Public Input No. 139-NFPA 70-2019 [New Definition after Definition: Fitting.]

Floating Building.

A building unit, as defined in Article 100, that floats on water, is moored in a permanent location, and has a premises wiring system served trough connection by permanent wiring to an electrical supply system not located on the premises.

Statement of Problem and Substantiation for Public Input

The definition of floating building, as it appears in Article 555.2 applies only to Article 555. However, the term floating building also appears in Article 90.2(A), (1) and 90.2(B), (1). If this definition is not relocated to Article 100, the term as used in Article 90 could apply to cruise ships, casino boats, river boats, etc. There would be conflicting meanings of the term floating building.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 138-NFPA 70-2019 [Definition: Floating Building.]	

Submitter Information Verification

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Submittal Date: Thu Nov 21 22:08:33 EST 2019
Committee: NEC-P07

Committee Statement

Resolution: FR-7690-NFPA 70-2020

Statement: All existing definitions under the purview of CMP-7 have been moved to Article 100 and revises for compliance with Section 2.2.2 of the NEC Style Manual. Additionally, all definition sections (545.2, 547.2, 550.2, 551.2, 552.2, 555.2, 604.2, and 675.2.2) in the articles under the responsibility of CMP-7 have been deleted.

Public Input No. 1918-NFPA 70-2020 [New Definition after Definition: Reconditioned.]

Recreational Vehicle.

A vehicular-type unit primarily designed as temporary living quarters for recreational, camping, or travel use, which either has its own motive power or is mounted on or drawn by another vehicle.

Informational Note: The basic entities are travel trailer, camping trailer, truck camper, and motor home as referenced in NFPA 1192-2018, *Standard on Recreational Vehicles* . See 3.3.52, *Recreational Vehicle* , and A.3.3.52 of NFPA 1192.

Statement of Problem and Substantiation for Public Input

In the 2020 NEC, the definition for "Recreational Vehicle" states "This definition shall apply within this article and throughout the Code." This implies that the defined term is present in more than one section of the NEC. A search of the NEC reveals that this term is present in article, 90, 545, 551, and 626. Section 2.2.2.1 of the NEC style manual reserves space in article 100 for definitions of terms that appear in more than one article.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1917-NFPA 70-2020 [Definition: Recreational Vehicle.]	
Public Input No. 1917-NFPA 70-2020 [Definition: Recreational Vehicle.]	

Submitter Information Verification

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Committee: NEC-P07

Committee Statement

Resolution: FR-7690-NFPA 70-2020

Statement: All existing definitions under the purview of CMP-7 have been moved to Article 100 and revises for compliance with Section 2.2.2 of the NEC Style Manual. Additionally, all definition sections (545.2, 547.2, 550.2, 551.2, 552.2, 555.2, 604.2, and 675.2.2) in the articles under the responsibility of CMP-7 have been deleted.

Public Input No. 3652-NFPA 70-2020 [Section No. 545.2]

(Relocate all definitions in the 545. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

545. 2 Definitions.

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

Building Component.

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

Building System.

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

Closed Construction.

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

Manufactured Building.

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

Relocatable Structure.

A factory-assembled structure or structures transportable in one or more sections that are built on a permanent chassis and designed to be used as other than a dwelling unit without a permanent foundation.

Informational Note: Examples of relocatable structures are those units that are equipped for sleeping purposes only, contractor's and other on-site offices, construction job dormitories, studio dressing rooms, banks, clinics, stores, shower facilities and restrooms, training centers, or for the display or demonstration of merchandise or machines.

Statement of Problem and Substantiation for Public Input

"The National Electrical Code has definitions in multiple parts in Article 100 and many definitions scattered through out the code many of them in the .2 section of the articles.
Most of the other standards under NFPA have their definitions in one location and this will allow the NEC the same requirement. The revisions to the NEC Style Manual require all the definitions to be relocated to Article 100. "

Submitter Information Verification

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Submittal Date: Wed Sep 09 10:08:57 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7690-NFPA 70-2020

Statement: All existing definitions under the purview of CMP-7 have been moved to Article 100 and revises for compliance with Section 2.2.2 of the NEC Style Manual. Additionally, all definition sections (545.2, 547.2, 550.2, 551.2, 552.2, 555.2, 604.2, and 675.2.2) in the articles under the responsibility of CMP-7 have been deleted.

Public Input No. 1255-NFPA 70-2020 [Section No. 545.22(D)]

(D) Grounding.

The ~~feeder(s)~~ relocatable structures shall be grounded in accordance with Parts I, II, and III of Article 250. Where two or more relocatable structures are structurally connected to form a single unit, and a common grounding electrode conductor and tap arrangement as specified in 250.64(D)(1) is utilized, it shall be permissible to use the chassis bonding conductor specified in 545.26 as the tap conductor.

Statement of Problem and Substantiation for Public Input

Subdivision (D) addresses relocatable structures as far as what is required to be grounded, rather than requiring the feeder to be grounded. The last sentence has been revised to be more consistent with the permissive text in accordance with the NECA Style Manual and Section 90.5(B).

Submitter Information Verification

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Submittal Date: Tue May 26 12:09:58 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7705-NFPA 70-2020
Statement: The panel revised the requirement to clarify that a relocatable structure needs to be supplied by a feeder. This clarification is in concert with Article 550 where service equipment is not allowed on a structure without a permanent foundation and the existing definition of a relocatable structure. The committee has divided 545.22(D) into listed items to meet the intent of PI-1255.

Public Input No. 2578-NFPA 70-2020 [Article 547]

Article 547 Agricultural Buildings

547.1 Scope.

This article applies to the following agricultural buildings or that part of a building or adjacent areas of similar or like nature as specified in 547.1(A) or (B).

(A) Excessive Dust and Dust with Water.

Agricultural buildings where excessive dust and dust with water may accumulate, including all areas of poultry, livestock, and fish confinement systems, where litter dust or feed dust, including mineral feed particles, may accumulate.

(B) Corrosive Atmosphere.

Agricultural buildings where a corrosive atmosphere exists. Such buildings include areas where the following conditions exist:

(1) Poultry and animal excrement may cause corrosive vapors.

(2) Corrosive particles may combine with water.

(3) The area is damp and wet by reason of periodic washing for cleaning and sanitizing with water and cleansing agents.

(4) Similar conditions exist.

547.2 Definitions.

The definitions in this section apply only within this article.

Distribution Point.

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

Informational Note No. 1: Distribution points are also known as the center yard pole, meterpole, or the common distribution point.

Informational Note No. 2: The service point as defined in Article 100 is typically at the distribution point.

Equipotential Plane (as applied to agricultural buildings).

An area where wire mesh or other conductive elements are embedded in or placed under concrete, bonded to all metal structures and fixed nonelectrical equipment that could become energized, and connected to the electrical grounding system to minimize voltage differences within the plane and between the planes, the grounded equipment, and the earth.

Site-Isolating Device.

A disconnecting means installed at the distribution point for the purposes of isolation, system maintenance, emergency disconnection, or connection of optional standby systems.

547.3 Other Articles.

For buildings and structures not having conditions as specified in 547.1, the electrical installations shall be made in accordance with the applicable articles in this *Code*.

547.4 Surface Temperatures.

Electrical equipment or devices installed in accordance with this article shall be installed in a manner such that they will function at full rating without developing surface temperatures in excess of the specified normal safe operating range of the equipment or device.

547.5 Wiring Methods.

(A) Wiring Systems.

Types UF, NMC, copper SE cables, jacketed Type MC cable, rigid nonmetallic conduit, liquidtight flexible nonmetallic conduit, or other cables or raceways suitable for the location, with approved termination fittings, shall be the wiring methods employed. The wiring methods of Article 502, Part II, shall be permitted for areas described in 547.1(A).

Informational Note: See 300.7, 352.44, and 355.44 for installation of raceway systems exposed to widely different temperatures.

(B) Mounting.

All cables shall be secured within 200 mm (8 in.) of each cabinet, box, or fitting. Nonmetallic boxes, fittings, conduit, and cables shall be permitted to be mounted directly to any building surface covered by this article without maintaining the 6 mm (¼ in.) airspace in accordance with 300.6(D).

(C) Equipment Enclosures, Boxes, Conduit Bodies, and Fittings.

(1) Excessive Dust.

Equipment enclosures, boxes, conduit bodies, and fittings installed in areas of buildings where excessive dust may be present shall be designed to minimize the entrance of dust and shall have no openings (such as holes for attachment screws) through which dust could enter the enclosure.

(2) Damp or Wet Locations.

In damp or wet locations, equipment enclosures, boxes, conduit bodies, and fittings shall be placed or equipped so as to prevent moisture from entering or accumulating within the enclosure, box, conduit body, or fitting. In wet locations, including normally dry or damp locations where surfaces are periodically washed or sprayed with water, boxes, conduit bodies, and fittings shall be listed for use in wet locations and equipment enclosures shall be weatherproof.

(3) Corrosive Atmosphere.

Where wet dust, excessive moisture, corrosive gases or vapors, or other corrosive conditions may be present, equipment enclosures, boxes, conduit bodies, and fittings shall have corrosion resistance properties suitable for the conditions.

Informational Note No. 1: See Table 110.28 for appropriate enclosure type designations.

Informational Note No. 2: Aluminum and magnetic ferrous materials may corrode in agricultural environments.

(D) Flexible Connections.

Where necessary to employ flexible connections, dusttight flexible connectors, liquidtight flexible metal conduit, liquidtight flexible nonmetallic conduit, or flexible cord listed and identified for hard usage shall be used.

(E) Physical Protection.

All electrical wiring and equipment subject to physical damage shall be protected.

(F) Separate Equipment Grounding Conductor.

Where a separate equipment grounding conductor, not part of a listed cable assembly, is installed underground within a location falling under the scope of Article 547, it shall be insulated.

Informational Note: For further information on aluminum and copper-clad aluminum conductors, see 250.120(B).

(G) Receptacles.

Ground-fault circuit-interrupter protection shall be provided as required in 210.8(B). GFCI protection shall not be required for other than 125-volt, 15- and 20-ampere receptacles installed within the following areas:

(1) Areas having an equipotential plane

(2) Outdoors

(3) Damp or wet locations

(4) Dirt confinement areas for livestock

547.6 Switches, Receptacles, Circuit Breakers, Controllers, and Fuses.

Switches, including pushbuttons, relays, and similar devices, receptacles, circuit breakers, controllers, and fuses, shall be provided with enclosures as specified in 547.5(C).

547.7 Motors.

Motors and other rotating electrical machinery shall be totally enclosed or designed so as to minimize the entrance of dust, moisture, or corrosive particles.

547.8 Luminaires.

Luminaires shall comply with 547.8(A) through (C).

(A) Minimize the Entrance of Dust.

Luminaires shall be installed to minimize the entrance of dust, foreign matter, moisture, and corrosive material.

(B) Exposed to Physical Damage.

Luminaires exposed to physical damage shall be protected by a suitable guard.

(C) Exposed to Water.

Luminaires exposed to water from condensation, building cleansing water, or solution shall be listed for use in wet locations.

547.9 Electrical Supply to Building(s) or Structure(s) from a Distribution Point.

Any agricultural building or structure for livestock located on the same premises shall be supplied from a distribution point. More than one distribution point on the same premises shall be permitted. The overhead electrical supply shall comply with 547.9(A) and (B) or with 547.9(C). The underground electrical supply shall comply with 547.9(C).

Any existing agricultural building or structure for other than livestock and any existing buildings and structures not under the scope of Article 547 shall be permitted to be supplied in accordance with 250.32(B)(1) Exception No. 1.

(A) Site-Isolating Device.

Site-isolating devices shall comply with 547.9(A)(1) through (A)(10).

(1) Where Required.

A site-isolating device shall be installed at the distribution point where two or more buildings or structures are supplied from the distribution point.

(2) Location.

The site-isolating device shall be pole-mounted and be not less than the height above grade required by 230.24 for the conductors it supplies.

(3) Operation.

The site-isolating device shall simultaneously disconnect all ungrounded service conductors from the premises wiring.

(4) Bonding Provisions.

The site-isolating device enclosure shall be connected to the grounded circuit conductor and the grounding electrode system.

(5) Grounding.

At the site-isolating device, the system grounded conductor shall be connected to a grounding electrode system via a grounding electrode conductor.

(6) Rating.

The site-isolating device shall be rated for the calculated load as determined by Part V of Article 220.

(7) Overcurrent Protection.

The site-isolating device shall not be required to provide overcurrent protection.

(8) Accessibility.

The site-isolating device shall be capable of being remotely operated by an operating handle installed at a readily accessible location. The operating handle of the site-isolating device, when in its highest position, shall not be more than 2.0 m (6 ft 7 in.) above grade or a working platform.

(9) Series Devices.

An additional site-isolating device for the premises wiring system shall not be required where a site-isolating device meeting all applicable requirements of this section is provided by the serving utility as part of their service requirements.

(10) Marking.

A site-isolating device shall be permanently marked to identify it as a site-isolating device. This marking shall be located on the operating handle or immediately adjacent thereto.

(B) Service Disconnecting Means and Overcurrent Protection at the Building(s) or Structure(s).

Where the service disconnecting means and overcurrent protection are located at the building(s) or structure(s), the requirements of 547.9(B)(1) through (B)(3) shall apply.

(1) Conductor Sizing.

The supply conductors shall be sized in accordance with Part V of Article 220.

(2) Conductor Installation.

The supply conductors shall be installed in accordance with the requirements of Part II of Article 225.

(3) Grounding and Bonding.

For each building or structure, grounding and bonding of the supply conductors shall be in accordance with the requirements of 250.32, and the following conditions shall be met:

(1) The equipment grounding conductor is not smaller than the largest supply conductor if of the same material or is adjusted in size in accordance with the equivalent size columns of Table 250.122 if of different materials.

(2) The equipment grounding conductor is connected to the grounded circuit conductor and the site-isolating device enclosure at the distribution point.

(C) Service Disconnecting Means and Overcurrent Protection at the Distribution Point.

The service disconnecting means and overcurrent protection for each set of feeders or branch circuits shall be located at the distribution point. The service disconnecting means shall be installed in accordance with Part VI of Article 230. The feeders or branch circuits supplied to buildings or structures shall comply with 250.32 and Article 225, Parts I and II.

Informational Note: Methods to reduce neutral-to-earth voltages in livestock facilities include supplying buildings or structures with 4-wire single-phase services, sizing 3-wire single-phase service and feeder conductors to limit voltage drop to 2 percent, and connecting loads line-to-line.

(D) Identification.

Where a site is supplied by more than one distribution point, a permanent plaque or directory shall be installed at each of these distribution points denoting the location of each of the other distribution points and the buildings or structures served by each.

547.10 Equipotential Planes and Bonding of Equipotential Planes.

The installation and bonding of equipotential planes shall comply with 547.10(A) and (B). For the purposes of this section, the term *livestock* shall not include poultry.

(A) Where Required.

Equipotential planes shall be installed where required in 547.10(A)(1) and (A)(2).

(1) Indoors.

Equipotential planes shall be installed in confinement areas with concrete floors where metallic equipment is located that may become energized and is accessible to livestock.

(2) Outdoors.

Equipotential planes shall be installed in concrete slabs where metallic equipment is located that may become energized and is accessible to livestock.

The equipotential plane shall encompass the area where the livestock stands while accessing metallic equipment that may become energized.

(B) Bonding.

Equipotential planes shall be connected to the electrical grounding system. The bonding conductor shall be solid copper, insulated, covered or bare, and not smaller than 8 AWG. The means of bonding to wire mesh or conductive elements shall be by pressure connectors or clamps of brass, copper, copper alloy, or an equally substantial approved means. Slatted floors that are supported by structures that are a part of an equipotential plane shall not require bonding.

Informational Note No. 1: Methods to establish equipotential planes are described in American Society of Agricultural and Biological Engineers (ASABE) EP473.2-2001 (R2015), *Equipotential Planes in Animal Containment Areas*.

Informational Note No. 2: Methods for safe installation of livestock waterers are described in American Society of Agricultural and Biological Engineers (ASABE) EP342.3-2010 (R2015), *Safety for Electrically Heated Livestock Waterers*.

Informational Note No. 3: Low grounding electrode system resistances may reduce voltage differences in livestock facilities.

Additional Proposed Changes

File Name	Description	Approved
ARTICLE_547_Agricultural_BuildingsDHDWDH.docx	The word document provides a rewrite of Article 547 that complies with the 2015 NEC Style Manual.	

ARTICLE_547_TG_WorkDH.docx	This Word document shows "track changes" so the committee can review each revision

Statement of Problem and Substantiation for Public Input

An NEC Correlating Committee appointed a task group of balanced interest to review the Articles within the purview of CMP 7 for compliance with the NEC Style Manual. A sub task group reviewed Article 547 and revised the entire article to comply with the NEC Style Manual. The sub task group members are David Hittinger, David Williams and Dean Hunter.
It was not possible to make all of the changes in Terra. Therefore, a "clean" Word file was uploaded for the committee to review as well as a Word document in "track changes" that shows each revision.

Submitter Information Verification

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Submittal Date: Mon Aug 24 19:39:16 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7816-NFPA 70-2020
Statement: CMP-7 accepts the re-write of Article 547 to comply with the structure required in The 2015 NEC Style Manual requirements (PI-2578).

CMP-7 reviewed Articles 545, 547, 550, 551, 552, 555, 604 and 675 for compliance with NEC Style Manual Section 2.1.4 and found that only article 547 required a revision (PI-3328).

ARTICLE 547 Agricultural Buildings

Part I. General

547.1 Scope.

This article applies to agricultural buildings or part of a building or adjacent areas of similar or like nature as specified in (A) or (B).

(A) **Excessive Dust and Dust with Water.** Agricultural buildings where excessive dust and dust with water may accumulate, including all areas of poultry, livestock, and fish confinement systems, where litter dust or feed dust, including mineral feed particles, may accumulate.

(B) **Corrosive Atmosphere.** Agricultural buildings where a corrosive atmosphere exists. Such buildings include areas where the following conditions exist:
(1) Poultry and animal excrement may cause corrosive vapors.
(2) Corrosive particles may combine with water.
(3) The area is damp and wet by reason of periodic washing for cleaning and sanitizing with water and cleansing agents.
(4) Similar conditions exist.

547.2 Definitions.

The definitions in this section apply only within this article.

Distribution Point.

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

Informational Note No. 1: Distribution points are also known as the center yard pole, meter pole, or the common distribution point.

Informational Note No. 2: The service point as defined in Article 100 is typically at the distribution point.

Equipotential Plane (as applied to agricultural buildings).

An area where wire mesh or other conductive elements are embedded in or placed under concrete, bonded to all metal structures and fixed nonelectrical equipment that could become energized, and connected to the electrical grounding system to minimize voltage differences
within the plane and between the planes, the grounded equipment, and the earth.

Site-Isolating Device. A disconnecting means installed at the distribution point for the purposes of isolation, system maintenance, emergency disconnection, or connection of optional standby systems.

547.4 Surface Temperatures.

Electrical equipment or devices installed in accordance with this article shall be installed in a manner such that they will function at full rating without developing surface temperatures in excess of the specified normal safe operating range of the equipment or device.

Informational Note: See Part III of Article 502 for use of equipment in Class 2 locations.

Part II. Installation

547.10 Wiring Methods. Conductor types shall be installed in accordance with the applicable requirements of this *Code* covering the type of wiring method used and shall be limited to the following methods:

(1) Type UF
(2) Type NMC
(3) Type SE cable-copper
(4) Type MC cable
(5) Rigid nonmetallic conduit
(6) Liquidtight flexible nonmetallic conduit (Type LFNC) with listed fittings
(7) Other cables or raceways suitable for the location

The wiring methods of Article 502, Part II, shall be permitted for areas described in 547.1.

Informational Note: See 300.7, 352.44, and 355.44 for installation of raceway systems exposed to widely different temperatures.

547.11 Mounting.
All cables shall be secured within 200 mm (8 in.) of each cabinet, box, or fitting. Nonmetallic boxes, fittings, conduit, and cables shall be permitted to be mounted directly to any building surface covered by this article without maintaining the 6 mm (1/4 in.) airspace in accordance with 300.6(D).

547.12 Equipment Enclosures, Boxes, Conduit Bodies, and Fittings.
Equipment enclosures, boxes, conduit bodies, and fittings installed in areas of buildings where excessive dust may be present shall be designed to minimize the entrance of dust and shall have no unused openings through which dust could enter the enclosure.

547.13 Damp or Wet Locations.
In damp or wet locations, equipment enclosures, boxes, conduit bodies, and fittings shall be placed or equipped so as to prevent moisture from entering or accumulating within the

enclosure, box, conduit body, or fitting. In wet locations, including normally dry or damp locations where surfaces are periodically washed or sprayed with water, boxes, conduit bodies, and fittings shall be listed for use in wet locations and equipment enclosures shall be weatherproof.

547.14 Corrosive Atmosphere.

Where wet dust, excessive moisture, corrosive gases or vapors, or other corrosive conditions may be present, equipment enclosures, boxes, conduit bodies, and fittings shall have corrosion resistance properties suitable for the conditions.

Informational Note No. 1: See Table 110.28 for appropriate enclosure type designations.

Informational Note No. 2: Aluminum and magnetic ferrous materials may corrode in agricultural environments.

547.15 Flexible Connections.
Where necessary to employ flexible connections, one or more of the following shall be permitted:

(1) Dusttight flexible connectors
(2) Liquidtight flexible metal conduit (Type LFMC) with listed fittings
(3) Liquidtight flexible nonmetallic conduit (Type LFNC) with listed fittings
(4) Flexible cord listed and identified for hard usage and terminated with listed dusttight cord connectors

547.16 Physical Protection.
All electrical wiring and equipment subject to physical damage shall be protected.

547.17 Separate Equipment Grounding Conductor.
Where a separate equipment grounding conductor, not part of a listed cable assembly, is installed underground within a location falling under the scope of Article 547, it shall be insulated.

Informational Note: For further information on aluminum and copper-clad aluminum conductors, see 250.120(B).

547.18 Ground-Fault Circuit-Interrupter Protection.
Ground-fault circuit-interrupter (GFCI) protection shall be provided as required in 210.8(B) for areas of agricultural buildings not included in the scope of this article. GFCI protection shall not be required for other than 125-volt, 15- and 20-ampere receptacles installed within the following areas:

(1) Areas having an equipotential plane
(2) Outdoors
(3) Damp or wet locations

(4) Dirt or concrete confinement areas for livestock

547.19 Switches, Receptacles, Circuit Breakers, Controllers, and Fuses.
Switches, including pushbuttons, relays, and similar devices, receptacles, circuit breakers, controllers, and fuses, shall be provided with enclosures as specified in 547.12.

547.20 Motors.

Motors and other rotating electrical machinery shall be totally enclosed or designed so as to minimize the entrance of dust, moisture, or corrosive particles.

547.21 Luminaires.
Luminaires shall comply with (A) through (C).

(A) Minimize the Entrance of Dust. Luminaires shall be installed to minimize the entrance of and accumulation of dust, foreign matter, moisture, and corrosive material.

(B) Exposed to Physical Damage. Luminaires exposed to physical damage shall be protected by a suitable guard.

(C) Exposed to Water. Luminaires exposed to water from condensation, building cleansing water, or solution shall be listed for use in wet locations.

Part III. Distribution

547.30 Electrical Supply to Building(s) or Structure(s) from a Distribution Point.
Any agricultural building or structure for livestock located on the same premises shall be supplied from a distribution point. More than one distribution point on the same premises shall be permitted.

Any existing agricultural building or structure for other than livestock not under the scope of Article 547 shall be permitted to be supplied in accordance with 250.32(B)(1) Exception No. 1.

547.31 Overhead Service. Overhead service installations shall comply with (A)(1) through (9) and (B)(1) through (3).

(A) Site-Isolating Device.
Site-isolating devices shall comply with (A)(1) through (A)(9).

(1) Where Required. A site-isolating device shall be installed at the distribution point where two or more buildings or structures are supplied from the distribution point.

(2) Location. The site-isolating device shall be pole-mounted and be not less than the height above grade required by 230.24 for the conductors it supplies.

(3) Operation. The site-isolating device shall simultaneously disconnect all ungrounded service conductors from the premises wiring.

(4) Grounding and Bonding. At the site-isolating device, the grounding electrode conductor shall be connected to the system grounded conductor and the enclosure.

(5) Rating. The site-isolating device shall be rated for the calculated load as determined by Part V of Article 220.

(6) Overcurrent Protection. The site-isolating device shall not be required to provide overcurrent protection.

(7) Accessibility. The site-isolating device shall be capable of being remotely operated by an operating handle installed at a readily accessible location. The operating handle of the site- isolating device, when in its highest position, shall not be more than 2.0 m (6 ft 7 in.) above grade or a working platform.

(8) Series Devices. An additional site-isolating device for the premises wiring system shall not be required where a site-isolating device meeting all applicable requirements of this section is provided by the serving utility as part of their service requirements.

(9) Marking. A site-isolating device shall be permanently marked to identify it as a site-isolating device. This marking shall be located on the operating handle or immediately adjacent thereto.

(B) Service Disconnecting Means and Overcurrent Protection Where the service disconnecting means and overcurrent protection are located at the building(s) or structure(s), the following requirements shall apply:

(1) Conductor Sizing. The supply conductors shall be sized in accordance with Part V of Article 220.

(2) Conductor Installation. The supply conductors shall be installed in accordance with the requirements of Part II of Article 225.

(3) Grounding and Bonding. For each building or structure, grounding and bonding of the supply conductors shall be in accordance with the requirements of 250.32.

547.32 Service Disconnecting Means and Overcurrent Protection at the Distribution Point. The service disconnecting means and overcurrent protection for each set of feeders or branch circuits shall be located at the distribution point. The service disconnecting means shall be installed in accordance with Part VI of Article 230. The feeders or branch circuits supplied to buildings or structures shall comply with 250.32 and Article 225, Parts I and II.

Informational Note: Methods to reduce in earth voltages in livestock facilities include supplying buildings or structures with 4-wire single-phase service or sizing 3-wire single-phase service and feeder conductors to limit voltage drop to 2 percent, and connecting loads line-to-line, will provide reasonable efficiency of operation.

547.33 Identification. Where a site is supplied by more than one distribution point, a permanent plaque or directory shall be installed at each of these distribution points denoting the location of each of the other distribution points and the buildings or structures served by each.

547.34 Equipotential Planes and Bonding of Equipotential Planes. The installation and bonding of equipotential planes shall comply with (A) and (B). For the purposes of this section, the term livestock shall not include poultry.

(A) Where Required. Equipotential planes shall be required in the following areas:

(1) Indoors. Equipotential planes shall be installed in confinement areas with concrete floors where metallic equipment is located that may become energized and is accessible to livestock.

(2) Outdoors. Equipotential planes shall be installed in concrete slabs where metallic equipment is located that may become energized and is accessible to livestock.

The equipotential plane shall encompass the area where the livestock stands while accessing metallic equipment that may become energized.

(B) Bonding. Equipotential planes shall be connected to the electrical grounding system. The bonding conductor shall be solid copper, insulated, covered or bare, and not smaller than 8 AWG. The means of bonding to wire mesh or conductive elements shall be by pressure connectors or clamps of brass, copper, copper alloy, or other approved means. Slatted floors that are supported by structures that are a part of an equipotential plane shall not require bonding.

Informational Note No. 1: Methods to establish equipotential planes are described in American Society of Agricultural and Biological Engineers (ASABE) EP473.2-2001 (R2015), Equipotential Planes in Animal Containment Areas.

Informational Note No. 2: Methods for safe installation of livestock waterers are described in American Society of Agricultural and Biological Engineers (ASABE) EP342.3-2010 (R2015), Safety for Electrically Heated Livestock Waterers.

Informational Note No. 3: Low grounding electrode system resistances may reduce voltage
differences in livestock facilities.

ARTICLE 547 Agricultural Buildings

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Part I. General

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~~**547.1 Scope.**~~

~~This article applies to the following agricultural buildings or that part of a building or adjacent areas of similar or like nature as specified in 547.1(A) or (B).~~**547.1 Scope.**

This article applies to ~~the following~~ agricultural buildings or ~~that~~ part of a building or adjacent areas of similar or like nature as specified in (A) or (B).

(A) **Excessive Dust and Dust with Water.** Agricultural buildings where excessive dust and dust with water may accumulate, including all areas of poultry, livestock, and fish confinement systems, where litter dust or feed dust, including mineral feed particles, may accumulate.

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(B) Corrosive Atmosphere. Agricultural buildings where a corrosive atmosphere exists. Such buildings include areas where the following conditions exist:

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(1) Poultry and animal excrement may cause corrosive vapors.

(2) Corrosive particles may combine with water.

(3) The area is damp and wet by reason of periodic washing for cleaning and sanitizing with water and cleansing agents.

(4) Similar conditions exist.

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~~**547.1(A) Excessive Dust and Dust with Water.**~~

~~Agricultural buildings where excessive dust and dust with water may accumulate, including all areas of poultry, livestock, and fish confinement systems, where litter dust or feed dust, including mineral feed particles, may accumulate.~~

~~**547.1(B) Corrosive Atmosphere.**~~

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~~Agricultural buildings where a corrosive atmosphere exists. Such buildings include areas where the following conditions exist:~~

~~(1)~~

~~Poultry and animal excrement may cause corrosive vapors.~~

~~(2)~~

~~Corrosive particles may combine with water.~~

~~(3)~~

~~The area is damp and wet by reason of periodic washing for cleaning and sanitizing with water and cleansing agents.~~

~~(4)~~

~~Similar conditions exist.~~

~~**Part I. General**~~

547.2 Definitions.
The definitions in this section apply only within this article.

Distribution Point.
An electrical supply point from which service drops, service conductors, feeders, or branch circuits to buildings or structures utilized under single management are supplied.

Informational Note No. 1: Distribution points are also known as the center yard pole, meter pole, or the common distribution point.

Informational Note No. 2: The service point as defined in Article 100 is typically at the distribution point.

Equipotential Plane (as applied to agricultural buildings).
An area where wire mesh or other conductive elements are embedded in or placed under concrete, bonded to all metal structures and fixed nonelectrical equipment that could become energized, and connected to the electrical grounding system to minimize voltage differences within the plane and between the planes, the grounded equipment, and the earth.

Site-Isolating Device.
A disconnecting means installed at the distribution point for the purposes of isolation, system maintenance, emergency disconnection, or connection of optional standby systems.~~.~~

~~Delete. No need to list what 547 is not.~~
~~**547.3 Other Articles.**~~
~~For buildings and structures not having conditions as specified in 547.1, the electrical installations shall be made in accordance with the applicable articles in this *Code*.~~
~~Delete Not needed. If this is really important then it needs to be rewritten.~~~~547.1(A) Excessive Dust and Dust with Water.~~
~~Agricultural buildings where excessive dust and dust with water may accumulate, including all areas of poultry, livestock, and fish confinement systems, where litter dust or feed dust, including mineral feed particles, may accumulate.~~

~~**547.1(B) Corrosive Atmosphere.**~~
~~Agricultural buildings where a corrosive atmosphere exists. Such buildings include areas where the following conditions exist:~~

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~~(1) Poultry and animal excrement may cause corrosive vapors.~~

~~(2) Corrosive particles may combine with water.~~

~~(3) The area is damp and wet by reason of periodic washing for cleaning and sanitizing with water and cleansing agents.~~

~~(4) Similar conditions exist.~~

547.~~46~~4 Surface Temperatures.
Electrical equipment or devices installed in accordance with this article shall be installed in a manner such that they will function at full rating without developing surface temperatures in excess of the specified normal safe operating range of the equipment or device.

Informational Note: See Part III of Article 502 for use of equipment in Class 2 locations.

Part II. Installation

547.~~610~~5 Wiring Methods. Conductor types shall be installed in accordance with the applicable requirements of this *Code* covering the type of wiring method used and shall be limited to the following methods:

(1)
~~547.5(A) Wiring Systems.~~
Type~~s~~ UF~~,~~
(2) Type NMC
(3) ~~, copper~~ Type SE cable~~ coppers~~,
(4) ~~jacketed~~ Type MC cable~~,~~
(5) ~~r~~Rigid nonmetallic conduit~~,~~
(6) L~~l~~iquidtight flexible nonmetallic conduit (Type LFNC) with listed fittings~~,~~
(7) ~~or~~ O~~o~~ther cables or raceways suitable for the location~~.location, with approved termination fittings, shall be the wiring methods employed.~~

The wiring methods of Article 502, Part II, shall be permitted for areas described in 547.1~~(A).~~.

Informational Note: See 300.7, 352.44, and 355.44 for installation of raceway systems exposed to widely different temperatures.

547.~~11~~7~~7.~~ ~~5(B)~~ Mounting. ~~Is this section necessary? Why does this not apply?~~
~~All cables shall be secured within 200 mm (8 in.) of each cabinet, box, or fitting. Nonmetallic boxes, fittings, conduit, and cables shall be permitted to be mounted directly to any building surface covered by this article without maintaining the 6 mm (1⁄4 in.) airspace in accordance with 300.6(D).~~All cables shall be secured within 200 mm (8 in.) of each cabinet, box, or fitting.

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Nonmetallic boxes, fittings, conduit, and cables shall be permitted to be mounted directly to any building surface covered by this article without maintaining the 6 mm ($^1/_4$ in.) airspace in accordance with 300.6(D).

547.~~12~~8 ~~.5(C)~~ Equipment Enclosures, Boxes, Conduit Bodies, and Fittings.

~~547.5(C)(1) Excessive Dust.~~

~~Equipment enclosures, boxes, conduit bodies, and fittings installed in areas of buildings where excessive dust may be present shall be designed to minimize the entrance of dust and shall have no openings (such as holes for attachment screws) through which dust could enter the enclosure.~~Equipment enclosures, boxes, conduit bodies, and fittings installed in areas of buildings where excessive dust may be present shall be designed to minimize the entrance of dust and shall have no unused openings through which dust could enter the enclosure.

547.~~5(C)(2)~~13~~9~~ Damp or Wet Locations.

In damp or wet locations, equipment enclosures, boxes, conduit bodies, and fittings shall be placed or equipped so as to prevent moisture from entering or accumulating within the enclosure, box, conduit body, or fitting. In wet locations, including normally dry or damp locations where surfaces are periodically washed or sprayed with water, boxes, conduit bodies, and fittings shall be listed for use in wet locations and equipment enclosures shall be weatherproof.

547.~~5(C)(3)~~14~~0~~ Corrosive Atmosphere.

Where wet dust, excessive moisture, corrosive gases or vapors, or other corrosive conditions may be present, equipment enclosures, boxes, conduit bodies, and fittings shall have corrosion resistance properties suitable for the conditions.

Informational Note No. 1: See Table 110.28 for appropriate enclosure type designations.

Informational Note No. 2: Aluminum and magnetic ferrous materials may corrode in agricultural environments.

547.~~5(D)~~15~~1~~ Flexible Connections.

~~Where necessary to employ flexible connections, the following methods shall apply:~~

- ~~Dusttight flexible connectors~~
- ~~, Lliquidtight flexible metal conduit,~~
- ~~Lliquidtight flexible nonmetallic conduit~~

~~, or F~~flexible cord listed and identified for hard usage ~~shall be used.~~Where necessary to employ flexible connections, one or more of the following shall be permitted:

(1) Dusttight flexible connectors

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(2) Liquidtight flexible metal conduit (Type LFMC) with listed fittings
(3) Liquidtight flexible nonmetallic conduit (Type LFNC) with listed fittings
(4) Flexible cord listed and identified for hard usage and terminated with listed dusttight cord connectors

547.~~5(E)~~16~~2~~ Physical Protection.
All electrical wiring and equipment subject to physical damage shall be protected.

547.~~5(F)~~17~~3~~ Separate Equipment Grounding Conductor.
Where a separate equipment grounding conductor, not part of a listed cable assembly, is installed underground within a location falling under the scope of Article 547, it shall be insulated.

Informational Note: For further information on aluminum and copper-clad aluminum conductors, see 250.120(B).

547.~~5(G)~~ 18~~4~~ ~~Receptacles,~~Ground-Fault Circuit-Interrupter Protection.
Ground-fault circuit-interrupter (GFCI) protection shall be provided as required in 210.8(B) for areas of agricultural buildings not included in the scope of this article. GFCI protection shall not be required for other than 125-volt, 15- and 20-ampere receptacles installed within the following areas: ~~as required in 210.8(B). GFCI protection shall not be required for other than for 125-volt, 15- and 20-ampere receptacles installed within the following areas:~~

~~(1)~~
~~(1)~~ Areas having an equipotential plane

(1)
(2) Outdoors
Damp or wet locations
(3)
~~(2)~~
~~(2) Outdoors~~

~~(3)~~
~~(3) Damp or wet locations~~

~~(4)~~
(4) Dirt or concrete confinement areas for livestock

547.~~6~~ 19~~5~~ Switches, Receptacles, Circuit Breakers, Controllers, and Fuses.

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Switches, including pushbuttons, relays, and similar devices, receptacles, circuit breakers, controllers, and fuses, shall be provided with enclosures as specified in 547.~~5(C).~~12~~8~~.

547.~~7~~ 20~~16~~ Motors.
Motors and other rotating electrical machinery shall be totally enclosed or designed so as to minimize the entrance of dust, moisture, or corrosive particles.

547.~~8~~ 21~~17~~ Luminaires.
Luminaires shall comply with ~~547.8~~17(A) through (C).

~~547.8~~(A) Minimize the Entrance of Dust.
Luminaires shall be installed to minimize the entrance of and accumulation of dust, foreign matter, moisture, and corrosive material.

~~547.8~~(B) Exposed to Physical Damage.
Luminaires exposed to physical damage shall be protected by a suitable guard.

~~547.8~~(C) Exposed to Water.
Luminaires exposed to water from condensation, building cleansing water, or solution shall be listed for use in wet locations.

Part III. Distribution

547.~~9~~ 30~~18~~ Electrical Supply to Building(s) or Structure(s) from a Distribution Point.
Any agricultural building or structure for livestock located on the same premises shall be supplied from a distribution point. ~~-~~More than one distribution point on the same premises shall be permitted. ~~The overhead electrical supply shall comply with 547.9(A) and (B) or with 547.9(C). The underground electrical supply shall comply with 547.9(C).~~

Any existing agricultural building or structure for other than livestock ~~and any existing buildings and structures~~ not under the scope of Article 547 shall be permitted to be supplied in accordance with 250.32(B)(1) Exception No. 1.

547.31~~19~~ Overhead Service. Overhead service installations shall comply with ~~547.19~~(A)(1) through (~~10~~9) and (B)(1) through (3).

~~547.19~~(A) Site-Isolating Device.
Site-isolating devices shall comply with ~~547.9~~(A)(1) through (A)(9~~10~~).

~~547.9(A)(~~(1) Where Required.
A site-isolating device shall be installed at the distribution point where two or more buildings or structures are supplied from the distribution point.

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~~547.9(A)~~**(2) Location.**
The site-isolating device shall be pole-mounted and be not less than the height above grade required by 230.24 for the conductors it supplies.

~~547.9(A)~~**(3) Operation.**
The site-isolating device shall simultaneously disconnect all ungrounded service conductors from the premises wiring.

~~**547.9(A)(4) Bonding Provisions.**~~
~~The site-isolating device enclosure shall be connected to the grounded circuit conductor and the grounding electrode system.~~

~~547.9(A)~~**(~~4~~5) Grounding and Bonding.**
At the site-isolating device, ~~the system grounded conductor shall be connected to a grounding electrode system via a grounding electrode conductor~~ t.he grounding electrode conductor shall be connected to the system grounded conductor and the enclosure.

~~547.9(A)~~**(~~5~~6) Rating.**
The site-isolating device shall be rated for the calculated load as determined by Part V of Article 220.

~~547.9(A)~~**(~~6~~7) Overcurrent Protection.**
The site-isolating device shall not be required to provide overcurrent protection.

~~547.9(A)~~**(~~7~~8) Accessibility.**
The site-isolating device shall be capable of being remotely operated by an operating handle installed at a readily accessible location. The operating handle of the site-isolating device, when in its highest position, shall not be more than 2.0 m (6 ft 7 in.) above grade or a working platform.

~~547.9(A)~~**(~~8~~9) Series Devices.**
An additional site-isolating device for the premises wiring system shall not be required where a site-isolating device meeting all applicable requirements of this section is provided by the serving utility as part of their service requirements.

~~547.9(A)~~**(~~9~~10) Marking.**
A site-isolating device shall be permanently marked to identify it as a site-isolating device. This marking shall be located on the operating handle or immediately adjacent thereto.

~~547.10~~**(B) Service Disconnecting Means and Overcurrent Protection ~~at the Building(s) or Structure(s).~~**

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Where the service disconnecting means and overcurrent protection are located at the building(s) or structure(s), the following requirements ~~of 547.19(B)(1) through (B)(3)~~ shall apply:~~.~~

~~547.9(B)~~(1) Conductor Sizing.
The supply conductors shall be sized in accordance with Part V of Article 220.

~~547.9(B)(~~(2) Conductor Installation.
The supply conductors shall be installed in accordance with the requirements of Part II of Article 225.

~~547.9(B)(~~(3) Grounding and Bonding.
For each building or structure, grounding and bonding of the supply conductors shall be in accordance with the requirements of 250.32~~, and the following conditions shall be met:~~

~~(1)~~
~~The equipment grounding conductor is not smaller than the largest supply conductor if of the same material or is adjusted in size in accordance with the equivalent size columns of Table 250.122 if of different materials.~~

~~(2)~~
~~The equipment grounding conductor is connected to the grounded circuit conductor and the site-isolating device enclosure at the distribution point.~~.

547.~~9(C) 3220~~ Service Disconnecting Means and Overcurrent Protection at the Distribution Point.
The service disconnecting means and overcurrent protection for each set of feeders or branch circuits shall be located at the distribution point. The service disconnecting means shall be installed in accordance with Part VI of Article 230. The feeders or branch circuits supplied to buildings or structures shall comply with 250.32 and Article 225, Parts I and II.

~~Informational Note: Methods to reduce neutral~~547.21 ~~Neutral~~ ~~to-earth voltages.~~Informational Note: Methods to reduce in earth voltages in livestock facilities include supplying buildings or structures with 4-wire single-phase service~~s~~ or~~,~~ sizing 3-wire single-phase service and feeder conductors to limit voltage drop to 2 percent, and connecting loads line-to-line, will provide reasonable efficiency of operation.

547.~~9(D)3322~~ Identification.
Where a site is supplied by more than one distribution point, a permanent plaque or directory shall be installed at each of these distribution points denoting the location of each of the other distribution points and the buildings or structures served by each.~~Where a building or structure is supplied by more than one service, or any combination of branch circuits, feeders, and services, a permanent plaque or directory shall be installed at each service disconnect location~~

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~~denoting all other services, feeders, and branch circuits supplying that building or structure and the area served by each. See 225.37.~~

~~Where a site is supplied by more than one distribution point, a permanent plaque or directory shall be installed at each of these distribution points denoting the location of each of the other distribution points and the buildings or structures served by each.~~

547.~~342310~~ Equipotential Planes and Bonding of Equipotential Planes.
The installation and bonding of equipotential planes shall comply with ~~547.2310~~(A) and (B). For the purposes of this section, the term livestock shall not include poultry.

~~547.10~~(A) Where Required.
Equipotential planes shall be ~~installed where~~ required in ~~547.1023(A)(1) and (A)(2).~~the following areas:

~~547.10(A)((~~1) Indoors.
Equipotential planes shall be installed in confinement areas with concrete floors where metallic equipment is located that may become energized and is accessible to livestock.

~~547.10(A)((~~2) Outdoors.
Equipotential planes shall be installed in concrete slabs where metallic equipment is located that may become energized and is accessible to livestock.

The equipotential plane shall encompass the area where the livestock stands while accessing metallic equipment that may become energized.

~~547.2310~~(B) Bonding.
Equipotential planes shall be connected to the electrical grounding system. The bonding conductor shall be solid copper, insulated, covered or bare, and not smaller than 8 AWG. The means of bonding to wire mesh or conductive elements shall be by pressure connectors or clamps of brass, copper, copper alloy, or ~~an equally substantial~~other approved means. Slatted floors that are supported by structures that are a part of an equipotential plane shall not require bonding.

Informational Note No. 1: Methods to establish equipotential planes are described in American Society of Agricultural and Biological Engineers (ASABE) EP473.2-2001 (R2015), Equipotential Planes in Animal Containment Areas.

Informational Note No. 2: Methods for safe installation of livestock waterers are described in American Society of Agricultural and Biological Engineers (ASABE) EP342.3-2010 (R2015), Safety for Electrically Heated Livestock Waterers.

Informational Note No. 3: Low grounding electrode system resistances may reduce voltage differences in livestock facilities.

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Public Input No. 3654-NFPA 70-2020 [Section No. 547.2]

(Relocate all definitions in the 547.2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

547. 2 Definitions.

The definitions in this section apply only within this article.

Distribution Point.

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

Informational Note No. 1: Distribution points are also known as the center yard pole, meterpole, or the common distribution point.

Informational Note No. 2: The service point as defined in Article 100 is typically at the distribution point.

Equipotential Plane (as applied to agricultural buildings).

An area where wire mesh or other conductive elements are embedded in or placed under concrete, bonded to all metal structures and fixed nonelectrical equipment that could become energized, and connected to the electrical grounding system to minimize voltage differences within the plane and between the planes, the grounded equipment, and the earth.

Site-Isolating Device.

A disconnecting means installed at the distribution point for the purposes of isolation, system maintenance, emergency disconnection, or connection of optional standby systems.

Statement of Problem and Substantiation for Public Input

"The National Electrical Code has definitions in multiple parts in Article 100 and many definitions scattered through out the code many of them in the .2 section of the articles.
Most of the other standards under NFPA have their definitions in one location and this will allow the NEC the same requirement. The revisions to the NEC Style Manual require all the definitions to be relocated to Article 100. "

Submitter Information Verification

Submitter Full Name: David Williams
Organization: Delta Charter Township
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 10:09:55 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7690-NFPA 70-2020

Statement: All existing definitions under the purview of CMP-7 have been moved to Article 100 and revises for compliance with Section 2.2.2 of the NEC Style Manual. Additionally, all definition sections (545.2, 547.2, 550.2, 551.2, 552.2, 555.2, 604.2, and 675.2.2) in the articles under the responsibility of CMP-7 have been deleted.

Public Input No. 1966-NFPA 70-2020 [Section No. 547.5]

547.5 Wiring Methods.

(A) Wiring Systems.

Types UF, NMC, copper SE cables, jacketed Type MC cable, rigid nonmetallic conduit, liquidtight flexible nonmetallic conduit, or other cables or raceways suitable for the location, with approved termination fittings, shall be the wiring methods employed. The wiring methods of Article 502, Part II, shall be permitted for areas described in 547.1(A).

Informational Note: See 300.7, 352.44, and 355.44 for installation of raceway systems exposed to widely different temperatures.

(B) Mounting.

All cables shall be secured within 200 mm (8 in.) of each cabinet, box, or fitting. Nonmetallic boxes, fittings, conduit, and cables shall be permitted to be mounted directly to any building surface covered by this article without maintaining the 6 mm (¼ in.) airspace in accordance with 300.6(D).

(C) Equipment Enclosures, Boxes, Conduit Bodies, and Fittings.

(1) Excessive Dust.

Equipment enclosures, boxes, conduit bodies, and fittings installed in areas of buildings where excessive dust may be present shall be designed to minimize the entrance of dust and shall have no openings (such as holes for attachment screws) through which dust could enter the enclosure.

(2) Damp or Wet Locations.

In damp or wet locations, equipment enclosures, boxes, conduit bodies, and fittings shall be placed or equipped so as to prevent moisture from entering or accumulating within the enclosure, box, conduit body, or fitting. In wet locations, including normally dry or damp locations where surfaces are periodically washed or sprayed with water, boxes, conduit bodies, and fittings shall be listed for use in wet locations and equipment enclosures shall be weatherproof.

(3) Corrosive Atmosphere.

Where wet dust, excessive moisture, corrosive gases or vapors, or other corrosive conditions may be present, equipment enclosures, boxes, conduit bodies, and fittings shall have corrosion resistance properties suitable for the conditions.

Informational Note No. 1: See Table 110.28 for appropriate enclosure type designations.

Informational Note No. 2: Aluminum and magnetic ferrous materials may corrode in agricultural environments.

(D) Flexible Connections.

Where necessary to employ flexible connections, dusttight flexible connectors, liquidtight flexible metal conduit, liquidtight flexible nonmetallic conduit, or flexible cord listed and identified for hard usage shall be used.

(E) Physical Protection.

All electrical wiring and equipment subject to physical damage shall be protected.

(F) Separate Equipment Grounding Conductor.

Where a separate equipment grounding conductor, not part of a listed cable assembly, is installed underground within a location falling under the scope of Article 547, it shall be insulated.

Informational Note: For further information on aluminum and copper-clad aluminum conductors, see 250.120(B).

(G) Receptacles.

Ground-fault circuit-interrupter protection shall be provided as required in 210.8(B). ~~GFCI protection shall not be required for other than 125-volt, 15- and 20-ampere receptacles installed within the following areas:~~ The requirements of 210.8(B) shall additional apply to the following locations:

(1) Areas having an equipotential plane

(2) ~~Outdoors~~

(3) ~~Damp or wet locations~~

(4) Dirt confinement areas for livestock

Statement of Problem and Substantiation for Public Input

Purpose
According to the National Safety Council, the industry sector with the highest rate of preventable fatal injuries is Agriculture (22.6/100,000 in 2017) [injuryfacts.nsc.org]. One of the major causes of death is electrocution. The hazards of electricity in agricultural environments are amplified, specifically in buildings with corrosive environments and wet areas, and outdoors.
There are several cases from the past few years where electrocution deaths of people and animals have resulted from the use of cord connected utilization equipment where no GFCI was present to provide protection. Some of the cases would likely not result in injury or death if the building were built to the 2020 NEC, but most would still have the same outcome because GFCIs are required only on limited circuit types in agricultural applications. Furthermore, equipment used may not have built-in GFCI protection because it is not required by the applicable product standards, no product standard was used to design and qualify the products, the product is old, or the product was modified in such a way to create a hazard.
To reduce hazards related to cord connected products used in agricultural environments, I have submitted this PI to urge an expanded GFCI requirement for agricultural applications so that receptacles installed in areas specified in 547.5(G)(1)- 547.5(G) (4), at minimum, have GFCI protection as areas specified in 210.8(B).
Current Situation
GFCI requirements for receptacles in agricultural applications are specified in 547.5(G) that essentially says that 210.8(B) applies, but adds exceptions limiting GFCI requirements to 15 and 20A, 125V circuits for areas with equipotential planes, outdoors, damp or wet locations, and dirt confinement areas for livestock.
Electricity in the presence water is especially hazardous as water can increase the conductance between the voltage source, a person, and the voltage sink increasing the likelihood of shock or electrocution. In that vein, pressure washers are a common tool used in agricultural buildings where animals are housed for "…periodic washing for cleaning and sanitizing with water…" to clear away excrement. A review of UL 1776 shows that integral GFCIs are required only for single phase pressure washer rated 250V or less. Additionally, it is very difficult to find high power commercial pressure washers that fall within the scope of UL 1776 available for purchase, the bulk of the available products rated > 20A, >250V, or 3 phases are do not have a UL listing and do not ship with an integral GFCI.
While a farm may construct a new building, it may still utilize old equipment. There can be several issues with older equipment that may lead to increased electrical hazard. The issues may include modifications, wear, obsolescence, or even damage as a result of animals pecking or chewing on electrical cords.
Problem
It is problematic that a newly manufactured UL listed pressure washer rated > 250V can be purchased and used inside newly constructed agricultural installations conforming with the 2020 NEC but provide

no GFCI protection for the user. Even more concerning, is the lack of UL listed high power commercial pressure washers available for purchase, and the high availability of non-UL listed products. This means that even in agricultural installations that are built to the 2020 NEC, no GFCI protection would be provided for users of many of the commercial pressure washers on the market that would be appropriately sized for these applications.
There have been several electrocutions related to cord connected utilization equipment in environments covered by 547.5(G) that have detailed reports on the cause, outcome, and recommended actions to prevent future accidents. In each of these cases coverage of these installations by 210.8(B) would have likely saved the lives of each of the people involved in these accidents. But, 547.5(G) would exclude these circuits from required GFCI protection. While these events happened several code cycles in the past, each of these incidents would likely still have a terrible outcome if they occurred in a building constructed to the 2020 NEC requirements.
Agricultural environments can amplify the hazards that electricity poses. This is especially true in locations that have a corrosive atmosphere or that are constantly wet or damp. The conditions can cause equipment to fail and increase the likelihood of electrocution. GFCIs can provide an increased level of safety in areas specified in 547.5(G) where increased probability electrical accidents exists and should be at minimum required for the same voltage and current levels as required in 210.8(B).

Submitter Information Verification

Submitter Full Name: Megan Hayes
Organization: Nema
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jul 22 13:55:37 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: CMP-7 does not agree with the expansion of GFCI protection for circuits in excess of 125V 15 and 20A receptacles due to interoperability concerns with farm equipment.

Public Input No. 2697-NFPA 70-2020 [Section No. 547.5(A)]

(A) Wiring Systems.

Types UF, NMC, ~~copper SE~~ SE cables, jacketed Type MC cable, rigid nonmetallic conduit, liquidtight flexible nonmetallic conduit, or other cables or raceways suitable for the location, with approved termination fittings, shall be the wiring methods employed. The wiring methods of Article 502, Part II, shall be permitted for areas described in 547.1(A).

Informational Note: See 300.7, 352.44, and 355.44 for installation of raceway systems exposed to widely different temperatures.

Statement of Problem and Substantiation for Public Input

In CAFO Dairy buildings where cows sleep and eat the manure they produce has an effect on Copper Material and makes the metal degrade by turning black and flaking inside Electrical Equipment.

Submitter Information Verification

Submitter Full Name: Brian Cornell
Organization: Brian Cornell
Affiliation: Electrical Construction
Street Address:
City:
State:
Zip:
Submittal Date: Fri Aug 28 15:56:16 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: CMP-7 resolves this public input due to inadequate technical substantiation to remove copper SE cable from the acceptable wiring methods. Removing copper SE cable could have negative consequences. The insulation on the conductors protect the copper from oxidation and it appears from the substantiation, the issue is with terminating inside the equipment. More technical substantiation would be needed to make such a change. The proposed change would have allowed other conductive material and would not have disallowed copper SE cables.

Public Input No. 4607-NFPA 70-2020 [Section No. 547.5(A)]

(A) Wiring Systems.

Types UF, NMC, copper SE cables, jacketed Type MC cable, rigid ~~nonmetallic~~ polyvinyl chloride conduit, liquidtight flexible nonmetallic conduit, or other cables or raceways suitable for the location, with approved termination fittings, shall be the wiring methods employed. The wiring methods of Article 502, Part II, shall be permitted for areas described in 547.1(A).

Informational Note: See 300.7, 352.44, and 355.44 for installation of raceway systems exposed to widely different temperatures.

Statement of Problem and Substantiation for Public Input

The 2008 NEC first referenced Reinforced Thermosetting Resin Conduit (RTRC) as a wiring method (Article 355). High Density Polyethylene Conduit (HDPE) first appeared in the 2005 NEC as Article 353. When Article 352 first changed (2008 NEC) to be titled “Rigid Polyvinyl Chloride Conduit” there were many changes throughout the Code to pick up this change and accordingly change text from “rigid nonmetallic conduit” to “rigid polyvinyl chloride conduit.”
In the 2002 NEC, this section referenced “rigid nonmetallic conduit” (as it still does in the 2020 NEC) before RTRC and HDPE appeared in the Code. This makes it clear that this section intended to permit only the use of rigid polyvinyl chloride conduit identified as “rigid nonmetallic conduit” as the other raceway types were not recognized by the NEC at the time. This term should be changed to rigid polyvinyl chloride and if the cmp wishes to add other types of nonmetallic raceways they should be listed separately as the metal raceways are.

Submitter Information Verification

Submitter Full Name: David Humphrey
Organization: County of Henrico, Virginia
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 15:45:19 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7746-NFPA 70-2020
Statement: CMP-7 agrees with the submitter that at the time rigid nonmetallic conduit was added to this article no other rigid nonmetallic conduits were in existence. No substantiation was submitted for other than Rigid PVC Conduit for use in agricultural installations.

Public Input No. 2629-NFPA 70-2020 [Section No. 547.5(E)]

(E) Physical Protection.

All electrical wiring and equipment subject to physical damage shall be protected.

Only wiring methods approved for the location shall be installed concealed in walls or ceilings of buildings, or portions thereof, which are contiguous with or adjoined livestock confinement areas (i.e. offices, lunchrooms, ancillary areas etc.). Nonmetallic cables are not permitted to be installed concealed in walls and ceilings.

Statement of Problem and Substantiation for Public Input

This input is being submitted on behalf of the Minnesota Department of Labor and Industry. The Department's 15 office/field staff, and 65 plus contract electrical inspectors complete over 150,000 electrical inspections annually and are involved in the daily enforcement and interpretation of the National Electrical Code.
Rodents and other pests are common around such installations and will damage nonmetallic sheath cable concealed wiring. It is common to see damage to this type of wiring from rodent and other pest chewing on the wiring. They will strip off the cable jacket and conductor insulation down to the bare conductor. This type of damage has resulted in catastrophic fires, loss of buildings, animals and property.

Submitter Information Verification

Submitter Full Name: Dean Hunter
Organization: Minnesota Department of Labor
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 26 09:11:08 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7748-NFPA 70-2020
Statement: CMP-7 agrees with the submitter that rodents and pests eating nonmetallic cables concealed in walls and ceilings of areas adjoining livestock containment areas is a potential hazard and should not be permitted.

Public Input No. 4082-NFPA 70-2020 [Section No. 547.9(B)(2)]

(2) Conductor Installation.

The supply conductors shall be installed in accordance ~~with the requirements of~~ with Part II of Article 225.

Statement of Problem and Substantiation for Public Input

Deleting the words "the requirements of" does not change the meaning of the section.

Submitter Information Verification

Submitter Full Name: David Williams
Organization: Delta Charter Township
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 20:21:33 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7750-NFPA 70-2020
Statement: CMP-7 agrees with the submitter that deleting the words “"the requirements of" does not change the meaning of the section. This removes redundant language from the section. This change aligns with the NEC Style Manual, 3.3.1.2.

Public Input No. 4083-NFPA 70-2020 [Section No. 547.9(B)(3)]

(3) Grounding and Bonding.

For each building or structure, grounding and bonding of the supply conductors shall be in accordance ~~with the requirements of~~ with 250.32, and the following conditions shall be met:

(1) The equipment grounding conductor is not smaller than the largest supply conductor if of the same material or is adjusted in size in accordance with the equivalent size columns of Table 250.122 if of different materials.

(2) The equipment grounding conductor is connected to the grounded circuit conductor and the site-isolating device enclosure at the distribution point.

Statement of Problem and Substantiation for Public Input

Deleting the words "the requirements of" does not change the meaning of the section.

Submitter Information Verification

Submitter Full Name: David Williams
Organization: Delta Charter Township
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 20:22:31 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7754-NFPA 70-2020
Statement: CMP-7 agrees with the submitter that deleting the words “"the requirements of" does not change the meaning of the section. This removes redundant language from the section. This change aligns with the NEC Style Manual, 3.3.1.2.

Public Input No. 3193-NFPA 70-2020 [Section No. 547.9 [Excluding any Sub-Sections]]

Any agricultural building or structure for livestock located on the same premises shall be permitted to be supplied from a distribution point. More than one distribution point on the same premises shall be permitted. The overhead electrical supply shall comply with 547.9(A) and (B) or with 547.9(C). The underground electrical supply shall comply with 547.9(C).

Any existing agricultural building or structure for other than livestock and any existing buildings and structures not under the scope of Article 547 shall be permitted to be supplied in accordance with 250.32(B)(1) Exception No. 1.

Statement of Problem and Substantiation for Public Input

Agricultural buildings and properties exist in many sizes and varieties and while a distribution point may be an advantage and asset at some properties, it seems that buildings could safely be supplied from a standard Article 230 service or a standard Article 225 outside feeder or branch circuit without using a distribution point.

Submitter Information Verification

Submitter Full Name: Donald Cook
Organization: Shelby County Department of De
Affiliation: self
Street Address:
City:
State:
Zip:
Submittal Date: Sun Sep 06 17:02:11 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: In the 2020 NEC CMP-7 removed the previous permissive language and does not choose to accept that permissive language this Code cycle. Mandatory text will help with applicability and enforcement. CMP-7 agrees the present Code text provides clarity that a distribution point is required for agricultural buildings and structures that are for livestock to assure they are supplied by a grounded four wire distribution to reduce stray voltages that may affect livestock. The verbiage also clarifies that for existing agricultural buildings and structures for other than other than livestock such as for grain handling, poultry and fish containment systems and for existing buildings or structures other than those covered under the scope of Article 547 such as a house or machine shed on the premises may be supplied in accordance with 250.32(B)(1)Exception No. 1 permitting a three wire distribution.

Public Input No. 1838-NFPA 70-2020 [Section No. 547.10(B)]

(B) Bonding.

Equipotential planes shall be bonded to a circuit equipment grounding conductor, any metal part connected to a circuit equipment grounding conductor, the grounding electrode conductor, any grounding electrode of the grounding electrode system, or the equipment grounding terminal in any panelboard of the electrical grounding system. The bonding conductor shall be solid copper, insulated, covered or bare, and not smaller than 8 AWG. The means of bonding to wire mesh or conductive elements shall be by pressure connectors or clamps of brass, copper, copper alloy, or an equally substantial approved means. Slatted floors that are supported by structures that are a part of an equipotential plane shall not require bonding.

Informational Note No. 1: Methods to establish equipotential planes are described in American Society of Agricultural and Biological Engineers (ASABE) EP473.2-2001 (R2015), *Equipotential Planes in Animal Containment Areas*.

Informational Note No. 2: Methods for safe installation of livestock waterers are described in American Society of Agricultural and Biological Engineers (ASABE) EP342.3-2010 (R2015), *Safety for Electrically Heated Livestock Waterers*.

Informational Note No. 3: Low grounding electrode system resistances may reduce voltage differences in livestock facilities.

Statement of Problem and Substantiation for Public Input

The current text is too vague. My proposed text gives the Code user a better understanding of where the solid 8 AWG conductor is to be bonded.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jul 10 12:41:51 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7756-NFPA 70-2020

Statement: CMP-7 agrees that clarification of the equipotential plane bonding requirements is needed to make clear the bonding connection shall be associated with the grounding system of the equipotential plane and not just any part of any nearby grounding system. In addition, bonding to a circuit equipment grounding conductor would create difficulties in bonding a 8 AWG bonding conductor with the equipment grounding conductors of smaller sizes such as 15 or 20 A branch circuits.

Public Input No. 3657-NFPA 70-2020 [Section No. 550.2]

(Relocate all definitions in the 550. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

550. 2 Definitions.

Appliance, Fixed.

This definition shall apply only within this article.

An appliance that is fastened or otherwise secured at a specific location.

Appliance, Portable.

This definition shall apply only within this article.

An appliance that is actually moved or can easily be moved from one place to another in normal use.

Informational Note: For the purpose of this article, the following major appliances, other than built-in, are considered portable if cord connected: refrigerators, range equipment, clothes washers, dishwashers without booster heaters, or other similar appliances.

Feeder Assembly.

This definition shall apply only within this article.

The overhead or under-chassis feeder conductors, including the equipment grounding conductor, together with the necessary fittings and equipment or a power-supply cord listed for mobile home use, identified for the delivery of energy from the source of electrical supply to the panelboard within the mobile home.

Manufactured Home.

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

A structure, transportable in one or more sections, which in the traveling mode is 2.4 m (8 ft) or more in width or 12.2 m (40 ft) or more in length, or when erected on site is 29.77 m^2 (320 ft^2) or more is built on a permanent chassis and is designed to be used as a dwelling with or without a permanent foundation, whether or not connected to the utilities, and includes plumbing, heating, air conditioning, and electrical systems contained therein. The term *manufactured home* includes any structure that meets all the requirements of this paragraph except the size requirements and with respect to which the manufacturer voluntarily files a certification required by the regulatory agency. Calculations used to determine the number of square meters (square feet) in a structure are based on the structure's exterior dimensions and include all expandable rooms, cabinets, and other projections containing interior space, but do not include bay windows. [**501:**1.2.13] For the purpose of this *Code* and unless otherwise indicated, the term *mobile home* includes manufactured homes and excludes park trailers defined in 552.4.

Informational Note No. 1: See the applicable building code for definition of the term *permanent foundation*.

Informational Note No. 2: See 24 CFR Part 3280, *Manufactured Home Construction and Safety Standards, of the Federal Department of Housing and Urban Development*, for additional information on the definition.

Mobile Home.

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

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

For the purpose of this *Code* and unless otherwise indicated, the term *mobile home* includes manufactured homes.

Mobile Home Accessory Building or Structure.

This definition shall apply only within this article.

Any awning, cabana, ramada, storage cabinet, carport, fence, windbreak, or porch established for the use of the occupant of the mobile home on a mobile home lot.

Mobile Home Lot.

This definition shall apply only within this article.

A designated portion of a mobile home park designed for the accommodation of one mobile home and its accessory buildings or structures for the exclusive use of its occupants.

Mobile Home Park.

This definition shall apply only within this article.

A contiguous parcel of land that is used for the accommodation of occupied mobile homes.

Mobile Home Service Equipment.

This definition shall apply only within this article.

The equipment containing the disconnecting means, overcurrent protective devices, and receptacles or other means for connecting a mobile home feeder assembly.

Park Electrical Wiring Systems.

This definition shall apply only within this article.

All of the electrical wiring, luminaires, equipment, and appurtenances related to electrical installations within a mobile home park, including the mobile home service equipment.

Statement of Problem and Substantiation for Public Input

"The National Electrical Code has definitions in multiple parts in Article 100 and many definitions scattered through out the code many of them in the .2 section of the articles.
Most of the other standards under NFPA have their definitions in one location and this will allow the NEC the same requirement. The revisions to the NEC Style Manual require all the definitions to be relocated to Article 100. "

Submitter Information Verification

Submitter Full Name: David Williams
Organization: Delta Charter Township
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 10:12:00 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7690-NFPA 70-2020

Statement: All existing definitions under the purview of CMP-7 have been moved to Article 100 and revises for compliance with Section 2.2.2 of the NEC Style Manual. Additionally, all definition sections (545.2, 547.2, 550.2, 551.2, 552.2, 555.2, 604.2, and 675.2.2) in the articles under the responsibility of CMP-7 have been deleted.

Public Input No. 3337-NFPA 70-2020 [Definition: Appliance, Fixed.]

Appliance, Fixed.

~~This definition shall apply only within this article.~~

An appliance that is fastened or otherwise secured at a specific location.

Statement of Problem and Substantiation for Public Input

The revised NEC Style Manual requires all definitions to be relocated to Article 100. If a definition is only for a specific article the Article number in parentheses following the definition and before the code making panel number in parentheses.

The Definition of Appliance, Fixed appears in Article 550 and 551, which is identical.

Submitter Information Verification

Submitter Full Name: David Williams
Organization: Delta Charter Township
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 08 08:15:53 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7690-NFPA 70-2020

Statement: All existing definitions under the purview of CMP-7 have been moved to Article 100 and revises for compliance with Section 2.2.2 of the NEC Style Manual. Additionally, all definition sections (545.2, 547.2, 550.2, 551.2, 552.2, 555.2, 604.2, and 675.2.2) in the articles under the responsibility of CMP-7 have been deleted.

Public Input No. 4609-NFPA 70-2020 [Section No. 550.10(I)]

(I) Mast Weatherhead or Raceway.

Where the calculated load exceeds 50 amperes or where a permanent feeder is used, the supply shall be by means of either of the following:

(1) One mast weatherhead installation, installed in accordance with Article 230, containing four continuous, insulated, color-coded feeder conductors, one of which shall be an equipment grounding conductor

(2) A metal raceway or rigid ~~nonmetallic conduit~~ polyvinyl chloride conduit from the disconnecting means in the mobile home to the underside of the mobile home, with provisions for the attachment to a suitable junction box or fitting to the raceway on the underside of the mobile home [with or without conductors as in 550.10(I)(1)]. The manufacturer shall provide written installation instructions stating the proper feeder conductor sizes for the raceway and the size of the junction box to be used.

Statement of Problem and Substantiation for Public Input

The 2008 NEC first referenced Reinforced Thermosetting Resin Conduit (RTRC) as a wiring method (Article 355). High Density Polyethylene Conduit (HDPE) first appeared in the 2005 NEC as Article 353. When Article 352 first changed (2008 NEC) to be titled “Rigid Polyvinyl Chloride Conduit” there were many changes throughout the Code to pick up this change and accordingly change text from “rigid nonmetallic conduit” to “rigid polyvinyl chloride conduit.”
In the 2002 NEC, this section referenced “rigid nonmetallic conduit” (as it still does in the 2020 NEC) before RTRC and HDPE appeared in the Code. This makes it clear that this section intended to permit only the use of rigid polyvinyl chloride conduit identified as “rigid nonmetallic conduit” as the other raceway types were not recognized by the NEC at the time. This term should be changed to rigid polyvinyl chloride and if the cmp wishes to add other types of nonmetallic raceways they should be listed separately.

Submitter Information Verification

Submitter Full Name: David Humphrey
Organization: County of Henrico, Virginia
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 15:47:53 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7763-NFPA 70-2020
Statement: CMP-7 agrees with the submitter that at the time rigid nonmetallic conduit was added to this article no other rigid nonmetallic conduits were in existence. Clarification has also been added that the requirement includes RMC and IMC are considered raceways as defined. The clarification would allow for identified rigid metal or nonmetallic raceways.

Public Input No. 4146-NFPA 70-2020 [Section No. 550.13(E)]

(E) Pipe Heating Cable(s) Outlet.

For the connection of pipe heating cable(s), a receptacle outlet shall be located on the underside of the unit as follows:

(1) Within 600 mm (2 ft) of the cold water inlet.

(2) Connected to an interior branch circuit, other than a small-appliance branch circuit. It shall be permitted to use a bathroom receptacle circuit for this purpose.

(3) On a circuit where all of the outlets are on the load side of ~~the~~ a listed and labeled ground-fault circuit interrupter.

(4) This outlet shall not be considered as the receptacle required by 550.13(D)(8).

Statement of Problem and Substantiation for Public Input

This is a device that depends on functional safety, without certification (Listing), how is an AHJ to know if it is going to properly perform the GFCI functions required by the product standard. Also, to promote consistency with Sections 410.184, 445.20, 518.3(B), 525.23(D), 600.10(C)(2), 680.5, 680.23(A)(8) which currently required listing.

Submitter Information Verification

Submitter Full Name: Richard Hollander
Organization: Shums Coda Associates
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 21:59:39 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: All devices in Article 550 are already required to be listed in 550.4(C). Additionally, the proposed redundant language does not improve clarity or usability of the code.

Public Input No. 4611-NFPA 70-2020 [Section No. 550.15(F)]

(F) Raceways.

Where rigid metal conduit or intermediate metal conduit is terminated at an enclosure with a locknut and bushing connection, two locknuts shall be provided, one inside and one outside of the enclosure. Rigid ~~nonmetallic conduit~~ polyvinyl chloride conduit , electrical nonmetallic tubing, or surface raceway shall be permitted. All cut ends of conduit and tubing shall be reamed or otherwise finished to remove rough edges.

Statement of Problem and Substantiation for Public Input

The 2008 NEC first referenced Reinforced Thermosetting Resin Conduit (RTRC) as a wiring method (Article 355). High Density Polyethylene Conduit (HDPE) first appeared in the 2005 NEC as Article 353. When Article 352 first changed (2008 NEC) to be titled “Rigid Polyvinyl Chloride Conduit” there were many changes throughout the Code to pick up this change and accordingly change text from “rigid nonmetallic conduit” to “rigid polyvinyl chloride conduit.”
In the 2002 NEC, this section referenced “rigid nonmetallic conduit” (as it still does in the 2020 NEC) before RTRC and HDPE appeared in the Code. This makes it clear that this section intended to permit only the use of rigid polyvinyl chloride conduit identified as “rigid nonmetallic conduit” as the other raceway types were not recognized by the NEC at the time. This term should be changed to rigid polyvinyl chloride and if the cmp wishes to add other types of nonmetallic raceways they should be listed separately as the metal raceways are.

Submitter Information Verification

Submitter Full Name: David Humphrey
Organization: County of Henrico, Virginia
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 15:50:13 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: CMP-7 disagrees with the PI submitter in this case since the proposed change could limit approved wiring methods and create unintentional design restrictions. The proposal restricts the use of other rigid nonmetallic conduit by specifying polyvinyl chloride conduit.

Public Input No. 1421-NFPA 70-2020 [Section No. 550.15(H)]

(H) Under-Chassis Wiring (Exposed to Weather).

(1)

~~Where outdoor or under-chassis line-voltage (120 volts, nominal, or higher) wiring is exposed, it shall be protected by a conduit or raceway identified for use in wet locations. The conductors shall be~~ Wiring methods under a chassis shall be listed for use in a wet ~~locations~~ location .

(2)

~~Where wiring is~~ Wiring methods exposed to physical damage ~~, it~~ shall be suitable for the applicaiton or be protected by ~~a raceway, conduit, or~~ other means.

Statement of Problem and Substantiation for Public Input

"Wiring" in this rule appears to imply "conductors." In reality the rule should be addressing "wiring methods." My edits are editorial, with no technical change to the rule.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jun 02 13:58:59 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: CMP-7 does not agree that this improves clarity and this change could create confusion since conductors must be listed is already a requirement. Although the submitter comments the change is editorial, it changes the requirements and requires the wiring methods to be listed which is not possible as only physical items can be listed. Additionally, the proposed change would have removed inclusions of outdoor installations.

Public Input No. 1493-NFPA 70-2020 [Section No. 550.15 [Excluding any Sub-Sections]]

Except as specifically limited in this section, the wiring methods and materials included in this *Code* shall be used in mobile homes. ~~Aluminum conductors, aluminum alloy conductors, and aluminum core conductors such as copper-clad aluminum shall be permitted for use where used with equipment listed for aluminum conductor connections.~~

Additional Proposed Changes

File Name	Description	Approved
Public_Input_No._1493-NFPA_70-2020_Section_550.15_excl_any_sub-sections_.docx	Public Input No. 1493-NFPA 70-2020 [Section 550.15 excl any sub-sections]	

Statement of Problem and Substantiation for Public Input

The Panel Statement for First Revision FR-8299-NFPA 70-2018, which was incorporated in the 2020 NEC®,:
.. “Aluminum conductors have been used safely in all other occupancies for decades, there is no
.. justification for denying owners of mobile or manufactured homes the option to use a safe and
.. practical conductor option that is available to all other home owners.”
is fully correct but the revised text of the second sentence attempting to achieve that end introduces several problems, including safety issues and correlation issues, and should be outright deleted in accordance with NEC® 90.3 and 110.3(B). The necessary requirements are already fully addressed correctly and safely by the first two sentences of NEC® 110.14, including avoidance of potentially unsafe intermixing of dissimilar conductor materials, overlooked by present 550.15. For the purpose of conductor materials (not for ampacity), copper-clad aluminum conductors are permitted to be treated as copper conductors, NOT as aluminum conductors as erroneously in present 550.15 second sentence.

See included non-Terra-fied Public Input Form for further background technical information.

Submitter Information Verification

Submitter Full Name: Brian Rock
Organization: Hubbell Incorporated
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jun 09 12:26:13 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: Removing this language and requirement could open the door to improper application and component selection. This information should remain for proper interpretation and clarity.

NFPA Public Input Form

NOTE: All Public Input must be received by 5:00 pm EST/EDST on the published Public Input Closing Date.

For further information on the standards-making process, please contact the Codes and Standards Administration at 617-984-7249 or visit www.nfpa.org/codes.

For technical assistance, please call NFPA at 1-800-344-3555

FOR OFFICE USE ONLY

Log #:

Date Rec'd:

Date 2020-June-09 **Name** Brian E. Rock **Tel. No.**

Company Hubbell Incorporated **Email**

Street Address 40 Waterview Drive **City** Shelton **State** CT **Zip** 06484

Please indicate organization represented (if any) Hubbell Incorporated

1. (a) Title of NFPA Standard National Electrical Code® **NFPA No. & Year** 70 - 2023

(b) Section/Paragraph 550.15

2. Public Input Recommends (check one): ☐ new text ☒ revised text ☐ deleted text

3. Proposed Text of Public Input (include proposed new or revised wording, or identification of wording to be deleted): [Note: Proposed text should be in legislative format; i.e., use underscore to denote wording to be inserted (inserted wording) and strike-through to denote wording to be deleted (~~deleted wording~~).]

Revise the charging text of 550.15 as follows:

Except as specifically limited in this section, the wiring methods and materials included in this Code shall be used in mobile homes. ~~Aluminum conductors, aluminum alloy conductors, and aluminum core conductors such as copper-clad aluminum shall be permitted for use where used with equipment listed for aluminum conductor connections~~.

4. Statement of Problem and Substantiation for Public Input: (Note: State the problem that would be resolved by your recommendation; give the specific reason for your Public Input, including copies of tests, research papers, fire experience, etc. If more than 200 words, it may be abstracted for publication.)

The Panel Statement for First Revision FR-8299-NFPA 70-2018, which was incorporated in the 2020 *NEC*®,:

> "Aluminum conductors have been used safely in all other occupancies for decades, there is no justification for denying owners of mobile or manufactured homes the option to use a safe and practical conductor option that is available to all other home owners."

is fully correct but the revised text of the second sentence attempting to achieve that end introduces several problems, including safety issues and correlation issues, and should be outright deleted in accordance with *NEC*® 90.3 and 110.3(B). The necessary requirements are already fully addressed correctly and safely by the first two sentences of *NEC*® 110.14, including avoidance of potentially unsafe intermixing of dissimilar conductor materials. For the purpose of conductor materials (not for ampacity), copper-clad aluminum conductors are permitted to be treated as copper conductors, NOT as aluminum conductors as erroneously in present 550.15 second sentence.

Background technical information:

Product safety requirements, conflicting with present *NEC*® 550.15 second sentence for equipment listed SOLELY FOR ALUMINUM CONDUCTORS:

[1] Terminals and connectors listed and identified as suitable for EITHER copper conductors OR aluminum conductors are indeed suitable for use with EITHER copper conductors OR aluminum conductors OR copper-clad aluminum. This metallurgical compatibility is reflected by product standards' marking requirements:

- » 10.8 A connector intended for use with aluminum, copper-clad aluminum, and copper conductor shall be legibly marked "AL-CU" or "CU-AL". In lieu of the marking on the connector, for connectors used with 6 AWG (13.3 mm²) or smaller conductors, the letters "AL-CU" or "CU-AL" may be printed on the unit container or on an information sheet packed in the unit container. « [*UL 486A-486B*, *Wire Connectors*]
- » 10.8 An equipment wiring terminal intended for use with aluminum and copper conductor shall be legibly marked "AL-CU" or "CU-AL". An equipment wiring terminal intended for use with aluminum or copper-clad aluminum and copper wire shall be plainly marked "AL-CU" or "CU-AL". …« [*UL 486E*, *Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors*]

- » 35 CO/ALR Type

  35.1 A receptacle rated 15 or 20 A and which is intended for use with BOTH copper AND aluminum conductors shall:

  c) Be marked in accordance with Reference No. 12 of Table 193.4, and …«

  Reference No. 12 of Table 193.4: “CO/ALR” and “Replace ONLY With CO/ALR Device”

  »36 AL-CU Type

  36.1 A receptacle rated 30 A or greater and which is intended for use with both copper and aluminum conductors shall comply with the Temperature Test, Section 118, the general performance requirements for receptacles employing pressure-wire terminals contained in Section 126, and either of the following marking requirements as applicable:

  a) Reference No. 13 of Table 193.4 for conductors rated 60°C (140°F), or

  b) Reference No. 14 of Table 193.4 for conductors rated 75°C (167°F). «

  Reference No. 13 of Table 193.4: A receptacle rated 30 A or greater which is intended for use with aluminum conductors OR copper and aluminum conductors shall be marked "AL-CU".

  Reference No. 14 of Table 193.4: A receptacle rated 30 A or greater which is intended for use with aluminum conductors OR copper and aluminum conductors rated 75 °C (167 °F) shall be marked "AL-CU, 75 °C"
  [*UL 498*, *Attachment Plugs and Receptacles*]

[2] Terminals and connectors listed and identified as suitable for INTERMIXING of BOTH copper conductors AND aluminum conductors are indeed suitable for INTERMIXED use with BOTH copper conductors AND aluminum conductors AND copper-clad aluminum. This metallurgical compatibility is reflected by product standards’ marking requirements:

- » 6.1.5 The construction of a connector intended to secure more than a single conductor shall be such that there will be no intermixing (direct conductor contact) between the conductors of different materials unless the connector is investigated and found to meet the performance requirements of this Standard and is marked in accordance with 10.24.«

  » 10.24 A connector intended for intermixing between conductor types shall be ADDITIONALLY marked "(INTERMIXED – DRY LOCATIONS)" immediately following the marking in 10.19 or 10.20; for example, "AL7CU (INTERMIXED – DRY LOCATIONS)". See 6.1.5.«
  [*UL 486A-486B*, *Wire Connectors*]

- » 6.1.6 The construction of an equipment wiring terminal intended to secure more than a single conductor shall be such that there will be no intermixing (direct conductor contact) between the conductors of different materials unless the equipment wiring terminal is investigated and found to meet the performance requirements of this Standard and is marked in accordance with 10.20.«

  » 10.20 An equipment wiring terminal intended for intermixing between conductor types shall be ADDITIONALLY marked "(INTERMIXED – DRY LOCATIONS)" immediately following the marking in 10.18 or 10.19; for example, "AL7CU (INTERMIXED – DRY LOCATIONS)". See 6.1.6.«
  [*UL 486E*, *Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors*]

- » … Conductors of dissimilar metals SHALL NOT BE INTERMIXED in a terminal or splicing connector where physical contact occurs between dissimilar conductors (such as copper and aluminum or ALUMINUM AND COPPER-CLAD ALUMINUM), UNLESS THE DEVICE IS IDENTIFIED FOR THE PURPOSE AND CONDITIONS OF USE. ...«
  [*NEC*®, 110.14]

[3] Terminals of listed 15 and 20 A flush receptacles with wire-binding screws, back-wired pressure plates (clamp terminals), and/or push-in terminals identified for use with SOLELY copper wire are indeed suitable for use with EITHER copper conductors OR copper-clad aluminum, but NOT for aluminum conductors. This metallurgical compatibility is reflected by product standards’ marking requirements:

Reference No. 22 of Table 193.4: “15 and 20 A flush receptacles with wire-binding screws, back-wired pressure plates (clamp terminals), and/or push-in terminals for use with copper wire only":

a) "Notice – Use only copper or copper-clad wire with this device",
b) "Notice – Connect only copper or copper-clad wire to this device", or
c) "Notice – Use only devices marked CO/ALR with aluminum wire".

Exception: When the device itself carries the marking, one of the following abbreviated markings or the symbol shown in Figure 193.1 meets the intent of the requirement.
a) "Use copper wire only",
b) "Cu wire only",
c) "Use copper or copper-clad wire only", or
d) "Cu and Cu-clad wire only".
[*UL 498*, *Attachment Plugs and Receptacles*]

5. Copyright Assignment

(a) ☒ **I am the author of the text or other material (such as illustrations, graphs) proposed in the Public Input.**

(b) ☐ **Some or all of the text or other material proposed in this Public Input was not authored by me. Its source is as follows:** (please identify which material and provide complete information on its source)

I hereby grant and assign to the NFPA all and full rights in copyright in this Public Input (including both the Proposed Text and the Statement of Problem and Substantiation). I understand that I acquire no rights in any publication of NFPA in which this Public Input in this or another similar or analogous form is used. Except to the extent that I do not have authority to make an assignment in materials that I have identified in (b) above, I hereby warrant that I am the author of this Public Input and that I have full power and authority to enter into this assignment.

Signature (Required)

PLEASE USE SEPARATE FORM FOR EACH PUBLIC INPUT

To: Secretary, Standards Council National Fire Protection Association
1 Batterymarch Park · Quincy, MA 02169-7471 OR
Fax to: (617) 770-3500 OR Email to: proposals_comments@nfpa.org

9/16/2020

Public Input No. 1772-NFPA 70-2020 [Section No. 550.15 [Excluding any Sub-Sections]]

Except as specifically limited in this section, the wiring methods and materials included in this *Code* shall be used in mobile homes. Aluminum conductors ~~, aluminum~~ and aluminum alloy conductors ~~, and aluminum core conductors such as copper~~ shall be permitted for use where used with equipment listed for aluminum conductor connections. Copper -clad aluminum conductors shall be permitted for use ~~where used~~ with equipment listed for copper-only and copper/ aluminum ~~conductor~~ connections.

Statement of Problem and Substantiation for Public Input

Copper-Clad Aluminum conductors and copper conductors are not considered dissimilar metals per article 110.14 "Electrical Connections"of NEC 2020. Current text might lead readers into terminating two dissimilar metals (copper-clad aluminum and aluminum) together, which constitutes a safety hazard. The proposed change on article 550.15 seeks to eliminate this hazard and achieve consistency with article 110.14.

Submitter Information Verification

Submitter Full Name: Rodrigo OByrne
Organization: ENERWIRE
Affiliation: American Bimetallic Association
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jun 30 12:03:07 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7786-NFPA 70-2020
Statement: This revision will clarify the intent to avoid terminating dissimilar metals in accordance with 110.14. Copper-clad aluminum is only permitted for terminations listed for CU-AL. See category code ZMVV in UL Product IQ database.

Public Input No. 541-NFPA 70-2020 [Section No. 550.15 [Excluding any Sub-Sections]]

Except as specifically limited in this section, the wiring methods and materials included in this *Code* shall be used in mobile homes. ~~Aluminum conductors, aluminum alloy conductors, and aluminum core conductors such as copper-clad aluminum shall be permitted for use where used with equipment listed for aluminum conductor connections.~~

Statement of Problem and Substantiation for Public Input

This material is already covered in Article 110 and applies via 90.3. Furthermore, the existing text does not make sense. Copper-clad aluminum does not need terminals rated for aluminium, it needs terminals rated for copper, otherwise dissimilar metal contact occurs and violates 110.14. This is another reason why letting 90.3 do its job is preferred, and why the Style Manual should be followed.

Submitter Information Verification

Submitter Full Name: Ryan Jackson
Organization: Ryan Jackson
Street Address:
City:
State:
Zip:
Submittal Date: Thu Feb 27 12:35:08 EST 2020
Committee: NEC-P07

Committee Statement

Resolution: Removing this language and requirement could open the door to improper application and component selection. This information should remain for proper interpretation and clarity.

Public Input No. 4492-NFPA 70-2020 [Section No. 550.16(A)(1)]

(1) Insulated.

The grounded circuit conductor shall be insulated from the equipment grounding conductors and from equipment enclosures and other grounded parts. The grounded circuit conductor terminals in the panelboard and in ranges, clothes dryers, counter-mounted cooking units, and wall-mounted ovens shall be insulated from the equipment enclosure. Bonding screws, straps, or buses in the panelboard or in appliances shall be removed and discarded. Where the panelboard is the service equipment as permitted by 550.32(B), the neutral conductors and the equipment grounding bus shall be connected.

Statement of Problem and Substantiation for Public Input

The term "grounding conductor" was deleted from the Article 100 definitions by CMP-5 in 2011 NEC. The term as defined was closest to defining a grounding electrode conductor, but the term was regularly being used where what was meant was "equipment grounding conductor" or a bonding conductor. Efforts in that cycle and subsequent cycles have identified where this term is still used and proposing changing to the defined terms found in the NEC. Using of undefined terminology is probably the greatest issues in misunderstanding the requirements for grounding and bonding. The proposed term "equipment grounding conductors" in this public input provides the correct term for the context of the requirements in this section.

Submitter Information Verification

Submitter Full Name: Charles Mello
Organization: cdcmello Consulting LLC
Affiliation: Self
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 14:10:53 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7792-NFPA 70-2020
Statement: CMP-7 agrees with the submitter of the public input and creates a FR as written by adding the term “equipment” before grounding conductors in the first sentence.

Public Input No. 1142-NFPA 70-2020 [Section No. 550.16(C)(1)]

(1) Exposed Non–Current-Carrying Metal Parts.

All exposed non–current-carrying metal parts that are likely to become energized shall be effectively bonded to the grounding terminal or enclosure of the panelboard. A bonding conductor shall be connected between the panelboard and an accessible terminal on the chassis. Chassis of multiple mobile home sections shall be bonded together with a copper only if of the wire type, # 8 AWG minimum, bonding conductor with terminations being 250.8 and 250.12 compliant.

Statement of Problem and Substantiation for Public Input

Double wide mobile homes have been around a long time but I wonder if 550.16(C)(1) is dated. Bonding all mobile home chassis should be sought and enforced.

Sometimes the crew (non-electricians probably) that sets up the two halves, bond chassis and sometimes they don't. When this crew does bond chassis, the lugs are zipped down with not-listed-for-electrical-bonding self-tapper screws to painted surfaces.

Steel or other could also be bolted or welded in place to serve as the bonding conductor/jumper.

Submitter Information Verification

Submitter Full Name: Norman Feck
Organization: State of Colorado
Street Address:
City:
State:
Zip:
Submittal Date: Mon May 18 17:37:41 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7794-NFPA 70-2020
Statement: CMP-7 creates a FR based on PI-1142 with the editorial corrections of removing the hashtag “#” from the wording and adds, solid, insulated or bare for applicability.

Public Input No. 2514-NFPA 70-2020 [Section No. 550.16(C)(2)]

(2) Grounding Terminals.

Grounding terminals shall be of the solderless type and listed as pressure-terminal connectors recognized for the wire size used. The bonding conductor shall be solid or stranded, insulated or bare, and shall be ~~8 AWG copper~~ 8 AWG copper-clad steel, copper-clad aluminum or copper minimum, or equivalent. The bonding conductor shall be routed so as not to be exposed to physical damage.

Additional Proposed Changes

File Name	Description	Approved
CCS_Corrosion_paper_Rev2.pdf	50 Year Corrosion Study Copper Clad Steel	
TD002391.doc	UL 467 Short Circuit and UL 486A-B Mechanical Sequence Testing Copper Clad Steel	
PL-03027_REP1.pdf	Fusing and Withstand Testing	
CEL_-_13_Grounding_Conductor_Current_Test_002_.pdf	Grade 40CCS Conductivity Test Report. Lewey and Rozer	

Statement of Problem and Substantiation for Public Input

COPPER-CLAD ALUMINUM CONDUCTORS:

Consult Sections 110.14 Electrical Connections and 110.5 Conductor Materials of the 2020 Edition of the NEC®. Copper-Clad Aluminum and Copper are considered by the NEC to be similar metals, and thus are both capable of withstanding similar corrosive environments. Copper-clad aluminum has been referenced by the NEC® as a conductor material for general wiring since the 1971 edition, and can be used as a equipment-grounding and bonding conductor. Copper-Clad Aluminum is referenced in Table 250.102(C)(1) Grounded Conductor, Main Bonding Jumper, System Bonding Jumper, and Supply-Side Bonding Jumper for Alternating-Current Systems

COPPER-CLAD STEEL CONDUCTORS:

Grade 40 Copper-Clad Steel for Grounding and Bonding Applications:

Grade 40 Copper-Clad Steel (40CCS), a copper bimetal, is another alternative designed for use as a bonding conductor, grounding electrode and grounding electrode conductor (GEC) and should be added to the NEC®. It is governed by ASTM B910/B910M-2007, the Standard Specification for Annealed Copper-Clad Steel Wire. The standard's scope states the following: This specification covers bare round copper-clad steel for the following applications: electrical, electronic, grounding, telecommunications, and other applications. Per the standard, the minimum tensile strength for all wire diameters must be higher than 40,000 PSI, which would elevate the strength of GEC materials currently provided in Article 250. The shear modulus of Grade 40CCS is 11,600 KSI. Because ASTM B910 requires 40CCS to be annealed (softened), the material is sufficiently pliable to allow for traditional installation practices for GEC's. Increased mechanical strength of a GEC elevates the protection of an electrical installation in two ways: 1) the GEC can better withstand fusing during ultra-high A/Hz lightning strikes (see connector and fusing discussions below); 2) the GEC is noticeably

more difficult to cut without proper tools, which aids as a theft deterrent when thieves attempt to remove it. Additionally, Copper Clad Steel has no scrap value, which also disincentives theft.

Terminations and Connectors
Grade 40CCS conductors have successfully passed UL 467 Short Circuit Testing for standard connectors available in the market. 40CCS conductors also successfully passed UL 486A and 486B for Mechanical Sequence Testing. Attached to this Public Input, please reference Test Report TD002391, Burndy, UL 467 Short Circuit & UL 486A – 486B Mechanical Sequence Tests with Copperweld 40% Copper Clad Steel. These results offer clear evidence that 40CCS performs satisfactorily with grounding connector hardware standard for grounding systems.

Corrosion Resistance
Corrosion can cause connections to fail in the grounding system. As a copper bimetal, Grade 40CCS maintains the corrosion resistance characteristics required to keep grounding systems intact. Copper Clad Steel was invented in 1915 by the Copperweld Company in Rankin, PA, for use as both a grounding electrode and GEC. One of grade 40 CCS's traditional applications is as a buried grounding electrode for utility substations meeting IEEE Standard 80, IEEE Guide for Safety in AC Substation Grounding. 40CCS can be exothermically welded per IEEE Standard 80. For substantiation of the corrosion resistance of Grade 40CCS, please refer to the white paper attached to this Public Input: CCS_Corrosion_Paper_Rev2. Corrosion on Buried Copper Clad Steel, by Syarif and Hale. The paper describes the condition of grade 40CCS after 50 years of use as part of a ground grid under a substation in Kentucky.

Resistance to Fusing at High Currents
The GE and GEC must also have the integrity to hold up to high-current forces such as lightning. Fusing and withstand testing was conducted to judge the suitability of Grade 40CCS as a GE and GEC. For reference, like-sized copper conductors were tested alongside CCS conductors. The results prove that grade 40CCS performs equal to or better than the same size copper conductor. Attached to this Public Input, please review test report PL-03027_REP1 "Copper and CCS Wire Withstand Current and Fusing Current Testing." Testing conducted at the Powertech Test Lab of Surrey, BC, Canada.

Conductivity
Although not required to carry current continuously, the grounding electrode must be conductive. The attached test report by Bill Lewey and Mike Rozer proves Grade 40CCS's conductivity. See CEL-13 Grounding Current Conductor Test.

Listing
There are other grades of copper-clad steel available and this change is to be specific to Grade 40CCS conductor material. To ensure that the conductor material being installed is Grade 40CCS, the conductor material should be listed to the applicable ASTM standards. In addition to ensuring there is 40 percent copper cladding on the steel core, suitable tensile strength, and other factors the listing also ensures the critical aspect of the corrosion resistant properties of 40CCS, a copper bimetal, are provided through the metallurgical bond between the steel and the copper. A listing would guarantee the metallurgical bond, the hallmark of a true bimetal. The listing and suitable markings on tags or packaging also provides the installer and inspector the information needed to make and approve the installation

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2467-NFPA 70-2020 [Section No. 250.66 [Excluding any Sub-Sections]]	

Submitter Information Verification

Submitter Full Name: Peter Graser
Organization: Copperweld

Affiliation: American Bimetallic Association
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 23 17:38:27 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: Copper clad steel is not a listed conductor, Submitter did not provide substantiation needed to approve this change.

Testing done for the safety of our valued customer.

Global Circulation Laboratory Test Report

For Global Distribution

UL467 SHORT CIRCUIT & UL 486A-486B MECHANICAL SEQUENCE TESTS

YGHP29C2, YGHC2C2, YGHC26C26, YGHP34C29, YGHC29C29, YGHP34C34, YGHC34C34 HYTAP™ Connectors
YGL2C2, YGL29C29, YGL34C34 HYGRID™ Connectors
YGA4C2N, YGHA272N, YGA282N, YGHA302N HYLUG™ Connectors

5/8" and 3/4"Copper Clad Steel Ground Rod, #4AWG Solid, 4/0AWG Stranded, 7#7, and 19#8 COPPERWELD® 40% IACS Copper Clad Steel Conductors

PAT750XT-18V PATRIOT® Tool
with
UC, UO, U28RT, U29RT, U32RT, U997, PU998, and U1011 Die Sets

TD002391 REV B

Requested by / Date:	***Authorized by / Date:***	***Completed by / Date:***
C. Gandhi 12-Dec-2014	R Robicheau 12-Dec-2014	R Charpentier 06-Apr-2015
Engineering Approval / Date:	***Marketing Approval / Date:***	***Laboratory Approval / Date:***
R.Roman 20-Aug-2020	J Hogan 20-Aug-2020	R Charpentier 20-Aug-2020

TD002391

Global Circulation Laboratory Test Report

For Global Distribution

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TEST EQUIPMENT : 5

Burndy LLC 47 East Industrial Park Dr.
Manchester / New Hampshire / 03109
Tel: 603 647 5000 Fax: 603 647 5205

TD002391

Global Circulation Laboratory Test Report

For Global Distribution

PURPOSE OF TEST:

To determine if the Burndy HYTAP™, HYGRID™, and HYLUG™ Connectors can meet the UL486A-486B mechanical sequence and UL467 Short time current requirements when installed on COPPERWELD® 40% IACS Copper Clad Steel (CCS) conductors per ASTM B910/B910M-07.

TEST REQUESTED:

UL486A-486B Mechanical Sequence
UL467 Short Time Current

TEST RESULTS:

Connector	Cable 1	Cable 2	Die	# of crimps	Securness	Pull	Short Time Current		
					Pass / Fail	Average Pull (lb)	Pass / Fail	Current (Amps)	Time (s)
YGHP29C2	5/8in CCS Ground Rod	#4 Solid CCS	U997	1	Pass	1021.3	Pass	1600	6
YGL2C2	#4 Solid CCS	#4 Solid CCS	U-O	1	Pass	1451.8	Pass	1600	6
YGHC2C2	#4 Solid CCS	#4 Solid CCS	U-C	1	Pass	1544.0	Pass	1600	6
YGA4C2N	#4 Solid CCS	n/a	U4CRT	1	Pass	814.0	Pass	1600	6
YGL29C29	7#7 STR CCS	7#7 STR CCS	U997	1	Pass	1643.2	Pass	4600	9
YGHC26C26	7#7 STRCCS	7#7 STR CCS	U-O	1	Pass	1239.4	Pass	4600	9
YGHA272N	7#7 STRCCS	n/a	U29RT	2	Pass	1574.0	Pass	4600	9
YGHP34C29	3/4in CCS Ground Rod	4/0 AWG CCS	PU998	1	Pass	1789.8	Pass	6100	9
YGL29C29	4/0 AWG CCS	4/0 AWG CCS	U997	1	Pass	1849.8	Pass	6100	9
YGHC29C29	4/0 AWG CCS	4/0 AWG CCS	U997	1	Pass	1779.1	Pass	6100	9
YGA282N	4/0 AWG CCS	n/a	U28RT	2	Pass	2489.3	Pass	6100	9
YGHP34C34	3/4in CCS Ground Rod	19#8 STR CCS	U1011	3	Pass	2126.8	Pass	9000	9
YGHP34C34	19#8 STR CCS	3/4in CCS Ground Rod	U1011	3	Pass	2380.0	Pass	9000	9
YGL34C34	19#8 STRCCS	19#8 STR CCS	U1011	3	Pass	3158.3	Pass	9000	9
YGHC34C34	19#8 STR CCS	19#8 STR CCS	U1011	3	Pass	3812.1	Pass	9000	9
YGHA302N	19#8 STR CCS	n/a	U32RT	2	Pass	4792.2	Pass	9000	9

Burndy LLC 47 East Industrial Park Dr.
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TD002391

Global Circulation Laboratory Test Report

For Global Distribution

CONCLUSIONS:

All samples tested met the UL486A-486B mechanical sequence and UL467 Short time current requirements when installed on COPPERWELD® 40% IACS Copper Clad Steel (CCS) conductors per ASTM B910/B910M-07.

TEST PROCEDURES

The table below shows the connector / conductor combinations tested.

Connector	Cable 1	Cable 2	Tool	Die	# of Crimps
YGHP29C2	5/8in CCS Ground Rod	#4 Solid CCS	PAT750	U997	1
YGL2C2	#4 Solid CCS	#4 Solid CCS	PAT750	U-O	1
YGHC2C2	#4 Solid CCS	#4 Solid CCS	PAT750	U-C	1
YGA4C2N	#4 Solid CCS	n/a	PAT750	U4CRT	1
YGL29C29	7#7 STR CCS	7#7 STR CCS	PAT750	U997	1
YGHC26C26	7#7 STR CCS	7#7 STR CCS	PAT750	U-O	1
YGHA272N	7#7 STR CCS	n/a	PAT750	U997	2
YGHP34C29	3/4in CCS Ground Rod	4/0 AWG CCS	PAT750	PU998	1
YGL29C29	4/0 AWG CCS	4/0 AWG CCS	PAT750	U997	1
YGHC29C29	4/0 AWG CCS	4/0 AWG CCS	PAT750	U997	1
YGA282N	4/0 AWG CCS	n/a	PAT750	U997	2
YGHP34C34	3/4in CCS Ground Rod	19#8 STR CCS	PAT750	U1011	3
YGHP34C34	19#8 STR CCS	3/4in CCS Ground Rod	PAT750	U1011	3
YGL34C34	19#8 STR CCS	19#8 STR CCS	PAT750	U1011	3
YGHC34C34	19#8 STR CCS	19#8 STR CCS	PAT750	U1011	3
YGHA302N	19#8 STR CCS	n/a	PAT750	U32RT	2

Burndy LLC 47 East Industrial Park Dr.
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TD002391

Global Circulation Laboratory Test Report

For Global Distribution

All conductors were cut to twenty four (24) inch lengths.
All ground rod was pre-crimped with the appropriate pre-crimp die
5/8in Rod UPRECRIMP58
3/4in Rod UPRECRIMP34

Mechanical Sequence
Four samples of each set were secured to the Secureness tester, the height; weight and bushing size were as specified in UL486A-486B Table 26. Samples were rotated for thirty minutes at 9rpm. Samples were then subjected to a 1-minute pull to the value specified in UL486A-486B Table 27 and then to failure.

Short Time Current
Test samples were assembled in a series loop configuration then attached to a current controller as shown below. The test current and duration are listed below. After completion of the test, electrical continuity was checked with a digital multi-meter.

Test current values were derived from the equation Annex C of IEEE Std 837-2002. The diameter of the conductor(s) were measured and the cross-sectional area of the conductors was calculated.

Conductor	***Current Value (A)***	***Duration (sec)***
#4AWG Solid COPPERWELD® 40% IACS CCS	1600	6
4/0AWG 19 strand COPPERWELD® 40% IACS CCS,	6100	9
7#7 stranded COPPERWELD® 40% IACS CCS	4600	9
19#8 stranded COPPERWELD® 40% IACS CCS	9000	9

TEST EQUIPMENT LIST:

MANUFACTURER	MODEL	DESCRIPTION	SERIAL #	RANGE
FLUKE	79 III	DMM	70591301 (Rene)	AUTO
OHIO SEMITRONICS		CURRENT TRANSDUCER	NA	15000:5
SATEC	T5000	TABLE TOP	2038	5000 lbs
VIRTECH	NA	HIGH CURRENT	NA	12V / 12000A
MITUTOYO	505-675	DIAL CALIPER	08914565 (Rene)	6"

Burndy LLC 47 East Industrial Park Dr.
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CORROSION ON BURIED COPPER CLAD STEEL

Cece Syarif

Global Application Engineer

&

Anthony Hale

Manager, Utility Products, North America

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For more information, contact sales@copperweld.com.
The results and conclusions obtained from studies done by Copperweld are only applicable to Copper Clad Steel manufactured by Copperweld. Due to proprietary process used to produce the wire, the findings cannot be superimposed on any other copper-clad steel conductor.

COPPERWELD

254 Cotton Mill Rd, Fayetteville, TN 37334. Tel. (931) 433 – 7177

July 26, 2011

This paper compiles several studies and analysis regarding the corrosion performance of buried Copperweld® Copper-Clad-Steel (CCS) conductors. These range from the early 1900's with the invention of Copperweld® through the present day with studies performed by independent parties as well as Copperweld Company in-house testing. The purpose is to present the available information so that prospective users of Copperweld® CCS wire and strand can evaluate the corrosion resistance and expected performance within their specific application and area. Copperweld uses oxygen free copper in the manufacture of Copperweld® wire and strand. The copper surface of CCS is expected to oxidize and turn color ranging from green (patination) to brown and black the same as any solid copper wire or strand when exposed to environmental stimuli. Corrosion on exposed steel at the cut tip or end of the wire is also expected. The question to be answered is if the corrosion on either material or the interface between the copper and steel (galvanic reaction) will result in degradation of the wire as to make it unsuitable for use as a grounding conductor.

The oldest known underground corrosion study of bimetallic material was performed in the early 1900s[1]. This study focused on the corrosion behavior of Copperweld® CCS underground rod as well as other materials such as Copper and galvanized steel ground rod. The National Bureau of Standards (NBS) conducted an extensive underground corrosion study that involves 36,500 specimens which include 333 varieties of ferrous, nonferrous, and protective coating materials buried in 128 test locations throughout U.S in 1910 - 1955.

The study summarizes the service life of a ground rod as following:

10 mils copper coating – acceptable for service life up to 40 years

13 mils copper coating – acceptable for service life up to 50 years

Similarly, the Naval Civil Engineering Laboratory in collaboration with the National Association of Corrosion Engineers conducted a 7-year program of testing metal rods for electrical grounding to determine the galvanic corrosion effect. The three metals tested were stainless clad steel, copper-bonded steel (CCS), and galvanized steel. The result on the ⅝" CCS ground rod was as expected. The copper surface of the CCS was

virtually free of corrosion and the steel core has corroded at the tip approximately 2 inches down the length of the rod.

Copperweld Corporation is the inventor and sole manufacturer of Copperweld® Copper-bonded ground rods and Copperweld® wire and strand since 1915. The corrosion behavior of a Copperweld® ground rod is similar to the corrosion on Copperweld® wire and strand conductor. Both materials consist of copper permanently bonded to a steel core. All Copperweld® 40% CCS has a copper thickness of 10% of the overall diameter. For example, Copperweld® 4THOUGHT™ has a configuration of 19 strands of 0.1055 inch wires. It means that each strand has a copper thickness of 10.55 mils. Based on the NBS study, 4THOUGHT™ will have at least a minimum service life of 40 years.

Copperweld has also conducted a 5-year study of buried bare 21% conductivity (copper thickness is 3% of the diameter) Copperweld® CCS in 10 different soil conditions in association with Southwest Research Institute[2]. The study reported 100% surface oxidation and various degrees of deterioration of the steel core as expected after 5 years. The exposed steel on the tip of the wire rusted and formed "scab", as shown in Figure 1. The rust appeared to "seal-off" the un-oxidized material from the corrosive medium. The maximum depth of corrosion was 70% of the wire diameter.

Figure 1: Example of Underground Corrosion of Copper Clad Steel

Although the copper surface oxidation was heavy, the samples showed no signs of pits or holes in the copper cladding. The copper thickness of a severely oxidized 5-year sample showed no discernable difference when compared to an un-oxidized control sample that was not subjected to the corrosive environment. The mechanical and resistance testing

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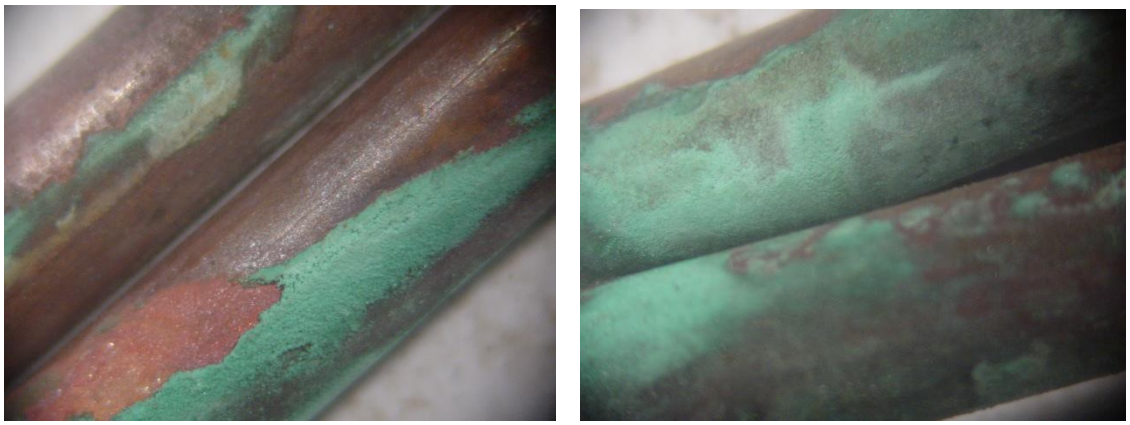
resulted in negligible differences between 5-year samples and the control samples. Thus, the oxidation had no discernable impact on the strength or electrical performance of the wire.

An accelerated corrosion study based on ASTM B117 was conducted on bare CCS and solid Copper wires to evaluate copper surface corrosion. The wires were exposed to salt fog spray for 504 hours. As a result, corrosion on the CCS copper surface showed no significant difference as compared to the corrosion of copper wire.



(a) Copper Clad Steel (b) Copper

Figure 2: Patination of Copper Surface after 504 hours exposure to Salt Fog Spray

In February 2011, three separate sample strands of Copper Clad Steel were un-earthed and cut out from a substation built in Louisville, KY. The conductors were 40% conductivity, Low Carbon Steel, Dead Soft Annealed, 7 No. 5 (231,613 circular mil) and were installed in 1962.

Table 1: Physical properties of the three strands of Copperweld® conductor that had been buried underground for 48 years in a Kentucky substation

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			Strand 1	Strand 2	Strand 3
Conductor Type			40% Low Carbon Annealed		
Conductor Size			7 No. 5		
Cross Section Area		in^2	0.1819	0.1819	0.1819
Diameter of Single end		*inch*	0.1819	0.1819	0.1819
Diameter of Conductor		*inch*	0.5457	0.5457	0.5457
Copper Thickness	Min	*inch*	0.0142	0.0114	0.0134
	Max	*inch*	0.0213	0.0209	0.01975
% Concentricity			83.30%	77.30%	83.90%
Depth of corrosion	Min	*inch*	0.004	0.028	0.111
	Max	*inch*	0.781	0.859	0.484

The 1962 conductors were manufactured by Copperweld with a nominal copper thickness of 10% of its diameter. Figure 3 shows the copper thickness ranges from 11.4 – 21.3 mils and the concentricity of the conductor averaged at 81.5%. Current manufacturing improvements yield concentricity of copper thickness above 85%.

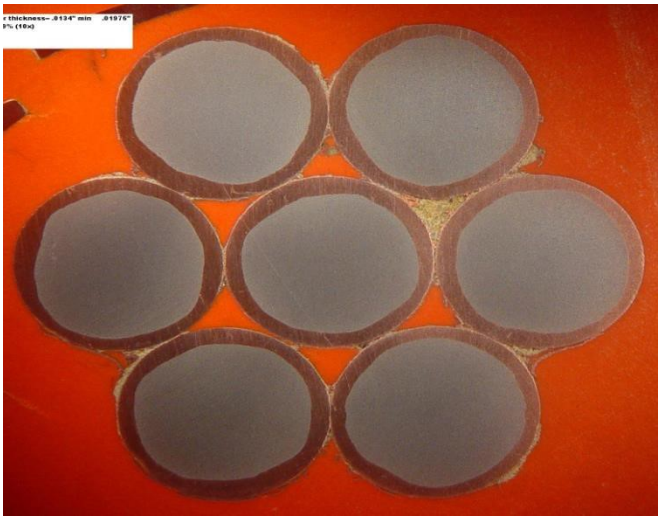

Figure 3: Copperweld® 40% LC DSA 7 No. 5 manufactured in 1962

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Figure 4a shows no visible corrosion observed other than oxidation and patination on the copper surface. At the ends of the wires, the corrosion occurred in the form of steel rust. The maximum depth of the corrosion is 0.859 inch with an average of 0.382 inch, as shown in Figure 4b.

Figure 4a: There is no visible corrosion between the copper and steel on all wires obtained from the substation in Kentucky.

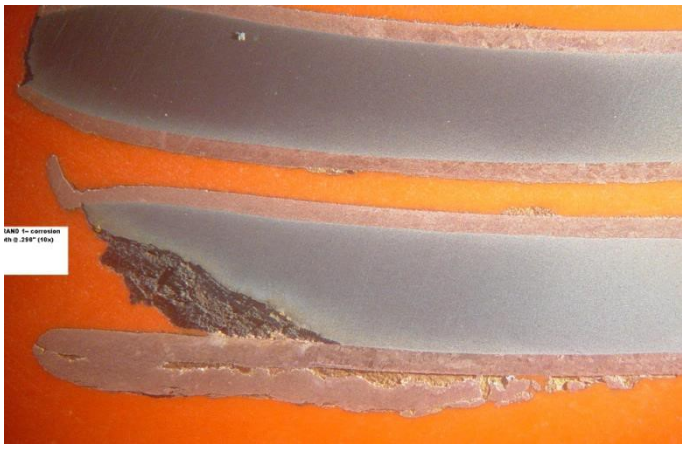

Figure 4b: Corrosion occurred at the ends of the wires. Maximum penetration depth is 0.859 inch.

From all the corrosion studies above, there have not been reported or observed any galvanic corrosion at the interface of copper and steel. The process of cladding for

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Copperweld® ensures a metallurgical bond between the two metals. That metallurgical bond prevents any moisture from penetrating between the two metals precluding the corrosion process. Any propagation of corrosion on an area of exposed steel averages two times the diameter of the wire then stops. The corrosion rate of the copper surface is equivalent to that observed on standard solid copper wire and strand. Based on the results of these studies, it can be summarized that CCS can be expected to have a 50 plus year service life as buried grounding conductors.

REFERENCES:

1. Rempe, Chris. 7 July 2003. "A Technical Report on the Service Life of Ground Rod Electrodes".
2. Fox, Dustin, Belado, Chris, and Brossia, Sean. 23 September 2009. "The Effect of Corrosion on Tracer Wire with a Copper Clad Steel Center Conductor".

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Revision: 0 Issued: 2020-04-15

Copper and CCS Wire Withstand Current and Fusing Current Tests

Copperweld Bimetallics, LLC

The Power of Trust. **The Future of Energy.**

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REPORT OF PERFORMANCE

CLIENT	Copperweld Bimetallics,LLC. 5141 Virginia Way, Suite 410 Brentwood, TN, United States 37027
TEST OBJECTS	Copper Clad Steel (CCS) Wires Manufacturer: Copperweld Bimetallics,LLC. Types: Scorpius Prototypes Part Nos.: 61 x 072 7 x 080 Condition: New Copper Conductor Manufacturer: Encore Wire Types: #4/0 AWG (19 strand) CU #6 AWG (single strand) CU Condition: New
TESTED BY	Powertech Labs Inc. 12388 - 88th Ave, Surrey, BC Canada V3W 7R7 www.powertechlabs.com
TEST DATE	2020-01-24 to 2020-01-25
TEST SPECIFICATION	Client Specified, with reference to IEEE Std 80-2013 and IEEE Std 837-2014

Powertech Labs Inc. does not accept any liability for any damages resulting from the use of this report. The results relate only to the item tested, and it is the responsibility of the manufacturer to maintain conformity of any object having the same designations. Information regarding the estimated measurement uncertainty is available upon request. The test report shall not be reproduced except in full, without written approval of Powertech Labs Inc.

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1 INTRODUCTION

At the request of Copperweld Bimetallics,LLC., withstand current and fusing current tests were performed on standard copper and copper clad steel (CCS) wires in accordance with specifications and procedures provided by the client. Reference was made to IEEE Std 80-2013 and IEEE Std 837-2014 as guides for determining current levels and durations for the tests.

The High Power Lab is accredited by the Standards Council of Canada to ISO 17025 for short-circuit testing.

2 TEST OBJECT INFORMATION

The test objects were identified by the client as follows:

Copper Clad Steel Wires (CCS)

Manufacturer:	Copperweld Bimetallics,LLC.
Types:	Scorpius Prototypes
Part Nos.:	61 x 072
	7 x 080
Condition:	New

Copper Conductor

Manufacturer:	Encore Wire
Types:	4/0 AWG (19 strand) CU
	#6 AWG (single strand) CU
Condition:	New

Conductor sample diameters and dc resistance values were measured by the laboratory before testing, as presented in Table 1.

3 GENERAL INFORMATION

3.1 Purpose

The purpose of the tests is to identify the current limits at short durations for standard copper and Copperweld CCS grounding wire products, and to determine if these products meet the applicable requirements of the referenced Standards.

3.2 Witnesses

Name	Company
Jeff Jordan	Copperweld Bimetallics,LLC.
Lora Aboulmouna	Copperweld Bimetallics,LLC.
Jason Smolko	Copperweld Bimetallics,LLC.
Ryan Hale	Copperweld Bimetallics,LLC.

3.3 Tests Performed

Test Standards/Specifications:

Withstand current tests were performed as requested by the client, with reference to the following Standards to determine the test levels:

IEEE Std 80-2013, Table 6 – Specification for the ultimate current carrying capacity of copper grounding cables using symmetrical current.

IEEE Std 837-2014, Clause 7.2 and Table 3 – Electromagnetic force (EMF) test

4 SHORT-CIRCUIT CURRENT TESTS

General Information:

Standard	Client's Specification, with reference to IEEE Std 80-2013 and IEEE Std 837-2014
Test Dates	2020-01-24 to 2020-01-25
Test Leader	Chris Morton

Environmental Conditions:

Ambient temperature	(7 – 9) °C
Relative Humidity	(95 – 99) %

Test Conditions:

Samples were tested in a covered test cell which was open on one side to the outdoor ambient conditions. During each test, one sample was connected horizontally between the laboratory source bus and ground bus, at a bus spacing of 48 inches, as shown in Figures 30 through 33. The samples were terminated using Burndy mechanical connectors, as shown in Figures 34 and 35. The length of each wire sample was the minimum length required to span the distance between the buses, and each sample was at approximately right angles (90°) to both the source and ground bus. Each sample was suspended in free air approximately 46 inches above the floor of the test cell. The temperature of the sample at the start of each test was the natural outdoor ambient temperature of the laboratory, except for tests performed to IEEE 837, where the sample was allowed to cool to less than 100 °C before the second shot.

All tests were performed at a power frequency of 60 Hz using the test circuit shown in Figure 1. Current was initiated by energizing a current limited source that was calibrated to provide the target current through the circuit. The rms current, current symmetry and duration of each test were specified by the client.

The test current was measured using a 300 kA_{peak} rated Rogowski coil (Powertech ID № 39444). The expanded uncertainty of the current measuring system is estimated as 2% (k=2).

Test Results:

The results of the tests are provided in Tables 2 through 5. Current and voltage waveforms for each test are provided in Figures 2 through 29.

The Encore #4/0 AWG Cu wire did not withstand the I^2t calculated from the current and duration specified in IEEE 80, Table 6, for a 500 ms duration (44 kA_{rms}). It was capable of carrying a maximum of 92% of this I^2t value without fusing.

The Encore #4/0 AWG Cu wire did not withstand the EMF current specified in IEEE 837, Table 3 (47 kA_{rms}). It was capable of carrying a maximum of 91% of this current value without failing.

The Copperweld Scorpius CCS 61 x 072 conductor exceeded the 500 ms rms withstand current requirement of IEEE 80, Table 6, and met the EMF current requirements of IEEE 837, Table 3, for a 4/0 conductor.

For the #6 AWG Cu conductor size the Standards did not have current values specified, so these were calculated using Equation (45) from IEEE 80 and Equation (C.1) from IEEE 837. The calculations are presented in Appendix D.

Both the Copperweld Scorpius CCS 7 x 080 conductor and the Encore #6 AWG Cu conductor met the 500 ms rms withstand current requirement of IEEE 80, Table 6 (5.29 kA_{rms}), and the EMF current requirements of IEEE 837, Table 3 (5.81 kA_{rms}), for a #6 AWG Cu conductor.

APPENDIX A – FUSING CURRENT TEST CIRCUIT AND DATA

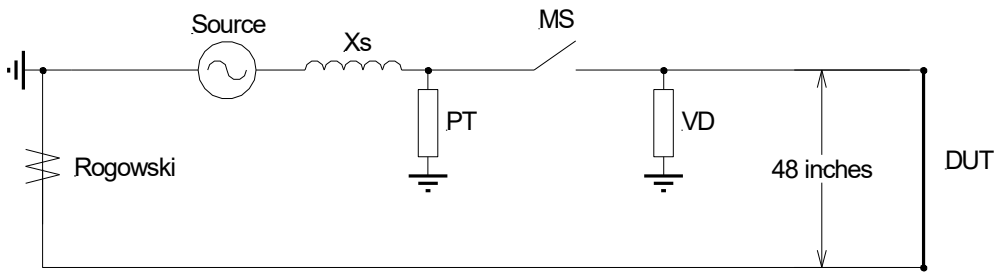

Figure 1: Test circuit schematic for all tests.

Notes:

1. X_S – Source current limiting reactance
2. MS – Making Switch
3. VD – Voltage measurement
4. Rogowski – Current measurement
5. DUT – Device Under Test

Table 1: Strand diameter and dc resistance measurements of sample conductors.

Wire Sample No.	Type	Strand Diameter [1] (in)		Conductor Diameter	Dc Resistance at 20°C
#		1	2	(in)	(μΩ/ft)
1	Encore Wire, 4/0 AWG, 19 strand CU	0.122	0.079	0.492	4.28
2	Encore Wire, 4/0 AWG, 19 strand CU	0.118	0.080	0.501	4.10
3	Encore Wire, 4/0 AWG, 19 strand CU	0.109	0.074	0.495	4.23
4	Encore Wire, 4/0 AWG, 19 strand CU	0.102	0.075	0.498	3.98
5	Encore Wire, 4/0 AWG, 19 strand CU	0.108	0.079	0.489	4.43
6	Encore Wire, 4/0 AWG, 19 strand CU	0.108	0.075	0.490	4.17
7	Encore Wire, 4/0 AWG, 19 strand CU	0.101	0.075	0.489	4.18
8	Encore Wire, 4/0 AWG, 19 strand CU	0.102	0.074	0.491	4.15
9	Encore Wire, 4/0 AWG, 19 strand CU	0.106	0.082	0.490	3.97
10	Encore Wire, 4/0 AWG, 19 strand CU	0.105	0.079	0.493	3.73
11	Scorpius 61 x 072 CCS	0.056	---	0.646	6.83
12	Scorpius 61 x 072 CCS	0.058	---	0.649	6.60
13	Scorpius 61 x 072 CCS	0.068	---	0.641	6.60
14	Scorpius 61 x 072 CCS	0.056	---	0.639	6.73
15	Scorpius 61 x 072 CCS	0.067	---	0.646	6.62
16	Scorpius 61 x 072 CCS	0.059	---	0.630	6.53
17	Scorpius 61 x 072 CCS	0.056	---	0.642	6.73
18	Scorpius 61 x 072 CCS	0.067	---	0.637	6.62
19	Scorpius 61 x 072 CCS	0.064	---	0.641	6.85
20	Scorpius 61 x 072 CCS	0.059	---	0.633	6.83
21	Encore Wire, #6 AWG, single strand CU	0.152	---	0.152	33.3
22	Encore Wire, #6 AWG, single strand CU	0.149	---	0.149	33.3
23	Encore Wire, #6 AWG, single strand CU	0.158	---	0.158	33.2
24	Encore Wire, #6 AWG, single strand CU	0.151	---	0.151	33.4
25	Encore Wire, #6 AWG, single strand CU	0.151	---	0.151	33.3
26	Encore Wire, #6 AWG, single strand CU	0.148	---	0.148	33.6
27	Encore Wire, #6 AWG, single strand CU	0.155	---	0.155	33.3
28	Encore Wire, #6 AWG, single strand CU	0.146	---	0.146	33.1
29	Encore Wire, #6 AWG, single strand CU	0.153	---	0.153	33.2
30	Encore Wire, #6 AWG, single strand CU	0.149	---	0.149	33.3
31	Scorpius 7 x 080 CCS	0.072	---	0.215	46.3
32	Scorpius 7 x 080 CCS	0.069	---	0.226	45.9
33	Scorpius 7 x 080 CCS	0.065	---	0.220	46.2
34	Scorpius 7 x 080 CCS	0.071	---	0.218	46.4
35	Scorpius 7 x 080 CCS	0.073	---	0.212	46.1
36	Scorpius 7 x 080 CCS	0.065	---	0.216	46.3
37	Scorpius 7 x 080 CCS	0.070	---	0.211	46.1

Note:

[1] Encore 4/0 AWG CU conductor had two sizes of strands, all remaining conductors had one size of strands. Strand and conductor diameters were measured using a digital caliper with a resolution of 0.001 in.

Table 2: Summary of tests on Encore 4/0 AWG Copper conductor.

Test №	Wire Sample No.	Type of Test [1]	Source Voltage [2]	Current		Duration [3]	I^2t [4]	Waveforms	Wire Fused?
				Symm.	Peak				
#	#		(kV_{rms})	(kA_{rms})	(kA_{peak})	(ms)	($A^2s \times 10^6$)	Figure #	Y/N
1	1	Run to fusing	3.85	41.7	60.0	530	923	2	Y
2	2	Withstand	3.85	41.8	62.5	509	889	3	N
3-1	3	EMF (IEEE 837)	4.24	48.0	130	262	826	4	N
3-2	3	EMF (IEEE 837)	4.26	48.0	130	127	503	5	Y
4	4	EMF (IEEE 837)	4.25	48.0	130	260	823	6	Y
5-1	5	EMF (IEEE 837)	4.20	47.4	129	262	808	7	N
5-2	5	EMF (IEEE 837)	4.19	47.4	128	9.9	77	8	Y
6-1	6	EMF (IEEE 837)	3.93	42.6	116	263	662	9	N
6-2	6	EMF (IEEE 837)	3.91	42.6	116	262	654	10	N

Table 3: Summary of tests on Copperweld Scorpius 61 x 072 CCS conductor.

Test №	Wire Sample No.	Type of Test [1]	Source Voltage [2]	Current		Duration [3]	I^2t [4]	Waveforms	Wire Fused?
				Symm.	Peak				
#	#		(kV_{rms})	(kA_{rms})	(kA_{peak})	(ms)	($A^2s \times 10^6$)	Figure #	Y/N
7	11	Run to fusing	3.84	41.7	59.6	673	1173	11	Y
8	12	Run to fusing	4.25	48.1	69.8	500	1157	12	Y
9	13	Run to fusing	4.21	47.5	68.9	508	1150	13	Y
10	14	Withstand	4.09	46.2	66.2	508	1089	14	N
11-1	15	EMF (IEEE 837)	4.21	47.6	129	262	803	15	N
11-2	15	EMF (IEEE 837)	4.20	47.7	129	262	803	16	N
12-1	16	EMF (IEEE 837)	4.21	47.6	129	254	784	17	N
12-2	16	EMF (IEEE 837)	4.19	47.4	128	254	767	18	N

Notes:

[1] EMF tests were performed with a test circuit with an X/R>30, and the sample wire was cooled to below 100 °C before the second test, as required by IEEE 837.

[2] The source voltage is the open circuit voltage of the test circuit.

[3] For the samples that didn't fuse during the test, the duration is the period of time that test current was applied. For samples that fused during the test, the duration is the time between the initiation of test current and fusing of the sample (as indicated by the occurrence of arc voltage).

[4] I^2t is calculated based on the instantaneous current and duration. For tests where the conductor fused, it is calculated up to the time of fusing.

Table 4: Summary of tests on Encore #6 AWG Copper conductor.

Test №	Wire Sample No.	Type of Test [1]	Source Voltage [2]	Current		Duration [3]	I^2t [4]	Waveforms	Wire Fused?
				Symm.	Peak				
#	#		(kV_{rms})	(kA_{rms})	(kA_{peak})	(ms)	($A^2s \times 10^6$)	Figure #	Y/N
13	21	Run to fusing	3.90	5.18	7.36	607	16.3	19	Y
14	23	Run to fusing	3.90	5.18	7.57	600	16.1	20	Y
15	24	Run to fusing	4.27	5.68	8.15	500	16.1	21	Y
16-1	25	EMF (IEEE 837)	3.77	5.86	16.2	262	13.9	22	N
16-2	25	EMF (IEEE 837)	3.77	5.86	16.1	262	13.9	23	N

Table 5: Summary of tests on Copperweld Scorpius 7 x 080 CCS conductor.

Test №	Wire Sample No.	Type of Test [1]	Source Voltage [2]	Current		Duration [3]	I^2t [4]	Waveforms	Wire Fused?
				Symm.	Peak				
#	#		(kV_{rms})	(kA_{rms})	(kA_{peak})	(ms)	($A^2s \times 10^6$)	Figure #	Y/N
17	31	Withstand	3.88	5.16	7.44	858	22.9	24	N
18	32	Run to fusing	3.89	5.16	7.43	908	24.2	25	Y
19	33	Run to fusing	4.48	7.00	10.3	493	24.1	26	Y
20	34	Run to fusing	4.41	6.91	10.2	502	23.9	27	Y
21-1	35	EMF (IEEE 837)	3.81	5.91	16.3	262	14.0	28	N
21-2	35	EMF (IEEE 837)	3.80	5.92	16.2	262	13.8	29	N

Notes:

[1] EMF tests were performed with a test circuit with an X/R>30, and the sample wire was cooled to below 100 °C before the second test, as required by IEEE 837.

[2] The source voltage is the open circuit voltage of the test circuit.

[3] For the samples that didn't fuse during the test, the duration is the period of time that test current was applied. For samples that fused during the test, the duration is the time between the initiation of test current and fusing of the sample (as indicated by the occurrence of arc voltage).

[4] I^2t is calculated based on the instantaneous current and duration. For tests where the conductor fused, it is calculated up to the time of fusing.

APPENDIX B – WAVEFORMS

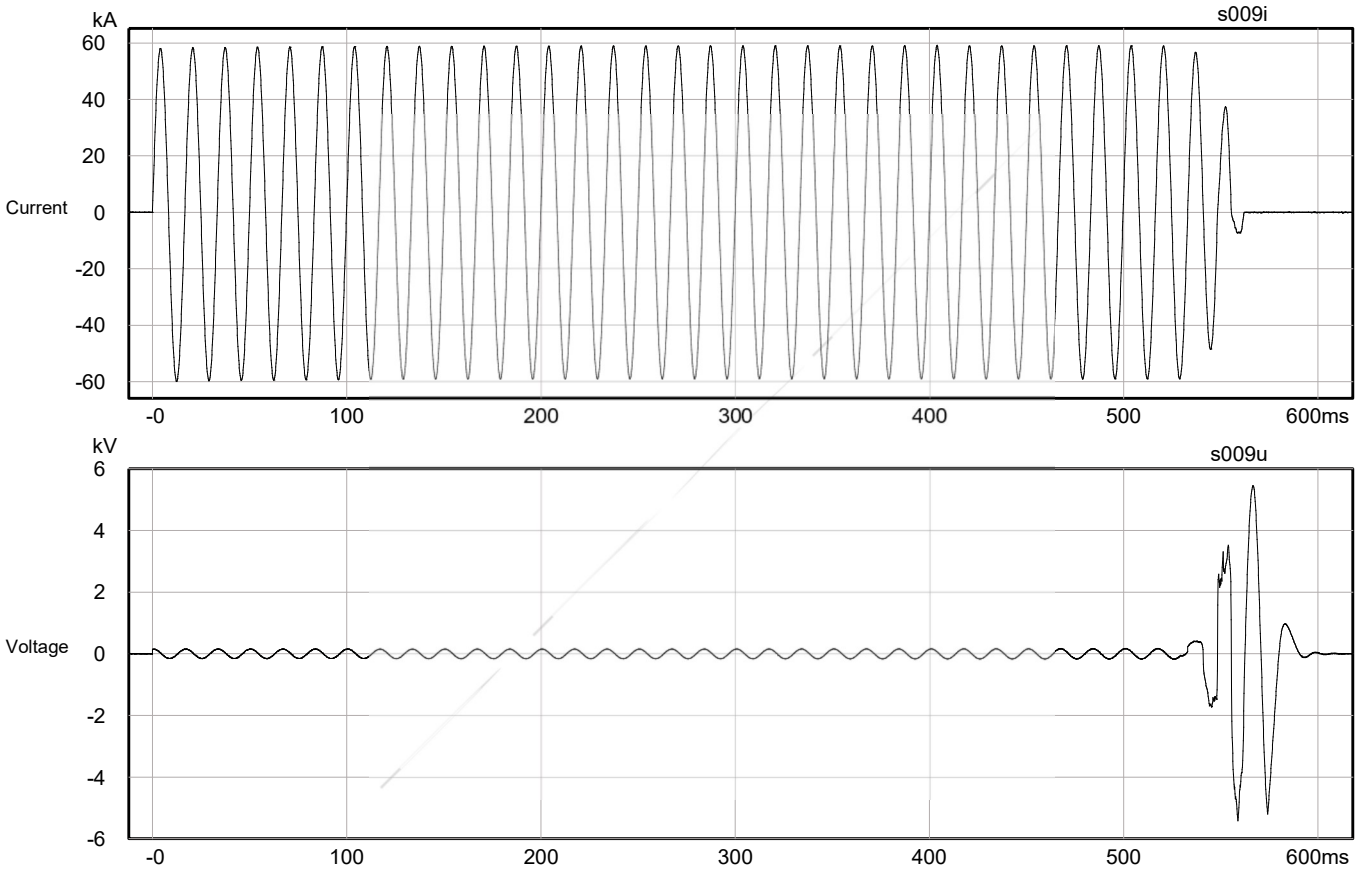

Figure 2: Waveforms for Test #1, Encore 4/0 AWG Sample 1.

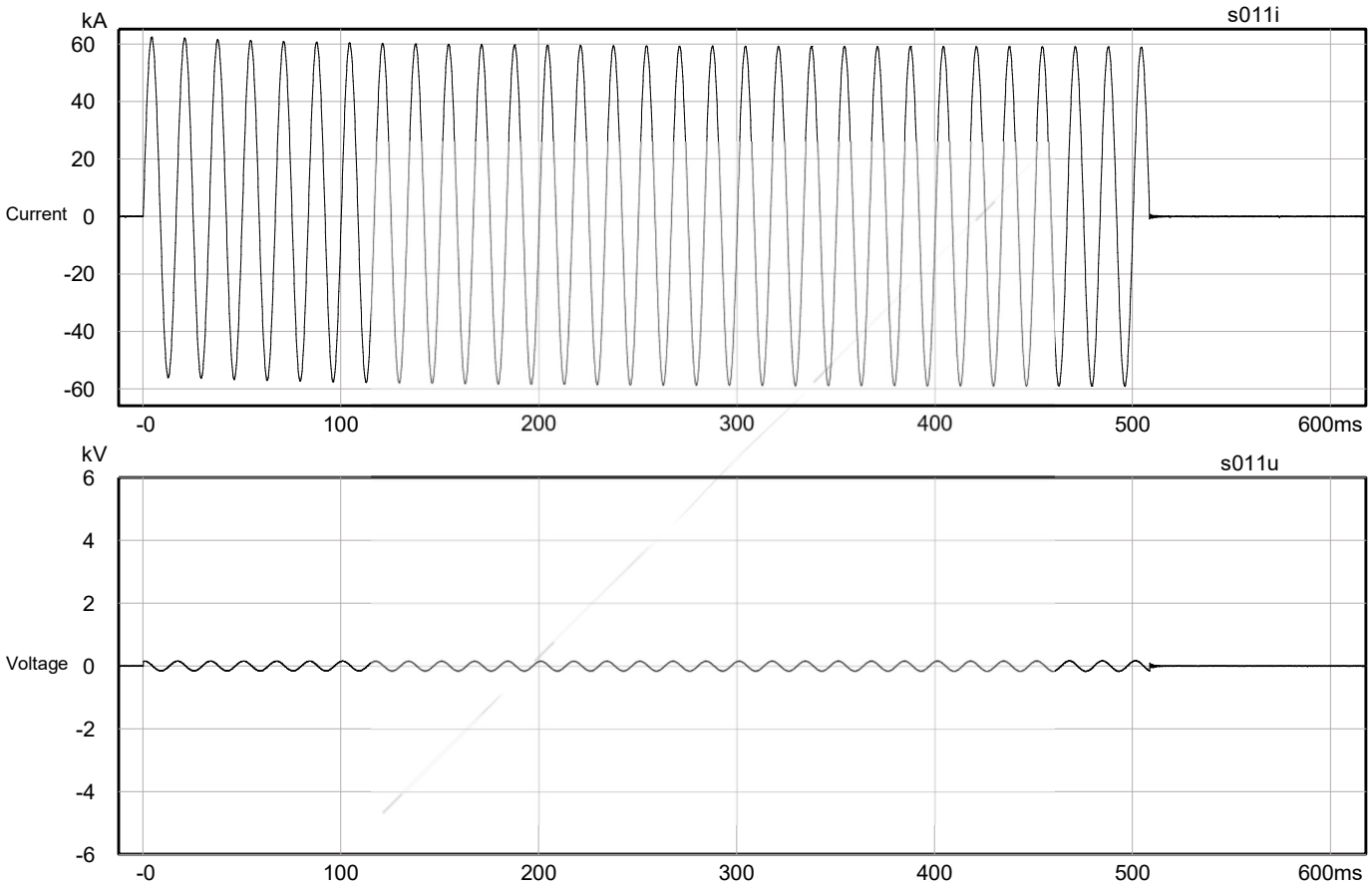

Figure 3: Waveforms for Test #2, Encore 4/0 AWG Sample 2.

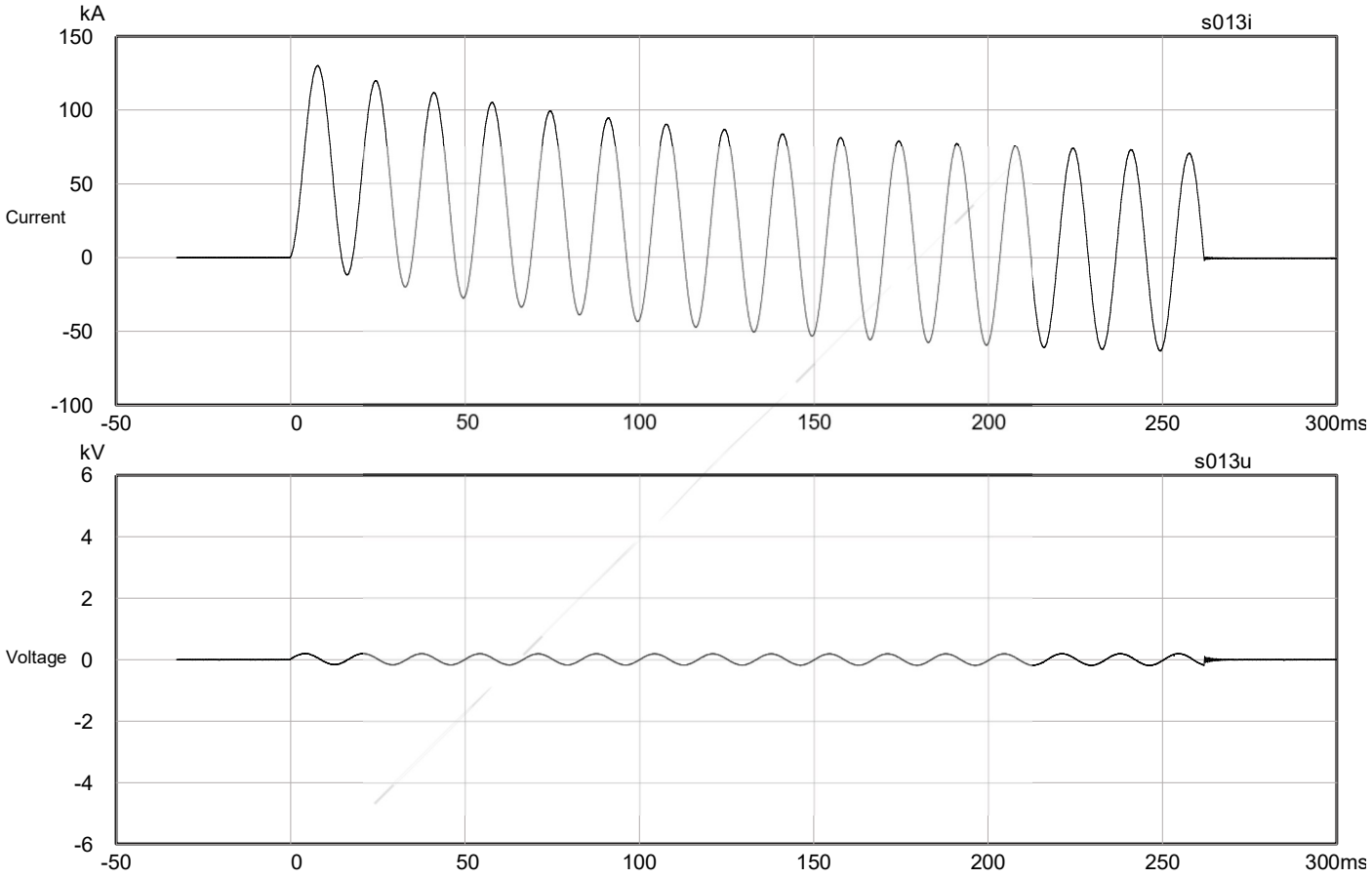

Figure 4: Waveforms for Test #3-1, Encore 4/0 AWG Sample 3.

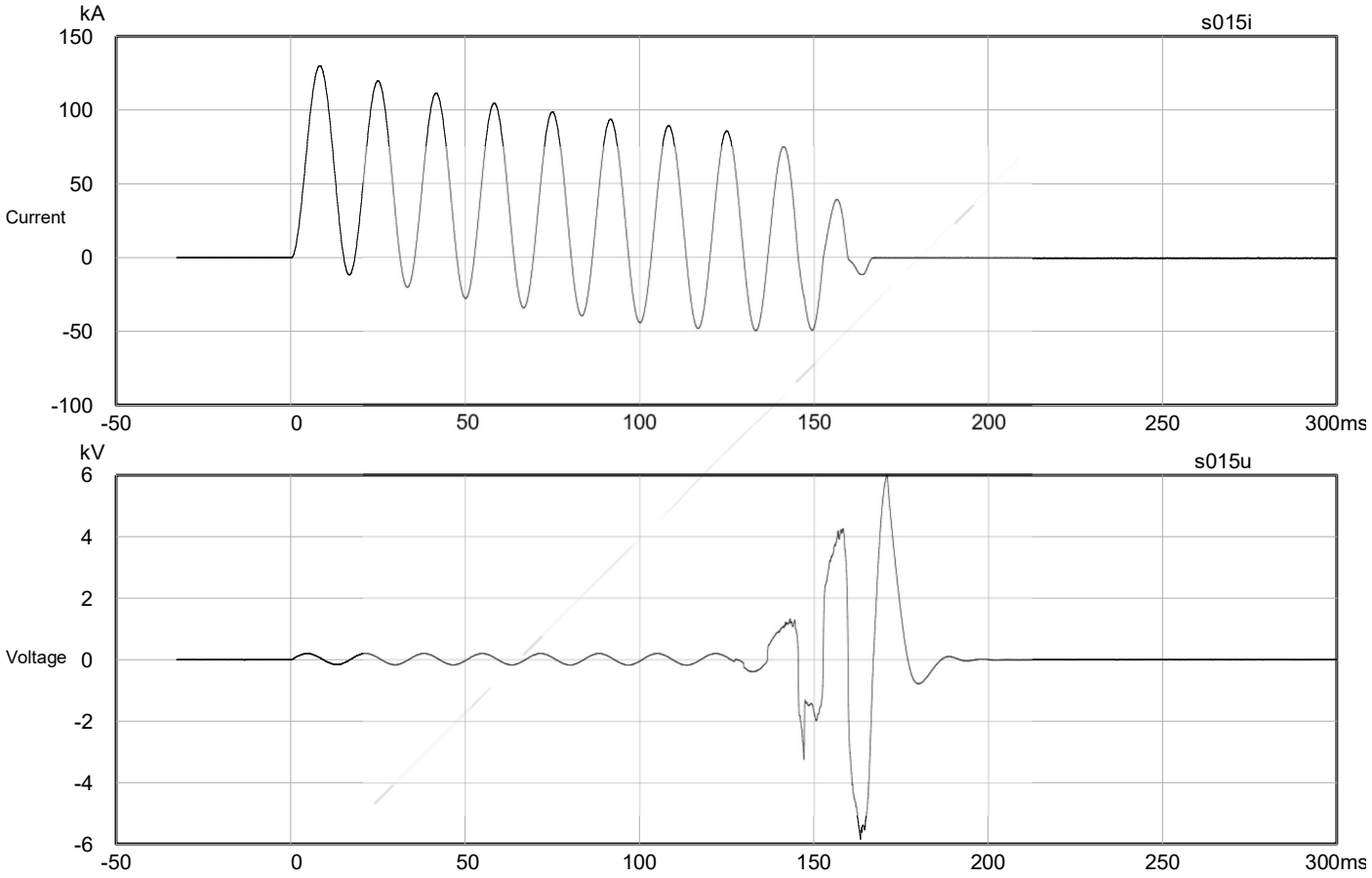

Figure 5: Waveforms for Test #3-2, Encore 4/0 AWG Sample 3.

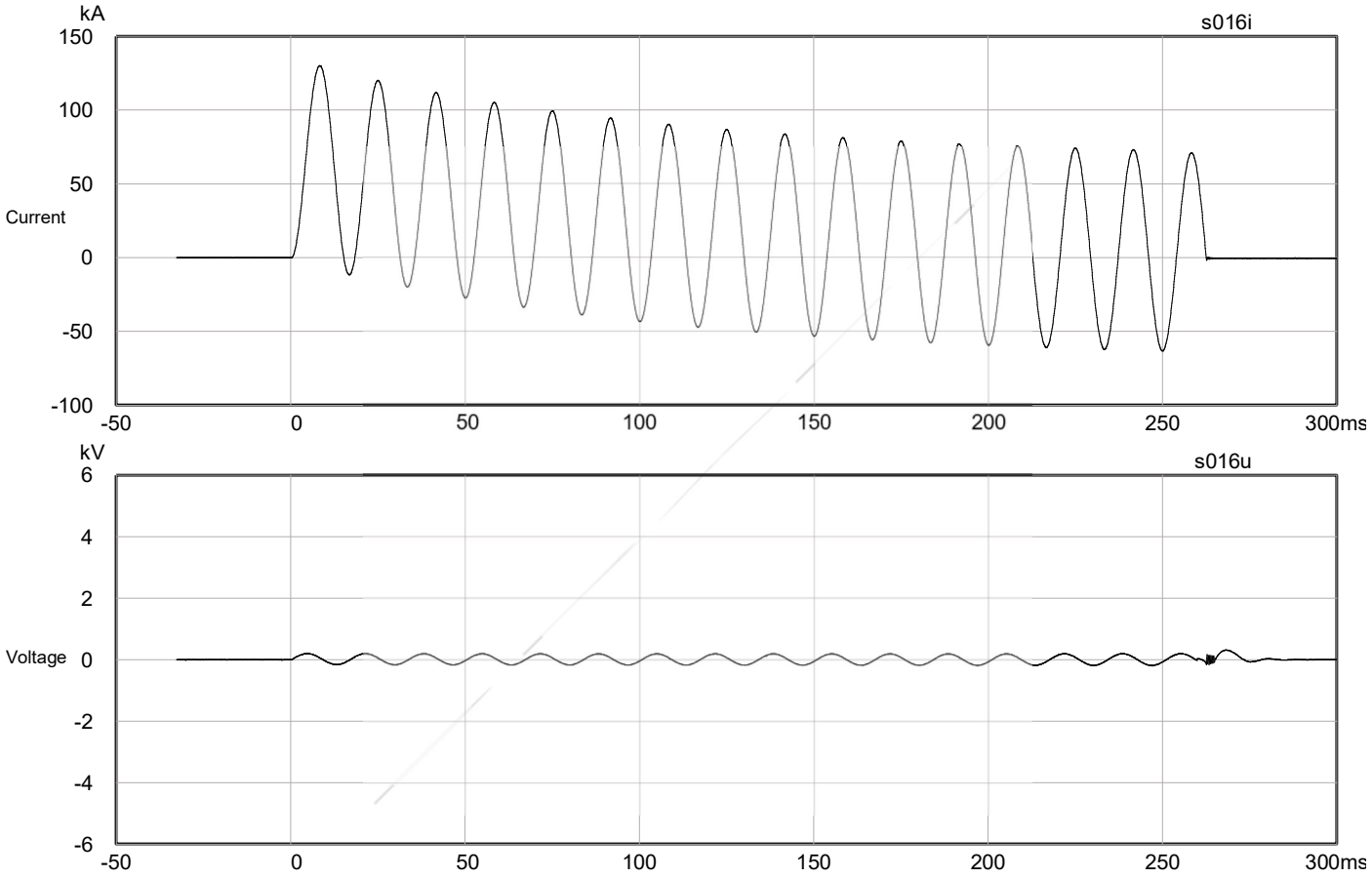

Figure 6: Waveforms for Test #4, Encore 4/0 AWG Sample 4.

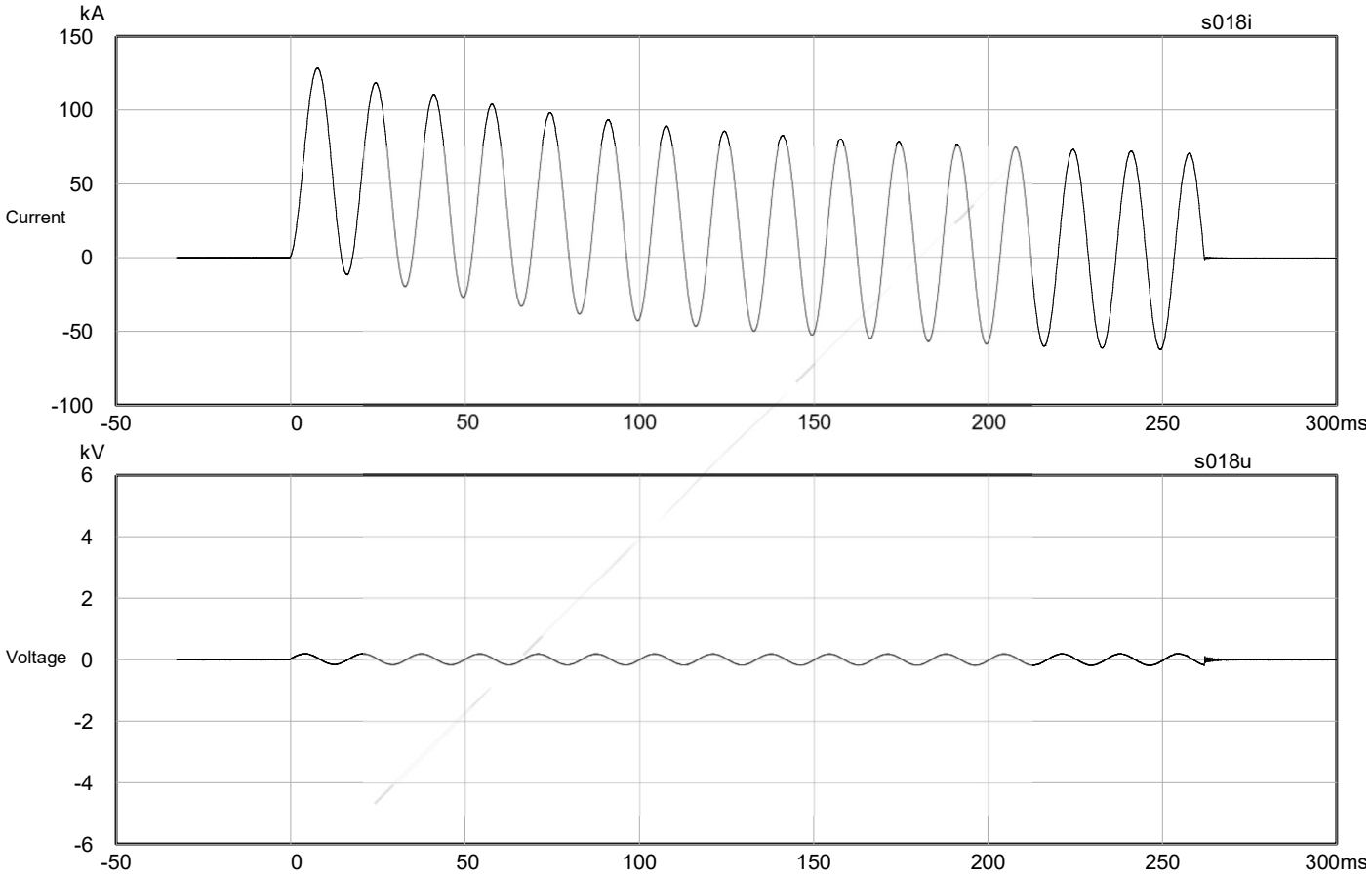

Figure 7: Waveforms for Test #5-1, Encore 4/0 AWG Sample 5.

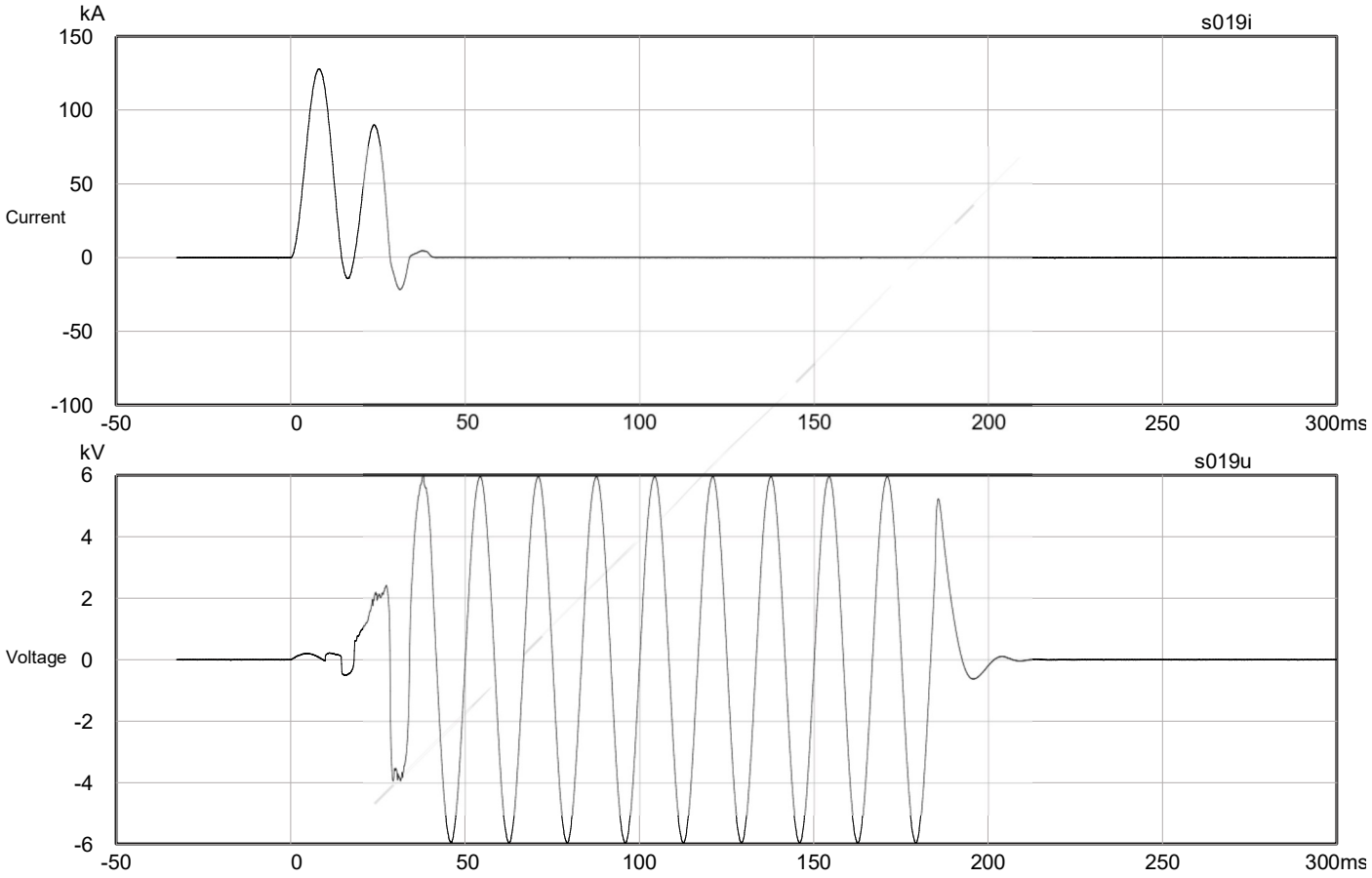

Figure 8: Waveforms for Test #5-2, Encore 4/0 AWG Sample 5.

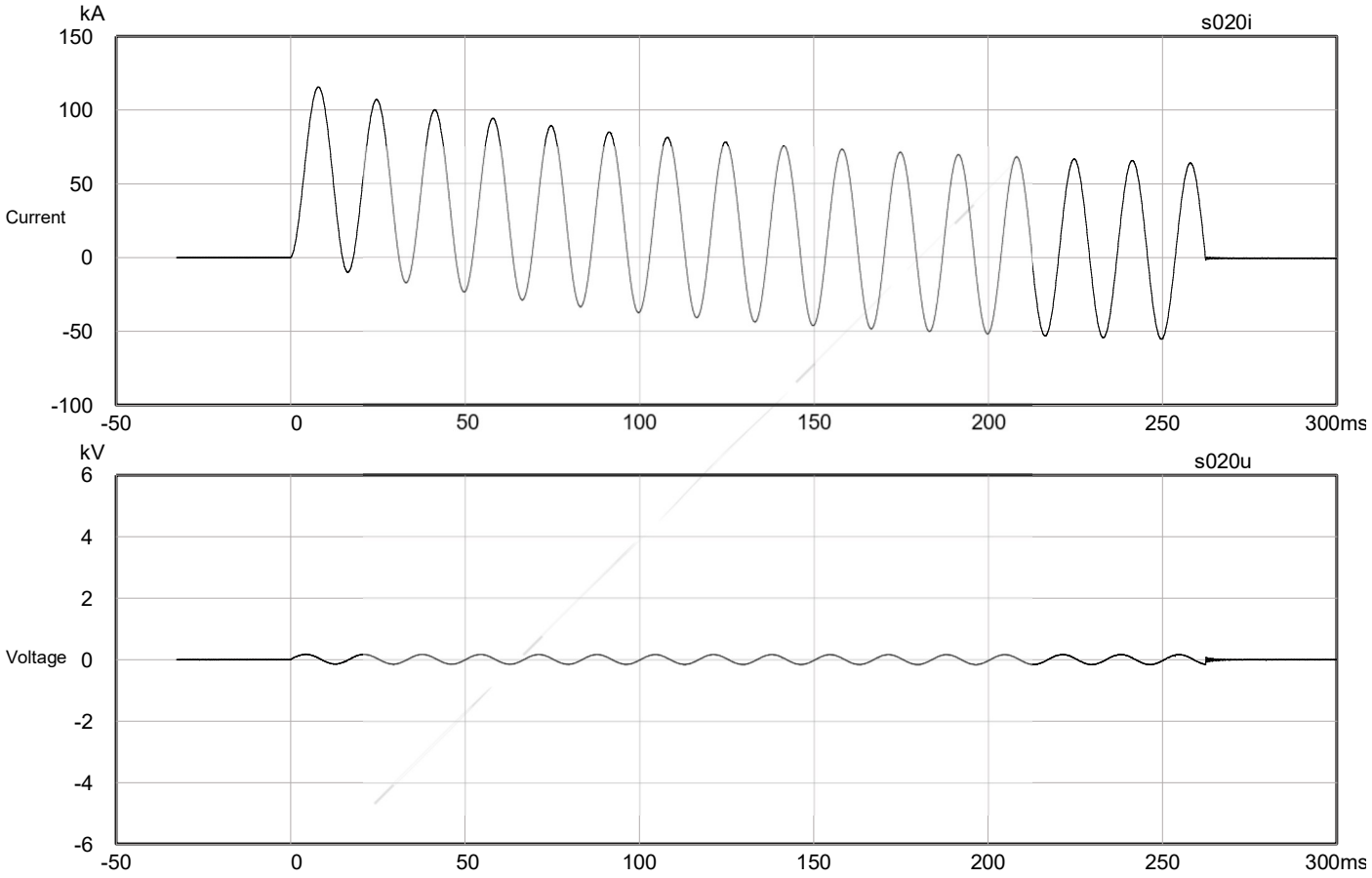

Figure 9: Waveforms for Test #6-1, Encore 4/0 AWG Sample 6.

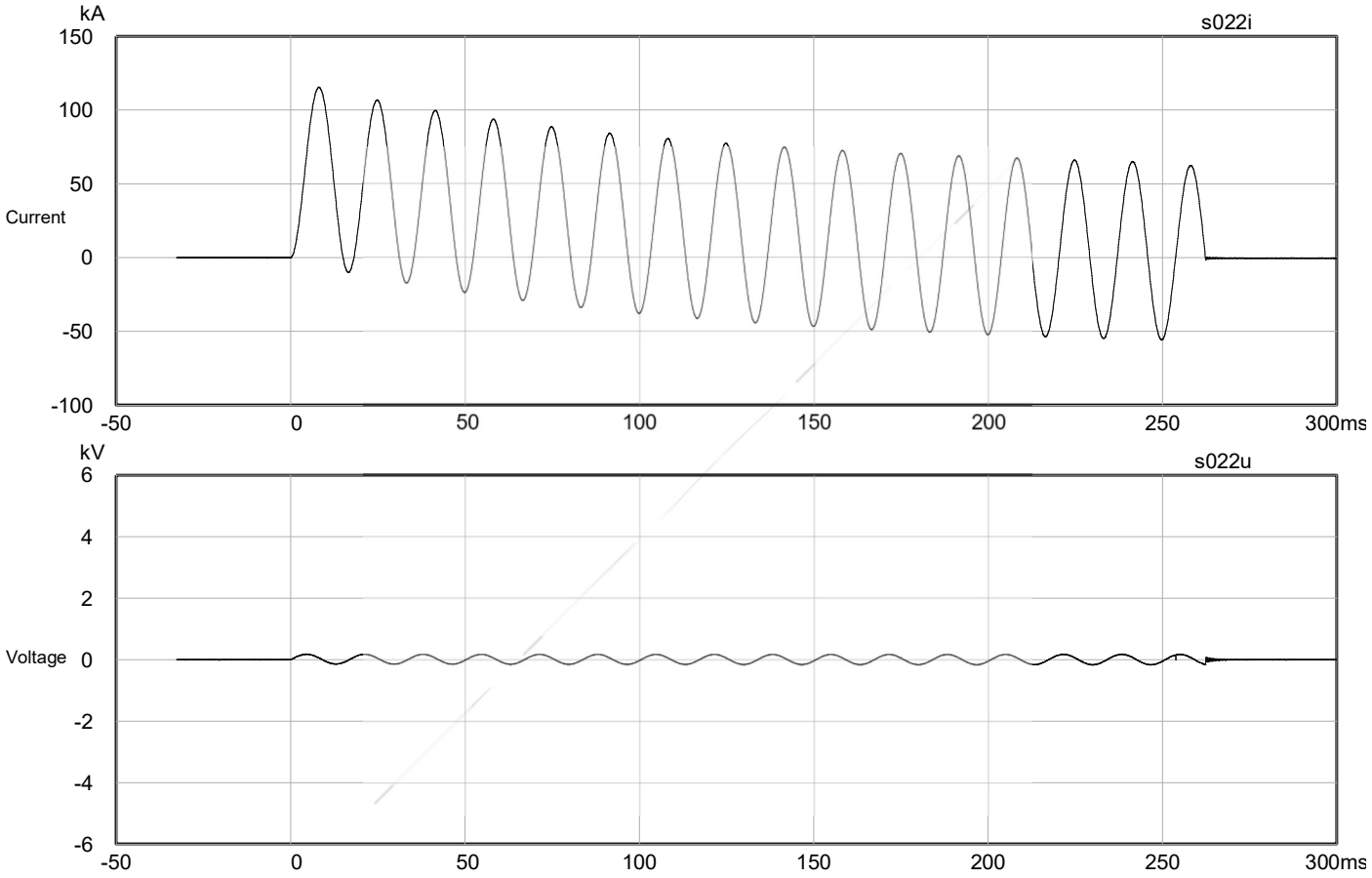

Figure 10: Waveforms for Test #6-2, Encore 4/0 AWG Sample 6.

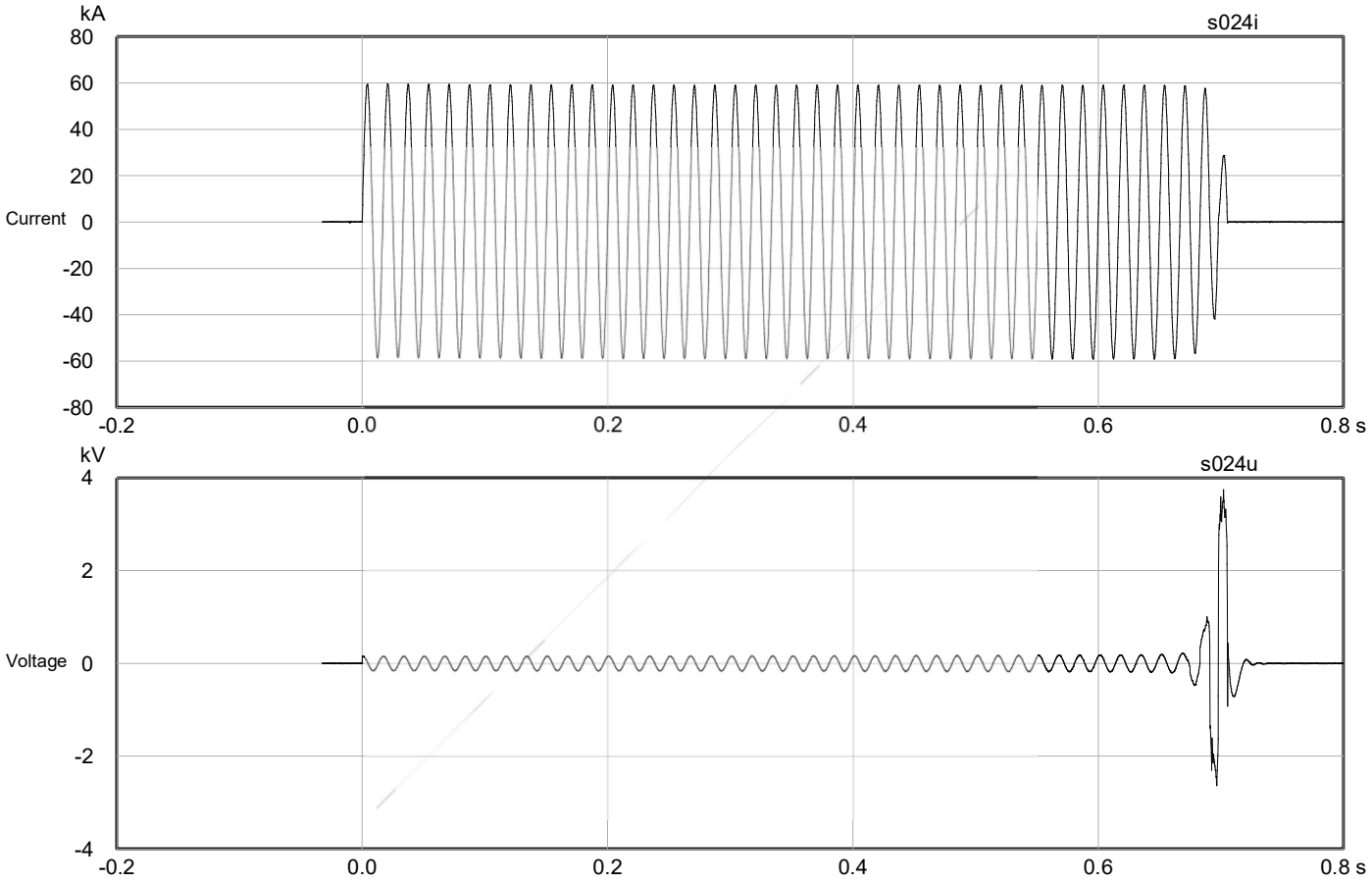

Figure 11: Waveforms for Test #7, Copperweld Scorpius 61 x 072 Sample 11.

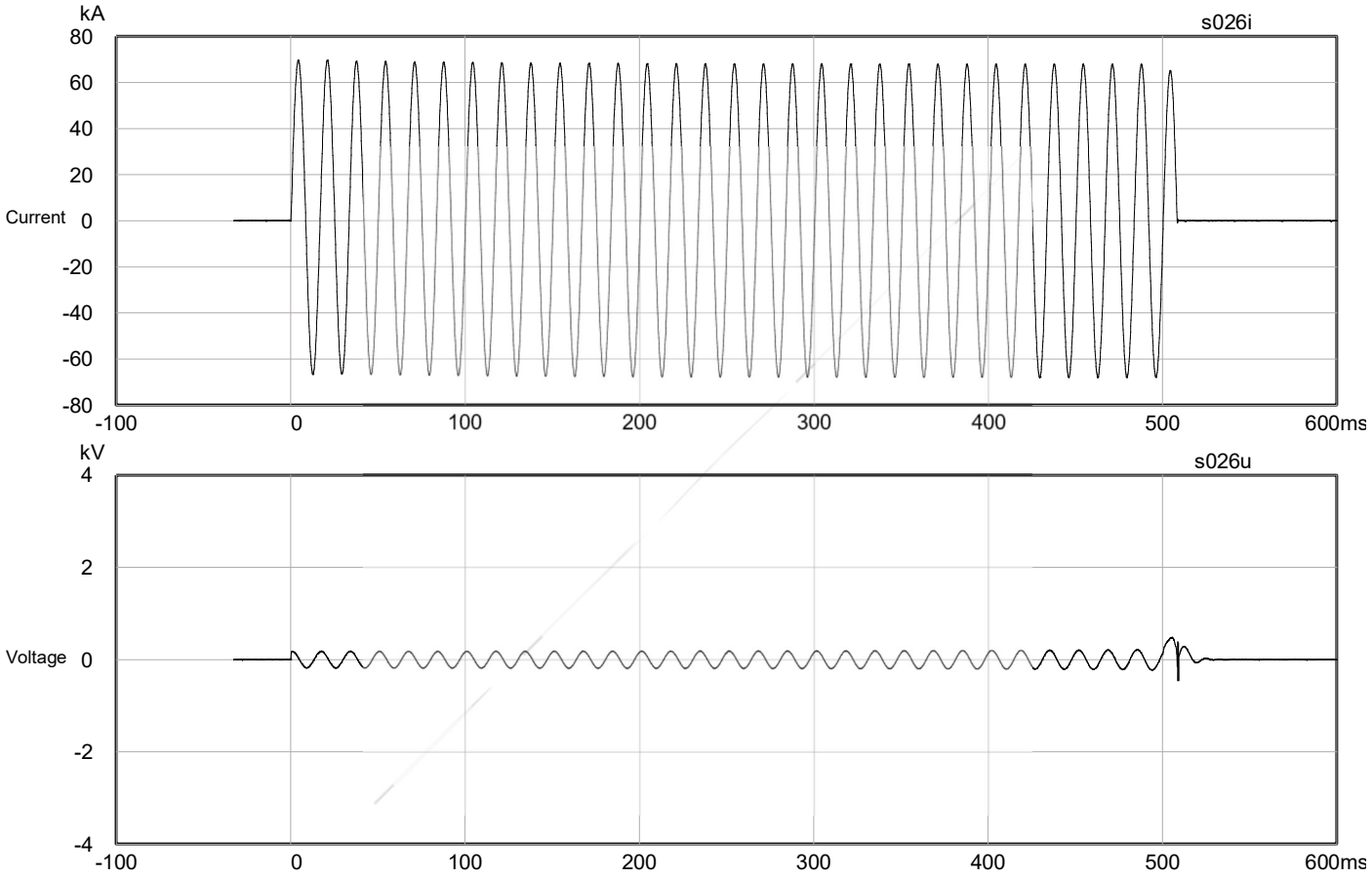

Figure 12: Waveforms for Test #6, Copperweld Scorpius 61 x 072 Sample 12.

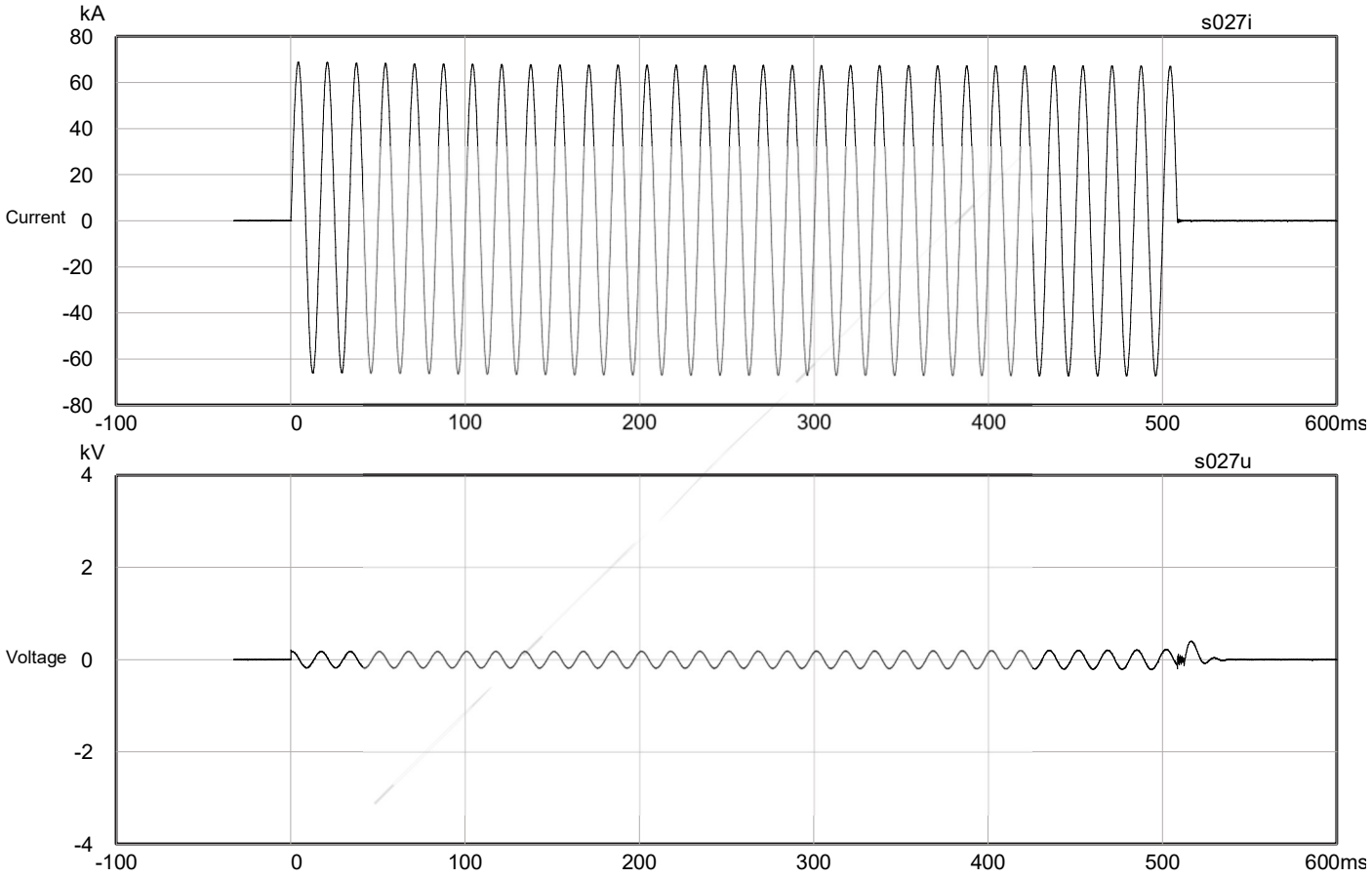

Figure 13: Waveforms for Test #9, Copperweld Scorpius 61 x 072 Sample 13.

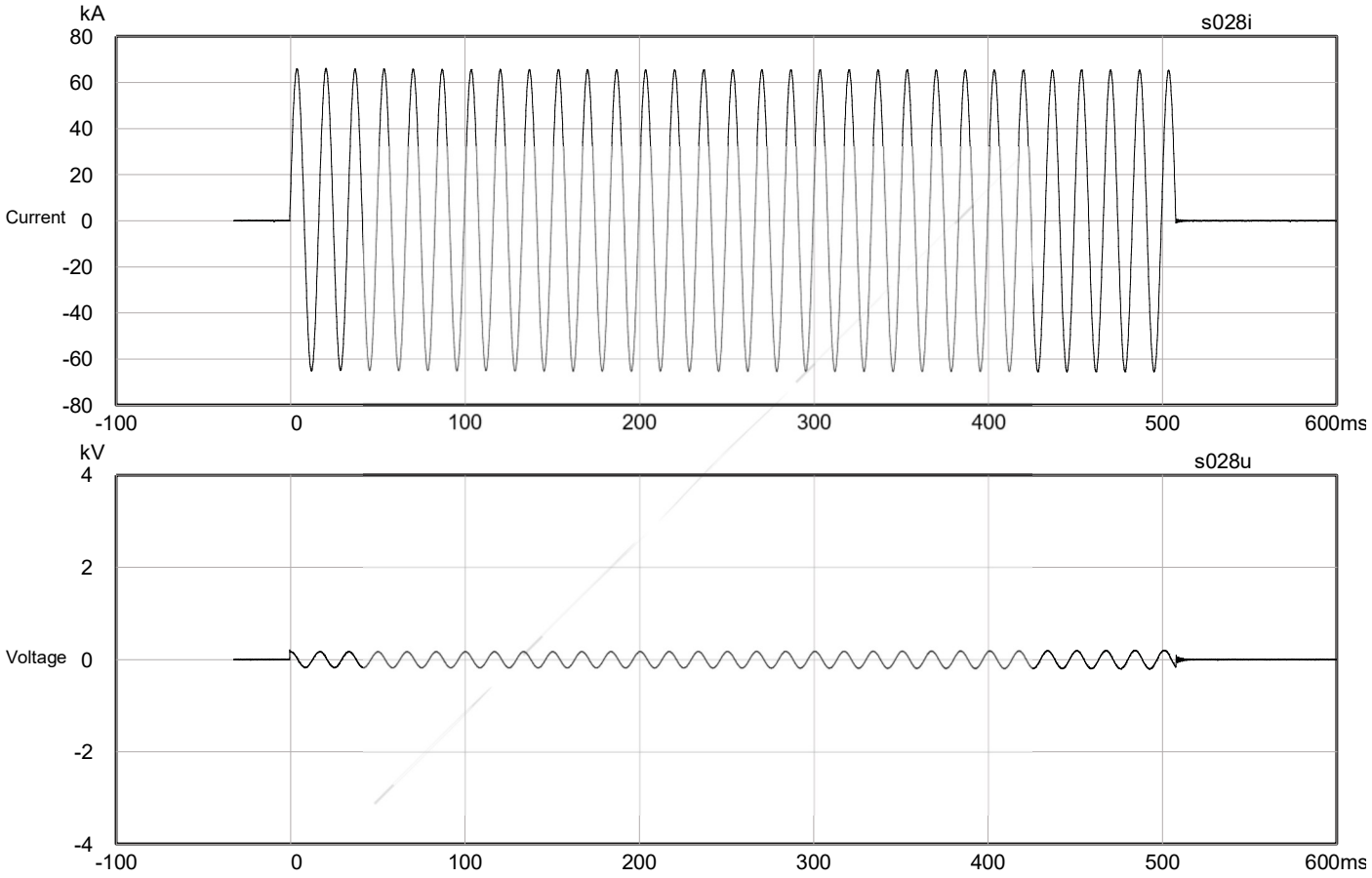

Figure 14: Waveforms for Test #10, Copperweld Scorpius 61 x 072 Sample 14.

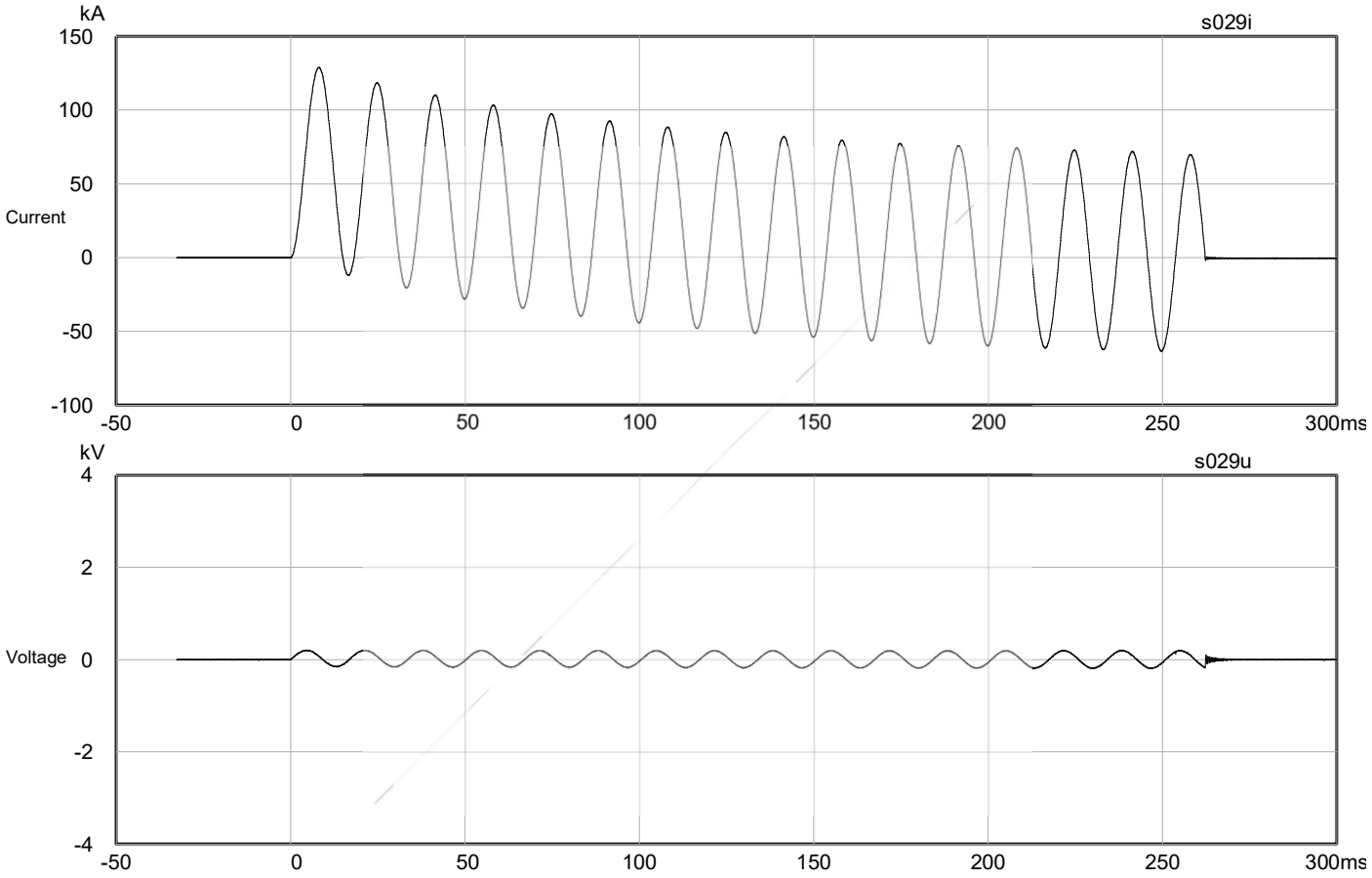

Figure 15: Waveforms for Test #11-1, Copperweld Scorpius 61 x 072 Sample 15.

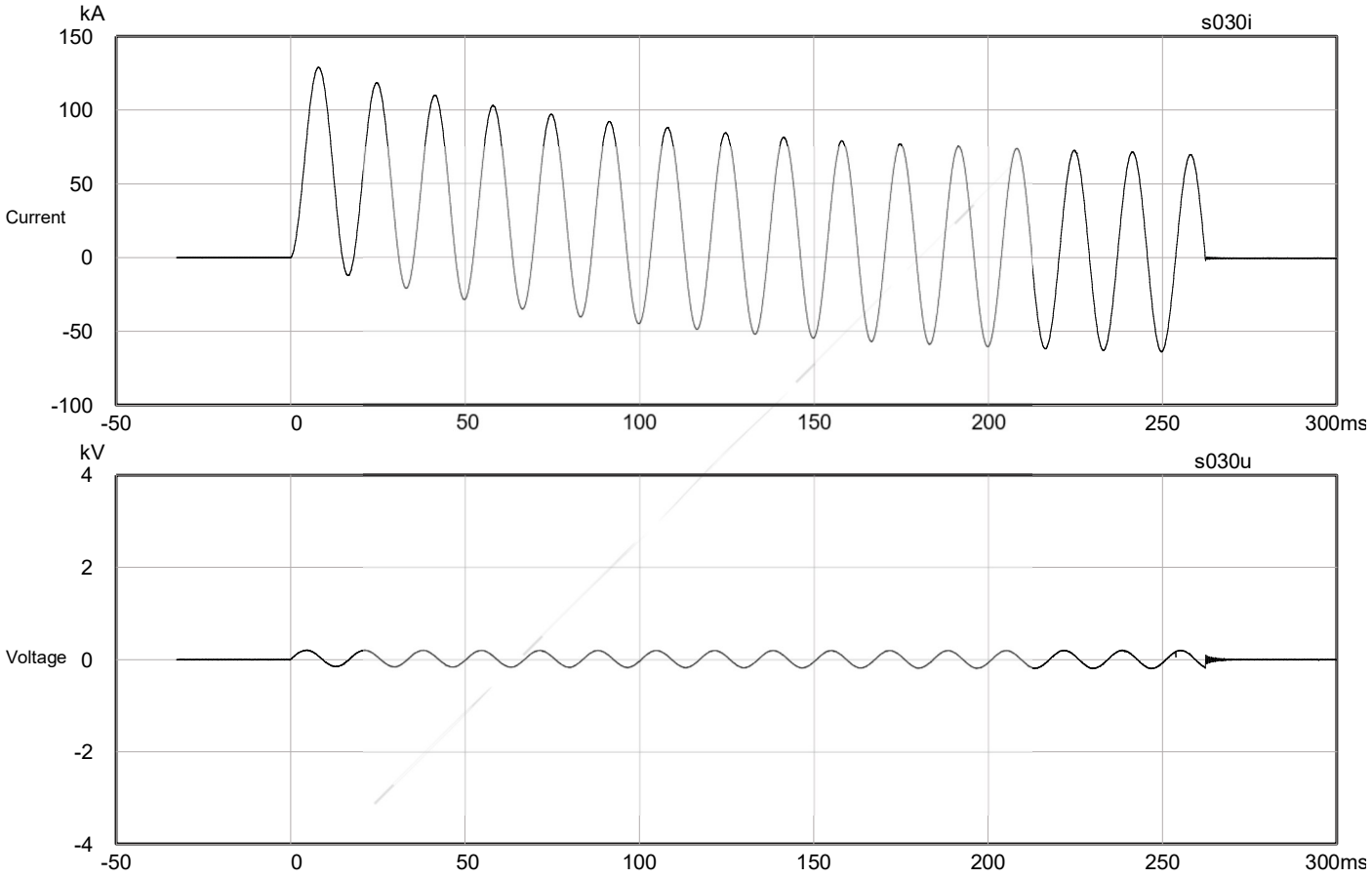

Figure 16: Waveforms for Test #11-2, Copperweld Scorpius 61 x 072 Sample 15.

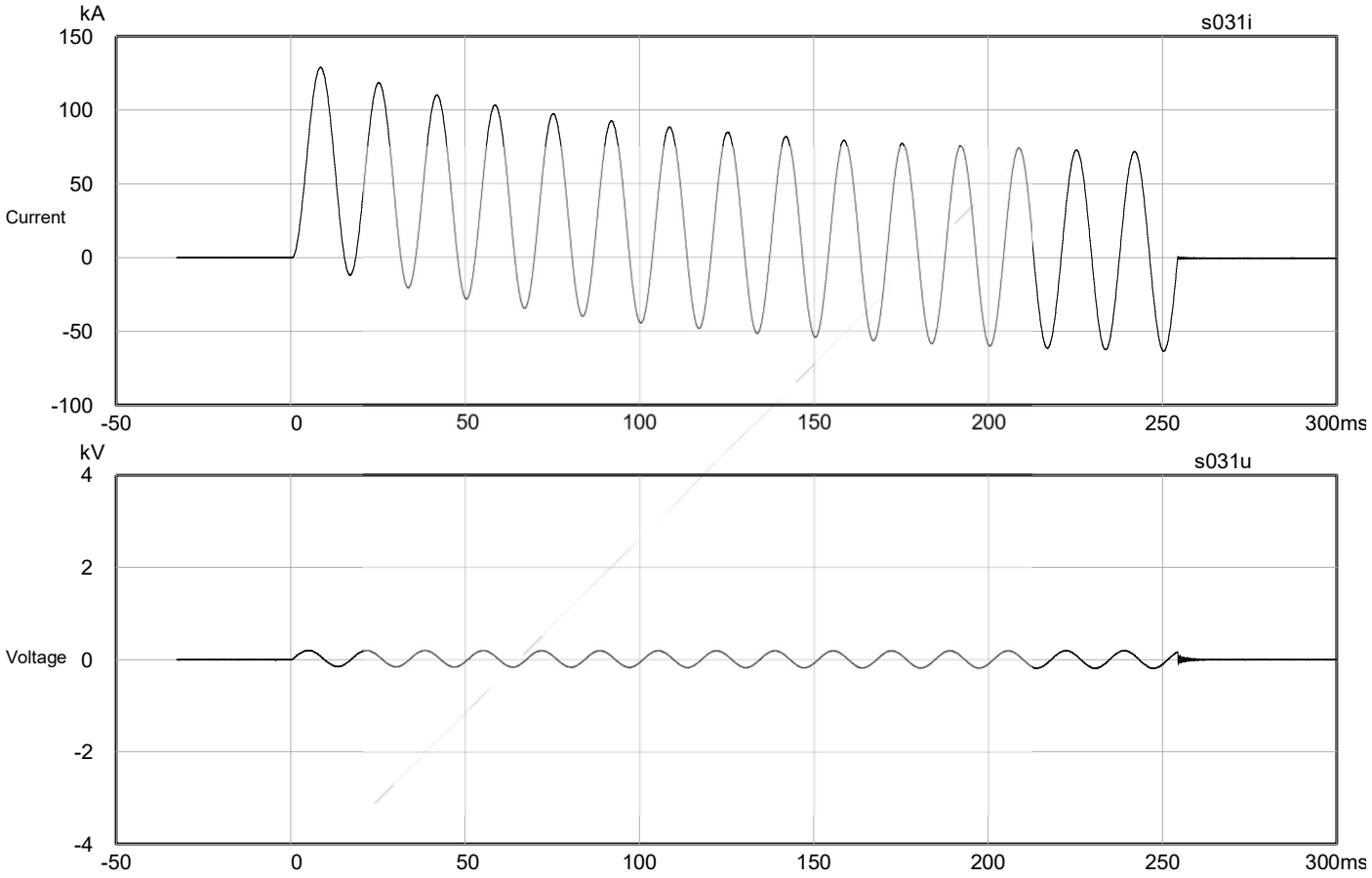

Figure 17: Waveforms for Test #12-1, Copperweld Scorpius 61 x 072 Sample 16.

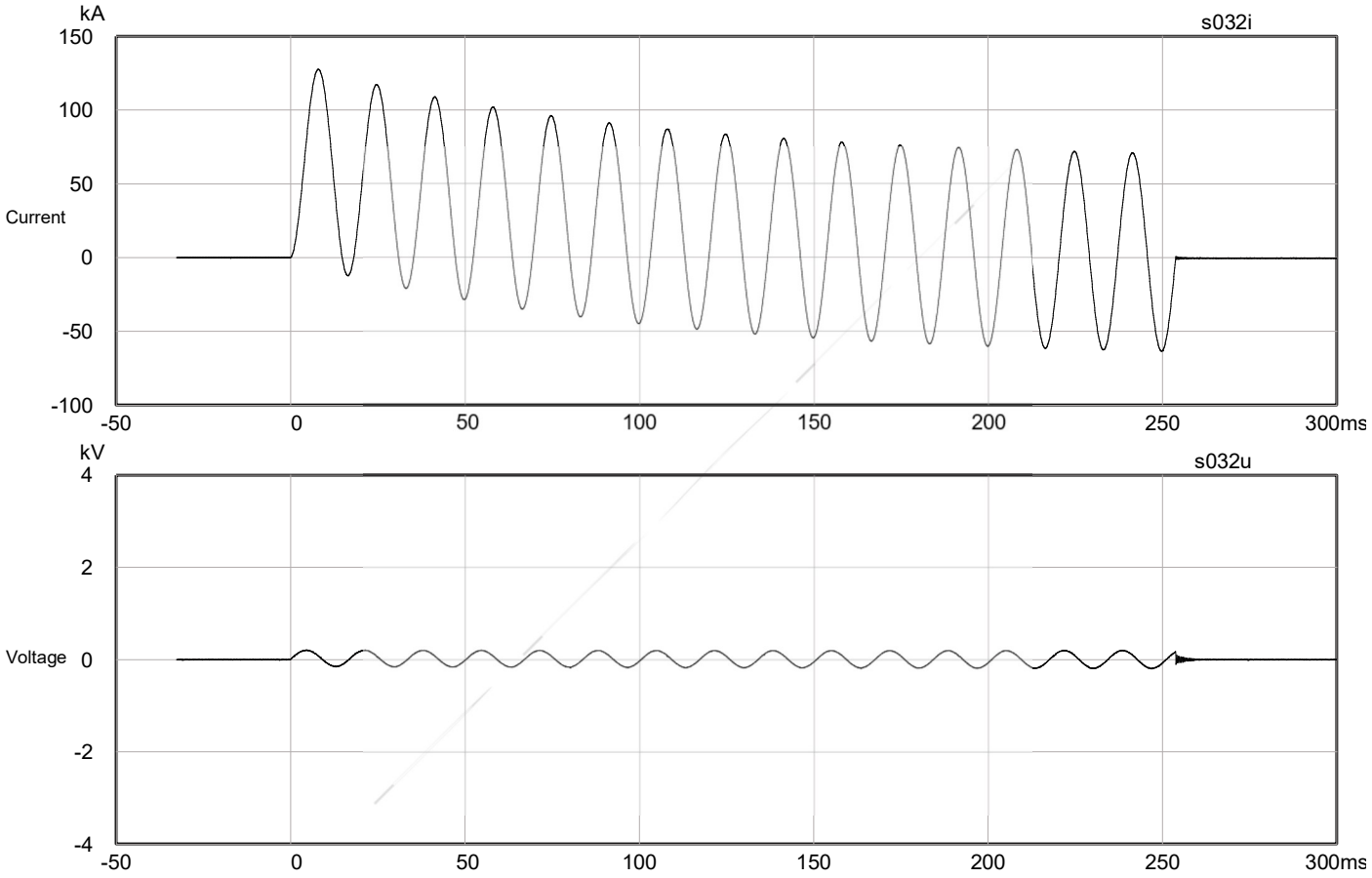

Figure 18: Waveforms for Test #12-2, Copperweld Scorpius 61 x 072 Sample 16.

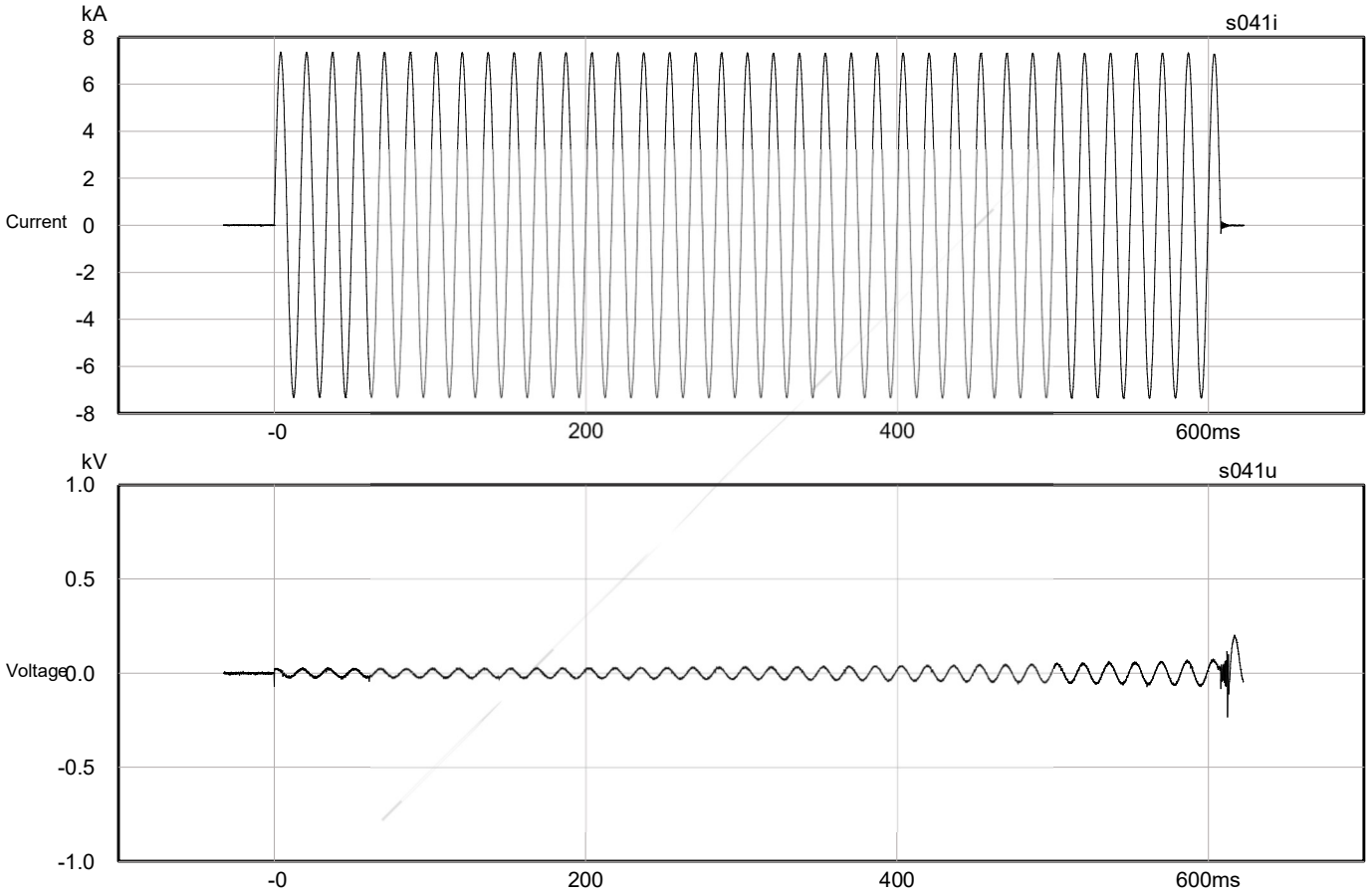

Figure 19: Waveforms for Test #13, Encore #6 AWG Sample 21.

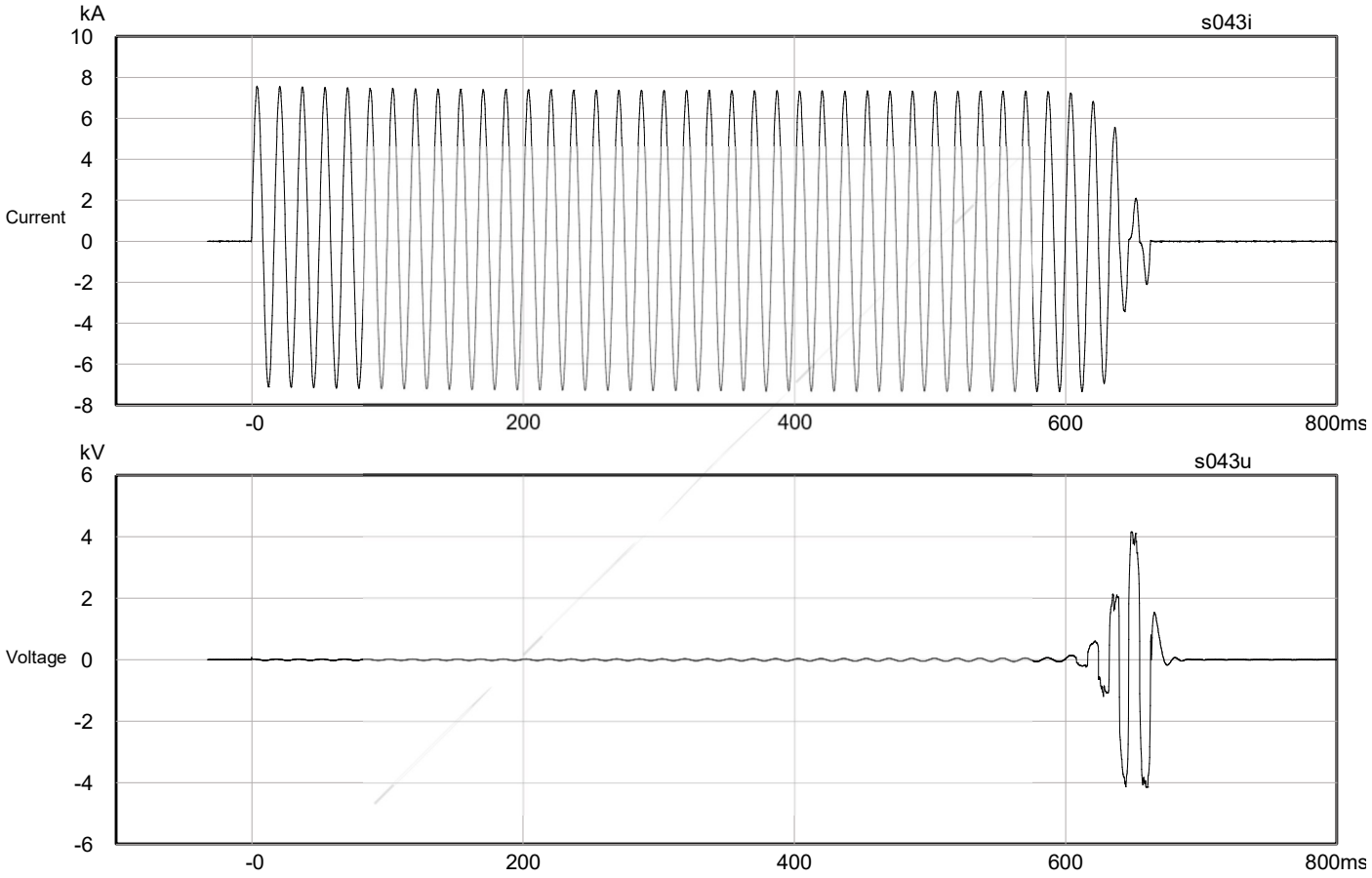

Figure 20: Waveforms for Test #14, Encore #6 AWG Sample 23.

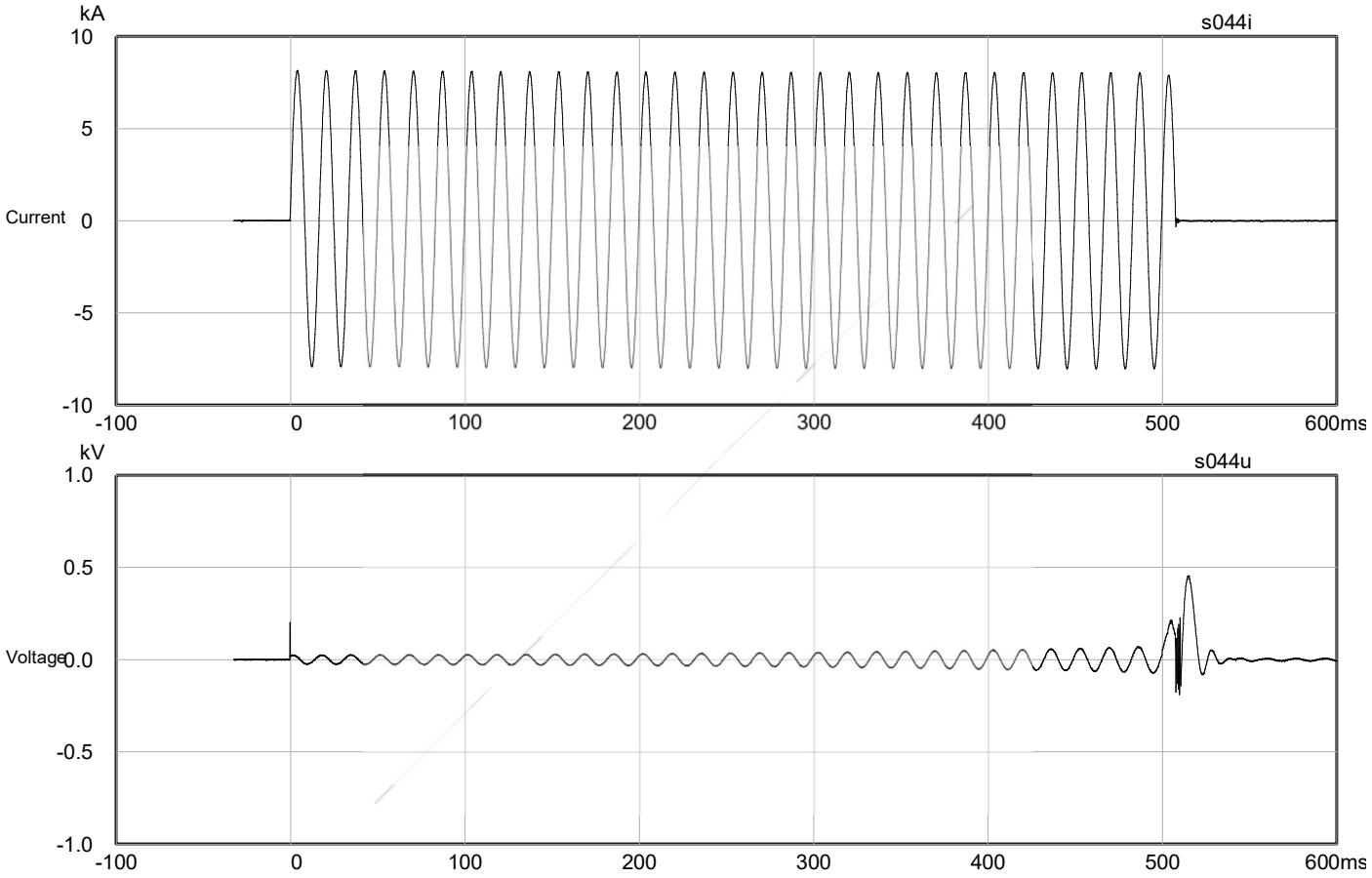

Figure 21: Waveforms for Test #15, Encore #6 AWG Sample 24.

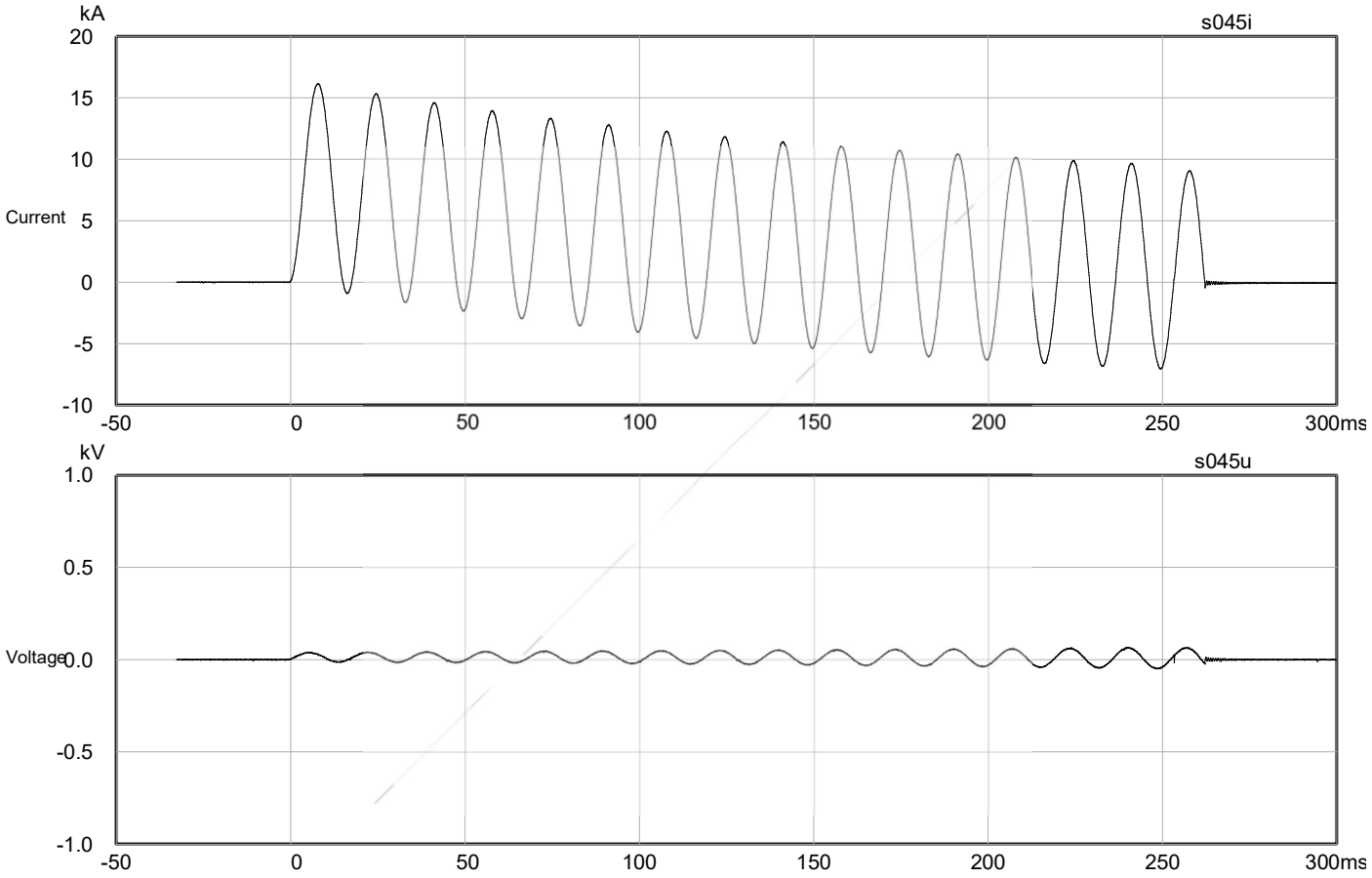

Figure 22: Waveforms for Test #16-1, Encore #6 AWG Sample 25.

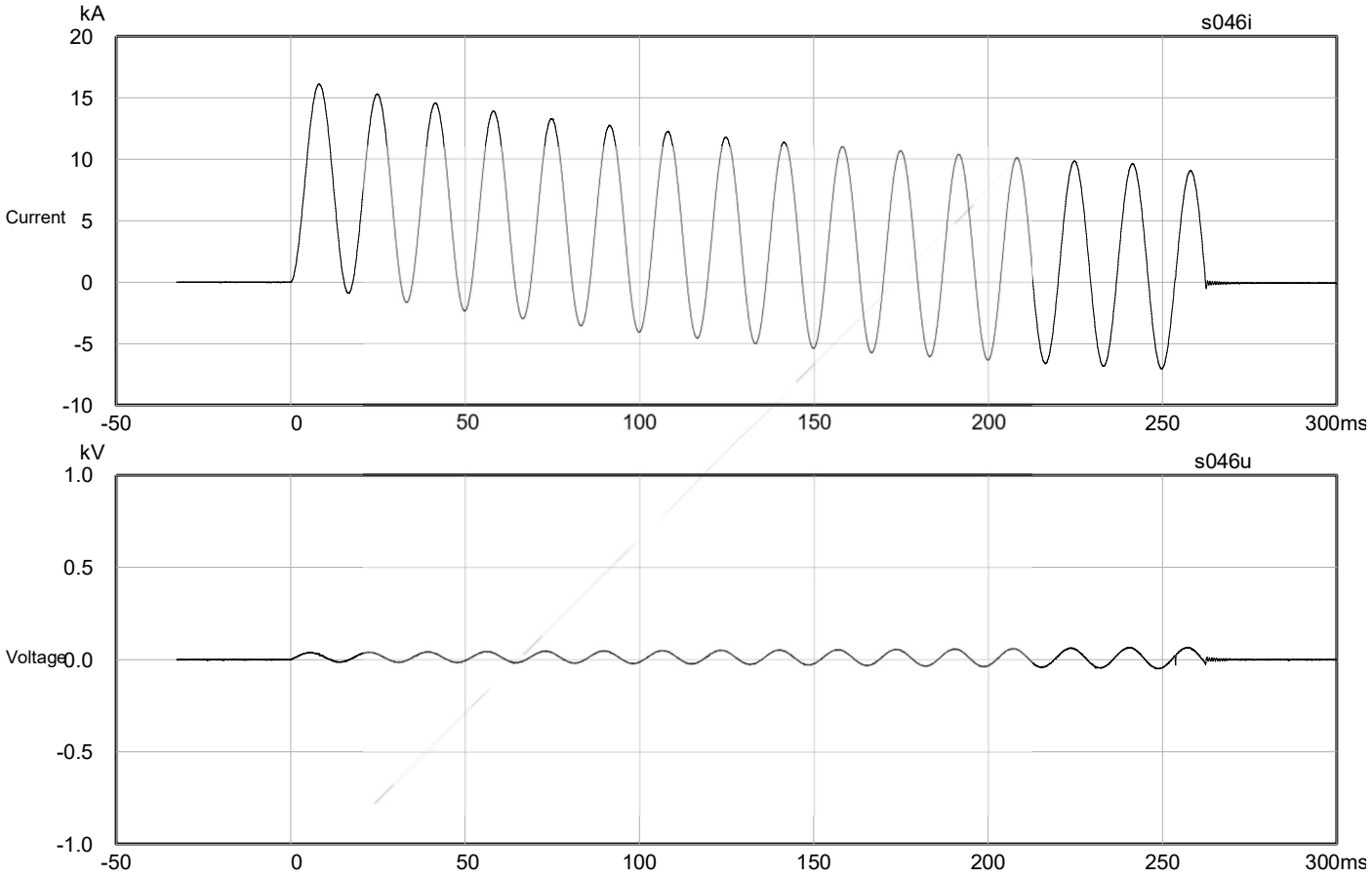

Figure 23: Waveforms for Test #16-2, Encore #6 AWG Sample 25.

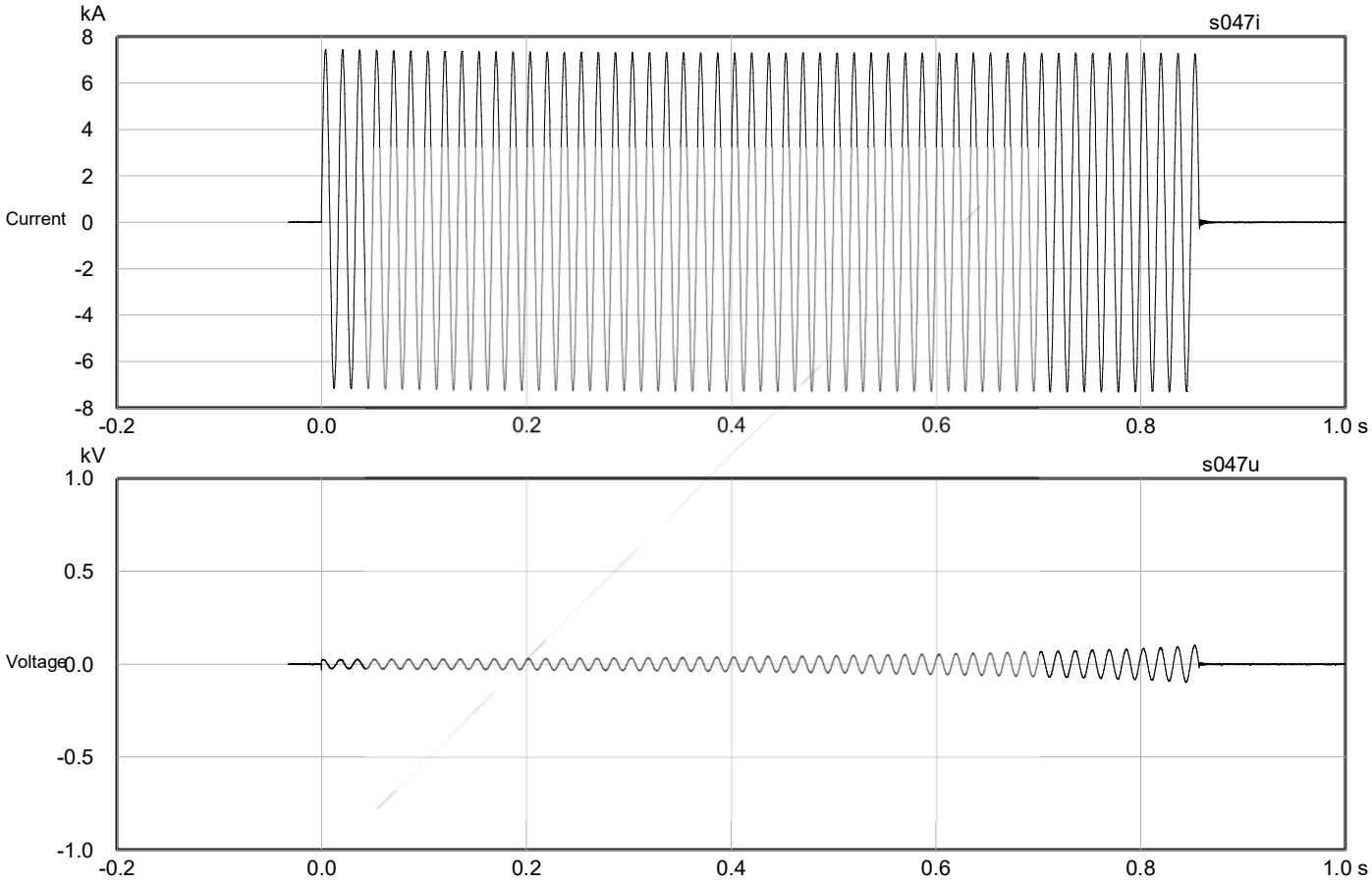

Figure 24: Waveforms for Test #17, Encore #6 AWG Sample 31.

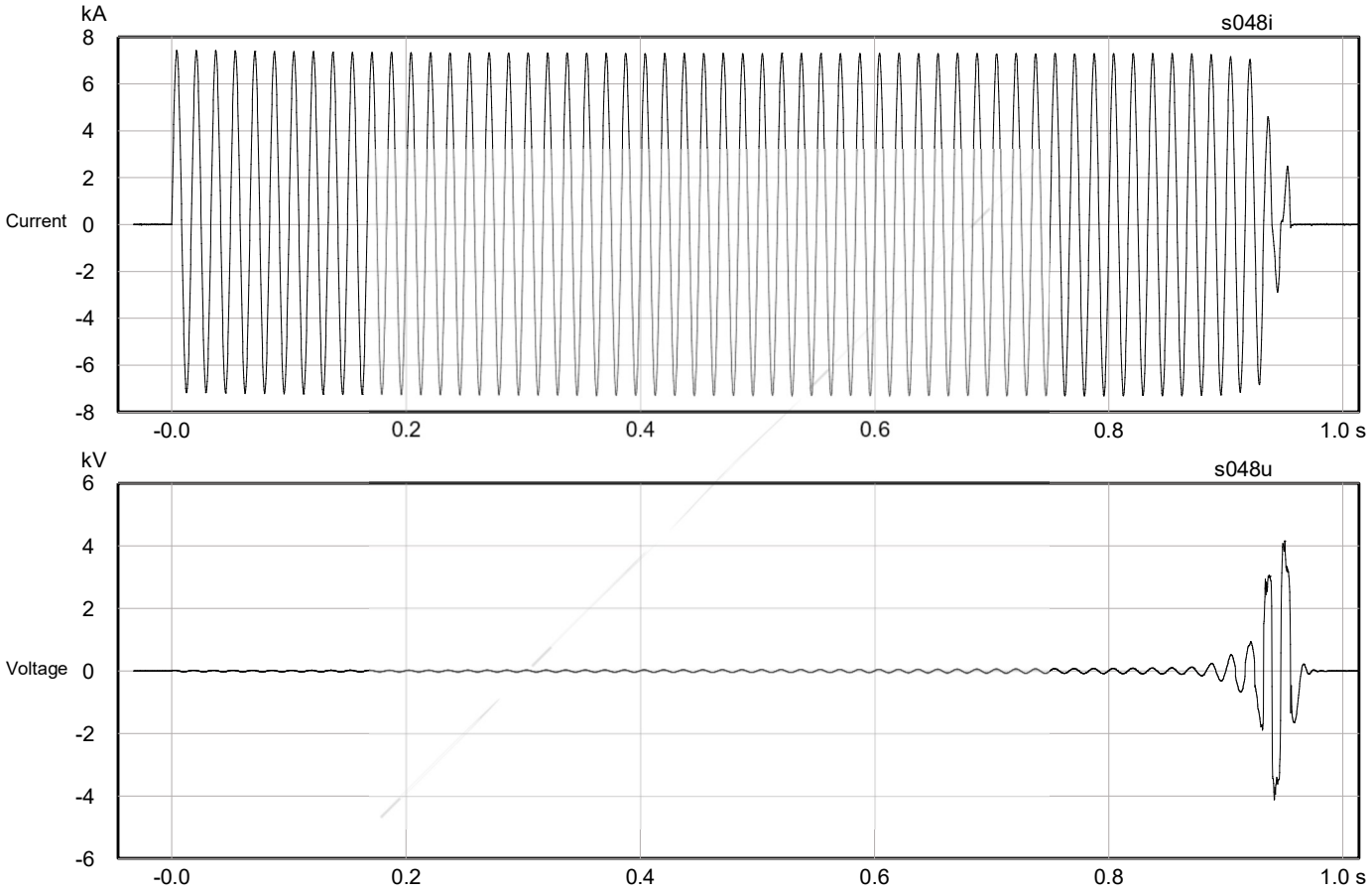

Figure 25: Waveforms for Test #18, Copperweld Scorpius 7 x 080 Sample 32.

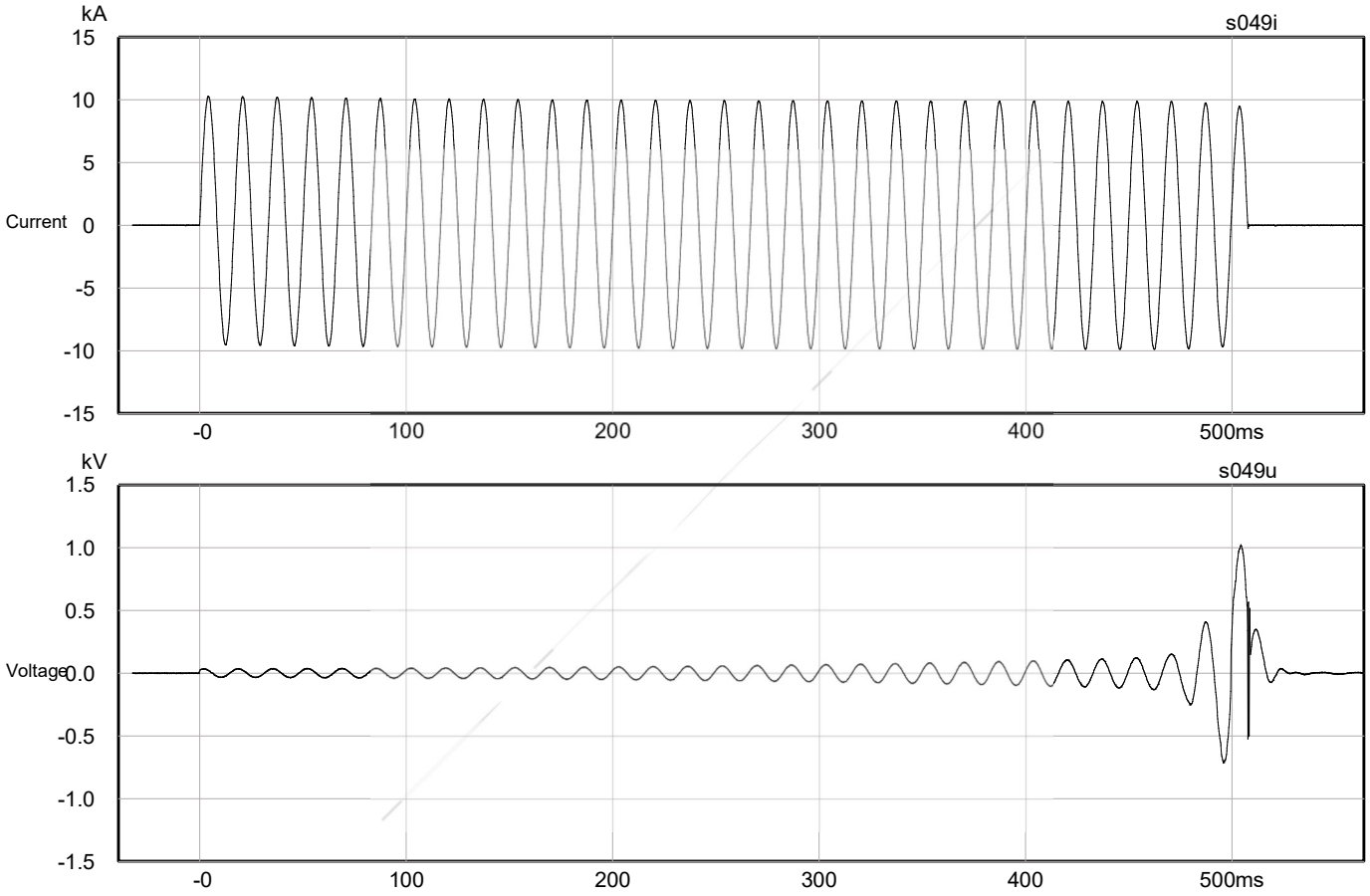

Figure 26: Waveforms for Test #19, Copperweld Scorpius 7 x 080 Sample 33.

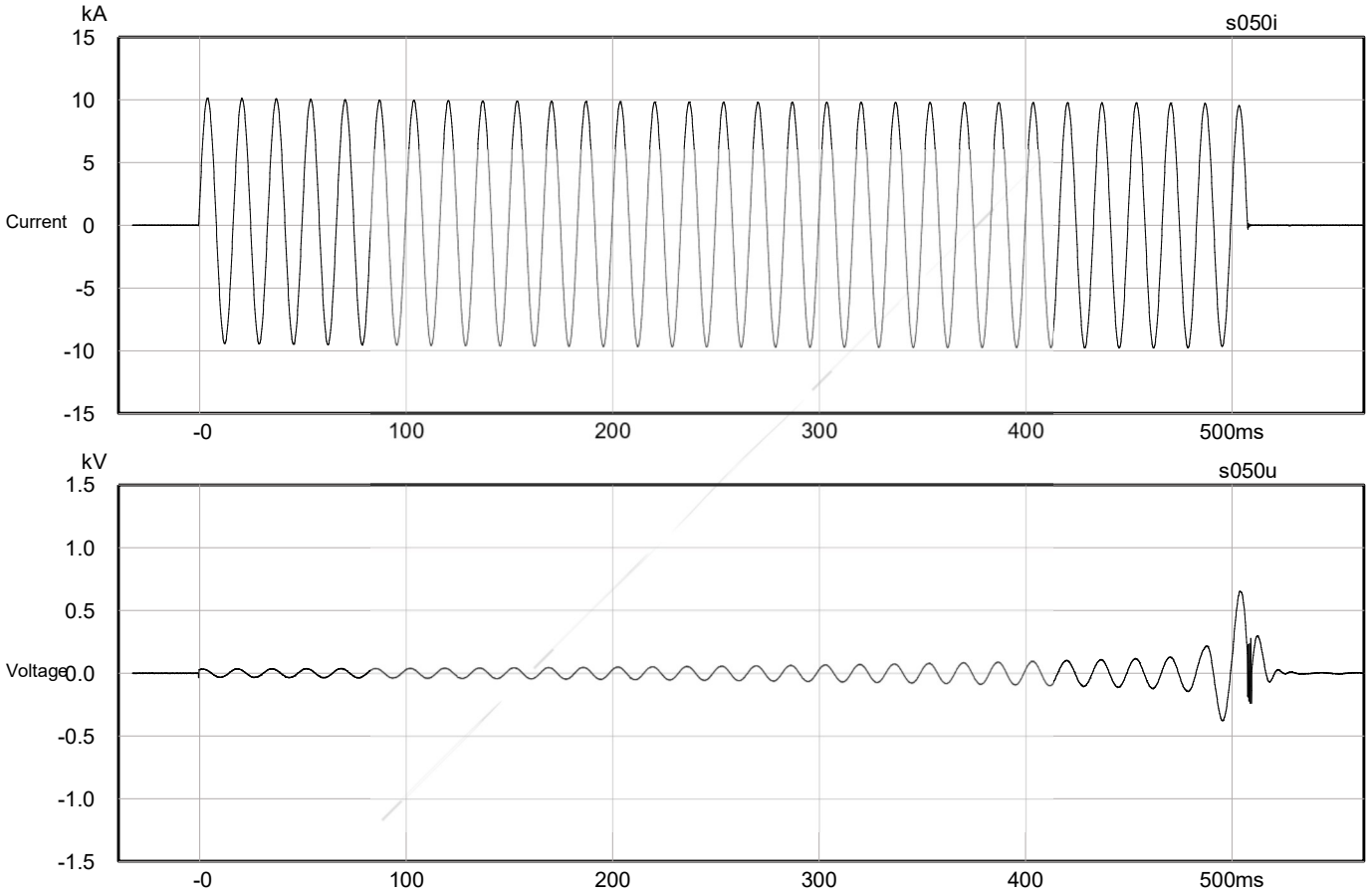

Figure 27: Waveforms for Test #20, Copperweld Scorpius 7 x 080 Sample 34.

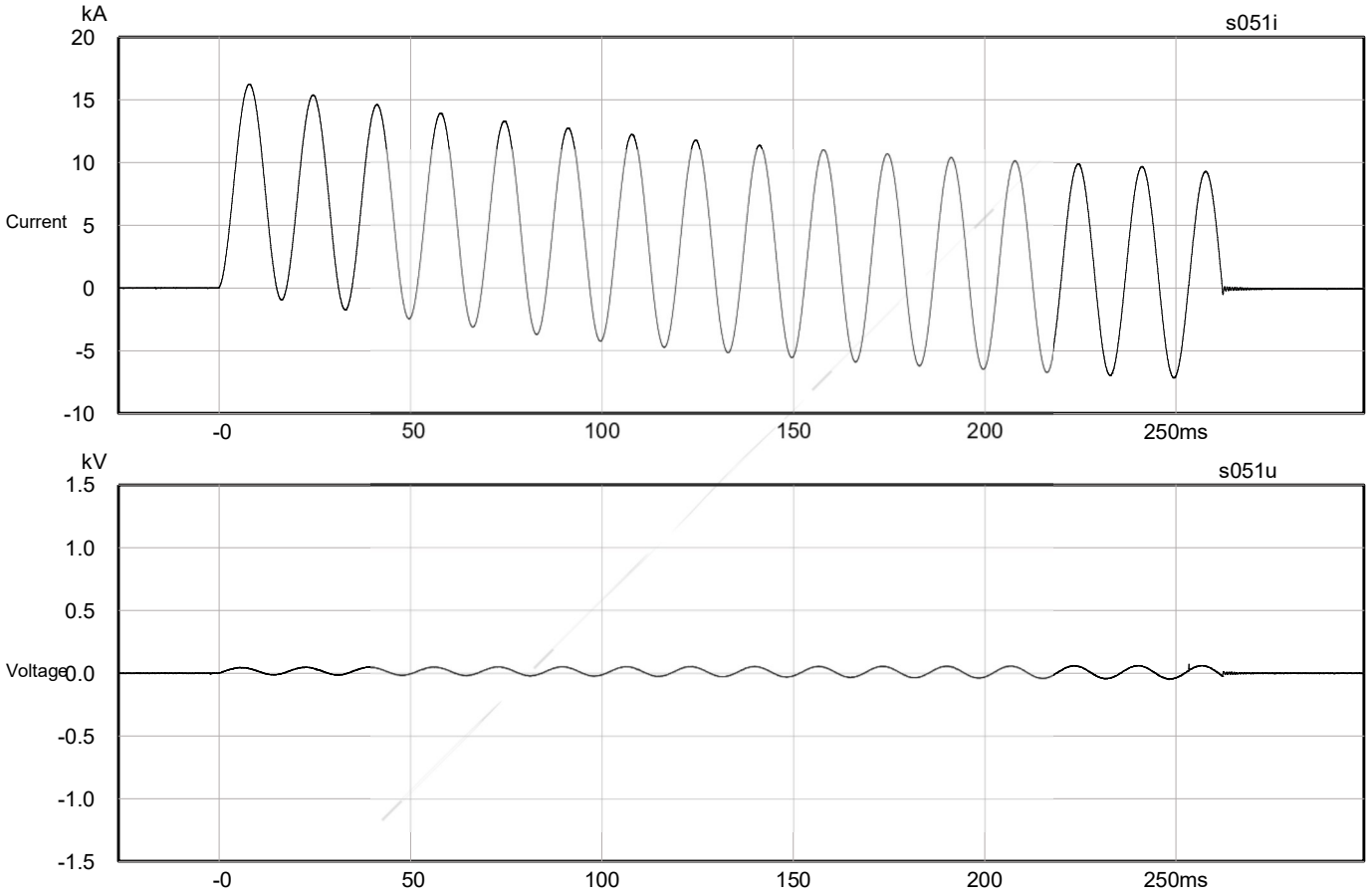

Figure 28: Waveforms for Test #21-1, Copperweld Scorpius 7 x 080 Sample 35.

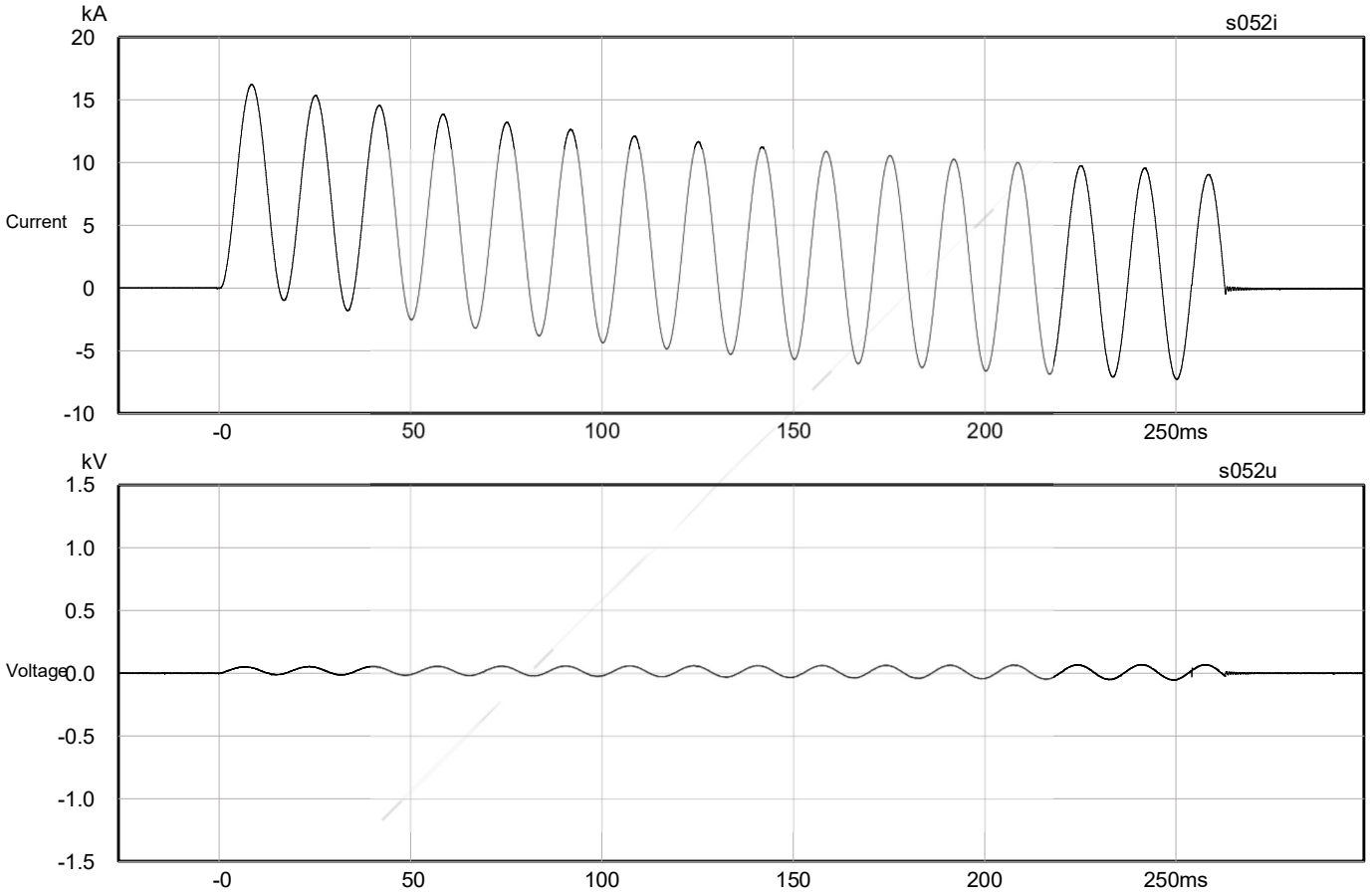

Figure 29: Waveforms for Test #21-2, Copperweld Scorpius 7 x 080 Sample 35.

APPENDIX C – PHOTOGRAPHS OF THE TEST OBJECTS

Figure 30: Test set up for the Encore 4/0 AWG Cu conductor. The power source bus is on the left and the ground bus is on the right.

Figure 31: Test set up for the Copperweld Scorpius 61 x 072 CCS conductor.

Figure 32: Test set up for the Encore #6 AWG Cu conductor.

Figure 33: Test set up for the Copperweld Scorpius 7 x 080 CCS conductor.

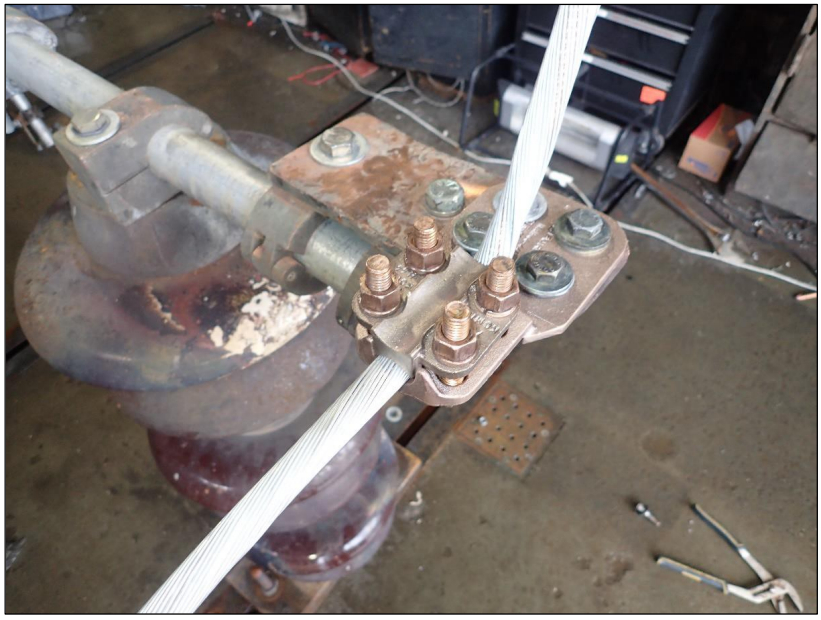

Figure 34: Typical Burndy terminal connector used to connect the Encore 4/0 AWG or Copperweld Scorpius 61 x 072 CCS conductors to the laboratory buses.

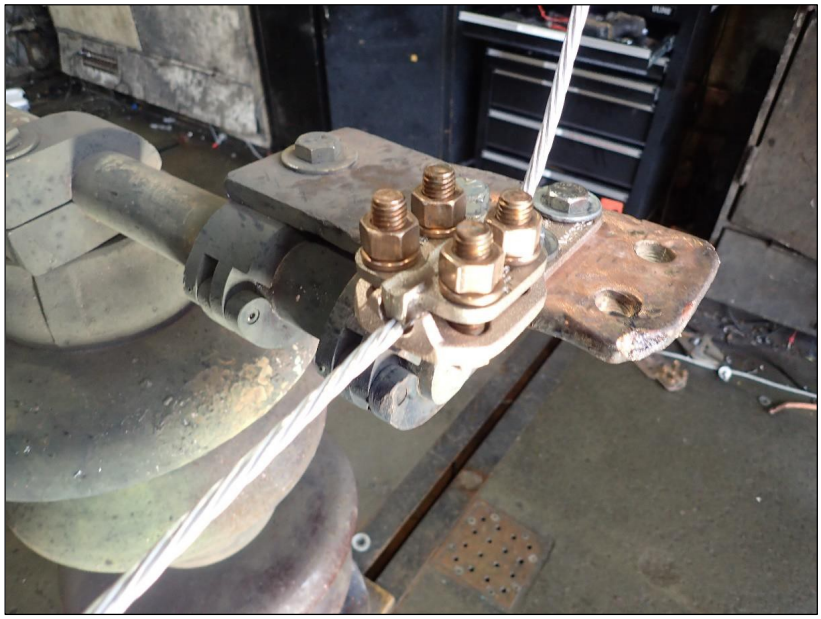

Figure 35: Typical Burndy terminal connector used to connect the Encore #6 AWG or Copperweld Scorpius 7 x 080 CCS conductors to the laboratory buses.

APPENDIX D – CALCUATIONS OF TEST CURRENT LEVELS FOR #6 AWG CU CONDUCTOR

Equation (45) in IEEE 80 and Equation (C.1) in IEEE 837 are the same, as follows:

$$I = A\sqrt{\left(\frac{TCAP\times10^{-4}}{t_c\times\alpha_r\times\rho_r}\right)\ln\left(\frac{K_0+T_m}{K_0+T_a}\right)}$$

where

I is root mean square (rms) current in kA
A is conductor cross section in mm^2
T_m is maximum allowable temperature in °C
T_a is initial conductor temperature in °C
T_r is reference temperature for material constants in °C
α_0 is thermal coefficient of resistivity at 0 °C
α_r is thermal coefficient of resistivity at reference temperature T_r
ρ_r is resistivity of the ground conductor at reference temperature T_r in μΩ-cm
K_0 is $1/\alpha_0$, or $(1/\alpha_r)–T_r$ in °C
t_c is time of current flow in seconds (s)
TCAP is thermal capacity factor in joules/cm^3°C

This equation is used to calculate the short-circuit ampacity of a conductor based on it's material constants.

For IEEE 80, Table 6, the symmetrical rms fusing current for #6 AWG soft-drawn Cu conductor at 500 ms duration is determined to be:

$$I_{sym} = (13.3)\sqrt{\frac{(3.4x10^{-4})}{(0.5)(0.00393)(1.72)}\cdot\ln\left(\frac{(234+1083)}{(234+40)}\right)} = \boxed{5.29\ kA_{rms}}$$

For IEEE 837, Table 3, the symmetrical rms fusing current for #6 AWG hard-drawn Cu conductor at 250 ms duration is determined to be:

$$I_{sym} = (13.3)\sqrt{\frac{(3.4x10^{-4})}{(0.25)(0.00381)(1.78)}\cdot\ln\left(\frac{(242+1084)}{(242+40)}\right)} = 7.41\ kA_{rms}$$

From IEEE 837 Equation (C.4), the asymmetrical rms fusing current is:

$$I_{asym} = \frac{(7.41\ kA)}{(1.148)} = 6.45\ kA_{rms}$$

For the EMF described in IEEE 837, Clause 7.2, a value of 90% of the fusing current is used for conductors up to 4/0 AWG:

$$I_{EMF} = (6.45)(0.9) = \boxed{5.81\ kA_{rms}}$$

Copperweld Bimetallics
Electrical Test Laboratory

Data Sheet Packet

Customer:	Copperweld Building Wire	Engineer:	Bill Lewey	Date:	8/25/2020
Sample ID:	EL-13	Tested By:	Bill Lewey, Mike Rozar	Date:	8/25/2020
Product:	Grade 40 Copper Clad Steel Wire Solid Bare #4 and #6 vs Equivalent Solid Copper: Grounding Electrode Conductor Equivalency Test	Sample Condition:	New		
Standard:	ASTM B910/910M Annealed Copper Clad Steel Wire				
Insulation: N/A - Bare		Jacket: N/A - Bare			

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Test Report Summary

Page	Test Performed	Date Completed	Pass/Fail
1	Grounding Electrode Conductor Test for Copper Clad Steel Grade 40	8/25/2020	**Pass**

Requirement:
#4 AWG Grade 40 Copper Clad Steel and #6 AWG Copper Clad Steel when compared to #4 solid copper and #6 solid copper for use as a grounding electrode conductor shall have equal ability to carry amperage during a ground fault condition.

Conclusion:
The ability of bare #4 AWG Copper Clad Steel Grade 40 and bare #6 AWG Copper Clad Steel Grade 40 performed equally to #4 AWG bare solid copper and #6 AWG bare solid copper when used as a grounding electrode conductor under a ground fault condition. The current measured proved equivalency.

Test Equipment Used

Item	Equipment Type	Equipment #	Cal. Due Date
1	Fluke 374FC Clamp Meter	AM-1	Nov 2020
2	Acme Electric 15KVA Transformer	T2535173S	N/A
3	Square D 60A / 600V Safety Interrupter	N/A	N/A
4	Eaton Service Panel	N/A	N/A
5	Eaton Type CH 20 Amp Breaker	N/A	N/A
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

VBU – Verify Before Use

N/A – Not Applicable

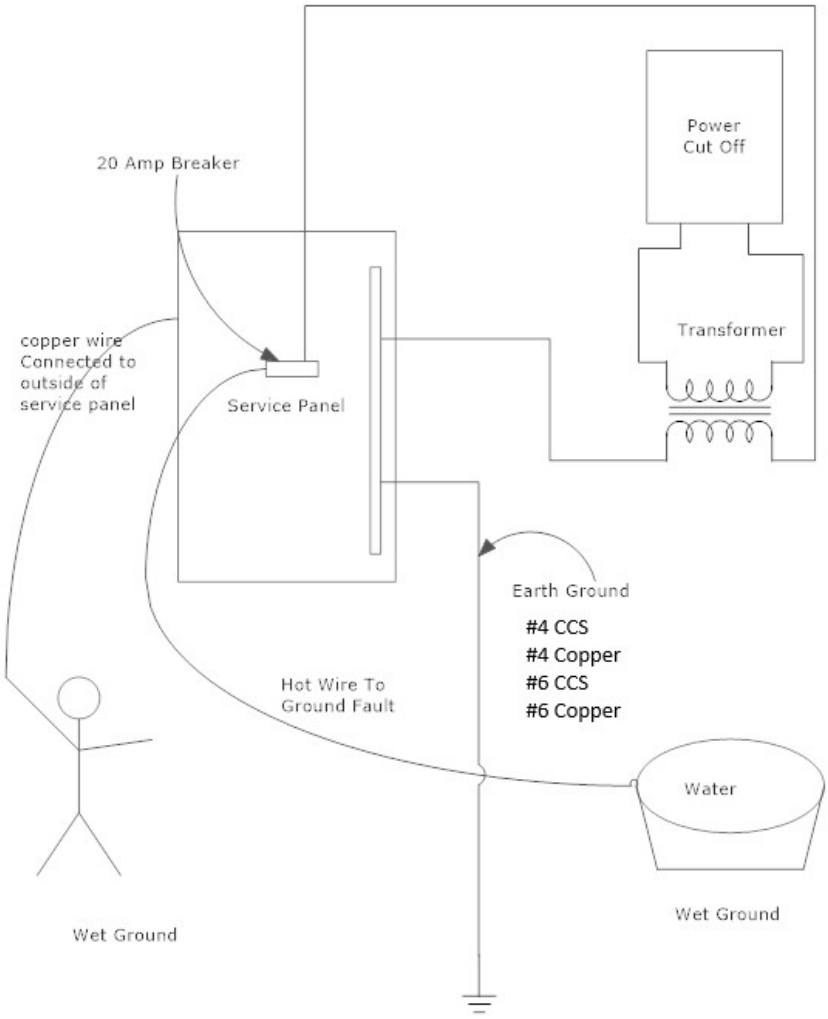
Sample Identification

Item	Description	Length/No. Rec'd
A	#4 AWG 40% Copper Clad Steel Bare	35 Ft
B	#4 AWG Solid Copper Bare	35 Ft
C	#6 AWG 40% Copper Clad Steel Bare	35 Ft
D	#6 AWG Solid Copper Bare	35 Ft
E		
F		

Grounding Electrode Conductor Test

Test Parameters:	
Conditioning:	No preconditioning.
Test Conductors:	1 each of #4 AWG/Grade 40 CCS Solid Bare grounding electrode conductor 1 each of #6 AWG/Grade 40 CCS Solid Bare grounding electrode conductor 1 each of #4 AWG Solid Bare copper grounding electrode conductor 1 each of #6 AWG Solid Bare copper grounding electrode conductor
Test Conductor Length:	Each conductor shall be 35 ft.
Test Circuit Configuration:	See schematic shown in Figure 1
Test Current:	Test current from 120 V / 20 A Residential Circuit
Method:	Testing was completed by creating a standard residential test circuit at 120V with 20A breaker wired to an intentional ground fault as shown in figure 1. The ground fault was created by connecting a hot wire from the breaker to a galvanized steel pan full of water and placing the pan on the wet ground. A conductor was also connected to the outside of the electrical panel and a Copper Plated Grounding Electrode (Copperweld Ground Rod) driven 6 inches into the wet ground to determine amount of current going through a grounded person touching the electrical panel during the ground fault condition. The ground fault and the grounded "man" were positioned 20 feet either side of the ground rod. The entire test area was soaked with water overnight using a sprinkler system When the ground fault was electrified, current measurements were taken from the ground fault conductor, the grounding electrode conductor and the grounded "man" conductor. For the four grounding electrode conductors tested, there was one test sequence for each. The current was measured for each. The objective: Compare the amperage measurements of the copper clad steel grounding electrode conductors to those of copper.

Figure 1



Results:			
Ground Conductor	**Fault Conductor Current**	**Current of the Grounding Electrode Conductor**	**Grounded Man Conductor Current**
#4 Copper	2.1 A	1.8 A	0.3 A
#4 40% CCS	2.1 A	1.8A	0.3 A
#6 Copper	1.7 A	1.6 A	0.1 A
#6 40% CCS	1.5 A	1.4 A	0.1 A

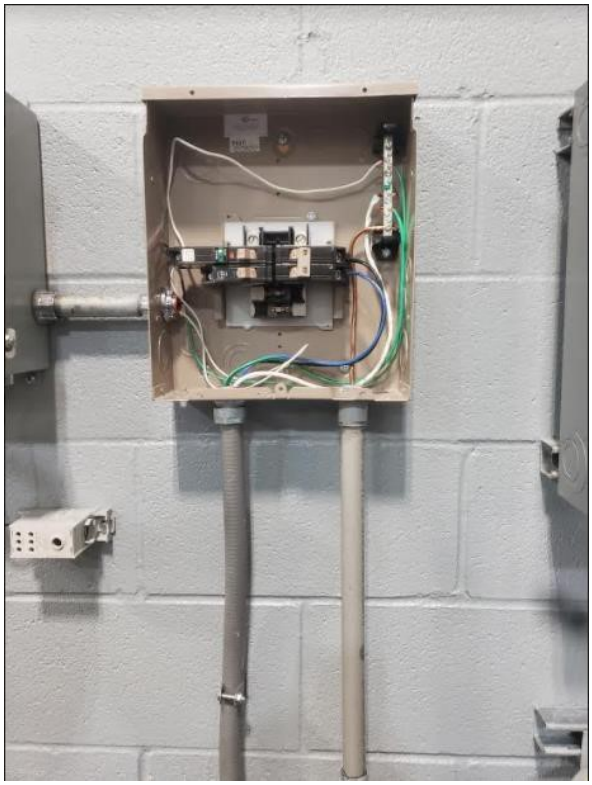
Requirement:
For equivalent sizes of Grade 40 Copper Clad steel vs. solid copper grounding conductors, the ability to carry amperage to ground during a ground fault condition is equal.

Comments:
____X__ (Pass) The product complies with all applicable requirements of this test. _____ (Fail) The product does not comply with the requirements of this test. **Test Date: 8/25/2020** **Tested By: Bill Lewey**

Environmental Conditions during Testing:

Humidity: % rh __74%_____ Ambient: °C___28_____

Test setup for the electrical service panel



Ground Rod with Grounding Conductor Attached

Ground Fault

Grounded “man”

Public Input No. 3048-NFPA 70-2020 [Section No. 550.25]

~~**(B)** Mobile Homes and Manufactured Homes.~~

550.25 Arc-Fault Circuit-Interrupter Protection.

~~**(A)** Definition.~~

~~Arc-fault circuit interrupters are defined in Article 100.~~

All 120-volt

~~branch circuits that supply~~

, single-phase, 15- and 20-ampere branch circuits supplying outlets or devices installed in mobile homes and manufactured homes shall comply with 210.12 .

Statement of Problem and Substantiation for Public Input

The proposed revisions to this section adds clarity and conciseness. A pointer to the Article 100 definition of “AFCI” is not necessary so is deleted. The requirements in 550.25(B) is relocated to the main section and has been revised to correlate with the language used in 210.12,

Submitter Information Verification

Submitter Full Name: Megan Hayes
Organization: Nema
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 04 10:53:22 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7797-NFPA 70-2020
Statement: CMP-7 deletes the list items in 550.25 and the language pointer to definitions in Article 100.

Public Input No. 1593-NFPA 70-2020 [Section No. 550.32]

550.32 Service Equipment and Feeder Disconnect .

(A) Mobile Home Service Equipment.

The mobile home service equipment or feeder disconnect shall be located adjacent to the mobile home and not mounted in or on the mobile home. The service equipment or feeder disconnect shall be located in sight from and not more than 9.0 m (30 ft) from the exterior wall of the mobile home it serves. The service equipment or feeder disconnect shall be permitted to be located elsewhere on the premises, if a disconnecting means suitable for use as service equipment is located within sight from and not more than 9.0 m (30 ft) from the exterior wall of the mobile home it serves and is rated not less than that required for service equipment in accordance with 550.32(C). Grounding at the disconnecting means shall be in accordance with 250.32.

(B) Manufactured Home Service Equipment or Feeder Disconnect .

The manufactured home service equipment or feeder disconnect shall be permitted to be installed in or on a manufactured home, provided that all of the following conditions are met:

(1) The manufacturer shall include in its written installation instructions information indicating that the home shall be secured in place by an anchoring system or installed on and secured to a permanent foundation.

(2) The installation of the service shall comply with Part I through Part VII of Article 230 and the feeder in accordance with Article 225 .

(3) Means shall be provided for the connection of a grounding electrode conductor to the service equipment or feeder disconnect and routing it outside the structure.

(4) Bonding and grounding of the service or feeder disconnect shall be in accordance with Part I through Part V of Article 250.

(5) The manufacturer shall include in its written installation instructions one method of grounding the service equipment or feeder disconnect at the installation site. The instructions shall clearly state that other methods of grounding are found in Article 250.

(6) The minimum size grounding electrode conductor shall be specified in the instructions.

(7) A warning label shall be mounted on or adjacent to the service equipment or feeder disconnect . The label shall meet the requirements in 110.21(B) and shall state the following:

WARNING

DO NOT PROVIDE ELECTRICAL POWER

UNTIL THE GROUNDING ELECTRODE(S)

IS INSTALLED AND CONNECTED

(SEE INSTALLATION INSTRUCTIONS).

Where the service equipment or feeder disconnect is not installed in or on the unit, the installation shall comply with the other requirements of this section.

(C) Rating.

Mobile home service equipment or feeder disconnect shall be rated at not less than 100 amperes at 120/240 volts, and provisions shall be made for connecting a mobile home feeder assembly by a permanent wiring method. Power outlets used as mobile home service equipment or disconnect shall also be permitted to contain receptacles rated up to 50 amperes with appropriate overcurrent protection. Fifty-ampere receptacles shall conform to the configuration shown in Figure 550.10(C).

Informational Note: Complete details of the 50-ampere plug and receptacle configuration can be found in ANSI/NEMA WD 6-2016, *Wiring Devices — Dimensional Specifications*, Figure 14-50.

(D) Additional Outside Electrical Equipment.

Means for connecting a mobile home accessory building or structure or additional electrical equipment located outside a mobile home by a fixed wiring method shall be provided in either the mobile home service equipment or the local external disconnecting means permitted in 550.32(A).

(E) Additional Receptacles.

Receptacles located outside a mobile or manufactured home shall be provided with ground-fault circuit-interrupter protection as specified by 210.8(A). Where receptacles provide power to a mobile or manufactured home in accordance with 550.10, ground-fault circuit-interrupter protection shall not be required.

(F) Mounting Height.

Outdoor mobile home disconnecting means shall be installed so the bottom of the enclosure containing the disconnecting means is not less than 600 mm (2 ft) above finished grade or working platform. The disconnecting means shall be installed so that the center of the grip of the operating handle, when in the highest position, is not more than 2.0 m (6 ft 7 in.) above the finished grade or working platform.

(G) Marking.

Where a 125/250-volt receptacle is used in mobile home service equipment or disconnect , the service equipment or disconnect shall be marked as follows:

TURN DISCONNECTING SWITCH OR

CIRCUIT BREAKER OFF BEFORE INSERTING

OR REMOVING PLUG. PLUG MUST BE FULLY

INSERTED OR REMOVED.

The marking shall be located on the service equipment or disconnect adjacent to the receptacle outlet.

Statement of Problem and Substantiation for Public Input

Adding the words 'or feeder disconnect' provides guidance to the Code user on installations where the disconnect is not part of service equipment.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jun 22 18:43:13 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: 550.32(A) refers to service equipment used for supplying a mobile home. 550.32(B) refers to service equipment used for supplying a manufactured home. Feeder requirements are addressed in 550.33.

Public Input No. 1143-NFPA 70-2020 [Section No. 550.32(A)]

(A) Mobile Home Service Equipment.

The mobile home service equipment shall be located adjacent to the mobile home and not mounted in or on the mobile home. The service equipment shall be located in sight from and not more than 9.0 m (30 ft) from the exterior wall of the mobile home it serves. The service equipment shall be permitted to be located elsewhere on the premises, if a disconnecting means suitable for use as service equipment is located within sight from and not more than 9.0 m (30 ft) from the exterior wall of the mobile home it serves and is rated not less than that required for service equipment in accordance with 550.32(C). Grounding at ~~the disconnecting~~ this feeder disconnecting means shall be in accordance with 250.32. Grounding at the mobile home served shall be in accordance with 250.32.

Statement of Problem and Substantiation for Public Input

Both 250.32(A) and (B) refer to 'homes'. The homes themselves are never referred to as 'equipment'. The 2017 NEC offered us new definitions for building and structure making it clear 'equipment' shouldn't be confused with 'building' or 'structure'. The NEC defines a mobile home as a 'structure' in 550.2 (This is a critical point!). This would mandate establishing a grounding electrode system at a mobile home structure in addition to the already required service grounding electrode system (or added disconnecting means) which is detached but within 30' of the mobile home. The mobile home will likely get two ground rods to create the separate structure grounding electrode system.

Mobile home structures have lots of metal and they are dwellings. It would be prudent to route some ground fault currents occurring at the mobile home and indirect lightning static discharges through the now mandatory mobile home grounding electrode system rather than fully through the equipment grounding conductor from the disconnecting means located up to 30' away.

Submitter Information Verification

Submitter Full Name: Norman Feck
Organization: State of Colorado
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City:
State:
Zip:
Submittal Date: Mon May 18 18:21:26 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: Ground currents to the metal skin of a mobile home could have adverse effects during a ground fault or short circuit. Lightning protection would be addressed by NFPA 780 and UL 96A. A mobile home is considered a building structure and, per 550.16, the metal is already required to be bonded.

Public Input No. 2630-NFPA 70-2020 [Section No. 550.32(A)]

(A) Mobile Home Service Equipment.

The mobile home service equipment shall be located adjacent to the mobile home and not mounted in or on the mobile home. The service equipment shall be located in sight from ~~and not more than 9.0 m (30 ft) from~~ the exterior wall of the mobile home it serves. The service equipment shall be permitted to be located elsewhere on the premises, if a disconnecting means suitable for use as service equipment is located within sight from ~~and not more than 9.0 m (30 ft) from~~ the exterior wall of the mobile home it serves and is rated not less than that required for service equipment in accordance with 550.32(C). Grounding at the disconnecting means shall be in accordance with 250.32.

Statement of Problem and Substantiation for Public Input

This input is being submitted on behalf of the Minnesota Department of Labor and Industry. The Department's 15 office/field staff, and 65 plus contract electrical inspectors complete over 150,000 electrical inspections annually and are involved in the daily enforcement and interpretation of the National Electrical Code.
The NEC uses the "In sight from" definition many other places in the code and the rule should be appropriate here also. The rule makes sense on many rural properties where a service is located on a pole or post on the property. In many cases, this rule change will result in the elimination of an additional disconnect.

Submitter Information Verification

Submitter Full Name: Dean Hunter
Organization: Minnesota Department of Labor
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 26 09:14:04 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7832-NFPA 70-2020
Statement: CMP-7 address the concerns of the submitter by revising the language in 550.32(A) to clarify mobile home service equipment locations and applications. This revision replaces within sight of and within 30ft with readily accessible and visible to the mobile home it serves. CMP-7 takes note of the 2020 NEC changes for an emergency disconnect now required at dwelling units.

Public Input No. 309-NFPA 70-2020 [Section No. 550.32(A)]

(A) Mobile Home Service Equipment.

The mobile home service equipment shall be located adjacent to the mobile home and not mounted in or on the mobile home. The service equipment shall be located in sight from ~~and not more than 9.0 m (30 ft) from~~ the exterior wall of the mobile home it serves. The service equipment shall be permitted to be located elsewhere on the premises, if a disconnecting means suitable for use as service equipment is located within sight from and not more than 9.0 m (30 ft) from the exterior wall of the mobile home it serves and is rated not less than that required for service equipment in accordance with 550.32(C). Grounding at the disconnecting means shall be in accordance with 250.32.

Statement of Problem and Substantiation for Public Input

this section has mandatory wording and contrary to the definition of in sight from. In the second sentence permissive wording is used with the restriction of the disconnect to be within thirty feet. in this way it justifies the permissive option.

Submitter Information Verification

Submitter Full Name: Alfio Torrisi
Organization: Master electrician
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jan 16 12:23:47 EST 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7832-NFPA 70-2020

Statement: CMP-7 address the concerns of the submitter by revising the language in 550.32(A) to clarify mobile home service equipment locations and applications. This revision replaces within sight of and within 30ft with readily accessible and visible to the mobile home it serves. CMP-7 takes note of the 2020 NEC changes for an emergency disconnect now required at dwelling units.

Public Input No. 1710-NFPA 70-2020 [Article 551]

Article 551 Recreational Vehicles and Recreational Vehicle Parks

Part I. General

551.1 Scope.

This article covers the electrical conductors and equipment other than extra- low-voltage and automotive vehicle circuits or extensions thereof, installed within or on recreational vehicles, the conductors that connect recreational vehicles to a supply of electricity, and the installation of equipment and devices related to electrical installations within a recreational vehicle park.

> Informational Note: For information on low-voltage systems, refer to NFPA 1192-2018, *Standard on Recreational Vehicles,* and ANSI/RVIA LV-2014, *Standard for Low Voltage Systems in Conversion and Recreational Vehicles*.

551.2 Definitions.

(See Article 100 for additional definitions.)

Air-Conditioning or Comfort-Cooling Equipment.

This definition shall apply only within this article.

All of that equipment intended or installed for the purpose of processing the treatment of air so as to control simultaneously or individually its temperature, humidity, cleanliness, and distribution to meet the requirements of the conditioned space.

Appliance, Fixed.

This definition shall apply only within this article.

An appliance that is fastened or otherwise secured at a specific location.

Camping Trailer.

This definition shall apply only within this article.

A vehicular portable unit mounted on wheels and constructed with collapsible partial side walls that fold for towing by another vehicle and unfold at the campsite to provide temporary living quarters for recreational, camping, or travel use. *(See Recreational Vehicle.)*

Converter.

This definition shall apply only within this article.

A device that changes electrical energy from one form to another, as from alternating current to direct current.

Dead Front (as applied to switches, circuit breakers, switchboards, and panelboards).

This definition shall apply only within this article.

Designed, constructed, and installed so that no current-carrying parts are normally exposed on the front.

Disconnecting Means.

This definition shall apply only within this article.

The necessary equipment usually consisting of a circuit breaker or switch and fuses, and their accessories, located near the point of entrance of supply conductors in a recreational vehicle and intended to constitute the means of cutoff for the supply to that recreational vehicle.

Frame.

This definition shall apply only within this article.

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

Extra- Low Voltage.

This definition shall apply only within this article.

An electromotive force rated 24 volts, nominal, or less.

Motor Home.

This definition shall apply only within this article.

A vehicular unit designed to provide temporary living quarters for recreational, camping, or travel use built on or permanently attached to a self-propelled motor vehicle chassis or on a chassis cab or van that is an integral part of the completed vehicle. *(See Recreational Vehicle.)*

Power-Supply Assembly.

This definition shall apply only within this article.

The conductors, including ungrounded, grounded, and equipment grounding conductors, the connectors, attachment plug caps, and all other fittings, grommets, or devices installed for the purpose of delivering energy from the source of electrical supply to the distribution panel within the recreational vehicle.

Recreational Vehicle.

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

A vehicular-type unit primarily designed as temporary living quarters for recreational, camping, or travel use, which either has its own motive power or is mounted on or drawn by another vehicle.

> Informational Note: The basic entities are travel trailer, camping trailer, truck camper, and motor home as referenced in NFPA 1192-2018, *Standard on Recreational Vehicles*. See 3.3.52, *Recreational Vehicle*, and A.3.3.52 of NFPA 1192.

Recreational Vehicle Park.

This definition shall apply only within this article.

Any parcel or tract of land under the control of any person, organization, or governmental entity wherein two or more recreational vehicle, recreational park trailer, and/or other camping sites are offered for use by the public or members of an organization for overnight stays.

Recreational Vehicle Site.

This definition shall apply only within this article.

A specific area within a recreational vehicle park or campground that is set aside for use by a camping unit.

Recreational Vehicle Site Feeder Circuit Conductors.

This definition shall apply only within this article.

The conductors from the park service equipment to the recreational vehicle site supply equipment.

Recreational Vehicle Site Supply Equipment.

This definition shall apply only within this article.

The necessary equipment, usually a power outlet, consisting of a circuit breaker or switch and fuse and their accessories, located near the point of entrance of supply conductors to a recreational vehicle site and intended to constitute the disconnecting means for the supply to that site.

Recreational Vehicle Stand.

This definition shall apply only within this article.

That area of a recreational vehicle site intended for the placement of a recreational vehicle.

Travel Trailer.

This definition shall apply only within this article.

A vehicular unit, mounted on wheels, designed to provide temporary living quarters for recreational, camping, or travel use, of such size or weight as not to require special highway movement permits when towed by a motorized vehicle, and of gross trailer area less than 30 m^2 (320 ft^2). *(See Recreational Vehicle.)*

Truck Camper.

This definition shall apply only within this article.

A portable unit constructed to provide temporary living quarters for recreational, travel, or camping use, consisting of a roof, floor, and sides, designed to be loaded onto and unloaded from the bed of a pickup truck. *(See Recreational Vehicle.)*

551.4 General Requirements.

(A) Not Covered.

A recreational vehicle not used for the purposes as defined in 551.2 shall not be required to meet the requirements of Part IV pertaining to the number or capacity of circuits required. It shall, however, meet all other applicable requirements of this article if the recreational vehicle is provided with an electrical installation intended to be energized from a 120-volt, 208Y/120-volt, or 120/240-volt, nominal, ac power-supply system.

(B) Systems.

This article covers combination electrical systems, generator installations, and 120-volt, 208Y/120-volt, or 120/240-volt, nominal, systems.

> Informational Note: For information on low-voltage systems, refer to NFPA 1192-2018, *Standard on Recreational Vehicles*, and ANSI/RVIA 12V-2011, *Standard for Low Voltage Systems in Conversion and Recreational Vehicles*.

(C) Labels.

Labels required by Article 551 shall be made of etched, metal-stamped, or embossed brass; stainless steel; plastic laminates not less than 0.13 mm (0.005 in.) thick; or anodized or alclad aluminum not less than 0.5 mm (0.020 in.) thick or the equivalent.

> Informational Note: For guidance on other label criteria used in the recreational vehicle industry, refer to ANSI Z535.4-2011, *Product Safety Signs and Labels*.

Part II. Combination Electrical Systems

551.20 Combination Electrical Systems.

(A) General.

Vehicle wiring suitable for connection to a battery or dc supply source shall be permitted to be connected to a 120-volt source, provided the entire wiring system and equipment are rated and installed in full conformity with Parts I, II, III, IV, and V requirements of this article covering 120-volt electrical systems. Circuits fed from ac transformers shall not supply dc appliances.

(B) Voltage Converters (120-Volt Alternating Current to Extra- Low-Voltage Direct Current).

The 120-volt ac side of the voltage converter shall be wired in full conformity with the requirements of Parts I, II, and IV of this article for 120-volt electrical systems.

Exception: Converters supplied as an integral part of a listed appliance shall not be subject to 551.20(B).

All converters and transformers shall be listed for use in recreational vehicles and designed or equipped to provide overtemperature protection. To determine the converter rating, the following percentages shall be applied to the total connected load, including average battery-charging rate, of all 12-volt equipment:

The first 20 amperes of load at 100 percent plus

The second 20 amperes of load at 50 percent plus

All load above 40 amperes at 25 percent

Exception: ~~A~~ An extra- low-voltage appliance that is controlled by a momentary switch (normally open) that has no means for holding in the closed position or refrigerators with a 120-volt function shall not be considered as a connected load when determining the required converter rating. Momentarily energized appliances shall be limited to those used to prepare the vehicle for occupancy or travel.

(C) Bonding Voltage Converter Enclosures.

The non–current-carrying metal enclosure of the voltage converter shall be connected to the frame of the vehicle with a minimum 8 AWG copper conductor. The voltage converter shall be provided with a separate chassis bonding conductor that shall not be used as a current-carrying conductor.

(D) Dual-Voltage Fixtures, Including Luminaires or Appliances.

Fixtures, including luminaires, or appliances having both 120-volt and extra- low-voltage connections shall be listed for dual voltage.

(E) Autotransformers.

Autotransformers shall not be used.

(F) Receptacles and Plug Caps.

Where a recreational vehicle is equipped with an ac system, ~~a~~ an extra- low-voltage system, or both, receptacles and plug caps of the ~~low~~ extra -ow- voltage system shall differ in configuration from those of the ac system. Where a vehicle equipped with a battery or other extra- low-voltage system has an external connection for extra- low-voltage power, the connector shall have a configuration that will not accept ac power.

Part III. Other Power Sources

551.30 Generator Installations.

(A) Mounting.

Generators shall be mounted in such a manner as to be effectively bonded to the recreational vehicle chassis.

(B) Generator Protection.

Equipment shall be installed to ensure that the current-carrying conductors from the engine generator and from an outside source are not connected to a vehicle circuit at the same time. Automatic transfer switches in such applications shall be listed for use in one of the following:

(1) Emergency systems

(2) Optional standby systems

Receptacles used as disconnecting means shall be accessible (as applied to wiring methods) and capable of interrupting their rated current without hazard to the operator.

(C) Installation of Storage Batteries and Generators.

Storage batteries and internal-combustion-driven generator units (subject to the provisions of this *Code*) shall be secured in place to avoid displacement from vibration and road shock.

(D) Ventilation of Generator Compartments.

Compartments accommodating internal-combustion-driven generator units shall be provided with ventilation in accordance with instructions provided by the manufacturer of the generator unit.

Informational Note: For generator compartment construction requirements, see NFPA 1192-2018, *Standard on Recreational Vehicles*.

(E) Supply Conductors.

The supply conductors from the engine generator to the first termination on the vehicle shall be of the stranded type and be installed in listed flexible conduit or listed liquidtight flexible conduit. The point of first termination shall be in one of the following:

(1) Panelboard

(2) Junction box with a blank cover

(3) Junction box with a receptacle

(4) Enclosed transfer switch

(5) Receptacle assembly listed in conjunction with the generator

The panelboard, enclosed transfer switch, or junction box with a receptacle shall be installed within 450 mm (18 in.) of the point of entry of the supply conductors into the vehicle. A junction box with a blank cover shall be mounted on the compartment wall inside or outside the compartment; to any part of the generator-supporting structure (but not to the generator); to the vehicle floor on the outside of the vehicle; or within 450 mm (18 in.) of the point of entry of the supply conductors into the vehicle. A receptacle assembly listed in conjunction with the generator shall be mounted in accordance with its listing.

551.31 Multiple Supply Source.

(A) Multiple Supply Sources.

Where a multiple supply system consisting of an alternate power source and a power-supply cord is installed, the feeder from the alternate power source shall be protected by an overcurrent protective device. Installation shall be in accordance with 551.30(A), 551.30(B), and 551.40.

(B) Multiple Supply Sources Capacity.

The multiple supply sources shall not be required to be of the same capacity.

(C) Alternate Power Sources Exceeding 30 Amperes.

If an alternate power source exceeds 30 amperes, 120 volts, nominal, it shall be permissible to wire it as a 120-volt, nominal, system, a 208Y/120-volt, nominal, system, or a 120/240-volt, nominal, system, provided an overcurrent protective device of the proper rating is installed in the feeder.

(D) Power-Supply Assembly Not Less Than 30 Amperes.

The external power-supply assembly shall be permitted to be less than the calculated load but not less than 30 amperes and shall have overcurrent protection not greater than the capacity of the external power-supply assembly.

551.32 Other Sources.

Other sources of ac power, such as inverters, motor generators, or engine generators, shall be listed for use in recreational vehicles and shall be installed in accordance with the terms of the listing. Other sources of ac power shall be wired in full conformity with the requirements in Parts I, II, III, IV, and V of this article covering 120-volt electrical systems.

551.33 Alternate Source Restrictions.

Transfer equipment, if not integral with the listed power source, shall be installed to ensure that the current-carrying conductors from other sources of ac power and from an outside source are not connected to the vehicle circuit at the same time. Automatic transfer switches in such applications shall be listed for use in one of the following:

(1) Emergency systems

(2) Optional standby systems

Part IV. Nominal 120-Volt or 120/240-Volt Systems

551.40 120-Volt or 120/240-Volt, Nominal, Systems.

(A) General Requirements.

The electrical equipment and material of recreational vehicles indicated for connection to a wiring system rated 120 volts, nominal, 2-wire with equipment grounding conductor, or a wiring system rated 120/240 volts, nominal, 3-wire with equipment grounding conductor, shall be listed and installed in accordance with the requirements of Parts I, II, III, IV, and V of this article. Electrical equipment connected line-to-line shall have a voltage rating of 208–230 volts.

(B) Materials and Equipment.

Electrical materials, devices, appliances, fittings, and other equipment installed in, intended for use in, or attached to the recreational vehicle shall be listed. All products shall be used only in the manner in which they have been tested and found suitable for the intended use.

(C) Ground-Fault Circuit-Interrupter Protection.

The internal wiring of a recreational vehicle having only one 15- or 20-ampere branch circuit as permitted in 551.42(A) and (B) shall have ground-fault circuit-interrupter protection for personnel. The ground-fault circuit interrupter shall be installed at the point where the power supply assembly terminates within the recreational vehicle. Where a separable cord set is not employed, the ground-fault circuit interrupter shall be permitted to be an integral part of the attachment plug of the power supply assembly. The ground-fault circuit interrupter shall provide protection also under the conditions of an open grounded circuit conductor, interchanged circuit conductors, or both.

(D) Reverse Polarity Device.

A reverse polarity indicating device that provides a continuous visible or audible signal shall be installed in the recreational vehicle in accordance with the installation instructions and shall respond to the reversal of the ungrounded and the grounded conductors in the 120-volt ac system.

551.41 Receptacle Outlets Required.

(A) Spacing.

Receptacle outlets shall be installed at wall spaces 600 mm (2 ft) wide or more so that no point along the floor line is more than 1.8 m (6 ft), measured horizontally, from an outlet in that space.

Exception No. 1: Bath and hallway areas shall not be required to comply with 551.41(A).

Exception No. 2: Wall spaces occupied by kitchen cabinets, wardrobe cabinets, built-in furniture, behind doors that can open fully against a wall surface, or similar facilities shall not be required to comply with 551.41(A).

Exception No. 3: Wall spaces in the special transportation area of a recreational vehicle designed to transport internal combustion vehicles shall not be required to comply with 551.41(A).

(B) Location.

Receptacle outlets shall be installed as follows:

(1) Adjacent to countertops in the kitchen [at least one on each side of the sink if countertops are on each side and are 300 mm (12 in.) or over in width and depth].

(2) Adjacent to the refrigerator and gas range space, except where a gas-fired refrigerator or cooking appliance, requiring no external electrical connection, is factory installed.

(3) Adjacent to countertop spaces of 300 mm (12 in.) or more in width and depth that cannot be reached from a receptacle required in 551.41(B)(1) by a cord of 1.8 m (6 ft) without crossing a traffic area, cooking appliance, or sink.

(4) Rooftop decks that are accessible from inside the recreational vehicle shall have at least one receptacle installed within the perimeter of the rooftop deck. The receptacle shall not be located more than 1.2 m (4 ft) above the balcony, deck, or porch surface. The receptacle shall comply with the requirements of 406.9(B) for wet locations.

(5) A special transportation area of recreational vehicles designed to transport internal combustion engine vehicles shall have at least one receptacle installed.

(C) Ground-Fault Circuit-Interrupter Protection.

Where provided, each 125-volt, single-phase, 15- or 20-ampere receptacle outlet shall have ground-fault circuit-interrupter protection for personnel in the following locations:

(1) Adjacent to a bathroom lavatory

(2) Where the receptacles are installed to serve the countertop surfaces and are within 1.8 m (6 ft) of any lavatory or sink

Exception No. 1: Receptacles installed for appliances in dedicated spaces, such as for disposals, refrigerators, and freezers shall not require ground-fault circuit-interrupter protection.

Exception No. 2: Single receptacles for interior connections of expandable room sections shall not require ground-fault circuit-interrupter protection.

Exception No. 3: De-energized receptacles that are within 1.8 m (6 ft) of any sink or lavatory due to the retraction of the expandable room section shall not require ground-fault circuit-interrupter protection.

(3) In the area occupied by a toilet, shower, tub, or any combination thereof

(4) On the exterior of the vehicle

Exception: Receptacles that are located inside of an access panel that is installed on the exterior of the vehicle to supply power for an installed appliance shall not be required to have ground-fault circuit-interrupter protection.

(5) In the special transportation area of a recreational vehicle that is separated from the living area by a wall

The receptacle outlet shall be permitted in a listed luminaire. A receptacle outlet shall not be installed in a tub or combination tub–shower compartment.

(D) Face-Up Position.

A receptacle shall not be installed in a face-up position in any countertop or similar horizontal surface.

551.42 Branch Circuits Required.

Each recreational vehicle containing an ac electrical system shall contain one of the circuit arrangements in 551.42(A) through (D).

(A) One 15-Ampere Circuit.

One 15-ampere circuit to supply lights, receptacle outlets, and fixed appliances. Such recreational vehicles shall be equipped with one 15-ampere switch and fuse or one 15-ampere circuit breaker.

(B) One 20-Ampere Circuit.

One 20-ampere circuit to supply lights, receptacle outlets, and fixed appliances. Such recreational vehicles shall be equipped with one 20-ampere switch and fuse or one 20-ampere circuit breaker.

(C) Two to Five 15- or 20-Ampere Circuits.

Two to five 15- or 20-ampere circuits to supply lights, receptacle outlets, and fixed appliances shall be permitted. Such recreational vehicles shall be permitted to be equipped with panelboards rated 120 volt maximum or 120/240 volt maximum and listed for 30-ampere application supplied by the appropriate power-supply assemblies. Not more than two 120-volt thermostatically controlled appliances shall be installed in such systems unless appliance isolation switching, energy management systems, or similar methods are used.

Exception No. 1: Additional 15- or 20-ampere circuits shall be permitted where a listed energy management system rated at 30-ampere maximum is employed within the system.

Exception No. 2: Six 15- or 20-ampere circuits shall be permitted without employing an energy management system, provided that the added sixth circuit serves only the power converter, and the combined load of all six circuits does not exceed the allowable load that was designed for use by the original five circuits.

Informational Note: See 210.23(A) for permissible loads. See 551.45(C) for main disconnect and overcurrent protection requirements.

(D) More Than Five Circuits Without a Listed Energy Management System.

A 50-ampere, 120/208–240-volt power-supply assembly and a minimum 50-ampere-rated panelboard shall be used where six or more circuits are employed. The load distribution shall ensure a reasonable current balance between phases.

551.43 Branch-Circuit Protection.

(A) Rating.

The branch-circuit overcurrent devices shall be rated as follows:

(1) Not more than the circuit conductors, and

(2) Not more than 150 percent of the rating of a single appliance rated 13.3 amperes or more and supplied by an individual branch circuit, but

(3) Not more than the overcurrent protection size marked on an air conditioner or other motor-operated appliances

(B) Protection for Smaller Conductors.

A 20-ampere fuse or circuit breaker shall be permitted for protection for fixtures, including luminaires, leads, cords, or small appliances, and 14 AWG tap conductors, not over 1.8 m (6 ft) long for recessed luminaires.

(C) Fifteen-Ampere Receptacles Considered Protected by 20 Amperes.

If more than one receptacle or load is on a branch circuit, 15-ampere receptacles shall be permitted to be protected by a 20-ampere fuse or circuit breaker.

551.44 Power-Supply Assembly.

Each recreational vehicle shall have only one of the main power-supply assemblies covered in 551.44(A) through (D).

(A) Fifteen-Ampere Main Power-Supply Assembly.

Recreational vehicles wired in accordance with 551.42(A) shall use a listed 15-ampere or larger main power-supply assembly.

(B) Twenty-Ampere Main Power-Supply Assembly.

Recreational vehicles wired in accordance with 551.42(B) shall use a listed 20-ampere or larger main power-supply assembly.

(C) Thirty-Ampere Main Power-Supply Assembly.

Recreational vehicles wired in accordance with 551.42(C) shall use a listed 30-ampere or larger main power-supply assembly.

(D) Fifty-Ampere Power-Supply Assembly.

Recreational vehicles wired in accordance with 551.42(D) shall use a listed 50-ampere, 120/208–240-volt main power-supply assembly.

551.45 Panelboard.

(A) Listed and Appropriately Rated.

A listed and appropriately rated panelboard or other equipment specifically listed for this purpose shall be used. The grounded conductor termination bar shall be insulated from the enclosure as provided in 551.54(C). An equipment grounding terminal bar shall be attached inside the enclosure of the panelboard.

(B) Location.

The panelboard shall be installed in a readily accessible location with the RV in the setup mode. Working clearance for the panelboard with the RV in the setup mode shall be not less than 600 mm (24 in.) wide and 750 mm (30 in.) deep.

Exception No. 1: Where the panelboard cover is exposed to the inside aisle space, one of the working clearance dimensions shall be permitted to be reduced to a minimum of 550 mm (22 in.). A panelboard is considered exposed where the panelboard cover is within 50 mm (2 in.) of the aisle's finished surface or not more than 25 mm (1 in.) from the backside of doors that enclose the space.

Exception No. 2: Compartment doors used for access to a generator shall be permitted to be equipped with a locking system.

(C) Dead-Front Type.

The panelboard shall be of the dead-front type and shall consist of one or more circuit breakers or Type S fuseholders. A main disconnecting means shall be provided where fuses are used or where more than two circuit breakers are employed. A main overcurrent protective device not exceeding the power-supply assembly rating shall be provided where more than two branch circuits are employed.

551.46 Means for Connecting to Power Supply.

(A) Assembly.

The power-supply assembly or assemblies shall be factory supplied or factory installed and be of one of the types specified herein.

(1) Separable.

Where a separable power-supply assembly consisting of a cord with a female connector and molded attachment plug cap is provided, the vehicle shall be equipped with a permanently mounted, flanged surface inlet (male, recessed-type motor-base attachment plug) wired directly to the panelboard by an approved wiring method. The attachment plug cap shall be of a listed type.

(2) Permanently Connected.

Each power-supply assembly shall be connected directly to the terminals of the panelboard or conductors within a junction box and provided with means to prevent strain from being transmitted to the terminals. The ampacity of the conductors between each junction box and the terminals of each panelboard shall be at least equal to the ampacity of the power-supply cord. The supply end of the assembly shall be equipped with an attachment plug of the type described in 551.46(C). Where the cord passes through the walls or floors, it shall be protected by means of conduit and bushings or equivalent. The cord assembly shall have permanent provisions for protection against corrosion and mechanical damage while the vehicle is in transit and while the cord assembly is being stored or removed for use.

(B) Cord.

The cord exposed usable length shall be measured from the point of entrance to the recreational vehicle or the face of the flanged surface inlet (motor-base attachment plug) to the face of the attachment plug at the supply end.

The cord exposed usable length, measured to the point of entry on the vehicle exterior, shall be a minimum of 7.5 m (25 ft) where the point of entrance is at the side of the vehicle or shall be a minimum 9.0 m (30 ft) where the point of entrance is at the rear of the vehicle.

Where the cord entrance into the vehicle is more than 900 mm (3 ft) above the ground, the minimum cord lengths above shall be increased by the vertical distance of the cord entrance heights above 900 mm (3 ft).

> Informational Note: See 551.46(E) for location of point of entrance of a power-supply assembly on the recreational vehicle exterior.

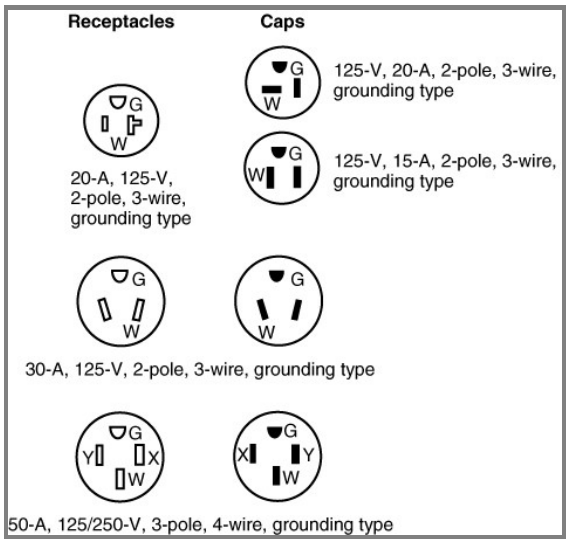
(C) Attachment Plugs.

(1) Units with One 15-Ampere Branch Circuit.

Recreational vehicles having only one 15-ampere branch circuit as permitted by 551.42(A) shall have an attachment plug that shall be 2-pole, 3-wire grounding type, rated 15 amperes, 125 volts, conforming to the configuration shown in Figure 551.46(C)(1) .

Informational Note: Complete details of this configuration can be found in ANSI/NEMA WD 6-2016, *Wiring Devices — Dimensional Specifications* , Figure 5.15.

Figure 551.46(C)(1) Configurations for Grounding-Type Receptacles and Attachment Plug Caps Used for Recreational Vehicle Supply Cords and Recreational Vehicle Lots.



(2) Units with One 20-Ampere Branch Circuit.

Recreational vehicles having only one 20-ampere branch circuit as permitted in 551.42(B) shall have an attachment plug that shall be 2-pole, 3-wire grounding type, rated 20 amperes, 125 volts, conforming to the configuration shown in Figure 551.46(C)(1) .

Informational Note: Complete details of this configuration can be found in ANSI/NEMA WD 6-2016, *Wiring Devices — Dimensional Specifications* , Figure 5.20.

(3) Units with Two to Five 15- or 20-Ampere Branch Circuits.

Recreational vehicles wired in accordance with 551.42(C) shall have an attachment plug that shall be 2-pole, 3-wire grounding type, rated 30 amperes, 125 volts, conforming to the configuration shown in Figure 551.46(C)(1) intended for use with units rated at 30 amperes, 125 volts.

Informational Note: Complete details of this configuration can be found in ANSI/NEMA WD 6-2016, *Wiring Devices — Dimensional Specifications* , Figure TT.

(4) Units with 50-Ampere Power-Supply Assembly.

Recreational vehicles having a power-supply assembly rated 50 amperes as permitted by 551.42(D) shall have a 3-pole, 4-wire grounding-type attachment plug rated 50 amperes, 125/250 volts, conforming to the configuration shown in Figure 551.46(C)(1) .

Informational Note: Complete details of this configuration can be found in ANSI/NEMA WD 6-2016, *Wiring Devices — Dimensional Specifications* , Figure 14.50.

(D)_ Labeling at Electrical Entrance.

Each recreational vehicle shall have a safety label with the signal word WARNING in minimum 6-mm (1/4 -in.) high letters and body text in minimum 3-mm (1/8 -in.) high letters on a contrasting background. The safety label shall be affixed to the exterior skin, at or near the point of entrance of the power-supply cord(s), and shall read, using one of the following warnings, as appropriate:

WARNING

THIS CONNECTION IS FOR 110–125-VOLT AC,

60 HZ, ____ AMPERE SUPPLY.

DO NOT EXCEED CIRCUIT RATING.

EXCEEDING THE CIRCUIT RATING CAN CAUSE A

FIRE AND RESULT IN DEATH OR SERIOUS INJURY.

or

WARNING

THIS CONNECTION IS FOR 208Y/120-VOLT or

120/240-VOLT AC, 3-POLE, 4-WIRE, 60 HZ, _____ AMPERE SUPPLY.

DO NOT EXCEED CIRCUIT RATING.

EXCEEDING THE CIRCUIT RATING CAN CAUSE A

FIRE AND RESULT IN DEATH OR SERIOUS INJURY.

The correct ampere rating shall be marked in the blank space.

(E) Location.

The point of entrance of a power-supply assembly shall be located within 4.5 m (15 ft) of the rear, on the left (road) side or at the rear, left of the longitudinal center of the vehicle, within 450 mm (18 in.) of the outside wall.

Exception No. 1: A recreational vehicle equipped with only a listed flexible drain system or a side-vent drain system shall be permitted to have the electrical point of entrance located on either side, provided the drain(s) for the plumbing system is (are) located on the same side.

Exception No. 2: A recreational vehicle shall be permitted to have the electrical point of entrance located more than 4.5 m (15 ft) from the rear. Where this occurs, the distance beyond the 4.5-m (15-ft) dimension shall be added to the cord's minimum length as specified in 551.46(B) .

Exception No. 3: Recreational vehicles designed for transporting livestock shall be permitted to have the electrical point of entrance located on either side or the front.

551.47 Wiring Methods.

(A) Wiring Systems.

Cables and raceways installed in accordance with Articles 320, 322, 330 through 340, 342 through 362, 386, and 388 shall be permitted in accordance with their applicable article, except as otherwise specified in this article. An equipment grounding means shall be provided in accordance with 250.118 .

(B) Conduit and Tubing.

Where rigid metal conduit or intermediate metal conduit is terminated at an enclosure with a locknut and bushing connection, two locknuts shall be provided, one inside and one outside of the enclosure. All cut ends of conduit and tubing shall be reamed or otherwise finished to remove rough edges.

(C) Nonmetallic Boxes.

Nonmetallic boxes shall be acceptable only with nonmetallic-sheathed cable or nonmetallic raceways.

(D) Boxes.

In walls and ceilings constructed of wood or other combustible material, boxes and fittings shall be flush with the finished surface or project therefrom.

(E) Mounting.

Wall and ceiling boxes shall be mounted in accordance with Article 314.

Exception No. 1: Snap-in-type boxes or boxes provided with special wall or ceiling brackets that securely fasten boxes in walls or ceilings shall be permitted.

Exception No. 2: A wooden plate providing a 38-mm (1 1/2 -in.) minimum width backing around the box and of a thickness of 13 mm (1/2 in.) or greater (actual) attached directly to the wall panel shall be considered as approved means for mounting outlet boxes.

(F) Raceway and Cable Continuity.

Raceways and cable sheaths shall be continuous between boxes and other enclosures.

(G) Protected.

Metal-clad, Type AC, or nonmetallic-sheathed cables and electrical nonmetallic tubing shall be permitted to pass through the centers of the wide side of 2 by 4 wood studs. However, they shall be protected where they pass through 2 by 2 wood studs or at other wood studs or frames where the cable or tubing would be less than 32 mm (1 1/4 in.) from the inside or outside surface. Steel plates on each side of the cable or tubing or a steel tube, with not less than 1.35 mm (0.053 in.) wall thickness, shall be installed to protect the cable or tubing. These plates or tubes shall be securely held in place. Where nonmetallic-sheathed cables pass through punched, cut, or drilled slots or holes in metal members, the cable shall be protected by bushings or grommets securely fastened in the opening prior to installation of the cable.

(H) Bends.

No bend shall have a radius of less than five times the cable diameter.

(I) Cable Supports.

Where connected with cable connectors or clamps, cables shall be secured and supported within 300 mm (12 in.) of outlet boxes, panelboards, and splice boxes on appliances.

Supports and securing shall be provided at intervals not exceeding 1.4 m (4 1/2 ft) at other places.

(J) Nonmetallic Box Without Cable Clamps.

Nonmetallic-sheathed cables shall be secured and supported within 200 mm (8 in.) of a nonmetallic outlet box without cable clamps. Where wiring devices with integral enclosures are employed with a loop of extra cable to permit future replacement of the device, the cable loop shall be considered as an integral portion of the device.

(K) Physical Damage.

Where subject to physical damage, exposed nonmetallic cable shall be protected by covering boards, guard strips, raceways, or other means.

(L) Receptacle Faceplates.

Metal faceplates shall comply with 406.5(A). Nonmetallic faceplates shall comply with 406.5(C).

(M) Metal Faceplates Grounded.

Metal faceplates shall be installed in compliance with 404.9(B) and 404.6(B).

(N) Moisture or Physical Damage.

Where outdoor or under-chassis wiring is 120 volts, nominal, or over and is exposed to moisture or physical damage, the wiring shall be protected by rigid metal conduit, by intermediate metal conduit, or by electrical metallic tubing, rigid nonmetallic conduit, or Type MI cable, that is closely routed against frames and equipment enclosures or other raceway or cable identified for the application.

(O) Component Interconnections.

Fittings and connectors that are intended to be concealed at the time of assembly shall be listed and identified for the interconnection of building components. Such fittings and connectors shall be equal to the wiring method employed in insulation, temperature rise, and fault-current withstanding and shall be capable of enduring the vibration and shock occurring in recreational vehicles.

(P) Method of Connecting Expandable Units.

The method of connecting expandable units to the main body of the vehicle shall comply with 551.47(P)(1) or (P)(2).

(1)_ Cord-and-Plug-Connected.

Cord-and-plug connections shall comply with 551.47(P)(1) (a) through (P)(1)(d).

(1) That portion of a branch circuit that is installed in an expandable unit shall be permitted to be connected to the portion of the branch circuit in the main body of the vehicle by means of an attachment plug and cord listed for hard usage. The cord and its connections shall comply with Part I and Part II, as applicable, of Article 400 and shall be considered as a permitted use under 400.10 . Where the attachment plug and cord are located within the vehicle's interior, use of plastic thermoset or elastomer parallel cord Type SPT-3, SP-3, or SPE shall be permitted.

(2) Where the receptacle provided for connection of the cord to the main circuit is located on the outside of the vehicle, it shall be protected with a ground-fault circuit interrupter for personnel and be listed for wet locations. A cord located on the outside of a vehicle shall be identified for outdoor use.

(3) Unless removable or stored within the vehicle interior, the cord assembly shall have permanent provisions for protection against corrosion and mechanical damage while the vehicle is in transit.

(4) The attachment plug and cord shall be installed so as not to permit exposed live attachment plug pins.

(2)_ Direct Wired.

That portion of a branch circuit that is installed in an expandable unit shall be permitted to be connected to the portion of the branch circuit in the main body of the vehicle by means of flexible cord installed in accordance with 551.47(P)(2)(a) through (P)(2)(e) or other approved wiring method.

(1) _ The flexible cord shall be listed for hard usage and for use in wet locations.

(2) The flexible cord shall be permitted to be exposed on the underside of the vehicle.

(3) The flexible cord shall be permitted to pass through the interior of a wall or floor assembly or both a maximum concealed length of 600 mm (24 in.) before terminating at an outlet or junction box.

(4) Where concealed, the flexible cord shall be installed in nonflexible conduit or tubing that is continuous from the outlet or junction box inside the recreational vehicle to a weatherproof outlet box, junction box, or strain relief fitting listed for use in wet locations that is located on the underside of the recreational vehicle. The outer jacket of the flexible cord shall be continuous into the outlet or junction box.

(5) Where the flexible cord passes through the floor to an exposed area inside of the recreational vehicle, it shall be protected by means of conduit and bushings or equivalent.

Where subject to physical damage, the flexible cord shall be protected with RMC, IMC, Schedule 80 PVC, reinforced thermosetting resin conduit (RTRC) listed for exposure to physical damage, or other approved means and shall extend at least 150 mm (6 in.) above the floor. A means shall be provided to secure the flexible cord where it enters the recreational vehicle.

(Q) Prewiring for Air-Conditioning Installation.

Prewiring installed for the purpose of facilitating future air-conditioning installation shall comply with the applicable portions of this article and the following:

(1) An overcurrent protective device with a rating compatible with the circuit conductors shall be installed in the panelboard and wiring connections completed.

(2) The load end of the circuit shall terminate in a junction box with a blank cover or other listed enclosure. Where a junction box with a blank cover is used, the free ends of the conductors shall be adequately capped or taped.

(3) A safety label with the signal word WARNING in minimum 6-mm (1/4 -in.) high letters and body text in minimum 3-mm (1/8 -in.) high letters on a contrasting background shall be affixed on or adjacent to the junction box and shall read as follows:

WARNING

AIR-CONDITIONING CIRCUIT.

THIS CONNECTION IS FOR AIR CONDITIONERS

RATED 110–125-VOLT AC, 60 HZ,

___ AMPERES MAXIMUM.

DO NOT EXCEED CIRCUIT RATING.

EXCEEDING THE CIRCUIT RATING MAY

CAUSE A FIRE AND RESULT IN DEATH

OR SERIOUS INJURY.

An ampere rating, not to exceed 80 percent of the circuit rating, shall be legibly marked in the blank space.

(4) The circuit shall serve no other purpose.

(R)_ Prewiring for Generator Installation.

Prewiring installed for the purpose of facilitating future generator installation shall comply with the other applicable portions of this article and the following:

(1) Circuit conductors shall be appropriately sized in relation to the anticipated load as stated on the label required in (R)(4).

(2) Where junction boxes are utilized at either of the circuit originating or terminus points, free ends of the conductors shall be adequately capped or taped.

(3) Where devices such as receptacle outlet, transfer switch, and so forth, are installed, the installation shall be complete, including circuit conductor connections.

(4) A safety label with the signal word WARNING in minimum 6-mm (1/4 -in.) high letters and body text in minimum 3-mm (1/8 -in.) high letters on a contrasting background shall be affixed on the cover of each junction box containing incomplete circuitry and shall read, using one of the following warnings, as appropriate:

WARNING

GENERATOR

ONLY INSTALL A GENERATOR LISTED

SPECIFICALLY FOR RV USE

HAVING OVERCURRENT PROTECTION

RATED 110–125-VOLT AC,

60 HZ, _____ AMPERES MAXIMUM.

or

WARNING

GENERATOR

ONLY INSTALL A GENERATOR LISTED

SPECIFICALLY FOR RV USE

HAVING OVERCURRENT PROTECTION

RATED 120–240-VOLT AC,

60 HZ, _____ AMPERES MAXIMUM.

The correct ampere rating shall be legibly marked in the blank space.

(S) Prewiring for Other Circuits.

Prewiring installed for the purpose of installing other appliances or devices shall comply with the applicable portions of this article and the following:

(1) An overcurrent protection device with a rating compatible with the circuit conductors shall be installed in the panelboard with wiring connections completed.

(2) The load end of the circuit shall terminate in a junction box with a blank cover or a device listed for the purpose. Where a junction box with blank cover is used, the free ends of the conductors shall be adequately capped or taped.

(3) A safety label with the signal word WARNING in minimum 6-mm (1/4 -in.) high letters and body text in minimum 3-mm (1/8 -in.) high letters on a contrasting background shall be affixed on or adjacent to the junction box or device listed for the purpose and shall read as follows:

WARNING

THIS CONNECTION IS FOR _____ RATED _____ VOLT AC, 60 HZ, _____ AMPERES MAXIMUM. DO NOT EXCEED CIRCUIT RATING.

EXCEEDING THE CIRCUIT RATING MAY

CAUSE A FIRE AND RESULT IN DEATH OR

SERIOUS INJURY.

An ampere rating not to exceed 80 percent of the circuit rating shall be legibly marked in the blank space.

551.48 Conductors and Boxes.

The maximum number of conductors permitted in boxes shall be in accordance with 314.16 .

551.49 Grounded Conductors.

The identification of grounded conductors shall be in accordance with 200.6 .

551.50 Connection of Terminals and Splices.

Conductor splices and connections at terminals shall be in accordance with 110.14 .

551.51 Switches.

(A) Rating.

Switches shall be rated in accordance with 551.51(A)(1) and (A)(2).

(1) Lighting Circuits.

For lighting circuits, switches shall be rated not less than 10 amperes, 120–125 volts and in no case less than the connected load.

(2) Motors or Other Loads.

Switches for motors or other loads shall comply with 404.14 .

(B) Location.

Switches shall not be installed within wet locations in tub or shower spaces unless installed as part of a listed tub or shower assembly.

551.52 Receptacles.

All receptacle outlets shall be of the grounding type and installed in accordance with 406.4 and 210.21 .

551.53 Luminaires and Other Equipment.

(A) General.

Any combustible wall or ceiling finish exposed between the edge of a canopy or pan of a luminaire or ceiling-suspended (paddle) fan and the outlet box shall be covered with noncombustible material.

(B) Shower Luminaires.

If a luminaire is provided over a bathtub or in a shower stall, it shall be of the enclosed and gasketed type and listed for the type of installation, and it shall be ground-fault circuit-interrupter protected.

(C) Outdoor Outlets, Luminaires, Air-Cooling Equipment, and So On.

Outdoor luminaires and other equipment shall be listed for outdoor use.

551.54 Grounding.

(See also 551.56 on bonding of non–current-carrying metal parts.)

(A) Power-Supply Grounding.

The equipment grounding conductor in the supply cord or feeder shall be connected to the equipment grounding bus or other approved equipment grounding means in the panelboard.

(B) Panelboard.

The panelboard shall have an equipment grounding bus with terminals for all equipment grounding conductors or other approved equipment grounding means.

(C) Insulated Grounded Conductor (Neutral Conductor).

The grounded circuit conductor (neutral conductor) shall be insulated from the equipment grounding conductors and from equipment enclosures and other grounded parts. The grounded circuit conductor (neutral conductor) terminals in the panelboard and in ranges, clothes dryers, counter-mounted cooking units, and wall-mounted ovens shall be insulated from the equipment enclosure. Bonding screws, straps, or buses in the panelboard or in appliances shall be removed and discarded. Connection of electric ranges and electric clothes dryers utilizing a grounded conductor, if cord-connected, shall be made with 4-conductor cord and 3-pole, 4-wire grounding-type plug caps and receptacles.

551.55 Interior Equipment Grounding.

(A) Exposed Metal Parts.

In the electrical system, all exposed metal parts, enclosures, frames, luminaire canopies, and so forth, shall be effectively bonded to the grounding terminals or enclosure of the panelboard.

(B)_ Equipment Grounding and Bonding Conductors.

Bare wires, insulated wire with an outer finish that is green or green with one or more yellow stripes, shall be used for equipment grounding or bonding conductors only.

(C)_ Grounding of Electrical Equipment.

Grounding of electrical equipment shall be accomplished by one or more of the following methods:

(1) Connection of metal raceway, the sheath of Type MC and Type MI cable where the sheath is identified for grounding, or the armor of Type AC cable to metal enclosures.

(2) A connection between the one or more equipment grounding conductors and a metal enclosure by means of a grounding screw, which shall be used for no other purpose, or a listed grounding device.

(3) The equipment grounding conductor in nonmetallic-sheathed cable shall be permitted to be secured under a screw threaded into the luminaire canopy other than a mounting screw or cover screw, or attached to a listed grounding means (plate) in a nonmetallic outlet box for luminaire mounting. [Grounding means shall also be permitted for luminaire attachment screws.]

(D)_ Grounding Connection in Nonmetallic Box.

A connection between the one or more equipment grounding conductors brought into a nonmetallic outlet box shall be so arranged that a connection of the equipment grounding conductor can be made to any fitting or device in that box that requires grounding.

(E)_ Grounding Continuity.

Where more than one equipment grounding or bonding conductor of a branch circuit enters a box, all such conductors shall be connected together using a method specified in 250.8 , and the arrangement shall be such that the disconnection or removal of a receptacle, luminaire, or other device fed from the box will not interfere with or interrupt the grounding continuity.

(F)_ Cord-Connected Appliances.

Cord-connected appliances, such as washing machines, clothes dryers, refrigerators, and the electrical system of gas ranges, and so forth, shall be grounded by means of an approved cord with equipment grounding conductor and grounding-type attachment plug.

551.56 Bonding of Non–Current-Carrying Metal Parts.

(A)_ Required Bonding.

All exposed non–current-carrying metal parts that are likely to become energized shall be effectively bonded to the grounding terminal or enclosure of the panelboard.

(B)_ Bonding Chassis.

A bonding conductor shall be connected between any panelboard and an accessible terminal on the chassis. Bonding terminations shall be suitable for the enviroment in which the conductors and terminations are installed.

Exception: Any recreational vehicle that employs a unitized metal chassis-frame construction to which the panelboard is securely fastened with a bolt(s) and nut(s) or by welding or riveting shall be considered to be bonded.

(C)_ Bonding Conductor Requirements.

Grounding terminals shall be of the solderless type and listed as pressure terminal connectors recognized for the wire size used. The bonding conductor shall be solid or stranded, insulated or bare, and shall be 8 AWG copper minimum, or equal.

(D) Metallic Roof and Exterior Bonding.

The metal roof and exterior covering shall be considered bonded where both of the following conditions apply:

(1) The metal panels overlap one another and are securely attached to the wood or metal frame parts by metal fasteners.

(2) The lower panel of the metal exterior covering is secured by metal fasteners at each cross member of the chassis, or the lower panel is connected to the chassis by a metal strap.

(E) Gas, Water, and Waste Pipe Bonding.

The gas, water, and waste pipes shall be considered grounded if they are bonded to the chassis.

(F) Furnace and Metal Air Duct Bonding.

Furnace and metal circulating air ducts shall be bonded.

551.57 Appliance Accessibility and Fastening.

Every appliance shall be accessible for inspection, service, repair, and replacement without removal of permanent construction. Means shall be provided to securely fasten appliances in place when the recreational vehicle is in transit.

Part V. Factory Tests

551.60 Factory Tests (Electrical).

Each recreational vehicle designed with a 120-volt or a 120/240-volt electrical system shall withstand the applied voltage without electrical breakdown of a 1-minute, 900-volt ac or 1280-volt dc dielectric strength test, or a 1-second, 1080-volt ac or 1530-volt dc dielectric strength test, with all switches closed, between ungrounded and grounded conductors and the recreational vehicle ground. During the test, all switches and other controls shall be in the “on” position. Fixtures, including luminaires and permanently installed appliances, shall not be required to withstand this test. The test shall be performed after branch circuits are complete prior to energizing the system and again after all outer coverings and cabinetry have been secured. The dielectric test shall be performed in accordance with the test equipment manufacturer’s written instructions.

Each recreational vehicle shall be subjected to all of the following:

(1) A continuity test to ensure that all metal parts are properly bonded

(2) Operational tests to demonstrate that all equipment is properly connected and in working order

(3) Polarity checks to determine that connections have been properly made

(4) GFCI test to demonstrate that the ground fault protection device(s) installed on the recreational vehicle are operating properly

Part VI. Recreational Vehicle Parks

551.71 Type Receptacles Provided.

(A) 20-Ampere.

Every recreational vehicle site with electrical supply shall be equipped with recreational vehicle site supply equipment with at least one 20-ampere, 125-volt weather-resistant receptacle. This receptacle, when used in recreational vehicle site electrical equipment, shall not be required to be tamper-resistant in accordance with 406.12 .

(B) 30-Ampere.

A minimum of 70 percent of all recreational vehicle sites with electrical supply shall each be equipped with a 30-ampere, 125-volt receptacle conforming to Figure 551.46(C)(1) . This supply shall be permitted to include additional receptacle configurations conforming to 551.81 . The remainder of all recreational vehicle sites with electrical supply shall be equipped with one or more of the receptacle configurations conforming to 551.81 .

(C) 50-Ampere.

A minimum of 20 percent of existing and 40 percent of all new recreational vehicle sites, with electrical supply, shall each be equipped with a 50-ampere, 125/250-volt receptacle conforming to the configuration as identified in Figure 551.46(C)(1) . Every recreational vehicle site equipped with a 50-ampere receptacle shall also be equipped with a 30-ampere, 125-volt receptacle conforming to Figure 551.46(C)(1) . These electrical supplies shall be permitted to include additional receptacles that have configurations in accordance with 551.81 .

Informational Note: The percentage of 50 ampere sites required by 551.71 could be inadequate for seasonal recreational vehicle sites serving a higher percentage of recreational vehicles with 50-ampere electrical systems. In that type of recreational vehicle park, the percentage of 50-ampere sites could approach 100 percent.

(D) Tent Sites.

Dedicated tent sites with a 15- or 20-ampere electrical supply shall be permitted to be excluded when determining the percentage of recreational vehicle sites with 30- or 50-ampere receptacles.

(E) Additional Receptacles.

Additional receptacles shall be permitted for the connection of electrical equipment outside the recreational vehicle within the recreational vehicle park.

(F) GFCI Protection.

Ground-fault circuit-interrupter protection shall be provided as required in 210.8(B) . GFCI protection shall not be required for other than 125-volt, 15- and 20-ampere receptacles used in the recreational vehicle site equipment.

Informational Note No. 1: Appliances used within the recreational vehicle can create leakage current levels at the supply receptacle(s) that could exceed the limits of a Class A GFCI device.

Informational Note No. 2: The definition of *Power-Supply Assembly* in 551.2 and the definition of *Feeder* in Article 100 clarifies that the power supply cord to a recreational vehicle is considered a feeder.

551.72 Distribution System.

(A) Systems.

Distribution systems shall provide the voltage and have a capacity for the receptacles provided in the recreational vehicle (RV) site supply equipment as calculated according to 551.73 and shall have an ampacity not less than 30 amperes. Systems permitted include 120 volts, 1-phase; 120/240 volts, 1-phase; and 120/208 volts, 1-phase.

(B) Three-Phase Systems.

Feeders from 208Y/120-volt, 3-phase systems shall be permitted to include two ungrounded conductors and shall include one grounded conductor and one equipment grounding conductor. So far as practicable, the loads shall be equally distributed on the 3-phase system.

(C) Receptacles.

Receptacles rated at 50 amperes shall be supplied from a branch circuit of the voltage class and rating of the receptacle. Other recreational vehicle sites with 125-volt, 20- and 30-ampere receptacles shall be permitted to be derived from any grounded distribution system that supplies 120-volt, single-phase power. The neutral conductors shall not be reduced in size below the size of the ungrounded conductors for the site distribution.

(D) Neutral Conductors.

Neutral conductors shall be permitted to be reduced in size below the minimum required size of the ungrounded conductors for 240-volt, line-to-line, permanently connected loads only.

Informational Note: Due to the long circuit lengths typical in most recreational vehicle parks, feeder conductor sizes found in the ampacity tables of Article 310 may be inadequate to maintain the voltage regulation suggested in 215.2(A)(1) Informational Note No. 2. Total circuit voltage drop is a sum of the voltage drops of each serial circuit segment, where the load for each segment is calculated using the load that segment sees and the demand factors shown in Table 551.73(A) .

(E) Connected Devices.

The use of autotransformers shall not be permitted. The use of listed surge protective devices shall be permitted.

(F) Connection to Recreational Vehicle Site Equipment.

Each recreational vehicle shall be powered by only one 30-ampere or one 50-ampere external power supply cord.

Informational Note: The requirement in 551.72(F) does not preclude the use of the 15- or 20-ampere receptacle convenience outlet on the recreational vehicle supply equipment.

551.73 Calculated Load.

(A) Basis of Calculations.

Electrical services and feeders shall be calculated on the basis of not less than 12,000 volt-amperes per site equipped with 50-ampere, 208Y/120 or 120/240-volt supply facilities; 3600 volt-amperes per site equipped with both 20-ampere and 30-ampere supply facilities; 2400 volt-amperes per site equipped with only 20-ampere supply facilities; and 600 volt-amperes per site equipped with only 20-ampere supply facilities that are dedicated to tent sites. The demand factors set forth in Table 551.73(A) shall be the minimum allowable demand factors that shall be permitted in calculating load for service and feeders. Where the electrical supply for a recreational vehicle site has more than one receptacle, the calculated load shall be calculated only for the highest rated receptacle.

Where the electrical supply is in a location that serves two recreational vehicles, the equipment for both sites shall comply with 551.77 , and the calculated load shall only be calculated for the two receptacles with the highest rating.

(B) Demand Factors.

The demand factor for a given number of sites shall apply to all sites indicated. For example, 20 sites calculated at 45 percent of 3600 volt-amperes results in a permissible demand of 1620 volt-amperes per site or a total of 32,400 volt-amperes for 20 sites.

Informational Note: These demand factors may be inadequate in areas of extreme hot or cold temperature with loaded circuits for heating or air conditioning.

Table 551.73(A) Demand Factors for Site Feeders and Service-Entrance Conductors for Park Sites

Number of Recreational Vehicle Sites	Demand Factor (%)
1	100
2	90
3	80
4	75
5	65
6	60
7–9	55
10–12	50
13–15	48
16–18	47
19–21	45
22–24	43
25–35	42
36 plus	41

Loads for other amenities such as, but not limited to, service buildings, recreational buildings, and swimming pools shall be calculated separately and then be added to the value calculated for the recreational vehicle sites where they are all supplied by a common service.

551.74 Overcurrent Protection.

Overcurrent protection shall be provided in accordance with Article 240.

551.76 Grounding — Recreational Vehicle Site Supply Equipment.

(A) Grounding Electrode.

Power outlets or recreational vehicle site supply equipment, other than those used as service equipment, shall not be required to have a grounding electrode. An auxiliary grounding electrode(s) in accordance with 250.54 shall be permitted to be installed.

(B) Exposed Non–Current-Carrying Metal Parts.

Exposed non–current-carrying metal parts of fixed equipment, metal boxes, cabinets, and fittings that are not electrically connected to grounded equipment shall be grounded by an equipment grounding conductor run with the circuit conductors from the service equipment or from the transformer of a secondary distribution system. Equipment grounding conductors shall be sized in accordance with 250.122 and shall be permitted to be spliced by listed means.

The arrangement of equipment grounding connections shall be such that the disconnection or removal of a receptacle or other device will not interfere with, or interrupt, the grounding continuity.

(C) Secondary Distribution System.

Each secondary distribution system shall be grounded at the transformer.

(D) Grounded Conductor Not to Be Used as an Equipment Ground.

The grounded conductor shall not be used as an equipment grounding conductor for recreational vehicles or equipment within the recreational vehicle park.

(E) No Connection on the Load Side.

No connection to a grounding electrode shall be made to the grounded conductor on the load side of the service disconnecting means except as covered in 250.30(A) for separately derived systems, and 250.32(B) Exception No. 1 for separate buildings.

551.77 Recreational Vehicle Site Supply Equipment.

(A) Location.

Where provided on back-in sites, the recreational vehicle site electrical supply equipment shall be located on the left (road) side of the parked vehicle, on a line that is 1.5 m to 2.1 m (5 ft to 7 ft) from the left edge (driver's side of the parked RV) of the stand and shall be located at any point on this line from the rear of the stand to 4.5 m (15 ft) forward of the rear of the stand.

For pull-through sites, the electrical supply equipment shall be permitted to be located at any point along the line that is 1.5 m to 2.1 m (5 ft to 7 ft) from the left edge (driver's side of the parked RV) from 4.9 m (16 ft) forward of the rear of the stand to the center point between the two roads that gives access to and egress from the pull-through sites.

The left edge (driver's side of the parked RV) of the stand shall be marked.

(B) Disconnecting Means.

A disconnecting switch or circuit breaker shall be provided in the site supply equipment for disconnecting the power supply to the recreational vehicle.

(C) Access.

All site supply equipment shall be accessible by an unobstructed entrance or passageway not less than 600 mm (2 ft) wide and 2.0 m (6 ft 6 in.) high.

(D) Mounting Height.

Site supply equipment shall be located not less than 600 mm (2 ft) or more than 2.0 m (6 ft 6 in.) above the ground.

(E) Working Space.

Sufficient space shall be provided and maintained about all electrical equipment to permit ready and safe operation, in accordance with 110.26 .

(F) Marking.

Where the site supply equipment contains a 125/250-volt receptacle, the equipment shall be marked as follows: "Turn disconnecting switch or circuit breaker off before inserting or removing plug. Plug must be fully inserted or removed." The marking shall be located on the equipment adjacent to the receptacle outlet.

551.78 Protection of Outdoor Equipment.

(A) Wet Locations.

All switches, circuit breakers, receptacles, control equipment, and metering devices located in wet locations shall be weatherproof.

(B) Meters.

If secondary meters are installed, meter sockets without meters installed shall be blanked off with an approved blanking plate.

551.79 Clearance for Overhead Conductors.

Open conductors of not over 1000 volts, nominal, shall have a vertical clearance of not less than 5.5 m (18 ft) and a horizontal clearance of not less than 900 mm (3 ft) in all areas subject to recreational vehicle movement. In all other areas, clearances shall conform to 225.18 and 225.19 .

Informational Note: For clearances of conductors over 600 volts, nominal, see 225.60 and 225.61 .

551.80 Underground Service, Feeder, Branch-Circuit, and Recreational Vehicle Site Feeder-Circuit Conductors.

(A) General.

All direct-burial conductors, including the equipment grounding conductor if of aluminum, shall be insulated and identified for the use. All conductors shall be continuous from equipment to equipment. All splices and taps shall be made in approved junction boxes or by use of listed material.

(B) Protection Against Physical Damage.

Direct-buried conductors and cables entering or leaving a trench shall be protected by rigid metal conduit, intermediate metal conduit, electrical metallic tubing with supplementary corrosion protection, rigid polyvinyl chloride conduit (PVC), nonmetallic underground conduit with conductors (NUCC), high density polyethylene conduit (HDPE), reinforced thermosetting resin conduit (RTRC), liquidtight flexible nonmetallic conduit, liquidtight flexible metal conduit, or other approved raceways or enclosures. Where subject to physical damage, the conductors or cables shall be protected by rigid metal conduit, intermediate metal conduit, Schedule 80 PVC conduit, or RTRC listed for exposure to physical damage. All such protection shall extend at least 450 mm (18 in.) into the trench from finished grade.

Informational Note: See 300.5 and Article 340 for conductors or Type UF cable used underground or in direct burial in earth.

551.81 Receptacles.

A receptacle to supply electric power to a recreational vehicle shall be one of the configurations shown in Figure 551.46(C)(1) in the following ratings:

(1) 50-ampere — 125/250-volt, 50-ampere, 3-pole, 4-wire grounding type for 120/240-volt systems

(2) 30-ampere — 125-volt, 30-ampere, 2-pole, 3-wire grounding type for 120-volt systems

(3) 20-ampere — 125-volt, 20-ampere, 2-pole, 3-wire grounding type for 120-volt systems

Informational Note: Complete details of these configurations can be found in ANSI/NEMA WD 6-2016, *Wiring Devices — Dimensional Specificications* , Figures 14-50, TT, and 5-20.

Statement of Problem and Substantiation for Public Input

Coordination with proposed new definitions for low voltage and extra-low voltage.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1695-NFPA 70-2020 [New Definition after Definition: Voltage (of a circuit).]	Go together
Public Input No. 1695-NFPA 70-2020 [New Definition after Definition: Voltage (of a circuit).]	

Submitter Information Verification

Submitter Full Name: Paul Harouff
Organization: Deltek
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jun 25 14:32:38 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: Although the proposal attempts to coordinate the language with PI 1695, the scope of section 551 references the ANSI/RVIA LV Standard for Low Voltage Systems for Conversion and Recreational Vehicles. This proposed change would contradict definition of low voltage in that standard. The ANSI/RVIA LV Standard would need to be updated to allow this change to occur for Section 551.

Public Input No. 4435-NFPA 70-2020 [Section No. 551.1]

551.1 Scope.

This article covers the electrical conductors and equipment other than low-voltage and automotive vehicle circuits or extensions thereof, installed within or on recreational vehicles, the conductors and equipment that connect recreational vehicles to a supply of electricity, and the installation of equipment and devices related to electrical installations within a recreational vehicle park.

Informational Note: For information on low-voltage systems, refer to NFPA 1192-2018, *Standard on Recreational Vehicles,* and ANSI/RVIA LV-2014, *Standard for Low Voltage Systems in Conversion and Recreational Vehicles*.

Statement of Problem and Substantiation for Public Input

The supply of electricity to recreational vehicles includes not only conductors, but equipment including but not limited to raceways, cables, fittings, disconnecting means overcurrent protection, disconnecting means and service equipment. The addition of words "and equipment" will make the scope much more inclusive and accurate.

Submitter Information Verification

Submitter Full Name: Phil Simmons
Organization: Simmons Electrical Services
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 13:00:11 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: The proposed action is not applicable to where it was being added.

Public Input No. 3658-NFPA 70-2020 [Section No. 551.2]

(Relocate all definitions in the 551. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

551. 2 Definitions.

(See Article 100 for additional definitions.)

Air-Conditioning or Comfort-Cooling Equipment.

This definition shall apply only within this article.

All of that equipment intended or installed for the purpose of processing the treatment of air so as to control simultaneously or individually its temperature, humidity, cleanliness, and distribution to meet the requirements of the conditioned space.

Appliance, Fixed.

This definition shall apply only within this article.

An appliance that is fastened or otherwise secured at a specific location.

Camping Trailer.

This definition shall apply only within this article.

A vehicular portable unit mounted on wheels and constructed with collapsible partial side walls that fold for towing by another vehicle and unfold at the campsite to provide temporary living quarters for recreational, camping, or travel use. *(See Recreational Vehicle.)*

Converter.

This definition shall apply only within this article.

A device that changes electrical energy from one form to another, as from alternating current to direct current.

Dead Front (as applied to switches, circuit breakers, switchboards, and panelboards).

This definition shall apply only within this article.

Designed, constructed, and installed so that no current-carrying parts are normally exposed on the front.

Disconnecting Means.

This definition shall apply only within this article.

The necessary equipment usually consisting of a circuit breaker or switch and fuses, and their accessories, located near the point of entrance of supply conductors in a recreational vehicle and intended to constitute the means of cutoff for the supply to that recreational vehicle.

Frame.

This definition shall apply only within this article.

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

Low Voltage.

This definition shall apply only within this article.

An electromotive force rated 24 volts, nominal, or less.

Motor Home.

This definition shall apply only within this article.

A vehicular unit designed to provide temporary living quarters for recreational, camping, or travel use built on or permanently attached to a self-propelled motor vehicle chassis or on a chassis cab or van that is an integral part of the completed vehicle. *(See Recreational Vehicle.)*

Power-Supply Assembly.

This definition shall apply only within this article.

The conductors, including ungrounded, grounded, and equipment grounding conductors, the connectors, attachment plug caps, and all other fittings, grommets, or devices installed for the purpose of delivering energy from the source of electrical supply to the distribution panel within the recreational vehicle.

Recreational Vehicle.

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

A vehicular-type unit primarily designed as temporary living quarters for recreational, camping, or travel use, which either has its own motive power or is mounted on or drawn by another vehicle.

> Informational Note: The basic entities are travel trailer, camping trailer, truck camper, and motor home as referenced in NFPA 1192-2018, *Standard on Recreational Vehicles*. See 3.3.52, *Recreational Vehicle*, and A.3.3.52 of NFPA 1192.

Recreational Vehicle Park.

This definition shall apply only within this article.

Any parcel or tract of land under the control of any person, organization, or governmental entity wherein two or more recreational vehicle, recreational park trailer, and/or other camping sites are offered for use by the public or members of an organization for overnight stays.

Recreational Vehicle Site.

This definition shall apply only within this article.

A specific area within a recreational vehicle park or campground that is set aside for use by a camping unit.

Recreational Vehicle Site Feeder Circuit Conductors.

This definition shall apply only within this article.

The conductors from the park service equipment to the recreational vehicle site supply equipment.

Recreational Vehicle Site Supply Equipment.

This definition shall apply only within this article.

The necessary equipment, usually a power outlet, consisting of a circuit breaker or switch and fuse and their accessories, located near the point of entrance of supply conductors to a recreational vehicle site and intended to constitute the disconnecting means for the supply to that site.

Recreational Vehicle Stand.

This definition shall apply only within this article.

That area of a recreational vehicle site intended for the placement of a recreational vehicle.

Travel Trailer.

This definition shall apply only within this article.

A vehicular unit, mounted on wheels, designed to provide temporary living quarters for recreational, camping, or travel use, of such size or weight as not to require special highway movement permits when towed by a motorized vehicle, and of gross trailer area less than 30 m^2 (320 ft^2). *(See Recreational Vehicle.)*

Truck Camper.

This definition shall apply only within this article.

A portable unit constructed to provide temporary living quarters for recreational, travel, or camping use, consisting of a roof, floor, and sides, designed to be loaded onto and unloaded from the bed of a pickup truck. *(See Recreational Vehicle.)*

Statement of Problem and Substantiation for Public Input

"The National Electrical Code has definitions in multiple parts in Article 100 and many definitions scattered through out the code many of them in the .2 section of the articles.
Most of the other standards under NFPA have their definitions in one location and this will allow the NEC the same requirement. The revisions to the NEC Style Manual require all the definitions to be relocated to Article 100. "

Submitter Information Verification

Submitter Full Name: David Williams
Organization: Delta Charter Township
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 10:12:58 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7690-NFPA 70-2020

Statement: All existing definitions under the purview of CMP-7 have been moved to Article 100 and revises for compliance with Section 2.2.2 of the NEC Style Manual. Additionally, all definition sections (545.2, 547.2, 550.2, 551.2, 552.2, 555.2, 604.2, and 675.2.2) in the articles under the responsibility of CMP-7 have been deleted.

Public Input No. 447-NFPA 70-2020 [Section No. 551.2]

551.2 Definitions.

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

(See Article 100 for additional definitions.)

Air-Conditioning or Comfort-Cooling Equipment.

~~This definition shall apply only within this article.~~

All of that equipment intended or installed for the purpose of processing the treatment of air so as to control simultaneously or individually its temperature, humidity, cleanliness, and distribution to meet the requirements of the conditioned space.

Appliance, Fixed.

~~This definition shall apply only within this article.~~

An appliance that is fastened or otherwise secured at a specific location.

Camping Trailer.

~~This definition shall apply only within this article.~~

A vehicular portable unit mounted on wheels and constructed with collapsible partial side walls that fold for towing by another vehicle and unfold at the campsite to provide temporary living quarters for recreational, camping, or travel use. *(See Recreational Vehicle.)*

Converter.

~~This definition shall apply only within this article.~~

A device that changes electrical energy from one form to another, as from alternating current to direct current.

Dead Front (as applied to switches, circuit breakers, switchboards, and panelboards).

~~This definition shall apply only within this article.~~

Designed, constructed, and installed so that no current-carrying parts are normally exposed on the front.

Disconnecting Means.

~~This definition shall apply only within this article.~~

The necessary equipment usually consisting of a circuit breaker or switch and fuses, and their accessories, located near the point of entrance of supply conductors in a recreational vehicle and intended to constitute the means of cutoff for the supply to that recreational vehicle.

Frame.

~~This definition shall apply only within this article.~~

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

Low Voltage.

~~This definition shall apply only within this article.~~

An electromotive force rated 24 volts, nominal, or less.

Motor Home.

~~This definition shall apply only within this article.~~

A vehicular unit designed to provide temporary living quarters for recreational, camping, or travel use built on or permanently attached to a self-propelled motor vehicle chassis or on a chassis cab or van that is an integral part of the completed vehicle. *(See Recreational Vehicle.)*

Power-Supply Assembly.

~~This definition shall apply only within this article.~~

The conductors, including ungrounded, grounded, and equipment grounding conductors, the connectors, attachment plug caps, and all other fittings, grommets, or devices installed for the purpose of delivering energy from the source of electrical supply to the distribution panel within the recreational vehicle.

Recreational Vehicle.

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

A vehicular-type unit primarily designed as temporary living quarters for recreational, camping, or travel use, which either has its own motive power or is mounted on or drawn by another vehicle.

Informational Note: The basic entities are travel trailer, camping trailer, truck camper, and motor home as referenced in NFPA 1192-2018, *Standard on Recreational Vehicles*. See 3.3.52, *Recreational Vehicle*, and A.3.3.52 of NFPA 1192.

Recreational Vehicle Park.

~~This definition shall apply only within this article.~~

Any parcel or tract of land under the control of any person, organization, or governmental entity wherein two or more recreational vehicle, recreational park trailer, and/or other camping sites are offered for use by the public or members of an organization for overnight stays.

Recreational Vehicle Site.

~~This definition shall apply only within this article.~~

A specific area within a recreational vehicle park or campground that is set aside for use by a camping unit.

Recreational Vehicle Site Feeder Circuit Conductors.

~~This definition shall apply only within this article.~~

The conductors from the park service ~~equipment to~~ equipment to the recreational vehicle site supply equipment.

Recreational Vehicle Site Supply Equipment.

~~This definition shall apply only within this article.~~

The necessary equipment, usually a power ~~outlet, consisting~~ outlet consisting of a circuit breaker or switch and fuse and their accessories, located near the point of entrance of supply conductors to a recreational vehicle site and intended to constitute the disconnecting means for the supply to that site.

Recreational Vehicle Stand.

~~This definition shall apply only within this article.~~

That area of a recreational vehicle site intended for the placement of a recreational vehicle.

Travel Trailer.

~~This definition shall apply only within this article.~~

A vehicular unit, mounted on wheels, designed to provide temporary living quarters for recreational, camping, or travel use, of such size or weight as not to require special highway movement permits when towed by a motorized vehicle, and of gross trailer area less than 30 m^2 (320 ft^2). *(See Recreational Vehicle.)*

Truck Camper.

~~This definition shall apply only within this article.~~

A portable unit constructed to provide temporary living quarters for recreational, travel, or camping use, consisting of a roof, floor, and sides, designed to be loaded onto and unloaded from the bed of a pickup truck. *(See Recreational Vehicle.)*

Statement of Problem and Substantiation for Public Input

Add the dot 2 language clarifies that the defined terms apply to this article. Move the definition for "Recreational Vehicle" to article 100 to comply with the NEC Style Manual since this term appears in more than one article.

Submitter Information Verification

Submitter Full Name: David Hittinger
Organization: IEC
Street Address:
City:
State:
Zip:
Submittal Date: Sat Feb 08 09:36:47 EST 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7690-NFPA 70-2020

Statement: All existing definitions under the purview of CMP-7 have been moved to Article 100 and revises for compliance with Section 2.2.2 of the NEC Style Manual. Additionally, all definition sections (545.2, 547.2, 550.2, 551.2, 552.2, 555.2, 604.2, and 675.2.2) in the articles under the responsibility of CMP-7 have been deleted.

Public Input No. 3340-NFPA 70-2020 [Definition: Appliance, Fixed.]

Appliance, Fixed.

~~This definition shall apply only within this article.~~

An appliance that is fastened or otherwise secured at a specific location.

Statement of Problem and Substantiation for Public Input

The revised NEC Style Manual requires all definitions to be relocated to Article 100. If a definition is only for a specific article the Article number in parentheses following the definition and before the code making panel number in parentheses.

The Definition of Appliance, Fixed appears in Article 550 and 551, which is identical.

Submitter Information Verification

Submitter Full Name: David Williams
Organization: Delta Charter Township
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 08 08:25:27 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7690-NFPA 70-2020

Statement: All existing definitions under the purview of CMP-7 have been moved to Article 100 and revises for compliance with Section 2.2.2 of the NEC Style Manual. Additionally, all definition sections (545.2, 547.2, 550.2, 551.2, 552.2, 555.2, 604.2, and 675.2.2) in the articles under the responsibility of CMP-7 have been deleted.

Public Input No. 1895-NFPA 70-2020 [Definition: Recreational Vehicle Site Feeder Circuit Conduc...]

Recreational Vehicle Site Feeder ~~Circuit Conductors~~ .

This definition shall apply only within this article.

The conductors ~~from~~ between the park service equipment ~~to~~ and the recreational vehicle site supply equipment.

Statement of Problem and Substantiation for Public Input

The proposed change improves clarity. The definition of Feeder in Article 100 states "All circuit conductors between…", makes 'Circuit Conductors' in the term 'Recreational Vehicle Site Feeder Circuit Conductors' redundant.

For consistency with the definition of Feeders given in Article 100 'from' and 'to' have been replaced with 'between' and 'and', respectively.

Submitter Information Verification

Submitter Full Name: John Cowans
Organization: Siemens
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jul 14 10:35:01 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7822-NFPA 70-2020
Statement: CMP-7 agrees that the proposed change improves clarity. The definition of Feeder in Article 100 states "All circuit conductors between…", makes 'Circuit Conductors' in the term 'Recreational Vehicle Site Feeder Circuit Conductors' redundant. For consistency with the definition of Feeders given in Article 100 'from' and 'to' have been replaced with 'between' and 'and', respectively.

Public Input No. 4446-NFPA 70-2020 [Definition: Recreational Vehicle Site Supply Equipment.]

Recreational Vehicle Site Supply Equipment.

This definition shall apply only within this article.

The necessary equipment, usually a power outlet, consisting of a circuit breaker or switch and fuse and their accessories, located ~~near the point of entrance of supply conductors to a recreational~~ at the recreational vehicle site and intended to constitute the disconnecting means for ~~the supply to that site~~ a recreational vehicle .

Statement of Problem and Substantiation for Public Input

This is intended to be an editorial rather than substantive Public Input. In reality, the power outlet and accessories including receptacles, is located at the RV site and constitutes the disconnecting means for the recreational vehicle.

Submitter Information Verification

Submitter Full Name: Phil Simmons
Organization: Simmons Electrical Services
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 13:11:49 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: CMP-7 chooses not to adopt the submitted editorial change to the current definition. Disconnecting means is covered by 551.77(B).

Public Input No. 781-NFPA 70-2020 [Definition: Recreational Vehicle Site Supply Equipment.]

Recreational Vehicle Site Supply Equipment.

This definition shall apply only within this article.

The necessary equipment, usually a power outlet, consisting of a circuit breaker or switch and fuse and their accessories, located near the point of entrance of supply conductors to a recreational vehicle site ~~and intended~~ , intended to constitute the disconnecting means for the supply to that site and identified for RV Site use .

Statement of Problem and Substantiation for Public Input

To provide consistency with other special occupancy articles and with UL 231, Power Outlets

Submitter Information Verification

Submitter Full Name:	Wade Elliott
Organization:	Utility Services Group, Inc.
Affiliation:	ARVC, National Association of RV Parks and Campgrounds
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Tue Mar 24 16:34:26 EDT 2020
Committee:	NEC-P07

Committee Statement

Resolution: Requirements cannot be added to definitions.

Public Input No. 1917-NFPA 70-2020 [Definition: Recreational Vehicle.]

~~**Recreational Vehicle.**~~

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

~~A vehicular-type unit primarily designed as temporary living quarters for recreational, camping, or travel use, which either has its own motive power or is mounted on or drawn by another vehicle.~~

~~Informational Note: The basic entities are travel trailer, camping trailer, truck camper, and motor home as referenced in NFPA 1192-2018, *Standard on Recreational Vehicles* . See 3.3.52, *Recreational Vehicle* , and A.3.3.52 of NFPA 1192.~~

Statement of Problem and Substantiation for Public Input

In the 2020 NEC, the definition for "Recreational Vehicle" states "This definition shall apply within this article and throughout the Code." This implies that the defined term is present in more than one section of the NEC. A search of the NEC reveals that this term is present in article, 90, 545, 551, and 626. Section 2.2.2.1 of the NEC style manual reserves space in article 100 for definitions of terms that appear in more than one article.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1918-NFPA 70-2020 [New Definition after Definition: Reconditioned.]	
Public Input No. 1918-NFPA 70-2020 [New Definition after Definition: Reconditioned.]	

Submitter Information Verification

Submitter Full Name: John Cowans
Organization: Siemens
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jul 16 11:31:33 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7690-NFPA 70-2020

Statement: All existing definitions under the purview of CMP-7 have been moved to Article 100 and revises for compliance with Section 2.2.2 of the NEC Style Manual. Additionally, all definition sections (545.2, 547.2, 550.2, 551.2, 552.2, 555.2, 604.2, and 675.2.2) in the articles under the responsibility of CMP-7 have been deleted.

Public Input No. 623-NFPA 70-2020 [Definition: Recreational Vehicle.]

Recreational Vehicle (RV) .

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

~~A vehicular-type unit~~ A vehicle or slide-in camper that is primarily designed as temporary living quarters for recreational, camping, ~~or travel use, which either~~ or seasonal use ; has its own motive power or is mounted on ~~or drawn~~ or towed by another vehicle; is regulated by the National Highway Traffic Safety Administration as a vehicle or vehicle equipment; does not require a special highway use permit for operation on the highways; and can be easily transported and set up on a daily basis by an individual .

Informational Note: The basic entities are travel trailer, camping trailer, truck camper, and motor home as referenced in NFPA 1192-2018, *Standard on Recreational Vehicles*. See 3.3.52, *Recreational Vehicle*, and A.3.3.52 of NFPA 1192.

Statement of Problem and Substantiation for Public Input

Correlates definition of RV with definition in NFPA 1192.

Submitter Information Verification

Submitter Full Name: John Cowans
Organization: Siemens
Street Address:
City:
State:
Zip:
Submittal Date: Tue Mar 10 09:03:42 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7826-NFPA 70-2020
Statement: CMP-7 accepts the definition change proposed by the PI to correlate with NFPA 1192, 2021.

Public Input No. 1518-NFPA 70-2020 [New Definition after Definition: Disconnecting Means.]

TITLE OF NEW CONTENT

Electrical Datum Plane .

This definition shall only apply within this article.

Electrical Datum Plane in Recreational Vehicle Parks is either the ground in areas away from natural or man-made bodies, or

(1) In land areas subject to tidal fluctuation, the electrical datum plane is the highest tide level for the area occurring under normal circumstances, that is, highest high tide.

(2) In land areas not subject to tidal fluctuation, the electrical datum plane is the highest water level for the area occurring under normal circumstances.

The Electrical Datum Plane encompasses areas subject to tidal movement and areas in which the water level is affected by conditions such as climate (rain or snowfall) or by human intervention (the opening or closing of dams or floodgates). In either case, the term covers the Normal Highest Water Level, such as an astronomical high tide. The term does not cover extremes due to natural or manmade disasters.

Statement of Problem and Substantiation for Public Input

No standard exists for where an Electric Datum Plane (EDP) is located. AHJ's are required to locally determine without a consistent result.

Article 682 does not fully identify EDP, what should be the EDP and what defines a Normal Highest Water Level. (See related PI for NHWL)

Many RV Parks are built in areas where permanent dwellings and commercials buildings are not built because of possible natural and man made disasters. Two notable states (MN, MT) have identified and defined “Normal Highest Water Level”. In one state (MT), this definition was confirmed by a US Supreme Court case.
This Public Input seeks to standardize the Normal Highest Water Level and its relationship to EDP for those special occupancies that allow temporary usage and/or movable non dwelling Recreational Vehicles.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1519-NFPA 70-2020 [New Definition after Definition: Motor Home.]	
Public Input No. 1519-NFPA 70-2020 [New Definition after Definition: Motor Home.]	

Submitter Information Verification

Submitter Full Name: Wade Elliott
Organization: Utility Services Group, Inc.
Affiliation: National Association of RV Parks and Campgrounds

Street Address:
City:
State:
Zip:
Submittal Date: Mon Jun 15 17:50:32 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7872-NFPA 70-2020

Statement: This definition for “Electrical Datum Plane” in Article 100 will be revised in the 2023 NEC to include the words “Normal High Water Level”. The information regarding determining the distance for the Electrical Datum Plane will be revised and added to section 551.3 and 555.3 to address both conditions. The added language adds clarity for the user and references the new term “Normal High Water Level” for more consistent enforcement.

Public Input No. 1519-NFPA 70-2020 [New Definition after Definition: Motor Home.]

TITLE OF NEW CONTENT

Normal Highest Water Level .

This definition shall only apply within this article.

Normal Highest Water Level is defined as an elevation delineating the highest water level that has been maintained for a sufficient period of time to leave evidence upon the landscape, commonly the point where the natural vegetation changes from predominantly aquatic to predominantly terrestrial.

Statement of Problem and Substantiation for Public Input

Many RV Parks are built in areas where permanent dwellings and commercials buildings are not built because of possible natural and man made disasters. Two notable states (MN, MT) have identified and defined “Normal Highest Water Level”. In one state (MT), this definition was confirmed by a US Supreme Court case.
This Public Input seeks to standardize the Normal Highest Water Level and its relationship to EDP for those special occupancies that allow temporary usage and/or movable non dwelling Recreational Vehicles.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1518-NFPA 70-2020 [New Definition after Definition: Disconnecting Means.]	
Public Input No. 1518-NFPA 70-2020 [New Definition after Definition: Disconnecting Means.]	

Submitter Information Verification

Submitter Full Name: Wade Elliott
Organization: Utility Services Group, Inc.
Affiliation: National Association of RV Parks and Campgrounds
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jun 15 18:18:19 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7875-NFPA 70-2020

Statement: CMP-7 has created a new definition for “Normal High Water Level” as it applies to Electrical Datum Plane distances to standardize the installations and enforceability according to the NEC.

Public Input No. 4453-NFPA 70-2020 [Section No. 551.30(A)]

(A) ~~Mounting~~ Installation .

Generators shall be mounted in such a manner ~~as to~~ that the frame will be effectively bonded to the recreational vehicle chassis. The connection of the electrical system produced by the generator shall provide an effective ground-fault return path when operational.

Statement of Problem and Substantiation for Public Input

The change of the title of the section is intended to provide broader application.
The addition of the frame of the generator being bonded is intended to be more descriptive.
It is important that the connection of the generator to the electrical system continue to provide a ground-fault return path so that protection is maintained whether the unit is supplied by shore power or by the generator.

Submitter Information Verification

Submitter Full Name: Phil Simmons
Organization: Simmons Electrical Services
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 13:22:54 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7841-NFPA 70-2020
Statement: CMP-7 does not accept the change in title but adds the submitter's second sentence in the proposed language for clarity and consistency. It is important that the connection of the generator to the electrical system continue to provide a ground-fault return path so that protection is maintained whether the unit is supplied by RVSE or by the generator.

Public Input No. 4084-NFPA 70-2020 [Section No. 551.40(A)]

(A) General Requirements.

The electrical equipment and material of recreational vehicles indicated for connection to a wiring system rated 120 volts, nominal, 2-wire with equipment grounding conductor, or a wiring system rated 120/240 volts, nominal, 3-wire with equipment grounding conductor, shall be listed and installed in accordance ~~with the requirements of~~ with Parts I, II, III, IV, and V of this article. Electrical equipment connected line-to-line shall have a voltage rating of 208–230 volts.

Statement of Problem and Substantiation for Public Input

Deleting the words "the requirements of" does not change the meaning of the section.

Submitter Information Verification

Submitter Full Name: David Williams
Organization: Delta Charter Township
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 20:26:32 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7842-NFPA 70-2020
Statement: CMP-7 creates a FR based on PI-4084 to delete “the requirements of” and adds the term nominal to be consistent with other references in the section.

Public Input No. 4139-NFPA 70-2020 [Section No. 551.40(C)]

(C) Ground-Fault Circuit-Interrupter Protection.

The internal wiring of a recreational vehicle having only one 15- or 20-ampere branch circuit as permitted in 551.42(A) and (B) shall have listed and labeled ground-fault circuit-interrupter protection for personnel. The ground-fault circuit interrupter shall be installed at the point where the power supply assembly terminates within the recreational vehicle. Where a separable cord set is not employed, the ground-fault circuit interrupter shall be permitted to be an integral part of the attachment plug of the power supply assembly. The ground-fault circuit interrupter shall provide protection also under the conditions of an open grounded circuit conductor, interchanged circuit conductors, or both.

Statement of Problem and Substantiation for Public Input

This is a device that depends on functional safety, without certification (Listing), how is an AHJ to know if it is going to properly perform the GFCI functions required by the product standard. Also, to promote consistency with Sections 410.184, 445.20, 518.3(B), 525.23(D), 600.10(C)(2), 680.5, 680.23(A)(8) which currently required listing.

Submitter Information Verification

Submitter Full Name: Richard Hollander
Organization: Shums Coda Associates
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 21:49:59 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: The additional language is not needed because the requirement already exists in 551.40(A).

Public Input No. 1804-NFPA 70-2020 [Section No. 551.40(D)]

(D) Reverse Polarity Device.

A reverse polarity indicating device that provides a continuous visible or audible signal shall be installed in the recreational vehicle in accordance with the installation instructions and shall respond to the reversal of the ungrounded and the grounded conductors in the 120-volt ac system. The receptacle portion of the reverse polarity indicating device shall be equipped with a cover that is weatherproof whether or not the attachment plug cap is inserted.

Statement of Problem and Substantiation for Public Input

The reverse polarity indicating devices are typically inserted into an enclosure that is weatherproof whether or not the attachment plug is inserted; however the receptacle portion of the reverse polarity indicating device then hangs below the enclosure providing no weatherproof protection for the recreational vehicle to plug into.

Submitter Information Verification

Submitter Full Name: Tj Woods
Organization: Wyoming Electrical Jatc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jul 07 17:51:22 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7849-NFPA 70-2020
Statement: CMP-7 TG-2 is creating a panel action to remove Section 551.40(D).

In the 2020 Code Cycle of the NEC, Section 551.40(D) was added by a CMP-7 action to create first revision 8404. This CMP-7 action was taken as a result of PI 2566. This action was taken as a step to reduce RV electrical shock accidents also known as “hot skin” conditions.

The 120V electrical systems of RVs are wired with the neutral conductor and grounding conductor isolated from each other. As a result, the grounding point for an RV is achieved through the electrical connection it makes when it is plugged in at a receptacle. The reversing of the hot and neutral conductors will not affect the operation of the RV nor will it allow the grounding portion of the vehicle to become energized as the 2020 FR 8404 substantiation suggests. The inclusion of a reverse polarity indicator will only indicate the pedestal is wired improperly. It does not improve the safety of the RV. Including this requirement into the RV electrical system to be detected after the connection is made to the receptacle is too late. The validation of the electrical receptacle that feeds the RV from campground or other authorized grounded receptacle should be done prior to the electrical connection. There are many after-market devices that perform this function that able to be purchased by a consumer. This requirement should not be placed upon the RV to perform.

Public Input No. 1990-NFPA 70-2020 [Section No. 551.40(D)]

(D) Reverse Polarity and Loss of Ground Device.

A ~~reverse polarity indicating device that provides a continuous visible or audible signal shall be installed in the recreational vehicle in accordance with the installation instructions and shall respond to the~~ device Listed to indicate reverse polarity and loss of ground shall be installed in one of the following locations:

(1) Integral to the power supply cord within 12 inches of the plug or

(2) Directly adjacent to the recreational vehicle entrance so that the external indicator display is visible prior to entry into the recreational vehicle.

The device shall provide a continuous visible or audible signal response to the reversal of the ungrounded and the grounded conductors and the loss of ground in the 120-volt ac system.

Statement of Problem and Substantiation for Public Input

This Public Input adds new requirements for the protection of the line voltage power supply for an RV. The PI adds “loss of ground” function to the reverse polarity device to notify users of the RV if the hazardous condition of a loss of equipment ground to the RV is present that may result in a potential "hot skin" condition. Also, as currently worded in the 2020 NEC, the display for the reverse polarity device could be installed anywhere in the vehicle so that it may never be seen. This Public Input addresses location of this protection to locate it outside the vehicle where the RV is connected to the power supply, or directly next to the entry door so that the user will be notified of the fault conditions prior to entering the vehicle. The Listing requirement will require these important safety devices comply with established safety certification requirements.

Submitter Information Verification

Submitter Full Name: Thomas Lichtenstein
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jul 23 21:06:52 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7851-NFPA 70-2020
Statement: CMP-7 chooses to separate this device into its own section and created a FR to add a loss of ground device indicator. To identify a possible loss of ground that could result in a hot skin condition.

Public Input No. 2198-NFPA 70-2020 [Section No. 551.40(D)]

(D) Reverse Polarity Device.

A reverse polarity indicating device that provides a continuous visible or audible signal to the user prior to vehicle entry shall be installed ~~in the recreational vehicle in accordance with the installation instructions and~~ within or at any point on the supply side of the recreational vehicle's 120/240-volt ac electrical system and shall respond to the reversal of the ungrounded and the grounded conductors ~~in the 120-volt ac system~~ .

Exception: Recreational vehicles equipped with reverse polarity protection.

Statement of Problem and Substantiation for Public Input

551.40(D) as presently written, is ambiguous and as such would permit the indicating device to be located in areas of no safety value to the consumer. The reference to installation instructions was removed as listed equipment have installation instructions. Further, if reverse polarity protection is provided, such as integral within some listed transfer switches, a continuous signal is not needed as electricity would not flow to the RV. The revision provides additional needed clarity

Submitter Information Verification

Submitter Full Name: Kent Perkins
Organization: Recreation Vehicle Industry As
Street Address:
City:
State:
Zip:
Submittal Date: Sat Aug 08 09:16:57 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7849-NFPA 70-2020
Statement: CMP-7 TG-2 is creating a panel action to remove Section 551.40(D).

In the 2020 Code Cycle of the NEC, Section 551.40(D) was added by a CMP-7 action to create first revision 8404. This CMP-7 action was taken as a result of PI 2566. This action was taken as a step to reduce RV electrical shock accidents also known as “hot skin” conditions.

The 120V electrical systems of RVs are wired with the neutral conductor and grounding conductor isolated from each other. As a result, the grounding point for an RV is achieved through the electrical connection it makes when it is plugged in at a receptacle. The reversing of the hot and neutral conductors will not affect the operation of the RV nor will it allow the grounding portion of the vehicle to become energized as the 2020 FR 8404 substantiation suggests. The inclusion of a reverse polarity indicator will only indicate the pedestal is wired improperly. It does not improve the safety of the RV. Including this requirement into the RV electrical system to be detected after the connection is made to the receptacle is too late. The validation of the electrical receptacle that feeds the RV from campground or other authorized grounded receptacle should be done prior to the

electrical connection. There are many after-market devices that perform this function that able to be purchased by a consumer. This requirement should not be placed upon the RV to perform.

Public Input No. 4194-NFPA 70-2020 [Section No. 551.40(D)]

(D) Reverse ~~Polarity~~ Connection Device.

A reverse ~~polarity~~ connection indicating device that provides a continuous visible or audible signal shall be installed in the recreational vehicle in accordance with the installation instructions and shall respond to the reversal of the ungrounded and the grounded conductors in the 120-volt ac system.

Statement of Problem and Substantiation for Public Input

The term "polarity" only applies to dc systems; these are not used on dc systems. This PI corrects the error.

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
Organization: Hartwell Electrical Services, Inc.
Affiliation: self
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 01:25:35 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7849-NFPA 70-2020
Statement: CMP-7 TG-2 is creating a panel action to remove Section 551.40(D).

In the 2020 Code Cycle of the NEC, Section 551.40(D) was added by a CMP-7 action to create first revision 8404. This CMP-7 action was taken as a result of PI 2566. This action was taken as a step to reduce RV electrical shock accidents also known as “hot skin” conditions.

The 120V electrical systems of RVs are wired with the neutral conductor and grounding conductor isolated from each other. As a result, the grounding point for an RV is achieved through the electrical connection it makes when it is plugged in at a receptacle. The reversing of the hot and neutral conductors will not affect the operation of the RV nor will it allow the grounding portion of the vehicle to become energized as the 2020 FR 8404 substantiation suggests. The inclusion of a reverse polarity indicator will only indicate the pedestal is wired improperly. It does not improve the safety of the RV. Including this requirement into the RV electrical system to be detected after the connection is made to the receptacle is too late. The validation of the electrical receptacle that feeds the RV from campground or other authorized grounded receptacle should be done prior to the electrical connection. There are many after-market devices that perform this function that able to be purchased by a consumer. This requirement should not be placed upon the RV to perform.

Public Input No. 2147-NFPA 70-2020 [Section No. 551.41(C)]

(C) Ground-Fault Circuit-Interrupter Protection.

~~Where provided, each 125-volt, single-phase, 15- or 20-ampere receptacle outlet shall have ground-fault~~
Ground-Fault circuit-interrupter protection
~~for personnel in the following locations:~~

- ~~Adjacent to a bathroom lavatory~~
~~Where the receptacles are installed to serve the countertop surfaces and are within 1.8 m (6 ft) of any lavatory or sink~~
shall be provided as required in 210.8(B).

Informational note: The special transportation area of a recreational vehicle that is separated from the living area by a wall is considered as a garage.

Exception No. 1: Receptacles installed for appliances in dedicated spaces, such as for disposals, refrigerators, and freezers shall not require ground-fault circuit-interrupter protection.

Exception No. 2: Single receptacles for interior connections of expandable room sections shall not require ground-fault circuit-interrupter protection.

Exception No. 3: De-energized receptacles that are within 1.8 m (6 ft) of any sink or lavatory due to the retraction of the expandable room section shall not require ground-fault circuit-interrupter protection.

- ~~In the area occupied by a toilet, shower, tub, or any combination thereof~~
~~On the exterior of the vehicle~~ ~~Exception~~

Exception No. 4 : Receptacles that are located inside of an access panel that is installed on the exterior of the vehicle to supply power for an installed appliance shall not be required to have ground-fault circuit-interrupter protection.

- ~~In the special transportation area of a recreational vehicle that is separated from the living area by a wall~~
The receptacle outlet shall be permitted in a listed luminaire. A receptacle outlet shall not be installed in a tub or combination tub–shower compartment.

Additional Proposed Changes

File Name	Description	Approved
551.41_C_Clean.docx		

Statement of Problem and Substantiation for Public Input

The changes suggested in this PI will add clarity for the reader, simplify the code, and make this section conform with the style introduced for many GFCI requirements in the 2020 NEC.

The updated style for GFCI requirements in sections other than 210.8 references the general GFCI requirements in 210.8 and duplication of requirements are eliminated. Only requirements that are not captured in 210.8 are described. Examples are available for review in the following locations:

-545.28
-547.5(G)
-551.71(F)

Elimination of duplicates allows for deletion of the following items because they are already specified in 210.8(B):

-Item (1) is removed because it is covered by 210.8(B)(1) and 210.8(B)(5) and lavatory appears to be intended to refer to a sink

-Item (2) is removed because it is covered by 210.8(B)(2) and 210.8(B)(5) and lavatory appears to be intended to refer to a sink

-Item (3) is removed because it is covered by 210.8(B)(1) and 210.8(B)(12)

-Item (4) is removed because it is covered by 210.8(B)(4)

Reference to 210.8(B) enforces the idea that RVs are not considered dwellings and requires the reader to apply the correct requirements for GFCI use.

Use of the word "lavatory" is confusing and should not be used in this code unless a definition is provided to clarify the intended meaning. Webster provides three definitions allowing this word to roughly describe either a sink, a toilet, or a room containing a sink and possibly a toilet, a shower, or a bathtub. Therefore, the wording used in 210.8(B) is more precise and should be sufficient to replace descriptions of locations related to "lavatories" that are used in the current code.

Submitter Information Verification

Submitter Full Name: John Cowans
Organization: Siemens
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 03 17:51:11 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: Section 210.8(B) as referenced by the submitter does not take into account the special nature of these vehicles that are not dwellings. The current language in section 551.41(C) addresses the unique nature of an RV layout and terminology and provides for clarity and ease of enforcement. In most cases, the code enforcement is done at the manufacturing facility of the vehicle and not by local AHJs. It is preferred to have all of the requirements located in one concise section to aide industry in the review and application of these requirements to the recreational vehicles.

(C) Ground-Fault Circuit-Interrupter Protection.

~~Where provided, each 125-volt, single-phase, 15- or 20-ampere receptacle outlet shall have ground-fault~~ Ground-Fault circuit-interrupter protection shall be provided as required in 210.8(B). ~~for personnel in the following locations:~~

Informational note: The special transportation area of a recreational vehicle that is separated from the living area by a wall is considered as a garage.

~~(1) Adjacent to a bathroom lavatory~~

~~(2) Where the receptacles are installed to serve the countertop surfaces and are within 1.8 m (6 ft) of any lavatory or sink~~

Exception No. 1: Receptacles installed for appliances in dedicated spaces, such as for disposals, refrigerators, and freezers shall not require ground-fault circuit-interrupter protection.

Exception No. 2: Single receptacles for interior connections of expandable room sections shall not require ground-fault circuit-interrupter protection.

Exception No. 3: De-energized receptacles that are within 1.8 m (6 ft) of any sink or lavatory due to the retraction of the expandable room section shall not require ground-fault circuit-interrupter protection.

~~(3) In the area occupied by a toilet, shower, tub, or any combination thereof~~

~~(4) On the exterior of the vehicle~~

Exception No. 4: Receptacles that are located inside of an access panel that is installed on the exterior of the vehicle to supply power for an installed appliance shall not be required to have ground-fault circuit-interrupter protection.

~~(5) In the special transportation area of a recreational vehicle that is separated from the living area by a wall~~

The receptacle outlet shall be permitted in a listed luminaire. A receptacle outlet shall not be installed in a tub or combination tub–shower compartment.

Public Input No. 4133-NFPA 70-2020 [Section No. 551.41(C)]

(C) Ground-Fault Circuit-Interrupter Protection.

Where provided, each 125-volt, single-phase, 15- or 20-ampere receptacle outlet shall have listed and labeled ground-fault circuit-interrupter protection for personnel in the following locations:

(1) Adjacent to a bathroom lavatory

(2) Where the receptacles are installed to serve the countertop surfaces and are within 1.8 m (6 ft) of any lavatory or sink

Exception No. 1: Receptacles installed for appliances in dedicated spaces, such as for disposals, refrigerators, and freezers shall not require ground-fault circuit-interrupter protection.

Exception No. 2: Single receptacles for interior connections of expandable room sections shall not require ground-fault circuit-interrupter protection.

Exception No. 3: De-energized receptacles that are within 1.8 m (6 ft) of any sink or lavatory due to the retraction of the expandable room section shall not require ground-fault circuit-interrupter protection.

(3) In the area occupied by a toilet, shower, tub, or any combination thereof

(4) On the exterior of the vehicle

Exception: Receptacles that are located inside of an access panel that is installed on the exterior of the vehicle to supply power for an installed appliance shall not be required to have ground-fault circuit-interrupter protection.

(5) In the special transportation area of a recreational vehicle that is separated from the living area by a wall

The receptacle outlet shall be permitted in a listed luminaire. A receptacle outlet shall not be installed in a tub or combination tub–shower compartment.

Statement of Problem and Substantiation for Public Input

This is a device that depends on functional safety, without certification (Listing), how is an AHJ to know if it is going to properly perform the GFCI functions required by the product standard. Also, to promote consistency with Sections 410.184, 445.20, 518.3(B), 525.23(D), 600.10(C)(2), 680.5, 680.23(A)(8) which currently required listing.

Submitter Information Verification

Submitter Full Name: Richard Hollander
Organization: Shums Coda Associates
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 21:44:22 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: The additional language is not needed because this requirement already exists in the code. See 551.40(A), General Requirements.

Public Input No. 3107-NFPA 70-2020 [New Section after 551.43]

TITLE OF NEW CONTENT

Type your content here ...

551.43(D) Arc-Fault Circuit-Interrupter Protection.

All 120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets or devices installed in recreational vehicles shall be protected by any of the means described in 210.12(A)(1) through (6).

Statement of Problem and Substantiation for Public Input

RVs are utilized by some people for temporary lodging arrangements and by others as semi-permanent homes. There are thousands of RV fires every year. The National Park Service states, “Mechanical or electrical failures cause roughly three-quarters of the highway vehicle fires” [https://www.nps.gov/articles/p52-rv-fire-safety-101.htm].

The electrical concerns in RVs are amplified by vibrations that are created by over the road travel and the operation of machinery such as the engine, refrigeration and generation equipment. These vibrations can create loose electrical connections and/or wear insulation away from conductors, each of which can lead to arcing and fire. The proximity between the electrical system wiring and combustible fuels can lead to disastrous results.

Examples are provided below to show that fires ignited by arcing are a real danger:

- https://www.crossingcreeksrvresort.com/index.php/categories/item/64-what-are-the-leading-causes-of-motorhome-fires
- https://liveworkdream.com/2017/03/15/rv-catastrophe-close-call/
- https://baltimore.cbslocal.com/2020/01/03/talbot-county-house-rv-fire/

Requiring AFCI protection for RVs would reduce the overall likelihood of fires by eliminating an ignition source.

Submitter Information Verification

Submitter Full Name:	Randy Dollar
Organization:	Siemens Industry
Affiliation:	American Circuit Breaker Manufacturers Association (ACBMA)
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Fri Sep 04 16:52:14 EDT 2020
Committee:	NEC-P07

Committee Statement

Resolution: The proposed change is not applicable as an RV is not a dwelling, per the definition. This is addressed in NFPA 1192. RV equipment must pass more rigorous testing due to possible vibration issues.

Public Input No. 3321-NFPA 70-2020 [Section No. 551.47(L)]

(L) Receptacle Faceplates.

Metal faceplates shall comply with 406.~~5~~ 6 (A). Nonmetallic faceplates shall comply with 406.~~5~~ 6 (C).

Statement of Problem and Substantiation for Public Input

551.47(L) Receptacle Faceplates requires compliance with the construction in section 406.6, Receptacle Faceplates (Cover Plates); but incorrectly reference 406.5(A) and 406.5(C) which are addressing Receptacle Mounting, The correct reference are 406.6(A) and 406.6(C) respectively.

Submitter Information Verification

Submitter Full Name: Mathher Abbassi
Organization: New York City Department Of Buildings
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 07 22:34:48 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7876-NFPA 70-2020
Statement: Metal faceplates shall comply with 406.5 6 (A). Nonmetallic faceplates shall comply with 406.5 6 (C).

Public Input No. 4618-NFPA 70-2020 [Section No. 551.47(N)]

(N) Moisture or Physical Damage.

Where outdoor or under-chassis wiring is 120 volts, nominal, or over and is exposed to moisture or physical damage, the wiring shall be protected by rigid metal conduit, by intermediate metal conduit, or by electrical metallic tubing, rigid ~~nonmetallic conduit~~ polyvinyl chloride conduit , or Type MI cable, that is closely routed against frames and equipment enclosures or other raceway or cable identified for the application.

Statement of Problem and Substantiation for Public Input

The 2008 NEC first referenced Reinforced Thermosetting Resin Conduit (RTRC) as a wiring method (Article 355). High Density Polyethylene Conduit (HDPE) first appeared in the 2005 NEC as Article 353. When Article 352 first changed (2008 NEC) to be titled “Rigid Polyvinyl Chloride Conduit” there were many changes throughout the Code to pick up this change and accordingly change text from “rigid nonmetallic conduit” to “rigid polyvinyl chloride conduit.”
In the 2002 NEC, this section referenced “rigid nonmetallic conduit” (as it still does in the 2020 NEC) before RTRC and HDPE appeared in the Code. This makes it clear that this section intended to permit only the use of rigid polyvinyl chloride conduit identified as “rigid nonmetallic conduit” as the other raceway types were not recognized by the NEC at the time. This term should be changed to rigid polyvinyl chloride and if the cmp wishes to add other types of nonmetallic raceways they should be listed separately as the metal raceways are.

Submitter Information Verification

Submitter Full Name: David Humphrey
Organization: County of Henrico, Virginia
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 15:53:21 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: CMP-7 disagrees with the PI submitter in this case since the proposed change could limit listed and identified wiring methods as required in 551.40(A) and 551.40(B) and create unintentional design restrictions. The proposal restricts the use of other rigid nonmetallic conduit by specifying polyvinyl chloride conduit.

Public Input No. 4132-NFPA 70-2020 [Section No. 551.47(P)(1)]

(1) Cord-and-Plug-Connected.

Cord-and-plug connections shall comply with 551.47(P)(1)(a) through (P)(1)(d).

(a) That portion of a branch circuit that is installed in an expandable unit shall be permitted to be connected to the portion of the branch circuit in the main body of the vehicle by means of an attachment plug and cord listed for hard usage. The cord and its connections shall comply with Part I and Part II, as applicable, of Article 400 and shall be considered as a permitted use under 400.10. Where the attachment plug and cord are located within the vehicle's interior, use of plastic thermoset or elastomer parallel cord Type SPT-3, SP-3, or SPE shall be permitted.

(b) Where the receptacle provided for connection of the cord to the main circuit is located on the outside of the vehicle, it shall be protected with a listed and labeled ground-fault circuit interrupter for personnel and be listed for wet locations. A cord located on the outside of a vehicle shall be identified for outdoor use.

(c) Unless removable or stored within the vehicle interior, the cord assembly shall have permanent provisions for protection against corrosion and mechanical damage while the vehicle is in transit.

(d) The attachment plug and cord shall be installed so as not to permit exposed live attachment plug pins.

Statement of Problem and Substantiation for Public Input

This is a device that depends on functional safety, without certification (Listing), how is an AHJ to know if it is going to properly perform the GFCI functions required by the product standard. Also, to promote consistency with Sections 410.184, 445.20, 518.3(B), 525.23(D), 600.10(C)(2), 680.5, 680.23(A)(8) which currently required listing.

Submitter Information Verification

Submitter Full Name: Richard Hollander
Organization: Shums Coda Associates
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 21:42:27 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: The additional language is not needed because this requirement in 551.40(A) and 551.40(B) already exists in the code.

Public Input No. 2197-NFPA 70-2020 [Section No. 551.47(R)]

(R) Prewiring for Generator Installation.

Prewiring installed for the purpose of facilitating future generator installation shall comply with the other applicable portions of this article and the following:

(1) Circuit conductors shall be appropriately sized in relation to the anticipated load as stated on the label required in (R)(4).

(2) Where junction boxes are utilized at either of the circuit originating or terminus points, free ends of the conductors shall be adequately capped or taped.

(3) Where devices such as receptacle outlet, transfer switch, and so forth, are installed, the installation shall be complete, including circuit conductor connections.

(4) A safety label with the signal word WARNING in minimum 6-mm (¼-in.) high letters and body text in minimum 3-mm (⅛-in.) high letters on a contrasting background shall be affixed on the cover of each junction box or transfer switch containing incomplete circuitry and shall read, using one of the following warnings, as appropriate:

WARNING

GENERATOR

ONLY INSTALL A GENERATOR LISTED

SPECIFICALLY FOR RV USE

HAVING OVERCURRENT PROTECTION

RATED 110–125-VOLT AC,

60 HZ, _____ AMPERES MAXIMUM.

or

WARNING

GENERATOR

ONLY INSTALL A GENERATOR LISTED

SPECIFICALLY FOR RV USE

HAVING OVERCURRENT PROTECTION

RATED 120–240-VOLT AC,

60 HZ, _____ AMPERES MAXIMUM.

The correct ampere rating shall be legibly marked in the blank space.

Statement of Problem and Substantiation for Public Input

This addresses the location of the required label when the generator prep circuit is terminated at a transfer switch instead of a junction box.

Submitter Information Verification

Submitter Full Name: Kent Perkins
Organization: Recreation Vehicle Industry As

Street Address:
City:
State:
Zip:
Submittal Date: Sat Aug 08 09:05:44 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7878-NFPA 70-2020
Statement: This revision addresses the location of the required label when the generator prep circuit is terminated at a transfer switch instead of a junction box.

Public Input No. 4144-NFPA 70-2020 [Section No. 551.53(B)]

(B) Shower Luminaires.

If a luminaire is provided over a bathtub or in a shower stall, it shall be of the enclosed and gasketed type and listed for the type of installation, and it shall proctected by a listed and labeled be ground-fault circuit-interrupter- ~~protected~~ .

Statement of Problem and Substantiation for Public Input

This is a device that depends on functional safety, without certification (Listing), how is an AHJ to know if it is going to properly perform the GFCI functions required by the product standard. Also, to promote consistency with Sections 410.184, 445.20, 518.3(B), 525.23(D), 600.10(C)(2), 680.5, 680.23(A)(8) which currently required listing.

Submitter Information Verification

Submitter Full Name: Richard Hollander
Organization: Shums Coda Associates
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 21:57:41 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: The additional language is not needed because this requirement already exists in the code. See 551.40(A), General Requirements.

Public Input No. 1373-NFPA 70-2020 [Section No. 551.54(C)]

(C) Insulated ~~Grounded Conductor (~~ Neutral Conductor~~)~~ .

The ~~grounded circuit conductor (neutral conductor) shall~~ neutral conductor shall be insulated from the equipment grounding conductors and from equipment enclosures and other grounded parts. The ~~grounded circuit conductor (neutral conductor) terminals~~ neutral conductor terminals in the panelboard and in ranges, clothes dryers, counter-mounted cooking units, and wall-mounted ovens shall be insulated from the equipment enclosure. Bonding screws, straps, or buses in the panelboard or in appliances shall be removed and discarded. Connection of electric ranges and electric clothes dryers utilizing a grounded conductor, if cord-connected, shall be made with 4-conductor cord and 3-pole, 4-wire grounding-type plug caps and receptacles.

Statement of Problem and Substantiation for Public Input

There is 'never' any reason to include both 'grounded' and 'neutral' conductors in the same sentence. A grounded conductor includes a grounded phase conductor, a neutral conductor is always the 'neutral' between two or more phases. The proper term for this rule is 'neutral conductor.'

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
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City:
State:
Zip:
Submittal Date: Mon Jun 01 20:14:06 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7879-NFPA 70-2020

Statement: In reference to RV there is no need to include Grounded and Neutral. A grounded conductor is the intentionally grounded phase conductor. The neutral conductor in an RV is always a floating conductor and is insulated from the ungrounded conductor and the equipment grounding conductor.

Public Input No. 4447-NFPA 70-2020 [Section No. 551.71]

551.71 Type Receptacles Provided.

(A) 20-Ampere.

Every recreational vehicle site with electrical supply shall be equipped with recreational vehicle site supply equipment with at least one 20-ampere, 125-volt weather-resistant receptacle. This receptacle, when used in recreational vehicle site electrical equipment, shall not be required to be tamper-resistant in accordance with 406.12.

(B) 30-Ampere.

A minimum of 70 percent of all recreational vehicle sites with electrical supply shall each be equipped with a 30-ampere, 125-volt weather-resistant receptacle conforming to Figure 551.46(C)(1). This supply shall be permitted to include additional receptacle configurations conforming to 551.81. The remainder of all recreational vehicle sites with electrical supply shall be equipped with one or more of the receptacle configurations conforming to 551.81.

(C) 50-Ampere.

A minimum of 20 percent of existing and 40 percent of all new recreational vehicle sites, with electrical supply, shall each be equipped with a 50-ampere, 125/250-volt weather-resistant receptacle conforming to the configuration as identified in Figure 551.46(C)(1). Every recreational vehicle site equipped with a 50-ampere receptacle shall also be equipped with a 30-ampere, 125-volt receptacle conforming to Figure 551.46(C)(1). These electrical supplies shall be permitted to include additional receptacles that have configurations in accordance with 551.81.

> Informational Note: The percentage of 50 ampere sites required by 551.71 could be inadequate for seasonal recreational vehicle sites serving a higher percentage of recreational vehicles with 50-ampere electrical systems. In that type of recreational vehicle park, the percentage of 50-ampere sites could approach 100 percent.

(D) Tent Sites.

Dedicated tent sites with a 15- or 20-ampere electrical supply shall be permitted to be excluded when determining the percentage of recreational vehicle sites with 30- or 50-ampere receptacles.

(E) Additional Receptacles.

Additional receptacles shall be permitted for the connection of electrical equipment outside the recreational vehicle within the recreational vehicle park.

(F) GFCI Protection.

Ground-fault circuit-interrupter protection shall be provided as required in 210.8(B). GFCI protection shall not be required for other than 125-volt, 15- and 20-ampere receptacles used in the recreational vehicle site equipment.

> Informational Note No. 1: Appliances used within the recreational vehicle can create leakage current levels at the supply receptacle(s) that could exceed the limits of a Class A GFCI device.
>
> Informational Note No. 2: The definition of *Power-Supply Assembly* in 551.2 and the definition of *Feeder* in Article 100 clarifies that the power supply cord to a recreational vehicle is considered a feeder.

Statement of Problem and Substantiation for Public Input

This public input intends to expand upon the current weather-resistant requirements which only applied

to 15- and 20-ampere, 125- and 250-volt receptacles installed in wet and damp locations. Receptacles other than 15- and 20-ampere, 125- and 250-volt rated are commonly installed in close-proximity and exposed to the same, and in many cases even more severe, environmental influences. Over-heating caused by corroded/compromised current path will be more severe due to the higher current drawn from these receptacles. Requiring these receptacles to be weather-resistant will result in improved safety for the users of these devices.

Submitter Information Verification

Submitter Full Name: James Lowe
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City:
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Zip:
Submittal Date: Thu Sep 10 13:13:53 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7880-NFPA 70-2020
Statement: CMP-7 accepts the changes to part B with the addition of “weather resistant” for 30 ampere receptacles but chooses not to add “weather resistant” at this time to part C based on unknown unavailability of 50 ampere devices in the near future.

Public Input No. 1967-NFPA 70-2020 [Section No. 551.71(F)]

(F) GFCI Protection.

Ground-fault circuit-interrupter protection shall be provided as required in 210.8(B) ~~. GFCI protection shall not be required for other than 125-volt, 15- and 20-ampere receptacles used in the recreational vehicle site equipment.~~

~~Informational Note No. 1: Appliances used within the recreational vehicle can create leakage current levels at the supply receptacle(s) that could exceed the limits of a Class A GFCI device.~~

~~Informational Note No. 2: The definition of *Power-Supply Assembly* in 551.2 and the definition of *Feeder* in Article 100 clarifies that the power supply cord to a recreational vehicle is considered a feeder.~~

and 625.54 .

Statement of Problem and Substantiation for Public Input

RV sites are ideal locations for EV charging as they are essentially parking spaces equipped with supply circuits that facilitate level 1 and, most attractively, level 2 charging. The public utilizes RV sites to charge their vehicles either because adequate charging facilities are not available in an area or because RV site equipment may be located near the campsite that they are using. The links provided are to YouTube videos that explain how to charge EVs using RV site equipment:

- https://www.youtube.com/watch?v=evE1IUiVOI0
- https://www.youtube.com/watch?v=uUI_JcS2nJ0
- https://www.youtube.com/watch?v=h-59sR8I-l4
- https://www.youtube.com/watch?v=dqAZ5cTVjno
- https://www.youtube.com/watch?v=kVoIL8qmdb0
- https://www.youtube.com/watch?v=dNiJY0DBd-E
- https://www.youtube.com/watch?v=tMBqbDGDrRo
- https://www.youtube.com/watch?v=m0gfpz_h100

EVs can be used to tow camping trailers. If parked at an RV site, the RV site equipment with 30 or 50A receptacles would be an added convenience for charging.

The 30 and 50A receptacle styles typically used in RV site equipment are NEMA TT-30 and NEMA 14-50, respectively.
Several vendors either integrate these styles into their EVSE design or sale adaptors to facilitate the connection of EVSE to RV site equipment including the following, Home Depot even has adaptors for sale:

- Tesla - NEMA 14-50 adapter
  - o https://www.tesla.com/sites/default/files/pdfs/installation-guides/nema-14-50-installation-guide.pdf
  - o https://shop.tesla.com/us/en/product/vehicle-accessories/gen-2-nema-adapters.html

- Clipper Creek - 14-50 plug integrated into a number of devices
  - o https://store.clippercreek.com/level2/lcs-25p-nema-14-50

- EVAdaptors.com sells Adapters for 30-TT and 14-50

- Home Depot sells adapters (https://www.homedepot.com/p/AC-WORKS-EVSE-Charging-Adapter-RV-TT-30P-30-Amp-Plug-to-50-Amp-Electric-Vehicle-Adapter-for-Tesla-Model-S-EVTT30MS/301768722?mtc=Shopping-VF-F_D27E-G-D27E-27_2_WIRING_DEVICES-Generic-NA-Feed-PLA-NA-NA-WIRING_DEVICES&cm_mmc=Shopping-VF-F_D27E-G-D27E-27_2_WIRING_DEVICES-

Generic-NA-Feed-PLA-NA-NA-WIRING_DEVICES-71700000033102358-58700003867202208-92700048704098237&gclid=EAIaIQobChMI3ZyXncqr5wIVDj0MCh0ZLgLzEAYYASABEgJkF_D_BwE&gclsrc=aw.ds)

The emergence of electric vehicles has introduced EV charging as a new use case for RV sites where the general public now uses RV site equipment as a power source for connecting portable EVSE devices to charge their vehicles. Because of the larger voltage and current supplied by the 30 and 50A receptacles facilitates Level 2 charging, these receptacles would tend to be the most attractive for people seeking to charge their vehicles, yet these are the only receptacles that are not required to have GFCI protection. There are several EVSE devices that will either mate with the receptacles provided at RV sites out-of-the-box or via a readily available adapter. There are also several videos promoting and providing how-to instructions for charging vehicles at RV sites. It is predicted that EV adoption will increase in time (https://www.jpmorgan.com/global/research/electric-vehicles) which would tend to increase the amount of people using RV installations for the purpose of charging their EVs.

Submitter Information Verification

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Submittal Date: Wed Jul 22 14:04:17 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: An RV pedestal and an RV park infrastructure is not intended to supply an EVSE Charging Station.

Public Input No. 4195-NFPA 70-2020 [Section No. 551.71(F)]

(F) GFCI Protection.

~~Ground~~ Listed ground -fault circuit-interrupter protection shall be provided ~~as required in 210.8(B) . GFCI protection shall not be required for other than~~ for all 125-volt, 15- and 20-ampere receptacle outlets at an RV site. GFCI protection shall not be required for receptacles with higher voltage or current ratings used in the recreational vehicle site equipment.

Informational Note No. 1: Appliances used within the recreational vehicle can create leakage current levels at the supply receptacle(s) that could exceed the limits of a Class A GFCI device.

Informational Note No. 2: The definition of *Power-Supply Assembly* in 551.2 and the definition of *Feeder* in Article 100 ~~clarifies that~~ support the classification of the power supply cord to a recreational vehicle ~~is considered~~ as a feeder.

Statement of Problem and Substantiation for Public Input

First, Terror View is presenting the agenda code text as that modified by the TIA. I have a serious problem with this, because the TIA has the status of an input at this stage of the process. The PI makes editorial improvements in the TIA text. The major issue is that the text says 1) GFCI must comply with 210.8(B). And then, the text says 210.8(B) does not apply. This text is much more cleanly rendered.

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
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Affiliation: self
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 01:28:55 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: Listing requirements already exist and GFCI protection for 125 volt, 15, and 20 ampere are addressed by 210.8(B) per the NEC correlating committee and GFCI protection for 30 and 50 amps are addressed in a subsequent TIA 20-8 that was incorporated into the 2020 NEC.

Public Input No. 554-NFPA 70-2020 [Section No. 551.71(F)]

(F) GFCI Protection.

Ground-fault circuit-interrupter protection shall be provided as required in 210.8(B). GFCI protection shall not be required for other than 125-volt, 15- and 20-ampere receptacles used in the recreational vehicle site equipment.

Informational Note No. 1: Appliances used within the recreational vehicle can create leakage current levels at the supply receptacle(s) that could exceed the limits of a Class A GFCI device.

Informational Note No. 2: The definition of *Power-Supply Assembly* in 551.2 and the definition of *Feeder* in Article 100 clarifies that the power supply cord to a recreational vehicle is considered a feeder.

Additional Proposed Changes

File Name	Description	Approved
CMP_7_TIA_1474_issued_TIA_70_20_8.pdf	NEC TIA 20-8 Log No. 1474	

Statement of Problem and Substantiation for Public Input

NOTE: This public input originates from Tentative Interim Amendment No. 20-8 (Log 1474) issued by the Standards Council on December 6, 2019 and per the NFPA Regs., needs to be reconsidered by the Code Making Panel for the next edition of the Document.

Substantiation:

The 2017 NEC included changes in Section 210.8 and CMP 7 did not have the opportunity to review and Correlate with Article 551 concerning the requirement of GFCI protection on 30- and 50- ampere receptacles in RV site equipment. This has introduced ambiguity about the application of 2017 NEC Section 210.8 new GFCI requirements with respect to 30- and 50- ampere receptacles supplying RV's. In numerous cases where the 2017 Code is in use debate has surfaced as to the applicability of the 210.8 requirements and has caused projects to be cancelled or shut down as a result.

During the 2020 Code cycle CMP 7 addressed the issue during both the First and Second Draft sessions. The panel, by votes of over 80% in both cases, determined that Section 210 requirements do not apply to the 30- and 50- ampere receptacles as these are considered feeders per the definition of a feeder in Article 100 and the definition of a Power Supply Assembly at Section 551.2. Furthermore, if GFCI protection were to be placed on the 30- and 50- ampere feeders the accumulative allowed GFCI leakage may exceed the limits of a Class A GFCI device. This TIA seeks to return to Section 551.71 language contained in SCR 30 created by the NEC Correlating Committee with an additional sentence reinforcing the Feeder – Power Supply Assembly relationship of the 30- and 50- ampere power in RV Site Equipment. By accepting the TIA the Code will be relieved of the ambiguous Code language and unnecessary GFCI protection of feeders. Of further concern is of the actions that users would perform to keep power on a circuit if a 30- or 50- amp device were to trip on GFCI. A commonaction is to clip off the ground pin on the feeder cord to the RV. Further, waiting for the 2023 cycle keeps the ambiguity and potentially unenforceable nature of the 2017 Code in place for another three years. Additionally, lost in the reverting back to the 2017 NEC language for the 2020 Code making process was an editorial move to 551.71(A) during the First Draft of the requirement for the 20 ampere receptacles to be weather resistant.

Emergency Nature: The NFPA Standard contains a conflict within the NFPA Standards or within another NFPA Standard. The proposed TIA intends to correct a circumstance in which the revised

NFPA Standard has resulted in an adverse impact on a product or method that was inadvertently overlooked in the total revision process or was without adequate technical (safety) justification of the action.

The emergency nature of this TIA is to fix serious correlation issues that would exist for the Code user whether you are an installer or enforcer. Due to the results of the rejection of CAM70- 36 by CMP-7; and the reversion of 551.71(F) to 2017 Code Language; an inconsistency now exists with other Special Occupancies in Chapter 5. CMP-7 is still under the impression that the result of the rejection of CAM 70-36 should have resulted in reverting back to First Draft language (last point of consensus) rather than reverting back to 2017 NEC text. This TIA is to adopt the language that was approved by CMP-7and the Coordinating Committee during their meetings for the 2020 NEC. In all of the other Articles that are under the purview of CMP-7 where a power supply cord is used, the supply cord is considered a feeder and there are no requirements for Class A GFCI protection. Feeder conductors being extended to a marina-receptacles need to be protected at the 100 mA level, but this is ground-fault protection (GFP) of equipment, not Class A GFCI protection. From the outset of the 2020 NEC revision cycle, the goal of CMP-7 was to remove the wide interpretation of 551.71(F) that existed in the 2017 NEC as a result of the then new requirements of 210.8(B). Without this TIA, we are right back to square one with inconsistent interpretation at 551.71(F).

Consider other Articles under CMP-7 purview: All of the reference NEC sections below would allow a cord and plug assembly without Class A GFCI protection.
545.22 Power Supply (A) Feeder. The feeder shall include four insulated color-coded conductors, one of which shall be an equipment grounding conductor. The equipment grounding conductor shall be permitted to be uninsulated if part of a cable assembly.
Informational Note: For temporary installation of feeder conductors see Article 590.
550.2 Feeder Assembly. The overhead or under-chassis feeder conductors, including the grounding conductor, together with the necessary fittings and equipment or a power-supply cord listed for mobile home use, identified for the delivery of energy from the source of electrical supply to the panelboard within the mobile home.
550.10 Power Supply. (A) Feeder. The power supply to the mobile home shall be a feeder assembly consisting of not more than one listed 50-ampere mobile home power-supply cord or a permanently installed feeder.
552.43 Power Supply. (A) Feeder. The power supply to the park trailer shall be a feeder assembly consisting of not more than one listed 30-ampere or 50-ampere park trailer powersupply cord, with an integrally molded or securely attached cap, or a permanently installed feeder.

In all of these examples, the Code language clearly states that these power-supply cords are feeders and were never intended to have Class A GFCI protection. CMP-7 was very diligent and intentional with treating the installation in an RV Park the same. As determined by our predecessors on CMP-19, and now CMP-7, the installation of these conductors would be installed as a feeder as defined in Article 100, and not treated differently between the articles. Finally, a change in the 2017 Code Language was not coordinated with (then) CMP-19 (now CMP-7) to allow this technical committee to insert language modifying or amending 210.8(B) for RV Site Equipment. CMP-19 should have had the option to either assert our ability to Modify or Amend 551.71 or to clarify that the 30- and 50- amp circuits are in fact feeders according to Article 100 and supported by 551.2 (Power Supply Assemblies) during the 2017 cycle.

Submitter Information Verification

Submitter Full Name: CMP ON NEC-P07
Organization: Code Making Panel 7
Street Address:
City:
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Submittal Date: Fri Feb 28 10:47:19 EST 2020
Committee: NEC-P07

Committee Statement

Resolution: The committee has resolved the public input so that the language of the TIA is maintained in section 551.71(F).

Tentative Interim Amendment

NFPA® 70®

National Electrical Code®

2020 Edition

Reference: 551.71(F)
TIA 20-8
(SC 19 12-4 / TIA Log #1474)

Pursuant to Section 5 of the NFPA *Regulations Governing the Development of NFPA Standards*, the National Fire Protection Association has issued the following Tentative Interim Amendment to NFPA 70®, *National Electrical Code*®, 2020 edition. The TIA was processed by the Code-Making Panel 7 and the Correlating Committee on National Electrical Code, and was issued by the Standards Council on December 6, 2019, with an effective date of December 26, 2019.

A Tentative Interim Amendment is tentative because it has not been processed through the entire standards development procedures. It is interim because it is effective only between editions of the standard. A TIA automatically becomes a public input of the proponent for the next edition of the standard; as such, it then is subject to all of the procedures of the standards development process.

1. Revise 551.71(F) to read as follows:

551.71(F) GFCI Protection.

~~All 125-volt, single-phase, 15- and 20-ampere receptacles shall have listed ground-fault circuit-interrupter protection for personnel. The GFCI devices used in RV site electrical equipment shall not be required to be weather or tamper resistant in accordance with 406.9 and 406.12.~~

~~Informational Note: The percentage of 50-ampere sites required by 551.71 could be inadequate for seasonal recreational vehicle sites serving a higher percentage of recreational vehicles with 50-ampere electrical systems. In that type of recreational vehicle park, the percentage of 50-ampere sites could approach 100 percent.~~

Ground-fault circuit-interrupter protection shall be provided as required in 210.8(B). GFCI protection shall not be required for other than 125-volt, 15- and 20-ampere receptacles used in the recreational vehicle site equipment.

Informational Note No. 1: Appliances used within the recreational vehicle can create leakage current levels at the supply receptacle(s) that could exceed the limits of a Class A GFCI device.

Informational Note No. 2: The definition of *Power-Supply Assembly* in 551.2 and the definition of *Feeder* in Article 100 clarifies that the power supply cord to a recreational vehicle is considered a feeder.

Issue Date: December 6, 2019

Effective Date: December 26, 2019

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

Public Input No. 689-NFPA 70-2020 [Section No. 551.71(F)]

(F) GFCI Protection.

~~Ground-fault circuit-interrupter protection shall be provided as required in 210.8(B) .~~ GFCI protection shall not be required for other than 125-volt, 15- and 20-ampere receptacles used in the recreational vehicle site equipment.

Informational Note No. 1: Appliances used within the recreational vehicle can create leakage current levels at the supply receptacle(s) that could exceed the limits of a Class A GFCI device.

Informational Note No. 2: The definition of *Power-Supply Assembly* in 551.2 and the definition of *Feeder* in Article 100 clarifies that the power supply cord to a recreational vehicle is considered a feeder.

Statement of Problem and Substantiation for Public Input

Section 210.8 has been revised in the 2017 NEC to require GFCI protection for branch circuits rated up to 50 A. Since the Informational Note 2 clarifies that the cord set for RV's is a feeder and not a branch circuit, the reference to 210.8 is not necessary.

Submitter Information Verification

Submitter Full Name: David Hittinger
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Street Address:
City:
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Zip:
Submittal Date: Wed Mar 18 10:44:26 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: Listing requirements already exist and GFCI protection for 125 volt, 15, and 20 ampere are addressed by 210.8(B) per the NEC correlating committee and GFCI protection for 30 and 50 amps are addressed in a subsequent TIA 20-8 that was incorporated into the 2020 NEC.

Public Input No. 4198-NFPA 70-2020 [Section No. 551.72(A)]

(A) Systems.

Distribution systems shall provide the voltage and have a capacity for the receptacles provided in the recreational vehicle (RV) site supply equipment as calculated according to 551.73 and shall have an ampacity not less than 30 amperes. Systems permitted include 120 volts, 1-phase; 120/240 volts, 1-phase; and 120/208 volts, ~~1-phase~~ two ungrounded and one neutral conductor taken from a 208Y/120 V system .

Statement of Problem and Substantiation for Public Input

120/208 volts is not a single phase distribution. it is a portion of the three-phase distribution. It must be described as such. 120/208 volts 1-phase is inaccurate trade slang and does not belong in the NEC.

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
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Affiliation: self
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 01:49:30 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7884-NFPA 70-2020
Statement: CMP-7 agrees that 120/208 volts is not a single-phase distribution. It is a portion of the three-phase distribution. The revised text clarifies the distribution system.

Public Input No. 4199-NFPA 70-2020 [Section No. 551.72(C)]

(C) Receptacles.

Receptacles rated at 50 amperes shall be supplied from a ~~branch~~ circuit of the voltage class and rating of the receptacle. Other recreational vehicle sites with 125-volt, 20- and 30-ampere receptacles shall be permitted to be derived from any grounded distribution system that supplies 120-volt, single-phase power. The neutral conductors shall not be reduced in size below the size of the ungrounded conductors for the site distribution.

Statement of Problem and Substantiation for Public Input

Much of the contention regarding 551.71(F) revolved around whether the power supply cord could be a feeder. The provision modified by this submittal inadvertently undermines the panel position on the TIA by describing these circuits as branch circuits. This PI eliminates this source of debate by removing the word "branch."

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
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Affiliation: self
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 02:01:42 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-8168-NFPA 70-2020
Statement: CMP-7 has moved information from 551.72(C) to 551.72(D) and made a clarification that the RV 50 amp circuit is a feeder. The moved language is more closely related to the topic within 551.72(D). The new informational note which follows 551.72(D) has new information for clarity between RV site loads and permanently connected loads. The informational note in the 2020 NEC has been updated to informational note 2.

Public Input No. 782-NFPA 70-2020 [Section No. 551.72(C)]

(C) Receptacles.

Receptacles rated at 50 amperes shall be supplied from a ~~branch~~ feeder circuit of the voltage class and rating of the receptacle. Other recreational vehicle sites with 125-volt, 20- and 30-ampere receptacles shall be permitted to be derived from any grounded distribution system that supplies 120-volt, single-phase power. ~~The neutral conductors shall not be reduced in size below the size of the ungrounded conductors for the site distribution.~~

Statement of Problem and Substantiation for Public Input

The circuit supplying the 50 amp receptacle is not a branch circuit per the definition of a feeder circuit in 551.2.
Moving the Neutral conductor requirement to 551.72 (D) Neutral Conductors

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 783-NFPA 70-2020 [Section No. 551.72(D)]	
Public Input No. 783-NFPA 70-2020 [Section No. 551.72(D)]	

Submitter Information Verification

Submitter Full Name:	Wade Elliott
Organization:	Utility Services Group, Inc.
Affiliation:	ARVC, National Association of RV Parks and Campgrounds
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Tue Mar 24 17:10:40 EDT 2020
Committee:	NEC-P07

Committee Statement

Resolution: FR-8168-NFPA 70-2020

Statement: CMP-7 has moved information from 551.72(C) to 551.72(D) and made a clarification that the RV 50 amp circuit is a feeder. The moved language is more closely related to the topic within 551.72(D). The new informational note which follows 551.72(D) has new information for clarity between RV site loads and permanently connected loads. The informational note in the 2020 NEC has been updated to informational note 2.

Public Input No. 783-NFPA 70-2020 [Section No. 551.72(D)]

(D) Neutral Conductors.

The neutral conductors shall not be reduced in size below the size of the ungrounded conductors for the site distribution. Neutral conductors shall be permitted to be reduced in size below the minimum required size of the ungrounded conductors for 240-volt, line-to-line, permanently connected loads only.

Informational Note 1 : All loads in a Recreational Vehicle are 120-volt, line-to-neutral non-permanently connected loads.

Informational Note 2: Due to the long circuit lengths typical in most recreational vehicle parks, feeder conductor sizes found in the ampacity tables of Article 310 may be inadequate to maintain the voltage regulation suggested in 215.2(A)(1) Informational Note No. 2. Total circuit voltage drop is a sum of the voltage drops of each serial circuit segment, where the load for each segment is calculated using the load that segment sees and the demand factors shown in Table 551.73(A).

Statement of Problem and Substantiation for Public Input

Moved from 551.72(C) to put in article more closely related to topic. Added informational note for clarity between RV site loads and permanently connected loads

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 782-NFPA 70-2020 [Section No. 551.72(C)]	
Public Input No. 782-NFPA 70-2020 [Section No. 551.72(C)]	

Submitter Information Verification

Submitter Full Name:	Wade Elliott
Organization:	Utility Services Group, Inc.
Affiliation:	ARVC, National Association of RV Parks and Campgrounds
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Tue Mar 24 17:21:11 EDT 2020
Committee:	NEC-P07

Committee Statement

Resolution: FR-8168-NFPA 70-2020

Statement: CMP-7 has moved information from 551.72(C) to 551.72(D) and made a clarification that the RV 50 amp circuit is a feeder. The moved language is more closely related to the topic within 551.72(D). The new informational note which follows 551.72(D) has new

information for clarity between RV site loads and permanently connected loads. The informational note in the 2020 NEC has been updated to informational note 2.

Public Input No. 3208-NFPA 70-2020 [Section No. 551.72(E)]

(E) Connected Devices.

The use of autotransformers shall not be permitted. The use of listed overvoltage and surge protective devices shall be permitted.

Additional Proposed Changes

File Name	Description	Approved
Code_Input.docx	input for improved overvoltage protection references	

Statement of Problem and Substantiation for Public Input

In the 2020 NEC cycle, ARTICLES 280 and 285 were combined to make ARTICLE 242. This was a positive change that began to address the issue of OVERVOLTAGE as a technical subject apart from particular product methods (SPDs and Surge Arresters). There are other technologies and products to address the issue of OVERVOLTAGE. This input attempts to add one such technology as well as correlate the other code references to the subject of OVERVOLTAGE, surge protective devices, and surge arresters to be consistent. This is important to allow for other technologies to be utilized without prejudice to certain products promoted by manufacturers.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3200-NFPA 70-2020 [Section No. 242.1]	
Public Input No. 3202-NFPA 70-2020 [New Article after 100]	
Public Input No. 3203-NFPA 70-2020 [New Article after 242]	
Public Input No. 3205-NFPA 70-2020 [Section No. 501.35]	
Public Input No. 3206-NFPA 70-2020 [Section No. 502.35]	
Public Input No. 3209-NFPA 70-2020 [Section No. 490.24]	
Public Input No. 3210-NFPA 70-2020 [Section No. 490.48(A)]	
Public Input No. 3211-NFPA 70-2020 [Section No. 620.51(E)]	
Public Input No. 3212-NFPA 70-2020 [Section No. 645.18]	
Public Input No. 3214-NFPA 70-2020 [Section No. 670.6]	
Public Input No. 3216-NFPA 70-2020 [Section No. 694.7(D)]	
Public Input No. 3217-NFPA 70-2020 [Section No. 695.15]	
Public Input No. 3218-NFPA 70-2020 [Section No. 700.8]	
Public Input No. 3219-NFPA 70-2020 [Section No. 708.20(D)]	

Submitter Information Verification

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Submittal Date: Sun Sep 06 18:24:19 EDT 2020

Committee: NEC-P07

Committee Statement

Resolution: The addition of an overvoltage device is not practical for an RV installation. An overvoltage device is not necessarily a surge protection device.

Substantiation for Changes: In the 2020 NEC cycle, ARTICLES 280 and 285 were combined to make ARTICLE 242. This was a positive change that began to address the issue of OVERVOLTAGE as a technical subject apart from particular product methods (SPDs and Surge Arresters). There are other technologies and products to address the issue of OVERVOLTAGE. This input attempts to add one such technology as well as correlate the other code references to the subject of OVERVOLTAGE, surge protective devices, and surge arresters to be consistent. This is important to allow for other technologies to be utilized without prejudice to certain products promoted by manufacturers.

ARTICLE 100 - DEFINITIONS

Voltage Stabilizing Ground Reference (VSGR) System – an engineered assembly of interconnected passive inductive devices that utilize mutual counter electro-magnetic inductance to stabilize phase voltages of a connected supply system with respect to each other and to ground.

ARTICLE 242 Overvoltage Protection

Part I. General

242.1 Scope.
This article provides the general requirements, installation requirements, and connection requirements for overvoltage protection and overvoltage protective devices. Part II covers surge-protective devices (SPDs) permanently installed on premises wiring systems of not more than 1000 volts, nominal, while Part III covers surge arresters permanently installed on premises wiring systems over 1000 volts, nominal. Part IV covers Voltage Stabilizing Ground Reference (VSGR) systems permanently installed on premises wiring systems for any voltage.

Informational Note: Article 242 combines and replaces Articles 280 and 285 in *NFPA 70*-2017.

242.3 Other Articles.
Equipment shall be protected against overvoltage in accordance with the article in this *Code* that covers the type of equipment or location specified in Table 242.3.

Table 242.3 Other Articles

Equipment	Article
Class I locations	501
Class II locations	502
Community antenna television and radio distribution systems	820
Critical operations power systems	708

Table 242.3 Other Articles

Equipment	Article
Elevators, dumbwaiters, escalators, moving walks, platform lifts, and stairway chairlifts	620
Emergency systems	700
Equipment over 1000 volts, nominal	490
Fire pumps	695
Industrial machinery	670
Information technology equipment	645
Modular data centers	646
Outdoor overhead conductors over 1000 volts	399
Radio and television equipment	810
Receptacles, cord connectors, and attachment plugs (caps)	406
Wind electric systems	694

Part II. Surge-Protective Devices (SPDs), 1000 Volts or Less

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

242.6 Uses Not Permitted.

An SPD device shall not be installed in the following:

1. (1)

   Circuits over 1000 volts

2. (2)

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

3. (3)

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

242.8 Listing.
An SPD shall be a listed device.

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

242.12 Type 1 SPDs.
Type 1 SPDs shall be installed in accordance with 242.12(A) and (B).

242.12(A) Installation.
Type 1 SPDs shall be permitted to be connected in accordance with one of the following:

1. (1)

   To the supply side of the service disconnect as permitted in 230.82(4)

2. (2)

   As specified in 242.14

242.12(B) At the Service.
When installed at services, Type 1 SPDs shall be connected to one of the following:

1. (1)

   Grounded service conductor

2. (2)

   Grounding electrode conductor

3. (3)

   Grounding electrode for the service

4. (4)

   Equipment grounding terminal in the service equipment

242.14 Type 2 SPDs.
Type 2 SPDs shall be installed in accordance with 242.14(A) through (C).

242.14(A) Service-Supplied Building or Structure.
Type 2 SPDs shall be connected anywhere on the load side of a service disconnect overcurrent device required in 230.91 unless installed in accordance with 230.82(8).

242.14(B) Feeder-Supplied Building or Structure.
Type 2 SPDs shall be connected at the building or structure anywhere on the load side of the first overcurrent device at the building or structure.

242.14(C) Separately Derived System.
The SPD shall be connected on the load side of the first overcurrent device in a separately derived system.

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

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

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

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

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

242.26 Connection.
Where an SPD device is installed, it shall comply with 242.12, 242.14, 242.16, 242.28. and 242.30.

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

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

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

Part III. Surge Arresters, Over 1000 Volts

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

242.42 Surge Arrester Selection.
The surge arresters shall comply with 242.42(A) and (B).

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

242.42(A)(1) Solidly Grounded Systems.
The maximum continuous operating voltage shall be the phase-to-ground voltage of the system.

242.42(A)(2) Impedance or Ungrounded System.

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

242.42(B) Silicon Carbide Types.

The rating of a silicon carbide-type surge arrester shall be not less than 125 percent of the rating specified in 242.42(A).

Informational Note No. 1: For further information on surge arresters, see IEEE C62.11-2012, *Standard for Metal-Oxide Surge Arresters for Alternating-Current Power Circuits (>1 kV)*, and IEEE C62.22-2009, *Guide for the Application of Metal-Oxide Surge Arresters for Alternating-Current Systems*.

Informational Note No. 2: The selection of a properly rated metal oxide arrester is based on considerations of maximum continuous operating voltage and the magnitude and duration of overvoltages at the arrester location as affected by phase-to-ground faults, system grounding techniques, switching surges, and other causes. See the manufacturer's application rules for selection of the specific arrester to be used at a particular location.

242.44 Number Required.

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

242.46 Location.

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

242.48 Routing of Surge Arrester Equipment Grounding Conductors.

The conductor used to connect the surge arrester to line, bus, or equipment and to an equipment grounding conductor or grounding electrode connection point as provided in 242.50 shall not be any longer than necessary and shall avoid unnecessary bends.

242.50 Connection.

The arrester shall be connected to one of the following:

1. (1)

   Grounded service conductor

2. (2)

   Grounding electrode conductor

3. (3)

   Grounding electrode for the service

4. (4)

   Equipment grounding terminal in the service equipment

242.52 Surge-Arrester Conductors.

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

242.54 Interconnections.

The surge arrester protecting a transformer that supplies a secondary distribution system shall be interconnected as specified in 242.54(A), (B), or (C).

242.54(A) Metal Interconnections.
A metal interconnection shall be made to the secondary grounded circuit conductor or the secondary circuit grounding electrode conductor, if, in addition to the direct grounding connection at the surge arrester, the connection complies with 242.54(A)(1) or (A)(2).

242.54(A)(1) Additional Grounding Connection.
The grounded conductor of the secondary has a grounding connection elsewhere to a continuous metal underground water piping system. In urban water-pipe areas where there are at least four water-pipe connections on the neutral conductor and not fewer than four such connections in each mile of neutral conductor, the metal interconnection shall be permitted to be made to the secondary neutral conductor with omission of the direct grounding connection at the surge arrester.

242.54(A)(2) Multigrounded Neutral System Connection.
The grounded conductor of the secondary system is part of a multigrounded neutral system or static wire of which the primary neutral conductor or static wire has at least four grounding connections in each 1.6 km (1 mile) of line in addition to a grounding connection at each service.

242.54(B) Through Spark Gap or Device.
Where the surge arrester grounding electrode conductor is not connected as in 242.54(A), or where the secondary is not grounded as in 242.54(A) but is otherwise grounded as in 250.52, an interconnection shall be made through a spark gap or listed device as required by 242.54(B)(1) or (B)(2).

242.54(B)(1) Ungrounded or Unigrounded Primary System.
For ungrounded or unigrounded primary systems, the spark gap for a listed device shall have a 60-Hz breakdown voltage of at least twice the primary circuit voltage but not necessarily more than 10 kV, and there shall be at least one other ground on the grounded conductor of the secondary that is not less than 6.0 m (20 ft) distant from the surge-arrester grounding electrode.

242.54(B)(2) Multigrounded Neutral Primary System.
For multigrounded neutral primary systems, the spark gap or listed device shall have a 60-Hz breakdown of not more than 3 kV, and there shall be at least one other ground on the grounded conductor of the secondary that is not less than 6.0 m (20 ft) distant from the surge-arrester grounding electrode.

242.54(C) By Special Permission.
An interconnection of the surge-arrester ground and the secondary neutral conductor, other than as provided in 242.54(A) or (B), shall be permitted to be made only by special permission.

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

Part IV. Voltage Stabilizing Ground Reference (VSGR) systems.

242.68 Listing.
A VSGR shall be a listed device or system composed of listed components.

242.70 Short-Circuit Current Rating.
The VSGR shall be marked with a short-circuit current rating and shall not be installed at a point on the system where the available fault current is in excess of that rating.

242.71 Voltage Rating.
The rating of the VSGR shall be equal to or greater than the maximum system continuous operating voltage at the point of application.

242.72 Installation.
VSGRs shall be installed in accordance with 242.72(A) through (C).

242.72(A) Service-Supplied Building or Structure.
VSGR shall be connected anywhere on the load side of a service disconnect overcurrent device required in 230.91 unless installed in accordance with 230.82(8).

242.72(B) Feeder-Supplied Building or Structure.
VSGR shall be connected at the building or structure anywhere on the load side of the first overcurrent device at the building or structure.

242.72(C) Separately Derived System.
VSGR shall be connected on the load side of the first overcurrent device in a separately derived system.

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

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

242.90 Connection Between Conductors.
VSGR connections shall follow the manufacturer's instructions for the system connections.

242.92 Grounding Electrode Conductor Connections and Enclosures.
Except as indicated in this article, VSGR grounding connections shall be made as specified in Article 250, Part III. Grounding electrode conductors installed in metal enclosures shall comply with 250.64(E).

501.35 Overvoltage ~~Surge~~ Protection.

501.35(A) Class I, Division 1.
Overvoltage protection devices, surge arresters, surge-protective devices, and capacitors shall be installed in enclosures identified for Class I, Division 1 locations. Surge-protective capacitors shall be of a type designed for specific duty.

501.35(B) Class I, Division 2.
Overvoltage protection devices, surge arresters and surge-protective devices shall be nonarcing, such as metal-oxide varistor (MOV) sealed type, and surge-protective capacitors shall be of a type designed for specific duty. Enclosures shall be permitted to be of the general-purpose type. Overvoltage ~~Surge~~ protection of types other than described in this paragraph shall be installed in enclosures identified for Class I, Division 1 locations.

502.35 Overvoltage ~~Surge~~ Protection — Class II, Divisions 1 and 2.
Overvoltage protection devices, surge arresters and surge-protective devices installed in a Class II, Division 1 location shall be in suitable enclosures. Surge-protective capacitors shall be of a type designed for specific duty.

551.72(E) Connected Devices.
The use of autotransformers shall not be permitted. The use of listed overvoltage and surge protective devices shall be permitted.

Table 490.24 Minimum Clearance of Live Parts

Note: The values given are the minimum clearance for rigid parts and bare conductors under favorable service conditions. They shall be increased for conductor movement or under unfavorable service conditions or wherever space limitations permit. The selection of the associated impulse withstand voltage for a particular system voltage is determined by the characteristics of the overvoltage ~~surge~~ protective equipment.

490.48(A) Design and Documentation.

(12) Overvoltage ~~Surge~~ arresters

620.51(E) Overvoltage ~~Surge~~ Protection.
Overvoltage protection shall be provided where any of the disconnecting means in 620.51 has been designated as supplying an emergency system load, a legally required system load, or a critical operation power system load, ~~listed surge protection shall be provided.~~

645.18 Overvoltage ~~Surge~~ Protection for Critical Operations Data Systems.
Overvoltage ~~Listed surge~~ protection shall be provided for critical operations data systems.

670.6 Surge Protection.
Industrial machinery with safety interlock control devices not effectively protected from voltage surges on the incoming supply circuit shall have overvoltage ~~surge~~ protection installed.

694.7(D) Overvoltage Protection ~~Surge Protective Devices (SPD).~~
Overvoltage protection ~~A surge protective device~~ shall be installed between a wind electric system and any loads served by the premises electrical system. The ~~surge~~ protective device shall be permitted to be a VSGR, or a Type 3 SPD on the circuit serving a wind electric system, or a Type 2 SPD located anywhere on the load side of the service disconnect. Overvoltage ~~Surge~~ protective devices shall be installed in accordance with Part II of Article 242.

695.15 Overvoltage ~~Surge~~ Protection.
Overvoltage ~~A listed surge~~ protection ~~device~~ shall be provided for ~~installed in or on~~ the fire pump controller.

700.8 Overvoltage ~~Surge~~ Protection.
Overvoltage protection ~~A listed SPD~~ shall be provided ~~installed in or on~~ for all emergency systems switchboards and panelboards.

708.20(D) Overvoltage ~~Surge~~ Protection ~~Devices~~.

Surge protection devices shall be provided at all facility distribution voltage levels

Public Input No. 690-NFPA 70-2020 [Section No. 551.72(E)]

(E) Connected Devices.

~~The~~ The use of ~~autotransformers shall not be permitted. The use of~~ listed surge protective devices shall be permitted.

Statement of Problem and Substantiation for Public Input

There has been no substantiation that shows the use of autotransformers in RV parks to be adversely affecting adjacent sites. The use of an autotransformer will not affect the overcurrent protective device's ability to protect the feeder circuit. The only loads that will increase are resistive loads. The inductive loads, like motors, will actually decrease with the increase in voltage for the same power delivered.

Submitter Information Verification

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Submittal Date: Wed Mar 18 10:56:26 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: The distribution system should be designed to prevent excessive voltage drop at the RV site supply equipment so that autotransformers are not necessary. Insufficient technical substantiation was provided by the submitter to justify revising the section as proposed. CMP-7 would welcome further substantiation for consideration to support the position of the submitter.

Public Input No. 1254-NFPA 70-2020 [Section No. 551.73]

551.73 Calculated Load.

(A) Basis of Calculations.

Electrical services and feeders shall be calculated on the basis of not less than the following:

1) 12,000 volt-amperes per site equipped with 50-ampere ~~, 208Y/120 or 120/240-volt~~ supply facilities;

2) 3600 volt-amperes per site equipped with both 20-ampere and 30-ampere supply facilities;

3) 2400 volt-amperes per site equipped with only 20-ampere supply facilities; and

4) 600 volt-amperes per site equipped with only 20-ampere supply facilities that are dedicated to tent sites. ~~The demand factors set forth in Table 551.73(A) shall be the minimum allowable demand factors that shall be permitted in calculating load for service and feeders.~~

Where the electrical supply for a recreational vehicle site has more than one receptacle, the calculated load shall be calculated only for the highest rated receptacle. ~~Where the electrical supply is in a location that serves two recreational vehicles, the equipment for both sites shall comply with 551.77 , and the calculated load shall only be calculated for the two receptacles with the highest rating.~~

(B) Demand Factors.

The demand factors set forth in Table 551.73(B) shall be the minimum allowable demand factors that shall be permitted in calculating load for service and feeders. The demand factor for a given number of sites shall apply to all sites indicated. For example, 20 sites calculated at 45 percent of 3600 volt-amperes results in a permissible demand of 1620 volt-amperes per site or a total of 32,400 volt-amperes for 20 sites.

Informational Note: These demand factors may be inadequate in areas of extreme hot or cold temperature with loaded circuits for heating or air conditioning.

Table 551.73(~~A~~ B) Demand Factors for Site Feeders and Service-Entrance Conductors for Park Sites

Number of Recreational Vehicle Sites	Demand Factor (%)
1	100
2	90
3	80
4	75
5	65
6	60
7–9	55
10–12	50
13–15	48
16–18	47
19–21	45
22–24	43
25–35	42
36 plus	41

Loads for other amenities such as, but not limited to, service buildings, recreational buildings, and swimming pools shall be calculated separately and then be added to the value calculated for the recreational vehicle sites where they are all supplied by a common service.

Statement of Problem and Substantiation for Public Input

First, adding (A)(1) through (4) improves the usability, per Section 3.3.2 in the NEC Style Manual which states to use lists or tables to present requirements, rather than long text descriptions.

Second, there is no need to include systems in Section 551.73. The permitted systems are already covered in Section 551.72(A), which references Section 551.73 and the verbiage is consistent with the 20-ampere and 30-ampere supply facilities.

Third, the sentence in Section 551.73(A) "The demand factors set forth in Table 551.73(B) shall be the minimum allowable demand factors that shall be permitted in calculating load for service and feeders." needs to be relocated to Section 551.73(B) which is titled Demand Factors.

Finally, renaming Table 551.73(A) to Table 551.73(B) only makes sense because Section 551.73(A) is specific to Basis of Calculations and Section 551.73(B) is specific to Demand Factors.

*Note: I did not delete the last sentence of Section 551.73(A) "Where the electrical supply is in a location that serves two recreational vehicles, the equipment for both sites shall comply with 551.77, and the calculated load shall only be calculated for the two receptacles with the highest rating." TerraView keeps deleting it. I gave up trying to fix it.

Submitter Information Verification

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Submittal Date: Mon May 25 09:07:23 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7886-NFPA 70-2020

Statement: The CMP-7 has revised 551.73(A) into a listed format in accordance with the NEC Style Manual. The location of text from 551.73(A) was not changed to 551.73(B) since it is more appropriate at its current location. Additionally, the current location of the language is made more readily available to users in the field. The associated table to section 551.73(A) is in alignment with the NEC Style Manual and will remain as shown, Table 551.73(A), in the 2020 edition of the NEC.

Public Input No. 1861-NFPA 70-2020 [Section No. 551.73]

551.73 Calculated Load.

(A) Basis of Calculations.

Electrical services and feeders shall be calculated on the basis of not less than:

(1) 12,000 volt-amperes per site equipped with 50-ampere, 208Y/120 or 120/240-volt supply facilities; ~~3600 volt~~

(2) 3,600 volt -amperes per site equipped with both 20-ampere and 30-ampere supply facilities; ~~2400 volt~~

(3) 2,400 volt -amperes per site equipped with only 20-ampere supply facilities; and

(4) 600 volt-amperes per site equipped with only 20-ampere supply facilities that are dedicated to tent sites.

The demand factors set forth in Table 551.73(A) shall be the minimum allowable demand factors that shall be permitted in calculating load for service and feeders. Where the electrical supply for a recreational vehicle site has more than one receptacle, the calculated load shall be calculated only for the highest rated receptacle.

Where the electrical supply is in a location that serves two recreational vehicles, the equipment for both sites shall comply with 551.77, and the calculated load shall only be calculated for the two receptacles with the highest rating.

(B) Demand Factors.

The demand factor for a given number of sites shall apply to all sites indicated. For example, 20 sites calculated at 45 percent of 3600 volt-amperes results in a permissible demand of 1620 volt-amperes per site or a total of 32,400 volt-amperes for 20 sites.

Informational Note: These demand factors may be inadequate in areas of extreme hot or cold temperature with loaded circuits for heating or air conditioning.

Table 551.73(A) Demand Factors for Site Feeders and Service-Entrance Conductors for Park Sites

Number of Recreational Vehicle Sites	Demand Factor (%)
1	100
2	90
3	80
4	75
5	65
6	60
7–9	55
10–12	50
13–15	48
16–18	47
19–21	45
22–24	43
25–35	42
36 plus	41

Loads for other amenities such as, but not limited to, service buildings, recreational buildings, and swimming pools shall be calculated separately and then be added to the value calculated for the recreational vehicle sites where they are all supplied by a common service.

Statement of Problem and Substantiation for Public Input

I suggest this be in a 'list' format for ease of use and application.

Submitter Information Verification

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Submittal Date: Sat Jul 11 19:01:25 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7886-NFPA 70-2020

Statement: The CMP-7 has revised 551.73(A) into a listed format in accordance with the NEC Style Manual. The location of text from 551.73(A) was not changed to 551.73(B) since it is more appropriate at its current location. Additionally, the current location of the language is made more readily available to users in the field. The associated table to section 551.73(A) is in alignment with the NEC Style Manual and will remain as shown, Table 551.73(A), in the 2020 edition of the NEC.

Public Input No. 1235-NFPA 70-2020 [Section No. 551.73(A)]

(A) Basis of Calculations.

Electrical services and feeders shall be calculated on the basis of not less than 12,000 volt-amperes per site equipped with 50-ampere, 208Y/120 or 120/240-volt supply facilities; 3600 volt-amperes per site equipped with both 20-ampere and 30-ampere supply facilities; 2400 volt-amperes per site equipped with only 20-ampere supply facilities; and 600 volt-amperes per site equipped with only 20-ampere supply facilities that are dedicated to tent sites. The demand factors set forth in Table 551.73(A) shall be the minimum allowable demand factors that shall be permitted in calculating load for service and feeders. Where the electrical supply for a recreational vehicle site has more than one receptacle, the calculated load shall be calculated only for the highest rated receptacle.

Where the electrical supply is in a location that serves two recreational vehicles, the equipment for both sites shall comply with 551.77, and the calculated load shall only be calculated for the two receptacles with the highest rating.

Change first half of Article to table format for ease of reading/understanding and application. See suggested table format.

Additional Proposed Changes

File Name	Description	Approved
Table_551.73_Electrical_Services_and_Feeders_Minimum_Size.docx	Table 551.73 ?? Electrical Services and Feeders – Minimum Size	

Statement of Problem and Substantiation for Public Input

Change first half of Article to table format for ease of reading/understanding and application. See suggested table format.

Submitter Information Verification

Submitter Full Name: Gary Hein
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Submittal Date: Sat May 23 12:34:49 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7886-NFPA 70-2020

Statement: The CMP-7 has revised 551.73(A) into a listed format in accordance with the NEC Style Manual. The location of text from 551.73(A) was not changed to 551.73(B) since it is more appropriate at its current location. Additionally, the current location of the language is made more readily available to users in the field. The associated table to section 551.73(A) is in alignment with the NEC Style Manual and will remain as shown, Table 551.73(A), in the 2020 edition of the NEC.

Table 551.73 ?? Electrical Services and Feeders – Minimum Size

Ampere rating of site supply facilities	Volt-amperes per site	Notes
50	12,000	
20 or 30	3,600	
20	2,400	
20	600	Dedicated to tent sites

Public Input No. 784-NFPA 70-2020 [Section No. 551.76(A)]

(A) Grounding Electrode.

~~Power outlets or recreational~~ Recreational vehicle site supply equipment, other than those used as service equipment, shall not be required to have a grounding electrode. An auxiliary grounding electrode(s) in accordance with 250.54 shall be permitted to be installed.

Statement of Problem and Substantiation for Public Input

By removing the term Power Outlet and using the term RV Site Equipment removes possible confusion. The term RV Site Equipment is only one of many types of equipment under the term Power Outlet. As such, it makes the requirement more specific and clear.

Submitter Information Verification

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Submittal Date:	Tue Mar 24 17:27:04 EDT 2020
Committee:	NEC-P07

Committee Statement

Resolution: FR-7887-NFPA 70-2020

Statement: By removing the term Power Outlet and using the term RV Site Equipment removes possible confusion. The term RV Site Equipment is only one of many types of equipment under the term Power Outlet. This change will provide clarity and consistency.

Public Input No. 792-NFPA 70-2020 [New Section after 551.77(A)]

(A) Proper Equipment.
The necessary equipment for RV site supply shall be identified as for use as RV Site Equipment.

Additional Proposed Changes

File Name	Description	Approved
PI_792_551.77A_Proper_Equipment_Additional_Proposed_Changes.docx	The intent here was to make this revision Subsection (A). I was unable to accomplish this location in Terra View	

Statement of Problem and Substantiation for Public Input

Provides clarification and coordination with UL 231, Power Outlets

Submitter Information Verification

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Zip:	
Submittal Date:	Wed Mar 25 15:53:34 EDT 2020
Committee:	NEC-P07

Committee Statement

Resolution: FR-7871-NFPA 70-2020

Statement: CMP-7 adds the requirement for listing of recreational vehicle site supply equipment to the parent text of 551.77. This was created based on the resolved action to PI-781 since requirements cannot be added to definitions.

The intent here was to make this revision Subsection (A). I was unable to accomplish this location in Terra View

Public Input No. 792-NFPA 70-2020 [New Section before current 551.77(A)] (will need to relabel following subsections)

(A) Proper Equipment.

The necessary equipment for RV site supply shall be identified as for use as RV Site Equipment.

Statement of Problem and Substantiation for Public Input

Provides clarification and coordination with UL 231, Power Outlets

Submitter Information Verification

Submitter Full Name: Wade Elliott
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Affiliation: ARVC, National Association of RV Parks and Campgrounds
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Submittal Date: Wed Mar 25 15:53:34 EDT 2020
Committee: NEC-AAC

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Public Input No. 1520-NFPA 70-2020 [Section No. 551.77(D)]

(D) Mounting Height.

Site supply equipment shall be located not less than 600 mm (2 ft) ~~or~~ above the Electrical Datum Plane for that RV Site, and no more than 2. ~~0 m (6 ft 6 in.~~ 0 m (6 ft 6 in) above the ground unless platform provisions are made to reach the circuit protection devices that are no more than 2 . 0 m (6 ft 6 in) above that platform.

Statement of Problem and Substantiation for Public Input

Many RV Parks are built in areas where permanent dwellings and commercials buildings are not built because of possible natural and man made disasters. Two notable states (MN, MT) have identified and defined “Normal Highest Water Level”. In one state (MT), this definition was confirmed by a US Supreme Court case.
This Public Input seeks to standardize the Normal Highest Water Level for those special occupancies that allow temporary usage and/or movable non dwelling Recreational Vehicles.

Submitter Information Verification

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Committee: NEC-P07

Committee Statement

Resolution: FR-7888-NFPA 70-2020
Statement: This FR standardizes the Normal High Water Level based on new definitions for those special occupancies that allow temporary usage and/or movable non dwelling Recreational Vehicles.

Public Input No. 4469-NFPA 70-2020 [New Section after 551.81]

551.82 Supply by Portable or Vehicle-Mounted Generator

If the recreational vehicle is supplied by a portable or vehicle-mounted generator, the neutral or grounded system conductor shall be connected to the frame of the generator to ensure that a ground-fault return path is provided.

Additional Proposed Changes

File Name	Description	Approved
20181028_115207.jpg		

Statement of Problem and Substantiation for Public Input

The addition of this requirement is critically important. Several manufacturers produce and sell portable or vehicle-mounted generators that have a 30-amp, 125-volt receptacle that is identified for recreational vehicle use and yet the neutral is identified as "floating:. As a result, a ground-fault return path is not established.
Ground-fault circuit interrupters cannot function. (Note that a GFCI receptacle will function when the "Test" button is pushed but that tests only the internal operation of the GFCI receptacle. A ground-fault return path does not exist if the neutral of the portable or vehicle-mounted generator is floating.)
Without the bonding of the neutral at the generator, a ground-fault return path does not exist from grounding-type receptacles or for equipment.

Submitter Information Verification

Submitter Full Name: Phil Simmons
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Submittal Date: Thu Sep 10 13:35:41 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: Not applicable in this location, RV's are not constructed in this manner, see 551.30(A).

OFF
ON
CHOKE
RUN
IGNITION
START
ON
OFF
ECONOMY
OUTPUT
OVERLOAD
WIRELESS SET
RV READY OUTLET
120V
BATTERY
ON
OFF
20A
120V
12V DC
8A
CHAMPION
GLOBAL POWER EQUIPMENT
WIRELESS REMOTE START
NEUTRAL FLOATING
NEUTRO FLOTANTE
TO RESET AC - RESTART ENGINE / PARA REESTABLECER LA CA - RE-ENCENDIDO DEL MOTOR
3100 WATTS
INVERTER

Public Input No. 1712-NFPA 70-2020 [Article 552]

Article 552 Park Trailers

Part I. General

552.1 Scope.

The provisions of this article cover the electrical conductors and equipment installed within or on park trailers not covered fully under Articles 550 and 551.

552.2 Definition.

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

(See Articles 100, 550, and 551 for additional definitions.)

Park Trailer.

A unit that is built on a single chassis mounted on wheels and has a gross trailer area not exceeding 37 m^2 (400 ft^2) in the set-up mode.

552.4 General Requirements.

A park trailer as specified in 552.2 is intended for seasonal use. It is not intended as a permanent dwelling unit or for commercial uses such as banks, clinics, offices, or similar.

552.5 Labels.

Labels required by Article 552 shall be made of etched, metal-stamped, or embossed brass or stainless steel; plastic laminates not less than 0.13 mm (0.005 in.) thick; or anodized or alclad aluminum not less than 0.5 mm (0.020 in.) thick or the equivalent.

Informational Note: For guidance on other label criteria used in the park trailer industry, refer to ANSI Z535.4-2011, *Product Safety Signs and Labels*.

Part II. Extra- Low-Voltage Systems

552.10 Extra- Low-Voltage Systems.

(A) Extra- Low-Voltage Circuits.

~~Low~~ Extra -low- voltage circuits furnished and installed by the park trailer manufacturer, other than those related to braking, shall be subject to this *Code*. Circuits supplying lights subject to federal or state regulations shall comply with applicable government regulations and this *Code*.

(B) Extra- Low-Voltage Wiring.

(1) Material.

Copper conductors shall be used for extra- low-voltage circuits.

Exception: A metal chassis or frame shall be permitted as the return path to the source of supply.

(2) Conductor Types.

Conductors shall conform to the requirements for Type GXL, HDT, SGT, SGR, or Type SXL or shall have insulation in accordance with Table 310.4(A) or the equivalent. Conductor sizes 6 AWG through 18 AWG or SAE shall be listed. Single-wire, extra- low-voltage conductors shall be of the stranded type.

Informational Note: See SAE J1128-2015, *Low Voltage Primary Cable,* for Types GXL, HDT, and SXL, and SAE J1127-2015, *Low Voltage Battery Cable,* for Types SGT and SGR.

(3) Marking.

All insulated extra- low-voltage conductors shall be surface marked at intervals not greater than 1.2 m (4 ft) as follows:

(1) Listed conductors shall be marked as required by the listing agency.

(2) SAE conductors shall be marked with the name or logo of the manufacturer, specification designation, and wire gauge.

(3) Other conductors shall be marked with the name or logo of the manufacturer, temperature rating, wire gauge, conductor material, and insulation thickness.

(C) Extra- Low-Voltage Wiring Methods.

(1) Physical Protection.

Conductors shall be protected against physical damage and shall be secured. Where insulated conductors are clamped to the structure, the conductor insulation shall be supplemented by an additional wrap or layer of equivalent material, except that jacketed cables shall not be required to be so protected. Wiring shall be routed away from sharp edges, moving parts, or heat sources.

(2) Splices.

Conductors shall be spliced or joined with splicing devices that provide a secure connection or by brazing, welding, or soldering with a fusible metal or alloy. Soldered splices shall first be spliced or joined to be mechanically and electrically secure without solder, and then soldered. All splices, joints, and free ends of conductors shall be covered with an insulation equivalent to that on the conductors.

(3) Separation.

Battery and other extra- low-voltage circuits shall be physically separated by at least a 13-mm (½-in.) gap or other approved means from circuits of a different power source. Acceptable methods shall be by clamping, routing, or equivalent means that ensure permanent total separation. Where circuits of different power sources cross, the external jacket of the nonmetallic-sheathed cables shall be deemed adequate separation.

(4) Ground Connections.

Ground connections to the chassis or frame shall be made in an accessible location and shall be mechanically secure. Ground connections shall be by means of copper conductors and copper or copper-alloy terminals of the solderless type identified for the size of wire used. The surface on which ground terminals make contact shall be cleaned and be free from oxide or paint or shall be electrically connected through the use of a cadmium, tin, or zinc-plated internal/external-toothed lockwasher or locking terminals. Ground terminal attaching screws, rivets or bolts, nuts, and lockwashers shall be cadmium, tin, or zinc-plated except rivets shall be permitted to be unanodized aluminum where attaching to aluminum structures.

The chassis-grounding terminal of the battery shall be connected to the unit chassis with a minimum 8 AWG copper conductor. In the event the unbonded lead from the battery exceeds 8 AWG, the bonding conductor size shall be not less than that of the unbonded lead.

(D) Battery Installations.

Storage batteries subject to this *Code* shall be securely attached to the unit and installed in an area vaportight to the interior and ventilated directly to the exterior of the unit. Where batteries are installed in a compartment, the compartment shall be ventilated with openings having a minimum area of 1100 mm^2 (1.7 $in.^2$) at both the top and at the bottom. Where compartment doors are equipped for ventilation, the openings shall be within 50 mm (2 in.) of the top and bottom. Batteries shall not be installed in a compartment containing spark- or flame-producing equipment.

(E) Overcurrent Protection.

(1) Rating.

~~Low~~ Extra -low- voltage circuit wiring shall be protected by overcurrent protective devices rated not in excess of the ampacity of copper conductors, in accordance with Table 552.10(E)(1).

Table 552.10(E)(1) ~~Low~~ Extra -Low- Voltage Overcurrent Protection

Wire Size (AWG)	Ampacity	Wire Type
18	6	Stranded only
16	8	Stranded only
14	15	Stranded or solid
12	20	Stranded or solid
10	30	Stranded or solid

(2) Type.

Circuit breakers or fuses shall be of an approved type, including automotive types. Fuseholders shall be clearly marked with maximum fuse size and shall be protected against shorting and physical damage by a cover or equivalent means.

> Informational Note: For further information, see ANSI/SAE J554-1987, *Standard for Electric Fuses (Cartridge Type)*; SAE J1284-1988, *Standard for Blade Type Electric Fuses*; and UL 275-2005, *Standard for Automotive Glass Tube Fuses*.

(3) Appliances.

Appliances such as pumps, compressors, heater blowers, and similar motor-driven appliances shall be installed in accordance with the manufacturer's instructions.

Motors that are controlled by automatic switching or by latching-type manual switches shall be protected in accordance with 430.32(B).

(4) Location.

The overcurrent protective device shall be installed in an accessible location on the unit within 450 mm (18 in.) of the point where the power supply connects to the unit circuits. If located outside the park trailer, the device shall be protected against weather and physical damage.

Exception: External extra- low-voltage supply shall be permitted to have the overcurrent protective device within 450 mm (18 in.) after entering the unit or after leaving a metal raceway.

(F) Switches.

Switches shall have a dc rating not less than the connected load.

(G) Luminaires.

All extra- low-voltage interior luminaires rated more than 4 watts, employing lamps rated more than 1.2 watts, shall be listed.

Part III. Combination Electrical Systems

552.20 Combination Electrical Systems.

(A) General.

Unit wiring suitable for connection to a battery or other extra- low-voltage supply source shall be permitted to be connected to a 120-volt source, provided that the entire wiring system and equipment are rated and installed in full conformity with Parts I, III, IV, and V requirements of this article covering 120-volt electrical systems. Circuits fed from ac transformers shall not supply dc appliances.

(B) Voltage Converters (120-Volt Alternating Current to Extra- Low-Voltage Direct Current).

The 120-volt ac side of the voltage converter shall be wired in full conformity with the requirements of Parts I and IV of this article for 120-volt electrical systems.

Exception: Converters supplied as an integral part of a listed appliance shall not be subject to 552.20(B).

All converters and transformers shall be listed for use in recreation units and designed or equipped to provide over-temperature protection. To determine the converter rating, the following percentages shall be applied to the total connected load, including average battery-charging rate, of all 12-volt equipment:

The first 20 amperes of load at 100 percent plus

The second 20 amperes of load at 50 percent plus

All load above 40 amperes at 25 percent

Exception: ~~A~~ An extra- low-voltage appliance that is controlled by a momentary switch (normally open) that has no means for holding in the closed position shall not be considered as a connected load when determining the required converter rating. Momentarily energized appliances shall be limited to those used to prepare the unit for occupancy or travel.

(C) Bonding Voltage Converter Enclosures.

The non–current-carrying metal enclosure of the voltage converter shall be connected to the frame of the unit with an 8 AWG copper conductor minimum. The equipment grounding conductor for the battery and the metal enclosure shall be permitted to be the same conductor.

(D) Dual-Voltage Fixtures Including Luminaires or Appliances.

Fixtures, including luminaires, or appliances having both 120-volt and extra- low-voltage connections shall be listed for dual voltage.

(E) Autotransformers.

Autotransformers shall not be used.

(F) Receptacles and Plug Caps.

Where a park trailer is equipped with a 120-volt or 120/240-volt ac system, ~~a~~ an extra- low-voltage system, or both, receptacles and plug caps of the extra- low-voltage system shall differ in configuration from those of the 120-volt or 120/240-volt system. Where a unit equipped with a battery or dc system has an external connection for extra- low-voltage power, the connector shall have a configuration that will not accept 120-volt power.

Part IV. Nominal 120-Volt or 120/240-Volt Systems

552.40 120-Volt or 120/240-Volt, Nominal, Systems.

(A) General Requirements.

The electrical equipment and material of park trailers indicated for connection to a wiring system rated 120 volts, nominal, 2-wire with an equipment grounding conductor, or a wiring system rated 120/240 volts, nominal, 3-wire with an equipment grounding conductor, shall be listed and installed in accordance with the requirements of Parts I, III, IV, and V of this article.

(B) Materials and Equipment.

Electrical materials, devices, appliances, fittings, and other equipment installed, intended for use in, or attached to the park trailer shall be listed. All products shall be used only in the manner in which they have been tested and found suitable for the intended use.

552.41 Receptacle Outlets Required.

(A) Spacing.

Receptacle outlets shall be installed at wall spaces 600 mm (2 ft) wide or more so that no point along the floor line is more than 1.8 m (6 ft), measured horizontally, from an outlet in that space.

Exception No. 1: Bath and hallway areas.

Exception No. 2: Wall spaces occupied by kitchen cabinets, wardrobe cabinets, built-in furniture; behind doors that may open fully against a wall surface; or similar facilities.

(B) Location.

Receptacle outlets shall be installed as follows:

(1) Adjacent to countertops in the kitchen [at least one on each side of the sink if countertops are on each side and are 300 mm (12 in.) or over in width and depth]

(2) Adjacent to the refrigerator and gas range space, except where a gas-fired refrigerator or cooking appliance, requiring no external electrical connection, is factory-installed

(3) Adjacent to countertop spaces of 300 mm (12 in.) or more in width and depth that cannot be reached from a receptacle required in 552.41(B)(1) by a cord of 1.8 m (6 ft) without crossing a traffic area, cooking appliance, or sink

(C) Ground-Fault Circuit-Interrupter Protection.

Each 125-volt, single-phase, 15- or 20-ampere receptacle shall have ground-fault circuit-interrupter protection for personnel in the following locations:

(1) Where the receptacles are installed to serve kitchen countertop surfaces

(2) Within 1.8 m (6 ft) of any lavatory or sink

Exception: Receptacles installed for appliances in dedicated spaces, such as for dishwashers, disposals, refrigerators, freezers, and laundry equipment.

(3) In the area occupied by a toilet, shower, tub, or any combination thereof

(4) On the exterior of the unit

Exception: Receptacles that are located inside of an access panel that is installed on the exterior of the unit to supply power for an installed appliance shall not be required to have ground-fault circuit-interrupter protection.

The receptacle outlet shall be permitted in a listed luminaire. A receptacle outlet shall not be installed in a tub or combination tub–shower compartment.

(D) Pipe Heating Cable Outlet.

Where a pipe heating cable outlet is installed, the outlet shall be as follows:

(1) Located within 600 mm (2 ft) of the cold water inlet

(2) Connected to an interior branch circuit, other than a small-appliance branch circuit

(3) On a circuit where all of the outlets are on the load side of the ground-fault circuit-interrupter protection for personnel

(4) Mounted on the underside of the park trailer and shall not be considered to be the outdoor receptacle outlet required in 552.41(E)

(E) Outdoor Receptacle Outlets.

At least one receptacle outlet shall be installed outdoors. A receptacle outlet located in a compartment accessible from the outside of the park trailer shall be considered an outdoor receptacle. Outdoor receptacle outlets shall be protected as required in 552.41(C)(4).

(F) Receptacle Outlets Not Permitted.

(1) Shower or Bathtub Space.

Receptacle outlets shall not be installed in or within reach [750 mm (30 in.)] of a shower or bathtub space.

(2) Face-Up Position.

A receptacle shall not be installed in a face-up position in any countertop or other similar horizontal surface.

552.42 Branch-Circuit Protection.

(A) Rating.

The branch-circuit overcurrent devices shall be rated as follows:

(1) Not more than the circuit conductors

(2) Not more than 150 percent of the rating of a single appliance rated 13.3 amperes or more and supplied by an individual branch circuit

(3) Not more than the overcurrent protection size marked on an air conditioner or other motor-operated appliances.

(B) Protection for Smaller Conductors.

A 20-ampere fuse or circuit breaker shall be permitted for protection for fixtures, including luminaires, leads, cords, or small appliances, and 14 AWG tap conductors, not over 1.8 m (6 ft) long for recessed luminaires.

(C) Fifteen-Ampere Receptacle Considered Protected by 20 Amperes.

If more than one receptacle or load is on a branch circuit, 15-ampere receptacles shall be permitted to be protected by a 20-ampere fuse or circuit breaker.

552.43 Power Supply.

(A) Feeder.

The power supply to the park trailer shall be a feeder assembly consisting of not more than one listed 30-ampere or 50-ampere park trailer power-supply cord, with an integrally molded or securely attached cap, or a permanently installed feeder.

(B) Power-Supply Cord.

If the park trailer has a power-supply cord, it shall be permanently attached to the panelboard, or to a junction box permanently connected to the panelboard, with the free end terminating in a molded-on attachment plug cap.

Cords with adapters and pigtail ends, extension cords, and similar items shall not be attached to, or shipped with, a park trailer.

A suitable clamp or the equivalent shall be provided at the panelboard knockout to afford strain relief for the cord to prevent strain from being transmitted to the terminals when the power-supply cord is handled in its intended manner.

The cord shall be a listed type with 3-wire, 120-volt or 4-wire, 120/240-volt conductors, one of which shall be identified by a continuous green color or a continuous green color with one or more yellow stripes for use as the equipment grounding conductor.

(C) Mast Weatherhead or Raceway.

Where the calculated load exceeds 50 amperes or where a permanent feeder is used, the supply shall be by means of one of the following:

(1) One mast weatherhead installation, installed in accordance with Article 230, containing four continuous, insulated, color-coded feeder conductors, one of which shall be an equipment grounding conductor

(2) A metal raceway, rigid nonmetallic conduit, or liquidtight flexible conduit from the disconnecting means in the park trailer to the underside of the park trailer

552.44 Cord.

(A) Permanently Connected.

Each power-supply assembly shall be factory supplied or factory installed and connected directly to the terminals of the panelboard or conductors within a junction box and provided with means to prevent strain from being transmitted to the terminals. The ampacity of the conductors between each junction box and the terminals of each panelboard shall be at least equal to the ampacity of the power-supply cord. The supply end of the assembly shall be equipped with an attachment plug of the type described in 552.44(C). Where the cord passes through the walls or floors, it shall be protected by means of conduit and bushings or equivalent. The cord assembly shall have permanent provisions for protection against corrosion and mechanical damage while the unit is in transit.

(B) Cord Length.

The cord-exposed usable length shall be measured from the point of entrance to the park trailer or the face of the flanged surface inlet (motor-base attachment plug) to the face of the attachment plug at the supply end.

The cord-exposed usable length, measured to the point of entry on the unit exterior, shall be a minimum of 7.0 m (23 ft) where the point of entrance is at the side of the unit, or shall be a minimum 8.5 m (28 ft) where the point of entrance is at the rear of the unit. The maximum length shall not exceed 11 m (36½ ft).

Where the cord entrance into the unit is more than 900 mm (3 ft) above the ground, the minimum cord lengths above shall be increased by the vertical distance of the cord entrance heights above 900 mm (3 ft).

(C) Attachment Plugs.

(1) Units with Two to Five 15- or 20-Ampere Branch Circuits.

Park trailers wired in accordance with 552.46(A) shall have an attachment plug that shall be 2-pole, 3-wire grounding type, rated 30 amperes, 125 volts, conforming to the configuration shown in Figure 552.44(C)(1) intended for use with units rated at 30 amperes, 125 volts.

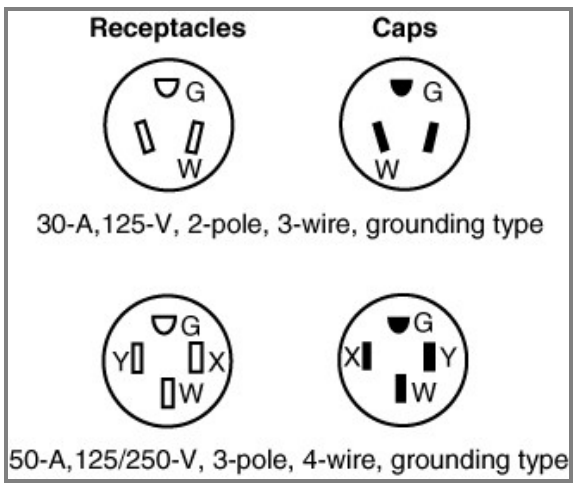
> Informational Note: Complete details of this configuration can be found in ANSI/NEMA WD 6-2016, *Wiring Devices — Dimensional Specifications*, Figure TT.

(2) Units with 50-Ampere Power Supply Assembly.

Park trailers having a power-supply assembly rated 50 amperes as permitted by 552.43(B) shall have a 3-pole, 4-wire grounding-type attachment plug rated 50 amperes, 125/250 volts, conforming to the configuration shown in Figure 552.44(C)(1).

> Informational Note: Complete details of this configuration can be found in ANSI/NEMA WD 6-2016, *Wiring Devices — Dimensional Specifications*, Figure 14-50.

Figure 552.44(C)(1) Attachment Cap and Receptacle Configurations.



(D) Labeling at Electrical Entrance.

Each park trailer shall have a safety label with the signal word WARNING in minimum 6 mm (¼ in.) high letters and body text in minimum 3 mm (⅛ in.) high letters on a contrasting background. The safety label shall be affixed to the exterior skin, at or near the point of entrance of the power-supply assembly and shall read, as appropriate:

WARNING:

THIS CONNECTION IS FOR 110–125-VOLT AC,

60 HZ, 30-AMPERE SUPPLY

or

WARNING:

THIS CONNECTION IS FOR 208Y/120-VOLT OR 120/240-VOLT AC, 3-POLE, 4-WIRE, 60 HZ, _____-AMPERE SUPPLY.

followed by

DO NOT EXCEED THE CIRCUIT RATING. EXCEEDING THE CIRCUIT RATING CAN CAUSE A FIRE AND RESULT IN DEATH OR SERIOUS INJURY.

The correct ampere rating shall be marked in the blank space and the label shall meet the requirements in 110.21(B).

(E) Location.

The point of entrance of a power-supply assembly shall be located on either side or the rear, within 450 mm (18 in.), of an outside wall.

552.45 Panelboard.

(A) Listed and Appropriately Rated.

A listed and appropriately rated panelboard shall be used. The grounded conductor termination bar shall be insulated from the enclosure as provided in 552.55(C). An equipment grounding terminal bar shall be attached inside the metal enclosure of the panelboard.

(B) Location.

The panelboard shall be installed in a readily accessible location. Working clearance for the panelboard shall be not less than 600 mm (24 in.) wide and 750 mm (30 in.) deep.

Exception: Where the panelboard cover is exposed to the inside aisle space, one of the working clearance dimensions shall be permitted to be reduced to a minimum of 550 mm (22 in.). A panelboard shall be considered exposed where the panelboard cover is within 50 mm (2 in.) of the aisle's finished surface or not more than 25 mm (1 in.) from the backside of doors that enclose the space.

(C) Dead-Front Type.

The panelboard shall be of the dead-front type. A main disconnecting means shall be provided where fuses are used or where more than two circuit breakers are employed. A main overcurrent protective device not exceeding the power-supply assembly rating shall be provided where more than two branch circuits are employed.

552.46 Branch Circuits.

Branch circuits shall be determined in accordance with 552.46(A) and (B).

(A) Two to Five 15- or 20-Ampere Circuits.

A maximum of five 15- or 20-ampere circuits to supply lights, receptacle outlets, and fixed appliances shall be permitted. Such park trailers shall be permitted to be equipped with panelboards rated at 120 volt maximum or 120/240 volt maximum and listed for a 30-ampere-rated main power supply assembly. Not more than two 120-volt thermostatically controlled appliances shall be installed in such systems unless appliance isolation switching, energy management systems, or similar methods are used.

Exception No. 1: Additional 15- or 20-ampere circuits shall be permitted where a listed energy management system rated at 30 amperes maximum is employed within the system.

Exception No. 2: Six 15- or 20-ampere circuits shall be permitted without employing an energy management system, provided that the added sixth circuit serves only the power converter, and the combined load of all six circuits does not exceed the allowable load that was designed for use by the original five circuits.

Informational Note: See 210.23(A) for permissible loads. See 552.45(C) for main disconnect and overcurrent protection requirements.

(B) More Than Five Circuits.

Where more than five circuits are needed, they shall be determined in accordance with 552.46(B)(1), (B)(2), and (B)(3).

(1) Lighting.

Based on 33 volt-amperes/m^2 (3 VA/ft^2) multiplied by the outside dimensions of the park trailer (coupler excluded) divided by 120 volts to determine the number of 15- or 20-ampere lighting area circuits, for example,

$$\frac{3 \times \text{length} \times \text{width}}{120 \times 15 \text{ (or } 20)} = \text{No. of 15- (or 20-) ampere circuits}$$

[552.46(B)(1

The lighting circuits shall be permitted to serve listed cord-connected kitchen waste disposers and to provide power for supplemental equipment and lighting on gas-fired ranges, ovens, or counter-mounted cooking units.

(2) Small Appliances.

Small-appliance branch circuits shall be installed in accordance with 210.11(C)(1).

(3) General Appliances.

(including furnace, water heater, space heater, range, and central or room air conditioner, etc.) An individual branch circuit shall be permitted to supply any load for which it is rated. There shall be one or more circuits of adequate rating in accordance with 552.46(B)(3)(a) through (B)(3)(d).

Informational Note No. 1: For the laundry branch circuit, see 210.11(C)(2).

Informational Note No. 2: For central air conditioning, see Article 440.

(a) The total rating of fixed appliances shall not exceed 50 percent of the circuit rating if lighting outlets, general-use receptacles, or both are also supplied.

(b) For fixed appliances with a motor(s) larger than ⅛ horsepower, the total calculated load shall be based on 125 percent of the largest motor plus the sum of the other loads. Where a branch circuit supplies continuous load(s) or any combination of continuous and noncontinuous loads, the branch-circuit conductor size shall be in accordance with 210.19(A).

(c) The rating of a single cord-and-plug-connected appliance supplied by other than an individual branch circuit shall not exceed 80 percent of the circuit rating.

(d) The rating of a range branch circuit shall be based on the range demand as specified for ranges in 552.47(B)(5).

552.47 Calculations.

The following method shall be employed in computing the supply-cord and distribution-panelboard load for each feeder assembly for each park trailer in lieu of the procedure shown in Article 220 and shall be based on a 3-wire, 208Y/120-volt or 120/240-volt supply with 120-volt loads balanced between the two phases of the 3-wire system.

(A) Lighting and Small-Appliance Load.

Lighting Volt-Amperes: Length times width of park trailer floor (outside dimensions) times 33 volt-amperes/m^2 (3 VA/ft^2). For example,

Length × width × 3 = lighting volt-amperes

Small-Appliance Volt-Amperes: Number of circuits times 1500 volt-amperes for each 20-ampere appliance receptacle circuit (see definition of *Appliance, Portable* with fine print note) including 1500 volt-amperes for laundry circuit. For example,

No. of circuits × 1500 = small-appliance volt-amperes

Total: Lighting volt-amperes plus small-appliance volt-amperes = total volt-amperes

First 3000 total volt-amperes at 100 percent plus remainder at 35 percent = volt-amperes to be divided by 240 volts to obtain current (amperes) per leg.

(B) Total Load for Determining Power Supply.

Total load for determining power supply is the sum of the following:

(1) Lighting and small-appliance load as calculated in 552.47(A).

(2) Nameplate amperes for motors and heater loads (exhaust fans, air conditioners, electric, gas, or oil heating). Omit smaller of the heating and cooling loads, except include blower motor if used as air-conditioner evaporator motor. Where an air conditioner is not installed and a 50-ampere power-supply cord is provided, allow 15 amperes per phase for air conditioning.

(3) Twenty-five percent of current of largest motor in item (2).

(4) Total of nameplate amperes for disposal, dishwasher, water heater, clothes dryer, wall-mounted oven, cooking units. Where the number of these appliances exceeds three, use 75 percent of total.

(5) Derive amperes for freestanding range (as distinguished from separate ovens and cooking units) by dividing the following values by 240 volts as shown in the following table.

(6) If outlets or circuits are provided for other than factory-installed appliances, include the anticipated load.

Informational Note: Refer to Informative Annex D, Example D12, for an illustration of the application of this calculation.

Nameplate Rating (watts)	Use (volt-amperes)
0–10,000	80 percent of rating
Over 10,000–12,500	8,000
Over 12,500–13,500	8,400
Over 13,500–14,500	8,800
Over 14,500–15,500	9,200
Over 15,500–16,500	9,600
Over 16,500–17,500	10,000

(C) Optional Method of Calculation for Lighting and Appliance Load.

For park trailers, the optional method for calculating lighting and appliance load shown in 220.82 shall be permitted.

552.48 Wiring Methods.

(A) Wiring Systems.

Cables and raceways installed in accordance with Articles 320, 322, 330 through 340, 342 through 362, 386, and 388 shall be permitted in accordance with their applicable article, except as otherwise specified in this article. An equipment grounding means shall be provided in accordance with 250.118.

(B) Conduit and Tubing.

Where rigid metal conduit or intermediate metal conduit is terminated at an enclosure with a locknut and bushing connection, two locknuts shall be provided, one inside and one outside of the enclosure. All cut ends of conduit and tubing shall be reamed or otherwise finished to remove rough edges.

(C) Nonmetallic Boxes.

Nonmetallic boxes shall be acceptable only with nonmetallic-sheathed cable or nonmetallic raceways.

(D) Boxes.

In walls and ceilings constructed of wood or other combustible material, boxes and fittings shall be flush with the finished surface or project therefrom.

(E) Mounting.

Wall and ceiling boxes shall be mounted in accordance with Article 314.

Exception No. 1: Snap-in-type boxes or boxes provided with special wall or ceiling brackets that securely fasten boxes in walls or ceilings shall be permitted.

Exception No. 2: A wooden plate providing a 38-mm (1½-in.) minimum width backing around the box and of a thickness of 13 mm (½ in.) or greater (actual) attached directly to the wall panel shall be considered as approved means for mounting outlet boxes.

(F) Cable Sheath.

The sheath of nonmetallic-sheathed cable, and the armor of metal-clad cable and Type AC cable, shall be continuous between outlet boxes and other enclosures.

(G) Protected.

Metal-clad, Type AC, or nonmetallic-sheathed cables and electrical nonmetallic tubing shall be permitted to pass through the centers of the wide side of 2 by 4 wood studs. However, they shall be protected where they pass through 2 by 2 wood studs or at other wood studs or frames where the cable or tubing would be less than 32 mm (1¼ in.) from the inside or outside surface. Steel plates on each side of the cable or tubing, or a steel tube, with not less than 1.35 mm (0.053 in.) wall thickness, shall be installed to protect the cable or tubing. These plates or tubes shall be securely held in place. Where nonmetallic-sheathed cables pass through punched, cut, or drilled slots or holes in metal members, the cable shall be protected by bushings or grommets securely fastened in the opening prior to installation of the cable.

(H) Cable Supports.

Where connected with cable connectors or clamps, cables shall be secured and supported within 300 mm (12 in.) of outlet boxes, panelboards, and splice boxes on appliances. Supports and securing shall be provided at intervals not exceeding 1.4 m (4½ ft) at other places.

(I) Nonmetallic Box Without Cable Clamps.

Nonmetallic-sheathed cables shall be secured and supported within 200 mm (8 in.) of a nonmetallic outlet box without cable clamps. Where wiring devices with integral enclosures are employed with a loop of extra cable to permit future replacement of the device, the cable loop shall be considered as an integral portion of the device.

(J) Physical Damage.

Where subject to physical damage, exposed nonmetallic cable shall be protected by covering boards, guard strips, raceways, or other means.

(K) Receptacle Faceplates.

Metal faceplates shall comply with 406.5(A). Nonmetallic faceplates shall comply with 406.5(C).

(L) Metal Faceplates Grounded.

Where metal faceplates are used, they shall be grounded.

(M) Moisture or Physical Damage.

Where outdoor or under-chassis wiring is 120 volts, nominal, or over and is exposed to moisture or physical damage, the wiring shall be protected by rigid metal conduit, by intermediate metal conduit, by electrical metallic tubing, by rigid nonmetallic conduit, or by Type MI cable that is closely routed against frames and equipment enclosures or other raceway or cable identified for the application.

(N) Component Interconnections.

Fittings and connectors that are intended to be concealed at the time of assembly shall be listed and identified for the interconnection of building components. Such fittings and connectors shall be equal to the wiring method employed in insulation, temperature rise, and fault-current withstanding, and shall be capable of enduring the vibration and shock occurring in park trailers.

(O) Method of Connecting Expandable Units.

The method of connecting expandable units to the main body of the park trailer shall comply with 552.48(O)(1) and 552.48(O)(2) as applicable.

(1) Cord-and-Plug Connected.

Cord-and-plug connections shall comply with 552.48(O)(1)(a) through (O)(1)(d).

(a) The portion of a branch circuit that is installed in an expandable unit shall be permitted to be connected to the portion of the branch circuit in the main body of the vehicle by means of an attachment plug and cord listed for hard usage. The cord and its connections shall comply with Parts I and II of Article 400 and shall be considered as a permitted use under 400.10. Where the attachment plug and cord are located within the park trailer's interior, use of plastic thermoset or elastomer parallel cord Type SPT-3, SP-3, or SPE shall be permitted.

(b) Where the receptacle provided for connection of the cord to the main circuit is located on the outside of the park trailer, it shall be protected with a ground-fault circuit interrupter for personnel and be listed for wet locations. A cord located on the outside of a park trailer shall be identified for outdoor use.

(c) Unless removable or stored within the park trailer interior, the cord assembly shall have permanent provisions for protection against corrosion and mechanical damage while the park trailer is in transit.

(d) The attachment plug and cord shall be installed so as not to permit exposed live attachment plug pins.

(2) Direct Wires Connected.

That portion of a branch circuit that is installed in an expandable unit shall be permitted to be connected to the portion of the branch circuit in the main body of the park trailer by means of flexible cord installed in accordance with 552.48(O)(2)(a) through (O)(2)(f) or other approved wiring method.

(a) The flexible cord shall be listed for hard usage and for use in wet locations.

(b) The flexible cord shall be permitted to be exposed on the underside of the vehicle.

(c) The flexible cord shall be permitted to pass through the interior of a wall or floor assembly or both a maximum concealed length of 600 mm (24 in.) before terminating at an outlet or junction box.

(d) Where concealed, the flexible cord shall be installed in nonflexible conduit or tubing that is continuous from the outlet or junction box inside the park trailer to a weatherproof outlet box, junction box, or strain relief fitting listed for use in wet locations that is located on the underside of the park trailer. The outer jacket of flexible cord shall be continuous into the outlet or junction box.

(e) Where the flexible cord passes through the floor to an exposed area inside of the park trailer, it shall be protected by means of conduit and bushings or equivalent.

(f) Where subject to physical damage, the flexible cord shall be protected with RMC, IMC, Schedule 80 PVC, reinforced thermosetting resin conduit (RTRC) listed for exposure to physical damage, or other approved means and shall extend at least 150 mm (6 in.) above the floor. A means shall be provided to secure the flexible cord where it enters the park trailer.

(P) Prewiring for Air-Conditioning Installation.

Prewiring installed for the purpose of facilitating future air-conditioning installation shall comply with the applicable portions of this article and the following:

(1) An overcurrent protective device with a rating compatible with the circuit conductors shall be installed in the panelboard and wiring connections completed.

(2) The load end of the circuit shall terminate in a junction box with a blank cover or other listed enclosure. Where a junction box with a blank cover is used, the free ends of the conductors shall be adequately capped or taped.

(3) A safety label with the word WARNING in minimum 6 mm (¼ in.) high letters and body text in minimum 3 mm (⅛ in.) high letters on a contrasting background shall be affixed on or adjacent to the junction box and shall read as follows:

WARNING

AIR-CONDITIONING CIRCUIT.

THIS CONNECTION IS FOR AIR CONDITIONERS

RATED 110–125-VOLT AC, 60 HZ,

____ AMPERES MAXIMUM.

DO NOT EXCEED CIRCUIT RATING.

EXCEEDING THE CIRCUIT RATING MAY

CAUSE A FIRE AND RESULT IN

DEATH OR SERIOUS INJURY

An ampere rating not to exceed 80 percent of the circuit rating shall be legibly marked in the blank space.

(4) The circuit shall serve no other purpose.

(Q) Prewiring for Other Circuits.

Prewiring installed for the purpose of installing other appliances or devices shall comply with the applicable portions of this article and the following:

(1) An overcurrent protection device with a rating compatible with the circuit conductors shall be installed in the panelboard with wiring connections completed.

(2) The load end of the circuit shall terminate in a junction box with a blank cover or a device listed for the purpose. Where a junction box with blank cover is used, the free ends of the conductors shall be adequately capped or taped.

(3) A safety label with the signal word WARNING in minimum 6 mm (¼ in.) high letters and body text in minimum 3 mm (⅛ in.) high letters on a contrasting background shall be affixed on or adjacent to the junction box or device listed for the purpose and shall read as follows:

WARNING

THIS CONNECTION IS FOR _____ RATED _____ VOLT AC, 60 HZ, _____ AMPERES MAXIMUM. DO NOT EXCEED CIRCUIT RATING. EXCEEDING THE CIRCUIT RATING MAY CAUSE A FIRE AND RESULT IN DEATH OR SERIOUS INJURY.

An ampere rating not to exceed 80 percent of the circuit rating shall be legibly marked in the blank space.

552.49 Maximum Number of Conductors in Boxes.

The maximum number of conductors permitted in boxes shall be in accordance with 314.16.

552.50 Grounded Conductors.

The identification of grounded conductors shall be in accordance with 200.6.

552.51 Connection of Terminals and Splices.

Conductor splices and connections at terminals shall be in accordance with 110.14.

552.52 Switches.

Switches shall be rated as required by 552.52(A) and (B).

(A) Lighting Circuits.

For lighting circuits, switches shall be rated not less than 10 amperes, 120/125 volts, and in no case less than the connected load.

(B) Motors or Other Loads.

For motors or other loads, switches shall have ampere or horsepower ratings, or both, adequate for loads controlled. (An ac general-use snap switch shall be permitted to control a motor 2 hp or less with full-load current not over 80 percent of the switch ampere rating.)

(C) Location.

Switches shall not be installed within wet locations in tub or shower spaces unless installed as part of a listed tub or shower assembly.

552.53 Receptacles.

All receptacle outlets shall be of the grounding type and installed in accordance with 210.21 and 406.4.

552.54 Luminaires.

(A) General.

Any combustible wall or ceiling finish exposed between the edge of a canopy or pan of a luminaire or ceiling suspended (paddle) fan and the outlet box shall be covered with noncombustible material or a material identified for the purpose.

(B) Shower Luminaires.

If a luminaire is provided over a bathtub or in a shower stall, it shall be of the enclosed and gasketed type and listed for the type of installation, and it shall be ground-fault circuit-interrupter protected.

(C) Outdoor Outlets, Luminaires, Air-Cooling Equipment, and So On.

Outdoor luminaires and other equipment shall be listed for outdoor use or wet locations.

552.55 Grounding.

(See also 552.57 on bonding of non–current-carrying metal parts.)

(A) Power-Supply Grounding.

The equipment grounding conductor in the supply cord or feeder shall be connected to the equipment grounding bus or other approved equipment grounding means in the panelboard.

(B) Panelboard.

The panelboard shall have an equipment grounding bus with sufficient terminals for all equipment grounding conductors or other approved grounding means.

(C) Insulated Grounded Conductor.

The grounded circuit conductor shall be insulated from the equipment grounding conductors and from equipment enclosures and other grounded parts. The grounded circuit conductor terminals in the panelboard and in ranges, clothes dryers, counter-mounted cooking units, and wall-mounted ovens shall be insulated from the equipment enclosure. Bonding screws, straps, or buses in the panelboard or in appliances shall be removed and discarded. Connection of electric ranges and electric clothes dryers utilizing a grounded conductor, if cord-connected, shall be made with 4-conductor cord and 3-pole, 4-wire, grounding-type plug caps and receptacles.

552.56 Interior Equipment Grounding.

(A) Exposed Metal Parts.

In the electrical system, all exposed metal parts, enclosures, frames, luminaire canopies, and so forth, shall be effectively bonded to the grounding terminals or enclosure of the panelboard.

(B) Equipment Grounding Conductors.

Bare conductors or conductors with insulation or individual covering that is green or green with one or more yellow stripes shall be used for equipment grounding conductors only.

(C) Grounding of Electrical Equipment.

Where grounding of electrical equipment is specified, it shall be permitted as follows:

(1) Connection of metal raceway (conduit or electrical metallic tubing), the sheath of Type MC and Type MI cable where the sheath is identified for grounding, or the armor of Type AC cable to metal enclosures.

(2) A connection between the one or more equipment grounding conductors and a metal box by means of a grounding screw, which shall be used for no other purpose, or a listed grounding device.

(3) The equipment grounding conductor in nonmetallic-sheathed cable shall be permitted to be secured under a screw threaded into the luminaire canopy other than a mounting screw or cover screw or attached to a listed grounding means (plate) in a nonmetallic outlet box for luminaire mounting (grounding means shall also be permitted for luminaire attachment screws).

(D) Grounding Connection in Nonmetallic Box.

A connection between the one or more grounding conductors brought into a nonmetallic outlet box shall be arranged so that a connection can be made to any fitting or device in that box that requires grounding.

(E) Grounding Continuity.

Where more than one equipment grounding conductor of a branch circuit enters a box, all such conductors shall be in good electrical contact with each other, and the arrangement shall be such that the disconnection or removal of a receptacle, fixture, including a luminaire, or other device fed from the box will not interfere with or interrupt the grounding continuity.

(F) Cord-Connected Appliances.

Cord-connected appliances, such as washing machines, clothes dryers, refrigerators, and the electrical system of gas ranges, and so on, shall be grounded by means of an approved cord with equipment grounding conductor and grounding-type attachment plug.

552.57 Bonding of Non–Current-Carrying Metal Parts.

(A) Required Bonding.

All exposed non–current-carrying metal parts that are likely to become energized shall be effectively bonded to the grounding terminal or enclosure of the panelboard.

(B) Bonding Chassis.

A bonding conductor shall be connected between any panelboard and an accessible terminal on the chassis. Bonding terminations shall be suitable for the environment in which the conductors and terminations are installed.

Exception: Any park trailer that employs a unitized metal chassis-frame construction to which the panelboard is securely fastened with a bolt(s) and nut(s) or by welding or riveting shall be considered to be bonded.

(C) Bonding Conductor Requirements.

Grounding terminals shall be of the solderless type and listed as pressure terminal connectors recognized for the wire size used. The bonding conductor shall be solid or stranded, insulated or bare, and shall be 8 AWG copper minimum or equivalent.

(D) Metallic Roof and Exterior Bonding.

The metal roof and exterior covering shall be considered bonded where both of the following conditions apply:

(1) The metal panels overlap one another and are securely attached to the wood or metal frame parts by metal fasteners.

(2) The lower panel of the metal exterior covering is secured by metal fasteners at each cross member of the chassis, or the lower panel is connected to the chassis by a metal strap.

(E) Gas, Water, and Waste Pipe Bonding.

The gas, water, and waste pipes shall be considered grounded if they are bonded to the chassis.

(F) Furnace and Metal Air Duct Bonding.

Furnace and metal circulating air ducts shall be bonded.

552.58 Appliance Accessibility and Fastening.

Every appliance shall be accessible for inspection, service, repair, and replacement without removal of permanent construction. Means shall be provided to securely fasten appliances in place when the park trailer is in transit.

552.59 Outdoor Outlets, Fixtures, Including Luminaires, Air-Cooling Equipment, and So On.

(A) Listed for Outdoor Use.

Outdoor fixtures, including luminaires, and equipment shall be listed for outdoor use. Outdoor receptacle outlets shall be in accordance with 406.9(A) and (B). Switches and circuit breakers installed outdoors shall comply with 404.4.

(B) Outside Heating Equipment, Air-Conditioning Equipment, or Both.

A park trailer provided with a branch circuit designed to energize outside heating equipment or air-conditioning equipment, or both, located outside the park trailer, other than room air conditioners, shall have such branch-circuit conductors terminate in a listed outlet box or disconnecting means located on the outside of the park trailer. A safety label with the word WARNING in minimum 6 mm (¼ in.) high letters and body text in minimum 3 mm (⅛ in.) high letters on a contrasting background shall be affixed within 150 mm (6 in.) from the listed box or disconnecting means and shall read as follows:

WARNING

THIS CONNECTION IS FOR HEATING

AND/OR AIR-CONDITIONING EQUIPMENT.

THE BRANCH CIRCUIT IS RATED AT NOT MORE THAN _____ AMPERES, AT _____ VOLTS, 60 HZ, _____ CONDUCTOR AMPACITY.

A DISCONNECTING MEANS SHALL BE

LOCATED WITHIN SIGHT OF THE EQUIPMENT.

EXCEEDING THE CIRCUIT RATING MAY CAUSE A FIRE AND RESULT IN DEATH OR SERIOUS INJURY.

The correct voltage and ampere rating shall be given.

Part V. Factory Tests

552.60 Factory Tests (Electrical).

Each park trailer shall be subjected to the tests required by 552.60(A) and (B).

(A) Circuits of 120 Volts or 120/240 Volts.

Each park trailer designed with a 120-volt or a 120/240-volt electrical system shall withstand the applied voltage without electrical breakdown of a 1 minute, 900-volt dielectric strength test, or a 1 second, 1080-volt dielectric strength test, with all switches closed, between ungrounded and grounded conductors and the park trailer ground. During the test, all switches and other controls shall be in the “on” position. Fixtures, including luminaires, and permanently installed appliances shall not be required to withstand this test.

Each park trailer shall be subjected to the following:

(1) A continuity test to ensure that all metal parts are properly bonded

(2) Operational tests to demonstrate that all equipment is properly connected and in working order

(3) Polarity checks to determine that connections have been properly made

(4) Receptacles requiring GFCI protection shall be tested for correct function by the use of a GFCI testing device

(B) Extra- Low-Voltage Circuits.

An operational test of extra- low-voltage circuits shall be conducted to demonstrate that all equipment is connected and in electrical working order. This test shall be performed in the final stages of production after all outer coverings and cabinetry have been secured.

Statement of Problem and Substantiation for Public Input

Coordinate with proposed new definitions for low voltage and extra-low voltage.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1695-NFPA 70-2020 [New Definition after Definition: Voltage (of a circuit).]	Go together
Public Input No. 1695-NFPA 70-2020 [New Definition after Definition: Voltage (of a circuit).]	

Submitter Information Verification

Submitter Full Name: Paul Harouff
Organization: Deltek
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jun 25 14:44:09 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: CMP-7 resolves this PI to not include the addition of the word “extra” in front of “low voltage”. “Extra low voltage” at the time of the CMP-7 proceedings is not a defined term within the NEC.

Public Input No. 3659-NFPA 70-2020 [Section No. 552.2]

(Relocate all definitions in the 552. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

552. 2 Definition.

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

(See Articles 100, 550, and 551 for additional definitions.)

Park Trailer.

A unit that is built on a single chassis mounted on wheels and has a gross trailer area not exceeding 37 m^2 (400 ft^2) in the set-up mode.

Statement of Problem and Substantiation for Public Input

"The National Electrical Code has definitions in multiple parts in Article 100 and many definitions scattered through out the code many of them in the .2 section of the articles.
Most of the other standards under NFPA have their definitions in one location and this will allow the NEC the same requirement. The revisions to the NEC Style Manual require all the definitions to be relocated to Article 100. "

Submitter Information Verification

Submitter Full Name: David Williams
Organization: Delta Charter Township
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 10:14:09 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7690-NFPA 70-2020
Statement: All existing definitions under the purview of CMP-7 have been moved to Article 100 and revises for compliance with Section 2.2.2 of the NEC Style Manual. Additionally, all definition sections (545.2, 547.2, 550.2, 551.2, 552.2, 555.2, 604.2, and 675.2.2) in the articles under the responsibility of CMP-7 have been deleted.

Public Input No. 1175-NFPA 70-2020 [New Definition after Definition: Park Trailer.]

THOWs (Tiny Houses on Wheels)

A unit that is built on a single chassis mounted on wheels with a maximum dimension allowed of 2.5908 m (8ft 6in) wide 4.1148 m (13ft 6in) tall 12.192 m (40 ft) or has a gross area not exceeding 37.068 m² (399 ft²) when finished.

Statement of Problem and Substantiation for Public Input

On March 2017 NFPA put out a document titled Applying Building Codes to Tiny Homes. It refers to the NEC as a whole for the electrical requirement . When looking in Article 551 the definitions clearly state that RV's are designed for temporary living and it didn't provide an option for small appliances or a laundry circuit.

Submitter Information Verification

Submitter Full Name: Allen Lowe
Organization: E Light Electric
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 21 01:04:48 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: This public input creates conflict with other definitions, a Tiny house is not an RV or park trailer as defined in ANSI 119.5 and is not applicable to Article 552. A separate Article specifically addressing tiny house on wheels may be appropriate in the future. The substantiation to the proposed language also does not include any documentation for the sizes included in the proposed language.

Public Input No. 1177-NFPA 70-2020 [Section No. 552.4]

552.4 General Requirements.

(1) A park trailer as specified in 552.2 is intended for seasonal use. It is not intended as a permanent dwelling unit or for commercial uses such as banks, clinics, offices, or similar.

(2) A Tiny House as specified in 552.2 is designed to provide living quarters intended as a permanent dwelling unit or for seasonal use.

Statement of Problem and Substantiation for Public Input

This change will clearly state that THOWs are designed for full-time living.

Submitter Information Verification

Submitter Full Name: Allen Lowe
Organization: E Light Electric
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 21 06:22:33 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: A park trailer is not considered a dwelling unit. A separate Article specifically addressing tiny house on wheels may be appropriate in the future.

Public Input No. 4200-NFPA 70-2020 [Section No. 552.4]

552.4 General Requirements.

A park trailer as specified in 552.2 is intended for seasonal use. It is not intended as a permanent dwelling unit or for commercial uses such as banks, clinics, offices, or similar. Units designed for such purposes are classified as relocatable structures and are covered in Part II of Article 545.

Statement of Problem and Substantiation for Public Input

Park trailer construction methods also supply the relocatable structure market. This additional sentence closes the loop.

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
Organization: Hartwell Electrical Services, Inc.
Affiliation: self
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 02:12:35 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7892-NFPA 70-2020
Statement: This correlates with actions taken by CMP-7 in the 2020 NEC revision cycle creating Part II of Article 545.

Public Input No. 4086-NFPA 70-2020 [Section No. 552.40(A)]

(A) General Requirements.

The electrical equipment and material of park trailers indicated for connection to a wiring system rated 120 volts, nominal, 2-wire with an equipment grounding conductor, or a wiring system rated 120/240 volts, nominal, 3-wire with an equipment grounding conductor, shall be listed and installed in accordance ~~with the requirements of~~ with Parts I, III, IV, and V of this article.

Statement of Problem and Substantiation for Public Input

Deleting the words "the requirements of" does not change the meaning of the section.

Submitter Information Verification

Submitter Full Name: David Williams
Organization: Delta Charter Township
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 20:28:11 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7893-NFPA 70-2020
Statement: CMP-7 chooses to remove the term “the requirement of” to be consistent with other actions taken by the panel.

Public Input No. 4129-NFPA 70-2020 [Sections 552.41(C), 552.41(D)]

Sections 552.41(C), 552.41(D)

(C) Ground-Fault Circuit-Interrupter Protection.

Each 125-volt, single-phase, 15- or 20-ampere receptacle shall have listed and labeled ground-fault circuit-interrupter protection for personnel in the following locations:

(1) Where the receptacles are installed to serve kitchen countertop surfaces

(2) Within 1.8 m (6 ft) of any lavatory or sink

Exception: Receptacles installed for appliances in dedicated spaces, such as for dishwashers, disposals, refrigerators, freezers, and laundry equipment.

(3) In the area occupied by a toilet, shower, tub, or any combination thereof

(4) On the exterior of the unit

Exception: Receptacles that are located inside of an access panel that is installed on the exterior of the unit to supply power for an installed appliance shall not be required to have ground-fault circuit-interrupter protection.

The receptacle outlet shall be permitted in a listed luminaire. A receptacle outlet shall not be installed in a tub or combination tub–shower compartment.

(D) Pipe Heating Cable Outlet.

Where a pipe heating cable outlet is installed, the outlet shall be as follows:

(1) Located within 600 mm (2 ft) of the cold water inlet

(2) Connected to an interior branch circuit, other than a small-appliance branch circuit

(3) On a circuit where all of the outlets are on the load side of the listed and labeled ground-fault circuit-interrupter protection for personnel

(4) Mounted on the underside of the park trailer and shall not be considered to be the outdoor receptacle outlet required in 552.41(E)

Statement of Problem and Substantiation for Public Input

This is a device that depends on functional safety, without certification (Listing), how is an AHJ to know if it is going to properly perform the GFCI functions required by the product standard. Also, to promote consistency with Sections 410.184, 445.20, 518.3(B), 525.23(D), 600.10(C)(2), 680.5, 680.23(A)(8) which currently required listing.

Submitter Information Verification

Submitter Full Name: Richard Hollander
Organization: Shums Coda Associates
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 21:38:09 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: Listed and labeled is already a requirement for this device in 552.40(A) and 552.40(B).

Public Input No. 4623-NFPA 70-2020 [Section No. 552.43(C)]

(C) Mast Weatherhead or Raceway.

Where the calculated load exceeds 50 amperes or where a permanent feeder is used, the supply shall be by means of one of the following:

(1) One mast weatherhead installation, installed in accordance with Article 230, containing four continuous, insulated, color-coded feeder conductors, one of which shall be an equipment grounding conductor

(2) A metal raceway, rigid ~~nonmetallic conduit~~ polyvinyl chloride conduit , or liquidtight flexible conduit from the disconnecting means in the park trailer to the underside of the park trailer

Statement of Problem and Substantiation for Public Input

The 2008 NEC first referenced Reinforced Thermosetting Resin Conduit (RTRC) as a wiring method (Article 355). High Density Polyethylene Conduit (HDPE) first appeared in the 2005 NEC as Article 353. When Article 352 first changed (2008 NEC) to be titled “Rigid Polyvinyl Chloride Conduit” there were many changes throughout the Code to pick up this change and accordingly change text from “rigid nonmetallic conduit” to “rigid polyvinyl chloride conduit.”
In the 2002 NEC, this section referenced “rigid nonmetallic conduit” (as it still does in the 2020 NEC) before RTRC and HDPE appeared in the Code. This makes it clear that this section intended to permit only the use of rigid polyvinyl chloride conduit identified as “rigid nonmetallic conduit” as the other raceway types were not recognized by the NEC at the time. This term should be changed to rigid polyvinyl chloride and if the cmp wishes to add other types of nonmetallic raceways they should be listed separately.

Submitter Information Verification

Submitter Full Name: David Humphrey
Organization: County of Henrico, Virginia
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 15:56:12 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7898-NFPA 70-2020
Statement: CMP-7 agrees with the submitter that at the time rigid nonmetallic conduit was added to this article no other rigid nonmetallic conduits were in existence. Clarification has also been added that the requirement includes RMC and IMC are considered raceways as defined. The clarification will would allow for identified rigid metal or nonmetallic raceways.

Public Input No. 3322-NFPA 70-2020 [Section No. 552.48(K)]

(K) Receptacle Faceplates.

Metal faceplates shall comply with 406.~~5~~ 6 (A). Nonmetallic faceplates shall comply with 406.~~5~~ 6 (C).

Statement of Problem and Substantiation for Public Input

552.48(K) Receptacle Faceplates requires compliance with the construction in section 406.6, Receptacle Faceplates (Cover Plates); but incorrectly reference 406.5(A) and 406.5(C) which are addressing Receptacle Mounting, The correct reference are 406.6(A) and 406.6(C) respectively.

Submitter Information Verification

Submitter Full Name: Mathher Abbassi
Organization: New York City Department Of Buildings
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 07 22:45:18 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7900-NFPA 70-2020
Statement: Accept Editorial Corrections as written to reference correct sections.

Public Input No. 4626-NFPA 70-2020 [Section No. 552.48(M)]

(M) Moisture or Physical Damage.

Where outdoor or under-chassis wiring is 120 volts, nominal, or over and is exposed to moisture or physical damage, the wiring shall be protected by rigid metal conduit, by intermediate metal conduit, by electrical metallic tubing, by rigid ~~nonmetallic conduit~~ polyvinyl chloride conduit , or by Type MI cable that is closely routed against frames and equipment enclosures or other raceway or cable identified for the application.

Statement of Problem and Substantiation for Public Input

The 2008 NEC first referenced Reinforced Thermosetting Resin Conduit (RTRC) as a wiring method (Article 355). High Density Polyethylene Conduit (HDPE) first appeared in the 2005 NEC as Article 353. When Article 352 first changed (2008 NEC) to be titled “Rigid Polyvinyl Chloride Conduit” there were many changes throughout the Code to pick up this change and accordingly change text from “rigid nonmetallic conduit” to “rigid polyvinyl chloride conduit.”
In the 2002 NEC, this section referenced “rigid nonmetallic conduit” (as it still does in the 2020 NEC) before RTRC and HDPE appeared in the Code. This makes it clear that this section intended to permit only the use of rigid polyvinyl chloride conduit identified as “rigid nonmetallic conduit” as the other raceway types were not recognized by the NEC at the time. This term should be changed to rigid polyvinyl chloride and if the cmp wishes to add other types of nonmetallic raceways they should be listed separately as the metal raceways are.

Submitter Information Verification

Submitter Full Name: David Humphrey
Organization: County of Henrico, Virginia
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 15:58:28 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7903-NFPA 70-2020
Statement: CMP-7 agrees with the submitter that at the time rigid nonmetallic conduit was added to this article no other rigid nonmetallic conduits were in existence. Clarification has also been added that the requirement includes RMC and IMC are considered raceways as defined. The clarification will would allow for identified rigid metal or nonmetallic raceways.

Public Input No. 4127-NFPA 70-2020 [Section No. 552.48(O)(1)]

(1) Cord-and-Plug Connected.

Cord-and-plug connections shall comply with 552.48(O)(1)(a) through (O)(1)(d).

(a) The portion of a branch circuit that is installed in an expandable unit shall be permitted to be connected to the portion of the branch circuit in the main body of the vehicle by means of an attachment plug and cord listed for hard usage. The cord and its connections shall comply with Parts I and II of Article 400 and shall be considered as a permitted use under 400.10. Where the attachment plug and cord are located within the park trailer's interior, use of plastic thermoset or elastomer parallel cord Type SPT-3, SP-3, or SPE shall be permitted.

(b) Where the receptacle provided for connection of the cord to the main circuit is located on the outside of the park trailer, it shall be protected with a listed and labeled ground-fault circuit interrupter for personnel and be listed for wet locations. A cord located on the outside of a park trailer shall be identified for outdoor use.

(c) Unless removable or stored within the park trailer interior, the cord assembly shall have permanent provisions for protection against corrosion and mechanical damage while the park trailer is in transit.

(d) The attachment plug and cord shall be installed so as not to permit exposed live attachment plug pins.

Statement of Problem and Substantiation for Public Input

This is a device that depends on functional safety, without certification (Listing), how is an AHJ to know if it is going to properly perform the GFCI functions required by the product standard. Also, to promote consistency with Sections 410.184, 445.20, 518.3(B), 525.23(D), 600.10(C)(2), 680.5, 680.23(A)(8) which currently required listing.

Submitter Information Verification

Submitter Full Name: Richard Hollander
Organization: Shums Coda Associates
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 21:35:30 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: Listed and labeled is already a requirement for this device 552.40(A) and 552.40(B).

Public Input No. 4125-NFPA 70-2020 [Section No. 552.54(B)]

(B) Shower Luminaires.

If a luminaire is provided over a bathtub or in a shower stall, it shall be of the enclosed and gasketed type and listed for the type of installation, and it shall ~~be~~ be protected by a listed and labeled ground-fault circuit-interrupter ~~protected~~ .

Statement of Problem and Substantiation for Public Input

This is a device that depends on functional safety, without certification (Listing), how is an AHJ to know if it is going to properly perform the GFCI functions required by the product standard. Also, to promote consistency with Sections 410.184, 445.20, 518.3(B), 525.23(D), 600.10(C)(2), 680.5, 680.23(A)(8) which currently required listing.

Submitter Information Verification

Submitter Full Name: Richard Hollander
Organization: Shums Coda Associates
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 21:30:31 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: Listed and labeled is already a requirement for this device552.40(A) and 552.40(B).

Public Input No. 3660-NFPA 70-2020 [Section No. 555.2]

(Relocate all definitions in the 555. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

555. 2 Definitions.

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

Berth.

The water space to be occupied by a boat or other vessel alongside or between bulkheads, piers, piles, fixed and floating docks, or any similar access structure. *(See also Slip.)* [**303:**3.3.1]

Boatyard.

A facility used for constructing, repairing, servicing, hauling from the water, storing (on land and in water), and launching of boats. [**303:**3.3.2]

Bulkhead.

A vertical structural wall, usually of stone, timber, metal, concrete, or synthetic material,constructed along, and generally parallel to, the shoreline to retain earth as an extension of the upland, and often to provide suitable water depth at the waterside face. [**303:**3.3.4]

Crane.

A mechanical device used for lifting or moving boats. [**303:**3.3.5]

Docking Facility.

A covered or open, fixed or floating structure that provides access to the water and to which boats are secured. [**303:**3.3.6]

Floating Building.

A building unit, as defined in Article 100, that floats on water, is moored in a permanent location, and has a premises wiring system served through connection by permanent wiring to an electrical supply system not located on the premises.

Marina.

A facility, generally on the waterfront, that stores and services boats in berths, on moorings, and in dry storage or dry stack storage. [**303:**3.3.12]

Marina Power Outlet.

An enclosed assembly that can include equipment such as receptacles, circuit breakers, fused switches, fuses, a watt-hour meter(s), panelboards, and monitoring means identified for marina use. [**303:**3.3.13]

Monorail.

Overhead track and hoist system for moving material around the boatyard or moving and launching boats. [**303:**3.3.15]

Mooring(s).

Any place where a boat is wet stored or berthed. [**303:**3.3.16]

Shore Power.

The electrical equipment required to power a floating vessel including, but not limited to, the receptacle and cords.

Slip.

A berthing space between or adjacent to piers, wharves, or docks; the water areas associated with boat occupation. *(See also Berth.)* [**303:**3.3.20]

Storage, Dry Stack.

A facility, either covered or uncovered, constructed of horizontal and vertical structural members designed to allow placement of small boats in defined slots arranged both horizontally and vertically. [**303:**3.3.23.2]

Wharf.

A structure at the shoreline that has a platform built along and parallel to a body of water with either an open deck or a superstructure. [**307:**3.3.24]

Statement of Problem and Substantiation for Public Input

"The National Electrical Code has definitions in multiple parts in Article 100 and many definitions scattered through out the code many of them in the .2 section of the articles.
Most of the other standards under NFPA have their definitions in one location and this will allow the NEC the same requirement. The revisions to the NEC Style Manual require all the definitions to be relocated to Article 100. "

Submitter Information Verification

Submitter Full Name: David Williams
Organization: Delta Charter Township
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 10:14:59 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7690-NFPA 70-2020
Statement: All existing definitions under the purview of CMP-7 have been moved to Article 100 and revises for compliance with Section 2.2.2 of the NEC Style Manual. Additionally, all definition sections (545.2, 547.2, 550.2, 551.2, 552.2, 555.2, 604.2, and 675.2.2) in the articles under the responsibility of CMP-7 have been deleted.

Public Input No. 138-NFPA 70-2019 [Definition: Floating Building.]

Floating Building.

A building unit, as defined in Article 100, that floats on water, is moored in a permanent location, and has a premises wiring system served through connection by permanent wiring to an electrical supply system not located on the premises.

Delete the definition from Article 555 and move it to Article 100.

Statement of Problem and Substantiation for Public Input

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

This statement does not apply to the term floating building. The term floating building is used in Article 555, but is also used in Article 90. 90.2(A) Covered, (1), has the term floating building as does 90.2(B) Not Covered, (1).

If this definition is not moved to article 100, then a floating building in 90.2(A) and (B) could be a cruise ship, a casino river boat, a tow boat, etc.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 139-NFPA 70-2019 [New Definition after Definition: Fitting.]	

Submitter Information Verification

Submitter Full Name: Roger Zieg
Organization: Zieg Electric
Street Address:
City:
State:
Zip:
Submittal Date: Thu Nov 21 21:29:20 EST 2019
Committee: NEC-P07

Committee Statement

Resolution: FR-7690-NFPA 70-2020

Statement: All existing definitions under the purview of CMP-7 have been moved to Article 100 and revises for compliance with Section 2.2.2 of the NEC Style Manual. Additionally, all definition sections (545.2, 547.2, 550.2, 551.2, 552.2, 555.2, 604.2, and 675.2.2) in the articles under the responsibility of CMP-7 have been deleted.

Public Input No. 1521-NFPA 70-2020 [New Definition after Definition: Docking Facility.]

TITLE OF NEW CONTENT

Electrical Datum Plane .

This definition shall only apply within this article.

Electrical Datum Plane in Marinas is either the ground in areas away from natural or man-made bodies, or

(1) In land areas subject to tidal fluctuation, the electrical datum plane is the highest tide level for the area occurring under normal circumstances, that is, highest high tide.

(2) In land areas not subject to tidal fluctuation, the electrical datum plane is the highest water level for the area occurring under normal circumstances.

The Electrical Datum Plane encompasses areas subject to tidal movement and areas in which the water level is affected by conditions such as climate (rain or snowfall) or by human intervention (the opening or closing of dams or floodgates). In either case, the term covers the Normal Highest Water Level, such as an astronomical high tide. The term does not cover extremes due to natural or manmade disasters.

Statement of Problem and Substantiation for Public Input

No standard exists for where an Electric Datum Plane (EDP) is located. AHJ's are required to locally determine without a consistent result.
Article 682 does not fully identify EDP, what should be the EDP and what defines a Normal Highest Water
Level. (See related PI for NHWL)
Many Marinas are built in areas where permanent dwellings and commercials buildings are not built because of possible natural and man made disasters. Two notable states (MN, MT) have identified and defined “Normal Highest Water Level”. In one state (MT), this definition was confirmed by a US Supreme
Court case.
This Public Input seeks to standardize the Normal Highest Water Level and its relationship to EDP for those special occupancies that allow temporary usage and/or movable non dwelling Boats or floating docs

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1522-NFPA 70-2020 [New Definition after Definition: Mooring(s).]	
Public Input No. 1522-NFPA 70-2020 [New Definition after Definition: Mooring(s).]	

Submitter Information Verification

Submitter Full Name: Wade Elliott
Organization: Utility Services Group, Inc.
Affiliation: National Association of RV Parks and Campgrounds

Street Address:
City:
State:
Zip:
Submittal Date: Mon Jun 15 18:29:57 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7872-NFPA 70-2020

Statement: This definition for “Electrical Datum Plane” in Article 100 will be revised in the 2023 NEC to include the words “Normal High Water Level”. The information regarding determining the distance for the Electrical Datum Plane will be revised and added to section 551.3 and 555.3 to address both conditions. The added language adds clarity for the user and references the new term “Normal High Water Level” for more consistent enforcement.

Public Input No. 1522-NFPA 70-2020 [New Definition after Definition: Mooring(s).]

TITLE OF NEW CONTENT

Normal Highest Water Level .

This definition shall only apply within this article.

Normal Highest Water Level is defined as an elevation delineating the highest water level that has been maintained for a sufficient period of time to leave evidence upon the landscape, commonly the point where the natural vegetation changes from predominantly aquatic to predominantly terrestrial.

Statement of Problem and Substantiation for Public Input

This Public Input seeks to standardize the Normal Highest Water Level and its relationship to EDP for those special occupancies that allow temporary usage and/or movable non dwelling Boats or floating docs

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1521-NFPA 70-2020 [New Definition after Definition: Docking Facility.]	
Public Input No. 1521-NFPA 70-2020 [New Definition after Definition: Docking Facility.]	

Submitter Information Verification

Submitter Full Name: Wade Elliott
Organization: Utility Services Group, Inc.
Affiliation: National Association of RV Parks and Campgrounds
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jun 15 18:35:56 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7875-NFPA 70-2020
Statement: CMP-7 has created a new definition for “Normal High Water Level” as it applies to Electrical Datum Plane distances to standardize the installations and enforceability according to the NEC.

Public Input No. 1556-NFPA 70-2020 [Section No. 555.4]

555.4 Location of Service Equipment.

The service equipment for a floating building, dock, or marina shall be located on land no closer than 1.5 m (5 ft) horizontally from and adjacent to the structure served, but not on or in the structure itself or any other floating structure. Service equipment shall be elevated a minimum of 300 mm (12 in.) above the electrical datum plane.

Statement of Problem and Substantiation for Public Input

This public input was prepared by the correlating committee task group focused on bodies of water. This task group consisted of the following members: Kevin Arnold (CMP 10, CMP 13), Thomas Blewitt (CMP 17), Donny Cook (CMP 17, CC), Thomas Domitrovich (CMP 2, CMP 10), Bill Fiske (CMP 14), Dean Hunter (CMP 7), Cliff Norton (CMP 7, NFPA 303), Christine Porter (CMP 5, CC), Mike Query (CMP 17), David Smith, Dave Watson (CMP 6).

This change aligns with language in 682.11. Added 5 ft. and 12 in. references to align with the requirements in 682 as similar hazards exist in both of these locations.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1557-NFPA 70-2020 [Section No. 682.11]	

Submitter Information Verification

Submitter Full Name: Thomas Domitrovich
Organization: Eaton Corporation
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 17 13:47:41 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7911-NFPA 70-2020
Statement: Adding the distance for the service location and height above the electrical datum plane, promotes electrical safety and enforceability. In addition, the new language will provide consistency between similar requirements in Articles 682 and 555.

Public Input No. 2423-NFPA 70-2020 [Section No. 555.6]

555.6 Load Calculations for Service and Feeder Conductors.

General lighting and other loads shall be calculated in accordance with Part III of Article 220, and, in addition, the demand factors set forth in Table 555.6 shall be permitted for each service and/or feeder circuit supplying receptacles that provide shore power for boats. These calculations shall be permitted to be modified as indicated in notes (1) and (2) to Table 555.6. Where demand factors of Table 555.6 are applied, the demand factor specified in 220.61(B) shall not be permitted.

Informational Note: These demand factors may be inadequate in areas of extreme hot or cold temperatures with loaded circuits for heating, air-conditioning, or refrigerating equipment.

Table 555.6 Demand Factors

Number of Shore Power Receptacles	Sum of the Rating of the Receptacles (%)
1–4	100
5–8	90
9–14	80
15–30	70
31–40	60
41–50	50
51–70	40
≥71	30

Notes:

1. Where shore power accommodations provide two receptacles specifically for an individual boat slip and these receptacles have different voltages (for example, one 30 ampere, 125 volt and one 50 ampere, 125/250 volt), only the receptacle with the larger kilowatt demand shall be required to be calculated.

2. If the facility being installed includes individual kilowatt-hour submeters for each slip and is being calculated using the criteria listed in Table 555.6, the total demand amperes may be multiplied by 0.9 to achieve the final demand amperes.

3. When a circuit feeding a boat hoist and shorepower for the same boat slip is shared, only the load with the larger KW demand shall be required to be counted in the load calculation.

Statement of Problem and Substantiation for Public Input

This public input was prepared by the correlating committee task group focused on bodies of water. This task group consisted of the following members: Kevin Arnold (CMP 10, CMP 13), Thomas Blewitt (CMP 17), Donny Cook (CMP 17, CC), Thomas Domitrovich (CMP 2, CMP 10), Bill Fiske (CMP 14), Dean Hunter (CMP 7), Cliff Norton (CMP 7, NFPA 303), Christine Porter (CMP 5, CC), Mike Query (CMP 17), David Smith, Dave Watson (CMP 6).

Boat hoists and shore power are rarely if ever used at the same time. Only the larger of the two loads should be considered in the load calculations.

Submitter Information Verification

Submitter Full Name: Thomas Domitrovich
Organization: Eaton Corporation
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 20 13:21:59 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7912-NFPA 70-2020

Statement: When the shore power and boat hoist utilize the same source (pedestal), the boat hoists wouldn't be in use when the shore power is connected. Because this is considered a non-coincidental load, the use of only the larger KW rating of the two loads would be appropriate for calculating purposes.

Public Input No. 3431-NFPA 70-2020 [Section No. 555.6]

555.6 Load Calculations for Service and Feeder Conductors.

General lighting and other loads shall be calculated in accordance with Part III of Article 220, and, in addition, the demand factors set forth in Table 555.6 shall be permitted for each service and/or feeder circuit supplying receptacles that provide shore power for boats. These calculations shall be permitted to be modified as indicated in notes (1) and (2) to Table 555.6. Where demand factors of Table 555.6 are applied, the demand factor specified in 220.61(B) shall not be permitted.

Informational Note: These demand factors may be inadequate in areas of extreme hot or cold temperatures with loaded circuits for heating, air-conditioning, or refrigerating equipment.

Table 555.6 Demand Factors

Number of Shore Power Receptacles	Sum of the Rating of the Receptacles (%)
1–4	100
5–8	90
9–14	80
15–30	70
31–40	60
41–50	50
51–70	40
≥71	30

Notes:

1. Where shore power accommodations provide two receptacles specifically for an individual boat slip and these receptacles have different voltages (for example, one 30 ampere, 125 volt and one 50 ampere, 125/250 volt), only the receptacle with the larger kilowatt demand shall be required to be calculated.

2. If the facility being installed includes individual kilowatt-hour submeters for each slip and is being calculated using the criteria listed in Table 555.6, the total demand amperes may be multiplied by 0.9 to achieve the final demand amperes.

3. When a circuit feeding a boat lift and shore power for the same boat slip is shared, only the load with the larger kW demand shall be required to be counted in the load calculation.

Statement of Problem and Substantiation for Public Input

When shore power is provided in the same boat slip as a boat lift, it should be considered to be non-coincident loads. It would be extremely unlikely that a shore power outlet would draw any significant load while the lift is operating. The largest loads on a boat are typically the stove, water heater, and AC system, none of which would be on while the boat is on a lift, basically in storage mode. Adding this note would provide for a more practical and accurate load calculation, especially in larger installations.

Submitter Information Verification

Submitter Full Name: Rudolph Garza
Organization: IAEI
Affiliation: IAEI
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 08 14:42:18 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7912-NFPA 70-2020
Statement: When the shore power and boat hoist utilize the same source (pedestal), the boat hoists wouldn't be in use when the shore power is connected. Because this is considered a non-coincidental load, the use of only the larger KW rating of the two loads would be appropriate for calculating purposes.

Public Input No. 3910-NFPA 70-2020 [Section No. 555.6]

555.6 Load Calculations for Service and Feeder Conductors.

General lighting and other loads shall be calculated in accordance with Part III of Article 220, and, in addition, the demand factors set forth in Table 555.6 shall be permitted for each service and/or feeder circuit supplying receptacles that provide shore power for boats. These calculations shall be permitted to be modified as indicated in notes (1) and (2) to Table 555.6. Where demand factors of Table 555.6 are applied, the demand factor specified in 220.61(B) shall not be permitted.

Informational Note: These demand factors may be inadequate in areas of extreme hot or cold temperatures with loaded circuits for heating, air-conditioning, or refrigerating equipment.

Table 555.6 Demand Factors

Number of Shore Power Receptacles	Sum of the Rating of the Receptacles (%)
1–4	100
5–8	90
9–14	80
15–30	70
31–40	60
41–50	50
51–70	40
≥71	30

Notes:

1. Where shore power accommodations provide two receptacles specifically for an individual boat slip and these receptacles have different voltages (for example, one 30 ampere, 125 volt and one 50 ampere, 125/250 volt), only the receptacle with the larger kilowatt demand shall be required to be calculated.

2. If the facility being installed includes individual kilowatt-hour submeters for each slip and is being calculated using the criteria listed in Table 555.6, the total demand amperes may be multiplied by 0.9 to achieve the final demand amperes.

3. When a circuit feeding a boat lift and shorepower for the same boat slip is shared, only the load with the larger KW demand shall be required to be counted in the load calculation.

Statement of Problem and Substantiation for Public Input

Item number 3 has been added to Notes. When shore power is provided in the same boat slip as a boat lift, we consider these to be non-coincident loads. It would be extremely unlikely that a shorepower outlet would draw any significant load while the lift is operating. The largest loads on a boat are typically the stove, water heater, and AC system, none of which would be on while the boat is on a lift, basically in storage mode. Adding this note would provide for a more practical and accurate load calculation, especially in larger installations.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3913-NFPA 70-2020 [Section No. 555.6]	

Submitter Information Verification

Submitter Full Name: William Pancake
Organization: CAP Government
Affiliation: ACRA Electric, Inc. Cape Coral, FL
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 15:22:02 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7912-NFPA 70-2020

Statement: When the shore power and boat hoist utilize the same source (pedestal), the boat hoists wouldn't be in use when the shore power is connected. Because this is considered a non-coincidental load, the use of only the larger KW rating of the two loads would be appropriate for calculating purposes.

Public Input No. 3913-NFPA 70-2020 [Section No. 555.6]

555.6 Load Calculations for Service and Feeder Conductors.

General lighting and other loads shall be calculated in accordance with Part III of Article 220, and, in addition, the demand factors set forth in Table 555.6 shall be permitted for each service and/or feeder circuit supplying receptacles that provide shore power for boats. These calculations shall be permitted to be modified as indicated in notes (1) and (2) to Table 555.6. Where demand factors of Table 555.6 are applied, the demand factor specified in 220.61(B) shall not be permitted.

Informational Note: These demand factors may be inadequate in areas of extreme hot or cold temperatures with loaded circuits for heating, air-conditioning, or refrigerating equipment.

Table 555.6 Demand Factors

Number of Shore Power Receptacles	Sum of the Rating of the Receptacles (%)
1–4	100
5–8	90
9–14	80
15–30	70
31–40	60
41–50	50
51–70	40
≥71	30

Notes:

1. Where shore power accommodations provide two receptacles specifically for an individual boat slip and these receptacles have different voltages (for example, one 30 ampere, 125 volt and one 50 ampere, 125/250 volt), only the receptacle with the larger kilowatt demand shall be required to be calculated.

2. If the facility being installed includes individual kilowatt-hour submeters for each slip and is being calculated using the criteria listed in Table 555.6, the total demand amperes may be multiplied by 0.9 to achieve the final demand amperes.

(A) Boat Hoist . Demand Factors for Boat Hoist Service and Feeder Conductors are set forth in Table 555,6(A)

Table 555.6A Demand Factors for Boat Hoist Service and Feeder Conductors.

Number of Boat Lifts	Demand Factor %
1-2	100
3-5	80
6-8	70
9-12	60
13-16	50
17-22	40
25+	30

Statement of Problem and Substantiation for Public Input

Feeders for multiple boat lifts should be derated due to the fact that boat lifts by their nature are a short duration load and rarely do multiple boat lifts operate concurrently at both condo and commercial

marinas. NEC Cranes and Hoists Table 610-14E has demand factors, but we feel that this article refers more to commercial and industrial cranes and hoists, not boat lifts, and the table, in our opinion, is not aggressive enough to provide practical sizing of feeders for boat lift feeders. Article 430.26 gives the AHJ authority to grant permission for lower demand factors, and in fact we have worked with local AHJ's which have allowed demand factors as low as 30%, but we feel that having a table in the NEC specifically addressing this issue would clarify and enhance the code.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3910-NFPA 70-2020 [Section No. 555.6]	Demand factors

Submitter Information Verification

Submitter Full Name: William Pancake
Organization: CAP Government
Affiliation: ACRA Electric, Inc. Cape Coral, FL
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 15:24:35 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: There is no technical substantiation for the proposed change. The proposed values and demand factors have not been validated and shown to be a concern.

Public Input No. 1486-NFPA 70-2020 [Section No. 555.9]

~~**555.9** Boat Hoists.~~

~~GFCI protection for personnel shall be provided for outlets not exceeding 240 volts that supply a boat hoist installed at dwelling unit docking facilities.~~

Statement of Problem and Substantiation for Public Input

This public input was prepared by the correlating committee task group focused on bodies of water. This task group consisted of the following members: Kevin Arnold (CMP 10, CMP 13), Thomas Blewitt (CMP 17), Donny Cook (CMP 17, CC), Thomas Domitrovich (CMP 2, CMP 10), Bill Fiske (CMP 14), Dean Hunter (CMP 7), Cliff Norton (CMP 7, NFPA 303), Christine Porter (CMP 5, CC), Mike Query (CMP 17), David Smith, Dave Watson (CMP 6).

This language / requirement was moved to 555.35 as part of another public input (PI 1484) as it is more appropriate to locate this requirement as part of Part II, marinas, Boatyards, and Docking Facilities. Boat hoists will only exist in locations that fall under the requirements of Part II because docking facilities are covered there.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1484-NFPA 70-2020 [Section No. 555.35]	Requirements moved as part of this PI

Submitter Information Verification

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Submittal Date: Tue Jun 09 10:26:25 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7917-NFPA 70-2020

Statement: The 555.9 Boat Hoist requirements has been moved to 555.35(D). This change places all the GFCI requirements under one location, which provides added clarity and usability. In addition, this was done since the GFCI requirements for boat hoist should include all docking facilities, not just those related to dwelling units, since the same electrical hazards can exist. However, changing the term “boat hoist” to “boat lift” is unnecessary. No technical substantiation was provided and the use of the alternate term doesn’t add clarity.

The reference to “sources” supplying a docking facility has been revised to cover either installation where you have a service or a feeder that supplies the docking facility or

wharf. Subpart (A) is titled in such a manner as to identify only those circuits that supply the docking facility or wharf shall be equipped with GFPE. This is not intended to apply to OCPDs and circuit upstream of this equipment. Clarification has been made that the GFPE protection at 100mA or 30 mA is not establishing a threshold for the product but rather pertains to the existing listed solutions that may be on the market. UL 1053 has a set performance requirement for GFPE devices. Added language to include GFCI protection for branch circuits in (C)(2) to cover “other than shore power” outlets. This requirement includes both hardwired and portable cord/plug connected outlets (i.e. luminaires or other electrical devices) located at docking facilities. As stated earlier, the GFCI protection for boat hoists was relocated to this section for consistency.

The revisions to requiring a Listed Leakage Current Measurement Device for use in marina applications will assure that the device complies with specific safety and performance requirements such as evaluating for a grounded neutral protection and is suitable for the harsh conditions in a marina.

Public Input No. 1852-NFPA 70-2020 [Section No. 555.9]

555.9 Boat Hoists.

GFCI protection for personnel shall be provided for outlets not exceeding 240 volts that supply a boat hoist installed at dwelling unit docking facilities.

555.9 Boat Lifts. GFCI protection for personnel shall be provided for outlets not exceeding 240 volts that supply a boat lift installed at all docking facilities.

Statement of Problem and Substantiation for Public Input

The title "Boat Hoists" does not reflect the accepted name for the widely used industry term "Boat Lift". These are devices that are used all over the world to protect individual boats from sea growth while not in use. They are always electric and rarely have any type of ground fault protection. Some are supplied via 20a outlets, which should be equipped with 5mA protection (555.35 (2), but many are hard wired and should have 30mA protection. Further 555.9 calls for dwelling unit docking facilities and therefore excuses commercial marina facilities, where the bulk of this equipment is installed. Change the term to "Boat Lift" and delete the "dwelling" content in the current requirement.

Submitter Information Verification

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Submittal Date: Fri Jul 10 16:26:19 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7917-NFPA 70-2020

Statement: The 555.9 Boat Hoist requirements has been moved to 555.35(D). This change places all the GFCI requirements under one location, which provides added clarity and usability. In addition, this was done since the GFCI requirements for boat hoist should include all docking facilities, not just those related to dwelling units, since the same electrical hazards can exist. However, changing the term “boat hoist” to “boat lift” is unnecessary. No technical substantiation was provided and the use of the alternate term doesn’t add clarity.

The reference to “sources” supplying a docking facility has been revised to cover either installation where you have a service or a feeder that supplies the docking facility or wharf. Subpart (A) is titled in such a manner as to identify only those circuits that supply the docking facility or wharf shall be equipped with GFPE. This is not intended to apply to OCPDs and circuit upstream of this equipment. Clarification has been made that the GFPE protection at 100mA or 30 mA is not establishing a threshold for the product but rather pertains to the existing listed solutions that may be on the market. UL 1053 has a set performance requirement for GFPE devices. Added language to include GFCI

protection for branch circuits in (C)(2) to cover “other than shore power” outlets. This requirement includes both hardwired and portable cord/plug connected outlets (i.e. luminaires or other electrical devices) located at docking facilities. As stated earlier, the GFCI protection for boat hoists was relocated to this section for consistency.

The revisions to requiring a Listed Leakage Current Measurement Device for use in marina applications will assure that the device complies with specific safety and performance requirements such as evaluating for a grounded neutral protection and is suitable for the harsh conditions in a marina.

Public Input No. 2210-NFPA 70-2020 [Section No. 555.9]

555.9 Boat Hoists.

Listed GFCI protection for personnel shall be provided for outlets not exceeding 240 volts that supply a boat hoist installed at dwelling unit docking facilities.

Statement of Problem and Substantiation for Public Input

I find it a bit ironic that such an important safety device is not required to tested and certified by an independent lab. GFCI devices are every bit as important, perhaps even more so than the AFCI devices specified in 210.12 which ARE required to be listed.
Using unlisted GFCI devices should not be permitted because these safety devices are simply too important to allow anything less.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2208-NFPA 70-2020 [Section No. 210.8 [Excluding any Sub-Sections]]	Listed GFCI devices
Public Input No. 2209-NFPA 70-2020 [Section No. 215.9]	Listed GFCI devices
Public Input No. 2211-NFPA 70-2020 [Section No. 422.5(A)]	
Public Input No. 2212-NFPA 70-2020 [Section No. 590.6]	
Public Input No. 2213-NFPA 70-2020 [Section No. 406.4(D)(3)]	

Submitter Information Verification

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Submittal Date: Tue Aug 11 07:16:09 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: The global requirement for GFCI devices are found in 210.8 and the requirement for listing of GFCI devices is better suited in that location.

Public Input No. 3439-NFPA 70-2020 [Section No. 555.9]

555.9 Boat Hoists.

GFCI protection for personnel shall be provided for outlets not exceeding 240 volts that supply a boat hoist installed at ~~dwelling unit~~ all docking facilities.

Statement of Problem and Substantiation for Public Input

Boat lifts and hoists, whether installed at a residential facility or a commercial marina both pose the same potential shock hazard to personnel. This appears to be an over site during the 2020 NEC revision cycle when this GFCI requirement was moved from 210.8(C) to Article 555.

More information can be found at NFPA's website on this hazard(s): "Marina Shock Hazard Research Planning Workshop" https://www.nfpa.org/-/media/Files/News-and-Research/Fire-statistics-andreports/Proceedings/MarinaShockHazardResearchPlanning.ashx

Submitter Information Verification

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Submittal Date: Tue Sep 08 15:03:22 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7917-NFPA 70-2020

Statement: The 555.9 Boat Hoist requirements has been moved to 555.35(D). This change places all the GFCI requirements under one location, which provides added clarity and usability. In addition, this was done since the GFCI requirements for boat hoist should include all docking facilities, not just those related to dwelling units, since the same electrical hazards can exist. However, changing the term "boat hoist" to "boat lift" is unnecessary. No technical substantiation was provided and the use of the alternate term doesn't add clarity.

The reference to "sources" supplying a docking facility has been revised to cover either installation where you have a service or a feeder that supplies the docking facility or wharf. Subpart (A) is titled in such a manner as to identify only those circuits that supply the docking facility or wharf shall be equipped with GFPE. This is not intended to apply to OCPDs and circuit upstream of this equipment. Clarification has been made that the GFPE protection at 100mA or 30 mA is not establishing a threshold for the product but rather pertains to the existing listed solutions that may be on the market. UL 1053 has a set performance requirement for GFPE devices. Added language to include GFCI protection for branch circuits in (C)(2) to cover "other than shore power" outlets. This requirement includes both hardwired and portable cord/plug connected outlets (i.e.

luminaires or other electrical devices) located at docking facilities. As stated earlier, the GFCI protection for boat hoists was relocated to this section for consistency.

The revisions to requiring a Listed Leakage Current Measurement Device for use in marina applications will assure that the device complies with specific safety and performance requirements such as evaluating for a grounded neutral protection and is suitable for the harsh conditions in a marina.

Public Input No. 3925-NFPA 70-2020 [Section No. 555.9]

555.9 Boat Hoists.

GFCI protection for personnel shall be provided for outlets not exceeding 240 volts that supply a boat hoist installed at dwelling unit docking facilities.

555.9 Boat Hoists.

GFCI protection for personnel shall be provided for outlets not exceeding 240 volts that supply a boat hoist installed at ~~dwelling unit~~ all docking facilities.

(1) Boat Hoists associated with Fire Dept, Law Enforcement or other Government Agencies shall be requiring GFCI Protection. It also shall install an emergency by-pass for such vessels from GFCI protection if not working. This by-pass shall be key or equivalent safety operation for Government Agencies only.

Informational Note: This emergency by-pass only to be installed so it would not prevent them on emergency calls.

Additional Proposed Changes

File Name	Description	Approved
Marina_Shock_Hazard_Research_Planning_Workshop_NFPA_.pdf	Marina Shock Hazard Research Planning Workshop (NFPA)	

Statement of Problem and Substantiation for Public Input

Boat Lifts and Hoists, whether installed at a residential facility or a commercial marina both pose the same danger to personnel. The exception would allow for emergency vessels to have the same protection as well as a fail-safe system in place. Go to NFPA for information and more substantiation on this hazard(s) and to see their research: “Marina Shock Hazard Research Planning Workshop” https://www.nfpa.org/-/media/Files/News-and-Research/Fire-statistics-and-reports/Proceedings/MarinaShockHazardResearchPlanning.ashx

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3930-NFPA 70-2020 [Section No. 555.9]	

Submitter Information Verification

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Submittal Date: Wed Sep 09 15:34:44 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: No documented evidence, e.g. specific incidents of occurrence, were given to support the removal of GFCI protection at first responder boat hoist locations. In addition, options already exist for designers and installers to install a boat hoist with a mechanical override if there is an incidence of power loss.

Marina Shock Hazard Research Planning Workshop

PROCEEDINGS

HELD:
13 August 2015 in Baltimore, Maryland

PREPARED BY:
Casey C. Grant, P.E.
Fire Protection Research Foundation
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RESEARCH FOUNDATION
RESEARCH FOR THE NFPA MISSION

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EXECUTIVE SUMMARY

These are the proceedings of a research planning session (a.k.a. workshop) to address "*Hazardous Voltage/Current in Marinas, Boatyards and Floating Buildings*". Reports in the mainstream media of Electric Shock Drowning (ESD), which can directly electrocute a swimmer in the water or cause a level of paralysis that ultimately results in drowning, is a concern in the vicinity of marinas, boatyards and floating buildings. How best to address this concern is the focus of this workshop.

The general desire by safety professionals to address this topic is not lacking, but rather the solution approaches are not obvious due to the technical and regulatory complexities that make this application particularly challenging. For example, electrical equipment in these applications are typically subjected to harsh conditions that can accelerate equipment degradation over time, and solution approaches are exacerbated due to factors such as different regulatory/enforcement realms for motorcraft versus marinas versus the shore-based infrastructure. The goal of the workshop is to address and clarify the research priorities for electrical applications involving marinas, boatyards and floating buildings.

The summary observations of these proceedings are organized into proposed solution approaches that are categorized as: (i) technical; (ii) awareness; and (iii) regulatory. These solution approaches are intended to provide useful information for directing future resources to efforts for preventing the occurrence of ESD events and mitigating their severity if they do occur.

ACKNOWLEDGEMENTS

The workshop has been made possible through support from the following:

Attwood Marine
Eaton Corporation
Hubbell
Intertek
Leviton Manufacturing Company
NEMA Electrical Connector Section
Underwriters Laboratories

This workshop summary report has been prepared by Casey Grant, Executive Director for the Fire Protection Research Foundation. The information contained herein is based on the input of numerous professionals and subject-matter-experts. While considerable effort has been taken to accurately document this input, the final interpretation of the information contained herein resides with the report author.

Photographs included in this report and not in PowerPoint slides were taken by Casey Grant, FPRF

About the Fire Protection Research Foundation

The Fire Protection Research Foundation plans, manages, and communicates research on a broad range of fire safety issues in collaboration with scientists and laboratories around the world. The Foundation is an affiliate of NFPA.

About the National Fire Protection Association (NFPA)

Founded in 1896, NFPA is a global, nonprofit organization devoted to eliminating death, injury, property and economic loss due to fire, electrical and related hazards. The association delivers information and knowledge through more than 300 consensus codes and standards, research, training, education, outreach and advocacy; and by partnering with others who share an interest in furthering the NFPA mission. All NFPA codes and standards can be viewed online for free. NFPA's membership totals more than 65,000 individuals around the world.

Keywords: electric shock drowning, ESD, electricity, voltage current, marinas, boatyards, floating buildings, motorcraft, national electrical code, NEC, NFPA 70, NFPA 302, NFPA 303, research planning

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1) BACKGROUND AND OVERVIEW

These are the proceedings of a research planning session (a.k.a. workshop) to address "*Hazardous Voltage/Current in Marinas, Boatyards and Floating Buildings*". This workshop was conducted on Thursday 13 August 2015, and held at the BWI Airport Marriott, 1743 West Nursery Road, Linthicum, Maryland.

Reports in the mainstream media of drowning in the vicinity of marinas, boatyards and floating buildings have raised questions on possible shock hazards from nearby electrical equipment. Of particular concern are incidents suspected of involving Electric Shock Drowning (ESD), which can directly electrocute a swimmer in the water or cause a level of paralysis that ultimately results in drowning. It is often difficult to link ESD to an incident due to multiple reasons, such as the transient nature of some electrical sources (e.g., from a boat, that relocates). Addressing this and related concerns are the primary focus of this workshop.

The safety of electrical equipment is a challenge when installed and used in the vicinity of marinas, boatyards and floating buildings. This typically requires designing, installing, operating and maintaining electrical equipment that balances inherently safe levels of equipment operation against nuisance interruptions of the applicable electrical infrastructure.

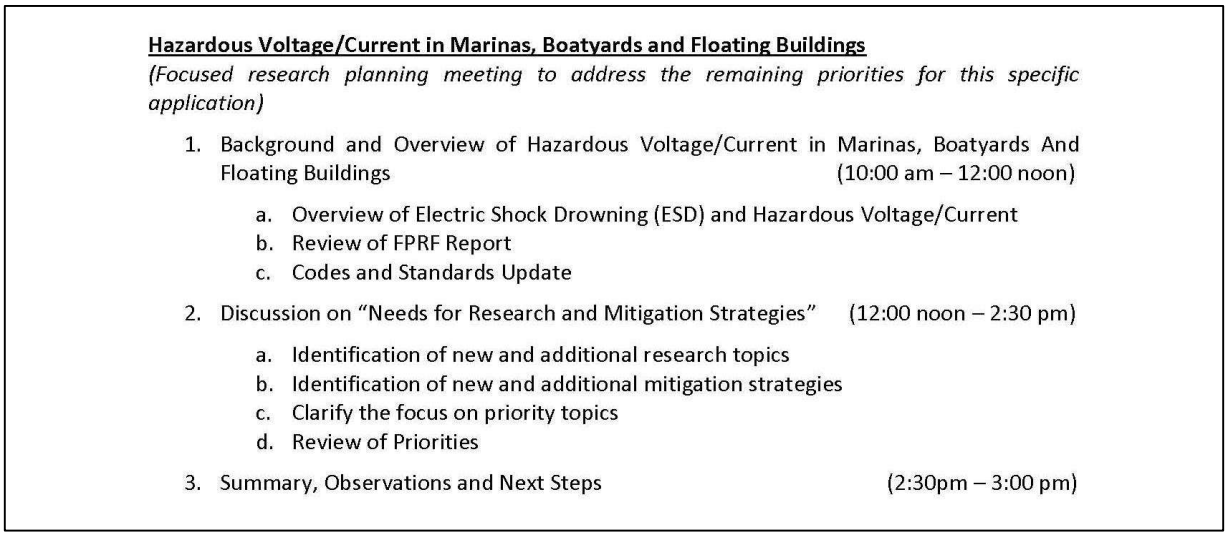
This electrical equipment is typically subjected to harsh environmental conditions that can result in deterioration and other long term maintenance concerns. Initial and on-going inspections as well as code enforcement likewise face special challenges due to factors such as the transitory existence of motorcraft and ultimate responsibility for the source of stray current from interconnected electrical equipment. The general desire by safety professionals to address this topic is not lacking, but rather the solution approaches are not obvious due to the technical and regulatory complexities that make this application particularly challenging.

To simplify the overall topic from a high level, the problem is the following: there is dangerous electric current in the water. The possible sources of this stray current are: Marina; Motorcraft; or Infrastructure. Thus the ultimate question is: What is lacking in the present safety approaches and infrastructure?

Figure 1: Typical Electrical Installation at a Marina

The goal of the workshop is to address and clarify the research priorities for electrical applications involving marinas, boatyards and floating buildings. Solution approaches are identified and reviewed with the intent to provide useful information for directing future resources to efforts for preventing the occurrence of ESD events and mitigating their severity if they do occur. The summary observations of these proceedings are organized into solution approaches that involve issues in one of the following three groups:

(i) Technical;
(ii) Awareness; and
(iii) Regulatory.



Hazardous Voltage/Current in Marinas, Boatyards and Floating Buildings

(Focused research planning meeting to address the remaining priorities for this specific application)

1. Background and Overview of Hazardous Voltage/Current in Marinas, Boatyards And Floating Buildings (10:00 am – 12:00 noon)
    a. Overview of Electric Shock Drowning (ESD) and Hazardous Voltage/Current
    b. Review of FPRF Report
    c. Codes and Standards Update
2. Discussion on "Needs for Research and Mitigation Strategies" (12:00 noon – 2:30 pm)
    a. Identification of new and additional research topics
    b. Identification of new and additional mitigation strategies
    c. Clarify the focus on priority topics
    d. Review of Priorities
3. Summary, Observations and Next Steps (2:30pm – 3:00 pm)

Figure 2: Workshop Agenda

The agenda for the workshop is shown in Figure 2. Thirty individuals participated representing the following professional communities: electrical, fire protection and safety, marinas, and motorcraft (boating). A summary of all the workshop participants is included in Annex A. The overall workshop was facilitated by Casey Grant of the Fire Protection Research Foundation, supported by Donny Cook, Chair of the FPRF Electrical Safety Research Advisory Committee. This was led using PowerPoint slides that are included in Annex B and Annex C.

Several model codes and standards are directly applicable to this topic, and they are monitoring this activity in pursuit of enhancements and revisions that are intended to prevent ESD occurrences and/or mitigate their severity if they do occur. These model codes and standards are important regulatory tools, and the most applicable for this particular application are:

- ABYC E-11, AC & DC Electrical Systems on Boats
- IEEE National Electrical Safety Code® (NESC®)
- ICC International Fire Code®
- NFPA 1, Fire Code
- NFPA 70, National Electrical Code® (NEC®)
- NFPA 70B, Recommended Practice for Electrical Equipment Maintenance
- NFPA 302, Fire Protection Standard for Pleasure and Commercial Motorcraft
- NFPA 303, Fire Protection Standard for Marinas and Boatyards

In support of the workshop, multiple handouts of background information were circulated beforehand and made available at the meeting. These are summarized for purposes of reference and are:

- November 2014 Fire Protection Research Foundation report, "Assessment of Hazardous Voltage/Current in Marinas, Boatyards, and Floating Buildings" co-authored by John Adey with ABYC Foundation and Bill Daley & Ryan Kelly with CED Technologies.
- October 2008 ABYC report "In-Water Shock Hazard Mitigation Strategies" on electric shock drowning coauthored by David Rifkin and James Shafer.
- May 2015 article in NFPA Journal titled "Troubled Waters" by Ashley Smith.
- November 2011 article in Marine Dock Age titled "Hot Boats: What Marinas Need to Know About the Dangers" by John McDevitt.
- May 2013 article in BoatingMag.com titled: "Does Death Lurk Below?", by Mike Telleria.
- Examples of State Legislative Activity relating to Hazardous Voltage/Current at Marinas, Boatyards and Floating Buildings, in Arkansas, Kentucky, Tennessee, and West Virginia.
- Website dedicated to addressing ESD: Electric Shock Drowning Prevention Association

2) DISCUSSION ON NEEDS

As attention is given to the safe use of electrical equipment in and around water oriented applications, professionals in the safety arena have been quick to agree on the need to maintain focused attention on ESD and address its inherent concerns. Rather, the challenge is what solution approaches are realistic, effective and achievable. The complexities of this topic suggest that a single, simple solution approach is not realistic, and multiple synergistic approaches will be required to make meaningful progress.

The overall topic of hazardous voltage/current in water-based applications like marinas, boatyards and floating buildings was discussed by the workshop attendees. This revealed certain concepts and methodologies that have been identified and documented in this section. This is in support of the overall workshop goal to address and clarify the research priorities for electrical applications in these settings.

A key reason why this overall topic is complicated is it involves three distinct realms of activity that arguably have equal share of the overall issue. These three realms of activity are: Marinas; Motorcraft; and Infrastructure. Marinas are intended to include boatyards and all facilities that are expressly designed to support motorcraft. Motorcraft are intended to include boats and other water-borne vessels that provide water based transport and come and go into and out of marinas and boatyards. Infrastructure is intended to include all the normal electrical service found in the built environment that supports the marinas and boatyards. The primary characteristics of this topic are illustrated in Figure 3.

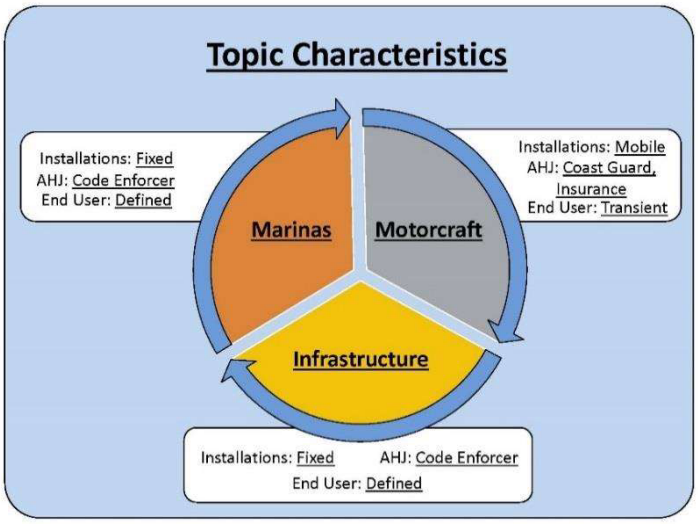


Figure 3: Topic Characteristics

The different characteristics of each of these three realms of activity help to understand the importance and complex interrelationship of the electrical equipment involved. The Marinas use electrical equipment that is generally in fixed locations, with end-use operators that are permanently located and well defined. The Authority Having Jurisdiction (AHJ) is normally the local code official. In contract, Motorcraft use electrical equipment that is mobile and can move from location to location, and similarly the boat owner/operator in more transient than for a fixed

marina. The local code official generally has no authority on motorcraft, and the regulatory oversight is generally applied via the Coast Guard or by insurance companies. The Infrastructure is all the electrical equipment from the grid and beyond that supports the electrical equipment in the marinas. Similar to the marinas, the infrastructure uses electrical equipment that is generally in fixed locations, utilize end-use operators that are permanently located and well defined, and local code official serves as the AHJ.

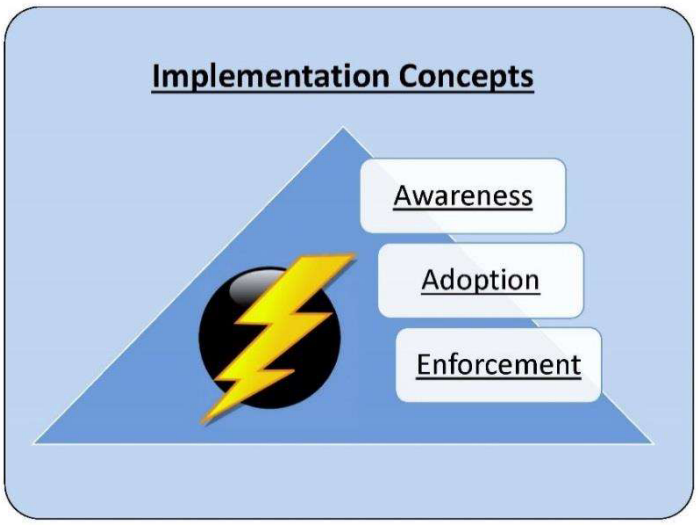


Figure 4: Implementation Concepts

Another concept that arose from the discussion was that there are multiple approaches for implementation, and these are referred to as Implementation Concepts. Three types evolved from this discussion, and these are: Awareness; Adoption; and Enforcement. These are illustrated in Figure 4, and each requires unique features depending on the realm of activities previously identified in Figure 3.

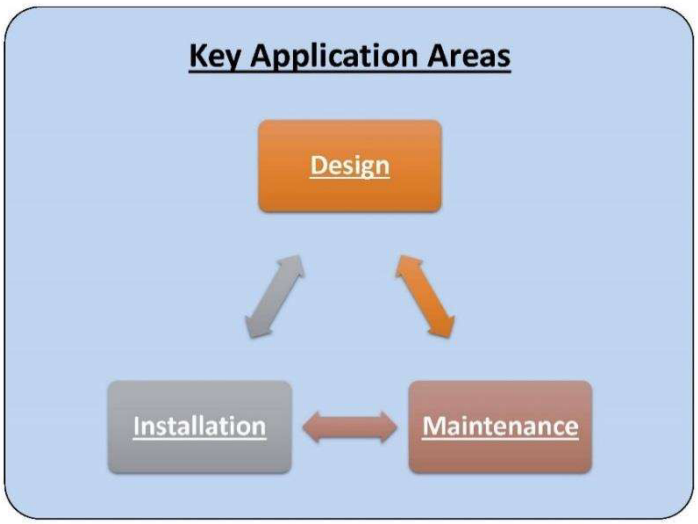


Figure 5: Key Application Areas

In similar fashion, discussion revealed the concept of three key application areas as: Design; Installation; and Maintenance. These are different from the realms of activity in Figure 3, and equally apply to each of these realms. The key application areas are illustrated in Figure 5.

The discussion of these conceptual elements forms the basis for the primary solution approaches. Multiple knowledge gaps and possible research projects were identified, and each falls into one of these three solution approaches. These are identified in Figure 6 and are: Technical; Awareness; and Regulatory.

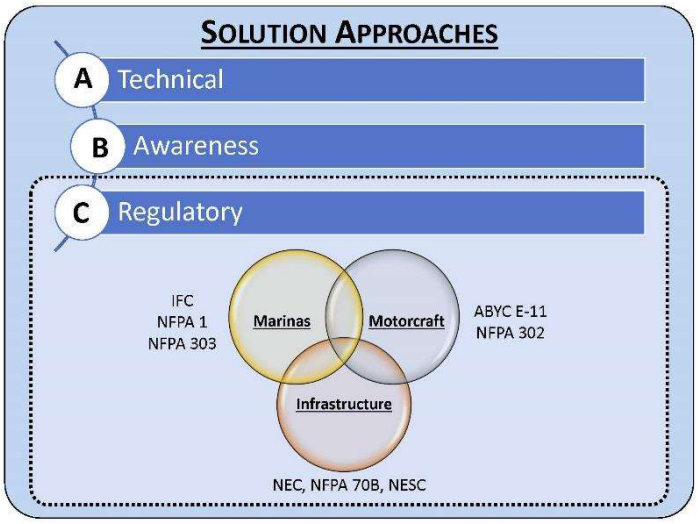


Figure 6: Solution Approaches

Figure 6 expands the Regulatory solution approach to clarify the model regulatory documents that apply in each of the three realms of activity identified earlier in Figure 3. Here, we see that for Marinas the key documents of interest are: NFPA 303, Fire Protection Standard for Marinas and Boatyards; NFPA 1, Fire Code; and the International Fire Code. For Motorcraft the applicable documents are: NFPA 302, Fire Protection Standard for Pleasure and Commercial Motorcraft; and ABYC E-11, "AC & DC Electrical Systems on Boats". For the Infrastructure the primary documents are: the National Electrical Code (NEC); NFPA 70B, Recommended Practice for Electrical Equipment Maintenance; and the National Electrical Safety Code (NESC).

The scopes of these specific regulatory documents are important, as well as the level of their adoption and regulatory implementation. For example, some documents are focused on maintenance and re-inspection like NFPA 70B, while others only address new installations like the NEC. Some documents have scopes that narrowly define the applications they address, like the NESC focusing on the transmission of electricity by power plants through the grid to facilities. Further, some documents are less widely adopted by regulators like NFPA 70B, while others such as the NEC has significant regulatory impact as one of the world's most widely adopted codes (e.g., used in virtually all 50 United States as well as multiple other countries). All of these factors add complexity to the proposed regulatory enhancements to address identified gaps to mitigate ESD, and suggest consideration of multiple solution approaches versus any single line of action.

Figure 7: Typical Electrical Installation at a Marina

3) SUMMARY OBSERVATIONS

The goal of the workshop has been to address and clarify the research priorities for electrical applications involving marinas, boatyards and floating buildings. The bottom-line intent is to provide useful information for directing future resources to efforts for preventing the occurrence of ESD events and mitigating their severity if they do occur.

Various research oriented efforts have been generated from the workshop discussions, and these are grouped according to the following three solution approaches: (i) technical; (ii) awareness; and (iii) regulatory. As certain proposed topics were identified, it was noted that some should be packaged using the FPRF Code Fund form for consideration as a potential research project. Anyone can submit these forms at any time, and a bland copy of the form is located in Annex D as well as at www.nfpa.org/CodeFund.

3.1) Summary Observations for "Technical" Solution Approaches

The Solution Approaches identified during the workshop that have been categorized as "Technical" include the following:

- Develop statistically valid data on currents (that expands on the 2008 study)
- Address the modeling of the person (different ages and gender) in the water, to investigate the behavior of the human body when it is subjected to electric fields. Due to the obvious difficulties in experimental verifications, such modeling may be carried out through numerical techniques, based on a mathematical representation of the human anatomy, which takes into account the boundaries of the internal organs.
- Identify and clarify the technical approaches in other parallel arenas, such as large shipping ports, military, IEEE applications, swimming pools, etc.
- Identify safe thresholds for emergency response to electrified water Injury (i.e., electric shock rescue), and establish the baseline criteria and approaches for ESD rescue.
- Conduct a hazard analysis that includes:
  - Defining the hazard,
  - Defining the appropriate levels of protection and strategies, and
  - Providing data for substantiation.
- Develop novel technologies and methods that would realistically enable field sensors and evaluation.
- Conduct field test evaluation in marinas that:
  - Establishes database(s)
  - Addresses ground fault detection devices
  - Clarifies leakage test of equipment
- Collect and analyze field data to clarify trip levels.
- Establish the basis for leakage current in marinas and motorcraft, with a focus on pre-event rather than post-event.
- Use modeling to establish device reliability for GFCIs (ground fault circuit interrupters) and RCDs (residual current devices) in marinas with harmonics.
- Define the threat level and clarify the appropriate levels and times for tripping electrical equipment.
- Consider technical solutions beyond only ground fault detection, which would not address other sources such as utility leakage.

- Clarify optimum location of ground fault equipment (e.g., branch circuits, feeder, receptacles, etc.)
- For ground fault protection, clarify the failure mode and default for safe levels. Also clarify the optimum levels, time, geometry, risk, etc. Consider approach with low level alarm and higher level trip.
- Consider a "transformer that isolates" (which is not the same as an isolation transformer). This would establish a new ground, and isolate the neutral. Consider for multiple transformers.
- Consider a "TN Island" that would create an island of loads. This would be transformer oriented and likely in the pedestals, and establish grounding of earth to grounding of the motorcraft.
- Establish the parameters for the design and development of a "marine grade" GFCI. This may be similar to the special purpose GFCI being considered by CMP-2.
- Consider an ECCI (Escaped Current Circuit Interrupter) approach. This would provide low-level fault detection and trip on any conductor imbalance.
- Clarify specific ground fault protection on the main, and necessary personal protection at the pedestal.
- Consider the inclusion of background currents for all research (or studies or measurements) of dangerous current levels and trip limits.

3.2) Summary Observations for "Awareness" Solution Approaches

The Solution Approaches identified during the workshop that have been categorized as "Awareness" include the following:

- Provide a policy focused report that clarifies the code enforcement landscape and also addresses the motivating political will among other motivating factors (e.g., insurance, litigation, consumer social media, etc.).
- Initiate a public safety campaign similar to other fire related and safety issues, such as fire prevention week, learn not to burn, stop, drop and roll, etc.
- Generate a white paper on marina safety to support public education efforts., which could ultimately reside as an annex in one of the applicable regulatory documents (e.g., NFPA 303)
- Collect and analyze data on ESD incidents, and expand on earlier summary of events from ESD Foundation.
- Clarify the need for tamper-resistant features to be balanced with public education.
- Clarify approach, content, and protocol for signage (e.g., no water entry including maintenance), and messages necessary for certain water entry (e.g., maintenance).
- Engage other key constituent groups and stakeholders in a public education campaign (e.g., marinas, insurers, Coast Guard, victim groups, maintainers, MMMA, AMI, marina designers, installers, enforcers, consumers, etc.
- Engage NFPA public education resources.
- Monitor and establish working relationships with other key constituents groups, such as the International Marina/Boatyard Conference.

3.3) Summary Observations for "Regulatory" Solution Approaches

The Solution Approaches identified during the workshop that have been categorized as "Regulatory" include the following:

- Identify and clarify the regulatory approaches in other parallel arenas, such as large shipping ports, military, IEEE applications, swimming pools, etc.
- Identify and coordinate all terminology and concepts used for electrical safety in the NEC and all other applicable documents.
- Generate summary of similar re-inspection and maintenance regulatory efforts (e.g., New Jersey approach to address swimming pools, etc.)
- Explore novel regulatory approaches that will promote re-inspections for these applications. In doing so, consider the following:
    - Philosophical approach of NFPA 3 Recommended Practice for Commissioning of Fire Protection and Life Safety Systems, which does not address electrical systems, implying that once they are in place they are okay forever (which is not necessarily true).
    - History that led to the development of NFPA 73, .Standard for Electrical Inspections for Existing Dwellings.
    - Model the requirements in NFPA 99, Health Care Facilities Code, on re-inspections.
- Conduct an "aging electrical equipment" research study for marinas and similar applications, similar to the earlier FPRF project that addressed this topic.
- Develop a scope coordination master plan for all the applicable regulatory documents, and clearly indicate who has responsibility for addressing/maintaining this topic, and include an outline of who will extract from who.
- Clarify regulatory oversight for all aspects of this issue, with consideration of ultimate goal of preventing ESD incidents.
- Develop adoption strategy for NFPA 303.
- Consider new on-site power generation sources, such as photovoltaic, wind turbines, and energy storage systems.

3.4) Solution Approach Priorities

As a final task for wrapping-up the workshop, attendees were asked to clarify the priority of key solution approaches they had identified in the preceding lists. One item received multiple indications as needing consideration, and this was the following Regulatory approach:

- Develop a scope coordination master plan for all the applicable regulatory documents, and clearly indicate who has responsibility for addressing/maintaining this topic, and include an outline of who will extract from who.

The following Technical approaches were indicated worthy of prioritization:

- Conduct field test evaluation in marinas by: establishing database(s), addressing ground fault detection devices, and clarifying leakage testing of equipment
- Define the threat level and clarify the appropriate levels and times for tripping electrical equipment.
- Address the modeling of the person in the water, to investigate the behavior of the human body when it is subjected to electric fields.
- Clarify specific ground fault protection on the main, and necessary personal protection at the pedestal.

The following Awareness approach was indicated worthy of prioritization:

- Initiate a public safety campaign similar to other fire related and safety issues, such as fire prevention week, learn not to burn, stop, drop and roll, etc.

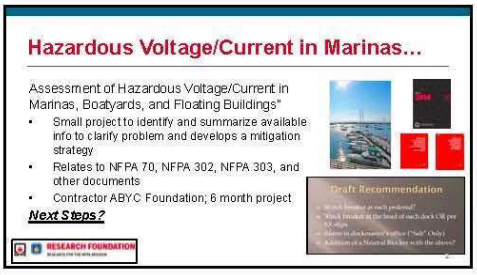
ANNEX A: WORKSHOP PARTICIPANTS AND ATTENDEES

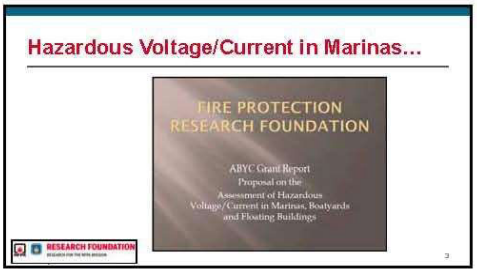
The following were the workshop attendees at the research planning session on "*Hazardous Voltage/Current in Marinas, Boatyards and Floating Buildings*", held in Linthicum, Maryland on Thursday 13 August 2015.

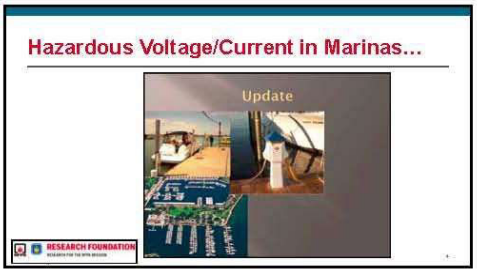
Randal Andress, Huntsville AL (call in)
Paul Brazis, UL LLC
Brett Brenner, ESFI (call in)
Ed Brill, SEA Ltd.
Larry Budd, Charles Marine
Ken Bush, MD SFMs Office & NFPA 303 Chair
Steve Campolo, Leviton (call in)
Ron Chilton, North Carolina DOI & CMP-19 Chair
Shane Clary, Bay Alarm Company (call in)
Donny Cook, IAEI
James Cote, Cote Marine
Gregory Davis, ESI
Mark Earley, NFPA
Lanny Floyd, Electrical Safety Group
Charlie Game, E. C. Game Engineering
Casey Grant, FPRF
John Goodsell, Hubbell
Palmer Hickman, IBEW
Ray Lauriello, Southern NJ Chapter of IAEI
Doug Lee, CPSC
Tim McClintock, NFPA
John McDevitt, MSFP & NFPA 302 Chair
Massimo Mitolo, ESI
Jim Rowland, South Jersey Electrical Inspectors Association
Larry Russell, NFPA
Jeff Sargent, NFPA
Terry Victor, Tyco / SimplexGrinnell
Wayne Waggoner, TN Fire Sprinkler Contractors Association (call in)
Chris Walker, Eaton
Donald Zipse, Electrical Forensic

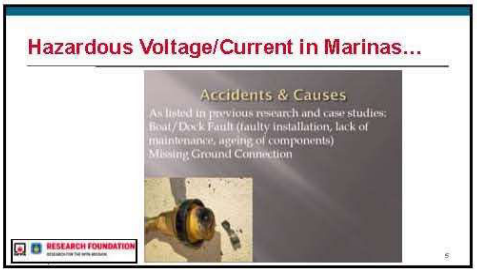
ANNEX B: WORKSHOP POWERPOINT SLIDES: OVERVIEW

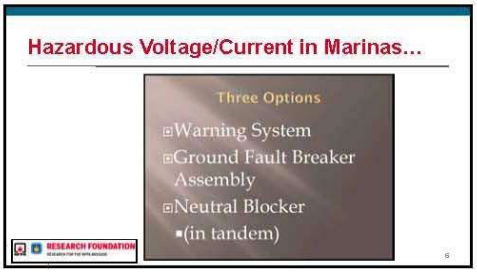
8/13/2015











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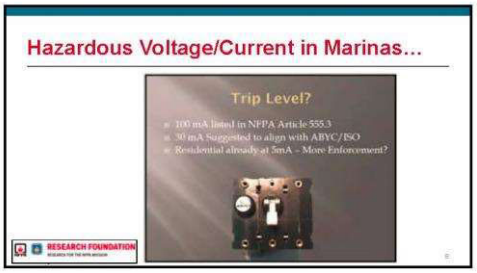
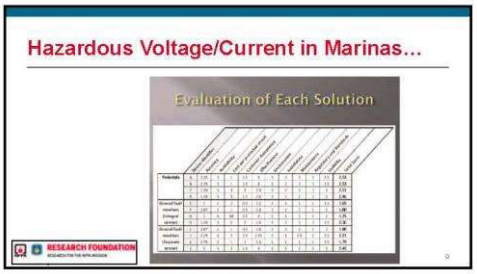
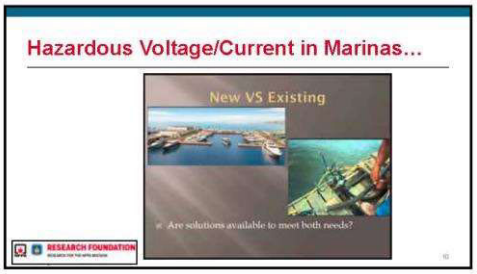
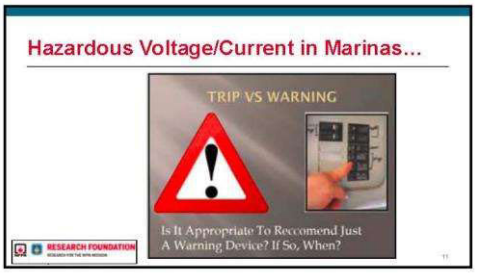
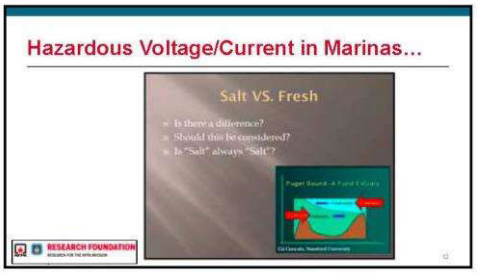
Annex B: Workshop PowerPoint Slides Overview (1 of 3)











Annex B: Workshop PowerPoint Slides Overview (2 of 3)

Hazardous Voltage/Current in Marinas...

Draft Recommendation

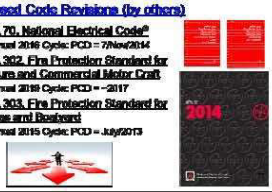
- 30 mA breaker at each pedestal
- Work must be done on a recommendation for a solution on the "main feeder"
- "Phantom" neutral current not enough to cause any harm.

RESEARCH FOUNDATION

Hazardous Voltage/Current in Marinas...

Proposed Code Revisions (by others)

- NFPA 70, National Electrical Code®
  - Annual 2016 Cycle: PCD = 7/Nov/2014
- NFPA 302, Fire Protection Standard for Pleasure and Commercial Motor Craft
  - Annual 2018 Cycle: PCD = ~2017
- NFPA 303, Fire Protection Standard for Marinas and Boatyard
  - Annual 2015 Cycle: PCD = July/2013



RESEARCH FOUNDATION

RESEARCH FOUNDATION
RESEARCH FOR THE NFPA MISSION

What are:

a) Research Priorities?
b) Next Steps?

Annex B: Workshop PowerPoint Slides Overview (3 of 3)

ANNEX C: WORKSHOP POWERPOINT SLIDES: NEC IMPLICATIONS

8/13/2015

Marinas

Tennessee

- Open Marina.
- NEC Articles 555 & 682.

Tennessee

- Open Marina.
- NEC Articles 555 & 682.

Tennessee

- Open Marina.
- NEC Articles 555 & 682.

Illinois

- Marina & Floating Building.
- NEC Articles 555, 553, & 682.

Illinois

- Open Marina.
- NEC Articles 555 & 682.

1

Annex C: Workshop PowerPoint Slides NEC Implications (1 of 8)

Illinois

- Open Marina.
- NEC Articles 555 & 682.

Florida

- Open Marina.
- NEC Articles 555 & 682.

Florida

- Open Marina.
- NEC Articles 555 & 682.

Florida

- Open Marina.
- NEC Articles 555 & 682.
- Building is in the water. Not sure if it is floating. Does it matter?

Massachusetts

- Open Marina with floating building on the pier.
- NEC Articles 555, 553 & 682.

Massachusetts

- Open Marina with floating building on the pier.
- NEC Articles 555, 553 & 682.

Annex C: Workshop PowerPoint Slides NEC Implications (2 of 8)

Massachusetts

- Open Marina with floating building on the pier.
- NEC Articles 555, 553 & 682.

Massachusetts

- Open Marina.
- NEC Articles 555 & 682.

Massachusetts

- Open Marina.
- NEC Articles 555 & 682.

California

- Pier.
- NEC Article 682.

California

- Pier.
- NEC Article 682.

California

- Marina.
- NEC Articles 555 & 682.

Annex C: Workshop PowerPoint Slides NEC Implications (3 of 8)

California

- Marina.
- NEC Articles 555 & 682.

California

- Marina & Building (Not floating, but does it matter).
- NEC Articles 555 & 682.

California

- Marina.
- NEC Articles 555 & 682.

Washington DC

- Marina.
- NEC Articles 555 & 682.

Alabama

- Marina & Floating Building.
- NEC Articles 555, 553, & 682.

Alabama

- Open Marina.
- NEC Articles 555 & 682.

Annex C: Workshop PowerPoint Slides NEC Implications (4 of 8)

Alabama

- Roofed Open Sided Marina.
- NEC Articles 555 & 682.

Alabama

- Marina/Pier & Floating Building.
- NEC Articles 555, 553, & 682.

Alabama

- Open Marina.
- NEC Articles 555 & 682.

Alabama

- Open Marina.
- NEC Articles 555 & 682.

Alabama

- Roofed Open Sided Marina.
- NEC Articles 555 & 682.

Alabama

- Open Marina with Fueling Dispenser.
- NEC Article 555, 514, & 682.

Annex C: Workshop PowerPoint Slides NEC Implications (5 of 8)

Alabama

- Residential Boathouses & Piers.
- NEC Articles 555? & 682, 210.8.

Alabama

- Residential Boathouses & Piers.
- NEC Articles 555? & 682, 210.8.

Alabama

- Residential Boathouses & Piers.
- NEC Articles 555? & 682, 210.8.

Alabama

- Residential Boathouses & Piers.
- NEC Articles 555? & 682, 210.8.

Alabama

- Residential Boathouses & Piers.
- NEC Articles 555? & 682, 210.8.

Alabama

- Residential Boathouses & Piers.
- NEC Articles 555? & 682, 210.8.

Annex C: Workshop PowerPoint Slides NEC Implications (6 of 8)

Alabama

- Residential Boathouses, Piers, & equipment (pumps, fountains, etc.)
- NEC Articles 555? & 682, 210.8.

Alabama

- Residential Boathouses, Piers, & equipment (pumps, fountains, etc.)
- NEC Articles 555? & 682, 210.8.

Alabama

- Residential Boathouses & Piers.
- NEC Articles 555? & 682, 210.8.

Alabama

- Residential Boathouses & Piers.
- NEC Articles 555? & 682, 210.8.

Alabama

- Residential Boathouses & Piers.
- NEC Articles 555? & 682, 210.8.

Alabama

- Residential Boathouses & Piers.
- NEC Articles 555? & 682, 210.8.

Annex C: Workshop PowerPoint Slides NEC Implications (7 of 8)

NEC Text

210.8 Ground-Fault Circuit-Interrupter Protection for Personnel. Ground-fault circuit-interrupter protection for personnel shall be provided as required in 210.8(A) through (C). The ground-fault circuit-interrupter shall be installed in a readily accessible location.

Informational Note: See 215.9 for ground-fault circuit-interrupter protection for personnel on feeders.

(A) Dwelling Units. All 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in 210.8(A)(1) through (10) shall have ground-fault circuit-interrupter protection for personnel.

NEC Text

(3) Outdoors
(8) Boathouses

(B) Other Than Dwelling Units. All 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in 210.8(B)(1) through (8) shall have ground-fault circuit-interrupter protection for personnel.

(4) Outdoors

NEC Text

(C) Boat Hoists. GFCI protection shall be provided for outlets not exceeding 240 volts that supply boat hoists installed in dwelling unit locations.

NEC Text

ARTICLE 553
Floating Buildings

I. General

553.1 Scope. This article covers wiring, services, feeders, and grounding for floating buildings.

553.2 Definition.

Floating Building. A building unit, as defined in Article 100, that floats on water, is moored in a permanent location, and has a premises wiring system served through connection by permanent wiring to an electrical supply system not located on the premises.

NEC Text

ARTICLE 555
Marinas and Boatyards

555.1 Scope. This article covers the installation of wiring and equipment in the areas comprising fixed or floating

piers, wharves, docks, and other areas in marinas, boatyards, boat basins, boathouses, yacht clubs, boat condominiums, docking facilities associated with residential condominiums, any multiple docking facility, or similar occupancies, and facilities that are used, or intended for use, for the purpose of repair, berthing, launching, storage, or fueling of small craft and the moorage of floating buildings.

Private, noncommercial docking facilities constructed or occupied for the use of the owner or residents of the associated single-family dwelling are not covered by this article.

Informational Note: See NFPA 303-2011, *Fire Protection Standard for Marinas and Boatyards*, for additional information.

NEC Text

ARTICLE 682
Natural and Artificially Made Bodies of Water

I. General

682.1 Scope. This article applies to the installation of electrical wiring for, and equipment in and adjacent to, natural

or artificially made bodies of water not covered by other articles in this *Code*, such as but not limited to aeration ponds, fish farm ponds, storm retention basins, treatment ponds, irrigation (channels) facilities.

Annex C: Workshop PowerPoint Slides NEC Implications (8 of 8)

ANNEX D: CODE FUND REQUEST FORM

The following is the Code Fund Request Form (available at www.nfpa.org/CodeFund) used to package and consider projects by the Fire Protection Research Foundation:

Project Statement Form

Return to research@nfpa.org

Fire Protection Research Foundation, One Batterymarch Park, Quincy, MA 02169-7471

1) **Proposed Project Title:**

2) **Problem Statement (One or two sentences addressing "What is the research or data need?"):**

3) **Research Objective (One or two sentences addressing "What is needed to solve the problem?" Examples include: Develop guidance for a specific issue, Determine effectiveness of current code/standard requirement):**

4) **Project Description (One or two paragraphs on study design & expected tasks. Project tasks can include literature reviews, data collection, loss summaries, field usage surveys, code comparisons, statistical analysis, computer modeling, hazard analysis, risk assessments, fire testing, recommendation development, and gap identification.):**

5) **Data Collection (If data collection is part of the project scope, does data exist? If data exists, is it available to be used in the study? Please identify potential data sources.)**

6) **Relevant NFPA Document(s), Technical Groups, or Foundation strategic research agenda item & How Project Will Impact:**

7) **Organizations That Could Possibly Fund (Examples: government grants, industry consortia, stakeholders):**

8) **When Do You Need Project Deliverables (when is information needed to coordinate with document revision cycles, sense of urgency):**

9) **Submitted By (Staff Liaison/TC Chair/etc) and Date Submitted:**

Form Updated: 24 July 2015

Public Input No. 3930-NFPA 70-2020 [Section No. 555.9]

555.9 Boat Hoists.

GFCI protection for personnel shall be provided for outlets not exceeding 240 volts that supply a boat hoist installed at dwelling unit docking facilities.

555.9 Boat Hoists.

GFCI protection for personnel shall be provided for outlets not exceeding 240 volts that supply a boat hoist installed at ~~dwelling unit~~ all docking facilities.

Additional Proposed Changes

File Name	Description	Approved
Marina_Shock_Hazard_Research_Planning_Workshop_NFPA_.pdf	Marina Shock Hazard Research Planning Workshop (NFPA)	

Statement of Problem and Substantiation for Public Input

Boat Lifts and Hoists, whether installed at a residential facility or a commercial marina both pose the same danger to personnel. Go to NFPA for information and more substantiation on this hazard(s) and to see their research: “Marina Shock Hazard Research Planning Workshop” https://www.nfpa.org/-/media/Files/News-and-Research/Fire-statistics-and-reports/Proceedings/MarinaShockHazardResearchPlanning.ashx

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3925-NFPA 70-2020 [Section No. 555.9]	GFCI Protection to all docking facilities

Submitter Information Verification

Submitter Full Name: William Pancake
Organization: CAP Government
Affiliation: ACRA Electric, Inc. Cape Coral, FL
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 15:40:37 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7917-NFPA 70-2020

Statement: The 555.9 Boat Hoist requirements has been moved to 555.35(D). This change places all the GFCI requirements under one location, which provides added clarity and usability. In addition, this was done since the GFCI requirements for boat hoist should include all docking facilities, not just those related to dwelling units, since the same electrical hazards can exist. However, changing the term “boat hoist” to “boat lift” is unnecessary. No technical substantiation was provided and the use of the alternate term doesn’t add clarity.

The reference to “sources” supplying a docking facility has been revised to cover either installation where you have a service or a feeder that supplies the docking facility or wharf. Subpart (A) is titled in such a manner as to identify only those circuits that supply the docking facility or wharf shall be equipped with GFPE. This is not intended to apply to OCPDs and circuit upstream of this equipment. Clarification has been made that the GFPE protection at 100mA or 30 mA is not establishing a threshold for the product but rather pertains to the existing listed solutions that may be on the market. UL 1053 has a set performance requirement for GFPE devices. Added language to include GFCI protection for branch circuits in (C)(2) to cover “other than shore power” outlets. This requirement includes both hardwired and portable cord/plug connected outlets (i.e. luminaires or other electrical devices) located at docking facilities. As stated earlier, the GFCI protection for boat hoists was relocated to this section for consistency.

The revisions to requiring a Listed Leakage Current Measurement Device for use in marina applications will assure that the device complies with specific safety and performance requirements such as evaluating for a grounded neutral protection and is suitable for the harsh conditions in a marina.

Marina Shock Hazard Research Planning Workshop

PROCEEDINGS

HELD:
13 August 2015 in Baltimore, Maryland

PREPARED BY:
Casey C. Grant, P.E.
Fire Protection Research Foundation
Quincy, Massachusetts USA

RESEARCH FOUNDATION
RESEARCH FOR THE NFPA MISSION

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EXECUTIVE SUMMARY

These are the proceedings of a research planning session (a.k.a. workshop) to address "*Hazardous Voltage/Current in Marinas, Boatyards and Floating Buildings*". Reports in the mainstream media of Electric Shock Drowning (ESD), which can directly electrocute a swimmer in the water or cause a level of paralysis that ultimately results in drowning, is a concern in the vicinity of marinas, boatyards and floating buildings. How best to address this concern is the focus of this workshop.

The general desire by safety professionals to address this topic is not lacking, but rather the solution approaches are not obvious due to the technical and regulatory complexities that make this application particularly challenging. For example, electrical equipment in these applications are typically subjected to harsh conditions that can accelerate equipment degradation over time, and solution approaches are exacerbated due to factors such as different regulatory/enforcement realms for motorcraft versus marinas versus the shore-based infrastructure. The goal of the workshop is to address and clarify the research priorities for electrical applications involving marinas, boatyards and floating buildings.

The summary observations of these proceedings are organized into proposed solution approaches that are categorized as: (i) technical; (ii) awareness; and (iii) regulatory. These solution approaches are intended to provide useful information for directing future resources to efforts for preventing the occurrence of ESD events and mitigating their severity if they do occur.

ACKNOWLEDGEMENTS

The workshop has been made possible through support from the following:

Attwood Marine
Eaton Corporation
Hubbell
Intertek
Leviton Manufacturing Company
NEMA Electrical Connector Section
Underwriters Laboratories

This workshop summary report has been prepared by Casey Grant, Executive Director for the Fire Protection Research Foundation. The information contained herein is based on the input of numerous professionals and subject-matter-experts. While considerable effort has been taken to accurately document this input, the final interpretation of the information contained herein resides with the report author.

Photographs included in this report and not in PowerPoint slides were taken by Casey Grant, FPRF

About the Fire Protection Research Foundation

The Fire Protection Research Foundation plans, manages, and communicates research on a broad range of fire safety issues in collaboration with scientists and laboratories around the world. The Foundation is an affiliate of NFPA.

About the National Fire Protection Association (NFPA)

Founded in 1896, NFPA is a global, nonprofit organization devoted to eliminating death, injury, property and economic loss due to fire, electrical and related hazards. The association delivers information and knowledge through more than 300 consensus codes and standards, research, training, education, outreach and advocacy; and by partnering with others who share an interest in furthering the NFPA mission. All NFPA codes and standards can be viewed online for free. NFPA's membership totals more than 65,000 individuals around the world.

Keywords: electric shock drowning, ESD, electricity, voltage current, marinas, boatyards, floating buildings, motorcraft, national electrical code, NEC, NFPA 70, NFPA 302, NFPA 303, research planning

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1) BACKGROUND AND OVERVIEW

These are the proceedings of a research planning session (a.k.a. workshop) to address "*Hazardous Voltage/Current in Marinas, Boatyards and Floating Buildings*". This workshop was conducted on Thursday 13 August 2015, and held at the BWI Airport Marriott, 1743 West Nursery Road, Linthicum, Maryland.

Reports in the mainstream media of drowning in the vicinity of marinas, boatyards and floating buildings have raised questions on possible shock hazards from nearby electrical equipment. Of particular concern are incidents suspected of involving Electric Shock Drowning (ESD), which can directly electrocute a swimmer in the water or cause a level of paralysis that ultimately results in drowning. It is often difficult to link ESD to an incident due to multiple reasons, such as the transient nature of some electrical sources (e.g., from a boat, that relocates). Addressing this and related concerns are the primary focus of this workshop.

The safety of electrical equipment is a challenge when installed and used in the vicinity of marinas, boatyards and floating buildings. This typically requires designing, installing, operating and maintaining electrical equipment that balances inherently safe levels of equipment operation against nuisance interruptions of the applicable electrical infrastructure.

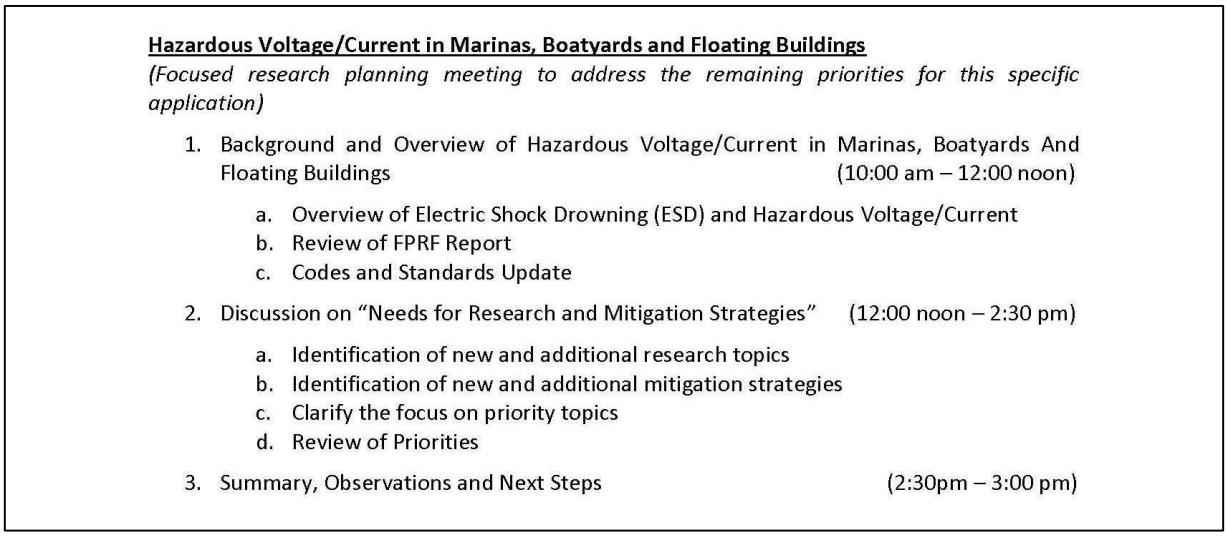
This electrical equipment is typically subjected to harsh environmental conditions that can result in deterioration and other long term maintenance concerns. Initial and on-going inspections as well as code enforcement likewise face special challenges due to factors such as the transitory existence of motorcraft and ultimate responsibility for the source of stray current from interconnected electrical equipment. The general desire by safety professionals to address this topic is not lacking, but rather the solution approaches are not obvious due to the technical and regulatory complexities that make this application particularly challenging.

To simplify the overall topic from a high level, the problem is the following: there is dangerous electric current in the water. The possible sources of this stray current are: Marina; Motorcraft; or Infrastructure. Thus the ultimate question is: What is lacking in the present safety approaches and infrastructure?

Figure 1: Typical Electrical Installation at a Marina

The goal of the workshop is to address and clarify the research priorities for electrical applications involving marinas, boatyards and floating buildings. Solution approaches are identified and reviewed with the intent to provide useful information for directing future resources to efforts for preventing the occurrence of ESD events and mitigating their severity if they do occur. The summary observations of these proceedings are organized into solution approaches that involve issues in one of the following three groups:

(i) Technical;
(ii) Awareness; and
(iii) Regulatory.



Hazardous Voltage/Current in Marinas, Boatyards and Floating Buildings

(Focused research planning meeting to address the remaining priorities for this specific application)

1. Background and Overview of Hazardous Voltage/Current in Marinas, Boatyards And Floating Buildings (10:00 am – 12:00 noon)
    a. Overview of Electric Shock Drowning (ESD) and Hazardous Voltage/Current
    b. Review of FPRF Report
    c. Codes and Standards Update
2. Discussion on "Needs for Research and Mitigation Strategies" (12:00 noon – 2:30 pm)
    a. Identification of new and additional research topics
    b. Identification of new and additional mitigation strategies
    c. Clarify the focus on priority topics
    d. Review of Priorities
3. Summary, Observations and Next Steps (2:30pm – 3:00 pm)

Figure 2: Workshop Agenda

The agenda for the workshop is shown in Figure 2. Thirty individuals participated representing the following professional communities: electrical, fire protection and safety, marinas, and motorcraft (boating). A summary of all the workshop participants is included in Annex A. The overall workshop was facilitated by Casey Grant of the Fire Protection Research Foundation, supported by Donny Cook, Chair of the FPRF Electrical Safety Research Advisory Committee. This was led using PowerPoint slides that are included in Annex B and Annex C.

Several model codes and standards are directly applicable to this topic, and they are monitoring this activity in pursuit of enhancements and revisions that are intended to prevent ESD occurrences and/or mitigate their severity if they do occur. These model codes and standards are important regulatory tools, and the most applicable for this particular application are:

- ABYC E-11, AC & DC Electrical Systems on Boats
- IEEE National Electrical Safety Code® (NESC®)
- ICC International Fire Code®
- NFPA 1, Fire Code
- NFPA 70, National Electrical Code® (NEC®)
- NFPA 70B, Recommended Practice for Electrical Equipment Maintenance
- NFPA 302, Fire Protection Standard for Pleasure and Commercial Motorcraft
- NFPA 303, Fire Protection Standard for Marinas and Boatyards

In support of the workshop, multiple handouts of background information were circulated beforehand and made available at the meeting. These are summarized for purposes of reference and are:

- November 2014 Fire Protection Research Foundation report, "Assessment of Hazardous Voltage/Current in Marinas, Boatyards, and Floating Buildings" co-authored by John Adey with ABYC Foundation and Bill Daley & Ryan Kelly with CED Technologies.
- October 2008 ABYC report "In-Water Shock Hazard Mitigation Strategies" on electric shock drowning coauthored by David Rifkin and James Shafer.
- May 2015 article in NFPA Journal titled "Troubled Waters" by Ashley Smith.
- November 2011 article in Marine Dock Age titled "Hot Boats: What Marinas Need to Know About the Dangers" by John McDevitt.
- May 2013 article in BoatingMag.com titled: "Does Death Lurk Below?", by Mike Telleria.
- Examples of State Legislative Activity relating to Hazardous Voltage/Current at Marinas, Boatyards and Floating Buildings, in Arkansas, Kentucky, Tennessee, and West Virginia.
- Website dedicated to addressing ESD: Electric Shock Drowning Prevention Association

2) DISCUSSION ON NEEDS

As attention is given to the safe use of electrical equipment in and around water oriented applications, professionals in the safety arena have been quick to agree on the need to maintain focused attention on ESD and address its inherent concerns. Rather, the challenge is what solution approaches are realistic, effective and achievable. The complexities of this topic suggest that a single, simple solution approach is not realistic, and multiple synergistic approaches will be required to make meaningful progress.

The overall topic of hazardous voltage/current in water-based applications like marinas, boatyards and floating buildings was discussed by the workshop attendees. This revealed certain concepts and methodologies that have been identified and documented in this section. This is in support of the overall workshop goal to address and clarify the research priorities for electrical applications in these settings.

A key reason why this overall topic is complicated is it involves three distinct realms of activity that arguably have equal share of the overall issue. These three realms of activity are: Marinas; Motorcraft; and Infrastructure. Marinas are intended to include boatyards and all facilities that are expressly designed to support motorcraft. Motorcraft are intended to include boats and other water-borne vessels that provide water based transport and come and go into and out of marinas and boatyards. Infrastructure is intended to include all the normal electrical service found in the built environment that supports the marinas and boatyards. The primary characteristics of this topic are illustrated in Figure 3.

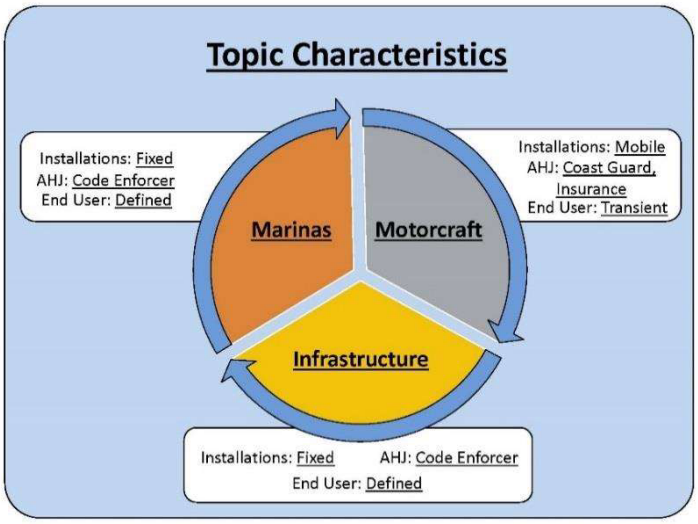


Figure 3: Topic Characteristics

The different characteristics of each of these three realms of activity help to understand the importance and complex interrelationship of the electrical equipment involved. The Marinas use electrical equipment that is generally in fixed locations, with end-use operators that are permanently located and well defined. The Authority Having Jurisdiction (AHJ) is normally the local code official. In contract, Motorcraft use electrical equipment that is mobile and can move from location to location, and similarly the boat owner/operator in more transient than for a fixed

marina. The local code official generally has no authority on motorcraft, and the regulatory oversight is generally applied via the Coast Guard or by insurance companies. The Infrastructure is all the electrical equipment from the grid and beyond that supports the electrical equipment in the marinas. Similar to the marinas, the infrastructure uses electrical equipment that is generally in fixed locations, utilize end-use operators that are permanently located and well defined, and local code official serves as the AHJ.

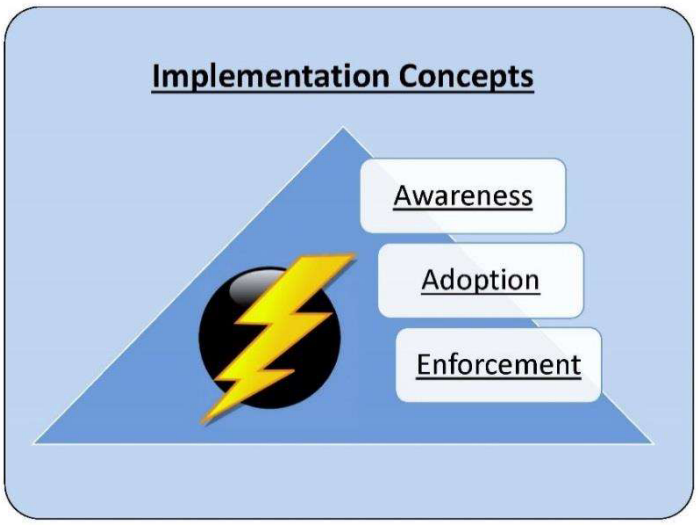


Figure 4: Implementation Concepts

Another concept that arose from the discussion was that there are multiple approaches for implementation, and these are referred to as Implementation Concepts. Three types evolved from this discussion, and these are: Awareness; Adoption; and Enforcement. These are illustrated in Figure 4, and each requires unique features depending on the realm of activities previously identified in Figure 3.

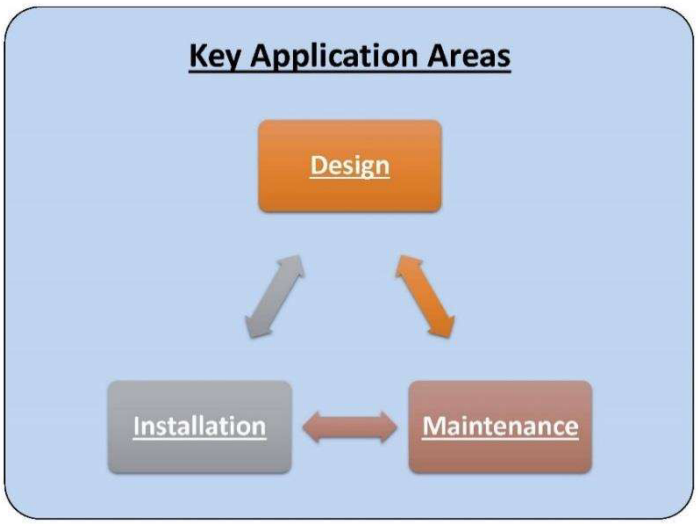


Figure 5: Key Application Areas

In similar fashion, discussion revealed the concept of three key application areas as: Design; Installation; and Maintenance. These are different from the realms of activity in Figure 3, and equally apply to each of these realms. The key application areas are illustrated in Figure 5.

The discussion of these conceptual elements forms the basis for the primary solution approaches. Multiple knowledge gaps and possible research projects were identified, and each falls into one of these three solution approaches. These are identified in Figure 6 and are: Technical; Awareness; and Regulatory.

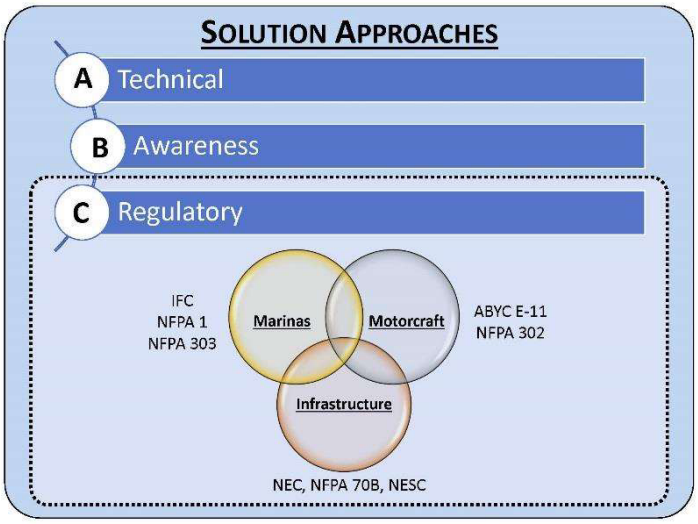


Figure 6: Solution Approaches

Figure 6 expands the Regulatory solution approach to clarify the model regulatory documents that apply in each of the three realms of activity identified earlier in Figure 3. Here, we see that for Marinas the key documents of interest are: NFPA 303, Fire Protection Standard for Marinas and Boatyards; NFPA 1, Fire Code; and the International Fire Code. For Motorcraft the applicable documents are: NFPA 302, Fire Protection Standard for Pleasure and Commercial Motorcraft; and ABYC E-11, "AC & DC Electrical Systems on Boats". For the Infrastructure the primary documents are: the National Electrical Code (NEC); NFPA 70B, Recommended Practice for Electrical Equipment Maintenance; and the National Electrical Safety Code (NESC).

The scopes of these specific regulatory documents are important, as well as the level of their adoption and regulatory implementation. For example, some documents are focused on maintenance and re-inspection like NFPA 70B, while others only address new installations like the NEC. Some documents have scopes that narrowly define the applications they address, like the NESC focusing on the transmission of electricity by power plants through the grid to facilities. Further, some documents are less widely adopted by regulators like NFPA 70B, while others such as the NEC has significant regulatory impact as one of the world's most widely adopted codes (e.g., used in virtually all 50 United States as well as multiple other countries). All of these factors add complexity to the proposed regulatory enhancements to address identified gaps to mitigate ESD, and suggest consideration of multiple solution approaches versus any single line of action.

Figure 7: Typical Electrical Installation at a Marina

3) SUMMARY OBSERVATIONS

The goal of the workshop has been to address and clarify the research priorities for electrical applications involving marinas, boatyards and floating buildings. The bottom-line intent is to provide useful information for directing future resources to efforts for preventing the occurrence of ESD events and mitigating their severity if they do occur.

Various research oriented efforts have been generated from the workshop discussions, and these are grouped according to the following three solution approaches: (i) technical; (ii) awareness; and (iii) regulatory. As certain proposed topics were identified, it was noted that some should be packaged using the FPRF Code Fund form for consideration as a potential research project. Anyone can submit these forms at any time, and a bland copy of the form is located in Annex D as well as at www.nfpa.org/CodeFund.

3.1) Summary Observations for "Technical" Solution Approaches

The Solution Approaches identified during the workshop that have been categorized as "Technical" include the following:

- Develop statistically valid data on currents (that expands on the 2008 study)
- Address the modeling of the person (different ages and gender) in the water, to investigate the behavior of the human body when it is subjected to electric fields. Due to the obvious difficulties in experimental verifications, such modeling may be carried out through numerical techniques, based on a mathematical representation of the human anatomy, which takes into account the boundaries of the internal organs.
- Identify and clarify the technical approaches in other parallel arenas, such as large shipping ports, military, IEEE applications, swimming pools, etc.
- Identify safe thresholds for emergency response to electrified water Injury (i.e., electric shock rescue), and establish the baseline criteria and approaches for ESD rescue.
- Conduct a hazard analysis that includes:
  - Defining the hazard,
  - Defining the appropriate levels of protection and strategies, and
  - Providing data for substantiation.
- Develop novel technologies and methods that would realistically enable field sensors and evaluation.
- Conduct field test evaluation in marinas that:
  - Establishes database(s)
  - Addresses ground fault detection devices
  - Clarifies leakage test of equipment
- Collect and analyze field data to clarify trip levels.
- Establish the basis for leakage current in marinas and motorcraft, with a focus on pre-event rather than post-event.
- Use modeling to establish device reliability for GFCIs (ground fault circuit interrupters) and RCDs (residual current devices) in marinas with harmonics.
- Define the threat level and clarify the appropriate levels and times for tripping electrical equipment.
- Consider technical solutions beyond only ground fault detection, which would not address other sources such as utility leakage.

- Clarify optimum location of ground fault equipment (e.g., branch circuits, feeder, receptacles, etc.)
- For ground fault protection, clarify the failure mode and default for safe levels. Also clarify the optimum levels, time, geometry, risk, etc. Consider approach with low level alarm and higher level trip.
- Consider a "transformer that isolates" (which is not the same as an isolation transformer). This would establish a new ground, and isolate the neutral. Consider for multiple transformers.
- Consider a "TN Island" that would create an island of loads. This would be transformer oriented and likely in the pedestals, and establish grounding of earth to grounding of the motorcraft.
- Establish the parameters for the design and development of a "marine grade" GFCI. This may be similar to the special purpose GFCI being considered by CMP-2.
- Consider an ECCI (Escaped Current Circuit Interrupter) approach. This would provide low-level fault detection and trip on any conductor imbalance.
- Clarify specific ground fault protection on the main, and necessary personal protection at the pedestal.
- Consider the inclusion of background currents for all research (or studies or measurements) of dangerous current levels and trip limits.

3.2) Summary Observations for "Awareness" Solution Approaches

The Solution Approaches identified during the workshop that have been categorized as "Awareness" include the following:

- Provide a policy focused report that clarifies the code enforcement landscape and also addresses the motivating political will among other motivating factors (e.g., insurance, litigation, consumer social media, etc.).
- Initiate a public safety campaign similar to other fire related and safety issues, such as fire prevention week, learn not to burn, stop, drop and roll, etc.
- Generate a white paper on marina safety to support public education efforts., which could ultimately reside as an annex in one of the applicable regulatory documents (e.g., NFPA 303)
- Collect and analyze data on ESD incidents, and expand on earlier summary of events from ESD Foundation.
- Clarify the need for tamper-resistant features to be balanced with public education.
- Clarify approach, content, and protocol for signage (e.g., no water entry including maintenance), and messages necessary for certain water entry (e.g., maintenance).
- Engage other key constituent groups and stakeholders in a public education campaign (e.g., marinas, insurers, Coast Guard, victim groups, maintainers, MMMA, AMI, marina designers, installers, enforcers, consumers, etc.
- Engage NFPA public education resources.
- Monitor and establish working relationships with other key constituents groups, such as the International Marina/Boatyard Conference.

3.3) Summary Observations for "Regulatory" Solution Approaches

The Solution Approaches identified during the workshop that have been categorized as "Regulatory" include the following:

- Identify and clarify the regulatory approaches in other parallel arenas, such as large shipping ports, military, IEEE applications, swimming pools, etc.
- Identify and coordinate all terminology and concepts used for electrical safety in the NEC and all other applicable documents.
- Generate summary of similar re-inspection and maintenance regulatory efforts (e.g., New Jersey approach to address swimming pools, etc.)
- Explore novel regulatory approaches that will promote re-inspections for these applications. In doing so, consider the following:
    - Philosophical approach of NFPA 3 Recommended Practice for Commissioning of Fire Protection and Life Safety Systems, which does not address electrical systems, implying that once they are in place they are okay forever (which is not necessarily true).
    - History that led to the development of NFPA 73, .Standard for Electrical Inspections for Existing Dwellings.
    - Model the requirements in NFPA 99, Health Care Facilities Code, on re-inspections.
- Conduct an "aging electrical equipment" research study for marinas and similar applications, similar to the earlier FPRF project that addressed this topic.
- Develop a scope coordination master plan for all the applicable regulatory documents, and clearly indicate who has responsibility for addressing/maintaining this topic, and include an outline of who will extract from who.
- Clarify regulatory oversight for all aspects of this issue, with consideration of ultimate goal of preventing ESD incidents.
- Develop adoption strategy for NFPA 303.
- Consider new on-site power generation sources, such as photovoltaic, wind turbines, and energy storage systems.

3.4) Solution Approach Priorities

As a final task for wrapping-up the workshop, attendees were asked to clarify the priority of key solution approaches they had identified in the preceding lists. One item received multiple indications as needing consideration, and this was the following Regulatory approach:

- Develop a scope coordination master plan for all the applicable regulatory documents, and clearly indicate who has responsibility for addressing/maintaining this topic, and include an outline of who will extract from who.

The following Technical approaches were indicated worthy of prioritization:

- Conduct field test evaluation in marinas by: establishing database(s), addressing ground fault detection devices, and clarifying leakage testing of equipment
- Define the threat level and clarify the appropriate levels and times for tripping electrical equipment.
- Address the modeling of the person in the water, to investigate the behavior of the human body when it is subjected to electric fields.
- Clarify specific ground fault protection on the main, and necessary personal protection at the pedestal.

The following Awareness approach was indicated worthy of prioritization:

- Initiate a public safety campaign similar to other fire related and safety issues, such as fire prevention week, learn not to burn, stop, drop and roll, etc.

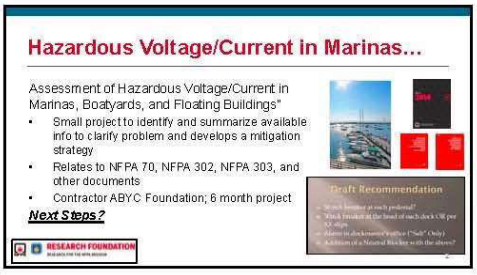
ANNEX A: WORKSHOP PARTICIPANTS AND ATTENDEES

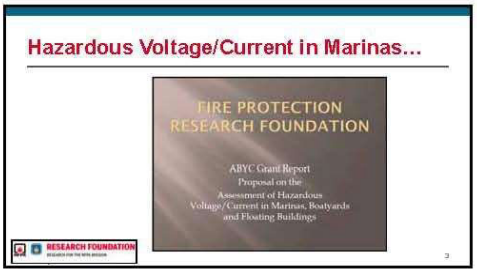
The following were the workshop attendees at the research planning session on "*Hazardous Voltage/Current in Marinas, Boatyards and Floating Buildings*", held in Linthicum, Maryland on Thursday 13 August 2015.

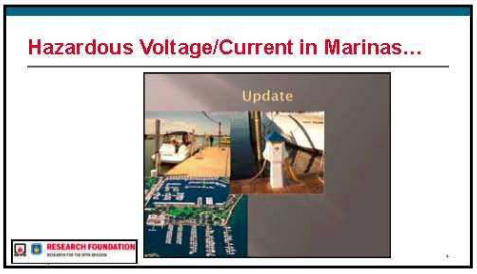
Randal Andress, Huntsville AL (call in)
Paul Brazis, UL LLC
Brett Brenner, ESFI (call in)
Ed Brill, SEA Ltd.
Larry Budd, Charles Marine
Ken Bush, MD SFMs Office & NFPA 303 Chair
Steve Campolo, Leviton (call in)
Ron Chilton, North Carolina DOI & CMP-19 Chair
Shane Clary, Bay Alarm Company (call in)
Donny Cook, IAEI
James Cote, Cote Marine
Gregory Davis, ESI
Mark Earley, NFPA
Lanny Floyd, Electrical Safety Group
Charlie Game, E. C. Game Engineering
Casey Grant, FPRF
John Goodsell, Hubbell
Palmer Hickman, IBEW
Ray Lauriello, Southern NJ Chapter of IAEI
Doug Lee, CPSC
Tim McClintock, NFPA
John McDevitt, MSFP & NFPA 302 Chair
Massimo Mitolo, ESI
Jim Rowland, South Jersey Electrical Inspectors Association
Larry Russell, NFPA
Jeff Sargent, NFPA
Terry Victor, Tyco / SimplexGrinnell
Wayne Waggoner, TN Fire Sprinkler Contractors Association (call in)
Chris Walker, Eaton
Donald Zipse, Electrical Forensic

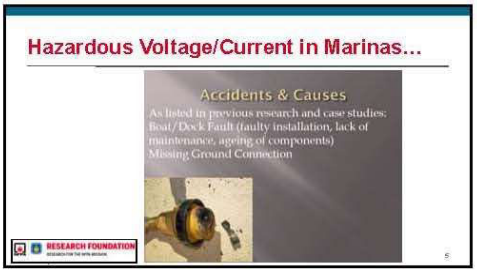
ANNEX B: WORKSHOP POWERPOINT SLIDES: OVERVIEW

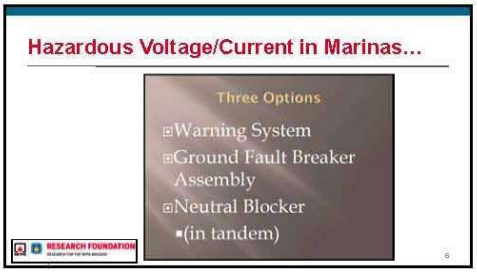
8/13/2015











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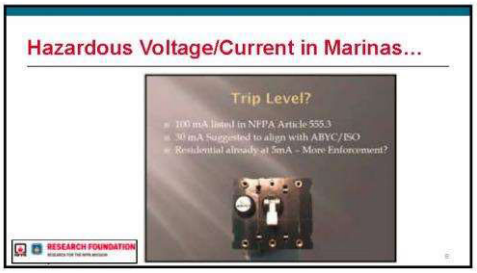
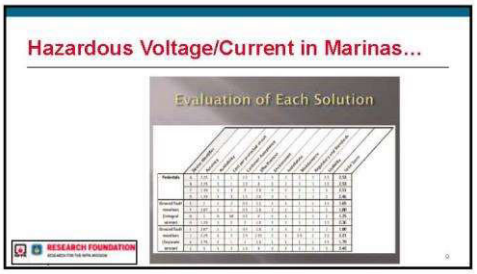
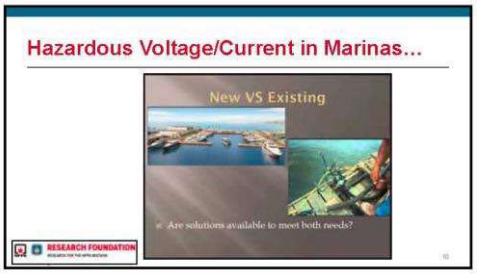
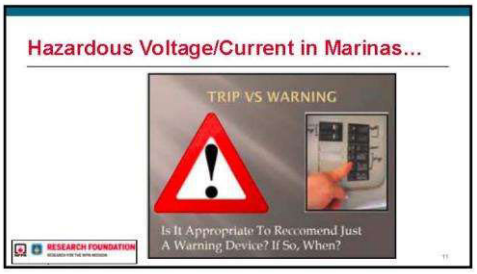
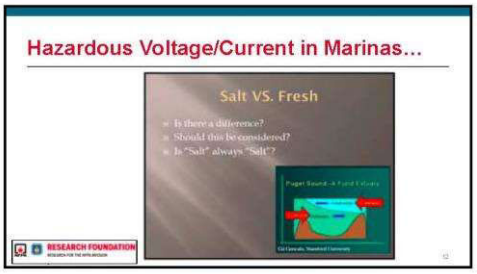
Annex B: Workshop PowerPoint Slides Overview (1 of 3)











Annex B: Workshop PowerPoint Slides Overview (2 of 3)

Hazardous Voltage/Current in Marinas...

Draft Recommendation

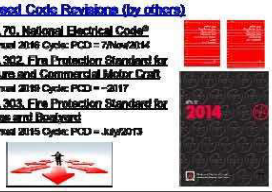
- 30 mA breaker at each pedestal
- Work must be done on a recommendation for a solution on the "main feeder"
- "Phantom" neutral current not enough to cause any harm.

RESEARCH FOUNDATION

Hazardous Voltage/Current in Marinas...

Proposed Code Revisions (by others)

- NFPA 70, National Electrical Code®
  - Annual 2016 Cycle: PCD = 7/Nov/2014
- NFPA 302, Fire Protection Standard for Pleasure and Commercial Motor Craft
  - Annual 2018 Cycle: PCD = ~2017
- NFPA 303, Fire Protection Standard for Marinas and Boatyard
  - Annual 2015 Cycle: PCD = July/2013



RESEARCH FOUNDATION

RESEARCH FOUNDATION
RESEARCH FOR THE NFPA MISSION

What are:

a) Research Priorities?
b) Next Steps?

Annex B: Workshop PowerPoint Slides Overview (3 of 3)

ANNEX C: WORKSHOP POWERPOINT SLIDES: NEC IMPLICATIONS

8/13/2015

Marinas

Tennessee

- Open Marina.
- NEC Articles 555 & 682.

Tennessee

- Open Marina.
- NEC Articles 555 & 682.

Tennessee

- Open Marina.
- NEC Articles 555 & 682.

Illinois

- Marina & Floating Building.
- NEC Articles 555, 553, & 682.

Illinois

- Open Marina.
- NEC Articles 555 & 682.

1

Annex C: Workshop PowerPoint Slides NEC Implications (1 of 8)

Illinois

- Open Marina.
- NEC Articles 555 & 682.

Florida

- Open Marina.
- NEC Articles 555 & 682.

Florida

- Open Marina.
- NEC Articles 555 & 682.

Florida

- Open Marina.
- NEC Articles 555 & 682.
- Building is in the water. Not sure if it is floating. Does it matter?

Massachusetts

- Open Marina with floating building on the pier.
- NEC Articles 555, 553 & 682.

Massachusetts

- Open Marina with floating building on the pier.
- NEC Articles 555, 553 & 682.

Annex C: Workshop PowerPoint Slides NEC Implications (2 of 8)

Massachusetts

- Open Marina with floating building on the pier.
- NEC Articles 555, 553 & 682.

Massachusetts

- Open Marina.
- NEC Articles 555 & 682.

Massachusetts

- Open Marina.
- NEC Articles 555 & 682.

California

- Pier.
- NEC Article 682.

California

- Pier.
- NEC Article 682.

California

- Marina.
- NEC Articles 555 & 682.

Annex C: Workshop PowerPoint Slides NEC Implications (3 of 8)

California

- Marina.
- NEC Articles 555 & 682.

California

- Marina & Building (Not floating, but does it matter).
- NEC Articles 555 & 682.

California

- Marina.
- NEC Articles 555 & 682.

Washington DC

- Marina.
- NEC Articles 555 & 682.

Alabama

- Marina & Floating Building.
- NEC Articles 555, 553, & 682.

Alabama

- Open Marina.
- NEC Articles 555 & 682.

Annex C: Workshop PowerPoint Slides NEC Implications (4 of 8)

Alabama

- Roofed Open Sided Marina.
- NEC Articles 555 & 682.

Alabama

- Marina/Pier & Floating Building.
- NEC Articles 555, 553, & 682.

Alabama

- Open Marina.
- NEC Articles 555 & 682.

Alabama

- Open Marina.
- NEC Articles 555 & 682.

Alabama

- Roofed Open Sided Marina.
- NEC Articles 555 & 682.

Alabama

- Open Marina with Fueling Dispenser.
- NEC Article 555, 514, & 682.

Annex C: Workshop PowerPoint Slides NEC Implications (5 of 8)

Alabama

- Residential Boathouses & Piers.
- NEC Articles 555? & 682, 210.8.

Alabama

- Residential Boathouses & Piers.
- NEC Articles 555? & 682, 210.8.

Alabama

- Residential Boathouses & Piers.
- NEC Articles 555? & 682, 210.8.

Alabama

- Residential Boathouses & Piers.
- NEC Articles 555? & 682, 210.8.

Alabama

- Residential Boathouses & Piers.
- NEC Articles 555? & 682, 210.8.

Alabama

- Residential Boathouses & Piers.
- NEC Articles 555? & 682, 210.8.

Annex C: Workshop PowerPoint Slides NEC Implications (6 of 8)

Alabama

- Residential Boathouses, Piers, & equipment (pumps, fountains, etc.)
- NEC Articles 555? & 682, 210.8.

Alabama

- Residential Boathouses, Piers, & equipment (pumps, fountains, etc.)
- NEC Articles 555? & 682, 210.8.

Alabama

- Residential Boathouses & Piers.
- NEC Articles 555? & 682, 210.8.

Alabama

- Residential Boathouses & Piers.
- NEC Articles 555? & 682, 210.8.

Alabama

- Residential Boathouses & Piers.
- NEC Articles 555? & 682, 210.8.

Alabama

- Residential Boathouses & Piers.
- NEC Articles 555? & 682, 210.8.

Annex C: Workshop PowerPoint Slides NEC Implications (7 of 8)

NEC Text

210.8 Ground-Fault Circuit-Interrupter Protection for Personnel. Ground-fault circuit-interrupter protection for personnel shall be provided as required in 210.8(A) through (C). The ground-fault circuit-interrupter shall be installed in a readily accessible location.

Informational Note: See 215.9 for ground-fault circuit-interrupter protection for personnel on feeders.

(A) Dwelling Units. All 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in 210.8(A)(1) through (10) shall have ground-fault circuit-interrupter protection for personnel.

NEC Text

(3) Outdoors
(8) Boathouses

(B) Other Than Dwelling Units. All 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in 210.8(B)(1) through (8) shall have ground-fault circuit-interrupter protection for personnel.

(4) Outdoors

NEC Text

(C) Boat Hoists. GFCI protection shall be provided for outlets not exceeding 240 volts that supply boat hoists installed in dwelling unit locations.

NEC Text

ARTICLE 553
Floating Buildings

I. General

553.1 Scope. This article covers wiring, services, feeders, and grounding for floating buildings.

553.2 Definition.

Floating Building. A building unit, as defined in Article 100, that floats on water, is moored in a permanent location, and has a premises wiring system served through connection by permanent wiring to an electrical supply system not located on the premises.

NEC Text

ARTICLE 555
Marinas and Boatyards

555.1 Scope. This article covers the installation of wiring and equipment in the areas comprising fixed or floating

piers, wharves, docks, and other areas in marinas, boatyards, boat basins, boathouses, yacht clubs, boat condominiums, docking facilities associated with residential condominiums, any multiple docking facility, or similar occupancies, and facilities that are used, or intended for use, for the purpose of repair, berthing, launching, storage, or fueling of small craft and the moorage of floating buildings.

Private, noncommercial docking facilities constructed or occupied for the use of the owner or residents of the associated single-family dwelling are not covered by this article.

Informational Note: See NFPA 303-2011, *Fire Protection Standard for Marinas and Boatyards*, for additional information.

NEC Text

ARTICLE 682
Natural and Artificially Made Bodies of Water

I. General

682.1 Scope. This article applies to the installation of electrical wiring for, and equipment in and adjacent to, natural

or artificially made bodies of water not covered by other articles in this *Code*, such as but not limited to aeration ponds, fish farm ponds, storm retention basins, treatment ponds, irrigation (channels) facilities.

Annex C: Workshop PowerPoint Slides NEC Implications (8 of 8)

ANNEX D: CODE FUND REQUEST FORM

The following is the Code Fund Request Form (available at www.nfpa.org/CodeFund) used to package and consider projects by the Fire Protection Research Foundation:

Project Statement Form

Return to research@nfpa.org

Fire Protection Research Foundation, One Batterymarch Park, Quincy, MA 02169-7471

1) **Proposed Project Title:**

2) **Problem Statement (One or two sentences addressing "What is the research or data need?"):**

3) **Research Objective (One or two sentences addressing "What is needed to solve the problem?" Examples include: Develop guidance for a specific issue, Determine effectiveness of current code/standard requirement):**

4) **Project Description (One or two paragraphs on study design & expected tasks. Project tasks can include literature reviews, data collection, loss summaries, field usage surveys, code comparisons, statistical analysis, computer modeling, hazard analysis, risk assessments, fire testing, recommendation development, and gap identification.):**

5) **Data Collection (If data collection is part of the project scope, does data exist? If data exists, is it available to be used in the study? Please identify potential data sources.)**

6) **Relevant NFPA Document(s), Technical Groups, or Foundation strategic research agenda item & How Project Will Impact:**

7) **Organizations That Could Possibly Fund (Examples: government grants, industry consortia, stakeholders):**

8) **When Do You Need Project Deliverables (when is information needed to coordinate with document revision cycles, sense of urgency):**

9) **Submitted By (Staff Liaison/TC Chair/etc) and Date Submitted:**

Form Updated: 24 July 2015

Public Input No. 1555-NFPA 70-2020 [New Section after 555.13]

555.14 Equipotential Planes and Bonding of Equipotential Planes.

An equipotential plane shall be installed where required in this section to mitigate step and touch voltages at electrical equipment.

(A) Areas Requiring Equipotential Planes.

Equipotential planes shall be installed adjacent to all outdoor service equipment or disconnecting means that control equipment in or on water where the following conditions exist:

1. Where the system voltage exceeds 250V to ground.

2. Where the equipment is located within 3 m (10 ft) of the body of water.

The equipotential plane shall include all metallic enclosure and controls accessible to personnel, and that are likely to become energized. The equipotential plane shall encompass the area around the equipment and shall extend from the area directly below the equipment out not less than 900 mm (36 in.) in all directions from which a person would be able to stand and come in contact with the equipment.

(B) Areas Not Requiring Equipotential Planes.

Equipotential planes shall not be required for the controlled utilization equipment on the docking facility or floating building supplied by the service equipment or disconnecting means.

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Statement of Problem and Substantiation for Public Input

This public input was prepared by the correlating committee task group focused on bodies of water. This task group consisted of the following members: Kevin Arnold (CMP 10, CMP 13), Thomas Blewitt (CMP 17), Donny Cook (CMP 17, CC), Thomas Domitrovich (CMP 2, CMP 10), Bill Fiske (CMP 14), Dean Hunter (CMP 7), Cliff Norton (CMP 7, NFPA 303), Christine Porter (CMP 5, CC), Mike Query (CMP 17), David Smith, Dave Watson (CMP 6).

This public input is an effort to correlate with 682.33 with same title. These applications are similar and so are the electrical hazards. This public input will ensure the same level of safety is provided in both of these applications.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1554-NFPA 70-2020 [Section No. 682.33]	Correlation

Submitter Information Verification

Submitter Full Name: Thomas Domitrovich
Organization: Eaton Corporation
Street Address:
City:
State:
Zip:

Submittal Date: Wed Jun 17 13:11:11 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7925-NFPA 70-2020

Statement: Enhanced safety will be achieved by requiring an equipotential plane to mitigate step and touch voltages for electrical equipment that supplies power to equipment located at or on docks. In addition, this section correlates with section 682.33 with same title.

Public Input No. 3145-NFPA 70-2020 [New Section after 555.13]

TITLE OF NEW CONTENT

555.XXX Replacement of Equipment. Any modification, replacement or repair of electrical enclosures, devices, or wiring methods on a docking facility shall be required to comply with the provisions of this code. When modification, replacement or repair of an electrical enclosure, device, or wiring method is necessary on a docking facility and the installation date exceeds ten years, the installation shall also comply with (A) or (B).

(A) The entire circuit shall be replaced with new electrical enclosures, devices, and wiring method and comply with this code.

(B) The entire circuit shall comply with the following conditions:

1. The marina is under continuous maintenance supervision
2. An inspection is conducted of the entire circuit
3. All identified concerns during the inspection are documented by a qualified person
4. Remediation is conducted on all identified concerns

Informational Note: NFPA 303 Fire Protection Standard for Marinas and Boatyards is a resource for guiding the electrical inspection of a marina.

Additional Proposed Changes

File Name	Description	Approved
081.JPG		
091.JPG		
285.JPG		
499.JPG		
534.JPG		
598.JPG		
609.JPG		
618.JPG		
720.JPG		
771.JPG		
810.JPG		
817.JPG		
875.JPG		
876.JPG		
884.JPG		
893.JPG		
1091.JPG		
1096.JPG		
1096.JPG		
1203.JPG		
1121.JPG		
1236.JPG		

1236.JPG
1248.JPG
1444.JPG
1447.JPG
1459.JPG
2017-07-31_08.49.11.jpg
2017-07-31_08.56.31.jpg
2018-05-14_08.49.15.jpg
2017-07-31_09.17.38-1.jpg
2018-05-14_08.49.15.jpg
2018-05-14_09.01.34.jpg
2018-05-14_09.05.09.jpg
2018-05-14_09.13.14_HDR.jpg
2018-05-14_09.57.11.jpg
2018-05-14_09.57.11.jpg
2018-05-14_09.57.22.jpg
2018-05-14_09.57.23.jpg
2018-05-14_12.08.37_HDR.jpg
2018-05-19_09.08.23_HDR.jpg
2018-05-19_09.21.44.jpg
2018-05-19_09.41.39.jpg
2018-05-19_09.42.43.jpg
2018-05-19_10.11.00.jpg
2018-05-19_10.43.53.jpg
2018-05-19_10.44.44.jpg
2018-05-19_10.47.14.jpg
2018-05-19_10.51.47_HDR.jpg
2018-05-19_11.12.30.jpg
2018-05-19_11.12.34.jpg
2018-05-19_11.12.43.jpg

Statement of Problem and Substantiation for Public Input

Electrical systems installed in marinas are exposed to an extremely harsh environment. Regular inspection and maintenance are critical to safe operation and use of the facilities based on that environment. NFPA 303 includes requirements for regular inspection and subsequent repair of electrical equipment and installations, however adoption and enforcement of NFPA 303 is not as common as NFPA 70 (NEC). For areas that do not adopt and enforce NFPA 303, this proposed new provision in the NEC would simply require equipment and installations to be replaced at some time frame. Similar public inputs were resolved in the 2020 cycle with statements that no substantiation was provided for the time frame. While that statement is correct, it is obvious that equipment will not perform safely for an unlimited amount of time. Pictures of many examples can be provided as examples. This PI also provides marina owners/operators an option to simply follow the requirements in NFPA 303 with no additional effort. Many marinas already implement that process, provide and maintain safe installations and this PI acknowledges that option. Based on recorded incidents across the country through the years, many systems are not required to adhere to the NFPA 303 requirements and choose not to include regular inspection and maintenance. It should also be noted the scope of NFPA 303 does not include noncommercial docks associated with single family homes. At least some of the incidents have occurred at installations not subject to the requirements of NFPA 303.

Submitter Information Verification

Submitter Full Name: Donald Cook
Organization: Shelby County Department of De
Affiliation: self
Street Address:
City:
State:
Zip:
Submittal Date: Sat Sep 05 15:53:51 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7926-NFPA 70-2020

Statement: Electrical systems installed at docking facilities are exposed to harsh environments. When equipment is replaced, the inspection, and maintenance of the entire circuit will ensure safe electrical installations to reduce the incidents related to electric shock drowning.

OVER CURRENT PROTECTION
IF BREAKER TRIPS, HANDLE WILL BE IN TRIP POSITION
TO RESTORE SERVICE:
1. MOVE HANDLE TO "OFF" POSITION.
2. THEN MOVE HANDLE TO "ON" POSITION.
PN 200026
US LISTED
30A 125V
20A 12
50A
DANGER- Turn disconnecti
or circuit breaker off before in
or removing plug. Plug must b
inserted or removed.
For Shore Power

WARNING
TEST BEFORE EACH USE
DO NOT USE IF ABOVE TEST FAILS!
Sump Guard

IFE /EST
NDER SEAT

5
HUBBELL POWER CENTER
Life is Better at the Lake

13
30A
125V
SANGAMO ELECTRIC
98312
47818023
Cutler-Hammer
Circuit Analyzer
Wiring Indicators

30A
125V

MADE IN U.S.A.
MAIN BREAKER

40
40
POWER OUTLE
F-510588
125V

LISTED
POWER
OUTLET
40 RF

T
NOT FOR SHORE POWER
FOR SHORE POWER ONLY
FOR SHORE POWER ONLY
LISTED
POWER
OUTLET
40 RF

NOT FOR SHORE POWER
FOR SHORE POWER ONLY
338

E HANDLE TO "OFF" POSITION, THEN BACK
ON" POSITION.
DESIGNATION AND HAVE
GREATER SHORT CIRCUIT

NOT FOR SHORE POWER
LIGHTHOUSE

as marina and boatyard service
equipment where an acceptable
grounding program is provided
for cord connected equipment.
OVER CURRENT PROTECTION
IF A BREAKER TRIPS, HANDLE WILL BE IN
INTERMEDIATE POSITION. TO RESTORE SERVICE,
MOVE HANDLE TO "OFF" POSITION, THEN BACK
TO "ON" POSITION.
PHOTOELECTRIC SWITCH BUT NO MORE THAN
10,000 RMS SYMMETRICAL AMPERES AT 240
VOLTS SINGLE PHASE. IF NO SHORT CIRCUIT
RATING IS GIVEN FOR A COMPONENT, IT IS
CONSIDERED TO HAVE THE FOLLOWING RATING:
PHOTOELECTRIC SWITCH 5,000 RMS
SYMMETRICAL AMPS AT 240 VOLTS SINGLE
PHASE, FUSE 10,000 RMS SYMMETRICAL AMPS
AT 125 VOLTS SINGLE PHASE. ADDITIONAL OR
REPLACEMENT COMPONENTS SHALL BE OF
THE SAME MANUFACTURERS AND TYPE
DESIGNATION AND HAVE AN EQUAL OR
GREATER SHORT CIRCUIT CURRENT RATING.
FOR SHORE POWER ONLY
NOT FOR SHORE POWER
MARINA POWER
1-800-723-8006

as marina and boatyard service
equipment where an acceptable
grounding program is provided
for cord connected equipment.
OVER CURRENT PROTECTION
IF A BREAKER TRIPS, HANDLE WILL BE IN
INTERMEDIATE POSITION. TO RESTORE SERVICE,
MOVE HANDLE TO "OFF" POSITION, THEN BACK
TO "ON" POSITION.
PHOTOELECTRIC SWITCH BUT NO MORE THAN
10,000 RMS SYMMETRICAL AMPERES AT 240
VOLTS SINGLE PHASE. IF NO SHORT CIRCUIT
RATING IS GIVEN FOR A COMPONENT, IT IS
CONSIDERED TO HAVE THE FOLLOWING RATING:
PHOTOELECTRIC SWITCH 5,000 RMS
SYMMETRICAL AMPS AT 240 VOLTS SINGLE
PHASE, FUSE 10,000 RMS SYMMETRICAL AMPS
AT 125 VOLTS SINGLE PHASE. ADDITIONAL OR
REPLACEMENT COMPONENTS SHALL BE OF
THE SAME MANUFACTURERS AND TYPE
DESIGNATION AND HAVE AN EQUAL OR
GREATER SHORT CIRCUIT CURRENT RATING.
FOR SHORE POWER ONLY
NOT FOR SHORE POWER
MARINA POWER
1-800-723-8006

Marina Power and Lighting, Inc.
149 Warwick Court • Williamsburg, VA 23185
"LIGHTHOUSE" UTILITY STATION MODEL LH 3050
Type 3R Weatherproof Enclosure
250 Amps Max., 2 Wire, 120 Volts or
3 Wire, 120/240 Volts AC, 60 Hz.
This unit is suitable for use
as marina and boatyard service
equipment where an acceptable
grounding program is provided
for cord connected equipment.
OVER CURRENT PROTECTION
IF A BREAKER TRIPS, HANDLE WILL BE IN
INTERMEDIATE POSITION. TO RESTORE SERVICE,
MOVE HANDLE TO "OFF" POSITIO
TO "ON POSITION.
THE SHORT CIRCUIT CURRENT RATING OF
POWER OUTLET IS EQUAL TO THE LOW
SHORT CIRCUIT CURRENT RATING OF A
INSTALLED CIRCUIT BREAKER, FUSE,
PHOTOELECTRIC SWITCH BUT NO MORE TH
10,000 RMS SYMMETRICAL AMPERES AT 2
VOLTS SINGLE PHASE. IF NO SHORT CIRCU
RATING IS GIVEN FOR A COMPONENT, IT I
CONSIDERED TO HAVE THE FOLLOWING RATING
PHOTOELECTRIC SWITCH 5,000 RMS
SYMMETRICAL AMPS AT 240 VOLTS SINGLE
PHASE FUSE 10,000 RMS SYMMETRICAL AMPS
AT 240 VOLTS SINGLE PHASE. ADDITIONAL OR
REPLACEMENT COMPONENTS SHALL BE OF
THE SAME MANUFACTURERS AND TYPE
DESIGNATION AND HAVE AN EQUAL OR
GREATER SHORT CIRCUIT CURRENT RATING.
NOT FOR SHORE POWER
240
120

AL1630ST
18

CAUTION-RISK OF FIRE
USE ONLY 70 WATT
MAXIMUM LAMP

SOUTH
BOAT
NORTH
BOAT
LIGHTS
PLUGS

On/I
On/I

LEVITON

TEST MONTHLY
TEST MECH

On/I

OK38YO
NOM 057
COUVERCLE ADAPTE A REMPLACEMENT MOUILLE
SUITABLE FOR WET LOCATIONS WHILE IN USE

Public Input No. 1494-NFPA 70-2020 [Section No. 555.30]

555.30 Electrical Equipment and Connections.

(A) ~~Floating Piers~~ General .

~~Electrical connections~~ All electrical equipment (excluding wiring methods) and connections not intended for operation while submerged shall be located at least 305 mm (12 in.) above the deck of a ~~floating pier~~ fixed or floating structure, but not below the electrical datum plane . Conductor splices, ~~withinjunction~~ within junction boxes identified for wet locations, utilizing sealed wire connector systems listed and identified for submersion shall be required for floating ~~piers~~ structures where located above the waterline but below the electrical datum plane ~~for floating piers~~ .

~~(C)~~

(B) ~~Fixed Piers.~~

~~All electrical connections shall be located at least 305 mm (12 in.) above the deck of a fixed pier but shall not be located below the electrical datum plane.~~

Replacements.

Replacement electrical connections shall be located at least 305 mm (12 in.) above the deck of a floating ~~pier~~ or fixed structure . Conductor splices, within junction boxes identified for wet locations, utilizing sealed wire connector systems listed and identified for submersion shall be required where located above the waterline but below the electrical datum plane ~~for floating piers~~ .

Statement of Problem and Substantiation for Public Input

This public input was prepared by the correlating committee task group focused on bodies of water. This task group consisted of the following members: Kevin Arnold (CMP 10, CMP 13), Thomas Blewitt (CMP 17), Donny Cook (CMP 17, CC, NFPA 303), Thomas Domitrovich (CMP 2, CMP 10), Bill Fiske (CMP 14), Dean Hunter (CMP 7), Cliff Norton (CMP 7, NFPA 303), Christine Porter (CMP 5, CC), Mike Query (CMP 17), David Smith, Dave Watson (CMP 6).

This change adds clarity and aligns with existing requirements in Article 682. First level sub-division (A) and (B) were combined and necessary changes made to accommodate. The references to electrical equipment in addition to connections further clarifies that fact that it is important that this equipment, other than wiring methods, that are not intended for operation while submerged be appropriately located above the deck or datum plane. Floating pier was replaced with fixed or floating structure for clarity and accuracy of this requirement. Piers was replaced with a more generic term of structures as any structure that is floating is impacted. The new (B) is the old (C) with minor modifications replacing "pier" with "or fixed structure." for clarity.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1495-NFPA 70-2020 [Section No. 682.12]	

Submitter Information Verification

Submitter Full Name: Thomas Domitrovich
Organization: Eaton Corporation
Street Address:

City:
State:
Zip:
Submittal Date: Tue Jun 09 12:41:33 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7929-NFPA 70-2020

Statement: The separate sections for fixed and floating structures should be combined under a new “General” heading and the term “piers” has been changed to “structures” throughout the section to clarify that the requirements apply to all fixed and floating structures.

Public Input No. 2926-NFPA 70-2020 [Section No. 555.30]

555.30 Electrical Connections.

(A) Floating Piers.

Electrical connections shall be located at least 305 mm (12 in.) above the deck of a floating pier. Conductor splices, withinjunction boxes identified for wet locations, utilizing sealed wire connector systems listed and identified for submersion shall be required for floating piers where located above the waterline but below the electrical datum plane for floating piers.

(B) Fixed Piers.

All electrical connections shall be located at least 305 mm (12 in.) above the deck of a fixed pier but shall not be located below the electrical datum plane.

(C) Replacements.

Replacement electrical connections shall be located at least 305 mm (12 in.) above the deck of a floating or fixed pier. Conductor splices, within junction boxes identified for wet locations, utilizing sealed wire connector systems listed and identified for submersion shall be required where located above the waterline but below the electrical datum plane for floating or fixed piers.

Statement of Problem and Substantiation for Public Input

The replacement requirements should also apply to fixed piers.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 03 09:37:44 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7929-NFPA 70-2020
Statement: The separate sections for fixed and floating structures should be combined under a new “General” heading and the term “piers” has been changed to “structures” throughout the section to clarify that the requirements apply to all fixed and floating structures.

Public Input No. 1015-NFPA 70-2020 [Section No. 555.30(A)]

(A) Floating Piers.

Electrical connections shall be located at least 305 mm (12 in.) above the deck of a floating pier. Conductor splices, ~~withinjunction~~ within junction boxes identified for wet locations, utilizing sealed wire connector systems listed and identified for submersion shall be required for floating piers where located above the waterline but below the electrical datum plane for floating piers.

Statement of Problem and Substantiation for Public Input

The problem could be a printing error, however, the words "withinjunction" needs to be separated. Both the words within and junction are two separate words and needs to have a space in between the two.

Submitter Information Verification

Submitter Full Name: Nija Jones
Organization: E Light Electric Services Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Sat May 09 11:17:21 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7929-NFPA 70-2020
Statement: The separate sections for fixed and floating structures should be combined under a new “General” heading and the term “piers” has been changed to “structures” throughout the section to clarify that the requirements apply to all fixed and floating structures.

Public Input No. 311-NFPA 70-2020 [Section No. 555.31]

555.31 Electrical Equipment ~~Enclosures~~ .

(A) Securing and Supporting.

Electrical equipment ~~enclosures~~ installed on piers above and below deck level shall be securely and substantially supported by structural members, independent of any conduit connected to them. If enclosures are not attached to mounting surfaces by means of external ears or lugs, the internal screw heads shall be sealed to prevent seepage of water through mounting holes.

(B) Location.

Electrical equipment ~~enclosures~~ on piers shall be located so as not to interfere with mooring lines.

Statement of Problem and Substantiation for Public Input

raceways or luminare are not addressed in this section and are subject to the same hazard

Submitter Information Verification

Submitter Full Name: Alfio Torrisi
Organization: Master electrician
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jan 16 13:34:23 EST 2020
Committee: NEC-P07

Committee Statement

Resolution: By removing the term “enclosures”, the requirements would apply to all electrical equipment as opposed to only electrical enclosures, which exceeds the intended scope of the section. The removal of the term would not add clarity and could create unintended consequences for installers.

Public Input No. 1635-NFPA 70-2020 [Section No. 555.33(B)]

(B) Other Than Shore Power.

(1) Ground-Fault Circuit-Interrupter (GFCI) Protection for Personnel.

Receptacles ~~in~~ for other ~~locations shall be protected~~ than shore power shall have GFCI protection in accordance with 210.8.

(2) Marking.

Receptacles other than those supplying shore power to boats shall be permitted to be enclosed in marina power outlets with the receptacles that provide shore power to boats, provided the receptacles are marked to clearly indicate that the receptacles are not to be used to supply power to boats.

Statement of Problem and Substantiation for Public Input

Slight text edit to make it clear that the rule is about other than shore power receptacles.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 24 16:23:26 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7930-NFPA 70-2020

Statement: GFCI protection requirements will be relocated to section 555.35. This language is not necessary as the requirements of 210.8 apply unless modified by this Article. The title of (2), “Marking”, was also deleted as it is not necessary.

Public Input No. 2424-NFPA 70-2020 [Section No. 555.33(B)]

(B) Other Than Shore Power.

~~**(1)** Ground-Fault Circuit-Interrupter (GFCI) Protection for Personnel.~~

Receptacles

~~in~~

other

~~locations shall be protected in accordance with~~ ~~210.8~~ .

~~**(2)** Marking.~~

~~Receptacles other~~

than those supplying shore power to boats shall be permitted to be enclosed in marina power outlets with the receptacles that provide shore power to boats, provided the receptacles are marked to clearly indicate that the receptacles are not to be used to supply power to boats.

Statement of Problem and Substantiation for Public Input

This public input was prepared by the correlating committee task group focused on bodies of water. This task group consisted of the following members: Kevin Arnold (CMP 10, CMP 13), Thomas Blewitt (CMP 17), Donny Cook (CMP 17, CC), Thomas Domitrovich (CMP 2, CMP 10), Bill Fiske (CMP 14), Dean Hunter (CMP 7), Cliff Norton (CMP 7, NFPA 303), Christine Porter (CMP 5, CC), Mike Query (CMP 17), David Smith, Dave Watson (CMP 6).

GFCI protection is covered as part of 555.35. This language is not necessary as the requirements of 210.8 apply unless modified by this Article. The title of (2), “Marking”, was also deleted as it is not necessary.

Submitter Information Verification

Submitter Full Name: Thomas Domitrovich
Organization: Eaton Corporation
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 20 13:47:41 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7930-NFPA 70-2020
Statement: GFCI protection requirements will be relocated to section 555.35. This language is not necessary as the requirements of 210.8 apply unless modified by this Article. The title of (2), “Marking”, was also deleted as it is not necessary.

Public Input No. 852-NFPA 70-2020 [New Section after 555.33(C)]

555.33 (D) Dock Lighting, Underwater luminaries

(A) Luminaire Design, Normal Operation. The design of an underwater luminaire supplied from a branch circuit either directly or by way of a transformer or power supply meeting the

requirements of this section shall be such that, where the luminaire is properly installed without a ground-fault circuit interrupter, there is no shock hazard with any likely combination

of fault conditions during normal use (not relamping).

(1) Transformers and Power Supplies. Transformers and

power supplies used for the supply of underwater luminaires,

together with the transformer or power supply enclosure, shall

be listed, labeled, and identified for underwater use. The transformer or power supply shall incorporate either a

transformer of the isolated winding type, with an ungrounded

secondary that has a grounded metal barrier between the

primary and secondary windings, or one that incorporates an

approved system of double insulation between the primary and

secondary windings.

(2) GFCI Protection, Lamping, Relamping, and Servicing.

Ground-fault circuit-interrupter protection for personnel shall

be installed in the branch circuit supplying luminaires operating

at voltages greater than the low-voltage contact limit.

(3) Bottom-Mounted Luminaires.

A luminaire facing upward

shall comply with either (1) or (2):

(1) Have the lens guarded to prevent contact by any person

(2) Be listed for use without a guard

(4) Dependence on Submersion.

Luminaires that depend on

submersion for safe operation shall be inherently protected

against the hazards of overheating when not submerged.

(8) Compliance. Compliance with these requirements shall

be obtained by the use of a listed underwater luminaire and by installation of a listed ground-fault circuit interrupter in the branch circuit or a listed transformer or power supply for luminaires operating at not more than the low voltage contact limit.

Additional Proposed Changes

File Name	Description	Approved
light-graphic.jpg	dock	
maxresdefault.jpg	dock 2	
gallery-dock-Sport_S3116d_1.jpg	dock 3	

Statement of Problem and Substantiation for Public Input

last code cycle this was dismissed because of the assumption 30 MA protection was sufficient however freeze current can occur at 15 MA this level of protection is needed to protect persons from electrical shock drownings.

Submitter Information Verification

Submitter Full Name: Alfio Torrisi
Organization: Master electrician
Street Address:
City:
State:
Zip:
Submittal Date: Fri Apr 10 10:02:47 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7931-NFPA 70-2020
Statement: Luminaires are currently not addressed in Article 555. The language adds clarity for both installers and AHJ's to address the electrically safe installations of luminaires at docking facilities in order to reduce the incidents of electric shock drowning.

DEEP GLOW
TEST
RESET
DEEPGLOW

Public Input No. 2191-NFPA 70-2020 [Section No. 555.34(A)]

(A) Wiring Methods.

(1) General.

Wiring methods of Chapter 3 that contain an insulated equipment grounding conductor shall be permitted where identified for use in wet locations.

(2) Portable Power Cables.

Extra-hard usage portable power cables that contain an insulated equipment grounding conductor rated not less than 75°C (167°F) ~~,~~ and 600 volts; listed for ~~both wet locations and sunlight resistance; and having an outer jacket rated to be resistant to temperature extremes, oil, gasoline, ozone, abrasion, acids, and chemicals~~ use in the environment within which it is installed, shall be permitted as follows:

(1) As permanent wiring on the underside of piers (floating or fixed)

(2) Where flexibility is necessary as on piers composed of floating sections

~~**(3)** Temporary Wiring.~~

~~Temporary wiring, except as permitted by Article 590 , shall not be used to supply power to boats.~~

Statement of Problem and Substantiation for Public Input

This public input was prepared by the correlating committee task group focused on bodies of water. This task group consisted of the following members: Kevin Arnold (CMP 10, CMP 13), Thomas Blewitt (CMP 17), Donny Cook (CMP 17, CC), Thomas Domitrovich (CMP 2, CMP 10), Bill Fiske (CMP 14), Dean Hunter (CMP 7), Cliff Norton (CMP 7, NFPA 303), Christine Porter (CMP 5, CC), Mike Query (CMP 17), David Smith, Dave Watson (CMP 6).

This public input adds the focus that the wiring methods of chapter 3 must include an insulated equipment grounding conductor as this is a requirement as part of these types of installations. The reference to temporary wiring was removed as the requirements of Article 590 would apply and this text is not necessary and its existence could cause confusion.

Added the word “and” in the rating of the extra hard usage portable power cables to ensure the not less than applies to both the temperature and voltage rating.

555.34(A)(2) was modified to allow better selection of the appropriate wiring method to be installed based on the environmental conditions of the installation location.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2192-NFPA 70-2020 [Section No. 682.13]	

Submitter Information Verification

Submitter Full Name: Thomas Domitrovich
Organization: Eaton Corporation
Street Address:

City:
State:
Zip:
Submittal Date: Fri Aug 07 14:32:10 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7932-NFPA 70-2020

Statement: For the revisions made to 55.34(A), Chapter chapter 3 wiring methods must include an insulated equipment grounding conductor to be consistent with 555.37. The reference to temporary wiring was removed as the requirements of Article 590 would apply, and was therefore redundant. In addition, the word “and” was added in the cable rating requirement to ensure that cable installations have both the proper temperature and voltage rating.

555.34(A)(2) was modified to include “extra hard usage cord” and eliminated the list or cable ratings to allow a cable to be installed based on the environmental conditions of the installation location.

For the revisions made to 55.34(B), Added intermediate metal conduit to list of approved conduits that provide protection from physical damage. Similar to the requirements in 300.5, text was added to limit the height to 2.5 m (8 ft.) to recognize that above this height, an approved Chapter 3 wiring method would be acceptable because severe physical damage is not likely.

Public Input No. 521-NFPA 70-2020 [Section No. 555.34(A)(1)]

(1) General.

~~Wiring~~ wiring methods for conditions of ~~Chapter 3~~ use shall be permitted where identified for use in ~~wet locations.~~ submersable locations

Statement of Problem and Substantiation for Public Input

Working in the field in Florida I have came across numorus extremely hazardous docking facilities,

-Consistant raceway separation
-AHJ's need stricter enforcement (or education) of table 352.44
-Deterioration due to intrusion of SEA WATER by means of raceway separation, THHN/THWN has zero corrosion resistive properties and is not UL listed for submersible applications.
- this has caused dangerous leakage issues around docking facilities.
-This deterioration of connections is also causing such high impedance back to the source OCPD's are not opening thus casing pedestal fires. these connections need to be protected, the EGC's are not doing their job in relation to fault current due to these permitted chapter three wiring methods.
-poses a safety concern for the public.

I strongly feel the language needs to be adjusted to not include all chapter three wiring methods. there are other forms of insulation available that will provide protection of conductors to seawater. the panel should possibly consider making the areas around certain terminations hermetically sealed with some form of a potting compound. or consider classifying them as a location where all wiring methods need to comply with a corrosive location.

Considering these proposed changes to this article will greatly help reduce EDS's, I feel strongly about any time we can help safe guard the public. I hope the panel examines this is great detail. it is something that needs to be done.

Submitter Information Verification

Submitter Full Name: anthony Solino
Organization: Southern Shores Electric Company (owner)
Street Address:
City:
State:
Zip:
Submittal Date: Sun Feb 23 11:31:11 EST 2020
Committee: NEC-P07

Committee Statement

Resolution: Cable insulation rated for “wet” locations is sufficient when the system is installed and maintained properly. Requiring cables identified for submersible locations would be an unnecessary burden with no significant benefit.

Public Input No. 3749-NFPA 70-2020 [Section No. 555.34(B)(4)]

(4) Protection.

Rigid metal conduit, intermediate metal conduit, reinforced thermosetting resin conduit (RTRC) listed for aboveground use, or rigid polyvinyl chloride (PVC) conduit suitable for the location, shall be installed to protect wiring above decks of piers and landing stages and below the enclosure that it serves. The conduit shall be connected to the enclosure by full standard threads or fittings listed for use in damp or wet locations, as applicable.

Statement of Problem and Substantiation for Public Input

There is no reason to allow RMC and prohibit IMC.

Submitter Information Verification

Submitter Full Name: Ryan Jackson
Organization: Ryan Jackson
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 11:45:20 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7932-NFPA 70-2020

Statement: For the revisions made to 55.34(A), Chapter chapter 3 wiring methods must include an insulated equipment grounding conductor to be consistent with 555.37. The reference to temporary wiring was removed as the requirements of Article 590 would apply, and was therefore redundant. In addition, the word “and” was added in the cable rating requirement to ensure that cable installations have both the proper temperature and voltage rating.

555.34(A)(2) was modified to include “extra hard usage cord” and eliminated the list or cable ratings to allow a cable to be installed based on the environmental conditions of the installation location.

For the revisions made to 55.34(B), Added intermediate metal conduit to list of approved conduits that provide protection from physical damage. Similar to the requirements in 300.5, text was added to limit the height to 2.5 m (8 ft.) to recognize that above this height, an approved Chapter 3 wiring method would be acceptable because severe physical damage is not likely.

Public Input No. 1484-NFPA 70-2020 [Section No. 555.35]

555.35 Ground-Fault Protection of Equipment (GFPE) and Ground-Fault Circuit-Interrupter (GFCI) Protection.

~~**(A)** Ground-Fault Protection.~~

For other than floating buildings, ground-fault protection for docking facilities shall be provided in accordance with 555.35(A) through (

~~1) through (A)(3)~~

E) .

(

~~1) Receptacles Providing Shore Power.~~

~~Receptacles installed in accordance with 555.33(A) shall have individual GFPE set to open at currents not exceeding 30 milliamperes.~~

~~**(2)** GFCI Protection for Personnel.~~

~~All 125-volt, single-phase, 15- and 20-ampere receptacles for other than shore power shall be protected in accordance with 555.33(B)(1) and (B)(2).~~

~~**(3)** Feeder and Branch-Circuit Conductors with GFPE.~~

~~Feeder and branch-circuit conductors that are installed on docking facilities shall be provided with GFPE set to open at currents not exceeding 100 milliamperes.~~

A) Sources Directly Supplying Docking Facilities or Wharfs .

Listed GFPE, rated not more than 100 milliamperes, shall be provided for sources directly supplying all docking facilities or wharfs. Coordination with downstream GFPE shall be permitted.

(B) Feeder

Listed GFPE, rated not more than 100 milliamperes, shall be provided for feeders installed on docking facilities. Coordination with downstream GFPE shall be permitted at the feeder overcurrent protective device.

Exception to (

~~3~~

B): Transformer secondary conductors of a separately derived system that do not exceed 3 m (10 ft) and are installed in a raceway shall be permitted to be installed without ground-fault protection. This exception shall also apply to the supply terminals of the equipment supplied by the transformer secondary conductors.

(

~~B) Leakage~~

C) Branch-Circuits

(1) Receptacles Providing Shore Power.

Listed GFPE, rated not more than 30 milliamperes, shall be provided for receptacles installed in accordance with 555.33(A) .

(2) Outlets for Other than Shore Power .

Outlets supplied by branch circuits not exceeding 150 volts to ground and 60 amperes, single-phase, and 150 Volts or less to ground, 100 amperes or less, three phase, shall be provide with GFCI protection for personnel.

Exception to (C): Low-voltage circuits not requiring grounding, not exceeding the low-voltage contact limit as defined in 680.2, and supplied by listed transformers or power supplies that comply with 680.23(A)(2) shall be permitted to be installed without Ground-Fault protection.

(D) Boat Hoists

GFCI protection for personnel shall be provided for outlets not exceeding 240 volts that supply a boat hoist installed at docking facilities. GFCI protected receptacles for other than shore power shall be permitted to supply boat hoists.

(E) Leakage Current Measurement Device.

Where more than three receptacles supply shore power to boats, a leakage current measurement device shall be available and be used to determine leakage current from each boat that will utilize shore power.

Informational Note No. 1: Leakage current measurement will provide the capability to determine when an individual boat has defective wiring or other problems contributing to hazardous voltage and current. The use of a test device will allow the facility operator to identify a boat that is creating problems. In some cases a single boat may cause an upstream GFPE device protecting a feeder to operate even though multiple boats are supplied from the same feeder. The use of a test device will help the facility operator prevent a particular boat from contributing to hazardous voltage and current in the marina area.

Informational Note No. 2: An annual test of each boat with the leakage current measurement device is a prudent step toward determining if a boat has defective wiring that may be contributing hazardous voltage and current. Where the leakage current measurement device reveals that a boat is contributing hazardous voltage and current, repairs should be made to the boat before it is permitted to utilize shore power.

Statement of Problem and Substantiation for Public Input

This public input was prepared by the correlating committee task group focused on bodies of water. This task group consisted of the following members: Kevin Arnold (CMP 10, CMP 13), Thomas Blewitt (CMP 17), Donny Cook (CMP 17, CC, NFPA 303), Thomas Domitrovich (CMP 2, CMP 10), Bill Fiske (CMP 14), Dean Hunter (CMP 7), Cliff Norton (CMP 7, NFPA 303), Christine Porter (CMP 5, CC), Mike Query (CMP 17), David Smith, Dave Watson (CMP 6).

This change impacts in the following ways:

Organized the section first level sub-divisions into a logical order of main, feeder and then branch circuits.

Removed the reference to services as the feeders supplying the docking facilities or wharfs are the main concern. Putting GFPE in the main which may also be covering buildings / structures that are not on teh wharf or docking facility goes beyond the scope of where the identified loss of life is. The NEC does not prohibit the installation of this technology in that location to meet these requirements it just does not require it to be there.

First level subdivision (A) is titled in such a manner as to identify only those circuits that supply the docking facility or wharfs shall be equipped with GFPE. This is not intended to apply to OCPDs and circuit upstream of this equipment.

Clarified that the GFPE protection at 100mA or 30 mA is not establishing a threshold for the product but rather pertains to the existing listed solutions that may be on the market. UL 1053 has a set performance requirement for GFPE devices. The intent of this Code language is not to set a requirement for a new product that does not trip beyond 100mA or 30mA establishing a new solution

required for these applications. Current listed GFPE product rated at 30mA and 100mA will meet the needs of these installations.

555.35(D) changes recognize that some boat hoists are chord and plug connected and may be plugged into receptacle outlets for other than shore power but are still required to be GFCI protected.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1486-NFPA 70-2020 [Section No. 555.9]	
Public Input No. 1487-NFPA 70-2020 [Section No. 682.15]	

Submitter Information Verification

Submitter Full Name: Thomas Domitrovich
Organization: Eaton Corporation
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jun 09 10:04:10 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7917-NFPA 70-2020

Statement: The 555.9 Boat Hoist requirements has been moved to 555.35(D). This change places all the GFCI requirements under one location, which provides added clarity and usability. In addition, this was done since the GFCI requirements for boat hoist should include all docking facilities, not just those related to dwelling units, since the same electrical hazards can exist. However, changing the term “boat hoist” to “boat lift” is unnecessary. No technical substantiation was provided and the use of the alternate term doesn’t add clarity.

The reference to “sources” supplying a docking facility has been revised to cover either installation where you have a service or a feeder that supplies the docking facility or wharf. Subpart (A) is titled in such a manner as to identify only those circuits that supply the docking facility or wharf shall be equipped with GFPE. This is not intended to apply to OCPDs and circuit upstream of this equipment. Clarification has been made that the GFPE protection at 100mA or 30 mA is not establishing a threshold for the product but rather pertains to the existing listed solutions that may be on the market. UL 1053 has a set performance requirement for GFPE devices. Added language to include GFCI protection for branch circuits in (C)(2) to cover “other than shore power” outlets. This requirement includes both hardwired and portable cord/plug connected outlets (i.e. luminaires or other electrical devices) located at docking facilities. As stated earlier, the GFCI protection for boat hoists was relocated to this section for consistency.

The revisions to requiring a Listed Leakage Current Measurement Device for use in marina applications will assure that the device complies with specific safety and performance requirements such as evaluating for a grounded neutral protection and is suitable for the harsh conditions in a marina.

Public Input No. 1636-NFPA 70-2020 [Section No. 555.35]

555.35 Ground-Fault Protection of Equipment (GFPE) and Ground-Fault Circuit-Interrupter (GFCI) Protection.

~~**(A)** Ground-Fault Protection.~~

For other than floating buildings, ground-fault protection for docking facilities shall be provided in accordance with 555.35(

~~A)~~(

1) through (A)(3).

(1) Receptacles Providing Shore Power.

Receptacles installed in accordance with 555.33(A) shall have individual GFPE set to open at currents not exceeding 30 milliamperes.

(2) GFCI Protection for Personnel.

All 125-volt, single-phase, 15- and 20-ampere receptacles for other than shore power shall be protected in accordance with 555.33(B)(1) and (B)(2).

(3) Feeder and Branch-Circuit Conductors with GFPE.

Feeder and branch-circuit conductors that are installed on docking facilities shall be provided with GFPE set to open at currents not exceeding 100 milliamperes. Coordination with downstream GFPE shall be permitted at the feeder overcurrent protective device.

Exception to (3): Transformer secondary conductors of a separately derived system that do not exceed 3 m (10 ft) and are installed in a raceway shall be permitted to be installed without ground-fault protection. This exception shall also apply to the supply terminals of the equipment supplied by the transformer secondary conductors.

~~**(B)** Leakage Current Measurement Device.~~

~~Where more than three receptacles supply shore power to boats, a leakage current measurement device shall be available and be used to determine leakage current from each boat that will utilize shore power.~~

~~Informational Note No. 1: Leakage current measurement will provide the capability to determine when an individual boat has defective wiring or other problems contributing to hazardous voltage and current. The use of a test device will allow the facility operator to identify a boat that is creating problems. In some cases a single boat may cause an upstream GFPE device protecting a feeder to operate even though multiple boats are supplied from the same feeder. The use of a test device will help the facility operator prevent a particular boat from contributing to hazardous voltage and current in the marina area.~~

~~Informational Note No. 2: An annual test of each boat with the leakage current measurement device is a prudent step toward determining if a boat has defective wiring that may be contributing hazardous voltage and current. Where the leakage current measurement device reveals that a boat is contributing hazardous voltage and current, repairs should be made to the boat before it is permitted to utilize shore power.~~

Statement of Problem and Substantiation for Public Input

Delete 555.35(B) If none of the shore power GFPE devices are tripping (not over 30 mA), but the feeder supplying the shower power receptacles is tripping (over 100 mA), then we have no hazard and no problem to solve. What will the leakage meter do? Identify the leakage of each boat? Okay, now what do we do with that information since none are over 30 mA? Who do you tell to move? But this

has nothing to do the the NEC.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 24 16:26:38 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: No technical substantiation was provided to delete this section. The wiring infrastructure is only one part of equation in reducing ESD. The leakage current device provides a level of accountability to both the marina operators and vessel owners before connecting into the premise wiring system.

Public Input No. 2115-NFPA 70-2020 [Section No. 555.35]

555.35 Ground-Fault Protection of Equipment (GFPE) and Ground-Fault Circuit-Interrupter (GFCI) Protection.

(A) Ground-Fault Protection.

For other than floating buildings, ground-fault protection for docking facilities shall be provided in accordance with 555.35(A)(1) through (A)(3).

(1) Receptacles Providing Shore Power.

Receptacles installed in accordance with 555.33(A) shall have individual GFPE set to open at currents not exceeding 30 milliamperes.

(2) GFCI Protection for Personnel.

All 125-volt, single-phase, 15- and 20-ampere receptacles for other than shore power shall be protected in accordance with 555.33(B)(1) and (B)(2).

(3) Feeder ~~and Branch-Circuit~~ Conductors with GFPE.

Feeder ~~and branch-circuit conductors~~ that are installed on docking facilities shall be provided with GFPE set to open at currents not exceeding 100 milliamperes. Coordination with downstream GFPE shall be permitted at the feeder overcurrent protective device.

Exception to (3): Transformer secondary conductors of a separately derived system that do not exceed 3 m (10 ft) and are installed in a raceway shall be permitted to be installed without ground-fault protection. This exception shall also apply to the supply terminals of the equipment supplied by the transformer secondary conductors.

(B) Leakage Current Measurement Device.

Where more than three receptacles supply shore power to boats, a leakage current measurement device shall be available and be used to determine leakage current from each boat that will utilize shore power.

Informational Note No. 1: Leakage current measurement will provide the capability to determine when an individual boat has defective wiring or other problems contributing to hazardous voltage and current. The use of a test device will allow the facility operator to identify a boat that is creating problems. In some cases a single boat may cause an upstream GFPE device protecting a feeder to operate even though multiple boats are supplied from the same feeder. The use of a test device will help the facility operator prevent a particular boat from contributing to hazardous voltage and current in the marina area.

Informational Note No. 2: An annual test of each boat with the leakage current measurement device is a prudent step toward determining if a boat has defective wiring that may be contributing hazardous voltage and current. Where the leakage current measurement device reveals that a boat is contributing hazardous voltage and current, repairs should be made to the boat before it is permitted to utilize shore power.

Statement of Problem and Substantiation for Public Input

The way the 2020 NEC is written, every branch circuit that is not part of shore power outlet must have GFPE, this would include receptacles and lighting, not related to shore power for a boat.

Submitter Information Verification

Submitter Full Name: Mike Holt

Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Sat Aug 01 15:22:55 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7917-NFPA 70-2020

Statement: The 555.9 Boat Hoist requirements has been moved to 555.35(D). This change places all the GFCI requirements under one location, which provides added clarity and usability. In addition, this was done since the GFCI requirements for boat hoist should include all docking facilities, not just those related to dwelling units, since the same electrical hazards can exist. However, changing the term “boat hoist” to “boat lift” is unnecessary. No technical substantiation was provided and the use of the alternate term doesn’t add clarity.

The reference to “sources” supplying a docking facility has been revised to cover either installation where you have a service or a feeder that supplies the docking facility or wharf. Subpart (A) is titled in such a manner as to identify only those circuits that supply the docking facility or wharf shall be equipped with GFPE. This is not intended to apply to OCPDs and circuit upstream of this equipment. Clarification has been made that the GFPE protection at 100mA or 30 mA is not establishing a threshold for the product but rather pertains to the existing listed solutions that may be on the market. UL 1053 has a set performance requirement for GFPE devices. Added language to include GFCI protection for branch circuits in (C)(2) to cover “other than shore power” outlets. This requirement includes both hardwired and portable cord/plug connected outlets (i.e. luminaires or other electrical devices) located at docking facilities. As stated earlier, the GFCI protection for boat hoists was relocated to this section for consistency.

The revisions to requiring a Listed Leakage Current Measurement Device for use in marina applications will assure that the device complies with specific safety and performance requirements such as evaluating for a grounded neutral protection and is suitable for the harsh conditions in a marina.

Public Input No. 3284-NFPA 70-2020 [New Section after 555.35(B)]

Exception:

Where the shore power equipment includes a leakage indicator and leakage alarm a separate leakage test device shall not be required.

Type your content here ...

Statement of Problem and Substantiation for Public Input

This is intended to be a new exception following 555.35(B). Some shore power equipment has built in leakage indicators and alarms. Where such shore power equipment is installed, there is no need for a separate leakage testing device.

Submitter Information Verification

Submitter Full Name: Don Ganiere
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Sep 07 14:50:16 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: The leakage current device needs to “measure” the level of current specific using specific performance requirements such as evaluating for a grounded neutral protection (PI 1853). The protection needs to be more than an audible indicator or alarm.

Public Input No. 1853-NFPA 70-2020 [Section No. 555.35(B)]

(B) Leakage Current Measurement Device.

Where more than three receptacles supply shore power to boats, a ~~leakage current measurement device shall~~ Listed Leakage Current Measurement Device for use in Marina Applications shall be available and be used to determine leakage current from each boat that will utilize shore power.

Informational Note No. 1: Leakage current measurement will provide the capability to determine when an individual boat has defective wiring or other problems contributing to hazardous voltage and current. The use of a test device will allow the facility operator to identify a boat that is creating problems. In some cases a single boat may cause an upstream GFPE device protecting a feeder to operate even though multiple boats are supplied from the same feeder. The use of a test device will help the facility operator prevent a particular boat from contributing to hazardous voltage and current in the marina area.

Informational Note No. 2: An annual test of each boat with the leakage current measurement device is a prudent step toward determining if a boat has defective wiring that may be contributing hazardous voltage and current. Where the leakage current measurement device reveals that a boat is contributing hazardous voltage and current, repairs should be made to the boat before it is permitted to utilize shore power.

Statement of Problem and Substantiation for Public Input

Substantiation- Requiring a Listed Leakage Current Measurement Device for use in Marina Applications will assure that the device complies with specific safety and performance requirements such as evaluating for a grounded neutral protection and is suitable for the harsh conditions in a marina. UL 1379, The Outline of Investigation for Leakage Current Measurement Devices for use in Marina Applications is under development to certify these devices.

Submitter Information Verification

Submitter Full Name: Thomas Lichtenstein
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jul 10 17:01:53 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7917-NFPA 70-2020

Statement: The 555.9 Boat Hoist requirements has been moved to 555.35(D). This change places all the GFCI requirements under one location, which provides added clarity and usability. In addition, this was done since the GFCI requirements for boat hoist should include all docking facilities, not just those related to dwelling units, since the same electrical hazards can exist. However, changing the term “boat hoist” to “boat lift” is unnecessary.

No technical substantiation was provided and the use of the alternate term doesn't add clarity.

The reference to "sources" supplying a docking facility has been revised to cover either installation where you have a service or a feeder that supplies the docking facility or wharf. Subpart (A) is titled in such a manner as to identify only those circuits that supply the docking facility or wharf shall be equipped with GFPE. This is not intended to apply to OCPDs and circuit upstream of this equipment. Clarification has been made that the GFPE protection at 100mA or 30 mA is not establishing a threshold for the product but rather pertains to the existing listed solutions that may be on the market. UL 1053 has a set performance requirement for GFPE devices. Added language to include GFCI protection for branch circuits in (C)(2) to cover "other than shore power" outlets. This requirement includes both hardwired and portable cord/plug connected outlets (i.e. luminaires or other electrical devices) located at docking facilities. As stated earlier, the GFCI protection for boat hoists was relocated to this section for consistency.

The revisions to requiring a Listed Leakage Current Measurement Device for use in marina applications will assure that the device complies with specific safety and performance requirements such as evaluating for a grounded neutral protection and is suitable for the harsh conditions in a marina.

Public Input No. 2811-NFPA 70-2020 [Section No. 555.36]

555.36 Disconnecting Means for Shore Power Connection(s).

Disconnecting means shall be provided to isolate each boat from its supply connection(s).

(A) Type.

The disconnecting means shall consist of a circuit breaker, switch, or both, and shall be properly identified as to which receptacle it controls.

(B) Location.

The disconnecting means shall be readily accessible, located not more than 762 mm (30 in.) from the receptacle it controls, and shall be located in the supply circuit ahead of the receptacle. Circuit breakers or switches located in marina power outlets complying with this section shall be permitted as the disconnecting means.

(C) Emergency Electrical Disconnect

Each marina power outlet or enclosure that provides shore power to boats shall be provided with a listed emergency shutoff device or electrical disconnect that is clearly marked "Emergency Shut Off" in accordance with 110.22(A). The emergency shut off device or electrical disconnect shall be within sight of the marina power outlet or other enclosure that provides shore power to boats, readily accessible, externally operable, manually resettable and listed for use in wet locations. The emergency shutoff device or electrical disconnect shall de-energize the power supply to all circuits supplied by the marina power outlet(s) or enclosure(s) that provide shore power to boats. A circuit breaker handle shall not be used for this purpose.

Statement of Problem and Substantiation for Public Input

This public input was prepared by the correlating committee task group focused on bodies of water. This task group consisted of the following members: Kevin Arnold (CMP 10, CMP 13), Thomas Blewitt (CMP 17), Donny Cook (CMP 17, CC, NFPA 303), Thomas Domitrovich (CMP 2, CMP 10), Bill Fiske (CMP 14), Dean Hunter (CMP 7), Cliff Norton (CMP 7, NFPA 303), Christine Porter (CMP 5, CC), Mike Query (CMP 17), David Smith, Dave Watson (CMP 6).

While the ground fault protection of equipment required in 555.35(A)(1) and (A)(3) may provide some protection to swimmers in the water away from an energized boat or dock, it will not provide electric shock protection for a swimmer touching an energized metal boat, dock or ladder. When a swimmer feels the tingle of electrical current in the water, their first reaction is to swim to the nearest boat or dock to get out of the water and that could be deadly. An emergency disconnect located on the marina power outlet or enclosure providing shore power to a boat, will allow bystanders to quickly de-energize power to the boat and dock nearest the swimmer and give the swimmer or rescuer a chance to live. This will permit local disconnection and resetting of the offending boats so to not disrupt the entire marina operation and not require maintenance staff from the marina to restore power. This requirement will save lives!

The location of the emergency disconnect is critical, it needs to be located at each boat slip to be effective at having a chance to save the lives of ESD victims and rescuers. If a swimmer is being subjected to electrical current in the water and struggling to stay afloat, there is very little time to act before the swimmer goes underwater and drowns. No bystander or loved one is going to let the struggling swimmer out of their sight to go locate an emergency disconnect at the service or feeder panel or head of the dock that could be several hundred yards away. We know that from the hemispheric spreading of current in the water, that the further a swimmer is from the source of current, the effects of the current will be considerably less on the swimmer and the boat closest to the swimmer

is most likely the offending boat. Therefore disconnecting the boat nearest the swimmer is most critical. The emergency disconnect at the point of supply to the boat will allow that to happen quickly and if it is the next boat slip 30 feet away, that can quickly be disconnected as well. Giving a chance to save the lives of those in the water without losing sight of the victim.

Some may have concerns about acts of vandalism possibly disconnecting boats with no oversight. There is nothing now that prevents any passerby from lifting the hinged cover on a pedestal and turning off the circuit breakers and it doesn't seem to be a problem.

Emergency disconnects have been required in NEC 514.11 and used successfully at every attended or unattended self-service motor fuel dispensing facility since the 1993 NEC. The public has unrestricted access to these gas stations and the emergency disconnects are accessible to everyone. I am not aware of any reports of vandals activating the emergency shutoff at a gas station. Nor am I aware of any proposals to remove the safety requirement from the NEC due to excessive vandalism. Clearly marked Emergency disconnects, fire alarm pull stations and other emergency safety devices have successfully been deployed for decades. They are widely understood and respected by the public to only use in case of an emergency and there is no data to suggest that it would be different at a marina.

NEC 90.1(A) Practical Safeguarding states: "The purpose of this Code is the practical safeguarding of persons and property from hazards arising from the use of electricity." If there is a concern regarding vandals possibly tripping these important emergency safety devices, it seems that this would be outside the scope of the NEC and would be better addressed by securing access to marina's where expensive watercraft worth thousands to millions of dollars are moored.

There are numerous documented incidents where an emergency disconnect on the marina power pedestal could have saved lives from ESD. One of the most recent examples that received national attention was in July 2020. Two brothers died and another woman injured from electrical current in the water at an incident at Scorpion Bay on Lake Pleasant in Arizona. One of the brothers and the injured woman jumped in to assist and were killed or injured. First responders were unable to assist until the entire marina was shut down to assure the water was not energized before rescue and recovery operations could be attempted.

The source of the electrical current that contributed to the drownings of two brothers at Lake Pleasant came from the victim's boat and not the marina. The victim’s boat had an electrical connection system which was not compatible with the marina’s receptacle. Electrical safety features were bypassed by the intentional and improper modification of the boat’s electrical connection system. This resulted in electricity being discharged into the water around the swim platform. Brothers Timothy Miller and Michael Miller died after stepping into the water while docked at the marina and into an electrical current. Timothy was first in the water and went under. Michael and Timothy's girlfriend jumped in to help, but were pulled out of the water after experiencing symptoms from the electrical current.

For more information, please see the links below.

https://www.azfamily.com/news/boat-of-brothers-who-died-at-lake-pleasant-had-electrical-issues-mcso-says/article_728cfab2-c6e1-11ea-a01b-6394482de9e5.html

https://www.12news.com/article/news/local/arizona/electricity-lake-pleasant-accident/75-ca7a3e52-b711-4ac0-87df-256d6c32b967

https://www.foxnews.com/us/arizona-lake-electrocution-incident-lake-pleasant-scorpion-bay-brothers-killed-boat-dock

https://www.abc15.com/news/region-west-valley/peoria/mcso-modification-on-victims-boat-was-cause-of-electrical-current-in-lake-pleasant-drownings

Submitter Information Verification

Submitter Full Name: Thomas Domitrovich
Organization: Eaton Corporation

Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 01 15:06:23 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7936-NFPA 70-2020

Statement: While the ground fault protection of equipment required in 555.35(A)(1) and (A)(3) may provide some protection to swimmers in the water away from an energized boat or dock, it will not provide electric shock protection for a swimmer touching an energized metal boat, dock or ladder. An emergency disconnect within sight of the marina power outlet or enclosure providing shore power to a boat, will allow bystanders to quickly de-energize power to the boat

and dock nearest the swimmer - greatly reducing ESD incidence.

Public Input No. 1496-NFPA 70-2020 [Section No. 555.37]

555.37 Equipment Grounding Conductor.

(A) Equipment to Be Connected to Equipment Grounding Conductor.

The following items shall be connected to an equipment grounding conductor run with the circuit conductors in the same raceway, cable, or trench:

(1) Metal boxes, metal cabinets, and all other metal enclosures

(2) Metal frames of utilization equipment

(3) Grounding terminals of grounding-type receptacles

(B) Type of Equipment Grounding Conductor.

~~The equipment~~ Equipment grounding ~~conductor~~ conductors shall be ~~an insulated conductor with a continuous outer finish that is either green or green with one or more yellow stripes. The equipment grounding conductor of Type MI cable shall be permitted to be identified at terminations. For conductors larger than 6 AWG, or where multiconductor cables are used, re-identification of conductors allowed in 250.119(A)(2)b. and (A)(2)c. or 250.119(B)(2) and (B)(3) shall be permitted.~~

~~**(C)** Size of Equipment Grounding Conductor.~~

~~The insulated equipment grounding conductor shall be sized in accordance with 250.122 but not smaller than 12 AWG.~~ insulated copper conductors sized in accordance with 250.122 but not smaller than 12 AWG.

(C) Feeders .

Where a feeder supplies a remote panelboard or other distribution equipment, an insulated equipment grounding conductor shall extend from a grounding terminal in the service to a grounding terminal and busbar in the remote panelboard or other distribution equipment.

(D) Branch-Circuit Equipment Grounding Conductor.

The insulated equipment grounding conductor for branch circuits shall terminate at a grounding terminal in a remote panelboard or the grounding terminal in the main service equipment.

(E)

~~– Feeder Equipment Grounding Conductor.~~

~~Where a feeder supplies a remote panelboard, an insulated equipment grounding conductor shall extend from a grounding terminal in the service equipment to a grounding terminal in the remote panelboard.~~

~~**Cord-and-Plug-Connected Appliances.**~~

~~Unless double-insulated, cord-and-plug-connected appliances shall be grounded by means of an equipment grounding conductor in the cord and a grounding-type attachment plug.~~

~~*Exception: An equipment grounding conductor shall be permitted to be uninsulated if a part of a listed cable assembly identified for the environment and not subject to atmospheres or environments such as, but not limited to, storm water basins, sewage treatment ponds, and natural bodies of water containing salt water.*~~

Statement of Problem and Substantiation for Public Input

This public input was prepared by the correlating committee task group focused on bodies of water.

This task group consisted of the following members: Kevin Arnold (CMP 10, CMP 13), Thomas Blewitt (CMP 17), Donny Cook (CMP 17, CC), Thomas Domitrovich (CMP 2, CMP 10), Bill Fiske (CMP 14), Dean Hunter (CMP 7), Cliff Norton (CMP 7, NFPA 303), Christine Porter (CMP 5, CC), Mike Query (CMP 17), David Smith, Dave Watson (CMP 6).

Organized for clarity and to align with 682. Added cord-and-plug connected appliances to address the hazards associated with those that are not double-insulated. Added the exception to permit an uninsulated grounding conductor where the environmental conditions of the installation permit.

The language requiring a continuous outer finish that is either green or green with one or more yellow stripes is removed realizing that 90.3 applies and since this is not amending 250.119 that requirement would still be in place.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1497-NFPA 70-2020 [Section No. 682.31]	
Public Input No. 1497-NFPA 70-2020 [Section No. 682.31]	

Submitter Information Verification

Submitter Full Name: Thomas Domitrovich
Organization: Eaton Corporation
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jun 09 13:17:44 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-8169-NFPA 70-2020

Statement: Organized for clarity and to align with 682. The identification of the equipment grounding conductor is already covered in 250.119. Added cord-and-plug connected appliances to address the hazards associated with those that are not double-insulated. Added the exception to permit an uninsulated grounding conductor where the environmental conditions of the installation permit.

Public Input No. 4238-NFPA 70-2020 [Section No. 555.53]

555.53 Ground-Fault Protection.

The main overcurrent protective device that feeds the floating building shall have ground-fault protection not exceeding 100 mA. Ground-fault protection of each individual branch or feeder circuit shall be permitted as a suitable alternative.

Exception: A floating building in full compliance with 555.13 and moored at an ocean waterfront shall not be required to have ground-fault protection.

Statement of Problem and Substantiation for Public Input

This PI is intended to open a conversation about ESD and salt water, and the application of these requirements to extremely large structures. ESD is about voltage gradients and swimmers, and salt water, due to high conductivity, presents a negligible voltage gradient. In addition, this proposed exception requires express compliance with the bonding requirement in 555.13 prior to being applicable, eliminating the most likely source of stray voltage even if the water were subject to damaging voltage gradients. The other reality is that oceanfront floating buildings are often very large with extremely large electrical supplies, even using medium voltage connections. Attempting to supply such buildings with GFPE is a complete nonstarter.

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
Organization: Hartwell Electrical Services, Inc.
Affiliation: self
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 07:49:34 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: It would be difficult for installers and AHJs to discern how much salt in the water would be inherently safer. The application of the NEC needs to be consistent in all types of water to reduce the incidences of ESD.

Public Input No. 3828-NFPA 70-2020 [Section No. 604.2]

(Relocate all definitions in the 604. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

604. 2 Definition.

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

Manufactured Wiring System.

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

Statement of Problem and Substantiation for Public Input

"The National Electrical Code has definitions in multiple parts in Article 100 and many definitions scattered through out the code many of them in the .2 section of the articles.
Most of the other standards under NFPA have their definitions in one location and this will allow the NEC the same requirement. The revisions to the NEC Style Manual require all the definitions to be relocated to Article 100. "

Submitter Information Verification

Submitter Full Name: David Williams
Organization: Delta Charter Township
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 13:44:33 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7690-NFPA 70-2020
Statement: All existing definitions under the purview of CMP-7 have been moved to Article 100 and revises for compliance with Section 2.2.2 of the NEC Style Manual. Additionally, all definition sections (545.2, 547.2, 550.2, 551.2, 552.2, 555.2, 604.2, and 675.2.2) in the articles under the responsibility of CMP-7 have been deleted.

Public Input No. 114-NFPA 70-2019 [Section No. 604.7]

~~**604.7** Installation.~~

~~Manufactured wiring systems shall be secured and supported in accordance with the applicable cable or conduit article for the cable or conduit type employed.~~

Statement of Problem and Substantiation for Public Input

NEC 90.3 indicates the requirements in Chapters 1-4 apply generally and the requirements in Chapters 5, 6, and 7 supplement or modify those general requirements. The current text in 604.7 provides no supplemental or modified requirement related to securing or supporting of the Chapter 3 wiring methods.

Submitter Information Verification

Submitter Full Name: Donald Cook
Organization: Shelby County Department Of De
Affiliation: Self
Street Address:
City:
State:
Zip:
Submittal Date: Tue Nov 19 15:24:10 EST 2019
Committee: NEC-P07

Committee Statement

Resolution: The committee does not agree that deleting section 604.7 for Installation would provide further clarity or enhance safety for the user and has decided to maintain the Code section. Pointing users of Article 604 to Chapter 3 Wiring Methods enhances usability of the Code and re-enforces 90.3.

Public Input No. 460-NFPA 70-2020 [Section No. 604.7]

604.7 Installation.

Manufactured wiring systems shall be secured and supported in accordance with the applicable cable or conduit article for the cable or conduit type employed.

Exception: Branch circuits and taps of manufactured wiring systems, not exceeding a rating of 30 amperes and employing Type AC cable, interlocked armor Type MC cable, FMC, LFMC, or LFNC, shall be permitted to be installed without securement within listed low-profile fixed height access flooring systems having a maximum height above the floor surface of 150 mm (6 in.) where those cables or flexible conduits are protected against physical damage by weight-load-rated wiring channel covers or access plates.

Informational Note No. 1: "Low-profile fixed height access flooring systems" and associated "wiring channels" are sometimes known as "reticulated grid-form cable trench systems" and as "cable trenches", respectively. "Low-profile fixed height access flooring systems" and "reticulated grid-form cable trench systems" are not considered to be "raised floors" as in 645.5(E) and are not considered to be "ducts" or "other spaces for environmental air (plenums)" as in 300.22(D).

Additional Proposed Changes

File Name	Description	Approved
3D_Channel.pdf	Wiring Channel	
3D_Corner.pdf	Corner Plate	
3D_FB.pdf	Floor Box	
3D_FM.pdf	Feed Module	
3D_Gridd_Power.pdf	Power Installation Overview	
3D_Gridd.pdf	Floor System	
3D_Tapoff.pdf	Tap Off Head Rendering	
FB_Diagram_-_3D.pdf	Floor Box Diagram	
Feeder_and_track_in_channel_01.pdf		
Floor_Box_in_Base_Unit_close_up_01.pdf		
Floor_Box_lid_close_up_01.pdf		
Floor_Boxes_Installed_-_Finished_Environment.pdf		
Floor_Boxes_Installed_-_MH_Note.pdf		
Floor_Boxes_Installed_01_-_MH_Note.pdf		
Floor_Boxes_Installed_03.pdf		
Floor_Boxes_n_Track_w_open_channel_01.pdf		
Relocatable_floor_box_whip_01.pdf		
Relocation_Procedure_01.pdf	Relocation Procedure	
Track_with_many_tap_offs_02.pdf	TYPICAL INSTALLATION	
Tracks_in_Channels_01.pdf	Overhead view of tracks in channels	
Floor_box_with_receptacles_wiring_diagram.pdf	Wiring diagram - floor box with receptacles	

Floor_Box_for_powered_furniture_wiring_diagram.pdf	Wiring Diagram - floor box for powered furniture

Statement of Problem and Substantiation for Public Input

This public input seeks to change the manufactured wiring system rules for the branch circuits and taps only. Feeders would remain unaffected and would still need to be supported and secured in place as per the appropriate article's rules for the type of wiring method installed.

Listed manufactured wiring systems that are installed within low-profile fixed height access flooring systems are DESIGNED AND INTENDED TO BE RELOCATABLE. The low-profile fixed height access floor is installed into a building to allow for reconfiguration of the interior environment. Typically, this involves the relocation of cubicles, powered desks, and floor receptacle boxes. In today's modern office environment, the ability to adapt the space to new business challenges is critical.

The low-profile fixed height access floor is used exclusively for power and data wiring. It is NOT a raised floor such as would be seen in an information technology room that is covered by the provisions of NFPA-70, Article 645. The low-profile fixed height access floor simply allows the end user to reconfigure their electrical locations without the need for power poles, core drilling, and other disruptive installation techniques. The space within the low-profile fixed height access floor cannot serve as a plenum, is not supplied environmental air by its own HVAC system, and is not in any way isolated from the office space above it. All terminations comply with the appropriate NEC® articles. The space that is provided within the wiring channels under the floor is no different than the space that is provided by stud and sheetrock construction.

The floor boxes in which the tap and branch circuit conductors terminate are securely fastened to the base unit of the floor system, as per the listing of the box. The Type AC, MC, FMC, LFMC, and LFNC employed by the manufactured wiring system are supported as they are laying directly on the floor for almost their entire length.

The branch circuits and taps installed in such a low-profile fixed height access floors are routed within confined and covered wiring channels and cable pathways. The channels and pathways are used for power and data wiring only. There are no ducts or pipes within the limited space created by those wiring channels or pathways. Other trades do not need to access the space within the floor to service their installations. The only tradespeople in the floor are the electricians and data/telecom technicians.

The branch circuits and taps, limited to 30 amperes maximum, are typically installed in Types AC, MC, FMC, LFMC, or LFNC and generally do not exceed metric designator 21 (trade size ¾). Because of the narrow channels that are within the low-profile fixed height access flooring, these wiring methods are prevented from moving by the physical limitations of the space provided. Securing the Type AC, MC, FMC, LFMC, or LFNC within the wiring channels provides no additional safety to the electrical installation. However, securing the wiring methods does inhibit the future relocation and alteration of the manufactured wiring system components when there are changes needed. This inhibits the intended usage of the manufactured wiring system that has been installed within the low-profile fixed height access flooring system.

Given that other trades do not use the space under the low-profile fixed height access floor, there is a very limited opportunity for any physical damage to occur to the wiring methods within those wiring channels. The low-profile fixed height access floor is rated to have the entire weight of the office above it placed on it. Therefore, the wiring is certainly protected from physical damage.

By allowing the Types AC, MC, FMC, LFMC and LFNC wiring methods that are used for the branch circuits and taps, limited to 30 amperes, to be installed without being secured, there is no loss of safety in the installation. However, the utility of the electrical system is greatly enhanced.

Please see attached drawings, renderings, and/or photographs. All images used with permission of FreeAxez LLC.

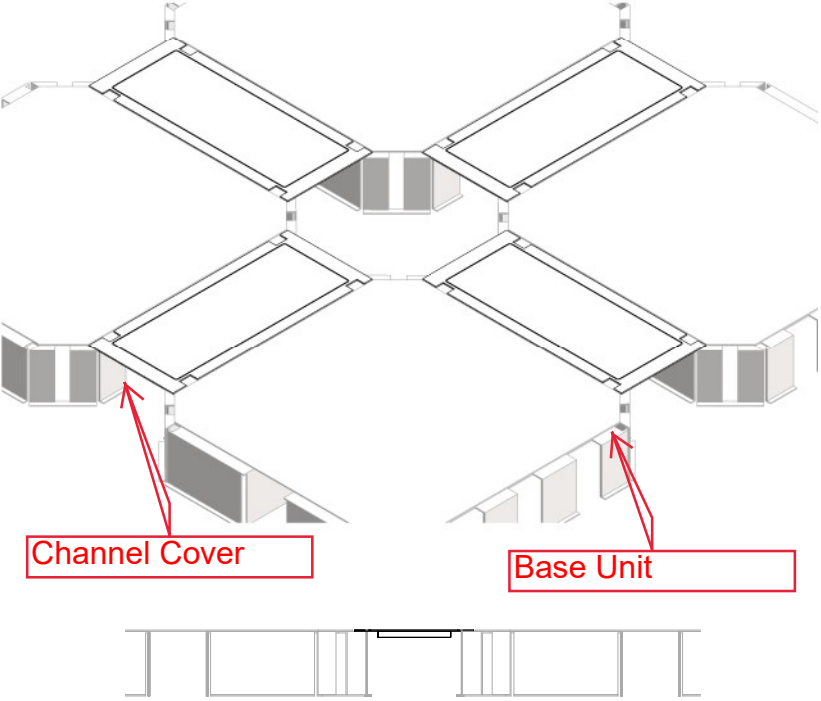
Example of listed low-profile fixed height access floor: www.freeaxez.com

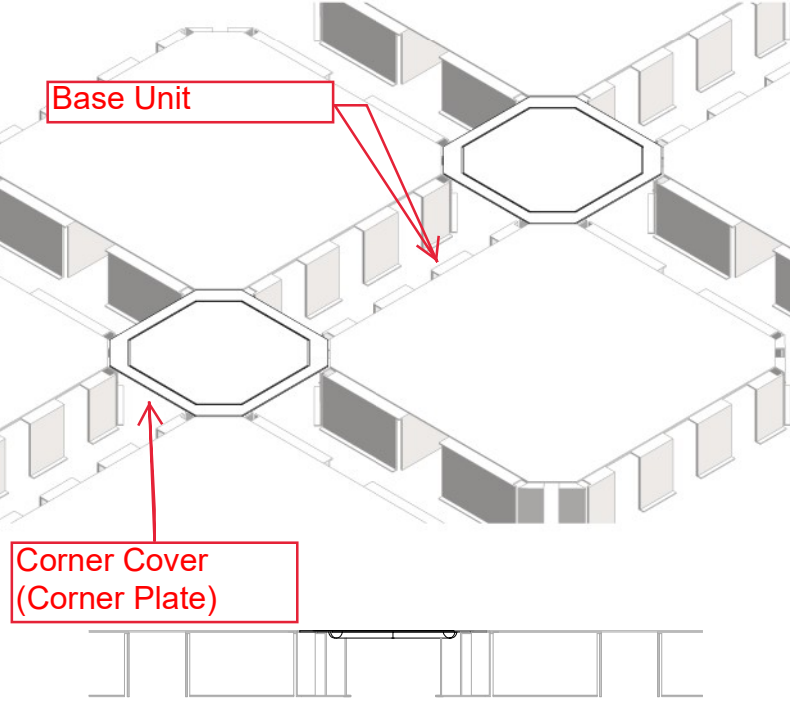
Submitter Information Verification

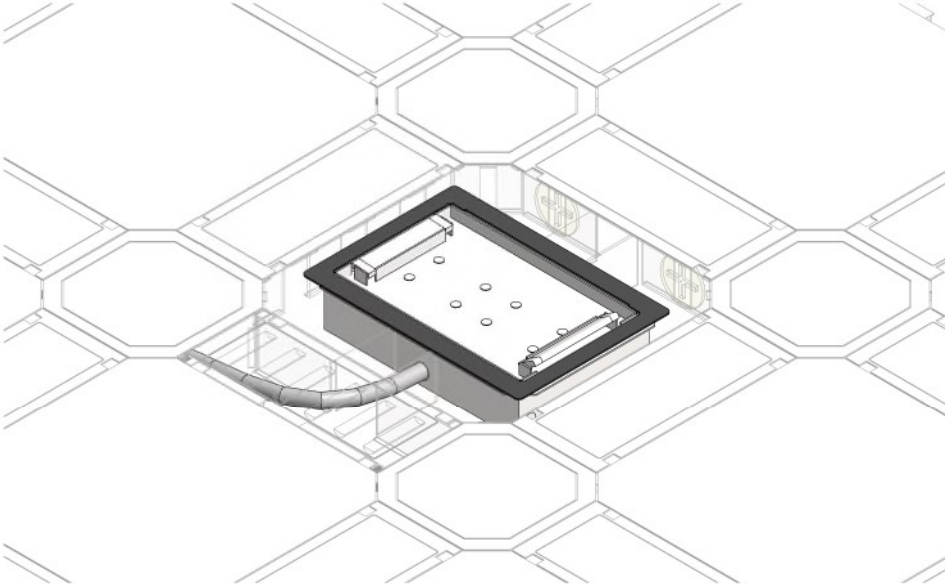
Submitter Full Name: Michal Hofkin
Organization: Middle Department Inspection Agency, Inc.
Affiliation: FreeAxez LLC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Feb 13 16:37:44 EST 2020
Committee: NEC-P07

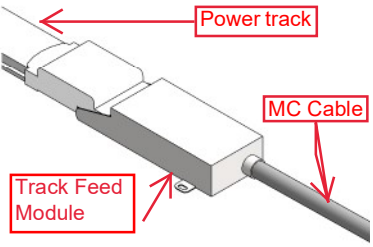
Committee Statement

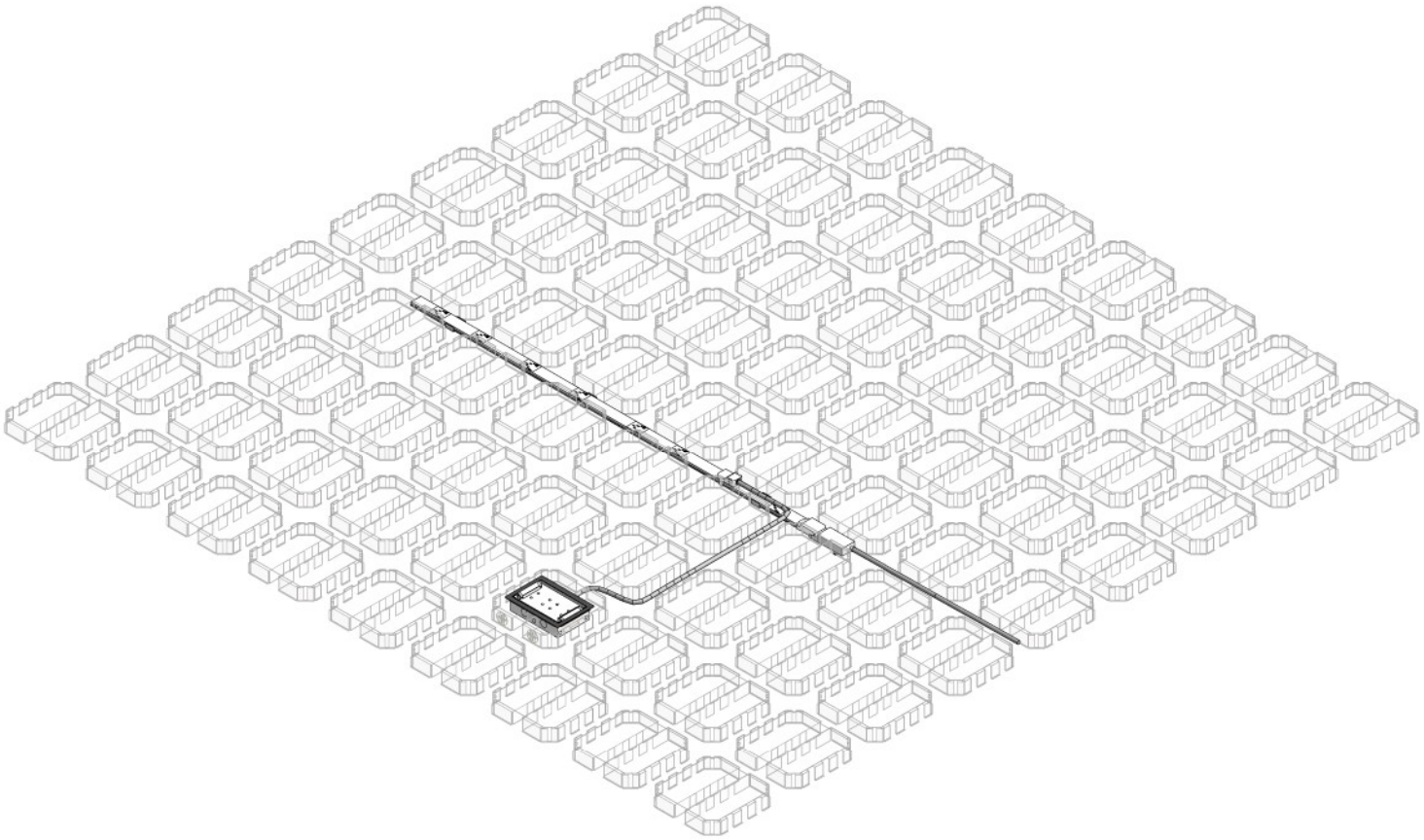
Resolution: The submitter provided no technical substantiation to remove support and securement requirements for manufacturer wiring systems. Other trades installing telephone and data lines would be utilizing the same channels and would potentially subject the manufactured wiring system to abuse from other installers. The submitter's substantiation referred to special rules for a proprietary floor system which is in violation of NFPA rules and regulations.

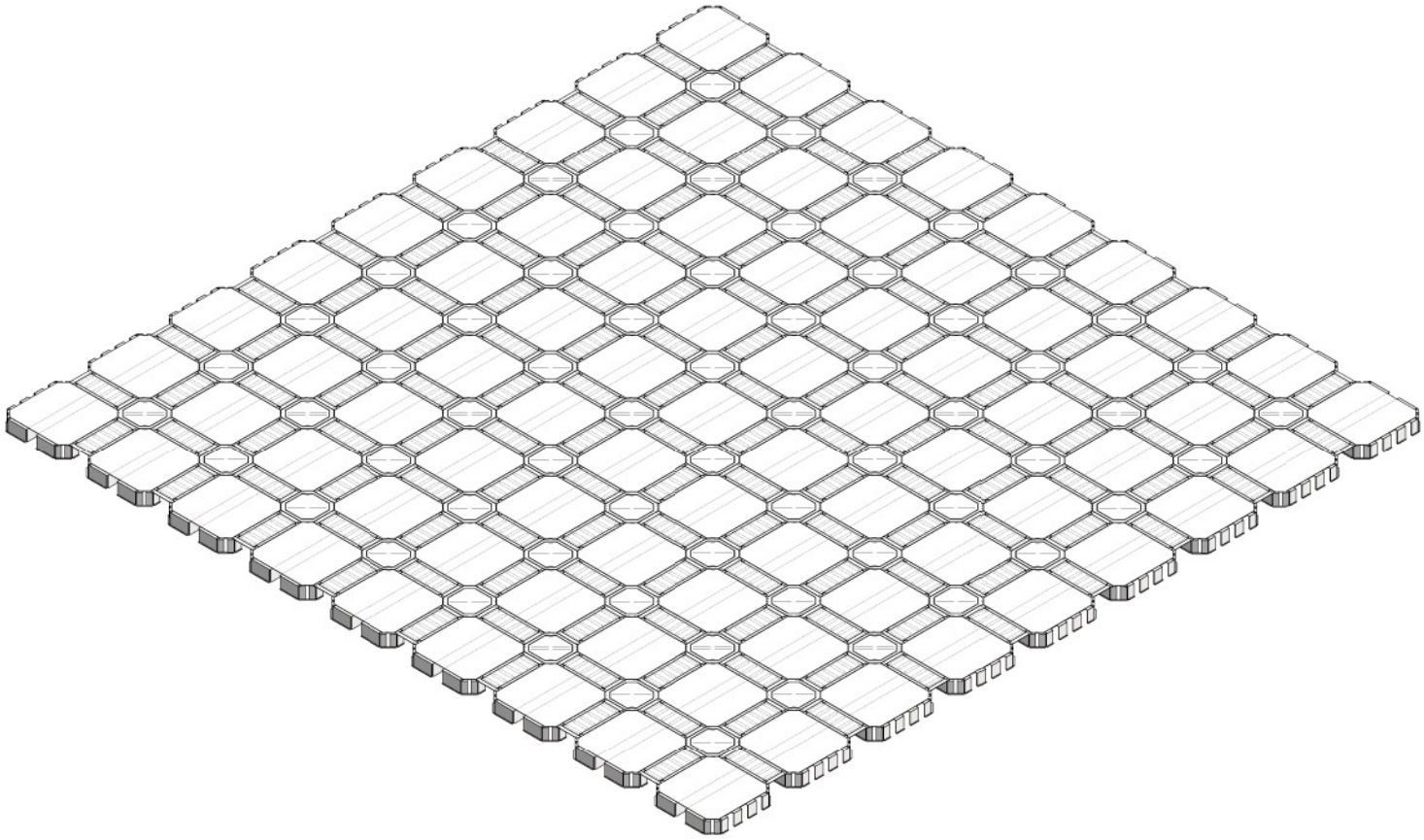

Channel Cover
Base Unit

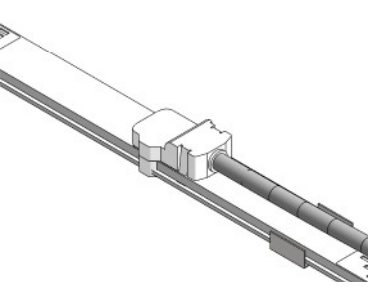

Base Unit
Corner Cover
(Corner Plate)

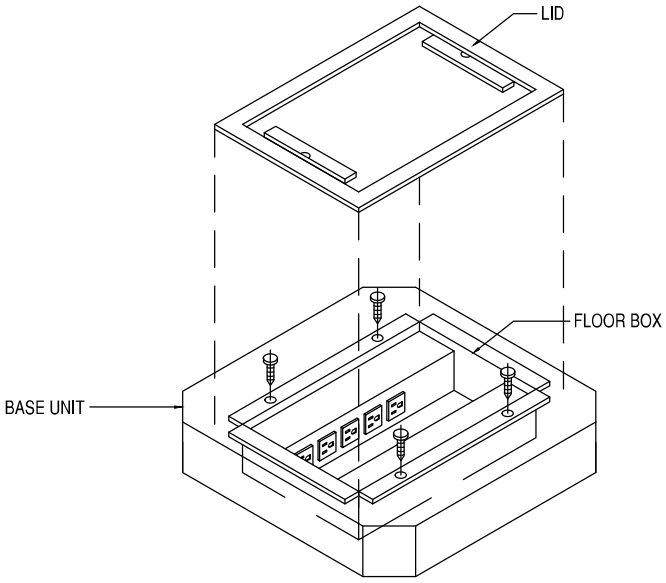


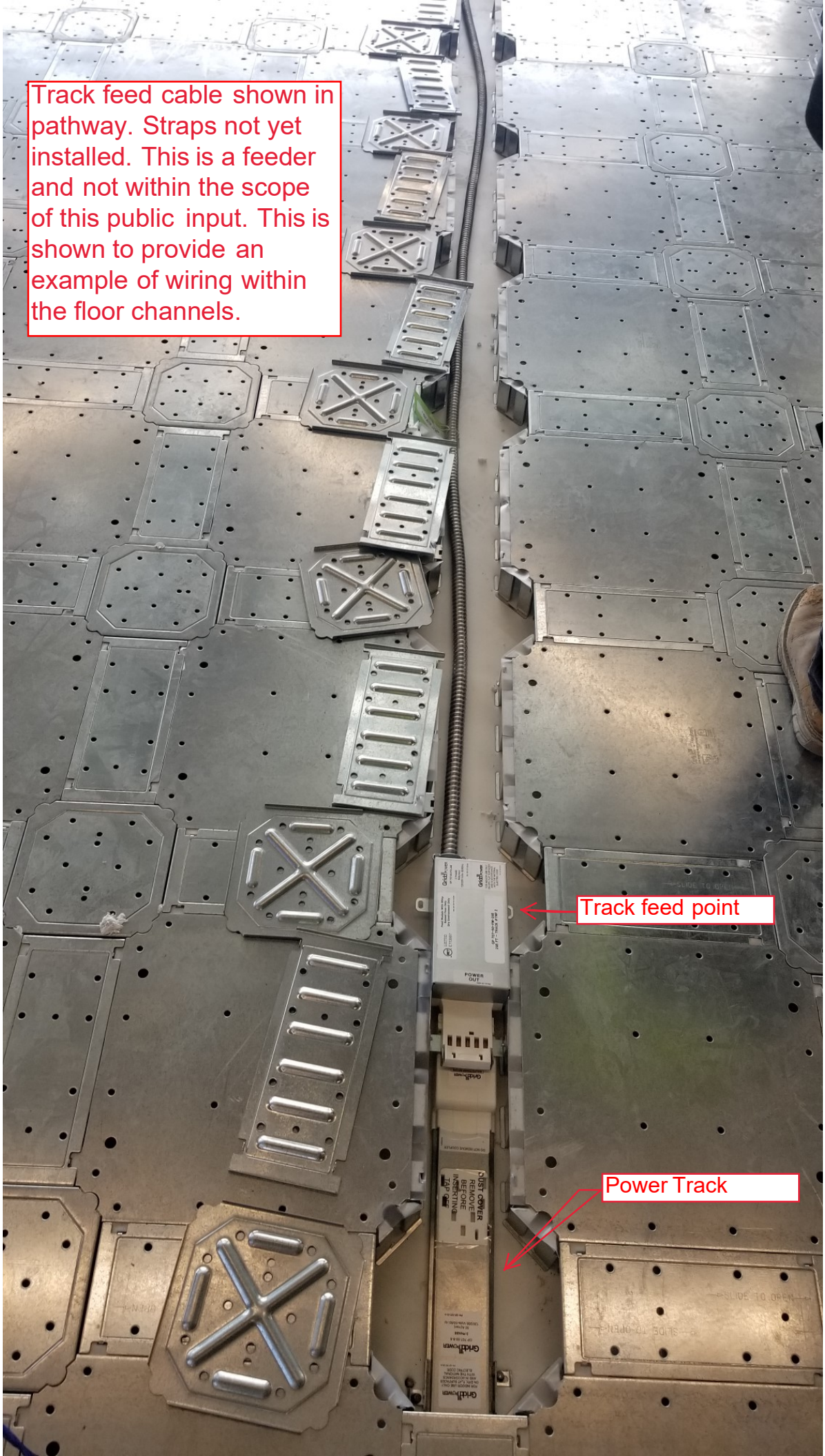

Power track
MC Cable
Track Feed
Module

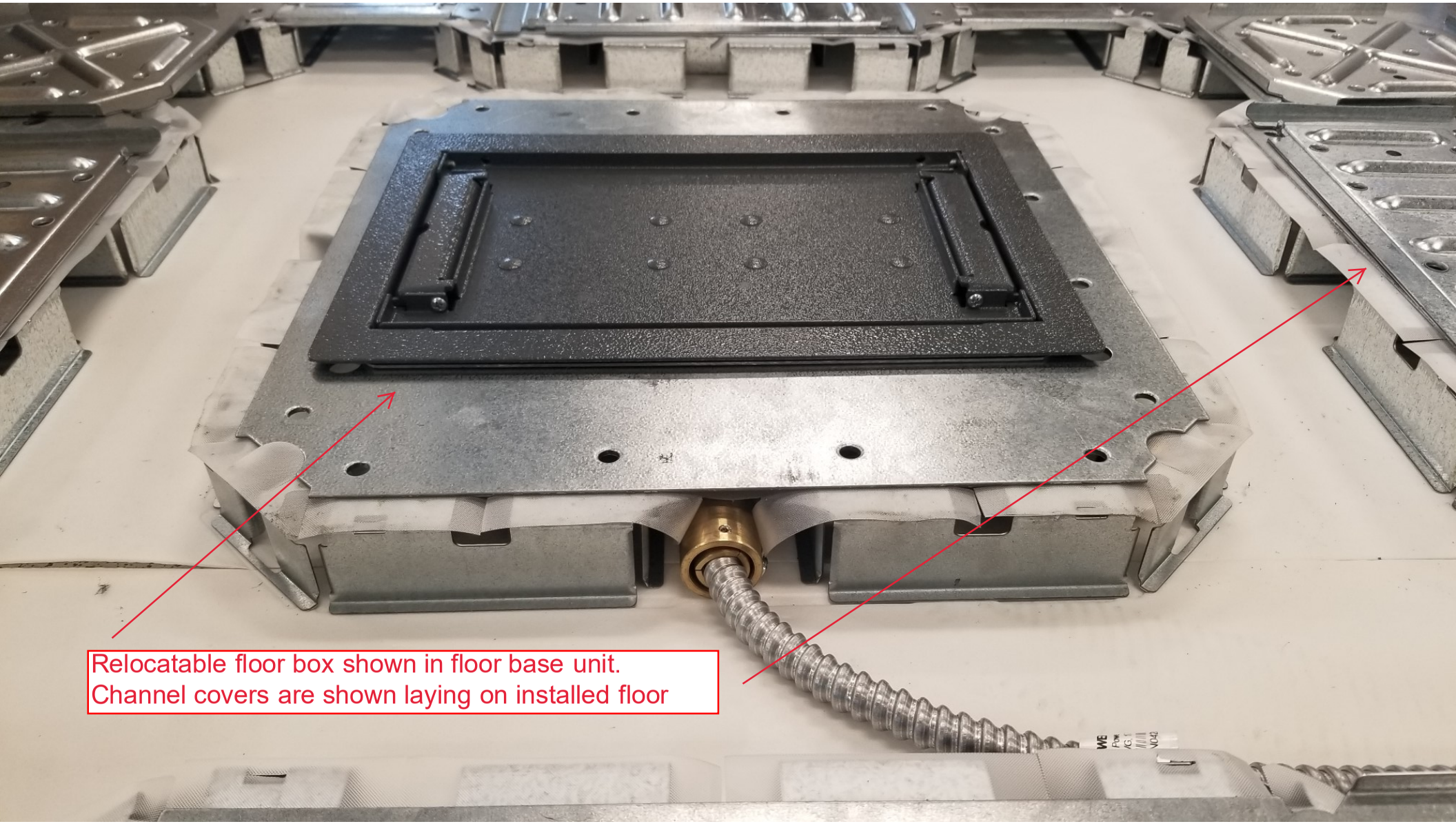




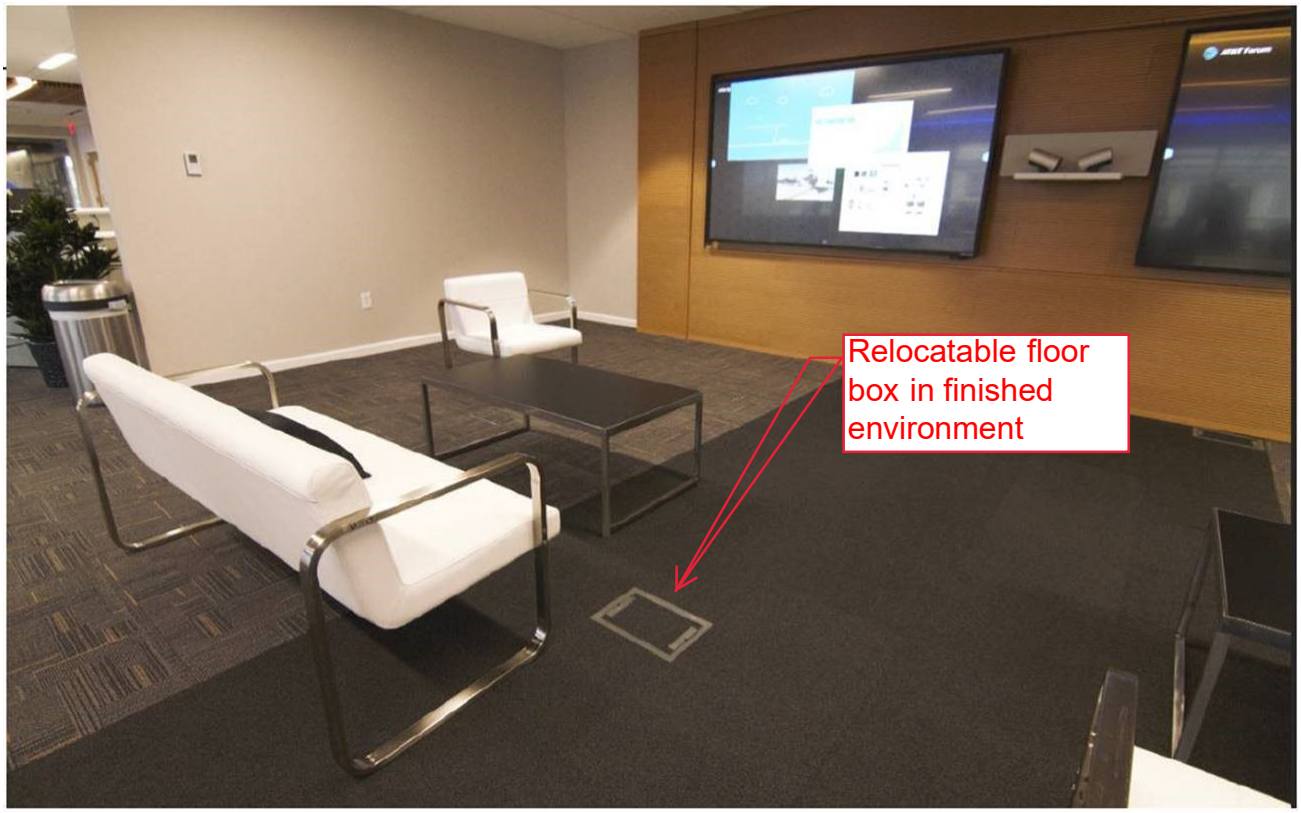


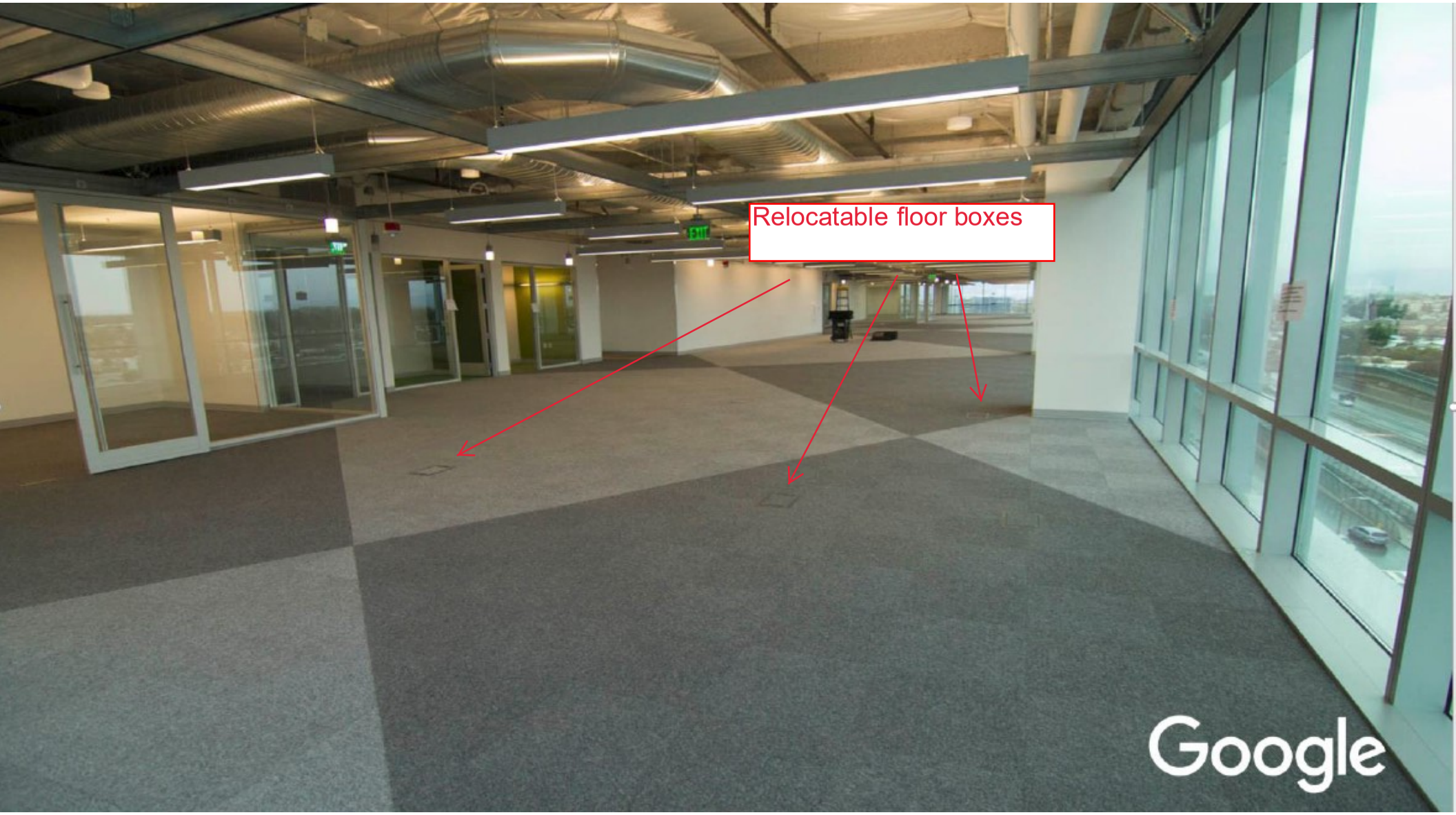

LID
FLOOR BOX
BASE UNIT

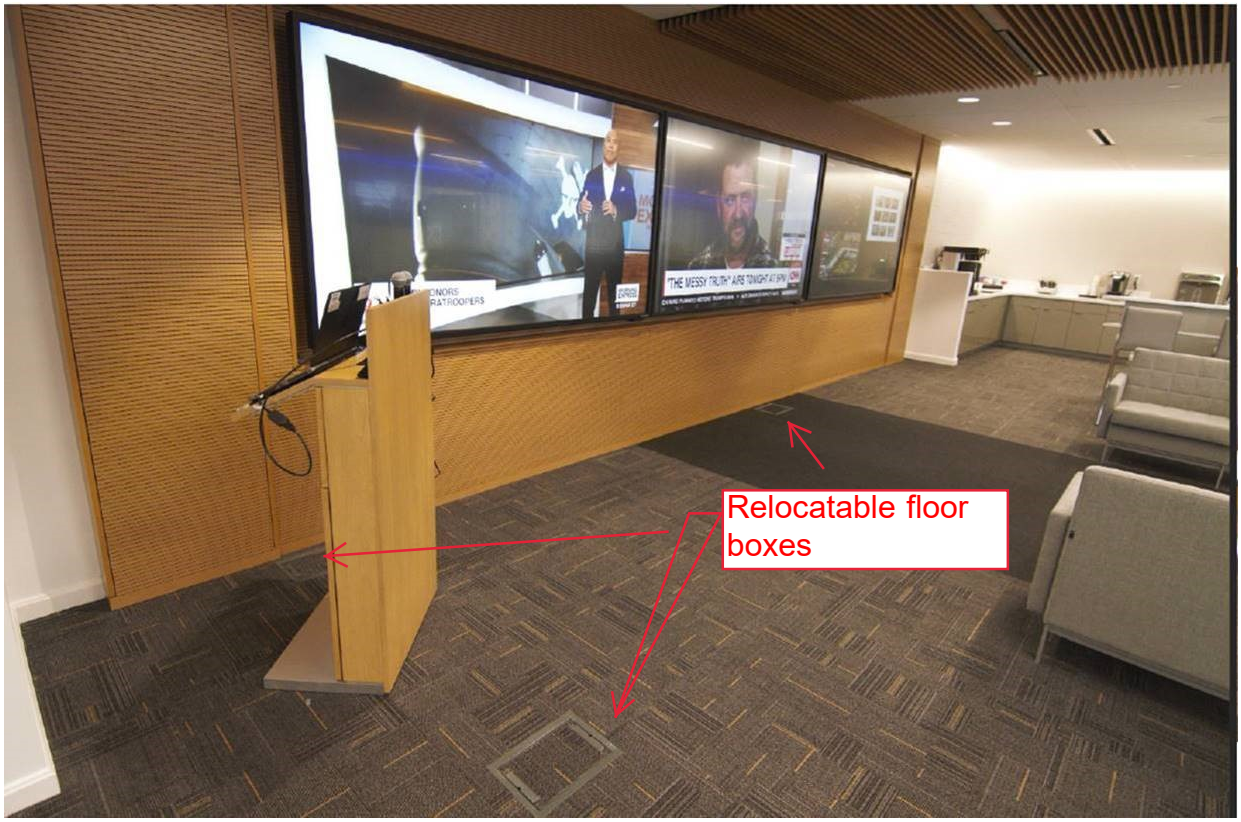

Track feed cable shown in pathway. Straps not yet installed. This is a feeder and not within the scope of this public input. This is shown to provide an example of wiring within the floor channels.
Track feed point
Power Track

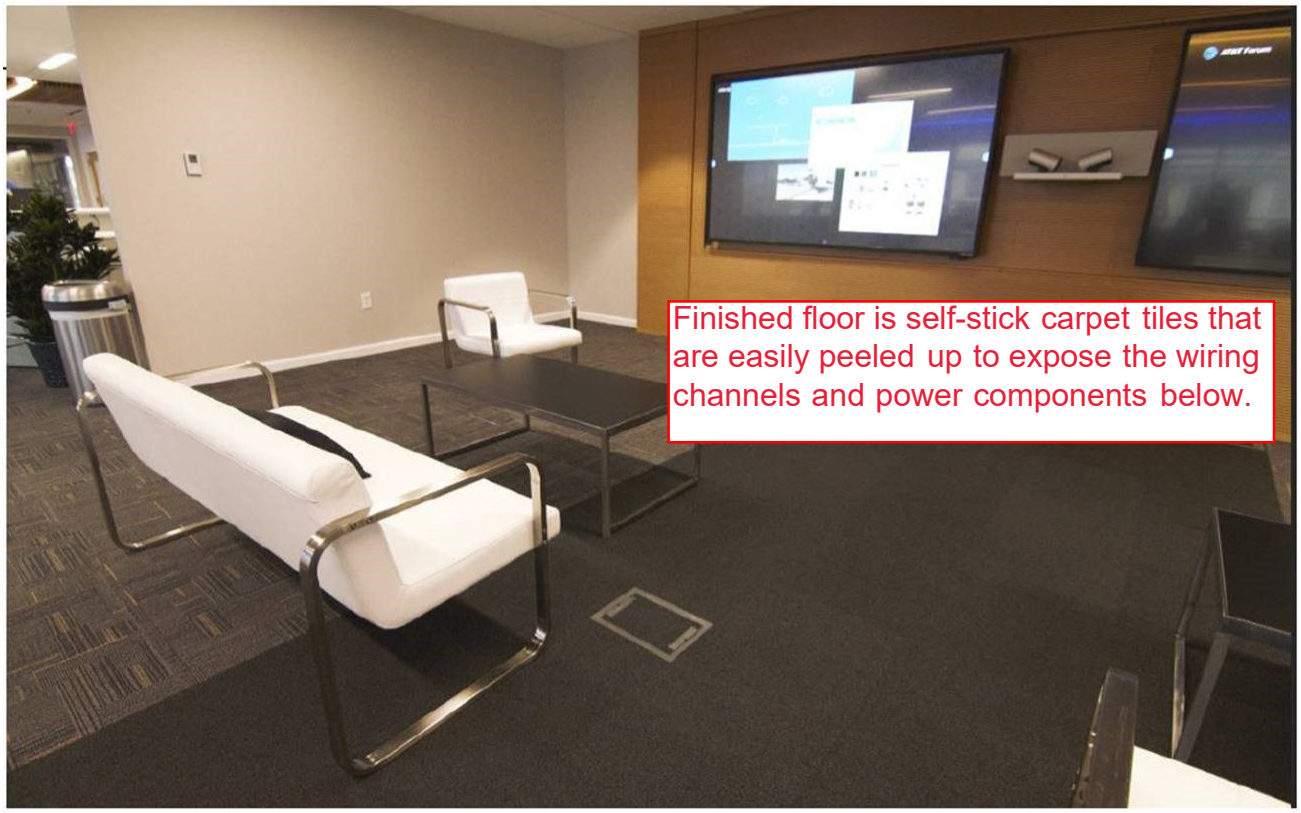

Relocatable floor box shown in floor base unit.
Channel covers are shown laying on installed floor

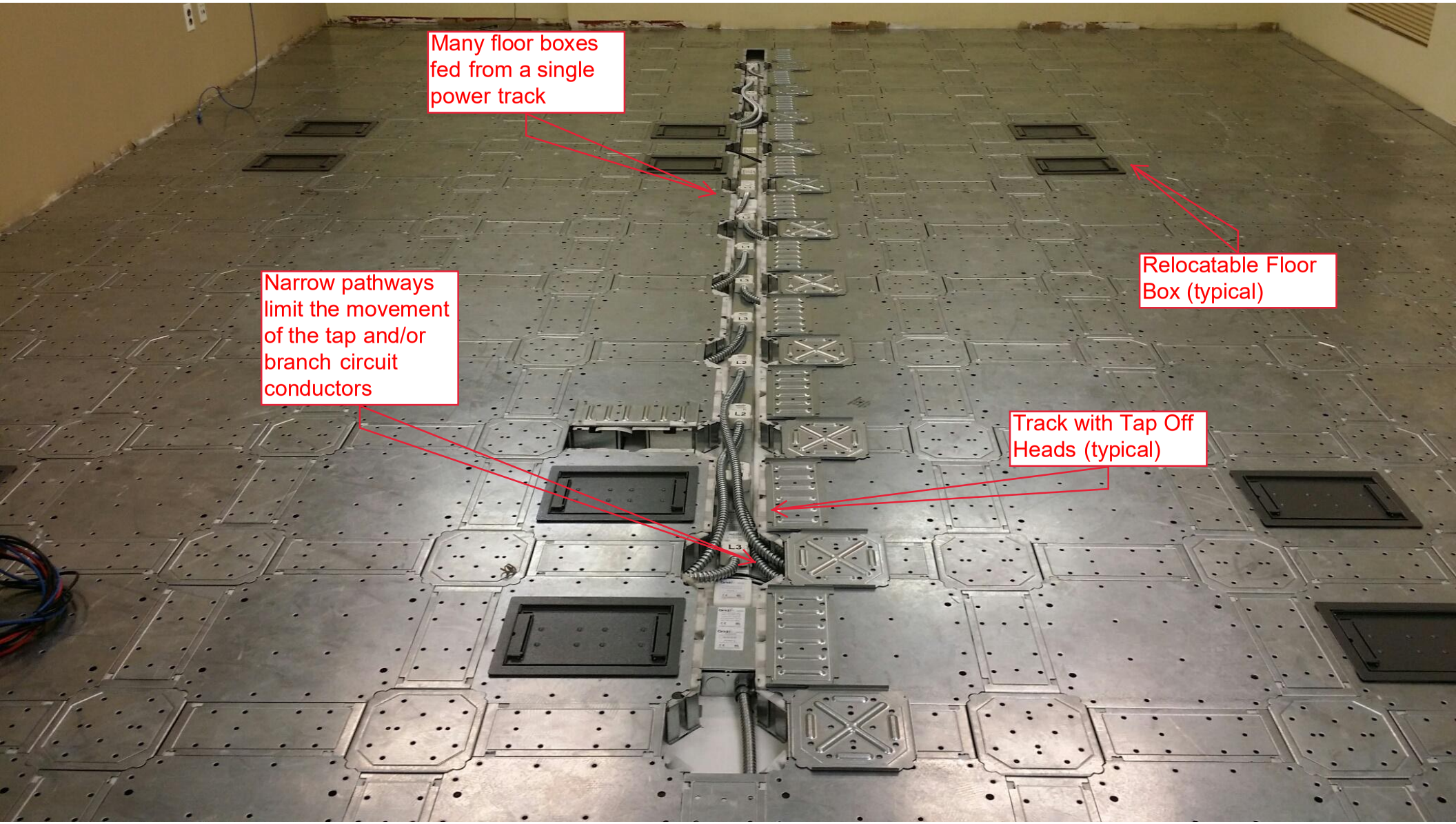
Close up of floor box with lid - installation is complete


Relocatable floor box in finished environment

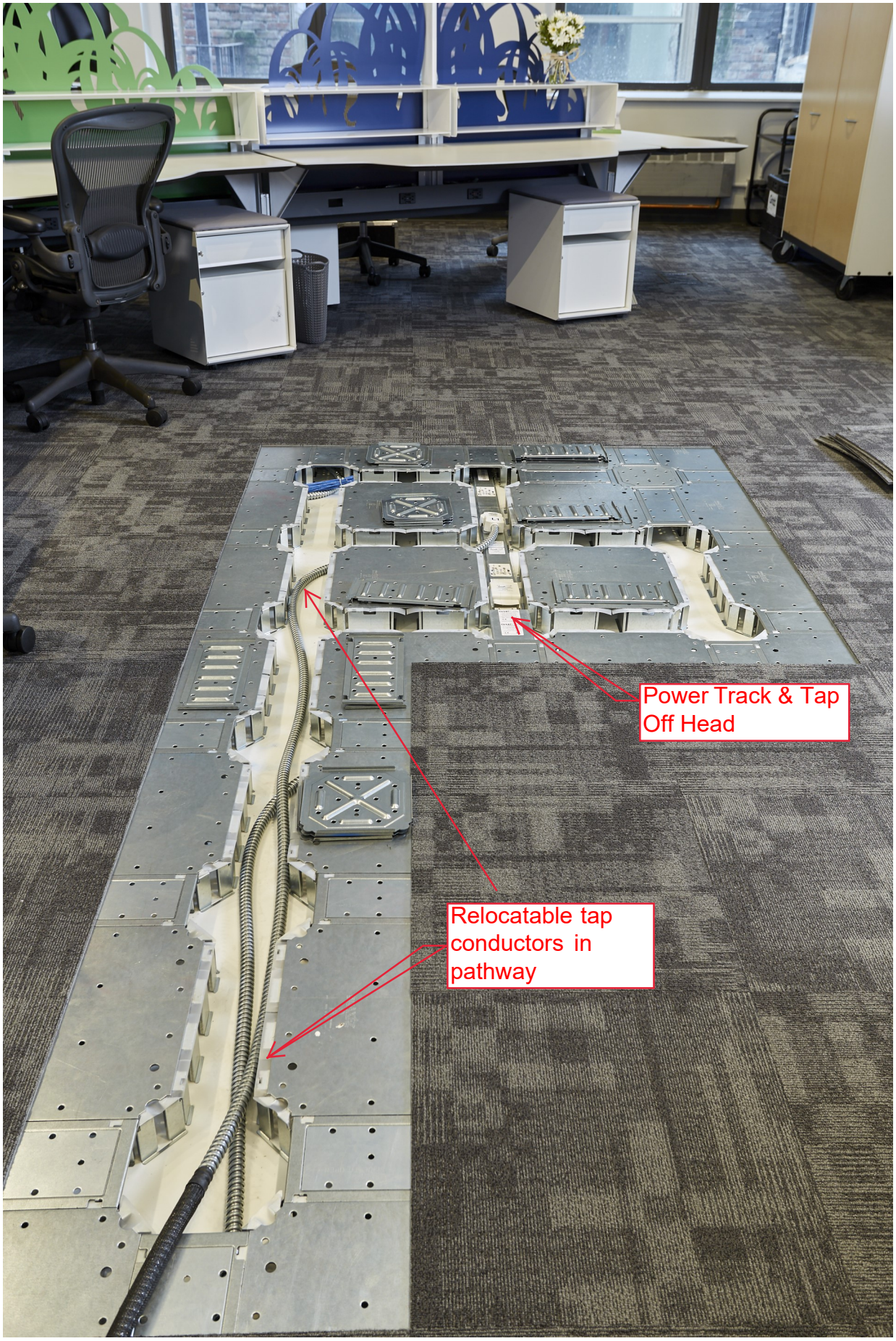

Relocatable floor boxes
Google

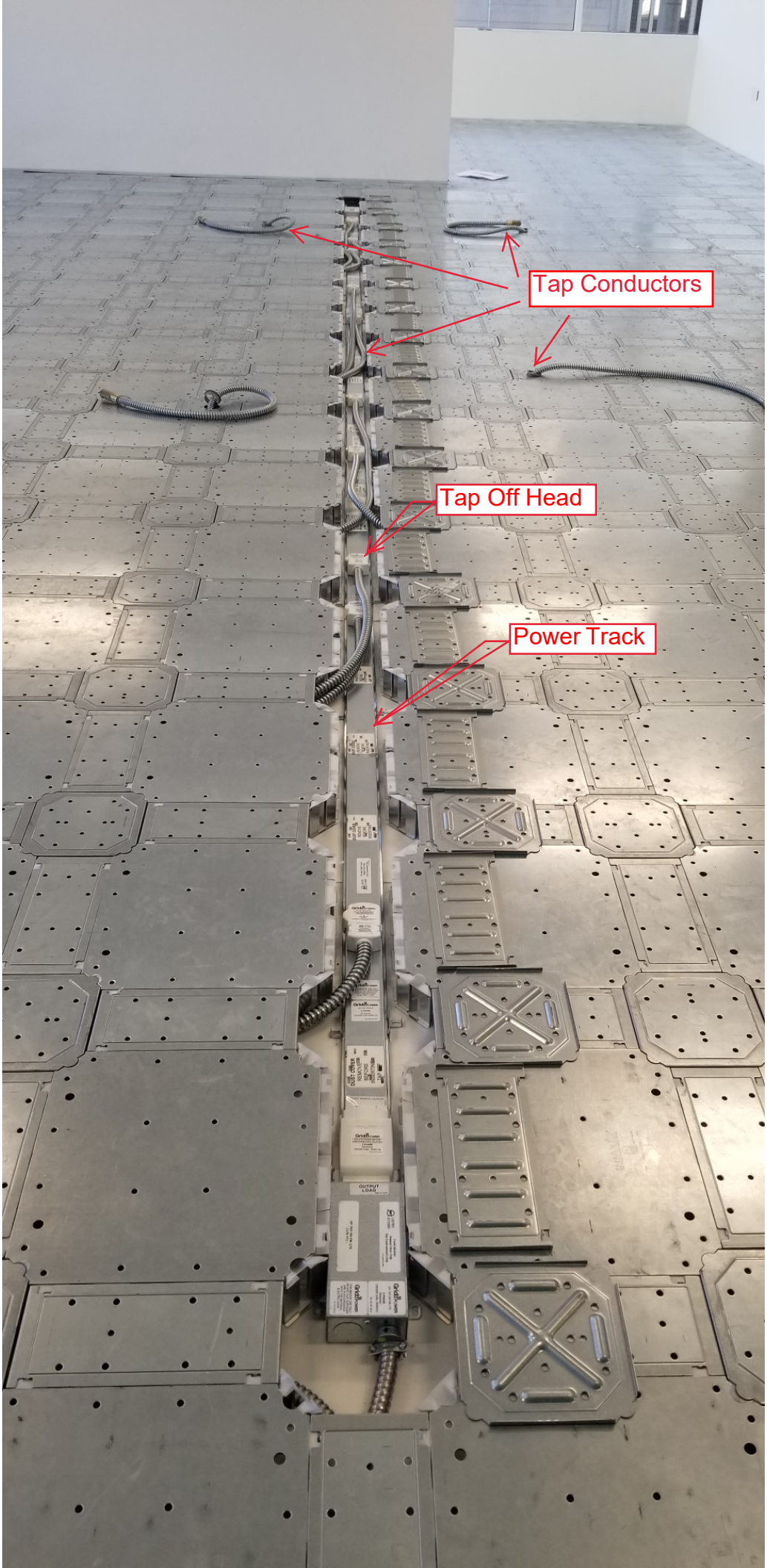

Relocatable floor boxes


Finished floor is self-stick carpet tiles that are easily peeled up to expose the wiring channels and power components below.

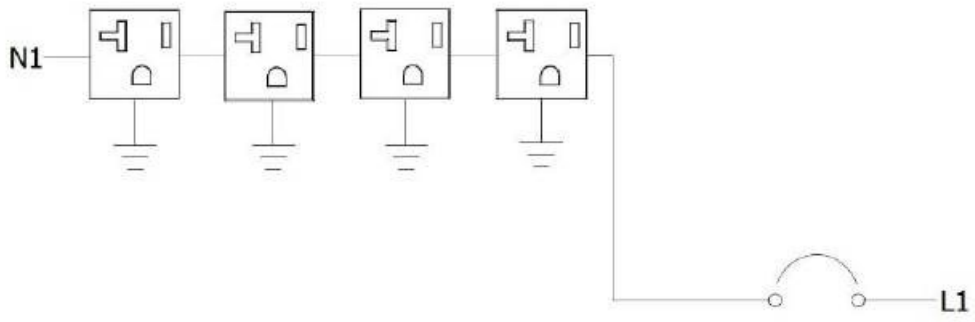

Many floor boxes fed from a single power track
Relocatable Floor Box (typical)
Narrow pathways limit the movement of the tap and/or branch circuit conductors
Track with Tap Off Heads (typical)

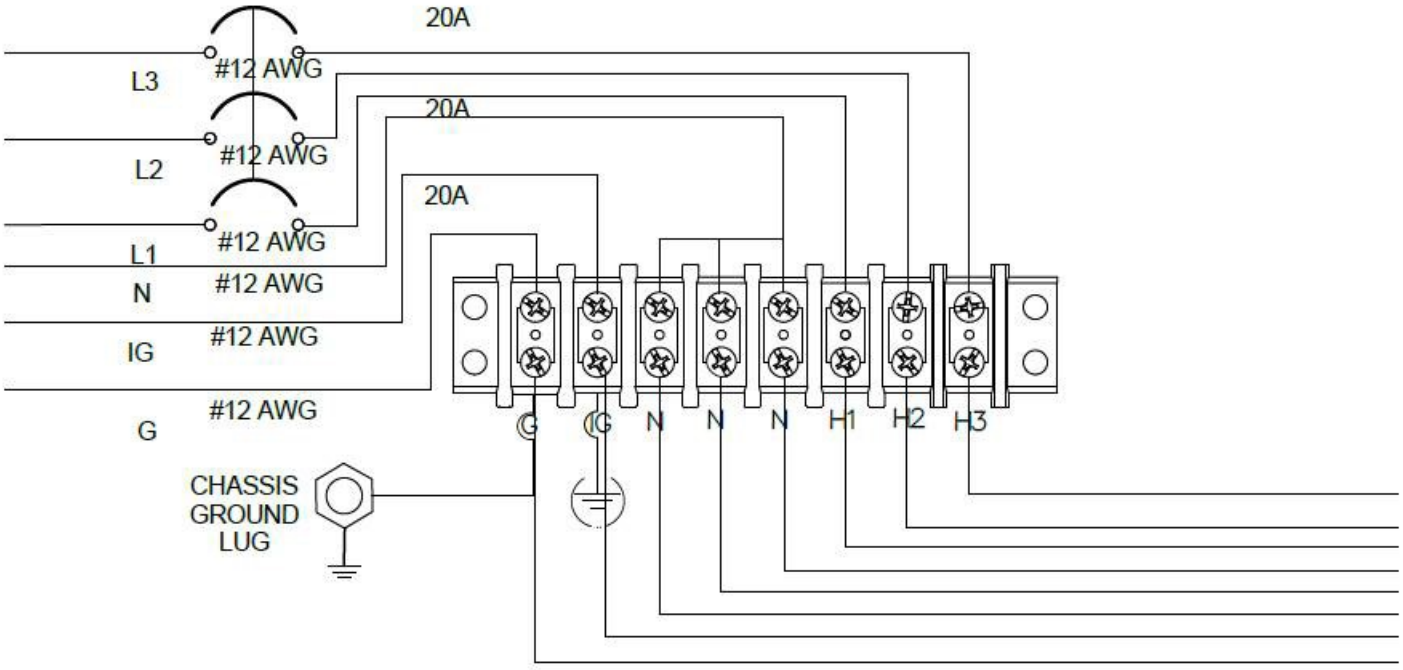
Tap Off Head With Whip and Relocatable Floor Box


Power Track & Tap Off Head
Relocatable tap conductors in pathway


Tap Conductors
Tap Off Head
Power Track

Power Track Is Secured To Floor


N1
L1


20A
20A
20A
L3
L2
L1
N
IG
G
#12 AWG
#12 AWG
#12 AWG
#12 AWG
#12 AWG
#12 AWG
CHASSIS
GROUND
LUG
G
IG
N
N
N
H1
H2
H3

Public Input No. 2484-NFPA 70-2020 [Section No. 604.100(A)(1)]

(1) Cables.

Cable shall be listed Type AC cable or listed Type MC cable containing nominal 600-volt, 8 to 12 AWG insulated copper-clad aluminum or copper conductors.

Other cables as listed in 725.154, 800.113, and 830.179 shall be permitted in manufactured wiring systems for wiring of equipment within the scope of their respective articles.

Statement of Problem and Substantiation for Public Input

Consult Sections 110.15 Electrical Connections and 110.5 Conductor Materials. Copper-Clad Aluminum as a conductor material should not be excluded from this application. Copper-Clad Aluminum is a similar metal to copper, and is one of three conductor materials for general wiring permitted by the NEC®. This PI aims to correct an inconsistency in correlation between Articles. It aims to bring safe alternatives to users of this Code. The NFPA Standards Council created in August 2019 a special Bimetals Task Group to bring attention to correlation issues effecting Copper-Clad Aluminum, as well as to study expanding its range of applications in 2023. The NFPA Bimetals Task Group will submit 19 Public Inputs in this cycle addressing this matter. Finally, Copper-Clad Aluminum has been referenced in Article 330 for decades as a safe and reliable conductor material.

Submitter Information Verification

Submitter Full Name: Peter Graser
Organization: Copperweld
Affiliation: American Bimetallic Association
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 23 13:59:49 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7713-NFPA 70-2020
Statement: Based on 2020 revisions to the NEC, Section 110.14, copper-clad aluminum is no longer considered a dissimilar metal to copper and as such is permitted in 604.100(A)(1).

Public Input No. 2485-NFPA 70-2020 [Section No. 604.100(A)(2)]

(2) Conduits.

Conduit shall be listed flexible metal conduit or listed liquidtight flexible conduit containing nominal 600-volt, 8 to 12 AWG insulated copper-clad aluminum or copper conductors with a bare or insulated copper-clad aluminum or copper equipment grounding conductor equivalent in size to the ungrounded conductor.

Exception No. 1 to (1) and (2): A luminaire tap, no longer than 1.8 m (6 ft) and intended for connection to a single luminaire, shall be permitted to contain conductors smaller than 12 AWG but not smaller than 18 AWG.

Exception No. 2 to (1) and (2): Listed manufactured wiring assemblies containing conductors smaller than 12 AWG shall be permitted for remote-control, signaling, or communications circuits.

Exception No. 3 to (2): Listed manufactured wiring systems containing unlisted flexible metal conduit of noncircular cross section or trade sizes smaller than permitted by 348.20(A), or both, shall be permitted where the wiring systems are supplied with fittings and conductors at the time of manufacture.

Statement of Problem and Substantiation for Public Input

Consult Sections 110.14 Electrical Connections and 110.5 Conductor Materials. Copper-Clad Aluminum as a conductor material should not be excluded for this application. Copper-Clad Aluminum is a similar metal to copper, and is one of three conductor materials for general wiring permitted by the NEC®. This Public Input aims to correct an inconsistency in correlation between Articles. It aims to bring safe alternatives to NEC® users. The NFPA Standards Council created in August 2019 a special Bimetals Task Group to in part bring attention to correlation issues effecting Copper-Clad Aluminum, as well as to study expanding its range of applications in 2023. The NFPA Bimetals Task Group will submit 19 Public Inputs in this cycle addressing these matters.

Submitter Information Verification

Submitter Full Name: Peter Graser
Organization: Copperweld
Affiliation: American Bimetallic Association
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 23 14:11:45 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7714-NFPA 70-2020
Statement: Based on 2020 revisions to the NEC, Section 110.14, copper-clad aluminum is no longer considered a dissimilar metal to copper and as such is permitted in 604.100(A)(2).

Public Input No. 2840-NFPA 70-2020 [Section No. 604.100(A)(2)]

(2) Conduits.

Conduit shall be listed flexible metal conduit ~~or~~ , listed liquidtight flexible conduit ~~containing~~ , or Electrical Metallic Tubing (EMT), containing nominal 600-volt, 8 to 12 AWG insulated copper conductors with a bare or insulated copper equipment grounding conductor equivalent in size to the ungrounded conductor.

Exception No. 1 to (1) and (2): A luminaire tap, no longer than 1.8 m (6 ft) and intended for connection to a single luminaire, shall be permitted to contain conductors smaller than 12 AWG but not smaller than 18 AWG.

Exception No. 2 to (1) and (2): Listed manufactured wiring assemblies containing conductors smaller than 12 AWG shall be permitted for remote-control, signaling, or communications circuits.

Exception No. 3 to (2): Listed manufactured wiring systems containing unlisted flexible metal conduit of noncircular cross section or trade sizes smaller than permitted by 348.20(A), or both, shall be permitted where the wiring systems are supplied with fittings and conductors at the time of manufacture.

Statement of Problem and Substantiation for Public Input

Some jurisdictions do not allow flexible wiring methods to be installed and currently the code does not show that a manufactured wiring system can be made from solid conduit. EMT is allowed to be used in exposed and concealed locations, in corrosive envirnments, and in wet locations. It provides superior physical protection than the wiring methods currently allowed in this section. This will be a specialty product that is listed by UL for the application with the conductors and connectors already installed in the EMT like that already listed listed with flexible metallic tubing. UL is in the process of listing this product now.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2846-NFPA 70-2020 [Section No. 358.30 [Excluding any Sub-Sections]]	

Submitter Information Verification

Submitter Full Name: Raymond Horner
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Submittal Date: Wed Sep 02 11:15:03 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7745-NFPA 70-2020

Statement: CMP 7 agrees with submitter that EMT would be a suitable wiring method in 604.100(A)(2) for manufactured wiring systems.

Public Input No. 3725-NFPA 70-2020 [Section No. 604.100(A)(3)]

(3) Flexible Cord.

Flexible cord suitable for hard usage, with minimum 12 AWG conductors, shall be permitted as part of a listed factory-made assembly not exceeding 1.8 m (6 ft) in length when making a transition between components of a manufactured wiring system and utilization equipment not permanently secured to the building structure. The cord ~~shall be visible for the entire length, shall not be subject to physical damage, and shall be~~ shall be provided with identified strain relief.

Exception: Listed electric-discharge luminaires that comply with 410.62(C) shall be permitted with conductors smaller than 12 AWG.

Statement of Problem and Substantiation for Public Input

This language does not belong in 604.100 as it is not a manufacturing requirement.

Submitter Information Verification

Submitter Full Name: Ryan Jackson
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Submittal Date: Wed Sep 09 11:25:22 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: The submitter doesn't provide technical substantiation to remove current language. The requirements is an installation requirement and not a manufacturing requirement as indicated by the submitter.

Public Input No. 3888-NFPA 70-2020 [Section No. 675.2]

(Relocate all definitions in the 675. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

675. 2 Definitions.

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

Center Pivot Irrigation Machine.

A multimotored irrigation machine that revolves around a central pivot and employs alignment switches or similar devices to control individual motors.

Collector Rings.

An assembly of slip rings for transferring electric energy from a stationary to a rotating member.

Irrigation Machine.

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

Statement of Problem and Substantiation for Public Input

"The National Electrical Code has definitions in multiple parts in Article 100 and many definitions scattered through out the code many of them in the .2 section of the articles.
Most of the other standards under NFPA have their definitions in one location and this will allow the NEC the same requirement. The revisions to the NEC Style Manual require all the definitions to be relocated to Article 100. "

Submitter Information Verification

Submitter Full Name: David Williams
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Submittal Date: Wed Sep 09 14:55:02 EDT 2020
Committee: NEC-P07

Committee Statement

Resolution: FR-7690-NFPA 70-2020
Statement: All existing definitions under the purview of CMP-7 have been moved to Article 100 and revises for compliance with Section 2.2.2 of the NEC Style Manual. Additionally, all definition sections (545.2, 547.2, 550.2, 551.2, 552.2, 555.2, 604.2, and 675.2.2) in the articles under the responsibility of CMP-7 have been deleted.

Public Input No. 759-NFPA 70-2020 [New Section after 675.17]

TITLE OF NEW CONTENT

Type your content here ...

675.18. Electromagnetic Pulse (EMP) Protection. Protection for electrically driven or controlled irrigation machines against the effects of electromagnetic pulses shall be provided at a minimum of Level 1. See 709.7 for levels of electromagnetic pulse protection. This requirement shall become effective January 1, 2026.

Statement of Problem and Substantiation for Public Input

A devastating electromagnetic pulse (EMP), caused by a sun-spot or a nuclear bomb exploded high in the atmosphere, can impress 50,000 volts per meter on unprotected electrical and electronic equipment. It is similar to a radio wave impressing a very small voltage on a radio antenna, only orders of magnitude larger. The problem is that a significant EMP will fry every electrical/electronic component or piece of equipment that is not protected.

The EMP won't directly harm or injure people, but because there is no longer a working electrical infrastructure, which may take years to repair/rebuild, people will die from the lack of clean water, medicine, food, fuel, and eventual rioting due to the breakdown of society. Unclassified studies, referenced at the end of this substantiation, have estimated from 66% to 90% of the US population will die within one year if a significant sun spot were to occur or if a nuclear explosion were to occur 25 to 250 miles over the Midwest.

Our US military already "hardens" systems/buildings so that our country's critical defensive capabilities are not completely destroyed. There are two major methods of protecting electrical/electronic systems. The first is that surge protective devices are installed on all "incoming" power and communications cables, shunting overvoltages to ground. The second is that Faraday cages are installed around equipment/rooms, preventing the EMP from reaching critical equipment/components.

The NEC® needs to address EMP protection for equipment, systems and special occupancies that are critical to our survival. Electrical and electronic equipment can and must be protected, as has been achieved by our military. Unfortunately, there are no requirements to protect civilian electrical and electronic equipment/systems from EMPs.

The NEC Correlating Committee has informally advised that an EMP Protection Article, if passed and adopted into the NEC®, would be most appropriately located after Article 708 (COPS). Thus, Public Input 756 has suggested a new Article 709 under jurisdiction of CMP 13, which already has purview over Emergency Systems (Article 700), Legally Required Standby Systems (Article 701), Optional Standby Systems (Article 702), and Critical Operations Power Systems (Article 708).

Levels of protection and associated protection requirements listed in the Public Input(s) are based upon the unclassified National Cybersecurity and Communications Integration Center report "Electromagnetic Pulse (EMP) Protection and Resilience Guidelines for Critical Infrastructure and Equipment". This study explains electromagnetic pulses and provides the necessary protective measures. It also contains estimates of the costs associated with properly protecting our electrical infrastructure.
The following table contains critical infrastructure components/special occupancies and the maximum time for outages caused by an EMP. Electrical components/infrastructure that is not functioning for periods longer than shown in this table may begin to cause injury or death to people and harm to society/economy.
Critical Infrastructure Component/Special Occupancy Permitted Outage Time
Branch banking facilities 10 hours

Critical Operations Power Systems 10 minutes
Data centers 10 minutes
Direct current microgrids 10 hours
Drug stores/distribution centers 10 hours
Electrically driven or controlled irrigation machines 1 week
Elevators, dumbwaiters, escalators, moving walks, platform lifts, and stairway chairlifts See facility requirements
Emergency systems 10 hours
Energy storage systems 10 hours
Fire alarm systems 1 week
Fire houses/stations 10 hours
Fire pumps 10 hours
Food processing and storage facilities 10 hours
Fuel cell systems 10 hours
Generators 10 hours
Grocery stores 10 hours
Hardware stores/home centers 10 hours
Healthcare facilities See NFPA 99
Information technology equipment 10 minutes
Interconnected electric power production sources 10 minutes
Jails and prisons 10 minutes
Large-scale photovoltaic (PV) electric supply stations 10 hours
Legally required standby systems 10 hours
Modular data centers 10 minutes
Motor fuel dispensing facilities 1 week
Motors, motor circuits, and controllers See facility requirements
Nuclear reactors 10 seconds
Optional standby systems 1 week
Petrochemical plants/facilities 10 hours
Pharmaceutical plants/facilities 10 hours
Police stations 10 minutes
Solar photovoltaic (PV) systems 10 hours
Stand-alone systems 10 hours
Storage batteries See facility requirements
Transformers See facility requirements
Waste water treatment facilities 10 minutes
Water supply facilities 10 hours
Wind electric systems 10 hours

An effectivity date of January 1, 2026 is chosen to allow time for engineering and industry to adequately pan and prepare for the required changes.

Opponents of EMP protection requirements will likely charge that it is too costly to protect our critical infrastructure, and that the NEC® is not a war-time document. A close reading of 90.1 reveals that there is no mention of the “cost” of safeguarding persons and property. Neither does 90.1 mention that safeguarding persons and property is only required during peacetime. Additionally, a significant EMP event, caused by a sunspot, would be an act of God, not an act of war.

The novel, “One Second After”, provides an understanding of what happens when the majority of all unprotected electrical and electronic equipment/systems is destroyed during an EMP event. An audio version of this book is available in two parts, for free, on YouTube.

This link provides the unclassified report “Electromagnetic Pulse (EMP) Protection and Resilience Guidelines for Critical Infrastructure and Equipment”
https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&
ved=2ahUKEwjQhp2-77DoAhXBHM0KHboOB2QQFjACegQIBRAC&url=https%3A%2F
%2Fwww.cisa.gov%2Fsites%2Fdefault%2Ffiles%2Fpublications%2F19_0307_CISA_EMP-Protection-Resilience-Guidelines.pdf&usg=AOvVaw2n7jLtJAUJtOJKHPMqWsTE

This link provides the study predicting up to 90% of our population could die from an EMP event

http://www.firstempcommission.org/uploads/1/1/9/5/119571849
/nuclear_emp_attack_scenarios_and_combined-arms_cyber_warfare_by_peter_pry_july_2017.pdf

This link provides unclassified guidelines for facility EMP protection
https://info.publicintelligence.net/DHS-FacilitiesGuidelinesEMP.pdf

These links provide Parts 1 and 2 of a national plan for EMP protection.
https://interferencetechnology.com/a-national-plan-for-emp-protection-part-1/
https://interferencetechnology.com/national-plan-emp-protection-part-2-protection-buildings/

We have all just witnessed the chaos and pain caused by not having the “protections” in place to quickly defeat the Covid-19 virus. As unfortunate, costly, painful, and deadly as Covid-19 was, it would be child’s play when compared to a significant EMP event if our critical electrical/electronic infrastructure remains unprotected. Quite simply, NEC® requirements to protect electrical and electronic equipment from an EMP event, could literally save millions of American lives.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 756-NFPA 70-2020 [New Section after 708.64]	

Submitter Information Verification

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Committee: NEC-P07

Committee Statement

Resolution: CMP 7 disagrees with the submitter that EMP protection should be required for Article 675 at this time as there is no established article for EMP protection in the NEC. No technical substantiation has been provided to add this requirement in Article 675.