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. 991-NFPA 70-2020 [Global Input]

620.11 Insulation of Conductors.

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

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

650.6(D) Cable Covering.

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

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

725.179(D) Types CL2X and CL3X.

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

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

800.179(D) Limited-Use Cables.

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

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

805.179(B) Type CMUC Undercarpet Wires and Cables.

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

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

Annex A Product safety standards

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

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

Additional Proposed Changes

File Name	Description	Approved
1581_code_proposal.docx	proposal	✓

Statement of Problem and Substantiation for Public Input

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

The name of the test in UL 2556 is FV-2/VW-2 to accommodate North American naming conventions. This

change is also reflected as an update.

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

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Rationale

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

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

Part II. Conductors

620.11 Insulation of Conductors.

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

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

650.6(D) Cable Covering.

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

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

725.179(D) Types CL2X and CL3X.

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

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

800.179(D) Limited-Use Cables.

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

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

805.179(B) Type CMUC Undercarpet Wires and Cables.

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

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

Annex A Product safety standards

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

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

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

Public Input No. 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. 2775-NFPA 70-2020 [Global Input]

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Several sections of Article 725 have been deleted because a new Article has been developed for Class 1 circuits

Additional Proposed Changes

File Name	Description	Approved
delete_from_article_725.docx		

Statement of Problem and Substantiation for Public Input

This public input is submitted on behalf of a CMP 3 Task Group consisting of Randy Ivans (Chair), Paul Casparro, Shane Clary, Michael Cogbill, Chad Jones, Robert Jones, Ward Judson, Tim Mikloiche, Samuel Rokowski, George Straniero, Ronald Tellas, and George Zimmerman.
A new Article has been developed for Class 1 circuits and all references to Class 1 circuits need to be removed from Article 725.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2774-NFPA 70-2020 [New Article after 725]	

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ARTICLE 725
~~Class 1~~, Class 2, and Class 3 ~~Remote-Control, Signaling, and~~ Power-Limited Circuits

Part I. General

725.1 Scope. This article covers ~~remote-control, signaling, and~~ power-limited circuits that are not an integral part of a device or of utilization equipment.

> Informational Note: The circuits described herein are characterized by usage and electrical power limitations that differentiate them from electric light and power circuits; therefore, alternative requirements to those of Chapters 1 through 4 are given with regard to minimum wire sizes, ampacity adjustment and correction factors, overcurrent protection, insulation requirements, and wiring methods and materials.

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

Abandoned Class 2, Class 3, and PLTC Cable. Installed Class 2, Class 3, and PLTC cable that is not terminated at equipment and not identified for future use with a tag.

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

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

725.3 Other Articles. In addition to the requirements of this article, circuits and equipment shall comply with the articles or sections listed in 725.3(A) through (P). Only those sections of Article 300 referenced in this article shall apply to ~~Class 1~~, Class 2, and Class 3 circuits.

(A) Number and Size of Conductors in Raceway. Section 300.17.

(B) Spread of Fire or Products of Combustion. Installation of Class 1, Class 2, and Class 3 circuits shall comply with 300.21.

(C) Ducts, Plenums, and Other Air-Handling Spaces. Class 1, Class 2, and Class 3 circuits installed in ducts, plenums, or other space used for environmental air shall comply with 300.22.

Exception No. 1: Class 2 and Class 3 cables selected in accordance with Table 725.154 and installed in accordance with 725.135(B) and 300.22(B), Exception shall be permitted to be installed in ducts specifically fabricated for environmental air.

Exception No. 2: Class 2 and Class 3 cables selected in accordance with Table 725.154 and installed in accordance with 725.135(C) shall be permitted to be installed in other spaces used for environmental air (plenums).

(D) Hazardous (Classified) Locations. ~~Class 1,~~ Class 2, and Class 3 circuits installed in hazardous (classified) locations shall comply with 501.10(B)(1), 501.150, 502.10(B)(1), 502.150, 503.10(A)(1), 503.150, 506.15(A), 506.15(C), 511.7(B)(1), 515.7(A), and Article 517, Part IV.

(E) Cable Trays. Parts I and II of Article 392, where installed in cable tray.

(F) Motor Control Circuits. Article 430, Part VI, where tapped from the load side of the motor branch-circuit protective device(s) as specified in 430.72(A).

(G) Instrumentation Tray Cable. See 727.1 and 727.4 through 727.9.

(H) Raceways Exposed to Different Temperatures. Installations shall comply with 300.7(A).

(I) Vertical Support for Fire-Rated Cables and Conductors. Vertical installations of circuit integrity (CI) cables and conductors installed in a raceway or conductors and cables of electrical circuit protective systems shall be installed in accordance with 300.19.

(J) Bushing. A bushing shall be installed where cables emerge from raceway used for mechanical support or protection in accordance with 300.15(C).

(K) Installation of Conductors with Other Systems. Installations shall comply with 300.8.

(L) Corrosive, Damp, or Wet Locations. Class 2 and Class 3 cables installed in corrosive, damp, or wet locations shall comply with the applicable requirements in 110.11, 300.5(B), 300.6, 300.9, and 310.10(F).

(M) Cable Routing Assemblies. Class 2, Class 3, and Type PLTC cables shall be permitted to be installed in plenum cable routing assemblies, riser cable routing assemblies, and general-purpose cable routing assemblies selected in accordance with Table 800.154(c), listed in accordance with 800.182, and installed in accordance with 800.110(C) and 800.113.

(N) Communications Raceways. Class 2, Class 3, and Type PLTC cables shall be permitted to be installed in plenum communications raceways, riser communications raceways, and general-purpose communications raceways selected in accordance with Table 800.154(b), listed in accordance with 800.182, and installed in accordance with 800.113 and 362.24 through 362.56, where the requirements applicable to electrical nonmetallic tubing (ENT) apply.

(O) Temperature Limitation of Class 2 and Class 3 Cables. The requirements of 310.14(A)(3) on the temperature limitation of conductors shall apply to Class 2 and Class 3 cables.

(P) Identification of Equipment Grounding Conductors. Equipment grounding conductors shall be identified in accordance with 250.119.

Exception: Conductors with green insulation shall be permitted to be used as ungrounded signal conductors for Types CL3P, CL2P, CL3R, CL2R, CL3, CL2, CL3X, CL2X, and substitute cables installed in accordance with 725.154(A).

725.21 Access to Electrical Equipment Behind Panels Designed to Allow Access. Access to electrical equipment shall not be denied by an accumulation of wires and cables that prevents removal of panels, including suspended ceiling panels.

725.24 Mechanical Execution of Work. ~~Class 1,~~ Class 2, and Class 3 circuits shall be installed in a neat and workmanlike manner. Cables and conductors installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be supported by straps, staples, hangers, cable ties, or similar fittings designed and installed so as not to damage the cable. The installation shall also comply with 300.4(D).

> Informational Note: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants can result in an undetermined alteration of ~~Class 1,~~ Class 2, Class 3, and PLTC cable properties.

725.25 Abandoned Cables. The accessible portion of abandoned Class 2, Class 3, and PLTC cables shall be removed. Where cables are identified for future use with a tag, the tag shall be of sufficient durability to withstand the environment involved.

725.30 ~~Class 1,~~ Class 2, and Class 3 Circuit Identification. ~~Class 1,~~ Class 2, and Class 3 circuits shall be identified at terminal and junction locations in a manner that prevents unintentional interference with other circuits during testing and servicing.

725.31 Safety-Control Equipment.

(A) Remote-Control Circuits. Remote-control circuits for safety-control equipment shall be classified as Class 1 if the failure of the equipment to operate introduces a direct fire or life hazard. Room thermostats, water temperature regulating devices, and similar controls used in conjunction with electrically controlled household heating and air conditioning shall not be considered safety-control equipment.

(B) Physical Protection. Where damage to remote-control circuits of safety-control equipment would introduce a hazard, as covered in 725.31(A), all conductors of such remote-control circuits shall be installed in rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, electrical metallic tubing, Type MI cable, or Type MC cable, or be otherwise suitably protected from physical damage.

725.35 ~~Class 1,~~ Class 2, and Class 3 Circuit Requirements. A remote-control, signaling, or power-limited circuit shall comply with the following parts of this article:

~~(1) Class 1 Circuits: Parts I and II~~

(2) Class 2 and Class 3 Circuits: Parts I and III

Part II. Class 1 Circuits

725.41 Class 1 Circuit Classifications and Power Source Requirements. Class 1 circuits shall be classified as either Class 1 power-limited circuits where they comply with the power limitations of 725.41(A) or as Class 1 remote-control and signaling circuits where they are used for remote-control or signaling purposes and comply with the power limitations of 725.41(B).

(A) Class 1 Power-Limited Circuits. These circuits shall be supplied from a source that has a rated output of not more than 30 volts and 1000 volt-amperes.

(1) Class 1 Transformers. Transformers used to supply power-limited Class 1 circuits shall comply with the applicable sections within Parts I and II of Article 450.

(2) Other Class 1 Power Sources. Power sources other than transformers shall be protected by overcurrent devices rated at not more than 167 percent of the volt-ampere rating of the source divided by the rated voltage. The overcurrent devices shall not be interchangeable with overcurrent devices of higher ratings. The overcurrent device shall be permitted to be an integral part of the power supply.

To comply with the 1000 volt-ampere limitation of 725.41(A), the maximum output (VA_{max}) of power sources other than transformers shall be limited to 2500 volt-amperes, and the product of the maximum current (I_{max}) and maximum voltage (V_{max}) shall not exceed 10,000 volt-amperes. These ratings shall be determined with any overcurrent protective device bypassed.

VA_{max} is the maximum volt-ampere output after one minute of operation regardless of load and with overcurrent protection bypassed, if used. Current-limiting impedance shall not be bypassed when determining VA_{max}.

I_{max} is the maximum output current under any noncapacitive load, including short circuit, and with overcurrent protection bypassed, if used. Current-limiting impedance should not be bypassed when determining I_{max}. Where a current-limiting impedance, listed for the purpose or as part of a listed product, is used in combination with a stored energy source, for example, storage battery, to limit the output current, I_{max} limits apply after 5 seconds.

V_{max} is the maximum output voltage regardless of load with rated input applied.

(B) Class 1 Remote-Control and Signaling Circuits. These circuits shall not exceed 600 volts. The power output of the source shall not be required to be limited.

725.43 Class 1 Circuit Overcurrent Protection. Overcurrent protection for conductors 14 AWG and larger shall be provided in accordance with the conductor ampacity, without applying the ampacity adjustment and correction factors of 310.14 to the ampacity calculation.

Overcurrent protection shall not exceed 7 amperes for 18 AWG conductors and 10 amperes for 16 AWG.

Exception: Where other articles of this Code permit or require other overcurrent protection.

Informational Note: For example, see 430.72 for motors, 610.53 for cranes and hoists, and 517.74(B) and 660.9 for X-ray equipment.

725.45 Class 1 Circuit Overcurrent Device Location. Overcurrent devices shall be located as specified in 725.45(A), (B), (C), (D), or (E).

(A) Point of Supply. Overcurrent devices shall be located at the point where the conductor to be protected receives its supply.

(B) Feeder Taps. Class 1 circuit conductors shall be permitted to be tapped, without overcurrent protection at the tap, where the overcurrent device protecting the circuit conductor is sized to protect the tap conductor.

(C) Branch-Circuit Taps. Class 1 circuit conductors 14 AWG and larger that are tapped from the load side of the overcurrent protective device(s) of a controlled light and power circuit shall require only short-circuit and ground-fault protection and shall be permitted to be protected by the branch-circuit overcurrent protective device(s) where the rating of the protective device(s) is not more than 300 percent of the ampacity of the Class 1 circuit conductor.

(D) Primary Side of Transformer. Class 1 circuit conductors supplied by the secondary of a single-phase transformer having only a 2-wire (single-voltage) secondary shall be permitted to be protected by overcurrent protection provided on the primary side of the transformer, provided this protection is in accordance with 450.3 and does not exceed the value determined by multiplying the secondary conductor ampacity by the secondary-to-primary transformer voltage ratio. Transformer secondary conductors other than 2-wire shall not be considered to be protected by the primary overcurrent protection.

(E) Input Side of Electronic Power Source. Class 1 circuit conductors supplied by the output of a single-phase, listed electronic power source, other than a transformer, having only a 2-wire (single-voltage) output for connection to Class 1 circuits shall be permitted to be protected by overcurrent protection provided on the input side of the electronic power source, provided this protection does not exceed the value determined by multiplying the Class 1 circuit conductor ampacity by the output-to-input voltage ratio. Electronic power source outputs, other than 2-wire (single-voltage), shall not be considered to be protected by the primary overcurrent protection.

725.46 Class 1 Circuit Wiring Methods. Class 1 circuits shall be installed in accordance with Part I of Article 300 and with the wiring methods from the appropriate articles in Chapter 3.

Exception No. 1: The provisions of 725.48 through 725.51 shall be permitted to apply in installations of Class 1 circuits.

Exception No. 2: Methods permitted or required by other articles of this Code shall apply to installations of Class 1 circuits.

725.48 Conductors of Different Circuits in the Same Cable, Cable Tray, Enclosure, or Raceway. Class 1 circuits shall be permitted to be installed with other circuits as specified in 725.48(A) and (B).

(A) Two or More Class 1 Circuits. Class 1 circuits shall be permitted to occupy the same cable, cable tray, enclosure, or raceway without regard to whether the individual circuits are alternating current or direct current, provided all conductors are insulated for the maximum voltage of any conductor in the cable, cable tray, enclosure, or raceway.

(B) Class 1 Circuits with Power-Supply Circuits. Class 1 circuits shall be permitted to be installed with power-supply conductors as specified in 725.48(B)(1) through (B)(4).

(1) In a Cable, Enclosure, or Raceway. Class 1 circuits and power-supply circuits shall be permitted to occupy the same cable, enclosure, or raceway without a barrier only where the equipment powered is functionally associated. Class 1 circuits shall be permitted to be installed together with the conductors of electric light, power, non-power-limited fire alarm, and medium power network-powered broadband communications circuits where separated by a barrier.

(2) In Factory- or Field-Assembled Control Centers. Class 1 circuits and power-supply circuits shall be permitted to be installed in factory- or field-assembled control centers.

(3) In a Manhole. Class 1 circuits and power-supply circuits shall be permitted to be installed as underground conductors in a manhole in accordance with one of the following:

(1) The power-supply or Class 1 circuit conductors are in a metal-enclosed cable or Type UF cable.

(2) The conductors are permanently separated from the power-supply conductors by a continuous firmly fixed nonconductor, such as flexible tubing, in addition to the insulation on the wire.

(3) The conductors are permanently and effectively separated from the power supply conductors and securely fastened to racks, insulators, or other approved supports.

(4) In Cable Trays. Installations in cable trays shall comply with 725.48(B)(4)(1) or (B)(4)(2).

(1) Class 1 circuit conductors and power-supply conductors not functionally associated with the Class 1 circuit conductors shall be separated by a solid fixed barrier of a material compatible with the cable tray.

(2) Class 1 circuit conductors and power-supply conductors not functionally associated with the Class 1 circuit conductors shall be permitted to be installed in a cable tray without barriers where all of the conductors are installed with separate multiconductor Type AC, Type MC, Type MI, or Type TC cables and all the conductors in the cables are insulated at 600 volts or greater.

725.49 Class 1 Circuit Conductors.

(A) Sizes and Use. Conductors of sizes 18 AWG and 16 AWG shall be permitted to be used, provided they supply loads that do not exceed the ampacities given in 402.5 and are installed in a raceway, an approved enclosure, or a listed cable. Conductors larger than 16 AWG shall not supply loads greater than the ampacities given in 310.14. Flexible cords shall comply with Article 400.

(B) Insulation. Insulation on conductors shall be rated for the system voltage and not less than 600 volts. Conductors larger than 16 AWG shall comply with Article 310. Conductors in sizes 18 AWG and 16 AWG shall be Type FFH-2, KF-2, KFF-2, PAF, PAFF, PF, PFF, PGF, PGFF, PTF, PTFF, RFH-2, RFHH-2, RFHH-3, SF-2, SFF-2, TF, TFF, TFFN, TFN, ZF, or ZFF. Conductors with other types and thicknesses of insulation shall be permitted if listed for Class 1 circuit use.

725.51 Number of Conductors in Cable Trays and Raceway, and Ampacity Adjustment.

(A) Class 1 Circuit Conductors. Where only Class 1 circuit conductors are in a raceway, the number of conductors shall be determined in accordance with 300.17. The ampacity adjustment factors given in 310.15(C)(1) shall apply only if such conductors carry continuous loads in excess of 10 percent of the ampacity of each conductor.

(B) Power-Supply Conductors and Class 1 Circuit Conductors. Where power-supply conductors and Class 1 circuit conductors are permitted in a raceway in accordance with 725.48, the number of conductors shall be determined in accordance with 300.17. The ampacity adjustment factors given in 310.15(C)(1) shall apply as follows:

(1) To all conductors where the Class 1 circuit conductors carry continuous loads in excess of 10 percent of the ampacity of each conductor and where the total number of conductors is more than three

(2) To the power-supply conductors only, where the Class 1 circuit conductors do not carry continuous loads in excess of 10 percent of the ampacity of each conductor and where the number of power-supply conductors is more than three

(C) Class 1 Circuit Conductors in Cable Trays. Where Class 1 circuit conductors are installed in cable trays, they shall comply with the provisions of 392.22 and 392.80(A).

725.52 Circuits Extending Beyond One Building. Class 1 circuits that extend aerially beyond one building shall also meet the requirements of Article 225.

Public Input No. 3671-NFPA 70-2020 [Global Input]

Type your content here ...Create a new article in Chapter 7 "Cables for Power Limited Circuits"

Additional Proposed Changes

File Name	Description	Approved
New_Article_7XX_Cables_for_Power_Limited_Circuits_final_1.0_.docx	This document is the text of the proposed new Article 7XX for Cables for Power Limited Circuits	

Statement of Problem and Substantiation for Public Input

This public input was developed by a Panel 3 appointed task group to address redundant cabling requirements in Articles 725, 760 and 770. The Panel 3 task group members included TG Chairman Randy Ivans (Panel 3 Principal, Panel 16 Alternate), Robert Jones (Chairman Panel 3), Paul Casparro, Shane Clary, Michael Cogbill, Chad Jones, Ward Judson, Tim Mikloiche, Samuel Rokowski, George Straniero, Ron Tellas, and George Zimmerman. The TG was broad-based and specifically included representation of those with knowledge and experience in electrical safety, installation, code enforcement, and wire and cable.

This proposed new Article combines common cabling requirements currently found in Articles 725, 760, and 770 and also relocates other cabling requirements from those articles into a single article. The proposal also removes the redundancy between the text-based requirements in 725.135, 760.135 and 770.113, and the tabular requirements in Tables 725.154, 760.154 and 770.154 by including most of the requirements only in tabular form. This has been found to be more user-friendly. Some of the text-based requirements do not lend themselves to being represented in tabular form and remain as text in the new Article. In some cases, such as 725.144, the cable requirements are integrated with equipment requirements and were not moved. In the case of 725.144 a pointer was added in the new article for clarity.

Informational notes were added to provide examples of applicable requirements for the listing of cables. The detailed description of PLTC cable was simplified since PLTC cable constructions are covered in great detail in UL 13, Standard for Power-Limited Circuit Cables.

This new Article significantly improves clarity and usability while removing redundant requirements. It is not the intent of this proposal to introduce any technical changes. Some editorial errors were found during this process and fixed within this PI. If this PI is resolved, there are separate PIs submitted to fix those issues. Multiple companion public inputs are submitted throughout the NEC as part of this overall effort.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3868-NFPA 70-2020 [Global Input]	This PI is for the revisions to Article 725 to accommodate the new cable article
Public Input No. 3993-NFPA 70-2020 [Global Input]	This PI is for the revisions to Article 760 to accommodate the new cable article
Public Input No. 4138-NFPA 70-2020 [Global Input]	This PI is for the revisions to Article 770 to accommodate the new cable article
Public Input No. 3868-NFPA 70-2020 [Global Input]	
Public Input No. 3993-NFPA 70-2020 [Global Input]	
Public Input No. 4138-NFPA 70-2020 [Global Input]	

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Article 7XX –Cables for Power Limited Circuits

Part I. General

7XX.1 Scope. This article covers the general requirements for the installation of single- and multiple-conductor cables used in Class 2 and Class 3 limited power circuits, power-limited fire alarm (PLFA) circuits and optical fiber installations. Parts I and V of this article provide the general cable requirements for power limited circuit conductors and cables. Part II covers additional cable requirements specifically for Class 2 and Class 3 circuits. Part III covers additional cable requirements specifically for fire alarm systems. Part IV covers additional cable requirements specifically for optical fiber cables.

7XX.2 Definitions. The definitions in this section shall apply only within this article.

Abandoned Cable. Installed Class 2, Class 3, and PLTC cable that is not terminated at equipment and not identified for future use with a tag.

General-Purpose Cables, Cable Routing Assemblies and Raceways. General-purpose cables, cable routing assemblies and raceways are suitable for general purpose applications and are resistant to the spread of fire.

Cables for Limited Use. Cables that are intended to be used with protection such as a raceway or for specific restricted applications.

Cable Sheath. A covering over the optical fiber assembly that includes one or more jackets and may include one or more metallic members or strength members.

Plenum Cable, Cable Routing Assemblies and Raceways. Cables, cable routing assemblies and raceways that have adequate fire-resistant and low smoke-producing characteristics and are suitable for use in ducts, plenums, and other spaces used for environmental air.

Riser Cable, Cable Routing Assemblies and Raceways. Cables, cable routing assemblies and raceways that have fire resistant characteristics capable of preventing the carrying of fire from floor to floor and are suitable for use in a vertical run in a shaft or from floor to floor.

Under Carpet Cable. Cables that are intended to be used under carpeting, floor covering, modular tiles, and planks.

7XX.3 Other Articles. In addition to the requirements of this article, installation of cables shall comply with the articles or sections listed in 7XX.3(A) through (P). Only those sections of Article 300 referenced in this article shall apply.

(A) Number and Size of Cables and Conductors in Raceway. Section 300.17 shall apply.

(B) Spread of Fire or Products of Combustion. Section 300.21 shall apply.

(C) Ducts, Plenums, and Other Air-Handling Spaces. Section 300.22 shall apply.

Exception No. 1: Cables selected in accordance with Table 7XX.154 and installed in accordance with 7XX.135(B) and 300.22(B), Exception shall be permitted to be installed in ducts specifically fabricated for environmental air.
Exception No. 2: Cables selected in accordance with Table 7XX.154 and installed in accordance with 7XX.135(C) shall be permitted to be installed in other spaces used for environmental air (plenums).

(D) Cables in Ducts for Dust, Loose Stock, or Vapor Removal. Section 300.22(A) for wiring systems shall apply.

Exception: Nonconductive optical fiber cables shall be permitted in ducts used for dust, loose stock, or vapor Removal.

(E) Cable Trays. Parts I and II of Article 392 shall apply where installed in cable tray.
(F) Instrumentation Tray Cable. Sections 727.1 and 727.4 through 727.9 shall apply.

(G) Raceways or Sleeves Exposed to Different Temperatures. Section 300.7(A) shall apply.

(H) Vertical Support for Fire-Rated Resistive Cables and Conductors. Vertical installations of circuit integrity (CI) cables and conductors installed in a raceway or conductors and cables of fire resistive-cable systems shall be installed in accordance with 300.19.

(I) Installation of Cables with Other Systems. Section 300.8. shall apply.

(J) Corrosive, Damp, or Wet Locations. The applicable requirements in sections 110.11, 300.5(B), 300.6, 300.9, and 310.10(F) shall apply.

(K) Cable Routing Assemblies. Cables installed in cable routing assemblies, shall be selected in accordance with Table 800.154(c), listed in accordance with 800.182, and installed in accordance with 800.110(C)(1), 800.110(C)(2) and 800.113

(L) Communications Raceways. Cables communications raceways shall be selected in accordance with Table 800.154(b), listed in accordance with 800.182, and installed in accordance with 800.113 and 362.24 through 362.56, where the requirements applicable to electrical nonmetallic tubing (ENT) apply.

(M) Temperature Limitation of Class 2 and Class 3 Cables. Section 310.14(A)(3) shall apply.

(N) Identification of Equipment Grounding Conductors. Section 250.119 shall apply.

Exception: Conductors with green insulation shall be permitted to be used as ungrounded signal conductors.

(O) Specific Requirements. As appropriate, the installation of wires and cables shall also comply with the requirements of the following:

(1) Class 2 and Class 3 cables - Article 725

(2) Fire alarm cables – Article 760

(3) Optical fiber cables - Article 770

(P) Composite Optical Fiber Cables. Composite optical fiber cables shall be classified as electrical cables in accordance with the type of electrical conductors. They shall be constructed, listed, and marked in accordance with the appropriate article for each type of electrical cable.

7XX.12 Uses Not Permitted. Cables shall not be installed in any hazardous (classified) location, except as permitted by other articles of this Code.

Informational Note: Hazardous locations are covered in Articles 500 through 516 and in Article 517 Part IV.

7XX.21 Access to Electrical Equipment Behind Panels Designed to Allow Access. Access to electrical equipment shall not be denied by an accumulation of cables that prevents removal of panels, including suspended ceiling panels.

7XX.24 Mechanical Execution of Work.

(A) General. Cables shall be installed in a neat and workmanlike manner. Cables installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be secured by hardware, including straps, staples, cable ties, hangers, or similar fittings, designed and installed so as not to damage the cable. The installation shall conform to 300.4 and 300.11. A bushing shall be installed where cables emerge from raceway used for mechanical support or protection in accordance with 300.15(C).

Nonmetallic cable ties and other nonmetallic cable accessories used to secure and support cables in other spaces used for environmental air (plenums) shall be listed as having low smoke and heat release properties in accordance with 300.22(C).

Informational Note No. 1: See NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, for discrete combustible components installed in accordance with 300.22(C).

Informational Note No. 2: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of cable properties.

(B) Support of Cables. Cables shall not be strapped, taped, or attached by any means to the exterior of any conduit or other raceway as a means of support.

Exception 1: Class 2 circuit conductors or cables shall be permitted to be installed as permitted by 300.11(C)(2).

Exception 2: Overhead (aerial) spans of optical fiber cables shall be permitted to be attached to the exterior of a raceway-type mast intended for the attachment and support of such cables.

(C) Circuit Integrity (CI) Cable. Circuit integrity (CI) cable shall be supported at a distance not exceeding 610 mm (24 in.). Cable shall be secured to the noncombustible surface of the building structure. Cable supports and fasteners shall be steel.

7XX.25 Abandoned Cables. The accessible portion of abandoned cables shall be removed. Where cables are identified for future use with a tag, the tag shall be of sufficient durability to withstand the environment involved.

7XX.135 Installation of Cables. The Installation of cables shall comply with 7XX.135 (A), or, 7XX.135(B) or 7XX.135(C), and 7XX.135 (D) through (G).

(A) Listing. Cables installed in buildings shall be listed.

(B) Cables in Buildings. The **i**nstallation of cables shall comply with Table 7XX.135(B).

Table 7XX.135(B) Installation of Listed Cables in Buildings

Applications		Cable Type					
		Plenum	Riser	General-Purpose	Limited Use	Under Carpet Note 3	PLTC
In ducts specifically fabricated for environmental air as described in 300.22(B) Note 2	Cables in lengths as short as practicable to perform the required function	Y*	N	N	N	N	N
	In metal raceway that complies with 300.22(B)	Y*	Y*	Y*	Y*	N	Y*
In other spaces used for environmental air (plenums) as described in 300.22(C)	Cables in other spaces used for environmental air	Y*	N	N	N	N	N
	Cables In metal raceway that complies with 300.22(C)	Y*	Y*	Y*	Y*	N	Y*
	Cables in plenum communications raceways	Y*	N	N	N	N	N
	Cables in plenum cable routing assemblies	Y*	N	N	N	N	N
	Cables supported by open metal cable trays	Y*	N	N	N	N	N
	Cables, or cables installed in raceways or cable routing assemblies supported by solid bottom metal cable trays with solid metal covers	Y*	Y*	Y*	Y*	N	Y
In risers and vertical runs	Cables in vertical runs penetrating one or more floors and in vertical runs in a shaft	Y*	Y*	N	N	N	N
	Cables in metal raceways	Y*	Y*	Y*	Y*	N	Y*
	Cables in fireproof shafts	Y*	Y*	Y*	N	N	Y*
	Cables in plenum communications raceways	Y*	Y*	N	N	N	N
	Cables in plenum cable routing assemblies	Y*	Y*	N	N	N	N
	Cables in riser communications raceways	Y*	Y*	N	N	N	N
	Cables in riser cable routing assemblies	Y*	Y*	N	N	N	N

Table 7XX.135(B) Installation of Listed Cables in Buildings

Applications		Cable Type					
		Plenum	Riser	General-Purpose	Limited Use	Under Carpet Note 3	PLTC
	Cables in one- and two-family dwellings	Y*	Y*	Y*	Y* Note 4	N	Y*
Cables and innerducts installed in metal raceways in a riser having firestops at each floor Note 2	Cables	Y*	Y*	Y*	Y*	N	Y*
	Cables in plenum communications raceways (innerduct)	Y*	Y*	Y*	Y*	N	Y*
	Cables in riser communications raceways (innerduct)	Y*	Y*	Y*	Y*	N	Y*
	Cables in general purpose communications raceways (innerduct)	Y*	Y*	Y*	Y*	N	Y*
In fireproof riser shafts having firestops at each floor Note 2	Cables	Y*	Y*	Y*	N	N	Y*
	Cables in plenum communications raceways or plenum cable routing assemblies	Y*	Y*	Y*	N	N	Y*
	Cables in riser communications raceways or riser cable routing assemblies	Y*	Y*	Y*	N	N	Y*
	Cables in general-purpose communications raceways or general-purpose cable routing assemblies	Y*	Y*	Y*	N	N	Y*
In cable trays	Outdoors	N	N	N	N	N	Y*
	Cables, or cables in plenum, riser or general-purpose communications raceways, installed indoors	Y*	Y*	Y*	N	N	Y*

Table 7XX.135(B) Installation of Listed Cables in Buildings

Applications		Cable Type					
		Plenum	Riser	General-Purpose	Limited Use	Under Carpet Note 3	PLTC
In cross-connect arrays	Cables, and cables in plenum, riser or general purpose communications raceways or cable routing assemblies	Y*	Y*	Y*	N	N	Y*
In one-, two-, and multi-family dwellings, and in building locations other than the locations covered above	Cables	Y*	Y*	Y*	Y* Note 4	N	Y*
	Cables in plenum, riser or general purpose communications raceways or cable routing assemblies, or, raceways recognized in Chapter 3	Y*	Y*	Y*	Y*	N	Y*
	Cables in non-concealed spaces	Y*	Y*	Y*	Y* Note 5	Y*	Y*
	Under carpet, floor covering, modular flooring, and planks	N	N	N	N	Y*	N

Note 1: "N" indicates that the cable type shall not be permitted to be installed in the application. "Y*" indicates that the cable type shall be permitted to be installed in the application, subject to any limitations described in this article or the articles described in 7XX.3(O).

Note 2: In 300.22(B), cables shall be permitted in ducts specifically fabricated for environmental air only if directly associated with the air distribution system.

Note 3: Limited-use cable shall be permitted to be installed only in one-, two-, and multi-family dwellings and only if the cable is smaller in diameter than 0.25 in or 6.35 mm.

Note 4: The exposed length of cable shall not exceed 10 ft or 3.05 m.

Informational Note 1: For information on fire protection of wiring installed in fabricated ducts, see 4.3.4.1 and 4.3.11.3.3 of NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

Informational Note 2: See 300.21 for firestop requirements for floor penetrations.

Informational Note 3: See Chapter 3 for the installation requirements for PLTC cables installed outdoors in cable trays.

Informational Note 4: One way to determine applicable requirements for plenum, riser and general purpose cable routing assemblies and raceways is to refer to UL2024, *Standard for Safety for Cable Routing Assemblies and Communications Raceways*

(C) Industrial Establishments. In industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons service the installation, Type PLTC cable shall be permitted in accordance with either (1) or (2) as follows:

(1) Where the cable is not subject to physical damage, Type PLTC cable that complies with the crush and impact requirements of Type MC cable and is identified as PLTC-ER for such use shall be permitted to be exposed between the cable tray and the utilization equipment or device. The cable shall be continuously supported and protected against physical damage using mechanical protection such as dedicated struts, angles, or channels. The cable shall be supported and secured at intervals not exceeding 1.8 m (6 ft). Where not subject to physical damage, Type PLTC-ER cable shall be permitted to transition between cable trays and between cable trays and utilization equipment or devices for a distance not to exceed 1.8 m (6 ft) without continuous support. The cable shall be mechanically supported where exiting the cable tray to ensure that the minimum bending radius is not exceeded.

(2) Type PLTC cable, with a metallic sheath or armor in accordance with 725.179(E), shall be permitted to be installed exposed. The cable shall be continuously supported and protected against physical damage using mechanical protection such as dedicated struts, angles, or channels. The cable shall be secured at intervals not exceeding 1.8 m (6 ft).

(D) In Hoistways. In hoistways, cables shall be installed in rigid metal conduit, rigid nonmetallic conduit, intermediate metal conduit, liquidtight flexible nonmetallic conduit, or electrical metallic tubing. For elevators or similar equipment, these conductors shall be permitted to be installed as provided in 620.21.

(E) Cable Substitutions. The substitutions for cables listed in Table 7XX.135(E)) shall be permitted. Where substitute cables are installed, the installation requirements of the articles described in 7XX.3(O) shall also apply. CI cables shall be permitted to be installed to provide 2-hour circuit integrity. See 7XX.154(B).

Informational Note: For information on Types CMP, CMR, CM, and CMX, see 805.179.

Table 7XX.135(E) Cable Substitutions

Cable Type	Permitted Substitutions
CL3P	CMP
CL2P	CMP, CL3P
CL3R	CMP, CL3P, CMR
CL2R	CMP, CL3P, CL2P, CMR, CL3R
PLTC	None
CL3	CMP, CL3P, CMR, CL3R, CMG, CM, PLTC
CL2	CMP, CL3P, CL2P, CMR, CL3R, CL2R, CMG, CM, PLTC, CL3

Table 7XX.135(E) Cable Substitutions

Cable Type	Permitted Substitutions
CL3X	CMP, CL3P, CMR, CL3R, CMG, CM, PLTC, CL3, CMX
CL2X	CMP, CL3P, CL2P, CMR, CL3R, CL2R, CMG, CM, PLTC, CL3, CL2, CMX, CL3X
FPLP	CMP
FPLR	CMP, FPLP, CMR
FPL	CMP, FPLP, CMR, FPLR, CMG, CM
OFNP	None
OFCP	OFNP
OFNR	OFNP
OFCR	OFNP, OFCP, OFNR
OFNG, OFN	OFNP, OFNR
OFCG, OFC	OFNP, OFCP, OFNR, OFCR, OFNG, OFN
CMUC	None

(F) Circuit Integrity (CI) Cable, Fire-Resistive Cable System or Electrical Circuit Protective System. Circuit integrity (CI) cable, a fire resistive cable system or a listed electrical circuit protective system shall be permitted for use in systems that supply critical circuits to ensure survivability for continued circuit operation for a specified time under fire conditions.

(G) Thermocouple Circuits. Conductors in Type PLTC cables used for Class 2 thermocouple circuits shall be permitted to be any of the materials used for thermocouple extension wire.

Part II. Class 2 and Class 3 Cables

7XX.140 Wiring Methods and Materials on Load Side of the Class 2 or Class 3 Power Source. Class 2 and Class 3 circuits on the load side of the power source shall be permitted to be installed using wiring methods and materials in accordance with 7XX.140(A), (B), or a combination of (A) and (B).

(A) Class 1 Wiring Methods and Materials. Installation shall be in accordance with 725.46.

Exception No. 1: The ampacity adjustment factors given in 310.15(C)(1) shall not apply.

Exception No. 2: Class 2 and Class 3 circuits shall be permitted to be reclassified and installed as Class 1 circuits if the Class 2 and Class 3 markings required in 725.124 are eliminated and

the entire circuit is installed using the wiring methods and materials in accordance with Part II, Class 1 circuits.

> Informational Note: Class 2 and Class 3 circuits reclassified and installed as Class 1 circuits are no longer Class 2 or Class 3 circuits, regardless of the continued connection to a Class 2 or Class 3 power source.

(B) Class 2 and Class 3 Wiring Methods. Cables on the load side of the power source shall be insulated at not less than the requirements of 7XX.179 and shall be installed in accordance with 7XX.135.

Exception No. 1: As provided for in 620.21 for elevators and similar equipment.

Exception No. 2: Other wiring methods and materials installed in accordance with the requirements of 7XX.3 shall be permitted to extend or replace the conductors and cables described in 7XX.179 and permitted by 7XX.140(B).

Exception No. 3: Bare Class 2 conductors shall be permitted as part of a listed intrusion protection system where installed in accordance with the listing instructions for the system.

725.141 Separation from Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm Circuit Conductors, and Medium-Power Network-Powered Broadband Communications Cables.

(A) General. Cables and conductors of Class 2 and Class 3 circuits shall not be placed in any cable, cable tray, compartment, enclosure, manhole, outlet box, device box, raceway, or similar fitting with conductors of electric light, power, Class 1, non–power-limited fire alarm circuits, and medium-power network-powered broadband communications circuits unless permitted by 7XX.141(B) through (H).

(B) Separated by Barriers. Class 2 and Class 3 circuits shall be permitted to be installed together with the conductors of electric light, power, Class 1, non–power-limited fire alarm and medium power network-powered broadband communications circuits where they are separated by a barrier.

(C) Raceways Within Enclosures. In enclosures, Class 2 and Class 3 circuits shall be permitted to be installed in a raceway to separate them from Class 1, non–power-limited fire alarm and medium-power network-powered broadband communications circuits.

(D) Associated Systems Within Enclosures. Class 2 and Class 3 circuit conductors in compartments, enclosures, device boxes, outlet boxes, or similar fittings shall be permitted to be installed with electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits where they are introduced solely to connect the equipment connected to Class 2 and Class 3 circuits, and where (1) or (2) applies:

(1) The electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuit conductors are routed to maintain a

minimum of 6 mm (0.25 in.) separation from the conductors and cables of Class 2 and Class 3 circuits.

(2) The circuit conductors operate at 150 volts or less to ground and also comply with one of the following:

a. The Class 2 and Class 3 circuits are installed using Type CL3, CL3R, or CL3P or permitted substitute cables, provided these Class 3 cable conductors extending beyond the jacket are separated by a minimum of 6 mm (0.25 in.) or by a nonconductive sleeve or nonconductive barrier from all other conductors.

b. The Class 2 and Class 3 circuit conductors are installed as a Class 1 circuit in accordance with 725.41.

(E) Enclosures with Single Opening. Class 2 and Class 3 circuit conductors entering compartments, enclosures, device boxes, outlet boxes, or similar fittings shall be permitted to be installed with Class 1, non–power-limited fire alarm and medium-power network-powered broadband communications circuits where they are introduced solely to connect the equipment connected to Class 2 and Class 3 circuits. Where Class 2 and Class 3 circuit conductors must enter an enclosure that is provided with a single opening, they shall be permitted to enter through a single fitting (such as a tee), provided the conductors are separated from the conductors of the other circuits by a continuous and firmly fixed nonconductor, such as flexible tubing.

(F) Manholes. Underground Class 2 and Class 3 circuit conductors in a manhole shall be permitted to be installed with Class 1, non–power-limited fire alarm and medium-power network-powered broadband communications circuits where one of the following conditions is met:

(1) The electric light, power, Class 1, non–power-limited fire alarm and medium-power network-powered broadband communications circuit conductors are in a metal-enclosed cable or Type UF cable.

(2) The Class 2 and Class 3 circuit conductors are permanently and effectively separated from the conductors of other circuits by a continuous and firmly fixed nonconductor, such as flexible tubing, in addition to the insulation or covering on the wire.

(3) The Class 2 and Class 3 circuit conductors are permanently and effectively separated from conductors of the other circuits and securely fastened to racks, insulators, or other approved supports.

(G) Cable Trays. Class 2 and Class 3 circuit conductors shall be permitted to be installed in cable trays, where the conductors of the electric light, Class 1, and non–power-limited fire alarm circuits are separated by a solid fixed barrier of a material compatible with the cable tray or where the Class 2 or Class 3 circuits are installed in Type MC cable.

(H) Other Applications. For other applications, conductors of Class 2 and Class 3 circuits shall be separated by at least 50 mm (2 in.) from conductors of any electric light, power, Class 1 non–

power-limited fire alarm or medium power network-powered broadband communications circuits unless one of the following conditions is met:

(1) Either all of the electric light, power, Class 1, non–power-limited fire alarm and medium-power network-powered broadband communications circuit conductors or all of the Class 2 and Class 3 circuit conductors are in a raceway or in metal-sheathed, metal-clad, non–metallic-sheathed, Type TC, or Type UF cables

(2) All of the electric light, power, Class 1 non–power-limited fire alarm, and medium-power network-powered broadband communications circuit conductors are permanently separated from all of the Class 2 and Class 3 circuit conductors by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the conductors

7XX.142 Installation of Conductors of Different Circuits in the Same Cable, Enclosure, Cable Tray, Raceway, or Cable Routing Assembly.

(A) Two or More Class 2 Circuits. Conductors of two or more Class 2 circuits shall be permitted within the same cable, enclosure, raceway, or cable routing assembly.

(B) Two or More Class 3 Circuits. Conductors of two or more Class 3 circuits shall be permitted within the same cable, enclosure, raceway, or cable routing assembly.

(C) Class 2 Circuits with Class 3 Circuits. Conductors of one or more Class 2 circuits shall be permitted within the same cable, enclosure, raceway, or cable routing assembly with conductors of Class 3 circuits, provided that the insulation of the Class 2 circuit conductors in the cable, enclosure, raceway, or cable routing assembly is at least that required for Class 3 circuits.

(D) Class 2 and Class 3 Circuits with Communications Circuits.

(1) Communications Cables. Conductors of one or more Class 2 or Class 3 circuits shall be permitted in the same cable with conductors of communications circuits provided the cable is a listed communications cable that shall be installed in accordance with the requirements of Part V of Article 805. The cables shall be listed as communications cables.

(2) Composite Cables. Cables constructed of individually listed Class 2, Class 3, and communications cables under a common jacket shall be permitted to be classified as communications cables. The fire resistance rating of the composite cable shall be determined by the performance of the composite cable.

(E) Class 2 or Class 3 Cables with Other Circuit Cables. Jacketed cables of Class 2 or Class 3 circuits shall be permitted in the same enclosure, cable tray, raceway, or cable routing assembly with jacketed cables of any of the following:

(1) Power-limited fire alarm systems in compliance with Parts I and III of Article 760

(2) Nonconductive and conductive optical fiber cables in compliance with Parts I and IV of Article 770

(3) Communications circuits in compliance with Parts I and IV of Article 805

(4) Community antenna television and radio distribution systems in compliance with Parts I and IV of Article 820

(5) Low-power, network-powered broadband communications in compliance with Parts I and IV of Article 830

(F) Class 2 or Class 3 Conductors or Cables and Audio System Circuits. Audio system circuits described in 640.9(C), and installed using Class 2 or Class 3 wiring methods in compliance with 725.133 and 725.154, shall not be permitted to be installed in the same cable, raceway, or cable routing assembly with Class 2 or Class 3 conductors or cables.

7XX.143 Class 2 and Class 3 Cable Voltage and Temperature Ratings. Class 2 cables shall have a voltage rating of not less than 150 volts. Class 3 cables shall have a voltage rating of not less than 300 volts. Class 2 and Class 3 cables shall have a temperature rating of not less than 60°C (140°F).

7XX.144 Bundling of 4-Pair Cables Transmitting Power and Data. 725.144 shall apply to 4-pair cables that are used to transmit power and data to a powered device.

7XX.145 Installation of Circuit Conductors Extending Beyond One Building. Where Class 2 or Class 3 circuit conductors extend beyond one building and are run so as to be subject to accidental contact with electric light or power conductors operating over 300 volts to ground, or are exposed to lightning on interbuilding circuits on the same premises, the requirements of the following shall also apply:

(1) Sections 800.44, 800.53, 800.100, 805.50, 805.93, 805.170(A), and 805.170(B) for other than coaxial conductors

(2) Sections 820.44, 820.93, and 820.100 for coaxial conductors

Part III. PLFA Cables

7XX.150 Wiring Methods and Materials on Load Side of the PLFA Power Source. Fire alarm circuits on the load side of the power source shall be permitted to be installed using wiring methods and materials in accordance with 7XX.150(A), (B), or a combination of (A) and (B).

(A) NPLFA Wiring Methods and Materials. Installation shall be in accordance with 760.46, and conductors shall be solid or stranded copper.
Exception No. 1: The ampacity adjustment factors given in 310.15(C)(1) shall not apply.

Exception No. 2: Conductors and multiconductor cables described in and installed in accordance with 760.49 and 760.53 shall be permitted.

Exception No. 3: Power-limited circuits shall be permitted to be reclassified and installed as non–power-limited circuits if the power-limited fire alarm circuit markings required by 760.124 are eliminated and the entire circuit is installed using the wiring methods and materials in accordance with Part II, Non–Power-Limited Fire Alarm Circuits.

Informational Note: Power-limited circuits reclassified and installed as non–power-limited circuits are no longer power-limited circuits, regardless of the continued connection to a power-limited source.

(B) PLFA Wiring Methods and Materials. Power-limited fire alarm conductors and cables described in 7XX.179 shall be installed as detailed in 7XX.150(B)(1), 7XX.150(B)(2), or 7XX.135. Devices shall be installed in accordance with 110.3(B), 300.11(A), and 300.15.

(1) In Raceways, Exposed on Ceilings or Sidewalls, or Fished in Concealed Spaces. Cable splices or terminations shall be made in listed fittings, boxes, enclosures, fire alarm devices, or utilization equipment. Where installed exposed, cables shall be adequately supported and installed in such a way that maximum protection against physical damage is afforded by building construction such as baseboards, door frames, ledges, and so forth. Where located within 2.1 m (7 ft) of the floor, cables shall be securely fastened in an approved manner at intervals of not more than 450 mm (18 in.).

(2) Passing Through a Floor or Wall. Cables shall be installed in metal raceways or rigid nonmetallic conduit where passing through a floor or wall to a height of 2.1 m (7 ft) above the floor, unless adequate protection can be afforded by building construction such as detailed in 760.130(B)(1), or unless an equivalent solid guard is provided.

760.151 Separation from Electric Light, Power, Class 1, NPLFA, and Medium-Power Network-Powered Broadband Communications Circuit Conductors.

(A) General. Power-limited fire alarm circuit cables and conductors shall not be placed in any cable, cable tray, compartment, enclosure, manhole, outlet box, device box, raceway, or similar fitting with conductors of electric light, power, Class 1, non–power-limited fire alarm circuits, and medium-power network-powered broadband communications circuits unless permitted by 760.151(B) through (F).

(B) Separated by Barriers. Power-limited fire alarm circuit cables shall be permitted to be installed together with Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits where they are separated by a barrier.

(C) Raceways Within Enclosures. In enclosures, power-limited fire alarm circuits shall be permitted to be installed in a raceway within the enclosure to separate them from Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits.

(D) Associated Systems Within Enclosures. Power-limited fire alarm conductors in compartments, enclosures, device boxes, outlet boxes, or similar fittings shall be permitted to be installed with electric light, power, Class 1, non–power-limited fire alarm, and medium power network-powered broadband communications circuits where they are introduced solely to connect the equipment connected to power-limited fire alarm circuits, and comply with either of the following conditions:

(1) The electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuit conductors are routed to maintain a

minimum of 6 mm (0.25 in.) separation from the conductors and cables of power-limited fire alarm circuits.

(2) The circuit conductors operate at 150 volts or less to ground and also comply with one of the following:

a. The fire alarm power-limited circuits are installed using Type FPL, FPLR, FPLP, or permitted substitute cables, provided these power-limited cable conductors extending beyond the jacket are separated by a minimum of 6 mm (0.25 in.) or by a nonconductive sleeve or nonconductive barrier from all other conductors.

b. The power-limited fire alarm circuit conductors are installed as non–power-limited circuits in accordance with 760.46.

(E) Enclosures with Single Opening. Power-limited fire alarm circuit conductors entering compartments, enclosures, device boxes, outlet boxes, or similar fittings shall be permitted to be installed with electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits where they are introduced solely to connect the equipment connected to power-limited fire alarm circuits or to other circuits controlled by the fire alarm system to which the other conductors in the enclosure are connected. Where power-limited fire alarm circuit conductors must enter an enclosure that is provided with a single opening, they shall be permitted to enter through a single fitting (such as a tee), provided the conductors are separated from the conductors of the other circuits by a continuous and firmly fixed nonconductor, such as flexible tubing.

(F) Other Applications. For other applications, power-limited fire alarm circuit conductors shall be separated by at least 50 mm (2 in.) from conductors of any electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits unless one of the following conditions is met:

(1) Either (a) all of the electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuit conductors or (b) all of the power-limited fire alarm circuit conductors are in a raceway or in metal-sheathed, metal-clad, nonmetallic-sheathed, or Type UF cables.

(2) All of the electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuit conductors are permanently separated from all of the power-limited fire alarm circuit conductors by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the conductors.

7XX.152 Installation of Conductors of Different PLFA Circuits, Class 2, Class 3, and Communications Circuits in the Same Cable, Enclosure, Cable Tray, Raceway, or Cable Routing Assembly.

(A) Two or More PLFA Circuits. Cable and conductors of two or more power-limited fire alarm circuits, communications circuits, or Class 3 circuits shall be permitted within the same cable, enclosure, cable tray, raceway, or cable routing assembly.

(B) Class 2 Circuits with PLFA Circuits. Conductors of one or more Class 2 circuits shall be permitted within the same cable, enclosure, cable tray, raceway, or cable routing assembly with conductors of power-limited fire alarm circuits, provided that the insulation of the Class 2 circuit conductors in the cable, enclosure, raceway, or cable routing assembly is at least that required by the power-limited fire alarm circuits.

(C) Low-Power Network-Powered Broadband Communications Cables and PLFA Cables. Low-power network-powered broadband communications circuits shall be permitted in the same enclosure, cable tray, raceway, or cable routing assembly with PLFA cables.

(D) Audio System Circuits and PLFA Circuits. Audio system circuits described in 640.9(C) and installed using Class 2 or Class 3 wiring methods in compliance with 7XX.135 shall not be permitted to be installed in the same cable, cable tray, raceway, or cable routing assembly with power-limited conductors or cables.

7XX.153 Cables. Cables shall comply with 7XX.153(A) through (D).

(A) Conductor Materials. Conductors for cables, other than coaxial cables, shall be solid or stranded copper. Coaxial cables shall be permitted to use 30 percent conductivity copper-covered steel center conductor wire.

(B) Conductor Size. The size of conductors in a multiconductor cable shall not be smaller than 26 AWG. Single conductors shall not be smaller than 18 AWG. Conductors of 26 AWG shall be permitted only where spliced with a connector listed as suitable for 26 AWG to 24 AWG or larger conductors that are terminated on equipment or where the 26 AWG conductors are terminated on equipment listed as suitable for 26 AWG conductors.

(C) Voltage Ratings. The cable shall have a voltage rating of not less than 300 volts.

(D) Temperature Ratings. The cable shall have a temperature rating of not less than 60°C (140°F).

7XX.154 Installation of PLFA Cables in Buildings. Installation of power-limited fire alarm cables in buildings shall be in accordance with 7XX.135, and 7XX.154 (A) and (B).

(A) Nonconcealed Spaces. Cables specified in Chapter 3 and meeting the requirements of 760.179(A) and (B) shall be permitted to be installed in nonconcealed spaces where the exposed length of cable does not exceed 3 m (10 ft).

(B) Portable Fire Alarm System. A portable fire alarm system provided to protect a stage or set when not in use shall be permitted to use wiring methods in accordance with 530.12.

7XX.155 Fire Alarm Circuits Extending Beyond One Building. Non–power-limited fire alarm circuits and power-limited fire alarm circuits that extend beyond one building and run

outdoors shall meet the installation requirements of Parts II, III, and IV of Article 805 and shall meet the installation requirements of Part I of Article 300.

Informational Note: An example of a protective device suitable to provide protection is a device tested to the requirements of ANSI/UL 497B, Protectors for Data Communications.

Part IV. Optical Fiber Cables - Installation Methods Within Buildings

7XX.160 Raceways, Cable Routing Assemblies, and Cable Trays for Optical Fiber Cables.

(A) Types of Raceways. Optical fiber cables shall be permitted to be installed in any raceway that complies with either 7XX.160(A)(1), (2) or (3).

(1) Raceways Recognized in Chapter 3. Optical fiber cables shall be permitted to be installed in any raceway included in Chapter 3. The raceways shall be installed in accordance with the requirements of Chapter 3.

(2) Communications Raceways. Optical fiber cables shall be permitted to be installed in listed communications raceways selected in accordance with Table 800.154(b).

(3) Innerduct for Optical Fiber Cables. Listed plenum communications raceway, listed riser communications raceway, and listed general-purpose communications raceway selected in accordance with Table 800.154(b) shall be permitted to be installed as innerduct in any type of listed raceway permitted in Chapter 3.

(B) Raceway Fill for Optical Fiber Cables. Raceway fill for optical fiber cables shall comply with either 7XX.160(B)(1) or (2).

(1) Without Electric Light or Power Conductors. Where optical fiber cables are installed in raceway without electric light or power conductors, the raceway fill requirements of Chapters 3 and 9 shall not apply.

(B)(2) Nonconductive Optical Fiber Cables with Electric Light or Power Conductors. Where nonconductive optical fiber cables are installed with electric light or power conductors in a raceway, the raceway fill requirements of Chapters 3 and 9 shall apply.

(C) Cable Routing Assemblies. Optical fiber cables shall be permitted to be installed in listed cable routing assemblies selected in accordance with Table 800.154(c)

(D) Cable Trays. Optical fiber cables shall be permitted to be installed in metal or listed nonmetallic cable tray systems.

7XX.161 Grounding. Non-current-carrying conductive members of optical fiber cables shall be bonded to a grounded equipment rack or enclosure, or grounded in accordance with the grounding methods specified by 770.100(B)(2).

7XX.162 Installation of Optical Fibers and Electrical Conductors.

(A) In Cable Trays and Raceways. Conductive optical fiber cables contained in an armored or metal-clad-type sheath and nonconductive optical fiber cables shall be permitted to occupy the same cable tray or raceway with conductors for electric light, power, Class 1, non-power-limited fire alarm, Type ITC, or medium-power network-powered broadband communications circuits operating at 1000 volts or less. Conductive optical fiber cables without an armored or metal-clad-type sheath shall not be permitted to occupy the same cable tray or raceway with conductors for electric light, power, Class 1, non-power-limited fire alarm, Type ITC, or medium-power network-powered broadband communications circuits, unless all of the conductors of electric light, power, Class 1, non-power-limited fire alarm, and medium-power network-powered broadband communications circuits are separated from all of the optical fiber cables by a permanent barrier or listed divider.

(B) In Cabinets, Outlet Boxes, and Similar Enclosures. Nonconductive optical fiber cables shall not be permitted to occupy the same cabinet, outlet box, panel, or similar enclosure housing the electrical terminations of an electric light, power, Class 1, non-power-limited fire alarm, or medium-power network-powered broadband communications circuit unless one or more of the following conditions exist:

(1) The nonconductive optical fiber cables are functionally associated with the electric light, power, Class 1, non-power-limited fire alarm, or medium-power network-powered broadband communications circuit.

(2) The conductors for electric light, power, Class 1, non-power-limited fire alarm, Type ITC, or medium-power network-powered broadband communications circuits operate at 1000 volts or less.

(3) The nonconductive optical fiber cables and the electrical terminations of electric light, power, Class 1, non-power-limited fire alarm, or medium-power network-powered broadband communications circuit are installed in factory- or field-assembled control centers.

(4) The nonconductive optical fiber cables are installed in an industrial establishment where conditions of maintenance and supervision ensure that only qualified persons service the installation.

When optical fibers are within the same composite cable for electric light, power, Class 1, non-power-limited fire alarm, or medium-power network-powered broadband communications circuits operating at 1000 volts or less, they shall be permitted to be installed only where the functions of the optical fibers and the electrical conductors are associated.

Optical fibers in composite optical fiber cables containing only current-carrying conductors for electric light, power, or Class 1 circuits rated 1000 volts or less shall be permitted to occupy the same cabinet, cable tray, outlet box, panel, raceway, or other termination enclosure with conductors for electric light, power, or Class 1 circuits operating at 1000 volts or less.

Optical fibers in composite optical fiber cables containing current-carrying conductors for electric light, power, or Class 1 circuits rated over 1000 volts shall be permitted to occupy the same cabinet, cable tray, outlet box, panel, raceway, or other termination enclosure with

conductors for electric light, power, or Class 1 circuits in industrial establishments, where conditions of maintenance and supervision ensure that only qualified persons service the installation.

(C) With Other Circuits. Optical fibers shall be permitted in the same cable, and conductive and nonconductive optical fiber cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly, with conductors of any of the following:

(1) Class 2 and Class 3 remote-control, signaling, and power-limited circuits in compliance with Article 645 or Parts I and III of Article 725

(2) Power-limited fire alarm systems in compliance with Parts I and III of Article 760

(3) Communications circuits in compliance with Parts I and V of Article 805

(4) Community antenna television and radio distribution systems in compliance with Parts I and V of Article 820

(5) Low-power network-powered broadband communications circuits in compliance with Parts I and V of Article 830

Part V. Listing Requirements

7XX.179 Listing and Marking of Cables. Cables installed in buildings shall be listed in accordance with 7XX.179(A), marked in accordance with 7XX.179(B) and shall be permitted to be marked in accordance with 7XX.179(C).
Exception: Optical fiber cables that are installed in compliance with 770.48 shall not be required to be listed.

(A) Listing of Cables. Cables, installed as wiring methods within buildings, shall be listed as resistant to the spread of fire and other criteria in accordance with 7XX.179(A)(1) through 7XX.179(A)(12).

Informational Note 1: One way to determine applicable requirements for listing of Class 2 and, Class 3 cable and Power-limited Tray Cable (PLTC) is to refer to UL 13, *Standard for Power-Limited Circuit Cables*.
Informational Note 2: One way to determine applicable requirements for listing of power-limited fire alarm cable is to refer to UL 1424, *Cables for Power-Limited Fire-Alarm Circuits.*

(1) Plenum Cable. Plenum cable shall be listed as suitable for use in ducts, plenums, and other space for environmental air and shall be listed as having adequate fire-resistant and low-smoke producing characteristics. Refer to Table 7XX.XX for plenum cable types.

Informational Note: One method of defining a cable that is low-smoke producing and fire resistant is that the cable exhibits a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.52 m (5 ft) or less when tested in accordance with NFPA 262-2019, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces*.

(2) Riser Cable. Riser cable shall be listed as suitable for use in a vertical run in a shaft or from floor to floor and shall be listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor.

Informational Note: One method of defining fire-resistant characteristics capable of preventing the carrying of fire from floor to floor is that the cables pass the requirements of ANSI/UL 1666-2012, *Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts*.

(3) General-Purpose Cable. General-Purpose cable shall be listed as suitable for general-purpose use, with the exception of risers, ducts, plenums, and other space used for environmental air, and shall be listed as resistant to the spread of fire.

Informational Note: One method of defining resistant to the spread of fire is that the cables do not spread fire to the top of the tray in the UL flame exposure, vertical tray flame test in ANSI/UL 1685-2010, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*. The smoke measurements in the test method are not applicable.
Another method of defining resistant to the spread of fire is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA vertical flame test for cables in cable trays, as described in CSA C22.2 No. 0.3-M-2001, *Test Methods for Electrical Wires and Cables*.

(4) Alternative General-Purpose Cable. Alternative general-purpose optical fiber cable shall be listed as suitable for general-purpose use, with the exception of risers and plenums, and shall also be resistant to the spread of fire.

Informational Note: One method of defining resistant to the spread of fire is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA vertical flame test — cables in cable trays, as described in CSA C22.2 No. 0.3-M-2001, *Test Methods for Electrical Wires and Cables*.

(5) Limited-Use Cable. Limited-use cable shall be listed as suitable for use in dwellings and raceways and shall be listed as resistant to flame spread.

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

(6) Type PLTC. Type PLTC nonmetallic-sheathed, power-limited tray cable shall be listed as being suitable for cable trays, resistant to the spread of fire, and, sunlight- and moisture-resistant. Type PLTC cable used in a wet location shall be listed for use in wet locations and marked “wet” or “wet location.

Informational Note: One method of defining resistant to the spread of fire is that the cables do not spread fire to the top of the tray in the UL flame exposure, vertical tray flame test in ANSI/UL 1685-2010, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables.* The smoke measurements in the test method are not applicable.
Another method of defining resistant to the spread of fire is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA vertical tray flame test for cables in cable trays, as described in CSA C22.2 No. 0.3-M-2001, *Test Methods for Electrical Wires and Cables*.

(7) Circuit Integrity (CI) Cable, Fire-Resistive Cable System or Electrical Circuit Protective System. Cables that are used for survivability of critical circuits under fire conditions shall meet either 7XX.179(A)(7)(a), (b) or (c) .

Informational Note: Fire alarm circuit integrity (CI) cable, fire-resistive cable systems or electrical circuit protective systems may be used for fire alarm circuits to comply with the survivability

requirements of NFPA 72-2019, *National Fire Alarm and Signaling Code*, 12.4.3 and 12.4.4, that the circuit maintain its electrical function during fire conditions for a defined period of time.

a) Circuit Integrity (CI) Cables.

Circuit integrity (CI) cables, of the types specified in Table 7XX.179(B)(1), *Cable Type Markings*, and used for survivability of critical circuits, shall be marked with the additional classification using the suffix "CI." In order to maintain its listed fire-resistive rating, circuit integrity (CI) cable shall only be installed in free air in accordance with 7XX.24(B). Circuit integrity (CI) cables shall only be permitted to be installed in a raceway where specifically listed and marked as part of a fire-resistive cable system as covered in 760.176(F)(2) .

Informational Note: One method of defining circuit integrity (CI) cable is by establishing a rating when tested in accordance with UL 2196, *Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables* as specified in UL 1425, *Cables for Non–Power-Limited Fire-Alarm Circuits*. UL Guide Information for Nonpower-limited Fire Alarm Circuits (HNHT) contains information to identify the cable and its installation limitations to maintain the fire-resistive rating.

(b) Fire-resistive cables of the types specified in Table 7XX.179(B)(1), *Cable Type Markings*, and 7XX.179(A)(7)(a), which are part of a fire-resistive cable system, shall be identified with the system identifier and hourly rating marked on the protectant or the smallest unit container and installed in accordance with the listing of the system.

Informational Note: One method of defining a fire-resistive cable system is by establishing a rating when tested in accordance with UL 2196*, Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables*. UL Guide Information for *Electrical Circuit Integrity Systems* (FHIT) contains information to identify the system and its installation limitations to maintain a minimum fire-resistive rating.

(c) Electrical Circuit Protective System.

Protectants for cables of the types specified in Table 7XX.179(B)(1), *Cable Type Markings* which are part of an electrical circuit protective system, shall be identified with the protective system identifier and hourly rating marked on the protectant or the smallest unit container and installed in accordance with the listing of the protective system.

Informational Note: One method of defining an electrical circuit protective system is by establishing a rating when tested in accordance with UL 1724, *Fire Tests for Electrical Circuit Protective Systems* . UL Guide Information for *Electrical Circuit Integrity Systems* (FHIT) contains information to identify the system and its installation limitations to maintain the fire-resistive rating.

(8) Class 3 Single Conductors. Class 3 single conductors used as other wiring within buildings shall be listed Type CL3 and shall not be smaller than 18 AWG.

Informational Note: One method of defining resistant to the spread of fire is that the cables do not spread fire to the top of the tray in the UL flame exposure, vertical tray flame test in ANSI/UL 1685-2010, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*. The smoke measurements in the test method are not applicable. Another method of defining resistant to the spread of fire is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA vertical tray flame test for cables in cable trays, as described in CSA C22.2 No. 0.3-M-2001, *Test Methods for Electrical Wires and Cables*.

(9) Limited Power (LP) Cable. Class 2 and Class 3 limited power (-LP) cables shall be listed as suitable for carrying power and data up to a specified current limit for each conductor without

exceeding the temperature rating of the cable where the cable is installed in cable bundles in free air or installed within a raceway, cable tray, or cable routing assembly. The cables shall be marked with the suffix "-LP (XXA)" where XXA designates the current limit is in amperes per conductor.

Informational Note: An example of the marking on a Class 2 cable with an LP rating is "CL2-LP (75°C) 23 AWG 4-pair," which indicates that it is a 4-pair plenum cable with 23 AWG conductors, a temperature rating of 75°C, and a current limit of 0.6 amperes per conductor (0.6 A).

(10) Undercarpet Cables. Undercarpet cable shall be listed as suitable for use under carpet, floor covering, modular tiles, and planks.

Informational Note: One method of determining the suitability of cable for undercarpet use is with the compressive loading test in UL 444, *Standard for Safety for Communications Cables*.

(11) Wet locations. Cable used in a wet location shall be listed for use in wet locations and be marked "wet" or "wet location", or have a moisture-impervious metal sheath.

(12) Field-Assembled Optical Fiber Cables. Field-assembled optical fiber cable shall comply with 7XX.179(A)(12)(a) through (d).

(a) The specific combination of jacket and optical fibers intended to be installed as a field-assembled optical fiber cable shall be one of the types in 7XX.179(A)(1), (2) or (3) and shall be marked in accordance with Table 179(B)(1).

(b) The jacket of a field-assembled optical fiber cable shall have a surface marking indicating the specific optical fibers with which it is identified for use.

(c) The optical fibers shall have a permanent marking, such as a marker tape, indicating the jacket with which they are identified for use.

(d) The jacket without fibers shall meet the listing requirements for communications raceways in 800.182(A), (B), or (C) in accordance with the cable marking.

(B) Marking. Cables shall be durably marked on the surface in accordance with 7XX.179(B)(1) through(##). The AWG size or circular mil area shall be repeated at intervals not exceeding 610 mm (24 in.). All other markings shall be repeated at intervals not exceeding 1.0 m (40 in.).

(1) The proper type designation for the type of cable in accordance with Table 179(B)(1).

(2) The manufacturer's name, trademark, or other distinctive marking by which the organization responsible for the product can be readily identified.

(3) The AWG size or circular mil area.

Informational Note: See Chapter 9, Table 8, Conductor Properties, for conductor area expressed in SI units for conductor sizes specified in AWG or circular mil area.

(4) The temperature rating for a temperature rating exceeding 60°C (140°F).

Informational Note: A minimum temperature rating of 60°C is assumed for cables not marked with a temperature rating

(5) Voltage ratings shall not be marked on the cables.
Exception: Voltage markings shall be permitted where the cable has multiple listings and a voltage marking is required for one or more of the listings.

Informational Note: Voltage markings on cables may be misinterpreted to suggest that the cables may be suitable for Class 1 electric light and power applications.

Table 7XX.179(B)(1) Cable Type Markings

Cable Type	Cable Marking
Class 3 Plenum Cable	CL3P
Class 2 Plenum Cable	CL2P
Power Limited Fire Alarm Plenum Cable	FPLP
Nonconductive Optical Fiber Plenum Cable	OFNP
Conductive Optical Fiber Plenum Cable	OFCP
Class 3 Riser Cable	CL3R
Class 2 Riser Cable	CL2R
Power Limited Fire Alarm Riser Cable	FPLR
Nonconductive Optical Fiber Riser Cable	OFNR
Conductive Optical Fiber Riser Cable	OFCR
Class 3 General-Purpose Cable	CL3
Class 2 General-Purpose Cable	CL2
Power Limited Fire Alarm Cable	FPL
Nonconductive General-Purpose Optical Fiber Cable	OFN
Conductive General-Purpose Optical Fiber Cable	OFC
Alternative Nonconductive General-Purpose Optical Fiber Cable	OFNG
Alternative Conductive General-Purpose Optical Fiber Cable	OFCG
Class 3 Cable – Limited Use	CL3X
Class 2 Cable – Limited Uses	CL2X
Under Carpet Cable	CMUC

Informational Note: Informational Note: Cable types are listed in descending order of fire resistance rating.

(C) Optional Markings. Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note No. 1: These markings include, but are not limited to, markings for limited smoke, halogen free, low smoke and halogen free, and sunlight resistant.

Informational Note No. 2: Some examples of optional markings are ST1 to indicate limited smoke characteristics in accordance with UL 2556, *Wire and Cable Test Methods*; HF to indicate halogen free as described in UL 2885, *Outline of Investigation for Acid Gas, Acidity and Conductivity of Combusted Materials*; and LSHF to indicate halogen free and low smoke characteristics in accordance with IEC 61034-2, *Measurement of smoke density of cables burning under defined conditions — Part 2: Test procedure and requirements*.

Public Input No. 3827-NFPA 70-2020 [Global Input]

See Attached Word Document for Changes

Additional Proposed Changes

File Name	Description	Approved
Chapter_3_MV_Restructuring_FINAL_.docx	Global PI to Revise Articles 300, 311, 314, 368, and 399, Adding New Articles 305 and 315	

Statement of Problem and Substantiation for Public Input

This Public Input is submitted on behalf of a Correlating Committee Long-Range Planning Task Group consisting of Robert Osborne (Chair), Paul Barnhart, Lou Grahor, David Temple, Donny Cook, Dean Hunter, Mike Querry, Roger McDaniel, Dave Burns, Rod Belisle, and Kevin Rogers. This Public Input, along with other companion Public Inputs, was developed with the goal of improving usability and providing a platform to increase the focus on requirements associated with Medium or High Voltage.

Installations, including campus-wide distribution systems, microgrids, alternative energy installations, etc., are covered by the Scope of the NEC®; however, requirements for conductors, equipment, and raceways used in applications operating in systems rated over 1000 volts are treated as an "after-thought" in how they are arranged in the document and covered by Technical Committees. In many cases, the "over 1000 volts" requirements exist in a dedicated "Part" within the Article – such is the case with existing Article 300. In other cases, similar products are handled in two separate Articles, such as with "switchgear", with equipment rated 1000 volts and below addressed in Article 408, and equipment rated over 1000 volts addressed in Article 490. In addition to these two approaches, there are Articles where the "over 1000 volts" is intermingled with the "under 1000 volt" requirements, such as the case with Article 225. In many of these cases, the information for over 1000 volts is very limited (for example, Article 240, has only 3 Sections in the Part dedicated to requirements for over 1000 volts).

This Task Group's initial tasks was to establish a demarcation for what can be referred to as Medium or High Voltage. The recommendation has been to establish this threshold as being equipment rated over 1000 Vac, 1500 Vdc. It is believed that levels below these voltages can be addressed with existing requirements for systems rated 1000 V ac max, and 1500 V dc, as this has been established as an upper limit for photovoltaic applications within Article 690, with requirements noting that those systems are not required to comply with Parts II and III of Article 490.

Using these limits, the Task Group then set out to identify a structure to better align requirements, improve consistency in approach, improve usability, and create the opportunity for a Code Making Panel to have an increased focus on higher voltage applications. Work during the 2020 Code cycle to separate conductor requirements into two Articles (310 and 311) also served as an example of how this could be accomplished; however, conductors and cables present a unique challenge insomuch that the line of demarcation for "general" and "medium" voltages do not conform to the limits established by the task group. While future work may result in these Articles realigning their voltage limits, the discrepancy was not considered by the Task Group to compromise the other changes from being pursued.

All changes to Chapter 3 are being submitted as a Global Input, and below is a summary of those changes:

- Article 300 remains "General Requirements for Wiring Methods and Materials," with requirements specific to installations above 1000 V being relocated to new Article 305.
- Article 305 is created to cover "Wiring Methods and Materials for Systems Rated Over 1000 Volts ac, 1500 Volts dc, Nominal
  - Table 305.7 provides an overview of those wiring methods that are permitted for use above 1000 Vac, 1500 V dc. Articles where it was practical to relocate requirements to 305 were revised – these are noted in subsequent bullet items in this list. Other Articles, where requirements were written in such a way that the extraction of the material was considered to likely adversely impact usability were not modified. Other Articles, where the wiring methods were agnostic to voltage, were also not modified. Table 305.7 is intended to serve as the single source for identifying what wiring methods shall be permitted for use in applications over 1000 V.
- Article 311 is renumbered to Article 315 (the Task Group's recommendation is to have all "over 1000 volt" Articles have a number that ends in "5").
- Article 314 is revised to relocate Part IV to Article 305, Part II.
- Article 368 is revised to relocate Part IV to Article 305, Part III.
- Article 399 is deleted, with all content for Article 399 being relocated to Article 305, Part IV.

Note: There are other Public Inputs being submitted that address restructuring, and these are identified as "Companion Public Inputs". Other Article or Section references may be impacted due restructuring activities by those companion Public Inputs; however, changes to references outside of Chapter 3 are not shown in this Public Input.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3728-NFPA 70-2020 [Global Input]	Companion Public Input (Articles 245 and 495)
Public Input No. 3765-NFPA 70-2020 [New Section after 250.194(B)]	Companion Public Input (Article 255)
Public Input No. 3772-NFPA 70-2020 [New Section after 110.79]	Companion Public Input (Article 115)
Public Input No. 3815-NFPA 70-2020 [New Section after 200.11]	Companion Public Input (Article 205)
Public Input No. 3819-NFPA 70-2020 [Global Input]	Companion Public Input (Article 235)
Public Input No. 3838-NFPA 70-2020 [Section No. 690.31(A)]	Companion Public Input (Section 690.31(A))
Public Input No. 3846-NFPA 70-2020 [Section No. 694.30(A)]	Companion Public Input (Section 694.30(A))
Public Input No. 3849-NFPA 70-2020 [New Part after IV.]	Companion Public Input (Section 706.30)
Public Input No. 3728-NFPA 70-2020 [Global Input]	
Public Input No. 3765-NFPA 70-2020 [New Section after 250.194(B)]	
Public Input No. 3772-NFPA 70-2020 [New Section after 110.79]	
Public Input No. 3815-NFPA 70-2020 [New Section after 200.11]	
Public Input No. 3819-NFPA 70-2020 [Global Input]	
Public Input No. 3838-NFPA 70-2020 [Section No. 690.31(A)]	
Public Input No. 3846-NFPA 70-2020 [Section No. 694.30(A)]	
Public Input No. 3849-NFPA 70-2020 [New Part after IV.]	

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Committee: NEC-P03

Substantiation:

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Using these limits, the Task Group then set out to identify a structure to better align requirements, improve consistency in approach, improve usability, and create the opportunity for a Code Making Panel to have an increased focus on higher voltage applications. Work during the 2020 Code cycle to separate conductor requirements into two Articles (310 and 311) also served as an example of how this could be accomplished; however, conductors and cables present a unique challenge insomuch that the line of demarcation for "general" and "medium" voltages do not conform to the limits established by the task group. While future work may result in these Articles realigning their voltage limits, the discrepancy was not considered by the Task Group to compromise the other changes from being pursued.

All changes to Chapter 3 are being submitted as a Global Input, and below is a summary of those changes:

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- Article 305 is created to cover "Wiring Methods and Materials for Systems Rated Over 1000 Volts ac, 1500 Volts dc, Nominal

    - Table 305.7 provides an overview of those wiring methods that are permitted for use above 1000 Vac, 1500 V dc. Articles where it was practical to relocate requirements to 305 were revised – these are noted in subsequent bullet items in this list. Other Articles, where requirements were written in such a way that the extraction of the material was considered to likely adversely impact usability were not modified. Other Articles, where the wiring methods were agnostic to voltage, were also not modified. Table 305.7 is intended to serve as the single source for identifying what wiring methods shall be permitted for use in applications over 1000 V.

- Article 311 is renumbered to Article 315 (the Task Group's recommendation is to have all "over 1000 volt" Articles have a number that ends in "5").
- Article 314 is revised to relocate Part IV to Article 305, Part II.
- Article 368 is revised to relocate Part IV to Article 305, Part III.
- Article 399 is deleted, with all content for Article 399 being relocated to Article 305, Part IV.

Note: There are other Public Inputs being submitted that address restructuring, and these are identified as "Companion Public Inputs". Other Article or Section references may be impacted due restructuring activities by those companion Public Inputs; however, changes to references outside of Chapter 3 are not shown in this Public Input.

Revised Article 300:

ARTICLE 300 General Requirements for Wiring Methods and Materials

~~Part I. General Requirements~~

300.1 Scope.

300.1(A) All Wiring Installations.
This article covers general requirements for wiring methods and materials for all wiring installations unless modified by other articles in Chapter 3.

300.1(B) Integral Parts of Equipment.
The provisions of this article are not intended to apply to the conductors that form an integral part of equipment, such as motors, controllers, motor control centers, or factory-assembled control equipment or listed utilization equipment.

300.1(C) Metric Designators and Trade Sizes.
Metric designators and trade sizes for conduit, tubing, and associated fittings and accessories shall be as designated in Table 300.1(C).

Table 300.1(C) Metric Designators and Trade Sizes

Metric Designator	Trade Size
12	3/8
16	1/2
21	3/4
27	1
35	1 1/4
41	1 1/2
53	2
63	2 1/2
78	3
91	3 1/2
103	4
129	5
155	6

Note: The metric designators and trade sizes are for identification purposes only and are not actual dimensions.

300.2 Limitations.

300.2(A) Voltage.
Wiring methods specified in Chapter 3, with the exception of those specified in Article 305, shall be used for 1000 volts ac, 1500 volts dc, nominal, or less. ~~where not specifically limited in some section of Chapter 3.~~ They shall be permitted for over 1000 volts ac, 1500 volts dc, nominal, where specifically permitted in Article 305~~elsewhere in this *Code*~~.

300.2(B) Temperature.

Temperature limitation of conductors shall be in accordance with 310.14(A)(3).

300.3 Conductors.

300.3(A) Single Conductors.
Single conductors specified in Table 310.4(A) shall only be installed where part of a recognized wiring method of Chapter 3.

Exception: Individual conductors shall be permitted where installed as separate overhead conductors in accordance with 225.6.

300.3(B) Conductors of the Same Circuit.
All conductors of the same circuit and, where used, the grounded conductor and all equipment grounding conductors and bonding conductors shall be contained within the same raceway, auxiliary gutter, cable tray, cablebus assembly, trench, cable, or cord, unless otherwise permitted in accordance with 300.3(B)(1) through (B)(4).

300.3(B)(1) Paralleled Installations.
Conductors shall be permitted to be run in parallel in accordance with the provisions of 310.10(G). The requirement to run all circuit conductors within the same raceway, auxiliary gutter, cable tray, trench, cable, or cord shall apply separately to each portion of the paralleled installation, and the equipment grounding conductors shall comply with 250.122. Connections, taps, or extensions made from paralleled conductors shall connect to all conductors of the paralleled set, grounded and ungrounded, as applicable. Parallel runs in cable trays shall comply with 392.20(C).

Exception: Conductors installed in nonmetallic raceways run underground shall be permitted to be arranged as isolated phase, neutral, and grounded conductor installations. The raceways shall be installed in close proximity, and the isolated phase, neutral, and grounded conductors shall comply with 300.20(B).

300.3(B)(2) Grounding and Bonding Conductors.
Equipment grounding conductors shall be permitted to be installed outside a raceway or cable assembly where in accordance with the provisions of 250.130(C) for certain existing installations or in accordance with 250.134, Exception No. 2, for dc circuits. Equipment bonding conductors shall be permitted to be installed on the outside of raceways in accordance with 250.102(E).

300.3(B)(3) Nonferrous Wiring Methods.
Conductors in wiring methods with a nonmetallic or other nonmagnetic sheath, where run in different raceways, auxiliary gutters, cable trays, trenches, cables, or cords, shall comply with 300.20(B). Conductors in single-conductor Type MI cable with a nonmagnetic sheath shall comply with 332.31. Conductors of single-conductor Type MC cable with a nonmagnetic sheath shall comply with 330.31, 330.116, and 300.20(B).

300.3(B)(4) Column-Width Panelboard Enclosures.
Where an auxiliary gutter runs between a column-width panelboard and a pull box, and the pull box includes neutral terminations, the neutral conductors of circuits supplied from the panelboard shall be permitted to originate in the pull box.

300.3(C) Conductors of Different Systems.

300.3(C)(1) 1000 Volts ac, 1500 Volts dc, Nominal, or Less.
Conductors of ac and dc circuits, rated 1000 volts ac, 1500 volts dc, nominal, or less, shall be permitted to occupy the same equipment wiring enclosure, cable, or raceway. All conductors shall have an insulation rating equal to at least the maximum circuit voltage applied to any conductor within the enclosure, cable, or raceway.

Secondary wiring to electric-discharge lamps of 1000 volts ac, 1500 volts dc, or less, if insulated for the secondary voltage involved, shall be permitted to occupy the same luminaire, sign, or outline lighting enclosure as the branch-circuit conductors.

Informational Note No. 1: See 725.136(A) for Class 2 and Class 3 circuit conductors.

Informational Note No. 2: See 690.31(B) for photovoltaic source and output circuits.

300.3(C)(2) Over 1000 Volts ac, 1500 Volts dc, Nominal.
Conductors of circuits rated over 1000 volts ac, 1500 volts dc, nominal, shall not occupy the same equipment wiring enclosure, cable, or raceway with conductors of circuits rated 1000 volts ac, 1500 volts dc, nominal, or less unless permitted in ~~in~~ 305.3. ~~otherwise permitted in 300.3(C)(2)(a) through 300.3(C)(2)(d).~~

> ~~(a) Primary leads of electric-discharge lamp ballasts insulated for the primary voltage of the ballast, where contained within the individual wiring enclosure, shall be permitted to occupy the same luminaire, sign, or outline lighting enclosure as the branch-circuit conductors.~~
> ~~(b) Excitation, control, relay, and ammeter conductors used in connection with any individual motor or starter shall be permitted to occupy the same enclosure as the motor circuit conductors.~~
> ~~(c) In motors, transformers, switchgear, switchboards, control assemblies, and similar equipment, conductors of different voltage ratings shall be permitted.~~
> ~~(d) In manholes, if the conductors of each system are permanently and effectively separated from the conductors of the other systems and securely fastened to racks, insulators, or other approved supports, conductors of different voltage ratings shall be permitted.~~

~~Conductors having nonshielded insulation and operating at different voltage levels shall not occupy the same enclosure, cable, or raceway.~~

300.4 Protection Against Physical Damage.
Where subject to physical damage, conductors, raceways, and cables shall be protected.

300.4(A) Cables and Raceways Through Wood Members.

300.4(A)(1) Bored Holes.
In both exposed and concealed locations, where a cable- or raceway-type wiring method is installed through bored holes in joists, rafters, or wood members, holes shall be bored so that the edge of the hole is not less than 32 mm (1$^{1}\!/_{4}$ in.) from the nearest edge of the wood member. Where this distance cannot be maintained, the cable or raceway shall be protected from penetration by screws or nails by a steel plate(s) or bushing(s), at least 1.6 mm ($^{1}\!/_{16}$ in.) thick, and of appropriate length and width installed to cover the area of the wiring.

Exception No. 1: Steel plates shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, or electrical metallic tubing.

Exception No. 2: A listed and marked steel plate less than 1.6 mm ($^{1}\!/_{16}$ in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

300.4(A)(2) Notches in Wood.
Where there is no objection because of weakening the building structure, in both exposed and concealed locations, cables or raceways shall be permitted to be laid in notches in wood studs, joists, rafters, or other wood members where the cable or raceway at those points is protected against nails or screws by a steel plate at least 1.6 mm ($^{1}\!/_{16}$ in.) thick, and of appropriate length and width, installed to cover the area of the wiring. The steel plate shall be installed before the building finish is applied.

Exception No. 1: Steel plates shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, or electrical metallic tubing.

Exception No. 2: A listed and marked steel plate less than 1.6 mm ($^{1}\!/_{16}$ in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

300.4(B) Nonmetallic-Sheathed Cables and Electrical Nonmetallic Tubing Through Metal Framing Members.

300.4(B)(1) Nonmetallic-Sheathed Cable.
In both exposed and concealed locations where nonmetallic-sheathed cables pass through either factory- or field-punched, cut, or drilled slots or holes in metal members, the cable shall be protected by listed bushings or listed grommets covering all metal edges that are securely fastened in the opening prior to installation of the cable.

300.4(B)(2) Nonmetallic-Sheathed Cable and Electrical Nonmetallic Tubing.

Where nails or screws are likely to penetrate nonmetallic-sheathed cable or electrical nonmetallic tubing, a steel sleeve, steel plate, or steel clip not less than 1.6 mm (1⁄16 in.) in thickness shall be used to protect the cable or tubing.

Exception: A listed and marked steel plate less than 1.6 mm (1⁄16 in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

300.4(C) Cables Through Spaces Behind Panels Designed to Allow Access.
Cables or raceway-type wiring methods, installed behind panels designed to allow access, shall be supported according to their applicable articles.

300.4(D) Cables and Raceways Parallel to Framing Members and Furring Strips.
In both exposed and concealed locations, where a cable- or raceway-type wiring method is installed parallel to framing members, such as joists, rafters, or studs, or is installed parallel to furring strips, the cable or raceway shall be installed and supported so that the nearest outside surface of the cable or raceway is not less than 32 mm (1¼ in.) from the nearest edge of the framing member or furring strips where nails or screws are likely to penetrate. Where this distance cannot be maintained, the cable or raceway shall be protected from penetration by nails or screws by a steel plate, sleeve, or equivalent at least 1.6 mm (1⁄16 in.) thick.

Exception No. 1: Steel plates, sleeves, or the equivalent shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, or electrical metallic tubing.

Exception No. 2: For concealed work in finished buildings, or finished panels for prefabricated buildings where such supporting is impracticable, it shall be permissible to fish the cables between access points.

Exception No. 3: A listed and marked steel plate less than 1.6 mm (1⁄16 in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

300.4(E) Cables, Raceways, or Boxes Installed in or Under Roof Decking.
A cable, raceway, or box, installed in exposed or concealed locations under metal-corrugated sheet roof decking, shall be installed and supported so there is not less than 38 mm (1½ in.) measured from the lowest surface of the roof decking to the top of the cable, raceway, or box. A cable, raceway, or box shall not be installed in concealed locations in metal-corrugated, sheet decking–type roof.

Informational Note: Roof decking material is often repaired or replaced after the initial raceway or cabling and roofing installation and may be penetrated by the screws or other mechanical devices designed to provide “hold down” strength of the waterproof membrane or roof insulating material.

Exception: Rigid metal conduit and intermediate metal conduit shall not be required to comply with 300.4(E).

300.4(F) Cables and Raceways Installed in Shallow Grooves.
Cable- or raceway-type wiring methods installed in a groove, to be covered by wallboard, siding, paneling, carpeting, or similar finish, shall be protected by 1.6 mm (1⁄16 in.) thick steel plate, sleeve, or equivalent or by not less than 32-mm (1¼-in.) free space for the full length of the groove in which the cable or raceway is installed.

Exception No. 1: Steel plates, sleeves, or the equivalent shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, or electrical metallic tubing.

Exception No. 2: A listed and marked steel plate less than 1.6 mm (1⁄16 in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

300.4(G) Fittings.
Where raceways contain 4 AWG or larger insulated circuit conductors, and these conductors enter a cabinet, a box, an enclosure, or a raceway, the conductors shall be protected in accordance with any of the following:

(1) An identified fitting providing a smoothly rounded insulating surface
(2) A listed metal fitting that has smoothly rounded edges

(3) Separation from the fitting or raceway using an identified insulating material that is securely fastened in place
(4) Threaded hubs or bosses that are an integral part of a cabinet, box, enclosure, or raceway providing a smoothly rounded or flared entry for conductors

Conduit bushings constructed wholly of insulating material shall not be used to secure a fitting or raceway. The insulating fitting or insulating material shall have a temperature rating not less than the insulation temperature rating of the installed conductors.

300.4(H) Structural Joints.
A listed expansion/deflection fitting or other approved means shall be used where a raceway crosses a structural joint intended for expansion, contraction or deflection, used in buildings, bridges, parking garages, or other structures.

300.5 Underground Installations.

300.5(A) Minimum Cover Requirements.
Direct-buried cable, conduit, or other raceways shall be installed to meet the minimum cover requirements of Table 300.5.

Table 300.5 Minimum Cover Requirements, 0 to 1000 Volts ac, 1500 Volts dc, Nominal, Burial in Millimeters (Inches)

Location of Wiring Method or Circuit	Type of Wiring Method or Circuit									
	Column 1 Direct Burial Cables or Conductors		Column 2 Rigid Metal Conduit or Intermediate Metal Conduit		Column 3 Nonmetallic Raceways Listed for Direct Burial Without Concrete Encasement or Other Approved Raceways		Column 4 Residential Branch Circuits Rated 120 Volts or Less with GFCI Protection and Maximum Overcurrent Protection of 20 Amperes		Column 5 Circuits for Control of Irrigation and Landscape Lighting Limited to Not More Than 30 Volts and Installed with Type UF or in Other Identified Cable or Raceway	
	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
All locations not specified below	600	24	150	6	450	18	300	12	150[a, b]	6[a, b]
In trench below 50 mm (2 in.) thick concrete or equivalent	450	18	150	6	300	12	150	6	150	6
Under a building	0	0 (in raceway or Type MC or Type MI cable identified for direct burial)	0	0	0	0	0	0 (in raceway or Type MC or Type MI cable identified for direct burial)	0	0 (in raceway or Type MC or Type MI cable identified for direct burial)
Under minimum of 102 mm (4 in.) thick concrete exterior	450	18	100	4	100	4	150 (direct burial)	6	150 (direct burial)	6

Table 300.5 Minimum Cover Requirements, 0 to 1000 Volts ac, 1500 Volts dc, Nominal, Burial in Millimeters (Inches)

Location of Wiring Method or Circuit	Type of Wiring Method or Circuit									
	Column 1 Direct Burial Cables or Conductors		Column 2 Rigid Metal Conduit or Intermediate Metal Conduit		Column 3 Nonmetallic Raceways Listed for Direct Burial Without Concrete Encasement or Other Approved Raceways		Column 4 Residential Branch Circuits Rated 120 Volts or Less with GFCI Protection and Maximum Overcurrent Protection of 20 Amperes		Column 5 Circuits for Control of Irrigation and Landscape Lighting Limited to Not More Than 30 Volts and Installed with Type UF or in Other Identified Cable or Raceway	
	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
slab with no vehicular traffic and the slab extending not less than 152 mm (6 in.) beyond the underground installation							100 (in raceway)	4	100 (in raceway)	4
Under streets, highways, roads, alleys, driveways, and parking lots	600	24	600	24	600	24	600	24	600	24
One- and two-family dwelling driveways and outdoor parking areas, and used only for dwelling-related purposes	450	18	450	18	450	18	300	12	450	18
In or under airport runways, including adjacent areas where trespassing prohibited	450	18	450	18	450	18	450	18	450	18

[a]A lesser depth shall be permitted where specified in the installation instructions of a listed low-voltage lighting system.
[b]A depth of 150 mm (6 in.) shall be permitted for pool, spa, and fountain lighting, installed in a nonmetallic raceway, limited to not more than 30 volts where part of a listed low-voltage lighting system.

Notes:

1. Cover is defined as the shortest distance in mm (in.) measured between a point on the top surface of any direct-buried conductor, cable, conduit, or other raceway and the top surface of finished grade, concrete, or similar cover.
2. Raceways approved for burial only where concrete encased shall require concrete envelope not less than 50 mm (2 in.) thick.
3. Lesser depths shall be permitted where cables and conductors rise for terminations or splices or where access is otherwise required.

4. Where one of the wiring method types listed in Columns 1 through 3 is used for one of the circuit types in Columns 4 and 5, the shallowest depth of burial shall be permitted.
5. Where solid rock prevents compliance with the cover depths specified in this table, the wiring shall be installed in a metal raceway, or a nonmetallic raceway permitted for direct burial. The raceways shall be covered by a minimum of 50 mm (2 in.) of concrete extending down to rock.

300.5(B) Wet Locations.
The interior of enclosures or raceways installed underground shall be considered to be a wet location. Insulated conductors and cables installed in these enclosures or raceways in underground installations shall comply with 310.10(C).

300.5(C) Underground Cables and Conductors Under Buildings.
Underground cable and conductors installed under a building shall be in a raceway.

Exception No. 1: Type MI cable shall be permitted under a building without installation in a raceway where embedded in concrete, fill, or other masonry in accordance with 332.10(6) or in underground runs where suitably protected against physical damage and corrosive conditions in accordance with 332.10(10).

Exception No. 2: Type MC cable listed for direct burial or concrete encasement shall be permitted under a building without installation in a raceway in accordance with 330.10(A)(5) and in wet locations in accordance with 330.10(A)(11).

300.5(D) Protection from Damage.
Direct-buried conductors and cables shall be protected from damage in accordance with 300.5(D)(1) through (D)(4).

300.5(D)(1) Emerging from Grade.
Direct-buried conductors and cables emerging from grade and specified in columns 1 and 4 of Table 300.5 shall be protected by enclosures or raceways extending from the minimum cover distance below grade required by 300.5(A) to a point at least 2.5 m (8 ft) above finished grade. In no case shall the protection be required to exceed 450 mm (18 in.) below finished grade.

300.5(D)(2) Conductors Entering Buildings.
Conductors entering a building shall be protected to the point of entrance.

300.5(D)(3) Service Conductors.
Underground service conductors that are not encased in concrete and that are buried 450 mm (18 in.) or more below grade shall have their location identified by a warning ribbon that is placed in the trench at least 300 mm (12 in.) above the underground installation.

300.5(D)(4) Enclosure or Raceway Damage.
Where the enclosure or raceway is subject to physical damage, the conductors shall be installed in electrical metallic tubing, rigid metal conduit, intermediate metal conduit, RTRC-XW, Schedule 80 PVC conduit, or equivalent.

300.5(E) Splices and Taps.
Direct-buried conductors or cables shall be permitted to be spliced or tapped without the use of splice boxes. The splices or taps shall be made in accordance with 110.14(B).

300.5(F) Backfill.
Backfill that contains large rocks, paving materials, cinders, large or sharply angular substances, or corrosive material shall not be placed in an excavation where materials may damage raceways, cables, conductors, or other substructures or prevent adequate compaction of fill or contribute to corrosion of raceways, cables, or other substructures.

Where necessary to prevent physical damage to the raceway, cable, or conductor, protection shall be provided in the form of granular or selected material, suitable running boards, suitable sleeves, or other approved means.

300.5(G) Raceway Seals.

Conduits or raceways through which moisture may contact live parts shall be sealed or plugged at either or both ends. Spare or unused raceways shall also be sealed. Sealants shall be identified for use with the cable insulation, conductor insulation, bare conductor, shield, or other components.

Informational Note: Presence of hazardous gases or vapors may also necessitate sealing of underground conduits or raceways entering buildings.

300.5(H) Bushing.
A bushing, or terminal fitting, with an integral bushed opening shall be used at the end of a conduit or other raceway that terminates underground where the conductors or cables emerge as a direct burial wiring method. A seal incorporating the physical protection characteristics of a bushing shall be permitted to be used in lieu of a bushing.

300.5(I) Conductors of the Same Circuit.
All conductors of the same circuit and, where used, the grounded conductor and all equipment grounding conductors shall be installed in the same raceway or cable or shall be installed in close proximity in the same trench.

Exception No. 1: Conductors shall be permitted to be installed in parallel in raceways, multiconductor cables, or direct-buried single conductor cables. Each raceway or multiconductor cable shall contain all conductors of the same circuit, including equipment grounding conductors. Each direct-buried single conductor cable shall be located in close proximity in the trench to the other single conductor cables in the same parallel set of conductors in the circuit, including equipment grounding conductors.

Exception No. 2: Isolated phase, polarity, grounded conductor, and equipment grounding and bonding conductor installations shall be permitted in nonmetallic raceways or cables with a nonmetallic covering or nonmagnetic sheath in close proximity where conductors are paralleled as permitted in 310.10(G), and where the conditions of 300.20(B) are met.

300.5(J) Earth Movement.
Where direct-buried conductors, raceways, or cables are subject to movement by settlement or frost, direct-buried conductors, raceways, or cables shall be arranged so as to prevent damage to the enclosed conductors or to equipment connected to the raceways.

Informational Note: This section recognizes “S” loops in underground direct burial cables and conductors to raceway transitions, expansion fittings in raceway risers to fixed equipment, and, generally, the provision of flexible connections to equipment subject to settlement or frost heaves.

300.5(K) Directional Boring.
Cables or raceways installed using directional boring equipment shall be approved for the purpose.

300.6 Protection Against Corrosion and Deterioration.
Raceways, cable trays, cablebus, auxiliary gutters, cable armor, boxes, cable sheathing, cabinets, elbows, couplings, fittings, supports, and support hardware shall be of materials suitable for the environment in which they are to be installed.

300.6(A) Ferrous Metal Equipment.
Ferrous metal raceways, cable trays, cablebus, auxiliary gutters, cable armor, boxes, cable sheathing, cabinets, metal elbows, couplings, nipples, fittings, supports, and support hardware shall be suitably protected against corrosion inside and outside (except threads at joints) by a coating of approved corrosion-resistant material. Where corrosion protection is necessary and the conduit is threaded in the field, the threads shall be coated with an approved electrically conductive, corrosion-resistant compound.

Informational Note: Field-cut threads are those threads that are cut in conduit, elbows, or nipples anywhere other than at the factory where the product is listed.

Exception: Stainless steel shall not be required to have protective coatings.

300.6(A)(1) Protected from Corrosion Solely by Enamel.

Where protected from corrosion solely by enamel, ferrous metal raceways, cable trays, cablebus, auxiliary gutters, cable armor, boxes, cable sheathing, cabinets, metal elbows, couplings, nipples, fittings, supports, and support hardware shall not be used outdoors or in wet locations as described in 300.6(D).

300.6(A)(2) Organic Coatings on Boxes or Cabinets.
Where boxes or cabinets have an approved system of organic coatings and are marked “Raintight,” “Rainproof,” or “Outdoor Type,” they shall be permitted outdoors.

300.6(A)(3) In Concrete or in Direct Contact with the Earth.
Ferrous metal raceways, cable armor, boxes, cable sheathing, cabinets, elbows, couplings, nipples, fittings, supports, and support hardware shall be permitted to be installed in concrete or in direct contact with the earth, or in areas subject to severe corrosive influences where made of material approved for the condition, or where provided with corrosion protection approved for the condition.

300.6(B) Aluminum Metal Equipment.
Aluminum raceways, cable trays, cablebus, auxiliary gutters, cable armor, boxes, cable sheathing, cabinets, elbows, couplings, nipples, fittings, supports, and support hardware embedded or encased in concrete or in direct contact with the earth shall be provided with supplementary corrosion protection.

300.6(C) Nonmetallic Equipment.
Nonmetallic raceways, cable trays, cablebus, auxiliary gutters, boxes, cables with a nonmetallic outer jacket and internal metal armor or jacket, cable sheathing, cabinets, elbows, couplings, nipples, fittings, supports, and support hardware shall be made of material approved for the condition and shall comply with 300.6(C)(1) and (C)(2) as applicable to the specific installation.

300.6(C)(1) Exposed to Sunlight.
Where exposed to sunlight, the materials shall be listed as sunlight resistant or shall be identified as sunlight resistant.

300.6(C)(2) Chemical Exposure.
Where subject to exposure to chemical solvents, vapors, splashing, or immersion, materials or coatings shall either be inherently resistant to chemicals based on their listing or be identified for the specific chemical reagent.

300.6(D) Indoor Wet Locations.
In portions of dairy processing facilities, laundries, canneries, and other indoor wet locations, and in locations where walls are frequently washed or where there are surfaces of absorbent materials, such as damp paper or wood, the entire wiring system, where installed exposed, including all boxes, fittings, raceways, and cable used therewith, shall be mounted so that there is at least a 6-mm ($1/4$-in.) airspace between it and the wall or supporting surface.

Exception: Nonmetallic raceways, boxes, and fittings shall be permitted to be installed without the airspace on a concrete, masonry, tile, or similar surface.

Informational Note: In general, areas where acids and alkali chemicals are handled and stored may present such corrosive conditions, particularly when wet or damp. Severe corrosive conditions may also be present in portions of meatpacking plants, tanneries, glue houses, and some stables; in installations immediately adjacent to a seashore and swimming pool areas; in areas where chemical deicers are used; and in storage cellars or rooms for hides, casings, fertilizer, salt, and bulk chemicals.

300.7 Raceways Exposed to Different Temperatures.

300.7(A) Sealing.
Where portions of a raceway or sleeve are known to be subjected to different temperatures, and where condensation is known to be a problem, as in cold storage areas of buildings or where passing from the interior to the exterior of a building, the raceway or sleeve shall be sealed to prevent the circulation of warm air to a colder section of the raceway or sleeve. Sealants shall be identified for use with cable insulation, conductor insulation, a bare conductor, a shield, or other components. An explosionproof seal shall not be required for this purpose.

300.7(B) Expansion, Expansion-Deflection, and Deflection Fittings.

Raceways shall be provided with expansion, expansion-deflection, or deflection fittings where necessary to compensate for thermal expansion, deflection, and contraction.

Informational Note: Table 352.44 and Table 355.44 provide the expansion information for polyvinyl chloride (PVC) and for reinforced thermosetting resin conduit (RTRC), respectively. A nominal number for steel conduit can be determined by multiplying the expansion length in Table 352.44 by 0.20. The coefficient of expansion for steel electrical metallic tubing, intermediate metal conduit, and rigid metal conduit is 1.170×10^{-5} (0.0000117 mm per mm of conduit for each °C in temperature change) [0.650×10^{-5} (0.0000065 in. per inch of conduit for each °F in temperature change)].

A nominal number for aluminum conduit and aluminum electrical metallic tubing can be determined by multiplying the expansion length in Table 352.44 by 0.40. The coefficient of expansion for aluminum electrical metallic tubing and aluminum rigid metal conduit is 2.34×10^{-5} (0.0000234 mm per mm of conduit for each °C in temperature change) [1.30×10^{-5} (0.000013 in. per inch of conduit for each °F in temperature change)].

300.8 Installation of Conductors with Other Systems.
Raceways or cable trays containing electrical conductors shall not contain any pipe, tube, or equal for steam, water, air, gas, drainage, or any service other than electrical.

300.9 Raceways in Wet Locations Abovegrade.
Where raceways are installed in wet locations abovegrade, the interior of these raceways shall be considered to be a wet location. Insulated conductors and cables installed in raceways in wet locations abovegrade shall comply with 310.10(C).

300.10 Electrical Continuity of Metal Raceways and Enclosures.
Metal raceways, cable armor, and other metal enclosures for conductors shall be metallically joined together into a continuous electrical conductor and shall be connected to all boxes, fittings, and cabinets so as to provide effective electrical continuity. Unless specifically permitted elsewhere in this *Code*, raceways and cable assemblies shall be mechanically secured to boxes, fittings, cabinets, and other enclosures.

Exception No. 1: Short sections of raceways used to provide support or protection of cable assemblies from physical damage shall not be required to be made electrically continuous.

Exception No. 2: Equipment enclosures to be isolated, as permitted by 250.96(B), shall not be required to be metallically joined to the metal raceway.

300.11 Securing and Supporting.

300.11(A) Secured in Place.
Raceways, cable assemblies, boxes, cabinets, and fittings shall be securely fastened in place.

300.11(B) Wiring Systems Installed Above Suspended Ceilings.
Support wires that do not provide secure support shall not be permitted as the sole support. Support wires and associated fittings that provide secure support and that are installed in addition to the ceiling grid support wires shall be permitted as the sole support. Where independent support wires are used, they shall be secured at both ends. Cables and raceways shall not be supported by ceiling grids.

300.11(B)(1) Fire-Rated Assemblies.
Wiring located within the cavity of a fire-rated floor–ceiling or roof–ceiling assembly shall not be secured to, or supported by, the ceiling assembly, including the ceiling support wires. An independent means of secure support shall be provided and shall be permitted to be attached to the assembly. Where independent support wires are used, they shall be distinguishable by color, tagging, or other effective means from those that are part of the fire-rated design.

Exception: The ceiling support system shall be permitted to support wiring and equipment that have been tested as part of the fire-rated assembly.

Informational Note: One method of determining fire rating is testing in accordance with ANSI/ASTM E119-18b, *Standard Test Methods for Fire Tests of Building Construction and Materials*.

300.11(B)(2) Non–Fire-Rated Assemblies.
Wiring located within the cavity of a non–fire-rated floor–ceiling or roof–ceiling assembly shall not be secured to, or supported by, the ceiling assembly, including the ceiling support wires. An independent means of secure support shall be provided and shall be permitted to be attached to the assembly. Where independent support wires are used, they shall be distinguishable by color, tagging, or other effective means.

Exception: The ceiling support system shall be permitted to support branch-circuit wiring and associated equipment where installed in accordance with the ceiling system manufacturer's instructions.

300.11(C) Raceways Used as Means of Support.
Raceways shall be used only as a means of support for other raceways, cables, or nonelectrical equipment under any of the following conditions:

(1) Where the raceway or means of support is identified as a means of support
(2) Where the raceway contains power supply conductors for electrically controlled equipment and is used to support Class 2 circuit conductors or cables that are solely for the purpose of connection to the equipment control circuits
(3) Where the raceway is used to support boxes or conduit bodies in accordance with 314.23 or to support luminaires in accordance with 410.36(E)

300.11(D) Cables Not Used as Means of Support.
Cable wiring methods shall not be used as a means of support for other cables, raceways, or nonelectrical equipment.

300.12 Mechanical Continuity — Raceways and Cables.
Raceways, cable armors, and cable sheaths shall be continuous between cabinets, boxes, fittings, or other enclosures or outlets.

Exception No. 1: Short sections of raceways used to provide support or protection of cable assemblies from physical damage shall not be required to be mechanically continuous.

Exception No. 2: Raceways and cables installed into the bottom of open bottom equipment, such as switchboards, motor control centers, and floor or pad-mounted transformers, shall not be required to be mechanically secured to the equipment.

300.13 Mechanical and Electrical Continuity — Conductors.

300.13(A) General.
Conductors in raceways shall be continuous between outlets, boxes, devices, and so forth. There shall be no splice or tap within a raceway unless permitted by 300.15, 368.56(A), 376.56, 378.56, 384.56, 386.56, 388.56, or 390.56.

300.13(B) Device Removal.
In multiwire branch circuits, the continuity of a grounded conductor shall not depend on device connections such as lampholders, receptacles, and so forth, where the removal of such devices would interrupt the continuity.

300.14 Length of Free Conductors at Outlets, Junctions, and Switch Points.
At least 150 mm (6 in.) of free conductor, measured from the point in the box where it emerges from its raceway or cable sheath, shall be left at each outlet, junction, and switch point for splices or the connection of luminaires or devices. Where the opening to an outlet, junction, or switch point is less than 200 mm (8 in.) in any dimension, each conductor shall be long enough to extend at least 75 mm (3 in.) outside the opening.

Exception: Conductors that are not spliced or terminated at the outlet, junction, or switch point shall not be required to comply with 300.14.

300.15 Boxes, Conduit Bodies, or Fittings — Where Required.
A box shall be installed at each outlet and switch point for concealed knob-and-tube wiring.

Fittings and connectors shall be used only with the specific wiring methods for which they are designed and listed.

Where the wiring method is conduit, tubing, Type AC cable, Type MC cable, Type MI cable, nonmetallic-sheathed cable, or other cables, a box or conduit body shall be installed at each conductor splice point, outlet point, switch point, junction point, termination point, or pull point, unless otherwise permitted in 300.15(A) through (L).

300.15(A) Wiring Methods with Interior Access.
A box or conduit body shall not be required for each splice, junction, switch, pull, termination, or outlet points in wiring methods with removable covers, such as wireways, multioutlet assemblies, auxiliary gutters, and surface raceways. The covers shall be accessible after installation.

300.15(B) Equipment.
An integral junction box or wiring compartment as part of approved equipment shall be permitted in lieu of a box.

300.15(C) Protection.
A box or conduit body shall not be required where cables enter or exit from conduit or tubing that is used to provide cable support or protection against physical damage. A fitting shall be provided on the end(s) of the conduit or tubing to protect the cable from abrasion.

300.15(D) Type MI Cable.
A box or conduit body shall not be required where accessible fittings are used for straight-through splices in mineral-insulated metal-sheathed cable.

300.15(E) Integral Enclosure.
A wiring device with integral enclosure identified for the use, having brackets that securely fasten the device to walls or ceilings of conventional on-site frame construction, for use with nonmetallic-sheathed cable, shall be permitted in lieu of a box or conduit body.

Informational Note: See 334.30(C); 545.10; 550.15(I); 551.47(E), Exception No. 1; and 552.48(E), Exception No. 1.

300.15(F) Fitting.
A fitting identified for the use shall be permitted in lieu of a box or conduit body where conductors are not spliced or terminated within the fitting. The fitting shall be accessible after installation, unless listed for concealed installation.

300.15(G) Direct-Buried Conductors.
As permitted in 300.5(E), a box or conduit body shall not be required for splices and taps in direct-buried conductors and cables.

300.15(H) Insulated Devices.
As permitted in 334.40(B), a box or conduit body shall not be required for insulated devices supplied by nonmetallic-sheathed cable.

300.15(I) Enclosures.
A box or conduit body shall not be required where a splice, switch, terminal, or pull point is in a cabinet or cutout box, in an enclosure for a switch or overcurrent device as permitted in 312.8, in a motor controller as permitted in 430.10(A), or in a motor control center.

300.15(J) Luminaires.
A box or conduit body shall not be required where a luminaire is used as a raceway as permitted in 410.64.

300.15(K) Embedded.
A box or conduit body shall not be required for splices where conductors are embedded as permitted in 424.40, 424.41(D), 426.22(C), 426.24(A), and 427.19(A).

300.15(L) Manholes and Handhole Enclosures.
A box or conduit body shall not be required for conductors in manholes or handhole enclosures, except where connecting to electrical equipment. The installation shall comply with the provisions of Part V of Article 110 for manholes, and 314.30 for handhole enclosures.

300.16 Raceway or Cable to Open or Concealed Wiring.

300.16(A) Box, Conduit Body, or Fitting.
A box, conduit body, or terminal fitting having a separately bushed hole for each conductor shall be used wherever a change is made from conduit, electrical metallic tubing, electrical nonmetallic tubing, nonmetallic-sheathed cable, Type AC cable, Type MC cable, or mineral-insulated, metal-sheathed cable and surface raceway wiring to open wiring or to concealed knob-and-tube wiring. A fitting used for this purpose shall contain no taps or splices and shall not be used at luminaire outlets. A conduit body used for this purpose shall contain no taps or splices, unless it complies with 314.16(C)(2).

300.16(B) Bushing.
A bushing shall be permitted in lieu of a box or terminal where the conductors emerge from a raceway and enter or terminate at equipment, such as open switchboards, unenclosed control equipment, or similar equipment. The bushing shall be of the insulating type for other than lead-sheathed conductors.

300.17 Number and Size of Conductors in Raceway.
The number and size of conductors in any raceway shall not be more than will permit dissipation of the heat and ready installation or withdrawal of the conductors without damage to the conductors or to their insulation.

Informational Note: See the following sections of this *Code*: intermediate metal conduit, 342.22; rigid metal conduit, 344.22; flexible metal conduit, 348.22; liquidtight flexible metal conduit, 350.22; PVC conduit, 352.22; HDPE conduit, 353.22; RTRC, 355.22; liquidtight nonmetallic flexible conduit, 356.22; electrical metallic tubing, 358.22; flexible metallic tubing, 360.22; electrical nonmetallic tubing, 362.22; cellular concrete floor raceways, 372.22; cellular metal floor raceways, 374.22; metal wireways, 376.22; nonmetallic wireways, 378.22; surface metal raceways, 386.22; surface nonmetallic raceways, 388.22; underfloor raceways, 390.22; fixture wire, 402.7; theaters, 520.6; signs, 600.31(C); elevators, 620.33; audio signal processing, amplification, and reproduction equipment, 640.23(A) and 640.24; Class 1, Class 2, and Class 3 circuits, Article 725; fire alarm circuits, Article 760; and optical fiber cables and raceways, Article 770.

300.18 Raceway Installations.

300.18(A) Complete Runs.
Raceways, other than busways or exposed raceways having hinged or removable covers, shall be installed complete between outlet, junction, or splicing points prior to the installation of conductors. Where required to facilitate the installation of utilization equipment, the raceway shall be permitted to be initially installed without a terminating connection at the equipment. Prewired raceway assemblies shall be permitted only where specifically permitted in this *Code* for the applicable wiring method.

Exception: Short sections of raceways used to contain conductors or cable assemblies for protection from physical damage shall not be required to be installed complete between outlet, junction, or splicing points.

300.18(B) Welding.
Metal raceways shall not be supported, terminated, or connected by welding to the raceway unless specifically designed to be or otherwise specifically permitted to be in this *Code*.

300.19 Supporting Conductors in Vertical Raceways.

300.19(A) Spacing Intervals — Maximum.
Conductors in vertical raceways shall be supported if the vertical rise exceeds the values in Table 300.19(A). At least one support method shall be provided for each conductor at the top of the vertical raceway or as close to the top as practical. Intermediate supports shall be provided as necessary to limit supported conductor lengths to not greater than those values specified in Table 300.19(A).

Exception: Steel wire armor cable shall be supported at the top of the riser with a cable support that clamps the steel wire armor. A safety device shall be permitted at the lower end of the riser to hold the cable in the event there is slippage of the cable in the wire-armored cable support. Additional wedge-type supports shall be permitted to relieve the strain on the equipment terminals caused by expansion of the cable under load.

Table 300.19(A) Spacings for Conductor Supports

		Conductors			
		Aluminum or Copper-Clad Aluminum		Copper	
Conductor Size	**Support of Conductors in Vertical Raceways**	**m**	**ft**	**m**	**ft**
18 AWG through 8 AWG	Not greater than	30	100	30	100
6 AWG through 1/0 AWG	Not greater than	60	200	30	100
2/0 AWG through 4/0 AWG	Not greater than	55	180	25	80
Over 4/0 AWG through 350 kcmil	Not greater than	41	135	18	60
Over 350 kcmil through 500 kcmil	Not greater than	36	120	15	50
Over 500 kcmil through 750 kcmil	Not greater than	28	95	12	40
Over 750 kcmil	Not greater than	26	85	11	35

300.19(B) Fire-Rated Cables and Conductors.
Support methods and spacing intervals for fire-rated cables and conductors shall comply with any restrictions provided in the listing of the electrical circuit protective system used and in no case shall exceed the values in Table 300.19(A).

300.19(C) Support Methods.
One of the following methods of support shall be used:

(1) Clamping devices constructed of or employing insulating wedges inserted in the ends of the raceways. Where clamping of insulation does not adequately support the cable, the conductor also shall be clamped.
(2) Inserting boxes at the required intervals in which insulating supports are installed and secured in an approved manner to withstand the weight of the conductors attached thereto, the boxes being provided with covers.
(3) In junction boxes, deflecting the cables not less than 90 degrees and carrying them horizontally to a distance not less than twice the diameter of the cable, the cables being carried on two or more insulating supports and additionally secured thereto by tie wires, if desired. Where this method is used, cables shall be supported at intervals not greater than 20 percent of the support spacing in Table 300.19(A).
(4) Other approved means.

300.20 Induced Currents in Ferrous Metal Enclosures or Ferrous Metal Raceways.

300.20(A) Conductors Grouped Together.
Where conductors carrying alternating current are installed in ferrous metal enclosures or ferrous metal raceways, they shall be arranged so as to avoid heating the surrounding ferrous metal by induction. To accomplish this, all phase conductors and, where used, the grounded conductor and all equipment grounding conductors shall be grouped together.

Exception No. 1: Equipment grounding conductors for certain existing installations shall be permitted to be installed separate from their associated circuit conductors where run in accordance with the provisions of 250.130(C).

Exception No. 2: A single conductor shall be permitted to be installed in a ferromagnetic enclosure and used for skin-effect heating in accordance with the provisions of 426.42 and 427.47.

300.20(B) Individual Conductors.
Where a single conductor carrying alternating current passes through metal with magnetic properties, the inductive effect shall be minimized by (1) cutting slots in the metal between the individual holes through which the individual conductors pass or (2) passing all the conductors in the circuit through an insulating wall sufficiently large for all of the conductors of the circuit.

Exception: In the case of circuits supplying vacuum or electric-discharge lighting systems or signs or X-ray apparatus, the currents carried by the conductors are so small that the inductive heating effect can be ignored where these conductors are placed in metal enclosures or pass through metal.

Informational Note: Because aluminum is not a magnetic metal, there will be no heating due to hysteresis; however, induced currents will be present. They will not be of sufficient magnitude to require grouping of conductors or special treatment in passing conductors through aluminum wall sections.

300.21 Spread of Fire or Products of Combustion.
Electrical installations in hollow spaces, vertical shafts, and ventilation or air-handling ducts shall be made so that the possible spread of fire or products of combustion will not be substantially increased. Openings around electrical penetrations into or through fire-resistant-rated walls, partitions, floors, or ceilings shall be firestopped using approved methods to maintain the fire resistance rating.

Informational Note: Directories of electrical construction materials published by qualified testing laboratories contain many listing installation restrictions necessary to maintain the fire-resistive rating of assemblies where penetrations or openings are made. Building codes also contain restrictions on membrane penetrations on opposite sides of a fire-resistance-rated wall assembly. An example is the 600-mm (24-in.) minimum horizontal separation that usually applies between boxes installed on opposite sides of the wall. Assistance in complying with 300.21 can be found in building codes, fire resistance directories, and product listings.

300.22 Wiring in Ducts Not Used for Air Handling, Fabricated Ducts for Environmental Air, and Other Spaces for Environmental Air (Plenums).
The provisions of this section shall apply to the installation and uses of electrical wiring and equipment in ducts used for dust, loose stock, or vapor removal; ducts specifically fabricated for environmental air; and other spaces used for environmental air (plenums).

Informational Note: See Article 424, Part VI, for duct heaters.

300.22(A) Ducts for Dust, Loose Stock, or Vapor Removal.
No wiring systems of any type shall be installed in ducts used to transport dust, loose stock, or flammable vapors. No wiring system of any type shall be installed in any duct, or shaft containing only such ducts, used for vapor removal or for ventilation of commercial-type cooking equipment.

300.22(B) Ducts Specifically Fabricated for Environmental Air.
Equipment, devices, and the wiring methods specified in this section shall be permitted within such ducts only if necessary for the direct action upon, or sensing of, the contained air. Where equipment or devices are installed and illumination is necessary to facilitate maintenance and repair, enclosed gasketed-type luminaires shall be permitted.

Only wiring methods consisting of Type MI cable without an overall nonmetallic covering, Type MC cable employing a smooth or corrugated impervious metal sheath without an overall nonmetallic covering, electrical metallic tubing, flexible metallic tubing, intermediate metal conduit, or rigid metal conduit without an overall nonmetallic covering shall be installed in ducts specifically fabricated to transport environmental air. Flexible metal conduit shall be permitted, in lengths not to exceed 1.2 m (4 ft), to connect physically adjustable equipment and devices permitted to be in these fabricated ducts. The connectors used with flexible metal conduit shall effectively close any openings in the connection.

Exception: Wiring methods and cabling systems, listed for use in other spaces used for environmental air (plenums), shall be permitted to be installed in ducts specifically fabricated for environmental air-handling purposes under the following conditions:

(1) The wiring methods or cabling systems shall be permitted only if necessary to connect to equipment or devices associated with the direct action upon or sensing of the contained air, and
(2) The total length of such wiring methods or cabling systems shall not exceed 1.2 m (4 ft).

300.22(C) Other Spaces Used for Environmental Air (Plenums).
This section shall apply to spaces not specifically fabricated for environmental air-handling purposes but used for air-handling purposes as a plenum. This section shall not apply to habitable rooms or areas of buildings, the prime purpose of which is not air handling.

Informational Note No. 1: The space over a hung ceiling used for environmental air-handling purposes is an example of the type of other space to which this section applies.

Informational Note No. 2: The phrase *other spaces used for environmental air (plenum)* as used in this section correlates with the use of the term *plenum* in NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, and other mechanical codes where the plenum is used for return air purposes, as well as some other air-handling spaces.

Exception: This section shall not apply to the joist or stud spaces of dwelling units where the wiring passes through such spaces perpendicular to the long dimension of such spaces.

300.22(C)(1) Wiring Methods.
The wiring methods for such other space shall be limited to totally enclosed, nonventilated, insulated busway having no provisions for plug-in connections, Type MI cable without an overall nonmetallic covering, Type MC cable without an overall nonmetallic covering, Type AC cable, or other factory-assembled multiconductor control or power cable that is specifically listed for use within an air-handling space, or listed prefabricated cable assemblies of metallic manufactured wiring systems without nonmetallic sheath. Other types of cables, conductors, and raceways shall be permitted to be installed in electrical metallic tubing, flexible metallic tubing, intermediate metal conduit, rigid metal conduit without an overall nonmetallic covering, flexible metal conduit, or, where accessible, surface metal raceway or metal wireway with metal covers.

Nonmetallic cable ties and other nonmetallic cable accessories used to secure and support cables shall be listed as having low smoke and heat release properties.

Informational Note: One method to determine low smoke and heat release properties is that the nonmetallic cable ties and other nonmetallic cable accessories exhibit a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a peak heat release rate of 100 kW or less when tested in accordance with ANSI/UL 2043-2008, *Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces.*

300.22(C)(2) Cable Tray Systems.
The provisions in 300.22(C)(2)(a) or (C)(2)(b) shall apply to the use of metallic cable tray systems in other spaces used for environmental air (plenums), where accessible, as follows:

a) *Metal Cable Tray Systems.* Metal cable tray systems shall be permitted to support the wiring methods in 300.22(C)(1).

b) *Solid Side and Bottom Metal Cable Tray Systems.* Solid side and bottom metal cable tray systems with solid metal covers shall be permitted to enclose wiring methods and cables, not already covered in 300.22(C)(1), in accordance with 392.10(A) and (B).

300.22(C)(3) Equipment.
Electrical equipment with a metal enclosure, or electrical equipment with a nonmetallic enclosure listed for use within an air-handling space and having low smoke and heat release properties, and associated wiring material suitable for the ambient temperature shall be permitted to be installed in such other space unless prohibited elsewhere in this *Code*.

Informational Note: One method to determine low smoke and heat release properties is that the equipment exhibits a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a peak heat release rate of 100 kW or less when tested in accordance with ANSI/UL 2043-2013, *Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces*.

Exception: Integral fan systems shall be permitted where specifically identified for use within an air-handling space.

300.22(D) Information Technology Equipment.
Where the installation complies with the special requirements in 645.4, electrical wiring in air-handling areas beneath raised floors for information technology equipment shall be permitted in accordance with 645.5(E).

300.23 Panels Designed to Allow Access.
Cables, raceways, and equipment installed behind panels designed to allow access, including suspended ceiling panels, shall be arranged and secured so as to allow the removal of panels and access to the equipment.

300.25 Exit Enclosures (Stair Towers).
Where an exit enclosure is required to be separated from the building, only electrical wiring methods serving equipment permitted by the authority having jurisdiction in the exit enclosure shall be installed within the exit enclosure.

Informational Note: For more information, refer to NFPA *101*-2018, *Life Safety Code*, 7.1.3.2.1(10)(b).

~~**Part II. Requirements for over 1000 Volts, Nominal**~~

~~**300.31 Covers Required.**~~
~~Suitable covers shall be installed on all boxes, fittings, and similar enclosures to prevent accidental contact with energized parts or physical damage to parts or insulation.~~

~~**300.32 Conductors of Different Systems.**~~
~~See 300.3(C)(2).~~

~~**300.34 Conductor Bending Radius.**~~
~~The conductor shall not be bent to a radius less than 8 times the overall diameter for nonshielded conductors or 12 times the overall diameter for shielded or lead-covered conductors during or after installation. For multiconductor or multiplexed single-conductor cables having individually shielded conductors, the minimum bending radius is 12 times the diameter of the individually shielded conductors or 7 times the overall diameter, whichever is greater.~~

~~**300.35 Protection Against Induction Heating.**~~
~~Metallic raceways and associated conductors shall be arranged so as to avoid heating of the raceway in accordance with the applicable provisions of 300.20.~~

~~**300.37 Aboveground Wiring Methods.**~~
~~Aboveground conductors shall be installed in rigid metal conduit, in intermediate metal conduit, in electrical metallic tubing, in RTRC and PVC conduit, in cable trays, in auxiliary gutters, as busways, as cablebus, in other identified raceways, or as exposed runs of metal-clad cable suitable for the use and purpose. In locations accessible to qualified persons only, exposed runs of Type MV cables, bare conductors, and bare busbars shall also be permitted. Busbars shall be permitted to be either copper or aluminum.~~

Exception: Airfield lighting cable used in series circuits that are powered by regulators and installed in restricted airport lighting vaults shall be permitted as exposed cable installations.

Informational Note: FAA L-824 cables installed as exposed runs within a restricted vault area are common applications.

300.38 Raceways in Wet Locations Above Grade.
Where raceways are installed in wet locations above grade, the interior of these raceways shall be considered to be a wet location. Insulated conductors and cables installed in raceways in wet locations above grade shall comply with 310.10(*C*).

300.39 Braid-Covered Insulated Conductors — Exposed Installation.
Exposed runs of braid-covered insulated conductors shall have a flame-retardant braid. If the conductors used do not have this protection, a flame-retardant saturant shall be applied to the braid covering after installation. This treated braid covering shall be stripped back a safe distance at conductor terminals, according to the operating voltage. Where practicable, this distance shall not be less than 25 mm (1 in.) for each kilovolt of the conductor-to-ground voltage of the circuit.

300.40 Insulation Shielding.
Metallic and semiconducting insulation shielding components of shielded cables shall be removed for a distance dependent on the circuit voltage and insulation. Stress reduction means shall be provided at all terminations of factory-applied shielding.

Metallic shielding components such as tapes, wires, or braids, or combinations thereof, shall be connected to an equipment grounding conductor, an equipment grounding busbar, or a grounding electrode.

300.42 Moisture or Mechanical Protection for Metal-Sheathed Cables.
Where cable conductors emerge from a metal sheath and where protection against moisture or physical damage is necessary, the insulation of the conductors shall be protected by a cable sheath terminating device.

300.45 Danger Signs.
Danger signs shall be conspicuously posted at points of access to conductors in all raceway systems and cable systems. The sign(s) shall meet the requirements in 110.21(B), shall be readily visible, and shall state the following:

DANGER—HIGH VOLTAGE—KEEP OUT

300.50 Underground Installations.

300.50(A) General.
Underground conductors shall be identified for the voltage and conditions under which they are installed. Direct-burial cables shall comply with the provisions of 310.10(E). Underground cables shall be installed in accordance with 300.50(A)(1), (A)(2), or (A)(3), and the installation shall meet the depth requirements of Table 300.50.

Table 300.50 Minimum Cover[a] Requirements

	General Conditions (not otherwise specified)						Special Conditions (use if applicable)					
	Column 1		Column 2		Column 3		Column 4		Column 5		Column 6	
	Direct-Buried Cables[b]		RTRC, PVC, and HDPE Conduit[c]		Rigid Metal Conduit and Intermediate Metal Conduit		Raceways Under Buildings or Exterior Concrete Slabs, 100 mm (4 in.) Minimum Thickness[d]		Cables in Airport Runways or Adjacent Areas Where Trespass Is Prohibited		Areas Subject to Vehicular Traffic, Such as Thoroughfares and Commercial Parking Areas	
Circuit Voltage	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
Over 1000 V through 22 kV	750	30	450	18	150	6	100	4	450	18	600	24
Over 22 kV through 40 kV	900	36	600	24	150	6	100	4	450	18	600	24
Over 40 kV	1000	42	750	30	150	6	100	4	450	18	600	24

General Notes:

1. Lesser depths shall be permitted where cables and conductors rise for terminations or splices or where access is otherwise required.
2. Where solid rock prevents compliance with the cover depths specified in this table, the wiring shall be installed in a metal or nonmetallic raceway permitted for direct burial. The raceways shall be covered by a minimum of 50 mm (2 in.) of concrete extending down to rock.
3. In industrial establishments, where conditions of maintenance and supervision ensure that qualified persons will service the installation, the minimum cover requirements, for other than rigid metal conduit and intermediate metal conduit, shall be permitted to be reduced 150 mm (6 in.) for each 50 mm (2 in.) of concrete or equivalent placed entirely within the trench over the underground installation.

Specific Footnotes:

[a] Cover is defined as the shortest distance in millimeters (inches) measured between a point on the top surface of any direct buried conductor, cable, conduit, or other raceway and the top surface of finished grade, concrete, or similar cover.

[b] Underground direct buried cables that are not encased or protected by concrete and are buried 750 mm (30 in.) or more below grade shall have their location identified by a warning ribbon that is placed in the trench at least 300 mm (12 in.) above the cables.

[c] Listed by a qualified testing agency as suitable for direct burial without encasement. All other nonmetallic systems shall require 50 mm (2 in.) of concrete or equivalent above conduit in addition to the table depth.

[d] The slab shall extend a minimum of 150 mm (6 in.) beyond the underground installation, and a warning ribbon or other effective means suitable for the conditions shall be placed above the underground installation.

300.50(A)(1) Shielded Cables and Nonshielded Cables in Metal-Sheathed Cable Assemblies.
Underground cables, including nonshielded, Type MC and moisture-impervious metal-sheath cables, shall have those sheaths grounded through an effective grounding path meeting the requirements of 250.4(A)(5) or (B)(4). They shall be direct buried or installed in raceways identified for the use.

300.50(A)(2) Industrial Establishments.
In industrial establishments, where conditions of maintenance and supervision ensure that only qualified persons service the installed cable, nonshielded single-conductor cables with insulation types up to 2000 volts that are listed for direct burial shall be permitted to be directly buried.

300.50(A)(3) Other Nonshielded Cables.
Other nonshielded cables not covered in 300.50(A)(1) or (A)(2) shall be installed in rigid metal conduit, intermediate metal conduit, or rigid nonmetallic conduit encased in not less than 75 mm (3 in.) of concrete.

300.50(B) Wet Locations.
The interior of enclosures or raceways installed underground shall be considered to be a wet location. Insulated conductors and cables installed in these enclosures or raceways in underground installations shall be listed for use in wet locations and shall comply with 310.10(C). Any connections or splices in an underground installation shall be approved for wet locations.

300.50(C) Protection from Damage.
Conductors emerging from the ground shall be enclosed in listed raceways. Raceways installed on poles shall be of rigid metal conduit, intermediate metal conduit, RTRC-XW, Schedule 80 PVC conduit, or equivalent, extending from the minimum cover depth specified in Table 300.50 to a point 2.5 m (8 ft) above finished grade. Conductors entering a building shall be protected by an approved enclosure or raceway from the minimum cover depth to the point of entrance. Where direct-buried conductors, raceways, or cables are subject to movement by settlement or frost, they shall be installed to prevent damage to the enclosed conductors or to the equipment connected to the raceways. Metallic enclosures shall be grounded.

300.50(D) Splices.
Direct burial cables shall be permitted to be spliced or tapped without the use of splice boxes, provided they are installed using materials suitable for the application. The taps and splices shall be watertight and protected from mechanical damage. Where cables are shielded, the shielding shall be continuous across the splice or tap.

Exception: At splices of an engineered cabling system, metallic shields of direct-buried single-conductor cables with maintained spacing between phases shall be permitted to be interrupted and overlapped. Where shields are interrupted and overlapped, each shield section shall be grounded at one point.

300.50(E) Backfill.
Backfill containing large rocks, paving materials, cinders, large or sharply angular substances, or corrosive materials shall not be placed in an excavation where materials can damage or contribute to the corrosion of raceways, cables, or other substructures or where it may prevent adequate compaction of fill.

Protection in the form of granular or selected material or suitable sleeves shall be provided to prevent physical damage to the raceway or cable.

300.50(F) Raceway Seal.
Where a raceway enters from an underground system, the end within the building shall be sealed with an identified compound so as to prevent the entrance of moisture or gases, or it shall be so arranged to prevent moisture from contacting live parts.

NEW Article 305:

ARTICLE 305 Requirements for Wiring Methods and Materials for Systems Rated Over 1000 Volts ac, 1500 Volts dc, Nominal

Part I. General Requirements

305.1 Scope.

This article covers requirements for wiring methods and materials for wiring installations for systems rated over 1000 volts ac, 1500 volts dc, nominal.

305.2 Definitions. The definition in this section shall only apply within this article.

Outdoor Overhead Conductors.
Single conductors, insulated, covered, or bare, installed outdoors on support structures in free air.

305.3 Conductors of Different Systems.
Conductors of circuits rated over 1000 volts ac, 1500 volts dc, nominal, shall not occupy the same equipment wiring enclosure, cable, or raceway with conductors of circuits rated 1000 volts ac, 1500 volts dc, nominal, or less unless otherwise permitted in 305.3(1) through 305.3(4).

(1) Primary leads of electric-discharge lamp ballasts insulated for the primary voltage of the ballast, where contained within the individual wiring enclosure, shall be permitted to occupy the same luminaire, sign, or outline lighting enclosure as the branch-circuit conductors.
(2) Excitation, control, relay, and ammeter conductors used in connection with any individual motor or starter shall be permitted to occupy the same enclosure as the motor-circuit conductors.
(3) In motors, transformers, switchgear, switchboards, control assemblies, and similar equipment, conductors of different voltage ratings shall be permitted.
(4) In manholes, if the conductors of each system are permanently and effectively separated from the conductors of the other systems and securely fastened to racks, insulators, or other approved supports, conductors of different voltage ratings shall be permitted.

Conductors having nonshielded insulation and operating at different voltage levels shall not occupy the same enclosure, cable, or raceway.

305.4 Conductor Bending Radius.
The conductor shall not be bent to a radius less than 8 times the overall diameter for nonshielded conductors or 12 times the overall diameter for shielded or lead-covered conductors during or after installation. For multiconductor or multiplexed single-conductor cables having individually shielded conductors, the minimum bending radius is 12 times the diameter of the individually shielded conductors or 7 times the overall diameter, whichever is greater.

305.5 Protection Against Induction Heating.
Metallic raceways and associated conductors shall be arranged so as to avoid heating of the raceway in accordance with the applicable provisions of 300.20.

305.6 Covers Required.
Suitable covers shall be installed on all boxes, fittings, and similar enclosures to prevent accidental contact with energized parts or physical damage to parts or insulation.

305.7 Wiring Methods.
Conductors shall be permitted to be installed in accordance with any of the wiring methods identified in Table 305.7.

Table 305.7 Wiring Methods for Permitted for use in Systems Rated Over 1000 Volts ac, 1500 Volts dc, Nominal

Wiring Methods Permitted for Use Above 1000 VAC, 1500 VDC	Voltage Levels	Reference

Pull and Junction Boxes, Conduit Bodies, and Hand-Hole Enclosures	Over 1000 Volts	Article 305, Part II
Metal-Clad Cable: Type MC	0 – 35,000	Article 330
Type P Cable	0 – 2000	Article 337
Intermediate Metal Conduit: Type IMC	Not Specified	Article 342
Rigid Metal Conduit: Type RMC	Not Specified	Article 344
Rigid Polyvinyl Chloride Conduit: Type PVC	Not Specified	Article 352
Reinforced Thermosetting Resin Conduit: Type RTRC	Not Specified	Article 355
Electrical Metallic Tubing: Type EMT	Not Specified	Article 358
Auxiliary Gutters	Not Specified	Article 366
Busway	Over 1000 Volts	Article 305, Part III
Cablebus	0 – 35,000	Article 370
Cable Trays	0 – 35,000	Article 392
Messenger-Supported Wiring	0 – 35,000	Article 396
Outdoor Overhead Conductors	Over 1000 Volts	Article 305, Part IV

In locations accessible to qualified persons only, exposed runs of Type MV cables, bare conductors, and bare busbars shall also be permitted. Busbars shall be permitted to be either copper or aluminum.

Exception: Airfield lighting cable used in series circuits that are powered by regulators and installed in restricted airport lighting vaults shall be permitted as exposed cable installations.

Informational Note: FAA L-824 cables installed as exposed runs within a restricted vault area are common applications.

305.8 Raceways in Wet Locations Above Grade.
Where raceways are installed in wet locations above grade, the interior of these raceways shall be considered to be a wet location. Insulated conductors and cables installed in raceways in wet locations above grade shall be either moisture-impervious metal-sheathed or be of a type listed for use in wet locations .

305.9 Braid-Covered Insulated Conductors — Exposed Installation.
Exposed runs of braid-covered insulated conductors shall have a flame-retardant braid. If the conductors used do not have this protection, a flame-retardant saturant shall be applied to the braid covering after installation. This treated braid covering shall be stripped back a safe distance at conductor terminals, according to the operating voltage. Where practicable, this distance shall not be less than 25 mm (1 in.) for each kilovolt of the conductor-to-ground voltage of the circuit.

305.10 Insulation Shielding.
Metallic and semiconducting insulation shielding components of shielded cables shall be removed for a distance dependent on the circuit voltage and insulation. Stress reduction means shall be provided at all terminations of factory-applied shielding.

Metallic shielding components such as tapes, wires, or braids, or combinations thereof, shall be connected to an equipment grounding conductor, an equipment grounding busbar, or a grounding electrode.

305.11 Moisture or Mechanical Protection for Metal-Sheathed Cables.
Where cable conductors emerge from a metal sheath and where protection against moisture or physical damage is necessary, the insulation of the conductors shall be protected by a cable sheath terminating device.

305.12 Danger Signs.
Danger signs shall be conspicuously posted at points of access to conductors in all raceway systems and cable systems. The sign(s) shall meet the requirements in 110.21(B), shall be readily visible, and shall state the following:

DANGER—HIGH VOLTAGE—KEEP OUT

305.15 Underground Installations.

305.15(A) General.
Underground conductors shall be identified for the voltage and conditions under which they are installed. Conductors used for direct-burial applications shall be of a type identified for such use. Underground cables shall be installed in accordance with 305.15(A)(1), (A)(2), or (A)(3), and the installation shall meet the depth requirements of Table 305.15.

Table 305.15 Minimum Cover[a] Requirements

	General Conditions (not otherwise specified)						Special Conditions (use if applicable)					
	Column 1		Column 2		Column 3		Column 4		Column 5		Column 6	
	Direct-Buried Cables[b]		RTRC, PVC, and HDPE Conduit[c]		Rigid Metal Conduit and Intermediate Metal Conduit		Raceways Under Buildings or Exterior Concrete Slabs, 100 mm (4 in.) Minimum Thickness[d]		Cables in Airport Runways or Adjacent Areas Where Trespass Is Prohibited		Areas Subject to Vehicular Traffic, Such as Thoroughfares and Commercial Parking Areas	
Circuit Voltage	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
Over 1000 V ac, 1500 V dc through 22 kV	750	30	450	18	150	6	100	4	450	18	600	24
Over 22 kV through 40 kV	900	36	600	24	150	6	100	4	450	18	600	24
Over 40 kV	1000	42	750	30	150	6	100	4	450	18	600	24

General Notes:

1. Lesser depths shall be permitted where cables and conductors rise for terminations or splices or where access is otherwise required.
2. Where solid rock prevents compliance with the cover depths specified in this table, the wiring shall be installed in a metal or nonmetallic raceway permitted for direct burial. The raceways shall be covered by a minimum of 50 mm (2 in.) of concrete extending down to rock.
3. In industrial establishments, where conditions of maintenance and supervision ensure that qualified persons will service the installation, the minimum cover requirements, for other than rigid metal conduit and intermediate metal conduit, shall be permitted to be reduced 150 mm (6 in.) for each 50 mm (2 in.) of concrete or equivalent placed entirely within the trench over the underground installation.

Specific Footnotes:

[a]Cover is defined as the shortest distance in millimeters (inches) measured between a point on the top surface of any direct-buried conductor, cable, conduit, or other raceway and the top surface of finished grade, concrete, or similar cover.
[b]Underground direct-buried cables that are not encased or protected by concrete and are buried 750 mm (30 in.) or more below grade shall have their location identified by a warning ribbon that is placed in the trench at least 300 mm (12 in.) above the cables.
[c]Listed by a qualified testing agency as suitable for direct burial without encasement. All other nonmetallic systems shall require 50 mm (2 in.) of concrete or equivalent above conduit in addition to the table depth.
[d]The slab shall extend a minimum of 150 mm (6 in.) beyond the underground installation, and a warning ribbon or other effective means suitable for the conditions shall be placed above the underground installation.

305.15(A)(1) Shielded Cables and Nonshielded Cables in Metal-Sheathed Cable Assemblies.
Underground cables, including nonshielded, Type MC and moisture-impervious metal sheath cables, shall have those sheaths grounded through an effective grounding path meeting the requirements of 250.4(A)(5) or (B)(4). They shall be direct buried or installed in raceways identified for the use.

305.15(A)(2) Industrial Establishments.
In industrial establishments, where conditions of maintenance and supervision ensure that only qualified persons service the installed cable, nonshielded single-conductor cables with insulation types up to 2000 volts that are listed for direct burial shall be permitted to be directly buried.

305.15(A)(3) Other Nonshielded Cables.
Other nonshielded cables not covered in 305.15(A)(1) or (A)(2) shall be installed in rigid metal conduit, intermediate metal conduit, or rigid nonmetallic conduit encased in not less than 75 mm (3 in.) of concrete.

305.15(B) Wet Locations.
The interior of enclosures or raceways installed underground shall be considered to be a wet location. Insulated conductors and cables installed in these enclosures or raceways in underground installations shall be listed for use in wet locations and shall be either moisture-impervious metal-sheathed or be of a type listed for use in wet locations.. Any connections or splices in an underground installation shall be approved for wet locations.

305.15(C) Protection from Damage.
Conductors emerging from the ground shall be enclosed in listed raceways. Raceways installed on poles shall be of rigid metal conduit, intermediate metal conduit, RTRC-XW, Schedule 80 PVC conduit, or equivalent, extending from the minimum cover depth specified in Table 305.15 to a point 2.5 m (8 ft) above finished grade. Conductors entering a building shall be protected by an approved enclosure or raceway from the minimum cover depth to the point of entrance. Where direct-buried conductors, raceways, or cables are subject to movement by settlement or frost, they shall be installed to prevent damage to the enclosed conductors or to the equipment connected to the raceways. Metallic enclosures shall be grounded.

305.15(D) Splices.
Direct burial cables shall be permitted to be spliced or tapped without the use of splice boxes, provided they are installed using materials suitable for the application. The taps and splices shall be watertight and protected from mechanical damage. Where cables are shielded, the shielding shall be continuous across the splice or tap.

Exception: At splices of an engineered cabling system, metallic shields of direct-buried single-conductor cables with maintained spacing between phases shall be permitted to be interrupted and overlapped. Where shields are interrupted and overlapped, each shield section shall be grounded at one point.

305.15(E) Backfill.
Backfill containing large rocks, paving materials, cinders, large or sharply angular substances, or corrosive materials shall not be placed in an excavation where materials can damage or contribute to the corrosion of raceways, cables, or other substructures or where it may prevent adequate compaction of fill.

Protection in the form of granular or selected material or suitable sleeves shall be provided to prevent physical damage to the raceway or cable.

305.15(F) Raceway Seal.

Where a raceway enters from an underground system, the end within the building shall be sealed with an identified compound so as to prevent the entrance of moisture or gases, or it shall be so arranged to prevent moisture from contacting live parts.

Part II. Pull and Junction Boxes, Conduit Bodies, and Handhole Enclosures

305.20 General.

305.20(A) Pull and Junction Boxes.
Where pull and junction boxes are used on systems over 1000 volts ac, 1500 volts dc, the installation shall comply with the provisions of Part II and with the following general provisions of article 314:

(1) Part I, 314.2; 314.3; and 314.4
(2) Part II, 314.15; 314.17; 314.20; 314.23(A), (B), or (G); 314.28(B); and 314.29
(3) Part III, 314.40(A) and (C); and 314.41

305.20(B) Conduit Bodies.
Where conduit bodies are used on systems over 1000 volts ac, 1500 volts dc, the installation shall comply with the provisions of Part II and with the following general provisions of article 314:

(1) Part I, 314.4
(2) Part II, 314.15; 314.17; 314.23(A), (E), or (G); 314.28(A)(3); and 314.29
(3) Part III, 314.40(A) and 314.41

305.20(C) Handhole Enclosures.
Where handhole enclosures are used on systems over 1000 volts ac, 1500 volts dc, the installation shall comply with the provisions of Part Ii and with the following general provisions of article 314:

(1) Part I, 314.3 and 314.4
(2) Part II, 314.15; 314.17; 314.23(G); 314.28(B); 314.29; and 314.30

305.21 Size of Pull and Junction Boxes, Conduit Bodies, and Handhole Enclosures.
Pull and junction boxes and handhole enclosures shall provide approved space and dimensions for the installation of conductors, and they shall comply with the specific requirements of this section. Conduit bodies shall be permitted if they meet the dimensional requirements for boxes.

305.21(A) For Straight Pulls.
The length of the box shall not be less than 48 times the outside diameter, over sheath, of the largest shielded or lead-covered conductor or cable entering the box. The length shall not be less than 32 times the outside diameter of the largest nonshielded conductor or cable.

305.21(B) For Angle or U Pulls.

305.21(B)(1) Distance to Opposite Wall.
The distance between each cable or conductor entry inside the box and the opposite wall of the box shall not be less than 36 times the outside diameter, over sheath, of the largest cable or conductor. This distance shall be increased for additional entries by the amount of the sum of the outside diameters, over sheath, of all other cables or conductor entries through the same wall of the box.

Exception No. 1: Where a conductor or cable entry is in the wall of a box opposite a removable cover, the distance from that wall to the cover shall be permitted to be not less than the bending radius for the conductors as provided in 305.4.

Exception No. 2: Where cables are nonshielded and not lead covered, the distance of 36 times the outside diameter shall be permitted to be reduced to 24 times the outside diameter.

305.21(B)(2) Distance Between Entry and Exit.

The distance between a cable or conductor entry and its exit from the box shall not be less than 36 times the outside diameter, over sheath, of that cable or conductor.

Exception: Where cables are nonshielded and not lead covered, the distance of 36 times the outside diameter shall be permitted to be reduced to 24 times the outside diameter.

305.21(C) Removable Sides.
One or more sides of any pull box shall be removable.

305.22 Construction and Installation Requirements.

305.22(A) Corrosion Protection.
Boxes shall be made of material inherently resistant to corrosion or shall be suitably protected, both internally and externally, by enameling, galvanizing, plating, or other means.

305.22(B) Passing Through Partitions.
Suitable bushings, shields, or fittings having smooth, rounded edges shall be provided where conductors or cables pass through partitions and at other locations where necessary.

305.22(C) Complete Enclosure.
Boxes shall provide a complete enclosure for the contained conductors or cables.

305.22(D) Wiring Is Accessible.
Boxes and conduit bodies shall be installed so that the conductors are accessible without removing any fixed part of the building or structure. Working space shall be provided in accordance with 110.34.

305.22(E) Suitable Covers.
Boxes shall be closed by suitable covers securely fastened in place. Underground box covers that weigh over 45 kg (100 lb) shall be considered meeting this requirement. Covers for boxes shall be permanently marked "DANGER — HIGH VOLTAGE — KEEP OUT." The marking shall be on the outside of the box cover and shall be readily visible. Letters shall be block type and at least 13 mm (1⁄2 in.) in height.

305.22(F) Suitable for Expected Handling.
Boxes and their covers shall be capable of withstanding the handling to which they are likely to be subjected.

Part III. Busway

305.32 Adjacent and Supporting Structures.
Metal-enclosed busways shall be installed so that temperature rise from induced circulating currents in adjacent ferrous metal parts will not be hazardous to personnel or constitute a fire hazard.

305.33 Barriers and Seals.

305.33(A) Vapor Seals.
Busway runs that have sections located both inside and outside of buildings shall have a vapor seal at the building wall to prevent interchange of air between indoor and outdoor sections.

Exception: Vapor seals shall not be required in forced-cooled bus.

305.33(B) Fire Barriers.
Fire barriers shall be provided where fire walls, floors, or ceilings are penetrated.

Informational Note: See 300.21 for information concerning the spread of fire or products of combustion.

305.34 Drain Facilities.
Drain plugs, filter drains, or similar methods shall be provided to remove condensed moisture from low points in busway run.

305.35 Ventilated Bus Enclosures.
Ventilated busway enclosures shall be installed in accordance with Article 110, Part III, and 490.24.

305.36 Terminations and Connections.
Where bus enclosures terminate at machines cooled by flammable gas, seal-off bushings, baffles, or other means shall be provided to prevent accumulation of flammable gas in the busway enclosures.

All conductor termination and connection hardware shall be accessible for installation, connection, and maintenance.

305.37 Switches.
Switching devices or disconnecting links provided in the busway run shall have the same momentary rating as the busway. Disconnecting links shall be plainly marked to be removable only when bus is de-energized. Switching devices that are not load-break shall be interlocked to prevent operation under load, and disconnecting link enclosures shall be interlocked to prevent access to energized parts.

305.38 Wiring 1000 Volts or Less, Nominal.
Secondary control devices and wiring that are provided as part of the metal-enclosed bus run shall be insulated by fire-retardant barriers from all primary circuit elements with the exception of short lengths of wire, such as at instrument transformer terminals.

305.39 Expansion Fittings.
Flexible or expansion connections shall be provided in long, straight runs of bus to allow for temperature expansion or contraction, or where the busway run crosses building vibration insulation joints.

305.40 Neutral Conductor.
Neutral bus, where required, shall be sized to carry all neutral load current, including harmonic currents, and shall have adequate momentary and short-circuit current rating consistent with system requirements.

305.41 Grounding.
Metal-enclosed busway shall be grounded.

305.42 Marking.
Each busway run shall be provided with a permanent nameplate on which the following information shall be provided:

(1) Rated voltage.
(2) Rated continuous current; if bus is forced-cooled, both the normal forced-cooled rating and the self-cooled (not forced-cooled) rating for the same temperature rise shall be given.
(3) Rated frequency.
(4) Rated impulse withstand voltage.
(5) Rated 60-Hz withstand voltage (dry).
(6) Rated momentary current.
(7) Manufacturer's name or trademark.

Informational Note: See IEEE C37.23-2015, *IEEE Standard for Metal-Enclosed Bus*, for construction and testing requirements for metal-enclosed bus assemblies.

Part IV Outdoor Overhead Conductors

305.50 Uses Permitted.
Outdoor overhead conductors as covered in this Part shall be permitted only for systems rated over 1000 volts ac, 1500 volts dc, nominal, as follows:

(1) Outdoors in free air
(2) For service conductors, feeders, or branch circuits

Informational Note: For additional information on outdoor overhead conductors covered by this Part, see IEEE C2, *National Electrical Safety Code*, and ANSI/IEEE 3001.2, *Recommended Practice for Evaluating the Electrical Service Requirements of Industrial and Commercial Power Systems*.

305.51 Support.

305.51(A) Conductors.
Documentation of the engineered design by a licensed professional engineer engaged primarily in the design of such systems for the spacing between conductors shall be available upon request of the authority having jurisdiction and shall include consideration of the following:

(1) Applied voltage
(2) Conductor size
(3) Distance between support structures
(4) Type of structure
(5) Wind/ice loading
(6) Surge protection

305.51(B) Structures.
Structures of wood, metal, or concrete, or combinations of those materials, shall be provided for support of overhead conductors. Documentation of the engineered design by a licensed professional engineer engaged primarily in the design of such systems and the installation of each support structure shall be available upon request of the authority having jurisdiction and shall include consideration of the following:

(1) Soil conditions
(2) Foundations and structure settings
(3) Weight of all supported conductors and equipment
(4) Weather loading and other conditions such as, but not limited to, ice, wind, temperature, and lightning
(5) Angle where change of direction occurs
(6) Spans between adjacent structures
(7) Effect of dead-end structures
(8) Strength of guy wires and guy anchors
(9) Structure size and material(s)
(10) Hardware

305.51(C) Insulators.
Insulators used to support conductors shall be rated for all of the following:

(1) Applied phase-to-phase voltage
(2) Mechanical strength required for each individual installation
(3) Impulse withstand BIL in accordance with Table 490.24

Informational Note: 305.51(A), (B), and (C) are not all-inclusive lists.

Article 310 Conductors for General Wiring

Part I. General

310.1 Scope.
This article covers general requirements for conductors rated up to and including 2000 volts and their type designations, insulations, markings, mechanical strengths, ampacity ratings, and uses. These requirements apply to conductors that form an integral part of equipment, such as motors, motor controllers, and similar equipment, or to conductors specifically provided for elsewhere in this *Code*.

Informational Note: For Medium Voltage Conductors and Cable, see Article 315. For flexible cords and cables, see Article 400. For fixture wires, see Article 402.

Article 311 to be renumbered "Article 315"

Revised Article 314:

ARTICLE 314 Outlet, Device, Pull, and Junction Boxes; Conduit Bodies; Fittings; and Handhole Enclosures for Systems Rated up to 1000 Volts ac, 1500 Volts dc, Nominal

Part I. Scope and General

314.1 Scope.
This article covers the installation and use of all boxes and conduit bodies used as outlet, device, junction, or pull boxes, depending on their use, and handhole enclosures. Cast metal, sheet metal, nonmetallic, and other boxes such as FS, FD, and larger boxes are not classified as conduit bodies. This article also includes installation requirements for fittings used to join raceways and to connect raceways and cables to boxes and conduit bodies.

Requirements in this article shall be used for 1000 volts ac, 1500 volts dc, nominal, or less. They shall be permitted for over 1000 volts ac, 1500 volts dc, nominal, where specifically permitted in Article 305.

Informational Note: See Article 305, Part II for requirements for Pull and Junction Boxes, Conduit Bodies, and Handhole Enclosures for use at over 1000 volts ac, 1500 volts dc, nominal.

314.2 Round Boxes.
Round boxes shall not be used where conduits or connectors requiring the use of locknuts or bushings are to be connected to the side of the box.

314.3 Nonmetallic Boxes.
Nonmetallic boxes shall be permitted only with open wiring on insulators, concealed knob-and-tube wiring, cabled wiring methods with entirely nonmetallic sheaths, flexible cords, and nonmetallic raceways.

Exception No. 1: Where internal bonding means are provided between all entries, nonmetallic boxes shall be permitted to be used with metal raceways or metal-armored cables.

Exception No. 2: Where integral bonding means with a provision for attaching an equipment bonding jumper inside the box are provided between all threaded entries in nonmetallic boxes listed for the purpose, nonmetallic boxes shall be permitted to be used with metal raceways or metal-armored cables.

314.4 Metal Boxes.
Metal boxes shall be grounded and bonded in accordance with Parts I, IV, V, VI, VII, and X of Article 250 as applicable, except as permitted in 250.112(I).

Part II. Installation

314.15 Damp or Wet Locations.

In damp or wet locations, boxes, conduit bodies, outlet box hoods, and fittings shall be placed or equipped so as to prevent moisture from entering or accumulating within the box, conduit body, or fitting. Boxes, conduit bodies, outlet box hoods, and fittings installed in wet locations shall be listed for use in wet locations. Approved drainage openings not smaller than 3 mm (⅛ in.) and not larger than 6 mm (¼ in.) in diameter shall be permitted to be installed in the field in boxes or conduit bodies listed for use in damp or wet locations. For installation of listed drain fittings, larger openings are permitted to be installed in the field in accordance with manufacturer's instructions.

Informational Note No. 1: For boxes in floors, see 314.27(B).

Informational Note No. 2: For protection against corrosion, see 300.6.

314.16 Number of Conductors in Outlet, Device, and Junction Boxes, and Conduit Bodies.
Boxes and conduit bodies shall be of an approved size to provide free space for all enclosed conductors. In no case shall the volume of the box, as calculated in 314.16(A), be less than the fill calculation as calculated in 314.16(B). The minimum volume for conduit bodies shall be as calculated in 314.16(C).

The provisions of this section shall not apply to terminal housings supplied with motors or generators.

Informational Note: For volume requirements of motor or generator terminal housings, see 430.12.

Boxes and conduit bodies enclosing conductors 4 AWG or larger shall also comply with the provisions of 314.28. Outlet and device boxes shall also comply with 314.24.

314.16(A) Box Volume Calculations.
The volume of a wiring enclosure (box) shall be the total volume of the assembled sections and, where used, the space provided by plaster rings, domed covers, extension rings, and so forth, that are marked with their volume or are made from boxes the dimensions of which are listed in Table 314.16(A). Where a box is provided with one or more securely installed barriers, the volume shall be apportioned to each of the resulting spaces. Each barrier, if not marked with its volume, shall be considered to take up 8.2 cm^3 (½ $in.^3$) if metal, and 16.4 cm^3 (1.0 $in.^3$) if nonmetallic.

314.16(A)(1) Standard Boxes.
The volumes of standard boxes that are not marked with their volume shall be as given in Table 314.16(A).

314.16(A)(2) Other Boxes.
Boxes 1650 cm^3 (100 $in.^3$) or less, other than those described in Table 314.16(A), and nonmetallic boxes shall be durably and legibly marked by the manufacturer with their volume(s). Boxes described in Table 314.16(A) that have a volume larger than is designated in the table shall be permitted to have their volume marked as required by this section.

Table 314.16(A) Metal Boxes

Box Trade Size			Minimum Volume		Maximum Number of Conductors* (arranged by AWG size)						
Mm	in.		cm^3	$in.^3$	18	16	14	12	10	8	6
100 × 32	(4 × 1¼)	round/octagonal	205	12.5	8	7	6	5	5	5	2
100 × 38	(4 × 1½)	round/octagonal	254	15.5	10	8	7	6	6	5	3
100 × 54	(4 × 2⅛)	round/octagonal	353	21.5	14	12	10	9	8	7	4
100 × 32	(4× 1¼)	square	295	18.0	12	10	9	8	7	6	3
100 × 38	(4 × 1½)	square	344	21.0	14	12	10	9	8	7	4

Table 314.16(A) Metal Boxes

Box Trade Size			Minimum Volume		Maximum Number of Conductors* (arranged by AWG size)						
Mm	in.		cm^3	$in.^3$	18	16	14	12	10	8	6
100 × 54	(4 × 2 1/8)	square	497	30.3	20	17	15	13	12	10	6
120 × 32	(4 11/16 × 1 1/4)	square	418	25.5	17	14	12	11	10	8	5
120 × 38	(4 11/16 × 1 1/2)	square	484	29.5	19	16	14	13	11	9	5
120 × 54	(4 11/16 × 2 1/8)	square	689	42.0	28	24	21	18	16	14	8
75 × 50 × 38	(3 × 2 × 1 1/2)	device	123	7.5	5	4	3	3	3	2	1
75 × 50 × 50	(3 × 2 × 2)	device	164	10.0	6	5	5	4	4	3	2
75× 50 × 57	(3× 2 × 2 1/4)	device	172	10.5	7	6	5	4	4	3	2
75 × 50 × 65	(3 × 2 × 2 1/2)	device	205	12.5	8	7	6	5	5	4	2
75 × 50 × 70	(3 × 2 × 2 3/4)	device	230	14.0	9	8	7	6	5	4	2
75 × 50 × 90	(3 × 2 × 3 1/2)	device	295	18.0	12	10	9	8	7	6	3
100 × 54 × 38	(4 × 2 1/8 × 1 1/2)	device	169	10.3	6	5	5	4	4	3	2
100 × 54 × 48	(4 × 2 1/8 × 1 7/8)	device	213	13.0	8	7	6	5	5	4	2
100 × 54 × 54	(4 × 2 1/8 × 2 1/8)	device	238	14.5	9	8	7	6	5	4	2
95 × 50 × 65	(3 3/4 × 2 × 2 1/2)	masonry box/gang	230	14.0	9	8	7	6	5	4	2
95 × 50 × 90	(3 3/4 × 2 × 3 1/2)	masonry box/gang	344	21.0	14	12	10	9	8	7	4
min. 44.5 depth	FS — single cover/gang (1 3/4)		221	13.5	9	7	6	6	5	4	2
min. 60.3 depth	FD — single cover/gang (2 3/8)		295	18.0	12	10	9	8	7	6	3
min. 44.5 depth	FS — multiple cover/gang (1 3/4)		295	18.0	12	10	9	8	7	6	3
min. 60.3 depth	FD — multiple cover/gang (2 3/8)		395	24.0	16	13	12	10	9	8	4

*Where no volume allowances are required by 314.16(B)(2) through (B)(5).

314.16(B) Box Fill Calculations.
The volumes in paragraphs 314.16(B)(1) through (B)(5), as applicable, shall be added together. No allowance shall be required for small fittings such as locknuts and bushings. Each space within a box installed with a barrier shall be calculated separately.

314.16(B)(1) Conductor Fill.
Each conductor that originates outside the box and terminates or is spliced within the box shall be counted once, and each conductor that passes through the box without splice or termination shall be counted once. Each loop or coil of unbroken conductor not less than twice the minimum length required for free conductors in 300.14 shall be counted

twice. The conductor fill shall be calculated using Table 314.16(B). A conductor, no part of which leaves the box, shall not be counted.

Exception: An equipment grounding conductor or conductors or not over four fixture wires smaller than 14 AWG, or both, shall be permitted to be omitted from the calculations where they enter a box from a domed luminaire or similar canopy and terminate within that box.

314.16(B)(2) Clamp Fill.
Where one or more internal cable clamps, whether factory or field supplied, are present in the box, a single volume allowance in accordance with Table 314.16(B) shall be made based on the largest conductor present in the box. No allowance shall be required for a cable connector with its clamping mechanism outside the box.

A clamp assembly that incorporates a cable termination for the cable conductors shall be listed and marked for use with specific nonmetallic boxes. Conductors that originate within the clamp assembly shall be included in conductor fill calculations covered in 314.16(B)(1) as though they entered from outside the box. The clamp assembly shall not require a fill allowance, but the volume of the portion of the assembly that remains within the box after installation shall be excluded from the box volume as marked in 314.16(A)(2).

314.16(B)(3) Support Fittings Fill.
Where one or more luminaire studs or hickeys are present in the box, a single volume allowance in accordance with Table 314.16(B) shall be made for each type of fitting based on the largest conductor present in the box.

314.16(B)(4) Device or Equipment Fill.
For each yoke or strap containing one or more devices or equipment, a double volume allowance in accordance with Table 314.16(B) shall be made for each yoke or strap based on the largest conductor connected to a device(s) or equipment supported by that yoke or strap. A device or utilization equipment wider than a single 50 mm (2 in.) device box as described in Table 314.16(A) shall have double volume allowances provided for each gang required for mounting.

Table 314.16(B) Volume Allowance Required per Conductor

	Free Space Within Box for Each Conductor	
Size of Conductor (AWG)	**cm^3**	**$in.^3$**
18	24.6	1.50
16	28.7	1.75
14	32.8	2.00
12	36.9	2.25
10	41.0	2.50
8	49.2	3.00
6	81.9	5.00

314.16(B)(5) Equipment Grounding Conductor Fill.
Where up to four equipment grounding conductors or equipment bonding jumpers enter a box, a single volume allowance in accordance with Table 314.16(B) shall be made based on the largest equipment grounding conductor or equipment bonding jumper entering the box. A ¼ volume allowance shall be made for each additional equipment grounding conductor or equipment bonding jumper that enters the box, based on the largest equipment grounding conductor or equipment bonding conductor.

314.16(C) Conduit Bodies.

314.16(C)(1) General.
Conduit bodies enclosing 6 AWG conductors or smaller, other than short-radius conduit bodies as described in 314.16(C)(3), shall have a cross-sectional area not less than twice the cross-sectional area of the largest conduit or tubing to which they can be attached. The maximum number of conductors permitted shall be the maximum number permitted by Table 1 of Chapter 9 for the conduit or tubing to which it is attached.

314.16(C)(2) With Splices, Taps, or Devices.
Only those conduit bodies that are durably and legibly marked by the manufacturer with their volume shall be permitted to contain splices, taps, or devices. The maximum number of conductors shall be calculated in accordance with 314.16(B). Conduit bodies shall be supported in a rigid and secure manner.

314.16(C)(3) Short Radius Conduit Bodies.
Conduit bodies such as capped elbows and service-entrance elbows that enclose conductors 6 AWG or smaller, and are only intended to enable the installation of the raceway and the contained conductors, shall not contain splices, taps, or devices and shall be of an approved size to provide free space for all conductors enclosed in the conduit body.

314.17 Conductors Entering Boxes, Conduit Bodies, or Fittings.
Conductors entering boxes, conduit bodies, or fittings shall be protected from abrasion and shall comply with 314.17(A) through (D).

314.17(A) Openings to Be Closed.
Openings through which conductors enter shall be closed in a manner identified for the application.

314.17(B) Boxes and Conduit Bodies.
The installation of the conductors in boxes and conduit bodies shall comply with 314.17(B)(1) through (B)(4).

314.17(B)(1) Conductors Entering Through Individual Holes or Through Flexible Tubing.
For messenger-supported wiring, open wiring on insulators, or concealed knob-and-tube wiring, the conductors shall enter the box through individual holes. In installations where metal boxes or conduit bodies are used with conductors unprotected by flexible tubing, the individual openings shall be provided with insulating bushings. Where flexible tubing is used to enclose the conductors, the tubing shall extend from the last insulating support to not less than 6 mm (1⁄4 in.) inside the box or conduit body and beyond any cable clamp. The wiring method shall be secured to the box or conduit body.

314.17(B)(2) Conductors Entering Through Cable Clamps.
Where cable assemblies with nonmetallic sheathes are used, the sheath shall extend not less than 6 mm (1⁄4 in.) inside the box and beyond any cable clamp. Except as provided in 300.15(C), the wiring method shall be secured to the box or conduit body.

Exception: Where nonmetallic-sheathed cable is used with single gang nonmetallic boxes not larger than a nominal size 57 mm × 100 mm (2 1⁄4 in. × 4 in.) mounted in walls or ceilings, and where the cable is fastened within 200 mm (8 in.) of the box measured along the sheath and where the sheath extends through a cable knockout not less than 6 mm (1⁄4 in.), securing the cable to the box shall not be required. Multiple cable entries shall be permitted in a single cable knockout opening.

314.17(B)(3) Conductors Entering Through Raceways.
Where the raceway is complete between boxes, conduit bodies, or both and encloses individual conductors or nonmetallic cable assemblies or both, the conductors or cable assemblies shall not be required to be additionally secured. Where raceways enclose cable assemblies as provided in 300.15(C), the cable assembly shall not be required to be additionally secured within the box or conduit body.

314.17(B)(4) Temperature Limitation.
Nonmetallic boxes and conduit bodies shall be suitable for the lowest temperature-rated conductor entering the box or conduit body.

314.17(C) Conductors 4 AWG or Larger.
Installation shall comply with 300.4(G).

Informational Note: See 110.12(A) for requirements on closing unused cable and raceway knockout openings.

314.19 Boxes Enclosing Flush Devices or Flush Equipment.
Boxes used to enclose flush devices or flush equipment shall be of such design that the devices or equipment will be completely enclosed on the back and sides, and substantial support for the devices or equipment will be provided. Screws for supporting the box shall not also be used to attach a device or equipment.

314.20 Flush-Mounted Installations.
Installations within or behind a surface of concrete, tile, gypsum, plaster, or other noncombustible material, including boxes employing a flush-type cover or faceplate, shall be made so that the front edge of the box, plaster ring, extension ring, or listed extender will not be set back of the finished surface more than 6 mm (1⁄4 in.).

Installations within a surface of wood or other combustible surface material, boxes, plaster rings, extension rings, or listed extenders shall extend to the finished surface or project therefrom.

314.21 Repairing Noncombustible Surfaces.
Noncombustible surfaces that are broken or incomplete around boxes employing a flush-type cover or faceplate shall be repaired so there will be no gaps or open spaces greater than 3 mm (1⁄8 in.) at the edge of the box.

314.22 Surface Extensions.
Surface extensions shall be made by mounting and mechanically securing an extension ring over the box. Equipment grounding shall be in accordance with Part VI of Article 250.

Exception: A surface extension shall be permitted to be made from the cover of a box where the cover is designed so it is unlikely to fall off or be removed if its securing means becomes loose. The wiring method shall be flexible for an approved length that permits removal of the cover and provides access to the box interior and shall be arranged so that any grounding continuity is independent of the connection between the box and cover.

314.23 Supports.
Enclosures within the scope of this article shall be supported in accordance with one or more of the provisions in 314.23(A) through (H).

314.23(A) Surface Mounting.
An enclosure mounted on a building or other surface shall be rigidly and securely fastened in place. If the surface does not provide rigid and secure support, additional support in accordance with other provisions of this section shall be provided.

314.23(B) Structural Mounting.
An enclosure supported from a structural member or from grade shall be rigidly supported either directly or by using a metal, polymeric, or wood brace.

314.23(B)(1) Nails and Screws.
Nails and screws, where used as a fastening means, shall secure boxes by using brackets on the outside of the enclosure, or by using mounting holes in the back or in one or more sides of the enclosure, or they shall pass through the interior within 6 mm (1⁄4 in.) of the back or ends of the enclosure. Screws shall not be permitted to pass through the box unless exposed threads in the box are protected using approved means to avoid abrasion of conductor insulation. Mounting holes made in the field shall be approved.

314.23(B)(2) Braces.
Metal braces shall be protected against corrosion and formed from metal that is not less than 0.51 mm (0.020 in.) thick uncoated. Wood braces shall have a cross section not less than nominal 25 mm × 50 mm (1 in. × 2 in.). Wood braces in wet locations shall be treated for the conditions. Polymeric braces shall be identified as being suitable for the use.

314.23(C) Mounting in Finished Surfaces.
An enclosure mounted in a finished surface shall be rigidly secured thereto by clamps, anchors, or fittings identified for the application.

314.23(D) Suspended Ceilings.
An enclosure mounted to structural or supporting elements of a suspended ceiling shall be not more than 1650 cm^3 (100 $in.^3$) in size and shall be securely fastened in place in accordance with either 314.23(D)(1) or (D)(2).

314.23(D)(1) Framing Members.
An enclosure shall be fastened to the framing members by mechanical means such as bolts, screws, or rivets, or by the use of clips or other securing means identified for use with the type of ceiling framing member(s) and enclosure(s) employed. The framing members shall be supported in an approved manner and securely fastened to each other and to the building structure.

314.23(D)(2) Support Wires.
The installation shall comply with 300.11(A). The enclosure shall be secured, using identified methods, to ceiling support wire(s), including any additional support wire(s) installed for ceiling support. Support wire(s) used for enclosure support shall be fastened at each end so as to be taut within the ceiling cavity.

314.23(E) Raceway-Supported Enclosure, Without Devices, Luminaires, or Lampholders.
An enclosure that does not contain a device(s), other than splicing devices, or supports a luminaire(s), a lampholder, or other equipment and is supported by entering raceways shall not exceed 1650 cm^3 (100 $in.^3$) in size. It shall have threaded entries or identified hubs. It shall be supported by two or more conduits threaded wrenchtight into the enclosure or hubs. Each conduit shall be secured within 900 mm (3 ft) of the enclosure, or within 450 mm (18 in.) of the enclosure if all conduit entries are on the same side.

Exception: The following wiring methods shall be permitted to support a conduit body of any size, including a conduit body constructed with only one conduit entry, provided that the trade size of the conduit body is not larger than the largest trade size of the conduit or tubing:

(1) Intermediate metal conduit, Type IMC
(2) Rigid metal conduit, Type RMC
(3) Rigid polyvinyl chloride conduit, Type PVC
(4) Reinforced thermosetting resin conduit, Type RTRC
(5) Electrical metallic tubing, Type EMT

314.23(F) Raceway-Supported Enclosures, with Devices, Luminaires, or Lampholders.
An enclosure that contains a device(s), other than splicing devices, or supports a luminaire(s), a lampholder, or other equipment and is supported by entering raceways shall not exceed 1650 cm^3 (100 $in.^3$) in size. It shall have threaded entries or identified hubs. It shall be supported by two or more conduits threaded wrenchtight into the enclosure or hubs. Each conduit shall be secured within 450 mm (18 in.) of the enclosure.

Exception No. 1: Rigid metal or intermediate metal conduit shall be permitted to support a conduit body of any size, including a conduit body constructed with only one conduit entry, provided the trade size of the conduit body is not larger than the largest trade size of the conduit.

Exception No. 2: An unbroken length(s) of rigid or intermediate metal conduit shall be permitted to support a box used for luminaire or lampholder support, or to support a wiring enclosure that is an integral part of a luminaire and used in lieu of a box in accordance with 300.15(B), where all of the following conditions are met:

(1) The conduit is securely fastened at a point so that the length of conduit beyond the last point of conduit support does not exceed 900 mm (3 ft).
(2) The unbroken conduit length before the last point of conduit support is 300 mm (12 in.) or greater, and that portion of the conduit is securely fastened at some point not less than 300 mm (12 in.) from its last point of support.
(3) Where accessible to unqualified persons, the luminaire or lampholder, measured to its lowest point, is at least 2.5 m (8 ft) above grade or standing area and at least 900 mm (3 ft) measured horizontally to the 2.5 m (8 ft) elevation from windows, doors, porches, fire escapes, or similar locations.

(4) A luminaire supported by a single conduit does not exceed 300 mm (12 in.) in any direction from the point of conduit entry.
(5) The weight supported by any single conduit does not exceed 9 kg (20 lb).
(6) At the luminaire or lampholder end, the conduit(s) is threaded wrenchtight into the box, conduit body, integral wiring enclosure, or identified hubs. Where a box or conduit body is used for support, the luminaire shall be secured directly to the box or conduit body, or through a threaded conduit nipple not over 75 mm (3 in.) long.

314.23(G) Enclosures in Concrete or Masonry.
An enclosure supported by embedment shall be identified as suitably protected from corrosion and securely embedded in concrete or masonry.

314.23(H) Pendant Boxes.
An enclosure supported by a pendant shall comply with 314.23(H)(1) or (H)(2).

314.23(H)(1) Flexible Cord.
A box shall be supported from a multiconductor cord or cable in an approved manner that protects the conductors against strain, such as a strain-relief connector threaded into a box with a hub.

314.23(H)(2) Conduit.
A box supporting lampholders or luminaires, or wiring enclosures within luminaires used in lieu of boxes in accordance with 300.15(B), shall be supported by rigid or intermediate metal conduit stems. For stems longer than 450 mm (18 in.), the stems shall be connected to the wiring system with listed swivel hangers suitable for the location. At the luminaire end, the conduit(s) shall be threaded wrenchtight into the box, wiring enclosure, or identified hubs.

Where supported by only a single conduit, the threaded joints shall be prevented from loosening by the use of set-screws or other effective means, or the luminaire, at any point, shall be at least 2.5 m (8 ft) above grade or standing area and at least 900 mm (3 ft) measured horizontally to the 2.5 m (8 ft) elevation from windows, doors, porches, fire escapes, or similar locations. A luminaire supported by a single conduit shall not exceed 300 mm (12 in.) in any horizontal direction from the point of conduit entry.

314.24 Depth of Boxes.
Outlet and device boxes shall have an approved depth to allow equipment installed within them to be mounted properly and without likelihood of damage to conductors within the box.

314.24(A) Outlet Boxes Without Enclosed Devices or Utilization Equipment.
Outlet boxes that do not enclose devices or utilization equipment shall have a minimum internal depth of 12.7 mm (1⁄2 in.).

314.24(B) Outlet and Device Boxes with Enclosed Devices or Utilization Equipment.
Outlet and device boxes that enclose devices or utilization equipment shall have a minimum internal depth that accommodates the rearward projection of the equipment and the size of the conductors that supply the equipment. The internal depth shall include, where used, that of any extension boxes, plaster rings, or raised covers. The internal depth shall comply with all applicable provisions of 314.24(B)(1) through (B)(5).

314.24(B)(1) Large Equipment.
Boxes that enclose devices or utilization equipment that projects more than 48 mm (1 7⁄8 in.) rearward from the mounting plane of the box shall have a depth that is not less than the depth of the equipment plus 6 mm (1⁄4 in.).

314.24(B)(2) Conductors Larger Than 4 AWG.
Boxes that enclose devices or utilization equipment supplied by conductors larger than 4 AWG shall be identified for their specific function.

Exception to (2): Devices or utilization equipment supplied by conductors larger than 4 AWG shall be permitted to be mounted on or in junction and pull boxes larger than 1650 cm^3 (100 $in.^3$) if the spacing at the terminals meets the requirements of 312.6.

314.24(B)(3) Conductors 8, 6, or 4 AWG.
Boxes that enclose devices or utilization equipment supplied by 8, 6, or 4 AWG conductors shall have an internal depth that is not less than 52.4 mm (2 1/16 in.).

314.24(B)(4) Conductors 12 or 10 AWG.
Boxes that enclose devices or utilization equipment supplied by 12 or 10 AWG conductors shall have an internal depth that is not less than 30.2 mm (1 3/16 in.). Where the equipment projects rearward from the mounting plane of the box by more than 25 mm (1 in.), the box shall have a depth not less than that of the equipment plus 6 mm (1/4 in.).

314.24(B)(5) Conductors 14 AWG and Smaller.
Boxes that enclose devices or utilization equipment supplied by 14 AWG or smaller conductors shall have a depth that is not less than 23.8 mm (15/16 in.).

Exception to (1) through (5): Devices or utilization equipment that is listed to be installed with specified boxes shall be permitted.

314.25 Covers and Canopies.
In completed installations, each box shall have a cover, faceplate, lampholder, or luminaire canopy, except where the installation complies with 410.24(B). Screws used for the purpose of attaching covers, or other equipment, to the box shall be either machine screws matching the thread gauge and size that is integral to the box or shall be in accordance with the manufacturer's instructions.

314.25(A) Nonmetallic or Metal Covers and Plates.
Nonmetallic or metal covers and plates shall be permitted. Where metal covers or plates are used, they shall comply with the grounding requirements of 250.110.

Informational Note: For additional grounding requirements, see 410.42 for metal luminaire canopies, and 404.12 and 406.6(B) for metal faceplates.

314.25(B) Exposed Combustible Wall or Ceiling Finish.
Where a luminaire canopy or pan is used, any combustible wall or ceiling finish exposed between the edge of the canopy or pan and the outlet box shall be covered with noncombustible material if required by 410.23.

314.25(C) Flexible Cord Pendants.
Covers of outlet boxes and conduit bodies having holes through which flexible cord pendants pass shall be provided with identified bushings or shall have smooth, well-rounded surfaces on which the cords may bear. So-called hard rubber or composition bushings shall not be used.

314.27 Outlet Boxes.

314.27(A) Boxes at Luminaire or Lampholder Outlets.
Outlet boxes or fittings designed for the support of luminaires and lampholders, and installed as required by 314.23, shall be permitted to support a luminaire or lampholder.

314.27(A)(1) Vertical Surface Outlets.
Boxes used at luminaire or lampholder outlets in or on a vertical surface shall be identified and marked on the interior of the box to indicate the maximum weight of the luminaire that is permitted to be supported by the box if other than 23 kg (50 lb).

Exception: A vertically mounted luminaire or lampholder weighing not more than 3 kg (6 lb) shall be permitted to be supported on other boxes or plaster rings that are secured to other boxes, provided that the luminaire or its supporting yoke, or the lampholder, is secured to the box with no fewer than two No. 6 or larger screws.

314.27(A)(2) Ceiling Outlets.
At every outlet used exclusively for lighting, the box shall be designed or installed so that a luminaire or lampholder may be attached. Boxes shall be required to support a luminaire weighing a minimum of 23 kg (50 lb). A luminaire that weighs more than 23 kg (50 lb) shall be supported independently of the outlet box, unless the outlet box is listed

for not less than the weight to be supported. The interior of the box shall be marked by the manufacturer to indicate the maximum weight the box shall be permitted to support.

314.27(B) Floor Boxes.
Boxes listed specifically for this application shall be used for receptacles located in the floor.

Exception: Where the authority having jurisdiction judges them free from likely exposure to physical damage, moisture, and dirt, boxes located in elevated floors of show windows and similar locations shall be permitted to be other than those listed for floor applications. Receptacles and covers shall be listed as an assembly for this type of location.

314.27(C) Boxes at Ceiling-Suspended (Paddle) Fan Outlets.
Outlet boxes or outlet box systems used as the sole support of a ceiling-suspended (paddle) fan shall be listed, shall be marked by their manufacturer as suitable for this purpose, and shall not support ceiling-suspended (paddle) fans that weigh more than 32 kg (70 lb). For outlet boxes or outlet box systems designed to support ceiling-suspended (paddle) fans that weigh more than 16 kg (35 lb), the required marking shall include the maximum weight to be supported.

Outlet boxes mounted in the ceilings of habitable rooms of dwelling occupancies in a location acceptable for the installation of a ceiling-suspended (paddle) fan shall comply with one of the following:

(1) Listed for the sole support of ceiling-suspended (paddle) fans
(2) An outlet box complying with the applicable requirements of 314.27 and providing access to structural framing capable of supporting of a ceiling-suspended (paddle) fan bracket or equivalent

314.27(D) Utilization Equipment.
Boxes used for the support of utilization equipment other than ceiling-suspended (paddle) fans shall meet the requirements of 314.27(A) for the support of a luminaire that is the same size and weight.

Exception: Utilization equipment weighing not more than 3 kg (6 lb) shall be permitted to be supported on other boxes or plaster rings that are secured to other boxes, provided the equipment or its supporting yoke is secured to the box with no fewer than two No. 6 or larger screws.

314.27(E) Separable Attachment Fittings.
Outlet boxes required in 314.27 shall be permitted to support listed locking support and mounting receptacles used in combination with compatible attachment fittings. The combination shall be identified for the support of equipment within the weight and mounting orientation limits of the listing. Where the supporting receptacle is installed within a box, it shall be included in the fill calculation covered in 314.16(B)(4).

314.28 Pull and Junction Boxes and Conduit Bodies.
Boxes and conduit bodies used as pull or junction boxes shall comply with 314.28(A) through (E).

Exception: Terminal housings supplied with motors shall comply with the provisions of 430.12.

314.28(A) Minimum Size.
For raceways containing conductors of 4 AWG or larger that are required to be insulated, and for cables containing conductors of 4 AWG or larger, the minimum dimensions of pull or junction boxes installed in a raceway or cable run shall comply with 314.28(A)(1) through (A)(3). Where an enclosure dimension is to be calculated based on the diameter of entering raceways, the diameter shall be the metric designator (trade size) expressed in the units of measurement employed.

314.28(A)(1) Straight Pulls.
In straight pulls, the length of the box or conduit body shall not be less than eight times the metric designator (trade size) of the largest raceway.

314.28(A)(2) Angle or U Pulls, or Splices.

Where splices or where angle or U pulls are made, the distance between each raceway entry inside the box or conduit body and the opposite wall of the box or conduit body shall not be less than six times the metric designator (trade size) of the largest raceway in a row. This distance shall be increased for additional entries by the amount of the sum of the diameters of all other raceway entries in the same row on the same wall of the box. Each row shall be calculated individually, and the single row that provides the maximum distance shall be used.

Exception: Where a raceway or cable entry is in the wall of a box or conduit body opposite a removable cover, the distance from that wall to the cover shall be permitted to comply with the distance required for one wire per terminal in Table 312.6(A).

The distance between raceway entries enclosing the same conductor shall not be less than six times the metric designator (trade size) of the larger raceway.

When transposing cable size into raceway size in 314.28(A)(1) and (A)(2), the minimum metric designator (trade size) raceway required for the number and size of conductors in the cable shall be used.

314.28(A)(3) Smaller Dimensions.
Listed boxes or listed conduit bodies of dimensions less than those required in 314.28(A)(1) and (A)(2) shall be permitted for installations of combinations of conductors that are less than the maximum conduit or tubing fill (of conduits or tubing being used) permitted by Table 1 of Chapter 9.

Listed conduit bodies of dimensions less than those required in 314.28(A)(2), and having a radius of the curve to the centerline not less than that indicated in Table 2 of Chapter 9 for one-shot and full-shoe benders, shall be permitted for installations of combinations of conductors permitted by Table 1 of Chapter 9. These conduit bodies shall be marked to show they have been specifically evaluated in accordance with this provision.

Where the permitted combinations of conductors for which the box or conduit body has been listed are less than the maximum conduit or tubing fill permitted by Table 1 of Chapter 9, the box or conduit body shall be permanently marked with the maximum number and maximum size of conductors permitted. For other conductor sizes and combinations, the total cross-sectional area of the fill shall not exceed the cross-sectional area of the conductors specified in the marking, based on the type of conductor identified as part of the product listing.

Informational Note: Unless otherwise specified, the applicable product standards evaluate the fill markings covered here based on conductors with Type XHHW insulation.

314.28(B) Conductors in Pull or Junction Boxes.
In pull boxes or junction boxes having any dimension over 1.8 m (6 ft), all conductors shall be cabled or racked up in an approved manner.

314.28(C) Covers.
All pull boxes, junction boxes, and conduit bodies shall be provided with covers compatible with the box or conduit body construction and suitable for the conditions of use. Where used, metal covers shall comply with the grounding requirements of 250.110.

314.28(D) Permanent Barriers.
Where permanent barriers are installed in a box, each section shall be considered as a separate box.

314.28(E) Power Distribution Blocks.
Power distribution blocks shall be permitted in pull and junction boxes over 1650 cm^3 (100 $in.^3$) for connections of conductors where installed in boxes and where the installation complies with 314.28(E)(1) through (E)(5).

Exception: Equipment grounding terminal bars shall be permitted in smaller enclosures.

314.28(E)(1) Installation.
Power distribution blocks installed in boxes shall be listed.

314.28(E)(2) Size.
In addition to the overall size requirement in the first sentence of 314.28(A)(2), the power distribution block shall be installed in a box with dimensions not smaller than specified in the installation instructions of the power distribution block.

314.28(E)(3) Wire Bending Space.
Wire bending space at the terminals of power distribution blocks shall comply with 312.6.

314.28(E)(4) Live Parts.
Power distribution blocks shall not have uninsulated live parts exposed within a box, whether or not the box cover is installed.

314.28(E)(5) Through Conductors.
Where the pull or junction boxes are used for conductors that do not terminate on the power distribution block(s), the through conductors shall be arranged so the power distribution block terminals are unobstructed following installation.

314.29 Boxes, Conduit Bodies, and Handhole Enclosures to Be Accessible.
Boxes, conduit bodies, and handhole enclosures shall be installed so that wiring contained in them can be rendered accessible in accordance with 314.29(A) and (B).

314.29(A) In Buildings and Other Structures.
Boxes and conduit bodies shall be installed so the contained wiring can be accessed without removing any part of the building or structure.

314.29(B) Underground.
Underground boxes and handhole enclosures shall be installed so they are accessible without excavating sidewalks, paving, earth, or other substance that is to be used to establish the finished grade.

Exception: Listed boxes and handhole enclosures shall be permitted where covered by gravel, light aggregate, or noncohesive granulated soil if their location is effectively identified and accessible for excavation.

314.30 Handhole Enclosures.
Handhole enclosures shall be designed and installed to withstand all loads likely to be imposed on them. They shall be identified for use in underground systems.

Informational Note: See ANSI/SCTE 77-2013, *Specification for Underground Enclosure Integrity*, for additional information on deliberate and nondeliberate traffic loading that can be expected to bear on underground enclosures.

314.30(A) Size.
Handhole enclosures shall be sized in accordance with 314.28(A) for conductors operating at 1000 volts or below, and in accordance with 314.71 for conductors operating at over 1000 volts. For handhole enclosures without bottoms where the provisions of 314.28(A)(2), Exception, or 314.71(B)(1), Exception No. 1, apply, the measurement to the removable cover shall be taken from the end of the conduit or cable assembly.

314.30(B) Wiring Entries.
Underground raceways and cable assemblies entering a handhole enclosure shall extend into the enclosure, but they shall not be required to be mechanically connected to the enclosure.

314.30(C) Enclosed Wiring.
All enclosed conductors and any splices or terminations, if present, shall be listed as suitable for wet locations.

314.30(D) Covers.
Handhole enclosure covers shall have an identifying mark or logo that prominently identifies the function of the enclosure, such as “electric.” Handhole enclosure covers shall require the use of tools to open, or they shall weigh over 45 kg (100 lb). Metal covers and other exposed conductive surfaces shall be bonded in accordance with 250.92 if the conductors in the handhole are service conductors, or in accordance with 250.96(A) if the conductors in the handhole are feeder or branch-circuit conductors.

Part III. Construction Specifications

314.40 Metal Boxes, Conduit Bodies, and Fittings.

314.40(A) Corrosion Resistant.
Metal boxes, conduit bodies, and fittings shall be corrosion resistant or shall be well-galvanized, enameled, or otherwise properly coated inside and out to prevent corrosion.

Informational Note: See 300.6 for limitation in the use of boxes and fittings protected from corrosion solely by enamel.

314.40(B) Thickness of Metal.
Sheet steel boxes not over 1650 cm^3 (100 $in.^3$) in size shall be made from steel not less than 1.59 mm (0.0625 in.) thick. The wall of a malleable iron box or conduit body and a die-cast or permanent-mold cast aluminum, brass, bronze, or zinc box or conduit body shall not be less than 2.38 mm ($^3/_{32}$ in.) thick. Other cast metal boxes or conduit bodies shall have a wall thickness not less than 3.17 mm ($^1/_8$ in.).

Exception No. 1: Listed boxes and conduit bodies shown to have equivalent strength and characteristics shall be permitted to be made of thinner or other metals.

Exception No. 2: The walls of listed short radius conduit bodies, as covered in 314.16(C)(2), shall be permitted to be made of thinner metal.

314.40(C) Metal Boxes Over 1650 cm^3 (100 $in.^3$).
Metal boxes over 1650 cm^3 (100 $in.^3$) in size shall be constructed so as to be of ample strength and rigidity. If of sheet steel, the metal thickness shall not be less than 1.35 mm (0.053 in.) uncoated.

314.40(D) Equipment Grounding Conductor Provisions.
A means shall be provided in each metal box for the connection of an equipment grounding conductor. The means shall be permitted to be a tapped hole or equivalent.

314.41 Covers.
Metal covers shall be of the same material as the box or conduit body with which they are used, or they shall be lined with firmly attached insulating material that is not less than 0.79 mm ($^1/_{32}$ in.) thick, or they shall be listed for the purpose. Metal covers shall be the same thickness as the boxes or conduit body for which they are used, or they shall be listed for the purpose. Covers of porcelain or other approved insulating materials shall be permitted if of such form and thickness as to afford the required protection and strength.

314.42 Bushings.
Covers of outlet boxes and conduit bodies having holes through which flexible cord pendants may pass shall be provided with approved bushings or shall have smooth, well-rounded surfaces on which the cord may bear. Where individual conductors pass through a metal cover, a separate hole equipped with a bushing of suitable insulating material shall be provided for each conductor. Such separate holes shall be connected by a slot as required by 300.20.

314.43 Nonmetallic Boxes.
Provisions for supports or other mounting means for nonmetallic boxes shall be outside of the box, or the box shall be constructed so as to prevent contact between the conductors in the box and the supporting screws.

314.44 Marking.
All boxes and conduit bodies, covers, extension rings, plaster rings, and the like shall be durably and legibly marked with the manufacturer's name or trademark.

~~**Part IV. Pull and Junction Boxes, Conduit Bodies, and Handhole Enclosures for Use on Systems over 1000 Volts, Nominal**~~

~~**314.70 General.**~~

~~**314.70(A) Pull and Junction Boxes.**~~

Where pull and junction boxes are used on systems over 1000 volts, the installation shall comply with the provisions of Part IV and with the following general provisions of this article:

(1) Part I, 314.2; 314.3; and 314.4
(2) Part II, 314.15; 314.17; 314.20; 314.23(A), (B), or (G); 314.28(B); and 314.29
(3) Part III, 314.40(A) and (C); and 314.41

314.70(B) Conduit Bodies.
Where conduit bodies are used on systems over 1000 volts, the installation shall comply with the provisions of Part IV and with the following general provisions of this article:

(1) Part I, 314.4
(2) Part II, 314.15; 314.17; 314.23(A), (E), or (G); 314.28(A)(3); and 314.29
(3) Part III, 314.40(A) and 314.41

314.70(C) Handhole Enclosures.
Where handhole enclosures are used on systems over 1000 volts, the installation shall comply with the provisions of Part IV and with the following general provisions of this article:

(1) Part I, 314.3 and 314.4
(2) Part II, 314.15; 314.17; 314.23(G); 314.28(B); 314.29; and 314.30

314.71 Size of Pull and Junction Boxes, Conduit Bodies, and Handhole Enclosures.
Pull and junction boxes and handhole enclosures shall provide approved space and dimensions for the installation of conductors, and they shall comply with the specific requirements of this section. Conduit bodies shall be permitted if they meet the dimensional requirements for boxes.

314.71(A) For Straight Pulls.
The length of the box shall not be less than 48 times the outside diameter, over sheath, of the largest shielded or lead-covered conductor or cable entering the box. The length shall not be less than 32 times the outside diameter of the largest nonshielded conductor or cable.

314.71(B) For Angle or U Pulls.

314.71(B)(1) Distance to Opposite Wall.
The distance between each cable or conductor entry inside the box and the opposite wall of the box shall not be less than 36 times the outside diameter, over sheath, of the largest cable or conductor. This distance shall be increased for additional entries by the amount of the sum of the outside diameters, over sheath, of all other cables or conductor entries through the same wall of the box.

Exception No. 1: Where a conductor or cable entry is in the wall of a box opposite a removable cover, the distance from that wall to the cover shall be permitted to be not less than the bending radius for the conductors as provided in 300.34.

Exception No. 2: Where cables are nonshielded and not lead covered, the distance of 36 times the outside diameter shall be permitted to be reduced to 24 times the outside diameter.

314.71(B)(2) Distance Between Entry and Exit.
The distance between a cable or conductor entry and its exit from the box shall not be less than 36 times the outside diameter, over sheath, of that cable or conductor.

Exception: Where cables are nonshielded and not lead covered, the distance of 36 times the outside diameter shall be permitted to be reduced to 24 times the outside diameter.

314.71(C) Removable Sides.
One or more sides of any pull box shall be removable.

314.72 Construction and Installation Requirements.

~~**314.72(A) Corrosion Protection.**~~
~~Boxes shall be made of material inherently resistant to corrosion or shall be suitably protected, both internally and externally, by enameling, galvanizing, plating, or other means.~~

~~**314.72(B) Passing Through Partitions.**~~
~~Suitable bushings, shields, or fittings having smooth, rounded edges shall be provided where conductors or cables pass through partitions and at other locations where necessary.~~

~~**314.72(C) Complete Enclosure.**~~
~~Boxes shall provide a complete enclosure for the contained conductors or cables.~~

~~**314.72(D) Wiring Is Accessible.**~~
~~Boxes and conduit bodies shall be installed so that the conductors are accessible without removing any fixed part of the building or structure. Working space shall be provided in accordance with 110.34.~~

~~**314.72(E) Suitable Covers.**~~
~~Boxes shall be closed by suitable covers securely fastened in place. Underground box covers that weigh over 45 kg (100 lb) shall be considered meeting this requirement. Covers for boxes shall be permanently marked "DANGER — HIGH VOLTAGE — KEEP OUT." The marking shall be on the outside of the box cover and shall be readily visible. Letters shall be block type and at least 13 mm (½ in.) in height.~~

~~**314.72(F) Suitable for Expected Handling.**~~
~~Boxes and their covers shall be capable of withstanding the handling to which they are likely to be subjected.~~

Revised Article 368:

ARTICLE 368 Busways Rated up to 1000 Volts ac, 1500 Volts dc, Nominal

Part I. General Requirements

368.1 Scope.
This article covers service-entrance, feeder, and branch-circuit busways and associated fittings rated up to 1000 volts ac, 1500 volts dc, nominal.

Informational Note: See Article 305, Part III for requirements for busways rated over 1000 volts ac, 1500 volts dc, nominal.

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

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

Informational Note: For cablebus, refer to Article 370.

Part II. Installation

368.10 Uses Permitted.
Busways shall be permitted to be installed where they are located in accordance with 368.10(A) through (C).

Informational Note: See 300.21 for information concerning the spread of fire or products of combustion.

368.10(A) Exposed.
Busways shall be permitted to be located in the open where visible, except as permitted in 368.10(C).

368.10(B) Behind Access Panels.
Busways shall be permitted to be installed behind access panels, provided the busways are totally enclosed, of nonventilating-type construction, and installed so that the joints between sections and at fittings are accessible for maintenance purposes. Where installed behind access panels, means of access shall be provided, and either of the following conditions shall be met:

(1) The space behind the access panels shall not be used for air-handling purposes.
(2) Where the space behind the access panels is used for environmental air, other than ducts and plenums, there shall be no provisions for plug-in connections, and the conductors shall be insulated.

368.10(C) Through Walls and Floors.
Busways shall be permitted to be installed through walls or floors in accordance with (C)(1) and (C)(2).

368.10(C)(1) Walls.
Unbroken lengths of busway shall be permitted to be extended through dry walls.

368.10(C)(2) Floors.
Floor penetrations shall comply with (a) and (b):

(a) Busways shall be permitted to be extended vertically through dry floors if totally enclosed (unventilated) where passing through and for a minimum distance of 1.8 m (6 ft) above the floor to provide adequate protection from physical damage.

(b) In other than industrial establishments, where a vertical riser penetrates two or more dry floors, a minimum 100-mm (4-in.) high curb shall be installed around all floor openings for riser busways to prevent liquids from entering the opening. The curb shall be installed within 300 mm (12 in.) of the floor opening. Electrical equipment shall be located so that it will not be damaged by liquids that are retained by the curb.

368.12 Uses Not Permitted.

368.12(A) Physical Damage.
Busways shall not be installed where subject to severe physical damage or corrosive vapors.

368.12(B) Hoistways.
Busways shall not be installed in hoistways.

368.12(C) Hazardous Locations.
Busways shall not be installed in any hazardous (classified) location, unless specifically approved for such use.

Informational Note: See 501.10(B).

368.12(D) Wet Locations.
Busways shall not be installed outdoors or in wet or damp locations unless identified for such use.

368.12(E) Working Platform.
Lighting busway and trolley busway shall not be installed less than 2.5 m (8 ft) above the floor or working platform unless provided with an identified cover.

368.17 Overcurrent Protection.
Overcurrent protection shall be provided in accordance with 368.17(A) through (D).

368.17(A) Rating of Overcurrent Protection — Feeders.
A busway shall be protected against overcurrent in accordance with the current rating of the busway.

Exception No. 1: The applicable provisions of 240.4 shall be permitted.

Exception No. 2: Where used as transformer secondary ties, 450.6(A)(3) shall be permitted.

368.17(B) Reduction in Ampacity Size of Busway.
Overcurrent protection shall be required where busways are reduced in ampacity.

Exception: For industrial establishments only, omission of overcurrent protection shall be permitted at points where busways are reduced in ampacity, provided that the length of the busway having the smaller ampacity does not exceed 15 m (50 ft) and has an ampacity at least equal to one-third the rating or setting of the overcurrent device next back on the line, and provided that such busway is free from contact with combustible material.

368.17(C) Feeder or Branch Circuits.
Where a busway is used as a feeder, devices or plug-in connections for tapping off feeder or branch circuits from the busway shall contain the overcurrent devices required for the protection of the feeder or branch circuits. The plug-in device shall consist of an externally operable circuit breaker or an externally operable fusible switch. Where such devices are mounted out of reach and contain disconnecting means, suitable means such as ropes, chains, or sticks shall be provided for operating the disconnecting means from the floor.

Exception No. 1: As permitted in 240.21.

Exception No. 2: For fixed or semifixed luminaires, where the branch-circuit overcurrent device is part of the luminaire cord plug on cord-connected luminaires.

Exception No. 3: Where luminaires without cords are plugged directly into the busway and the overcurrent device is mounted on the luminaire.

Exception No. 4: Where the branch-circuit overcurrent plug-in device is directly supplying a readily accessible disconnect, a method of floor operation shall not be required.

368.17(D) Rating of Overcurrent Protection — Branch Circuits.
A busway used as a branch circuit shall be protected against overcurrent in accordance with 210.20.

368.30 Support.
Busways shall be securely supported at intervals not exceeding 1.5 m (5 ft) unless otherwise designed and marked.

368.56 Branches from Busways.
Branches from busways shall be permitted to be made in accordance with 368.56(A), (B), and (C).

368.56(A) General.
Branches from busways shall be permitted to use any of the following wiring methods:

(1) Type AC armored cable
(2) Type MC metal-clad cable
(3) Type MI mineral-insulated, metal-sheathed cable
(4) Type IMC intermediate metal conduit
(5) Type RMC rigid metal conduit
(6) Type FMC flexible metal conduit
(7) Type LFMC liquidtight flexible metal conduit
(8) Type PVC rigid polyvinyl chloride conduit
(9) Type RTRC reinforced thermosetting resin conduit
(10) Type LFNC liquidtight flexible nonmetallic conduit
(11) Type EMT electrical metallic tubing
(12) Type ENT electrical nonmetallic tubing
(13) Busways
(14) Strut-type channel raceway
(15) Surface metal raceway

(16) Surface nonmetallic raceway

Where a separate equipment grounding conductor is used, connection of the equipment grounding conductor to the busway shall comply with 250.8 and 250.12.

368.56(B) Cord and Cable Assemblies.
Suitable cord and cable assemblies identified for extra-hard usage or hard usage and listed bus drop cable shall be permitted as branches from busways for the connection of portable equipment or the connection of stationary equipment to facilitate their interchange in accordance with 400.10 and 400.12 and the following conditions:

(1) The cord or cable shall be attached to the building by an approved means.
(2) The length of the cord or cable from a busway plug-in device to a suitable tension take-up support device shall not exceed 1.8 m (6 ft).
(3) The cord and cable shall be installed as a vertical riser from the tension take-up support device to the equipment served.
(4) Strain relief cable grips shall be provided for the cord or cable at the busway plug-in device and equipment terminations.

Exception to (B)(2): In industrial establishments only, where the conditions of maintenance and supervision ensure that only qualified persons service the installation, lengths exceeding 1.8 m (6 ft) shall be permitted between the busway plug-in device and the tension take-up support device where the cord or cable is supported at intervals not exceeding 2.5 m (8 ft).

368.56(C) Branches from Trolley-Type Busways.
Suitable cord and cable assemblies identified for extra-hard usage or hard usage and listed bus drop cable shall be permitted as branches from trolley-type busways for the connection of movable equipment in accordance with 400.10 and 400.12.

368.58 Dead Ends.
A dead end of a busway shall be closed.

368.60 Grounding.
Busway shall be connected to an equipment grounding conductor(s), to an equipment bonding jumper, or to the grounded conductor where permitted or required by 250.92(B)(1) or 250.142.

Part III. Construction

368.120 Marking.
Busways shall be marked with the voltage and current rating for which they are designed, and with the manufacturer's name or trademark in such a manner as to be visible after installation.

~~**Part IV. Requirements for Over 1000 Volts, Nominal**~~

~~**368.214 Adjacent and Supporting Structures.**~~
~~Metal-enclosed busways shall be installed so that temperature rise from induced circulating currents in adjacent ferrous metal parts will not be hazardous to personnel or constitute a fire hazard.~~

~~**368.234 Barriers and Seals.**~~

~~**368.234(A) Vapor Seals.**~~
~~Busway runs that have sections located both inside and outside of buildings shall have a vapor seal at the building wall to prevent interchange of air between indoor and outdoor sections.~~

~~*Exception: Vapor seals shall not be required in forced-cooled bus.*~~

~~**368.234(B) Fire Barriers.**~~
~~Fire barriers shall be provided where fire walls, floors, or ceilings are penetrated.~~

~~Informational Note: See 300.21 for information concerning the spread of fire or products of combustion.~~

368.236 Drain Facilities.
Drain plugs, filter drains, or similar methods shall be provided to remove condensed moisture from low points in busway run.

368.237 Ventilated Bus Enclosures.
Ventilated busway enclosures shall be installed in accordance with Article 110, Part III, and 490.24.

368.238 Terminations and Connections.
Where bus enclosures terminate at machines cooled by flammable gas, seal-off bushings, baffles, or other means shall be provided to prevent accumulation of flammable gas in the busway enclosures.

All conductor termination and connection hardware shall be accessible for installation, connection, and maintenance.

368.239 Switches.
Switching devices or disconnecting links provided in the busway run shall have the same momentary rating as the busway. Disconnecting links shall be plainly marked to be removable only when bus is de-energized. Switching devices that are not load-break shall be interlocked to prevent operation under load, and disconnecting link enclosures shall be interlocked to prevent access to energized parts.

368.240 Wiring 1000 Volts or Less, Nominal.
Secondary control devices and wiring that are provided as part of the metal-enclosed bus run shall be insulated by fire-retardant barriers from all primary circuit elements with the exception of short lengths of wire, such as at instrument transformer terminals.

368.244 Expansion Fittings.
Flexible or expansion connections shall be provided in long, straight runs of bus to allow for temperature expansion or contraction, or where the busway run crosses building vibration insulation joints.

368.258 Neutral Conductor.
Neutral bus, where required, shall be sized to carry all neutral load current, including harmonic currents, and shall have adequate momentary and short-circuit current rating consistent with system requirements.

368.260 Grounding.
Metal-enclosed busway shall be grounded.

368.320 Marking.
Each busway run shall be provided with a permanent nameplate on which the following information shall be provided:

(1) Rated voltage.
(2) Rated continuous current; if bus is forced-cooled, both the normal forced-cooled rating and the self-cooled (not forced-cooled) rating for the same temperature rise shall be given.
(3) Rated frequency.
(4) Rated impulse withstand voltage.
(5) Rated 60-Hz withstand voltage (dry).
(6) Rated momentary current.
(7) Manufacturer's name or trademark.

Informational Note: See IEEE C37.23-2015, *IEEE Standard for Metal-Enclosed Bus*, for construction and testing requirements for metal-enclosed bus assemblies.

Article 399 Revisions (entire Article deleted, as text is relocated to 305):

ARTICLE 399 Outdoor Overhead Conductors over 1000 Volts

399.1 Scope.
This article covers the use and installation for outdoor overhead conductors over 1000 volts, nominal.

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

Outdoor Overhead Conductors.
Single conductors, insulated, covered, or bare, installed outdoors on support structures in free air.

399.10 Uses Permitted.
Outdoor overhead conductors over 1000 volts, nominal, shall be permitted only for systems rated over 1000 volts, nominal, as follows:

(1) Outdoors in free air
(2) For service conductors, feeders, or branch circuits

Informational Note: For additional information on outdoor overhead conductors over 1000 volts, see IEEE C2, *National Electrical Safety Code*, and ANSI/IEEE 3001.2, *Recommended Practice for Evaluating the Electrical Service Requirements of Industrial and Commercial Power Systems*.

399.30 Support.

399.30(A) Conductors.
Documentation of the engineered design by a licensed professional engineer engaged primarily in the design of such systems for the spacing between conductors shall be available upon request of the authority having jurisdiction and shall include consideration of the following:

(1) Applied voltage
(2) Conductor size
(3) Distance between support structures
(4) Type of structure
(5) Wind/ice loading
(6) Surge protection

399.30(B) Structures.
Structures of wood, metal, or concrete, or combinations of those materials, shall be provided for support of overhead conductors over 1000 volts, nominal. Documentation of the engineered design by a licensed professional engineer engaged primarily in the design of such systems and the installation of each support structure shall be available upon request of the authority having jurisdiction and shall include consideration of the following:

(1) Soil conditions
(2) Foundations and structure settings
(3) Weight of all supported conductors and equipment
(4) Weather loading and other conditions such as, but not limited to, ice, wind, temperature, and lightning
(5) Angle where change of direction occurs
(6) Spans between adjacent structures
(7) Effect of dead-end structures
(8) Strength of guy wires and guy anchors
(9) Structure size and material(s)
(10) Hardware

399.30(C) Insulators.
Insulators used to support conductors shall be rated for all of the following:

(1) Applied phase-to-phase voltage
(2) Mechanical strength required for each individual installation

(3) Impulse withstand BIL in accordance with Table 490.24

Informational Note: 399.30(A), (B), and (C) are not all inclusive lists.

Public Input No. 3868-NFPA 70-2020 [Global Input]

Revise Article 725 per the attached.

Additional Proposed Changes

File Name	Description	Approved
2020_NEC_Article_725_Changes_-_REVISION_MODE_TRACK_CHANGES_ON.docx	This document incorporates the revisions to Article 725 needed to accommodate the consolidation of requirements and new Article for cables with track changes on and revisions shown.	
2020_NEC_Article_725_Changes_-_CHANGES_ACCEPTED.pdf	This document shows what the 725 changes look like with all of the changes accepted.	

Statement of Problem and Substantiation for Public Input

This public input was developed by a Panel 3 appointed task group to address redundant cabling requirements in Articles 725, 760 and 770. The Panel 3 task group members included TG Chairman Randy Ivans (Panel 3 Principal, Panel 16 Alternate), Robert Jones (Chairman Panel 3), Paul Casparro, Shane Clary, Michael Cogbill, Chad Jones, Ward Judson, Tim Mikloiche, Samuel Rokowski, George Straniero, Ron Tellas, and George Zimmerman. The TG was broad-based and specifically included representation of those with knowledge and experience in electrical safety, installation, code enforcement, and wire and cable.

This proposed new Article combines common cabling requirements currently found in Articles 725, 760, and 770 and also relocates other cabling requirements from those articles into a single article. The proposal also removes the redundancy between the text-based requirements in 725.135, 760.135 and 770.113, and the tabular requirements in Tables 725.154, 760.154 and 770.154 by including most of the requirements only in tabular form. This has been found to be more user-friendly. Some of the text-based requirements do not lend themselves to being represented in tabular form and remain as text in the new Article. In some cases, such as 725.144, the cable requirements are integrated with equipment requirements and were not moved. In the case of 725.144 a pointer was added in the new article for clarity. The new Article is being proposed in Public Input No. 3671.

This PI deletes or modifies text in the original Article 725 to accommodate the above consolidation of requirements. Hazardous locations was moved from 725.3 to a new 725.12 to simplify the references. The reference in 725.24 was changed from 300.4(D) to 300.11 since 300.4(D) deals with cables which are being relocated and 300.11 includes equipment. It should be noted that parallel sections 770.24 and 800.24 both already reference 300.11.

The work of the TG also proposes moving Class 1 circuits into a new Article. This is being handled by separate PIs. PI 2775 Gobal Input for deletion of Class 1 from Article 725. PI 2774 for the new New Article for Class 1 circuits.

These changes significantly improve clarity and usability while removing redundant requirements. It is not the intent of these proposals to introduce any technical changes. Some editorial errors were found during this process and fixed within this PI. If this PI is resolved, there are separate PIs submitted to fix those issues. Multiple companion public inputs are submitted throughout the NEC as part of this overall effort.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3671-NFPA 70-2020 [Global Input]	PI to add the new Article 7XX for Cables for Power Limited Circuits
Public Input No. 3993-NFPA 70-2020 [Global Input]	This PI is for the revisions to Article 760 to accommodate the new cable article
Public Input No. 4138-NFPA 70-2020 [Global Input]	This PI is for the revisions to Article 770 to accommodate the new cable article
Public Input No. 3671-NFPA 70-2020 [Global Input]	
Public Input No. 3993-NFPA 70-2020 [Global Input]	
Public Input No. 4138-NFPA 70-2020 [Global Input]	

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ARTICLE 725 Class 1, Class 2, and Class 3 Remote-Control, Signaling, and Power-Limited Circuits

Part I. General

725.1 Scope. This article covers remote-control, signaling, and power-limited circuits that are not an integral part of a device or of utilization equipment.

Informational Note: The circuits described herein are characterized by usage and electrical power limitations that differentiate them from electric light and power circuits; therefore, alternative requirements to those of Chapters 1 through 4 are given with regard to minimum wire sizes, ampacity adjustment and correction factors, overcurrent protection, insulation requirements, and wiring methods and materials.

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

~~**Abandoned Class 2, Class 3, and PLTC Cable.** Installed Class 2, Class 3, and PLTC cable that is not terminated at equipment and not identified for future use with a tag.~~

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

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

725.3 Other Articles. In addition to the requirements of this article, circuits and equipment shall comply with the articles or sections listed in 725.3(A) through (PE). Only those sections of Article 300 referenced in this article shall apply to Class 1, Class 2, and Class 3 circuits.

~~**725.3(A) Number and Size of Conductors in Raceway.** Section 300.17.~~

725.3(BA) Spread of Fire or Products of Combustion. Installation of Class 1, Class 2, and Class 3 ~~circuits~~ equipment shall comply with 300.21.

725.3(~~C~~B) Ducts, Plenums, and Other Air-Handling Spaces. Class 1, Class 2, and Class 3 ~~circuits~~ equipment installed in ducts, plenums, or other space used for environmental air shall comply with 300.22.

~~*Exception No. 1: Class 2 and Class 3 cables selected in accordance with Table 725.154 and installed in accordance with 725.135(B) and 300.22(B), Exception shall be permitted to be installed in ducts specifically fabricated for environmental air.*~~

~~*Exception No. 2: Class 2 and Class 3 cables selected in accordance with Table 725.154 and installed in accordance with 725.135(C) shall be permitted to be installed in other spaces used for environmental air (plenums).*~~

~~**725.3(D) Hazardous (Classified) Locations.**~~

~~Class 1, Class 2, and Class 3 circuits installed in hazardous (classified) locations shall comply with 501.10(B)(1), 501.150, 502.10(B)(1), 502.150, 503.10(A)(1), 503.150, 506.15(A), 506.15(C), 511.7(B)(1), 515.7(A), and Article 517, Part IV.~~

~~**725.3(E) Cable Trays.**~~

~~Parts I and II of Article 392, where installed in cable tray.~~

725.3(FC) Motor Control Circuits. Article 430, Part VI, where tapped from the load side of the motor branch-circuit protective device(s) as specified in 430.72(A).

~~**725.3(G) Instrumentation Tray Cable.** See 727.1 and 727.4 through 727.9.~~

~~**725.3(H) Raceways Exposed to Different Temperatures.** Installations shall comply with 300.7(A).~~

~~**725.3(I) Vertical Support for Fire-Rated Cables and Conductors.** Vertical installations of circuit integrity (CI) cables and conductors installed in a raceway or conductors and cables of electrical circuit protective systems shall be installed in accordance with 300.19.~~

~~**725.3(J) Bushing.**A bushing shall be installed where cables emerge from raceway used for mechanical support or protection in accordance with 300.15(C).~~

~~**725.3(K) Installation of Conductors with Other Systems.**Installations shall comply with 300.8.~~

~~**725.3(L) Corrosive, Damp, or Wet Locations.**Class 2 and Class 3 cables installed in corrosive, damp, or wet locations shall comply with the applicable requirements in 110.11, 300.5(B), 300.6, 300.9, and 310.10(F).~~

~~**725.3(M) Cable Routing Assemblies.**Class 2, Class 3, and Type PLTC cables shall be permitted to be installed in plenum cable routing assemblies, riser cable routing assemblies, and general-purpose cable routing assemblies selected in accordance with Table 800.154(c), listed in accordance with 800.182, and installed in accordance with 800.110(C) and 800.113.~~

~~**725.3(N) Communications Raceways.**Class 2, Class 3, and Type PLTC cables shall be permitted to be installed in plenum communications raceways, riser communications raceways, and general-purpose communications raceways selected in accordance with Table 800.154(b), listed in accordance with 800.182, and installed in accordance with 800.113 and 362.24 through 362.56, where the requirements applicable to electrical nonmetallic tubing (ENT) apply.~~

~~**725.3(O) Temperature Limitation of Class 2 and Class 3 Cables.**The requirements of 310.14(A)(3) on the temperature limitation of conductors shall apply to Class 2 and Class 3 cables.~~

725.3(PD) Identification of Equipment Grounding Conductors. Equipment grounding conductors shall be identified in accordance with 250.119.

~~*Exception:* Conductors with green insulation shall be permitted to be used as ungrounded signal conductors for Types CL3P, CL2P, CL3R, CL2R, CL3, CL2, CL3X, CL2X, and substitute cables installed in accordance with *725.154(A)*.~~

725.3(E) Cables for Class 2 and 3 Circuits. The listing and installation of cables for Class 2 and Class 3 circuits shall comply with Article 7XX Parts I, II and V.

725.12 Uses Not Permitted. Cables and equipment shall not be installed in any hazardous (classified) location, except as permitted by other articles of this Code.

Informational Note: Hazardous locations are covered in Articles 500 through 516 and in Article 517 Part IV.

725.21 Access to Electrical Equipment Behind Panels Designed to Allow Access. Access to electrical equipment shall not be denied by an accumulation of wires and cables that prevents removal of panels, including suspended ceiling panels.

725.24 Mechanical Execution of Work. Class 1, Class 2, and Class 3 equipment~~circuits~~ shall be installed in a neat and workmanlike manner. ~~Cables and conductors installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be supported by straps, staples, hangers, cable ties, or similar fittings designed and installed so as not to damage the cable.~~ The installation shall also comply with 300.4 300.11(D).

~~Informational Note: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants can result in an undetermined alteration of Class 1, Class 2, Class 3, and PLTC cable properties.~~

~~**725.25 Abandoned Cables.**The accessible portion of abandoned Class 2, Class 3, and PLTC cables shall be removed. Where cables are identified for future use with a tag, the tag shall be of sufficient durability to withstand the environment involved.~~

725.30 Class 1, Class 2, and Class 3 Circuit Identification. Class 1, Class 2, and Class 3 circuits shall be identified at terminal and junction locations in a manner that prevents unintentional interference with other circuits during testing and servicing.

725.31 Safety-Control Equipment.

725.31(A) Remote-Control Circuits. Remote-control circuits for safety-control equipment shall be classified as Class 1 if the failure of the equipment to operate introduces a direct fire or life hazard. Room thermostats, water temperature regulating devices, and similar controls used in conjunction with electrically controlled household heating and air conditioning shall not be considered safety-control equipment.

725.31(B) Physical Protection. Where damage to remote-control circuits of safety-control equipment would introduce a hazard, as covered in 725.31(A), all conductors of such remote-control circuits shall be installed in rigid metal conduit,

intermediate metal conduit, rigid nonmetallic conduit, electrical metallic tubing, Type MI cable, or Type MC cable, or be otherwise suitably protected from physical damage.

725.35 Class 1, Class 2, and Class 3 Circuit Requirements. A remote-control, signaling, or power-limited circuit shall comply with the following parts of this article:

(1) Class 1 Circuits: Parts I and II

(2) Class 2 and Class 3 Circuits: Parts I and III

Part II. Class 1 Circuits

725.41 Class 1 Circuit Classifications and Power Source Requirements. Class 1 circuits shall be classified as either Class 1 power-limited circuits where they comply with the power limitations of 725.41(A) or as Class 1 remote-control and signaling circuits where they are used for remote-control or signaling purposes and comply with the power limitations of 725.41(B).

725.41(A) Class 1 Power-Limited Circuits. These circuits shall be supplied from a source that has a rated output of not more than 30 volts and 1000 volt-amperes.

725.41(A)(1) Class 1 Transformers. Transformers used to supply power-limited Class 1 circuits shall comply with the applicable sections within Parts I and II of Article 450.

725.41(A)(2) Other Class 1 Power Sources. Power sources other than transformers shall be protected by overcurrent devices rated at not more than 167 percent of the volt-ampere rating of the source divided by the rated voltage. The overcurrent devices shall not be interchangeable with overcurrent devices of higher ratings. The overcurrent device shall be permitted to be an integral part of the power supply.

To comply with the 1000 volt-ampere limitation of 725.41(A), the maximum output (VA_{max}) of power sources other than transformers shall be limited to 2500 volt-amperes, and the product of the maximum current (I_{max}) and maximum voltage (V_{max}) shall not exceed 10,000 volt-amperes. These ratings shall be determined with any overcurrent-protective device bypassed.

VA_{max} is the maximum volt-ampere output after one minute of operation regardless of load and with overcurrent protection bypassed, if used. Current-limiting impedance shall not be bypassed when determining VA_{max}.

I_{max} is the maximum output current under any noncapacitive load, including short circuit, and with overcurrent protection bypassed, if used. Current-limiting impedance should not be bypassed when determining I_{max}. Where a current-limiting impedance, listed for the purpose or as part of a listed product, is used in combination with a stored energy source, for example, storage battery, to limit the output current, I_{max} limits apply after 5 seconds.

V_{max} is the maximum output voltage regardless of load with rated input applied.

725.41(B) Class 1 Remote-Control and Signaling Circuits. These circuits shall not exceed 600 volts. The power output of the source shall not be required to be limited.

725.43 Class 1 Circuit Overcurrent Protection. Overcurrent protection for conductors 14 AWG and larger shall be provided in accordance with the conductor ampacity, without applying the ampacity adjustment and correction factors of 310.14 to the ampacity calculation. Overcurrent protection shall not exceed 7 amperes for 18 AWG conductors and 10 amperes for 16 AWG.

Exception: Where other articles of this Code permit or require other overcurrent protection.

Informational Note: For example, see 430.72 for motors, 610.53 for cranes and hoists, and 517.74(B) and 660.9 for X-ray equipment.

725.45 Class 1 Circuit Overcurrent Device Location. Overcurrent devices shall be located as specified in 725.45(A), (B), (C), (D), or (E).

725.45(A) Point of Supply. Overcurrent devices shall be located at the point where the conductor to be protected receives its supply.

725.45(B) Feeder Taps. Class 1 circuit conductors shall be permitted to be tapped, without overcurrent protection at the tap, where the overcurrent device protecting the circuit conductor is sized to protect the tap conductor.

725.45(C) Branch-Circuit Taps. Class 1 circuit conductors 14 AWG and larger that are tapped from the load side of the overcurrent protective device(s) of a controlled light and power circuit shall require only short-circuit and ground-fault protection and shall be permitted to be protected by the branch-circuit overcurrent protective device(s) where the rating of the protective device(s) is not more than 300 percent of the ampacity of the Class 1 circuit conductor.

725.45(D) Primary Side of Transformer. Class 1 circuit conductors supplied by the secondary of a single-phase transformer having only a 2-wire (single-voltage) secondary shall be permitted to be protected by overcurrent protection provided on the primary side of the transformer, provided this protection is in accordance with 450.3 and does not exceed the value determined by multiplying the secondary conductor ampacity by the secondary-to-primary transformer voltage ratio. Transformer secondary conductors other than 2-wire shall not be considered to be protected by the primary overcurrent protection.

725.45(E) Input Side of Electronic Power Source. Class 1 circuit conductors supplied by the output of a single-phase, listed electronic power source, other than a transformer, having only a 2-wire (single-voltage) output for connection to Class 1 circuits shall be permitted to be protected by overcurrent protection provided on the input side of the electronic power source, provided this protection does not exceed the value determined by multiplying the Class 1 circuit conductor ampacity by the output-to-input voltage ratio. Electronic power source outputs, other than 2-wire (single voltage), shall not be considered to be protected by the primary overcurrent protection.

725.46 Class 1 Circuit Wiring Methods. Class 1 circuits shall be installed in accordance with Part I of Article 300 and with the wiring methods from the appropriate articles in Chapter 3.

Exception No. 1: The provisions of 725.48 through 725.51 shall be permitted to apply in installations of Class 1 circuits.

Exception No. 2: Methods permitted or required by other articles of this Code shall apply to installations of Class 1 circuits.

725.48 Conductors of Different Circuits in the Same Cable, Cable Tray, Enclosure, or Raceway. Class 1 circuits shall be permitted to be installed with other circuits as specified in 725.48(A) and (B).

725.48(A) Two or More Class 1 Circuits. Class 1 circuits shall be permitted to occupy the same cable, cable tray, enclosure, or raceway without regard to whether the individual circuits are alternating current or direct current, provided all conductors are insulated for the maximum voltage of any conductor in the cable, cable tray, enclosure, or raceway.

725.48(B) Class 1 Circuits with Power-Supply Circuits. Class 1 circuits shall be permitted to be installed with power-supply conductors as specified in 725.48(B)(1) through (B)(4).

725.48(B)(1) In a Cable, Enclosure, or Raceway. Class 1 circuits and power-supply circuits shall be permitted to occupy the same cable, enclosure, or raceway without a barrier only where the equipment powered is functionally associated. Class 1 circuits shall be permitted to be installed together with the conductors of electric light, power, non-power-limited fire alarm, and medium power network-powered broadband communications circuits where separated by a barrier.

725.48(B)(2) In Factory- or Field-Assembled Control Centers. Class 1 circuits and power-supply circuits shall be permitted to be installed in factory- or field-assembled control centers.

725.48(B)(3) In a Manhole. Class 1 circuits and power-supply circuits shall be permitted to be installed as underground conductors in a manhole in accordance with one of the following:

(1) The power-supply or Class 1 circuit conductors are in a metal-enclosed cable or Type UF cable.

(2) The conductors are permanently separated from the power-supply conductors by a continuous firmly fixed nonconductor, such as flexible tubing, in addition to the insulation on the wire.

(3) The conductors are permanently and effectively separated from the power supply conductors and securely fastened to racks, insulators, or other approved supports.

725.48(B)(4) In Cable Trays. Installations in cable trays shall comply with 725.48(B)(4)(1) or (B)(4)(2).

(1) Class 1 circuit conductors and power-supply conductors not functionally associated with the Class 1 circuit conductors shall be separated by a solid fixed barrier of a material compatible with the cable tray.

(2) Class 1 circuit conductors and power-supply conductors not functionally associated with the Class 1 circuit conductors shall be permitted to be installed in a cable tray without barriers where all of the conductors are installed with separate multiconductor Type AC, Type MC, Type MI, or Type TC cables and all the conductors in the cables are insulated at 600 volts or greater.

725.49 Class 1 Circuit Conductors.

725.49(A) Sizes and Use. Conductors of sizes 18 AWG and 16 AWG shall be permitted to be used, provided they supply loads that do not exceed the ampacities given in 402.5 and are installed in a raceway, an approved enclosure, or a listed cable. Conductors larger than 16 AWG shall not supply loads greater than the ampacities given in 310.14. Flexible cords shall comply with Article 400.

725.49(B) Insulation. Insulation on conductors shall be rated for the system voltage and not less than 600 volts. Conductors larger than 16 AWG shall comply with Article 310. Conductors in sizes 18 AWG and 16 AWG shall be Type FFH-2, KF-2, KFF-2, PAF, PAFF, PF, PFF, PGF, PGFF, PTF, PTFF, RFH-2, RFHH-2, RFHH-3, SF-2, SFF-2, TF, TFF, TFFN, TFN, ZF, or ZFF. Conductors with other types and thicknesses of insulation shall be permitted if listed for Class 1 circuit use.

725.51 Number of Conductors in Cable Trays and Raceway, and Ampacity Adjustment.

725.51(A) Class 1 Circuit Conductors. Where only Class 1 circuit conductors are in a raceway, the number of conductors shall be determined in accordance with 300.17. The ampacity adjustment factors given in 310.15(C)(1) shall apply only if such conductors carry continuous loads in excess of 10 percent of the ampacity of each conductor.

725.51(B) Power-Supply Conductors and Class 1 Circuit Conductors. Where power-supply conductors and Class 1 circuit conductors are permitted in a raceway in accordance with 725.48, the number of conductors shall be determined in accordance with 300.17. The ampacity adjustment factors given in 310.15(C)(1) shall apply as follows:

(1) To all conductors where the Class 1 circuit conductors carry continuous loads in excess of 10 percent of the ampacity of each conductor and where the total number of conductors is more than three

(2) To the power-supply conductors only, where the Class 1 circuit conductors do not carry continuous loads in excess of 10 percent of the ampacity of each conductor and where the number of power-supply conductors is more than three

725.51(C) Class 1 Circuit Conductors in Cable Trays. Where Class 1 circuit conductors are installed in cable trays, they shall comply with the provisions of 392.22 and 392.80(A).

725.52 Circuits Extending Beyond One Building. Class 1 circuits that extend aerially beyond one building shall also meet the requirements of Article 225.

Part III. Class 2 and Class 3 Circuits

725.121 Power Sources for Class 2 and Class 3 Circuits.

725.121(A) Power Source. The power source for a Class 2 or a Class 3 circuit shall be as follows:

Informational Note No. 1: Informational Note Figure 725.121 illustrates the relationships between Class 2 or Class 3 power sources, their supply, and the Class 2 or Class 3 circuits.

Informational Note No. 2: Table 11(A) and Table 11(B) in Chapter 9 provide the requirements for listed Class 2 and Class 3 power sources.

(1) A listed Class 2 or Class 3 transformer

(2) A listed Class 2 or Class 3 power supply

(3) Other listed equipment marked to identify the Class 2 or Class 3 power source

Exception No. 1 to (3): Thermocouples shall not require listing as a Class 2 power source.

Exception No. 2 to (3): Limited power circuits of listed equipment where these circuits have energy levels rated at or below the limits established in Chapter 9, Table 11(A) and Table 11(B).

Informational Note: Examples of other listed equipment are as follows:

(1) A circuit card listed for use as a Class 2 or Class 3 power source where used as part of a listed assembly

(2) A current-limiting impedance, listed for the purpose, or part of a listed product, used in conjunction with a non-power-limited transformer or a stored energy source, for example, storage battery, to limit the output current

(3) A thermocouple

(d Limited voltage/current or limited impedance secondary communications circuits of listed industrial control equipment

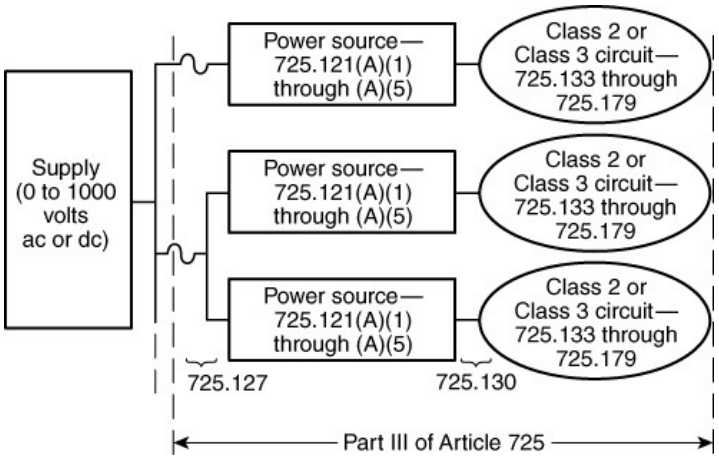
(4) Listed audio/video, information technology (computer), communications, and industrial equipment limited-power circuits

Informational Note: One way to determine applicable requirements for listing of information technology (computer) equipment is to refer to UL 60950-1-2011, *Standard for Safety of Information Technology Equipment*. Another way to determine applicable requirements for listing of audio/video, information technology, and communications equipment is to refer to UL 62368-1-2014, *Safety of audio/video, information and communication technology equipment*. Typically such circuits are used to interconnect data circuits for the purpose of exchanging information data. One way to determine applicable requirements for listing of industrial equipment is to refer to UL 61010-2-201, *Safety requirements for electrical equipment for measurement, control, and laboratory use — Part 2-201: Particular requirements for control equipment*, and/or UL 61800-5-1, *Adjustable speed electrical power drive systems — Part 5-1: Safety requirements — Electrical, thermal and energy*.

(5) A battery source or battery source system that is listed and identified as Class 2

725.121(B) Interconnection of Power Sources. Class 2 or Class 3 power sources shall not have the output connections paralleled or otherwise interconnected unless listed for such interconnection.

Informational Note Figure 725.121 Class 2 and Class 3 Circuits.



725.121(C) Marking. The equipment supplying the circuits shall be durably marked where plainly visible to indicate each circuit that is a Class 2 or Class 3 circuit.

The power sources for limited power circuits in 725.121(A)(3), limited power circuits for listed audio/video equipment, listed information technology equipment, listed communications equipment, and listed industrial equipment in 725.121(A)(4) shall have a label indicating the maximum voltage and rated current output per conductor for each connection point on the power source. Where multiple connection points have the same rating, a single label shall be permitted to be used. For equipment with a rated current per conductor less than 0.3 amperes, the effective date shall be January 1, 2021.

Informational Note No. 1: Rated current for power sources covered in 725.144 is the output current per conductor the power source is designed to deliver to an operational load at normal operating conditions, as declared by the manufacturer.

Informational Note No. 2: An example of a label is “52V @ 0.433A, 57V MAX” for an IEEE 802.3 compliant Class 8 power source.

~~**725.124 Circuit Marking.** The equipment supplying the circuits shall be durably marked where plainly visible to indicate each circuit that is a Class 2 or Class 3 circuit.~~

725.127 Wiring Methods on Supply Side of the Class 2 or Class 3 Power Source. Conductors and equipment on the supply side of the power source shall be installed in accordance with the appropriate requirements of Chapters 1 through 4. Transformers or other devices supplied from electric light or power circuits shall be protected by an overcurrent device rated not over 20 amperes.

Exception: The input leads of a transformer or other power source supplying Class 2 and Class 3 circuits shall be permitted to be smaller than 14 AWG, but not smaller than 18 AWG if they are not over 305 mm (12 in.) long and if they have insulation that complies with 725.49(B).

725.130 Wiring Methods and Materials on Load Side of the Class 2 or Class 3 Power Source. Parts I, II and V of Article 7XX shall apply to wiring methods and materials on load side of the class 2 or class 3 power source. ~~Class 2 and Class 3 circuits on the load side of the power source shall be permitted to be installed using wiring methods and materials in accordance with either 725.130(A) or (B).~~

~~**725.130(A) Class 1 Wiring Methods and Materials.** Installation shall be in accordance with 725.46.~~

~~*Exception No. 1: The ampacity adjustment factors given in 310.15(C)(1) shall not apply.*~~

Exception No. 2: Class 2 and Class 3 circuits shall be permitted to be reclassified and installed as Class 1 circuits if the Class 2 and Class 3 markings required in 725.124 are eliminated and the entire circuit is installed using the wiring methods and materials in accordance with Part II, Class 1 circuits.

Informational Note: Class 2 and Class 3 circuits reclassified and installed as Class 1 circuits are no longer Class 2 or Class 3 circuits, regardless of the continued connection to a Class 2 or Class 3 power source.

725.130(B) Class 2 and Class 3 Wiring Methods. Conductors on the load side of the power source shall be insulated at not less than the requirements of 725.179 and shall be installed in accordance with 725.133 and 725.154.

Exception No. 1: As provided for in 620.21 for elevators and similar equipment.

Exception No. 2: Other wiring methods and materials installed in accordance with the requirements of 725.3 shall be permitted to extend or replace the conductors and cables described in 725.179 and permitted by 725.130(B).

Exception No. 3: Bare Class 2 conductors shall be permitted as part of a listed intrusion protection system where installed in accordance with the listing instructions for the system.

725.133 Installation of Conductors and Equipment in Cables, Compartments, Cable Trays, Enclosures, Manholes, Outlet Boxes, Device Boxes, Raceways, and Cable Routing Assemblies for Class 2 and Class 3 Circuits. Conductors and equipment for Class 2 and Class 3 circuits shall be installed in accordance with 725.135 through 725.144.

725.135 Installation of Class 2, Class 3, and PLTC Cables. Installation of Class 2, Class 3, and PLTC cables shall comply with 725.135(A) through (M).

725.135(A) Listing. Class 2, Class 3, and PLTC cables installed in buildings shall be listed.

725.135(B) Ducts Specifically Fabricated for Environmental Air. The following cables shall be permitted in ducts specifically fabricated for environmental air as described in 300.22(B) if directly associated with the air distribution system:

(1) Types CL2P and CL3P cables in lengths as short as practicable to perform the required function

(2) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X, and PLTC cables installed in raceways that are installed in compliance with 300.22(B)

Informational Note: For information on fire protection of wiring installed in fabricated ducts, see 4.3.4.1 and 4.3.11.3.3 of NFPA 90A-2018, Standard for the Installation of Air-Conditioning and Ventilating Systems.

725.135(C) Other Spaces Used for Environmental Air (Plenums). The following cables shall be permitted in other spaces used for environmental air as described in 300.22(C):

(1) Types CL2P and CL3P cables

(2) Types CL2P and CL3P cables installed in plenum communications raceways

(3) Types CL2P and CL3P cables installed in plenum cable routing assemblies

(4) Types CL2P and CL3P cables and plenum communications raceways supported by open metallic cable trays or cable tray systems

(5) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X, and PLTC cables installed in raceways that are installed in compliance with 300.22(C)

(6) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X, and PLTC cables supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)

(7) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X, and PLTC cables installed in plenum communications raceways, riser communications raceways, and general-purpose communications raceways supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)

725.135(D) Risers — Cables in Vertical Runs. The following cables shall be permitted in vertical runs penetrating one or more floors and in vertical runs in a shaft:

(1) Types CL2P, CL3P, CL2R, and CL3R cables

(2) Types CL2P, CL3P, CL2R, and CL3R cables installed in the following:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

Informational Note: See 300.21 for firestop requirements for floor penetrations.

725.135(E) Risers — Cables and Innerducts in Metal Raceways. The following cables shall be permitted in metal raceways in a riser having firestops at each floor:

(1) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X, and PLTC cables

(2) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X, and PLTC cables installed in the following:

a. Plenum communications raceways (innerduct)

b. Riser communications raceways (innerduct)

c. General-purpose communications raceways (innerduct)

Informational Note: See 300.21 for firestop requirements for floor penetrations.

725.135(F) Risers — Cables in Fireproof Shafts. The following shall be permitted to be installed in fireproof riser shafts having firestops at each floor:

(1) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X, and PLTC cables

(2) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, and PLTC cables installed in the following:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

Informational Note: See 300.21 for firestop requirements for floor penetrations.

725.135(G) Risers — One- and Two-Family Dwellings. The following cables shall be permitted in one- and two-family dwellings:

(1) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, and PLTC cables

(2) Types CL2X and CL3X cables less than 6 mm (0.25 in.) in diameter

(3) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, and PLTC cables installed in the following:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

725.135(H) Cable Trays. Cables installed in cable trays outdoors shall be Type PLTC. The following cables shall be permitted to be supported by cable trays in buildings:

(1) Types CM CL2P, CL3P, CL2R, CL3R, CL2, CL3, and PLTC cables

(2) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, and PLTC cables installed in the following:

a. Plenum communications raceways

b. Riser communications raceways

c. General-purpose communications raceways

725.135(I) Cross-Connect Arrays. The following cables shall be permitted to be installed in cross-connect arrays:

(1) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, and PLTC cables

(2) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, and PLTC cables installed in the following:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

725.135(J) Industrial Establishments. In industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons service the installation, Type PLTC cable shall be permitted in accordance with either (1) or (2) as follows:

(1) Where the cable is not subject to physical damage, Type PLTC cable that complies with the crush and impact requirements of Type MC cable and is identified as PLTC-ER for such use shall be permitted to be exposed between the cable tray and the utilization equipment or device. The cable shall be continuously supported and protected against physical damage using mechanical protection such as dedicated struts, angles, or channels. The cable shall be supported and secured at intervals not exceeding 1.8 m (6 ft). Where not subject to physical damage, Type PLTC-ER cable shall be permitted to transition between cable trays and between cable trays and utilization equipment or devices for a distance not to exceed 1.8 m (6 ft) without continuous support. The cable shall be mechanically supported where exiting the cable tray to ensure that the minimum bending radius is not exceeded.

(2) Type PLTC cable, with a metallic sheath or armor in accordance with 725.179(E), shall be permitted to be installed exposed. The cable shall be continuously supported and protected against physical damage using mechanical protection such as dedicated struts, angles, or channels. The cable shall be secured at intervals not exceeding 1.8 m (6 ft).

725.135(K) Other Building Locations. The following cables shall be permitted to be installed in building locations other than the locations covered in 725.135(B) through (I):

(1) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, and PLTC cables

(2) A maximum of 3 m (10 ft) of exposed Type CL2X cables in nonconcealed spaces

(3) A maximum of 3 m (10 ft) of exposed Type CL3X cables in nonconcealed spaces

(4) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, and PLTC cables installed in the following:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

(5) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X, and PLTC cables installed in raceways recognized in Chapter 3

(6) Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks

725.135(L) Multifamily Dwellings. The following cables shall be permitted to be installed in multifamily dwellings in locations other than the locations covered in 725.135(B) through (I):

(1) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, and PLTC cables

(2) Type CL2X cables less than 6 mm (¼ in.) in diameter in nonconcealed spaces

(3) Type CL3X cables less than 6 mm (¼ in.) in diameter in nonconcealed spaces

(4) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, and PLTC cables installed in the following:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

(5) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X, and PLTC wires and cables installed in raceways recognized in Chapter 3

(6) Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks

725.135(M) One- and Two-Family Dwellings. The following cables shall be permitted to be installed in one- and two-family dwellings in locations other than the locations covered in 725.135(B) through (I):

(1) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, and PLTC cables

(2) Type CL2X cables less than 6 mm (¼ in.) in diameter

(3) Type CL3X cables less than 6 mm (¼ in.) in diameter

(4) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, and PLTC cables installed in the following:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

(5) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X, and PLTC cables installed in raceways recognized in Chapter 3

(6) Type CMUC under-carpet communications cables installed under carpet, modular flooring, and planks

725.136 Separation from Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm Circuit Conductors, and Medium-Power Network-Powered Broadband Communications Cables.

725.136(A) General. Cables and conductors of Class 2 and Class 3 circuits shall not be placed in any cable, cable tray, compartment, enclosure, manhole, outlet box, device box, raceway, or similar fitting with conductors of electric light, power, Class 1, non–power-limited fire alarm circuits, and medium-power network-powered broadband communications circuits unless permitted by 725.136(B) through (I).

725.136(B) Separated by Barriers. Class 2 and Class 3 circuits shall be permitted to be installed together with the conductors of electric light, power, Class 1, non–power-limited fire alarm and medium power network-powered broadband communications circuits where they are separated by a barrier.

725.136(C) Raceways Within Enclosures. In enclosures, Class 2 and Class 3 circuits shall be permitted to be installed in a raceway to separate them from Class 1, non–power-limited fire alarm and medium-power network-powered broadband communications circuits.

725.136(D) Associated Systems Within Enclosures. Class 2 and Class 3 circuit conductors in compartments, enclosures, device boxes, outlet boxes, or similar fittings shall be permitted to be installed with electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits where

they are introduced solely to connect the equipment connected to Class 2 and Class 3 circuits, and where (1) or (2) applies:

(1) The electric light, power, Class 1, non-power-limited fire alarm, and medium-power network-powered broadband communications circuit conductors are routed to maintain a minimum of 6 mm (0.25 in.) separation from the conductors and cables of Class 2 and Class 3 circuits.

(2) The circuit conductors operate at 150 volts or less to ground and also comply with one of the following:

a. The Class 2 and Class 3 circuits are installed using Type CL3, CL3R, or CL3P or permitted substitute cables, provided these Class 3 cable conductors extending beyond the jacket are separated by a minimum of 6 mm (0.25 in.) or by a nonconductive sleeve or nonconductive barrier from all other conductors.

b. The Class 2 and Class 3 circuit conductors are installed as a Class 1 circuit in accordance with 725.41.

725.136(E) Enclosures with Single Opening. Class 2 and Class 3 circuit conductors entering compartments, enclosures, device boxes, outlet boxes, or similar fittings shall be permitted to be installed with Class 1, non-power-limited fire alarm and medium-power network-powered broadband communications circuits where they are introduced solely to connect the equipment connected to Class 2 and Class 3 circuits. Where Class 2 and Class 3 circuit conductors must enter an enclosure that is provided with a single opening, they shall be permitted to enter through a single fitting (such as a tee), provided the conductors are separated from the conductors of the other circuits by a continuous and firmly fixed nonconductor, such as flexible tubing.

725.136(F) Manholes. Underground Class 2 and Class 3 circuit conductors in a manhole shall be permitted to be installed with Class 1, non-power-limited fire alarm and medium-power network-powered broadband communications circuits where one of the following conditions is met:

(1) The electric light, power, Class 1, non-power-limited fire alarm and medium-power network-powered broadband communications circuit conductors are in a metal-enclosed cable or Type UF cable.

(2) The Class 2 and Class 3 circuit conductors are permanently and effectively separated from the conductors of other circuits by a continuous and firmly fixed nonconductor, such as flexible tubing, in addition to the insulation or covering on the wire.

(3) The Class 2 and Class 3 circuit conductors are permanently and effectively separated from conductors of the other circuits and securely fastened to racks, insulators, or other approved supports.

725.136(G) Cable Trays. Class 2 and Class 3 circuit conductors shall be permitted to be installed in cable trays, where the conductors of the electric light, Class 1, and non-power-limited fire alarm circuits are separated by a solid fixed barrier of a material compatible with the cable tray or where the Class 2 or Class 3 circuits are installed in Type MC cable.

725.136(H) In Hoistways. In hoistways, Class 2 or Class 3 circuit conductors shall be installed in rigid metal conduit, rigid nonmetallic conduit, intermediate metal conduit, liquidtight flexible nonmetallic conduit, or electrical metallic tubing. For elevators or similar equipment, these conductors shall be permitted to be installed as provided in 620.21.

725.136(I) Other Applications. For other applications, conductors of Class 2 and Class 3 circuits shall be separated by at least 50 mm (2 in.) from conductors of any electric light, power, Class 1 non-power-limited fire alarm or medium power network-powered broadband communications circuits unless one of the following conditions is met:

(1) Either all of the electric light, power, Class 1, non-power-limited fire alarm and medium-power network-powered broadband communications circuit conductors or all of the Class 2 and Class 3 circuit conductors are in a raceway or in metal-sheathed, metal-clad, non-metallic-sheathed, Type TC, or Type UF cables

(2) All of the electric light, power, Class 1 non-power-limited fire alarm, and medium-power network-powered broadband communications circuit conductors are permanently separated from all of the Class 2 and Class 3 circuit conductors by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the conductors

725.139 Installation of Conductors of Different Circuits in the Same Cable, Enclosure, Cable Tray, Raceway, or Cable Routing Assembly.

725.139(A) Two or More Class 2 Circuits. Conductors of two or more Class 2 circuits shall be permitted within the same cable, enclosure, raceway, or cable routing assembly.

725.139(B) Two or More Class 3 Circuits. Conductors of two or more Class 3 circuits shall be permitted within the same cable, enclosure, raceway, or cable routing assembly.

~~**725.139(C) Class 2 Circuits with Class 3 Circuits.** Conductors of one or more Class 2 circuits shall be permitted within the same cable, enclosure, raceway, or cable routing assembly with conductors of Class 3 circuits, provided that the insulation of the Class 2 circuit conductors in the cable, enclosure, raceway, or cable routing assembly is at least that required for Class 3 circuits.~~

~~**725.139(D) Class 2 and Class 3 Circuits with Communications Circuits.**~~

~~**725.139(D)(1) Communications Cables.**Conductors of one or more Class 2 or Class 3 circuits shall be permitted in the same cable with conductors of communications circuits provided the cable is a listed communications cable that shall be installed in accordance with the requirements of Part V of Article 805. The cables shall be listed as communications cables.~~

~~**725.139(D)(2) Composite Cables.**Cables constructed of individually listed Class 2, Class 3, and communications cables under a common jacket shall be permitted to be classified as communications cables. The fire resistance rating of the composite cable shall be determined by the performance of the composite cable.~~

~~**725.139(E) Class 2 or Class 3 Cables with Other Circuit Cables.**Jacketed cables of Class 2 or Class 3 circuits shall be permitted in the same enclosure, cable tray, raceway, or cable routing assembly with jacketed cables of any of the following:~~

~~(1) Power-limited fire alarm systems in compliance with Parts I and III of Article 760~~

~~(2) Nonconductive and conductive optical fiber cables in compliance with Parts I and IV of Article 770~~

~~(3) Communications circuits in compliance with Parts I and IV of Article 805~~

~~(4) Community antenna television and radio distribution systems in compliance with Parts I and IV of Article 820~~

~~(5) Low-power, network-powered broadband communications in compliance with Parts I and IV of Article 830~~

~~**725.139(F) Class 2 or Class 3 Conductors or Cables and Audio System Circuits.**Audio system circuits described in 640.9(C), and installed using Class 2 or Class 3 wiring methods in compliance with 725.133 and 725.154, shall not be permitted to be installed in the same cable, raceway, or cable routing assembly with Class 2 or Class 3 conductors or cables.~~

~~**725.141 Installation of Circuit Conductors Extending Beyond One Building.**Where Class 2 or Class 3 circuit conductors extend beyond one building and are run so as to be subject to accidental contact with electric light or power conductors operating over 300 volts to ground, or are exposed to lightning on interbuilding circuits on the same premises, the requirements of the following shall also apply:~~

~~(1) Sections 800.44, 800.53, 800.100, 805.50, 805.93, 805.170(A), and 805.170(B) for other than coaxial conductors~~

~~(2) Sections 820.44, 820.93, and 820.100 for coaxial conductors~~

~~**725.143 Support of Conductors.**~~

~~Class 2 or Class 3 circuit conductors shall not be strapped, taped, or attached by any means to the exterior of any conduit or other raceway as a means of support. These conductors shall be permitted to be installed as permitted by 300.11(C)(2).~~

725.144 Transmission of Power and Data. Sections 725.144(A) and (B) shall apply to Class 2 and Class 3 circuits that transmit power and data to a powered device. Section 300.11 and Parts I and III of Article 725 shall apply to Class 2 and Class 3 circuits that transmit power and data. The conductors that carry power for the data circuits shall be copper. The current in the power circuit shall not exceed the current limitation of the connectors.

Informational Note No. 1: One example of the use of cables that transmit power and data is the connection of closed-circuit TV cameras (CCTV).

Informational Note No. 2: The 8P8C connector is in widespread use with powered communications systems. IEC 60603-7-2008, *Connectors for electronic equipment — Part 7-1: Detail specification for 8-way, unshielded, free and fixed connectors,* specifies these connectors to have a current-carrying capacity per contact of 1.0 amperes maximum at 60°C (149°F). See IEC 60603-7 for more information on current-carrying capacity at higher and lower temperatures.

Informational Note No. 3: The requirements of Table 725.144 were derived for carrying power and data over 4-pair copper balanced twisted pair cabling. This type of cabling is described in ANSI/TIA 568-C.2-2009, *Commercial Building Telecommunications Cabling Standard — Part 2: Balanced Twisted-Pair Telecommunications Cabling and Components*.

Informational Note No. 4: See TIA-TSB-184-A-2017, *Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling*, for information on installation and management of balanced twisted pair cabling supporting power delivery.

Informational Note No. 5: 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.

Informational Note No. 6: Rated current for power sources covered in 725.144 is the output current per conductor the power source is designed to deliver to an operational load at normal operating conditions, as declared by the manufacturer. In the design of these systems, the actual current in a given conductor might vary from the rated current per conductor by as much as 20 percent. An increase in current in one conductor is offset by a corresponding decrease in current in one or more conductors of the same cable.

Table 725.144 Ampacities of Each Conductor in Amperes in 4-Pair Class 2 or Class 3 Balanced Twisted-Pair Cables Based on Copper Conductors at an Ambient Temperature of 30°C (86°F) with All Conductors in All Cables Carrying Current, 60°C (140°F), 75°C (167°F), and 90°C (194°F) Rated Cables

	Number of 4-Pair Cables in a Bundle																	
	1–7			8–19			20–37			38–61			62–91			92–192		
	Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating		
AWG	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C
26	1.00	1.23	1.42	0.71	0.87	1.02	0.55	0.68	0.78	0.46	0.57	0.67	0.45	0.55	0.64	NA	NA	NA
24	1.19	1.46	1.69	0.81	1.01	1.17	0.63	0.78	0.91	0.55	0.67	0.78	0.46	0.56	0.65	0.40	0.48	0.55
23	1.24	1.53	1.78	0.89	1.11	1.28	0.77	0.95	1.10	0.66	0.80	0.93	0.58	0.71	0.82	0.45	0.55	0.63
22	1.50	1.86	2.16	1.04	1.28	1.49	0.77	0.95	1.11	0.66	0.82	0.96	0.62	0.77	0.89	0.53	0.63	0.72

Note 1: For bundle sizes over 192 cables, or for conductor sizes smaller than 26 AWG, ampacities shall be permitted to be determined by qualified personnel under engineering supervision.
Note 2: Where only half of the conductors in each cable are carrying current, the values in the table shall be permitted to be increased by a factor of 1.4.
Informational Note No. 1: Elevated cable temperatures can reduce a cable's data transmission performance. For information on practices for 4-pair balanced twisted pair cabling, see TIA-TSB-184-A and 6.4.7, 6.6.3, and Annex G of ANSI/TIA-568-C.2, which provide guidance on adjustments for operating temperatures between 20°C and 60°C.
Informational Note No. 2: The per-contact current rating of connectors can limit the maximum allowable current below the ampacity shown in Table 725.144.

725.144(A) Use of Class 2 or Class 3 Cables to Transmit Power and Data. Where Types CL3P, CL2P, CL3R, CL2R, CL3, or CL2 transmit power and data, the rated current per conductor of the power source shall not exceed the ampacities in Table 725.144 at an ambient temperature of 30°C (86°F). For ambient temperatures above 30°C (86°F), the correction factors in Table 310.15(B)(1) or in Equation 310.15(B) shall apply.

Exception: Compliance with Table 725.144 shall not be required for installations where conductors are 24 AWG or larger and the rated current per conductor of the power source does not exceed 0.3 amperes.

Informational Note: One example of the use of Class 2 cables is a network of closed-circuit TV cameras using 24 AWG, 60°C rated, Type CL2R, Category 5e balanced twisted-pair cabling.

725.144(B) Use of Class 2-LP or Class 3-LP Cables to Transmit Power and Data. Types CL3P-LP, CL2P-LP, CL3R-LP, CL2R-LP, CL3-LP, or CL2-LP shall be permitted to supply power to equipment from a power source with a rated current per conductor up to the marked current limit located immediately following the suffix "-LP" and shall be permitted to transmit data to the equipment. Where the number of bundled LP cables is 192 or less and the selected ampacity of the cables in accordance with Table 725.144 exceeds the marked current limit of the cable, the ampacity determined from the table shall be permitted to be used. For ambient temperatures above 30°C (86°F), the correction factors of Table 310.15(B)(1) or Equation 310.15(B) shall apply. The Class 2-LP and Class 3-LP cables shall comply with the following, as applicable:

(1) Cables with the suffix "-LP" shall be permitted to be installed in bundles, raceways, cable trays, communications raceways, and cable routing assemblies.

(2) Cables with the suffix "-LP" and a marked current limit shall follow the substitution hierarchy of Table 725.154 and Figure 725.154(A) for the cable type without the suffix "-LP" and without the marked current limit.

(3) System design shall be permitted by qualified persons under engineering supervision.

Informational Note: An example of a limited power (LP) cable is a cable marked Type CL2-LP(0.5A), 23 AWG.

~~**725.154 Applications of Listed Class 2, Class 3, and PLTC Cables.** Class 2, Class 3, and PLTC cables shall comply with any of the requirements described in 725.154(A) through (C) and as indicated in Table 725.154.~~

Table 725.154 Applications of Listed Class 2, Class 3, CMUC, and PLTC Cables in Buildings

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Applications		Cable Type					
		CL2P & CL3P	CL2R & CL3R	CL2 & CL3	CL2X & CL3X	CMUC	PLTC
In fabricated ducts as described in 300.22(B)	In fabricated ducts	Y*	N	N	N	N	N
	In metal raceway that complies with 300.22(B)	Y*	Y*	Y*	Y*	N	Y*
In other spaces used for environmental air as described in 300.22(C)	In other spaces used for environmental air	Y*	N	N	N	N	N
	In metal raceway that complies with 300.22(C)	Y*	Y*	Y*	Y*	N	Y*
	In plenum communications raceways	Y*	N	N	N	N	N
	In plenum cable routing assemblies	Y*	N	N	N	N	N
	Supported by open metal cable trays	Y*	N	N	N	N	N
	Supported by solid bottom metal cable trays with solid metal covers	Y*	Y*	Y*	Y*	N	N
In risers	In vertical runs	Y*	Y*	N	N	N	N
	In metal raceways	Y*	Y*	Y*	Y*	N	Y*
	In fireproof shafts	Y*	Y*	Y*	Y*	N	Y*
	In plenum communications raceways	Y*	Y*	N	N	N	N
	In plenum cable routing assemblies	Y*	Y*	N	N	N	N
	In riser communications raceways	Y*	Y*	N	N	N	N
	In riser cable routing assemblies	Y*	Y*	N	N	N	N
	In one- and two-family dwellings	Y*	Y*	Y*	Y*	N	Y*
Within buildings in other than air-handling spaces and risers	General	Y*	Y*	Y*	Y*	N	Y*
	In one- and two-family dwellings	Y*	Y*	Y*	Y*	Y*	Y*

Table 725.154 Applications of Listed Class 2, Class 3, CMUC, and PLTC Cables in Buildings

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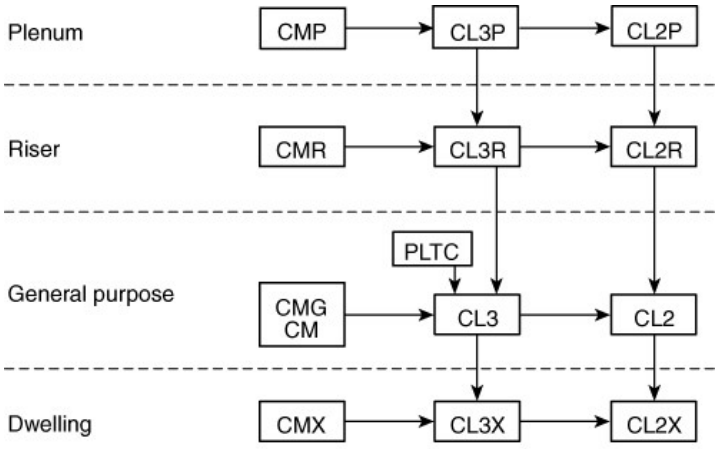
Applications		Cable Type					
		CL2P & CL3P	CL2R & CL3R	CL2 & CL3	CL2X & CL3X	CMUC	PLTC
	In multifamily dwellings	Y*	Y*	Y*	Y*	Y*	Y*
	In nonconcealed spaces	Y*	Y*	Y*	Y*	Y*	Y*
	Supported by cable trays	Y*	Y*	Y*	N	N	Y*
	Under carpet	N	N	N	N	Y*	N
	In cross-connect arrays	Y*	Y*	Y*	N	N	Y*
	In any raceway recognized in Chapter 3	Y*	Y*	Y*	Y*	N	Y*
	In plenum communications raceways	Y*	Y*	Y*	N	N	Y*
	In plenum cable routing assemblies	Y*	Y*	Y*	N	N	Y*
	In riser communications raceways	Y*	Y*	Y*	N	N	Y*
	In riser cable routing assemblies	Y*	Y*	Y*	N	N	Y*
	In general-purpose communications raceways	Y*	Y*	Y*	N	N	Y*
	In general-purpose cable routing assemblies	Y*	Y*	Y*	N	N	Y*

Note: "N" indicates that the cable type shall not be permitted to be installed in the application.
"Y*" indicates that the cable type shall be permitted to be installed in the application, subject to the limitations described in 725.130 through 725.143.

Table 725.154(A) Cable Substitutions

Cable Type	Permitted Substitutions
CL3P	CMP
CL2P	CMP, CL3P
CL3R	CMP, CL3P, CMR
CL2R	CMP, CL3P, CL2P, CMR, CL3R
PLTC	
CL3	CMP, CL3P, CMR, CL3R, CMG, CM, PLTC
CL2	CMP, CL3P, CL2P, CMR, CL3R, CL2R, CMG, CM, PLTC, CL3
CL3X	CMP, CL3P, CMR, CL3R, CMG, CM, PLTC, CL3, CMX
CL2X	CMP, CL3P, CL2P, CMR, CL3R, CL2R, CMG, CM, PLTC, CL3, CL2, CMX, CL3X

~~**Figure 725.154(A) Cable Substitution Hierarchy.**~~



~~**725.154(B) Class 2, Class 3, PLTC Circuit Integrity (CI) Cable or Electrical Circuit Protective System.**~~~~Circuit integrity (CI) cable or a listed electrical circuit protective system shall be permitted for use in remote control, signaling, or power-limited systems that supply critical circuits to ensure survivability for continued circuit operation for a specified time under fire conditions.~~

~~**725.154(C) Thermocouple Circuits.**~~~~Conductors in Type PLTC cables used for Class 2 thermocouple circuits shall be permitted to be any of the materials used for thermocouple extension wire.~~

Part IV. Listing Requirements

725.170 Listing and Marking of Equipment for Power and Data Transmission. The listed power source for circuits intended to provide power and data over Class 2 cables to remote equipment shall be as specified in 725.121(A)(1), (A)(2), (A)(3), or (A)(4). In accordance with 725.121(B), the power sources shall not have the output connections paralleled or otherwise interconnected, unless listed for such interconnection. Powered devices connected to a circuit supplying data and power shall be listed. Marking of equipment output connections shall be in accordance with 725.121(C).

~~**725.179 Listing and Marking of Class 2, Class 3, and Type PLTC Cables.**~~

~~Class 2, Class 3, and Type PLTC cables, installed as wiring methods within buildings, shall be listed as resistant to the spread of fire and other criteria in accordance with 725.179(A) through (I), shall be marked in accordance with 725.179(J), and shall be permitted to be marked in accordance with 725.179(K).~~

~~**725.179(A) Types CL2P and CL3P.**~~

Types CL2P and CL3P plenum cable shall be listed as suitable for use in ducts, plenums, and other space for environmental air and shall be listed as having adequate fire-resistant and low-smoke producing characteristics.

Informational Note: One method of defining a cable that is low-smoke producing and fire resistant is that the cable exhibits a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.52 m (5 ft) or less when tested in accordance with NFPA 262-2019, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces*.

725.179(B) Types CL2R and CL3R.

Types CL2R and CL3R riser cables shall be marked as Type CL2R or CL3R, respectively, and be listed as suitable for use in a vertical run in a shaft or from floor to floor and shall be listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor.

Informational Note: One method of defining fire-resistant characteristics capable of preventing the carrying of fire from floor to floor is that the cables pass the requirements of ANSI/UL 1666-2012, *Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts.*

725.179(C) Types CL2 and CL3.

Types CL2 and CL3 cables shall be marked as Type CL2 or CL3, respectively, and be listed as suitable for general-purpose use, with the exception of risers, ducts, plenums, and other space used for environmental air, and shall be listed as resistant to the spread of fire.

Informational Note: One method of defining *resistant to the spread of fire* is that the cables do not spread fire to the top of the tray in the UL flame exposure, vertical tray flame test in ANSI/UL 1685-2010, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*. The smoke measurements in the test method are not applicable.

Another method of defining *resistant to the spread of fire* is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA vertical flame test for cables in cable trays, as described in CSA C22.2 No. 0.3-M-2001, *Test Methods for Electrical Wires and Cables*.

725.179(D) Types CL2X and CL3X.

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

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

725.179(E) Type PLTC.

Type PLTC nonmetallic-sheathed, power-limited tray cable shall be listed as being suitable for cable trays and shall consist of a factory assembly of two or more insulated conductors under a nonmetallic jacket. The insulated conductors shall be 22 AWG through 12 AWG. The conductor material shall be copper (solid or stranded). Insulation on conductors shall be rated for 300 volts. The cable core shall be two or more parallel conductors, one or more group assemblies of twisted or parallel conductors, or a combination thereof. A metallic shield or a metallized foil shield with drain wire(s) shall be permitted to be applied over the cable core, over groups of conductors, or both. The cable shall be listed as resistant to the spread of fire. The outer jacket shall be a sunlight- and moisture-resistant nonmetallic material. Type PLTC cable used in a wet location shall be listed for use in wet locations or have a moisture-impervious metal sheath.

Exception No. 1: Where a smooth metallic sheath, continuous corrugated metallic sheath, or interlocking tape armor is applied over the nonmetallic jacket, an overall nonmetallic jacket shall not be required. On metallic-sheathed cable without an overall nonmetallic jacket, the information required in 310.8 shall be located on the nonmetallic jacket under the sheath.

Exception No. 2: Conductors in PLTC cables used for Class 2 thermocouple circuits shall be permitted to be any of the materials used for thermocouple extension wire.

Informational Note: One method of defining *resistant to the spread of fire* is that the cables do not spread fire to the top of the tray in the UL flame exposure, vertical tray flame test in ANSI/UL 1685-2010, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*. The smoke measurements in the test method are not applicable.

~~Another method of defining *resistant to the spread of fire* is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA vertical tray flame test for cables in cable trays, as described in CSA C22.2 No. 0.3-M-2001, *Test Methods for Electrical Wires and Cables*.~~

~~**725.179(F) Circuit Integrity (CI) Cable or Electrical Circuit Protective System.**~~

~~Cables that are used for survivability of critical circuits under fire conditions shall meet the requirements of either 725.179(F)(1) or (F)(2).~~

~~**725.179(F)(1) Circuit Integrity (CI) Cables.**~~

~~Circuit Integrity (CI) cables, specified in 725.179(A), (B), (C), and (E), and used for survivability of critical circuits, shall have the additional classification using the suffix "CI." Circuit integrity (CI) cables shall only be permitted to be installed in a raceway where specifically listed and marked as part of an electrical circuit protective system as covered in 725.179(F)(2).~~

~~**725.179(F)(2) Electrical Circuit Protective System.**~~

~~Cables specified in 725.179(A), (B), (C), (E), and (F)(1) that are part of an electrical circuit protective system shall be identified with the protective system number and hourly rating printed on the outer jacket of the cable and installed in accordance with the listing of the protective system.~~

~~Informational Note No. 1: One method of defining circuit integrity (CI) cable or an electrical circuit protective system is by establishing a minimum 2-hour fire-resistive rating when tested in accordance with ANSI/UL 2196-2017, *Standard for Fire Test for Circuit Integrity of Fire -Resistive Power, Instrumentation, Control and Data Cables*.~~

~~Informational Note No. 2: UL guide information for electrical circuit protective systems (FHIT) contains information on proper installation requirements to maintain the fire rating.~~

~~**725.179(G) Class 2 and Class 3 Cable Voltage and Temperature Ratings.**~~

~~Class 2 cables shall have a voltage rating of not less than 150 volts. Class 3 cables shall have a voltage rating of not less than 300 volts. Class 2 and Class 3 cables shall have a temperature rating of not less than 60°C (140°F).~~

~~**725.179(H) Class 3 Single Conductors.**~~

~~Class 3 single conductors used as other wiring within buildings shall not be smaller than 18 AWG and shall be Type CL3. Conductor types described in 725.49(B) that are also listed as Type CL3 shall be permitted.~~

~~Informational Note: One method of defining *resistant to the spread of fire* is that the cables do not spread fire to the top of the tray in the UL flame exposure, vertical tray flame test in ANSI/UL 1685-2010, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*. The smoke measurements in the test method are not applicable.~~

~~Another method of defining *resistant to the spread of fire* is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA vertical tray flame test for cables in cable trays, as described in CSA C22.2 No. 0.3-M-2001, *Test Methods for Electrical Wires and Cables*.~~

~~**725.179(I)**~~ **725.179 Listing and Marking of Limited Power (LP) Cables.**

Limited power (LP) cables shall be listed as suitable for carrying power and data up to a specified current limit for each conductor without exceeding the temperature rating of the cable where the cable is installed in cable bundles in free air or installed within a raceway, cable tray, or cable routing assembly. The cables shall be marked with the suffix "LP (XXA)" where XXA designates the current limit is in amperes per conductor.

Informational Note: An example of the marking on a Class 2 cable with an LP rating is "CL2-LP (75°C) 23 AWG 4-pair," which indicates that it is a 4-pair plenum cable with 23 AWG conductors, a temperature rating of 75°C, and a current limit of 0.6 amperes per conductor (0.6 A).

~~**725.179(J) Marking.**~~

~~Cables shall be marked in accordance with 310.8(A)(2), (A)(3), (A)(4), (A)(5), and Table 725.179(J). Voltage ratings shall not be marked on the cables.~~

~~Informational Note: Voltage markings on cables may be misinterpreted to suggest that the cables may be suitable for Class 1 electric light and power applications.~~

Exception: Voltage markings shall be permitted where the cable has multiple listings and a voltage marking is required for one or more of the listings.

The temperature rating shall be marked on the jacket of Class 2 and Class 3 cables that have a temperature rating exceeding 60°C (140°F).

Table 725.179(J) Cable Marking

Cable Marking	Type
CL3P	Class 3 plenum cable
CL2P	Class 2 plenum cable
CL3R	Class 3 riser cable
CL2R	Class 2 riser cable
PLTC	Power-limited tray cable
CL3	Class 3 cable
CL2	Class 2 cable
CL3X	Class 3 cable, limited use
CL2X	Class 2 cable, limited use

Informational Note: Class 2 and Class 3 cable types are listed in descending order of fire performance, and Class 3 cables are listed above Class 2 cables because Class 3 cables can substitute for Class 2 cables.

725.179(K) Optional Markings.

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note No. 1: These markings include, but are not limited to, markings for limited smoke, halogen free, low smoke and halogen free, and sunlight resistant.

Informational Note No. 2: Some examples of optional markings are ST1 to indicate limited smoke characteristics in accordance with UL 2556, *Wire and Cable Test Methods*; HF to indicate halogen free as described in UL 2885, *Outline of Investigation for Acid Gas, Acidity and Conductivity of Combusted Materials*; and LSHF to indicate halogen free and low smoke characteristics in accordance with IEC 61034-2, *Measurement of smoke density of cables burning under defined conditions — Part 2: Test procedure and requirements*

ARTICLE 725 Class 1, Class 2, and Class 3 Remote-Control, Signaling, and Power-Limited Circuits

Part I. General

725.1 Scope. This article covers remote-control, signaling, and power-limited circuits that are not an integral part of a device or of utilization equipment.

Informational Note: The circuits described herein are characterized by usage and electrical power limitations that differentiate them from electric light and power circuits; therefore, alternative requirements to those of Chapters 1 through 4 are given with regard to minimum wire sizes, ampacity adjustment and correction factors, overcurrent protection, insulation requirements, and wiring methods and materials.

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

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

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

725.3 Other Articles. In addition to the requirements of this article, circuits and equipment shall comply with the articles or sections listed in 725.3(A) through (E). Only those sections of Article 300 referenced in this article shall apply to Class 1, Class 2, and Class 3 circuits.

725.3(A) Spread of Fire or Products of Combustion. Installation of Class 1, Class 2, and Class 3 equipment shall comply with 300.21.

725.3(B) Ducts, Plenums, and Other Air-Handling Spaces. Class 1, Class 2, and Class 3 equipment installed in ducts, plenums, or other space used for environmental air shall comply with 300.22.

725.3(C) Motor Control Circuits. Article 430, Part VI, where tapped from the load side of the motor branch-circuit protective device(s) as specified in 430.72(A).

725.3(D) Identification of Equipment Grounding Conductors. Equipment grounding conductors shall be identified in accordance with 250.119.

725.3(E) Cables for Class 2 and 3 Circuits. The listing and installation of cables for Class 2 and Class 3 circuits shall comply with Article 7XX Parts I, II and V.

725.12 Uses Not Permitted. Cables and equipment shall not be installed in any hazardous (classified) location, except as permitted by other articles of this Code.

> Informational Note: Hazardous locations are covered in Articles 500 through 516 and in Article 517 Part IV.

725.21 Access to Electrical Equipment Behind Panels Designed to Allow Access. Access to electrical equipment shall not be denied by an accumulation of wires and cables that prevents removal of panels, including suspended ceiling panels.

725.24 Mechanical Execution of Work. Class 1, Class 2, and Class 3 equipment shall be installed in a neat and workmanlike manner. The installation shall also comply with 300.11.

725.30 Class 1, Class 2, and Class 3 Circuit Identification. Class 1, Class 2, and Class 3 circuits shall be identified at terminal and junction locations in a manner that prevents unintentional interference with other circuits during testing and servicing.

725.31 Safety-Control Equipment.

725.31(A) Remote-Control Circuits. Remote-control circuits for safety-control equipment shall be classified as Class 1 if the failure of the equipment to operate introduces a direct fire or life hazard. Room thermostats, water temperature regulating devices, and similar controls used in conjunction with electrically controlled household heating and air conditioning shall not be considered safety-control equipment.

725.31(B) Physical Protection. Where damage to remote-control circuits of safety-control equipment would introduce a hazard, as covered in 725.31(A), all conductors of such remote-control circuits shall be installed in rigid metal conduit,

intermediate metal conduit, rigid nonmetallic conduit, electrical metallic tubing, Type MI cable, or Type MC cable, or be otherwise suitably protected from physical damage.

725.35 Class 1, Class 2, and Class 3 Circuit Requirements. A remote-control, signaling, or power-limited circuit shall comply with the following parts of this article:

(1) Class 1 Circuits: Parts I and II

(2) Class 2 and Class 3 Circuits: Parts I and III

Part II. Class 1 Circuits

725.41 Class 1 Circuit Classifications and Power Source Requirements. Class 1 circuits shall be classified as either Class 1 power-limited circuits where they comply with the power limitations of 725.41(A) or as Class 1 remote-control and signaling circuits where they are used for remote-control or signaling purposes and comply with the power limitations of 725.41(B).

725.41(A) Class 1 Power-Limited Circuits. These circuits shall be supplied from a source that has a rated output of not more than 30 volts and 1000 volt-amperes.

725.41(A)(1) Class 1 Transformers. Transformers used to supply power-limited Class 1 circuits shall comply with the applicable sections within Parts I and II of Article 450.

725.41(A)(2) Other Class 1 Power Sources. Power sources other than transformers shall be protected by overcurrent devices rated at not more than 167 percent of the volt-ampere rating of the source divided by the rated voltage. The overcurrent devices shall not be interchangeable with overcurrent devices of higher ratings. The overcurrent device shall be permitted to be an integral part of the power supply.

To comply with the 1000 volt-ampere limitation of 725.41(A), the maximum output (VA_{max}) of power sources other than transformers shall be limited to 2500 volt-amperes, and the product of the maximum current (I_{max}) and maximum voltage (V_{max}) shall not exceed 10,000 volt-amperes. These ratings shall be determined with any overcurrent-protective device bypassed.

VA_{max} is the maximum volt-ampere output after one minute of operation regardless of load and with overcurrent protection bypassed, if used. Current-limiting impedance shall not be bypassed when determining VA_{max}.

I_{max} is the maximum output current under any noncapacitive load, including short circuit, and with overcurrent protection bypassed, if used. Current-limiting impedance should not be bypassed when determining I_{max}. Where a current-limiting impedance, listed for the purpose or as part of a listed product, is used in combination with a stored energy source, for example, storage battery, to limit the output current, I_{max} limits apply after 5 seconds.

V_{max} is the maximum output voltage regardless of load with rated input applied.

725.41(B) Class 1 Remote-Control and Signaling Circuits. These circuits shall not exceed 600 volts. The power output of the source shall not be required to be limited.

725.43 Class 1 Circuit Overcurrent Protection. Overcurrent protection for conductors 14 AWG and larger shall be provided in accordance with the conductor ampacity, without applying the ampacity adjustment and correction factors of 310.14 to the ampacity calculation. Overcurrent protection shall not exceed 7 amperes for 18 AWG conductors and 10 amperes for 16 AWG.

Exception: Where other articles of this Code permit or require other overcurrent protection.

Informational Note: For example, see 430.72 for motors, 610.53 for cranes and hoists, and 517.74(B) and 660.9 for X-ray equipment.

725.45 Class 1 Circuit Overcurrent Device Location. Overcurrent devices shall be located as specified in 725.45(A), (B), (C), (D), or (E).

725.45(A) Point of Supply. Overcurrent devices shall be located at the point where the conductor to be protected receives its supply.

725.45(B) Feeder Taps. Class 1 circuit conductors shall be permitted to be tapped, without overcurrent protection at the tap, where the overcurrent device protecting the circuit conductor is sized to protect the tap conductor.

725.45(C) Branch-Circuit Taps. Class 1 circuit conductors 14 AWG and larger that are tapped from the load side of the overcurrent protective device(s) of a controlled light and power circuit shall require only short-circuit and ground-fault

protection and shall be permitted to be protected by the branch-circuit overcurrent protective device(s) where the rating of the protective device(s) is not more than 300 percent of the ampacity of the Class 1 circuit conductor.

725.45(D) Primary Side of Transformer. Class 1 circuit conductors supplied by the secondary of a single-phase transformer having only a 2-wire (single-voltage) secondary shall be permitted to be protected by overcurrent protection provided on the primary side of the transformer, provided this protection is in accordance with 450.3 and does not exceed the value determined by multiplying the secondary conductor ampacity by the secondary-to-primary transformer voltage ratio. Transformer secondary conductors other than 2-wire shall not be considered to be protected by the primary overcurrent protection.

725.45(E) Input Side of Electronic Power Source. Class 1 circuit conductors supplied by the output of a single-phase, listed electronic power source, other than a transformer, having only a 2-wire (single-voltage) output for connection to Class 1 circuits shall be permitted to be protected by overcurrent protection provided on the input side of the electronic power source, provided this protection does not exceed the value determined by multiplying the Class 1 circuit conductor ampacity by the output-to-input voltage ratio. Electronic power source outputs, other than 2-wire (single voltage), shall not be considered to be protected by the primary overcurrent protection.

725.46 Class 1 Circuit Wiring Methods. Class 1 circuits shall be installed in accordance with Part I of Article 300 and with the wiring methods from the appropriate articles in Chapter 3.

Exception No. 1: The provisions of 725.48 through 725.51 shall be permitted to apply in installations of Class 1 circuits.

Exception No. 2: Methods permitted or required by other articles of this Code shall apply to installations of Class 1 circuits.

725.48 Conductors of Different Circuits in the Same Cable, Cable Tray, Enclosure, or Raceway. Class 1 circuits shall be permitted to be installed with other circuits as specified in 725.48(A) and (B).

725.48(A) Two or More Class 1 Circuits. Class 1 circuits shall be permitted to occupy the same cable, cable tray, enclosure, or raceway without regard to whether the individual circuits are alternating current or direct current, provided all conductors are insulated for the maximum voltage of any conductor in the cable, cable tray, enclosure, or raceway.

725.48(B) Class 1 Circuits with Power-Supply Circuits. Class 1 circuits shall be permitted to be installed with power-supply conductors as specified in 725.48(B)(1) through (B)(4).

725.48(B)(1) In a Cable, Enclosure, or Raceway. Class 1 circuits and power-supply circuits shall be permitted to occupy the same cable, enclosure, or raceway without a barrier only where the equipment powered is functionally associated. Class 1 circuits shall be permitted to be installed together with the conductors of electric light, power, non-power-limited fire alarm, and medium power network-powered broadband communications circuits where separated by a barrier.

725.48(B)(2) In Factory- or Field-Assembled Control Centers. Class 1 circuits and power-supply circuits shall be permitted to be installed in factory- or field-assembled control centers.

725.48(B)(3) In a Manhole. Class 1 circuits and power-supply circuits shall be permitted to be installed as underground conductors in a manhole in accordance with one of the following:

(1) The power-supply or Class 1 circuit conductors are in a metal-enclosed cable or Type UF cable.

(2) The conductors are permanently separated from the power-supply conductors by a continuous firmly fixed nonconductor, such as flexible tubing, in addition to the insulation on the wire.

(3) The conductors are permanently and effectively separated from the power supply conductors and securely fastened to racks, insulators, or other approved supports.

725.48(B)(4) In Cable Trays. Installations in cable trays shall comply with 725.48(B)(4)(1) or (B)(4)(2).

(1) Class 1 circuit conductors and power-supply conductors not functionally associated with the Class 1 circuit conductors shall be separated by a solid fixed barrier of a material compatible with the cable tray.

(2) Class 1 circuit conductors and power-supply conductors not functionally associated with the Class 1 circuit conductors shall be permitted to be installed in a cable tray without barriers where all of the conductors are installed with separate multiconductor Type AC, Type MC, Type MI, or Type TC cables and all the conductors in the cables are insulated at 600 volts or greater.

725.49 Class 1 Circuit Conductors.

725.49(A) Sizes and Use. Conductors of sizes 18 AWG and 16 AWG shall be permitted to be used, provided they supply loads that do not exceed the ampacities given in 402.5 and are installed in a raceway, an approved enclosure, or a listed

cable. Conductors larger than 16 AWG shall not supply loads greater than the ampacities given in 310.14. Flexible cords shall comply with Article 400.

725.49(B) Insulation. Insulation on conductors shall be rated for the system voltage and not less than 600 volts. Conductors larger than 16 AWG shall comply with Article 310. Conductors in sizes 18 AWG and 16 AWG shall be Type FFH-2, KF-2, KFF-2, PAF, PAFF, PF, PFF, PGF, PGFF, PTF, PTFF, RFH-2, RFHH-2, RFHH-3, SF-2, SFF-2, TF, TFF, TFFN, TFN, ZF, or ZFF. Conductors with other types and thicknesses of insulation shall be permitted if listed for Class 1 circuit use.

725.51 Number of Conductors in Cable Trays and Raceway, and Ampacity Adjustment.

725.51(A) Class 1 Circuit Conductors. Where only Class 1 circuit conductors are in a raceway, the number of conductors shall be determined in accordance with 300.17. The ampacity adjustment factors given in 310.15(C)(1) shall apply only if such conductors carry continuous loads in excess of 10 percent of the ampacity of each conductor.

725.51(B) Power-Supply Conductors and Class 1 Circuit Conductors. Where power-supply conductors and Class 1 circuit conductors are permitted in a raceway in accordance with 725.48, the number of conductors shall be determined in accordance with 300.17. The ampacity adjustment factors given in 310.15(C)(1) shall apply as follows:

(1) To all conductors where the Class 1 circuit conductors carry continuous loads in excess of 10 percent of the ampacity of each conductor and where the total number of conductors is more than three

(2) To the power-supply conductors only, where the Class 1 circuit conductors do not carry continuous loads in excess of 10 percent of the ampacity of each conductor and where the number of power-supply conductors is more than three

725.51(C) Class 1 Circuit Conductors in Cable Trays. Where Class 1 circuit conductors are installed in cable trays, they shall comply with the provisions of 392.22 and 392.80(A).

725.52 Circuits Extending Beyond One Building. Class 1 circuits that extend aerially beyond one building shall also meet the requirements of Article 225.

Part III. Class 2 and Class 3 Circuits

725.121 Power Sources for Class 2 and Class 3 Circuits.

725.121(A) Power Source. The power source for a Class 2 or a Class 3 circuit shall be as follows:

Informational Note No. 1: Informational Note Figure 725.121 illustrates the relationships between Class 2 or Class 3 power sources, their supply, and the Class 2 or Class 3 circuits.

Informational Note No. 2: Table 11(A) and Table 11(B) in Chapter 9 provide the requirements for listed Class 2 and Class 3 power sources.

(1) A listed Class 2 or Class 3 transformer

(2) A listed Class 2 or Class 3 power supply

(3) Other listed equipment marked to identify the Class 2 or Class 3 power source

Exception No. 1 to (3): Thermocouples shall not require listing as a Class 2 power source.

Exception No. 2 to (3): Limited power circuits of listed equipment where these circuits have energy levels rated at or below the limits established in Chapter 9, Table 11(A) and Table 11(B).

Informational Note: Examples of other listed equipment are as follows:

(1) A circuit card listed for use as a Class 2 or Class 3 power source where used as part of a listed assembly

(2) A current-limiting impedance, listed for the purpose, or part of a listed product, used in conjunction with a non-power-limited transformer or a stored energy source, for example, storage battery, to limit the output current

(3) A thermocouple

(d Limited voltage/current or limited impedance secondary communications circuits of listed industrial control equipment

(4) Listed audio/video, information technology (computer), communications, and industrial equipment limited-power circuits

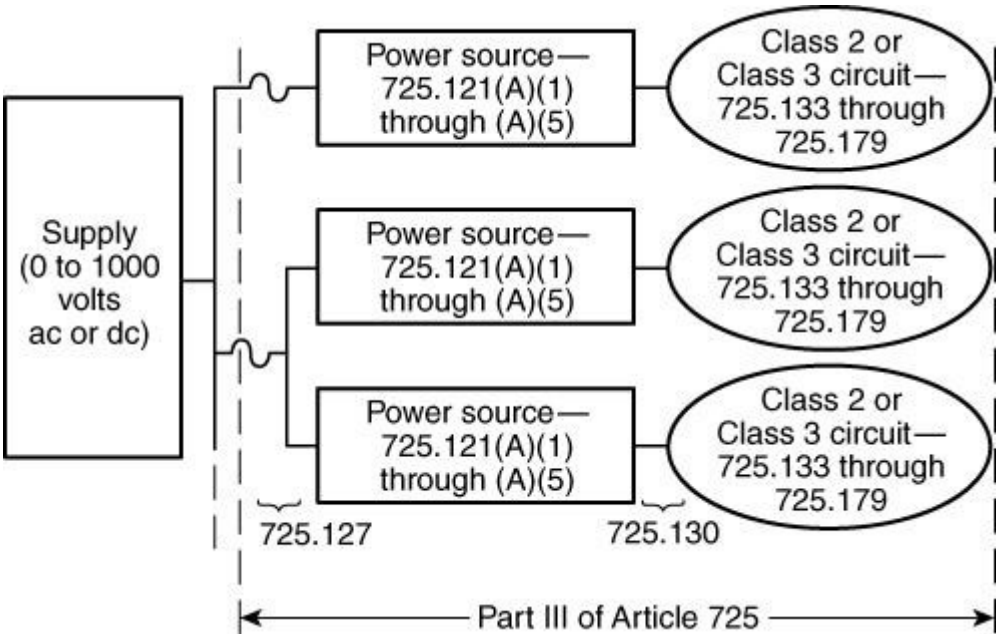
Informational Note: One way to determine applicable requirements for listing of information technology (computer) equipment is to refer to UL 60950-1-2011, *Standard for Safety of Information Technology Equipment*. Another way to

determine applicable requirements for listing of audio/video, information technology, and communications equipment is to refer to UL 62368-1-2014, *Safety of audio/video, information and communication technology equipment*. Typically such circuits are used to interconnect data circuits for the purpose of exchanging information data. One way to determine applicable requirements for listing of industrial equipment is to refer to UL 61010-2-201, *Safety requirements for electrical equipment for measurement, control, and laboratory use — Part 2-201: Particular requirements for control equipment*, and/or UL 61800-5-1, *Adjustable speed electrical power drive systems — Part 5-1: Safety requirements — Electrical, thermal and energy.*

(5) A battery source or battery source system that is listed and identified as Class 2

725.121(B) Interconnection of Power Sources. Class 2 or Class 3 power sources shall not have the output connections paralleled or otherwise interconnected unless listed for such interconnection.

Informational Note Figure 725.121 Class 2 and Class 3 Circuits.



725.121(C) Marking. The equipment supplying the circuits shall be durably marked where plainly visible to indicate each circuit that is a Class 2 or Class 3 circuit.

The power sources for limited power circuits in 725.121(A)(3), limited power circuits for listed audio/video equipment, listed information technology equipment, listed communications equipment, and listed industrial equipment in 725.121(A)(4) shall have a label indicating the maximum voltage and rated current output per conductor for each connection point on the power source. Where multiple connection points have the same rating, a single label shall be permitted to be used. For equipment with a rated current per conductor less than 0.3 amperes, the effective date shall be January 1, 2021.

Informational Note No. 1: Rated current for power sources covered in 725.144 is the output current per conductor the power source is designed to deliver to an operational load at normal operating conditions, as declared by the manufacturer.

Informational Note No. 2: An example of a label is “52V @ 0.433A, 57V MAX” for an IEEE 802.3 compliant Class 8 power source.

725.127 Wiring Methods on Supply Side of the Class 2 or Class 3 Power Source. Conductors and equipment on the supply side of the power source shall be installed in accordance with the appropriate requirements of Chapters 1 through 4. Transformers or other devices supplied from electric light or power circuits shall be protected by an overcurrent device rated not over 20 amperes.

Exception: The input leads of a transformer or other power source supplying Class 2 and Class 3 circuits shall be permitted to be smaller than 14 AWG, but not smaller than 18 AWG if they are not over 305 mm (12 in.) long and if they have insulation that complies with 725.49(B).

725.130 Wiring Methods and Materials on Load Side of the Class 2 or Class 3 Power Source. Parts I, II and V of Article 7XX shall apply to wiring methods and materials on load side of the class 2 or class 3 power source.

725.144 Transmission of Power and Data. Sections 725.144(A) and (B) shall apply to Class 2 and Class 3 circuits that transmit power and data to a powered device. Section 300.11 and Parts I and III of Article 725 shall apply to Class 2 and Class 3 circuits that transmit power and data. The conductors that carry power for the data circuits shall be copper. The current in the power circuit shall not exceed the current limitation of the connectors.

Informational Note No. 1: One example of the use of cables that transmit power and data is the connection of closed-circuit TV cameras (CCTV).

Informational Note No. 2: The 8P8C connector is in widespread use with powered communications systems. IEC 60603-7-2008, *Connectors for electronic equipment — Part 7-1: Detail specification for 8-way, unshielded, free and fixed connectors,* specifies these connectors to have a current-carrying capacity per contact of 1.0 amperes maximum at 60°C (149°F). See IEC 60603-7 for more information on current-carrying capacity at higher and lower temperatures.

Informational Note No. 3: The requirements of Table 725.144 were derived for carrying power and data over 4-pair copper balanced twisted pair cabling. This type of cabling is described in ANSI/TIA 568-C.2-2009, *Commercial Building Telecommunications Cabling Standard — Part 2: Balanced Twisted-Pair Telecommunications Cabling and Components*.
Informational Note No. 4: See TIA-TSB-184-A-2017, *Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling*, for information on installation and management of balanced twisted pair cabling supporting power delivery.
Informational Note No. 5: 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.
Informational Note No. 6: Rated current for power sources covered in 725.144 is the output current per conductor the power source is designed to deliver to an operational load at normal operating conditions, as declared by the manufacturer. In the design of these systems, the actual current in a given conductor might vary from the rated current per conductor by as much as 20 percent. An increase in current in one conductor is offset by a corresponding decrease in current in one or more conductors of the same cable.

Table 725.144 Ampacities of Each Conductor in Amperes in 4-Pair Class 2 or Class 3 Balanced Twisted-Pair Cables Based on Copper Conductors at an Ambient Temperature of 30°C (86°F) with All Conductors in All Cables Carrying Current, 60°C (140°F), 75°C (167°F), and 90°C (194°F) Rated Cables

	Number of 4-Pair Cables in a Bundle																	
	1–7			8–19			20–37			38–61			62–91			92–192		
	Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating		
AWG	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C
26	1.00	1.23	1.42	0.71	0.87	1.02	0.55	0.68	0.78	0.46	0.57	0.67	0.45	0.55	0.64	NA	NA	NA
24	1.19	1.46	1.69	0.81	1.01	1.17	0.63	0.78	0.91	0.55	0.67	0.78	0.46	0.56	0.65	0.40	0.48	0.55
23	1.24	1.53	1.78	0.89	1.11	1.28	0.77	0.95	1.10	0.66	0.80	0.93	0.58	0.71	0.82	0.45	0.55	0.63
22	1.50	1.86	2.16	1.04	1.28	1.49	0.77	0.95	1.11	0.66	0.82	0.96	0.62	0.77	0.89	0.53	0.63	0.72

Note 1: For bundle sizes over 192 cables, or for conductor sizes smaller than 26 AWG, ampacities shall be permitted to be determined by qualified personnel under engineering supervision.
Note 2: Where only half of the conductors in each cable are carrying current, the values in the table shall be permitted to be increased by a factor of 1.4.
Informational Note No. 1: Elevated cable temperatures can reduce a cable's data transmission performance. For information on practices for 4-pair balanced twisted pair cabling, see TIA-TSB-184-A and 6.4.7, 6.6.3, and Annex G of ANSI/TIA-568-C.2, which provide guidance on adjustments for operating temperatures between 20°C and 60°C.
Informational Note No. 2: The per-contact current rating of connectors can limit the maximum allowable current below the ampacity shown in Table 725.144.

725.144(A) Use of Class 2 or Class 3 Cables to Transmit Power and Data. Where Types CL3P, CL2P, CL3R, CL2R, CL3, or CL2 transmit power and data, the rated current per conductor of the power source shall not exceed the ampacities in Table 725.144 at an ambient temperature of 30°C (86°F). For ambient temperatures above 30°C (86°F), the correction factors in Table 310.15(B)(1) or in Equation 310.15(B) shall apply.

Exception: Compliance with Table 725.144 shall not be required for installations where conductors are 24 AWG or larger and the rated current per conductor of the power source does not exceed 0.3 amperes.

Informational Note: One example of the use of Class 2 cables is a network of closed-circuit TV cameras using 24 AWG, 60°C rated, Type CL2R, Category 5e balanced twisted-pair cabling.

725.144(B) Use of Class 2-LP or Class 3-LP Cables to Transmit Power and Data. Types CL3P-LP, CL2P-LP, CL3R-LP, CL2R-LP, CL3-LP, or CL2-LP shall be permitted to supply power to equipment from a power source with a rated current per conductor up to the marked current limit located immediately following the suffix "-LP" and shall be permitted to transmit data to the equipment. Where the number of bundled LP cables is 192 or less and the selected ampacity of the cables in accordance with Table 725.144 exceeds the marked current limit of the cable, the ampacity determined from the table shall be permitted to be used. For ambient temperatures above 30°C (86°F), the correction factors of Table 310.15(B)(1) or Equation 310.15(B) shall apply. The Class 2-LP and Class 3-LP cables shall comply with the following, as applicable:

(1) Cables with the suffix "-LP" shall be permitted to be installed in bundles, raceways, cable trays, communications raceways, and cable routing assemblies.

(2) Cables with the suffix "-LP" and a marked current limit shall follow the substitution hierarchy of Table 725.154 and Figure 725.154(A) for the cable type without the suffix "-LP" and without the marked current limit.

(3) System design shall be permitted by qualified persons under engineering supervision.

Informational Note: An example of a limited power (LP) cable is a cable marked Type CL2-LP(0.5A), 23 AWG.

Part IV. Listing Requirements

725.170 Listing and Marking of Equipment for Power and Data Transmission. The listed power source for circuits intended to provide power and data over Class 2 cables to remote equipment shall be as specified in 725.121(A)(1), (A)(2), (A)(3), or (A)(4). In accordance with 725.121(B), the power sources shall not have the output connections paralleled or otherwise interconnected, unless listed for such interconnection. Powered devices connected to a circuit supplying data and power shall be listed. Marking of equipment output connections shall be in accordance with 725.121(C).

725.179 Listing and Marking of Limited Power (LP) Cables.

Limited power (LP) cables shall be listed as suitable for carrying power and data up to a specified current limit for each conductor without exceeding the temperature rating of the cable where the cable is installed in cable bundles in free air or installed within a raceway, cable tray, or cable routing assembly. The cables shall be marked with the suffix "LP (XXA)" where XXA designates the current limit is in amperes per conductor.

Informational Note: An example of the marking on a Class 2 cable with an LP rating is "CL2-LP (75°C) 23 AWG 4-pair," which indicates that it is a 4-pair plenum cable with 23 AWG conductors, a temperature rating of 75°C, and a current limit of 0.6 amperes per conductor (0.6 A).

Public Input No. 3993-NFPA 70-2020 [Global Input]

Revise Article 760 per the attached.

Additional Proposed Changes

File Name	Description	Approved
2020_NEC_Article_760_Changes_-_REVISION_MODE_TRACK_CHANGES_ON.docx	This document incorporates the Article 760 changes necessary for the Chapter 7 consolidations in REVISION MODE with TRACK CHANGES on.	
2020_NEC_Article_760_Changes_-_CHANGES_ACCEPTED.pdf	This document shows how Article 760 would look with all of the changes accepted.	

Statement of Problem and Substantiation for Public Input

This public input was developed by a Panel 3 appointed task group to address redundant cabling requirements in Articles 725, 760 and 770. The Panel 3 task group members included TG Chairman Randy Ivans (Panel 3 Principal, Panel 16 Alternate), Robert Jones (Chairman Panel 3), Paul Casparro, Shane Clary, Michael Cogbill, Chad Jones, Ward Judson, Tim Mikloiche, Samuel Rokowski, George Straniero, Ron Tellas, and George Zimmerman. The TG was broad-based and specifically included representation of those with knowledge and experience in electrical safety, installation, code enforcement, and wire and cable.

This proposed new Article combines common cabling requirements currently found in Articles 725, 760, and 770 and also relocates other cabling requirements from those articles into a single article. The proposal also removes the redundancy between the text-based requirements in 725.135, 760.135 and 770.113, and the tabular requirements in Tables 725.154, 760.154 and 770.154 by including most of the requirements only in tabular form. This has been found to be more user-friendly. Some of the text-based requirements do not lend themselves to being represented in tabular form and remain as text in the new Article. In some cases, such as 725.144, the cable requirements are integrated with equipment requirements and were not moved. In the case of 725.144 a pointer was added in the new article for clarity. The new Article is being proposed in Public Input No. 3671.

This PI deletes or modifies text in the original Article 760 to accommodate the above consolidation of requirements. Only PLFA cable requirements are being relocated. Non-power limited cables remain in 760. Hazardous locations was moved from 760.3 to a new 760.12 to simplify the references. The reference in 725.24 was changed to 300.4 and 300.11 since 300.11 includes equipment and the installation requirements in 300.11are appropriate for all fire system equipment. It should be noted that parallel sections 770.24 and 800.24 both already reference 300.11.

These changes significantly improve clarity and usability while removing redundant requirements. It is not the intent of these proposals to introduce any technical changes. Some editorial errors were found during this process and fixed within this PI. If this PI is resolved, there are separate PIs submitted to fix those issues. Multiple companion public inputs are submitted throughout the NEC as part of this overall effort.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3671-NFPA 70-2020 [Global Input]	This PI adds the new Article 7XX for Cables for Power Limited Circuits
Public Input No. 3868-NFPA 70-2020 [Global Input]	This PI is for the revisions to Article 725 to accommodate the new cable article
Public Input No. 4138-NFPA 70-2020 [Global Input]	This PI is for the revisions to Article 770 to accommodate the new cable article
Public Input No. 3671-NFPA 70-2020 [Global Input]	
Public Input No. 3868-NFPA 70-2020 [Global Input]	
Public Input No. 4138-NFPA 70-2020 [Global Input]	

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Submittal Date: Wed Sep 09 16:53:15 EDT 2020
Committee: NEC-P03

ARTICLE 760 Fire Alarm Systems

Part I. General

760.1 Scope. This article covers the installation of wiring and equipment of fire alarm systems, including all circuits controlled and powered by the fire alarm system.

Informational Note No. 1: Fire alarm systems include fire detection and alarm notification, guard's tour, sprinkler waterflow, and sprinkler supervisory systems. Circuits controlled and powered by the fire alarm system include circuits for the control of building systems safety functions, elevator capture, elevator shutdown, door release, smoke doors and damper control, fire doors and damper control and fan shutdown, but only where these circuits are powered by and controlled by the fire alarm system. For further information on the installation and monitoring for integrity requirements for fire alarm systems, refer to the *NFPA 72*-2019, *National Fire Alarm and Signaling Code*.
Informational Note No. 2: Class 1, 2, and 3 circuits are defined in Article 725.

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

Abandoned Fire Alarm Cable. Installed fire alarm cable that is not terminated at equipment other than a connector and not identified for future use with a tag.

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

Fire Alarm Circuit Integrity (CI) Cable. Cable used in fire alarm systems to ensure continued operation of critical circuits during a specified time under fire conditions.

Non–Power-Limited Fire Alarm Circuit (NPLFA). A fire alarm circuit powered by a source that complies with 760.41 and 760.43.

Power-Limited Fire Alarm Circuit (PLFA). A fire alarm circuit powered by a source that complies with 760.121.

760.3 Other Articles. Circuits and equipment shall comply with 760.3(A) through (O). Only those sections of Article 300 referenced in this article shall apply to fire alarm systems.

760.3(A) Spread of Fire or Products of Combustion. See 300.21.

760.3(B) Ducts, Plenums, and Other Air-Handling Spaces. ~~Power-limited and n~~Non-power-limited fire alarm cables installed in ducts, plenums, or other spaces used for environmental air shall comply with 300.22.

~~*Exception No. 1: Power-limited fire alarm cables selected in accordance with Table 760.154 and installed in accordance with 760.135(B) and 300.22(B), Exception shall be permitted to be installed in ducts specifically fabricated for environmental air.*~~

~~*Exception No. 2: Power-limited fire alarm cables selected in accordance with Table 760.154 and installed in accordance with 760.135(C) shall be permitted to be installed in other spaces used for environmental air (plenums).*~~

~~**760.3(C) Hazardous (Classified) Locations.** Articles 500 through 516 and Article 517, Part IV, where installed in hazardous (classified) locations.~~

760.3(~~D~~C) Corrosive, Damp, or Wet Locations. Sections 110.11, 300.5(B), 300.6, 300.9, and 310.10(F), where installed in corrosive, damp, or wet locations.

760.3(~~E~~)D Building Control Circuits. Article 725, where building control circuits (e.g., elevator capture, fan shutdown) are associated with the fire alarm system.

760.3(~~F~~E) Optical Fiber Cables. Where optical fiber cables are utilized for fire alarm circuits, the cables shall be installed in accordance with Article ~~770~~7XX Parts I, IV and V.

760.3(~~G~~F) Installation of Conductors with Other Systems. Installations shall comply with 300.8.

760.3(~~H~~G) Raceways or Sleeves Exposed to Different Temperatures. Installations shall comply with 300.7(A).

760.3(~~I~~H) Vertical Support for Fire Rated Cables and Conductors. Vertical installations of circuit integrity (CI) cables and conductors installed in a raceway or conductors and cables of electrical circuit protective systems shall be installed in accordance with 300.19.

760.3(~~J~~I) Number and Size of Cables and Conductors in Raceway. Installations shall comply with 300.17.

760.3(~~K~~J) Bushing. A bushing shall be installed where cables emerge from raceway used for mechanical support or protection in accordance with 300.15(C).

760.3(~~L~~K) Cable Routing Assemblies. Power-limited fire alarm cables shall be permitted to be installed in plenum cable routing assemblies, riser cable routing assemblies, and general-purpose cable routing assemblies selected in accordance with Table 800.154(c), listed in accordance with 800.182, and installed in accordance with 800.110(C) and 800.113.

760.3(~~M~~L) Communications Raceways. Power-limited fire alarm cables shall be permitted to be installed in plenum communications raceways, riser communications raceways, and general-purpose communications raceways selected in accordance with Table 800.154(b), listed in accordance with 800.182, and installed in accordance with 800.113 and 362.24 through 362.56, where the requirements applicable to electrical nonmetallic tubing apply.

760.3(~~N~~M) Temperature Limitations of Power-Limited and Non–Power-Limited Fire Alarm Cables. The requirements of 310.14(A)(3) on the temperature limitation of conductors shall apply to power-limited fire alarm cables and non–power-limited fire alarms cables.

760.3(~~O~~N) Identification of Equipment Grounding Conductors. Equipment grounding conductors shall be identified in accordance with 250.119.

~~*Exception: Conductors with green insulation shall be permitted to be used as ungrounded signal conductors for Types FPLP, FPLR, FPL, and substitute cables installed in accordance with 760.154(A).*~~

725.3(O) Cables for Power-limited Fire Alarm (PLFA) Circuits. The listing and installation of cables for power limited fire alarm circuits shall comply with Article 7XX Parts I, III and V.

760.12 Uses Not Permitted. Cables and equipment shall not be installed in any hazardous (classified) location, except as permitted by other articles of this Code.

Informational Note: Hazardous locations are covered in Articles 500 through 516 and in Article 517 Part IV.

760.21 Access to Electrical Equipment Behind Panels Designed to Allow Access. Access to electrical equipment shall not be denied by an accumulation of conductors and cables that prevents removal of panels, including suspended ceiling panels.

760.24 Mechanical Execution of Work.

760.24(A) General. Fire alarm circuits shall be installed in a neat workmanlike manner. Cables and conductors installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be supported by straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also comply with 300.4 and 300.11.

Informational Note: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants might result in an undetermined alteration of PLFA and NPLFA cable properties.

760.24(B) Circuit Integrity (CI) Cable. Circuit integrity (CI) cables shall be supported at a distance not exceeding 610 mm (24 in.). Where located within 2.1 m (7 ft) of the floor, as covered in 760.53(A)(1) and 760.130(B)(1), as applicable, the cable shall be fastened in an approved manner at intervals of not more than 450 mm (18 in.). Cable supports and fasteners shall be steel.

760.25 Abandoned Cables. The accessible portion of abandoned fire alarm cables shall be removed. Where cables are identified for future use with a tag, the tag shall be of sufficient durability to withstand the environment involved.

760.30 Fire Alarm Circuit Identification. Fire alarm circuits shall be identified at terminal and junction locations in a manner that helps to prevent unintentional signals on fire alarm system circuit(s) during testing and servicing of other systems.

760.32 Fire Alarm Circuits Extending Beyond One Building. Non–power-limited fire alarm circuits and power-limited fire alarm circuits that extend beyond one building and run outdoors shall meet the installation requirements of Parts II, III, and IV of Article 805 and shall meet the installation requirements of Part I of Article 300.

Informational Note: An example of a protective device suitable to provide protection is a device tested to the requirements of ANSI/UL 497B, *Protectors for Data Communications*.

760.35 Fire Alarm Circuit Requirements. Fire alarm circuits shall comply with 760.35(A) and (B).

760.35(A) Non–Power-Limited Fire Alarm (NPLFA) Circuits. See Parts I and II.

760.35(B) Power-Limited Fire Alarm (PLFA) Circuits. See Parts I and III.

Part II. Non–Power-Limited Fire Alarm (NPLFA) Circuits

760.41 NPLFA Circuit Power Source Requirements.

760.41(A) Power Source. The power source of non–power-limited fire alarm circuits shall comply with Chapters 1 through 4, and the output voltage shall be not more than 600 volts, nominal. The fire alarm circuit disconnect shall be permitted to be secured in the “on” position.

760.41(B) Branch Circuit. The branch circuit supplying the fire alarm equipment(s) shall supply no other loads. The location of the branch-circuit overcurrent protective device shall be permanently identified at the fire alarm control unit. The circuit disconnecting means shall have red identification, shall be accessible only to qualified personnel, and shall be identified as “FIRE ALARM CIRCUIT.” The red identification shall not damage the overcurrent protective devices or obscure the manufacturer's markings. This branch circuit shall not be supplied through ground-fault circuit interrupters or arc-fault circuit-interrupters.

Informational Note: See 210.8(A)(5), Exception, for receptacles in dwelling-unit unfinished basements that supply power for fire alarm systems.

760.43 NPLFA Circuit Overcurrent Protection. Overcurrent protection for conductors 14 AWG and larger shall be provided in accordance with the conductor ampacity without applying the ampacity adjustment and correction factors of 310.14 to the ampacity calculation. Overcurrent protection shall not exceed 7 amperes for 18 AWG conductors and 10 amperes for 16 AWG conductors.

Exception: Where other articles of this Code permit or require other overcurrent protection.

760.45 NPLFA Circuit Overcurrent Device Location. Overcurrent devices shall be located at the point where the conductor to be protected receives its supply.

Exception No. 1: Where the overcurrent device protecting the larger conductor also protects the smaller conductor.

Exception No. 2: Transformer secondary conductors. Non–power-limited fire alarm circuit conductors supplied by the secondary of a single-phase transformer that has only a 2-wire (single-voltage) secondary shall be permitted to be protected by overcurrent protection provided by the primary (supply) side of the transformer, provided the protection is in accordance with 450.3 and does not exceed the value determined by multiplying the secondary conductor ampacity by the secondary-to-primary transformer voltage ratio. Transformer secondary conductors other than 2-wire shall not be considered to be protected by the primary overcurrent protection.

Exception No. 3: *Electronic power source output conductors. Non–power-limited circuit conductors supplied by the output of a single-phase, listed electronic power source, other than a transformer, having only a 2-wire (single-voltage) output for connection to non–power-limited circuits shall be permitted to be protected by overcurrent protection provided on the input side of the electronic power source, provided this protection does not exceed the value determined by multiplying the non–power-limited circuit conductor ampacity by the output-to-input voltage ratio. Electronic power source outputs, other than 2-wire (single voltage), connected to non–power-limited circuits shall not be considered to be protected by overcurrent protection on the input of the electronic power source.*

Informational Note: A single-phase, listed electronic power supply whose output supplies a 2-wire (single-voltage) circuit is an example of a non–power-limited power source that meets the requirements of 760.41.

760.46 NPLFA Circuit Wiring. Installation of non–power-limited fire alarm circuits shall be in accordance with 110.3(B), 300.7, 300.11, 300.15, 300.17, 300.19(B), and other appropriate articles of Chapter 3.

Exception No. 1: *As provided in 760.48 through 760.53.*

Exception No. 2: *Where other articles of this Code require other methods.*

760.48 Conductors of Different Circuits in Same Cable, Enclosure, or Raceway.

760.48(A) Class 1 with NPLFA Circuits. Class 1 and non–power-limited fire alarm circuits shall be permitted to occupy the same cable, enclosure, or raceway without regard to whether the individual circuits are alternating current or direct current, provided all conductors are insulated for the maximum voltage of any conductor in the enclosure or raceway.

760.48(B) Fire Alarm with Power-Supply Circuits. Power-supply and fire alarm circuit conductors shall be permitted in the same cable, enclosure, or raceway only where connected to the same equipment.

760.49 NPLFA Circuit Conductors.

760.49(A) Sizes and Use. Only copper conductors shall be permitted to be used for fire alarm systems. Size 18 AWG and 16 AWG conductors shall be permitted to be used, provided they supply loads that do not exceed the ampacities given in Table 402.5 and are installed in a raceway, an approved enclosure, or a listed cable. Conductors larger than 16 AWG shall not supply loads greater than the ampacities given in 310.14, as applicable.

760.49(B) Insulation. Insulation on conductors shall be rated for the system voltage and not less than 600 volts. Conductors larger than 16 AWG shall comply with Article 310. Conductors 18 AWG and 16 AWG shall be Type KF-2, KFF-2, PAFF, PTFF, PF, PFF, PGF, PGFF, RFH-2, RFHH-2, RFHH-3, SF-2, SFF-2, TF, TFF, TFN, TFFN, ZF, or ZFF. Conductors with other types and thickness of insulation shall be permitted if listed for non–power-limited fire alarm circuit use.

Informational Note: For application provisions, see Table 402.3.

760.49(C) Conductor Materials. Conductors shall be solid or stranded copper.

Exception to (B) and (C): *Wire Types PAF and PTF shall be permitted only for high-temperature applications between 90°C (194°F) and 250°C (482°F).*

760.51 Number of Conductors in Cable Trays and Raceways, and Ampacity Adjustment Factors.

760.51(A) NPLFA Circuits and Class 1 Circuits. Where only non-power-limited fire alarm circuit and Class 1 circuit conductors are in a raceway, the number of conductors shall be determined in accordance with 300.17. The ampacity adjustment factors given in 310.15(C)(1) shall apply if such conductors carry continuous load in excess of 10 percent of the ampacity of each conductor.

760.51(B) Power-Supply Conductors and NPLFA Circuit Conductors. Where power-supply conductors and non-power-limited fire alarm circuit conductors are permitted in a raceway in accordance with 760.48, the number of conductors shall be determined in accordance with 300.17. The ampacity adjustment factors given in 310.15(C)(1) shall apply as follows:

(1) To all conductors where the fire alarm circuit conductors carry continuous loads in excess of 10 percent of the ampacity of each conductor and where the total number of conductors is more than three

(2) To the power-supply conductors only, where the fire alarm circuit conductors do not carry continuous loads in excess of 10 percent of the ampacity of each conductor and where the number of power-supply conductors is more than three

760.51(C) Cable Trays. Where fire alarm circuit conductors are installed in cable trays, they shall comply with 392.22 and 392.80(A).

760.53 Multiconductor NPLFA Cables. Multiconductor non-power-limited fire alarm cables that meet the requirements of 760.176 shall be permitted to be used on fire alarm circuits operating at 150 volts or less and shall be installed in accordance with 760.53(A) and (B).

760.53(A) NPLFA Wiring Method. Multiconductor non-power-limited fire alarm circuit cables shall be installed in accordance with 760.53(A)(1), (A)(2), and (A)(3).

760.53(A)(1) In Raceways, Exposed on Ceilings or Sidewalls, or Fished in Concealed Spaces. Cable splices or terminations shall be made in listed fittings, boxes, enclosures, fire alarm devices, or utilization equipment. Where installed exposed, cables shall be adequately supported and installed in such a way that maximum protection against physical damage is afforded by building construction such as baseboards, door frames, ledges, and so forth. Where located within 2.1 m (7 ft) of the floor, cables shall be securely fastened in an approved manner at intervals of not more than 450 mm (18 in.).

760.53(A)(2) Passing Through a Floor or Wall. Cables shall be installed in metal raceway or rigid nonmetallic conduit where passing through a floor or wall to a height of 2.1 m (7 ft) above the floor, unless adequate protection can be afforded by building construction such as detailed in 760.53(A)(1), or unless an equivalent solid guard is provided.

760.53(A)(3) In Hoistways. Cables shall be installed in rigid metal conduit, rigid nonmetallic conduit, intermediate metal conduit, liquidtight flexible nonmetallic conduit, or electrical metallic tubing where installed in hoistways.

Exception: As provided for in 620.21 for elevators and similar equipment.

760.53(B) Applications of Listed NPLFA Cables. The use of non–power-limited fire alarm circuit cables shall comply with 760.53(B)(1) through (B)(4).

760.53(B)(1) Ducts Specifically Fabricated for Environmental Air. Multiconductor non–power-limited fire alarm circuit cables, Types NPLFP, NPLFR, and NPLF, shall not be installed exposed in ducts specifically fabricated for environmental air.

Informational Note: See 300.22(B).

760.53(B)(2) Other Spaces Used for Environmental Air (Plenums). Cables installed in other spaces used for environmental air shall be Type NPLFP.

Exception No. 1: Types NPLFR and NPLF cables installed in compliance with 300.22(C).

Exception No. 2: Other wiring methods in accordance with 300.22(C) and conductors in compliance with 760.49(C).

Exception No. 3: Type NPLFP-CI cable shall be permitted to be installed to provide a 2-hour circuit integrity rated cable.

760.53(B)(3) Riser. Cables installed in vertical runs and penetrating one or more floors, or cables installed in vertical runs in a shaft, shall be Type NPLFR. Floor penetrations requiring Type NPLFR shall contain only cables suitable for riser or plenum use.

Exception No. 1: Type NPLF or other cables that are specified in Chapter 3 and are in compliance with 760.49(C) and encased in metal raceway.

Exception No. 2: Type NPLF cables located in a fireproof shaft having firestops at each floor.

Informational Note: See 300.21 for firestop requirements for floor penetrations.

Exception No. 3: Type NPLF-CI cable shall be permitted to be installed to provide a 2-hour circuit integrity rated cable.

760.53(B)(4) Other Wiring Within Buildings. Cables installed in building locations other than the locations covered in 760.53(B)(1), (B)(2), and (B)(3) shall be Type NPLF.

Exception No. 1: Chapter 3 wiring methods with conductors in compliance with 760.49(C).

Exception No. 2: Type NPLFP or Type NPLFR cables shall be permitted.

Exception No. 3: Type NPLFR-CI cable shall be permitted to be installed to provide a 2-hour circuit integrity rated cable.

Part III. Power-Limited Fire Alarm (PLFA) Circuits

760.121 Power Sources for PLFA Circuits.

760.121(A) Power Source. The power source for a power-limited fire alarm circuit shall be as specified in the following:

Informational Note No. 1: Tables 12(A) and 12(B) in Chapter 9 provide the listing requirements for power-limited fire alarm circuit sources.
Informational Note No. 2: See 210.8(A)(5), Exception, for receptacles in dwelling-unit unfinished basements that supply power for fire alarm systems.

(1) A listed PLFA or Class 3 transformer

(2) A listed PLFA or Class 3 power supply

(3) Listed equipment marked to identify the PLFA power source

Informational Note: Examples of listed equipment are a fire alarm control panel with integral power source; a circuit card listed for use as a PLFA source, where used as part of a listed assembly; a current-limiting impedance, listed for the purpose or part of a listed product, used in conjunction with a non-power-limited transformer or a stored energy source, for example, storage battery, to limit the output current.

760.121(B) Branch Circuit. The branch circuit supplying the fire alarm equipment(s) shall supply no other loads. The location of the branch-circuit overcurrent protective device shall be permanently identified at the fire alarm control unit. The circuit disconnecting means shall have red identification, shall be accessible only to qualified personnel, and shall be identified as “FIRE ALARM CIRCUIT.” The red identification shall not damage the overcurrent protective devices or obscure the manufacturer's markings. This branch circuit shall not be supplied through ground-fault circuit interrupters or arc-fault circuit interrupters. The fire alarm branch-circuit disconnecting means shall be permitted to be secured in the “on” position.

760.124 Circuit Marking. The equipment supplying PLFA circuits shall be durably marked where plainly visible to indicate each circuit that is a power-limited fire alarm circuit.

Informational Note: See 760.130(A), Exception No. 3, where a power-limited circuit is to be reclassified as a non–power-limited circuit.

760.127 Wiring Methods on Supply Side of the PLFA Power Source. Conductors and equipment on the supply side of the power source shall be installed in accordance with the appropriate requirements of Part II and Chapters 1 through 4. Transformers or other devices supplied from power-supply conductors shall be protected by an overcurrent device rated not over 20 amperes.

Exception: The input leads of a transformer or other power source supplying power-limited fire alarm circuits shall be permitted to be smaller than 14 AWG, but not smaller than 18 AWG, if they are not over 300 mm (12 in.) long and if they have insulation that complies with 760.49(B).

760.130 Wiring Methods and Materials on Load Side of the PLFA Power Source. Parts I, III and V of Article 7XX shall apply to wiring methods and materials on load side of the PLFA power source.

~~Fire alarm circuits on the load side of the power source shall be permitted to be installed using wiring methods and materials in accordance with 760.130(A), (B), or a combination of (A) and (B).~~

~~**760.130(A) NPLFA Wiring Methods and Materials.** Installation shall be in accordance with 760.46, and conductors shall be solid or stranded copper.~~

~~*Exception No. 1: The ampacity adjustment factors given in 310.15(C)(1) shall not apply.*~~

~~*Exception No. 2: Conductors and multiconductor cables described in and installed in accordance with 760.49 and 760.53 shall be permitted.*~~

~~*Exception No. 3: Power-limited circuits shall be permitted to be reclassified and installed as non-power-limited circuits if the power-limited fire alarm circuit markings required by 760.124 are eliminated and the entire circuit is installed using the wiring methods and materials in accordance with Part II, Non-Power-Limited Fire Alarm Circuits.*~~

> ~~Informational Note: Power-limited circuits reclassified and installed as non-power-limited circuits are no longer power-limited circuits, regardless of the continued connection to a power-limited source.~~

~~**760.130(B) PLFA Wiring Methods and Materials.** Power-limited fire alarm conductors and cables described in 760.179 shall be installed as detailed in 760.130(B)(1), (B)(2), or (B)(3) of this section and 300.7. Devices shall be installed in accordance with 110.3(B), 300.11(A), and 300.15.~~

~~**760.130(B)(1) In Raceways, Exposed on Ceilings or Sidewalls, or Fished in Concealed Spaces.** Cable splices or terminations shall be made in listed fittings, boxes, enclosures, fire alarm devices, or utilization equipment. Where installed exposed, cables shall be adequately supported and installed in such a way that maximum protection against physical damage is afforded by building construction such as baseboards, door frames, ledges, and so forth. Where located within 2.1 m (7 ft) of the floor, cables shall be securely fastened in an approved manner at intervals of not more than 450 mm (18 in.).~~

~~**760.130(B)(2) Passing Through a Floor or Wall.** Cables shall be installed in metal raceways or rigid nonmetallic conduit where passing through a floor or wall to a height of 2.1 m (7 ft) above the floor, unless adequate protection can be afforded by building construction such as detailed in 760.130(B)(1), or unless an equivalent solid guard is provided.~~

~~**760.130(B)(3) In Hoistways.** Cables shall be installed in rigid metal conduit, rigid nonmetallic conduit, intermediate metal conduit, or electrical metallic tubing where installed in hoistways.~~

~~*Exception: As provided for in 620.21 for elevators and similar equipment.*~~

~~**760.133 Installation of Conductors and Equipment in Cables, Compartments, Cable Trays, Enclosures, Manholes, Outlet Boxes, Device Boxes, Raceways, and Cable Routing Assemblies for Power-Limited Fire Alarm Circuits.** Conductors and equipment for power-limited fire alarm circuits shall be installed in accordance with 760.135 through 760.143.~~

~~**760.135 Installation of PLFA Cables in Buildings.** Installation of power-limited fire alarm cables in buildings shall comply with 760.135(A) through (J).~~

~~**760.135(A) Listing.** PLFA cables installed in buildings shall be listed.~~

~~**760.135(B) Ducts Specifically Fabricated for Environmental Air.** The following cables shall be permitted in ducts specifically fabricated for environmental air as described in 300.22(B), if they are directly associated with the air distribution system:~~

~~(1) Types FPLP and FPLP-CI cables in lengths as short as practicable to perform the required function~~

~~(2) Types FPLP, FPLP-CI, FPLR, FPLR-CI, FPL, and FPL-CI cables installed in raceways that are installed in compliance with 300.22(B)~~

Informational Note: For information on fire protection of wiring installed in fabricated ducts, see 4.3.4.1 and 4.3.11.3.3 of NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

760.135(C) Other Spaces Used For Environmental Air (Plenums). The following cables shall be permitted in other spaces used for environmental air as described in 300.22(C):

(1) Type FPLP cables

(2) Type FPLP cables installed in plenum communications raceways

(3) Type FPLP cables installed in plenum routing assemblies

(4) Types FPLP and FPLP-CI cables supported by open metallic cable trays or cable tray systems

(5) Types FPLP, FPLR, and FPL cables installed in raceways that are installed in compliance with 300.22(C)

(6) Types FPLP, FPLR, and FPL cables supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)

(7) Types FPLP, FPLR, and FPL cables installed in plenum communications raceways, riser communications raceways, or general-purpose communications raceways supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)

760.135(D) Risers — Cables in Vertical Runs. The following cables shall be permitted in vertical runs penetrating one or more floors and in vertical runs in a shaft:

(1) Types FPLP and FPLR cables

(2) Types FPLP and FPLR cables installed in the following:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

Informational Note: See 300.21 for firestop requirements for floor penetrations.

760.135(E) Risers — Cables in Metal Raceways. The following cables shall be permitted in metal raceways in a riser having firestops at each floor:

(1) Types FPLP, FPLR, and FPL cables

(2) Types FPLP, FPLR, and FPL cables installed in the following:

a. Plenum communications raceways

b. Riser communications raceways

c. General-purpose communications raceways

Informational Note: See 300.21 for firestop requirements for floor penetrations.

760.135(F) Risers — Cables in Fireproof Shafts. The following cables shall be permitted to be installed in fireproof riser shafts having firestops at each floor:

(1) Types FPLP, FPLR, and FPL cables

(2) Types FPLP, FPLR, and FPL cables installed in the following:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

Informational Note: See 300.21 for firestop requirements for floor penetrations.

760.135(G) Risers — One- and Two-Family Dwellings. The following cables shall be permitted in one- and two-family dwellings:

(1) Types FPLP, FPLR, and FPL cables

(2) Types FPLP, FPLR, and FPL cables installed in the following:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

760.135(H) Other Building Locations. The following cables shall be permitted to be installed in building locations other than the locations covered in 770.113(B) through (H):

(1) Types FPLP, FPLR, and FPL cables

(2) Types FPLP, FPLR, and FPL cables installed in the following:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

(3) Types FPLP, FPLR, and FPL cables installed in a raceway of a type recognized in Chapter 3

760.135(I) Nonconcealed Spaces. Cables specified in Chapter 3 and meeting the requirements of 760.179(A) and (B) shall be permitted to be installed in nonconcealed spaces where the exposed length of cable does not exceed 3 m (10 ft).

760.135(J) Portable Fire Alarm System. A portable fire alarm system provided to protect a stage or set when not in use shall be permitted to use wiring methods in accordance with 530.12.

760.136 Separation from Electric Light, Power, Class 1, NPLFA, and Medium-Power Network-Powered Broadband Communications Circuit Conductors.

760.136(A) General. Power-limited fire alarm circuit cables and conductors shall not be placed in any cable, cable tray, compartment, enclosure, manhole, outlet box, device box, raceway, or similar fitting with conductors of electric light, power, Class 1, non-power-limited fire alarm circuits, and medium-power network-powered broadband communications circuits unless permitted by 760.136(B) through (G).

760.136(B) Separated by Barriers. Power-limited fire alarm circuit cables shall be permitted to be installed together with Class 1, non-power-limited fire alarm, and medium-power network-powered broadband communications circuits where they are separated by a barrier.

760.136(C) Raceways Within Enclosures. In enclosures, power-limited fire alarm circuits shall be permitted to be installed in a raceway within the enclosure to separate them from Class 1, non-power-limited fire alarm, and medium-power network-powered broadband communications circuits.

760.136(D) Associated Systems Within Enclosures. Power-limited fire alarm conductors in compartments, enclosures, device boxes, outlet boxes, or similar fittings shall be permitted to be installed with electric light, power, Class 1, non-power-limited fire alarm, and medium power network-powered broadband communications circuits where they are introduced solely to connect the equipment connected to power-limited fire alarm circuits, and comply with either of the following conditions:

(1) The electric light, power, Class 1, non-power-limited fire alarm, and medium-power network-powered broadband communications circuit conductors are routed to maintain a minimum of 6 mm (0.25 in.) separation from the conductors and cables of power-limited fire alarm circuits.

(2) The circuit conductors operate at 150 volts or less to ground and also comply with one of the following:

a. The fire alarm power-limited circuits are installed using Type FPL, FPLR, FPLP, or permitted substitute cables, provided these power-limited cable conductors extending beyond the jacket are separated by a minimum of 6 mm (0.25 in.) or by a nonconductive sleeve or nonconductive barrier from all other conductors.

b. The power-limited fire alarm circuit conductors are installed as non-power-limited circuits in accordance with 760.46.

760.136(E) Enclosures with Single Opening. Power-limited fire alarm circuit conductors entering compartments, enclosures, device boxes, outlet boxes, or similar fittings shall be permitted to be installed with electric light, power, Class 1, non-power-limited fire alarm, and medium-power network-powered broadband communications circuits where they are introduced solely to connect the equipment connected to power-limited fire alarm circuits or to other circuits controlled by the fire alarm system to which the other conductors in the enclosure are connected. Where power-limited fire alarm circuit conductors must enter an enclosure that is provided with a single opening, they shall be permitted to enter through a single fitting (such as a tee), provided the conductors are separated from the conductors of the other circuits by a continuous and firmly fixed nonconductor, such as flexible tubing.

760.136(F) In Hoistways. In hoistways, power-limited fire alarm circuit conductors shall be installed in rigid metal conduit, rigid nonmetallic conduit, intermediate metal conduit, liquidtight flexible nonmetallic conduit, or electrical metallic tubing. For elevators or similar equipment, these conductors shall be permitted to be installed as provided in 620.21.

760.136(G) Other Applications. For other applications, power-limited fire alarm circuit conductors shall be separated by at least 50 mm (2 in.) from conductors of any electric light, power, Class 1, non-power-limited fire alarm, or medium-power network-powered broadband communications circuits unless one of the following conditions is met:

(1) Either (a) all of the electric light, power, Class 1, non-power-limited fire alarm, and medium-power network-powered broadband communications circuit conductors or (b) all of the power-limited fire alarm circuit conductors are in a raceway or in metal-sheathed, metal-clad, nonmetallic-sheathed, or Type UF cables.

(2) All of the electric light, power, Class 1, non-power-limited fire alarm, and medium-power network-powered broadband communications circuit conductors are permanently separated from all of the power-limited fire alarm circuit conductors by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the conductors.

760.139 Installation of Conductors of Different PLFA Circuits, Class 2, Class 3, and Communications Circuits in the Same Cable, Enclosure, Cable Tray, Raceway, or Cable Routing Assembly.

~~**760.139(A) Two or More PLFA Circuits.**Cable and conductors of two or more power-limited fire alarm circuits, communications circuits, or Class 3 circuits shall be permitted within the same cable, enclosure, cable tray, raceway, or cable routing assembly.~~

~~**760.139(B) Class 2 Circuits with PLFA Circuits.**Conductors of one or more Class 2 circuits shall be permitted within the same cable, enclosure, cable tray, raceway, or cable routing assembly with conductors of power-limited fire alarm circuits, provided that the insulation of the Class 2 circuit conductors in the cable, enclosure, raceway, or cable routing assembly is at least that required by the power-limited fire alarm circuits.~~

~~**760.139(C) Low-Power Network-Powered Broadband Communications Cables and PLFA Cables.**Low-power network-powered broadband communications circuits shall be permitted in the same enclosure, cable tray, raceway, or cable routing assembly with PLFA cables.~~

~~**760.139(D) Audio System Circuits and PLFA Circuits.**Audio system circuits described in 640.9(C) and installed using Class 2 or Class 3 wiring methods in compliance with 725.133 and 725.154 shall not be permitted to be installed in the same cable, cable tray, raceway, or cable routing assembly with power-limited conductors or cables.~~

~~**760.142 Conductor Size.**Conductors of 26 AWG shall be permitted only where spliced with a connector listed as suitable for 26 AWG to 24 AWG or larger conductors that are terminated on equipment or where the 26 AWG conductors are terminated on equipment listed as suitable for 26 AWG conductors. Single conductors shall not be smaller than 18 AWG.~~

~~**760.143 Support of Conducto**Power-limited fire alarm circuit conductors shall not be strapped, taped, or attached by any means to the exterior of any conduit or other raceway as a means of support.~~

760.145 Current-Carrying Continuous Line-Type Fire Detectors.

760.145(A) Application. Listed continuous line-type fire detectors, including insulated copper tubing of pneumatically operated detectors, employed for both detection and carrying signaling currents shall be permitted to be used in power-limited circuits.

760.145(B) Installation. Continuous line-type fire detectors shall be installed in accordance with 760.124 through 760.130 and 760.133.

~~**760.154 Applications of Listed PLFA Cables.**PLFA cables shall comply with the requirements described in Table 760.154 or where cable substitutions are made as shown in 760.154(A). Where substitute cables are installed, the wiring requirements of Article 760, Parts I and III, shall apply. Types FPLP-CI, FPLR-CI, and FPL-CI cables shall be permitted to be installed to provide 2-hour circuit integrity rated cables.~~

Table 760.154 Applications of Listed PLFA Cables in Buildings

Applications		Cable Type		
		FPLP & FPLP-CI	FPLR & FPLR-CI	FPL & FPL-CI
In fabricated ducts as described in 300.22(B)	In fabricated ducts	Y*	N	N
	In metal raceway that complies with 300.22(B)	Y*	Y*	Y*
In other spaces used for environmental air as described in 300.22(C)	In other spaces used for environmental air	Y*	N	N
	In metal raceway that complies with 300.22(C)	Y*	Y*	Y*
	In plenum communications raceways	Y*	N	N
	In plenum cable routing assemblies	Y*	N	N
	Supported by open metal cable trays	Y*	N	N
	Supported by solid bottom metal cable trays with solid metal covers	Y*	Y*	Y*
In risers	In vertical runs	Y*	Y*	N
	In metal raceways	Y*	Y*	Y*
	In fireproof shafts	Y*	Y*	Y*
	In plenum communications raceways	Y*	Y*	N
	In plenum cable routing assemblies	Y*	Y*	N
	In riser communications raceways	Y*	Y*	N
	In riser cable routing assemblies	Y*	Y*	N

Table 760.154 Applications of Listed PLFA Cables in Buildings

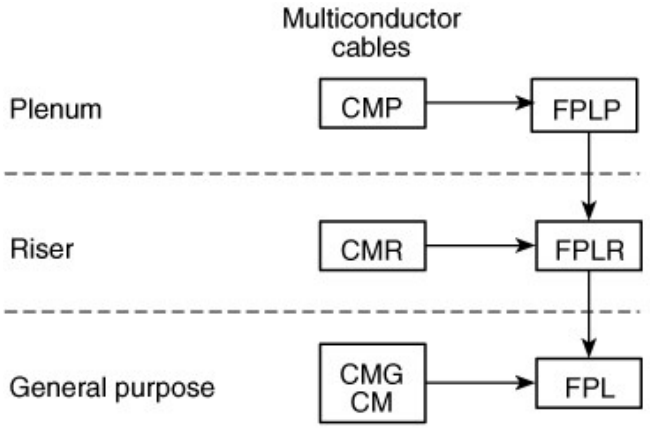
Applications		Cable Type		
		FPLP & FPLP-CI	FPLR & FPLR-CI	FPL & FPL-CI
	In one- and two-family dwellings	Y*	Y*	Y*
Within buildings in other than air-handling spaces and risers	General	Y*	Y*	Y*
	Supported by cable trays	Y*	Y*	Y*
	In any raceway recognized in Chapter 3	Y*	Y*	Y*
	In plenum communications raceway	Y*	Y*	Y*
	In plenum cable routing assemblies	Y*	Y*	Y*
	In riser communications raceways	Y*	Y*	Y*
	In riser cable routing assemblies	Y*	Y*	Y*
	In general-purpose communications raceways	Y*	Y*	Y*
	In general-purpose cable routing assemblies	Y*	Y*	Y*

Note:
"N" indicates that the cable type shall not be permitted to be installed in the application.
"Y*" indicates that the cable type shall be permitted to be installed in the application subject to the limitations described in 760.130 through 760.145.

~~**760.154(A) Fire Alarm Cable Substitutions.** The substitutions for fire alarm cables listed in Table 760.154(A) and illustrated in Figure 760.154(A) shall be permitted. Where substitute cables are installed, the wiring requirements of Article 760, Parts I and III, shall apply.~~

~~Informational Note: For information on communications cables (CMP, CMR, CMG, CM), see 805.179.~~

~~**Figure 760.154(A) Cable Substitution Hierarchy.**~~



Type CM—Communications wires and cables
Type FPL—Power-limited fire alarm cables

A → B Cable A shall be permitted to be used in place of cable B, 26 AWG minimum

~~**Table 760.154(A) Cable Substitutions**~~

~~Cable Type~~	~~Permitted Substitutions~~
~~FPLP~~	~~CMP~~
~~FPLR~~	~~CMP, FPLP, CMR~~
~~FPL~~	~~CMP, FPLP, CMR, FPLR, CMG, CM~~

Part IV. Listing Requirements

760.176 Listing and Marking of NPLFA Cables. Non-power-limited fire alarm cables installed as wiring within buildings shall be listed in accordance with 760.176(A) and (B) and as being resistant to the spread of fire in accordance with 760.176(C) through (F), and shall be marked in accordance with 760.176(G). Cable used in a wet location shall be listed for use in wet locations or have a moisture-impervious metal sheath. Non-power-limited fire alarm cables shall have a temperature rating of not less than 60°C (140°F).

760.176(A) NPLFA Conductor Materials. Conductors shall be 18 AWG or larger solid or stranded copper.

760.176(B) Insulated Conductors. Insulation on conductors shall be rated for the system voltage and not less than 600 V. Insulated conductors 14 AWG and larger shall be one of the types listed in Table 310.4(A) or one that is identified for this use. Insulated conductors 18 AWG and 16 AWG shall be in accordance with 760.49.

760.176(C) Type NPLFP. Type NPLFP non-power-limited fire alarm cable for use in other space used for environmental air shall be listed as being suitable for use in other space used for environmental air as described in 300.22(C) and shall also be listed as having adequate fire-resistant and low smoke–producing characteristics.

Informational Note: One method of defining a cable that is low-smoke producing cable and fire-resistant cable is that the cable exhibits a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.52 m (5 ft) or less when tested in accordance with NFPA 262-2019, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces*.

760.176(D) Type NPLFR. Type NPLFR non–power-limited fire alarm riser cable shall be listed as being suitable for use in a vertical run in a shaft or from floor to floor and shall also be listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor.

Informational Note: One method of defining fire-resistant characteristics capable of preventing the carrying of fire from floor to floor is that the cables pass ANSI/UL 1666-2012, *Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts*.

760.176(E) Type NPLF. Type NPLF non–power-limited fire alarm cable shall be listed as being suitable for general-purpose fire alarm use, with the exception of risers, ducts, plenums, and other space used for environmental air, and shall also be listed as being resistant to the spread of fire.

Informational Note: One method of defining *resistant to the spread of fire* is that the cables do not spread fire to the top of the tray in the "UL Flame Exposure, Vertical Tray Flame Test" in ANSI/UL 1685-2010, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*. The smoke measurements in the test method are not applicable.
Another method of defining *resistant to the spread of fire* is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA "Vertical Flame Test — Cables in Cable Trays," as described in CSA C22.2 No. 0.3-M-2001, *Test Methods for Electrical Wires and Cables*.

760.176(F) Fire Alarm Circuit Integrity (CI) Cable or Electrical Circuit Protective System. Cables that are used for survivability of critical circuits under fire conditions shall meet either 760.176(F)(1) or (F)(2).

Informational Note No. 1: Fire alarm circuit integrity (CI) cable and electrical circuit protective systems may be used for fire alarm circuits to comply with the survivability requirements of NFPA 72-2019, National Fire Alarm and Signaling Code, 12.4.3 and 12.4.4, that the circuit maintain its electrical function during fire conditions for a defined period of time.
Informational Note No. 2: One method of defining circuit integrity (CI) cable or an electrical circuit protective system is by establishing a minimum 2-hour fire-resistive rating for the cable when tested in accordance with ANSI/UL 2196-2017, *Standard for Fire Test for Circuit Integrity of Fire -Resistive Power, Instrumentation, Control, and Data Cables*.
Informational Note No. 3: UL guide information for electrical circuit protective systems (FHIT) contains information on proper installation requirements for maintaining the fire rating.

760.176(F)(1) Circuit Integrity (CI) Cables. Circuit integrity (CI) cables, specified in 760.176(C), (D), and (E), and used for survivability of critical circuits, shall have an additional classification using the suffix "CI." Circuit integrity (CI) cables shall only be permitted to be installed in a raceway where specifically listed and marked as part of an electrical circuit protective system as covered in 760.176(F)(2).

760.176(F)(2) Electrical Circuit Protective System. Cables specified in 760.176(C), (D), (E), and (F)(1), that are part of an electrical circuit protective system, shall be identified with the protective system number and hourly rating printed on the outer jacket of the cable and installed in accordance with the listing of the protective system.

760.176(G) NPLFA Cable Markings. Multiconductor non–power-limited fire alarm cables shall be marked in accordance with Table 760.176(G). Non–power-limited fire alarm circuit cables shall be permitted to be marked with a maximum usage voltage rating of 150 volts. Cables that are listed for circuit integrity shall be identified with the suffix "-CI" as defined in 760.176(F). The temperature rating shall be marked on the jacket of NPLFA cables that have a temperature rating exceeding 60°C (140°F). The jacket of NPLFA cables shall be marked with the conductor size.

Informational Note: Cable types are listed in descending order of fire performance.

Table 760.176(G) NPLFA Cable Markings

Cable Marking	Type	Reference
NPLFP	Non–power-limited fire alarm circuit cable for use in "other space used for environmental air"	760.176(C) and (G)
NPLFR	Non–power-limited fire alarm circuit riser cable	760.176(D) and (G)
NPLF	Non–power-limited fire alarm circuit cable	760.176(E) and (G)

Note: Cables identified in 760.176(C), (D), and (E) and meeting the requirements for circuit integrity shall have the additional classification using the suffix "-CI" (for example, NPLFP-CI, NPLFR-CI, and NPLF-CI).

760.179 Listing and Marking of ~~PLFA Cables and~~ Insulated Continuous Line-Type Fire Detectors. ~~PLFA cables installed as wiring within buildings shall be listed as being resistant to the spread of fire and other criteria in accordance with 760.179(A) through (H) and shall be marked in accordance with 760.179(I).~~ Insulated continuous line-type fire detectors shall be listed in accordance with760.179(A) through (D) ~~760.179(J)~~. ~~Cable used in a wet location shall be listed for use in wet locations or have a moisture-impervious metal sheath.~~

(A) The cable shall be listed as being resistant to the spread of fire in accordance with 7XX.179(A)(1), (2) and (3)

(B) The cable shall have a voltage rating of not less than 300 volts. The cable shall have a temperature rating of not less than 60°C (140°F).

(C) The cable shall be marked with a fire resistance type FPLP, FPLR or FPL in accordance with 7XX.179(B). The voltage rating shall not be marked on the cable. The temperature rating shall be marked on the jacket that have a temperature rating exceeding 60°C (140°F). The jacket of PLFA cables shall be marked with the conductor size.

Informational Note: Voltage ratings on cables may be misinterpreted to suggest that the cables may be suitable for Class 1, electric light, and power applications.

Exception: Voltage markings shall be permitted where the cable has multiple listings and voltage marking is required for one or more of the listings.

(D) The cable jacket compound shall have a high degree of abrasion resistance.

~~**760.179(E) Type FPLR.**Type FPLR power-limited fire alarm riser cable shall be listed as being suitable for use in a vertical run in a shaft or from floor to floor and shall also be listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor.~~

~~Informational Note: One method of defining fire-resistant characteristics capable of preventing the carrying of fire from floor to floor is that the cables pass the requirements of ANSI/UL 1666-2012, *Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts*.~~

~~**760.179(F) Type FPL.**Type FPL power-limited fire alarm cable shall be listed as being suitable for general-purpose fire alarm use, with the exception of risers, ducts, plenums, and other spaces used for environmental air, and shall also be listed as being resistant to the spread of fire.~~

~~Informational Note: One method of defining *resistant to the spread of fire* is that the cables do not spread fire to the top of the tray in the "UL Flame Exposure, Vertical Tray Flame Test" in ANSI/UL 1685-2012, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*. The smoke measurements in the test method are not applicable.~~
~~Another method of defining *resistant to the spread of fire* is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA "Vertical Flame Test — Cables in Cable Trays," as described in CSA C22.2 No. 0.3-M 2001, *Test Methods for Electrical Wires and Cables*.~~

~~**760.179(G) Fire Alarm Circuit Integrity (CI) Cable or Electrical Circuit Protective System.**Cables that are used for survivability of critical circuits under fire conditions shall meet either 760.179(G)(1) or (G)(2).~~

Informational Note No. 1: Fire alarm circuit integrity (CI) cable and electrical circuit protective systems may be used for fire alarm circuits to comply with the survivability requirements of *NFPA 72*-2019,, *National Fire Alarm and Signaling Code*, 12.4.3 and 12.4.4, that the circuit maintain its electrical function during fire conditions for a defined period of time.
Informational Note No. 2: One method of defining circuit integrity (CI) cable or an electrical circuit protective system is by establishing a minimum 2-hour fire-resistive rating for the cable when tested in accordance with ANSI/UL 2196-2017, *Standard for Fire Test for Circuit Integrity of Fire -Resistive Power, Instrumentation, Control and Data Cables*.
Informational Note No. 3: UL guide information for electrical circuit protective systems (FHIT) contains information on proper installation requirements for maintaining the fire rating.

760.179(G)(1) Circuit Integrity (CI) Cables. Circuit integrity (CI) cables specified in 760.179(D), (E), (F), and (H), and used for survivability of critical circuits, shall have an additional classification using the suffix "CI." Circuit integrity (CI) cables shall only be permitted to be installed in a raceway where specifically listed and marked as part of an electrical circuit protective system as covered in 760.179(G)(2).

760.179(G)(2) Electrical Circuit Protective System. Cables specified in 760.179(D), (E), (F), (H), and (G)(1), that are part of an electrical circuit protective system, shall be identified with the protective system number and hourly rating printed on the outer jacket of the cable and installed in accordance with the listing of the protective system.

760.179(H) Coaxial Cables. Coaxial cables shall be permitted to use 30 percent conductivity copper-covered steel center conductor wire and shall be listed as Type FPLP, FPLR, or FPL cable.

760.179(I) Cable Marking. The cable shall be marked in accordance with Table 760.179(I). The voltage rating shall not be marked on the cable. Cables that are listed for circuit integrity shall be identified with the suffix "-CI" as defined in 760.179(G). The temperature rating shall be marked on the jacket of PLFA cables that have a temperature rating exceeding 60°C (140°F). The jacket of PLFA cables shall be marked with the conductor size.

Informational Note: Voltage ratings on cables may be misinterpreted to suggest that the cables may be suitable for Class 1, electric light, and power applications.

Exception: **Voltage markings shall be permitted where the cable has multiple listings and voltage marking is required for one or more of the listings.**

Table 760.179(I) Cable Markings

Cable Marking	Type
FPLP	Power-limited fire alarm plenum cable
FPLR	Power-limited fire alarm riser cable
FPL	Power-limited fire alarm cable

Note: Cables identified in 760.179(D), (E), and (F) as meeting the requirements for circuit integrity shall have the additional classification using the suffix "-CI" (for example, FPLP-CI, FPLR-CI, and FPL-CI).
Informational Note: Cable types are listed in descending order of fire performance.

ARTICLE 760 Fire Alarm Systems

Part I. General

760.1 Scope. This article covers the installation of wiring and equipment of fire alarm systems, including all circuits controlled and powered by the fire alarm system.

Informational Note No. 1: Fire alarm systems include fire detection and alarm notification, guard's tour, sprinkler waterflow, and sprinkler supervisory systems. Circuits controlled and powered by the fire alarm system include circuits for the control of building systems safety functions, elevator capture, elevator shutdown, door release, smoke doors and damper control, fire doors and damper control and fan shutdown, but only where these circuits are powered by and controlled by the fire alarm system. For further information on the installation and monitoring for integrity requirements for fire alarm systems, refer to the *NFPA 72*-2019, *National Fire Alarm and Signaling Code*.
Informational Note No. 2: Class 1, 2, and 3 circuits are defined in Article 725.

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

Abandoned Fire Alarm Cable. Installed fire alarm cable that is not terminated at equipment other than a connector and not identified for future use with a tag.

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

Fire Alarm Circuit Integrity (CI) Cable. Cable used in fire alarm systems to ensure continued operation of critical circuits during a specified time under fire conditions.

Non–Power-Limited Fire Alarm Circuit (NPLFA). A fire alarm circuit powered by a source that complies with 760.41 and 760.43.

Power-Limited Fire Alarm Circuit (PLFA). A fire alarm circuit powered by a source that complies with 760.121.

760.3 Other Articles. Circuits and equipment shall comply with 760.3(A) through (O). Only those sections of Article 300 referenced in this article shall apply to fire alarm systems.

760.3(A) Spread of Fire or Products of Combustion. See 300.21.

760.3(B) Ducts, Plenums, and Other Air-Handling Spaces. Non-power-limited fire alarm cables installed in ducts, plenums, or other spaces used for environmental air shall comply with 300.22.

760.3(C) Corrosive, Damp, or Wet Locations. Sections 110.11, 300.5(B), 300.6, 300.9, and 310.10(F), where installed in corrosive, damp, or wet locations.

760.3(D Building Control Circuits. Article 725, where building control circuits (e.g., elevator capture, fan shutdown) are associated with the fire alarm system.

760.3(E) Optical Fiber Cables. Where optical fiber cables are utilized for fire alarm circuits, the cables shall be installed in accordance with Article 7XX Parts I, IV and V.

760.3(F) Installation of Conductors with Other Systems. Installations shall comply with 300.8.

760.3(G) Raceways or Sleeves Exposed to Different Temperatures. Installations shall comply with 300.7(A).

760.3(H) Vertical Support for Fire Rated Cables and Conductors. Vertical installations of circuit integrity (CI) cables and conductors installed in a raceway or conductors and cables of electrical circuit protective systems shall be installed in accordance with 300.19.

760.3(I) Number and Size of Cables and Conductors in Raceway. Installations shall comply with 300.17.

760.3(J) Bushing. A bushing shall be installed where cables emerge from raceway used for mechanical support or protection in accordance with 300.15(C).

760.3(K) Cable Routing Assemblies. Power-limited fire alarm cables shall be permitted to be installed in plenum cable routing assemblies, riser cable routing assemblies, and general-purpose cable routing assemblies selected in accordance with Table 800.154(c), listed in accordance with 800.182, and installed in accordance with 800.110(C) and 800.113.

760.3(L) Communications Raceways. Power-limited fire alarm cables shall be permitted to be installed in plenum communications raceways, riser communications raceways, and general-purpose communications raceways selected in accordance with Table 800.154(b), listed in accordance with 800.182, and installed in accordance with 800.113 and 362.24 through 362.56, where the requirements applicable to electrical nonmetallic tubing apply.

760.3(M) Temperature Limitations of Power-Limited and Non–Power-Limited Fire Alarm Cables. The requirements of 310.14(A)(3) on the temperature limitation of conductors shall apply to power-limited fire alarm cables and non–power-limited fire alarms cables.

760.3(N) Identification of Equipment Grounding Conductors. Equipment grounding conductors shall be identified in accordance with 250.119.

725.3(O) Cables for Power-limited Fire Alarm (PLFA) Circuits. The listing and installation of cables for power limited fire alarm circuits shall comply with Article 7XX Parts I, III and V.

760.12 Uses Not Permitted. Cables and equipment shall not be installed in any hazardous (classified) location, except as permitted by other articles of this Code.

> Informational Note: Hazardous locations are covered in Articles 500 through 516 and in Article 517 Part IV.

760.21 Access to Electrical Equipment Behind Panels Designed to Allow Access. Access to electrical equipment shall not be denied by an accumulation of conductors and cables that prevents removal of panels, including suspended ceiling panels.

760.24 Mechanical Execution of Work.

760.24(A) General. Fire alarm circuits shall be installed in a neat workmanlike manner. Cables and conductors installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be supported by straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also comply with 300.4 and 300.11.

> Informational Note: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants might result in an undetermined alteration of PLFA and NPLFA cable properties.

760.24(B) Circuit Integrity (CI) Cable. Circuit integrity (CI) cables shall be supported at a distance not exceeding 610 mm (24 in.). Where located within 2.1 m (7 ft) of the floor, as covered in 760.53(A)(1) and 760.130(B)(1), as applicable, the cable shall be fastened in an approved manner at intervals of not more than 450 mm (18 in.). Cable supports and fasteners shall be steel.

760.25 Abandoned Cables. The accessible portion of abandoned fire alarm cables shall be removed. Where cables are identified for future use with a tag, the tag shall be of sufficient durability to withstand the environment involved.

760.30 Fire Alarm Circuit Identification. Fire alarm circuits shall be identified at terminal and junction locations in a manner that helps to prevent unintentional signals on fire alarm system circuit(s) during testing and servicing of other systems.

760.32 Fire Alarm Circuits Extending Beyond One Building. Non–power-limited fire alarm circuits and power-limited fire alarm circuits that extend beyond one building and run outdoors shall meet the installation requirements of Parts II, III, and IV of Article 805 and shall meet the installation requirements of Part I of Article 300.

> Informational Note: An example of a protective device suitable to provide protection is a device tested to the requirements of ANSI/UL 497B, *Protectors for Data Communications*.

760.35 Fire Alarm Circuit Requirements. Fire alarm circuits shall comply with 760.35(A) and (B).

760.35(A) Non–Power-Limited Fire Alarm (NPLFA) Circuits. See Parts I and II.

760.35(B) Power-Limited Fire Alarm (PLFA) Circuits. See Parts I and III.

Part II. Non–Power-Limited Fire Alarm (NPLFA) Circuits

760.41 NPLFA Circuit Power Source Requirements.

760.41(A) Power Source. The power source of non–power-limited fire alarm circuits shall comply with Chapters 1 through 4, and the output voltage shall be not more than 600 volts, nominal. The fire alarm circuit disconnect shall be permitted to be secured in the "on" position.

760.41(B) Branch Circuit. The branch circuit supplying the fire alarm equipment(s) shall supply no other loads. The location of the branch-circuit overcurrent protective device shall be permanently identified at the fire alarm control unit. The circuit disconnecting means shall have red identification, shall be accessible only to qualified personnel, and shall be identified as "FIRE ALARM CIRCUIT." The red identification shall not damage the overcurrent protective devices or obscure the manufacturer's markings. This branch circuit shall not be supplied through ground-fault circuit interrupters or arc-fault circuit-interrupters.

Informational Note: See 210.8(A)(5), Exception, for receptacles in dwelling-unit unfinished basements that supply power for fire alarm systems.

760.43 NPLFA Circuit Overcurrent Protection. Overcurrent protection for conductors 14 AWG and larger shall be provided in accordance with the conductor ampacity without applying the ampacity adjustment and correction factors of 310.14 to the ampacity calculation. Overcurrent protection shall not exceed 7 amperes for 18 AWG conductors and 10 amperes for 16 AWG conductors.

Exception: Where other articles of this Code permit or require other overcurrent protection.

760.45 NPLFA Circuit Overcurrent Device Location. Overcurrent devices shall be located at the point where the conductor to be protected receives its supply.

Exception No. 1: Where the overcurrent device protecting the larger conductor also protects the smaller conductor.

Exception No. 2: Transformer secondary conductors. Non–power-limited fire alarm circuit conductors supplied by the secondary of a single-phase transformer that has only a 2-wire (single-voltage) secondary shall be permitted to be protected by overcurrent protection provided by the primary (supply) side of the transformer, provided the protection is in accordance with 450.3 and does not exceed the value determined by multiplying the secondary conductor ampacity by the secondary-to-primary transformer voltage ratio. Transformer secondary conductors other than 2-wire shall not be considered to be protected by the primary overcurrent protection.

Exception No. 3: Electronic power source output conductors. Non–power-limited circuit conductors supplied by the output of a single-phase, listed electronic power source, other than a transformer, having only a 2-wire (single-voltage) output for connection to non–power-limited circuits shall be permitted to be protected by overcurrent protection provided on the input side of the electronic power source, provided this protection does not exceed the value determined by multiplying the non–power-limited circuit conductor ampacity by the output-to-input voltage ratio. Electronic power source outputs, other than 2-wire (single voltage), connected to non–power-limited circuits shall not be considered to be protected by overcurrent protection on the input of the electronic power source.

Informational Note: A single-phase, listed electronic power supply whose output supplies a 2-wire (single-voltage) circuit is an example of a non–power-limited power source that meets the requirements of 760.41.

760.46 NPLFA Circuit Wiring. Installation of non–power-limited fire alarm circuits shall be in accordance with 110.3(B), 300.7, 300.11, 300.15, 300.17, 300.19(B), and other appropriate articles of Chapter 3.

Exception No. 1: As provided in 760.48 through 760.53.

Exception No. 2: Where other articles of this Code require other methods.

760.48 Conductors of Different Circuits in Same Cable, Enclosure, or Raceway.

760.48(A) Class 1 with NPLFA Circuits. Class 1 and non–power-limited fire alarm circuits shall be permitted to occupy the same cable, enclosure, or raceway without regard to whether the individual circuits are alternating current or direct current, provided all conductors are insulated for the maximum voltage of any conductor in the enclosure or raceway.

760.48(B) Fire Alarm with Power-Supply Circuits. Power-supply and fire alarm circuit conductors shall be permitted in the same cable, enclosure, or raceway only where connected to the same equipment.

760.49 NPLFA Circuit Conductors.

760.49(A) Sizes and Use. Only copper conductors shall be permitted to be used for fire alarm systems. Size 18 AWG and 16 AWG conductors shall be permitted to be used, provided they supply loads that do not exceed the ampacities given in Table 402.5 and are installed in a raceway, an approved enclosure, or a listed cable. Conductors larger than 16 AWG shall not supply loads greater than the ampacities given in 310.14, as applicable.

760.49(B) Insulation. Insulation on conductors shall be rated for the system voltage and not less than 600 volts. Conductors larger than 16 AWG shall comply with Article 310. Conductors 18 AWG and 16 AWG shall be Type KF-2, KFF-2, PAFF, PTFF, PF, PFF, PGF, PGFF, RFH-2, RFHH-2, RFHH-3, SF-2, SFF-2, TF, TFF, TFN, TFFN, ZF, or ZFF. Conductors with other types and thickness of insulation shall be permitted if listed for non–power-limited fire alarm circuit use.

Informational Note: For application provisions, see Table 402.3.

760.49(C) Conductor Materials. Conductors shall be solid or stranded copper.

Exception to (B) and (C): Wire Types PAF and PTF shall be permitted only for high-temperature applications between 90°C (194°F) and 250°C (482°F).

760.51 Number of Conductors in Cable Trays and Raceways, and Ampacity Adjustment Factors.

760.51(A) NPLFA Circuits and Class 1 Circuits. Where only non-power-limited fire alarm circuit and Class 1 circuit conductors are in a raceway, the number of conductors shall be determined in accordance with 300.17. The ampacity adjustment factors given in 310.15(C)(1) shall apply if such conductors carry continuous load in excess of 10 percent of the ampacity of each conductor.

760.51(B) Power-Supply Conductors and NPLFA Circuit Conductors. Where power-supply conductors and non-power-limited fire alarm circuit conductors are permitted in a raceway in accordance with 760.48, the number of conductors shall be determined in accordance with 300.17. The ampacity adjustment factors given in 310.15(C)(1) shall apply as follows:

(1) To all conductors where the fire alarm circuit conductors carry continuous loads in excess of 10 percent of the ampacity of each conductor and where the total number of conductors is more than three

(2) To the power-supply conductors only, where the fire alarm circuit conductors do not carry continuous loads in excess of 10 percent of the ampacity of each conductor and where the number of power-supply conductors is more than three

760.51(C) Cable Trays. Where fire alarm circuit conductors are installed in cable trays, they shall comply with 392.22 and 392.80(A).

760.53 Multiconductor NPLFA Cables. Multiconductor non-power-limited fire alarm cables that meet the requirements of 760.176 shall be permitted to be used on fire alarm circuits operating at 150 volts or less and shall be installed in accordance with 760.53(A) and (B).

760.53(A) NPLFA Wiring Method. Multiconductor non-power-limited fire alarm circuit cables shall be installed in accordance with 760.53(A)(1), (A)(2), and (A)(3).

760.53(A)(1) In Raceways, Exposed on Ceilings or Sidewalls, or Fished in Concealed Spaces. Cable splices or terminations shall be made in listed fittings, boxes, enclosures, fire alarm devices, or utilization equipment. Where installed exposed, cables shall be adequately supported and installed in such a way that maximum protection against physical damage is afforded by building construction such as baseboards, door frames, ledges, and so forth. Where located within 2.1 m (7 ft) of the floor, cables shall be securely fastened in an approved manner at intervals of not more than 450 mm (18 in.).

760.53(A)(2) Passing Through a Floor or Wall. Cables shall be installed in metal raceway or rigid nonmetallic conduit where passing through a floor or wall to a height of 2.1 m (7 ft) above the floor, unless adequate protection can be afforded by building construction such as detailed in 760.53(A)(1), or unless an equivalent solid guard is provided.

760.53(A)(3) In Hoistways. Cables shall be installed in rigid metal conduit, rigid nonmetallic conduit, intermediate metal conduit, liquidtight flexible nonmetallic conduit, or electrical metallic tubing where installed in hoistways.

Exception: As provided for in 620.21 for elevators and similar equipment.

760.53(B) Applications of Listed NPLFA Cables. The use of non–power-limited fire alarm circuit cables shall comply with 760.53(B)(1) through (B)(4).

760.53(B)(1) Ducts Specifically Fabricated for Environmental Air. Multiconductor non–power-limited fire alarm circuit cables, Types NPLFP, NPLFR, and NPLF, shall not be installed exposed in ducts specifically fabricated for environmental air.

Informational Note: See 300.22(B).

760.53(B)(2) Other Spaces Used for Environmental Air (Plenums). Cables installed in other spaces used for environmental air shall be Type NPLFP.

Exception No. 1: *Types NPLFR and NPLF cables installed in compliance with 300.22(C).*

Exception No. 2: *Other wiring methods in accordance with 300.22(C) and conductors in compliance with 760.49(C).*

Exception No. 3: *Type NPLFP-CI cable shall be permitted to be installed to provide a 2-hour circuit integrity rated cable.*

760.53(B)(3) Riser. Cables installed in vertical runs and penetrating one or more floors, or cables installed in vertical runs in a shaft, shall be Type NPLFR. Floor penetrations requiring Type NPLFR shall contain only cables suitable for riser or plenum use.

Exception No. 1: *Type NPLF or other cables that are specified in Chapter 3 and are in compliance with 760.49(C) and encased in metal raceway.*

Exception No. 2: *Type NPLF cables located in a fireproof shaft having firestops at each floor.*

Informational Note: See 300.21 for firestop requirements for floor penetrations.

Exception No. 3: *Type NPLF-CI cable shall be permitted to be installed to provide a 2-hour circuit integrity rated cable.*

760.53(B)(4) Other Wiring Within Buildings. Cables installed in building locations other than the locations covered in 760.53(B)(1), (B)(2), and (B)(3) shall be Type NPLF.

Exception No. 1: *Chapter 3 wiring methods with conductors in compliance with 760.49(C).*

Exception No. 2: *Type NPLFP or Type NPLFR cables shall be permitted.*

Exception No. 3: *Type NPLFR-CI cable shall be permitted to be installed to provide a 2-hour circuit integrity rated cable.*

Part III. Power-Limited Fire Alarm (PLFA) Circuits

760.121 Power Sources for PLFA Circuits.

760.121(A) Power Source. The power source for a power-limited fire alarm circuit shall be as specified in the following:

Informational Note No. 1: Tables 12(A) and 12(B) in Chapter 9 provide the listing requirements for power-limited fire alarm circuit sources.
Informational Note No. 2: See 210.8(A)(5), Exception, for receptacles in dwelling-unit unfinished basements that supply power for fire alarm systems.

(1) A listed PLFA or Class 3 transformer

(2) A listed PLFA or Class 3 power supply

(3) Listed equipment marked to identify the PLFA power source

Informational Note: Examples of listed equipment are a fire alarm control panel with integral power source; a circuit card listed for use as a PLFA source, where used as part of a listed assembly; a current-limiting impedance, listed for the purpose or part of a listed product, used in conjunction with a non-power-limited transformer or a stored energy source, for example, storage battery, to limit the output current.

760.121(B) Branch Circuit. The branch circuit supplying the fire alarm equipment(s) shall supply no other loads. The location of the branch-circuit overcurrent protective device shall be permanently identified at the fire alarm control unit. The circuit disconnecting means shall have red identification, shall be accessible only to qualified personnel, and shall be identified as “FIRE ALARM CIRCUIT.” The red identification shall not damage the overcurrent protective devices or obscure the manufacturer's markings. This branch circuit shall not be supplied through ground-fault circuit interrupters or arc-fault circuit interrupters. The fire alarm branch-circuit disconnecting means shall be permitted to be secured in the “on” position.

760.124 Circuit Marking. The equipment supplying PLFA circuits shall be durably marked where plainly visible to indicate each circuit that is a power-limited fire alarm circuit.

Informational Note: See 760.130(A), Exception No. 3, where a power-limited circuit is to be reclassified as a non–power-limited circuit.

760.127 Wiring Methods on Supply Side of the PLFA Power Source. Conductors and equipment on the supply side of the power source shall be installed in accordance with the appropriate requirements of Part II and Chapters 1 through 4. Transformers or other devices supplied from power-supply conductors shall be protected by an overcurrent device rated not over 20 amperes.

Exception: The input leads of a transformer or other power source supplying power-limited fire alarm circuits shall be permitted to be smaller than 14 AWG, but not smaller than 18 AWG, if they are not over 300 mm (12 in.) long and if they have insulation that complies with 760.49(B).

760.130 Wiring Methods and Materials on Load Side of the PLFA Power Source. Parts I, III and V of Article 7XX shall apply to wiring methods and materials on load side of the PLFA power source.

760.145 Current-Carrying Continuous Line-Type Fire Detectors.

760.145(A) Application. Listed continuous line-type fire detectors, including insulated copper tubing of pneumatically operated detectors, employed for both detection and carrying signaling currents shall be permitted to be used in power-limited circuits.

760.145(B) Installation. Continuous line-type fire detectors shall be installed in accordance with 760.124 through 760.130 and 760.133.

Part IV. Listing Requirements

760.176 Listing and Marking of NPLFA Cables. Non-power-limited fire alarm cables installed as wiring within buildings shall be listed in accordance with 760.176(A) and (B) and as being resistant to the spread of fire in accordance with 760.176(C) through (F), and shall be marked in accordance with 760.176(G). Cable used in a wet location shall be listed for use in wet locations or have a moisture-impervious metal sheath. Non-power-limited fire alarm cables shall have a temperature rating of not less than 60°C (140°F).

760.176(A) NPLFA Conductor Materials. Conductors shall be 18 AWG or larger solid or stranded copper.

760.176(B) Insulated Conductors. Insulation on conductors shall be rated for the system voltage and not less than 600 V. Insulated conductors 14 AWG and larger shall be one of the types listed in Table 310.4(A) or one that is identified for this use. Insulated conductors 18 AWG and 16 AWG shall be in accordance with 760.49.

760.176(C) Type NPLFP. Type NPLFP non-power-limited fire alarm cable for use in other space used for environmental air shall be listed as being suitable for use in other space used for environmental air as described in 300.22(C) and shall also be listed as having adequate fire-resistant and low smoke–producing characteristics.

> Informational Note: One method of defining a cable that is low-smoke producing cable and fire-resistant cable is that the cable exhibits a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.52 m (5 ft) or less when tested in accordance with NFPA 262-2019, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces*.

760.176(D) Type NPLFR. Type NPLFR non–power-limited fire alarm riser cable shall be listed as being suitable for use in a vertical run in a shaft or from floor to floor and shall also be listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor.

> Informational Note: One method of defining fire-resistant characteristics capable of preventing the carrying of fire from floor to floor is that the cables pass ANSI/UL 1666-2012, *Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts*.

760.176(E) Type NPLF. Type NPLF non–power-limited fire alarm cable shall be listed as being suitable for general-purpose fire alarm use, with the exception of risers, ducts, plenums, and other space used for environmental air, and shall also be listed as being resistant to the spread of fire.

> Informational Note: One method of defining *resistant to the spread of fire* is that the cables do not spread fire to the top of the tray in the "UL Flame Exposure, Vertical Tray Flame Test" in ANSI/UL 1685-2010, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*. The smoke measurements in the test method are not applicable.
> Another method of defining *resistant to the spread of fire* is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA "Vertical Flame Test — Cables in Cable Trays," as described in CSA C22.2 No. 0.3-M-2001, *Test Methods for Electrical Wires and Cables*.

760.176(F) Fire Alarm Circuit Integrity (CI) Cable or Electrical Circuit Protective System. Cables that are used for survivability of critical circuits under fire conditions shall meet either 760.176(F)(1) or (F)(2).

Informational Note No. 1: Fire alarm circuit integrity (CI) cable and electrical circuit protective systems may be used for fire alarm circuits to comply with the survivability requirements of NFPA 72-2019, National Fire Alarm and Signaling Code, 12.4.3 and 12.4.4, that the circuit maintain its electrical function during fire conditions for a defined period of time.
Informational Note No. 2: One method of defining circuit integrity (CI) cable or an electrical circuit protective system is by establishing a minimum 2-hour fire-resistive rating for the cable when tested in accordance with ANSI/UL 2196-2017, *Standard for Fire Test for Circuit Integrity of Fire -Resistive Power, Instrumentation, Control, and Data Cables*.
Informational Note No. 3: UL guide information for electrical circuit protective systems (FHIT) contains information on proper installation requirements for maintaining the fire rating.

760.176(F)(1) Circuit Integrity (CI) Cables. Circuit integrity (CI) cables, specified in 760.176(C), (D), and (E), and used for survivability of critical circuits, shall have an additional classification using the suffix "CI." Circuit integrity (CI) cables shall only be permitted to be installed in a raceway where specifically listed and marked as part of an electrical circuit protective system as covered in 760.176(F)(2).

760.176(F)(2) Electrical Circuit Protective System. Cables specified in 760.176(C), (D), (E), and (F)(1), that are part of an electrical circuit protective system, shall be identified with the protective system number and hourly rating printed on the outer jacket of the cable and installed in accordance with the listing of the protective system.

760.176(G) NPLFA Cable Markings. Multiconductor non–power-limited fire alarm cables shall be marked in accordance with Table 760.176(G). Non–power-limited fire alarm circuit cables shall be permitted to be marked with a maximum usage voltage rating of 150 volts. Cables that are listed for circuit integrity shall be identified with the suffix "-CI" as defined in 760.176(F). The temperature rating shall be marked on the jacket of NPLFA cables that have a temperature rating exceeding 60°C (140°F). The jacket of NPLFA cables shall be marked with the conductor size.

Informational Note: Cable types are listed in descending order of fire performance.

Table 760.176(G) NPLFA Cable Markings

Cable Marking	Type	Reference
NPLFP	Non–power-limited fire alarm circuit cable for use in "other space used for environmental air"	760.176(C) and (G)
NPLFR	Non–power-limited fire alarm circuit riser cable	760.176(D) and (G)
NPLF	Non–power-limited fire alarm circuit cable	760.176(E) and (G)

Note: Cables identified in 760.176(C), (D), and (E) and meeting the requirements for circuit integrity shall have the additional classification using the suffix "-CI" (for example, NPLFP-CI, NPLFR-CI, and NPLF-CI).

760.179 Listing and Marking of Insulated Continuous Line-Type Fire Detectors. Insulated continuous line-type fire detectors shall be listed in accordance with760.179(A) through (D) .

(A) The cable shall be listed as being resistant to the spread of fire in accordance with 7XX.179(A)(1), (2) and (3)

(B) The cable shall have a voltage rating of not less than 300 volts. The cable shall have a temperature rating of not less than 60°C (140°F).

(C) The cable shall be marked with a fire resistance type FPLP, FPLR or FPL in accordance with 7XX.179(B). The voltage rating shall not be marked on the cable. The temperature rating shall be marked on the jacket that have a temperature rating exceeding 60°C (140°F). The jacket of PLFA cables shall be marked with the conductor size.

Informational Note: Voltage ratings on cables may be misinterpreted to suggest that the cables may be suitable for Class 1, electric light, and power applications.

Exception: Voltage markings shall be permitted where the cable has multiple listings and voltage marking is required for one or more of the listings.

(D) The cable jacket compound shall have a high degree of abrasion resistance.

Public Input No. 988-NFPA 70-2020 [Global Input]

abovegrade
change to:
above grade

Statement of Problem and Substantiation for Public Input

This purpose of this PI is just for clean up and also for consistency throughout the NEC. As far as I can research, the term abovegrade simply isn't a word. Merriam Webster does not contain this word.
The correct phrase is "above grade." It's easier to see in the opposite - would a person ever use the phrase, "belowgrade?" No - the proper term is below grade.

Abovegrade can be found in the following Articles:
300.9
362.10(2) Exception to 2
382.10(C)
410.30(B) Exception No. 1
410.30(B) Exception No. 3
426.41
555.13(B)(2)

It will need to be fixed in the Style Manual, as well.

Note: The terms
aboveground
and
belowground
are contained within Merriam Webster

Articles that use the correct phrase "above grade" include but are not limited to:
210.52(E)(1)
210.52(E)(2)
300.38
314.23(H)(2)
362.10(1)
362.10(2)
362.10(5)
425.8(C)
Table 514.3(B)(1) Class I Locations (a total of six times)
514.8
Table 515.3 (a total of six times)
547.9(A)(2)
547.9(A)(8)
550.13(D)(7)
555.34(B)(2)
625.102(B)
680 Definitions - Through-Wall Lighting Assembly
680.42(B)(3)

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Committee: NEC-P03

Public Input No. 849-NFPA 70-2020 [Definition: Circuit Integrity (CI) Cable.]

Circuit Integrity (CI) Cable.

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

Informational Note: Where power circuits are installed for survivability, see 728.4.

Statement of Problem and Substantiation for Public Input

The current definition does not refer to other uses like fire alarm cables, communications cables, or fiber optic cables which all are permitted in their respective articles to use the (-CI) suffix. It is recommended that this Public Input be directed to both CMP3 (responsible for the definition) and CMP 16 as both code making panels have language accordingly in their articles. This public input is a result of the Correlating Committee Task Group for Circuit Integrity Cable efforts to correlate information on Circuit Integrity (-CI) cable throughout the NEC®. Members of the task group included Blake Shugarman from UL – Principal Engineer for Circuit Integrity Systems, Larry Shudak from UL - Principal Engineer for Life Safety Technologies and member of NFPA 72, Anthony Tassone from UL – Principal Engineer Seasonal and Holiday Decorative Products and Telecommunications Cables - CMP16, Jim Conrad from Marmon Innovation and Technology Group – CMP13, George Straniero from AFC Cable Systems – CMP6, CMP3, and CC, Paul Casparro from IBEW – CMP3, and Rich Holub from DuPont – CMP14 and CC.

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Public Input No. 3476-NFPA 70-2020 [Definition: Class 1 Circuit.]

Class 1 Circuit.

The portion of the wiring system between the load side of the ~~overcurrent device or~~ power-limited supply and the connected equipment. (CMP-3)

~~Informational Note: See 725.41 for voltage and power limitations of Class 1 circuits.~~

Statement of Problem and Substantiation for Public Input

Class 1 circuits are limited to 30 volts and 1000 volt-amperes. Class 1 remote-control and signaling circuits, as described in previous editions of the NEC, are actually branch circuits and the installation requirements for these circuits are in the first four Chapters of the NEC. This definition will clarify how to identify a Class 1 circuit.

The informational note is not necessary because the requirement to limit voltage and volt-amperes is contained in the Article for Class 1 circuits.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2774-NFPA 70-2020 [New Article after 725]	deletion of terms
Public Input No. 3463-NFPA 70-2020 [Definition: Remote-Control Circuit.]	
Public Input No. 3471-NFPA 70-2020 [Definition: Signaling Circuit.]	

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Committee: NEC-P03

Public Input No. 3871-NFPA 70-2020 [Definition: Class 1 Circuit.]

Class 1 Circuit.

The ~~portion of the wiring system between~~ wiring for remote-control or signaling and running from the load side of the overcurrent device or power-limited supply ~~and~~ to the ~~connected~~ controlled equipment. (CMP-3)

Informational Note: See 725.41 for voltage and power limitations of Class 1 circuits.

Statement of Problem and Substantiation for Public Input

When this definition moved to Article 100, it lost any limitation applied by the scope of Article 725. As a result, the current text is indistinguishable from a branch circuit. This input is carefully drawn to not use the defined term within its content, and express the intended meaning.

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Public Input No. 2963-NFPA 70-2020 [Definition: Plenum.]

Plenum.

A compartment or chamber, not specifically fabricated for environmental air-handling purposes, and not used for occupancy or storage, but to which one or more air ducts are connected and that forms part of the air distribution system, such as the space over a suspended (hung) ceiling or below a raised floor. (CMP-3)

Informational Note: An equipment room, an air handling unit and associated ductwork is not considered a plenum. A plenum is often formed in part or in total by portions of the building. See 300.22(C) for more information on plenums. For additional information, refer to NFPA 90A-2021, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, ANSI/ASHRAE 62.1-2019, *Ventilation for Acceptable Indoor Air Quality*, Section 5.1.2, and ANSI/ASHRAE 90.1-2019, *Energy Standard for Buildings Except Low-Rise Residential Buildings*, Section 3.2.

Statement of Problem and Substantiation for Public Input

There is confusion regarding the meaning of plenum and the space it constitutes. The inclusion of “not specifically fabricated for environmental air-handling spaces” (from 300.22(C)), “not used for occupancy or storage” (from ASHRAE 90.1 plenum definition) and the examples provide additional clarity in defining the term. The informational note addresses a specific common misapplication of the term which needs to be stated affirmatively.

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Public Input No. 3463-NFPA 70-2020 [Definition: Remote-Control Circuit.]

Branch Circuit, Remote-Control ~~- Circuit.~~

~~Any electrical~~ A branch circuit that controls any other branch circuit through a relay or an equivalent device. (CMP-3)

Statement of Problem and Substantiation for Public Input

Class 1 remote-control circuits have been a part of Article 725 for many years and there has been a public input submitted to delete this circuit from the power-limited Articles in Chapter 7. Article 725 is focused on power-limited circuits and Class 1 remote-control circuits can be power-limited or non-power limited and up to 600 volts. If a remote-control circuit is a power-limited circuit then it would be installed in accordance with the appropriate power-limited Article. Having a definition for “remote-control branch circuits” makes it clear that these circuits are to be installed in accordance with the first four Chapters of the NEC. The definition of Branch Circuit does not exactly address a remote-control circuit because the definition of “outlet” does not include control devices.

An example of a remote-control circuit would be a circuit that originates on a 20-amp overcurrent device, breaks through a photo cell and then terminates on the coil of a lighting contactor. This circuit would control all of the lighting circuits connected to the lighting contactor. It would be unusual for an installer or an inspector to look at Article 725 for installation requirements for this circuit.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2774-NFPA 70-2020 [New Article after 725]	deletion of term
Public Input No. 3471-NFPA 70-2020 [Definition: Signaling Circuit.]	similar definition
Public Input No. 3471-NFPA 70-2020 [Definition: Signaling Circuit.]	
Public Input No. 3476-NFPA 70-2020 [Definition: Class 1 Circuit.]	

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Committee: NEC-P03

Public Input No. 3471-NFPA 70-2020 [Definition: Signaling Circuit.]

Branch Circuit, Signaling ~~Circuit~~ .

Any ~~electrical~~ branch circuit that energizes signaling equipment. (CMP-3)

Statement of Problem and Substantiation for Public Input

Class 1 signaling circuits have been a part of Article 725 for many years and there has been a public input submitted to delete this circuit from the power-limited Articles in Chapter 7. Article 725 is focused on power-limited circuits and Class 1 signaling circuits can be power-limited or non-power limited and up to 600 volts. If a signaling circuit is a power-limited circuit then it would be installed in accordance with the appropriate power-limited Article. Having a definition for “signaling branch circuits” makes it clear that these circuits are to be installed in accordance with the first four Chapters of the NEC. The definition of Branch Circuit does not exactly address a signaling circuit because the definition of “outlet” does not include signaling equipment.

An example of a signaling circuit would be a circuit that originates on a 20-amp overcurrent device, breaks through a float switch and then terminates on a bell. This circuit would make the bell ring and sound an alarm that the basement is filling with water because of a malfunction of the sump pump. It would be unusual for an installer or an inspector to look at Article 725 for installation requirements for this circuit.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3463-NFPA 70-2020 [Definition: Remote-Control Circuit.]	similar definition
Public Input No. 2774-NFPA 70-2020 [New Article after 725]	deletion of term
Public Input No. 3463-NFPA 70-2020 [Definition: Remote-Control Circuit.]	
Public Input No. 3476-NFPA 70-2020 [Definition: Class 1 Circuit.]	

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Public Input No. 980-NFPA 70-2020 [New Definition after Definition: Field Labeled (as applied ...]

TITLE OF NEW CONTENT

Type your content here ...

Article 100 Definitions

Fished (as applied to Wiring Methods).

Wiring methods within the voids of buildings or structures that can't feasibly be humanly reached without removing structure or building finishes or employing the use of tools.

Statement of Problem and Substantiation for Public Input

Oxford dictionary does not offer a definition for 'fish' the way the electrical industry uses the term. Cables and raceways of Chapter 3 offer fishing as an allowed wiring installation. Adding the electrician use of 'fish' in Article 100 would make it clear to inspectors and electricians what is an allowed fish-able void. An electrician adding recessed luminaires would have to get into an accessible attic to support cabling, for example.

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Public Input No. 373-NFPA 70-2020 [Section No. 300.3(B)(1)]

(1) Paralleled Installations.

Conductors shall be permitted to be run in parallel in accordance with the provisions of 310.10(G). The requirement to run all circuit conductors within the same raceway, auxiliary gutter, cable tray, trench, cable, or cord shall apply separately to each portion of the paralleled installation~~, and the equipment grounding conductors shall comply with 250~~ . ~~122.~~ Connections, taps, or extensions made from paralleled conductors shall connect to all conductors of the paralleled set, grounded and ungrounded, as applicable. Parallel runs in cable trays shall comply with 392.20(C).

Exception: Conductors installed in nonmetallic raceways run underground shall be permitted to be arranged as isolated phase, neutral, ~~and grounded~~ grounded, equipment grounding and equipment bonding conductor installations. The raceways shall be installed in close proximity, and the isolated phase, neutral, and grounded conductors shall comply with 300.20(B).

Statement of Problem and Substantiation for Public Input

this is common knowledge that an EGC is size per table 250.122 now with the addition of equipment/supply side bonding conductor a reference to table 250.102 would be need however this to is common knowledge so neither table is required

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Public Input No. 4119-NFPA 70-2020 [Section No. 300.3(B)(1)]

(1) Paralleled Installations.

Conductors shall be permitted to be run in parallel in accordance ~~with the provisions of~~ with 310.10(G). The requirement to run all circuit conductors within the same raceway, auxiliary gutter, cable tray, trench, cable, or cord shall apply separately to each portion of the paralleled installation, and the equipment grounding conductors shall comply with 250.122. Connections, taps, or extensions made from paralleled conductors shall connect to all conductors of the paralleled set, grounded and ungrounded, as applicable. Parallel runs in cable trays shall comply with 392.20(C).

Exception: Conductors installed in nonmetallic raceways run underground shall be permitted to be arranged as isolated phase, neutral, and grounded conductor installations. The raceways shall be installed in close proximity, and the isolated phase, neutral, and grounded conductors shall comply with 300.20(B).

Statement of Problem and Substantiation for Public Input

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

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Public Input No. 4120-NFPA 70-2020 [Section No. 300.3(B)(2)]

(2) Grounding and Bonding Conductors.

Equipment grounding conductors shall be permitted to be installed outside a raceway or cable assembly where in accordance with ~~the provisions of~~ 250.130(C) for certain existing installations or in accordance with 250.134, Exception No. 2, for dc circuits. Equipment bonding conductors shall be permitted to be installed on the outside of raceways in accordance with 250.102(E).

Statement of Problem and Substantiation for Public Input

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

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State:
Zip:
Submittal Date: Wed Sep 09 21:22:35 EDT 2020
Committee: NEC-P03

Public Input No. 378-NFPA 70-2020 [Section No. 300.3(B) [Excluding any Sub-Sections]]

All conductors of the same circuit and, where used, the grounded conductor and all equipment grounding conductors and bonding conductors shall be contained within the same raceway, conduit body, auxiliary gutter, cable tray, cablebus assembly, trench, cable, or cord, unless otherwise permitted in accordance with 300.3(B)(1) through (B)(4).

Additional Proposed Changes

File Name	Description	Approved
0.jfif	LB on right	

Statement of Problem and Substantiation for Public Input

Conduit body's are missing from the list and as shown in the photo this type of installation is occurring. the same issue exist. Because conduit body's are not included it technically can not be enforceable. The conduit body should also have the same requirement to contain all system conductors.

Submitter Information Verification

Submitter Full Name: Alfio Torrisi
Organization: electrician
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 29 09:13:22 EST 2020
Committee: NEC-P03

DO NOT ENTER
CAUTION

Public Input No. 1704-NFPA 70-2020 [Section No. 300.3(C)]

(C) Conductors of Different Systems.

(1) 1000 Volts, Nominal, or Less.

Conductors of ac and dc circuits, rated 1000 volts, nominal, or less, shall be permitted to occupy the same equipment wiring enclosure, cable, raceway, or ~~raceway~~ trench . All conductors shall have an insulation rating equal to at least the maximum circuit voltage applied to any conductor within the enclosure, cable, or raceway.

Secondary wiring to electric-discharge lamps of 1000 volts or less, if insulated for the secondary voltage involved, shall be permitted to occupy the same luminaire, sign, or outline lighting enclosure as the branch-circuit conductors.

Informational Note No. 1: See 725.136(A) for Class 2 and Class 3 circuit conductors.

Informational Note No. 2: See 690.31(B) for photovoltaic source and output circuits.

(2) Over 1000 Volts, Nominal.

Conductors of circuits rated over 1000 volts, nominal, shall not occupy the same equipment wiring enclosure, cable, raceway, or ~~raceway~~ trench with conductors of circuits rated 1000 volts, nominal, or less unless otherwise permitted in 300.3(C)(2)(a) through 300.3(C)(2)(d) .

(a) Primary leads of electric-discharge lamp ballasts insulated for the primary voltage of the ballast, where contained within the individual wiring enclosure, shall be permitted to occupy the same luminaire, sign, or outline lighting enclosure as the branch-circuit conductors.

(b) Excitation, control, relay, and ammeter conductors used in connection with any individual motor or starter shall be permitted to occupy the same enclosure as the motor-circuit conductors.

(c) In motors, transformers, switchgear, switchboards, control assemblies, and similar equipment, conductors of different voltage ratings shall be permitted.

(d) In manholes, if the conductors of each system are permanently and effectively separated from the conductors of the other systems and securely fastened to racks, insulators, or other approved supports, conductors of different voltage ratings shall be permitted.

Conductors having nonshielded insulation and operating at different voltage levels shall not occupy the same enclosure, cable, raceway, or ~~raceway~~ trench .

Statement of Problem and Substantiation for Public Input

300.3(C) needs to address the mixing of conductors in the same trench as well as in enclosures, cables, and raceways.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jun 25 14:19:06 EDT 2020
Committee: NEC-P03

Public Input No. 701-NFPA 70-2020 [Section No. 300.4]

300.4 Protection Against Physical Damage.

Where subject to physical damage, conductors, raceways, and cables shall be protected.

(A) Cables and Raceways Through Wood Members.

(1) Bored Holes.

In both exposed and concealed locations, where a cable- or raceway-type wiring method is installed through bored holes in joists, rafters, or wood members, holes shall be bored ~~so~~ to 29 mm (1-1/8 in) diameter and that the edge of the hole is not less than 32 mm (1¼ in.) from the nearest edge of the wood member. ~~Where this distance cannot be maintained, the~~ The cable or raceway shall be protected 360 degrees from penetration by screws or nails by ~~a~~ insulated steel ~~plate~~ bushing (s) ~~or bushing~~ . In areas that a steel bushing cannot be installedan exception will be to install a steel plate (s) ~~,~~ at least 1.6 mm (1⁄16 in.) thick, and of appropriate length and width installed to cover the area of the wiring.

Exception No. 1: Steel bushings or plates shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, or electrical metallic tubing.

Exception No. 2: A listed and marked steel plate less than 1.6 mm (1⁄16 in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

(2) Notches in Wood.

Where there is no objection because of weakening the building structure, in both exposed and concealed locations, cables or raceways shall be permitted to be laid in notches in wood studs, joists, rafters, or other wood members where the cable or raceway at those points is protected against nails or screws by a steel plate at least 1.6 mm (1⁄16 in.) thick, and of appropriate length and width, installed to cover the area of the wiring. The steel plate shall be installed before the building finish is applied.

Exception No. 1: Steel plates shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, or electrical metallic tubing.

Exception No. 2: A listed and marked steel plate less than 1.6 mm (1⁄16 in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

(B) Nonmetallic-Sheathed Cables and Electrical Nonmetallic Tubing Through Metal Framing Members.

(1) Nonmetallic-Sheathed Cable.

In both exposed and concealed locations where nonmetallic-sheathed cables pass through either factory- or field-punched, cut, or drilled slots or holes in metal members, the cable shall be protected by listed bushings or listed grommets covering all metal edges that are securely fastened in the opening prior to installation of the cable.

(2) Nonmetallic-Sheathed Cable and Electrical Nonmetallic Tubing.

Where nails or screws are likely to penetrate nonmetallic-sheathed cable or electrical nonmetallic tubing, a steel sleeve, steel plate, or steel clip not less than 1.6 mm (1⁄16 in.) in thickness shall be used to protect the cable or tubing.

Exception: A listed and marked steel plate less than 1.6 mm (1⁄16 in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

(C) Cables Through Spaces Behind Panels Designed to Allow Access.

Cables or raceway-type wiring methods, installed behind panels designed to allow access, shall be supported according to their applicable articles.

(D) Cables and Raceways Parallel to Framing Members and Furring Strips.

In both exposed and concealed locations, where a cable- or raceway-type wiring method is installed parallel to framing members, such as joists, rafters, or studs, or is installed parallel to furring strips, the cable or raceway shall be installed and supported so that the nearest outside surface of the cable or raceway is not less than 32 mm (1¼ in.) from the nearest edge of the framing member or furring strips where nails or screws are likely to penetrate. Where this distance cannot be maintained, the cable or raceway shall be protected from penetration by nails or screws by a steel plate, sleeve, or equivalent at least 1.6 mm (1⁄16 in.) thick.

Exception No. 1: Steel plates, sleeves, or the equivalent shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, or electrical metallic tubing.

Exception No. 2: For concealed work in finished buildings, or finished panels for prefabricated buildings where such supporting is impracticable, it shall be permissible to fish the cables between access points.

Exception No. 3: A listed and marked steel plate less than 1.6 mm (1⁄16 in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

(E) Cables, Raceways, or Boxes Installed in or Under Roof Decking.

A cable, raceway, or box, installed in exposed or concealed locations under metal-corrugated sheet roof decking, shall be installed and supported so there is not less than 38 mm (1½ in.) measured from the lowest surface of the roof decking to the top of the cable, raceway, or box. A cable, raceway, or box shall not be installed in concealed locations in metal-corrugated, sheet decking–type roof.

Informational Note: Roof decking material is often repaired or replaced after the initial raceway or cabling and roofing installation and may be penetrated by the screws or other mechanical devices designed to provide “hold down” strength of the waterproof membrane or roof insulating material.

Exception: Rigid metal conduit and intermediate metal conduit shall not be required to comply with 300.4(E).

(F) Cables and Raceways Installed in Shallow Grooves.

Cable- or raceway-type wiring methods installed in a groove, to be covered by wallboard, siding, paneling, carpeting, or similar finish, shall be protected by 1.6 mm (1⁄16 in.) thick steel plate, sleeve, or equivalent or by not less than 32-mm (1¼-in.) free space for the full length of the groove in which the cable or raceway is installed.

Exception No. 1: Steel plates, sleeves, or the equivalent shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, or electrical metallic tubing.

Exception No. 2: A listed and marked steel plate less than 1.6 mm (1⁄16 in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

(G) Fittings.

Where raceways contain 4 AWG or larger insulated circuit conductors, and these conductors enter a cabinet, a box, an enclosure, or a raceway, the conductors shall be protected in accordance with any of the following:

(1) An identified fitting providing a smoothly rounded insulating surface

(2) A listed metal fitting that has smoothly rounded edges

(3) Separation from the fitting or raceway using an identified insulating material that is securely fastened in place

(4) Threaded hubs or bosses that are an integral part of a cabinet, box, enclosure, or raceway providing a smoothly rounded or flared entry for conductors

Conduit bushings constructed wholly of insulating material shall not be used to secure a fitting or raceway. The insulating fitting or insulating material shall have a temperature rating not less than the insulation temperature rating of the installed conductors.

(H) Structural Joints.

A listed expansion/deflection fitting or other approved means shall be used where a raceway crosses a structural joint intended for expansion, contraction or deflection, used in buildings, bridges, parking garages, or other structures.

Additional Proposed Changes

File Name	Description	Approved
EZ_Guard.docx	Photo of EZ Guard in application	
Installation_Instructions.docx	Installation Instructions	
EZ_Electrical_Catalog-_2019_2nd_Edition_-_WEB_003_.pdf	Catolog info see page 6	

Statement of Problem and Substantiation for Public Input

Problem : 50-75% of electrical fires in homes are caused by "Arc Fault" conditions. More Home / stick build building owners are mounting large screen tv's computer monitors etc. The are not using small screw but much longer larger screw to mount these items. Providing 360 deg wire protection every place a wire runs through a stud will greatly reduce the amount of potential "Arc Fault" conditions. Thus reducing the amount of Electrical fires in homes making life safer.

Submitter Information Verification

Submitter Full Name: Glenn Liubakka
Organization: Electrical System Solutions
Affiliation: EZ Electrical System Solutions, LLC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Mar 19 14:02:17 EDT 2020
Committee: NEC-P03



585 Hillside Ave
Pine City, MN 55063

Installation Instructions EZ Guard #1014


FIG # 1

Step # 1

Drill 1-1/8, inch diameter hole in each stud that an electrical wire will pass through.

The hole should be located at 1-3/4 inch from the face of the stud. *(The use of the EZ Guide drill guide will ensure proper hole location as shown in fig #1 above).*

Step # 2

Insert EZ Guard product in each hole that an electrical wire is intended to pass through as shown in fig #2 below.


FIG # 2

2019
2nd EDITION

HOW WOULD YOU MOUNT A BOX WITHOUT SCREWS OR NAILS?

PRODUCT CATALOG

electrical system solutions™

Public Input No. 1155-NFPA 70-2020 [Section No. 300.4(A)(1)]

300.4 Protection Against Physical Damage

Where subject to physical damage, conductors, raceways, and cables shall be protected.

(A) Cables and Raceways Through Wood Members

(1) Bored Holes.

In both exposed and concealed locations, where a cable- or raceway-type wiring method is installed through bored holes in joists, rafters, or wood members, holes shall be bored so that the edge of the hole is not less than 32 mm (1¼ in.) from the nearest edge of the wood member. Where this distance cannot be maintained, the cable or raceway shall be protected from penetration by screws or nails by a steel plate(s) or bushing(s), at least 1.6 mm (⅛ in.) thick, and of appropriate length and width installed to cover the area of the wiring.

Exception No. 1: Steel plates shall ~~not~~ and will be required to protect and indicate the location of rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, or electrical metallic tubing from metal fasteners that exceed 1 1/2" in length . (Even if the conductors are encased in metal armor the conduit still runs the risk of puncture from the sharp fasteners and knowing the location of such conduits in many cases is very important).

Exception No. 2: A listed and marked steel plate less than 1.6 mm (⅛ in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

Statement of Problem and Substantiation for Public Input

I've come across several projects where previous builders and new constructors have punctured through Rigid Conduits and EMT Conduits with self tapping screws and even cut through with saws. Knowing where these conduits are placed with a Stud Plate would be beneficial and very cost effective.

Submitter Information Verification

Submitter Full Name: Emigdio Amador
Organization: [Not Specified]
Affiliation: Self
Street Address:
City:
State:
Zip:
Submittal Date: Tue May 19 00:28:02 EDT 2020
Committee: NEC-P03

Public Input No. 2403-NFPA 70-2020 [Section No. 300.4(A)(1)]

(1) Bored Holes.

In both exposed and concealed locations, where a cable- or raceway-type wiring method is installed through bored holes in joists, rafters, or wood members, holes shall be bored so that the edge of the hole is not less than 32 mm (1¼ in.) from the nearest edge of the wood member. Where this distance cannot be maintained, the cable or raceway shall be protected from penetration by screws or nails by a steel plate(s) or bushing(s), at least 1.6 mm (1⁄16 in.) thick, and of appropriate length and width installed to cover the area of the wiring.

Exception No. 1: Steel plates shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid ~~nonmetallic conduit~~ type PVC , or electrical metallic tubing.

Exception No. 2: A listed and marked steel plate less than 1.6 mm (1⁄16 in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

Statement of Problem and Substantiation for Public Input

Replacing "nonmetallic" with "type PVC" aligns with the definition of Rigid Polyvinyl Chloride Conduit (PVC) and is the common term used in the industry.

Submitter Information Verification

Submitter Full Name: David Hittinger
Organization: IEC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 19 10:43:26 EDT 2020
Committee: NEC-P03

Public Input No. 2740-NFPA 70-2020 [Section No. 300.4(A)(1)]

(1) Bored Holes.

In both exposed and concealed locations, where a cable- or raceway-type wiring method is installed through bored holes in joists, rafters, or wood members, holes shall be bored so that the edge of the hole is not less than 32 mm (1¼ in.) from the nearest edge of the wood member. Where this distance cannot be maintained, the cable or raceway shall be protected from penetration by screws or nails by a steel plate(s) or bushing(s), at least 1.6 mm (⅛ in.) thick, and of appropriate length and ~~width~~ width **but not less than 33mm (1-1/4in.) on either side of joists, rafters or wood members** installed to cover the area of the wiring.

Exception No. 1: Steel plates shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, or electrical metallic tubing.

Exception No. 2: A listed and marked steel plate less than 1.6 mm (⅛ in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

Additional Proposed Changes

File Name	Description	Approved
IAEI_Public_Input_Form_A1-2_.pdf	NEC 300.4 (A1) & (2)	

Statement of Problem and Substantiation for Public Input

When the NECode adopted the spacing requirement of 33mm (1-1/4"in.) through bored holes in joists, rafters, or wood members to protect NonMetalic-Sheathed Cable (NMSC) or Electrical Nonmetallic Tubing (EMT) from getting damaged it was a very wise decision. That Code change probably saved a lot of homes from catching fire or being destroyed and most importantly saved a lot of lives. I would like to see the NECode go one step further in protecting the NMSC or ENT from getting damaged by protecting it on either side of the bored holes in joists, rafters, or wood members as it passes through. If the wire does not have the 1-1/4" in. spacing through the framing member it is unprotected as it enters through bored holes in joists, rafters, or wood members. The wire is exposed to damage from nails or screws that could penetrate the cable or tubing by a slight mistake by the drywall installer with a wayward screw or nail. This small addition to the NECode will ensure the safety of the NMSC or ENT from getting damaged and comply fully with the intent of the NEC as the wire will be protected for that 1-1/4" area entering and leaving the framing member. As you know all nail plates manufactured today and what is seen on the jobsite, are only the width of the 2x4 framing member (1-1/2" in.). This NECode change in wording would be more specific to the requirement to protect the NMSC or ENT and extend the metal nail plate to either side of the framing member.

Submitter Information Verification

Submitter Full Name: Vincent LAPORTA
Organization: Employee of Pinellas County Florida Building Dept. until April 2021 then retired. LaPorta Inspection Service LLC
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 30 12:51:23 EDT 2020
Committee: NEC-P03

IAEI Public Input Form

Date: 5/17/2020 **Name: Vincent N. LaPorta** **Tel. No: 941-585-8451**

Company: Pinellas County Building Dept. **Email: LaPorta.Inspection@gmail.com**

Street Address: P.O. Box 381 / 504 Ohio Ave.
City: Crystal Beach **State: Florida** **Zip: 34681**

Please indicate organization represented (if any): N/A

1. **(a) Title of NFPA Standard: NFPA 70 NEC** **NFPA No & Year: NFPA 70 & 2023**

   (b) Section/Paragraph: 300.4 (A) Cables and Raceways Through Wood Members
   (A1) Bored Holes (A2) Notches in Wood

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~~).]

(A) Cables and Raceways Through Wood Members.

(1) Bored Holes. In both exposed and concealed locations, where a cable- or raceway-type wiring method is installed through bored holes in joists, rafters or wood members, holes shall be bored so that the edge of the hole is not less than 33mm (1-1/4in.) from the nearest edge of the wood member. Where this distance cannot be maintained, the cable or raceway shall be protected from penetration by screw or nails by a steel plate(s) or bushing(s), at least1.6mm (1/16in.) thick, and of the appropriate length and width but not less than 33mm (1-1/4in.) on either side of joists, rafters or wood members installed to cover the area of the wiring.

(2) Notches in Wood. Where there is no objection because of weakening the building structure, in both exposed and concealed location, cables or raceways shall be permitted to be laid in notches in wood studs, joists, rafters or other wood members where the cable or raceway at those points is protected against nails or screws by a steel plate at least 1.6 mm(1/16” in.) thick and of appropriate length and width, but not less than 33mm (1-1/4 in.) on either side of joists, rafters or wood members installed to cover the area of wiring. The steel plate shall be installed before the building finish is applied.

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.)

When the NECode adopted the spacing requirement of 33mm (1-1/4"in.) through bored holes in joists, rafters, or wood members to protect NonMetalic-Sheathed Cable (NMSC) or Electrical Nonmetallic Tubing (EMT) from getting damaged it was a very wise decision. That Code change probably saved a lot of homes from catching fire or being destroyed and most importantly saved a lot of lives. I would like to see the NECode go one step further in protecting the NMSC or ENT from getting damaged by protecting it on either side of the bored holes in joists, rafters, or wood members as it passes through. If the wire does not have the 1-1/4" in. spacing through the framing member it is unprotected as it enters through bored holes in joists, rafters, or wood members. The wire is exposed to damage from nails or screws that could penetrate the cable or tubing by a slight mistake by the drywall installer with a wayward screw or nail. This small addition to the NECode will ensure the safety of the NMSC or ENT from getting damaged and comply fully with the intent of the NEC as the wire will be protected for that 1-1/4" area entering and leaving the framing member. As you know all nail plates manufactured today and what is seen on the jobsite, are only the width of the 2x4 framing member (1-1/2" in.). This NECode change in wording would be more specific to the requirement to protect the NMSC or ENT and extend the metal nail plate to either side of the framing member.

My research has brought forward some home electrical fire statistics with two articles from the NFPA and from two different authors listed below.

National Fire Protection Association, Fire Analysis and Research Division
"Home Electrical Fires" John R. Hall, Jr. January 2012
Based on the report above, I am listing this one section found on page 50 that most closely relates to where branch circuit wiring would be damaged in the wall not having protection from a screw or nail with a metal nail plate.
Home Fires Involving Wiring and Related Equipment, by Item First Ignited, Annual Average of 2005-2009.
D. Branch Circuit wiring.
Structural member or framing, 700 fires. Wire or cable insulation, 560 fires. Exterior wall covering, 50 fires. Interior wall covering, 60 fires.

National Fire Protection Association, Research
"Home Electrical Fires", Richard Campbell March 2019
Local fire departments responded to an estimated average of 44,880 home fires involving electrical failure or malfunction each year in 2012-2016. • Home fires involving electrical failure or malfunction caused an estimated average of 440 civilian deaths and 1,250 civilian injuries each year in 2012-2016, as well as an estimated $1.3 billion in direct property damage a year.

Electrical failures or malfunctions are a leading factor in the ignition of fires in U.S. homes. Electrical failures or malfunctions were responsible for 13% of home structure fires in 2012-2016, ranking as the second leading contributing factor behind fires caused by unattended equipment. Electrical failure or malfunction fires also accounted for nearly one-fifth (18%) of civilian deaths (the second leading contributing factor behind fires caused by heat sources too close to combustibles), 11% of civilian injuries, and accounted for the greatest share of direct property damage (20%).

Short circuits from defective and worn insulation caused 14% of civilian home fire deaths as shown in Figure 2. This can be caused when cords are pinched by doors or furniture or through repetitive flexing of appliance cords. It can also be due to damaged wiring inside walls from nails, screws, or drill bits that puncture insulation during ordinary activities like hanging a picture.

Other reasons to address and adopt this NECode change is that currently the 2015 International Residential Code Fuel Gas, Pluming and Mechanical code as referenced below, already requires their respected trades to protect their piping by shield plates that extend past the framing member on each side.

Chapter 24 FUEL GAS G2415.7.1 (404.7.1) Piping Through Bored Holes or Notches
Where piping is installed through holes or notches in framing members and the piping is located less than 1 1/2 inches (38 mm) from the framing member face to which wall, ceiling or floor membranes will be attached, the pipe shall be protected by shield plates that cover the width of the pipe and the framing member and that extend not less than 4 inches (51 mm) to each side of the framing member. Where the framing member that the piping passes through is a bottom plate, bottom track, top plate or top track, the shield plates shall cover the framing member and extend not less than 4 inches (51 mm) above the bottom framing member and not less than 4 inches (51 mm) below the top framing member.

The 2015 International Residential Code Plumbing has similar requirements of an 1-1/4" inch from nearest edge of the member the pipe shall be protected by shield plates. But also goes on to say that such plates shall extend not less than 2" inches above sole plates and below top plates.

Chapter 26 General Plumbing Requirements P2603.2.1 Protection against physical damage
In concealed locations where piping, other than cast-iron or galvanized steel, is installed through holes or notches in studs, joists, rafters or similar members less than 1 1/2 inches (38 mm) from the nearest edge of the member, the pipe shall be protected by steel shield plates. Such shield plates shall have a thickness of not less than 0.0575 inch (1.463 mm) (No. 16 gage). Such plates shall cover the area of the pipe where the member is notched or bored and shall extend not less than 2 inches (51 mm) above sole plates and below top plates.

The 2015 International Residential Code Mechanical again has a similar requirement where the piping is less than 1-1/2 inches from framing members it shall be protected by shield plates that cover the width of pipe and framing member and that extends 2 inches to each side of the framing member.

Chapter 13 General Mechanical System Requirements M1308.2 Protection against physical damage
M1308.2.1 Piping Through Bored Holes or Notches
Where piping is installed through holes or notches in framing members and is located less than 1 1/2 inches (38 mm) from the framing member face to which wall, ceiling or floor membranes will be attached, the pipe shall be protected by shield plates that cover the width of the pipe and the framing member and that extend 2 inches (51 mm) to each side of the framing member. Where the framing member that the piping passes through is a bottom plate, bottom track, top plate or top track, the shield plates shall cover the framing member and extend 2 inches (51 mm) above the bottom framing member and 2 inches (51 mm) below the top framing member.

Signature (Required) **Vincent N. LaPorta** Vincent N. LaPorta

Member # 339125

PLEASE USE SEPARATE FORM FOR EACH PUBLIC INPUT

To: IAEI
901 Waterfall Way, Suite 602, Richardson, TX 75080
OR Fax to: (972) 235-3855 / Email to: iaei@iaei.org

Updated: 6/5/2018

Public Input No. 4454-NFPA 70-2020 [Section No. 300.4(A)(1)]

(1) Bored Holes.

In both exposed and concealed locations, where a cable- or raceway-type wiring method is installed through bored holes in joists, rafters, or wood members, holes shall be bored so that the edge of the hole is not less than 32 mm (1¼ in.) from the nearest edge of the wood member. Where this distance cannot be maintained, the cable or raceway shall be protected from penetration by screws or nails by a steel plate(s) or bushing(s), at least 1.6 mm (⅛ in.) thick, and of appropriate length and width installed to cover the area of the wiring.

Exception No. 1: Steel plates shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid ~~nonmetallic~~ polyvinyl chloride conduit, or electrical metallic tubing.

Exception No. 2: A listed and marked steel plate less than 1.6 mm (⅛ in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

Statement of Problem and Substantiation for Public Input

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

Submitter Information Verification

Submitter Full Name: David Humphrey
Organization: County of Henrico, Virginia
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 13:23:47 EDT 2020
Committee: NEC-P03

Public Input No. 2741-NFPA 70-2020 [Section No. 300.4(A)(2)]

(2) Notches in Wood.

Where there is no objection because of weakening the building structure, in both exposed and concealed locations, cables or raceways shall be permitted to be laid in notches in wood studs, joists, rafters, or other wood members where the cable or raceway at those points is protected against nails or screws by a steel plate at least 1.6 mm (1⁄16 in.) thick, and of appropriate length and width, **but not less than 33mm (1-1/4 in.) on either side of joists, rafters, or wood members** installed to cover the area of the wiring. The steel plate shall be installed before the building finish is applied.

Exception No. 1: Steel plates shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, or electrical metallic tubing.

Exception No. 2: A listed and marked steel plate less than 1.6 mm (1⁄16 in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

Statement of Problem and Substantiation for Public Input

When the NECode adopted the spacing requirement of 33mm (1-1/4"in.) through notches in wood joists, rafters, or wood members to protect NonMetalic-Sheathed Cable (NMSC) or Electrical Nonmetallic Tubing (EMT) from getting damaged it was a very wise decision. That Code change probably saved a lot of homes from catching fire or being destroyed and most importantly saved a lot of lives. I would like to see the NECode go one step further in protecting the NMSC or ENT from getting damaged by protecting it on either side of the bored holes in joists, rafters, or wood members as it passes through. If the wire does not have the 1-1/4" in. spacing through the framing member it is unprotected as it enters through bored holes in joists, rafters, or wood members. The wire is exposed to damage from nails or screws that could penetrate the cable or tubing by a slight mistake by the drywall installer with a wayward screw or nail. This small addition to the NECode will ensure the safety of the NMSC or ENT from getting damaged and comply fully with the intent of the NEC as the wire will be protected for that 1-1/4" area entering and leaving the framing member. As you know all nail plates manufactured today and what is seen on the jobsite, are only the width of the 2x4 framing member (1-1/2" in.). This NECode change in wording would be more specific to the requirement to protect the NMSC or ENT and extend the metal nail plate to either side of the framing member.

Submitter Information Verification

Submitter Full Name: Vincent LAPORTA
Organization: Employee of Pinellas County Florida until April 2021 then retired. LaPorta Inspection Service LLC
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 30 13:08:14 EDT 2020
Committee: NEC-P03

Public Input No. 4476-NFPA 70-2020 [Section No. 300.4(A)(2)]

(2) Notches in Wood.

Where there is no objection because of weakening the building structure, in both exposed and concealed locations, cables or raceways shall be permitted to be laid in notches in wood studs, joists, rafters, or other wood members where the cable or raceway at those points is protected against nails or screws by a steel plate at least 1.6 mm (1⁄16 in.) thick, and of appropriate length and width, installed to cover the area of the wiring. The steel plate shall be installed before the building finish is applied.

Exception No. 1: Steel plates shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid ~~nonmetallic conduit~~ polyvinyl chloride conduit , or electrical metallic tubing.

Exception No. 2: A listed and marked steel plate less than 1.6 mm (1⁄16 in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

Statement of Problem and Substantiation for Public Input

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

Submitter Information Verification

Submitter Full Name: David Humphrey
Organization: County of Henrico, Virginia
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 13:45:40 EDT 2020
Committee: NEC-P03

Public Input No. 2742-NFPA 70-2020 [Section No. 300.4(B)(2)]

(2) Nonmetallic-Sheathed Cable and Electrical Nonmetallic Tubing.

Where nails or screws are likely to penetrate nonmetallic-sheathed cable or electrical nonmetallic tubing ~~, a~~ **and shall extend at least 33mm (1-1/4 in.) on either side of joists, rafters or wood members** a steel sleeve, steel plate, or steel clip not less than 1.6 mm (1⁄16 in.) in thickness shall be used to protect the cable or tubing.

Exception: A listed and marked steel plate less than 1.6 mm (1⁄16 in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

Additional Proposed Changes

File Name	Description	Approved
IAEI_Public_Input_Form_300.4_B2-D_.pdf	NEC 300.4 B2) and (D)	

Statement of Problem and Substantiation for Public Input

When the NECode adopted the spacing requirement of 33mm (1-1/4"in.) from framing members or furring strips to protect NonMetalic Sheath Cable (NMSC) or Electrical Nonmetallic Tubing (ENT) from getting damaged it was a very wise decision. That Code change probably saved a lot of homes from catching fire or being destroyed and most importantly saved a lot of lives. I would like to see the NECode go one step further in protecting the NMSC or ENT from getting damaged by protecting it on either side of the framing members or furring strips as it passes through. The 1-1/4" in. spacing area where the wire turns toward the framing member is unprotected as it enters the notched furring strips or through bored holes of framing members. The wire is exposed to damage from nails or screws that could penetrate the cable or tubing by a slight mistake by the drywall installer with a wayward screw or nail. This small addition to the NECode will ensure the safety of the NMSC or ENT from getting damaged and comply fully with the intent of the NECode as the wire will be protected for that 1-1/4" area entering and leaving the framing member or furring strip. This NECode change in wording would be more specific to the requirement to protect the NMSC or ENT and extend the metal nail plate to either side of the framing member of furring strip.

Submitter Information Verification

Submitter Full Name: Vincent LAPORTA
Organization: Employee of Pinellas County Florida Building Dept.until April 2021 then retired. LaPorta Inspection Service LLC
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 30 13:28:50 EDT 2020
Committee: NEC-P03

IAEI Public Input Form

Date: 5/17/2020 **Name: Vincent N. LaPorta** **Tel. No: 941-585-8451**

Company: LaPorta Inspection Service LLC Email: LaPorta.Inspection@gmail.com

Street Address: P.O. Box 381 / 504 Ohio Ave.
City: Crystal Beach State: Florida Zip: 34681

Please indicate organization represented (if any): N/A

1. **(a) Title of NFPA Standard: NFPA 70 NEC** **NFPA No & Year: NFPA 70 & 2023**

   (b) Section/Paragraph: 300.4 (B2) Nonmetalic-Sheath Cables and Electrical Nonmetalic Tubing.
   (D) Cables and Raceways Parallel to Framing Members and Furring Strips.

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~~).]

(B) Nonmetalic-Sheath Cables and Electrical Nonmetalic Tubing Through Metal Framing Members.

(2) Nonmetalic-Sheath Cables and Electrical Nonmetalic Tubing. Where nails or screws are likely to penetrate Nonmetalic-Sheath Cables and Electrical Nonmetalic Tubing, a steel sleeve, steel plate, or steel clip not less than 1.6mm (1/16in.) in thickness shall be used to protect the cable or tubing and shall extend at least 33mm (1-1/4 in.) on either side joists, rafters or wood members.

(D) Cables and Raceways Parallel to Framing Members and Furring Strips. In both exposed and concealed locations, where a cable or raceway type wiring method is installed parallel to framing members, such as joists, rafters, or studs, or is installed parallel to furring strips, the cable or raceway shall be installed and supported so that the nearest outside surface of cable or raceway is not less than 32mm (1-1/4in) from the nearest edge of framing member or furring strips where nails or screws are likely to penetrate. Where this distance cannot be maintained, the cable or raceway shall be protected from penetration by nails or screws by a steel plate, sleeve, or equivalent at least 1.6mm(1/16 in.) thick. This protection shall extend at least 33mm (1-1/4 in.) on either side of framing members or furring strips.

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.)

When the NECode adopted the spacing requirement of 33mm (1-1/4"in.) from framing members or furring strips to protect NonMetalic Sheath Cable (NMSC) or Electrical Nonmetallic Tubing (ENT) from getting damaged it was a very wise decision. That Code change probably saved a lot of homes from catching fire or being destroyed and most importantly saved a lot of lives. I would like to see the NECode go one step further in protecting the NMSC or ENT from getting damaged by protecting it on either side of the framing members or furring strips as it passes through. The 1-1/4" in. spacing area where the wire turns toward the framing member is unprotected as it enters the notched furring strips or through bored holes of framing members. The wire is exposed to damage from nails or screws that could penetrate the cable or tubing by a slight mistake by the drywall installer with a wayward screw or nail. This small addition to the NECode will ensure the safety of the NMSC or ENT from getting damaged and comply fully with the intent of the NECode as the wire will be protected for that 1-1/4" area entering and leaving the framing member or furring strip. This NECode change in wording would be more specific to the requirement to protect the NMSC or ENT and extend the metal nail plate to either side of the framing member of furring strip.

My research has brought forward some home electrical fire statistics with two articles from the NFPA and from two different authors listed below.

National Fire Protection Association, Fire Analysis and Research Division
"Home Electrical Fires" John R. Hall, Jr. January 2012

Based on the report above, I am listing this one section found on page 50 that most closely relates to where branch circuit wiring would be damaged in the wall not having protection from a screw or nail with a metal nail plate.

Home Fires Involving Wiring and Related Equipment, by Item First Ignited, Annual Average of 2005-2009.
D. Branch Circuit wiring.
Structural member or framing, 700 fires. Wire or cable insulation, 560 fires. Exterior wall covering, 50 fires. Interior wall covering, 60 fires.

National Fire Protection Association, Research
"Home Electrical Fires", Richard Campbell March 2019

Local fire departments responded to an estimated average of 44,880 home fires involving electrical failure or malfunction each year in 2012-2016. • Home fires involving electrical failure or malfunction caused an estimated average of 440 civilian deaths and 1,250 civilian injuries each year in 2012-2016, as well as an estimated $1.3 billion in direct property damage a year.

Electrical failures or malfunctions are a leading factor in the ignition of fires in U.S. homes. Electrical failures or malfunctions were responsible for 13% of home structure fires in 2012-2016, ranking as the second leading contributing factor behind fires caused by unattended equipment. Electrical failure or malfunction fires also accounted for nearly one-fifth (18%) of civilian deaths (the second leading contributing factor behind fires caused by heat sources too close to combustibles), 11% of civilian injuries, and accounted for the greatest share of direct property damage (20%).

Short circuits from defective and worn insulation caused 14% of civilian home fire deaths as shown in Figure 2. This can be caused when cords are pinched by doors or furniture or through repetitive flexing of appliance cords. It can also be due to damaged wiring inside walls from nails, screws, or drill bits that puncture insulation during ordinary activities like hanging a picture.

Other reasons to address and adopt this NECode change is that currently the 2015 International Residential Code Fuel Gas, Pluming and Mechanical code as referenced below, already requires their respected trades to protect their piping by shield plates that extend past the framing member on each side.

Chapter 24 FUEL GAS G2415.7.1 (404.7.1) Piping Through Bored Holes or Notches
Where piping is installed through holes or notches in framing members and the piping is located less than 1 1/2 inches (38 mm) from the framing member face to which wall, ceiling or floor membranes will be attached, the pipe shall be protected by shield plates that cover the width of the pipe and the framing member and that extend not less than 4 inches (51 mm) to each side of the framing member. Where the framing member that the piping passes through is a bottom plate, bottom track, top plate or top track, the shield plates shall cover the framing member and extend not less than 4 inches (51 mm) above the bottom framing member and not less than 4 inches (51 mm) below the top framing member.

The 2015 International Residential Code Plumbing has similar requirements of an 1-1/4" inch from nearest edge of the member the pipe shall be protected by shield plates. But also goes on to say that such plates shall extend not less than 2" inches above soleplates and below top plates.

Chapter 26 General Plumbing Requirements P2603.2.1 Protection against physical damage
In concealed locations where piping, other than cast-iron or galvanized steel, is installed through holes or notches in studs, joists, rafters or similar members less than 1 1/2 inches (38 mm) from the nearest edge of the member, the pipe shall be protected by steel shield plates. Such shield plates shall have a thickness of not less than 0.0575 inch (1.463 mm) (No. 16 gage). Such plates shall cover the area of the pipe where the member is notched or bored and shall extend not less than 2 inches (51 mm) above sole plates and below top plates.

The 2015 International Residential Code Mechanical again has a similar requirement where the piping is less than 1-1/2 inches from framing members it shall be protected by shield plates that cover the width of pipe and framing member and that extends 2 inches to each side of the framing member.

Chapter 13 General Mechanical System Requirements M1308.2 Protection against physical damage
M1308.2.1 Piping Through Bored Holes or Notches
Where piping is installed through holes or notches in framing members and is located less than 1 1/2 inches (38 mm) from the framing member face to which wall, ceiling or floor membranes will be attached, the pipe shall be protected by shield plates that cover the width of the pipe and the framing member and that extend 2 inches (51 mm) to each side of the framing member. Where the framing member that the piping passes through is a bottom plate, bottom track, top plate or top track, the shield plates shall cover the framing member and extend 2 inches (51 mm) above the bottom framing member and 2 inches (51 mm) below the top framing member.

Signature (Required) **Vincent N. LaPorta** Vincent N. LaPorta

Member # 339125

PLEASE USE SEPARATE FORM FOR EACH PUBLIC INPUT

To: IAEI
901 Waterfall Way, Suite 602, Richardson, TX 75080
OR Fax to: (972) 235-3855 / Email to: iaei@iaei.org

Updated: 6/5/2018

Public Input No. 1055-NFPA 70-2020 [Section No. 300.4(D)]

(D) Cables and Raceways Parallel to Framing Members and Furring Strips.

In both exposed and concealed locations, where a cable- or raceway-type wiring method is installed parallel to framing members, such as joists, rafters, or studs, or is installed parallel to furring strips, the cable or raceway shall be installed and supported so that the nearest outside surface of the cable or raceway is not less than 32 mm (1¼ in.) from the nearest edge of the framing member or furring strips where nails or screws are likely to penetrate. Where this distance cannot be maintained, the cable or raceway shall be protected from penetration by nails or screws by a steel plate, sleeve, or equivalent at least 1.6 mm (⅛ in.) thick.

Exception No. 1: Steel plates, sleeves, or the equivalent shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, or electrical metallic tubing.

Exception No. 2: For concealed work in finished buildings, or finished panels for prefabricated buildings where such supporting is impracticable, it shall be permissible to fish the cables between access points.

Exception No. 3: A listed and marked steel plate less than 1.6 mm (⅛ in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

Exception No.4: Where cables enter junction boxes or enclosures that have entries within 1 1/4" of the framing member face, that portion of the cable between the box or enclosure and the closest cable securement to the box or enclosure that is within 1 1/4" of the framing member face, is allowed without nail plates or other physical protection.

Statement of Problem and Substantiation for Public Input

Due to the depth and the rear entry of typical plastic junction boxes for devices, NM cabling is forced to be well within 1 1/4" of wood or steel framing members. I've seen nail plates at every junction box on 2" x 4" framing where cabling enters the box. Previous inspectors might have called it this way. Two solutions are either to allow it and document it in the NEC, or have manufacturers shroud 1/16" steel around plastic box entries. Otherwise, mandated nail plates at every junction box entry within 1 1/4" is a justified call.

Submitter Information Verification

Submitter Full Name: Norman Feck
Organization: State of Colorado
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 13 18:03:45 EDT 2020
Committee: NEC-P03

Public Input No. 2743-NFPA 70-2020 [Section No. 300.4(D)]

(D) Cables and Raceways Parallel to Framing Members and Furring Strips.

In both exposed and concealed locations, where a cable- or raceway-type wiring method is installed parallel to framing members, such as joists, rafters, or studs, or is installed parallel to furring strips, the cable or raceway shall be installed and supported so that the nearest outside surface of the cable or raceway is not less than 32 mm (1¼ in.) from the nearest edge of the framing member or furring strips where nails or screws are likely to penetrate. Where this distance cannot be maintained, the cable or raceway shall be protected from penetration by nails or screws by a steel plate, sleeve, or equivalent at least 1.6 mm (⅛ in.) thick. **This protection shall extend at least 33mm (1-1/4 in.) on either side of framing members or furring strips.**

Exception No. 1: Steel plates, sleeves, or the equivalent shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, or electrical metallic tubing.

Exception No. 2: For concealed work in finished buildings, or finished panels for prefabricated buildings where such supporting is impracticable, it shall be permissible to fish the cables between access points.

Exception No. 3: A listed and marked steel plate less than 1.6 mm (⅛ in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

Statement of Problem and Substantiation for Public Input

When the NECode adopted the spacing requirement of 33mm (1-1/4"in.) from framing members or furring strips to protect NonMetalic Sheath Cable (NMSC) or Electrical Nonmetallic Tubing (ENT) from getting damaged it was a very wise decision. That Code change probably saved a lot of homes from catching fire or being destroyed and most importantly saved a lot of lives. I would like to see the NECode go one step further in protecting the NMSC or ENT from getting damaged by protecting it on either side of the framing members or furring strips as it passes through. The 1-1/4" in. spacing area where the wire turns toward the framing member is unprotected as it enters the notched furring strips or through bored holes of framing members. The wire is exposed to damage from nails or screws that could penetrate the cable or tubing by a slight mistake by the drywall installer with a wayward screw or nail. This small addition to the NECode will ensure the safety of the NMSC or ENT from getting damaged and comply fully with the intent of the NECode as the wire will be protected for that 1-1/4" area entering and leaving the framing member or furring strip. This NECode change in wording would be more specific to the requirement to protect the NMSC or ENT and extend the metal nail plate to either side of the framing member of furring strip.

Submitter Information Verification

Submitter Full Name: Vincent LAPORTA
Organization: Employee of Pinellas County Florida Building Dept. until April 2021 then retired. LaPorta Inspection Service LLC
Street Address:
City:
State:
Zip:
Submittal Date: Sun Aug 30 13:40:03 EDT 2020
Committee: NEC-P03

Public Input No. 4478-NFPA 70-2020 [Section No. 300.4(D)]

(D) Cables and Raceways Parallel to Framing Members and Furring Strips.

In both exposed and concealed locations, where a cable- or raceway-type wiring method is installed parallel to framing members, such as joists, rafters, or studs, or is installed parallel to furring strips, the cable or raceway shall be installed and supported so that the nearest outside surface of the cable or raceway is not less than 32 mm (1¼ in.) from the nearest edge of the framing member or furring strips where nails or screws are likely to penetrate. Where this distance cannot be maintained, the cable or raceway shall be protected from penetration by nails or screws by a steel plate, sleeve, or equivalent at least 1.6 mm (⅛ in.) thick.

Exception No. 1: Steel plates, sleeves, or the equivalent shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid ~~nonmetallic conduit~~ polyvinyl chloride conduit , or electrical metallic tubing.

Exception No. 2: For concealed work in finished buildings, or finished panels for prefabricated buildings where such supporting is impracticable, it shall be permissible to fish the cables between access points.

Exception No. 3: A listed and marked steel plate less than 1.6 mm (⅛ in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

Statement of Problem and Substantiation for Public Input

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

Submitter Information Verification

Submitter Full Name: David Humphrey
Organization: County of Henrico, Virginia
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 13:49:36 EDT 2020
Committee: NEC-P03

Public Input No. 1057-NFPA 70-2020 [Section No. 300.4(E)]

(E) Cables, Raceways, or Boxes Installed in or Under Roof Decking.

A cable, raceway, or box, installed in exposed or concealed locations under ~~metal-corrugated sheet~~ any roof decking, shall be installed and supported so there is not less than 38 mm (1½ in.) measured from the lowest surface of the roof decking to the top of the cable, raceway, or box. A cable, raceway, or box shall not be installed in concealed locations in metal-corrugated, sheet decking–type roof.

Informational Note: Roof decking material is often repaired or replaced after the initial raceway or cabling and roofing installation and may be penetrated by the screws or other mechanical devices designed to provide "hold down" strength of the waterproof membrane or roof insulating material.

Exception: Rigid metal conduit and intermediate metal conduit shall not be required to comply with 300.4(E).

Statement of Problem and Substantiation for Public Input

Corrugated metal sheet roofing isn't the only threat. Any roof can have the metal, shingles, etc replaced. Roofers miss the trusses or rafters when nailing/screwing plywood or OSB sheeting and could puncture wiring methods.

Article 690 used to call for a full 10" gap for firemen saws for any roofing.

Submitter Information Verification

Submitter Full Name: Norman Feck
Organization: State of Colorado
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 14 08:27:41 EDT 2020
Committee: NEC-P03

Public Input No. 1509-NFPA 70-2020 [Section No. 300.4(E)]

(E) Cables, Raceways, or Boxes Installed in or Under Roof Decking.

A cable, raceway, or box, installed in exposed or concealed locations under metal-corrugated sheet roof decking, shall be installed and supported so there is not less than 38 mm (1½ in.) measured from the lowest surface of the roof decking to the top of the cable, raceway, or box. A cable, raceway, or box shall not be installed in concealed locations in metal-corrugated, sheet decking–type roof.

Informational Note: Roof decking material is often repaired or replaced after the initial raceway or cabling and roofing installation and may be penetrated by the screws or other mechanical devices designed to provide "hold down" strength of the waterproof membrane or roof insulating material.

Exception 1 : Rigid metal conduit and intermediate metal conduit shall not be required to comply with 300.4(E).

Exception 2: A heavy-duty device box fabricated of malleable iron shall not be required to comply with 300.4(E) .

Additional Proposed Changes

File Name	Description	Approved
roof_decking_code_violation.PNG	roof decking code violation	

Statement of Problem and Substantiation for Public Input

There is currently no exception for the box. It makes total sense, since an exception exists for the wiring method.

Please see the code violations in the attached picture. NEC provides a way to use rigid conduit to achieve a code-compliant installation, but what about the box? We need something for that. This proposed change would solve the problem.

Submitter Information Verification

Submitter Full Name: Nick Sasso
Organization: Clark County Building and Fire
Street Address:
City:
State:
Zip:
Submittal Date: Fri Jun 12 10:11:11 EDT 2020
Committee: NEC-P03



Public Input No. 177-NFPA 70-2019 [Section No. 300.4(E)]

(E) Cables, Raceways, or Boxes Installed in or Under Roof Decking.

A cable, raceway, or box, installed in exposed or concealed locations under ~~metal-corrugated sheet roof decking~~ profiled metal roof decks , shall be installed and supported so there is not less than 38 mm (1½ in.) measured from the lowest surface of the roof decking to the top of the cable, raceway, or box. A cable, raceway, or box shall not be installed in concealed locations in profiled metal ~~-corrugated, sheet decking-type~~ roof decks .

Informational Note: Roof decking material is often repaired or replaced after the initial raceway or cabling and roofing installation and may be penetrated by the screws or other mechanical devices designed to provide “hold down” strength of the waterproof membrane or roof insulating material.

Exception 1 : Rigid metal conduit and intermediate metal conduit shall not be required to comply with 300.4(E).

Exception 2: Steel plates installed between electrical boxes and profiled metal roof decks that prevent roofing "hold down" screws from penetrating the installed boxes may be used when mounting boxes within the profiled metal roof deck corrugations or cavities.

Statement of Problem and Substantiation for Public Input

Metal roof deck are now produced in profiles up to 15" deep. These deep cavities are used for routing conduits and mounting electrical boxes for speakers., lights, communications etc. The code forces the installed to mount all electrical boxes 1.5 inches below the lowest metal deck surface, which is not reasonable when using deep metal deck panels. The use of steel plates that prevent roofing fasteners from penetrating the electrical boxes is a reasonable solution for mounting boxes within the metal deck cavities. The thickness of the steel plates needs to be specified.

Submitter Information Verification

Submitter Full Name: Stephen Potts
Organization: Epic Metals
Affiliation: Epic Metals
Street Address:
City:
State:
Zip:
Submittal Date: Tue Dec 10 08:22:37 EST 2019
Committee: NEC-P03

Public Input No. 2165-NFPA 70-2020 [Section No. 300.4(E)]

(E) Cables, Raceways, or Boxes Installed in or Under Roof Decking.

A cable, raceway, or box, installed in exposed or concealed locations under metal-corrugated sheet roof decking or plywood decking , shall be installed and supported so there is not less than 38 mm (1½ in.) measured from the lowest surface of the roof decking to the top of the cable, raceway, or box. A cable, raceway, or box shall not be installed in concealed locations in metal-corrugated, sheet decking–type roof.

Informational Note: Roof decking material is often repaired or replaced after the initial raceway or cabling and roofing installation and may be penetrated by the screws or other mechanical devices designed to provide “hold down” strength of the waterproof membrane or roof insulating material.

Exception: Rigid metal conduit and intermediate metal conduit shall not be required to comply with 300.4(E).

Statement of Problem and Substantiation for Public Input

300.4(E) only currently applies where the roof decking material is metal-corrugated sheet metal. The code is silent on installations where the decking material is plywood which is a commonly installed decking material. A cable, conductor, or raceway should be protected from physical damage from the fasteners used with plywood decking materials, or the fasteners used to secure equipment like PV racking to the decking materials.

Submitter Information Verification

Submitter Full Name: Brian Baughman
Organization:
Affiliation: myself
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 06 09:55:42 EDT 2020
Committee: NEC-P03

Public Input No. 2185-NFPA 70-2020 [Section No. 300.4(E)]

(E) Cables, Raceways, or Boxes Installed in or Under Roof Decking.

A cable, raceway, or box, installed in exposed or concealed locations under ~~metal-corrugated sheet~~ **wood/** metal sheet roof decking, shall be installed and supported so there is not less than 38 mm (1½ in.) measured from the lowest surface of the roof decking to the top of the cable, raceway, or box. A cable, raceway, or box shall not be installed in concealed locations in metal-corrugated, sheet decking–type roof.

Informational Note: Roof decking material is often repaired or replaced after the initial raceway or cabling and roofing installation and may be penetrated by the screws or other mechanical devices designed to provide "hold down" strength of the waterproof membrane or roof insulating material.

Exception: Rigid metal conduit and intermediate metal conduit shall not be required to comply with 300.4(E).

Additional Proposed Changes

File Name	Description	Approved
.1596805616948	conduit under roof decking	

Statement of Problem and Substantiation for Public Input

More and more solar/pv conduits are being installed in dwelling attics and often fastened to underside of roof trusses, this would insure install crews would not try fastening to roof sheathing.

Submitter Information Verification

Submitter Full Name: michael kidwell
Organization: washington county government Maryland
Affiliation: department of construction
Street Address:
City:
State:
Zip:
Submittal Date: Fri Aug 07 09:03:24 EDT 2020
Committee: NEC-P03

Public Input No. 369-NFPA 70-2020 [Section No. 300.4(E)]

(E) Cables, Raceways, or Boxes Installed in or Under Roof Decking.

A cable, raceway, or box, installed in exposed or concealed locations under metal-corrugated sheet roof decking, shall be installed and supported so there is not less than 38 mm (1½ in.) measured from the lowest surface of the roof decking to the top of the cable, raceway, or box. A cable, raceway, or box shall not be installed in concealed locations in metal-corrugated, sheet decking–type roof.

Informational Note: Roof decking material is often repaired or replaced after the initial raceway or cabling and roofing installation and may be penetrated by the screws or other mechanical devices designed to provide "hold down" strength of the waterproof membrane or roof insulating material.

Exception No. 1 : Rigid metal conduit and intermediate metal conduit shall not be required to comply with 300.4(E).

Exception No. 2: The 38 mm (1 1/2 in.) spacing is not required where metal-corrugated sheet roof decking is covered with a minimum thickness 50 mm (2 in.) concrete slab.

Additional Proposed Changes

File Name	Description	Approved
300.4_E_Exception_photo_1.jpg	concrete slab on top of metal roof decking	
300.4_E_Exception_photo_2_.jpg	raceway beneath metal roof decking with concrete slab	

Statement of Problem and Substantiation for Public Input

Renumber exception 1 and add new exception 2. Another exception is needed here to recognize construction techniques using poured concrete on top of the metal roof decking. In these instances there is virtually zero chance of sheet metal screws penetrating wiring methods installed below the deck. The 1 1/2 inch spacing requirements should be relaxed for this type of construction.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 370-NFPA 70-2020 [Section No. 410.10(F)]	

Submitter Information Verification

Submitter Full Name: Russ Leblanc
Organization: Leblanc Consulting Services
Street Address:
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State:
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Submittal Date: Sun Jan 26 14:37:14 EST 2020
Committee: NEC-P03


Concrete slab poured on top of metal corrugated roof decking


Concrete slab poured on top of metal currugated roof decking is visible near skylight oipening
EMT installed below metal currugated roof decking where a concrete slab was poured on top of metal roof deckingh.
01 . 13 . 2020

Public Input No. 4480-NFPA 70-2020 [Section No. 300.4(F)]

(F) Cables and Raceways Installed in Shallow Grooves.

Cable- or raceway-type wiring methods installed in a groove, to be covered by wallboard, siding, paneling, carpeting, or similar finish, shall be protected by 1.6 mm (1⁄16 in.) thick steel plate, sleeve, or equivalent or by not less than 32-mm (1¼-in.) free space for the full length of the groove in which the cable or raceway is installed.

Exception No. 1: Steel plates, sleeves, or the equivalent shall not be required to protect rigid metal conduit, intermediate metal conduit, rigid ~~nonmetallic conduit~~ polyvinl chloride conduit , or electrical metallic tubing.

Exception No. 2: A listed and marked steel plate less than 1.6 mm (1⁄16 in.) thick that provides equal or better protection against nail or screw penetration shall be permitted.

Statement of Problem and Substantiation for Public Input

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

Submitter Information Verification

Submitter Full Name: David Humphrey
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Submittal Date: Thu Sep 10 13:51:38 EDT 2020
Committee: NEC-P03

Public Input No. 1412-NFPA 70-2020 [Section No. 300.4(G)]

(G)– **Conductor Protection** Fittings.

Where raceways contain 4 AWG or larger insulated circuit conductors, and these conductors enter a cabinet, a box, an enclosure, or a raceway, prior to the installation of conductors, the conductors shall be protected in accordance with any of the following:

(1) An identified fitting providing a smoothly rounded insulating surface

(2) A listed metal fitting that has smoothly rounded edges

(3) Separation from the fitting or raceway using an identified insulating material that is securely fastened in place

(4) Threaded hubs or bosses that are an integral part of a cabinet, box, enclosure, or raceway providing a smoothly rounded or flared entry for conductors

Conduit bushings constructed wholly of insulating material shall not be used to secure a fitting or raceway. The insulating fitting or insulating material shall have a temperature rating not less than the insulation temperature rating of the installed conductors.

Statement of Problem and Substantiation for Public Input

The word “installation” is intended to make it clear the protective fitting needs to be installed “prior to the installation of conductors” - not after (which is a common practice).

Submitter Information Verification

Submitter Full Name: Mike Holt
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Submittal Date: Tue Jun 02 12:41:09 EDT 2020
Committee: NEC-P03

Public Input No. 2031-NFPA 70-2020 [Section No. 300.4(G)]

(G) Fittings.

Where raceways contain 4 AWG or larger insulated circuit conductors, and these conductors enter a cabinet, a box, an enclosure, or a raceway, the conductors shall be protected in accordance with any of the following:

(1) An identified fitting providing a smoothly rounded insulating surface

(2) A listed metal fitting that has smoothly rounded edges

(3) Separation from the fitting or raceway using an identified insulating material that is securely fastened in place

(4) Threaded hubs or bosses that are an integral part of a cabinet, box, enclosure, or raceway providing a smoothly rounded or flared entry for conductors

Conduit bushings constructed wholly of insulating material shall not be used to secure a fitting or raceway. The insulating fitting or insulating material shall have a temperature rating not less than the insulation temperature rating of the installed conductors.

The protective devices in items (1) though (4) shall be installed prior to the installation of the insulated circuit conductors.

Statement of Problem and Substantiation for Public Input

These devices are intended to protect the conductor insulation from damage. This damage can occur over time from the pressure between the conductor and the fitting, or it can occur at while the conductors are being installed. The code does not currently address when the protective device is to be installed. It is a common practice to install a non-metallic bushing after the conductors have been installed because the bushing often gets damaged during the conductor installation. If the bushing itself is being damaged from installing the conductors, what happens to the conductor insulation where the conductors are installed without the protective bushing in place?

Submitter Information Verification

Submitter Full Name: Don Ganiere
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Street Address:
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Submittal Date: Sun Jul 26 12:13:08 EDT 2020
Committee: NEC-P03

Public Input No. 1059-NFPA 70-2020 [Section No. 300.4(H)]

(H) Structural Joints and the Conductors Within .

A listed expansion/deflection fitting or other approved means shall be used where a raceway crosses a structural joint intended for expansion, contraction or deflection, used in buildings, bridges, parking garages, or other structures.

Where expansion, contraction, or deflection fittings are used for physical raceway movement, ample lengths of conductors shall be provided at the ends of raceways utilizing such fittings. Conductors within the enclosures shall be routed in the enclosures in a manner that allows for conductor movement.

Statement of Problem and Substantiation for Public Input

It isn't enough to have strictly the raceways compensate for physical movement. A more generous length of conductor must be left within the enclosure at each end of raceways containing expansion, contraction, or deflection fittings. Also, the conductors shouldn't be forced over a fitting immediately after entering an enclosure but remain straight for a sufficient length.

Submitter Information Verification

Submitter Full Name: Norman Feck
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State:
Zip:
Submittal Date: Thu May 14 08:41:51 EDT 2020
Committee: NEC-P03

Public Input No. 217-NFPA 70-2019 [Section No. 300.4(H)]

(H) ~~Structural Joints~~ Expansion or Seismic Joints and similar areas .

A listed expansion/deflection fitting or other approved means shall be used where a raceway crosses a ~~structural joint~~ point intended for expansion, contraction or deflection, used in equipment, buildings, bridges, parking garages, or other structures.

Statement of Problem and Substantiation for Public Input

There are other areas that are not being addressed requiring expansion and deflection. Because the title only addresses structural joints the AHJ is limited to this specific area or point in the building/structure, however this can take place supplying power to equipment designed to move in a seismic event or manufacturing machinery where they connect to designed anchors (seismic controls) or vibration isolators

Submitter Information Verification

Submitter Full Name: Alfio Torrisi
Organization: Master electrician
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State:
Zip:
Submittal Date: Sun Dec 29 09:11:16 EST 2019
Committee: NEC-P03

Public Input No. 218-NFPA 70-2019 [Section No. 300.5]

300.5 Underground Installations.

(A) Minimum Cover Requirements.

Direct-buried ~~cable, conduit, or other~~ conductors, cables and raceways shall be installed to meet the minimum cover requirements of Table 300.5.

Table 300.5 Minimum Cover Requirements, 0 to 1000 Volts, Nominal, Burial in Millimeters (Inches)

	Type of Wiring Method or Circuit									
	Column 1 Direct Burial Cables or Conductors		Column 2 Rigid Metal Conduit or Intermediate Metal Conduit		Column 3 Nonmetallic Raceways Listed for Direct Burial Without Concrete Encasement or Other Approved Raceways		Column 4 Residential Branch Circuits Rated 120 Volts or Less with GFCI Protection and Maximum Overcurrent Protection of 20 Amperes		Circuits for C Lighting Lim Installed with	
Location of Wiring Method or Circuit	mm	in.	mm	in.	mm	in.	mm	in.	m	
All locations not specified below	600	24	150	6	450	18	300	12	150	[3]
In trench below 50 mm (2 in.) thick concrete or equivalent	450	18	150	6	300	12	150	6	150	
Under a building , other than service circuits	0	0	0	0	0	0	0	0	0	
(in raceway or Type MC or Type MI cable identified for direct burial)										

					(in raceway or Type MC or Type MI cable identified for direct burial)		(in raceway or Type cable identified for d			
Under minimum of 102 mm (4 in.) thick concrete exterior slab with no vehicular traffic and the slab extending not less than 152 mm (6 in.) beyond the underground installation	450	18	100	4	100	4			15	

								10
Under streets, highways, roads, alleys, driveways, and parking lots . Service lateral and underground service entrance conductors in all areas	600	24 24	600	24 24	600	24		60
One- and two-family dwelling driveways and outdoor parking areas, and used only for dwelling-related purposes	450	18	450	18	450	18		30
In or under airport runways, including adjacent areas where trespassing prohibited	450	18	450	18	450	18		45

[a]A lesser depth shall be permitted where specified in the installation instructions of a listed low-voltage lighting system.

[b]A depth of 150 mm (6 in.) shall be permitted for pool, spa, and fountain lighting, installed in a nonmetallic raceway, limited to not more than 30 volts where part of a listed low-voltage lighting system.

Notes:

1. Cover is defined as the shortest distance in mm (in.) measured between a point on the top surface of any direct-buried conductor, cable, conduit, or other raceway and the top surface of finished grade, concrete, or similar cover.

2. Raceways approved for burial only where concrete encased shall require concrete envelope not less than 50 mm (2 in.) thick.

3. Lesser depths shall be permitted where cables and conductors rise for terminations or splices or where access is otherwise required.

4. Where one of the wiring method types listed in Columns 1 through 3 is used for one of the circuit types in Columns 4 and 5, the shallowest depth of burial shall be permitted.

5. Where solid rock prevents compliance with the cover depths specified in this table, the wiring shall be installed in a metal raceway, or a nonmetallic raceway permitted for direct burial. The raceways shall be covered by a minimum of 50 mm (2 in.) of concrete extending down to rock.

(B) Wet Locations.

The interior of enclosures or raceways installed underground shall be considered to be a wet location. Insulated conductors and cables installed in these enclosures or raceways in underground installations shall comply with 310.10(C).

(C) Underground Cables and Conductors Under Buildings.

Underground cable and conductors installed under a building shall be in a raceway.

Exception No. 1: Type MI cable shall be permitted under a building without installation in a raceway where embedded in concrete, fill, or other masonry in accordance with 332.10(6) or in underground runs where suitably protected against physical damage and corrosive conditions in accordance with 332.10(10).

Exception No. 2: Type MC cable listed for direct burial or concrete encasement shall be permitted under a building without installation in a raceway in accordance with 330.10(A)(5) and in wet locations in accordance with 330.10(A)(11).

(D) Protection from Damage.

Direct-buried conductors and cables shall be protected from damage in accordance with 300.5(D)(1) through (D)(4).

(1) Emerging from Grade.

Direct-buried conductors and cables emerging from grade and specified in columns 1 and 4 of Table 300.5 shall be protected by enclosures or raceways extending from the minimum cover distance below grade required by 300.5(A) to a point at least 2.5 m (8 ft) above finished grade. In no case shall the protection be required to exceed 450 mm (18 in.) below finished grade.

(2) Conductors Entering Buildings.

Conductors entering a building shall be protected to the point of entrance.

(3) Service Conductors.

Underground service conductors that are not encased in concrete and that are buried 450 mm (~~18 in~~ 24in .) or more below grade shall have their location identified by a warning ribbon that is placed in the trench at least 300 mm (12 in.) above the underground installation.

(4) Enclosure or Raceway Damage.

Where the enclosure or raceway is subject to physical damage, the conductors shall be installed in electrical metallic tubing, rigid metal conduit, intermediate metal conduit, RTRC-XW, Schedule 80 PVC conduit, or equivalent.

(E) Splices and Taps.

Direct-buried conductors or cables shall be permitted to be spliced or tapped without the use of splice boxes. The splices or taps shall be made in accordance with 110.14(B).

(F) Backfill.

Backfill that contains large rocks, paving materials, cinders, large or sharply angular substances, or corrosive material shall not be placed in an excavation where materials may damage raceways, cables, conductors, or other substructures or prevent adequate compaction of fill or contribute to corrosion of raceways, cables, or other substructures.

Where necessary to prevent physical damage to the raceway, cable, or conductor, protection shall be provided in the form of granular or selected material, suitable running boards, suitable sleeves, or other approved means.

(G) Raceway Seals.

Conduits or raceways through which moisture may contact live parts shall be sealed or plugged at either or both ends. Spare or unused raceways shall also be sealed. Sealants shall be identified for use with the cable insulation, conductor insulation, bare conductor, shield, or other components.

Informational Note: Presence of hazardous gases or vapors may also necessitate sealing of underground conduits or raceways entering buildings.

(H) Bushing.

A bushing, or terminal fitting, with an integral bushed opening shall be used at the end of a conduit or other raceway that terminates underground where the conductors or cables emerge as a direct burial wiring method. A seal incorporating the physical protection characteristics of a bushing shall be permitted to be used in lieu of a bushing.

(I) Conductors of the Same Circuit.

All conductors of the same circuit and, where used, the grounded conductor and all equipment grounding conductors shall be installed in the same raceway or cable or shall be installed in close proximity in the same trench.

Exception No. 1: Conductors shall be permitted to be installed in parallel in raceways, multiconductor cables, or direct-buried single conductor cables. Each raceway or multiconductor cable shall contain all conductors of the same circuit, including equipment grounding conductors. Each direct-buried single conductor cable shall be located in close proximity in the trench to the other single conductor cables in the same parallel set of conductors in the circuit, including equipment grounding conductors.

Exception No. 2: Isolated phase, polarity, grounded conductor, and equipment grounding and bonding conductor installations shall be permitted in nonmetallic raceways or cables with a nonmetallic covering or nonmagnetic sheath in close proximity where conductors are paralleled as permitted in 310.10(G), and where the conditions of 300.20(B) are met.

(J) Earth Movement.

Where direct-buried conductors, raceways, or cables emerging from grade are subject to movement by settlement or frost, direct-buried conductors, raceways, or cables shall be arranged so as to prevent damage to the enclosed conductors or to equipment connected to the raceways.

Informational Note: This section recognizes “S” loops in underground direct burial cables and conductors to raceway transitions, expansion fittings in raceway risers to fixed equipment, and, generally, the provision of flexible connections to equipment subject to settlement or frost heaves.

(K) Directional Boring.

Cables or raceways installed using directional boring equipment shall be approved for the purpose.

Statement of Problem and Substantiation for Public Input

the title dose not reflex all types of wiring methods that are in the section, also it states "conduit and other raceways" this language is redundant and only raceways is needed. the Table did not allow for a column to be added please see attached. Service conductors are the most dangerous circuits based on the lack of short circuit protection. this danger is more prevalent with today's modern heavy equipment which can dig in on scope up two 2 feet. treating this type of circuit the same as a feeder or branch circuit is not practical and dose not address the danger present in this type of circuit. buy burying the service circuit a min of two feet it would provide add protection neede

Submitter Information Verification

Submitter Full Name: Alfio Torrisi
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Submittal Date: Sun Dec 29 09:54:39 EST 2019
Committee: NEC-P03

Public Input No. 429-NFPA 70-2020 [New Section after 300.5(A)]

TITLE OF NEW CONTENT

during my work on field i have many times exposed to the following requirements on the electrical specifications regards to the conduits embedded on concrete: the ACI code, 318 (American Concrete Institute), article 6.3.6 requires some aaditional verifiations beyond the requirements of the NEC. especially like having the conduits embdded on concrete on the middle third of the slab. and Not to have more than 2 layers of conduits crossing on the slab.Many times the installed electrical work is satisfying the NEC requirements and still violating the ACI code which lead to type of rework as itis not brought up on the inspector's mind or check list. i am just wondering if we can add an informative note, or a clause to bring to the installed's mind this information. I am Mostafa Morsi, certifed resdential electrical inspector, from the international assosiation of electrical inspectors. Licience # CEI-R-199

Statement of Problem and Substantiation for Public Input

Satisfying the NEC requirements for the embedded conduits in slab, and bring the installer and inspector's attention to the other standards requirements which could cause rework or violation and endanger the concrete work

Submitter Information Verification

Submitter Full Name: Mostafa Morsi
Organization: BI Harbert
Street Address:
City:
State:
Zip:
Submittal Date: Thu Feb 06 02:15:17 EST 2020
Committee: NEC-P03

Public Input No. 1399-NFPA 70-2020 [Section No. 300.5(A)]

(A) Minimum Cover Requirements.

Direct-buried cable, conduit, or other raceways shall be installed to meet the minimum cover requirements of Table 300.5.

Table 300.5 Minimum Cover Requirements, 0 to 1000 Volts, Nominal, Burial in Millimeters (Inches)

Location of Wiring Method or Circuit	Type of Wiring Method or Circuit											
	Column 1 Direct Burial Cables or Conductors		Column 2 Rigid Metal Conduit or , Intermediate Metal Conduit, or Schedule 80 PVC		Column 3 Nonmetallic Raceways Listed for Direct Burial Without Concrete Encasement or Other Approved Raceways		Column 4 Residential Branch Circuits Rated 120 Volts or Less with GFCI Protection and Maximum Overcurrent Protection of 20 Amperes		Column 5 Circuits for Control of Irrigation and Landscape Lighting Limited to Not More Than 30 Volts and Installed with Type UF or in Other Identified Cable or Raceway			
	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.		
All locations not specified below	600	24	150	6	450	18	300	12	150[a, b]	6[a, b]		
In trench below 50 mm (2 in.) thick concrete or equivalent	450	18	150	6	300	12	150	6	150	6		
Under a building	0	0	0	0	0	0	0	0	0	0		
	-	(in raceway or Type MC or Type MI cable identified for direct burial)	-	-	-	-					(in raceway or Type MC or Type MI cable identified for direct burial)	(in raceway or Type MC or Type MI cable identified for direct burial)
Under minimum of 102 mm (4 in.) thick concrete exterior slab with no vehicular traffic and the slab extending not less than 152 mm (6 in.) beyond the underground installation	450	18	100	4	100	4	150 (direct burial) 100 (in raceway)	6 4	150 (direct burial) 100 (in raceway)	6 4		
Under streets, highways, roads, alleys, driveways, and parking lots	600	24	600	24	600	24	600	24	600	24		
One- and two-family dwelling driveways and outdoor parking areas, and used only for dwelling-related purposes	450	18	450	18	450	18	300	12	450	18		
In or under airport runways, including adjacent areas where trespassing prohibited	450	18	450	18	450	18	450	18	450	18		

[a] A lesser depth shall be permitted where specified in the installation instructions of a listed low-voltage lighting system.

[b] A depth of 150 mm (6 in.) shall be permitted for pool, spa, and fountain lighting, installed in a nonmetallic raceway, limited to not more than 30 volts where part of a listed low-voltage lighting system.

Notes:

1. Cover is defined as the shortest distance in mm (in.) measured between a point on the top surface of any direct-buried conductor, cable, conduit, or other raceway and the top surface of finished grade, concrete, or similar cover.

2. Raceways approved for burial only where concrete encased shall require concrete envelope not less than 50 mm (2 in.) thick.

3. Lesser depths shall be permitted where cables and conductors rise for terminations or splices or where access is otherwise required.

4. Where one of the wiring method types listed in Columns 1 through 3 is used for one of the circuit types in Columns 4 and 5, the shallowest depth of burial shall be permitted.

5. Where solid rock prevents compliance with the cover depths specified in this table, the wiring shall be installed in a metal raceway, or a nonmetallic raceway permitted for direct burial. The raceways shall be covered by a minimum of 50 mm (2 in.) of concrete extending down to rock.

Statement of Problem and Substantiation for Public Input

Added Schedule 80 PVC to Column 2 since Schedule 80 PVC is listed to provide protection for “severe physical damage.” Removed the text “Residential” from Column 4 since the electrons do not know the difference between “residential” and other than “residential.” In addition, there is no definition of “Residential” in the NEC.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jun 02 11:28:21 EDT 2020
Committee: NEC-P03

Public Input No. 2278-NFPA 70-2020 [Section No. 300.5(A)]

(A) Minimum Cover Requirements.

Direct-buried cable, conduit, or other raceways shall be installed to meet the minimum cover requirements of Table 300.5.

Table 300.5 Minimum Cover Requirements, 0 to 1000 Volts, Nominal, Burial in Millimeters (Inches)

Location of Wiring Method or Circuit	Type of Wiring Method or Circuit											
	Column 1 Direct Burial Cables or Conductors		Column 2 Rigid Metal Conduit or Intermediate Metal Conduit		Column 3 Nonmetallic Raceways Listed for Direct Burial Without Concrete Encasement or Other Approved Raceways		Column 4 Residential Branch Circuits Rated 120 Volts or Less with GFCI Protection and Maximum Overcurrent Protection of 20 Amperes		Column 5 Circuits for Control of Irrigation and Landscape Lighting Limited to Not More Than 30 Volts and Installed with Type UF or in Other Identified Cable or Raceway			
	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.		
All locations not specified below	600	24	150	6	450	18	300	12	150[a, b]	6[a, b]		
In trench below 50 mm (2 in.) thick concrete or equivalent	450	18	150	6	300	12	150	6	150	6		
Under a building	0 (in raceway or Type MC or Type MI cable identified for direct burial)	0	0	0	0	0	0	0	0	0	(in raceway or Type MC or Type MI cable identified for direct burial)	(in raceway or Type MC or Type MI cable identified for direct burial)
Under minimum of 102 mm (4 in.) thick concrete exterior slab with no vehicular traffic and the slab extending not less than 152 mm (6 in.) beyond the underground installation	450	18	100	4	100	4	150 (direct burial) 100 (in raceway)	6 4	150 (direct burial) 100 (in raceway)	6 4		
Under streets, highways, roads, alleys, driveways, and parking lots	600	24	600	24	600	24	600	24	600	24		
One- and two-family dwelling driveways ~~and outdoor~~ , outdoor parking areas, and yards and used only for dwelling-related purposes	450	18	450	18	450	18	300	12	450	18		
In or under airport runways, including adjacent areas where trespassing prohibited	450	18	450	18	450	18	450	18	450	18		

[a] A lesser depth shall be permitted where specified in the installation instructions of a listed low-voltage lighting system.

[b] A depth of 150 mm (6 in.) shall be permitted for pool, spa, and fountain lighting, installed in a nonmetallic raceway, limited to not more than 30 volts where part of a listed low-voltage lighting system.

Notes:

1. Cover is defined as the shortest distance in mm (in.) measured between a point on the top surface of any direct-buried conductor, cable, conduit, or other raceway and the top surface of finished grade, concrete, or similar cover.

2. Raceways approved for burial only where concrete encased shall require concrete envelope not less than 50 mm (2 in.) thick.

3. Lesser depths shall be permitted where cables and conductors rise for terminations or splices or where access is otherwise required.

4. Where one of the wiring method types listed in Columns 1 through 3 is used for one of the circuit types in Columns 4 and 5, the shallowest depth of burial shall be permitted.

5. Where solid rock prevents compliance with the cover depths specified in this table, the wiring shall be installed in a metal raceway, or a nonmetallic raceway permitted for direct burial. The raceways shall be covered by a minimum of 50 mm (2 in.) of concrete extending down to rock.

Statement of Problem and Substantiation for Public Input

Table 300.5 allows eighteen inches of cover for installations at "one- and two-family dwelling driveways, and outdoor parking areas, and used only for dwelling related purposes." Because the existing language specifically refers to "driveways and parking areas," the yard is not included in this list. Therefore, the wiring would have to be installed with twenty-four inches of cover under the Column 1, Row 1 parameters, unless GFCI protection is provided.

Example: Type UF cable is installed from a one-family dwelling to a detached building without GFCI protection. As per Table 300.5, the wiring would need to be installed with twenty-four inches of cover in the yard, but could then be installed with eighteen inches of cover under the driveway. This is not logical and does not improve safety.

I believe that industry practice is to allow for the shallower depth in the yard, but I think it is important that the NEC states that clearly.

Submitter Information Verification

Submitter Full Name: Michal Hofkin
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Submittal Date: Thu Aug 13 14:16:40 EDT 2020
Committee: NEC-P03

Public Input No. 3061-NFPA 70-2020 [Section No. 300.5(A)]

(A) Minimum Cover Requirements.

Direct-buried cable, conduit, or other raceways shall be installed to meet the minimum cover requirements of Table 300.5.

Table 300.5 Minimum Cover Requirements, 0 to 1000 Volts, Nominal, Burial in Millimeters (Inches)

Location of Wiring Method or Circuit	Type of Wiring Method or Circuit											
	Column 1 Direct Burial Cables or Conductors		Column 2 Rigid Metal Conduit ~~or~~, Intermediate Metal Conduit, Schedule 80 PVC Conduit		Column 3 Nonmetallic Raceways Listed for Direct Burial Without Concrete Encasement or Other Approved Raceways		Column 4 Residential Branch Circuits Rated 120 Volts or Less with GFCI Protection and Maximum Overcurrent Protection of 20 Amperes		Column 5 Circuits for Control of Irrigation and Landscape Lighting Limited to Not More Than 30 Volts and Installed with Type UF or in Other Identified Cable or Raceway			
	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.		
All locations not specified below	600	24	150	6	450	18	300	12	150[a, b]	6[a, b]		
In trench below 50 mm (2 in.) thick concrete or equivalent	450	18	150	6	300	12	150	6	150	6		
Under a building	0	0	0	0	0	0	0	0	0	0		
	-	(in raceway or Type MC or Type MI cable identified for direct burial)	-	-	-	-					(in raceway or Type MC or Type MI cable identified for direct burial)	(in raceway or Type MC or Type MI cable identified for direct burial)
Under minimum of 102 mm (4 in.) thick concrete exterior slab with no vehicular traffic and the slab extending not less than 152 mm (6 in.) beyond the underground installation	450	18	100	4	100	4	150 100	6 (direct burial) 4 (in raceway)	150 100	6 (direct burial) 4 (in raceway)		
Under streets, highways, roads, alleys, driveways, and parking lots	600	24	600	24	600	24	600	24	600	24		
One- and two-family dwelling driveways and outdoor parking areas, and used only for dwelling-related purposes	450	18	450	18	450	18	300	12	450	18		
In or under airport runways, including adjacent areas where trespassing prohibited	450	18	450	18	450	18	450	18	450	18		

[a] A lesser depth shall be permitted where specified in the installation instructions of a listed low-voltage lighting system.

[b] A depth of 150 mm (6 in.) shall be permitted for pool, spa, and fountain lighting, installed in a nonmetallic raceway, limited to not more than 30 volts where part of a listed low-voltage lighting system.

Notes:

1. Cover is defined as the shortest distance in mm (in.) measured between a point on the top surface of any direct-buried conductor, cable, conduit, or other raceway and the top surface of finished grade, concrete, or similar cover.

2. Raceways approved for burial only where concrete encased shall require concrete envelope not less than 50 mm (2 in.) thick.

3. Lesser depths shall be permitted where cables and conductors rise for terminations or splices or where access is otherwise required.

4. Where one of the wiring method types listed in Columns 1 through 3 is used for one of the circuit types in Columns 4 and 5, the shallowest depth of burial shall be permitted.

5. Where solid rock prevents compliance with the cover depths specified in this table, the wiring shall be installed in a metal raceway, or a nonmetallic raceway permitted for direct burial. The raceways shall be covered by a minimum of 50 mm (2 in.) of concrete extending down to rock.

Statement of Problem and Substantiation for Public Input

Schedule 80 PVC is readily availble in smaller sizes and has the same strength comparisons and should be included in column two with the metal conduits.

Submitter Information Verification

Submitter Full Name: Mark Rochon
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 04 12:52:48 EDT 2020
Committee: NEC-P03

Public Input No. 650-NFPA 70-2020 [Section No. 300.5(A)]

(A) Minimum Cover Requirements.

Direct-buried cable, conduit, or other raceways shall be installed to meet the minimum cover requirements of Table 300.5.

Table 300.5 Minimum Cover Requirements, 0 to 1000 Volts, Nominal, Burial in Millimeters (Inches)

Location of Wiring Method or Circuit	Type of Wiring Method or Circuit									
	Column 1 Direct Burial Cables or Conductors		Column 2 Rigid Metal Conduit or Intermediate Metal Conduit		Column 3 Nonmetallic Raceways Listed for Direct Burial Without Concrete Encasement or Other Approved Raceways		Column 4 Residential Branch Circuits Rated 120 Volts or Less with GFCI Protection and Maximum Overcurrent Protection of 20 Amperes		Column 5 Circuits for Control of Irrigation and Landscape Lighting Limited to Not More Than 30 Volts and Installed with Type UF or in Other Identified Cable or Raceway	
	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
All locations not specified below	600	24	150							
6										
0							450	18	300	12
In trench below 50 mm (2 in.) thick concrete or equivalent							450	18	150	
6										
0	300	12	150	6	150	6				
Under a building	0	0	0	0	0	0	0	0	0	0
-										
(in raceway or Type MC or Type MI cable identified for direct burial)										

			(in raceway or Type MC or Type MI cable identified for direct burial)		(in raceway or Type MC or Type MI cable identified for direct burial)					
Under minimum of 102 mm (4 in.) thick concrete exterior slab with no vehicular traffic and the slab extending not less than 152 mm (6 in.) beyond the underground installation	450	18	100	4	100	4	150 (direct burial) 100 (in raceway)	6 4	150 (direct burial) 100 (in raceway)	6 4
Under streets, highways, roads, alleys, driveways, and parking lots	600	24	600	24	600	24	600	24	600	24
One- and two-family dwelling driveways and outdoor parking areas, and used only for dwelling-related purposes	450	18	450	18	450	18	300	12	450	18
In or under airport runways, including adjacent areas where trespassing prohibited	450	18	450	18	450	18	450	18	450	18

[a] A lesser depth shall be permitted where specified in the installation instructions of a listed low-voltage lighting system.

[b] A depth of 150 mm (6 in.) shall be permitted for pool, spa, and fountain lighting, installed in a nonmetallic raceway, limited to not more than 30 volts where part of a listed low-voltage lighting system.

Notes:

1. Cover is defined as the shortest distance in mm (in.) measured between a point on the top surface of any direct-buried conductor, cable, conduit, or other raceway and the top surface of finished grade, concrete, or similar cover.

2. Raceways approved for burial only where concrete encased shall require concrete envelope not less than 50 mm (2 in.) thick.

3. Lesser depths shall be permitted where cables and conductors rise for terminations or splices or where access is otherwise required.

4. Where one of the wiring method types listed in Columns 1 through 3 is used for one of the circuit types in Columns 4 and 5, the shallowest depth of burial shall be permitted.

5. Where solid rock prevents compliance with the cover depths specified in this table, the wiring shall be installed in a metal raceway, or a nonmetallic raceway permitted for direct burial. The raceways shall be covered by a minimum of 50 mm (2 in.) of concrete extending down to rock.

Statement of Problem and Substantiation for Public Input

IMC(342) and RMC (344) are both permitted to be installed where subject to severe physical damage (342.10 (E) and 344.10 (E). What is the justification to require a 6-inch minimum depth for a product that does not have a "Uses Not Permitted" section and is designed for severe physical damage? These conduits can be surface mounted on the ground but if installed in the ground it must have 6 inches of cover -Why? There are times when running conduit inside a flower bed next to the curb that we cannot get 6 inches of cover due to the asphalt that extends past the curb.

Submitter Information Verification

Submitter Full Name: David Hittinger
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Submittal Date: Sun Mar 15 17:01:30 EDT 2020
Committee: NEC-P03

Public Input No. 2446-NFPA 70-2020 [Section No. 300.5(D)(1)]

(1) Emerging from Grade.

Direct-buried conductors and cables emerging from grade and specified in columns 1 and 4 of Table 300.5 shall be protected by enclosures or by raceways extending from the minimum cover distance below grade required by 300.5(A) to the point where they enter enclosures, or without enclosures , to a point at least 2.5 m (8 ft) above finished grade. In no case shall the protection be required to exceed 450 mm (18 in.) below finished grade.

Statement of Problem and Substantiation for Public Input

Read literally--and unfortunately, some people now tasked with enforcing the NEC don't have the training or experience to do anything but at best enforce it literally--this could require underground wiring to be protected by a raceway till it enters an enclosure, and then if the enclosure doesn't reach to 2.5 M, leave the enclosure in a raceway rather than a cable wiring method. "But it's no longer the same wiring!" Argue it out with the new inspector. Let's just simply clarify the wording.

Submitter Information Verification

Submitter Full Name: David Shapiro
Organization: Safety First Electrical
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City:
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Submittal Date: Sat Aug 22 15:46:22 EDT 2020
Committee: NEC-P03

Public Input No. 1030-NFPA 70-2020 [Section No. 300.5(D)(3)]

(3) Service Conductors.

Underground service conductors that are not encased in concrete and that are buried 450 mm (18 in.) or more below grade shall have their location identified by a warning ribbon that is placed in the trench at least 300 mm (12 in.) above the underground installation. Trenches containing service conductors shall not contain any pipe, tube, or equal for steam, water, air, gas, drainage, or any system other than electrical.

Statement of Problem and Substantiation for Public Input

This Public Input is specific with regard to service conductors only, and not all underground electrical installations.

The International Fuel Gas code permits gas pipe to be installed at a minimum depth of 12-inches below grade and in some cases, 8-inches below grade. Service conductors are usually required to be installed at greater depths.

Allowing the electrical service conductors in the same trench with other systems creates a potentially deadly conflict with section 300.5(D)(3). Someone who is digging may encounter the [required] warning ribbon and think that all is well, when in reailty there may be a gas line or some other system near that same depth. They can strike a gas line. Trenches for service conductors should contain no other system, and the warning ribbon should be placed in the trench at the mandated depth. We can (and should) regulate that underground service conductors be installed in their own trench.

In addition, allowing electrical service conductors in the same trench with other systems can create confusion, as the person who encounters the electrical warning tape may believe that the "other system" is actually the electrical installation.

In the event that the proposed language is not accepted by the panel, then more clarification is requested. I will use a gas line in the same trench as the service conductors, for my example.
In the case of underground service conductors buried at 24-inches below grade in the same trench as a gas line buried at 12-inches below grade, where is the electrician supposed to install the required warning ribbon?
Should it be placed above the gas line?
Or should it be placed below the gas line, or to the side of it...and how far away, etc., etc., (you get the point)?

Currently, the NEC creates a defacto relationship with regard to underground service conductors and other systems in the same trench by not having any language to prohibit this questionable practice.

Every electrical installer (helper, journeyman, master) and inspector that I speak with feels that it is "stupid" to allow electrical service conductors in the same trench as other systems.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1043-NFPA 70-2020 [Section No. 230.50(A)]	
Public Input No. 1043-NFPA 70-2020 [Section No. 230.50(A)]	

Submitter Information Verification

Submitter Full Name: Nick Sasso
Organization: Clark County Building and Fire
Street Address:
City:
State:
Zip:
Submittal Date: Mon May 11 16:01:37 EDT 2020
Committee: NEC-P03

Public Input No. 1060-NFPA 70-2020 [Section No. 300.5(D)(3)]

~~(3) Service Conductors.~~

~~Underground service~~

Underground Circuit Conductors 120 volts or greater to Ground .

Service, feeder,and branch circuit conductors that are not encased in concrete and that are buried 450 mm (18 in.) or more below grade shall have their location identified by a warning ribbon that is placed in the trench at least 300 mm (12 in.) above the underground installation.

Statement of Problem and Substantiation for Public Input

The NEC Handbook tells us the ribbon is not required for feeders or branch circuit conductors because unlike service conductors these have short circuit and overload protection. Throughout the NEC we go to great lengths to provide physical protection for conductors so it's difficult to find logic with the reason given in the NEC Handbook. A warning ribbon installed at the proper height above the conductors provides a higher degree of safety. It also can be a great value for so little cost considering repairs and down time in the event these conductors are hit. A warning ribbon that includes feeders and branch circuits is one more sensible precaution in preventing ground faults and short circuits. Yes, the overcurrent protective devices should do their job and open in the event of a fault be we should try to prevent throwing sparks.

Note: Depending on the demarcation location, an electrical inspector may have little jurisdiction on what happens on the line side of the service point of connection therefore little say on the service conductors' installation.

Submitter Information Verification

Submitter Full Name: Norman Feck
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Submittal Date: Thu May 14 08:53:02 EDT 2020
Committee: NEC-P03

Public Input No. 226-NFPA 70-2019 [Section No. 300.5(D)(3)]

(3) Service Conductors.

Underground service conductors ~~that are not encased in concrete and that are buried 450 mm (18 in.) or more below grade~~ , cables or raceways shall have their location identified by a warning ribbon ~~that is placed in the trench at least 300 mm~~ 304 mm (12 in.) above the underground installation.

Statement of Problem and Substantiation for Public Input

Service conductor are a hazards based on no short circuit protection, back hoes and heavy equipment can easily rip up a conduit or cable. A warring ribbon should be identified this hazard before it is encounter. the removal of the 18 inches is because this burial depth can be reduced by Table 300.5 note 5, although this may have the ribbon directly above the concrete encased raceway it wit identify the installation as a hazard when encountered by laypersons.

Submitter Information Verification

Submitter Full Name: Alfio Torrisi
Organization: Master Electrician
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City:
State:
Zip:
Submittal Date: Mon Dec 30 12:24:35 EST 2019
Committee: NEC-P03

Public Input No. 4408-NFPA 70-2020 [Section No. 300.5(D)(3)]

(3) Service Conductors, Feeders and Branch Circuits .

Underground service conductors, feeders and branch circuits that are not encased in concrete and that are buried 450 mm (18 in.) or more below grade shall have their location identified by a warning ribbon that is placed in the trench at least 300 mm (12 in.) above the underground installation.

Statement of Problem and Substantiation for Public Input

Feeders and branch circuits that are not encased in concrete pose a significant risk to property owners as when they contact the locating services provided by the utilities these conductors are identified by the locating service as they are downstream from the utilities responsibilities. The property owner does not necessarily know where these circuits are located and could start unknowingly digging with out warning contact these conductors. If the insulation is damaged it will not necessarily operate the OCPD. If an individual contacts the damaged conductor they may suffer a severe shock or electrocution. By providing marking tape at a minimum this would alert the individual of the impending danger.

Submitter Information Verification

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Submittal Date: Thu Sep 10 12:19:07 EDT 2020
Committee: NEC-P03

Public Input No. 4304-NFPA 70-2020 [Section No. 300.5(D) [Excluding any Sub-Sections]]

Direct-buried conductors and cables shall be protected from damage in accordance with 300.5(D)(1) through (D)(4). Buried raceways enclosing service conductors shall additionally meet the requirement in 300.5(D)(3).

Statement of Problem and Substantiation for Public Input

The present literal text only applies the service path marking requirement to direct burial installations. It clearly should apply, and historically did apply prior to reorganization activity, to buried service raceways that are unencased in concrete, which is its own marking. A backhoe operating in the vicinity of a buried PVC service raceway should have the same warning as is now required for direct burial work.

Submitter Information Verification

Submitter Full Name: Frederic Hartwell
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Affiliation: self
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 09:51:06 EDT 2020
Committee: NEC-P03

Public Input No. 1842-NFPA 70-2020 [Section No. 300.5(G)]

(G) Raceway Seals.

~~Conduits or raceways~~ Underground raceways entering a building from the outside through which moisture may contact live parts shall be sealed or plugged at either or both ends. Spare or unused raceways shall also be sealed. Sealants shall be identified for use with the cable insulation, conductor insulation, bare conductor, shield, or other components. An explosionproof seal shall not be required for this purpose.

Informational Note: Presence of hazardous gases or vapors may also necessitate sealing of underground conduits or raceways entering buildings.

Statement of Problem and Substantiation for Public Input

Added text "entering a building from the outside' so that it is consistent with 225.27 and 230.8.
Added text "An explosionproof seal shall not be required for this purpose.' so that it's consistent with 300.7(A)

There are four rules related to raceway seals and they all are 'slightly different.' I am submiting a PI so they all are consistent with each other.

225.27 Raceway Seal.
Where a raceway enters a building or structure from outside, it shall be sealed or plugged at either or both ends. Spare or unused raceways shall also be sealed. Sealants shall be identified for use with cable insulation, conductor insulation, bare conductor, shield, or other components.
An explosionproof seal shall not be required for this purpose.

230.8 Raceway Seal.
Where a raceway enters a building or structure from the outside, it shall be sealed or plugged at either or both ends. Spare or unused raceways shall also be sealed. Sealants shall be identified for use with the cable insulation, conductor insulation, bare conductor, shield, or other components.
An explosionproof seal shall not be required for this purpose.

300.5 (G) Raceway Seals. Underground raceways entering a building from the outside through which moisture may contact live parts shall be sealed or plugged at either or both ends. Spare or unused raceways shall also be sealed. Sealants shall be identified for use with the cable insulation, conductor insulation, bare conductor, shield, or other components.
An explosionproof seal shall not be required for this purpose.

Informational Note: Presence of hazardous gases or vapors may also necessitate sealing of underground conduits or raceways entering buildings.
300.50 (F) Raceway Seal. Underground raceways enters a building through which moisture may contact live parts shall be sealed or plugged at either or both ends. Spare or unused raceways shall also be sealed. Sealants shall be identified for use with the cable insulation, conductor insulation, bare conductor, shield, or other components. An explosionproof seal shall not be required for this purpose.

Informational Note: Presence of hazardous gases or vapors may also necessitate sealing of underground conduits or raceways entering buildings.
225.27 Raceway Seal.
Where a raceway enters a building or structure from outside, it shall be sealed or plugged at either or both ends. Spare or unused raceways shall also be sealed. Sealants shall be identified for use with cable insulation, conductor insulation, bare conductor, shield, or other components.
An explosionproof seal shall not be required for this purpose.

230.8 Raceway Seal.
Where a raceway enters a building or structure from the outside, it shall be sealed or plugged at either or both ends. Spare or unused raceways shall also be sealed. Sealants shall be identified for use with the cable insulation, conductor insulation, bare conductor, shield, or other components.
An explosionproof seal shall not be required for this purpose.

300.5 (G) Raceway Seals. Underground raceways entering a building from the outside through which moisture may contact live parts shall be sealed or plugged at either or both ends. Spare or unused raceways shall also be sealed. Sealants shall be identified for use with the cable insulation, conductor insulation, bare conductor, shield, or other components.
An explosionproof seal shall not be required for this purpose.

Informational Note: Presence of hazardous gases or vapors may also necessitate sealing of underground conduits or raceways entering buildings.
300.50 (F) Raceway Seal. Underground raceways enters a building through which moisture may contact live parts shall be sealed or plugged at either or both ends. Spare or unused raceways shall also be sealed. Sealants shall be identified for use with the cable insulation, conductor insulation, bare conductor, shield, or other components. An explosionproof seal shall not be required for this purpose.

Informational Note: Presence of hazardous gases or vapors may also necessitate sealing of underground conduits or raceways entering buildings.

Submitter Information Verification

Submitter Full Name: Mike Holt
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City:
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Zip:
Submittal Date: Fri Jul 10 13:38:52 EDT 2020
Committee: NEC-P03

Public Input No. 2095-NFPA 70-2020 [Section No. 300.5(G)]

(G) Raceway Seals.

Conduits or raceways through which moisture may contact live parts shall be sealed or plugged at ~~either or both ends~~ the point where the conduit or raceway penetrates the building or at least at one end . Spare or unused raceways shall also be sealed. Sealants shall be identified for use with the cable insulation, conductor insulation, bare conductor, shield, or other components.

Informational Note: Presence of hazardous gases or vapors may also necessitate sealing of underground conduits or raceways entering buildings.

Statement of Problem and Substantiation for Public Input

As written, the existing text limits the location of seals or plugs used to satisfy this requirement to the ends of raceways or conduits. Reliable and effective sealing of raceways or conduits can be accomplished at locations other than the ends without reducing safety, if the design allows. Limiting the location of seals and plugs to the ends of raceways or conduits reduces opportunities for design innovation and installation flexibility.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2096-NFPA 70-2020 [Section No. 300.50(F)]	
Public Input No. 2096-NFPA 70-2020 [Section No. 300.50(F)]	

Submitter Information Verification

Submitter Full Name: John Cowans
Organization: Siemens
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Submittal Date: Thu Jul 30 09:57:22 EDT 2020
Committee: NEC-P03

Public Input No. 1825-NFPA 70-2020 [New Section after 300.5(K)]

300.5(L) Raceway Uniformity

Underground raceway systems shall maintain a uniform interior diameter. Reducing fittings shall not be used below grade.

Statement of Problem and Substantiation for Public Input

Installing reducing fittings underground have long been taboo, but some electricians still do this as there is no specific prohibition in the code. This could lead to difficulty and problems should the wire ever need to be re-pulled or upgraded. In addition, 300.12 requires the raceway to be "continuous" from point to point. The debate ensues as to whether an underground conduit containing a reducing fitting constitutes "continuous." It is probably better to just avoid the debate entirely.

Also, the use of a reducing bushing to save a few dollars would have the net result of imposing a limit on wire size since part of the run is a smaller size conduit.

Reason for the proposed language is consistency with 300.12 and to provide a safe installation, free from defect.

Submitter Information Verification

Submitter Full Name: Nick Sasso
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City:
State:
Zip:
Submittal Date: Thu Jul 09 14:38:42 EDT 2020
Committee: NEC-P03

Public Input No. 1429-NFPA 70-2020 [Section No. 300.5(K)]

(K) Directional Boring.

Cables or raceways installed using directional boring equipment shall be ~~approved~~ listed and identified for the purpose.

Statement of Problem and Substantiation for Public Input

Currently 300.5(K) only requires raceways and cables installed using directional boring equipment to be approved. It is burdensome for AHJ's to have the technological knowledge to approve these products. Adding a listing requirement here as a general requirement will negate the need to identify all of the .10 or .12 sections of Chapter 3 where directional boring is applicable or prohibited. NEC Section 110.2 states that equipment and conductors are only acceptable if approved. Without a listing requirement, how is an AHJ to inspect and approve the directional boring of products that they are unable to be inspected after installation? The listing requirements for directional boring include joint water tightness tests, joint separation pull and bending tests and that both the conduit and push-fit fittings are marked "Directional Boring" or "Dir. Boring".

Submitter Information Verification

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Affiliation: UL LLC
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Submittal Date: Tue Jun 02 19:55:44 EDT 2020
Committee: NEC-P03

Public Input No. 2438-NFPA 70-2020 [Section No. 300.6]

300.6 Protection Against Corrosion and Deterioration.

Raceways, cable trays, cablebus, auxiliary gutters, cable armor, boxes, cable sheathing, cabinets, enclosures other than fences or walls surrounding an installation, elbows, couplings, fittings, supports, and support hardware shall be of materials suitable for the environment in which they are to be installed.

(A) Ferrous Metal Equipment.

Ferrous metal raceways, cable trays, cablebus, auxiliary gutters, cable armor, boxes, cable sheathing, cabinets, enclosures other than fences or walls surrounding an installation, metal elbows, couplings, nipples, fittings, supports, and support hardware shall be suitably protected against corrosion inside and outside (except threads at joints) by a coating of approved corrosion-resistant material. Where corrosion protection is necessary and the conduit is threaded in the field, the threads shall be coated with an approved electrically conductive, corrosion-resistant compound.

Informational Note: Field-cut threads are those threads that are cut in conduit, elbows, or nipples anywhere other than at the factory where the product is listed.

Exception: Stainless steel shall not be required to have protective coatings.

(1) Protected from Corrosion Solely by Enamel.

Where protected from corrosion solely by enamel, ferrous metal raceways, cable trays, cablebus, auxiliary gutters, cable armor, boxes, cable sheathing, cabinets, enclosures other than fences or walls surrounding an installation, metal elbows, couplings, nipples, fittings, supports, and support hardware shall not be used outdoors or in wet locations as described in 300.6(D).

(2) Organic Coatings on Boxes or Cabinets.

Where boxes ~~or cabinets~~ , cabinets, or enclosures, other than fences or walls surrounding an installation, have an approved system of organic coatings and are marked "Raintight," "Rainproof," or "Outdoor Type," they shall be permitted outdoors.

(3) In Concrete or in Direct Contact with the Earth.

Ferrous metal raceways, cable armor, boxes, cable sheathing, cabinets, enclosures other than fences or walls surrounding an installation, elbows, couplings, nipples, fittings, supports, and support hardware shall be permitted to be installed in concrete or in direct contact with the earth, or in areas subject to severe corrosive influences where made of material approved for the condition, or where provided with corrosion protection approved for the condition.

(B) Aluminum Metal Equipment.

Aluminum raceways, cable trays, cablebus, auxiliary gutters, cable armor, boxes, cable sheathing, cabinets, enclosures other than fences or walls surrounding an installation, elbows, couplings, nipples, fittings, supports, and support hardware embedded or encased in concrete or in direct contact with the earth shall be provided with supplementary corrosion protection.

(C) Nonmetallic Equipment.

Nonmetallic raceways, cable trays, cablebus, auxiliary gutters, boxes, cables with a nonmetallic outer jacket and internal metal armor or jacket, cable sheathing, cabinets, enclosures other than fences or walls surrounding an installation, elbows, couplings, nipples, fittings, supports, and support hardware shall be made of material approved for the condition and shall comply with 300.6(C)(1) and (C)(2) as applicable to the specific installation.

(1) Exposed to Sunlight.

Where exposed to sunlight, the materials shall be listed as sunlight resistant or shall be identified as sunlight resistant.

(2) Chemical Exposure.

Where subject to exposure to chemical solvents, vapors, splashing, or immersion, materials or coatings shall either be inherently resistant to chemicals based on their listing or be identified for the specific chemical reagent.

(D) Indoor Wet Locations.

In portions of dairy processing facilities, laundries, canneries, and other indoor wet locations, and in locations where walls are frequently washed or where there are surfaces of absorbent materials, such as damp paper or wood, the entire wiring system, where installed exposed, including all boxes, cabinets, enclosures other than fences or walls surrounding an installation, fittings, raceways, and cable used therewith, shall be mounted so that there is at least a 6-mm (¼-in.) airspace between it and the wall or supporting surface.

Exception: Nonmetallic raceways, boxes, cabinets, enclosures other than fences or walls surrounding an installation, and fittings shall be permitted to be installed without the airspace on a concrete, masonry, tile, or similar surface.

Informational Note: In general, areas where acids and alkali chemicals are handled and stored may present such corrosive conditions, particularly when wet or damp. Severe corrosive conditions may also be present in portions of meatpacking plants, tanneries, glue houses, and some stables; in installations immediately adjacent to a seashore and swimming pool areas; in areas where chemical deicers are used; and in storage cellars or rooms for hides, casings, fertilizer, salt, and bulk chemicals.

Statement of Problem and Substantiation for Public Input

Although Section 300.6 addresses corrosion resistance requirements for boxes and cabinets, Article 312 includes cabinets, (cutout) boxes, and (meter-socket) enclosures. In terms of applications, there's little difference in the construction of cabinets, cutout boxes, and meter-socket enclosure, and little difference in the operating environment. Consequently, in CORRELATION with Article 312, the encompassing term "enclosures" is added to 300.6 charging text, 300.6(A), 300.6(A)(1), 300.6(A)(2), 300.6(A)(3), 300.6(B), 300.6(C), and 300.6(D), all following occurrences of "cabinets". Further, in CORRELATION with 110.28, 110.31 and the Article 100 definition for "Enclosure", fences and walls that can comprise an enclosure that surrounds an installation are explicitly excluded to maintain consistency throughout.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 1811-NFPA 70-2020 [Section No. 110.28]	Clarification that enclosures in 110.28 exclude fences and walls
Public Input No. 2434-NFPA 70-2020 [Definition: Enclosure.]	consideration of fences and walls surrounding an installation
Public Input No. 1811-NFPA 70-2020 [Section No. 110.28]	
Public Input No. 2434-NFPA 70-2020 [Definition: Enclosure.]	

Submitter Information Verification

Submitter Full Name: Brian Rock
Organization: Hubbell Incorporated
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City:
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Zip:
Submittal Date: Fri Aug 21 12:12:45 EDT 2020
Committee: NEC-P03

Public Input No. 3039-NFPA 70-2020 [Section No. 300.6]

300.6 Protection Against Corrosion and Deterioration.

Raceways, cable trays, cablebus, auxiliary gutters, cable armor, boxes, cable sheathing, cabinets, enclosures (other than surrounding fences or walls), elbows, couplings, fittings, supports, and support hardware shall be of materials suitable for the environment in which they are to be installed.

(A) Ferrous Metal Equipment.

Ferrous metal raceways, cable trays, cablebus, auxiliary gutters, cable armor, boxes, cable sheathing, cabinets, enclosures (other than surrounding fences or walls), metal elbows, couplings, nipples, fittings, supports, and support hardware shall be suitably protected against corrosion inside and outside (except threads at joints) by a coating of approved corrosion-resistant material. Where corrosion protection is necessary and the conduit is threaded in the field, the threads shall be coated with an approved electrically conductive, corrosion-resistant compound.

Informational Note: Field-cut threads are those threads that are cut in conduit, elbows, or nipples anywhere other than at the factory where the product is listed.

Exception: Stainless steel shall not be required to have protective coatings.

(1) Protected from Corrosion Solely by Enamel.

Where protected from corrosion solely by enamel, ferrous metal raceways, cable trays, cablebus, auxiliary gutters, cable armor, boxes, cable sheathing, cabinets, enclosures (other than surrounding fences or walls), metal elbows, couplings, nipples, fittings, supports, and support hardware shall not be used outdoors or in wet locations as described in 300.6(D).

(2) Organic Coatings on Boxes or Cabinets.

Where boxes ~~or cabinets~~ , cabinets, or enclosures (other than surrounding fences or walls) have an approved system of organic coatings and are marked "Raintight," "Rainproof," or "Outdoor Type," they shall be permitted outdoors.

(3) ~~In~~ Ferrous Metal Equipment In Concrete or in Direct Contact with the Earth.

Ferrous metal raceways, cable armor, boxes, cable sheathing, cabinets, enclosures (other than surrounding fences or walls), elbows, couplings, nipples, fittings, supports, and support hardware shall be permitted to be installed in concrete or in direct contact with the earth, or in areas subject to severe corrosive influences where made of material approved for the condition, or where provided with corrosion protection approved for the condition.

(B) Aluminum Metal Equipment in Concrete or in Direct Contact with the Earth .

Aluminum raceways, cable trays, cablebus, auxiliary gutters, cable armor, boxes, cable sheathing, cabinets, enclosures (other than surrounding fences or walls), elbows, couplings, nipples, fittings, supports, and support hardware embedded or encased in concrete or in direct contact with the earth shall be provided with supplementary corrosion protection.

(C) Nonmetallic Equipment.

Nonmetallic raceways, cable trays, cablebus, auxiliary gutters, boxes, cables with a nonmetallic outer jacket and internal metal armor or jacket, cable sheathing, cabinets, enclosures (other than surrounding fences or walls), elbows, couplings, nipples, fittings, supports, and support hardware shall be made of material approved for the condition and shall comply with 300.6(C)(1) and (C)(2) as applicable to the specific installation.

(1) Exposed to Sunlight.

Where exposed to sunlight, the materials shall be listed as sunlight resistant or shall be identified as sunlight resistant.

(2) Chemical Exposure.

Where subject to exposure to chemical solvents, vapors, splashing, or immersion, materials or coatings shall either be inherently resistant to chemicals based on their listing or be identified for the specific chemical reagent.

(D) Indoor Wet Locations.

In portions of dairy processing facilities, laundries, canneries, and other indoor wet locations, and in locations where walls are frequently washed or where there are surfaces of absorbent materials, such as damp paper or wood, the entire wiring system, where installed exposed, including all boxes, fittings, raceways, and cable used therewith, shall be mounted so that there is at least a 6-mm (¼-in.) airspace between it and the wall or supporting surface.

Exception: Nonmetallic raceways, boxes, and fittings shall be permitted to be installed without the airspace on a concrete, masonry, tile, or similar surface.

Informational Note: In general, areas where acids and alkali chemicals are handled and stored may present such corrosive conditions, particularly when wet or damp. Severe corrosive conditions may also be present in portions of meatpacking plants, tanneries, glue houses, and some stables; in installations immediately adjacent to a seashore and swimming pool areas; in areas where chemical deicers are used; and in storage cellars or rooms for hides, casings, fertilizer, salt, and bulk chemicals.

Statement of Problem and Substantiation for Public Input

To correlate with the use of "enclosures" in 110.28 and to improve readability, the more-inclusive term "enclosures" is added throughout 300.6 following occurrences of the term "cabinets". In many contexts, the term "enclosures" is the more frequently used term and likely to be used as a search term. From the product standard perspective, the term "cabinets" often can be a more specific end-product. Nonetheless, corrosion resistance should apply equally, regardless of semantics.

Submitter Information Verification

Submitter Full Name: Megan Hayes
Organization: Nema
Street Address:
City:
State:
Zip:
Submittal Date: Fri Sep 04 10:13:08 EDT 2020
Committee: NEC-P03

Public Input No. 1061-NFPA 70-2020 [Section No. 300.7(B)]

(B) Expansion, Expansion-Deflection, and Deflection Fittings and the Conductors Within .

Raceways shall be provided with expansion, expansion-deflection, or deflection fittings where necessary to compensate for thermal expansion, deflection, and contraction.

Where expansion, expansion-deflection, or defection fittings are used for thermal raceway movement, ample lengths of conductor(s) shall be provided in the enclosures at the ends of the raceways utilizing such fittings. Conductors within the enclosure shall be routed in the enclosure in a manner that allows for conductor movement.

Informational Note: Table 352.44 and Table 355.44 provide the expansion information for polyvinyl chloride (PVC) and for reinforced thermosetting resin conduit (RTRC), respectively. A nominal number for steel conduit can be determined by multiplying the expansion length in Table 352.44 by 0.20. The coefficient of expansion for steel electrical metallic tubing, intermediate metal conduit, and rigid metal conduit is 1.170×10^{-5} (0.0000117 mm per mm of conduit for each °C in temperature change) [0.650×10^{-5} (0.0000065 in. per inch of conduit for each °F in temperature change)].

A nominal number for aluminum conduit and aluminum electrical metallic tubing can be determined by multiplying the expansion length in Table 352.44 by 0.40. The coefficient of expansion for aluminum electrical metallic tubing and aluminum rigid metal conduit is 2.34×10^{-5} (0.0000234 mm per mm of conduit for each °C in temperature change) [1.30×10^{-5} (0.000013 in. per inch of conduit for each °F in temperature change)].

Statement of Problem and Substantiation for Public Input

It isn't enough to have strictly the raceways compensate for thermal raceway movement. A more generous length of conductor must be left within the enclosures at each end of raceways containing, expansion, expansion- deflection, or deflection fittings. Also, the conductors shouldn't be forced over fittings upon entering an enclosure but remain straight for a sufficient length.

Submitter Information Verification

Submitter Full Name: Norman Feck
Organization: State of Colorado
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 14 09:16:12 EDT 2020
Committee: NEC-P03

Public Input No. 1268-NFPA 70-2020 [Section No. 300.7(B)]

(B) Expansion, Expansion-Deflection, and Deflection Fittings.

Raceways shall be provided with expansion, expansion-deflection, or deflection fittings where necessary to compensate for thermal expansion, deflection, and contraction.

Informational Note 1 : Table 352.44 and Table 355.44 provide the expansion information for polyvinyl chloride (PVC) and for reinforced thermosetting resin conduit (RTRC), respectively. A nominal number for steel conduit can be determined by multiplying the expansion length in Table 352.44 by 0.20. The coefficient of expansion for steel electrical metallic tubing, intermediate metal conduit, and rigid metal conduit is 1.170×10^{-5} (0.0000117 mm per mm of conduit for each °C in temperature change) [0.650×10^{-5} (0.0000065 in. per inch of conduit for each °F in temperature change)].

A nominal number for aluminum conduit and aluminum electrical metallic tubing can be determined by multiplying the expansion length in Table 352.44 by 0.40. The coefficient of expansion for aluminum electrical metallic tubing and aluminum rigid metal conduit is 2.34×10^{-5} (0.0000234 mm per mm of conduit for each °C in temperature change) [1.30×10^{-5} (0.000013 in. per inch of conduit for each °F in temperature change)].

Informational note 2: For further information on expansion and expansion deflection fittings, see NEMA FB 2.40-2019, *Installation Guidelines for Expansion and Expansion/Deflection Fittings.*

Statement of Problem and Substantiation for Public Input

Informational Note 2 is proposed to be added to 300.7(B) so that the installer is aware that an installation guideline for expansion and expansion deflection fittings is available.

Submitter Information Verification

Submitter Full Name: Megan Hayes
Organization: Nema
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 28 09:48:59 EDT 2020
Committee: NEC-P03

Public Input No. 1584-NFPA 70-2020 [Section No. 300.8]

300.8 Installation of Conductors with Other Systems.

Raceways or cable trays containing electrical conductors shall not contain any pipe, tube, or equal, including any supports or support hardware for steam, water, air, gas, drainage, or any service other than electrical.

Additional Proposed Changes

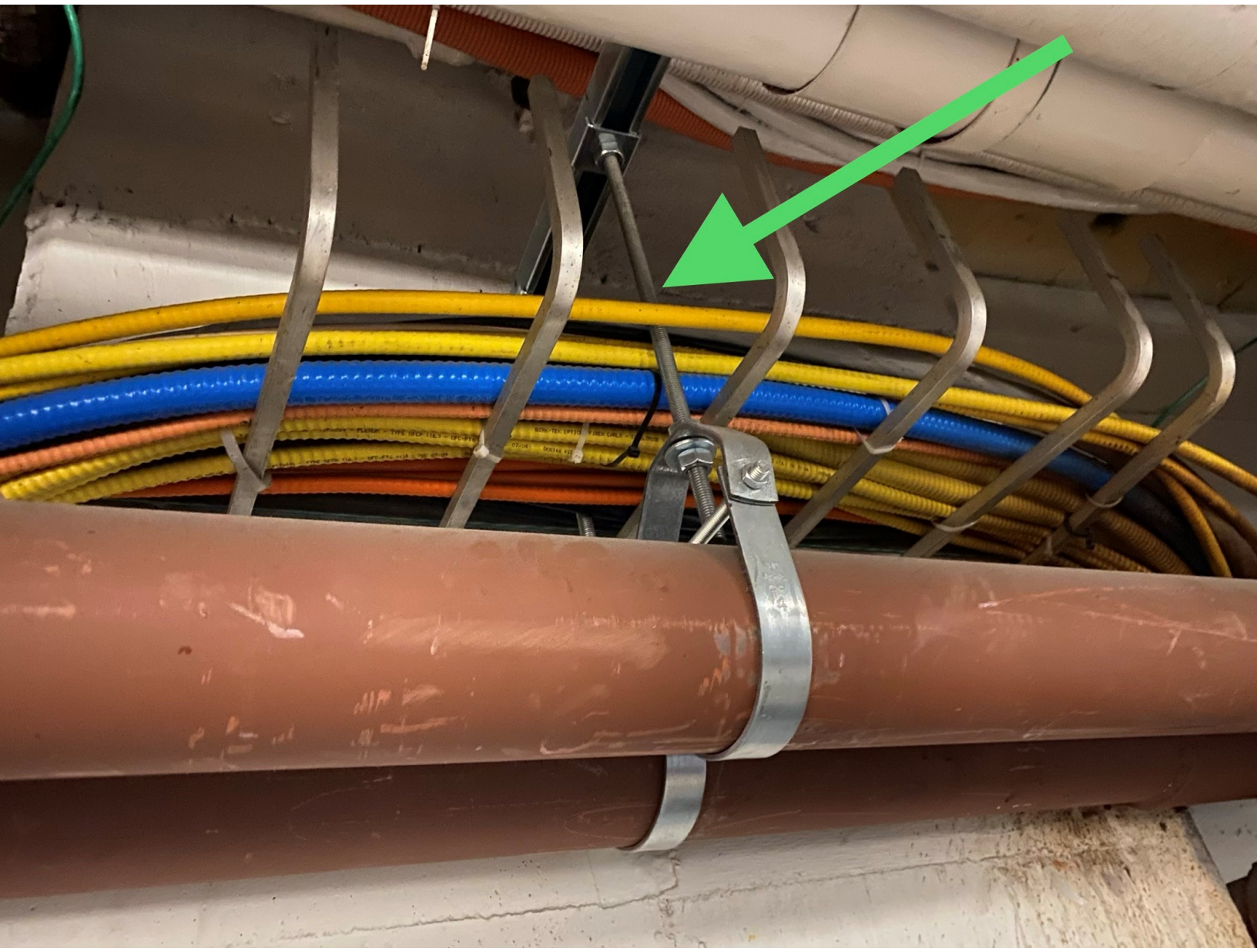
File Name	Description	Approved
EF55C205-8953-4587-9D37-4D5BCA7027C2.jpeg	Threaded rod in middle of cable tray 1	
8677E567-FC3A-45C0-A456-A3FC30D20331.jpeg	Threaded rod in middle of cable tray 2	

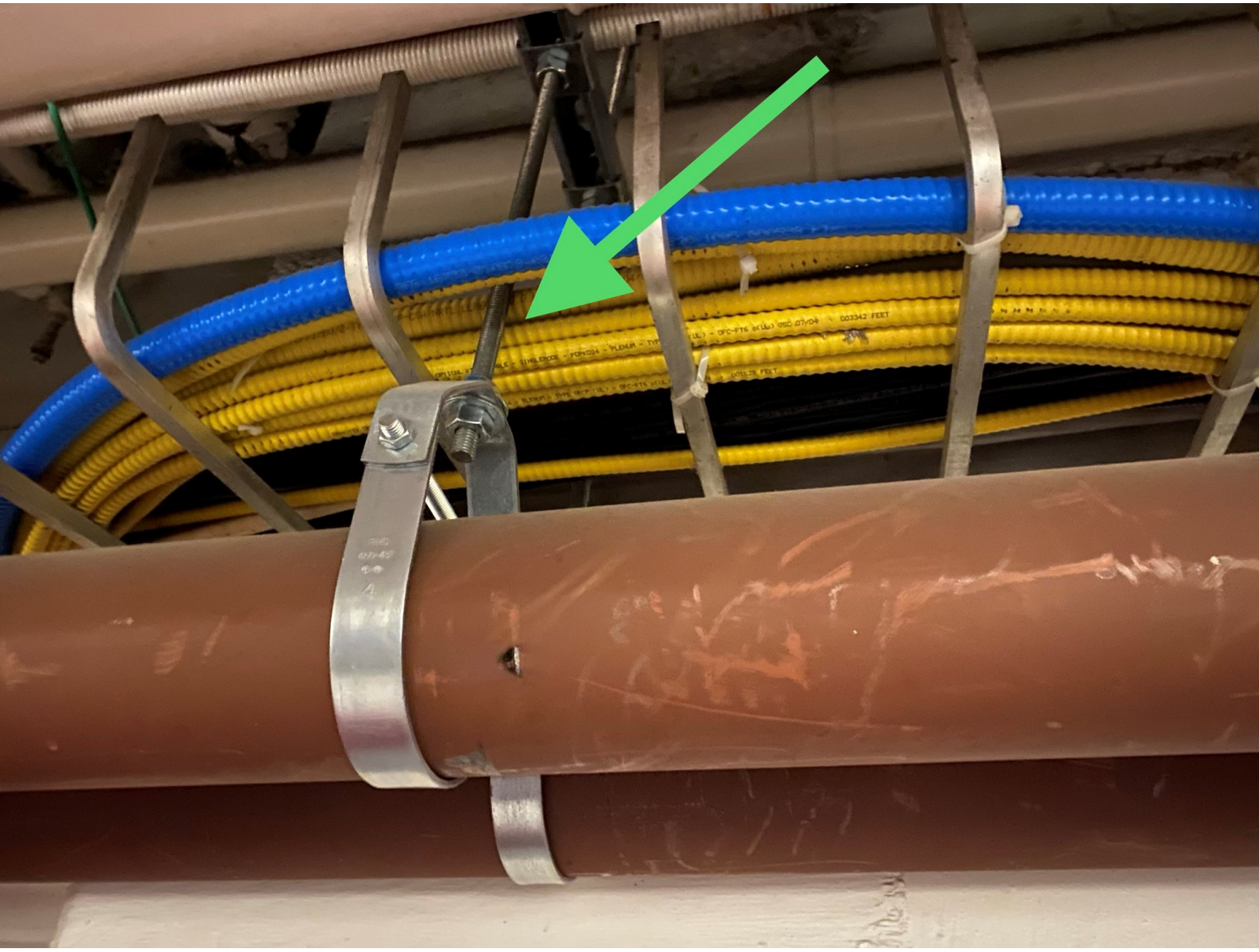
Statement of Problem and Substantiation for Public Input

Threaded rods, pipe hangers, brackets and other supporting means for steam pipes, water lines, drain lines, fuel lines and other foreign systems should not be installed in any manner that could interfere with the installation of conductors or cables. These foreign systems could also cause damage to conductors in the cable tray. Threaded rod run right through the middle of a cable tray could easily damage the insulation of conductors, particularly on larger conductors that may be too stiff and rigid to simply roll aside. This revision is needed to include these items in this rule.

Submitter Information Verification

Submitter Full Name: Russ Leblanc
Organization: Leblanc Consulting Services
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jun 22 09:57:06 EDT 2020
Committee: NEC-P03





Public Input No. 147-NFPA 70-2019 [Section No. 300.9]

300.9 Raceways or Cables in Wet Locations Abovegrade.

Where raceways or cables are installed in wet locations abovegrade, the interior of these raceways or cables shall be considered to be a wet location. Insulated conductors and cables installed in raceways or cables in wet locations abovegrade shall comply with 310.10(C).

Statement of Problem and Substantiation for Public Input

Greetings CMP Members,

Since there are cable type wiring methods, such as PVC Jacketed Metal-Clad Cable, that are permitted for this application it stands to reason the language should be amended to reflect those additional above-grade outside installation conditions.

Submitter Information Verification

Submitter Full Name: Paul Abernathy
Organization: ElectricianLIVE.com
Street Address:
City:
State:
Zip:
Submittal Date: Mon Nov 25 16:27:36 EST 2019
Committee: NEC-P03

Public Input No. 2034-NFPA 70-2020 [Section No. 300.9]

300.9 Raceways in Wet Locations Abovegrade.

(A) Where raceways are installed in wet locations abovegrade, the interior of these raceways shall be considered to be a wet location. Insulated conductors and cables installed in raceways in wet locations abovegrade shall comply with 310.10(C).

(B) Raceways installed in wet locations abovegrade, shall be arranged to drain and shall be listed or approved for use in wet locations

Statement of Problem and Substantiation for Public Input

Water can accumulate in interior raceways that are installed in wet locations, but there is no rule in the code that requires provisions to let this water drain out. This drainage is only currently required for raceways installed on the exterior surfaces of building or structures by 225.22.
The problem of water accumulation in a raceway occurs in all wet locations, not just outside wet locations. This PI requires that all abovegrade raceways installed in either interior or exterior wet locations be arranged to drain. This PI also applies the language from 225.22 that raceways installed in wet locations be listed or approved for use in those locations.

Submitter Information Verification

Submitter Full Name: Don Ganiere
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Street Address:
City:
State:
Zip:
Submittal Date: Sun Jul 26 12:25:54 EDT 2020
Committee: NEC-P03

Public Input No. 146-NFPA 70-2019 [Section No. 300.10]

300.10 Electrical Continuity of Metal Raceways, Cable Armor, and Enclosures.

Metal raceways, cable armor, and other metal enclosures for conductors shall be metallically joined together into a continuous electrical conductor and shall be connected to all boxes, fittings, and cabinets so as to provide effective electrical continuity. Unless specifically permitted elsewhere in this *Code*, raceways and cable assemblies shall be mechanically secured to boxes, fittings, cabinets, and other enclosures.

Exception No. 1: Short sections of raceways used to provide support or protection of cable assemblies from physical damage shall not be required to be made electrically continuous.

Exception No. 2: Equipment enclosures to be isolated, as permitted by 250.96(B), shall not be required to be metallically joined to the metal raceway.

Statement of Problem and Substantiation for Public Input

Greetings CMP-5,
This proposed change is an attempt to unify the section title with the actual code language. The reference to "Cable Armor" is in the code language and should also be expressed in the section title as well.

Submitter Information Verification

Submitter Full Name: Paul Abernathy
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Submittal Date: Mon Nov 25 16:23:48 EST 2019
Committee: NEC-P03

Public Input No. 1734-NFPA 70-2020 [Section No. 300.10]

300.10 Electrical Continuity of Metal Raceways and Enclosures.

Metal raceways, cable armor, and other metal enclosures for conductors shall be metallically joined together into a continuous electrical conductor and shall be connected to all boxes, fittings, and cabinets so as to provide effective electrical continuity. Unless specifically permitted elsewhere in this *Code*, raceways and cable assemblies shall be mechanically secured to boxes, fittings, cabinets, and other enclosures.

Where nonmetallic-sheathed cable or multiconductor Type UF cable is used, the sheath shall extend not less than 6 mm (1⁄4 in.) inside the equipment and beyond any cable clamp.

Exception No. 1: ~~Short sections of raceways~~ Raceways used to provide support or protection of cable assemblies from physical damage shall not be required to be made electrically continuous.

Exception No. 2: Equipment enclosures to be isolated, as permitted by 250.96(B), shall not be required to be metallically joined to the metal raceway.

Statement of Problem and Substantiation for Public Input

The additional text "Where nonmetallic-sheathed cable or multiconductor Type UF cable is used, the sheath shall extend not less than 6 mm (1⁄4 in.) inside the equipment and beyond any cable clamp." is needed in the 'general requirements of Chapter 3, so that it's clear that the cable sheath is required to have a minimum length inside 'equipment. This text was extracrted from 314.17(B), but this rule 314.17(B) only applies to boxes.
Remove "Short sections of" text. The electrician is only going to run the raceway long enough to meet the needs of the installation. No need to have vague text to cause confusion between the installer and inspector.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jun 25 17:02:53 EDT 2020
Committee: NEC-P03

Public Input No. 3716-NFPA 70-2020 [Section No. 300.10]

300.10 Electrical Continuity of Metal Raceways and Enclosures.

Metal raceways, cable armor, and other metal enclosures for conductors shall be metallically joined together into a continuous electrical conductor and shall be connected to all boxes, fittings, and cabinets so as to provide effective electrical continuity. Unless specifically permitted elsewhere in this *Code*, raceways and cable assemblies shall be mechanically secured to boxes, fittings, cabinets, and other enclosures.

Exception No. 1: Short sections of raceways used to provide support or protection of cable assemblies from physical damage shall not be required to be made electrically continuous.

Exception No. 2: Equipment enclosures to be isolated, as permitted by 250.96(B), shall not be required to be metallically joined to the metal raceway.

Exception No. 3: Raceways and cables installed into the bottom of open bottom equipment, such as switchboards, motor control centers, and floor or pad-mounted transformers, shall not be required to be mechanically secured to the equipment.

Statement of Problem and Substantiation for Public Input

This PI moves the exception from 300.12 to 300.10, as that is where it belongs.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3713-NFPA 70-2020 [Section No. 300.12]	Relocation of text

Submitter Information Verification

Submitter Full Name: Ryan Jackson
Organization: Ryan Jackson
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 11:16:46 EDT 2020
Committee: NEC-P03

Public Input No. 1481-NFPA 70-2020 [Section No. 300.11]

300.11 Securing and Supporting.

~~**(A)** Secured in Place.~~

Raceways, cable assemblies, boxes, cabinets, and fittings shall be securely fastened in place

~~**(B)** Wiring Systems Installed Above Suspended Ceilings.~~

~~Support wires that do not provide secure support shall not be permitted as the sole support. Support wires and associated fittings that provide secure support and that are installed in addition to the ceiling grid support wires shall be permitted as the sole support. Where independent support wires are used, they shall be secured at both ends. Cables and raceways shall not be supported by ceiling grids.~~

~~**(1)** Fire-Rated Assemblies.~~

~~Wiring located within the cavity of a fire-rated floor–ceiling or roof–ceiling assembly shall not be secured to, or supported by, the ceiling assembly, including the ceiling support wires. An independent means of secure support shall be provided and shall be permitted to be attached to the assembly. Where independent support wires are used, they shall be distinguishable by color, tagging, or other effective means from those that are part of the fire-rated design.~~

~~*Exception: The ceiling support system shall be permitted to support wiring and equipment that have been tested as part of the fire-rated assembly.*~~

~~Informational Note: One method of determining fire rating is testing in accordance with ANSI/ASTM E119-18b, *Standard Test Methods for Fire Tests of Building Construction and Materials* .~~

~~**(2)** Non-Fire-Rated Assemblies.~~

~~Wiring located within the cavity of a non–fire-rated floor–ceiling or roof–ceiling assembly shall not be secured to, or supported by, the ceiling assembly, including the ceiling support wires. An independent means of secure support shall be provided and shall be permitted to be attached to the assembly. Where independent support wires are used, they shall be distinguishable by color, tagging, or other effective means.~~

~~*Exception: The ceiling support system shall be permitted to support branch-circuit wiring and associated equipment where installed in accordance with the ceiling system manufacturer's instructions.*~~

~~**(C)** Raceways Used as Means of Support.~~

~~Raceways shall be used only as a means of support for other raceways, cables, or nonelectrical equipment under any of the following conditions:~~

(1) ~~Where the raceway or means of support is identified as a means of support~~

(2) ~~Where the raceway contains power supply conductors for electrically controlled equipment and is used to support Class 2 circuit conductors or cables that are solely for the purpose of connection to the equipment control circuits~~

(3) ~~Where the raceway is used to support boxes or conduit bodies in accordance with 314.23 or to support luminaires in accordance with 410.36(E)~~

~~**(D)** Cables Not Used as Means of Support.~~

~~Cable wiring methods shall not be used as a means of support for other cables, raceways, or nonelectrical equipment.~~

and independently supported free from all other systems unless the supports have been engineered for the load. The electrical support system shall be composed of three elements, the upper attachment to the building, the hanger itself, and the lower attachment. All three components shall be minimally rated to support the intended load.

Exception: Raceways that support devices, apparatus' or piece of equipment associated with the HVAC system shall be permitted to be mounted to the duct work within 3 feet of the device box.

Additional Proposed Changes

File Name	Description	Approved
Hangers_and_Supports.pdf	Mechanic code and SMACNA	

Statement of Problem and Substantiation for Public Input

When inspecting remodels, I notice installers hanging their conduits, boxes, supports etc. off of preexisting non-electrical hangers and equipment. They are frequently exceeding the weight limit of the anchors. If we eliminate being able to support off of other non-electrical supports we could eliminate potential failures. Additionally we know the whole support system is rated for what the load is intended. This allows us to verify that the manufacturers load ratings and application data can safely support the intended load.

I have attached documentation from the mechanical code and SMACNA. Mechanical code 603.4 and 603.10 reference ANSI/SMACNA. ANSI/SMACNA states no other loads shall be on their trapeze. SMACNA 4.1-4.2.11 talks about the hanging system

Submitter Information Verification

Submitter Full Name: Desiree Weigel
Organization: University of Minnesota
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jun 08 15:36:49 EDT 2020
Committee: NEC-P03

4.1 HANGING AND SUPPORTING SYSTEMS

4.1.1 S4.0 Requirements

S4.1 Rigid round, rectangular, and flat oval metal ducts shall be installed with support systems indicated in Tables 4-1 to 4-3 and Figures 4-1 to 4-8. They shall be installed as required to maintain alignment. Horizontal ducts shall have a support within two feet (0.61 m) of each elbow and within four feet of each branch intersection. (Upper attachments to structures shall have an allowable load not more than one-fourth of the failure (proof test) load but are not limited to the specific methods shown here.

4.2 COMMENTARY

The duct hanging system is composed of three elements, the upper attachment to the building, the hanger itself, and the lower attachment to the duct. The manufacturer's load ratings and application data should be followed for all devices and materials.

4.2.1 Concrete Inserts

Concrete inserts must be installed before the concrete is poured. They are used primarily where the duct layout is simple and there is enough lead time to determine accurate placement. The simplest insert is a piece of bent flat bar. Manufactured inserts are available individually or in long lengths; the latter are generally used where many hangers will be installed in a small area, or where individual inserts cannot be precisely spotted at the time of placing the concrete.

4.2.2 Concrete Fasteners

Concrete fasteners are installed after the concrete has been poured and the forms have been removed. Their application allows greater flexibility than concrete inserts because their exact location can be determined after all interferences between the various trades' work have been coordinated.

There are several variations of powder-actuated fasteners, which are placed by an explosive charge. These fasteners should not be used in certain lightweight aggregate concretes, or in slabs less than 4 inches (107 mm) thick.

Expanding concrete anchors should be made of steel. Nonferrous anchors tend to creep with vibration. Holes for expanding fasteners are drilled either by a carbide bit or by teeth on the fastener itself. The expansion shield is "set" by driving it into the hole and expanding it with the conical plug. The expansion nail is a lighter duty fastener. Powder-actuated fasteners are popular for smaller ducts.

4.2.3 Structural Steel Fasteners

Several types of beam clamps are available. Some should be used with a retaining clip. Powder-actuated fasteners may also be used on steel. Welded studs may be installed using special welding equipment. Certain manufactured devices that are driven onto the flange will support either a rod or a band type hanger.

4.2.4 Cellular Metal Deck

Many office buildings are now built with a cellular steel deck that carries the electrical and communication systems and is covered with concrete fill. The wiring in the cells and the concrete above the deck preclude the use of fasteners, such as sheet metal screws, that must pierce the deck. Some manufacturers of this type of deck now offer an integral hanging system. In cases where there are no integral hangers at the required hanging points, install the rod or strap hangers before concrete placement, or install welded studs after concrete placement. In all cases, the upper attachments to the decking should be in place before the application of fireproofing materials.

4.2.5 Upper Attachment

Upper attachment methods should be selected with care. A safety factor of 4 or 5 (based on ultimate failure) is practical unless it can be shown that few unpredictable variables exist and that quality control is disciplined.

4.2.6 Hangers

Hangers are usually strips of galvanized steel or round steel rod. For hangers made of round steel rod, use uncoated hot-rolled steel except where the installation is in a corrosive atmosphere. Where corrosion is a problem, hanger rods should be electro-galvanized, all-thread rods or hot-dipped galvanized rods with their threads painted after installation.

4.2.7 Lower Attachment

The lower attachment is the connection between the hanger and the duct section. Fasteners that penetrate the duct may be sheet metal screws, blind rivets, or self-tapping metal screws.

4.2.8 Hanger Spacing

A straight duct section is actually a box section beam of considerable strength. As in many structures, the joint is the weakest point, so that is where the support is. Duct joints, however, are normally strong enough to permit maximum hanger spacing at 8 (2.44) or 10 foot (3.05 m) intervals, even with one or two intermediate joints. Very wide ducts require closer hanger spacing in order to limit individual hanger loads to safe values. They also require intermediate hangers to prevent the upper portion of the duct from sagging.

4.2.9 Trapeze Selection

Trapeze members must be selected with careful attention to the position of the loads on the horizontal bar. Load analysis is discussed in the notes for Figures 4-4 and 4-5.

4.2.10 Riser Supports

Rectangular risers should be supported by angles or channels secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets. Here again, for ducts over 30 inches (762 mm) wide, caution must be used in fastening the support to the sheet because the expansion of the sheet due to internal pressures will tend to tear the fasteners out. Riser support intervals should be at one or two story intervals, i.e., 12 feet (3.66 m) to 24 feet (7.32 m), as suitable for loading. Another method is to support the riser by its reinforcing. The load can be transferred to the riser support by angles or by rods.

4.2.11 Hanging System Selection

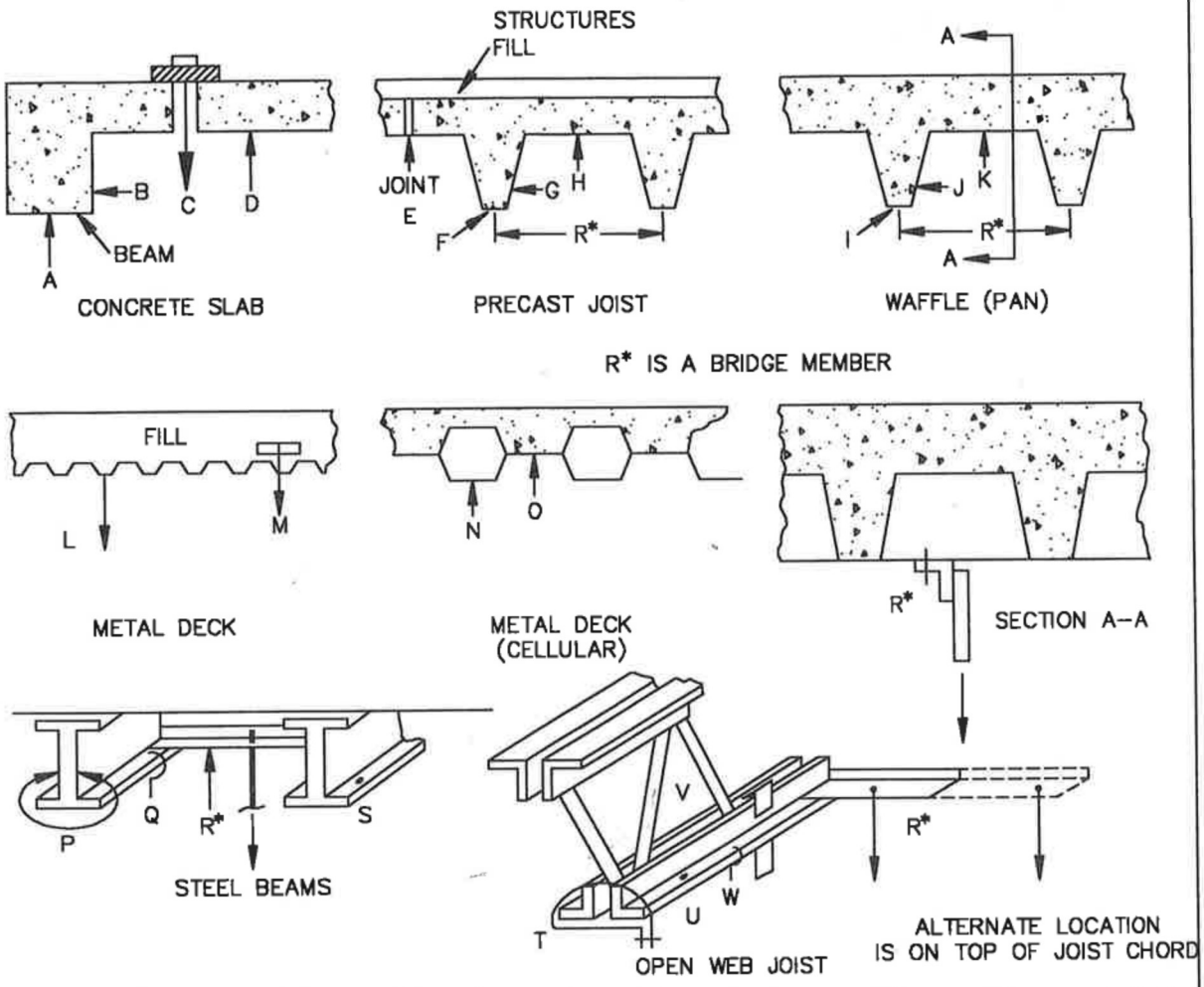
The selection of a hanging system should not be taken lightly not only because it involves a significant portion of the erection labor, but also because an inadequate hanging system can be disastrous. In any multiple hanger system, the failure of one hanger transfers that its load to adjacent hangers. If one of these fails, an even greater load is transferred to the next. The result is a cascading failure in which an entire run of duct might fall.

There are many hanger alternatives, especially in the upper attachments. Besides structural adequacy, the contractor's choice of hanging system must also take into account the particulars of the building structure, the skills of the workmen, the availability of tooling, and the recommendations of the fastener manufacturer. Because of these variables, it is suggested that the hanging system be the contractor's choice, subject to the approval of the mechanical engineer.

Figures in this manual show typical hanger constructions. When special conditions require high safety factors or the ability to withstand vibrations, individual concrete or steel attachments can be specified to be capable of supporting test loads equal to the minimum rating listed when they are tested in accordance with methods described by Underwriters' Laboratory, Inc., for Pipe Hanger Equipment, Bulletin UL 203, latest edition. *See* pages 3-19 to 3-21 for support of flexible duct.

The supports discussed here are not seismicly qualified. Refer to SMACNA's *Seismic Restraint Manual* for additional reinforcement required by earthquake hazards.

ALPHABET LETTER ONLY INDICATES AN ALTERNATIVE LOCATION OR SITUATION THAT MAY BE PERMITTED OR RESTRICTED BY DESIGN DOCUMENTS. ILLUSTRATIONS OF CONCRETE AND STEEL DO NOT PRECLUDE ATTACHMENTS TO WOOD.



CONVENTIONAL HANGER METHODS AND DEVICES

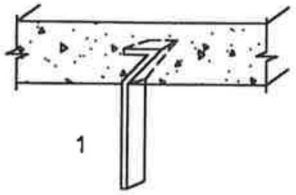
CONCRETE INSERTS, SINGLE	DRILLED HOLE AND BOLT
CONCRETE INSERTS, SLOTTED	STANCHION
POWDER ACTUATED FASTENERS	SELF TAPPING SCREWS PLUS STRAPS
"C" CLAMPS	DROP IN EXPANSION ANCHORS
WELDED STUDS	KNEE BRACKET FROM WALL
FRICTION CLAMPS	LAG SCREW EXPANSION ANCHOR
STRAP	NAILED PIN FASTENERS
ROD, THREADED, UNTHREADED	RIVETS
BRIDGE	SWAY BRACING
BEAM CLAMP, HALF FLANGE	"FISH" PLATE OR WASHER AND ROD
BEAM CLAMP, FULL FLANGE	HOOK OR LOOP
EYE BOLT (OR ROD)	VIBRATION ISOLATOR
TOGGLE BOLTS	WIRE

SELECT HANGERS FOR TYPE OF STRUCTURE AND SUSPENSION.
DO NOT EXCEED ALLOWABLE OR SPECIFIED LOAD LIMITS.

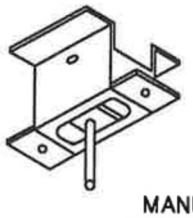
ALLOWABLE LOAD ON UPPER ATTACHMENT IS 1/4 OF FAILURE LOAD

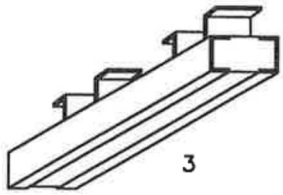
HANGER ATTACHMENTS TO STRUCTURES FIG. 4-1

UNLESS OTHERWISE APPROVED ALLOWABLE LOAD ON UPPER ATTACHMENT IS 1/4 OF FAILURE LOAD. UPPER ATTACHMENTS MAY BE TO WOOD STRUCTURES ALSO.

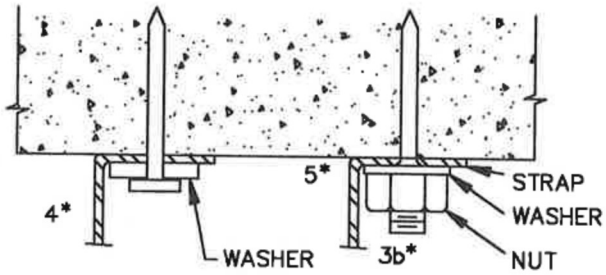


FLAT BAR CONCRETE INSERT

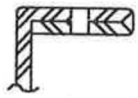


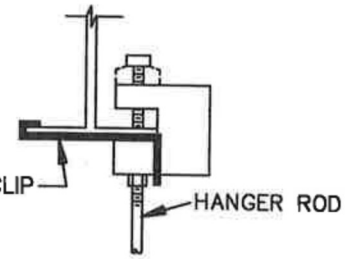


MANUFACTURED CONCRETE INSERTS



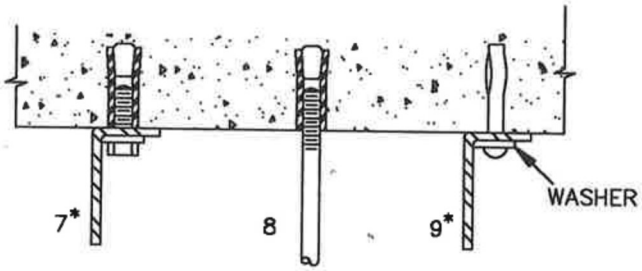
WASHER MAY BE OMITTED WITH 100 LB (45 KG) MAX LOAD ON 22 GA (0.85 mm) STRAP WHEN FOLDED





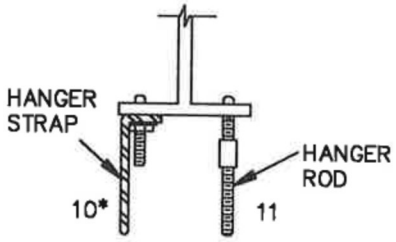
6a C–CLAMP W/ RETAINING CLIP OR
6b C–CLAMP W/ LOCK NUT (OPTIONAL)

A HANGER STRAP MAY ALSO BE C CLAMPED TO THE STRUCTURAL FLANGE



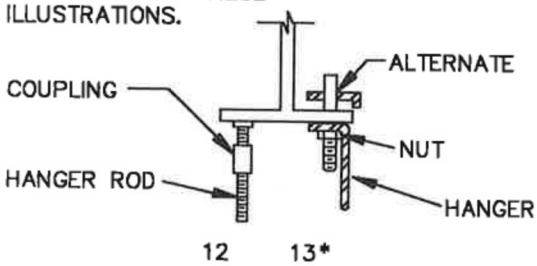
EXPANSION SHIELDS EXPANSION NAIL

CONCRETE ANCHORS

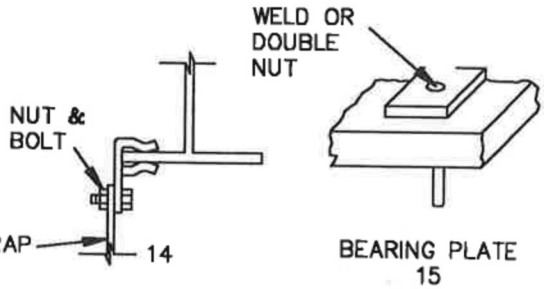


POWER ACTUATED STUDS INTO STEEL (STRUCTURE OR DECK)

WIRE USE IS NOT PRECLUDED BY THESE ILLUSTRATIONS.



WELDED STUDS

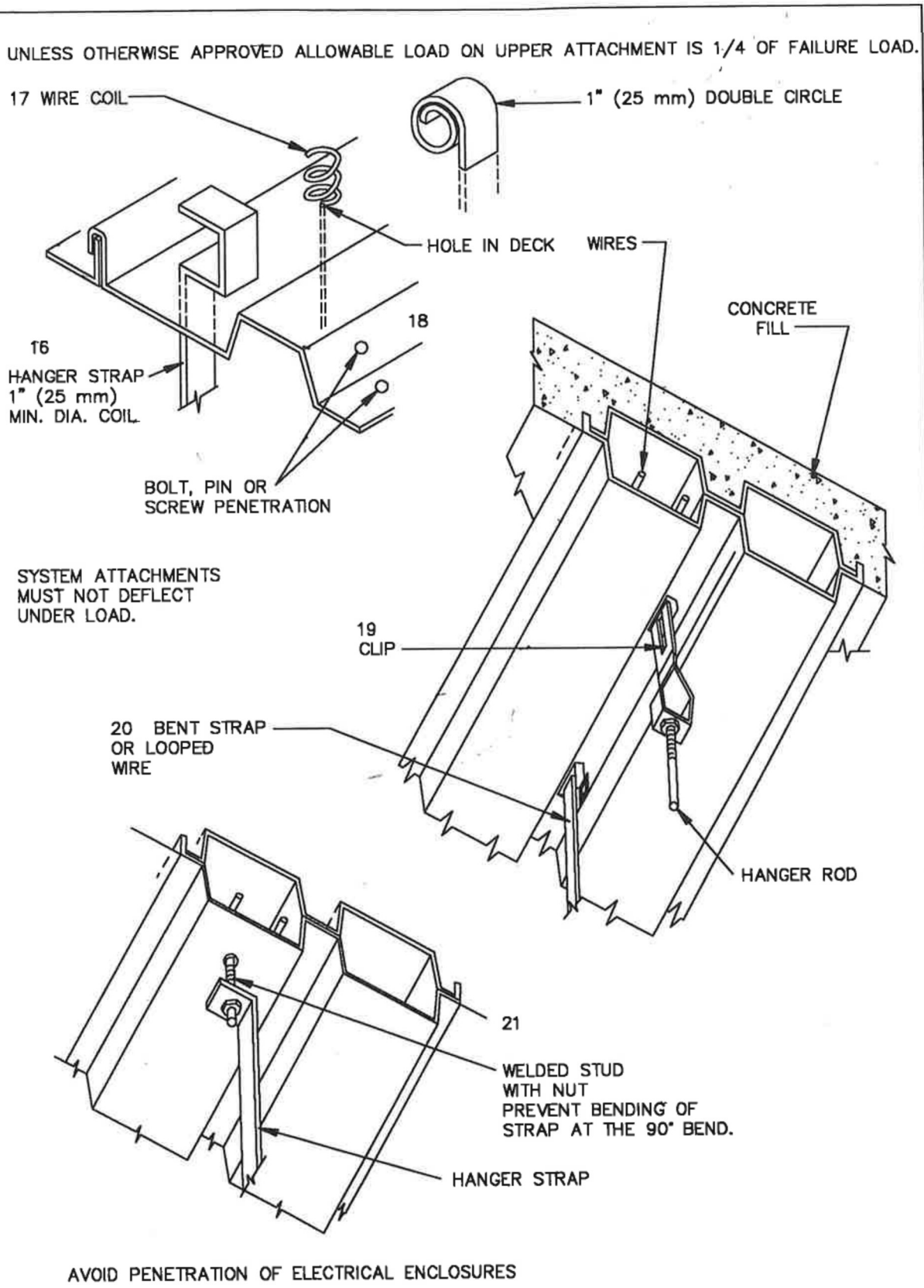


FRICTION CLAMPS

* IMPORTANT! PREVENT BENDING OF STRAP AT 90° BEND UNDER LOAD.

THE NUMBERS ASSOCIATED WITH THE ART ARE ONLY FOR CONVENIENT REFERENCE.

UPPER ATTACHMENT DEVICES - TYPICAL FIG. 4-2



UPPER ATTACHMENTS - TYPICAL **FIG. 4-3**

TABLE 4-1
RECTANGULAR DUCT HANGERS
MINIMUM SIZE

MAXIMUM HALF OF DUCT PERIMETER	Pair at 10 ft Spacing		Pair at 8 ft Spacing		Pair at 5 ft Spacing		Pair at 4 ft Spacing	
	STRAP	WIRE/ ROD	STRAP	WIRE/ ROD	STRAP	WIRE/ ROD	STRAP	WIRE/ ROD
P/2 = 30"	1" x 22 ga.	10 ga. (.135")	1" x 22 ga.	10 ga. (.135")	1" x 22 ga.	12 ga. (.106")	1" x 22 ga.	12 ga. (.106")
P/2 = 72"	1" x 18 ga.	3/8"	1" x 20 ga.	1/4"	1" x 22 ga.	1/4"	1" x 22 ga.	1/4"
P/2 = 96"	1" x 16 ga.	3/8"	1" x 18 ga.	3/8"	1" x 20 ga.	3/8"	1" x 22 ga.	1/4"
P/2 = 120"	1 1/2" x 16 ga.	1/2"	1" x 16 ga.	3/8"	1" x 18 ga.	3/8"	1" x 20 ga.	1/4"
P/2 = 168"	1 1/2" x 16 ga.	1/2"	1 1/2" x 16 ga.	1/2"	1" x 16 ga.	3/8"	1" x 18 ga.	3/8"
P/2 = 192"	Not Given	1/2"	1 1/2" x 16 ga.	1/2"	1" x 16 ga.	3/8"	1" x 16 ga.	3/8"
P/2 = 193" up	SPECIAL ANALYSIS REQUIRED							

WHEN STRAPS ARE LAP JOINED USE THESE MINUMUM FASTENERS:	SINGLE HANGER MAXIMUM ALLOWABLE LOAD	
	STRAP	WIRE OR ROD (Dia.)
1" x 18, 20, 22 ga. -two #10 or one 1/4" bolt 1" x 16 ga. -two 1/4" dia. 1 1/2" x 16 ga. -two 3/8" dia. Place fasteners in series, not side by side.	1" x 22 ga.- 260 lbs. 1" x 20 ga.- 320 lbs. 1" x 18 ga.- 420 lbs. 1" x 16 ga.- 700 lbs. 1 1/2" x 16 ga.- 1100 lbs.	0.106"- 80 lbs. 0.135"- 120 lbs. 0.162"- 160 lbs. 1/4"- 270 lbs. 3/8"- 680 lbs. 1/2"- 1250 lbs. 5/8"- 2000 lbs. 3/4"- 3000 lbs.

NOTES:

1. Dimensions other than gage are in inches.
2. Tables allow for duct weight, 1 lb./sf insulation weight and normal reinforcement and trapeze weight, but no external loads!
3. For custom design of hangers, designers may consult SMACNA's *Rectangular Industrial Duct Standards*, the AISI *Cold Formed Steel Design Manual* and the AISC *Steel Construction Manual.*
4. Straps are galvanized steel; other materials are uncoated steel.
5. Allowable loads for P/2 assume that ducts are 16 ga. maximum, except that when maximum duct dimension (w) is over 60" then p/2 maximum is 1.25 w.
6. For upper attachments *see* Fig. 4-2.
7. For lower attachments *see* Fig. 4-4.
8. For trapeze sizes see Table 4-3 and Fig. 4-5.
9. 12, 10, or 8 ga. wire is steel of black annealed, bright basic, or galvanized type.

with that certification. Unlisted duct tape is not permitted as a sealant on any duct.

Exception: Continuously welded and locking-type longitudinal joints and seams in ducts operating at static pressures less than 2 inches of water column (500 Pa) pressure classification shall not require additional closure systems.

603.10 Supports. Ducts shall be supported at intervals not to exceed 12 feet (3658 mm) and shall be in accordance with SMACNA *HVAC Duct Construction Standards—Metal and Flexible*. Flexible and other factory-made ducts shall be supported in accordance with the manufacturer's instructions.

603.11 Furnace connections. Ducts connecting to a furnace shall have a *clearance* to combustibles in accordance with the furnace manufacturer's installation instructions.

603.12 Condensation. Provisions shall be made to prevent the formation of condensation on the exterior of any duct.

[B] 603.13 Flood hazard areas. For structures in flood hazard areas, ducts shall be located above the elevation required by Section 1612 of the *International Building Code* for utilities and attendant equipment or shall be designed and constructed to prevent water from entering or accumulating within the ducts during floods up to such elevation. If the ducts are located below the elevation required by Section 1612 of the *International Building Code* for utilities and attendant equipment, the ducts shall be capable of resisting hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding up to such elevation.

603.14 Location. Ducts shall not be installed in or within 4 inches (102 mm) of the earth, except where such ducts comply with Section 603.8.

603.15 Mechanical protection. Ducts installed in locations where they are exposed to mechanical damage by vehicles or from other causes shall be protected by *approved* barriers.

603.16 Weather protection. All ducts including linings, coverings and vibration isolation connectors installed on the exterior of the building shall be protected against the elements.

603.17 Air dispersion systems. Air dispersion systems shall:

1. Be installed entirely in exposed locations.
2. Be utilized in systems under positive pressure.
3. Not pass through or penetrate fire-resistant-rated construction.
4. Be listed and labeled in compliance with UL 2518.

603.18 Registers, grilles and diffusers. Duct registers, grilles and diffusers shall be installed in accordance with the manufacturer's installation instructions. Volume dampers or other means of supply air adjustment shall be provided in the branch ducts or at each individual duct register, grille or diffuser. Each volume damper or other means of supply air adjustment used in balancing shall be provided with access.

603.18.1 Floor registers. Floor registers shall resist, without structural failure, a 200-pound (90.8 kg) concentrated load on a 2-inch-diameter (51 mm) disc applied to the most critical area of the exposed face.

603.18.2 Prohibited locations. Diffusers, registers and grilles shall be prohibited in the floor or its upward extension within toilet and bathing rooms required by the *International Building Code* to have smooth, hard, nonabsorbent surfaces.

Exception: *Dwelling units*.

603.18.3 Adjustment of volume dampers. Volume dampers shall be adjusted to the required airflow of the system and locked in place. In finished or inaccessible locations, a friction-type register box may be used.

SECTION 604
INSULATION

604.1 General. Duct insulation shall conform to the requirements in Minnesota Rules, Chapter 1322 or 1323, as applicable.

604.2 Surface temperature. Ducts that operate at temperatures exceeding 120°F (49°C) shall have sufficient thermal insulation to limit the exposed surface temperature to 120°F (49°C).

604.3 Coverings and linings. Coverings and linings, including adhesives when used, shall have a flame spread index not more than 25 and a smoke-developed index not more than 50, when tested in accordance with ASTM E84 or UL 723, using the specimen preparation and mounting procedures of ASTM E2231. Duct coverings and linings shall not flame, glow, smolder or smoke when tested in accordance with ASTM C411 at the temperature to which they are exposed in service. The test temperature shall not fall below 250°F (121°C). Coverings and linings shall be listed and labeled.

604.4 Foam plastic insulation. Foam plastic used as duct coverings and linings shall conform to the requirements of Section 604.

604.5 Appliance insulation. *Listed* and *labeled* appliances that are internally insulated shall be considered as conforming to the requirements of Section 604.

604.6 Penetration of assemblies. Duct coverings shall not penetrate a wall or floor required to have a fire-resistance rating or required to be fireblocked.

604.7 Identification. External duct insulation, except spray polyurethane foam, and factory-insulated flexible duct shall be legibly printed or identified at intervals not greater than 36 inches (914 mm) with the name of the manufacturer, the thermal resistance *R*-value at the specified installed thickness and the flame spread and smoke-developed indexes of the composite materials. All duct insulation product *R*-values shall be based on insulation only, excluding air films, vapor retarders or other duct components, and shall be based on tested *C*-values at 75°F (24°C) mean temperature at the installed thickness, in accordance with recognized industry procedures. The installed thickness of duct insulation used to determine its *R*-value shall be determined as follows:

1. For duct board, duct liner and factory-made rigid ducts not normally subjected to compression, the nominal insulation thickness shall be used.

11.1 SCOPE

A variety of materials have been used in the construction of ducts. Selection of the materials used throughout the duct system, should follow the same careful consideration as the other HVAC system components. The materials used in duct systems can substantially affect the overall performance of the systems. The listed "advantages" should be evaluated with the "limiting characteristics," prior to the material selection.

Materials used for ducts include: galvanized steel, black carbon steel, aluminum, stainless steel, copper, fiberglass reinforced plastic (FRP), polyvinyl chloride (PVC), polyvinyl steel (PVS), concrete, fibrous glass (duct board), and gypsum board. Technical information will be given for each of the above materials but duct sizing and duct construction specifications will generally be stated in this manual in terms of use of galvanized steel as the material from which ducts are made. Figure A-2 and Table A-1 gives correction factors used to adjust duct friction losses for materials other than galvanized steel (multiply duct friction loss by the appropriate factor in the Table). Friction loss can be one of the most important factors to consider when selecting duct material, especially if low operating cost is a principal design objective.

Consideration must also be given to selection of duct construction components, other than those used for the duct walls. Items such as flexible ducts, duct liner, pressure-sensitive tapes, sealants, adhesives, reinforcements, and hangers, are described in individual SMACNA manuals, as well as many other publications.

Special material selection and construction may be necessary when designing systems serving nuclear projects, earthquake-prone areas, and projects with other unusual requirements.

11.2 DUCT SYSTEM SPECIFICATION CHECK LIST

In addition to SMACNA duct construction standards, specifications and detail drawings should include the following duct system requirements:

a. Local code requirements.

b. Duct system static pressure classifications, standard flag designation.

c. Duct material selection.

d. Allowable duct leakage, specify sealing system classification.

e. Insulation requirement, external and liner.

f. Sound control devices and methods.

g. Outlet and inlet performance.

h. Filters.

i. Dampers—fire, smoke, and volume control—and their location, size, and type.

j. Duct mounted apparatus.

k. Duct mounted equipment.

l. Special duct suspension requirements—such as seismic bracing, *see* SMACNA *Seismic Restraint Manual*.

A complete duct design specification needs to include all of the above specification requirements in sufficient detail to provide performance standards, materials, and design methods for all ducts and duct components required for the total HVAC system.

11.3 DUCT CONSTRUCTION MATERIALS

11.3.1 Galvanized Steel

Unless otherwise specified steel sheet and strip used for duct and connectors shall be G-60 coated galvanized steel of lockforming grade conforming to ASTM A653 and A924 standards. Minimum yield strength for steel sheet and reinforcements is 30,000 psi (207 kPa).

11.3.1.1 Applications

Widely used as a duct material for most air handling systems; not recommended for corrosive product handling or temperatures above 400 degree F (200 degree C).

11.3.1.2 Advantages

High strength, rigidity, durability, rust resistance, availability, non-porous, smooth surface, workability, and weldability.

11.3.1.3 Limiting Characteristics

Weldability, paintable, weight, corrosion resistance.

11.3.1.4 Remarks

Galvanized steel sheet is customarily available in: commercial quality, lock-forming quality, drawing

Public Input No. 1154-NFPA 70-2020 [Section No. 300.11(A)]

(A) Secured in Place.

Raceways, cable assemblies, boxes, cabinets, and fittings shall be securely fastened in place.

All raceways, cable assemblies, boxes, cabinets and fittings shall be securely fastened in place within one foot (12 in.) of any box, and every five feet (60 in) thereafter, regardless of type.

Statement of Problem and Substantiation for Public Input

Often, apprentices and experienced, licensed electricians alike falter on what is the appropriate length and/or distance a certain type of raceway or cable needs to be supported from a box and every interval thereafter. If every type was required to be supported at the same intervals, less time would be spent during installations and inspections. Since labor is the largest expense of the field in every corner, this would ultimately increase profitability and completion times - not only for the contractors, but for the inspectors as well.

Submitter Information Verification

Submitter Full Name: Alexander Logan
Organization: E Light Electric Services, Inc
Affiliation: Employee
Street Address:
City:
State:
Zip:
Submittal Date: Mon May 18 23:31:17 EDT 2020
Committee: NEC-P03

Public Input No. 2032-NFPA 70-2020 [Section No. 300.11(A)]

(A) Secured in Place.

Raceways, cable assemblies, boxes, and cabinets, ~~and fittings~~ shall be securely fastened in place.

Statement of Problem and Substantiation for Public Input

Fittings as defined in Article 100 are not independently secured. They are secured by their attachment to other electrical equipment.

Submitter Information Verification

Submitter Full Name: Don Ganiere
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Sun Jul 26 12:20:44 EDT 2020
Committee: NEC-P03

Public Input No. 2293-NFPA 70-2020 [Section No. 300.11(B)(2)]

(2) Non–Fire-Rated Assemblies.

Wiring located within the cavity of a non–fire-rated floor–ceiling or roof–ceiling assembly shall not be secured to, or supported by, the ceiling assembly, including the ceiling support wires. An independent means of secure support shall be provided and shall be ~~permitted to be attached to the~~ independent of the ceiling assembly. Where independent conductor support wires are used, they shall be distinguishable by color, tagging, or other effective means.

Exception: The ceiling support system shall be permitted to support branch-circuit wiring and associated equipment where installed in accordance with the ceiling system manufacturer's instructions.

Statement of Problem and Substantiation for Public Input

the phrase "shall be permitted to be attached to the assembly" contradicts the intent of the paragraph.

Submitter Information Verification

Submitter Full Name: John Blissett
Organization: Bernhard TME
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 13 17:21:43 EDT 2020
Committee: NEC-P03

Public Input No. 1062-NFPA 70-2020 [Section No. 300.11(B) [Excluding any Sub-Sections]]

Support wires that do not provide secure support shall not be permitted as the sole support. Support wires and associated fittings that provide secure support and that are installed in addition to the ceiling grid support wires shall be permitted as the sole support. Where independent support wires are used, they shall be secured at both ends. Grid wires used for the support of electrical wiring shall be 12 gauge or greater and be made for the purpose as a grid support wire. Cables and raceways shall not be supported by ceiling grids. No device shall be supported by grid tile(s).

Statement of Problem and Substantiation for Public Input

This added sentence ensures residential grade grid wire, bailing wire, scrap copper wire, etc form being installed to support electrical wiring.

Besides the strength of lesser gauge grid wires, clips, like Caddy bat wing KX, K8, and 4Z34 utility, that are made for the support of electrical cables, conduits, and boxes are made for the heavier gauge wire. They don't grab or clip outside of their design.

Often, grid tiles aren't substantial enough to support anything but themselves. Some tiles may have adequate strength but wording of this public input takes away debate at the job site. Code may address this enough already but direct NEC wording is needed.

Submitter Information Verification

Submitter Full Name: Norman Feck
Organization: State of Colorado
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 14 09:39:41 EDT 2020
Committee: NEC-P03

Public Input No. 238-NFPA 70-2020 [Section No. 300.11(B) [Excluding any Sub-Sections]]

Support wires that do not provide secure support shall not be permitted as the sole support. Support wires and associated fittings that do not provide secure support ~~and that are installed~~ , installed in addition to the ceiling grid support wires, shall not be permitted as the sole support. Where independent support wires are used, they shall be secured at both ends. Cables and raceways shall not be supported by ceiling grids.

Statement of Problem and Substantiation for Public Input

Contractors assume that if a clip or fitting is used, it will automatically provide secure support. Revising the language makes it much easier for the inspector to enforce the requirements of this section. Not all clips and fittings on the market will provide secure support when used in addition to the support wires.

As it reads now, section (B) language can be interpreted that if associated fittings are used, then "secure support" is achieved. This simply isn't true.

Rewriting this section in the negative will eradicate the logical fallacy that using clips or fittings will automatically provide secure support. This new language will help the electrical inspector. I have personally encountered many situations where boxes were not secure even after providing clips or support fittings.

Submitter Information Verification

Submitter Full Name: Nick Sasso
Organization: Clark County Building and Fire
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jan 02 17:36:58 EST 2020
Committee: NEC-P03

Public Input No. 933-NFPA 70-2020 [Section No. 300.11(B) [Excluding any Sub-Sections]]

Support wires that do not provide secure support shall not be permitted as the sole support. Support wires and associated fittings that provide secure support and that are installed in addition to the ceiling grid support wires shall be permitted as the sole support. Where independent support wires are used, they shall be secured at both ends and to be taut within the ceiling cavity . Cables and raceways shall not be supported by ceiling grids.

Statement of Problem and Substantiation for Public Input

The only addition I am asking for is to mirror the language in NEC 314.23(D)(2). I have been an inspector for almost 20 years & realize that grid wires for a support system is a common method. What installers have done is taken the language as "secured at both ends" to bend the grid wire as many times as needed to pick up stray MC cables. I believe the intent is to keep the grid wire taut to keep connectors from pulling out of boxes in case a fault occurs. This change is only to be consistent with supporting of jboxes. grid wires used for support for a box or cable shall remain taut in this inspectors opinion. please consider this change

Submitter Information Verification

Submitter Full Name: James Dorsey
Organization: Douglas County Electrical Insp
Street Address:
City:
State:
Zip:
Submittal Date: Sat May 02 18:27:33 EDT 2020
Committee: NEC-P03

Public Input No. 1211-NFPA 70-2020 [Section No. 300.11(C)]

(C) Raceways Used as Means of Support.

Raceways shall be used only as a means of support for other raceways, cables, or nonelectrical equipment under any of the following conditions:

(1) Where the raceway or means of support is identified as a means of support

(2) Where the raceway contains power supply conductors for electrically controlled equipment and is used to support Class 2 and Class 3 circuit conductors or cables that are solely for the purpose of connection to the equipment control circuits

(3) Where the raceway is used to support boxes or conduit bodies in accordance with 314.23 or to support luminaires in accordance with 410.36(E)

Statement of Problem and Substantiation for Public Input

300.11 (C) (2) add Class 3 circuit conductors or cables that are permitted to use raceways as a means of support.

Article 725.143 Support of Conductors covers Class 2 and 3 circuit conductors. The article states “These conductors shall be permitted to be installed as permitted by 300.11 (C).

Article 300.11 (C) only references Class 2 circuits. Including Class 3 circuit conductors to 300.11 (C) will align 300.11 (C) with the language of 725.143. For the purposes of securement there should not a significant difference between the means of securement.

Submitter Information Verification

Submitter Full Name: Gary Hein
Organization: Submission is independent of employer.
Street Address:
City:
State:
Zip:
Submittal Date: Sat May 23 08:22:50 EDT 2020
Committee: NEC-P03

Public Input No. 3718-NFPA 70-2020 [Section No. 300.11(C)]

(C) Raceways Used as Means of Support.

Raceways shall be used only as a means of support for other raceways, cables, or nonelectrical equipment under any of the following conditions:

(1) Where the raceway or means of support is identified as a means of support

(2) Where the raceway contains power supply conductors for electrically controlled equipment and is used to support Class 2 or Class 3 circuit conductors or cables that are solely for the purpose of connection to the equipment control circuits

(3) Where the raceway is used to support boxes or conduit bodies in accordance with 314.23 or to support luminaires in accordance with 410.36(E)

Statement of Problem and Substantiation for Public Input

There is no justification for allowing Class 2 and prohibiting Class 3 cables from being attached to their associated raceway. The cables are usually the same, as a CL2 cable that is not also listed as CL3 (or a permitted substitute) is fairly uncommon.

Submitter Information Verification

Submitter Full Name: Ryan Jackson
Organization: Ryan Jackson
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 11:18:09 EDT 2020
Committee: NEC-P03

Public Input No. 1735-NFPA 70-2020 [Section No. 300.12]

300.12 Mechanical Continuity — Raceways and Cables.

Raceways, cable armors, and cable sheaths shall be continuous between cabinets, boxes, fittings, or other enclosures or outlets.

Exception No. 1: ~~Short sections of raceways~~ Raceways used to provide support or protection of cable assemblies from physical damage shall not be required to be mechanically continuous.

Exception No. 2: Raceways and cables installed into the bottom of open bottom equipment, such as switchboards, motor control centers, and floor or pad-mounted transformers, shall not be required to be mechanically secured to the equipment.

Statement of Problem and Substantiation for Public Input

I submitted a similar PI to remove "Short sections of" from 300.10 Exception No. 1 and the logic for this PI is the same. Let the rule be clear please.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jun 25 17:05:40 EDT 2020
Committee: NEC-P03

Public Input No. 1857-NFPA 70-2020 [Section No. 300.12]

300.12 Mechanical ~~Continuity —~~ Secured to Equipment — Raceways and Cables.

~~Raceways, cable armors, and cable sheaths shall be continuous between cabinets, boxes, fittings, or other enclosures or outlets.~~ Raceway and cable terminations shall be mechanically secured to equipment with a termination fitting listed for the wiring method.

Exception No. 1: Short sections of raceways used to provide support or protection of cable assemblies from physical damage shall not be required to be mechanically continuous.

Exception No. 2: Raceways and cables installed into the bottom of open bottom equipment, such as switchboards, motor control centers, and floor or pad-mounted transformers, shall not be required to be mechanically secured to the equipment.

Additional Proposed Changes

File Name	Description	Approved
20200702_105155.jpg	300.12 Raceway with Wireway	

Statement of Problem and Substantiation for Public Input

The addition of the word “wireway” is necessary (see photo) since cables and raceways often terminate to a wireway. I removed “or outlets” since an outlet is not an enclosure of any type, and it does not add any value to the rule.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
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City:
State:
Zip:
Submittal Date: Sat Jul 11 17:27:28 EDT 2020
Committee: NEC-P03



Public Input No. 2035-NFPA 70-2020 [Section No. 300.12]

300.12 Mechanical Continuity — Raceways and Cables.

Raceways, cable armors, and cable sheaths shall be continuous between cabinets, boxes, ~~fittings~~ conduit bodies , or other enclosures or outlets and shall be mechanically connected thereto .

Exception No. 1: Short sections of raceways used to provide support or protection of cable assemblies from physical damage shall not be required to be mechanically continuous.

Exception No. 2: Raceways and cables installed into the bottom of open bottom equipment, such as switchboards, motor control centers, and floor or pad-mounted transformers, shall not be required to be mechanically secured to the equipment.

Statement of Problem and Substantiation for Public Input

The language in the section and in Exception #2 implies that there be a mechanical connection between the raceway and the equipment, but stops short of actually requiring that mechanical connection. This PI makes it clear that a mechanical connection is required.

It appears that the term "fittings" really should be "conduit bodies". Fittings does not seam to fit with the requirement, but conduit bodies does.

Submitter Information Verification

Submitter Full Name: Don Ganiere
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Sun Jul 26 12:41:05 EDT 2020
Committee: NEC-P03

Public Input No. 3713-NFPA 70-2020 [Section No. 300.12]

300.12 Mechanical Continuity — Raceways and Cables.

Raceways, cable armors, and cable sheaths shall be continuous between cabinets, boxes, fittings, or other enclosures or outlets.

~~*Exception No. 1*~~ *Exception : Short sections of raceways used to provide support or protection of cable assemblies from physical damage shall not be required to be mechanically continuous.*

~~*Exception No. 2: Raceways and cables installed into the bottom of open bottom equipment, such as switchboards, motor control centers, and floor or pad-mounted transformers, shall not be required to be mechanically secured to the equipment.*~~

Statement of Problem and Substantiation for Public Input

This exception belongs in 300.10, not 300.12.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3716-NFPA 70-2020 [Section No. 300.10]	

Submitter Information Verification

Submitter Full Name: Ryan Jackson
Organization: Ryan Jackson
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 11:15:51 EDT 2020
Committee: NEC-P03

Public Input No. 1407-NFPA 70-2020 [Section No. 300.14]

300.14 Length of Free Conductors at Outlets, Junctions, and Switch Points.

At least 150 mm (6 in.) of free conductor, measured from the point in the box where it emerges from its raceway or cable sheath, shall be left at each outlet, junction, and switch point for splices or the connection of luminaires or devices. The 150 mm (6 in.) free conductor is permitted to be spliced or unspliced.

Where the opening to an outlet, junction, or switch point is less than 200 mm (8 in.) in any dimension, each conductor shall be long enough to extend at least 75 mm (3 in.) outside the opening.

Exception: Conductors that are not spliced or terminated at the outlet, junction, or switch point shall not be required to comply with 300.14.

Statement of Problem and Substantiation for Public Input

I submitted a 'proposal' in 2008 [3-76 Log #1340 NEC-P03 Final Action: Reject] to require the free conductor to be unspliced, but the panel rejected my proposal.

Panel Statement: The purpose of Section 300.14 is to permit access to the end of the conductor. Whether this conductor is spliced or un-spliced does not affect the length of this free end of the conductor. Many conductors originate inside the box and are spliced to other conductors within the box but extend out of the box for connection to a device of some kind. Making this change would not permit this very common application. Even the exception to this section states that unspliced or unterminated conductors do not have to comply with 300.14.
Number Eligible to Vote: 13 Ballot Results: Affirmative: 13

However, nobody knows the panels intent and this has caused great stress for the industry; especially when the drywall installer damages conductors, or the remodel to the kitchen or bath results in the wall surface having a backsplash where the conductors (without splice) no longer provide 6 in. of free unspliced conductors. Some inspectors are requiring the contractor to replace the wiring in the existing structure. Clearly that is not the panels intent but without clear language, the industry will continue to struggle.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jun 02 12:10:44 EDT 2020
Committee: NEC-P03

Public Input No. 2205-NFPA 70-2020 [Section No. 300.14]

300.14 Length of Free Conductors at Outlets, Junctions, and Switch Points.

~~At least 150 mm (6 in~~
The length of free conductors at outlets, junctions, and switch points shall comply with 300.14 (A) and (B).

(A) There shall be at least 150 mm (6 in ,) of free conductor, measured from the point in the box where it emerges from its raceway or cable sheath,

~~shall be~~
left at each outlet, junction, and switch point for splices or the connection of luminaires or devices.

~~Where the opening~~

(B) Each length of free conductor shall be long enough to extend at least 75 mm (3 in.) outside the opening where the opening, to an outlet, junction, or switch point is less than

~~200 mm~~
200 mm (

~~8 in~~
8 in ,) in any dimension

~~, each conductor shall be long enough to extend at least 75 mm (3 in~~
.

~~) outside the opening.~~

Exception: Conductors that are not spliced or terminated at the outlet, junction, or switch point shall not be required to comply with 300.14.

Statement of Problem and Substantiation for Public Input

This Public Input is patterned after the structure of 240.41 and is intended to editorially revise 300.14 into two first level subdivisions as follows for clarity and usability as permitted by Section 2.1.5 of the 2015 NEC Style Manual which is the current style manual on August 10, 2020 when this Public Input was submitted (The title to 300.14 remains unchanged):
The length of free conductors at outlets, junctions, and switch points shall comply with 300.14 (A) and (B).
(A) There shall be at least 150 mm (6 in.) of free conductor, measured from the point in the box where it emerges from its raceway or cable sheath, left at each outlet, junction, and switch point for splices or the connection of luminaires or devices.
(B) Each length of free conductor shall be long enough to extend at least 75 mm (3 in.) outside the opening where the opening to an outlet, junction, or switch point is less than 200 mm (8 in.) in any dimension.

The existing exception is not a part of this Public Input.

Note that Section 2.1.5 of the 2015 NEC Style Manual states, in part, that "Sections shall be permitted to be subdivided for clarity, with each subdivision representing either a rule or a part of a rule."

Submitter Information Verification

Submitter Full Name: Palmer Hickman
Organization: Electrical Training Alliance
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 10 16:17:26 EDT 2020
Committee: NEC-P03

Public Input No. 2645-NFPA 70-2020 [Section No. 300.14]

300.14 Length of Free Conductors at Outlets, Junctions, and Switch Points.

At least 150 mm (6 in.) of free conductor, measured from the point in the box where it emerges from its raceway or cable sheath, shall be left at each outlet, junction, and switch point for splices or the connection of luminaires or devices. Where the opening to an outlet, junction, or switch point is less than 200 mm (8 in.) in any dimension, each conductor shall be long enough to extend at least 75 mm (3 in.) outside the opening. Where the opening to an outlet, junction, or switch point is equal to or greater than 200 mm (8 in.) in any dimension, each conductor shall be long enough to extend outside the opening a distance that is at least 60 percent of the longest dimension of the opening.

Exception: Conductors that are not spliced or terminated at the outlet, junction, or switch point shall not be required to comply with 300.14.

Statement of Problem and Substantiation for Public Input

Requiring only 6 inches of free conductor at an outlet, junction, or switch point where the opening is equal to or greater than 8 inches in any dimension does not allow for a sufficient length of free conductor for splices or the connection of luminaires or devices. The value 60 percent was chosen so that the conductor length would overlap by a distance sufficient to allow for the conductors to be spliced or connected to luminaires or devices. For example, a 10 inch x 10 inch box would require both at least 150 mm (6 in.) of free conductor, measured from the point in the box where it emerges from its raceway or cable sheath, and extend at least 6 inches (60 per cent of 10 inches) outside the opening.

Submitter Information Verification

Submitter Full Name: Palmer Hickman
Organization: Electrical Training Alliance
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 26 14:15:02 EDT 2020
Committee: NEC-P03

Public Input No. 2646-NFPA 70-2020 [Section No. 300.14]

300.14 Length of Free Conductors at Outlets, Junctions, and Switch Points.

At least 150 mm (6 in.) of free conductor, measured from the point in the box where it emerges from its raceway or cable sheath, shall be left at each outlet, junction, and switch point for splices or the connection of luminaires or devices. Where the ~~opening to an outlet, junction, or switch point is less than 200 mm (8 in.) in any dimension, each conductor shall be long enough to extend at least 75 mm (3 in.) outside the~~ box is only used for splicing conductors, the length of the conductors shall have 150 mm (6 in.) of free conductor plus the diimension of the junction box opening.

Exception: Conductors that are not spliced or terminated at the outlet, junction, or switch point shall not be required to comply with 300.14.

Statement of Problem and Substantiation for Public Input

The way this Section is written now, if conductors were to be installed in a 16 x 16 x 6 inch junction box for example, and the Code is followed as written, the conductors would not meet in the middle of the box if the conduits or cables were to be brought into opposing sides. This would be especially true if one conduit or cable was entering the top left hand corner of the junction and the other in the bottom right hand side. As the Code is written now and followed the conductors would not meet in the middle of the junction box and would have to be spliced two times to ensure a correct termination. This could be a significant problem when calculating box fill considering each termination device counts as a conductor. By adding a requirement for adequate length of conductors for splices only will ensure a safe and neat installation.

Submitter Information Verification

Submitter Full Name: Mark Christian
Organization: Electrical Training Alliance
Street Address:
City:
State:
Zip:
Submittal Date: Wed Aug 26 14:22:47 EDT 2020
Committee: NEC-P03

Public Input No. 4675-NFPA 70-2020 [Section No. 300.14]

300.14 Length of Free Conductors at Outlets, Junctions, and Switch Points.

At least 150 mm (6 in.) of free conductor, measured from the point in the box where it emerges from its raceway or cable sheath, shall be left at each outlet, junction, and switch point for splices or the connection of luminaires or devices. Where the opening to an outlet, junction, or switch point is less than 200 mm (8 in.) in any dimension, each conductor shall be long enough to extend at least 75 mm (3 in.) outside the opening. All conductor that are connecting to outlets and switch points other than disconnect switches shall be pigtailed such that each pole or terminal connection only has a single connection to the device.

Exception: Conductors that are not spliced or terminated at the outlet, junction, or switch point shall not be required to comply with 300.14.

Statement of Problem and Substantiation for Public Input

Using outlets and switches as feed through devices the terminals can result in improper or loose connections resulting in failure of the electrical equipment. It should also be noted that by pig-tailing the connections the current is flowing through the spliced connections rather than relying on the internal bussing of the device. If a device should fail then the rest of the devices downstream will not necessarily be rendered inoperable. This also makes for a safe, neat and workmanlike installation.

Submitter Information Verification

Submitter Full Name: Wendell Whistler
Organization: IBEW Local 280
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 16:40:16 EDT 2020
Committee: NEC-P03

Public Input No. 1065-NFPA 70-2020 [Section No. 300.15(C)]

(C) Protection.

A box or conduit body shall not be required where cables enter or exit from conduit or tubing that is used to provide cable support or protection against physical damage. A fitting shall be provided on the end(s) of the conduit or tubing to protect the cable from abrasion.

Exception: A fitting shall not be required where conductors exit a conduit within the pole of a pole-mounted luminaire.

Statement of Problem and Substantiation for Public Input

Often, underground conduits are sized up (less now with LEDs availability) from what is required for ease pulling lengthy conductors. Conduits may also be sized up for increased conductor size, considering voltage drop in parking lots and such. Grouping more than 2 conduits to enter the bottom of a light pole can make it physically difficult to fit fittings adjacent to each other. I don't think this fitting is necessary for pulling or after-installation reasons. The conductors would be pulled in a direct direction when working through a handhole cover, causing no damage to the conductors. The conductors, in their stagnant after-installation position, exit the conduits in a direct direction, causing no damage to the conductors.

300.4G does not provide an exception for bushings required on PVC type or non-metallic raceways. I believe this is the right call not just because of the 'heavier' conductors mentioned in the Handbook, but because of the position of the conductors may be placed in, within an enclosure where the insulation can be gouged into by the fitting; metallic or non-metallic. This is not the case for the confines of a light pole.

The likeliest way I see damage occurring would be if the installer(s) pulled or fed the conductors into the conduit without the light pole in place and at an angle other than directly out faced direction of the conduit. The installer's qualifications could be questioned if so.

I didn't see 410.6 or 410 Part IV make an added mention that luminaire poles are required to be a listed product. 110.2 makes it possible for an inspector to look for a listing already therefore I didn't mention that in the proposal

Submitter Information Verification

Submitter Full Name: Norman Feck
Organization: State of Colorado
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 14 17:53:06 EDT 2020
Committee: NEC-P03

Public Input No. 1212-NFPA 70-2020 [Section No. 300.15(C)]

(C) Protection.

A box or conduit body shall not be required where cables enter or exit from conduit or tubing that is used to provide cable support or protection against physical damage. A fitting shall be provided on the end(s) of ~~the~~ metallic conduit or tubing to protect the cable from abrasion.

Statement of Problem and Substantiation for Public Input

Add language requiring the required fitting at the end of the conduit or tubing be required only for conduit or tubing that is metallic. Alternatively add an exception that exempts PVC, LFNC, ENT, HDPE, NUCC along with other forms of non-metallic conduit or tubing from requiring a fitting at the end of the conduit or tubing.

Adding a non-metallic fitting to the end of a non-metallic conduit or tubing adds no appreciable protection against cable abrasion.

Submitter Information Verification

Submitter Full Name: Gary Hein
Organization: Submission is independent of employer.
Street Address:
City:
State:
Zip:
Submittal Date: Sat May 23 08:28:41 EDT 2020
Committee: NEC-P03

Public Input No. 4118-NFPA 70-2020 [Section No. 300.15(F)]

(F) Fitting.

A fitting identified for the use shall be permitted in lieu of a box or conduit body where conductors are not spliced or terminated within the fitting. The fitting shall be accessible after installation, ~~unless listed for concealed installation.~~ if the fitting is designed as a pull point

Statement of Problem and Substantiation for Public Input

The change in the 2017 NEC was helpful but most fittings like couplings and connectors are not "listed for concealment" I believe adding that if the transition fitting is not a pull point it should be treated as the same as a coupling or connector and therefor be allowed for concealment

Submitter Information Verification

Submitter Full Name: James Dorsey
Organization: Douglas County Electrical Insp
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 21:17:05 EDT 2020
Committee: NEC-P03

Public Input No. 4181-NFPA 70-2020 [Section No. 300.15(F)]

(F) Fitting.

A fitting identified for the use shall be permitted in lieu of a box or conduit body where conductors are not spliced or terminated within the fitting. ~~The~~ The fitting shall be accessible after installation, unless listed for concealed installation.Threaded couplings used with rigid conduit wiring methods shall not be used as transition fittings for different wiring methods.

Statement of Problem and Substantiation for Public Input

Threaded couplings used in rigid conduit systems are very frequently used as transition fittings for different wiring methods in the field. The threaded rigid couplings have been evaluated only for use with their respective wiring method. The addition of this statement is to attempt to prevent the frequent use of threaded rigid couplings as transitional fittings and to move to the use of fittings that are already listed and available for wiring method transitions.

Submitter Information Verification

Submitter Full Name: William Gross
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 00:12:50 EDT 2020
Committee: NEC-P03

Public Input No. 4483-NFPA 70-2020 [Section No. 300.15(F)]

(F) Fitting.

A fitting identified for the use shall be permitted in lieu of a box or conduit body where conductors are not spliced or terminated within the fitting. ~~The fitting~~ A fitting provided with a removable cover for installation or removal of conductors shall be accessible after installation~~, unless listed for concealed installation~~ .

Statement of Problem and Substantiation for Public Input

A change to this section for the 2020 NEC was to resolve issues with inconsistent application of the accessibility requirement for conduit fittings after installation. Reading the code text, prior to the 2020 NEC change, for this stand alone statement, was in some cases requiring every conduit coupling, conduit connector, wiring method transition fitting to be accessible which was not the intent. The conduit fittings that require access would be conduit bodies (conduletts) or certain conduit connectors, such as an 90 degree angle flexible metal conduit connector where the back is removed to facilitate the installation or removal of the conductors. Any fitting that is installed in the conduit run that does not have a removable cover nor needs access to pull in or remove conductors should not require access after building finish is installed. This would include conduit and cable to conduit transition fittings. The requirement to now have a listing and related markings for every fitting that would be allowed to be concealed by building finish creates a requirement that has no specific testing or investigation involved. The revised text in this public input clarifies that that access after the building finish is applied is only required where the fitting has a removable cover necessary to install or remove the conductors in the conduit system. This is a requirement that can be easily visibly verified by the AHJ without the need for a listing and related marking.

Submitter Information Verification

Submitter Full Name: Charles Mello
Organization: cdcmello Consulting LLC
Affiliation: Self
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 13:55:04 EDT 2020
Committee: NEC-P03

Public Input No. 4574-NFPA 70-2020 [Section No. 300.15(F)]

(F) Fitting.

A fitting identified for the use shall be permitted in lieu of a box or conduit body where conductors are not spliced or terminated within the fitting. Cable armor or jackets shall not be permitted to be removed within a raceway. . The fitting shall be accessible after installation, unless listed for concealed installation.

Statement of Problem and Substantiation for Public Input

Add a sentence to address the use of transition fittings: Presently there is no guidance in the NEC regarding whether armor or jackets can or need to be removed at transition fittings. There are varying interpretations of what is necessary. Alternatively, if the panel believes that they can be removed then I suggest adding this sentence instead: Cable armor or jackets shall be permitted to be removed within the raceway.
It would also be nice if the word "transition" was added before "Fitting" but I'll leave that decision to the panel.

Submitter Information Verification

Submitter Full Name: Paul Dobrowsky
Organization: Innovative Technology Services
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 10 15:18:16 EDT 2020
Committee: NEC-P03

Public Input No. 534-NFPA 70-2020 [Section No. 300.15(G)]

(G) Direct-Buried Conductors ~~-~~ and Cables

As permitted in 300.5(E), a box or conduit body shall not be required for splices and taps in direct-buried conductors and cables.

Statement of Problem and Substantiation for Public Input

This revision is merely to mention cables in the Section title in order to correlate with what is actually covered by this rule. No technical changes here. It's just to help make it more user friendly.

Submitter Information Verification

Submitter Full Name: Russ Leblanc
Organization: Leblanc Consulting Services
Street Address:
City:
State:
Zip:
Submittal Date: Wed Feb 26 08:49:29 EST 2020
Committee: NEC-P03

Public Input No. 4121-NFPA 70-2020 [Section No. 300.15(L)]

(L) Manholes and Handhole Enclosures.

A box or conduit body shall not be required for conductors in manholes or handhole enclosures, except where connecting to electrical equipment. The installation shall comply ~~with the provisions of~~ with Part V of Article 110 for manholes, and 314.30 for handhole enclosures.

Statement of Problem and Substantiation for Public Input

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

Submitter Information Verification

Submitter Full Name: David Williams
Organization: Delta Charter Township
Street Address:
City:
State:
Zip:
Submittal Date: Wed Sep 09 21:23:39 EDT 2020
Committee: NEC-P03

Public Input No. 3334-NFPA 70-2020 [Section No. 300.15 [Excluding any Sub-Sections]]

A box shall be installed at each outlet and switch point for concealed knob-and-tube wiring.

Fittings and connectors shall be used only with the specific wiring methods for which they are designed and listed.

Where the wiring method is conduit, tubing, Type AC cable, Type MC cable, Type MI cable, nonmetallic-sheathed cable, or other cables, a box or conduit body shall be installed at each ~~conductor splice point,~~ outlet point, switch point, ~~junction~~ conductor splice point, conductor junction point, conductor termination point, or conductor pull point, unless otherwise permitted in 300.15(A) through (L).

Additional Proposed Changes

File Name	Description	Approved
300.15.pdf	A PDF to explain 300.15	

Statement of Problem and Substantiation for Public Input

The revised wording in the 3rd. paragraph is needed to clarify that "termination point" is referring to a CONDUCTOR termination points, rather than raceway termination points, and “pull points” is referring to CONDUCTOR pull points, rather than raceway or cable pull points, and “splice points” is referring to CONDUCTOR splice points rather than raceway splice points, and “junction point” is referring to CONDUCTOR junction points rather than raceway junction points. Some examples of misinterpretations- Many installers and inspectors alike are requiring transition fittings such as an EMT to FMC changeover fitting to be accessible because the original intent of this rule is not known or has been forgotten. Prior to 2002 the words "termination point" did not exist in this section. It was never intended to apply to raceway terminations or raceway junctions. It was always intended to apply to CONDUCTOR terminations, conductor splices, conductor pull points and conductor junctions. Yet it is often misapplied. A few more examples.... An EMT coupling is a raceway junction point, but it is NOT a Conductor junction point, therefore a box is not required, and therefore 300.15(F) is also not applicable. And likewise, an EMT to FMC changeover connector is a raceway junction point, but it is NOT a conductor junction point, conductor splice point, or conductor termination point and a box is not required, which means the fitting is merely a type of "coupling" and not being used "in lieu of a box" therefore 300.15(F) is also not applicable. An underground run of PVC is often changed to RMC where it emerges from grade. This underground location where the PVC connects to the RMC is a raceway junction point, but it is not a CONDUCTOR junction point. A box is certainly not required at this point, and 300.15(F) was also never meant to apply here. A UF cable sleeved in a PVC conduit where the UF emerges from ground is a similar example where a box is not required underground where the UF enters the PVC conduit and thus, the 3rd. paragraph of 300.15 was never meant to apply at this raceway termination either. The 3rd. paragraph of 300.15 was meant to cover installations where single insulated conductors would otherwise exist- at outlets, switch points, conductor splice points, conductor junction points, conductor termination points, or conductor pull points. These are locations where a box would be required...unless otherwise permitted in 300.15(A) through (L). It seems as though the original intent of this section has unfortunately been forgotten.

Here is the wording form the original Proposal for the 2002 NEC to add the words “termination point...

(Log #3012)
3- 83 - (300-15(a)): Accept in Principle
SUBMITTER: Robert H. Keis, Dover, DE
RECOMMENDATION: Insert the words "termination point" into the required locations or points where a box is required.
300-15. Boxes, Conduit Bodies, or Fittings—Where Required.
(a) Box or Conduit Body. Where the wiring method is conduit, electrical metallic tubing, Type AC cable, Type MC cable, Type MI cable, nonmetallic-sheathed cable, or other cables, a box or conduit body complying with Article 370 shall be installed at each conductor splice point, outlet, switch point, junction point, termination point, or pull point, unless otherwise permitted in (b) through (n). A box shall be installed at each outlet and switch point for concealed knob-and-tube wiring.
SUBSTANTIATION: The argument has come up recently about just taping the ends of an abandoned, but usable cable and leaving the cable end buried in a wall or laying in a ceiling. Nowhere in the code can I find a requirement that abandoned cables need to be removed and a lot of times that would be needless expense. Often cables are discontinued for one reason or another and may or could be utilized again in the future. This will settle a long standing argument. We tell the electrician when he violates the code to "read the words." He did just that, and that is reason for this proposal. The words aren't there!
PANEL ACTION: Accept in Principle.
PANEL STATEMENT: See panel action on Proposal 3-81. However, truly abandoned wires should not remain energized or connected to a possible source of potential.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 11
VOTE ON PANEL ACTION:
AFFIRMATIVE: 11

I am acutely familiar with this issue since it was my conversation with Robert that caused him to submit this proposal. Since 2002, taping the ends of the conductors of an abandoned but live, NM cable are considered conductor terminations and would generally require a box. The revised wording will help clarify the intent. This revision will also help make it clear that a "changeover" connector is not being used in lieu of a box or required to be accessible in accordance with 300.15(F) since it is not a conductor pull point, conductor termination point, or conductor splice point. An example of a fitting that would need to comply with 300.15(F) is a 90 degree FMC connector where the back of the connector can be removed so it can be used as a CONDUCTOR pull point. I have provided a photo example of that type of fitting too.

Submitter Information Verification

Submitter Full Name: Russ Leblanc
Organization: Leblanc Consulting Services
Street Address:
City:
State:
Zip:
Submittal Date: Tue Sep 08 08:01:32 EDT 2020
Committee: NEC-P03

300.15

Where is a “box” or “conduit body”required?

We must make the distinction between conductors and raceways.

Splice points, junction points, pull points and termination points for CONDUCTORS need a box or conduit body, while splice points, junction points, pull points and termination points for raceways do not!

See the following examples.

300.15
3rd paragraph

Conductor splices and conductor terminations for AC or MC cable.

A box or conduit body is required.



300.15
3rd paragraph

Outlet point for raceway, or cable wiring methods,

A box or conduit body is required.



300.15
3rd paragraph

Switch point on raceway, or cable wiring methods.

A box or conduit body is required.



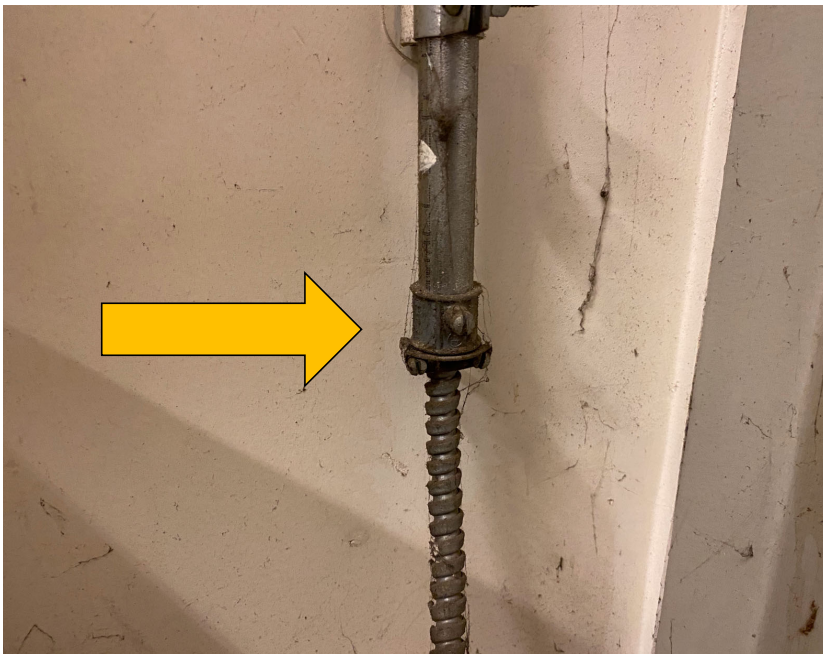
300.15
3rd paragraph

Raceway termination and cable pull point.

A box or conduit body is NOT required.

Fitting is NOT required to be accessible per 300.15(F) since this fitting is NOT being used in lieu of a box or conduit body.

Raceway termination, rather than a conductor termination.



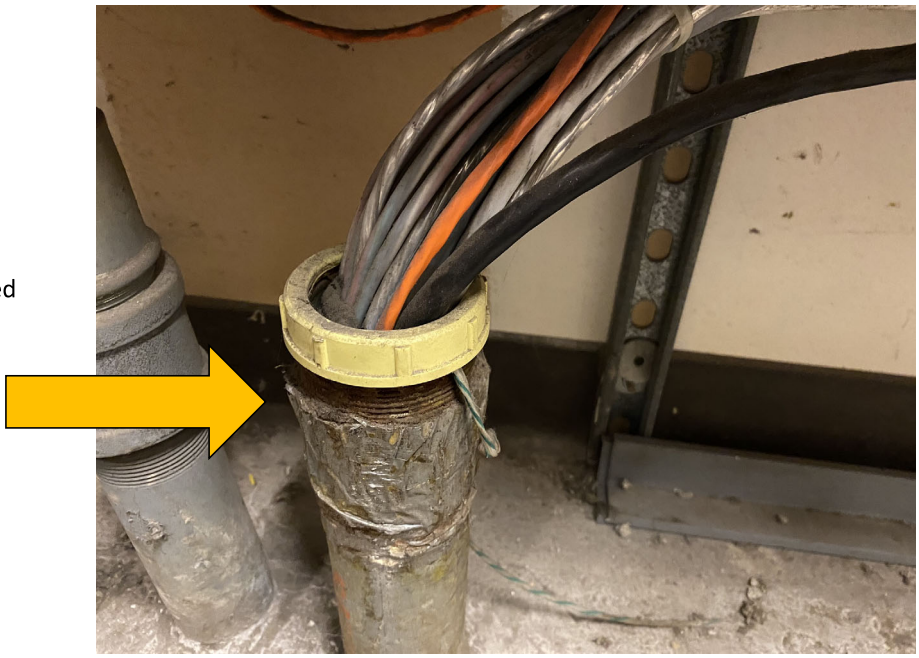
300.15
3rd paragraph

Raceway termination and cable pull point.

A box or conduit body is NOT required.

Fitting is NOT required to be accessible per 300.15(F) since this fitting is NOT being used in lieu of a box or conduit body.

Raceway termination, rather than a conductor termination.



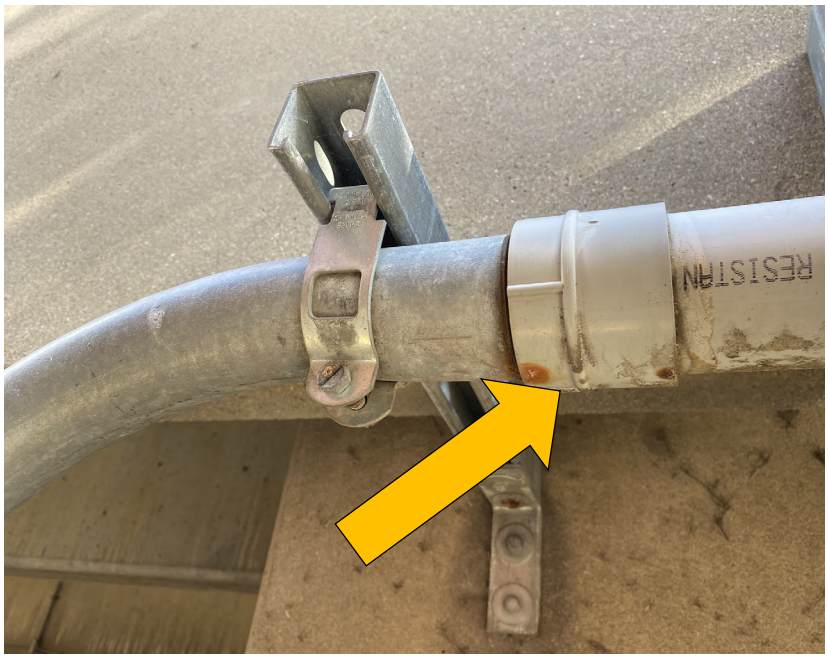
300.15
3rd paragraph

Conduit junction point.

A box or conduit body is NOT required.

Fitting is NOT required to be accessible per 300.15(F) since this fitting is NOT being used in lieu of a box or conduit body.

Conduit junction point, rather than a conductor junction point.



300.15
3rd paragraph

This ceiling access hatch is used as a Cable or raceway “pull point”.

A box or conduit body is NOT required here.

Cable or raceway pull point, rather than a conductor pull point.



300.15
3rd paragraph

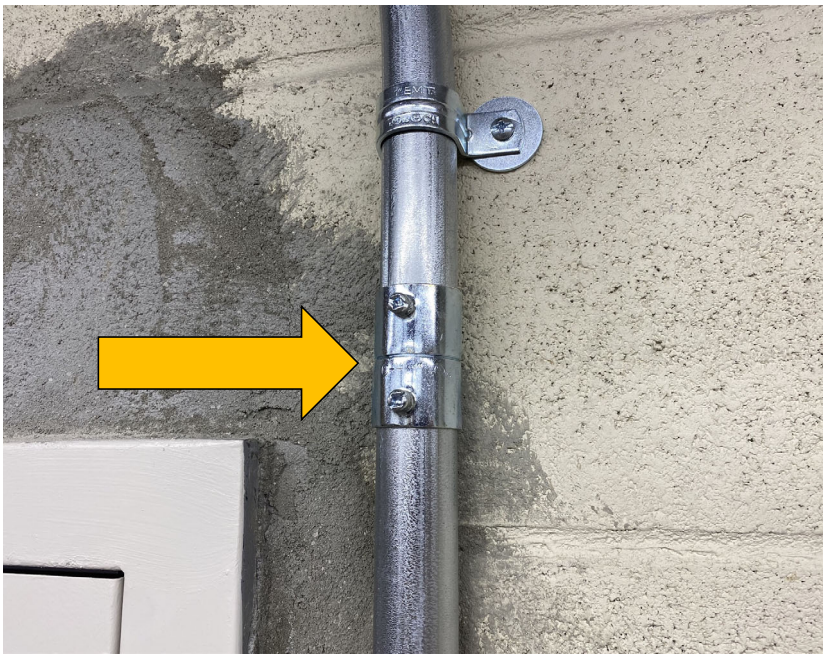
Raceway junction point.

A box or conduit body is NOT required.

Coupling is not being used in lieu of a box or conduit body.

Fitting is NOT required to be accessible per 300.15(F) since this fitting is NOT being used in lieu of a box or conduit body.

Raceway junction point, rather than a conductor junction point.

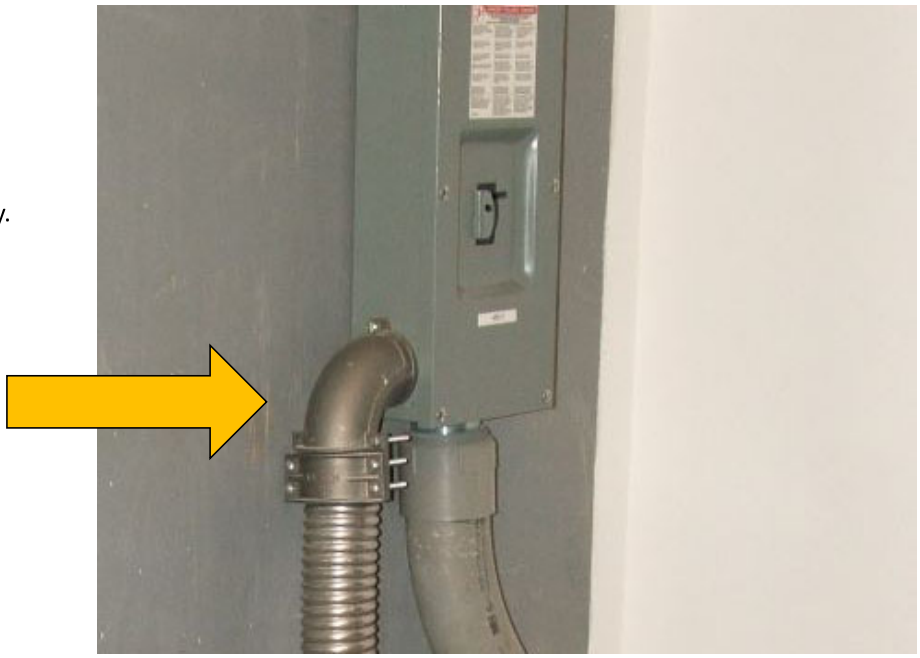


300.15
3rd paragraph

Conductor pull point.

Fitting used in lieu of a box or conduit body.

A fitting with a removable back, used as a CONDUCTOR pull point. This type of fitting would need to comply with 300.15(F) and would need to remain accessible



300.15(F)- This type of fitting is used as a conductor pull point!
These fittings ARE required to remain accessible!





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300.15
3rd paragraph

Conductor pull point.

Fitting used in lieu of a box or conduit body.

A fitting with a removable cover, used as a CONDUCTOR pull point. This type of fitting would need to comply with 300.15(F) and would need to remain accessible



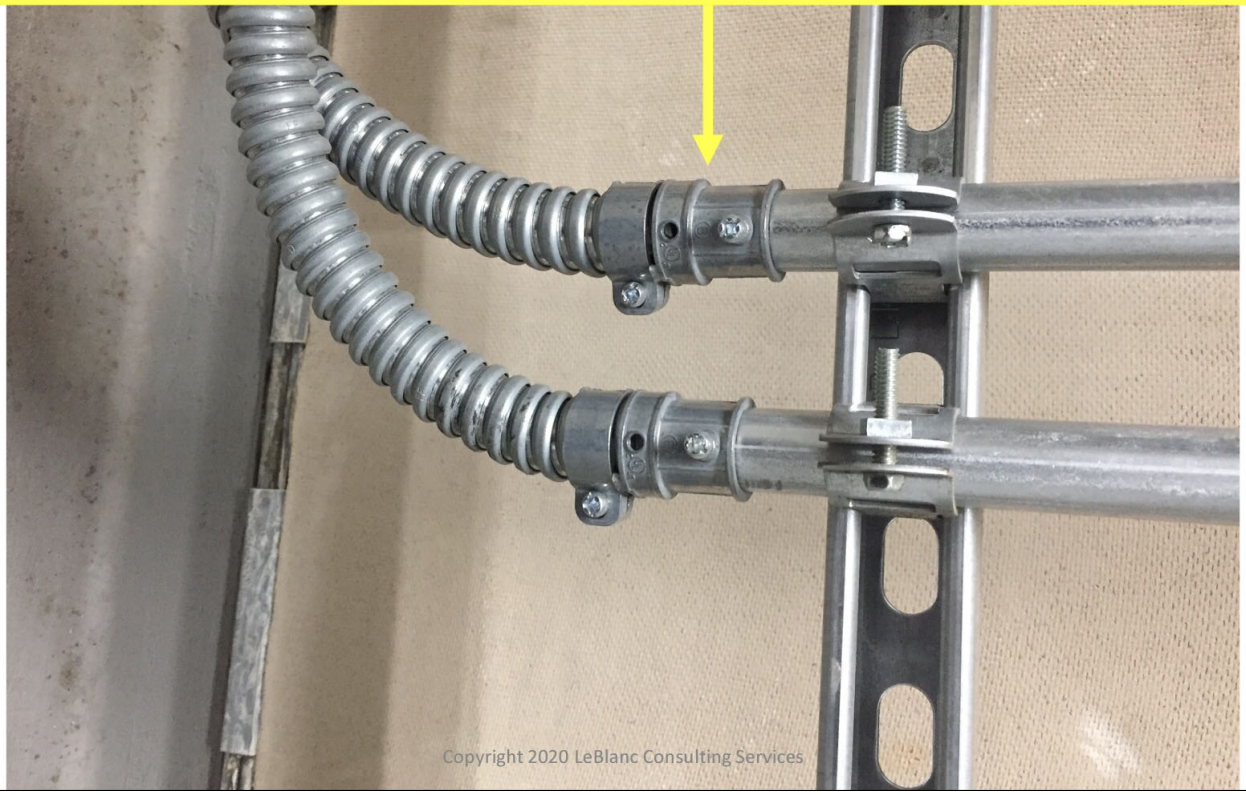
300.15(F)- These types of fittings (in lieu of a boxes) are used as a conductor pull point! These fittings ARE required to remain accessible!





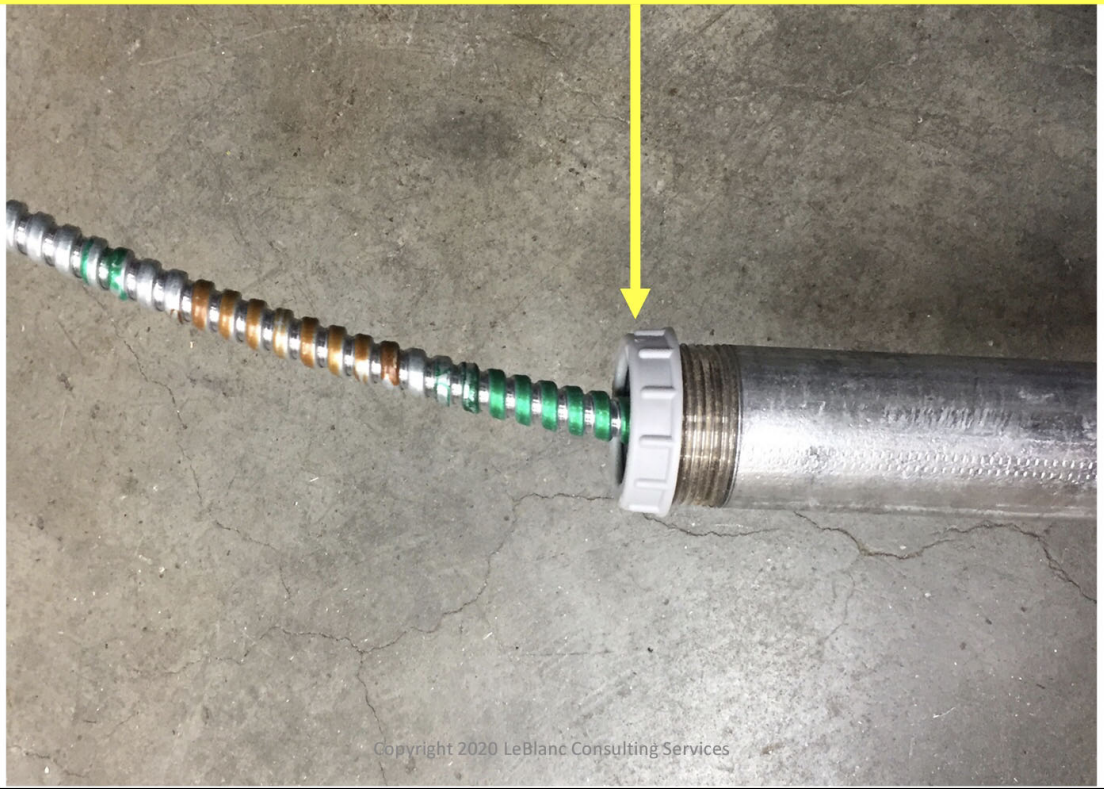
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300.15(F)- A box is NOT required at a conduit transition!
These fittings are NOT required to remain accessible!



Copyright 2020 LeBlanc Consulting Services

300.15(F)- A box is NOT required on a conduit sleeve!
This fitting is NOT required to remain accessible!



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Public Input No. 3816-NFPA 70-2020 [Section No. 300.17]

300.17 Number and Size of Conductors in Raceway.

The number and size of conductors in any raceway shall not be more than will permit dissipation of the heat and ready installation or withdrawal of the conductors without damage to the conductors or to their insulation.

Informational Note: See the following sections of this *Code*: intermediate metal conduit, 342.22; rigid metal conduit, 344.22; flexible metal conduit, 348.22; liquidtight flexible metal conduit, 350.22; PVC conduit, 352.22; HDPE conduit, 353.22; RTRC, 355.22; liquidtight nonmetallic flexible conduit, 356.22; electrical metallic tubing, 358.22; flexible metallic tubing, 360.22; electrical nonmetallic tubing, 362.22; cellular concrete floor raceways, 372.22; cellular metal floor raceways, 374.22; metal wireways, 376.22; nonmetallic wireways, 378.22; surface metal raceways, 386.22; surface nonmetallic raceways, 388.22; underfloor raceways, 390.22; fixture wire, 402.7; theaters, 520.6; signs, 600.31(C); elevators, 620.33; audio signal processing, amplification, and reproduction equipment, 640.23(A) and 640.24; Class 1 circuits , 725.51; Class 2 , and Class 3 circuits, ~~Article~~ 725.133 ; fire alarm circuits, ~~Article~~ 760.51 ; and optical fiber cables and raceways, ~~Article~~ 770. 110(B) .

Statement of Problem and Substantiation for Public Input

Section 4.1.4 of the 2020 NEC(r) Style Manual prohibits reference to entire articles, with the exception of Article 100. As such, it is proposed to change the references to Article 725, 760, and 770 in this section to specifically refer to the sections of those articles dealing with raceway fill and ampacity adjustment to correlate with the language in this informational note.

Submitter Information Verification

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Submittal Date: Wed Sep 09 13:29:28 EDT 2020
Committee: NEC-P03

Public Input No. 535-NFPA 70-2020 [Section No. 300.17]

300.17 Number and Size of Conductors and Cables in Raceway.

The number and size of conductors ~~in~~ and cables in any raceway shall not be more than will permit dissipation of the heat and ready installation or withdrawal of the conductors or cables without damage to the cables, or conductors or to their insulation.

Informational Note: See the following sections of this *Code*: intermediate metal conduit, 342.22; rigid metal conduit, 344.22; flexible metal conduit, 348.22; liquidtight flexible metal conduit, 350.22; PVC conduit, 352.22; HDPE conduit, 353.22; RTRC, 355.22; liquidtight nonmetallic flexible conduit, 356.22; electrical metallic tubing, 358.22; flexible metallic tubing, 360.22; electrical nonmetallic tubing, 362.22; cellular concrete floor raceways, 372.22; cellular metal floor raceways, 374.22; metal wireways, 376.22; nonmetallic wireways, 378.22; surface metal raceways, 386.22; surface nonmetallic raceways, 388.22; underfloor raceways, 390.22; fixture wire, 402.7; theaters, 520.6; signs, 600.31(C); elevators, 620.33; audio signal processing, amplification, and reproduction equipment, 640.23(A) and 640.24; Class 1, Class 2, and Class 3 circuits, Article 725; fire alarm circuits, Article 760; and optical fiber cables and raceways, Article 770.

Statement of Problem and Substantiation for Public Input

This revision is needed since cables are also permitted to be installed in raceways.
We can't ignore cables from being damaged when installing them or removing them from raceways.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 536-NFPA 70-2020 [Section No. 300.18(A)]	

Submitter Information Verification

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Committee: NEC-P03

Public Input No. 2841-NFPA 70-2020 [Section No. 300.18]

300.18 Raceway Installations.

(A) Complete Runs.

Raceways, other than busways ~~or~~ , listed manufactured assemblies for use in Article 604, or exposed raceways having hinged or removable covers, shall be installed complete between outlet, junction, or splicing points prior to the installation of conductors. Where required to facilitate the installation of utilization equipment, the raceway shall be permitted to be initially installed without a terminating connection at the equipment. Prewired raceway assemblies shall be permitted only where specifically permitted in this *Code* for the applicable wiring method.

Exception: Short sections of raceways used to contain conductors or cable assemblies for protection from physical damage shall not be required to be installed complete between outlet, junction, or splicing points.

(B) Welding.

Metal raceways shall not be supported, terminated, or connected by welding to the raceway unless specifically designed to be or otherwise specifically permitted to be in this *Code*.

Statement of Problem and Substantiation for Public Input

UL is listing prewired systems for use in 604 that are made from EMT so we need to add this option here. Thes will be pre-wired and have connectors so there is no concern of damaging the conductors during installation.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2846-NFPA 70-2020 [Section No. 358.30 [Excluding any Sub-Sections]]	

Submitter Information Verification

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Committee: NEC-P03

Public Input No. 536-NFPA 70-2020 [Section No. 300.18(A)]

(A) Complete Runs.

Raceways, other than busways or exposed raceways having hinged or removable covers, shall be installed complete between outlet, junction, or splicing points prior to the installation of conductors or cables . Where required to facilitate the installation of utilization equipment, the raceway shall be permitted to be initially installed without a terminating connection at the equipment. Prewired raceway assemblies shall be permitted only where specifically permitted in this *Code* for the applicable wiring method.

Exception: Short sections of raceways used to contain conductors or cable assemblies for protection from physical damage shall not be required to be installed complete between outlet, junction, or splicing points.

Statement of Problem and Substantiation for Public Input

This revision is needed to recognize that cables can also be installed in raceways.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 535-NFPA 70-2020 [Section No. 300.17]	cables in raceways

Submitter Information Verification

Submitter Full Name: Russ Leblanc
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Submittal Date: Wed Feb 26 08:58:06 EST 2020
Committee: NEC-P03

Public Input No. 1092-NFPA 70-2020 [New Section after 300.18(B)]

TITLE OF NEW CONTENT 300.18(C) Tubing and Raceway Nipples.

Type your content here ...

Tubing nipples 600mm (24") or less in length are to be considered raceways. Tubing nipples between two enclosures shall not require added securing or support. Each tubing nipple shall be installed according to its assigned Chapter 3 article. Tubing nipples may be factory made or field made short sections of raceway.

The following is intended for the blue text of the NEC Handbook (or it could be CMP public input reasoning) -

This allows:

1. Cables entering an enclosure may use a chase nipple as a raceway for protection instead of their article 300.6 fitting (Ex: NM entering the back of a residential panelboard.) The second sentence of 300.15 wouldn't be violated either.

2. Easier enforcement of 250.80 and 250.92A metal service raceway bonding.

3. Aligns with Chapter 9 Notes to Tables (4).

4. Gets rid of the mystery, "Do short sections of raceway require securing?" since it isn't sufficiently spelled out in the NEC.

5. Mates nicely with articles such as 250.102C2 and 250.122F1b. Nipples are treated as raceways in practice but it needs to be stated that they are regarded raceways not fittings.

6. As proposed, chase nipples are also raceways.

Statement of Problem and Substantiation for Public Input

The shown public input proposal is overdue for clarity. The new blue text for the NEC Handbook shows the reasoning.

Submitter Information Verification

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Submittal Date: Sat May 16 09:42:47 EDT 2020
Committee: NEC-P03

Public Input No. 1213-NFPA 70-2020 [Section No. 300.19(A)]

(A) Spacing Intervals — Maximum.

Conductors in vertical raceways shall be supported if the vertical rise exceeds the values in Table 300.19(A). At least one support method shall be provided for each conductor at the top of the vertical raceway or as close to the top as practical. Intermediate supports shall be provided as necessary to limit supported conductor lengths to not greater than those values specified in Table 300.19(A).

Exception: Steel wire armor cable shall be supported at the top of the riser with a cable support that clamps the steel wire armor. A safety device shall be permitted at the lower end of the riser to hold the cable in the event there is slippage of the cable in the wire-armored cable support. Additional wedge-type supports shall be permitted to relieve the strain on the equipment terminals caused by expansion of the cable under load.

Table 300.19(A) Spacings for Conductor Supports

Conductor Size	Support of Conductors in Vertical Raceways	Conductors					
		Copper		Aluminum or Copper-Clad Aluminum		Copper	
		m	ft	m	ft		
18 AWG through 8 AWG	Not greater than	30	100	30	100		
6 AWG through 1/0 AWG	Not greater than	30	100	60	200	~~30~~	~~100~~
2/0 AWG through 4/0 AWG	Not greater than	25	80	55	180	~~25~~	~~80~~
Over 4/0 AWG through 350 kcmil	Not greater than	18	60	41	135	~~18~~	~~60~~
Over 350 kcmil through 500 kcmil	Not greater than	15	50	36	120	~~15~~	~~50~~
Over 500 kcmil through 750 kcmil	Not greater than	12	40	28	95	~~12~~	~~40~~
Over 750 kcmil	Not greater than	11	35	26	85	~~11~~	~~35~~

Statement of Problem and Substantiation for Public Input

Change formatting of Table 300.19 (A) by switching the positions of the conductor columns; swap the placement of the “Copper” conductor columns with the “Aluminum or Copper-Clad Aluminum” columns.

Copper conductors are typically more often referenced than Aluminum or Copper-Clad Aluminum conductors. The NEC has improved significantly in large part due to improved formatting and readability. This change will continue the trend of making the NEC an easier to document for inspectors, installers and others.

Submitter Information Verification

Submitter Full Name: Gary Hein
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Submittal Date: Sat May 23 08:31:56 EDT 2020
Committee: NEC-P03

Public Input No. 2098-NFPA 70-2020 [Section No. 300.19(B)]

(B) Fire-~~Rated~~ Resistive Cables and Conductors.

Support methods and spacing intervals for fire-~~rated~~ restive cables and conductors shall comply with any restrictions provided in the listing of the ~~electrical circuit protective~~ fire-resistive cable system used and in no case shall exceed the values in Table 300.19(A).

Statement of Problem and Substantiation for Public Input

The proposed update corrects the term “fire-rated” to the more appropriate “fire-resistive cables” consistent with the use elsewhere throughout the NEC®. This public input is a result of the Correlating Committee Task Group for Circuit Integrity Cable efforts to correlate information on Circuit Integrity (-CI) cable throughout the NEC®. Members of the task group included Blake Shugarman from UL – Principal Engineer for Circuit Integrity Systems, Larry Shudak from UL - Principal Engineer for Life Safety Technologies and member of NFPA 72, Anthony Tassone from UL – Principal Engineer Seasonal and Holiday Decorative Products and Telecommunications Cables - CMP16, Jim Conrad from Marmon Innovation and Technology Group – CMP13, George Straniero from AFC Cable Systems – CMP6, CMP3, and CC, Paul Casparro from IBEW – CMP3, and Rich Holub from DuPont – CMP14 and CC.

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Submittal Date: Thu Jul 30 11:13:23 EDT 2020
Committee: NEC-P03

Public Input No. 117-NFPA 70-2019 [Section No. 300.19(C)]

(C) Support Methods.

One or more of the following methods of support shall be used:

(1) Clamping devices constructed of or employing insulating wedges inserted in the ends of the raceways. Where clamping of insulation does not adequately support the cable, the conductor also shall be clamped.

(2) Inserting boxes at the required intervals in which insulating supports are installed and secured in an approved manner to withstand the weight of the conductors attached thereto, the boxes being provided with covers.

(3) In junction boxes, deflecting the cables not less than 90 degrees and carrying them horizontally to a distance not less than twice the diameter of the cable, the cables being carried on two or more insulating supports and additionally secured thereto by tie wires, if desired. Where this method is used, cables shall be supported at intervals not greater than 20 percent of the support spacing in Table 300.19(A).

(4) Other approved means.

Statement of Problem and Substantiation for Public Input

The literal wording presently permits only one method to be used. Obviously I don't believe this to be the intent of the rule, but without the additional words, "or more", the rule seems to imply that installers must choose only one method to support conductors, and to choose any other method in addition, would be a violation. I believe this simple revision will help clarify that multiple support methods can be used on any one installation.

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Submittal Date: Wed Nov 20 09:00:10 EST 2019
Committee: NEC-P03

Public Input No. 4123-NFPA 70-2020 [Section No. 300.20(A)]

(A) Conductors Grouped Together.

Where conductors carrying alternating current are installed in ferrous metal enclosures or ferrous metal raceways, they shall be arranged so as to avoid heating the surrounding ferrous metal by induction. To accomplish this, all phase conductors and, where used, the grounded conductor and all equipment grounding conductors shall be grouped together.

Exception No. 1: Equipment grounding conductors for certain existing installations shall be permitted to be installed separate from their associated circuit conductors where run in accordance ~~with the provisions of~~ with 250.130(C).

Exception No. 2: A single conductor shall be permitted to be installed in a ferromagnetic enclosure and used for skin-effect heating in accordance with the provisions of 426.42 and 427.47.

Statement of Problem and Substantiation for Public Input

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

Submitter Information Verification

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Submittal Date: Wed Sep 09 21:24:58 EDT 2020
Committee: NEC-P03

Public Input No. 459-NFPA 70-2020 [Section No. 300.20(B)]

(B) Individual Conductors.

Where a single conductor ~~carrying~~ , or set of conductors paralled in accordance with 310.10(G) carrying alternating current passes through metal with magnetic properties, the inductive effect shall be minimized by (1) cutting slots in the metal between the individual holes through which the individual conductors pass or (2) passing all the conductors in the circuit through an insulating wall sufficiently large for all of the conductors of the circuit.

Exception: In the case of circuits supplying vacuum or electric-discharge lighting systems or signs or X-ray apparatus, the currents carried by the conductors are so small that the inductive heating effect can be ignored where these conductors are placed in metal enclosures or pass through metal.

Informational Note: Because aluminum is not a magnetic metal, there will be no heating due to hysteresis; however, induced currents will be present. They will not be of sufficient magnitude to require grouping of conductors or special treatment in passing conductors through aluminum wall sections.

Statement of Problem and Substantiation for Public Input

This revision is needed to recognize that multiple parallel conductors (acting as one conductor) can also be passed through individual openings in ferrous metal enclosures. For example, a raceway with 3-conductors paralleled for line 1 passing through an individual opening next to the raceway for line 2 having 3-paralleled conductors passing through an individual opening, next to the raceway for line 3 having 3-paralleled conductors passing through an individual opening. The present wording ignores this situation. Does this mean we don't need to cut slots between paralleled isolated phases as described in 300.5(I) exception 2 ????? I certainly don't think that is the intent of this rule!

310.10(H)(4) requires parallel conductors to be counted as MULTIPLE conductors for ampacity adjustment. But does that also mean they must be considered MULTIPLE conductors when installing parallel Isolated phases as described in 300.5(I) exception 2 and trying to comply with 300.20(B)...."Where a SINGLE conductor carrying alternating current passes through metal with magnetic properties, the inductive effect shall be minimized by (1) cutting slots in the metal between the individual holes through which the individual conductors pass or (2) passing all the conductors in the circuit through an insulating wall sufficiently large for all of the conductors of the circuit.
I believe this revision will clarify the requirements for paralleled conductors run through individual openings.

Submitter Information Verification

Submitter Full Name: Russ Leblanc
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Submittal Date: Tue Feb 11 11:21:46 EST 2020
Committee: NEC-P03

Public Input No. 371-NFPA 70-2020 [Section No. 300.21]

300.21 Spread of Fire or Products of Combustion. ~~, Repairing of Fireproofing on Structural Elements~~

(A) Spread of Fire or Products of Combustion. Electrical installations in hollow spaces, vertical shafts, and ventilation or air-handling ducts shall be made so that the possible spread of fire or products of combustion will not be substantially increased. Openings around electrical penetrations into or through fire-resistant-rated walls, partitions, floors, or ceilings shall be firestopped using approved methods to maintain the fire resistance rating.

Informational Note: Directories of electrical construction materials published by qualified testing laboratories contain many listing installation restrictions necessary to maintain the fire-resistive rating of assemblies where penetrations or openings are made. Building codes also contain restrictions on membrane penetrations on opposite sides of a fire-resistance-rated wall assembly. An example is the 600-mm (24-in.) minimum horizontal separation that usually applies between boxes installed on opposite sides of the wall. Assistance in complying with 300.21 can be found in building codes, fire resistance directories, and product listings.

(B) Repairing of Fireproofing on Structural Elements. Where fireproofing material on structural elements is damaged or removed for installation of raceways, cables, or other electrical equipment, the fireproofing material shall be repaired in an approved manner to maintain the required fire-resistance-rating of the structural element.

Additional Proposed Changes

File Name	Description	Approved
Damaged_fireproofing_01.JPG	damaged fireproofing on beam	
Damaged_fireproofing_02.JPG	fireproofing scraped off beam	
Damaged_fireproofing_03.JPG	fireproofing removed from beams	
Repaired_firproofing_01.JPG	repaired fireproofing on beam 01	
Repaired_fireproofing_02.JPG	repaired fireproofing on beam 02	

Statement of Problem and Substantiation for Public Input

First let me state that TerraView would not allow me to properly format the code text. Rename section, and create sections (A) and (B). This revision is needed to remind electricians to fix the damage they have done when scraping or smashing off the fireproofing material on structural beams in order to install their cables, raceways, and other equipment. Removing fireproofing spray or coatings from metal beams can seriously compromise the integrity of the beam during fire conditions. Will it warp? Will it collapse? These beams are not meant to be bare metal exposed to fire. They are meant to be covered in some materials that help protect them from the severe heat conditions that can develop during a fire. This new rule will also allow electrical inspectors to cite this violation and force the electrician to fix his mistake. I have provided several photos showing damaged fireproofing and repaired fireproofing too.

Submitter Information Verification

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Submittal Date: Sun Jan 26 15:17:47 EST 2020
Committee: NEC-P03


01 . 24 . 2020




01 . 24 . 2020


01.24.2020


01.24.2020

Public Input No. 678-NFPA 70-2020 [Section No. 300.22(C) [Excluding any Sub-Sections]]

This section shall apply to spaces not specifically fabricated for environmental air-handling purposes but used for air-handling purposes as a plenum. This section shall not apply to habitable rooms or areas of buildings, the prime purpose of which is not air handling.

Informational Note No. 1: The space over a hung ceiling used for environmental air-handling purposes is an example of the type of other space to which this section applies.

Informational Note No. 2: The phrase *other spaces used for environmental air (plenum)* as used in this section correlates with the use of the term *plenum* in NFPA 90A ~~2018~~ 2021 , *Standard for the Installation of Air-Conditioning and Ventilating Systems*, and other mechanical codes where the plenum is used for return air purposes, as well as some other air-handling spaces.

Exception: This section shall not apply to the joist or stud spaces of dwelling units where the wiring passes through such spaces perpendicular to the long dimension of such spaces.

Statement of Problem and Substantiation for Public Input

Update issue date of NFPA 90A.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 679-NFPA 70-2020 [Section No. 725.135(B)]	Update issue date of NFPA 90A.
Public Input No. 680-NFPA 70-2020 [Section No. 760.135(B)]	Update issue date of NFPA 90A.
Public Input No. 681-NFPA 70-2020 [Section No. 770.24]	Update issue date of NFPA 90A.
Public Input No. 682-NFPA 70-2020 [Section No. 770.113(C)]	Update issue date of NFPA 90A.
Public Input No. 683-NFPA 70-2020 [Section No. 800.24]	Update issue date of NFPA 90A.
Public Input No. 684-NFPA 70-2020 [Section No. 800.113(B)]	Update issue date of NFPA 90A.
Public Input No. 685-NFPA 70-2020 [Section No. 800.113(C)]	Update issue date of NFPA 90A.
Public Input No. 686-NFPA 70-2020 [Section No. 800.182(A)]	Update issue date of NFPA 90A.
Public Input No. 687-NFPA 70-2020 [Section No. 805.170(C)]	Update issue date of NFPA 90A.
Public Input No. 688-NFPA 70-2020 [Section No. 770.113(B)]	Update issue date of NFPA 90A.
Public Input No. 679-NFPA 70-2020 [Section No. 725.135(B)]	
Public Input No. 680-NFPA 70-2020 [Section No. 760.135(B)]	
Public Input No. 681-NFPA 70-2020 [Section No. 770.24]	
Public Input No. 682-NFPA 70-2020 [Section No. 770.113(C)]	
Public Input No. 683-NFPA 70-2020 [Section No. 800.24]	
Public Input No. 684-NFPA 70-2020 [Section No. 800.113(B)]	
Public Input No. 685-NFPA 70-2020 [Section No. 800.113(C)]	
Public Input No. 686-NFPA 70-2020 [Section No. 800.182(A)]	
Public Input No. 687-NFPA 70-2020 [Section No. 805.170(C)]	
Public Input No. 688-NFPA 70-2020 [Section No. 770.113(B)]	

Submitter Information Verification

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Affiliation: CCCA
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Zip:
Submittal Date: Wed Mar 18 03:54:55 EDT 2020
Committee: NEC-P03

Public Input No. 2364-NFPA 70-2020 [New Section after 300.25]

300.26 Abandoned Wiring

Permanent wiring abandoned in place shall be tagged or otherwise identified at its termination and junction points as "Abandoned in Place" or removed from all accessible areas and insulated from contact with other live electrical wiring or devices.

Statement of Problem and Substantiation for Public Input

This important requirement already exists in Section 11.1.2.3 of NFPA1-2018 edition, but this requirement needs to be added to the NEC to ensure that electricians and inspectors alike "get the same message". The NEC has many requirements for tagging or removing "abandoned" or "discontinued" wiring including 372.58, 374.58, 390.57, 590.3(D), 640.6(B), 645.5(G), 650.7, 725.25, 760.25, 770.25, 800,25, 820.25, and 830.25. But, why is there is no general requirement for removing other abandoned or discontinued wiring? Are abandoned NM cables or MC cables any less hazardous than abandoned fire alarm cables or Class 2 cables? I don't think they are. Does this make any sense to you especially considering the increased possibility of a fire or shock hazard due to the possibility of inadvertently re-energizing abandoned wiring capable of causing electrocutions or starting fires. It makes no sense to me. This is why I am submitting this Public Input. I will also be submitting a companion PI to create a definition for "abandoned wiring".

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2365-NFPA 70-2020 [New Section after 300.50(F)]	abandoned wiring
Public Input No. 2365-NFPA 70-2020 [New Section after 300.50(F)]	
Public Input No. 2366-NFPA 70-2020 [New Part after I.]	
Public Input No. 2367-NFPA 70-2020 [New Part after II.]	

Submitter Information Verification

Submitter Full Name: Russ Leblanc
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Submittal Date: Tue Aug 18 06:34:57 EDT 2020
Committee: NEC-P03

Public Input No. 1988-NFPA 70-2020 [Section No. 300.25]

300.25 Egress Exit Enclosures (Stair Towers).

Where an egress exit enclosure is required to be ~~separated from the building~~ fire rated and separated from a building or structure , only electrical wiring methods ~~serving equipment permitted by the authority having jurisdiction~~ supplying equipment in the exit enclosure unless otherwise permitted by the authority having jurisdiction .

Informational Note: For more information, refer to NFPA *101*-2018, *Life Safety Code*, 7.1.3.2.1(10)(b).

Statement of Problem and Substantiation for Public Input

Editorial revisions have been made to improve clarity and usability. The word egress has been add to clarify application of this section along with the concept of required fire ratings. The informational note referring to NFPA 101 is the only indication that the exit enclosure is typically a fire-rated egress path out of the building or structure.

Submitter Information Verification

Submitter Full Name: Agnieszka Golriz
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Submittal Date: Thu Jul 23 10:03:47 EDT 2020
Committee: NEC-P03

Public Input No. 808-NFPA 70-2020 [Section No. 300.25]

300.25 Exit Enclosures (Stair Towers).

Where an exit enclosure is required to be separated from the building, only electrical wiring methods serving equipment permitted by the authority having jurisdiction in the exit enclosure shall be installed within the exit enclosure.

Exception: *Where egress lighting is required on outside exterior doorways from the exit enclosure, luminaires shall be permitted to be supplied from the inside of the exit enclosure.*

Informational Note: For more information, refer to NFPA *101*-2018, *Life Safety Code*, 7.1.3.2.1(10)(b).

Statement of Problem and Substantiation for Public Input

Egress lighting luminaires on the outside exterior which are located either above or to the side of an exterior doorway will require a wiring method to be used that is surface mounted in addition to wiring right above the doorway on the inside for an exit luminaire. Supplying power to the outside luminaire could beprovided from the exit sign to make this a very easy and clean installation.

Submitter Information Verification

Submitter Full Name: David Hittinger
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Submittal Date: Mon Mar 30 14:19:01 EDT 2020
Committee: NEC-P03

Public Input No. 4124-NFPA 70-2020 [Section No. 300.35]

300.35 Protection Against Induction Heating.

Metallic raceways and associated conductors shall be arranged so as to avoid heating of the raceway in accordance ~~with the applicable provisions of~~ with 300.20.

Statement of Problem and Substantiation for Public Input

Deleting the words "the applicable provisions of" does not change the meaning of the section.

Submitter Information Verification

Submitter Full Name: David Williams
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Submittal Date: Wed Sep 09 21:26:34 EDT 2020
Committee: NEC-P03

Public Input No. 2590-NFPA 70-2020 [Section No. 300.37]

300.37 Aboveground Wiring Methods.

Aboveground conductors shall be installed in rigid metal conduit, in intermediate metal conduit, in electrical metallic tubing, in RTRC and PVC conduit, in cable trays, in auxiliary gutters, as busways, as cablebus, in other identified raceways, or as exposed runs of metal-clad cable suitable for the use and purpose. In locations accessible to qualified persons only, exposed runs of Type MV cables, ~~bare~~ listed Insulated Bus Pipe (IBP), bare conductors, and bare busbars shall also be permitted. Busbars shall be permitted to be either copper or aluminum.

Exception: Airfield lighting cable used in series circuits that are powered by regulators and installed in restricted airport lighting vaults shall be permitted as exposed cable installations.

Informational Note: FAA L-824 cables installed as exposed runs within a restricted vault area are common applications.

Statement of Problem and Substantiation for Public Input

A companion PI 2589 has been submitted to add Insulated Bus Pipe (IBP), Type IBP as an acceptable wiring method. This PI is to propose adding this method as an approved above ground wiring method if PI 2589 should be accepted.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2589-NFPA 70-2020 [New Article after 368]	Companion
Public Input No. 2589-NFPA 70-2020 [New Article after 368]	

Submitter Information Verification

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Submittal Date: Tue Aug 25 08:39:48 EDT 2020
Committee: NEC-P03

Public Input No. 957-NFPA 70-2020 [Section No. 300.37]

300.37 Aboveground Wiring Methods.

Aboveground conductors shall be installed in rigid metal conduit, in intermediate metal conduit, in electrical metallic tubing, in RTRC and PVC conduit, in cable trays, in auxiliary gutters, as busways, as cablebus, in other identified raceways, or as exposed runs of metal-clad cable suitable for the use and purpose. In locations accessible to qualified persons only, exposed runs of Type MV cables, bare conductors, and bare busbars shall also be permitted. Busbars shall be permitted to be either copper or aluminum.

Exception:-- L-824 Airfield lighting cable used in series circuits that are powered by constant current regulators and installed in restricted airport lighting vaults shall be permitted as exposed cable installations.

Informational Note: FAA L-824 cables installed as exposed runs within a restricted vault area are common applications.

Statement of Problem and Substantiation for Public Input

L-824 is the Federal Aviation Administrations (FAA) designation for airfield lighting cable.
The term "regulator" is used in several places in NFPA 70. Art 392.10 uses "constant current regulator", Art 490.23 applies to a "voltage regulator". For this specific application the correct term would be "constant current regulator".

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 958-NFPA 70-2020 [Section No. 311.36]	
Public Input No. 958-NFPA 70-2020 [Section No. 311.36]	

Submitter Information Verification

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Submittal Date: Tue May 05 17:18:39 EDT 2020
Committee: NEC-P03

Public Input No. 2958-NFPA 70-2020 [Section No. 300.50]

300.50 Underground Installations.

(A) General.

Underground conductors shall be identified for the voltage and conditions under which they are installed. Direct-burial cables shall comply with the provisions of 310.10(E). Underground cables shall be installed in accordance with 300.50(A)(1), (A)(2), or (A)(3), and the installation shall meet the depth requirements of Table 300.50.

Table 300.50 Minimum Cover[a] Requirements

		General Conditions (not otherwise specified)						Special Conditions (use if applicable)				
		Column 1		Column 2		Column 3		Column 4		Column 5		Column 6
		Direct-Buried Cables[b]		EMT, RTRC, PVC, and HDPE Conduit[c]		Rigid Metal Conduit and Intermediate Metal Conduit		Raceways Under Buildings or Exterior Concrete Slabs, 100 mm (4 in.) Minimum Thickness[d]		Cables in Airport Runways or Adjacent Areas Where Trespass Is Prohibited		Areas Subject to Vehicular Traffic, Such as Thoroughfares and Commercial Parking Areas
Circuit Voltage	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
Over 1000 V through 22 kV	750	30	450	18	150	6	100	4	450	18	600	24
Over 22 kV through 40 kV	900	36	600	24	150	6	100	4	450	18	600	24
Over 40 kV	1000	42	750	30	150	6	100	4	450	18	600	24

General Notes:

1. Lesser depths shall be permitted where cables and conductors rise for terminations or splices or where access is otherwise required.

2. Where solid rock prevents compliance with the cover depths specified in this table, the wiring shall be installed in a metal or nonmetallic raceway permitted for direct burial. The raceways shall be covered by a minimum of 50 mm (2 in.) of concrete extending down to rock.

3. In industrial establishments, where conditions of maintenance and supervision ensure that qualified persons will service the installation, the minimum cover requirements, for other than rigid metal conduit and intermediate metal conduit, shall be permitted to be reduced 150 mm (6 in.) for each 50 mm (2 in.) of concrete or equivalent placed entirely within the trench over the underground installation.

Specific Footnotes:

[a]Cover is defined as the shortest distance in millimeters (inches) measured between a point on the top surface of any direct-buried conductor, cable, conduit, or other raceway and the top surface of finished grade, concrete, or similar cover.

[b]Underground direct-buried cables that are not encased or protected by concrete and are buried 750 mm (30 in.) or more below grade shall have their location identified by a warning ribbon that is placed in the trench at least 300 mm (12 in.) above the cables.

[c]Listed by a qualified testing agency as suitable for direct burial without encasement. All other nonmetallic systems shall require 50 mm (2 in.) of concrete or equivalent above conduit in addition to the table depth.

[d]The slab shall extend a minimum of 150 mm (6 in.) beyond the underground installation, and a warning ribbon or other effective means suitable for the conditions shall be placed above the underground installation.

(1) Shielded Cables and Nonshielded Cables in Metal-Sheathed Cable Assemblies.

Underground cables, including nonshielded, Type MC and moisture-impervious metal sheath cables, shall have those sheaths grounded through an effective grounding path meeting the requirements of 250.4(A)(5) or (B)(4). They shall be direct buried or installed in raceways identified for the use.

(2) Industrial Establishments.

In industrial establishments, where conditions of maintenance and supervision ensure that only qualified persons service the installed cable, nonshielded single-conductor cables with insulation types up to 2000 volts that are listed for direct burial shall be permitted to be directly buried.

(3) Other Nonshielded Cables.

Other nonshielded cables not covered in 300.50(A)(1) or (A)(2) shall be installed in rigid metal conduit, intermediate metal conduit, or rigid nonmetallic conduit encased in not less than 75 mm (3 in.) of concrete.

(B) Wet Locations.

The interior of enclosures or raceways installed underground shall be considered to be a wet location. Insulated conductors and cables installed in these enclosures or raceways in underground installations shall be listed for use in wet locations and shall comply with 310.10(C). Any connections or splices in an underground installation shall be approved for wet locations.

(C) Protection from Damage.

Conductors emerging from the ground shall be enclosed in listed raceways. Raceways installed on poles shall be of rigid metal conduit, intermediate metal conduit, RTRC-XW, Schedule 80 PVC conduit, or equivalent, extending from the minimum cover depth specified in Table 300.50 to a point 2.5 m (8 ft) above finished grade. Conductors entering a building shall be protected by an approved enclosure or raceway from the minimum cover depth to the point of entrance. Where direct-buried conductors, raceways, or cables are subject to movement by settlement or frost, they shall be installed to prevent damage to the enclosed conductors or to the equipment connected to the raceways. Metallic enclosures shall be grounded.

(D) Splices.

Direct burial cables shall be permitted to be spliced or tapped without the use of splice boxes, provided they are installed using materials suitable for the application. The taps and splices shall be watertight and protected from mechanical damage. Where cables are shielded, the shielding shall be continuous across the splice or tap.

Exception: At splices of an engineered cabling system, metallic shields of direct-buried single-conductor cables with maintained spacing between phases shall be permitted to be interrupted and overlapped. Where shields are interrupted and overlapped, each shield section shall be grounded at one point.

(E) Backfill.

Backfill containing large rocks, paving materials, cinders, large or sharply angular substances, or corrosive materials shall not be placed in an excavation where materials can damage or contribute to the corrosion of raceways, cables, or other substructures or where it may prevent adequate compaction of fill.

Protection in the form of granular or selected material or suitable sleeves shall be provided to prevent physical damage to the raceway or cable.

(F) Raceway Seal.

Where a raceway enters from an underground system, the end within the building shall be sealed with an identified compound so as to prevent the entrance of moisture or gases, or it shall be so arranged to prevent moisture from contacting live parts.

Statement of Problem and Substantiation for Public Input

Table 300.50, Column 2 was revised to clarify that EMT is included in the list of "Other Approved Raceways". The current UL directory recognizes the use of Stainless Steel, Aluminum, and Galvanized EMT for direct burial applications.

Submitter Information Verification

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Committee: NEC-P03

Public Input No. 791-NFPA 70-2020 [Section No. 300.50(A)(1)]

(1) Shielded Cables,_ and Nonshielded Cables in Metal-Sheathed Cable Assemblies.

Underground cables, including nonshielded, Type MC and moisture-impervious metal sheath cables, shall have those sheaths grounded through an effective grounding path meeting the requirements of 250.4(A)(5) or (B)(4). They shall be direct buried or installed in raceways identified for the use.

Statement of Problem and Substantiation for Public Input

The title of 300.50(A)(1) is currently "Shielded Cables and Nonshielded Cables in Metal-Sheathed Cable Assemblies". With the current wording it is not clear whether this means "Shielded Cables in Metal-Sheathed Cable Assemblies" and "Nonshielded Cables in Metal-Sheathed Cable Assemblies", or if this means "Shielded Cables" and "Nonshielded Cables in Metal-Sheathed Cable Assemblies".

Based on the cable types that are listed in 300.50(A)(2) and 300.50(A)(3), it appears that 300.50(A)(1) is intended to include shielded cables without a metal sheath, because otherwise a 5kV shielded cable without a metal sheath, for example, would not fall into any of the 3 sections. Adding a comma after "Shielded Cables" in the title of 300.50(A)(1) would clarify this.

Submitter Information Verification

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Submittal Date: Wed Mar 25 14:27:20 EDT 2020
Committee: NEC-P03

Public Input No. 4525-NFPA 70-2020 [Section No. 300.50(A)(3)]

(3) Other Nonshielded Cables.

Other nonshielded cables not covered in 300.50(A)(1) or (A)(2) shall be installed in rigid metal conduit, intermediate metal conduit, or rigid ~~nonmetallic conduit.~~ polyvinl chloride conduit encased in not less than 75 mm (3 in.) of concrete.

Statement of Problem and Substantiation for Public Input

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

Submitter Information Verification

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Submittal Date: Thu Sep 10 14:41:40 EDT 2020
Committee: NEC-P03

Public Input No. 2092-NFPA 70-2020 [Section No. 300.50(A) [Excluding any Sub-Sections]]

Underground conductors shall be identified for the voltage and conditions under which they are installed. Direct-burial cables shall comply with the provisions of 310.10(E). Underground cables shall be installed in accordance with 300.50(A)(1), (A)(2), or (A)(3), and the installation shall meet the depth requirements of Table 300.50.

Table 300.50 Minimum Cover[a] Requirements

		General Conditions (not otherwise specified)						Special Conditions (use if applicable)				
		Column 1		Column 2		Column 3		Column 4		Column 5		Column 6
		Direct-Buried Cables[b]		RTRC, PVC, and HDPE Conduit[c]		Rigid Metal Conduit and Intermediate Metal Conduit		Raceways Under Buildings or Exterior Concrete Slabs, 100 mm (4 in.) Minimum Thickness[d]		Cables in Airport Runways or Adjacent Areas Where Trespass Is Prohibited		Areas Subject to Vehicular Traffic, Such as Thoroughfares and Commercial Parking Areas
Circuit Voltage	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
Over 1000 V through 22 kV	750	30	450	18	150	6	100	4	450	18	600	24
Over 22 kV through 40 kV	900	36	600	24	150	6	100	4	450	18	600	24
Over 40 kV	1000	42	750	30	150	6	100	4	450	18	600	24

General Notes:

1. Lesser depths shall be permitted where cables and conductors rise for terminations or splices or where access is otherwise required.

2. Where solid rock prevents compliance with the cover depths specified in this table, the wiring shall be installed in a metal or nonmetallic raceway permitted for direct burial. The raceways shall be covered by a minimum of 50 mm (2 in.) of concrete extending down to rock.

3. In ~~industrial establishments~~ controlled access establishments , where conditions of maintenance and supervision ensure that qualified persons will service the installation, the minimum cover requirements, for other than rigid metal conduit and intermediate metal conduit, shall be permitted to be reduced 150 mm (6 in.) for each 50 mm (2 in.) of concrete or equivalent placed entirely within the trench over the underground installation.

Specific Footnotes:

[a]Cover is defined as the shortest distance in millimeters (inches) measured between a point on the top surface of any direct-buried conductor, cable, conduit, or other raceway and the top surface of finished grade, concrete, or similar cover.

[b]Underground direct-buried cables that are not encased or protected by concrete and are buried 750 mm (30 in.) or more below grade shall have their location identified by a warning ribbon that is placed in the trench at least 300 mm (12 in.) above the cables.

[c]Listed by a qualified testing agency as suitable for direct burial without encasement. All other nonmetallic systems shall require 50 mm (2 in.) of concrete or equivalent above conduit in addition to the table depth.

[d]The slab shall extend a minimum of 150 mm (6 in.) beyond the underground installation, and a warning ribbon or other effective means suitable for the conditions shall be placed above the underground installation.

Statement of Problem and Substantiation for Public Input

This exception shouldn't be limited to industrial locations. It should apply to any location that has controlled access where only trained workers are able to service the installation. The Department of Energy facilities, for example, are not necessarily "industrial" but have extremely strict rules for working on the premises. The contractors must undergo extensive training, work packages must be created, means and methods must all be approved. This is part of a series of proposals to change "industrial locations/premises/occupancies/wiring-systems/..." to "controlled access locations."

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2047-NFPA 70-2020 [Section No. 110.21(A)(2)]	part of global proposal to change 'industrial location' to 'controlled access location'
Public Input No. 2048-NFPA 70-2020 [Section No. 110.24(B)]	part of global proposal to change 'industrial location' to 'controlled access location'
Public Input No. 2049-NFPA 70-2020 [Section No. 110.70]	part of global proposal to change 'industrial location' to 'controlled access location'
Public Input No. 2050-NFPA 70-2020 [Section No. 210.8(B)]	part of global proposal to change 'industrial location' to 'controlled access location'
Public Input No. 2051-NFPA 70-2020 [Section No. 210.8(B)]	part of global proposal to change 'industrial location' to 'controlled access location'
Public Input No. 2052-NFPA 70-2020 [Section No. 210.9]	part of global proposal to change 'industrial location' to 'controlled access location'
Public Input No. 2053-NFPA 70-2020 [Section No. 210.18]	part of global proposal to change 'industrial location' to 'controlled access location'
Public Input No. 2054-NFPA 70-2020 [Section No. 215.11]	part of global proposal to change 'industrial location' to 'controlled access location'
Public Input No. 2087-NFPA 70-2020 [Section No. 225.37]	part of global proposal to change 'industrial location' to 'controlled access location'
Public Input No. 2088-NFPA 70-2020 [Section No. 225.52(A)]	part of global proposal to change 'industrial location' to 'controlled access location'
Public Input No. 2090-NFPA 70-2020 [Section No. 230.205(C)]	part of global proposal to change 'industrial location' to 'controlled access location'
Public Input No. 2091-NFPA 70-2020 [Section No. 240.21(C)(3)]	part of global proposal to change 'industrial location' to 'controlled access location'
Public Input No. 2093-NFPA 70-2020 [Section No. 336.10]	
Public Input No. 2094-NFPA 70-2020 [Section No. 368.56(B)]	

Submitter Information Verification

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Committee: NEC-P03

Public Input No. 4170-NFPA 70-2020 [Section No. 300.50(A) [Excluding any Sub-Sections]]

Underground conductors shall be identified for the voltage and conditions under which they are installed. Direct-burial cables shall comply with the provisions of 310.10(E). Underground cables shall be installed in accordance with 300.50(A)(1), (A)(2), or (A)(3), and the installation shall meet the depth requirements of Table 300.50.

Table 300.50 Minimum Cover[a] Requirements

-	General Conditions (not otherwise specified)						Special Conditions (use if applicable)					
-	Column 1		Column 2		Column 3		Column 4		Column 5		Column 6	
-	Direct-Buried Cables[b]		RTRC, PVC, and HDPE Conduit[c]		Rigid Metal Conduit and Intermediate Metal Conduit		Raceways Under Buildings or Exterior Concrete Slabs, 100 mm (4 in.) Minimum Thickness[d]		Cables in Airport Runways or Adjacent Areas Where Trespass Is Prohibited		Areas Subject to Vehicular Traffic, Such as Thoroughfares and Commercial Parking Areas	
Circuit Voltage	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
Over 1000 V through 22 kV	750	30	450	18	150	6	100	4	450	18	600	24
Over 22 kV through 40 kV	900	36	600	24	150	6	100	4	450	18	600	24
Over 40 kV	1000	42	750	30	150	6	100	4	450	18	600	24

General Notes:

1. Lesser depths shall be permitted where cables and conductors rise for terminations or splices or where access is otherwise required.

2. Where solid rock prevents compliance with the cover depths specified in this table, the wiring shall be installed in a metal or nonmetallic raceway permitted for direct burial. The raceways shall be covered by a minimum of 50 mm (2 in.) of concrete extending down to rock.

3. In industrial establishments, where conditions of maintenance and supervision ensure that qualified persons will service the installation, the minimum cover requirements, for other than rigid metal conduit and intermediate metal conduit, shall be permitted to be reduced 150 mm (6 in.) for each 50 mm (2 in.) of concrete or equivalent placed entirely within the trench over the underground installation.

Specific Footnotes:

[a]Cover is defined as the shortest distance in millimeters (inches) measured between a point on the top surface of any direct-buried conductor, cable, conduit, or other raceway and the top surface of finished grade, concrete, or similar cover.

[b]Underground direct-buried cables that are not encased or protected by concrete and are buried 750 mm (30 in.) or more below grade shall have their location identified by a warning ribbon that is placed in the trench at least 300 mm (12 in.) above the cables.

[c]Listed by a qualified testing agency as suitable for direct burial without encasement. All other nonmetallic systems shall require 50 mm (2 in.) of concrete or equivalent above conduit in addition to the table depth.

[d]The slab shall extend a minimum of 150 mm (6 in.) beyond the underground installation, and a warning ribbon or other effective means suitable for the conditions shall be placed above the underground installation.

Additional Proposed Changes

File Name	Description	Approved
300.50_EMT.docx	Add EMT to Table 300.50	

Statement of Problem and Substantiation for Public Input

This PI seeks to add Electrical Metallic Tubing (EMT) to Table 300.50. EMT is listed for use on systems over 1000 volts to ground, listed for direct burial, is suitable for use where subject to physical damage, and is required to have corrosion protection applied at the factory. It is being proposed to be added to Column 2 because it best fits with the wiring methods already itemized there. This PI also coordinates with a similar PI to add EMT to Table 300.5 for clarity. Should the soil conditions prove to be extremely corrosive there are supplemental corrosion protection products available. There is no technical justification for omitting EMT from this table. Designers and installers should have this option available to them. (Note that the proposed change is not in TerraView format as the program would not allow me to modify the table directly.)

Submitter Information Verification

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Submittal Date: Wed Sep 09 23:33:17 EDT 2020
Committee: NEC-P03

Table 300.50 Minimum Cover[a] Requirements

	General Conditions (not otherwise specified)						Special Conditions (use if applicable)					
	Column 1		Column 2		Column 3		Column 4		Column 5		Column 6	
	Direct-Buried Cables[b]		Electrical Metallic Tubing and RTRC, PVC, and HDPE Conduit[c]		Rigid Metal Conduit and Intermediate Metal Conduit		Raceways Under Buildings or Exterior Concrete Slabs, 100 mm (4 in.) Minimum Thickness[d]		Cables in Airport Runways or Adjacent Areas Where Trespass Is Prohibited		Areas Subject to Vehicular Traffic, Such as Thoroughfares and Commercial Parking Areas	
Circuit Voltage	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
Over 1000 V through 22 kV	750	30	450	18	150	6	100	4	450	18	600	24
Over 22 kV through 40 kV	900	36	600	24	150	6	100	4	450	18	600	24
Over 40 kV	1000	42	750	30	150	6	100	4	450	18	600	24

Public Input No. 866-NFPA 70-2020 [Section No. 300.50(A) [Excluding any Sub-Sections]]

Underground conductors shall be identified for the voltage and conditions under which they are installed. Direct-burial cables shall comply with the provisions of 310.10(E). Underground cables shall be installed in accordance with 300.50(A)(1), (A)(2), or (A)(3), and the installation shall meet the depth requirements of Table 300.50.

Table 300.50 Minimum Cover[a] Requirements

-	General Conditions (not otherwise specified)						Special Conditions (use if applicable)					
-	Column 1		Column 2		Column 3		Column 4		Column 5		Column 6	
-	Direct-Buried Cables[b]		RTRC, PVC, and HDPE Conduit[c]		Rigid Metal Conduit and Intermediate Metal Conduit		Raceways Under Buildings or Exterior Concrete Slabs, 100 mm (4 in.) Minimum Thickness[d]		Cables in Airport Runways or Adjacent Areas Where Trespass Is Prohibited		Areas Subject to Vehicular Traffic, Such as Thoroughfares and Commercial Parking Areas	
Circuit Voltage	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
Over 1000 V through 22 kV	750	30	450	18	150	6	100	4	450	18	600	24
Over 22 kV through 40 kV	900	36	600	24	150	6	100	4	450	18	600	24
Over 40 kV	1000	42	750	30	150	6	100	4	450	18	600	24

General Notes:

1. Lesser depths shall be permitted where cables and conductors rise for terminations or splices or where access is otherwise required.

2. Where solid rock prevents compliance with the cover depths specified in this table, the wiring shall be installed in a metal or nonmetallic raceway permitted for direct burial. The raceways shall be covered by a minimum of 50 mm (2 in.) of concrete extending down to rock.

3. In industrial establishments, where conditions of maintenance and supervision ensure that qualified persons will service the installation, the minimum cover requirements, for other than rigid metal conduit and intermediate metal conduit, shall be permitted to be reduced 150 mm (6 in.) for each 50 mm (2 in.) of concrete or equivalent placed entirely within the trench over the underground installation.

Specific Footnotes:

[a]Cover is defined as the shortest distance in millimeters (inches) measured between a point on the top surface of any direct-buried conductor, cable, conduit, or other raceway and the top surface of finished grade, concrete, or similar cover.

[b]Underground direct-buried cables that are not encased or protected by concrete and are buried 750 mm (30 in.) or more below grade shall have their location identified by a warning ribbon that is placed in the trench at least 300 mm (12 in.) above the cables.

[c]Listed by a qualified testing agency as suitable for direct burial without encasement. All other nonmetallic systems shall require 50 mm (2 in.) of concrete or equivalent above conduit in addition to the table depth.

[d]The slab shall extend a minimum of 150 mm (6 in.) beyond the underground installation, and a warning ribbon or other effective means suitable for the conditions shall be placed above the underground installation.

Statement of Problem and Substantiation for Public Input

Rewrite Table 300.50 to a layout similar to Table 300.5; that is, distinguish the wiring method (Columns 1, 2, and 3 in the present table) from the location (Columns 4, 5 and 6 in the present table). Table 300.5 accomplishes this by making the "method" the columns and the "location" the rows. Doing so with Table 300.5 may require a separate table for each voltage range, or having multiple values within each cell.

Because the current arrangement of Table 300.50 has the "method" and the "location" both as columns in the same table, the usage of the table is unclear.

The strict reading of the heading implies that the intent is to use the location (Columns 4, 5, and 6) "if applicable" and only use the method (Columns 1, 2, and 3) when the location is "not otherwise specified".

Using this approach, a 69 kV cable that is direct-buried in a "not specified" location requires 42" of cover. However, if the cable were to cross an area that may be subject to vehicle traffic (such as an access road in a substation or a residential gravel driveway), then only 24" of cover is required. It is unclear the reason for the requirement for direct-buried cable be less severe when subject to traffic. For comparison, in Table 300.5, for all methods (direct-buried, PVC, or RMC) the depth requirement is more severe when installed underneath roads or driveways than when in a "not specified" location.

Also, using this approach, a 69 kV cable, direct-buried under an exterior concrete slab requires 4" of cover, but in Table 300.5, a 120 V cable, direct-buried under an exterior concrete slab requires 18" of cover. It is unclear the reason for the 69 kV requirement to be less stringent than the 120 V requirement.

If one assumes that the headings are misleading, then another approach could be to use the more stringent of the location and the method. If that is the case, then Column 4 is not needed, as the cover requirements of Columns 1, 2, and 3 are always more stringent than Column 4. The column headings would also need to be re-written to indicate that the more stringent requirement shall be used.

Submitter Information Verification

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Committee: NEC-P03

Public Input No. 2655-NFPA 70-2020 [Section No. 300.50(B)]

(B) Wet Locations.

The interior of enclosures or raceways installed underground shall be considered to be a wet location. Insulated conductors and cables installed in these enclosures or raceways in underground installations shall be listed for use in wet locations and shall comply with 310.10(C). Any connections ~~or splices in~~ , splices, or type MV cable joints in an underground installation shall be approved for wet locations.

Statement of Problem and Substantiation for Public Input

This is a companion PI to PI 2642 for the addition of Type MV cable joints and terminations to article 311.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2642-NFPA 70-2020 [Article 311]	Companion
Public Input No. 2642-NFPA 70-2020 [Article 311]	

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Committee: NEC-P03

Public Input No. 2656-NFPA 70-2020 [Section No. 300.50(D)]

(D) Splices **and Type MV Cable Joints** .

Direct burial cables shall be permitted to be spliced ~~or tapped~~ , jointed or tapped without the use of splice boxes, provided they are installed using materials suitable for the application. The taps ~~and splices~~ , splices and type MV cable joints shall be watertight and protected from mechanical damage. Where cables are shielded, the shielding shall be continuous across the splice ~~or tap~~ , tap or type MV cable joint .

Exception: At splices of an engineered cabling system, metallic shields of direct-buried single-conductor cables with maintained spacing between phases shall be permitted to be interrupted and overlapped. Where shields are interrupted and overlapped, each shield section shall be grounded at one point.

Statement of Problem and Substantiation for Public Input

This PI is a companion PI to PI 2642 for the addition of type MV cable joints and terminations to article 311.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2642-NFPA 70-2020 [Article 311]	Companion
Public Input No. 2642-NFPA 70-2020 [Article 311]	

Submitter Information Verification

Submitter Full Name: Paul Knapp
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Aug 27 13:11:15 EDT 2020
Committee: NEC-P03

Public Input No. 2365-NFPA 70-2020 [New Section after 300.50(F)]

300.51 Abandoned Wiring

Permanent wiring abandoned in place shall be tagged or otherwise identified at its termination and junction points as "Abandoned in Place" or removed from all accessible areas and insulated from contact with other live electrical wiring or devices.

Statement of Problem and Substantiation for Public Input

This important requirement already exists in Section 11.1.2.3 of NFPA1-2018 edition, but this requirement needs to be added to the NEC to ensure that electricians and inspectors alike "get the same message". The NEC has many requirements for tagging or removing "abandoned" or "discontinued" wiring including 372.58, 374.58, 390.57, 590.3(D), 640.6(B), 645.5(G), 650.7, 725.25, 760.25, 770.25, 800,25, 820.25, and 830.25. But, why is there is no general requirement for removing other abandoned or discontinued wiring? Are abandoned high-voltage cables any less hazardous than abandoned fire alarm cables or Class 2 cables? I don't think they are. Does this make any sense to you especially considering the increased possibility of a fire or shock hazard due to the possibility of inadvertently re-energizing abandoned wiring capable of causing electrocutions or starting fires? It makes no sense to me. This is why I am submitting this Public Input. I will also be submitting a companion PI to create a definition for "abandoned wiring".

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2364-NFPA 70-2020 [New Section after 300.25]	abandoned wiring
Public Input No. 2364-NFPA 70-2020 [New Section after 300.25]	
Public Input No. 2366-NFPA 70-2020 [New Part after I.]	
Public Input No. 2367-NFPA 70-2020 [New Part after II.]	

Submitter Information Verification

Submitter Full Name: Russ Leblanc
Organization: Leblanc Consulting Services
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 18 07:20:49 EDT 2020
Committee: NEC-P03

Public Input No. 1843-NFPA 70-2020 [Section No. 300.50(F)]

(F) Raceway Seal.

~~Where a raceway enters from an underground system, the end within the building shall be sealed with an identified compound so as to prevent the entrance of moisture or gases, or it shall be so arranged to prevent moisture from contacting live parts~~ Underground raceways , enters a building through which moisture may contact live parts shall be sealed or plugged at either or both ends. Spare or unused raceways shall also be sealed. Sealants shall be identified for use with the cable insulation, conductor insulation, bare conductor, shield, or other components. An explosionproof seal shall not be required for this purpose .

Statement of Problem and Substantiation for Public Input

My revisions to this sub-section is intended that it read exactly like 300.5(G) after my PI to 300.5(G) has been accepted.

There are four rules related to raceway seals and they all are 'slightly different.' I am submiting a PI so they all are consistent with each other.

225.27 Raceway Seal.
Where a raceway enters a building or structure from outside, it shall be sealed or plugged at either or both ends. Spare or unused raceways shall also be sealed. Sealants shall be identified for use with cable insulation, conductor insulation, bare conductor, shield, or other components.
An explosionproof seal shall not be required for this purpose.

230.8 Raceway Seal.
Where a raceway enters a building or structure from the outside, it shall be sealed or plugged at either or both ends. Spare or unused raceways shall also be sealed. Sealants shall be identified for use with the cable insulation, conductor insulation, bare conductor, shield, or other components.
An explosionproof seal shall not be required for this purpose.

300.5 (G) Raceway Seals. Underground raceways entering a building from the outside through which moisture may contact live parts shall be sealed or plugged at either or both ends. Spare or unused raceways shall also be sealed. Sealants shall be identified for use with the cable insulation, conductor insulation, bare conductor, shield, or other components.
An explosionproof seal shall not be required for this purpose.

Informational Note: Presence of hazardous gases or vapors may also necessitate sealing of underground conduits or raceways entering buildings.
300.50 (F) Raceway Seal. Underground raceways enters a building through which moisture may contact live parts shall be sealed or plugged at either or both ends. Spare or unused raceways shall also be sealed. Sealants shall be identified for use with the cable insulation, conductor insulation, bare conductor, shield, or other components. An explosionproof seal shall not be required for this purpose.

Informational Note: Presence of hazardous gases or vapors may also necessitate sealing of underground conduits or raceways entering buildings.
225.27 Raceway Seal.
Where a raceway enters a building or structure from outside, it shall be sealed or plugged at either or both ends. Spare or unused raceways shall also be sealed. Sealants shall be identified for use with cable insulation, conductor insulation, bare conductor, shield, or other components.
An explosionproof seal shall not be required for this purpose.

230.8 Raceway Seal.
Where a raceway enters a building or structure from the outside, it shall be sealed or plugged at either or both ends. Spare or unused raceways shall also be sealed. Sealants shall be identified for use with the cable insulation, conductor insulation, bare conductor, shield, or other components.
An explosionproof seal shall not be required for this purpose.

300.5 (G) Raceway Seals. Underground raceways entering a building from the outside through which moisture may contact live parts shall be sealed or plugged at either or both ends. Spare or unused raceways shall also be sealed. Sealants shall be identified for use with the cable insulation, conductor insulation, bare conductor, shield, or other components.
An explosionproof seal shall not be required for this purpose.

Informational Note: Presence of hazardous gases or vapors may also necessitate sealing of underground conduits or raceways entering buildings.
300.50 (F) Raceway Seal. Underground raceways enters a building through which moisture may contact live parts shall be sealed or plugged at either or both ends. Spare or unused raceways shall also be sealed. Sealants shall be identified for use with the cable insulation, conductor insulation, bare conductor, shield, or other components. An explosionproof seal shall not be required for this purpose.

Informational Note: Presence of hazardous gases or vapors may also necessitate sealing of underground conduits or raceways entering buildings.

Submitter Information Verification

Submitter Full Name: Mike Holt
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Street Address:
City:
State:
Zip:
Submittal Date: Fri Jul 10 13:43:07 EDT 2020
Committee: NEC-P03

Public Input No. 2096-NFPA 70-2020 [Section No. 300.50(F)]

(F) Raceway Seal.

Where a raceway enters from an underground system, ~~the end~~ it shall be sealed within the building ~~shall be sealed~~ with an identified compound so as to prevent the entrance of moisture or gases, or it shall be so arranged to prevent moisture from contacting live parts.

Statement of Problem and Substantiation for Public Input

As written, the existing text limits the location of seals used to satisfy this requirement to the end of the raceway that is inside of the building. Reliable and effective sealing of raceways can be accomplished at locations other than at the end without reducing safety, if the design allows. Limiting the location of seals to the end of raceways reduces opportunities for design innovation and installation flexibility.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2095-NFPA 70-2020 [Section No. 300.5(G)]	
Public Input No. 2095-NFPA 70-2020 [Section No. 300.5(G)]	

Submitter Information Verification

Submitter Full Name: John Cowans
Organization: Siemens
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City:
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Zip:
Submittal Date: Thu Jul 30 10:04:26 EDT 2020
Committee: NEC-P03

Public Input No. 878-NFPA 70-2020 [Section No. 300.50(F)]

(F) Raceway Seal.

Where a raceway enters from an underground system, the end within the building shall be sealed with an identified compound so as to prevent the entrance of gases. The end of ~~moisture or gases, or~~ the raceway shall be sealed with an identified compound to prevent the entrance of moisture, or it shall be so arranged to prevent moisture from contacting live parts.

Statement of Problem and Substantiation for Public Input

This clarifies that gasses are treated separately apart from the entrance of moisture in regards to sealing of the conduit. As written in the 2020 edition, if the raceways are arranged to prevent moisture from contacting live parts, then no sealing that prevents the entrance of gasses is required because of where the "or" statement is located.

Submitter Information Verification

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Affiliation: Self
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Zip:
Submittal Date: Mon Apr 20 13:07:55 EDT 2020
Committee: NEC-P03

Public Input No. 787-NFPA 70-2020 [Section No. 590.2(A)]

(A) Other Articles.

Except as specifically modified in this article, all other requirements of this *Code* for permanent wiring shall apply to temporary wiring installations.

Exception: The provisions of 210.12 shall not be required.

Statement of Problem and Substantiation for Public Input

No one is enforcing the AFCI requirement on temp wiring and no fire incidents have occurring during this time. The need to be clear no AFCI is required at this time is necessary.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 788-NFPA 70-2020 [Section No. 210.12(A)]	

Submitter Information Verification

Submitter Full Name: Alfio Torrisi
Organization: electrician
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City:
State:
Zip:
Submittal Date: Wed Mar 25 10:16:47 EDT 2020
Committee: NEC-P03

Public Input No. 785-NFPA 70-2020 [Section No. 590.3(A)]

(A) During the Period of Construction.

Temporary electric power and lighting installations shall be permitted during the period of construction, remodeling, maintenance, repair, and removal of equipment or demolition of buildings, structures, equipment, or similar activities.

Statement of Problem and Substantiation for Public Input

In many circumstances various complex electrical installations are removed. Removal does not involve the destruction of the equipment however they require the use of temp. power or lighting. Under these conditions Article 590 should also apply.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 786-NFPA 70-2020 [Section No. 590.6]	

Submitter Information Verification

Submitter Full Name: Alfio Torrisi
Organization: Electrician
Street Address:
City:
State:
Zip:
Submittal Date: Wed Mar 25 09:33:00 EDT 2020
Committee: NEC-P03

Public Input No. 2162-NFPA 70-2020 [Section No. 590.4(A)]

~~(A)~~ ~~Services.~~

~~Services shall be installed in conformance with Parts I through VIII of Article 230, as applicable.~~

Statement of Problem and Substantiation for Public Input

This is already covered by 90.3 and 590.2(A). Referring to Parts I-VIII is not needed since Article 230 consists only of those parts.

Submitter Information Verification

Submitter Full Name: Ryan Jackson
Organization: Ryan Jackson
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City:
State:
Zip:
Submittal Date: Wed Aug 05 14:11:17 EDT 2020
Committee: NEC-P03

Public Input No. 1927-NFPA 70-2020 [Section No. 590.4(B)]

(B) Feeders.

Overcurrent protection shall be provided in accordance with 240.4, 240.5, 240.100, ~~and~~ 240.101~~. Conductors~~ , 445.12, 445.13 (A) and 445.13 (B). Conductors shall be permitted within cable assemblies or within multiconductor cords or cables of a type identified in Table 400.4 for hard usage or extra-hard usage. For the purpose of this section, the following wiring methods shall be permitted:

(1) Type NM, Type NMC, and Type SE cables shall be permitted to be used in any dwelling, building, or structure without any height limitation or limitation by building construction type and without concealment within walls, floors, or ceilings.

(2) Type SE cable shall be permitted to be installed in a raceway in an underground installation.

Exception: Single insulated conductors shall be permitted where installed for the purpose(s) specified in 590.3(C), where accessible only to qualified persons.

Statement of Problem and Substantiation for Public Input

Temporary installations are often supplied from generators. The appropriate rules in Article 445 for overcurrent protection of feeders supplied from a generator should be referenced along with the rules from Article 240 to eliminate AHJ's from requiring added redundant protection.

Submitter Information Verification

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City:
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Zip:
Submittal Date: Thu Jul 16 14:30:21 EDT 2020
Committee: NEC-P03

Public Input No. 1093-NFPA 70-2020 [Section No. 590.4(F)]

(F) Lamp Protection.

All lamps for general illumination shall be protected from accidental contact or breakage by a suitable luminaire or lampholder with a guard.

Brass shell, paper-lined sockets, or other metal-cased sockets shall not be used unless the shell is connected to the circuit ~~equipment grounding~~ grounded conductor (neutral) .

Statement of Problem and Substantiation for Public Input

The center contact for a lamp shell is connected to the line, or hot conductor. The shell is connected to the neutral, or grounded conductor. An equipment grounding conductor may or may not be included, but will never be connected to the shell.

Submitter Information Verification

Submitter Full Name: David Bredhold
Organization: DB Technical Services
Street Address:
City:
State:
Zip:
Submittal Date: Sat May 16 09:48:08 EDT 2020
Committee: NEC-P03

Public Input No. 2212-NFPA 70-2020 [Section No. 590.6]

590.6 Ground-Fault Protection for Personnel.

Ground-fault protection for personnel for all temporary wiring installations shall be provided to comply with 590.6(A) and (B). This section shall apply only to temporary wiring installations used to supply temporary power to equipment used by personnel during construction, remodeling, maintenance, repair, or demolition of buildings, structures, equipment, or similar activities. This section shall apply to power derived from an electric utility company or from an on-site-generated power source.

(A) Receptacle Outlets.

Temporary receptacle installations used to supply temporary power to equipment used by personnel during construction, remodeling, maintenance, repair, or demolition of buildings, structures, equipment, or similar activities shall comply with the requirements of 590.6(A)(1) through (A)(3), as applicable.

Exception: In industrial establishments only, where conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program as specified in 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power were interrupted or having a design that is not compatible with GFCI protection.

(1) Receptacle Outlets Not Part of Permanent Wiring.

All 125-volt, single-phase, 15-, 20-, and 30-ampere receptacle outlets that are not a part of the permanent wiring of the building or structure and that are in use by personnel shall have ~~ground~~ listed ground -fault circuit-interrupter protection for personnel. In addition to this required ground-fault circuit-interrupter protection for personnel, listed cord sets or devices incorporating listed ground-fault circuit-interrupter protection for personnel identified for portable use shall be permitted.

(2) Receptacle Outlets Existing or Installed as Permanent Wiring.

Listed Ground-fault circuit-interrupter protection for personnel shall be provided for all 125-volt, single-phase, 15-, 20-, and 30-ampere receptacle outlets installed or existing as part of the permanent wiring of the building or structure and used for temporary electric power. Listed cord sets or devices incorporating listed ground-fault circuit-interrupter protection for personnel identified for portable use shall be permitted.

(3) Receptacles on 15-kW or less Portable Generators.

All 125-volt and 125/250-volt, single-phase, 15-, 20-, and 30-ampere receptacle outlets that are a part of a 15-kW or smaller portable generator shall have listed ground-fault circuit-interrupter protection for personnel. All 15- and 20-ampere, 125- and 250-volt receptacles, including those that are part of a portable generator, used in a damp or wet location shall comply with 406.9(A) and (B). Listed cord sets or devices incorporating listed ground-fault circuit-interrupter protection for personnel identified for portable use shall be permitted for use with 15-kW or less portable generators manufactured or remanufactured prior to January 1, 2011.

(B) Other Receptacle Outlets.

For temporary wiring installations, receptacles, other than those covered by 590.6(A)(1) through (A)(3) used to supply temporary power to equipment used by personnel during construction, remodeling, maintenance, repair, or demolition of buildings, structures, or equipment, or similar activities, shall have protection in accordance with 590.6(B)(1) or the assured equipment grounding conductor program in accordance with 590.6(B)(2).

(1) GFCI Protection.

Ground-fault circuit-interrupter protection for personnel.

(2) Assured Equipment Grounding Conductor Program.

A written assured equipment grounding conductor program continuously enforced at the site by one or more designated persons to ensure that equipment grounding conductors for all cord sets, receptacles that are not a part of the permanent wiring of the building or structure, and equipment connected by cord and plug are installed and maintained in accordance with the applicable requirements of 250.114, 250.138, 406.4(C), and 590.4(D).

(a) The following tests shall be performed on all cord sets, receptacles that are not part of the permanent wiring of the building or structure, and cord-and-plug-connected equipment required to be connected to an equipment grounding conductor:

(2) All equipment grounding conductors shall be tested for continuity and shall be electrically continuous.

(3) Each receptacle and attachment plug shall be tested for correct attachment of the equipment grounding conductor. The equipment grounding conductor shall be connected to its proper terminal.

(4) All required tests shall be performed as follows:

(5) Before first use on site

(6) When there is evidence of damage

(7) Before equipment is returned to service following any repairs

(8) At intervals not exceeding 3 months

(i) The tests required in 590.6(B)(2)(a) shall be recorded and made available to the authority having jurisdiction.

The assured equipment grounding conductor program shall be documented and made available to the authority having jurisdiction.

Informational Note: The Occupational Safety and Health Administration 29 CFR 1910 and 1926 contain requirements for assured equipment grounding conductor programs. Additional information is provided in NFPA 70E-2018, *Standard for Electrical Safety in the Workplace.*

Statement of Problem and Substantiation for Public Input

I find it a bit ironic that such an important safety device is not required to tested and certified by an independent lab. GFCI devices are every bit as important, perhaps even more so than the AFCI devices specified in 210.12 which ARE required to be listed.
Using unlisted GFCI devices should not be permitted because these safety devices are simply too important to allow anything less.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2208-NFPA 70-2020 [Section No. 210.8 [Excluding any Sub-Sections]]	Listed GFCI devices
Public Input No. 2209-NFPA 70-2020 [Section No. 215.9]	Listed GFCI devices
Public Input No. 2210-NFPA 70-2020 [Section No. 555.9]	Listed GFCI devices
Public Input No. 2211-NFPA 70-2020 [Section No. 422.5(A)]	Listed GFCI devices
Public Input No. 2213-NFPA 70-2020 [Section No. 406.4(D)(3)]	

Submitter Information Verification

Submitter Full Name: Russ Leblanc
Organization: Leblanc Consulting Services
Street Address:
City:
State:

Zip:
Submittal Date: Tue Aug 11 07:25:35 EDT 2020
Committee: NEC-P03

Public Input No. 786-NFPA 70-2020 [Section No. 590.6]

590.6 Ground-Fault Protection for Personnel.

Ground-fault protection for personnel for all temporary wiring installations shall be provided to comply with 590.6(A) and (B). This section shall apply only to temporary wiring installations used to supply temporary power to equipment used by personnel during construction, remodeling, maintenance, repair, and removal of equipment or demolition of buildings, structures, equipment, or similar activities. This section shall apply to power derived from an electric utility company or from an on-site-generated power source.

(A) Receptacle Outlets.

Temporary power receptacle installations ~~used to supply temporary power to equipment used by personnel during construction, remodeling, maintenance, repair, or demolition of buildings, structures, equipment, or similar activities~~ shall comply with the requirements of 590.6(A)(1) through (A)(3), as applicable.

Exception: In industrial establishments only, where conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program as specified in 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power were interrupted or having a design that is not compatible with GFCI protection.

(1) Receptacle Outlets Not Part of Permanent Wiring.

All 125-volt, single-phase, 15-, 20-, and 30-ampere receptacle outlets that are not a part of the permanent wiring of the building or structure and that are in use by personnel shall have ground-fault circuit-interrupter protection for personnel. In addition to this required ground-fault circuit-interrupter protection for personnel, listed cord sets or devices incorporating listed ground-fault circuit-interrupter protection for personnel identified for portable use shall be permitted.

(2) Receptacle Outlets Existing or Installed as Permanent Wiring.

Ground-fault circuit-interrupter protection for personnel shall be provided for all 125-volt, single-phase, 15-, 20-, and 30-ampere receptacle outlets installed or existing as part of the permanent wiring of the building or structure and used for temporary electric power. Listed cord sets or devices incorporating listed ground-fault circuit-interrupter protection for personnel identified for portable use shall be permitted.

(3) Receptacles on 15-kW or less Portable Generators.

All 125-volt and 125/250-volt, single-phase, 15-, 20-, and 30-ampere receptacle outlets that are a part of a 15-kW or smaller portable generator shall have listed ground-fault circuit-interrupter protection for personnel. All 15- and 20-ampere, 125- and 250-volt receptacles, including those that are part of a portable generator, used in a damp or wet location shall comply with 406.9(A) and (B). Listed cord sets or devices incorporating listed ground-fault circuit-interrupter protection for personnel identified for portable use shall be permitted for use with 15-kW or less portable generators manufactured or remanufactured prior to January 1, 2011.

(B) Other Receptacle Outlets.

For temporary wiring installations, receptacles, other than those covered by 590.6(A)(1) through (A)(3) used to supply temporary power to equipment ~~used by personnel during construction~~ , ~~remodeling, maintenance, repair, or demolition of buildings, structures, or equipment, or similar activities,~~ shall have protection in accordance with 590.6(B)(1) or the assured equipment grounding conductor program in accordance with 590.6(B)(2).

(1) GFCI Protection.

Ground-fault circuit-interrupter protection for personnel.

(2) Assured Equipment Grounding Conductor Program.

A written assured equipment grounding conductor program continuously enforced at the site by one or more designated qualifed persons to ensure that equipment grounding conductors for all cord sets, receptacles that are not a part of the permanent wiring of the building or structure, and equipment connected by cord and plug are installed and maintained in accordance with the applicable requirements of 250.114, 250.138, 406.4(C), and 590.4(D).

(a) The following tests shall be performed on all cord sets, receptacles that are not part of the permanent wiring of the building or structure, and cord-and-plug-connected equipment required to be connected to an equipment grounding conductor:

(2) All equipment grounding conductors shall be tested for continuity and shall be electrically continuous.

(3) Each receptacle and attachment plug shall be tested for correct attachment of the equipment grounding conductor. The equipment grounding conductor shall be connected to its proper terminal.

(4) All required tests shall be performed as follows:

(5) Before first use on site

(6) When there is evidence of damage

(7) Before equipment is returned to service following any repairs

(8) At intervals not exceeding 3 months

(i) The tests required in 590.6(B)(2)(a) shall be recorded and made available to the authority having jurisdiction.

The assured equipment grounding conductor program shall be documented and made available to the authority having jurisdiction.

Informational Note: The Occupational Safety and Health Administration 29 CFR 1910 and 1926 contain requirements for assured equipment grounding conductor programs. Additional information is provided in NFPA 70E-2018, *Standard for Electrical Safety in the Workplace.*

Statement of Problem and Substantiation for Public Input

The removed text is all ready in the general rule and is redundant. the addition of "removal of equipment" is in line with a new PI

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 785-NFPA 70-2020 [Section No. 590.3(A)]	

Submitter Information Verification

Submitter Full Name: Alfio Torrisi
Organization: electrician
Street Address:
City:
State:
Zip:
Submittal Date: Wed Mar 25 09:52:25 EDT 2020
Committee: NEC-P03

Public Input No. 2929-NFPA 70-2020 [Section No. 590.6(A)]

(A) Receptacle Outlets.

Temporary receptacle installations used to supply temporary power to equipment used by personnel during construction, remodeling, maintenance, repair, or demolition of buildings, structures, equipment, or similar activities shall comply with the requirements of 590.6(A)(1) through (A)(3), as applicable.

Exception: In industrial establishments only, where conditions of maintenance and supervision ensure that only qualified personnel are involved, an assured equipment grounding conductor program as specified in 590.6(B)(2) shall be permitted for only those receptacle outlets used to supply equipment that would create a greater hazard if power were interrupted or having a design that is not compatible with GFCI protection.

(1) Receptacle Outlets Not Part of Permanent Wiring.

All 125-volt, single-phase, 15-, 20-, and 30-ampere receptacle outlets that are not a part of the permanent wiring of the building or structure and that are in use by personnel shall have ground-fault circuit-interrupter protection for personnel. In addition to this required ground-fault circuit-interrupter protection for personnel, listed cord sets or devices incorporating listed ground-fault circuit-interrupter protection for personnel identified for portable use shall be permitted.

(2) Receptacle Outlets Existing or Installed as Permanent Wiring.

Ground-fault circuit-interrupter protection for personnel shall be provided for all 125-volt, single-phase, 15-, 20-, and 30-ampere receptacle outlets installed or existing as part of the permanent wiring of the building or structure and used for temporary electric power. ~~Listed cord sets or devices incorporating listed ground-fault circuit-interrupter protection for personnel identified for portable use shall be permitted.~~

(3) Receptacles on 15-kW or less Portable Generators.

All 125-volt and 125/250-volt, single-phase, 15-, 20-, and 30-ampere receptacle outlets that are a part of a 15-kW or smaller portable generator shall have listed ground-fault circuit-interrupter protection for personnel. All 15- and 20-ampere, 125- and 250-volt receptacles, including those that are part of a portable generator, used in a damp or wet location shall comply with 406.9(A) and (B). Listed cord sets or devices incorporating listed ground-fault circuit-interrupter protection for personnel identified for portable use shall be permitted for use with 15-kW or less portable generators manufactured or remanufactured prior to January 1, 2011.

Statement of Problem and Substantiation for Public Input

Delete this sentence for two reasons, No. 1 it servies no purpose and No. 2 it give the impression that GFCI protection is not required if you use a listed cord set with GFCI protection.

Submitter Information Verification

Submitter Full Name: Mike Holt
Organization: Mike Holt Enterprises Inc
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 03 09:40:02 EDT 2020
Committee: NEC-P03

Public Input No. 2077-NFPA 70-2020 [Section No. 590.6(A)(1)]

(1) Receptacle Outlets Not Part of Permanent Wiring.

All branch circuits supplying 125-volt, single-phase, 15-, 20-, and 30-ampere receptacle outlets that are not a part of the permanent wiring of the building or structure and that are in use by personnel shall have ground-fault circuit-interrupter protection for personnel. ~~In addition to this required ground-fault circuit-interrupter protection for personnel, listed cord sets or devices incorporating listed ground-fault circuit-interrupter protection for personnel identified for portable use shall be permitted~~

Exception: Branch Circuits protected by a GFCI device located within 5 feet of the branch circuit overcurrent device .

Additional Proposed Changes

File Name	Description	Approved
Damaged_Temp_Wiring_2.jpg	Damaged Temp Wiring Home Run	
Damaged_Temp_Wiring_2a.jpg	Damaged Temp Wiring 2 Home Run	
Damaged_Temp_Wiring.docx	Damaged Temp Wiring 3	

Statement of Problem and Substantiation for Public Input

Construction sites provide a wide range of damaging conditions to temporary wiring. Spray on fireproofing can sometimes conceal the temporary home runs that feed the first receptacle in the circuit. As construction trades start to install equipment and hangers in the ceiling area, damage to the temporary wiring can happen and create a shock hazard. As an electrician, I have seen this happen on numerous job sites. Under the severe conditions that temporary wiring is exposed to on job sites, the entire branch circuit should be protected from shock hazards.

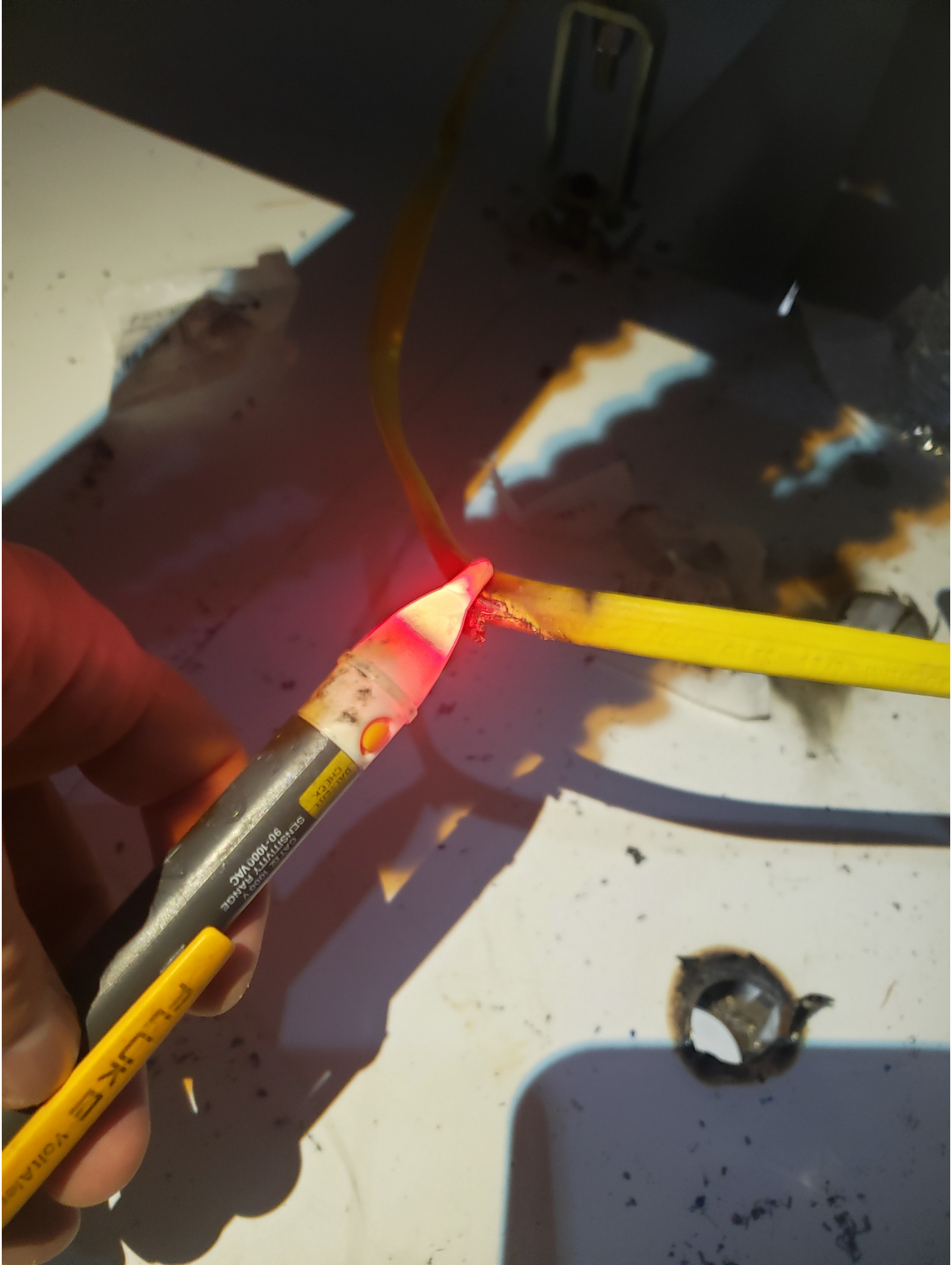
The exception is in place to allow relief for temporary power stations and distribution boxes where the GFCI protection is built in or located within 5 feet of the branch circuit overcurrent device.

Thank You for your consideration on this important safety issue.

Submitter Information Verification

Submitter Full Name: Daniel Naughton
Organization: Jatc Of Greater Boston
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jul 28 15:17:38 EDT 2020
Committee: NEC-P03




SENSITIVITY RANGE
90-1000 VAC
FLUKE



Public Input No. 152-NFPA 70-2019 [Section No. 590.6(A)(3)]

(3) Receptacles on 15-kW or less Portable Generators.

All 125-volt and 125/250-volt, single-phase, 15-, 20-, and 30-ampere receptacle outlets ~~that~~ " *Note: No such product exists as a part of a 30A receptacle (30A GFCI receptacle)." Can you clarify this reference with what is intended?"* that are a part of a 15-kW or smaller portable generator shall have listed ground-fault circuit-interrupter protection for personnel. All 15- and 20-ampere, 125- and 250-volt receptacles, including those that are part of a portable generator, used in a damp or wet location shall comply with 406.9(A) and (B). Listed cord sets or devices incorporating listed ground-fault circuit-interrupter protection for personnel identified for portable use shall be permitted for use with 15-kW or less portable generators manufactured or remanufactured prior to January 1, ~~2011.~~ 2015 *"NOTE: this was a conflict from 445.20 (B) Exception paragraph - There are 2 different dates"* .

Statement of Problem and Substantiation for Public Input

Fix conflicting reference dates for manufacture or remanufacture of portable generators. One reference has 2011 and one has 2015. Also, reference is made to 30A receptacle having GFCI protection. Since a 30A GFCI receptacle does not exist, please clarify what the intent is for this clause.

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Public Input No. 4247-NFPA 70-2020 [Section No. 590.8(B)]

(B) Service Overcurrent Protective Devices.

Overcurrent protective devices for solidly grounded wye electrical services of more than 150 volts to ground but not exceeding 1000 volts phase-to-phase, on systems with available fault current greater than 10,000 amperes shall be current limiting.

Informational Note: The phrase “evidence of impending failure” means that there is evidence such as arcing, overheating, loose or bound equipment parts, visible damage, or deterioration. The phrase “properly maintained” means that the equipment has been maintained in accordance with the manufacturers’ recommendations and applicable industry codes and standards. References for manufacturers’ recommendations and applicable industry codes and standards include but are not limited to NEMA AB 4-2017, *Guidelines for Inspection and Preventative Maintenance of Molded-Case Circuit Breakers Used in Commercial and Industrial Applications*; NFPA 70B-2019, *Recommended Practice for Electrical Equipment Maintenance*; NEMA GD 1-2016, *Evaluating Water-Damaged Electrical Equipment*; and IEEE 1458-2017, *IEEE Recommended Practice for the Selection, Field Testing, and Life Expectancy of Molded-Case Circuit Breakers for Industrial Applications*.

Statement of Problem and Substantiation for Public Input

Current limiting overcurrent devices do not accomplish very much in terms of increased safety when the available fault current is within the clearing range of conventional devices. The substantiation for this new rule implied far higher exposures, and in such cases the 2020 edition initiative is fully valid.

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Public Input No. 2440-NFPA 70-2020 [Article 720]

~~**Article 720** Circuits and Equipment Operating at Less Than 50 Volts~~

~~**720.1** Scope.~~

~~This article covers installations operating at less than 50 volts, direct current or alternating current.~~

~~**720.2** Other Articles.~~

~~Direct current or alternating-current installations operating at less than 50 volts, as covered in 411.1 through 411.8 ; Part VI of Article 517 ; Part II of Article 551 ; Parts II and III and 552.60(B) of Article 552 ; 650.1 through 650.9 ; 669.1 through 669.9 ; Parts I and VIII of Article 690 ; Parts I, II, and III of Article 725 ; or Parts I, II, and III of Article 760 , shall not be required to comply with this article.~~

~~**720.3** Hazardous (Classified) Locations.~~

~~Installations within the scope of this article and installed in hazardous (classified) locations shall also comply with the appropriate provisions for hazardous (classified) locations in other applicable articles of this *Code* .~~

~~**720.4** Conductors.~~

~~Conductors shall not be smaller than 12 AWG copper or equivalent. Conductors for appliance branch circuits supplying more than one appliance or appliance receptacle shall not be smaller than 10 AWG copper or equivalent.~~

~~**720.5** Lampholders.~~

~~Standard lampholders that have a rating of not less than 660 watts shall be used.~~

~~**720.6** Receptacle Rating.~~

~~Receptacles shall have a rating of not less than 15 amperes.~~

~~**720.7** Receptacles Required.~~

~~Receptacles of not less than 20-ampere rating shall be provided in kitchens, laundries, and other locations where portable appliances are likely to be used.~~

~~**720.9** Batteries.~~

~~Installations of storage batteries shall comply with 480.1 through 480.6 and 480.9 through 480.11 .~~

~~**720.11** Mechanical Execution of Work.~~

~~Circuits operating at less than 50 volts shall be installed in a neat and workmanlike manner. Cables shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use.~~

Statement of Problem and Substantiation for Public Input

This public input is submitted on behalf of a CMP 3 Task Group consisting of Randy Ivans (Chair), Paul Casparro, Shane Clary, Michael Cogbill, Chad Jones, Robert Jones, Ward Judson, Tim Mikloiche, Samuel Rokowski, George Straniero, Ronald Tellas, and George Zimmerman.

This article adds confusion to the Code and should be deleted. The current title suggests that this Article applies to all circuits and equipment operating at less than 50 volts; however, section 720.2 has several places where this article shall not comply.

Article 720 first appeared in the 1920 edition of the NEC. It was written for stand-alone electrical power systems for farms. Generators were manufactured specifically for farms because the distribution of electrical power had not reached the rural areas of the country. These generators supplied electrical loads with a 32-volt DC system. Wiring methods were established in Article 720 to accommodate the loads supplied by these generators. This equipment has not been manufactured since the beginning of World War II. There are no known systems operating today.

Several manufacturers produced these generators and several hundred thousand were in operation during the 1920s and 1930s. The end of their existence came with the Rural Electrification Act of 1936. Although several manufacturers built the farm electrical plants, the most common was the Delco-Light Farm Electrical Plant. There is an abundance of very interesting information available about these power plants and they were very remarkable for their time.

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Public Input No. 2774-NFPA 70-2020 [New Article after 725]

TITLE OF NEW CONTENT

Type your content here ...

ARTICLE 7XX Class 1 Circuits

Additional Proposed Changes

File Name	Description	Approved
Class_1_Article_as_submitted.docx		

Statement of Problem and Substantiation for Public Input

This public input is submitted on behalf of a CMP 3 Task Group consisting of Randy Ivans (Chair), Paul Casparro, Shane Clary, Michael Cogbill, Chad Jones, Robert Jones, Ward Judson, Tim Mikloiche, Samuel Rokowski, George Straniero, Ronald Tellas, and George Zimmerman.

A new article has been created for Class 1 circuits because these circuits are not recognized by the IT industry as power-limited circuits and cannot be in the same article with class 2 and class 3 circuits. Class 1 remote-control and signaling circuits have been eliminated from this article because the installation of these circuits is covered by the first four chapters of the NEC and there are no special conditions associated with these circuits. Also, Class 1 remote-control and signaling circuit installation requirements are not dependent on the equipment being supplied unless specifically referenced in the Article.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2775-NFPA 70-2020 [Global Input]	
Public Input No. 3463-NFPA 70-2020 [Definition: Remote-Control Circuit.]	
Public Input No. 3471-NFPA 70-2020 [Definition: Signaling Circuit.]	
Public Input No. 3476-NFPA 70-2020 [Definition: Class 1 Circuit.]	

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ARTICLE 7XX Class 1 Circuits

7XX.1 Scope. This article covers Class 1 circuits that are not an integral part of a device or of utilization equipment.

7XX.3 Other Articles. In addition to the requirements of this article, circuits and equipment shall comply with the articles or sections listed in 7XX.3(A) through (J). Only those sections of Article 300 referenced in this article shall apply to Class 1 circuits.

(A) Number and Size of Conductors in Raceway. Installations shall comply with section 300.17.

(B) Spread of Fire or Products of Combustion. Installation of Class 1 circuits shall comply with 300.21.

(C) Ducts, Plenums, and Other Air-Handling Spaces. Class 1 circuits installed in ducts, plenums, or other space used for environmental air shall comply with 300.22.

(D) Hazardous (Classified) Locations. Class 1 circuits shall not be installed in any hazardous (classified) location except as permitted by other articles of this Code.

(E) Cable Trays. Parts I and II of Article 392, where installed in cable tray.

(F) Raceways Exposed to Different Temperatures. Installations shall comply with 300.7(A).

(G) Vertical Support for Fire-Rated Cables and Conductors. Vertical installations of circuit integrity (CI) cables and conductors installed in a raceway or conductors and cables of electrical circuit protective systems shall be installed in accordance with 300.19.

(H) Bushing. A bushing shall be installed where cables emerge from raceway used for mechanical support or protection in accordance with 300.15(C).

(I) Installation of Conductors with Other Systems. Installations shall comply with 300.8.

(J) Identification of Equipment Grounding Conductors. Equipment grounding conductors shall be identified in accordance with 250.119.

7XX.21 Access to Electrical Equipment Behind Panels Designed to Allow Access. Access to electrical equipment shall not be denied by an accumulation of wires and cables that prevents removal of panels, including suspended ceiling panels.

7XX.24 Mechanical Execution of Work. Class 1 circuits shall be installed in a neat and workmanlike manner. Cables and conductors installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be supported by straps, staples, hangers,

cable ties, or similar fittings designed and installed so as not to damage the cable. The installation shall also comply with 300.4(D)

> Informational Note: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants can result in an undetermined alteration of Class 1 cable properties.

7XX.30 Class 1 Circuit Identification. Class 1 circuits shall be identified at terminal and junction locations in a manner that prevents unintentional interference with other circuits during testing and servicing.

7XX.31 Safety-Control Equipment. Class 1 circuits shall be provided with physical protection when controlling safety-control equipment if the failure of the equipment to operate introduces a direct fire or life hazard. All conductors of such circuits shall be installed in rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, electrical metallic tubing, Type MI cable, or Type MC cable, or be otherwise suitably protected from physical damage.

7XX.41 Class 1 Circuits. Class 1 circuits shall be supplied from a source that has a rated output of not more than 30 volts and 1000 volt-amperes.

(A) Class 1 Transformers. Transformers used to supply Class 1 circuits shall comply with the applicable sections within Parts I and II of Article 450.

(B) Other Class 1 Power Sources. Power sources other than transformers shall be protected by overcurrent devices rated at not more than 167 percent of the volt-ampere rating of the source divided by the rated voltage. The overcurrent devices shall not be interchangeable with overcurrent devices of higher ratings. The overcurrent device shall be permitted to be an integral part of the power supply.

To comply with the 1000 volt-ampere limitation of 7XX.41(A), the maximum output (VA_{max}) of power sources other than transformers shall be limited to 2500 volt-amperes, and the product of the maximum current (I_{max}) and maximum voltage (V_{max}) shall not exceed 10,000 volt-amperes. These ratings shall be determined with any overcurrent-protective device bypassed.

VA_{max} is the maximum volt-ampere output after one minute of operation regardless of load and with overcurrent protection bypassed, if used. Current-limiting impedance shall not be bypassed when determining VA_{max}.

I_{max} is the maximum output current under any noncapacitive load, including short circuit, and with overcurrent protection bypassed, if used. Current-limiting impedance should not be bypassed when determining I_{max}. Where a current-limiting impedance, listed for the purpose or as part of a listed product, is used in combination with a stored energy source, for example, storage battery, to limit the output current, I_{max} limits apply after 5 seconds.

V_{max} is the maximum output voltage regardless of load with rated input applied.

7XX.43 Class 1 Circuit Overcurrent Protection. Overcurrent protection for conductors 14 AWG and larger shall be provided in accordance with the conductor ampacity, without applying the ampacity adjustment and correction factors of 310.14 to the ampacity calculation. Overcurrent protection shall not exceed 7 amperes for 18 AWG conductors and 10 amperes for 16 AWG.

Exception: Where other articles of this Code permit or require other overcurrent protection.

7XX.45 Class 1 Circuit Overcurrent Device Location. Overcurrent devices shall be located as specified in 7xx.45 (A), (B), (C), (D), or (E).

(A) Point of Supply. Overcurrent devices shall be located at the point where the conductor to be protected receives its supply.

(B) Feeder Taps. Class 1 circuit conductors shall be permitted to be tapped, without overcurrent protection at the tap, where the overcurrent device protecting the circuit conductor is sized to protect the tap conductor.

(C) Branch-Circuit Taps. Class 1 circuit conductors 14 AWG and larger that are tapped from the load side of the overcurrent protective device(s) of a controlled light and power circuit shall require only short-circuit and ground-fault protection and shall be permitted to be protected by the branch-circuit overcurrent protective device(s) where the rating of the protective device(s) is not more than 300 percent of the ampacity of the Class 1 circuit conductor.

(D) Primary Side of Transformer. Class 1 circuit conductors supplied by the secondary of a single-phase transformer having only a 2-wire (single-voltage) secondary shall be permitted to be protected by overcurrent protection provided on the primary side of the transformer, provided this protection is in accordance with 450.3 and does not exceed the value determined by multiplying the secondary conductor ampacity by the secondary-to-primary transformer voltage ratio. Transformer secondary conductors other than 2-wire shall not be considered to be protected by the primary overcurrent protection.

(E) Input Side of Electronic Power Source. Class 1 circuit conductors supplied by the output of a single-phase, listed electronic power source, other than a transformer, having only a 2-wire (single-voltage) output for connection to Class 1 circuits shall be permitted to be protected by overcurrent protection provided on the input side of the electronic power source, provided this protection does not exceed the value determined by multiplying the Class 1 circuit conductor ampacity by the output-to-input voltage ratio. Electronic power source outputs, other than 2-wire (single voltage), shall not be considered to be protected by the primary overcurrent protection.

7XX.46 Class 1 Circuit Wiring Methods. Class 1 circuits shall be installed in accordance with Part I of Article 300 and with the wiring methods from the appropriate articles in Chapter 3.

Exception No. 1: The provisions of 7xx.48 through 7xx.51 shall be permitted to apply in installations of Class 1 circuits.

Exception No. 2: Methods permitted or required by other articles of this Code shall apply to installations of Class 1 circuits.

7XX.48 Conductors of Different Circuits in the Same Cable, Cable Tray, Enclosure, or Raceway. Class 1 circuits shall be permitted to be installed with other circuits as specified in 7xx.14(A) and (B).

(A) Two or More Class 1 Circuits. Class 1 circuits shall be permitted to occupy the same cable, cable tray, enclosure, or raceway without regard to whether the individual circuits are alternating current or direct current, provided all conductors are insulated for the maximum voltage of any conductor in the cable, cable tray, enclosure, or raceway.

(B) Class 1 Circuits with Power-Supply Circuits. Class 1 circuits shall be permitted to be installed with power-supply conductors as specified in 7XX.48 (B)(1) through (B)(4).
7XX.48 (B)(1) In a Cable, Enclosure, or Raceway.

(1) In a Cable, Enclosure, or Raceway. Class 1 circuits and power-supply circuits shall be permitted to occupy the same cable, enclosure, or raceway without a barrier only where the equipment powered is functionally associated. Class 1 circuits shall be permitted to be installed together with the conductors of electric light, power, non-power-limited fire alarm, and medium power network-powered broadband communications circuits where separated by a barrier.

(2) In Factory- or Field-Assembled Control Centers. Class 1 circuits and power-supply circuits shall be permitted to be installed in factory- or field-assembled control centers.

(3) In a Manhole. Class 1 circuits and power-supply circuits shall be permitted to be installed as underground conductors in a manhole in accordance with one of the following:

(1) The power-supply or Class 1 circuit conductors are in a metal-enclosed cable or Type UF cable.

(2) The conductors are permanently separated from the power-supply conductors by a continuous firmly fixed nonconductor, such as flexible tubing, in addition to the insulation on the wire.

(3) The conductors are permanently and effectively separated from the power supply conductors and securely fastened to racks, insulators, or other approved supports.

(4) In Cable Trays. Installations in cable trays shall comply with 7XX.48 (B)(4)(1) or (B)(4)(2).

(1) Class 1 circuit conductors and power-supply conductors not functionally associated with the Class 1 circuit conductors shall be separated by a solid fixed barrier of a material compatible with the cable tray.

(2) Class 1 circuit conductors and power-supply conductors not functionally associated with the Class 1 circuit conductors shall be permitted to be installed in a cable tray without barriers where

all of the conductors are installed with separate multiconductor Type AC, Type MC, Type MI, or Type TC cables and all the conductors in the cables are insulated at 600 volts or greater.

7XX.49 Class 1 Circuit Conductors.

(A) Sizes and Use. Conductors of sizes 18 AWG and 16 AWG shall be permitted to be used, provided they supply loads that do not exceed the ampacities given in 402.5 and are installed in a raceway, an approved enclosure, or a listed cable. Conductors larger than 16 AWG shall not supply loads greater than the ampacities given in 310.14. Flexible cords shall comply with Article 400.

(B) Insulation. Insulation on conductors shall be rated for the system voltage and not less than 600 volts. Conductors larger than 16 AWG shall comply with Article 310. Conductors in sizes 18 AWG and 16 AWG shall be Type FFH-2, KF-2, KFF-2, PAF, PAFF, PF, PFF, PGF, PGFF, PTF, PTFF, RFH-2, RFHH-2, RFHH-3, SF-2, SFF-2, TF, TFF, TFFN, TFN, ZF, or ZFF. Conductors with other types and thicknesses of insulation shall be permitted if listed for Class 1 circuit use.

7XX.51 Number of Conductors in Cable Trays and Raceway, and Ampacity Adjustment.

(A) Class 1 Circuit Conductors. Where only Class 1 circuit conductors are in a raceway, the number of conductors shall be determined in accordance with 300.17. The ampacity adjustment factors given in 310.15(C)(1) shall apply only if such conductors carry continuous loads in excess of 10 percent of the ampacity of each conductor.

(B) Power-Supply Conductors and Class 1 Circuit Conductors. Where power-supply conductors and Class 1 circuit conductors are permitted in a raceway in accordance with7XX.48, the number of conductors shall be determined in accordance with 300.17. The ampacity adjustment factors given in 310.15(C)(1) shall apply as follows:

(1) To all conductors where the Class 1 circuit conductors carry continuous loads in excess of 10 percent of the ampacity of each conductor and where the total number of conductors is more than three

(2) To the power-supply conductors only, where the Class 1 circuit conductors do not carry continuous loads in excess of 10 percent of the ampacity of each conductor and where the number of power-supply conductors is more than three

7XX.51 (C) Class 1 Circuit Conductors in Cable Trays. Where Class 1 circuit conductors are installed in cable trays, they shall comply with the provisions of 392.22 and 392.80(A).

7XX.52 Circuits Extending Beyond One Building. Class 1 circuits that extend aerially beyond one building shall also meet the requirements of Part I of Article 225.

Public Input No. 3740-NFPA 70-2020 [New Article after 725]

ARTICLE 726 – Class 4 (CL4) Power Systems

Add to Article 100, Part I

Fault Managed Power (FMP) . Powering systems that monitor for faults and control power delivered to ensure fault energy is limited. The monitoring and control systems differentiate them from electric light and power circuits; therefore, alternative requirements to those of Chapters 1 through 4 are given with regard to minimum wire sizes, ampacity adjustment and correction factors, overcurrent protection, insulation requirements, and wiring methods and materials. (CMP-3)

ARTICLE 726 – Class 4 (CL4) Power Systems

Part I. General

726.1 . **Scope.**

This article covers the installation of wiring and equipment of Fault Managed Power (FMP) systems including utilization equipment incorporating parts of these systems.

Informational Note No. 1: Class 4 power systems consist of a Class 4 power transmitter and a Class 4 power receiver connected by a cabling system. These systems are characterized by monitoring the circuit for faults and controlling the power transmitted to ensure that the energy and power delivered into any fault is limited. Class 4 systems differ from Class 1, 2, and 3 systems in that they are not limited for power delivered to an appropriate load. They are power limited with respect to risk of shock and fire between the Class 4 transmitter and Class 4 receiver.

Informational Note No. 2: The circuits described herein are characterized by monitoring and control systems that differentiate them from electric light and power circuits; therefore, alternative requirements to those of Chapters 1 through 4 are given with regard to minimum wire sizes, ampacity adjustment and correction factors, overcurrent protection, insulation requirements, and wiring methods and materials.

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

Class 4 Circuit . The portion of the wiring system between the load side of a Class 4 transmitter and the Class 4 receiver, or Class 4 utilization equipment, as appropriate. Due to the active monitoring and control of the power transmitted, a Class 4 circuit is not considered a possible ignition source, and it minimizes the risk of electric shock.

Class 4 Device. Any active device connected to the Class 4 circuit. Some examples of Class 4 devices can include a Class 4 power transmitter, a Class 4 power receiver, or Class 4 utilization equipment.

Class 4 Power System . An actively monitored and controlled system that consists of one or more Class 4 power transmitters and one or more Class 4 power receivers connected by a cabling system.

Class 4 Receiver . A device that accepts Class 4 power and converts the Class 4 power to be used by utilization equipment.

Class 4 Transmitter . A device that sources Class 4 power, monitors the line for faults, ceases power transmission if a fault is sensed, and limits the energy and power into a fault to the levels described in 726.121(A).

Class 4 Tray Cable (CL4TC). A factory assembly of two or more insulated conductors rated at 450 volts DC, with or without associated bare or insulated equipment grounding conductors, under a nonmetallic jacket.

Class 4 Utilization Equipment . Devices that are directly powered by a Class 4 transmitter without the need for a separate Class 4 receiver.

726.3 . **Other Articles.**

In addition to the requirements of this article, circuits and equipment shall comply with the articles or sections listed in 726.3 (A) through (N). Only those sections of Article 300 referenced in this article shall apply to Class 4 Power Systems .

(A) Number and Size of Conductors in Raceway.

See 300.17.

(B) Spread of Fire or Products of Combustion.

Installation of Class 4 circuits shall comply with 300.21.

(C) Ducts, Plenums, and Other Air-Handling Spaces.

Class 4 circuits installed in ducts, plenums, or other space used for environmental air shall comply with 300.22.

(D) Cable Trays.

See Parts I and II of Article 392, where installed in cable tray.

(E) Instrumentation Tray Cable.

See 727.1 and 727.4 through 727.9.

(F) Raceways Exposed to Different Temperatures.

Installations shall comply with 300.7(A).

(G) Bushing.

A bushing shall be installed where cables emerge from raceway used for mechanical support or protection in accordance with 300.15(C).

(H) Installation of Conductors with Other Systems.

Installations shall comply with 300.8.

(I) Corrosive, Damp, or Wet Locations.

Class 4 cables installed in corrosive, damp, or wet locations shall comply with the applicable requirements in 110.11, 300.5(B), 300.6, 300.9, and 310.10(F).

(J) Cable Routing Assemblies.

Class 4 and Type CL4TC cables shall be permitted to be installed in plenum cable routing assemblies, riser cable routing assemblies, and general-purpose cable routing assemblies selected in accordance with Table 800.154(c), listed in accordance with 800.182, and installed in accordance with 800.110(C) and 800.113.

(K) Communications Raceways.

Class 4 and Type CL4TC cables shall be permitted to be installed in plenum communications raceways, riser communications raceways, and general-purpose communications raceways selected in accordance with Table 800.154(b), listed in accordance with 800.182, and installed in accordance with 800.113 and 362.24 through 362.56, where the requirements applicable to electrical nonmetallic tubing (ENT) apply.

(L) Temperature Limitation of Class 4 Cables.

The requirements of 310.14(A)(3) on the temperature limitation of conductors shall apply to Class 4 cables.

(M) Identification of Equipment Grounding Conductors.

Equipment grounding conductors shall be identified in accordance with 250.119.

Exception No. 1: Class 4 cables that do not contain an equipment grounding conductor shall be permitted to use a conductor with green insulation or green with one or more yellow stripes for other than equipment grounding purposes.

726.12 Uses Not Permitted.

(A) Cables shall not be installed in any hazardous (classified) location, except as permitted by other articles of this Code.

Informational Note: Hazardous locations are covered in Articles 500 through 516 and in Article 517 Part IV.

(B) Class 4 cables shall not be permitted for any applications that are not part of a CL4 distribution system.

Exception: Use of CL4 cable for other applications shall be permitted if the cable has multiple listings.

726.21 Access to Electrical Equipment Behind Panels Designed to Allow Access.

Access to electrical equipment shall not be denied by an accumulation of wires and cables that prevents removal of panels, including suspended ceiling panels

726.24 Mechanical Execution of Work.

CL4 cables shall be installed in a neat and workmanlike manner. Cables and conductors installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be supported by straps, staples, hangers, cable ties, or similar fittings designed and installed so as not to damage the cable. The installation shall also comply with 300.4 and 300.11.

Informational Note: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants can result in an undetermined alteration of CL4 cable properties.

726.25 Abandoned Cables.

The accessible portion of abandoned Class 4 and CL4TC cables shall be removed. Where cables are identified for future use with a tag, the tag shall be of sufficient durability to withstand the environment involved.

726.28 Noninterchangeability. Receptacles, cord connectors, and attachment plugs used on CL4 distribution systems shall be constructed so that they are not interchangeable with other receptacles, cord connectors, and attachment plugs.

726.33 Guarding. Any junctions and mating connectors shall be constructed and installed so as to guard against inadvertent contact with live parts by persons.

Part II. CL4 Circuits

726.121 Power Sources for Class 4 Circuits. The power source shall be a listed Class 4 power transmitter or listed Class 4 power transmitter/ receiver system and shall provide the protections in 726.121(A) and (B). Class 4 circuits shall be supplied from a power source (transmitter) that has a peak voltage output of not more than 450 volts DC line to line or 225 volts DC line to ground.

Informational Note No. 1: Informational Note No.1 Figure 726.121 illustrates the relationships between Class 4 power transmitters (power sources), their supply, Class 4 circuits, Class 4 power receivers, and utilization equipment.

Informational Note No. 2: One way to determine applicable requirements for listing of Class 4 power equipment is to refer to UL ##### , *Standard for Class 4 Power Systems.*



Informational Note No. 1 Figure 726.121 Class 4 Circuits

(A) Fault Energy and Power Limitations. For listing purposes, under the conditions specified in 726.121(B), the energy available into a fault shall be limited according to the requirements of 726.121(A)(1) through 726.121(A)(3).

Informational Note: One way to determine requirements for listing of Class 4 power systems is to refer to UL XXXX, Standard for Class 4 Power Systems.

(1) A Class 4 power source shall provide protection of personnel against the risk of electric shock by de-energizing the circuit or portion thereof, or limiting the current, within an established period of time.

Informational Note No. 1: This requirement is intended to provide an equivalent level of protection from electric shock as Class 2 circuits as defined in UL XXXX.

(2) The maximum power that can be delivered into a fault between conductors or between any conductor and ground shall not exceed 100 VA, measured after 5 seconds.

Informational Note No. 1: This requirement is intended to reduce the risk of fire due to resistive heating, matching the PS2 limits in UL 62368-1.

(3) A Class 4 power source shall provide protection from the effects of arc faults by recognizing characteristics unique to arcing and by functioning to deenergize

the circuit when an arc fault is detected.

Informational Note: This requirement is intended to reduce the risk fire due to arcing.

(B) Fault Management. A listed transmitter interrupts an energized circuit within the limits of 726.121(A) when any of the following conditions occur:

(1) An abnormal condition is identified in the system, such as abnormal voltage, current, waveform, or load condition

(2) A short circuit

(3) Human skin contact with energized parts

(4) A ground-fault condition exists

(5) An overcurrent condition exists

(6) Intentional shorting of the line at the receiving or transmitting end to force de-energization for purposes of maintenance or repair

(7) A malfunction of the monitoring or control system

726.124 Marking.

The equipment supplying the CL4 circuits shall be durably marked where plainly visible to indicate each circuit that is a CL4 circuit. The marking shall also include the maximum voltage and current output for each connection point. Where multiple connection points have the same rating, a single label shall be permitted to be used.

Informational Note: An example of marking is “Class 4: +/-190V, 5A” for a Class 4 system capable of delivering 1.9kW from 380V line to line.

726.128 CL4 Receiver Output

Any voltage that is user accessible at the CL4 receiver that is not compliant to this article is subject to the requirements of the rest of this *Code* and shall have a label indicating the maximum voltage and current output for each connection point.

Part III. Installation

726.135 Installation of CL4 Cables.

Installation of CL4 and CL4TC cables shall comply with 726.135(A) through (M).

(A) Listing.

CL4 cables installed in buildings shall be listed.

(B) Ducts Specifically Fabricated for Environmental Air.

The following cables shall be permitted in ducts specifically fabricated for environmental air as described in 300.22(B) if directly associated with the air distribution system:

(1) Type CL4 cables in lengths as short as practicable to perform the required function

(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in raceways that are installed in compliance with 300.22(B)

Informational Note: For information on fire protection of wiring installed in fabricated ducts, see 4.3.4.1 and 4.3.11.3.3 of NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems* .

(C) Other Spaces Used for Environmental Air (Plenums).

The following cables shall be permitted in other spaces used for environmental air as described in 300.22(C):

(1) Type CL4P cables

(2) Type CL4P cables installed in plenum communications raceways

(3) Type CL4P cables installed in plenum cable routing assemblies

(4) Type CL4P cables and plenum communications raceways supported by open metallic cable trays or cable tray systems

(5) Types CL4, CL4R, CL4P, and CL4TC cables installed in raceways that are installed in compliance with 300.22(C)

(6) Types CL4, CL4R, CL4P, and CL4TC cables supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)

(7) Types CL4, CL4R, CL4P, and CL4TC cables installed in plenum communications raceways, riser communications raceways, and general-purpose communications raceways supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)

(D) Risers — Cables in Vertical Runs.

The following cables shall be permitted in vertical runs penetrating one or more floors and in vertical runs in a shaft:

(1) Types CL4R and CL4P cables

(2) Types CL4R and CL4P cables installed in the following:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

Informational Note: See 300.21 for firestop requirements for floor penetrations.

(E) Risers — Cables and Innerducts in Metal Raceways.

The following cables shall be permitted in metal raceways in a riser having firestops at each floor:

(1) Types CL4, CL4R, CL4P, and CL4TC cables

(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:

a. Plenum communications raceways (innerduct)

b. Riser communications raceways (innerduct)

c. General-purpose communications raceways (innerduct)

Informational Note: See 300.21 for firestop requirements for floor penetrations.

(F) Risers — Cables in Fireproof Shafts.

The following shall be permitted to be installed in fireproof riser shafts having firestops at each floor:

(1) Types CL4, CL4R, CL4P, and CL4TC cables

(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

—

Informational Note: See 300.21 for firestop requirements for floor penetrations.

(G) Risers — One- and Two-Family Dwellings.

The following cables shall be permitted in one- and two-family dwellings:

(1) Types CL4, CL4R, CL4P, and CL4TC cables

(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

(H) Cable Trays.

Cables installed in cable trays outdoors shall be Type CL4TC. The following cables shall be permitted to be supported by cable trays in buildings:

(1) Types CL4, CL4R, CL4P, and CL4TC cables

(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:

a. Plenum communications raceways

b. Riser communications raceways

c. General-purpose communications raceways

(I) Cross-Connect Arrays.

The following cables shall be permitted to be installed in cross-connect arrays:

(1) Types CL4, CL4R, CL4P, and CL4TC cables

(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

(J) Industrial Establishments. In industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons service the installation, Type CL4TC cable shall be permitted in accordance with either (1) or (2) as follows:

(1) Where the cable is not subject to physical damage, Type CL4TC cable that complies with the crush and impact requirements of Type MC cable and is identified as CL4TC -ER for such use shall be permitted to be exposed between the cable tray and the utilization equipment or device. The cable shall be continuously supported and protected against physical damage using mechanical protection such as dedicated struts, angles, or channels. The cable shall be supported and secured at intervals not exceeding 1.8 m (6 ft). Where not subject to physical damage, Type CL4TC -ER cable shall be permitted to transition between cable trays and between cable trays and utilization equipment or devices for a distance not to exceed 1.8 m (6 ft) without continuous support. The cable shall be mechanically supported where exiting the cable tray to ensure that the minimum bending radius is not exceeded.

(2) Type CL4TC cable, with a metallic sheath or armor in accordance with 725.179(E), shall be permitted to be installed exposed. The cable shall be continuously supported and protected against physical damage using mechanical protection such as dedicated struts, angles, or channels. The cable shall be secured at intervals not exceeding 1.8 m (6 ft)

(K) Other Building Locations.

The following cables shall be permitted to be installed in building locations other than the locations covered in 726.135(B) through (I):

(1) Types CL4, CL4R, CL4P, and CL4TC cables

(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

(3) Types CL4, CL4R, CL4P, and CL4TC cables installed in raceways recognized in Chapter 3

(L) Multifamily Dwellings.

The following cables shall be permitted to be installed in multifamily dwellings in locations other than the locations covered in 726.135(B) through (I):

(1) Types CL4, CL4R, CL4P, and CL4TC cables

(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

(3) Types CL4, CL4R, CL4P, and CL4TC wires and cables installed in raceways recognized in Chapter 3

(M) One- and Two-Family Dwellings.

The following cables shall be permitted to be installed in one- and two-family dwellings in locations other than the locations covered in 726.135(B) through (I):

(1) Types CL4, CL4R, CL4P, and CL4TC cables

(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

(3) Types CL4, CL4R, CL4P, and CL4TC cables installed in raceways recognized in Chapter 3.

726.136 Separation from Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm Circuit Conductors, and Medium-Power Network-Powered Broadband Communications Cables.

726.136(A) General.

Cables and conductors of CL4 circuits shall not be placed in any cable, cable tray, compartment, enclosure, manhole, outlet box, device box, raceway, or similar fitting with conductors of electric light, power, Class 1, non–power-limited fire alarm circuits, and medium-power network-powered broadband communications circuits unless permitted by 726.136(B) through (I).

726.136(B) Separated by Barriers.

CL4 circuits shall be permitted to be installed together with the conductors of electric light, power, Class 1, non–power-limited fire alarm and medium power network-powered broadband communications circuits where they are separated by a barrier.

726.136(C) Raceways Within Enclosures.

In enclosures, CL4 circuits shall be permitted to be installed in a raceway to separate them from Class 1, non–power-limited fire alarm and medium-power network-powered broadband communications circuits.

726.136(D) Associated Systems Within Enclosures.

CL4 circuit conductors in compartments, enclosures, device boxes, outlet boxes, or similar fittings shall be permitted to be installed with electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits where they are introduced solely to connect the equipment connected to CL4 circuits, and where (1) or (2) applies:

(1) The electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuit conductors are routed to maintain a minimum of 6 mm (0.25 in.) separation from the conductors and cables of CL4 circuits.

(2) The non-CL4 circuit conductors operate at 150 volts or less to ground and the CL4 circuits are installed using Type CL4, CL4R, or CL4P cables, provided any CL4 cable conductors extending beyond the jacket are separated by a minimum of 6 mm (0.25 in.) or by a nonconductive sleeve or nonconductive barrier from all other conductors.

726.136(E) Enclosures with Single Opening.

CL4 circuit conductors entering compartments, enclosures, device boxes, outlet boxes, or similar fittings shall be permitted to be installed with Class 1, non–power-limited fire alarm and medium-power network-powered broadband communications circuits where they are introduced solely to connect the equipment connected to CL4 circuits. Where CL4 circuit conductors must enter an enclosure that is provided with a single opening, they shall be permitted to enter through a single fitting (such as a tee), provided the conductors are separated from the conductors of the other circuits by a continuous and firmly fixed nonconductor, such as flexible tubing.

726.136(F) Manholes.

Underground CL4 circuit conductors in a manhole shall be permitted to be installed with Class 1, non–power-limited fire alarm and medium-power network-powered broadband communications circuits where one of the following conditions is met:

(1) The electric light, power, Class 1, non–power-limited fire alarm and medium-power network-powered broadband communications circuit conductors are in a metal-enclosed cable or Type UF cable.

(2) The CL4 circuit conductors are permanently and effectively separated from the conductors of other circuits by a continuous and firmly fixed nonconductor, such as flexible tubing, in addition to the insulation or covering on the wire.

(3) The CL4 circuit conductors are permanently and effectively separated from conductors of the other circuits and securely fastened to racks, insulators, or other approved supports.

726.136(G) Cable Trays.

CL4 circuit conductors shall be permitted to be installed in cable trays, where the conductors of the electric light, Class 1, and non–power-limited fire alarm circuits are

separated by a solid fixed barrier of a material compatible with the cable tray or where the CL4 circuits are installed in Type MC cable.

726.136(H) . In Hoistways.

In hoistways, CL4 circuit conductors shall be installed in rigid metal conduit, rigid nonmetallic conduit, intermediate metal conduit, liquidtight flexible nonmetallic conduit, or electrical metallic tubing. For elevators or similar equipment, these conductors shall be permitted to be installed as provided in 620.21 .

726.136(I) . Other Applications.

For other applications, conductors of CL4 circuits shall be separated by at least 50 mm (2 in.) from conductors of any electric light, power, Class 1, non–power-limited fire alarm or medium power network-powered broadband communications circuits unless one of the following conditions is met:

(1) Either all of the electric light, power, Class 1, non–power-limited fire alarm and medium-power network-powered broadband communications circuit conductors or all of the CL4 circuit conductors are in a raceway or in metal-sheathed, metal-clad, non–metallic-sheathed, Type TC, or Type UF cables

(2) All of the electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuit conductors are permanently separated from all of the CL4 circuit conductors by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the conductors

726.139 . Installation of Conductors of Different Circuits in the Same Cable, Enclosure, Cable Tray, Raceway, or Cable Routing Assembly.

(A) Two or More Class 4 Circuits.

Conductors of two or more Class 4 circuits shall be permitted within the same cable, enclosure, raceway, or cable routing assembly.

(B) Class 4 Circuits with Class 2, Class 3, or Communications Circuits.

Conductors of one or more Class 4 circuits shall be permitted within the same cable, enclosure, raceway, or cable routing assembly with conductors of Class 2, Class 3 or Communications circuits, provided that the insulation of the Class 2, Class 3, and/or Communications circuit conductors in the cable, enclosure, raceway, or cable routing assembly is at least that required for Class 4 circuits.

(C) Class 4 Cables with Other Circuit Cables.

Jacketed cables of Class 4 circuits shall be permitted in the same enclosure, cable tray, raceway, or cable routing assembly with jacketed cables of any of the following:

(1) Power-limited fire alarm systems in compliance with Parts I and III of Article 760

(2) Nonconductive and conductive optical fiber cables in compliance with Parts I and IV of Article 770

(3) Communications circuits in compliance with Parts I and IV of Article 805

(4) Community antenna television and radio distribution systems in compliance with Parts I and IV of Article 820

(5) Low-power, network-powered broadband communications in compliance with Parts I and IV of Article 830

726.141 . Installation of Circuit Conductors Extending Beyond One Building.

Where CL4 circuit conductors extend beyond one building and are run so as to be subject to accidental contact with electric light or power conductors operating over 300 volts to ground, or are exposed to lightning on interbuilding circuits on the same premises, the requirements of the following shall also apply:

(1) Sections 800.44, 800.53, 800.100, 805.50, 805.93, 805.170(A), and 805.170(B) for other than coaxial conductors

(2) Sections 820.44, 820.93, and 820.100 for coaxial conductors

726.143 . Support of Conductors.

CL4 circuit conductors shall not be strapped, taped, or attached by any means to the exterior of any conduit or other raceway as a means of support. These conductors shall be permitted to be installed as permitted by 300.11(C)(2).

Part IV. Listing Requirements

726.170 . Listing of Equipment for Class 4 Systems. The active components of a Class 4 system shall be listed as a Class 4 device.

Informational Note: Some examples of Class 4 devices can include a Class 4 power transmitter, a Class 4 power receiver, or Class 4 utilization equipment.

Where there is reliance on the interoperability of the system devices for the safety of the CL4 system, the listing shall identify interoperability.

Informational Note: One way to determine applicable requirements for listing of Class 4 power systems is to refer to UL #####, *Standard for Class 4 Power Systems* .

726.172 Listing of Class 4 Systems for Dwellings. Equipment intended for installation in dwellings shall be listed and identified for such use.

726.179 . Listing and Marking of Class 4 Cables.

Cables for Class 4 Power systems shall be types CL4, CL4R, or CL4P and shall be listed for a CL4 distribution system use. CL4 cables, installed as wiring methods within buildings, shall be listed as resistant to the spread of fire and other criteria in accordance with 726.179(A) through (D), shall be constructed in accordance with 726.179(E), shall be marked in accordance with 726.179(F), and shall be permitted to be marked in accordance with 726.179(G).

Informational Note: One way to determine applicable requirements for listing of Class 4 (CL4) cable is to refer to UL XXX, Cables for Class 4 Circuits.

726.179(A) . Type CL4P.

Type CL4P plenum cable shall be marked as Type CL4P and shall be listed as suitable for use in ducts, plenums, and other space for environmental air and shall be listed as having adequate fire-resistant and low-smoke producing characteristics.

Informational Note: One method of defining a cable that is low-smoke producing and fire resistant is that the cable exhibits a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.52 m (5 ft) or less when tested in accordance with NFPA 262-2019, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces* .

726.179(B) . Type CL4R.

Type CL4R riser cable shall be marked as Type CL4R and be listed as suitable for use in a vertical run in a shaft or from floor to floor and shall be listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor.

Informational Note: One method of defining fire-resistant characteristics capable of preventing the carrying of fire from floor to floor is that the cables pass the requirements of ANSI/UL 1666-2012, *Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts.*

726.179(C) . Type CL4.

Type CL4 cables shall be marked as Type CL4, and be listed as suitable for general-purpose use, with the exception of risers, ducts, plenums, and other space used for environmental air, and shall be listed as resistant to the spread of fire.

Informational Note: One method of defining *resistant to the spread of fire* is that the cables do not spread fire to the top of the tray in the UL flame exposure, vertical tray flame test in ANSI/UL 1685-2010, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables* . The smoke measurements in the test method are not applicable.

Another method of defining *resistant to the spread of fire* is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA vertical flame test for

cables in cable trays, as described in CSA C22.2 No. 0.3-M-2001, *Test Methods for Electrical Wires and Cables* .

726.179(D) Type CL4TC.

Type CL4TC nonmetallic-sheathed tray cable shall be marked as Type CL4TC and shall be listed as being suitable for cable trays and shall consist of a factory assembly of two or more insulated conductors under a nonmetallic jacket. The insulated conductors shall be at least 24 AWG copper (solid or stranded). Insulation on conductors shall be rated for 450 volts DC. The cable core shall be two or more parallel conductors, one or more group assemblies of twisted or parallel conductors, or a combination thereof. A metallic shield or a metallized foil shield with drain wire(s) shall be permitted to be applied over the cable core, over groups of conductors, or both. The cable shall be listed as resistant to the spread of fire. The outer jacket shall be a sunlight- and moisture-resistant nonmetallic material. Type CL4TC cable used in a wet location shall be listed for use in wet locations or have a moisture-impervious metal sheath.

Exception No. 1: Where a smooth metallic sheath, continuous corrugated metallic sheath, or interlocking tape armor is applied over the nonmetallic jacket, an overall nonmetallic jacket shall not be required. On metallic-sheathed cable without an overall nonmetallic jacket, the information required in 310.8 shall be located on the nonmetallic jacket under the sheath.

Informational Note: One method of defining resistant to the spread of fire is that the cables do not spread fire to the top of the tray in the UL flame exposure, vertical tray flame test in ANSI/UL 1685-2010 , *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables* , The smoke measurements in the test method are not applicable.

Another method of defining resistant to the spread of fire is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA vertical tray flame test for cables in cable trays, as described in CSA C22.2 No. 0.3- M-2001 , *Test Methods for Electrical Wires and Cables* .

726.179(E) Cable Construction.

(1) **Sizes.** Conductors of sizes not smaller than 24 AWG shall be permitted to be used.

(2) **Insulation.** Insulation on conductors shall be rated not less than 450 volts DC.

(1) **Voltage rating.** Cables shall have a voltage rating of not less than 450 volts DC. Voltage ratings shall not be marked on the cables.

(1) **Temperature Rating.** Cables shall have a temperature rating of not less than 60°C (140°F).

(2) **Cabling.** Cables shall comply with any requirements provided in the listing of the system.

Informational Note: Excessive cable lengths can result in higher capacitance which could affect the safety of the circuit. For further information see <insert listing standard>.

726.179(F) Marking.

All cables shall be marked to indicate the following information, using the applicable method described in 310.8(B):

(1) The cable type as described in 726.179 (A) through (D).

(2) The manufacturer's name, trademark, or other distinctive marking by which the organization responsible for the product can be readily identified.

(3) The AWG size or circular mil area.

(4) The temperature rating of CL4 cables that have a temperature rating exceeding 60°C (140°F).

726.179(G) Optional Markings.

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note No. 1: These markings include, but are not limited to, markings for limited smoke, halogen free, low smoke and halogen free, and sunlight resistant.

Informational Note No. 2: Some examples of optional markings are ST1 to indicate limited smoke characteristics in accordance with UL 2556, *Wire and Cable Test Methods* ; HF to indicate halogen free as described in UL 2885, *Outline of Investigation for Acid Gas, Acidity and Conductivity of Combusted Materials* ; and LSHF to indicate halogen free and low smoke characteristics in accordance with IEC 61034-2, *Measurement of smoke density of cables burning under defined conditions — Part 2: Test procedure and requirements* .

Additional Proposed Changes

File Name	Description	Approved
ARTICLE_726_Class_4_CL4_Power_Systems_Proposal.docx	Word document of proposed new Article 726	
Art726_Substantiation.docx	Word document of substantiation for proposed new Article 726	

Statement of Problem and Substantiation for Public Input

Substantiation
This Public Input (PI) was created by a Correlating Committee appointed task group to address Packet Energy Transfer (PET) systems. TG members included: Ernest Gallo – Chair (CMP1, 5, CC), Terry Coleman (CMP16), Randy Ivans (CMP3, 16), Chad Jones (CMP3), David Johnson (CMP2), Robert Osbourne (CMP9, CC), Mario Spina (CMP13, Verizon), George Straniero (CMP3, 6, CC), Ron Tellas (CMP3), Keith Waters (CMP11, 3), and George Zimmerman (CMP3). The TG was broad-based and specifically included representation of those with knowledge and experience in electrical safety, installation, code enforcement, wire and cable.

Why a new article is needed.
Revisions to the NEC are needed to realize the full potential of this emerging technology. The technology referred to as Class 4 in this Public Input has been publicly referred to by the names including, but not limited to, Packet Energy Transfer (PET), Digital Electricity (DE), Pulsed Power, Smart Transfer Systems and Fault Managed Power (FMP).

The Class 4 Power System is a fault-managed system that relies on an electronic handshake to verify that the powered device is present and operating correctly before greater than Class 2 power is applied. Faults result in immediate termination of output power. Digital monitoring is not a new concept or unique to these systems to control and mitigate safety risks. There are a number of standards that rely on "digital" monitoring and controls in very critical safety areas, including but not limited to: patient care equipment, electronic circuit breakers, alarm systems. The necessary requirements for functional safety, including mean time between failures of critical components, software reliability and the like are well known.

Some of these systems have been described as being able to provide power over LAN/Communications cables. This has led to the (incorrect) perception that these systems are the same as PoE which is used to provide limited power on cables handling data and communications. However, they are not the same.

Class 4 technology employs circuits and software to provide fault protection for safety. It is important to ensure that it is safe in design, implementation, installation and use. Appropriate requirements are needed to allow the continued rapid and safe deployment of these systems.

The Task Group decided that these new systems would not fit well into existing NEC articles and that a new article should be developed. It was also determined that Class 4 power systems are necessary to power a new generation of utilization equipment, including appliances and communications equipment. Recognition of these systems is also essential for the large-scale rollout of 5G technology. There are over 700 of these types of systems installed in the US already.

Class 4 different than LPS. Section 725.121(A)(4) indicates that listed equipment with a limited power source (LPS) output can be considered a Class 2 circuit. UL 62368-1 requires the

output of a limited power source to be power limited. These Class 4 systems do not limit the output of the power source but rather the systems limit the energy and power available into a fault condition. If monitored and controlled correctly, Class 4 is as safe or safer than an LPS, but it is different and needs to be treated differently in the NEC and in product standards. Class 4 circuits have a receiver as part of the system; Class 2 circuits will supply any load. Electric shock concerns in Class 4 circuits are mitigated by limiting exposure times (short pulses) and eliminating repetitive impulses (fast shut off).

The complexity and applications of this technology warrant the development of new
installation code requirements. Some vendors want to utilize wiring systems more like Class 2 and communications installations than traditional power distribution systems. They rely on sophisticated monitoring and control systems to mitigate the risks rather than mechanical protection. These monitoring and control safety systems will involve solid state controls, microprocessors, firmware and software elements that will require fault analysis, critical software testing and general functional safety evaluations.

Unlike Class 2 circuits which place finite limits for sinusoidal ac and dc voltages to reduce the risk of electric shock, Class 4 circuits need to consider voltage levels, pulse widths, repetitive pulses, time to shut-off, and stored charge from cable capacitance and equipment. This is not something an installer or an AHJ can do in the field. There will have to be reliance on the safety standard and the listing of equipment.

The proposed new article also includes a new cable type specifically for Class 4.

New Article Proposed. This PI proposes a new Article 726 on Class 4 Power Systems. Since there are some technology similarities with Article 725, this proposed article follows the same common code format.

Article 726 Section-Specific Substantiations
Below is additional information on specific sections. Where practices were considered equivalent to Class 2, text from 725 was mirrored as closely as possible.
Section 726.3 is similar to Article 725, and it provides a roadmap as to how this fits with the rest of the Code. The differences:
725.3(D) Hazardous locations moved to 726.12, subsequent lettering reduced by one letter (i.e. 725.3(E) maps to 726.3(D).)
725.3(F) motor control circuits – not included in the Class 4 article. subsequent lettering reduced by one additional letter (i.e. 725.3(G) maps to 726.3(E).)
725.3(I) vertical support for fire rated cables – not included in the Class 4 article. subsequent lettering reduced by one additional letter (i.e. 725.3(J) maps to 726.3(G).)

Section 726.12 Uses not permitted this is not included in Art 725. This is modeled after section 352.12(A) as the authors feel this is the better model to use. The result is the same requirements that hazardous locations are disallowed unless you follow the applicable sections in chapter 5. Another TG will be recommending a 725.12 section similar to this.

Section 726.28 ensures Class 4 circuits can only be used on a Class 4 system and that other utilization equipment that is not designed for a Class 4 system cannot be connected to a Class 4 system.

Section 726.121 this section provides listing requirements for the new Class 4 systems.

726.121(A)(1) This section establishes the listing criteria for acceptable protection from electric shock.

726.121(A)(2) The 100VA, 5 second limit matches the PS2 requirements in IEC 62368, which is equivalent to a Class 2 circuit.

726.121(A)(3) This section requires arc fault protection to reduce the risk of fire from arcing.

726.121(B) defines the qualifying characteristic of a Class 4 power circuit. Specifically, that there will be no transmission of power unless the presence of a properly operating Class 4 receiver is confirmed, and will interrupt an energized circuit under fault conditions, eliminating hazard.
726.128 notifies that any output voltage from a Class 4 receiver that is not Class 4 compliant is subject to the rest of the requirements in the NEC and is required to be marked.
726.135, 136, and 139 are modeled after 725 because Class 4 systems are intended to have similar installation practices as Class 2. The differences:
726.135, 136 – none. [726.135(G,L,M) may need further discussion by the panel. (one and two family dwellings and multifamily dwellings)]
725.139 has 6 subsections (A – F). 726.139 has three (A – C). 725.139(A)&(B) collapsed into 726.139(A). 725.139(C)&(D) collapsed into 726.139(B). 725.139(E) maps to 726.139(C).
725.139(F) not included in 726.
726.170 establishes that any Class 4 device that is connected to a Class 4 circuit must be listed and does not list only a subset of Class 4 devices as the full range of Class 4 devices may not be realized for years to come.
The applicable requirements for systems are being developed in a new UL standard. There is no industry standard for Class 4 circuit interoperability at this time. We expect the interoperability of Class 4 devices to be listed as systems. In the future, Class 4 devices could be listed on a standalone basis if they are compliant with such a standard.
726.179 is modeled after 725 because Class 4 systems are intended to have similar installation practices as Class 2. This section provides for the new cable types for Class 4 to be consistent with the operating characteristics of Class 4 power sources. The differences:
726.179 includes plenum, riser, general use and tray cable varieties. Limited use, circuit integrity, and limited power cables were excluded.
A cable construction section was added [726.179(E).]

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Add to Article 100, Part I
Fault Managed Power (FMP). Powering systems that monitor for faults and control power delivered to ensure fault energy is limited. The monitoring and control systems differentiate them from electric light and power circuits; therefore, alternative requirements to those of Chapters 1 through 4 are given with regard to minimum wire sizes, ampacity adjustment and correction factors, overcurrent protection, insulation requirements, and wiring methods and materials. (CMP-3)

ARTICLE 726 – Class 4 (CL4) Power Systems

Part I. General

726.1 Scope.

This article covers the installation of wiring and equipment of Fault Managed Power (FMP) systems including utilization equipment incorporating parts of these systems.

Informational Note No. 1: Class 4 power systems consist of a Class 4 power transmitter and a Class 4 power receiver connected by a cabling system. These systems are characterized by monitoring the circuit for faults and controlling the power transmitted to ensure that the energy and power delivered into any fault is limited. Class 4 systems differ from Class 1, 2, and 3 systems in that they are not limited for power delivered to an appropriate load. They are power limited with respect to risk of shock and fire between the Class 4 transmitter and Class 4 receiver.

Informational Note No. 2: The circuits described herein are characterized by monitoring and control systems that differentiate them from electric light and power circuits; therefore, alternative requirements to those of Chapters 1 through 4 are given with regard to minimum wire sizes, ampacity adjustment and correction factors, overcurrent protection, insulation requirements, and wiring methods and materials.

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

Class 4 Circuit. The portion of the wiring system between the load side of a Class 4 transmitter and the Class 4 receiver, or Class 4 utilization equipment, as appropriate. Due to the active monitoring and control of the power transmitted, a Class 4 circuit is not considered a possible ignition source, and it minimizes the risk of electric shock.

Class 4 Device. Any active device connected to the Class 4 circuit. Some examples of Class 4 devices can include a Class 4 power transmitter, a Class 4 power receiver, or Class 4 utilization equipment.

Class 4 Power System. An actively monitored and controlled system that consists of one or more Class 4 power transmitters and one or more Class 4 power receivers connected by a cabling system.

Class 4 Receiver. A device that accepts Class 4 power and converts the Class 4 power to be used by utilization equipment.

Class 4 Transmitter. A device that sources Class 4 power, monitors the line for faults, ceases power transmission if a fault is sensed, and limits the energy and power into a fault to the levels described in 726.121(A).

Class 4 Tray Cable (CL4TC). A factory assembly of two or more insulated conductors rated at 450 volts DC, with or without associated bare or insulated equipment grounding conductors, under a nonmetallic jacket.

Class 4 Utilization Equipment. Devices that are directly powered by a Class 4 transmitter without the need for a separate Class 4 receiver.

726.3 Other Articles.

In addition to the requirements of this article, circuits and equipment shall comply with the articles or sections listed in 726.3 (A) through (N). Only those sections of Article 300 referenced in this article shall apply to Class 4 Power Systems.

(A) Number and Size of Conductors in Raceway.

See 300.17.

(B) Spread of Fire or Products of Combustion.

Installation of Class 4 circuits shall comply with 300.21.

(C) Ducts, Plenums, and Other Air-Handling Spaces.

Class 4 circuits installed in ducts, plenums, or other space used for environmental air shall comply with 300.22.

(D) Cable Trays.

See Parts I and II of Article 392, where installed in cable tray.

(E) Instrumentation Tray Cable.

See 727.1 and 727.4 through 727.9.

(F) Raceways Exposed to Different Temperatures.

Installations shall comply with 300.7(A).

(G) Bushing.

A bushing shall be installed where cables emerge from raceway used for mechanical support or protection in accordance with 300.15(C).

(H) Installation of Conductors with Other Systems.

Installations shall comply with 300.8.

(I) Corrosive, Damp, or Wet Locations.

Class 4 cables installed in corrosive, damp, or wet locations shall comply with the applicable requirements in 110.11, 300.5(B), 300.6, 300.9, and 310.10(F).

(J) Cable Routing Assemblies.

Class 4 and Type CL4TC cables shall be permitted to be installed in plenum cable routing assemblies, riser cable routing assemblies, and general-purpose cable routing assemblies selected in accordance with Table 800.154(c), listed in accordance with 800.182, and installed in accordance with 800.110(C) and 800.113.

(K) Communications Raceways.

Class 4 and Type CL4TC cables shall be permitted to be installed in plenum communications raceways, riser communications raceways, and general-purpose communications raceways selected in accordance with Table 800.154(b), listed in accordance with 800.182, and installed in accordance with 800.113 and 362.24 through 362.56, where the requirements applicable to electrical nonmetallic tubing (ENT) apply.

(L) Temperature Limitation of Class 4 Cables.

The requirements of 310.14(A)(3) on the temperature limitation of conductors shall apply to Class 4 cables.

(M) Identification of Equipment Grounding Conductors.

Equipment grounding conductors shall be identified in accordance with 250.119.

Exception No. 1: Class 4 cables that do not contain an equipment grounding conductor shall be permitted to use a conductor with green insulation or green with one or more yellow stripes for other than equipment grounding purposes.

726.12 Uses Not Permitted.

(A) Cables shall not be installed in any hazardous (classified) location, except as permitted by other articles of this Code.
Informational Note: Hazardous locations are covered in Articles 500 through 516 and in Article 517 Part IV.

(B) Class 4 cables shall not be permitted for any applications that are not part of a CL4 distribution system.

Exception: Use of CL4 cable for other applications shall be permitted if the cable has multiple listings.

726.21 Access to Electrical Equipment Behind Panels Designed to Allow Access. Access to electrical equipment shall not be denied by an accumulation of wires and cables that prevents removal of panels, including suspended ceiling panels

726.24 Mechanical Execution of Work.
CL4 cables shall be installed in a neat and workmanlike manner. Cables and conductors installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be supported by straps, staples, hangers, cable ties, or similar fittings designed and installed so as not to damage the cable. The installation shall also comply with 300.4 and 300.11.

Informational Note: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants can result in an undetermined alteration of CL4 cable properties.

726.25 Abandoned Cables.
The accessible portion of abandoned Class 4 and CL4TC cables shall be removed. Where cables are identified for future use with a tag, the tag shall be of sufficient durability to withstand the environment involved.

726.28 Noninterchangeability. Receptacles, cord connectors, and attachment plugs used on CL4 distribution systems shall be constructed so that they are not interchangeable with other receptacles, cord connectors, and attachment plugs.

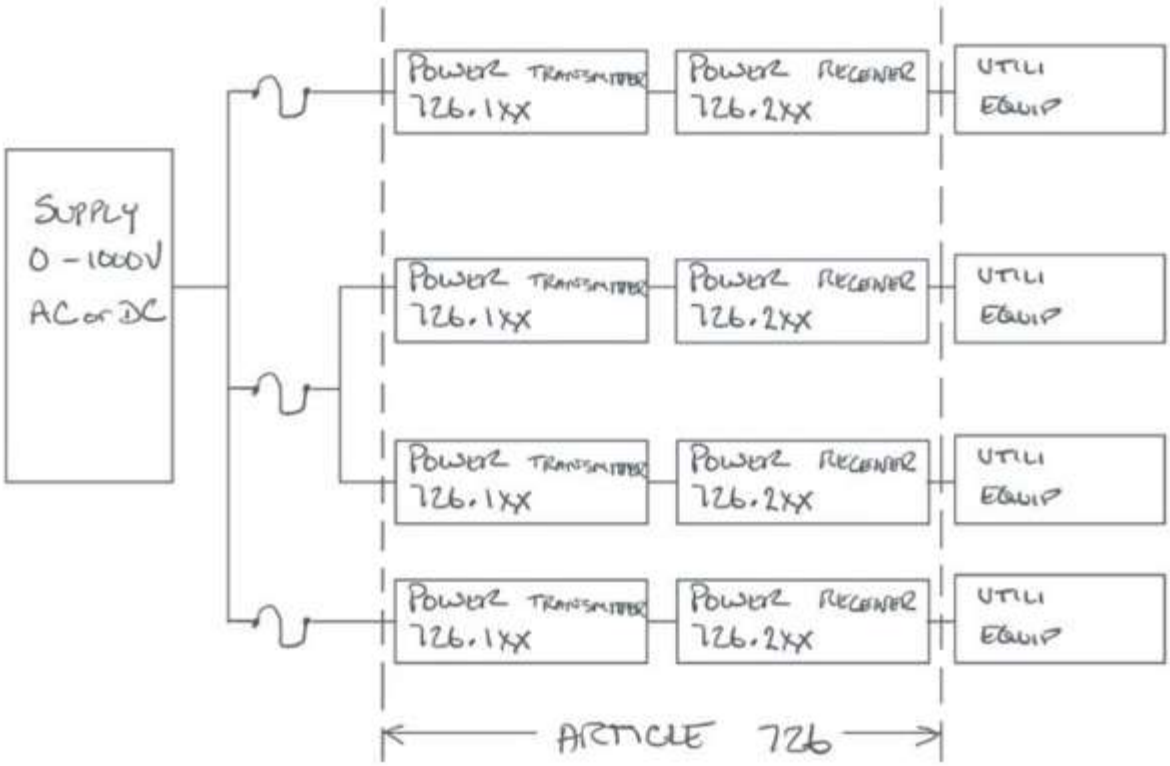
726.33 Guarding. Any junctions and mating connectors shall be constructed and installed so as to guard against inadvertent contact with live parts by persons.

Part II. CL4 Circuits

726.121 Power Sources for Class 4 Circuits. The power source shall be a listed Class 4 power transmitter or listed Class 4 power transmitter/ receiver system and shall provide the protections in 726.121(A) and (B). Class 4 circuits shall be supplied from a power source (transmitter) that has a peak voltage output of not more than 450 volts DC line to line or 225 volts DC line to ground.

Informational Note No. 1: Informational Note No.1 Figure 726.121 illustrates the relationships between Class 4 power transmitters (power sources), their supply, Class 4 circuits, Class 4 power receivers, and utilization equipment.

Informational Note No. 2: One way to determine applicable requirements for listing of Class 4 power equipment is to refer to UL #####, *Standard for Class 4 Power Systems.*



Informational Note No. 1 Figure 726.121 Class 4 Circuits

(A) Fault Energy and Power Limitations. For listing purposes, under the conditions specified in 726.121(B), the energy available into a fault shall be limited according to the requirements of 726.121(A)(1) through 726.121(A)(3).
Informational Note: One way to determine requirements for listing of Class 4 power systems is to refer to UL XXXX, Standard for Class 4 Power Systems.

(1) A Class 4 power source shall provide protection of personnel against the risk of electric shock by de-energizing the circuit or portion thereof, or limiting the current, within an established period of time.
Informational Note No. 1: This requirement is intended to provide an equivalent level of protection from electric shock as Class 2 circuits as defined in UL XXXX.

(2) The maximum power that can be delivered into a fault between conductors or between any conductor and ground shall not exceed 100 VA, measured after 5 seconds.

Informational Note No. 1: This requirement is intended to reduce the risk of fire due to resistive heating, matching the PS2 limits in UL 62368-1.

(3) A Class 4 power source shall provide protection from the effects of arc faults by recognizing characteristics unique to arcing and by functioning to deenergize the circuit when an arc fault is detected.

Informational Note: This requirement is intended to reduce the risk fire due to arcing.

(B) Fault Management. A listed transmitter interrupts an energized circuit within the limits of 726.121(A) when any of the following conditions occur:

a) An abnormal condition is identified in the system, such as abnormal voltage, current, waveform, or load condition
b) A short circuit
c) Human skin contact with energized parts
d) A ground-fault condition exists
e) An overcurrent condition exists
f) Intentional shorting of the line at the receiving or transmitting end to force de-energization for purposes of maintenance or repair
g) A malfunction of the monitoring or control system

726.124 Marking.

The equipment supplying the CL4 circuits shall be durably marked where plainly visible to indicate each circuit that is a CL4 circuit. The marking shall also include the maximum voltage and current output for each connection point. Where multiple connection points have the same rating, a single label shall be permitted to be used.

Informational Note: An example of marking is “Class 4: +/-190V, 5A” for a Class 4 system capable of delivering 1.9kW from 380V line to line.

726.128 CL4 Receiver Output

Any voltage that is user accessible at the CL4 receiver that is not compliant to this article is subject to the requirements of the rest of this *Code* and shall have a label indicating the maximum voltage and current output for each connection point.

Part III. Installation

726.135 Installation of CL4 Cables.

Installation of CL4 and CL4TC cables shall comply with 726.135(A) through (M).

(A) Listing.

CL4 cables installed in buildings shall be listed.

(B) Ducts Specifically Fabricated for Environmental Air.

The following cables shall be permitted in ducts specifically fabricated for environmental air as described in 300.22(B) if directly associated with the air distribution system:

(1) Type CL4 cables in lengths as short as practicable to perform the required function
(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in raceways that are installed in compliance with 300.22(B)

Informational Note: For information on fire protection of wiring installed in fabricated ducts, see 4.3.4.1 and 4.3.11.3.3 of NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

(C) Other Spaces Used for Environmental Air (Plenums).

The following cables shall be permitted in other spaces used for environmental air as described in 300.22(C):

(1) Type CL4P cables
(2) Type CL4P cables installed in plenum communications raceways
(3) Type CL4P cables installed in plenum cable routing assemblies
(4) Type CL4P cables and plenum communications raceways supported by open metallic cable trays or cable tray systems
(5) Types CL4, CL4R, CL4P, and CL4TC cables installed in raceways that are installed in compliance with 300.22(C)
(6) Types CL4, CL4R, CL4P, and CL4TC cables supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)
(7) Types CL4, CL4R, CL4P, and CL4TC cables installed in plenum communications raceways, riser communications raceways, and general-purpose communications raceways supported by solid bottom metal cable trays with solid

metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)

(D) Risers — Cables in Vertical Runs.
The following cables shall be permitted in vertical runs penetrating one or more floors and in vertical runs in a shaft:

(1) Types CL4R and CL4P cables
(2) Types CL4R and CL4P cables installed in the following:
a. Plenum communications raceways
b. Plenum cable routing assemblies
c. Riser communications raceways
d. Riser cable routing assemblies
Informational Note: See 300.21 for firestop requirements for floor penetrations.

(E) Risers — Cables and Innerducts in Metal Raceways.
The following cables shall be permitted in metal raceways in a riser having firestops at each floor:

(1) Types CL4, CL4R, CL4P, and CL4TC cables
(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:
a. Plenum communications raceways (innerduct)
b. Riser communications raceways (innerduct)
c. General-purpose communications raceways (innerduct)

Informational Note: See 300.21 for firestop requirements for floor penetrations.

(F) Risers — Cables in Fireproof Shafts.
The following shall be permitted to be installed in fireproof riser shafts having firestops at each floor:
(1) Types CL4, CL4R, CL4P, and CL4TC cables
(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:
a. Plenum communications raceways
b. Plenum cable routing assemblies
c. Riser communications raceways
d. Riser cable routing assemblies
e. General-purpose communications raceways
f. General-purpose cable routing assemblies

Informational Note: See 300.21 for firestop requirements for floor penetrations.

(G) Risers — One- and Two-Family Dwellings.
The following cables shall be permitted in one- and two-family dwellings:

(1) Types CL4, CL4R, CL4P, and CL4TC cables
(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:

a. Plenum communications raceways
b. Plenum cable routing assemblies
c. Riser communications raceways
d. Riser cable routing assemblies
e. General-purpose communications raceways
f. General-purpose cable routing assemblies

(H) Cable Trays.
Cables installed in cable trays outdoors shall be Type CL4TC. The following cables shall be permitted to be supported by cable trays in buildings:

(1) Types CL4, CL4R, CL4P, and CL4TC cables
(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:
a. Plenum communications raceways
b. Riser communications raceways
c. General-purpose communications raceways

(I) Cross-Connect Arrays.
The following cables shall be permitted to be installed in cross-connect arrays:

(1) Types CL4, CL4R, CL4P, and CL4TC cables
(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:
a. Plenum communications raceways
b. Plenum cable routing assemblies
c. Riser communications raceways
d. Riser cable routing assemblies
e. General-purpose communications raceways
f. General-purpose cable routing assemblies

(J) Industrial Establishments. In industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons service the installation, Type CL4TC cable shall be permitted in accordance with either (1) or (2) as follows:

(1) Where the cable is not subject to physical damage, Type CL4TC cable that complies with the crush and impact requirements of Type MC cable and is identified as CL4TC -ER for such use shall be permitted to be exposed between the cable tray and the utilization equipment or device. The cable shall be continuously supported and protected against physical damage using mechanical protection such as dedicated struts, angles, or channels. The cable shall be supported and secured at intervals not exceeding 1.8 m (6 ft). Where not subject to physical damage, Type CL4TC -ER cable shall be permitted to transition between cable trays and between cable trays and utilization equipment or devices for a distance not to exceed 1.8 m (6 ft) without continuous support. The cable shall be mechanically supported where exiting the cable tray to ensure that the minimum bending radius is not exceeded.

(2) Type CL4TC cable, with a metallic sheath or armor in accordance with 725.179(E), shall be permitted to be installed exposed. The cable shall be continuously supported and protected against physical damage using mechanical protection such as dedicated struts, angles, or channels. The cable shall be secured at intervals not exceeding 1.8 m (6 ft)

(K) Other Building Locations.
The following cables shall be permitted to be installed in building locations other than the locations covered in 726.135(B) through (I):

(1) Types CL4, CL4R, CL4P, and CL4TC cables
(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:
a. Plenum communications raceways
b. Plenum cable routing assemblies
c. Riser communications raceways
d. Riser cable routing assemblies
e. General-purpose communications raceways
f. General-purpose cable routing assemblies
(3) Types CL4, CL4R, CL4P, and CL4TC cables installed in raceways recognized in Chapter 3

(L) Multifamily Dwellings.
The following cables shall be permitted to be installed in multifamily dwellings in locations other than the locations covered in 726.135(B) through (I):

(1) Types CL4, CL4R, CL4P, and CL4TC cables
(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:
a. Plenum communications raceways
b. Plenum cable routing assemblies
c. Riser communications raceways
d. Riser cable routing assemblies
e. General-purpose communications raceways
f. General-purpose cable routing assemblies
(3) Types CL4, CL4R, CL4P, and CL4TC wires and cables installed in raceways recognized in Chapter 3

(M) One- and Two-Family Dwellings.
The following cables shall be permitted to be installed in one- and two-family dwellings in locations other than the locations covered in 726.135(B) through (I):

(1) Types CL4, CL4R, CL4P, and CL4TC cables
(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:
a. Plenum communications raceways
b. Plenum cable routing assemblies
c. Riser communications raceways
d. Riser cable routing assemblies

e. General-purpose communications raceways
f. General-purpose cable routing assemblies

(3) Types CL4, CL4R, CL4P, and CL4TC cables installed in raceways recognized in Chapter 3.

726.136 Separation from Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm Circuit Conductors, and Medium-Power Network-Powered Broadband Communications Cables.

726.136(A) General.
Cables and conductors of CL4 circuits shall not be placed in any cable, cable tray, compartment, enclosure, manhole, outlet box, device box, raceway, or similar fitting with conductors of electric light, power, Class 1, non–power-limited fire alarm circuits, and medium-power network-powered broadband communications circuits unless permitted by 726.136(B) through (I).

726.136(B) Separated by Barriers.
CL4 circuits shall be permitted to be installed together with the conductors of electric light, power, Class 1, non–power-limited fire alarm and medium power network-powered broadband communications circuits where they are separated by a barrier.

726.136(C) Raceways Within Enclosures.
In enclosures, CL4 circuits shall be permitted to be installed in a raceway to separate them from Class 1, non–power-limited fire alarm and medium-power network-powered broadband communications circuits.

726.136(D) Associated Systems Within Enclosures.
CL4 circuit conductors in compartments, enclosures, device boxes, outlet boxes, or similar fittings shall be permitted to be installed with electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits where they are introduced solely to connect the equipment connected to CL4 circuits, and where (1) or (2) applies:

(1) The electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuit conductors are routed to maintain a minimum of 6 mm (0.25 in.) separation from the conductors and cables of CL4 circuits.
(2) The non-CL4 circuit conductors operate at 150 volts or less to ground and the CL4 circuits are installed using Type CL4, CL4R, or CL4P cables, provided any CL4 cable conductors extending beyond the jacket are separated by a minimum of 6 mm (0.25 in.) or by a nonconductive sleeve or nonconductive barrier from all other conductors.

726.136(E) Enclosures with Single Opening.
CL4 circuit conductors entering compartments, enclosures, device boxes, outlet boxes, or similar fittings shall be permitted to be installed with Class 1, non–power-limited fire

alarm and medium-power network-powered broadband communications circuits where they are introduced solely to connect the equipment connected to CL4 circuits. Where CL4 circuit conductors must enter an enclosure that is provided with a single opening, they shall be permitted to enter through a single fitting (such as a tee), provided the conductors are separated from the conductors of the other circuits by a continuous and firmly fixed nonconductor, such as flexible tubing.

726.136(F) Manholes.
Underground CL4 circuit conductors in a manhole shall be permitted to be installed with Class 1, non–power-limited fire alarm and medium-power network-powered broadband communications circuits where one of the following conditions is met:

(1) The electric light, power, Class 1, non–power-limited fire alarm and medium-power network-powered broadband communications circuit conductors are in a metal-enclosed cable or Type UF cable.
(2) The CL4 circuit conductors are permanently and effectively separated from the conductors of other circuits by a continuous and firmly fixed nonconductor, such as flexible tubing, in addition to the insulation or covering on the wire.
(3) The CL4 circuit conductors are permanently and effectively separated from conductors of the other circuits and securely fastened to racks, insulators, or other approved supports.

726.136(G) Cable Trays.
CL4 circuit conductors shall be permitted to be installed in cable trays, where the conductors of the electric light, Class 1, and non–power-limited fire alarm circuits are separated by a solid fixed barrier of a material compatible with the cable tray or where the CL4 circuits are installed in Type MC cable.

726.136(H) In Hoistways.
In hoistways, CL4 circuit conductors shall be installed in rigid metal conduit, rigid nonmetallic conduit, intermediate metal conduit, liquidtight flexible nonmetallic conduit, or electrical metallic tubing. For elevators or similar equipment, these conductors shall be permitted to be installed as provided in 620.21.

726.136(I) Other Applications.
For other applications, conductors of CL4 circuits shall be separated by at least 50 mm (2 in.) from conductors of any electric light, power, Class 1, non–power-limited fire alarm or medium power network-powered broadband communications circuits unless one of the following conditions is met:

(1) Either all of the electric light, power, Class 1, non–power-limited fire alarm and medium-power network-powered broadband communications circuit conductors or all of the CL4 circuit conductors are in a raceway or in metal-sheathed, metal-clad, non–metallic-sheathed, Type TC, or Type UF cables
(2) All of the electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuit conductors are permanently

separated from all of the CL4 circuit conductors by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the conductors

726.139 Installation of Conductors of Different Circuits in the Same Cable, Enclosure, Cable Tray, Raceway, or Cable Routing Assembly.

(A) Two or More Class 4 Circuits.

Conductors of two or more Class 4 circuits shall be permitted within the same cable, enclosure, raceway, or cable routing assembly.

(B) Class 4 Circuits with Class 2, Class 3, or Communications Circuits.

Conductors of one or more Class 4 circuits shall be permitted within the same cable, enclosure, raceway, or cable routing assembly with conductors of Class 2, Class 3 or Communications circuits, provided that the insulation of the Class 2, Class 3, and/or Communications circuit conductors in the cable, enclosure, raceway, or cable routing assembly is at least that required for Class 4 circuits.

(C) Class 4 Cables with Other Circuit Cables.

Jacketed cables of Class 4 circuits shall be permitted in the same enclosure, cable tray, raceway, or cable routing assembly with jacketed cables of any of the following:

(1) Power-limited fire alarm systems in compliance with Parts I and III of Article 760

(2) Nonconductive and conductive optical fiber cables in compliance with Parts I and IV of Article 770

(3) Communications circuits in compliance with Parts I and IV of Article 805

(4) Community antenna television and radio distribution systems in compliance with Parts I and IV of Article 820

(5) Low-power, network-powered broadband communications in compliance with Parts I and IV of Article 830

726.141 Installation of Circuit Conductors Extending Beyond One Building.

Where CL4 circuit conductors extend beyond one building and are run so as to be subject to accidental contact with electric light or power conductors operating over 300 volts to ground, or are exposed to lightning on interbuilding circuits on the same premises, the requirements of the following shall also apply:

(1) Sections 800.44, 800.53, 800.100, 805.50, 805.93, 805.170(A), and 805.170(B) for other than coaxial conductors
(2) Sections 820.44, 820.93, and 820.100 for coaxial conductors

726.143 Support of Conductors.
CL4 circuit conductors shall not be strapped, taped, or attached by any means to the exterior of any conduit or other raceway as a means of support. These conductors shall be permitted to be installed as permitted by 300.11(C)(2).

Part IV. Listing Requirements

726.170 Listing of Equipment for Class 4 Systems. The active components of a Class 4 system shall be listed as a Class 4 device.

Informational Note: Some examples of Class 4 devices can include a Class 4 power transmitter, a Class 4 power receiver, or Class 4 utilization equipment.

Where there is reliance on the interoperability of the system devices for the safety of the CL4 system, the listing shall identify interoperability.

Informational Note: One way to determine applicable requirements for listing of Class 4 power systems is to refer to UL #####, *Standard for Class 4 Power Systems*.

726.172 Listing of Class 4 Systems for Dwellings. Equipment intended for installation in dwellings shall be listed and identified for such use.

726.179 Listing and Marking of Class 4 Cables.
Cables for Class 4 Power systems shall be types CL4, CL4R, or CL4P and shall be listed for a CL4 distribution system use. CL4 cables, installed as wiring methods within buildings, shall be listed as resistant to the spread of fire and other criteria in accordance with 726.179(A) through (D), shall be constructed in accordance with 726.179(E), shall be marked in accordance with 726.179(F), and shall be permitted to be marked in accordance with 726.179(G).

Informational Note: One way to determine applicable requirements for listing of Class 4 (CL4) cable is to refer to UL XXX, Cables for Class 4 Circuits.

726.179(A) Type CL4P.
Type CL4P plenum cable shall be marked as Type CL4P and shall be listed as suitable for use in ducts, plenums, and other space for environmental air and shall be listed as having adequate fire-resistant and low-smoke producing characteristics.

Informational Note: One method of defining a cable that is low-smoke producing and fire resistant is that the cable exhibits a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.52 m (5 ft) or less when tested in accordance with NFPA 262-2019, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces*.

726.179(B) Type CL4R.

Type CL4R riser cable shall be marked as Type CL4R and be listed as suitable for use in a vertical run in a shaft or from floor to floor and shall be listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor.

Informational Note: One method of defining fire-resistant characteristics capable of preventing the carrying of fire from floor to floor is that the cables pass the requirements of ANSI/UL 1666-2012, *Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts.*

726.179(C) Type CL4.

Type CL4 cables shall be marked as Type CL4, and be listed as suitable for general-purpose use, with the exception of risers, ducts, plenums, and other space used for environmental air, and shall be listed as resistant to the spread of fire.

Informational Note: One method of defining *resistant to the spread of fire* is that the cables do not spread fire to the top of the tray in the UL flame exposure, vertical tray flame test in ANSI/UL 1685-2010, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*. The smoke measurements in the test method are not applicable.
Another method of defining *resistant to the spread of fire* is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA vertical flame test for cables in cable trays, as described in CSA C22.2 No. 0.3-M-2001, *Test Methods for Electrical Wires and Cables*.

726.179(D) Type CL4TC.

Type CL4TC nonmetallic-sheathed tray cable shall be marked as Type CL4TC and shall be listed as being suitable for cable trays and shall consist of a factory assembly of two or more insulated conductors under a nonmetallic jacket. The insulated conductors shall be at least 24 AWG copper (solid or stranded). Insulation on conductors shall be rated for 450 volts DC. The cable core shall be two or more parallel conductors, one or more group assemblies of twisted or parallel conductors, or a combination thereof. A metallic shield or a metallized foil shield with drain wire(s) shall be permitted to be applied over the cable core, over groups of conductors, or both. The cable shall be listed as resistant to the spread of fire. The outer jacket shall be a sunlight- and moisture-resistant nonmetallic material. Type CL4TC cable used in a wet location shall be listed for use in wet locations or have a moisture-impervious metal sheath.

Exception No. 1: Where a smooth metallic sheath, continuous corrugated metallic sheath, or interlocking tape armor is applied over the nonmetallic jacket, an overall nonmetallic jacket shall not be required. On metallic-sheathed cable without an overall nonmetallic jacket, the information required in 310.8 shall be located on the nonmetallic jacket under the sheath.

Informational Note: One method of defining resistant to the spread of fire is that the cables do not spread fire to the top of the tray in the UL flame exposure, vertical tray flame test in ANSI/UL 1685-2010, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*. The smoke measurements in the test method are not applicable.

Another method of defining resistant to the spread of fire is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA vertical tray flame test for cables in cable trays, as described in CSA C22.2 No. 0.3- M-2001*, Test Methods for Electrical Wires and Cables*.

726.179(E) Cable Construction.

a) **Sizes.** Conductors of sizes not smaller than 24 AWG shall be permitted to be used.
b) **Insulation.** Insulation on conductors shall be rated not less than 450 volts DC.

c) **Voltage rating.** Cables shall have a voltage rating of not less than 450 volts DC. Voltage ratings shall not be marked on the cables.

d) **Temperature Rating.** Cables shall have a temperature rating of not less than 60°C (140°F).
e) **Cabling.** Cables shall comply with any requirements provided in the listing of the system.
Informational Note: Excessive cable lengths can result in higher capacitance which could affect the safety of the circuit. For further information see <insert listing standard>.

726.179(F) Marking.

All cables shall be marked to indicate the following information, using the applicable method described in 310.8(B):

a) The cable type as described in 726.179 (A) through (D).
b) The manufacturer's name, trademark, or other distinctive marking by which the organization responsible for the product can be readily identified.
c) The AWG size or circular mil area.
d) The temperature rating of CL4 cables that have a temperature rating exceeding 60°C (140°F).

726.179(G) Optional Markings.

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note No. 1: These markings include, but are not limited to, markings for limited smoke, halogen free, low smoke and halogen free, and sunlight resistant.

Informational Note No. 2: Some examples of optional markings are ST1 to indicate limited smoke characteristics in accordance with UL 2556, *Wire and Cable Test Methods*; HF to indicate halogen free as described in UL 2885, *Outline of Investigation for Acid Gas, Acidity and Conductivity of Combusted Materials*; and LSHF to indicate halogen free and low smoke characteristics in accordance with IEC 61034-2, *Measurement of smoke density of cables burning under defined conditions — Part 2: Test procedure and requirements*.

Substantiation

This Public Input (PI) was created by a Correlating Committee appointed task group to address Packet Energy Transfer (PET) systems. TG members included: Ernest Gallo – Chair (CMP1, 5, CC), Terry Coleman (CMP16), Randy Ivans (CMP3, 16), Chad Jones (CMP3), David Johnson (CMP2), Robert Osbourne (CMP9, CC), Mario Spina (CMP13, Verizon), George Straniero (CMP3, 6, CC), Ron Tellas (CMP3), Keith Waters (CMP11, 3), and George Zimmerman (CMP3). The TG was broad-based and specifically included representation of those with knowledge and experience in electrical safety, installation, code enforcement, wire and cable.

Why a new article is needed.
Revisions to the NEC are needed to realize the full potential of this emerging technology. The technology referred to as Class 4 in this Public Input has been publicly referred to by the names including, but not limited to, Packet Energy Transfer (PET), Digital Electricity (DE), Pulsed Power, Smart Transfer Systems and Fault Managed Power (FMP).

The Class 4 Power System is a fault-managed system that relies on an electronic handshake to verify that the powered device is present and operating correctly before greater than Class 2 power is applied. Faults result in immediate termination of output power. Digital monitoring is not a new concept or unique to these systems to control and mitigate safety risks. There are a number of standards that rely on "digital" monitoring and controls in very critical safety areas, including but not limited to: patient care equipment, electronic circuit breakers, alarm systems. The necessary requirements for functional safety, including mean time between failures of critical components, software reliability and the like are well known.

Some of these systems have been described as being able to provide power over LAN/Communications cables. This has led to the (incorrect) perception that these systems are the same as PoE which is used to provide limited power on cables handling data and communications. However, they are not the same.

Class 4 technology employs circuits and software to provide fault protection for safety. It is important to ensure that it is safe in design, implementation, installation and use. Appropriate requirements are needed to allow the continued rapid and safe deployment of these systems.

The Task Group decided that these new systems would not fit well into existing NEC articles and that a new article should be developed. It was also determined that Class 4 power systems are necessary to power a new generation of utilization equipment, including appliances and communications equipment. Recognition of these systems is also essential for the large-scale rollout of 5G technology. There are over 700 of these types of systems installed in the US already.

Class 4 different than LPS. Section 725.121(A)(4) indicates that listed equipment with a limited power source (LPS) output can be considered a Class 2 circuit. UL 62368-1 requires the output of a limited power source to be power limited. These Class 4 systems do not limit the output of the power source but rather the systems limit the energy and power available into a fault condition. If monitored and controlled correctly, Class 4 is as safe or safer than an LPS, but it is different and needs to be treated differently in the NEC and in product standards. Class 4 circuits have a receiver as part of the system; Class 2 circuits will supply any load. Electric shock concerns in Class 4 circuits are mitigated by limiting exposure times (short pulses) and eliminating repetitive impulses (fast shut off).

The complexity and applications of this technology warrant the development of new

installation code requirements. Some vendors want to utilize wiring systems more like Class 2 and communications installations than traditional power distribution systems. They rely on sophisticated monitoring and control systems to mitigate the risks rather than mechanical protection. These monitoring and control safety systems will involve solid state controls, microprocessors, firmware and software elements that will require fault analysis, critical software testing and general functional safety evaluations.

Unlike Class 2 circuits which place finite limits for sinusoidal ac and dc voltages to reduce the risk of electric shock, Class 4 circuits need to consider voltage levels, pulse widths, repetitive pulses, time to shut-off, and stored charge from cable capacitance and equipment. This is not something an installer or an AHJ can do in the field. There will have to be reliance on the safety standard and the listing of equipment.

The proposed new article also includes a new cable type specifically for Class 4.

New Article Proposed. This PI proposes a new Article 726 on Class 4 Power Systems. Since there are some technology similarities with Article 725, this proposed article follows the same common code format.

Article 726 Section-Specific Substantiations
Below is additional information on specific sections. Where practices were considered equivalent to Class 2, text from 725 was mirrored as closely as possible.

Section 726.3 is similar to Article 725, and it provides a roadmap as to how this fits with the rest of the Code. The differences:
725.3(D) Hazardous locations moved to 726.12, subsequent lettering reduced by one letter (i.e. 725.3(E) maps to 726.3(D).)
725.3(F) motor control circuits – not included in the Class 4 article. subsequent lettering reduced by one additional letter (i.e. 725.3(G) maps to 726.3(E).)
725.3(I) vertical support for fire rated cables – not included in the Class 4 article. subsequent lettering reduced by one additional letter (i.e. 725.3(J) maps to 726.3(G).)

Section 726.12 Uses not permitted this is not included in Art 725. This is modeled after section 352.12(A) as the authors feel this is the better model to use. The result is the same requirements that hazardous locations are disallowed unless you follow the applicable sections in chapter 5. Another TG will be recommending a 725.12 section similar to this.

Section 726.28 ensures Class 4 circuits can only be used on a Class 4 system and that other utilization equipment that is not designed for a Class 4 system cannot be connected to a Class 4 system.

Section 726.121 this section provides listing requirements for the new Class 4 systems.

726.121(A)(1) This section establishes the listing criteria for acceptable protection from electric shock.

726.121(A)(2) The 100VA, 5 second limit matches the PS2 requirements in IEC 62368, which is equivalent to a Class 2 circuit.

726.121(A)(3) This section requires arc fault protection to reduce the risk of fire from arcing.

726.121(B) defines the qualifying characteristic of a Class 4 power circuit. Specifically, that there will be no transmission of power unless the presence of a properly operating Class 4 receiver is confirmed, and will interrupt an energized circuit under fault conditions, eliminating hazard.

726.128 notifies that any output voltage from a Class 4 receiver that is not Class 4 compliant is subject to the rest of the requirements in the NEC and is required to be marked.

726.135, 136, and 139 are modeled after 725 because Class 4 systems are intended to have similar installation practices as Class 2. The differences:

726.135, 136 – none. [726.135(G,L,M) may need further discussion by the panel. (one and two family dwellings and multifamily dwellings)]

725.139 has 6 subsections (A – F). 726.139 has three (A – C). 725.139(A)&(B) collapsed into 726.139(A). 725.139(C)&(D) collapsed into 726.139(B). 725.139(E) maps to 726.139(C). 725.139(F) not included in 726.

726.170 establishes that any Class 4 device that is connected to a Class 4 circuit must be listed and does not list only a subset of Class 4 devices as the full range of Class 4 devices may not be realized for years to come.

The applicable requirements for systems are being developed in a new UL standard. There is no industry standard for Class 4 circuit interoperability at this time. We expect the interoperability of Class 4 devices to be listed as systems. In the future, Class 4 devices could be listed on a standalone basis if they are compliant with such a standard.

726.179 is modeled after 725 because Class 4 systems are intended to have similar installation practices as Class 2. This section provides for the new cable types for Class 4 to be consistent with the operating characteristics of Class 4 power sources. The differences:

726.179 includes plenum, riser, general use and tray cable varieties. Limited use, circuit integrity, and limited power cables were excluded.

A cable construction section was added [726.179(E).]

Public Input No. 4536-NFPA 70-2020 [New Article after 725]

ARTICLE 726 – Class 4 (CL4) Power Systems

Part I. General

726.1 Scope.

This article covers the installation of wiring and equipment of Class 4 (CL4) power systems including utilization equipment incorporating parts of these systems. [need to elaborate more, perhaps use 'touch-safe' and define. Need to describe that these systems replace mechanical protection with HW based electrical protection.]

Informational Note No. 1: Class 4 power systems consist of a Class 4 power transmitter and a Class 4 power receiver connected by a cabling system. These systems are characterized by monitoring the circuit for faults and controlling the power transmitted to ensure that the energy delivered into any fault is limited. Class 4 systems differ from Class 1, 2, and 3 systems in that they are not limited for power delivered to an appropriate load. They are power limited with respect to risk of shock and fire between the Class 4 transmitter and Class 4 receiver.

Informational Note No. 2: The circuits described herein are characterized by monitoring and control systems that differentiate them from electric light and power circuits; therefore, alternative requirements to those of Chapters 1 through 4 are given with regard to minimum wire sizes, ampacity adjustment and correction factors, overcurrent protection, insulation requirements, and wiring methods and materials.

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

Class 4 Circuit . The portion of the wiring system between the load side of a Class 4 transmitter and the Class 4 receiver, or Class 4 utilization equipment, as appropriate. Due to the active monitoring and control of the power transmitted, a Class 4 circuit is not considered a possible ignition source, and it minimizes the risk of electric shock.

Class 4 Device. Any active device connected to the Class 4 circuit. Some examples of Class 4 devices can include a Class 4 power transmitter, a Class 4 power receiver, or Class 4 utilization equipment.

Class 4 Negotiation . The process by which a Class 4 transmitter and Class 4 receiver mutually confirm they are Class 4 devices. This happens before voltages above Class 2 levels can be transmitted.

Class 4 Power System . An actively monitored and controlled system that consists of a Class 4 power transmitter and a Class 4 power receiver connected by a cabling system.

Class 4 Receiver . A device that accepts Class 4 power, converts the Class 4 power to be used by utilization equipment, and can negotiate to Class 4 levels.

Class 4 Transmitter . A device that sources Class 4 power, monitors the line for faults, ceases power transmission if a fault is sensed, and limits the power into a fault to the levels described in Table 726.121.

Class 4 Tray Cable (CL4TC). A factory assembly of two or more insulated conductors rated at 600 volts, with or without associated bare or insulated equipment grounding conductors, under a nonmetallic jacket.

Class 4 Utilization Equipment . Devices that are directly powered by a Class 4 transmitter without the need for a separate Class 4 receiver.

Standby . This is the state of a Class 4 transmitter when it is ready to transmit power but does not have a qualified transmit partner (either a Class 4 receiver has not been connected or a fault has occurred in between the transmitter and receiver). A Class 4 Transmitter conforms to Class 2 requirements while in Standby.

726.3 Other Articles.

In addition to the requirements of this article, circuits and equipment shall comply with the articles or sections listed in 726.3 (A) through (N). Only those sections of Article 300 referenced in this article shall apply to Class 4 Power Systems .

(A) Number and Size of Conductors in Raceway.

Section 300.17.

(B) Spread of Fire or Products of Combustion.

Installation of Class 4 circuits shall comply with 300.21.

(C) Ducts, Plenums, and Other Air-Handling Spaces.

Class 4 circuits installed in ducts, plenums, or other space used for environmental air shall comply with 300.22.

(D) Hazardous (Classified) Locations.

Class 4 circuits installed in hazardous (classified) locations shall comply with 501.10(B)(1), 501.150, 502.10(B)(1), 502.150, 503.10(A)(1), 503.150, 506.15(A), 506.15(C), 511.7(B)(1), 515.7(A), and Article 517, Part IV.

(E) Cable Trays.

Parts I and II of Article 392, where installed in cable tray.

(F) Instrumentation Tray Cable.

See 727.1 and 727.4 through 727.9.

(G) Raceways Exposed to Different Temperatures.

Installations shall comply with 300.7(A).

(H) Bushing.

A bushing shall be installed where cables emerge from raceway used for mechanical support or protection in accordance with 300.15(C).

(I) Installation of Conductors with Other Systems.

Installations shall comply with 300.8.

(J) Corrosive, Damp, or Wet Locations.

Class 4 cables installed in corrosive, damp, or wet locations shall comply with the applicable requirements in 110.11, 300.5(B), 300.6, 300.9, and 310.10(F).

(K) Cable Routing Assemblies.

Class 4 and Type CL4TC cables shall be permitted to be installed in plenum cable routing assemblies, riser cable routing assemblies, and general-purpose cable routing assemblies selected in accordance with Table 800.154(c), listed in accordance with 800.182, and installed in accordance with 800.110(C) and 800.113.

(L) Communications Raceways.

Class 4 and Type CL4TC cables shall be permitted to be installed in plenum communications raceways, riser communications raceways, and general-purpose communications raceways selected in accordance with Table 800.154(b), listed in accordance with 800.182, and installed in accordance with 800.113 and 362.24 through 362.56, where the requirements applicable to electrical nonmetallic tubing (ENT) apply.

(M) Temperature Limitation of Class 4 Cables.

The requirements of 310.14(A)(3) on the temperature limitation of conductors shall apply to Class 4 cables.

(N) Identification of Equipment Grounding Conductors.

Equipment grounding conductors shall be identified in accordance with 250.119.

Exception No. 1: Class 4 cables that do not contain an equipment grounding conductor shall be permitted to use a conductor with green insulation or green with one or more yellow stripes for other than equipment grounding purposes.

726.21 Access to Electrical Equipment Behind Panels Designed to Allow Access.

Access to electrical equipment shall not be denied by an accumulation of wires and cables that prevents removal of panels, including suspended ceiling panels

726.24 Mechanical Execution of Work.

CL4 cables shall be installed in a neat and workmanlike manner. Cables and conductors installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be supported by straps, staples, hangers, cable ties, or similar fittings designed and installed so as not to damage the cable. The installation shall also comply with 300.4(D) .

Informational Note: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants can result in an undetermined alteration of CL4 cable properties.

726.25 Abandoned Cables.

The accessible portion of abandoned Class 4 and CL4TC cables shall be removed. Where cables are identified for future use with a tag, the tag shall be of sufficient durability to withstand the environment involved.

726.26 Spread of Fire or Products of Combustion . Openings around penetrations of CL4 cables and raceways routed through fire-resistant–rated walls, partitions, floors, or ceilings shall be fire-stopped using approved methods to maintain the fire resistance rating.

726.28 Noninterchangeability. Receptacles, cord connectors, and attachment plugs used on CL4 distribution systems shall be constructed so that they are not interchangeable with other receptacles, cord connectors, and attachment plugs.

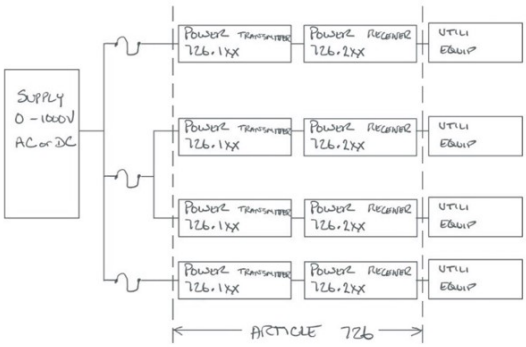
726.33 Guarding. Any junctions and mating connectors shall be constructed and installed so as to guard against inadvertent contact with live parts by persons.

Part II. CL4 Circuits

726.121 Power Sources for Class 4 Circuits. Class 4 circuits shall be supplied from a power source (transmitter) that has a peak voltage output of not more than 600 volts line to line or 300 volts line to ground. The power source shall be a listed Class 4 power transmitter and shall be as specified in 726.121(A) and (B).

Informational Note No. 1: Informational Note No.1 Figure 726.121 illustrates the relationships between Class 4 power transmitters (power sources), their supply, Class 4 circuits, Class 4 power receivers, and utilization equipment.

Informational Note No. 2: One way to determine applicable requirements for listing of Class 4 power equipment is to refer to UL ##### , *Standard for Class 4 Power Systems.*



Informational Note No. 1 Figure 726.121 Class 4 Circuits

(A) Power Source Limitations. For listing purposes, under the conditions specified in 726.121(B)(2), the power source shall be limited according to the requirements of 726.121(A)(1) through 726.121(A)(3).

(1) The maximum energy (I^2t), shall not exceed XX% of the minimum value which under given conditions (current-path, heart-phase) causes ventricular fibrillation with a certain probability.

Informational Note No. 1: This requirement is intended to provide acceptable protection from electric shock.

Informational Note No. 2: One way to determine the risks associated with electric shock is to refer to IEC 60479-1, *Effects of current on human beings and livestock – Part 1: General aspects.* Another way to determine the risks associated with electric shock is to refer to IEC 60479-2, *Effects of current on human beings and livestock – Part 2: Special aspects.*

Editor's Note 1: UL is preparing a white paper entitled "Electric Shock Hazard Considerations for Fault Managed Power Distribution Technologies". Our electric shock experts will provide additional input as needed.

Editor's Note 2: From IEC 60479-2, just to present a concept example.

specific fibrillating energy

F_e

minimum $I^2 \cdot t$ value of a unidirectional impulse of short duration which under given conditions

(current-path, heart-phase) causes ventricular fibrillation with a certain probability

Note 1 to entry: F_e is determined by the form of the impulse as the integral $\int_0^{t_i} i^2 dt$

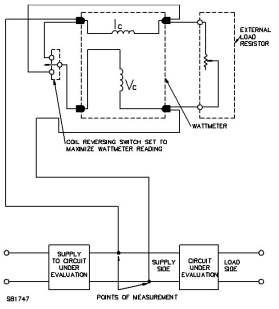
where t_i is defined in Figure 20 and Figure 21. F_e multiplied by the body resistance gives the energy dissipated in the human body during the impulse.

Note 2 to entry: F_e is expressed in Ws/ Ω or A^2s.

(2) The maximum power that can be delivered into an external variable resistor/wattmeter circuit connected between conductors or between any conductor and ground shall not exceed 15 VA, measured after 3 seconds.

Informational Note No. 1: This requirement is intended to reduce the risk of fire due to resistive heating, matching the PS1 limits in UL 62368-1.

Informational Note No. 2.: See Informational Note No. 2 Figure 726.121(A)(2) for an example of a measuring circuit.



Informational Note No. 2 Figure 726.121(A)(2)

(From UL 1492 Fig 77.2 "Connection of Wattmeter")

(3) The maximum energy that can be delivered into an arc shall be limited to XX.

Informational Note: This requirement is intended to reduce the risk fire due to arcing.

Editor's Note: From UL 62368-1. I'm not sure how to translate this into something applicable to PET systems. I2t? Joules? Measurement methods and analysis will be part of the safety standard.

An ARCING PIS is a location with the following characteristics:

– an open circuit voltage (measured after 3 s) across an open conductor or opening electrical contact exceeding 50 V (peak) a.c. or d.c.; and

– the product of the peak of the open circuit voltage (V_p) and the measured r.m.s. current (I_{rms}) exceeds 15 (that is, $V_p \times I_{rms} > 15$) for any of the following:

• a contact, such as a switch or connector;

• a termination, such as one made by a crimp, spring or solder termination;

• opening of a conductor, such as a printed wiring board trace, as a consequence of a SINGLE FAULT CONDITION. This condition does not apply if electronic protection circuits or additional constructional measures are used to reduce the likelihood that such a fault becomes an ARCING PIS.

An ARCING PIS is considered not to exist in a PS1 because of the limits of the power source.

(B) Control. The power and fault management of the system shall operate according to the requirements of 726.121(B)(1) and 726.121(B)(2).

(1) Negotiation and Energization. The transmitter shall not apply a voltage or current that exceeds Class 2 limits as defined in Table 11(A) or 11(B) until the transmitter and receiver complete negotiation.

(2) Standby. A transmitter shall interrupt an energized circuit within the limits of 726.121(A) when any of the following conditions occur:

(1) An abnormal condition is identified in the system, such as abnormal voltage, current, waveform, or load condition

(2) A short or open circuit, or disconnection of the receiver

(3) Human skin contact with energized parts

(4) A ground-fault condition exists

(5) An overcurrent condition exists

(6) Intentional shorting of the line at the receiving or transmitting end to force de-energization for purposes of maintenance or repair

(7) A malfunction of the monitoring or control system

726.124 Marking.

The equipment supplying the CL4 circuits shall be durably marked where plainly visible to indicate each circuit that is a CL4 circuit.

Informational Note: An example of marking is "Class 4: +/-300V, 5A" for a Class 4 system capable of delivering 3kW from 600V line to line.

Editor's Note: There is a Panel 3 TG that will be looking at consolidating all similar / common cable requirements into a new Chapter 7 Article for cables. It is likely that most of the following cable requirements would be folded into the new article.

726.135 Installation of CL4 Cables.

Installation of CL4 and CL4TC cables shall comply with 726.135(A) through (M).

(A) Listing.

CL4 cables installed in buildings shall be listed.

(B) Ducts Specifically Fabricated for Environmental Air.

The following cables shall be permitted in ducts specifically fabricated for environmental air as described in 300.22(B) if directly associated with the air

distribution system:

(1) Type CL4 cables in lengths as short as practicable to perform the required function

(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in raceways that are installed in compliance with 300.22(B)

Informational Note: For information on fire protection of wiring installed in fabricated ducts, see 4.3.4.1 and 4.3.11.3.3 of NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

(C) Other Spaces Used for Environmental Air (Plenums).

The following cables shall be permitted in other spaces used for environmental air as described in 300.22(C):

(1) Type CL4P cables

(2) Type CL4P cables installed in plenum communications raceways

(3) Type CL4P cables installed in plenum cable routing assemblies

(4) Type CL4P cables and plenum communications raceways supported by open metallic cable trays or cable tray systems

(5) Types CL4, CL4R, CL4P, and CL4TC cables installed in raceways that are installed in compliance with 300.22(C)

(6) Types CL4, CL4R, CL4P, and CL4TC cables supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)

(7) Types CL4, CL4R, CL4P, and CL4TC cables installed in plenum communications raceways, riser communications raceways, and general-purpose communications raceways supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)

(D) Risers — Cables in Vertical Runs.

The following cables shall be permitted in vertical runs penetrating one or more floors and in vertical runs in a shaft:

(1) Types CL4R and CL4P cables

(2) Types CL4R and CL4P cables installed in the following:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

Informational Note: See 300.21 for firestop requirements for floor penetrations.

(E) Risers — Cables and Innerducts in Metal Raceways.

The following cables shall be permitted in metal raceways in a riser having firestops at each floor:

(1) Types CL4, CL4R, CL4P, and CL4TC cables

(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:

a. Plenum communications raceways (innerduct)

b. Riser communications raceways (innerduct)

c. General-purpose communications raceways (innerduct)

Informational Note: See 300.21 for firestop requirements for floor penetrations.

(F) Risers — Cables in Fireproof Shafts.

The following shall be permitted to be installed in fireproof riser shafts having firestops at each floor:

(1) Types CL4, CL4R, CL4P, and CL4TC cables

(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

Informational Note: See 300.21 for firestop requirements for floor penetrations.

(G) Risers — One- and Two-Family Dwellings.

The following cables shall be permitted in one- and two-family dwellings:

(1) Types CL4, CL4R, CL4P, and CL4TC cables

(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

(H) Cable Trays.

Cables installed in cable trays outdoors shall be Type CL4TC. The following cables shall be permitted to be supported by cable trays in buildings:

(1) Types CL4, CL4R, CL4P, and CL4TC cables

(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:

a. Plenum communications raceways

b. Riser communications raceways

c. General-purpose communications raceways

(I) Cross-Connect Arrays.

The following cables shall be permitted to be installed in cross-connect arrays:

(1) Types CL4, CL4R, CL4P, and CL4TC cables

(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

(J) Industrial Establishments. In industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons service the installation, Type CL4TC cable shall be permitted in accordance with either (1) or (2) as follows:

(1) Where the cable is not subject to physical damage, Type CL4TC cable that complies with the crush and impact requirements of Type MC cable and is identified as CL4TC -ER for such use shall be permitted to be exposed between the cable tray and the utilization equipment or device. The cable shall be continuously supported and protected against physical damage using mechanical protection such as dedicated struts, angles, or channels. The cable shall be supported and secured at intervals not exceeding 1.8 m (6 ft). Where not subject to physical damage, Type CL4TC -ER cable shall be permitted to transition between cable trays and between cable trays and utilization equipment or devices for a distance not to exceed 1.8 m (6 ft) without continuous support. The cable shall be mechanically supported where exiting the cable tray to ensure that the minimum bending radius is not exceeded.

(2) Type CL4TC cable, with a metallic sheath or armor in accordance with 725.179(E), shall be permitted to be installed exposed. The cable shall be continuously supported and protected against physical damage using mechanical protection such as dedicated struts, angles, or channels. The cable shall be secured at intervals not exceeding 1.8 m (6 ft)

(K) Other Building Locations.

The following cables shall be permitted to be installed in building locations other than the locations covered in 726.135(B) through (I):

(1) Types CL4, CL4R, CL4P, and CL4TC cables

(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

(3) Types CL4, CL4R, CL4P, and CL4TC cables installed in raceways recognized in Chapter 3

(L) Multifamily Dwellings.

The following cables shall be permitted to be installed in multifamily dwellings in locations other than the locations covered in 726.135(B) through (I):

(1) Types CL4, CL4R, CL4P, and CL4TC cables

(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

(3) Types CL4, CL4R, CL4P, and CL4TC wires and cables installed in raceways recognized in Chapter 3

(M) One- and Two-Family Dwellings.

The following cables shall be permitted to be installed in one- and two-family dwellings in locations other than the locations covered in 726.135(B) through (I):

(1) Types CL4, CL4R, CL4P, and CL4TC cables

(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

e. General-purpose communications raceways

f. General-purpose cable routing assemblies

(3) Types CL4, CL4R, CL4P, and CL4TC cables installed in raceways recognized in Chapter 3.

726.136 Separation from Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm Circuit Conductors, and Medium-Power Network-Powered Broadband Communications Cables.

726.136(A) General.

Cables and conductors of CL4 circuits shall not be placed in any cable, cable tray, compartment, enclosure, manhole, outlet box, device box, raceway, or similar fitting with conductors of electric light, power, Class 1, non–power-limited fire alarm circuits, and medium-power network-powered broadband communications circuits unless permitted by 726.136(B) through (I).

726.136(B) Separated by Barriers.

CL4 circuits shall be permitted to be installed together with the conductors of electric light, power, Class 1, non–power-limited fire alarm and medium power network-powered broadband communications circuits where they are separated by a barrier.

726.136(C) Raceways Within Enclosures.

In enclosures, CL4 circuits shall be permitted to be installed in a raceway to separate them from Class 1, non–power-limited fire alarm and medium-power network-powered broadband communications circuits.

726.136(D) Associated Systems Within Enclosures.

CL4 circuit conductors in compartments, enclosures, device boxes, outlet boxes, or similar fittings shall be permitted to be installed with electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits where they are introduced solely to connect the equipment connected to CL4 circuits, and where (1) or (2) applies:

(1) The electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuit conductors are routed to maintain a minimum of 6 mm (0.25 in.) separation from the conductors and cables of CL4 circuits.

(2) The non-CL4 circuit conductors operate at 150 volts or less to ground and the CL4 circuits are installed using Type CL4, CL4R, or CL4P cables, provided any CL4 cable conductors extending beyond the jacket are separated by a minimum of 6 mm (0.25 in.) or by a nonconductive sleeve or nonconductive barrier from all other conductors.

726.136(E) Enclosures with Single Opening.

CL4 circuit conductors entering compartments, enclosures, device boxes, outlet boxes, or similar fittings shall be permitted to be installed with Class 1, non–power-limited fire alarm and medium-power network-powered broadband communications circuits where they are introduced solely to connect the equipment connected to CL4 circuits. Where CL4 circuit conductors must enter an enclosure that is provided with a single opening, they shall be permitted to enter through a single fitting (such as a tee), provided the conductors are separated from the conductors of the other circuits by a continuous and firmly fixed nonconductor, such as flexible tubing.

726.136(F) Manholes.

Underground CL4 circuit conductors in a manhole shall be permitted to be installed with Class 1, non–power-limited fire alarm and medium-power network-powered broadband communications circuits where one of the following conditions is met:

(1) The electric light, power, Class 1, non–power-limited fire alarm and medium-power network-powered broadband communications circuit conductors are in a metal-enclosed cable or Type UF cable.

(2) The CL4 circuit conductors are permanently and effectively separated from the conductors of other circuits by a continuous and firmly fixed nonconductor, such as flexible tubing, in addition to the insulation or covering on the wire.

(3) The CL4 circuit conductors are permanently and effectively separated from conductors of the other circuits and securely fastened to racks, insulators, or other approved supports.

726.136(G) Cable Trays.

CL4 circuit conductors shall be permitted to be installed in cable trays, where the conductors of the electric light, Class 1, and non–power-limited fire alarm circuits are separated by a solid fixed barrier of a material compatible with the cable tray or where the CL4 circuits are installed in Type MC cable.

726.136(H) In Hoistways.

In hoistways, CL4 circuit conductors shall be installed in rigid metal conduit, rigid nonmetallic conduit, intermediate metal conduit, liquidtight flexible nonmetallic conduit, or electrical metallic tubing. For elevators or similar equipment, these conductors shall be permitted to be installed as provided in 620.21 .

726.136(I) Other Applications.

For other applications, conductors of CL4 circuits shall be separated by at least 50 mm (2 in.) from conductors of any electric light, power, Class 1, non–power-limited fire alarm or medium power network-powered broadband communications circuits unless one of the following conditions is met:

(1) Either all of the electric light, power, Class 1, non–power-limited fire alarm and medium-power network-powered broadband communications circuit conductors or all of the CL4 circuit conductors are in a raceway or in metal-sheathed, metal-clad, non–metallic-sheathed, Type TC, or Type UF cables

(2) All of the electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuit conductors are permanently separated from all of the CL4 circuit conductors by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the conductors

726.139 Installation of Conductors of Different Circuits in the Same Cable, Enclosure, Cable Tray, Raceway, or Cable Routing Assembly.

(A) Two or More Class 4 Circuits.

Conductors of two or more Class 4 circuits shall be permitted within the same cable, enclosure, raceway, or cable routing assembly.

(B) Class 4 Circuits with Class 2 and Class 3 Circuits.

Conductors of one or more Class 4 circuits shall be permitted within the same cable, enclosure, raceway, or cable routing assembly with conductors of Class 2 and Class 3 circuits, provided that the insulation of the Class 2 and/or Class 3 circuit conductors in the cable, enclosure, raceway, or cable routing assembly is at least that required for Class 4 circuits.

(C) Class 4 Circuits with Communications Circuits in Composite Cables

Cables constructed of individually listed Class 4 and communications cables under a common jacket shall be permitted to be classified as communications cables. The fire resistance rating of the composite cable shall be determined by the performance of the composite cable.

(D) Class 4 Cables with Other Circuit Cables.

Jacketed cables of Class 4 circuits shall be permitted in the same enclosure, cable tray, raceway, or cable routing assembly with jacketed cables of any of the following:

(1) Power-limited fire alarm systems in compliance with Parts I and III of Article 760

(2) Nonconductive and conductive optical fiber cables in compliance with Parts I and IV of Article 770

(3) Communications circuits in compliance with Parts I and IV of Article 805

(4) Community antenna television and radio distribution systems in compliance with Parts I and IV of Article 820

(5) Low-power, network-powered broadband communications in compliance with Parts I and IV of Article 830

(E) Class 2 or Class 3 Conductors or Cables and Audio System Circuits.

Audio system circuits described in 640.9(C), and installed using Class 2, Class 3, or Class 4 wiring methods in compliance with 725.133 and 725.154 or 726.135, shall not be permitted to be installed in the same cable, raceway, or cable routing assembly with Class 4 conductors or cables.

726.141 Installation of Circuit Conductors Extending Beyond One Building.

Where CL4 circuit conductors extend beyond one building and are run so as to be subject to accidental contact with electric light or power conductors operating over 300 volts to ground, or are exposed to lightning on interbuilding circuits on the same premises, the requirements of the following shall also apply:

(1) Sections 800.44, 800.53, 800.100, 805.50, 805.93, 805.170(A), and 805.170(B) for other than coaxial conductors

(2) Sections 820.44, 820.93, and 820.100 for coaxial conductors

726.143 Support of Conductors.

CL4 circuit conductors shall not be strapped, taped, or attached by any means to the exterior of any conduit or other raceway as a means of support. These conductors shall be permitted to be installed as permitted by 300.11(C)(2).

726.170 Listing of Equipment for Class 4 Systems. The active components of a Class 4 system shall be listed as a Class 4 device.

Informational Note: Some examples of Class 4 devices can include a Class 4 power transmitter, a Class 4 power receiver, or Class 4 utilization equipment.

Where there is reliance on the interoperability of the system devices for the operation and safety of the CL4 system, the devices shall be listed as a system.

Informational Note: One way to determine applicable requirements for listing of Class 4 power systems is to refer to UL #####, *Standard for Class 4 Power Systems* .

726.176 Cables.

(1) **Cable types.** Cables for Class 4 Power systems shall be types CL4, CL4R, or CL4P and shall be listed for a CL4 distribution system use.

(2) **Uses not permitted.** CL4 cables shall not be permitted for any applications that are not part of a CL4 distribution system.

Exception: Use of CL4 cable for other applications shall be permitted if the cable has multiple listings.

(1) **Sizes.** Conductors of sizes not smaller than 24 AWG shall be permitted to be used.

(2) **Insulation.** Insulation on conductors shall be rated not less than 600 volts.

(3) **Voltage rating.** Cables shall have a voltage rating of not less than 600 volts.

(4) **Temperature Rating.** Cables shall have a temperature rating of not less than 60°C (140°F).

(5) **Cabling.** Cables shall comply with any requirements provided in the listing of the system.

Informational Note: Excessive cable lengths can result in higher capacitance which could affect the safety of the circuit. For further information see <insert listing standard>.

726.179 Listing and Marking of CL4 Cables.

CL4 cables, installed as wiring methods within buildings, shall be listed as resistant to the spread of fire and other criteria in accordance with 726.179(A) through (D), shall be marked in accordance with 726.179(E), and shall be permitted to be marked in accordance with 726.179(F).

726.179(A) Type CL4P.

Type CL4P plenum cable shall be listed as suitable for use in ducts, plenums, and other space for environmental air and shall be listed as having adequate fire-resistant and low-smoke producing characteristics.

Informational Note: One method of defining a cable that is low-smoke producing and fire resistant is that the cable exhibits a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.52 m (5 ft) or less when tested in accordance with NFPA 262-2019, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces* .

726.179(B) Type CL4R.

Type CL4R riser cable shall be marked as Type CL4R, and be listed as suitable for use in a vertical run in a shaft or from floor to floor and shall be listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor.

Informational Note: One method of defining fire-resistant characteristics capable of preventing the carrying of fire from floor to floor is that the cables pass the requirements of ANSI/UL 1666-2012, *Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts.*

726.179(C) Type CL4.

Type CL4 cables shall be marked as Type CL4, and be listed as suitable for general-purpose use, with the exception of risers, ducts, plenums, and other space used for environmental air, and shall be listed as resistant to the spread of fire.

Informational Note: One method of defining *resistant to the spread of fire* is that the cables do not spread fire to the top of the tray in the UL flame exposure, vertical tray flame test in ANSI/UL 1685-2010, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables* . The smoke measurements in the test method are not applicable.

Another method of defining *resistant to the spread of fire* is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA vertical flame test for cables in cable trays, as described in CSA C22.2 No. 0.3-M-2001, *Test Methods for Electrical Wires and Cables* .

726.179(D) Type CL4TC.

Type CL4TC nonmetallic-sheathed tray cable shall be listed as being suitable for cable trays and shall consist of a factory assembly of two or more insulated conductors under a nonmetallic jacket. The insulated conductors shall be at least 24 AWG copper (solid or stranded). Insulation on conductors shall be rated for 600 volts. The cable core shall be two or more parallel conductors, one or more group assemblies of twisted or parallel conductors, or a combination thereof. A metallic shield or a metallized foil shield with drain wire(s) shall be permitted to be applied over the cable core, over groups of conductors, or both. The cable shall be listed as resistant to the spread of fire. The outer jacket shall be a sunlight- and moisture-resistant nonmetallic material. Type CL4TC cable used in a wet

location shall be listed for use in wet locations or have a moisture-impervious metal sheath.

Exception No. 1: Where a smooth metallic sheath, continuous corrugated metallic sheath, or interlocking tape armor is applied over the nonmetallic jacket, an overall nonmetallic jacket shall not be required. On metallic-sheathed cable without an overall nonmetallic jacket, the information required in 310.8 shall be located on the nonmetallic jacket under the sheath.

Informational Note: One method of defining resistant to the spread of fire is that the cables do not spread fire to the top of the tray in the UL flame exposure, vertical tray flame test in ANSI/UL 1685-2010 , *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables* . The smoke measurements in the test method are not applicable.

Another method of defining resistant to the spread of fire is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA vertical tray flame test for cables in cable trays, as described in CSA C22.2 No. 0.3- M-2001 , *Test Methods for Electrical Wires and Cables* .

726.179(E) Marking.

All conductors and cables shall be marked to indicate the following information, using the applicable method described in 310.8(B):

(1) The maximum rated voltage.

(2) The cable type as described in 726.179 (A) through (D).

(3) The manufacturer's name, trademark, or other distinctive marking by which the organization responsible for the product can be readily identified.

(4) The AWG size or circular mil area.

(5) The temperature rating of CL4 cables that have a temperature rating exceeding 60°C (140°F).

726.179(F) Optional Markings.

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note No. 1: These markings include, but are not limited to, markings for limited smoke, halogen free, low smoke and halogen free, and sunlight resistant.

Informational Note No. 2: Some examples of optional markings are ST1 to indicate limited smoke characteristics in accordance with UL 2556, *Wire and Cable Test Methods* ; HF to indicate halogen free as described in UL 2885, *Outline of Investigation for Acid Gas, Acidity and Conductivity of Combusted Materials* ; and LSHF to indicate halogen free and low smoke characteristics in accordance with IEC 61034-2, *Measurement of smoke density of cables burning under defined conditions — Part 2: Test procedure and requirements* .

Additional Proposed Changes

File Name	Description	Approved
ARTICLE_7XX_Class_4_CL4_Power_Systems_Proposal_Draft_jrg1_0a.docx		

Statement of Problem and Substantiation for Public Input

The digital building space, where power systems, communications systems, and operational systems are all interconnected, is upon us. Commercial, residential, and industrial demands for integrated power delivery methods, as well as needs for segmented DC micro-grids, require delivery methods that are touch safe at voltage levels from 100VDC to over 500VDC.
This new article describes a class 4 touch limited power system that satisfies these requirements.

Submitter Information Verification

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City:
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Submittal Date: Thu Sep 10 14:49:02 EDT 2020
Committee: NEC-P03

ARTICLE 726 – Class 4 (CL4) Power Systems

Part I. General

726.1 Scope.

This article covers the installation of wiring and equipment of Class 4 (CL4) power systems including utilization equipment incorporating parts of these systems. [need to elaborate more, perhaps use 'touch-safe' and define. Need to describe that these systems replace mechanical protection with HW based electrical protection.]

Informational Note No. 1: Class 4 power systems consist of a Class 4 power transmitter and a Class 4 power receiver connected by a cabling system. These systems are characterized by monitoring the circuit for faults and controlling the power transmitted to ensure that the energy delivered into any fault is limited. Class 4 systems differ from Class 1, 2, and 3 systems in that they are not limited for power delivered to an appropriate load. They are power limited with respect to risk of shock and fire between the Class 4 transmitter and Class 4 receiver.

Informational Note No. 2: The circuits described herein are characterized by monitoring and control systems that differentiate them from electric light and power circuits; therefore, alternative requirements to those of Chapters 1 through 4 are given with regard to minimum wire sizes, ampacity adjustment and correction factors, overcurrent protection, insulation requirements, and wiring methods and materials.

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

Class 4 Circuit. The portion of the wiring system between the load side of a Class 4 transmitter and the Class 4 receiver, or Class 4 utilization equipment, as appropriate. Due to the active monitoring and control of the power transmitted, a Class 4 circuit is not considered a possible ignition source, and it minimizes the risk of electric shock.

Class 4 Device. Any active device connected to the Class 4 circuit. Some examples of Class 4 devices can include a Class 4 power transmitter, a Class 4 power receiver, or Class 4 utilization equipment.

Class 4 Negotiation. The process by which a Class 4 transmitter and Class 4 receiver mutually confirm they are Class 4 devices. This happens before voltages above Class 2 levels can be transmitted.

Class 4 Power System. An actively monitored and controlled system that consists of a Class 4 power transmitter and a Class 4 power receiver connected by a cabling system.

Class 4 Receiver. A device that accepts Class 4 power, converts the Class 4 power to be used by utilization equipment, and can negotiate to Class 4 levels.

Class 4 Transmitter. A device that sources Class 4 power, monitors the line for faults, ceases power transmission if a fault is sensed, and limits the power into a fault to the levels described in Table 726.121.

Class 4 Tray Cable (CL4TC). A factory assembly of two or more insulated conductors rated at 600 volts, with or without associated bare or insulated equipment grounding conductors, under a nonmetallic jacket.

Class 4 Utilization Equipment. Devices that are directly powered by a Class 4 transmitter without the need for a separate Class 4 receiver.

Standby. This is the state of a Class 4 transmitter when it is ready to transmit power but does not have a qualified transmit partner (either a Class 4 receiver has not been connected or a fault has occurred in between the transmitter and receiver). A Class 4 Transmitter conforms to Class 2 requirements while in Standby.

726.3 Other Articles.

In addition to the requirements of this article, circuits and equipment shall comply with the articles or sections listed in 726.3 (A) through (N). Only those sections of Article 300 referenced in this article shall apply to Class 4 Power Systems.

(A) Number and Size of Conductors in Raceway.

Section 300.17.

(B) Spread of Fire or Products of Combustion.

Installation of Class 4 circuits shall comply with 300.21.

(C) Ducts, Plenums, and Other Air-Handling Spaces.

Class 4 circuits installed in ducts, plenums, or other space used for environmental air shall comply with 300.22.

(D) Hazardous (Classified) Locations.

Class 4 circuits installed in hazardous (classified) locations shall comply with 501.10(B)(1), 501.150, 502.10(B)(1), 502.150, 503.10(A)(1), 503.150, 506.15(A), 5 06.15(C), 511.7(B)(1), 515.7(A), and Article 517, Part IV.

(E) Cable Trays.

Parts I and II of Article 392, where installed in cable tray.

(F) Instrumentation Tray Cable.

See 727.1 and 727.4 through 727.9.

(G) Raceways Exposed to Different Temperatures.

Installations shall comply with 300.7(A).

(H) Bushing.

A bushing shall be installed where cables emerge from raceway used for mechanical support or protection in accordance with 300.15(C).

(I) Installation of Conductors with Other Systems.

Installations shall comply with 300.8.

(J) Corrosive, Damp, or Wet Locations.

Class 4 cables installed in corrosive, damp, or wet locations shall comply with the applicable requirements in 110.11, 300.5(B), 300.6, 300.9, and 310.10(F).

(K) Cable Routing Assemblies.

Class 4 and Type CL4TC cables shall be permitted to be installed in plenum cable routing assemblies, riser cable routing assemblies, and general-purpose cable routing assemblies selected in accordance with Table 800.154(c), listed in accordance with 800.182, and installed in accordance with 800.110(C) and 800.113.

(L) Communications Raceways.

Class 4 and Type CL4TC cables shall be permitted to be installed in plenum communications raceways, riser communications raceways, and general-purpose communications raceways selected in accordance with Table 800.154(b), listed in accordance with 800.182, and installed in accordance with 800.113 and 362.24 through 362.56, where the requirements applicable to electrical nonmetallic tubing (ENT) apply.

(M) Temperature Limitation of Class 4 Cables.

The requirements of 310.14(A)(3) on the temperature limitation of conductors shall apply to Class 4 cables.

(N) Identification of Equipment Grounding Conductors.

Equipment grounding conductors shall be identified in accordance with 250.119.

Exception No. 1: Class 4 cables that do not contain an equipment grounding conductor shall be permitted to use a conductor with green insulation or green with one or more yellow stripes for other than equipment grounding purposes.

726.21 Access to Electrical Equipment Behind Panels Designed to Allow Access.

Access to electrical equipment shall not be denied by an accumulation of wires and cables that prevents removal of panels, including suspended ceiling panels

726.24 Mechanical Execution of Work.
CL4 cables shall be installed in a neat and workmanlike manner. Cables and conductors installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be supported by straps, staples, hangers, cable ties, or similar fittings designed and installed so as not to damage the cable. The installation shall also comply with 300.4(D).

Informational Note: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants can result in an undetermined alteration of CL4 cable properties.

726.25 Abandoned Cables.
The accessible portion of abandoned Class 4 and CL4TC cables shall be removed. Where cables are identified for future use with a tag, the tag shall be of sufficient durability to withstand the environment involved.

726.26 Spread of Fire or Products of Combustion. Openings around penetrations of CL4 cables and raceways routed through fire-resistant–rated walls, partitions, floors, or ceilings shall be fire-stopped using approved methods to maintain the fire resistance rating.

726.28 Noninterchangeability. Receptacles, cord connectors, and attachment plugs used on CL4 distribution systems shall be constructed so that they are not interchangeable with other receptacles, cord connectors, and attachment plugs.

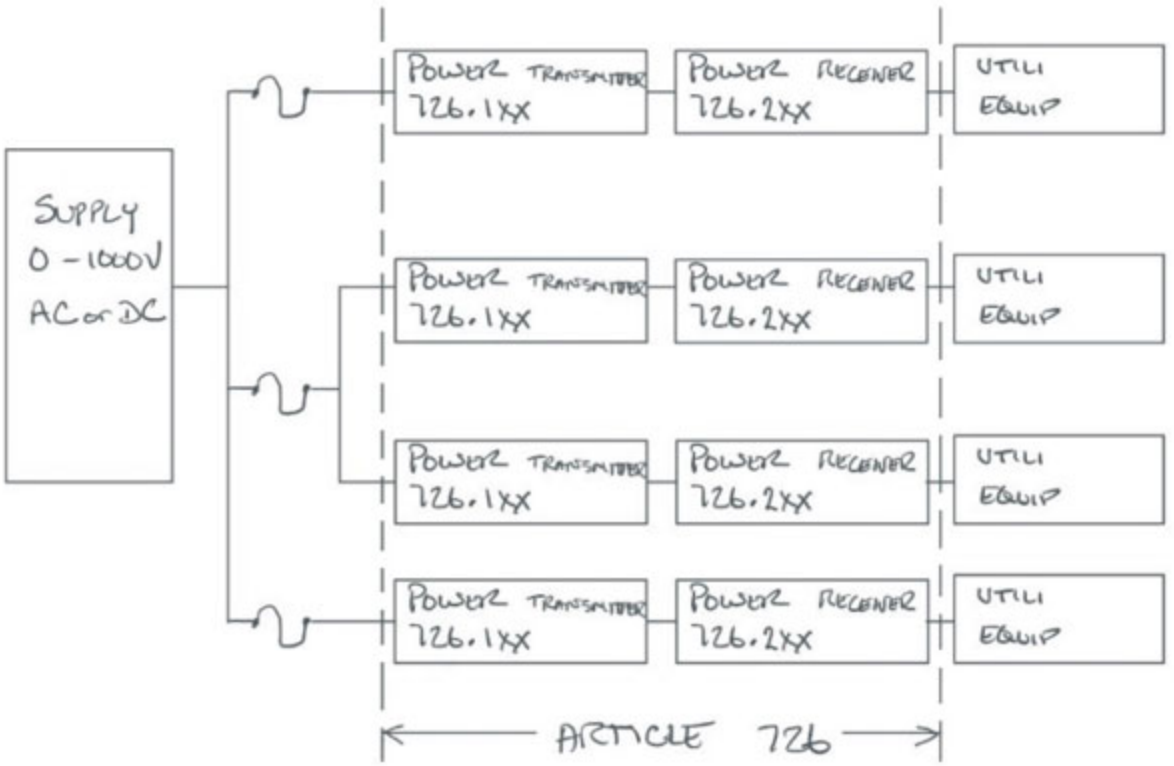
726.33 Guarding. Any junctions and mating connectors shall be constructed and installed so as to guard against inadvertent contact with live parts by persons.

Part II. CL4 Circuits

726.121 Power Sources for Class 4 Circuits. Class 4 circuits shall be supplied from a power source (transmitter) that has a peak voltage output of not more than 600 volts line to line or 300 volts line to ground. The power source shall be a listed Class 4 power transmitter and shall be as specified in 726.121(A) and (B).

Informational Note No. 1: Informational Note No.1 Figure 726.121 illustrates the relationships between Class 4 power transmitters (power sources), their supply, Class 4 circuits, Class 4 power receivers, and utilization equipment.

Informational Note No. 2: One way to determine applicable requirements for listing of Class 4 power equipment is to refer to UL #####, *Standard for Class 4 Power Systems.*



Informational Note No. 1 Figure 726.121 Class 4 Circuits

(A) Power Source Limitations. For listing purposes, under the conditions specified in 726.121(B)(2), the power source shall be limited according to the requirements of 726.121(A)(1) through 726.121(A)(3).

(1) The maximum energy (I^2t), shall not exceed XX% of the minimum value which under given conditions (current-path, heart-phase) causes ventricular fibrillation with a certain probability.

Informational Note No. 1: This requirement is intended to provide acceptable protection from electric shock.

Informational Note No. 2: One way to determine the risks associated with electric shock is to refer to IEC 60479-1, *Effects of current on human beings and livestock – Part 1: General aspects.* Another way to determine the risks associated with electric shock is to refer to IEC 60479-2, *Effects of current on human beings and livestock – Part 2: Special aspects.*

Editor's Note 1: UL is preparing a white paper entitled "Electric Shock Hazard Considerations for Fault Managed Power Distribution Technologies". Our electric shock experts will provide additional input as needed.

Editor's Note 2: From IEC 60479-2, just to present a concept example.

specific fibrillating energy
Fe
minimum $I2 \cdot t$ value of a unidirectional impulse of short duration which under given conditions (current-path, heart-phase) causes ventricular fibrillation with a certain probability
Note 1 to entry: Fe is determined by the form of the impulse as the integral ²

$$\int_0^{t_i} i^2 dt$$

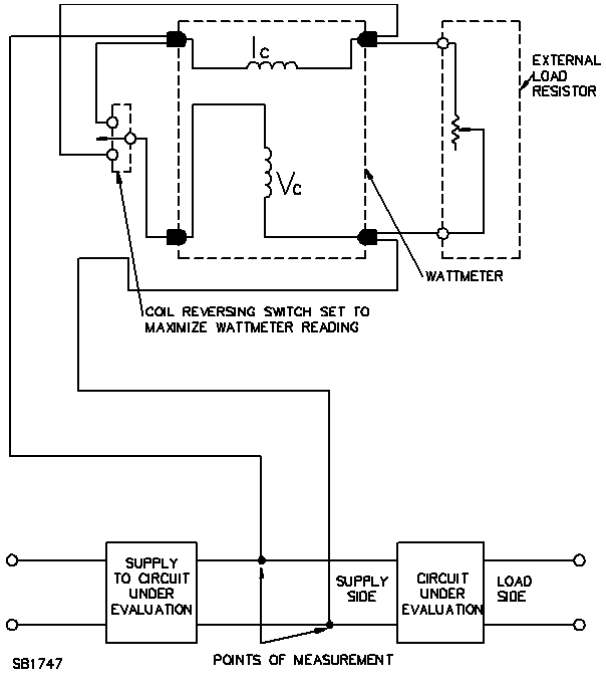
where t_i is defined in Figure 20 and Figure 21. F_e multiplied by the body resistance gives the energy dissipated in the human body during the impulse.
Note 2 to entry: F_e is expressed in Ws/Ω or A^2s.

(2) The maximum power that can be delivered into an external variable resistor/wattmeter circuit connected between conductors or between any conductor and ground shall not exceed 15 VA, measured after 3 seconds.

Informational Note No. 1: This requirement is intended to reduce the risk of fire due to resistive heating, matching the PS1 limits in UL 62368-1.

Informational Note No. 2.: See Informational Note No. 2 Figure 726.121(A)(2) for an example of a measuring circuit.

Editor's Note: Should we use 100 watts (PS2 Circuit) or the 15 watts specified for a PS1 circuit in UL 62368-1? "PS1 is a circuit where the power source, (see Figure 36) measured according to 6.2.2, does not exceed 15 W measured after 3 s. No SUPPLEMENTARY SAFEGUARDS are needed for protection against PS1. A PS1 is not considered to contain enough energy to result in materials reaching ignition temperatures."



Informational Note No. 2 Figure 726.121(A)(2)

(From UL 1492 Fig 77.2 "Connection of Wattmeter")

(3) The maximum energy that can be delivered into an arc shall be limited to XX.

Informational Note: This requirement is intended to reduce the risk fire due to arcing.

Editor's Note: From UL 62368-1. I'm not sure how to translate this into something applicable to PET systems. I2t? Joules? Measurement methods and analysis will be part of the safety standard.

An ARCING PIS is a location with the following characteristics:
– an open circuit voltage (measured after 3 s) across an open conductor or opening electrical contact exceeding 50 V (peak) a.c. or d.c.; and
– the product of the peak of the open circuit voltage (V_p) and the measured r.m.s. current (I_{rms}) exceeds 15 (that is, $V_p \times I_{rms} > 15$) for any of the following:
• a contact, such as a switch or connector;
• a termination, such as one made by a crimp, spring or solder termination;
• opening of a conductor, such as a printed wiring board trace, as a consequence of a SINGLE FAULT CONDITION. This condition does not apply if electronic protection circuits or additional constructional measures are used to reduce the likelihood that such a fault becomes an ARCING PIS.
An ARCING PIS is considered not to exist in a PS1 because of the limits of the power source.

(B) Control. The power and fault management of the system shall operate according to the requirements of 726.121(B)(1) and 726.121(B)(2).

(1) Negotiation and Energization. The transmitter shall not apply a voltage or current that exceeds Class 2 limits as defined in Table 11(A) or 11(B) until the transmitter and receiver complete negotiation.

(2) Standby. A transmitter shall interrupt an energized circuit within the limits of 726.121(A) when any of the following conditions occur:

a) An abnormal condition is identified in the system, such as abnormal voltage, current, waveform, or load condition
b) A short or open circuit, or disconnection of the receiver
c) Human skin contact with energized parts
d) A ground-fault condition exists
e) An overcurrent condition exists
f) Intentional shorting of the line at the receiving or transmitting end to force de-energization for purposes of maintenance or repair
g) A malfunction of the monitoring or control system

726.124 Marking.
The equipment supplying the CL4 circuits shall be durably marked where plainly visible to indicate each circuit that is a CL4 circuit.

Informational Note: An example of marking is "Class 4: +/-300V, 5A" for a Class 4 system capable of delivering 3kW from 600V line to line.

Editor's Note: There is a Panel 3 TG that will be looking at consolidating all similar / common cable requirements into a new Chapter 7 Article for cables. It is likely that most of the following cable requirements would be folded into the new article.

726.135 Installation of CL4 Cables.

Installation of CL4 and CL4TC cables shall comply with 726.135(A) through (M).

(A) Listing.

CL4 cables installed in buildings shall be listed.

(B) Ducts Specifically Fabricated for Environmental Air.

The following cables shall be permitted in ducts specifically fabricated for environmental air as described in 300.22(B) if directly associated with the air distribution system:

(1) Type CL4 cables in lengths as short as practicable to perform the required function
(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in raceways that are installed in compliance with 300.22(B)

Informational Note: For information on fire protection of wiring installed in fabricated ducts, see 4.3.4.1 and 4.3.11.3.3 of NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

(C) Other Spaces Used for Environmental Air (Plenums).

The following cables shall be permitted in other spaces used for environmental air as described in 300.22(C):

(1) Type CL4P cables
(2) Type CL4P cables installed in plenum communications raceways
(3) Type CL4P cables installed in plenum cable routing assemblies
(4) Type CL4P cables and plenum communications raceways supported by open metallic cable trays or cable tray systems
(5) Types CL4, CL4R, CL4P, and CL4TC cables installed in raceways that are installed in compliance with 300.22(C)
(6) Types CL4, CL4R, CL4P, and CL4TC cables supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)
(7) Types CL4, CL4R, CL4P, and CL4TC cables installed in plenum communications raceways, riser communications raceways, and general-purpose communications raceways supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)

(D) Risers — Cables in Vertical Runs.

The following cables shall be permitted in vertical runs penetrating one or more floors and in vertical runs in a shaft:

(1) Types CL4R and CL4P cables
(2) Types CL4R and CL4P cables installed in the following:
    a. Plenum communications raceways
    b. Plenum cable routing assemblies
    c. Riser communications raceways
    d. Riser cable routing assemblies
    Informational Note: See 300.21 for firestop requirements for floor penetrations.

(E) Risers — Cables and Innerducts in Metal Raceways.
The following cables shall be permitted in metal raceways in a riser having firestops at each floor:

(1) Types CL4, CL4R, CL4P, and CL4TC cables
(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:
    a. Plenum communications raceways (innerduct)
    b. Riser communications raceways (innerduct)
    c. General-purpose communications raceways (innerduct)

Informational Note: See 300.21 for firestop requirements for floor penetrations.

(F) Risers — Cables in Fireproof Shafts.
The following shall be permitted to be installed in fireproof riser shafts having firestops at each floor:
(1) Types CL4, CL4R, CL4P, and CL4TC cables
(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:
    a. Plenum communications raceways
    b. Plenum cable routing assemblies
    c. Riser communications raceways
    d. Riser cable routing assemblies
    e. General-purpose communications raceways
    f. General-purpose cable routing assemblies

Informational Note: See 300.21 for firestop requirements for floor penetrations.

(G) Risers — One- and Two-Family Dwellings.
The following cables shall be permitted in one- and two-family dwellings:

(1) Types CL4, CL4R, CL4P, and CL4TC cables
(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:
    a. Plenum communications raceways
    b. Plenum cable routing assemblies
    c. Riser communications raceways
    d. Riser cable routing assemblies
    e. General-purpose communications raceways
    f. General-purpose cable routing assemblies

(H) Cable Trays.
Cables installed in cable trays outdoors shall be Type CL4TC. The following cables shall be permitted to be supported by cable trays in buildings:

(1) Types CL4, CL4R, CL4P, and CL4TC cables
(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:
    a. Plenum communications raceways
    b. Riser communications raceways
    c. General-purpose communications raceways

(I) Cross-Connect Arrays.
The following cables shall be permitted to be installed in cross-connect arrays:

(1) Types CL4, CL4R, CL4P, and CL4TC cables
(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:
    a. Plenum communications raceways
    b. Plenum cable routing assemblies
    c. Riser communications raceways
    d. Riser cable routing assemblies
    e. General-purpose communications raceways
    f. General-purpose cable routing assemblies

(J) Industrial Establishments. In industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons service the installation, Type CL4TC cable shall be permitted in accordance with either (1) or (2) as follows:

(1) Where the cable is not subject to physical damage, Type CL4TC cable that complies with the crush and impact requirements of Type MC cable and is identified as CL4TC -ER for such use shall be permitted to be exposed between the cable tray and the utilization equipment or device. The cable shall be continuously supported and protected against physical damage using mechanical protection such as dedicated struts, angles, or channels. The cable shall be supported and secured at intervals not exceeding 1.8 m (6 ft). Where not subject to physical damage, Type CL4TC -ER cable shall be permitted to transition between cable trays and between cable trays and utilization equipment or devices for a distance not to exceed 1.8 m (6 ft) without continuous support. The cable shall be mechanically supported where exiting the cable tray to ensure that the minimum bending radius is not exceeded.
(2) Type CL4TC cable, with a metallic sheath or armor in accordance with 725.179(E), shall be permitted to be installed exposed. The cable shall be continuously supported and protected against physical damage using mechanical protection such as dedicated struts, angles, or channels. The cable shall be secured at intervals not exceeding 1.8 m (6 ft)

(K) Other Building Locations.

The following cables shall be permitted to be installed in building locations other than the locations covered in 726.135(B) through (I):

(1) Types CL4, CL4R, CL4P, and CL4TC cables
(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:
    a. Plenum communications raceways
    b. Plenum cable routing assemblies
    c. Riser communications raceways
    d. Riser cable routing assemblies
    e. General-purpose communications raceways
    f. General-purpose cable routing assemblies
(3) Types CL4, CL4R, CL4P, and CL4TC cables installed in raceways recognized in Chapter 3

(L) Multifamily Dwellings.
The following cables shall be permitted to be installed in multifamily dwellings in locations other than the locations covered in 726.135(B) through (I):

(1) Types CL4, CL4R, CL4P, and CL4TC cables
(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:
    a. Plenum communications raceways
    b. Plenum cable routing assemblies
    c. Riser communications raceways
    d. Riser cable routing assemblies
    e. General-purpose communications raceways
    f. General-purpose cable routing assemblies
(3) Types CL4, CL4R, CL4P, and CL4TC wires and cables installed in raceways recognized in Chapter 3

(M) One- and Two-Family Dwellings.
The following cables shall be permitted to be installed in one- and two-family dwellings in locations other than the locations covered in 726.135(B) through (I):

(1) Types CL4, CL4R, CL4P, and CL4TC cables
(2) Types CL4, CL4R, CL4P, and CL4TC cables installed in the following:
    a. Plenum communications raceways
    b. Plenum cable routing assemblies
    c. Riser communications raceways
    d. Riser cable routing assemblies
    e. General-purpose communications raceways
    f. General-purpose cable routing assemblies
(3) Types CL4, CL4R, CL4P, and CL4TC cables installed in raceways recognized in Chapter 3.

726.136 Separation from Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm Circuit Conductors, and Medium-Power Network-Powered Broadband Communications Cables.

726.136(A) General.
Cables and conductors of CL4 circuits shall not be placed in any cable, cable tray, compartment, enclosure, manhole, outlet box, device box, raceway, or similar fitting with conductors of electric light, power, Class 1, non–power-limited fire alarm circuits, and medium-power network-powered broadband communications circuits unless permitted by 726.136(B) through (I).

726.136(B) Separated by Barriers.
CL4 circuits shall be permitted to be installed together with the conductors of electric light, power, Class 1, non–power-limited fire alarm and medium power network-powered broadband communications circuits where they are separated by a barrier.

726.136(C) Raceways Within Enclosures.
In enclosures, CL4 circuits shall be permitted to be installed in a raceway to separate them from Class 1, non–power-limited fire alarm and medium-power network-powered broadband communications circuits.

726.136(D) Associated Systems Within Enclosures.
CL4 circuit conductors in compartments, enclosures, device boxes, outlet boxes, or similar fittings shall be permitted to be installed with electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits where they are introduced solely to connect the equipment connected to CL4 circuits, and where (1) or (2) applies:

(1) The electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuit conductors are routed to maintain a minimum of 6 mm (0.25 in.) separation from the conductors and cables of CL4 circuits.
(2) The non-CL4 circuit conductors operate at 150 volts or less to ground and the CL4 circuits are installed using Type CL4, CL4R, or CL4P cables, provided any CL4 cable conductors extending beyond the jacket are separated by a minimum of 6 mm (0.25 in.) or by a nonconductive sleeve or nonconductive barrier from all other conductors.

726.136(E) Enclosures with Single Opening.
CL4 circuit conductors entering compartments, enclosures, device boxes, outlet boxes, or similar fittings shall be permitted to be installed with Class 1, non–power-limited fire alarm and medium-power network-powered broadband communications circuits where they are introduced solely to connect the equipment connected to CL4 circuits. Where CL4 circuit conductors must enter an enclosure that is provided with a single opening, they shall be permitted to enter through a single fitting (such as a tee), provided the conductors are separated from the conductors of the other circuits by a continuous and firmly fixed nonconductor, such as flexible tubing.

726.136(F) Manholes.

Underground CL4 circuit conductors in a manhole shall be permitted to be installed with Class 1, non–power-limited fire alarm and medium-power network-powered broadband communications circuits where one of the following conditions is met:

(1) The electric light, power, Class 1, non–power-limited fire alarm and medium-power network-powered broadband communications circuit conductors are in a metal-enclosed cable or Type UF cable.
(2) The CL4 circuit conductors are permanently and effectively separated from the conductors of other circuits by a continuous and firmly fixed nonconductor, such as flexible tubing, in addition to the insulation or covering on the wire.
(3) The CL4 circuit conductors are permanently and effectively separated from conductors of the other circuits and securely fastened to racks, insulators, or other approved supports.

726.136(G) Cable Trays.

CL4 circuit conductors shall be permitted to be installed in cable trays, where the conductors of the electric light, Class 1, and non–power-limited fire alarm circuits are separated by a solid fixed barrier of a material compatible with the cable tray or where the CL4 circuits are installed in Type MC cable.

726.136(H) In Hoistways.

In hoistways, CL4 circuit conductors shall be installed in rigid metal conduit, rigid nonmetallic conduit, intermediate metal conduit, liquidtight flexible nonmetallic conduit, or electrical metallic tubing. For elevators or similar equipment, these conductors shall be permitted to be installed as provided in 620.21.

726.136(I) Other Applications.

For other applications, conductors of CL4 circuits shall be separated by at least 50 mm (2 in.) from conductors of any electric light, power, Class 1, non–power-limited fire alarm or medium power network-powered broadband communications circuits unless one of the following conditions is met:

(1) Either all of the electric light, power, Class 1, non–power-limited fire alarm and medium-power network-powered broadband communications circuit conductors or all of the CL4 circuit conductors are in a raceway or in metal-sheathed, metal-clad, non–metallic-sheathed, Type TC, or Type UF cables
(2) All of the electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuit conductors are permanently separated from all of the CL4 circuit conductors by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the conductors

726.139 Installation of Conductors of Different Circuits in the Same Cable, Enclosure, Cable Tray, Raceway, or Cable Routing Assembly.

(A) Two or More Class 4 Circuits.
Conductors of two or more Class 4 circuits shall be permitted within the same cable, enclosure, raceway, or cable routing assembly.

(B) Class 4 Circuits with Class 2 and Class 3 Circuits.
Conductors of one or more Class 4 circuits shall be permitted within the same cable, enclosure, raceway, or cable routing assembly with conductors of Class 2 and Class 3 circuits, provided that the insulation of the Class 2 and/or Class 3 circuit conductors in the cable, enclosure, raceway, or cable routing assembly is at least that required for Class 4 circuits.

(C) Class 4 Circuits with Communications Circuits in Composite Cables

Cables constructed of individually listed Class 4 and communications cables under a common jacket shall be permitted to be classified as communications cables. The fire resistance rating of the composite cable shall be determined by the performance of the composite cable.

(D) Class 4 Cables with Other Circuit Cables.

Jacketed cables of Class 4 circuits shall be permitted in the same enclosure, cable tray, raceway, or cable routing assembly with jacketed cables of any of the following:

(1) Power-limited fire alarm systems in compliance with Parts I and III of Article 760

(2) Nonconductive and conductive optical fiber cables in compliance with Parts I and IV of Article 770

(3) Communications circuits in compliance with Parts I and IV of Article 805

(4) Community antenna television and radio distribution systems in compliance with Parts I and IV of Article 820

(5) Low-power, network-powered broadband communications in compliance with Parts I and IV of Article 830

(E) Class 2 or Class 3 Conductors or Cables and Audio System Circuits.

Audio system circuits described in 640.9(C), and installed using Class 2, Class 3, or Class 4 wiring methods in compliance with 725.133 and 725.154 or 726.135, shall not be permitted to be installed in the same cable, raceway, or cable routing assembly with Class 4 conductors or cables.

726.141 Installation of Circuit Conductors Extending Beyond One Building.

Where CL4 circuit conductors extend beyond one building and are run so as to be subject to accidental contact with electric light or power conductors operating over

300 volts to ground, or are exposed to lightning on interbuilding circuits on the same premises, the requirements of the following shall also apply:

(1) Sections 800.44, 800.53, 800.100, 805.50, 805.93, 805.170(A), and 805.170(B) for other than coaxial conductors
(2) Sections 820.44, 820.93, and 820.100 for coaxial conductors

726.143 Support of Conductors.
CL4 circuit conductors shall not be strapped, taped, or attached by any means to the exterior of any conduit or other raceway as a means of support. These conductors shall be permitted to be installed as permitted by 300.11(C)(2).

726.170 Listing of Equipment for Class 4 Systems. The active components of a Class 4 system shall be listed as a Class 4 device.

Informational Note: Some examples of Class 4 devices can include a Class 4 power transmitter, a Class 4 power receiver, or Class 4 utilization equipment.

Where there is reliance on the interoperability of the system devices for the operation and safety of the CL4 system, the devices shall be listed as a system.

Informational Note: One way to determine applicable requirements for listing of Class 4 power systems is to refer to UL #####, *Standard for Class 4 Power Systems*.

726.176 Cables.

a) **Cable types.** Cables for Class 4 Power systems shall be types CL4, CL4R, or CL4P and shall be listed for a CL4 distribution system use.
b) **Uses not permitted.** CL4 cables shall not be permitted for any applications that are not part of a CL4 distribution system.

   Exception: Use of CL4 cable for other applications shall be permitted if the cable has multiple listings.

c) **Sizes.** Conductors of sizes not smaller than 24 AWG shall be permitted to be used.
d) **Insulation.** Insulation on conductors shall be rated not less than 600 volts.
e) **Voltage rating.** Cables shall have a voltage rating of not less than 600 volts.
f) **Temperature Rating.** Cables shall have a temperature rating of not less than 60°C (140°F).
g) **Cabling.** Cables shall comply with any requirements provided in the listing of the system.
   Informational Note: Excessive cable lengths can result in higher capacitance which could affect the safety of the circuit. For further information see <insert listing standard>.

726.179 Listing and Marking of CL4 Cables.

CL4 cables, installed as wiring methods within buildings, shall be listed as resistant to the spread of fire and other criteria in accordance with 726.179(A) through (D), shall be marked in accordance with 726.179(E), and shall be permitted to be marked in accordance with 726.179(F).

726.179(A) Type CL4P.

Type CL4P plenum cable shall be listed as suitable for use in ducts, plenums, and other space for environmental air and shall be listed as having adequate fire-resistant and low-smoke producing characteristics.

Informational Note: One method of defining a cable that is low-smoke producing and fire resistant is that the cable exhibits a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.52 m (5 ft) or less when tested in accordance with NFPA 262-2019, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces*.

726.179(B) Type CL4R.

Type CL4R riser cable shall be marked as Type CL4R, and be listed as suitable for use in a vertical run in a shaft or from floor to floor and shall be listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor.

Informational Note: One method of defining fire-resistant characteristics capable of preventing the carrying of fire from floor to floor is that the cables pass the requirements of ANSI/UL 1666-2012, *Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts.*

726.179(C) Type CL4.

Type CL4 cables shall be marked as Type CL4, and be listed as suitable for general-purpose use, with the exception of risers, ducts, plenums, and other space used for environmental air, and shall be listed as resistant to the spread of fire.

Informational Note: One method of defining *resistant to the spread of fire* is that the cables do not spread fire to the top of the tray in the UL flame exposure, vertical tray flame test in ANSI/UL 1685-2010, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*. The smoke measurements in the test method are not applicable.
Another method of defining *resistant to the spread of fire* is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA vertical flame test for cables in cable trays, as described in CSA C22.2 No. 0.3-M-2001, *Test Methods for Electrical Wires and Cables*.

726.179(D) Type CL4TC.

Type CL4TC nonmetallic-sheathed tray cable shall be listed as being suitable for cable trays and shall consist of a factory assembly of two or more insulated conductors under a nonmetallic jacket. The insulated conductors shall be at least 24 AWG copper (solid or stranded). Insulation on conductors shall be rated for 600 volts. The cable core shall be two or more parallel conductors, one or more group assemblies of twisted or parallel conductors, or a combination thereof. A metallic shield or a metallized foil shield with drain wire(s) shall be permitted to be applied over the cable core, over groups of conductors, or both. The cable shall be listed as resistant to the spread of fire. The outer jacket shall be a sunlight- and moisture-resistant nonmetallic material. Type CL4TC

cable used in a wet location shall be listed for use in wet locations or have a moisture-impervious metal sheath.

Exception No. 1: Where a smooth metallic sheath, continuous corrugated metallic sheath, or interlocking tape armor is applied over the nonmetallic jacket, an overall nonmetallic jacket shall not be required. On metallic-sheathed cable without an overall nonmetallic jacket, the information required in 310.8 shall be located on the nonmetallic jacket under the sheath.

Informational Note: One method of defining resistant to the spread of fire is that the cables do not spread fire to the top of the tray in the UL flame exposure, vertical tray flame test in ANSI/UL 1685-2010*, Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*. The smoke measurements in the test method are not applicable.

Another method of defining resistant to the spread of fire is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA vertical tray flame test for cables in cable trays, as described in CSA C22.2 No. 0.3- M-2001*, Test Methods for Electrical Wires and Cables*.

726.179(E) Marking.

All conductors and cables shall be marked to indicate the following information, using the applicable method described in 310.8(B):

a) The maximum rated voltage.
b) The cable type as described in 726.179 (A) through (D).
c) The manufacturer's name, trademark, or other distinctive marking by which the organization responsible for the product can be readily identified.
d) The AWG size or circular mil area.
e) The temperature rating of CL4 cables that have a temperature rating exceeding 60°C (140°F).

726.179(F) Optional Markings.

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note No. 1: These markings include, but are not limited to, markings for limited smoke, halogen free, low smoke and halogen free, and sunlight resistant.

Informational Note No. 2: Some examples of optional markings are ST1 to indicate limited smoke characteristics in accordance with UL 2556, *Wire and Cable Test Methods*; HF to indicate halogen free as described in UL 2885, *Outline of Investigation for Acid Gas, Acidity and Conductivity of Combusted Materials*; and LSHF to indicate halogen free and low smoke characteristics in accordance with IEC 61034-2, *Measurement of smoke density of cables burning under defined conditions — Part 2: Test procedure and requirements*.

Public Input No. 3962-NFPA 70-2020 [Section No. 725.2]

(Relocate all definitions in the 725. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

725. 2 Definitions.

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

Abandoned Class 2, Class 3, and PLTC Cable.

Installed Class 2, Class 3, and PLTC cable that is not terminated at equipment and not identified for future use with a tag.

Cable Bundle.

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

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

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. 4695-NFPA 70-2020 [Section No. 725.2]

725.2 Definitions.

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

Abandoned Class 2, Class 3, and PLTC Cable.

Installed Class 2, Class 3, and PLTC cable that is not terminated at equipment and not identified for future use with a tag.

Cable Bundle.

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

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

Class 2 Circuit, Bundle Limited (Bundle-limited Class 2 Circuit).

A Class 2 circuit subject to bundle size restrictions as defined in Table 725.144. (CMP-3)

Class 3 Circuit, Bundle Limited (Bundle-limited Class 3 Circuit).

A Class 3 circuit subject to bundle size restrictions as defined in Table 725.144. (CMP-3)

Statement of Problem and Substantiation for Public Input

These definitions are added to improve clarity along with a permissive rewrite of 725.144(A). The new definitions are used to clarify where Table 725.144 shoudl apply, and are part of the removal of the exception previously found in 725.144(A)

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4683-NFPA 70-2020 [Section No. 725.144(A)]	Section in which the new definitions are used
Public Input No. 4683-NFPA 70-2020 [Section No. 725.144(A)]	

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Public Input No. 1746-NFPA 70-2020 [Section No. 725.3]

725.3 Other Articles.

In addition to the requirements of this article, Class 1, Class 2, and Class 3 circuits and equipment shall comply with the articles or sections listed in 725.3(A) through (P). Only those sections of Article 300 referenced in this article shall apply to Class 1, Class 2, and Class 3 circuits.

(A) Number and Size of Conductors in Raceway.

~~Section.~~ The number of conductors and cables, as well as raceway sizing shall comply with 300.17.

(B) Spread of Fire or Products of Combustion.

Installation of Class 1, Class 2, and Class 3 circuits ~~shall comply~~ in hollow spaces, vertical shafts, and ventilation or air-handling ducts shall be made so that the possible spread of

fire or products of combustion will not be substantially increased in accordance with 300.21 .

(C) Ducts, Plenums, and Other Air-Handling Spaces.

Class 1, Class 2, and Class 3 circuits installed in ducts, plenums, or other space used for environmental air shall comply with 300.22.

Exception No. 1: Class 2 and Class 3 cables selected in accordance with Table 725.154 and installed in accordance with 725.135(B) and 300.22(B), Exception shall be permitted to be installed in ducts specifically fabricated for environmental air.

Exception No. 2: Class 2 and Class 3 cables selected in accordance with Table 725.154 and installed in accordance with 725.135(C) shall be permitted to be installed in other spaces used for environmental air (plenums).

(D) Hazardous (Classified) Locations.

Class 1, Class 2, and Class 3 circuits installed in hazardous (classified) locations shall comply with 501.10(B)(1), 501.150, 502.10(B)(1), 502.150, 503.10(A)(1), 503.150, 506.15(A), 506.15(C), 511.7(B)(1), 515.7(A), and Article 517, Part IV.

(E) Cable Trays.

Parts I and II of Article 392, where installed in cable tray.

(F) Motor Control Circuits.

~~Article 430, Part VI, where~~ Motor control circuits tapped from the load side of the motor branch-circuit protective device(s) as specified in 430.72(A) shall comply with Part IV of Article 430 .

(G) Instrumentation Tray Cable.

See 727.1 and 727.4 through 727.9.

(H) Raceways Exposed to Different Temperatures.

Installations shall comply with 300.7(A).

(I) Vertical Support for Fire-Rated Cables and Conductors.

Vertical installations of circuit integrity (CI) cables and conductors installed in a raceway or conductors and cables of electrical circuit protective systems shall be installed in accordance with 300.19.

(J) Bushing.

A bushing shall be installed where cables emerge from raceway used for mechanical support or protection in accordance with 300.15(C).

(K) Installation of Conductors with Other Systems.

Installations shall comply with 300.8.

(L) Corrosive, Damp, or Wet Locations.

Class 2 and Class 3 cables installed in corrosive, damp, or wet locations shall comply with the applicable requirements in 110.11, 300.5(B), 300.6, 300.9, and 310.10(F).

(M) Cable Routing Assemblies.

Class 2, Class 3, and Type PLTC cables shall be permitted to be installed in plenum cable routing assemblies, riser cable routing assemblies, and general-purpose cable routing assemblies selected in accordance with Table 800.154(c), listed in accordance with 800.182, and installed in accordance with 800.110(C) and 800.113.

(N) Communications Raceways.

Class 2, Class 3, and Type PLTC cables shall be permitted to be installed in plenum communications raceways, riser communications raceways, and general-purpose communications raceways selected in accordance with Table 800.154(b), listed in accordance with 800.182, and installed in accordance with 800.113 and 362.24 through 362.56, where the requirements applicable to electrical nonmetallic tubing (ENT) apply.

(O) Temperature Limitation of Class 2 and Class 3 Cables.

The requirements of 310.14(A)(3) on the temperature limitation of conductors shall apply to Class 2 and Class 3 cables.

(P) Identification of Equipment Grounding Conductors.

Equipment grounding conductors shall be identified in accordance with 250.119.

Exception: Conductors with green insulation shall be permitted to be used as ungrounded signal conductors for Types CL3P, CL2P, CL3R, CL2R, CL3, CL2, CL3X, CL2X, and substitute cables installed in accordance with 725.154(A).

Statement of Problem and Substantiation for Public Input

My edits are only editorial in nature. They are intended to make the rules so that they are easier to ready and add some 'body.'

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Public Input No. 1693-NFPA 70-2020 [Section No. 725.3(A)]

(A) ~~Number and Size of Conductors in~~ Raceway Installations .

~~Section~~

The number and size of conductors shall comply with 300.17 .

Statement of Problem and Substantiation for Public Input

The existing text of (A) does not comply with the NEC Style Manual. As currently written some sections of 725. 3 are complete sentences, others are phrases, and this one was simply a title followed by a section number. I am submitting public inputs to provide a consistent format for 725.3(A) through (P).

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Public Input No. 1694-NFPA 70-2020 [Section No. 725.3(E)]

(E) Cable Trays.

Cable tray installations shall comply with Parts I and II of Article 392~~, where installed in cable tray~~ .

Statement of Problem and Substantiation for Public Input

The existing text of (E) does not comply with the NEC Style Manual. As currently written some sections of 725. 3 are complete sentences, others are phrases. This one is not a complete sentence. I am submitting public inputs to provide a consistent format for 725.3(A) through (P).

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Public Input No. 1696-NFPA 70-2020 [Section No. 725.3(F)]

(F) Motor Control Circuits.

~~Article 430, Part VI, where~~ Class 1 motor control circuits that are tapped from the load side of the motor branch-circuit protective device(s) as specified in 430.72(A) shall comply with Article 430, Part VI .

Statement of Problem and Substantiation for Public Input

The existing text of (F) does not comply with the NEC Style Manual. As currently written some sections of 725. 3 are complete sentences, others are phrases. This one is an incomplete sentence. I am submitting public inputs to provide a consistent format for 725.3(A) through (P).

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Public Input No. 1697-NFPA 70-2020 [Section No. 725.3(G)]

(G) Instrumentation Tray Cable.

~~See.~~ Circuits wired using instrument tray cable shall comply with 727.1 ~~and 727.~~ 4 through 727.9.

Statement of Problem and Substantiation for Public Input

The existing text of (G) does not comply with the NEC Style Manual. As currently written some sections of 725. 3 are complete sentences, others are phrases. This one is not a complete sentence. I am submitting public inputs to provide a consistent format for 725.3(A) through (P).

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Committee: NEC-P03

Public Input No. 2756-NFPA 70-2020 [Section No. 725.3(G)]

(G) Instrumentation Tray Cable.

See ~~727~~ 341 .1~~ and 727.4 through 727.9~~ , 341.10, 341.12, 341.24, 341.80, 341.100, and 341.120

Statement of Problem and Substantiation for Public Input

This Public Comment is submitted on behalf of a task group appointed by the Chairs of NEC® CMP-3 & CMP-6. This Task Group was appointed to review whether NEC® Article 727 should be relocated to Chapter 3 where it was originally proposed. Task Group members are Dennis Nielsen, George Zimmerman, Jerry Kent, Ron Tellas, Kelly Lamp and Keith Waters.

Task Group members noted that ITC tray cable was originally accepted by CMP-6 for Chapter 3, however, the correlating committee at the time chose to have it put in Chapter 7. This Task Group's work confirmed that the material should be moved, but changes needed to be made to meet the chapter 3 style manual requirements. The PI to make this change is PI 2696.

The changes needed to be made to correlate the movement of Article 727 to Article 341 require these revisions in Article 725. These revisions match the requirements listed in 727 with the exception of overcurrent protection which is not needed per the chapter 3 style manual.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2696-NFPA 70-2020 [Article 727]	PI that creates the need for this change

Submitter Information Verification

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Committee: NEC-P03

Public Input No. 2140-NFPA 70-2020 [Section No. 725.3(I)]

(I) Vertical Support for Fire-~~Rated~~ Resistive Cables and Conductors.

Vertical installations of circuit integrity (CI) cables and conductors installed in a raceway or conductors and cables of ~~electrical circuit protective~~ fire resistive-cable systems shall be installed in accordance with 300.19.

Statement of Problem and Substantiation for Public Input

The language is revised to use the term “fire-resistive cable system” as used elsewhere in the NEC®. The language is updated to remain consistent with other uses throughout the NEC®, for correlation.

This public input is a result of the Correlating Committee Task Group for Circuit Integrity Cable efforts to correlate information on Circuit Integrity (-CI) cable throughout the NEC®. Members of the task group included Blake Shugarman from UL – Principal Engineer for Circuit Integrity Systems, Larry Shudak from UL - Principal Engineer for Life Safety Technologies and member of NFPA 72, Anthony Tassone from UL – Principal Engineer Seasonal and Holiday Decorative Products and Telecommunications Cables - CMP16, Jim Conrad from Marmon Innovation and Technology Group – CMP13, George Straniero from AFC Cable Systems – CMP6, CMP3, and CC, Paul Casparro from IBEW – CMP3, and Rich Holub from DuPont – CMP14 and CC.

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Committee: NEC-P03

Public Input No. 2732-NFPA 70-2020 [Section No. 725.3(M)]

(M) Cable Routing Assemblies.

Class 2, Class 3, and Type PLTC cables shall be permitted to be installed in plenum cable routing assemblies, riser cable routing assemblies, and general-purpose cable routing assemblies ~~selected in accordance with Table 800.154(c)~~ , listed in accordance with 800.182, and installed in accordance with 800.110(C) and 800.113.

Statement of Problem and Substantiation for Public Input

This is a coordinating Public Input to PI 2716.

PI 2716 recommends deletion of 800.154, which includes Tables 800.154(a), (b) & (c).

If the recommendation of PI 2716 is accepted, then all references to 800.154, and Tables 800.154(a), (b) &(c), will need to be deleted.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2716-NFPA 70-2020 [Section No. 800.154]	Deletes 800.154

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Committee: NEC-P03

Public Input No. 2733-NFPA 70-2020 [Section No. 725.3(N)]

(N) Communications Raceways.

Class 2, Class 3, and Type PLTC cables shall be permitted to be installed in plenum communications raceways, riser communications raceways, and general-purpose communications raceways ~~selected in accordance with Table 800.154(b)~~ , listed in accordance with 800.182, and installed in accordance with 800.113 and 362.24 through 362.56, where the requirements applicable to electrical nonmetallic tubing (ENT) apply.

Statement of Problem and Substantiation for Public Input

This is a coordinating Public Input to PI 2716.

PI 2716 recommends deletion of 800.154, which includes Tables 800.154(a), (b) & (c).

If the recommendation of PI 2716 is accepted, then all references to 800.154, and Tables 800.154(a), (b) &(c), will need to be deleted.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2716-NFPA 70-2020 [Section No. 800.154]	Deletes 800.154

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Public Input No. 3922-NFPA 70-2020 [Section No. 725.3(O)]

~~(O) Temperature Limitation of Class 2 and Class 3 Cables.~~

~~The requirements of 310.14(A)(3) on the temperature limitation of conductors shall apply to Class 2 and Class 3 cables.~~

Statement of Problem and Substantiation for Public Input

Referring to 310.14(A)(3) leads to Table 310.4(A) which does not include any conductor size smaller than 18 AWG. Most Class 2, Class 3 and power-limited fire alarm cables use smaller than 18 AWG conductors. In many cases, listed communications cables are substituted for Class 2, Class 3 and power-limited fire alarm cables. Article 800 has a simple requirement for the temperature limitation of communications cables:

“800.27 Temperature Limitation of Wires and Cables. No wire or cable shall be used in such a manner that its operating temperature exceeds that of its rating.”

This PI recommends a simple statement for the temperature limitation of cables in this article.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3920-NFPA 70-2020 [New Section after 725.25]	Linked action

Submitter Information Verification

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Submittal Date: Wed Sep 09 15:31:46 EDT 2020
Committee: NEC-P03

Public Input No. 2141-NFPA 70-2020 [Section No. 725.24]

725.24 Mechanical Execution of Work.

(A) General

Class 1, Class 2, and Class 3 circuits shall be installed in a neat and workmanlike manner. Cables and conductors installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be supported by straps, staples, hangers, cable ties, or similar fittings designed and installed so as not to damage the cable. The installation shall also comply with 300.4(D).

Informational Note: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants can result in an undetermined alteration of Class 1, Class 2, Class 3, and PLTC cable properties.

(B) Circuit Integrity (CI) Cable

Circuit integrity (CI) cable shall be supported at a distance not exceeding 610 mm (24 in.). Cable shall be secured to the noncombustible surface of the building structure. Cable supports and fasteners shall be steel.

Statement of Problem and Substantiation for Public Input

The language is revised to address support requirements for Circuit Integrity cable to remain consistent with other uses throughout the NEC®, for correlation.

This public input is a result of the Correlating Committee Task Group for Circuit Integrity Cable efforts to correlate information on Circuit Integrity (-CI) cable throughout the NEC®. Members of the task group included Blake Shugarman from UL – Principal Engineer for Circuit Integrity Systems, Larry Shudak from UL - Principal Engineer for Life Safety Technologies and member of NFPA 72, Anthony Tassone from UL – Principal Engineer Seasonal and Holiday Decorative Products and Telecommunications Cables - CMP16, Jim Conrad from Marmon Innovation and Technology Group – CMP13, George Straniero from AFC Cable Systems – CMP6, CMP3, and CC, Paul Casparro from IBEW – CMP3, and Rich Holub from DuPont – CMP14 and CC.

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Committee: NEC-P03

Public Input No. 301-NFPA 70-2020 [Section No. 725.24]

725.24 Mechanical Execution of Work.

See Section 110.12(C) for installations of Class 1, Class 2, and Class 3 circuits ~~shall be installed in a neat and workmanlike manner~~ . ~~Cables and conductors installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be supported by straps, staples, hangers, cable ties, or similar fittings designed and installed so as not to damage the cable. The installation shall also comply with 300.4(D)~~ .

~~Informational Note: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants can result in an undetermined alteration of Class 1, Class 2, Class 3, and PLTC cable properties.~~

Statement of Problem and Substantiation for Public Input

These requirements for the mechanical execution of work are now covered in Section 110.12(C) and are redundant here.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 305-NFPA 70-2020 [Section No. 800.24]	

Submitter Information Verification

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Committee: NEC-P03

Public Input No. 3038-NFPA 70-2020 [Section No. 725.24]

725.24 Mechanical Execution of Work.

Class 1, Class 2, and Class 3 circuits shall be installed in a neat and workmanlike manner. Cables and conductors installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be supported by straps, staples, hangers, cable ties listed and identified for securement and support , or similar fittings designed and installed so as not to damage the cable. The installation shall also comply with 300.4(D).

Informational Note: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants can result in an undetermined alteration of Class 1, Class 2, Class 3, and PLTC cable properties.

Statement of Problem and Substantiation for Public Input

The intent of this public input is to harmonize the cable securing and supporting requirements for Class 1, Class 2, and Class 3 circuits with the securing and supporting requirements for cable wirings methods in Chapter 3. Sections 320.30, 330.30, 334.30, and 337.30 require cable ties to be “listed and identified for securement and support”. This specific language is being added to 725.24 to ensure the same listing and securement requirement for cable ties also applies to cable ties used to support Class 1, Class 2, and Class 3 circuits.
As noted in the committee statement for First Revision No. 1803-NFPA 70-2015 covering this added language to 334.30; “Listing of cable ties approved for support of flexible conduits and cables is appropriate as the standard requires markings that identify critical performance ranges that can impact their suitability for use, including minimum and maximum operating temperature and resistance to ultraviolet light for outdoor installations. The proposed new requirements will provide for objective determination for suitability of cable ties for this use”.
This statement holds true for cable tie use to comply with 725.24.
Identical public inputs have been submitted for Sections 760.24, 770.24, and 800.24.

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Committee: NEC-P03

Public Input No. 3064-NFPA 70-2020 [Section No. 725.24]

725.24 Mechanical Execution of Work.

Class 1, Class 2, and Class 3 circuits shall be installed in a neat and workmanlike manner. Cables and conductors installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be supported by straps, staples, hangers, cable ties, or similar fittings designed and installed so as not to damage the cable. The installation shall also comply with 300.4~~(D)~~ .

Informational Note: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants can result in an undetermined alteration of Class 1, Class 2, Class 3, and PLTC cable properties.

Statement of Problem and Substantiation for Public Input

In the 2017 version of the NEC it was true that only 300.4(D) (rather than all of 300.4) needed to be followed for Articles 725 and 760 and for Chapter 8. However, in the last Code cycle CMPs started to appreciate the fact that these circuits need to be protected if the failure of the circuit could introduce an indirect fire or life hazard. In the 2020 version of the Code, Article 760 and Chapter 8 now require that the entirety of 300.4 be followed. To that end, this change would bring Article 725 in line with the rest of the NEC. There are already entire buildings (such as the Sinclair Hotel in Fort Worth) that are run entirely on Class 2, Class 3, and equivalent circuits and cables. Therefore, it is obvious that all life safety electrical systems in buildings such as this (including emergency lighting and building control circuits) must have the protection afforded to other types of circuits. Further, with the increasing use of technologies such as Power over Ethernet and Voltserver's Digital Electricity to power life safety systems, this change is not only necessary, it is likely overdue.

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Committee: NEC-P03

Public Input No. 3920-NFPA 70-2020 [New Section after 725.25]

725.27 Temperature Limitation of Class 2 and Class 3 Cables

No . Class 2 or Class 3 . cable shall be used in such a manner that its operating temperature exceeds that of its rating.

Statement of Problem and Substantiation for Public Input

Referring to 310.14(A)(3) leads to Table 310.4(A) which does not include any conductor size smaller than 18 AWG. Most Class 2, Class 3 and power-limited fire alarm cables use smaller than 18 AWG conductors. In many cases, listed communications cables are substituted for Class 2, Class 3 and power-limited fire alarm cables. Article 800 has a simple requirement for the temperature limitation of communications cables:

“800.27 Temperature Limitation of Wires and Cables. No wire or cable shall be used in such a manner that its operating temperature exceeds that of its rating.”

This PI recommends a simple statement for the temperature limitation of cables in this article.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3922-NFPA 70-2020 [Section No. 725.3(O)]	

Submitter Information Verification

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Committee: NEC-P03

Public Input No. 3351-NFPA 70-2020 [Section No. 725.31]

725.

~~31~~

31 Safety-Control Equipment.

(A)

Power Limited Circuits. ~~Remote-Control Circuits.~~

If the failure of safety-control equipment introduces a direct fire or life safety hazard, power-limited circuits shall be installed in accordance with Part I of Article 300 and with the wiring methods from the appropriate articles in Chapter 3. ~~Remote-control circuits for safety-control equipment shall be classified as~~

~~Class 1~~

~~Class 1 if the failure of the equipment to operate introduces a direct fire or life hazard. Room thermostats, water temperature regulating devices, and similar controls used in conjunction with electrically controlled household heating and air conditioning shall not be considered safety-control equipment.~~

Exception: Room thermostats, water temperature regulating devices, and similar controls used in conjunction with electrically controlled household heating and air conditioning is not considered safety-control equipment .

(B)

Physical Protection.

Where damage to ~~remote-control~~ power-limited circuits of safety-control equipment would introduce a hazard, as covered in 725.31(A) , all power-limited ~~conductors of such remote-control~~ circuits shall be installed in rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, electrical metallic tubing, Type MI cable, or Type MC cable, or be otherwise suitably protected from physical damage.

Statement of Problem and Substantiation for Public Input

Trying to clean up some confusion regarding section 725.31 (A) and (B). The original text states that remote control circuits shall be be classified as class 1 circuits when used for safety-control circuits, but this is incorrect. Classification of circuits are based on power sources, not protection requirements. Made the section more readable, and user friendly.

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Committee: NEC-P03

Public Input No. 1850-NFPA 70-2020 [Section No. 725.48(B)(3)]

(3) In a ~~Manhole~~ Maintenance hole .

Class 1 circuits and power-supply circuits shall be permitted to be installed as underground conductors in a ~~manhole~~ maintenance hole in accordance with one of the following:

(1) The power-supply or Class 1 circuit conductors are in a metal-enclosed cable or Type UF cable.

(2) The conductors are permanently separated from the power-supply conductors by a continuous firmly fixed nonconductor, such as flexible tubing, in addition to the insulation on the wire.

(3) The conductors are permanently and effectively separated from the power supply conductors and securely fastened to racks, insulators, or other approved supports.

Statement of Problem and Substantiation for Public Input

This is a general comment that applies to about 43 instances in several chapters of the code. A global update is needed to align with current terminology and other standards using the generic term maintenance hole defined below (from ANSI/TIA-569-E:2019):

maintenance hole: A vault located in the ground or earth as part of an underground duct system and used to facilitate placing, connecting, and maintaining cables as well as the placing of associated equipment, in which it is expected that a person will enter to perform work.

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Public Input No. 552-NFPA 70-2020 [Section No. 725.121(C)]

(C) Marking.

The power sources for limited power circuits in 725.121(A)(3), limited power circuits for listed audio/video equipment, listed information technology equipment, listed communications equipment, and listed industrial equipment in 725.121(A)(4) shall have a label indicating the maximum voltage and rated current output per conductor for each connection point on the power source. Where multiple connection points have the same rating, a single label shall be permitted to be used. For equipment with a rated current per conductor less than 0.3 amperes, the effective date shall be January 1, 2021.

Informational Note No. 1: Rated current for power sources covered in 725.144 is the output current per conductor the power source is designed to deliver to an operational load at normal operating conditions, as declared by the manufacturer.

Informational Note No. 2: An example of a label is “52V @ 0.433A, 57V MAX” for an IEEE 802.3 compliant Class 8 power source.

Additional Proposed Changes

File Name	Description	Approved
CMP_3_TIA_1438_issued_TIA_70_20_1.docx	NEC TIA 20-1 Log No. 1438	

Statement of Problem and Substantiation for Public Input

NOTE: This public input originates from Tentative Interim Amendment No. 20-1 (Log 1438) issued by the Standards Council on August 6, 2019 and per the NFPA Regs., needs to be reconsidered by the Code Making Panel for the next edition of the Document.

Substantiation: CMP-3 removed this exemption in the First Revision for 2020: “Exception – Marking shall not be required for power sources providing 0.3 amperes nominal current or less per conductor.” This imposes a new requirement on this equipment. Manufacturers will not be able to instantly comply and therefore, require time to make the appropriate changes to their equipment. The added text intentionally does not include equipment where the rated current exceeds 0.3A per conductor. This requirement was imposed in 2017 with an effective date ofJanuary 1, 2018. This equipment should already have this label and therefore is purposely excluded from coverage under this TIA.

Emergency Nature: The standard contains an error or an omission that was overlooked during the regular revision process. The proposed TIA intends to correct a circumstance in which the revised NFPA Standard has resulted in an adverse impact on a product or method that was inadvertently overlooked in the total revision process or was without adequate technical (safety) justification of the action.

As the 2020 code sits today, manufacturers will be required to comply on January 1, 2020. Unless they are involved in the revision process, they will not be aware of this new requirement and will not be able to comply on January 1, 2020.

Submitter Information Verification

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Submittal Date: Fri Feb 28 10:31:45 EST 2020
Committee: NEC-P03

Tentative Interim Amendment

NFPA® 70®

National Electrical Code®

2020 Edition

Reference: 725.121(C)
TIA 20-1
(SC 19-8-19 / TIA Log #1438)

Note: Text of the TIA was issued and approved for incorporation into the document prior to printing.

1. Revise 725.121(C) to read as follows:

725.121(C) Marking. The power sources for limited power circuits in 725.121(A)(3), limited power circuits for listed audio/video equipment, listed information technology equipment, listed communications equipment, and listed industrial equipment in 725.121(A)(4) shall have a label indicating the maximum voltage and maximum current or maximum voltage and nominal current output per conductor for each connection point on the power source. Where multiple connection points have the same rating, a single label shall be permitted to be used. For equipment with a rated current per conductor less than 0.3 amperes, the effective date shall be January 1, 2021.

Issue Date: August 6, 2019

Effective Date: August 26, 2019

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

Public Input No. 553-NFPA 70-2020 [Section No. 725.121(C)]

(C) Marking.

The power sources for limited power circuits in 725.121(A)(3), limited power circuits for listed audio/video equipment, listed information technology equipment, listed communications equipment, and listed industrial equipment in 725.121(A)(4) shall have a label indicating the maximum voltage and rated current output per conductor for each connection point on the power source. Where multiple connection points have the same rating, a single label shall be permitted to be used. For equipment with a rated current per conductor less than 0.3 amperes, the effective date shall be January 1, 2021.

Informational Note No. 1: Rated current for power sources covered in 725.144 is the output current per conductor the power source is designed to deliver to an operational load at normal operating conditions, as declared by the manufacturer.

Informational Note No. 2: An example of a label is “52V @ 0.433A, 57V MAX” for an IEEE 802.3 compliant Class 8 power source.

Additional Proposed Changes

File Name	Description	Approved
CMP_3_TIA_1444_issued_TIA_70_20_3.pdf	NEC TIA 70-3 Log No. 1444	

Statement of Problem and Substantiation for Public Input

NOTE: This public input originates from Tentative Interim Amendment No. 20-3 (Log 1444) issued by the Standards Council on August 6, 2019 and per the NFPA Regs., needs to be reconsidered by the Code Making Panel for the next edition of the Document.

Substantiation: There is concern about how PoE systems will be inspected to comply with the NEC. A consistent label format will greatly ease the inspector burden, making it easy to confirm an install complies with 840.160 or 725.144 with a glance. This was overlooked by the CMP. Time is of the essence; if this isn’t added to the 2020 code, waiting until 2023 will be too late. This timing issue is why this is being submitted as a TIA instead of waiting for the next revision cycle.

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

Labeling PoE ports for NEC compliance was introduced in the 2017 code, but only for devices that hadn’t yet started shipping in volume. The 2020 code will make a label mandatory for all new PSEs. The intention of the TIA is to get all the manufacturers to label their systems the same way, making it easy for anyone to quickly find the information required to confirm compliance.

Submitter Information Verification

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Committee: NEC-P03

Tentative Interim Amendment

NFPA® 70®

National Electrical Code®

2020 Edition

Reference: 725.121(C)
TIA 20-3
(SC 19-8-21 / TIA Log #1444)

Note: Text of the TIA was issued and approved for incorporation into the document prior to printing.

1. Revise 725.121(C) to read as follows:

725.121(C) Marking. The power sources for limited power circuits in 725.121(A)(3), limited power circuits for listed audio/video equipment, listed information technology equipment, listed communications equipment, and listed industrial equipment in 725.121(A)(4) shall have a label indicating the maximum voltage and rated current output per conductor for each connection point on the power source. Where multiple connection points have the same rating, a single label shall be permitted to be used.

Informational Note No. 1: Rated current for power sources covered in 725.144 is the output current per conductor the power source is designed to deliver to an operational load at normal operating conditions, as declared by the manufacturer.

Informational Note No. 2: An example of a label is "52V @ 0.433A, 57V MAX" for an IEEE 802.3 compliant Class 8 power source.

Issue Date: August 6, 2019

Effective Date: August 26, 2019

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

Public Input No. 4475-NFPA 70-2020 [Section No. 725.127]

725.127 Wiring Methods on Supply Side of the Class 2 or Class 3 Power Source.

Conductors and equipment on the supply side of the power source shall be installed in accordance with the appropriate requirements of Chapters 1 through 4. Transformers or other devices supplied from electric light or power circuits shall be protected by an overcurrent device rated not over 20 amperes.

Exception: The input leads of a transformer or other power source supplying Class 2 and Class 3 circuits shall be permitted to be smaller than 14 AWG, but not smaller than 18 AWG if they are not over 305 mm (12 in.) long and if they have insulation that complies with 725.49(B).

Exception: Equipent with inherently limited power sources shall be protected by an overcurrent device rated for the equipment power input requirements.

Statement of Problem and Substantiation for Public Input

The present language applies to equipment without internal current limiting or protection. Limited power systems powered from a internal equipment power source have current limiting and current protection. Power limited sources using a listed supply to generate the equipment power should have input circuit protection based on the input power supply requirements to that particular equipment. This input may, for example, use 239V at 30A or 40A to power equipment that has multiple power limited class 2 devices, as is common in power over Ethernet communications systems.

Submitter Information Verification

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Submittal Date: Thu Sep 10 13:44:32 EDT 2020
Committee: NEC-P03

Public Input No. 2116-NFPA 70-2020 [Section No. 725.130]

725.130 Wiring Methods and Materials on Load Side of the Class 2 or Class 3 Power Source.

(A) Class 1 Wiring Methods and Materials.

Class 2 and Class 3 circuits on the load side of the power source shall be permitted to

~~be installed using~~

use Class 1 wiring methods

~~and materials~~

installed in accordance with

~~either~~

725.

~~130(A) or (B).~~

~~**(A)** Class 1 Wiring Methods and Materials.~~

~~Installation shall be in accordance with 725.~~

46 .

Exception No. 1: The ampacity adjustment factors given in 310.15(C)(1) shall not apply.

Exception No. 2: Class 2 and Class 3 circuits shall be permitted to be reclassified and installed as Class 1 circuits if the Class 2 and Class 3 markings required in 725.124 are eliminated and the entire circuit is installed using the wiring methods and materials in accordance with Part II, Class 1 circuits.

Informational Note: Class 2 and Class 3 circuits reclassified and installed as Class 1 circuits are no longer Class 2 or Class 3 circuits, regardless of the continued connection to a Class 2 or Class 3 power source.

(B) Class 2 and Class 3 Wiring Methods.

Conductors on the load side of the power source shall be insulated at not less than the requirements of 725.179 and shall be installed in accordance with 725.133 and 725.154.

Exception No. 1: As provided for in 620.21 for elevators and similar equipment.

Exception No. 2: Other wiring methods and materials installed in accordance with the requirements of 725.3 shall be permitted to extend or replace the conductors and cables described in 725.179 and permitted by 725.130(B).

Exception No. 3: Bare Class 2 conductors shall be permitted as part of a listed intrusion protection system where installed in accordance with the listing instructions for the system.

Statement of Problem and Substantiation for Public Input

My edits are just to make it easier to understand what is permitted.

Submitter Information Verification

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Submittal Date: Sat Aug 01 15:35:44 EDT 2020
Committee: NEC-P03

Public Input No. 433-NFPA 70-2020 [Section No. 725.130]

725.130 Wiring Methods ~~and Materials~~ on Load Side of the Class 2 or Class 3 Power Source.

Class 2 and Class 3 circuits on the load side of the power source shall be permitted to be installed using wiring methods and materials in accordance with either 725.130(A) or (B).

(A) Class 1 Wiring Methods ~~and Materials~~ .

Installation shall be in accordance with 725.46.

Exception No. 1: The ampacity adjustment factors given in 310.15(C)(1) shall not apply.

Exception No. 2: Class 2 and Class 3 circuits shall be permitted to be reclassified and installed as Class 1 circuits if the Class 2 and Class 3 markings required in 725.124 are eliminated and the entire circuit is installed using the wiring methods and materials in accordance with Part II, Class 1 circuits.

Informational Note: Class 2 and Class 3 circuits reclassified and installed as Class 1 circuits are no longer Class 2 or Class 3 circuits, regardless of the continued connection to a Class 2 or Class 3 power source.

(B) Class 2 and Class 3 Wiring Methods.

Conductors on the load side of the power source shall be insulated at not less than the requirements of 725.179 and shall be installed in accordance with 725.133 and 725.154.

Exception No. 1: As provided for in 620.21 for elevators and similar equipment.

Exception No. 2: Other wiring methods and materials installed in accordance with the requirements of 725.3 shall be permitted to extend or replace the conductors and cables described in 725.179 and permitted by 725.130(B).

Exception No. 3: Bare Class 2 conductors shall be permitted as part of a listed intrusion protection system where installed in accordance with the listing instructions for the system.

Statement of Problem and Substantiation for Public Input

Revising the title in 725.130 and 725.130(A) will help match the format in 725.130(B). There is no need to include the term "materials". This will provide more usability, clarity and simplicity to Article 725.

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Submittal Date: Thu Feb 06 21:30:29 EST 2020
Committee: NEC-P03

Public Input No. 4112-NFPA 70-2020 [Section No. 725.130(B)]

(B) Class 2 and Class 3 Wiring Methods.

Conductors on the load side of the power source shall be insulated at not less ~~than the requirements of~~ than 725.179 and shall be installed in accordance with 725.133 and 725.154.

Exception No. 1: As provided for in 620.21 for elevators and similar equipment.

Exception No. 2: Other wiring methods and materials installed in accordance ~~with the requirements of~~ with 725.3 shall be permitted to extend or replace the conductors and cables described in 725.179 and permitted by 725.130(B).

Exception No. 3: Bare Class 2 conductors shall be permitted as part of a listed intrusion protection system where installed in accordance with the listing instructions for the system.

Statement of Problem and Substantiation for Public Input

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

Submitter Information Verification

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Submittal Date: Wed Sep 09 21:04:58 EDT 2020
Committee: NEC-P03

Public Input No. 434-NFPA 70-2020 [Section No. 725.133]

725.133 Installation of Conductors and Equipment ~~in Cables, Compartments, Cable Trays, Enclosures, Manholes, Outlet Boxes, Device Boxes, Raceways, and Cable Routing Assemblies~~ for Class 2 and Class 3 Circuits.

Conductors and equipment for Class 2 and Class 3 circuits shall be installed in accordance with 725.135 through 725.144.

Statement of Problem and Substantiation for Public Input

The title of section 725.133 is too cumbersome and needs to be simple. The proposed wording provides additional clarity, usability, and simplicity.

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Public Input No. 646-NFPA 70-2020 [Section No. 725.135(A)]

(A) Listing.

Class 2, Class 3, and PLTC cables installed in buildings shall be listed and installed in accordance with the limitations of the lsting .

Statement of Problem and Substantiation for Public Input

The requirement that cables be installed in accordance with the limitations of the listing is in 770.113(A). Logically, this requirement should also apply to copper cables.

Section 800.3(D) requires compliance with 110.3(B) which requires that equipment be installed in accordance with the listing. Explicit requirements for cables are need because the definition of equipment in Article 100 doesn't include cables.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 645-NFPA 70-2020 [Section No. 800.113(A)]	Companion PI for communications (Chapter 8) cables.
Public Input No. 647-NFPA 70-2020 [Section No. 760.135(A)]	Companion PI for Article 760 cables
Public Input No. 647-NFPA 70-2020 [Section No. 760.135(A)]	

Submitter Information Verification

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Submittal Date: Sat Mar 14 07:57:42 EDT 2020
Committee: NEC-P03

Public Input No. 679-NFPA 70-2020 [Section No. 725.135(B)]

(B) Ducts Specifically Fabricated for Environmental Air.

The following cables shall be permitted in ducts specifically fabricated for environmental air as described in 300.22(B) if directly associated with the air distribution system:

(1) Types CL2P and CL3P cables in lengths as short as practicable to perform the required function

(2) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X, and PLTC cables installed in raceways that are installed in compliance with 300.22(B)

Informational Note: For information on fire protection of wiring installed in fabricated ducts, see 4.3.4.1 and 4.3.11.3.3 of NFPA 90A ~~2018~~ 2021 , *Standard for the Installation of Air-Conditioning and Ventilating Systems.*

Statement of Problem and Substantiation for Public Input

Update issue date of NFPA 90A.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 678-NFPA 70-2020 [Section No. 300.22(C) [Excluding any Sub-Sections]]	Update issue date of NFPA 90A.
Public Input No. 680-NFPA 70-2020 [Section No. 760.135(B)]	Update issue date of NFPA 90A.
Public Input No. 681-NFPA 70-2020 [Section No. 770.24]	Update issue date of NFPA 90A.
Public Input No. 682-NFPA 70-2020 [Section No. 770.113(C)]	Update issue date of NFPA 90A.
Public Input No. 683-NFPA 70-2020 [Section No. 800.24]	Update issue date of NFPA 90A.
Public Input No. 684-NFPA 70-2020 [Section No. 800.113(B)]	Update issue date of NFPA 90A.
Public Input No. 685-NFPA 70-2020 [Section No. 800.113(C)]	Update issue date of NFPA 90A.
Public Input No. 686-NFPA 70-2020 [Section No. 800.182(A)]	Update issue date of NFPA 90A.
Public Input No. 687-NFPA 70-2020 [Section No. 805.170(C)]	Update issue date of NFPA 90A.
Public Input No. 688-NFPA 70-2020 [Section No. 770.113(B)]	Update issue date of NFPA 90A.
Public Input No. 678-NFPA 70-2020 [Section No. 300.22(C) [Excluding any Sub-Sections]]	
Public Input No. 680-NFPA 70-2020 [Section No. 760.135(B)]	
Public Input No. 681-NFPA 70-2020 [Section No. 770.24]	
Public Input No. 682-NFPA 70-2020 [Section No. 770.113(C)]	
Public Input No. 683-NFPA 70-2020 [Section No. 800.24]	
Public Input No. 684-NFPA 70-2020 [Section No. 800.113(B)]	
Public Input No. 685-NFPA 70-2020 [Section No. 800.113(C)]	
Public Input No. 686-NFPA 70-2020 [Section No. 800.182(A)]	
Public Input No. 687-NFPA 70-2020 [Section No. 805.170(C)]	
Public Input No. 688-NFPA 70-2020 [Section No. 770.113(B)]	

Submitter Information Verification

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Submittal Date: Wed Mar 18 03:57:21 EDT 2020
Committee: NEC-P03

Public Input No. 649-NFPA 70-2020 [Section No. 725.135(C)]

(C) Other Spaces Used for Environmental Air (Plenums).

The following cables shall be permitted in other spaces used for environmental air as described in 300.22(C):

(1) Types CL2P and CL3P cables

(2) Types CL2P and CL3P cables installed in plenum communications raceways

(3) Types CL2P and CL3P cables installed in plenum cable routing assemblies

(4) Types CL2P and CL3P cables and plenum communications raceways supported by open metallic cable trays or cable tray systems

(5) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X, and PLTC cables installed in raceways that are installed in compliance with 300.22(C)

(6) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X, and PLTC cables supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)

(7) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, CL2X, CL3X, and PLTC cables installed in plenum communications raceways, riser communications raceways, and general-purpose communications raceways supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)

Informational Note: For information on fire protection of wiring installed in other spaces used for environmental air (plenums), see NFPA 90A -2021, *Standard for the Installation of Air-Conditioning and Ventilating Systems.*

Statement of Problem and Substantiation for Public Input

The Standards Council has assigned primary responsibility for fire protection in air handling spaces to the Technical Committee on Air Conditioning and its document NFPA 90A Standard for the Installation of Air-Conditioning and Ventilating Systems. The informational note in 725.135 (B) Ducts Specifically Fabricated for Environmental Air, has a reference to NFPA 90A, while 725.135(C) Other Spaces Used for Environmental Air (Plenums), does not reference NFPA 90A. Why not?

Also, sections 770.113(C) and 800.113(C), with parallel requirements to 725.135(C) for Other Spaces Used or Environmental Air, reference NFPA 90A.

Please consider the NEC Style Manual statement on parallel construction:

“3.3.5 Parallel Construction. Parallel construction means stating similar requirements in similar ways for greater consistency. This helps makes the NEC clear for users. Lack of consistency often creates confusion, causing users to ask: Does this difference in wording represent a different requirement? Or is it simply two different ways of trying to say the same thing? There are several kinds of parallel construction…..”

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 660-NFPA 70-2020 [Section No. 760.135(C)]	Parallel PI for Article 760
Public Input No. 660-NFPA 70-2020 [Section No. 760.135(C)]	

Submitter Information Verification

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Committee: NEC-P03

Public Input No. 2435-NFPA 70-2020 [Section No. 725.135(H)]

(H) Cable Trays.

Cables installed in cable trays outdoors shall be Type PLTC. The following cables shall be permitted to be supported by cable trays in buildings:

(1) Types ~~CM~~ CL2P, CL3P, CL2R, CL3R, CL2, CL3, and PLTC cables

(2) Types CL2P, CL3P, CL2R, CL3R, CL2, CL3, and PLTC cables installed in the following:

(3) Plenum communications raceways

(4) Riser communications raceways

(5) General-purpose communications raceways

Statement of Problem and Substantiation for Public Input

The text 'CM' looks to be a cut paste error, further evidenced by the lack of proper punctuation in the list. This section doesn't cover CM cable and therefore it should be deleted. This PI is being entered in case the Chapter 7 Task Group cable reorganization text is rejected. If the output of that TG is accepted, then this text will have been corrected.

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Committee: NEC-P03

Public Input No. 2528-NFPA 70-2020 [New Section after 725.136(D)]

Multi-voltage (single junction, entry, pathway or connection) signaling control relay equipment

Packaged, or box type, control relays that physically cannot provide proper class 1,2 & 3 wire separation shall not be permitted for use in class 1 separation from either class 2 or class 3 wiring. Devices of this nature shall be permitted for use in controlling similar class wiring only. Relay devices with separate pathway's shall be required for use in separation of class 1,2 & 3 wiring.

Statement of Problem and Substantiation for Public Input

During building final inspections with AHCA for hospitals and electrical inspectors the same hurdle is constantly approached. There would be a single junction box with a relay mounted to it for exhaust fans, fire smoke dampers, roll up doors, variable frequency drives and all other types of start stop equipment. These common raceway junction boxes are always filled with a multitude of 24vac control wires and 120v/208/277/480 wires and wire nuts as well. This not only goes against the NEC/NFPA intent, but it also creates the issue of high voltages present in areas that are being accessed by low voltage controls and install contractors. This causes high voltage to hit low voltage wires and/or cause interference with building management and life safety equipment monitoring systems. It also poses maintenance problems for the owners of the buildings later in time when they have to repair or replace failed equipment. There are relay devices out that have solved this problem but have not yet been implemented into the requirements. Union workers have issues with these devices as well as they are not to have different trades/skill levels in the same equipment for liability purposes.

For reference, Functional Devices (Functionaldevices.com) RIBU1C and Veris Industries (Veris.com) Victory relay are 2 primary examples of the currently used devices that have led me to this submission.
Sigma-Innovations (Sigma-Innovations.com) has a SDR-N1LL that is designed to fully comply with the NEC/NFPA

Thank you for your consideration on this matter.

Submitter Information Verification

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Submittal Date: Mon Aug 24 09:36:31 EDT 2020
Committee: NEC-P03

Public Input No. 4260-NFPA 70-2020 [Section No. 725.136(D)]

(D) Associated Systems Within Enclosures.

Class 2 and Class 3 circuit conductors in compartments, enclosures, device boxes, outlet boxes, or similar fittings shall be permitted to be installed with electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits where they are introduced solely to connect the equipment connected to Class 2 and Class 3 circuits, and where (1) or (2) applies:

(1) The electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuit conductors are routed to maintain a minimum of 6 mm (~~0.25 in.~~ 1/4 in.) separation from the conductors and cables of Class 2 and Class 3 circuits.

(2) The circuit conductors operate at 150 volts or less to ground and also comply with one of the following:

(3) The Class 2 and Class 3 circuits are installed using Type CL3, CL3R, or CL3P or permitted substitute cables, provided these Class 3 cable conductors extending beyond the jacket are separated by a minimum of 6 mm (

~~0.25 in.~~

a. 1/4 in.) or by a nonconductive sleeve or nonconductive barrier from all other conductors.

b. The Class 2 and Class 3 circuit conductors are installed as a Class 1 circuit in accordance with 725.41 .

Statement of Problem and Substantiation for Public Input

By editing the text at 725.136(D)(1) and (d)(2), 725.136(D) the system added list items and broke up the original text. This was not my intent.

My intent was to replace the 0.25 with ¼ in. so as to be consistent with other areas of the NEC and also comply with the NEC Style Manual.

Other areas included as examples where this is designated as 6 mm (¼ in.) include: (partial list and not an all-inclusive list)

- 110.12(A)
- 250.30(A)(6)(c)(2)
- 250.64(D)(1)(3)
- 250.64(F)(3)
- 250.94(B)
- 300.6(D)
- 312.2
- 312.3

Submitter Information Verification

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Submittal Date: Thu Sep 10 08:44:07 EDT 2020
Committee: NEC-P03

Public Input No. 3058-NFPA 70-2020 [Section No. 725.139]

725.139 Installation of Conductors of Different Circuits in the Same Cable, Enclosure, Cable Tray, Raceway, or Cable Routing Assembly.

(A) Two or More Class 2 Circuits.

Conductors of two or more Class 2 circuits shall be permitted within the same cable, enclosure, raceway, or cable routing assembly.

(B) Two or More Class 3 Circuits.

Conductors of two or more Class 3 circuits shall be permitted within the same cable, enclosure, raceway, or cable routing assembly.

(C) Class 2 Circuits with Class 3 Circuits.

Conductors of one or more Class 2 circuits shall be permitted within the same cable, enclosure, raceway, or cable routing assembly with conductors of Class 3 circuits, provided that the insulation of the Class 2 circuit conductors in the cable, enclosure, raceway, or cable routing assembly is at least that required for Class 3 circuits.

(D) Class 2 and Class 3 Circuits with Communications Circuits.

(1) Communications Cables.

Conductors of one or more Class 2 or Class 3 circuits shall be permitted in the same cable with conductors of communications circuits provided the cable is a listed communications cable that shall be installed in accordance with the requirements of Part V of Article 805. The cables shall be listed as communications cables.

(2) Composite Cables.

Cables constructed of individually listed Class 2, Class 3, and communications cables under a common jacket shall be permitted to be classified as communications cables. The fire resistance rating of the composite cable shall be determined by the performance of the composite cable.

(E)

~~Class 2 or~~

Class 2 Circuits with Other Circuit Cables.

Class 2 circuits with an insulation of at least that required for Class 3 circuits shall be permitted in the same enclosure, cable tray, raceway, or cable routing assembly with jacketed cables of any of the following:

(1) Power-limited fire alarm systems in compliance with Parts I and III of Article 760

(2) Nonconductive and conductive optical fiber cables in compliance with Parts I and IV of Article 770

(3) Communications circuits in compliance with Parts I and IV of Article 805

(4) Community antenna television and radio distribution systems in compliance with Parts I and IV of Article 820

(5) Low-power, network-powered broadband communications in compliance with Parts I and IV of Article 830

(F) Class 3 Cables with Other Circuit Cables.

Jacketed cables of ~~Class 2 or~~ Class 3 circuits shall be permitted in the same enclosure, cable tray, raceway, or cable routing assembly with jacketed cables of any of the following:

(1) Power-limited fire alarm systems in compliance with Parts I and III of Article 760

(2) Nonconductive and conductive optical fiber cables in compliance with Parts I and IV of Article 770

(3) Communications circuits in compliance with Parts I and IV of Article 805

(4) Community antenna television and radio distribution systems in compliance with Parts I and IV of Article 820

(5) Low-power, network-powered broadband communications in compliance with Parts I and IV of Article 830

(F G) Class 2 or Class 3 Conductors or Cables and Audio System Circuits.

Audio system circuits described in 640.9(C), and installed using Class 2 or Class 3 wiring methods in compliance with 725.133 and 725.154, shall not be permitted to be installed in the same cable, raceway, or cable routing assembly with Class 2 or Class 3 conductors or cables.

Statement of Problem and Substantiation for Public Input

This is the change is necessary because as the section currently reads, Class 2 circuits on Class 2 cables is allowed to mix with PLFA circuits in PLFA cables along with the other cables in the list. Normally, an issue such as this would not be allowed by 300.3(C)(1), but due to the 725.3 exclusion of Article 300 and neither Parts I nor III of 725 citing 300.3(C)(1) this loophole has been left in place. The intent of this change is to close that loophole.

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Committee: NEC-P03

Public Input No. 4114-NFPA 70-2020 [Section No. 725.139(D)(1)]

(1) Communications Cables.

Conductors of one or more Class 2 or Class 3 circuits shall be permitted in the same cable with conductors of communications circuits provided the cable is a listed communications cable that shall be installed in accordance with ~~the requirements of~~ Part V of Article 805. The cables shall be listed as communications cables.

Statement of Problem and Substantiation for Public Input

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

Submitter Information Verification

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Committee: NEC-P03

Public Input No. 1766-NFPA 70-2020 [Section No. 725.144]

725.144 ~~Transmission of Power~~ Bundling of 4-Pair Cables Transmitting Power and Data.

Sections 725.144(A) and (B) shall apply to Class 2 and Class 3 circuits that transmit power and data to a powered device over listed 4-pair (8 conductor) cabling . Section 300.11 and Parts I and III of Article 725 shall apply to Class 2 and Class 3 circuits that transmit power and data. The conductors that carry power for the data circuits shall be copper. The current in the power circuit shall not exceed the current limitation of the connectors.

Informational Note No. 1: One example of the use of cables that transmit power and data is the connection of closed-circuit TV cameras (CCTV).

Informational Note No. 2: The 8P8C connector is in widespread use with powered communications systems. IEC 60603-7-2008, *Connectors for electronic equipment — Part 7-1: Detail specification for 8-way, unshielded, free and fixed connectors,* specifies these connectors to have a current-carrying capacity per contact of 1.0 amperes maximum at 60°C (149°F). See IEC 60603-7 for more information on current-carrying capacity at higher and lower temperatures.

Informational Note No. 3: The requirements of Table 725.144 were derived for carrying power and data over 4-pair copper balanced twisted pair cabling. This type of cabling is described in ANSI/TIA 568-C.2-2009, *Commercial Building Telecommunications Cabling Standard — Part 2: Balanced Twisted-Pair Telecommunications Cabling and Components*.

Informational Note No. 4: See TIA-TSB-184-A-2017, *Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling*, for information on installation and management of balanced twisted pair cabling supporting power delivery.

Informational Note No. 5: 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.

Informational Note No. 6: Rated current for power sources covered in 725.144 is the output current per conductor the power source is designed to deliver to an operational load at normal operating conditions, as declared by the manufacturer. In the design of these systems, the actual current in a given conductor might vary from the rated current per conductor by as much as 20 percent. An increase in current in one conductor is offset by a corresponding decrease in current in one or more conductors of the same cable.

Table 725.144 Ampacities of Each Conductor in Amperes in 4-Pair Class 2 or Class 3 Balanced Twisted-Pair Cables Based on Copper Conductors at an Ambient Temperature of 30°C (86°F) with All Conductors in All Cables Carrying Current, 60°C (140°F), 75°C (167°F), and 90°C (194°F) Rated Cables

		Number of 4-Pair Cables in a Bundle																	
		1–7			8–19			20–37			38–61			62–91			92–192		
		Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating		
AWG	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C
26	1.00	1.23	1.42	0.71	0.87	1.02	0.55	0.68	0.78	0.46	0.57	0.67	0.45	0.55	0.64	NA	NA	NA
24	1.19	1.46	1.69	0.81	1.01	1.17	0.63	0.78	0.91	0.55	0.67	0.78	0.46	0.56	0.65	0.40	0.48	0.55
23	1.24	1.53	1.78	0.89	1.11	1.28	0.77	0.95	1.10	0.66	0.80	0.93	0.58	0.71	0.82	0.45	0.55	0.63
22	1.50	1.86	2.16	1.04	1.28	1.49	0.77	0.95	1.11	0.66	0.82	0.96	0.62	0.77	0.89	0.53	0.63	0.72

Note 1: For bundle sizes over 192 cables, or for conductor sizes smaller than 26 AWG, ampacities shall be permitted to be determined by qualified personnel under engineering supervision.

Note 2: Where only half of the conductors in each cable are carrying current, the values in the table shall be permitted to be increased by a factor of 1.4.

Informational Note No. 1: Elevated cable temperatures can reduce a cable's data transmission performance. For information on practices for 4-pair balanced twisted pair cabling, see TIA-TSB-184-A and 6.4.7, 6.6.3, and Annex G of ANSI/TIA-568-C.2, which provide guidance on adjustments for operating temperatures between 20°C and 60°C.

Informational Note No. 2: The per-contact current rating of connectors can limit the maximum allowable current below the ampacity shown in Table 725.144.

(A) Use of Class 2 or Class 3 Cables to Transmit Power and Data.

Where Types CL3P, CL2P, CL3R, CL2R, CL3, or CL2 transmit power and data, the rated current per conductor of the power source shall not exceed the ampacities in Table 725.144 at an ambient temperature of 30°C (86°F). For ambient temperatures above 30°C (86°F), the correction factors in Table 310.15(B)(1) or in Equation 310.15(B) shall apply.

Exception: Compliance with Table 725.144 shall not be required for installations where conductors are 24 AWG or larger and the rated current per conductor of the power source does not exceed 0.3 amperes.

Informational Note: One example of the use of Class 2 cables is a network of closed-circuit TV cameras using 24 AWG, 60°C rated, Type CL2R, Category 5e balanced twisted-pair cabling.

(B) Use of Class 2-LP or Class 3-LP Cables to Transmit Power and Data.

Types CL3P-LP, CL2P-LP, CL3R-LP, CL2R-LP, CL3-LP, or CL2-LP shall be permitted to supply power to equipment from a power source with a rated current per conductor up to the marked current limit located immediately following the suffix "-LP" and shall be permitted to transmit data to the equipment. Where the number of bundled LP cables is 192 or less and the selected ampacity of the cables in accordance with Table 725.144 exceeds the marked current limit of the cable, the ampacity determined from the table shall be permitted to be used. For ambient temperatures above 30°C (86°F), the correction factors of Table 310.15(B)(1) or Equation 310.15(B) shall apply. The Class 2-LP and Class 3-LP cables shall comply with the following, as applicable:

(1) Cables with the suffix "-LP" shall be permitted to be installed in bundles, raceways, cable trays, communications raceways, and cable routing assemblies.

(2) Cables with the suffix "-LP" and a marked current limit shall follow the substitution hierarchy of Table 725.154 and Figure 725.154(A) for the cable type without the suffix "-LP" and without the marked current limit.

(3) System design shall be permitted by qualified persons under engineering supervision.

Informational Note: An example of a limited power (LP) cable is a cable marked Type CL2-LP(0.5A), 23 AWG.

Statement of Problem and Substantiation for Public Input

The revised title more accurately reflects the content of the section. The section relates to bundling of cables, and has no requirements specific to carrying data. The fact finding report provided for inclusion in the 2017 NEC did not include any data transmission in its experiments, and was focused entirely on cable heating due to the powering current in 4-pair cables.

The title of Table 725.144, like the data from the fact finding report it was based on, were specific to 4-Pair cabling. The informational note 3 to 725.144 clearly calls out that these requirements were derived for 4-Pair LAN cabling of the type described in TIA-568C.2-2009, which is commonly used for Ethernet systems, including power over Ethernet, and referred to as "Category" cabling. Table 725.144 clearly calls out it is for 4-Pair cabling in its title, leaving the user of the code at a loss for requirements for single-pair or other-than-four-pair cabling.

Additionally, if Table 725.144 were to be applied to single-pair cable, the ampacities in Table 725.144 are inconsistent with other sections and tables in the code, such as Table 522.22 which lists the ampacities of 60C 24 AWG and 22 AWG cables as 2 and 3 Amperes per conductor, respectively, whereas Table 725.144 lists them for 1 to 7 cables as 1.19 and 1.50 Amperes. These differences are likely due to the fact that Table 725.144 is based on the heat generated from 4 times as many conductors carrying current per cable, resulting in about 2 times the allowable current of a single pair cable.

Further, the proposed change improves correlation, by aligning 725.144 with 840.160 as it was revised in the 2020 code, which recognizes that the table and its data considered 4-pair cable only, and are only applicable to 4-pair cables.

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Public Input No. 2977-NFPA 70-2020 [Section No. 725.144]

725.144 Transmission of Power and Data.

Sections 725.144(A) and (B) shall apply to Class 2 and Class 3 circuits that transmit power and data to a powered device. Section 300.11 and Parts I and III of Article 725 shall apply to Class 2 and Class 3 circuits that transmit power and data. The conductors that carry power for the data circuits shall be copper. The current in the power circuit shall not exceed the current limitation of the connectors.

Informational Note No. 1: One example of the use of cables that transmit power and data is the connection of closed-circuit TV cameras (CCTV).

Informational Note No. 2: The 8P8C connector is in widespread use with powered communications systems. IEC 60603-7-2008, *Connectors for electronic equipment — Part 7-1: Detail specification for 8-way, unshielded, free and fixed connectors,* specifies these connectors to have a current-carrying capacity per contact of 1.0 amperes maximum at 60°C (149°F). See IEC 60603-7 for more information on current-carrying capacity at higher and lower temperatures.

Informational Note No. 3: The requirements of Table 725.144 were derived for carrying power and data over 4-pair copper balanced twisted pair cabling. This type of cabling is described in ANSI/TIA 568-C.2-2009, *Commercial Building Telecommunications Cabling Standard — Part 2: Balanced Twisted-Pair Telecommunications Cabling and Components*.

Informational Note No. 4: See TIA-TSB-184-A-2017, *Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling*, for information on installation and management of balanced twisted pair cabling supporting power delivery.

Informational Note No. 5: 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.

Informational Note No. 6: Rated current for power sources covered in 725.144 is the output current per conductor the power source is designed to deliver to an operational load at normal operating conditions, as declared by the manufacturer. In the design of these systems, the actual current in a given conductor might vary from the rated current per conductor by as much as 20 percent. An increase in current in one conductor is offset by a corresponding decrease in current in one or more conductors of the same cable.

Table 725.144 Ampacities of Each Conductor in Amperes in 4-Pair Class 2 or Class 3 Balanced Twisted-Pair Cables Based on Copper Conductors at an Ambient Temperature of 30°C (86°F) with All Conductors in All Cables Carrying Current, 60°C (140°F), 75°C (167°F), and 90°C (194°F) Rated Cables

		Number of 4-Pair Cables in a Bundle																	
		1–7			8–19			20–37			38–61			62–91			92–192		
		Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating		
AWG	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C
26	1.00	1.23	1.42	0.71	0.87	1.02	0.55	0.68	0.78	0.46	0.57	0.67	0.45	0.55	0.64	NA	NA	NA
24	1.19	1.46	1.69	0.81	1.01	1.17	0.63	0.78	0.91	0.55	0.67	0.78	0.46	0.56	0.65	0.40	0.48	0.55
23	1.24	1.53	1.78	0.89	1.11	1.28	0.77	0.95	1.10	0.66	0.80	0.93	0.58	0.71	0.82	0.45	0.55	0.63
22	1.50	1.86	2.16	1.04	1.28	1.49	0.77	0.95	1.11	0.66	0.82	0.96	0.62	0.77	0.89	0.53	0.63	0.72

Note 1: For bundle sizes over 192 cables, or for conductor sizes smaller than 26 AWG, ampacities shall be permitted to be determined by qualified personnel under engineering supervision.

Note 2: Where only half of the conductors in each cable are carrying current, the values in the table shall be permitted to be increased by a factor of 1.4.

Note 3: The count of cables in the bundle shall not include cables connected to electrical components that cannot be simultaneously energized.

Informational Note No. 1: Elevated cable temperatures can reduce a cable's data transmission performance. For information on practices for 4-pair balanced twisted pair cabling, see TIA-TSB-184-A and 6.4.7, 6.6.3, and Annex G of ANSI/TIA-568-C.2, which provide guidance on adjustments for operating temperatures between 20°C and 60°C.

Informational Note No. 2: The per-contact current rating of connectors can limit the maximum allowable current below the ampacity shown in Table 725.144.

(A) Use of Class 2 or Class 3 Cables to Transmit Power and Data.

Where Types CL3P, CL2P, CL3R, CL2R, CL3, or CL2 transmit power and data, the rated current per conductor of the power source shall not exceed the ampacities in Table 725.144 at an ambient temperature of 30°C (86°F). For ambient temperatures above 30°C (86°F), the correction factors in Table 310.15(B)(1) or in Equation 310.15(B) shall apply.

Exception: Compliance with Table 725.144 shall not be required for installations where conductors are 24 AWG or larger and the rated current per conductor of the power source does not exceed 0.3 amperes.

Informational Note: One example of the use of Class 2 cables is a network of closed-circuit TV cameras using 24 AWG, 60°C rated, Type CL2R, Category 5e balanced twisted-pair cabling.

(B) Use of Class 2-LP or Class 3-LP Cables to Transmit Power and Data.

Types CL3P-LP, CL2P-LP, CL3R-LP, CL2R-LP, CL3-LP, or CL2-LP shall be permitted to supply power to equipment from a power source with a rated current per conductor up to the marked current limit located immediately following the suffix "-LP" and shall be permitted to transmit data to the equipment. Where the number of bundled LP cables is 192 or less and the selected ampacity of the cables in accordance with Table 725.144 exceeds the marked current limit of the cable, the ampacity determined from the table shall be permitted to be used. For ambient temperatures above 30°C (86°F), the correction factors of Table 310.15(B)(1) or Equation 310.15(B) shall apply. The Class 2-LP and Class 3-LP cables shall comply with the following, as applicable:

(1) Cables with the suffix "-LP" shall be permitted to be installed in bundles, raceways, cable trays, communications raceways, and cable routing assemblies.

(2) Cables with the suffix "-LP" and a marked current limit shall follow the substitution hierarchy of Table 725.154 and Figure 725.154(A) for the cable type without the suffix "-LP" and without the marked current limit.

(3) System design shall be permitted by qualified persons under engineering supervision.

Informational Note: An example of a limited power (LP) cable is a cable marked Type CL2-LP(0.5A), 23 AWG.

Statement of Problem and Substantiation for Public Input

Table 725.144 is based on all cables being connected to a PoE power source capable of providing full power to all cables. However, it is seldom the case that all the cables in a bundle are connected to such a source. The NEC provides guidance for counting unpowered conductors in Table 310.15(C)(1), noting that conductors that cannot be simultaneously energized shall not be counted, and should do similarly here.

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Public Input No. 4683-NFPA 70-2020 [Section No. 725.144(A)]

(A) Use of Class 2 or Class 3 Cables to Transmit Power and Data.

~~Where Types~~

Eight-conductor (4 pair) type CL3P, CL2P, CL3R, CL2R, CL3, or CL2

~~transmit power and data,~~

cables using 24 AWG or larger conductors shall be permitted to carry power and data utilizing power sources with rated currents up to 0.3 amperes per conductor without bundle size restrictions.

Bundle-limited Class 2 Circuits and bundle-limited Class 3 Circuit s are circuits utilizing power sources with rated current per conductor exceeding 0.3 amperes, or cables with smaller than 24 AWG conductors. For Bundle-limited class 2 or bundle-limited class 3 circuits, the rated current per conductor of the power source shall not exceed the ampacities for the given bundle size and cable temperature rating in Table 725.144 at an ambient temperature of 30°C (86°F) for eight-conductor (4 pair) type CL3P, CL2P, CL3R, CL2R, CL3, or CL2 cables . For ambient temperatures above 30°C (86°F), the correction factors in Table 310.15(B)(1) or in Equation 310.15(B) shall apply

.

~~Exception: Compliance with~~

to the ampacities in Table 725.144

~~shall not be required for installations where conductors are 24 AWG or larger and the rated current per conductor of the power source does not exceed 0~~

.

~~3 amperes.~~

Informational Note: One example of the use of Class 2 cables is a network of closed-circuit TV cameras using 24 AWG, 60°C rated, Type CL2R, Category 5e balanced twisted-pair cabling.

Statement of Problem and Substantiation for Public Input

It has been reported that this section is still not completely clear to installers and inspectors. In order to clarify, as well as to agree with style guidelines, eliminating the exception, and improve correlation, 725.144(A) and its exception are rewritten in permissive language, correlating with 840.160 and the title of Table 725.144 to relate to 4-pair cabling. Other than the correlation, there is no technical change.

Further, the creation of 725.144(A) introduced requirements for both Class 2 and Class 3 circuits that effectively divided them into two classes: those that must comply with the bundle limit tables, and those that that are exempted. However, the code did not provide specific terminology to differentiate these circuits. This change would provide clear terms for code users to use when describing bundle-limited circuit types, which differ significantly in the installation procedure and inspection requirements.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 4695-NFPA 70-2020 [Section No. 725.2]	Definitions used to distinguish circuits subject to Table 725.144
Public Input No. 4695-NFPA 70-2020 [Section No. 725.2]	

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Public Input No. 1722-NFPA 70-2020 [Section No. 725.144(B)]

(B) Use of Class 2-LP or Class 3-LP Cables to Transmit Power and Data.

Types CL3P-LP, CL2P-LP, CL3R-LP, CL2R-LP, CL3-LP, or CL2-LP shall be permitted to supply power to equipment from a power source with a rated current per conductor up to the marked current limit located immediately following the suffix "-LP" and shall be permitted to transmit data to the equipment. Where the number of bundled LP cables is 192 or less and the selected ampacity of the cables in accordance with Table 725.144 exceeds the marked current limit of the cable, the ampacity determined from the table shall be permitted to be used. For ambient temperatures above 30°C (86°F), the correction factors of Table 310.15(B)(1) or Equation 310.15(B) shall apply. The Class 2-LP and Class 3-LP cables shall comply with the following, as applicable:

(1) Cables with the suffix "-LP" shall be permitted to be installed in bundles, raceways, cable trays, communications raceways, and cable routing assemblies.

(2) Cables with the suffix "-LP" and a marked current limit shall follow the substitution hierarchy of Table 725.154 and Figure 725.154(A) for the cable type without the suffix "-LP" and without the marked current limit.

(3) System design shall be permitted by qualified persons under engineering supervision.

Informational Note: An example of a limited power (LP) cable is a cable marked Type CL2-LP(0.5A) ~~, 23 AWG~~ 75°C 23 AWG .

Statement of Problem and Substantiation for Public Input

A reference to the required temperature rating marking of LP cables should be included to be complete and consistent with required cable markings. This reference will clarify that the ampacity values are derived based on the maximum cable temperature rating.

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Public Input No. 4022-NFPA 70-2020 [Section No. 725.144(B)]

(B) Use of Class 2-LP or Class 3-LP Cables to Transmit Power and Data.

Types CL3P-LP, CL2P-LP, CL3R-LP, CL2R-LP, CL3-LP, or CL2-LP shall be permitted to supply power

~~to equipment from a power source with a~~

and data to equipment. When installed in bundles of 192 or less and operated in ambient temperatures of 30°C (86°F) or less, these cables are permitted to supply power up to the rated current per conductor

~~up to the marked current limit~~

marked on the cable, located immediately following the suffix "-LP"

~~and shall be permitted to transmit data to the equipment. Where the number of bundled LP cables is 192 or less and the selected ampacity of the cables in accordance with Table 725.144 exceeds the marked current limit of the cable, the ampacity determined from the table shall be permitted to be used. For~~

. These cables may also be installed using the ampacity values and bundle size limits given in Table 725.144. When operated in ambient temperatures above 30°C (86°F), the correction factors of Table 310.15(B)(1) or Equation 310.15(B)

~~shall apply. The Class 2-LP and Class 3-LP cables shall comply with the following, as applicable:~~

need to be applied to the ampacity limits given in table 725.144 as well as the rated current limit marked on the cable.

Types CL3P-LP, CL2P-LP, CL3R-LP, CL2R-LP, CL3-LP, or CL2-LP shall be permitted to supply power and data to equipment.

(1) Cables with the suffix "-LP" shall be permitted to be installed in bundles, raceways, cable trays, communications raceways, and cable routing assemblies.

(2) Cables with the suffix "-LP" and a marked current limit shall follow the substitution hierarchy of Table 725.154 and Figure 725.154(A) for the cable type without the suffix "-LP" and without the marked current limit.

(3) System design shall be permitted by qualified persons under engineering supervision.

Informational Note: An example of the markings on a Class 2 limited power (LP) cable ~~is a cable marked Type CL2~~ having a rated current of 0.5 amperes per conductor at 30°C (86°F), and a temperature rating of 75°C are "CL2 -LP(0. ~~5A~~ 5A@30°C) , ~~23 AWG~~ 75°C 23 AWG" .

Statement of Problem and Substantiation for Public Input

Rational: The proposed text clarifies the existing text. In addition "@30°C" is added to the markings on the cable immediately following the LP current limit so that it is made clear that the marked LP value only applies up to @30°C (86°F). This is needed because with the existing method of marking, the cable's temperature rating immediately follows the cable's LP current rating which incorrectly suggests that it would apply at the rated temperature of the cable. This would potentially cause the cable to overheat if installed accordingly. Above @30°C (86°F) table 310.15(B)(1) or Equation 310.15(B) needs to be applied to the ampacity limits given in table 725.144 as well as the rated current limit marked on the cable as instructed in the text.

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Public Input No. 3732-NFPA 70-2020 [Section No. 725.144 [Excluding any Sub-Sections]]

Sections 725.144(A) and (B) shall apply to Class 2 and Class 3 circuits that transmit power and data to a powered device. ~~Section 300.11 and Parts I and III of Article 725 shall apply to Class 2 and Class 3 circuits that transmit power and data. The~~ The conductors that carry power for the data circuits shall be copper. The current in the power circuit shall not exceed the current limitation of the connectors.

Informational Note No. 1: One example of the use of cables that transmit power and data is the connection of closed-circuit TV cameras (CCTV).

Informational Note No. 2: The 8P8C connector is in widespread use with powered communications systems. IEC 60603-7-2008, *Connectors for electronic equipment — Part 7-1: Detail specification for 8-way, unshielded, free and fixed connectors,* specifies these connectors to have a current-carrying capacity per contact of 1.0 amperes maximum at 60°C (149°F). See IEC 60603-7 for more information on current-carrying capacity at higher and lower temperatures.

Informational Note No. 3: The requirements of Table 725.144 were derived for carrying power and data over 4-pair copper balanced twisted pair cabling. This type of cabling is described in ANSI/TIA 568-C.2-2009, *Commercial Building Telecommunications Cabling Standard — Part 2: Balanced Twisted-Pair Telecommunications Cabling and Components*.

Informational Note No. 4: See TIA-TSB-184-A-2017, *Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling*, for information on installation and management of balanced twisted pair cabling supporting power delivery.

Informational Note No. 5: 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.

Informational Note No. 6: Rated current for power sources covered in 725.144 is the output current per conductor the power source is designed to deliver to an operational load at normal operating conditions, as declared by the manufacturer. In the design of these systems, the actual current in a given conductor might vary from the rated current per conductor by as much as 20 percent. An increase in current in one conductor is offset by a corresponding decrease in current in one or more conductors of the same cable.

Table 725.144 Ampacities of Each Conductor in Amperes in 4-Pair Class 2 or Class 3 Balanced Twisted-Pair Cables Based on Copper Conductors at an Ambient Temperature of 30°C (86°F) with All Conductors in All Cables Carrying Current, 60°C (140°F), 75°C (167°F), and 90°C (194°F) Rated Cables

	-	Number of 4-Pair Cables in a Bundle																
	-	1–7			8–19			20–37			38–61			62–91			92–192	
	-	Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating			Temperature Rating	
AWG	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C	60°C	75°C	90°C
26	1.00	1.23	1.42	0.71	0.87	1.02	0.55	0.68	0.78	0.46	0.57	0.67	0.45	0.55	0.64	NA	NA	NA
24	1.19	1.46	1.69	0.81	1.01	1.17	0.63	0.78	0.91	0.55	0.67	0.78	0.46	0.56	0.65	0.40	0.48	0.55
23	1.24	1.53	1.78	0.89	1.11	1.28	0.77	0.95	1.10	0.66	0.80	0.93	0.58	0.71	0.82	0.45	0.55	0.63
22	1.50	1.86	2.16	1.04	1.28	1.49	0.77	0.95	1.11	0.66	0.82	0.96	0.62	0.77	0.89	0.53	0.63	0.72

Note 1: For bundle sizes over 192 cables, or for conductor sizes smaller than 26 AWG, ampacities shall be permitted to be determined by qualified personnel under engineering supervision.

Note 2: Where only half of the conductors in each cable are carrying current, the values in the table shall be permitted to be increased by a factor of 1.4.

Informational Note No. 1: Elevated cable temperatures can reduce a cable's data transmission performance. For information on practices for 4-pair balanced twisted pair cabling, see TIA-TSB-184-A and 6.4.7, 6.6.3, and Annex G of ANSI/TIA-568-C.2, which provide guidance on adjustments for operating temperatures between 20°C and 60°C.

Informational Note No. 2: The per-contact current rating of connectors can limit the maximum allowable current below the ampacity shown in Table 725.144.

Statement of Problem and Substantiation for Public Input

There is no reason for this text to exist.

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Public Input No. 2142-NFPA 70-2020 [Section No. 725.154(B)]

(B) Class 2, Class 3, PLTC Circuit Integrity (CI) Cable, Fire-Resistive Cable System or Electrical Circuit Protective System.

Listed Circuit integrity (CI) cable,a listed fire resistive cable system or a listed electrical circuit protective system shall be permitted for use in remote control, signaling, or power-limited systems that supply critical circuits to ensure survivability for continued circuit operation for a specified time under fire conditions.

Statement of Problem and Substantiation for Public Input

The language is revised to allow a fire-resistive cable system or an electrical circuit protective system. The language is updated to remain consistent with other uses throughout the NEC®, for correlation.

This public input is a result of the Correlating Committee Task Group for Circuit Integrity Cable efforts to correlate information on Circuit Integrity (-CI) cable throughout the NEC®. Members of the task group included Blake Shugarman from UL – Principal Engineer for Circuit Integrity Systems, Larry Shudak from UL - Principal Engineer for Life Safety Technologies and member of NFPA 72, Anthony Tassone from UL – Principal Engineer Seasonal and Holiday Decorative Products and Telecommunications Cables - CMP16, Jim Conrad from Marmon Innovation and Technology Group – CMP13, George Straniero from AFC Cable Systems – CMP6, CMP3, and CC, Paul Casparro from IBEW – CMP3, and Rich Holub from DuPont – CMP14 and CC.

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Public Input No. 2436-NFPA 70-2020 [Section No. 725.154 [Excluding any Sub-Sections]]

Class 2, Class 3, and PLTC cables shall comply with any of the requirements described in 725.154(A) through (C) and as indicated in Table 725.154.

Table 725.154 Applications of Listed Class 2, Class 3, CMUC, and PLTC Cables in Buildings

Applications		- CL2P & CL3P	- CL2R & CL3R	Cable Type CL2 & CL3	CL2X & CL3X	CMUC	PLTC	
In fabricated ducts as described in 300.22(B)	In fabricated ducts	Y*	N	N	N	N	N	
	In metal raceway that complies with 300.22(B)	Y*	Y*	Y*	Y*	N	Y*	
In other spaces used for environmental air as described in 300.22(C)	In other spaces used for environmental air	Y*	N	N	N	N	N	
	In metal raceway that complies with 300.22(C)	Y*	Y*	Y*	Y*	N	Y*	
	In plenum communications raceways	Y*	N	N	N	N	N	
	In plenum cable routing assemblies	Y*	N	N	N	N	N	
	Supported by open metal cable trays	Y*	N	N	N	N	N	
	Supported by solid bottom metal cable trays with solid metal covers	Y*	Y*	Y*	Y*	N	~~N~~ Y*	
In risers	In vertical runs	Y*	Y*	N	N	N	N	
	-	In metal raceways	Y*	Y*	Y*	Y*	N	Y*
	-	In fireproof shafts	Y*	Y*	Y*	Y*	N	Y*
	-	In plenum communications raceways	Y*	Y*	N	N	N	N
	-	In plenum cable routing assemblies	Y*	Y*	N	N	N	N
	-	In riser communications raceways	Y*	Y*	N	N	N	N
	-	In riser cable routing assemblies	Y*	Y*	N	N	N	N
	-	In one- and two-family dwellings	Y*	Y*	Y*	Y*	N	Y*
Within buildings in other than air-handling spaces and risers	General	Y*	Y*	Y*	Y*	N	Y*	
	In one- and two-family dwellings	Y*	Y*	Y*	Y*	Y*	Y*	
	In multifamily dwellings	Y*	Y*	Y*	Y*	Y*	Y*	
	In nonconcealed spaces	Y*	Y*	Y*	Y*	Y*	Y*	
	Supported by cable trays	Y*	Y*	Y*	N	N	Y*	
	Under carpet	N	N	N	N	Y*	N	
	In cross-connect arrays	Y*	Y*	Y*	N	N	Y*	
	In any raceway recognized in Chapter 3	Y*	Y*	Y*	Y*	N	Y*	
	In plenum communications raceways	Y*	Y*	Y*	N	N	Y*	
	In plenum cable routing assemblies	Y*	Y*	Y*	N	N	Y*	
	In riser communications raceways	Y*	Y*	Y*	N	N	Y*	
	In riser cable routing assemblies	Y*	Y*	Y*	N	N	Y*	
	In general-purpose communications raceways	Y*	Y*	Y*	N	N	Y*	
	In general-purpose cable routing assemblies	Y*	Y*	Y*	N	N	Y*	

Note: “N” indicates that the cable type shall not be permitted to be installed in the application.

“Y*” indicates that the cable type shall be permitted to be installed in the application, subject to the limitations described in 725.130 through 725.143.

Statement of Problem and Substantiation for Public Input

This entry maps to the test in 725.135(C)(6). That section clearly states that PLTC is allowed.

This PI is being entered in case the Chapter 7 Task Group cable reorganization text is rejected. If the output of that TG is accepted, then this text will have been corrected.

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Public Input No. 313-NFPA 70-2020 [Section No. 725.179]

725.179 Listing and Marking of Class 2, Class 3, and Type PLTC Cables.

Class 2, Class 3, and Type PLTC cables, installed as wiring methods within buildings, shall be listed as resistant to the spread of fire and other criteria in accordance with 725.179(A) through (I), shall be marked in accordance with 725.179(J K), and shall be permitted to be marked in accordance with 725.179(K L).

(A) Types CL2P and CL3P.

Types CL2P and CL3P plenum cable shall be listed as suitable for use in ducts, plenums, and other space for environmental air and shall be listed as having adequate fire-resistant and low-smoke producing characteristics.

Informational Note: One method of defining a cable that is low-smoke producing and fire resistant is that the cable exhibits a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.52 m (5 ft) or less when tested in accordance with NFPA 262-2019, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces*.

(B) Types CL2R and CL3R.

Types CL2R and CL3R riser cables shall be marked as Type CL2R or CL3R, respectively, and be listed as suitable for use in a vertical run in a shaft or from floor to floor and shall be listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor.

Informational Note: One method of defining fire-resistant characteristics capable of preventing the carrying of fire from floor to floor is that the cables pass the requirements of ANSI/UL 1666-2012, *Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts*.

(C) Types CL2 and CL3.

Types CL2 and CL3 cables shall be marked as Type CL2 or CL3, respectively, and be listed as suitable for general-purpose use, with the exception of risers, ducts, plenums, and other space used for environmental air, and shall be listed as resistant to the spread of fire.

Informational Note: One method of defining *resistant to the spread of fire* is that the cables do not spread fire to the top of the tray in the UL flame exposure, vertical tray flame test in ANSI/UL 1685-2010, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*. The smoke measurements in the test method are not applicable.

Another method of defining *resistant to the spread of fire* is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA vertical flame test for cables in cable trays, as described in CSA C22.2 No. 0.3-M-2001, *Test Methods for Electrical Wires and Cables*.

(D) Types CL2X and CL3X.

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

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

(E) Type PLTC.

Type PLTC nonmetallic-sheathed, power-limited tray cable shall be listed as being suitable for cable trays and shall consist of a factory assembly of two or more insulated conductors under a nonmetallic jacket. The insulated conductors shall be 22 AWG through 12 AWG. The conductor material shall be copper (solid or stranded). Insulation on conductors shall be rated for 300 volts. The cable core shall be two or more parallel conductors, one or more group assemblies of twisted or parallel conductors, or a combination thereof. A metallic shield or a metallized foil shield with drain wire(s) shall be permitted to be applied over the cable core, over groups of conductors, or both. The cable shall be listed as resistant to the spread of fire. The outer jacket shall be a sunlight- and moisture-resistant nonmetallic material. Type PLTC cable used in a wet location shall be listed for use in wet locations or have a moisture-impervious metal sheath.

Exception No. 1: Where a smooth metallic sheath, continuous corrugated metallic sheath, or interlocking tape armor is applied over the nonmetallic jacket, an overall nonmetallic jacket shall not be required. On metallic-sheathed cable without an overall nonmetallic jacket, the information required in 310.8 shall be located on the nonmetallic jacket under the sheath.

Exception No. 2: Conductors in PLTC cables used for Class 2 thermocouple circuits shall be permitted to be any of the materials used for thermocouple extension wire.

Informational Note: One method of defining *resistant to the spread of fire* is that the cables do not spread fire to the top of the tray in the UL flame exposure, vertical tray flame test in ANSI/UL 1685-2010, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*. The smoke measurements in the test method are not applicable.

Another method of defining *resistant to the spread of fire* is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA vertical tray flame test for cables in cable trays, as described in CSA C22.2 No. 0.3-M-2001, *Test Methods for Electrical Wires and Cables*.

(F) Circuit Integrity (CI) Cable or Electrical Circuit Protective System.

Cables that are used for survivability of critical circuits under fire conditions shall meet the requirements of either 725.179(F)(1) or (F)(2).

(1) Circuit Integrity (CI) Cables.

Circuit Integrity (CI) cables, specified in 725.179(A), (B), (C), and (E), and used for survivability of critical circuits, shall have the additional classification using the suffix "CI." Circuit integrity (CI) cables shall only be permitted to be installed in a raceway where specifically listed and marked as part of an electrical circuit protective system as covered in 725.179(F)(2).

(2) Electrical Circuit Protective System.

Cables specified in 725.179(A), (B), (C), (E), and (F)(1) that are part of an electrical circuit protective system shall be identified with the protective system number and hourly rating printed on the outer jacket of the cable and installed in accordance with the listing of the protective system.

Informational Note No. 1: One method of defining circuit integrity (CI) cable or an electrical circuit protective system is by establishing a minimum 2-hour fire-resistive rating when tested in accordance with ANSI/UL 2196-2017, *Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables*.

Informational Note No. 2: UL guide information for electrical circuit protective systems (FHIT) contains information on proper installation requirements to maintain the fire rating.

(G) Class 2 and Class 3 Cable Voltage and Temperature Ratings.

Class 2 cables shall have a voltage rating of not less than 150 volts. Class 3 cables shall have a voltage rating of not less than 300 volts. Class 2 and Class 3 cables shall have a temperature rating of not less than 60°C (140°F).

(H) Class 3 Single Conductors.

Class 3 single conductors used as other wiring within buildings shall not be smaller than 18 AWG and shall be Type CL3. Conductor types described in 725.49(B) that are also listed as Type CL3 shall be permitted.

Informational Note: One method of defining *resistant to the spread of fire* is that the cables do not spread fire to the top of the tray in the UL flame exposure, vertical tray flame test in ANSI/UL 1685-2010, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*. The smoke measurements in the test method are not applicable.

Another method of defining *resistant to the spread of fire* is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA vertical tray flame test for cables in cable trays, as described in CSA C22.2 No. 0.3-M-2001, *Test Methods for Electrical Wires and Cables*.

(I) Limited Power (LP) Cables.

Limited power (LP) cables shall be listed as suitable for carrying power and data up to a specified current limit for each conductor without exceeding the temperature rating of the cable where the cable is installed in cable bundles in free air or installed within a raceway, cable tray, or cable routing assembly. The cables shall be marked with the suffix "LP (XXA)" where XXA designates the current limit is in amperes per conductor.

Informational Note: An example of the marking on a Class 2 cable with an LP rating is "CL2-LP (75°C) 23 AWG 4-pair," which indicates that it is a 4-pair plenum cable with 23 AWG conductors, a temperature rating of 75°C, and a current limit of 0.6 amperes per conductor (0.6 A).

(J) Optical Fibers. Class 2. Class 3 and Type PLTC cables shall be permitted to contain optical fibers.

(K) Marking.

Cables shall be marked in accordance with 310.8(A)(2), (A)(3), (A)(4), (A)(5), and Table 725.179(J). Voltage ratings shall not be marked on the cables. Cables containing optical fibers shall be marked with the suffix -OF.

Informational Note: Voltage markings on cables may be misinterpreted to suggest that the cables may be suitable for Class 1 electric light and power applications.

Exception: Voltage markings shall be permitted where the cable has multiple listings and a voltage marking is required for one or more of the listings.

The temperature rating shall be marked on the jacket of Class 2 and Class 3 cables that have a temperature rating exceeding 60°C (140°F).

Table 725.179(J) Cable Marking

Cable Marking	Type
CL3P	Class 3 plenum cable
CL2P	Class 2 plenum cable
CL3R	Class 3 riser cable
CL2R	Class 2 riser cable
PLTC	Power-limited tray cable
CL3	Class 3 cable
CL2	Class 2 cable
CL3X	Class 3 cable, limited use
CL2X	Class 2 cable, limited use

Informational Note: Class 2 and Class 3 cable types are listed in descending order of fire performance, and Class 3 cables are listed above Class 2 cables because Class 3 cables can substitute for Class 2 cables.

(K L) Optional Markings.

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note No. 1: These markings include, but are not limited to, markings for limited smoke, halogen free, low smoke and halogen free, and sunlight resistant.

Informational Note No. 2: Some examples of optional markings are ST1 to indicate limited smoke characteristics in accordance with UL 2556, *Wire and Cable Test Methods*; HF to indicate halogen free as described in UL 2885, *Outline of Investigation for Acid Gas, Acidity and Conductivity of Combusted Materials*; and LSHF to indicate halogen free and low smoke characteristics in accordance with IEC 61034-2, *Measurement of smoke density of cables burning under defined conditions — Part 2: Test procedure and requirements*.

Statement of Problem and Substantiation for Public Input

This PI acknowledges that some Class 2, Class 3 and PLTC cables contain optical fibers. Marking with the suffix -OF aligns the NEC with UL listing requirements.

This PI coordinates with 770.3(C) which states:

770.3(C) Composite Cables.
Composite optical fiber cables shall be classified as electrical cables in accordance with the type of electrical conductors. They shall be constructed, listed, and marked in accordance with the appropriate article for each type of electrical cable.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 299-NFPA 70-2020 [Section No. 760.179]	Coordinating PI for Article 760
Public Input No. 210-NFPA 70-2019 [Section No. 800.179]	
Public Input No. 299-NFPA 70-2020 [Section No. 760.179]	
Public Input No. 314-NFPA 70-2020 [Section No. 770.133(C)]	
Public Input No. 315-NFPA 70-2020 [Section No. 760.176]	

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Public Input No. 2437-NFPA 70-2020 [Section No. 725.179(A)]

(A) Types CL2P and CL3P.

Types CL2P and CL3P plenum ~~cable shall~~ cables shall be marked as Type CL2P and CL3P, respectively, and be listed as suitable for use in ducts, plenums, and other space for environmental air and shall be listed as having adequate fire-resistant and low-smoke producing characteristics.

Informational Note: One method of defining a cable that is low-smoke producing and fire resistant is that the cable exhibits a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.52 m (5 ft) or less when tested in accordance with NFPA 262-2019, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces*.

Statement of Problem and Substantiation for Public Input

725.179(B), (C), and (D) all have this language that is missing from 725.179(A). There is no rational that plenum cable wouldn't be required to be marked while riser, general-purpose, and limited-use would be marked.

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Public Input No. 2215-NFPA 70-2020 [Section No. 725.179(F)]

(F) Circuit Integrity (CI) Cable, Fire-Resistive Cable System or Electrical Circuit Protective System.

Cables that are used for survivability of critical circuits under fire conditions shall meet the requirements of either 725.179(F)(1) or (F)(2).

(1) Circuit Integrity (CI) Cables.

Circuit ~~Integrity~~ integrity (CI) cables, specified in 725.179(A), (B), (C), and (E), and used for survivability of critical circuits, shall ~~have~~ be marked with the additional classification using the suffix "CI." In order to maintain its listed fire-resistive rating, circuit integrity (CI) cable shall only be installed in free air in accordance with 725.24(B). Circuit integrity (CI) cables shall only be permitted to be installed in a raceway where specifically listed and marked as part of ~~an electrical circuit protective~~ a fire-resistive cable system as covered in 725.179(F)(2).

Informational Note:One method of defining circuit integrity (

~~2) Electrical Circuit Protective System.~~

~~Cables CI) cable is by establishing a rating when tested in accordance with UL 2196, *Fire Test for Circuit Integrity of Fire Resistive Power, Instrumentation, Control and Data Cables* as specified in UL 13, *Power Limited Circuit Cables* . UL Guide Information for Power Limited Circuit Cable (QPTZ) contains information to identify the cable and its installation limitations to maintain the fire-resistive rating.~~

(2) Fire-Resistive Cable System.

Fire-resistive cables specified in 725.179(A) , (B), (C), (E), and (F)(1)

~~that~~

, which are part of

~~an electrical circuit protective system~~

a fire-resistive cable system, shall be identified with the

~~protective~~

system

~~number~~

identifier and hourly rating

~~printed~~

marked on the outer jacket of the cable and installed in accordance with the listing of the

~~protective~~

system.

Informational Note

~~No. 1~~

:

~~One~~

One method of defining

~~circuit integrity (CI) cable or an electrical circuit protective~~

a fire-resistive cable system is by establishing a

~~minimum 2-hour fire-resistive~~

rating when tested in accordance with

~~ANSI/~~

UL 2196

~~-2017~~

~~Standard for~~

Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables . UL *Guide Information for Electrical Circuit Integrity Systems* (FHIT) contains information to identify the system and its installation limitations to maintain a minimum fire-resistive rating

~~Informational Note No. 2: UL guide information for electrical circuit protective systems~~

(3) Electrical Circuit Protective System.

Protectants for cables specified in 725.179(A) , (B), (C), and (E) which are part of an electrical circuit protective system shall be identified with the protective system identifier and hourly rating marked on the protectant or the smallest unit container and installed in accordance with the listing of the system.

Informational Note: One method of defining an electrical circuit protective system is by establishing a rating when tested in accordance with UL 1724, *Fire Tests for Electrical Circuit Protective Systems* , UL *Guide Information for Electrical Circuit Integrity Systems* (FHIT) contains information

~~on proper installation requirements~~

to identify the system and its installation limitations to maintain the fire-resistive rating.

Additional Proposed Changes

File Name	Description	Approved
725.179_F_PI_2215_final_revised_text_.jpg	Final view of proposed revision	

Statement of Problem and Substantiation for Public Input

The language is revised to use the term "fire-resistive cable system" as used elsewhere in the NEC® as that's the defined term and more appropriate than fire-rated and more inclusive than simply electrical circuit protective systems.. The language is updated to remain consistent with other uses throughout the NEC®, for correlation. The organization of this section has been revised for clarity and Informational notes were relocated to follow the appropriate code text. This public input is a result of the Correlating Committee Task Group for Circuit Integrity Cable efforts to correlate information on Circuit Integrity (-CI) cable throughout the NEC®. Members of the task group included Blake Shugarman from UL – Principal Engineer for Circuit Integrity Systems, Larry Shudak from UL - Principal Engineer for Life Safety Technologies and member of NFPA 72, Anthony Tassone from UL – Principal Engineer Seasonal and Holiday Decorative Products and Telecommunications Cables - CMP16, Jim Conrad from Marmon Innovation and Technology Group – CMP13, George Straniero from AFC Cable Systems – CMP6, CMP3, and CC, Paul Casparro from IBEW – CMP3, and Rich Holub from DuPont – CMP14 and CC.

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(F) Circuit Integrity (CI) Cable, Fire-Resistive Cable System or Electrical Circuit Protective System.

Cables that are used for survivability of critical circuits under fire conditions shall meet the requirements of either 725.179(F)(1) or (F)(2).

(1) Circuit Integrity (CI) Cables.

Circuit integrity (CI) cables, specified in 725.179(A), (B), (C), and (E), and used for survivability of critical circuits, shall be marked with the additional classification using the suffix "CI." In order to maintain its listed fire-resistive rating, circuit integrity (CI) cable shall only be installed in free air in accordance with 725.24(B). Circuit integrity (CI) cables shall only be permitted to be installed in a raceway where specifically listed and marked as part of a fire-resistive cable system as covered in 725.179(F)(2).

Informational Note:One method of defining circuit integrity (CI) cable is by establishing a rating when tested in accordance with UL 2196, *Fire Test for Circuit Integrity of Fire Resistive Power, Instrumentation, Control and Data Cables* as specified in UL 13, *Power-Limited Circuit Cables*. UL Guide Information for Power-Limited Circuit Cable (QPTZ) contains information to identify the cable and its installation limitations to maintain the fire-resistive rating.

(2) Fire-Resistive Cable System.

Fire-resistive cables specified in 725.179(A), (B), (C), (E), and (F)(1), which are part of a fire-resistive cable system, shall be identified with the system identifier and hourly rating marked on the outer jacket of the cable and installed in accordance with the listing of the system.

Informational Note: One method of defining a fire-resistive cable system is by establishing a rating when tested in accordance with UL 2196, *Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables*. UL *Guide Information for Electrical Circuit Integrity Systems* (FHIT) contains information to identify the system and its installation limitations to maintain a minimum fire-resistive rating

(3) Electrical Circuit Protective System.

Protectants for cables specified in 725.179(A), (B), (C), and (E) which are part of an electrical circuit protective system shall be identified with the protective system identifier and hourly rating marked on the protectant or the smallest unit container and installed in accordance with the listing of the system.

Informational Note: One method of defining an electrical circuit protective system is by establishing a rating when tested in accordance with UL 1724, *Fire Tests for Electrical Circuit Protective Systems*. UL *Guide Information for Electrical Circuit Integrity Systems* (FHIT) contains information to identify the system and its installation limitations to maintain the fire-resistive rating.

Public Input No. 1774-NFPA 70-2020 [Section No. 725.179(I)]

(I) Limited Power (LP) Cables.

Limited power (LP) cables shall be listed as suitable for carrying power and data up to a specified current limit for each conductor without exceeding the temperature rating of the cable marked in accordance with 725.179(J) , where the cable is installed in cable bundles in free air or installed within a raceway, cable tray, or cable routing assembly. The cables shall be marked with the suffix "LP (XXA)" where XXA designates the current limit is in amperes per conductor.

Informational Note: An example of the marking on a Class 2 cable with an LP rating is "CL2-LP (75°C) 23 AWG 4-pair," which indicates that it is a 4-pair plenum cable with 23 AWG conductors, a temperature rating of 75°C, and a current limit of 0.6 amperes per conductor (0.6 A).

Statement of Problem and Substantiation for Public Input

Referencing the article 725.179(J) for the marking of the temperature rating is an essential part of the ampacity since current capacity changes with the cable temperature rating. It is important to reflect this close association in article 725.179(I) for accuracy and consistency with the marking requirements. This change will also be consistent with the example in the informational note in article 725.179(J) where the temperature rating of (75°C) is included in the marking ""CL2-LP (75°C) 23 AWG 4-pair,".

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Public Input No. 4031-NFPA 70-2020 [Section No. 725.179(I)]

(I) Limited Power (LP) Cables.

Limited power (LP) cables shall be listed as suitable for carrying power and ~~data up to a specified current limit for each conductor without exceeding the temperature rating of the cable where the cable is installed~~ data when installed in cable bundles in free air or installed within a raceway, cable tray, or cable routing assembly~~. The cables shall be marked with the suffix "LP (XXA)" where XXA designates the current limit is in amperes per conductor.~~

~~Informational Note: An example of the marking on a Class 2 cable with an LP rating is "CL2-LP (75°C) 23 AWG 4-pair," which indicates that it is a 4-pair plenum cable with 23 AWG conductors, a temperature rating of 75°C, and a current limit of 0.6 amperes per conductor (0.6 A~~

, and installed in accordance with 725.144(B).

Statement of Problem and Substantiation for Public Input

Clarifies conditions under which cables are listed. Eliminates repetitive cable marking method and example already given in 724.144(B) and 725.179(J).

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Public Input No. 343-NFPA 70-2020 [Section No. 725.179 [Excluding any Sub-Sections]]

Class 2, Class 3, and Type PLTC cables, installed as wiring methods within buildings, shall be listed as resistant to the spread of fire and other criteria in accordance with 725.179(A) through (I), shall be marked in accordance with 725.179(J), and shall be permitted to be marked in accordance with 725.179(K).

Informational Note: For information on Class 2, Class 3 and PLTC cables see *UL 13, Standard for Power-Limited Circuit Cables* , 2015.

Statement of Problem and Substantiation for Public Input

Adding an informational note referring the user to the listing standard for the cables in this section provides useful information. UL listing standards are referred to throughout this Code.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 341-NFPA 70-2020 [Section No. 800.179 [Excluding any Sub-Sections]]	Similar PI for Article 800
Public Input No. 342-NFPA 70-2020 [Section No. 770.179 [Excluding any Sub-Sections]]	Similar PI for Article 770
Public Input No. 344-NFPA 70-2020 [Section No. 760.179 [Excluding any Sub-Sections]]	Similar PI for 760.179
Public Input No. 345-NFPA 70-2020 [Section No. 760.176 [Excluding any Sub-Sections]]	Similar PI for 760.176
Public Input No. 341-NFPA 70-2020 [Section No. 800.179 [Excluding any Sub-Sections]]	
Public Input No. 342-NFPA 70-2020 [Section No. 770.179 [Excluding any Sub-Sections]]	
Public Input No. 344-NFPA 70-2020 [Section No. 760.179 [Excluding any Sub-Sections]]	
Public Input No. 345-NFPA 70-2020 [Section No. 760.176 [Excluding any Sub-Sections]]	

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Public Input No. 2696-NFPA 70-2020 [Article 727]

~~Article 727 Instrumentation~~
ARTICLE 341 Instrumentation Tray Cable: Type ITC

~~727.1 Scope.~~
Part I. General

341.1 Scope.

This article covers the use, installation, and construction specifications of instrumentation tray cable for application to instrumentation and control circuits operating at 150 volts or less and 5 amperes or less.

~~727~~
341 .

~~2 Definition~~
2 Definition .

The definition in this section shall apply within this article and throughout

~~the~~
the *Code* .

Type ITC Instrumentation Tray Cable.

A factory assembly of two or more insulated conductors, with or

~~without~~
without an equipment

~~grounding~~
grounding conductor(s), enclosed in a nonmetallic sheath.

~~727~~
341 .

~~3 Other~~
3 Other Articles.

In addition to the provisions of this article, installation of Type ITC cable shall comply with other applicable articles of

~~this~~
this *Code* .

~~727.4 Uses~~
341.6 Listing Requirements

Type ITC cables shall be listed.

Part II. Installation

341.10 Uses Permitted .

Type ITC cable shall be permitted to be used as follows in industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons service the installation:

(1) In cable trays.

(2) In raceways.

(3) In hazardous locations as permitted

~~in~~

(1) in 501.10 , 502.10 , 503.10 , 504.20 , 504.30 , 504.80 ,

~~and~~

(1) and 505.15 .

(2) Enclosed in a smooth metallic sheath, continuous corrugated metallic sheath, or interlocking tape armor applied over the nonmetallic sheath in accordance

~~with 727~~

(1) with 341 .

~~6~~

(1) 100 . . The cable shall be supported and secured at intervals not exceeding 1.8 m (6 ft).

(2) Cable, without a metallic sheath or armor, that complies with the crush and impact requirements of Type MC cable and is identified for such use with the

~~marking~~

(1) marking *ITC-ER*

~~shall~~

(1) shall be permitted to be installed exposed. The cable shall be continuously supported and protected against physical damage using mechanical protection such as dedicated struts, angles, or channels. The cable shall be secured at intervals not exceeding 1.8 m (6 ft).

Exception to (5):

~~Where~~

Where not subject to physical damage, Type ITC-ER shall be permitted to transition between cable trays and between cable trays and utilization equipment or devices for a distance not to exceed 1.8 m (6 ft) without continuous support. The cable shall be mechanically supported where exiting the cable tray to ensure that the minimum bending radius is not exceeded.

(1) As aerial cable on a messenger.

(2) Direct buried where identified for the use.

(3) Under raised floors in rooms containing industrial process control equipment and rack rooms where arranged to prevent damage to the cable.

(4) Under raised floors in information technology equipment rooms in accordance

~~with~~

(1) with 645.5(E) (2) .

~~727~~
341 .

~~5 Uses~~
12 Uses Not Permitted .

Type ITC cable shall not be

~~installed~~
instal l ed on circuits operating at more than 150 volts or more than 5 amperes.

Installation of Type ITC cable with other cables shall be subject to the stated provisions of the specific articles for the other cables. Where the governing articles do not contain stated provisions for installation with Type ITC cable, the installation of Type ITC cable with the other cables shall not be permitted.

Type ITC cable shall not be installed with power, lighting, Class 1 circuits that are not power limited, or non–power-limited circuits.

Exception No. 1:

~~Where~~
Where terminated within equipment or junction boxes and separations are maintained by insulating barriers or other means.

Exception No. 2:

~~Where~~
Where a metallic sheath or armor is applied over the nonmetallic sheath of the Type ITC cable.

~~727~~
341 .

~~6 Construction~~
24 Bends .

~~The insulated conductors of~~
Bends in Type ITC

~~cable~~
cables shall be

~~in sizes 22 AWG through 12 AWG. The conductor material shall be copper or thermocouple alloy. Insulation on~~
made so as not to damage the cable.

341.80 Ampacity .

The ampacity of the conductors shall be

~~rated for 300 volts. Shielding shall be permitted.~~
5 amperes, except for 22 AWG conductors, which shall have an ampacity of 3 amperes. Overcurrent protection shall not exceed 5 amperes for 20 AWG and larger conductors, and 3 amperes for 22 AWG conductors.

Part III. Construction Specifications

341.100 Construction .

The cable shall be

~~listed as being~~
resistant to the spread of fire. The outer jacket shall be sunlight and moisture resistant.

~~– Where a smooth metallic sheath, continuous corrugated metallic sheath, or interlocking tape armor is applied over the nonmetallic sheath, an overall nonmetallic jacket shall not be required.~~

~~Informational Note:~~

~~One~~
~~One method of~~

~~defining~~
~~defining *resistant to the spread of fire*~~

~~is~~
~~is that the cables do not spread fire to the top of the tray in the UL flame exposure, vertical tray flame test in ANSI/UL 1685~~

~~2010~~
~~2015 , *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables* . The smoke measurements in the test method are not applicable.~~

~~Another method of~~

~~defining~~
~~defining *resistant to the spread of fire*~~

~~is~~
~~is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA vertical flame test — cables in cable trays, as described in CSA C22.2 No. 0.3 M~~

~~2001~~
~~2014 , *Test Methods for Electrical Wires and Cables* .~~

~~727~~
~~**341 .**~~

~~7 Marking~~
~~**104 Conductors . .**~~

~~The insulated conductors of Type ITC cable shall be in sizes 22 AWG through 12 AWG. The conductor material shall be copper or thermocouple alloy. Insulation on the conductors shall be rated for 300 volts. Shielding shall be permitted.~~

~~**341.120 Marking.**~~

~~The cable shall be marked in accordance~~

~~with~~
~~with. 310.8(A)(2) , (A)(3), (A)(4), and (A)(5). Voltage ratings shall not be marked on the cable.~~

~~**727.8** Ampacity.~~

~~The ampacity of the conductors shall be 5 amperes, except for 22 AWG conductors, which shall have an ampacity of 3 amperes.~~

~~**727.9** Overcurrent Protection.~~

~~Overcurrent protection shall not exceed 5 amperes for 20 AWG and larger conductors, and 3 amperes for 22 AWG conductors.~~

~~**727.10** Bends.~~

~~Bends in Type ITC cables shall be made so as not to damage the cable.~~

-

Additional Proposed Changes

File Name	Description	Approved
New_Article_341_Public_Input_R1.docx	The file shows the deletion of Article 727 and movement to New Article 341. Article 727 has been rewritten for Article 341 to meet the chapter 3 style manual	

Statement of Problem and Substantiation for Public Input

This Public Comment is submitted on behalf of a task group appointed by the Chairs of NEC® CMP-3 & CMP-6. This Task Group was appointed to review whether NEC® Article 727 should be relocated to Chapter 3 where it was originally proposed. Task Group members are Dennis Nielsen, George Zimmerman, Jerry Kent, Ron Tellas, Kelly Lamp and Keith Waters.

Task Group members noted that ITC tray cable was originally accepted by CMP-6 for Chapter 3, however, the correlating committee at the time chose to have it put in Chapter 7. This Task Group's work confirmed that the material should be moved, but changes needed to be made to meet the chapter 3 style manual requirements. The Task Group recommends acceptance of this public input to move requirements for Instrumentation Tray Cable (ITC) to Chapter 3 and placed under the purview of CMP-6. We ask CMP-3 and CMP-6 to accept this change to better coordinate tray cable wiring methods.

The following list provides other locations in the code where Article 727 is referenced. The task group asks the correlating committee to forward to the appropriate CMP for review. PI's were submitted to each code panel for their review.

Table 240.4G Reference Art. 727 and 727.9
Table 392.10A Reference Art. 727
Art. 501.10 A (1) (4) Reference Art. 727.4
Art. 501.10 B (1) #4 Reference Art. 727.4
Art. 502.10 A (1) #5 Reference Art. 727.4
Art. 502.10 B (1) #6 Reference Art. 727.4
Art. 503.10 A (1) #3 Reference Art. 727.4
Art. 505.15 B (1) #3 Reference Art. 727.4 and 727.5
Art. 505.15 C (1) #3 Reference Art. 727.4
Art. 506.15 A #4 Reference Art. 727.4
Art. 506.15 C #6 Reference Art. 727.4
Art. 511.7 A (1) Reference Art. 727
Art. 515.7 A Reference Art. 727.4
Art. 725.3 G Reference Art. 727.1, 727.4 and 727.9
Annex A references Art. 727

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2752-NFPA 70-2020 [Section No. 240.4(G)]	
Public Input No. 2754-NFPA 70-2020 [Section No. 392.10(A)]	
Public Input No. 2755-NFPA 70-2020 [Definition:]	
Public Input No. 2756-NFPA 70-2020 [Section No. 725.3(G)]	
Public Input No. 2760-NFPA 70-2020 [Global Input]	

Submitter Information Verification

Submitter Full Name: Keith Waters
Organization: Schneider Electric
Street Address:
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Submittal Date: Fri Aug 28 15:36:18 EDT 2020
Committee: NEC-P03

Public Input:

Delete Article 727 and move the requirements as shown in the following:

~~ARTICLE 727 Instrumentation Tray Cable: Type ITC~~

~~727.1 Scope.~~
~~This article covers the use, installation, and construction specifications of instrumentation tray cable for application to instrumentation and control circuits operating at 150 volts or less and 5 amperes or less.~~

~~727.2 Definition.~~
~~The definition in this section shall apply within this article and throughout the *Code*.~~

~~Type ITC Instrumentation Tray Cable.~~
~~A factory assembly of two or more insulated conductors, with or without an equipment grounding conductor(s), enclosed in a nonmetallic sheath.~~

~~727.3 Other Articles.~~
~~In addition to the provisions of this article, installation of Type ITC cable shall comply with other applicable articles of this *Code*.~~

~~727.4 Uses Permitted.~~

~~Type ITC cable shall be permitted to be used as follows in industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons service the installation:~~

~~(1) In cable trays.~~

~~(2) In raceways.~~

~~(3) In hazardous locations as permitted in 501.10, 502.10, 503.10, 504.20, 504.30, 504.80, and 505.15.~~

~~(4) Enclosed in a smooth metallic sheath, continuous corrugated metallic sheath, or interlocking tape armor applied over the nonmetallic sheath in accordance with 727.6. The cable shall be supported and secured at intervals not exceeding 1.8 m (6 ft).~~

~~(5) Cable, without a metallic sheath or armor, that complies with the crush and impact requirements of Type MC cable and is identified for such use with the marking *ITC-ER* shall be permitted to be installed exposed. The cable shall be continuously supported and protected against physical damage using mechanical protection such as dedicated struts, angles, or channels. The cable shall be secured at intervals not exceeding 1.8 m (6 ft).~~

Exception to (5): Where not subject to physical damage, Type ITC-ER shall be permitted to transition between cable trays and between cable trays and utilization equipment or devices for a distance not to exceed 1.8 m (6 ft) without continuous support. The cable shall be mechanically supported where exiting the cable tray to ensure that the minimum bending radius is not exceeded.

(6) As aerial cable on a messenger.

(7) Direct buried where identified for the use.

(8) Under raised floors in rooms containing industrial process control equipment and rack rooms where arranged to prevent damage to the cable.

(9) Under raised floors in information technology equipment rooms in accordance with 645.5(E)(2).

727.5 Uses Not Permitted.

Type ITC cable shall not be installed on circuits operating at more than 150 volts or more than 5 amperes.

Installation of Type ITC cable with other cables shall be subject to the stated provisions of the specific articles for the other cables. Where the governing articles do not contain stated provisions for installation with Type ITC cable, the installation of Type ITC cable with the other cables shall not be permitted.

Type ITC cable shall not be installed with power, lighting, Class 1 circuits that are not power limited, or non–power-limited circuits.

Exception No. 1: Where terminated within equipment or junction boxes and separations are maintained by insulating barriers or other means.

Exception No. 2: Where a metallic sheath or armor is applied over the nonmetallic sheath of the Type ITC cable.

727.6 Construction.

The insulated conductors of Type ITC cable shall be in sizes 22 AWG through 12 AWG. The conductor material shall be copper or thermocouple alloy. Insulation on the conductors shall be rated for 300 volts. Shielding shall be permitted.

The cable shall be listed as being resistant to the spread of fire. The outer jacket shall be sunlight and moisture resistant.

Where a smooth metallic sheath, continuous corrugated metallic sheath, or interlocking tape armor is applied over the nonmetallic sheath, an overall nonmetallic jacket shall not be required.

~~Informational Note: One method of defining *resistant to the spread of fire* is that the cables do not spread fire to the top of the tray in the UL flame exposure, vertical tray flame test in ANSI/UL 1685-2010, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*. The smoke measurements in the test method are not applicable.~~

~~Another method of defining *resistant to the spread of fire* is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA vertical flame test — cables in cable trays, as described in CSA C22.2 No. 0.3-M-2001, *Test Methods for Electrical Wires and Cables*.~~

~~727.7 Marking.~~
~~The cable shall be marked in accordance with 310.8(A)(2), (A)(3), (A)(4), and (A)(5). Voltage ratings shall not be marked on the cable.~~

~~727.8 Ampacity.~~
~~The ampacity of the conductors shall be 5 amperes, except for 22 AWG conductors, which shall have an ampacity of 3 amperes.~~

~~727.9 Overcurrent Protection.~~
~~Overcurrent protection shall not exceed 5 amperes for 20 AWG and larger conductors, and 3 amperes for 22 AWG conductors.~~

~~727.10 Bends.~~
~~Bends in Type ITC cables shall be made so as not to damage the cable.~~

ARTICLE 341 Instrumentation Tray Cable: Type ITC

Part I. General

341.1 Scope.

This article covers the use, installation, and construction specifications of instrumentation tray cable for application to instrumentation and control circuits operating at 150 volts or less and 5 amperes or less.

341.2 Definition.

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

Type ITC Instrumentation Tray Cable.

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

341.3 Other Articles.

In addition to the provisions of this article, installation of Type ITC cable shall comply with other applicable articles of this *Code*.

341.6 Listing Requirements

Type ITC cables shall be listed.

Part II. Installation

341.10 Uses Permitted.

Type ITC cable shall be permitted to be used as follows in industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons service the installation:

1. In cable trays.
2. In raceways.
3. In hazardous locations as permitted in 501.10, 502.10, 503.10, 504.20, 504.30, 504.80, and 505.15.
4. Enclosed in a smooth metallic sheath, continuous corrugated metallic sheath, or interlocking tape armor applied over the nonmetallic sheath in accordance with 341.100. The cable shall be supported and secured at intervals not exceeding 1.8 m (6 ft).
5. Cable, without a metallic sheath or armor, that complies with the crush and impact requirements of Type MC cable and is identified for such use with the marking *ITC-ER* shall be permitted to be installed exposed. The cable shall be continuously supported and protected against physical damage using mechanical protection such as dedicated struts, angles, or channels. The cable shall be secured at intervals not exceeding 1.8 m (6 ft).

   Exception to (5): Where not subject to physical damage, Type ITC-ER shall be permitted to transition between cable trays and between cable trays and utilization equipment or devices for a distance not to exceed 1.8 m (6 ft) without continuous support. The cable shall be mechanically supported where exiting the cable tray to ensure that the minimum bending radius is not exceeded.

6. As aerial cable on a messenger.
7. Direct buried where identified for the use.
8. Under raised floors in rooms containing industrial process control equipment and rack rooms where arranged to prevent damage to the cable.
9. Under raised floors in information technology equipment rooms in accordance with 645.5(E)(2).

341.12 Uses Not Permitted.

Type ITC cable shall not be installed on circuits operating at more than 150 volts or more than 5 amperes.

Installation of Type ITC cable with other cables shall be subject to the stated provisions of the specific articles for the other cables. Where the governing articles do not contain stated provisions for installation with Type ITC cable, the installation of Type ITC cable with the other cables shall not be permitted.

Type ITC cable shall not be installed with power, lighting, Class 1 circuits that are not power limited, or non–power-limited circuits.

Exception No. 1: Where terminated within equipment or junction boxes and separations are maintained by insulating barriers or other means.

Exception No. 2: Where a metallic sheath or armor is applied over the nonmetallic sheath of the Type ITC cable.

341.24 Bends.

Bends in Type ITC cables shall be made so as not to damage the cable.

341.80 Ampacity.

The ampacity of the conductors shall be 5 amperes, except for 22 AWG conductors, which shall have an ampacity of 3 amperes. Overcurrent protection shall not exceed 5 amperes for 20 AWG and larger conductors, and 3 amperes for 22 AWG conductors.

Part III. Construction Specifications

341.100 Construction.

The cable shall be resistant to the spread of fire. The outer jacket shall be sunlight and moisture resistant. Where a smooth metallic sheath, continuous corrugated metallic sheath, or interlocking tape armor is applied over the nonmetallic sheath, an overall nonmetallic jacket shall not be required.

Informational Note: One method of defining *resistant to the spread of fire* is that the cables do not spread fire to the top of the tray in the UL flame exposure, vertical tray flame test in ANSI/UL 1685-2015, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*. The smoke measurements in the test method are not applicable.

Another method of defining *resistant to the spread of fire* is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA vertical flame test — cables in cable trays, as described in CSA C22.2 No. 0.3-M-2014, *Test Methods for Electrical Wires and Cables*.

341.104 Conductors.

The insulated conductors of Type ITC cable shall be in sizes 22 AWG through 12 AWG. The conductor material shall be copper or thermocouple alloy. Insulation on the conductors shall be rated for 300 volts. Shielding shall be permitted.

341.120 Marking.

The cable shall be marked in accordance with 310.8(A)(2), (A)(3), (A)(4), and (A)(5). Voltage ratings shall not be marked on the cable.

Substantiation:

This Public Comment is submitted on behalf of a task group appointed by the Chairs of NEC® CMP-3 & CMP-6. This Task Group was appointed to review whether NEC® Article 727 should be relocated to Chapter 3 where it was originally proposed. Task Group members are Dennis Nielsen, George Zimmerman, Jerry Kent, Ron Tellas, Kelly Lamp and Keith Waters.

Task Group members noted that ITC tray cable was originally accepted by CMP-6 for Chapter 3, however, the correlating committee at the time chose to have it put in Chapter 7. This Task Group's work confirmed that the material should be moved, but changes needed to be made to meet the chapter 3 style manual requirements. The Task Group recommends acceptance of this public input to move requirements for Instrumentation Tray Cable (ITC) to Chapter 3 and placed under the purview of CMP-6. We ask CMP-3 and CMP-6 to accept this change to better coordinate tray cable wiring methods.

The following list provides other locations in the code where Article 727 is referenced. The task group asks the correlating committee to forward to the appropriate CMP for review. PI's were submitted to each code panel for their review.

Other NEC® Code Articles affected:

Table 240.4G Reference Art. 727 and 727.9

Table 392.10A Reference Art. 727

Art. 501.10 A (1) (4) Reference Art. 727.4

Art. 501.10 B (1) #4 Reference Art. 727.4

Art. 502.10 A (1) #5 Reference Art. 727.4

Art. 502.10 B (1) #6 Reference Art. 727.4

Art. 503.10 A (1) #3 Reference Art. 727.4

Art. 505.15 B (1) #3 Reference Art. 727.4 and 727.5

Art. 505.15 C (1) #3 Reference Art. 727.4

Art. 506.15 A #4 Reference Art. 727.4

Art. 506.15 C #6 Reference Art. 727.4

Art. 511.7 A (1) Reference Art. 727

Art. 515.7 A Reference Art. 727.4

Art. 725.3 G Reference Art. 727.1, 727.4 and 727.9

Annex A references Art. 727

Public Input No. 3963-NFPA 70-2020 [Section No. 727.2]

(Relocate all definitions in the 727. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

727. 2 Definition.

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

Type ITC Instrumentation Tray Cable.

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

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 16:23:13 EDT 2020
Committee: NEC-P03

Public Input No. 3902-NFPA 70-2020 [Section No. 728.2]

~~**728.2** Definition.~~

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

~~**Fire-Resistive Cable System.**~~

~~A cable and components used to ensure survivability of critical circuits for a specified time under fire conditions.~~

Statement of Problem and Substantiation for Public Input

If a definition of a “fire-resistive cable system” as recommended by PI 3900 is adopted in Article 100, then the definition in Article 728 needs to be deleted.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3900-NFPA 70-2020 [New Definition after Definition: Field Labeled (as applied ...]	Companion Change

Submitter Information Verification

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Submittal Date: Wed Sep 09 15:09:45 EDT 2020
Committee: NEC-P03

Public Input No. 3964-NFPA 70-2020 [Section No. 728.2]

(Relocate all definitions in the 728. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

728. 2 Definition.

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

Fire-Resistive Cable System.

A cable and components used to ensure survivability of critical circuits for a specified time under fire conditions.

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-P03

Public Input No. 2316-NFPA 70-2020 [Section No. 728.4]

728.4 General.

Fire-resistive cables, fire-resistive conductors, and components shall be tested and listed as a complete system, shall be designated for use in a ~~specific fire-rated system~~ specific system , and shall not be interchangeable between systems.

Informational Note~~ No. 1~~ : One method of defining the fire rating is by testing the system in accordance with ~~ANSI/~~ UL 2196~~-2017~~ , ~~*Standard for*~~ *Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables*.~~Informational Note No. 2: Fire-resistive cable systems are considered part of an electrical circuit protective system. UL *Guide Information for Electrical Circuit Integrity Systems* (FHIT) contains information to identify the system and its installation limitations to maintain the fire rating.~~

Additional Proposed Changes

File Name	Description	Approved
PI_2316_for_728.4.JPG	Correct wording for PI 2316 Section 728.4	

Statement of Problem and Substantiation for Public Input

The language is revised to reflect the proper title of the standards, deleting the reference to ANSI at UL's request. This public input is a result of the Correlating Committee Task Group for Circuit Integrity Cable efforts to correlate information on Circuit Integrity (-CI) cable throughout the NEC®. Members of the task group included Blake Shugarman from UL – Principal Engineer for Circuit Integrity Systems, Larry Shudak from UL - Principal Engineer for Life Safety Technologies and member of NFPA 72, Anthony Tassone from UL – Principal Engineer Seasonal and Holiday Decorative Products and Telecommunications Cables - CMP16, Jim Conrad from Marmon Innovation and Technology Group – CMP13, George Straniero from AFC Cable Systems – CMP6, CMP3, and CC, Paul Casparro from IBEW – CMP3, and Rich Holub from DuPont – CMP14 and CC. See the attachment for correct wording since edits in Terra are not correct.

Submitter Information Verification

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Submittal Date: Fri Aug 14 12:41:32 EDT 2020
Committee: NEC-P03

and components shall be tested and listed as a complete system, shall be designated for use in a ~~specific fire rated system~~ specific system , and shall not be interchangeable betwe

the fire rating is by testing the system in accordance with ~~ANSI/~~ UL 2196~~-2017~~ , ~~*Standard for*~~ *Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables* ~~Informational Note No. 2:~~ *nformation for Electrical Circuit Integrity Systems* (FHIT) contains information to identify the system and its installation limitations to maintain the fire rating.

Public Input No. 2317-NFPA 70-2020 [Section No. 728.5(B)]

(B) Supports.

The fire-resistive cable system shall be supported in accordance with the listing and the manufacturer's installation instructions.

Informational Note: The supports are critical for survivability of the system. Each system has its specific support requirements.

Statement of Problem and Substantiation for Public Input

The section is revised as a fire-resistive cable is installed in a raceway, not a fire-resistive system. The "fire rated system" is changed to fire-resistive system for consistency in this article.This public input is a result of the Correlating Committee Task Group for Circuit Integrity Cable efforts to correlate information on Circuit Integrity (-CI) cable throughout the NEC®. Members of the task group included Blake Shugarman from UL – Principal Engineer for Circuit Integrity Systems, Larry Shudak from UL - Principal Engineer for Life Safety Technologies and member of NFPA 72, Anthony Tassone from UL – Principal Engineer Seasonal and Holiday Decorative Products and Telecommunications Cables - CMP16, Jim Conrad from Marmon Innovation and Technology Group – CMP13, George Straniero from AFC Cable Systems – CMP6, CMP3, and CC, Paul Casparro from IBEW – CMP3, and Rich Holub from DuPont – CMP14 and CC.

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Public Input No. 2319-NFPA 70-2020 [Section No. 728.5(C)]

(C) Raceways and Couplings.

Where the fire-resistive ~~system~~ cable is listed to be installed in a raceway, the raceways enclosing the ~~system~~ cable , any couplings, and connectors shall be listed as part of the fire-~~rated~~ resistive cable system.

The raceway fill for each system shall comply with the listing requirements for the system and shall not be greater than the fill permitted in Table 1, Chapter 9.

Informational Note: Raceway fill may not be the same for all listed fire-resistive cable systems.

Statement of Problem and Substantiation for Public Input

The section is revised as a fire-resistive cable is installed in a raceway, not a fire-resistive system. The “fire rated system” is changed to fire-resistive system for consistency in this article.This public input is a result of the Correlating Committee Task Group for Circuit Integrity Cable efforts to correlate information on Circuit Integrity (-CI) cable throughout the NEC®. Members of the task group included Blake Shugarman from UL – Principal Engineer for Circuit Integrity Systems, Larry Shudak from UL - Principal Engineer for Life Safety Technologies and member of NFPA 72, Anthony Tassone from UL – Principal Engineer Seasonal and Holiday Decorative Products and Telecommunications Cables - CMP16, Jim Conrad from Marmon Innovation and Technology Group – CMP13, George Straniero from AFC Cable Systems – CMP6, CMP3, and CC, Paul Casparro from IBEW – CMP3, and Rich Holub from DuPont – CMP14 and CC.

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Public Input No. 2320-NFPA 70-2020 [Section No. 728.5(D)]

(D) Cable Trays.

Cable trays used as part of a fire-resistive cable system shall be listed as part of the fire-resistive cable system.

Statement of Problem and Substantiation for Public Input

This public input is a result of the Correlating Committee Task Group for Circuit Integrity Cable efforts to correlate information on Circuit Integrity cable throughout the NEC®. Members of the task group included Blake Shugarman from UL – Principal Engineer for Circuit Integrity Systems, Larry Shudak from UL - Principal Engineer for Life Safety Technologies and member of NFPA 72, Anthony Tassone from UL – Principal Engineer Seasonal and Holiday Decorative Products and Telecommunications Cables - CMP16, Jim Conrad from Marmon Innovation and Technology Group – CMP13, George Straniero from AFC Cable Systems – CMP6, CMP3, and CC, Paul Casparro from IBEW – CMP3, and Rich Holub from DuPont – CMP14 and CC.

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Committee: NEC-P03

Public Input No. 2321-NFPA 70-2020 [Section No. 728.5(E)]

(E) Boxes.

Boxes or enclosures used as part of a fire-resistive cable system shall be listed as part of the fire-resistive cable system and shall be secured to the building structure independently of the raceways or cables listed in the system.

Statement of Problem and Substantiation for Public Input

This public input is a result of the Correlating Committee Task Group for Circuit Integrity Cable efforts to correlate information on Circuit Integrity cable throughout the NEC®. Members of the task group included Blake Shugarman from UL – Principal Engineer for Circuit Integrity Systems, Larry Shudak from UL - Principal Engineer for Life Safety Technologies and member of NFPA 72, Anthony Tassone from UL – Principal Engineer Seasonal and Holiday Decorative Products and Telecommunications Cables - CMP16, Jim Conrad from Marmon Innovation and Technology Group – CMP13, George Straniero from AFC Cable Systems – CMP6, CMP3, and CC, Paul Casparro from IBEW – CMP3, and Rich Holub from DuPont – CMP14 and CC.

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Submittal Date: Fri Aug 14 12:59:26 EDT 2020
Committee: NEC-P03

Public Input No. 2322-NFPA 70-2020 [Section No. 728.5(F)]

(F) Pulling Lubricants.

Fire-resistive ~~cable systems installed~~ cable installed in a raceway shall only use pulling lubricants listed as part of the fire-resistive cable system.

Statement of Problem and Substantiation for Public Input

Fire-resistive cable system is revised to properly reflect only the cable is pulled into the raceway.This public input is a result of the Correlating Committee Task Group for Circuit Integrity Cable efforts to correlate information on Circuit Integrity cable throughout the NEC®. Members of the task group included Blake Shugarman from UL – Principal Engineer for Circuit Integrity Systems, Larry Shudak from UL - Principal Engineer for Life Safety Technologies and member of NFPA 72, Anthony Tassone from UL – Principal Engineer Seasonal and Holiday Decorative Products and Telecommunications Cables - CMP16, Jim Conrad from Marmon Innovation and Technology Group – CMP13, George Straniero from AFC Cable Systems – CMP6, CMP3, and CC, Paul Casparro from IBEW – CMP3, and Rich Holub from DuPont – CMP14 and CC.

Submitter Information Verification

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Submittal Date: Fri Aug 14 13:02:41 EDT 2020
Committee: NEC-P03

Public Input No. 2323-NFPA 70-2020 [Section No. 728.5(G)]

(G) Vertical Supports.

Cables and conductors installed in vertical raceways shall be supported in accordance with the listing of the fire-resistive cable system and in accordance with 300 . 19 .

Statement of Problem and Substantiation for Public Input

This reference to 300.19 is added for consistency with 760. (I). This public input is a result of the Correlating Committee Task Group for Circuit Integrity Cable efforts to correlate information on Circuit Integrity cable throughout the NEC®. Members of the task group included Blake Shugarman from UL – Principal Engineer for Circuit Integrity Systems, Larry Shudak from UL - Principal Engineer for Life Safety Technologies and member of NFPA 72, Anthony Tassone from UL – Principal Engineer Seasonal and Holiday Decorative Products and Telecommunications Cables - CMP16, Jim Conrad from Marmon Innovation and Technology Group – CMP13, George Straniero from AFC Cable Systems – CMP6, CMP3, and CC, Paul Casparro from IBEW – CMP3, and Rich Holub from DuPont – CMP14 and CC.

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Committee: NEC-P03

Public Input No. 483-NFPA 70-2020 [Section No. 728.5 [Excluding any Sub-Sections]]

Fire-resistive cable systems installed ~~outside~~ within the fire-rated ~~rooms that they serve, such as the electrical room or the fire pump room~~ areas of a building or structure , shall comply with the requirements of 728.5(A) through (H) and all other installation instructions provided in the listing.

Statement of Problem and Substantiation for Public Input

This is written in the negative. A better understanding would be if the language is specific to where it is installed as apposed to when it is not. Plus you are not always originating from a room the FRC could be entering from the outside of a building.

Submitter Information Verification

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Submittal Date: Wed Feb 19 11:35:58 EST 2020
Committee: NEC-P03

Public Input No. 2324-NFPA 70-2020 [Section No. 728.60]

728.60 Equipment Grounding Conductor.

Fire-resistive ~~systems~~ cables installed in a raceway requiring an equipment grounding conductor shall use the same fire-~~rated~~ resistive cable described in the system, unless alternative equipment grounding conductors are listed with the system. Any alternative equipment grounding conductor shall be marked with the system number. The system shall specify a permissible equipment grounding conductor. If not specified, the equipment grounding conductor shall be the same as the fire ~~-rated~~ resistive cable described in the system.

Statement of Problem and Substantiation for Public Input

Fire-resistive system is revised to properly reflect fire-resistive cable system, as defined and the subject of this entire article, for consistency/correlation. This public input is a result of the Correlating Committee Task Group for Circuit Integrity Cable efforts to correlate information on Circuit Integrity (-CI) cable throughout the NEC®. Members of the task group included Blake Shugarman from UL – Principal Engineer for Circuit Integrity Systems, Larry Shudak from UL - Principal Engineer for Life Safety Technologies and member of NFPA 72, Anthony Tassone from UL – Principal Engineer Seasonal and Holiday Decorative Products and Telecommunications Cables - CMP16, Jim Conrad from Marmon Innovation and Technology Group – CMP13, George Straniero from AFC Cable Systems – CMP6, CMP3, and CC, Paul Casparro from IBEW – CMP3, and Rich Holub from DuPont – CMP14 and CC.

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Submittal Date: Fri Aug 14 13:14:08 EDT 2020
Committee: NEC-P03

Public Input No. 2639-NFPA 70-2020 [Section No. 760.1]

760.1 Scope.

This article covers the installation of wiring and equipment of fire alarm systems, including all circuits controlled and powered by the fire alarm system.

Informational Note No. 1: Fire alarm systems include fire detection and alarm notification, guard's tour, sprinkler waterflow, and sprinkler supervisory systems. Circuits controlled and powered by the fire alarm system include circuits for the control of building systems safety functions, elevator capture, elevator shutdown, door release, smoke doors and damper control, fire doors and damper control and fan shutdown, but only where these circuits are powered by and controlled by the fire alarm system. For further information on the installation and monitoring for integrity requirements for fire alarm systems, refer to the *NFPA* 72-2019, *National Fire Alarm and Signaling Code*.

Informational Note No. 2: Smoke detectors (alarms) are installed in single-family dwellings to provide early warning of a fire. Their installation is required by International Residential Code, International Building Code and by the International Fire Code and enforced in many states', municipalities' by building and fire officials. National Fire Protection Association *(NFPA) 72* , the *National Fire Alarm Code* , provides guidance for the proper selection, installation, operation, testing and maintenance of smoke detector (alarm) systems.

Informational Note No. 3: Class 1, 2, and 3 circuits are defined in Article 725.

Statement of Problem and Substantiation for Public Input

This input is being submitted on behalf of the Minnesota Department of Labor and Industry. The Department's 15 office/field staff, and 65 plus contract electrical inspectors complete over 150,000 electrical inspections annually and are involved in the daily enforcement and interpretation of the National Electrical Code.
It is imperative that installers understand where the requirements for the installation, and the operation of the listed fire alarm equipment is found. Previously, the installation of smoke detectors was not addressed by the NEC and installers may not know where do you find the requirements. The importance of the proper installation of residential smoke detectors is a very important task to help safeguard families from the ravages of fire.

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Committee: NEC-P03

Public Input No. 3966-NFPA 70-2020 [Section No. 760.2]

(Relocate all definitions in the 760. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

760. 2 Definitions.

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

Abandoned Fire Alarm Cable.

Installed fire alarm cable that is not terminated at equipment other than a connector and not identified for future use with a tag.

Fire Alarm Circuit.

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

Fire Alarm Circuit Integrity (CI) Cable.

Cable used in fire alarm systems to ensure continued operation of critical circuits during a specified time under fire conditions.

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

A fire alarm circuit powered by a source that complies with 760.41 and 760.43.

Power-Limited Fire Alarm Circuit (PLFA).

A fire alarm circuit powered by a source that complies with 760.121.

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 16:25:48 EDT 2020
Committee: NEC-P03

Public Input No. 1698-NFPA 70-2020 [Section No. 760.3(A)]

(A) Spread of Fire or Products of Combustion.

~~See.~~ The spread of fire and products of combustion shall be limited in accordance with 300.21.

Statement of Problem and Substantiation for Public Input

The existing text of (A) does not comply with the NEC Style Manual. As currently written some sections of 760.3 are complete sentences, others are phrases, and this one was simply a title followed by a section number. I am submitting public inputs to provide a consistent format for 760.3(A) through (O).

Submitter Information Verification

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Committee: NEC-P03

Public Input No. 1699-NFPA 70-2020 [Section No. 760.3(D)]

(D) Corrosive, Damp, or Wet Locations.

~~Sections~~ Fire alarm circuits and equipment shall comply with 110.11, 300.5(B), 300.6, 300.9, and 310.10(F), where installed in corrosive, damp, or wet locations.

Statement of Problem and Substantiation for Public Input

The existing text of (D) does not comply with the NEC Style Manual. As currently written some sections of 760.3 are complete sentences, others are phrases. This one is an incomplete sentence. I am submitting public inputs to provide a consistent format for 760.3(A) through (O)D

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Public Input No. 2174-NFPA 70-2020 [Section No. 760.3(I)]

(I) Vertical Support for Fire- ~~Rated~~ -Resistive Cables and Conductors.

Vertical installations of circuit integrity (CI) cables and conductors installed in a raceway or conductors and cables of ~~electrical circuit protective~~ fire-resistive cable systems shall be installed in accordance with 300.19.

Statement of Problem and Substantiation for Public Input

The language is revised to use the term “fire-resistive cable system” as used elsewhere in the NEC® as that’s the defined term and more appropriate than fire-rated and more inclusive than simply electrical circuit protective systems.. The language is updated to remain consistent with other uses throughout the NEC®, for correlation.

This public input is a result of the Correlating Committee Task Group for Circuit Integrity Cable efforts to correlate information on Circuit Integrity (-CI) cable throughout the NEC®. Members of the task group included Blake Shugarman from UL – Principal Engineer for Circuit Integrity Systems, Larry Shudak from UL - Principal Engineer for Life Safety Technologies and member of NFPA 72, Anthony Tassone from UL – Principal Engineer Seasonal and Holiday Decorative Products and Telecommunications Cables - CMP16, Jim Conrad from Marmon Innovation and Technology Group – CMP13, George Straniero from AFC Cable Systems – CMP6, CMP3, and CC, Paul Casparro from IBEW – CMP3, and Rich Holub from DuPont – CMP14 and CC.

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Committee: NEC-P03

Public Input No. 1702-NFPA 70-2020 [Section No. 760.3(J)]

(J) ~~Number and Size of Cables and Conductors in Raceway.~~
~~Installations~~
Raceway Installations.
The number and size of cables and conductors shall comply with 300.17.

Statement of Problem and Substantiation for Public Input

Changes were proposed to 725.3(A) to comply with the NEC Style Manual. This change aligns with that change while by simplifying the title and using similar language.

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Public Input No. 2734-NFPA 70-2020 [Section No. 760.3(L)]

(L) Cable Routing Assemblies.

Power-limited fire alarm cables shall be permitted to be installed in plenum cable routing assemblies, riser cable routing assemblies, and general-purpose cable routing assemblies ~~selected in accordance with Table 800.154(c) ,~~ listed in accordance with 800.182, and installed in accordance with 800.110(C) and 800.113.

Statement of Problem and Substantiation for Public Input

This is a coordinating Public Input to PI 2716.

PI 2716 recommends deletion of 800.154, which includes Tables 800.154(a), (b) & (c).

If the recommendation of PI 2716 is accepted, then all references to 800.154, and Tables 800.154(a), (b) &(c), will need to be deleted.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2716-NFPA 70-2020 [Section No. 800.154]	Deletes 800.154

Submitter Information Verification

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Committee: NEC-P03

Public Input No. 2735-NFPA 70-2020 [Section No. 760.3(M)]

(M) Communications Raceways.

Power-limited fire alarm cables shall be permitted to be installed in plenum communications raceways, riser communications raceways, and general-purpose communications raceways ~~selected in accordance with Table 800.154(b) ,~~ listed in accordance with 800.182, and installed in accordance with 800.113 and 362.24 through 362.56, where the requirements applicable to electrical nonmetallic tubing apply.

Statement of Problem and Substantiation for Public Input

This is a coordinating Public Input to PI 2716.

PI 2716 recommends deletion of 800.154, which includes Tables 800.154(a), (b) & (c).

If the recommendation of PI 2716 is accepted, then all references to 800.154, and Tables 800.154(a), (b) &(c), will need to be deleted.

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Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2716-NFPA 70-2020 [Section No. 800.154]	Deletes 800.154

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Committee: NEC-P03

Public Input No. 3927-NFPA 70-2020 [Section No. 760.3(N)]

~~(N) Temperature Limitations of Power-Limited and Non–Power-Limited Fire Alarm Cables.~~

~~The requirements of 310.14(A)(3) on the temperature limitation of conductors shall apply to power-limited fire alarm cables and non–power-limited fire alarms cables.~~

Statement of Problem and Substantiation for Public Input

Referring to 310.14(A)(3) leads to Table 310.4(A) which does not include any conductor size smaller than 18 AWG. Most Class 2, Class 3 and power-limited fire alarm cables use smaller than 18 AWG conductors. In many cases, listed communications cables are substituted for Class 2, Class 3 and power-limited fire alarm cables. Article 800 has a simple requirement for the temperature limitation of communications cables:

“800.27 Temperature Limitation of Wires and Cables. No wire or cable shall be used in such a manner that its operating temperature exceeds that of its rating.”

This PI recommends a simple statement for the temperature limitation of cables in this article.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3923-NFPA 70-2020 [New Section after 760.25]	Linked Change

Submitter Information Verification

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Submittal Date: Wed Sep 09 15:35:14 EDT 2020
Committee: NEC-P03

Public Input No. 3037-NFPA 70-2020 [Section No. 760.24]

760.24 Mechanical Execution of Work.

(A) General.

Fire alarm circuits shall be installed in a neat workmanlike manner. Cables and conductors installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be supported by straps, staples, cable ties listed and identified for securement and support , hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also comply with 300.4.

Informational Note: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants might result in an undetermined alteration of PLFA and NPLFA cable properties.

(B) Circuit Integrity (CI) Cable.

Circuit integrity (CI) cables shall be supported at a distance not exceeding 610 mm (24 in.). Where located within 2.1 m (7 ft) of the floor, as covered in 760.53(A)(1) and 760.130(B)(1), as applicable, the cable shall be fastened in an approved manner at intervals of not more than 450 mm (18 in.). Cable supports and fasteners shall be steel.

Statement of Problem and Substantiation for Public Input

The intent of this public input is to harmonize the cable securing and supporting requirements for fire alarm circuits with the securing and supporting requirements for cable wirings methods in Chapter 3. Sections 320.30, 330.30, 334.30, and 337.30 require cable ties to be “listed and identified for securement and support”. This specific language is being added to 760.24 to ensure the same listing and securement requirement for cable ties also applies to cable ties used to support fire alarm circuits.
As noted in the committee statement for First Revision No. 1803-NFPA 70-2015 covering this added language to 334.30; “Listing of cable ties approved for support of flexible conduits and cables is appropriate as the standard requires markings that identify critical performance ranges that can impact their suitability for use, including minimum and maximum operating temperature and resistance to ultraviolet light for outdoor installations. The proposed new requirements will provide for objective determination for suitability of cable ties for this use”.
This statement holds true for cable tie use to comply with 760.24.
Identical public inputs have been submitted for Sections 725.24, 770.24, and 800.24.

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Committee: NEC-P03

Public Input No. 302-NFPA 70-2020 [Section No. 760.24(A)]

(A) General.

~~Fire alarm circuits shall be installed in a neat workmanlike manner. Cables and conductors installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use. Such cables shall be supported by straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also comply with~~ 300.4 .

~~Informational Note: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants might result in an undetermined alteration of PLFA and NPLFA cable properties.~~

See Section 110.12(C).

Statement of Problem and Substantiation for Public Input

These requirements for the mechanical execution of work are now covered in Section 110.12(C) and are redundant here.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 305-NFPA 70-2020 [Section No. 800.24]	

Submitter Information Verification

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Submittal Date: Thu Jan 16 10:30:08 EST 2020
Committee: NEC-P03

Public Input No. 3923-NFPA 70-2020 [New Section after 760.25]

760.27 Temperature Limitations of Power-Limited and Non–Power-Limited Fire Alarm Cables

No power-limited fire alarm cable or non–power-limited fire alarms cable shall be used in such a manner that its operating temperature exceeds that of its rating.

Statement of Problem and Substantiation for Public Input

Referring to 310.14(A)(3) leads to Table 310.4(A) which does not include any conductor size smaller than 18 AWG. Most Class 2, Class 3 and power-limited fire alarm cables use smaller than 18 AWG conductors. In many cases, listed communications cables are substituted for Class 2, Class 3 and power-limited fire alarm cables. Article 800 has a simple requirement for the temperature limitation of communications cables:

“800.27 Temperature Limitation of Wires and Cables. No wire or cable shall be used in such a manner that its operating temperature exceeds that of its rating.”

This PI recommends a simple statement for the temperature limitation of cables in this article.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 3927-NFPA 70-2020 [Section No. 760.3(N)]	

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Submittal Date: Wed Sep 09 15:33:07 EDT 2020
Committee: NEC-P03

Public Input No. 3317-NFPA 70-2020 [Section No. 760.32]

760.32 Fire Alarm Circuits Extending Beyond One Building.

Non–power-limited fire alarm circuits and power-limited fire alarm circuits that extend beyond one building and run outdoors shall meet the installation requirements of Parts II, III, and IV of Article 805 and shall meet the installation requirements of Part I of Article 300.

Informational Note: An example of a protective device suitable to provide protection is a device tested to the requirements of ANSI/UL 497B, *Protectors for Data Communications and Fire Alarm Circuits* .

Statement of Problem and Substantiation for Public Input

The UL 497B standard title is incomplete. Propose to add the missing portion of the Standard's title.

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Committee: NEC-P03

Public Input No. 4360-NFPA 70-2020 [Section No. 760.32]

760.32 Fire Alarm Circuits Extending Beyond One Building.

Non–power-limited fire alarm circuits and power-limited fire alarm circuits that extend beyond one building and run outdoors shall meet the installation requirements of Parts II, III, and IV of Article 805 and shall meet the installation requirements of Part I of Article 300.

Informational Note: An example of a protective device suitable to provide protection is a device tested to the requirements of ANSI/~~UL 497B,~~ UL 497, **Standard For Safety For Protectors for** ~~Data~~ **Paired-Conductor Communications Circuits** .

Statement of Problem and Substantiation for Public Input

The reference to UL 497B in the informational note of 760.32 is incorrect. UL 497B is intended for protectors for intrabuilding circuits.
UL 497B protectors don't get the surge testing needed for outside plant applications. The proper reference should be UL 497, Protectors for Paired-Conductor Communications Circuits.

The scope of UL 497B says:
1.1 These requirements cover protectors for data communications and fire-alarm circuits.
1.2 As covered by these requirements, data communications circuit protectors and fire-alarm circuit protectors consist of single- and multiple-pair air-gap arresters, gas-tube arresters, or solid-state arresters, with or without fuses or other voltage-limiting devices. Data communications circuit protectors and fire-alarm circuit protectors are intended to protect equipment, wiring, and personnel against the effects of excessive potentials and currents caused by lightning in communications alarm-initiating or alarm-indicating loop circuits.

Alarm loop circuits are generally not exposed to direct lightning strikes or power line faults in the outside plant.

The scope of UL 497 says:
1.1 These requirements cover protectors for paired-conductor communications circuits to be used in accordance with Article 800 of the National Electrical Code, NFPA 70.
1.2 As covered by these requirements, a communications circuit protector consists of single- and multiple-pair air gap arresters, gas tube arresters, or solid state arresters, with or without fuses or other voltage-limiting devices. A circuit protector is intended to protect equipment, wiring, and personnel against the effects of excessive potentials and currents in telephone lines caused by lightning, contacts with power conductors, power induction, and rises in ground potential.

"Article 800" is now Article 805 (this needs to be updated to Article 805 in UL 497) and Article 805 references UL 497 in the informational note to 805.170(A) - Primary Protectors.

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Committee: NEC-P03

Public Input No. 3036-NFPA 70-2020 [New Section after 760.35]

760.36 Overvoltage Protection

A listed surge-protective device (SPD) shall be installed in or on the fire alarm control panel in accordance with Part II of Article 242.

Statement of Problem and Substantiation for Public Input

Surge protection for the fire pump controller (Article 695.15) was added to the 2017 NEC. The specific verbiage states: “A listed surge protection device shall be installed in or on the fire pump controller”.
Electronic life-saving equipment such as fire alarm systems, fire pump controllers, IDCI’s, GFCI’s, AFCI’s and smoke alarms, may be damaged when a surge occurs due to lightning, internal local switching as well as external utility switching. Egress equipment such as emergency lighting, fire control systems, smoke control systems, occupant evacuation elevator may also be damaged when subjected to surge. In many cases, electronic devices and equipment can be damaged and rendered inoperable by a surge and yet this damage is undetected by the owner. It is practical to require a SPD to provide a general level of protection. In new service installations, as well as service replacements, no consideration is given to providing a general level of protection to the “whole structure” which would include those devices that cannot be afforded a cord connected Type 3 SPD protection. In conjunction with this coverage expansion to 230.67(A), 230.67(D) would require that where these services are replaced, an SPD is to be installed.

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Committee: NEC-P03

Public Input No. 763-NFPA 70-2020 [New Section after 760.35(B)]

TITLE OF NEW CONTENT

Type your content here ...

760.36 Electromagnetic Pulse (EMP) Protection. Protection for fire alarm systems against the effects of electromagnetic pulses shall be provided at a minimum of Level 1. See 709.7 for levels of electromagnetic pulse protection. This requirement shall become effective January 1, 2026.

Statement of Problem and Substantiation for Public Input

A devastating electromagnetic pulse (EMP), caused by a sun-spot or a nuclear bomb exploded high in the atmosphere, can impress 50,000 volts per meter on unprotected electrical and electronic equipment. It is similar to a radio wave impressing a very small voltage on a radio antenna, only orders of magnitude larger. The problem is that a significant EMP will fry every electrical/electronic component or piece of equipment that is not protected.

The EMP won't directly harm or injure people, but because there is no longer a working electrical infrastructure, which may take years to repair/rebuild, people will die from the lack of clean water, medicine, food, fuel, and eventual rioting due to the breakdown of society. Unclassified studies, referenced at the end of this substantiation, have estimated from 66% to 90% of the US population will die within one year if a significant sun spot were to occur or if a nuclear explosion were to occur 25 to 250 miles over the Midwest.

Our US military already "hardens" systems/buildings so that our country's critical defensive capabilities are not completely destroyed. There are two major methods of protecting electrical/electronic systems. The first is that surge protective devices are installed on all "incoming" power and communications cables, shunting overvoltages to ground. The second is that Faraday cages are installed around equipment/rooms, preventing the EMP from reaching critical equipment/components.

The NEC® needs to address EMP protection for equipment, systems and special occupancies that are critical to our survival. Electrical and electronic equipment can and must be protected, as has been achieved by our military. Unfortunately, there are no requirements to protect civilian electrical and electronic equipment/systems from EMPs.

The NEC Correlating Committee has informally advised that an EMP Protection Article, if passed and adopted into the NEC®, would be most appropriately located after Article 708 (COPS). Thus, Public Input 756 has suggested a new Article 709 under jurisdiction of CMP 13, which already has purview over Emergency Systems (Article 700), Legally Required Standby Systems (Article 701), Optional Standby Systems (Article 702), and Critical Operations Power Systems (Article 708).

Levels of protection and associated protection requirements listed in the Public Input(s) are based upon the unclassified National Cybersecurity and Communications Integration Center report "Electromagnetic Pulse (EMP) Protection and Resilience Guidelines for Critical Infrastructure and Equipment". This study explains electromagnetic pulses and provides the necessary protective measures. It also contains estimates of the costs associated with properly protecting our electrical infrastructure.
The following table contains critical infrastructure components/special occupancies and the maximum time for outages caused by an EMP. Electrical components/infrastructure that is not functioning for periods longer than shown in this table may begin to cause injury or death to people and harm to society/economy.

Critical Infrastructure Component/Special Occupancy	Permitted Outage Time
Branch banking facilities	10 hours
Critical Operations Power Systems	10 minutes
Data centers	10 minutes
Direct current microgrids	10 hours
Drug stores/distribution centers	10 hours
Electrically driven or controlled irrigation machines	1 week
Elevators, dumbwaiters, escalators, moving walks, platform lifts, and stairway chairlifts	See facility requirements
Emergency systems	10 hours
Energy storage systems	10 hours
Fire alarm systems	1 week
Fire houses/stations	10 hours
Fire pumps	10 hours
Food processing and storage facilities	10 hours
Fuel cell systems	10 hours
Generators	10 hours
Grocery stores	10 hours
Hardware stores/home centers	10 hours
Healthcare facilities	See NFPA 99
Information technology equipment	10 minutes
Interconnected electric power production sources	10 minutes
Jails and prisons	10 minutes
Large-scale photovoltaic (PV) electric supply stations	10 hours
Legally required standby systems	10 hours
Modular data centers	10 minutes
Motor fuel dispensing facilities	1 week
Motors, motor circuits, and controllers	See facility requirements
Nuclear reactors	10 seconds
Optional standby systems	1 week
Petrochemical plants/facilities	10 hours
Pharmaceutical plants/facilities	10 hours
Police stations	10 minutes
Solar photovoltaic (PV) systems	10 hours
Stand-alone systems	10 hours
Storage batteries	See facility requirements
Transformers	See facility requirements
Waste water treatment facilities	10 minutes
Water supply facilities	10 hours
Wind electric systems	10 hours

An effectivity date of January 1, 2026 is chosen to allow time for engineering and industry to adequately pan and prepare for the required changes.

Opponents of EMP protection requirements will likely charge that it is too costly to protect our critical infrastructure, and that the NEC® is not a war-time document. A close reading of 90.1 reveals that there is no mention of the "cost" of safeguarding persons and property. Neither does 90.1 mention that safeguarding persons and property is only required during peacetime. Additionally, a significant EMP event, caused by a sunspot, would be an act of God, not an act of war.

The novel, "One Second After", provides an understanding of what happens when the majority of all unprotected electrical and electronic equipment/systems is destroyed during an EMP event. An audio version of this book is available in two parts, for free, on YouTube.

This link provides the unclassified report "Electromagnetic Pulse (EMP) Protection and Resilience Guidelines for Critical Infrastructure and Equipment"
https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&ved=2ahUKEwjQhp2-77DoAhXBHM0KHboOB2QQFjACegQIBRAC&url=https%3A%2F%2Fwww.cisa.gov%2Fsites%2Fdefault%2Ffiles%2Fpublications%2F19_0307_CISA_EMP-Protection-Resilience-Guidelines.pdf&usg=AOvVaw2n7jLtJAUJtOJKHPMqWsTE

This link provides the study predicting up to 90% of our population could die from an EMP event
http://www.firstempcommission.org/uploads/1/1/9/5/119571849/nuclear_emp_attack_scenarios_and_combined-arms_cyber_warfare_by_peter_pry_july_2017.pdf

This link provides unclassified guidelines for facility EMP protection
https://info.publicintelligence.net/DHS-FacilitiesGuidelinesEMP.pdf

These links provide Parts 1 and 2 of a national plan for EMP protection.
https://interferencetechnology.com/a-national-plan-for-emp-protection-part-1/

https://interferencetechnology.com/national-plan-emp-protection-part-2-protection-buildings/

We have all just witnessed the chaos and pain caused by not having the “protections” in place to quickly defeat the Covid-19 virus. As unfortunate, costly, painful, and deadly as Covid-19 was, it would be child’s play when compared to a significant EMP event if our critical electrical/electronic infrastructure remains unprotected. Quite simply, NEC® requirements to protect electrical and electronic equipment from an EMP event, could literally save millions of American lives.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 756-NFPA 70-2020 [New Section after 708.64]	
Public Input No. 756-NFPA 70-2020 [New Section after 708.64]	

Submitter Information Verification

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Committee: NEC-P03

Public Input No. 2362-NFPA 70-2020 [Section No. 760.41(B)]

(B) Branch Circuit.

The branch circuit supplying the fire alarm equipment(s) shall supply no other loads. The location of the branch-circuit overcurrent protective device shall be permanently identified at the fire alarm control unit. The circuit disconnecting means shall have red identification, shall be accessible only to qualified personnel, and shall be identified as "FIRE ALARM CIRCUIT." The red identification shall not damage the overcurrent protective devices or obscure the manufacturer's markings. ~~This branch circuit shall not be~~ The branch circuit shall comply with all of the following:

1. Be installed in a metal raceway, metal auxiliary gutter, steel-armored cable, Type MC or Type AC, meeting the applicable requirements of 250.118, with metal boxes, conduit bodies, and enclosures and,

2. Not be supplied through ground-fault circuit interrupters or arc-fault circuit-interrupters.

Informational Note: See 210.8(A)(5), Exception, for receptacles in dwelling-unit unfinished basements that supply power for fire alarm systems.

Statement of Problem and Substantiation for Public Input

This section prohibits the branch circuit from AFCI protection, but falls short of requiring the wiring method to be of one identified in Section 210.12(A)(5).See PI's for 760.121(B) and 210.12(A).

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2361-NFPA 70-2020 [Section No. 210.12(A)]	Currently 210.12(A) Exception modifies this requirement by permitting AFCI protection.
Public Input No. 2363-NFPA 70-2020 [Section No. 760.121(B)]	Harmonize requirements
Public Input No. 2361-NFPA 70-2020 [Section No. 210.12(A)]	
Public Input No. 2363-NFPA 70-2020 [Section No. 760.121(B)]	

Submitter Information Verification

Submitter Full Name: Jeffrey Fecteau
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Submittal Date: Mon Aug 17 18:54:15 EDT 2020
Committee: NEC-P03

Public Input No. 319-NFPA 70-2020 [New Section after 760.121(B)]

760.121 (C) Disconnect.

PLEASE SEE SUBSTANTIATION - TERRA WILL NOT ALLOW ME TO ENTER IT CORRECTLY

Statement of Problem and Substantiation for Public Input

This is clearly a very important section. There is quite a bit going on in this section, and I've attempted a complete rewrite and put everything in list form. I've broken out the section into two sections:
760.121(B) Branch Circuit.
760.121(C) Disconnect. (new section- please see the related PI)
Here is the proposed text:

****

760.121(B) Branch Circuit.

The branch circuit supplying the fire alarm equipment shall comply with the following:

1. the branch circuit shall supply no other loads
2. the branch circuit shall not be supplied through ground-fault circuit interrupters
3. the branch circuit shall not be supplied through arc-fault circuit interrupters
4. the branch circuit wiring shall not be routed with other power and lighting conductors, unless permitted in 760.48(B)
5. the branch circuit shall be identified at the source using one of the following:
    1. handwritten words "FIRE ALARM" with all letters capitalized
    2. permanent label or signage with all letters capitalized, in white on a red background with the words "FIRE ALARM"

760.121(C) Disconnect.

The disconnecting means for the fire alarm circuit(s) shall comply with the following:

1. be equipped with an approved lock-on device in order to prevent accidental shutoff
2. the location of the disconnecting means shall be permanently identified at the fire alarm control panel
3. if the disconnecting means is a safety switch, it shall be identified in accordance with 760.121(B)(5)(2)
4. if the disconnecting means is a molded case circuit breaker or molded case switch, the face of the molded case circuit breaker or molded case switch shall be manufactured red in color

Exception: The face of the molded case circuit breaker or molded case switch shall be permitted to be field-identified red in color, provided that it does not damage the device or obscure any of the manufacturers' markings

****

One huge problem that we face with enforcement of the NEC is that the panel schedules continually have the abbreviation "FACP" instead of the required labeling per 760.121(B). This usually begins at the plan review phase when the engineer or other registered design professional crafts the panel schedule. 90 out 100 will enter "FACP" on the panel schedule. I call this, "The FACP retrovirus" and I explain it here (for your reading pleasure):
https://www.ecmag.com/section/codes-standards/facp-retrovirus-doctor

I believe that putting the requirements in list form draws more attention to the required labeling. Additionally, NFPA-72 Section 10.6.5.2.2 no longer uses the term "FIRE ALARM CIRCUIT" and only states, "FIRE ALARM." Eliminating the extraneous word also makes for additional room on the panel schedule.

The new language and structure complies with the NEC Style manual.

Another issue that the rewrite solves (in my opinion) is the issue of running fire alarm control panel power with other conductors. It is currently unclear in NFPA-72 and the NEC whether this is allowed. Many times, an occupancy will change use, and a fire alarm will now be required. In real life some low-bidder will attempt to use existing conduit and junction boxes (which contain numerous other conductors, along with preexisting code violations) to route the fire alarm power. Better contractors on the other hand, will use a separate cable or raceway - some even go to the great length of coloring all fire alarm raceways and junction boxes red. Adding this new language to 760.121(B) "Branch Circuit" makes it clear that fire alarm control panel power can be run with other conductors only when connected to the same equipment. I believe that this is necessary in order to maintain the integrity of the fire alarm system as a whole.

Another problem or issue that this rewrite solves is that of the red marking. It has always been unclear in the field what is meant by the red marking. Some people use a red dot, and others use a red star, etc. This language would allow manufacturers' to envision a new product - to make the face of the breaker red (if they choose to do so). Currently the manufacturers that sell a "fire alarm breaker" make only the tiny handle red. This reminds me of the old Bryant circuit breakers, where every handle was a different color. In my opinion, the tiny, red handle is of no distinction. The section would still allow for red field identification, by paint or red nail polish or some other commonsensical means.

Another problem that this rewrite solves is the problem of the lock-on device. While I realize that this has been updated in the 2020 NEC, the language needs to be mandatory language and not permissive language. NFPA-72 Section 10.6.5.4 requires that, "Where a circuit breaker is the disconnecting means, an approved breaker locking device SHALL be installed..." NEC seems to be less restrictive and only permits this to be done but doesn't specifically require it to be done. I believe that the code panel's intent was to always have the lock-on device installed. The additional cost for this lock-on device is negligible, and doesn't pose any added burden on the contractor to do this. I believe that this is needed.

Lastly, I've added language about the required identification - in case the disconnect is a safety switch.

Overall, I believe that breaking the requirements out into two sections, "branch circuit" and "disconnect" makes total sense. It is much clearer, and it makes it easier to enforce these very important requirements.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 241-NFPA 70-2020 [Section No. 760.121(B)]	

Submitter Information Verification

Submitter Full Name: Nick Sasso
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Submittal Date: Sat Jan 18 12:51:18 EST 2020
Committee: NEC-P03

Public Input No. 2363-NFPA 70-2020 [Section No. 760.121(B)]

(B) Branch Circuit.

The branch circuit supplying the fire alarm equipment(s) shall supply no other loads. The location of the branch-circuit overcurrent protective device shall be permanently identified at the fire alarm control unit. The circuit disconnecting means shall have red identification, shall be accessible only to qualified personnel, and shall be identified as "FIRE ALARM CIRCUIT." The red identification shall not damage the overcurrent protective devices or obscure the manufacturer's markings. ~~This branch circuit shall not be supplied through ground-fault circuit interrupters or arc-fault circuit interrupters.~~ The fire alarm branch-circuit disconnecting means shall be permitted to be secured in the "on" position.

The branch circuit shall comply with all of the following:

1. Be installed in a metal raceway, metal auxiliary gutter, steel-armored cable, Type MC or Type AC, meeting the applicable requirements of 250.118, with metal boxes, conduit bodies, and enclosures and,

2. Not be supplied through ground-fault circuit interrupters or arc-fault circuit-interrupters.

Statement of Problem and Substantiation for Public Input

This section prohibits the branch circuit from AFCI protection, but falls short of requiring the wiring method to be of one identified in Section 210.12(A)(5). See PI's for 760.41(B) and 210.12(A).

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2361-NFPA 70-2020 [Section No. 210.12(A)]	Currently modifies this section by permitting AFCI protection.
Public Input No. 2362-NFPA 70-2020 [Section No. 760.41(B)]	Harmonizing requirements.
Public Input No. 2361-NFPA 70-2020 [Section No. 210.12(A)]	
Public Input No. 2362-NFPA 70-2020 [Section No. 760.41(B)]	

Submitter Information Verification

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Committee: NEC-P03

Public Input No. 241-NFPA 70-2020 [Section No. 760.121(B)]

~~**(B)** Branch Circuit.~~

~~The branch circuit supplying the fire alarm equipment(s) shall supply no other loads. The location of the branch-circuit overcurrent protective device shall be permanently identified at the fire alarm control unit. The circuit disconnecting means shall have red identification, shall be accessible only to qualified personnel, and shall be identified as "FIRE ALARM CIRCUIT." The red identification shall not damage the overcurrent protective devices or obscure the manufacturer's markings. This branch circuit shall not be supplied through ground-fault circuit interrupters or arc-fault circuit interrupters. The fire alarm branch-circuit disconnecting means shall be permitted to be secured in the "on" position.~~

PLEASE SEE SUBSTANTIATION - TERRA WILL NOT ALLOW ME TO ENTER IT CORRECTLY

Statement of Problem and Substantiation for Public Input

This is clearly a very important section. There is quite a bit going on in this section, and I've attempted a complete rewrite and put everything in list form. I've broken out the section into two sections:
760.121(B) Branch Circuit.
760.121(C) Disconnect. (new section- please see the related PI)
Here is the proposed text:

****

760.121(B) Branch Circuit.

The branch circuit supplying the fire alarm equipment shall comply with the following:

1. the branch circuit shall supply no other loads
2. the branch circuit shall not be supplied through ground-fault circuit interrupters
3. the branch circuit shall not be supplied through arc-fault circuit interrupters
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760.121(C) Disconnect.

The disconnecting means for the fire alarm circuit(s) shall comply with the following:

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Exception: The face of the molded case circuit breaker or molded case switch shall be permitted to be field-identified red in color, provided that it does not damage the device or obscure any of the manufacturers' markings

****

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I believe that putting the requirements in list form draws more attention to the required labeling. Additionally, NFPA-72 Section 10.6.5.2.2 no longer uses the term "FIRE ALARM CIRCUIT" and only states, "FIRE ALARM." Eliminating the extraneous word also makes for additional room on the panel schedule.

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Another problem or issue that this rewrite solves is that of the red marking. It has always been unclear in the field what is meant by the red marking. Some people use a red dot, and others use a red star, etc. This language would allow manufacturers' to envision a new product - to make the face of the breaker red (if they choose to do so). Currently the manufacturers that sell a "fire alarm breaker" make only the tiny handle red. This reminds me of the old Bryant circuit breakers, where every handle was a different color. In my opinion, the tiny, red handle is of no distinction. The section would still allow for red field identification, by paint or red nail polish or some other commonsensical means.

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Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 319-NFPA 70-2020 [New Section after 760.121(B)]	

Submitter Information Verification

Submitter Full Name: Nick Sasso
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Submittal Date:	Fri Jan 03 11:08:02 EST 2020
Committee:	NEC-P03

Public Input No. 1539-NFPA 70-2020 [Section No. 760.130(B)(2)]

(2) Passing Through a Floor or Wall.

Cables shall be installed in metal raceways or rigid nonmetallic conduit where passing through a floor or wall to a height of 2.1 m (7 ft) above the floor, unless adequate protection can be afforded by building construction such as detailed in 760.130(B)(1), or unless an equivalent solid guard is provided.

Exception: the metal raceway or rigid nonmetalic protection is not required in the hollow or concealed space of a wall or ceiling cavity

Statement of Problem and Substantiation for Public Input

Clarify is need for the situations where you sleeved thru a floor in a wall, it is not required to have the raceway for protection up to a height of 7 ft inside a normal wall cavity space. Some persons interpret the 7 ft protection is required every time you go thru a floor whether it is inside a wall or not.. Protection from the building construction itself as in (1) is referenced; however there is not suitable clarity for this hollow space

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Public Input No. 647-NFPA 70-2020 [Section No. 760.135(A)]

(A) Listing.

PLFA cables installed in buildings shall be listed and installed in accordance with the limitations of the listing .

Statement of Problem and Substantiation for Public Input

The requirement that cables be installed in accordance with the limitations of the listing is in 770.113(A). Logically, this requirement should also apply to copper cables.

Section 800.3(D) requires compliance with 110.3(B) which requires that equipment be installed in accordance with the listing. Explicit requirements for cables are need because the definition of equipment in Article 100 doesn't include cables.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 645-NFPA 70-2020 [Section No. 800.113(A)]	Companion PI for communications (Chapter 8) cables.
Public Input No. 646-NFPA 70-2020 [Section No. 725.135(A)]	Companion PI for Article 725 cables.
Public Input No. 646-NFPA 70-2020 [Section No. 725.135(A)]	

Submitter Information Verification

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Committee: NEC-P03

Public Input No. 680-NFPA 70-2020 [Section No. 760.135(B)]

(B) Ducts Specifically Fabricated for Environmental Air.

The following cables shall be permitted in ducts specifically fabricated for environmental air as described in 300.22(B), if they are directly associated with the air distribution system:

(1) Types FPLP and FPLP-CI cables in lengths as short as practicable to perform the required function

(2) Types FPLP, FPLP-CI, FPLR, FPLR-CI, FPL, and FPL-CI cables installed in raceways that are installed in compliance with 300.22(B)

Informational Note: For information on fire protection of wiring installed in fabricated ducts, see 4.3.4.1 and 4.3.11.3.3 of NFPA 90A ~~2018~~ 2021 , *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

Statement of Problem and Substantiation for Public Input

Update issue date of NFPA 90A.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 678-NFPA 70-2020 [Section No. 300.22(C) [Excluding any Sub-Sections]]	Update issue date of NFPA 90A.
Public Input No. 679-NFPA 70-2020 [Section No. 725.135(B)]	Update issue date of NFPA 90A.
Public Input No. 681-NFPA 70-2020 [Section No. 770.24]	Update issue date of NFPA 90A.
Public Input No. 682-NFPA 70-2020 [Section No. 770.113(C)]	Update issue date of NFPA 90A.
Public Input No. 683-NFPA 70-2020 [Section No. 800.24]	Update issue date of NFPA 90A.
Public Input No. 684-NFPA 70-2020 [Section No. 800.113(B)]	Update issue date of NFPA 90A.
Public Input No. 685-NFPA 70-2020 [Section No. 800.113(C)]	Update issue date of NFPA 90A.
Public Input No. 686-NFPA 70-2020 [Section No. 800.182(A)]	Update issue date of NFPA 90A.
Public Input No. 687-NFPA 70-2020 [Section No. 805.170(C)]	Update issue date of NFPA 90A.
Public Input No. 688-NFPA 70-2020 [Section No. 770.113(B)]	Update issue date of NFPA 90A.
Public Input No. 678-NFPA 70-2020 [Section No. 300.22(C) [Excluding any Sub-Sections]]	
Public Input No. 679-NFPA 70-2020 [Section No. 725.135(B)]	
Public Input No. 681-NFPA 70-2020 [Section No. 770.24]	
Public Input No. 682-NFPA 70-2020 [Section No. 770.113(C)]	
Public Input No. 683-NFPA 70-2020 [Section No. 800.24]	
Public Input No. 684-NFPA 70-2020 [Section No. 800.113(B)]	
Public Input No. 685-NFPA 70-2020 [Section No. 800.113(C)]	
Public Input No. 686-NFPA 70-2020 [Section No. 800.182(A)]	
Public Input No. 687-NFPA 70-2020 [Section No. 805.170(C)]	
Public Input No. 688-NFPA 70-2020 [Section No. 770.113(B)]	

Submitter Information Verification

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Submittal Date: Wed Mar 18 03:59:08 EDT 2020
Committee: NEC-P03

Public Input No. 660-NFPA 70-2020 [Section No. 760.135(C)]

(C) Other Spaces Used For Environmental Air (Plenums).

The following cables shall be permitted in other spaces used for environmental air as described in 300.22(C):

(1) Type FPLP cables

(2) Type FPLP cables installed in plenum communications raceways

(3) Type FPLP cables installed in plenum routing assemblies

(4) Types FPLP and FPLP-CI cables supported by open metallic cable trays or cable tray systems

(5) Types FPLP, FPLR, and FPL cables installed in raceways that are installed in compliance with 300.22(C)

(6) Types FPLP, FPLR, and FPL cables supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)

(7) Types FPLP, FPLR, and FPL cables installed in plenum communications raceways, riser communications raceways, or general-purpose communications raceways supported by solid bottom metal cable trays with solid metal covers in other spaces used for environmental air (plenums) as described in 300.22(C)

Informational Note: For information on fire protection of wiring installed in other spaces used for environmental air (plenums), see NFPA 90A -2021, *Standard for the Installation of Air-Conditioning and Ventilating Systems.*

Statement of Problem and Substantiation for Public Input

The Standards Council has assigned primary responsibility for fire protection in air handling spaces to the Technical Committee on Air Conditioning and its document NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems. The informational note in 760.135 (B) Ducts Specifically Fabricated for Environmental Air, has a reference to NFPA 90A, while 760.135(C) Other Spaces Used for Environmental Air (Plenums), does not reference NFPA 90A. Why not?

Also, sections 770.113(C) and 800.113(C), with parallel requirements to 725.135(C) for Other Spaces Used or Environmental Air, reference NFPA 90A.

Please consider the NEC Style Manual statement on parallel construction:

"3.3.5 Parallel Construction. Parallel construction means stating similar requirements in similar ways for greater consistency. This helps makes the NEC clear for users. Lack of consistency often creates confusion, causing users to ask: Does this difference in wording represent a different requirement? Or is it simply two different ways of trying to say the same thing? There are several kinds of parallel construction….."

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 649-NFPA 70-2020 [Section No. 725.135(C)]	Parallel PI for Article 725
Public Input No. 649-NFPA 70-2020 [Section No. 725.135(C)]	

Submitter Information Verification

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Submittal Date: Mon Mar 16 10:42:54 EDT 2020
Committee: NEC-P03

Public Input No. 3053-NFPA 70-2020 [Section No. 760.139]

760.139 Installation of Conductors of Different PLFA Circuits, Class 2, Class 3, and Communications Circuits in the Same Cable, Enclosure, Cable Tray, Raceway, or Cable Routing Assembly.

(A) Two or More PLFA Circuits.

Cable and conductors of two or more power-limited fire alarm ~~circuits, communications circuits, or Class 3 circuits shall~~ circuits shall be permitted within the same cable, enclosure, cable tray, raceway, or cable routing assembly.

(B) Class 2 Circuits with PLFA Circuits.

Conductors of one or more Class 2 circuits shall be permitted within the same cable, enclosure, cable tray, raceway, or cable routing assembly with conductors of power-limited fire alarm circuits, provided that the insulation of the Class 2 circuit conductors in the cable, enclosure, raceway, or cable routing assembly is at least that required by the power-limited fire alarm circuits.

(C) Class 3 and Communication Circuits with PLFA Circuits.

Cable and conductors of Class 3 and communications circuits shall be permitted within the same cable, enclosure, cable tray, raceway, or cable routing assembly with cables and conductors of power-limited fire alarm circuits.

(D) Low-Power Network-Powered Broadband Communications Cables and PLFA Cables.

Low-power network-powered broadband communications circuits shall be permitted in the same enclosure, cable tray, raceway, or cable routing assembly with PLFA cables.

(D E) Audio System Circuits and PLFA Circuits.

Audio system circuits described in 640.9(C) and installed using Class 2 or Class 3 wiring methods in compliance with 725.133 and 725.154 shall not be permitted to be installed in the same cable, cable tray, raceway, or cable routing assembly with power-limited conductors or cables.

Statement of Problem and Substantiation for Public Input

The problem with how this is currently written is that the allowance for mixing a PLFA circuit with other circuits is under the first level subdivision title “Two or More PLFA Circuits.” The only thing that would be appropriate under that title is the allowance for multiple PLFA circuits. Therefore, this change would allow the mixing of circuits that are not PLFA circuits with those circuits, but would no longer hide that circuit mixing under an inappropriate title.

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Committee: NEC-P03

Public Input No. 315-NFPA 70-2020 [Section No. 760.176]

760.176 Listing and Marking of NPLFA Cables.

Non-power-limited fire alarm cables installed as wiring within buildings shall be listed in accordance with 760.176(A) and (B) and as being resistant to the spread of fire in accordance with 760.176(C) through (F), and shall be marked in accordance with 760.176(G). Cable used in a wet location shall be listed for use in wet locations or have a moisture-impervious metal sheath. Non-power-limited fire alarm cables shall have a temperature rating of not less than 60°C (140°F).

(A) ~~NPLFA Conductor Materials~~ Conductors and Optical Fibers .

Conductors shall be 18 AWG or larger solid or stranded copper. NPLFA cables shall be permitted to contain optical fibers.

(B) Insulated Conductors.

Insulation on conductors shall be rated for the system voltage and not less than 600 V. Insulated conductors 14 AWG and larger shall be one of the types listed in Table 310.4(A) or one that is identified for this use. Insulated conductors 18 AWG and 16 AWG shall be in accordance with 760.49.

(C) Type NPLFP.

Type NPLFP non-power-limited fire alarm cable for use in other space used for environmental air shall be listed as being suitable for use in other space used for environmental air as described in 300.22(C) and shall also be listed as having adequate fire-resistant and low smoke–producing characteristics.

Informational Note: One method of defining a cable that is low-smoke producing cable and fire-resistant cable is that the cable exhibits a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.52 m (5 ft) or less when tested in accordance with NFPA 262-2019, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces*.

(D) Type NPLFR.

Type NPLFR non–power-limited fire alarm riser cable shall be listed as being suitable for use in a vertical run in a shaft or from floor to floor and shall also be listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor.

Informational Note: One method of defining fire-resistant characteristics capable of preventing the carrying of fire from floor to floor is that the cables pass ANSI/UL 1666-2012, *Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts*.

(E) Type NPLF.

Type NPLF non–power-limited fire alarm cable shall be listed as being suitable for general-purpose fire alarm use, with the exception of risers, ducts, plenums, and other space used for environmental air, and shall also be listed as being resistant to the spread of fire.

Informational Note: One method of defining *resistant to the spread of fire* is that the cables do not spread fire to the top of the tray in the "UL Flame Exposure, Vertical Tray Flame Test" in ANSI/UL 1685-2010, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*. The smoke measurements in the test method are not applicable.

Another method of defining *resistant to the spread of fire* is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA "Vertical Flame Test — Cables in Cable Trays," as described in CSA C22.2 No. 0.3-M-2001, *Test Methods for Electrical Wires and Cables*.

(F) Fire Alarm Circuit Integrity (CI) Cable or Electrical Circuit Protective System.

Cables that are used for survivability of critical circuits under fire conditions shall meet either 760.176(F)(1) or (F)(2).

Informational Note No. 1: Fire alarm circuit integrity (CI) cable and electrical circuit protective systems may be used for fire alarm circuits to comply with the survivability requirements of *NFPA 72*-2019, *National Fire Alarm and Signaling Code*, 12.4.3 and 12.4.4, that the circuit maintain its electrical function during fire conditions for a defined period of time.

Informational Note No. 2: One method of defining circuit integrity (CI) cable or an electrical circuit protective system is by establishing a minimum 2-hour fire-resistive rating for the cable when tested in accordance with ANSI/UL 2196-2017, *Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control, and Data Cables*.

Informational Note No. 3: UL guide information for electrical circuit protective systems (FHIT) contains information on proper installation requirements for maintaining the fire rating.

(1) Circuit Integrity (CI) Cables.

Circuit integrity (CI) cables, specified in 760.176(C), (D), and (E), and used for survivability of critical circuits, shall have an additional classification using the suffix "CI." Circuit integrity (CI) cables shall only be permitted to be installed in a raceway where specifically listed and marked as part of an electrical circuit protective system as covered in 760.176(F)(2).

(2) Electrical Circuit Protective System.

Cables specified in 760.176(C), (D), (E), and (F)(1), that are part of an electrical circuit protective system, shall be identified with the protective system number and hourly rating printed on the outer jacket of the cable and installed in accordance with the listing of the protective system.

(G) NPLFA Cable Markings.

Multiconductor non–power-limited fire alarm cables shall be marked in accordance with Table 760.176(G). Non–power-limited fire alarm circuit cables shall be permitted to be marked with a maximum usage voltage rating of 150 volts. Cables that are listed for circuit integrity shall be identified with the suffix "-CI" as defined in 760.176(F). The temperature rating shall be marked on the jacket of NPLFA cables that have a temperature rating exceeding 60°C (140°F). The jacket of NPLFA cables shall be marked with the conductor size. Cables containing optical fibers shall be marked with the suffix -OF.

Informational Note: Cable types are listed in descending order of fire performance.

Table 760.176(G) NPLFA Cable Markings

Cable Marking	Type	Reference
NPLFP	Non–power-limited fire alarm circuit cable for use in "other space used for environmental air"	760.176(C) and (G)
NPLFR	Non–power-limited fire alarm circuit riser cable	760.176(D) and (G)
NPLF	Non–power-limited fire alarm circuit cable	760.176(E) and (G)

Note: Cables identified in 760.176(C), (D), and (E) and meeting the requirements for circuit integrity shall have the additional classification using the suffix "-CI" (for example, NPLFP-CI, NPLFR-CI, and NPLF-CI).

Statement of Problem and Substantiation for Public Input

This PI acknowledges that some fire alarm cables contain optical fibers. Marking with the suffix -OF aligns the NEC with UL listing requirements.

This PI coordinates with 770.3(C) which states:

770.3(C) Composite Cables.
Composite optical fiber cables shall be classified as electrical cables in accordance with the type of electrical conductors. They shall be constructed, listed, and marked in accordance with the appropriate article for each type of electrical cable.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 299-NFPA 70-2020 [Section No. 760.179]	Coordinating PI for PLFA cables
Public Input No. 313-NFPA 70-2020 [Section No. 725.179]	Coordinating PI for Article 725
Public Input No. 314-NFPA 70-2020 [Section No. 770.133(C)]	Coordinating PI for Article 770

Public Input No. 210-NFPA 70-2019 [Section No. 800.179]	Coordinating PI for Article 800
Public Input No. 210-NFPA 70-2019 [Section No. 800.179]	
Public Input No. 299-NFPA 70-2020 [Section No. 760.179]	
Public Input No. 314-NFPA 70-2020 [Section No. 770.133(C)]	

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Committee: NEC-P03

Public Input No. 2175-NFPA 70-2020 [Section No. 760.176(F)]

(F) Fire Alarm Circuit Integrity (CI) Cable, **Fire-Resistive Cable System** or Electrical Circuit Protective System.

Cables that are used for survivability of critical circuits under fire conditions shall meet either 760.176(F)(1) ~~or~~ , (F)(2) or (F)(3) .

Informational ~~Note No. 1:~~ Note Fire alarm circuit integrity (CI) cable ~~and~~ , fire-resistive cable systems or electrical circuit protective systems may be used for fire alarm circuits to comply with the survivability requirements of *NFPA 72*-2019, *National Fire Alarm and Signaling Code*, 12.4.3 and 12.4.4, that the circuit maintain its electrical function during fire conditions for a defined period of time. ~~Informational Note No. 2: One method of defining circuit integrity~~

~~(~~

~~CI) cable or an electrical circuit protective system is by establishing a minimum 2-hour fire-resistive rating for the cable when tested in accordance with ANSI/UL 2196-2017, *Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control, and Data Cables* .~~

~~Informational Note No. 3: UL guide information for electrical circuit protective systems (FHIT) contains information on proper installation requirements for maintaining the fire rating.~~

~~(~~

1) Circuit Integrity (CI) Cables.

Circuit integrity (CI) cables, specified in 760.176(C) , (D), and (E), and used for survivability of critical circuits, shall

~~have an~~

be marked with the additional classification using the suffix "CI." In order to maintain its listed fire-resistive rating, circuit integrity (CI) cable shall only be installed in free air in accordance with 760.24(B). Circuit integrity (CI) cables shall only be permitted to be installed in a raceway where specifically listed and marked as part of an

~~electrical circuit protective~~

fire-resistive cable system as covered in 760.176(F)(2) .

~~**(2)** Electrical Circuit Protective System.~~

~~Cables~~

Informational Note: One method of defining circuit integrity (CI) cable is by establishing a rating when tested in accordance with UL 2196, *Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables* as specified in UL 1425, *Cables for Non–Power-Limited Fire-Alarm Circuits* . UL *Guide Information for Nonpower-limited Fire Alarm Circuits* (HNHT) contains information to identify the cable and its installation limitations to maintain the fire-resistive rating.

(2) Fire-resistive cables specified in 760.176(C) , (D), (E), and (F)(1),

~~that are part of~~

which are part of a fire-resistive cable system, shall be identified with the system identifier and hourly rating marked on theprotectant or the smallest unit container and installed in accordance with the listing of the system.

Informational Note: One method of defining a fire-resistive cable system is by establishing a rating when tested in accordance with UL 2196, *Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables* . UL *Guide Information for Electrical Circuit Integrity Systems* (FHIT) contains information to identify the system and its installation limitations to maintain a minimum fire-resistive rating.

(3) Electrical Circuit Protective System.

Protectants for cables specified in 760.176(C) , (D), and (E) which are part of an electrical circuit protective system, shall be identified with the protective system

~~number~~

identifier and hourly rating

~~printed~~

marked on the

~~outer jacket of the cable~~

protectant or the smallest unit container and installed in accordance with the listing of the protective system.

Informational Note: One method of defining an electrical circuit protective system is by establishing a rating when tested in accordance with UL 1724, *Fire Tests for Electrical Circuit Protective Systems* . UL *Guide Information for Electrical Circuit Integrity Systems* (FHIT) contains information to identify the system and its installation limitations to maintain the fire-resistive rating.

Statement of Problem and Substantiation for Public Input

The language is revised to use the term "fire-resistive cable system" as used elsewhere in the NEC® as that's the defined term and more appropriate than fire-rated and more inclusive than simply electrical circuit protective systems.. The language is updated to remain consistent with other uses throughout the NEC®, for correlation.

The organization of this section has been revised for clarity and Informational notes were relocated to follow the appropriate code text.

This public input is a result of the Correlating Committee Task Group for Circuit Integrity Cable efforts to correlate information on Circuit Integrity (-CI) cable throughout the NEC®. Members of the task group included Blake Shugarman from UL – Principal Engineer for Circuit Integrity Systems, Larry Shudak from UL - Principal Engineer for Life Safety Technologies and member of NFPA 72, Anthony Tassone from UL – Principal Engineer Seasonal and Holiday Decorative Products and Telecommunications Cables - CMP16, Jim Conrad from Marmon Innovation and Technology Group – CMP13, George Straniero from AFC Cable Systems – CMP6, CMP3, and CC, Paul Casparro from IBEW – CMP3, and Rich Holub from DuPont – CMP14 and CC.

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Public Input No. 345-NFPA 70-2020 [Section No. 760.176 [Excluding any Sub-Sections]]

Non-power-limited fire alarm cables installed as wiring within buildings shall be listed in accordance with 760.176(A) and (B) and as being resistant to the spread of fire in accordance with 760.176(C) through (F), and shall be marked in accordance with 760.176(G). Cable used in a wet location shall be listed for use in wet locations or have a moisture-impervious metal sheath. Non-power-limited fire alarm cables shall have a temperature rating of not less than 60°C (140°F).

Informational Note: For information on Non-Power-Limited Fire Alarm cables see *UL 1425, Standard for Cables for Non-Power-Limited Fire-Alarm Circuits*, 2015.

Statement of Problem and Substantiation for Public Input

Adding an informational note referring the user to the listing standard for the cables in this section provides useful information. UL listing standards are referred to throughout this Code.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 341-NFPA 70-2020 [Section No. 800.179 [Excluding any Sub-Sections]]	Similar PI for Article 800
Public Input No. 342-NFPA 70-2020 [Section No. 770.179 [Excluding any Sub-Sections]]	Similar PI for Article 770
Public Input No. 343-NFPA 70-2020 [Section No. 725.179 [Excluding any Sub-Sections]]	Similar PI for Article 725
Public Input No. 344-NFPA 70-2020 [Section No. 760.179 [Excluding any Sub-Sections]]	Similar PI for 760.179
Public Input No. 341-NFPA 70-2020 [Section No. 800.179 [Excluding any Sub-Sections]]	
Public Input No. 342-NFPA 70-2020 [Section No. 770.179 [Excluding any Sub-Sections]]	
Public Input No. 343-NFPA 70-2020 [Section No. 725.179 [Excluding any Sub-Sections]]	
Public Input No. 344-NFPA 70-2020 [Section No. 760.179 [Excluding any Sub-Sections]]	

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Public Input No. 299-NFPA 70-2020 [Section No. 760.179]

760.179 Listing and Marking of PLFA Cables and Insulated Continuous Line-Type Fire Detectors.

PLFA cables installed as wiring within buildings shall be listed as being resistant to the spread of fire and other criteria in accordance with 760.179(A) through (H) and shall be marked in accordance with 760.179(I). Insulated continuous line-type fire detectors shall be listed in accordance with 760.179(J). Cable used in a wet location shall be listed for use in wet locations or have a moisture-impervious metal sheath.

(A) ~~Conductor Materials~~ Conductors and Optical Fibers .

Conductors shall be solid or stranded copper. PLFA cables shall be permitted to contain optical fibers.

(B) Conductor Size.

The size of conductors in a multiconductor cable shall not be smaller than 26 AWG. Single conductors shall not be smaller than 18 AWG.

(C) Voltage and Temperature Ratings.

The cable shall have a voltage rating of not less than 300 volts. The cable shall have a temperature rating of not less than 60°C (140°F).

(D) Type FPLP.

Type FPLP power-limited fire alarm plenum cable shall be listed as being suitable for use in ducts, plenums, and other space used for environmental air and shall also be listed as having adequate fire-resistant and low smoke-producing characteristics.

Informational Note: One method of defining a cable that is low-smoke producing cable and fire-resistant cable is that the cable exhibits a maximum peak optical density of 0.50 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.52 m (5 ft) or less when tested in accordance with NFPA 262-2019, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces*.

(E) Type FPLR.

Type FPLR power-limited fire alarm riser cable shall be listed as being suitable for use in a vertical run in a shaft or from floor to floor and shall also be listed as having fire-resistant characteristics capable of preventing the carrying of fire from floor to floor.

Informational Note: One method of defining fire-resistant characteristics capable of preventing the carrying of fire from floor to floor is that the cables pass the requirements of ANSI/UL 1666-2012, *Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts*.

(F) Type FPL.

Type FPL power-limited fire alarm cable shall be listed as being suitable for general-purpose fire alarm use, with the exception of risers, ducts, plenums, and other spaces used for environmental air, and shall also be listed as being resistant to the spread of fire.

Informational Note: One method of defining *resistant to the spread of fire* is that the cables do not spread fire to the top of the tray in the "UL Flame Exposure, Vertical Tray Flame Test" in ANSI/UL 1685-2012, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*. The smoke measurements in the test method are not applicable.

Another method of defining *resistant to the spread of fire* is for the damage (char length) not to exceed 1.5 m (4 ft 11 in.) when performing the CSA "Vertical Flame Test — Cables in Cable Trays," as described in CSA C22.2 No. 0.3-M-2001, *Test Methods for Electrical Wires and Cables*.

(G) Fire Alarm Circuit Integrity (CI) Cable or Electrical Circuit Protective System.

Cables that are used for survivability of critical circuits under fire conditions shall meet either 760.179(G)(1) or (G)(2).

Informational Note No. 1: Fire alarm circuit integrity (CI) cable and electrical circuit protective systems may be used for fire alarm circuits to comply with the survivability requirements of *NFPA 72*-2019,, *National Fire Alarm and Signaling Code*, 12.4.3 and 12.4.4, that the circuit maintain its electrical function during fire conditions for a defined period of time.

Informational Note No. 2: One method of defining circuit integrity (CI) cable or an electrical circuit protective system is by establishing a minimum 2-hour fire-resistive rating for the cable when tested in accordance with ANSI/UL 2196-2017, *Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables*.

Informational Note No. 3: UL guide information for electrical circuit protective systems (FHIT) contains information on proper installation requirements for maintaining the fire rating.

(1) Circuit Integrity (CI) Cables.

Circuit integrity (CI) cables specified in 760.179(D), (E), (F), and (H), and used for survivability of critical circuits, shall have an additional classification using the suffix "CI." Circuit integrity (CI) cables shall only be permitted to be installed in a raceway where specifically listed and marked as part of an electrical circuit protective system as covered in 760.179(G)(2).

(2) Electrical Circuit Protective System.

Cables specified in 760.179(D), (E), (F), (H), and (G)(1), that are part of an electrical circuit protective system, shall be identified with the protective system number and hourly rating printed on the outer jacket of the cable and installed in accordance with the listing of the protective system.

(H) Coaxial Cables.

Coaxial cables shall be permitted to use 30 percent conductivity copper-covered steel center conductor wire and shall be listed as Type FPLP, FPLR, or FPL cable.

(I) Cable Marking.

The cable shall be marked in accordance with Table 760.179(I). The voltage rating shall not be marked on the cable. Cables that are listed for circuit integrity shall be identified with the suffix "-CI" as defined in 760.179(G). The temperature rating shall be marked on the jacket of PLFA cables that have a temperature rating exceeding 60°C (140°F). The jacket of PLFA cables shall be marked with the conductor size. Cables containing optical fibers shall be marked with the suffix -OF.

Informational Note: Voltage ratings on cables may be misinterpreted to suggest that the cables may be suitable for Class 1, electric light, and power applications.

Exception: Voltage markings shall be permitted where the cable has multiple listings and voltage marking is required for one or more of the listings.

Table 760.179(I) Cable Markings

Cable Marking	Type
FPLP	Power-limited fire alarm plenum cable
FPLR	Power-limited fire alarm riser cable
FPL	Power-limited fire alarm cable

Note: Cables identified in 760.179(D), (E), and (F) as meeting the requirements for circuit integrity shall have the additional classification using the suffix "-CI" (for example, FPLP-CI, FPLR-CI, and FPL-CI).

Informational Note: Cable types are listed in descending order of fire performance.

(J) Insulated Continuous Line-Type Fire Detectors.

Insulated continuous line-type fire detectors shall be rated in accordance with 760.179(C), listed as being resistant to the spread of fire in accordance with 760.179(D) through (F), and marked in accordance with 760.179(I), and the jacket compound shall have a high degree of abrasion resistance.

Statement of Problem and Substantiation for Public Input

This PI acknowledges that some fire alarm cables contain optical fibers. Marking with the suffix -OF aligns the NEC with UL listing requirements.

This PI coordinates with 770.3(C) which states:

770.3(C) Composite Cables.
Composite optical fiber cables shall be classified as electrical cables in accordance with the type of electrical conductors. They shall be constructed, listed, and marked in accordance with the appropriate article for each type of electrical cable.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 313-NFPA 70-2020 [Section No. 725.179]	Coordinating PI for Article 760
Public Input No. 314-NFPA 70-2020 [Section No. 770.133(C)]	Coordinating PI for Article 770
Public Input No. 315-NFPA 70-2020 [Section No. 760.176]	Coordinating PI for NPLFA cables
Public Input No. 209-NFPA 70-2019 [Section No. 770.179(C)]	Coordinating PI for Article 770
Public Input No. 210-NFPA 70-2019 [Section No. 800.179]	Coordinating PI for Article 800
Public Input No. 210-NFPA 70-2019 [Section No. 800.179]	
Public Input No. 313-NFPA 70-2020 [Section No. 725.179]	
Public Input No. 314-NFPA 70-2020 [Section No. 770.133(C)]	
Public Input No. 315-NFPA 70-2020 [Section No. 760.176]	

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Public Input No. 2180-NFPA 70-2020 [Section No. 760.179(G)]

(G) Fire Alarm Circuit Integrity (CI) Cable, Fire-Resistive Cable System or Electrical Circuit Protective System.

Cables that are used for survivability of critical circuits under fire conditions shall be listed and meet either 760.179(G)(1) ~~or~~ , (G)(2) or (G)(3) .

Informational Note ~~No. 1~~ : Fire alarm circuit integrity (CI) cable ~~and~~ , fire-resistive cable systems or electrical circuit protective systems may be used for fire alarm circuits to comply with the survivability requirements of *NFPA 72*-2019,, *National Fire Alarm and Signaling Code*, 12.4.3 and 12.4.4, that the circuit maintain its electrical function during fire conditions for a defined period of time. ~~Informational Note No. 2: One method of defining circuit integrity~~

~~(~~

~~CI) cable or an electrical circuit protective system is by establishing a minimum 2-hour fire-resistive rating for the cable when tested in accordance with ANSI/UL 2196-2017, *Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables* .~~

~~Informational Note No. 3: UL guide information for electrical circuit protective systems (FHIT) contains information on proper installation requirements for maintaining the fire rating.~~

(

1) Circuit Integrity (CI) Cables.

Circuit integrity (CI) cables specified in 760.179(D) , (E), (F), and (H), and used for survivability of critical circuits, shall

~~have an~~

be marked with the additional classification using the suffix "CI." In order to maintain its listed fire-resistive rating, circuit integrity (CI) cable shall only be installed in free air in accordance with 760.24(B). Circuit integrity (CI) cables shall only be permitted to be installed in a raceway where specifically listed and marked as part of

~~an electrical circuit protective Cables~~

a fire resistive system as covered in 760.179(G)(2) .

~~**(2)** Electrical Circuit Protective System.~~

Informational Note: One method of defining circuit integrity (CI) cable is by establishing a rating when tested in accordance with UL 2196, *Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables* as specified in UL 1424, *Cables for Power-Limited Fire-Alarm Circuits* , UL *Guide Information for Power-Limited Fire Alarm Cable* (HNIR) contains information to identify the cable and its installation limitations to maintain the fire-resistive rating

(2) Fire-resistive cables specified in 760.179(D) , (E), (F), , (H), and (G)(1)

~~, that~~

which are part of a fire-resistive cable system, shall be identified with the system identifier and hourly rating marked on the outer jacket of the cable and installed in accordance with the listing of the system.

Informational Note: One method of defining a fire-resistive cable system is by establishing a rating when tested in accordance with UL 2196, *Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables* , UL *Guide Information for Electrical Circuit Integrity Systems* (FHIT) contains information to identify the system and its installation limitations to maintain a minimum fire-resistive rating.

(2) Electrical Circuit Protective System.

Protectants for cables specified in 760.179(D) , (E), (F), and (H), which are part of an electrical circuit protective system, shall be identified with the protective system

~~number~~

identifier and hourly rating

~~printed~~

marked on

~~the outer jacket of the cable~~

theprotectant or the smallest unit container and installed in accordance with the listing of the protective system.

Informational Note: One method of defining an electrical circuit protective system is by establishing a rating when tested in accordance with UL 1724, *Fire Tests for Electrical Circuit Protective Systems* , UL *Guide Information for Electrical Circuit Integrity Systems* (FHIT) contains information to identify the system and its installation limitations to maintain a minimum fire-resistive rating.

Statement of Problem and Substantiation for Public Input

The language is revised to use the term "fire-resistive cable system" as used elsewhere in the NEC® as that's the defined term and more appropriate than fire-rated and more inclusive than simply electrical circuit protective systems.. The language is updated to remain consistent with other uses throughout the NEC®, for correlation.

The organization of this section has been revised for clarity and Informational notes were relocated to follow the appropriate code text.

This public input is a result of the Correlating Committee Task Group for Circuit Integrity Cable efforts to correlate information on Circuit Integrity (-CI) cable throughout the NEC®. Members of the task group included Blake Shugarman from UL – Principal Engineer for Circuit Integrity Systems, Larry Shudak from UL - Principal Engineer for Life Safety Technologies and member of NFPA 72, Anthony Tassone from UL – Principal Engineer Seasonal and Holiday Decorative Products and Telecommunications Cables - CMP16, Jim Conrad from Marmon Innovation and Technology Group – CMP13, George Straniero from AFC Cable Systems – CMP6, CMP3, and CC, Paul Casparro from IBEW – CMP3, and Rich Holub from DuPont – CMP14 and CC.

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Committee: NEC-P03

Public Input No. 344-NFPA 70-2020 [Section No. 760.179 [Excluding any Sub-Sections]]

PLFA cables installed as wiring within buildings shall be listed as being resistant to the spread of fire and other criteria in accordance with 760.179(A) through (H) and shall be marked in accordance with 760.179(I). Insulated continuous line-type fire detectors shall be listed in accordance with 760.179(J). Cable used in a wet location shall be listed for use in wet locations or have a moisture-impervious metal sheath.

Informational Note: For information on Power-Limited Fire Alarm cables see *UL 1424, Standard for Cables for Power-Limited Fire-Alarm Circuits*, 2015.

Statement of Problem and Substantiation for Public Input

Adding an informational note referring the user to the listing standard for the cables in this section provides useful information. UL listing standards are referred to throughout this Code.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 341-NFPA 70-2020 [Section No. 800.179 [Excluding any Sub-Sections]]	Similar PI for Article 800
Public Input No. 342-NFPA 70-2020 [Section No. 770.179 [Excluding any Sub-Sections]]	Similar PI for Article 770
Public Input No. 343-NFPA 70-2020 [Section No. 725.179 [Excluding any Sub-Sections]]	Similar PI for Article 725
Public Input No. 345-NFPA 70-2020 [Section No. 760.176 [Excluding any Sub-Sections]]	Similar PI for 760.176
Public Input No. 341-NFPA 70-2020 [Section No. 800.179 [Excluding any Sub-Sections]]	
Public Input No. 342-NFPA 70-2020 [Section No. 770.179 [Excluding any Sub-Sections]]	
Public Input No. 343-NFPA 70-2020 [Section No. 725.179 [Excluding any Sub-Sections]]	
Public Input No. 345-NFPA 70-2020 [Section No. 760.176 [Excluding any Sub-Sections]]	

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Public Input No. 2366-NFPA 70-2020 [New Part after I.]

Abandoned Wiring

Conductors, cords or cables that are not terminated at equipment other than a connector and not identified for future use with a tag.

Statement of Problem and Substantiation for Public Input

This new definition is needed to correlate with the Public Inputs I have submitted to Article 300 addressing the removal or tagging of abandoned wiring.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2364-NFPA 70-2020 [New Section after 300.25]	Abandoned wiring
Public Input No. 2365-NFPA 70-2020 [New Section after 300.50(F)]	Abandoned wiring
Public Input No. 2367-NFPA 70-2020 [New Part after II.]	

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Public Input No. 4364-NFPA 70-2020 [Part I.]

Part I. General- ~~Requirements~~

Statement of Problem and Substantiation for Public Input

"Article 300 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. 2367-NFPA 70-2020 [New Part after II.]

Abandoned Wiring
Conductors, or cables that are not terminated at equipment other than a connector and not identified for future use with a tag.

Statement of Problem and Substantiation for Public Input

This new definition is needed to correlate with the Public Inputs I submitted to Article 300 addressing the removal or tagging of abandoned wiring.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 2364-NFPA 70-2020 [New Section after 300.25]	abandoned wiring
Public Input No. 2365-NFPA 70-2020 [New Section after 300.50(F)]	abandoned wiring
Public Input No. 2366-NFPA 70-2020 [New Part after I.]	abandoned wiring

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