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

Copyright Assignment

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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
Organization: Clark County Building and Fire
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 08 14:31:09 EST 2020
Committee: NEC-P01

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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
Organization: Clark County Building and Fire
Street Address:
City:
State:
Zip:
Submittal Date: Sat Jan 11 17:27:37 EST 2020
Committee: NEC-P01

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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
Organization: Clark County Building and Fire
Street Address:
City:
State:
Zip:
Submittal Date: Sat Jan 11 17:33:21 EST 2020
Committee: NEC-P01

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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

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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

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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
Street Address:
City:
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Submittal Date: Thu Sep 03 19:32:38 EDT 2020
Committee: NEC-P01

Copyright Assignment

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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
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 03 21:41:22 EDT 2020
Committee: NEC-P01

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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
Organization: Shelby County Department of De
Affiliation: Self
Street Address:
City:
State:
Zip:
Submittal Date: Sat Sep 05 15:11:40 EDT 2020
Committee: NEC-P01

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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
Organization: Delta Charter Township
Street Address:
City:
State:
Zip:
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
Organization: Delta Charter Township
Street Address:
City:
State:
Zip:
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.

Submitter Information Verification

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

Submitter Full Name: David Williams
Organization: Delta Charter Township
Street Address:
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
Organization: Delta Charter Township
Street Address:
City:
State:
Zip:
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
Organization: Delta Charter Township
Street Address:
City:
State:
Zip:
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
Organization: Delta Charter Township
Street Address:
City:
State:
Zip:
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.

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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.

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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

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Public Input No. 2182-NFPA 70-2020 [New Article after 100]

Health Care Microgrid

A group of interconnected loads and distributed energy resources within clearly defined boundaries that acts as a single controllable entity with respect to the utility.

Statement of Problem and Substantiation for Public Input

NFPA 99 has included the concept for a Health Care Microgrid, including its definition. We are submitting a series of PIs to NFPA 70 to correlate with NFPA 99.

This comment is being made by a committee comprised of members of NFPA 99 ELS, NFPA 70 CMP15, and NFPA 110 who has worked over the summer to create a series of proposals to help correlate better with NFPA 99.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2173-NFPA 70-2020 [New Section after 517.30(B)]	

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Public Input No. 2766-NFPA 70-2020 [Global Input]

Clarify terminology of power system types and power supply system types.

For NFPA 70, 99, 110, and 111 taken together, there are seven (7) or more codified power distribution system types and seven (7) or more codified power supply system types that would benefit from a consistently applied pattern in their terminology. It is proposed that wherever there is a particular codified type of power system, apply uniform terminology in the definition.

For distinctive codified types of power distribution, include either "Power System" or "Power Distribution System" in the defining terminology, with examples as follows;

A. Essential Electrical System of NFPA 70 Article 517 and NFPA 99; revise to "Essential Power System."

B. Fire pump circuits of Article 695; revise to "Fire Pump Power System."

C. Emergency Systems of Article 700; revise to "Required Emergency Power System."

D. Legally Required Standby System of Article 701; revise to "Required Standby Power System."

E. Optional Standby System of Article 702; revise to "Optional Standby Power System."

F. Critical Operations Power System of Article 708 remains unchanged.

G. And for references to normal power; revise code text to "Normal Power System." And, codify it in NEC Article 100 with a proper definition.

For distinctive codified types of a power source, include "Power Supply System" in the defining terminology. Also, preface with the term "Essential" wherever the Power Supply System must comply to an elevated class of resilience due to load criticality, "Essential Power Supply System". Examples are as follows;

A. Emergency Power Supply System of NFPA 110; revise to "Engine Driven Essential Power Supply System". The "Engine Driven" term is added to distinguish this essential power system distinctly apart from all other types of essential power systems; "Stored Energy Essential Power Supply System" and "Fuel Cell Essential Power Supply System." It used to be that NFPA 110 sources encompassed all those sources that NFPA 111 did not; however, with the advent of fuel cells into the foray of permitted essential power sources, this is no longer the case. *Although at the time of this writing, it is not yet clear what code standard for fuel cells measures up to the system resilience robustness intent of NFPA 110 and 111.*

SIDEBAR: these three essential power systems together share a unique characterization of supplying emergency, critical, and essential power systems. If another new distinctive definition were to be coined to describe the group of these essential power system sources; it would be dutiful to consider the inclusion or exclusion of unitized batteries with that category, or else derive a more functional other category.

B. Stored Energy Emergency Power Supply System (SEPSS) in accordance with NFPA 111; revise to "Stored Energy Essential Power Supply System." Swapping the term 'essential' for 'emergency' accomplishes three things.

1. By not using the term 'emergency', it affirms that there are more types of code required alternate power system types beyond just the 'emergency' type (of NEC Article 700) that this

standard should also apply to.

2. The term 'essential' can function to associate this as one of the few select sources approved for similar applications.
3. The importance factor of "essential" can maintain distinction of this power source supply system as an elevated class of resilience apart from the power source supply system of NEC Article 706, Energy Storage Systems.

C. Solar Photovoltaic (PV) Systems in accordance with Article 690; revise to "Solar Photovoltaic (PV) Power Supply System."

D. Large-Scale Photovoltaic (PV) Electric Power Production Facility Systems in accordance with Article 691; revise to "Large Scale Solar Photovoltaic (PV) Power Supply System."

E. Fuel Cell Power Systems in accordance with Article 692; revise to "Fuel Cell Power Supply System."

a. Where used for supplying required alternate power (e.g. Article 517 and NFPA 99 where permitted to supply the Essential Electrical System), another terminology should be employed to cite whatever code standard is intended to outline compliance with those particular code requirements; "Fuel Cell Essential Power Supply System."

F. Wind Electric Systems in accordance with Article 694; "Wind Power Supply System."

G. Energy Storage Systems in accordance with Article 706; " Energy Storage Power Supply System."

Statement of Problem and Substantiation for Public Input

BASIS FOR CODE REVISION:
1) The word "emergency" is defined as a serious, unexpected, often dangerous situation requiring immediate action. Even within NEC, "emergency" is used in both power and non-power applications; emergency stop, emergency disconnect, emergency conditions, emergency battery-powered lighting (allowable to be used for non-emergency applications), emergency generator (allowable to be used for non-emergency applications), emergency purposes, emergency management, emergency communications, emergency use, emergency operations, emergency room, emergency treatment areas, emergency egress, and other NFPA standards offer other emergency systems that are outside the application of power distribution.
To help mitigate inadvertent misappropriation of the term "emergency" or "emergency systems" by users of the NEC and other NFPA codes, it would be prudent to use discreet terminology to clarify when the application strictly regards power systems. The key to optimal clarity is to uniquely distinguish applications of power from each other. And too, make them more easily distinguishable from all other possible interpretations of "emergency" or "emergency system."
NEC Article 700 use of the term "nonemergency" and "non-emergency" should be standardized to a single term. They are intended to apply to any source other than those of Article 700, but may be construed otherwise due to other types of use for the term "emergency." Refer to the last sentence of 70012(H), where after non-emergency is discussed, the code text juxtaposes "normal supply" with that of the "emergency standby system," which could easily confuse this paragraph's intent and be interpreted as either Article 700 power or Article 701 power or both.
2) Power system type categorization can be accomplished by building upon two base level characterizations, "Power System" types (or "Power Distribution System" types) and "Power Supply System" types. This intuitively functions in two ways;
a. For each individual type, the grouping illustrates their association to each other. The common defining term 'power' shows that one of their principal characteristics is shared with each other.
b. Then to distinguish between the (6) code recognized types of power systems and (7) code recognized types of power supply systems, strategic modifier terminology is selected based on their principal distinctions between each other. To do this with the with the most simply stated yet most recognizable principal characteristic would help ensure that definitions are understood most clearly and easily.
The intuitive comprehension aide that this yields to NEC would similarly extend as a benefit throughout the

other NFPA codes, by readily distinguishing these power terms and applications from other kinds of use of the terms "emergency" and "emergency systems." Thus, also helping improve intuitive understandings for those NFPA references outside of NEC, which are potentially being referenced by disciplines not especially versed in electrical, and could benefit from these intuitive clues.
These two base level characterizations may be suited to get their own defined terminologies for particular power group type categories. This may be implemented to simplify general references in code text meant to address one or another entire category; "Power Systems" (where normal power and optional standby power are encompassed with all others) versus "Essential Power Systems" (only those which are code required alternate power sources). And similarly, "Power Supply Systems" versus "Essential Power Supply Systems".
3) The term "emergency" is used frequently throughout the NFPA (refer to NFPA 2018 Glossary) with many diverse meanings and applications of criticality. Distinctions in the differentiation of the terminology itself are especially important in clarifying intent for matters of code requirements. Without obvious clear distinctions in terminology, unintended cross-correlations of requirements may be inadvertently interpreted. For code reference examples, see;
a. "Emergency" in NFPA: 59A, 130, 424, 450, 502, 1006 & 1221
b. "Emergency Power Supply" and "Emergency Power Supply System" in NFPA: 110 & 111
4) The term "emergency system" is used in multiple instances of NFPA codes and is near identical to the pluralized version of the term "emergency systems" used in Article 700 of the NEC (NFPA 70). Some examples from NFPA outside of NEC are;
• "Emergency Systems" from NFPA: 3 & 4. The set of NFPA 3 & 4 definitions for required alternate power system types is an open-ended generalized approximation that makes reference to; COPS (NEC 708), EPS (NFPA 110), EPSS (NFPA 110), Emergency Systems (NEC 700), and Legally Required Standby Systems (NEC 701). The NFPA: 3 & 4 definition fails to reference the following: NFPA 111; the essential electrical systems of NEC 517 and NFPA 99 with its sub-branches; any power system type that could be derived to strictly serve fire pumps; and fuel cells when used as a required alternate power source.
• "Emergency Alarm System" from NFPA: 318 & 5000
• "Emergency Communication System" from NFPA: 72 & 130
• "Emergency Services System" from NFPA: 1250
• "Emergency Shutdown System" from NFPA: 160
• "Emergency Power Supply System" from NFPA: 110
5) The risk of users inadvertently crossing code requirements inappropriately based on the potential for terminology confusion is twofold.
a. The first is that code text applications which may not intend to correlate, based on the term "emergency", could be interpreted to correlate inappropriately. At least until supplemental review and research of code text is exercised diligently within the time permitted to validate clarification otherwise.
b. The second is that applications meant to apply to Article 700, and reference Article 700, should also be referencing other types of essential, critical, life safety, which are not being stated explicitly because the term "emergency" or "emergency system" was believed adequate to cover intent. The types of other such power system types, depending on the application, may include the following;
i. Emergency Power Supply System circuit in accordance with NFPA 110
ii. Stored Energy Power Supply System circuit in accordance with NFPA 111
iii. Essential Electrical System circuits in accordance with Article 517 and NFPA 99, or any of its sub-system branches as follows;
1. Life Safety Branch
2. Critical Branch
3. Equipment Branch
a. Equipment Branch A
b. Equipment Branch B
iv. Emergency system circuit in accordance with Article 700.
v. Legally required standby system circuit in accordance with Article 701.
vi. Optional standby system circuit in accordance with Article 702.
vii. Critical Operations Power system circuit in accordance with Article 708
viii. Fuel cell power supply system circuit, when used as a power source for power system type (3) through (7) above.
ix. A multi-source power system type derived to strictly serve fire pumps in accordance with Article 695. With its alternate source, as permitted from a power source type (1) through (8) above, or derived from an alternate normal power service to satisfy the reliability requirements.
6) Examples of potentially misinterpreted terminology within the NEC are:
a. 230.85 Emergency Disconnects.
b. Emergency Lighting [646.16 & 17]; may be interpreted to be unequivocally associated with Article

700. But, such fault resistant lighting requirements may potentially apply also to;
i. Life Safety Branch AND/OR Critical Branch of Essential Electrical System circuits in accordance with Article 517 and NFPA 99.
ii. Critical Operations Power system circuit in accordance with Article 708
c. Emergency shutoff [680.41]; this use of 'emergency' is of a different character to Article 700. Although there could be an "emergency shutoff" system for the source of an "emergency (power) system" where the term 'emergency' in each vernacular has disparate intonations.
7) Terminology revision can also standardize power type definitions and Article titles around the use of pluralization of power system types; where each definition uses the singular version of the word "system" rather than having the varied usage of both plural and no-plural versions; such as the word "systems" as in Article 700. An exception could be developed for titles of NFPA standards 110 and 111, which might perhaps be best suited to the plural version of system, "systems."
8) It may be prudent to clarify in code definitions of power system types, and power supply system types, and any definitions for the groups of such power types, that in practice, users may also use their own terminology. Users may be explicitly permitted describe or label the power system types on their premises. For example, a power system named after an equipment type; e.g. elevator, imaging equipment, etc. However, it should also be explicitly disallowed for a power system to be unclear, as to which of the (7) codified "power system" types or (7) codified "power supply system" types that any power distribution system is being held in compliance to. Nor should it be permitted to be unclear at which points in the power distribution, that one type of power system converts to another. It may behoove any capacity for inspection, commissioning, service, and consistency within a facility to require specific labeling and/or diagramming that details what all types of power systems are present, and at which specific points of named equipment within the power distribution that power system types convert from one type to another type. In other words, make clear the origination point of each power system type. Grammatical protocol for defined power systems types should uniformly reference them as proper nouns by always using the full term and by employing capitalized letters, so to prevent confusion when the same words are used for other purposes.
9) For consistency across NFPA standards, other subsequent edits would also be submitted as Public Input for NFPA revisions that would correlate to those uses of terminology outlined above, so to maximize the benefits that consistency adds to clarity if done similarly throughout the NFPA standards. Examples of such edits include;
a. The revisions to power system terminologies outlined above, which are associated with NEC Article 517, would also to apply to NFPA 99.
b. The title of NFPA 110 "Emergency and Standby Power Systems" revised to "Engine Driven Essential Power Supply Systems."
d. The title of NFPA 111 " Stored Electrical Energy Emergency and Standby Power Systems" revised to "Stored Energy Essential Power Supply Systems."
d. And perhaps some NFPA standard of the same resiliency caliber as NFPA 110 & 111, but instead structured to address fuel cell based essential power supplies, "Fuel Cell Essential Power Supply Systems."

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Public Input No. 4337-NFPA 70-2020 [Global Input]

Many diverse undefined terminologies are used to invoke some manner of required approval from an AHJ. It may benefit the clarity of intent to either consolidate the use of terminologies or to define their distinctions in respect to each other, or to do some combination of both.

Statement of Problem and Substantiation for Public Input

BASIS FOR CODE REVISION
Here are examples of the diverse types of AHJ approval requirements in code;
1. Approved means; 215.12(C)(1), 215.12(C)(2), 230.24, 230.30(A&B), 230.40, 230.50(B), 230.51, 230.53, 240.5(B)(1) , 240.21(B)(2&3), 240.67(A), 250.6(B) 250.68(C)(2), 250.70 (4), 250.94 exception (3), 300.4(H), 300.5, 300.5(F), 300.5(K), 300.6(A)(2), 300.6(A)(2), 300.6(A)(3), 300.6(C)(1), 300.6(C)(2), 300.11(C), 300.15, 300.19(B&C), 300.21, 300.25, 300.50(C).
2. Acceptable to AHJ; 500.8(A), 505.9, 506.9(A).
3. Made available if requested by AHJ; 110.31(A)(3), 110.70, 215.5, 225.56(A) 399.30(A), 399.30(B), 691.6, 691.7, 691.8, 691.9.
4. Made available to AHJ; 110.41, 230.95(C), 240.67(C), 240.87(C) 490.48(A), 517.17(D), 590.6(B)(2), 645.27.
5. Given to AHJ prior to energization; 225.56(B).
6. If Adopted by Local AHJ; 220.12(B), 225.22, 225.36.
7. Preventative Maintenance Plan Required by AHJ; 708.6 (A-E)
8. Initial/Periodic Witness Test by AHJ; 700.3(A), 700.3(D), 708.6 (A-E).

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Public Input No. 1234-NFPA 70-2020 [Global Input]

RESEQUENCING OF ARTICLES 520, 522, 525, 530, 540

Resequence the following chapters:

- 520 Theaters, Audience Areas of Motion Pictures and Television Studios, Performance Areas, and Similar Locations
- 522 Control Systems for Permanent Amusement Attractions
- 525 Carnivals, Circuses, Fairs, and Similar Events
- 530 Motion Picture and Television Studios and Similar Locations
- 540 Motion Picture Projection Rooms

Articles 520, 530 and 540 are significantly and functionally associated. If a user of the NEC is referencing 520, 530 or 540 chances are high that the user will also reference one of more of the three functionally associated articles. Having articles 522 and 525, which are not functionally associated 520, 530 or 540 with placed between articles 530 and 540 is somewhat disjointed. Articles 522 and 525 are also significantly and functionally associated and likewise should be grouped together, however the grouping of articles 522 and 525 should not be sequenced between articles 520, 530 and 540.

While the article titles have evolved **since at least the 1953** NEC, articles 520, 530 and 540 **until 1996 NEC** were sequential in their placement. The functional interruption of articles 520, 530 and 540 began when the 1996 NEC introduced article 525, the 2002 NEC with article 527 for one code cycle and the 2002 NEC with article 522. If perhaps for historical continuity there is a desire to maintain the functional titling and numbering of articles 520, 530 and 540 then articles 522 and 525 could be renumbered as new articles.

...

Statement of Problem and Substantiation for Public Input

RESEQUENCING OF ARTICLES 520, 522, 525, 530, 540

Resequence the following chapters:

- 520 Theaters, Audience Areas of Motion Pictures and Television Studios, Performance Areas, and Similar Locations
- 522 Control Systems for Permanent Amusement Attractions
- 525 Carnivals, Circuses, Fairs, and Similar Events
- 530 Motion Picture and Television Studios and Similar Locations
- 540 Motion Picture Projection Rooms

Articles 520, 530 and 540 are significantly and functionally associated. If a user of the NEC is referencing 520, 530 or 540 chances are high that the user will also reference one of more of the three functionally associated articles. Having articles 522 and 525, which are not functionally associated 520, 530 or 540 with placed between articles 530 and 540 is somewhat disjointed. Articles 522 and 525 are also significantly and functionally associated and likewise should be grouped together, however the grouping of articles 522 and 525 should not be sequenced between articles 520, 530 and 540.

While the article titles have evolved since at least the 1953 NEC, articles 520, 530 and 540 until 1996 were sequential in their placement. The functional interruption of articles 520, 530 and 540 began when the 1996 NEC introduced article 525, the 2002 NEC with article 527 for one code cycle and the 2002 NEC with article 522. If perhaps for historical continuity there is a desire to maintain the functional titling and numbering of articles 520, 530 and 540 then articles 522 and 525 could be renumbered as new articles.

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Public Input No. 4518-NFPA 70-2020 [New Section after 517.1]

517.2 Reconditioned Equipment.

The reconditioning requirements of this code shall not apply to healthcare facilities that meet the requirements of NFPA 99 and where the reconditioned equipment meets or exceeds minimum testing requirements of another ANSI certified reconditioning standard.

Statement of Problem and Substantiation for Public Input

Added language for addition to 110.21(A)(2)

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4496-NFPA 70-2020 [Section No. 110.21(A)(2)]	
Public Input No. 4524-NFPA 70-2020 [Section No. 695.10]	
Public Input No. 4526-NFPA 70-2020 [Section No. 700.5(C)]	
Public Input No. 4528-NFPA 70-2020 [Section No. 701.5(C)]	
Public Input No. 4529-NFPA 70-2020 [Section No. 702.5(A)]	
Public Input No. 4531-NFPA 70-2020 [Section No. 708.24(A)]	

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Public Input No. 3070-NFPA 70-2020 [New Section after 517.2]

517.3 Cybersecurity

Health Care Facility electrical systems that are connected to a communication network and permitted to control any portion of the premises electrical system 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 system.

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 and UL 2900-2-3 for Security and Life Safety Signaling Systems.

Informational note (2): Examples of the commissioning certification used to demonstrate the system has been investigated for cybersecurity vulnerabilities could be one of the following:

(a) The ISA Security Compliance Institute (ISCI) conformity assessment program

(b) Certification of compliance by a nationally recognized test laboratory

(c) Manufacturer certification for the specific type and brand of system provided

Additional Proposed Changes

File Name	Description	Approved
State_of_Cyber_Attacks_in_Hospital_Emergency_Management_2019.pdf	Hospital Emergency Management	
Cyber_Attack_on_U.S._Hospital_Group_Highlights_Vulnerability_of_Critical_Infrastructure.pdf	Cyber Attack Vulnerabilities for Hospital Critical Infrastructure	
History_of_Industrial_Control_System_Cyber_Incidents.pdf	Control System Cyber Incidents	
Hackers_force_water_utilities_to_sink_or_swim.pdf	Hacker Attacks 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 Health Care Facility's electrical system. If an attacker can affect the building control system, emergency electrical systems, 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, health care facilities, and other installations can be made to create unsafe conditions. Examples of these unsafe conditions can be indicating a medical device's operation, changing overcurrent protection rating of a circuit breaker, arc energy reduction settings, building management systems, security systems, SCADA systems, emergency, 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 Health Care Facilities and their patients. The NFPA 99 technical committee has seen the need for safeguards to mitigate malicious control of or damage to the healthcare microgrid. The issues being addressed for microgrids need be expanded to include any of the connected parts of the electrical system of a Health Care Facility.

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 single breach in the healthcare industry was $6.5 Million
- Average cost of a single 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]	
Public Input No. 3075-NFPA 70-2020 [New Section after 670.6]	
Public Input No. 3080-NFPA 70-2020 [New Section after 700.8]	

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Public Input No. 3383-NFPA 70-2020 [New Section after 517.2]

517.X

Reconditioned Equipment. The requirements for listing of reconditioned equipment shall not apply to health care facilities where reconditioned equipment is necessary to provide business continuity.

Informational Note: It is common to use refurbished medical equipment and other electrical distribution equipment in health care facilities.

Statement of Problem and Substantiation for Public Input

As we have seen and experienced throughout the pandemic it is imperative that hospitals be able to use reconditioned equipment to maintain business operations. Hundreds of patients would have been put at risk of death or major injury with this change had it been adopted or during the pandemic. Hospitals with aging infrastructure can't always get new parts in a timely manor and may have ready access at reconditioned equipment. being able to use reconditioned equipment proved to save countless lives and provide services to COVID patients as many hospitals were brought back online to accommodate the patients. It is understood that the use of reconditioned equipment will hurt some manufactures financially it is important not to jeopardize patient safety for this reason. There has been no failure history of reconditioned equipment in health care that would suggest that reconditioned equipment performs at a rate any less than new equipment.

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Public Input No. 3384-NFPA 70-2020 [New Section after 517.2]

517.XSources

(A) A hospital shall utilize a distribution system that consists of normal source and a secondary source.

(B) It shall be permissible for a hospital to be served by a Health Care Microgrid.

Informational Note: For additional information on Health Care Microgrids see NFPA 99. A traditional microgrid that does not meet the requirements of NFPA 99 would still require a secondary source.

Statement of Problem and Substantiation for Public Input

"Traditional" micorgrids may include several single points of failure. NFPA 99 "Health Care Microgrids" attempt to remove those single points of failure to provide a robust system that includes the necessary redundancies. As such, the health care microgrid includes several sources and controls to utilize those sources and ensure that power is available at all times (at least within the 10 sec. transfer time). It needs to be explained in NFPA 70 that a traditional microgrid can't be used to avoid a secondary source, but if designing to the standard of a "health care microgrid" per NFPA 99, these redundancies are factored in.

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Public Input No. 3367-NFPA 70-2020 [Section No. 517.2]

517.2 Definitions.

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

Alternate Power Source.

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

Ambulatory Health Care Occupancy.

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

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

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

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

[***101:***3.3.196.1]

Anesthetizing Location.

Any area of a facility that has been designated to be used for the administration of any flammable or nonflammable inhalation anesthetic agent in the course of examination or treatment, including the use of such agents for relative analgesia.

Battery-Powered Lighting Units.

Individual unit equipment for backup illumination consisting of the following:

(1) Rechargeable battery

(2) Battery-charging means

(3) Provisions for one or more lamps mounted on the equipment, or with terminals for remote lamps, or both

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

Critical Branch.

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

Dental Office.

A building or part thereof in which the following occur:

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

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

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

[**99:**3.3.38]

Electrical Life-Support Equipment.

Electrically powered equipment whose continuous operation is necessary to maintain a patient's life. [**99:**3.3.45]

Equipment Branch.

A system of feeders and branch circuits arranged for delayed, automatic, or manual connection to the alternate power source and that serves primarily 3-phase power equipment. [**99:**3.3.49]

Essential Electrical System.

A system comprised of alternate sources of power and all connected distribution systems and ancillary equipment, designed to ensure continuity of electrical power to designated areas and functions of a health care facility during disruption of normal power sources, and also to minimize disruption within the internal wiring system. [**99:**3.3.51]

Exposed Conductive Surfaces.

Those surfaces that are capable of carrying electric current and that are unprotected, uninsulated, unenclosed, or unguarded, permitting personal contact. [**99:**3.3.53]

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

Fault Hazard Current.

See *Hazard Current*.

Flammable Anesthetics.

Gases or vapors, such as fluroxene, cyclopropane, divinyl ether, ethyl chloride, ethyl ether, and ethylene, which may form flammable or explosive mixtures with air, oxygen, or reducing gases such as nitrous oxide.

Flammable Anesthetizing Location.

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

Hazard Current.

For a given set of connections in an isolated power system, the total current that would flow through a low impedance if it were connected between either isolated conductor and ground. [**99:**3.3.70]

Fault Hazard Current.

The hazard current of a given isolated power system with all devices connected except the line isolation monitor. [**99:**3.3.70.1]

Monitor Hazard Current.

The hazard current of the line isolation monitor alone. [**99:**3.3.70.2]

Total Hazard Current.

The hazard current of a given isolated system with all devices, including the line isolation monitor, connected. [**99:**3.3.70.3]

Health Care Facilities.

Buildings, portions of buildings, or mobile enclosures in which human medical, dental, psychiatric, nursing, obstetrical, or surgical care is provided. [**99:**3.3.71]

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

Health Care Facility's Governing Body.

The person or persons who have the overall legal responsibility for the operation of a health care facility. [**99:**3.3.72]

Health Care Microgrid

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

Hospital.

A building or portion thereof used on a 24-hour basis for the medical, psychiatric, obstetrical, or surgical care of four or more inpatients. [***101:***3.3.150]

Invasive Procedure.

Any procedure that penetrates the protective surfaces of a patient's body (i.e., skin, mucous membrane, cornea) and that is performed with an aseptic field (procedural site). [Not included in this category are placement of peripheral intravenous needles or catheters used to administer fluids and/or medications, gastrointestinal endoscopies (i.e., sigmoidoscopies), insertion of urethral catheters, and other similar procedures.] [**99:**3.3.87]

Isolated Power System.

A system comprising an isolating transformer or its equivalent, a line isolation monitor, and its ungrounded circuit conductors. [**99:**3.3.89]

Isolation Transformer.

A transformer of the multiple-winding type, with the primary and secondary windings physically separated, that inductively couples its ungrounded secondary winding(s) to the grounded feeder system that energizes its primary winding(s). [**99:**3.3.90]

Life Safety Branch.

A system of feeders and branch circuits supplying power for lighting, receptacles, and equipment essential for life safety that is automatically connected to alternate power sources by one or more transfer switches during interruption of the normal power source. [**99:**3.3.93]

Limited Care Facility.

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

Line Isolation Monitor.

A test instrument designed to continually check the balanced and unbalanced impedance from each line of an isolated circuit to ground and equipped with a built-in test circuit to exercise the alarm without adding to the leakage current hazard. [**99:**3.3.95]

Medical Office.

A building or part thereof in which the following occur:

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

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

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

[**99:**3.3.106]

Monitor Hazard Current.

See *Hazard Current*.

Nurses' Stations.

Areas intended to provide a center of nursing activity for a group of nurses serving bed patients, where the patient calls are received, nurses are dispatched, nurses' notes written, inpatient charts prepared, and medications prepared for distribution to patients. Where such activities are carried on in more than one location within a nursing unit, all such separate areas are considered a part of the nurses' station.

Nursing Home.

A building or portion of a building used on a 24-hour basis for the housing and nursing care of four or more persons who, because of mental or physical incapacity, might be unable to provide for their own needs and safety without the assistance of another person. [***101:***3.3.148.2]

Patient Bed Location.

The location of a patient sleeping bed, or the bed or procedure table of a Category 1 (critical care) space. [**99:**3.3.135]

Patient Care Space.

Any space of a health care facility wherein patients are intended to be examined or treated. [**99:**3.3.136]

Informational Note No. 1: The health care facility's governing body designates patient care space in accordance with the type of patient care anticipated.

Informational Note No. 2: Business offices, corridors, lounges, day rooms, dining rooms, or similar areas typically are not classified as patient care spaces. [**99:**A.3.3.136]

Category 1 (Critical Care) Space.

Space in which failure of equipment or a system is likely to cause major injury or death of patients, staff, or visitors. [**99:**3.3.136.1]

Informational Note: Category 1 spaces, formerly known as critical care rooms, are typically where patients are intended to be subjected to invasive procedures and connected to line-operated, patient care–related appliances. Examples include, but are not limited to, special care patient rooms used for critical care, intensive care, and special care treatment rooms such as angiography laboratories, cardiac catheterization laboratories, delivery rooms, operating rooms, post-anesthesia care units, trauma rooms, and other similar rooms. [**99:**A.3.3.136.1]

Category 2 (General Care) Space.

Space in which failure of equipment or a system is likely to cause minor injury to patients, staff, or visitors. [**99:**3.3.136.2]

Informational Note: Category 2 spaces were formerly known as general care rooms. Examples include, but are not limited to, inpatient bedrooms, dialysis rooms, in vitro fertilization rooms, procedural rooms, and similar rooms. [**99:**A.3.3.136.2]

Category 3 (Basic Care) Space.

Space in which failure of equipment or a system is not likely to cause injury to the patients, staff, or visitors but can cause patient discomfort. [**99:**3.3.136.3]

Informational Note: Category 3 spaces, formerly known as basic care rooms, are typically where basic medical or dental care, treatment, or examinations are performed. Examples include, but are not limited to, examination or treatment rooms in clinics, medical and dental offices, nursing homes, and limited care facilities. [**99:**A.3.3.136.3]

Category 4 (Support) Space.

Space in which failure of equipment or a system is not likely to have a physical impact on patient care. [**99:**3.3.136.4]

Informational Note: Category 4 spaces were formerly known as support rooms. Examples of support spaces include, but are not limited to, anesthesia work rooms, sterile supply, laboratories, morgues, waiting rooms, utility rooms, and lounges. [**99:**A.3.3.136.4]

Patient Care Vicinity.

A space, within a location intended for the examination and treatment of patients, extending 1.8 m (6 ft) beyond the normal location of the bed, chair, table, treadmill, or other device that supports the patient during examination and treatment and extending vertically to 2.3 m (7 ft 6 in.) above the floor. [**99:**3.3.139]

Patient Equipment Grounding Point.

A jack or terminal that serves as the collection point for redundant grounding of electric appliances serving a patient care vicinity or for grounding other items in order to eliminate electromagnetic interference problems. [**99:**3.3.140]

Psychiatric Hospital.

A building used exclusively for the psychiatric care, on a 24-hour basis, of four or more inpatients.

Reference Grounding Point.

The ground bus of the panelboard or isolated power system panel supplying the patient care room. [**99:**3.3.154]

Relative Analgesia.

A state of sedation and partial block of pain perception produced in a patient by the inhalation of concentrations of nitrous oxide insufficient to produce loss of consciousness (conscious sedation).

Selected Receptacles.

A minimal number of receptacles selected by the health care facility's governing body as necessary to provide essential patient care and facility services during loss of normal power. [**99:**3.3.160]

Task Illumination.

Provisions for the minimum lighting required to carry out necessary tasks in the areas described in 517.34, including safe access to supplies and equipment and access to exits. [**99:**3.3.173]

Wet Procedure Location.

The area in a patient care space where a procedure is performed that is normally subject to wet conditions while patients are present, including standing fluids on the floor or drenching of the work area, either of which condition is intimate to the patient or staff. [**99:**3.3.183]

Informational Note: Routine housekeeping procedures and incidental spillage of liquids do not define a wet procedure location. [**99:**A.3.3.183]

X-Ray Installations, Long-Time Rating.

A rating based on an operating interval of 5 minutes or longer.

X-Ray Installations, Mobile.

X-ray equipment mounted on a permanent base with wheels, casters, or a combination of both to facilitate moving the equipment while completely assembled.

X-Ray Installations, Momentary Rating.

A rating based on an operating interval that does not exceed 5 seconds.

X-Ray Installations, Portable.

X-ray equipment designed to be hand carried.

X-Ray Installations, Transportable.

X-ray equipment to be conveyed by a vehicle or that is readily disassembled for transport by a vehicle.

Statement of Problem and Substantiation for Public Input

This change is in alignment with the revisions in NFPA 99. It correlates with the proposals submitted by the Emergency Sources Task Group appointed by the NEC Correlating Committee for alternate power sources that serve emergency loads in Article 700 and legally required standby systems in Article 701. Refer to public input PI 2788 for entirety of Task Group

changes.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3368-NFPA 70-2020 [Section No. 517.30(B)(2)]	All three PIs create the proposed change
Public Input No. 3371-NFPA 70-2020 [Section No. 517.30(B)(3)]	All three PIs create the proposed change
Public Input No. 3368-NFPA 70-2020 [Section No. 517.30(B)(2)]	
Public Input No. 3371-NFPA 70-2020 [Section No. 517.30(B)(3)]	

Submitter Information Verification

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Committee: NEC-P15

Public Input No. 3643-NFPA 70-2020 [Section No. 517.2]

(Relocate all definitions in the 517. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

517. 2 Definitions.

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

Alternate Power Source.

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

Ambulatory Health Care Occupancy.

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

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

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

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

[***101:***3.3.196.1]

Anesthetizing Location.

Any area of a facility that has been designated to be used for the administration of any flammable or nonflammable inhalation anesthetic agent in the course of examination or treatment, including the use of such agents for relative analgesia.

Battery-Powered Lighting Units.

Individual unit equipment for backup illumination consisting of the following:

(1) Rechargeable battery

(2) Battery-charging means

(3) Provisions for one or more lamps mounted on the equipment, or with terminals for remote lamps, or both

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

Critical Branch.

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

Dental Office.

A building or part thereof in which the following occur:

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

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

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

[**99:**3.3.38]

Electrical Life-Support Equipment.

Electrically powered equipment whose continuous operation is necessary to maintain a patient's life. [**99:**3.3.45]

Equipment Branch.

A system of feeders and branch circuits arranged for delayed, automatic, or manual connection to the alternate power source and that serves primarily 3-phase power equipment. [**99:**3.3.49]

Essential Electrical System.

A system comprised of alternate sources of power and all connected distribution systems and ancillary equipment, designed to ensure continuity of electrical power to designated areas and functions of a health care facility during disruption of normal power sources, and also to minimize disruption within the internal wiring system. [**99:**3.3.51]

Exposed Conductive Surfaces.

Those surfaces that are capable of carrying electric current and that are unprotected, uninsulated, unenclosed, or unguarded, permitting personal contact. [**99:**3.3.53]

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

Fault Hazard Current.

See *Hazard Current*.

Flammable Anesthetics.

Gases or vapors, such as fluroxene, cyclopropane, divinyl ether, ethyl chloride, ethyl ether, and ethylene, which may form flammable or explosive mixtures with air, oxygen, or reducing gases such as nitrous oxide.

Flammable Anesthetizing Location.

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

Hazard Current.

For a given set of connections in an isolated power system, the total current that would flow through a low impedance if it were connected between either isolated conductor and ground. [**99:**3.3.70]

Fault Hazard Current.

The hazard current of a given isolated power system with all devices connected except the line isolation monitor. [**99:**3.3.70.1]

Monitor Hazard Current.

The hazard current of the line isolation monitor alone. [**99:**3.3.70.2]

Total Hazard Current.

The hazard current of a given isolated system with all devices, including the line isolation monitor, connected. [**99:**3.3.70.3]

Health Care Facilities.

Buildings, portions of buildings, or mobile enclosures in which human medical, dental, psychiatric, nursing, obstetrical, or surgical care is provided. [**99:**3.3.71]

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

Health Care Facility's Governing Body.

The person or persons who have the overall legal responsibility for the operation of a health care facility. [**99:**3.3.72]

Hospital.

A building or portion thereof used on a 24-hour basis for the medical, psychiatric, obstetrical, or surgical care of four or more inpatients. [***101:***3.3.150]

Invasive Procedure.

Any procedure that penetrates the protective surfaces of a patient's body (i.e., skin, mucous membrane, cornea) and that is performed with an aseptic field (procedural site). [Not included in this category are placement of peripheral intravenous needles or catheters used to administer fluids and/or medications, gastrointestinal endoscopies (i.e., sigmoidoscopies), insertion of urethral catheters, and other similar procedures.] [**99:**3.3.87]

Isolated Power System.

A system comprising an isolating transformer or its equivalent, a line isolation monitor, and its ungrounded circuit conductors. [**99:**3.3.89]

Isolation Transformer.

A transformer of the multiple-winding type, with the primary and secondary windings physically separated, that inductively couples its ungrounded secondary winding(s) to the grounded feeder system that energizes its primary winding(s). [**99:**3.3.90]

Life Safety Branch.

A system of feeders and branch circuits supplying power for lighting, receptacles, and equipment essential for life safety that is automatically connected to alternate power sources by one or more transfer switches during interruption of the normal power source. [**99:**3.3.93]

Limited Care Facility.

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

Line Isolation Monitor.

A test instrument designed to continually check the balanced and unbalanced impedance from each line of an isolated circuit to ground and equipped with a built-in test circuit to exercise the alarm without adding to the leakage current hazard. [**99:**3.3.95]

Medical Office.

A building or part thereof in which the following occur:

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

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

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

[**99:**3.3.106]

Monitor Hazard Current.

See *Hazard Current*.

Nurses' Stations.

Areas intended to provide a center of nursing activity for a group of nurses serving bed patients, where the patient calls are received, nurses are dispatched, nurses' notes written, inpatient charts prepared, and medications prepared for distribution to patients. Where such activities are carried on in more than one location within a nursing unit, all such separate areas are considered a part of the nurses' station.

Nursing Home.

A building or portion of a building used on a 24-hour basis for the housing and nursing care of four or more persons who, because of mental or physical incapacity, might be unable to provide for their own needs and safety without the assistance of another person. [***101:***3.3.148.2]

Patient Bed Location.

The location of a patient sleeping bed, or the bed or procedure table of a Category 1 (critical care) space. [**99:**3.3.135]

Patient Care Space.

Any space of a health care facility wherein patients are intended to be examined or treated. [**99:**3.3.136]

Informational Note No. 1: The health care facility's governing body designates patient care space in accordance with the type of patient care anticipated.

Informational Note No. 2: Business offices, corridors, lounges, day rooms, dining rooms, or similar areas typically are not classified as patient care spaces. [**99:**A.3.3.136]

Category 1 (Critical Care) Space.

Space in which failure of equipment or a system is likely to cause major injury or death of patients, staff, or visitors. [**99:**3.3.136.1]

Informational Note: Category 1 spaces, formerly known as critical care rooms, are typically where patients are intended to be subjected to invasive procedures and connected to line-operated, patient care–related appliances. Examples include, but are not limited to, special care patient rooms used for critical care, intensive care, and special care treatment rooms such as angiography laboratories, cardiac catheterization laboratories, delivery rooms, operating rooms, post-anesthesia care units, trauma rooms, and other similar rooms. [**99:**A.3.3.136.1]

Category 2 (General Care) Space.

Space in which failure of equipment or a system is likely to cause minor injury to patients, staff, or visitors. [**99:**3.3.136.2]

Informational Note: Category 2 spaces were formerly known as general care rooms. Examples include, but are not limited to, inpatient bedrooms, dialysis rooms, in vitro fertilization rooms, procedural rooms, and similar rooms. [**99:**A.3.3.136.2]

Category 3 (Basic Care) Space.

Space in which failure of equipment or a system is not likely to cause injury to the patients, staff, or visitors but can cause patient discomfort. [**99:**3.3.136.3]

Informational Note: Category 3 spaces, formerly known as basic care rooms, are typically where basic medical or dental care, treatment, or examinations are performed. Examples include, but are not limited to, examination or treatment rooms in clinics, medical and dental offices, nursing homes, and limited care facilities. [**99:**A.3.3.136.3]

Category 4 (Support) Space.

Space in which failure of equipment or a system is not likely to have a physical impact on patient care. [**99:**3.3.136.4]

Informational Note: Category 4 spaces were formerly known as support rooms. Examples of support spaces include, but are not limited to, anesthesia work rooms, sterile supply, laboratories, morgues, waiting rooms, utility rooms, and lounges. [**99:**A.3.3.136.4]

Patient Care Vicinity.

A space, within a location intended for the examination and treatment of patients, extending 1.8 m (6 ft) beyond the normal location of the bed, chair, table, treadmill, or other device that supports the patient during examination and treatment and extending vertically to 2.3 m (7 ft 6 in.) above the floor. [**99:**3.3.139]

Patient Equipment Grounding Point.

A jack or terminal that serves as the collection point for redundant grounding of electric appliances serving a patient care vicinity or for grounding other items in order to eliminate electromagnetic interference problems. [**99:**3.3.140]

Psychiatric Hospital.

A building used exclusively for the psychiatric care, on a 24-hour basis, of four or more inpatients.

Reference Grounding Point.

The ground bus of the panelboard or isolated power system panel supplying the patient care room. [**99:**3.3.154]

Relative Analgesia.

A state of sedation and partial block of pain perception produced in a patient by the inhalation of concentrations of nitrous oxide insufficient to produce loss of consciousness (conscious sedation).

Selected Receptacles.

A minimal number of receptacles selected by the health care facility's governing body as necessary to provide essential patient care and facility services during loss of normal power. [**99:**3.3.160]

Task Illumination.

Provisions for the minimum lighting required to carry out necessary tasks in the areas described in 517.34, including safe access to supplies and equipment and access to exits. [**99:**3.3.173]

Wet Procedure Location.

The area in a patient care space where a procedure is performed that is normally subject to wet conditions while patients are present, including standing fluids on the floor or drenching of the work area, either of which condition is intimate to the patient or staff. [**99:**3.3.183]

Informational Note: Routine housekeeping procedures and incidental spillage of liquids do not define a wet procedure location. [**99:**A.3.3.183]

X-Ray Installations, Long-Time Rating.

A rating based on an operating interval of 5 minutes or longer.

X-Ray Installations, Mobile.

X-ray equipment mounted on a permanent base with wheels, casters, or a combination of both to facilitate moving the equipment while completely assembled.

X-Ray Installations, Momentary Rating.

A rating based on an operating interval that does not exceed 5 seconds.

X-Ray Installations, Portable.

X-ray equipment designed to be hand carried.

X-Ray Installations, Transportable.

X-ray equipment to be conveyed by a vehicle or that is readily disassembled for transport by 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 10:03:47 EDT 2020
Committee: NEC-P15

Public Input No. 304-NFPA 70-2020 [Definition: Category 1 (Critical Care) Space.]

Category 1 (Critical Care) Space.

Space in which failure of equipment or a system is likely to cause major injury or death of patients, staff, or visitors. [**99:**3.3.136.1]

Informational Note: Category 1 spaces, formerly known as critical care rooms, are typically where patients are intended to be subjected to invasive procedures and connected to line-operated, patient care–related appliances. Examples include, but are not limited to, special care patient rooms used for critical care, intensive care, and special care treatment rooms such as angiography laboratories, cardiac catheterization laboratories, delivery rooms, operating rooms, post-anesthesia care units, trauma rooms, and other similar rooms. Category 1 spaces can also include various types of outpatient plastic surgery centers that offer procedures including but not limited to breast augmentation or reduction, buttock lift, facelift, eyelid or brow lift, labiaplasty, and liposuction. [**99:**A.3.3.136.1]

Statement of Problem and Substantiation for Public Input

There are issues within the definition of Category 1 that need to be addressed. Please allow me to elaborate...

For example, there are at least 3000 deaths per year for the "Brazilian butt lift" procedure when using general anesthesia and less than that when using local anesthesia. I consider this to be an invasive procedure, and NFPA 99.3.3.87 would also consider this to be an invasive procedure (as far as I can tell). I receive a large amount of push-back when trying to mandate an Essential Electrical System for these types of outpatient offices (the plastic surgery doctors refer to these facilities as "offices"). I also receive a large amount of push-back when trying to require the correct amount of operating room receptacles and alike. The doctor usually refers to the operating room as a "procedure room." I've had stand-alone facilities here in Las Vegas that even have "recovery areas." It is a huge problem - as procedure rooms are called out in the Definition of Category 2.

In order to help the electrical plans examiner and others like me, we need certain plastic surgery procedures specifically CALLED OUT BY NAME in the informational note, in order to do our job effectively. The owners of the plastic surgery centers try to build them for the least amount of money possible. In addition, some doctors will state in letters that there is no, "life-support." It makes the job too difficult when I have medical professionals submitting carefully-crafted letters indicating that they aren't doing that which they are doing.

I'm specifically asking for plastic surgery to be called out in definition of Category 1.
I don't believe that it fits into Category 2.

It may lie somewhere between Category 1 and Category 2, and in that regard I have to look at it as Category 1. Please add this language. Electrical plans examiners are not medical professionals and without this proposed language, our hands are often tied. I've given a few specific examples that I feel should be included in the Informational Note. Even though an Informational Note is not necessarily enforceable, the proposed language would solve the problem, and help to get us to the finish line.

Note - If the panel feels that these types of offices are in fact Category 2, then please insert the proposed language into the informational note for Category 2 spaces. Please give us a starting point, either Category 1 or Category 2. Electrical plans examiners and electrical inspectors are not medical professionals, and we need this language to help to do our job.

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Submittal Date: Thu Jan 16 10:36:58 EST 2020
Committee: NEC-P15

Public Input No. 3388-NFPA 70-2020 [Definition: Patient Care Space.]

Patient Care Space.

Any space of a health care facility wherein patients are intended to be examined or treated. [**99:**3.3.136]

Informational Note No. 1: The health care facility's governing body designates patient care space in accordance with the type of patient care anticipated.

Informational Note No. 2: Business offices, corridors, lounges, day rooms, dining rooms, or similar areas typically are not classified as patient care spaces. [**99:**A.3.3.136]

Category ~~1 (Critical Care) Space~~ 1 Space .

Space in which failure of equipment or a system is likely to cause major injury or death of patients, staff, or visitors. [**99:**3.3.136.1]

Informational Note: Category 1 spaces, formerly known as critical care rooms, are typically where patients are intended to be subjected to invasive procedures and connected to line-operated, patient care–related appliances. Examples include, but are not limited to, special care patient rooms used for critical care, intensive care, and special care treatment rooms such as angiography laboratories, cardiac catheterization laboratories, delivery rooms, operating rooms, post-anesthesia care units, trauma rooms, and other similar rooms. [**99:**A.3.3.136.1]

Category 2 ~~(General Care)~~ Space.

Space in which failure of equipment or a system is likely to cause minor injury to patients, staff, or visitors. [**99:**3.3.136.2]

Informational Note: Category 2 spaces were formerly known as general care rooms. Examples include, but are not limited to, inpatient bedrooms, dialysis rooms, in vitro fertilization rooms, procedural rooms, and similar rooms. [**99:**A.3.3.136.2]

Category ~~3 (Basic Care) Space~~ 3 Space .

Space in which failure of equipment or a system is not likely to cause injury to the patients, staff, or visitors but can cause patient discomfort. [**99:**3.3.136.3]

Informational Note: Category 3 spaces, formerly known as basic care rooms, are typically where basic medical or dental care, treatment, or examinations are performed. Examples include, but are not limited to, examination or treatment rooms in clinics, medical and dental offices, nursing homes, and limited care facilities. [**99:**A.3.3.136.3]

Category ~~4 (Support) Space~~ 4 Space .

Space in which failure of equipment or a system is not likely to have a physical impact on patient care. [**99:**3.3.136.4]

Informational Note: Category 4 spaces were formerly known as support rooms. Examples of support spaces include, but are not limited to, anesthesia work rooms, sterile supply, laboratories, morgues, waiting rooms, utility rooms, and lounges. [**99:**A.3.3.136.4]

Statement of Problem and Substantiation for Public Input

as part of a phased in approach to making the NEC terminology consistent with NFPA 99 it was decided by the committee three cycles ago that these terms would eventually go away as they are misleading for application of the code.

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Committee: NEC-P15

Public Input No. 665-NFPA 70-2020 [New Definition after Definition: Hospital.]

Hospital (Grade) Receptacle

Receptacles for hospital use in other than hazardous (classified) locations, that are identified by the marking Hospital Only or by the marking Hospital Grade (HG) and a green dot on the face of the receptacle that is visible after installation with the cover plate installed.

Statement of Problem and Substantiation for Public Input

Hospital Grade for receptacles is always in quotations as if the user know what it implies. However the UL listing of the receptacles not only require the HG marking but also to include a green dot. It is time the NEC recognizes the green dot as Hospital grade.

https://iq.ulprospector.com/en/profile?e=210947

Hospital Receptacle — Receptacles for hospital use in other than hazardous (classified) locations in accordance with Article 517 of the NEC are identified (1) by the marking "Hospital Only" (used to identify a specific grounding locking configuration rated 20 A, 125 V used for the connection of mobile x-ray and similar equipment), or (2) by the marking "Hospital Grade" (or "Hosp. Grade" or "HG") and a green dot on the face of the receptacle. The identification is visible during installation on the wiring system or, in the case of the appliance outlet, after installation on the utilization equipment.

UL 498 Marking requirements In Part;
MARKINGS
SC30.2 A receptacle shall be marked with the phrase "Hospital Grade" "Hosp. Grade or "HG"" where visible during installation and with a green dot that is visible after installation with the cover plate secured as intended.
SC30.3 The green dot shall be a contrasting shade of green if on a green-bodied device and shall be 3/16 inch (4.8 mm) minimum, 1/4 inch (6.4 mm) maximum in diameter.

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Committee: NEC-P15

Public Input No. 666-NFPA 70-2020 [New Definition after Definition: Hospital.]

Hospital (Grade) Attachment plug

An attachment plug or cord connector marked with the phrase Hospital Grade (HG)

and with a green dot. The markings is located on an external surface including the

face of the device and is visible after installation on flexible cord. The green dot is not located

on any external (removable) strain relief clamp.

Statement of Problem and Substantiation for Public Input

This is a UL requirement for cord cap and attachment plug and this standard is enforceable by the AHJ and should be include in the definition to make it know to the installer and inspector

UL 498 markings
SC30.1 An attachment plug or cord connector shall be marked with the phrase "Hospital Grade", "Hosp. Grade" or "HG" and with a green dot. The markings shall be located on any external surface including the face of the device so that it is visible after installation on flexible cord. The green dot shall not be located on an external (removable) strain relief clamp.

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Committee: NEC-P15

Public Input No. 22-NFPA 70-2019 [New Definition after Definition: Patient Equipment Groundin...]

Pharmacy.
A secured space within which pharmaceutical medicines are compounded, prepared, stored, dispensed, or preserved.

Statement of Problem and Substantiation for Public Input

A definition to support the use of the term "pharmacy" in 517.10(B), assuming Public Input No 17 is Accepted by CMP-15. This definition serves to avoid confusion with the commercial occupancy colloquially called "drugstore".

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 17-NFPA 70-2019 [Section No. 517.10(B)]	Definition of term used in 517.10(B)
Public Input No. 17-NFPA 70-2019 [Section No. 517.10(B)]	

Submitter Information Verification

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Submittal Date: Mon Nov 04 11:53:24 EST 2019
Committee: NEC-P15

Public Input No. 17-NFPA 70-2019 [Section No. 517.10(B)]

(B) Not Covered.

Part II shall not apply to the following:

(1) Business offices, corridors, waiting rooms, and the like in clinics, medical and dental offices, and outpatient facilities

(2) ~~Areas~~ Spaces of nursing homes and limited care facilities wired in accordance with Chapters 1 through 4 of this Code where these ~~areas~~ spaces are used exclusively as patient sleeping rooms

(3) ~~Areas~~ Spaces used exclusively for any of the following purposes:

(4) Intramuscular injections (immunizations)

(5) Psychiatry and psychotherapy

(6) Alternative medicine

(7) Optometry

(8) Pharmacies that are not contiguous to health care occupancies

Informational Note: See NFPA *101*-2018, *Life Safety Code*.

Statement of Problem and Substantiation for Public Input

NOTE: In 210.10(B)(3), contrary to TerrorView's spontaneous underlining, this Public Input makes no changes to list items a through d. List item e is NEW.

Spaces that store and dispense pharmaceutical medicines and that are not contiguous to healthcare facilities do not treat patients or perform patient procedures (with the exception of administering immunizations already exempted by list item a) and therefore do not require the wiring and protection methods of Article 517 Part II to mitigate patient risk.

Editorial: The term "areas" is revised to "spaces", consistent with NFPA 99® and with Article 57

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 22-NFPA 70-2019 [New Definition after Definition: Patient Equipment Groundin...]	
Public Input No. 22-NFPA 70-2019 [New Definition after Definition: Patient Equipment Groundin...]	

Submitter Information Verification

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City:
State:
Zip:
Submittal Date: Fri Nov 01 18:38:38 EDT 2019
Committee: NEC-P15

Public Input No. 1779-NFPA 70-2020 [Section No. 517.10(B)]

(B) Not Covered.

Part II shall not apply to the following:

(1) Business offices, corridors, waiting rooms, and the like in clinics, medical and dental offices, and outpatient ~~facilities~~ facilities **Informational Note:** See 406.112(5) for 125- and 250-volt, single phase, 15- and 20-ampere non-locking receptacles located in healthcare facility business offices, corridors, waiting rooms, required to be tamper resistant.

(2) Areas of nursing homes and limited care facilities wired in accordance with Chapters 1 through 4 of this Code where these areas are used exclusively as patient sleeping rooms **Informational Note:** See 210.12(C) for 120-volt, single-phase, 15- and 20-ampere branch circuits supplying outlets and receptacles located in patient sleeping rooms in nursing homes and limited care facilities connected to arc-fault circuit-interrupter circuits.

(3) Areas used exclusively for any of the following purposes:

(4) Intramuscular injections (immunizations)

(5) Psychiatry and psychotherapy

(6) Alternative medicine

(7) Optometry

Informational Note: See NFPA *101*-2018, *Life Safety Code*.

Statement of Problem and Substantiation for Public Input

The two Code sections shown in these information notes, 210.12(C) for arc-fault circuit interrupters and tamper resistant receptacle requirement in healthcare facilities were added in recent additions of the Code. Adding the two informational notes will serve as a reminder to installers, designers, and maintenance users of the code that receptacle outlets located outside of patient care spaces in all healthcare facility business offices, corridors, waiting rooms, and in medical and dental clinics are to be listed tamper resistant receptacle types. 406.12(5) requires arc-fault circuit-interrupters are required to protect branch circuits outlets and devices in the patient sleeping areas of nursing homes and limited care facilities.

Submitter Information Verification

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Submittal Date: Wed Jul 01 12:59:58 EDT 2020
Committee: NEC-P15

Public Input No. 3744-NFPA 70-2020 [Section No. 517.11]

~~**517.11** General Installation — Construction Criteria.~~

~~The purpose of this article is to specify the installation criteria and wiring methods that minimize electrical hazards by the maintenance of adequately low potential differences only between exposed conductive surfaces that are likely to become energized and could be contacted by a patient.~~

~~Informational Note: In a health care facility, it is difficult to prevent the occurrence of a conductive or capacitive path from the patient's body to some grounded object, because that path may be established accidentally or through instrumentation directly connected to the patient. Other electrically conductive surfaces that may make an additional contact with the patient, or instruments that may be connected to the patient, then become possible sources of electric currents that can traverse the patient's body. The hazard is increased as more apparatus is associated with the patient, and, therefore, more intensive precautions are needed. Control of electric shock hazard requires the limitation of electric current that might flow in an electrical circuit involving the patient's body by raising the resistance of the conductive circuit that includes the patient, or by insulating exposed surfaces that might become energized, in addition to reducing the potential difference that can appear between exposed conductive surfaces in the patient care vicinity, or by combinations of these methods. A special problem is presented by the patient with an externalized direct conductive path to the heart muscle. The patient may be electrocuted at current levels so low that additional protection in the design of appliances, insulation of the catheter, and control of medical practice is required.~~

Statement of Problem and Substantiation for Public Input

If this language is worth retaining it should be moved to an informational note to 517.1. Why are we telling people the purpose of a code article in the middle of the code article?

Submitter Information Verification

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Submittal Date: Wed Sep 09 11:40:48 EDT 2020
Committee: NEC-P15

Public Input No. 4652-NFPA 70-2020 [Section No. 517.11]

517.11 General Installation — Construction Criteria.

The purpose of this article is to specify the installation criteria and wiring methods that minimize electrical hazards by the maintenance of adequately low potential differences only between exposed conductive surfaces that are likely to become energized and could be contacted by a patient.

Informational Note 1 : In a health care facility, it is difficult to prevent the occurrence of a conductive or capacitive path from the patient's body to some grounded object, because that path may be established accidentally or through instrumentation directly connected to the patient. Other electrically conductive surfaces that may make an additional contact with the patient, or instruments that may be connected to the patient, then become possible sources of electric currents that can traverse the patient's body. The hazard is increased as more apparatus is associated with the patient, and, therefore, more intensive precautions are needed. Control of electric shock hazard requires the limitation of electric current that might flow in an electrical circuit involving the patient's body by raising the resistance of the conductive circuit that includes the patient, or by insulating exposed surfaces that might become energized, in addition to reducing the potential difference that can appear between exposed conductive surfaces in the patient care vicinity, or by combinations of these methods. A special problem is presented by the patient with an externalized direct conductive path to the heart muscle. The patient may be electrocuted at current levels so low that additional protection in the design of appliances, insulation of the catheter, and control of medical practice is required.

Informational Note 2: Informational Note 2: Service, feeder and branch circuit load calculations for health care facilities shall be permitted to be based upon demonstrated loads, provided that such calculations are performed by a qualified person, as determined by the Authority Having Jurisdiction.

Additional Proposed Changes

File Name	Description	Approved
.1599769577481	Mazzetti FPRF Project Meeting Minutes September 2020	
NFPA_FPRF_minutes_-_electric_circuit_data_collection.pdf		
Pages_from_Section_8_from_Ark.pdf		

Statement of Problem and Substantiation for Public Input

This proposal pairs with the proposal for a new term -- "Demonstrated Load" -- which takes its inspiration from the Canadian Electrical Code which permits a broader application of engineering judgement. The intent is to "rightsize" health care facilities power chain by giving design experts more freedom than presently allowed in Chapter 2. Oversized building premise wiring and equipment is not safe.

Last cycle the TCC referred similar proposals to a study group which provided inspiration for a study now underway, administered by the Fire Protection Research Foundation and performed by Mazzetti Associates. The oversight committee is still active, as is the research. Minutes of the most recent meeting are attached herewith.

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Submitter Information Verification

Submitter Full Name: Michael Anthony
Organization: Standards Michigan
Affiliation: IEEE Education & Healthcare Facility Electrotechnology Committee
Street Address:
City:
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Submittal Date: Thu Sep 10 16:17:41 EDT 2020
Committee: NEC-P15

RESEARCH FOUNDATION

RESEARCH FOR THE NFPA MISSION

Electric Circuit Data Collection: Interim Deliverable Review

Tuesday, September 1, 2020 | 4:00 – 5:00 PM
Location: Microsoft Teams Meeting

1) Call to Order and Attendees. The meeting was called to order at 4:00 pm ET by Victoria Hutchison of the Fire Protection Research Foundation. The following were in attendance:

Brent Anderson, University of Iowa (IA) – Alt. to Lou Galante
Mike Anthony, Standards Michigan & University of Michigan (MI)
Larry Ayer, Biz Com Electric & IEC (OH)
Chad Beebe, ASHE (WA)
Kara Brooks, ASHE
Tom Domitrovich, Eaton Corporation (MO)
Lou Galante, APPA and University of Iowa (IA)
Victoria Hutchison, FPRF (MA)
Alan Manche, Schneider Electric (KY)
Eric Nimer, Mazzetti
Roger McDaniel, Georgia Power Company (GA)
Robert Osborne, UL LLC (NC)
Sreeni Ranganathan, FPRF (MA)
Jeff Sargent, NFPA (MA)
Troy Savage, Mazzetti (VA)
Walt Vernon, Mazzetti (CA)

For reference, the slides used during this meeting are included herein as Attachment A. The purpose of the meeting was to review the data analysis and methodology with the panel and solicit their feedback before finalizing the rest of the data analysis and deliverables.

2) Review of adjustment in scope. Victoria Hutchison started the meeting by providing a few updates since the last panel call:

- The last panel call was on May 18, 2020. Since this call, the research team has continued to collect and analyze data from 4 hospitals.
- Note that during the last panel meeting, we announced a slight modification in scope for the healthcare occupancies - focusing on high demand areas (i.e. patient care spaces) instead of common office spaces.

- Data collection for the other occupancies is currently being put on hold, due to the on-going covid-19 pandemic. The other occupancies will collect data in the spaces originally specified in the statement of work.

Troy Savage and Walt Vernon, from Mazzetti, led a general review of the interim data analysis:

- Circuit level data was collected at 1 hospital; Panel level data was collected at 3 other hospitals.
- The research team had data on the actual demand and calculated demand, based on the original floor plans, for some locations
    - At locations that the research team was unable to get access to the floor plans, the electrical demand (load) was compared to a baseline to determine the change. In this analysis, the research team also compared the data being captured now, during the pandemic, to previous data collected prior to the pandemic to compare it to "normal conditions"
- Since COVID-19 made for some unusual conditions in hospitals, the research team sought to collect data from Hospitals in regions of the country that were experiencing "surge" conditions from COVID to capture a "worse-case" scenario. Data was collected from hospitals in the following states:
    - California
    - Georgia
    - Alabama
    - Massachusetts
- Data from Oregon that was collected prior to the pandemic is being used as historical baseline data, for a comparison between normal demand vs pandemic demand and measured loads vs comparative calculated loads.

Eric Nimer, electrical engineer, from Mazzetti presented a background of the analysis of circuit level data (based on the floor plans):

- In this analysis, we were looking at normal power vs critical power.
- Looking at design/calculated load vs metered load.
    - Focused on dedicated cord and plug receptacles; did not consider lighting.
- Circuits 17 and 19, for example, is for normal power (e.g. refrigerators, microwave, etc.). For general purpose receptacles we usually use 180 kVA.
- Looking at the data for W4L1 (top) W4LC1(bottom), we were focusing on ICU patient rooms (normal power) and ICU Patient rooms (emergency power)
    - Calculating for "overdesign"
- We took the maximum KVA value (peak load) that was captured/metered over the past 5 months. At this peak load, the safety factor was 465%

This is the same methodology that we used in the Portland data we previously submitted to the NEC (unrelated to this current FPRF project). There were several concerns with the data originally; we believe we have been able to address those outstanding questions in this project. This study is assessing everything with plug loads.

Discussion:

- We need to make sure we have enough capacity for all of both normal and emergency power.
- Impact of seasons on load.
- We have a unique opportunity to gather data that will be useful to others
- What is the impact of the pandemic?
    - We don't have results at this point because of the nature of the pandemic.
    - At beginning of the pandemic, most hospital loads went to 0 because they sent all patients home.
    - We have seen a surge in a few places.
    - The use of ventilators has a significant impact on electrical load. All used in the ICU rooms.
- There were a lot of questions around how we show the pieces of equipment on the circuits

3. Discussion:

What else should we show in the data? What did we miss?

- General feedback on the analysis and methodology was positive from the panel members.

Are all the circuits metered?

- Nearly all are metered, yes.
    - We looked for areas that had both normal and emergency power.
    - Sum of the peak loads vs panel level
- Are you measuring in KVA or KW in column A?
    - It is measured in kVA
- What is the goal, down the road? Is that peak or demand?
    - It's the max load (in kVA) in the 5-month period.
- What's the goal with this data?
    - Is the goal to treat dedicated vs non-dedicated circuits separate or combine? Combining may make it confusing.
    - The ultimate goal of the project was to collect data that could be used by the NEC code-making panels to inform discussions around demand factors.
- Is there a sensitivity analysis that helps us assess the data?
    - Safety factor of 50% versus 5000% raises questions?
        - Will there be a day that one of the other circuits will have a lower safety factor than normal?
    - As you aggregate the data, there is more uncertainty and diversity. This isn't there as much at the circuit level.
- How do we simplify this?
    - This is challenging. When you summarize the data, a lot of questions come up.
    - We must build the story. We have a lot of data and good information, now we have to build out the story (e.g. what are the outliers, what happens if "…", etc.)

    - It should be noted that all the values were showing the "max" load seen over a 5-month period.
    - What percentage of safety is the code-making panels okay with?
- What was going on during those periods that were monitored?
    - What impact did COVID have on this activity?
    - Surgeries are coming back, because they were on hold during COVID. So, we are getting back to normal conditions in hospitals.
    - We need to think about how we put the data in the context of the "hospital conditions"
        - We have a lot of good data from the MA hospital. We have census data as part of that assessment.
- Do we have appliance load versus equipment? And general-purpose vs receptacle. These were fixed loads; others were random. Should we separate them?
    - We can separate the charts for clarity
- I'd like to address the issue of separating the data into the categories of receptacles vs dedicated equipment. It has been mentioned that we should show these separately. Should we alter how we show the data at all?
    - I think you need to convey what was general purpose vs what was dedicated.
    - This study is only focused on plug loads. Not considering lighting.
    - We measured circuits with dedicated equipment or general-purpose receptacles (180 kVA).
        - The lighting is typically less than the peak of the other loads we measured. How we calculated it builds in a safety factor.
- What else do you want to see that we didn't show?
    - Would like to see us get to a point that the sizing of electrical systems are informed by data.
    - There's a lot of great work here. But as we bring the infrastructure size down, we also need to understand the other performance aspects (e.g. power quality, voltage drop, etc.) This all got taken care of when things are sized large. When you bring it down, at what point do we need to get concerned?

A key takeaway from the panel discussion was that the project should focus on collecting data in hospitals, for now. Data in the other occupancies (e.g. education or business) would likely show inaccurate loads in comparison to the “norm” and would not be worth dedicating resources to at this time. It was also noted that it may be worth keeping meters installed in hospitals to see the difference in load as more Non-COVID and elective surgery patients fill the hospitals capacity.

4. Next Steps and Wrap-Up. The research team will continue analyzing the rest of the hospital data and will follow up with a revised draft and additional analyzed data.

5. Adjournment. Panel members were thanked for their participation, and the meeting adjourned at 5:02 PM ET.

MAZZETTI

Hospital Pandemic Metering

Discuss Hospital Data
September 1, 2020

Purpose

- Discuss procedure for determining the data
- Discuss any additional analysis needs from technical panel

Types of Data Collected

1. Circuit Level Data
2. Panel Level Data

Types of Analysis

1. Compare actual demand to a calculated demand (based on floor plans, etc.)
2. Compare change in demand to a baseline.

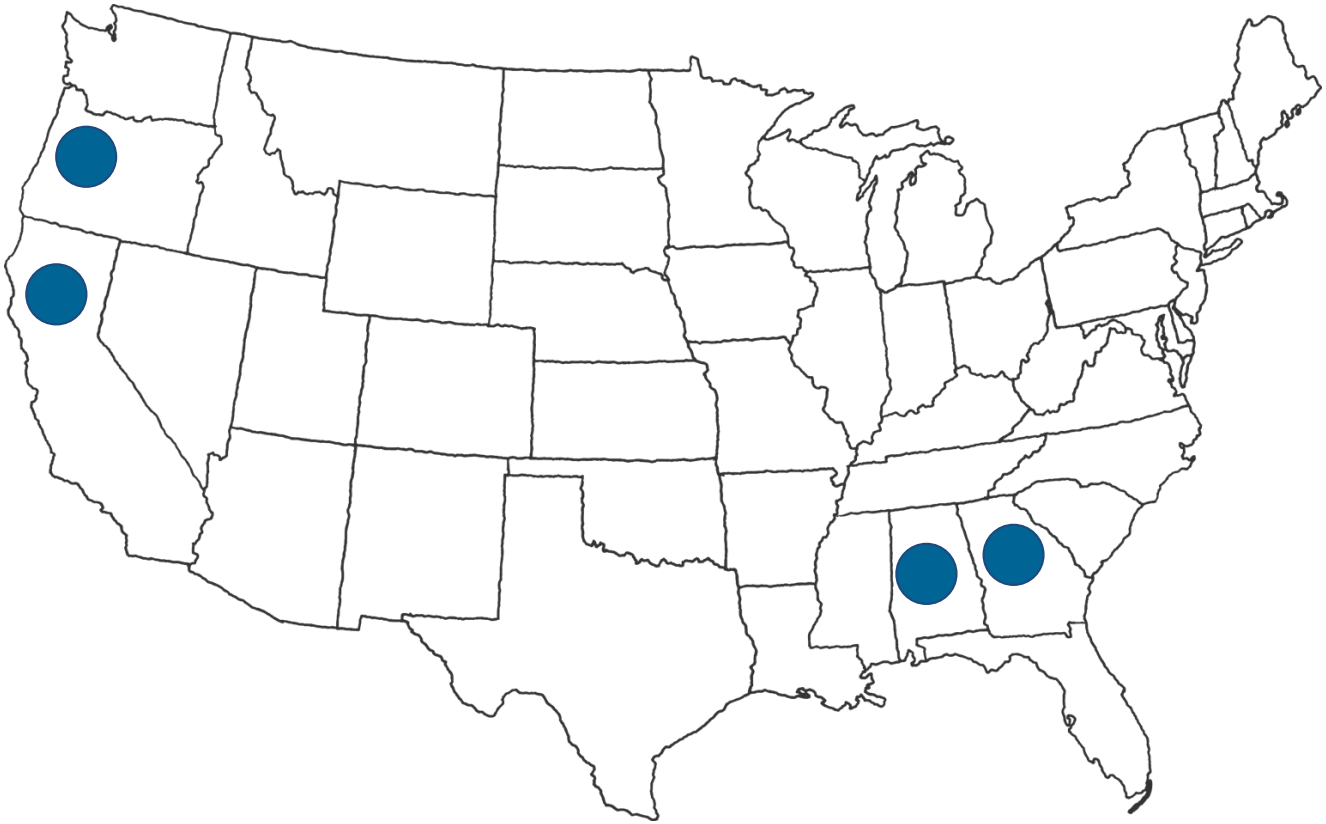
Data collection locations

- Hospital in California – 3/26/20 (panel and circuit level data collected)
- Hospital in Alabama - 4/14/20 (panel level data collected)
- Second campus of the Alabama Hospital – 4/14/20 (panel level data collected)
- Hospital in Georgia - (panel level data collected)
- Hospital in Georgia - 4/13/20 - (panel level data collected)
- Hospital in Georgia – 4/17/20 - (panel level data collected)



Compare Actual Demand to Calculated Demand

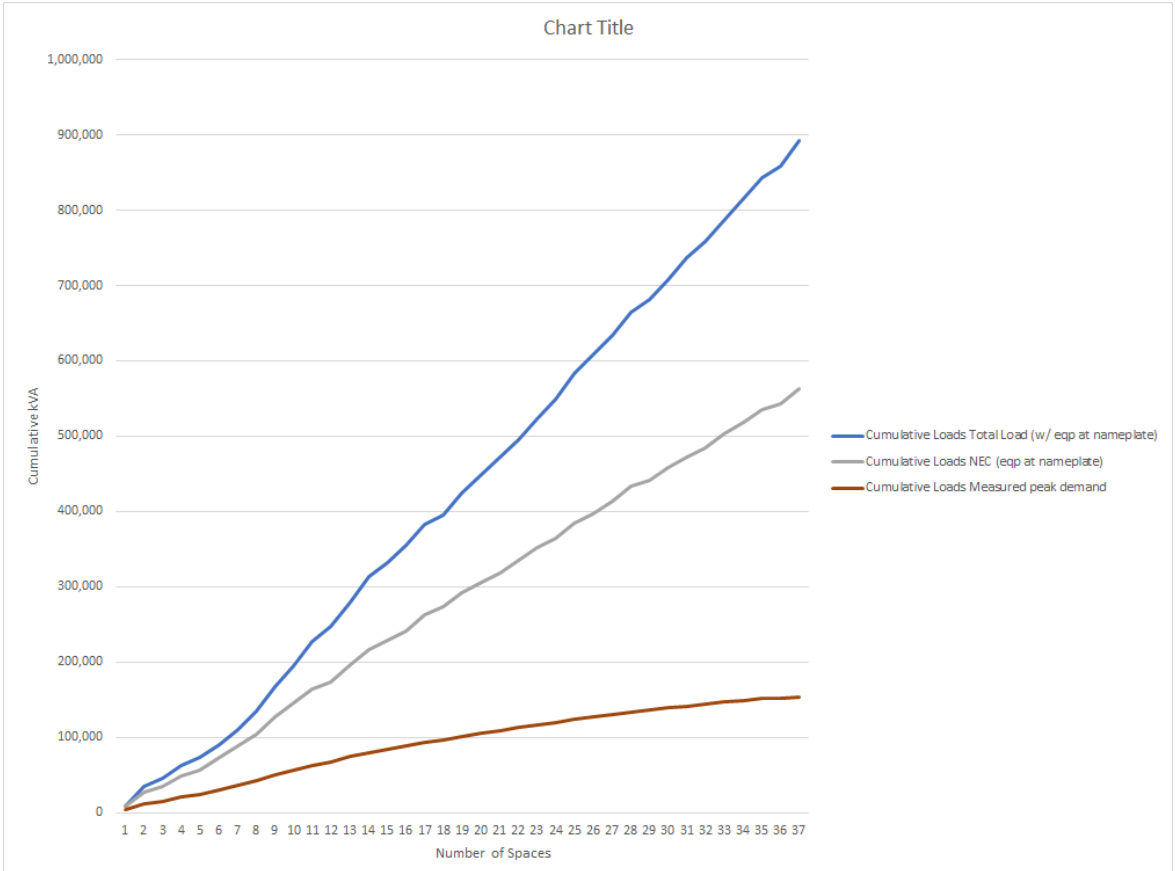
DATA LOCATIONS



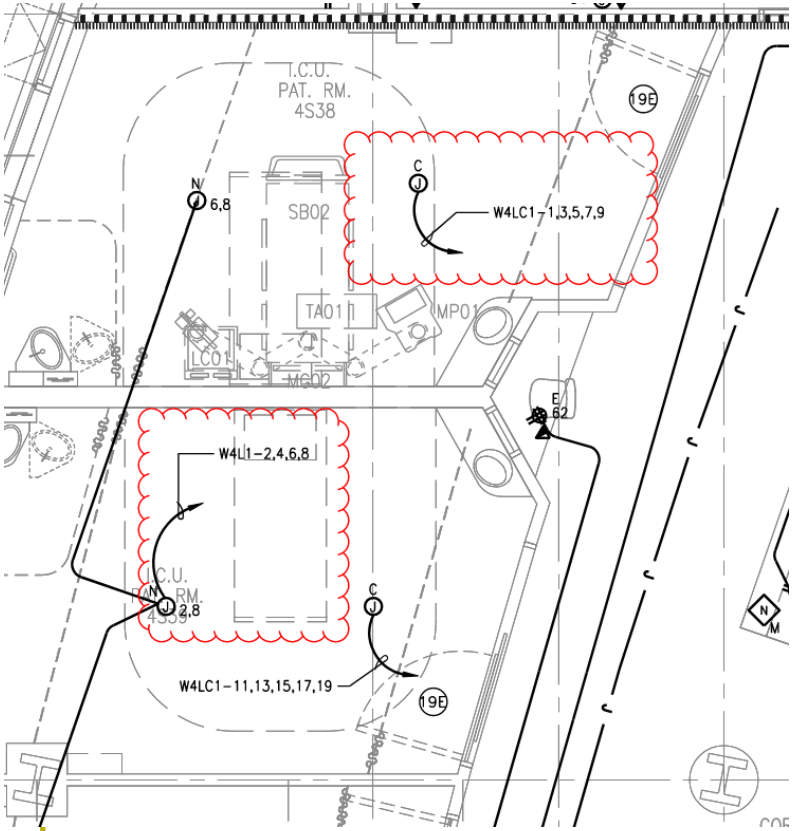
Previous Study for Context - Portland

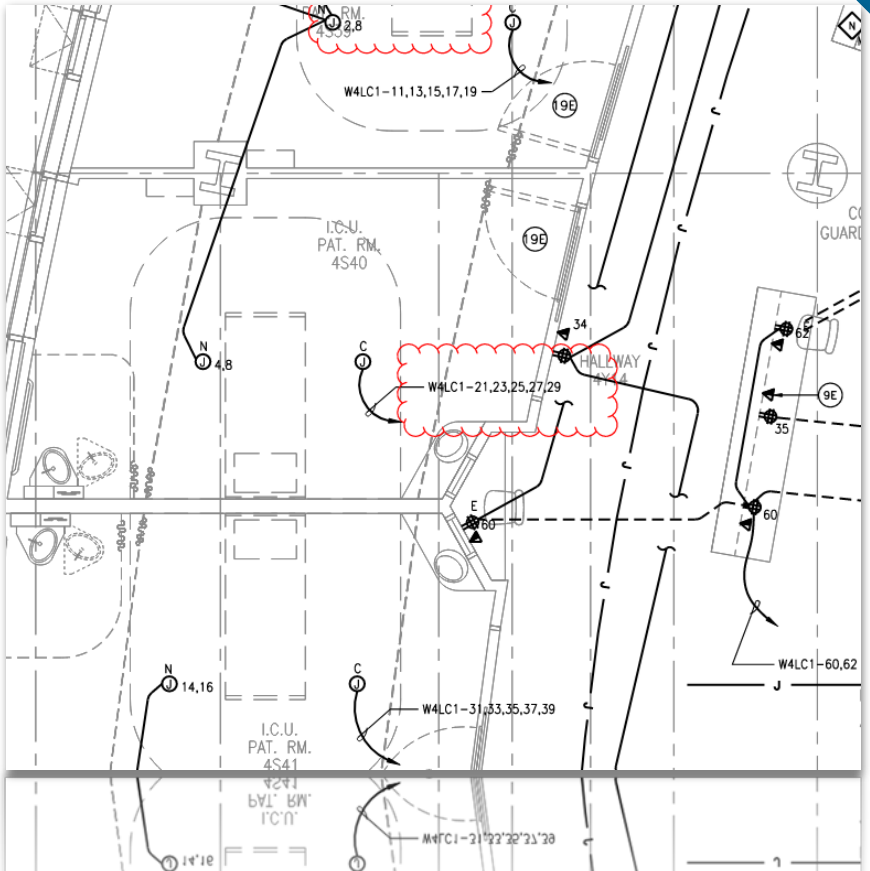
Row #	Connected Load (VA)					Measured Peak VA	NEC DEMAND LOAD	Safety Factor Above Measured	Cumulative Loads					Cumulative Loads		
	# Receps	Recep load	# CORD CONN EQP	Cord Con Load (nameplate)	Total Conn. Load, equip at nameplate		CORD CONN AT nameplate	NEC (w/ eqp at nameplate)	Measured peak demand	Recep Load	Cord Conn Load (nameplate)	Total Load (w/ eqp at nameplate)	NEC (w/ eqp at nameplate)	Total Load (w/ eqp at nameplate)	NEC (eqp at nameplate)	Measured peak demand
22	22	3,960	8	4,681	8,641	3,290	8,641	163%	3,290	3,960	4,681	8,641	8,641	8,641	8,641	3,290
37	113	20,340	5	5,080	25,420	7,550	20,250	168%	10,840	24,300	9,761	34,061	26,911	34,061	26,911	10,840
34	28	5,040	7	5,843	10,883	3,790	10,883	187%	14,630	29,340	15,604	44,944	35,274	44,944	35,274	14,630
26	47	8,460	7	8,302	16,762	5,760	16,762	191%	20,390	37,800	23,906	61,706	47,806	61,706	47,806	20,390
35	28	5,040	7	5,663	10,703	3,670	10,703	192%	24,060	42,840	29,569	72,409	55,989	72,409	55,989	24,060
16	3	540	23	16,712	17,252	5,780	17,252	198%	29,840	43,380	46,281	89,661	72,971	89,661	72,971	29,840
25	50	9,000	13	11,302	20,302	6,420	20,302	216%	36,260	52,380	57,583	109,963	88,773	109,963	88,773	36,260
21	92	16,560	9	7,602	24,162	6,140	20,882	240%	42,400	68,940	65,185	134,125	104,655	134,125	104,655	42,400
8	118	21,240	11	11,326	32,566	7,680	26,946	251%	50,080	90,180	76,511	166,691	126,601	166,691	126,601	50,080
9	107	19,260	14	8,976	28,236	6,620	23,606	257%	56,700	109,440	85,487	194,927	145,207	194,927	145,207	56,700
1	164	29,520	4	3,400	32,920	6,240	23,160	271%	62,940	138,960	88,887	227,847	163,367	227,847	163,367	62,940
20	102	18,360	1	360	18,720	3,850	14,540	278%	66,790	157,320	89,247	246,567	172,907	246,567	172,907	66,790
5	111	19,980	17	12,914	32,894	7,230	27,904	286%	74,020	177,300	102,161	279,461	195,811	279,461	195,811	74,020
7	147	26,460	10	7,007	33,467	5,950	25,237	324%	79,970	203,760	109,168	312,928	216,048	312,928	216,048	79,970

Previous Study for Context - Portland

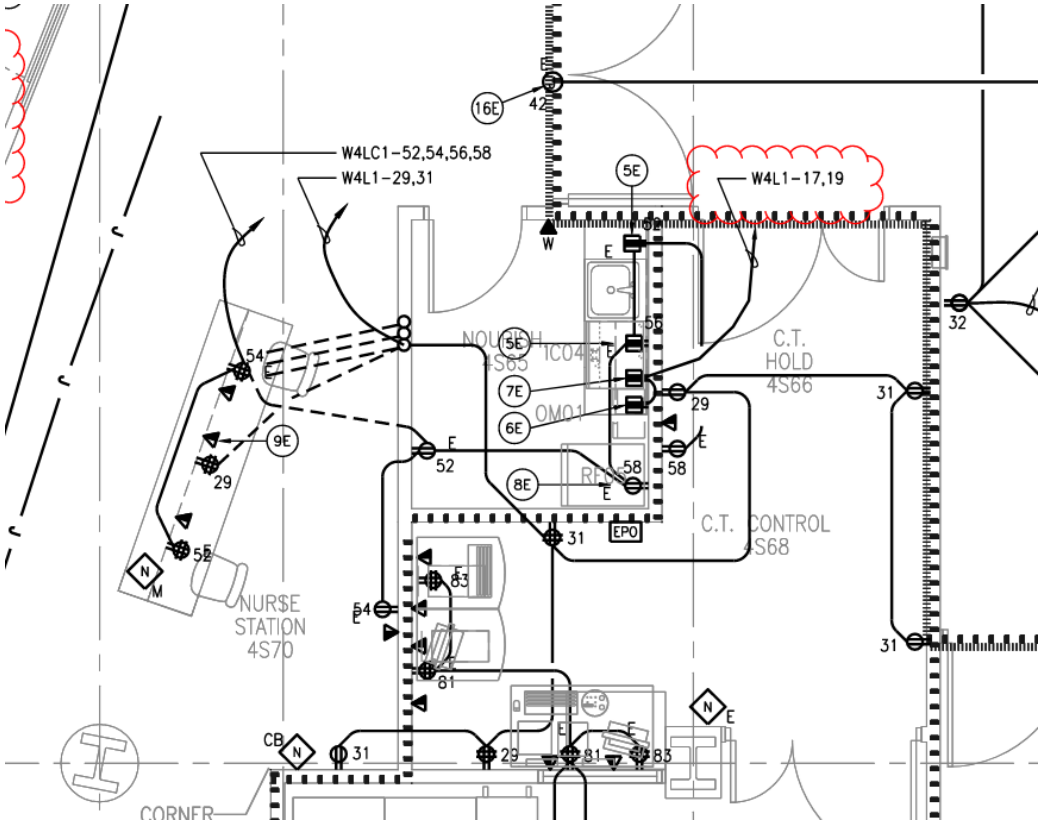


Floor Plan of analyzed circuits

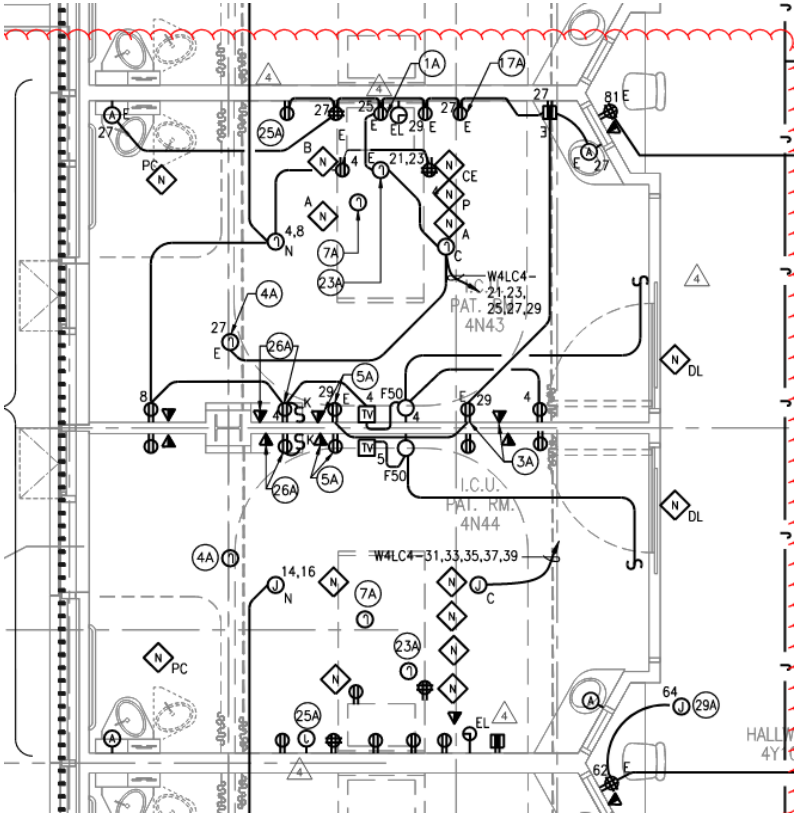




Floor Plan of analyzed circuits (cont.)



Floor Plan of ICU power plan layouts



Panel Schedules with design loads

Panel: W4L1 (NORMAL, FCB = 225A) Bus Rating (Amps): 225
Main: L.O. Volts (L-L): 120/208
Enclosure: Surface Phase: 3
AIC Rating: 10,000 Wires: 4

Ckt	Description	Load Type	Load (KVA)	OC Device Amps	OC Device Poles	Phase	OC Device Amps	OC Device Poles	Load (KVA)	Load Type	Description	Ckt
1	4SO- ICU rm -Recept- 5GP	2	0.90	20	1	A	20	1	0.90	2	4SO- ICU rm -Recept- 5GP	2
3	4SO- ICU rm -Recept- 5GP	2	0.90	20	1	B	20	1	0.90	2	4SO- ICU rm -Recept- 5GP	4
5	4SO- ICU rm -Recept- 5GP	2	0.90	20	1	C	20	1	0.90	2	4SO- ICU rm -Recept- 5GP	6
7	4SO- ICU rm-Recpt-3GP	2	0.54	20	1	A	20	1	0.54	2	4SO- ICU rm-Recpt-3GP	8
9	SPARE			20	1	B	20	1	0.90	2	4SO- ICU rm -Recept- 5GP	10
11	SPARE			20	1	C	20	1	0.90	2	4SO- ICU rm -Recept- 5GP	12
13	SPARE			20	1	A	20	1	0.90	2	4SO- ICU rm -Recept- 5GP	14
15	SPARE			20	1	B	20	1	0.54	2	4SO- ICU rm-Recpt-3GP	16
17	4SO- Nourish - Coffee	7	1.44	20	1	C	20	1	0.90	2	4SO- ICU rm -Recept- 5GP	18
19	4SO- Nourish - Microwave	7	0.96	20	1	A	20	1	0.90	2	4SO- ICU rm -Recept- 5GP	20
21	4SO- CORE - Microwave		0.90	20	1	B	20	1	0.90	2	4SO- ICU rm -Recept- 5GP	22
23	4SO- CORE	7	0.72	20	1	C	20	1	0.54	2	4SO- ICU rm-Recpt-3GP	24
25	4SO- CORE - Recept- 4GP	2	0.72	20	1	A	20	1	0.90	2	4SO- CORE - Recept- 5GP	26
27	4SO- CORE - Recept- 3GP	2	0.54	20	1	B	20	1	0.90	2	4SO- CORE - Recept- 5GP	28
29	4SO- NS, CT - Recept- 5GP	2	0.90	20	1	C	20	1	1.08	2	4SO- CORE - Recept- 6GP	30
31	4SO- NS, CT - Recept- 5GP	2	0.90	20	1	A	20	1	1.08	2	4SO- Corridor - Recept- 6GP	32
33	4SO- CORE - Recept- 5GP	2	0.90	20	1	B	20	1	1.08	2	4SO- Corridor - Recept- 6GP	34
35	4SO- CORE - Recept- 5GP	2	0.90	20	1	C	20	1	1.08	2	4SO- Corridor - Recept- 6GP	36
37	4SO- CORE - Recept- 5GP	2	0.90	20	1	A	20	1	1.00	7	4LV1	38
39	4SO- X-RAY - Recept- 4GP	2	0.72	20	1	B	20	1			SPARE	40
41	4SO- CORE - Recept- 5GP	2	0.90	20	1	C	20	1			SPARE	42

LOAD TYPE (NUMBER)	0	1	2	3	4	5	6	7	
LOAD TYPE (DESCRIPTION)	P.Rm.Lt	Lighting	Receps	Motors	L. Mot.	Kitch	Elevator	Equip	Total
CONNECTED LOAD SECTION 1 (KVA)	0.00	0.00	27.42	0.00	0.00	0.00	0.00	4.12	31.54
CONNECTED LOAD SECTION 2 (KVA)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL CONNECTED LOAD	0.00	0.00	27.42	0.00	0.00	0.00	0.00	4.12	31.54
DEMAND MULTIPLIER:	1.00	1.25	formula	1.00	1.25	1.00	1.00	1.00	
TOTAL DESIGN LOAD	0.00	0.00	18.71	0.00	0.00	0.00	0.00	4.12	22.83

FEEDER:

*Type 2 (receptacles) formula is as follows: If the Total Connected Load is greater than 10KVA, Then the demand load is ((Connected Load - 10) * .5) +10, Else Demand Load equals Connected Lo

NOTES
1 -
2 -

Panel: W4LC1 Bus Rating (Amps): 225
Main: L.O. Volts (L-L): 120/208
Enclosure: Surface Phase: 3
AIC Rating: 10,000 Wires: 4

Ckt	Description	Load Type	Load (KVA)	OC Device Amps	OC Device Poles	Phase	OC Device Amps	OC Device Poles	Load (KVA)	Load Type	Description	Ckt
1	4SO- ICU rm -Boom	2	0.54	20	1	A	20	1	0.54	2	4SO- ICU rm -Boom	2
3	4SO- ICU rm -Boom	2	0.54	20	1	B	20	1	0.54	2	4SO- ICU rm -Boom	4
5	4SO- ICU rm -Bed	2	1.20	20	1	C	20	1	1.20	2	4SO- ICU rm -Bed	6
7	4SO- ICU rm -Recept-5GP	2	0.90	20	1	A	20	1	0.90	2	4SO- ICU rm -Recept-5GP	8
9	4SO- ICU rm -Recept-4GP	2	0.72	20	1	B	20	1	0.72	2	4SO- ICU rm -Recept-4GP	10
11	4SO- ICU rm -Boom	2	0.54	20	1	C	20	1	0.54	2	4SO- ICU rm -Boom	12
13	4SO- ICU rm -Boom	2	0.54	20	1	A	20	1	0.54	2	4SO- ICU rm -Boom	14
15	4SO- ICU rm -Bed	2	1.20	20	1	B	20	1	1.20	2	4SO- ICU rm -Bed	16
17	4SO- ICU rm -Recept-5GP	2	0.90	20	1	C	20	1	0.90	2	4SO- ICU rm -Recept-5GP	18
19	4SO- ICU rm -Recept-4GP	2	0.72	20	1	A	20	1	0.72	2	4SO- ICU rm -Recept-4GP	20
21	4SO- ICU rm -Boom	2	0.54	20	1	B	20	1	0.54	2	4SO- ICU rm -Boom	22
23	4SO- ICU rm -Boom	2	0.54	20	1	C	20	1	0.54	2	4SO- ICU rm -Boom	24
25	4SO- ICU rm -Bed	2	1.20	20	1	A	20	1	1.20	2	4SO- ICU rm -Bed	26
27	4SO- ICU rm -Recept-5GP	2	0.90	20	1	B	20	1	0.90	2	4SO- ICU rm -Recept-5GP	28
29	4SO- ICU rm -Recept-4GP	2	0.72	20	1	C	20	1	0.72	2	4SO- ICU rm -Recept-4GP	30
31	4SO- ICU rm -Boom	2	0.54	20	1	A	20	1	0.54	2	4SO- ICU rm -Boom	32
33	4SO- ICU rm -Boom	2	0.54	20	1	B	20	1	0.54	2	4SO- ICU rm -Boom	34
35	4SO- ICU rm -Bed	2	1.20	20	1	C	20	1	1.20	2	4SO- ICU rm -Bed	36
37	4SO- ICU rm -Recept-5GP	2	0.90	20	1	A	20	1	0.90	2	4SO- ICU rm -Recept-5GP	38
39	4SO- ICU rm -Recept-4GP	2	0.72	20	1	B	20	1	0.72	2	4SO- ICU rm -Recept-4GP	40
41	4SO- ICU rm -Boom	2	0.54	20	1	C	20	1	0.54	2	4SO- ICU rm -Boom	42

LOAD TYPE (NUMBER)	0	1	2	3	4	5	6	7	
LOAD TYPE (DESCRIPTION)	P.Rm.Lt	Lighting	Receps	Motors	L. Mot.	Kitch	Elevator	Equip	Total
CONNECTED LOAD SECTION 1 (KVA)	0.00	0.00	32.28	0.00	0.00	0.00	0.00	0.00	32.28
CONNECTED LOAD SECTION 2 (KVA)	0.00	0.00	29.86	0.00	0.00	0.00	0.00	6.18	36.04
TOTAL CONNECTED LOAD	0.00	0.00	62.14	0.00	0.00	0.00	0.00	6.18	68.32
DEMAND MULTIPLIER:	1.00	1.25	formula	1.00	1.25	1.00	1.00	1.00	
TOTAL DESIGN LOAD	0.00	0.00	36.07	0.00	0.00	0.00	0.00	6.18	42.25

FEEDER:

*Type 2 (receptacles) formula is as follows: If the Total Connected Load is greater than 10KVA, Then the demand load is ((Connected Load - 10) * .5) +10, Else Demand Load equals Connected Load.

NOTES
1 -
2 -

W4L1 (top) W4LC1 (bottom)

ICU Patient rooms (normal power)	Max KVA	# of gen recetpcales	calculated design load at 180 va/ rec	Safety factor
CT-2 (kW)	0.4703	5	0.9	91%
CT-4 (kW)	0.445	5	0.9	102%
CT-6 (kW)	0.4317	3	0.54	25%
CT-8 (kW)	0.4052	5	0.9	122%

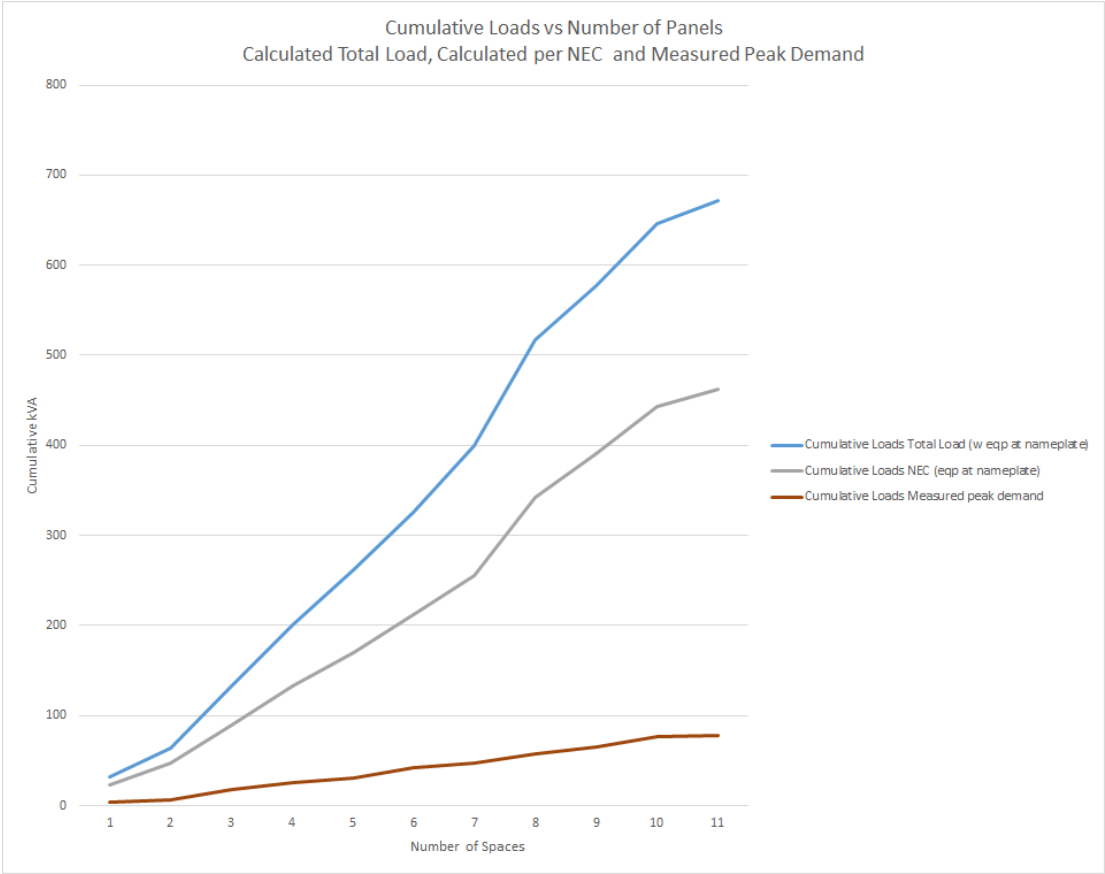
ICU Patient rooms (emergency power)	Max KVA	# of gen recetpcales	calculated design load at 180 va/ rec	Safety factor
CT-7 (kW)	0.1534	5	0.9	487%
CT-9 (kW)	0.4815	4	0.72	50%
CT-27 (kW)	0.0164	5	0.9	5388%
CT-29 (kW)	0.0365	4	0.72	1873%

Panel Summary

	Site/Panel Information (kVA)						Calculated Load Information (kVA)			CUMULATIVE LOADS						Cumulative Loads			
Panel	Department Served	Max Power KVA (metered) Peak Load	# of Receptacles (non-dedicated)	Receptacle Load (non-dedicated) (KVA)	# Cord Connected (dedicated) Equipment circuits	Nameplate Dedicated Equipment - KVA	Total Load (0.18kVA per recep + equipment at nameplate)	NEC Demand Load (w eqp at nameplate)	Safety Factor Above Measured	Measured Peak Demand	Receptacle (non-dedicated) Load	Cord connected (dedicated) load	Total Load (w/ eqp at nameplate)	NEC (eqp at nameplate	Cumulative Safety Factor	Total Load (w/eqp at nameplate)	NEC (eqp at nameplate)	Measured peak demand	Calculated (Design) Load from Panel Schedule (KVA)
W4L1	ICU/Core/Nurse Stati	4.052	153	27.54	4	4.12	31.66	22.89	465%	4.052	27.54	4.12	31.66	22.89	465%	31.66	22.89	4.052	22.83
W4L2	ICU/Core/Nurse Stati	2.615	145	26.1	5	6.72	32.82	24.77	847%	6.667	53.64	10.84	64.48	47.66	615%	64.48	47.66	6.667	24.71
W4LC1 Sec 1 & 2	ICU patient rooms	11.115	346	62.28	5	6.18	68.46	42.32	281%	17.781	115.92	17.02	132.94	89.98	406%	132.94	89.98	17.781	42.25
W4LC3 Sec 1 & 2	ICU patient Rooms	8.229	319	57.42	9	9.64	67.06	43.35	427%	26.010	173.34	26.66	200	133.33	413%	200	133.33	26.010	43.32
W4LC4 Sec 1	ICU patient beds	4.500	336	60.48	1	0.96	61.44	36.2	704%	30.510	233.82	27.62	261.44	169.53	456%	261.44	169.53	30.510	21.45
W4CL2 Pnl Sec 1 &2	ICU	11.281	293	52.74	12	11.64	64.38	43.01	281%	41.792	286.56	39.26	325.82	212.54	409%	325.82	212.54	41.792	43.31
3L3 pnl sec 1& 2	PACU/Office/ Printer	5.667	394	70.92	3	2.72	73.64	43.18	662%	47.458	357.48	41.98	399.46	255.72	439%	399.46	255.72	47.458	43.2
3LC3 pnl sec 1& 2	PACU/Cath	9.844	398	71.64	20	45.88	117.52	86.7	781%	57.302	429.12	87.86	516.98	342.42	498%	516.98	342.42	57.302	90.2
3LC6 pnl sec 1& 2	IT Room/OR supply/C	8.000	192	34.56	27	26.11	60.67	48.39	505%	65.302	463.68	113.97	577.65	390.81	498%	577.65	390.81	65.302	49.6
3LC7 pnl	PACU/Cath/FSD/Brai	11.281	239	43.02	21	25.38	68.4	51.89	360%	76.583	506.7	139.35	646.05	442.7	478%	646.05	442.7	76.583	51.9
3L7 pnl	Consult/Corridor/Ca	1.500	110	19.8	3	5.25	25.05	20.15	1243%	78.083	526.5	144.6	671.1	462.85	493%	671.1	462.85	78.083	20.6

	Site/Panel Information (kVA)						Calculated Load Information (kVA)		
Panel	Department Served	Max Power KVA (metered) Peak Load	# of Receptacles (non-dedicated)	Receptacle Load (non-dedicated) (KVA)	# Cord Connected (dedicated) Equipment circuits	Nameplate Dedicated Equipment - KVA	Total Load (0.18kVA per recep + equipment at nameplate)	NEC Demand Load (w eqp at nameplate)	Safety Factor Above Measured
W4L1	ICU/Core/Nurse Stati	4.052	153	**27.54**	4	4.12	**31.66**	**22.89**	**465%**
W4L2	ICU/Core/Nurse Stati	2.615	145	**26.1**	5	6.72	**32.82**	**24.77**	**847%**
W4LC1 Sec 1 & 2	ICU patient rooms	11.115	346	**62.28**	5	6.18	**68.46**	**42.32**	**281%**
W4LC3 Sec 1 & 2	ICU patient Rooms	8.229	319	**57.42**	9	9.64	**67.06**	**43.35**	**427%**
W4LC4 Sec 1	ICU patient beds	4.500	336	**60.48**	1	0.96	**61.44**	**36.2**	**704%**
W4CL2 Pnl Sec 1 &2	ICU	11.281	293	**52.74**	12	11.64	**64.38**	**43.01**	**281%**
3L3 pnl sec 1& 2	PACU/Office/ Printer	5.667	394	**70.92**	3	2.72	**73.64**	**43.18**	**662%**
3LC3 pnl sec 1& 2	PACU/Cath	9.844	398	**71.64**	20	45.88	**117.52**	**86.7**	**781%**
3LC6 pnl sec 1& 2	IT Room/OR supply/(	8.000	192	**34.56**	27	26.11	**60.67**	**48.39**	**505%**
3LC7 pnl	PACU/Cath/FSD/Brai	11.281	239	**43.02**	21	25.38	**68.4**	**51.89**	**360%**
3L7 pnl	Consult/Corridor/Ca	1.500	110	**19.8**	3	5.25	**25.05**	**20.15**	**1243%**
...									

Cumulative Loads





Panel Data from Georgia Hospital

Georgia Hospital Panel Data Example

Panel name	Average of Average Metered Load KVA (Metered)	Peak Load KVA (Metered)	Phase A (Peak) Amps	Phase B (Peak) Amps	Phase C (Peak) Amps
CEL2 (1 Section)					
CELIN	4.416420815	15.05205988	63.94	94.89	71.25
CL2A (3 Section)	10.02326185	19.7848	121.074	17.6618	50.053
CL2B (3 Section)	3.349822846	47.2848	103.378	92.5803	187.253
CLIN (1 Section)	1.96498392	9.49945	73.1567	48.4907	60.7833
L2PN (2 Section)	5.466229067	18.42	116.596	93.5031	107.764
L2PS (2 Section)	5.704168635	20.9402	102.47	107.91	102.941
LIPZ (2 Section)	5.11730858	15.19552918	74.74	94.25	55.83

Discussion

- Anything to add/change in analysis?
- Items to discuss?

MAZZETTI

THANKYOU

Section 8 — Circuit loading and demand factors

Scope

8-000 Scope

This Section covers

(a) conductor ampacities and equipment ratings required for consumer's services, feeders, and branch circuits; and

(b) branch circuit positions required for dwelling units.

Δ **8-002 Special terminology** (see Appendix B)

Basic load — the load of lighting and receptacle circuits, based on the outside dimensions of a specific area of building occupancy, as listed in Table 14.

Calculated load — the load calculated in accordance with the applicable requirements of this Section.

Demonstrated load — historical maximum demand watt information recorded over at least a 24-month period for the same type of facility as the one in question, equated to watts per m^2.

General

8-100 Current calculations

When calculating currents that will result from loads, expressed in watts or volt amperes, to be supplied by a low-voltage ac system, the voltage divisors to be used shall be 120, 208, 240, 277, 347, 416, 480, or 600 as applicable.

Δ **8-102 Voltage drop** (see Appendices B and D)

(1) The voltage drop in an installation shall be based on the connected load of the feeder or branch circuit if known; otherwise it shall be based on 80% of the rating of the overload or overcurrent device protecting the branch circuit or feeder, and not exceed

(a) 3% in a feeder or branch circuit; and

(b) 5% from the supply side of the consumer's service (or equivalent) to the point of utilization.

(2) Notwithstanding Subrule (1), where overcurrent devices are selected in accordance with other Sections of this Code, the voltage drop shall be based on the calculated demand load of the feeder or branch circuit.

(3) Notwithstanding Subrule (1), wiring for general-use branch circuits rated at not more than 120 V or 20 A in dwelling units, with the conductor length measured from the supply side of the consumer's service to the furthest point of utilization in accordance with the values in Table 68, shall be acceptable.

(4) Notwithstanding Subrule (1), at industrial establishments where conditions of maintenance and supervision ensure use by qualified persons, the design shall ensure that the voltage at the point of utilization is within the rating or voltage tolerance of the connected device(s).

8-104 Maximum circuit loading (see Appendix B)

(1) The ampere rating of a consumer's service, feeder, or branch circuit shall be the ampere rating of the overcurrent device protecting the circuit or the ampacity of the conductors, whichever is less.

(2) The calculated load in a circuit shall not exceed the ampere rating of the circuit.

(3) The calculated load in a consumer's service, feeder, or branch circuit shall be considered a continuous load unless it can be shown that in normal operation it will not persist for

(a) a total of more than 1 h in any two-hour period if the load does not exceed 225 A; or

(b) a total of more than 3 h in any six-hour period if the load exceeds 225 A.

Δ (4) A load of a cyclic or intermittent nature shall be classified as continuous unless it meets the requirements of Subrule (3).

(5) Where a fused switch or circuit breaker is marked for continuous operation at 100% of the ampere rating of its overcurrent devices, the continuous load as determined from the calculated load shall not exceed

(a) 100% of the rating of the circuit where the ampacity of the conductors is based on Column 2, 3, or 4 of Table 2 or 4; or

(b) 85% of the rating of the circuit where the ampacity of the conductors is based on Column 2, 3, or 4 of Table 1 or 3.

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(6) Where a fused switch or circuit breaker is marked for continuous operation at 80% of the ampere rating of its overcurrent devices, the continuous load as determined from the calculated load shall not exceed
   (a) 80% of the rating of the circuit where the ampacity of the conductors is based on Column 2, 3, or 4 of Table 2 or 4; or
   (b) 70% of the rating of the circuit where the ampacity of the conductors is based on Column 2, 3, or 4 of Table 1 or 3.

(7) If other derating factors are applied to reduce the conductor ampacity, the conductor size shall be the greater of that so determined or that determined by Subrule (5) or (6).

(8) Notwithstanding the requirements of Rule 4-004(1)(d) and (2)(d), the ampacity of the underground conductors shall not exceed in any case those determined by Subrules (5)(b) and (6)(b) of this Rule.

8-106 Use of demand factors (see Appendix B)

(1) The size of conductors and switches computed in accordance with this Section shall be the minimum used except that, if the next smaller standard size in common use has an ampacity not more than 5% less than this minimum, the smaller size conductor shall be permitted.

(2) In any case other than a service calculated in accordance with Rules 8-200 and 8-202, where the design of an installation is based on requirements in excess of those given in this Section, the service and feeder capacities shall be increased accordingly.

(3) Where two or more loads are installed so that only one can be used at any one time, the one providing the greatest demand shall be used in determining the calculated demand.

(4) Where it is known that electric space-heating and air-conditioning loads are installed and will not be used simultaneously, whichever is the greater load shall be used in calculating the demand.

(5) Where a feeder supplies loads of a cyclic or similar nature such that the maximum connected load will not be supplied at the same time, the ampacity of the feeder conductors shall be permitted to be based on the maximum load that may be connected at any one time.

Δ (6) Where a feeder or service supplies motor or air-conditioning loads, a demand factor as determined by a qualified person shall be permitted to be applied to these loads, provided that a deviation has been allowed in accordance with Rule 2-030.

(7) The ampacity of conductors of feeders or branch circuits shall be in accordance with the Section(s) dealing with the respective equipment being supplied.

(8) Notwithstanding the requirements of this Section, the ampacity of the conductors of a feeder or branch circuit need not exceed the ampacity of the conductors of the service or of the feeder from which they are supplied.

(9) Where additional loads are to be added to an existing service or feeder, the augmented load shall be permitted to be calculated by adding the sum of the additional loads, with demand factors as permitted by this Code to the maximum demand load of the existing installation as measured over the most recent 12-month period, but the new calculated load shall be subject to Rule 8-104(5) and (6).

Δ (10) For loads other than those calculated in accordance with Rules 8-200 and 8-202, feeder and service load calculations shall be permitted to be based on demonstrated loads, provided that such calculations are performed by a qualified person, as determined by the regulatory authority having jurisdiction.

8-108 Number of branch circuit positions

(1) For a single dwelling, the panelboard shall provide space for at least the equivalent of the following number of 120 V branch circuit overcurrent devices, including space for two 35 A double-pole overcurrent devices:
   (a) 16 — of which at least half shall be double-pole, where the required ampacity of the service or feeder conductors does not exceed 60 A;
   (b) 24 — of which at least half shall be double-pole
      (i) where the required ampacity of the service or feeder conductors exceeds 60 A but does not exceed 100 A; or
      (ii) where the required ampacity of the service or feeder conductors exceeds 100 A but does not exceed 125 A and provision is made for a central electric furnace;
   (c) 30 — of which at least half shall be double-pole
      (i) where the required ampacity of the service or feeder conductors exceeds 100 A but does not exceed 125 A; or
      (ii) where the required ampacity of the service or feeder conductors exceeds 125 A but does not exceed 200 A and provision is made for a central electric furnace; and

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Public Input No. 4632-NFPA 70-2020 [New Section after 517.12]

Nurse Call, contactless controls

Nurse call systems and all their associated componets shall be allowed controls of the contactless type, including voice activation.

Statement of Problem and Substantiation for Public Input

Nurse call system controls have become antiquated and extremely outdated comparable to current available technologies. The need for pull cords and push buttons has become irrelevant and the code should allow for new and innovate, simultaneously secure, solutions for nurse call systems. Traditional pull cord and push button systems are tragically flawed and ripe for disease and infection transmission. Furthermore, patients can't always reach these devices after an event to reach the nursing staff. Voice activation should be an allowable form of control for nurse call systems and I would like it be be specifically allowed for in article 517.

Submitter Information Verification

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Committee: NEC-P15

Public Input No. 295-NFPA 70-2020 [New Section after 517.13]

517.13(C) Lighting.

Lighting in patient care areas shall be permitted to be controlled with one or more switches. Control by automatic means shall not be permitted to control lighting in patient care areas.

Statement of Problem and Substantiation for Public Input

In the case of a dental office, for example - (this is just one example)
If an occupancy sensor is used, it may shut the lights off if the dentist stands in the same position for too long.

Occupancy sensors should not be allowed in medical (patient care) rooms. I don't believe that the use of task lighting should negate this proposal.
It is necessary to write this new language into the code, as it is a valid concern and a safety precaution, exactly similar to 110.26(D):

"...Control by automatic means shall not be permitted to control all illumination within the working space."

Reason for change is increased safety in patient care areas.

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Public Input No. 1634-NFPA 70-2020 [Section No. 517.13]

517.13 Equipment Grounding Conductor for Receptacles and Fixed Electrical Equipment in Patient Care Spaces.

Wiring in patient care spaces shall comply with 517.13(A) and (B).

(A) Wiring Methods.

All branch circuits serving patient care spaces shall be provided with an effective ground-fault current path by installation in a metal raceway ~~system~~ or ~~a cable having a metallic armor or sheath assembly~~ cable wiring method . The metal raceway ~~system, metallic cable armor, or sheath assembly~~ or cable wiring method shall itself qualify as an equipment grounding conductor in accordance with 250.118.

(B) Insulated Equipment Grounding Conductors and Insulated Equipment Bonding Jumpers.

(1) General.

The following shall be directly connected to an insulated copper equipment grounding conductor that is clearly identified along its entire length by green insulation and installed with the branch circuit conductors in the wiring methods as provided in 517.13(A):

(1) The grounding terminals of all receptacles other than isolated ground receptacles

(2) Metal outlet boxes, metal device boxes, or metal enclosures

(3) All non–current-carrying conductive surfaces of fixed electrical ~~equipment likely to become energized that are subject to personal contact, operating~~ equipment operating at over 100 volts

Metal faceplates, shall be connected to an effective ground-fault current path by means of a metal mounting screw(s) securing the faceplate to a metal yoke or strap of a receptacle or to a metal outlet box

Exception No. 1: For other than isolated ground receptacles, an insulated equipment bonding jumper that directly connects to the equipment grounding conductor is permitted to connect the box and receptacle(s) to the equipment grounding conductor. Isolated ground receptacles shall be connected in accordance with 517.16.

Exception No. 2: Luminaires more than 2.3 m (7½ ft) above the floor and switches located outside of the patient care vicinity shall be permitted to be connected to an equipment grounding return path ~~complying~~ in accordance with 517.13(A) ~~or~~ instead of the insulated equipment grounding conductor required by 517.13 (B).

(2) Sizing.

Equipment grounding conductors and equipment bonding jumpers shall be sized in accordance with 250.122.

Statement of Problem and Substantiation for Public Input

(A) was revised so it is more consistent with Code language. (B) was revised by relocating the content of (4) metal faceplates from the list of items required to be directly connected to the circuit EGC (since that is not physically possible). Revised (B) Exception No. 2 to make it clear that the EGC of the wire-type is not required if the effective ground-fault path is provided by 517.13(A).

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Committee: NEC-P15

Public Input No. 3745-NFPA 70-2020 [Section No. 517.13]

517.13 Equipment Grounding Conductor for Receptacles and Fixed Electrical Equipment in Patient Care Spaces.

Wiring in patient care spaces shall comply with 517.13(A) and (B).

Exception: Luminaires more than 2.3 m (7 1/2 ft) above the floor and switches located outside of the patient care vicinity shall be permitted to be connected to an equipment grounding return path complying with 517.13(A) or (B).

(A) Wiring Methods.

All branch circuits serving patient care spaces shall be provided with an effective ground-fault current path by installation in a metal raceway system or a cable having a metallic armor or sheath assembly. The metal raceway system, metallic cable armor, or sheath assembly shall itself qualify as an equipment grounding conductor in accordance with 250.118.

(B) Insulated Equipment Grounding Conductors and Insulated Equipment Bonding Jumpers.

(1) General.

The following shall be directly connected to an insulated copper equipment grounding conductor that is clearly identified along its entire length by green insulation and installed with the branch circuit conductors in the wiring methods as provided in 517.13(A):

(1) The grounding terminals of all receptacles other than isolated ground receptacles

(2) Metal outlet boxes, metal device boxes, or metal enclosures

(3) All non–current-carrying conductive surfaces of fixed electrical equipment likely to become energized that are subject to personal contact, operating at over 100 volts

(4) Metal faceplates, by means of a metal mounting screw(s) securing the faceplate to a metal yoke or strap of a receptacle or to a metal outlet box

~~*Exception No. 1*~~ *Exception : For other than isolated ground receptacles, an insulated equipment bonding jumper that directly connects to the equipment grounding conductor is permitted to connect the box and receptacle(s) to the equipment grounding conductor. Isolated ground receptacles shall be connected in accordance with 517.16.*~~*Exception No. 2: Luminaires more than 2.3 m*~~

(

~~7~~ 1/

2

~~ft~~

)

~~above the floor and switches located outside of the patient care vicinity shall be permitted to be connected to an equipment grounding return path complying with 517.13(A) or (B).~~

~~(2)~~

_ Sizing.

Equipment grounding conductors and equipment bonding jumpers shall be sized in accordance with 250.122 .

Statement of Problem and Substantiation for Public Input

This PI simply relocates the exception from (B) to the parent language before (A) because it acts as an exception to either (but not both) (A) or (B).

Submitter Information Verification

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Committee: NEC-P15

Public Input No. 383-NFPA 70-2020 [Section No. 517.13]

517.13 Equipment Grounding Conductor for Receptacles and Fixed Electrical Equipment in Patient Care Spaces.

Wiring in patient care spaces shall comply with 517.13(A) and (B).

Exception No. 1: Wiring to luminaires more than 2.3 m (7 1/2 ft) above the floor and to switches located outside of the patient care vicinity shall be permitted to be connected to an equipment grounding return path complying with 517.13(A) or (B).

(A) Wiring Methods.

All branch circuits serving patient care spaces shall be provided with an effective ground-fault current path by installation in a metal raceway system or a cable having a metallic armor or sheath assembly. The metal raceway system, metallic cable armor, or sheath assembly shall itself qualify as an equipment grounding conductor in accordance with 250.118.

(B) Insulated Equipment Grounding Conductors and Insulated Equipment Bonding Jumpers.

(1) General.

~~The following shall be directly connected to an~~ An insulated copper equipment grounding conductor that is clearly identified along its entire length by green insulation and installed with the branch circuit conductors ~~in~~ within the wiring ~~methods~~ method as ~~provided~~ selected in 517.13(A) ~~:The~~ shall be connected to the following in 517.13(B)(1)(1) through (B)(1)(4) :

(1) Directly to the grounding terminals of all receptacles other than isolated ground receptacles

(2) ~~Metal~~ Directly to metal outlet boxes, metal device boxes, or metal enclosures

(3) ~~All~~ Directly to all non–current-carrying conductive surfaces of fixed electrical equipment likely to become energized that are subject to personal contact, operating at over 100 volts

(4) ~~Metal~~ To metal faceplates, by means of a metal mounting screw(s) securing the faceplate to a metal yoke or strap of a receptacle or to a metal outlet box

Exception No. ~~1~~ 2 : For other than isolated ground receptacles, an insulated equipment bonding jumper that directly connects to the equipment grounding conductor is permitted to connect the box and receptacle(s) to the equipment grounding conductor. Isolated ground receptacles shall be connected in accordance with 517.16.~~~~*Exception No. 2: Luminaires more than 2.3 m (7 1/2 ft) above the floor and switches located outside of the patient care vicinity shall be permitted to be connected to an equipment grounding return path complying with 517.13(A) or (B).*~~

(2) Sizing.

Equipment grounding conductors and equipment bonding jumpers shall be sized in accordance with 250.122.

Additional Proposed Changes

File Name	Description	Approved
Public_Input_No._383-NFPA_70-2020_Section_517.13_uploaded_text.docx	The Public Input displayed legislatively revised correctly, for the TerraView®-impaired.	

Statement of Problem and Substantiation for Public Input

When 2020 Exception No.2 to 517.13 [2017 Exception No.3] was corrected for content, from "complying with 517.13(A) and (B)" to "complying with 517.13(A) or (B)" for 2017, thereby expressing the wiring options intended by CMP-15, this Exception STILL does not comply with NEC® Style Manual 2.6.1 requiring an Exception to follow IMMEDIATELY the primary rule to which it applies. Consequently, with the Exception following 517.13(B)(1), the "or" of this Exception appears to modify 517.13(B)(1)'s reference SOLELY to "517.13(A)", resulting in confusion to many readers.

This existing Exception actually modifies the CHARGING text of 517.13 that reads "comply with 517.13(A) and (B)" and must be relocated to follow immediately that charging text in accordance with NEC® Style Manual 2.6.1 and the Exceptions of 517.13 must be renumbered in accordance with NEC® Style Manual 2.6.2.

Further, the requirement of 517.13(B)(1) mandates "DIRECTLY connected" but list item (4) is INDIRECTLY connected. This violates NEC® Style Manual 1.2.1 and Manual of Style for NFPA Technical Committee Documents 3.3.1.2.1. Accordingly, "directly" is relocated to solely those applicable list items (1) through (3).

Last Code cycle, Public Input No. 3453-NFPA 70-2017 [Global Input] sought to remove "the provisions of". 517.13(B)(1) includes a variation on that , " ... as provided in ...", overlooked in CMP-15's search. Therefore, revise "provided" to "selected" because 517.13(A) is truly addressing the selection of eligible wiring methods. The sentence is rearranged to be able to reference unambiguously the list items to follow, in accordance with NEC® Style Manual 2.1.5.1 and 2.6.2 and Manual of Style for NFPA Technical Committee Documents 3.3.1.4.

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Committee: NEC-P15

Public Input No. 383-NFPA 70-2019 [Section 517.13] uploaded text

The following is displayed as legislatively revised, for the Terra-View-impaired:

517.13 Equipment Grounding Conductor for Receptacles and Fixed Electrical Equipment in Patient Care Spaces.

Wiring in patient care spaces shall comply with 517.13(A) and (B).

Exception No. 1: Wiring to luminaires more than 2.3 m (7½ ft) above the floor and to switches located outside of the patient care vicinity shall be permitted to be connected to an equipment grounding return path complying with 517.13(A) or (B).

517.13(A) Wiring Methods.

All branch circuits serving patient care spaces shall be provided with an effective ground-fault current path by installation in a metal raceway system or a cable having a metallic armor or sheath assembly. The metal raceway system, metallic cable armor, or sheath assembly shall itself qualify as an equipment grounding conductor in accordance with 250.118.

517.13(B) Insulated Equipment Grounding Conductors and Insulated Equipment Bonding Jumpers.

517.13(B)(1) General.

~~The following shall be directly connected to an~~ An insulated copper equipment grounding conductor that is clearly identified along its entire length by green insulation and installed with the branch circuit conductors ~~in~~ within the wiring ~~methods~~ method as ~~provided~~ selected in 517.13(A) shall be connected to the following in 517.13(B)(1)(1) through (B)(1)(4):

(1) Directly to ~~The~~ the grounding terminals of all receptacles other than isolated ground receptacles

(2) Directly to ~~Metal~~ metal outlet boxes, metal device boxes, or metal enclosures

(3) Directly to ~~All~~ all non–current-carrying conductive surfaces of fixed electrical equipment likely to become energized that are subject to personal contact, operating at over 100 volts

(4) To ~~Metal~~ metal faceplates, by means of a metal mounting screw(s) securing the faceplate to a metal yoke or strap of a receptacle or to a metal outlet box

Exception No. ~~1~~2: For other than isolated ground receptacles, an insulated equipment bonding jumper that directly connects to the equipment grounding conductor is permitted to connect the box and receptacle(s) to the equipment grounding conductor. Isolated ground receptacles shall be connected in accordance with 517.16.

~~*Exception No. 2: Luminaires more than 2.3 m (7½ ft) above the floor and switches located outside of the patient care vicinity shall be permitted to be connected to an equipment grounding return path complying with* 517.13(A) *or (B).*~~

517.13(B)(2) Sizing.

Equipment grounding conductors and equipment bonding jumpers shall be sized in accordance with 250.122.

Public Input No. 1141-NFPA 70-2020 [Section No. 517.13 [Excluding any Sub-Sections]]

Wiring ~~in patient~~ for patient care spaces shall comply with 517.13(A) and (B).

Statement of Problem and Substantiation for Public Input

Replace the 'in' with 'for' if the code intent is to allow strictly metal raceways or metal jacketed cables to the source even if the source is outside a patient care space. 'In' a patient care means just that, 'in' it. Outside the space could be other than metal raceways or metal jacketed cables such as PVC within a concrete slab.

517.13 looks to limit the metal raceways and cable to the patient care space. 517.13(A) looks to require the metal raceways and cables from the source which could travel through a non-patient care space. 517.13 refers us to 517.13(A) and (B) so 517.13 should not conflict with 517.13(A).

Article 500.5(A) says Chapter 5 Special Occupancies are to be read as applicable to the affected "room, section, or area". Example: "547.1 This article applies to the following agricultural buildings or that part of a building or adjacent areas of similar or like nature as specified in 547.1(A) or (B)."

517.40B makes a point to write 'from the source' in its text.

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Committee: NEC-P15

Public Input No. 1408-NFPA 70-2020 [Section No. 517.14]

517.14 Panelboard Bonding.

The equipment grounding terminal buses of the normal and essential branch-circuit panelboards serving the same individual patient care vicinity shall be connected together with an insulated continuous copper conductor not smaller than 10 AWG. Where two or more panelboards serving the same individual patient care vicinity are served from separate transfer switches on the essential electrical system, the equipment grounding terminal buses of those panelboards shall be connected together with an insulated continuous copper conductor not smaller than 10 AWG. This conductor shall be permitted to be broken in order to terminate on the equipment grounding terminal bus in each panelboard.

Exception: The insulated continuous copper conductor not smaller than 10 AWG shall be permitted to be terminated on listed connections to aluminum or copper busbars not smaller than 6 mm thick × 50 mm wide (1⁄4 in. thick × 2 in. wide) and of sufficient length to accommodate the number of terminations necessary for the bonding of the panelboards. The busbar shall be securely fastened and shall be installed in an accessible location.

Additional Proposed Changes

File Name	Description	Approved
E21EB478-C666-451F-BB0F-8B0B4D0520AB.jpeg	grounding/bonding busbar 1	
113195A4-662F-43C6-9D31-D672EAF26D21.jpeg	grounding/bonding busbar 2	

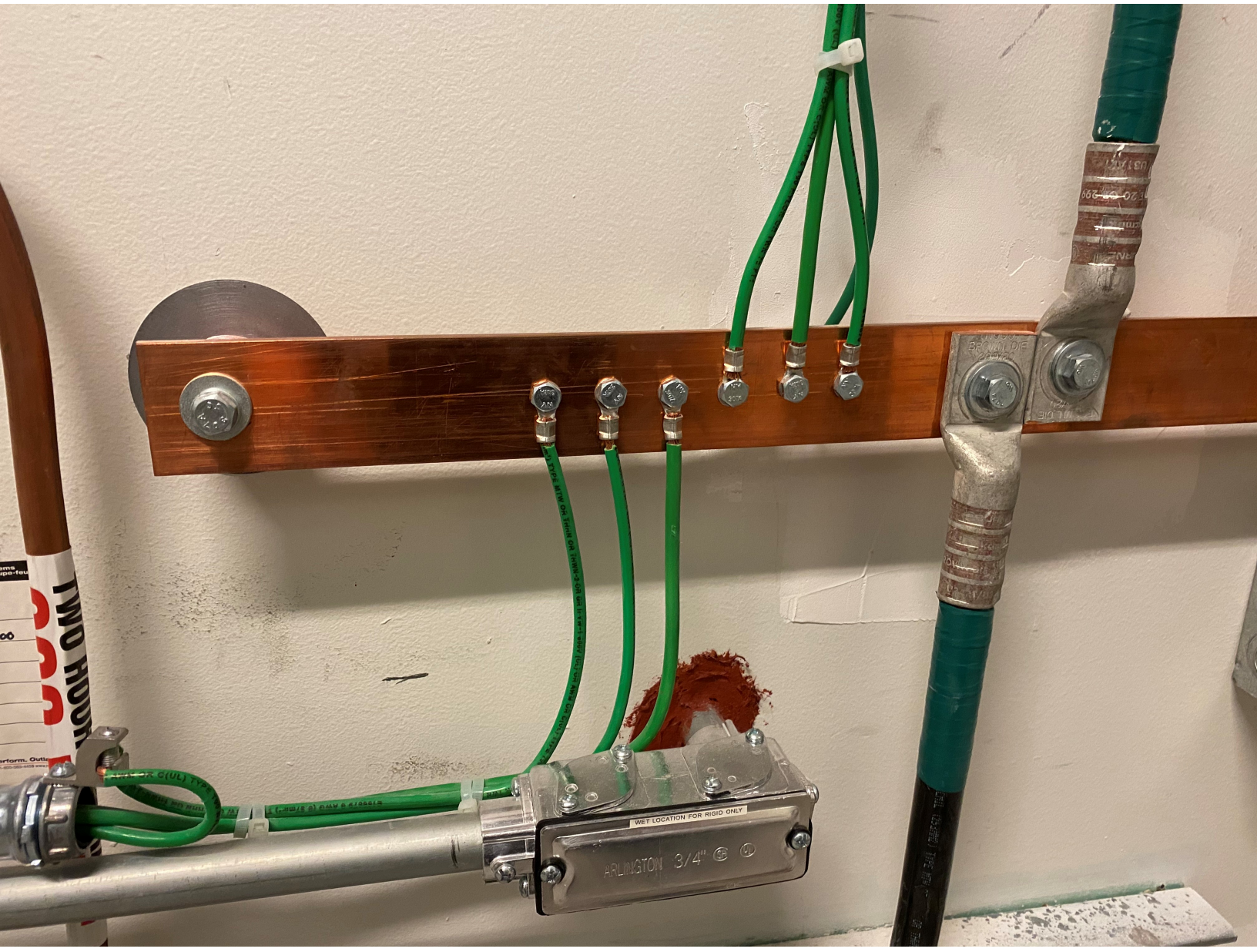
Statement of Problem and Substantiation for Public Input

This exception is needed to allow the very common practice of using busbars as a means of terminating grounding and bonding conductors. This practice is permitted in Section 250.30(A)(6)(c) for grounding electrode tap connections of separately derived systems, 250.64(D)(1)(3) for termination of grounding electrode conductor taps, and 250.94(B) for bonding of systems. I believe this type of busbar installation can provide the same quality bonding connections required by Section 517.14 as presently permitted by several sections in Article 250. Please see my photo examples of bonding busbar installations.

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Committee: NEC-P15




WET LOCATION FOR RIGID ONLY
ARLINGTON 3/4"

Public Input No. 3389-NFPA 70-2020 [Section No. 517.17(A)]

(A) Applicability.

The requirements of 517.17 shall apply to buildings or portions of buildings containing health care facilities with Category ~~1 (critical care) spaces~~ 1 spaces or utilizing electrical life-support equipment, and buildings that provide the required essential utilities or services for the operation of Category ~~1 (critical care) spaces~~ 1 spaces or electrical life-support equipment.

Statement of Problem and Substantiation for Public Input

as part of a phased approach it was decided by the committee several cycles ago to remove these misleading terms and make consistent with NFPA 99 terminology.

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Submittal Date: Tue Sep 08 13:29:58 EDT 2020
Committee: NEC-P15

Public Input No. 2879-NFPA 70-2020 [Section No. 517.17(D)]

~~(D) Testing.~~

~~When ground-fault protection of equipment is first installed, each level shall be performance tested to ensure compliance with 517.17(C) . This testing shall be conducted by a qualified person(s) using a test process in accordance with the instruction provided with the equipment. A written record of this testing shall be made and shall be available to the authority having jurisdiction.~~

Statement of Problem and Substantiation for Public Input

This revision correlates with PI 2877 which adds a new section after 517.26 to require commissioning of type 1 and type 2 essential electrical systems. Since commissioning includes all necessary system testing the existing testing requirement in this section is no longer needed.

Common requirements for device and system commissioning are being proposed to Article 110 in PI 2844 that will help drive consistency in the actions necessary prior to devices and systems being placed into service. This public input is part of a series of revisions proposed throughout the code to include commissioning where the existing requirements only mention testing.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2844-NFPA 70-2020 [New Section after 110.16]	
Public Input No. 2877-NFPA 70-2020 [New Section after 517.26]	

Submitter Information Verification

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Committee: NEC-P15

Public Input No. 1781-NFPA 70-2020 [Section No. 517.18]

517.18 Category

~~2 (General Care)~~

1 Spaces.

(A)

General Requirements for Receptacles in Patient Bed

~~Location~~

Locations .

(1) Each patient bed location shall be supplied by

~~at least two branch circuits, one from the critical branch and one from the normal system. All branch circuits from the normal system shall originate in the same panelboard. The electrical receptacles or the~~

a minimum of fourteen (14) non-locking-type, 125-volt, 15- or 20- ampere receptacles. They shall be permitted to be of the single, duplex, or quadruplex type, or any combinations of the three. Other receptacles (e.g., portable X-ray receptacles) serving special-purpose, cord-and-plug-connected equipment shall be permitted to be of the locking or non-locking type.

(2) Receptacles at each patient bed location shall be supplied by two or more branch circuits. These circuits shall have no other outlets. At least seven (7) of the receptacle outlets at each patient bed location shall be connected to critical branch circuits(s) and at least seven (7) receptacles shall be connected to either the normal power source branch circuit(s) or by separate critical branch circuit(s) supplied from a different transfer switch other than the receptacles at the same location. Where patient bed location receptacles are served from two or more separate transfer switches on the critical branch(s), receptacles are not required to be supplied from the normal power source. All branch circuits supplied from the normal power source shall originate from the same panelboard.

(3) No more than six (6) receptacle outlets shall be connected to a 15- ampere branch circuit. No more than eight (8) receptacle outlets shall be connected to a 20- ampere branch circuit. This provision shall apply to new or remodeled health care facilities only.

Informational Note: It is not intended that there be a total, immediate replacement of branch circuit wiring and receptacle requirements in an existing health care facility. It is intended that receptacle outlet requirements be updated during modification of use, or as existing circuits are replaced.

(4) The electrical receptacles or cover plate for the electrical receptacles

~~supplied from the critical branch shall have a distinctive color or marking so as to be readily identifiable and shall also indicate the panelboard and branch-circuit number supplying them.~~

~~Branch circuits serving patient bed locations shall not be part of a multiwire branch circuit.~~

~~*Exception No. 1: Branch circuits serving only special purpose outlets or receptacles, such as portable X-ray outlets, shall not be required to be served from the same distribution panel or panels.*~~

~~*Exception No. 2: The requirements of 517.18(A) shall not apply to patient bed locations in clinics, medical and dental offices, and outpatient facilities; psychiatric, substance abuse, and rehabilitation hospitals; sleeping rooms of nursing homes; and limited care facilities meeting the requirements of 517.10(B)(2) .*~~

~~*Exception No. 3: A Category 2 (general care) patient bed location served from two separate transfer switches on the critical branch shall not be required to have circuits from the normal system.*~~

~~*Exception No. 4: Circuits served by Type 2 essential electrical systems shall be permitted to be fed by the equipment branch of the essential electrical system.*~~

~~**(B)** Patient Bed Location Receptacles.~~

~~**(1)** Minimum Number and Supply.~~

~~Each patient bed location shall be provided with a minimum of eight receptacles.~~

~~(2)~~ ~~Receptacle Requirements.~~

~~The receptacles required in~~ ~~517.18(B)(1)~~

shall be identified as per 517.31(E) and 517.42(E).

(5) All receptacles shall be listed "hospital grade: and shall be so identified.

Informational Note: It is not intended there be a total replacement of existing non-hospital grade receptacles. It is intended however, that non-hospital grade receptacles be replaced with hospital grade receptacles upon modification of use, or as existing receptacles are replaced.

(6) Each receptacle shall provide at least one separate, grounding terminal capable of maintaining low-contact resistance with its matting plug, despite severe electrical and mechanical use of the receptacle. The grounding terminal of each receptacle shall be connected to the reference grounding point by means of an insulated copper equipment grounding conductor. [99:6.3.2.2.1(A)] The equipment grounding conductor shall be installed in accordance with 517.13(A) and (B) and sized in accordance with 250.122.

(7) Branch circuits serving patient bed locations shall not be part of a multiwire branch circuit.

(B) Operating Room Receptacles.

(1) Each operating room shall be provided with a minimum of thirty-six (36), 125-volt, 15- or 20- ampere receptacles. They shall be permitted to be of the single, duplex, or

~~quadruplex~~

quadruples type , or any combination of the three.

~~All receptacles shall be listed “hospital grade” and shall be so identified. The grounding terminal of each receptacle shall be connected to an insulated copper equipment grounding conductor sized in accordance with~~ ~~Table 250.122~~ .

~~*Exception No. 1:* *The requirements of* *517.18(B)(1)* *and (B)(2) shall not apply to psychiatric, substance abuse, and rehabilitation hospitals meeting the requirements of* *517.10(B)(2)* .~~

~~*Exception No. 2:* *Psychiatric security rooms shall not be required to have receptacle outlets installed in the room.*~~

~~Informational Note: It is not intended that there be a total, immediate replacement of existing non–hospital grade receptacles. It is intended, however, that non–hospital~~

Other receptacles (e.g., portable X-ray receptacles) serving special-purpose equipment shall be permitted to be of the locking or non-locking type.

(2)) Receptacles at each patient bed location shall be supplied by two or more branch circuits. These circuits shall have no other outlets. At least twelve (12) of the receptacle outlets shall be connected to either the normal branch or a critical branch supplied by a different transfer switch other than the receptacles in the same location. Where patient bed location receptacles are served from two or more separate transfer switches on the critical branch(s), receptacles are not required to be supplied from the normal system. All branch circuits from the normal branch shall originate from the same panelboard.

(3) Not more than six (6) receptacles outlets shall be connected to a 15-ampere branch circuit. Not more than eight (8) receptacle outlets shall be connected to a 20-ampere branch circuit.

Informational Note: It is not intended that there be a total, replacement of branch circuit wiring and receptacle requirements in an existing health care facility. It is intended that receptacle outlet requirements be updated during modification of use, or as existing circuits are replaced.

(4) The electrical receptacles or the cover plates for the electrical receptacles supplied from the life safety or critical branch shall have a distinctive color or marking to be readily identifiable and shall indicate the panelboard and branch circuit number supplying them.

(5) The receptacles shall be listed "hospital grade" and shall be so identified.

Informational Note: It is not intended there be a total replacement of existing non-hospital grade receptacles. It is intended however, that non-hospital grade receptacles be replaced with hospital grade receptacles upon modification

~~of~~

or use,

~~renovation,~~

or as existing receptacles

~~need replacement~~

are replaced . .

(

C) Designated Category 2 (General Care) Pediatric Locations.

Receptacles that are located within patient rooms, bathrooms, playrooms, and activity rooms of pediatric units or spaces with similar risk as determined by the health care facility's governing body by conducting a risk assessment, other than infant nurseries, shall be listed and identified as "tamper-resistant" or shall employ a listed tamper-resistant cover. [**99:** 6.3.2.2.1(D)]

6) The grounding terminal of each receptacle shall be connected to the reference grounding point by means of an insulated copper equipment grounding conductor. The equipment grounding conductor shall be installed in accordance with 517.13 (A) and (B) and sized in accordance with 250.122.

(7) Branch circuits serving patient bed locations shall not be part of a multiwire branch circuit.

(C) Patient Care Vicinity Grounding and Bonding (Optional).

A patient care vicinity shall be permitted to have a patient equipment grounding point. The patient equipment grounding point, where supplied, shall be permitted to contain one or more listed grounding and bonding jacks. An equipment bonding jumper not smaller than 10 AWG shall be used to connect the grounding terminal of all grounding-type receptacles to the patient equipment grounding point. The bonding conductor shall be permitted to be arranged centrically or looped as convenient.

Informational Note: Where there is no patient equipment grounding point, it is important that the distance between the reference grounding point and the patient care vicinity be as short as possible to minimize any potential differences.

(D) Equipment Grounding and Bonding.

Where a grounded electrical distribution system is used and metal feeder raceway or Type MC or MI cable that qualifies as an equipment grounding conductor in accordance with 250.118 is installed, grounding of enclosures and equipment, such as panelboards, switchboards, and switchgear, shall be ensured by one of the following bonding means at each termination or junction point of the metal raceway or Type MC or MI cable:

(1) A grounding bushing and a continuous copper bonding jumper, sized in accordance with 250.122, with the bonding jumper connected to the junction enclosure or the ground bus of the panel

(2) Connection of feeder raceways or Type MC or MI cable to threaded hubs or bosses on terminating enclosures

(3) Other approved devices such as bonding-type locknuts or bushings. Standard locknuts shall not be used for bonding.

(E) Additional Protective Techniques in Category 1 Spaces (Optional).

Isolated power systems shall be permitted to be used for Category 1 spaces, and, if used, the isolated power system equipment shall be listed as isolated power equipment. The isolated power system shall be designed and installed in accordance with 517.160.

Exception: The audible and visual indicators of the line isolation monitor shall be permitted to be located at the nursing station for the area being served.

(F) Isolated Power System Equipment Grounding.

Where an isolated ungrounded power source is used and limits the first-fault current to a low magnitude, the equipment grounding conductor associated with the secondary circuit shall be permitted to be run outside of the enclosure of the power conductors in the same circuit.

Informational Note: Although it is permitted to run the equipment grounding conductor outside of the conduit, it is safer to run it with the power conductors to provide better protection in case of a second ground fault.

(G) Special-Purpose Receptacle Grounding.

The equipment grounding conductor for special-purpose receptacles, such as the operation of mobile X-ray equipment, shall be extended to the reference grounding points of branch circuits for all locations likely to be served from such receptacles. Where such a circuit is served from an isolated ungrounded system, the equipment grounding conductor shall not be required to be run with the power conductors; however, the equipment grounding terminal of the special-purpose receptacle shall be connected to the reference grounding point.

Statement of Problem and Substantiation for Public Input

The order of 517.18 and 517.19 are reversed to show Category 1 patient care space first and Category 2 patent care space second . Language for Category 1 spaces is clarified for better use by code users. Language is added to clarify that critical branch circuits from separate transfer switches in allowed to connect all receptacles in place of using receptacles from the

normal branch. Due to circuit loading and use the number of receptacles connected to 15- and 20-ampere branch circuits is added for patient safety. As noted in the Informational Notes the changes and additions to several of these sub sections are not required in existing facilities until major changes or upgrades (remodels) occur to the electrical distribution system.

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Public Input No. 3402-NFPA 70-2020 [Section No. 517.18]

517.18 Category 2 ~~(General Care)~~ Spaces.

(A) Patient Bed Location.

Each patient bed location shall be supplied by at least two branch circuits, one from the critical branch and one from the normal system. All branch circuits from the normal system shall originate in the same panelboard. The electrical receptacles or the cover plate for the electrical receptacles supplied from the critical branch shall have a distinctive color or marking so as to be readily identifiable and shall also indicate the panelboard and branch-circuit number supplying them.

Branch circuits serving patient bed locations shall not be part of a multiwire branch circuit.

Exception No. 1: Branch circuits serving only special purpose outlets or receptacles, such as portable X-ray outlets, shall not be required to be served from the same distribution panel or panels.

Exception No. 2: The requirements of 517.18(A) shall not apply to patient bed locations in clinics, medical and dental offices, and outpatient facilities; psychiatric, substance abuse, and rehabilitation hospitals; sleeping rooms of nursing homes; and limited care facilities meeting the requirements of 517.10(B)(2).

Exception No. 3: A Category 2 ~~(general care)~~ patient bed location served from two separate transfer switches on the critical branch shall not be required to have circuits from the normal system.

Exception No. 4: Circuits served by Type 2 essential electrical systems shall be permitted to be fed by the equipment branch of the essential electrical system.

(B) Patient Bed Location Receptacles.

(1) Minimum Number and Supply.

Each patient bed location shall be provided with a minimum of eight receptacles.

(2) Receptacle Requirements.

The receptacles required in 517.18(B)(1) shall be permitted to be of the single, duplex, or quadruplex type or any combination of the three. All receptacles shall be listed “hospital grade” and shall be so identified. The grounding terminal of each receptacle shall be connected to an insulated copper equipment grounding conductor sized in accordance with Table 250.122.

Exception No. 1: The requirements of 517.18(B)(1) and (B)(2) shall not apply to psychiatric, substance abuse, and rehabilitation hospitals meeting the requirements of 517.10(B)(2).

Exception No. 2: Psychiatric security rooms shall not be required to have receptacle outlets installed in the room.

Informational Note: It is not intended that there be a total, immediate replacement of existing non–hospital grade receptacles. It is intended, however, that non–hospital grade receptacles be replaced with hospital grade receptacles upon modification of use, renovation, or as existing receptacles need replacement.

(C) Designated Category ~~2 (General Care) Pediatric~~ 2 Pediatric Locations.

Receptacles that are located within patient rooms, bathrooms, playrooms, and activity rooms of pediatric units or spaces with similar risk as determined by the health care facility’s governing body by conducting a risk assessment, other than infant nurseries, shall be listed and identified as “tamper-resistant” or shall employ a listed tamper-resistant cover. [**99:**6.3.2.2.1(D)]

Statement of Problem and Substantiation for Public Input

as part of a phased approach it was decided by the committee several cycles ago to remove these misleading terms and make consistent with NFPA 99 terminology.

Submitter Information Verification

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Submittal Date: Tue Sep 08 13:50:21 EDT 2020
Committee: NEC-P15

Public Input No. 2276-NFPA 70-2020 [Section No. 517.19]

517.19 Category

~~1~~

2 (

~~Critical~~

General Care) Spaces.

(A)

~~Patient~~

Patient Bed Location

~~Branch Circuits~~

.

(1) Each patient bed location shall be supplied by

~~at least two branch circuits, one or more from the critical branch and one or more circuits from the normal system. At least one branch circuit from the critical branch shall supply an outlet(s) only at that bed location.~~

~~The electrical receptacles or the cover plates for the electrical receptacles supplied from the life safety and critical branches shall have a distinctive color or marking so as to be readily identifiable. [**99:** 6.7.2.3.5(B)]~~

~~All branch circuits from the normal system shall be from a single panelboard. Critical branch receptacles shall be identified and shall also indicate the panelboard and circuit number supplying them.~~

~~The branch circuit serving patient bed locations shall not be part of a multiwire branch circuit.~~

~~*Exception No. 1: Branch circuits serving only special-purpose receptacles or equipment in Category 1 (critical care) spaces shall be permitted to be served by other panelboards.*~~

~~*Exception No. 2: Category 1 (critical care) spaces served from two separate critical branch transfer switches shall not be required to have circuits from the normal system.*~~

~~**(B)** Patient Bed Location Receptacles.~~

~~**(1)** Minimum Number and Supply.~~

~~Each patient bed location shall be provided with a minimum of 14 receptacles, at least one of which shall be connected to either of the following:~~

(1) ~~The normal system branch circuit required in 517.19(A)~~

(2) ~~A critical branch circuit supplied by a different transfer switch than the other receptacles at the same patient bed location~~

~~**(2)** Receptacle Requirements.~~

~~The receptacles required in 517.19(B)(1) shall be permitted to be single, duplex, or quadruplex type or any combination thereof. All receptacles shall be listed "hospital grade" and shall be so identified. The grounding terminal of each receptacle shall be connected to the reference grounding point by means of an insulated copper equipment grounding conductor.~~

~~**(C)** Operating Room Receptacles.~~

~~**(1)** Minimum Number and Supply.~~

~~Each operating room shall be provided with a minimum of 36 receptacles divided between at least two branch circuits. At least 12 receptacles, but no more than 24, shall be connected to either of the following:~~

(1) ~~The normal system branch circuit required in 517.19(A)~~

(2) ~~A critical branch circuit supplied by a different transfer switch than the other receptacles at the same location~~

~~**(2)** Receptacle Requirements.~~

~~The receptacles shall be permitted to be of the locking or nonlocking type, single, duplex, or quadruplex types or any combination of the three.~~

~~All nonlocking-type receptacles shall be listed hospital grade and so identified.~~

a minimum of eight (8) non-locking-type, 125-volt, 15- or 20- ampere receptacles. They shall be permitted to be of the single, duplex, or quadruplex type, or any combination of the three. Other receptacles (e.g., portable x-ray receptacles) serving special-purpose, cord-and-plug-connected equipment shall be permitted to be of the locking or non-locking type.

(2) Receptacles at each patient bed location shall be supplied by two or more branch circuits. These circuits shall have no other outlets. At least four (4) of the receptacle outlets at each patient bed location shall be connected to critical branch circuits(s) and at least four (4) receptacles shall be connected to either the normal branch circuit(s) or by separate critical branch circuit(s) supplied from a different transfer switch other than the receptacles at the same location. Where patient bed location receptacles are served from two or more separate transfer switches on the critical branch(s), receptacles are not required to be supplied from the normal power source. All branch circuits supplied from the normal power source shall originate from the same panelboard.

(3) Not more than six (6) receptacle outlets shall be connected to a 15- ampere branch circuit. Not more than eight (8) receptacle outlets shall be connected to a 20- ampere branch circuit. This provision shall apply to new or remodeled health care facilities only.

Informational Note: It is not intended that there be a total, immediate replacement of branch circuit wiring and receptacle requirements in an existing health care facility. It is intended that receptacle outlet requirements be updated during modification of use, or as existing circuits are replaced.

(4) The electrical receptacles or cover plate for the electrical receptacles shall be identified as per 517.31(E) and 517.42(E).

(5) All receptacles shall be listed "hospital grade" and shall be so identified.

Informational Note: It is not intended there be a total replacement of existing non-hospital grade receptacles. It is intended however, that non-hospital grade receptacles be replaced with hospital grade receptacles upon modification of use, or as existing receptacles are replaced.

(6) The grounding terminal of each receptacle shall be connected to

~~the reference grounding point by means of~~

~~**(H)** Special-Purpose Receptacle Grounding.~~

~~The equipment grounding conductor for special-purpose receptacles, such as the operation of mobile X-ray equipment, shall be extended to the reference grounding points of branch circuits for all locations likely to be served from such receptacles. Where such a circuit is served from an isolated ungrounded system, the equipment grounding conductor shall not be required to be run with the power conductors; however, the equipment grounding terminal of the special-purpose receptacle shall be connected to the reference grounding point.~~

an insulated copper equipment grounding conductor sized in accordance with Table 250 . 122.

~~**(D)** Patient Care Vicinity Grounding and Bonding (Optional).~~

~~A patient care vicinity shall be permitted to have a patient equipment grounding point. The patient equipment grounding point, where supplied, shall be permitted to contain one or more listed grounding and bonding jacks. An equipment bonding jumper not smaller than 10 AWG shall be used to connect the grounding terminal of all grounding-type receptacles to the patient equipment grounding point. The bonding conductor shall be permitted to be arranged centrically or looped as convenient.~~

> ~~Informational Note: Where there is no patient equipment grounding point, it is important that the distance between the reference grounding point and the patient care vicinity be as short as possible to minimize any potential differences.~~

~~**(E)** Equipment Grounding and Bonding.~~

~~Where a grounded electrical distribution system is used and metal feeder raceway or Type MC or MI cable that qualifies as an equipment grounding conductor in accordance with 250.118 is installed, grounding of enclosures and equipment, such as panelboards, switchboards, and switchgear, shall be ensured by one of the following bonding means at each termination or junction point of the metal raceway or Type MC or MI cable:~~

(1) ~~A grounding bushing and a continuous copper bonding jumper, sized in accordance with 250.122 , with the bonding jumper connected to the junction enclosure or the ground bus of the panel~~

(2) ~~Connection of feeder raceways or Type MC or MI cable to threaded hubs or bosses on terminating enclosures~~

(3) ~~Other approved devices such as bonding-type locknuts or bushings. Standard locknuts shall not be used for bonding.~~

~~**(F)** Additional Protective Techniques in Category 1 (Critical Care) Spaces (Optional).~~

~~Isolated power systems shall be permitted to be used for Category 1 (critical care) spaces, and, if used, the isolated power system equipment shall be listed as isolated power equipment. The isolated power system shall be designed and installed in accordance with 517.160 .~~

~~*Exception: The audible and visual indicators of the line isolation monitor shall be permitted to be located at the nursing station for the area being served.*~~

~~**(G)** Isolated Power System Equipment Grounding.~~

~~Where an isolated ungrounded power source is used and limits the first-fault current to a low magnitude, the equipment grounding conductor associated with the secondary circuit shall be permitted to be run outside of the enclosure of the power conductors in the same circuit.~~

~~Informational Note: Although it is permitted to run the equipment grounding conductor outside of the conduit, it is safer to run it with the power conductors to provide better protection in case of a second ground fault.~~

Informational Note: See 517.13(A) and (B) for equipment grounding requirements for patient care spaces.

(7) Branch circuits serving patient bed locations shall not be part of a multiwire branch circuit.

Exception No 1: The requirements of 517.18(A)(1 - 6) shall not apply to clinics, medical and dental offices; sleeping rooms of nursing homes; and limited care facilities meeting the requirements of 517 .10(B)(2).

Exception No 2: The requirements of 517.18(A)(1, 3, and 5) shall not apply to psychiatric, substance abuse, and rehabilitation hospitals meeting the requirements of 517.10(B)(2) .

Exception No. 3: Receptacles shall not be required in rooms where medical requirements mandate otherwise (e.g., certain psychiatric (security rooms), pediatric, or hydrotherapy rooms.

Exception No. 4: Branch circuits serving only special purpose outlets or receptacles, such as portable X-ray outlets, shall not be required to be served from the same distribution panel(s).

(B) Designated Category 2 (General Care) Pediatric Locations.

Receptacles that are located within patient rooms, bathrooms, playrooms, and activity rooms of pediatric units or spaces with similar risk as determined by the health care facility's governing body by conducting a risk assessment, other than infant nurseries, shall be listed and identified as "tamper-resistant" or shall employ a listed tamper-resistant cover.

Statement of Problem and Substantiation for Public Input

The order of 517.18 and 517.19 are reversed to show Category 1 patient care space first and Category 2 patent care space second . Language for Category 1 spaces is clarified for better use by code users. Language is added to clarify that critical branch circuits from separate transfer switches in allowed to connect all receptacles in place of using receptacles from the normal branch. Due to circuit loading and use the number of receptacles connected to 15- and 20-ampere branch circuits is added for patient safety. As noted in the Informational Notes the changes and additions to several of these sub sections are not required in existing facilities until major changes or upgrades (remodels) occur to the electrical distribution system.

Submitter Information Verification

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Submittal Date: Thu Aug 13 13:16:02 EDT 2020
Committee: NEC-P15

Public Input No. 3390-NFPA 70-2020 [Section No. 517.19(A)]

(A) Patient Bed Location Branch Circuits.

Each patient bed location shall be supplied by at least two branch circuits, one or more from the critical branch and one or more circuits from the normal system. At least one branch circuit from the critical branch shall supply an outlet(s) only at that bed location.

The electrical receptacles or the cover plates for the electrical receptacles supplied from the life safety and critical branches shall have a distinctive color or marking so as to be readily identifiable. [**99:**6.7.2.3.5(B)]

All branch circuits from the normal system shall be from a single panelboard. Critical branch receptacles shall be identified and shall also indicate the panelboard and circuit number supplying them.

The branch circuit serving patient bed locations shall not be part of a multiwire branch circuit.

Exception No. 1: Branch circuits serving only special-purpose receptacles or equipment in Category ~~1 (critical care) spaces~~ 1 spaces shall be permitted to be served by other panelboards.

Exception No. 2: Category ~~1 (critical care) spaces~~ 1 spaces served from two separate critical branch transfer switches shall not be required to have circuits from the normal system.

Statement of Problem and Substantiation for Public Input

as part of a phased approach it was decided by the committee several cycles ago to remove these misleading terms and make consistent with NFPA 99 terminology.

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Public Input No. 3392-NFPA 70-2020 [Section No. 517.19(F)]

(F) Additional Protective Techniques in Category ~~1~~ 1 Spaces (~~Critical Care) Spaces (~~ Optional).

Isolated power systems shall be permitted to be used for Category ~~1 (critical care) spaces~~ 1 spaces , and, if used, the isolated power system equipment shall be listed as isolated power equipment. The isolated power system shall be designed and installed in accordance with 517.160.

Exception: The audible and visual indicators of the line isolation monitor shall be permitted to be located at the nursing station for the area being served.

Statement of Problem and Substantiation for Public Input

as part of a phased approach it was decided by the committee several cycles ago to remove these misleading terms and make consistent with NFPA 99 terminology.

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Submittal Date: Tue Sep 08 13:33:46 EDT 2020
Committee: NEC-P15

Public Input No. 4040-NFPA 70-2020 [New Section after 517.20]

TITLE OF NEW CONTENT

Type your content here ...operating rooms shall be considered to be a wet location, unless a risk assessment conducted by the health care governing body determines otherwise (99:6.3.2.3.5)

Statement of Problem and Substantiation for Public Input

adding this NFPA 99 requirement to this NEC section will make it clear that without a risk assessment the operating shall be considered a wet location. if a design professional specifies an operating room that is not a wet location requiring the risk assessment will provide documentation for plan review and field inspection.

Submitter Information Verification

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Submittal Date: Wed Sep 09 18:44:49 EDT 2020
Committee: NEC-P15

Public Input No. 2271-NFPA 70-2020 [Section No. 517.20(A)]

(A) Receptacles and Fixed Equipment.

Wet procedure locations shall be provided with special protection against electric shock. [**99:**6.3.2.3.1]

This special protection shall be provided as follows:

(1) ~~Power distribution system that~~ Isolated power systems that remain in operation in the event of a single line-to-ground fault condition inherently limits the possible ground-fault current due to a first fault to a low value, without interrupting the power supply. _ Informational Note: Isolated power systems can eliminate the danger of an electric shock to patients who may be more susceptible to leakage current and unable to move in their beds.

(2) Power distribution system ~~in which the~~ connecting a ground fault circuit interrupter to interrupt the power supply ~~is interrupted~~ if ~~the ground~~ a ground -fault current ~~does, in fact, exceed~~ exceeds the trip value of a Class A GFCI.

~~[99: 6.3.2.3.2]~~

Exception: Branch circuits supplying only listed, fixed, therapeutic and diagnostic equipment shall be permitted to be supplied from a grounded service, single- or 3-phase system, provided that

(1) Wiring for grounded and isolated circuits does not occupy the same raceway, and

(2) All conductive surfaces of the equipment are connected to an insulated copper equipment grounding conductor.

Statement of Problem and Substantiation for Public Input

Change to the wording of this section adds clarity to difficult to understand language in the Code. This was extracted material from NFPA 99, 2018 6.3.2.3 and does not directly indicate the use of power isolated systems by name. The extracted material refence will need to be changed in the next edition of NFPA 99. For now, the best option is to change the language of this section in the NEC and remove the extracted reference.

Submitter Information Verification

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Submittal Date: Thu Aug 13 08:42:36 EDT 2020
Committee: NEC-P15

Public Input No. 4219-NFPA 70-2020 [New Section after 517.21]

517.22 Demand Factors

517.22 . Demand Factors.

Rating of feeders, buses, transformers, generators, and services shall be calculated in accordance with Table 517.22(a) and Table 517.22(b) , with respect to cord-connected equipment.

Table 517.22(a) Receptacle Outlet Demand Factors for Health Care Facilities

Portion of Receptacle Load to Which Demand Factor Applies	Demand Factor (percent)
First 5.0 kVA or less	100
Second 5.0 kVA to 10 kVA	50
Remainder over 10 kVA	25

Table 517.22(b) Cord-Connected Equipment Demand Factors for Health Care Facilities

Number of Cord-Connected Equipment	Percent of Full Load
Largest 1 to 5 pieces	100
Additional (more than 5)	50

Additional Proposed Changes

File Name	Description	Approved
HospitalPowerUseStudy.xlsx	Hospital Power Use Study	

Statement of Problem and Substantiation for Public Input

The revised text reduces oversizing of hospital electrical systems, as justified by the hospital power study provided to the panel.

Hospital electrical system designers generally know that current Health Care receptacle and cord connected equipment demand factors lead to oversizing of feeders associated with these systems.
Due to the requirements of NFPA 99 and FGI Guidelines (which are enforced through the Federal Centers of Medicare & Medicaid Services) the outlet quantity in health care facilities are mandated to be far higher than normally encountered in other occupancies. This high density of outlets is intended to allow clinicians the flexibility to provide care in multiple case scenarios within the same space. In addition, many of these spaces are required to have a set of completely redundant electrical outlets to accommodate medical equipment in the event of an isolated electrical failure. In nearly all of these spaces, the outlets are not intended for simultaneous use.

The attached hospital power study provides substantiation of this trend. The study was
The study is from the monitoring of receptacle loads in Kaiser Permanente Westside Hospital. Over the course of 6 months and 8 individual phases, Panoramic Power amperage meters were installed on 37 panels and over 1000 individual circuits. For each phase, 1 minute interval data was collected for 2 weeks, then removed and installed on new panels for the next phase. Circuits and panels were mapped to floor plans, to determine the room type, department, and square footage that they serve. Aggregated panel level peak demand is presented in this data.
Tab Bourgault 1.1&2 provides an analysis that compares the current NEC calculated required design KVA, the required design KVA if this proposal were implemented and the actual peak demand. The current NEC results in a cumulative KVA 5.8 times the peak demand. (892,100VA / 153,960VApeak = 5.794). The proposed demand factors would result in a cumulative KVA (283,605VA/153960VApeak = 1.84) that is 1.8 times the peak demand.
Note, the proposal herein is exactly the same as proposed and accepted by CMP-15 during the last revision cycle. In forwarding the proposal, CMP noted that per Section 90.3, Chapters 5, 6, and 7 apply to special occupancies, special equipment, or other special conditions and may supplement or modify the requirements in Chapters 1 through 7. During the last cycle, Panel 15 that this information belongs in Article 517 instead of Chapter 2.
An NFPA Research Foundation project is gathering data during the COVID-19 surge. This data answers questions about impact of a pandemic/surge on plug and cord connected electrical load, providing additional justification for the proposed change.

Submitter Information Verification

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Submittal Date: Thu Sep 10 06:55:09 EDT 2020
Committee: NEC-P15

Definitions

Method	Receptacle Loads
Current NEC	1st 10kVA @ 100% Remainder @ 50%
Bourgault 1.0	1st 10kVA @ 100% Remainder @ 50%
Bourgault 1.1	1st 10kVA @ 100% Remainder @ 50%
Bourgault 2	1st 5kVA @ 100% 2nd 5kVA @ 50% Remainder @ 25%
Bourgaut 1.1 & 2	1st 5kVA @ 100% 2nd 5kVA @ 50% Remainder @ 25%

TAB Summary:

Tab 1	Definitions
Tab 2	Current NEC

Tab 3	Bourgault 1.0
Tab 4	Bourgault 1.1
Tab 5	Bourgault 2
Tab 6	Bourgault 1.1 & 2
Tab 7	All Methods

Cord Connected Equipment
Nameplate Values
pieces <=5: all equip. @ 100% of nameplate value. 6 <= # pieces <= 10: all equip. @ 50% of nameplate value. # pieces > 10: all equip. @ 25% of nameplate value.
pieces <=5: all equip. @ 100% of nameplate value. # pieces > 5: all equip. @ 50% of nameplate value.
Nameplate Values
pieces <=5: all equip. @ 100% of nameplate value. # pieces > 5: all equip. @ 50% of nameplate value.

Definitions:

Current NEC Cord

Bourgault 1 -

Bourgault 1.1

Bourgault 2 -

Bourgault 1.1

definitions of the different methods
comparison of connected to NEC to actual, including safety factor

comparison of the NEC for receps plus the proposed formula for medical equipment. You will see, from line 1, this method does not work in all cases.
Comparison of NEC for receps and the REVISED formula for medical equipment, including safety factors
comparison of Nameplate for medical equipment, and the revised recep table we proposed, including safety factors.
revised recep table AND the revised formula for medical equipment
Depicts All Methods

- Recep Loads: 1st 10kVA @ 100%, remainder @ 50%
connected equipment: Nameplate values.

Recep Loads: 1st 10kVA @ 100%, remainder @ 50%;
Cord connected equipment: Less than 6 pieces @ 100%
pieces @ 50%, greater than 10 pieces @ 25% of namep

- Recep Loads: 1st 10kVA @ 100%, remainder @ 50%;
Cord connected equipment: Less than or equal to 5 piec
than 5 pieces @ 50% of nameplate values.

Recep Loads: 1st 5kVA @ 100%, 2nd 5kVA @ 50% rem
connected equipment: Nameplate Values.

&2 - Recep Loads: 1st 5kVA @ 100%, 2nd 5kVA @ 50%
Cord connected equipment: Less than or equal to 5 pi
greater than 5 pieces @ 50% of nameplate values.

;

, btwn 6 and 10
late values.

es @ 100%, greater

ainder at 25%; Cord

% remainder at 25%;
eces @ 100%,

Row #	Connected Load (VA)					Measured Peak VA
	# Receps	Recep load	# CORD CONN EQP	Cord Con Load (nameplate)	Total Conn. Load, equip at nameplate	
22	22	3,960	8	4,681	8,641	3,290
37	113	20,340	5	5,080	25,420	7,550
34	28	5,040	7	5,843	10,883	3,790
26	47	8,460	7	8,302	16,762	5,760
35	28	5,040	7	5,663	10,703	3,670
16	3	540	23	16,712	17,252	5,780
25	50	9,000	13	11,302	20,302	6,420
21	92	16,560	9	7,602	24,162	6,140
8	118	21,240	11	11,326	32,566	7,680
9	107	19,260	14	8,976	28,236	6,620
1	164	29,520	4	3,400	32,920	6,240
20	102	18,360	1	360	18,720	3,850
5	111	19,980	17	12,914	32,894	7,230
7	147	26,460	10	7,007	33,467	5,950
30	76	13,680	7	5,584	19,264	4,000
15	110	19,800	6	2,310	22,110	3,880
31	66	11,880	13	15,805	27,685	5,920
10	28	5,040	21	8,716	13,756	3,010
32	113	20,340	7	7,837	28,177	4,750
24	119	21,420	5	3,620	25,040	3,710
14	128	23,040	0	0	23,040	3,150
27	57	10,260	18	12,767	23,027	4,350
17	138	24,840	4	3,333	28,173	3,650
12	147	26,460	0	0	26,460	3,170
11	148	26,640	8	6,205	32,845	4,160
23	136	24,480	0	0	24,480	2,890
19	114	20,520	5	6,704	27,224	3,410
18	117	21,060	8	9,165	30,225	3,740
13	95	17,100	1	500	17,600	2,000
28	112	20,160	8	5,728	25,888	2,930
2	164	29,520	0	0	29,520	2,780
29	106	19,080	2	2,522	21,602	2,350
36	97	17,460	11	10,372	27,832	2,870
4	156	28,080	0	0	28,080	2,170

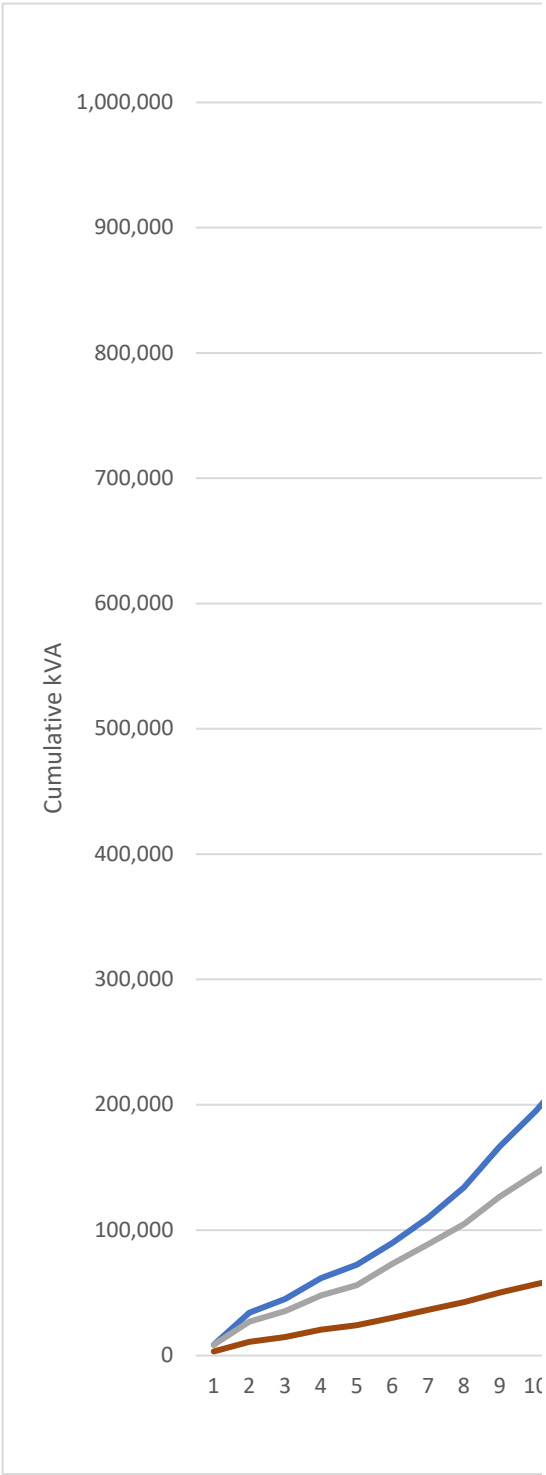
3	119	21,420	10	6,883	28,303	2,170
33	87	15,660	0	0	15,660	1,030
6	156	28,080	9	5,101	33,181	1,900

NEC DEMAND LOAD	Safety Factor Above Measured Demand	Cumulative Loads				
CORD CONN AT nameplate	NEC (w/ eqp at nameplate)	Measured peak demand	Recep Load	Cord Conn Load (nameplate)	Total Load (w/ eqp at nameplate)	NEC (w/ eqp at nameplate)
8,641	163%	3,290	3,960	4,681	8,641	8,641
20,250	168%	10,840	24,300	9,761	34,061	26,911
10,883	187%	14,630	29,340	15,604	44,944	35,274
16,762	191%	20,390	37,800	23,906	61,706	47,806
10,703	192%	24,060	42,840	29,569	72,409	55,989
17,252	198%	29,840	43,380	46,281	89,661	72,971
20,302	216%	36,260	52,380	57,583	109,963	88,773
20,882	240%	42,400	68,940	65,185	134,125	104,655
26,946	251%	50,080	90,180	76,511	166,691	126,601
23,606	257%	56,700	109,440	85,487	194,927	145,207
23,160	271%	62,940	138,960	88,887	227,847	163,367
14,540	278%	66,790	157,320	89,247	246,567	172,907
27,904	286%	74,020	177,300	102,161	279,461	195,811
25,237	324%	79,970	203,760	109,168	312,928	216,048
17,424	336%	83,970	217,440	114,752	332,192	228,472
17,210	344%	87,850	237,240	117,062	354,302	240,682
26,745	352%	93,770	249,120	132,867	381,987	262,427
13,756	357%	96,780	254,160	141,583	395,743	273,663
23,007	384%	101,530	274,500	149,420	423,920	291,670
19,330	421%	105,240	295,920	153,040	448,960	306,000
16,520	424%	108,390	318,960	153,040	472,000	317,520
22,897	426%	112,740	329,220	165,807	495,027	335,417
20,753	469%	116,390	354,060	169,140	523,200	351,170
18,230	475%	119,560	380,520	169,140	549,660	364,400
24,525	490%	123,720	407,160	175,345	582,505	383,925
17,240	497%	126,610	431,640	175,345	606,985	396,165
21,964	544%	130,020	452,160	182,049	634,209	413,129
24,695	560%	133,760	473,220	191,214	664,434	432,824
14,050	603%	135,760	490,320	191,714	682,034	441,874
20,808	610%	138,690	510,480	197,442	707,922	457,682
19,760	611%	141,470	540,000	197,442	737,442	472,442
17,062	626%	143,820	559,080	199,964	759,044	484,504
24,102	740%	146,690	576,540	210,336	786,876	503,606
19,040	777%	148,860	604,620	210,336	814,956	517,646

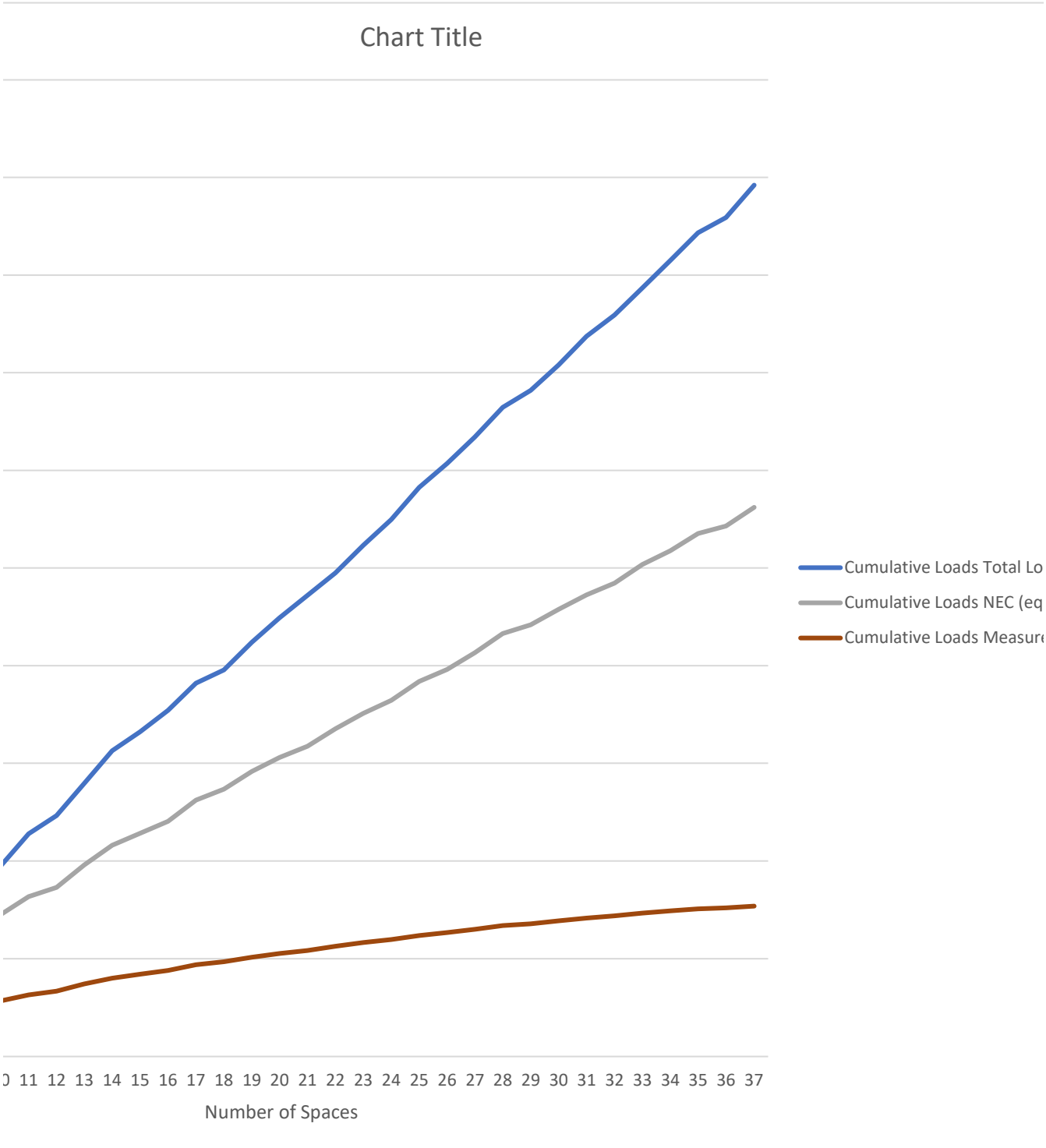
22,593	941%	151,030	626,040	217,219	843,259	535,239
12,830	1146%	152,060	641,700	217,219	858,919	543,069
24,141	1171%	153,960	669,780	222,320	892,100	562,210

Data For Graph:

Cumulative Loads		
Total Load (w/ eqp at nameplate)	NEC (eqp at nameplate)	Measured peak demand
8,641	8,641	3,290
34,061	26,911	10,840
44,944	35,274	14,630
61,706	47,806	20,390
72,409	55,989	24,060
89,661	72,971	29,840
109,963	88,773	36,260
134,125	104,655	42,400
166,691	126,601	50,080
194,927	145,207	56,700
227,847	163,367	62,940
246,567	172,907	66,790
279,461	195,811	74,020
312,928	216,048	79,970
332,192	228,472	83,970
354,302	240,682	87,850
381,987	262,427	93,770
395,743	273,663	96,780
423,920	291,670	101,530
448,960	306,000	105,240
472,000	317,520	108,390
495,027	335,417	112,740
523,200	351,170	116,390
549,660	364,400	119,560
582,505	383,925	123,720
606,985	396,165	126,610
634,209	413,129	130,020
664,434	432,824	133,760
682,034	441,874	135,760
707,922	457,682	138,690
737,442	472,442	141,470
759,044	484,504	143,820
786,876	503,606	146,690
814,956	517,646	148,860



843,259	535,239	151,030
858,919	543,069	152,060
892,100	562,210	153,960


Chart Title
Cumulative Loads Total Lo
Cumulative Loads NEC (eq
Cumulative Loads Measur
0 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37
Number of Spaces

ad (w/ eqp at nameplate)

p at nameplate)

ed peak demand

Row #	Connected Load (VA)					Measured Peak VA
	# Receps	Recep load	# CORD CONN EQP	Cord Con Load (nameplate)	Total Conn. Load, equip at nameplate	
16	3	540	23	16,712	17,252	5,780
25	50	9,000	13	11,302	20,302	6,420
22	22	3,960	8	4,681	8,641	3,290
34	28	5,040	7	5,843	10,883	3,790
35	28	5,040	7	5,663	10,703	3,670
26	47	8,460	7	8,302	16,762	5,760
10	28	5,040	21	8,716	13,756	3,010
8	118	21,240	11	11,326	32,566	7,680
31	66	11,880	13	15,805	27,685	5,920
5	111	19,980	17	12,914	32,894	7,230
9	107	19,260	14	8,976	28,236	6,620
37	113	20,340	5	5,080	25,420	7,550
21	92	16,560	9	7,602	24,162	6,140
27	57	10,260	18	12,767	23,027	4,350
7	147	26,460	10	7,007	33,467	5,950
30	76	13,680	7	5,584	19,264	4,000
1	164	29,520	4	3,400	32,920	6,240
20	102	18,360	1	360	18,720	3,850
32	113	20,340	7	7,837	28,177	4,750
15	110	19,800	6	2,310	22,110	3,880
11	148	26,640	8	6,205	32,845	4,160
24	119	21,420	5	3,620	25,040	3,710
14	128	23,040	0	0	23,040	3,150
18	117	21,060	8	9,165	30,225	3,740
17	138	24,840	4	3,333	28,173	3,650
36	97	17,460	11	10,372	27,832	2,870
12	147	26,460	0	0	26,460	3,170
23	136	24,480	0	0	24,480	2,890
28	112	20,160	8	5,728	25,888	2,930
19	114	20,520	5	6,704	27,224	3,410
13	95	17,100	1	500	17,600	2,000
2	164	29,520	0	0	29,520	2,780
29	106	19,080	2	2,522	21,602	2,350
4	156	28,080	0	0	28,080	2,170

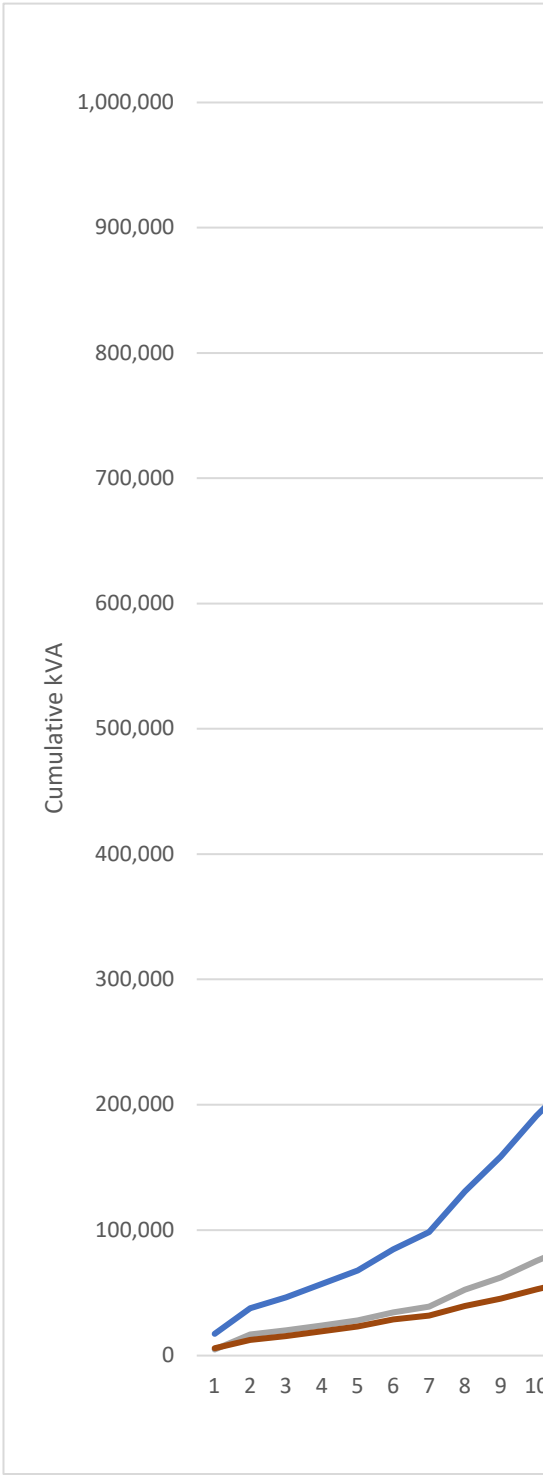
3	119	21,420	10	6,883	28,303	2,170
6	156	28,080	9	5,101	33,181	1,900
33	87	15,660	0	0	15,660	1,030

Bourgault 1.0	Safety Factor Above Measured Demand	Cumulative Loads				
rec at NEC, eqp at bourgault	Bourgault 1.0	Measured peak demand	Recep Load	Cord Conn Load (nameplate)	Total Load (w/ eqp at nameplate)	Cumulative Bourgault 1.0
4,718	-18%	5,780	540	16,712	17,252	4,718
11,826	84%	12,200	9,540	28,014	37,554	16,544
6,301	92%	15,490	13,500	32,695	46,195	19,924
7,962	110%	19,280	18,540	38,538	57,078	23,905
7,872	114%	22,950	23,580	44,201	67,781	27,840
12,611	119%	28,710	32,040	52,503	84,543	34,146
7,219	140%	31,720	37,080	61,219	98,299	38,845
18,452	140%	39,400	58,320	72,545	130,865	52,296
14,891	152%	45,320	70,200	88,350	158,550	62,188
18,219	152%	52,550	90,180	101,264	191,444	75,406
16,874	155%	59,170	109,440	110,240	219,680	87,280
20,250	168%	66,720	129,780	115,320	245,100	98,720
17,081	178%	72,860	146,340	122,922	269,262	108,901
13,322	206%	77,210	156,600	135,689	292,289	117,222
21,734	265%	83,160	183,060	142,696	325,756	132,204
14,632	266%	87,160	196,740	148,280	345,020	140,440
23,160	271%	93,400	226,260	151,680	377,940	156,050
14,540	278%	97,250	244,620	152,040	396,660	165,320
19,089	302%	102,000	264,960	159,877	424,837	177,449
16,055	314%	105,880	284,760	162,187	446,947	187,927
21,423	415%	110,040	311,400	168,392	479,792	202,798
19,330	421%	113,750	332,820	172,012	504,832	214,413
16,520	424%	116,900	355,860	172,012	527,872	225,933
20,113	438%	120,640	376,920	181,177	558,097	238,754
20,753	469%	124,290	401,760	184,510	586,270	252,008
16,323	469%	127,160	419,220	194,882	614,102	263,331
18,230	475%	130,330	445,680	194,882	640,562	276,561
17,240	497%	133,220	470,160	194,882	665,042	288,801
17,944	512%	136,150	490,320	200,610	690,930	300,313
21,964	544%	139,560	510,840	207,314	718,154	312,249
14,050	603%	141,560	527,940	207,814	735,754	320,924
19,760	611%	144,340	557,460	207,814	765,274	335,684
17,062	626%	146,690	576,540	210,336	786,876	345,854
19,040	777%	148,860	604,620	210,336	814,956	359,894

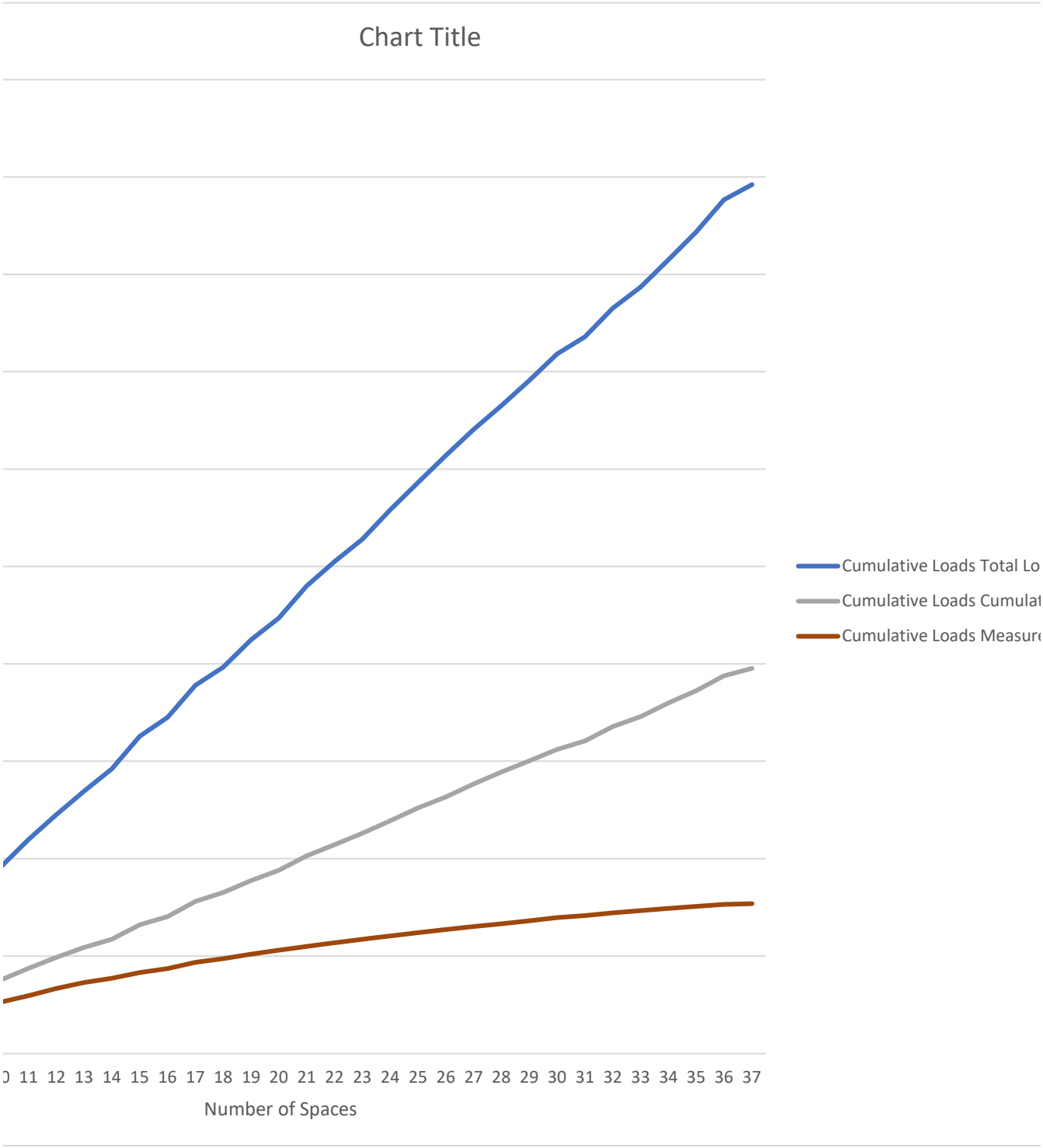
19,152	783%	151,030	626,040	217,219	843,259	372,325
21,591	1036%	152,930	654,120	222,320	876,440	387,640
12,830	1146%	153,960	669,780	222,320	892,100	395,470

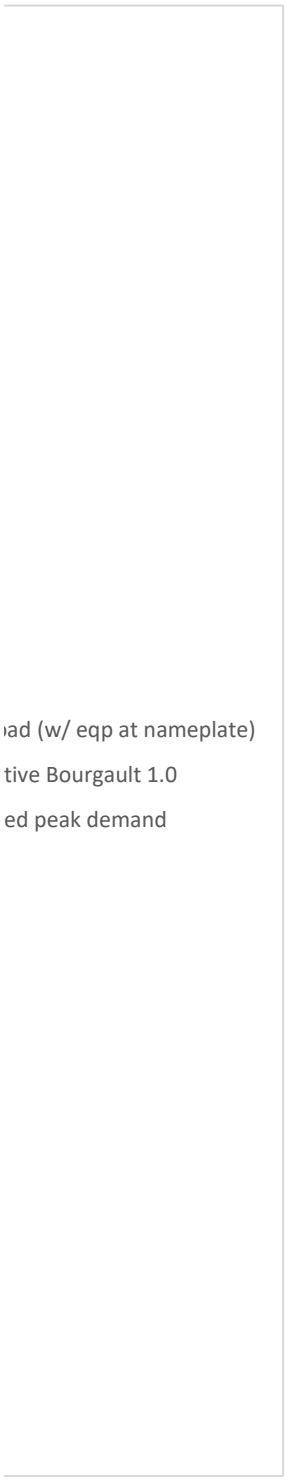
Data For Graph:

Cumulative Loads		
Total Load (w/ eqp at nameplate)	Cumulative Bourgault 1.0	Measured peak demand
17,252	4,718	5,780
37,554	16,544	12,200
46,195	19,924	15,490
57,078	23,905	19,280
67,781	27,840	22,950
84,543	34,146	28,710
98,299	38,845	31,720
130,865	52,296	39,400
158,550	62,188	45,320
191,444	75,406	52,550
219,680	87,280	59,170
245,100	98,720	66,720
269,262	108,901	72,860
292,289	117,222	77,210
325,756	132,204	83,160
345,020	140,440	87,160
377,940	156,050	93,400
396,660	165,320	97,250
424,837	177,449	102,000
446,947	187,927	105,880
479,792	202,798	110,040
504,832	214,413	113,750
527,872	225,933	116,900
558,097	238,754	120,640
586,270	252,008	124,290
614,102	263,331	127,160
640,562	276,561	130,330
665,042	288,801	133,220
690,930	300,313	136,150
718,154	312,249	139,560
735,754	320,924	141,560
765,274	335,684	144,340
786,876	345,854	146,690
814,956	359,894	148,860



843,259	372,325	151,030
876,440	387,640	152,930
892,100	395,470	153,960


Chart Title
Cumulative Loads Total Lo
Cumulative Loads Cumulat
Cumulative Loads Measur
0 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37
Number of Spaces


ad (w/ eqp at nameplate)
tive Bourgault 1.0
ed peak demand

Row #	Connected Load (VA)					Measured Peak VA
	# Receps	Recep load	# CORD CONN EQP	Cord Con Load (nameplate)	Total Conn. Load, equip at nameplate	
16	3	540	23	16,712	17,252	5,780
22	22	3,960	8	4,681	8,641	3,290
34	28	5,040	7	5,843	10,883	3,790
35	28	5,040	7	5,663	10,703	3,670
26	47	8,460	7	8,302	16,762	5,760
25	50	9,000	13	11,302	20,302	6,420
37	113	20,340	5	5,080	25,420	7,550
8	118	21,240	11	11,326	32,566	7,680
21	92	16,560	9	7,602	24,162	6,140
9	107	19,260	14	8,976	28,236	6,620
5	111	19,980	17	12,914	32,894	7,230
10	28	5,040	21	8,716	13,756	3,010
31	66	11,880	13	15,805	27,685	5,920
7	147	26,460	10	7,007	33,467	5,950
30	76	13,680	7	5,584	19,264	4,000
1	164	29,520	4	3,400	32,920	6,240
20	102	18,360	1	360	18,720	3,850
27	57	10,260	18	12,767	23,027	4,350
32	113	20,340	7	7,837	28,177	4,750
15	110	19,800	6	2,310	22,110	3,880
11	148	26,640	8	6,205	32,845	4,160
24	119	21,420	5	3,620	25,040	3,710
14	128	23,040	0	0	23,040	3,150
18	117	21,060	8	9,165	30,225	3,740
17	138	24,840	4	3,333	28,173	3,650
12	147	26,460	0	0	26,460	3,170
23	136	24,480	0	0	24,480	2,890
28	112	20,160	8	5,728	25,888	2,930
19	114	20,520	5	6,704	27,224	3,410
36	97	17,460	11	10,372	27,832	2,870
13	95	17,100	1	500	17,600	2,000
2	164	29,520	0	0	29,520	2,780
29	106	19,080	2	2,522	21,602	2,350
4	156	28,080	0	0	28,080	2,170

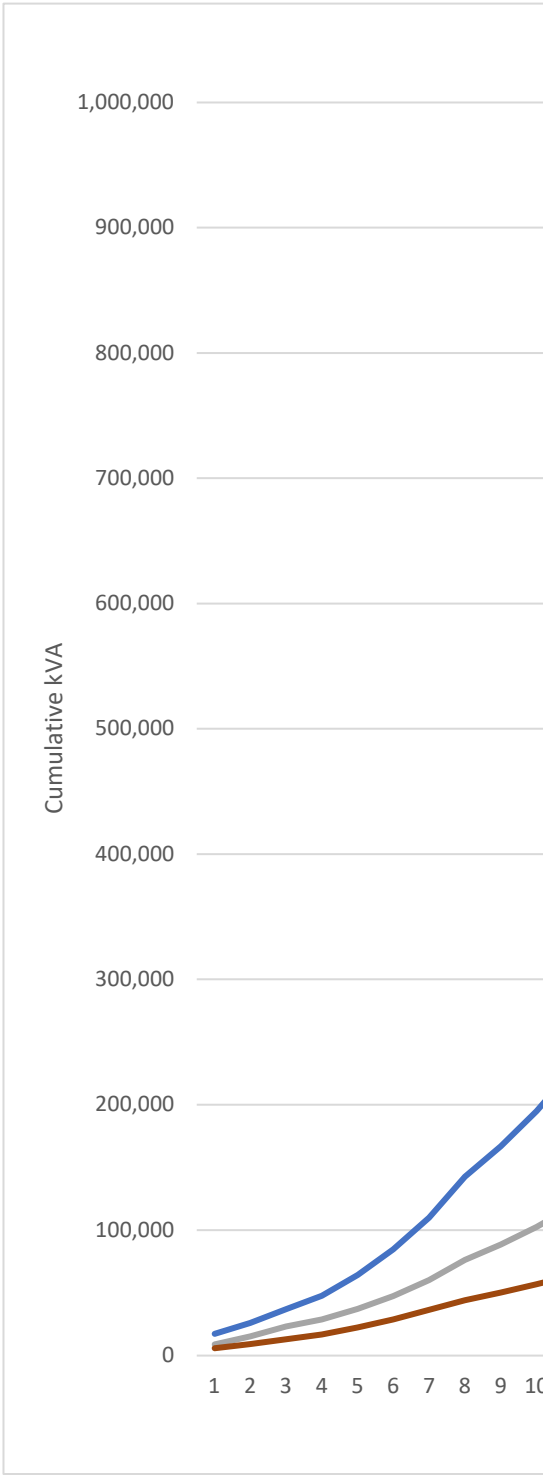
3	119	21,420	10	6,883	28,303	2,170
6	156	28,080	9	5,101	33,181	1,900
33	87	15,660	0	0	15,660	1,030

Bourgault 1.1	Safety Factor Above Measured Demand	Cumulative Loads				
rec at NEC, eqp at bourgault	Bourgault 1.1	Measured peak demand	Recep Load	Cord Conn Load (nameplate)	Total Load (w/ eqp at nameplate)	Cumulative Bourgault 1.1
8,896	54%	5,780	540	16,712	17,252	8,896
6,301	92%	9,070	4,500	21,393	25,893	15,197
7,962	110%	12,860	9,540	27,236	36,776	23,158
7,872	114%	16,530	14,580	32,899	47,479	28,740
12,611	119%	22,290	23,040	41,201	64,241	37,121
14,651	128%	28,710	32,040	52,503	84,543	47,272
20,250	168%	36,260	52,380	57,583	109,963	59,982
21,283	177%	43,940	73,620	68,909	142,529	76,265
17,081	178%	50,080	90,180	76,511	166,691	88,346
19,118	189%	56,700	109,440	85,487	194,927	102,464
21,447	197%	63,930	129,420	98,401	227,821	118,911
9,398	212%	66,940	134,460	107,117	241,577	125,789
18,843	218%	72,860	146,340	122,922	269,262	139,631
21,734	265%	78,810	172,800	129,929	302,729	156,365
14,632	266%	82,810	186,480	135,513	321,993	165,997
23,160	271%	89,050	216,000	138,913	354,913	182,457
14,540	278%	92,900	234,360	139,273	373,633	191,817
16,514	280%	97,250	244,620	152,040	396,660	203,330
19,089	302%	102,000	264,960	159,877	424,837	217,419
16,055	314%	105,880	284,760	162,187	446,947	228,474
21,423	415%	110,040	311,400	168,392	479,792	244,896
19,330	421%	113,750	332,820	172,012	504,832	257,416
16,520	424%	116,900	355,860	172,012	527,872	268,936
20,113	438%	120,640	376,920	181,177	558,097	284,049
20,753	469%	124,290	401,760	184,510	586,270	298,135
18,230	475%	127,460	428,220	184,510	612,730	311,365
17,240	497%	130,350	452,700	184,510	637,210	323,605
17,944	512%	133,280	472,860	190,238	663,098	336,549
21,964	544%	136,690	493,380	196,942	690,322	350,161
18,916	559%	139,560	510,840	207,314	718,154	364,077
14,050	603%	141,560	527,940	207,814	735,754	372,877
19,760	611%	144,340	557,460	207,814	765,274	387,637
17,062	626%	146,690	576,540	210,336	786,876	398,438
19,040	777%	148,860	604,620	210,336	814,956	412,478

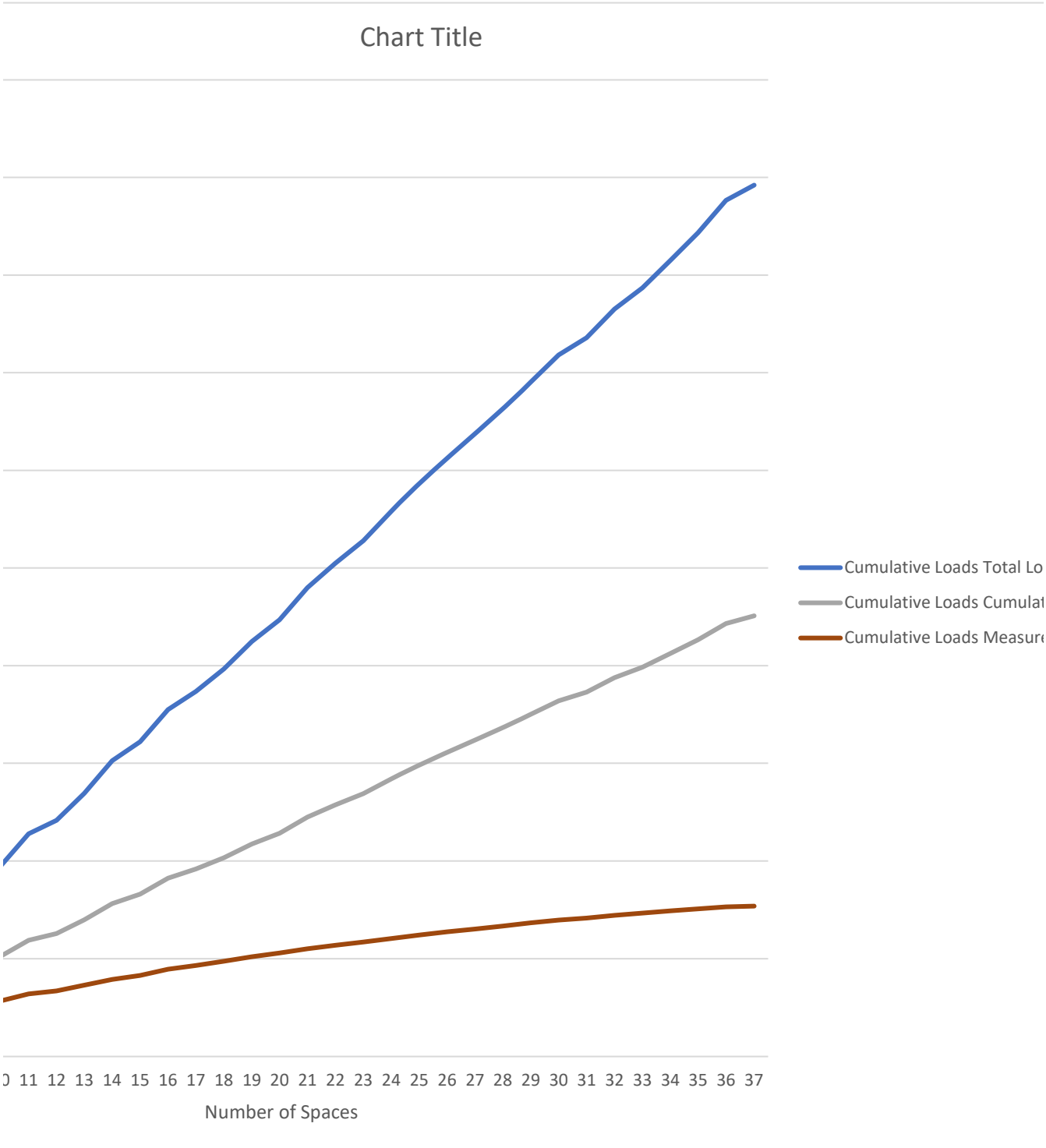
19,152	783%	151,030	626,040	217,219	843,259	426,630
21,591	1036%	152,930	654,120	222,320	876,440	443,220
12,830	1146%	153,960	669,780	222,320	892,100	451,050

Data For Graph:

Cumulative Loads		
Total Load (w/ eqp at nameplate)	Cumulative Bourgault 1.1	Measured peak demand
17,252	8,896	5,780
25,893	15,197	9,070
36,776	23,158	12,860
47,479	28,740	16,530
64,241	37,121	22,290
84,543	47,272	28,710
109,963	59,982	36,260
142,529	76,265	43,940
166,691	88,346	50,080
194,927	102,464	56,700
227,821	118,911	63,930
241,577	125,789	66,940
269,262	139,631	72,860
302,729	156,365	78,810
321,993	165,997	82,810
354,913	182,457	89,050
373,633	191,817	92,900
396,660	203,330	97,250
424,837	217,419	102,000
446,947	228,474	105,880
479,792	244,896	110,040
504,832	257,416	113,750
527,872	268,936	116,900
558,097	284,049	120,640
586,270	298,135	124,290
612,730	311,365	127,460
637,210	323,605	130,350
663,098	336,549	133,280
690,322	350,161	136,690
718,154	364,077	139,560
735,754	372,877	141,560
765,274	387,637	144,340
786,876	398,438	146,690
814,956	412,478	148,860



843,259	426,630	151,030
876,440	443,220	152,930
892,100	451,050	153,960


Chart Title
Cumulative Loads Total Lo
Cumulative Loads Cumulat
Cumulative Loads Measur
0 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37
Number of Spaces

ad (w/ eqp at nameplate)

tive Bourgault 1.1

ed peak demand

Row #	Connected Load (VA)					Measured Peak VA
	# Receps	Recep load	# CORD CONN EQP	Cord Con Load (nameplate)	Total Conn. Load, equip at nameplate	
37	113	20,340	5	5,080	25,420	7,550
1	164	29,520	4	3,400	32,920	6,240
20	102	18,360	1	360	18,720	3,850
26	47	8,460	7	8,302	16,762	5,760
22	22	3,960	8	4,681	8,641	3,290
21	92	16,560	9	7,602	24,162	6,140
8	118	21,240	11	11,326	32,566	7,680
9	107	19,260	14	8,976	28,236	6,620
25	50	9,000	13	11,302	20,302	6,420
34	28	5,040	7	5,843	10,883	3,790
35	28	5,040	7	5,663	10,703	3,670
16	3	540	23	16,712	17,252	5,780
7	147	26,460	10	7,007	33,467	5,950
15	110	19,800	6	2,310	22,110	3,880
5	111	19,980	17	12,914	32,894	7,230
14	128	23,040	0	0	23,040	3,150
30	76	13,680	7	5,584	19,264	4,000
12	147	26,460	0	0	26,460	3,170
24	119	21,420	5	3,620	25,040	3,710
32	113	20,340	7	7,837	28,177	4,750
23	136	24,480	0	0	24,480	2,890
17	138	24,840	4	3,333	28,173	3,650
31	66	11,880	13	15,805	27,685	5,920
11	148	26,640	8	6,205	32,845	4,160
2	164	29,520	0	0	29,520	2,780
10	28	5,040	21	8,716	13,756	3,010
27	57	10,260	18	12,767	23,027	4,350
13	95	17,100	1	500	17,600	2,000
19	114	20,520	5	6,704	27,224	3,410
18	117	21,060	8	9,165	30,225	3,740
29	106	19,080	2	2,522	21,602	2,350
28	112	20,160	8	5,728	25,888	2,930
4	156	28,080	0	0	28,080	2,170
36	97	17,460	11	10,372	27,832	2,870

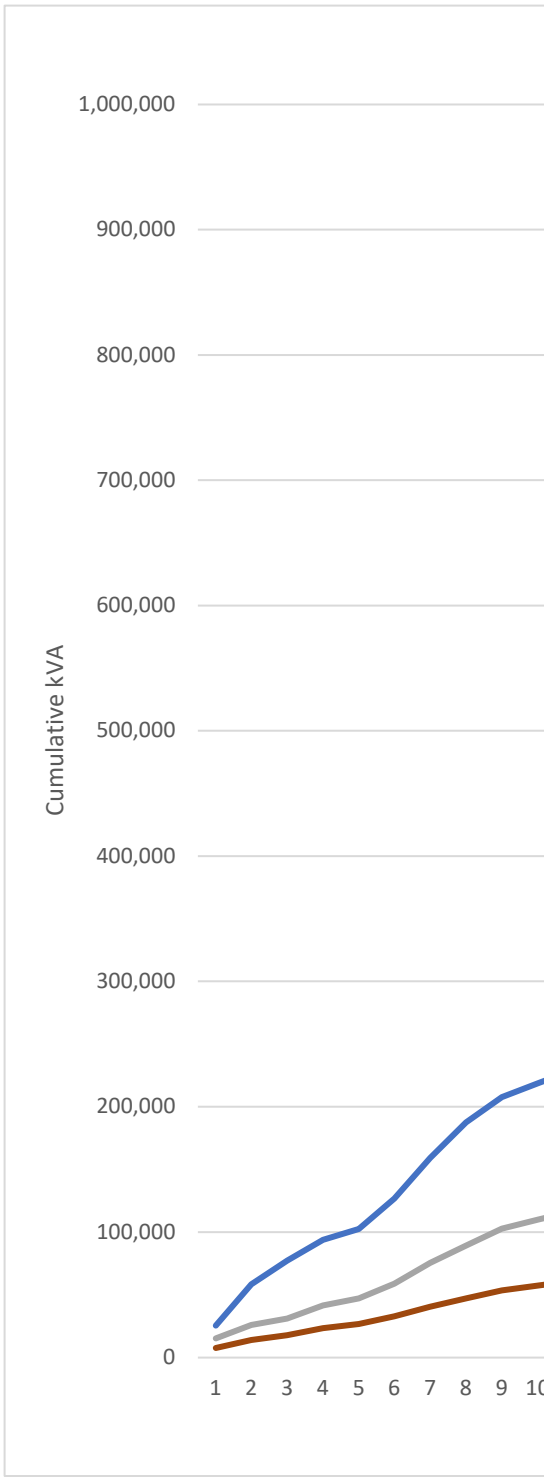
3	119	21,420	10	6,883	28,303	2,170
33	87	15,660	0	0	15,660	1,030
6	156	28,080	9	5,101	33,181	1,900

Bourgault 2	Safety Factor Above Measured Demand	Cumulative Loads				
rec at bourgault, eqp at nameplate	Bourgault 2	Measured peak demand	Recep Load	Cord Conn Load (nameplate)	Total Load (w/ eqp at nameplate)	Cumulative Bourgault 2
15,165	101%	7,550	20,340	5,080	25,420	15,165
15,780	153%	13,790	49,860	8,480	58,340	25,945
9,950	158%	17,640	68,220	8,840	77,060	30,895
15,032	161%	23,400	76,680	17,142	93,822	41,312
8,641	163%	26,690	80,640	21,823	102,463	46,983
16,742	173%	32,830	97,200	29,425	126,625	58,725
21,636	182%	40,510	118,440	40,751	159,191	75,361
18,791	184%	47,130	137,700	49,727	187,427	89,152
18,302	185%	53,550	146,700	61,029	207,729	102,704
10,863	187%	57,340	151,740	66,872	218,612	109,807
10,683	191%	61,010	156,780	72,535	229,315	116,730
17,252	198%	66,790	157,320	89,247	246,567	133,577
18,622	213%	72,740	183,780	96,254	280,034	147,199
12,260	216%	76,620	203,580	98,564	302,144	154,459
22,909	217%	83,850	223,560	111,478	335,038	172,368
10,760	242%	87,000	246,600	111,478	358,078	178,128
14,004	250%	91,000	260,280	117,062	377,342	187,132
11,615	266%	94,170	286,740	117,062	403,802	193,747
13,975	277%	97,880	308,160	120,682	428,842	202,722
17,922	277%	102,630	328,500	128,519	457,019	215,644
11,120	285%	105,520	352,980	128,519	481,499	221,764
14,543	298%	109,170	377,820	131,852	509,672	231,307
23,775	302%	115,090	389,700	147,657	537,357	250,082
17,865	329%	119,250	416,340	153,862	570,202	262,947
12,380	345%	122,030	445,860	153,862	599,722	270,327
13,736	356%	125,040	450,900	162,578	613,478	280,303
20,332	367%	129,390	461,160	175,345	636,505	295,635
9,775	389%	131,390	478,260	175,845	654,105	300,410
16,834	394%	134,800	498,780	182,549	681,329	312,244
19,430	420%	138,540	519,840	191,714	711,554	326,674
12,292	423%	140,890	538,920	194,236	733,156	333,966
15,768	438%	143,820	559,080	199,964	759,044	344,734
12,020	454%	145,990	587,160	199,964	787,124	351,754
19,737	588%	148,860	604,620	210,336	814,956	366,491

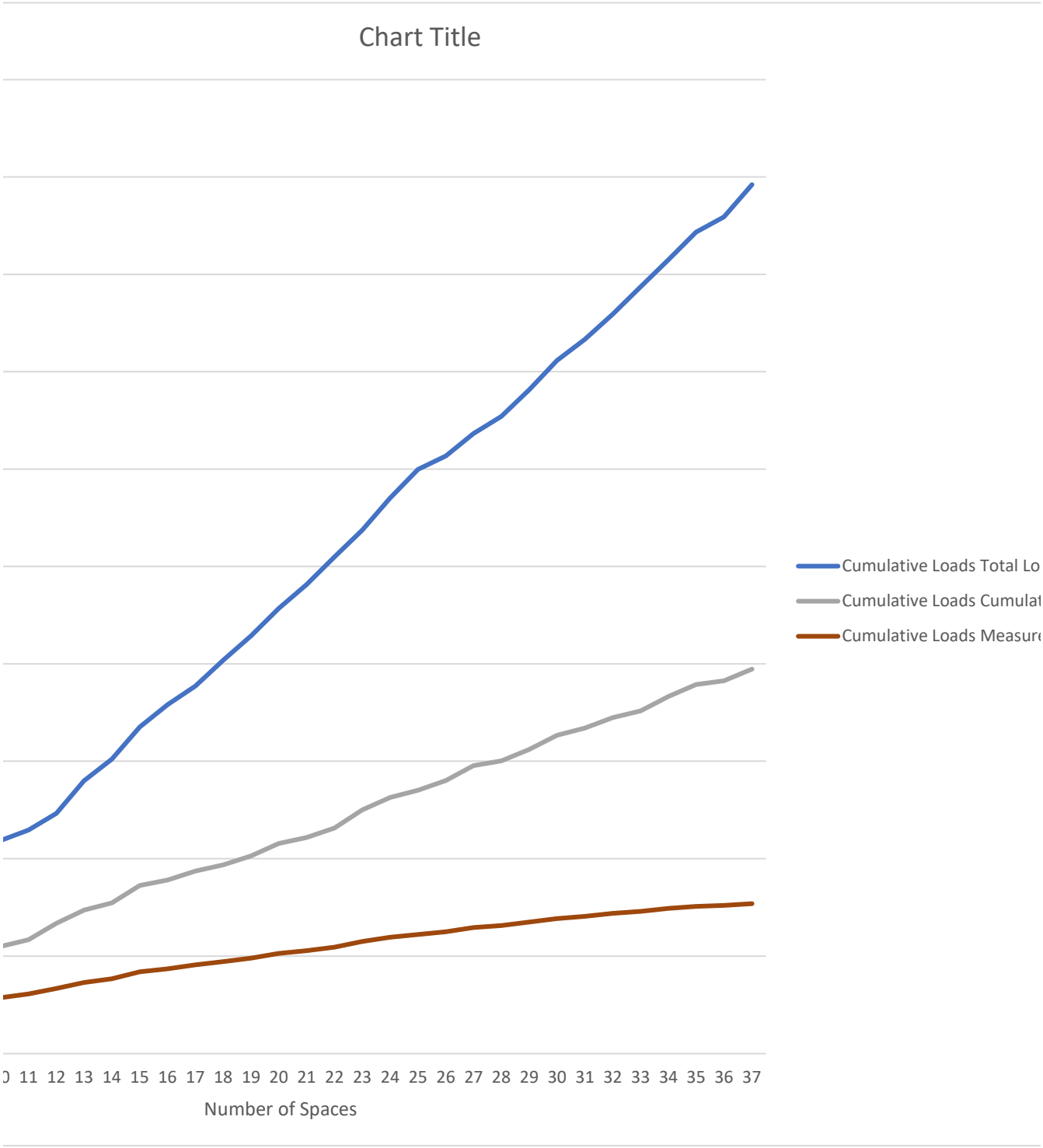
17,238	694%	151,030	626,040	217,219	843,259	378,729
8,915	766%	152,060	641,700	217,219	858,919	382,644
17,121	801%	153,960	669,780	222,320	892,100	394,765

Data For Graph:

Cumulative Loads		
Total Load (w/ eqp at nameplate)	Cumulative Bourgault 2	Measured peak demand
25,420	15,165	7,550
58,340	25,945	13,790
77,060	30,895	17,640
93,822	41,312	23,400
102,463	46,983	26,690
126,625	58,725	32,830
159,191	75,361	40,510
187,427	89,152	47,130
207,729	102,704	53,550
218,612	109,807	57,340
229,315	116,730	61,010
246,567	133,577	66,790
280,034	147,199	72,740
302,144	154,459	76,620
335,038	172,368	83,850
358,078	178,128	87,000
377,342	187,132	91,000
403,802	193,747	94,170
428,842	202,722	97,880
457,019	215,644	102,630
481,499	221,764	105,520
509,672	231,307	109,170
537,357	250,082	115,090
570,202	262,947	119,250
599,722	270,327	122,030
613,478	280,303	125,040
636,505	295,635	129,390
654,105	300,410	131,390
681,329	312,244	134,800
711,554	326,674	138,540
733,156	333,966	140,890
759,044	344,734	143,820
787,124	351,754	145,990
814,956	366,491	148,860



843,259	378,729	151,030
858,919	382,644	152,060
892,100	394,765	153,960


Chart Title
Cumulative Loads Total Lo
Cumulative Loads Cumulat
Cumulative Loads Measur
0 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37
Number of Spaces

ad (w/ eqp at nameplate)

tive Bourgault 2

ed peak demand

Row #	Connected Load (VA)					Measured Peak VA
	# Receps	Recep load	# CORD CONN EQP	Cord Con Load (nameplate)	Total Conn. Load, equip at nameplate	
16	3	540	23	16,712	17,252	5,780
26	47	8,460	7	8,302	16,762	5,760
22	22	3,960	8	4,681	8,641	3,290
25	50	9,000	13	11,302	20,302	6,420
37	113	20,340	5	5,080	25,420	7,550
8	118	21,240	11	11,326	32,566	7,680
34	28	5,040	7	5,843	10,883	3,790
21	92	16,560	9	7,602	24,162	6,140
35	28	5,040	7	5,663	10,703	3,670
9	107	19,260	14	8,976	28,236	6,620
5	111	19,980	17	12,914	32,894	7,230
1	164	29,520	4	3,400	32,920	6,240
7	147	26,460	10	7,007	33,467	5,950
20	102	18,360	1	360	18,720	3,850
31	66	11,880	13	15,805	27,685	5,920
30	76	13,680	7	5,584	19,264	4,000
15	110	19,800	6	2,310	22,110	3,880
32	113	20,340	7	7,837	28,177	4,750
10	28	5,040	21	8,716	13,756	3,010
27	57	10,260	18	12,767	23,027	4,350
14	128	23,040	0	0	23,040	3,150
11	148	26,640	8	6,205	32,845	4,160
12	147	26,460	0	0	26,460	3,170
24	119	21,420	5	3,620	25,040	3,710
23	136	24,480	0	0	24,480	2,890
18	117	21,060	8	9,165	30,225	3,740
17	138	24,840	4	3,333	28,173	3,650
28	112	20,160	8	5,728	25,888	2,930
2	164	29,520	0	0	29,520	2,780
13	95	17,100	1	500	17,600	2,000
19	114	20,520	5	6,704	27,224	3,410
36	97	17,460	11	10,372	27,832	2,870
29	106	19,080	2	2,522	21,602	2,350
4	156	28,080	0	0	28,080	2,170

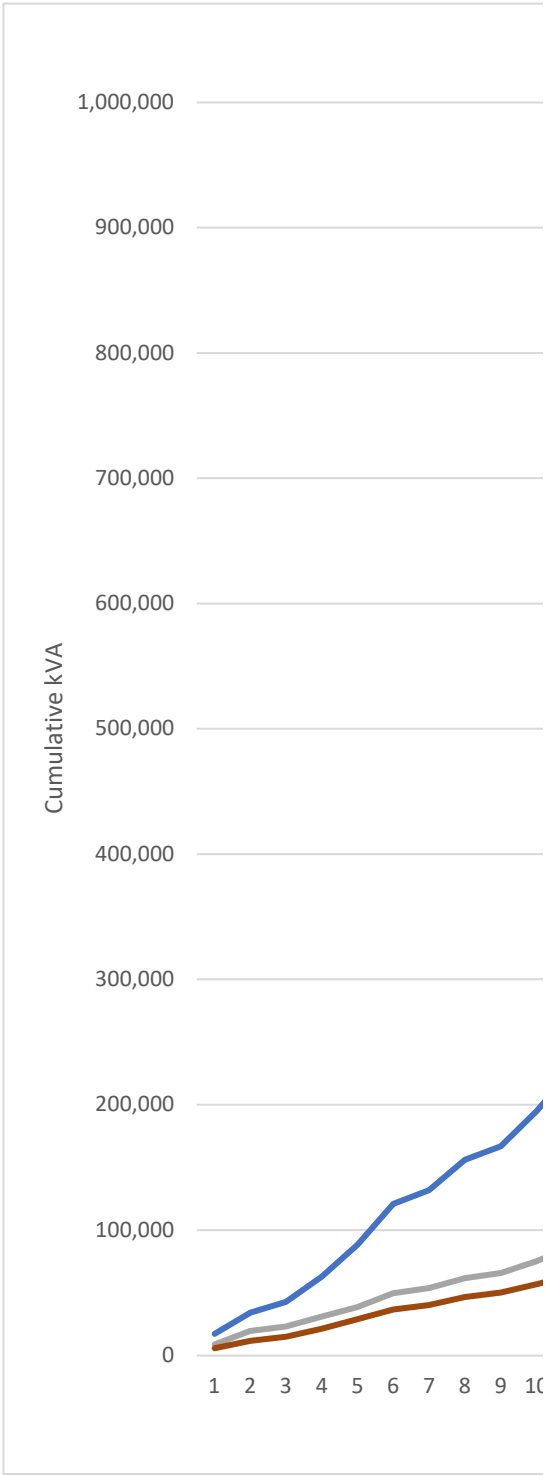
3	119	21,420	10	6,883	28,303	2,170
6	156	28,080	9	5,101	33,181	1,900
33	87	15,660	0	0	15,660	1,030

Bourgault 1.1 & 2	Safety Factor Above Measured Demand	Cumulative Loads				
rec at bourgault 2, eqp at bourgault 1.1	Bourgault 1.1 & 2	Measured peak demand	Recep Load	Cord Conn Load (nameplate)	Total Load (w/ eqp at nameplate)	Cumulative Bourgault 1.1 & 2
8,896	54%	5,780	540	16,712	17,252	8,896
10,881	89%	11,540	9,000	25,014	34,014	19,507
6,301	92%	14,830	12,960	29,695	42,655	23,088
12,651	97%	21,250	21,960	40,997	62,957	30,989
15,165	101%	28,800	42,300	46,077	88,377	38,614
15,973	108%	36,480	63,540	57,403	120,943	49,587
7,942	110%	40,270	68,580	63,246	131,826	53,768
12,941	111%	46,410	85,140	70,848	155,988	61,709
7,852	114%	50,080	90,180	76,511	166,691	65,801
14,303	116%	56,700	109,440	85,487	194,927	75,104
16,452	128%	63,930	129,420	98,401	227,821	86,556
15,780	153%	70,170	158,940	101,801	260,741	95,636
15,119	154%	76,120	185,400	108,808	294,208	105,754
9,950	158%	79,970	203,760	109,168	312,928	110,524
15,873	168%	85,890	215,640	124,973	340,613	121,397
11,212	180%	89,890	229,320	130,557	359,877	127,609
11,105	186%	93,770	249,120	132,867	381,987	133,714
14,004	195%	98,520	269,460	140,704	410,164	142,717
9,378	212%	101,530	274,500	149,420	423,920	148,335
13,949	221%	105,880	284,760	162,187	446,947	157,284
10,760	242%	109,030	307,800	162,187	469,987	163,044
14,763	255%	113,190	334,440	168,392	502,832	172,806
11,615	266%	116,360	360,900	168,392	529,292	179,421
13,975	277%	120,070	382,320	172,012	554,332	186,586
11,120	285%	122,960	406,800	172,012	578,812	192,706
14,848	297%	126,700	427,860	181,177	609,037	202,554
14,543	298%	130,350	452,700	184,510	637,210	210,430
12,904	340%	133,280	472,860	190,238	663,098	218,334
12,380	345%	136,060	502,380	190,238	692,618	225,714
9,775	389%	138,060	519,480	190,738	710,218	230,239
16,834	394%	141,470	540,000	197,442	737,442	238,721
14,551	407%	144,340	557,460	207,814	765,274	248,272
12,292	423%	146,690	576,540	210,336	786,876	254,303
12,020	454%	148,860	604,620	210,336	814,956	261,323

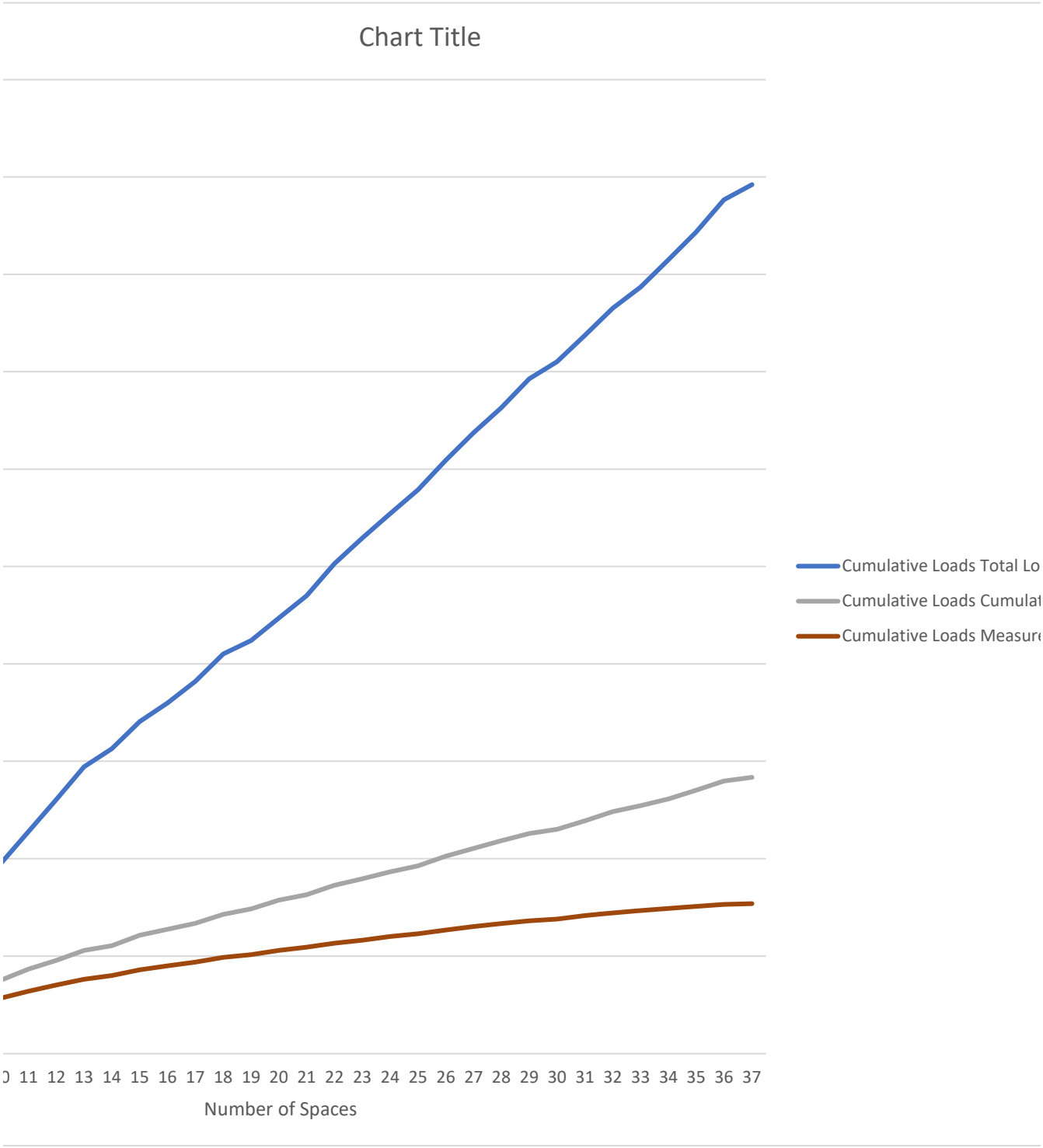
13,797	536%	151,030	626,040	217,219	843,259	270,120
14,571	667%	152,930	654,120	222,320	876,440	279,690
8,915	766%	153,960	669,780	222,320	892,100	283,605

Data For Graph:

Cumulative Loads		
Total Load (w/ eqp at nameplate)	Cumulative Bourgault 1.1 & 2	Measured peak demand
17,252	8,896	5,780
34,014	19,507	11,540
42,655	23,088	14,830
62,957	30,989	21,250
88,377	38,614	28,800
120,943	49,587	36,480
131,826	53,768	40,270
155,988	61,709	46,410
166,691	65,801	50,080
194,927	75,104	56,700
227,821	86,556	63,930
260,741	95,636	70,170
294,208	105,754	76,120
312,928	110,524	79,970
340,613	121,397	85,890
359,877	127,609	89,890
381,987	133,714	93,770
410,164	142,717	98,520
423,920	148,335	101,530
446,947	157,284	105,880
469,987	163,044	109,030
502,832	172,806	113,190
529,292	179,421	116,360
554,332	186,586	120,070
578,812	192,706	122,960
609,037	202,554	126,700
637,210	210,430	130,350
663,098	218,334	133,280
692,618	225,714	136,060
710,218	230,239	138,060
737,442	238,721	141,470
765,274	248,272	144,340
786,876	254,303	146,690
814,956	261,323	148,860



843,259	270,120	151,030
876,440	279,690	152,930
892,100	283,605	153,960


Chart Title
Cumulative Loads Total Lo
Cumulative Loads Cumulat
Cumulative Loads Measur
0 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37
Number of Spaces

ad (w/ eqp at nameplate)

tive Bourgault 1.1 & 2

ed peak demand

Row #	Connected Load (VA)					Measured Peak VA
	# Receps	Recep load	# CORD CONN EQP	Cord Con Load (nameplate)	Total Conn. Load, equip at nameplate	
6	156	28,080	9	5,101	33,181	1,900
22	22	3,960	8	4,681	8,641	3,290
34	28	5,040	7	5,843	10,883	3,790
35	28	5,040	7	5,663	10,703	3,670
10	28	5,040	21	8,716	13,756	3,010
26	47	8,460	7	8,302	16,762	5,760
13	95	17,100	1	500	17,600	2,000
20	102	18,360	1	360	18,720	3,850
25	50	9,000	13	11,302	20,302	6,420
30	76	13,680	7	5,584	19,264	4,000
16	3	540	23	16,712	17,252	5,780
29	106	19,080	2	2,522	21,602	2,350
15	110	19,800	6	2,310	22,110	3,880
24	119	21,420	5	3,620	25,040	3,710
14	128	23,040	0	0	23,040	3,150
27	57	10,260	18	12,767	23,027	4,350
21	92	16,560	9	7,602	24,162	6,140
23	136	24,480	0	0	24,480	2,890
19	114	20,520	5	6,704	27,224	3,410
28	112	20,160	8	5,728	25,888	2,930
5	111	19,980	17	12,914	32,894	7,230
12	147	26,460	0	0	26,460	3,170
3	119	21,420	10	6,883	28,303	2,170
32	113	20,340	7	7,837	28,177	4,750
9	107	19,260	14	8,976	28,236	6,620
18	117	21,060	8	9,165	30,225	3,740
17	138	24,840	4	3,333	28,173	3,650
2	164	29,520	0	0	29,520	2,780
4	156	28,080	0	0	28,080	2,170
11	148	26,640	8	6,205	32,845	4,160
8	118	21,240	11	11,326	32,566	7,680
1	164	29,520	4	3,400	32,920	6,240
7	147	26,460	10	7,007	33,467	5,950
31	66	11,880	13	15,805	27,685	5,920

33	87	15,660	0	0	15,660	1,030
36	97	17,460	11	10,372	27,832	2,870
37	113	20,340	5	5,080	25,420	7,550

NEC DEMAND LOAD	Cumulative Loads					
CORD CONN AT nameplate	Measured peak demand	Recep Load	Cord Conn Load (nameplate)	Total Load (w/ eqp at nameplate)	NEC (w/ eqp at nameplate)	Bourgault 1.0 (rec at NEC, eqp at bourgault)
24,141	1,900	28,080	5,101	33,181	24,141	21,591
8,641	5,190	32,040	9,782	41,822	30,802	6,301
10,883	8,980	37,080	15,625	52,705	39,165	7,962
10,703	12,650	42,120	21,288	63,408	47,348	7,872
13,756	15,660	47,160	30,004	77,164	58,584	7,219
16,762	21,420	55,620	38,306	93,926	71,116	12,611
14,050	23,420	72,720	38,806	111,526	80,166	14,050
14,540	27,270	91,080	39,166	130,246	89,706	14,540
20,302	33,690	100,080	50,468	150,548	105,508	11,826
17,424	37,690	113,760	56,052	169,812	117,932	14,632
17,252	43,470	114,300	72,764	187,064	134,914	4,718
17,062	45,820	133,380	75,286	208,666	146,976	17,062
17,210	49,700	153,180	77,596	230,776	159,186	16,055
19,330	53,410	174,600	81,216	255,816	173,516	19,330
16,520	56,560	197,640	81,216	278,856	185,036	16,520
22,897	60,910	207,900	93,983	301,883	202,933	13,322
20,882	67,050	224,460	101,585	326,045	218,815	17,081
17,240	69,940	248,940	101,585	350,525	231,055	17,240
21,964	73,350	269,460	108,289	377,749	248,019	21,964
20,808	76,280	289,620	114,017	403,637	263,827	17,944
27,904	83,510	309,600	126,931	436,531	286,731	18,219
18,230	86,680	336,060	126,931	462,991	299,961	18,230
22,593	88,850	357,480	133,814	491,294	317,554	19,152
23,007	93,600	377,820	141,651	519,471	335,561	19,089
23,606	100,220	397,080	150,627	547,707	354,167	16,874
24,695	103,960	418,140	159,792	577,932	373,862	20,113
20,753	107,610	442,980	163,125	606,105	389,615	20,753
19,760	110,390	472,500	163,125	635,625	404,375	19,760
19,040	112,560	500,580	163,125	663,705	418,415	19,040
24,525	116,720	527,220	169,330	696,550	437,940	21,423
26,946	124,400	548,460	180,656	729,116	459,886	18,452
23,160	130,640	577,980	184,056	762,036	478,046	23,160
25,237	136,590	604,440	191,063	795,503	498,283	21,734
26,745	142,510	616,320	206,868	823,188	520,028	14,891

12,830	143,540	631,980	206,868	838,848	527,858	12,830
24,102	146,410	649,440	217,240	866,680	546,960	16,323
20,250	153,960	669,780	222,320	892,100	562,210	20,250

			Proposed Methods			
Cumulative Bourgault 1.0	Bourgault 1.1 (rec at NEC, eqp at bourgault)	Cumulative Bourgault 1.1	Bourgault 2 (rec at bourgault, eqp at nameplate)	Cumulative Bourgault 2	Bourgault 1.1 & 2 (rec at bourgault 2, eqp at bourgault 1.1)	Cumulative Bourgault 1.1 & 2
21,591	21,591	21,591	17,121	17,121	14,571	14,571
23,466	6,301	25,911	8,641	22,792	6,301	17,901
27,446	7,962	31,353	10,863	29,895	7,942	22,083
31,382	7,872	36,704	10,683	36,818	7,852	26,174
36,081	9,398	43,582	13,736	46,794	9,378	31,792
42,387	12,611	51,963	15,032	57,211	10,881	38,058
51,062	14,050	60,763	9,775	61,986	9,775	42,583
60,332	14,540	70,123	9,950	66,936	9,950	47,353
67,657	14,651	80,274	18,302	80,488	12,651	55,254
75,893	14,632	89,906	14,004	89,492	11,212	61,466
80,341	8,896	98,532	17,252	106,339	8,896	69,957
90,512	17,062	109,333	12,292	113,631	12,292	75,988
100,989	16,055	120,388	12,260	120,891	11,105	82,093
112,604	19,330	132,908	13,975	129,866	13,975	89,258
124,124	16,520	144,428	10,760	135,626	10,760	95,018
132,446	16,514	155,942	20,332	150,958	13,949	103,967
142,626	17,081	168,023	16,742	162,700	12,941	111,908
154,866	17,240	180,263	11,120	168,820	11,120	118,028
166,802	21,964	193,875	16,834	180,654	16,834	126,510
178,314	17,944	206,819	15,768	191,422	12,904	134,414
191,533	21,447	223,266	22,909	209,331	16,452	145,866
204,763	18,230	236,496	11,615	215,946	11,615	152,481
217,194	19,152	250,647	17,238	228,184	13,797	161,277
229,323	19,089	264,736	17,922	241,106	14,004	170,281
241,197	19,118	278,854	18,791	254,897	14,303	179,584
254,018	20,113	293,966	19,430	269,327	14,848	189,431
267,271	20,753	308,053	14,543	278,870	14,543	197,308
282,031	19,760	322,813	12,380	286,250	12,380	204,688
296,071	19,040	336,853	12,020	293,270	12,020	211,708
310,943	21,423	353,275	17,865	306,135	14,763	221,470
324,394	21,283	369,558	21,636	322,771	15,973	232,443
340,004	23,160	386,018	15,780	333,551	15,780	241,523
354,986	21,734	402,752	18,622	347,173	15,119	251,642
364,877	18,843	416,594	23,775	365,948	15,873	262,514

372,707	12,830	424,424	8,915	369,863	8,915	266,429
384,030	18,916	438,340	19,737	384,600	14,551	275,980
395,470	20,250	451,050	15,165	394,765	15,165	283,605

gsf	Space Type	Bourgault 3	Cumulative Bourgault 3	Safety Factor Above Meas (row by row		
				NEC (w/ eqp at nameplate)	Bourgault 1.0	Bourgault 1.1
1,590	3	1,988	1,988	1171%	1036%	1036%
305	1	915	2,903	163%	92%	92%
520	1	1,560	4,463	187%	110%	110%
520	1	1,560	6,023	192%	114%	114%
3,325	3	4,156	10,179	357%	140%	212%
685	1	2,055	12,234	191%	119%	119%
5,100	3	6,375	18,609	603%	603%	603%
2,788	2	5,576	24,185	278%	278%	278%
620	1	1,860	26,045	216%	84%	128%
3,990	3	4,988	31,032	336%	266%	266%
1,820	3	2,275	33,307	198%	-18%	54%
3,215	3	4,019	37,326	626%	626%	626%
5,010	3	6,263	43,589	344%	314%	314%
2,975	2	5,950	49,539	421%	421%	421%
5,000	3	6,250	55,789	424%	424%	424%
2,700	3	3,375	59,164	426%	206%	280%
3,485	2	6,970	66,134	240%	178%	178%
3,660	2	7,320	73,454	497%	497%	497%
3,000	4	3,750	77,204	544%	544%	544%
1,300	4	1,625	78,829	610%	512%	512%
3,650	3	4,563	83,391	286%	152%	197%
5,000	3	6,250	89,641	475%	475%	475%
3,600	2	7,200	96,841	941%	783%	783%
6,500	4	8,125	104,966	384%	302%	302%
3,300	4	4,125	109,091	257%	155%	189%
2,615	3	3,269	112,360	560%	438%	438%
4,700	4	5,875	118,235	469%	469%	469%
5,045	1	15,135	133,370	611%	611%	611%
2,720	2	5,440	138,810	777%	777%	777%
4,245	4	5,306	144,116	490%	415%	415%
3,300	4	4,125	148,241	251%	140%	177%
5,045	1	15,135	163,376	271%	271%	271%
3,325	4	4,156	167,532	324%	265%	265%
590	4	738	168,270	352%	152%	218%

3,950	3	4,938	173,207
6,000	4	7,500	180,707
8,050	4	10,063	190,770

1146%	1146%	1146%
740%	469%	559%
168%	168%	168%

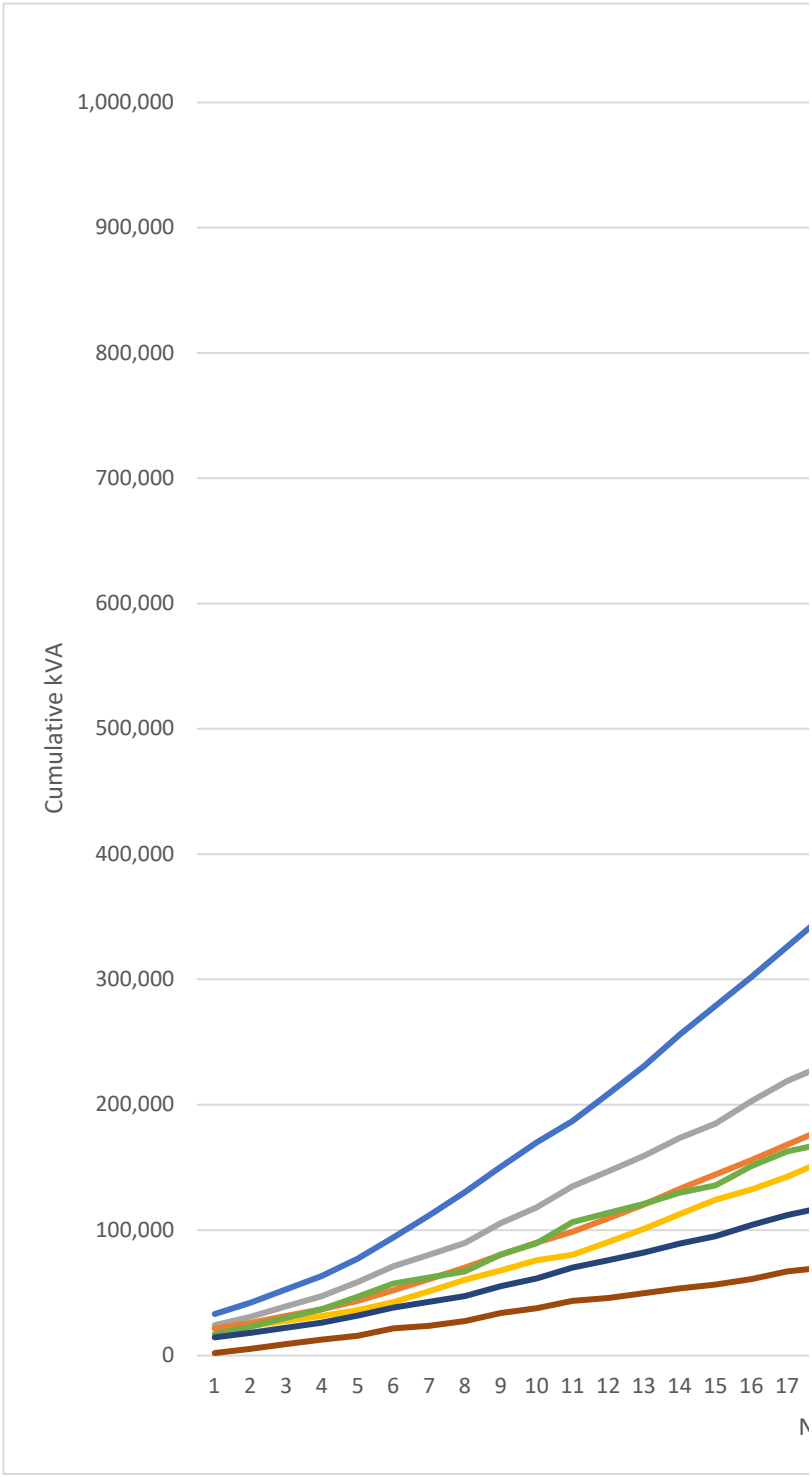
Data For Graph:

sured Demand)		Cumulative Loads				
Bourgault 2	Bourgault 1.1 & 2	Total Load (w/ eqp at nameplate)	NEC (eqp at nameplate)	Cumulative Bourgault 1.0	Cumulative Bourgault 1.1	Cumulative Bourgault 2
801%	667%	33,181	24,141	21,591	21,591	17,121
163%	92%	41,822	30,802	23,466	25,911	22,792
187%	110%	52,705	39,165	27,446	31,353	29,895
191%	114%	63,408	47,348	31,382	36,704	36,818
356%	212%	77,164	58,584	36,081	43,582	46,794
161%	89%	93,926	71,116	42,387	51,963	57,211
389%	389%	111,526	80,166	51,062	60,763	61,986
158%	158%	130,246	89,706	60,332	70,123	66,936
185%	97%	150,548	105,508	67,657	80,274	80,488
250%	180%	169,812	117,932	75,893	89,906	89,492
198%	54%	187,064	134,914	80,341	98,532	106,339
423%	423%	208,666	146,976	90,512	109,333	113,631
216%	186%	230,776	159,186	100,989	120,388	120,891
277%	277%	255,816	173,516	112,604	132,908	129,866
242%	242%	278,856	185,036	124,124	144,428	135,626
367%	221%	301,883	202,933	132,446	155,942	150,958
173%	111%	326,045	218,815	142,626	168,023	162,700
285%	285%	350,525	231,055	154,866	180,263	168,820
394%	394%	377,749	248,019	166,802	193,875	180,654
438%	340%	403,637	263,827	178,314	206,819	191,422
217%	128%	436,531	286,731	191,533	223,266	209,331
266%	266%	462,991	299,961	204,763	236,496	215,946
694%	536%	491,294	317,554	217,194	250,647	228,184
277%	195%	519,471	335,561	229,323	264,736	241,106
184%	116%	547,707	354,167	241,197	278,854	254,897
420%	297%	577,932	373,862	254,018	293,966	269,327
298%	298%	606,105	389,615	267,271	308,053	278,870
345%	345%	635,625	404,375	282,031	322,813	286,250
454%	454%	663,705	418,415	296,071	336,853	293,270
329%	255%	696,550	437,940	310,943	353,275	306,135
182%	108%	729,116	459,886	324,394	369,558	322,771
153%	153%	762,036	478,046	340,004	386,018	333,551
213%	154%	795,503	498,283	354,986	402,752	347,173
302%	168%	823,188	520,028	364,877	416,594	365,948

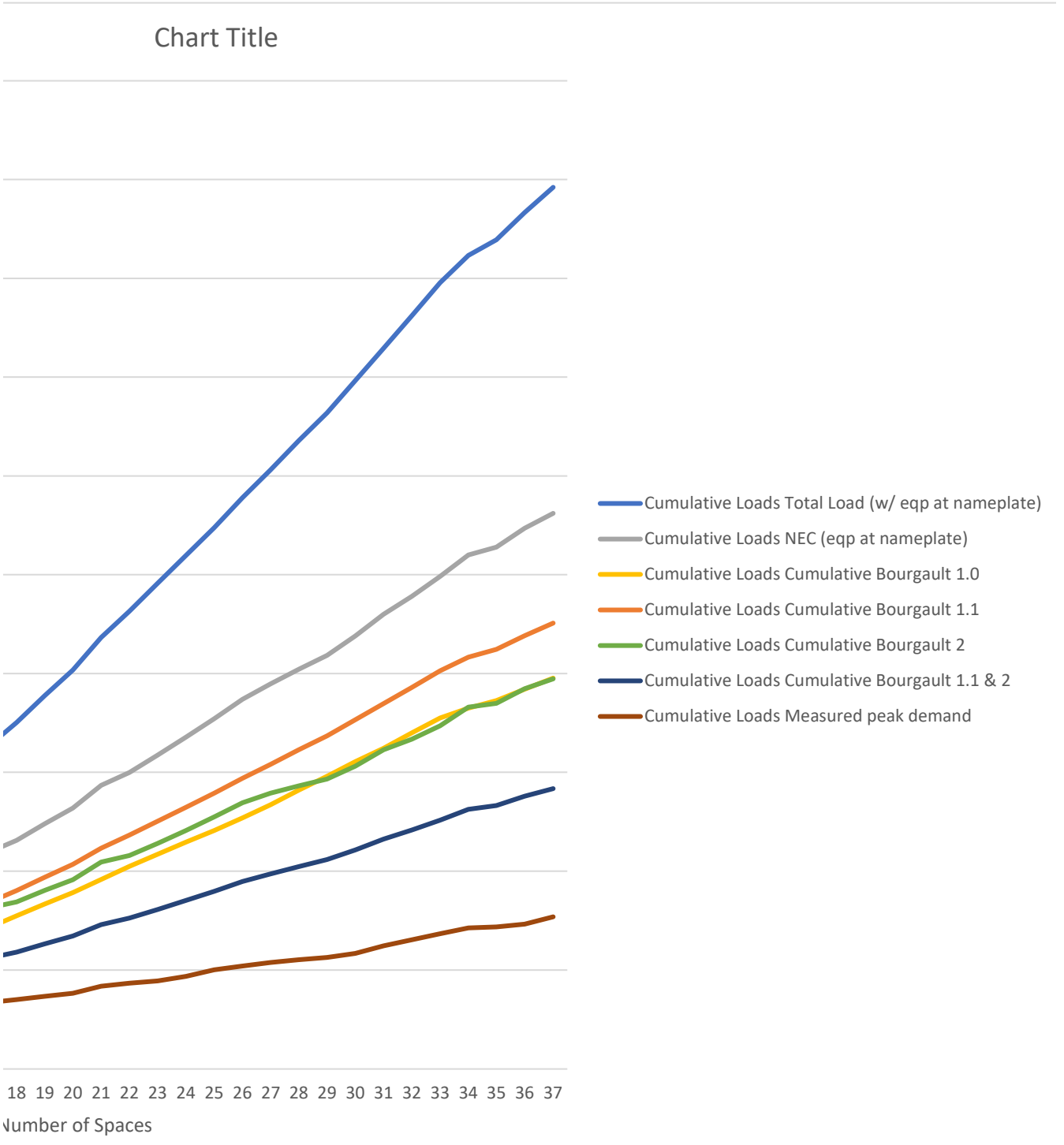
766%	766%
588%	407%
101%	101%

838,848	527,858	372,707	424,424	369,863
866,680	546,960	384,030	438,340	384,600
892,100	562,210	395,470	451,050	394,765

Cumulative Bourgault 1.1 & 2	Measured peak demand
14,571	1,900
17,901	5,190
22,083	8,980
26,174	12,650
31,792	15,660
38,058	21,420
42,583	23,420
47,353	27,270
55,254	33,690
61,466	37,690
69,957	43,470
75,988	45,820
82,093	49,700
89,258	53,410
95,018	56,560
103,967	60,910
111,908	67,050
118,028	69,940
126,510	73,350
134,414	76,280
145,866	83,510
152,481	86,680
161,277	88,850
170,281	93,600
179,584	100,220
189,431	103,960
197,308	107,610
204,688	110,390
211,708	112,560
221,470	116,720
232,443	124,400
241,523	130,640
251,642	136,590
262,514	142,510



266,429	143,540
275,980	146,410
283,605	153,960


Chart Title
Cumulative Loads Total Load (w/ eqp at nameplate)
Cumulative Loads NEC (eqp at nameplate)
Cumulative Loads Cumulative Bourgault 1.0
Cumulative Loads Cumulative Bourgault 1.1
Cumulative Loads Cumulative Bourgault 2
Cumulative Loads Cumulative Bourgault 1.1 & 2
Cumulative Loads Measured peak demand
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37
Number of Spaces

Public Input No. 767-NFPA 70-2020 [New Section after 517.21]

TITLE OF NEW CONTENT

Type your content here ...

517.22 Electromagnetic Pulse (EMP) Protection. Protection for heath care facilities 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

Note that the NEC does not have jurisdiction over performance requirements for healthcare facilities, which are under NFPA 99, so this proposed requirement does not specify the level of EMP protection, just that it must be installed (installation requirement). NFPA 99 should then mandate the level of EMP protection that is required.

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 13:48:15 EDT 2020
Committee:	NEC-P15

Public Input No. 3393-NFPA 70-2020 [Section No. 517.21]

517.21 Ground-Fault Circuit-Interrupter Protection for Personnel in Category 2 ~~(General Care)~~ and Category 1 ~~(Critical Care)~~ Spaces.

Receptacles shall not be required in bathrooms or toilet rooms. [**99:**6.3.2.2.2(D)] Receptacles located in patient bathrooms and toilet rooms in Category 2 (general care) spaces shall have ground-fault circuit-interrupter protection in accordance with 210.8(B)(1).

Ground-fault circuit-interrupter protection for personnel shall not be required for receptacles installed in those ~~Category 2 (general care) and Category 1 (critical care) spaces~~ Category 2 and Category 1 spaces where a basin, sink, or other similar plumbing fixture is installed in the patient bed location.

Informational Note: For information on the supply connection of life-support equipment to circuits providing ground-fault circuit-interrupter (GFCI) protection of personnel at outlets, see ANSI/UL 943-2018, *Ground-Fault Circuit-Interrupters*, Annex E, and, in accordance with 110.3(B), the manufacturers' installation instructions of listed ground-fault circuit interrupters.

Statement of Problem and Substantiation for Public Input

as part of a phased approach it was decided by the committee several cycles ago to remove these misleading terms and make consistent with NFPA 99 terminology.

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Public Input No. 4546-NFPA 70-2020 [New Section after 517.25]

Site Acceptance Testing [99:6.8]

Site acceptance testing shall be performed on the electrical system and all electrical components serving Category 1 and Category 2 spaces. [99:6.8.1]

(Extract or reference applicable requirements from NFPA 99 Section 6.8 as TC deems appropriate)

Statement of Problem and Substantiation for Public Input

This proposed input is to correlate with the action taken by NFPA 99 ELS TC requiring Site Acceptance Testing for electrical systems and components serving Category 1 and 2 spaces. The submitter yields to the TC to determine the best location and way to correlate these requirements in the document.

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Committee: NEC-P15

Public Input No. 4555-NFPA 70-2020 [New Section after 517.25]

Electrical Preventive Maintenance (EPM) [99:6.9]

EPM Program [99:6.9.1]

[99:6.9.1] All electrical components which are part of an electrical system serving a Category 1 and Category 2 space shall be part of an electrical preventive maintenance (EPM) program.

(Extract or reference additional parts of this section from NFPA 99 as the TC deems appropriate).

Statement of Problem and Substantiation for Public Input

This proposed input is to correlate with the action taken by NFPA 99 ELS TC requiring an Electrical Preventive Maintenance program for electrical systems and components serving Category 1 and 2 spaces. The submitter yields to the TC to determine if this is within the scope and requires inclusion. If it is determined to require correlation the TC can determine the best location within Art. 517.

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Committee: NEC-P15

Public Input No. 2877-NFPA 70-2020 [New Section after 517.26]

Commissioning.

Type 1 and Type 2 essential electrical systems shall be commissioned per 110.17 to verify system operation and performance. Where additional levels of ground-fault protection of equipment are required by 517.17, each level shall be included in the system commissioning to verify compliance with 517.17(C).

Statement of Problem and Substantiation for Public Input

Common requirements for device and system commissioning are being proposed to Article 110 in PI 2844 that will help drive consistency in the actions necessary prior to devices and systems being placed into service. This public input is part of a series of revisions proposed throughout the code to include commissioning where the existing requirements only mention testing.

Confirming the installation, setup, and initial performance for devices and equipment necessary for proper system operation and safety extend well beyond a simple testing requirement. Existing requirements for specific tests are not focused on how the device or equipment fits within the overall system. In addition to verifying operational controls and sequence of operation, this revision also adds clarity that overcurrent and protective devices must have settings that have been adjusted and verified when inspected by the AHJ. The requirement to include as-built documentation and a record of the actions taken to correct any shortcomings will enhance the safety of those who will operate, maintain, and service the equipment.

The importance of commissioning Type 1 EESs serving Category 1 and Category 2 spaces has been recognized in Section 6.8 of NFPA 99-2021. Although commissioning includes all required system testing, a specific reference to the ground-fault protection requirements and testing in 517.17 was added to ensure the verification of this protection was included.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2844-NFPA 70-2020 [New Section after 110.16]	
Public Input No. 2887-NFPA 70-2020 [Definition: Commissioning.]	
Public Input No. 2879-NFPA 70-2020 [Section No. 517.17(D)]	

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Public Input No. 3105-NFPA 70-2020 [Section No. 517.26]

517.26 Application of Other Articles.

The life safety branch and critical branch of the essential electrical system shall meet the requirements of Article 700, except as amended by Article 517.

(1) Section 700.4 shall not apply.

(2) Section 700.10(B)(5) shall be replaced with the following for essential electrical systems 150kVA or larger.

Wiring from an emergency source to supply the essential electrical syste shall be in accordance with 517.26(2)(a) through 517.26(2)(c).

(a) Life safety branch circuits and critical branch circuits shall be supplied by any of the means described in (a)1 - (a)3:

(1) Separate vertical switchgear sections or separate switchboard sections with or without a common bus.

(2) Multiple circuits, separate from all other loads, in the same vertical switchgear section or same vertical switchboard section, with or without a common bus.

(3) Individual disconnects mounted in separate enclosures separate from all other loads.

(b) The common bus of separate sections of the switchgear, separate sections of the switchboard, or the individual enclosures shall be either of the following:

(1) Supplied by single or multipe feeders without overcurrent protection at the source.

(2) Supplied by single or multiple feeders with overcurrent protection, provided that the overcurrent protection that is common to an emergency system and any nonemergency system(s) is selectively coordinated with the next downstream overcurrent protective device(s) in the nonemergency system(s)

(c) It shall be permissible to utilize single or multiple feeders to supply distribution equipment between an emergency source and the point where the emergency loads are separated from all other loads.

(3) Section 700.10(D) shall not apply.

(4) Section 700.17 shall be replaced with the following: Branch circuits that supply emergency lighting shall be installed to provide service from a source complying with 700.12 when normal supply for lighting is interrupted or where single circuits supply luminaires containing secondary batteries.

~~Section~~
(5) Section 700.32 shall not apply.

Informational Note No. 1: For additional information, see NFPA 110-2019, *Standard for Emergency and Standby Power Systems*.

Informational Note No. 2: For additional information, see 517.29 and NFPA 99-2018, *Health Care Facilities Code*.

Additional Proposed Changes

File Name	Description	Approved
517.26_Proposed_Change.pdf	Proposed Revision Summary	

Statement of Problem and Substantiation for Public Input

This change makes the Switchgear and Switchboard requirements consistent with the final sentence of section 710.10(C); “Wiring of two or more emergency circuits supplied from the same source shall be permitted in the same raceway, cable, box, or cabinet.” The change also clarifies that it is both the life safety branch and critical branch that must be separated from other loads. The difference in the EES between Article 517 and Article 700 makes this level of specificity necessary.

Item c) is removed because the requirement is fully covered in (a).

There is little consistency in the industry on what is required for dedicated sections on emergency distribution layouts. Some engineers, city inspectors, and city plan reviewers have required dedicated sections for each life safety, critical, and equipment branch distribution while other engineers have allowed the branches of the essential system to be in shared vertical sections. This inconsistency not only creates different variations of the essential system distribution but inconstancies within a project.

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517.26 Application of Other Articles.

The life safety branch and the critical branch of the essential electrical system shall meet the requirements of Article 700, except as amended by Article 517.

(1) Section 700.4 shall not apply.

(2) Section 700.10(B)(5) shall be replaced with the following for essential electrical systems 150kVA or larger:

Wiring from an emergency source to supply the essential electrical system shall be in accordance with 517.26(2)(a) through 517.26(2)c.

a. Life safety branch circuits and critical branch circuits shall be supplied by any of the means described in (a)(1) through (a)(3):

(1) Separate vertical switchgear sections or separate vertical switchboard sections, with or without a common bus.

(2) Multiple circuits separate from all other loads, in the same vertical switchgear section or same vertical switchboard section, with or without a common bus.

(3) Individual disconnects mounted in separate enclosures separate from all other loads.

b. The common bus of separate sections of the switchgear, separate sections of the switchboard, or the individual enclosures shall be either of the following:

(1) Supplied by single or multiple feeders without overcurrent protection at the source

(2) Supplied by single or multiple feeders with overcurrent protection, provided that the overcurrent protection that is common to an emergency system and any nonemergency system(s) is selectively coordinated with the next downstream overcurrent protective device in the nonemergency system(s)

c. It shall be permissible to utilize single or multiple feeders to supply distribution equipment between an emergency source and the point where the emergency loads are separated from all other loads.

~~(2)~~ (3) Section 700.10(D) shall not apply.

~~(3)~~ (4) Section 700.17 shall be replaced with the following: Branch circuits that supply emergency lighting shall be installed to provide service from a source complying with700.12 when normal supply for lighting is interrupted or where single circuits supply luminaires containing secondary batteries.

~~(4)~~ (5) Section 700.32 shall not apply.

Substantiation:

This change makes the Switchgear and Switchboard requirements consistent with the final sentence of section 710.10(C); “Wiring of two or more emergency circuits supplied from the same source shall be permitted in the same raceway, cable, box, or cabinet.”

The change also clarifies that it is both the life safety branch and critical branch that must be separated from other loads. The difference in the EES between Article 517 and Article 700 makes this level of specificity necessary.

Item c) is removed because the requirement is fully covered in (a).

There is little consistency in the industry on what is required for dedicated sections on emergency distribution layouts. Some engineers, city inspectors, and city plan reviewers have required dedicated sections for each life safety, critical, and equipment branch distribution while other engineers have allowed the branches of the essential system to be in shared vertical sections. This inconsistency not only creates different variations of the essential system distribution but inconstancies within a project.

. . = Revisions

Public Input No. 3510-NFPA 70-2020 [Section No. 517.26]

517.26 Application of Other Articles.

The life safety branch and the critical branch of the essential electrical system shall meet the requirements of Article 700, except as amended by Article 517.

(1) Section 700.4 shall not apply.

(2) Section 700.10(D) shall not apply.

(3) Section 700.17 shall be replaced with the following: Branch circuits that supply emergency lighting shall be installed to provide service from a source complying with 700.12 when normal supply for lighting is interrupted or where single circuits supply luminaires containing secondary batteries.

(4) Section 700.32 shall not apply.

Informational Note No. 1: For additional information, see NFPA 110-2019, *Standard for Emergency and Standby Power Systems*.

Informational Note No. 2: For additional information, see 517.29 and NFPA 99-2018, *Health Care Facilities Code*.

Statement of Problem and Substantiation for Public Input

Most all task lighting and receptacles installed within a healthcare facility are supplied by either the normal branch or the critical branch. The only receptacle outlet permitted to be supplied by the life safety branch is a receptacle located at the essential generator set or the automatic transfer switch (ATS). When a facility has only one backup generator, and has an ATS and power inlet as required in Article 700.3(F) for use when the primary generator is offline for maintenance, only the life safety system is required to be supplied. This is a hazard since all the critical receptacles in the Category 1 and Category 2 rooms would lose power in the event of normal power loss. That means the 36 required receptacles within the operating rooms would be useless. Also the task lighting within the ORs, ERs and ICUs/PICUs would not work as well.

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Public Input No. 4658-NFPA 70-2020 [Section No. 517.26]

517.26 Application of Other Articles.

The life safety branch of the essential electrical system shall meet the emergency systems requirements of ~~Article 700~~ this Code , except as amended by ~~Article 517~~ this article .

(1) Section 700.4 shall not apply.

(2) Section 700.10(D) shall not apply.

(3) Section 700.17 shall be replaced with the following: Branch circuits that supply emergency lighting shall be installed to provide service from a source complying with 700.12 when normal supply for lighting is interrupted or where single circuits supply luminaires containing secondary batteries.

(4) Section 700.32 shall not apply.

Informational Note No. 1: For additional information, see NFPA 110-2019, *Standard for Emergency and Standby Power Systems*.

Informational Note No. 2: For additional information, see 517.29 and NFPA 99-2018, *Health Care Facilities Code*.

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the 2020 NEC(r) Style Manual prohibits references to an entire article, with the exception of Article 100. Replacing the Article 700 language in the charging instructions with "the emergency systems requirements in this Code except as amended by this article" accomplishes the requirement without changing the intent of the section.

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Public Input No. 3394-NFPA 70-2020 [Section No. 517.29(A)]

(A) Applicability.

The requirements of Part III, 517.29 through 517.35, shall apply to Type 1 essential electrical systems. Type 1 systems shall be required for Category ~~1 (critical care) spaces~~ 1 spaces . Type 1 systems shall be permitted to serve Category 2 ~~(general care)~~ , Category 3 ~~(basic care)~~ , and Category 4 ~~(support)~~ spaces.

Informational Note No. 1: For performance, maintenance, and testing requirements of essential electrical systems in hospitals, see NFPA 99-2018, *Health Care Facilities Code*. For installation of centrifugal fire pumps, see NFPA 20-2019, *Standard for the Installation of Stationary Pumps for Fire Protection*.

Informational Note No. 2: For additional information on Type 1 and Type 2 essential electrical systems, see NFPA 99-2018, *Health Care Facilities Code*, 6.7.5 and 6.7.6.

Statement of Problem and Substantiation for Public Input

as part of a phased approach it was decided by the committee several cycles ago to remove these misleading terms and make consistent with NFPA 99 terminology.

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Public Input No. 3395-NFPA 70-2020 [Section No. 517.29(B)]

(B) Type 1 Essential Electrical Systems.

Category 1 ~~(critical care)~~ spaces shall be served by a Type 1 essential electrical system. [**99:**6.4.1]

Category 1 spaces shall not be served by a Type 2 EES. [**99:**6.4.2]

Statement of Problem and Substantiation for Public Input

as part of a phased approach it was decided by the committee several cycles ago to remove these misleading terms and make consistent with NFPA 99 terminology.

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Committee: NEC-P15

Public Input No. 2188-NFPA 70-2020 [Section No. 517.29 [Excluding any Sub-Sections]]

~~Informational Note: Type 1 essential electrical systems are comprised of three separate branches capable of supplying a limited amount of lighting and power service that is considered essential for life safety and effective facility operation during the time the normal electrical service is interrupted for any reason. These three separate branches are the life safety, critical, and equipment branches. [**99:** A.6.7.2.3]~~

Statement of Problem and Substantiation for Public Input

This PI proposes to delete this Informational Note due to similar positive text language existing at 517.31(A). Both describe the separate branches associated with a Type 1 EES. For clarity and consistency it would be beneficial to users of the Code to have the requirements stated once and not repeated.

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Public Input No. 2194-NFPA 70-2020 [Section No. 517.30]

517.30 Sources of Power.

(A) Two Independent Power Sources.

Essential electrical systems shall have a minimum of the following two independent sources of power: a normal source generally supplying the entire electrical system and one or more alternate sources for use when the normal source is interrupted. [**99:**6.7.1.2.2] Acceptable Alternate sources include:

(

~~B) Types of Power Sources.~~

~~**(1)** Generating Units.~~

~~(2) Where the normal source consists of generating units on the premises, the alternate source shall be either another generating set or an external utility service. [**99:** 6.7.1.2.3]~~

(2 3) Fuel Cell Systems.

Fuel cell systems shall be permitted to serve as the alternate source for all or part of an essential electrical system, provided the following conditions apply: [**99:**6.7.1.4]

(1) Installation of fuel cells shall comply with the requirements in Parts I through VII of Article 692 for 1000 volts or less and Part VIII for over 1000 volts.

Informational Note: For information on installation of stationary fuel cells, see NFPA 853-2015, *Standard for the Installation of Stationary Fuel Cell Power Systems*.

(2) N + 1 units shall be provided where N units have sufficient capacity to supply the demand load of the portion of the system served. [**99:**6.7.1.4.2]

(3) Systems shall be able to assume loads within 10 seconds of loss of normal power source. [**99:**6.7.1.4.3]

(4) Systems shall have a continuing source of fuel supply, together with sufficient on-site fuel storage for the essential system type. [**99:**6.7.1.4.4]

(5) Where life safety and critical portions of the distribution system are present, a connection shall be provided for a portable diesel generator. [**99:**6.7.1.4.5]

(3) ~~Battery~~ 4) Energy Storage Systems.

Battery systems shall be permitted to serve as the alternate source for all or part of an essential electrical system.

Informational Note: For information on installation of battery systems, see NFPA 111-2019, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*.

(C) **B) Health Care Microgrid.**

Essential electrical systems shall be permitted to be supplied by a health care microgrid that also supplies non-essential loads. The health care microgrid is permitted to share distributed resources with the normal system. Healthcare microgrid systems shall be designed with sufficient reliability to provide effective facility operation consistent with the facility emergency operations plan. Healthcare microgrid system components shall not be compromised by failure of the normal source.

Informational Note: The health care microgrid is intended to take the place of, and include, both the normal source and the alternate source.

Informational Note: For information on health care microgrids, see NFPA 99-2-10 Health Facilities Code.

Informational Note: If this health care microgrid also serves normal loads, the equipment associated with the normal loads is not required to conform to requirements for essential system components.

(C) Location of Essential Electrical System Components.

Essential electrical system components shall be located to minimize interruptions caused by natural forces common to the area (e.g., storms, floods, earthquakes, or hazards created by adjoining structures or activities). [**99:**6.2.4.1]

(1) Services.

Installation of electrical service distribution equipment shall be located to reduce possible interruption of normal electrical services resulting from natural or manmade causes as well as possible disruption of normal electrical services due to internal wiring and equipment failures.

(2) Feeders.

Feeders shall be located to provide physical separation of the feeders of the alternate source and from the feeders of the normal electrical source to prevent possible simultaneous interruption. [**99:**6.2.4.3]

Informational Note: Facilities in which the normal source of power is supplied by two or more separate central station-fed services experience greater than normal electrical service reliability than those with only a single feed. Such a dual source of normal power consists of two or more electrical services fed from separate generator sets or a utility distribution network that has multiple power input sources and is arranged to provide mechanical and electrical separation so that a fault between the facility and the generating sources is not likely to cause an interruption of more than one of the facility service feeders.

Statement of Problem and Substantiation for Public Input

In truth, a microgrid works best when it includes the utility as one of several sources. Our current rules allow, as a normal source, a utility, a generator, a fuel cell, an energy storage system, or a microgrid. Our current rules also allow, as an alternate source, a utility, a generator, a fuel cell, an energy storage system, or a microgrid. Both the normal source and the alternate source can run all the time. The only meaningful distincition between a "normal source" and an "alternate source" is some additional restrictions on the alternate sources for testing and maintenance and mechanical protection. What we really want is a set of redundant sources and a set of redundant feeders that deliver the needed power availability. We should be defining the performance we want, and not the presriptive set of requirements we now have, for the sources (not for the systems). Technology is advancing quickly, and needs for resilience are advancing quickly. Energy markets are evolving quickly. Healthcare organizations, as essential facilities, need reliable, cost-effective power. We need to give them the ability to take advantage of new technologies and respond to new needs, while ensuring needed availability.

This proposal was created by a multi-standard NFPA committee, with members from NFPA 99 ELS, NFPA 70 CMP-15, and NFPA-110 to meet this urgent need and opportunity. Our committee included members of numerous vendors for microgrid manufacturers, AHJs, and health care owners. We unanimously support the need for, and the essence of this proposal.

This proposal is an alternate, and preferred, to our other microgrid proposal.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2173-NFPA 70-2020 [New Section after 517.30(B)]	2173 is an alternate, not as good.

Submitter Information Verification

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Submittal Date: Fri Aug 07 21:13:45 EDT 2020
Committee: NEC-P15

Public Input No. 2189-NFPA 70-2020 [Section No. 517.30(A)]

(A) Two Independent Power Sources.

Essential electrical systems shall have a minimum of the following two independent sources of power: a normal source generally supplying the entire electrical system and one or more alternate power sources for use when the normal source is interrupted. [**99:**6.7.1.2.2]

Additional Proposed Changes

File Name	Description	Approved
NFPA_99_SR_959_global_alternate_power_source.docx	SR 959 NFPA 99 Alternate Power Source	

Statement of Problem and Substantiation for Public Input

This PI proposes to correlate recent changes to the 2021 edition of NFPA 99 concerning the use of the defined term "alternate power source". See attached Second Revision No. 959-NFPA 99-2019 [Global Comment] where "alternate power source" was used in place of "alternate source of power". Article 517 is not consistent in the use of the defined term "alternate power source". For clarity and consistency it would be beneficial to review the entire article. Other sections to consider are:

517.30(A)

517.30(B)(1) though (3)

517.30(C)(2)

517.31(D), (F)

517.35(B)(6)

517.41 (A), (B), (C)

517.43

Submitter Information Verification

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Submittal Date: Fri Aug 07 12:21:53 EDT 2020
Committee: NEC-P15

Second Revision No. 959-NFPA 99-2019 [Global Comment]

Anywhere in Chapter 6 where it says " alternate source of power" it should be replaced with "alternate power source".

Submitter Information Verification

Committee: HEA-ELS

Submittal Date: Wed Jun 26 09:03:32 EDT 2019

Committee Statement

Committee Statement: This change is to make the term consistent the definition in chapter 3 for alternate power source.

Response Message: SR-959-NFPA 99-2019

Public Comment No. 96-NFPA 99-2019 [Section No. 6.7.2.2.3]
Public Comment No. 97-NFPA 99-2019 [Section No. 6.7.2.2.4 [Excluding any Sub-Sections]]
Public Comment No. 95-NFPA 99-2019 [Section No. 6.7.2.2.2]
Public Comment No. 94-NFPA 99-2019 [Section No. 6.7.2.1]

Ballot Results

This item has passed ballot

x

31 Eligible Voters
2 Not Returned
28 Affirmative All
0 Affirmative with Comments
1 Negative with Comments
0 Abstention

X
Not Returned
Jamil, Jason Ryan
Riechers, Keith
X
Affirmative All
Beckstrand, Gary A.
Campbell, David M.
Chandler, H. David
Chilton, Nancy W.
Chisholm, Sr., Dan
Cowles, Charles
D'Antona, Jason
Daugherty, Herbert H.
Day, Richard L.

Della Croce, Vincent
Finen, Chris M.
Gwynn, Pamela
Krupa, Gary J.
Lipster, Stephen M.
McKinch, Terrance L.
Parrish, Thomas J.
Peterson, John W.
Porter, Kevin T.
Rabel, Don
Rea, Vincent M.
Rock, Brian E.
Sappington, Steve R.
Scarlett, Kevin A.
Smidt, Ronald M.
Vann, Joshua
Vernon, IV, Walter N.
White, Leonard W.
Wolff, Robert
X
Negative with Comment
Dagenais, David A.
This will be confusing to the users, the word “type” is used in 110 and is not the same in 99.

Public Input No. 2173-NFPA 70-2020 [New Section after 517.30(B)]

TITLE OF NEW CONTENT

Type your content here ...517.30 (B)

(4) **Health Care Microgrid.** A Health Care microgrid shall be permitted to serve as the alternate source for all or part of an essential electrical system.

Informational Note: The health care microgrid components shall meet the installation and maintenance requirements of the applicable NFPA code.

Informational Note: For information on health care microgrids, see NFPA 99-2-10 Health Care Facilities Code.

Statement of Problem and Substantiation for Public Input

NFPA 99 has now adopted language permitting the use of a microgrid as the alternate source for a healthcare facility. That document includes a set of requirements. This proposal is intended to create the correlation between these two documents.

This comment is being made by a committee comprised of members of NFPA 99 ELS, NFPA 70 CMP15, and NFPA 110 who has worked over the summer to create a series of proposals to help correlate better with NFPA 99.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2182-NFPA 70-2020 [New Article after 100]	
Public Input No. 2194-NFPA 70-2020 [Section No. 517.30]	

Submitter Information Verification

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Committee: NEC-P15

Public Input No. 4516-NFPA 70-2020 [New Section after 517.30(B)]

Health Care Microgrid

A health care microgrid in accordance with XXX.X shall be permitted to service as the EPS for all or part of an essential electrical system. [99:6.7.1.6]

Statement of Problem and Substantiation for Public Input

This is to correlate with the actions taken by NFPA 99 ELS TC around health care microgrids. There were several changes made in NFPA 99 around Sources permitted to service as the EPS allowed to serve the Essential Electrical System that need to be correlated in Art. 517. The XXX.X in the submission refers to a separate section within NFPA 99 that outlines health care microgrid requirements. However the TC thinks is best to correlate these requirements (either extracted language from NFPA 99 or direct reference to NFPA 99) is acceptable.

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Committee: NEC-P15

Public Input No. 2171-NFPA 70-2020 [Section No. 517.30(B)]

(B) Types of Alternate Power Sources.

(1) Generating Units.

Where the normal source consists of generating units on the premises, the alternate source shall be either another generating set or an external utility service. [**99:**6.7.1.2.3]

(2) Fuel Cell Systems.

Fuel cell systems shall be permitted to serve as the alternate source for all or part of an essential electrical system, provided the following conditions apply: [**99:**6.7.1.4]

(1) Installation of fuel cells shall comply with the requirements in Parts I through VII of Article 692 for 1000 volts or less and Part VIII for over 1000 volts.

Informational Note: For information on installation of stationary fuel cells, see NFPA 853-2015, *Standard for the Installation of Stationary Fuel Cell Power Systems*.

(2) N + 1 units shall be provided where N units have sufficient capacity to supply the demand load of the portion of the system served. [**99:**6.7.1.4.2]

(3) Systems shall be able to assume loads within 10 seconds of loss of normal power source. [**99:**6.7.1.4.3]

(4) Systems shall have a continuing source of fuel supply, together with sufficient on-site fuel storage for the essential system type. [**99:**6.7.1.4.4]

(5) Where life safety and critical portions of the distribution system are present, a connection shall be provided for a portable diesel generator. [**99:**6.7.1.4.5]

(3) Battery Systems.

Battery systems shall be permitted to serve as the alternate source for all or part of an essential electrical system.

Informational Note: For information on installation of battery systems, see NFPA 111-2019, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*.

Statement of Problem and Substantiation for Public Input

The language in (A) for this section refers to two sources of power, a "Normal source" (which our document does not define) and "one or more alternate sources." The sources described in B are the acceptable alternate power sources, and the title of (B) should be slightly modified to reflect this.

This comment is being made by a committee comprised of members of NFPA 99 ELS, NFPA 70 CMP15, and NFPA 110 who has worked over the summer to create a series of proposals to help correlate better with NFPA 99.

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Committee: NEC-P15

Public Input No. 4156-NFPA 70-2020 [Section No. 517.30(B)(1)]

(1) Generating Units.

Where the normal source consists of generating units on the premises, the alternate power source shall be either another generating set or an external utility service. [**99:**6.7.1.2.3]

Statement of Problem and Substantiation for Public Input

This public input is submitted on behalf of the task group formed under the direction of the Correlating Committee to harmonize terminology across NFPA70, 99, 110, and 111 that relate to emergency and standby power and energy storage. This task group was appointed to identify potential proposed changes to the 2023 edition of the NEC in the form of Public Inputs (PIs) that within the Task Group's scope of activity as specified by the Correlating Committee.
The task group members are; Alan Manche-Co-Chair, Todd Lottmann Co-Chair, Steve Froemming, David Stymiest, John Kovacik, Chad Kennedy, Duke Schamel, Linda Little, Jason D'Antona, Chris Coache, Mike McCabe, and Chad Beebe. This task group of balanced interests provided the expertise to develop these public inputs covering the harmonization of terms across NFPA70, 99, 110, and 111.
Public Inputs are being submitted in the following sections: Article 100 definitions, 480.2, 517.30 (B)(1), 517.30(B)(3), 517.31(D), 517.31(F), 517.41(B), 692.41(C), 695.3(C)(2), 700.2, 700.12(D)(1), 700.12(D)(2), 700.18, 701.2, 701.12(D)(1), and 708.20(F)(1)
Summary of Changes
These proposed PIs are intended provide consistent use of terms between the NEC®, NFPA 110, 111. These proposed revisions identified correlating terminology issues and looked across all three standards to determine the changes necessary to harmonize key terms. These public inputs were the changes recommended for the NEC by the task group.

Technical Substantiation
The following substantiation is provided for each change separated by section:
Article 100 – Uninterruptible Power Supply definition was revised to align with the NFPA111 definition.
480.2 – definition for storage battery revised to match NFPA855
517.30 (B)(1) – revised to text to align with references across NEC, NFPA110, and NFPA111
517.30(B)(3) – revised to text to align with references across NEC, NFPA110, and NFPA111
517.31(D) – revised to text to align with references across NEC, NFPA110, and NFPA111
517.31(F) – revised to text to align with references across NEC, NFPA110, and NFPA111
517.41(B) – revised to text to align with references across NEC, NFPA110, and NFPA111
692.41(C) – removed the word power since fuel cell system is a defined term in the NEC
695.3(C)(2) – revised to text to align with references across NEC, NFPA110, and NFPA111
700.2, - Added informational note number 2 to describe the interaction of the terms used in NFPA110 and NFPA111with emergency systems in the NEC. Revised definition for Branch-Circuit Emergency Lighting Transfer Switch to align with terminology in NFPA110 and NFPA111. Added informational note 3 to tie the levels defined in NFPA110 to the systems used in the NEC. This will aid in the interaction of these standards.
700.12(D)(1), - Normal service implies that the normal or primary power source can only be a utility per the NEC definition of "service." This section was revised to say power source to allow other types of sources for the normal power.
700.12(D)(2) – revised wording since legally required standby system and emergency system are defined terms.
700.18 – added the word "system" since emergency system is a defined term
701.2 - Added informational note 2 to tie the levels defined in NFPA110 to the systems used in the NEC. This will aid in the interaction of these standards. It also provides guidance as to which legally required standby systems are considered level 1 due to their critical nature tied to loss of life or serious injury versus the level 2 that is less critical.
701.12(D)(1) - Normal service implies that the normal or primary power source can only be a utility per the NEC definition of "service." This section was revised to say power source to allow other types of sources for the normal power.
708.2 - Added informational note to tie the levels defined in NFPA110 to the systems used in the NEC. This will aid in the interaction of these standards.
708.20(F)(1) - Normal service implies that the normal or primary power source can only be a utility per the NEC definition of "service." This section was revised to say power source to allow other types of sources for the normal power.

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Committee: NEC-P15

Public Input No. 3368-NFPA 70-2020 [Section No. 517.30(B)(2)]

(2) ~~Fuel Cell Systems~~ Stored-Energy Power Supply Systems (SEPSS) .

Fuel cell systems shall be permitted to serve as the alternate source for all or part of an essential electrical system, provided the following conditions apply: [**99:**6.7.1.4]

(1) ~~Installation of fuel cells shall comply with the requirements in Parts I through VII of Article 692 for 1000 volts or less and Part VIII for over 1000 volts~~ Systems shall consist of one or more of the following system types

(2) Uninterruptible Power Supply (UPS) .

(3) Informational Note:

(1)

(1) For further information

~~on installation of stationary fuel cells, see NFPA 853-2015, Standard for the Installation of Stationary Fuel Cell~~

(1)

(1) see UL 1778, *Uninterruptible Power Systems* .

(4) ~~N + 1 units shall be provided where N units have sufficient capacity to supply the demand load of the portion of the system served. [**99:** 6.7.1.4.2]~~

(5) ~~Systems shall be able to assume loads within 10 seconds of loss of normal power source. [**99:** 6.7.1.4.3]~~

(6) ~~Systems shall have a continuing source of fuel supply, together with sufficient on-site fuel storage for the essential system type. [**99:** 6.7.1.4.4]~~

~~Where life safety and critical portions of the distribution system are present, a connection shall be provided for a portable diesel generator. [**99:** 6.7.1.4.5]~~

(7)

(1) Fuel Cell System. Fuel cell systems used as a source of power shall also meet the requirements of Article 692.

(2) Energy Storage System (ESS). The installation of an energy storage system shall also meet the requirements of Article 706.

(3) Battery Systems. Battery systems shall be permitted to serve as the alternate source for all or part of an essential electrical system. A storage battery used as a source of power for dc loads shall also comply with Article 480.

(8) Informational Note: For information on installation of battery systems, see NFPA 111-2019, Standard on Stored Electrical Energy Emergency and Standby Power Systems.

(4) Other approved equivalent stored energy sources that comply with Article 517.30.

(9) Systems shall be installed with the fire protection and suppression, ventilation and separation requirements specified in the manufacturer's instructions or equipment listing.

Additional Proposed Changes

File Name	Description	Approved
517.30_B_2_.JPG	This is what the intent of the changes were meant to look like without the formatting issues in Terra.	

Statement of Problem and Substantiation for Public Input

These changes are intended to expand what can be utilized for the newly defined stored-energy power supply systems (SEPSS) to include a number of different technologies that are currently available and can be used for this application including UPS, fuel cell systems, ESS, storage batteries for DC loads and an “other” option since these technologies may not represent an all-inclusive list. The term SEPSS has been introduced as a public input into 700.2 to apply code wide.

The changes to requirements for fuel cells is in alignment with revisions in NFPA 99.

This correlates with the proposals submitted by the Emergency Sources Task Group appointed by the NEC Correlating Committee for alternate power sources that serve emergency loads in Article 700 and legally required standby in Article 701. Refer to PI 2788 for entirety of modifications to these sections.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3367-NFPA 70-2020 [Section No. 517.2]	All three PIs create the proposed change
Public Input No. 3371-NFPA 70-2020 [Section No. 517.30(B)(3)]	All three PIs create the proposed change
Public Input No. 3367-NFPA 70-2020 [Section No. 517.2]	
Public Input No. 3371-NFPA 70-2020 [Section No. 517.30(B)(3)]	

Submitter Information Verification

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Submittal Date: Tue Sep 08 11:23:23 EDT 2020
Committee: NEC-P15

)(2) ~~Fuel Cell Systems.~~**Stored-Energy Power Supply Systems (SEPSS).**

nergy Power Supply Systems shall comply with all of the following:

1. Systems shall consists of one or more of the following system types
   a) Uninterruptible Power Supply (UPS).
      Informational Note: For further information, see UL 1778, *Uninterru Power Systems*.
   b) Fuel Cell System. Fuel cell systems used as a source of power shall also the requirements of Article 692.
   c) Energy Storage System (ESS). The installation of an energy storage sys shall also meet the requirements of Article 706.
   d) Battery Systems. Battery systems shall be permitted to serve as the alte source for all or part of an essential electrical system. A storage battery as a source of power for dc loads shall also comply with Article 480.

Informational Note: For information on installation of battery systems, see NFPA 111-2 Standard on Stored Electrical Energy Emergency and Standby Power Systems.

   e) Other approved equivalent stored energy sources that comply with 517.3

2. Systems shall be Installed with the fire protection and suppression, ventilation and separation requirements specified in the manufacturer's instructions or equipment lis

Public Input No. 2172-NFPA 70-2020 [Section No. 517.30(B)(3)]

(3) ~~Battery~~ Energy Storage Systems.

~~Battery~~ Energy Storage systems shall be permitted to serve as the alternate source for all or part of an essential electrical system.

Informational Note: For information on installation of battery systems, see NFPA 111-2019, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*.

Statement of Problem and Substantiation for Public Input

This is simply for better correlation. Other NFPA documents and other portions of this NFPA document use the proposed term.

This comment is being made by a committee comprised of members of NFPA 99 ELS, NFPA 70 CMP15, and NFPA 110 who has worked over the summer to create a series of proposals to help correlate better with NFPA 99.

Submitter Information Verification

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Submittal Date: Thu Aug 06 13:07:58 EDT 2020
Committee: NEC-P15

Public Input No. 3371-NFPA 70-2020 [Section No. 517.30(B)(3)]

~~(3) Battery Systems.~~

~~Battery systems shall be permitted to serve as the alternate source for all or part of an essential electrical system.~~

~~Informational Note: For information on installation of battery systems, see NFPA 111-2019, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*~~

Health Care Microgrid Systems

On-site sources, designated as alternate source(s), shall be permitted to be connected to a health care microgrid system. The system shall isolate the essential electrical system from all non-essential loads when the normal electrical supply is interrupted or shall meet the requirements of 517.31(B)(1). Interruption, partial or complete failure of the normal source(s) shall not impact the availability, capacity and duration provided by the designated alternate power source(s).

Designated stored-energy alternate power source(s) of a microgrid system shall be permitted to remain interconnected to an available power production source during the alternate power source(s) operation where the lack of, or failure, of the interconnected power production source(s) does not impact system operation. interconnected power production sources, other than those designated as the alternate power source(s) shall not be required to meet the requirements of Article 517.30.

Informational Note: For information on Health Care microgrids, see NFPA 99-2021 Health Care Facilities Code .

Statement of Problem and Substantiation for Public Input

This new section aligns with the NFPA 99 revisions to allow a health care microgrid to serve loads within an essential electrical system. The importance of supply to the EES during interruptions within the system warrant the inclusion of requirements to have these sources on-site and capable of separating from other parts of the system as needed to support the EES. This includes rules to address the condition where there is a failure of one or more interconnected sources not categorized as EES alternate sources. This language would require that an evaluation of these conditions is considered in the installation of such a system.

The final paragraph provides an allowance that where a stored-energy alternate source, such as a battery or ESS, is used as part of the alternate power system, it shall be permitted to be charged by other sources, not just those categorized as alternate sources.

This aligns with the proposals submitted by the Emergency Sources Task Group appointed by the NEC Correlating Committee for alternate power sources that serve emergency loads in Article 700 and legally required standby in Article 701. Refer to PI 2788 for entirety of changes to Articles 700 and 701.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3367-NFPA 70-2020 [Section No. 517.2]	All three PIs create the proposed change
Public Input No. 3368-NFPA 70-2020 [Section No. 517.30(B)(2)]	All three PIs create the proposed change
Public Input No. 3367-NFPA 70-2020 [Section No. 517.2]	
Public Input No. 3368-NFPA 70-2020 [Section No. 517.30(B)(2)]	

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Committee: NEC-P15

Public Input No. 4158-NFPA 70-2020 [Section No. 517.30(B)(3)]

(3) Battery Systems.

Battery systems shall be permitted to serve as the alternate power source for all or part of an essential electrical system.

Informational Note: For information on installation of battery systems, see NFPA 111-2019, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*.

Statement of Problem and Substantiation for Public Input

This public input is submitted on behalf of the task group formed under the direction of the Correlating Committee to harmonize terminology across NFPA70, 99, 110, and 111 that relate to emergency and standby power and energy storage. This task group was appointed to identify potential proposed changes to the 2023 edition of the NEC in the form of Public Inputs (PIs) that within the Task Group's scope of activity as specified by the Correlating Committee.
The task group members are; Alan Manche-Co-Chair, Todd Lottmann Co-Chair, Steve Froemming, David Stymiest, John Kovacik, Chad Kennedy, Duke Schamel, Linda Little, Jason D'Antona, Chris Coache, Mike McCabe, and Chad Beebe. This task group of balanced interests provided the expertise to develop these public inputs covering the harmonization of terms across NFPA70, 99, 110, and 111.
Public Inputs are being submitted in the following sections: Article 100 definitions, 480.2, 517.30 (B)(1), 517.30(B)(3), 517.31(D), 517.31(F), 517.41(B), 692.41(C), 695.3(C)(2), 700.2, 700.12(D)(1), 700.12(D)(2), 700.18, 701.2, 701.12(D)(1), and 708.20(F)(1)
Summary of Changes
These proposed PIs are intended provide consistent use of terms between the NEC®, NFPA 110, 111. These proposed revisions identified correlating terminology issues and looked across all three standards to determine the changes necessary to harmonize key terms. These public inputs were the changes recommended for the NEC by the task group.

Technical Substantiation
The following substantiation is provided for each change separated by section:
Article 100 – Uninterruptible Power Supply definition was revised to align with the NFPA111 definition.
480.2 – definition for storage battery revised to match NFPA855
517.30 (B)(1) – revised to text to align with references across NEC, NFPA110, and NFPA111
517.30(B)(3) – revised to text to align with references across NEC, NFPA110, and NFPA111
517.31(D) – revised to text to align with references across NEC, NFPA110, and NFPA111
517.31(F) – revised to text to align with references across NEC, NFPA110, and NFPA111
517.41(B) – revised to text to align with references across NEC, NFPA110, and NFPA111
692.41(C) – removed the word power since fuel cell system is a defined term in the NEC
695.3(C)(2) – revised to text to align with references across NEC, NFPA110, and NFPA111
700.2, - Added informational note number 2 to describe the interaction of the terms used in NFPA110 and NFPA111with emergency systems in the NEC. Revised definition for Branch-Circuit Emergency Lighting Transfer Switch to align with terminology in NFPA110 and NFPA111. Added informational note 3 to tie the levels defined in NFPA110 to the systems used in the NEC. This will aid in the interaction of these standards.
700.12(D)(1), - Normal service implies that the normal or primary power source can only be a utility per the NEC definition of "service." This section was revised to say power source to allow other types of sources for the normal power.
700.12(D)(2) – revised wording since legally required standby system and emergency system are defined terms.
700.18 – added the word "system" since emergency system is a defined term
701.2 - Added informational note 2 to tie the levels defined in NFPA110 to the systems used in the NEC. This will aid in the interaction of these standards. It also provides guidance as to which legally required standby systems are considered level 1 due to their critical nature tied to loss of life or serious injury versus the level 2 that is less critical.
701.12(D)(1) - Normal service implies that the normal or primary power source can only be a utility per the NEC definition of "service." This section was revised to say power source to allow other types of sources for the normal power.
708.2 - Added informational note to tie the levels defined in NFPA110 to the systems used in the NEC. This will aid in the interaction of these standards.
708.20(F)(1) - Normal service implies that the normal or primary power source can only be a utility per the NEC definition of "service." This section was revised to say power source to allow other types of sources for the normal power.

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Committee: NEC-P15

Public Input No. 4664-NFPA 70-2020 [Section No. 517.31(B)(1)]

(1) Optional Loads.

Loads served by the generating equipment not specifically named in ~~Article~~ ~~517~~ - this article shall be served by their own transfer switches such that the following conditions apply:

(1) These loads shall not be transferred if the transfer will overload the generating equipment.

(2) These loads shall be automatically shed upon generating equipment overloading.

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the 2020 NEC(r) Style Manual prohibits references to an entire article, with the exception of Article 100. Changing to "this article" satisfies the Style Manual without changing the requirement of this section.

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Submittal Date: Thu Sep 10 16:33:38 EDT 2020
Committee: NEC-P15

Public Input No. 3396-NFPA 70-2020 [Section No. 517.31(C)(1)]

(1) Separation from Other Circuits.

The life safety branch and critical branch [of the essential electrical system] shall be kept independent of all other wiring and equipment. [**99:**6.7.5.2.1]

(a) Raceways, cables, or enclosures of the life safety and critical branch shall be readily identified as a component of the essential electrical system (EES). Boxes and enclosures (including transfer switches, generators, and power panels) shall be field- or factory-marked and identified as a component of the EES. Raceways and cables shall be field- or factory-marked as a component of the EES at intervals not to exceed 7.6 m (25 ft).

(b) Conductors of the life safety branch or critical branch shall not enter the same raceways, boxes, or cabinets with each other or any other wiring system. It shall be permitted for the branch conductors to occupy common equipment, raceways, boxes, or cabinets of other circuits not part of the life safety branch and critical branch where such wiring complies with one of the following:

(3) Is in transfer equipment enclosures

(4) Is in exit or emergency luminaires supplied from two sources

(5) Is in a common junction box attached to exit or emergency luminaires supplied from two sources

(6) Is for two or more circuits supplied from the same branch and same transfer switch

(g) The wiring of the equipment branch shall be permitted to occupy the same raceways, boxes, or cabinets of other circuits that are not part of the essential electrical system.

(h) Where Category 2 ~~(general care)~~ locations are served from two separate transfer switches on the essential electrical system in accordance with 517.18(A), Exception No. 3, the Category 2 ~~(general care)~~ circuits from the two separate systems shall be kept independent of each other.

(i) Where Category 1 ~~(critical care)~~ locations are served from two separate transfer switches on the essential electrical system in accordance with 517.19(A), Exception No. 2, the critical care circuits from the two separate systems shall be kept independent of each other.

Statement of Problem and Substantiation for Public Input

as part of a phased approach it was decided by the committee several cycles ago to remove these misleading terms and make consistent with NFPA 99 terminology.

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Submittal Date: Tue Sep 08 13:38:13 EDT 2020
Committee: NEC-P15

Public Input No. 1031-NFPA 70-2020 [Section No. 517.31(C)(3)]

(3) Mechanical Protection of the Essential Electrical System.

The wiring of the life safety and critical branches shall be mechanically protected by raceways. [**99:**6.7.5.2.2] Where installed as branch circuits in patient care spaces, the installation shall comply with the requirements of 517.13(A) and (B) and 250.118. Only the following wiring methods shall be permitted:

(1) Nonflexible metal raceways, Type MI cable, Type RTRC marked with the suffix –XW, or Schedule 80 PVC conduit. Nonmetallic raceways shall not be used for branch circuits that supply patient care areas.

(2) Where encased in not less than 50 mm (2 in.) of concrete, Schedule 40 PVC conduit, flexible nonmetallic or jacketed metallic raceways, or jacketed metallic cable assemblies listed for installation in concrete. Nonmetallic raceways shall not be used for branch circuits that supply patient care areas.

(3) Listed flexible metal raceways and listed metal sheathed cable assemblies in any of the following:

(4) Where used in listed prefabricated medical headwalls

(5) In listed office furnishings

(6) Where fished into existing walls or ceilings, not otherwise accessible and not subject to physical damage

(7) Where necessary for flexible connection to equipment

(8) For equipment that requires a flexible connection due to movement, vibration, or operation

(9) Luminaires installed in ceiling structures

(10) Flexible power cords of appliances or other utilization equipment connected to the ~~emergency~~ essential electrical system.

(11) Cables for Class 2 or Class 3 systems permitted by Part VI of this article, with or without raceways.

Informational Note: See 517.13 for additional grounding requirements in patient care areas.

Statement of Problem and Substantiation for Public Input

During the NEC 2017 cycle the figures were modified to remove the emergency system and to be included in the essential electrical system. This terminology was missed and this change aligns with the title of this section and the use of the terms essential versus emergency.

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Committee: NEC-P15

Public Input No. 3440-NFPA 70-2020 [Section No. 517.31(C)(3)]

(3) ~~Mechanical~~ Protection Against Physical Damage of the Essential Electrical System.

The wiring of the life safety and critical branches shall be ~~mechanically~~ protected against physical damage by raceways. [**99:**6.7.5.2.2] Where installed as branch circuits in patient care spaces, the installation shall comply with the requirements of 517.13(A) and (B) and 250.118. Only the following wiring methods shall be permitted:

(1) Nonflexible metal raceways, Type MI cable, Type RTRC marked with the suffix –XW, or Schedule 80 PVC conduit. Nonmetallic raceways shall not be used for branch circuits that supply patient care areas.

(2) Where encased in not less than 50 mm (2 in.) of concrete, Schedule 40 PVC conduit, flexible nonmetallic or jacketed metallic raceways, or jacketed metallic cable assemblies listed for installation in concrete. Nonmetallic raceways shall not be used for branch circuits that supply patient care areas.

(3) Listed flexible metal raceways and listed metal sheathed cable assemblies in any of the following:

(4) Where used in listed prefabricated medical headwalls

(5) In listed office furnishings

(6) Where fished into existing walls or ceilings, not otherwise accessible and not subject to physical damage

(7) Where necessary for flexible connection to equipment

(8) For equipment that requires a flexible connection due to movement, vibration, or operation

(9) Luminaires installed in ceiling structures

(10) Flexible power cords of appliances or other utilization equipment connected to the emergency system.

(11) Cables for Class 2 or Class 3 systems permitted by Part VI of this article, with or without raceways.

Informational Note: See 517.13 for additional grounding requirements in patient care areas.

Statement of Problem and Substantiation for Public Input

The term 'mechanical protection' is not defined by the NEC Article 100 Definitions or Article 517.2 Definitions. The NEC Style Manual prefers the use of the standardized term 'protection against physical damage' rather than 'mechanical protection'. An example would be 230.50 Protection Against Physical Damage for service entrance conductors. This article similarly provides a list of raceways that are to be utilized for that physical protection as does 517.31(C)(3). The revised title and text of 517.31(C)(3) provides a clearer intent of the requirement than found in the current wording.
NEC Style Manual 3.2.5.5 Provisions on Protection Against Physical Damage. If protection against physical damage is to be one of requirements, this can be standardized by the use of this terminology instead of using the phrase provided with mechanical protection to mean the same thing.
The NEC Style Manual goes on to explain issues created by mis-using the terminology and using a Informational Note per NEC 90.5 to sufficiently make clear and convey the importance and intent of the code requirement.

Submitter Information Verification

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Submittal Date: Tue Sep 08 15:04:41 EDT 2020
Committee: NEC-P15

Public Input No. 4646-NFPA 70-2020 [Section No. 517.31(C)(3)]

(3) Mechanical Protection of the Essential Electrical System.

The wiring of the life safety and critical branches shall be mechanically protected by raceways. [**99:**6.7.5.2.2] Where installed as branch circuits in patient care spaces, the installation shall comply with the requirements of 517.13(A) and (B) and 250.118. Only the following wiring methods shall be permitted:

(1) Nonflexible metal raceways, Type MI cable, Type RTRC marked with the suffix –XW, or Schedule 80 PVC conduit. Nonmetallic raceways shall not be used for branch circuits that supply patient care areas.

(2) Where encased in not less than 50 mm (2 in.) of concrete, Schedule 40 PVC conduit, flexible nonmetallic or jacketed metallic raceways, or jacketed metallic cable assemblies listed for installation in concrete. Nonmetallic raceways shall not be used for branch circuits that supply patient care areas.

(3) Listed flexible metal raceways and listed metal sheathed cable assemblies in any of the following:

(4) Where used in listed prefabricated medical headwalls

(5) In listed office furnishings

(6) Where fished into existing walls or ceilings, not otherwise accessible and not subject to physical damage

(7) Where necessary for flexible connection to equipment

(8) For equipment that requires a flexible connection due to movement, vibration, or operation

(9) Luminaires installed in ceiling structures

(10) Flexible power cords of appliances or other utilization equipment connected to the emergency system.

(11) Cables for Class 2 or Class 3 systems permitted by Part VI of this article, with or without raceways.

(12) For IT Under Raised Floors only, any method listed under Information Technology Equipment 645.5(E) & 645.5(F)

Informational Note: See 517.13 for additional grounding requirements in patient care areas.

Statement of Problem and Substantiation for Public Input

(1)Hard pipe for critical and life safety raceways should be used as much as possible, which is the intent of this code section. However, just like there are exceptions for this in inaccessible ceilings and walls, there should be an exception to this in hospital IT rooms where there are existing raised floors and other wiring methods allowed in Article 645 might be more practical.

(2) IT rooms in hospitals should be permitted to use specific sections of Article 645 since there is no patient care provided in these spaces.

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Submittal Date: Thu Sep 10 16:15:04 EDT 2020
Committee: NEC-P15

Public Input No. 989-NFPA 70-2020 [Section No. 517.31(C)(3)]

(3) Mechanical Protection of the Essential Electrical System.

The wiring of the life safety and critical branches shall be mechanically protected by raceways. [**99:**6.7.5.2.2] Where installed as branch circuits in patient care spaces, the installation shall comply with the requirements of 517.13(A) and (B) and 250.118. Only the following wiring methods shall be permitted:

(1) Nonflexible metal raceways, Type MI cable, Type RTRC marked with the suffix –XW, or Schedule 80 PVC conduit. Nonmetallic raceways shall not be used for branch circuits that supply patient care ~~areas~~ spaces .

(2) Where encased in not less than 50 mm (2 in.) of concrete, Schedule 40 PVC conduit, flexible nonmetallic or jacketed metallic raceways, or jacketed metallic cable assemblies listed for installation in concrete. Nonmetallic raceways shall not be used for branch circuits that supply patient care ~~areas~~ spaces .

(3) Listed flexible metal raceways and listed metal sheathed cable assemblies in any of the following:

(4) Where used in listed prefabricated medical headwalls

(5) In listed office furnishings

(6) Where fished into existing walls or ceilings, not otherwise accessible and not subject to physical damage

(7) Where necessary for flexible connection to equipment

(8) For equipment that requires a flexible connection due to movement, vibration, or operation

(9) Luminaires installed in ceiling structures

(10) Flexible power cords of appliances or other utilization equipment connected to the emergency system.

(11) Cables for Class 2 or Class 3 systems permitted by Part VI of this article, with or without raceways.

Informational Note: See 517.13 for additional grounding requirements in patient care areas.

Statement of Problem and Substantiation for Public Input

The phrase “Patient Care Area” is no longer used in Article 517. Change “Patient Care Areas” to “Patient Care Spaces” in order to match terminology defined in 517.2 Definitions.

Submitter Information Verification

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Submittal Date: Wed May 06 19:12:44 EDT 2020
Committee: NEC-P15

Public Input No. 4688-NFPA 70-2020 [Section No. 517.31(D)]

(D) Capacity of Systems.

The essential electrical system shall have the capacity and rating to meet the maximum actual demand likely to be produced by the connected load.

Feeders shall be sized in accordance with 215.2 and Part III of Article 220. The alternate power source(s) required in 517.30 shall have the capacity and rating to meet the demand produced by the load at any given time.

Demand calculations for sizing of the alternate power source(s) shall be based on any of the following:

(1) Prudent demand factors and historical data

(2) Connected load

(3) Feeder calculation~~- procedures described in Article 220~~ s in accordance with this Code

(4) Any combination of the above

The sizing requirements in 700.4 and 701.4 shall not apply to alternate sources.

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the 2020 NEC(r) Style Manual prohibits references to an entire article, with the exception of Article 100. Changing to "Feeder calculations in accordance with this Code" should meet the intent of the style manual without changing the requirements in this section.

Submitter Information Verification

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Public Input No. 1468-NFPA 70-2020 [Section No. 517.31(E)]

(E) Receptacle Identification.

The cover plates ~~for the electrical receptacles supplied~~ or receptacles supplied from the life safety and critical branches shall have ~~a distinctive color~~ different distinctive colors or marking so as to be readily identifiable from each other and the normal branch . [**99:**6.7.2.3.5(B)]

Statement of Problem and Substantiation for Public Input

Reinstating the identification requirements for life safety lighting and receptacles was well needed. I would ask that you take this a bit further and require different color code schemes for each branch. I believe this was the intent but the wording allows for a different interpretation allowing life safety and critical branch to both have the same color

Submitter Information Verification

Submitter Full Name: James Dorsey
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Submittal Date: Sat Jun 06 18:39:02 EDT 2020
Committee: NEC-P15

Public Input No. 990-NFPA 70-2020 [Section No. 517.31(E)]

(E) Receptacle Identification.

The electrical receptacles or the cover plates for the electrical receptacles supplied from the life safety and critical branches shall have a distinctive color or marking so as to be readily identifiable. [**99:**6.7.2.3.5(B)]

Statement of Problem and Substantiation for Public Input

In 2017 NEC, 517.30(E) required either the Type 1 essential electrical system (ESS) receptacles or cover plates to have a distinctive color or marking. For 2020 NEC, 517.31(E) has been revised by deleting option to identify Type 1 ESS life safety and critical branch receptacles with a distinctive color or marking. This deletion appears to be an error because 2018 NFPA 6.7.2.3.5(B), which is referenced in the 517.31(E), provides an option for either the receptacles or cover plates for life safety and critical branches receptacles to have a distinctive color or marking. Furthermore, 517.42(E) requires either the Type 2 ESS life safety and equipment branches receptacles or cover plates to have a distinctive color or marking. I recommend restoring 517.31(E) to allow either Type 1 EES life safety and critical branches receptacles or cover plates be identified with a distinctive color or marking.

Submitter Information Verification

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Submittal Date: Wed May 06 19:41:51 EDT 2020
Committee: NEC-P15

Public Input No. 4159-NFPA 70-2020 [Section No. 517.31(F)]

(F) Feeders from Alternate Power Source.

A single feeder supplied by a local or remote alternate power source shall be permitted to supply the essential electrical system to the point at which the life safety, critical, and equipment branches are separated. Installation of the transfer equipment shall be permitted at other than the location of the alternate power source.

Statement of Problem and Substantiation for Public Input

This public input is submitted on behalf of the task group formed under the direction of the Correlating Committee to harmonize terminology across NFPA70, 99, 110, and 111 that relate to emergency and standby power and energy storage. This task group was appointed to identify potential proposed changes to the 2023 edition of the NEC in the form of Public Inputs (PIs) that within the Task Group's scope of activity as specified by the Correlating Committee.
The task group members are; Alan Manche-Co-Chair, Todd Lottmann Co-Chair, Steve Froemming, David Stymiest, John Kovacik, Chad Kennedy, Duke Schamel, Linda Little, Jason D'Antona, Chris Coache, Mike McCabe, and Chad Beebe. This task group of balanced interests provided the expertise to develop these public inputs covering the harmonization of terms across NFPA70, 99, 110, and 111.
Public Inputs are being submitted in the following sections: Article 100 definitions, 480.2, 517.30 (B)(1), 517.30(B)(3), 517.31(D), 517.31(F), 517.41(B), 692.41(C), 695.3(C)(2), 700.2, 700.12(D)(1), 700.12(D)(2), 700.18, 701.2, 701.12(D)(1), and 708.20(F)(1)
Summary of Changes
These proposed PIs are intended provide consistent use of terms between the NEC®, NFPA 110, 111. These proposed revisions identified correlating terminology issues and looked across all three standards to determine the changes necessary to harmonize key terms. These public inputs were the changes recommended for the NEC by the task group.

Technical Substantiation
The following substantiation is provided for each change separated by section:
Article 100 – Uninterruptible Power Supply definition was revised to align with the NFPA111 definition.
480.2 – definition for storage battery revised to match NFPA855
517.30 (B)(1) – revised to text to align with references across NEC, NFPA110, and NFPA111
517.30(B)(3) – revised to text to align with references across NEC, NFPA110, and NFPA111
517.31(D) – revised to text to align with references across NEC, NFPA110, and NFPA111
517.31(F) – revised to text to align with references across NEC, NFPA110, and NFPA111
517.41(B) – revised to text to align with references across NEC, NFPA110, and NFPA111
692.41(C) – removed the word power since fuel cell system is a defined term in the NEC
695.3(C)(2) – revised to text to align with references across NEC, NFPA110, and NFPA111
700.2, - Added informational note number 2 to describe the interaction of the terms used in NFPA110 and NFPA111with emergency systems in the NEC. Revised definition for Branch-Circuit Emergency Lighting Transfer Switch to align with terminology in NFPA110 and NFPA111. Added informational note 3 to tie the levels defined in NFPA110 to the systems used in the NEC. This will aid in the interaction of these standards.
700.12(D)(1), - Normal service implies that the normal or primary power source can only be a utility per the NEC definition of "service." This section was revised to say power source to allow other types of sources for the normal power.
700.12(D)(2) – revised wording since legally required standby system and emergency system are defined terms.
700.18 – added the word "system" since emergency system is a defined term
701.2 - Added informational note 2 to tie the levels defined in NFPA110 to the systems used in the NEC. This will aid in the interaction of these standards. It also provides guidance as to which legally required standby systems are considered level 1 due to their critical nature tied to loss of life or serious injury versus the level 2 that is less critical.
701.12(D)(1) - Normal service implies that the normal or primary power source can only be a utility per the NEC definition of "service." This section was revised to say power source to allow other types of sources for the normal power.
708.2 - Added informational note to tie the levels defined in NFPA110 to the systems used in the NEC. This will aid in the interaction of these standards.
708.20(F)(1) - Normal service implies that the normal or primary power source can only be a utility per the NEC definition of "service." This section was revised to say power source to allow other types of sources for the normal power.

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Submittal Date: Wed Sep 09 23:06:45 EDT 2020

Committee: NEC-P15

Public Input No. 2814-NFPA 70-2020 [New Section after 517.31(G)]

TITLE OF NEW CONTENT

Type your content here ...

H. Selective Coordination. Where the Essential Electrical System(s) overcurrent protective devices are not installed to be selectively coordinated with all supply-side overcurrent protective devices, a selective coordination study, performed by a licensed professional engineer or other qualified persons engaged primarily in the design, installation, or maintenance of electrical systems, shall be documented and made available to the owner and those authorized to design, install, inspect, maintain, and operate the system.

Statement of Problem and Substantiation for Public Input

While 517.31(G) requires essential electrical system overcurrent protective devices to be coordinated for times greater than 0.1 seconds, it does not require selective coordination for all values of available fault currents and the opening times associated with those overcurrents. This allowance for a potential blackout comes from a Standards Council decision which gave purview of performance requirements, such as selective coordination, to NFPA 99. This Public Input does not go against the Standards Council decision, nor against the "coordination" requirement in NFPA 99, as it is an installation requirement. It does assure that the owner is made aware of potential blackouts due to the design of the electrical system. The owner then may wish to inquire as to why the essential electrical system can't be designed to a service continuity level equivalent to emergency systems, legally required standby systems, and critical operations power systems in all but healthcare facilities. If the owner is not satisfied with the expected service continuity under fault conditions, the engineer can be asked to modify the design. At least the owner is made aware that a blackout potential exists, before a blackout occurs, always at the worst possible time. Note: this is an installation requirement, not a performance requirement, so NFPA 99 does not have purview.

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Public Input No. 3138-NFPA 70-2020 [Section No. 517.31(G)]

(G) Coordination.

Overcurrent protective devices serving the essential electrical system shall be coordinated for the period of time that a fault's duration extends beyond 0.1 second. coordination shall be selected by a licensed professional engineer or other qualified persons engaged primarily in the design, installation or maintenance of electrical systems. coordination beyond 0.1 shall be documented and made available to those authorized to design, install, inspect, maintain and operate the system.

Exception No. 1: Between transformer primary and secondary overcurrent protective devices, where only one overcurrent protective device or set of overcurrent protective devices exists on the transformer secondary.

Exception No. 2: Between overcurrent protective devices of the same size (ampere rating) in series.

Informational Note No. 1: The terms *coordination* and *coordinated* as used in this section do not cover the full range of overcurrent conditions.

Informational Note No. 2: See 517.17(C) for information on requirements for the coordination of ground-fault protection.

Statement of Problem and Substantiation for Public Input

providing documentation will provide a permanent record and will specify specific overcurrent devices used to meet the 0.1 coordination requirements for AHJ plan review and field inspection to verify compliance during construction and also for future maintenace of the system or replacement of overcurrent devices if required

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Committee: NEC-P15

Public Input No. 4672-NFPA 70-2020 [Section No. 517.31(G)]

(G) Coordination.

Overcurrent protective devices serving the essential electrical system shall be coordinated for the period of time that a fault's duration extends beyond 0.1 second.

Exception No. 1: Between transformer primary and secondary overcurrent protective devices, where only one overcurrent protective device or set of overcurrent protective devices exists on the transformer secondary.

Exception No. 2: Between overcurrent protective devices of the same size (ampere rating) in series.

Exception No. 3: Selective coordination shall not be required for overcurrent devices located inside listed equipment or between listed equipment and their feeder overcurrent device.

Informational Note No. 1: The terms *coordination* and *coordinated* as used in this section do not cover the full range of overcurrent conditions.

Informational Note No. 2: See 517.17(C) for information on requirements for the coordination of ground-fault protection.

Statement of Problem and Substantiation for Public Input

Oftentimes, the overcurrent protection devices in listed emergency inverters or listed uninterruptible power supplies (UPS) cannot be changed out without voiding either or both the manufacture warranty and/or the listing of equipment, making selective coordination costly, impracticable, or impossible.

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Committee: NEC-P15

Public Input No. 3397-NFPA 70-2020 [Section No. 517.34(A)]

(A) Task Illumination, Fixed Equipment, and Selected Receptacles.

The critical branch shall supply power for task illumination, fixed equipment, select receptacles, and select power circuits serving the following spaces and functions related to patient care:

(1) Category 1 ~~(critical care)~~ spaces where deep sedation or general anesthesia is administered, task illumination, selected receptacles, and fixed equipment

(2) Task illumination and select receptacles in the following:

(3) Patient care spaces, including infant nurseries, select acute nursing areas, psychiatric bed areas (omit receptacles), and ward treatment rooms

(4) Medication preparation spaces

(5) Pharmacy dispensing spaces

(6) Nurses' stations — unless adequately lighted by corridor luminaires

(7) Additional specialized patient care task illumination and receptacles, where needed

(8) Nurse call systems

(9) Blood, bone, and tissue banks

(10) Telecommunications entrance facility, telecommunications equipment rooms, and telecommunications rooms and equipment in these rooms

(11) Task illumination, select receptacles, and select power circuits for the following areas:

(12) Category 1

~~(critical care)~~

a. or 2

~~(general care)~~

a. spaces with at least one duplex receptacle per patient bed location, and task illumination as required by the governing body of the health care facility

b. Angiographic labs

c. Cardiac catheterization labs

d. Coronary care units

e. Hemodialysis rooms or areas

f. Emergency room treatment areas (select)

g. Human physiology labs

h. Intensive care units

i. Postoperative recovery rooms (select)

(13) Clinical IT-network equipment

(14) Wireless phone and paging equipment for clinical staff communications

(15) Additional task illumination, receptacles, and select power circuits needed for effective facility operation, including single-phase fractional horsepower motors, which are permitted to be connected to the critical branch.

[**99:**6.7.5.1.3.2]

Statement of Problem and Substantiation for Public Input

as part of a phased approach it was decided by the committee several cycles ago to remove these misleading terms and make consistent with NFPA 99 terminology.

Submitter Information Verification

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Submittal Date: Tue Sep 08 13:39:32 EDT 2020
Committee: NEC-P15

Public Input No. 3399-NFPA 70-2020 [Section No. 517.34(C)]

(C) Subdivision of the Critical Branch.

The critical branch shall be permitted to be subdivided into two or more branches. [**99:**6.7.5.1.3.1]

Informational Note: It is important to analyze the consequences of supplying an area with only critical ~~care~~ branch power when failure occurs between the area and the transfer switch. Some proportion of normal and critical power or critical power from separate transfer switches may be appropriate.

Statement of Problem and Substantiation for Public Input

seems to be an error - there is not "Critical Care Branch" just "Critical Branch"

Submitter Information Verification

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Submittal Date: Tue Sep 08 13:41:07 EDT 2020
Committee: NEC-P15

Public Input No. 3594-NFPA 70-2020 [Section No. 517.35(A)]

(A) Equipment for Delayed Automatic Connection.

The following equipment shall be permitted to be arranged for delayed automatic connection to the alternate power source:

(1) Central suction systems serving medical and surgical functions, including controls, with such suction systems permitted to be placed on the critical branch

(2) Sump pumps and other equipment required to operate for the safety of major apparatus, including associated control systems and alarms

(3) Compressed air systems serving medical and surgical functions, including controls with such air systems permitted to be placed on the critical branch

(4) Smoke control and stair pressurization systems, with such systems permitted to be placed on the life safety branch. INFORMATIONAL NOTE: See NFPA 92-2018, Standard for Smoke Control Systems, Section 6.4.5.3

(5) Kitchen hood supply or exhaust systems, or both, if required to operate during a fire in or under the hood

(6) Supply, return, and exhaust ventilating systems for the following:

(7) Airborne infectious/isolation rooms

(8) Protective environment rooms

(9) Exhaust fans for laboratory fume hoods

(10) Nuclear medicine areas where radioactive material is used

(11) Ethylene oxide evacuation

(12) Anesthetic evacuation

[99:6.7.5.1.4.3(A)]

Where delayed automatic connection is not appropriate, the ventilation systems specified in 517.35(A)(6) shall be permitted to be placed on the critical branch. [**99:**6.7.5.1.4.3(B)]

(13) Supply, return, and exhaust ventilating systems for operating and delivery rooms

(14) Supply, return, exhaust ventilating systems and/or air-conditioning systems serving telephone equipment rooms and closets and data equipment rooms and closets, such systems shall be permitted to be connected to the critical branch

Exception: Sequential delayed automatic connection to the alternate power source to prevent overloading the generator shall be permitted where engineering studies indicate it is necessary.

(9) Fire Suppression Jockey Pump, with such equipment permitted to be placed on the life safety branch

Statement of Problem and Substantiation for Public Input

For the first revision: The primary purpose of the life safety branch is to power devices, equipment, alarms, and other systems that allow and help the building occupants evacuate safely. Smoke control and stair pressurization systems are only powered and used during a fire and/or partial/full building evacuation. These systems & equipment should be permitted to be circuited to the life safety branch for this reason. Being on the equipment branch can pose a number of problems if these systems are not on a priority 1 equipment automatic transfer switch. Priority 1 is defined as being connected to a live generator bus within 10 seconds and also be a non-sheddable load. Equipment branches can be shed by the generator or the paralleling switchgear if a generator overloads or fails. This is especially problematic if there is a fire or explosion in the building that causes the need for both a generator shutdown and the need to power on the smoke control system and/or stair pressurization fans. The second issue is that not all equipment branches are designed to be on with 10 seconds or even 60 seconds, which is the time duration specified by NFPA 92-2018 6.4.5.3 that smoke control fan equipment are required to be on and working. These systems and equipment should be powered within 10 seconds and be non-sheddable which can be done either by circuiting to the life safety branch ATS or a priority 1 equipment branch ATS.

For the second revision: Damage to IT room equipment, which are vital to a hospital's effective operation, can occur quickly if the A/C in the room goes out. While A/C equipment is permitted to be connected to the equipment branch, this approach can cause problems if the equipment branch ATS does not connect automatically in a reasonable amount of time or the equipment branch is shed from the generator. It also makes sense to be able to run IT A/C systems from the same branch of power that the room equipment is fed from itself. If the A/C system is on a different branch of power than the IT room equipment, now the IT room is dependent on two branches of power to function correctly and sustainably. Motors are permitted on the critical branch if the motor is fractional horsepower, however, there are times when the motor or compressor for the IT room A/C

equipment is bigger than a fractional horsepower motor and is therefore no longer permitted to be on the critical branch. Specifically permitting IT A/C systems on the critical branch solves these issues.

For the third revision: NFPA 99 6.7.5.1.5 lists the jockey pump as a load that is not permitted to be shed from the generator. Similar to the first proposed revision, this the jockey pump supports the fire pump, which is essential for fire suppression and occupant evacuation. Right now the code only allows it to be on a priority 1 (as defined above) equipment branch. It should be permitted to be on the life safety branch since that branch is a non-sheddable switch and it supports equipment that is essential for fire suppression and building evacuation.

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Public Input No. 3609-NFPA 70-2020 [New Section after 517.35(B)]

TITLE OF NEW CONTENT

517.36 Generator load-shed circuits designed for the purpose of load reduction or for load priority systems shall not shed life safety branch loads, critical branch loads serving Category 1 spaces, medical air compressors, medical-surgical vacuum pumps, fire pumps, the pressure maintenance (i.e. jockey) pump(s) for water-based fire protection systems, generator fuel pumps, or other generator accessories. (99:6.7.5.1.5)

Statement of Problem and Substantiation for Public Input

A lot of electrical code is mirrored from NFPA 99 into 517. This code section, taken word from word from NPFA 99, is vital information that should be included in both NFPA codes. For some equipment listed in NFPA 99 6.7.5.1.5., it implies a need for either a priority 1, non-sheddable, non-delayed (on within 10 seconds) equipment branch automatic transfer switch and/or a need to power some equipment to a non-equipment branch ATS as permitted by both codes.

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Public Input No. 3400-NFPA 70-2020 [Section No. 517.40]

517.40 Type 2 Essential Electrical Systems.

Informational Note No. 1: Nursing homes and other limited care facilities can contain Category 1 ~~(critical care)~~ spaces and/or Category 2 ~~(general care)~~ patient care spaces depending on the design and type of care administered in the facility. For Category 1 ~~(critical care)~~ spaces, see 517.29 through 517.35. For Category 2 ~~(general care)~~ spaces not served by Type 1 essential electrical systems, see 517.40 through 517.44 .

Informational Note No. 2: Type 2 essential electrical systems are comprised of two separate branches capable of supplying a limited amount of lighting and power service that is considered essential for the protection of life and safety and effective operation of the institution during the time normal electrical service is interrupted for any reason. These two separate branches are the life safety and equipment branches. The number of transfer switches to be used should be based upon reliability, design, and load considerations. Each branch of the essential electrical system should have one or more transfer switches. One transfer switch should be permitted to serve one or more branches in a facility with a maximum demand on the essential electrical system of 150 kVA (120 kW). [**99:**A.6.7.6.2.1]

(A) Applicability.

The requirements of Part III, 517.40(C) through 517.44, shall apply to Category 2 ~~(general care)~~ spaces.

Exception: The requirements of Part III, 517.40(C) through 517.44, shall not apply to freestanding buildings used as nursing homes and limited care facilities, provided that the following apply:

(1) Admitting and discharge policies are maintained that preclude the provision of care for any patient or resident who may need to be sustained by electrical life-support equipment.

(2) No surgical treatment requiring general anesthesia is offered.

(3) An automatic battery-operated system(s) or equipment shall be effective for at least 1½ hours and is otherwise in accordance with 700.12 and that shall be capable of supplying lighting for exit lights, exit corridors, stairways, nursing stations, medical preparation areas, boiler rooms, and communications areas. This system shall also supply power to operate all alarm systems.

Informational Note: See NFPA *101*-2018, *Life Safety Code*.

(B) Category 1 ~~(Critical Care) Spaces~~ Spaces , Inpatient Hospital Care Facilities.

For those nursing homes and limited care facilities that admit patients who need to be sustained by electrical life-support equipment, the essential electrical system from the source to the portion of the facility where such patients are treated shall comply with the requirements of Part III, 517.29 through 517.35.

(C) Facilities Contiguous or Located on the Same Site with Hospitals.

Nursing homes and limited care facilities that are contiguous or located on the same site with a hospital shall be permitted to have their essential electrical systems supplied by the hospital.

Informational Note No. 1: For performance, maintenance, and testing requirements of essential electrical systems in nursing homes and limited care facilities, see NFPA 99-2018, *Health Care Facilities Code*.

Informational Note No. 2: Where optional loads include contiguous or same-site facilities not covered in this *Code*, see the requirements of Article 700 of this *Code*; NFPA *101*-2018, *Life Safety Code*; and other applicable NFPA requirements for emergency egress under loadshed conditions.

Statement of Problem and Substantiation for Public Input

as part of a phased approach it was decided by the committee several cycles ago to remove these misleading terms and make consistent with NFPA 99 terminology.

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Public Input No. 4699-NFPA 70-2020 [Section No. 517.40(C)]

(C) Facilities Contiguous or Located on the Same Site with Hospitals.

Nursing homes and limited care facilities that are contiguous or located on the same site with a hospital shall be permitted to have their essential electrical systems supplied by the hospital.

Informational Note No. 1: For performance, maintenance, and testing requirements of essential electrical systems in nursing homes and limited care facilities, see NFPA 99-2018, *Health Care Facilities Code*.

Informational Note No. 2: ~~Where optional loads include contiguous or same-site facilities not covered in this *Code* , see the requirements of Article 700 of this *Code*~~ See 700.1 ; NFPA 101 -2018, *Life Safety Code* ; and other ~~applicable~~ NFPA requirements for emergency egress under loadshed conditions where optional loads include contiguous or same-site facilities not covered in this *Code* .

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the 2020 NEC(r) Style Manual prohibits references to an entire article, with the exception of Article 100. The informational note has been "inverted" to list the references first, in accordance with Section 4.1.3 of the Style Manual, and the user is pointed to the scope of Article 700 to avoid a reference to the entire article. This should make it clear how Article 700 applies. That said, this is done in an informational note and the CMP is cautioned that the informational note is not enforceable and cannot make a requirement so the CMP may wish to rewrite this as an actual requirement.

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Public Input No. 4160-NFPA 70-2020 [Section No. 517.41(B)]

(B) Types of Power Sources.

Where the normal source consists of generating units on the premises, the alternate power source shall be either another generating set or an external utility service. [**99:**6.7.1.2.3]

Statement of Problem and Substantiation for Public Input

This public input is submitted on behalf of the task group formed under the direction of the Correlating Committee to harmonize terminology across NFPA70, 99, 110, and 111 that relate to emergency and standby power and energy storage. This task group was appointed to identify potential proposed changes to the 2023 edition of the NEC in the form of Public Inputs (PIs) that within the Task Group's scope of activity as specified by the Correlating Committee.
The task group members are; Alan Manche-Co-Chair, Todd Lottmann Co-Chair, Steve Froemming, David Stymiest, John Kovacik, Chad Kennedy, Duke Schamel, Linda Little, Jason D'Antona, Chris Coache, Mike McCabe, and Chad Beebe. This task group of balanced interests provided the expertise to develop these public inputs covering the harmonization of terms across NFPA70, 99, 110, and 111.
Public Inputs are being submitted in the following sections: Article 100 definitions, 480.2, 517.30 (B)(1), 517.30(B)(3), 517.31(D), 517.31(F), 517.41(B), 692.41(C), 695.3(C)(2), 700.2, 700.12(D)(1), 700.12(D)(2), 700.18, 701.2, 701.12(D)(1), and 708.20(F)(1)
Summary of Changes
These proposed PIs are intended provide consistent use of terms between the NEC®, NFPA 110, 111. These proposed revisions identified correlating terminology issues and looked across all three standards to determine the changes necessary to harmonize key terms. These public inputs were the changes recommended for the NEC by the task group.

Technical Substantiation
The following substantiation is provided for each change separated by section:
Article 100 – Uninterruptible Power Supply definition was revised to align with the NFPA111 definition.
480.2 – definition for storage battery revised to match NFPA855
517.30 (B)(1) – revised to text to align with references across NEC, NFPA110, and NFPA111
517.30(B)(3) – revised to text to align with references across NEC, NFPA110, and NFPA111
517.31(D) – revised to text to align with references across NEC, NFPA110, and NFPA111
517.31(F) – revised to text to align with references across NEC, NFPA110, and NFPA111
517.41(B) – revised to text to align with references across NEC, NFPA110, and NFPA111
692.41(C) – removed the word power since fuel cell system is a defined term in the NEC
695.3(C)(2) – revised to text to align with references across NEC, NFPA110, and NFPA111
700.2, - Added informational note number 2 to describe the interaction of the terms used in NFPA110 and NFPA111with emergency systems in the NEC. Revised definition for Branch-Circuit Emergency Lighting Transfer Switch to align with terminology in NFPA110 and NFPA111. Added informational note 3 to tie the levels defined in NFPA110 to the systems used in the NEC. This will aid in the interaction of these standards.
700.12(D)(1), - Normal service implies that the normal or primary power source can only be a utility per the NEC definition of "service." This section was revised to say power source to allow other types of sources for the normal power.
700.12(D)(2) – revised wording since legally required standby system and emergency system are defined terms.
700.18 – added the word "system" since emergency system is a defined term
701.2 - Added informational note 2 to tie the levels defined in NFPA110 to the systems used in the NEC. This will aid in the interaction of these standards. It also provides guidance as to which legally required standby systems are considered level 1 due to their critical nature tied to loss of life or serious injury versus the level 2 that is less critical.
701.12(D)(1) - Normal service implies that the normal or primary power source can only be a utility per the NEC definition of "service." This section was revised to say power source to allow other types of sources for the normal power.
708.2 - Added informational note to tie the levels defined in NFPA110 to the systems used in the NEC. This will aid in the interaction of these standards.
708.20(F)(1) - Normal service implies that the normal or primary power source can only be a utility per the NEC definition of "service." This section was revised to say power source to allow other types of sources for the normal power.

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Public Input No. 4512-NFPA 70-2020 [Section No. 517.41(B)]

(B) Types of Power Sources.

Where the normal source consists of generating units on the premises, the alternate source shall be either another generating set or an external utility service. [**99:**6.7.1.2.3]

Informational Note: See IEEE 3006 Standards Collection for information about power system reliability.

Additional Proposed Changes

File Name	Description	Approved
IEEE_IAS_Published_Paper_Why_Existing_Utility_Metrics_Do_Not_Work_for_Industrial_Reliability_Analysis_-_Schuerger_Arno_Dowling.pdf	This paper identifies the need to expand the vocabulary for power system reliability on both sides of the service point; with special consideration for healthcare facilities.	

Statement of Problem and Substantiation for Public Input

This is continuation of an effort to drive reliability perspective that originated in the legacy IEEE Color Books into the NEC. Safety concepts in the Color Books have been in the process of being mapped into the IEEE 3000 Collection of best practice literature for several years now.

Reliable power (Available power) is an essential characteristic of electrical safety. Note the relevant titles in the header link for the reliability titles: https://standards.ieee.org/products-services/3000/index.html

IEEE 3006.2™-2016 Recommended Practice for Evaluating the Reliability of Existing Industrial and Commercial Power Systems
IEEE 3006.3™-2017 Recommended Practice for Determining the Impact of Preventative Maintenance on the Reliability of Industrial and Commercial Power Systems
IEEE 3006.5™-2014 Recommended Practice for the Use of Probability Methods for Conducting a Reliability Analysis of Industrial and Commercial Power Systems
IEEE 3006.7™-2013 Recommended Practice for Determining the Reliability of 7x24 Continuous Power Systems in Industrial and Commercial Facilities
IEEE 3006.8™-2018 Recommended Practice for Analyzing Reliability Data for Equipment Used in Industrial and Commercial Power Systems
IEEE 3006.9™-2013 Recommended Practice for Collecting Data for Use in Reliability, Availability, and Maintainability Assessments of Industrial and Commercial Power Systems
IEEE P3006.1™ Recommended Practice for Reliability Planning and Design of Industrial and Commercial Power Systems

Our point in listing these is to demonstrate that the 3006 Collection is a significant update of the Orange Book (IEEE 446 Recommended Practice for Emergency and Standby Power for Industrial & Commercial Applications) and the White Book (IEEE 602 Recommended Practice for Electric Systems in Health Care Facilities) -- on the specific topic of reliability.

The primary source of power to healthcare facilities should require a quantitative risk analysis. The paper, attached herewith, describes some considerations when evaluating the availability of the utility source; the subject of Section 517.41

"Why Existing Utility Metrics Do Not Work for Industrial Reliability Analysis" (Schuerger, Arno, Dowling)

ABSTRACT: Electrical utility reliability indices such as System Average Interruption Frequency Index, System Average Interruption Duration Index, Customer Average Interruption Duration Index, Customer Average Interruption Frequency Index, and Momentary Average Interruption Frequency Index are adequately defined in IEEE Std. 1366-2012, and serve the purpose for which they were developed. However, the explosive growth of the electronics industry moving toward internet of things, along with the data center development necessary to support such explosive growth, has had significant impact on an aging power distribution system. As the utility world evolves toward the notion of smart grid, several new reliability metrics are

needed to evaluate the electrical power to the customer's side of the meter.

https://ieeexplore.ieee.org/document/7448901

The committee may opt to locate this content elsewhere.

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Why Existing Utility Metrics Do Not Work for Industrial Reliability Analysis

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***Abstract* -- Electrical utility reliability indices, such as SAIFI, SAIDI, CAIDI, CAIFI, and MAIFI are adequately defined in IEEE Std. 1366-2012 [1] and serve the purpose for which they were developed. However, the explosive growth of the electronics industry moving toward an "internet of things," along with the data center development necessary to support such explosive growth has had significant impact on an aging power distribution system. As the utility world evolves toward the notion of "smart grid," several new reliability metrics are needed to evaluate the electrical power to the customer's side of the meter.**

***Index Terms* -- SAIFI, SAIDI, CAIDI, CAIFI, MAIFI, reliability, availability, failure rate, mean time between failures, mean time to repair**

I. INTRODUCTION

For most people, the only time they are consciously aware of electrical power is when there is a problem and it is NOT AVAILABLE to them. The rest of the time they do not pay any attention to it whatsoever. That is actually a very big complement to the electric utility industry as a whole, the original 7x24x365 industry. The electric utility industry is made up of many separate companies across a wide geography with innumerable factors to deal with continually, including working with the other electric utility companies on a continuous basis. There is no intention on the part of the authors to criticize what works in the electrical utility world for reliability metrics. This paper is to point out why the existing electrical utility metrics do not work for industrial and commercial power system reliability analysis. It will also point out an existing gap that will need to be addressed along the road to establishing a workable "smart grid," which many companies are currently actively working on developing.

There is a Public Utility Commission (PUC) or Public Service Commission (or some other variation of the name) in all 50 states and the District of Columbia. The PUC oversees the local utility companies (electricity, natural gas, sometimes water, etc.) and determines what that utility can charge their customers, since most utilities have a monopoly over a certain area of service. For the electrical power utilities, there is a group of common reliability indices used to measure the company's performance. These indices are used to compare the company's performance last year as compared to previous year and also to compare one utility's performance with another similar company. The yearly result for each of the common reliability indices of each electrical utility company is publicly available information.

In the next section the common reliability indices used to measure the performance of each electrical utility will be briefly reviewed. However, we are already in a position to present the most significant issue preventing the reliability indices of the electrical utility world from being useful reliability metrics for industrial and commercial power system analysis. The PUC is only interested in evaluating the utility's performance in areas they could reasonably be expected to control. The utility company obviously cannot control the weather, so the reliability indices are calculated with all of the power disturbances that were weather related REMOVED from data set. When the energy delivery system experienced stresses beyond that normally expected, such as during severe weather, it is considered a Major Event Day and the data is analyzed separately.

The first thing the authors of this paper would like to address is that the idea that the purpose of IEEE Std. 1366 is ONLY to evaluate the performance of the utility companies. We would like it to be useful for BOTH sides of the meter. The new metrics that this paper is proposing are not for the PUC's use in evaluating the utilities performance. They are for the use of the engineer performing reliability analysis for industrial and commercial power system, such as mission critical facilities. For this type of reliability analysis, the data set that includes ALL power disturbances is required. The weather related failures are often the failures that are the most significant to protect against.

II. ELECTRIC UTILITY RELIABILITY INDICES:

We will start with a review of the existing electric utility reliability indices. To fully understand them, it is important to review a few specific definitions used in their calculation:

Customer: a metered electrical service point for which an active bill account is established at a specific location.

Interruption: the total loss of electric power on one or more normally energized conductors to one or more customers connected to the distribution portion of the system.

Interruption duration: the time period from the initiation of an interruption until service has been restored to the affected customers.

Momentary Interruption: the brief loss of power delivery to one or more customers, caused by the opening and closing operation of an interrupting device.

Outage: the loss of ability of a component to deliver power.

Sustained Interruption: any interruption not classified as part of a momentary event. That is, any interruption that lasts more than five minutes.

It is also important to point out what is not included in ANY of the indices in [1]. The definition of *Interruption* has a second sentence (that has been moved to here for emphasis): This does not include any power quality issues such as: sags, swells, impulse or harmonics.

Another point worth mentioning is that not all PUCs use IEEE Std 1366 definitions of the reliability indices for what they required the local electric utility companies to report. In the definition above, a sustained interruption lasts five minutes or more. Another common the time period used by some PUCs is any interruption one minute or longer.

The electric utility reliability indices defined in [1] that are used as a basis for what this paper proposes as the new reliability metrics needed are as follows.

System Average Interruption Frequency Index (SAIFI) indicates how often the average customer experiences a sustained interruption over a predefined period of time.

$$SAIFI = \frac{\sum Total\ Number\ of\ Customers\ Interrupted}{Total\ Number\ of\ Customers\ Served}$$

System Average Interruption Duration Index (SAIDI) indicates the total duration of interruptions for the average customer during a predefined period of time. It is commonly measured in minutes or hours of interruption.

$$SAIDI = \frac{\sum Customer\ Minutes\ of\ Interruption}{Total\ Number\ of\ Customers\ Served}$$

Customer Average Interruption Duration Index (CAIDI) represents the average time required to restore service.

$$CAIDI = \frac{\sum Customer\ Minutes\ of\ Interruption}{Total\ Number\ of\ Customers\ Interrupted}$$

Customer Average Interruption Frequency Index (CAIFI) gives the average frequency of sustained interruptions for those customers experiencing sustained interruptions.

$$CAIFI = \frac{\sum Number\ of\ Customer\ Interruptions}{Number\ of\ Distinct\ Customers\ Interrupted}$$

Momentary Average Interruption Frequency Index (MAIFI) indicates the average frequency of momentary interruptions.

$$MAIFI = \frac{\sum Number\ of\ Customer\ Momentary\ Interruptions}{Total\ Number\ of\ Customers\ Served}$$

III. RELIABILITY TERMINOLOGY AND METRICS:

The next step is a review of the basic definitions of Reliability and the common metrics used for analyzing industrial and commercial power systems. These standard IEEE definitions of Reliability are from [2], [3].

Much of the terminology of Reliability Engineering is common English words and terms borrowed from Statistics. It would probably be more correct to say that Reliability Engineering depends upon the subject of Statistics, since statistics and probability are used extensively for quantification of what is being analyzed.

Reliability (R): the probability that a component or service will perform required functions under stated conditions for a stated period of time or (for discrete missions) a stated number of demands.

Reliability is time dependent; R(t). The longer the time, the lower the reliability, regardless of what the system design is. The better the system design, the higher the probability of successful operation *for a longer period of time*. However, by definition, when a failure does occur $R = 0$.

Reliability is the probability of success. The probability of failure (which is also called *Unreliability*) is *F(t) = 1 - R(t)*.

failure rate (λ): The mean (arithmetic average) number of failures of a component and/or system per unit exposure time. The most common unit in reliability analysis is hours (h) or years (y). Therefore, the failure rate is expressed in failures per hour (f/h) or failures per year (f/y).

For example, select a time interval of 1 year. At the beginning of the interval we turn on 10,000 light bulbs. At the end of the year, 100 light bulbs have failed. The failure rate for those light bulbs would be 100/10,000 = 0.01 failures/year for that first year.

The Reliability *R(t)* for this PDF is the remaining area under the curve from t to ∞: $R(t) = \int_t^{\infty} f(t)\,dt$

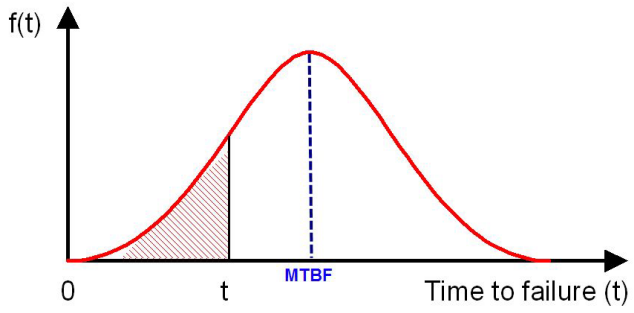


Fig. 1: Probability of failure at t is $F(t) = \int_0^t f(t)\,dt$

Mean time between failures (MTBF): the arithmetic mean of the times (observed or calculated) between random failures of a component or system.

Mean time to repair (MTTR): the mean time to replace or repair a failed component. Logistics time associated with the repair, such as parts acquisitions, crew mobilizations are not included. It can be estimated by dividing the summation of repair times by the number of repairs and, therefore, is practically the average repair time.

For the case of a constant failure rate, MTBF = 1/λ and Reliability as a function of time is:

$$R(t) = e^{-\lambda t}$$

Availability (A): Availability is the long-term average fraction of time that a repairable component or system is in service and satisfactorily performing its intended function.

For example, if the electricity is off for one hour in a year, but the rest of the year the electricity is on, the availability of electrical power for that year is 8759 hours divided by 8760 hours, which is 0.999886.

$$Availability = \frac{operating\ time}{operating\ time - down\ time}$$

There are two common measures of availability, *inherent availability* (A_i) and *operational availability* (A_o). The difference between the two is based on what is included as "down time" or "repair time." For inherent availability, only the time it takes to fix the equipment is included. Inherent availability assumes that the technician is immediately available to work on the equipment the moment it fails, and that he has all the parts, etc., necessary to complete the repair.

Inherent Availability is mathematically defined as the mean time between failures divided by the mean time between failures plus the mean time to repair:

$$A_i = \frac{MTBF}{MTBF+MTTR}$$

Operational Availability is mathematically defined as the mean time between failures divided by the mean time between failures plus the mean time to repair plus logistics time:

$$A_o = \frac{MTBF}{MTBF+MTTR+Logistics\ time}$$

For operational availability, all the delays for scheduling, travel time for the technician and/or parts, etc. are included. If it takes 24 hours to fly a part in to repair the equipment, that adds to the "repair time." With operational availability, the time it takes to actually perform the repair plus the time spent on handling the logistics required to do the repair are all included in the metric A_o. Operational availability reflects how the system performs in real life.

Inherent availability is a more useful tool in analyzing the system design. Since there are wide variations in the maintenance practices from facility to facility, access to parts and qualified personnel, etc., operational availability could vary significantly between two facilities with identical infrastructures. Eliminating all of the logistics and counting only the actual repair time provides a more accurate evaluation of the infrastructure design. It shows the availability that is "inherent" to the design, if the spare parts inventory and repairs are perfect.

Reliability is the "probability of success" for a given period of time. Reliability is a metric directly related to how often (or how fast) the system fails. As shown in Table 1, the system that failed once in a year for 5.26 minutes would have a much better reliability than the system that failed 315 times for one second, but nowhere near as good as the system that failed once in 20 years for 1.77 hours, even though all have the same availability.

TABLE I
THREE OUTAGES WITH THE FIVE 9'S AVAILABILITY

Availability	Number outages per year	Failure rate (failures/hr)	MTBF (hours)	MTBF (years)	Reliability (1 year)
0.99999	315	3.60E-02	27.81	0.0032	0%
0.99999	1	1.14E-04	8,760	1.0	36.78%
0.99999	0.05	5.71E-06	175,200	20	95.12%

The discussion above demonstrates the importance of using both reliability and availability as metrics to determine how dependable the component or system is. This can also be seen in the existing utility metrics. MAIFI shows how reliable the power is in terms of short interruptions. The customer would have to have UPS available to continue operation with no momentary disruption. SAIFI and CAIFI provide an indication of how reliable the utility is to the average customer in terms of sustained outages. The customer would have to have on-site generation to continue to operate beyond the length of time the batteries in the UPS would last. By using SAIDI and CAIDI with SAIFI and CAIFI the availability can be determined.

IV. ISSUES WITH UTILITY RELIABILITY INDICES:

At this point we will discuss why the electric utility reliability indices are not adequate to use in performing reliability analysis of industrial or commercial power distribution systems. In addition to the primary issue of removing the all of weather related power disturbances from the data set already mentioned, there is another specific issue with the indices.

The issue impacts all five of the indices presented earlier, SAIFI, SAIDI, CAIDI, CAIFI and MAIFI. It is the definition of customer: a metered electrical service point for which an active bill account is established at a specific location. Most electric utilities serve MILLIONS of RESIDENTIAL customers. The number of residential customers far outweighs the number of industrial and commercial customers. This factor alone significantly skews the data to the point in which it is not usable for reliability analysis.

V. WHAT IS NEEDED?

By this point is should be obvious that what is needed is another set of reliability indices for industrial and commercial customers. The Scope (section 1.2) of IEEE Std 1366-2012 states "this guide identifies distribution reliability indices and factors that affect their calculation. It includes indices, which are useful today, as well as ones that may be useful in the future."

Unlike the existing utility metrics, the purpose of the new metrics is NOT to evaluate the performance of the utility company. The purpose of the proposed metrics is to provide the correct and complete failure and repair data for utility power to perform reliability analysis of the power distribution system of the industrial or commercial customer.

Take for example the design of a major data center. In order to achieve "five 9's" of availability, on-site generation and UPS systems are going to be required. But how many on-site generators will be needed? That depends a great deal on how reliable utility power is at the data center location. Are the generators going to be needed about twice a year for about one hour and twenty minutes, which is the typical "generic utility power" from [2]? Or are they going to be needed much more (or less) frequently? Adding or removing one generator has significant financial impact to the cost of the overall project.

We propose adding the following definitions to IEEE Std. 1366, which would certainly be useful for performing the reliability analysis of Industrial and Commercial Power Systems:

Industrial Customer: a metered electrical service point for which an active bill account is established at a specific industrial or commercial location.

Total Number of Industrial Customers Served: the average number of industrial and commercial customers served during the reporting period.

We propose adding the following reliability indices:

Industrial Customer Average Interruption Duration Index (ICAIDI) is the average time required to restore service for all sustained interruptions to industrial and commercial customers, including Major Event Days and all weather related data.

$$ICAIDI = \frac{\sum Industrial\ Customer\ Minutes\ of\ Interruption}{Total\ No.\ of\ Industrial\ Customers\ Interrupted}$$

Industrial Customer Average Interruption Frequency Index (ICAIFI) gives the average frequency of all sustained interruptions to industrial and commercial customers, including Major Event Days and all weather related data. The customer is counted once, regardless of the number of times interrupted for this calculation.

$$ICAIFI = \frac{\sum Number\ of\ Industrial\ Customer\ Interruptions}{No.\ of\ Distinct\ Industrial\ Customers\ Interruppted}$$

Industrial Customer Momentary Average Interruption Frequency Index (ICMAIFI) gives the average frequency of all momentary interruptions to industrial and commercial customers, including Major Event Days and all weather related data. The customer is counted once, regardless of the number of times interrupted for this calculation.

$$ICMAIFI = \frac{\sum Industrial\ Customer\ Momentary\ Interruptions}{Number\ of\ Industrial\ Customers\ Server}$$

VI. WHAT THE NEW INDICES WOULD PROVIDE

In comparing section III to section V, it should be obvious what the proposed reliability indices for the electrical power provide; ICAIFI and ICAIDI are the MTBF and MTTR respectively for utility power to the average industrial site within that electric utility's service area.

MTBF and MTTR data for utility power directly impacts the reliability analysis on whether or not standby generation is needed. Where standby generation is obviously needed, it also provides the means to more accurately evaluate how much redundancy in the standby generation is warranted.

For example, a site that only loses utility power once every five years (MTBF) for 2 hours (MTTR), may decide the N standby generators (the number needed to carry the load) will suffice, if the load being served is not that critical. If the load is critical, N+1 (one redundant) standby generators may be sufficient. However, if utility power is lost every three months for eighteen hours, even the site that is less critical will probably need N+1 standby generators and the critical site would need at least N+2 for the same level of reliability for electrical power to the loads.

The definition of "momentary outage" as "the opening and closing operation of an interrupting device" makes the typical time frame 3 to 5 cycles (50 to 83 milliseconds). Very few of the electronic devices on the market today have

that length of ride-thru capability internally. Therefore some form of energy storage to provide power during the interruption would be needed for any equipment that cannot be allowed to be interrupted and require rebooting.

The proposed index ICMAIFI would provide direct insight for the reliability analysis in this area. For example, a site that experiences two momentary interruptions a year is far more likely to decide that allowing the power interruption to stop operation and reboot the system is acceptable than a site that experiences two momentary interruptions a month.

VII. OTHER FACTORS – WHAT UTILITY RELIABILITY INDICES DO NOT ADDRESS

In section II, under the definition of Interruption we pointed out that the reliability indices do not address Power Quality issues such as sags, swell, transients, etc. There are numerous reasons why this is the case. A primary one is the cost of gathering that level of data and the lack of the necessary monitoring equipment throughout most of the electrical distribution system. With the recent evolution towards "smart grid," that is changing. However, the sheer size and complexity of the electrical power grid makes smart grid an evolutionary process that will take many years to complete.

In the meantime, there is another side to the issue that can be addressed; the tolerance levels of the equipment the power is being supplied to. When analyzing the problem in terms of at what level of power does the equipment begin to misoperate or fail completely, it is called "susceptibility."

The two most famous susceptibility curves are the original CBEMA (named after the group that developed it, Computer and Business Equipment Manufacturers Association) and ITIC Curve (named after the same group who had changed their name to Information Technology Industry Council by the time it was developed). Both are badly outdated. The newer of the two, the ITIC Curve was published in IEEE Std 1100 – 1999 (Emerald Book) [4]. Updated susceptibility curves for the various types of electronic equipment would help the design engineers providing power a great deal. Looking at the discussion in section VI on momentary outage, it is readily apparent that increasing the ride-thru of electronic equipment to be greater than 83 milliseconds could eliminate the need for UPS in some applications.

The topic of electronic equipment susceptibility is also addressed from the other side in IEEE Std 1668-2014 [5], which recommends voltage-sag immunity levels as to the equipment manufacturer. It is similar to SEMI F47 developed by the semi-conductor industry so the tools used in making the chips would ride thru voltage sags without damaging the products being manufactured.

With the definition of sustained outage as lasting longer than either one minute (for some PUCs) or five minutes (IEEE Std 1366 definition), a UPS alone will seldom have the required battery storage. In the data center world, battery storage for 5 to 15 minutes is quite common, with an occasional requirement of 30 minutes. Only in the – 48 VDC world of the telecomm industry, in central offices for example, are batteries sized to carry the load for hours. In the industrial and commercial worlds, some form of standby generation will be required to continue operating during a sustained outage of significant length.

VIII. DATA FOR THE P1366 WORKING GROUP

Though the IEEE does have full time employees working for them, the vast majority of the work of standards development is done by volunteers who willing donate their time and expertise to improving the industry they are a part of. Therefore the less work something requires of the Working Group doing the project, the more likely it is to get done. Since the authors of this paper are not currently a part of the P1366 Working Group, here is the majority of what would need to be added to P1366 for our proposed indices:

Add the following basic factors:

Ir_i – Restoration Time for each Industrial Customer Sustained Interruption Event

Ir_{mi} – Restoration Time for each Industrial Customer Momentary Interruption Event

IN_i – Number of Interrupted Industrial Customers for each Sustained Interruption Event during the reporting period

IN_{mi} – Number of Interrupted Industrial Customers for each Momentary Interruption Event during the reporting period

ICN – Total Number of distinct Industrial Customers who have experienced a Sustained Interruption during the reporting period

ICN_m – Total Number of distinct Industrial Customers who have experienced a Momentary Interruption during the reporting period

Add 4.2.9 ICAIDI: Industrial Customer Average Interruption Duration Index. The Industrial Customer Average Interruption Duration Index (ICAIDI) represents the average time required to restore service for all sustained interruptions to industrial and commercial customers, including Major Event Days. Mathematically it is given by equation (xx): ICAIDI = The sum of Industrial Customer Minutes of Interruption / Total Number of Industrial Customers Interrupted. To calculate this index, use equation (xx): $ICAIDI = (\Sigma\, Ir_i\, IN_i)/(\Sigma\, IN_i)$

Add 4.2.10 ICAIFI: Industrial Customer Average Interruption Frequency Index. The Industrial Customer Average Interruption Frequency Index (ICAIFI) gives the average

frequency of all sustained interruptions to industrial and commercial customers, including Major Event Days. The customer is counted once, regardless of the number of times interrupted for this calculation. Mathematically it is given by equation (xx): ICAIFI = (The sum of Total Number of Industrial Customer Interruptions) / Total Number of Industrial Customers Interrupted. To calculate this index, use equation (xx): ICAIFI = (Σ IN_i)/ICN)

Add 4.2.11 ICMAIFI: Industrial Customer Momentary Average Interruption Frequency Index. The Industrial Customer Momentary Average Interruption Frequency Index (ICMAIFI) gives the average frequency of all momentary interruptions to industrial and commercial customers. The customer is counted once, regardless of the number of times interrupted for this calculation. Mathematically it is given by equation (xx): ICAIFI = (The sum of Total Number of Industrial Customer Interruptions) / Total Number of Industrial Customers Interrupted To calculate this index, use equation (xx): ICAIFI = (Σ IN_{mi})/ICN_m)

IX. SUMMARY

This paper has provided the basic understanding of the existing reliability indices used by the Public Utilities Commissions to measure the performance of the electric utility industry. It has also provided an overview of the metrics used in reliability analysis such as reliability, availability, MTBF and MTTR. It has explained why the electrical power indices used to measure utility performance are not adequate for doing reliability analysis for the customer. Finally the paper proposes three new "industrial customer" reliability indices that would be useful in determining the reliability of power at an industrial or commercial facility. The specific details needed to add these new indices to the next revision of IEEE Std. 1366 have been provide for the Working Group.

REFERENCES

[1] IEEE Std. 1366 – 2012*, Guide for Electric Power Distribution Reliability Indices*.

[2] IEEE Std. 493 – 2007, *Recommended Practice for Design of Reliable Industrial and Commercial Power Systems.*

[3] IEEE Std. 3006.5 – 2013*, Recommended Practice for Use of Probability Methods for Conducting a Reliability Analysis of Industrial and Commercial Power Systems.*

[4] IEEE Std. 1100- 2005, *Recommended Practice for Powering and Grounding electronic Equipment.*

[5] IEEE Std 1668-2014 *Trial-Use Recommended Practice for Voltage Sag and Short Interruption Ride-Through Testing for End-Use Electrical Equipment Rated Less than 1000 V.*

Public Input No. 2186-NFPA 70-2020 [Section No. 517.41(C)]

(C) Location of Essential Electrical System Components.

~~Essential~~ The location of the essential electrical system components shall ~~be located to minimize interruptions caused by natural forces common to the area (e.g., storms, floods, earthquakes, or hazards created by adjoining structures or activities). [**99:** 6.2.4.1]~~

~~Installations of electrical services shall be located to reduce possible interruption of normal electrical services resulting from similar causes as well as possible disruption of normal electrical service due to internal wiring and equipment failures. [**99:** 6.2.4.2]~~

~~Feeders shall be located to provide physical separation of the feeders of the alternate source and from the feeders of the normal electrical source to prevent possible simultaneous interruption. [**99:** 6.2.4.3]~~

comply with 517.30(C).

Statement of Problem and Substantiation for Public Input

This PI proposes to delete redundant text at 517.41(C) with a reference to 517.30(C). Section 517.30(C) has, for the most part, extracted material from NFPA 99 which is shown below for reference. The existing language at 517.41(C) describes identical requirements as 517.30(C), although formatted differently. For clarity and consistency it would be beneficial to users of the Code to have the requirements stated once and not repeated.

2021 NFPA 99 requirements for reference:

6.2.4* Location of Essential Electrical System Components.

6.2.4.1 Essential electrical system components shall be located to minimize interruptions caused by natural forces common to the area (e.g., storms, floods, earthquakes, or hazards created by adjoining structures or activities).

6.2.4.2 Installations of electrical services shall be located to reduce possible interruption of normal electrical services resulting from similar causes as well as possible disruption of normal electrical service due to internal wiring and equipment failures.

6.2.4.3 Feeders shall be located to provide physical separation of the feeders of the alternate source and from the feeders of the normal electrical source to prevent possible simultaneous interruption.

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Public Input No. 2187-NFPA 70-2020 [Section No. 517.42(A)]

(A) General.

Type 2 essential electrical systems shall be divided into the following two branches:

(1) Life safety branch

(2) Equipment branch

[**99:**6.7.6.2.1.2]

The division between the branches shall occur at transfer switches where more than one transfer switch is required. [**99:**6.7.2.3.1]

Informational Note No. 1: For more information on a Type 2 essential electrical ~~systems are comprised of two separate branches capable of supplying a limited amount of lighting and power service that is considered essential for the protection of life and safety and effective operation of the institution during the time normal electrical service is interrupted for any reason. These two separate branches are the life safety and equipment branches. [**99:** A.6.7.6.2.1] Informational Note No. 2: The number of transfer switches to be used should be based upon reliability, design, and load considerations. Each branch of the essential electrical system should have one or more transfer switches. One transfer switch should be permitted to serve one or more branches in a facility with a maximum demand on the essential electrical system of 150 kVA (120 kW).~~ ~~[**99:** A.6.7.6.2.1]~~ system, see 517.40 Informational Note No.2

Informational Note No. ~~3~~ 2 : For more information, see NFPA 99-2018, *Health Care Facilities Code*, 6.7.2.3.

Statement of Problem and Substantiation for Public Input

This PI proposes to delete redundant text at 517.42 Informational Notes with a reference to 517.40 Informational Note No. 2. The same language associated with a Type 2 EES is repeated in the IN's at both sections. For clarity and consistency it would be beneficial to users of the Code to have the requirements stated once and not repeated.

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Public Input No. 2190-NFPA 70-2020 [Section No. 517.42(B)]

(B) Transfer Switches.

~~The number of transfer switches to be used shall be based on reliability, design, and load considerations. [**99:** 6.7.2.3.3]~~

Transfer switches shall ~~be in accordance with one of the following:~~

- ~~Each branch of the essential electrical system shall have one or more transfer switches. [**99:** 6.7.2.3.3.1]~~

~~One transfer switch shall be permitted to serve one or more branches or systems in a facility with a continuous load on the switch of 150 kVA (120 kW) or less. [**99:** 6.7.2.3.3.2]~~ comply with 517.31(B).

Informational Note No. 1: See NFPA 99-2018, *Health Care Facilities Code*, 6.7.2.2.4, Automatic Transfer Switch; 6.7.2.2.5, Automatic Transfer Switch Features; 6.7.2.2.5.15, Nonautomatic Transfer Switch Features; and 6.7.2.2.7, Nonautomatic Transfer Device Features.

Informational Note No. 2: See Informational Note Figure 517.42(a).

Informational Note No. 3: See Informational Note Figure 517.42(b).

Figure Informational Note Figure 517.42(a) Type 2 Essential Electrical Systems (Nursing Home and Limited Health Care Facilities) — Minimum Requirement (greater than 150 kVA) for Transfer Switch Arrangement.

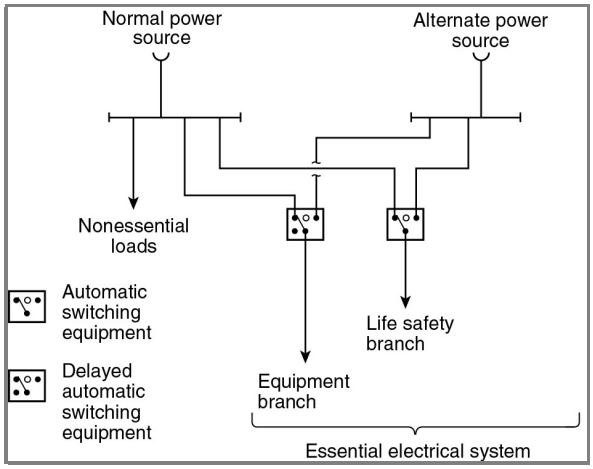
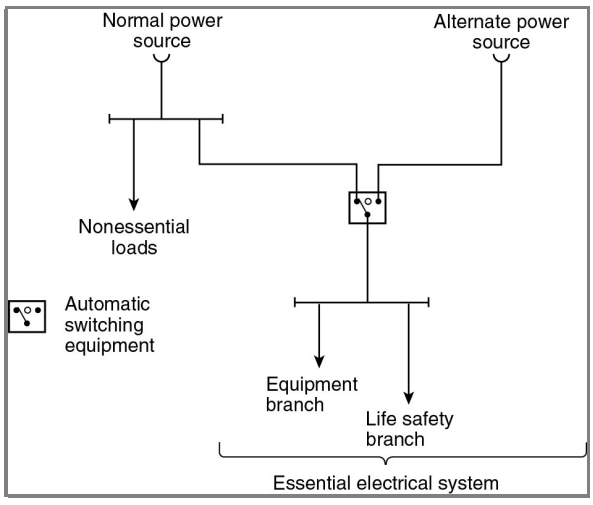


Figure Informational Note Figure 517.42(b) Type 2 Essential Electrical Systems (Nursing Home and Limited Health Care Facilities) — Minimum Requirement (150 kVA or less) for Transfer Switch Arrangement.



Additional Proposed Changes

File Name	Description	Approved
2021_NFPA_99_6.7.2.2.3.docx	2021 NFPA 6.7.2.2.3	

Statement of Problem and Substantiation for Public Input

This PI proposes to delete redundant text at 517.42(B) with a reference to 517.31(B). Section 517.31(B) has, for the most part, extracted material from NFPA 99 . The existing language at 517.42(B) describes identical requirements as 517.31(B), although formatted differently. For clarity and consistency it would be beneficial to users of the Code to have the requirements stated once and not repeated. For reference, see the attached word doc from 2021 NFPA 99 second draft language which correlates with 517.31(B).

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6.7.2.2.3

The number of transfer switches to be used shall be based upon reliability, design, and load considerations.

6.7.2.2.3.1

Each branch of the essential electrical system shall have one or more transfer switches.

6.7.2.2.3.2

One transfer switch shall be permitted to serve one or more branches in a facility with a continuous load on the switch of 150 kVA (120 kW) or less.

Public Input No. 904-NFPA 70-2020 [Section No. 517.44(B)]

(B) Delayed Automatic or Manual Connection to the Equipment Branch.

The following equipment shall be permitted to be connected to the equipment branch and shall be arranged for either delayed automatic or manual connection to the alternate power source:

(1) *Heating Equipment to Provide Heating for General Patient Rooms.* Heating of general patient rooms during disruption of the normal source shall not be required under any of the following conditions:

(2) The outside design temperature is higher than −6.7°C (20°F).

(3) The outside design temperature is lower than −6.7°C (20°F) and where a selected room(s) is provided for the needs of all confined patients, only such room(s) need be heated.

(4) The facility is served by a dual source of normal power as described in 517.30(C) , Informational Note.

Informational Note: The outside design temperature is based on the 97.5 percent design values, as shown in Chapter 24 of the ASHRAE *Handbook of Fundamentals* (2013).

(5) *Elevator Service.* In instances where disruption of power would result in elevators stopping between floors, throw-over facilities shall be provided to allow the temporary operation of any elevator for the release of passengers.

(6) *Optional Connections to the Equipment Branch.* Additional illumination, receptacles, and equipment shall be permitted to be connected only to the ~~critical branch~~ equipment branch .

(7) *Multiple Systems.* Where one switch serves multiple systems as permitted in 517.43, transfer for all loads shall be nondelayed automatic.

[**99**:6.7.6.2.1.6(E)]

Informational Note: For elevator cab lighting, control, signal system requirements, see 517.43(G).
[**99:**A.6.7.6.2.1.6(E)(2)]

Statement of Problem and Substantiation for Public Input

In 2017 NEC, Type 2 essential electrical systems change the “critical branch” to “equipment branch” in order to align with the requirements of NFPA 99. Requirement 517.44(B)(3) - Optional Connections to the Equipment Branch – language did not get updated to change “critical branch” to “equipment branch”, and it did not get updated in 2020 NEC. Please update this requirement.

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Public Input No. 3401-NFPA 70-2020 [Section No. 517.45]

517.45 Essential Electrical Systems for Other Health Care Facilities.

(A) Essential Electrical Distribution.

If required by the governing body, the essential electrical distribution system for Category 3 ~~(basic care) patient care~~ 3 patient care spaces shall be comprised of an alternate power system capable of supplying a limited amount of lighting and power service for the orderly cessation of procedures during a time normal electrical service is interrupted.

Informational Note: See NFPA 99-2018, *Health Care Facilities Code*.

(B) Electrical Life Support Equipment.

Where electrical life support equipment is required, the essential electrical distribution system shall be as described in 517.29 through 517.30.

(C) Category ~~1 (Critical Care) Patient Care~~ 1 Patient Care Spaces.

Where Category 1 ~~(critical care)~~ patient care spaces are present, the essential electrical distribution system shall be as described in 517.29 through 517.30.

(D) Category 2 ~~(General Care)~~ Patient Care Spaces.

Where Category 2 ~~(general care)~~ patient care spaces are present, the essential electrical distribution system shall be as described in 517.40 through 517.45.

(E) Power Systems.

If required, alternate power sources acceptable to the governing body shall comply with the requirements of NFPA 99-2018, *Health Care Facilities Code*.

Statement of Problem and Substantiation for Public Input

as part of a phased approach it was decided by the committee several cycles ago to remove these misleading terms and make consistent with NFPA 99 terminology.

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Public Input No. 1708-NFPA 70-2020 [Section No. 517.64]

517.64 Extra- Low-Voltage Equipment and Instruments.

(A) Equipment Requirements.

~~Low~~ Extra -~~low-~~ voltage equipment that is frequently in contact with the bodies of persons or has exposed current-carrying elements shall comply with one of the following:

(1) Operate on an electrical potential of 10 volts or less

(2) Be approved as intrinsically safe or double-insulated equipment

(3) Be moisture resistant

(B) Power Supplies.

Power shall be supplied to extra- low-voltage equipment from one of the following:

(1) An individual portable isolating transformer (autotransformers shall not be used) connected to an isolated power circuit receptacle by means of an appropriate cord and attachment plug

(2) A common extra- low-voltage isolating transformer installed in an unclassified location

(3) Individual dry-cell batteries

(4) Common batteries made up of storage cells located in an unclassified location

(C) Isolated Circuits.

Isolating-type transformers for supplying extra- low-voltage circuits shall have both of the following:

(1) Approved means for insulating the secondary circuit from the primary circuit

(2) The core and case connected to an equipment grounding conductor

(D) Controls.

Resistance or impedance devices shall be permitted to control extra- low-voltage equipment but shall not be used to limit the maximum available voltage to the equipment.

(E) Battery-Powered Appliances.

Battery-powered appliances shall not be capable of being charged while in operation unless their charging circuitry incorporates an integral isolating-type transformer.

(F) Receptacles or Attachment Plugs.

Any receptacle or attachment plug used on extra- low-voltage circuits shall be of a type that does not permit interchangeable connection with circuits of higher voltage.

Informational Note: Any interruption of the circuit, even circuits as low as 10 volts, either by any switch or loose or defective connections anywhere in the circuit, may produce a spark that is sufficient to ignite flammable anesthetic agents.

Statement of Problem and Substantiation for Public Input

Coordinate with proposed new definitions for low voltage and extra-low voltage.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1695-NFPA 70-2020 [New Definition after Definition: Voltage (of a circuit).]	Go together
Public Input No. 1695-NFPA 70-2020 [New Definition after Definition: Voltage (of a circuit).]	

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Public Input No. 4545-NFPA 70-2020 [Section No. 517.71(A)]

(A) Fixed and Stationary Equipment.

Fixed and stationary ~~X-ray~~ Diagnostic imaging equipment shall be connected to the power supply by means of a wiring method complying with applicable requirements of Chapters 1 through 4 of this *Code*, as modified by this article.

Exception: Equipment properly supplied by a branch circuit rated at not over 30 amperes shall be permitted to be supplied through a suitable attachment plug and hard-service cable or cord.

Statement of Problem and Substantiation for Public Input

The current language poorly distinguishes between x-ray equipment and other modalities for diagnostic imaging. More and more, non-x-ray diagnostic equipment is becoming the norm, and the NEC needs to better define these needs. Similarly, the language around therapeutic equipment needs some updating.
As important, the current demand factors given in this section result in over-sized systems and wasted resources that could be better used in providing care. ASHRAE and the University of California are engaged in research efforts now to better collect and document reality, and to propose revisions to the demand factors. Unfortunately, the coronavirus slowed down this work, so the data is not available as of this submission. We will submit the data for further consideration in the near future, hopefully by the time of the CMP-15 meeting.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4541-NFPA 70-2020 [Part V.]	shifting xray to diagnostic equipment
Public Input No. 4552-NFPA 70-2020 [Section No. 517.71(B)]	
Public Input No. 4556-NFPA 70-2020 [Section No. 517.72(B)]	

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Public Input No. 4552-NFPA 70-2020 [Section No. 517.71(B)]

~~**(B)** Portable, Mobile, and Transportable Equipment.~~

~~Individual branch circuits shall not be required for portable, mobile, and transportable medical X-ray equipment requiring a capacity of not over 60 amperes.~~

Statement of Problem and Substantiation for Public Input

The current language poorly distinguishes between x-ray equipment and other modalities for diagnostic imaging. More and more, non-x-ray diagnostic equipment is becoming the norm, and the NEC needs to better define these needs. Similarly, the language around therapeutic equipment needs some updating.
As important, the current demand factors given in this section result in over-sized systems and wasted resources that could be better used in providing care. ASHRAE and the University of California are engaged in research efforts now to better collect and document reality, and to propose revisions to the demand factors. Unfortunately, the coronavirus slowed down this work, so the data is not available as of this submission. We will submit the data for further consideration in the near future, hopefully by the time of the CMP-15 meeting.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4545-NFPA 70-2020 [Section No. 517.71(A)]	We dont want to include fixed station or transportable equipment

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Public Input No. 4556-NFPA 70-2020 [Section No. 517.72(B)]

(B) Location.

The disconnecting means shall be operable from a location readily accessible from the ~~X-ray~~ equipment control.

Statement of Problem and Substantiation for Public Input

The current language poorly distinguishes between x-ray equipment and other modalities for diagnostic imaging. More and more, non-x-ray diagnostic equipment is becoming the norm, and the NEC needs to better define these needs. Similarly, the language around therapeutic equipment needs some updating.
As important, the current demand factors given in this section result in over-sized systems and wasted resources that could be better used in providing care. ASHRAE and the University of California are engaged in research efforts now to better collect and document reality, and to propose revisions to the demand factors. Unfortunately, the coronavirus slowed down this work, so the data is not available as of this submission. We will submit the data for further consideration in the near future, hopefully by the time of the CMP-15 meeting.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4545-NFPA 70-2020 [Section No. 517.71(A)]	replacing xray with diagnostic

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Public Input No. 4560-NFPA 70-2020 [Section No. 517.73(A)]

(A) Diagnostic Imaging Equipment.

(1) Branch Circuits.

The ampacity of supply branch-circuit conductors and the current rating of overcurrent protective devices shall not be less than 50 percent of the momentary rating or 100 percent of the long-time rating, whichever is greater.

(2) Feeders.

The ampacity of supply feeders and the current rating of overcurrent protective devices supplying two or more branch circuits supplying X-ray units shall not be less than 50 percent of the momentary demand rating of the largest unit plus ~~25 percent~~ 10 percent of the momentary demand rating of the next largest unit plus ~~10 percent~~ 5 percent of the momentary demand rating of each additional unit. Where simultaneous biplane examinations are undertaken with the X-ray units, the supply conductors and overcurrent protective devices shall be 100 percent of the momentary demand rating of each X-ray unit.

Informational Note: The minimum conductor size for branch and feeder circuits is also governed by voltage regulation requirements. For a specific installation, the manufacturer usually specifies minimum distribution transformer and conductor sizes, rating of disconnecting means, and overcurrent protection.

Statement of Problem and Substantiation for Public Input

The current language poorly distinguishes between x-ray equipment and other modalities for diagnostic imaging. More and more, non-x-ray diagnostic equipment is becoming the norm, and the NEC needs to better define these needs. Similarly, the language around therapeutic equipment needs some updating.
As important, the current demand factors given in this section result in over-sized systems and wasted resources that could be better used in providing care. ASHRAE and the University of California are engaged in research efforts now to better collect and document reality, and to propose revisions to the demand factors. Unfortunately, the coronavirus slowed down this work, so the data is not available as of this submission. We will submit the data for further consideration in the near future, hopefully by the time of the CMP-15 meeting.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4541-NFPA 70-2020 [Part V.]	replacing Xray with Diagnostic imaging

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Submittal Date: Thu Sep 10 15:09:22 EDT 2020
Committee: NEC-P15

Public Input No. 4563-NFPA 70-2020 [Section No. 517.73(B)]

(B) Therapeutic Equipment.

The ampacity of conductors and rating of overcurrent protective devices shall not be less than 100 percent of the current rating ~~of medical X-ray therapy equipment~~ of therapuetic equipment .

Informational Note: The ampacity of the branch-circuit conductors and the ratings of disconnecting means and overcurrent protection for ~~X-ray~~ therapuetic equipment are usually designated by the manufacturer for the specific installation.

Statement of Problem and Substantiation for Public Input

The current language poorly distinguishes between x-ray equipment and other modalities for diagnostic imaging. More and more, non-x-ray diagnostic equipment is becoming the norm, and the NEC needs to better define these needs. Similarly, the language around therapeutic equipment needs some updating.
As important, the current demand factors given in this section result in over-sized systems and wasted resources that could be better used in providing care. ASHRAE and the University of California are engaged in research efforts now to better collect and document reality, and to propose revisions to the demand factors. Unfortunately, the coronavirus slowed down this work, so the data is not available as of this submission. We will submit the data for further consideration in the near future, hopefully by the time of the CMP-15 meeting.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4541-NFPA 70-2020 [Part V.]	include imagining diagnostic equipment beyond xray

Submitter Information Verification

Submitter Full Name: Eric Nimer
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Submittal Date: Thu Sep 10 15:12:45 EDT 2020
Committee: NEC-P15

Public Input No. 4705-NFPA 70-2020 [Section No. 517.76]

517.76 Transformers and Capacitors.

Transformers and capacitors that are part of X-ray equipment shall not be required to comply with ~~Articles 450 and 460~~ the requirements of their respective articles .

Capacitors shall be mounted within enclosures of insulating material or grounded metal.

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the 2020 NEC(r) Style Manual prohibits references to an entire article, with the exception of Article 100. Changing the language to not require compliance "with the requirements of their respective articles" should meet the intent of the Style Manual without changing the requirement as previously stated in this section.

Submitter Information Verification

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Submittal Date: Thu Sep 10 17:05:12 EDT 2020
Committee: NEC-P15

Public Input No. 3147-NFPA 70-2020 [Section No. 517.80]

517.80 Patient Care Spaces.

Equivalent insulation and isolation to that required for the electrical distribution systems in patient care areas shall be provided for communications, signaling systems, data system circuits, fire alarm systems, and systems less than 120 volts, nominal.

Class 2 and Class 3 signaling and communications systems, Class 2 circuits that transmit power and data to a powered device, and power-limited fire alarm systems shall not be required to comply with the grounding requirements of 517.13, to comply with the mechanical protection requirements of 517.31(C)(3)(5), or to be enclosed in raceways, unless otherwise specified by Chapter 7 or 8.

Secondary circuits of transformer-powered communications or signaling systems shall not be required to be enclosed in raceways unless otherwise specified by Chapters 7 or 8. [**99:**6.7.2.3.7]

Informational Note: See ANSI/NEMA C137.3-2017, American National Standard for Lighting Systems — Minimum Requirements for Installation of Energy Efficient Power over Ethernet (PoE) Lighting Systems, for information on installation of cables for PoE lighting systems.

Statement of Problem and Substantiation for Public Input

The second paragraph has been in the NEC since the 2011 edition. The third paragraph is extracted language from NFPA 99 starting in 2008. (This is now 6.7.2.2.7 (text unchanged) in the 2021 edition of NFPA 99).

A recent staff interpretation of this section essentially stated that since the words “Power over Ethernet” aren’t in the clause, Power over Ethernet (PoE) is not covered by this exception to the grounding and mechanical requirements of 517.31(C)(3)(5). Quite simply, that is wrong – Power over Ethernet is a Power-Limited system that provides signaling and communications – and it also delivers power to devices such as Wireless Access Points and Lighting. It falls under the requirements/restrictions of Class 2. While the term “Power over Ethernet” is not defined directly in the NEC, it is referred to under its basic definition of circuits that “transmit power and data to a powered device.”

A paper published by the Ethernet Alliance (https://ethernetalliance.org/; https://ethernetalliance.org/wp-content/uploads/2019/12/WP_EA_Overview8023bt_V2p1_FINAL.pdf) that provides an overview of the latest version of the PoE part of the IEEE 802.3 standard states in the Introduction (page 7): “Power over Ethernet is a technology to transfer a limited amount of low voltage DC power over a standard communication cable, concurrent with the Ethernet data flow. …”

Additionally, 725.144 [Transmission of Power & Data] under Part III of Article 725 [Class 2 and Class 3 circuits] specifically addresses “Class 2 and Class 3 circuits that transmit power and data to a powered device” – i.e., Power Over Ethernet. Article 840 [Premise-Powered Broadband Communications Systems] does address PoE: 840.3(B)(4) refers back to 725.21 and Part III of 725. Sections 840.160 and 840.170(G) also address the Class 2 aspect.

Use of PoE has become ubiquitous over the past decade and more, and updates to the original IEEE 802.3 standard have allowed for higher power levels, such that, in addition to powering the phones on your desk and Wireless (Wi-Fi) Access points and similar devices, PoE is now also used for lighting.

This added language and Informational Note (copied from 725.144 Informational Note No. 5) rectify that misunderstanding.

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Submittal Date: Sat Sep 05 18:02:12 EDT 2020
Committee: NEC-P15

Public Input No. 2374-NFPA 70-2020 [Section No. 517.160(A)(5)]

(5) Conductor Identification.

The isolated circuit conductors shall be identified as follows:

(1) Isolated Conductor No. 1 — Orange with at least one distinctive colored stripe other than white, green, or gray along the entire length of the conductor

(2) Isolated Conductor No. 2 — Brown with at least one distinctive colored stripe other than white, green, or gray along the entire length of the conductor

For 3-phase systems, the third conductor shall be identified as yellow with at least one distinctive colored stripe other than white, green, or gray along the entire length of the conductor. Where isolated circuit conductors supply 125-volt, single-phase, 15- and 20-ampere receptacles, the striped orange conductor(s) shall be connected to the terminal(s) on the receptacles that are identified in accordance with 200.10(B) for connection to the grounded circuit conductor.

Informational Note: see 200.6, 210.5, 215.12, 250.119, and 455.6(B) for conductor identification and posting requirements that may apply.

Statement of Problem and Substantiation for Public Input

The code has other conductor identification and posting requirements on the topic of facility-wide consistency of conductor marking by voltage system and by phase. A portion of these other codes likely always apply to this application of 517.160(A)(5). And, each of the separate code requirements on this topic should correlate each other to facilitate consistency across a facility; 200.6 [grounded phase conductors], 210.5 [branch conductors], 215.12 [feeder conductors], 250.119 [equipment grounding conductors], 455.6(B) for conductors of manufactured phases, and 517.160(A)(5) [Isolated Power Systems].

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2368-NFPA 70-2020 [Section No. 455.6(B)]	similar need and edit
Public Input No. 2370-NFPA 70-2020 [Section No. 200.6]	similar need and edit
Public Input No. 2371-NFPA 70-2020 [Section No. 210.5]	similar need and edit
Public Input No. 2372-NFPA 70-2020 [Section No. 215.12]	similar need and edit
Public Input No. 2373-NFPA 70-2020 [Section No. 250.119]	similar need and edit
Public Input No. 2368-NFPA 70-2020 [Section No. 455.6(B)]	
Public Input No. 2370-NFPA 70-2020 [Section No. 200.6]	
Public Input No. 2371-NFPA 70-2020 [Section No. 210.5]	
Public Input No. 2372-NFPA 70-2020 [Section No. 215.12]	
Public Input No. 2373-NFPA 70-2020 [Section No. 250.119]	

Submitter Information Verification

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Submittal Date: Tue Aug 18 11:20:46 EDT 2020
Committee: NEC-P15

Public Input No. 3357-NFPA 70-2020 [Section No. 517.160(B)(3)]

(3) Ammeter.

An ammeter calibrated in the total hazard current of the system (contribution of the fault hazard current plus monitor hazard current) shall be mounted in a plainly visible place on the line isolation monitor with the “alarm on” zone at approximately the center of the scale.

Exception: The line isolation monitor shall be permitted to be a composite unit, with a sensing section cabled to a separate display panel section on which the total hazard current value, alarm or test functions are located. The total hazard current value can be a digital display of the value or the equivalent of an ammeter display shown on the isolation monitor.

Informational Note: It is desirable to locate the ammeter so that it is conspicuously visible to persons in the anesthetizing location.

Statement of Problem and Substantiation for Public Input

The display panel section of a line isolation monitor should include an indication of the total hazard current being measured so that the anesthesiologist can view the total hazard current value. The informational note to this section provides guidance on locating the ammeter where it can be seen at the anesthetizing location however, the existing requirements do not clearly state that a display panel section must include an ammeter or digital indication of the total hazard current. This revision would provide clarity on the requirements for the display panel section and ensure the total hazard current level is provided to the anesthesiologist.

Submitter Information Verification

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Submittal Date: Tue Sep 08 10:23:44 EDT 2020
Committee: NEC-P15

Public Input No. 1660-NFPA 70-2020 [Section No. 518.2(A)]

(A) Examples.

Assembly occupancies shall include, but not be limited to, the following:

Armories	Exhibition halls	
Assembly halls	Gymnasiums	
Auditoriums	Mortuary chapels	
Bowling lanes	Multipurpose rooms~~Club rooms~~	
Casinos and gaming facilities	Museums	
~~Conference~~ Club rooms	Places of awaiting transportation	
~~Courtrooms~~ Conference rooms	Places of religious worship	
~~Dance halls~~ Courtrooms	Pool rooms	
Dance halls	Restaurants	
Dining and drinking facilities	~~Restaurants~~	- Skating rinks

Additional Proposed Changes

File Name	Description	Approved
Public_Input_No._1660-NFPA_70-2020_Section_518.2_A_.docx	Clean MSWord DOCX copy of this Public Input No. 1660 WITHOUT TerraView alteration of the Submtter's intent	

Statement of Problem and Substantiation for Public Input

See the uploaded attachment of a manual entry of this Public Input with text content that hasn't been Terrarized and is consequently readable. .

.

Casinos and gaming facilities are assembly occupancies more prevalent than some of those already tabulated 518.2(A). This revision serves to preclude interpretations to the contrary. Often, electrical equipment suitable for use in exhibition halls are intended equally for use in casinos and similar gaming facilities.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1761-NFPA 70-2020 [Section No. 518.5]	

Submitter Information Verification

Submitter Full Name: Brian Rock
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Submittal Date: Wed Jun 24 19:49:26 EDT 2020
Committee: NEC-P15

NFPA Public Input Form

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

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

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

FOR OFFICE USE ONLY

Log #:

Date Rec'd:

Date 2020-June-24 **Name** Brian E. Rock **Tel. No.** [redacted]

Company Hubbell Incorporated **Email** [redacted]

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

Please indicate organization represented (if any) Hubbell Incorporated

1. (a) Title of NFPA Standard National Electrical Code® **NFPA No. & Year** 70 - 2020

(b) Section/Paragraph 518.2

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

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

518.2(A) Examples.
Assembly occupancies shall include, but not be limited to, the following:

Armories	Exhibition halls
Assembly halls	Gymnasiums
Auditoriums	Mortuary chapels
Bowling lanes	Multipurpose rooms
~~Club rooms~~ Casinos and gaming facilities	Museums
~~Conference rooms~~ Club rooms	Places of awaiting transportation
~~Courtrooms~~ Conference rooms	Places of religious worship
~~Dance halls~~ Courtrooms	Pool rooms
~~Dining and drinking facilities~~ Dance halls	Restaurants
Dining and drinking facilities	Skating rinks

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

Casinos and gaming facilities are assembly occupancies more prevalent than some of those already tabulated 518.2(A). This revision serves to preclude interpretations to the contrary. Often, electrical equipment suitable for use in exhibition halls are intended equally for use in casinos and similar gaming facilities.

5. Copyright Assignment

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

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

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

Signature (Required) [redacted]

PLEASE USE SEPARATE FORM FOR EACH PUBLIC INPUT

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

9/16/2020

Public Input No. 3182-NFPA 70-2020 [Section No. 518.3(A)]

~~(A) Hazardous (Classified) Areas.~~

~~Electrical installations in hazardous (classified) areas located in assembly occupancies shall comply with Article 500 .~~

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. Text in 518.3 (A) provides a reference to Article 500 for assembly occupancies in hazardous locations. That reference seems to already be available through NEC 90.3 and the Table of Contents without repeating it in this text.

Submitter Information Verification

Submitter Full Name: Donald Cook
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Submittal Date: Sun Sep 06 16:06:18 EDT 2020
Committee: NEC-P15

Public Input No. 3181-NFPA 70-2020 [Section No. 518.3(C)]

~~(C)~~ ~~Emergency Systems.~~

~~Control of emergency systems shall comply with Article~~ ~~700~~ ~~.~~

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. Text in 518.3 (C) provides a reference to Article 700 for emergency systems. That reference seems to already be available through NEC 90.3 and the Table of Contents without repeating it in this text.

Submitter Information Verification

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Submittal Date: Sun Sep 06 15:57:32 EDT 2020
Committee: NEC-P15

Public Input No. 1406-NFPA 70-2020 [Section No. 518.4(A)]

(A) General.

The fixed wiring methods shall be metal raceways, flexible metal raceways, ~~nonmetallic raceways~~ Type PVC conduit or Type RTRC conduit encased in not less than 50 mm (2 in.) of concrete, Type MI, MC, or AC cable. The wiring method shall itself qualify as an equipment grounding conductor according to 250.118 or shall contain an equipment grounding conductor sized in accordance with Table 250.122.

Exception: Fixed wiring methods shall be as provided in the following:

(1) Audio signal processing, amplification, and reproduction equipment — Article 640

(2) Communications systems — Chapter 8

(3) Class 2 and Class 3 remote-control and signaling circuits — Article 725

(4) Fire alarm circuits — Article 760

Statement of Problem and Substantiation for Public Input

There is no such thing as a nonmetallic raceway anymore and there is no reason to prohibit the use of RTRC conduit for this application.

Submitter Information Verification

Submitter Full Name: Mike Holt
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Submittal Date: Tue Jun 02 12:08:28 EDT 2020
Committee: NEC-P15

Public Input No. 3149-NFPA 70-2020 [Section No. 518.4(A)]

(A) General.

The fixed wiring methods shall be metal raceways, flexible metal raceways, nonmetallic raceways encased in not less than 50 mm (2 in.) of concrete, Type MI, MC, or AC cable. The wiring method shall itself qualify as an equipment grounding conductor according to 250.118 or shall contain an equipment grounding conductor sized in accordance with Table 250.122.

~~Exception: Fixed wiring methods shall be as provided in the following:~~Audio

(B) Communications, Signaling Systems, Data Systems, Fire Alarm Systems, and Systems Less Than 120 Volts, Nominal.

Communications circuits; audio signal processing, amplification, and reproduction

~~equipment — Article~~ 640

- ~~Communications systems — Chapter 8~~
~~Class 2 and Class 3~~

~~circuits; Class 1, Class 2, and Class 3~~ remote- control

~~and signaling circuits — Article~~ 725

- ~~Fire alarm circuits — Article~~ 760

~~or signaling circuits; Class 2 circuits that transmit power, data, or both to a powered device; and power-limited fire alarm circuits shall be permitted to be wired in accordance with Articles 640, 725, 760, 805, and 840.~~

~~Informational Note: See ANSI/NEMA C137.3-2017, American National Standard for Lighting Systems — Minimum Requirements for Installation of Energy Efficient Power over Ethernet (PoE) Lighting Systems, for information on installation of cables for PoE lighting systems.~~

Additional Proposed Changes

File Name	Description	Approved
518.4_FINAL_PI_Text_Only_2020-0905mkh.docx	Word Version of PI on 518.4 since TerraView interspersed new language within deleted exception	

Statement of Problem and Substantiation for Public Input

The exception to fixed wiring methods from 518.4(A) General which addresses permanent wiring is now in its own sub-section. The relocation complies with the Style Guide preference to minimize exceptions and use positive language. Content is added to clarify Power over Ethernet (PoE) wiring is included. PoE is addressed in Article 725 – specifically 725.144 [Transmission of Power & Data] under Part III of Article 725 [Class 2 and Class 3 circuits] - “Class 2 circuits that transmit power, data, or both to a powered device” – i.e., Power Over Ethernet.

Article 840 [Premise-Powered Broadband Communications Systems] does address PoE: 840.3(B)(4) refers back to 725.21 and Part III of 725. Sections 840.160 and 840.170(G) also address the Class 2 aspect.

Use of PoE has become ubiquitous over the past two decades. Two of the first applications for PoE were IP phones such as the phones on your office desk, and in theatres and similar locations for more sophisticated lighting control. Updates to the original IEEE 802.3 standard have allowed for higher power levels, powering Wireless (Wi-Fi) Access points and similar devices. PoE is now also used for lighting

The Informational Note (copied from 725.144 Informational Note No. 5) adds a valuable reference for additional clarification on cabling for PoE.

Existing sections B & C renumbered to C & D.

Submitter Information Verification

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Submittal Date:	Sat Sep 05 18:20:04 EDT 2020
Committee:	NEC-P15

Date	September 5, 2020	Mitch Hefter	[redacted]
Company	Signify		
Representing			
NFPA 70	2023	518.4	**FINAL Public Input – Text Change**

PI is Revised Text

Proposed Text of PI:

518.4 Wiring Methods.

518.4(A) General.

The fixed wiring methods shall be metal raceways, flexible metal raceways, nonmetallic raceways encased in not less than 50 mm (2 in.) of concrete, Type MI, MC, or AC cable. The wiring method shall itself qualify as an equipment grounding conductor according to 250.118 or shall contain an equipment grounding conductor sized in accordance with Table 250.122.

~~*Exception: Fixed wiring methods shall be as provided in the following:*~~

~~*(1) Audio signal processing, amplification, and reproduction equipment — Article 640*~~
~~*(2) Communications systems — Chapter 8*~~
~~*(3) Class 2 and Class 3 remote-control and signaling circuits — Article 725*~~
~~*(4) Fire alarm circuits — Article 760*~~

518.4(B) Communications, Signaling Systems, Data Systems, Fire Alarm Systems, and Systems Less Than 120 Volts, Nominal. Communications circuits; audio signal processing, amplification, and reproduction circuits; Class 1, Class 2, and Class 3 remote- control or signaling circuits; Class 2 circuits that transmit power, data, or both to a powered device; and power-limited fire alarm circuits shall be permitted to be wired in accordance with Articles 640, 725, 760, 805, and 840.

Informational Note: See ANSI/NEMA C137.3-2017, *American National Standard for Lighting Systems — Minimum Requirements for Installation of Energy Efficient Power over Ethernet (PoE) Lighting Systems*, for information on installation of cables for PoE lighting systems.

~~**518.4(B)**~~ **518.4(C) Nonrated Construction**.

[text unchanged]

~~**518.4(C)**~~ **518.4(D) Spaces with Finish Ratings.**

[text unchanged]

=-=-=-=-=-=-=

Public Input No. 501-NFPA 70-2020 [Sections 518.4(A), 518.4(B)]

Sections 518.4(A), 518.4(B)

(A) General.

The fixed wiring methods shall be ~~metal raceways, flexible metal raceways, nonmetallic raceways encased in not less than 50 mm (2 in.) of concrete, Type MI, MC, or AC cable~~ any of those listed below . The wiring method shall itself qualify as an equipment grounding conductor according to 250.118 or shall contain an equipment grounding conductor sized in accordance with Table 250.122.

1. metal raceways
2. flexible metal raceways
3. nonmetallic raceways encased in not less than 50 mm (2 in.) of concrete
4. Type MI cable
5. Type MC cable

Type AC cable

Exception: Fixed wiring methods shall be as provided in the following:

(1) Audio signal processing, amplification, and reproduction equipment — Article 640

(2) Communications systems — Chapter 8

(3) Class 2 and Class 3 remote-control and signaling circuits — Article 725

(4) Fire alarm circuits — Article 760

(B) Nonrated Construction.

In addition to the wiring methods of 518.4(A), ~~nonmetallic-sheathed cable, electrical nonmetallic tubing, and rigid nonmetallic conduit~~ and any of those listed below, shall be permitted to be installed in those buildings or portions thereof that are not required to be of fire-rated construction by the applicable building code.

1. Nonmetallic-Sheathed cable
2. Electrical Nonmetallic Tubing
3. Rigid Nonmetallic Conduit

Informational Note: Fire-rated construction is the fire-resistive classification used in building codes.

Statement of Problem and Substantiation for Public Input

The list format complies with the NEC Style Manual and clarifies the permitted wiring methods used in a Place of Assembly.

Submitter Information Verification

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Submittal Date: Thu Feb 20 12:19:05 EST 2020
Committee: NEC-P15

Public Input No. 3514-NFPA 70-2020 [Section No. 518.4(B)]

(B) Nonrated Construction.

~~In addition to the wiring methods of 518.4(A) , nonmetallic-sheathed cable, electrical nonmetallic tubing, and rigid nonmetallic conduit shall be permitted to be installed in those buildings or portions thereof that are~~ A building or portions of a building not required to be of fire-rated construction by the applicable building ~~code~~ code shall be permited to use of any of the wiring methods of Chapter 3 as permitted by the applicable article .

Informational Note: Fire-rated construction is the fire-resistive classification used in building codes.

Statement of Problem and Substantiation for Public Input

The current text limits the wiring methods in non-fire-rated portions of the building to three additional choices. Any of the wiring methods of Chapter 3 should be permitted in non-fire-rated areas. The current text would prohibit SE Cable, UF Cable, etc. Additionally, by naming the specific wiring methods that are permitted in these non-fire-rated areas it may be construed as a modification of 334.10 and 334.12 by 518.4(B) allowing carte blanche use of Type NM cable.

Submitter Information Verification

Submitter Full Name: Rudolph Garza
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Affiliation: IAEI
Street Address:
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Submittal Date: Tue Sep 08 19:27:43 EDT 2020
Committee: NEC-P15

Public Input No. 3715-NFPA 70-2020 [Section No. 518.4(B)]

(B) Nonrated Construction.

~~In addition to the wiring methods of 518.4(A) , nonmetallic-sheathed cable, electrical nonmetallic tubing, and rigid nonmetallic conduit shall be permitted to be installed in those~~ Those buildings or portions ~~thereof that are~~ of buildings not required to be of fire - rated construction by the applicable building code shall permit the use of any of the wiring methods of Chapter 3 as permitted by the applicable article .

Informational Note: Fire-rated construction is the fire-resistive classification used in building codes.

Statement of Problem and Substantiation for Public Input

The current text limits the wiring methods in the non-rated portions of the building to three additional choices. Any of the wiring methods of Chapter 3 used in accordance with the permissions and limitation of their respective article should be permitted. Additionally naming specific wiring methods such as nm cable serves to modify the general rule of chapter 3 which place restrictions on the use of nm cable to dwellings and types 3,4 and 5 construction. By the current text nm cable would be permitted via this section for the non-rated portions of assembly occupancy regardless of building classification or type of construction as the rules of sections 334.10 and 334.12 have been amended by section 518.4(B).

Submitter Information Verification

Submitter Full Name: David Humphrey
Organization: County of Henrico, Virginia
Street Address:
City:
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Submittal Date: Wed Sep 09 11:16:15 EDT 2020
Committee: NEC-P15

Public Input No. 3758-NFPA 70-2020 [Section No. 518.4(C)]

(C) Spaces with Finish Rating.

Electrical nonmetallic tubing and rigid ~~nonmetallic~~ polyvinyl chloride conduit shall be permitted to be installed in club rooms, conference and meeting rooms in hotels or motels, courtrooms, dining facilities, restaurants, mortuary chapels, museums, libraries, and places of religious worship where the following apply:

(1) The electrical nonmetallic tubing or rigid ~~nonmetallic conduit~~ polyvinyl chloride conduit is installed concealed within walls, floors, and ceilings where the walls, floors, and ceilings provide a thermal barrier of material that has at least a 15-minute finish rating as identified in listings of fire-rated assemblies.

(2) The electrical nonmetallic tubing or rigid ~~nonmetallic conduit~~ rigid polyvinyl conduit is installed above suspended ceilings where the suspended ceilings provide a thermal barrier of material that has at least a 15-minute finish rating as identified in listings of fire-rated assemblies.

Electrical nonmetallic tubing and rigid ~~nonmetallic conduit~~ polyvinylconduit are not recognized for use in other space used for environmental air in accordance with 300.22(C).

Informational Note: A finish rating is established for assemblies containing combustible (wood) supports. The finish rating is defined as the time at which the wood stud or wood joist reaches an average temperature rise of 121°C (250°F) or an individual temperature rise of 163°C (325°F) as measured on the plane of the wood nearest the fire. A finish rating is not intended to represent a rating for a membrane ceiling.

Statement of Problem and Substantiation for Public Input

Rigid nonmetallic conduit when first used with this section applied to pvc or as know known rigid polyvinyl chloride raceways only as other types of non-metallic raceway such as hdpe or rtrc were not yet recognized by the NEC. The definition for rigid nonmetallic conduit was subsequently removed from the 2008 NEC section 352.2 and replaced with a definition for rigid polyvinyl chloride conduit type pvc. This revision will clarify that the raceway permitted by this section is rigid polyvinyl chloride. If other types of nonmetallic raceways are acceptable for use in this application they should be listed by their respective names. Rtrc, hdpe etc.

Submitter Information Verification

Submitter Full Name: David Humphrey
Organization: County of Henrico, Virginia
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 11:56:48 EDT 2020
Committee: NEC-P15

Public Input No. 1761-NFPA 70-2020 [Section No. 518.5]

518.5 Supply.

~~Portable switchboards and portable power distribution equipment shall be supplied only from listed power outlets of sufficient voltage and ampere rating. Such power outlets shall~~ **(A) Power Outlets and Commercial Appliance Outlet Centers.**

Power outlets and commercial appliance outlet centers shall provide overcurrent protection or shall be protected by overcurrent devices. Such overcurrent devices ~~and power outlets~~ , power outlets, and commercial appliance outlet centers shall not be accessible to the general public. ~~Provisions for connection~~ Connection means of an equipment grounding conductor shall be provided in power outlets and commercial appliance outlet centers . A panelboard installed in a listed commercial appliance outlet center enclosure designed for in-floor mounting shall be permitted to be oriented in the face-up position.

(B) Neutral Conductor of Feeders.

The neutral conductor of feeders supplying solid-state phase control, 3-phase, 4-wire dimmer systems shall be considered a current-carrying conductor for purposes of ampacity adjustment. The neutral conductor of feeders supplying solid-state sine wave, 3-phase, 4-wire dimming systems shall not be considered a current-carrying conductor for purposes of ampacity adjustment.

Exception: The neutral conductor of feeders supplying systems that use or are capable of using both phase-control and sine-wave dimmers shall be considered as current-carrying for purposes of ampacity adjustment.

Informational Note: For definitions of solid-state dimmer types, see 520.2.

(C) Portable Switchboards and Portable Power Distribution Equipment.

Portable switchboards and portable power distribution equipment shall be supplied only from listed power outlets or listed commercial appliance outlet centers, each having sufficient voltage and ampere ratings.

Additional Proposed Changes

File Name	Description	Approved
Public_Input_No._1761-NFPA_70-2020_Section_518.5_.docx	Clean MSWord DOCX copy of this Public Input No. 1761 WITHOUT TerraView alteration of the Submtter's intent	

Statement of Problem and Substantiation for Public Input

See the uploaded attachment of a manual entry of this Public Input with text content that hasn't been Terrarized and is consequently readable.

.

New 2020 NEC® Section 408.43, in conjunction with the Article 100 Panelboard definition as worded (“accessible only from the front”), has had in some jurisdictions the consequence of potentially disallowing a long-existing, listed product type: in-floor-mounted commercial appliance outlet centers, composed of factory- or field-installed panelboards and commercial appliance outlet center enclosures. Because of the generalizations of this new 2020 NEC® Section 408.43, it is essential to recognize explicitly these in-floor-mounted commercial appliance outlet centers having face-up panelboards accessed from the top.

.

The definition for “Panelboard” in Article 100 is indicated as being “designed to be placed in a cabinet”. For assembly occupancies such as convention centers, exhibition halls, casinos, gaming facilities, et alibi (as well as non-assembly occupancies such as hotels and warehouses), commercial appliance outlet centers are listed to receive factory- or field-installed panelboards and are listed for in-floor mounting in large facilities and venues (not all assembly occupancies), to supply electrical power and other services. Such listed commercial appliance outlet centers and listed commercial appliance outlet center enclosures that provide for diversion and routing of water spillage away from face-up panelboards installed flat or slightly angled within and for adequate drainage, and can be found in UL Product Category AUUZ.

.

Editorially, the existing Section contained a variety of requirement that have been divided into titled Subsections for Code usability. The first sentence has been relocated, with the addition of commercial appliance outlet centers, to a new Subsection C addressing the supply of portable switchboards and portable power distribution equipment. The requirement is essentially unchanged.

.

The final two sentences of the existing Section, plus the associated Exception and associated Informational Note, have been divided into a new titled Subsection B. Beyond the division into a new Subsection, there are no revisions of these sentences whatsoever.

The remaining sentences of existing 518.5 are located in Subsection A, This Subsection reflects explicitly the inclusion of commercial appliance outlet centers and that panelboards can be installed with a face-up orientation into in-floor-mounted, contrary to new 2020 NEC® Section 408.43, despite long-standing usage, design, and listing evaluation for such equipment in

assembly occupancy venues. Furthermore, the new wording now recognizes explicitly that some power outlets or commercial appliance outlet centers “upstream” may contain the overcurrent protection for power outlets or commercial appliance outlet centers “downstream”.

.

Finally, “PROVISIONS for connection … shall be PROVIDED” is restated in grammatical EFL (English As A First Language).

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1731-NFPA 70-2020 [Definition: Panelboard.]	related Definition
Public Input No. 1705-NFPA 70-2020 [Section No. 408.43]	overgeneralized panelboard requirement
Public Input No. 1660-NFPA 70-2020 [Section No. 518.2(A)]	assembly occupancies clarification
Public Input No. 1705-NFPA 70-2020 [Section No. 408.43]	
Public Input No. 1731-NFPA 70-2020 [Definition: Panelboard.]	

Submitter Information Verification

Submitter Full Name: Brian Rock
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Submittal Date: Mon Jun 29 13:58:03 EDT 2020
Committee: NEC-P15

NFPA Public Input Form

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

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

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

FOR OFFICE USE ONLY

Log #:

Date Rec'd:

Date 2020-June-26 **Name** Brian E. Rock **Tel. No.** [redacted]

Company Hubbell Incorporated **Email** [redacted]

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

Please indicate organization represented (if any) Hubbell Incorporated

1. (a) Title of NFPA Standard National Electrical Code® **NFPA No. & Year** 70 - 2020

(b) Section/Paragraph 518.5

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

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

518.5 Supply.

(A) Power Outlets and Commercial Appliance Outlet Centers.

~~Portable switchboards and portable power distribution equipment shall be supplied only from listed power outlets of sufficient voltage and ampere rating. Such power~~ Power outlets and commercial appliance outlet centers shall provide overcurrent protection or shall be protected by overcurrent devices. Such overcurrent devices, ~~and~~ power outlets, and commercial appliance outlet centers shall not be accessible to the general public. ~~Provisions for connection of~~ Connection means for an equipment grounding conductor shall be provided in power outlets and commercial appliance outlet centers. A panelboard installed in a listed commercial appliance outlet center enclosure designed for in-floor mounting shall be permitted to be oriented in the face-up position.

(B) Neutral Conductor of Feeders.

The neutral conductor of feeders supplying solid-state phase control, 3-phase, 4-wire dimmer systems shall be considered a current-carrying conductor for purposes of ampacity adjustment. The neutral conductor of feeders supplying solid-state sine wave, 3-phase, 4-wire dimming systems shall not be considered a current-carrying conductor for purposes of ampacity adjustment.

Exception: The neutral conductor of feeders supplying systems that use or are capable of using both phase-control and sine-wave dimmers shall be considered as current-carrying for purposes of ampacity adjustment.

Informational Note: For definitions of solid-state dimmer types, see 520.2

(C) Portable Switchboards and Portable Power Distribution Equipment.

Portable switchboards and portable power distribution equipment shall be supplied only from listed power outlets or listed commercial appliance outlet centers, each having sufficient voltage and ampere ratings.

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

New 2020 NEC® Section 408.43, in conjunction with the Article 100 Panelboard definition as worded ("accessible only from the front"), has had in some jurisdictions the consequence of potentially disallowing a long-existing, listed product type: in-floor-mounted commercial appliance outlet centers, composed of factory- or field-installed panelboards and commercial appliance outlet center enclosures. Because of the generalizations of this new 2020 NEC® Section 408.43, it is essential to recognize explicitly these in-floor-mounted commercial appliance outlet centers having face-up panelboards accessed from the top.

The definition for "Panelboard" in Article 100 is indicated as being "designed to be placed in a cabinet". For assembly occupancies such as convention centers, exhibition halls, casinos, gaming facilities, et alibi ["et alibi" applies to places; "et cetera" applies to things; "et alia" applies to persons] (as well as non-assembly occupancies such as hotels and warehouses), commercial appliance outlet centers are listed to receive factory- or field-installed panelboards and are listed for in-floor mounting in large facilities and venues (not all assembly occupancies), to supply electrical power and other services. Such listed commercial appliance outlet centers and listed commercial appliance outlet center enclosures that provide for diversion and routing of water spillage away from face-up panelboards installed within and for adequate drainage, and can be found in UL Product Category AUUZ.

Editorially, the existing Section contained a variety of requirement that have been divided into titled Subsections for Code usability. The first sentence has been relocated, with the addition of commercial appliance outlet centers, to a new Subsection C addressing the supply of portable switchboards and portable power distribution equipment. The requirement imposed is essentially unchanged.

The final two sentences of the existing Section, plus the associated Exception and associated Informational Note, have been divided into a new titled Subsection B. Beyond the division into a new Subsection, there are no revisions of these sentences whatsoever.

The remaining sentences of existing 518.5 are located in Subsection A, This Subsection reflects explicitly the inclusion of commercial appliance outlet centers and that panelboards can be installed with a face-up orientation into in-floor-mounted, contrary to new 2020 NEC® Section 408.43, despite long-standing usage, design, and listing evaluation for such equipment in assembly occupancy venues. Furthermore, the new wording now recognizes explicitly that some power outlets or commercial appliance outlet centers "upstream" may contain the overcurrent protection for power outlets or commercial appliance outlet centers "downstream".

Finally, "PROVISIONS for connection … shall be PROVIDED" is restated in grammatical EFL (English As A First Language).

5. Copyright Assignment

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

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

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

Signature (Required) [redacted]

PLEASE USE SEPARATE FORM FOR EACH PUBLIC INPUT

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

9/16/2020

Public Input No. 1300-NFPA 70-2020 [New Section after 518.6]

TITLE OF NEW CONTENT

Type your content here ...

Additional Proposed Changes

File Name	Description	Approved
Article_519_High_Rise_Bldgs_.docx		

Statement of Problem and Substantiation for Public Input

Since most electricians only look at the NEC and not in NFPA 101 or the IBC this will help provide the information already in these other codes. This new article will not add any new requirements that are not already adopted by other codes, but will put them in a place where electricians will know of there existence.

Submitter Information Verification

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Submittal Date: Thu May 28 16:15:11 EDT 2020
Committee: NEC-P15

ARTICLE 519 High-Rise Buildings

519.1 Scope. The Scope of this Article covers additional electrical requirements for High-Rise Buildings

519.2 Definitions

(1) High-Rise. A building with an occupied floor located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access. IBC chapter 202 definitions

(2) Fire Command Center. The principal attended or unattended location where the status of detection, alarm communications and control systems is displayed, and from which the systems can be manually controlled. NFPA 101 IBC chapter 202 definitions

(3) Smokeproof Enclosure An enclosure designed to limit the movement of products of combustion produced by a fire. (Enclosing Exit Stairwell towers, Elevators, Dumbwaiters, Platform lifts, vertical shafts etc.) NFPA 101 3.3.257 IBC chapter 202 definitions

519.3 **Other Articles**

(A) Fire Pumps shall comply with Article 695

(B) Elevators shall comply with Article 620

(C) Emergency power systems shall comply with Article 700

(D) Legally Required Standby systems shall comply with Article 701

519.6 **Power & Control wiring required to be on Emergency power.**

1. Exit signs and means of egress illumination.
   IBC 405.8.2 403.4.8.4
2. Elevator Car Lighting.
   IBC 405.8.2 3007.8 403.4.8.4 NFPA 101 7.14.8.1 (NFPA 101 only requires it on Legally Required Standby)
3. Emergency voice\Alarm Communications systems.
   IBC 405.8.2 403.4.8.4 907.5.2.2.5 2702.2.4
4. Automatic fire detection systems.
   IBC 405.8.2 403.4.8.4
5. Fire Alarm systems.
   IBC 405.8.2 403.4.8.4
6. Electrically driven fire pumps.
   IBC 405.8.2 403.4.8.4
7. Power and Lighting for the Fire Command Center required for High Rise Buildings.
   IBC 403.4.8.4 (NFPA 101 11.8.5.2.4(4) only requires it on Legally Required Standby)

519.7 **Power and Control wiring loads required to be on Legally Required Standby power.**

1. Smoke Control System. Smoke control systems are intended to maintain a tenable environment in a building to allow the occupants ample time to evacuate or relocate to protected areas. IBC 405.8.1 909.11 NFPA 101 12.4.6.5.1.4

2. Jockey Pump NFPA 101 11.8.5.2.4(2)
3. Air Compressor serving Fire sprinkler systems serving Dry-pipe and Pre-action systems NFPA 101 11.8.5.2.4(2)
4. Stairway video monitoring equipment. NFPA 101 11.8.5.2.4(8)
5. Ventilation (Stair Pressurization Fans, Smoke Evacuation, Smoke control systems, Fans etc.) and Automatic fire detection equipment for smokeproof enclosures. (enclosing Stairways, Elevators, Platform lifts, Dumbwaiters etc…) & Mechanical vestibules of stairwells. IBC 403.4.8.3, 405.8.1 909.20.6.1 909.20.6.2 3007.8 NFPA 101 7.2.13.7 11.8.5.2.4(6)
6. Elevators, Platform lifts, Dumbwaiters. IBC 403.4.8.3, 405.8.1 2702.2.1 NFPA 101 7.14.8.1
7. Elevators that are considered accessible means of egress for the public or fire access elevators for first responders. IBC 403.4.8.3, 405.8.1 3007.8 IBC 403.4.8.3, 405.8.1 3007.8 NFPA 101 11.8.5.2.4(2) & 12.4.6.5.1.4
8. Hoistway lighting for elevators that are considered accessible means of egress for the public or fire access elevators for first responders shall achieve a minimum illumination level of 1-foot candle (11 lux). IBC 3003.1 3007.5.
9. Ventilation and cooling equipment for elevator machine rooms, control rooms, machine spaces and control spaces. IBC 3003.1.4 NFPA 101 7.14.8.1
10. Exhaust Systems. common exhaust systems for domestic kitchens, common exhaust systems for clothes dryers. IBC 2702.2.5
7. Gas Detection Systems IBC 916.5 2702.2.7
8. Laboratories above the 6th floor IBC 2702.2.7

519.8 **Power and Control wiring requiring 2-hour fire protection.**

1. Wires or cables that are located outside of the elevator hoistway and machine room and that provide normal or legally required Standby power, control signals, communications with the car, lighting, heating, air conditioning, ventilation and fire detecting systems to fire access elevators and occupant evacuation elevators. Feeder & branch circuits shall comply with one of the following 2-hour fire protection. IBC 909 20.6.1 3007.8.1 NFPA 101 7.14.8.2

   (1) The cable or raceway is protected by a listed electrical circuit protective system with a minimum 2-hour fire rating.

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

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

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

   Informational Note No. 1: Fire-resistive cables are tested to ANSI/UL 2196, Tests for Fire Resistive Cables.

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

(3) Construction having a fire-resistance rating of not less than 2 hours.

Public Input No. 239-NFPA 70-2020 [Section No. 518.6]

518.6 Illumination.

Illumination of 200lux minimum shall be provided for all working spaces about fixed service equipment, switchboards, switchgear, panelboards, or motor control centers installed outdoors that serve assembly occupancies. Control by automatic means only shall not be permitted. Additional lighting outlets shall not be required where the workspace is illuminated by an adjacent light source.

Additional Proposed Changes

File Name	Description	Approved
Table_22.2_IES_hb.JPG	IES HB Table 222	

Statement of Problem and Substantiation for Public Input

The NEC needs to identify a level of illumination required and or reference source for illumination information that is required. This will help justify a level of illumination at outdoor electrical equipment working spaces that may require separate manual control and higher levels of illumination during times of work or operation of the electrical equipment.

Submitter Information Verification

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Submittal Date: Thu Jan 02 18:25:09 EST 2020
Committee: NEC-P15

Public Input No. 3644-NFPA 70-2020 [Section No. 520.2]

(Relocate all definitions in the 520. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

520. 2 Definitions.

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

Adapter.

A device used to adapt a circuit from one configuration of an attachment plug or receptacle to another configuration with the same current rating.

Border Light.

A permanently installed overhead strip light.

Breakout Assembly.

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

Bundled.

Cables or conductors that are tied, wrapped, taped, or otherwise periodically bound together.

Connector Strip.

A metal wireway containing pendant or flush receptacles.

Drop Box.

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

Footlight.

A border light installed on or in the stage.

Grouped.

Cables or conductors positioned adjacent to one another but not in continuous contact with each other.

Performance Area.

The stage and audience seating area associated with a temporary stage structure, whether indoors or outdoors, constructed of scaffolding, truss, platforms, or similar devices, that is used for the presentation of theatrical or musical productions or for public presentations.

Portable Equipment.

Equipment fed with portable cords or cables intended to be moved from one place to another.

Portable Power Distribution Unit.

A power distribution box containing receptacles and overcurrent devices.

Proscenium.

The wall and arch that separates the stage from the auditorium (house).

Solid-State Phase-Control Dimmer.

A solid-state dimmer where the wave shape of the steady-state current does not follow the wave shape of the applied voltage, such that the wave shape is nonlinear.

Solid-State Sine Wave Dimmer.

A solid-state dimmer where the wave shape of the steady-state current follows the wave shape of the applied voltage such that the wave shape is linear.

Stage Equipment.

Equipment at any location on the premises integral to the stage production including, but not limited to, equipment for lighting, audio, special effects, rigging, motion control, projection, or video.

Stage Lighting Hoist.

A motorized lifting device that contains a mounting position for one or more luminaires, with wiring devices for connection of luminaires to branch circuits, and integral flexible cables to allow the luminaires to travel over the lifting range of the hoist while energized.

Stage Switchboard.

A permanently installed switchboard, panelboard, or rack containing dimmers or relays with associated overcurrent protective devices, or overcurrent protective devices alone, used primarily to feed stage equipment.

Stage Switchboard, Portable.

A portable rack or pack containing dimmers or relays with associated overcurrent protective devices, or overcurrent protective devices alone that are used to feed stage equipment.

Stand Lamp (Work Light).

A portable stand that contains a general-purpose luminaire or lampholder with guard for the purpose of providing general illumination on the stage or in the auditorium.

Strip Light.

A luminaire with multiple lamps arranged in a row.

Two-Fer.

An assembly containing one male plug and two female cord connectors used to connect two loads to one branch circuit.

Statement of Problem and Substantiation for Public Input

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

Submitter Information Verification

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Submittal Date: Wed Sep 09 10:04:34 EDT 2020
Committee: NEC-P15

Public Input No. 823-NFPA 70-2020 [Section No. 520.2]

520.2 Definitions.

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

Adapter.

A device used to adapt a circuit from one configuration of an attachment plug or receptacle to another configuration with the same current rating.

Border Light.

A permanently installed overhead strip light.

Breakout Assembly.

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

Bundled.

Cables or conductors that are tied, wrapped, taped, or otherwise periodically bound together.

Connector Strip.

A metal wireway containing pendant or flush receptacles.

Drop Box.

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

Footlight.

A border light installed on or in the stage.

Grouped.

Cables or conductors positioned adjacent to one another but not in continuous contact with each other.

Multi-Circuit Cable Outlet Enclosure.

An enclosure containing one or more multi-circuit plugs, receptacles or both.

Performance Area.

The stage and audience seating area associated with a temporary stage structure, whether indoors or outdoors, constructed of scaffolding, truss, platforms, or similar devices, that is used for the presentation of theatrical or musical productions or for public presentations.

Portable Equipment.

Equipment fed with portable cords or cables intended to be moved from one place to another.

Portable Power Distribution Unit.

A power distribution box containing receptacles and overcurrent devices.

Proscenium.

The wall and arch that separates the stage from the auditorium (house).

Solid-State Phase-Control Dimmer.

A solid-state dimmer where the wave shape of the steady-state current does not follow the wave shape of the applied voltage, such that the wave shape is nonlinear.

Solid-State Sine Wave Dimmer.

A solid-state dimmer where the wave shape of the steady-state current follows the wave shape of the applied voltage such that the wave shape is linear.

Special-Purpose Multi-Circuit Cable System.

A portable branch circuit distribution system consisting of one or more Trunk Cables and optional Breakout Assemblies or Multi-Circuit outlet enclosures

Stage Equipment.

Equipment at any location on the premises integral to the stage production including, but not limited to, equipment for lighting, audio, special effects, rigging, motion control, projection, or video.

Stage Lighting Hoist.

A motorized lifting device that contains a mounting position for one or more luminaires, with wiring devices for connection of luminaires to branch circuits, and integral flexible cables to allow the luminaires to travel over the lifting range of the hoist while energized.

Stage Switchboard.

A permanently installed switchboard, panelboard, or rack containing dimmers or relays with associated overcurrent protective devices, or overcurrent protective devices alone, used primarily to feed stage equipment.

Stage Switchboard, Portable.

A portable rack or pack containing dimmers or relays with associated overcurrent protective devices, or overcurrent protective devices alone that are used to feed stage equipment.

Stand Lamp (Work Light).

A portable stand that contains a general-purpose luminaire or lampholder with guard for the purpose of providing general illumination on the stage or in the auditorium.

Strip Light.

A luminaire with multiple lamps arranged in a row.

Trunk Cable.

A portable extension cable containing six or more branch circuits, a male multipole plug and a female multipole receptacle.

Two-Fer.

An assembly containing one male plug and two female cord connectors used to connect two loads to one branch circuit.

Statement of Problem and Substantiation for Public Input

Three new definitions are needed to support my associated proposal on Special-Purpose Multi-Circuit Cable Systems.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 824-NFPA 70-2020 [New Section after 520.68(C)]	Proposal that requires new definitions
Public Input No. 824-NFPA 70-2020 [New Section after 520.68(C)]	
Public Input No. 825-NFPA 70-2020 [New Section after 530.12(C)]	

Submitter Information Verification

Submitter Full Name: Steven Terry
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Affiliation: USITT
Street Address:
City:
State:
Zip:
Submittal Date: Wed Apr 01 15:32:30 EDT 2020
Committee: NEC-P15

Public Input No. 842-NFPA 70-2020 [Definition: Portable Power Distribution Unit.]

Portable Power Distribution Unit.

A power distribution box containing receptacles and overcurrent devices.

Informational Note: See ANSI/UL 1640, *Portable Power Distribution Equipment* , for information covering portable power distribution units

Statement of Problem and Substantiation for Public Input

My associated PI 840 modifies 520.62 to require listing of Portable Power Distribution Units. If that PI is accepted, a pointer to UL 1640 is needed in this definition.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 840-NFPA 70-2020 [Section No. 520.62]	Proposed listing requirement
Public Input No. 840-NFPA 70-2020 [Section No. 520.62]	

Submitter Information Verification

Submitter Full Name: Steven Terry
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Submittal Date: Wed Apr 08 11:51:41 EDT 2020
Committee: NEC-P15

Public Input No. 3183-NFPA 70-2020 [Section No. 520.3]

~~**520.3** Motion Picture Projectors.~~

~~Motion picture equipment and its installation and use shall comply with Article 540 .~~

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. Text in 520.3 provides a reference to Article 540 for motion picture equipment. That reference seems to already be available through NEC 90.3 and the Table of Contents without repeating it in this text.

Submitter Information Verification

Submitter Full Name: Donald Cook
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Submittal Date: Sun Sep 06 16:09:54 EDT 2020
Committee: NEC-P15

Public Input No. 3184-NFPA 70-2020 [Section No. 520.4]

~~**520.4** Audio Signal Processing, Amplification, and Reproduction Equipment.~~

~~Audio signal processing, amplification, and reproduction equipment and its installation shall comply with Article 640 .~~

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. Text in 520.4 provides a reference to Article 640 for audio signal processing, amplification, and reproduction equipment. That reference seems to already be available through NEC 90.3 and the Table of Contents without repeating it in this text.

Submitter Information Verification

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Submittal Date: Sun Sep 06 16:12:40 EDT 2020
Committee: NEC-P15

Public Input No. 194-NFPA 70-2019 [Section No. 520.5(A)]

(A) General.

The fixed wiring method shall be metal raceways, nonmetallic raceways encased in at least 50 mm (2 in.) of concrete, Type MI cable, MC cable, or AC cable containing an insulated equipment grounding conductor sized in accordance with Table 250.122.

Exception: Fixed wiring methods shall be as provided in Article 640 for audio signal processing, amplification, and reproduction equipment, in ~~Article~~ Articles 800 & 805 for communications circuits, in Article 725 for Class 2 and Class 3 remote-control and signaling circuits, and in Article 760 for fire alarm circuits.

Statement of Problem and Substantiation for Public Input

The 2020 NEC introduced Article 800, General Requirements for Communications Systems. This PI corrects an apparent omission by adding reference to Article 800.

Submitter Information Verification

Submitter Full Name: Stanley Kaufman
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State:
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Submittal Date: Fri Dec 20 10:01:13 EST 2019
Committee: NEC-P15

Public Input No. 3150-NFPA 70-2020 [Section No. 520.5(A)]

(A) General.

The fixed wiring method shall be metal raceways, nonmetallic raceways encased in at least 50 mm (2 in.) of concrete, Type MI cable, MC cable, or AC cable containing an insulated equipment grounding conductor sized in accordance with Table 250.122.

~~Exception: Fixed wiring methods shall be as provided in Article 640 for~~

(B) Communications, Signaling Systems, Data Systems, Fire Alarm Systems, and Systems Less Than 120 Volts, Nominal.

Communications circuits; audio signal processing, amplification, and reproduction

~~equipment, in Article 805 for communications circuits, in Article 725 for Class 2 and Class 3~~

circuits; Class 1, Class 2, and Class 3 remote-control

~~and~~

or signaling circuits ; Class 2 circuits that transmit power ,

~~and in Article 760 for fire alarm circuits.~~

data, or both to a powered device; and power-limited fire alarm circuits shall be permitted to be wired in accordance with Articles 640, 725, 760, 805, and 840.

Informational Note: See ANSI/NEMA C137.3-2017, American National Standard for Lighting Systems — Minimum Requirements for Installation of Energy Efficient Power over Ethernet (PoE) Lighting Systems, for information on installation of cables for PoE lighting systems.

-

Additional Proposed Changes

File Name	Description	Approved
520.5_FINAL_PI_Text_Only_2020-0905mkh.docx	Word Version of PI on 520.5 since TerraView interspersed new language within deleted exception	

Statement of Problem and Substantiation for Public Input

The exception from 520.5(A) General which addresses permanent wiring is now in its own sub-section. The relocation complies with the Style Guide preference to minimize exceptions and use positive language. Content is added to clarify Power over Ethernet (PoE) wiring is included. PoE is addressed in Article 725 – specifically 725.144 [Transmission of Power & Data] under Part III of Article 725 [Class 2 and Class 3 circuits] - “Class 2 circuits that transmit power, data, or both to a powered device” – i.e., Power Over Ethernet.

Article 840 [Premise-Powered Broadband Communications Systems] does address PoE: 840.3(B)(4) refers back to 725.21 and Part III of 725. Sections 840.160 and 840.170(G) also address the Class 2 aspect.

Use of PoE has become ubiquitous over the past two decades, two of the first applications for PoE were IP phones such as the phones on your office desk, and in theatres and similar locations for more sophisticated lighting control. Updates to the original IEEE 802.3 standard have allowed for higher power levels, powering Wireless (Wi-Fi) Access points and similar devices. PoE is now also used for lighting.

The Informational Note (copied from 725.144 Informational Note No. 5) adds a valuable reference for additional clarification on cabling for PoE.

Existing sections B & C renumbered to C & D.

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Committee: NEC-P15

Date	September 5, 2020	Mitch Hefter	[redacted]
Company	Signify		
Representing			
NFPA 70	2023	520.5	**FINAL Public Input – Text Change**

PI is Revised Text

Proposed Text of PI:

520.5 Wiring Methods.

520.5(A) General.

The fixed wiring method shall be metal raceways, nonmetallic raceways encased in at least 50 mm (2 in.) of concrete, Type MI cable, MC cable, or AC cable containing an insulated equipment grounding conductor sized in accordance with Table 250.122.

~~*Exception: Fixed wiring methods shall be as provided in Article 640 for audio signal processing, amplification, and reproduction equipment, in Article 805 for communications circuits, in Article 725 for Class 2 and Class 3 remote-control and signaling circuits, and in Article 760 for fire alarm circuits.*~~

520.5(B) Communications, Signaling Systems, Data Systems, Fire Alarm Systems, and Systems Less Than 120 Volts, Nominal. Communications circuits; audio signal processing, amplification, and reproduction circuits; Class 1, Class 2, and Class 3 remote-control or signaling circuits; Class 2 circuits that transmit power, data, or both to a powered device; and power-limited fire alarm circuits shall be permitted to be wired in accordance with Articles 640, 725, 760, 805, and 840.

Informational Note: See ANSI/NEMA C137.3-2017, *American National Standard for Lighting Systems — Minimum Requirements for Installation of Energy Efficient Power over Ethernet (PoE) Lighting Systems*, for information on installation of cables for PoE lighting systems.

~~520.5(B)~~ 520.5(C) Portable Equipment.

[text unchanged]

~~520.5(C)~~ 520.5(D) Nonrated Construction.

[text unchanged]

=-=-=-=-=-=-=

Public Input No. 3516-NFPA 70-2020 [Section No. 520.5(C)]

(C) Nonrated Construction.

~~Nonmetallic-sheathed cable, Type AC cable, electrical nonmetallic tubing, and rigid nonmetallic conduit shall be permitted to be installed in those buildings or portions thereof that are~~ A building or portions of a building not required to be of fire-rated construction by the applicable building code shall be permited to use of any of the wiring methods of Chapter 3 as permitted by the applicable article .

Statement of Problem and Substantiation for Public Input

The current text limits the wiring methods in non-fire-rated portions of the building to three additional choices. Any of the wiring methods of Chapter 3 should be permitted in non-fire-rated areas. The current text would prohibit SE Cable, UF Cable, etc. Additionally, by naming the specific wiring methods that are permitted in these non-fire-rated areas it may be construed as a modification of 334.10 and 334.12 by 520.5(C) allowing carte blanche use of Type NM cable including allowing Type NM Cable in Type II construction as an example.

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Public Input No. 3773-NFPA 70-2020 [Section No. 520.5(C)]

(C) Nonrated Construction.

Nonmetallic-sheathed cable, Type AC cable, electrical nonmetallic tubing, and rigid ~~nonmetallic conduit~~ polyvinyl chloride conduit shall be permitted to be installed in those buildings or portions thereof that are not required to be of fire-rated construction by the applicable building code.

Statement of Problem and Substantiation for Public Input

Rigid nonmetallic conduit when first used with this section applied to pvc or as know known rigid polyvinyl chloride raceways only as other types of non-metallic raceway such as hdpe or rtrc were not yet recognized by the NEC. The definition for rigid nonmetallic conduit was subsequently removed from the 2008 NEC section 352.2 and replaced with a definition for rigid polyvinyl chloride conduit type pvc. This revision will clarify that the raceway permitted by this section is rigid polyvinyl chloride. If other types of nonmetallic raceways are acceptable for use in this application they should be listed by their respective names, rtrc, hdpe etc.

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Public Input No. 4642-NFPA 70-2020 [Section No. 520.5(C)]

(C) Nonrated Construction.

Nonmetallic-sheathed cable, Type AC cable, electrical nonmetallic tubing, and rigid ~~nonmetallic conduit~~ polyvinyl chloride conduit shall be permitted to be installed in those buildings or portions thereof that are not required to be of fire-rated construction by the applicable building code.

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, Section 520.5(C) referenced “rigid nonmetallic conduit” (as it still does in the 2020 NEC) before RTRC and HDPE appeared in the Code. This appears to 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 PI is an attempt to get CMP-15 to address this issue by specifically stating the type(s) of nonmetallic raceways permitted as a wiring method for theaters, motion picture and television studios and similar locations. In the opinion of the submitter of this PI, the term currently used at 520.5(C), “rigid nonmetallic conduit” is too broad of a term and appears to cover a variety of nonmetallic conduits as this term is used a total of (37) times throughout the 2020 NEC.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4637-NFPA 70-2020 [Section No. 520.6]	
Public Input No. 4637-NFPA 70-2020 [Section No. 520.6]	

Submitter Information Verification

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Submittal Date: Thu Sep 10 16:09:34 EDT 2020
Committee: NEC-P15

Public Input No. 3617-NFPA 70-2020 [Section No. 520.6]

520.6 Number of Conductors in Raceway.

The number of conductors permitted in any metal conduit, rigid ~~nonmetallic conduit as~~ polyvinyl chloride conduit as permitted in this article, or electrical metallic tubing for circuits or for remote-control conductors shall not exceed the percentage fill shown in Table 1 of Chapter 9. Where contained within an auxiliary gutter or a wireway, the sum of the cross-sectional areas of all contained conductors at any cross section shall not exceed 20 percent of the interior cross-sectional area of the auxiliary gutter or wireway. The 30-conductor limitation of 366.22 and 376.22 shall not apply.

Statement of Problem and Substantiation for Public Input

The term rigid nonmetallic is a term that changed with the 2008 NEC to rigid polyvinyl chloride to distinguish this product from other types of non metal raceways. Prior to the inclusion of RTRC as Article 355 in the 2008 and HDPE in the 2005 the term rigid nonmetallic conduit as used in section 520.6 of the 2002 edition and prior applied only to PVC. If it be the will of the CMP that other raceways such as HDPE, RTRC etc are permissible I encourage that these other types of raceways be specifically delineated.

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Public Input No. 4637-NFPA 70-2020 [Section No. 520.6]

520.6 Number of Conductors in Raceway.

The number of conductors permitted in any metal conduit, rigid ~~nonmetallic~~ polyvinyl chloride conduit as permitted in this article, or electrical metallic tubing for circuits or for remote-control conductors shall not exceed the percentage fill shown in Table 1 of Chapter 9. Where contained within an auxiliary gutter or a wireway, the sum of the cross-sectional areas of all contained conductors at any cross section shall not exceed 20 percent of the interior cross-sectional area of the auxiliary gutter or wireway. The 30-conductor limitation of 366.22 and 376.22 shall not apply.

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, Section 520.6 referenced “rigid nonmetallic conduit” (as it still does in the 2020 NEC) before RTRC and HDPE appeared in the Code. This appears to 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 PI is an attempt to get CMP-15 to address this issue by specifically stating the type(s) of nonmetallic raceways permitted as a wiring method for theaters, motion picture and television studios and similar locations. In the opinion of the submitter of this PI, the term currently used at 520.6, “rigid nonmetallic conduit” is too broad of a term and appears to cover a variety of nonmetallic conduits as this term is used a total of (37) times throughout the 2020 NEC.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4642-NFPA 70-2020 [Section No. 520.5(C)]	
Public Input No. 4642-NFPA 70-2020 [Section No. 520.5(C)]	

Submitter Information Verification

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Public Input No. 3185-NFPA 70-2020 [Section No. 520.8]

~~**520.8** Emergency Systems.~~

~~Control of emergency systems shall comply with Article 700 .~~

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. Text in 520.8 provides a reference to Article 700 for emergency systems. That reference seems to already be available through NEC 90.3 and the Table of Contents without repeating it in this text.

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Public Input No. 2109-NFPA 70-2020 [Section No. 520.10]

520.10 Portable Equipment Used Outdoors.

Portable stage and studio lighting equipment and portable power distribution equipment not identified for outdoor use shall be permitted for temporary use outdoors, provided the equipment is supervised by qualified personnel while energized and barriered from the general public.

Informational Note: See ANSI/ESTA E1.58 *Electrical Safety Standard for Portable Stage and Studio Equipment Used Outdoors* for information on use of portable stage and studio lighting equipment outdoors.

-

Statement of Problem and Substantiation for Public Input

A new ANSI/ESTA standard E1.58 has been recently published that directly covers use of stage and studio equipment outdoors in compliance with 520.10. An Informational Note is now needed to direct NEC users of 520.10 to this standard for additional information.

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Public Input No. 2065-NFPA 70-2020 [Section No. 520.44(C)(2)]

(2) Cords and Cables Not in Contact with Heat-Producing Equipment.

Listed multiconductor extra-hard-usage-type cords and cables not in direct contact with equipment containing heat-producing elements shall be permitted to have their ampacity determined by Table 520.44(C)(2). Maximum load current in any conductor with an ampacity determined by Table 520.44(C)(2) shall not exceed the values in Table 520.44(C)(2).

Table 520.44(C)(2) Ampacity of Listed Extra-Hard-Usage Cords and Cables with Temperature Ratings of 75°C (167°F) and 90°C (194°F) [Based on Ambient Temperature of 30°C (86°F)]

Size (AWG)	Temperature Rating of Cords and Cables		Maximum Rating of Overcurrent Device
	75°C (167°F)	90°C (194°F)	
14	24	28	15
12	32	35	20
10	41	47	25
8	57	65	35
6	77	87	45
4	101	114	60
2	133	152	80

Note: Ampacity shown is the ampacity for multiconductor cords and cables where only three copper conductors are current-carrying as described in 400.5. If the number of current-carrying conductors in a cord or cable exceeds three and the load diversity is 50 percent or less, the ampacity of each conductor shall be reduced as shown in the following table:

Table 520.44(C)(3) Ampacity Adjustment Factors for More Than Three Current-Carrying Conductors in a Cord or Cable Where Load Diversity Is 50 Percent or Less

Number of Conductors	Percent of Ampacity Value in Table 520.44(C)(3 2)
4–6	80
7–24	70
25–42	60
43 and above	50

Note: Ultimate insulation temperature. In no case shall conductors be associated together in such a way with respect to the kind of circuit, the wiring method used, or the number of conductors such that the temperature limit of the conductors is exceeded.

A neutral conductor that carries only the unbalanced current from other conductors of the same circuit need not be considered as a current-carrying conductor.

In a 3-wire circuit consisting of two-phase conductors and the neutral conductor of a 4-wire, 3-phase, wye-connected system, the neutral conductor carries approximately the same current as the line-to-neutral currents of the other conductors and shall be considered to be a current-carrying conductor.

On a 4-wire, 3-phase wye circuit where the major portion of the load consists of nonlinear loads, there are harmonic currents in the neutral conductor. Therefore, the neutral conductor shall be considered to be a current-carrying conductor.

Informational Note: For the purposes of Table 520.44(C)(3), load diversity is the percentage of the total current of all simultaneously energized circuits fed by the cable to the sum of the ampacity of all circuits in that cable.

Statement of Problem and Substantiation for Public Input

There is a typo in the second column heading of table 520.44(C)(3). The current column heading references table 520.44(C)(3) itself, which has no ampacity values. The ampacity values are in 520.44(C)(2), so the column heading needs to be changed to correct that error.

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Public Input No. 4190-NFPA 70-2020 [Section No. 520.44(C)(2)]

(2) Cords and Cables Not in Contact with Heat-Producing Equipment.

Listed multiconductor extra-hard-usage-type cords and cables not in direct contact with equipment containing heat-producing elements shall be permitted to have their ampacity determined by Table 520.44(C)(2). Maximum load current in any conductor with an ampacity determined by Table 520.44(C)(2) shall not exceed the values in Table 520.44(C)(2).

Table 520.44(C)(2) Ampacity of Listed Extra-Hard-Usage Cords and Cables with Temperature Ratings of 75°C (167°F) and 90°C (194°F) [Based on Ambient Temperature of 30°C (86°F)]

Size (AWG)	Temperature Rating of Cords and Cables		Maximum Rating of Overcurrent Device
	75°C (167°F)	90°C (194°F)	
14	24	28	15
12	32	35	20
10	41	47	25
8	57	65	35
6	77	87	45
4	101	114	60
2	133	152	80

Note: Ampacity shown is the ampacity for multiconductor cords and cables where only three copper conductors are current-carrying as described in 400.5. If the number of current-carrying conductors in a cord or cable exceeds three and the load diversity is 50 percent or less, the ampacity of each conductor shall be reduced as shown in the following table:

Table 520.44(C)(3) Ampacity Adjustment Factors for More Than Three Current-Carrying Conductors in a Cord or Cable Where Load Diversity Is 50 Percent or Less

Number of Conductors	Percent of Ampacity Value in Table 520.44(C)(3)
4–6	80
7–24	70
25–42	60
43 and above	50

Note: Ultimate insulation temperature. In no case shall conductors be associated together in such a way with respect to the kind of circuit, the wiring method used, or the number of conductors such that the temperature limit of the conductors is exceeded.

A neutral conductor that carries only the unbalanced current from other conductors of the same circuit need not be considered as a current-carrying conductor.

In a 3-wire circuit consisting of two-phase conductors and the neutral conductor of a 4-wire, 3-phase, wye-connected system, the neutral conductor carries approximately the same current as the line-to-neutral currents of the other conductors and shall be considered to be a current-carrying conductor.

On a 4-wire, 3-phase wye circuit where the major portion of the load consists of nonlinear loads, there are harmonic currents in the neutral conductor. Therefore, the neutral conductor shall be considered to be a current-carrying conductor.

Informational Note: For the purposes of Table 520.44(C)(3), load diversity is the percentage of the total current of all simultaneously energized circuits fed by the cable to the sum of the ~~ampacity~~ ampacities of all ~~circuits~~ circuit conductors in that cable.

Statement of Problem and Substantiation for Public Input

This PI corrects a misuse of the term ampacity, making it descriptive of circuits. Circuits do not have ampacities. Only conductors have ampacities. The rewording correctly applies the term to what is being described.

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Public Input No. 2181-NFPA 70-2020 [Section No. 520.53(C)]

(C) Single-Pole Separable Connectors.

~~Where single~~ Single -pole ~~portable cable connectors are used on a portable stage switchboard, they shall be listed and of the locking type. Sections~~ separable connectors shall comply with 406.13. Sections 400.14, 406.7, and 406.8 shall not apply to listed single-pole separable connectors and single-conductor cable assemblies utilizing listed single-pole separable connectors. Where paralleled sets of current-carrying, single-pole separable connectors are provided as input devices, they shall be prominently labeled with a warning indicating the presence of internal parallel connections. ~~The use of single-pole separable connectors shall comply with at least one of the following conditions:~~

- ~~Connection and disconnection of connectors are possible only where the supply connectors are interlocked to the source, and it is not possible to connect or disconnect connectors when the supply is energized.~~
- ~~Line connectors are of the listed sequential-interlocking type so that load connectors shall be connected in the following sequence:~~

(1) ~~Equipment grounding conductor connection~~

(2) ~~Grounded circuit conductor connection, if provided~~

(3) ~~Ungrounded conductor connection, and that disconnection shall be in the reverse order~~

- ~~A caution notice shall be provided adjacent to the line connectors indicating that plug connection shall be in the following order:~~

(1) ~~Equipment grounding conductor connectors~~

(2) ~~Grounded circuit conductor connectors, if provided~~

(3) ~~Ungrounded conductor connectors, and that disconnection shall be in the reverse order~~

~~The warning sign(s) or label(s) shall comply with 110.21(B) .~~

Statement of Problem and Substantiation for Public Input

In the 2020 edition, single-pole separable connectors moved to 406.13. Therefore, it is not appropriate for the general requirements of single-pole separable connectors to also appear in Article 520. Only article 520-specific requirements for these device should appear in article 520.

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Public Input No. 840-NFPA 70-2020 [Section No. 520.62]

520.62 Portable Power Distribution Units.

Portable power distribution units shall comply with 520.62(A) ~~through~~ and (~~F~~ B).

(A) ~~– Enclosure.~~

~~The construction shall be such that no current-carrying part will be exposed.~~

~~(B)~~ ~~Receptacles and Overcurrent Protection.~~

~~Receptacles shall comply with 520.45 and shall have branch-circuit overcurrent protection in the box. Fuses and circuit breakers shall be protected against physical damage. Flexible cords or cables supplying pendant receptacles or cord connectors shall be listed for extra-hard usage.~~

~~(C)~~ ~~Busbars and Terminals.~~

~~Busbars shall have an ampacity equal to the sum of the ampere ratings of all the circuits connected to the busbar. Lugs shall be provided for the connection of the master cable.~~

~~(D)~~ ~~Flanged Surface Inlets.~~

~~Flanged surface inlets (recessed plugs) that are used to accept the power shall be rated in amperes.~~

~~(E)~~ ~~Cable Arrangement.~~

~~Cables shall be protected where they pass through enclosures and be arranged so that tension on the cable is not transmitted to the terminations.~~

~~(F)~~

Listing

Portable power distribution units shall be listed

(B) Single-Conductor Feeders .

Portable power distribution equipment fed by single-conductor feeder systems shall comply with 520.53(C) and (D) and 520.54 .

Statement of Problem and Substantiation for Public Input

There is no functional difference between a Portable Switchboard and a Portable Power Distribution Unit from a construction safety point-of-view. Currently, a Portable switchboard is required to be listed by 520.53, while a Portable Power Distribution Unit covered by 520.62 is not. Many years ago, "shop-built" Portable Power Distribution Units without listings were the norm in the entertainment industry. At the time, no standard existed for these units. The creation of the UL1640 Standard for Portable Power Distribution Equipment provided a guide to the safe construction of these units while incorporating necessary industry safe practices. Listed units have displaced unlisted units as the industry norm. It is now time to eliminate construction requirements from 520.62 and replace them with a listing requirement, in the same way that 520.53 was modified to require listing of portable switchboards.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 842-NFPA 70-2020 [Definition: Portable Power Distribution Unit.]	Adds UL1640 Informational Note to definition
Public Input No. 842-NFPA 70-2020 [Definition: Portable Power Distribution Unit.]	

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Committee: NEC-P15

Public Input No. 824-NFPA 70-2020 [New Section after 520.68(C)]

520.XX (new) Special-Purpose Multi-Circuit Cable Systems.

Special-Purpose Multi-Circuit Cable Systems shall comply with 1 through 7:

(1) Branch circuits shall be rated at not more than 20A and not more than 150V to ground.

(2) Cable types for Trunk cables shall be extra-hard usage (hard service) or hard usage (junior hard service) .

(3) Ampacity of trunk cables shall be determined by table 520.44(C)(2).

(4) Trunk cables, breakout assemblies, and multi-circuit enclosures shall be listed.

(5) 406.8 shall not apply to multi-circuit, multipole plugs or receptacles that are part of a Special-Purpose Multi-Circuit Cable System.

(6) All multi-circuit, multipole connectors shall be clearly marked with the voltage of the branch circuits serviced by the connector.

(7) Installation and operation shall be by qualified personnel.

Statement of Problem and Substantiation for Public Input

For more than 30 years, large numbers of portable multi-circuit cable systems have been safely used on a wide variety of applications in article 520 and 530 occupancies. These special-purpose systems utilize multi-circuit, multipole connectors that service a variety of branch circuit ratings. They are installed and operated by qualified personnel, like other special-purpose equipment in article 520 occupancies. Since there is no configuration standard for these connectors, cables operating at different branch circuit ratings may be intermateable.

Such intermateability of different connector ratings has long precedent of safe usage in article 520 occupancies with single-pole separable connectors covered by 520.53(C) and 520.54(I) and in article 530 occupancies covered by 530.22.

However, this intermateability issue has prevented listing of these systems and resulted in a lack of requirements for them in article 520 and 530. It is now time for the NEC to acknowledge the long history of safe use of these systems and include them in article 520 and 530.

In addition, cable types that have been used safely in these systems over the last 30 years have been of hard usage construction, not extra-hard usage. This is because of the unusable weight, size, and lack of flexibility that would result in cables of six circuits or more if they were of extra-hard usage construction. That is why this proposal permits hard usage or extra-hard usage cable types for Trunk Cables.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 823-NFPA 70-2020 [Section No. 520.2]	Defintions needed for this proposal
Public Input No. 823-NFPA 70-2020 [Section No. 520.2]	
Public Input No. 825-NFPA 70-2020 [New Section after 530.12(C)]	

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Public Input No. 3646-NFPA 70-2020 [Section No. 522.2]

(Relocate all definitions in the 522. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

522. 2 Definitions.

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

Entertainment Device.

A mechanical or electromechanical device that provides an entertainment experience.

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

Permanent Amusement Attraction.

Ride devices, entertainment devices, or combination thereof, that are installed so that portability or relocation is impracticable.

Ride Device.

A device or combination of devices that carry, convey, or direct a person(s) over or through a fixed or restricted course within a defined area for the primary purpose of amusement or entertainment.

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. 3647-NFPA 70-2020 [Section No. 525.2]

(Relocate all definitions in the 525. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

525. 2 Definitions.

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

Operator.

The individual responsible for starting, stopping, and controlling an amusement ride or supervising a concession.

Portable Structures.

Units designed to be moved including, but not limited to, amusement rides, attractions, concessions, tents, trailers, trucks, and similar units.

Statement of Problem and Substantiation for Public 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 10:06:25 EDT 2020
Committee: NEC-P15

Public Input No. 853-NFPA 70-2020 [Definition: Portable Structures.]

Portable Structures.

Units designed to be moved including, but not limited to, amusement rides, attractions, concessions, tents, trailers, ~~trucks,~~ and similar units.

Statement of Problem and Substantiation for Public Input

90.2 (B) (1) Not cover (in this code); States in part: Automotive vehicles (are excluded) Chapter 5 can not modify or supplement Article 90. as a result no regulations on Trucks which are automotive vehicles by definition would be applicable. Removing Truck from the portable structures definition would bring it back inline with 90.2 (B) (1)

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Public Input No. 3188-NFPA 70-2020 [Section No. 525.3(B)]

~~(B) Permanent Structures.~~

~~Articles 518 and 520 shall apply to wiring in permanent structures.~~

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. Text in 525.3 (B) provides a references to Articles 518 and 520 for permanent structures. In addition to the NEC Style manual concerns, it seems very possible to have an Article 525 application where a permanent restroom structure, a permanent storage structure, a permanent ticket booth structure, or many other permanent structures could be encountered that are clearly not an Article 518 or 520 application.

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Public Input No. 3186-NFPA 70-2020 [Section No. 525.3(C)]

~~(C) Audio Signal Processing, Amplification, and Reproduction Equipment.~~

~~Article 640 shall apply to the wiring and installation of audio signal processing, amplification, and reproduction equipment.~~

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. Text in 525.3 (C) provides a reference to Article 640 for audio signal processing, amplification, and reproduction equipment. That reference seems to already be available through NEC 90.3 and the Table of Contents without repeating it in this text.

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Public Input No. 3187-NFPA 70-2020 [Section No. 525.3(D)]

~~(D) Attractions Utilizing Pools, Fountains, and Similar Installations with Contained Volumes of Water.~~

~~This equipment shall be installed to comply with the applicable requirements of Article 680 .~~

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. Text in 525.3 (D) provides a reference to Article 680 for attractions with utilizing pools, fountains, and similar installations with contained volumes of water. That reference seems to already be available through NEC 90.3 and the Table of Contents without repeating it in this text.

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Public Input No. 4192-NFPA 70-2020 [Section No. 525.3(D)]

(D) Attractions Utilizing Pools, Fountains, and Similar Installations with Contained Volumes of Water.
This equipment shall be installed to comply with the applicable requirements of Parts I, II, III, and V of Article 680.

Statement of Problem and Substantiation for Public Input

This PI is intended to cure a violation of the whole-article cross reference prohibition in the NEC Style Manual, 4.1.1.

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Public Input No. 3521-NFPA 70-2020 [Section No. 525.20(G)]

(G) Protection.

Flexible cords or cables accessible to the public shall be arranged to minimize the tripping hazard and shall be permitted to be covered with nonconductive matting secured to the walkway surface or protected with another ~~approved~~ identified cable protection method, provided that the matting or other protection method does not constitute a greater tripping hazard than the uncovered cables. Burying cables shall be permitted. The requirements of 300.5 shall not apply.

Statement of Problem and Substantiation for Public Input

Prior to the 2020 NEC, 525.20(G) called for a nonconductive matting to minimize the tripping hazard for flexible cords and cables used at carnivals, circuses, fairs, and similar events. For the 2020 NEC, this provision was strengthened a bit more by requiring the nonconductive matting used for this purpose to be “secured to the walkway surface.” Also added for the 2020 NEC was an addition to this matting provision by allowing other “approved cable protection methods.” Who does approving? According to Article 100, the authority having jurisdiction (AHJ) does approving. No respectable AHJ would make such a ruling, but could the AHJ “approve” something like a newspaper as an “approved cable protection method?” Maybe a better term here might be protected with another “identified” cable protection method. This would limit this provision to something like listed and identified cable floor covering or channels identified for this very purpose that are readily available.

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Public Input No. 379-NFPA 70-2020 [Section No. 525.23]

525.23 Ground-Fault Circuit-Interrupter (GFCI) Protection.

(A) Where GFCI Protection Is Required.

In addition to the requirements of 210.8(B), GFCI protection for personnel shall be provided for the following:

(1) All 125-volt, single-phase, 15- and 20-ampere non-locking-type receptacles used for disassembly and reassembly ~~or readily accessible to the general public~~

(2) Equipment that is readily accessible to the general public ~~and supplied from a 125-volt, single-phase, 15- or 20-ampere branch circuit~~

The GFCI shall be permitted to be an integral part of the attachment plug or located in the power-supply cord within 300 mm (12 in.) of the attachment plug. Listed cord sets incorporating GFCI for personnel shall be permitted.

(B) Where GFCI Protection Is Not

~~Required.~~

~~Receptacles that are not accessible from grade level and that only facilitate quick disconnecting and reconnecting of electrical equipment shall not be required to be provided with GFCI protection. These receptacles shall be of the locking type.~~

~~(C) Where GFCI Protection Is Not~~

Permitted.

Egress lighting shall not be protected by a GFCI.

(

~~D~~

C) Receptacles Supplied by

~~Portable~~

Flexible Cords or Cable .

Where GFCI protection is provided through the use of GFCI receptacles, and the branch circuits supplying receptacles utilize flexible cord or cable , the GFCI protection shall be listed, labeled, and identified for portable use.

Statement of Problem and Substantiation for Public Input

section 210.8(B) has been expanded with the understanding the hazard exist at higher levels. The transit nature of this industry and the demands on the equipment make them prone to failures. The proposed language recognize this environment and new the requirements in 210.8 (B)

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Public Input No. 3190-NFPA 70-2020 [Section No. 525.31]

525.31 Equipment Grounding.

~~All equipment to be grounded shall be connected to an equipment grounding conductor of a type recognized by 250.118 and installed in accordance with Parts VI and VII of Article 250 .~~ The equipment grounding conductor shall be connected to the system grounded conductor at the service disconnecting means or, in the case of a separately derived system such as a generator, at the generator or first disconnecting means supplied by the generator. ~~The grounded circuit conductor shall not be connected to the equipment grounding conductor on the load side of the service disconnecting means or on the load side of a separately derived system disconnecting means.~~

Statement of Problem and Substantiation for Public Input

The current 2020 NEC text in 525.31 recommended to be deleted 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 occupancies 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 as it seems to to modify the general requirements in 250.32 for feeder or branch circuit supplied buildings or structures.

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Public Input No. 3103-NFPA 70-2020 [Article 530]

Article 530 Motion Picture and Television Studios and Similar Locations

Part I. General

530.1 Scope.

The requirements of this article shall apply to television studios and motion picture studios using either film or electronic cameras, except as provided in 520.1 , and exchanges, factories, laboratories, stages, or a portion of the building in which film or tape more than 22 mm (**7** ⁄ **8** in.) in width is exposed, developed, printed, cut, edited, rewound, repaired, or stored.

Informational Note: For methods of protecting against cellulose nitrate film hazards, see NFPA 40-2019, *Standard for the Storage and Handling of Cellulose Nitrate Film* .

530.2 Definitions.

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

Alternating-Current Power Distribution Box (Alternating-Current Plugging Box, Scatter Box).

An ac distribution center or box that contains one or more grounding-type polarized receptacles that may contain overcurrent protective devices.

Bull Switch.

An externally operated wall-mounted safety switch that may or may not contain overcurrent protection and is designed for the connection of portable cables and cords.

Location (Shooting Location).

A place outside a motion picture studio where a production or part of it is filmed or recorded.

Location Board (Deuce Board).

Portable equipment containing a lighting contactor or contactors and overcurrent protection designed for remote control of stage lighting.

Motion Picture Studio (Lot).

A building or group of buildings and other structures designed, constructed, or permanently altered for use by the entertainment industry for the purpose of motion picture or television production.

Plugging Box.

A dc device consisting of one or more 2-pole, 2-wire, nonpolarized, nongrounding-type receptacles intended to be used on dc circuits only.

Portable Equipment.

Equipment intended to be moved from one place to another.

Spider (Cable Splicing Block).

A device that contains busbars that are insulated from each other for the purpose of splicing or distributing power to portable cables and cords that are terminated with single-pole busbar connectors.

Stage Effect (Special Effect).

An electrical or electromechanical piece of equipment used to simulate a distinctive visual or audible effect such as wind machines, lightning simulators, sunset projectors, and the like.

Stage Property.

An article or object used as a visual element in a motion picture or television production, except painted backgrounds (scenery) and costumes.

Stage Set.

A specific area set up with temporary scenery and properties designed and arranged for a particular scene in a motion picture or television production.

Stand Lamp (Work Light).

A portable stand that contains a general-purpose luminaire or lampholder with guard for the purpose of providing general illumination in the studio or stage.

Television Studio or Motion Picture Stage (Sound Stage).

A building or portion of a building usually insulated from the outside noise and natural light for use by the entertainment industry for the purpose of motion picture, television, or commercial production.

530.6 Portable Equipment.

Portable stage and studio lighting equipment and portable power distribution equipment shall be permitted for temporary use outdoors if the equipment is supervised by qualified personnel while energized and barriered from the general public.

Part II. Stage or Set

530.11 Permanent Wiring.

The permanent wiring shall be Type MC cable, Type AC cable containing an insulated equipment grounding conductor sized in accordance with Table 250.122 , Type MI cable, or in approved raceways.

Exception: Communications circuits; audio signal processing, amplification, and reproduction circuits; Class 1, Class 2, and Class 3 remote-control or signaling circuits and power-limited fire alarm circuits shall be permitted to be wired in accordance with Articles 640 , 725 , 760 , and 805 .

530.12 Portable Wiring.

(A) Stage Set Wiring.

The wiring for stage set lighting and other supply wiring not fixed as to location shall be done with listed hard usage flexible cords and cables. Where subject to physical damage, such wiring shall be listed extra-hard usage flexible cords and cables. Splices or taps in cables shall be permitted if the total connected load does not exceed the maximum ampacity of the cable.

(B) Stage Effects and Electrical Equipment Used as Stage Properties.

The wiring for stage effects and electrical equipment used as stage properties shall be permitted to be wired with single- or multiconductor listed flexible cords or cables if the conductors are protected from physical damage and secured to the scenery by approved cable ties or by insulated staples. Splices or taps shall be permitted where such are made with listed devices and the circuit is protected at not more than 20 amperes.

(C) Other Electrical Equipment.

Cords and cables other than extra-hard usage, where supplied as a part of a listed assembly, shall be permitted.

530.13 Stage Lighting and Effects Control.

Switches used for studio stage set lighting and effects (on the stages and lots and on location) shall be of the externally operable type. Where contactors are used as the disconnecting means for fuses, an individual externally operable switch, suitably rated, for the control of each contactor shall be located at a distance of not more than 1.8 m (6 ft) from the contactor, in addition to remote-control switches. A single externally operable switch shall be permitted to simultaneously disconnect all the contactors on any one location board, where located at a distance of not more than 1.8 m (6 ft) from the location board.

530.14 Plugging Boxes.

Each receptacle of dc plugging boxes shall be rated at not less than 30 amperes.

530.15 Enclosing and Guarding Live Parts.

(A) Live Parts.

Live parts shall be enclosed or guarded to prevent accidental contact by persons and objects.

(B) Switches.

All switches shall be of the externally operable type.

(C) Rheostats.

Rheostats shall be placed in approved cases or cabinets that enclose all live parts, having only the operating handles exposed.

(D) Current-Carrying Parts.

Current-carrying parts of bull switches, location boards, spiders, and plugging boxes shall be enclosed, guarded, or located so that persons cannot accidentally come into contact with them or bring conductive material into contact with them.

530.16 Portable Luminaires.

Portable luminaires and work lights shall be equipped with flexible cords, composition or metal-sheathed porcelain sockets, and guards.

Exception: Portable luminaires used as properties in a motion picture set or television stage set, on a studio stage or lot, or on location shall not be considered to be portable luminaires for the purpose of this section.

530.17 Portable Arc Lamps.

(A) Portable Carbon Arc Lamps.

Arc lamps shall be provided with an enclosure designed to retain sparks and carbons and to prevent persons or materials from coming into contact with the arc or bare live parts. The enclosures shall be ventilated. All switches shall be of the externally operable type.

(B) Portable Noncarbon Arc Electric-Discharge Lamps.

Portable noncarbon arc lamps, including enclosed arc lamps, and associated ballasts shall be listed. Interconnecting cord sets and interconnecting cords and cables shall be extra-hard usage type and listed.

530.18 Overcurrent Protection — General.

Automatic overcurrent protective devices (circuit breakers or fuses) for motion picture studio stage set lighting and the stage cables for such stage set lighting shall be as given in 530.18(A) through (G). The maximum ampacity allowed on a given conductor, cable, or cord size shall be as given in the applicable tables of Articles 310 and 400.

(A) Stage Cables.

Stage cables for stage set lighting shall be protected by means of overcurrent devices set at not more than 400 percent of the ampacity given in the applicable tables of Articles 310 and 400.

(B) Feeders.

In buildings used primarily for motion picture production, the feeders from the substations to the stages shall be protected by means of overcurrent devices (generally located in the substation) having a suitable ampere rating. The overcurrent devices shall be permitted to be multipole or single-pole gang operated. No pole shall be required in the neutral conductor. The overcurrent device setting for each feeder shall not exceed 400 percent of the ampacity of the feeder, as given in the applicable tables of Article 310.

(C) Cable Protection.

Cables shall be protected by bushings where they pass through enclosures and shall be arranged so that tension on the cable is not transmitted to the connections. Where power conductors pass through metal, the requirements of 300.20 shall apply.

Portable feeder cables shall be permitted to temporarily penetrate fire-rated walls, floors, or ceilings provided that all of the following apply:

(1) The opening is of noncombustible material.

(2) When in use, the penetration is sealed with a temporary seal of a listed firestop material.

(3) When not in use, the opening shall be capped with a material of equivalent fire rating.

(D) Location Boards.

Overcurrent protection (fuses or circuit breakers) shall be provided at the location boards. Fuses in the location boards shall have an ampere rating of not over 400 percent of the ampacity of the cables between the location boards and the plugging boxes.

(E) Plugging Boxes.

Cables and cords supplied through plugging boxes shall be of copper. Cables and cords smaller than 8 AWG shall be attached to the plugging box by means of a plug containing two cartridge fuses or a 2-pole circuit breaker. The rating of the fuses or the setting of the circuit breaker shall not be over 400 percent of the ampacity of the cables or cords as given in the applicable tables of Articles 310 and 400. Plugging boxes shall not be permitted on ac systems.

(F) Alternating-Current Power Distribution Boxes.

Alternating-current power distribution boxes used on sound stages and shooting locations shall contain connection receptacles of a polarized, grounding type.

(G) Lighting.

Work lights, stand lamps, and luminaires rated 1000 watts or less and connected to dc plugging boxes shall be by means of plugs containing two cartridge fuses not larger than 20 amperes, or they shall be permitted to be connected to special outlets on circuits protected by fuses or circuit breakers rated at not over 20 amperes. Plug fuses shall not be used unless they are on the load side of the fuse or circuit breakers on the location boards.

530.19 Sizing of Feeder Conductors for Television Studio Sets.

(A) General.

It shall be permissible to apply the demand factors listed in Table 530.19(A) to that portion of the maximum possible connected load for studio or stage set lighting for all permanently installed feeders between substations and stages and to all permanently installed feeders between the main stage switchboard and stage distribution centers or location boards.

Table 530.19(A) Demand Factors for Stage Set Lighting

Portion of Stage Set Lighting Load

to Which Demand Factor Applied

(volt-amperes) Feeder Demand Factor

(percent) First 50,000 or less at 100 From 50,001 to 100,000 at 75 From 100,001 to 200,000 at 60 Remaining over 200,000 at 50

(B) Portable Feeders.

A demand factor of 50 percent of maximum possible connected load shall be permitted for all portable feeders.

530.20 Equipment Grounding Conductor.

Type MC cable, Type MI cable, Type AC cable containing an insulated equipment grounding conductor, metal raceways, and all non–current-carrying metal parts of appliances, devices, and equipment shall be connected to an equipment grounding conductor. This shall not apply to pendant and portable lamps, to portable stage lighting and stage sound equipment, or to other portable and special stage equipment operating at not over 150 volts dc to ground.

530.21 Plugs and Receptacles.

(A) Rating.

Plugs and receptacles, including cord connectors and flanged surface devices, shall be rated in amperes. The voltage rating of the plugs and receptacles shall not be less than the nominal circuit voltage. Plug and receptacle ampere ratings for ac circuits shall not be less than the feeder or branch-circuit overcurrent device ampere rating. Table 210.21(B)(2) shall not apply.

(B) Interchangeability.

Plugs and receptacles used in portable professional motion picture and television equipment shall be permitted to be interchangeable for ac or dc use on the same premises, provided they are listed for ac/dc use and marked to identify the system to which they are connected.

530.22 Single-Pole Separable Connectors.

(A) General.

Where ac single-pole portable cable connectors are used, they shall be listed and of the locking type. Sections 400.14 , 406.7 , and 406.8 shall not apply to listed single-pole separable connections and single-conductor cable assemblies utilizing listed single-pole separable connectors. Where paralleled sets of current-carrying single-pole separable connectors are provided as input devices, they shall be prominently labeled with a warning indicating the presence of internal parallel connections. The use of single-pole separable connectors shall comply with at least one of the following conditions:

(1) Connection and disconnection of connectors are only possible where the supply connectors are interlocked to the source and it is not possible to connect or disconnect connectors when the supply is energized.

(2) Line connectors are of the listed sequential-interlocking type so that load connectors shall be connected in the following sequence:

(3) Equipment grounding conductor connection

(4) Grounded circuit conductor connection, if provided

(5) Ungrounded conductor connection, and that disconnection shall be in the reverse order

(6) A caution notice shall be provided adjacent to the line connectors, indicating that plug connection shall be in the following order:

(7) Equipment grounding conductor connectors

(8) Grounded circuit-conductor connectors, if provided

(9) Ungrounded conductor connectors, and that disconnection shall be in the reverse order

The warning sign(s) or label(s) shall comply with 110.21(B) .

(B) Interchangeability.

Single-pole separable connectors used in portable professional motion picture and television equipment shall be permitted to be interchangeable for ac or dc use or for different current ratings on the same premises, provided they are listed for ac/dc use and marked to identify the system to which they are connected.

530.23 Branch Circuits.

A branch circuit of any size supplying one or more receptacles shall be permitted to supply stage set lighting loads.

The requirements in 210.8(B) , other than 210.8(B)(4) , shall apply.

Part III. Dressing Rooms

530.31 Dressing Rooms.

Fixed wiring in dressing rooms shall be installed in accordance with the wiring methods covered in Chapter 3 . Wiring for portable dressing rooms shall be approved.

~~**Part IV.** Viewing, Cutting, and Patching Tables~~

~~**530.41** Lamps at Tables.~~

~~Only composition or metal-sheathed, porcelain, keyless lampholders equipped with suitable means to guard lamps from physical damage and from film and film scrap shall be used at patching, viewing, and cutting tables.~~

~~**Part V.** Cellulose Nitrate Film Storage Vaults~~

~~**530.51** Lamps in Cellulose Nitrate Film Storage Vaults.~~

~~Lamps in cellulose nitrate film storage vaults shall be installed in rigid luminaires of the glass-enclosed and gasketed type. Lamps shall be controlled by a switch having a pole in each ungrounded conductor. This switch shall be located outside of the vault and provided with a pilot light to indicate whether the switch is on or off. This switch shall disconnect from all sources of supply all ungrounded conductors terminating in any outlet in the vault.~~

~~**530.52** Electrical Equipment in Cellulose Nitrate Film Storage Vaults.~~

~~Except as permitted in 530.51 , no receptacles, outlets, heaters, portable lights, or other portable electrical equipment shall be located in cellulose nitrate film storage vaults. Electric motors shall be permitted, provided they are listed for the application and comply with Article 500 , Class I, Division 2.~~

~~**Part VI.** Substations~~

~~**530.61** Substations.~~

~~Wiring and equipment of over 1000 volts, nominal, shall comply with Article 490 .~~

~~**530.62** Portable Substations.~~

~~Wiring and equipment in portable substations shall conform to the sections applying to installations in permanently fixed substations, but, due to the limited space available, the working spaces shall be permitted to be reduced, provided that the equipment shall be arranged so that the operator can work safely and so that other persons in the vicinity cannot accidentally come into contact with current-carrying parts or bring conducting objects into contact with them while they are energized.~~

~~**530.63** Overcurrent Protection of Direct-Current Generators.~~

~~Three-wire generators shall have overcurrent protection in accordance with 445.12(E) .~~

~~**530.64** Direct-Current Switchboards.~~

~~**(A)** General.~~

~~Switchboards of not over 250 volts dc between conductors, where located in substations or switchboard rooms accessible to qualified persons only, shall not be required to be dead-front.~~

~~**(B)** Circuit Breaker Frames.~~

~~Frames of dc circuit breakers installed on switchboards shall not be required to be connected to an equipment grounding conductor.~~

Additional Proposed Changes

File Name	Description	Approved
NEC530Submission-AMR-FINAL.docx	This file is intended to completely replace the current Article 530.	

Statement of Problem and Substantiation for Public Input

Substantiation for draft revision of article 530

September 4, 2020

This PI was created by an entertainment industry task group with broad representation from motion picture producers, labor, supply chain, and users.

Chair: Alan M. Rowe, CMP 15, IATSE Local 728 Studio Electrical Lighting Technicians. Representing: International Alliance of Theatrical Stage Employees.
Steven R. Terry, CMP 15, Electronic Theatre Controls, Inc., Representing: US Institute for Theatre Technology
Mitchell K. Hefter, CMP 15, Signify. Representing: Illuminating Engineering Society
Michael Skinner, CMP 15, CSATF. Representing: Alliance of Motion Picture and Television Producers
Edwin Kramer, CMP 15, Radio City Music Hall. Representing: International Alliance of Theatrical Stage Employees.
Hans Lau, DADCO, LLC. Representing: IATSE Local 728 Studio Electrical Lighting Technicians.
Ron Dahlquist, DADCO, LLC. Representing: IATSE Training Trust Fund

In addition to this core group, several focus group meetings were held with wide groups of stakeholders to gain industry input and guidance.

For many years, equipment and safe practice in article 530 occupancies did not change in any material way, and thus the wording of article 530 needed little change. However, over the past five years, there has been an onslaught of new

technology that has been brought to studios and locations. Old technologies have disappeared and been replaced with new technologies that bear directly on the content of article 530.

Old technologies that have disappeared or are quickly reducing in use include:
1. DC power and associated distribution equipment
2. Carbon-arc luminaires
3. Tungsten luminaires
4. Fused extension cables
5. Video tape of any width
6. Film

New Technologies that are dominant or emerging:
7. AC power provided by portable or permanent facility generators
8. Portable and permanent AC power distribution
9. AC enclosed-arc luminaires
10. AC LED luminaires and stage effects
11. Digital cameras with much lower light requirements and associated reduction in power consumption

As a result, much of the current content of article 530, as well as the organization of the article sections, has become obsolete when viewed in the context of current safe industry practice all over the US.. The task group that authored this PI elected to propose a complete removal of current article 530 and replacement with the proposed text. Some of the proposed text is similar or identical to current article 530, but has been located in a different place in the article.

Substantiations for specific sections with material changes:
530.1 Scope. An acknowledgement of current safe practice has been added: the fact that article 530 occupancies are staffed by qualified personnel. In addition, “locations” has been added to areas covered by 530. Motion picture production no longer occurs only in major centers such as Hollywood and New York—it happens all over the country. The fact that “locations” is a common place where production occurs and it was missing from article 530 resulted in uneven enforcement of safe practice depending on geographic location. The addition of requirements for “locations” to article 530 seeks to correct this. In addition, the changes in this PI should provide additional clarity for AHJ’s in locations where motion picture or television was not previously the norm.

Part reorganization. Parts have been reorganized to better separate the different requirements of different areas of a studio or location. New parts are:
I. General
II. Portable Equipment, Studio Production and Location Areas
III. Portable Equipment, Support Areas
IV. Dressing Rooms
V. Portable Substations

530.2 Definitions. Obsolete definitions have been removed and updated and new definitions have been added.

530.3 Restricted Public Access and 530.4 Supervision by Qualified Personnel. These two sections make clear that the safe use of current practices allowed by Article 530 is dependent on restricted public access and supervision by qualified personnel.

530.6 Communications, Signaling Systems, Data Systems, Fire Alarm Systems, and Systems Less Than 120 Volts, Nominal. The exception from 530.11 Permanent Wiring (now 530.5) is now its own section. The relocation complies with the Style Guide preference to minimize exceptions and use positive language. Content is added to clarify Power over Ethernet (PoE) wiring is included. PoE is addressed in Article 725 – specifically 725.144 [Transmission of Power & Data] under Part III of Article 725 [Class 2 and Class 3 circuits] - “Class 2 circuits that transmit power, data, or both to a powered device” – i.e., Power Over Ethernet.
Article 840 [Premise-Powered Broadband Communications Systems] does address PoE: 840.3(B)(4) refers back to 725.21 and Part III of 725. Sections 840.160 and 840.170(G) also address the Class 2 aspect.

530.9 Plugs and Receptacles. Updated to match requirements of 520.67. Requirements are identical in 530 and 520 occupancies.
530.10 Single-Pole Separable Connectors. Reflects the move of general requirements to 406.13, leaving only Article 530-specific requirements.
530.21 Portable Equipment. Removes construction requirements and adds a listing requirement for all portable equipment. Most portable studio equipment is now too complex to be field evaluated without a listing. Certain portable equipment is purpose-built for a specific production, is not serially produced, and therefore not suitable for listing. Such unlisted equipment must be approved. Adds an informational note pointing to ANSI/ESTA E1.58 for safe use of equipment outdoors.
530.22 Portable Wiring. Now makes clear that portable feeder cables that penetrate Walls, Floors, or Ceilings must be protected by an overcurrent protective device rated not greater than the cable ampacity. Clarifies that 530.23(B) 400% overcurrent protective device allowance does not apply in this application.

530.23 Overcurrent Protection. Limits the allowable use of current safe industry practice of 400% overcurrent protection and makes clear that if 400% overcurrent protection is used, the connected load on a cable cannot exceed the ampacity of the cable.
530.27 Portable Luminaires. Removes construction requirements and adds a listing requirement. Removes obsolete carbon-arc fixtures and adds informational note pointing to ANSI/ESTA E1.16 for requirements on enclosed-arc interconnecting cord

sets.

Part III. Portable Equipment, Support Areas. This part introduces the fact that requirements are different for support areas and production areas.
530.44 Ground-Fault Circuit Interrupter (GFCI) Protection. Clarifies that while some circuits in production areas are exempt from outdoor GFCI requirements per 530.11, there is no such exemption for certain 15A and 20A circuits in support areas.
530.45 Portable Trailers and Production Vehicles. Adds specific requirements for such vehicles in order to address recurring field conditions where electric shock occurred due to improper multiple neutral-grounding conductor bonds in a field-assembled system.
530.71 Portable Substations, General. Clarifies that reduction in working spaces must be approved.

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ARTICLE 530 PROPOSED REVISION– ALAN M. ROWE

Part I. General

Scope 530.1. The requirements of this article shall apply to motion picture and television production in facilities and locations staffed by qualified personnel, except as provided in 520.1. Such occupancies shall include those using either electronic or film cameras for image capture.

> Informational Note: For methods of protecting against cellulose nitrate film hazards, see NFPA 40-2019, *Standard for the Storage and Handling of Cellulose Nitrate Film*.

530.2 Definitions. The definitions in this section shall apply only in this article.

Basecamp. The main support area.

Bull Switch (Disconnect). An externally operated wall-mounted or portable safety switch that may or may not contain overcurrent protection and is designed for the connection of portable cables and cords.

DC Plugging Box. A dc device consisting of one or more 2-pole, 2-wire, nonpolarized, non-grounding type receptacles intended to be used on dc circuits only.

Motion Picture and/or Television Studio. A building, group of buildings, other structures, and outdoor areas designed, constructed, permanently altered, designated, or approved for the purpose of motion picture or television production.

Motion Picture and/or Television Studio Sound Stage. A building or portion of a building, usually insulated from outside noise and natural light, designed, constructed, or altered for the purpose of image capture.

Portable Equipment. Equipment intended to be moved from one place to another.

Portable Power Distribution Unit. A power distribution box containing single-pole separable connectors and/or grounding-type polarized receptacles, and overcurrent protection devices.

> Informational Note: See ANSI/UL 1640 *Portable Power Distribution Equipment* for information on portable power distribution units

Portable Substation. A portable assembly, usually mounted on a trailer, containing primary and secondary switchgear, and a transformer.

Production Areas. Areas where portable electrical equipment covered by this article is used to implement the capture of images.

Purpose-Built. A custom luminaire, piece of lighting equipment, or effect that is constructed for a specific purpose and is not serially manufactured or available for general sale.

Remote Location. A location, other than a motion picture or television studio, where a production is filmed or recorded.

Spider (Cable Splicing Block). A listed device that contains busbars, but no overcurrent protection devices, for the purpose of splicing or distributing power to portable cables and cords that are terminated with single-pole busbar connectors or listed single-pole separable connectors.

Stage or Special Effect. An electrical or electromechanical piece of equipment used to generate a visual, audible, or other physical effect including, but not limited to, wind machines, lightning simulators, stunt rigs, and the like.

Stage Property. An article or object used as a visual element in a motion picture or television production, except painted backgrounds (scenery) and costumes.

Stage Set. A specific area set up with scenery and properties designed and arranged for a particular scene in a motion picture or television production.

Stand Lamp (Work Light). A portable stand that contains a general-purpose luminaire or lampholder with guard for the purpose of providing general illumination in the studio or stage.

Support Areas. Areas, other than fixed production offices, intended to support production and where the capture of the image will not take place. Such areas include, but are not limited to, mobile production office, storage, and workspaces; vehicles and trailers for cast, makeup, hair, lighting, grip, wardrobe, props, catering, craft services; and portable restrooms.

530.3 Restricted Public Access.

(A) Studios. The electrical equipment covered by this article shall be used in motion picture or television studios with restricted public access.

(B) Remote Locations. Where the equipment is deployed on remote locations, restricted public access shall be provided in the form of physical barriers or other access control measures.

530.4 Supervision by Qualified Personnel. Portable electrical equipment, including distribution systems, generators, battery systems, and other power-sources, shall be deployed, energized, and while energized, operated and continuously supervised by trained, qualified, and employer-authorized personnel.

530.5 Permanent Wiring. The permanent wiring shall be Type MC cable, Type AC cable containing an insulated equipment grounding conductor sized in accordance with Table 250.122, Type MI cable, or in approved raceways.

530.6 Communications, Signaling Systems, Data Systems, Fire Alarm Systems, and Systems Less Than 120 Volts, Nominal. Communications circuits; audio signal processing, amplification, and reproduction circuits; Class 1, Class 2, and Class 3 remote- control or signaling circuits ; Class 2 circuits that transmit power, data, or both to a powered device; and power-limited fire alarm circuits shall be permitted to be wired in accordance with Articles 640, 725, 760, 805, and 840.

530.7 Sizing of Feeder Conductors for Motion Picture and/or Television Studio Sets

(A) General. It shall be permissible to apply the demand factors listed in Table 530.19(A) to that portion of the maximum possible connected load for studio or stage set lighting for all permanently installed feeders between substations and stages and to all permanently installed feeders between the main stage switchboard and stage distribution centers.

Table 530.7(A) Demand Factors for Stage Set Lighting.

Portion of Stage Set Lighting Load to Which Demand Factor Applied (volt-amperes)	Feeder Demand Factor (Percent)
First 50,000 or less at	100
From 50,001 to 100,000 at	75
From 100,001 to 200,000 at	60
Remaining over 200,000 at	50

530.8 Equipment Grounding Conductor. Type MC Cable, Type MI cable, Type AC cable containing an insulated equipment grounding conductor, metal raceways, and all non-current-carrying metal parts of appliances, devices and equipment shall be connected to an equipment grounding conductor. This requirement shall not apply to pendant and portable lamps, portable stage lighting, and special stage equipment operating at not over 150 volts dc to ground

530.9 Plugs and Receptacles.

ARTICLE 530 PROPOSED REVISION– ALAN M. ROWE

(A) Rating. Plugs and receptacles, including cord connectors and flanged surface devices, shall be rated in amperes. The voltage rating of the plugs and receptacles shall not be less that the nominal circuit voltage. Plug and receptacle ampere rating for ac circuits shall not be less than the feeder or branch-circuit overcurrent device ampere rating. Plugs and receptacles shall be designed so that differently rated devices cannot be connected together; however, a 20-ampere T-slot receptacle shall be permitted to accept a 15-ampere attachment plug of the same voltage rating. Table 210.21 (B) (2) shall not apply. Alternating-current multipole connectors shall be polarized and comply with 406.7 and 406.10.

(B) Interchangeability. Plugs and receptacles used in portable professional motion picture and television equipment shall be permitted to be interchangeable for ac or dc use on the same premises, provided they are listed for ac and dc use and clearly marked to identify the system to which they are connected.

530.10 Single-Pole Separable Connectors.

(A) General. Single-pole separable connectors shall comply with the requirements of 406.13. Sections 400.14, 406.7 and 406.8 shall not apply to listed single-pole separable connectors.

(B) Paralleled Input Devices. Where paralleled sets of current-carrying single-pole separable connectors are provided as input devices, they shall be prominently labeled with a warning indicating the presence of internal parallel connections. All paralleled input devices other than the primary input devices shall be guarded against accidental contact.

(C) Supply Feed-Through Outlets. Where portable equipment contains a feed-through outlet of the same rating as its supply inlet, the feed-through outlet shall not require overcurrent protection in the equipment.

530.11 Branch Circuits. A branch circuit of any size supplying one or more receptacles shall be permitted to supply stage set lighting loads.

The requirements of 210.8(B), other than 210.8(B)(4), shall apply.

530.12 Enclosing and Guarding Live Parts.

(A) Live Parts. (A) Live parts, and other parts likely to become energized, of all electrical equipment shall be enclosed, guarded, or located so that persons cannot accidentally come in contact with them or bring conductive material into contact with them.

(B) Switches. All switches shall be of the externally operable type.

Part II. Portable Equipment, Production Areas in Studios and Remote Locations

530. 21 Portable Equipment.

(A) Listing. Portable stage and studio electrical equipment shall be listed or approved. Field assembled extension cords and multi conductor cable assemblies consisting of listed connectors and cable shall be permitted in production areas.

(B) Outdoor Use. Portable stage and studio equipment and portable power distribution equipment not identified for outdoor use shall be permitted for temporary use, provided the equipment is supervised by qualified personnel while energized and barriered from the general public.

> Informational note: For requirements covering temporary outdoor use of equipment not identified for outdoor use see ANSI/ESTA E1.58 *Electrical Safety Standard for Portable Stage and Studio Equipment Used Outdoors.*

530.22 Portable Wiring.

ARTICLE 530 PROPOSED REVISION– ALAN M. ROWE

(A) Stage Set Wiring. The wiring for stage set lighting and other supply wiring not fixed as to location shall use listed hard usage flexible cords and cables. Where subject to physical damage, such wiring shall use listed extra-hard usage flexible cords and cables. Splices and taps in cables shall be permitted if the total connected load does not exceed the maximum ampacity of the cable.

(B) Stage or Special Effects and Electrical Equipment Used as Stage Properties. The wiring for stage effects and electrical equipment used as stage properties shall be permitted to be wired with single- or multiconductor listed flexible cords or cables if the conductors are protected from physical damage and secured to the scenery by approved methods including, but not limited to, cable ties or insulated staples. Splices or taps shall be permitted where such are made with listed devices and the circuit is protected at not more than 20 amperes.

(C) Other Electrical Equipment. Cords and cables other than hard usage, where supplied as part of a listed assembly, shall be permitted.

(D) Portable Feeder Cable Penetration of Walls, Floors, or Ceilings. Portable feeder cables shall be permitted to temporarily penetrate fire-rated walls, floors, or ceilings provided that all of the following apply:

(1) The cable is protected by an overcurrent device with a rating that does not exceed the ampacity of the cable in Table 400.5(A)(2).

(2) The opening is on noncombustible materials.

(3) When in use, the penetration is sealed with a temporary seal of a listed firestop material.

When not in use, the opening shall be capped with a material of equivalent fire rating.

(E) Connectors. Connectors shall be rated in amperes and designed so that differently rated devices cannot be connected together; however, a 20-ampere T-slot receptacle shall be permitted to accept a 15-ampere attachment plug of the same voltage rating.

(F) Cable Protection. Cables shall be protected by bushings where they pass through enclosures and shall be arranged so that the tension on the cable is not transmitted to the connections. Where power conductors pass through metal, the requirements of 300.23 shall apply.

530.23 Overcurrent Protection. Overcurrent protective devices in production areas shall comply with 530.23(A) through (D).

(A) Portable Stage Cables. Overcurrent protection for portable stage cables shall comply with 240.5.

(B) Portable Single Conductor Feeder Cables Utilizing Single-Pole Separable Connectors. Portable feeder cables in production areas shall be protected by means of overcurrent devices set at not more than 400 percent of the ampacity of the cable in Table 400.5(A)(2). The maximum load on a single conductor portable feeder cable shall not exceed the cable ampacity in Table 400.5(A)(2).

(C) DC Plugging boxes. Cables and cords supplied through plugging boxes shall be of copper. Cables and cords smaller than 8 AWG shall be attached to a plugging box by means of a plug containing two cartridge fuses or a 2-pole circuit breaker. Plugging boxes shall not be permitted on ac systems. Receptacles in dc plugging boxes shall be rated at not less than 30 amperes.

(D) Alternating-Current Power Distribution Boxes. Alternating-current power distribution boxes used in production areas shall contain receptacles of a polarized, grounding type. A feed-through outlet of the same rating as its supply inlet shall not require overcurrent protection in the equipment. Alternating-current power distribution boxes shall be listed.

Informational note: for information on alternating-current power distribution boxes see ANSI UL 1640 *Standard for Portable Power Distribution*.

ARTICLE 530 PROPOSED REVISION– ALAN M. ROWE

530.24 Purpose-built luminaires, lighting, and effects equipment. Purpose-built luminaires, lighting, and effects equipment shall not be required to be listed but shall be approved.

530.26 Portable Luminaires.

(A) Portable Luminaires shall be listed.

Exception: Portable luminaires used as properties in a motion picture set or television stage set, on a studio stage or lot, or on location shall not be considered to be portable luminaires for the purpose of this section.

(B) Portable enclosed-arc luminaires. Portable enclosed-arc lamps, and associated ballasts shall be listed. Interconnecting cord sets and interconnecting cords and cables for enclosed-arc luminaires shall be extra-hard usage type and listed.

Note: for information on enclosed-arc luminaire interconnecting cord sets and cables see ANSI/ESTA E1.16 Entertainment Technology - Configuration Standard for Metal-Halide Power Cables.

Part III. Portable Equipment, Support Areas

530.41 Restricted Public Access. The electrical equipment used in non-production areas shall be restricted from access by the general public.

530.42 Overcurrent Protection for portable cable.

Overcurrent protection of conductors for portables shall comply with 240.5.

530.43 Portable Generators.

(A) Location. Portable and vehicle mounted generators shall be located away from flammable materials and exhaust shall be vented away from structures and other areas where people may congregate.

(B) Ventilation. Portable and vehicle mounted generators shall not be operated in areas without natural or provided ventilation to prevent the buildup of exhaust.

530.44 Ground-Fault Circuit Interrupter (GFCI) Protection

(A) Where GFCI Protection Is Required. GFCI protection for personnel shall be provided for the following:

(1) All 125-volt, single-phase, 15- and 20-ampere non-locking type receptacles used for disassembly and reassembly or readily accessible to unqualified personnel

(2) Equipment that is readily accessible to unqualified personnel and supplied from a 125-volt, single-phase, 15- or 20-ampere branch circuit

The GFCI shall be permitted to be an integral part of the attachment plug or located in the power-supply cord within 300 mm (12 in.) of the attachment plug. Listed cord sets incorporating GFCI for personnel shall be permitted.

(B) Where GFCI Protection Is Not Permitted. Egress lighting shall not be protected by a GFCI.

(C) Receptacles Supplied By Portable Cords. Where GFCI protection is provided through the use of GFCI receptacles, and the branch circuits supplying receptacles utilize flexible cord, the GFCI protection shall be listed, labeled, and identified for portable use.

530.45 Production Vehicles and Trailers. Where the wiring of production vehicles and trailers are supplied by a grounded ac service or by a grounded separately derived ac source, they shall comply with (A) through (F) of this section.

(A) Internal Panelboards (where used). A listed and appropriately rated panelboard or other equipment specifically listed for this purpose shall be used. The grounded conductor termination bar shall be insulated from the enclosure.

(B) Grounding. The panelboard shall have an equipment grounding bus with terminals for all equipment grounding conductors or other approved equipment grounding means.

(C) Power-Supply Grounding. The equipment grounding conductor in the supply cord or feeder shall be connected to the equipment grounding bus or other approved equipment ground means in the panelboard.

(D) Insulated Grounded Conductor (Neutral Conductor). The grounded circuit conductor (neutral conductor) shall be insulated from the equipment grounding conductors and from equipment enclosures and other grounded parts.

(E) Required Bonding. All exposed non-current-carrying metal parts that are likely to become energized shall be effectively bonded to the grounding terminal or enclosure of the panelboard. A bonding conductor shall be connected between any panelboard and an accessible terminal on the chassis of the portable trailer or vehicle.

(F) Production Vehicles and Trailers with Onboard Generators. Production vehicles and trailers with onboard generators shall comply with 551.30.

530.46 Protection. Flexible cords and cables accessible to personnel shall be arranged to minimize the tripping hazard and shall be permitted to be covered with a nonconductive matting secured to the walkway surface or protected with another approved cable protection method, provided that the matting or other protection method does not constitute a greater tripping hazard than the uncovered cables.

Part V. Dressing Rooms

530.61 Dressing Rooms. Fixed wiring in dressing rooms shall be installed in accordance with the wiring methods covered in Chapter 3.

Part VI. Portable substations.

530.71 General. Wiring and equipment in portable substations rated 50 to 1000 volts, nominal, shall conform to the sections applying to installations in permanently fixed substations, but, due to the limited space available, when approved, the working spaces shall be permitted to be reduced, provided the equipment is arranged so that the qualified operator can work safely and the equipment is guarded so that other persons in the vicinity cannot accidentally come into contact with current-carrying parts or bring conducting objects into contact with them while they are energized.

530.72 Over 1000 Volts, Nominal. Wiring and equipment of portable substations rated over 1000 volts, nominal, shall comply with the requirements of Part IV of Article 490.

Public Input No. 3649-NFPA 70-2020 [Section No. 530.2]

(Relocate all definitions in the 530. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

530. 2 Definitions.

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

Alternating-Current Power Distribution Box (Alternating-Current Plugging Box, Scatter Box).

An ac distribution center or box that contains one or more grounding-type polarized receptacles that may contain overcurrent protective devices.

Bull Switch.

An externally operated wall-mounted safety switch that may or may not contain overcurrent protection and is designed for the connection of portable cables and cords.

Location (Shooting Location).

A place outside a motion picture studio where a production or part of it is filmed or recorded.

Location Board (Deuce Board).

Portable equipment containing a lighting contactor or contactors and overcurrent protection designed for remote control of stage lighting.

Motion Picture Studio (Lot).

A building or group of buildings and other structures designed, constructed, or permanently altered for use by the entertainment industry for the purpose of motion picture or television production.

Plugging Box.

A dc device consisting of one or more 2-pole, 2-wire, nonpolarized, nongrounding-type receptacles intended to be used on dc circuits only.

Portable Equipment.

Equipment intended to be moved from one place to another.

Spider (Cable Splicing Block).

A device that contains busbars that are insulated from each other for the purpose of splicing or distributing power to portable cables and cords that are terminated with single-pole busbar connectors.

Stage Effect (Special Effect).

An electrical or electromechanical piece of equipment used to simulate a distinctive visual or audible effect such as wind machines, lightning simulators, sunset projectors, and the like.

Stage Property.

An article or object used as a visual element in a motion picture or television production, except painted backgrounds (scenery) and costumes.

Stage Set.

A specific area set up with temporary scenery and properties designed and arranged for a particular scene in a motion picture or television production.

Stand Lamp (Work Light).

A portable stand that contains a general-purpose luminaire or lampholder with guard for the purpose of providing general illumination in the studio or stage.

Television Studio or Motion Picture Stage (Sound Stage).

A building or portion of a building usually insulated from the outside noise and natural light for use by the entertainment industry for the purpose of motion picture, television, or commercial production.

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-P15

Public Input No. 195-NFPA 70-2019 [Section No. 530.11]

530.11 Permanent Wiring.

The permanent wiring shall be Type MC cable, Type AC cable containing an insulated equipment grounding conductor sized in accordance with Table 250.122, Type MI cable, or in approved raceways.

Exception: Communications circuits; audio signal processing, amplification, and reproduction circuits; Class 1, Class 2, and Class 3 remote-control or signaling circuits and power-limited fire alarm circuits shall be permitted to be wired in accordance with Articles 640, 725, 760, 800 and 805.

Statement of Problem and Substantiation for Public Input

The 2020 NEC introduced Article 800, General Requirements for Communications Systems. This PI corrects an apparent omission by adding reference to Article 800.

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Public Input No. 1776-NFPA 70-2020 [Section No. 530.12(A)]

(A) Stage Set Wiring.

The wiring for stage set lighting and other supply wiring not fixed in place or as to location shall be ~~done~~ installed with listed hard usage flexible cords and cables. Where subject to physical damage, such wiring shall be listed extra-hard usage flexible cords and cables. Splices or taps in cables shall be permitted if the total connected load does not exceed the maximum ampacity of the cable.

Statement of Problem and Substantiation for Public Input

This suggested change is editorial in nature to provide code users clarity for installation of stage set lighting and supply wiring.

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Public Input No. 825-NFPA 70-2020 [New Section after 530.12(C)]

Special-Purpose Multi-Circuit Cable Systems.

Special-Purpose Multi-Circuit Cable Systems shall comply with 520.XX.

Statement of Problem and Substantiation for Public Input

Special-Purpose Multi-Circuit Cable Systems are used predominantly in article 520 occupancies but identical systems are also used with identical requirements in article 530 occupancies. These systems and their components are defined in my PI 823. Requirements for these systems are contained in my PI 824. A pointer is now needed in article 530 to the definitions and requirements contained in article 520.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 823-NFPA 70-2020 [Section No. 520.2]	Definitions realing to this proposal
Public Input No. 824-NFPA 70-2020 [New Section after 520.68(C)]	Requirements Relating to this proposal

Submitter Information Verification

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Committee: NEC-P15

Public Input No. 3650-NFPA 70-2020 [Section No. 540.2]

(Relocate all definitions in the 540. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

540. 2 Definitions.

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

Nonprofessional Projector.

Nonprofessional projectors are those types of projectors that do not comply with the definition of *Professional-Type Projector*.

Professional-Type Projector.

A type of projector using 35- or 70-mm film that has a minimum width of 35 mm (1⅜ in.) and has on each edge 212 perforations per meter (5.4 perforations per inch), or a type using carbon arc, xenon, or other light source equipment that develops hazardous gases, dust, or radiation.

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. 3191-NFPA 70-2020 [Section No. 540.50]

~~**540.50** Audio Signal Processing, Amplification, and Reproduction Equipment.~~

~~Audio signal processing, amplification, and reproduction equipment shall be installed as provided in Article 640 .~~

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. Text in 540.50 provides a reference to Article 640 for audio signal processing, amplification, and reproduction equipment. That reference seems to already be available through NEC 90.3 and the Table of Contents without repeating it in this text. A companion input is submitted to delete the title to Part IV as this section includes the complete text of that part.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3192-NFPA 70-2020 [Part IV.]	
Public Input No. 3192-NFPA 70-2020 [Part IV.]	

Submitter Information Verification

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Public Input No. 4383-NFPA 70-2020 [Part I.]

Part I. ~~General Requirements~~ General

Statement of Problem and Substantiation for Public Input

"Article 525 is subdivided into multiple parts and needs to comply with the revised NEC Style Manual on Parts 2.1.4 Part titles shall be descriptive and as concise as possible.
2.4.2.1 ...Where an article has multiple parts, Part I. shall be titled “General”. "

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Public Input No. 4610-NFPA 70-2020 [New Part after II.]

CATEGORY 4 (SUPPORT) SPACES - NURSES' STATION MINIMUM USB RECEPTACLE OUTLET REQUIREMENTS

517.22 Category 4 (Support) Spaces.

517.22(A) Nurses' Station Minimum USB Receptacle Outlet Requirements.

517.22(A)(1) Countertops, Work Surfaces, and other Similar Work Areas.

Countertops, work surfaces, and other similar work areas serving a nurses' station area shall be provided with a minimum of one receptacle outlet per each sixteen (16) square-feet of countertop or work surface area.

517.22(A)(2) Receptacle Requirements.

The receptacle(s) required in 517.22(A)(1) shall be permitted to be of the single, duplex, or quadruplex type or any combination of the three. All receptacles serving the nurses' station countertop, work surface, and other similar work area shall be Receptacles with USB Chargers as described in 406.3(F).

Statement of Problem and Substantiation for Public Input

The Nurses' Station acts as the "central nervous system" of the modern medical facility where all front-line health care providers send and receive patient data to and from the larger medical data recording system. This patient information is normally be captured by the medical professional and recorded using a "Computer on Wheels" (COW) or "Workspace on Wheels" (WOW). This COW or WOW device is wheeled into the patient room where data is collected bedside.

According to Martha Power (APRN, SCRN, FAHA) who has served for ten years as the Stroke Coordinator at the West Virginia University Ruby Memorial Hospital, medical facilities have recently adapted to record this information via Tablet PCs. The Tablet PC provides a handheld solution to quickly input the necessary patient information and thus minimizing the needed time bedside in an isolation environment. This device also has the capability of an alternate communication method via visual teleconference between a patient admitted in isolation and their families who have limited to no safe visitation arrangement.

This recent pivot toward Tablet PCs by the medical field has highlighted a need of infrastructure to support these devices. Tablet PCs can be charged via USB connection which is often hard to come by in the hospital environment. The lack of available receptacle outlets at nurses' stations due to the amount of administrative equipment needed at this central hub is exasperated by the common blocking of multiple available receptacle outlets due to the horizontal output design of a USB charging adapter. This phenomenon has causes front-line health care workers to search for available receptacle outlets where the device can be replenished. The worker must then notify the location of the Tablet PC to other coworkers who may later need to use this device. If this message is not relayed, the situation arises of missing Tablet PCs leading to the hunting of necessary equipment in times of emergency.

The proposed square-footage method of required receptacles serving nurses' stations is consistent with similar Chapter 2 methods to calculate lighting loads or required minimum receptacles in dwelling units serving island and peninsular countertops and work surfaces. The selected value of one required receptacle outlet per each sixteen square-feet is based on the intention to require one receptacle outlet per each computer workstation present at the nurses' station. "Computer workstation" is not a term defined in Article 100 nor are all nurses' stations created equally. In order to avoid proposing the term "computer workstation" to be defined in Chapter 5, sixteen square-feet is to be used as a proxy to represent what would be the dimensions of the average US computer workstation in a nurses' station. According to a white paper published by the Cleveland Clinic titled "Computer Workstation Design Standard", a work surface without a keyboard tray shall be 28-30 inches high, 30 inches deep, and at least 36 inches wide to ensure computer workstations are designed utilizing ergonomic principles to minimize known risk factors for musculoskeletal disorders and/or physical or visual discomfort. Additional area was attributed to the final calculation in order to accommodate for space used by stationary supplies and the eventual storage of Tablet PCs that this Public Input proposes.

This Public Input is submitted with the intention of requiring Receptacles with USB Chargers as described in 406.3(F) to be installed at nurses' stations in order to provide a uniform charging area for Tablet PCs. Every second in a medical care facility not searching for necessary equipment or charging infrastructure in the field aids the front-line health care workers to do what they do best.

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Public Input No. 4621-NFPA 70-2020 [New Part after II.]

Contactless lighting controls

Contact free lighting controls shall be allowed in healthcare facilities

Statement of Problem and Substantiation for Public Input

The need for lighting controls to be contact free particularly in healthcare facilities is more critical than ever. Toggle switches specifically are hot spots for contamination and infection transmission. To clarify, I'm not suggesting occupancy senors or vacancy sensors. I am suggesting both the on and off functions would still both be controlled via user interface via voice activation or other active means not motion, infrared etc. I simply want specific allowance for this type of lighting control in healthcare facilities.

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Public Input No. 3192-NFPA 70-2020 [Part IV.]

~~**Part IV.** Audio Signal Processing, Amplification, and Reproduction Equipment~~

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. Text in 540.50 provides a reference to Article 640 for audio signal processing, amplification, and reproduction equipment. That reference seems to already be available through NEC 90.3 and the Table of Contents without repeating it in this text. This companion input is submitted to delete the title to Part IV as this section includes the complete text of that part.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3191-NFPA 70-2020 [Section No. 540.50]	
Public Input No. 3191-NFPA 70-2020 [Section No. 540.50]	

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State:
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Submittal Date: Sun Sep 06 16:56:05 EDT 2020
Committee: NEC-P15

Public Input No. 4541-NFPA 70-2020 [Part V.]

Part V. – ~~X-Ray Installations~~ Diagnostic Imaging and Theraputic Equipment Installations

Statement of Problem and Substantiation for Public Input

The current language poorly distinguishes between x-ray equipment and other modalities for diagnostic imaging. More and more, non-x-ray diagnostic equipment is becoming the norm, and the NEC needs to better define these needs. Similarly, the language around therapeutic equipment needs some updating.
As important, the current demand factors given in this section result in over-sized systems and wasted resources that could be better used in providing care. ASHRAE and the University of California are engaged in research efforts now to better collect and document reality, and to propose revisions to the demand factors. Unfortunately, the coronavirus slowed down this work, so the data is not available as of this submission. We will submit the data for further consideration in the near future, hopefully by the time of the CMP-15 meeting.

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