Public Input No. 207-NFPA 70-2019 [Global Input]

"no less than"

change to

"not less than"

Statement of Problem and Substantiation for Public Input

The term "no less than" is used approximately 6 times in the NEC.
The term "not less than" is used approximately 881 times in the NEC.

Reason for the global change is for consistency, and to comply with the style manual. The "no less than's" can be found in:

Definitions, Overcurrent Protective Device, Branch-Circuit.
240.21(B)(4)(9)
430.109(F)
600.32(A)(4) [appears twice in this section]
691.1

Submitter Information Verification

Submitter Full Name: Nick Sasso

Organization: Clark County Building and Fire

Street Address:

City:

State:

Zip:

Submittal Date: Thu Dec 26 19:34:36 EST 2019

Committee: NEC-P01

Public Input No. 259-NFPA 70-2020 [Global Input]

"unless permitted by..."   or   "unless permitted by Article..."

change to

"unless permitted in..."

Statement of Problem and Substantiation for Public Input

Basically this is just clean up language, and to be in accordance with section 4.1.2 of the style manual. Let's pick one or the other. I believe that the correct language should be "unless permitted in..."

The unless permitted by's are located in:

300.13(A)

348.20(A)

356.20(A)

411.5(B)

625.46

626.26

725.136(A)

760.136(A)

The unless permitted in's are located in

225.30

230.2

348.20

356.20

411.5(B)

625.46

626.26

725.136(A)

760.136(A)

Submitter Information Verification

Submitter Full Name: Nick Sasso
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City:
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Submittal Date: Wed Jan 08 14:31:09 EST 2020
Committee: NEC-P01

Public Input No. 276-NFPA 70-2020 [Global Input]

(capable of being) locked in the open position

to

(capable of being) lockable open

Statement of Problem and Substantiation for Public Input

There are approximately 21 references to, "capable of being locked in the open position..."
and
there are approximately 26 references to, "capable of being lockable open..."

Let's pick one. Reason for change is consistency throughout NEC

Submitter Information Verification

Submitter Full Name: Nick Sasso

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City:

State:

Zip:

Submittal Date: Sat Jan 11 17:27:37 EST 2020

Committee: NEC-P01

Public Input No. 277-NFPA 70-2020 [Global Input]

(capable of being) lockable open

change to

(capable of being) locked in the open position

Statement of Problem and Substantiation for Public Input

There are approximately 26 references to, "capable of being lockable open..."

and

there are approximately 21 references to, "capable of being locked in the open position..."

Let's pick one. Reason for change is consistency throughout NEC. Personally, I prefer "capable of being locked in the open position."

Submitter Information Verification

Submitter Full Name:	Nick Sasso
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Submittal Date:	Sat Jan 11 17:33:21 EST 2020
Committee:	NEC-P01

Public Input No. 368-NFPA 70-2020 [Global Input]

Please provide page headers with the appropriate identifiers to make use of the code less confusing.

Example 1: Chapter 1 Article 100 - Definitions - PART III - Haz Locs

Example 2: 110.31 Article 110 - Reqs for Electrical Installations -Part III - OVER 1000 VOLTS nom

Example 3: Annex C- Tables Informative Annex C - Table C-3 (FMC) cont.

Statement of Problem and Substantiation for Public Input

Earlier versions of the document included shorthand page headers that greatly improved user ease of finding the correct code sections. As written now the document is confusing with important distinctions hard to ferret out. For example the sections that are limited in application to certain voltages or locations may run for pages but the transition to that distinction is hard to find, and any page after the initial distinguishing information is not notated in any way to indicate that a limitation of scope applies.. Identifiers such as Part III Over 1000 volts is not prominently distinguished in the body of the text and is not reflected in the page heading on latter pages, leading to much confusion when using the document in the field. (Earlier versions also had the PART III or similar transitions prominently bold to make finding them easier.) Please accept my apology if this is submitted in the incorrect format or to the incorrect panel or group. This would appear to be a style request more than a code request but I did not find any public input option for style or page headers.

Submitter Information Verification

Submitter Full Name: Joe Kunkel

Organization: NU Electric Co

Street Address:

City:

State:

Zip:

Submittal Date: Sun Jan 26 12:24:46 EST 2020

Committee: NEC-P01

Public Input No. 454-NFPA 70-2020 [Global Input]

Type your content here: I would like to see one of the two things I have listed happen; either put all definitions in article 100 no matter how many times the term is used throughout the NEC or keep the NEC at the current format limiting article 100 for definitions of terms used more than twice in the NEC and using xxx.2 for definitions that are only used in that particular article. Do not use xxx.2 for anything besides definitions. Currently if an article does not contain any definitions, xxx.2 is used for anything. Example; 90.2 SCOPE, 110.2 APPROVAL, 200.2 GENERAL, plus many other articles, although this change would not in essence save lifes, it would add consistincey to the NEC, ...

Statement of Problem and Substantiation for Public Input

This would add consistency to the NEC,

Submitter Information Verification

Submitter Full Name:	Ray Pritchett
Organization:	NJATC
Affiliation:	Evansville Electrical Training Center IBEW Local 16
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Sun Feb 09 22:55:07 EST 2020
Committee:	NEC-P01

Public Input No. 2989-NFPA 70-2020 [Global Input]

Regarding the division of NEC Articles into “Parts”;

Where "Parts" are used to sub-divide NEC Articles by topic, it is proposed to amend the Part description text with a set of brackets that enclose the span of paragraph numbers that is encompassed by the respective Part category.

For example, NEC Chapter 2, Article 210, Part III.

This "Part" text string is represented as;

Part III. Over 1000 Volts

The proposal is to revise this "Part" text string to;

Part III. Over 1000 Volts (210.50-.70)

And, to do the same for all "Parts" of all NEC Articles.

Statement of Problem and Substantiation for Public Input

BASIS FOR CODE REVISION: to facilitate quicker more efficient code searches by providing a context clue via association of the paragraphs that are correlated to the "Part" sub-category. Page-by-page code searches that miss seeing the keyword "Part" somewhere on the page, could now be less prone to such erroneous mis-associations

Submitter Information Verification

Submitter Full Name: John Blissett

Organization: Bernhard TME

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City:

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Zip:

Submittal Date: Thu Sep 03 19:32:38 EDT 2020

Committee: NEC-P01

Public Input No. 3013-NFPA 70-2020 [Global Input]

Move all definitions in the code to Article 100, arrange them in alphabetical order and without any subdivisions.

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 require all the definitions to be moved to Article 100.

Submitter Information Verification

Submitter Full Name: David Williams
Organization: Delta Charter Township
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State:
Zip:

Submittal Date: Thu Sep 03 21:41:22 EDT 2020
Committee: NEC-P01

Public Input No. 3141-NFPA 70-2020 [Global Input]

Move all definitions in current (2020) NEC text to Article 100. Insert those definitions in alphabetical order. For definitions that apply in only one article, the article number in parentheses shall follow the definition. The CMP responsible for the definition shall be identified in parentheses at the end of the definition following any extract or article information.

Type your content here ...

Statement of Problem and Substantiation for Public Input

This revision provides a more usable code by providing a uniform process to find definitions. Users are currently required to look in multiple locations to determine if a term is defined. Other NFPA codes and standards utilize a single location for all definitions.

Submitter Information Verification

Submitter Full Name:	Donald Cook
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Affiliation:	Self
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City:	
State:	
Zip:	
Submittal Date:	Sat Sep 05 15:11:40 EDT 2020
Committee:	NEC-P01

Public Input No. 3327-NFPA 70-2020 [Global Input]

Review the revisions to the new NEC Style Manual and make changes to comply with the Style Manual.

Statement of Problem and Substantiation for Public Input

The NEC Style Manual has been revised and every code making panel needs to review the manual and make changes to their code articles to comply with the Style Manual revisions.

Submitter Information Verification

Submitter Full Name:	David Williams
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Submittal Date:	Tue Sep 08 07:31:11 EDT 2020
Committee:	NEC-P01

Public Input No. 3328-NFPA 70-2020 [Global Input]

Review the Articles with multiple parts to comply with the revisions made to the NEC Style Manual. Make changes based on the Style Manual revisions.

Statement of Problem and Substantiation for Public Input

Section 2.1.4 was revised by adding the last two sentences. Where an article contains multiple parts and includes general installation requirements, such requirements shall be located in the first part titled “Part I. General”. Part titles shall be descriptive and as concise as possible.

Submitter Information Verification

Submitter Full Name:	David Williams
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Submittal Date:	Tue Sep 08 07:34:42 EDT 2020
Committee:	NEC-P01

Public Input No. 3329-NFPA 70-2020 [Global Input]

Revise the Definition Title Structure to comply with the NEC Style Manual.

Statement of Problem and Substantiation for Public Input

Review the Style Manual Revisions in 2.2.2.3 Definition Title Structure. Definitions that have sub-parts shall be listed alphabetically by the base term, with a comma and then the modifying descriptor.

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Submittal Date:	Tue Sep 08 07:36:42 EDT 2020
Committee:	NEC-P01

Public Input No. 3330-NFPA 70-2020 [Global Input]

Verify that all exceptions are written in completed sentences.

Statement of Problem and Substantiation for Public Input

The NEC Style Manual requires that all exceptions are written as complete sentences in accordance with 3.1.4.1.

Submitter Information Verification

Submitter Full Name: David Williams
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State:
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Submittal Date: Tue Sep 08 07:40:56 EDT 2020
Committee: NEC-P01

Public Input No. 3331-NFPA 70-2020 [Global Input]

Revise the definitions in Article 100 to include an acronym, as desired, for subsequent use in the NEC without having to state the term.

Statement of Problem and Substantiation for Public Input

The permitted use of acronyms in the NEC has changed with the Style Manual revisions in 3.2.3. When a term is defined in Article 100 and includes an acronym, that acronym is permitted to be used elsewhere through out the code.

Submitter Information Verification

Submitter Full Name:	David Williams
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Submittal Date:	Tue Sep 08 07:43:12 EDT 2020
Committee:	NEC-P01

Public Input No. 3332-NFPA 70-2020 [Global Input]

Review the structure of all Informational Notes to comply with the revised NEC Style Manual.

Statement of Problem and Substantiation for Public Input

Sections 3.1.3.1 and 4.1.3 of the revised NEC Style Manual includes designed structure for references in Informational Notes.

Submitter Information Verification

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City:

State:

Zip:

Submittal Date: Tue Sep 08 07:48:58 EDT 2020

Committee: NEC-P01

Public Input No. 3333-NFPA 70-2020 [Global Input]

Review all references to articles or parts of articles to comply with the Style Manual.

Statement of Problem and Substantiation for Public Input

Section 4.1.4 References to a Part Within an Article. Except for Article 100, references shall not be made to an entire article. References to parts within articles shall be permitted.

Submitter Information Verification

Submitter Full Name:	David Williams
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Submittal Date:	Tue Sep 08 07:50:17 EDT 2020
Committee:	NEC-P01

Public Input No. 3335-NFPA 70-2020 [Global Input]

Review the use of Parts within an article and the section number for parts of an article.

Statement of Problem and Substantiation for Public Input

The code panels need to review the sections under their purview to comply with the revisions made to the NEC Style Manual. 2.4.2.1 Parts. If an article is subdivided into parts, it is recommended that the section numbering within each part start with the next decade as a minimum to allow for future growth. New or significantly reorganized articles shall follow this numbering convention. Where an article has multiple parts, Part I. shall be titled “General”.

Submitter Information Verification

Submitter Full Name: David Williams
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City:
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Submittal Date: Tue Sep 08 08:02:00 EDT 2020
Committee: NEC-P01

Public Input No. 3336-NFPA 70-2020 [Global Input]

More than one informational note in a section or subdivision shall be consectutively numbered.

Statement of Problem and Substantiation for Public Input

The numbering of informational notes need to comply with the changes made to the revised Style Manual.
2.4.3. Numbering Informational Notes. If there are two or more informational notes in a definition, section or subdivision, consecutive numbering of the informational notes shall only occur in that definition, section or subdivision.

Submitter Information Verification

Submitter Full Name:	David Williams
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Submittal Date:	Tue Sep 08 08:10:27 EDT 2020
Committee:	NEC-P01

Public Input No. 3490-NFPA 70-2020 [Global Input]

100 Definitions

Defined terminology associated with Manufacture and Construction activities.

1. The term “Construction” shall be defined as the process of deploying product or installation of a device, material, or item of equipment in accordance to its designated purpose. An owner or owner's agent (e.g. contractor) implements construction at a specific worksite location for either a permanent installation, or a temporary application as permitted by code. Installation shall comply with manufacturer terms and ratings unless permitted otherwise in this code. All code delegated responsibilities for testing, marking, labeling, identification, documentation, etc., which are not the clear accomplished responsibility of the manufacture production process, shall be the due diligence responsibility of those involved with the construction process, unless approved otherwise by the authority having jurisdiction.

Informational Note: construction applications include, but are not limited to, activities associated with activities involved with: install, field installed, field applied, field tested, field assembled, field evaluation, field wiring, field marking, field conversion, and field labeled.

2. The term “Fabricated” shall be defined to apply to equipment or an assembly that is neither necessarily listed nor mass-produced. For example, custom equipment, a custom assembly, or equipment that is altered from its original listing. Fabrication may occur in whole or part onsite or offsite. Component parts and materials may be listed, or may be required to be listed by this code or by the authority having jurisdiction. Generally, where fabricated products are permitted by this code, code compliant product qualification shall be by a Field Evaluation Body, where duties typically include: product testing, marking, labeling, identification, standards compliance, product documentation and instructions sufficient for the safe operation appropriate per the application criteria. Fabricated applications also include reconditioned equipment and retrofit equipment, as permitted by this code, wherever equipment is functionally restored to other than conformance to the original manufacturer's equipment ratings and life cycle projections. Fabricated equipment and systems that encompass, in part or whole, any associated construction activities and elements, shall absorb the associated due diligence responsibilities involved, except as approved otherwise by the authority having jurisdiction.

Informational Note: fabrication applications generally include, but are not limited to, activities associated with pre-fabricated equipment and systems: electrical system assemblies, mechanical system assemblies, and modular building assemblies. Where the assembly is listed as a unit, then the manufacture application responsibilities apply.

3. The term “Pre-fabricated” shall be defined to apply to those fabricated equipment assembly activities that occur at a site other than the permanent installation location.

4. The term “Manufacture” shall be defined as the factory assembly of a product, characteristically mass produced and distributed. Examples include: equipment, wire, devices, material, and compounds. The manufacture process includes production activities including: factory testing, marking, labeling, identification; NRTL Listing where applicable; standards compliance, product document publication for sales and designer specifications including those used for: shipping, install, field

testing, owner use, and maintenance. By definition, final assembly or other in-field activites of a product at its permanently installed location will not constitute an aspect of manufacture, unless performed by the manufacturer.

Informational Note 1: applications where a product's permanent or temporary installation occurs at a point-of-use location under direct supervision of the manufacturer, the requirement duties of both the manufacture process(es) and associated construction process shall be the responsibility of the manufacturer, except as approved otherwise by the authority having jurisdiction.

Informational Note 2: manufacture applications shall include modular equipment, where an assemblage of different products has been hybridized into a singular unit, when the unitized equipment is listed. Where the unitized equipment is not listed as a unit, then the fabricated application responsibilities apply.

Statement of Problem and Substantiation for Public Input

BASIS FOR CODE REVISION:
The term "construction" is used throughout NEC in reference to code requirements that are aimed at typically different segments of industry, which only occasionally overlap each other's general task sets. Product construction during manufacture is one application, versus product install during site construction. The code text describes both contexts as construction. Where practicable, it would improve functional clarity in code text requirements to employ distinct construction-like terms wherever reasonable and appropriate. The terms and definitions proposed are suggestions; to serve as a basis to move this discussion and consensus forward.
Where code requirements clearly intend compliance fulfillment to be about the product's activities prior to leaving the factory, distinct terminology can communicate this with added clarity. Similarly, where code compliance fulfillment clearly applies to the implementation of a product, as regards its permanent installation, a distinctly defined term for 'construction' will yield improved comprehension as to intended context. A third distinct category can also be established by definition that encompasses fabrication, to serve to encompass custom fabrication assemblies, reconditioned equipment, and retrofits.
Applications where the code responsibility can fall into gray areas for accountability between the three, can be attended to by a default assignment of responsibility. This explicit clarity helps ensure that enforceable code compliance responsibilities are clearly stated. Allowance for an exception, per AHJ acceptance, provides a mechanism to formally transfer an obligation of responsibility.
Where the code speaks to putting an identifying mark, or information, or color onto a cable or item of equipment, it more often refers to those which would intend to be understood as the responsibility of the manufacturer. The following two sets of code citations illustrate where the manufacturer is to provide a mark or color (first set) versus where the installer is to provide a mark or color. The third set of code citations is where it is intuitively apparent that either the manufacturer or installer could either be involved (or both involved) in providing a mark or color on the electrical equipment.
Example requirements for manufacturer marks or color include but are not necessarily limited to; 110.14(D), 110.28, 200.4(B), 200.6, 200.7, 200.9, 200.10(B), 200.10(D), 215.12(A), 215.12(B), 225.30(A)(7), 230.46, 230.66(A), 230.70(B), 230.77, 240.50(C), 240.81, 240.82, 240.83(A&B), 240.83(D), 240.85, 250.28(B), 250.110 Ex3, 250.119, 250.119(A), 250.119(B), 250.119(C), 250.126, 250.28(B), 250.112, 250.114, 250.119, 250.126, 300.11(B)(1), 300.11(B)(2), 310.3(D), Table 310.4(A), 310.6(ABC), 310.8(C)&(D), 310.10(C), 310.10(D), 311.14, 311.16(A), 311.16(B)(1&2)), 311.16(B4&C), 311.32, 314.16(C)(2), 322.56(B), 322.120(C), 336.120, 338.120, 368.12(E), 386.70, 388.70, 406.3(D), 406.3(E), 406.10(B), 406.13 (A-D), 409.110, 430.52(C)(5), 500.8, 501.5, 501.17, 501.105(B)(1), 501.130(A)(1, 502.6, 502.130(B)(1), 502.130(B)(2), 503.130(A), 504.80(C), 505.8, 505.20(B&C), 505.22, 505.26, 506.9(C)(1), 506.9(C)(2), 506.9(D), 517.18(A), 517.19(A), 517.61(C)(2), 530.21(B), 530.22(B), 545.22(A), 551.77(A), 552.10(B)(3), 552.10(E)(2), 555.8, 555.33(B)(2), 600.23(F), 600.33(A)(3), 600.33(A)(4), 690.12(C), 690.51, 694.22(A), 700.10(A), 705.12(D), 705.20, 706.15(C), 708.10(A)(2), 712.37, 725.3(P), 725.179, 760.3(O), 760.30, 760.176(G), 760.179(G)(1), 770.179, 800.182, 805.179, 820.179, 830.90(A)(2), 830.179(C&D), 840.170(B), and 840.170(E).
Example requirements for the installer to do the marks or color indications include but are not necessarily limited to; 200.4(B), 200.6, 210.5(C)(1), 210.5(C)(2), 210.12, 215.12(A), 215.12(C)(1), 215.12(C)(2), 225.30(B), 225.38(C), 225.52(D&E), 230.72(A), 300.5(D)(3), Table 300.50, 310.6(ABC), 311.14, 406.3(E),

406.10(B), 408.3(E)(2), 408.3(F)(1), 408.3(F)(2), 408.3(F)(3), 408.3(F)(4), 408.3(F)(5), 517.18(A), 517.19(A), 517.160(A)(5), 530.21(B), 530.22(B), 547.9(A)(10, 550.33(A), 552.43(C), 620.53, 620.55, 647.4(C), 647.7(A)(4), 668.21(C), 690.54, 690.55, 700.10(A), 712.25, 712.55, 725.124, 760.30, and 770.179(F).

Example requirements for either the manufacturer and/or the installer to do the marks or color indications include but are not necessarily limited to; 230.56, 250.21(C), 250.167(C), 408.3(E)(1), 409.102(B), 430.97(B), 430.109(A)(6), 430.109(E), 517.31(C)(1), 517.31(E), 517.42(E), 520.44(C)(3), 520.54(C), 520.54(J)(1), 520.54(K), 530.21(B), 530.22(B), 550.10(I), 690.1, 690.31(B)(1), 690.31(D)(2), 770.179(G), 805.90(A)(2), and 805.170(A).

As regards reconditioned equipment and retrofit equipment, the code is in its developing infancy as regards code requirements for marks, as they are few, yet likely to grow in upcoming code cycles. Having distinct groups for manufacture, installation, and fabrication also serves to help make obvious, the places in code that similar code requirements between them may be missing but warranted.

Similar to the topic above for equipment marks between manufacture, installation, and fabrication, are topics for labels and signage which are beyond marks.

In NEC Chapter 3,4 and 7 the term “manufacture specifications” can substituted for “construction specifications”. And in NEC Chapter 5 and 6, where specifications have other terminology variations based on product qualities, “manufacture specifications” can be used with such term descriptors for NEC consistency to augment transparency when a code specification is intended to apply to manufacture apart from installation criterion.

Another example benefit from having a distinction between manufacture, installation, and fabrication are for the code required documentation and whom is to provide it. Such as; instructions for shipping, install, or maintenance, versus installer instructions for operation sequence, equipment ratings guidance or site-specific diagnostic protocols.

Where an entity assumes multiple roles of manufacture, installation, and/or fabrication, they are intended to assume the respective responsibilities. And, what those responsibilities are will have improved certainty, when there are improvements to distinctions of terminology and nomenclature. Inspections and commissioning processes will similarly be improved for the same basis of improved enforceable clarity.

SIDEBAR: a supplemental suggestion, in the earnest of minimizing code text where practicable, is to utilize a letter or symbol icon, for use in NEC margins, that correlates to each of the three definitions for, manufacture, versus fabricated, versus construction. For example, a symbol icon for manufacturer (e.g. Hex Note enclosing an 'M'), versus those affiliated with the product install construction process (e.g. Hex Note with 'C'), versus the symbol for the fabrication process (e.g. Hex Note with 'F'). One example of benefit of deploying a symbolic nomenclature is the topic of labels, signage, and markings; which are often able to be grouped by: manufacturer, fabricated, or installer. Each instance in code for label, mark, or sign can include one or more of these three symbols in the margin alongside the code text without adding pages to the code. A raised bar of label and signage compliance is likely the result, plus an improved ease and capacity for enforcement by way of inspection or commissioning.

Submitter Information Verification

Submitter Full Name:	John Blissett
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Street Address:	
City:	
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Submittal Date:	Tue Sep 08 17:16:57 EDT 2020
Committee:	NEC-P01

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

Public Input No. 4390-NFPA 70-2020 [Global Input]

When an Article has Parts the revised Style Manual requires the following in 2.1.4.

Part titles shall be descriptive and as concise as possible.

Example:

Part I. General

Part II. Installation

Part III. Construction

Statement of Problem and Substantiation for Public Input

The revised Style Manual requires Article Part titles to be descriptive and concise as possible and provides examples for the code panels to use.

Submitter Information Verification

Submitter Full Name:	David Williams
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Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Thu Sep 10 11:45:05 EDT 2020
Committee:	NEC-P01

Public Input No. 4707-NFPA 70-2020 [Global Input]

Globally revise the use of term "Listed", and revise use of the term "Labeled"

To distinguish the NRTL (testing lab) context for the term "labeled" and "listed" from other NEC context uses of these words in all their forms; label, labels, labeling and labeled, it recommended to apply capitalization to the word "Labeled" and "Listed" when intended for this particular context of a testing organization. Capitalization as proper nouns will make this context more readily recognizable.

For additional distinctive clarity for this context of these terms ‘listed’ and "labeled", apply them with their "NRTL" modifier; and deploy "NRTL Listed" and "NRTL Labeled" throughout the Code text. Of course, all variants formed for grammatical correctness would also be amended and capitalized, such as "NRTL Listing" and "NRTL Label" etc.

In the definitions, it is appropriate to associate NRTL to "Nationally Recognized Testing Laboratory", which is generally the type of testing agency. Any other testing agency, where approved by an AHJ, is allowed. It is also appropriate to include a reference to the industry standard organization that acknowledged to govern this industry acceptance standard for each NRTL, the Occupational Safety and Health Administration (OSHA). With OSHA acknowledged as the official agency, it becomes a Code-legitimized reference, able to facilitate any follow-up enquiries regarding code compliance. To help facilitate back-checks has never been more suitable than in this age of ever-increasing pirating of product and other pretenders to suitability.

Wherever the term ‘Labeled’ is used as part of ‘NRTL Listed and Labeled’, it shall refer to the equipment mounted labeling that is pertinent to all of the equipment item’s application-specific Listing(s) and shall include the equipment ratings.

Wherever the term ‘Marked’ is used as part of ‘NRTL Listed and Marked’ or ‘NRTL Listed and Labeled and Marked’, ‘marked’ shall refer to the marking or labeling that is associated with the Listing and shall include the specific qualification of use mentioned in code. E.g. listed and labeled and marked as being suitable for use as service equipment.

Statement of Problem and Substantiation for Public Input

BASIS FOR CODE REVISION:

The term ‘Listing’ and ‘Listed’ will be capitalized and treated as a proper noun; short for ‘NRLT Listing’ and ‘NRTL Listed’. The term ‘Labeled’ will also be capitalized as a proper noun when used to indicate ‘NRTL Labeled’ or ‘Manufacturer Labeled’ as regards the manufacturer’s terms of use for the equipment. NFPA codes does not capitalize these three terms generally so they are indistinguishable from the other contexts for a list or label. Manufacturer terms of use regarding labeling can include ratings, Listing types, or other declarations of compliance to particular industry standards.

There Code text of NEC 110.3, Part (C) may have intended for equipment generally to be Listed, but technically it is not ever stated. All that is stated is the terms for who will do the testing and evaluation as regards a Listing.

The Occupational Safety and Health Administration (OSHA) is the official agency that recognizes qualified testing laboratories, of which there are 23 approved labs to date. OSHA confirms that NEC’s “electrical” sub-distinction of labs in NEC 110.3, Part (C) doesn’t formally exist as an industry recognized group. The ‘electrical’ testing laboratory distinction is an obscure reference used in two other places in the NEC [90.7, 490.48(A)], but not in the NEC's other (14) references of a testing laboratory. Underwriter Laboratories (UL) is the only distinct NRTL lab whose standards are cited in the NEC and there are hundreds of UL citations (see. NEC Informative Annex A). One relevant ATS example is cited in NEC; UL1008 for transfer switches up to 600V. And one relevant ATS example is not cited in NEC; UL1008A for 750V-46kV ATSs. Whether another NRTL lab other than UL may qualify NEC's intent as an "electrical lab" is unknown. The NEC requirements are functional without the "electrical" sub-distinction, and so this likely warrants deletion of "electrical" in an upcoming NEC code revision.

Though these code articles infer an expectation that an ATS shall be used, an ATS is not overtly mandated as required. Only when an ATS is used, then definitive code requirements apply, like a Listing for emergency use.

NEC Article 705 applies to Interconnected Power Production Sources that parallel with the normal source, which is typically the utility supplied power source. There is an incongruence of code due to what NEC 705 allows. That is whenever the 705 code language is interpreted as an absolute permission due to the omission of disallowances of use as an essential-class power system. The code requirement variance compared to similar applications is a risk, because it then grants an emergency power distribution topology absolution because the code language allows it. NEC Article 705 has no requirements for equipment to be Listed for any aspect.

NEC 705 applies to distribution gear that interconnects normal power (e.g. utility) with an alternate source of power (e.g. generator). The 705 distribution gear may serve in place of an automatic transfer switch because the code does not disallow that use. Yet code does not require it be listed for emergency use, nor does it even require the automated switching mechanisms to be electrically operated and mechanically held. The NEC 705 gear has latitude to have more than two sources and more than one load. The function of NEC 705 gear may be no less critical but it is more susceptible to dysfunction than an ATS. It is arguably more important even than any single automatic transfer switch as it can perform the duty of multiple transfer switches or be the power source to many ATSs. It is like using a string to support a chain. This example illustrates how language of one NEC article (705) can permit use of a power distribution topology that is inconsistent to all other instances of code text regarding transfer switching of emergency power, which would otherwise be fairly consistent.

Application Specific Code Requirements

A summary of code findings on power source selection for emergency applications is as follows;

1. FOR ALL CODIFIED POWER SYSTEM TYPES OTHER THAN NORMAL: An ATS shall be NRTL Listed for Emergency Use (and also identified for Standby Use). Exceptions are:

A. Optional Standby Power System (NEC 702; other Listing requirements may apply)

B. Fire Pump (NEC 695; other Listing applies)

C. Interconnected Power Production Sources (NEC 705)

D. Medium Voltage (see caveats below)

2. MEDIUM VOLTAGE CAVEATS:

A. NFPA 99 indicates an ATS <600V must be Listed for the purpose. No mention of requirements for other voltages >600V. Allowance for ATS >600V to not be Listed is one logical inference.

B. NFPA 110 states MV transfer of central plant or mechanical equipment is allowed using electrically interlocked medium voltage circuit breakers; but the equipment branch MV transfer switch is not to include life safety (LS), emergency (RE), or critical branch (CR) loads. By mention of critical branch this code regards healthcare but is not correlated by any healthcare code; neither by NFPA 99 nor by NEC 517. Allowance by Listing omission may be logically inferred for power system types not mentioned; SEPSS (NFPA 111), RSPSS (NEC 701), EQ (NEC 517), FPPSS (NEC 695), FCPSS (NEC 692), and EPSS (NFPA 110). Note that an MV transfer equipment is not disallowed for LS, RE, or CR if the MV switch is separated from mechanical loads. Also, there is no disallowance to separate loads if the MV ATS is Listed.

C. NFPA 70 (NEC) does not mandate a Listing requirement specific to distribution gear generally, including medium voltage (MV) equipment. NEC makes no mention of MV ATSs, nor provides any specific exemption for an MV ATS. That paralleling gear has no Listing requirement at all would apparently extend to MV types of paralleling gear.

3. FOR FIRE PUMP APPLICATIONS: A fire pump's local ATS and/or controller shall be NRTL Listed for electric motor-driven fire pump service. Other transfer equipment upstream of a fire pump ATS does not qualify it as a fire pump ATS also; so only the lower level ATS must meet these 'Fire Pump ATS' requirements.

4. GENERAL REQUIREMENTS: NRTL Listing types compound for each condition of use that applies; 'emergency', 'wet location', etc; whenever the NRTL Listed Use is an available product offering. An ATS must be NRTL Listed for all of the load types to be served. Field labeling by a Field Evaluation Body is an alternate compliance path for a Listing requirement generally, except where a Listing is overtly stated as the only compliance path such as for an ATS and select other NEC applications.

5. OPTIONAL STANDBY APPLICATIONS: Transfer equipment shall be NRTL 'Listed as Transfer Equipment' wherever supplemental circuit protection devices (CPD) are integral to the transfer equipment. No other Listing requirements apply for Optional Standby transfer equipment.

6. INTERCONNECTED POWER PRODUCTION SOURCES are a recognized transfer switch application apart from an ATS. NEC 705 scope only applies to multiple sources if the normal source (e.g. utility) is one of the sources. Where field labeling is provided, the NEC does not mandate any requirement for a Listing of any kind. Even if it is Listed, NEC doesn't require the gear to be NRTL 'Listed as Transfer Equipment' (as CPD optional standby transfer equipment must do), nor 'Listed for Emergency Use' (as all other emergency power transfer equipment must do). Where NEC 705 is applied to critical grade topologies, NEC suffers a glaring omission for any code-required NRTL type validation for a failsafe style of integrity, suitable for essential-class loads.

7. PARALLELING GEAR for automatic transfer switching of multiple sources (apart from an Article 705 type system) has no code article that governs its performance requirements. Only if the paralleling gear is connected to a normal (utility) source must it then comply with NEC 705. But even then the 705 requirements are not up to the usual code standards for critical or emergency gear and so it does not impose any failsafe standard for integrity including associated Listings.

Ironically, NEC 110.3(B) does state (by omission) that only the Listed or Labeled equipment needs to be used in accordance with the equipment manufacturer's instructions. Because the NEC makes no similar requirement of equipment that is not Listed nor Labeled, this equipment category escapes the stipulation to comply with the manufacturer's terms of use. This however is recognizable as nonsense, and an intonation of NEC intent must be interpolated.

NEC 110.3, Part (C) fails to identify that multiple Listings may be required for a product, and that one Listing may not be adequate. An individual separate Listing for each specific category of use is required whenever such Listing categories apply to the conditions of the equipment use.

NEC 110.3, Part (C) also fails to identify NEC's own exemptions for its general requirement that everything be Listed, and whether there are terms for when these exceptions are permitted or disallowed. One category is custom fabricated equipment, of which certain field assemblies may qualify as hybrid sub-category. One other category is equipment that has been reconditioned, refurbished or remanufactured. One final category is non-Listed equipment where NEC has outlined the specific terms of permitted use based on application. The problems arising from potential distinctions of allowances for non-Listed equipment is much more pronounced when the inconsistencies of Listing requirements by specific application are attempted to be put into a proper context (more on this in Chapter 8).

A best practice default for equipment selection is to choose a Listed product whenever one is available, and include each Listing application type that applies. Only when a Listed product cannot meet the design requirement should an alternative be considered; such as a custom fabricated product. Even then, such non-Listed applications shall be responsibly managed to best show coherence to all other code intent toward trustworthy integrity of; the components, the assembly work, and the resultant functionality. And where NEC outlines terms for use specific to "non-Listed" equipment (as done in Chapter 8), it shall be considered an acceptable form of compliance.

The NEC variations of terminology for Listed and for Labeled is diverse but the reason for this inconsistency is not always evident. The numeral in parenthesis is the number of occurrences found for each term in the NEC.

SIDEBAR: As the deadline for 2020 Public Comment is impending, the values and citations from here forward were not back-checked to 2020 NEC from the v2017 they were derived from .

1. Listed (1715), Listing (247), List (9)

2. Approved (473), Approving (2), Approval (44)

3. Labeled (65), Labeling (30), Labels (57), Label (55), Field Labeled (3), clearly Labeled (1)

4. Identified (2), Identifying (35), Identify (41)

5. Marked (647), Marking (555), Mark (31), Marks (3)

6. " Listed for" (332)

7. "Listed and Labeled" (21)

8. "Listed and Labeled for" (2)

9. "Listed or Labeled" (6)

10. "Listed, Labeled, and identified" (18)

11. "Listed, Labeled, or identified" (1)

12. "Prominently Labeled" (2)

13. "Listed, Labeled, and marked" (1)

14. "Listed and Labeled or field identified" (1)

Situation specific NEC requirements for equipment to be "Listed" vary case-by-case, whether by code article, or by site application type, or by equipment category. The way the requirements varied indicate that either code intent is not always consistent, or that the manner in which NEC requirements are written are a mixed bag of inconsistencies. In actuality, it is both.

The code citations below are selected to indicate general requirements and the requirements specific to switch transfer of emergency power sources. Other unrelated code citations are included to illustrate how the code may show consistency and how it shows inconsistency.

1. Listing Requirements by NEC Article

Every material item used for Trailer Parks (NEC 552), RVs (NEC 551), and mobile homes (NEC 550) must be Listed. But not a thing is mandated as needing to be Listed for hospitals (NEC 517), floating buildings (NEC 553), and certain other applications in NEC such as; Cablebus (370), Multioutlet Assemblies (380), Underfloor Raceways (390), Concealed Knob and Tube Wiring (394), Open Wiring on Insulators (398), Outdoor Overhead Conductors Over 1000V (399), Flexible Cords and Flexible Cables (400; though only nearly nil), Fixture Wires (402), Industrial Control Panels (409), Fixed Industrial Heating Equipment (455), Capacitors (460), Resistors and Reactors (470), Equipment Over 1000V (490), Integrated Electrical Systems (685), Interconnected Power Production Sources (705; aka paralleling gear), Circuits and Equipment Under 50V (720), and Energy Management Systems (750).

2. Listing Requirements by Equipment Category

For other NEC articles, the requirements for Listed equipment amounts to an honorable mention of oddities in bits and pieces; not because those bits are especially significant, or associated with criticality. NEC will mention a Listing requirement for the parenthetically consequential 1% and miss the more essential 99%. Switchgear (408) requires that insulated conductors are Listed, but NEC invokes no other requirements of anything else to do with switchgear to be Listed. There are times that NEC chapters or paragraphs only apply technically for any equipment which is Unlisted.

Most all raceways and cabling, but one, are required to be Listed from the 300 series articles of NEC. But at many points amongst the other code articles, only the fittings are indicated as needing to be Listed. The singular 300-series article for cablebus that was inadvertently skipped, is likely an oversight.

3. Listing Requirements by Application Type

Some aspects of Listings are meant to apply categorically, like a Wet Location Listing for any equipment in wet locations; but NEC consistency is sporadic and omissions prolific where they should apply. This inconsistency is similar to the requirements mentioned for sun exposure considerations.

At some points of code there are common applications with common importance factors but they are treated with uncommon requirements.

4. Observations of Inconsistent and Irrelevant Text

The terminologies for similar types of Listings has aspects of inconsistency, such as the five different terms used for an ATS to be Listed for Emergency Use. The verbiage variations could infer that these refined differences in text vary for good reason (with potentially varying requirements), but under scrutiny they do not.

There are code sentences that are superfluous because the Listing requirement for a subcomponent item being mentioned was already imposed generally at some other NEC article prior. Such as for particular conduit fittings to be Listed. To make matters worse, the requirements at one location in code doesn't always match the other location.

Other code text is a waste of language as the statement is redundant unto itself. Such as stating that use of equipment is okay if the Listing says it's okay. Or employing a double-negative to state that equipment is not to be used in a way that the Listing doesn't say is okay. As a side issue, such statements infer that there are "Listing Instructions" to follow for each Listing type. That such instructions exist and are published respective to Listing types is not affirmed to be an industry accepted understanding. How is it proposed that such reference materials are to be captured with consistent integrity by electrical system designers?

At times one or two specifications or features of the Listing itself, are mentioned with the NEC code text. But the exclusion of the other Listing features beckons follow-up questions as to why a partial redundant mention is relevant for some features of the Listing but not the others.

Some NEC text has inferences that a Listing requirement exists without an actual requirement of a Listing ever being stated overtly, only as an inference that the requirement already exists. Conditional statements employing logical grouping sometimes miss clear meaning due to commas missing at relevant points of the sentence.

The benefit that the above comments hope to achieve is in universal applications of Listing requirements as a categorical default wherever practicable, with caveats to follow as to exceptions or specialty additions, such that taken together, the Code edits would amount to less text and simpler forms of clarity. It would be an aide, perhaps suited to Chapter 9 indexes if nowhere else, to have a running list of all potential types of Listings that may be suited to electrical applications governed by NEC. Of course, such a reference list would be subject to on-going updates, but to see them all is perhaps the opportune way to know them.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4586-NFPA 70-2020 [Definition: Labeled.]	similar topic
Public Input No. 4591-NFPA 70-2020 [Definition: Listed.]	similar topic

Public Input No. 4619-NFPA 70-2020 [Section No. 110.3(B)]	similar topic
Public Input No. 4624-NFPA 70-2020 [Section No. 110.3(C)]	similar topic

Submitter Information Verification

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Copyright Assignment

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Public Input No. 991-NFPA 70-2020 [Global Input]

620.11 Insulation of Conductors.

The insulation of conductors shall comply with 620.11(A) through (D).

Informational Note: One method of determining that the insulation of conductors is flame retardant is by testing the conductors or cables to the FV-2/ VW-1 test ~~(Vertical-Wire) Flame Test~~ in ANSI/UL ~~1581-2011~~ 255 6 , *Standard for Wire and Cable Test Methods* ~~*Reference Standard for Electrical Wires, Cables, and Flexible Cords*~~ .

650.6(D) Cable Covering.

Each cable shall be provided with an outer covering, either overall or on each of any subassemblies of grouped conductors. Tape shall be permitted in place of a covering. Where not installed in metal raceway, the covering shall be resistant to flame spread, or the cable or each cable subassembly shall be covered with a closely wound listed fireproof tape.

Informational Note: One method of determining that cable is resistant to flame spread is by testing the cable to the FV-2/ VW-1 test ~~(vertical-wire)~~ ~~flame test~~ in ANSI/UL 2556, *Standard for Wire and Cable Test Methods* ~~1581- 2017~~ ~~, *Reference Standard for Electrical Wires, Cables and Flexible Cords*~~ .

725.179(D) Types CL2X and CL3X.

Types CL2X and CL3X limited-use cables shall be marked as Type CL2X or CL3X, and be listed as suitable for use in dwellings and raceways and shall be listed as resistant to flame spread.

Informational Note: One method of determining that cable is resistant to flame spread is by testing the cable to the FV-2/ VW-1 test ~~(vertical wire) flame test~~ in ANSI/UL 2556, *Standard for Wire and Cable Test Methods* ~~1581-2011, *Reference Standard for Electrical Wires, Cables and Flexible Cords*~~ .

800.179(D) Limited-Use Cables.

Type CMX limited-use communications cables, Type CATVX limited-use community antenna television coaxial cables, and Type BLX limited-use network-powered broadband low-power cables shall be listed as being suitable for use in dwellings and for use in raceway and shall also be listed as being resistant to flame spread.

Informational Note: One method of determining that cable is resistant to flame spread is by testing the cable to the FV-2/ VW-1 test ~~(vertical-wire)~~ flame ~~test~~ in ANSI/UL 2556, *Standard for Wire and Cable Test Methods* ~~1581-2017, *Reference Standard for Electrical Wires, Cables and Flexible Cords*~~ .

805.179(B) Type CMUC Undercarpet Wires and Cables.

Type CMUC under-carpet communications wires and cables shall be listed as being suitable for under-carpet use and shall also be listed as being resistant to flame spread.

Informational Note: One method of determining that cable is resistant to flame spread is by testing the cable to the FV-2/ VW-1 test ~~(vertical-wire~~) flame test in ANSI/UL 2556, *Standard for Wire and Cable Test Methods* ~~1581~~-2017~~, *Reference Standard for Electrical Wires, Cables and Flexible Cords*~~ .

Annex A Product safety standards

Note – only a portion of the table is shown for brevity

300	UL 263	Fire Tests of Building Construction and Materials
	UL Subject 267	Wire Pulling Compounds
	UL 514B	Conduit, Tubing, and Cable Fittings
	UL 635	Insulated Bushings
	UL 1479	Fire Tests of Through-Penetration Firestops
	UL 1565	Positioning Devices
	UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords
	UL 2043	Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
	UL Subject 2419	Electrically Conductive Corrosion Resistant Compounds
	UL 2556	Standard for Wire and Cable Test Methods
	UL 60730-1	Automatic Electrical Controls — Part 1: General Requirements

Additional Proposed Changes

File Name	Description	Approved
1581_code_proposal.docx	proposal	✓

Statement of Problem and Substantiation for Public Input

During the last several years, the specifics regarding many tests found in UL 1581 have been relocated to UL 2556, the Standard for Wire and Cable Test Methods, which is harmonized across the US, Canada and Mexico. UL 1581 has a reference to UL 2556 for those documents that still reference UL 1581. In order to point directly to the standard where the method resides, it is proposed to remove the reference to UL 1581 and replace it with a reference directly to UL 2556.

The name of the test in UL 2556 is FV-2/VW-2 to accommodate North American naming conventions. This change is also reflected as an update.

Note – footnote to Table 8 shall continue to reference UL 1581 as this info is not contained in UL 2556.

Submitter Information Verification

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Committee: NEC-P01

Rationale

During the last several years, the specifics regarding many tests found in UL 1581 have been relocated to UL 2556, the Standard for Wire and Cable Test Methods, which is harmonized across the US, Canada and Mexico. UL 1581 has a reference to UL 2556 for those documents that still reference UL 1581. In order to point directly to the standard where the method resides, it is proposed to remove the reference to UL 1581 and replace it with a reference directly to UL 2556. The name of the test in UL 2556 is FV-2/VW-2 to accommodate North American naming conventions. This change is also reflected as an update.

Note – footnote to Table 8 shall continue to reference UL 1581 as this info is not contained in UL 2556.

Part II. Conductors

620.11 Insulation of Conductors.

The insulation of conductors shall comply with 620.11(A) through (D).

Informational Note: One method of determining that the insulation of conductors is flame retardant is by testing the conductors or cables to the FV-2/VW-1 test ~~(Vertical-Wire) Flame Test~~ in ANSI/UL ~~1581-2011~~ 2556, *Standard for Wire and Cable Test Methods*~~*Reference Standard for Electrical Wires, Cables, and Flexible Cords*~~.

650.6(D) Cable Covering.

Each cable shall be provided with an outer covering, either overall or on each of any subassemblies of grouped conductors. Tape shall be permitted in place of a covering. Where not installed in metal raceway, the covering shall be resistant to flame spread, or the cable or each cable subassembly shall be covered with a closely wound listed fireproof tape.

Informational Note: One method of determining that cable is resistant to flame spread is by testing the cable to the FV-2/VW-1 test ~~(vertical-wire) flame test~~ in ANSI/UL 2556, *Standard for Wire and Cable Test Methods*~~1581-2017~~~~*, Reference Standard for Electrical Wires, Cables and Flexible Cords*~~.

725.179(D) Types CL2X and CL3X.

Types CL2X and CL3X limited-use cables shall be marked as Type CL2X or CL3X, and be listed as suitable for use in dwellings and raceways and shall be listed as resistant to flame spread.

Informational Note: One method of determining that cable is resistant to flame spread is by testing the cable to the FV-2/VW-1 test ~~(vertical wire) flame test~~ in ANSI/UL 2556, *Standard for Wire and Cable Test Methods*~~1581-2011~~~~*, Reference Standard for Electrical Wires, Cables and Flexible Cords*~~.

800.179(D) Limited-Use Cables.

Type CMX limited-use communications cables, Type CATVX limited-use community antenna television coaxial cables, and Type BLX limited-use network-powered broadband low-power cables shall be listed as being suitable for use in dwellings and for use in raceway and shall also be listed as being resistant to flame spread.

Informational Note: One method of determining that cable is resistant to flame spread is by testing the cable to the FV-2/VW-1 test ~~(vertical-wire)~~ flame ~~test~~ in ANSI/UL 2556, *Standard for Wire and Cable Test Methods*~~1581-2017, *Reference Standard for Electrical Wires, Cables and Flexible Cords*~~.

805.179(B) Type CMUC Undercarpet Wires and Cables.

Type CMUC under-carpet communications wires and cables shall be listed as being suitable for under-carpet use and shall also be listed as being resistant to flame spread.

Informational Note: One method of determining that cable is resistant to flame spread is by testing the cable to the FV-2/VW-1 test ~~(vertical-wire~~) flame test in ANSI/UL 2556, *Standard for Wire and Cable Test Methods*~~1581-2017, *Reference Standard for Electrical Wires, Cables and Flexible Cords*~~.

Annex A Product safety standards

Note – only a portion of the table is shown for brevity

300	UL 263	Fire Tests of Building Construction and Materials
	UL Subject 267	Wire Pulling Compounds
	UL 514B	Conduit, Tubing, and Cable Fittings
	UL 635	Insulated Bushings
	UL 1479	Fire Tests of Through-Penetration Firestops
	UL 1565	Positioning Devices
	UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords
	UL 2043	Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
	UL 2239	Hardware for the Support of Conduit, Tubing and Cable
	UL Subject	Electrically Conductive Corrosion Resistant Compounds

	2419	
	UL 2556	Standard for Wire and Cable Test Methods
	UL 60730-1	Automatic Electrical Controls — Part 1: General Requirements

Public Input No. 331-NFPA 70-2020 [Definition: Electric Vehicle (EV).]

Electric Vehicle (EV).

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

Informatinal Note: Off-road, self-propelled electric mobile equipment, such as industrial trucks, hoists, lifts, transports, golf carts, airline ground support equipment, tractors, ~~boats, and the like, are~~ and boats are not considered electric vehicles. ~~(CMP-12)~~

Statement of Problem and Substantiation for Public Input

A definition should describe what the term being defined is, not describe what the term being defined is not. What is not an electric vehicle is better suited for an informational note after the definition.
References to "and the like" have been removed as they are vague and unenforceable.
The NEC Style Manual states:
Paragraph 1.3 Regulatory Adoption
Because the NEC is intended to be suitable for adoption as a regulatory document, it is important that it contain clearly stated mandatory requirements in the Code text.

Paragraph 3.2.1 Unenforceable Terms
The NEC shall not contain references or requirements that are unenforceable or vague.

Paragraph 3.3.4 Word Clarity
Words and terms used in the NEC shall be specific and clear in meaning, and shall avoid jargon, trade terminology, industry specific terms, or colloquial language that is difficult to understand.

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Committee: NEC-P12

Public Input No. 735-NFPA 70-2020 [Definition: Electric Vehicle (EV).]

Electric Vehicle (EV).

An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, neighborhood electric vehicles, electric motorcycles, and the like, primarily powered by an electric motor that draws current from a rechargeable storage battery, fuel cell, photovoltaic array, or other source of electric current. Hybrid vehicles, or Plug-in hybrid electric vehicles (PHEV), are electric vehicles having a second source ~~of motive power~~ of power . Off-road, self-propelled electric mobile equipment, such as industrial trucks, hoists, lifts, transports, golf carts, airline ground support equipment, tractors, boats, and the like, are ~~not considered electric vehicles~~ outside the scope of this *Code* . (CMP-12)

Statement of Problem and Substantiation for Public Input

The definition, as written, is not entirely accurate. A hybrid vehicle, or plug in hybrid, has two sources of power. Most of the current hybrid vehicles can develop forward motion from either the fossil fuel power plant or the electric power plant. There are others where the only source of motive power is from the electric motors. The other power source, the fossil fuel source, is not motive but can only generate electricity. The list of vehicles in the end are, in fact, electric vehicles. They are not, however, in the scope of the NEC.

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Public Input No. 3831-NFPA 70-2020 [Section No. 610.2]

(Relocate all definitions in the 610. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

610. 2 Definition.

This definition shall apply only within this article.

Festoon Cable.

Single- and multiple-conductor cable intended for use and installation in accordance with Article 610 where flexibility is required.

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. "

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Committee:	NEC-P12

Public Input No. 3438-NFPA 70-2020 [Section No. 610.11(E)]

(E) ~~Flexibility~~ Flexible Connections to Moving Parts.

~~Where~~ **(1) Parts rated 0-2000 Volts.** Where flexibility is required for power or control to moving parts, listed festoon cable or a cord suitable for the purpose shall be permitted, provided the following apply:

(A) Suitable strain relief and protection from physical damage is provided.

(B) In ~~Class I~~ Class I , Division 2 locations, the cord is approved for extra-hard usage.

(2) Parts rated over 2000 Volts. Where flexibility is required for power to moving parts, listed portable power feeder cable having a grounded shield shall be permitted to be installed withou the use of a raceway, provided the following apply:

(A) Suitable strain relief is provided.

(B) Protection from physical damage is provided.

Additional Proposed Changes

File Name	Description	Approved
PI_for_610.11_for_submission.docx	Word Document version of the proposed PI.	

Statement of Problem and Substantiation for Public Input

The existing text of 610.11 does not adequate address cases where cranes operate at voltages above 2000 V, and there is a need for flexibility to moving parts. In order to maintain the necessary flexibility, installing the cable in raceways as required in 610.11(C) may be too restrictive. Adding 610.11(F) will provide the needed guidance for the use of portable power feeder cable to provide the flexibility required, while ensuring the cable is appropriate for the application.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2700-NFPA 70-2020 [New Section after 400.36]	Companion
Public Input No. 2700-NFPA 70-2020 [New Section after 400.36]	

Submitter Information Verification

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Submittal Date: Tue Sep 08 15:02:46 EDT 2020
Committee: NEC-P12

610.11 Wiring Method.
Conductors shall be enclosed in raceways or be Type AC cable with insulated equipment grounding conductor, Type MC cable, or Type MI cable unless otherwise permitted or required in 610.11(A) through (~~E~~F).

610.11(A) Contact Conductor.
Contact conductors shall not be required to be enclosed in raceways.

610.11(B) Exposed Conductors.
Short lengths of exposed conductors at resistors, collectors, and other equipment shall not be required to be enclosed in raceways.

610.11(C) Flexible Connections to Motors and Similar Equipment.
Where flexible connections are necessary, flexible stranded conductors shall be used. Conductors shall be in flexible metal conduit, liquidtight flexible metal conduit, liquidtight flexible nonmetallic conduit, multiconductor cable, or an approved nonmetallic flexible raceway.

610.11(D) Pushbutton Station Multiconductor Cable.
Where multiconductor cable is used with a suspended pushbutton station, the station shall be supported in some satisfactory manner that protects the electrical conductors against strain.

610.11(E) Flexible~~ity~~ Connections to Moving Parts.

(1) Parts rated 0 – 2000V
Where flexibility is required for power or control to moving parts, listed festoon cable or a cord suitable for the purpose shall be permitted, provided the following apply:

(~~1~~A) Suitable strain relief and protection from physical damage is provided.

(~~2~~B) In Class I, Division 2 locations, the cord is approved for extra-hard usage.

(2) Parts rated over 2000V

Where flexibility is required for power to moving parts, listed portable power feeder cable having a grounded shield shall be permitted to be installed without the use of a raceway, provided the following apply:

(A) Suitable strain relief is provided

(B) Protection from physical damage is provided.

Substantiation: The existing text of 610.11 does not adequate address cases where cranes operate at voltages above 2000 V, and there is a need for flexibility to moving parts. In order to maintain the necessary flexibility, installing the cable in raceways as required in 610.11(C) may be too restrictive. Adding 610.11(F) will provide the needed guidance for the use of portable power feeder cable to provide the flexibility required, while ensuring the cable is appropriate for the application.

Public Input No. 3832-NFPA 70-2020 [Section No. 620.2]

(Relocate all definitions in the 620. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

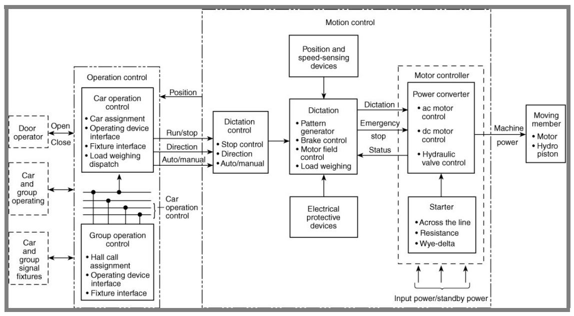
620. 2 Definitions.

The following definitions shall apply only within this article.

Informational Note No. 1: The motor controller, motion controller, and operation controller are located in a single enclosure or a combination of enclosures.

Informational Note No. 2: Informational Note Figure 620.2, No. 2 is for information only.

Figure Informational Note Figure 620.2, No. 2 Control System.



Control Room (for Elevator, Dumbwaiter).

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

Control Space (for Elevator, Dumbwaiter).

A space inside or outside the hoistway, intended to be accessed with or without full bodily entry, that contains the elevator motor controller. This space could also contain electrical and/or mechanical equipment used directly in connection with the elevator or dumbwaiter but not the electrical driving machine or the hydraulic machine.

Control System.

The overall system governing the starting, stopping, direction of motion, acceleration, speed, and retardation of the moving member.

Controller, Motion.

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

Controller, Motor.

The operative units of the control system comprised of the starter device(s) and power conversion equipment used to drive an electric motor, or the pumping unit used to power hydraulic control equipment.

Controller, Operation.

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

Machine Room (for Elevator, Dumbwaiter).

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

Machinery Space (for Elevator, Dumbwaiter, Platform Lift, and Stairway Chairlift).

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

Operating Device.

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

Remote Machine Room and Control Room (for Elevator, Dumbwaiter).

A machine room or control room that is not attached to the outside perimeter or surface of the walls, ceiling, or floor of the hoistway.

Remote Machinery Space and Control Space (for Elevator, Dumbwaiter).

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

Signal Equipment.

Includes audible and visual equipment such as chimes, gongs, lights, and displays that convey information to the user.

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 13:47:42 EDT 2020
Committee:	NEC-P12

Public Input No. 386-NFPA 70-2020 [Definition: Control Room (for Elevator, Dumbwaiter).]

Control Room (for Elevator, Dumbwaiter, Escalator, Moving Walk, and Platform Lift).

An enclosed control space ~~outside the hoistway~~ other than a hoistway , intended for full bodily entry, that contains ~~the elevator motor~~ the motor controller. The room could also contain electrical and/or mechanical equipment used directly in connection with the elevator ~~or dumbwaiter~~ , dumbwaiter, escalator, moving walk, or platform lift, but not ~~the electric~~ any electric driving machine or the hydraulic machine.

Statement of Problem and Substantiation for Public Input

Many buildings, airports, malls, etc., have indoor escalators. Also, there are many outdoor malls that have outdoor escalators. It is common that escalators have control rooms. It is next to impossible for electrical inspectors to enforce the provisions of 620.23(A) and 620.24(A) when the definition of "Control Rooms" doesn't include escalators. Inspectors receive a large amount of pushback, and the proposed language is necessary in order that code sections including but not limited to 620.23(A) and 620.24(A) be enforced, according to the panel's intent.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 387-NFPA 70-2020 [Definition: Control Space (for Elevator, Dumbwaiter).]	
Public Input No. 387-NFPA 70-2020 [Definition: Control Space (for Elevator, Dumbwaiter).]	

Submitter Information Verification

Submitter Full Name: Nick Sasso
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Submittal Date: Thu Jan 30 10:48:55 EST 2020
Committee: NEC-P12

Public Input No. 387-NFPA 70-2020 [Definition: Control Space (for Elevator, Dumbwaiter).]

Control Space (for Elevator, Dumbwaiter, Escalator, Moving Walk, and Platform Lift).

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

Statement of Problem and Substantiation for Public Input

Many buildings, airports, malls, etc., have indoor escalators. Also, there are many outdoor malls that have outdoor escalators. It is common that escalators have control spaces. It is next to impossible for electrical inspectors to enforce the provisions of 620.23(A) and 620.24(A) when the definition of "Control Spaces" doesn't include escalators. Inspectors receive a large amount of pushback, and the proposed language is necessary in order that code sections including but not limited to 620.23(A) and 620.24(A) be enforced, according to the panel's intent.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 386-NFPA 70-2020 [Definition: Control Room (for Elevator, Dumbwaiter).]	
Public Input No. 386-NFPA 70-2020 [Definition: Control Room (for Elevator, Dumbwaiter).]	

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Submittal Date: Thu Jan 30 11:01:58 EST 2020
Committee: NEC-P12

Public Input No. 1714-NFPA 70-2020 [Section No. 620.5]

620.5 Working Clearances.

Working space shall be provided about controllers, disconnecting means, and other electrical equipment in accordance with 110.26(A).

Where conditions of maintenance and supervision ensure that only qualified persons examine, adjust, service, and maintain the equipment, the clearance requirements of 110.26(A) shall not be required where any of the conditions in 620.5(A) through (D) are met.

(A) Flexible Connections to Equipment.

Electrical equipment in (A)(1) through (A)(4) is provided with flexible leads to all external connections so that it can be repositioned to meet the clear working space requirements of 110.26:

(1) Controllers and disconnecting means for dumbwaiters, escalators, moving walks, platform lifts, and stairway chairlifts installed in the same space with the driving machine

(2) Controllers and disconnecting means for elevators installed in the hoistway or on the car

(3) Controllers for door operators

(4) Other electrical equipment installed in the hoistway or on the car

(B) Guards.

Live parts of the electrical equipment are suitably guarded, isolated, or insulated to reduce the likelihood of inadvertent contact with live parts operating at voltages greater than 30 volts ac rms, 42 volts ac peak, or 60 volts dc, and the equipment can be examined, adjusted, serviced, or maintained while energized without removal of this protection.

(C) Examination, Adjusting, and Servicing.

Electrical equipment is not required to be examined, adjusted, serviced, or maintained while energized.

(D) Extra- Low Voltage.

Uninsulated parts are at a voltage not greater than 30 volts rms, 42 volts peak, or 60 volts dc.

Statement of Problem and Substantiation for Public Input

Coordinate with proposed new definition 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

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Committee:	NEC-P12

Public Input No. 1299-NFPA 70-2020 [New Section after 620.6]

TITLE OF NEW CONTENT

Type your content here ...Shunt breakers shall not be installed on elevator systems used for occupant evacuation.

Statement of Problem and Substantiation for Public Input

This would help this section correlate more closely with NFPA 101 7.14.6.2

Submitter Information Verification

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Committee:	NEC-P12

Public Input No. 760-NFPA 70-2020 [New Section after 620.6]

TITLE OF NEW CONTENT

Type your content here ...

620.8 Electromagnetic Pulse (EMP) Protection. Where elevators are utilized in facilities that are required to be EMP-protected, EMP protection for elevators against the effects of electromagnetic pulses shall be provided. 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]	
Public Input No. 756-NFPA 70-2020 [New Section after 708.64]	

Submitter Information Verification

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Submittal Date: Mon Mar 23 13:22:46 EDT 2020
Committee: NEC-P12

Public Input No. 2944-NFPA 70-2020 [Section No. 620.6]

620.6 Ground-Fault Circuit-Interrupter Protection for Personnel.

(A) GFCI Receptacle. Each 125-volt, single-phase, 15- and 20-ampere receptacle installed in pits, in hoistways, on the cars of elevators and dumbwaiters associated with wind turbine tower elevators, on the platforms or in the runways and machinery spaces of platform lifts and stairway chairlifts, and in escalator and moving walk wellways shall be of the ground-fault circuit-interrupter type.

(B) GFCI Receptacle or GFCI Circuit Breaker. All 125-volt, single-phase, 15- and 20-ampere receptacles installed in machine rooms, control spaces, machinery spaces, and control rooms shall have ground-fault circuit-interrupter protection for personnel.

(C) Single Receptacle GFCI Protected. A permanently installed sump pump shall be permanently wired or shall be supplied by a single receptacle that is ground-fault circuit-interrupter protected.

Statement of Problem and Substantiation for Public Input

I suggest this be in 'list' format so that the reader understand there are three different requirements.

Submitter Information Verification

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Submittal Date: Thu Sep 03 13:24:34 EDT 2020
Committee: NEC-P12

Public Input No. 4265-NFPA 70-2020 [Section No. 620.6]

620.6 Ground-Fault Circuit-Interrupter Protection for Personnel.

Each 125-volt, single-phase, 15- and 20-ampere receptacle installed in pits, in hoistways, on the cars of elevators and dumbwaiters ~~associated with~~ , in the wellways or the landings of escalators or moving walks, in the travel path or on the cars of wind turbine tower elevators, ~~on the platforms~~ or in the runways and machinery spaces of platform lifts and stairway chairlifts ~~, and in escalator and moving walk wellways~~ shall be of the ground-fault circuit-interrupter type.

All 125-volt, single-phase, 15- and 20-ampere receptacles installed in machine rooms, control spaces, machinery spaces, and control rooms shall have ground-fault circuit-interrupter protection for personnel.

A permanently installed sump pump shall be permanently wired or shall be supplied by a single receptacle that is ~~ground-fault circuit-interrupter protected.~~ GFCI protected by an adjacent device that is not equipped with flush receptacles. Where permanently wired, 422.5(A)(6) shall not apply..

Statement of Problem and Substantiation for Public Input

This submittal corrects glaring editorial errors in the existing text. Because most elevators are not associated with wind tower elevators, the comma placements in the literal text effectively remove the requirement from every conventional elevator. The public input that put this change in motion, from an elevator professional, used the following wording: “installed on the cars of elevators and dumbwaiters, in the wellways or the landings of escalators or moving walks, in the travel path or on the cars of wind turbine tower elevators, or in the runways and machinery spaces of platform lifts and stairway chairlifts shall be of the ground-fault circuit-interrupter type.” This is substantively what the sentence is actually supposed to say, based on technical merit. This input fully implements the original intent.

The special requirement for sump pumps requires clarification as well. It calls for a single receptacle with GFCI protection, or hard wiring. It may appear that hard wiring defeats the GFCI requirement, but it is not quite worded as a Chapter 6 amendment of Chapter 4. The hard wiring as worded preceded the creation of Sec. 422.5(A)(6), and it does not directly countermand that rule. The Art. 620 wording in its former (2017 NEC) home expressly stated that a single receptacle for a sump pump did not require GFCI protection. That was absolutely a Chapter 6 amendment. This new (2020 NEC) wording can be interpreted as a rejection of hard wiring GFCI protection, and precedent supports that view, but in fact the wording is not correct on this point This imput fully implements that intent. In addition, the current rule requires a single receptacle. Single receptacle point-of-use GFCIs have long disappeared from the market, which suggests GFCI protection with a separate device ahead of the single receptacle, with a faceless GFCI adjacent to the receptacle.

Submitter Information Verification

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Committee:	NEC-P12

Public Input No. 4307-NFPA 70-2020 [Section No. 620.6]

620.6 Ground-Fault Circuit-Interrupter Protection for Personnel.

Each 125-volt, single-phase, 15- and 20-ampere receptacle installed in pits, in hoistways, on the cars of elevators and dumbwaiters associated with wind turbine tower elevators, on the platforms or in the runways and machinery spaces of platform lifts and stairway chairlifts, and in escalator and moving walk wellways shall be of the ground-fault circuit-interrupter type.

All 125-volt, single-phase, 15- and 20-ampere receptacles installed in machine rooms, control spaces, machinery spaces, and control rooms shall have ground-fault circuit-interrupter protection for personnel.

A permanently installed sump pump shall be permanently wired or shall be supplied by a ~~single~~ receptacle outlet that is ground-fault circuit-interrupter protected.

Statement of Problem and Substantiation for Public Input

This rule calls for GFCI protection for all receptacles in pits AND a single receptacle for sump pump. No need to call for a “single receptacle” for the sump pump now since BOTH require GFCI protection. The first sentence of 620.6 requires the GFCI protection to be provided by a GFCI receptacle at the outlet. The first sentence conflicts with current third sentence. Do device manufactures even make a single GFCI receptacle?

Submitter Information Verification

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Affiliation: None

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Submittal Date: Thu Sep 10 09:53:45 EDT 2020

Committee: NEC-P12

Public Input No. 4521-NFPA 70-2020 [Section No. 620.6]

620.6 Ground-Fault Circuit-Interrupter Protection for Personnel.

Each 125-volt, single-phase, 15- and 20-ampere receptacle installed in pits, in hoistways, on the cars of elevators and dumbwaiters associated with wind turbine tower elevators, on the platforms or in the runways and machinery spaces of platform lifts and stairway chairlifts, and in escalator and moving walk wellways shall be ~~of the ground~~ a listed and labeled ground -fault circuit-interrupter type.

All 125-volt, single-phase, 15- and 20-ampere receptacles installed in machine rooms, control spaces, machinery spaces, and control rooms shall have listed and labeled ground-fault circuit-interrupter protection for personnel.

A permanently installed sump pump shall be permanently wired or shall be supplied by a single receptacle that is 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, and 680.23(A)(8) which currently require listing.

Submitter Information Verification

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Submittal Date: Thu Sep 10 14:37:40 EDT 2020
Committee: NEC-P12

Public Input No. 545-NFPA 70-2020 [Section No. 620.6]

620.6 Ground-Fault Circuit-Interrupter Protection for Personnel.

Each 125-volt, single-phase, 15- and 20-ampere receptacle installed in pits, in hoistways, on the cars of elevators and dumbwaiters associated with wind turbine tower elevators, on the platforms or in the runways and machinery spaces of platform lifts and stairway chairlifts, and in escalator and moving walk wellways shall be of the ground-fault circuit-interrupter type.

All 125-volt, single-phase, 15- and 20-ampere receptacles installed in machine rooms, control spaces, machinery spaces, and control rooms shall have ground-fault circuit-interrupter protection for personnel.

~~A permanently installed sump pump shall be permanently wired or shall be supplied by a single receptacle that is ground-fault circuit-interrupter protected.~~

Statement of Problem and Substantiation for Public Input

As currently written, this rule does not modify the requirement of 422.5(A)(6). All it does is give two options for wiring it-- cord-and-plug connection and direct connection. Neither option, as written, removes the GFCI protection. Furthermore, there is no reason to not provide the GFCI protection, considering that it is already required by several manufacturers of sump pumps.

Submitter Information Verification

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Submittal Date: Thu Feb 27 14:59:15 EST 2020
Committee: NEC-P12

Public Input No. 3045-NFPA 70-2020 [New Section after 620.12(A)]

TITLE OF NEW CONTENT

620.12(A)(3) Paralleled Conductors. Where ampacity requirements or voltage drop conditions in a traveling cable circuit prevent the use of a single conductor of AWG 14 or smaller, conductors shall be permitted in parallel in compliance with 620.12.(A)(3)(a) through (d):

(a) Each conductor shall be no smaller than 20 AWG copper,

(b) The paralleled conductors shall be the same type and have the same ampacity rating,

(c) No more than 3 conductors shall be paralleled, and

(d) The overcurrent protection is such that the ampacity of each individual conductor will not be exceeded if one of the parallel conductors becomes inadvertently disconnected.

Statement of Problem and Substantiation for Public Input

To clarify that parallel conductors are permitted in elevator traveling cables and to specify the conditions under which they are permitted.

Submitter Information Verification

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Submittal Date:	Fri Sep 04 10:39:46 EDT 2020
Committee:	NEC-P12

Public Input No. 406-NFPA 70-2020 [Section No. 620.12(A)]

(A) Traveling Cables.

(1) Lighting Circuits.

For lighting circuits, 14 AWG copper, 20 AWG copper or larger conductors shall be permitted in parallel, provided the ampacity is equivalent to at least that of 14 AWG copper.

(2) Class 2 Circuits:

Cables used in Class 2 power-limited circuits shall be permitted, provided the cables are supported and protected from physical damage and are of a jacketed and flame-retardant type. Cables transmitting power and data shall comply with Article 725.144.

(3) Communication Circuits:

Cables used in communication circuits shall be permitted, provided the cables are supported and protected from physical damage and are of a jacketed and flame-retardant type.

(4) Other Circuits.

For other circuits, 20 AWG copper.

Statement of Problem and Substantiation for Public Input

The current Code wording of the Article prohibits communication or information technology cables in the travelling cable. Since information technology cables are 24 or 23 AWG and smaller that 20 AWG indicated in Article 620.12 A 2 Class 2 type network cables are effectively banned from traveling cables. Current International Codes allow these cables in traveling cables used in IEC countries.

This effectively restricts any networked equipment in the elevator car to only the use of fiber optic communication cables for networked devices that will by their nature require locally powered network hardware in the car. The change would allow power over Ethernet devices such as cameras, access control and internet protocol (IP) phones or intercom without providing additional equipment to power these devices. The requirements of Article 725.144 shall apply to Class 2 cables carrying power and data. Bundle size, ratings, ampacities, temperature de-rating, etc. shall all apply to the travelling cable Class 2 cables used.

The Class 2 cables are allowed in the hoistway and pit now per Article 620.21 A 1 a and thus would not create any additional risk in the hoistway.

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Submittal Date:	Mon Feb 03 13:50:01 EST 2020
Committee:	NEC-P12

Public Input No. 3041-NFPA 70-2020 [Section No. 620.12(A)(2)]

(2) Other Circuits.

For other circuits, 20 AWG copper.

Exception: For data communication circuits a minimum of 26 AWG is permitted.

Statement of Problem and Substantiation for Public Input

To allow for Ethernet cables to be included in elevator traveling cables. Requirements for Ethernet communications to elevator cars are becoming commonplace.
In addition, Ethernet in elevator travel cables are needed in order to provide the bandwidth needed to comply with the two-way video requirements specified in the IBC-2018 and ASME A17.1-2019
See Also Public Input No. 3040-NFPA 70-2020 [Section No. 400.4]

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3040-NFPA 70-2020 [Section No. 400.4]	Allow Ethernet in Elevator Traveling Cables
Public Input No. 3043-NFPA 70-2020 [Section No. 620.36]	

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Committee: NEC-P12

Public Input No. 3122-NFPA 70-2020 [Section No. 620.14]

620.14 Feeder or Service Demand Factor.

Feeder or Service Entrance conductors of less ampacity than required by 620.13 shall be permitted, subject to the requirements of Table 620.14.

Table 620.14 Feeder or Service Demand Factors for Elevators

Number of Elevators on a Single Feeder or Service	Demand Factor*
1	1.00
2	0.95
3	0.90
4	0.85
5	0.82
6	0.79
7	0.77
8	0.75
9	0.73
10 or more	0.72

* Demand factors are based on 50 percent duty cycle (i.e., half time on and half time off).

Statement of Problem and Substantiation for Public Input

Not sure why the demand factors for elevator feeders would not apply to services as well. Other sections of the code related to calculating feeder demand.. ie 220.82 or 220.87 are for Feeders or Services.

Submitter Information Verification

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Submittal Date: Sat Sep 05 06:59:40 EDT 2020
Committee: NEC-P12

Public Input No. 34-NFPA 70-2019 [Section No. 620.21(A)(1)]

(1) Hoistways and Pits.

(a) ~~Cables used in Class 2 power-limited circuits~~ Types CL2P, CL2R and CL2 cables shall be permitted, provided the cables are supported and protected from physical damage ~~and are of a jacketed and flame-retardant type.~~ . Substitute cables for Class 2 cables installed in accordance with 725.154(A) shall be permitted.

(b) Flexible cords and cables that are components of listed equipment and used in circuits operating at 30 volts rms or less or 42 volts dc or less shall be permitted, provided the cords and cables are supported and protected from physical damage and are of a jacketed and flame-retardant type.

(c) The following wiring methods shall be permitted in the hoistway in lengths not to exceed 1.8 m (6 ft):

(4) Flexible metal conduit.

(5) Liquidtight flexible metal conduit.

(6) Liquidtight flexible nonmetallic conduit.

(7) Flexible cords and cables, or conductors grouped together and taped or corded, shall be permitted to be installed without a raceway. They shall be located to be protected from physical damage, shall be of a flame-retardant type, and shall be part of one of the following:

(8) Listed equipment

(9) Driving machine

(10) Driving machine brake

Exception 620.21(A)(1)(c)(1), (A)(1)(c)(2), and (A)(1)(c)(3): The conduit length shall not be required to be limited between risers and limit switches, interlocks, operating buttons, and similar devices.

(k) A sump pump or oil recovery pump located in the pit shall be permitted to be cord connected. The cord shall be a hard usage oil-resistant type, of a length not to exceed 1.8 m (6 ft), and shall be located to be protected from physical damage.

(l) Hard-service cords and junior hard-service cords that conform to the requirements of Article 400 (Table 400.4) shall be permitted as flexible connections between the fixed wiring in the hoistway and hoistway access switches when located in the hoistway door sight guard.

Informational Note: See ASME A17.1-2016/CSA B44-16, *Safety Code for Elevators and Escalators*.

Statement of Problem and Substantiation for Public Input

Code usability is improved by specifically citing the Class 2 cable types. Adding an explicit permission to use substitute cables also promotes code usability because listed communications cables are regularly used as substitutes for Class 2 cables.

This PI recommends changes to 620.21(A)(1) only. Please ignore the additional underling created by the software.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 33-NFPA 70-2019 [Section No. 620.21(C)(2)]	Clearly identify permitted cables and cable substitutions
Public Input No. 35-NFPA 70-2019 [Section No. 620.21(B)(2)]	Clearly identify permitted cables and cable substitutions
Public Input No. 33-NFPA 70-2019 [Section No. 620.21(C)(2)]	
Public Input No. 35-NFPA 70-2019 [Section No. 620.21(B)(2)]	

Submitter Information Verification

Submitter Full Name: Stanley Kaufman
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Submittal Date: Wed Nov 06 13:26:25 EST 2019
Committee: NEC-P12

Public Input No. 35-NFPA 70-2019 [Section No. 620.21(B)(2)]

(2) Class 2 Circuit Cables.

~~Cables used in Class 2 power-limited circuits~~ Types CL2P, CL2R and CL2 cables shall be permitted to be installed within escalators and moving walkways, provided the cables are supported and protected from physical damage ~~and are of a jacketed and flame-retardant type.~~ . Substitute cables for Class 2 cables installed in accordance with 725.154(A) shall be permitted.

Statement of Problem and Substantiation for Public Input

Code usability is improved by specifically citing the Class 2 cable types. Adding an explicit permission to use substitute cables also promotes code usability because listed communications cables are regularly used as substitutes for Class 2 cables.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 33-NFPA 70-2019 [Section No. 620.21(C)(2)]	Clearly identify permitted cables and cable substitutions
Public Input No. 34-NFPA 70-2019 [Section No. 620.21(A)(1)]	Clearly identify permitted cables and cable substitutions
Public Input No. 33-NFPA 70-2019 [Section No. 620.21(C)(2)]	
Public Input No. 34-NFPA 70-2019 [Section No. 620.21(A)(1)]	

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Submittal Date: Wed Nov 06 13:32:04 EST 2019

Committee: NEC-P12

Public Input No. 33-NFPA 70-2019 [Section No. 620.21(C)(2)]

(2) Class 2 Circuit Cables.

~~Cables used in Class 2 power-limited circuits~~ Types CL2P, CL2R and CL2 cables shall be permitted to be installed within platform lifts and stairway chairlift runways and machinery spaces, provided the cables are supported and protected from physical damage ~~and are of a jacketed and flame-retardant type.~~ . Substitute cables for Class 2 cables installed in accordance with 725.154(A) shall be permitted.

Statement of Problem and Substantiation for Public Input

Code usability is improved by specifically citing the Class 2 cable types. Adding an explicit permission to use substitute cables also promotes code usability because listed communications cables are regularly used as substitutes for Class 2 cables.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 34-NFPA 70-2019 [Section No. 620.21(A)(1)]	Clearly identify permitted cables and cable substitutions
Public Input No. 35-NFPA 70-2019 [Section No. 620.21(B)(2)]	Clearly identify permitted cables and cable substitutions
Public Input No. 34-NFPA 70-2019 [Section No. 620.21(A)(1)]	
Public Input No. 35-NFPA 70-2019 [Section No. 620.21(B)(2)]	

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Public Input No. 4633-NFPA 70-2020 [Section No. 620.21 [Excluding any Sub-Sections]]

Conductors, cables, and optical fiber cables located in hoistways, escalator and moving walk wellways, platform lifts, stairway chairlift runways, machinery spaces, control spaces, in or on cars, machine rooms, and control rooms, not including the traveling cables connecting the car or counterweight and hoistway wiring, shall be installed in rigid metal conduit, intermediate metal conduit, electrical metallic tubing, rigid ~~nonmetallic conduit~~ polyvinyl chloride conduit , or wireways, or shall be Type MC, MI, or AC cable unless otherwise permitted in 620.21(A) through (C). Unused conductors in an enclosure shall be insulated or protected from accidental contact with exposed live parts.

Exception: Cords and cables of listed cord-and-plug-connected equipment shall not be required to be installed in a raceway.

Informational Note: When an elevator is classified as a fire service access elevator or occupant evacuation operation elevator, some building codes require additional protection for conductors that are located outside of the elevator hoistway and machine room.

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

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Committee:	NEC-P12

Public Input No. 3022-NFPA 70-2020 [Section No. 620.22(A)]

(A) Car Light Receptacles, Auxiliary Lighting, and Ventilation.

A separate branch circuit shall supply the car lights. The car lights branch circuit shall be permitted to supply receptacles, ~~accessory equipment (~~ alarm devices, ~~alarm bells,~~ Emergency Responder Radio Coverage (ERRC) equipment, cab environmental purification systems, monitoring devices not part of the control system~~)~~ , auxiliary lighting power source, car emergency signalling and communication devices (including their associated charging circuits), and ventilation on each elevator car or inside the operation controller. The overcurrent device protecting the branch circuit shall be located in the elevator machine room, control room, machinery space, or control space. Where there is no machine room, control room, machinery space, or control space outside the hoistway, the overcurrent device shall be located outside the hoistway and accessible to qualified persons only.

Required lighting shall not be connected to the load side of a ground-fault circuit interrupter.

Statement of Problem and Substantiation for Public Input

1) To specifically clarify that Emergency Responder radio Coverage (ERRC) Remote Repeater Units RRU) installed in the elevator car are permitted to be connect to the branch circuit for car lights.

2) With the advent of the Covid-19 crisis and the need to ensure that the elevator environment is provided with a means to help prevent spread of the virus to elevator passengers, to allow these systems to be connected to the branch circuit for car lighting under Clause 620.22(A).

3) In some cases, the building code or NFPA 99 requires auxiliary power to be available for the emergency signalling device when it is connected to normal building power. Further, ASME A17.1/CSA B44 requires the power to be capable of providing for the means of communications for at least 4 hours and the audible signalling device for at least 1 hour. Permitting the lighting circuit to also provide power to the emergency signalling devices under Clause 620.22(a) will enhance safety without having to add additional traveling cable conductors as would be the case under Clause 620.25.

4) To clarify the specific devices that are permitted to be connected to the lighting circuit, eliminating the confusion related to the words “accessory equipment”. Devices other than in this list must comply with 620.25.

Submitter Information Verification

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Committee:	NEC-P12

Public Input No. 3689-NFPA 70-2020 [Section No. 620.22(A)]

(A) Car Light Receptacles, Auxiliary Lighting, and Ventilation.

A separate branch circuit shall supply the car lights. The car lights branch circuit shall not be permitted to supply receptacles, accessory equipment (alarm devices, alarm bells, monitoring devices not part of the control system), auxiliary lighting power source, and ventilation on each elevator car or inside the operation controller. The overcurrent device protecting the branch circuit shall be located in the elevator machine room, control room, machinery space, or control space. Where there is no machine room, control room, machinery space, or control space outside the hoistway, the overcurrent device shall be located outside the hoistway and accessible to qualified persons only.

Required lighting shall not be connected to the load side of a ground-fault circuit interrupter.

Statement of Problem and Substantiation for Public Input

To safeguard car top lighting circuit for elevator personal, elevator inspectors, elevator consultants, and emergency personal and to align language used in article 620.23

Submitter Information Verification

Submitter Full Name:	Frank Belio
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Submittal Date:	Wed Sep 09 10:52:19 EDT 2020
Committee:	NEC-P12

Public Input No. 391-NFPA 70-2020 [Section No. 620.22(A)]

(A) Car Light Receptacles, Auxiliary Lighting, and Ventilation.

A separate branch circuit shall supply the car lights. The car lights branch circuit shall be permitted to supply receptacles, accessory equipment (alarm devices, alarm bells, monitoring devices not part of the control system), auxiliary lighting power source, and ventilation on each elevator car or inside the operation controller. The overcurrent device protecting the branch circuit shall be located in the elevator machine room, control room, machinery space, or control space. Where there is no machine room, control room, machinery space, or control space outside the hoistway, the overcurrent device shall be located outside the hoistway and accessible to qualified persons only.

~~Required lighting shall not be connected to the load side of a ground-fault circuit interrupter~~ The required lighting branch circuit(s) shall not incorporate GFCI protection .

Statement of Problem and Substantiation for Public Input

The current language is a bit ambiguous and can easily be misinterpreted. The first few times that I read this section, it made me think of a GFCI receptacle (line side-load side). As a logical fallacy, it could lead the installer to think that it is prohibited to connect to the load side, but permissible if connected to the "line side" of the GFCI device.

This could also lead the installer to think that it may be possible to use one circuit for both receptacle and lighting. This is the problem that we are having.

At face value, the section appears to be in conflict with itself. I agree that this would be a misinterpretation on the installer's part. I believe that the intent of the panel is clear. Using the proposed language would leave no room for misinterpretation. Reason for proposed change is for clarity and to help the electrical inspector with enforcement of this section. I've run this by a few electrical engineers and they agree that the present language can be confusing.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 384-NFPA 70-2020 [Section No. 620.23(A)]	
Public Input No. 385-NFPA 70-2020 [Section No. 620.24(A)]	
Public Input No. 384-NFPA 70-2020 [Section No. 620.23(A)]	
Public Input No. 385-NFPA 70-2020 [Section No. 620.24(A)]	

Submitter Information Verification

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Submittal Date: Thu Jan 30 17:28:38 EST 2020

Committee:	NEC-P12

Public Input No. 3025-NFPA 70-2020 [Section No. 620.22(B)]

(B) Air-Conditioning and Heating Source.

A separate branch circuit shall supply the air-conditioning and heating units on each elevator car. The overcurrent device protecting the branch circuit shall be located in the elevator machine room, control room, machinery space, or control ~~room/~~ space. Where there is no machine room, control room, machinery space, or control space outside the hoistway, the overcurrent device shall be located outside the hoistway and accessible to qualified persons only .

Statement of Problem and Substantiation for Public Input

These clarifications were added to 620.22(A) during the last cycle but are also needed in 620.22(B)

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Committee: NEC-P12

Public Input No. 3028-NFPA 70-2020 [Section No. 620.23]

620.23 Branch Circuits for Machine Room or Control Room/Machinery Space or Control Space and Truss Interior Lighting and Receptacle(s).

(A) Separate Branch Circuits.

The branch circuit(s) supplying the lighting for machine rooms, control rooms, machinery spaces, ~~or~~ control spaces or truss interiors shall be separate from the branch circuit(s) supplying the receptacle(s) in those places. These circuits shall supply no other loads.

Required lighting shall not be connected to the load side of a ground-fault circuit interrupter.

(B) Lighting Switch.

The machine room or control room/machinery space or control space lighting switch shall be located at the point of entry.

(C) Duplex Receptacle.

At least one 125-volt, single-phase, 15- or 20-ampere duplex receptacle shall be provided in each machine room or control room and machinery space or control space and truss interior .

Informational Note: See ASME A17.1-2016/CSA B44-16, *Safety Code for Elevators and Escalators*, for illumination levels.

Statement of Problem and Substantiation for Public Input

Modifications to these rules in recent code cycles were done primarily with elevator applications in mind. This modification clarifies which rules apply escalator spaces and also clarifies that 620.25 applies to escalator applications as well. Also clarifies what is to be done when there is no machine room, control room, machinery space, or control space outside the hoistway

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Submittal Date: Fri Sep 04 09:40:07 EDT 2020

Committee: NEC-P12

Public Input No. 4263-NFPA 70-2020 [Section No. 620.23]

620.23 Branch Circuits for Machine Room or Control Room/Machinery Space or Control Space or Cartop Lighting and Receptacle(s).

(A) Separate Branch Circuits.

The branch circuit(s) supplying the lighting for machine rooms, control rooms, machinery spaces, or control spaces shall be separate from the branch circuit(s) supplying the receptacle(s) in those places. These circuits shall supply no other loads.

Required lighting shall not be connected to the load side of a ground-fault circuit interrupter.

(B) Lighting Switch.

The machine room or control room/machinery space or control space lighting switch shall be located at the point of entry.

(C) Duplex Receptacle.

At least one 125-volt, single-phase, 15- or 20-ampere duplex receptacle shall be provided in each machine room or control room and machinery space or control space.

Informational Note: See ASME A17.1-2016/CSA B44-16, *Safety Code for Elevators and Escalators*, for illumination levels.

Statement of Problem and Substantiation for Public Input

To safeguard cartop lighting circuit to include all areas accessible to elevator personal, elevator inspectors, elevator consultants, and emergency personal in the performance of their duties.

Submitter Information Verification

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Committee: NEC-P12

Public Input No. 384-NFPA 70-2020 [Section No. 620.23(A)]

(A) Separate Branch Circuits.

The branch circuit(s) supplying the lighting for machine rooms, control rooms, machinery spaces, or control spaces shall be separate from the branch circuit(s) supplying the receptacle(s) in those places. These circuits shall supply no other loads.

~~Required lighting shall not be connected to the load side of a ground-fault circuit interrupter~~

<u>The required lighting branch circuit(s) shall not incorporate GFCI protection .</u>

Statement of Problem and Substantiation for Public Input

The current language is a bit ambiguous and can easily be misinterpreted. The first few times that I read this section, it made me think of a GFCI receptacle (load side). As a logical fallacy, it could lead the installer to think that it is prohibited to connect to the load side, but permissible if they connect to the "line side" of the GFCI device.

This could also lead the installer to think that it may be permissible to use one circuit for both receptacle and lighting. This is the problem we are having in the field.

At face value, the section appears to be in conflict with itself. I agree that this would be a misinterpretation on the installer's part. I believe that the intent of the panel is clear. Using the proposed language would leave no room for misinterpretation. Reason for proposed change is for clarity and to help the electrical inspector with enforcement of this section. I've run this by a few electrical engineers and they agree that the present language can be confusing.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 385-NFPA 70-2020 [Section No. 620.24(A)]	
Public Input No. 391-NFPA 70-2020 [Section No. 620.22(A)]	
Public Input No. 385-NFPA 70-2020 [Section No. 620.24(A)]	
Public Input No. 391-NFPA 70-2020 [Section No. 620.22(A)]	

Submitter Information Verification

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Submittal Date: Thu Jan 30 10:30:27 EST 2020
Committee: NEC-P12

Public Input No. 1799-NFPA 70-2020 [Section No. 620.24(A)]

(A) Separate Branch Circuits.

Separate branch circuits shall supply the hoistway pit lighting and receptacles. <u>The branch circuit supplying the pit lighting shall be separate from the branch circuit supplying the pit receptacle(s). These circuits shall supply no other loads.</u>

Required lighting shall not be connected to the load side of a ground-fault circuit interrupter.

Statement of Problem and Substantiation for Public Input

The proposed change will provide clarification to the electrical community on what is meant by separate branch circuits for pit lighting and receptacles. Because Section 620.24(A) does not parallel the style and clarity of Section 620.23(A), many people are asking if a separate branch circuit is required to serve hoistway pit lighting and receptacles, or if separate branch circuits (one for the pit lighting and one for the pit receptacle(s)) are required. Based on conversations on this topic that have occurred on NFPA XChange, it appears that the code making panel's intent was to require the branch circuit serving the pit lighting to be separate from the branch circuit serving the pit receptacle(s). The proposed change should make the intent obvious and clear.

Submitter Information Verification

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Submittal Date: Mon Jul 06 21:44:00 EDT 2020
Committee: NEC-P12

Public Input No. 385-NFPA 70-2020 [Section No. 620.24(A)]

(A) Separate Branch Circuits.

Separate branch circuits shall supply the hoistway pit lighting and receptacles.

~~Required lighting shall not be connected to the load side of a ground-fault circuit interrupter~~ The required lighting branch circuit(s) shall not incorporate GFCI protection .

Statement of Problem and Substantiation for Public Input

The current language is a bit ambiguous and can easily be misinterpreted. The first few times that I read this section, it made me think of a GFCI receptacle (load side). As a logical fallacy, it could lead the installer to think that it is prohibited to connect to the load side, but permissible if they connect to the "line side" of the GFCI device.

This could also lead the installer to think that it may be possible to use one circuit for both receptacle and lighting. This is the problem that we are having in the field.

At face value, the section appears to be in conflict with itself. I agree that this would be a misinterpretation on the installer's part. I believe that the intent of the panel is clear. Using the proposed language would leave no room for misinterpretation. Reason for proposed change is for clarity and to help the electrical inspector with enforcement of this section. I've run this by a few electrical engineers and they agree that the present language can be confusing.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 384-NFPA 70-2020 [Section No. 620.23(A)]	
Public Input No. 391-NFPA 70-2020 [Section No. 620.22(A)]	
Public Input No. 384-NFPA 70-2020 [Section No. 620.23(A)]	
Public Input No. 391-NFPA 70-2020 [Section No. 620.22(A)]	

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Submittal Date: Thu Jan 30 10:38:18 EST 2020
Committee: NEC-P12

Public Input No. 1063-NFPA 70-2020 [New Section after 620.25]

TITLE OF NEW CONTENT

Type your content here ... **620.26 Fire Protection of branch circuits for power,control fire protection, ventilation and a/c of Elevator, Hoistways and machine room equipment. Branch Circuits for Stairwells of high rise buildings 75 feet and taller for ventilation (stairway pressurization, smoke exhaust, fire dampers etc..) and emergency lighting.**

(a) Independent Routing. The conductors shall be kept

entirely independent of all other wiring.

(b) Associated Loads. The conductors shall

supply only loads that are directly associated with the system.

(c) Protection from Potential Damage. The conductors shall

be protected from potential damage by fire, structural failure,or operational accident.

(d) Inside of a Building. Where routed outside the rated stairwell or hoistway the conductors shall be protected from fire for 2 hours

using one of the following methods:

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

(2) The cable or raceway is a listed fire-resistive cable system.

Informational Note 1: Fire-resistive cables are tested to ANSI/UL 2196,Tests for Fire Resistive Cables.

Informational Note 2: The listing organization provides information for fire-resistive cable systems on proper installation

requirements to maintain the two hour fire rating.

(3) The cable or raceway is a listed electrical circuit protective system.

Informational Note 1: Electrical circuit protective systems could

include, but are not limited to, thermal barriers or a protective

shaft and are tested in accordance with UL 1724, Fire Tests for

Electrical Circuit Protection Systems.

Informational Note 2: The listing organization provides information for electrical circuit protective systems on proper

installation requirements to maintain the fire rating.

Exception to 620.26(d): The supply conductors located in the electrical equipment room where they originate.

Statement of Problem and Substantiation for Public Input

This would align the requirements for 2 hour fire protection of branch circuits for elevators and stairwells with 909.20.6.1 in the 2018 International Building Code these were put in the IBC in part because of fatalities (smoke inhalation) in the stairwells after the truck bombing of the twin towers in New York City. The smoke evacuation and stairwell pressurization fans stopped working because of fire in the basement caused by fire from the truck bomb. This is already required in the IBC but electricians normally are not aware because they are only familiar with the NEC.

Submitter Information Verification

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Submittal Date:	Thu May 14 10:04:10 EDT 2020
Committee:	NEC-P12

Public Input No. 3031-NFPA 70-2020 [Section No. 620.25(B)]

(B) Overcurrent Devices.

The overcurrent devices protecting the branch circuit(s) shall be located in the elevator machine room, control room, machinery space, or control space. Where there is no machine room, control room, machinery space, or control space outside the hoistway, or for escalator and moving walk applications, the overcurrent device shall be located outside the hoistway and accessible to qualified persons only.

Statement of Problem and Substantiation for Public Input

These clarifications were added to 620.22(A) during the last cycle but are also needed in 620.25(B)

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Submittal Date:	Fri Sep 04 09:46:29 EDT 2020
Committee:	NEC-P12

Public Input No. 3043-NFPA 70-2020 [Section No. 620.36]

620.36 Different Systems in One Raceway or Traveling Cable.

Optical fiber cables and conductors for operating devices, operation and motion control, power, signaling, fire alarm, lighting, heating, and air-conditioning circuits of 1000 volts or less shall be permitted to be run in the same traveling cable or raceway system if all conductors are insulated for the maximum voltage applied to any conductor within the cables or raceway system and if all live parts of the equipment are insulated from ground for this maximum voltage. Such a traveling cable or raceway shall also be permitted to include shielded conductors, one or more coaxial cables, and/or one or more ~~coaxial~~ Ethernet cables if such conductors are insulated for the maximum voltage applied to any conductor within the cable or raceway system. Conductors shall be permitted to be covered with suitable shielding for telephone, audio, video, data transfer or higher frequency communications circuits.

Statement of Problem and Substantiation for Public Input

To allow for Ethernet cables to be included in elevator traveling cables. Requirements for Ethernet communications to elevator cars are becoming commonplace.
In addition, Ethernet in elevator travel cables are needed in order to provide the bandwidth needed to comply with the two-way video requirements specified in the IBC-2018 and ASME A17.1-2019
See Also Public Input No. 3040-NFPA 70-2020 [Section No. 400.4], and Public Input No. 3041-NFPA 70-2020 [Section No. 620.12(A)(2)]

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3040-NFPA 70-2020 [Section No. 400.4]	Allows Ethernet in Elevator Traveling Cables
Public Input No. 3041-NFPA 70-2020 [Section No. 620.12(A)(2)]	Allows Ethernet in Elevator Traveling Cables

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Committee: NEC-P12

Public Input No. 3121-NFPA 70-2020 [Section No. 620.37(A)]

(A) Uses Permitted.

Only such electrical wiring, raceways, and cables used directly in connection with the elevator or dumbwaiter, including wiring for signals, for communication with the car, for lighting, heating, air conditioning, and ventilating the elevator car, for fire detecting systems, for pit sump pumps, for the pit receptacle required by 620.24 (C), and for heating, lighting, and ventilating the hoistway, shall be permitted inside the hoistway, machine rooms, control rooms, machinery spaces, and control spaces.

Statement of Problem and Substantiation for Public Input

The pit receptacle required by 620.24 C does not always serve a pit sump pump. In some cases a sump pump is not required and a gravity drain is provided. But the pit receptacle is still code required. Not sure why the pit receptacle would not be provided with the same hoistway wiring requirements as all other electrical items in the hoistway.

Submitter Information Verification

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Submittal Date: Sat Sep 05 06:55:16 EDT 2020

Committee: NEC-P12

Public Input No. 3518-NFPA 70-2020 [Section No. 620.37(A)]

(A) Uses Permitted.

Only such electrical wiring, raceways, and cables used directly in connection with the elevator or dumbwaiter, including wiring for signals, for communication with the car, for lighting, heating, air conditioning, and ventilating the elevator car, for fire detecting systems, for pit sump pumps, branch circuitss identified in 620.24, and for heating, lighting, and ventilating the hoistway, shall be permitted inside the hoistway, machine rooms, control rooms, machinery spaces, and control spaces.

Statement of Problem and Substantiation for Public Input

Branch circuits required in 620.22 may originate from the elevator machine rooms, control rooms, or machinery spaces and installed along the walls of the hoistways. A clear permissive language must be added to 620.37(A) to permit such installation and removes any ambiguity about the permitted branch circuits in hoistways.

Submitter Information Verification

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Submittal Date: Tue Sep 08 19:50:25 EDT 2020
Committee: NEC-P12

Public Input No. 3727-NFPA 70-2020 [Section No. 620.37(C)]

(C) ~~Main~~ Feeders.

~~Main feeders~~ Feeders for supplying power to elevators and dumbwaiters shall be installed outside the hoistway unless as follows:

(1) By special permission, feeders for elevators shall be permitted within an existing hoistway if no conductors are spliced within the hoistway.

(2) Feeders shall be permitted inside the hoistway for elevators with driving machine motors located in the hoistway or on the car or counterweight.

Statement of Problem and Substantiation for Public Input

What is a "main feeder"? There is no such definition.

Submitter Information Verification

Submitter Full Name: Ryan Jackson

Organization: Ryan Jackson

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Submittal Date: Wed Sep 09 11:27:32 EDT 2020

Committee: NEC-P12

Public Input No. 2631-NFPA 70-2020 [Section No. 620.51(A)]

(A) Type.

The disconnecting means shall be an enclosed externally operable fused motor circuit switch or circuit breaker that is lockable only in the open position in accordance with 110.25.

The disconnecting means shall be a listed device.

Informational Note: For additional information, see ASME A17.1-2016/CSA B44-16, *Safety Code for Elevators and Escalators*.

Exception No. 1: Where an individual branch circuit supplies a platform lift, the disconnecting means required by 620.51(C)(4) shall be permitted to comply with 430.109(C). This disconnecting means shall be listed and shall be lockable open in accordance with 110.25.

Exception No. 2: Where an individual branch circuit supplies a stairway chairlift <u>that does not use batteries as the primary source</u> , the stairway chairlift shall be permitted to be cord-and-plug-connected, provided it complies with 422.16(A) and the cord does not exceed 1.8 m (6 ft) in length.

Statement of Problem and Substantiation for Public 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.
New technology for chairlifts utilizes batteries as a primary source, and the 120-v source is only used to charge the batteries. It is not necessary to have an individual branch circuit to supply this type equipment as it is not the primary source.

Submitter Information Verification

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Submittal Date: Wed Aug 26 09:17:26 EDT 2020
Committee: NEC-P12

Public Input No. 3033-NFPA 70-2020 [Section No. 620.51(D)(1)]

(1) More than One Driving Machine.

Where there is more than one driving machine in a machine room, the disconnecting means shall ~~be numbered to correspond to the identifying number of the driving machine that they control.~~ be provided with a unique identification corresponding to the driving machine controlled.

Informational Note: See ASME A17.1-2019/CSA B44-19 Safety Code for Elevators and Escalators for Identification requirements for elevators and associated equipment.

The disconnecting means shall be provided with a sign to identify the location of the supply side overcurrent protective device.

Statement of Problem and Substantiation for Public Input

A17.1-2019 Elevator Safety Code allows elevators to be identified by a unique alphabetic, numeric, or alphanumeric identification. This proposal harmonizes the NEC rule with that requirement.

Submitter Information Verification

Submitter Full Name: Jeffrey Blain
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Public Input No. 2680-NFPA 70-2020 [Section No. 620.51(D)(2)]

(2) Available Fault Current Field Marking.

Where an elevator control panel is used, it shall be legibly marked in the field with the available fault current at its line terminals. The field marking(s) shall include the date the available fault current calculation was performed and be of sufficient durability to withstand the environment involved.

When modifications to the electrical installation occur that affect the available fault current at the elevator control panel, the available fault current shall be verified or recalculated as necessary to ensure the elevator control panel's short-circuit current rating is sufficient for the available fault current at the line terminals of the equipment. The required field marking(s) shall be adjusted to reflect the new level of available fault current.

Exception: Elevator control panels located in one and two-family dwellings.

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 exception would be consistent with 110.24 and 408.6 to forgo the available fault current label in one and two family dwellings. The panel needs to consider that the available fault current in residential distribution systems are typically low levels.

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Committee:	NEC-P12

Public Input No. 3024-NFPA 70-2020 [Section No. 620.51(D)(2)]

(2) Available Fault Current Field Marking.

~~Where an elevator control panel is used, it~~ The disconnecting means shall be legibly marked in the field with the available fault current at its line terminals. The field marking(s) shall include the date the available fault current calculation was performed and be of sufficient durability to withstand the environment involved.

When modifications to the electrical installation occur that affect the available fault current at the ~~elevator control panel~~ disconnecting means , the available fault current shall be verified or recalculated as necessary to ensure the ~~elevator control panel's short~~ equipment's short -circuit current rating is sufficient for the available fault current at the line terminals of the equipment. The required field marking(s) shall be adjusted to reflect the new level of available fault current.

Statement of Problem and Substantiation for Public Input

The field marking should be applied to the disconnect required in 620.51. This disconnect is usually not located in the elevator control panel.

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Committee: NEC-P12

Public Input No. 3211-NFPA 70-2020 [Section No. 620.51(E)]

(E) Surge Protection.

~~Where~~ 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~~ .

Additional Proposed Changes

File Name	Description	Approved
Code_Input.docx	input to improve overvoltage protection requirements	

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. 3208-NFPA 70-2020 [Section No. 551.72(E)]	
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. 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 18:38:30 EDT 2020
Committee:	NEC-P12

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. 3669-NFPA 70-2020 [Section No. 620.51(E)]

(E) – ~~Surge~~ Overvoltage Protection.

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, a listed surge ~~protection shall be provided~~ -protective device (SPD) shall be installed in accordance with Part II of Article 242 .

Statement of Problem and Substantiation for Public Input

The purpose of this public input is to correlate and harmonize all of the current sections of the code where "overvoltage protection" is required by:

1. Changing the section titles to "Overvoltage Protection" to properly correlate with Article 242.

2. Correcting the product description to "listed surge-protective device (SPD)" which is defined in Article 100 and correlates with Article 242.

3. Adding a pointer to "Part II. of Article 242" to ensure compliance with all of the requirements for SPDs are met when complying with the rule.

This public input is one of eleven correlating public inputs covering Sections 230.67, 501.35, 502.35, 620.51(E), 645.18, 670.6, 694.7(D), 695.15, 700.8, 708.20(D), and Informative Annex G

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Committee:	NEC-P12

Public Input No. 4087-NFPA 70-2020 [Section No. 620.61(A)]

(A) Operating Devices and Control and Signaling Circuits.

Operating devices and control and signaling circuits shall be protected against overcurrent in accordance with ~~the requirements of~~ 725.43 and 725.45.

Class 2 power-limited circuits shall be protected against overcurrent in accordance ~~with the requirements of~~ with Chapter 9, Notes to Tables 11(A) and 11(B).

Statement of Problem and Substantiation for Public Input

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

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Committee: NEC-P12

Public Input No. 1912-NFPA 70-2020 [Section No. 620.62]

620.62 Selective Coordination.

Where more than one driving machine disconnecting means is supplied by the same source, the overcurrent protective devices in each disconnecting means shall be selectively coordinated with any other supply side overcurrent protective devices.

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

Exception No. 1: Selective coordination shall not be required between transformer primary and secondary overcurrent protective devices ~~where only one overcurrent device or set of overcurrent devices exists on the transformer secondary~~ .

Exception No. 2: Selective coordination shall not be required between overcurrent protective devices of the same rating located in series where no loads are connected in parallel with the downstream device.

Statement of Problem and Substantiation for Public Input

The text removed is confusing and appears to be redundant. It appears to say that coordination is not required if there are greater than 0 OCPDs on the secondary side of the transformer.

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Committee: NEC-P12

Public Input No. 2407-NFPA 70-2020 [Section No. 620.91 [Excluding any Sub-Sections]]

~~Elevators shall be~~

The use of backup power systems for elevators shall comply with the following;

1) Elevator motors, pump systems, and associated ventilation equipment, once determined to be on an essential backup power system, either by code or by the authority having jurisdiction, shall be permitted to be powered by any of the following types of emergency backup power systems. Backup power shall be configured to be restored within 60 seconds and shall not be permitted to be automatically load shed

A) Required Standby Power system in accordance with Article 701.

B) Essential Electrical System in accordance with Article 517, where an

~~emergency or standby power system.~~

Essential Electrical System exists..

C) Critical Operations Power System (COPS) in accordance with Article 708, where a COPS exists.

2) Elevator motors, pump systems, and associated ventilation equipment, if voluntarily determined to be on a backup power system, shall be permitted to be powered by an optional standby backup power system in accordance with Article 702.

3) Elevator car lighting, communication systems, and alarms shall be powered by one of the following types of emergency backup power systems. The backup power for this load shall be restored within 10 seconds and shall not be permitted to be automatically load shed.

A) Emergency Power system in accordance with Article 700.

B) The Life Safety branch of an Essential Electrical System in accordance with Article 517, where an Essential Electrical System exists.

C) Critical Operations Power System (COPS) in accordance with Article 708, where a COPS exists.

Informational Note No. 1:

~~See~~

See ASME A17.1-2016/CSA B44-16, *Safety Code for Elevators and Escalators* , 2.27.2, for additional information.

Informational Note No. 2:

~~When~~

When an elevator is classified as a fire service access elevator or occupant evacuation operation elevator, some building codes require the elevator equipment, elevator hoistway lighting, ventilation and cooling equipment for elevator machine rooms, control rooms, machine spaces, and control spaces as well as elevator car lighting to be supplied by standby power systems in compliance with Article 701.

Statement of Problem and Substantiation for Public Input

1) A standby power system could be interpreted as a required standby power system per 701 or as an optional standby power system per 702, and application distinctions could disallow either to be appropriate, or both to be inappropriate.
2) There are distinct elevator equipment sub-categories that require separate power system types. The power system distinctions can be based on the time allowed for power restoration, 10 seconds or 60 seconds, and whether or not the load is permitted to be shed automatically. required backup versus voluntary (optional) backup.
3) Loads that are not required to be on emergency power are generally disallowed from being on emergency power and must instead be placed onto an optional standby power system. This condition is not yet addressed by this code text.
4) Standard industry practice for elevators on backup power in healthcare occupancies often presumes that the load must be put onto the equipment branch. However, the equipment branch is allowed to be automatically load shed which sets up an inconsistency in code. The inconsistency being that other occupancies must comply with Article 701; which only allows up to 60 seconds for power restoration, and does not allow the load to be shed, neither of which is a requirement of Article 517 for the equipment branch.

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Submittal Date: Wed Aug 19 12:08:57 EDT 2020

Committee: NEC-P12

Public Input No. 1932-NFPA 70-2020 [Section No. 625.1]

625.1 Scope.

This article covers the electrical conductors and equipment connecting an electric vehicle to premises wiring <u>or utilization equipment</u> for the purposes of charging, power export, or bidirectional current flow.

Informational Note No. 1: For industrial trucks, see NFPA 505-2018, *Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operations*.

Informational Note No. 2: UL 2594-2013, *Standard for Electric Vehicle Supply Equipment*, is a safety standard for conductive electric vehicle supply equipment. UL 2202-2009, *Standard for Electric Vehicle Charging System Equipment*, is a safety standard for conductive electric vehicle charging equipment.

Statement of Problem and Substantiation for Public Input

The language in the scope, today, doesn't specifically address the changes made in the 2020 cycle to add language in 625.60 governing the receptacles used to export power to utilization equipment.

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Submittal Date: Fri Jul 17 11:34:49 EDT 2020

Committee: NEC-P12

Public Input No. 2081-NFPA 70-2020 [Section No. 625.1]

625.1 Scope.

This article covers the electrical conductors and equipment connecting an electric vehicle to premises wiring for the purposes of charging, power export, or bidirectional current flow.

Informational Note No. 1: For industrial trucks, see NFPA 505-2018, *Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operations*.

Informational Note No. 2: UL 2594-2013, *Standard for Electric Vehicle Supply Equipment*, is a safety standard for conductive electric vehicle supply equipment. UL 2202-2009, *Standard for Electric Vehicle Charging System Equipment*, is a safety standard for conductive electric vehicle charging equipment.

Informational Note No. 3: UL 2750-2020, *An Outline of Investigation For Wireless Power Transfer Equipment For Electric Vehicles,* a document covering wireless power transfer (WPT) equipment for transferring power to an electric vehicle.

Statement of Problem and Substantiation for Public Input

The first two informational notes list documents which provide information related to Industrial Trucks and to Conductive Charging for Electric Vehicles. Nothing is stated regarding Wireless Charging. This proposed additional note provides information related to a new document, UL 2750, which provides information related to Wireless Charging of Electric Vehicles. UL 2750 is referenced as the safety standard in SAE J2954:2020 (Wireless Power Transfer for Light-Duty Plug-in/Electric Vehicles and Alignment Methodology)

Submitter Information Verification

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Submittal Date: Wed Jul 29 10:09:49 EDT 2020
Committee: NEC-P12

Public Input No. 3065-NFPA 70-2020 [Section No. 625.1]

625.1 Scope.

This article covers the electrical conductors and equipment ~~connecting an~~ external to an electric vehicle connecting to premises wiring for the purposes of charging, power export, or bidirectional current flow.

Informational Note No. 1: For industrial trucks, see NFPA 505-2018, *Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operations*.

Informational Note No. 2: UL 2594-~~2013~~ 2016 , *Standard for Electric Vehicle Supply Equipment*, is a safety standard for conductive electric vehicle supply equipment. UL 2202-2009, *Standard for Electric Vehicle Charging System Equipment*, is a safety standard for conductive electric vehicle charging equipment.

Statement of Problem and Substantiation for Public Input

Since the NEC is enforced by a large variety of AHJs, the NEC must be consistent and specific in scope to avoid misinterpretation at the state and local levels. This is particularly important since the design, construction, and performance requirements for motor vehicle safety are federally regulated by NHTSA, whereas installation requirements can be controlled by a local AHJ. Importantly, installations cannot move whereas motor vehicles certainly do. It is not practical for individual AHJs to judge conformance to the NEC which includes requirements for vehicles that may or may not be present at the time of inspection and can certainly travel between different AHJ jurisdictions. This separation between on-board and off-board is a necessary distinction to allow for enforcement of the NEC at the installation.

The current language of 625.1 contains three issues:
1) 625.1 is not consistent with 90.2 which states that the NEC does cover “installations used to export power from vehicles to premises wiring” but does not cover “automotive vehicles”.
2) 625.1 extends coverage to onboard vehicle components, which substantially overlaps with NHTSA’s federal regulatory oversight for motor vehicle safety. While the NEC in itself is intended to be a voluntary standard for installations, it becomes regulation for motor vehicle components when the NEC is adopted into state or local laws. This significantly impacts the automaker’s duty to respond in a timely manner should NHTSA be required to utilize its enforcement and recall authority.
3) The language is not sufficiently clear which vehicle components, regardless of whether it is on-board or off-board the vehicles, are covered by the scope in 625.1.

Due to the lack of identified safety need by the CMP, in addition to conflicts with NHTSA’s authority, the scope should be limited to off-board components.

The updated version of UL 2594 was published in 2016. The informational note shall be updated accordingly

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Submittal Date:	Fri Sep 04 13:37:01 EDT 2020
Committee:	NEC-P12

Public Input No. 3600-NFPA 70-2020 [Section No. 625.1]

625.1 Scope.

This article covers the electrical conductors and equipment connecting an electric vehicle to premises wiring for the purposes of charging, power export, or bidirectional ~~current flow~~ power flow including the ability to interact with other power sources .

Informational Note No. 1: For industrial trucks, see NFPA 505-2018, *Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operations*.

Informational Note No. 2: UL 2594-2013, *Standard for Electric Vehicle Supply Equipment*, is a safety standard for conductive electric vehicle supply equipment. UL 2202-2009, *Standard for Electric Vehicle Charging System Equipment*, is a safety standard for conductive electric vehicle charging equipment.

Statement of Problem and Substantiation for Public Input

The existing scope statement in 625.1, specifies “current flow” which is proposed to be revised to specify “power flow” for clarity. 625.1 is further proposed to be revised to include EV interaction with other power sources, such as distributed energy resources (DER).

The PV Industry Forum (PVIF) is a collaborative initiative of several organizations dedicated to continually improving the installation safety of PV systems in the U.S. The organizations are the Solar Energy Industry Association (SEIA), the PV Industry Codes Council (PVICC), Solar Energy International (SEI), the Interstate Renewable Energy Council (IREC), and the Large-Scale Solar Association (LSA). This coalition has come together to organize, convene, support and mentor solar industry professionals through the NEC public input process, which is open to all solar industry participants.

This collaborative effort has resulted in the consensus development of numerous solar-related Public Input proposals for consideration. The list of task group members indicates those individuals who have contributed to the development of various Public Inputs in nine different tasks groups. A consensus process was used to develop each Public Input, therefore this list does not necessarily indicate that each individual or their representative organization participated in or has agreed with every proposed Public Input submitted under the PVIF effort. Each participant has agreed that any original proposal that they submitted and which was subsequently improved by our process is assigned as original and / or improved work to PVIF for submittal and release to NFPA as a proposed Public Input.

Members of the PVIF’s effort include the following representatives. Note that those noted below participated in specific task groups and not necessarily all task groups on specific items proposed. Each member is at their discretion to individually comment on PI’s as they deem appropriate.

Evelyn Butler, SEIA; Jason Fisher, SEIA; Ward Bower, Ward Bower Innovations LLC/SEIA; Joseph Cain, P.E., SEIA; Bill Brooks, Brooks Engineering/PVICC; Rebekah Hren, Solar Energy International; Brian Mehalic, Solar Energy International; Mark Rodriguez, Sunrun; Paul Joyce, Sunrun; Brian Ewing, Swinerton; Sumana Seshadri, Swinerton; Christian Eder, Fronius USA; Isaac Opalinsky, SunPower; Chris Fox, SunPower; James Cormican, RBI Solar; Dave Compaan, RBI Solar; Shawn Shaw, Natural Power; Cody Oram, Vivint Solar; Greg Elvestad, Vivint Solar; Mike Weimer, Westwood Professional Services; Doug Mutcher, Westwood Professional Services; Jeff Wang, Staubli; Colleen O'Brien, UL; John Doty, UL; Laurie Florence, UL; Tim Zgonena, UL ; Gokul Kalyan, FTC Solar; Ali Sedaghat, FTC Solar; K.C. Radford, Radian Generation; Jan Dominguez, LG Electronics; Ben Chamberlain, Olivewood Energy; Klaus Nicolaedis, Unirac Inc.; Leif Cook, Core Development Group; Martin Herzfeld, Herzfeld; Dave Click, esaSolar; Sean White, principal; Kate Collardson, BayWa r.e. Solar Systems; Bryan Holland, NEMA; Jack Lyons, NEMA; Mike Stone, NEMA; Evan Martin, BURNDY; Terry McKinch, Mortenson; Jason Bobruk, SolarEdge Technologies; Reid ; train, Savion; Charlie Dearie, McCalmont Engineering; Sumanth Lokanath, Ray Illuminati LLC; Yann Schwarz, Esdec Inc.; Joseph

Armano, PanelClaw, Inc.; Michael Heinrich, PanelClaw, Inc.; Steve Wurmlinger, SMA Solar Technology AG; Thomas Wegener, SMA Solar Technology AG; Chris Flueckiger, Key Renewables; Matt Piantedosi, Ridgeline Energy Analytics; Samantha Doshi, Intertek; Kyle Breuning, Tesla; Charles Picard, Tesla; Steve Connolly, Tesla; Greg Ball, Tesla; Jake West, Tesla; Jamie Daggett, DNV GL; MinWah Leung, DNV GL; Bob White, Fimer SpA; Marvin Hamon, Pure Power Engineering; Milton Nogueira, Roof Tech; Peter Seidel, First Solar; Jason Smolko, Copperweld;

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Committee:	NEC-P12

Public Input No. 898-NFPA 70-2020 [Section No. 625.1]

625.1 Scope.

This article covers the electrical conductors and equipment connecting an electric vehicle to premises wiring for the purposes of charging, power export, or bidirectional current flow.

Informational Note No. 1: For industrial trucks, see NFPA 505-2018, *Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operations*.

Informational Note No. 2: UL 2594-2013, *Standard for Electric Vehicle Supply Equipment*, is a safety standard for conductive electric vehicle supply equipment. UL 2202-2009, *Standard for Electric Vehicle Charging System Equipment*, is a safety standard for conductive electric vehicle charging equipment.

Informational Note No. 3: For additional information about installing electric vehicle supply equipment see NECA 413-2019, *Standard for Installing and Maintaining Electric Vehicle Supply Equipment (EVSE).*

Statement of Problem and Substantiation for Public Input

The proposed informational note provides users with a reference that assists with increasing understanding of the importance of performing accurate site assessments for electric vehicle supply equipment installations. This standard describes the types of EVSE and the load profiles expected with each. While the NEC addresses the minimum requirements for safe installations of EVSE, the workmanship aspects are left to the generalized text in Section 110.12. As these installations become more common, this quality performance standard provides valuable insight that assists with this understanding of what constitute good workmanship in all aspects of EVSE installation.

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Committee:	NEC-P12

Public Input No. 3833-NFPA 70-2020 [Section No. 625.2]

(Relocate all definitions in the 625. 2 to Article 100, arrange them in alphabetical order and without any subdivisions)

625. 2 Definitions.

The following definitions shall apply only within this article.

Cable Management System.

An apparatus designed to control and organize the output cable to the electric vehicle or to the primary pad.

Charger Power Converter.

The device used to convert energy from the power grid to a high-frequency output for wireless power transfer.

Electric Vehicle Connector.

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

Informational Note: For further information, see 625.48 for interactive systems.

Electric Vehicle Power Export Equipment (EVPE).

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

Informational Note: Electric vehicle power export equipment and electric vehicle supply equipment are sometimes contained in one piece of equipment, sometimes referred to as a bidirectional EVSE.

Electric Vehicle Supply Equipment (EVSE).

The conductors, including the ungrounded, grounded, and equipment grounding conductors, and the electric vehicle connectors, attachment plugs, personnel protection system, and all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the electric vehicle.

Informational Note: Electric vehicle power export equipment and electric vehicle supply equipment are sometimes contained in one piece of equipment, sometimes referred to as a bidirectional EVSE.

Fastened in Place.

Mounting means of equipment in which the fastening means are specifically designed to permit periodic removal, without the use of a tool, for relocation, interchangeability, maintenance, or repair.

Fixed in Place.

Mounting means of an EVSE attached to a wall or surface with fasteners that require a tool to be removed.

Output Cable to the Electric Vehicle.

An assembly consisting of a length of flexible EV cable and an electric vehicle connector (supplying power to the electric vehicle).

Output Cable to the Primary Pad.

A multi-conductor, shielded cable assembly consisting of conductors to carry the high-frequency energy and any status signals between the charger power converter and the primary pad.

Personnel Protection System.

A system of personnel protection devices and constructional features that when used together provide protection against electric shock of personnel.

Portable (as applied to EVSE).

A device intended for indoor or outdoor use that can be carried from charging location to charging location and is designed to be transported in the vehicle when not in use.

Power-Supply Cord.

An assembly consisting of an attachment plug and length of flexible cord that connects equipment to a receptacle.

Primary Pad.

A device external to the EV that transfers power via the contactless coupling as part of a wireless power transfer system.

Wireless Power Transfer (WPT).

The transfer of electrical energy from a power source to an electrical load via electric and magnetic fields or waves by a contactless inductive means between a primary and a secondary device.

Wireless Power Transfer Equipment (WPTE).

Equipment consisting of a charger power converter and a primary pad. The two devices are either separate units or contained within one enclosure.

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. "

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Committee:	NEC-P12

Public Input No. 3462-NFPA 70-2020 [Definition: Cable Management System.]

Relocate this definition to Article 100 and consider revising the term to coordinate with the same term in 626.2.

Cable Management System.

An apparatus designed to control and organize the output cable to the electric vehicle or to the primary pad.

Statement of Problem and Substantiation for Public Input

The term Cable Management System is defined by CMP-12 in Articles 625 and 626.
The NEC Style Manual revisions in Section 2.2.2 and its subdivisions requires multiple changes to the definitions in Article 100 and all Articles in the NEC including the use of acronyms in Section 3.2.3. Every panel should review all definitions under their purview and make the necessary changes to comply with the style manual revisions.

Section 2.2.2.4 Terms with Multiple Definitions. Where two or more definitions exist for a term, a task group shall be formed to work on the development of a single acceptable definition. When this cannot be accomplished, another term shall be selected or the term shall be identified in the context of the specific application.

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Submittal Date:	Tue Sep 08 15:55:01 EDT 2020
Committee:	NEC-P12

Public Input No. 2375-NFPA 70-2020 [Definition: Electric Vehicle Power Export Equipment (EVPE).]

Electric Vehicle Power Export Equipment (EVPE).

The equipment, including the outlet on the vehicle in the case of plug in charging and the energy receiving coil and electronics in the case of wireless charging , that is used to provide electrical power at voltages greater than or equal to 30 Vac or 60 Vdc to loads external to the vehicle, using the vehicle as the source of supply.

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

Statement of Problem and Substantiation for Public Input

This Public Input proposal is made for the purpose of better integrating WPT into Article 625.

It is part of a set of related Public Inputs (PI) which all share the same Purpose and General Justification, although the specifics for each PI are different.

The Public Inputs in this related set and the sections they apply to are:

PI 2375	625.2
PI 2236	625.2
PI 2082	625.2
PI 2376	625.2
PI 2377	625.17(C)(2)
PI 2384	625.41
PI 2385	625.48
PI 2387	625.102(A), 625.102(B), 625.102(C)
PI 2392	615.102(D)

GENERAL JUSTIFICATION (This text is stated IN FULL in this PI (since this is the first related PI; each of the other related PI's reference the General Justification stated in this PI 2375)

WPT was first explicitly introduced into Article 625 of the 2017 edition, and some improvements were made in the 2020 edition. To date very few installations of WPT have been made, so any gaps in requirements related to WPT and possible confusion about which sections apply or don't apply to WPT have not been a big issue.

By the time the 2023 edition is published the number of WPT installations is likely to have significantly increased; there are several automotive OEMs that have plans to offer WPT charging for their electric vehicles, supported by the issuance of international standards for WPT such as SAE J2954, the IEC 61980 series, ISO 19363 and the GB/T 38775 series (China).

These related Public Input proposals are intended to be clarifying in nature with no intention of adding new requirements, unless otherwise stated; they are presented in order to clearly state the requirements for wireless charging and to differentiate them from plug in charging where appropriate.

EXPLANATION FOR THIS PUBLIC INPUT PROPOSAL, PI 2375

The informational note in the current text indicates that this definition is meant to apply to bi-directional systems. Since both plug-in and wireless systems can be bi-directional, the purpose of this proposal is to explicitly include WPT in the definition, but to do it with minimal change to the current text.

The main physical difference between plug-in charging and wireless charging is the interface to the vehicle, so the added wording is meant to specifically include both interfaces. Also see PI 2236 and PI 2376 - definitions of EVSE and WPTE.

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Submittal Date: Tue Aug 18 11:37:42 EDT 2020
Committee: NEC-P12

Public Input No. 3066-NFPA 70-2020 [Definition: Electric Vehicle Power Export Equipment (EVPE).]

~~**Electric Vehicle Power Export Equipment (EVPE).**~~

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

~~Informational Note: Electric vehicle power export equipment and electric vehicle supply equipment are sometimes contained in one piece of equipment, sometimes referred to as a bidirectional EVSE.~~

Statement of Problem and Substantiation for Public Input

There are a variety of forms that enable a vehicle to export power to outside of the vehicle. Depending on the configuration, functions of individual components will be significantly different, and therefore, it is not reasonable to just define a term EVPE and to attempt to set an overgeneralized requirement. Individual system configurations need to be carefully investigated and issues underlying such configurations shall be carefully addressed.

For example, a 120 V AC outlet receptacle in the vehicle cabin does export power to the laptop, but it is unlikely used or is not intended for use on the earth ground. A 120/240 V AC outlet receptacle installed on the outside of the vehicle may be used to export power to an off-board standalone device, a house, or a building. A direct-current (DC) vehicle charging receptacle may be used to export power to an off-board inverter, so the inverter can supply power to an off-board standalone device, a house, or a building. Each of these examples requires different equipment, which means required technical consideration will be different on each case.

It is not appropriate to consider everything in one category. Therefore, we respectfully oppose to defining the term EVPE. Instead, necessary technical requirements have to defined in appropriate standards, sometimes Code of Federal Regulations that controls vehicle requirements.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3067-NFPA 70-2020 [Definition: Electric Vehicle Power Export Equipment (EVPE).]	

Submitter Information Verification

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Submittal Date: Fri Sep 04 13:40:09 EDT 2020

Committee: NEC-P12

Public Input No. 3067-NFPA 70-2020 [Definition: Electric Vehicle Power Export Equipment (EVPE).]

Electric Vehicle Power Export Equipment (EVPE).

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

Informational Note: Electric vehicle power export equipment and electric vehicle supply equipment are sometimes contained in one piece of equipment, sometimes referred to as a bidirectional EVSE.

Statement of Problem and Substantiation for Public Input

It is impractical to distinguish on-board equipment that is used to provide electrical power from other on-board equipment that is not, and hence, this definition shall not include on-board equipment.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3066-NFPA 70-2020 [Definition: Electric Vehicle Power Export Equipment (EVPE).]	Two options proposed

Submitter Information Verification

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Submittal Date: Fri Sep 04 13:42:16 EDT 2020

Committee: NEC-P12

Public Input No. 2236-NFPA 70-2020 [Definition: Electric Vehicle Supply Equipment (EVSE).]

Electric Vehicle Supply Equipment (EVSE).

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

Informational Note: Electric vehicle power export equipment and electric vehicle supply equipment are sometimes contained in one piece of equipment, sometimes referred to as a bidirectional EVSE.

Statement of Problem and Substantiation for Public Input

This Public Input proposal is made for the purpose of better integrating WPT into Article 625 and is part of a set of Public Inputs which share the same General Justification. See PI 2375 for more details.

EXPLANATION FOR THIS PUBLIC INPUT PROPOSAL PI 2236

The proposed change here is solely for the purpose of clarifying the relationship between EVSE and WPTE. Since both have definitions in this section 625.2, the current wording could lead to someone trying to apply EVSE requirements elsewhere in this Article 625 to WPTE. By stating that EVSE is for plug-in only and also making the definition of WPTE more descriptive (see PI 2376) this possible confusion can be prevented. The proposed change here is meant to accomplish the intent with minimal change to existing text.

Submitter Information Verification

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Submittal Date: Wed Aug 12 10:43:21 EDT 2020

Committee: NEC-P12

Public Input No. 3068-NFPA 70-2020 [Definition: Electric Vehicle Supply Equipment (EVSE).]

Electric Vehicle Supply Equipment (EVSE).

The conductors, including the ungrounded, grounded, and equipment grounding conductors, and the electric vehicle connectors, attachment plugs, personnel protection system, ~~and~~ all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of ~~transferring energy between the~~ delivering energy from the premises wiring ~~and the~~ to the electric vehicle.

Informational Note: Electric vehicle power export equipment and electric vehicle supply equipment are sometimes contained in one piece of equipment, sometimes referred to as a bidirectional EVSE.

Statement of Problem and Substantiation for Public Input

Requirements for the equipment that constantly receives power from the premises wiring, and those for the equipment that receives power from the vehicle shall be completely different. EV supply equipment shall not include equipment that takes power out of vehicle to external loads. The definition shall be equivalent to that in SAE J1772.

Submitter Information Verification

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Submittal Date: Fri Sep 04 13:44:12 EDT 2020

Committee: NEC-P12

Public Input No. 3245-NFPA 70-2020 [Definition: Fastened in Place.]

~~**Fastened in Place.**~~

~~Mounting means of equipment in which the fastening means are specifically designed to permit periodic removal, without the use of a tool, for relocation, interchangeability, maintenance, or repair.~~

Statement of Problem and Substantiation for Public Input

The phrase "fastened in place" is used consistently throughout the CODE and is not defined. It is only used in two places in this chapter and one of those entries do not require a specific definition while the other can be eliminated. Using a term differently, though allowable, is not wise and contributes to confusion in the CODE.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3240-NFPA 70-2020 [Section No. 625.44]	

Submitter Information Verification

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Submittal Date:	Mon Sep 07 10:30:04 EDT 2020
Committee:	NEC-P12

Public Input No. 3244-NFPA 70-2020 [Definition: Fixed in Place.]

~~**Fixed in Place.**~~

~~Mounting means of an EVSE attached to a wall or surface with fasteners that require a tool to be removed.~~

Statement of Problem and Substantiation for Public Input

This definition is used in one place and is eliminated by a minor modification of the wording. This helps with CODE consistency.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3242-NFPA 70-2020 [Section No. 625.44(C)]	

Submitter Information Verification

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Submittal Date: Mon Sep 07 10:26:39 EDT 2020
Committee: NEC-P12

Public Input No. 3069-NFPA 70-2020 [Definition: Portable (as applied to EVSE).]

Portable (as applied to EVSE).

A device intended for indoor or outdoor use that ~~can~~ <u>is designed to</u> be carried from charging location to charging location and is designed to be transported in the vehicle when not in use.

Statement of Problem and Substantiation for Public Input

Requirements for portable EVSE in this article are intended only for a portable cordset that charges power to the electric vehicle. “Can be carried” may lead to subjectivity in interpreting what is portable or not. Propose to add “designed to be carried” in order to provide greater objectivity in this definition.

Submitter Information Verification

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Submittal Date:	Fri Sep 04 13:46:36 EDT 2020
Committee:	NEC-P12

Public Input No. 2082-NFPA 70-2020 [Definition: Wireless Power Transfer (WPT).]

Wireless Power Transfer (WPT).

The transfer of electrical energy from a power source to an electrical load ~~via electric and magnetic fields or waves by a contactless inductive means~~ via magnetic fields by contactless means between a primary device and a secondary device.

Statement of Problem and Substantiation for Public Input

This Public Input proposal is made for the purpose of better integrating WPT into Article 625 and is part of a set of Public Inputs which share the same General Justification. See PI 2375 for more details.

EXPLANATION FOR THIS PUBLIC INPUT PROPOSAL 2082

The current definition for WPT does not properly describe the wireless systems anticipated to be covered by this Article for the time period covered by this next edition.

Inductive charging already is described as an approach in plug-in charging and is specifically mentioned in the definition of the Electric Vehicle Connector in 625.2 and in 625.50; it refers to the original plug-in paddle charging system covered by EVSE. Including the word inductive in wireless charging could cause confusion and does not add value.

The definition proposed herein is consistent with the definition in the current international standard documents. Specifically, SAE J2954:2020, as an example, defines Wireless Power Transfer (WPT) as

"the transfer of electrical power from the AC supply network to the electric vehicle by contactless means"

Submitter Information Verification

Submitter Full Name: Jon Sirota

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Submittal Date: Wed Jul 29 11:12:42 EDT 2020

Committee: NEC-P12

Public Input No. 2376-NFPA 70-2020 [Definition: Wireless Power Transfer Equipment (WPTE).]

Wireless Power Transfer Equipment (WPTE).

Equipment

~~consisting of a charger power converter~~

for wireless charging, comprising the conductors, including the ungrounded, grounded, and equipment grounding conductors, personnel protection system, power and control electronics, communication electronics, the output cable to the primary pad, the primary pad and all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the electric vehicle without galvanic contact.

Informational Note 1: The general form of WPTE consists of two physical packages, a control box and a primary pad.

~~The two devices are either separate units or contained within one enclosure~~

The control box receives supply power from the premises wiring (625.43) and connects to the primary pad through the output cable to the primary pad. The packaging of the necessary functions to perform WPT into the control box or the primary pad is at the discretion of the manufacturer.

Informational Note 2: Electric vehicle power export equipment and wireless power transfer equipment are sometimes contained in one set of equipment, sometimes referred to as a bidirectional WPTE .

Statement of Problem and Substantiation for Public Input

This Public Input proposal is made for the purpose of better integrating WPT into Article 625 and is part of a set of Public Inputs which share the same General Justification. See PI 2375 for more details.

EXPLANATION FOR THIS PUBLIC INPUT PROPOSAL 2376

The original definition of WPTE did not contain similar detail as the definition of EVSE. This PI proposal addresses that shortcoming, so that the improved definition text lists the "bits and pieces" of WPTE, in similar form and text as for EVSE.

The first informational note describes the physical elements of WPTE and is meant to facilitate the clarification and simplification of installation (625.102).

The second informational note mirrors the informational note for EVSE. The minor change of "piece of equipment" in EVSE to "set of equipment" in this note is because the two packages mentioned in the first informational note could be mistakenly construed as two "pieces of equipment".

See PI 2387 and PI 2392.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2387-NFPA 70-2020 [Sections 625.102(A), 625.102(B), 625.102(C)]	
Public Input No. 2392-NFPA 70-2020 [Section No. 625.102(D)]	

Submitter Information Verification

Submitter Full Name:	Jon Sirota
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Submittal Date:	Tue Aug 18 11:48:28 EDT 2020
Committee:	NEC-P12

Public Input No. 3016-NFPA 70-2020 [Section No. 625.4]

625.4 Voltages.

Unless other voltages are specified, the nominal ac system input voltages of 120, 120/240, 208Y/120, 240, 480Y/277, 480, 600Y/347, 600, and 1000 volts and dc system input voltages of up to 1000 volts shall be used to supply equipment covered by this article. Output voltages to the electric vehicle are not specified.

Statement of Problem and Substantiation for Public Input

Although it is understood that the National Electrical Code provides rules governing the installation of electrical equipment, there is a fundamental misunderstanding in the industry. For DC chargers, equipment standards allow for output voltages up to 1500 V dc. Some within industry are concerned because the National Electrical Code sets voltages at 1000 V dc. Although this would not pertain to the output rating of equipment, it seems beneficial to clarify that here.

Submitter Information Verification

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Submittal Date:	Fri Sep 04 00:38:39 EDT 2020
Committee:	NEC-P12

Public Input No. 3071-NFPA 70-2020 [Section No. 625.4]

625.4 Voltages.

Unless other voltages are specified, the nominal ac system voltages of 120, 120/240, 208Y/120, 240, 480Y/277, 480, 600Y/347, 600, ~~and 1000 volts and dc~~ or 1000 volts or dc system voltages of up to 1000 volts shall be used to supply equipment covered by this article.

Statement of Problem and Substantiation for Public Input

The definition of voltages should be “or” not “and”.

Submitter Information Verification

Submitter Full Name:	DAVID LIU
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Submittal Date:	Fri Sep 04 13:48:17 EDT 2020
Committee:	NEC-P12

Public Input No. 1262-NFPA 70-2020 [Section No. 625.5]

625.~~5~~ 6 Listed.

All equipment covered by the scope of this article shall be listed.

Statement of Problem and Substantiation for Public Input

To promote uniformity of the NEC. The .6 section has become the location associated with listing requirements. The wiring methods within Chapter 3 use the .6 section to identify listing requirements, additionally within Chapter 6; 604.6, 605.6, 630.6 and 692.6 identify listing requirements. Currently within Article 625, the .6 section is open and this proposed change will not require any additional renumbering.

Submitter Information Verification

Submitter Full Name: Jeffrey Fecteau

Organization: UL LLC

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City:

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Submittal Date: Wed May 27 15:26:41 EDT 2020

Committee: NEC-P12

Public Input No. 1623-NFPA 70-2020 [Section No. 625.5]

625.~~5~~ 6 Listed.

All equipment covered by the scope of this article shall be listed.

Statement of Problem and Substantiation for Public Input

The 'practice' is to use xx.6 for the rules covering 'listing.' So changing this just makes it easier to follow 'parallel' rules.

Submitter Information Verification

Submitter Full Name:	Mike Holt
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Submittal Date:	Wed Jun 24 14:04:08 EDT 2020
Committee:	NEC-P12

Public Input No. 3285-NFPA 70-2020 [Section No. 625.5]

625.~~5~~ 6 Listed.

All equipment covered by the scope of this article shall be listed.

Statement of Problem and Substantiation for Public Input

Where the xxx.6 section is available, it should be used for the listing requirement rule. This just makes the code easier to use and is consistent with the parallel numbering that is used in the Chapter 3 articles.

Submitter Information Verification

Submitter Full Name: Don Ganiere

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Submittal Date: Mon Sep 07 14:57:32 EDT 2020

Committee: NEC-P12

Public Input No. 737-NFPA 70-2020 [Section No. 625.5]

625.~~5~~ 6 Listed.

All equipment covered by the scope of this article shall be listed.

Statement of Problem and Substantiation for Public Input

Many of the other sections that deal with listing, in other Articles, are in the .6 section. Changing this section from .5 to .6 would bring it into alignment with an overall effort to align the sections throughout the Code.

Submitter Information Verification

Submitter Full Name:	Eric Stromberg
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Submittal Date:	Sat Mar 21 22:06:57 EDT 2020
Committee:	NEC-P12

Public Input No. 2238-NFPA 70-2020 [Section No. 625.17(A)]

(A) Power-Supply Cord.

The cable for cord-connected equipment shall comply with all of the following:

(1) Be any of the types specified in 625.17(B)(1) or hard service cord, junior hard service cord, or portable power cable types in accordance with Table 400.4. Hard service cord, junior hard service cord, or portable power cable types shall be listed, as applicable, for exposure to oil and damp and wet locations.

(2) Have an ampacity as specified in Table 400.5(A)(1) or, for 8 AWG and larger, in the 60°C columns of Table 400.5(A)(2).

(3) Have an overall length as specified in either of the following:

(4) When the interrupting device of the personnel protection system specified in 625.22 is located within the enclosure of the supply equipment or charging system, the power-supply cord shall be not more than the length indicated in (i) or (ii):

(5) For portable equipment in accordance with 625.44(A) , the power supply cord shall be not more than 300 mm (12 in.) long.

(6) For

~~stationary~~

a.

i. fastened-in-place equipment in accordance with 625.44(B) , the power supply cord shall be not more than 1.8 m (6 ft) long and the equipment shall be installed at a height that prevents the power supply cord from contacting the floor when it is connected to the proper receptacle.

b. When the interrupting device of the personnel protection system specified in 625.22 is located at the attachment plug, or within the first 300 mm (12 in.) of the power-supply cord, the overall cord length shall be not greater than 4.6 m (15 ft).

Statement of Problem and Substantiation for Public Input

Stationary equipment is no longer described or defined in Article 625, and the reference to 625.44 (B) is now for "fastened-in-place equipment". This is simply an editorial change, with no intended technical implication to correct the wording.

Submitter Information Verification

Submitter Full Name: Jon Sirota
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Submittal Date: Wed Aug 12 11:13:25 EDT 2020

Committee:	NEC-P12

Public Input No. 3072-NFPA 70-2020 [Section No. 625.17(A)]

(A) Power-Supply Cord.

The cable for cord-connected ~~equipment~~ EVSE shall comply with all of the following:

(1) Be any of the types specified in 625.17(B)(1) or hard service cord, junior hard service cord, or portable power cable types in accordance with Table 400.4. Hard service cord, junior hard service cord, or portable power cable types shall be listed, as applicable, for exposure to oil and damp and wet locations.

(2) Have an ampacity as specified in Table 400.5(A)(1) or, for 8 AWG and larger, in the 60°C columns of Table 400.5(A)(2).

(3) Have an overall length as specified in either of the following:

(4) When the interrupting device of the personnel protection system specified in 625.22 is located within the enclosure of the supply equipment or charging system, the power-supply cord shall be not more than the length indicated in (i) or (ii):

(5) For portable equipment in accordance with 625.44(A), the power supply cord shall be not more than 300 mm (12 in.) long.

(6) For stationary equipment in accordance with 625.44(B), the power supply cord shall be not more than 1.8 m (6 ft) long and the equipment shall be installed at a height that prevents the power supply cord from contacting the floor when it is connected to the proper receptacle.

(7) When the interrupting device of the personnel protection system specified in 625.22 is located at the attachment plug, or within the first 300 mm (12 in.) of the power-supply cord, the overall cord length shall be not greater than 4.6 m (15 ft).

Statement of Problem and Substantiation for Public Input

The term EVSE was not properly defined until 2020 Edition. In the same way, this clause is not properly phrased yet. To clarify what equipment is described, this clause shall clearly specify that the requirement is for EVSE.

Since the NEC is enforced by a large variety of AHJs, the NEC must be consistent and specific in scope to avoid misinterpretation at the state and local levels. This is particularly important since the design, construction, and performance requirements for motor vehicle safety are federally regulated by NHTSA, whereas installation requirements can be controlled by a local AHJ. Importantly, installations cannot move whereas motor vehicles certainly do. It is not practical for individual AHJs to judge conformance to the NEC which includes requirements for vehicles that may or may not be present at the time of inspection and can certainly travel between different AHJ jurisdictions. This separation between on-board and off-board is a necessary distinction to allow for enforcement of the NEC at the installation.

Submitter Information Verification

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Submittal Date:	Fri Sep 04 13:51:09 EDT 2020
Committee:	NEC-P12

Public Input No. 3074-NFPA 70-2020 [Section No. 625.17(A)]

(A) Power-Supply Cord.

The cable for cord-connected equipment shall comply with all of the following:

(1) Be any of the types specified in 625.17(B)(1) or hard service cord, junior hard service cord, or portable power cable types in accordance with Table 400.4. Hard service cord, junior hard service cord, or portable power cable types shall be listed, as applicable, for exposure to oil and damp and wet locations.

(2) Have an ampacity as specified in Table 400.5(A)(1) or, for 8 AWG and larger, in the 60°C columns of Table 400.5(A)(2).

(3) Have an overall length as specified in either of the following:

(4) When the interrupting device of the personnel protection system specified in 625.22 is located within the enclosure of the supply equipment or charging system, the power-supply cord shall be not more than the length indicated in (i) or (ii):

(5) For portable equipment in accordance with 625.44(A) , the power - supply cord shall be not more than 300 mm (12 in.) long.

(6) For stationary equipment in accordance with 625.44(B) , the power - supply cord shall be not more than 1.8 m (6 ft) long and the equipment shall be installed at a height that prevents the power - supply cord from contacting the floor when it is connected to the proper receptacle.

(7) When the interrupting device of the personnel protection system specified in 625.22 is located at the attachment plug, or within the first 300 mm (12 in.) of the power-supply cord, the overall cord length shall be not greater than 4.6 m (15 ft).

Statement of Problem and Substantiation for Public Input

In 625.2, power-supply cord is defined. Therefore, in this section, "power- supply cord" is noted for consistency.

Submitter Information Verification

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City:
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Submittal Date: Fri Sep 04 13:54:04 EDT 2020
Committee: NEC-P12

Public Input No. 4281-NFPA 70-2020 [Section No. 625.17(A)]

(A) Power-Supply Cord.

The cable for cord-connected equipment shall comply with all of the following:

(1) Be any of the types specified in 625.17(B)(1) or hard service cord, junior hard service cord, or portable power cable types in accordance with Table 400.4. Hard service cord, junior hard service cord, or portable power cable types shall be listed, as applicable, for exposure to oil and damp and wet locations.

(2) Have an ampacity as specified in Table 400.5(A)(1) or, for 8 AWG and larger, in the 60°C columns of Table 400.5(A)(2).

(3) Have an overall length as specified in either of the following:

(4) When the interrupting device of the personnel protection system specified in 625.22 is located within the enclosure of the supply equipment or charging system, the power-supply cord shall be not more than the length indicated in (i) or (ii):

(5) For portable equipment in accordance with 625.44(A), the power supply cord shall be not more than 300 mm (12 in.) long.

(6) For

~~stationary~~

a.

i. fastened-in- place equipment in accordance with 625.44(B), the power supply cord shall be not more than 1.8 m (6 ft) long and the equipment shall be installed at a height that prevents the power supply cord from contacting the floor when it is connected to the proper receptacle.

b. When the interrupting device of the personnel protection system specified in 625.22 is located at the attachment plug, or within the first 300 mm (12 in.) of the power-supply cord, the overall cord length shall be not greater than 4.6 m (15 ft).

Statement of Problem and Substantiation for Public Input

Terror View strikes again. The only thing this input does is to change the word "stationary" to "fastened-in-place" in order to correlate with the defined terminology.

Submitter Information Verification

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Affiliation: self

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Submittal Date:	Thu Sep 10 09:14:16 EDT 2020
Committee:	NEC-P12

Public Input No. 903-NFPA 70-2020 [Section No. 625.17(B)]

(B) Output Cable to Plug Connected Electric ~~Vehicle~~ Vehicles .

The output cable to ~~the~~ plug connected electric ~~vehicle~~ vehicles shall be one of the following:

(1) Listed Type EV, EVJ, EVE, EVJE, EVT, or EVJT flexible cable as specified in Table 400.4

(2) An integral part of listed electric vehicle supply equipment

Informational Note: For information and listing requirements for electric vehicle supply equipment, see UL 2594-2016, *Standard for Electric Vehicle Supply Equipment,* and UL 2202-2009, *Standard for Electric Vehicle (EV) Charging System Equipment*.

Statement of Problem and Substantiation for Public Input

In January 2020 SAE adopted standard J3105 for Electric Vehicle Power Transfer System Using Conductive Automated Connection Devices. The present language was written when only cord connected power delivery systems were in use, and needs to be clarified.

Submitter Information Verification

Submitter Full Name: JE Degnan

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Submittal Date: Thu Apr 23 11:26:59 EDT 2020

Committee: NEC-P12

Public Input No. 2377-NFPA 70-2020 [Section No. 625.17(C)(2)]

(2) Fastened in Place.

Where the electric vehicle supply equipment (EVSE) is fastened in place, the usable length of the output cable to the electric vehicle shall be measured from the cable exit of the electric vehicle supply equipment to the face of the electric vehicle connector.

Where the wireless power transfer equipment (WPTE) is fastened in place, the output cable to the primary pad shall be measured from the cable exit of the control box to the cable inlet at the primary pad.

Statement of Problem and Substantiation for Public Input

This Public Input proposal is made for the purpose of better integrating WPT into Article 625 and is part of a set of Public Inputs which share the same General Justification. See PI 2375 for more details.

EXPLANATION FOR THIS PUBLIC INPUT PROPOSAL 2377

The original 625.17(B) only addressed the cord and cable length for a fixed-in-place installation for an EVSE. But it also should address the cord and cable length for WPTE. This is accomplished by adding a statement specifically for WPTE.

Submitter Information Verification

Submitter Full Name: Jon Sirota
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Street Address:
City:
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Submittal Date: Tue Aug 18 11:59:32 EDT 2020
Committee: NEC-P12

Public Input No. 1498-NFPA 70-2020 [New Section after 625.22]

625.23 Energy Storage System.

An energy storage system connected to EV charging equipment shall be installed in accordance with Article 706.

Statement of Problem and Substantiation for Public Input

Currently ESS's are being installed in conjunction with EV charging equipment. As Article 706 is a relatively new article, there needs to be a requirement similar to 690.71 where users of this code are directed to the additional requirements of ESS's.

Submitter Information Verification

Submitter Full Name:	Jeffrey Fecteau
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Submittal Date:	Tue Jun 09 14:50:03 EDT 2020
Committee:	NEC-P12

Public Input No. 3015-NFPA 70-2020 [Section No. 625.22]

625.22 Personnel Protection System.

~~The equipment~~ All equipment that is provided with a conductive connection to the vehicle shall have a listed system of protection against electric shock of personnel. Where cord-and-plug-connected equipment is used, the interrupting device of a listed personnel protection system shall be provided according to 625.17(A). A personnel protection system shall not be required for supplies less than 60 volts dc. Personnel protection systems shall not be required for wireless power transfer equipment covered in Section IV.

Statement of Problem and Substantiation for Public Input

The purpose of the personnel protection system is to disconnect the off board system from the vehicle if a hazardous condition exists on the vehicle accessible conductive surfaces. Personnel protection systems that are used for equipment that is conductively connected to the vehicle relies on that conductive connection to monitor ground, ground current, isolation resistance, and the like, in order to assess whether or not a hazardous condition exists. However, for wireless power transfer system equipment, there is no conductive connection to the vehicle. There is no method of monitoring the vehicle accessible conductive surfaces available to the off board system other than relying on communication from the vehicle to indicate a shutdown is required. Therefore, the vehicle must monitor its own systems and react accordingly to prevent a shock hazard. The off board system is then protected through normal wiring methods and cannot be relied on to protect the vehicle.

Submitter Information Verification

Submitter Full Name: John Kovacik

Organization: UL LLC

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Submittal Date: Fri Sep 04 00:32:19 EDT 2020

Committee: NEC-P12

Public Input No. 3076-NFPA 70-2020 [Section No. 625.22]

625.22 Personnel Protection System.

~~The equipment shall~~ EVSE and WPTE shall have a listed system of protection against electric shock of personnel. Where cord-and-plug-connected equipment is used, the interrupting device of a listed personnel protection system shall be provided according to 625.17(A). A personnel protection system shall not be required for supplies less than 60 volts dc.

Statement of Problem and Substantiation for Public Input

Since the NEC is enforced by a large variety of AHJs, the NEC must be consistent and specific in scope to avoid misinterpretation at the state and local levels. This is particularly important since the design, construction, and performance requirements for motor vehicle safety are federally regulated by NHTSA, whereas installation requirements can be controlled by a local AHJ. Importantly, installations cannot move whereas motor vehicles certainly do. It is not practical for individual AHJs to judge conformance to the NEC which includes requirements for vehicles that may or may not be present at the time of inspection and can certainly travel between different AHJ jurisdictions. This separation between on-board and off-board is a necessary distinction to allow for enforcement of the NEC at the installation.

The term equipment in this clause is not specific enough. It has to clearly state "EVSE and WPTE." If this clause was written with the intent to include equipment that enables the vehicle to export power, the Code has to clearly include which equipment in which use case shall have what kind of protection because there are a variety of forms of designing a vehicle to export power to outside of the vehicle. Depending on the configuration, functions of individual components will be significantly different, and requirements will be subsequently different.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3078-NFPA 70-2020 [Section No. 625.43]	

Submitter Information Verification

Submitter Full Name:	DAVID LIU
Organization:	AMERICAN HONDA
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Submittal Date:	Fri Sep 04 13:57:11 EDT 2020
Committee:	NEC-P12

Public Input No. 1238-NFPA 70-2020 [Section No. 625.40]

625.40 Electric Vehicle Branch Circuit.

Each outlet installed for the purpose of charging electric vehicles shall be supplied by an individual branch circuit. Each circuit shall have no other outlets. B ranch circuit conductors shall be considered a continuous load (electric vehicle charger).

Statement of Problem and Substantiation for Public Input

Add language to clearly require branch circuit conductors to be sized at 125% of the continuous load (electric vehicle charger).
625.41 requires overcurrent protection to be sized for a continuous load.
625.42 state that electric vehicle charging loads shall be considered to be a continuous load.

Submitter Information Verification

Submitter Full Name: Gary Hein
Organization: Submission is independent of employer.
Street Address:
City:
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Submittal Date: Sat May 23 12:55:32 EDT 2020
Committee: NEC-P12

Public Input No. 3111-NFPA 70-2020 [Section No. 625.40]

625.40 Electric Vehicle Branch Circuit.

Each outlet installed for the purpose of charging electric vehicles shall be supplied by an individual branch circuit. Each circuit shall have no other outlets.

Exception - EV charge supply equipment shall be permitted to use load control to distribute current to one or more EV charging equipment devices if listed and labeled for the purpose.

Statement of Problem and Substantiation for Public Input

One EV connector may have output terminals that allow a second unit to connect and be controlled via load control on the first connector/charger. The existing language could prevent safe, listed equipment to be installed based on the original restrictive language. The exception addresses the concerns of adding non-EV outlets on the circuit.

The PV Industry Forum (PVIF) is a collaborative initiative of several organizations dedicated to continually improving the installation safety of PV systems in the U.S. The organizations are the Solar Energy Industry Association (SEIA), the PV Industry Codes Council (PVICC), Solar Energy International (SEI), the Interstate Renewable Energy Council (IREC), and the Large-Scale Solar Association (LSA). This coalition has come together to organize, convene, support and mentor solar industry professionals through the NEC public input process, which is open to all solar industry participants.

This collaborative effort has resulted in the consensus development of numerous solar-related Public Input proposals for consideration. The list of task group members indicates those individuals who have contributed to the development of various Public Inputs in nine different tasks groups. A consensus process was used to develop each Public Input, therefore this list does not necessarily indicate that each individual or their representative organization participated in or has agreed with every proposed Public Input submitted under the PVIF effort. Each participant has agreed that any original proposal that they submitted and which was subsequently improved by our process is assigned as original and / or improved work to PVIF for submittal and release to NFPA as a proposed Public Input.

Members of the PVIF's effort include the following representatives. Note that those noted below participated in specific task groups and not necessarily all task groups on specific items proposed. Each member is at their discretion to individually comment on PI's as they deem appropriate.

Evelyn Butler, SEIA; Jason Fisher, SEIA; Ward Bower, Ward Bower Innovations LLC/SEIA; Joseph Cain, P.E., SEIA; Bill Brooks, Brooks Engineering/PVICC; Rebekah Hren, Solar Energy International; Brian Mehalic, Solar Energy International; Mark Rodriguez, Sunrun; Paul Joyce, Sunrun; Brian Ewing, Swinerton; Sumana Seshadri, Swinerton; Christian Eder, Fronius USA; Isaac Opalinsky, SunPower; Chris Fox, SunPower; James Cormican, RBI Solar; Dave Compaan, RBI Solar; Shawn Shaw, Natural Power; Cody Oram, Vivint Solar; Greg Elvestad, Vivint Solar; Mike Weimer, Westwood Professional Services; Doug Mutcher, Westwood Professional Services; Jeff Wang, Staubli; Colleen O'Brien, UL; John Doty, UL; Laurie Florence, UL; Tim Zgonena, UL ; Gokul Kalyan, FTC Solar; Ali Sedaghat, FTC Solar; K.C. Radford, Radian Generation; Jan Dominguez, LG Electronics; Ben Chamberlain, Olivewood Energy; Klaus Nicolaedis, Unirac Inc.; Leif Cook, Core Development Group; Martin Herzfeld, Herzfeld; Dave Click, esaSolar; Sean White, principal; Kate Collardson, BayWa r.e. Solar Systems; Bryan Holland, NEMA; Jack Lyons, NEMA; Mike Stone, NEMA; Evan Martin, BURNDY; Terry McKinch, Mortenson; Jason Bobruk, SolarEdge Technologies; Reid ; train, Savion; Charlie Dearie, McCalmont Engineering; Sumanth Lokanath, Ray Illuminati LLC; Yann Schwarz, Esdec Inc.; Joseph Armano, PanelClaw, Inc.; Michael Heinrich, PanelClaw, Inc.; Steve Wurmlinger, SMA Solar Technology AG; Thomas Wegener, SMA Solar Technology AG; Chris Flueckiger, Key Renewables; Matt Piantedosi, Ridgeline Energy Analytics; Samantha Doshi, Intertek; Kyle Breuning, Tesla; Charles Picard, Tesla; Steve Connolly, Tesla; Greg Ball, Tesla; Jake West, Tesla; Jamie Daggett, DNV GL; MinWah Leung, DNV GL; Bob White, Fimer SpA; Marvin Hamon, Pure Power Engineering; Milton Nogueira, Roof Tech; Peter Seidel, First Solar; Jason Smolko, Copperweld;

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Public Input No. 4450-NFPA 70-2020 [Section No. 625.40]

625.40 Electric Vehicle Branch Circuit.

Each outlet installed for the purpose of ~~charging electric vehicles~~ supplying EVSE rated equal to or above 12 amperes at 120 volts shall be supplied by an individual branch circuit. ~~Each circuit shall have no other outlets.~~

Statement of Problem and Substantiation for Public Input

The individual branch circuit requirement is excessive for small charging facilities. In addition, the second sentence is entirely redundant to the first sentence requiring an individual branch circuit, and can be deleted.

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Public Input No. 1402-NFPA 70-2020 [Section No. 625.41]

625.41 ~~Overcurrent Protection~~ Circuit Rating .

~~Overcurrent~~ Conductor and overcurrent protection protection devices for feeders and branch circuits supplying EVSE, including bidirectional EVSE, and WPTE shall be sized for continuous duty and shall have ~~a~~ an ampere rating of not less than 125 percent of the maximum load of the equipment. Where noncontinuous loads are supplied from the same feeder, the overcurrent device shall have ~~a~~ an ampere rating of not less than the sum of the noncontinuous loads plus 125 percent of the continuous loads.

Statement of Problem and Substantiation for Public Input

Revisions adds the sizing of the conductor to 625.41, since Article 625 does not have a requirement for conductor sizing.

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Committee: NEC-P12

Public Input No. 2384-NFPA 70-2020 [Section No. 625.41]

625.41 Overcurrent Protection.

Overcurrent protection for feeders and branch circuits supplying ~~EVSE~~ EVSE and WPTE , including bidirectional ~~EVSE~~ EVSE and WPTE , ~~and WPTE~~ _ shall be sized for continuous duty and shall have a rating of not less than 125 percent of the maximum load of the equipment. Where noncontinuous loads are supplied from the same feeder, the overcurrent device shall have a rating of not less than the sum of the noncontinuous loads plus 125 percent of the continuous loads.

Statement of Problem and Substantiation for Public Input

This Public Input proposal is made for the purpose of better integrating WPT into Article 625 and is part of a set of Public Inputs which share the same General Justification. See PI 2375 for more details.

EXPLANATION FOR THIS PUBLIC INPUT PROPOSAL 2384

This section on overcurrent protection should apply to both EVSE and WPTE.

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Public Input No. 25-NFPA 70-2019 [Section No. 625.41]

625.41 Overcurrent Protection.

(a) Overcurrent protection for feeders and branch circuits supplying ~~EVSE~~ Levels 1 and 2 EVSE , including bidirectional EVSE, and WPTE shall be sized for continuous duty and shall have a rating of not less than 125 percent of the maximum load of the ~~equipment~~ Level 1 and 2 equipment . Where noncontinuous loads are supplied from the same feeder, the overcurrent device shall have a rating of not less than the sum of the noncontinuous loads plus 125 percent of the continuous Level 1 and Level 2 loads.

(b) Overcurrent protection for feeders and branch circuits supplying Level 3 EVSE, including bidirectional EVSE, and WPTE may be sized for continuous duty and shall have a rating of not less than 100 percent of the maximum load of the Level 3 equipment. Where noncontinuous loads are supplied from the same feeder, the overcurrent device shall have a rating of not less than the sum of the noncontinuous loads plus 100 percent of the continuous Level 3 load . Overcurrent protection for feeders and branch circuits supplying Level 3 EVSE, including bidirectional EVSE, and WPTE may be sized for 100% rated overcurrent protection devices per Article 210.20(A) Exception or Article 215.3 Exception No. 1.

Statement of Problem and Substantiation for Public Input

Level 1 and 2 EVSE chargers are typically used for residential and light commercial applications where the 125% rule applies. This makes sense.
However, Level 3 EVSE ("DC Fast Chargers") chargers are in the range of 500+ amps now using 480V 3-phase input power. There are plans in the works now from the manufacturers to use even higher amperage devices. At this level, sizing for 125% OCPD and conductors does not make economic sense since 100% rated breakers can be safely used and have been within the industry for years. Depending upon the distance between the OCPD device and the DC Fast Charger (Level 3 device), a significant increase in costs may accumulate between a 100% solution and its 125% solution.

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Public Input No. 3077-NFPA 70-2020 [Section No. 625.42]

625.42 Rating.

The ~~power transfer equipment~~ EVSE equipment shall have sufficient rating to supply the load served. Electric vehicle charging loads shall be considered to be continuous loads for the purposes of this article. Service and feeder shall be sized in accordance with the product ratings. Where an automatic load management system is used, the maximum equipment load on a service and feeder shall be the maximum load permitted by the automatic load management system.

Adjustable settings shall be permitted ~~on fixed-in-place equipment only~~ . If adjustments have an impact on the rating label, those changes shall be in accordance with manufacturer's instructions, and the adjusted rating shall appear with sufficient durability to withstand the environment involved on the rating label. Electric vehicle supply equipment with restricted access to an ampere adjusting means shall be permitted to have ampere ratings that are equal to the adjusted current setting. Sizing the service and feeder to match the adjusting means shall be permitted. ~~Restricted access shall prevent the user from gaining access~~ Access to the ampere adjusting means ~~. Restricted~~ of an EVSE shall be restricted if it is intended not to be accessed by a user after installation. Such restricted access shall be accomplished by at least one of the following:

(1) A cover or door that requires the use of a tool to open

(2) Locked doors accessible only to qualified personnel

(3) Password protected commissioning software accessible only to qualified personnel

Statement of Problem and Substantiation for Public Input

The concern this clause was attempting to address is not clear whether
Settings shall be adjusted within the maximum rating stated on the rating label;
Settings shall not be adjusted after an electrician installs the EVSE; or
Settings shall not be adjusted by a user, no matter what happens.
If the concern 1) was intended, the clause shall not describe the condition of adjusting settings having an impact on the rating label.
If the concern 2) was intended, it is meaningless to prohibit a portable EVSE from having adjustable settings.
The concern 3) is not valid, but this clause unnecessarily prohibits adjustable settings on a portable EVSE, prevents consumers from receiving the benefit of operating both a clothes washer and an EVSE at the same time without tripping the breaker for example, and prevents technology from advancing.

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Public Input No. 3118-NFPA 70-2020 [Section No. 625.42]

625.42 Rating.

The power transfer equipment shall have sufficient rating to supply the load served. Electric vehicle charging loads shall be considered to be continuous loads for the purposes of this article. ~~Service~~ Feeder and ~~feeder~~ branch shall be sized in accordance with the product ratings unless the overall rating of the installation is provided with controls as permitted by (A) or (B) .

(A) Automatic Load Management. Where an automatic load management system is used, the maximum equipment load on a service and feeder shall be the maximum load permitted by the automatic load management system. The load management system may be integral to one piece of equipment or may be integral to a listed system consisting of more than one piece of equipment. When one or more pieces of equipment are provided with an integral load management control, the system shall be marked to indicate this control is provided.

(B) EVSE with Adjustable settings . Adjustable settings shall be permitted on ~~fixed-in-place~~ charging equipment ~~only~~ . If adjustments have an impact on the rating label, those changes shall be in accordance with manufacturer's instructions, and the adjusted rating shall appear on the rating label with sufficient durability to withstand the environment involved ~~on the rating label~~ . Electric vehicle supply equipment with restricted access to an ampere adjusting means shall be permitted to have ampere ratings that are equal to the adjusted current setting. Sizing the service and feeder to match the adjusting means shall be permitted. Restricted access shall prevent the user from gaining access to the adjusting means after installation . Restricted access shall be accomplished by at least one of the following:

(1) A cover or door that requires the use of a tool to open

(2) Locked doors accessible only to qualified personnel

(3) Password protected commissioning software accessible only to qualified personnel

(4) Commissioning software that defaults to the factory setting after the initial installation setting with the factory setting being the lowest setting in the range

Statement of Problem and Substantiation for Public Input

A system, consisting of one or more EVSE, can be controlled by load management systems that allow for a specific combined current draw for all EVSE on the system that will not exclude the specific feeder or branch rating. For example, five 30 A EVSE can be installed on a 100 branch circuit and the load management system will ensure that each EVSE adjusts it current draw in order to comply with the rules for the installation. From this example, if only 1 EVSE is on, it can pull the full 30 A. If the second is energized, they can both pull the full 30 A. When the third EVSE is energized, the maximum allowed rating of 80A must be met, so each EVSE is adjusted to 26 A. When the fourth EVSE is energized, all EVSE are dropped to 20 A, and so on. This load management control function is part of the listing of the EVSE and the EVSE is marked to indicate that load management functionality is present so that the installation can occur based on the manufacturer's intended operational use case. This change allows for the Authority Having Jurisdiction to accept a branch or feeder that is rated for the actual use scenario.

Additionally, EVSE provided with an adjustment means is already in the Code. However, it is limited to permanently connected devices only. Cord connected EVSE that are provided with adjustment means can also be allowed, provided they meet the same restrictions as the permanently connected equipment. Also, as an added method of control of the adjustment means, the EVSE can be provided with a default setting that corresponds to the lowest rating of the EVSE and any attempt to adjust the setting after the initial installation will default the EVSE to the factory setting. For example, a product can be set for 12 A, 16A, 30A, or 40A. It is listed for all of these rating and based on the size of the circuit at the installation, the EVSE can be adjusted to match the existing circuit. If the circuit is a 40 A branch and the unit is adjusted to a 30 A rating, it can then be set and installation can occur. Any attempt to readjust the initial setting would revert to 12 A as the default rating. This method of control would be just as safe as the existing methods that are already allowed.

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Public Input No. 1797-NFPA 70-2020 [New Section after 625.43]

625.43.1 The disconnecting means shall be located within sight of the charger

Statement of Problem and Substantiation for Public Input

The means of disconnect being readily acceptable is too vague. The means of disconnect must be located within sight of the charger especially for emergency conditions. We recently had a fire involve a charger in MA that ended up with a FF being electrically shocked as the incident could not identify the means of disconnect appropriately. If the means was in sight should have easily corrected this issue. Photos of the incident along with an email from the local fire chief describing the event can be made available to the committee upon request. As I'm sure this committee is aware that these chargers are showing up everywhere. Many are in the higher voltage range for optimum reduced charging time. The reality of fire and knock over/crashing into will most likely increase. Many installations utilize exposed conduit raceways that transition into a flexible conduit. At these locations there is typically a junction box. This junction box can easily be a solution for locating a disconnect keeping it economically feasible. The pedestal underground fed chargers may need just a little bit more creativity for locating the disconnect, however, typically the feeders come from a building and again perhaps locating the disconnect on the building can assist with keeping the overall costs low. This is the time in this code cycle to get these very important within sight disconnects into the requirements for maximum safety. Thank you for your consideration.

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Public Input No. 1547-NFPA 70-2020 [Section No. 625.43]

625.43 Disconnecting Means.

For equipment rated more than 60 amperes or more than 150 volts to ground, the disconnecting means shall be provided and installed in a readily accessible location, <u>adjacent to or remote from the equipment location</u> . The disconnecting means shall be lockable open in accordance with 110.25.

Statement of Problem and Substantiation for Public Input

Remove the confusion about if a disconnecting means for EVSE equipment, rated more than 60 amperes or more than 150 volts to ground, is required to be adjacent to the EVSE equipment.

The definition of Readily Accessible is contradictory. Can a readily accessible item be reached quickly for operation behind a keyed lock? What is the meaning of “quickly.” Does “quickly” start when whom ready access is requiste is in front of the EVSE equipment or when in front of the disconnecting means?

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Public Input No. 3078-NFPA 70-2020 [Section No. 625.43]

625.43 Disconnecting Means.

For ~~equipment rated~~ EVSE or WPTE rated more than 60 amperes or more than 150 volts to ground, the disconnecting means shall be provided and installed in a readily accessible location. The disconnecting means shall be lockable open in accordance with 110.25.

Statement of Problem and Substantiation for Public Input

Since the NEC is enforced by a large variety of AHJs, the NEC must be consistent and specific in scope to avoid misinterpretation at the state and local levels. This is particularly important since the design, construction, and performance requirements for motor vehicle safety are federally regulated by NHTSA, whereas installation requirements can be controlled by a local AHJ. Importantly, installations cannot move whereas motor vehicles certainly do. It is not practical for individual AHJs to judge conformance to the NEC which includes requirements for vehicles that may or may not be present at the time of inspection and can certainly travel between different AHJ jurisdictions. This separation between on-board and off-board is a necessary distinction to allow for enforcement of the NEC at the installation.

The term equipment in this clause is not specific enough. It has to clearly state “EVSE and WPTE.”

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3076-NFPA 70-2020 [Section No. 625.22]	Similar comment regarding definition of equipment

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Public Input No. 3604-NFPA 70-2020 [Section No. 625.43]

625.43 Disconnecting Means.

For equipment rated more than 60 amperes or more than 150 volts to ground, the disconnecting means shall be provided and installed in a readily accessible location. The disconnecting means shall be lockable open in accordance with 110.25. <u>EVSE, including bidirectional EVSE, and WPTE with connections to multiple power sources shall comply with 705.20.</u>

Statement of Problem and Substantiation for Public Input

This section is revised to better address EVSE, bidirectional EVES and WPTE which may need additional disconnect devices. These applications need to reference the requirements within article 705 for disconnection of other power sources where interconnected together.

The PV Industry Forum (PVIF) is a collaborative initiative of several organizations dedicated to continually improving the installation safety of PV systems in the U.S. The organizations are the Solar Energy Industry Association (SEIA), the PV Industry Codes Council (PVICC), Solar Energy International (SEI), the Interstate Renewable Energy Council (IREC), and the Large-Scale Solar Association (LSA). This coalition has come together to organize, convene, support and mentor solar industry professionals through the NEC public input process, which is open to all solar industry participants.

This collaborative effort has resulted in the consensus development of numerous solar-related Public Input proposals for consideration. The list of task group members indicates those individuals who have contributed to the development of various Public Inputs in nine different tasks groups. A consensus process was used to develop each Public Input, therefore this list does not necessarily indicate that each individual or their representative organization participated in or has agreed with every proposed Public Input submitted under the PVIF effort. Each participant has agreed that any original proposal that they submitted and which was subsequently improved by our process is assigned as original and / or improved work to PVIF for submittal and release to NFPA as a proposed Public Input.

Members of the PVIF's effort include the following representatives. Note that those noted below participated in specific task groups and not necessarily all task groups on specific items proposed. Each member is at their discretion to individually comment on PI's as they deem appropriate.

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Public Input No. 3994-NFPA 70-2020 [Section No. 625.43]

625.43 Disconnecting Means.

For equipment rated more than 60 amperes or more than 150 volts to ground, the disconnecting means shall be provided and installed in a readily accessible location. The disconnecting means shall be lockable open in accordance with 110.25.

<u>A means shall be provided to verify the absence of voltage in accordance with an acceptable industry practice that does not expose personnel to shock or arc flash hazards or live parts at the test point for the disconnecting means for any voltage supplies or stored energy sources that present a shock or arc flash hazard up to and including 1000V.</u>

<u>Informational Note: NFPA 70E-2021 Standard for Electrical Safety in the Workplace provides guidance for safely verifying the absence of voltage including the use of devices like a permanently mounted absence of voltage tester.</u>

Statement of Problem and Substantiation for Public Input

Testing for absence of voltage is an important step that helps increase safety by detecting several conditions that could lead to an electrical incident:

- Presence of stored electrical energy from a capacitor, present after the disconnect is opened and locked out (see examples from OSHA Summaries)
- Power remains present when the disconnect handle is in the off position if the disconnect experiences a mechanical failure (see Recall Notices below)
- Power remains on if the wrong disconnecting means is utilized or the source is mislabeled (see examples from OSHA Summaries)

An easily accessible means to test for and visually convey the status of presence and absence of voltage that is part of the equipment installation at the charging station before accessing equipment would prevent this type of incident, especially where higher voltages and stored energy are present, (see examples from OSHA below) and further the purpose of the code in practical safeguarding of persons and property by leveraging safety by design principles. Absence of Voltage Testers (AVT) listed to UL 1436 are permanently mounted testers that visually indicate when less than 3 V (ac and dc) is detected at the test point. This test is initiated before doors and covers are removed preventing accidental contact with energized parts. AVTs listed to UL 1436 have been recognized as an acceptable method to test for the absence of voltage in NFPA 70E since 2018 (120.5 (7) Exception 1).

Permanently mounted AVTs installed on or near the equipment increase the likelihood that the test for absence of voltage test occurs before the equipment is accessed when compared to portable voltage test instruments. Additionally, AVTs often have a feature to visually indicate when ac or dc voltage that would cause a shock hazard is present, which is important when people who are not electrically qualified are interacting with or near the equipment. In several incidents, the voltage presence indicators (for AC and DC) would have provided a visual warning that voltage was still present. This is particularly applicable to equipment with batteries or capacitors that can present electrical hazards after the disconnect is opened.

OSHA Fatality and Catastrophe Investigation Summaries
A keyword search of the OSHA Fatality and Catastrophe Investigation Summaries (https://www.osha.gov/pls/imis/accidentsearch.html) reveals several incidents resulting in severe injury or death that are attributed to failure to test for absence of voltage after de-energizing the disconnecting means. Some examples of recorded incidents with characteristics similar to EV power transfer systems:

1. Report ID: 0728900

Employee #1 was on the roof of a customer's building, changing filters for the customer's air conditioning units. The employee had shut off the unit, but he did not lock out the unit or check its power supply for stored energy. As he reached into the unit, he came into contact with a capacitor charged to 280 volts and received an electric shock.

2. Report ID: 0420600

An employee turned off the known energy source to an air conditioning and heat unit at the panel box in a private residence. He pulled the disconnect switch in a box adjacent to the fan or blower assembly in the attic and was attempting to remove the air handler inside the blower housing. The heavy gold chain that the employee was wearing around his neck came in contact with or came in close proximity to a 10 microfarad, mfd, capacitor which can store 370 or more volts of alternating current. The chain burned an arc in his neck and carried sufficient current to his heart via the vascular tract to cause his death.

3. Report ID: 0316300

Employee #1 and his helper were installing a fan on a HVAC chiller unit. Employee asked his helper to open the circuit breaker to deenergize the unit, but Employee #1 never tested the fan circuit to ensure it was deenergized. Employee #1's helper opened the wrong breaker and when Employee #1 touched the conductors for the fan, he was electrocuted.

4. Report ID: 0452110

Employee #1 turned off breaker #22 in a panel box so that he could make a connection in a junction box. He was using a wire stripper to cut into the insulation around a conductor when he was electrocuted. The breakers in the panel box were not labeled, and breaker #22 did not control the current in the circuit on which Employee #1 was preparing to work. He also did not use a voltmeter or another type of instrument to test the circuit and confirm that the power was off.

5. Report ID 0522300

Employee #1 was working on an HVAC air handling unit that had not been cooling adequately. The "lockout" procedure did not include de-energization at the power supply or application of locks. Therefore, although the unit was shut off, it was still energized. Employee #1 was killed.

6. Report ID 0728900

Employee #1 was testing an electrical circuit with a multi-meter on a railcar. The railcar was supposed to be de-energized and locked out. Employee #1 was not using any form of personal protective equipment because there was not supposed to be any voltage applied to the system. As he tested the low voltage circuit, his hand contacted a higher voltage exposed wire connector, which was energized to approximately 650 volts DC. Employee #1 was insulated sufficiently to prevent a large amount of amperage form transferring from the energized object through his body and only suffered an electrical shock.

Disconnect Recall Notices

Several brands of disconnects that are commonly used in industrial and commercial applications have experienced recalls due to defects that allow power to remain present when the disconnect handle is in the off position, posing a shock hazard. This failure mode is an example of why testing for absence of voltage is critical in all applications.

Recalls (https://www.cpsc.gov/Recalls)

1. Example 1

Company A recalled more than a million safety switches manufactured between January 1, 2014 and January 18, 2018 because the power can stay on when the safety switch handle is in the off position, posing an electric shock or electrocution hazard. The switches may be installed in or around commercial buildings, outbuildings, apartments and homes with air conditioning units.

2. Example 2

Company B issued a safety recall of 26 models of safety switches that may not disconnect power when the handle is in the “off” position. The affected devices cover certain models of 30A and 60A heavy-duty safety switches manufactured between Nov. 19, 2015, and Jan. 23, 2018.

3. Example 3

Company C recalled 19,000 toggle and rotary switches. When switched OFF, one electrical pole may remain energized, posing a risk of electrical shock hazard. The switches are typically used with HVAC units, electric distribution and control panels and industrial uses. Primarily the switches are used commercially, however they may also be found in residential applications.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3835-NFPA 70-2020 [New Section after 110.25]	
Public Input No. 3908-NFPA 70-2020 [New Part after I.]	

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Committee: NEC-P12

Public Input No. 3240-NFPA 70-2020 [Section No. 625.44]

625.44 Equipment Connection.

EVSE and WPTE shall be connected to the premises wiring system in accordance with one of the methods in 625.44(A) ~~through~~ or (~~C~~ B) .

(A) Portable Equipment.

Portable equipment shall be connected to the premises wiring system by one or more of the following methods:

~~Equipment that is fastened in place shall be connected to the premises wiring system by one of the following methods:~~

~~A nonlocking, 2-pole, 3-wire grounding-type receptacle outlet rated 125 volts or~~

(1) A nonlocking, 2-pole, 3-wire grounding-type receptacle outlet rated ~~at~~ 125 volts ~~, single phase, 15~~ or ~~20 amperes~~

(2) ~~A nonlocking, 2-pole, 3-wire grounding-type receptacle outlet rated at 250 volts, single phase, 15 or 20 amperes~~

(3) ~~A nonlocking, 2-pole, 3-wire or 3-pole, 4-wire grounding-type receptacle outlet rated at 250 volts, single phase, 30 or 50 amperes~~

(4) ~~A nonlocking, 2-pole, 3-wire grounding-type receptacle outlet rated at 60 volts dc maximum, 15 or 20 amperes~~

~~**(B)** Fastened-in-Place Equipment.~~

(1) 250 volts, single phase, up to 50 amperes

(1) A nonlocking, 3-pole, 4-wire grounding-type receptacle outlet rated 250 volts, three phase, up to 50 amperes

(2) A nonlocking, 3-pole, 4-wire grounding-type receptacle outlet rated 250 volts, single phase, ~~30 or 50~~ up to 50 amperes

(3) A nonlocking, 2-pole, 3-wire grounding-type receptacle outlet rated 60 volts dc maximum, ~~15 or 20~~ up to 20 amperes

(~~C~~ B) Fixed Equipment.

All other EVSE and WPTE shall be permanently wired and fixed in place to the supporting surface.

Statement of Problem and Substantiation for Public Input

The use of "fastened in place" as defined in this chapter is similar to portable as used elsewhere in the CODE. As well, portable and other cord connected equipment is often supplied with the same types of plugs and receptacles as specified under the "fastened in place" list. There does not appear a valid reason to limit the cord types under portable nor separate into two categories. This appears to be a product specific issue.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3245-NFPA 70-2020 [Definition: Fastened in Place.]	

Submitter Information Verification

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Submittal Date:	Mon Sep 07 10:03:44 EDT 2020
Committee:	NEC-P12

Public Input No. 4461-NFPA 70-2020 [Section No. 625.44(A)]

(A) Portable Equipment.

Portable equipment shall be connected to the premises wiring system by one or more of the following methods:

(1) A nonlocking, 2-pole, 3-wire grounding-type receptacle outlet rated at 125 volts, single phase, 15 or 20 amperes

(2) A nonlocking, 2-pole, 3-wire grounding-type receptacle outlet rated at 250 volts, single phase, 15 or 20 amperes

(3) A nonlocking, 2-pole, 3-wire or 3-pole, 4-wire grounding-type receptacle outlet rated at 250 volts, single phase, 30 or 50 amperes<u>, or 125/250 volts, single-phase, 30 or 50 amperes</u>

(4) A nonlocking, 2-pole, 3-wire grounding-type receptacle outlet rated at 60 volts dc maximum, 15 or 20 amperes

Statement of Problem and Substantiation for Public Input

The narrative of (3) is incomplete; it fails to cover the 3-pole 4-wire grounding device.

Submitter Information Verification

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City:	
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Submittal Date:	Thu Sep 10 13:30:28 EDT 2020
Committee:	NEC-P12

Public Input No. 4468-NFPA 70-2020 [Section No. 625.44(B)]

(B) Fastened-in-Place Equipment.

Equipment that is fastened in place shall be connected to the premises wiring system by one of the following methods:

(1) A nonlocking, 2-pole, 3-wire grounding-type receptacle outlet rated 125 volts or 250 volts, single phase, up to 50 amperes

(2) A nonlocking, 3-pole, 4-wire grounding-type receptacle outlet rated 250 volts, three phase, up to 50 amperes

(3) A nonlocking, 3-pole, 4-wire grounding-type receptacle outlet rated 125/ 250 volts, single phase, 30 or 50 amperes

(4) A nonlocking, 2-pole, 3-wire grounding-type receptacle outlet rated 60 volts dc maximum, 15 or 20 amperes

Statement of Problem and Substantiation for Public Input

The 3-pole 4-wire grounding device is a dual voltage device.

Submitter Information Verification

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Submittal Date: Thu Sep 10 13:35:18 EDT 2020
Committee: NEC-P12

Public Input No. 4709-NFPA 70-2020 [New Section after 625.44(C)]

(D) Temporary Installations.

Equipment that is meant to be in use by qualified personnel on a temporary basis of 9 months or less, may be connected by the use of a locking or non-locking, suitably rated plug rated up to 480 volts, single or three phase, and up to 100 amperes. The power-supply cord shall be a hard service cord type in accordance to Table 400.4 that is oil & water resistant and shall be provided with protective features such that it is protected from abuse in the installation and during the temporary use.

Statement of Problem and Substantiation for Public Input

Current rules in the code address cord connection of products rated 40 A or less and are intended for connection to the premise wiring system by the general public with the possibility of plugging and unplugging with each use. There is an additional use case that benefits from cable connection to the premise wiring system but could be inferred as being prohibited due to current language. For EV charging equipment that is rated higher than 250 V, 50 A and has a DC output to the vehicle, these products are historically permanently connected. There is a need for charging infrastructure to be allowed on a temporary basis for things such as extended test drives, trial periods, and other forms of temporary installation. A DC output EVSE can be cord and plugged connected to the premise wiring system using a suitably rated cable and plug, which is not intended to be disconnected during the temporary use condition. At the end of the use period, the product can be disconnected and moved to a new location for further use. This reduces or eliminates the need for expensive and intrusive installation of EV charging equipment that is not intended to be permanent. The current code does not provide guidance to the authority on how to accept these installations with a cord connection that may be larger than 250 volts and 50 amperes maximum.

There is a need for temporary use electric vehicle DC fast chargers that don’t require costly and time consuming, permanent installations. Daimler Trucks North America (DTNA) created a demonstration program in which a fleet of all-electric, class 6-8, heavy duty trucks will be used by customers in their day to day operations on a temporary, rotating basis. Rather than require each customer to purchase and permanently install charging hardware, DTNA will supply temporary chargers that are connected to the existing site electrical connection through the use of a pin and sleeve type plug and receptacle. There are currently five of said EV charging system in operation in the field and two more to come online very soon. Additionally, other manufacturers are utilizing similar installations in the field at this time. Authorities having jurisdiction need rules to allow these installations in support of the installations that have already occurred and any future installation. These rules will allow of the safe and consistent installation of these temporary use chargers.

Submitter Information Verification

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Submittal Date: Fri Sep 11 12:57:15 EDT 2020
Committee: NEC-P12

Public Input No. 3242-NFPA 70-2020 [Section No. 625.44(C)]

(C) Fixed Equipment.

All other EVSE and WPTE shall be permanently wired and ~~fixed in place~~ permanently affixed to the supporting surface.

Statement of Problem and Substantiation for Public Input

This language does not change the meaning but eliminates the need for a specific definition for "fixed in place". It adds consistency to the CODE.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3244-NFPA 70-2020 [Definition: Fixed in Place.]	

Submitter Information Verification

Submitter Full Name:	Karl Cunningham
Organization:	Self Employed
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Mon Sep 07 10:23:45 EDT 2020
Committee:	NEC-P12

Public Input No. 1148-NFPA 70-2020 [Section No. 625.47]

625.47 Multiple Feeder or Branch Circuits.

Where equipment is identified for the application, more than one feeder or branch circuit shall be permitted to supply equipment. Provide a placard at each EVSE station stating if there is more than one power source and where the sources are physically located from an EVSE station.

Statement of Problem and Substantiation for Public Input

Example: MECHANICAL ROOM PANEL 'C'
Two Power Sources: Circuits 20.22 and 24,26
130 yards south

See the Norman Feck 2023 public input on 408.4(B) also, regarding this 625.47 public input.

Submitter Information Verification

Submitter Full Name:	Norman Feck
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Submittal Date:	Mon May 18 19:04:00 EDT 2020
Committee:	NEC-P12

Public Input No. 3640-NFPA 70-2020 [New Section after 625.48]

625.49 Power for Systems Operating in Island Mode.

EVPE and bidirectional EVSE that incorporate a power export function is permitted to be part of an on-site power system operating in island mode.

Statement of Problem and Substantiation for Public Input

To address expansion of EVPE and EVSE functionality within on-site power systems operating is island mode a new 625.49 section is being proposed. This new section clarifies that this equipment can be a source for these types of systems. The new term "on-site" is used in this case as this PI is impacted by many PIs related to changing the first word in the name of Article 705 from "Interconnected" to "On-Site".

The PV Industry Forum (PVIF) is a collaborative initiative of several organizations dedicated to continually improving the installation safety of PV systems in the U.S. The organizations are the Solar Energy Industry Association (SEIA), the PV Industry Codes Council (PVICC), Solar Energy International (SEI), the Interstate Renewable Energy Council (IREC), and the Large-Scale Solar Association (LSA). This coalition has come together to organize, convene, support and mentor solar industry professionals through the NEC public input process, which is open to all solar industry participants.

This collaborative effort has resulted in the consensus development of numerous solar-related Public Input proposals for consideration. The list of task group members indicates those individuals who have contributed to the development of various Public Inputs in nine different tasks groups. A consensus process was used to develop each Public Input, therefore this list does not necessarily indicate that each individual or their representative organization participated in or has agreed with every proposed Public Input submitted under the PVIF effort. Each participant has agreed that any original proposal that they submitted and which was subsequently improved by our process is assigned as original and / or improved work to PVIF for submittal and release to NFPA as a proposed Public Input.

Members of the PVIF's effort include the following representatives. Note that those noted below participated in specific task groups and not necessarily all task groups on specific items proposed. Each member is at their discretion to individually comment on PI's as they deem appropriate.

Evelyn Butler, SEIA; Jason Fisher, SEIA; Ward Bower, Ward Bower Innovations LLC/SEIA; Joseph Cain, P.E., SEIA; Bill Brooks, Brooks Engineering/PVICC; Rebekah Hren, Solar Energy International; Brian Mehalic, Solar Energy International; Mark Rodriguez, Sunrun; Paul Joyce, Sunrun; Brian Ewing, Swinerton; Sumana Seshadri, Swinerton; Christian Eder, Fronius USA; Isaac Opalinsky, SunPower; Chris Fox, SunPower; James Cormican, RBI Solar; Dave Compaan, RBI Solar; Shawn Shaw, Natural Power; Cody Oram, Vivint Solar; Greg Elvestad, Vivint Solar; Mike Weimer, Westwood Professional Services; Doug Mutcher, Westwood Professional Services; Jeff Wang, Staubli; Colleen O'Brien, UL; John Doty, UL; Laurie Florence, UL; Tim Zgonena, UL ; Gokul Kalyan, FTC Solar; Ali Sedaghat, FTC Solar; K.C. Radford, Radian Generation; Jan Dominguez, LG Electronics; Ben Chamberlain, Olivewood Energy; Klaus Nicolaedis, Unirac Inc.; Leif Cook, Core Development Group; Martin Herzfeld, Herzfeld; Dave Click, esaSolar; Sean White, principal; Kate Collardson, BayWa r.e. Solar Systems; Bryan Holland, NEMA; Jack Lyons, NEMA; Mike Stone, NEMA; Evan Martin, BURNDY; Terry McKinch, Mortenson; Jason Bobruk, SolarEdge Technologies; Reid ; train, Savion; Charlie Dearie, McCalmont Engineering; Sumanth Lokanath, Ray Illuminati LLC; Yann Schwarz, Esdec Inc.; Joseph Armano, PanelClaw, Inc.; Michael Heinrich, PanelClaw, Inc.; Steve Wurmlinger, SMA Solar Technology AG; Thomas Wegener, SMA Solar Technology AG; Chris Flueckiger, Key Renewables; Matt Piantedosi, Ridgeline Energy Analytics; Samantha Doshi, Intertek; Kyle Breuning, Tesla; Charles Picard, Tesla; Steve Connolly, Tesla; Greg Ball, Tesla; Jake West, Tesla; Jamie Daggett, DNV GL; MinWah Leung, DNV GL; Bob White, Fimer SpA; Marvin Hamon, Pure Power Engineering; Milton Nogueira, Roof Tech; Peter Seidel, First Solar; Jason Smolko, Copperweld;

Submitter Information Verification

Submitter Full Name:	Evelyn Butler
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Submittal Date:	Wed Sep 09 10:01:13 EDT 2020
Committee:	NEC-P12

Public Input No. 2385-NFPA 70-2020 [Section No. 625.48]

625.48 Interactive Systems.

~~EVSE that~~ EVSE or WPTE that incorporates a power export function and that is part of an interactive system that serves as an optional standby system, an electric power production source, or a bidirectional power feed shall be listed and marked as suitable for that purpose. When used as an optional standby system, the requirements of Article 702 shall apply; when used as an electric power production source, the requirements of Article 705 shall apply. EVPE that consists of a receptacle outlet only shall be in accordance with 625.60.

Informational Note: For further information on supply equipment, see ANSI/UL 1741, *Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources*, and ANSI/UL 9741, *Bidirectional Electric Vehicle (EV) Charging System Equipment*; for vehicle interactive systems, see SAE J3072, *Standard for Interconnection Requirements for Onboard, Utility-Interactive Inverter Systems*.

Statement of Problem and Substantiation for Public Input

This Public Input proposal is made for the purpose of better integrating WPT into Article 625 and is part of a set of Public Inputs which share the same General Justification. See PI 2375 for more details.

EXPLANATION FOR THIS PUBLIC INPUT PROPOSAL 2385

This section 625.48 on Interactive Systems should apply to both EVSE and WPTE.

Submitter Information Verification

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Committee: NEC-P12

Public Input No. 3079-NFPA 70-2020 [Section No. 625.48]

625.48 Interactive Systems.

EVSE that incorporates a power export function and that is part of an interactive system that serves as an optional standby system, an electric power production source, or a bidirectional power feed shall be listed and marked as suitable for that purpose. When used as an optional standby system, the requirements of Article 702 shall apply; when used as an electric power production source, the requirements of Article 705 shall apply. ~~EVPE that consists of a receptacle outlet only shall be in accordance with 625.60 .~~

Informational Note: For further information on supply equipment, see ANSI/UL 1741, *Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources*, and ANSI/UL 9741, *Bidirectional Electric Vehicle (EV) Charging System Equipment*; for vehicle interactive systems, see SAE J3072, *Standard for Interconnection Requirements for Onboard, Utility-Interactive Inverter Systems*.

Statement of Problem and Substantiation for Public Input

Even if there is a 120 V outlet receptacle, power output requires multiple subcomponents, including wires, an inverter, a switch, and other devices. Among those, it is not clear what is included in the definition of EVPE. If devices beyond the receptacle is included in the definition of EVPE, there is no such thing like “EVPE that consists of a receptacle outlet only.” Because of the inarticulateness of the definition of EVPE, the sentence that includes the term EVPE shall be deleted.

Submitter Information Verification

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Submittal Date: Fri Sep 04 14:03:02 EDT 2020

Committee: NEC-P12

Public Input No. 3613-NFPA 70-2020 [Section No. 625.48]

625.48 Interactive ~~Systems~~ Equipment .

EVPE and bidirectional EVSE that incorporates a power export function and that is part of ~~an interactive system that serves as an optional standby system, an electric power production source, or a bidirectional power feed shall~~ a system that is interactive with other power sources shall be listed and marked as suitable for that purpose. When used as an ~~optional standby system, the requirements of Article 702 shall apply; when used as an~~ electric power production source, the requirements of Article 705 shall apply. EVPE that consists of a receptacle outlet only shall be in accordance with 625.60.

Informational Note: For further information on supply equipment, see ANSI/UL 1741, *Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources*, and ANSI/UL 9741, *Bidirectional Electric Vehicle (EV) Charging System Equipment*; for vehicle interactive systems, see SAE J3072, *Standard for Interconnection Requirements for Onboard, Utility-Interactive Inverter Systems*.

Statement of Problem and Substantiation for Public Input

This section covers interactive equipment, not systems, and not solely bidirectional power flow. Listings do not identify a bidirectional power feed. The listing will identify the equipment as bidirectional EVSE or EVPE. The proposed revisions better align this requirement with interactive equipment functionality and terminology. These systems are not used for Article 702 installations but are likely to be used for Article 705 installations that also include systems operating in island mode that is similar to those defined in Article 702

The PV Industry Forum (PVIF) is a collaborative initiative of several organizations dedicated to continually improving the installation safety of PV systems in the U.S. The organizations are the Solar Energy Industry Association (SEIA), the PV Industry Codes Council (PVICC), Solar Energy International (SEI), the Interstate Renewable Energy Council (IREC), and the Large-Scale Solar Association (LSA). This coalition has come together to organize, convene, support and mentor solar industry professionals through the NEC public input process, which is open to all solar industry participants.
This collaborative effort has resulted in the consensus development of numerous solar-related Public Input proposals for consideration. The list of task group members indicates those individuals who have contributed to the development of various Public Inputs in nine different tasks groups. A consensus process was used to develop each Public Input, therefore this list does not necessarily indicate that each individual or their representative organization participated in or has agreed with every proposed Public Input submitted under the PVIF effort. Each participant has agreed that any original proposal that they submitted and which was subsequently improved by our process is assigned as original and / or improved work to PVIF for submittal and release to NFPA as a proposed Public Input.
Members of the PVIF's effort include the following representatives. Note that those noted below participated in specific task groups and not necessarily all task groups on specific items proposed. Each member is at their discretion to individually comment on PI's as they deem appropriate.
Evelyn Butler, SEIA; Jason Fisher, SEIA; Ward Bower, Ward Bower Innovations LLC/SEIA; Joseph Cain, P.E., SEIA; Bill Brooks, Brooks Engineering/PVICC; Rebekah Hren, Solar Energy International; Brian Mehalic, Solar Energy International; Mark Rodriguez, Sunrun; Paul Joyce, Sunrun; Brian Ewing, Swinerton; Sumana Seshadri, Swinerton; Christian Eder, Fronius USA; Isaac Opalinsky, SunPower; Chris Fox, SunPower; James Cormican, RBI Solar; Dave Compaan, RBI Solar; Shawn Shaw, Natural Power; Cody Oram, Vivint Solar; Greg Elvestad, Vivint Solar; Mike Weimer, Westwood Professional Services; Doug Mutcher, Westwood Professional Services; Jeff Wang, Staubli; Colleen O'Brien, UL; John Doty, UL; Laurie Florence, UL; Tim Zgonena, UL ; Gokul Kalyan, FTC Solar; Ali Sedaghat, FTC

Solar; K.C. Radford, Radian Generation; Jan Dominguez, LG Electronics; Ben Chamberlain, Olivewood Energy; Klaus Nicolaedis, Unirac Inc.; Leif Cook, Core Development Group; Martin Herzfeld, Herzfeld; Dave Click, esaSolar; Sean White, principal; Kate Collardson, BayWa r.e. Solar Systems; Bryan Holland, NEMA; Jack Lyons, NEMA; Mike Stone, NEMA; Evan Martin, BURNDY; Terry McKinch, Mortenson; Jason Bobruk, SolarEdge Technologies; Reid ; train, Savion; Charlie Dearie, McCalmont Engineering; Sumanth Lokanath, Ray Illuminati LLC; Yann Schwarz, Esdec Inc.; Joseph Armano, PanelClaw, Inc.; Michael Heinrich, PanelClaw, Inc.; Steve Wurmlinger, SMA Solar Technology AG; Thomas Wegener, SMA Solar Technology AG; Chris Flueckiger, Key Renewables; Matt Piantedosi, Ridgeline Energy Analytics; Samantha Doshi, Intertek; Kyle Breuning, Tesla; Charles Picard, Tesla; Steve Connolly, Tesla; Greg Ball, Tesla; Jake West, Tesla; Jamie Daggett, DNV GL; MinWah Leung, DNV GL; Bob White, Fimer SpA; Marvin Hamon, Pure Power Engineering; Milton Nogueira, Roof Tech; Peter Seidel, First Solar; Jason Smolko, Copperweld;

Submitter Information Verification

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Submittal Date:	Wed Sep 09 09:04:50 EDT 2020
Committee:	NEC-P12

Public Input No. 4300-NFPA 70-2020 [Section No. 625.48]

625.48 Interactive Systems.

EVSE that incorporates a power export function and that is part of an interactive system that serves as an optional standby system, an electric power production source, or a bidirectional power feed shall be listed and marked as suitable for that purpose. When used as an optional standby system, the requirements of Article 702 shall apply; when used as an electric power production source, the requirements of Article 705 shall apply. EVPE that consists of a receptacle outlet only shall be in accordance with 625.60.

Informational Note: For further information on supply equipment, see ANSI/UL 1741, *Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources*, and ANSI/UL 9741, *Bidirectional Electric Vehicle (EV) Charging System Equipment*; for vehicle interactive systems, see SAE J3072, *Standard for Interconnection Requirements for Onboard, Utility-Interactive Inverter Systems*.

Delete above text. Replace with:

EVSEs and Vehicles which incorporate a power export function for the purposes of bi-directional power feed, shall conform to SAE J3072. The original equipment manufacturer owner's manual for such vehciles shall include statements of assurance that all equipment meet the safety and interconnection requirements of the SAE standard.

Additional Proposed Changes

File Name	Description	Approved
NEC_Proposal_-_2023_code_September_10_2020.docx	Letter of explanation for the proposed change from Dr. Daniel Mikat of Toyota Motor North America.	

Statement of Problem and Substantiation for Public Input

1. Scope statements of Article 90.2 and 625.60 conflict with SAE established standards.
2. Article 625 introduces requirements for on-board power outlets. The justification (stated by Scott Cline in the general assembly meeting) is that these outlets could be used by automotive manufacturers to backflow power to the premises and/or grid. However, the outlets inside of the vehicle cannot be used in this manner. They are low-power, convenience outlets which are active only when the vehicle IG is on. If these outlets cannot be used for power flow to the premises, then there is no need to generate such requirements.
3. GFCI requirements, as stated in 625 pose technical dilemmas for automakers. i.e. no physical ground in the vehicle.
4. Testing and listing is a new requirement which poses problems for automakers for the following reasons:

a. No specification is included which identifies a test method/criteria.
b. Third party listing presents a significant conflict with the preemptive federal authority of NHTSA which establishes that motor vehicle manufacturers must self-certify compliance. NHTSA has been granted the authority to set and administer safety standards for motor vehicle safety and holds broad authority to conduct recalls for safety defects.
c. Outside lab certification compromises the OEMs' ability to rapidly respond to NHTSA directives to produce field resolutions to safety concerns in design and production.

Submitter Information Verification

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Submittal Date:	Thu Sep 10 09:49:57 EDT 2020
Committee:	NEC-P12

NFPA 70 – NEC 2023 Proposed Input

Code-Making Panel 12

Dr. Daniel Mikat, Sr. Program Manager – Toyota Motor, N.A., Inc.

Reference: NEC Article 625.

Background:

Prior to publication of the NEC 2020 code, Automotive Manufacturers and the Society of Automotive Engineers (SAE) submitted a number of motions to the NFPA general assembly and to the Standards Committee objecting to language in Article 625 which introduced a number of OEM vehicle requirements.

The Basis for the objections centered on the following observations in the code:

1. Scope statements of Article 90.2 and 625.60 conflict with SAE established standards.
2. Article 625 introduces requirements for on-board power outlets. The justification (stated by Scott Cline in the general assembly meeting) is that these outlets could be used by automotive manufacturers to backflow power to the premises and/or grid. However, the outlets inside of the vehicle cannot be used in this manner. They are low-power, convenience outlets which are active only when the vehicle IG is on. If these outlets cannot be used for power flow to the premises, then there is no need to generate such requirements.
3. GFCI requirements, as stated in 625 pose technical dilemmas for automakers. i.e. no physical ground in the vehicle.
4. Testing and listing is a new requirement which poses problems for automakers for the following reasons:
    a. No specification is included which identifies a test method/criteria.
    b. Third party listing presents a significant conflict with the preemptive federal authority of NHTSA which establishes that motor vehicle manufacturers must self-certify compliance. NHTSA has been granted the authority to set and administer safety standards for motor vehicle safety and holds broad authority to conduct recalls for safety defects.
    c. Outside lab certification compromises the OEMs' ability to rapidly respond to NHTSA directives to produce field resolutions to safety concerns in design and production.

During a final review of motions from the automotive manufacturing community, the NFPA Standards Council recommended that NFPA and SAE create a joint working group to address the issue of safe interaction of vehicle receptacles to premises wiring. The members of the OEM group involved continue to agree with the NFPA that harmonized standards should be developed in the interest of maintaining safe interaction between the vehicle and premises wiring. It is proposed that a collaboration between the NFPA and automotive development/testing specialists be utilized which will meet the objectives of the NFPA while providing vehicle architecture expertise in a productive way.

SAE J3072:

SAE committee for “Interconnection Requirements for Onboard, Utility-Interactive Inverter Systems” (J3072) includes experts in Automotive Engineering, Suppliers of charging/discharging equipment, the collective electric utility market, and testing facilities. Several years of collaborative work, including many hundreds of hours of technical development, have been expended in creating a standard which addresses all of the concerns stated by the chairman of Code-making panel 12.

The scope statement of the J3072 standard states the following:

This SAE J3072 establishes interconnection requirements for a utility-interactive inverter system which is integrated into a plug-in electric vehicle (PEV) and connects in parallel with an electric power system (EPS) by way of conductively coupled, electric vehicle supply equipment (EVSE). This standard also defines the communication between the PEV and the EVSE required for the PEV onboard inverter to be configured and authorized by the EVSE for discharging at a site. This standard shall support four-quadrant inverters which conform to the requirements of IEEE 1547-2018 and IEEE 1547.1-2020. It shall also support bidirectional inverters which conform to the requirements of IEEE 1547-2003 and IEEE 1547.1-2005. (SAE J3072 2020, p. 5)

Background statements in J3072 include the following:

A roaming V2G-AC PEV inverter creates some unique technical and interconnection approval issues. The PEV can easily cross utility service areas and state lines and connect at locations with different site settings. For example, one EVSE could be connected to 208 VAC service and another EVSE could use 240 VAC service. For an onboard inverter that needs to meet an IEEE 1547 requirement to stop discharging if the grid voltage drops below 88% of the reference voltage, the inverter needs to know the reference voltage for the specific EVSE. It is not practicable to allow this to be an explicit inverter setting in the PEV. SAE J3072 defines requirements for these settings to be made in the EVSE and transferred to the PEV when it connects to the EVSE.

It is expected that a vehicle manufacturer (VM) will perform the analyses, inspections, and tests to ensure that each inverter system model that is authorized by the VM to be installed in one of their PEV models conforms to the requirements of SAE J3072. The VM will issue a certificate of conformance to SAE J3072 for each authorized inverter system model.

It is expected that an EVSE manufacturer (EVSE OEM) will perform the analyses, inspections, and tests to ensure that each EVSE model that is authorized by the EVSE OEM to be used with a PEV with an onboard inverter system conforms to the requirements of SAE J3072. The EVSE OEM will issue a certificate of conformance to SAE J3072 for each authorized EVSE model. Alternatively, the EVSE model could be listed by a Nationally Recognized Testing Laboratory (NRTL) as conforming to the requirements of SAE J3072 or to an EVSE safety standard which calls out conformance to SAE J3072 as a requirement. (SAE J3072 2020, p. 5.)

Specifically, J3072 includes the following requirements for vehicles and related charging equipment related to V2G power management.

1. System architecture/configuration (4.3.1),.
2. Testing configuration (4.4.2).
3. Point-to-point communication (4.6.2).
4. Utility interaction (4.8).
5. Certification process (4.4, 4.5).

The J3072 committee is currently making revisions to this standard for purposes of improving utility interaction for issues such as phase quadrant alignment and communication protocol between the EVSE and the vehicle.

It is noteworthy that these five sections of requirements found in J3072 are all absent from the 2020 NEC related code sections.

Proposal:

Replace 625.48 and 625.60 with following requirements:

EVSEs and Vehicles which incorporate a power export function for the purposes of bi-directional power feed, shall conform to SAE J3072. The original equipment manufacturer owner's manual for such vehicles shall include statements of assurance that all equipment meet the safety and interconnection requirements of the SAE standard.

Respectfully submitted to Code-making panel #12, NFPA.

Dr. Daniel Mikat
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734-995-4581

Public Input No. 4473-NFPA 70-2020 [Section No. 625.48]

625.48 Interactive Systems.

EVSE that incorporates a power export function and that is part of an interactive system that serves as an optional standby system, an electric power production source, or a bidirectional power feed shall be listed and marked as suitable for that purpose. When used as an optional standby system, the requirements of Article 702 shall apply; when used as an electric power production source, the requirements of Article 705 shall apply. EVPE that ~~consists of~~ provides a receptacle outlet ~~only~~ as its point of power export shall be in accordance with 625.60.

> Informational Note: For further information on supply equipment, see ANSI/UL 1741, *Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources*, and ANSI/UL 9741, *Bidirectional Electric Vehicle (EV) Charging System Equipment*; for vehicle interactive systems, see SAE J3072, *Standard for Interconnection Requirements for Onboard, Utility-Interactive Inverter Systems*.

Statement of Problem and Substantiation for Public Input

It will never be true that a receptacle outlet will be the "only" constituent of an EVPE system; 625.60 guarantees there will be a number of protective devices supporting the export of power through the receptacle. The wording in this PI provides a more accurate depiction of how this will be applied.

Submitter Information Verification

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Committee:	NEC-P12

Public Input No. 4479-NFPA 70-2020 [Section No. 625.54]

625.54 Ground-Fault Circuit-Interrupter Protection for Personnel.

In addition to the requirements in 210.8, all receptacles installed for the connection of electric vehicle charging and rated not more than 50 amperes at 125/250 or 250 volts shall have ground-fault circuit-interrupter protection for personnel.

Statement of Problem and Substantiation for Public Input

The GFCI mandate in this section will be impossible to meet with level 3 charging.

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Public Input No. 3081-NFPA 70-2020 [Section No. 625.60]

~~**625.60** AC Receptacle Outlets Used for EVPE.~~

~~AC receptacles installed in electric vehicles and intended to allow for connection of off-board utilization equipment shall comply with 625.60(A) through (D).~~

~~**(A)** Type.~~

~~The receptacle outlet shall be listed.~~

~~**(B)** Rating.~~

~~The receptacle outlet shall be rated 250 volts maximum, single phase 50 amperes maximum.~~

~~**(C)** Overcurrent Protection.~~

~~Electric vehicles provided with receptacle outlets for power export shall be provided with overcurrent protection integral to the power export system. The overcurrent protection shall have a nominal rating sufficient for the receptacle it protects. The overcurrent protection shall also be sufficiently rated for the maximum available fault current at the receptacle and shall be included in the interactive equipment evaluation. See 625.48 .~~

~~**(D)** GFCI Protection for Personnel.~~

~~Ground-fault circuit-interrupter protection for personnel shall be provided for all receptacles. The ground-fault circuit-interrupter indication and reset shall be installed in a readily accessible location.~~

~~Informational Note: There are various methods available to achieve ground-fault circuit-interrupter protection.~~

Statement of Problem and Substantiation for Public Input

The proposed section 625.60 is in direct conflict with Article 625.1 and 90.2 which clearly states that the scope of the NEC is limited to the equipment external to vehicles. Furthermore, the proposed definitions that include vehicle equipment is in direct conflict with NHTSA's broad authority to regulate and enforce vehicle safety which includes the Federal Motor Vehicle Safety Standards intended to reduce deaths and injuries from electrical shock. In addition, the following flaws are included in this section.
Issues that the Code-Making Panel would like to address with this section are not clear because, depending on the category of AC receptacle, the usage conditions will be significantly different.
o Regarding AC reverse power flow from EV charging receptacle (namely SAE J1772 receptacle or equivalent) through an EVSE wired to the premises, the EVSE shall be listed in accordance with Section 625.5, and the EVSE shall be equipped with overcurrent protection and a ground-fault detection method. The on-board charging receptacle does not have to have overcurrent protection or a ground-fault circuit interrupter.
o Regarding AC reverse power flow from EV charging receptacle (namely SAE J1772 receptacle or equivalent) for powering an individual stand-alone device, such a stand-alone device is not electrically grounded, and the on-board wires conductively connected to the AC receptacle are electrically insulated. Hence, even when a ground fault occurs, a current return path that might cause electrocution would not be formed. Therefore, a ground-fault circuit interrupter is not needed.
o The phrase "AC receptacles intended to allow for connection of off-board utilization equipment" is not clear whether this includes NEMA 5-15R AC outlets in the cabin. AC outlets in the cabin are basically for on-board use, and not intended for devices off-board. However, some AHJ might consider on-board receptacles can be used for off-board equipment. Such ambiguity is not acceptable for an automaker selling identical products nationwide. Also, utilization equipment in the cabin is not electrically grounded, and the on-board wires conductively connected to the AC receptacle are electrically insulated. Hence, even when a ground fault occurs, a current return path that might cause

electrocution would not be formed. Therefore, a ground-fault circuit interrupter is not needed.
o Installing a NEMA AC receptacle on the outside of the vehicle body panel is not realistic in order to conform to Federal Motor Vehicle Safety Standard. Should this section be intended to specify requirements for such a case, it would not give any benefits and would cause confusion.
- On-board overcurrent protection has various forms. For instance, a fuse box includes fuses of various circuits, and with the fuses, overcurrent of those circuits are prevented. It does not matter whether a fuse is integral with a device or not. Also, in the case of using an on-board inverter, the inverter will be designed to suppress its output current before overcurrent flows. The requirement for overcurrent protection in the First Draft is not appropriate.
- There is not an appropriate standard for an on-board inverter that a listing organization and the auto industry have reached a consensus on. Wiring, cooling, configuration, etc. of automotive devices are very different from what the existing inverter standard intends. The current language in the First Draft requires even a low power on-board inverter to be listed, but it is not reasonable to require an on-board inverter to be listed for the reasons above.

On the whole, this section is not clear about technical issues to be addressed, and the requirements herein are not reasonable. Unreasonable requirements would create additional complexity without any safety benefits. This complexity risks prohibiting the advancement of electric vehicle technology in the United States and may have adverse effects in achieving crash integrity. Therefore, it is suggested that this section be deleted.

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Public Input No. 4324-NFPA 70-2020 [Section No. 625.60]

625.60 AC Receptacle Outlets Used for EVPE.

AC receptacles installed in electric vehicles and intended to allow for connection of off-board utilization equipment shall comply with 625.60(A) through (D).

(A) Type.

The receptacle outlet shall be listed.

(B) Rating.

The receptacle outlet shall be rated 250 volts maximum, single phase 50 amperes maximum.

(C) Overcurrent Protection.

Electric vehicles provided with receptacle outlets for power export shall be provided with overcurrent protection integral to the power export system. The overcurrent protection shall have a nominal rating sufficient for the receptacle it protects. The overcurrent protection shall also be sufficiently rated for the maximum available fault current at the receptacle and shall be included in the interactive equipment evaluation. See 625.48.

(D) GFCI Protection for Personnel.

Ground-fault circuit-interrupter protection for personnel shall be provided for all receptacles. The ground-fault circuit-interrupter indication and reset shall be installed in a readily accessible location.

Informational Note: There are various methods available to achieve ground-fault circuit-interrupter protection.

<u>Delete the above text and replace with:</u>

<u>AC receptacles for use in electric vehicles which incorporate a power export function for the purposes of bi-directional power feed, shall conform to SAE J3072. The original equipment manufacturer owner's manual for such vehicles shall include statements of assurance that all equipment meet the safety and interconnection requirements of the SAE standard.</u>

Additional Proposed Changes

File Name	Description	Approved
NEC_Proposal_-_2023_code_September_10_2020.docx	Letter of explanation of the proposed change from Dr. Daniel Mikat of Toyota Motor North America	

Statement of Problem and Substantiation for Public Input

1. Scope statements of Article 90.2 and 625.60 conflict with SAE established standards.
2. Article 625 introduces requirements for on-board power outlets. The justification (stated by Scott Cline in the general assembly meeting) is that these outlets could be used by automotive manufacturers to backflow power to the premises and/or grid. However, the outlets inside of the vehicle cannot be used in this manner. They are low-power, convenience outlets which are active only when the vehicle IG is on. If these outlets cannot be used for power flow to the premises, then there is no need to generate such requirements.
3. GFCI requirements, as stated in 625 pose technical dilemmas for automakers. i.e. no physical ground in the vehicle.
4. Testing and listing is a new requirement which poses problems for automakers for the following reasons:

a. No specification is included which identifies a test method/criteria.

b. Third party listing presents a significant conflict with the preemptive federal authority of NHTSA which establishes that motor vehicle manufacturers must self-certify compliance. NHTSA has been granted the authority to set and administer safety standards for motor vehicle safety and holds broad authority to conduct recalls for safety defects.

c. Outside lab certification compromises the OEMs' ability to rapidly respond to NHTSA directives to produce field resolutions to safety concerns in design and production.

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Committee:	NEC-P12

NFPA 70 – NEC 2023 Proposed Input

Code-Making Panel 12

Dr. Daniel Mikat, Sr. Program Manager – Toyota Motor, N.A., Inc.

Reference: NEC Article 625.

Background:

Prior to publication of the NEC 2020 code, Automotive Manufacturers and the Society of Automotive Engineers (SAE) submitted a number of motions to the NFPA general assembly and to the Standards Committee objecting to language in Article 625 which introduced a number of OEM vehicle requirements.

The Basis for the objections centered on the following observations in the code:

1. Scope statements of Article 90.2 and 625.60 conflict with SAE established standards.
2. Article 625 introduces requirements for on-board power outlets. The justification (stated by Scott Cline in the general assembly meeting) is that these outlets could be used by automotive manufacturers to backflow power to the premises and/or grid. However, the outlets inside of the vehicle cannot be used in this manner. They are low-power, convenience outlets which are active only when the vehicle IG is on. If these outlets cannot be used for power flow to the premises, then there is no need to generate such requirements.
3. GFCI requirements, as stated in 625 pose technical dilemmas for automakers. i.e. no physical ground in the vehicle.
4. Testing and listing is a new requirement which poses problems for automakers for the following reasons:
    a. No specification is included which identifies a test method/criteria.
    b. Third party listing presents a significant conflict with the preemptive federal authority of NHTSA which establishes that motor vehicle manufacturers must self-certify compliance. NHTSA has been granted the authority to set and administer safety standards for motor vehicle safety and holds broad authority to conduct recalls for safety defects.
    c. Outside lab certification compromises the OEMs' ability to rapidly respond to NHTSA directives to produce field resolutions to safety concerns in design and production.

During a final review of motions from the automotive manufacturing community, the NFPA Standards Council recommended that NFPA and SAE create a joint working group to address the issue of safe interaction of vehicle receptacles to premises wiring. The members of the OEM group involved continue to agree with the NFPA that harmonized standards should be developed in the interest of maintaining safe interaction between the vehicle and premises wiring. It is proposed that a collaboration between the NFPA and automotive development/testing specialists be utilized which will meet the objectives of the NFPA while providing vehicle architecture expertise in a productive way.

SAE J3072:

SAE committee for "Interconnection Requirements for Onboard, Utility-Interactive Inverter Systems" (J3072) includes experts in Automotive Engineering, Suppliers of charging/discharging equipment, the collective electric utility market, and testing facilities. Several years of collaborative work, including many hundreds of hours of technical development, have been expended in creating a standard which addresses all of the concerns stated by the chairman of Code-making panel 12.

The scope statement of the J3072 standard states the following:

This SAE J3072 establishes interconnection requirements for a utility-interactive inverter system which is integrated into a plug-in electric vehicle (PEV) and connects in parallel with an electric power system (EPS) by way of conductively coupled, electric vehicle supply equipment (EVSE). This standard also defines the communication between the PEV and the EVSE required for the PEV onboard inverter to be configured and authorized by the EVSE for discharging at a site. This standard shall support four-quadrant inverters which conform to the requirements of IEEE 1547-2018 and IEEE 1547.1-2020. It shall also support bidirectional inverters which conform to the requirements of IEEE 1547-2003 and IEEE 1547.1-2005. (SAE J3072 2020, p. 5)

Background statements in J3072 include the following:

A roaming V2G-AC PEV inverter creates some unique technical and interconnection approval issues. The PEV can easily cross utility service areas and state lines and connect at locations with different site settings. For example, one EVSE could be connected to 208 VAC service and another EVSE could use 240 VAC service. For an onboard inverter that needs to meet an IEEE 1547 requirement to stop discharging if the grid voltage drops below 88% of the reference voltage, the inverter needs to know the reference voltage for the specific EVSE. It is not practicable to allow this to be an explicit inverter setting in the PEV. SAE J3072 defines requirements for these settings to be made in the EVSE and transferred to the PEV when it connects to the EVSE.

It is expected that a vehicle manufacturer (VM) will perform the analyses, inspections, and tests to ensure that each inverter system model that is authorized by the VM to be installed in one of their PEV models conforms to the requirements of SAE J3072. The VM will issue a certificate of conformance to SAE J3072 for each authorized inverter system model.

It is expected that an EVSE manufacturer (EVSE OEM) will perform the analyses, inspections, and tests to ensure that each EVSE model that is authorized by the EVSE OEM to be used with a PEV with an onboard inverter system conforms to the requirements of SAE J3072. The EVSE OEM will issue a certificate of conformance to SAE J3072 for each authorized EVSE model. Alternatively, the EVSE model could be listed by a Nationally Recognized Testing Laboratory (NRTL) as conforming to the requirements of SAE J3072 or to an EVSE safety standard which calls out conformance to SAE J3072 as a requirement. (SAE J3072 2020, p. 5.)

Specifically, J3072 includes the following requirements for vehicles and related charging equipment related to V2G power management.

1. System architecture/configuration (4.3.1),.
2. Testing configuration (4.4.2).
3. Point-to-point communication (4.6.2).
4. Utility interaction (4.8).
5. Certification process (4.4, 4.5).

The J3072 committee is currently making revisions to this standard for purposes of improving utility interaction for issues such as phase quadrant alignment and communication protocol between the EVSE and the vehicle.

It is noteworthy that these five sections of requirements found in J3072 are all absent from the 2020 NEC related code sections.

Proposal:

Replace 625.48 and 625.60 with following requirements:

EVSEs and Vehicles which incorporate a power export function for the purposes of bi-directional power feed, shall conform to SAE J3072. The original equipment manufacturer owner's manual for such vehicles shall include statements of assurance that all equipment meet the safety and interconnection requirements of the SAE standard.

Respectfully submitted to Code-making panel #12, NFPA.

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Public Input No. 4530-NFPA 70-2020 [Section No. 625.60(D)]

(D) GFCI Protection for Personnel.

~~Ground~~ Listed and labeled ground -fault circuit-interrupter protection for personnel shall be provided for all receptacles. The ground-fault circuit-interrupter indication and reset shall be installed in a readily accessible location.

Informational Note: There are various methods available to achieve ground-fault circuit-interrupter protection.

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, and 680.23(A)(8) which currently require listing.

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Committee: NEC-P12

Public Input No. 1375-NFPA 70-2020 [Section No. 625.101]

625.101 Equipment Grounding Conductor .

The primary pad base plate shall be of a non-ferrous metal and shall be ~~grounded~~ connected to the circuit equipment grounding conductor unless the listed WPTE employs a double-insulation system. The base plate shall be sized to match the size of the primary pad enclosure.

Statement of Problem and Substantiation for Public Input

No. 1. According to the NFPA Style Manual, the Section Title needs to reflect the content of the rule. The rule is about the equipment grounding conductor, not about “Grounding.” No. 2. The text was revised to make it clear that the rule is about the connection to the equipment grounding conductor, not “ground.”

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Committee: NEC-P12

Public Input No. 2387-NFPA 70-2020 [Sections 625.102(A), 625.102(B), 625.102(C)]

Sections 625.102(A), 625.102(B), 625.102(C)

(A) ~~Type~~ General .

The ~~charger power converter, where integral to the primary pad~~ control box, if the WPTE configuration includes one , shall comply with 625.102(~~C~~ B). The ~~charger power converter, if not integral to the~~ primary pad ~~,~~ shall ~~be provided with a minimum Type 3R enclosure rating.~~ comply with 625.102(C).

(B) ~~General.~~

~~If the charger power converter is not integral to the primary pad, it shall be~~

Control Box.

The control box shall be provided with a minimum Type 3R enclosure rating and shall be mounted at a height of not less than 450 mm (18 in.) above the floor level for indoor locations or 600 mm (24 in.) above grade level for outdoor locations. The ~~charger power converter~~ control box shall be mounted in one of the following forms:

(1) Pedestal

(2) Wall or pole

(3) Building or structure

(4) Raised concrete pad

(C) Primary Pad.

The primary pad shall be installed ~~on~~ by securing the ~~surface, embedded in the~~ pad to the surface or embedding the pad in the surface of the floor with its top flush with the surface ~~,~~ or ~~embedded in~~ with the ~~surface of the floor with its top below the surface. This includes primary pad constructions with the charger power converter located in the primary pad enclosure.~~ top below the surface, all per the manufacturer's instructions.

(1) If the primary pad is located in an area requiring snow removal, it shall not be ~~located~~ installed on or above the surface.

Exception: Where installed on private property where snow removal is done manually, the primary pad shall be permitted to be ~~located~~ installed on or above the surface.

(2) The ~~enclosure shall be provided with a suitable enclosure rating~~ primary pad enclosure shall have a minimum Type 3 rating . If the primary pad is located in an area subject to severe climatic conditions (e.g., flooding), ~~it shall~~ the primary pad enclosure shall be suitably rated for those conditions ~~or be provided with a suitably rated enclosure~~ .

Statement of Problem and Substantiation for Public Input

This Public Input proposal is made for the purpose of better integrating WPT into Article 625 and is part of a set of Public Inputs which share the same General Justification. See PI 2375 for more details.

EXPLANATION FOR THIS PUBLIC INPUT PROPOSAL 2387

Per the Explanation detail in PI 2376 (625.2 definition of WPTE and Informational Note 1) the term “charger power converter” no longer is part of the definition. Instead the term "control box" is described, and will be used in this PI 2387 (and in PI 2392) as one of the installation elements.

The intent of these changes is to reorganize the sections so that (A) is General, stating that (B) applies to installing the control box (if there is one) and the rating of its enclosure and (C) applies to installing the primary pad and its enclosure rating.

In (C) there are some previously unstated requirements - securing the primary pad, which was already implicitly intended (see the wording in 625.102(D) regarding why the cable is secured) and that the primary pad installation is per the manufacturer specification. This is critical because the primary pad for each of the different installation scenarios (surface mount, mounted with top flush with surface, mounted with top below the surface) is a different primary pad. If the manufacturer specification provides for surface mounting with a spacer, that would be allowed, provided the primary pad is secured in place, so the words "or above" is removed from the text in bullet 1.

As a result, the sections addressed by this PI 2387 more simply stated and clearer.

In 625.102(A) replace the text with the much simpler suggested text, and change the title of 625.102(A) to "General". Remove the enclosure rating from this section (A) and instead put it in section (B).

In 625.102(B), change the title to "Control Box" and in the text change "charger power converter" to "control box" and reword to simplify, including the enclosure rating from current section (A).

In 625.102(C), the change explicitly states that the installation is accomplished by securing the primary pad and adds the phrase "per the manufacturer's instructions".

The manufacturer instructions will state that (a) the primary pad is to be installed on the surface, or, (b) with a spacer beneath the primary pad of a specific thickness, or, (c) in a pocket in the surface so that the top of the primary pad is flush with the surface, or (d) in a pocket in the surface so that the top of the primary pad is a specific number of mm below the surface and, after installation, how to treat the space between the top of the primary pad and the surrounding surface.

The last sentence of the current first paragraph of the original text starting with “this includes..” is no longer needed for clarification as 625.102(A) is now explicit.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2376-NFPA 70-2020 [Definition: Wireless Power Transfer Equipment (WPTE).]	Control Box, a physical element, is described in 2376

Submitter Information Verification

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Submittal Date: Tue Aug 18 15:14:28 EDT 2020

Committee: NEC-P12

Public Input No. 2392-NFPA 70-2020 [Section No. 625.102(D)]

(D) Protection of ~~Output Cable~~ Cords and Cables to the Primary Pad .

The output cable to the primary pad shall be secured in place over its entire length for the purpose of restricting its movement and to prevent strain at the connection points. If installed in conditions where drive-over could occur, the cable shall be provided with supplemental protection. ~~Where the charger power converter is a part of the primary pad assembly, the power supply cord to the primary pad shall also be protected~~

In the case where there is no control box, the cord or cable supplying power to the primary pad shall be secured in place in order to restrict movement and to prevent strain at the connection points. If installed in conditions where drive-over could occur, it shall be provided with supplemental protection .

Statement of Problem and Substantiation for Public Input

This Public Input proposal is made for the purpose of better integrating WPT into Article 625 and is part of a set of Public Inputs which share the same General Justification. See PI 2375 for more details.

EXPLANATION FOR THIS PUBLIC INPUT PROPOSAL 2392

The title is proposed to be changed to more accurately reflect the text in this section. Change the title to "Protection of Cords or Cables to the Primary Pad"

When the WPTE has a control box, an output cable to the primary pad exists, and the first two sentences of the text is unchanged. The case of WPTE without a control box is separately addressed and explained here.

The current last sentence of the existing paragraph is removed, and instead, a new second paragraph is created to cover the case where there is no control box and therefore there is no output cable to the primary pad, but only a supply network connection.

WPTE cannot be portable, since 625.102(C) requires securing the primary pad. But it can be fastened in place or a fixed installation. Higher power systems (i.e SAE J2954 WPT3 systems) with input levels of 11.1 kVA cannot be fastened-in-place equipment because of the provisions of 625.44, so they must be fixed equipment.

Fastened-in-place WPTE with no control box will use a power supply cord, while fixed equipment will connect by premises wiring.
The wording proposed for the second paragraph is general in order to cover both of these cases. Securing it "over its entire length" for cord connected equipment is not consistent with being cord connected, so that phrase is included in the first paragraph but is not included in the second paragraph.

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Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2376-NFPA 70-2020 [Definition: Wireless Power Transfer Equipment (WPTE).]	Control box, a physical element of WPTE, is described in PI 2376

Submitter Information Verification

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Committee:	NEC-P12

Public Input No. 902-NFPA 70-2020 [Section No. 626.1]

626.1 Scope.

This article covers the electrical conductors and equipment external to the truck or transport refrigerated unit that ~~connect~~ connects non-propulsion electrical elements of trucks or transport refrigerated units to a supply of electricity, and the installation of equipment and devices related to electrical installations within an electrified truck parking space.

Statement of Problem and Substantiation for Public Input

It is necessary to clarify that Article 626 is not intended to apply to delivering electricity to charge batteries that provide propulsion power to trucks.

Without this clarification it could be construed that a truck battery charging parking space is an electrified truck parking space and subject to article 626.

Charging of Electric Vehicles (which per Article 100 includes trucks) is covered by Article 625. The panel may find it desirable to restrict article 625 to delivering electricity to vehicles for the purpose of propulsion.

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Committee: NEC-P12

Public Input No. 3836-NFPA 70-2020 [Section No. 626.2]

(Relocate all definitions in the 626. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

626. 2 Definitions.

The following definitions shall apply only within this article.

Cable Management System (Electrified Truck Parking Spaces).

An apparatus designed to control and organize unused lengths of cable or cord at electrified truck parking spaces.

Cord Connector.

A device that, by inserting it into a truck flanged surface inlet, establishes an electrical connection to the truck for the purpose of providing power for the on-board electric loads and may provide a means for information exchange. This device is part of the truck coupler.

Disconnecting Means, Parking Space.

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 an electrified truck parking space and intended to constitute the means of cutoff for the supply to that truck.

Electrified Truck Parking Space.

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

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

Electrified Truck Parking Space Wiring Systems.

All of the electrical wiring, equipment, and appurtenances related to electrical installations within an electrified truck parking space, including the electrified parking space supply equipment.

Overhead Gantry.

A structure consisting of horizontal framework, supported by vertical columns spanning above electrified truck parking spaces, that supports equipment, appliances, raceway, and other necessary components for the purpose of supplying electrical, HVAC, internet, communications, and other services to the spaces.

Separable Power Supply Cable Assembly.

A flexible cord or cable, including ungrounded, grounded, and equipment grounding conductors, provided with a cord connector, an attachment plug, and all other fittings, grommets, or devices installed for the purpose of delivering energy from the source of electrical supply to the truck or TRU flanged surface inlet.

Transport Refrigerated Unit (TRU).

A trailer or container, with integrated cooling or heating, or both, used for the purpose of maintaining the desired environment of temperature-sensitive goods or products.

Truck.

A motor vehicle designed for the transportation of goods, services, and equipment.

Truck Coupler.

A truck flanged surface inlet and mating cord connector.

Truck Flanged Surface Inlet.

The device(s) on the truck into which the connector(s) is inserted to provide electric energy and other services. This device is part of the truck coupler. For the purposes of this article, the truck flanged surface inlet is considered to be part of the truck and not part of the electrified truck parking space supply equipment.

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 13:50:03 EDT 2020
Committee:	NEC-P12

Public Input No. 3466-NFPA 70-2020 [Definition: Cable Management System (Electrified Truck Park...]

Relocate this definition to Article 100 and consider revising the term to coordinate with the same term in 625.2.

Cable Management System (Electrified Truck Parking Spaces).

An apparatus designed to control and organize unused lengths of cable or cord at electrified truck parking spaces.

Statement of Problem and Substantiation for Public Input

The term Cable Management System is defined by CMP-12 in Articles 625 and 626. It is not used in other articles of the code.
The NEC Style Manual revisions in Section 2.2.2 and its subdivisions requires multiple changes to the definitions in Article 100 and all Articles in the NEC including the use of acronyms in Section 3.2.3. Every panel should review all definitions under their purview and make the necessary changes to comply with the style manual revisions.

Section 2.2.2.4 Terms with Multiple Definitions. Where two or more definitions exist for a term, a task group shall be formed to work on the development of a single acceptable definition. When this cannot be accomplished, another term shall be selected or the term shall be identified in the context of the specific application.

Submitter Information Verification

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Committee: NEC-P12

Public Input No. 924-NFPA 70-2020 [Section No. 630.13]

630.13 Disconnecting Means.

A disconnecting means shall be provided in the supply circuit for each arc welder that is not equipped with a disconnect mounted as an integral part of the welder. The disconnecting means identity shall be marked in accordance with 110.22(A).~~The disconnecting means shall be a switch or circuit breaker, and its rating shall be not less than that necessary to accommodate overcurrent protection as specified under 630.12 .~~

Statement of Problem and Substantiation for Public Input

OSHA requires a disconnecting means for each Arc welder which can be accomplished be any means, including a listed cord and plug connection. the additional requirement in this section for the disconnect to be only a Switch or Circuit breaker limits the other means available and brings no added benefit to the safe operation of the welder.

1926.406 (c)(1) AC transformer, and DC rectifier arc welders. A disconnecting means shall be provided in the supply circuit for each AC transformer and DC rectifier arc welder which is not equipped with a disconnect mounted as an integral part of the welder.

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Public Input No. 925-NFPA 70-2020 [Section No. 630.15]

630.15 Grounding of Welder Secondary Circuit.

The secondary circuit conductors of an arc welder, ~~consisting of the electrode conductor and the work conductor,~~ shall not be ~~considered as premises wiring for the purpose of applying Article 250.~~ grounded

Informational Note: Connecting welder secondary circuits to grounded objects can create parallel paths and can cause objectionable current over equipment grounding conductors.

Statement of Problem and Substantiation for Public Input

the title points to grounding the welders secondary conductors. to say they are not premise wiring for the provisions of Article 250. The whole Article ! The point here is not to ground the secondary side if the system. Lets not forget this is a listed piece of equipment

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Public Input No. 2410-NFPA 70-2020 [Section No. 630.33]

630.33 Disconnecting Means.

A switch or circuit breaker shall be provided by which each resistance welder and its control equipment can be disconnected from the supply circuit. The ampere rating of this disconnecting means shall not be less than the supply conductor ampacity determined in accordance with 630.31. The supply circuit switch shall be permitted as the welder disconnecting means where the circuit supplies only one welder. The disconnecting means identity shall be marked in accordance with 110.22(A).

Statement of Problem and Substantiation for Public Input

The requirement to indicate the disconnect purpose, and the reference to 110.22(A) is because 110.22(A) applies to all disconnects. To state it in this code text is to be consistent with the similar disconnect requirements for Arc Welders (630.13).

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Committee: NEC-P12

Public Input No. 2430-NFPA 70-2020 [New Section after 630.34]

630.35 Ground-Fault Circuit-Interrupter Protection for Personnel in welding shops. All 125-volt, single-phase, 15- and 20-ampere receptacles installed in work areas where welders are operated, for electrical hand tools or portable lighting equipment, shall have ground-fault circuit-interrupter protection for personnel.

Statement of Problem and Substantiation for Public Input

Secondary and trade schools and community colleges have branch circuiting for welding equipment that is used by students who pose an elevated risk. The requirement for GFCI protection for people with hand tools should be expanded here. As noted previous public input on this issue, this change would create consistency with other sections of the code.

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Public Input No. 3839-NFPA 70-2020 [Section No. 640.2]

(Relocate all definitions in the 640. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

640. 2 Definitions.

The following definitions shall apply only within this article.

Abandoned Audio Distribution Cable.

Installed audio distribution cable that is not terminated at equipment and not identified for future use with a tag.

Audio Amplifier or Pre-Amplifier.

Electronic equipment that increases the current or voltage, or both, of an audio signal intended for use by another piece of audio equipment. *Amplifier* is the term used within this article to denote an audio amplifier.

Audio Autotransformer.

A transformer with a single winding and multiple taps intended for use with an amplifier loudspeaker signal output.

Audio Signal Processing Equipment.

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

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

Audio System.

Within this article, the totality of all equipment and interconnecting wiring used to fabricate a fully functional audio signal processing, amplification, and reproduction system.

Audio Transformer.

A transformer with two or more electrically isolated windings and multiple taps intended for use with an amplifier loudspeaker signal output.

Equipment Rack.

A framework for the support, enclosure, or both, of equipment; can be portable or stationary.

> Informational Note: See EIA/ECA 310-E-2005, *Cabinets, Racks, Panels and Associated Equipment*.

Loudspeaker.

Equipment that converts an ac electric signal into an acoustic signal. The term *speaker* is commonly used to mean *loudspeaker*.

Maximum Output Power.

The maximum power delivered by an amplifier into its rated load as determined under specified test conditions.

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

Mixer.

Equipment used to combine and level match a multiplicity of electronic signals, such as from microphones, electronic instruments, and recorded audio.

Portable Equipment.

Equipment fed with portable cords or cables intended to be moved from one place to another.

Rated Output Power.

The amplifier manufacturer's stated or marked output power capability into its rated load.

Technical Power System.

An electrical distribution system where the equipment grounding conductor is isolated from the premises grounded conductor and the premises equipment grounding conductor except at a single grounded termination point within a branch-circuit panelboard, at the originating (main breaker) branch-circuit panelboard, or at the premises grounding electrode.

Temporary Equipment.

Portable wiring and equipment intended for use with events of a transient or temporary nature where all equipment is presumed to be removed at the conclusion of the event.

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. "

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Public Input No. 36-NFPA 70-2019 [New Section after 640.3(B)]

TITLE OF NEW CONTENT

640.3(C) Communications Cables. Types CMP, CMR, CMG and CM communications cables shall be permitted to substitute for Class 2 and Class 3 cables in accordance with 725.154(A).

Statement of Problem and Substantiation for Public Input

Adding an explicit permission to use substitute cables promotes code usability because listed communications cables are regularly used as substitutes for Class 2 cables.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 38-NFPA 70-2019 [Section No. 640.3 [Excluding any Sub-Sections]]	Renumber to accomate new subsection established by PI 36
Public Input No. 38-NFPA 70-2019 [Section No. 640.3 [Excluding any Sub-Sections]]	

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Public Input No. 674-NFPA 70-2020 [Section No. 640.3(B)]

(B) Ducts, Plenums, and Other Air-Handling Spaces.

Section 300.22(B) shall apply to circuits and equipment installed in ducts specifically fabricated for environmental air. Section 300.22(C) shall apply to circuits and equipment installed in other spaces used for environmental air (plenums).

Exception No. 1: Class 2 and Class 3 cables installed in accordance with 725.135(B) and Table 725.154 shall be permitted to be installed in ducts specifically fabricated for environmental air.

Exception No. 2: Class 2 and Class 3 cables installed in accordance with 725.135(C) and Table 725.154 shall be permitted to be installed in other spaces used for environmental air (plenums).

Informational Note: NFPA 90A-~~2018~~ 2021 , *Standard for the Installation of Air-Conditioning and Ventilating Systems*, 4.3.11.2.6.5, permits loudspeakers, loudspeaker assemblies, and their accessories listed in accordance with UL 2043-2013, *Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces*, to be installed in other spaces used for environmental air (ceiling cavity plenums).

Statement of Problem and Substantiation for Public Input

Update issue date of NFPA 90A.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 675-NFPA 70-2020 [Section No. 110.12(C)]	Update issue date of NFPA 90A.
Public Input No. 676-NFPA 70-2020 [Section No. 424.66]	Update issue date of NFPA 90A.
Public Input No. 675-NFPA 70-2020 [Section No. 110.12(C)]	
Public Input No. 676-NFPA 70-2020 [Section No. 424.66]	

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Public Input No. 37-NFPA 70-2019 [Section No. 640.3(C)]

(C) Cable Trays.

Cable trays and cable tray systems shall be installed in accordance with Article 392 .

~~Informational Note: See~~

~~The installation of Class 2, Class 3 and Type PLTC cables in cable trays shall be in accordance with 725.135(H) , 725.136(G)~~

~~,~~

~~and Table 725.154~~

~~for the use of Class 2, Class 3, and Type PLTC cable in cable trays~~

~~.~~

Statement of Problem and Substantiation for Public Input

Code usability is improved by specifically citing the sections in Article 725 that deal with cable trays.

It appears that the software has a problem with this PI. The recommended text should read:

(C) Cable Trays.
Cable trays and cable tray systems shall be installed in accordance with Article 392. The installation of Class 2, Class 3 and Type PLTC cables in cable trays shall be in accordance with 725.135(H), 725.136(G) and Table 725.154.

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Public Input No. 38-NFPA 70-2019 [Section No. 640.3 [Excluding any Sub-Sections]]

Circuits and equipment shall comply with 640.3(A) through (~~M~~ N), as applicable.

Statement of Problem and Substantiation for Public Input

PI 36 introduces a new (C) which requires the renumbering of the existing sections 640.3(C) through 640.3(M).

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 36-NFPA 70-2019 [New Section after 640.3(B)]	Establishes new subsection 640.3(C)
Public Input No. 36-NFPA 70-2019 [New Section after 640.3(B)]	

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Public Input No. 2308-NFPA 70-2020 [Section No. 640.6(C)]

(C) Installed Audio Distribution Cable Identified for Future Use.

(1)– **Cable Identification Means**

Cables identified for future use shall be marked with a tag of sufficient durability to withstand the environment involved.

(2)– **Cable Tag Criteria**

Cable tags shall have the following information:

(1) Date cable was identified for future use

(2) Date of intended use

(3) Information related to the intended future use of cable

Statement of Problem and Substantiation for Public Input

The word description for this numerical paragraph heading is absent, and is not consistent to the typical NEC text format. The topical heading may help clarify distinctions in application for code text searches.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2309-NFPA 70-2020 [Section No. 645.5(H)]	
Public Input No. 2309-NFPA 70-2020 [Section No. 645.5(H)]	

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Public Input No. 423-NFPA 70-2020 [Section No. 640.21(B)]

(B) Between Loudspeakers and Amplifiers or Between Loudspeakers.

Cables used to connect loudspeakers to each other or to an amplifier shall comply with Article 725. Other listed cable types and assemblies, including optional hybrid communications, signal, and ~~composite~~ hybrid optical fiber cables, shall be permitted.

Statement of Problem and Substantiation for Public Input

Public Input No. 416 proposes to change "composite optical fiber cable" to "hybrid optical fiber cable" in order to align the NEC with current U.S and international definitions. Acceptance of PI 416 necessitates changing "composite optical fiber cable" to "hybrid optical fiber cable" throughout the NEC. This is a coordinating Public Input to PI 416.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 416-NFPA 70-2020 [Definition: Cable, Optical Fiber, Composite.]	Changes definition of composite optical fiber cable to hybrid optical fiber cable
Public Input No. 417-NFPA 70-2020 [Section No. 770.3(C)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 418-NFPA 70-2020 [Section No. 770.133(B)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 419-NFPA 70-2020 [Section No. 830.1]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 420-NFPA 70-2020 [Section No. 500.8(F)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 421-NFPA 70-2020 [Section No. 505.9(F)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 422-NFPA 70-2020 [Section No. 506.9(F)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 424-NFPA 70-2020 [Section No. 640.21(C)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 425-NFPA 70-2020 [Section No. 640.42(B)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 426-NFPA 70-2020 [Section No. 640.42(C)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 416-NFPA 70-2020 [Definition: Cable, Optical Fiber, Composite.]	
Public Input No. 417-NFPA 70-2020 [Section No. 770.3(C)]	
Public Input No. 418-NFPA 70-2020 [Section No. 770.133(B)]	
Public Input No. 419-NFPA 70-2020 [Section No. 830.1]	

Public Input No. 420-NFPA 70-2020
[Section No. 500.8(F)]

Public Input No. 421-NFPA 70-2020
[Section No. 505.9(F)]

Public Input No. 422-NFPA 70-2020
[Section No. 506.9(F)]

Public Input No. 424-NFPA 70-2020
[Section No. 640.21(C)]

Public Input No. 425-NFPA 70-2020
[Section No. 640.42(B)]

Public Input No. 426-NFPA 70-2020
[Section No. 640.42(C)]

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Public Input No. 424-NFPA 70-2020 [Section No. 640.21(C)]

(C) Between Equipment.

Cables used for the distribution of audio signals between equipment shall comply with Article 725. Other listed cable types and assemblies, including optional hybrid communications, signal, and ~~composite~~ hybrid optical fiber cables, shall be permitted. Other cable types and assemblies specified by the equipment manufacturer as acceptable for the use shall be permitted in accordance with 110.3(B).

Informational Note: See 770.3 for the classification of ~~composite~~ hybrid optical fiber cables.

Statement of Problem and Substantiation for Public Input

Public Input No. 416 proposes to change “composite optical fiber cable” to “hybrid optical fiber cable” in order to align the NEC with current U.S and international definitions. Acceptance of PI 416 necessitates changing “composite optical fiber cable” to “hybrid optical fiber cable” throughout the NEC. This is a coordinating Public Input to PI 416.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 416-NFPA 70-2020 [Definition: Cable, Optical Fiber, Composite.]	Changes definition of composite optical fiber cable to hybrid optical fiber cable
Public Input No. 417-NFPA 70-2020 [Section No. 770.3(C)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 418-NFPA 70-2020 [Section No. 770.133(B)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 419-NFPA 70-2020 [Section No. 830.1]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 420-NFPA 70-2020 [Section No. 500.8(F)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 421-NFPA 70-2020 [Section No. 505.9(F)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 422-NFPA 70-2020 [Section No. 506.9(F)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 423-NFPA 70-2020 [Section No. 640.21(B)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 425-NFPA 70-2020 [Section No. 640.42(B)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 426-NFPA 70-2020 [Section No. 640.42(C)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 416-NFPA 70-2020 [Definition: Cable, Optical Fiber, Composite.]	
Public Input No. 417-NFPA 70-2020 [Section No. 770.3(C)]	
Public Input No. 418-NFPA 70-2020 [Section No. 770.133(B)]	

Public Input No. 419-NFPA 70-2020 [Section No. 830.1]

Public Input No. 420-NFPA 70-2020 [Section No. 500.8(F)]

Public Input No. 421-NFPA 70-2020 [Section No. 505.9(F)]

Public Input No. 422-NFPA 70-2020 [Section No. 506.9(F)]

Public Input No. 423-NFPA 70-2020 [Section No. 640.21(B)]

Public Input No. 425-NFPA 70-2020 [Section No. 640.42(B)]

Public Input No. 426-NFPA 70-2020 [Section No. 640.42(C)]

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Public Input No. 4088-NFPA 70-2020 [Section No. 640.21(D)]

(D) Between Equipment and Power Supplies Other Than Branch-Circuit Power.

The following power supplies, other than branch-circuit power supplies, shall be installed and wired between equipment in accordance ~~with the requirements of~~ with this *Code* for the voltage and power delivered:

(1) Storage batteries

(2) Transformers

(3) Transformer rectifiers

(4) Other ac or dc power supplies

Informational Note: For some equipment, these sources such as in items (1) and (2) serve as the only source of power. These could, in turn, be supplied with intermittent or continuous branch-circuit power.

Statement of Problem and Substantiation for Public Input

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

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Public Input No. 425-NFPA 70-2020 [Section No. 640.42(B)]

(B) Between Loudspeakers and Amplifiers, or Between Loudspeakers.

Installation of flexible cords and cables used to connect loudspeakers to each other or to an amplifier shall comply with Part I of Article 400 and Parts I, II, III, and IV of Article 725, respectively. Cords and cables listed for portable use, either hard or extra-hard usage as defined by Article 400, shall also be permitted. Other listed cable types and assemblies, including optional hybrid communications, signal, and ~~composite~~ hybrid optical fiber cables, shall be permitted.

Statement of Problem and Substantiation for Public Input

Public Input No. 416 proposes to change "composite optical fiber cable" to "hybrid optical fiber cable" in order to align the NEC with current U.S and international definitions. Acceptance of PI 416 necessitates changing "composite optical fiber cable" to "hybrid optical fiber cable" throughout the NEC. This is a coordinating Public Input to PI 416.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 416-NFPA 70-2020 [Definition: Cable, Optical Fiber, Composite.]	Changes definition of composite optical fiber cable to hybrid optical fiber cable
Public Input No. 417-NFPA 70-2020 [Section No. 770.3(C)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 418-NFPA 70-2020 [Section No. 770.133(B)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 419-NFPA 70-2020 [Section No. 830.1]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 420-NFPA 70-2020 [Section No. 500.8(F)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 421-NFPA 70-2020 [Section No. 505.9(F)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 422-NFPA 70-2020 [Section No. 506.9(F)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 423-NFPA 70-2020 [Section No. 640.21(B)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 424-NFPA 70-2020 [Section No. 640.21(C)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 426-NFPA 70-2020 [Section No. 640.42(C)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 416-NFPA 70-2020 [Definition: Cable, Optical Fiber, Composite.]	
Public Input No. 417-NFPA 70-2020 [Section No. 770.3(C)]	
Public Input No. 418-NFPA 70-2020 [Section No. 770.133(B)]	

Public Input No. 419-NFPA 70-2020 [Section No. 830.1]

Public Input No. 420-NFPA 70-2020 [Section No. 500.8(F)]

Public Input No. 421-NFPA 70-2020 [Section No. 505.9(F)]

Public Input No. 422-NFPA 70-2020 [Section No. 506.9(F)]

Public Input No. 423-NFPA 70-2020 [Section No. 640.21(B)]

Public Input No. 424-NFPA 70-2020 [Section No. 640.21(C)]

Public Input No. 426-NFPA 70-2020 [Section No. 640.42(C)]

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Public Input No. 426-NFPA 70-2020 [Section No. 640.42(C)]

(C) Between Equipment and/or Between Equipment Racks.

Installation of flexible cords and cables used for the distribution of audio signals between equipment shall comply with Parts I and II of Article 400 and Parts I, II, and III of Article 725, respectively. Cords and cables listed for portable use, either hard or extra-hard service as defined by Article 400, shall also be permitted. Other listed cable types and assemblies, including optional hybrid communications, signal, and ~~composite~~ hybrid optical fiber cables, shall be permitted.

Statement of Problem and Substantiation for Public Input

Public Input No. 416 proposes to change “composite optical fiber cable” to “hybrid optical fiber cable” in order to align the NEC with current U.S and international definitions. Acceptance of PI 416 necessitates changing “composite optical fiber cable” to “hybrid optical fiber cable” throughout the NEC. This is a coordinating Public Input to PI 416.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 416-NFPA 70-2020 [Definition: Cable, Optical Fiber, Composite.]	Changes definition of composite optical fiber cable to hybrid optical fiber cable
Public Input No. 417-NFPA 70-2020 [Section No. 770.3(C)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 418-NFPA 70-2020 [Section No. 770.133(B)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 419-NFPA 70-2020 [Section No. 830.1]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 420-NFPA 70-2020 [Section No. 500.8(F)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 421-NFPA 70-2020 [Section No. 505.9(F)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 422-NFPA 70-2020 [Section No. 506.9(F)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 423-NFPA 70-2020 [Section No. 640.21(B)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 424-NFPA 70-2020 [Section No. 640.21(C)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 425-NFPA 70-2020 [Section No. 640.42(B)]	Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416
Public Input No. 416-NFPA 70-2020 [Definition: Cable, Optical Fiber, Composite.]	
Public Input No. 417-NFPA 70-2020 [Section No. 770.3(C)]	
Public Input No. 418-NFPA 70-2020 [Section No. 770.133(B)]	

Public Input No. 419-NFPA 70-2020
[Section No. 830.1]

Public Input No. 420-NFPA 70-2020
[Section No. 500.8(F)]

Public Input No. 421-NFPA 70-2020
[Section No. 505.9(F)]

Public Input No. 422-NFPA 70-2020
[Section No. 506.9(F)]

Public Input No. 423-NFPA 70-2020
[Section No. 640.21(B)]

Public Input No. 424-NFPA 70-2020
[Section No. 640.21(C)]

Public Input No. 425-NFPA 70-2020
[Section No. 640.42(B)]

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Committee:	NEC-P12

Public Input No. 4090-NFPA 70-2020 [Section No. 640.42(D)]

(D) Between Equipment, Equipment Racks, and Power Supplies Other Than Branch-Circuit Power.

Wiring between the following power supplies, other than branch-circuit power supplies, shall be installed, connected, or wired in accordance ~~with the requirements of~~ with this *Code* for the voltage and power required:

(1) Storage batteries

(2) Transformers

(3) Transformer rectifiers

(4) Other ac or dc power supplies

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

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Committee: NEC-P12

Public Input No. 3840-NFPA 70-2020 [Section No. 645.2]

(Relocate all definitions in the 645. 2 to Article 100, arrange them in alphabetical order and without any subdivisions)

645. 2 Definitions.

The following definitions shall apply only within this article.

Abandoned Supply Circuits and Interconnecting Cables.

Installed supply circuits and interconnecting cables that are not terminated at equipment and not identified for future use with a tag.

Critical Operations Data System.

An information technology equipment system that requires continuous operation for reasons of public safety, emergency management, national security, or business continuity.

Remote Disconnect Control.

An electric device and circuit that controls a disconnecting means through a relay or equivalent device.

Zone.

A physically identifiable area (such as barriers or separation by distance) within an information technology equipment room, with dedicated power and cooling systems for the information technology equipment or systems.

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. "

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Committee:	NEC-P12

Public Input No. 546-NFPA 70-2020 [Section No. 645.3]

~~**645.3** Other Articles.~~

~~Circuits and equipment shall comply with 645.3(A) through (I), as applicable.~~

~~**(A)** Spread of Fire or Products of Combustion.~~

~~Sections 300.21 , 770.26 , and 800.26 shall apply to penetrations of the fire-resistant room boundary.~~

~~**(B)** Wiring and Cabling in Other Spaces Used for Environmental Air (Plenums).~~

~~The following sections and tables shall apply to wiring and cabling in other spaces used for environmental air (plenums) above an information technology equipment room:~~

(1) ~~Wiring methods: 300.22(C)(1)~~

(2) ~~Class 2, Class 3, and PLTC cables: 725.135(C) and Table 725.154~~

(3) ~~Fire alarm systems: 760.53(B)(2) , 760.135(C) , and Table 760.154~~

(4) ~~Optical fiber cables: 770.113(C) and Table 770.154(a)~~

(5) ~~Communications circuits: 800.113 and Table 800.154(a)~~

(6) ~~CATV and radio distribution systems: 800.113 and Table 800.154(a)~~

~~**(C)** Bonding and Grounding.~~

~~The non-current-carrying conductive members of optical fiber cables in an information technology equipment room shall be bonded and grounded in accordance with 770.114 .~~

~~**(D)** Electrical Classification of Data Circuits.~~

~~Section 725.121(A)(4) shall apply to the electrical classification of listed information technology equipment signaling circuits. Sections 725.139(D)(1) and 805.133(A)(1) (c) shall apply to the electrical classification of Class 2 and Class 3 circuits in the same cable with communications circuits.~~

~~**(E)** Fire Alarm Cables and Equipment.~~

~~Parts I, II, and III of Article 760 shall apply to fire alarm systems cables and equipment installed in an information technology equipment room. Only fire alarm cables listed in accordance with Part IV of Article 760 and listed fire alarm equipment shall be permitted to be installed in an information technology equipment room.~~

~~**(F)** Cable Routing Assemblies, Communications Wires, Cables, Raceways, and Equipment.~~

~~Sections 800.110 , 800.113 , and 800.154 shall apply to cable routing assemblies and communications raceways. Parts I, II, III, IV, and V of Article 805 shall apply to communications wires, cables, and equipment installed in an information technology equipment room. Only communications wires and cables listed in accordance with 805.179 , cable routing assemblies, and communications raceways listed in accordance with 800.182 , and communications equipment listed in accordance with 805.170 shall be permitted to be installed in an information technology equipment room. Article 645 shall apply to the powering of communications equipment in an information technology equipment room.~~

> ~~Informational Note: See Part I of Article 100, Definitions, for a definition of communications equipment.~~

~~**(G)** Community Antenna Television and Radio Distribution Systems Cables and Equipment.~~

~~Parts I, II, III, IV, and V of Article 820 shall apply to community antenna television and radio distribution systems cables and equipment installed in an information technology equipment room. Only community antenna television and radio distribution cables listed in accordance with 820.179 and listed CATV equipment shall be permitted to be installed in an information technology equipment room. Article 645 shall apply to the powering of community antenna television and radio distribution systems equipment installed in an information technology equipment room.~~

~~**(H)** Optical Fiber Cables.~~

~~Only optical fiber cables listed in accordance with 770.179 shall be permitted to be installed in an information technology equipment room.~~

~~**(I)** Cables Not in Information Technology Equipment Room.~~

~~Cables extending beyond the information technology equipment room shall be subject to the applicable requirements of this *Code* .~~

Statement of Problem and Substantiation for Public Input

This is covered by 90.3.

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Public Input No. 2727-NFPA 70-2020 [Section No. 645.3(B)]

(B) Wiring and Cabling in Other Spaces Used for Environmental Air (Plenums).

The following sections and tables shall apply to wiring and cabling in other spaces used for environmental air (plenums) above an information technology equipment room:

(1) Wiring methods: 300.22(C)(1)

(2) Class 2, Class 3, and PLTC cables: 725.135(C) and Table 725.154

(3) Fire alarm systems: 760.53(B)(2), 760.135(C), and Table 760.154

(4) Optical fiber cables: 770.113(C) ~~and Table 770.154(a)~~

(5) Communications circuits: 800.113 ~~and Table 800.154(a)~~

(6) CATV and radio distribution systems: 800.113 ~~and Table 800.154(a)~~

Statement of Problem and Substantiation for Public Input

This is a coordinating Public Input to Public Inputs 2556 & 2716.

PI 2556 recommends the deletion of Table 770.154(a). PI 2716 recommends deletion of 800.154, which includes Tables 800.154(a), (b) & (c).

If the recommendations of Public Inputs 2556 & PI 2716 are accepted, then all references to Table 770.154(a), 800.154, and Tables 800.154(a) ,(b) &(c), will need to be deleted.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2556-NFPA 70-2020 [Section No. 770.154]	Deletes Table 770.154(a)
Public Input No. 2716-NFPA 70-2020 [Section No. 800.154]	Deletes 800.154

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Committee: NEC-P12

Public Input No. 39-NFPA 70-2019 [Section No. 645.3(B)]

(B) Wiring and Cabling in Other Spaces Used for Environmental Air (Plenums).

The following sections and tables shall apply to wiring and cabling in other spaces used for environmental air (plenums) above an information technology equipment room:

(1) Wiring methods: 300.22(C)(1)

(2) Class 2, Class 3, and PLTC cables: 725.135(C) and Table 725.154

(3) Fire alarm systems: 760.53(B)(2), 760.135(C), and Table 760.154

(4) Optical fiber cables: 770.113(C) and Table 770.154(a)

(5) Communications circuits: 800.113(C) and Table 800.154(a)

(6) CATV and radio distribution systems: 800.113(C) and Table 800.154(a)

Statement of Problem and Substantiation for Public Input

This PI is corrects the references to 800.113.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 45-NFPA 70-2019 [Section No. 646.3(B)]	Correct references to Article 800
Public Input No. 44-NFPA 70-2019 [Section No. 645.10(B)]	Correct references to Article 800
Public Input No. 44-NFPA 70-2019 [Section No. 645.10(B)]	
Public Input No. 45-NFPA 70-2019 [Section No. 646.3(B)]	

Submitter Information Verification

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Committee: NEC-P12

Public Input No. 40-NFPA 70-2019 [Section No. 645.3(D)]

(D) Electrical Classification of Data Circuits.

Section 725.121(A)(4) shall apply to the electrical classification of listed information technology equipment signaling circuits. ~~Sections 725.139(D)(1) and 805.133(A)(1) (c) shall apply to the electrical classification of Class 2 and Class 3 circuits in the same cable with communications circuits.~~

Statement of Problem and Substantiation for Public Input

The deleted text refers to text that was in the 2017 NEC but deleted from the 2020 NEC.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 46-NFPA 70-2019 [Section No. 646.3(D)]	Parallel PI for Article 646
Public Input No. 46-NFPA 70-2019 [Section No. 646.3(D)]	

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Committee: NEC-P12

Public Input No. 2729-NFPA 70-2020 [Section No. 645.3(F)]

(F) Cable Routing Assemblies, Communications Wires, Cables, Raceways, and Equipment.

Sections 800.110 ~~,~~ and 800.113~~, and 800.154 shall~~ shall apply to cable routing assemblies and communications raceways. Parts I, II, III, IV, and V of Article 805 shall apply to communications wires, cables, and equipment installed in an information technology equipment room. Only communications wires and cables listed in accordance with 805.179, cable routing assemblies, and communications raceways listed in accordance with 800.182, and communications equipment listed in accordance with 805.170 shall be permitted to be installed in an information technology equipment room. Article 645 shall apply to the powering of communications equipment in an information technology equipment room.

Informational Note: See Part I of Article 100, Definitions, for a definition of communications equipment.

Statement of Problem and Substantiation for Public Input

This is a coordinating Public Input to PI 2716.

PI 2716 recommends deletion of 800.154, which includes Tables 800.154(a), (b) & (c).

If the recommendation of PI 2716 is accepted, then all references to 800.154, and Tables 800.154(a), (b) &(c), will need to be deleted.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2716-NFPA 70-2020 [Section No. 800.154]	Deletes 800.154

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Committee: NEC-P12

Public Input No. 41-NFPA 70-2019 [Section No. 645.3(F)]

(F) Cable Routing Assemblies, Communications Wires, Cables, Raceways, and Equipment.

Sections 800.110, 800.113, and 800.154 shall apply to cable routing assemblies and communications raceways. Parts I, II, III, IV, and V of ~~Article~~ Articles 800 and 805 shall apply to communications wires, cables, and equipment installed in an information technology equipment room. Only communications wires and cables listed in accordance with 805.179, cable routing assemblies, and communications raceways listed in accordance with 800.182, and communications equipment listed in accordance with 800.179 and 805.170 shall be permitted to be installed in an information technology equipment room. Article 645 shall apply to the powering of communications equipment in an information technology equipment room.

Informational Note: See Part I of Article 100, Definitions, for a definition of communications equipment.

Statement of Problem and Substantiation for Public Input

The requirements for installation of communications wires and cables are in Articles 800 and 805.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 47-NFPA 70-2019 [Section No. 646.3(F)]	Adds references to Article 800
Public Input No. 42-NFPA 70-2019 [Section No. 645.3(G)]	Adds references to Article 800
Public Input No. 48-NFPA 70-2019 [Section No. 646.3(G)]	Adds references to Article 800
Public Input No. 42-NFPA 70-2019 [Section No. 645.3(G)]	
Public Input No. 47-NFPA 70-2019 [Section No. 646.3(F)]	
Public Input No. 48-NFPA 70-2019 [Section No. 646.3(G)]	

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Public Input No. 42-NFPA 70-2019 [Section No. 645.3(G)]

(G) Community Antenna Television and Radio Distribution Systems Cables and Equipment.

Parts I, II, III, IV, and V of ~~Article~~ Articles 800 and 820 shall apply to community antenna television and radio distribution systems cables and equipment installed in an information technology equipment room. Only community antenna television and radio distribution cables listed in accordance with 820.179 and listed CATV equipment shall be permitted to be installed in an information technology equipment room. Article 645 shall apply to the powering of community antenna television and radio distribution systems equipment installed in an information technology equipment room.

Statement of Problem and Substantiation for Public Input

CATV requirements are in Articles 800 and 820.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 48-NFPA 70-2019 [Section No. 646.3(G)]	Adds references to Article 800
Public Input No. 41-NFPA 70-2019 [Section No. 645.3(F)]	Adds references to Article 800
Public Input No. 47-NFPA 70-2019 [Section No. 646.3(F)]	Adds references to Article 800
Public Input No. 41-NFPA 70-2019 [Section No. 645.3(F)]	
Public Input No. 47-NFPA 70-2019 [Section No. 646.3(F)]	
Public Input No. 48-NFPA 70-2019 [Section No. 646.3(G)]	

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Committee: NEC-P12

Public Input No. 526-NFPA 70-2020 [Section No. 645.4]

645.4 Special Requirements for Information Technology Equipment Room.

<u>All requirements of this article shall be considered optional, other than as follows.</u>

The alternative wiring methods to Chapter 3 and Parts I and III of Article 725 for signaling wiring and Parts I and V of Article 770 for optical fiber cabling shall be permitted where all of the following conditions are met:

(1) Disconnecting means complying with 645.10 are provided.

(2) A heating/ventilating/air-conditioning (HVAC) system is provided in one of the methods identified in 645.4(2) a or b.

(3) <u>A separate HVAC system that is dedicated for information technology equipment use and is separated from other areas of occupancy; or</u>

(4) <u>An HVAC system that serves other occupancies and meets all of the following:</u>

(5) <u>Also serves the information technology equipment room</u>

(6) <u>Provides fire/smoke dampers at the point of penetration of the room boundary</u>

(7) <u>Activates the damper operation upon initiation by smoke detector alarms, by operation of the disconnecting means required by 645.10 , or by both</u>

Informational Note: For further information, see NFPA 75-2017, *Standard for the Fire Protection of Information Technology Equipment*, Chapter 10, 10.1, 10.1.1, 10.1.2, and 10.1.3.

(8) All information technology and communications equipment installed in the room is listed.

(9) The room is occupied by, and accessible to, only those personnel needed for the maintenance and functional operation of the installed information technology equipment.

(10) The room is separated from other occupancies by fire-resistant-rated walls, floors, and ceilings with protected openings.

Informational Note: For further information on room construction requirements, see NFPA 75-2017, *Standard for the Fire Protection of Information Technology Equipment*, Chapter 5.

(11) Only electrical equipment and wiring associated with the operation of the information technology room is installed in the room.

Informational Note: HVAC systems, communications systems, and monitoring systems such as telephone, fire alarm systems, security systems, water detection systems, and other related protective equipment are examples of equipment associated with the operation of the information technology room.

Statement of Problem and Substantiation for Public Input

The definition of an IT equipment room includes any office in a commercial building, as well as essentially every dwelling unit. The fact that I have a computer or a modem in a room should not initiate the requirements of this article. I wonder how many of the CMP members have a 645.10 disconnecting mean in their house?

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Public Input No. 1390-NFPA 70-2020 [Section No. 645.5(A)]

(A) Branch-Circuit ~~Conductors~~ .

The branch-circuit conductors ~~supplying~~ and overcurrent protective device for one or more units of information technology equipment shall have an ampacity not less than 125 percent of the total connected load.

Statement of Problem and Substantiation for Public Input

I added 'overcurrent protective device' to the rule, since that is also sized to 125%.

Submitter Information Verification

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Submittal Date: Tue Jun 02 10:32:44 EDT 2020
Committee: NEC-P12

Public Input No. 4702-NFPA 70-2020 [Section No. 645.5(B)]

(B) Power-Supply Cords.

Information technology equipment shall be permitted to be connected to a branch circuit by a power-supply cord.

(1) Power-supply cords shall not exceed 4.5 m (15 ft).

(2) Power cords shall be listed and a type permitted for use on listed information technology equipment or shall be constructed of listed flexible cord and listed attachment plugs and cord connectors of a type permitted for information technology equipment.

(3) Plugs and receptacles used to connect the power cords shall be listed and identified for the system voltage for it is applied.

Informational Note 1 : One method of determining if cords are of a type permitted for the purpose is found in UL 60950-1-2007, *Safety of Information Technology Equipment — Safety — Part 1: General Requirements;* or UL 62368-1-2012, *Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements* .

Informational Note 2: NEMA WD-6 2016 identifies plugs and receptacle configurations L25-30P and L25-30R for 240Vac and L26-30P and L26-30R for 240/415Vac.

Statement of Problem and Substantiation for Public Input

Data center power cord plugs and receptacles have been permitted to be used outside of their voltage rating on system voltages such as 415Vac as that is a common voltage used for data center racks/servers. A label created and applied in the field was allowed to be used to “re-identify” the plug/receptacle as there was not a NEMA configuration plug and receptacle for the specific applied voltage commercially available. Since, at least 2 manufacturers along with NEMA has created the L25 and L26 NEMA configurations and manufactured the plug/receptacle for these specific applications. This previous misapplication needs to have attention brought to it as the equipment with the incorrect plugs/receptacles could be moved and utilized in a voltage system that the plug/receptacle could physically be plugged into and an incorrect system voltage applied to the equipment creating a significantly unsafe installation. The L25 and L26 NEMA configuration plug/receptacle will provide physical rejection to applying the incorrect system voltage to what the equipment is actually rated for.

Submitter Information Verification

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Committee: NEC-P12

Public Input No. 795-NFPA 70-2020 [Section No. 645.5(B)]

(B) Power-Supply Cords.

Information technology equipment shall be permitted to be connected to a branch circuit by a power-supply cord.

(1) Power-supply cords shall not exceed 4.5 m (15 ft).

(2) Power-supply cords shall be listed and a type permitted for use on listed information technology equipment or shall be constructed of listed flexible cord and listed attachment plugs and cord connectors of a type permitted for information technology equipment.

Informational Note: One method of determining if power-supply cords are of a type permitted for the purpose is found in UL 60950-1-2007, *Safety of Information Technology Equipment — Safety — Part 1: General Requirements;* or UL 62368-1-2012, *Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements*.

Statement of Problem and Substantiation for Public Input

The term "power-supply cord" should be consistently used throughout 645(B)

Submitter Information Verification

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Submittal Date: Thu Mar 26 15:42:46 EDT 2020
Committee: NEC-P12

Public Input No. 796-NFPA 70-2020 [Section No. 645.5(D)]

(D) Physical Protection.

Where exposed to physical damage, ~~supply circuits~~ power-supply cords, branch circuit supply conductors and interconnecting cables shall be protected.

Statement of Problem and Substantiation for Public Input

The proposed modifications are for consistency with the terms used in 645(B) and 645(E)(1)

Submitter Information Verification

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Committee:	NEC-P12

Public Input No. 797-NFPA 70-2020 [Section No. 645.5(E)]

(E) Under Raised Floors.

Where the area under the floor is accessible and openings minimize the entrance of debris beneath the floor, power- ~~cables~~ -supply cords , communications cables, connecting cables, interconnecting cables, cord-and-plug connections, and receptacles associated with the information technology equipment shall be permitted under a raised floor of approved construction. The installation requirement shall comply with 645.5(E)(1) through (E)(3).

(1) Installation Requirements for Branch Circuit Supply Conductors Under a Raised Floor.

(a) The supply conductors shall be installed in accordance with the requirements of 300.11.

(b) In addition to the wiring methods of 300.22(C), the following wiring methods shall also be permitted:

(3) Rigid metal conduit

(4) Rigid nonmetallic conduit

(5) Intermediate metal conduit

(6) Electrical metallic tubing

(7) Electrical nonmetallic tubing

(8) Metal wireway

(9) Nonmetallic wireway

(10) Surface metal raceway with metal cover

(11) Surface nonmetallic raceway

(12) Flexible metal conduit

(13) Liquidtight flexible metal conduit

(14) Liquidtight flexible nonmetallic conduit

(15) Type MI cable

(16) Type MC cable

(17) Type AC cable

(18) Associated metallic and nonmetallic boxes or enclosures

(19) Type TC power and control tray cable

(2) Installation Requirements for ~~Electrical~~ Power- Supply Cords, Data Cables, Interconnecting Cables, and Grounding Conductors Under a Raised Floor.

The following cords, cables, and conductors shall be permitted to be installed under a raised floor:

(1) ~~Supply~~ Power-supply cords of listed information technology equipment in accordance with 645.5(B).

(2) Interconnecting cables enclosed in a raceway.

(3) Equipment grounding conductors.

(4) Where the air space under a raised floor is protected by an automatic fire suppression system, in addition to wiring installed in compliance with 725.135(C), Types CL2R, CL3R, CL2, and CL3 and substitute cables including CMP, CMR, CM, and CMG installed in accordance with 725.154(A) shall be permitted under raised floors.

Informational Note: Figure 725.154(A) illustrates the cable substitution hierarchy for Class 2 and Class 3 cables.

(5) Where the air space under a raised floor is not protected by an automatic fire suppression system, in addition to wiring installed in compliance with 725.135(C), substitute cable Type CMP installed in accordance with 725.154(A) shall be permitted under raised floors.

(6) Listed Type DP cable having adequate fire-resistant characteristics suitable for use under raised floors of an information technology equipment room.

Informational Note: One method of defining *fire resistance* is by establishing that the cables do not spread fire to the top of the tray in the “UL Flame Exposure, Vertical Tray Flame Test” in UL 1685-2015, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*. The smoke measurements in the test method are not applicable.

Another method of defining *fire resistance* is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA “Vertical Flame Test — Cables in Cable Trays,” as described in CSA C22.2 No. 0.3-2014, *Test Methods for Electrical Wires and Cables*.

(3) Installation Requirements for Optical Fiber Cables Under a Raised Floor.

The installation of optical fiber cables shall comply with either of the following:

(1) Where the air space under a raised floor is protected by an automatic fire suppression system, optical fiber cables installed in accordance with 770.113(C), Types OFNR, OFCR, OFN, and OFC shall be permitted under raised floors.

(2) Where the air space under a raised floor is not protected by an automatic fire suppression system, only optical fiber cables installed in accordance with 770.113(C) shall be permitted under raised floors.

Statement of Problem and Substantiation for Public Input

The proposed modifications are for consistency with the term used in 645(B)

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Committee:	NEC-P12

Public Input No. 1403-NFPA 70-2020 [Section No. 645.5(E)(1)]

(1) Installation Requirements for Branch Circuit Supply Conductors Under a Raised Floor.

(a) ~~The supply conductors shall be installed in accordance with the requirements of 300.11 .~~

(b) ~~In addition to the wiring methods of 300.22(C) , the following wiring methods shall also be permitted:~~

(3) ~~Rigid metal conduit~~

(4) ~~Rigid nonmetallic conduit~~

(5) ~~Intermediate metal conduit~~

(6) ~~Electrical metallic tubing~~

(7) ~~Electrical nonmetallic tubing~~

(8) ~~Metal wireway~~

(9) ~~Nonmetallic wireway~~

(10) ~~Surface metal raceway with metal cover~~

(11) ~~Surface nonmetallic raceway~~

(12) ~~Flexible metal conduit~~

(13) ~~Liquidtight flexible metal conduit~~

(14) ~~Liquidtight flexible nonmetallic conduit~~

(15) ~~Type MI cable~~

(16) ~~Type MC cable~~

(17) ~~Type AC cable~~

(18) ~~Associated metallic and nonmetallic boxes or enclosures~~

(19) ~~Type TC power and control tray cable~~

(a) Any Chapter 3 wiring method shall be permitted.

(b) Raceways, cable assemblies, and enclosures shall be securely fastened in place.

Statement of Problem and Substantiation for Public Input

The text was revised to make it easier to know that Chapter 3 wiring is permitted and is required to be secured. The NEC user is not required to go to a different Code section (300.11).

Submitter Information Verification

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Committee:	NEC-P12

Public Input No. 1404-NFPA 70-2020 [Section No. 645.5(E)(1)]

(1) Installation Requirements for Branch Circuit Supply Conductors Under a Raised Floor.

(a) The supply conductors shall be installed in accordance with the requirements of 300.11.

(b) In addition to the wiring methods of 300.22(C), the following wiring methods shall also be permitted:

(3) Rigid metal conduit

(4) Rigid nonmetallic conduit

(5) Intermediate metal conduit

(6) Electrical metallic tubing

(7) Electrical nonmetallic tubing

(8) Metal wireway

~~Nonmetallic wireway~~

(1) ~~, nonmetallic wireways~~

(2) ~~PVC Conduit, ENT, HDPE, RTRC, LFNC,~~

(3) ~~Surface metal raceway with metal cover~~

(4) ~~Surface nonmetallic raceway~~

(5) ~~Flexible metal conduit~~

(6) ~~Liquidtight flexible metal conduit~~

(7) ~~Liquidtight flexible nonmetallic conduit~~

(8) ~~Type MI cable~~

(9) ~~Type MC cable~~

(10) ~~Type AC cable~~

(11) ~~Associated metallic and nonmetallic boxes or enclosures~~

(12) ~~Type TC power and control tray cable~~

Statement of Problem and Substantiation for Public Input

It would be better to delete the entire list and simply say any Chapter 3 wiring method is permitted or add all wiring methods permitted. There is no such thing as a nonmetallic raceway anymore.

Submitter Information Verification

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Submittal Date:	Tue Jun 02 12:02:27 EDT 2020
Committee:	NEC-P12

Public Input No. 4092-NFPA 70-2020 [Section No. 645.5(E)(1)]

(1) Installation Requirements for Branch Circuit Supply Conductors Under a Raised Floor.

(a) The supply conductors shall be installed in accordance ~~with the requirements of~~ with 300.11.

(b) In addition to the wiring methods of 300.22(C), the following wiring methods shall also be permitted:

(3) Rigid metal conduit

(4) Rigid nonmetallic conduit

(5) Intermediate metal conduit

(6) Electrical metallic tubing

(7) Electrical nonmetallic tubing

(8) Metal wireway

(9) Nonmetallic wireway

(10) Surface metal raceway with metal cover

(11) Surface nonmetallic raceway

(12) Flexible metal conduit

(13) Liquidtight flexible metal conduit

(14) Liquidtight flexible nonmetallic conduit

(15) Type MI cable

(16) Type MC cable

(17) Type AC cable

(18) Associated metallic and nonmetallic boxes or enclosures

(19) Type TC power and control tray cable

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

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Submittal Date:	Wed Sep 09 20:33:30 EDT 2020
Committee:	NEC-P12

Public Input No. 4640-NFPA 70-2020 [Section No. 645.5(E)(1)]

(1) Installation Requirements for Branch Circuit Supply Conductors Under a Raised Floor.

(a) The supply conductors shall be installed in accordance with the requirements of 300.11.

(b) In addition to the wiring methods of 300.22(C), the following wiring methods shall also be permitted:

(3) Rigid metal conduit

(4) Rigid

~~nonmetallic conduit~~

(1) polyvinyl chloride conduit

(2) Intermediate metal conduit

(3) Electrical metallic tubing

(4) Electrical nonmetallic tubing

(5) Metal wireway

(6) Nonmetallic wireway

(7) Surface metal raceway with metal cover

(8) Surface nonmetallic raceway

(9) Flexible metal conduit

(10) Liquidtight flexible metal conduit

(11) Liquidtight flexible nonmetallic conduit

(12) Type MI cable

(13) Type MC cable

(14) Type AC cable

(15) Associated metallic and nonmetallic boxes or enclosures

(16) Type TC power and control tray cable

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

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Submittal Date: Thu Sep 10 16:08:21 EDT 2020
Committee: NEC-P12

Public Input No. 43-NFPA 70-2019 [Section No. 645.5(E)(3)]

(3) Installation Requirements for Optical Fiber Cables Under a Raised Floor.

The installation of optical fiber cables shall comply with either of the following:

(1) Where the air space under a raised floor is protected by an automatic fire suppression system, optical fiber cables installed in accordance with 770.113(C), Types OFNR, OFCR, <u>OFNG, OFCG,</u> OFN, and OFC shall be permitted under raised floors.

(2) Where the air space under a raised floor is not protected by an automatic fire suppression system, only optical fiber cables installed in accordance with 770.113(C) shall be permitted under raised floors.

Statement of Problem and Substantiation for Public Input

Types OFNG and OFCG were inadvertently omitted. This PI corrects that omission.

Submitter Information Verification

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Submittal Date: Wed Nov 06 14:29:25 EST 2019
Committee: NEC-P12

Public Input No. 798-NFPA 70-2020 [Section No. 645.5(F)]

(F) Securing in Place.

Power- ~~cables~~ -supply cords ; communications cables, connecting cables, interconnecting cables, and associated boxes, connectors, plugs, and receptacles that are listed as part of, or for, information technology equipment shall not be required to be secured in place where installed under raised floors.

Informational Note: Securement requirements for raceways, cords, and cables not listed as part of, or for, information technology equipment are found in 300.11.

Statement of Problem and Substantiation for Public Input

The proposed modifications are for consistency with the terms used in 645(B) and 645(E)(2)

Submitter Information Verification

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Submittal Date: Thu Mar 26 16:34:28 EDT 2020

Committee: NEC-P12

Public Input No. 2309-NFPA 70-2020 [Section No. 645.5(H)]

(H) Installed Supply Circuits and Interconnecting Cables Identified for Future Use.

(1) Cable Identification Means

Supply circuits and interconnecting cables identified for future use shall be marked with a tag of sufficient durability to withstand the environment involved.

(2) Cable Tag Criteria

Supply circuit tags and interconnecting cable tags shall have the following information:

(1) Date identified for future use

(2) Date of intended use

(3) Information relating to the intended future use

Statement of Problem and Substantiation for Public Input

The word description for this numerical paragraph heading is absent, and is not consistent to the typical NEC text format. The topical heading may help clarify distinctions in application for code text searches

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2308-NFPA 70-2020 [Section No. 640.6(C)]	
Public Input No. 2308-NFPA 70-2020 [Section No. 640.6(C)]	

Submitter Information Verification

Submitter Full Name: John Blissett

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Submittal Date: Fri Aug 14 11:21:24 EDT 2020

Committee: NEC-P12

Public Input No. 2310-NFPA 70-2020 [Section No. 645.10(A)]

(A) Remote Disconnect Controls.

(1) Emergency Access

Remote disconnect controls shall be located at approved locations readily accessible in case of fire to authorized personnel and emergency responders.

(2) Disconnect Identification

The remote disconnect means for the control of electronic equipment power and HVAC systems shall be grouped and identified. A single means to control both systems shall be permitted.

(3) Fire/Smoke Zone Isolation

Where multiple zones are created, each zone shall have an approved means to confine fire or products of combustion to within the zone.

(4) System Operation Continuity

Additional means to prevent unintentional operation of remote disconnect controls shall be permitted.

Informational Note: For further information, see NFPA 75-2017, *Standard for the Fire Protection of Information Technology Equipment.*

Statement of Problem and Substantiation for Public Input

The word description for this numerical paragraph heading is absent, and is not consistent to the typical NEC text format. The topical heading may help clarify distinctions in application per paragraph for code text searches.

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Submittal Date: Fri Aug 14 11:47:34 EDT 2020

Committee: NEC-P12

Public Input No. 2728-NFPA 70-2020 [Section No. 645.10(B)]

(B) Critical Operations Data Systems.

Remote disconnecting controls shall not be required for critical operations data systems when all of the following conditions are met:

(1) An approved procedure has been established and maintained for removing power and air movement within the room or zone.

(2) Qualified personnel are continuously available to advise emergency responders and to instruct them of disconnecting methods.

(3) A smoke-sensing fire detection system is in place.

Informational Note: For further information, see *NFPA 72*-2019, *National Fire Alarm and Signaling Code*.

(4) An approved fire suppression system suitable for the application is in place.

(5) Cables installed under a raised floor, other than branch-circuit wiring, and power cords are installed in compliance with 645.5(E)(2) or (E)(3), or in compliance with Table 645.10(B)(5).

Table 645.10(B)(5) Cables Installed Under Raised Floors

Cable Type	Applicable Sections
Branch circuits under raised floors	645.5(E)(1)
Supply cords of listed information technology equipment	645.5(E)(2)(a), 300.22(C)
Class 2 and Class 3 remote control and PLTC cables in other spaces used for environmental air (plenums)	725.135(C) and Table 725.154
Optical fiber cable in other spaces used for environmental air (plenums)	770.113(C)~~ and Table 770.154(a)~~
Communications wires and cables, cable routing assemblies, and communications raceways in other spaces used for environmental air (plenums)	800.113 ~~,~~ and 800.113(C)~~, and Tables 800.154(a), (b), and (c)~~
Coaxial CATV and radio distribution cables in other spaces used for environmental air (plenums)	800.113(C)~~ and Table 800.154(a)~~

Statement of Problem and Substantiation for Public Input

This is a coordinating Public Input to Public Inputs 2556 & 2716.

PI 2556 recommends the deletion of Table 770.154(a). PI 2716 recommends deletion of 800.154, which includes Tables 800.154(a), (b) & (c).

If the recommendations of Public Inputs 2556 & PI 2716 are accepted, then all references to Table 770.154(a), 800.154, and Tables 800.154(a) ,(b) &(c), will need to be deleted.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2556-NFPA 70-2020 [Section No. 770.154]	Deletes Table 770.154(a)
Public Input No. 2716-NFPA 70-2020 [Section No. 800.154]	Deletes 800.154

Submitter Information Verification

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Committee:	NEC-P12

Public Input No. 44-NFPA 70-2019 [Section No. 645.10(B)]

(B) Critical Operations Data Systems.

Remote disconnecting controls shall not be required for critical operations data systems when all of the following conditions are met:

(1) An approved procedure has been established and maintained for removing power and air movement within the room or zone.

(2) Qualified personnel are continuously available to advise emergency responders and to instruct them of disconnecting methods.

(3) A smoke-sensing fire detection system is in place.

Informational Note: For further information, see *NFPA 72*-2019, *National Fire Alarm and Signaling Code*.

(4) An approved fire suppression system suitable for the application is in place.

(5) Cables installed under a raised floor, other than branch-circuit wiring, and power cords are installed in compliance with 645.5(E)(2) or (E)(3), or in compliance with Table 645.10(B)(5).

Table 645.10(B)(5) Cables Installed Under Raised Floors

Cable Type	Applicable Sections
Branch circuits under raised floors	645.5(E)(1)
Supply cords of listed information technology equipment	645.5(E)(2)(a), 300.22(C)
Class 2 and Class 3 remote control and PLTC cables in other spaces used for environmental air (plenums)	725.135(C) and Table 725.154
Optical fiber cable in other spaces used for environmental air (plenums)	770.113(C) and Table 770.154(a)
Communications wires and cables, cable routing assemblies, and communications raceways in other spaces used for environmental air (plenums)	~~800~~ 800 .113~~, 800.113~~ (C), and Tables 800.154(a), (b), and (c)
Coaxial CATV and radio distribution cables in other spaces used for environmental air (plenums)	800.113(C) and Table 800.154(a)

Statement of Problem and Substantiation for Public Input

Reference to all of 800.113 is an error. The correct reference is to 800.113(C).

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 39-NFPA 70-2019 [Section No. 645.3(B)]	Correct references to Article 800
Public Input No. 45-NFPA 70-2019 [Section No. 646.3(B)]	Correct references to Article 800
Public Input No. 39-NFPA 70-2019 [Section No. 645.3(B)]	
Public Input No. 45-NFPA 70-2019 [Section No. 646.3(B)]	

Submitter Information Verification

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Submittal Date:	Wed Nov 06 14:34:17 EST 2019
Committee:	NEC-P12

Public Input No. 3212-NFPA 70-2020 [Section No. 645.18]

645.~~18~~ ~~Surge~~ 18 Overvoltage Protection for Critical Operations Data Systems.

~~Listed surge protection~~ Overvoltage proteciton shall be provided for critical operations data systems.

Additional Proposed Changes

File Name	Description	Approved
Code_Input.docx	input to improve overvoltage protection requirements	

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. 3208-NFPA 70-2020 [Section No. 551.72(E)]	
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. 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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Organization: Self Employed

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Submittal Date:	Sun Sep 06 18:42:55 EDT 2020
Committee:	NEC-P12

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. 3673-NFPA 70-2020 [Section No. 645.18]

645.~~18~~ ~~Surge Protection~~ 18 Overvoltage Protection for Critical Operations Data Systems.

~~Listed surge protection shall be provided~~ A listed surge-protective device (SPD) shall be installed for critical operations data systems in accordance with Part II of Article 242 .

Statement of Problem and Substantiation for Public Input

The purpose of this public input is to correlate and harmonize all of the current sections of the code where "overvoltage protection" is required by:

1. Changing the section titles to "Overvoltage Protection" to properly correlate with Article 242.

2. Correcting the product description to "listed surge-protective device (SPD)" which is defined in Article 100 and correlates with Article 242.

3. Adding a pointer to "Part II. of Article 242" to ensure compliance with all of the requirements for SPDs are met when complying with the rule.

This public input is one of eleven correlating public inputs covering Sections 230.67, 501.35, 502.35, 620.51(E), 645.18, 670.6, 694.7(D), 695.15, 700.8, 708.20(D), and Informative Annex G

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Submittal Date: Wed Sep 09 10:37:24 EDT 2020

Committee: NEC-P12

Public Input No. 768-NFPA 70-2020 [New Section after 645.27]

TITLE OF NEW CONTENT

Type your content here ...

645.28 Electromagnetic Pulse (EMP) Protection. Protection for information technology equipment against the effects of electromagnetic pulses shall be provided at a minimum of Level 3. 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]	
Public Input No. 756-NFPA 70-2020 [New Section after 708.64]	

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Committee:	NEC-P12

Public Input No. 3843-NFPA 70-2020 [Section No. 646.2]

(Relocate all definitions in the 646. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

646. 2 Definitions.

The following definition shall apply only within this article.

Modular Data Center (MDC).

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

Informational Note No. 1: A typical construction may use a standard ISO shipping container or other structure as the outer enclosure, racks or cabinets of ITE, service-entrance equipment and power distribution components, power storage such as a UPS, and an air or liquid cooling system. Modular data centers are intended for fixed installation, either indoors or outdoors, based on their construction and resistance to environmental conditions. MDCs can be configured as an all-in-one system housed in a single equipment enclosure or as a system with the support equipment housed in separate equipment enclosures.

Informational Note No. 2: For information on listing requirements for both information technology equipment and communications equipment contained within a modular data center, see UL 60950-1-2014, *Information Technology Equipment — Safety — Part 1: General Requirements,* and UL 62368-1-2012, *Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements*.

Informational Note No. 3: *Modular data centers* as defined in this article are sometimes referred to as containerized data centers.

Informational Note No. 4: Equipment enclosures housing only support equipment (e.g., HVAC or power distribution equipment) that are not part of a specific modular data center are not considered a modular data center as defined in this article.

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. "

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Public Input No. 2730-NFPA 70-2020 [Section No. 646.3(B)]

(B) Wiring and Cabling in Other Spaces Used for Environmental Air (Plenums).

The following sections and tables shall apply to wiring and cabling in other spaces used for environmental air (plenums) within a modular data center space:

(1) Wiring methods: 300.22(C)(1)

(2) Class 2, Class 3, and PLTC cables: 725.135(C), and Table 725.154

(3) Fire alarm systems: 760.53(B)(2), 760.135(C), and Table 760.154

(4) Optical fiber cables: 770.113(C)~~ and Table 770.154(a)~~

(5) Communications circuits: 800.113~~ and Table 800.154(a)~~

(6) CATV and radio distribution systems: 800.113~~ and Table 800.154(a)~~

Informational Note: Environmentally controlled working spaces, aisles, and equipment areas in an MDC are not considered a plenum.

Statement of Problem and Substantiation for Public Input

This is a coordinating Public Input to Public Inputs 2556 & 2716.

PI 2556 recommends the deletion of Table 770.154(a). PI 2716 recommends deletion of 800.154, which includes Tables 800.154(a), (b) & (c).

If the recommendations of Public Inputs 2556 & PI 2716 are accepted, then all references to Table 770.154(a), 800.154, and Tables 800.154(a) ,(b) &(c), will need to be deleted.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2556-NFPA 70-2020 [Section No. 770.154]	Deletes Table 770.154(a)
Public Input No. 2716-NFPA 70-2020 [Section No. 800.154]	Deletes 800.154)

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Committee: NEC-P12

Public Input No. 45-NFPA 70-2019 [Section No. 646.3(B)]

(B) Wiring and Cabling in Other Spaces Used for Environmental Air (Plenums).

The following sections and tables shall apply to wiring and cabling in other spaces used for environmental air (plenums) within a modular data center space:

(1) Wiring methods: 300.22(C)(1)

(2) Class 2, Class 3, and PLTC cables: 725.135(C), and Table 725.154

(3) Fire alarm systems: 760.53(B)(2), 760.135(C), and Table 760.154

(4) Optical fiber cables: 770.113(C) and Table 770.154(a)

(5) Communications circuits: 800.113(C) and Table 800.154(a)

(6) CATV and radio distribution systems: 800.113(C) and Table 800.154(a)

Informational Note: Environmentally controlled working spaces, aisles, and equipment areas in an MDC are not considered a plenum.

Statement of Problem and Substantiation for Public Input

This PI is corrects the reference to 800.113.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 39-NFPA 70-2019 [Section No. 645.3(B)]	Correct references to Article 800
Public Input No. 44-NFPA 70-2019 [Section No. 645.10(B)]	Correct references to Article 800
Public Input No. 39-NFPA 70-2019 [Section No. 645.3(B)]	
Public Input No. 44-NFPA 70-2019 [Section No. 645.10(B)]	

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Submittal Date: Wed Nov 06 14:39:20 EST 2019
Committee: NEC-P12

Public Input No. 46-NFPA 70-2019 [Section No. 646.3(D)]

(D) Electrical Classification of Data Circuits.

Section 725.121(A)(4) shall apply to the electrical classification of listed information technology equipment signaling circuits. ~~Sections 725.139(D)(1) and 805.133(A)(1) (c) shall apply to the electrical classification of Class 2 and Class 3 circuits in the same cable with communications circuits.~~

Statement of Problem and Substantiation for Public Input

The deleted text refers to text that was in the 2017 NEC but deleted from the 2020 NEC.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 40-NFPA 70-2019 [Section No. 645.3(D)]	Parallel PI for Article 645
Public Input No. 40-NFPA 70-2019 [Section No. 645.3(D)]	

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Committee: NEC-P12

Public Input No. 2731-NFPA 70-2020 [Section No. 646.3(F)]

(F) Cable Routing Assemblies and Communications Wires, Cables, Raceways, and Equipment.

Sections 800.110 ~~, 800.113 ,~~ and 800.~~154~~ 113 shall apply to cable routing assemblies and communications raceways. Parts I, II, III, IV, and V of Article 805 shall apply to communications wires, cables, and equipment installed in an MDC. Only communications wires and cables listed in accordance with 805.179, cable routing assemblies and communications raceways listed in accordance with 800.182, and communications equipment listed in accordance with 805.170 shall be permitted to be installed in an MDC.

Informational Note: See Part I of Article 100 for a definition of *communications equipment*.

Statement of Problem and Substantiation for Public Input

This is a coordinating Public Input to PI 2716.

PI 2716 recommends deletion of 800.154, which includes Tables 800.154(a), (b) & (c).

If the recommendation of PI 2716 is accepted, then all references to 800.154, and Tables 800.154(a), (b) &(c), will need to be deleted.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2716-NFPA 70-2020 [Section No. 800.154]	Deletes 800.154

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Committee: NEC-P12

Public Input No. 47-NFPA 70-2019 [Section No. 646.3(F)]

(F) Cable Routing Assemblies and Communications Wires, Cables, Raceways, and Equipment.

Sections 800.110, 800.113, and 800.154 shall apply to cable routing assemblies and communications raceways. Parts I, II, III, IV, and V of ~~Article~~ <u>Articles 800 and</u> 805 shall apply to communications wires, cables, and equipment installed in an MDC. Only communications wires and cables listed in accordance with <u>800.179 and</u> 805.179, cable routing assemblies and communications raceways listed in accordance with 800.182, and communications equipment listed in accordance with 805.170 shall be permitted to be installed in an MDC.

Informational Note: See Part I of Article 100 for a definition of *communications equipment*.

Statement of Problem and Substantiation for Public Input

The requirements for communications wires and cables are in Articles 800 and 805.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 41-NFPA 70-2019 [Section No. 645.3(F)]	Adds references to Article 800
Public Input No. 42-NFPA 70-2019 [Section No. 645.3(G)]	Adds references to Article 800
Public Input No. 48-NFPA 70-2019 [Section No. 646.3(G)]	Adds references to Article 800
Public Input No. 41-NFPA 70-2019 [Section No. 645.3(F)]	
Public Input No. 42-NFPA 70-2019 [Section No. 645.3(G)]	
Public Input No. 48-NFPA 70-2019 [Section No. 646.3(G)]	

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Committee: NEC-P12

Public Input No. 48-NFPA 70-2019 [Section No. 646.3(G)]

(G) Community Antenna Television and Radio Distribution Systems Cables and Equipment.

Parts I, II, III, IV, and V of ~~Article~~ Articles 800 and 820 shall apply to community antenna television and radio distribution systems equipment installed in an MDC. Only community antenna television and radio distribution cables listed in accordance with 820.179 and listed CATV equipment shall be permitted to be installed in an MDC.

Statement of Problem and Substantiation for Public Input

CATV requirements ae in Articles 800 and 820.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 42-NFPA 70-2019 [Section No. 645.3(G)]	Adds references to Article 800
Public Input No. 41-NFPA 70-2019 [Section No. 645.3(F)]	Adds references to Article 800
Public Input No. 47-NFPA 70-2019 [Section No. 646.3(F)]	Adds references to Article 800
Public Input No. 41-NFPA 70-2019 [Section No. 645.3(F)]	
Public Input No. 42-NFPA 70-2019 [Section No. 645.3(G)]	
Public Input No. 47-NFPA 70-2019 [Section No. 646.3(F)]	

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Public Input No. 4094-NFPA 70-2020 [Section No. 646.11(B)]

(B) Non-Utility-Owned Premises Transformers.

Non-utility-owned premises distribution transformers installed in the vicinity of an MDC shall be of the dry type or the type filled with a noncombustible dielectric medium. Such transformers shall be installed in accordance ~~with the requirements of~~ with Article 450. Non-utility-owned premises distribution transformers shall not be permitted in an MDC.

Statement of Problem and Substantiation for Public Input

Deleting the words "the requirements of" does not change the meaning of the section.
The panel should consider revising the section due to a Style Manual issue 4.1.4 where a section shall not reference a complete article.

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Public Input No. 4095-NFPA 70-2020 [Section No. 646.11(C)]

(C) Power Transformers.

Power transformers that supply power only to the MDC shall be permitted to be installed in the MDC equipment enclosure. Only dry-type transformers shall be permitted to be installed in the MDC equipment enclosure. Such transformers shall be installed in accordance with the requirements of Article 450.

Statement of Problem and Substantiation for Public Input

"Deleting the words ""the requirements of"" does not change the meaning of the section.
The panel should consider revising the section due to a Style Manual issue 4.1.4 where a section shall not reference a complete article."

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Public Input No. 3575-NFPA 70-2020 [Section No. 646.19 [Excluding any Sub-Sections]]

For equipment over 1.8 m (6 ft) wide or deep, there shall be one entrance to and egress from the required working space not less than 610 mm (24 in.) wide and 2.0 m (6 ½ ft) high at each end of the working space. Doors shall open at least 90 degrees in the direction of egress and be equipped with listed panic hardware or listed fire exit hardware. A single entrance to and egress from the required working space shall be permitted where either of the conditions in 646.19(A) or (B) is met.

Additional Proposed Changes

File Name	Description	Approved
Door_obstruction.jpg	sprinkler pipe preventing electric room door from fully opening	

Statement of Problem and Substantiation for Public Input

Doors must be able to open at least 90 degrees in order for people to escape danger in an emergency situation such as an electrical explosion or arc flash event. If the door were to come to a sudden stop at only 30 degrees open due to an obstruction, people rushing through the door could be hindered or even injured during their escape. I have actually been "stunned" and even disoriented by doors not opening fully and coming to an unexpected and sudden early stop. Now imagine that scenario during an panic situation! It could result in injuries or even death.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3563-NFPA 70-2020 [Section No. 110.26(C)(3)]	door swing
Public Input No. 3566-NFPA 70-2020 [Section No. 110.33(A)(3)]	door swing
Public Input No. 3568-NFPA 70-2020 [Section No. 480.10(E)]	door swing
Public Input No. 3570-NFPA 70-2020 [Section No. 450.43(C)]	door swing
Public Input No. 3582-NFPA 70-2020 [Section No. 110.31(A)(4)]	

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THIS IS A RATED F
DO NOT PENETRAT
AT EXT. 6-2422 FOR

Public Input No. 1717-NFPA 70-2020 [Section No. 646.20(A)]

(A) Extra- Low-Voltage Circuits.

The working space about ITE where any live parts that may be exposed during routine servicing operate at not greater than 30 volts rms, 42 volts peak, or 60 volts dc shall not be required to comply with the workspace requirements of 646.19.

Statement of Problem and Substantiation for Public Input

Coordinate with proposed new definitions of 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

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Committee: NEC-P12

Public Input No. 772-NFPA 70-2020 [New Section after 646.22]

TITLE OF NEW CONTENT

Type your content here ...

Part V Electromagnetic Pulse (EMP) Protection

646.23 Electromagnetic Pulse (EMP) Protection. Protection for modular data centers against the effects of electromagnetic pulses shall be provided at a minimum of Level 3. 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]	
Public Input No. 756-NFPA 70-2020 [New Section after 708.64]	

Submitter Information Verification

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Committee:	NEC-P12

Public Input No. 3845-NFPA 70-2020 [Section No. 650.2]

(Relocate all definitions in the 650. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

650. **2** Definitions.

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

Electronic Organ.

A musical instrument that imitates the sound of a pipe organ by producing sound electronically.

Informational Note: Most new electronic organs produce sound digitally and are called digital organs.

Pipe Organ.

A musical instrument that produces sound by driving pressurized air (called wind) through pipes selected via a keyboard.

Pipe Organ Sounding Apparatus.

The sound-producing part of a pipe organ, including, but not limited to, pipes, chimes, bells, the pressurized air (wind)-producing equipment (blower), associated controls, and power equipment.

Informational Note: The pipe organ sounding apparatus is also referred to as the “pipe organ chamber.”

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. "

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Submittal Date: Wed Sep 09 13:53:46 EDT 2020
Committee: NEC-P12

Public Input No. 3876-NFPA 70-2020 [Section No. 660.2]

(Relocate all definitions in the 660. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

660. 2 Definitions.

The following definitions shall apply only within this article.

Long-Time Rating.

A rating based on an operating interval of 5 minutes or longer.

Mobile.

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

Momentary Rating.

A rating based on an operating interval that does not exceed 5 seconds.

Portable.

X-ray equipment designed to be hand-carried.

Transportable.

X-ray equipment that is to be installed in a vehicle or that may be readily disassembled for transport in a 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. "

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Submittal Date:	Wed Sep 09 14:34:38 EDT 2020
Committee:	NEC-P12

Public Input No. 3174-NFPA 70-2020 [Section No. 660.48]

660.48 Grounding.

~~Non–current-carrying metal parts of~~ Battery-operated X-ray ~~and associated~~ equipment ~~(controls, tables, X-ray tube supports, transformer tanks, shielded cables, X-ray tube heads, and so forth) shall be grounded in the manner specified in Article 250 . Portable and mobile equipment shall be provided with an approved grounding-type attachment plug cap.~~

~~*Exception: Battery-operated equipment.*~~

shall not be required to comply with the general NEC grounding requirements.

Statement of Problem and Substantiation for Public Input

The reference to an entire Article is prohibited in Section 4.1.4 of the NEC Style Manual. The current 2020 NEC text in 660.48 does not supplement or modify the grounding requirements in Article 250, but simply repeats that general requirement. NEC 90.3 indicates those general requirements apply to special equipment without repeating the text. Remaining text appears to be the only part of this requirement that supplements or modifies the general requirements in Article 250.

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Submittal Date: Sun Sep 06 14:38:22 EDT 2020
Committee: NEC-P12

Public Input No. 3883-NFPA 70-2020 [Section No. 665.2]

(Relocate all definitions in the 665. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

665. 2 Definitions.

The following definitions shall apply only within this article.

Applicator.

The device used to transfer energy between the output circuit and the object or mass to be heated.

Converting Device.

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

Dielectric Heating.

Heating of a nominally insulating material due to its own dielectric losses when the material is placed in a varying electric field.

Heating Equipment.

Any equipment that is used for heating purposes and whose heat is generated by induction or dielectric methods.

Induction Heating, Melting, and Welding.

The heating, melting, or welding of a nominally conductive material due to its own I^2R losses when the material is placed in a varying electromagnetic field.

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. "

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Submittal Date: Wed Sep 09 14:51:56 EDT 2020

Committee: NEC-P12

Public Input No. 3176-NFPA 70-2020 [Section No. 665.11]

~~**665.11** Overcurrent Protection.~~

~~Overcurrent protection for the heating equipment shall be provided as specified in Article 240 . This overcurrent protection shall be permitted to be provided separately or as a part of the equipment.~~

Statement of Problem and Substantiation for Public Input

Reference to an entire Article is prohibited in Section 4.1.4 of the NEC Style Manual. The current 2020 NEC text in 665.11 does not supplement or modify the overcurrent protection requirements in Article 240, but simply repeats that general requirement. NEC 90.3 indicates those general requirements apply to special equipment without repeating the text. Remaining text that allows the protection to be provided separately or as part of the equipment does not seem necessary as nothing in the general requirements of Chapters 1-4 limits the location of equipment overcurrent protection.

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Public Input No. 3884-NFPA 70-2020 [Section No. 668.2]

(Relocate all definitions in the 668. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

668. 2 Definitions.

The following definitions shall apply only within this article.

Cell Line.

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

Cell Line Attachments and Auxiliary Equipment.

A term that includes, but is not limited to, auxiliary tanks; process piping; ductwork; structural supports; exposed cell line conductors; conduits and other raceways; pumps, positioning equipment, and cell cutout or bypass electrical devices. Auxiliary equipment includes tools, welding machines, crucibles, and other portable equipment used for operation and maintenance within the electrolytic cell line working zone.

In the cell line working zone, auxiliary equipment includes the exposed conductive surfaces of ungrounded cranes and crane-mounted cell-servicing equipment.

Electrically Connected.

A connection capable of carrying current as distinguished from connection through electromagnetic induction.

Electrolytic Cell.

A tank or vat in which electrochemical reactions are caused by applying electric energy for the purpose of refining or producing usable materials.

Electrolytic Cell Line Working Zone.

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

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. "

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Submittal Date: Wed Sep 09 14:52:54 EDT 2020

Committee:	NEC-P12

Public Input No. 3691-NFPA 70-2020 [Section No. 670.2]

670.2 Definition.

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

Industrial Machinery (Machine).

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

Safety Circuit . The part of control system containing one or more devices that perform a safety related function.

Informational Note: "Safety-related control system" and "safety interlock circuit" are common terms that can be used to refer to the safety circuit in other standards. The safety circuit can include hard-wired, communication, and software-related components. For further information see NFPA 79-2021, Electrical Standard for Industrial Machinery.

Statement of Problem and Substantiation for Public Input

The proposed change adds the definition of “Safety Circuit” and aligns with upcoming revisions to the 2021 edition of NFPA 79 and is a companion to the NEMA Public Input for 670.6, which uses the term “Safety Circuit”.

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Committee: NEC-P12

Public Input No. 3886-NFPA 70-2020 [Section No. 670.2]

(Relocate all definitions in the 670. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

670. 2 Definition.

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

Industrial Machinery (Machine).

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

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. "

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Submittal Date: Wed Sep 09 14:54:00 EDT 2020

Committee: NEC-P12

Public Input No. 2394-NFPA 70-2020 [Section No. 670.3(A)]

(A) Permanent Nameplate.

A permanent nameplate shall be attached to the outside of the control equipment enclosure or ~~machine and shall be plainly~~ on the machine immediately adjacent to the enclosure that is visible after installation. The nameplate shall include the following information:

(1) Supply voltage, number of phases, frequency, and full-load current

(2) Maximum ampere rating of the short-circuit and ground-fault protective device

(3) Ampere rating of largest motor, from the motor nameplate, or load

(4) Short-circuit current rating of the machine industrial control panel based on one of the following:

(5) Short-circuit current rating of a listed and labeled machine control enclosure or assembly

(6) Short-circuit current rating established utilizing an approved method

Informational Note: UL 508A-2017, *Standard for Industrial Control Panels* , Supplement SB, is an example of an approved method.

(7) Electrical diagram number(s) or the number of the index to the electrical drawings

The full-load current shown on the nameplate shall not be less than the sum of the full-load currents required for all motors and other equipment that may be in operation at the same time under normal conditions of use. Where unusual type loads, duty cycles, and so forth require oversized conductors or permit reduced-size conductors, the required capacity shall be included in the marked “full-load current.” Where more than one incoming supply circuit is to be provided, the nameplate shall state the preceding information for each circuit.

Statement of Problem and Substantiation for Public Input

The term “plainly visible” is not defined and creates confusion as to the location of the nameplate marking. This revision clarifies the location and aligns with the requirement for nameplate marking per NFPA 79 16.4.1.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2390-NFPA 70-2020 [Section No. 409.110]	Similar nameplate marking requirements

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Public Input No. 4000-NFPA 70-2020 [Section No. 670.4(B)]

(B) Disconnecting Means.

A machine shall be considered as an individual unit and therefore shall be provided with disconnecting means. The disconnecting means shall be permitted to be supplied by branch circuits protected by either fuses or circuit breakers. The disconnecting means shall not be required to incorporate overcurrent protection.

<u>A means shall be provided to verify the absence of voltage in accordance with an acceptable industry practice that does not expose personnel to shock or arc flash hazards or live parts at the test point for the disconnecting means for any voltage supplies or stored energy sources that present a shock or arc flash hazard up to and including 1000V.</u>

<u>Informational Note: NFPA 70E-2021 Standard for Electrical Safety in the Workplace provides guidance for safely verifying the absence of voltage including the use of devices like a permanently mounted absence of voltage tester.</u>

Statement of Problem and Substantiation for Public Input

Testing for absence of voltage is an important step that helps increase safety by detecting several conditions that could lead to an electrical incident:

• Power remains on if the wrong disconnecting means is utilized or the source is mislabeled (see examples from OSHA Summaries)
• Presence of stored electrical energy from a capacitor, present after the disconnect is opened and locked out (see examples from OSHA Summaries)
• Power remains present when the disconnect handle is in the off position if the disconnect experiences a mechanical failure (see Recall Notices below)

An easily accessible means to test for and visually convey the status of presence and absence of voltage that is part of the equipment installation at the point of work before accessing industrial machinery would prevent this type of incident (several examples are included below) and further the purpose of the code in practical safeguarding of persons and property by leveraging safety by design principles. Absence of Voltage Testers (AVT) listed to UL 1436 are permanently mounted testers that visually indicate when all voltages are less than 3 V (ac and dc) at the test point. This test is initiated before doors and covers are removed preventing accidental contact with energized parts. AVTs listed to UL 1436 have been recognized as an acceptable method to test for the absence of voltage in NFPA 70E since 2018 (120.5 (7) Exception 1).

Permanently mounted AVTs installed on or near the equipment increase the likelihood that the test for absence of voltage test occurs before the equipment is accessed when compared to portable voltage test instruments. Additionally, AVTs often have a feature to visually indicate when ac or dc voltage that would cause a shock hazard is present. In each of the incidents described below, the voltage presence indicators (for AC and DC) would have provided a visual warning that voltage was still present.

Disconnect Recall Notices
Several brands of disconnects that are commonly used in industrial applications, including industrial machinery, have experienced recalls due to defects that allow power to remain present when the disconnect handle is in the off position, posing a shock hazard. This failure mode is an example of why testing for absence of voltage is critical in all applications.
Recalls (https://www.cpsc.gov/Recalls)
1. Example 1
Company A recalled more than a million safety switches manufactured between January 1, 2014 and

January 18, 2018 because the power can stay on when the safety switch handle is in the off position, posing an electric shock or electrocution hazard. The switches may be installed in or around commercial buildings, outbuildings, apartments and homes with air conditioning units.

2. Example 2

Company B issued a safety recall of 26 models of safety switches that may not disconnect power when the handle is in the “off” position. The affected devices cover certain models of 30A and 60A heavy-duty safety switches manufactured between Nov. 19, 2015, and Jan. 23, 2018.

3. Example 3

Company C recalled 19,000 toggle and rotary switches. When switched OFF, one electrical pole may remain energized, posing a risk of electrical shock hazard. The switches are typically used with HVAC units, electric distribution and control panels and industrial uses. Primarily the switches are used commercially, however they may also be found in residential applications.

OSHA Fatality and Catastrophe Investigation Summaries

A keyword search of the OSHA Fatality and Catastrophe Investigation Summaries (https://www.osha.gov/pls/imis/accidentsearch.html) reveals several incidents resulting in severe injury or death that are attributed to failure to de-energize and/or test for absence of voltage. Some examples from industrial equipment with characteristics similar to industrial machinery:

1. Report ID: 0728900

Employee #1 was on the roof of a customer's building, changing filters for the customer's air conditioning units. The employee had shut off the unit, but he did not lock out the unit or check its power supply for stored energy. As he reached into the unit, he came into contact with a capacitor charged to 280 volts and received an electric shock.

2. Report ID: 0420600

An employee turned off the known energy source to an air conditioning and heat unit at the panel box in a private residence. He pulled the disconnect switch in a box adjacent to the fan or blower assembly in the attic and was attempting to remove the air handler inside the blower housing. The heavy gold chain that the employee was wearing around his neck came in contact with or came in close proximity to a 10 microfarad, mfd, capacitor which can store 370 or more volts of alternating current. The chain burned an arc in his neck and carried sufficient current to his heart via the vascular tract to cause his death.

3. Report ID: 0316300

Employee #1 and his helper were installing a fan on a HVAC chiller unit. Employee asked his helper to open the circuit breaker to deenergize the unit, but Employee #1 never tested the fan circuit to ensure it was deenergized. Employee #1's helper opened the wrong breaker and when Employee #1 touched the conductors for the fan, he was electrocuted.

4. Report ID: 0452110

Employee #1 turned off breaker #22 in a panel box so that he could make a connection in a junction box. He was using a wire stripper to cut into the insulation around a conductor when he was electrocuted. The breakers in the panel box were not labeled, and breaker #22 did not control the current in the circuit on which Employee #1 was preparing to work. He also did not use a voltmeter or another type of instrument to test the circuit and confirm that the power was off.

5. Report ID 0522300

Employee #1 was working on an HVAC air handling unit that had not been cooling adequately. The "lockout" procedure did not include de-energization at the power supply or application of locks. Therefore, although the unit was shut off, it was still energized. Employee #1 was killed.

6. Report ID 0729700

An employee was repairing the head switch of the primary motor control center at an oil pumping site. The oil pump motor control center and the saltwater motor control center were not labeled as to what circuits were either controlled by them and/or passed through them. The motor control center was secured in anticipation of replacing the head switch. The employee opened a nearby junction box to perform the initial disconnection of wiring to the switch. The employee came into contact with a 480 volt unused circuit that passed through the motor control center. This 480 volt circuit was not de-energized by the cutout used to secure the motor control center and the employee did not test the circuits within the junction box to ensure they were all de-energized and sustained extensive electrical burns to the right hand and less serious burns to the left.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3835-NFPA 70-2020 [New Section after 110.25]	
Public Input No. 3908-NFPA 70-2020 [New Part after I.]	

Submitter Information Verification

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Committee: NEC-P12

Public Input No. 2312-NFPA 70-2020 [Section No. 670.5]

670.5 Short-Circuit Current Rating.

(1) Installation

Industrial machinery shall not be installed where the available fault current exceeds its short-circuit current rating as marked in accordance with 670.3(A)(4).

(2) Available Short-Circuit Current Field Marking

Industrial machinery shall be legibly marked in the field with the available fault current. The field marking(s) shall include the date the available fault current calculation was performed and be of sufficient durability to withstand the environment involved.

Statement of Problem and Substantiation for Public Input

The word description for this numerical paragraph heading is absent, and is not consistent to the typical NEC text format. The topical heading may help clarify distinctions in application for code text searches.
The use of the term "Installation" as a header.for this requirement is similar to 620.16(B).
The use of the term "Available Short-Circuit Current Field Marking" as a header.for this requirement is similar to 620.51(D)(2)

Submitter Information Verification

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Committee: NEC-P12

Public Input No. 3075-NFPA 70-2020 [New Section after 670.6]

670.7 Cybersecurity

Industrial Machinery that is connected to a communication network and permitted to control any portion of the machinery shall comply with (1) and (2).

(1) A Cybersecurity Assessment shall be conducted on the connected system determine vulnerabilities to cyber-attacks.

(2) A Cybersecurity Commissioning Certification shall be conducted on the connected system to ensure they are designed against cyber-attacks and known vulnerabilities.

Documentation of the assessment and certification shall be made available to those authorized to inspect, operate, and maintain the machinery.

Informational note (1): ANSI/ISA 62443 Cybersecurity Standards series can be utilized to meet the assessment requirement. Another way is thru the NIST Framework for Improving Critical Infrastructure Cybersecurity, Version 1.1.

Informational note (2): ISASecure® is one certification method that could be used to demonstrate the system has been investigated for cybersecurity vulnerabilities.

Additional Proposed Changes

File Name	Description	Approved
Water_Treatment_Plant_Hit_by_Cyber-attack.pdf	Cyber Attack on Water Treatment Plant	
History_of_Industrial_Control_System_Cyber_Incidents.pdf	Cyber Attacks on Industrial Control Systems	
Hackers_force_water_utilities_to_sink_or_swim.pdf	Hackers assault on water utilities	

Statement of Problem and Substantiation for Public Input

Cybersecurity should be considered as an aspect of safety and reliability in addition to the other factors affecting industrial machinery. If an attacker can affect the machinery control system, individual sensors or other IoT devices to the point of either preventing normal operation or displaying the appearance of normal operation while failing the system, creates an unsafe condition. The increase in cyber-attacks on industrial, utility, and other installations where industrial machinery can be made to create unsafe conditions. Examples of these unsafe conditions can be changing overcurrent protection rating of a circuit breaker, arc energy reduction settings, SCADA systems, emergency stop functions, motor controllers, or Fire Protection Systems. The public input is focused only on electrical systems that can be controlled from external communication networks such as the internet. These connections can be wired, wireless, or use other data media. cybersecurity is essential to expand the safety and security of industrial machinery.

https://www.eenews.net/stories/1060131769 (Water Treatment facility Cyber Attack)
https://www.infosecurity-magazine.com/news/water-treatment-plant-hit-by/ (Water treatment plant hit by cyber-attack)
https://www.osti.gov/servlets/purl/1505628. (History of Industrial Control System Cyber Incidents)
https://www.varonis.com/blog/cybersecurity-statistics/

- 71% of data breaches were financially motivated and 25% were motivated by espionage
- Cybersecurity breaches have increased by 11% since 2018 and 67% since 2014
- 61% of organizations have experienced an IoT security incident
- IoT devices experience an average of 5,200 attacks per month
- The cost of a data breach in the healthcare industry was $6.5 Million
- Average cost of a malware attack on a company is $2.6M

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3055-NFPA 70-2020 [New Section after 110.28]	General Requirement's for Cybersecurity PI
Public Input No. 3070-NFPA 70-2020 [New Section after 517.2]	Health Care Facilites use similar control and emergency power systems

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Committee: NEC-P12

Public Input No. 3214-NFPA 70-2020 [Section No. 670.6]

670.6 Surge Protection.

Industrial machinery with safety interlock control devices not effectively protected from voltage surges on the incoming supply circuit shall have ~~surge protection~~ overvoltage protection installed.

Additional Proposed Changes

File Name	Description	Approved
Code_Input.docx	input to improve overvoltage protection requirements	

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. 3208-NFPA 70-2020 [Section No. 551.72(E)]	
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. 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)]	

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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. 3678-NFPA 70-2020 [Section No. 670.6]

670.6 ~~Surge Protection~~ 6 Overvoltage Protection .

Industrial machinery with safety ~~interlock control devices not effectively protected from voltage surges on the incoming supply circuit shall have surge protection installed~~ circuits shall have a listed surge protection installed in accordance with Part II of Article 242 .

Statement of Problem and Substantiation for Public Input

The proposed change clarifies the requirements for SPD protection for industrial machinery and correlates with the definition of “safety circuits” proposed in a companion NEMA Public Input for 670.2.

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Public Input No. 4581-NFPA 70-2020 [Section No. 670.6]

~~**670.6** Surge Protection.~~

~~Industrial machinery with safety interlock control devices not effectively protected from voltage surges on the incoming supply circuit shall have surge protection installed.~~

Statement of Problem and Substantiation for Public Input

Delete this section because it is not within the scope of Article 670. The requirement presently exists in NFPA 79, 7.8.1 (with additional details in the 2021 edition) and belongs under that committee's responsibility. The scope of NFPA 79, 1.1.1 indicates that it covers "electrical equipment of the machine".

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Public Input No. 1718-NFPA 70-2020 [Sections Part IV., 660.47]

Sections Part IV., 660.47

Part IV. Guarding and Grounding

660.47 General.

(A) ~~-~~ Medium-Voltage and High-Voltage Parts.

All medium-voltage and high-voltage parts, including X-ray tubes, shall be mounted within grounded enclosures. Air, oil, gas, or other suitable insulating media shall be used to insulate the high voltage from the grounded enclosure. The connection from the high-voltage equipment to X-ray tubes and other high-voltage components shall be made with high-voltage shielded cables.

(B) Low-Voltage Cables.

Low-voltage cables connecting to oil-filled units that are not completely sealed, such as transformers, condensers, oil coolers, and high-voltage switches, shall have insulation of the oil-resistant type.

Statement of Problem and Substantiation for Public Input

Coordinate with proposed new definitions for low voltage, medium voltage, and high 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

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