# 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
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**Street Address:**
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**Submittal Date:** Thu Dec 26 19:34:36 EST 2019
**Committee:** NEC-P01

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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:**
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**State:**
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**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:**
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**State:**
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**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

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**Organization:** Clark County Building and Fire
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**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:**
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**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
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**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

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**Submittal Date:** Thu Sep 03 19:32:38 EDT 2020
**Committee:** NEC-P01

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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:**
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**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
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**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

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**Organization:** Delta Charter Township
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**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:**
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**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

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**Street Address:**
**City:**
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**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

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**Submittal Date:** Tue Sep 08 07:50:17 EDT 2020
**Committee:** NEC-P01

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

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

## Statement of Problem and Substantiation for Public Input

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

## Submitter Information Verification

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

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

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

## Statement of Problem and Substantiation for Public Input

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

## Submitter Information Verification

**Submitter Full Name:** David Williams
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**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.

## Submitter Information Verification

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**Committee:** NEC-P01

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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. 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 |

## Submitter Information Verification

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**Committee:** NEC-P03

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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. 1561-NFPA 70-2020 [ Global Input ]

**Move Article 770 Optical Fiber Cables to Chapter 8 and renumber as 870.**

## Statement of Problem and Substantiation for Public Input

770 Optical Fiber Cables deals with low or zero voltage communications systems and therefore, more appropriately belongs in chapter 8 with other communications systems such as telephony, cable television, and antenna installations.

## Submitter Information Verification

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**Submittal Date:** Thu Jun 18 13:53:02 EDT 2020
**Committee:** NEC-P16

# Public Input No. 3234-NFPA 70-2020 [ Global Input ]

**Relocate all listing and installation requirements for wires, cables, cable routing assemblies and communication raceways to the new Article being developed for Power limited Cables, specifically section 800.113 and 800.179, 800.154, and the Tables to 800.154.**

**Combine Table 800.154 with similar Table in new Article being developed for Power limited Cables.**

**Relocate all substitution cable charts to new Article.**

## Statement of Problem and Substantiation for Public Input

This public input is being submitted by a Correlating Committee Task Group to improve the correlation between Chapter 7 and 8. At the present time there are significant correlation issues with regards to what constitutes an installation in Chapter 7 and what constitutes an installation in Chapter 8.

This public input seeks to remove duplicate material in Chapter 7 and Chapter 8. This proposal would relocate all cable listing requirements, all cable type, all substitution tables, and Tables 800.154 to the newly created article located in Chapter 7 for Power Limited Cables. Panel 16 would maintain purview over the cable types that have been relocated.

The NEC strongly needs to correlate these Chapters since much of the technological advancement in the electrical industry is occurring in this limited energy world. The Correlating Committee seeks to remove correlation and duplication issues to make the NEC more clear, concise and usable in both Chapters 7 and 8.

The Correlating Committee Task Group is a long range planning committee that is seeking to make improvement over the next two to three cycles. The Task Group is made up of the following members: Alan Manche, Donny Cook, George Zimmerman and Thomas Domitrovich.

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**Committee:** NEC-P16

# Public Input No. 4138-NFPA 70-2020 [ Global Input ]

**Revise Article 770 per the attached.**

## Additional Proposed Changes

| File Name | Description | Approved |
|---|---|---|
| 2020_NEC_Article_770_Changes_-_REVISION_MODE_TRACK_CHANGES_ON.docx | This document contains the necessary revisions to Article 770 to accommodate the consolidation of requirements in REVISION MODE TRACK CHANGES. | |
| 2020_NEC_Article_770_Changes_-_CHANGES_ACCEPTED.pdf | This document shows Article 770 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 770 to accommodate the above consolidation of requirements. Hazardous locations was moved from 770.3 to a new 725.12 to simplify the references. 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 is the new Article 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. 3993-NFPA 70-2020 [Global Input]<br>Public Input No. 3671-NFPA 70-2020 [Global Input]<br>Public Input No. 3868-NFPA 70-2020 [Global Input]<br>Public Input No. 3993-NFPA 70-2020 [Global Input] | This PI is for the revisions to Article 760 to accommodate the new cable article |

## Submitter Information Verification

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**Committee:** NEC-P16

# ARTICLE 770 Optical Fiber Cables Outside and Entering Buildings

**Part I. General**

**770.1 Scope.** This article covers the installation of optical fiber cables outside and entering buildings. This article does not cover the construction of optical fiber cables.

**770.2 Definitions.** See Part I of Article 100. The definitions in this section shall apply only within Article 770.

**Abandoned Optical Fiber Cable.** Installed optical fiber cable that is not terminated at equipment other than a connector and not identified for future use with a tag.

**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.

**Exposed (to Accidental Contact).** A conductive optical fiber cable in such a position that, in case of failure of supports or insulation, contact between the cable's non–current-carrying conductive members and an electrical circuit might result.

Informational Note: See Part I of Article 100 for two other definitions of Exposed: Exposed (as applied to live parts) and Exposed (as applied to wiring methods).

**Point of Entrance.** The point within a building at which the optical fiber cable emerges from an external wall or from a concrete floor slab.

**770.3 Other Articles.** Installations of optical fiber cables shall comply with 770.3(A), ~~and~~ (B) and (C). Only those sections of Chapter 2 and Article 300 referenced in this article shall apply to optical fiber cables.

~~**770.3(A) Hazardous (Classified) Locations.** Listed optical fiber cables shall be permitted to be installed in hazardous (classified) locations. The cables shall be sealed in accordance with the requirements of 501.15, 502.15, 505.16, or 506.16, as applicable.~~

**(~~B~~A) Cables in Ducts for Dust, Loose Stock, or Vapor Removal.** The requirements of 300.22(A) for wiring systems shall apply to conductive optical fiber cables.

**(~~C~~B) 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.

**725.3(C) Optical Fiber Cables within Buildings.** The listing and installation of optical fiber cables within buildings shall comply with Article 7XX Parts I, IV and V.

**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.

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

**770.24 Mechanical Execution of Work.** Optical fiber 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 also conform to 300.4 and 300.11. 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: Accepted industry practices are described in ANSI/NECA/FOA 301-2016, Standard for Installing and Testing Fiber Optic Cables; ANSI/TIA-568.0-D-

2015, Generic Telecommunications Cabling for Customer Premises; and ANSI/TIA 568.3-D-2016, Optical Fiber Cabling and Components Standard.
Informational Note No. 2: 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. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of optical fiber cable properties.

**770.25 Abandoned Cables.** The accessible portion of abandoned optical fiber 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.

**770.26 Spread of Fire or Products of Combustion.** Installations of optical fiber cables and communications raceways 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 penetrations of optical fiber cables and communications raceways 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 770.26 can be found in building codes, fire resistance directories, and product listings.

## Part II. Cables Outside and Entering Buildings

**770.44 Overhead (Aerial) Optical Fiber Cables.** Overhead optical fiber cables containing a non–current-carrying metallic member entering buildings shall comply with 800.44(A) and (B).

**(A) On Poles and In-Span.** Where outside plant optical fiber cables and electric light or power conductors are supported by the same pole or are run parallel to each other in-span, the conditions described in 770.44(A)(1) through (A)(4) shall be met.

**(1) Relative Location.** Where practicable, the outside plant optical fiber cables shall be located below the electric light or power conductors.

**(2) Attachment to Cross-Arms.** Attachment of outside plant optical fiber cables to a cross-arm that carries electric light or power conductors shall not be permitted.

**(3) Climbing Space.** The climbing space through outside plant optical fiber cables shall comply with the requirements of 225.14(D).

**(4) Clearance.** Supply service drops and sets of overhead service conductors of 0 to 750 volts running above and parallel to optical fiber cable service drops shall have a minimum separation of 300 mm (12 in.) at any point in the span, including the point of their attachment to the building. Clearance of not less than 1.0 m (40 in.) shall be maintained between the two services at the pole.

**(B) Above Roofs.** Outside plant optical fiber cables shall have a vertical clearance of not less than 2.5 m (8 ft) from all points of roofs above which they pass.

*Exception No. 1: The requirement of 770.44(B) shall not apply to auxiliary buildings such as garages and the like.*

*Exception No. 2: A reduction in clearance above only the overhanging portion of the roof to not less than 450 mm (18 in.) shall be permitted if (a) not more than 1.2 m (4 ft) of optical fiber cable service drop cable passes above the roof overhang, and (b) the cable is terminated at a through- or above-the-roof raceway or approved support.*

*Exception No. 3: Where the roof has a slope of not less than 100 mm in 300 mm (4 in. in 12 in.), a reduction in clearance to not less than 900 mm (3 ft) shall be permitted.*

Informational Note: For additional information regarding overhead wires and cables, see ANSI/IEEE C2-2012, National Electric Safety Code, Part 2, Safety Rules for Overhead Lines.

**770.47 Underground Optical Fiber Cables Entering Buildings.** Underground optical fiber cables entering buildings shall comply with 770.47(A) and (B).

**(A) Underground Systems with Electric Light, Power, Class 1, or Non–Power-Limited Fire Alarm Circuit Conductors.** Underground conductive optical fiber cables entering buildings with electric light, power, Class 1, or non–power-limited fire alarm circuit conductors in a raceway, handhole enclosure, or manhole shall be located in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier.

**(B) Direct-Buried Cables and Raceways.** Direct-buried conductive optical fiber cables shall be separated by at least 300 mm (12 in.) from conductors of any electric light, power, non–power-limited fire alarm circuit conductors, or Class 1 circuit.

*Exception No. 1: Direct-buried conductive optical fiber cables shall not be required to be separated by at least 300 mm (12 in.) from electric service conductors where electric service conductors are installed in raceways or have metal cable armor.*

*Exception No. 2: Direct-buried conductive optical fiber cables shall not be required to be separated by at least 300 mm (12 in.) from electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors where electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables.*

**770.48 Unlisted Cables Entering Buildings.**

**(A) Conductive and Nonconductive Cables.** Unlisted conductive and nonconductive outside plant optical fiber cables shall be permitted to be installed in building spaces, other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated in an enclosure.

The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance optical fiber cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) to the point of emergence.

Informational Note: Splice cases or terminal boxes, both metallic and plastic types, typically are used as enclosures for splicing or terminating optical fiber cables.

**(B) Nonconductive Cables in Raceway.** Unlisted nonconductive outside plant optical fiber cables shall be permitted to enter the building from the outside and shall be permitted to be installed in any of the following raceways:

(1) Intermediate metal conduit (IMC)

(2) Rigid metal conduit (RMC)

(3) Rigid polyvinyl chloride conduit (PVC)

(4) Electrical metallic tubing (EMT)

Unlisted nonconductive outside plant cables installed in rigid polyvinyl chloride conduit (PVC) or electrical metallic tubing (EMT) shall not be permitted to be installed in risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air.

**770.49 Metal Entrance Conduit Grounding.** Metal conduit containing optical fiber entrance cable shall be connected by a bonding conductor or grounding electrode conductor to a grounding electrode or, where present, the building grounding electrode system in accordance with 770.100(B).

## Part III. Protection

**770.93 Grounding, Bonding, or Interruption of Non–Current-Carrying Metallic Members of Optical Fiber Cables.** Optical fiber cables entering the building or terminating on the outside of the building shall comply with 770.93(A) or (B).

**(A) Entering Buildings.** In installations where an optical fiber cable is exposed to contact with electric light or power conductors and the cable enters the building, the non–current-carrying metallic members shall be either grounded or bonded as specified in 770.100 or interrupted by an insulating joint or equivalent device. The grounding or interruption shall be as close as practicable to the point of entrance.

**(B) Terminating on the Outside of Buildings.** In installations where an optical fiber cable is exposed to contact with electric light or power conductors and the cable is terminated on the outside of the building, the non–current-carrying metallic members shall be either grounded or bonded as specified in 770.100 or interrupted by an insulating joint or equivalent device. The grounding, bonding, or interruption shall be as close as practicable to the point of termination of the cable.

## Part IV. Grounding Methods

**770.100 Entrance Cable Bonding and Grounding.** Where required, the non–current-carrying metallic members of optical fiber cables entering buildings shall be bonded or grounded as specified in 770.100(A) through (D).

**(A) Bonding Conductor or Grounding Electrode Conductor.**

**(1) Insulation.** The bonding conductor or grounding electrode conductor shall be listed and shall be permitted to be insulated, covered, or bare.

**(2) Material.** The bonding conductor or grounding electrode conductor shall be copper or other corrosion-resistant conductive material, stranded or solid.

**(3) Size.** The bonding conductor or grounding electrode conductor shall not be smaller than 14 AWG. It shall have a current-carrying capacity not less than that of the grounded metallic member(s). The bonding conductor or grounding electrode conductor shall not be required to exceed 6 AWG.

**(4) Length.** The bonding conductor or grounding electrode conductor shall be as short as practicable. In one- and two-family dwellings, the bonding conductor or grounding electrode conductor shall be as short as practicable not to exceed 6.0 m (20 ft) in length.

> Informational Note: Similar bonding conductor or grounding electrode conductor length limitations applied at apartment buildings and commercial buildings help to reduce voltages that may develop between the building's power and communications systems during lightning events.

*Exception: In one- and two-family dwellings where it is not practicable to achieve an overall maximum bonding conductor or grounding electrode conductor length of 6.0 m (20 ft), a separate ground rod meeting the minimum dimensional criteria of 770.100(B)(3)(2) shall be driven, the grounding electrode conductor shall be connected to the separate ground rod in accordance with 770.100(C), and the separate ground rod shall be bonded to the power grounding electrode system in accordance with 770.100(D).*

**(5) Run in Straight Line.** The bonding conductor or grounding electrode conductor shall be run in as straight a line as practicable.

**(6) Physical Protection.** Bonding conductors and grounding electrode conductors shall be protected where exposed to physical damage. Where the bonding conductor or grounding electrode conductor is installed in a metal raceway, both ends of the raceway shall be bonded to the contained conductor or to the same terminal or electrode to which the bonding conductor or grounding electrode conductor is connected.

**(B) Electrode.** The bonding conductor and grounding electrode conductor shall be connected in accordance with 770.100(B)(1), (B)(2), or (B)(3).

**(1) In Buildings or Structures with an Intersystem Bonding Termination.** If the building or structure served has an intersystem bonding termination as required by 250.94, the bonding conductor shall be connected to the intersystem bonding termination.

Informational Note: See Informational Note Figure 800.100(B)(1) for an illustration of the application of the bonding conductor in buildings or structures equipped with an intersystem bonding termination.

**(2) In Buildings or Structures with Grounding Means.** If an intersystem bonding termination is established, 250.94(A) shall apply.

If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on one of the following:

(1) The building or structure grounding electrode system as covered in 250.50

(2) The grounded interior metal water piping system, within 1.5 m (5 ft) from its point of entrance to the building, as covered in 250.52

(3) The power service accessible means external to enclosures using the options identified in 250.94(A), Exception

(4) The nonflexible metal power service raceway

(5) The service equipment enclosure

(6) The grounding electrode conductor or the grounding electrode conductor metal enclosure of the power service

(7) The grounding electrode conductor or the grounding electrode of a building or structure disconnecting means that is connected to a grounding electrode as covered in 250.32

> Informational Note: See Informational Note Figure 800.100(B)(2) for an illustration of the application of the bonding conductor in buildings or structures not equipped with an intersystem bonding termination or terminal block providing access to the building grounding electrode system.

**(3) In Buildings or Structures Without Intersystem Bonding Termination or Grounding Means.** If the building or structure served has no intersystem bonding termination or grounding means, as described in 770.100(B)(2), the grounding electrode conductor shall be connected to either of the following:

(1) To any one of the individual grounding electrodes described in 250.52(A)(1), (A)(2), (A)(3), or (A)(4).

(2) If the building or structure served has no grounding means, as described in 770.100(B)(2) or (B)(3)(1), to any one of the individual grounding electrodes described in 250.52(A)(7) and (A)(8) or to a ground rod or pipe not less than 1.5 m (5 ft) in length and 12.7 mm (1⁄2 in.) in diameter, driven, where practicable, into permanently damp earth and separated from lightning protection system conductors as covered in 805.53 and at least 1.8 m (6 ft) from electrodes of other systems. Steam, hot water pipes, or lightning protection system conductors shall not be employed as electrodes for non–current-carrying metallic members.

**(C) Electrode Connection.** Connections to grounding electrodes shall comply with 250.70.

**(D) Bonding of Electrodes.** A bonding jumper not smaller than 6 AWG copper or equivalent shall be connected between the grounding electrode and power grounding electrode system at the building or structure served where separate electrodes are used.

*Exception: At mobile homes as covered in 770.106.*

> Informational Note No. 1: See 250.60 for connection to a lightning protection system.
> Informational Note No. 2: Bonding together of all separate electrodes limits potential differences between them and between their associated wiring systems.

**770.106 Grounding and Bonding of Entrance Cables at Mobile Homes.**

**(A) Grounding.** Grounding shall comply with 770.106(A)(1) and (A)(2).

(1) Where there is no mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, the non–current-carrying metallic members of optical fiber cables entering the mobile home shall be grounded in accordance with 770.100(B)(3).

(2) Where there is no mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, the non–current-carrying metallic members of optical fiber cables entering the mobile home shall be grounded in accordance with 770.100(B)(3).

**(B) Bonding.**

The grounding electrode shall be bonded to the metal frame or available grounding terminal of the mobile home with a copper conductor not smaller than 12 AWG under either of the following conditions:

(1) Where there is no mobile home service equipment or disconnecting means as in 770.106(A)

(2) Where the mobile home is supplied by cord and plug

## Part V. Installation Methods Within Buildings

**770.110** Parts I, IV and V of Article 7XX shall apply to wiring methods and materials for optical fiber cable used within buildings.

~~**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 770.110(A)(1) or (A)(2).~~

~~**(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 770.110(B)(1) or (B)(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.~~

~~**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.~~

~~**770.113 Installation of Optical Fiber Cables.** Installation of optical fiber cables shall comply with 770.113(A) through (J). Installation of raceways and cable routing assemblies shall comply with 770.110.~~

**(A) Listing.** Optical fiber cables installed in buildings shall be listed in accordance with 770.179 and installed in accordance with the limitations of the listing.

*Exception: Optical fiber cables that are installed in compliance with 770.48 shall not be required to 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 they are directly associated with the air distribution system:

(1) Up to 1.22 m (4 ft) of Types OFNP and OFCP

(2) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC 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 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) Types OFNP and OFCP

(2) Types OFNP and OFCP installed in plenum communications raceways

(3) Types OFNP and OFCP installed in plenum cable routing assemblies

(4) Types OFNP and OFCP supported by open metal cable tray systems

(5) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in raceways that are installed in compliance with 300.22(C)

(6) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC 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 OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in plenum communications raceways, riser communications raceways, or general-purpose communications raceways or 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, see NFPA 90A-2018, Standard for the Installation of Air-Conditioning and Ventilating Systems.

**(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 OFNP, OFCP, OFNR, and OFCR

(2) Types OFNP, OFCP, OFNR, and OFCR installed in:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

Informational Note: See 770.26 for firestop requirements for floor penetrations.

**(E) Risers — Cables and Innerducts in Metal Raceways.** The following cables and innerducts shall be permitted in metal raceways in a riser having firestops at each floor:

(1) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC

(2) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in:

a. Plenum communications raceways (innerduct)

b. Riser communications raceways (innerduct)

c. General-purpose communications raceways (innerduct)

Informational Note: See 770.26 for firestop requirements for floor penetrations.

**(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 OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC

(2) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in:

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 770.26 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 OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC

(2) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in:

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.** The following cables shall be permitted to be supported by cable trays:

(1) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC

(2) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in:

a. Plenum communications raceways

b. Riser communications raceways

c. General-purpose communications raceways

**(I) Distributing Frames and Cross-Connect Arrays.** The following cables shall be permitted to be installed in distributing frames and cross-connect arrays:

(1) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC

(2) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in:

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) 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 (I):

(1) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC

(2) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in:

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 OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in a raceway of a type recognized in Chapter 3

**770.114 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).

**770.133 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

**(D) Support of Optical Fiber Cables.** Raceways shall be used for their intended purpose. Optical fiber cables shall not be strapped, taped, or attached by any means to the exterior of any conduit or raceway as a means of support.

*Exception: 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.*

**770.154 Applications of Listed Optical Fiber Cables.** Permitted and nonpermitted applications of listed optical fiber cables shall be as indicated in Table 770.154(a). The permitted applications shall be subject to the installation requirements of 770.110 and 770.113. The substitutions for optical fiber cables in Table 770.154(b) and illustrated in Figure 770.154 shall be permitted.

## Table 770.154(a) Applications of Listed Optical Fiber Cables in Buildings

| Applications | | Listed Optical Fiber Cable Type | | |
|---|---|---|---|---|
| | | OFNP, OFCP | OFNR, OFCR | OFNG, OFCG, OFN, OFC |
| In ducts specifically fabricated for environmental air 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 (plenums) 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 |
| | In one- and two-family dwellings | Y* | Y* | Y* |
| | General | Y* | Y* | Y* |

## Table 770.154(a) Applications of Listed Optical Fiber Cables in Buildings

| Applications | | Listed Optical Fiber Cable Type | | |
|---|---|---|---|---|
| | | OFNP, OFCP | OFNR, OFCR | OFNG, OFCG, OFN, OFC |
| Within buildings in other than air-handling spaces and risers | Supported by cable trays | Y* | Y* | Y* |
| | In distributing frames and cross-connect arrays | Y* | Y* | Y* |
| | In any raceway recognized in Chapter 3 | Y* | Y* | Y* |
| | In plenum communications raceways | 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* |

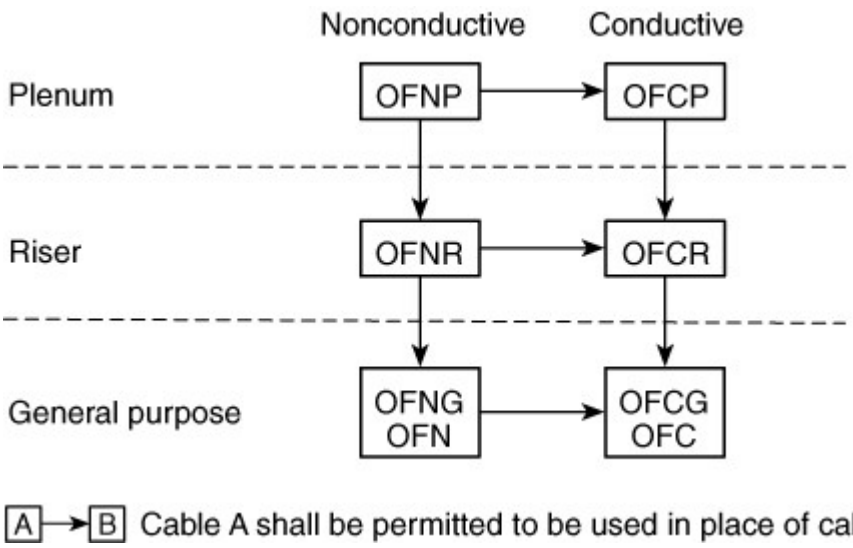
Note: "N" indicates that the cable type shall not be permitted to be installed in the application.

"Y*" indicates that the cable type shall be permitted to be installed in the application subject to the limitations described in 770.110 and 770.113.
Informational Note No. 1: Part V of Article 770 covers installation methods within buildings. This table covers the applications of listed optical fiber cables in buildings. The definition of *Point of Entrance* is in 770.2.
Informational Note No. 2: For information on the restrictions to the installation of optical fiber cables in ducts specifically fabricated for environmental air, see 770.113(B).

**~~Table 770.154(b) Cable Substitutions~~**

| ~~Cable Type~~ | ~~Permitted Substitutions~~ |
|---|---|
| ~~OFNP~~ | ~~None~~ |
| ~~OFCP~~ | ~~OFNP~~ |
| ~~OFNR~~ | ~~OFNP~~ |
| ~~OFCR~~ | ~~OFNP, OFCP, OFNR~~ |
| ~~OFNG, OFN~~ | ~~OFNP, OFNR~~ |
| ~~OFCG, OFC~~ | ~~OFNP, OFCP, OFNR, OFCR, OFNG, OFN~~ |

**~~Figure 770.154 Cable Substitution Hierarchy.~~**



## Part VI. Listing Requirements

**770.179 Optical Fiber Cables.** Optical fiber cables shall be listed and identified in accordance with 770.179(A) through (G) and shall be marked in accordance with Table 770.179. Optical fiber cables shall have a temperature rating of not less than 60°C (140°F). The temperature rating shall be marked on the jacket of optical fiber cables that have a temperature rating exceeding 60°C (140°F).

**(A) Types OFNP and OFCP.** Types OFNP and OFCP nonconductive and conductive optical fiber plenum cables shall be suitable for use in ducts, plenums, and other space used for environmental air and shall also have adequate fire-resistant and low smoke producing characteristics.

Informational Note: One method of defining a cable that has adequate fire-resistant and low-smoke producing characteristics 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 OFNR and OFCR.** Types OFNR and OFCR nonconductive and conductive optical fiber riser cables shall be suitable for use in a vertical run in a shaft or from floor to floor and shall also have the 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 1666-2011, Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts.

**(C) Types OFNG and OFCG.** Types OFNG and OFCG nonconductive and conductive general-purpose optical fiber cables shall be 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.

**(D) Types OFN and OFC.** Types OFN and OFC nonconductive and conductive optical fiber cables shall be suitable for general-purpose use, with the exception of risers, plenums, and other spaces used for environmental air, and shall also be resistant to the spread of fire.

Informational Note No. 1: 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.
Informational Note No. 2: Cable types are listed in descending order of fire resistance rating. Within each fire resistance rating, nonconductive cable is listed first because it is often substituted for conductive cable.

### Table 770.179 Cable Markings

| Cable Marking | Type |
|---|---|
| OFNP | Nonconductive optical fiber plenum cable |
| OFCP | Conductive optical fiber plenum cable |
| OFNR | Nonconductive optical fiber riser cable |
| OFCR | Conductive optical fiber riser cable |
| OFNG | Nonconductive optical fiber general-purpose cable |
| OFCG | Conductive optical fiber general-purpose cable |
| OFN | Nonconductive optical fiber general-purpose cable |

**~~Table 770.179 Cable Markings~~**

| ~~Cable Marking~~ | ~~Type~~ |
|---|---|
| ~~OFC~~ | ~~Conductive optical fiber general-purpose cable~~ |

**~~770.179(E) Circuit Integrity (CI) Cable or Electrical Circuit Protective System.~~**~~Cables that are used for survivability of critical circuits under fire conditions shall meet either 770.179(E)(1) or (E)(2).~~

~~Informational Note: The listing organization provides information for circuit integrity (CI) cable and electrical circuit protective systems, including installation requirements necessary to maintain the fire rating.~~

**~~(1) Circuit Integrity (CI) Cables.~~**~~Circuit integrity (CI) cables specified in 770.179(A) through (D), and used for survivability of critical circuits, shall have an additional classification using the suffix "CI." In order to maintain its listed fire rating, circuit integrity (CI) cable shall only be installed in free air.~~

~~Informational Note: One method of defining circuit integrity (CI) cable is by establishing a minimum 2-hour fire resistance 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.~~

**~~(2) Fire-Resistive Cables.~~**~~Cables specified in 770.179(A) through (D) and 770.179(E)(1) that are part of an electrical circuit protective system shall be fire-resistive cable and identified with the protective system number on the product or on the smallest unit container in which the product is packaged and installed in accordance with the listing of the protective system.~~

~~Informational Note No. 1: One method of defining an electrical circuit protective system is by establishing a minimum 2-hour fire resistance rating for the system when tested in accordance with UL Subject 1724, Outline of Investigation for Fire Tests for Electrical Circuit Protective Systems.~~
~~Informational Note No. 2: The listing organization provides information for electrical circuit protective systems (FHIT), including installation requirements for maintaining the fire rating.~~

**~~(F) Field-Assembled Optical Fiber Cables.~~**~~Field-assembled optical fiber cable shall comply with 770.179(F)(1) through (F)(4).~~

~~(1) 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 770.179(A), (B), or (D) and shall be marked in accordance with Table 770.179.~~

~~(2) 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.~~

~~(3) The optical fibers shall have a permanent marking, such as a marker tape, indicating the jacket with which they are identified for use.~~

~~(4) 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.~~

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

~~Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.~~

**770.180 Grounding Devices.** Where bonding or grounding is required, devices used to connect a shield, a sheath, or non–current-carrying metallic members of a cable to a bonding conductor or grounding electrode conductor shall be listed or be part of listed equipment.

# ARTICLE 770 Optical Fiber Cables Outside and Entering Buildings

**Part I. General**

**770.1 Scope.** This article covers the installation of optical fiber cables outside and entering buildings. This article does not cover the construction of optical fiber cables.

**770.2 Definitions.** See Part I of Article 100. The definitions in this section shall apply only within Article 770.

**Abandoned Optical Fiber Cable.** Installed optical fiber cable that is not terminated at equipment other than a connector and not identified for future use with a tag.

**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.

**Exposed (to Accidental Contact).** A conductive optical fiber cable in such a position that, in case of failure of supports or insulation, contact between the cable's non–current-carrying conductive members and an electrical circuit might result.

> Informational Note: See Part I of Article 100 for two other definitions of Exposed: Exposed (as applied to live parts) and Exposed (as applied to wiring methods).

**Point of Entrance.** The point within a building at which the optical fiber cable emerges from an external wall or from a concrete floor slab.

**770.3 Other Articles.** Installations of optical fiber cables shall comply with 770.3(A), (B) and (C). Only those sections of Chapter 2 and Article 300 referenced in this article shall apply to optical fiber cables.

**(A) Cables in Ducts for Dust, Loose Stock, or Vapor Removal.** The requirements of 300.22(A) for wiring systems shall apply to conductive optical fiber cables.

**(B) 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.

**725.3(C) Optical Fiber Cables within Buildings.** The listing and installation of optical fiber cables within buildings shall comply with Article 7XX Parts I, IV and V.

**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.

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

**770.24 Mechanical Execution of Work.** Optical fiber 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 also conform to 300.4 and 300.11. 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: Accepted industry practices are described in ANSI/NECA/FOA 301-2016, Standard for Installing and Testing Fiber Optic Cables; ANSI/TIA-568.0-D-2015, Generic Telecommunications Cabling for Customer Premises; and ANSI/TIA 568.3-D-2016, Optical Fiber Cabling and Components Standard.
> Informational Note No. 2: 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. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of optical fiber cable properties.

**770.25 Abandoned Cables.** The accessible portion of abandoned optical fiber 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.

**770.26 Spread of Fire or Products of Combustion.** Installations of optical fiber cables and communications raceways 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 penetrations of optical fiber cables and

communications raceways 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 770.26 can be found in building codes, fire resistance directories, and product listings.

## Part II. Cables Outside and Entering Buildings

**770.44 Overhead (Aerial) Optical Fiber Cables.** Overhead optical fiber cables containing a non–current-carrying metallic member entering buildings shall comply with 800.44(A) and (B).

**(A) On Poles and In-Span.** Where outside plant optical fiber cables and electric light or power conductors are supported by the same pole or are run parallel to each other in-span, the conditions described in 770.44(A)(1) through (A)(4) shall be met.

**(1) Relative Location.** Where practicable, the outside plant optical fiber cables shall be located below the electric light or power conductors.

**(2) Attachment to Cross-Arms.** Attachment of outside plant optical fiber cables to a cross-arm that carries electric light or power conductors shall not be permitted.

**(3) Climbing Space.** The climbing space through outside plant optical fiber cables shall comply with the requirements of 225.14(D).

**(4) Clearance.** Supply service drops and sets of overhead service conductors of 0 to 750 volts running above and parallel to optical fiber cable service drops shall have a minimum separation of 300 mm (12 in.) at any point in the span, including the point of their attachment to the building. Clearance of not less than 1.0 m (40 in.) shall be maintained between the two services at the pole.

**(B) Above Roofs.** Outside plant optical fiber cables shall have a vertical clearance of not less than 2.5 m (8 ft) from all points of roofs above which they pass.

*Exception No. 1: The requirement of 770.44(B) shall not apply to auxiliary buildings such as garages and the like.*

*Exception No. 2: A reduction in clearance above only the overhanging portion of the roof to not less than 450 mm (18 in.) shall be permitted if (a) not more than 1.2 m (4 ft) of optical fiber cable service drop cable passes above the roof overhang, and (b) the cable is terminated at a through- or above-the-roof raceway or approved support.*

*Exception No. 3: Where the roof has a slope of not less than 100 mm in 300 mm (4 in. in 12 in.), a reduction in clearance to not less than 900 mm (3 ft) shall be permitted.*

> Informational Note: For additional information regarding overhead wires and cables, see ANSI/IEEE C2-2012, National Electric Safety Code, Part 2, Safety Rules for Overhead Lines.

**770.47 Underground Optical Fiber Cables Entering Buildings.** Underground optical fiber cables entering buildings shall comply with 770.47(A) and (B).

**(A) Underground Systems with Electric Light, Power, Class 1, or Non–Power-Limited Fire Alarm Circuit Conductors.** Underground conductive optical fiber cables entering buildings with electric light, power, Class 1, or non–power-limited fire alarm circuit conductors in a raceway, handhole enclosure, or manhole shall be located in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier.

**(B) Direct-Buried Cables and Raceways.** Direct-buried conductive optical fiber cables shall be separated by at least 300 mm (12 in.) from conductors of any electric light, power, non–power-limited fire alarm circuit conductors, or Class 1 circuit.

*Exception No. 1: Direct-buried conductive optical fiber cables shall not be required to be separated by at least 300 mm (12 in.) from electric service conductors where electric service conductors are installed in raceways or have metal cable armor.*

*Exception No. 2: Direct-buried conductive optical fiber cables shall not be required to be separated by at least 300 mm (12 in.) from electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors where electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm*

*circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables.*

**770.48 Unlisted Cables Entering Buildings.**

**(A) Conductive and Nonconductive Cables.** Unlisted conductive and nonconductive outside plant optical fiber cables shall be permitted to be installed in building spaces, other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated in an enclosure.

The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance optical fiber cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) to the point of emergence.

Informational Note: Splice cases or terminal boxes, both metallic and plastic types, typically are used as enclosures for splicing or terminating optical fiber cables.

**(B) Nonconductive Cables in Raceway.** Unlisted nonconductive outside plant optical fiber cables shall be permitted to enter the building from the outside and shall be permitted to be installed in any of the following raceways:

(1) Intermediate metal conduit (IMC)

(2) Rigid metal conduit (RMC)

(3) Rigid polyvinyl chloride conduit (PVC)

(4) Electrical metallic tubing (EMT)

Unlisted nonconductive outside plant cables installed in rigid polyvinyl chloride conduit (PVC) or electrical metallic tubing (EMT) shall not be permitted to be installed in risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air.

**770.49 Metal Entrance Conduit Grounding.** Metal conduit containing optical fiber entrance cable shall be connected by a bonding conductor or grounding electrode conductor to a grounding electrode or, where present, the building grounding electrode system in accordance with 770.100(B).

## Part III. Protection

**770.93 Grounding, Bonding, or Interruption of Non–Current-Carrying Metallic Members of Optical Fiber Cables.** Optical fiber cables entering the building or terminating on the outside of the building shall comply with 770.93(A) or (B).

**(A) Entering Buildings.** In installations where an optical fiber cable is exposed to contact with electric light or power conductors and the cable enters the building, the non–current-carrying metallic members shall be either grounded or bonded as specified in 770.100 or interrupted by an insulating joint or equivalent device. The grounding or interruption shall be as close as practicable to the point of entrance.

**(B) Terminating on the Outside of Buildings.** In installations where an optical fiber cable is exposed to contact with electric light or power conductors and the cable is terminated on the outside of the building, the non–current-carrying metallic members shall be either grounded or bonded as specified in 770.100 or interrupted by an insulating joint or equivalent device. The grounding, bonding, or interruption shall be as close as practicable to the point of termination of the cable.

## Part IV. Grounding Methods

**770.100 Entrance Cable Bonding and Grounding.** Where required, the non–current-carrying metallic members of optical fiber cables entering buildings shall be bonded or grounded as specified in 770.100(A) through (D).

**(A) Bonding Conductor or Grounding Electrode Conductor.**

**(1) Insulation.** The bonding conductor or grounding electrode conductor shall be listed and shall be permitted to be insulated, covered, or bare.

**(2) Material.** The bonding conductor or grounding electrode conductor shall be copper or other corrosion-resistant conductive material, stranded or solid.

**(3) Size.** The bonding conductor or grounding electrode conductor shall not be smaller than 14 AWG. It shall have a current-carrying capacity not less than that of the grounded metallic member(s). The bonding conductor or grounding electrode conductor shall not be required to exceed 6 AWG.

**(4) Length.** The bonding conductor or grounding electrode conductor shall be as short as practicable. In one- and two-family dwellings, the bonding conductor or grounding electrode conductor shall be as short as practicable not to exceed 6.0 m (20 ft) in length.

> Informational Note: Similar bonding conductor or grounding electrode conductor length limitations applied at apartment buildings and commercial buildings help to reduce voltages that may develop between the building's power and communications systems during lightning events.

*Exception: In one- and two-family dwellings where it is not practicable to achieve an overall maximum bonding conductor or grounding electrode conductor length of 6.0 m (20 ft), a separate ground rod meeting the minimum dimensional criteria of 770.100(B)(3)(2) shall be driven, the grounding electrode conductor shall be connected to the separate ground rod in accordance with 770.100(C), and the separate ground rod shall be bonded to the power grounding electrode system in accordance with 770.100(D).*

**(5) Run in Straight Line.** The bonding conductor or grounding electrode conductor shall be run in as straight a line as practicable.

**(6) Physical Protection.** Bonding conductors and grounding electrode conductors shall be protected where exposed to physical damage. Where the bonding conductor or grounding electrode conductor is installed in a metal raceway, both ends of the raceway shall be bonded to the contained conductor or to the same terminal or electrode to which the bonding conductor or grounding electrode conductor is connected.

**(B) Electrode.** The bonding conductor and grounding electrode conductor shall be connected in accordance with 770.100(B)(1), (B)(2), or (B)(3).

**(1) In Buildings or Structures with an Intersystem Bonding Termination.** If the building or structure served has an intersystem bonding termination as required by 250.94, the bonding conductor shall be connected to the intersystem bonding termination.

Informational Note: See Informational Note Figure 800.100(B)(1) for an illustration of the application of the bonding conductor in buildings or structures equipped with an intersystem bonding termination.

**(2) In Buildings or Structures with Grounding Means.** If an intersystem bonding termination is established, 250.94(A) shall apply.

If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on one of the following:

(1) The building or structure grounding electrode system as covered in 250.50

(2) The grounded interior metal water piping system, within 1.5 m (5 ft) from its point of entrance to the building, as covered in 250.52

(3) The power service accessible means external to enclosures using the options identified in 250.94(A), Exception

(4) The nonflexible metal power service raceway

(5) The service equipment enclosure

(6) The grounding electrode conductor or the grounding electrode conductor metal enclosure of the power service

(7) The grounding electrode conductor or the grounding electrode of a building or structure disconnecting means that is connected to a grounding electrode as covered in 250.32

> Informational Note: See Informational Note Figure 800.100(B)(2) for an illustration of the application of the bonding conductor in buildings or structures not equipped with an intersystem bonding termination or terminal block providing access to the building grounding electrode system.

**(3) In Buildings or Structures Without Intersystem Bonding Termination or Grounding Means.** If the building or structure served has no intersystem bonding termination or grounding means, as described in 770.100(B)(2), the grounding electrode conductor shall be connected to either of the following:

(1) To any one of the individual grounding electrodes described in 250.52(A)(1), (A)(2), (A)(3), or (A)(4).

(2) If the building or structure served has no grounding means, as described in 770.100(B)(2) or (B)(3)(1), to any one of the individual grounding electrodes described in 250.52(A)(7) and (A)(8) or to a ground rod or pipe not less than 1.5 m

(5 ft) in length and 12.7 mm (1⁄2 in.) in diameter, driven, where practicable, into permanently damp earth and separated from lightning protection system conductors as covered in 805.53 and at least 1.8 m (6 ft) from electrodes of other systems. Steam, hot water pipes, or lightning protection system conductors shall not be employed as electrodes for non–current-carrying metallic members.

**(C) Electrode Connection.** Connections to grounding electrodes shall comply with 250.70.

**(D) Bonding of Electrodes.** A bonding jumper not smaller than 6 AWG copper or equivalent shall be connected between the grounding electrode and power grounding electrode system at the building or structure served where separate electrodes are used.

*Exception: At mobile homes as covered in 770.106.*

Informational Note No. 1: See 250.60 for connection to a lightning protection system.
Informational Note No. 2: Bonding together of all separate electrodes limits potential differences between them and between their associated wiring systems.

**770.106 Grounding and Bonding of Entrance Cables at Mobile Homes.**

**(A) Grounding.** Grounding shall comply with 770.106(A)(1) and (A)(2).

(1) Where there is no mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, the non–current-carrying metallic members of optical fiber cables entering the mobile home shall be grounded in accordance with 770.100(B)(3).

(2) Where there is no mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, the non–current-carrying metallic members of optical fiber cables entering the mobile home shall be grounded in accordance with 770.100(B)(3).

**(B) Bonding.**

The grounding electrode shall be bonded to the metal frame or available grounding terminal of the mobile home with a copper conductor not smaller than 12 AWG under either of the following conditions:

(1) Where there is no mobile home service equipment or disconnecting means as in 770.106(A)

(2) Where the mobile home is supplied by cord and plug

## Part V. Installation Methods Within Buildings

**770.110** Parts I, IV and V of Article 7XX shall apply to wiring methods and materials for optical fiber cable used within buildings.

**770.114 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).

## Part VI. Listing Requirements

**770.180 Grounding Devices.** Where bonding or grounding is required, devices used to connect a shield, a sheath, or non–current-carrying metallic members of a cable to a bonding conductor or grounding electrode conductor shall be listed or be part of listed equipment.

## Public Input No. 416-NFPA 70-2020 [ Definition: Cable, Optical Fiber, Composite. ]

**Cable, Optical Fiber, ~~Composite~~ Hybrid .**

A cable containing optical fibers and current-carrying electrical conductors. (CMP-16)

## Additional Proposed Changes

| File Name | Description | Approved |
|---|---|---|
| Pages_from_NEC-TCRA-1993-Articles_551_to_Chapter_9_proposal_16-171.pdf | Proposal 16-171 for the 1993 NEC | |

## Statement of Problem and Substantiation for Public Input

NFPA 70-1984 was the first edition of the National Electrical Code to include Article 770, Optical Fiber Cables. Section 770-3(c) of that edition stated:

"Hybrid. These cables contain optical fibers and current-carrying electrical conductors and shall be classified as electrical cables in accordance with the type of electrical conductors."

The 1993 Code changed “hybrid optical fiber cable” to “composite optical fiber cable”. Section 770-4(c) stated:

"Composite. These cables contain optical fibers and current-carrying electrical conductors and shall be permitted to contain noncurrent-carrying conductive members such as metallic strength members and metallic vapor barriers. Composite optical fiber cables shall be classified as electrical cables in accordance with the type of electrical conductors."

The change was based on Proposal 16-171 (copy attached) which was submitted by H. Marvin McNeil, who represented the Insulated Cable Engineers Association (ICEA) on Panel 16. The change from “hybrid” to “composite” was made in order to align the NEC with the terminology used in the United States.

While ICEA and TIA (Telecommunications Industry Association) in the U.S called these cables “composite optical fiber cables”, IEC (International Electrotechnical Commission) and CENELEC (European Committee for Electrotechnical Standardization) called them “hybrid”. In 2012 ICEA switched their definitions to align with the international definitions.

Consequently, ICEA now proposes to change from “composite optical fiber cable” back to “hybrid optical fiber cable”.

We have submitted companion Public Inputs to change “composite optical fiber cable” to “hybrid optical fiber cable” each time the term is used in the Code.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 417-NFPA 70-2020 [Section No. 770.3(C)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 418-NFPA 70-2020 [Section No. 770.133(B)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |

| | |
|---|---|
| Public Input No. 419-NFPA 70-2020 [Section No. 830.1] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 420-NFPA 70-2020 [Section No. 500.8(F)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 421-NFPA 70-2020 [Section No. 505.9(F)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 422-NFPA 70-2020 [Section No. 506.9(F)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 423-NFPA 70-2020 [Section No. 640.21(B)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 424-NFPA 70-2020 [Section No. 640.21(C)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 425-NFPA 70-2020 [Section No. 640.42(B)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 426-NFPA 70-2020 [Section No. 640.42(C)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 417-NFPA 70-2020 [Section No. 770.3(C)] | |
| Public Input No. 418-NFPA 70-2020 [Section No. 770.133(B)] | |
| Public Input No. 419-NFPA 70-2020 [Section No. 830.1] | |
| Public Input No. 420-NFPA 70-2020 [Section No. 500.8(F)] | |
| Public Input No. 421-NFPA 70-2020 [Section No. 505.9(F)] | |
| Public Input No. 422-NFPA 70-2020 [Section No. 506.9(F)] | |
| Public Input No. 423-NFPA 70-2020 [Section No. 640.21(B)] | |
| Public Input No. 424-NFPA 70-2020 [Section No. 640.21(C)] | |
| Public Input No. 425-NFPA 70-2020 [Section No. 640.42(B)] | |
| Public Input No. 426-NFPA 70-2020 [Section No. 640.42(C)] | |

## Submitter Information Verification

**Submitter Full Name:** Stanley Kaufman
**Organization:** CableSafe, Inc./OFS
**Affiliation:** Insulated Cable Engineers Association (ICEA)
**Street Address:**
**City:**
**State:**
**Zip:**
**Submittal Date:** Tue Feb 04 12:26:37 EST 2020
**Committee:** NEC-P16

**PANEL ACTION:** Accept in Principle
Delete proposer's recommendation in total. Provide new FPN for Section 770-4 to read as follows:
"(FPN): Plastic innerduct that is commonly used in underground outside plant construction is highly combustible and not suitable for use in buildings."
**PANEL STATEMENT:** This more easily meets the submitter's intent.
**VOTE ON PANEL ACTION:** Unanimously Affirmative.

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Log #766

16-170- (770-5, FPN): Accept in Principle
**SUBMITTER:** W. R. Barnett, Raleigh, NC
**RECOMMENDATION:** Delete FPN.
**SUBSTANTIATION:** Wording of the FPN can be interpreted to mean that unlisted cable may be used in cable trays. The note provides no clarification of requirements and only tends to confuse one.
**PANEL ACTION:** Accept in Principle
In place of the submitter's request for deletion of the FPN, reword the existing Section 770-5 to read as follows:
"Optical fiber cables of the types listed in Table 770-50 shall be permitted to be installed in cable trays."
Change the wording of the existing FPN to read as follows:
"(FPN): It is not the intent to require that these optical fiber cables be listed specifically for use in cable trays."
**PANEL STATEMENT:** This revision clarifies the intent of Section 770-5 and satisifes the concern of the submitter.
**VOTE ON PANEL ACTION:** Unanimously Affirmative.

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Log # 3242

16-171- (770-6(c)): Accept in Principle
**SUBMITTER:** H. Marvin McNeil, Siecor Corporation
**RECOMMENDATION:** Delete: (c) Hybrid. These cables . . . and metallic vapor barriers. Hybrid optical fiber cables shall be...
Substitute: (c) Composite. These cables . . . and metallic vapor barriers. Composite optical fiber cables shall be . . .
(From a quick review of the NEC, this appears to be the only place where the term "Hybrid" is used, although an extensive review of this has not been made.)
**SUBSTANTIATION:** The term "HYBRID" is improperly applied here. As used in the field of fiber optics, both manufacturers and users apparently think of "hybrid" as descriptive, not only of combinations of optical and electrical transmission elements, but of mixed fiber types and sizes as well (e.g., single-mode and multimode fibers in one cable, or different fiber sizes in one cable, or both). This problem turned up when a TIA (Telecommunications Industry Association) Working Group tried to apply the term to a proposed fiber optic cable specification, and use it in the same manner as it now appears in the NEC; comments (primarily from users) forced a change in the proposed document.
For consistency among standards developers, the NEC should stop mis-using the term.
**PANEL ACTION:** Accept in Principle
The new term "composite" must also be used in Section 770-52(a) in the first line of the text to read as follows:
"Optical fibers shall be permitted within the same composite cable ..." and in the ninth line which starts as "Hybrid optical fiber cables ..." to read as follows:
"Composite optical fiber cables containing only current-carrying ..."
**PANEL STATEMENT:** The Panel has changed the word "hybrid" in these two locations as editorial changes.
**VOTE ON PANEL ACTION:** Unanimously Affirmative.
**COMMENT ON VOTE:**
ANNA: The Panel Action should be to accept the proposal and to also make the changes in Section 770-52(a).

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Log # 199

16-172- (770-7-(New)): Reject
**SUBMITTER:** Stanley Kaufman, AT&T Bell Laboratories
**RECOMMENDATION:** Add a definition of open conductor. Also, add a fine print note.
Definitions.
Open Conductor: A conductor that is not in a cable or in a raceway.
(FPN) Knob-and-tube wiring (Article 324) is an example of an open conductor.
**SUBSTANTIATION:** The term open conductor is used in Sections 725-38, 760-52, 800-52 and 820-52 without a definition. A definition is needed for clarity. This definition has been proposed for Article 100. If it is accepted in Article 100, then Article 100 can be referenced instead of adopting the definition here.
**PANEL ACTION:** Reject
**PANEL STATEMENT:** Same as Panel Statement on Proposal 16-24 (Log # 193).
**VOTE ON PANEL ACTION:** Unanimously Affirmative.

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Log # 1742

16-173- (770-33): Reject
**SUBMITTER:** Geraldine V. Cox, Chemical Manufacturers Association
**RECOMMENDATION:** Delete the following words at the beginning of the first sentence:
"Where exposed to contact with electric light or power conductors,"
**SUBSTANTIATION:** Grounding of noncurrent-carrying metallic members or installation of an insulating joint at the cable point of entrance into buildings is also desirable to avoid propagation of induced voltages throughout building wiring systems. Induced voltages may be caused by lightning. The proposed revision is consistent with the philosophy expressed in Article 250-1, FPN No.1.
**PANEL ACTION:** Reject
**PANEL STATEMENT:** There is no technical substantiation to support this major change in the practice of grounding or interrupting the metal members of optical fiber cables where there is no exposure to power. The lightning surges of concern to the submitter generally are not present in cables not exposed to power since they are located in underground installations in large metropolitan areas. Furthermore, lightning surges may appear on power conductors entering buildings and there are no mitigating requirements.
The proposal would require all cables at the entrance to have a total splice with attendant signal loss or would require grounded metal conduit to enclose the cable until it reaches its termination where the metal members are grounded. Section 770-50 limits the length of unlisted cable within a building already.
**VOTE ON PANEL ACTION:**
AFFIRMATIVE: 15
NEGATIVE: Bagnall
**EXPLANATION OF VOTE:**
BAGNALL: Panel Member Ballot Action: Accept in Principle and delete "Where exposed to contact with electric light or power conductors, "the" from the beginning of Section 770-33 and change the "n" in "noncurrent-carrying" to upper case.
Panel Member Ballot Substantiation: Although the proposer's intent appears to be to protect from electrical ingress hazards of all sources, the actual intent should be to make Section 770-33 identical to the requirements of Section 800-33 for the same reasons Section 800-33 was accepted, i.e., to dispel the need to determine whether the cable is exposed.
CMP-16's panel statement correctly notes no technical substantiation to support the change was presented. However, the concern is how do you know a cable is actually unexposed or how can you assure that a cable will always remain unexposed after its installation. CMP-16's statement regarding lightning identifies a condition which "generally" may exist and not be of concern but leaves open the possibility for conditions that can be of concern. Lightning may, in fact, hit (seek) electrically conducting elements buried in the ground. In addition, in rare exceptions power lines enter premises through kilowatt-hour meters which have built in surge protection of about 8 kV and each ungrounded circuit must be connected to a current limiting device near their point of entry into the premises. All these normally provided power service equipment provisions introduce an inherent level of surge protection which obviates the need to prescribe or require additional levels of surge protection for fire and safety considerations. Present requirements and routine installations methods for fiber optical do not provide the same type of inherent surge protection.
Substantiation for this proposal should be the same as the substantiation provided for Section 800-33 in Proposal No. 16-195 of the 1990 NEC revision cycle. The proposer's substantiation reads as follows: "This proposal would require sheath grounding under all conditions. The installer would not have to determine if there is exposure to power. Sheath grounding is standard practice in the telephone industry. It is necessary."
It seems that if sheath grounding or isolating is always necessary for the telephone industry (metallic) cables that it should always be necessary for their shields and metallic strength members of fiber optic cables. Although grounding of the metallic elements in fiber

# Public Input No. 3897-NFPA 70-2020 [ New Definition after Definition: Communications Equipment. ]

**Communications Utility**

An organization, either designated by or recognized by public service commissions or public utility commissions, or recognized as such under federal, state, or local law, that installs, operates, and maintains communication systems such as, but not limited to, telephone, wireless, VoIP, CATV, internet, satellite, or data service.

## Statement of Problem and Substantiation for Public Input

NFPA 76-2020, Standard for the Fire Protection of Telecommunications Facilities, defines Utility, as follows:

“3.3.19 Utility. An organization, either designated by or recognized by public service commissions or public utility commissions, or recognized as such under federal, state, or local law, that installs, operates, and maintains electric supply or communication systems such as, but not limited to, telephone, wireless, VoIP, CATV, internet, satellite, or data service.”

The NEC does not define utility, but it has an informational note below 90.2(B) Not Covered:

“Informational Note to (4) and (5): Examples of utilities may include those entities that are typically designated or recognized by governmental law or regulation by public service/utility commissions and that install, operate, and maintain electric supply (such as generation, transmission, or distribution systems) or communications systems (such as telephone, CATV, Internet, satellite, or data services). Utilities may be subject to compliance with codes and standards covering their regulated activities as adopted under governmental law or regulation. Additional information can be found through consultation with the appropriate governmental bodies, such as state regulatory commissions, the Federal Energy Regulatory Commission, and the Federal Communications Commission.”

Since the term “Communications Utility” is used in mandatory text in the NEC, see 90.2(B)(4), it should be defined in the NEC. Adoption of the definition in NFPA 76, with the clarifying word “Communications” inserted before “Utility” is suitable for the NEC and compatible with the Informational Note to (4) and (5) shown above.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 3899-NFPA 70-2020 [Section No. 90.2(B)] | |

## Submitter Information Verification

**Submitter Full Name:** Jeff Silveira
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**Submittal Date:** Wed Sep 09 15:02:31 EDT 2020
**Committee:** NEC-P16

## Public Input No. 1056-NFPA 70-2020 [ New Article after 770 ]

**Article 770 Optical fiber cables should be moved to chapter 8 into communications. fiber optics has been use around the world do to its reliable source of transmitting communication with coded language using 0's and 1's. the article could discuss how to decode the coded messages and how the both electricity and fiber optic are relatable.**

## Statement of Problem and Substantiation for Public Input

I believe by moving article 770 into chapter 8 communication could help future and present electrician how fiber optics code language is used, understand the difference between traveling information through fiber optics and copper cable.

## Submitter Information Verification

**Submitter Full Name:** Michael Martinez
**Organization:** E light Electric
**Affiliation:** Curtis Elliot
**Street Address:**
**City:**
**State:**
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**Submittal Date:** Wed May 13 22:49:33 EDT 2020
**Committee:** NEC-P16

## Public Input No. 3967-NFPA 70-2020 [ Section No. 770.2 ]

(Relocate all definitions in the 770. 2 to Article 100, arrange them in alphabetical order and without any subdivisions)

**770. 2** Definitions.

See Part I of Article 100. The definitions in this section shall apply only within Article 770.

**Abandoned Optical Fiber Cable.**

Installed optical fiber cable that is not terminated at equipment other than a connector and not identified for future use with a tag.

**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.

**Exposed (to Accidental Contact).**

A conductive optical fiber cable in such a position that, in case of failure of supports or insulation, contact between the cable's non–current-carrying conductive members and an electrical circuit might result.

Informational Note: See Part I of Article 100 for two other definitions of Exposed: Exposed (as applied to live parts) and Exposed (as applied to wiring methods).

**Point of Entrance.**

The point within a building at which the optical fiber cable emerges from an external wall or from a concrete floor slab.

## Statement of Problem and Substantiation for Public Input

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

## Submitter Information Verification

**Submitter Full Name:** David Williams
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**State:**
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**Submittal Date:** Wed Sep 09 16:27:02 EDT 2020
**Committee:** NEC-P16

# Public Input No. 3472-NFPA 70-2020 [ Definition: Cable Sheath. ]

Relocate this definition to Article 100 and consider revising the definition to coordinate with the same term used in Article 800 and other articles of the code.

**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.

## Statement of Problem and Substantiation for Public Input

The NEC Style Manual revisions in Section 2.2.2 and its subdivisions requires multiple changes to the definitions in Article 100 and all Articles in the NEC including the use of acronyms in Section 3.2.3. Section 2.2.2.4 Terms with Multiple Definitions. Where two or more definitions exist for a term, a task group shall be formed to work on the development of a single acceptable definition. When this cannot be accomplished, another term shall be selected or the term shall be identified in the context of the specific application.
The term cable sheath is commonly used in the code and the panel should consider deleting the definition.

## Submitter Information Verification

**Submitter Full Name:** David Williams
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**Submittal Date:** Tue Sep 08 16:17:00 EDT 2020
**Committee:** NEC-P16

## Public Input No. 2168-NFPA 70-2020 [ Section No. 770.3 ]

**770.3** Other Articles.

Installations of optical fiber cables shall comply with 770.3(A) ~~and~~ , (B), and (D) . Only those sections of Chapter 2 and Article 300 referenced in this article shall apply to optical fiber cables.

**(A)** Hazardous (Classified) Locations.

Listed optical fiber cables shall be permitted to be installed in hazardous (classified) locations. The cables shall be sealed in accordance with the requirements of 501.15, 502.15, 505.16, or 506.16, as applicable.

**(B)** Cables in Ducts for Dust, Loose Stock, or Vapor Removal.

The requirements of 300.22(A) for wiring systems shall apply to conductive optical fiber cables.

**(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.

(D) Vertical Support for Fire-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 their listing.

## Statement of Problem and Substantiation for Public Input

Current vertical support requirements for conductors are found in Section 300.19, but Article 770 doesn't reference it so we need to add vertical support requirements specific to cables with -CI and those part of a fire-resistive cable system so that optical cables are properly supported in the vertical arrangements.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.

## Submitter Information Verification

**Submitter Full Name:** Richard Holub
**Organization:** The DuPont Company, Inc.
**Street Address:**
**City:**
**State:**
**Zip:**
**Submittal Date:** Thu Aug 06 12:01:52 EDT 2020
**Committee:** NEC-P16

## Public Input No. 4115-NFPA 70-2020 [ Section No. 770.3(A) ]

**(A)** Hazardous (Classified) Locations.

Listed optical fiber cables shall be permitted to be installed in hazardous (classified) locations. The cables shall be sealed in accordance ~~with the requirements of~~ with 501.15, 502.15, 505.16, or 506.16, as applicable.

## Statement of Problem and Substantiation for Public Input

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

## Submitter Information Verification

**Submitter Full Name:** David Williams
**Organization:** Delta Charter Township
**Street Address:**
**City:**
**State:**
**Zip:**
**Submittal Date:** Wed Sep 09 21:08:00 EDT 2020
**Committee:** NEC-P16

## Public Input No. 417-NFPA 70-2020 [ Section No. 770.3(C) ]

**(C)** ~~Composite~~ Hybrid Cables.

~~Composite~~ Hybrid 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.

## Statement of Problem and Substantiation for Public Input

Public Input No. 416 proposes to change “composite optical fiber cable” to “hybrid optical fiber cable” in order to align the NEC with current U.S and international definitions. Acceptance of PI 416 necessitates changing “composite optical fiber cable” to “hybrid optical fiber cable” throughout the NEC. This is a coordinating Public Input to PI 416.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 416-NFPA 70-2020 [Definition: Cable, Optical Fiber, Composite.] | Changes definition of composite optical fiber cable to hybrid optical fiber cable |
| Public Input No. 418-NFPA 70-2020 [Section No. 770.133(B)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 419-NFPA 70-2020 [Section No. 830.1] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 420-NFPA 70-2020 [Section No. 500.8(F)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 421-NFPA 70-2020 [Section No. 505.9(F)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 422-NFPA 70-2020 [Section No. 506.9(F)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 423-NFPA 70-2020 [Section No. 640.21(B)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 424-NFPA 70-2020 [Section No. 640.21(C)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 425-NFPA 70-2020 [Section No. 640.42(B)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 426-NFPA 70-2020 [Section No. 640.42(C)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 416-NFPA 70-2020 [Definition: Cable, Optical Fiber, Composite.] | |
| Public Input No. 418-NFPA 70-2020 [Section No. 770.133(B)] | |
| Public Input No. 419-NFPA 70-2020 [Section No. 830.1] | |
| Public Input No. 420-NFPA 70-2020 [Section No. 500.8(F)] | |

Public Input No. 421-NFPA 70-2020 [Section No. 505.9(F)]

Public Input No. 422-NFPA 70-2020 [Section No. 506.9(F)]

Public Input No. 423-NFPA 70-2020 [Section No. 640.21(B)]

Public Input No. 424-NFPA 70-2020 [Section No. 640.21(C)]

Public Input No. 425-NFPA 70-2020 [Section No. 640.42(B)]

Public Input No. 426-NFPA 70-2020 [Section No. 640.42(C)]

## Submitter Information Verification

**Submitter Full Name:** Stanley Kaufman
**Organization:** CableSafe, Inc./OFS
**Affiliation:** Insulated Cable Engineers Association (ICEA)
**Street Address:**
**City:**
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**Zip:**
**Submittal Date:** Tue Feb 04 12:36:19 EST 2020
**Committee:** NEC-P16

## Public Input No. 2169-NFPA 70-2020 [ Section No. 770.24 ]

**770.24** Mechanical Execution of Work.

(A) General.

Optical fiber 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 also conform to 300.4 and 300.11. 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: Accepted industry practices are described in ANSI/NECA/FOA 301-2016, *Standard for Installing and Testing Fiber Optic Cables*; ANSI/TIA-568.0-D-2015, *Generic Telecommunications Cabling for Customer Premises*; and ANSI/TIA 568.3-D-2016, *Optical Fiber Cabling and Components Standard*.

Informational Note No. 2: 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. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of optical fiber cable properties.

(B) Circuit Integrity (CI) Cable.

Circuit ingegrity (CI( cable shall be supported at a distance not exceeding 610mm (24in.). 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 intent here is to split this into an (A) General and (B) Circuit Integrity, to correlate with 760.24 (as well as proposed changes in Articles 725, 728, and 800). Circuit Integrity Cable has specific installation requirements which are currently not covered adequately in Article 770 and proposals are made to 770.179(E) to address this and point to this mechanical execution of work language.The current language in the NEC(r) is not specific to what building surface the cable may be mounted to. The language proposed here correlates with the other mentioned articles and mirrors the requirements for a circuit protective system installation. Circuit integrity (-CI) cable's support is critical to the survivability of the cable. If the supporting structure doesn't survive the fire for the required time, the critical circuit may not survive as well. 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.

## Submitter Information Verification

**Submitter Full Name:** Richard Holub

**Organization:** The DuPont Company, Inc.

| | |
|---|---|
| **Street Address:** | |
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| **Zip:** | |
| **Submittal Date:** | Thu Aug 06 12:09:09 EDT 2020 |
| **Committee:** | NEC-P16 |

# Public Input No. 303-NFPA 70-2020 [ Section No. 770.24 ]

**770.24** Mechanical Execution of Work.

~~Optical fiber 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 also conform to 300.4 and 300.11 . Nonmetallic cable ties and~~ See Section 110.12(C) for general requirements. 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: Accepted industry practices are described in ANSI/NECA/FOA 301-2016, *Standard for Installing and Testing Fiber Optic Cables*; ANSI/TIA-568.0-D-2015, *Generic Telecommunications Cabling for Customer Premises*; and ANSI/TIA 568.3-D-2016, *Optical Fiber Cabling and Components Standard*.

Informational Note No. 2: 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. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of optical fiber cable properties.~~

## Statement of Problem and Substantiation for Public Input

The general information for mechanical protection of optical fiber cables, as well as Informational Note No. 3, is now contained in 110.12(C) and is redundant and may be deleted here. Information specific to optical fiber cables should be retained here as Section 110.12 generally covers electrical installations.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 305-NFPA 70-2020 [Section No. 800.24] | |
| Public Input No. 308-NFPA 70-2020 [Section No. 840.24] | |

## Submitter Information Verification

| | |
|---|---|
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| **Submittal Date:** | Thu Jan 16 10:36:12 EST 2020 |

**Committee:** NEC-P16

# Public Input No. 3768-NFPA 70-2020 [ Section No. 770.24 ]

**770.24** Mechanical Execution of Work.

Optical fiber 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 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 conform to 300.4 and 300.11. 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: Accepted industry practices are described in ANSI/NECA/FOA 301-2016, *Standard for Installing and Testing Fiber Optic Cables*; ANSI/TIA-568.0-D-2015, *Generic Telecommunications Cabling for Customer Premises*; and ANSI/TIA 568.3-D-2016, *Optical Fiber Cabling and Components Standard*.

Informational Note No. 2: 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. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of optical fiber 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 optical fiber cable 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 770.24 to ensure the same listing and securement requirement for cable ties also applies to cable ties used to support optical fiber cable. 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 770.24.
Identical public inputs have been submitted for Sections 725.24, 760.24, and 800.24.

## Submitter Information Verification

**Submitter Full Name:** Megan Hayes
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**Submittal Date:** Wed Sep 09 12:09:44 EDT 2020
**Committee:** NEC-P16

## Public Input No. 4275-NFPA 70-2020 [ Section No. 770.24 ]

**770.24** Mechanical Execution of Work.

Optical fiber 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~~ Hammer driven supports installed over the cable shall not be used. The installation shall also conform to 300.4 and 300.11. 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: Accepted industry practices are described in ANSI/NECA/FOA 301-2016 , *Standard for Installing and Testing Fiber Optic Cables*; ANSI/TIA-568.0-D-2015, *Generic Telecommunications Cabling for Customer Premises*; and ANSI/TIA 568.3-D-2016, *Optical Fiber Cabling and Components Standard*.

Informational Note No. 2: 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. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of optical fiber cable properties.

## Statement of Problem and Substantiation for Public Input

Further explanation needs to be addressed concerning certain fastener installation practices to prevent inadvertent physical damage to these sensitive cables. By inserting the new text we can clearing indicate that we intend to keep the safety of the cable in mind so that “installed so as not to damage the cable” will be adhered to. Article 300.4- “Where subject to physical damage, conductors, raceways, and cables shall be protected. A support that places the cable in line with a hammer swing is quite possibly subject to physical damage.

## Submitter Information Verification

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**Submittal Date:** Thu Sep 10 09:05:38 EDT 2020
**Committee:** NEC-P16

# Public Input No. 64-NFPA 70-2019 [ Section No. 770.24 ]

**770.24** Mechanical Execution of Work.

Optical fiber 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 also conform to 300.4 and 300.11. ~~Nonmetallic~~ Plenum 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)~~ 800.170 .

Informational Note No. 1: Accepted industry practices are described in ANSI/NECA/FOA 301-2016, *Standard for Installing and Testing Fiber Optic Cables*; ANSI/TIA-568.0-D-2015, *Generic Telecommunications Cabling for Customer Premises*; and ANSI/TIA 568.3-D-2016, *Optical Fiber Cabling and Components Standard*.

Informational Note No. 2: 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. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of optical fiber cable properties.

## Statement of Problem and Substantiation for Public Input

PI 65 and PI 66 move the listing requirements for plenum cable ties from Article 805 to general Article 800. This PI coordinates with PIs 65 & 66.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 65-NFPA 70-2019 [New Part after V.] | Moves listing requirements for plenum cable ties to Article 800 |
| Public Input No. 66-NFPA 70-2019 [Section No. 805.170(C)] | Deletes listing requirements for plenum cable ties from Article 805 |
| Public Input No. 67-NFPA 70-2019 [Section No. 800.24] | Parallel PI for Article 800 |
| Public Input No. 67-NFPA 70-2019 [Section No. 800.24] | |

## Submitter Information Verification

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**Organization:** PLASTICS Industry Association
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**Submittal Date:** Fri Nov 08 08:46:05 EST 2019
**Committee:** NEC-P16

# Public Input No. 681-NFPA 70-2020 [ Section No. 770.24 ]

**770.24** Mechanical Execution of Work.

Optical fiber 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 also conform to 300.4 and 300.11. 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: Accepted industry practices are described in ANSI/NECA/FOA 301-2016, *Standard for Installing and Testing Fiber Optic Cables*; ANSI/TIA-568.0-D-2015, *Generic Telecommunications Cabling for Customer Premises*; and ANSI/TIA 568.3-D-2016, *Optical Fiber Cabling and Components Standard*.

Informational Note No. 2: See NFPA 90A-~~2018~~ 2021 , *Standard for the Installation of Air-Conditioning and Ventilating Systems*, for discrete combustible components installed in accordance with 300.22(C).

Informational Note No. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of optical fiber cable properties.

## 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. 680-NFPA 70-2020 [Section No. 760.135(B)] | 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. 680-NFPA 70-2020 [Section No. 760.135(B)]

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

**Submitter Full Name:** David Kiddoo
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**Affiliation:** CCCA
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**Submittal Date:** Wed Mar 18 04:00:37 EDT 2020
**Committee:** NEC-P16

## Public Input No. 68-NFPA 70-2019 [ New Section after 770.26 ]

**770.27 Temperature Limitation of Optical Fiber Cables.**

No optical fiber 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

The requirement that the temperature of a cable shall not exceed its temperature rating is a general requirement for communications cables; see 800.27. Logically, this requirement should also apply to optical fiber cables.

## Submitter Information Verification

**Submitter Full Name:** Terry Peters
**Organization:** PLASTICS Industry Association
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**State:**
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**Submittal Date:** Fri Nov 08 09:24:24 EST 2019
**Committee:** NEC-P16

## Public Input No. 499-NFPA 70-2020 [ Section No. 770.47(B) ]

**(B)** Direct-Buried Cables and Raceways.

Direct-buried conductive optical fiber cables shall be separated by at least 300 mm (12 in.) from conductors of any electric light, power, non–power-limited fire alarm circuit conductors, or Class 1 circuit.

*Exception No. 1: ~~Direct-buried conductive optical fiber cables~~ Separation shall not be required ~~to be separated by at least 300 mm (12 in.) from~~ where the electric service conductors ~~where electric service conductors~~ are installed in raceways or have metal cable armor.*

*Exception No. 2: ~~Direct-buried conductive optical fiber cables shall not be required to be separated by at least 300 mm (12 in.) from electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors where~~ Separation shall not be required where the electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables.*

## Statement of Problem and Substantiation for Public Input

This is an editorial PI. The revised text is simpler and parallel to the text in the exceptions in 820.47(B) and 830.47(B).

See 3.3.5 Parallel Construction in the NEC Style manual.

## Submitter Information Verification

**Submitter Full Name:** Ashley Hood-Morley
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**Submittal Date:** Thu Feb 20 11:47:15 EST 2020
**Committee:** NEC-P16

## Public Input No. 2491-NFPA 70-2020 [ Section No. 770.100(A)(2) ]

**(2)** Material.

The bonding conductor or grounding electrode conductor shall be copper-clad steel, copper or other corrosion-resistant conductive material, stranded or solid.

## Additional Proposed Changes

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

## Statement of Problem and Substantiation for Public Input

Grounding Electrode Conductor Purpose:

The purpose of the grounding electrode system, grounding electrode(s) and grounding electrode conductor(s) is to provide a connection to earth for the electrical system and equipment. The grounding electrode system functions to limit errant voltages caused by lightning, transients and high voltage line clashes. For grounded systems it stabilizes the voltage of the electrical system during normal operations and keeps the voltage to ground at predictable limits. A grounding electrode conductor must be both strong and conductive. It should be strong enough mechanically to withstand high current/frequency (A/Hz) lightning strikes as well as any damage from normal use. Where terminated in or near ground level, it must be corrosion resistant. Finally, a grounding electrode conductor must be able to be connected with standard industry-accepted connectors that are used within the grounding electrode system.

Grounding Electrode Conductor Materials:

The present materials permitted for grounding electrode conductors are copper, aluminum and copper-clad aluminum. The aluminum and copper-clad aluminum are limited in use by 250.64(A) where the bare conductor is in or near the ground or concrete at grade level. Grade 40 Copper-Clad Steel (40CCS), a copper bimetal, is another alternative designed for use as a grounding electrode conductor (GEC) and should be added to the NEC®. It is governed by ASTM B910/B910M-2007, the Standard Specification for Annealed Copper-Clad Steel Wire. The standard's scope states the following: This specification covers bare round copper-clad steel for the following applications: electrical, electronic, grounding, telecommunications, and other applications. Per the standard, the minimum tensile strength for all wire diameters must be higher than 40,000 PSI, which would elevate the strength of GEC materials currently provided in Article 250. The shear modulus of Grade 40CCS is 11,600 KSI. Because ASTM B910 requires 40CCS to be annealed (softened), the material is sufficiently pliable to allow for traditional installation practices for GEC's. Increased mechanical strength of a GEC elevates

the protection of an electrical installation in two ways: 1) the GEC can better withstand fusing during ultra-high A/Hz lightning strikes (see connector and fusing discussions below); 2) the GEC is noticeably more difficult to cut without proper tools, which aids as a theft deterrent when thieves attempt to remove it. Additionally, Copper Clad Steel has no scrap value, which also disincentives theft.

Terminations and Connectors:

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

Corrosion Resistance:

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

Resistance to Fusing at High Currents:

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

Conductivity:

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

Current NEC® Applications:

Copper Clad Steel as a GEC material is currently referenced in section 810.21(A) of the NEC®. . In addition to the substantiation information provided above for correlation purposes 40CCS should be included in applicate Articles, such as Article 250, and sections that specify grounding electrode conductor material. Public inputs have been submitted for this action in a number of sections.

Listing:

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

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 2462-NFPA 70-2020 [Section No. 250.62] | CCS Grounding Conductors |
| Public Input No. 2472-NFPA 70-2020 [Section No. 250.102(C)(2)] | CCS Bonding Conductors |
| Public Input No. 2467-NFPA 70-2020 [Section No. 250.66 [Excluding any Sub-Sections]] | CCS Grounding Conductors |

## Submitter Information Verification

**Submitter Full Name:** Peter Graser
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**Affiliation:** American Bimetallic Association
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**City:**
**State:**
**Zip:**
**Submittal Date:** Sun Aug 23 15:22:11 EDT 2020
**Committee:** NEC-P16

*Testing done for the safety of our valued customer.*

# Global Circulation Laboratory Test Report

*For Global Distribution*

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

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

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

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

**TD002391 REV B**

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

TD002391

# Global Circulation Laboratory Test Report

*For Global Distribution*

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# Global Circulation Laboratory Test Report

*For Global Distribution*

## PURPOSE OF TEST:

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

## TEST REQUESTED:

UL486A-486B Mechanical Sequence
UL467 Short Time Current

## TEST RESULTS:

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

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# Global Circulation Laboratory Test Report

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## CONCLUSIONS:

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

## TEST PROCEDURES

The table below shows the connector / conductor combinations tested.

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

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*For Global Distribution*

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

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

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

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

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

## TEST EQUIPMENT LIST:

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

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# CORROSION ON BURIED COPPER CLAD STEEL




Cece Syarif

Global Application Engineer

&

Anthony Hale

Manager, Utility Products, North America

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

COPPERWELD

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

July 26, 2011

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

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

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

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

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

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

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

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

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



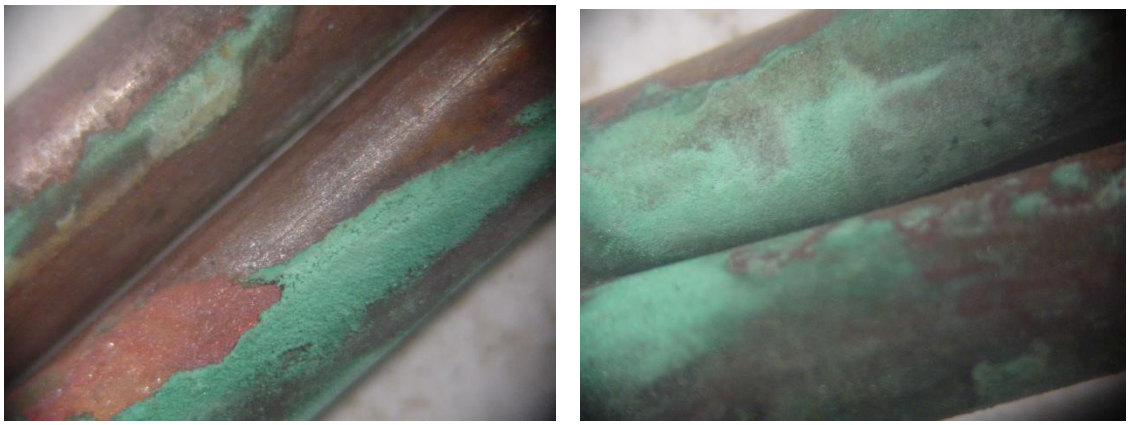
Figure 1: Example of Underground Corrosion of Copper Clad Steel

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

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

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



(a) Copper Clad Steel (b) Copper

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

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

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

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

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

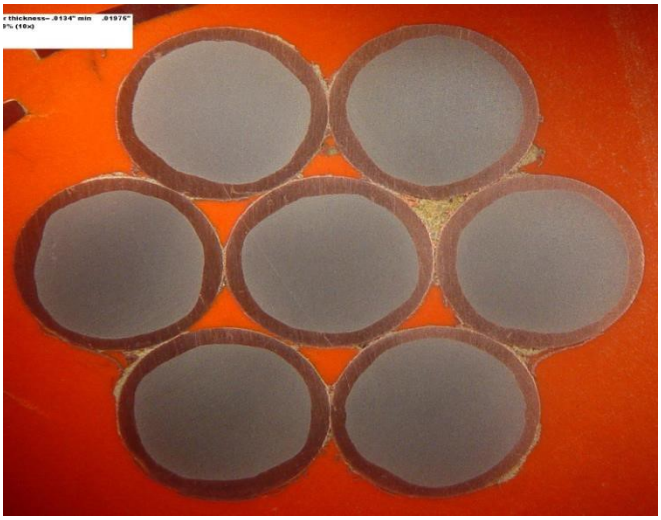


Figure 3: Copperweld® 40% LC DSA 7 No. 5 manufactured in 1962

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



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

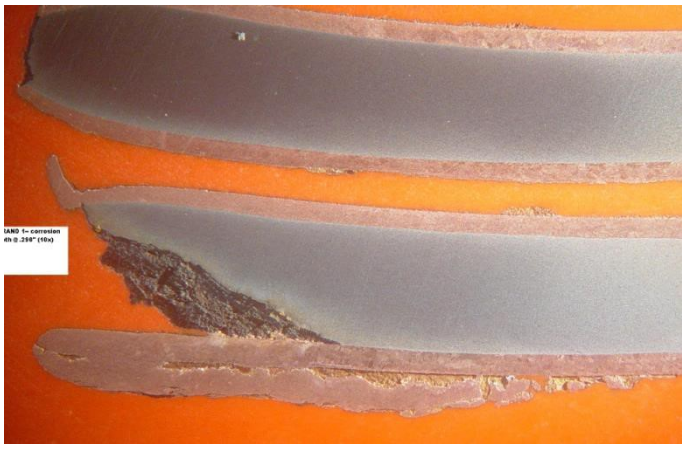


Figure 4b: Corrosion occurred at the ends of the wires. Maximum penetration depth is 0.859 inch.

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

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

**REFERENCES:**

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

Powertech

*Report ID: PL-03027 REP1*
*Revision: 0  Issued: 2020-04-15*

# Copper and CCS Wire Withstand Current and Fusing Current Tests

Copperweld Bimetallics, LLC




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

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## REPORT OF PERFORMANCE

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

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

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# 1 INTRODUCTION

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

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

# 2 TEST OBJECT INFORMATION

The test objects were identified by the client as follows:

Copper Clad Steel Wires (CCS)

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

Copper Conductor

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

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

# 3 GENERAL INFORMATION

## 3.1 Purpose

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

## 3.2 Witnesses

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

## 3.3 Tests Performed

**Test Standards/Specifications:**

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

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

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

## 4 SHORT-CIRCUIT CURRENT TESTS

**General Information:**

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

**Environmental Conditions:**

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

**Test Conditions:**

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

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

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

**Test Results:**

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

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

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

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

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

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

## APPENDIX A – FUSING CURRENT TEST CIRCUIT AND DATA

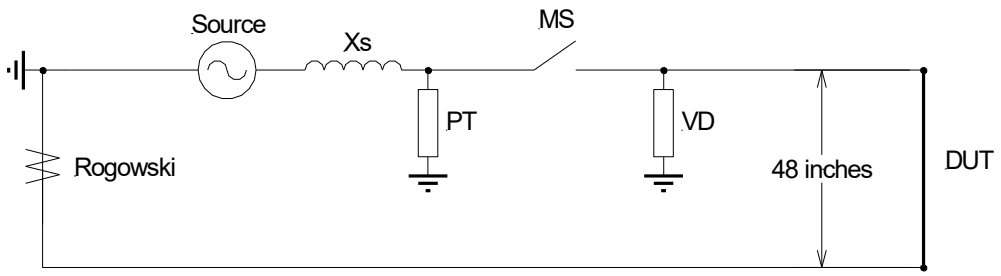



***Figure 1: Test circuit schematic for all tests.***

*Notes:*

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

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

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

Note:

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

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

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

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

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

Notes:

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

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

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

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

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

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

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

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

Notes:

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

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

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

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

## APPENDIX B – WAVEFORMS

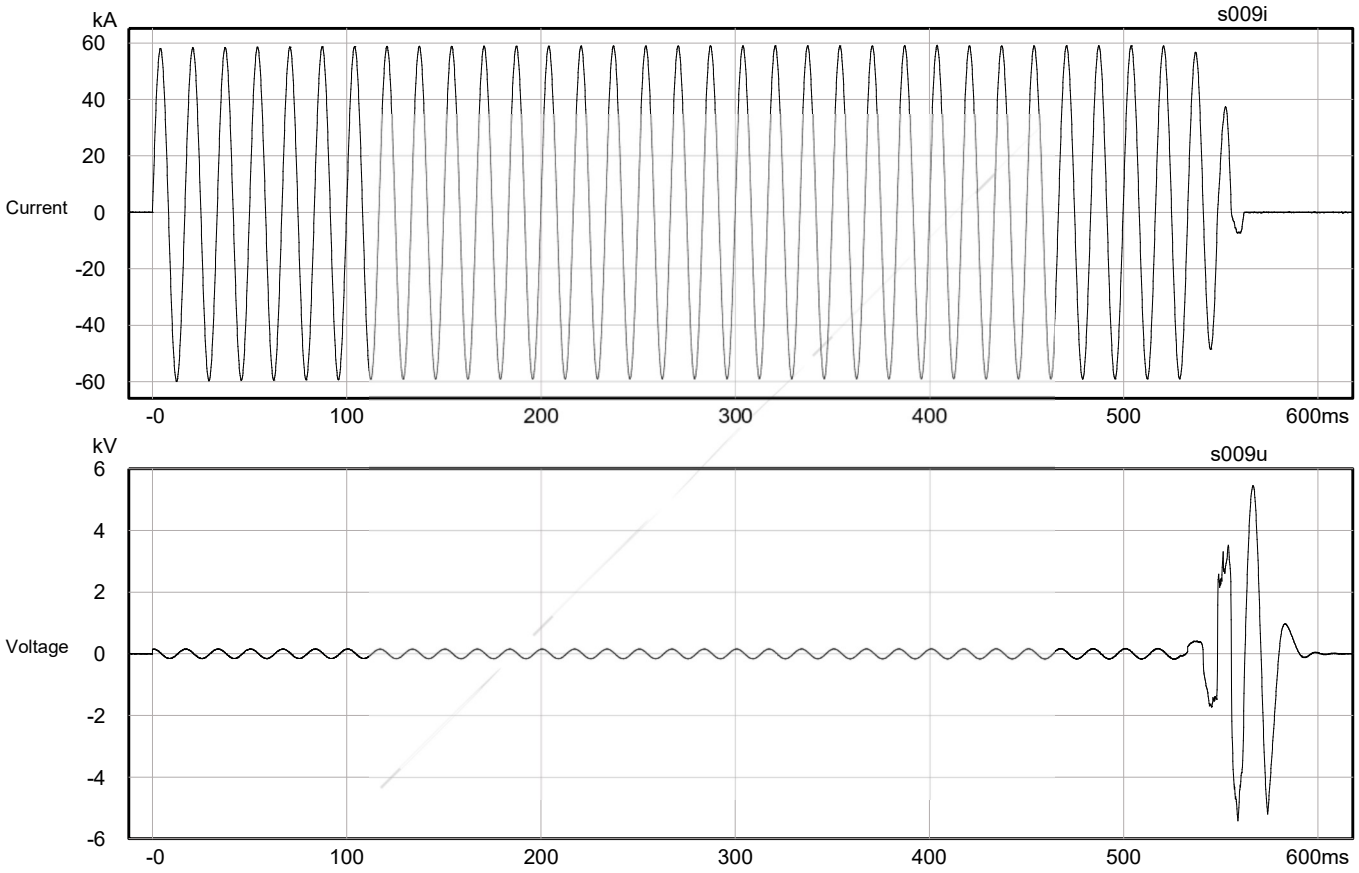



***Figure 2: Waveforms for Test #1, Encore 4/0 AWG Sample 1.***

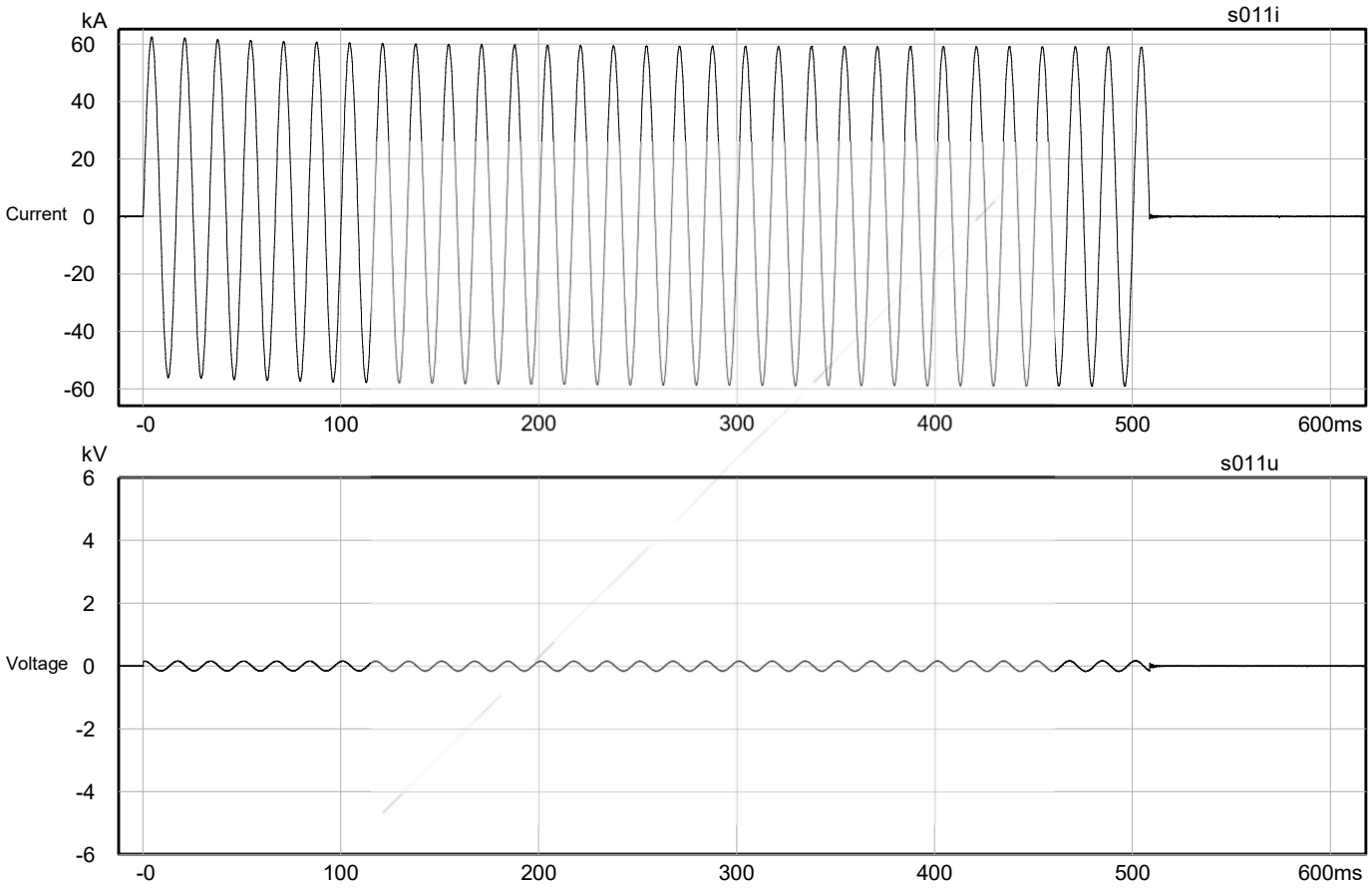



***Figure 3: Waveforms for Test #2, Encore 4/0 AWG Sample 2.***

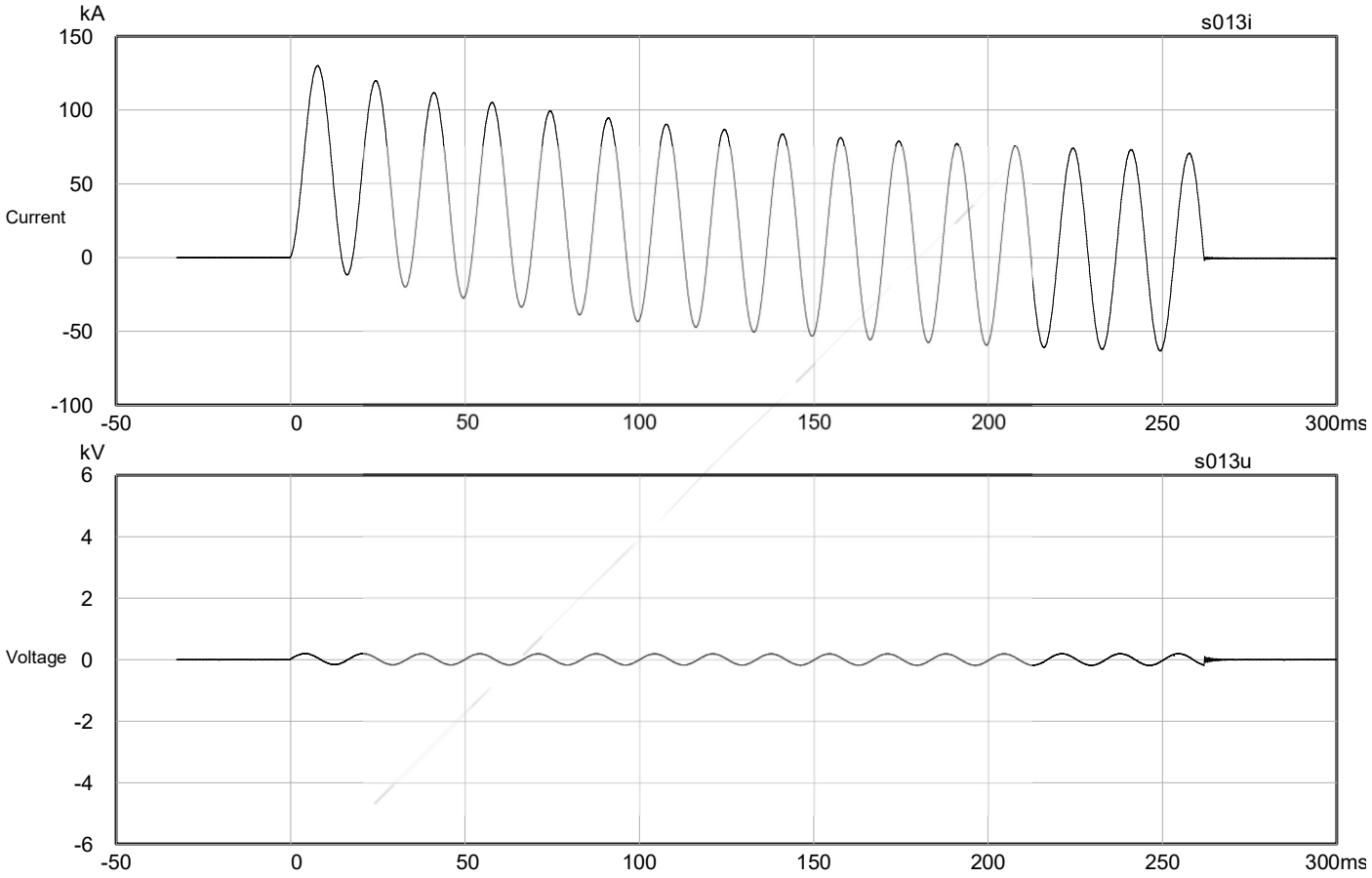



***Figure 4: Waveforms for Test #3-1, Encore 4/0 AWG Sample 3.***

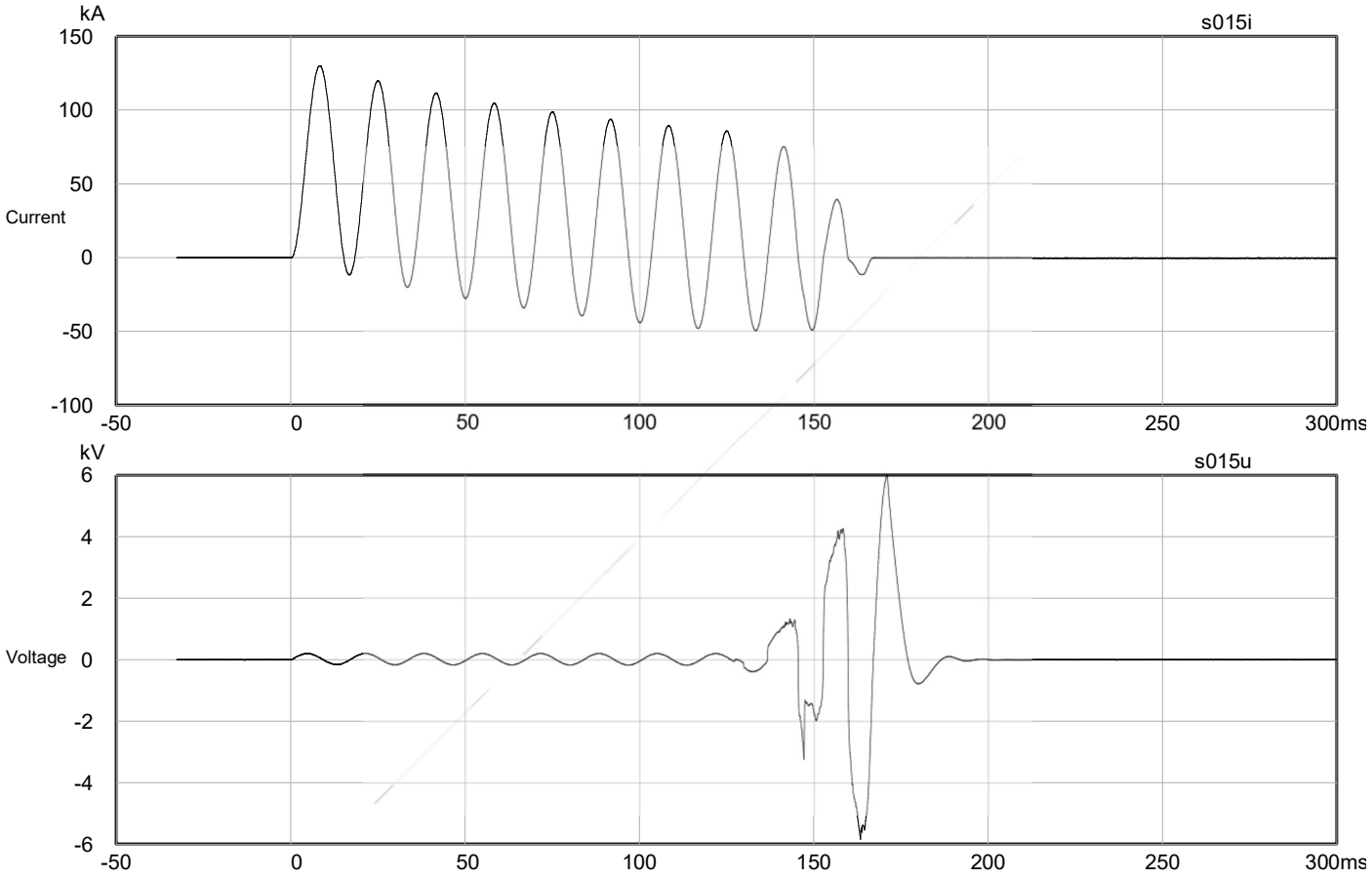



***Figure 5: Waveforms for Test #3-2, Encore 4/0 AWG Sample 3.***

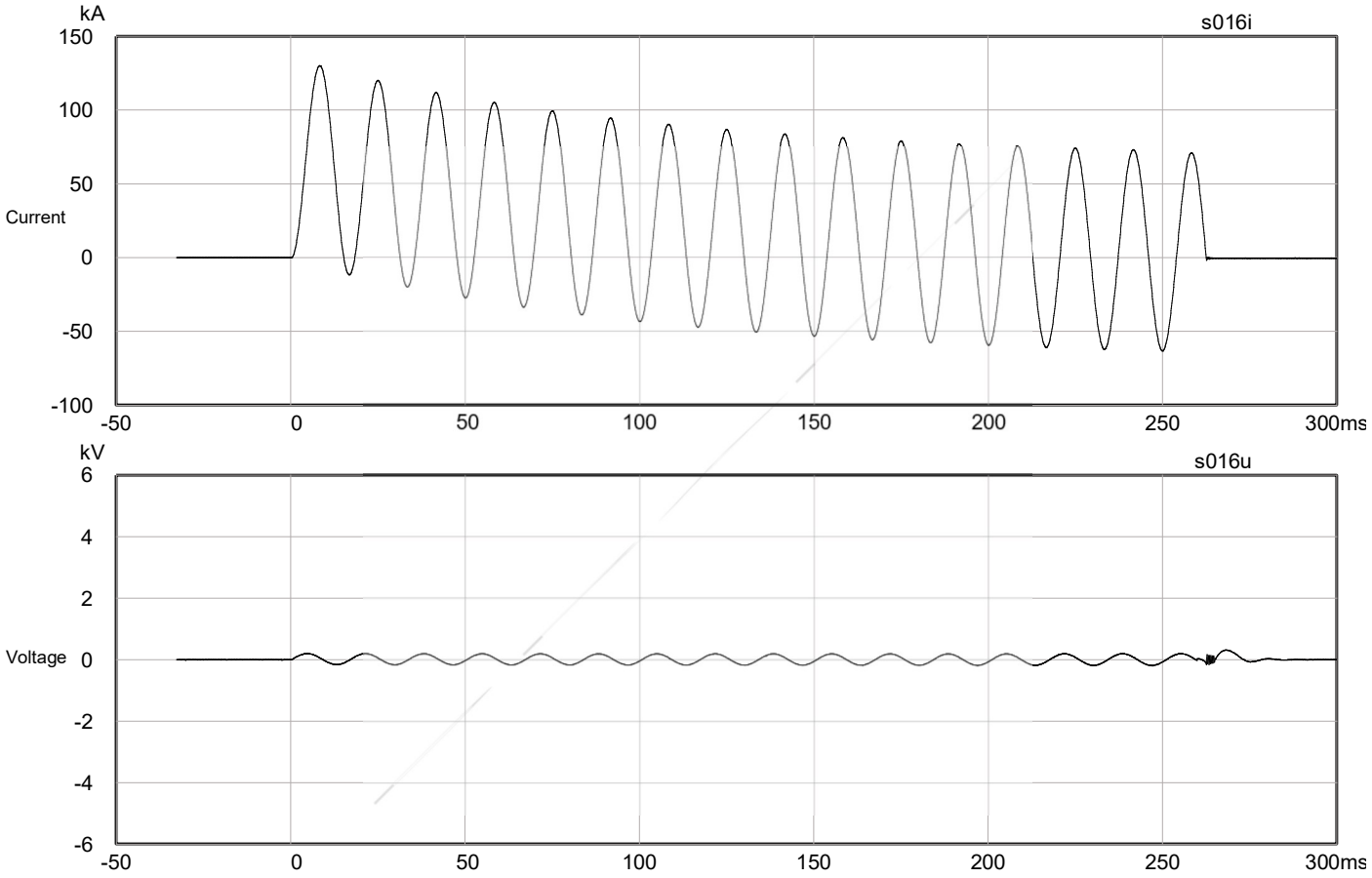



***Figure 6: Waveforms for Test #4, Encore 4/0 AWG Sample 4.***

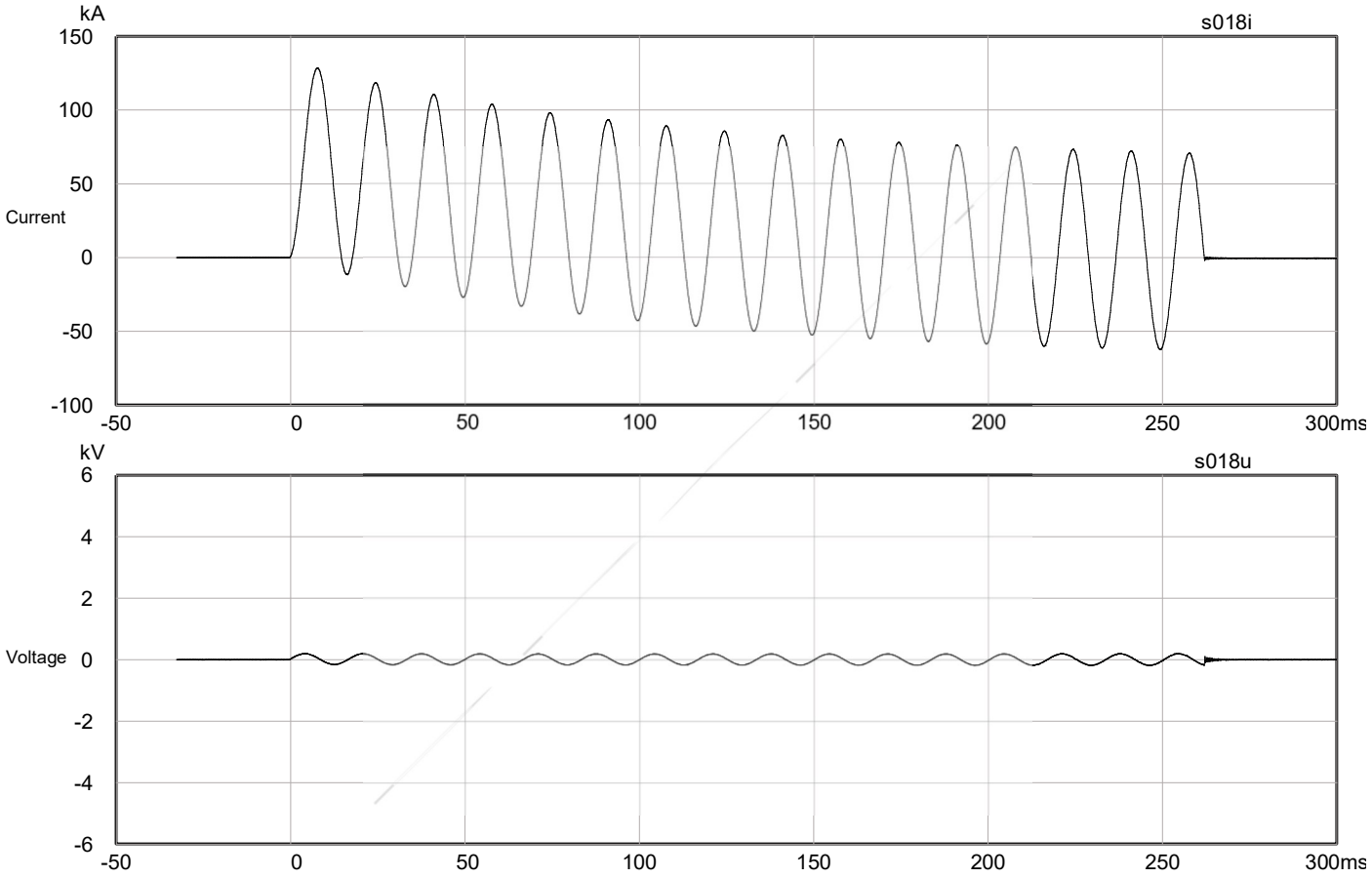



***Figure 7: Waveforms for Test #5-1, Encore 4/0 AWG Sample 5.***

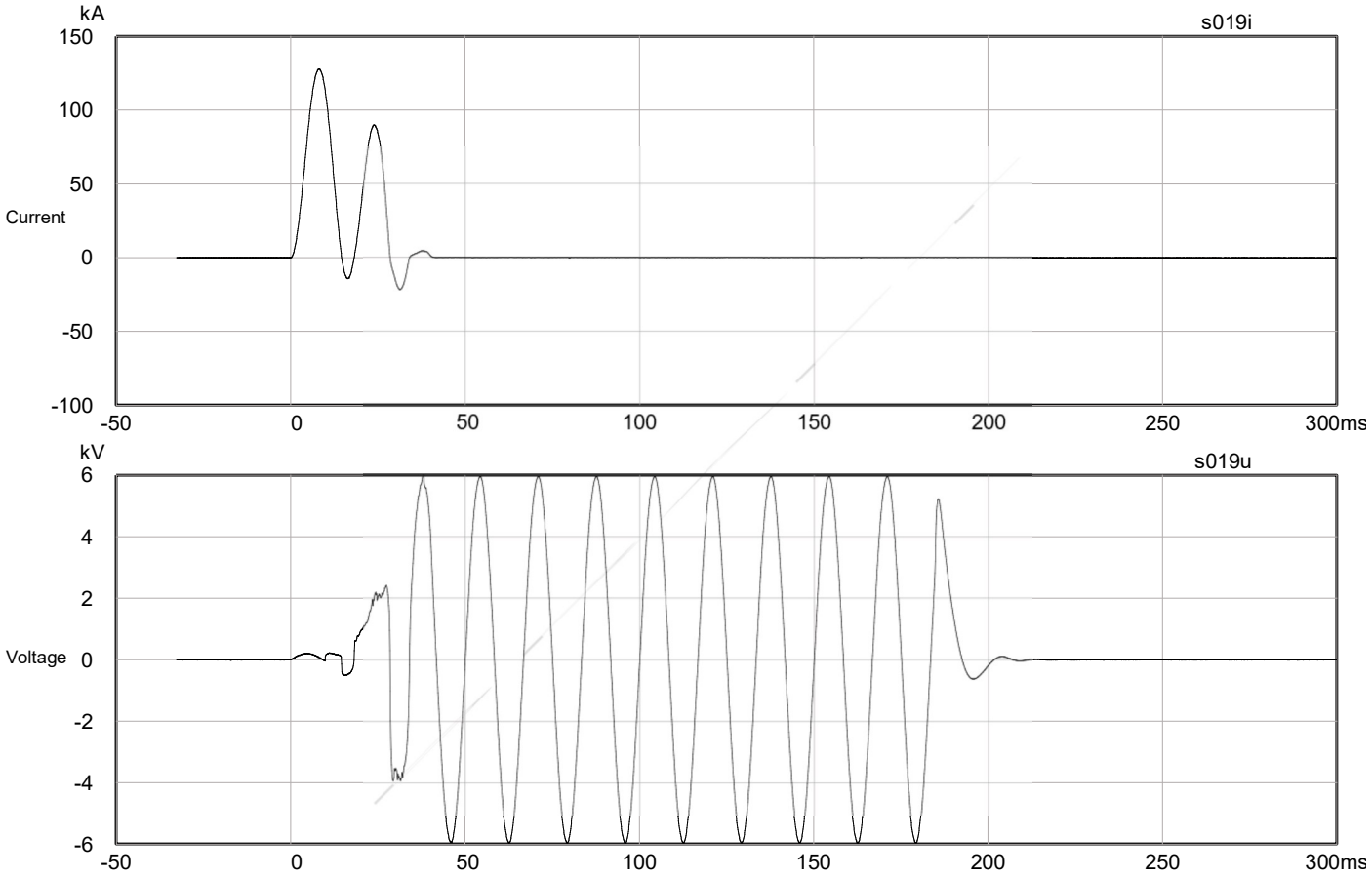



***Figure 8: Waveforms for Test #5-2, Encore 4/0 AWG Sample 5.***

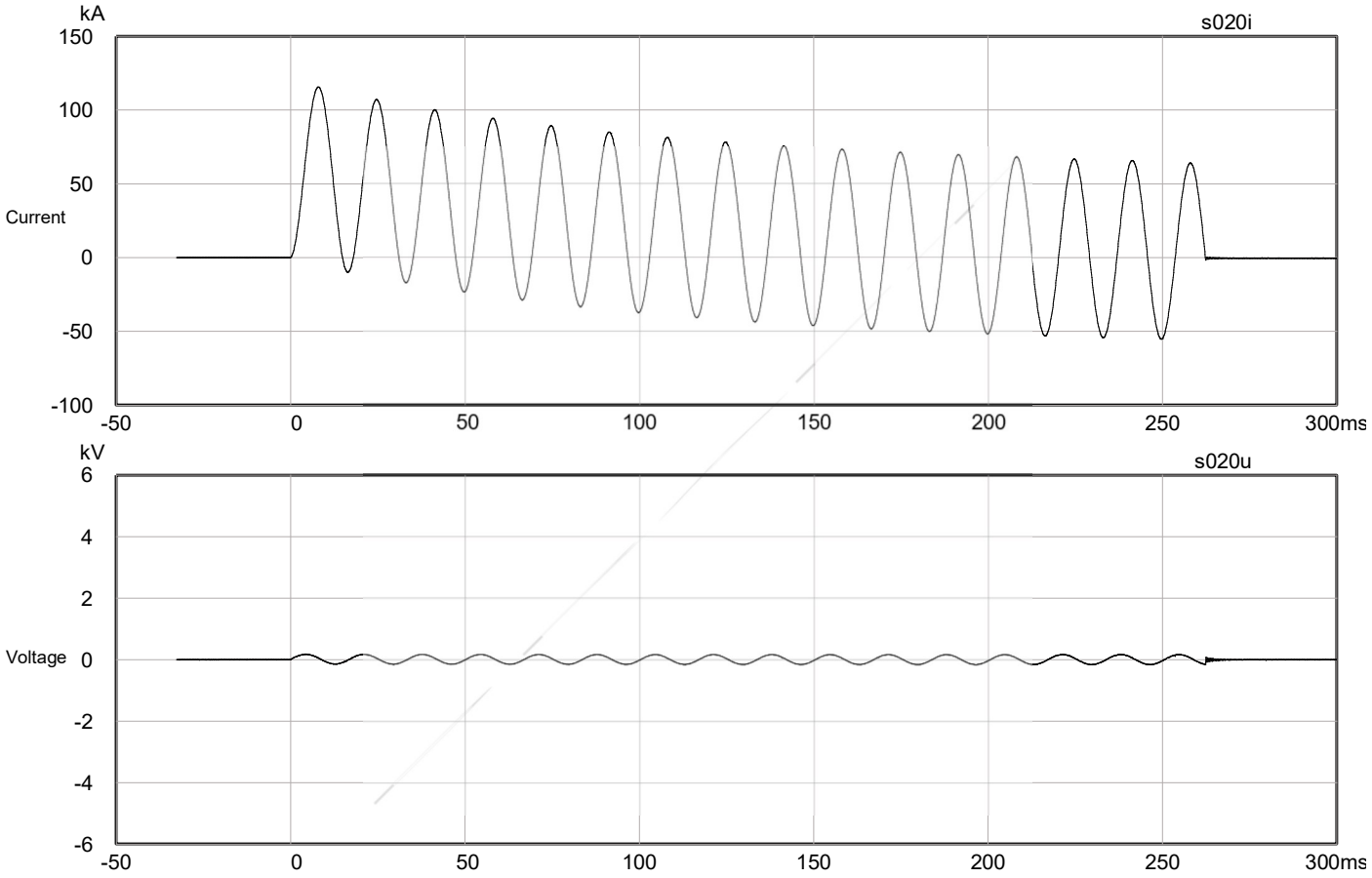



***Figure 9: Waveforms for Test #6-1, Encore 4/0 AWG Sample 6.***

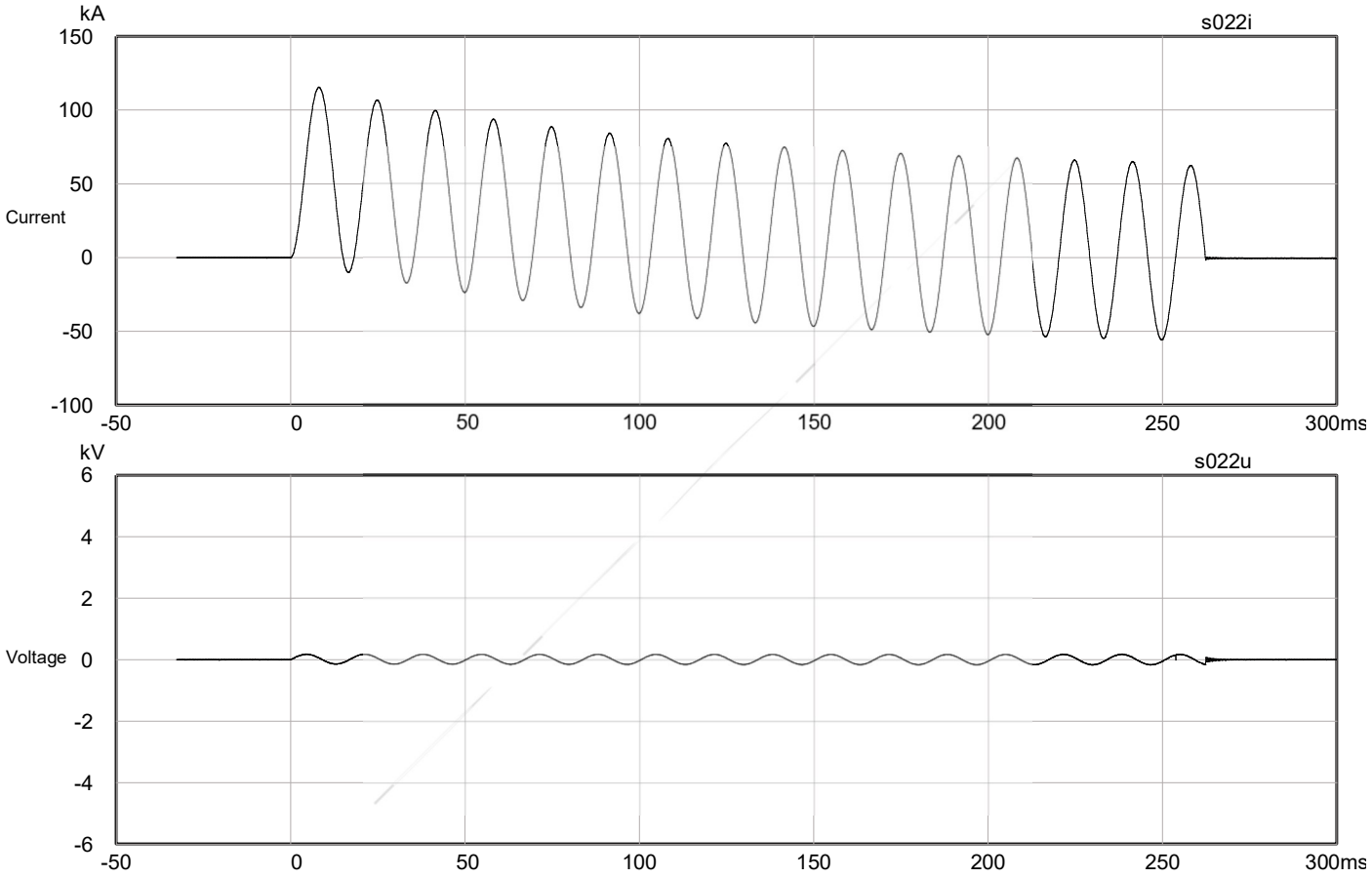



***Figure 10: Waveforms for Test #6-2, Encore 4/0 AWG Sample 6.***

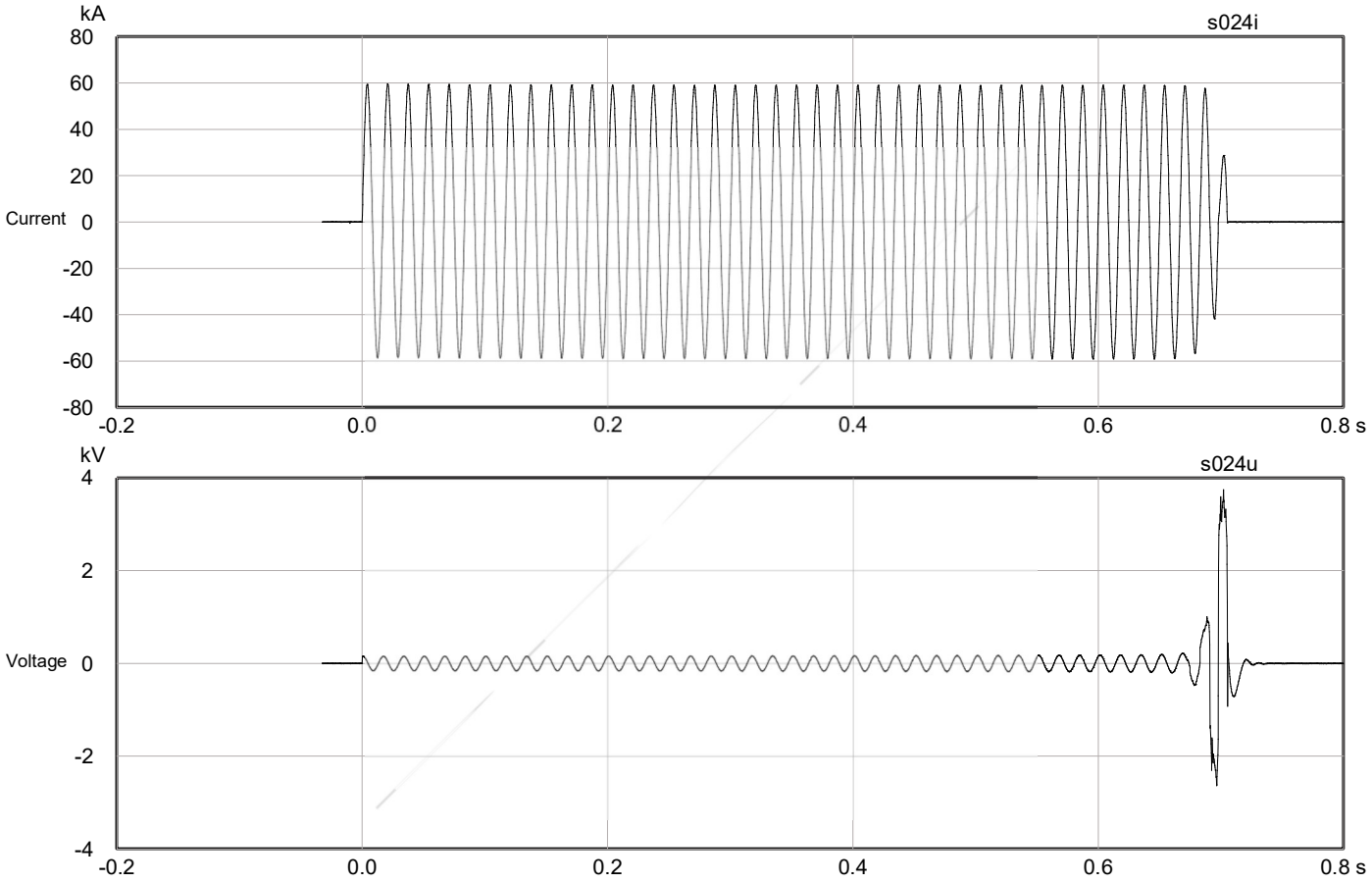



***Figure 11: Waveforms for Test #7, Copperweld Scorpius 61 x 072 Sample 11.***

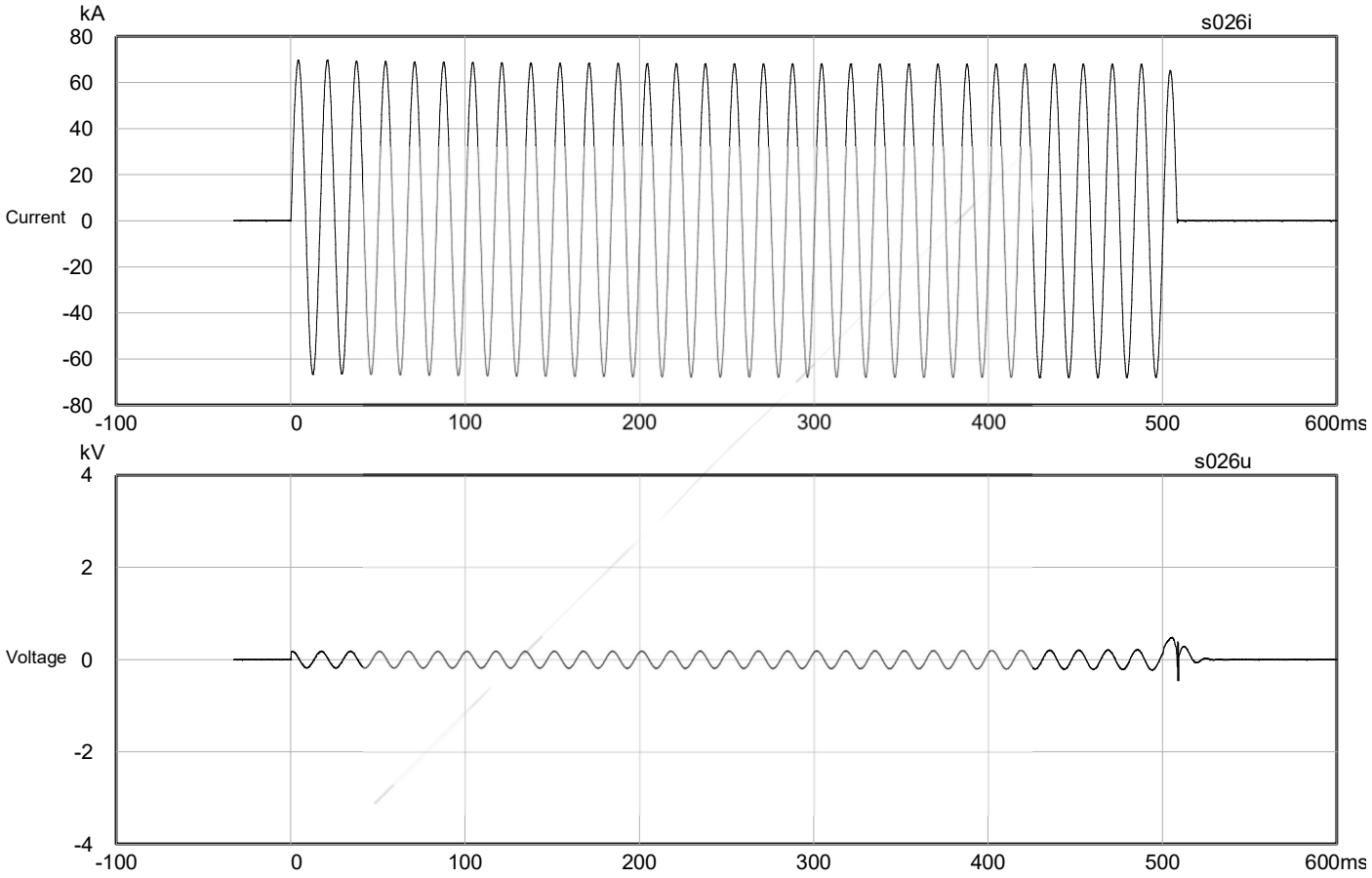



***Figure 12: Waveforms for Test #6, Copperweld Scorpius 61 x 072 Sample 12.***

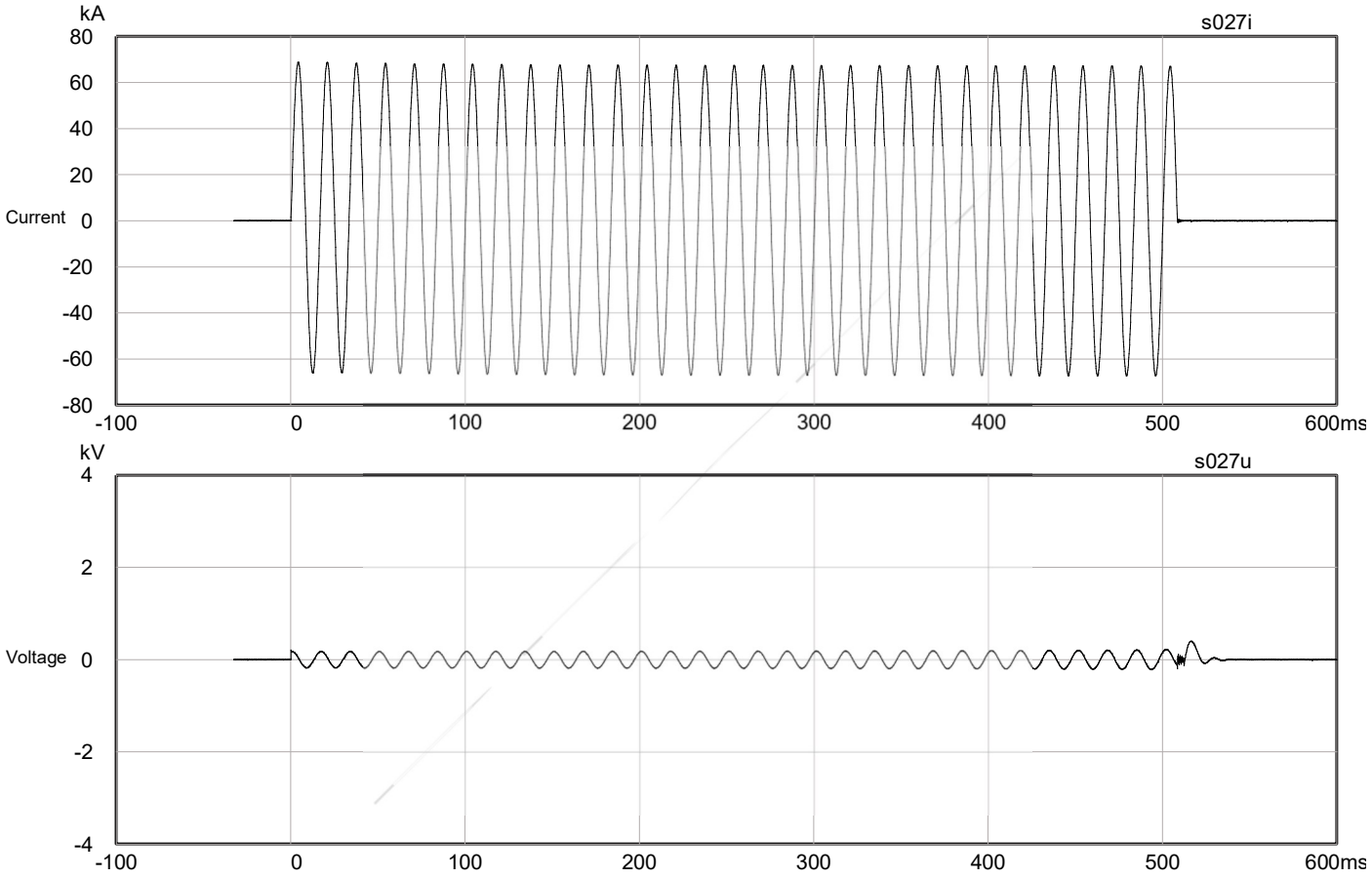



***Figure 13: Waveforms for Test #9, Copperweld Scorpius 61 x 072 Sample 13.***

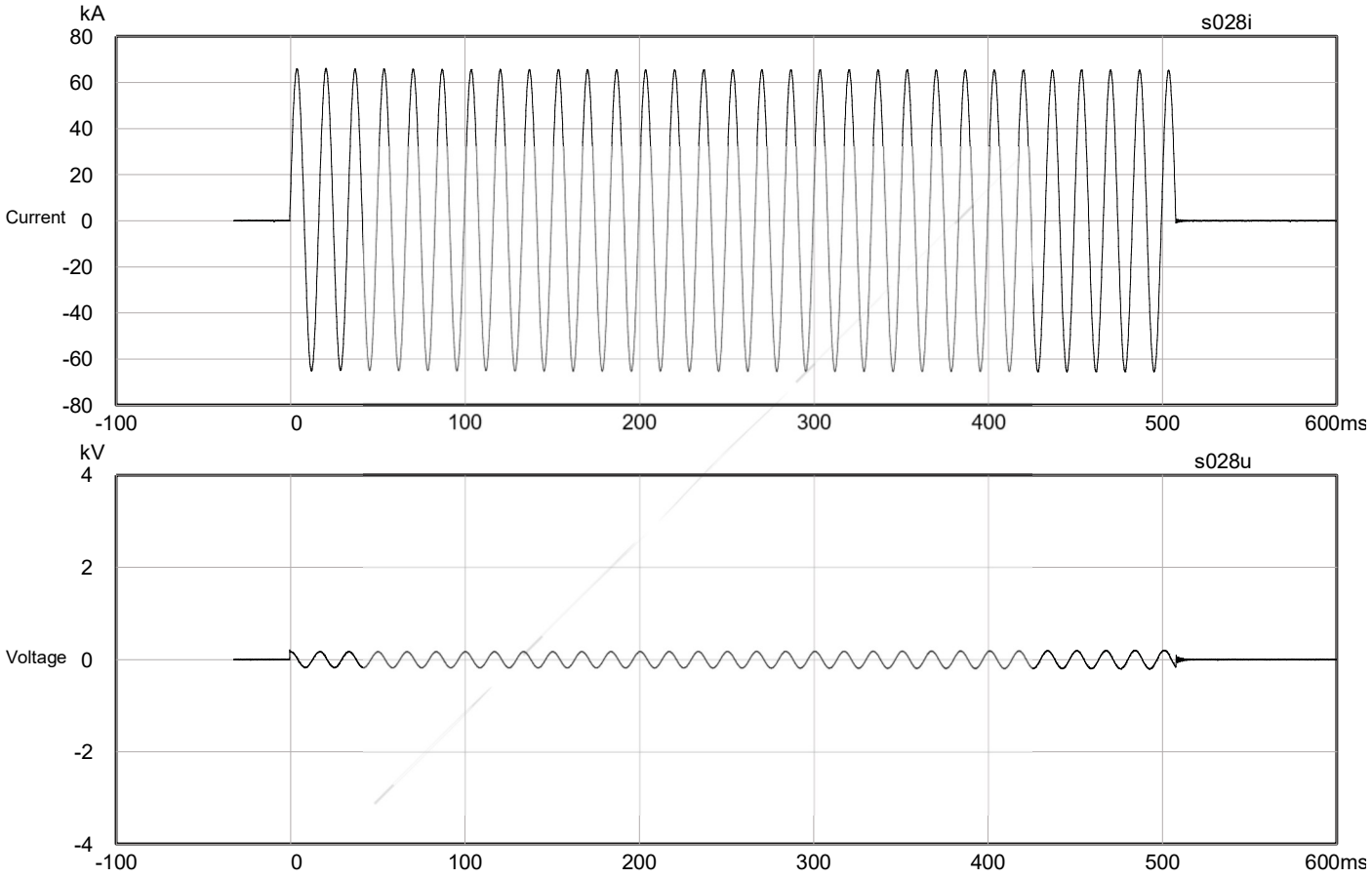



***Figure 14: Waveforms for Test #10, Copperweld Scorpius 61 x 072 Sample 14.***

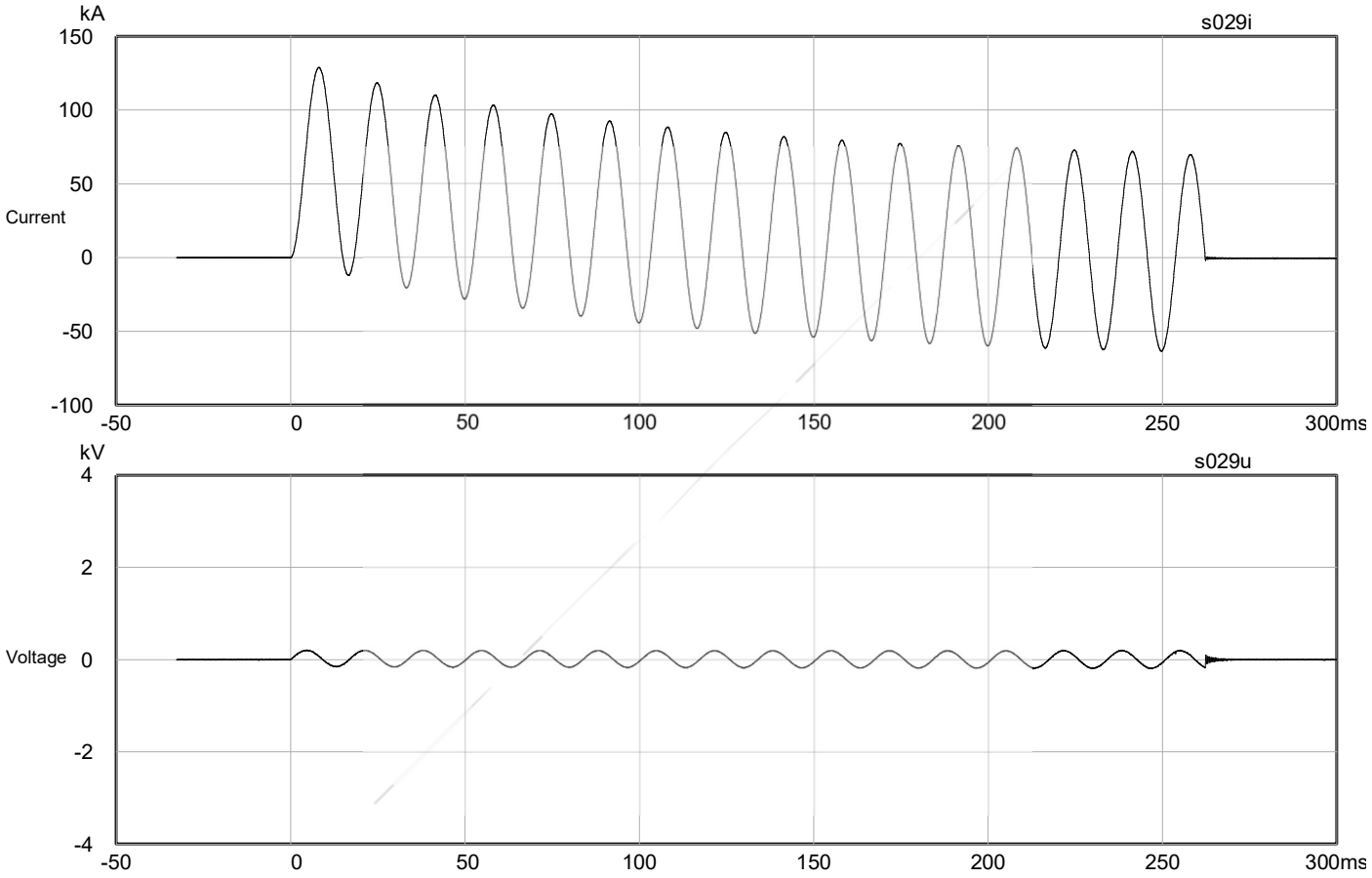



***Figure 15: Waveforms for Test #11-1, Copperweld Scorpius 61 x 072 Sample 15.***

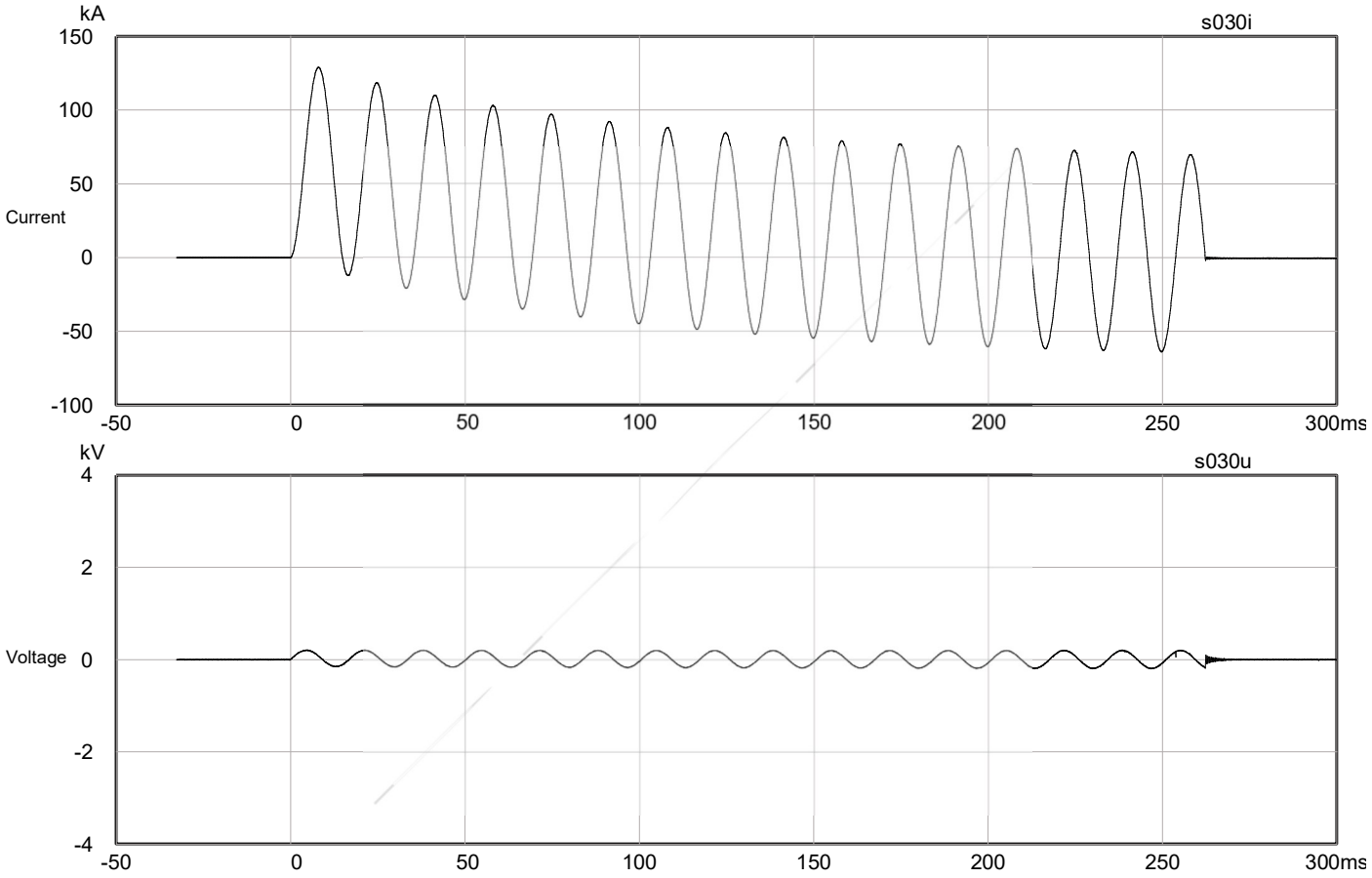



***Figure 16: Waveforms for Test #11-2, Copperweld Scorpius 61 x 072 Sample 15.***

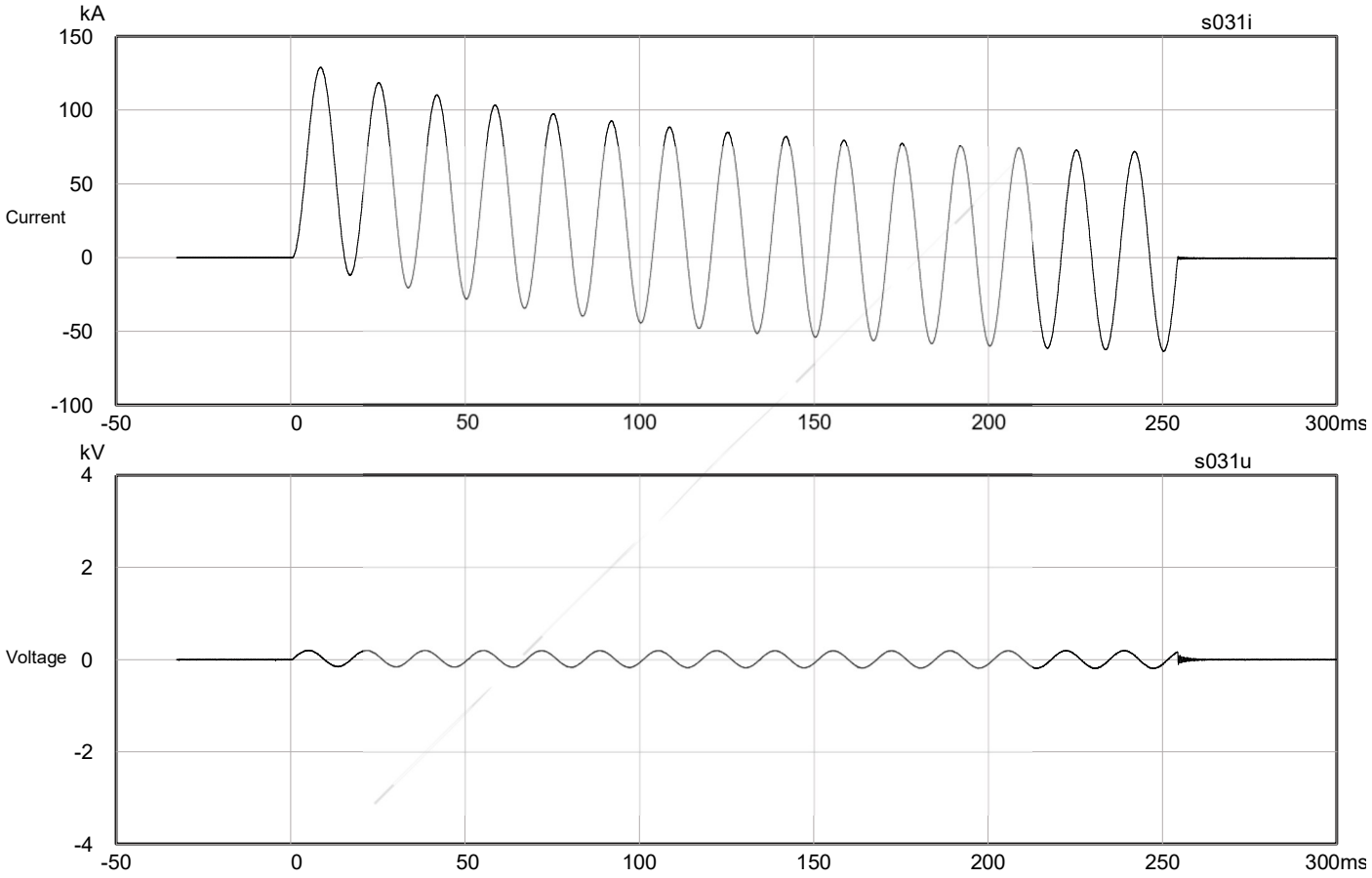



***Figure 17: Waveforms for Test #12-1, Copperweld Scorpius 61 x 072 Sample 16.***

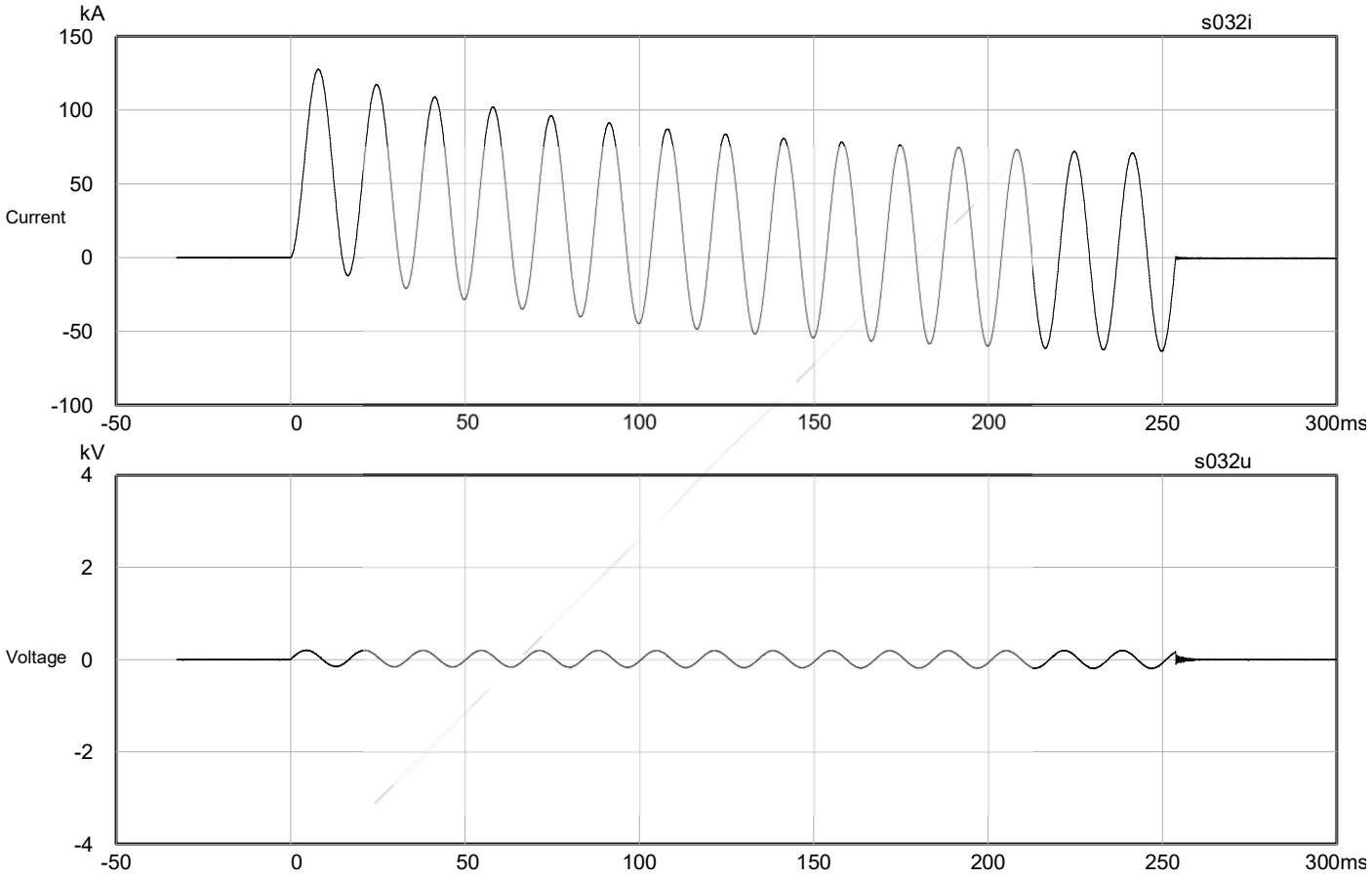



***Figure 18: Waveforms for Test #12-2, Copperweld Scorpius 61 x 072 Sample 16.***

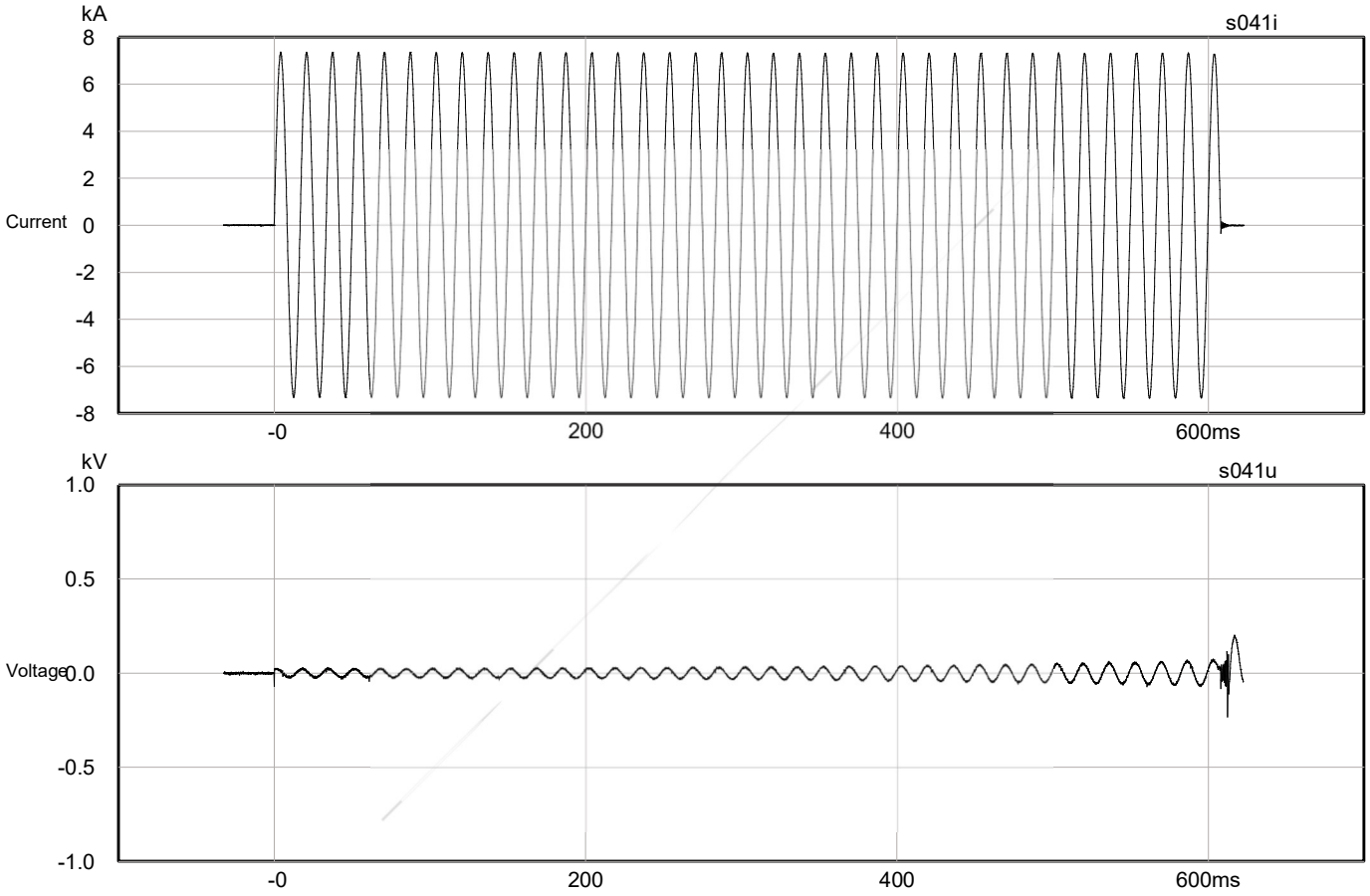



***Figure 19: Waveforms for Test #13, Encore #6 AWG Sample 21.***

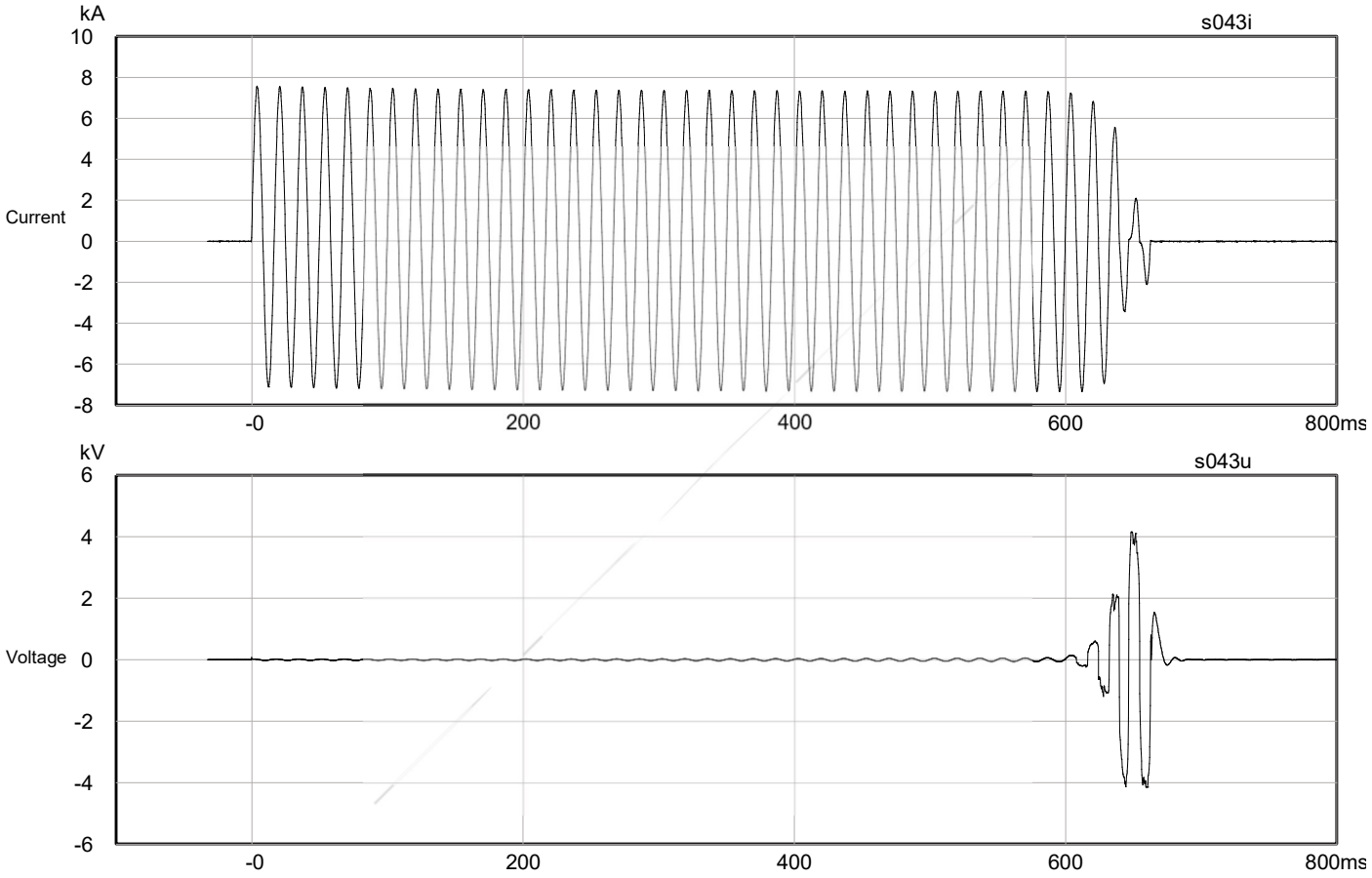



***Figure 20: Waveforms for Test #14, Encore #6 AWG Sample 23.***

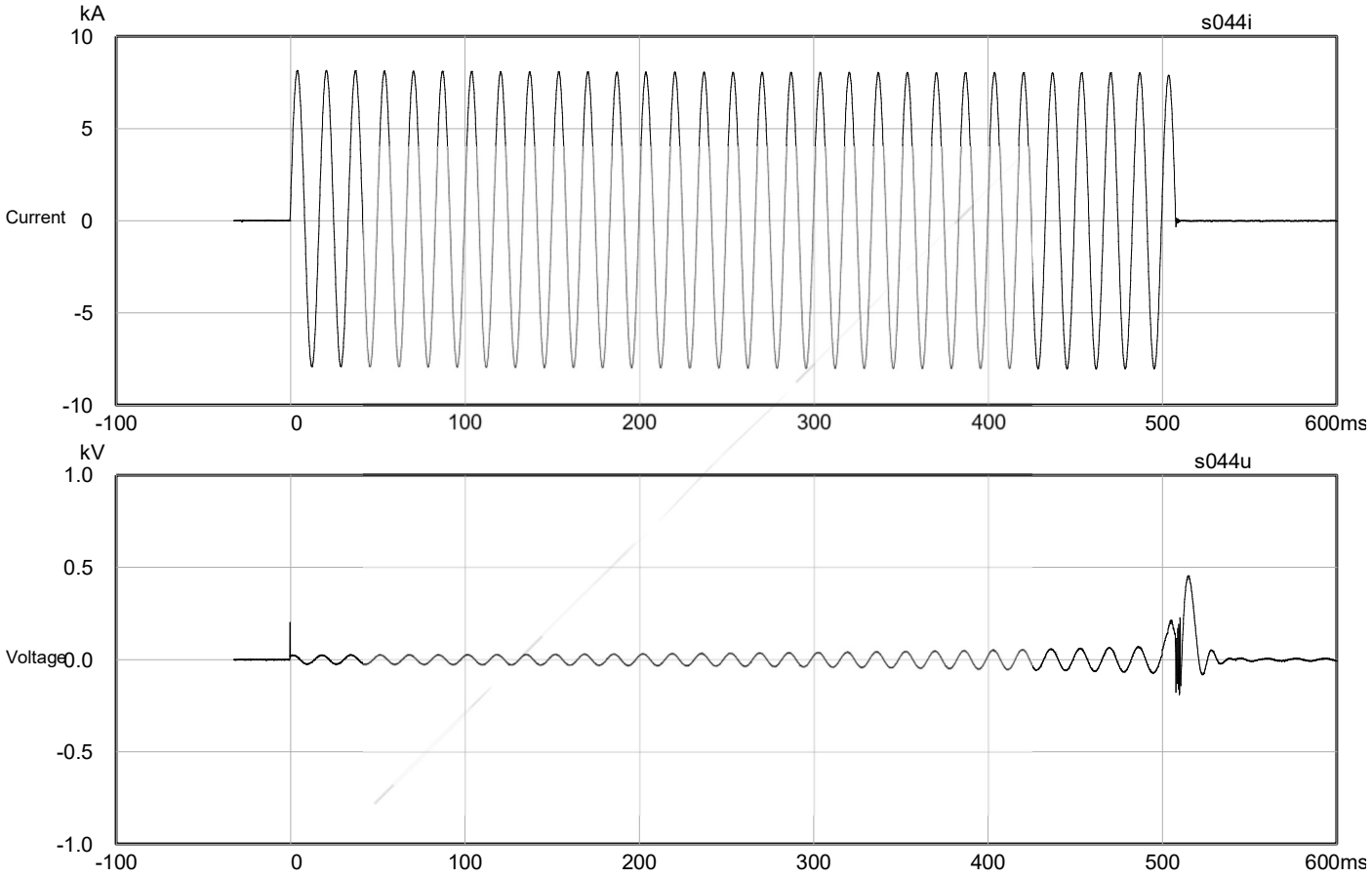



***Figure 21: Waveforms for Test #15, Encore #6 AWG Sample 24.***

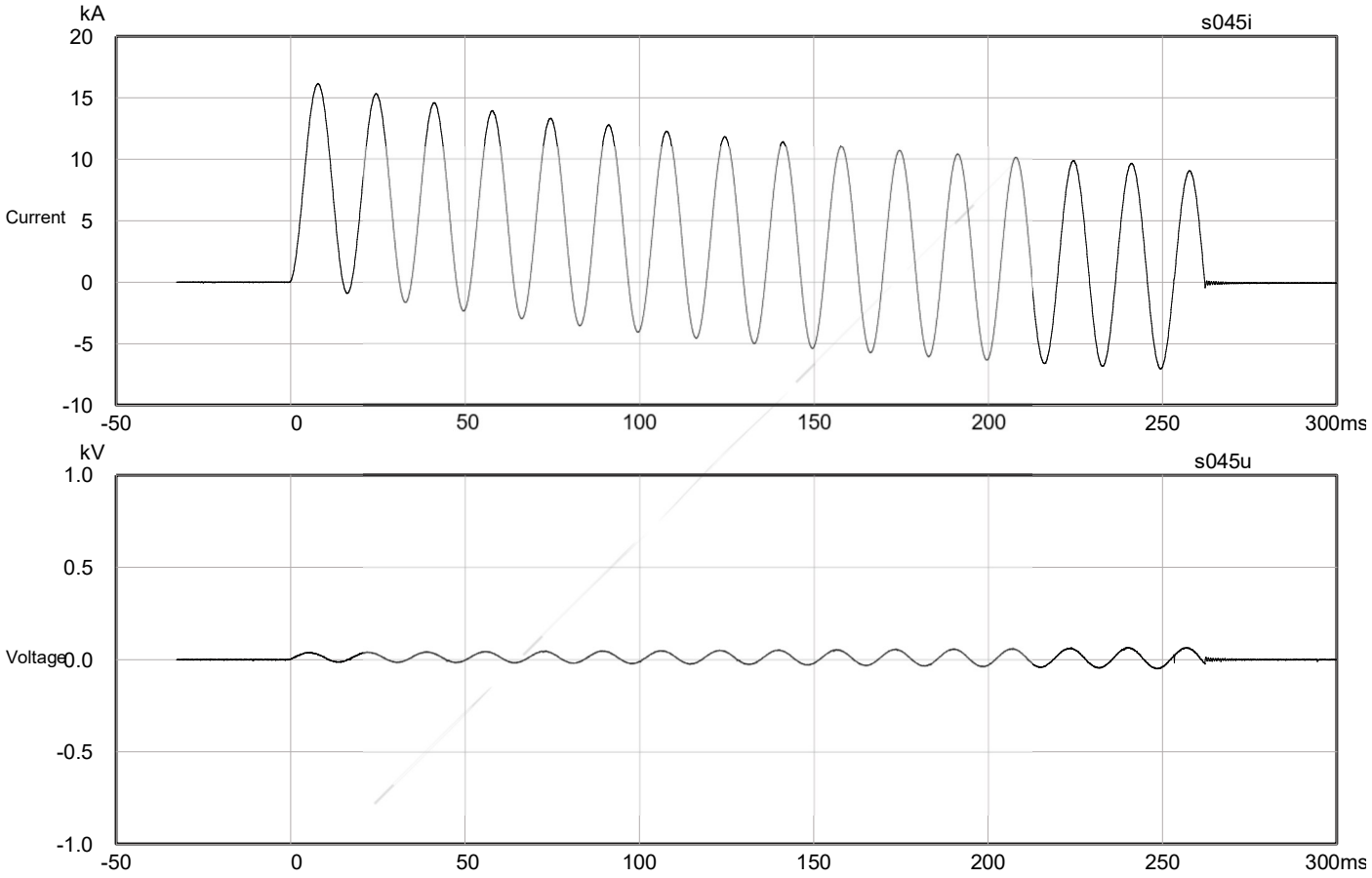



***Figure 22: Waveforms for Test #16-1, Encore #6 AWG Sample 25.***

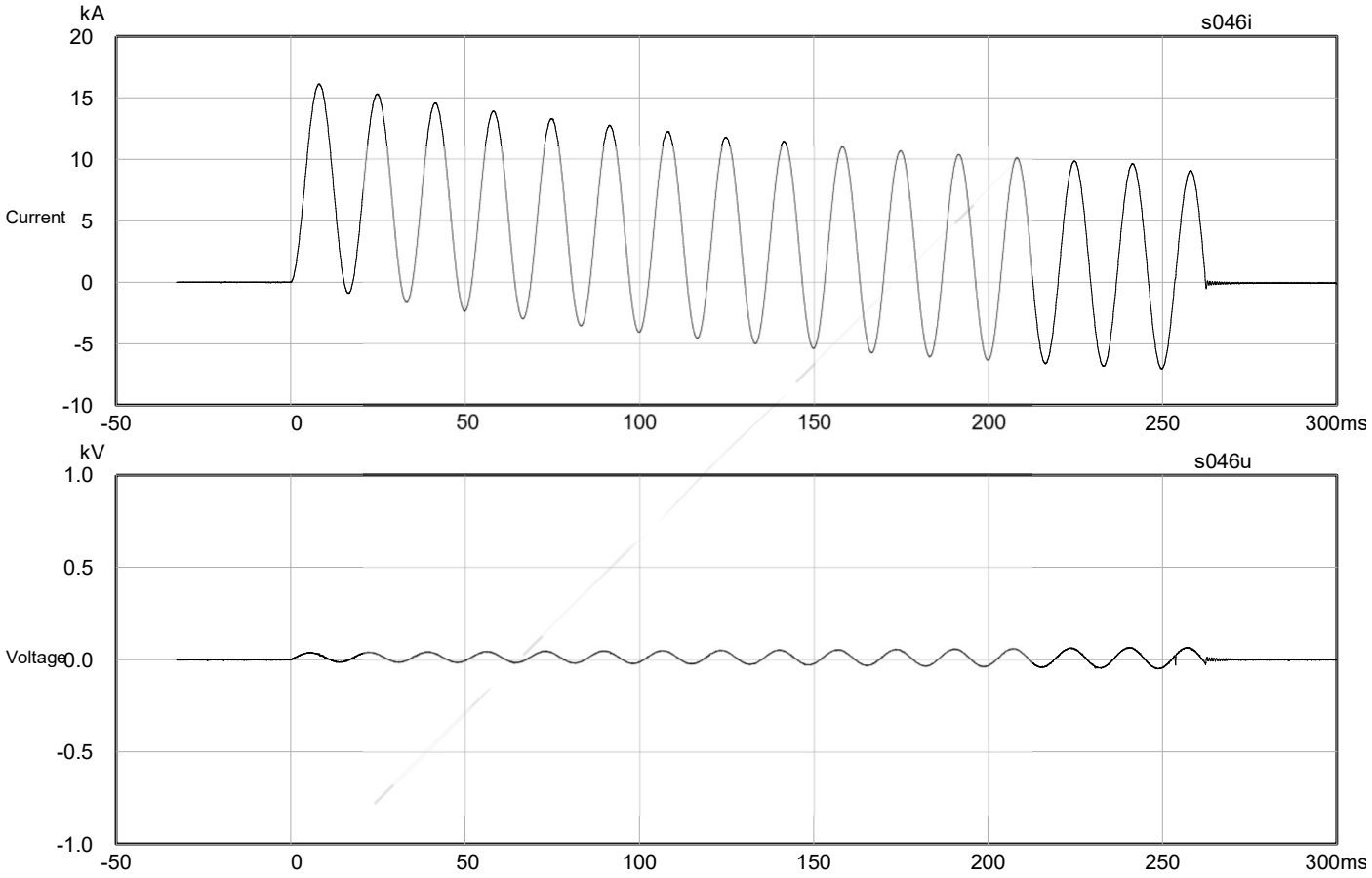



***Figure 23: Waveforms for Test #16-2, Encore #6 AWG Sample 25.***

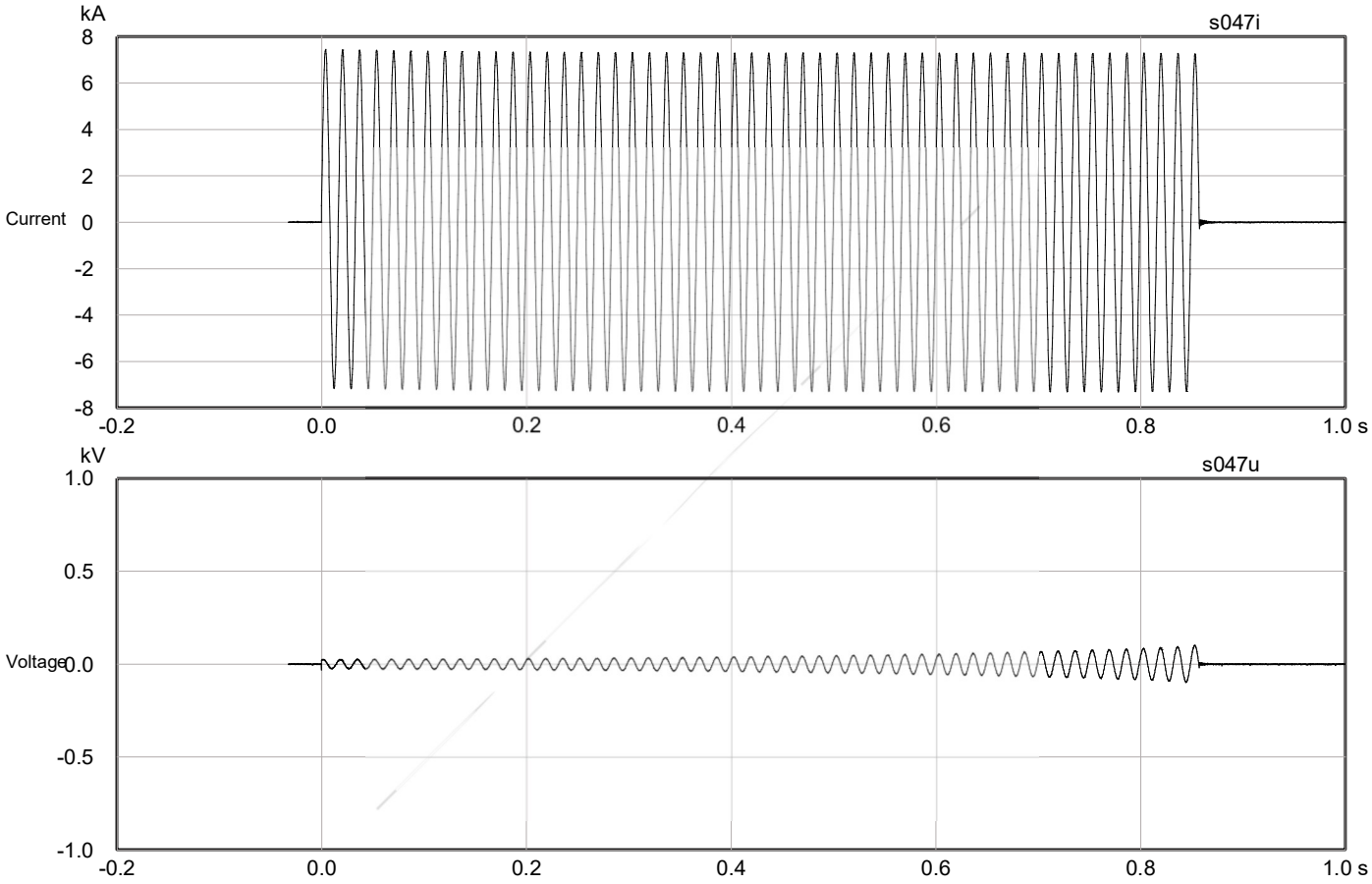



***Figure 24: Waveforms for Test #17, Encore #6 AWG Sample 31.***

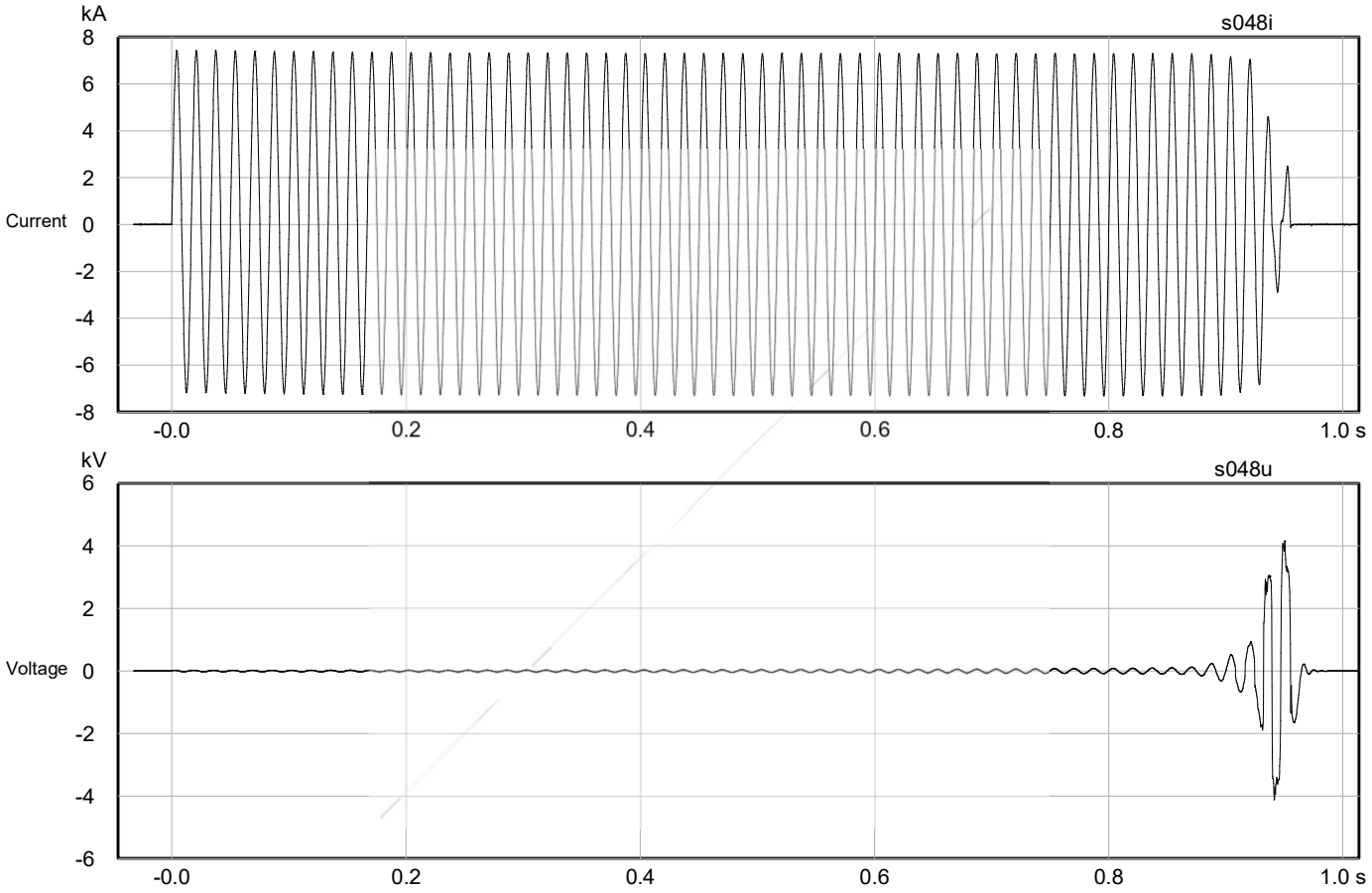



***Figure 25: Waveforms for Test #18, Copperweld Scorpius 7 x 080 Sample 32.***

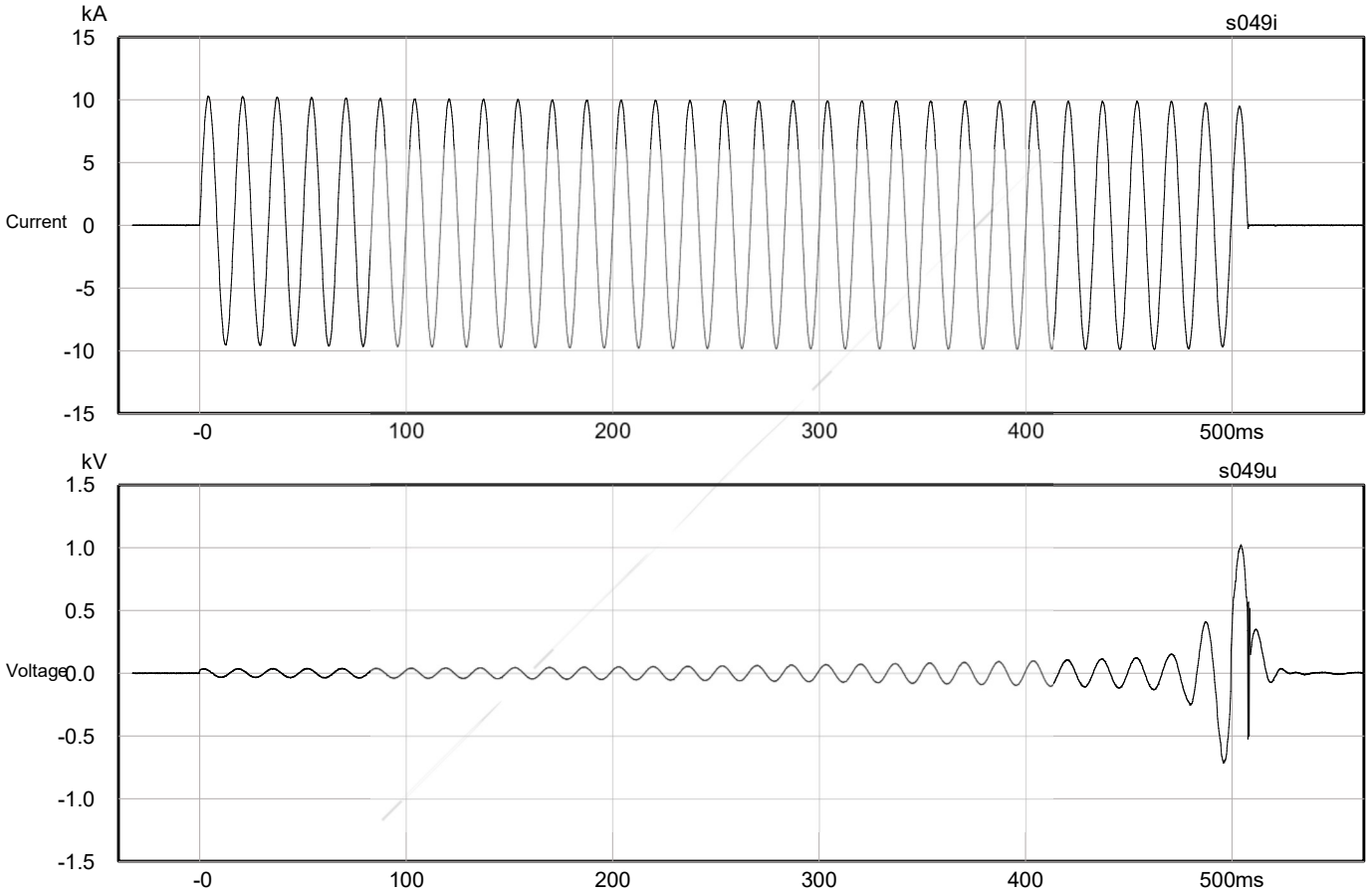



***Figure 26: Waveforms for Test #19, Copperweld Scorpius 7 x 080 Sample 33.***

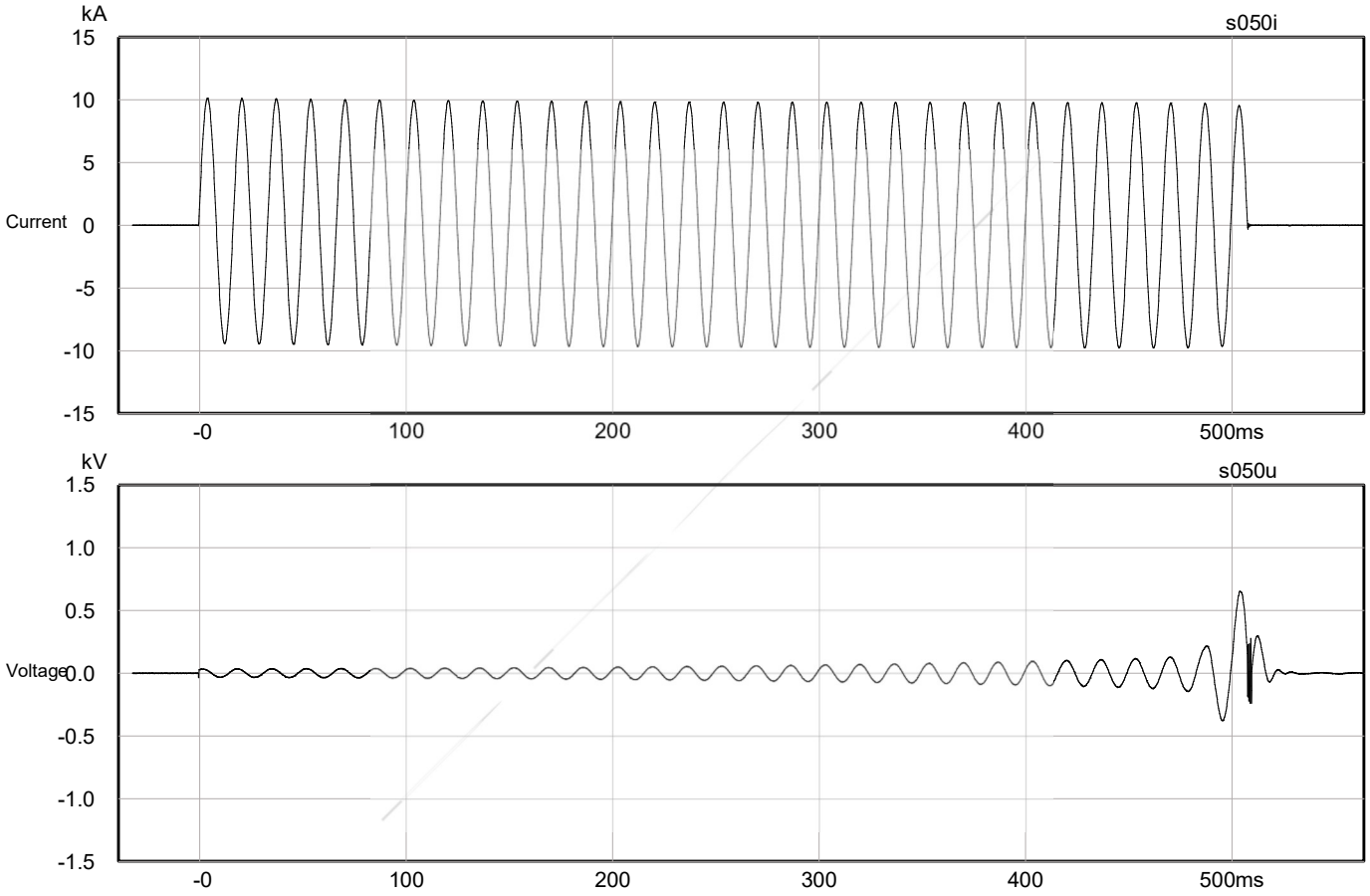



***Figure 27: Waveforms for Test #20, Copperweld Scorpius 7 x 080 Sample 34.***

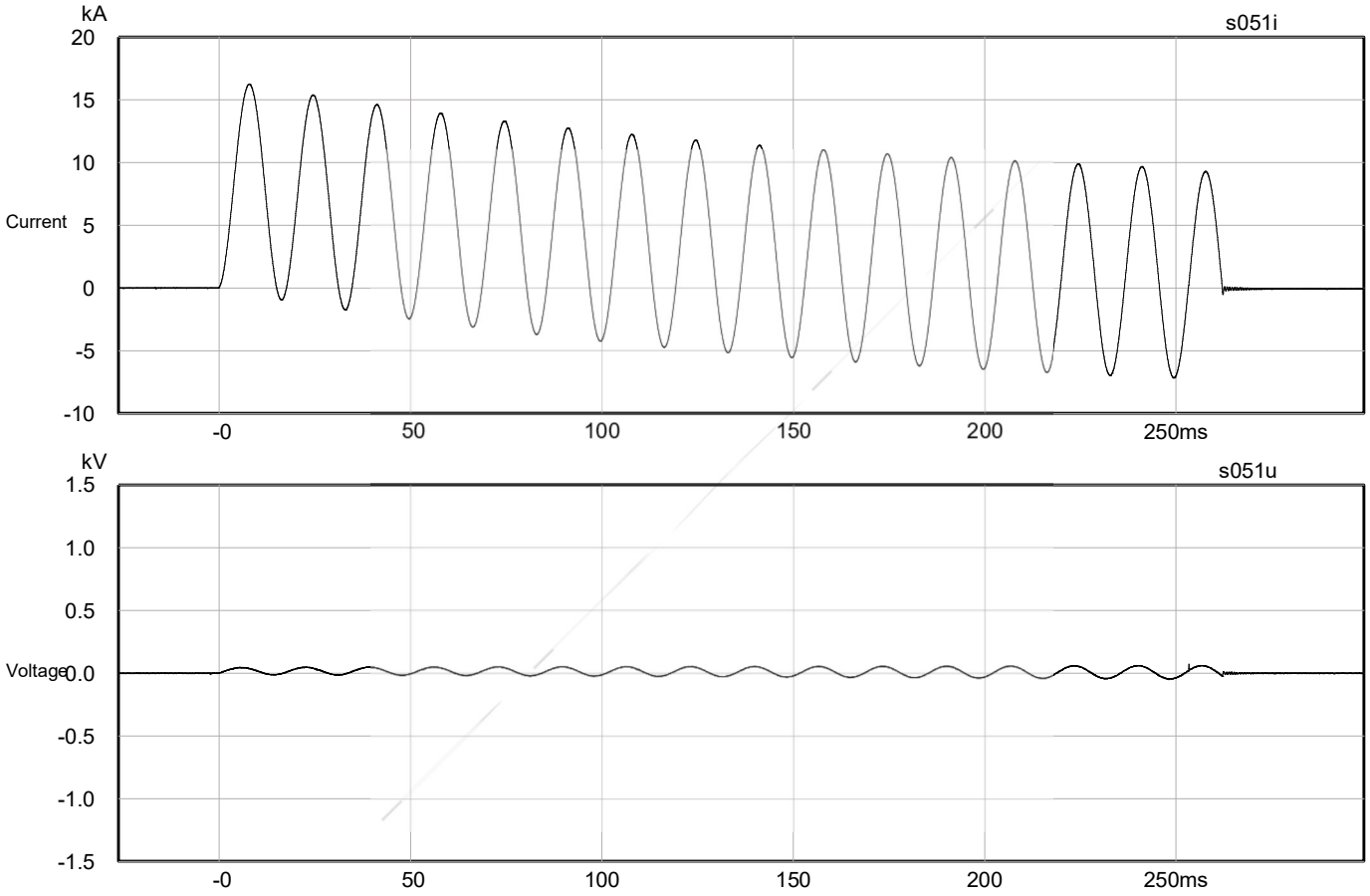



***Figure 28: Waveforms for Test #21-1, Copperweld Scorpius 7 x 080 Sample 35.***

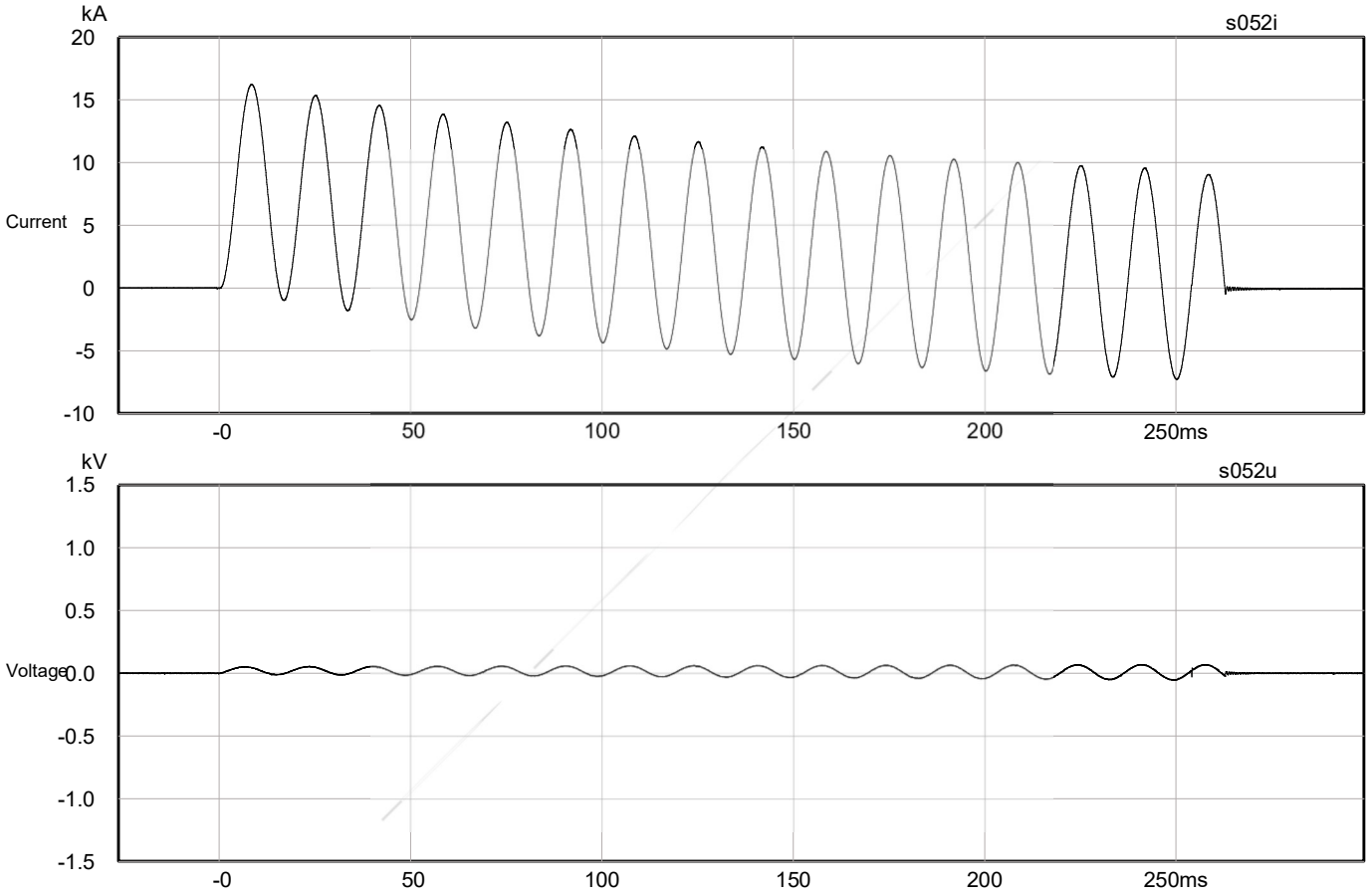



***Figure 29: Waveforms for Test #21-2, Copperweld Scorpius 7 x 080 Sample 35.***

## APPENDIX C – PHOTOGRAPHS OF THE TEST OBJECTS



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



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



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



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

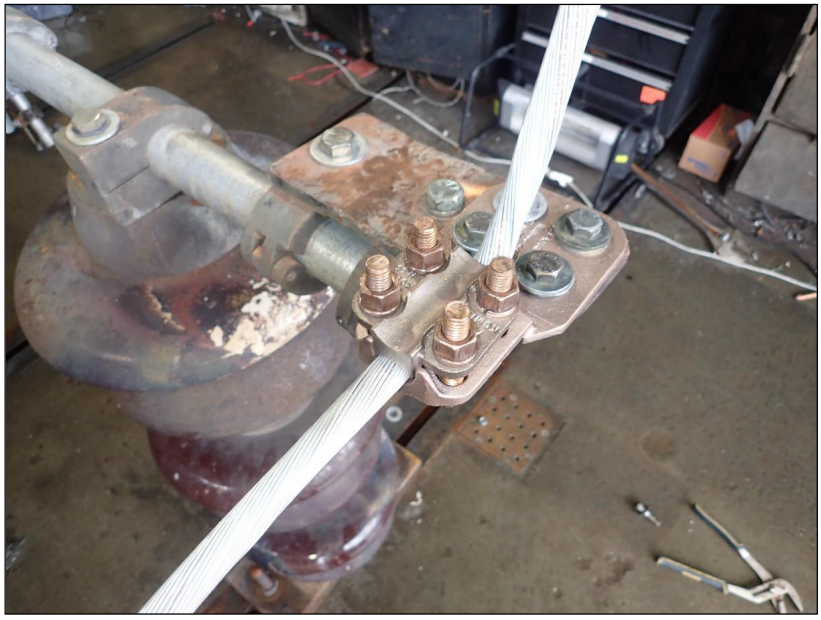


*Figure 34: Typical Burndy terminal connector used to connect the Encore 4/0 AWG or Copperweld Scorpius 61 x 072 CCS conductors to the laboratory buses.*

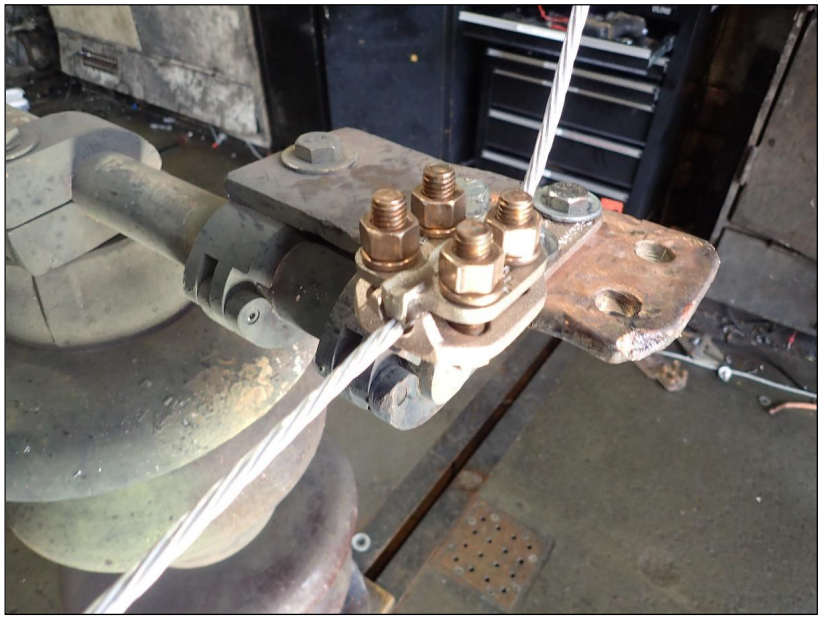


*Figure 35: Typical Burndy terminal connector used to connect the Encore #6 AWG or Copperweld Scorpius 7 x 080 CCS conductors to the laboratory buses.*

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

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

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

where

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

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

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

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

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

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

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

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

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

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

**Copperweld Bimetallics**
**Electrical Test Laboratory**

Data Sheet Packet

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

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## Test Report Summary

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

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

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

## Test Equipment Used

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

VBU – Verify Before Use

N/A – Not Applicable

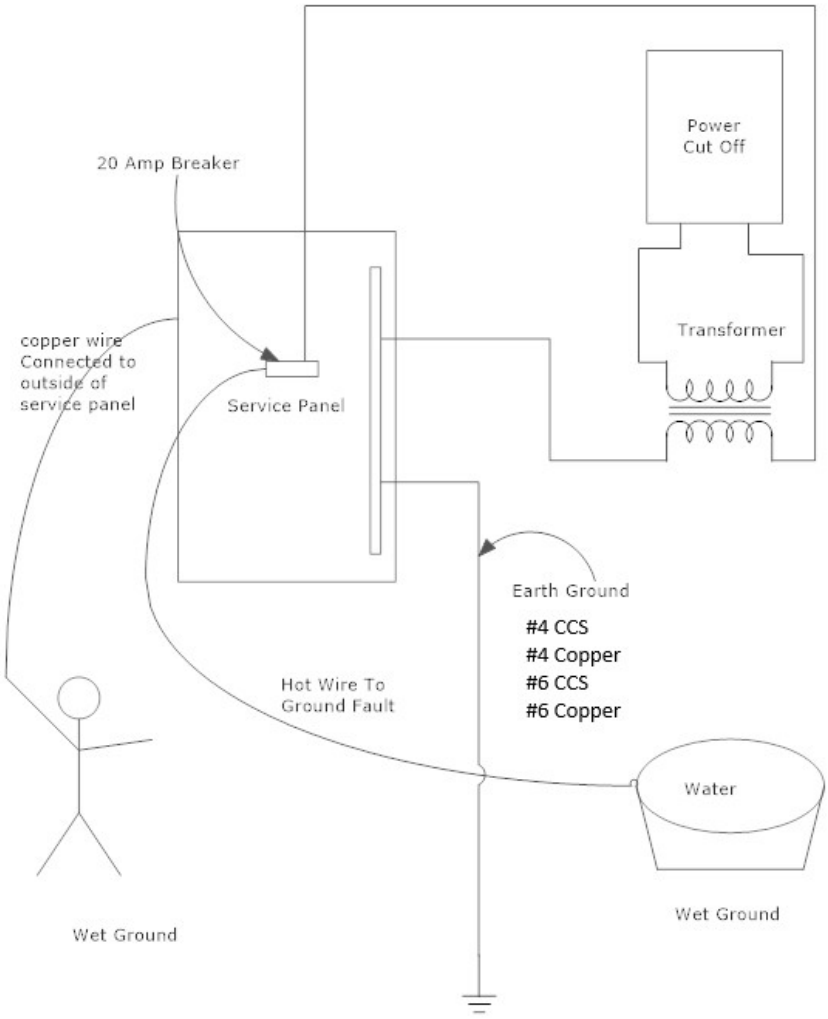
## Sample Identification

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

## Grounding Electrode Conductor Test

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

**Figure 1**




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

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

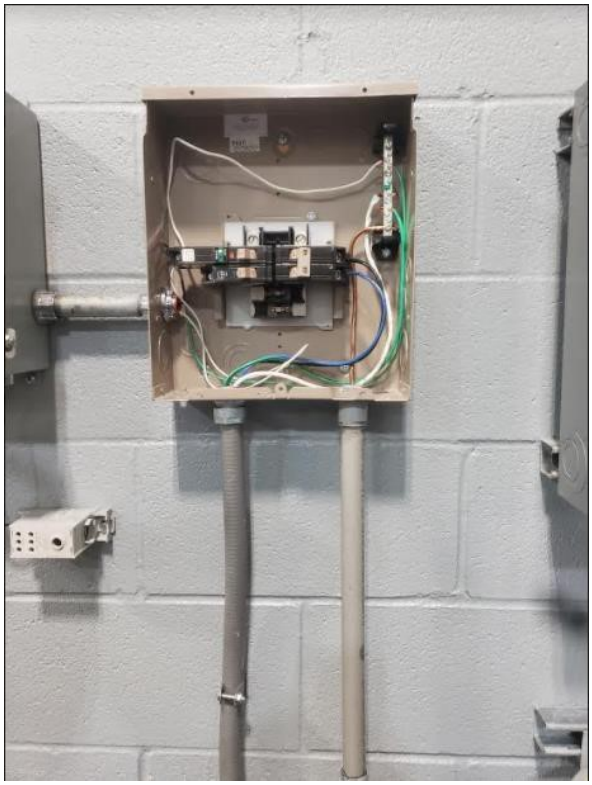
| **Comments:** |
| --- |
| ____X__ (Pass) The product complies with all applicable requirements of this test.<br><br>_____ (Fail) The product does not comply with the requirements of this test.<br><br>**Test Date: 8/25/2020** **Tested By: Bill Lewey** |

Environmental Conditions during Testing:

Humidity: % rh __74%_____ Ambient: °C___28_____

Test setup for the electrical service panel







Ground Rod with Grounding Conductor Attached



Ground Fault



Grounded “man”

## Public Input No. 3155-NFPA 70-2020 [ Section No. 770.100(B)(2) ]

**(2)** In Buildings or Structures with Grounding Means.

If an intersystem bonding termination is established, 250.94(A) shall apply.

If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on one of the following:

(1) The building or structure grounding electrode system as covered in 250.50

(2) The ~~grounded interior metal water piping system, within 1.5 m (5 ft) from its point of entrance to the building, as covered in 250.52~~

~~The~~

(3) power service accessible means external to enclosures using the options identified in 250.94(A) , Exception

(4) The nonflexible metal power service raceway

(5) The service equipment enclosure

(6) The grounding electrode conductor or the grounding electrode conductor metal enclosure of the power service

(7) The grounding electrode conductor or the grounding electrode of a building or structure disconnecting means that is connected to a grounding electrode as covered in 250.32

(8) The grounded interior metal water piping systems, within 1.52 m (5 ft) from its point of entrance to the building, as covered in 250.52 providing the continuity of the water pipe to earth (ground) has been verified.

Informational Note: See Informational Note Figure 800.100(B)(2) for an illustration of the application of the bonding conductor in buildings or structures not equipped with an intersystem bonding termination or terminal block providing access to the building grounding electrode system.

## Statement of Problem and Substantiation for Public Input

The use of the water pipe as a grounding means should be de-emphasized by moving it to the end of the list (making it item 7 and moving items 3 through 7 up one).and adding a qualification to ensure continuity exists.
The use of plastic (non-conductive) pipe for water has become more widespread and therefore water pipe may not be a reliable connection means to ground (earth). The continuity of the metal water pipe needs to be traced and verified that an effective ground connection to earth exists.

The Terraview preview version in legislative text and the printed PDF of the PI does not match the edited version - the intent of this PI is for item (2) to be moved to bottom of list (making in item 7) and add a phrase to that item to include a test to verify continuity..

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 3156-NFPA 70-2020 [Section No. 800.100(B)(2)] | corresponding change for different rule |
| Public Input No. 3157-NFPA 70-2020 [Section No. 810.21(F)(2)] | corresponding change for different rule |

Public Input No. 3156-NFPA 70-2020 [Section No. 800.100(B)(2)]

Public Input No. 3157-NFPA 70-2020 [Section No. 810.21(F)(2)]

## Submitter Information Verification

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**Organization:** Telcordia (Ericsson)
**Street Address:**
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**State:**
**Zip:**
**Submittal Date:** Sat Sep 05 19:36:47 EDT 2020
**Committee:** NEC-P16

## Public Input No. 2493-NFPA 70-2020 [ Section No. 770.100(D) ]

**(D)** Bonding of Electrodes.

A bonding jumper not smaller than 6 AWG copper, copper-clad steel or equivalent shall be connected between the grounding electrode and power grounding electrode system at the building or structure served where separate electrodes are used.

*Exception: At mobile homes as covered in 770.106.*

Informational Note No. 1: See 250.60 for connection to a lightning protection system.

Informational Note No. 2: Bonding together of all separate electrodes limits potential differences between them and between their associated wiring systems.

## Additional Proposed Changes

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

## Statement of Problem and Substantiation for Public Input

Grounding Electrode Conductor Purpose:

The purpose of the grounding electrode system, grounding electrode(s) and grounding electrode conductor(s) is to provide a connection to earth for the electrical system and equipment. The grounding electrode system functions to limit errant voltages caused by lightning, transients and high voltage line clashes. For grounded systems it stabilizes the voltage of the electrical system during normal operations and keeps the voltage to ground at predictable limits. A grounding electrode conductor must be both strong and conductive. It should be strong enough mechanically to withstand high current/frequency (A/Hz) lightning strikes as well as any damage from normal use. Where terminated in or near ground level, it must be corrosion resistant. Finally, a grounding electrode conductor must be able to be connected with standard industry-accepted connectors that are used within the grounding electrode system.

Grounding Electrode Conductor Materials:

The present materials permitted for grounding electrode conductors are copper, aluminum and copper-clad aluminum. The aluminum and copper-clad aluminum are limited in use by 250.64(A) where the bare conductor is in or near the ground or concrete at grade level. Grade 40 Copper-Clad Steel (40CCS), a copper bimetal, is another alternative designed for use as a grounding electrode conductor (GEC) and should be added to the NEC®. It is governed by ASTM B910/B910M-2007, the Standard Specification for Annealed Copper-Clad Steel Wire. The standard's scope states the following: This specification covers bare round copper-clad steel for the following applications: electrical, electronic, grounding, telecommunications, and other applications. Per the standard, the minimum tensile

strength for all wire diameters must be higher than 40,000 PSI, which would elevate the strength of GEC materials currently provided in Article 250. The shear modulus of Grade 40CCS is 11,600 KSI. Because ASTM B910 requires 40CCS to be annealed (softened), the material is sufficiently pliable to allow for traditional installation practices for GEC's. Increased mechanical strength of a GEC elevates the protection of an electrical installation in two ways: 1) the GEC can better withstand fusing during ultra-high A/Hz lightning strikes (see connector and fusing discussions below); 2) the GEC is noticeably more difficult to cut without proper tools, which aids as a theft deterrent when thieves attempt to remove it. Additionally, Copper Clad Steel has no scrap value, which also disincentives theft.

Terminations and Connectors:

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

Corrosion Resistance:

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

Resistance to Fusing at High Currents:

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

Conductivity:

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

Current NEC® Applications:

Copper Clad Steel as a GEC material is currently referenced in section 810.21(A) of the NEC®. . In addition to the substantiation information provided above for correlation purposes 40CCS should be included in applicate Articles, such as Article 250, and sections that specify grounding electrode conductor material. Public inputs have been submitted for this action in a number of sections.

Listing:

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

the metallurgical bond, the hallmark of a true bimetal. The listing and suitable markings on tags or packaging also provides the installer and inspector the information needed to make and approve the installation.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 2472-NFPA 70-2020 [Section No. 250.102(C)(2)] | CCS Bonding Conductors |

## Submitter Information Verification

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**Affiliation:** American Bimetallic Association
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**State:**
**Zip:**
**Submittal Date:** Sun Aug 23 15:33:09 EDT 2020
**Committee:** NEC-P16

*Testing done for the safety of our valued customer.*

# Global Circulation Laboratory Test Report

*For Global Distribution*

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

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

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

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

**TD002391 REV B**

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

TD002391

# Global Circulation Laboratory Test Report

*For Global Distribution*

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TD002391

# Global Circulation Laboratory Test Report

*For Global Distribution*

## PURPOSE OF TEST:

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

## TEST REQUESTED:

UL486A-486B Mechanical Sequence
UL467 Short Time Current

## TEST RESULTS:

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

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TD002391

# Global Circulation Laboratory Test Report

*For Global Distribution*

## CONCLUSIONS:

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

## TEST PROCEDURES

The table below shows the connector / conductor combinations tested.

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

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# Global Circulation Laboratory Test Report

*For Global Distribution*

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

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

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

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

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

## TEST EQUIPMENT LIST:

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

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# CORROSION ON BURIED COPPER CLAD STEEL




Cece Syarif

Global Application Engineer

&

Anthony Hale

Manager, Utility Products, North America

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

COPPERWELD

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

July 26, 2011

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

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

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

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

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

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

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

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

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



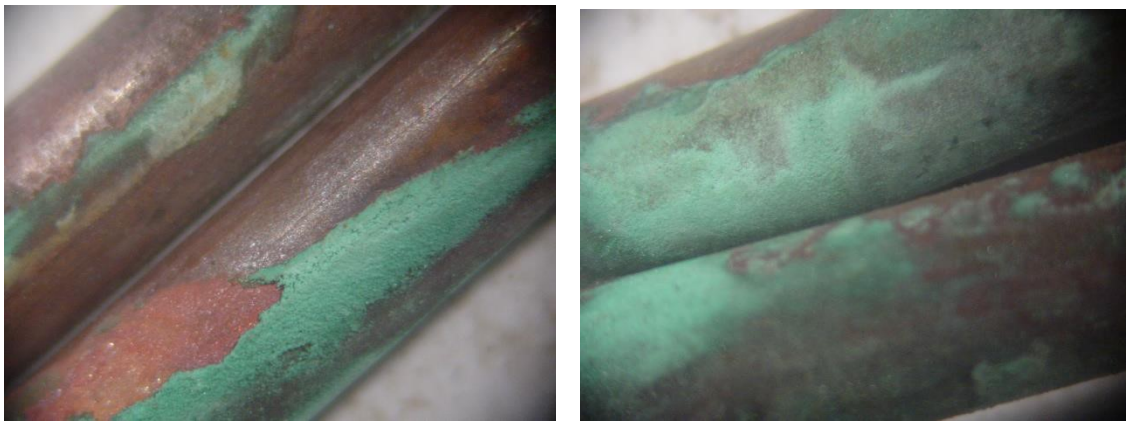
Figure 1: Example of Underground Corrosion of Copper Clad Steel

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

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

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



(a) Copper Clad Steel (b) Copper

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

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

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

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

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

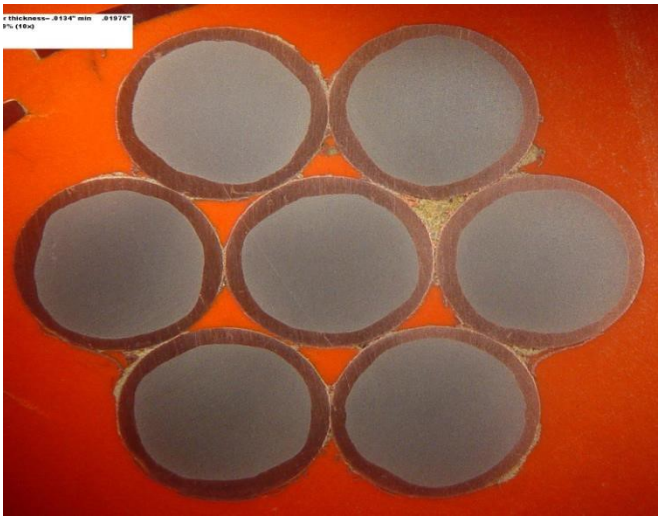


Figure 3: Copperweld® 40% LC DSA 7 No. 5 manufactured in 1962

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



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

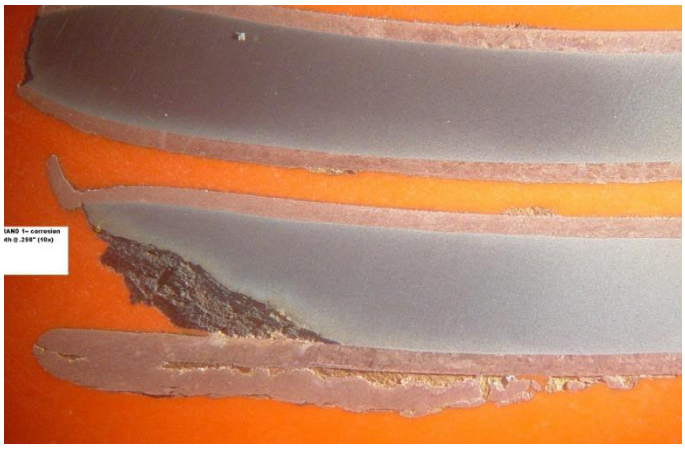


Figure 4b: Corrosion occurred at the ends of the wires. Maximum penetration depth is 0.859 inch.

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

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

**REFERENCES:**

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

Powertech

*Report ID: PL-03027 REP1*
*Revision: 0  Issued: 2020-04-15*

# Copper and CCS Wire Withstand Current and Fusing Current Tests

Copperweld Bimetallics, LLC




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

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## REPORT OF PERFORMANCE

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

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

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# 1 INTRODUCTION

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

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

# 2 TEST OBJECT INFORMATION

The test objects were identified by the client as follows:

Copper Clad Steel Wires (CCS)

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

Copper Conductor

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

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

# 3 GENERAL INFORMATION

## 3.1 Purpose

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

## 3.2 Witnesses

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

## 3.3 Tests Performed

**Test Standards/Specifications:**

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

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

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

## 4 SHORT-CIRCUIT CURRENT TESTS

**General Information:**

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

**Environmental Conditions:**

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

**Test Conditions:**

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

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

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

**Test Results:**

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

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

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

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

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

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

## APPENDIX A – FUSING CURRENT TEST CIRCUIT AND DATA

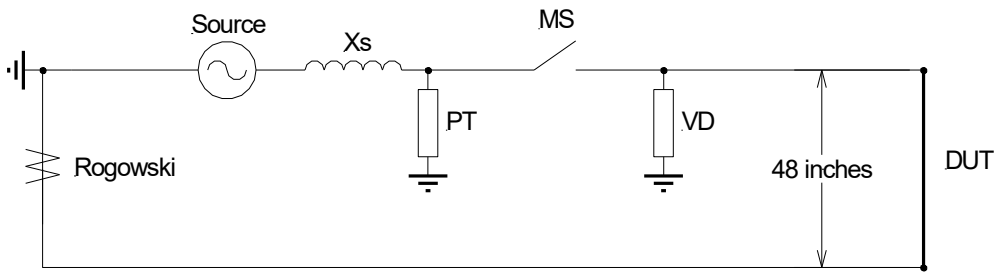



***Figure 1: Test circuit schematic for all tests.***

*Notes:*

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

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

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

Note:

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

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

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

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

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

Notes:

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

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

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

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

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

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

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

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

Notes:

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

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

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

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

## APPENDIX B – WAVEFORMS

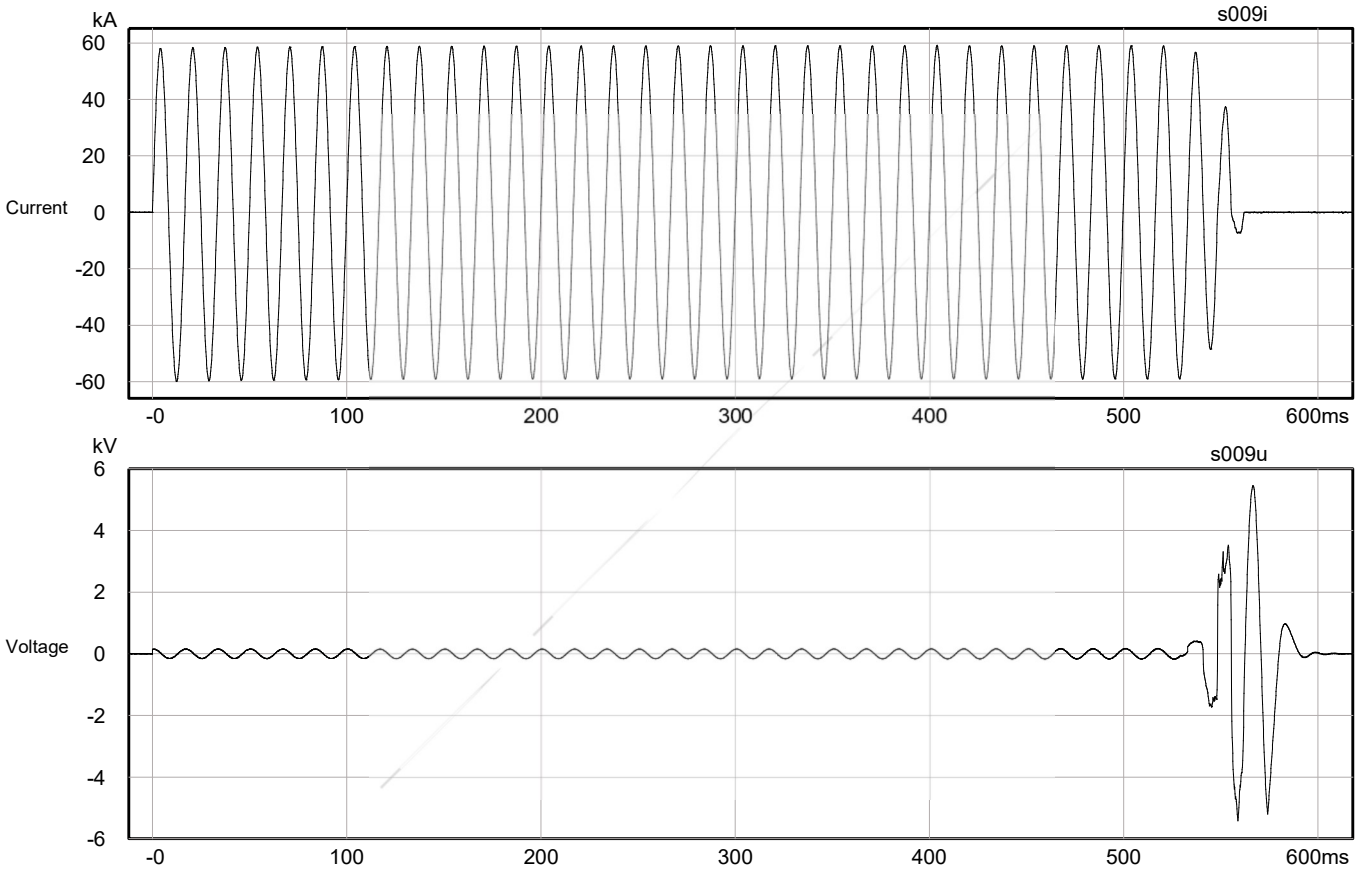



***Figure 2: Waveforms for Test #1, Encore 4/0 AWG Sample 1.***

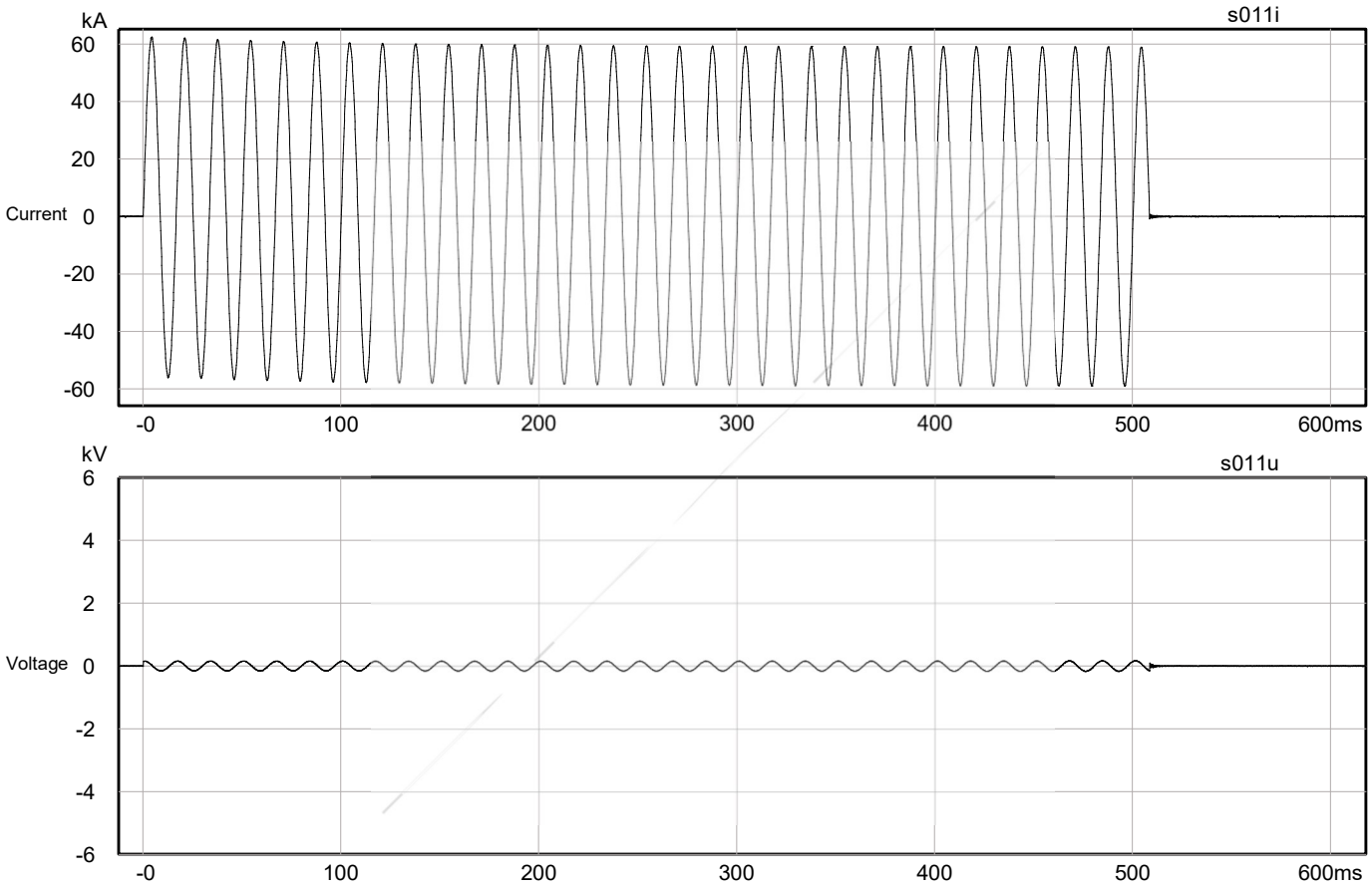



***Figure 3: Waveforms for Test #2, Encore 4/0 AWG Sample 2.***

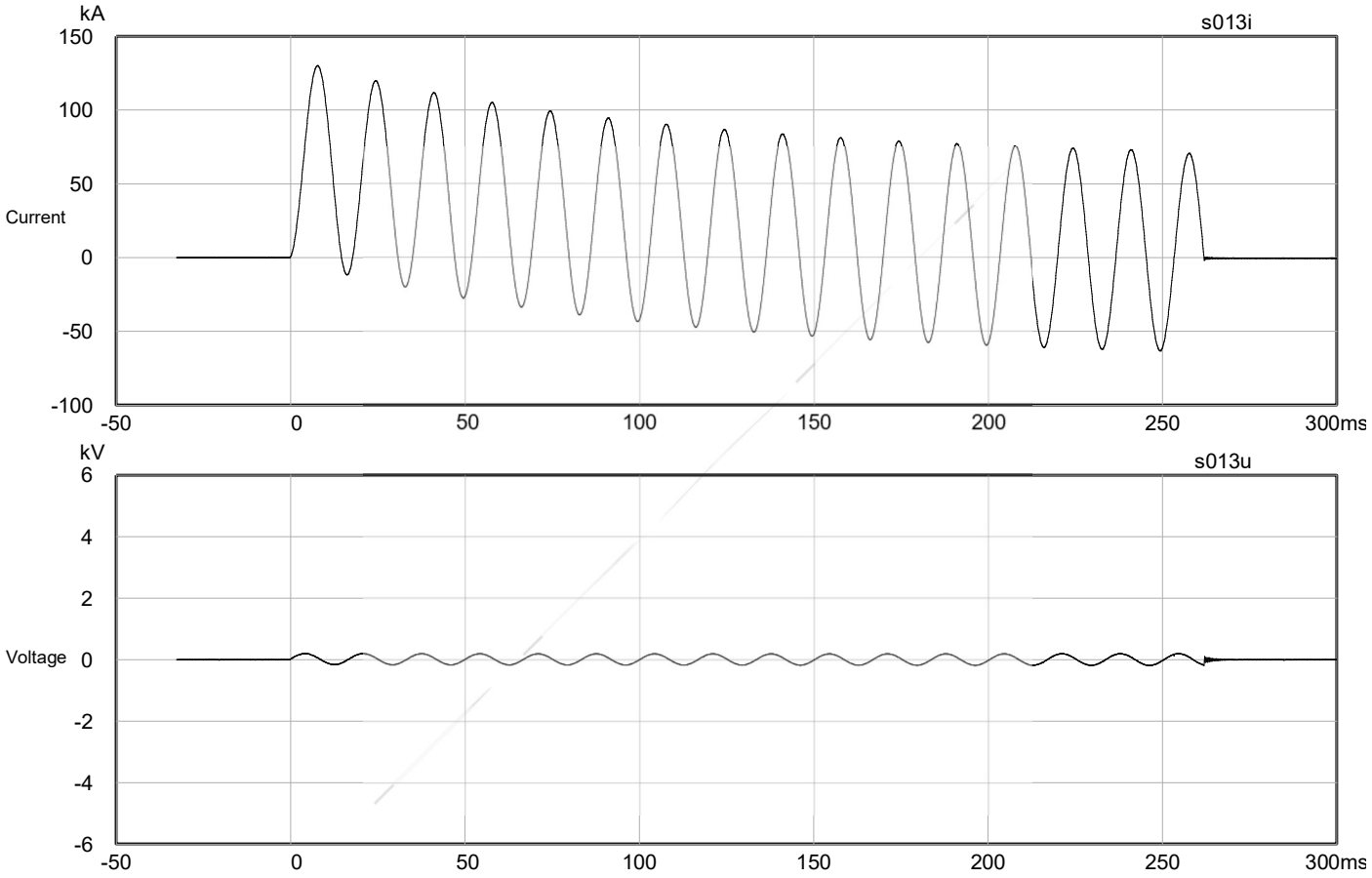



***Figure 4: Waveforms for Test #3-1, Encore 4/0 AWG Sample 3.***

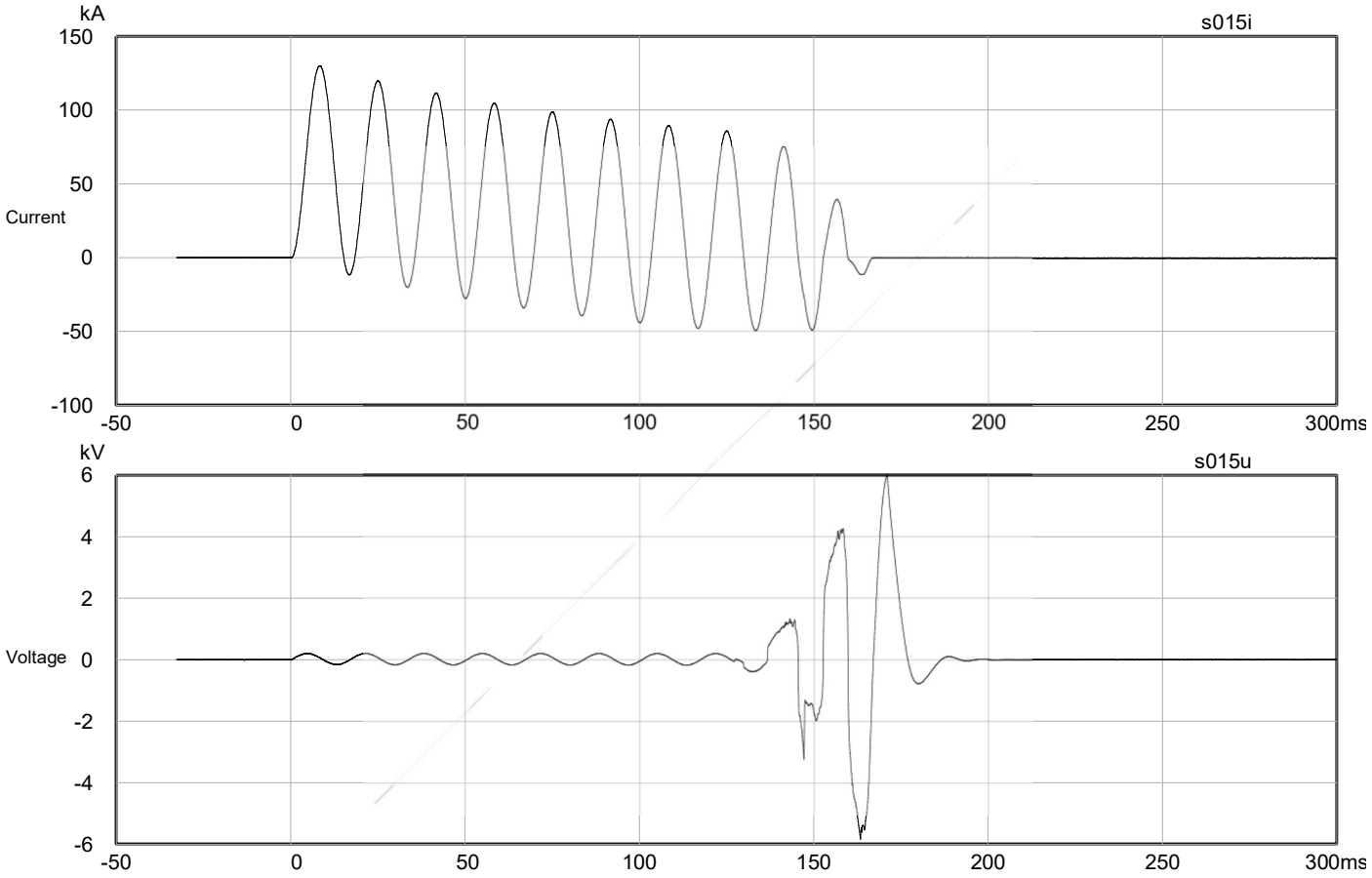



***Figure 5: Waveforms for Test #3-2, Encore 4/0 AWG Sample 3.***

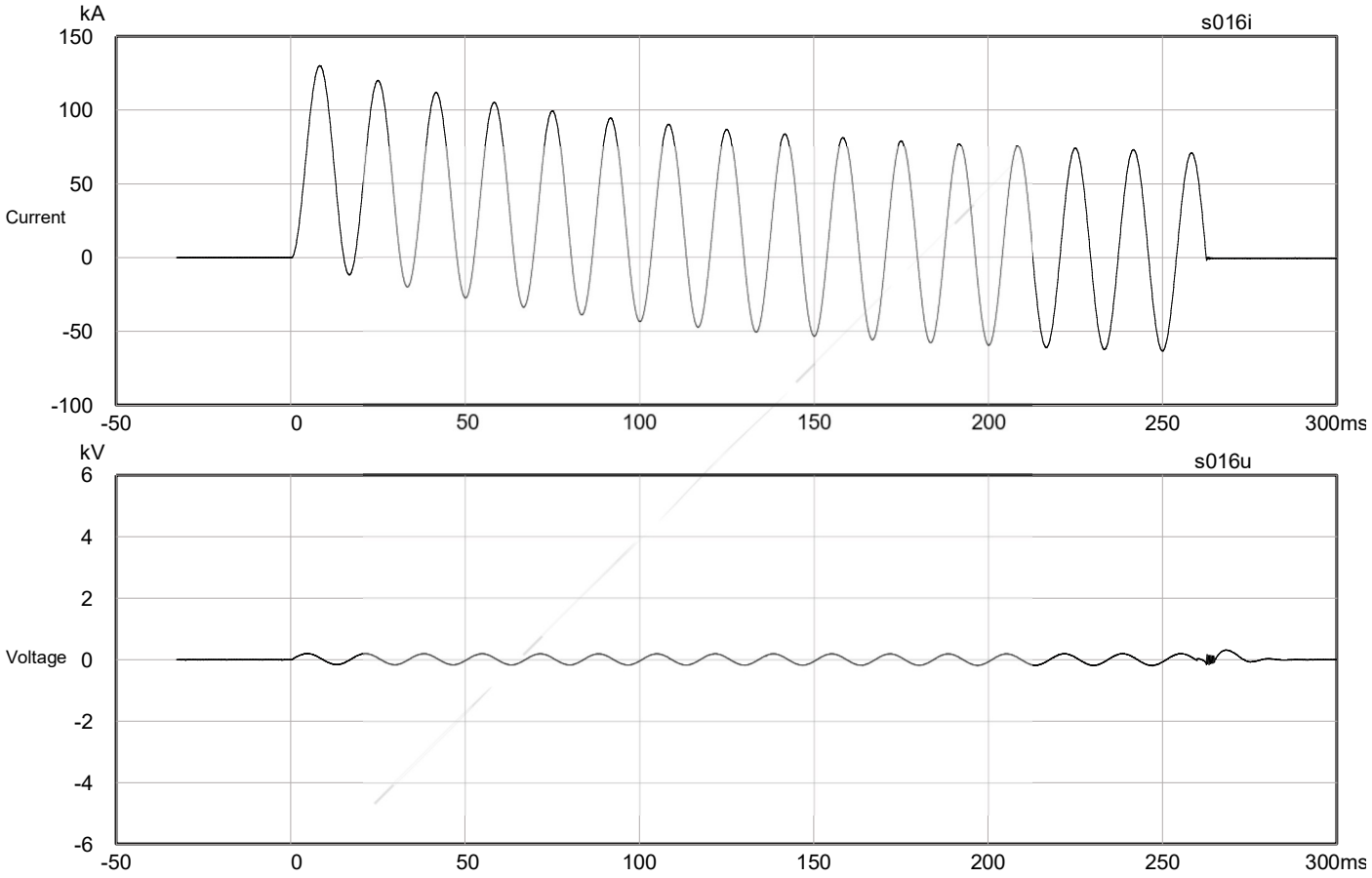



***Figure 6: Waveforms for Test #4, Encore 4/0 AWG Sample 4.***

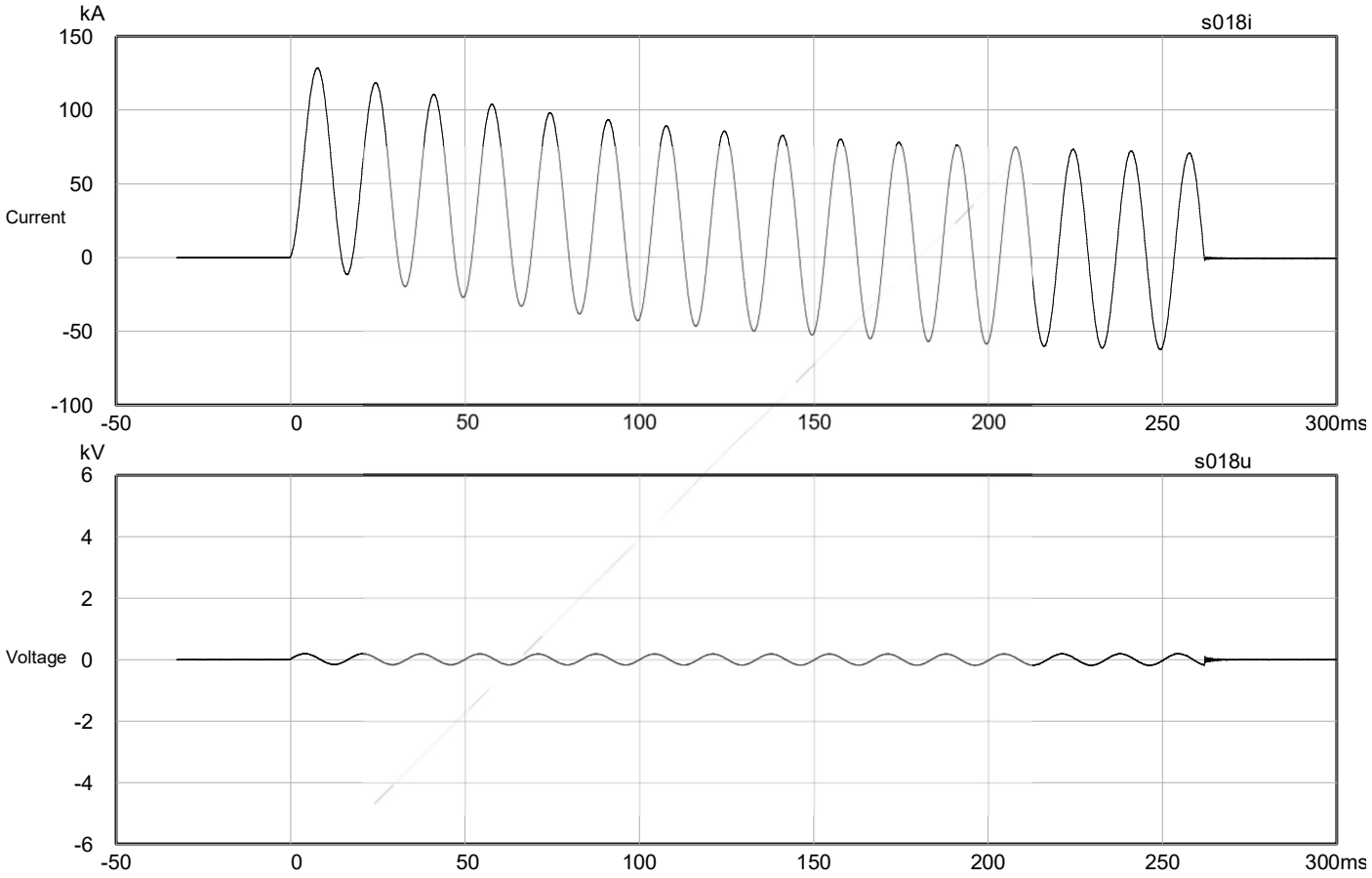



***Figure 7: Waveforms for Test #5-1, Encore 4/0 AWG Sample 5.***

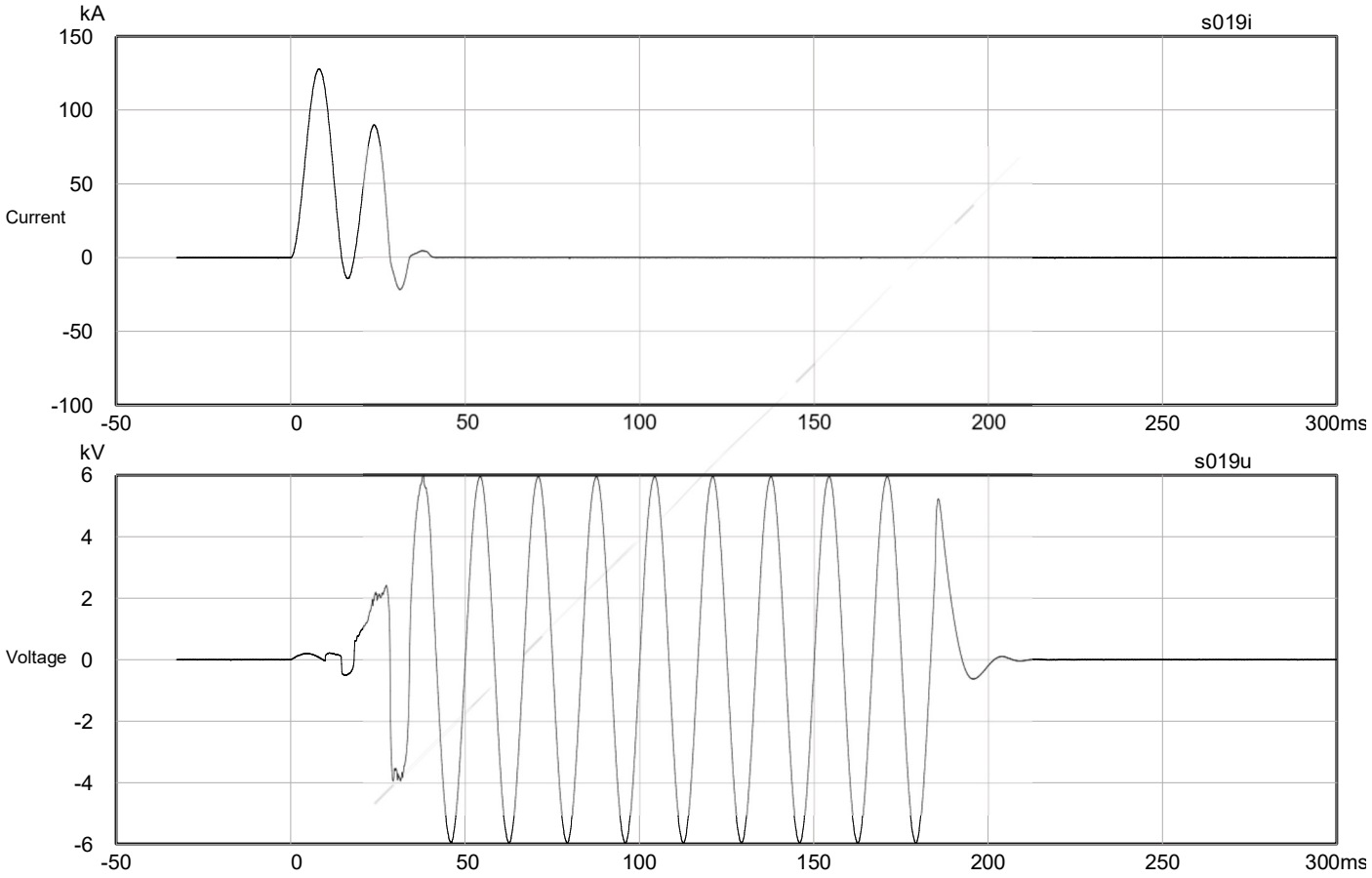



***Figure 8: Waveforms for Test #5-2, Encore 4/0 AWG Sample 5.***

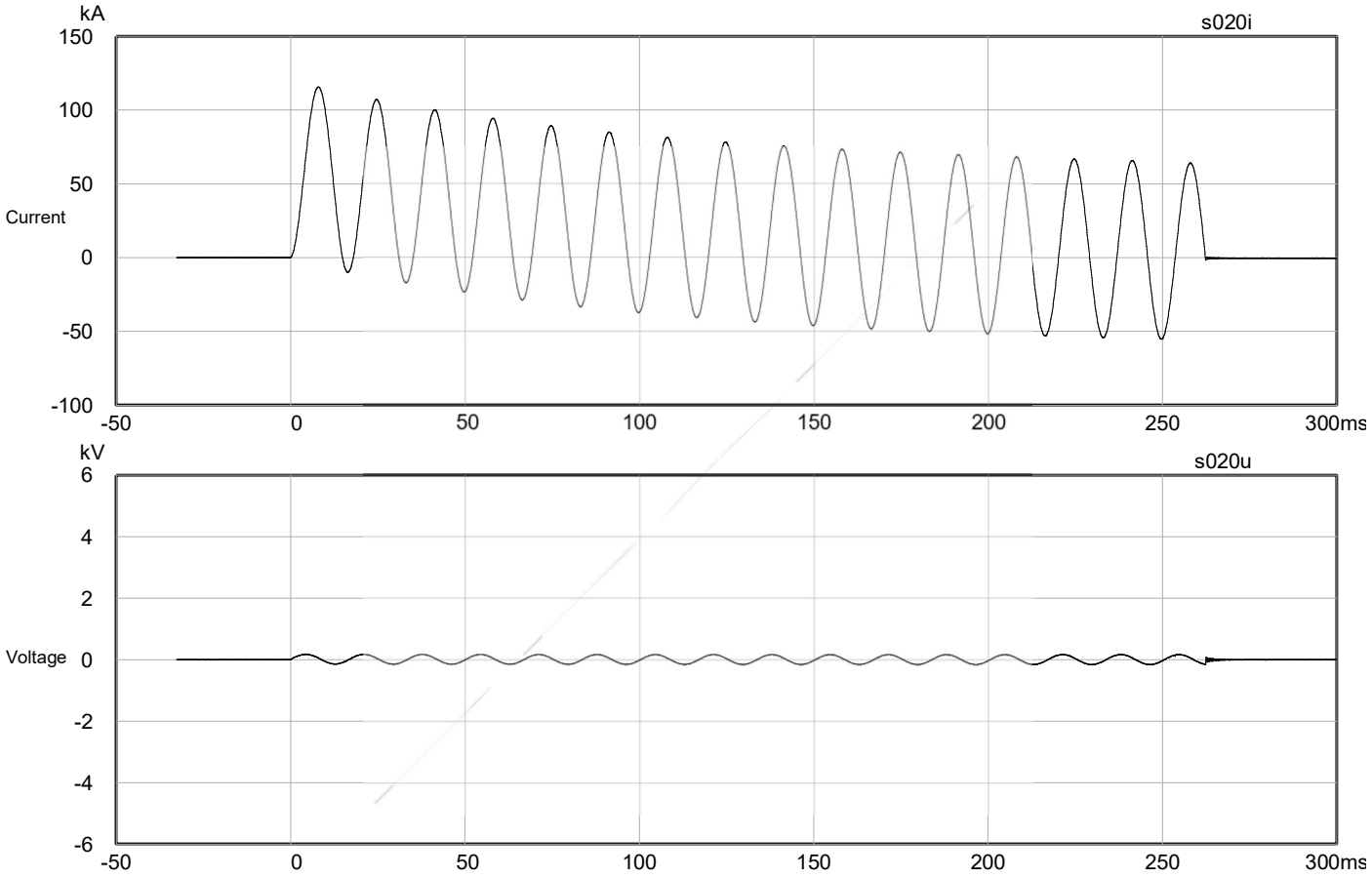



***Figure 9: Waveforms for Test #6-1, Encore 4/0 AWG Sample 6.***

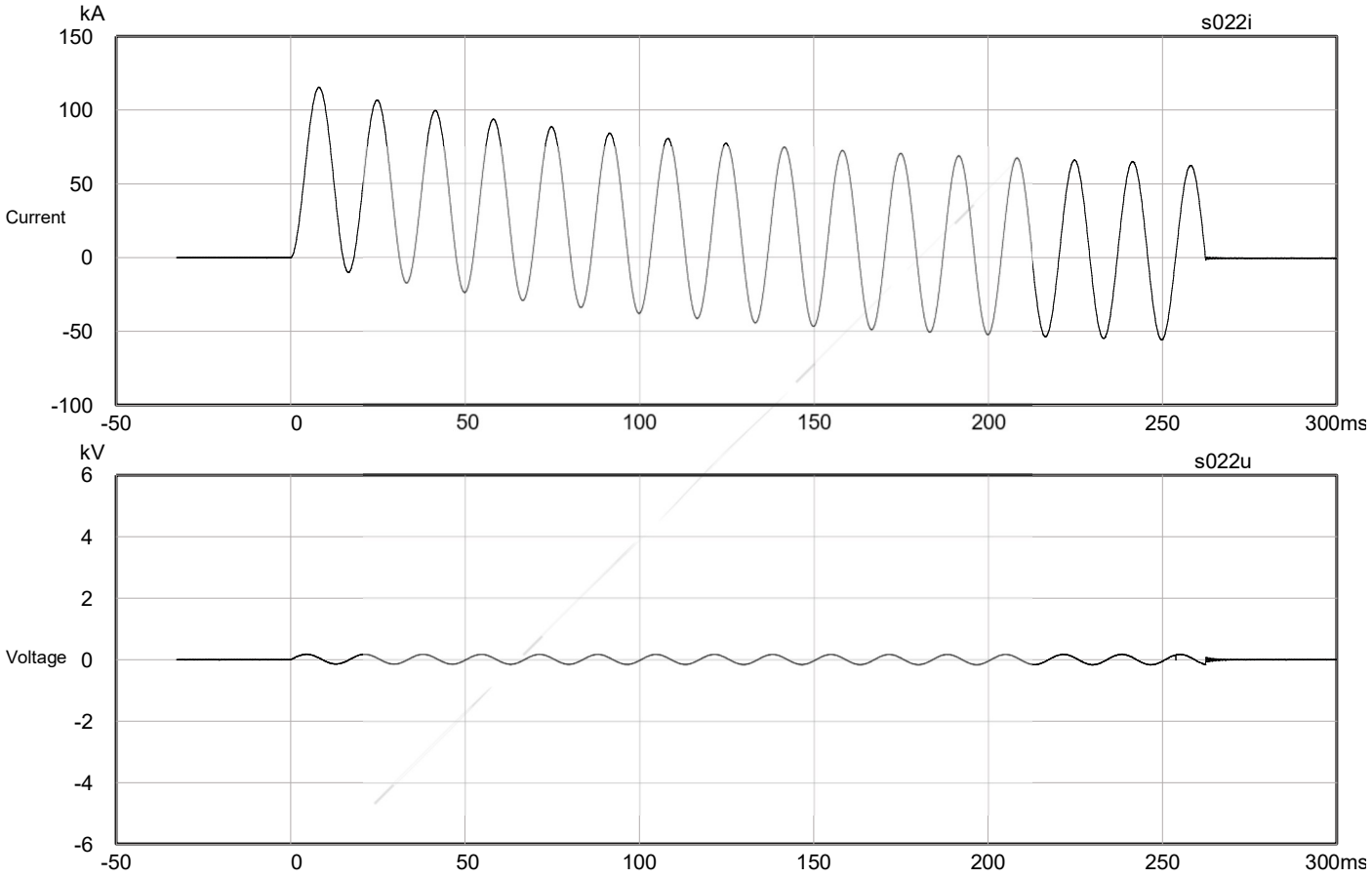



***Figure 10: Waveforms for Test #6-2, Encore 4/0 AWG Sample 6.***

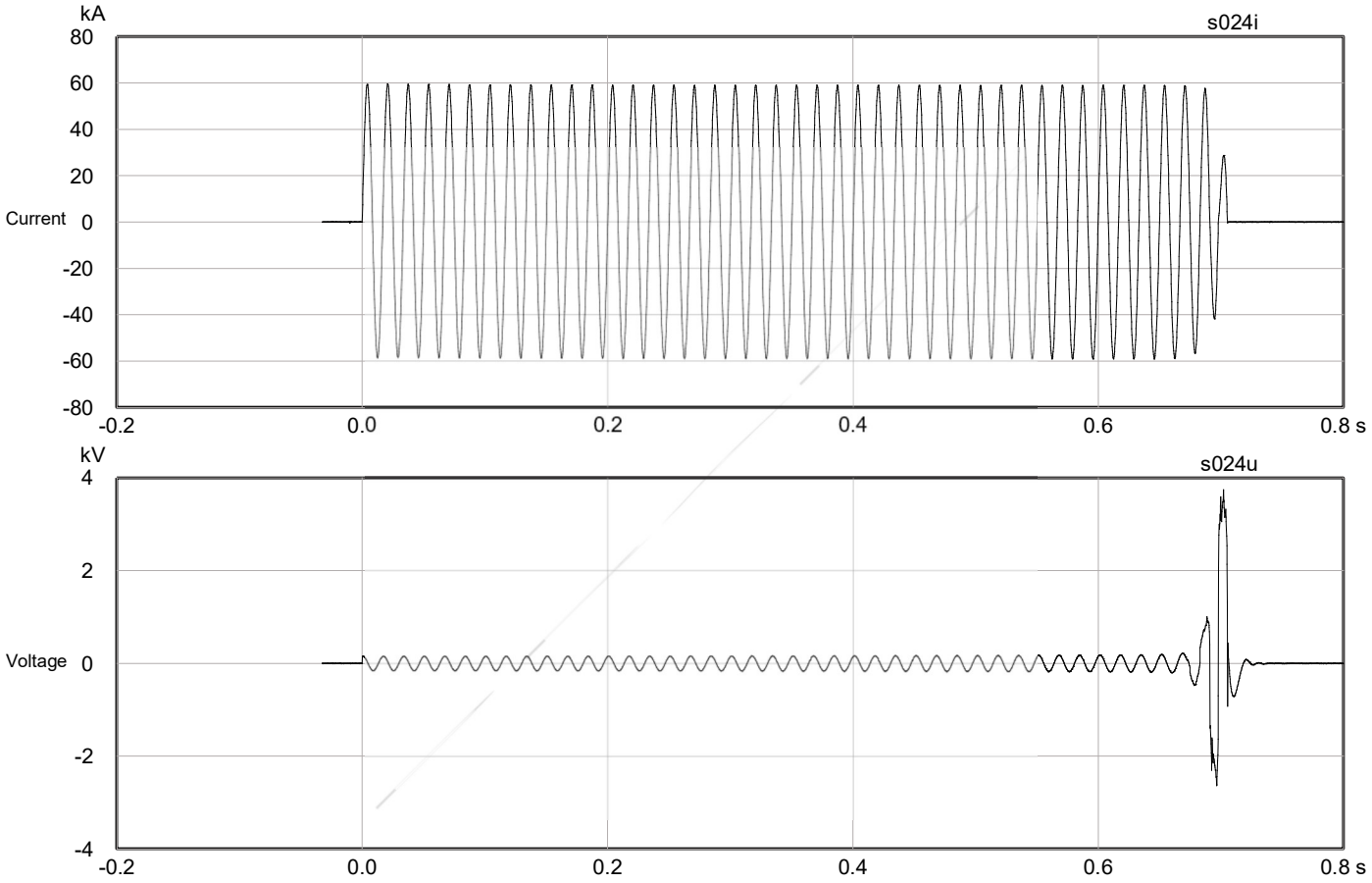



***Figure 11: Waveforms for Test #7, Copperweld Scorpius 61 x 072 Sample 11.***

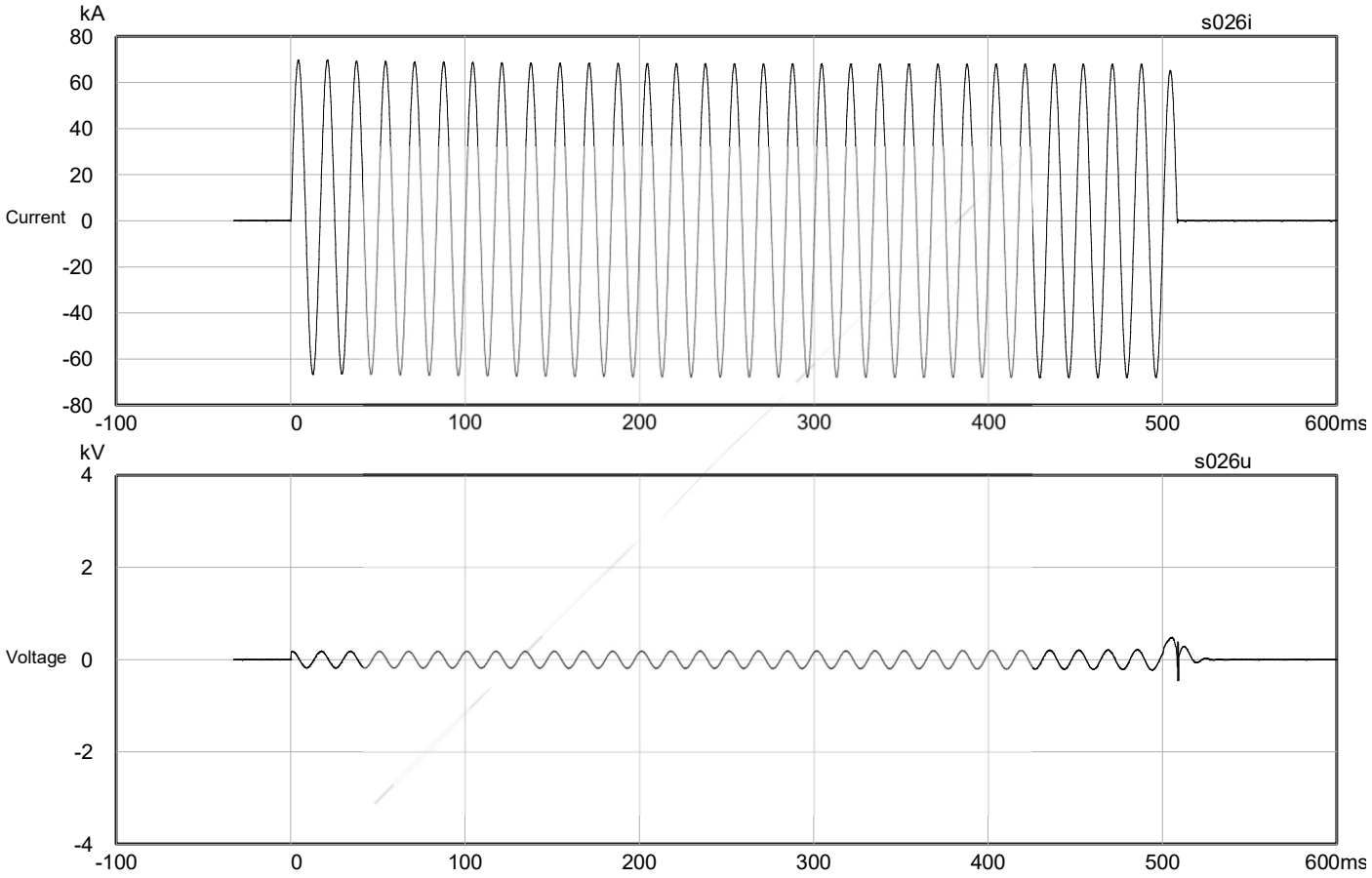



***Figure 12: Waveforms for Test #6, Copperweld Scorpius 61 x 072 Sample 12.***

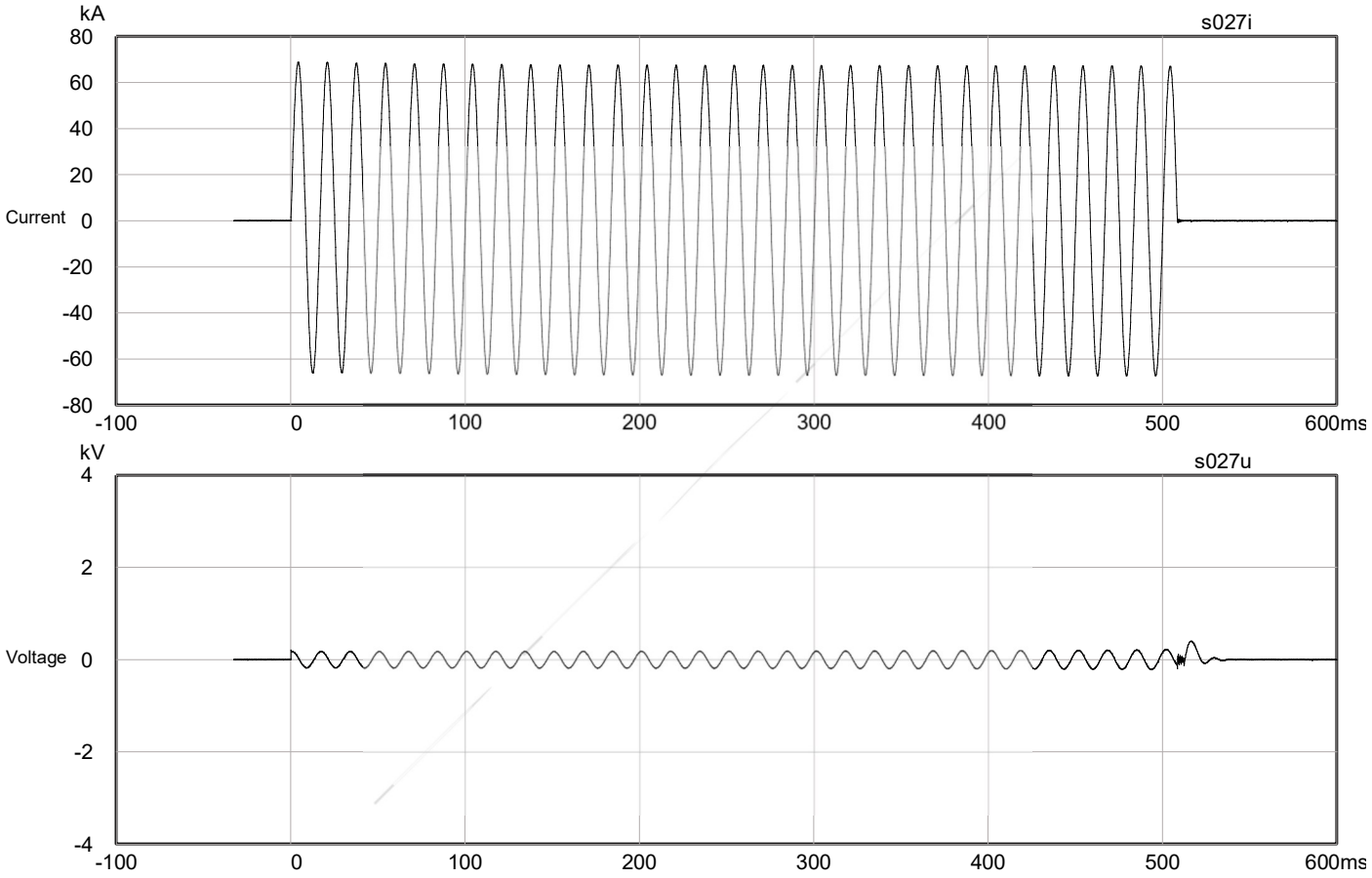



***Figure 13: Waveforms for Test #9, Copperweld Scorpius 61 x 072 Sample 13.***

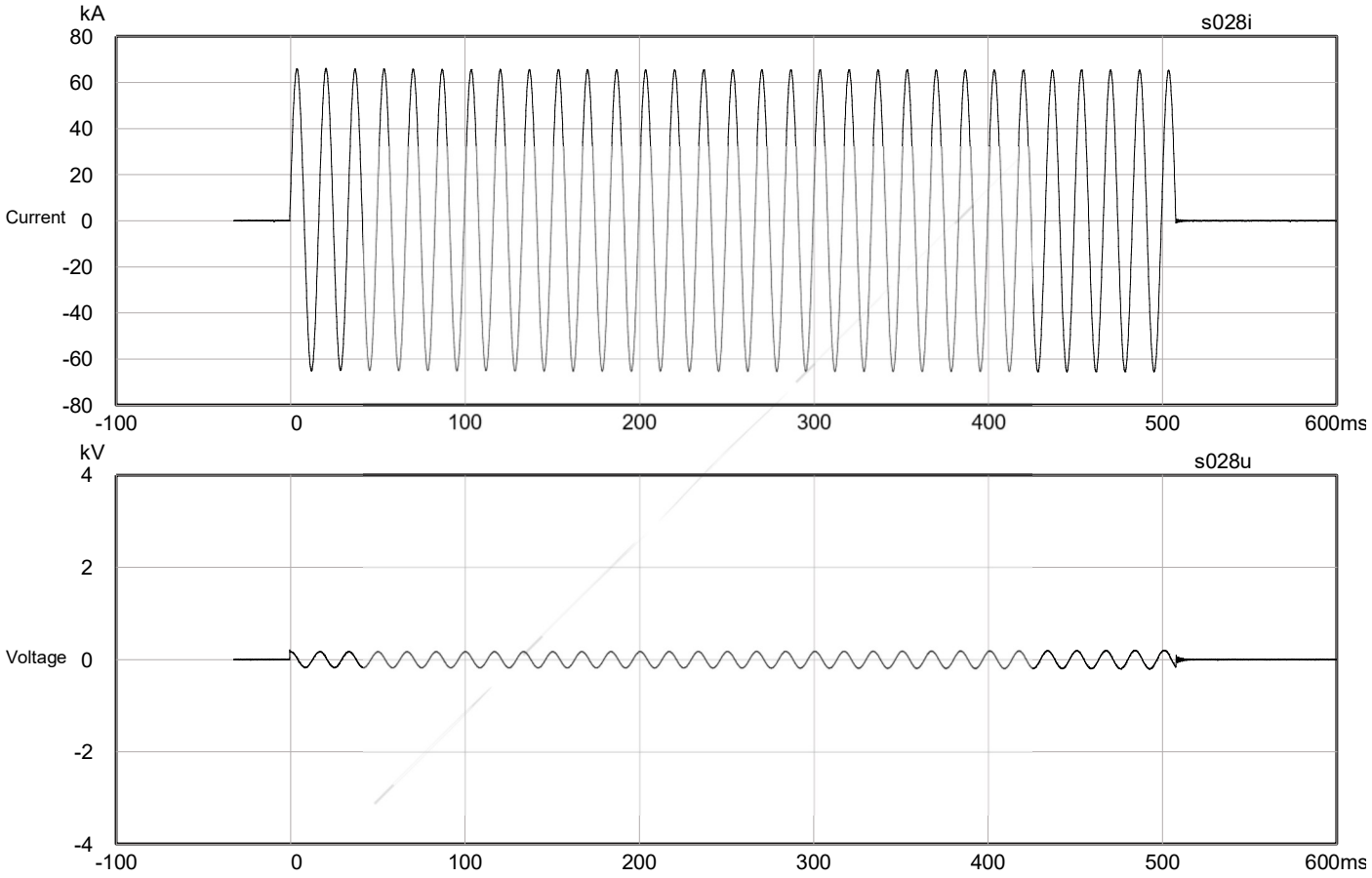



***Figure 14: Waveforms for Test #10, Copperweld Scorpius 61 x 072 Sample 14.***

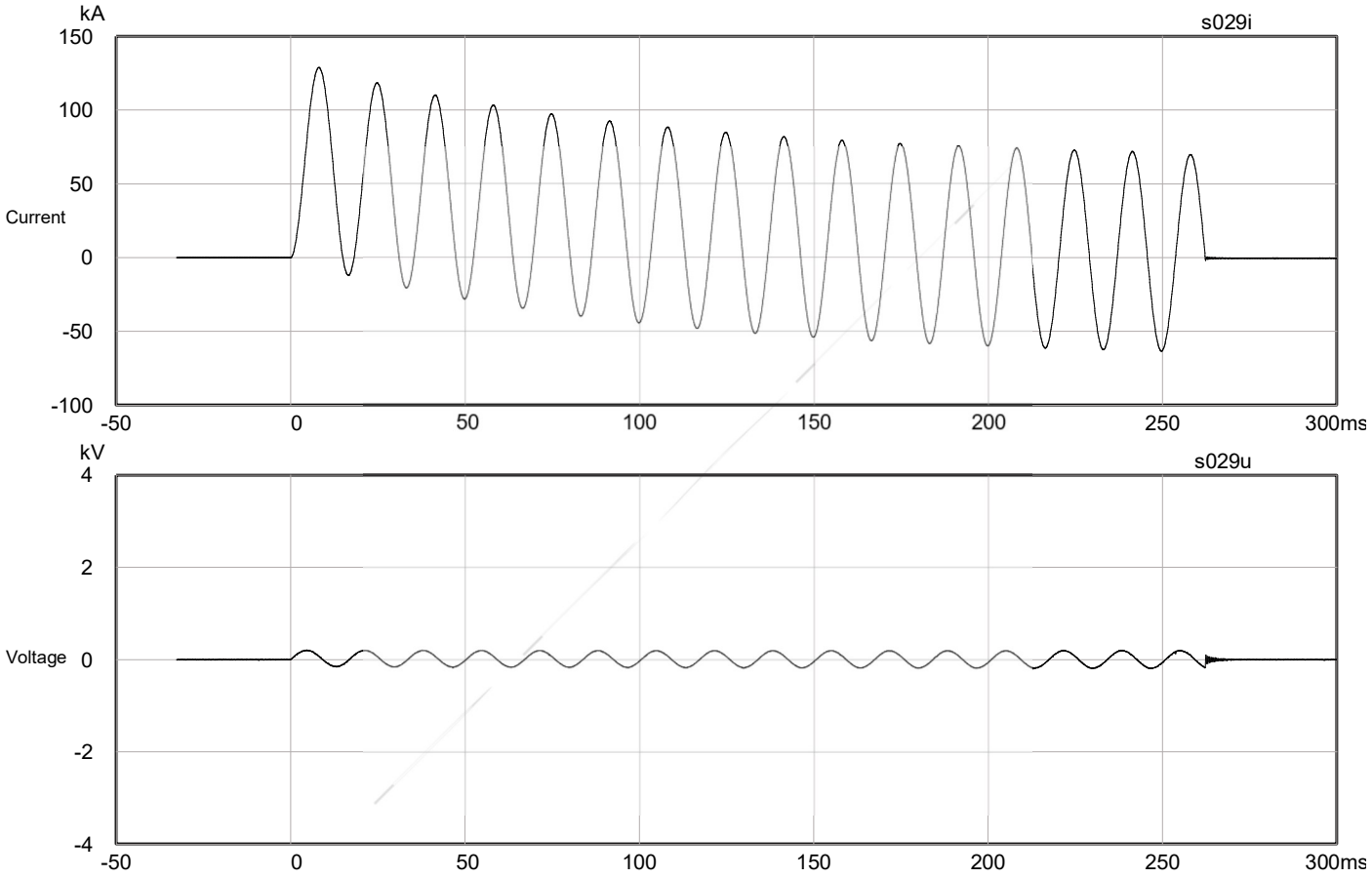



***Figure 15: Waveforms for Test #11-1, Copperweld Scorpius 61 x 072 Sample 15.***

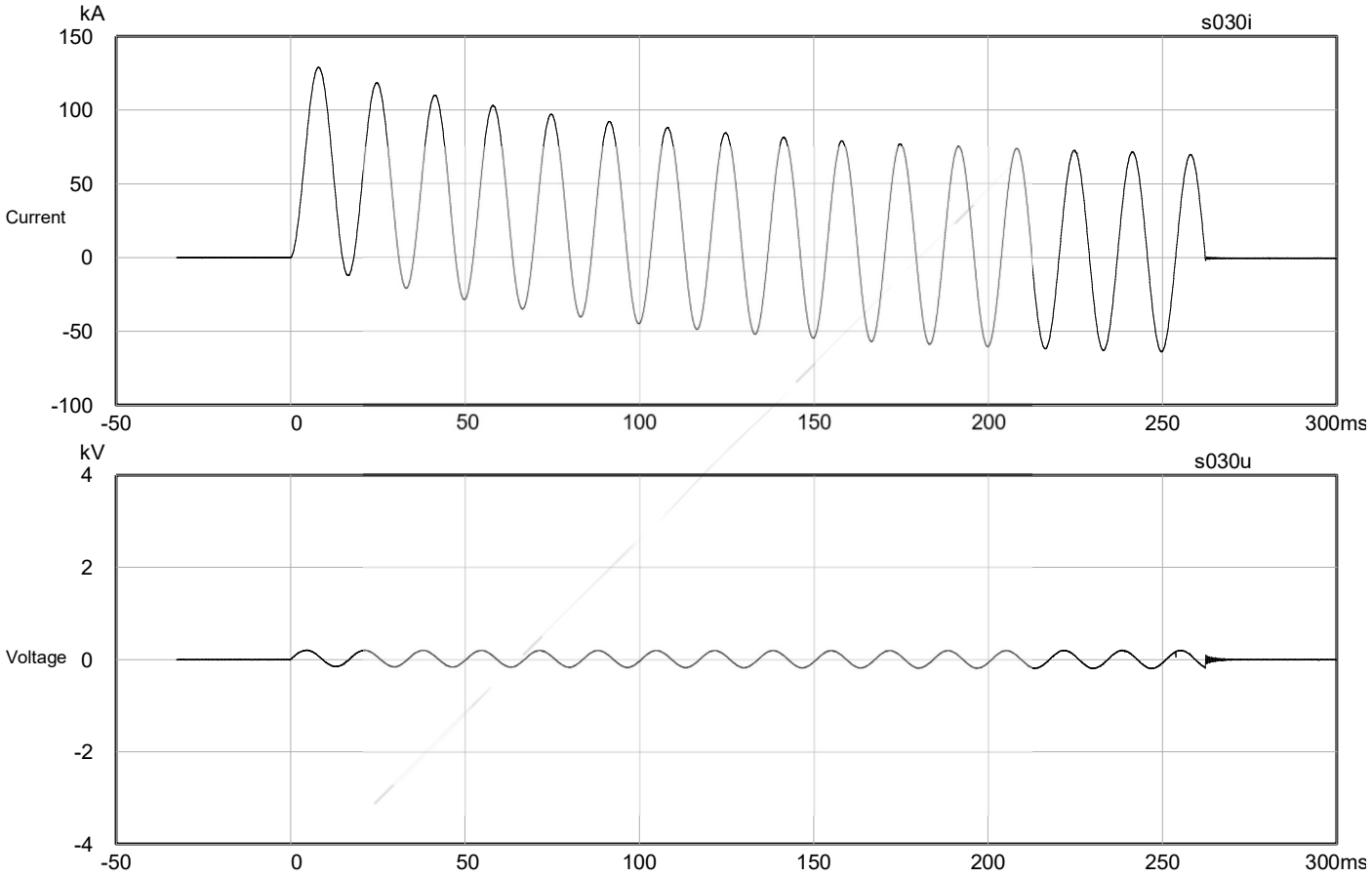



***Figure 16: Waveforms for Test #11-2, Copperweld Scorpius 61 x 072 Sample 15.***

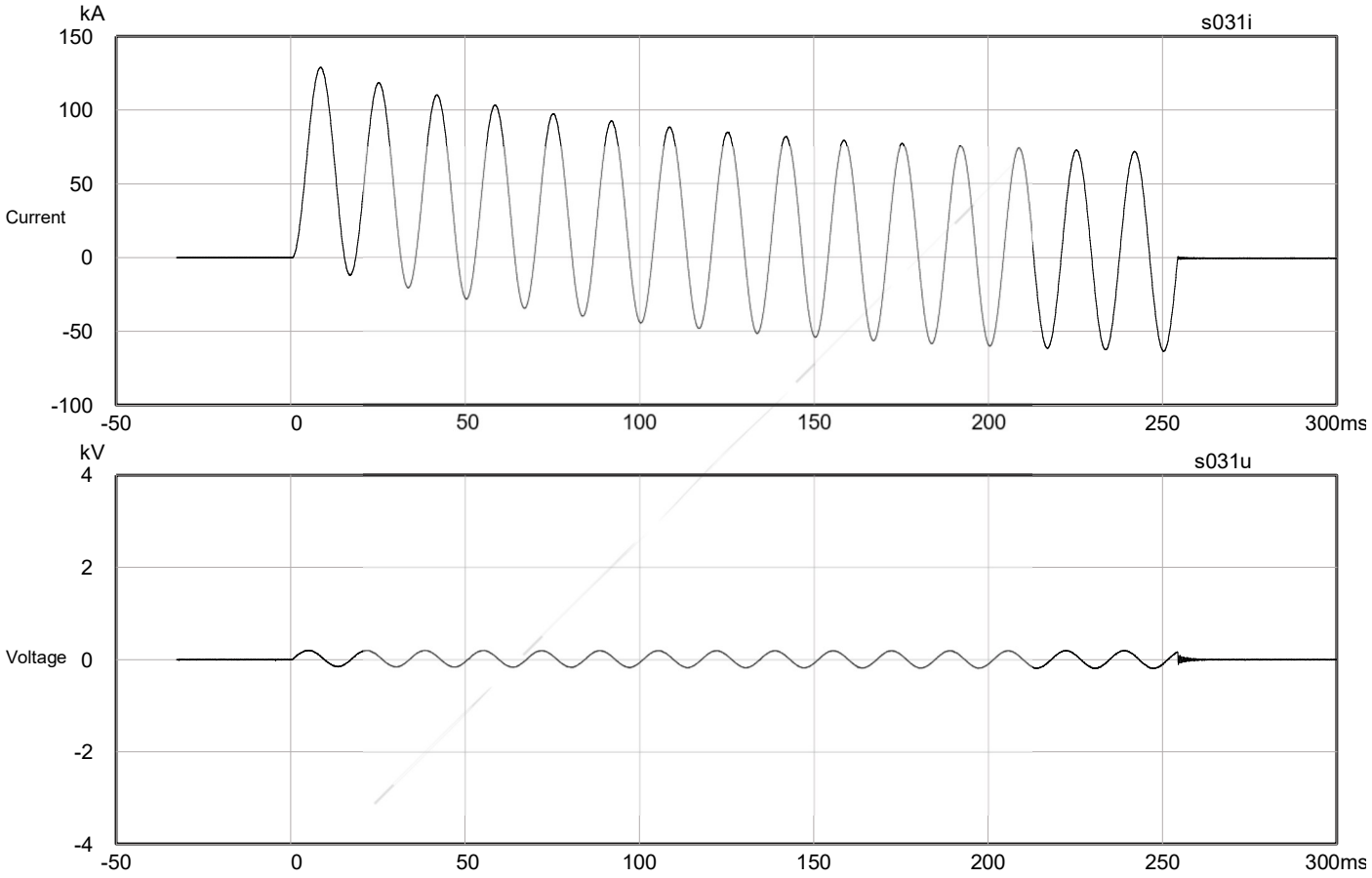



***Figure 17: Waveforms for Test #12-1, Copperweld Scorpius 61 x 072 Sample 16.***

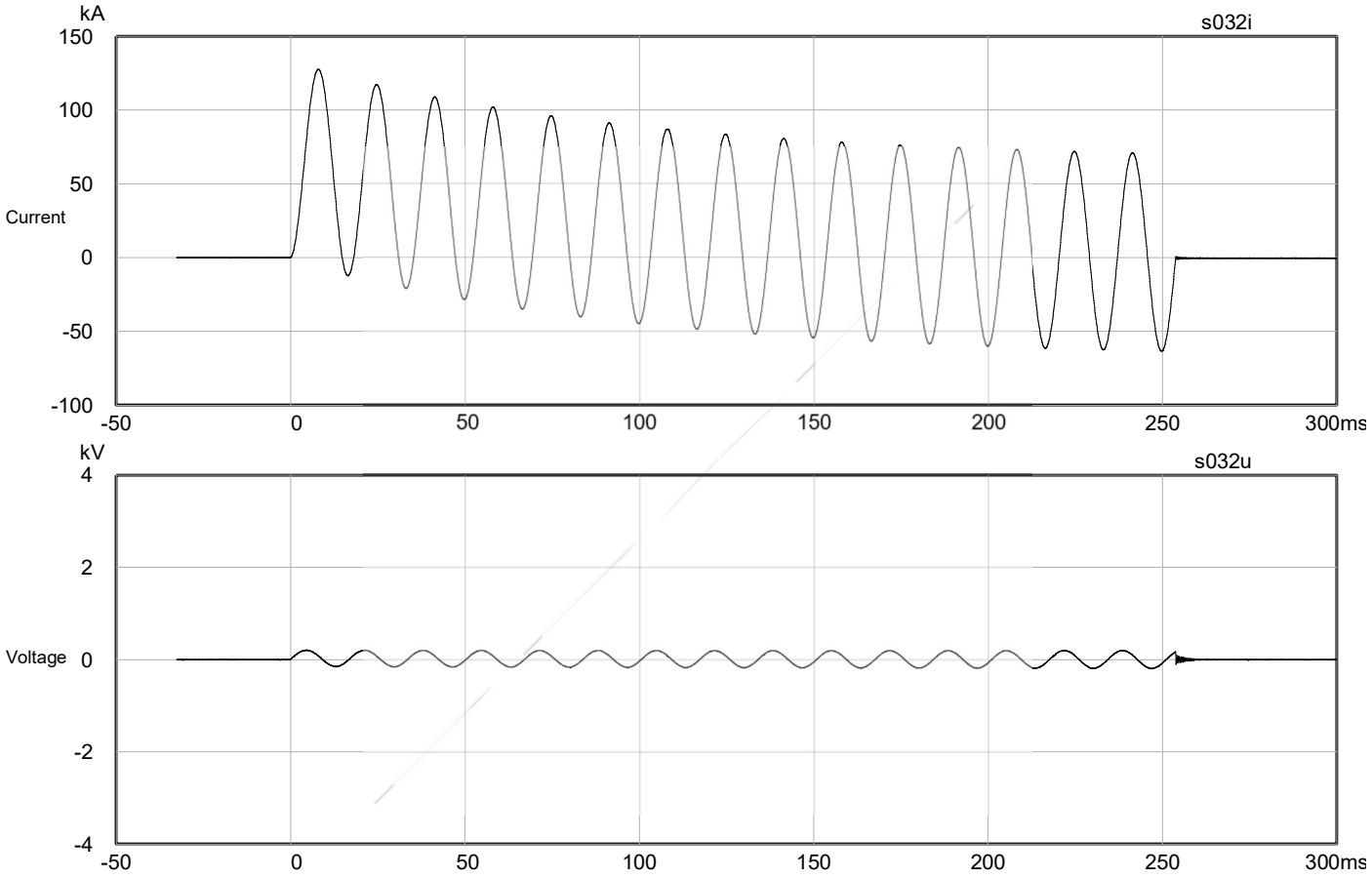



***Figure 18: Waveforms for Test #12-2, Copperweld Scorpius 61 x 072 Sample 16.***

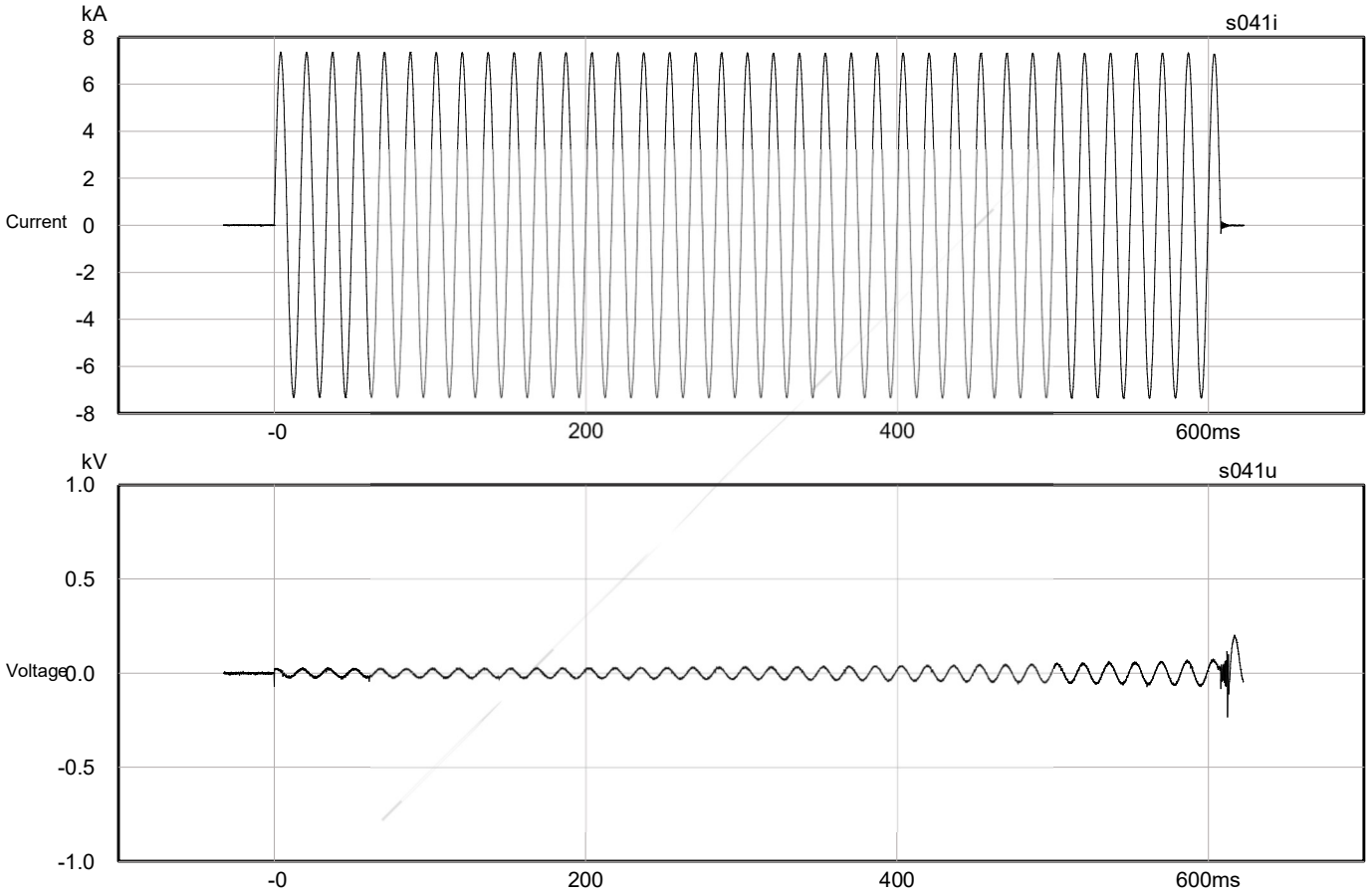



***Figure 19: Waveforms for Test #13, Encore #6 AWG Sample 21.***

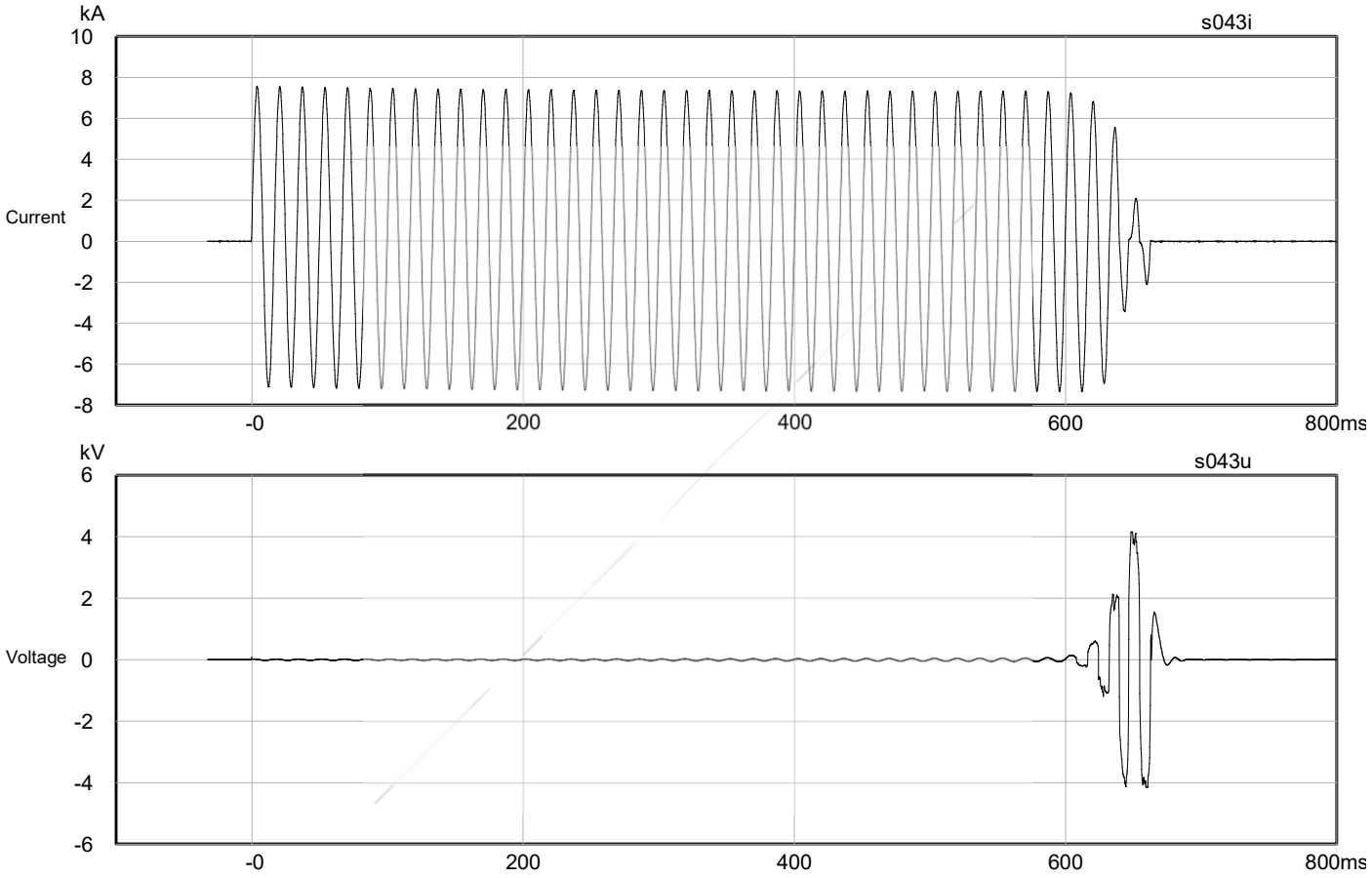



***Figure 20: Waveforms for Test #14, Encore #6 AWG Sample 23.***

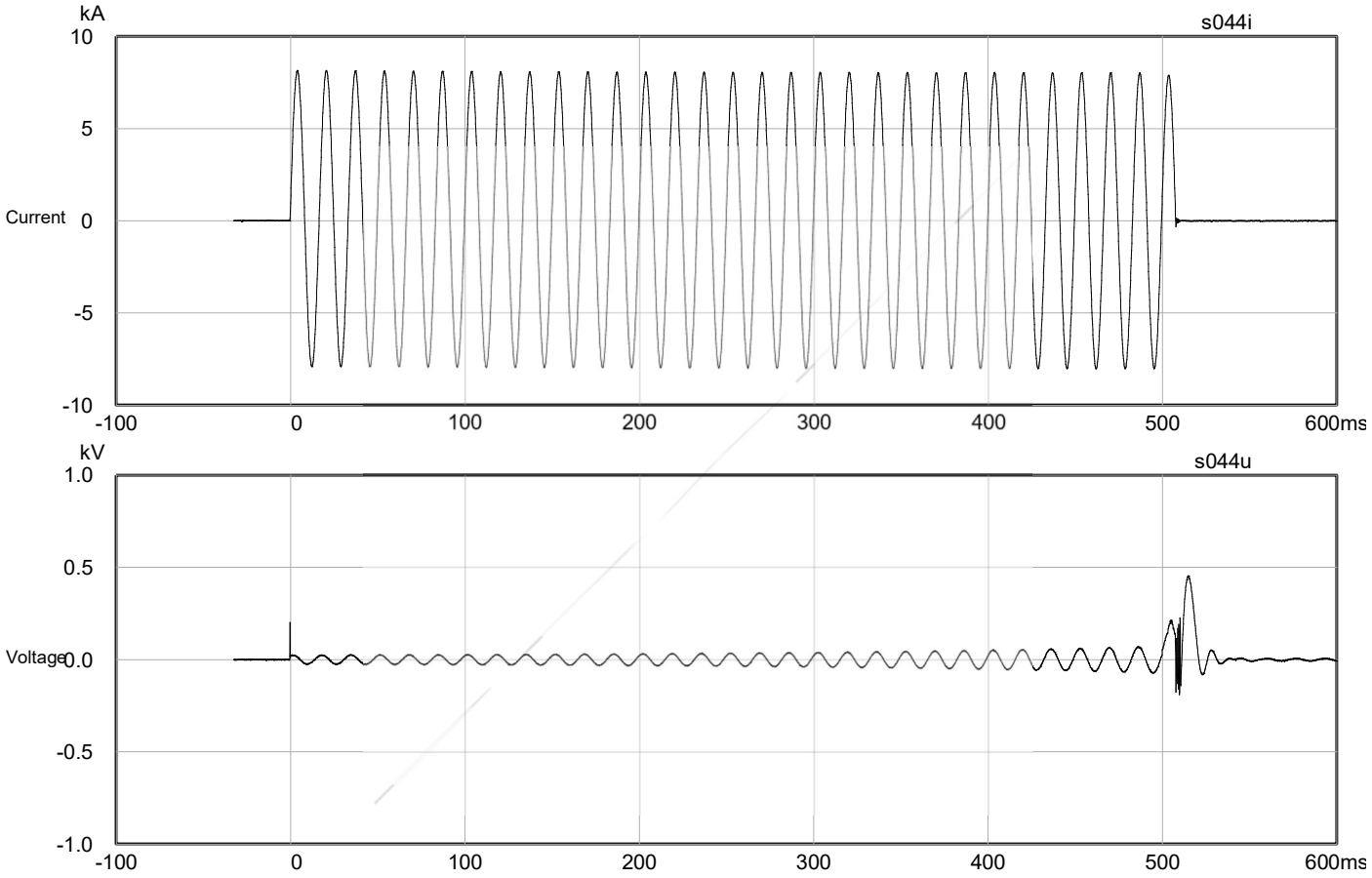



***Figure 21: Waveforms for Test #15, Encore #6 AWG Sample 24.***

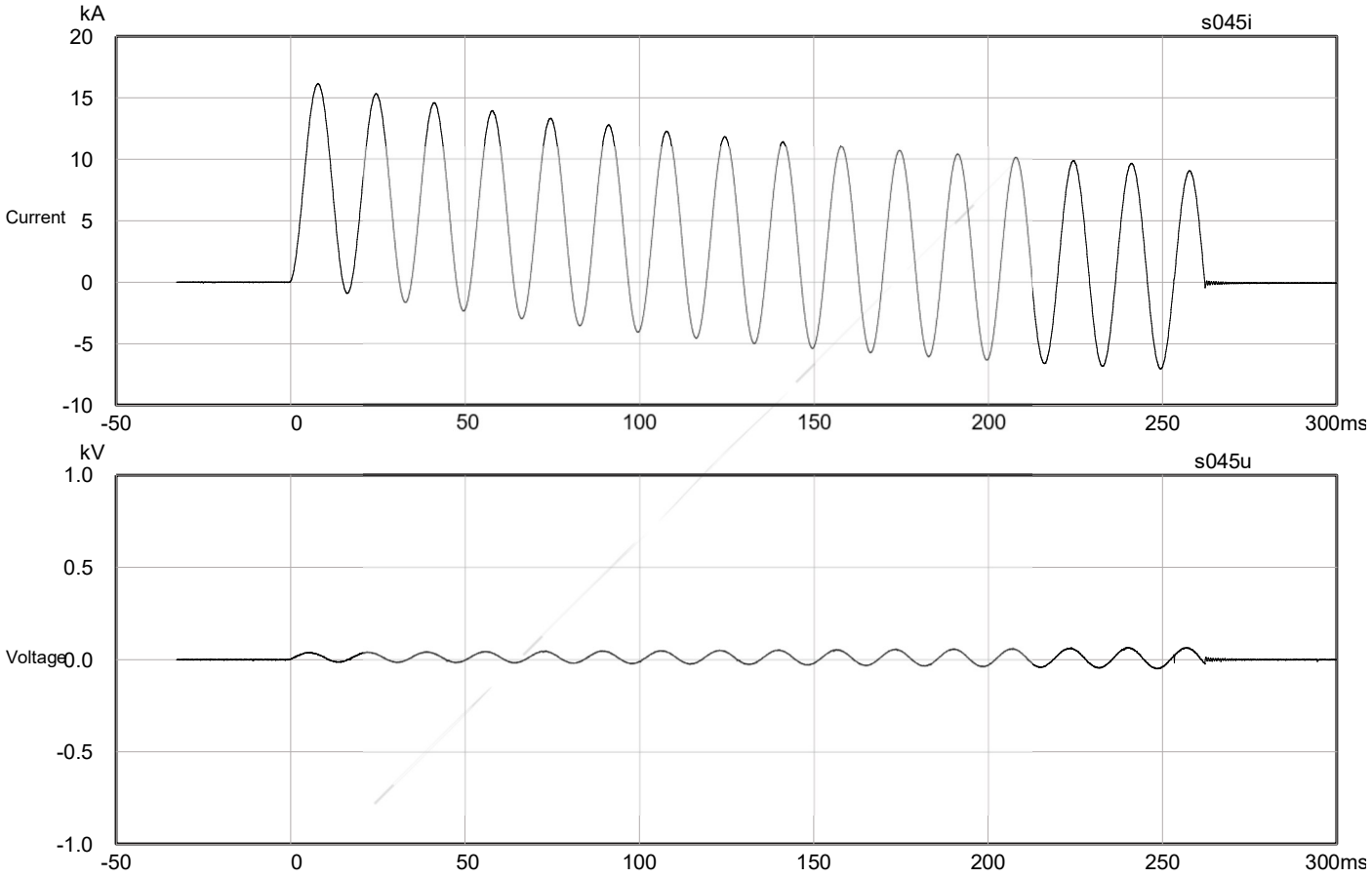



***Figure 22: Waveforms for Test #16-1, Encore #6 AWG Sample 25.***

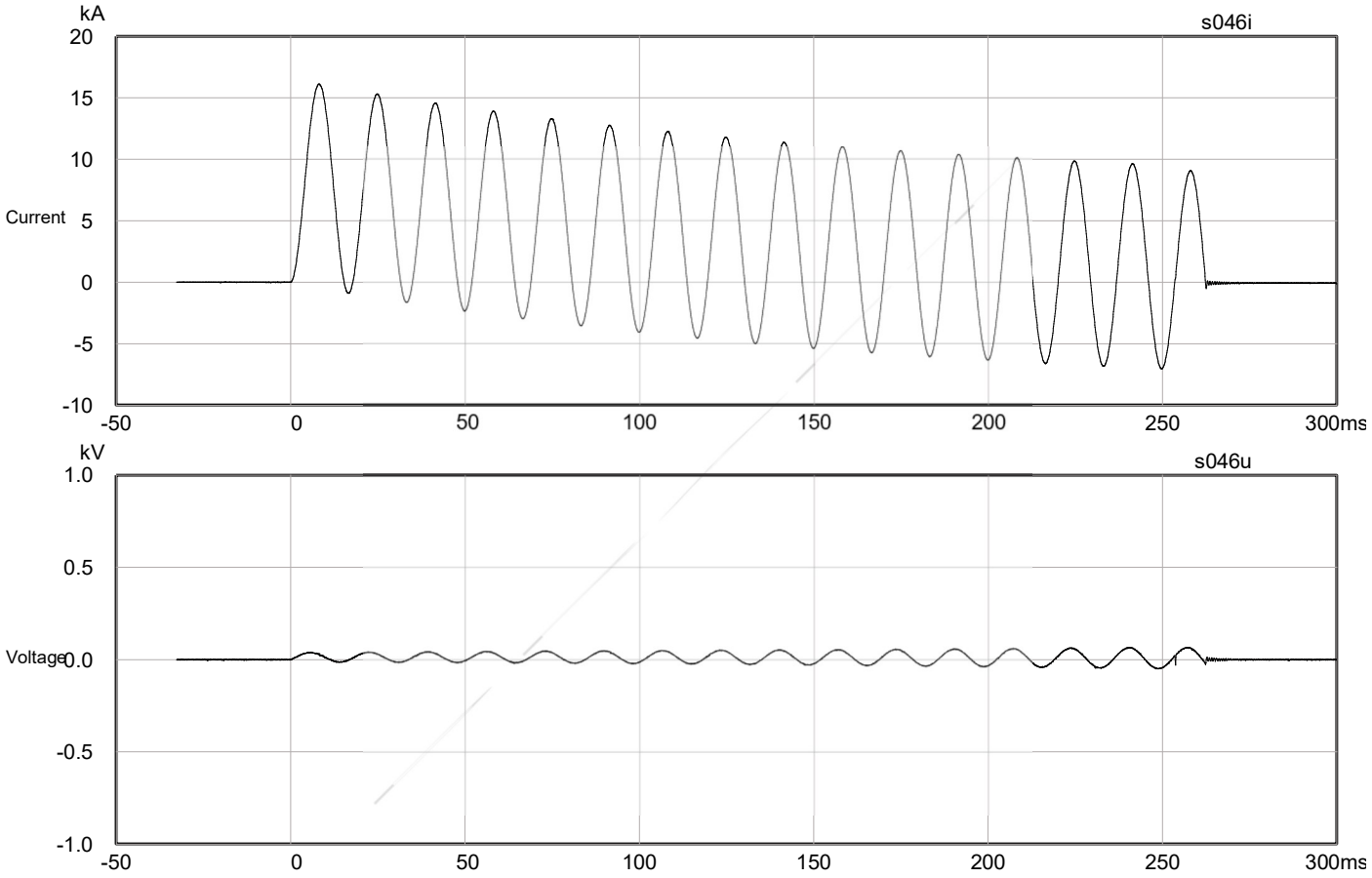



***Figure 23: Waveforms for Test #16-2, Encore #6 AWG Sample 25.***

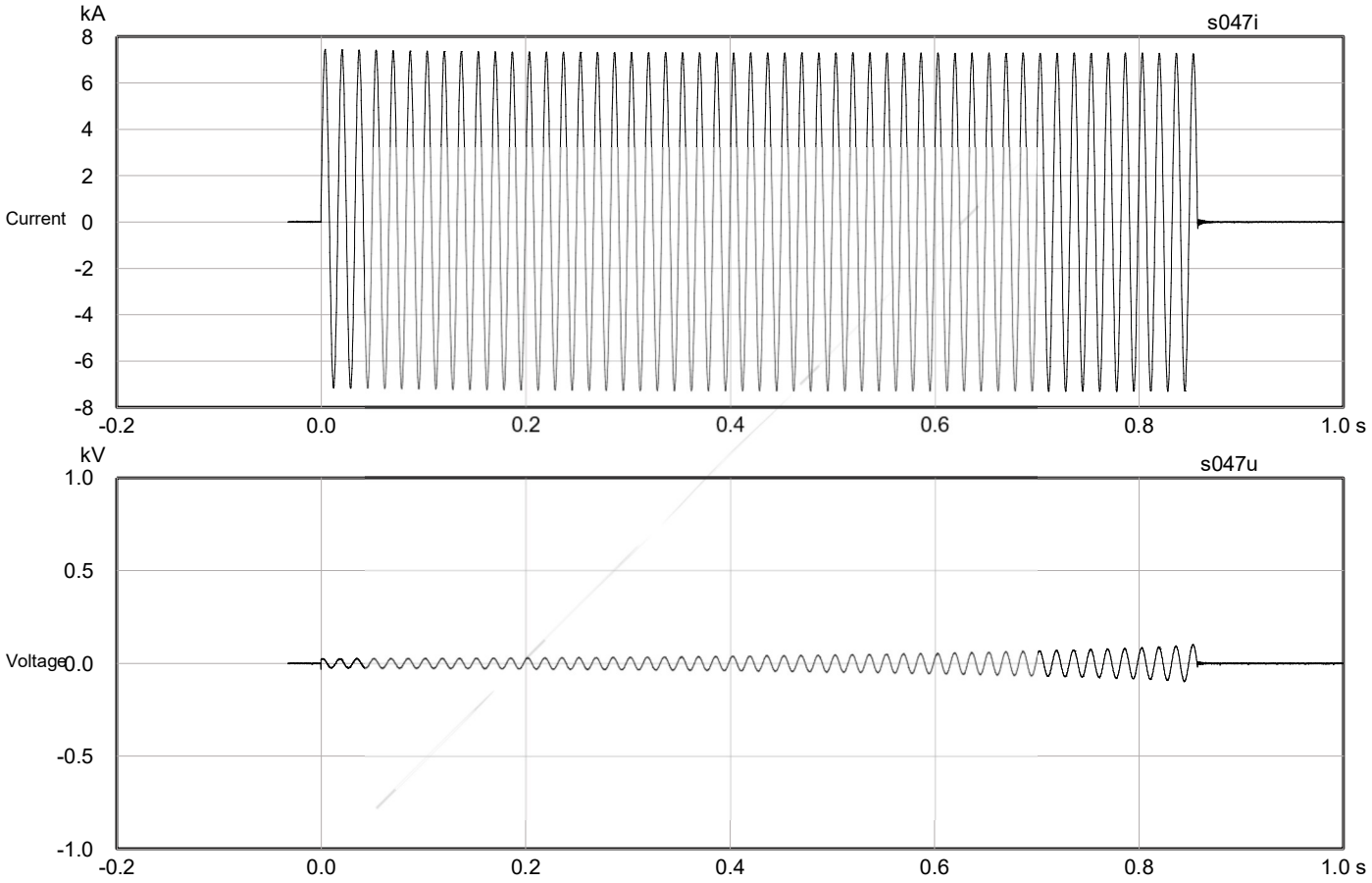



***Figure 24: Waveforms for Test #17, Encore #6 AWG Sample 31.***

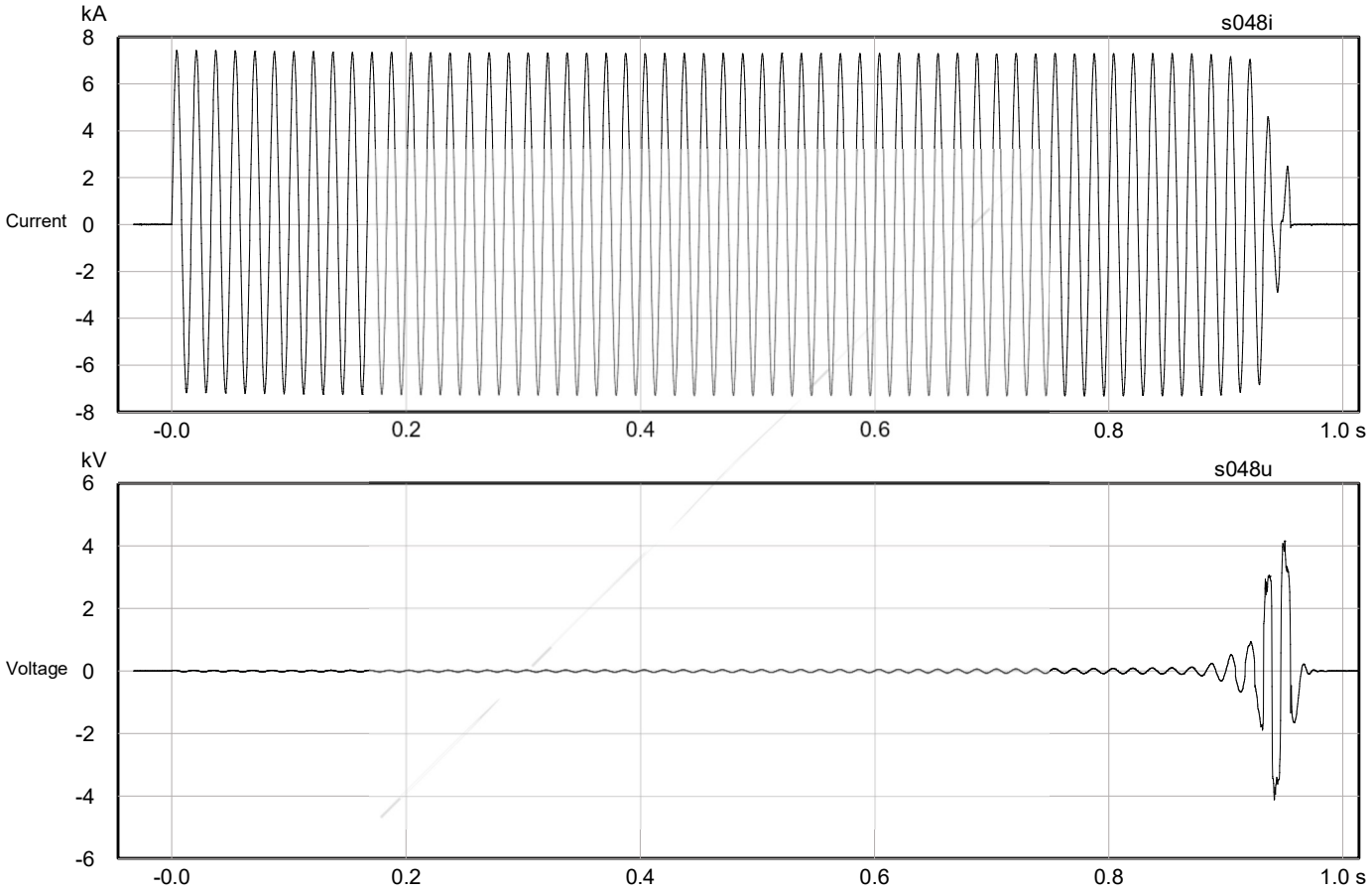



***Figure 25: Waveforms for Test #18, Copperweld Scorpius 7 x 080 Sample 32.***

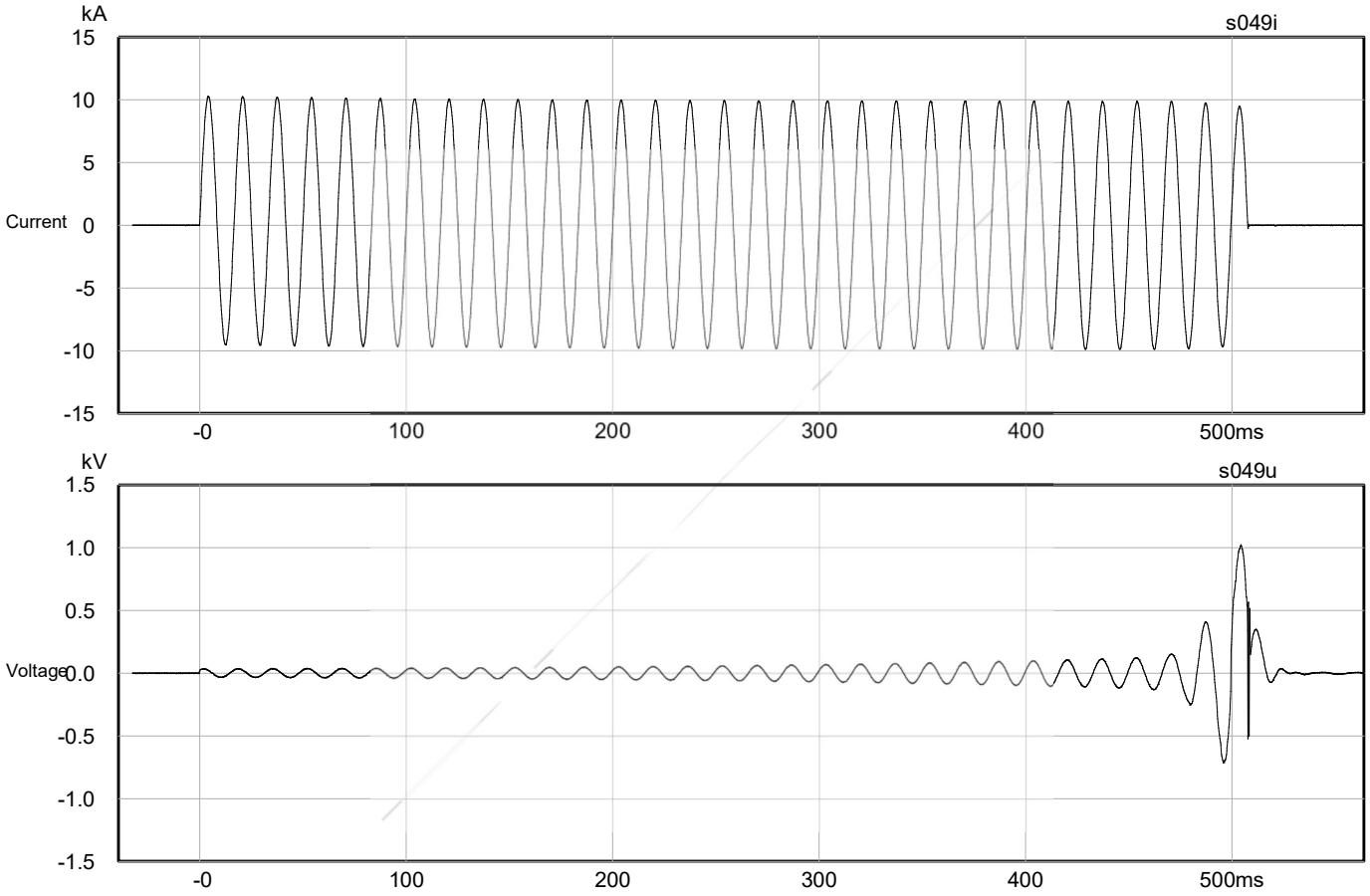



***Figure 26: Waveforms for Test #19, Copperweld Scorpius 7 x 080 Sample 33.***

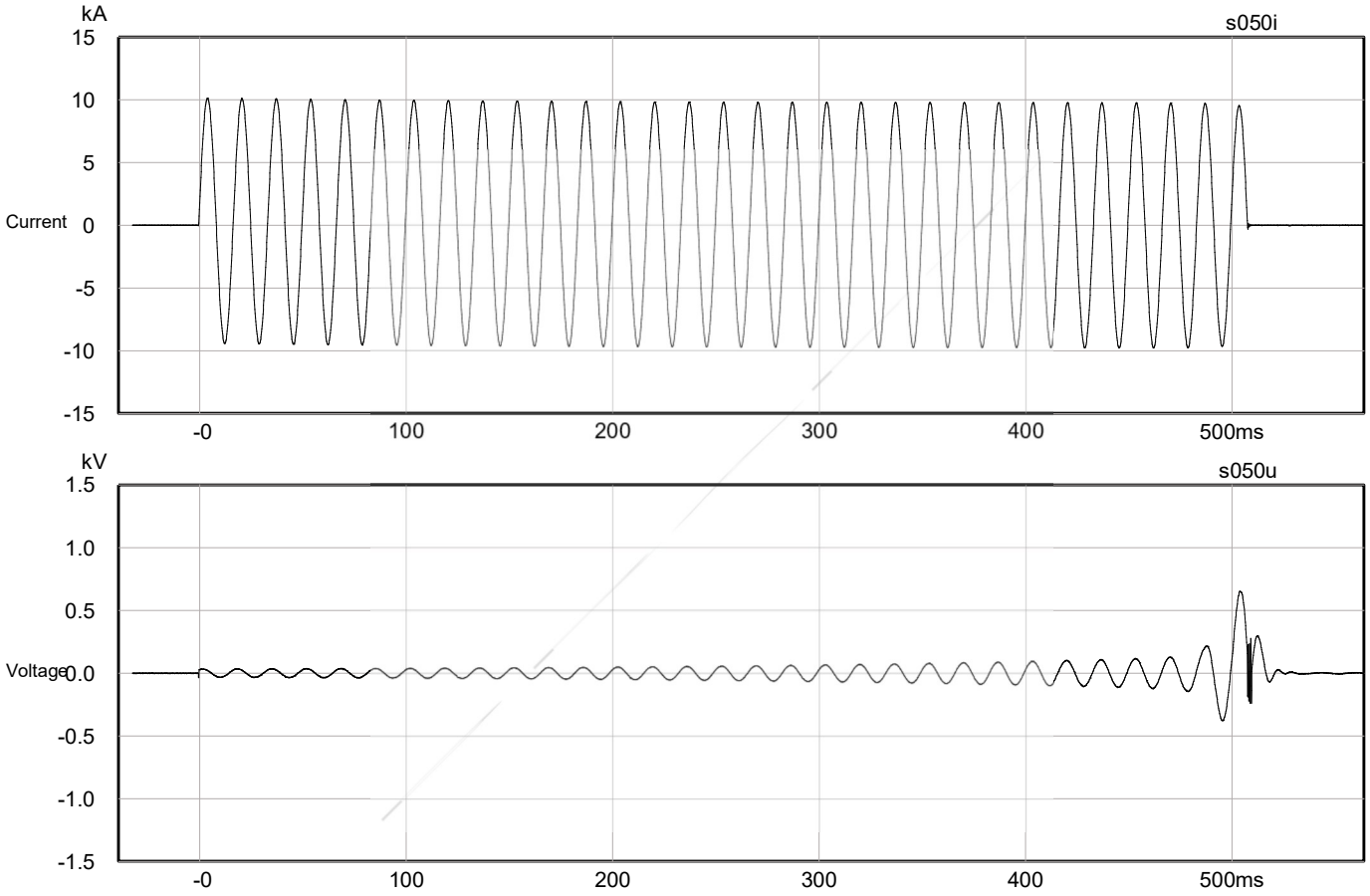



***Figure 27: Waveforms for Test #20, Copperweld Scorpius 7 x 080 Sample 34.***

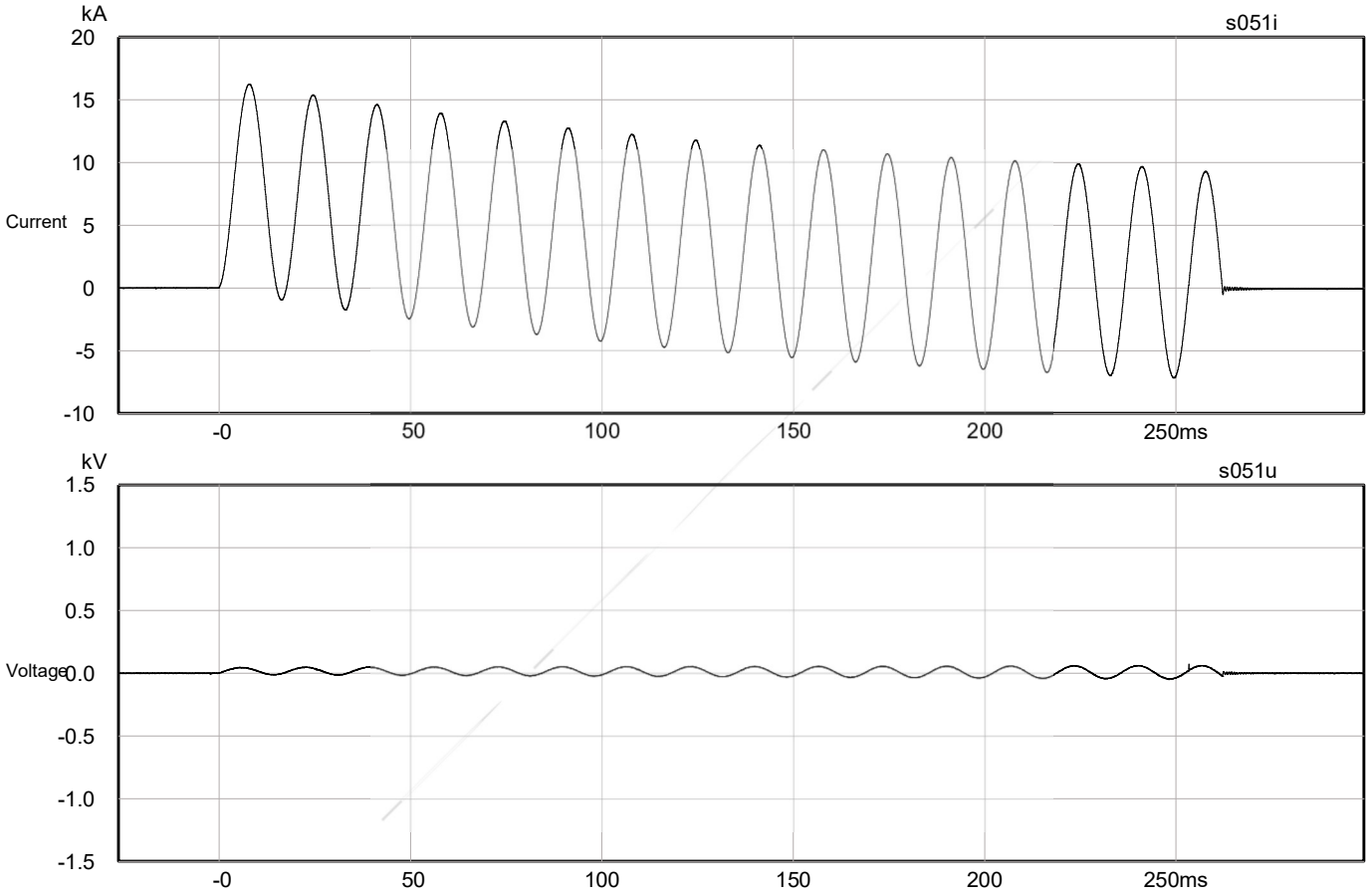



***Figure 28: Waveforms for Test #21-1, Copperweld Scorpius 7 x 080 Sample 35.***

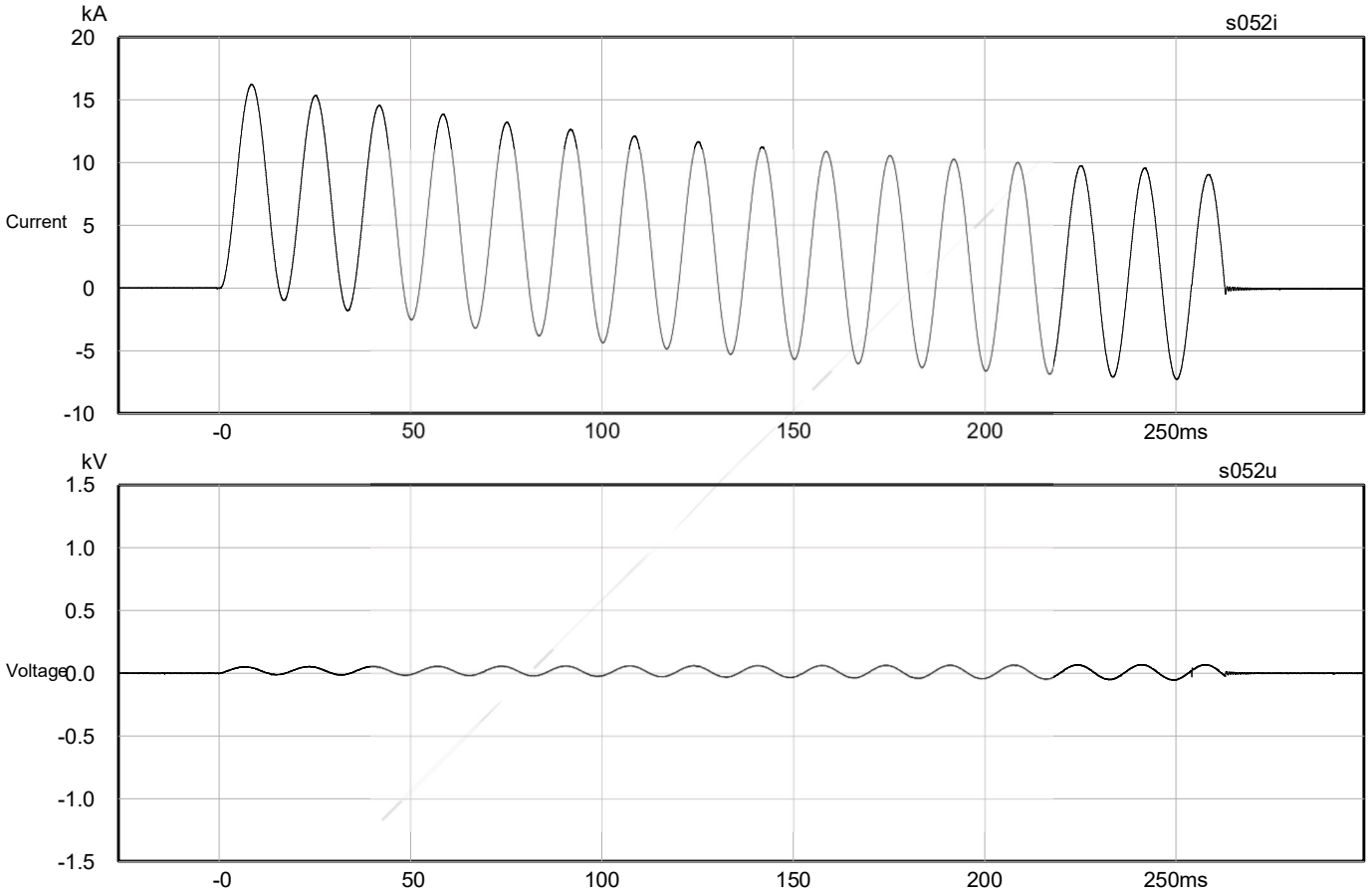



***Figure 29: Waveforms for Test #21-2, Copperweld Scorpius 7 x 080 Sample 35.***

## APPENDIX C – PHOTOGRAPHS OF THE TEST OBJECTS



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



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



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



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

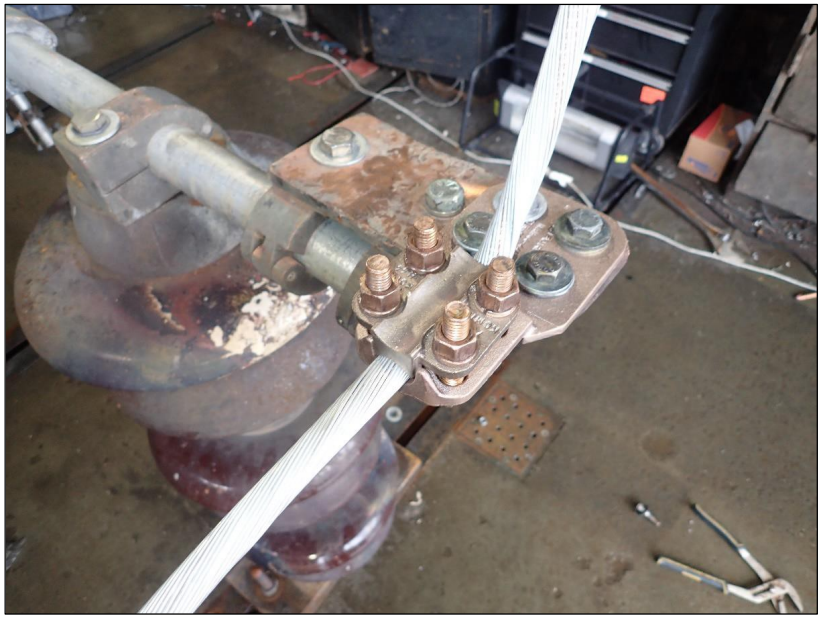


*Figure 34: Typical Burndy terminal connector used to connect the Encore 4/0 AWG or Copperweld Scorpius 61 x 072 CCS conductors to the laboratory buses.*

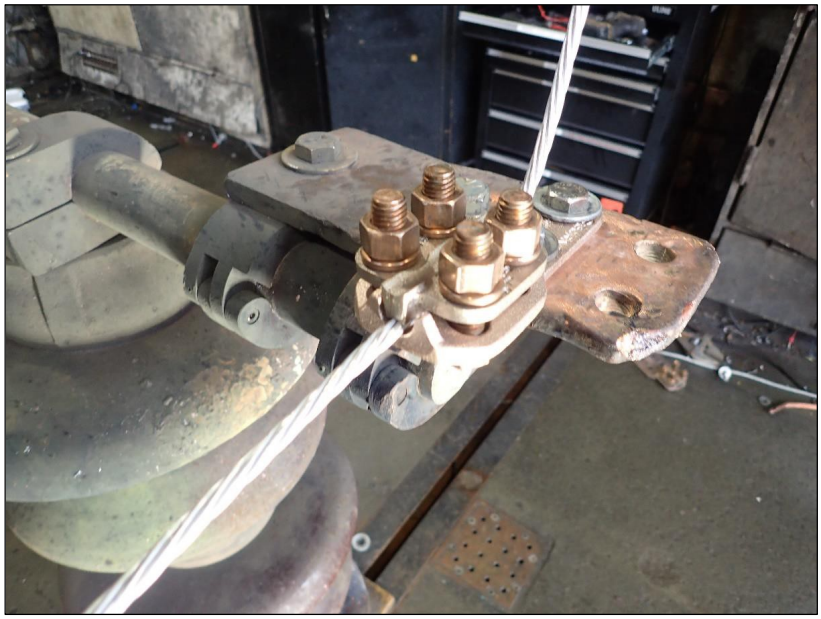


*Figure 35: Typical Burndy terminal connector used to connect the Encore #6 AWG or Copperweld Scorpius 7 x 080 CCS conductors to the laboratory buses.*

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

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

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

where

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

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

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

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

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

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

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

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

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

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

**Copperweld Bimetallics**
**Electrical Test Laboratory**

Data Sheet Packet

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

## Table of Contents


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Test Equipment Used.....3

Sample Identification.....3

Test Setup & Description.....4

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## Test Report Summary

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

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

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

## Test Equipment Used

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

VBU – Verify Before Use

N/A – Not Applicable

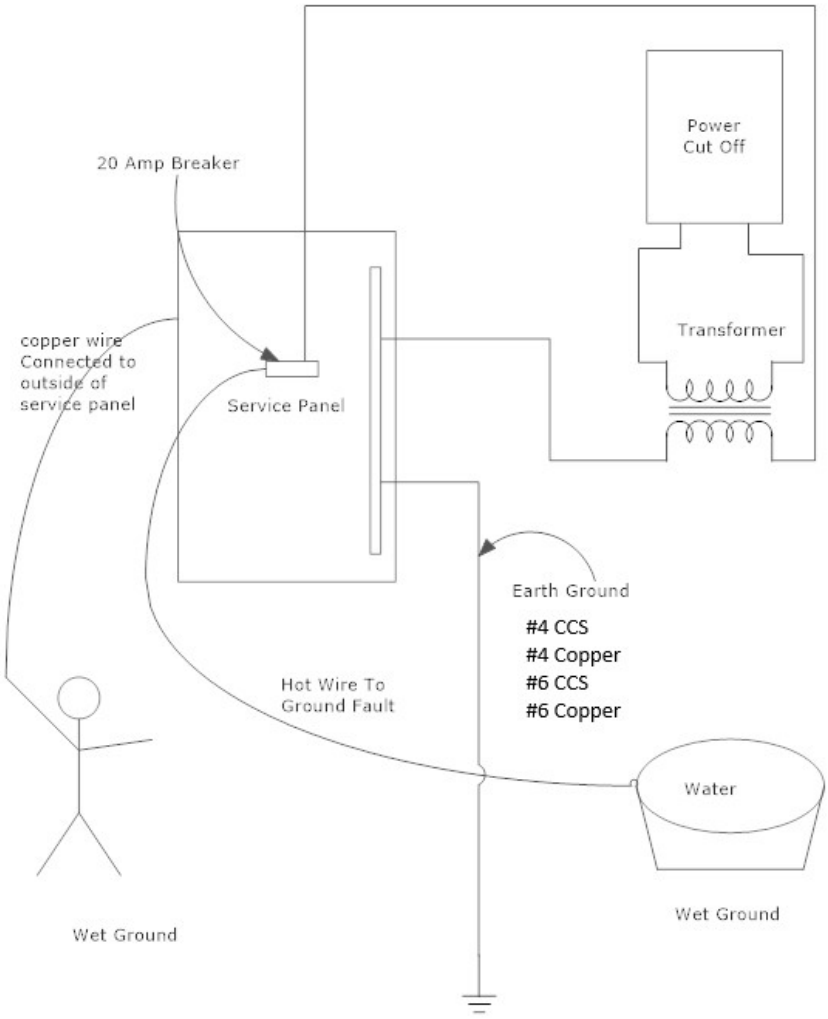
## Sample Identification

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

## Grounding Electrode Conductor Test

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

**Figure 1**




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

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

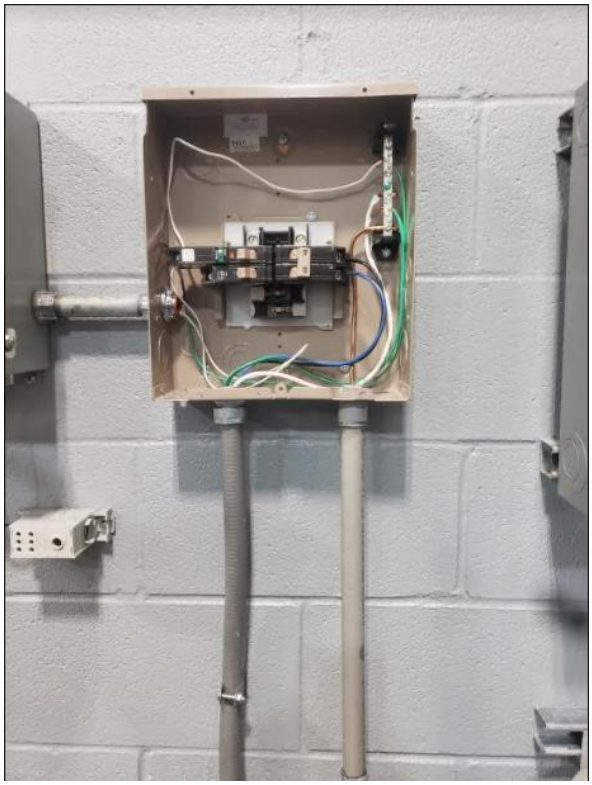
| **Comments:** |
| --- |
| ____X__ (Pass) The product complies with all applicable requirements of this test.<br><br>_____ (Fail) The product does not comply with the requirements of this test.<br><br>**Test Date: 8/25/2020** **Tested By: Bill Lewey** |

Environmental Conditions during Testing:

Humidity: % rh __74%_____ Ambient: °C___28_____

Test setup for the electrical service panel







Ground Rod with Grounding Conductor Attached



Ground Fault



Grounded “man”

## Public Input No. 2512-NFPA 70-2020 [ Section No. 770.106(B) ]

**(B)** Bonding.

The grounding electrode shall be bonded to the metal frame or available grounding terminal of the mobile home with a copper-clad steel or copper conductor not smaller than 12 AWG under either of the following conditions:

(1) Where there is no mobile home service equipment or disconnecting means as in 770.106(A)

(2) Where the mobile home is supplied by cord and plug

## Additional Proposed Changes

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

## Statement of Problem and Substantiation for Public Input

Grounding Electrode Conductor Purpose:

The purpose of the grounding electrode system, grounding electrode(s) and grounding electrode conductor(s) is to provide a connection to earth for the electrical system and equipment. The grounding electrode system functions to limit errant voltages caused by lightning, transients and high voltage line clashes. For grounded systems it stabilizes the voltage of the electrical system during normal operations and keeps the voltage to ground at predictable limits. A grounding electrode conductor must be both strong and conductive. It should be strong enough mechanically to withstand high current/frequency (A/Hz) lightning strikes as well as any damage from normal use. Where terminated in or near ground level, it must be corrosion resistant. Finally, a grounding electrode conductor must be able to be connected with standard industry-accepted connectors that are used within the grounding electrode system.

Grounding Electrode Conductor Materials:

The present materials permitted for grounding electrode conductors are copper, aluminum and copper-clad aluminum. The aluminum and copper-clad aluminum are limited in use by 250.64(A) where the bare conductor is in or near the ground or concrete at grade level. Grade 40 Copper-Clad Steel (40CCS), a copper bimetal, is another alternative designed for use as a grounding electrode conductor (GEC) and should be added to the NEC®. It is governed by ASTM B910/B910M-2007, the Standard Specification for Annealed Copper-Clad Steel Wire. The standard's scope states the following: This specification covers bare round copper-clad steel for the following applications: electrical, electronic, grounding, telecommunications, and other applications. Per the standard, the minimum tensile strength for all wire diameters must be higher than 40,000 PSI, which would elevate the strength of

GEC materials currently provided in Article 250. The shear modulus of Grade 40CCS is 11,600 KSI. Because ASTM B910 requires 40CCS to be annealed (softened), the material is sufficiently pliable to allow for traditional installation practices for GEC's. Increased mechanical strength of a GEC elevates the protection of an electrical installation in two ways: 1) the GEC can better withstand fusing during ultra-high A/Hz lightning strikes (see connector and fusing discussions below); 2) the GEC is noticeably more difficult to cut without proper tools, which aids as a theft deterrent when thieves attempt to remove it. Additionally, Copper Clad Steel has no scrap value, which also disincentives theft.

Terminations and Connectors:

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

Corrosion Resistance:

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

Resistance to Fusing at High Currents:

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

Conductivity:

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

Current NEC® Applications:

Copper Clad Steel as a GEC material is currently referenced in section 810.21(A) of the NEC®. . In addition to the substantiation information provided above for correlation purposes 40CCS should be included in applicate Articles, such as Article 250, and sections that specify grounding electrode conductor material. Public inputs have been submitted for this action in a number of sections.

Listing:

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

packaging also provides the installer and inspector the information needed to make and approve the installation.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 2472-NFPA 70-2020 [Section No. 250.102(C)(2)] | Copper-Clad Steel Bonding Conductors |

## Submitter Information Verification

**Submitter Full Name:** Peter Graser
**Organization:** Copperweld
**Affiliation:** American Bimetallic Association
**Street Address:**
**City:**
**State:**
**Zip:**
**Submittal Date:** Sun Aug 23 17:29:32 EDT 2020
**Committee:** NEC-P16

*Testing done for the safety of our valued customer.*

# Global Circulation Laboratory Test Report

*For Global Distribution*

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

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

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

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

**TD002391 REV B**

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

TD002391

# Global Circulation Laboratory Test Report

*For Global Distribution*

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**Burndy LLC** 47 East Industrial Park Dr.
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# Global Circulation Laboratory Test Report

*For Global Distribution*

## PURPOSE OF TEST:

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

## TEST REQUESTED:

UL486A-486B Mechanical Sequence
UL467 Short Time Current

## TEST RESULTS:

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

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# Global Circulation Laboratory Test Report

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## CONCLUSIONS:

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

## TEST PROCEDURES

The table below shows the connector / conductor combinations tested.

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

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# Global Circulation Laboratory Test Report

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

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

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

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

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

## TEST EQUIPMENT LIST:

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

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# CORROSION ON BURIED COPPER CLAD STEEL




Cece Syarif

Global Application Engineer

&

Anthony Hale

Manager, Utility Products, North America

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

COPPERWELD

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

July 26, 2011

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

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

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

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

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

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

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

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

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



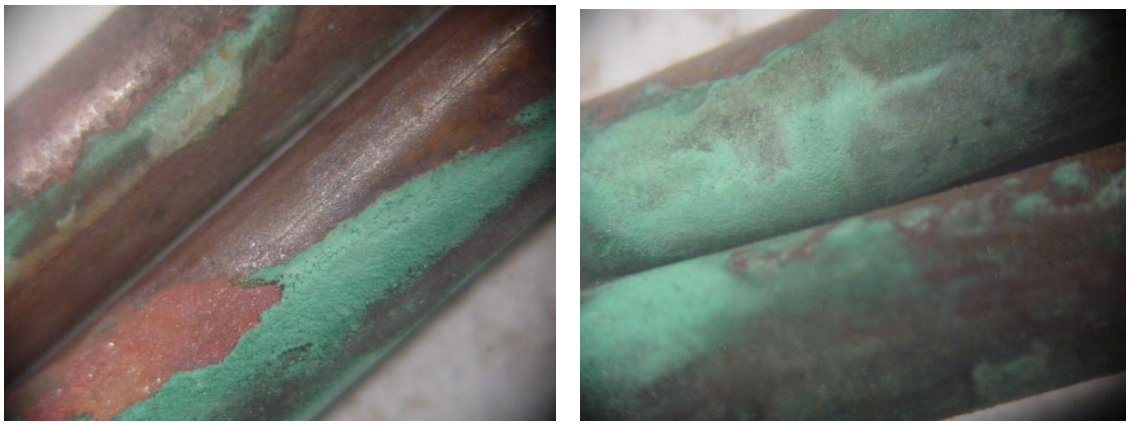
Figure 1: Example of Underground Corrosion of Copper Clad Steel

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

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

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



(a) Copper Clad Steel (b) Copper

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

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

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

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

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

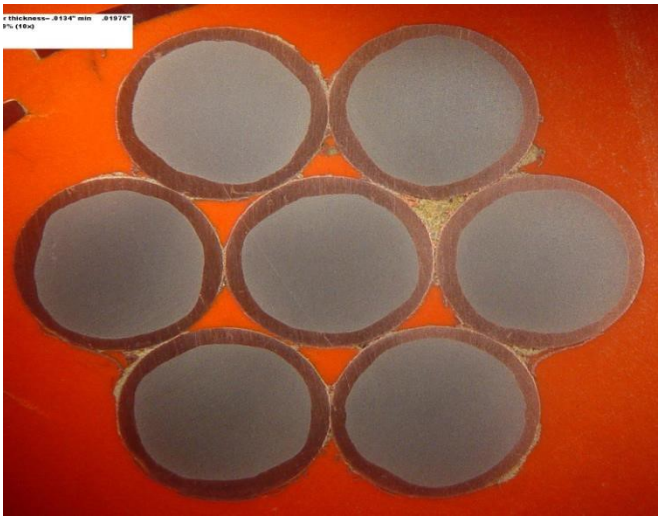


Figure 3: Copperweld® 40% LC DSA 7 No. 5 manufactured in 1962

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



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

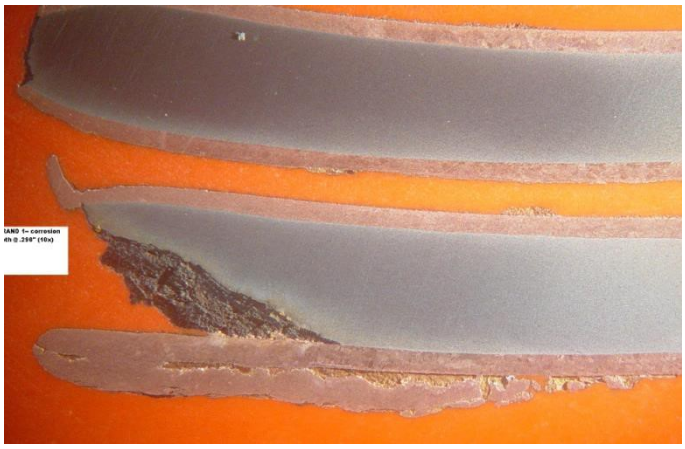


Figure 4b: Corrosion occurred at the ends of the wires. Maximum penetration depth is 0.859 inch.

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

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

**REFERENCES:**

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

Powertech

*Report ID: PL-03027 REP1*
*Revision: 0  Issued: 2020-04-15*

# Copper and CCS Wire Withstand Current and Fusing Current Tests

Copperweld Bimetallics, LLC




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

Powertech

## REPORT OF PERFORMANCE

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

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

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# 1 INTRODUCTION

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

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

# 2 TEST OBJECT INFORMATION

The test objects were identified by the client as follows:

Copper Clad Steel Wires (CCS)

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

Copper Conductor

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

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

# 3 GENERAL INFORMATION

## 3.1 Purpose

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

## 3.2 Witnesses

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

## 3.3 Tests Performed

**Test Standards/Specifications:**

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

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

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

## 4 SHORT-CIRCUIT CURRENT TESTS

**General Information:**

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

**Environmental Conditions:**

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

**Test Conditions:**

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

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

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

**Test Results:**

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

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

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

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

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

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

## APPENDIX A – FUSING CURRENT TEST CIRCUIT AND DATA

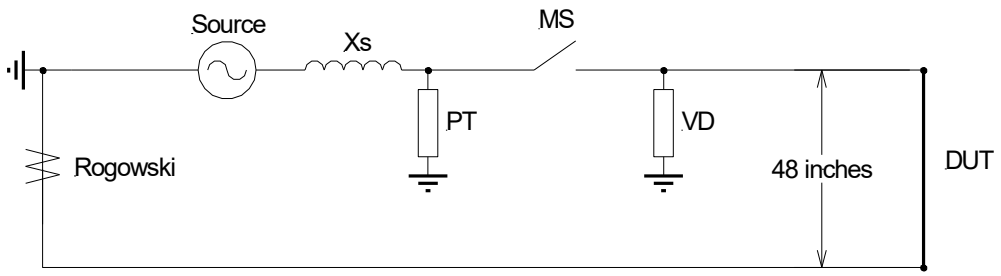



***Figure 1: Test circuit schematic for all tests.***

*Notes:*

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

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

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

Note:

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

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

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

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

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

Notes:

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

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

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

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

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

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

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

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

Notes:

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

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

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

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

## APPENDIX B – WAVEFORMS

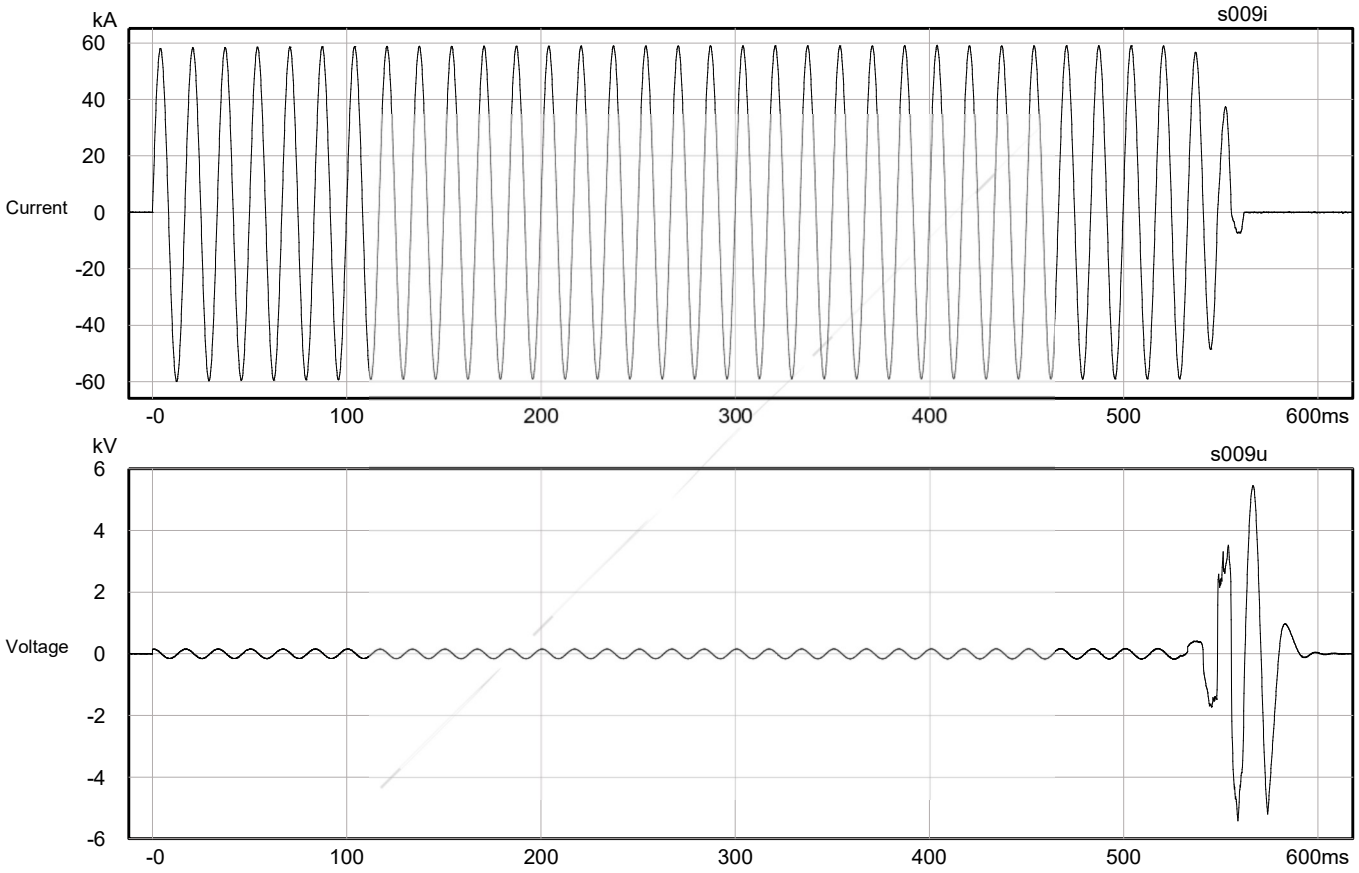



***Figure 2: Waveforms for Test #1, Encore 4/0 AWG Sample 1.***

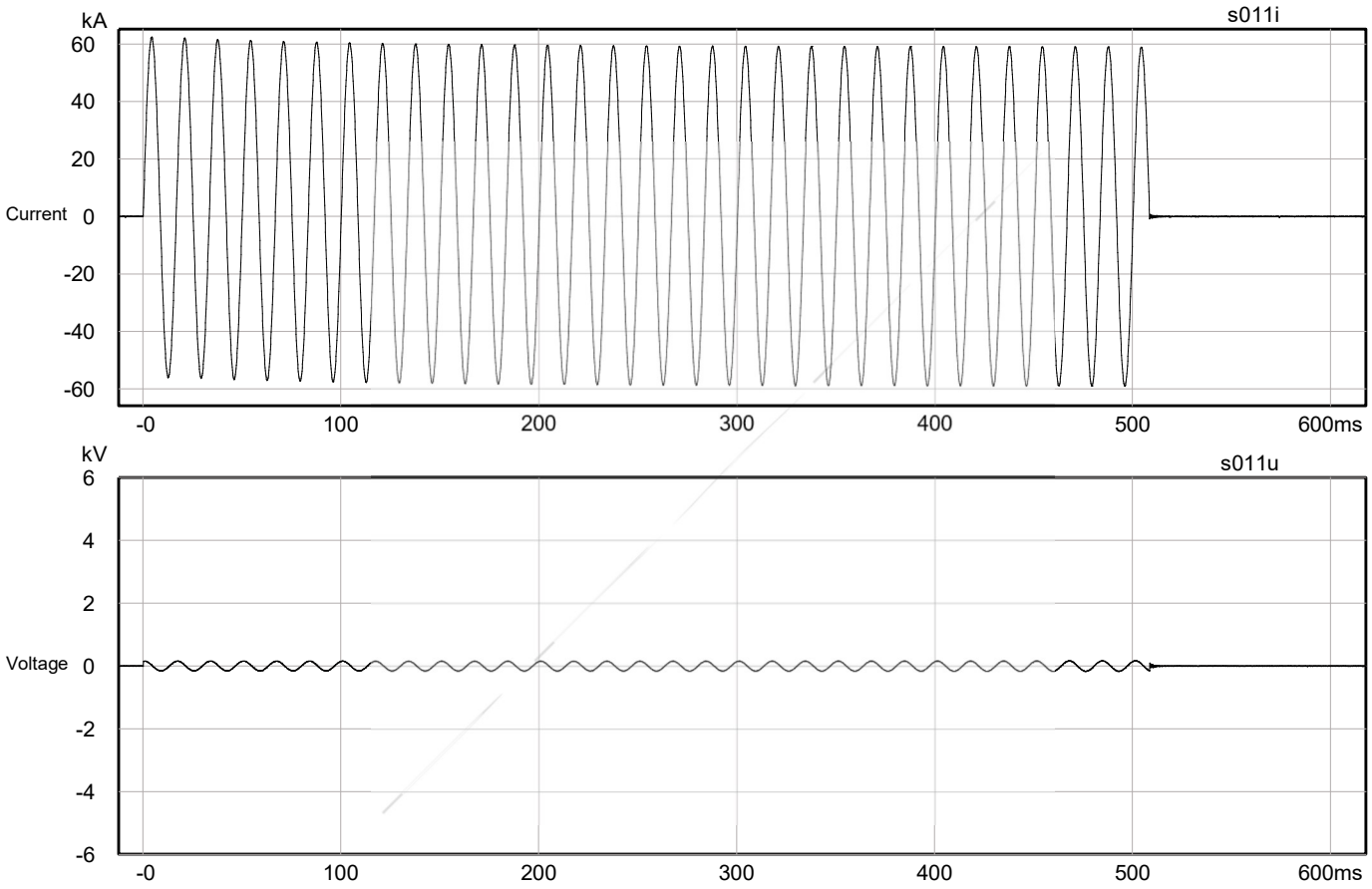



***Figure 3: Waveforms for Test #2, Encore 4/0 AWG Sample 2.***

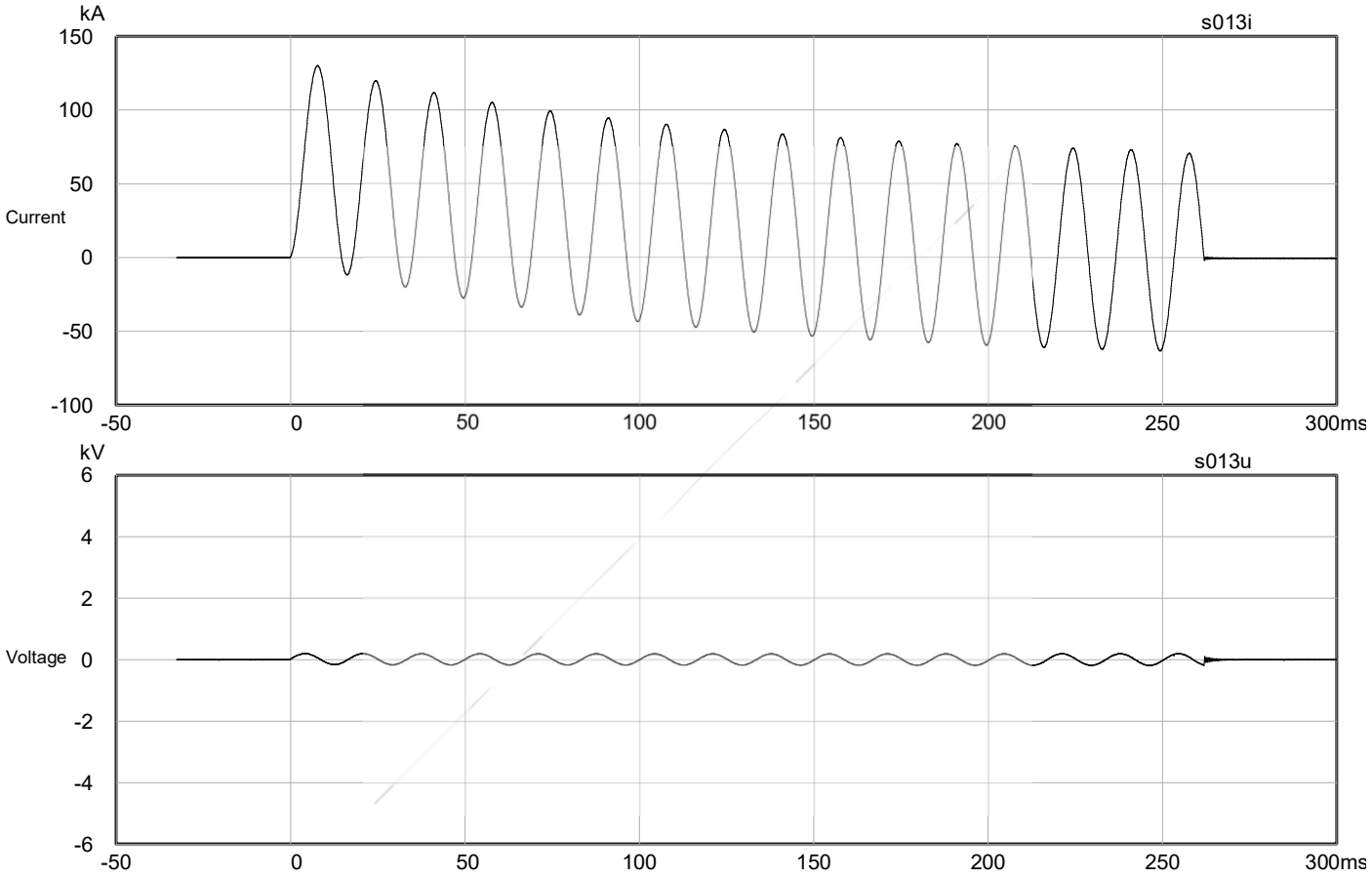



***Figure 4: Waveforms for Test #3-1, Encore 4/0 AWG Sample 3.***

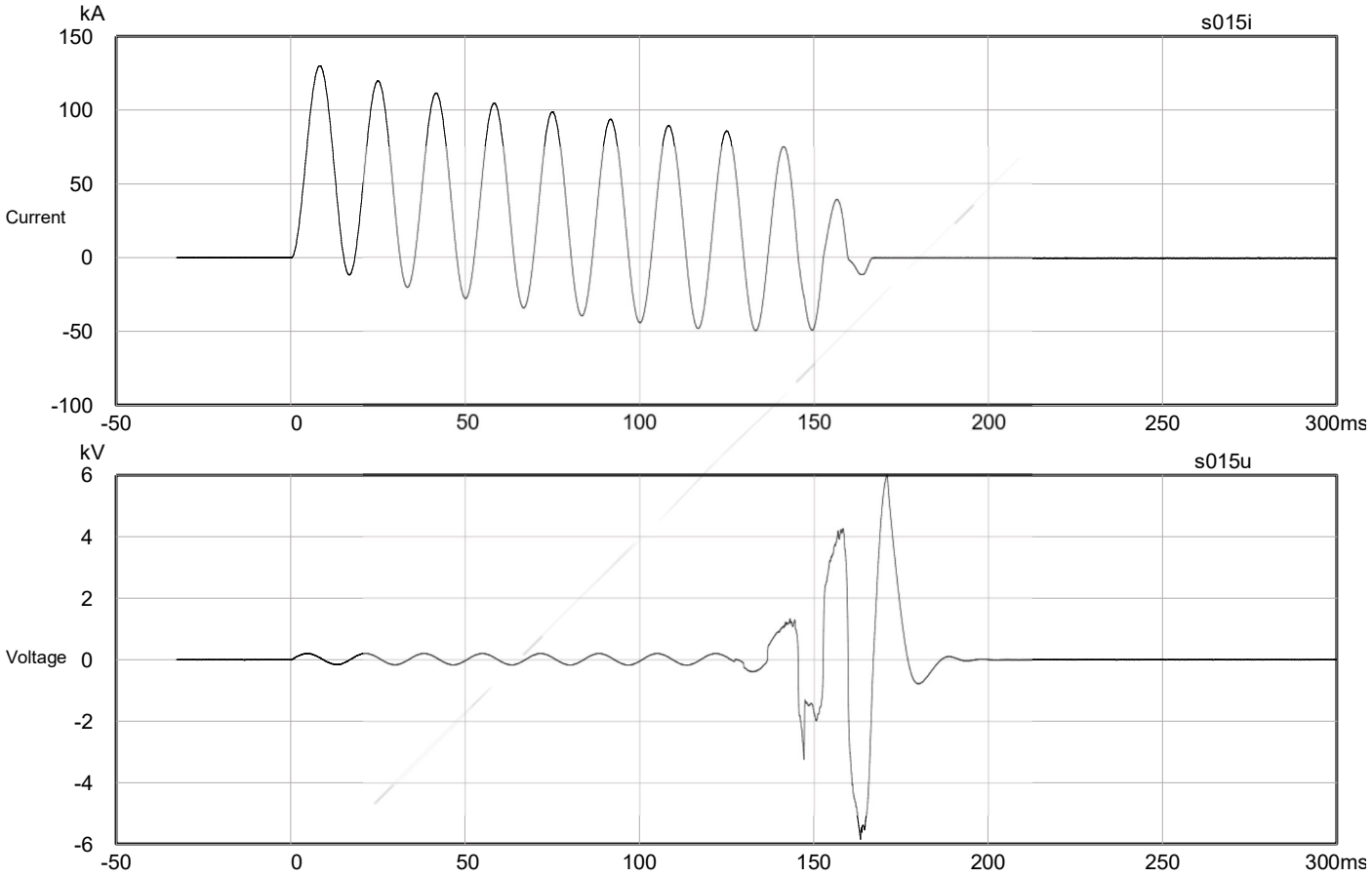



***Figure 5: Waveforms for Test #3-2, Encore 4/0 AWG Sample 3.***

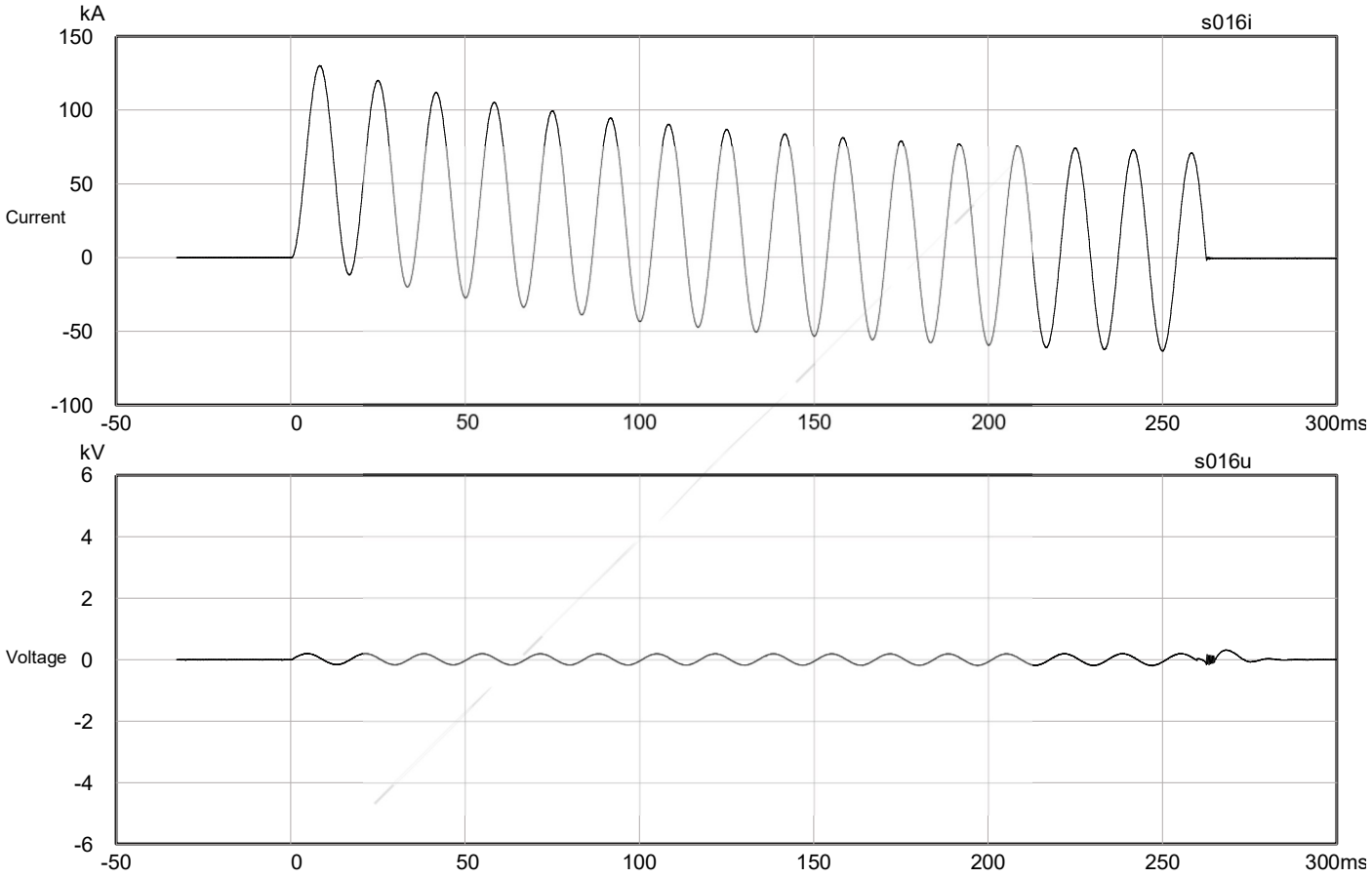



***Figure 6: Waveforms for Test #4, Encore 4/0 AWG Sample 4.***

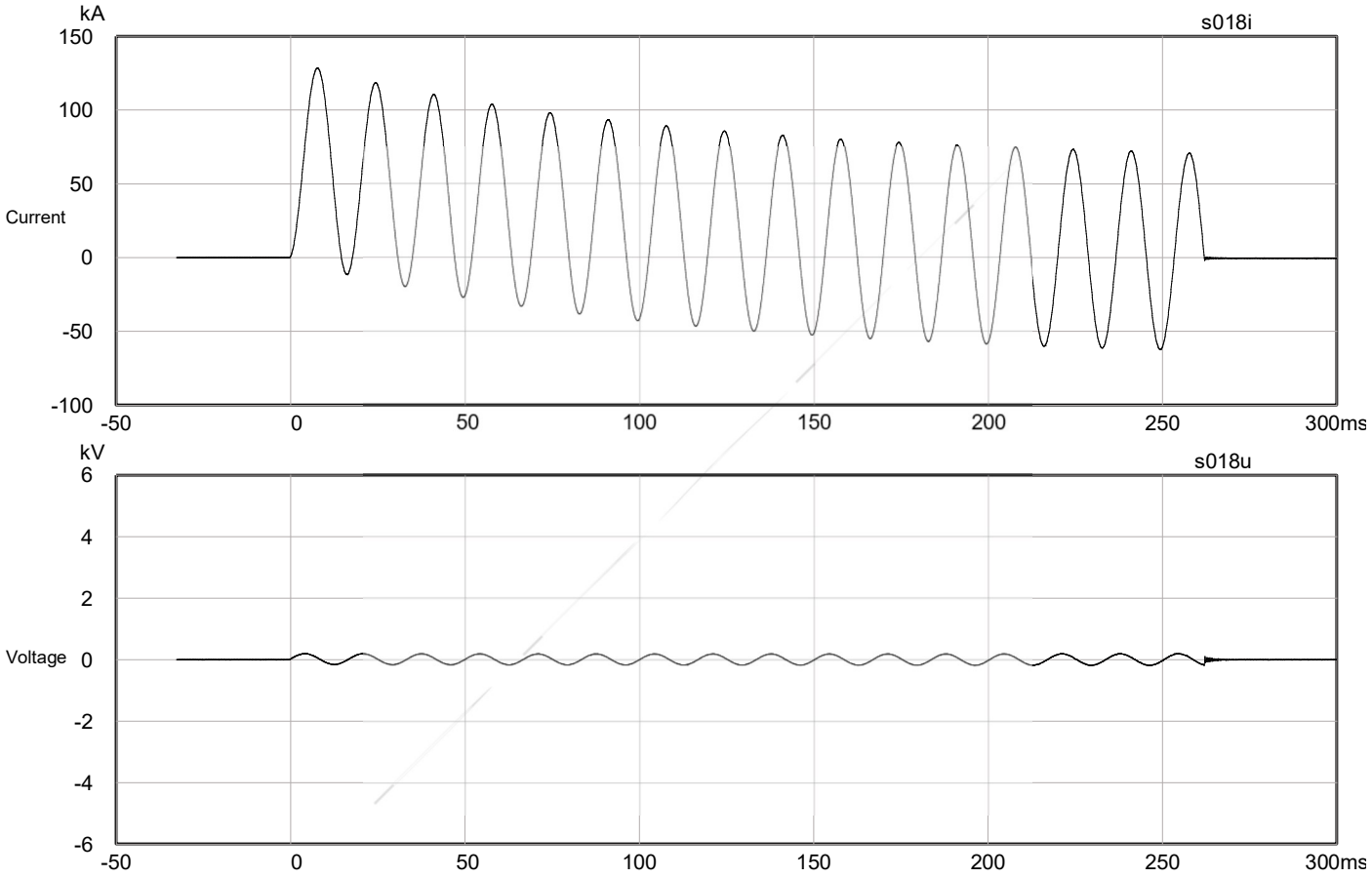



***Figure 7: Waveforms for Test #5-1, Encore 4/0 AWG Sample 5.***

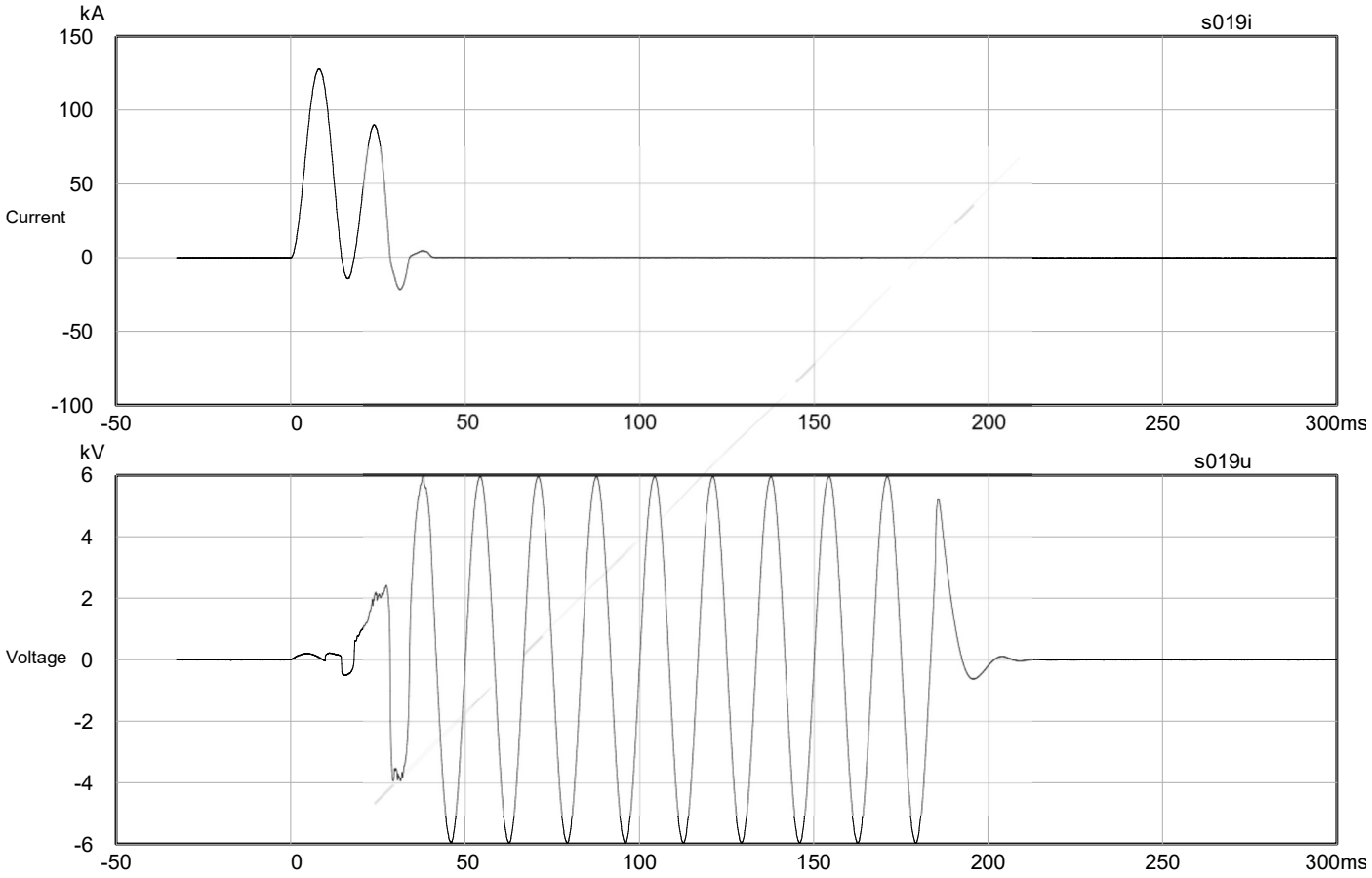



***Figure 8: Waveforms for Test #5-2, Encore 4/0 AWG Sample 5.***

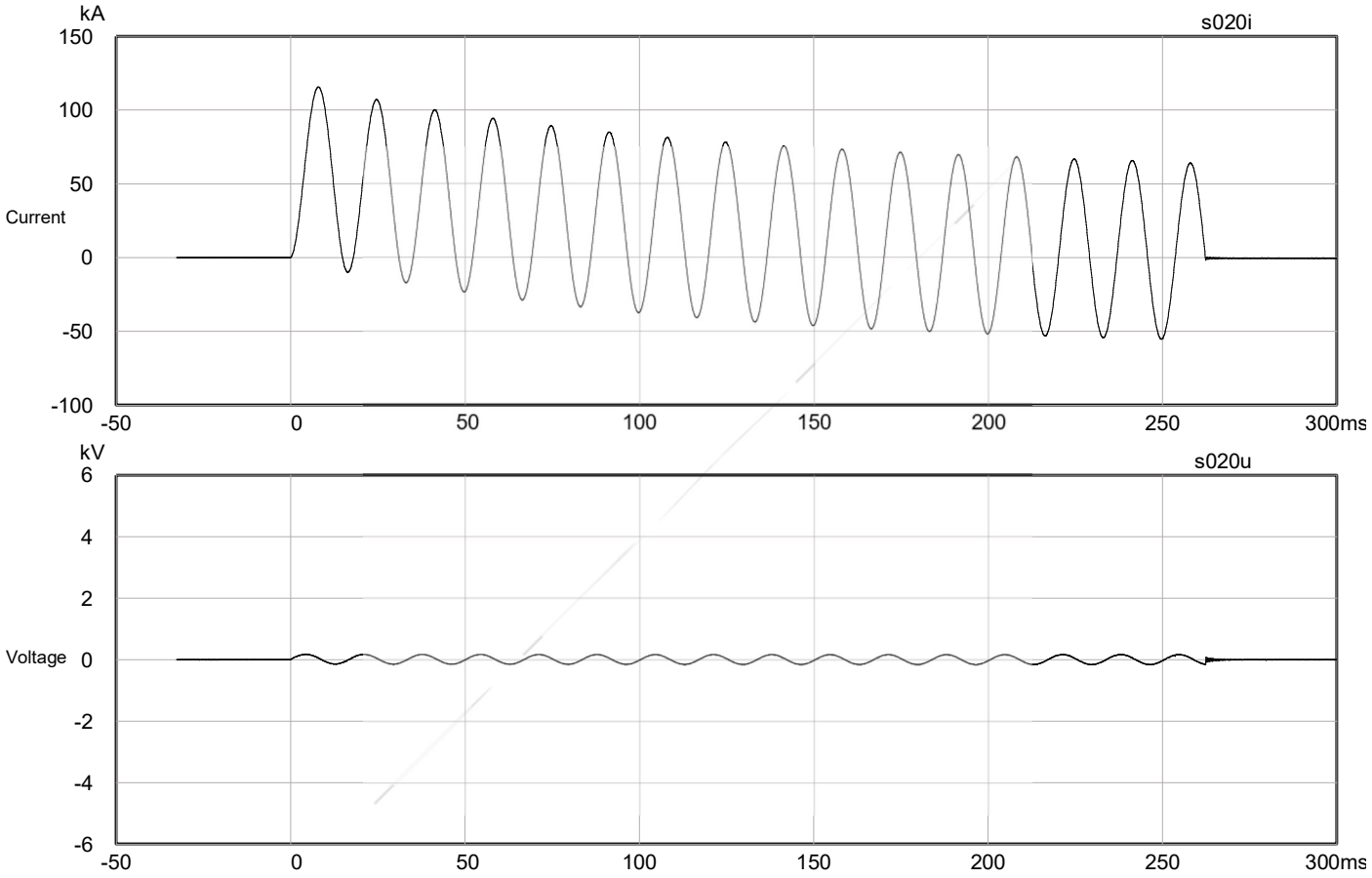



***Figure 9: Waveforms for Test #6-1, Encore 4/0 AWG Sample 6.***

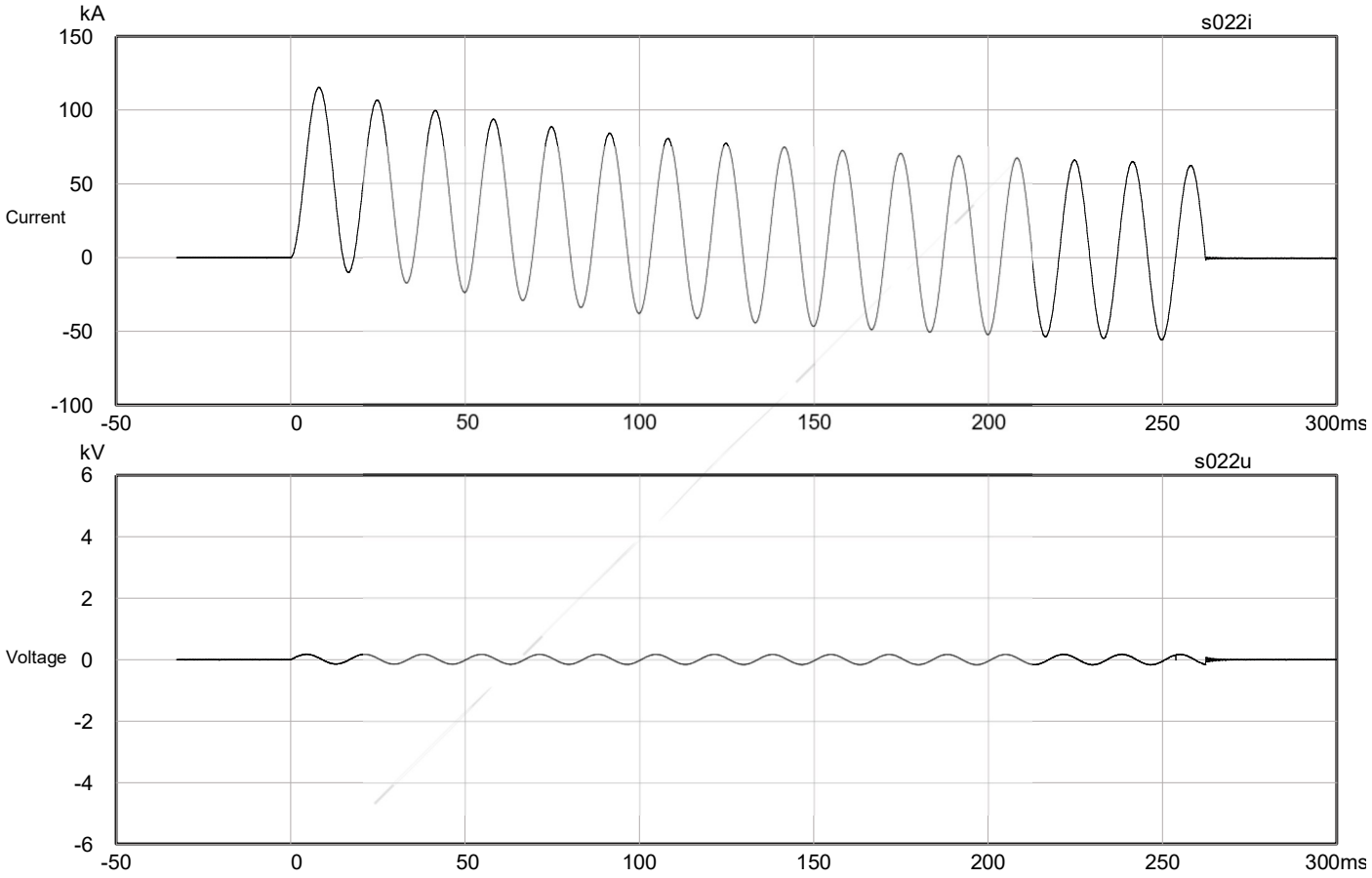



***Figure 10: Waveforms for Test #6-2, Encore 4/0 AWG Sample 6.***

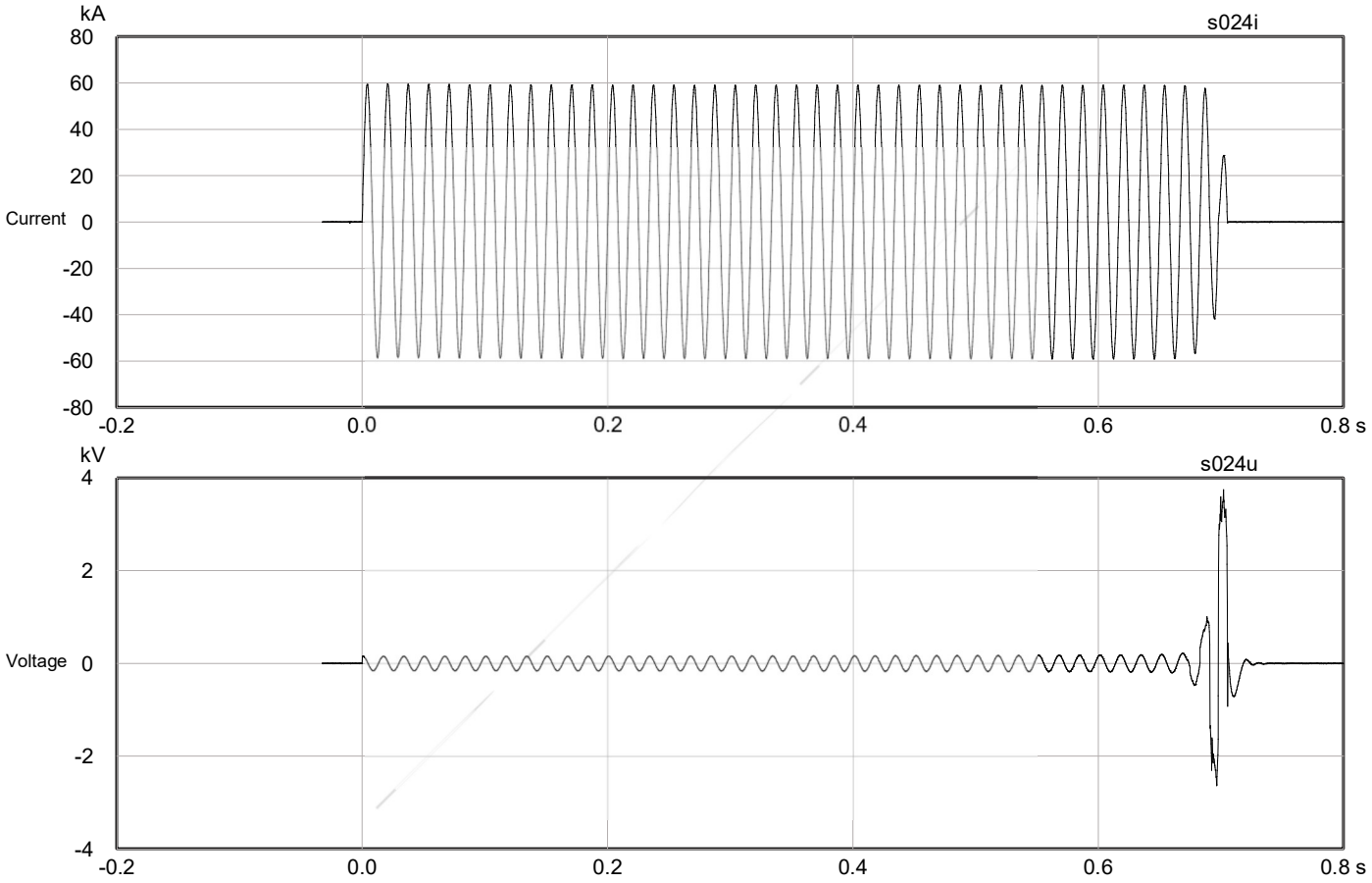



***Figure 11: Waveforms for Test #7, Copperweld Scorpius 61 x 072 Sample 11.***

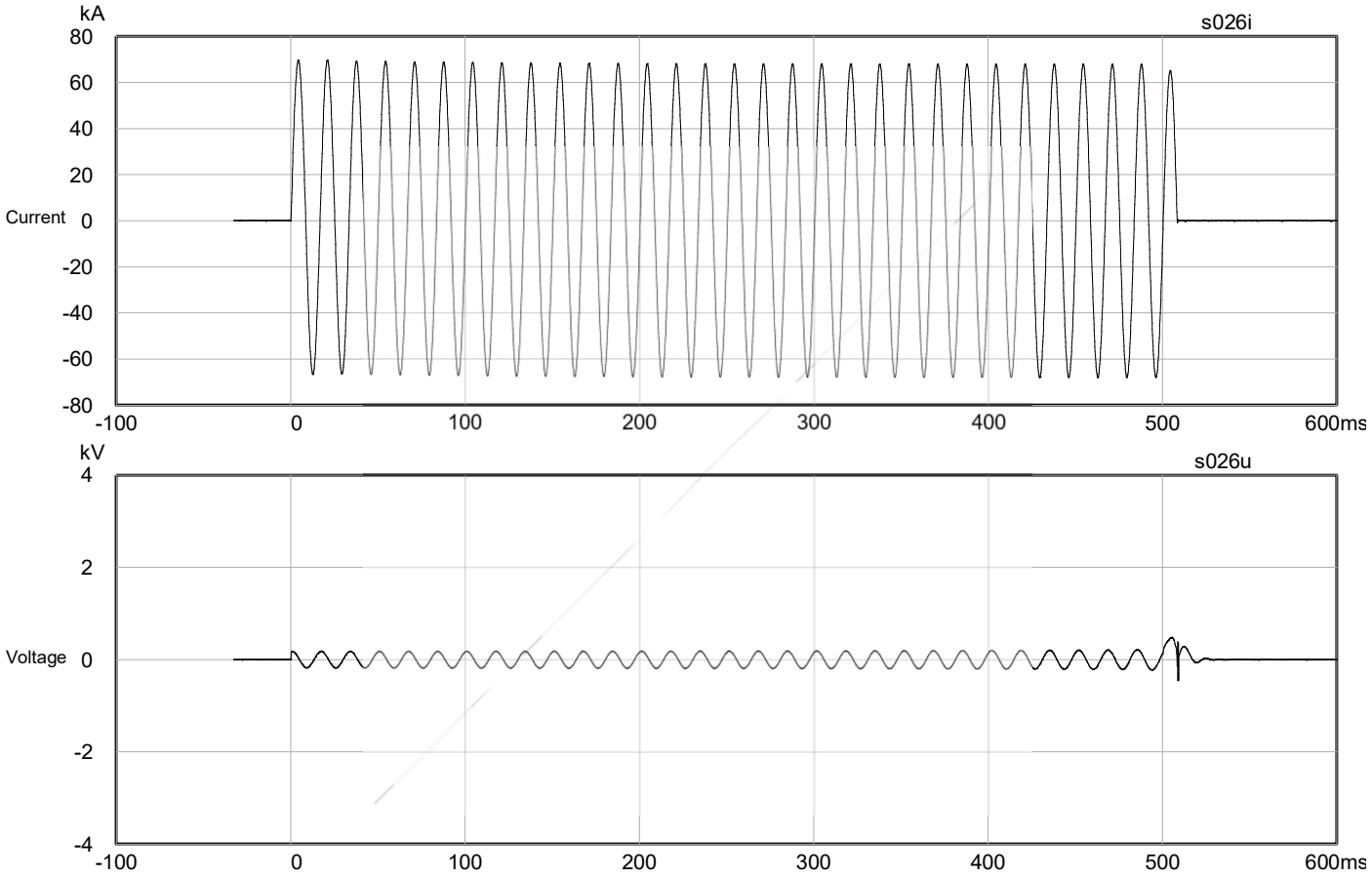



***Figure 12: Waveforms for Test #6, Copperweld Scorpius 61 x 072 Sample 12.***

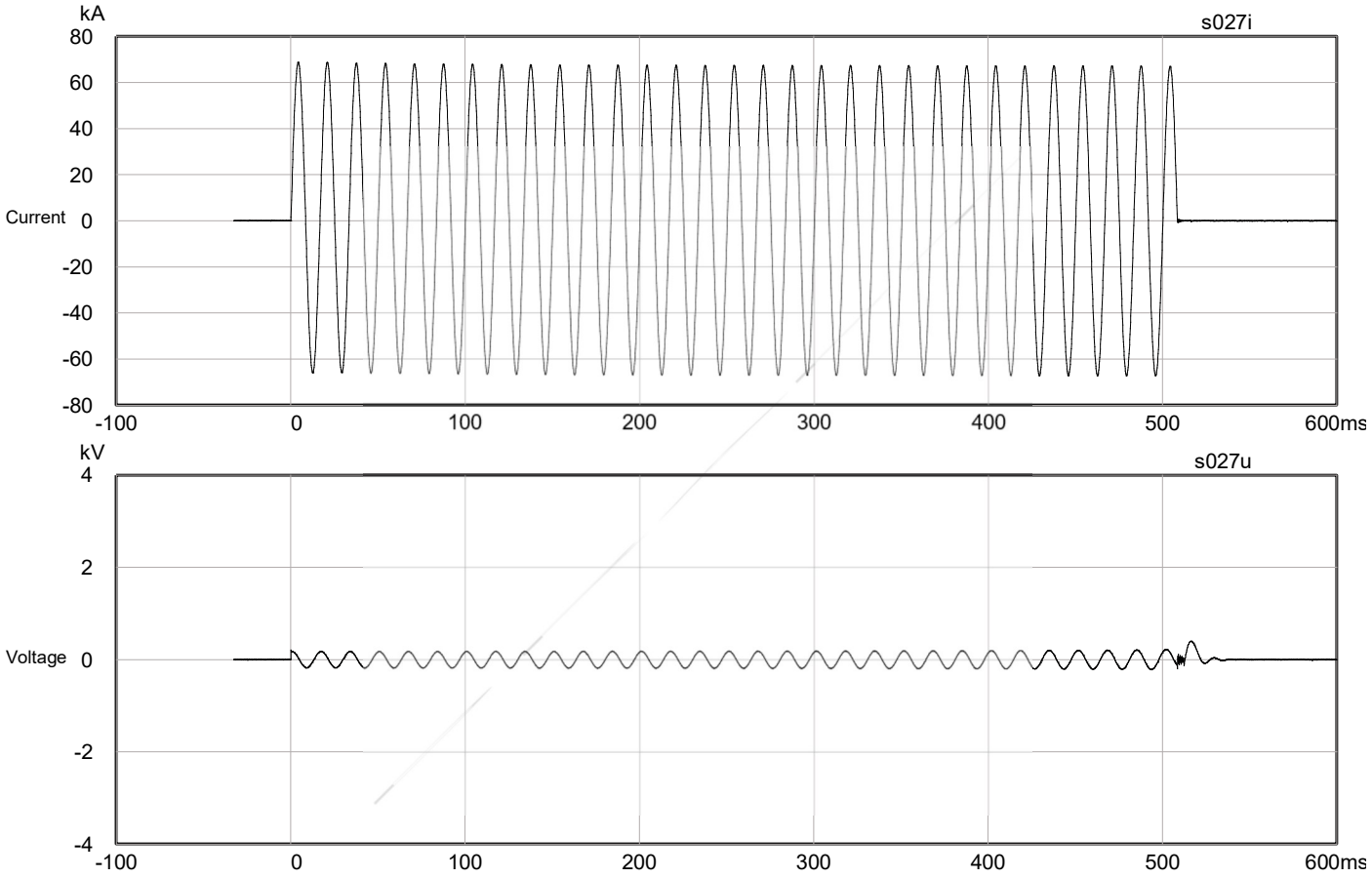



***Figure 13: Waveforms for Test #9, Copperweld Scorpius 61 x 072 Sample 13.***

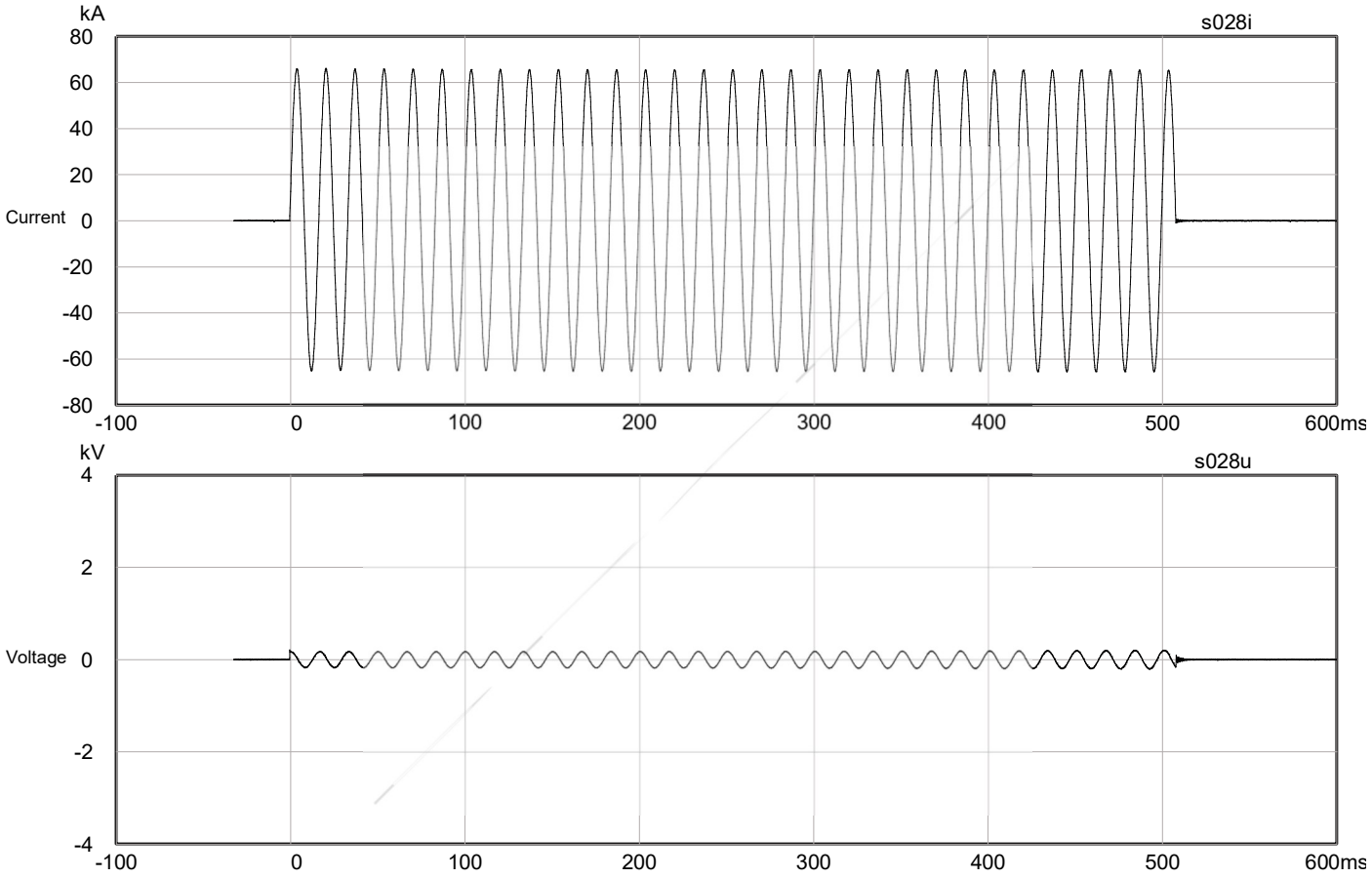



***Figure 14: Waveforms for Test #10, Copperweld Scorpius 61 x 072 Sample 14.***

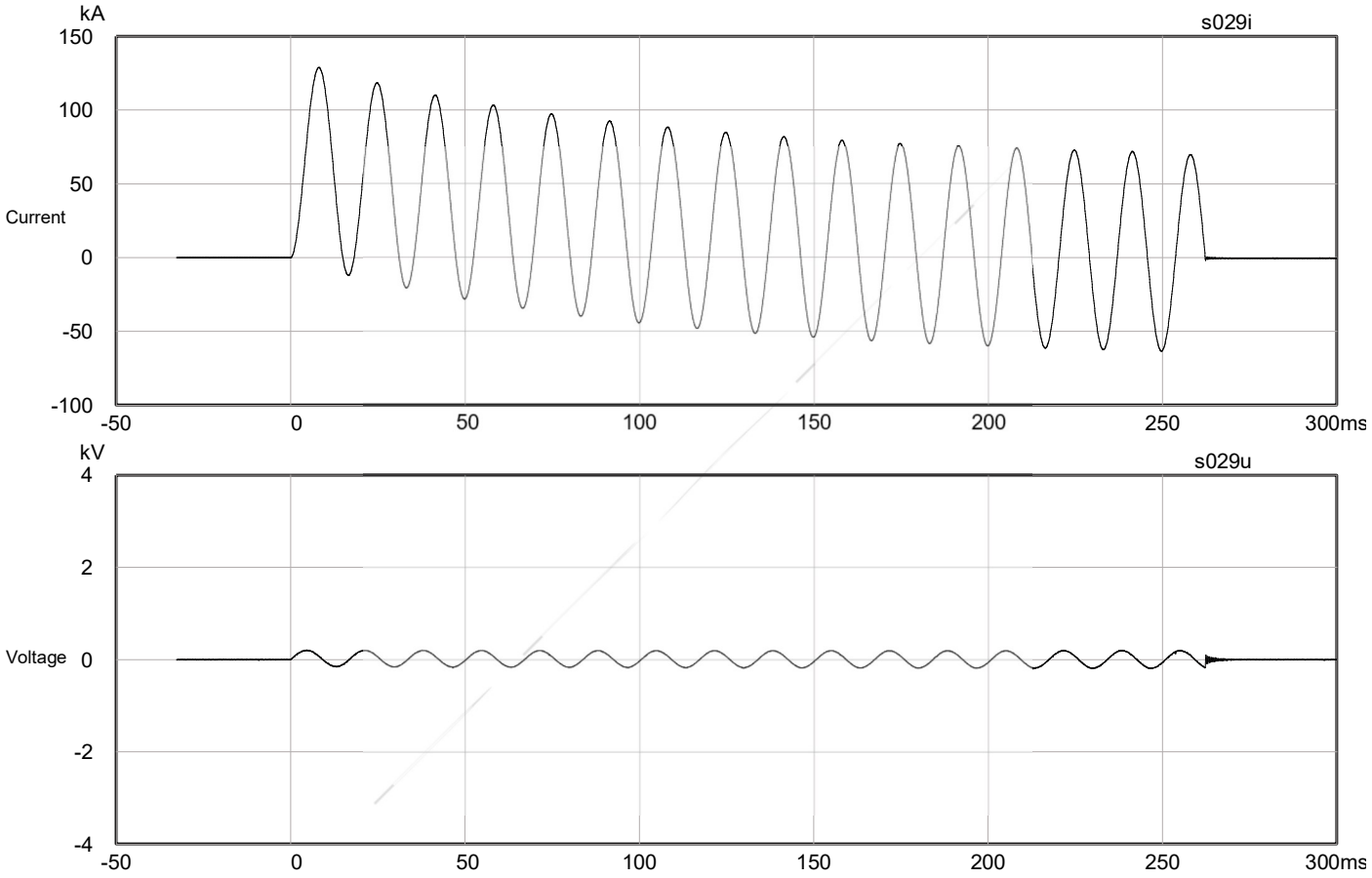



***Figure 15: Waveforms for Test #11-1, Copperweld Scorpius 61 x 072 Sample 15.***

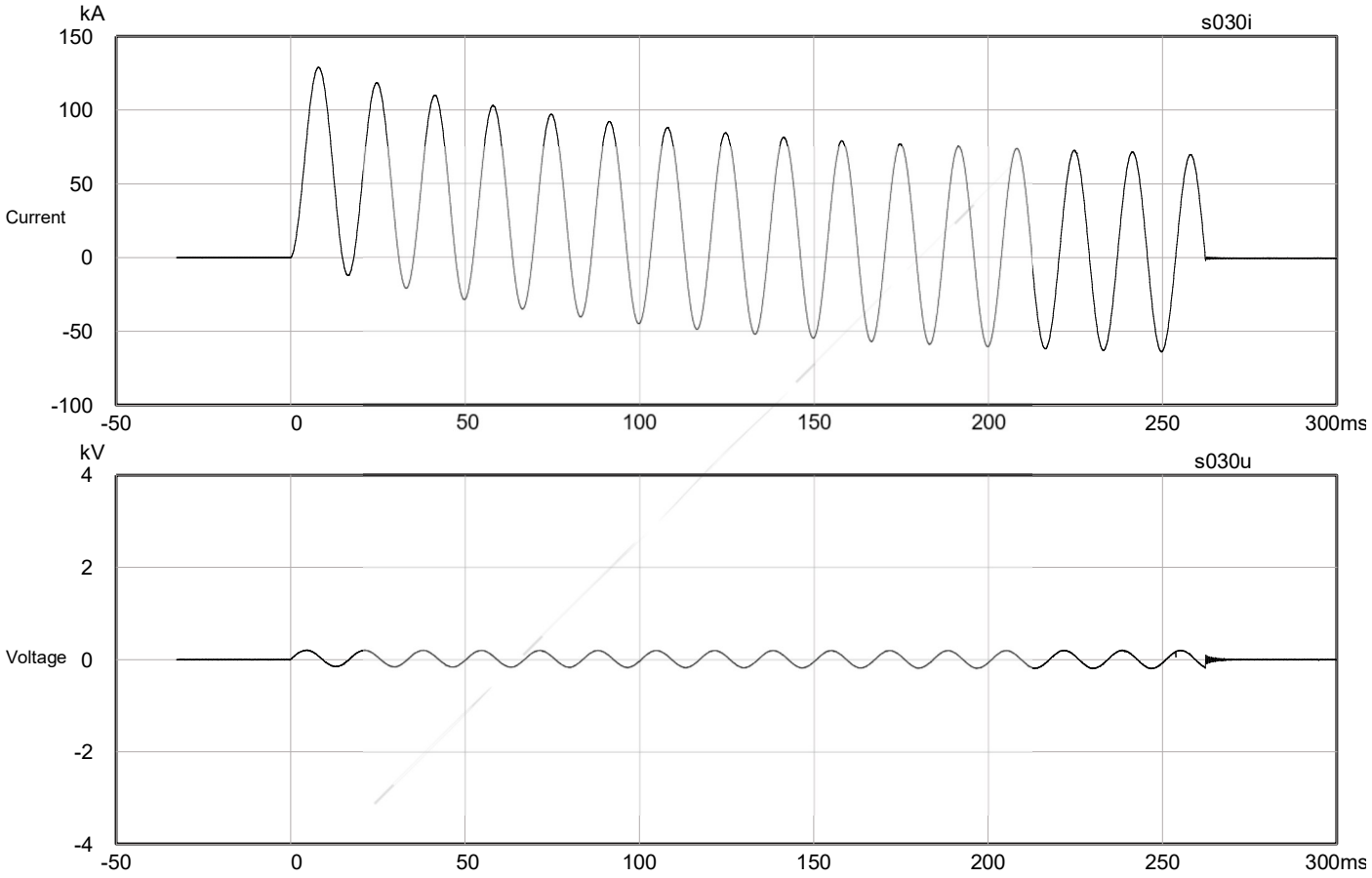



***Figure 16: Waveforms for Test #11-2, Copperweld Scorpius 61 x 072 Sample 15.***

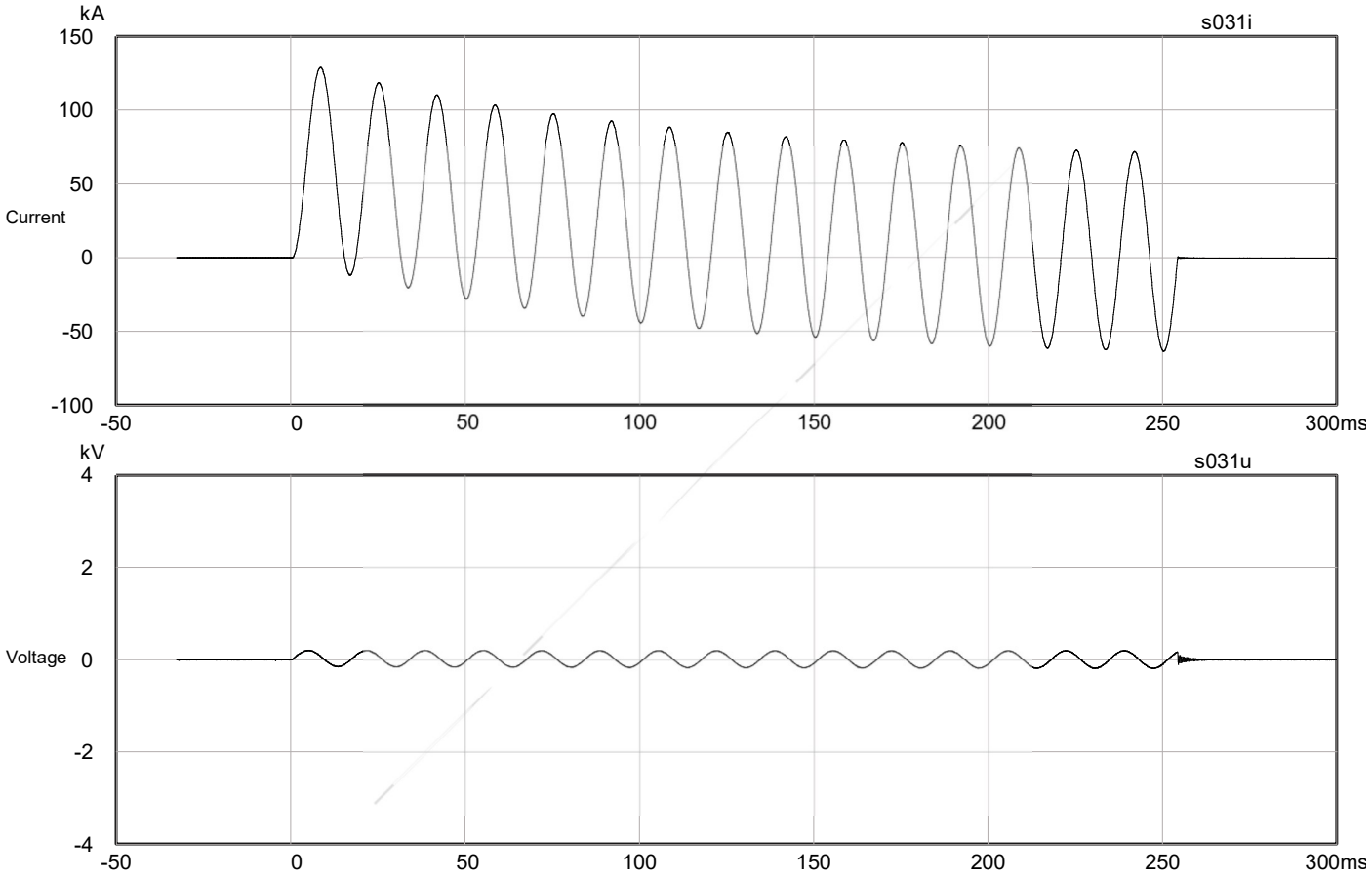



***Figure 17: Waveforms for Test #12-1, Copperweld Scorpius 61 x 072 Sample 16.***

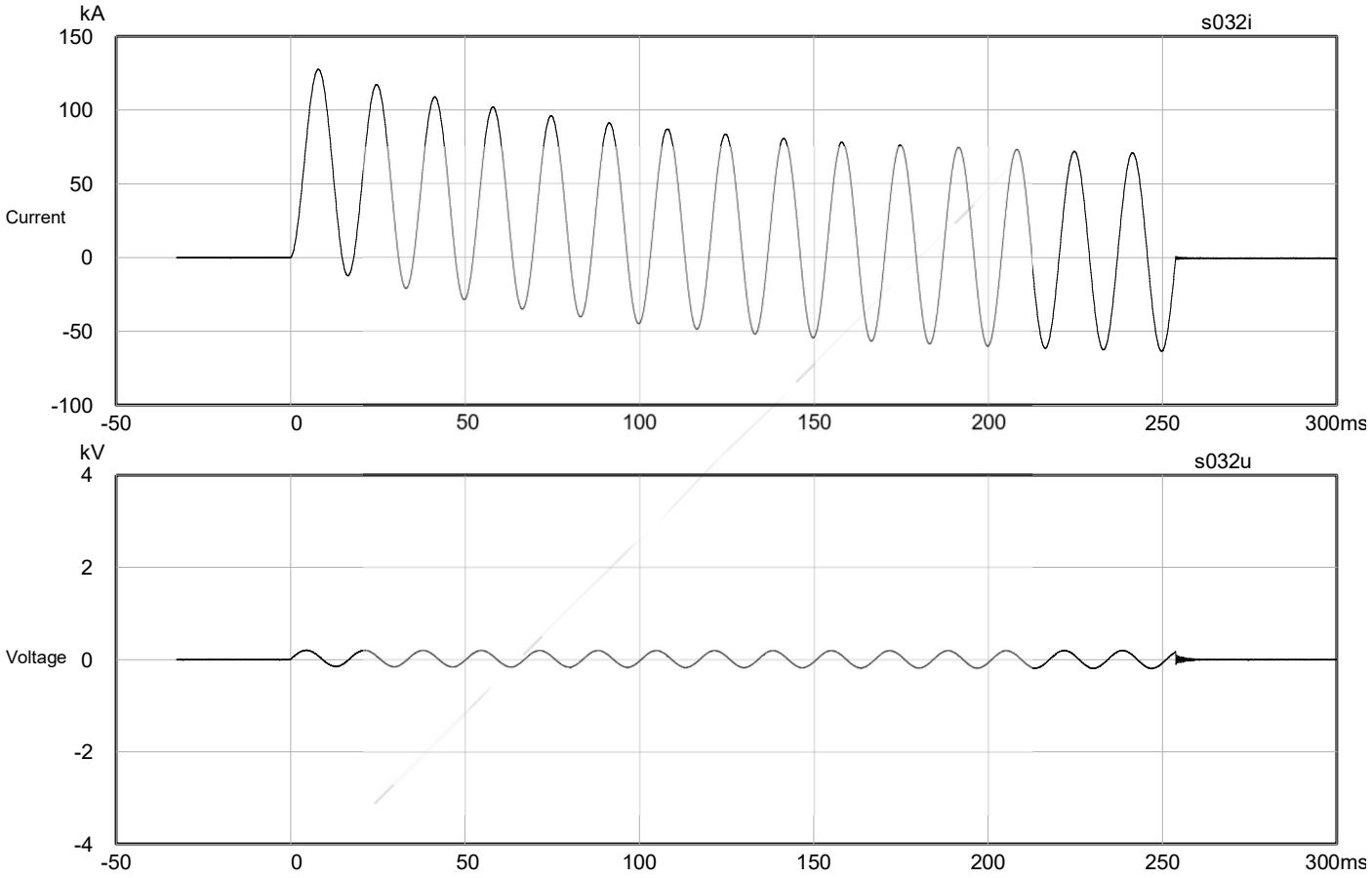



***Figure 18: Waveforms for Test #12-2, Copperweld Scorpius 61 x 072 Sample 16.***

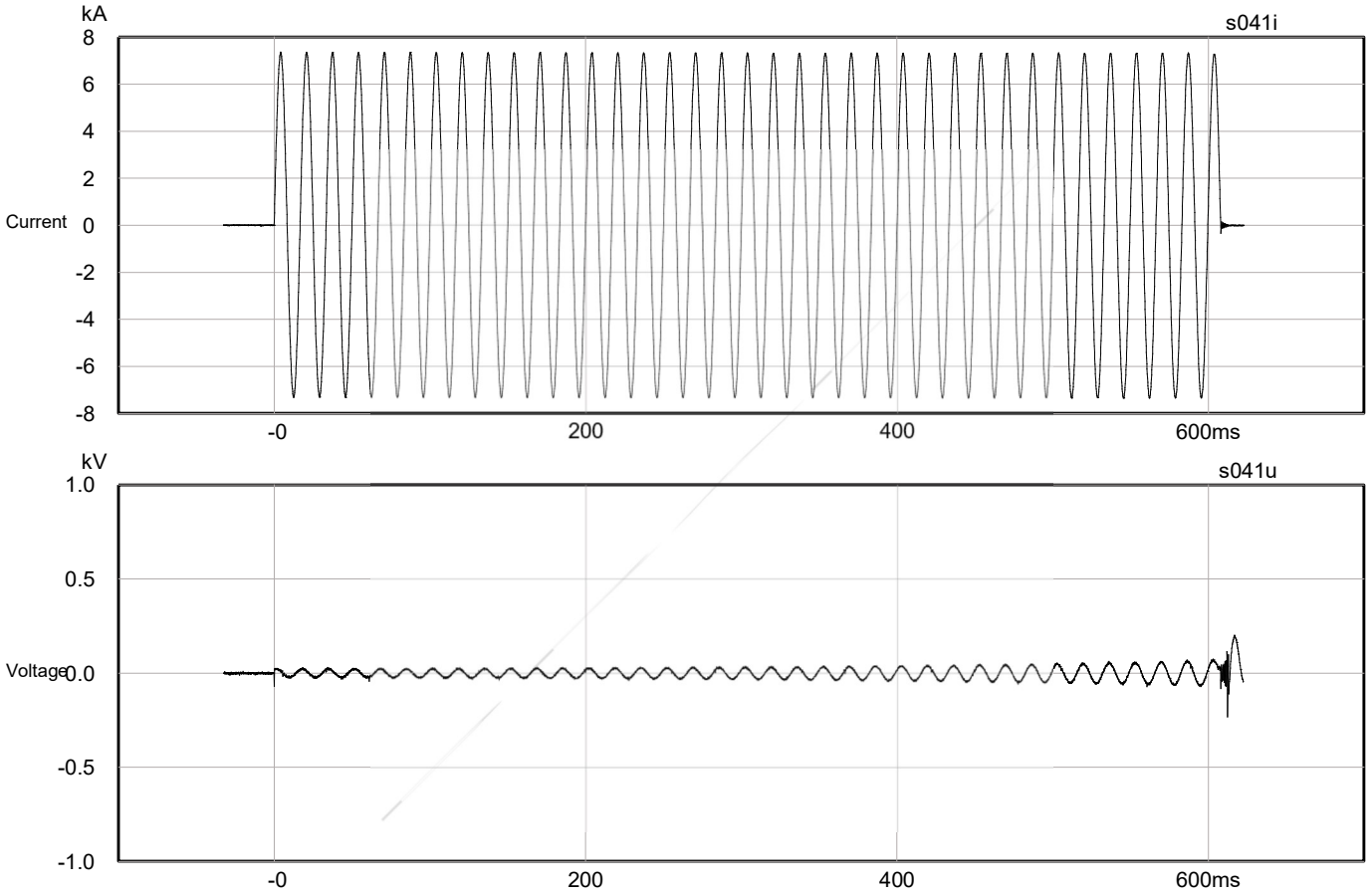



***Figure 19: Waveforms for Test #13, Encore #6 AWG Sample 21.***

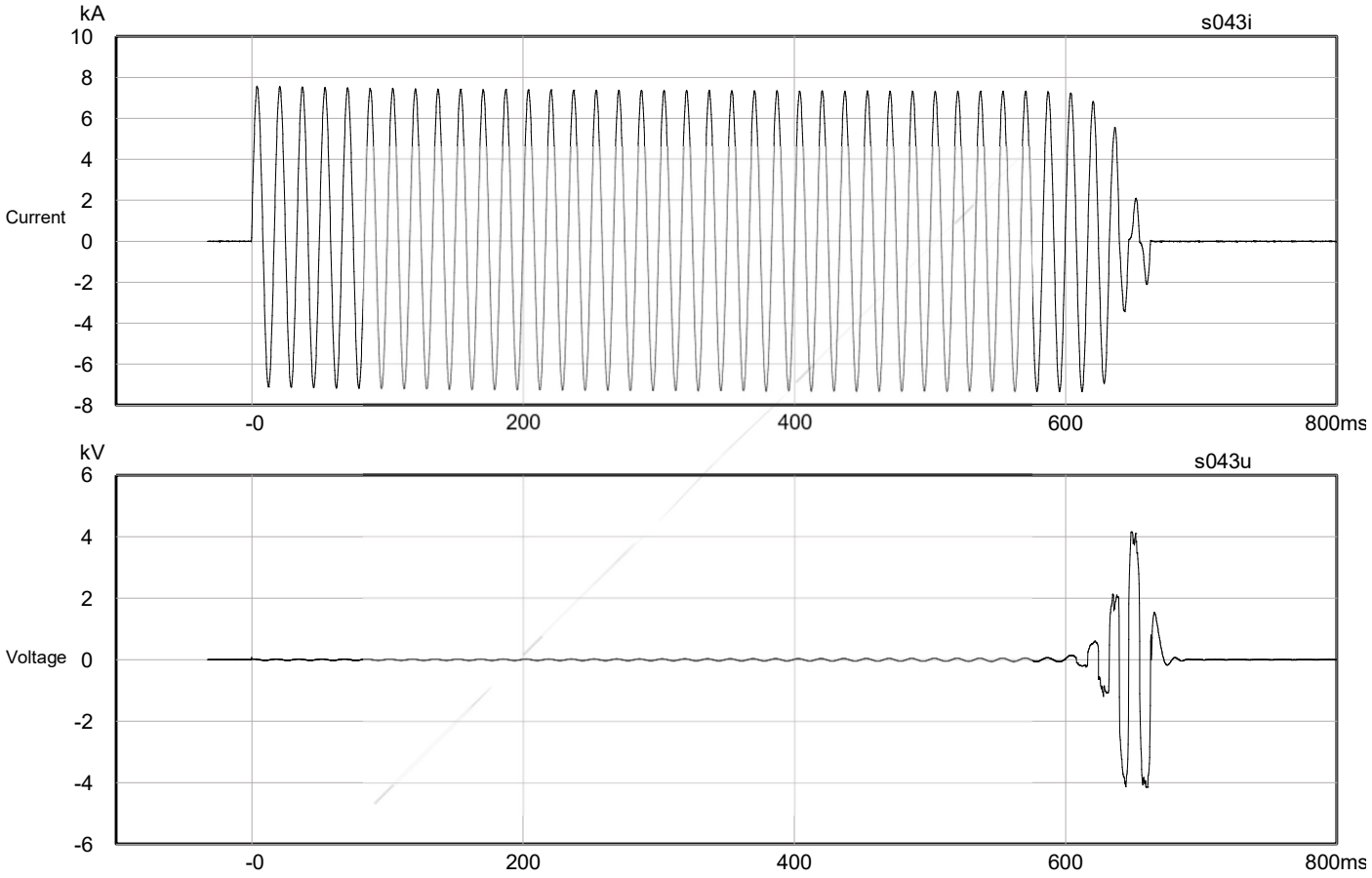



***Figure 20: Waveforms for Test #14, Encore #6 AWG Sample 23.***

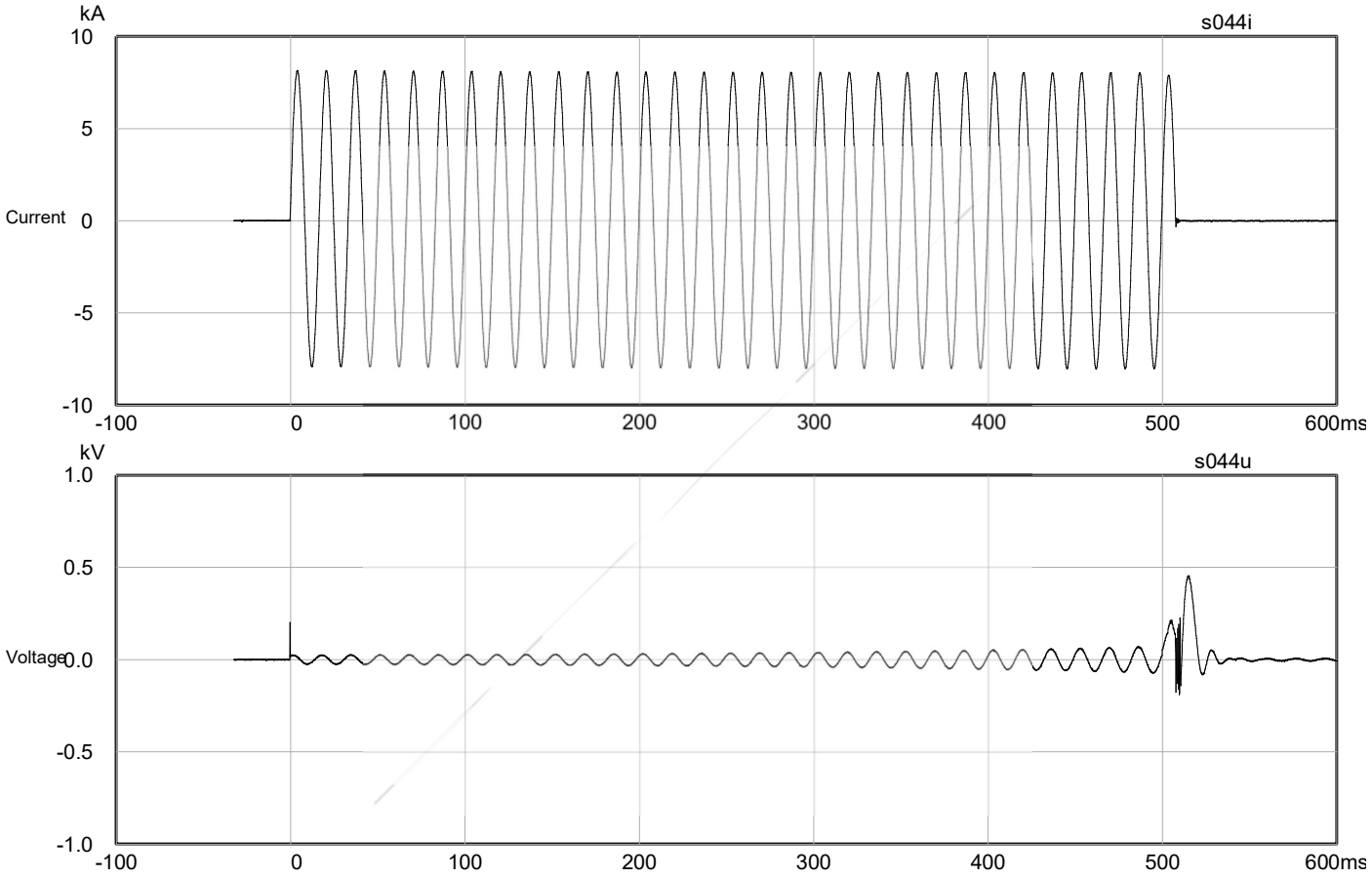



***Figure 21: Waveforms for Test #15, Encore #6 AWG Sample 24.***

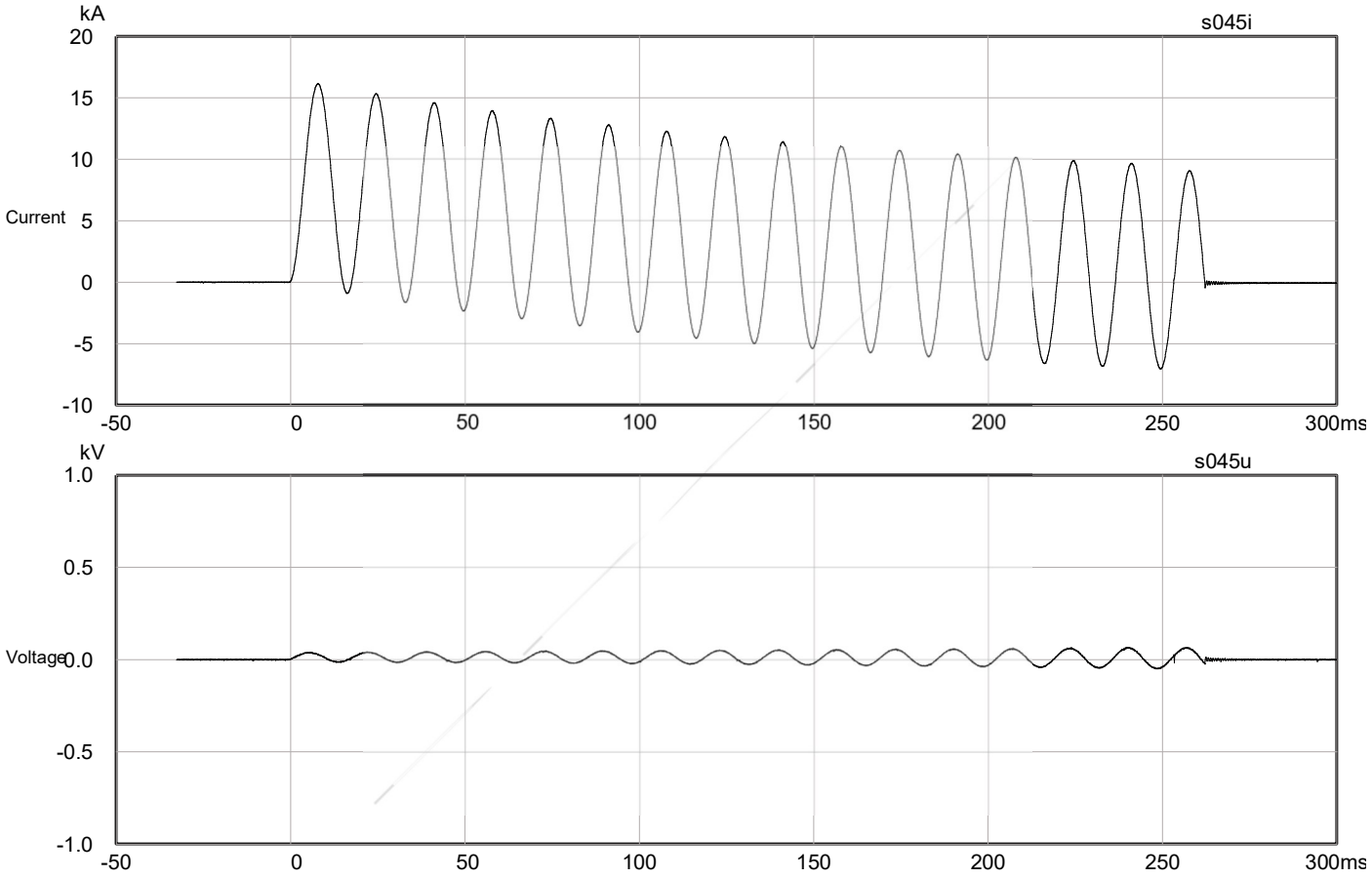



***Figure 22: Waveforms for Test #16-1, Encore #6 AWG Sample 25.***

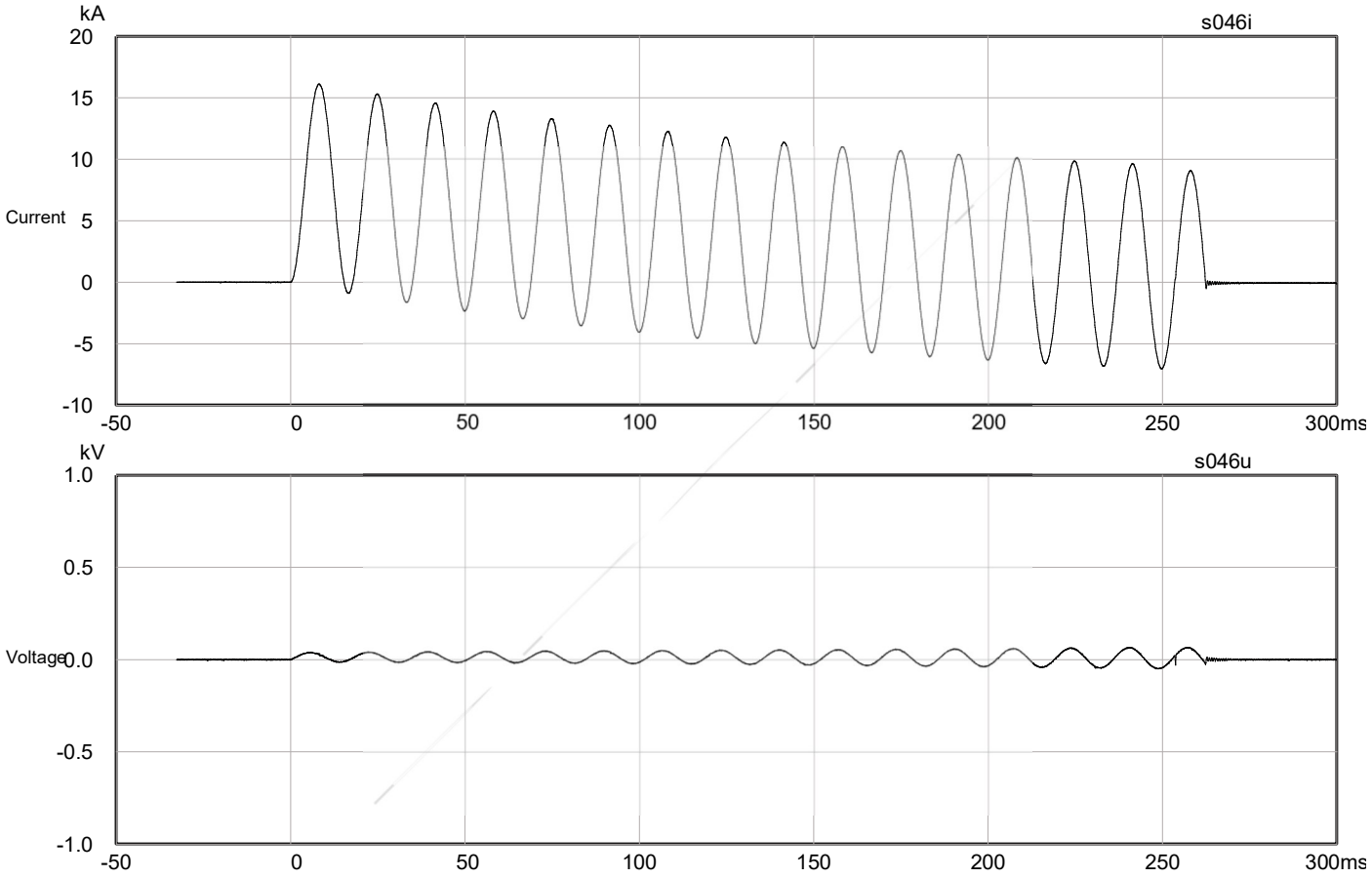



***Figure 23: Waveforms for Test #16-2, Encore #6 AWG Sample 25.***

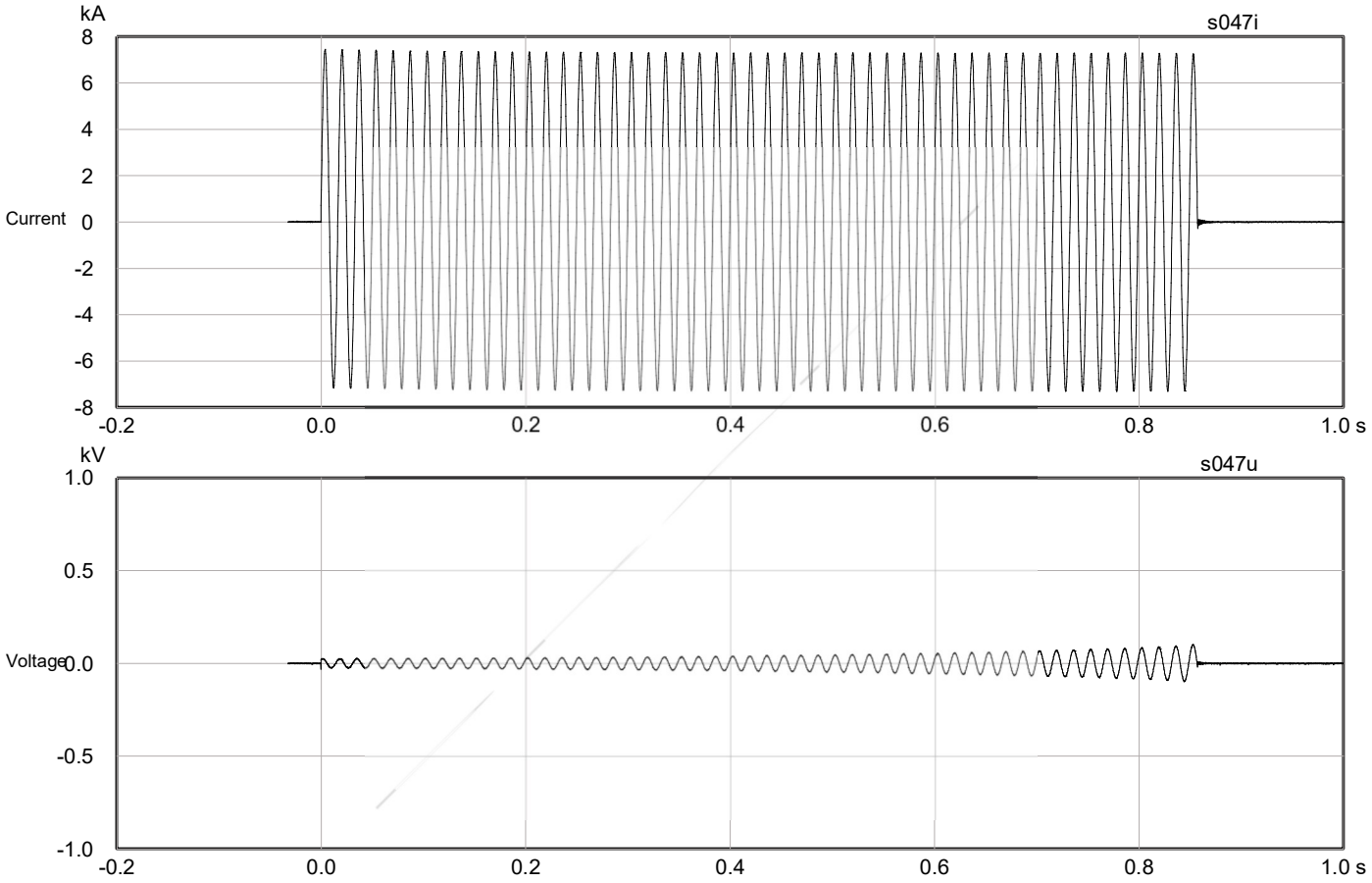



***Figure 24: Waveforms for Test #17, Encore #6 AWG Sample 31.***

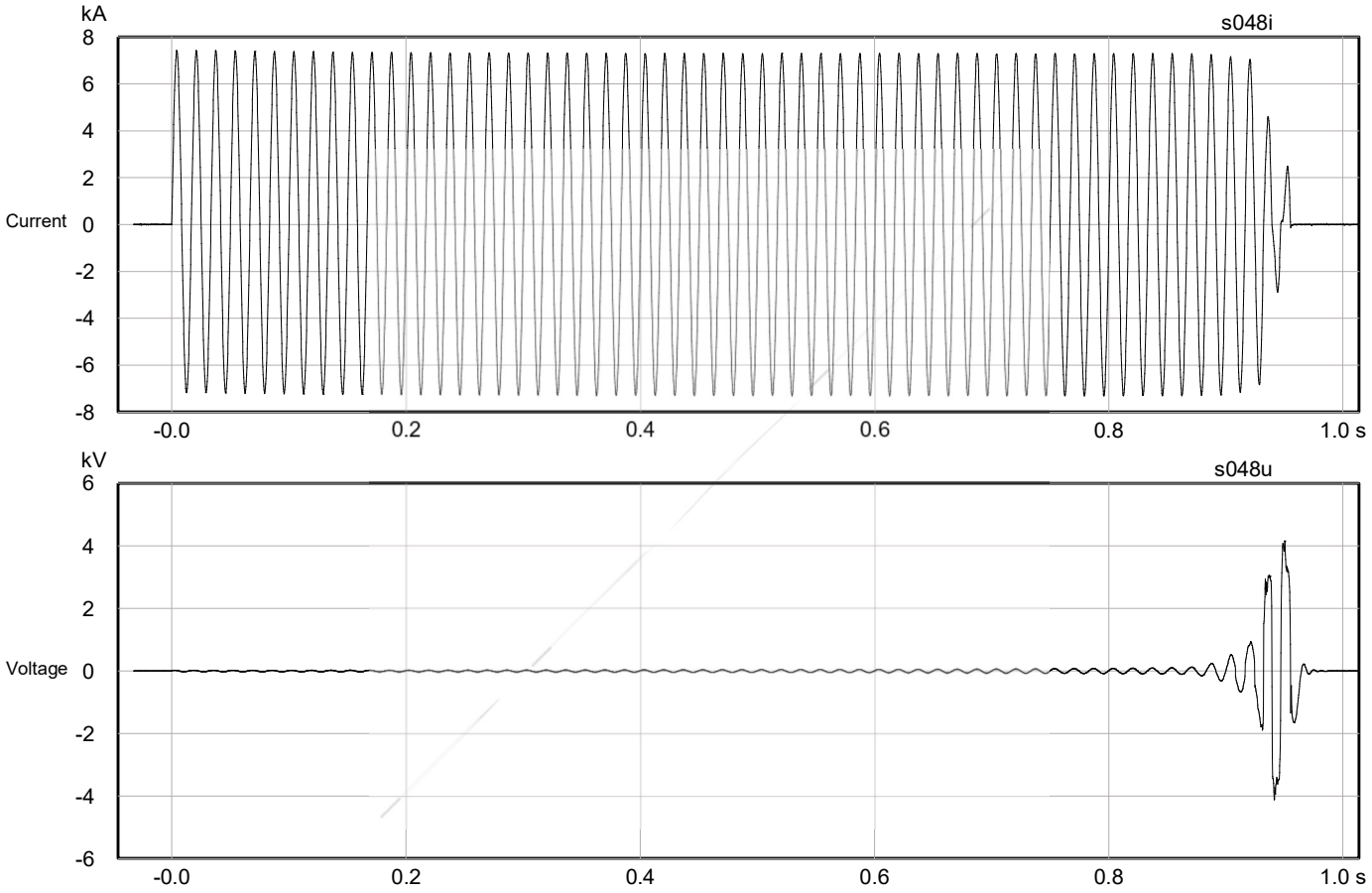



***Figure 25: Waveforms for Test #18, Copperweld Scorpius 7 x 080 Sample 32.***

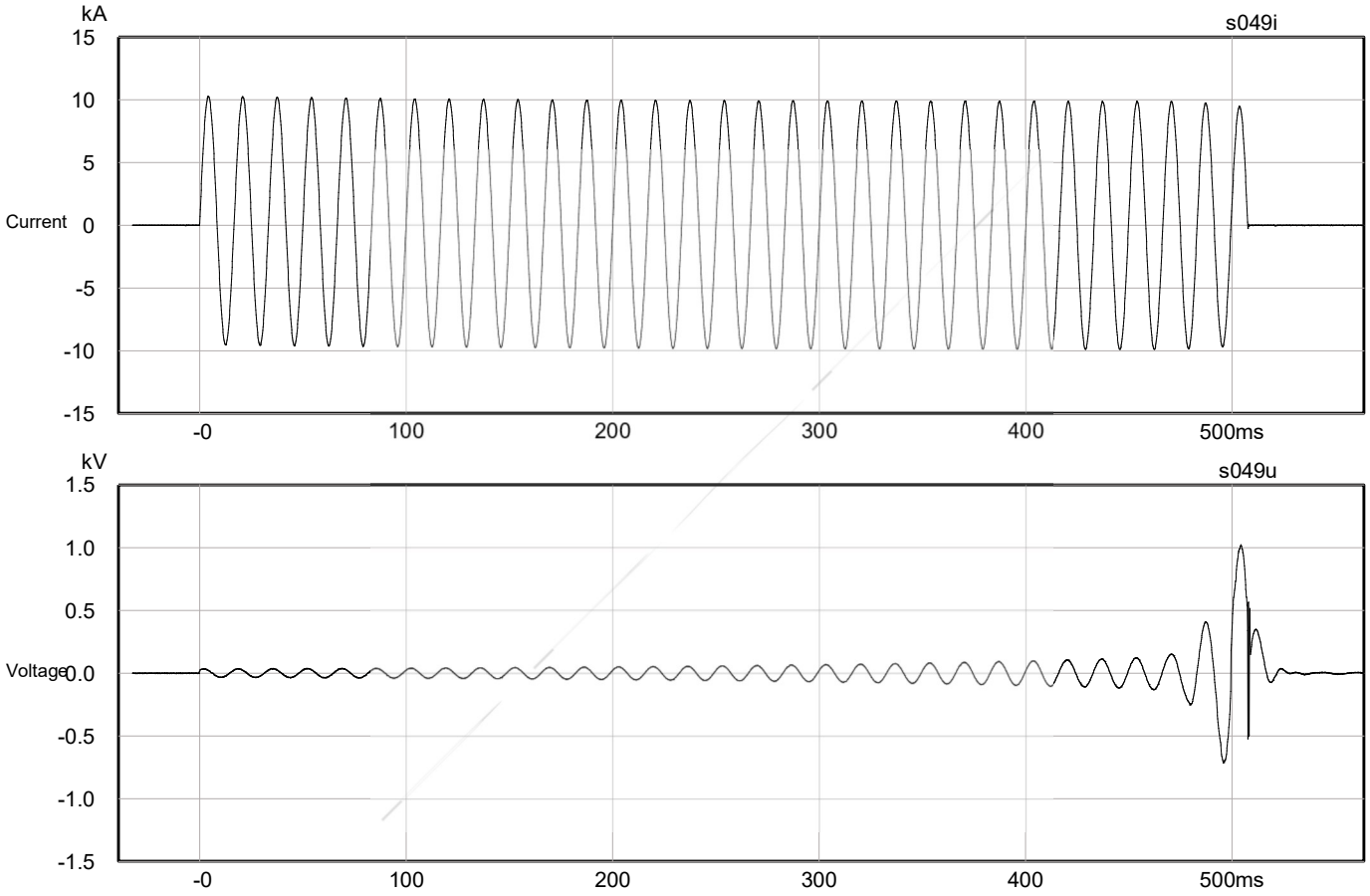



***Figure 26: Waveforms for Test #19, Copperweld Scorpius 7 x 080 Sample 33.***

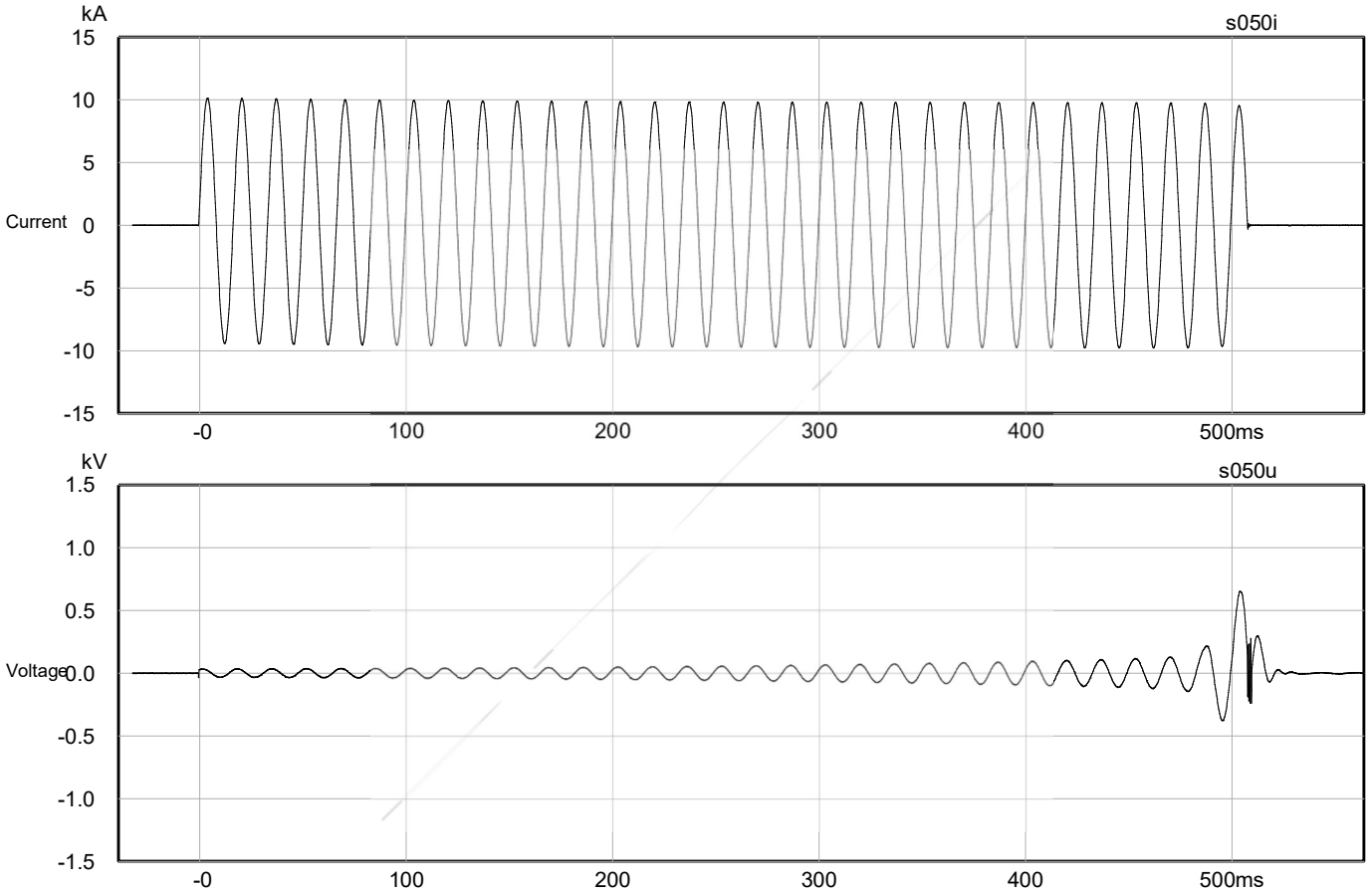



***Figure 27: Waveforms for Test #20, Copperweld Scorpius 7 x 080 Sample 34.***

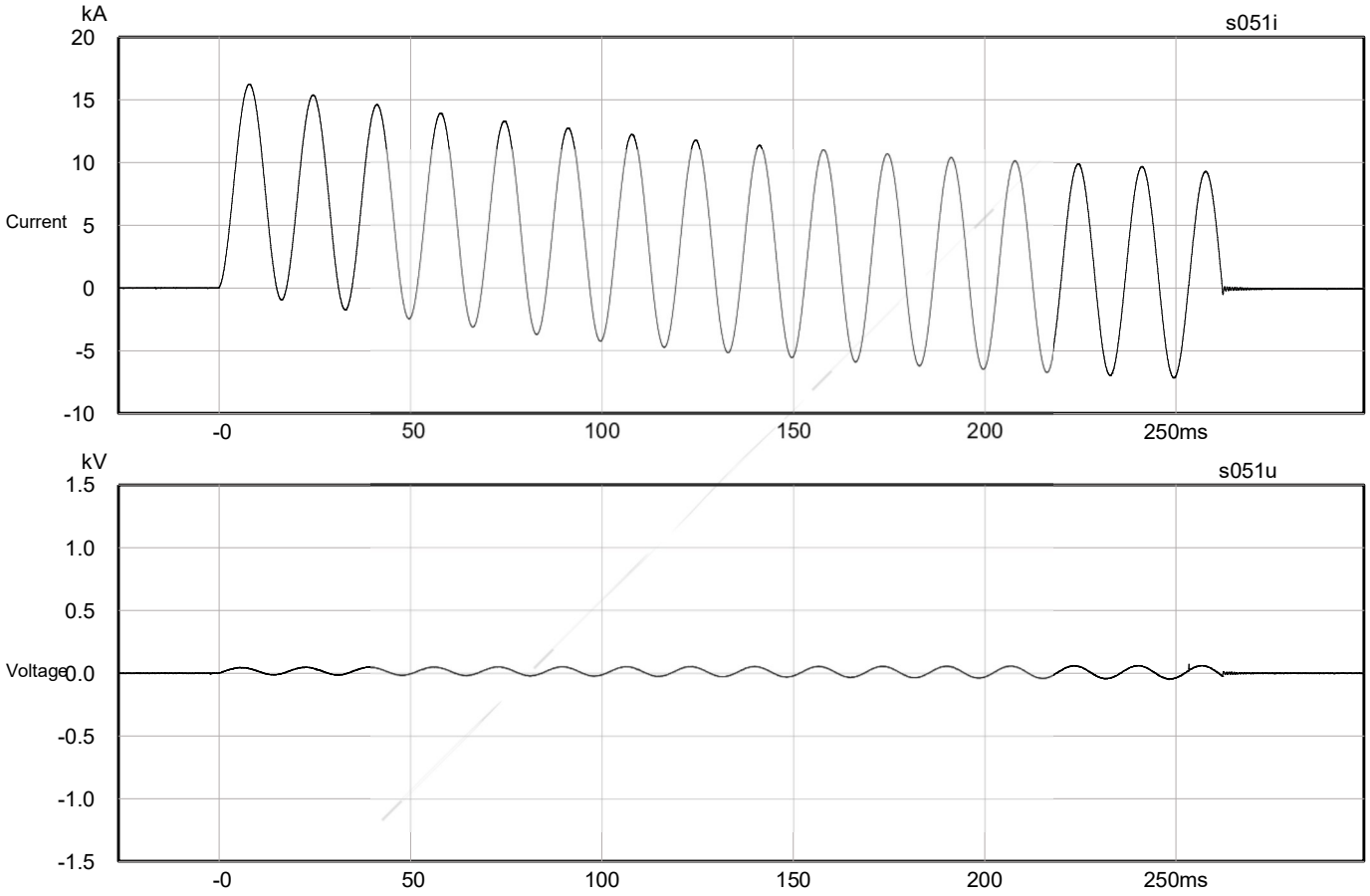



***Figure 28: Waveforms for Test #21-1, Copperweld Scorpius 7 x 080 Sample 35.***

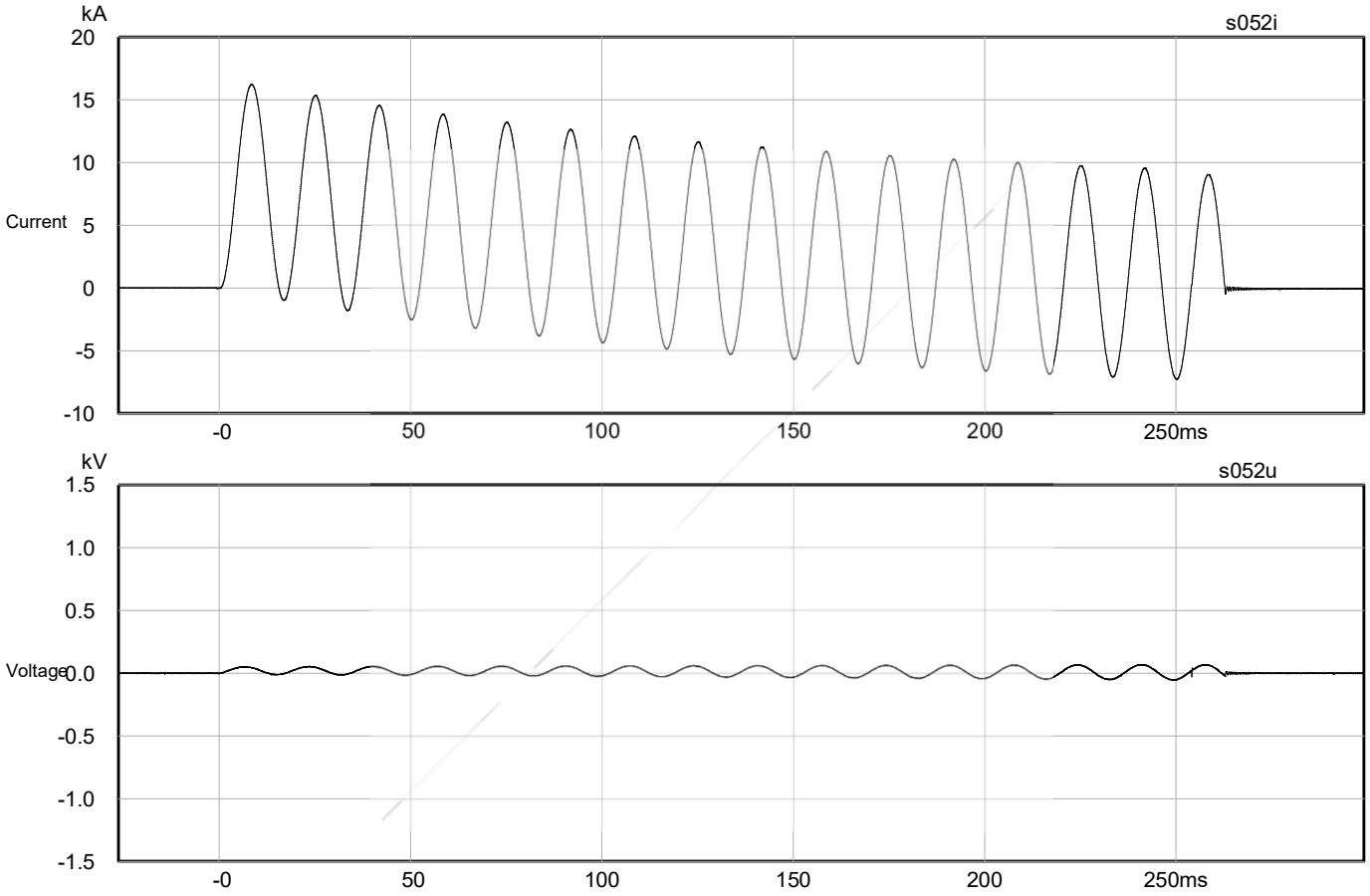



***Figure 29: Waveforms for Test #21-2, Copperweld Scorpius 7 x 080 Sample 35.***

## APPENDIX C – PHOTOGRAPHS OF THE TEST OBJECTS



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



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



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



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

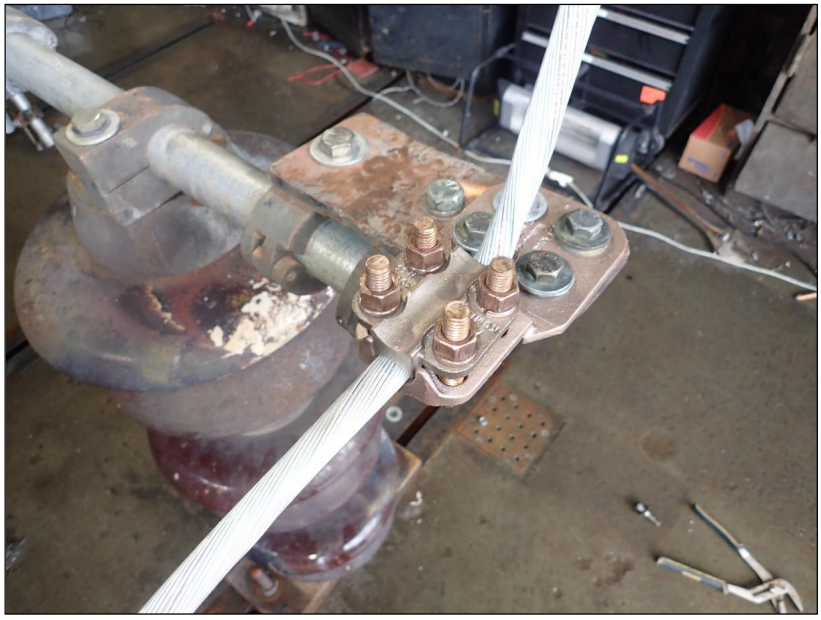


*Figure 34: Typical Burndy terminal connector used to connect the Encore 4/0 AWG or Copperweld Scorpius 61 x 072 CCS conductors to the laboratory buses.*

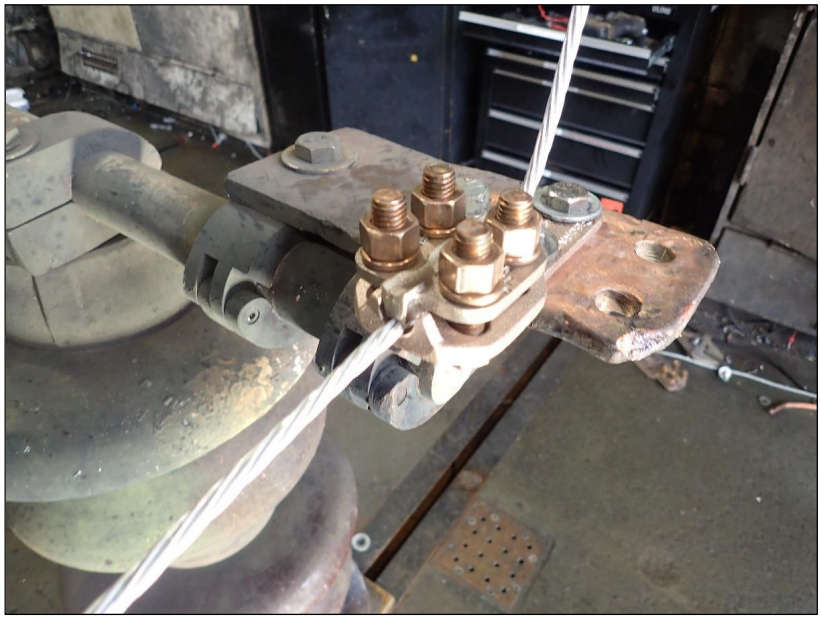


*Figure 35: Typical Burndy terminal connector used to connect the Encore #6 AWG or Copperweld Scorpius 7 x 080 CCS conductors to the laboratory buses.*

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

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

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

where

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

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

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

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

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

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

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

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

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

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

**Copperweld Bimetallics**
**Electrical Test Laboratory**

Data Sheet Packet

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

## Table of Contents


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## Test Report Summary

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

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

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

## Test Equipment Used

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

VBU – Verify Before Use

N/A – Not Applicable

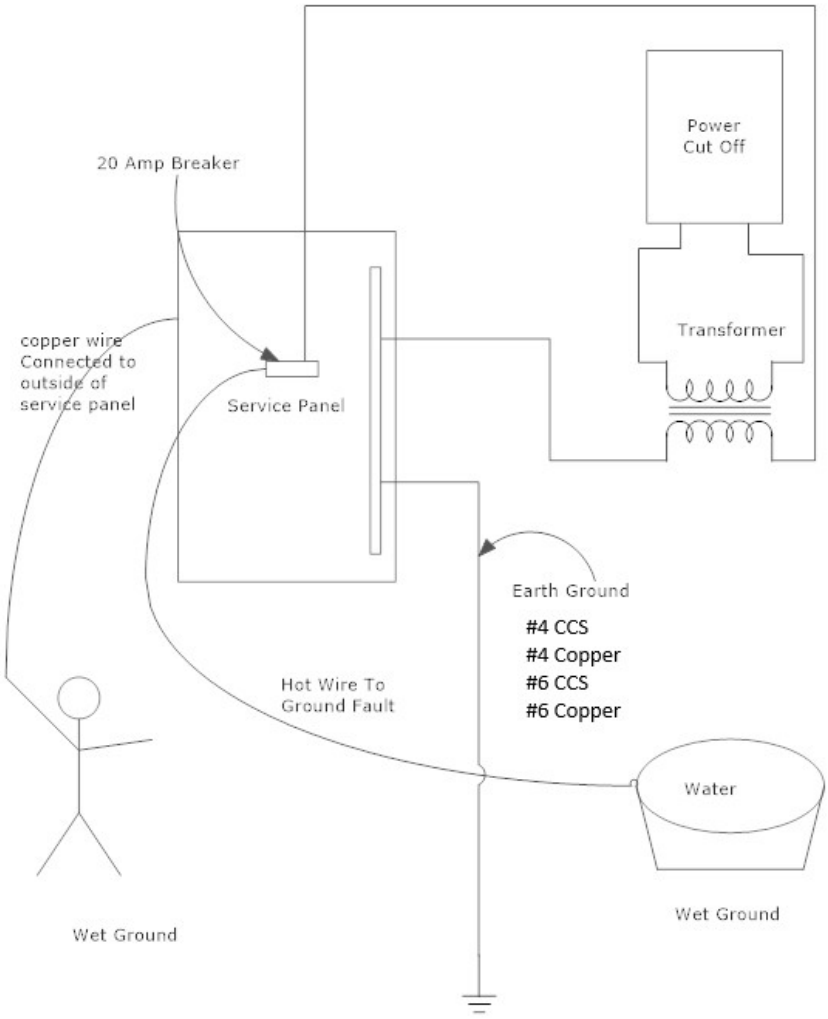
## Sample Identification

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

## Grounding Electrode Conductor Test

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

**Figure 1**




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

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

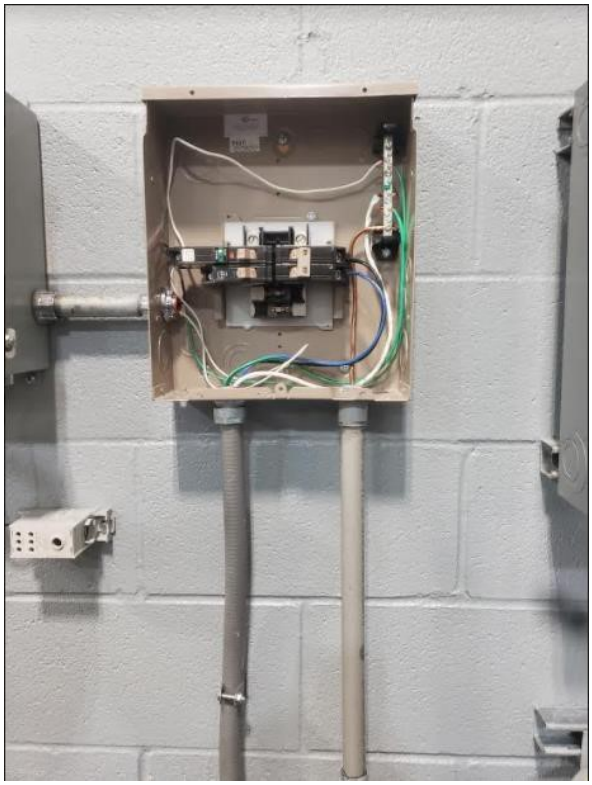
| **Comments:** |
| --- |
| ____X__ (Pass) The product complies with all applicable requirements of this test.<br><br>_____ (Fail) The product does not comply with the requirements of this test.<br><br>**Test Date: 8/25/2020** **Tested By: Bill Lewey** |

Environmental Conditions during Testing:

Humidity: % rh __74%_____ Ambient: °C___28_____

Test setup for the electrical service panel







Ground Rod with Grounding Conductor Attached



Ground Fault



Grounded “man”

## Public Input No. 2736-NFPA 70-2020 [ Section No. 770.110 ]

**770.110** 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 770.110(A)(1) or (A)(2).

**(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~~ raceways , listed riser communications ~~raceway~~ raceways , and listed general-purpose communications ~~raceway selected in accordance with~~ ~~Table 800.154(b)~~ - raceways 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 770.110(B)(1) or (B)(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.

**(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.

## 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

**Submitter Full Name:** Ashley Hood-Morley
**Organization:** Plastics Industry Association
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**Street Address:**
**City:**
**State:**
**Zip:**
**Submittal Date:** Sun Aug 30 03:59:12 EDT 2020
**Committee:** NEC-P16

## Public Input No. 4116-NFPA 70-2020 [ Section No. 770.110(A)(1) ]

**(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~~ with Chapter 3.

## Statement of Problem and Substantiation for Public Input

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

## Submitter Information Verification

**Submitter Full Name:** David Williams
**Organization:** Delta Charter Township
**Street Address:**
**City:**
**State:**
**Zip:**
**Submittal Date:** Wed Sep 09 21:08:47 EDT 2020
**Committee:** NEC-P16

## Public Input No. 2554-NFPA 70-2020 [ Section No. 770.113 ]

~~770.~~

**Revise** **770.113** ~~Installation of Optical Fiber Cables.~~

~~Installation of optical fiber cables shall comply with~~

**113**

~~(A) through (J). Installation of raceways and cable routing assemblies shall comply with 770.110 .~~

**~~(A)~~** ~~Listing.~~

~~Optical fiber cables installed in buildings shall be listed in accordance with 770.179 and installed in accordance with the limitations of the listing.~~

~~*Exception: Optical fiber cables that are installed in compliance with 770.48 shall not be required to 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 they are directly associated with the air distribution system:~~

(1) ~~Up to 1.22 m (4 ft) of Types OFNP and OFCP~~

(2) ~~Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC 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 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) ~~Types OFNP and OFCP~~

(2) ~~Types OFNP and OFCP installed in plenum communications raceways~~

(3) ~~Types OFNP and OFCP installed in plenum cable routing assemblies~~

(4) ~~Types OFNP and OFCP supported by open metal cable tray systems~~

(5) ~~Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in raceways that are installed in compliance with 300.22(C)~~

(6) ~~Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC 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 OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in plenum communications raceways, riser communications raceways, or general-purpose communications raceways or 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, see NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems* .~~

**(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 OFNP, OFCP, OFNR, and OFCR

(2) Types OFNP, OFCP, OFNR, and OFCR installed in:

(3) Plenum communications raceways

(4) Plenum cable routing assemblies

(5) Riser communications raceways

(6) Riser cable routing assemblies

Informational Note: See 770.26 for firestop requirements for floor penetrations.

**(E)** Risers — Cables and Innerducts in Metal Raceways.

The following cables and innerducts shall be permitted in metal raceways in a riser having firestops at each floor:

(1) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC

(2) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in:

(3) Plenum communications raceways (innerduct)

(4) Riser communications raceways (innerduct)

(5) General-purpose communications raceways (innerduct)

Informational Note: See 770.26 for firestop requirements for floor penetrations.

**(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 OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC

(2) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in:

(3) Plenum communications raceways

(4) Plenum cable routing assemblies

(5) Riser communications raceways

(6) Riser cable routing assemblies

(7) General-purpose communications raceways

(8) General-purpose cable routing assemblies

Informational Note: See 770.26 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 OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC~~

(2) ~~Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in:~~

(3) ~~Plenum communications raceways~~

(4) ~~Plenum cable routing assemblies~~

(5) ~~Riser communications raceways~~

(6) ~~Riser cable routing assemblies~~

(7) ~~General-purpose communications raceways~~

(8) ~~General-purpose cable routing assemblies~~

~~**(H)** Cable Trays.~~

~~The following cables shall be permitted to be supported by cable trays:~~

(1) ~~Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC~~

(2) ~~Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in:~~

(3) ~~Plenum communications raceways~~

(4) ~~Riser communications raceways~~

(5) ~~General-purpose communications raceways~~

~~**(I)** Distributing Frames and Cross-Connect Arrays.~~

~~The following cables shall be permitted to be installed in distributing frames and cross-connect arrays:~~

(1) ~~Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC~~

(2) ~~Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in:~~

(3) ~~Plenum communications raceways~~

(4) ~~Plenum cable routing assemblies~~

(5) ~~Riser communications raceways~~

(6) ~~Riser cable routing assemblies~~

(7) ~~General-purpose communications raceways~~

(8) ~~General-purpose cable routing assemblies~~

~~**(J)** 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 (I):~~

(1) ~~Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC~~

(2) ~~Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in:~~

(3) ~~Plenum communications raceways~~

(4) ~~Plenum cable routing assemblies~~

(5) ~~Riser communications raceways~~

(6) ~~Riser cable routing assemblies~~

(7) ~~General-purpose communications raceways~~

(8) ~~General-purpose cable routing assemblies~~

(9) ~~Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in a raceway of a type recognized in Chapter 3~~

**as shown in the attached file.**

## Additional Proposed Changes

| File Name | Description | Approved |
|---|---|---|
| PI_2554_text_for_770.113-2.docx | Recommended text for 770.113 in MS Word format | |
| PI_2554_text_for_770.113-2-changes_accepted.pdf | Recommended text for 770.113 with all the changes accepted in PDF format | |

## Statement of Problem and Substantiation for Public Input

This is a companion PI to the PI (PI 2556) to delete Table 770.154(a), Applications of Listed Optical fiber Cables in Buildings. Most of the entries in the table are "Y*" which indicates that the application is permitted within the limitations of 770.110 and 770.113. If all the "Y*" entries were deleted, no mandatory requirements would be lost because they are already in 770.110 and 770.113. The entries that are shown as "N" are equivalent to a "use not permitted". Consequently, if we add the "Uses Not Permitted" to 770.113, Table 770.154(a) becomes redundant; Table 770.154(a) can then be deleted.

This PI adds "Uses Permitted" to the title of the sections showing all the existing permitted uses.This PI also adds "Uses Not Permitted" wherever appropriate. Organizing text into "Uses Permitted" and "Uses Not Permitted" sections is editorially consistent with usage throughout the Code.

Additional editorial changes are the updating of the issue date of NFPA -90A and deleting of "and innerducts" in 770.113(E) because innerducts are already covered in 770.110.

All the recommended changes are shown in the attached MS Word file.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 2556-NFPA 70-2020 [Section No. 770.154] | Deletes Table 770.154(a) |
| Public Input No. 2556-NFPA 70-2020 [Section No. 770.154] | |

## Submitter Information Verification

**Submitter Full Name:** Ashley Hood-Morley
**Organization:** Plastics Industry Association
**Affiliation:** PLASTICS Industry Association (PLASTICS)
**Street Address:**
**City:**
**State:**
**Zip:**
**Submittal Date:** Mon Aug 24 16:09:51 EDT 2020
**Committee:** NEC-P16

# PI 2554 Text

**770.113 Installation of Optical Fiber Cables.**
Installation of optical fiber cables shall comply with 770.113(A) through (J). Installation of raceways and cable routing assemblies shall comply with 770.110.

**770.113(A) Listing.**
Optical fiber cables installed in buildings shall be listed in accordance with 770.179 and installed in accordance with the limitations of the listing.

Exception: Optical fiber cables that are installed in compliance with 770.48 shall not be required to be listed.

**770.113(B) Ducts Specifically Fabricated for Environmental Air.** Installations of optical fiber cables in ducts specifically fabricated for environmental air shall be in accordance with 770.113(B)(1) and 770.113(B)(2).

**(B)(1) Uses Permitted.** 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) Up to 1.22 m (4 ft) of Types OFNP and OFCP

(2) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in raceways that are installed in compliance with 300.22(B)

**(B)(2) Uses Not Permitted.** Types OFNR, OFCR, OFNG, OFCG, OFN and OFC shall not be permitted to be installed in ducts specifically fabricated for environmental air as described in 300.22(B).

Informational Note: For information on fire protection of wiring installed in fabricated ducts, see NFPA 90A-2021~~8~~, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

**770.113(C) Other Spaces Used for Environmental Air (Plenums).** Installations of optical fiber cables in other spaces used for environmental air shall be in accordance with 770.113(C)(1) and 770.113(C)(2).

**(C)(1) Uses Permitted.** The following cables shall be permitted in other spaces used for environmental air as described in 300.22(C):

(1) Types OFNP and OFCP

(2) Types OFNP and OFCP installed in plenum communications raceways

(3) Types OFNP and OFCP installed in plenum cable routing assemblies

(4) Types OFNP and OFCP supported by open metal cable tray systems

(5) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in raceways that are installed in compliance with 300.22(C)

(6) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC 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 OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in plenum communications raceways, riser communications raceways, or general-purpose communications raceways or 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)

**(B)(2) Uses Not Permitted.** Types OFNR, OFCR, OFNG, OFCG, OFN and OFC shall not be permitted to be installed in other spaces used for environmental air (plenums).

Informational Note: For information on fire protection of wiring installed in other spaces used for environmental air, see NFPA 90A-2021~~8~~, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

**770.113(D) Risers — Cables in Vertical Runs.** Installations of optical fiber cables in vertical runs shall be in accordance with 770.113(D)(1) and 770.113(D)(2).

**(D)(1) Uses Permitted.** The following cables shall be permitted in vertical runs penetrating one or more floors and in vertical runs in a shaft:

(1) Types OFNP, OFCP, OFNR, and OFCR

(2) Types OFNP, OFCP, OFNR, and OFCR installed in:

a. Plenum communications raceways

b. Plenum cable routing assemblies

c. Riser communications raceways

d. Riser cable routing assemblies

**(D)(2) Uses Not Permitted.** Types OFNG, OFCG, OFN and OFC shall not be permitted to be installed in vertical runs.

Informational Note: See 770.26 for firestop requirements for floor penetrations.

**770.113(E) Risers — Cables ~~and Innerducts~~ in Metal Raceways.**

**Uses Permitted.** The following cables ~~and innerducts~~ shall be permitted in metal raceways in a riser having firestops at each floor:

(1) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC

(2) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in:

a. Plenum communications raceways (innerduct)

b. Riser communications raceways (innerduct)

c. General-purpose communications raceways (innerduct)

Informational Note: See 770.26 for firestop requirements for floor penetrations.

**770.113(F) Risers — Cables in Fireproof Shafts.**

**Uses Permitted.** The following cables shall be permitted to be installed in fireproof riser shafts having firestops at each floor:

(1) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC

(2) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in:
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 770.26 for firestop requirements for floor penetrations.

**770.113(G) Risers — One- and Two-Family Dwellings.**

**Uses Permitted.** The following cables shall be permitted in one- and two-family dwellings:

(1) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC
(2) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in:
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

**770.113(H) Cable Trays.**

**Uses Permitted.** The following cables shall be permitted to be supported by cable trays:

(1) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC
(2) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in:
a. Plenum communications raceways
b. Riser communications raceways
**c.** General-purpose communications raceways

**770.113(I) Distributing Frames and Cross-Connect Arrays.**

**Uses Permitted.** The following cables shall be permitted to be installed in distributing frames and cross-connect arrays:

(1) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC
(2) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in:
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

**770.113(J) Other Building Locations.**

**Uses Permitted.** The following cables shall be permitted to be installed in building locations other than the locations covered in 770.113(B) through (I):

(1) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC

(2) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in:

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 OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in a raceway of a type recognized in Chapter 3

# PI 2554 Text

**770.113 Installation of Optical Fiber Cables.**
Installation of optical fiber cables shall comply with 770.113(A) through (J). Installation of raceways and cable routing assemblies shall comply with 770.110.

**770.113(A) Listing.**
Optical fiber cables installed in buildings shall be listed in accordance with 770.179 and installed in accordance with the limitations of the listing.

Exception: Optical fiber cables that are installed in compliance with 770.48 shall not be required to be listed.

**770.113(B) Ducts Specifically Fabricated for Environmental Air.** Installations of optical fiber cables in ducts specifically fabricated for environmental air shall be in accordance with 770.113(B)(1) and 770.113(B)(2).

**(B)(1) Uses Permitted.** 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) Up to 1.22 m (4 ft) of Types OFNP and OFCP

(2) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in raceways that are installed in compliance with 300.22(B)

**(B)(2) Uses Not Permitted.** Types OFNR, OFCR, OFNG, OFCG, OFN and OFC shall not be permitted to be installed in ducts specifically fabricated for environmental air as described in 300.22(B).

Informational Note: For information on fire protection of wiring installed in fabricated ducts, see NFPA 90A-2021, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

**770.113(C) Other Spaces Used for Environmental Air (Plenums).** Installations of optical fiber cables in other spaces used for environmental air shall be in accordance with 770.113(C)(1) and 770.113(C)(2).

**(C)(1) Uses Permitted.** The following cables shall be permitted in other spaces used for environmental air as described in 300.22(C):

(1) Types OFNP and OFCP

(2) Types OFNP and OFCP installed in plenum communications raceways

(3) Types OFNP and OFCP installed in plenum cable routing assemblies

(4) Types OFNP and OFCP supported by open metal cable tray systems

(5) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in raceways that are installed in compliance with 300.22(C)

(6) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC 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 OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in plenum communications raceways, riser communications raceways, or general-purpose communications raceways or 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)

**(C)(2) Uses Not Permitted.** Types OFNR, OFCR, OFNG, OFCG, OFN and OFC shall not be permitted to be installed in other spaces used for environmental air (plenums).

Informational Note: For information on fire protection of wiring installed in other spaces used for environmental air, see NFPA 90A-2021, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

**770.113(D) Risers — Cables in Vertical Runs.** Installations of optical fiber cables in vertical runs shall be in accordance with 770.113(D)(1) and 770.113(D)(2).

**(D)(1) Uses Permitted.** The following cables shall be permitted in vertical runs penetrating one or more floors and in vertical runs in a shaft:

(1) Types OFNP, OFCP, OFNR, and OFCR

(2) Types OFNP, OFCP, OFNR, and OFCR installed in:

a. Plenum communications raceways

b. Plenum cable routing assemblies

**770.113(E) Risers — Cables in Metal Raceways.**

**Uses Permitted.** The following cables shall be permitted in metal raceways in a riser having firestops at each floor:

(1) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC

(2) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in:

a. Plenum communications raceways (innerduct)

b. Riser communications raceways (innerduct)

c. General-purpose communications raceways (innerduct)

Informational Note: See 770.26 for firestop requirements for floor penetrations.

**770.113(F) Risers — Cables in Fireproof Shafts.**

**Uses Permitted.**The following cables shall be permitted to be installed in fireproof riser shafts having firestops at each floor:

(1) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC

(2) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in:
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 770.26 for firestop requirements for floor penetrations.

**770.113(G) Risers — One- and Two-Family Dwellings.**

**Uses Permitted.** The following cables shall be permitted in one- and two-family dwellings:

(1) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC
(2) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in:
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

**770.113(H) Cable Trays.**

**Uses Permitted.** The following cables shall be permitted to be supported by cable trays:

(1) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC
(2) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in:
a. Plenum communications raceways
b. Riser communications raceways
**c.** General-purpose communications raceways

**770.113(I) Distributing Frames and Cross-Connect Arrays.**

**Uses Permitted.** The following cables shall be permitted to be installed in distributing frames and cross-connect arrays:

(1) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC
(2) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in:
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

**770.113(J) Other Building Locations.**

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 OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in a raceway of a type recognized in Chapter 3

## Public Input No. 688-NFPA 70-2020 [ Section No. 770.113(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) Up to 1.22 m (4 ft) of Types OFNP and OFCP

(2) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC 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 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. 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. 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. 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)]

## Submitter Information Verification

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**Committee:** NEC-P16

## Public Input No. 682-NFPA 70-2020 [ Section No. 770.113(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 OFNP and OFCP

(2) Types OFNP and OFCP installed in plenum communications raceways

(3) Types OFNP and OFCP installed in plenum cable routing assemblies

(4) Types OFNP and OFCP supported by open metal cable tray systems

(5) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in raceways that are installed in compliance with 300.22(C)

(6) Types OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC 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 OFNP, OFCP, OFNR, OFCR, OFNG, OFCG, OFN, and OFC installed in plenum communications raceways, riser communications raceways, or general-purpose communications raceways or 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, see 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. 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. 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)]

Public Input No. 688-NFPA 70-2020 [Section No. 770.113(B)]

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. 680-NFPA 70-2020 [Section No. 760.135(B)]

Public Input No. 681-NFPA 70-2020 [Section No. 770.24]

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)]

Update issue date of NFPA 90A.

Update issue date of NFPA 90A.

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**Committee:** NEC-P16

## Public Input No. 2369-NFPA 70-2020 [ Section No. 770.114 ]

**770.114** 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), using a conductor specified in 770 . 100(A) .

## Statement of Problem and Substantiation for Public Input

Currently the conductor that is specified is only for entrance cables. Without this change it leaves people guessing what conductor is required (are they supposed to go to 250 or is the 770.100(A) conductor safe enough). Therefore, for the sake clarity and specificity this change should be accepted.

## Submitter Information Verification

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## Public Input No. 271-NFPA 70-2020 [ Section No. 770.114 ]

**770.114** 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)~~ .

## Statement of Problem and Substantiation for Public Input

There are numerous grounding (bonding) options in 770.100(B) that include not only the items in 770.100(B)(2), but the intersystem bonding termination of 770.100(B)(1), and where grounding options of 770.100(B)(1) or (B)(2) are not present, the options presented in 770.100(B)(3). The requirement of 770.114 should reference all the grounding (bonding) options of 770.100(B) for completeness, not just (B)(2).

## Submitter Information Verification

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| **Committee:** | NEC-P16 |

## Public Input No. 418-NFPA 70-2020 [ Section No. 770.133(B) ]

**(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~~ hybrid 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~~ hybrid 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~~ hybrid 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.

### Statement of Problem and Substantiation for Public Input

Public Input No. 416 proposes to change “composite optical fiber cable” to “hybrid optical fiber cable” in order to align the NEC with current U.S and international definitions. Acceptance of PI 416 necessitates changing “composite optical fiber cable” to “hybrid optical fiber cable” throughout the NEC. This is a coordinating Public Input to PI 416.

### Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 416-NFPA 70-2020 [Definition: Cable, Optical Fiber, Composite.] | Changes definition of composite optical fiber cable to hybrid optical fiber cable |

| | |
|---|---|
| Public Input No. 417-NFPA 70-2020 [Section No. 770.3(C)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 419-NFPA 70-2020 [Section No. 830.1] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 420-NFPA 70-2020 [Section No. 500.8(F)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 421-NFPA 70-2020 [Section No. 505.9(F)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 422-NFPA 70-2020 [Section No. 506.9(F)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 423-NFPA 70-2020 [Section No. 640.21(B)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 424-NFPA 70-2020 [Section No. 640.21(C)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 425-NFPA 70-2020 [Section No. 640.42(B)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 426-NFPA 70-2020 [Section No. 640.42(C)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 416-NFPA 70-2020 [Definition: Cable, Optical Fiber, Composite.] | |
| Public Input No. 417-NFPA 70-2020 [Section No. 770.3(C)] | |
| Public Input No. 419-NFPA 70-2020 [Section No. 830.1] | |
| Public Input No. 420-NFPA 70-2020 [Section No. 500.8(F)] | |
| Public Input No. 421-NFPA 70-2020 [Section No. 505.9(F)] | |
| Public Input No. 422-NFPA 70-2020 [Section No. 506.9(F)] | |
| Public Input No. 423-NFPA 70-2020 [Section No. 640.21(B)] | |
| Public Input No. 424-NFPA 70-2020 [Section No. 640.21(C)] | |
| Public Input No. 425-NFPA 70-2020 [Section No. 640.42(B)] | |
| Public Input No. 426-NFPA 70-2020 [Section No. 640.42(C)] | |

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## Public Input No. 314-NFPA 70-2020 [ Section No. 770.133(C) ]

**(C)** With Other Circuits.

~~Optical fibers shall be permitted in the same cable, and conductive 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

## Statement of Problem and Substantiation for Public Input

It is outside the scope of Article 770 to cover the construction of Class 2, Class 3, power-limited fire alarm and communications cables.

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.

We have submitted coordinating PIs to cover the inclusion of optical fibers in the cables in Articles 725, 760 and Chapter 8.

## 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. 313-NFPA 70-2020 [Section No. 725.179] | Coordinating PI for Article 725 |
| Public Input No. 210-NFPA 70-2019 [Section No. 800.179] | Coordinating PI for Article 800 |
| Public Input No. 315-NFPA 70-2020 [Section No. 760.176] | 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. 315-NFPA 70-2020 [Section No. 760.176] | |

## Submitter Information Verification

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| **Submittal Date:** | Fri Jan 17 07:01:19 EST 2020 |
| **Committee:** | NEC-P16 |

## Public Input No. 2556-NFPA 70-2020 [ Section No. 770.154 ]

**770.154** ~~Applications of~~ Substitutions for Listed Optical Fiber Cables.

Permitted and nonpermitted applications of listed optical fiber cables shall be as indicated in Table 770.154(a) . The permitted applications shall be subject to the installation requirements of 770.110 and 770.113 . The substitutions for optical fiber cables in Table 770.154(b) and and illustrated in Figure 770.154 shall be permitted.

**Table 770.**

154(a) Applications of Listed Optical Fiber Cables in Buildings

Listed Optical Fiber

Cable Type Applications OFNP, OFCP OFNR, OFCR OFNG, OFCG, OFN, OFC In ducts specifically fabricated for environmental air 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 (plenums) 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 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 distributing frames and cross-connect arrays Y* Y* Y* In any raceway recognized in Chapter 3 Y* Y* Y* In plenum communications raceways 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 770.110 and 770.113.

Informational Note No. 1: Part V of Article 770 covers installation methods within buildings. This table covers the applications of listed optical fiber cables in buildings. The definition of *Point of Entrance* is in 770.2.

Informational Note No. 2: For information on the restrictions to the installation of optical fiber cables in ducts specifically fabricated for environmental air, see 770.113(B).

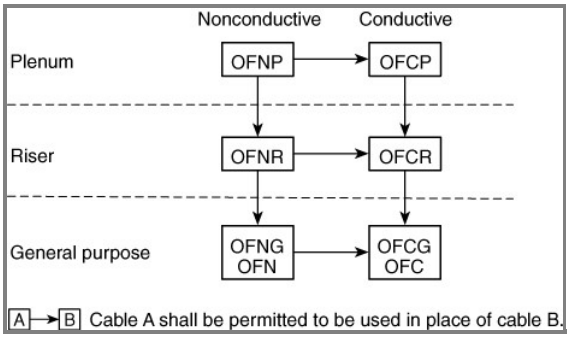
Table 770.154(b) Cable

**154 Cable Substitutions**

| Cable Type | Permitted Substitutions |
|---|---|
| OFNP | None |
| OFCP | OFNP |
| OFNR | |

| |
|---|
| OFNP |
| OFCR |
| |
| OFNP, OFCP, OFNR |
| OFNG, OFN |
| |
| OFNP, OFNR |
| OFCG, OFC |
| |
| OFNP, OFCP, OFNR, OFCR, OFNG, OFN |

**Figure 770.154 Cable Substitution Hierarchy.**




## Statement of Problem and Substantiation for Public Input

Most of the entries in Table 770.154(a), Applications of Listed Optical fiber Cables in Buildings are "Y*" which indicates that the application is permitted within the limitations of 770.110 and 770.113. If all the "Y*" entries were deleted, no mandatory requirements would be lost because they are already in 770.110 and 770.113. The entries that are shown as "N" are equivalent to a "use not permitted". With the changes to 770.113 in PI 2554, 770.154(a) becomes redundant and can be deleted.

This PI deletes Table 770.154(a) and all of its notes, and renumbers Table 770.154(b) to Table 770.154.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 2554-NFPA 70-2020 [Section No. 770.113] | Revises 770.113 to permit the deletion of Table 770.154(a) |
| Public Input No. 2554-NFPA 70-2020 [Section No. 770.113] | |
| Public Input No. 2727-NFPA 70-2020 [Section No. 645.3(B)] | |
| Public Input No. 2728-NFPA 70-2020 [Section No. 645.10(B)] | |
| Public Input No. 2730-NFPA 70-2020 [Section No. 646.3(B)] | |

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# Public Input No. 78-NFPA 70-2019 [ Section No. 770.179(B) ]

**(B)** Types OFNR and OFCR.

Types OFNR and OFCR nonconductive and conductive optical fiber riser cables shall be suitable for use in a vertical run in a shaft or from floor to floor and shall also have the 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-~~2011~~ 2017 , *Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts*.

## Statement of Problem and Substantiation for Public Input

This PI updates the referenced standard.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 77-NFPA 70-2019 [Section No. 800.179(B)] | Updates referenced standard |
| Public Input No. 75-NFPA 70-2019 [Section No. 800.182(B)] | Updates referenced standard |
| Public Input No. 76-NFPA 70-2019 [Section No. 800.182(C)] | Updates referenced standard |
| Public Input No. 79-NFPA 70-2019 [Section No. 770.179(D)] | Updates referenced standard |
| Public Input No. 80-NFPA 70-2019 [Section No. 800.179(C)] | Updates referenced standard |
| Public Input No. 88-NFPA 70-2019 [Section No. 800.53] | Updates referenced standard |
| Public Input No. 74-NFPA 70-2019 [Section No. 800.182(A)] | |
| Public Input No. 75-NFPA 70-2019 [Section No. 800.182(B)] | |
| Public Input No. 76-NFPA 70-2019 [Section No. 800.182(C)] | |
| Public Input No. 77-NFPA 70-2019 [Section No. 800.179(B)] | |
| Public Input No. 79-NFPA 70-2019 [Section No. 770.179(D)] | |
| Public Input No. 80-NFPA 70-2019 [Section No. 800.179(C)] | |
| Public Input No. 88-NFPA 70-2019 [Section No. 800.53] | |

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**Committee:** NEC-P16

## Public Input No. 209-NFPA 70-2019 [ Section No. 770.179(C) ]

**(C)** Types OFNG and OFCG.

Types OFNG and OFCG nonconductive and conductive general-purpose optical fiber cables shall be 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~~ Vertical Flame Test — Cables in Cable Trays , as described in CSA C22.2 No. 0.3-~~M-2001~~ 09 (R2019) , *Test Methods for Electrical Wires and Cables*.

## Statement of Problem and Substantiation for Public Input

This PI updates the reference to CSA Vertical Flame Test C22.2 No.3 to the current edition.

See https://store.csagroup.org/ccrz__ProductList?cartID=&operation=quickSearch&searchText=wires%20and%20cables&searchFilter=all&portalUser=&store=&cclcl=en_US .

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| 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] | |

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## Public Input No. 79-NFPA 70-2019 [ Section No. 770.179(D) ]

**(D)** Types OFN and OFC.

Types OFN and OFC nonconductive and conductive optical fiber cables shall be suitable for general-purpose use, with the exception of risers, plenums, and other spaces used for environmental air, and shall also be resistant to the spread of fire.

Informational Note No. 1: 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~~ 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-2001, *Test Methods for Electrical Wires and Cables*.

Informational Note No. 2: Cable types are listed in descending order of fire resistance rating. Within each fire resistance rating, nonconductive cable is listed first because it is often substituted for conductive cable.

Table 770.179 Cable Markings

| Cable Marking | Type |
|---|---|
| OFNP | Nonconductive optical fiber plenum cable |
| OFCP | Conductive optical fiber plenum cable |
| OFNR | Nonconductive optical fiber riser cable |
| OFCR | Conductive optical fiber riser cable |
| OFNG | Nonconductive optical fiber general-purpose cable |
| OFCG | Conductive optical fiber general-purpose cable |
| OFN | Nonconductive optical fiber general-purpose cable |
| OFC | Conductive optical fiber general-purpose cable |

## Statement of Problem and Substantiation for Public Input

This PI updates the referenced standard.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 76-NFPA 70-2019 [Section No. 800.182(C)] | Updates referenced standard |
| Public Input No. 75-NFPA 70-2019 [Section No. 800.182(B)] | Updates referenced standard |
| Public Input No. 77-NFPA 70-2019 [Section No. 800.179(B)] | Updates referenced standard |
| Public Input No. 78-NFPA 70-2019 [Section No. 770.179(B)] | Updates referenced standard |
| Public Input No. 80-NFPA 70-2019 [Section No. 800.179(C)] | Updates referenced standard |
| Public Input No. 88-NFPA 70-2019 [Section No. 800.53] | Updates referenced standard |
| Public Input No. 74-NFPA 70-2019 [Section No. 800.182(A)] | |
| Public Input No. 75-NFPA 70-2019 [Section No. 800.182(B)] | |

Public Input No. 76-NFPA 70-2019 [Section No. 800.182(C)]
Public Input No. 77-NFPA 70-2019 [Section No. 800.179(B)]
Public Input No. 78-NFPA 70-2019 [Section No. 770.179(B)]
Public Input No. 80-NFPA 70-2019 [Section No. 800.179(C)]
Public Input No. 88-NFPA 70-2019 [Section No. 800.53]

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## Public Input No. 2170-NFPA 70-2020 [ Section No. 770.179(E) ]

**(E)** 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 770.179(E)(1) ~~or~~ , (E)(2) ~~.~~

~~Informational Note: The listing organization provides information for circuit integrity (CI) cable and electrical circuit protective systems, including installation requirements necessary to maintain the fire rating~~

or (E)(3) .

**(1)** Circuit Integrity (CI) Cables.

Circuit integrity (CI) cables specified in 770.179(A) through (D), 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 770 . 24(B). Circuit integrity (CI) cables shall only be permitted to be installed in a raceway where specifically listed and marked as party of a fire-resistive cable system as covered in 770.179(E)(2).

Informational Note: One method of defining circuit integrity (CI) cable is by establishing a

~~minimum 2-hour fire resistance~~

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* as specified in UL 1651, Optical Fiber Cable . UL Guide Information for Optical Cable Fiber (QAYK) contains information to identify the cable and its installation limitations to maintain the fire-resistive rating.

**(2)** Fire-Resistive

~~Cables~~

**Cable System .**

Cables specified in 770.179(A) through (D) and 770.179(E)(1) that are part of an electrical circuit protective system shall be fire-resistive cable and identified with the protective system number on the product or on the smallest unit container in which the product is packaged and installed in accordance with the listing of the protective system.

Informational Note

~~No. 1~~

: One method of defining an electrical circuit protective system is by establishing a

~~minimum 2-hour fire resistance~~

rating for the system when tested in accordance with UL

~~Subject 1724, Outline of Investigation for Fire Tests~~

2196, *Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables.* UL *Guide Information for Electrical Circuit*

~~Protective Systems. Informational Note No. 2: The listing organization provides information for electrical circuit protective systems (FHIT), including installation requirements for maintaining the fire~~

*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 770.179(A) through (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.

## Statement of Problem and Substantiation for Public Input

The intent here is to mirror language used in Articles 725, 728, 760, and 800 all regarding the installation of Circuit Integrity Systems, Fire-Resistive Cable Systems, and Electrical Circuit Protective Systems. There are three distinct methods to provide survivability and they need to be properly identified here with their installation requirements documented accordingly. The prior reference to "minimum 2-hour fire-resistance"in the informational notes was deleted to avoid the appearance of a requirement in an informational note and to align with text proposed for the other sections to correlate. 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-P16 |

## Public Input No. 342-NFPA 70-2020 [ Section No. 770.179 [Excluding any Sub-Sections] ]

Optical fiber cables shall be listed and identified in accordance with 770.179(A) through (G) and shall be marked in accordance with Table 770.179. Optical fiber cables shall have a temperature rating of not less than 60°C (140°F). The temperature rating shall be marked on the jacket of optical fiber cables that have a temperature rating exceeding 60°C (140°F).

Informational Note: For information on Optical Fiber cables see *UL 1651, Standard for Optical Fiber Cable* , 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. 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. 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. 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]] | |
| Public Input No. 345-NFPA 70-2020 [Section No. 760.176 [Excluding any Sub-Sections]] | |

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**Committee:** NEC-P16

## Public Input No. 1504-NFPA 70-2020 [ Section No. 800.2 ]

**800.2** Definitions.

The definitions in Part I of Article 100 shall apply throughout Chapter 8. The definitions in 800.2 shall apply only within Chapter 8.

**Abandoned Cable.**

Cable that is not terminated at equipment or is not identified for future use with a tag.

**Block.**

A square or portion of a city, town, or village enclosed by streets and including the alleys so enclosed, but not any street.

**Cable Sheath.**

A covering over the conductor assembly that may include one or more metallic members, strength members, or jackets.

**Communications Circuit.**

The circuit that extends service from the communications utility or service provider up to and including the customer's communications equipment.

**Communications Service Provider.**

An organization, business, or individual that offers communications service to others, interconnecting more than a single premises network .

**Exposed (to Accidental Contact).**

A circuit in such a position that, in case of failure of supports or insulation, contact with another circuit may result.

Informational Note: See Part I of Article 100 for two other definitions of Exposed: *Exposed (as applied to live parts)* and *Exposed (as applied to wiring methods)*.

**Point of Entrance.**

The point within a building at which the wire or cable emerges from an external wall or from a concrete floor slab.

**Premises.**

The land and buildings of a user located on the user side of the utility-user network point of demarcation.

## Statement of Problem and Substantiation for Public Input

This Public Input (PI) was created by a Task Group chartered by the chair of the NEC AAC to consider correlation issues between chapters 7 and 8. TG members included: George Zimmerman - Chair, George Bish, Trevor Bowmer, Tim Cooke, Ernest Gallo, Joel Goergen, Randy Ivans, Steve Johnson, Chad Jones, Alan Manche, and Anthony Tassone. The TG was broad-based and specifically included representation of those with knowledge and experience in telecommunications and members of code panels 3 and 16.

This definition, as revised in the 2017 NEC, inadvertently creates confusion and correlating issues between communications within a single premises, such as a local area network, covered by article 725, and communications between premises, which would be covered under chapter 8. For example, under the existing definition, any individual within a premises with an ethernet switch and IP phones could be considered a communications service provider, confusing whether computer ethernet circuits

are communications circuits under chapter 8, or under Chapter 7.
The change makes it clear that the communications service provider mentioned in chapter 8 provides communications external to the premises itself.

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**Committee:** NEC-P16

# Public Input No. 3968-NFPA 70-2020 [ Section No. 800.2 ]

(Relocate all definitions in the 800. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

**800. 2** Definitions.

The definitions in Part I of Article 100 shall apply throughout Chapter 8. The definitions in 800.2 shall apply only within Chapter 8.

**Abandoned Cable.**

Cable that is not terminated at equipment or is not identified for future use with a tag.

**Block.**

A square or portion of a city, town, or village enclosed by streets and including the alleys so enclosed, but not any street.

**Cable Sheath.**

A covering over the conductor assembly that may include one or more metallic members, strength members, or jackets.

**Communications Circuit.**

The circuit that extends service from the communications utility or service provider up to and including the customer's communications equipment.

**Communications Service Provider.**

An organization, business, or individual that offers communications service to others.

**Exposed (to Accidental Contact).**

A circuit in such a position that, in case of failure of supports or insulation, contact with another circuit may result.

Informational Note: See Part I of Article 100 for two other definitions of Exposed: *Exposed (as applied to live parts)* and *Exposed (as applied to wiring methods)*.

**Point of Entrance.**

The point within a building at which the wire or cable emerges from an external wall or from a concrete floor slab.

**Premises.**

The land and buildings of a user located on the user side of the utility-user network point of demarcation.

## 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 16:28:34 EDT 2020 |
| **Committee:** | NEC-P16 |

# Public Input No. 53-NFPA 70-2019 [ Definition: Abandoned Cable. ]

**Abandoned Cable.**

~~Cable~~ Installed cable that is not terminated at equipment or is not identified for future use with a tag.

## Statement of Problem and Substantiation for Public Input

Code usability is improved by explicitly stating that abandoned cable is installed cable. It also complies with the NEC Style Manual section 3.3.5. See the parallel definition in 770.2.

## Submitter Information Verification

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**Submittal Date:** Fri Nov 08 06:35:17 EST 2019
**Committee:** NEC-P16

# Public Input No. 3478-NFPA 70-2020 [ Definition: Cable Sheath. ]

Relocate this definition to Article 100 and consider revising the definition to coordinate with the same term used in Article 770 and other articles of the code.

**Cable Sheath.**

A covering over the conductor assembly that may include one or more metallic members, strength members, or jackets.

## Statement of Problem and Substantiation for Public Input

The NEC Style Manual revisions in Section 2.2.2 and its subdivisions requires multiple changes to the definitions in Article 100 and all Articles in the NEC including the use of acronyms in Section 3.2.3. Section 2.2.2.4 Terms with Multiple Definitions. Where two or more definitions exist for a term, a task group shall be formed to work on the development of a single acceptable definition. When this cannot be accomplished, another term shall be selected or the term shall be identified in the context of the specific application.
The term cable sheath is commonly used in the code and the panel should consider deleting the definition.

## Submitter Information Verification

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**Committee:** NEC-P16

# Public Input No. 4635-NFPA 70-2020 [ Definition: Communications Circuit. ]

**Communications Circuit.**

~~The circuit that extends service from the communications utility or service provider up to and including the customer's communications equipment.~~ A metallic, fiber or wireless circuit that provides voice/data (and associated powering) for a communication related service(s) between communications equipment

## Statement of Problem and Substantiation for Public Input

Communications circuits need to be safe and not present a fire or electrical shock hazard and use appropriate cable and be bonded and grounded properly and used in the prescribed acceptable manner regardless of who installs it!

Currently, if a utility or service provider is not providing a communications service to the equipment or circuit, or premises then 800 can be claimed as not applicable and out of scope. This creates the possibility of improper installations and fire or electrical shock hazards.

The scope of 800, as detailed in 800.1 requires a "communications circuit", and the definition of communications circuit requires a utility or service provider to be involved, which often is not the case in modern communications systems installations in both commercial as well as residential applications.

The criteria and rules established in Chapter 8 need to be able to be applied even if a utility/service provider service is not active or relevant to the installation.

For example IT departments and home owners install communications systems and networks on a daily basis and in exponentially increasing numbers every day. Yet a typical Ethernet LAN network for instance would not be a "communications circuit" or communications system and be outside the scope of Chapter 8 under the current definitions. It would not fall under 725 either as it has no Class 2/Class 3 power sources and uses CM (communications cabling.

Many claim that these installations are not required to be installed in accordance with Chapter 8 or Chapter 7, as out of scope. But very important information regarding these installations are contained in Chapter 8.

The Listing standards mentioned in Chapter 7 and 8 for ICT equipment for example do not differentiate on whether equipment is communications equipment or a communications system, based on who provides the service or who installs it either!

To ensure ALL communications systems are installed safely and have an appropriate place within the code, to prevent fires and shock, and are Listed, etc, the definition of a "communications circuit" needs to be modified to align with the safety standards, the intent, the modern real world, and not arcanely be based on who may or may not have a service connected to the system in some fashion. Otherwise many modern installations and networks will be claimed as out of scope for Chapter 7 and 8.

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| **Submittal Date:** | Thu Sep 10 16:05:58 EDT 2020 |
| **Committee:** | NEC-P16 |

## Public Input No. 1245-NFPA 70-2020 [ Definition: Point of Entrance. ]

**Point of Entrance.**

The point within a building at which the wire or cable emerges from an external wall~~, or~~ , through a roof via a weatherhead, from a concrete floor slab.

## Statement of Problem and Substantiation for Public Input

Allows for greater flexibility and consistency with field applications.

## Submitter Information Verification

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**Committee:** NEC-P16

## Public Input No. 4686-NFPA 70-2020 [ Definition: Premises. ]

**Premises.**

The ~~land and~~ commercial and residential land, as well as buildings of a user ~~located on the user~~ , excluding land, buildings, structures, cabling and infra-structure located on the utility or service provider side of the ~~utility-user~~ network point of demarcation, if any .

## Statement of Problem and Substantiation for Public Input

The problem is that a premises exists regardless of the service provided, who provides the service, or if there is any service provided by a traditional utility or service provider.

Simply disconnecting a service from a utility or service provider does not make a premises simply not exist.

The definition needs to encompass the idea of what a premises is and what it excludes for code purposes, with the goal being to make sense, and be able to be applied equally without checking someones utility bill. More importantly ensure the rules relating to communications systems are applied to existing and future installations to prevent fires and electrical shock.

Whether some entity has an arrangement with a utility or service provider to bring in some fiber or wireless or even copper service on premises has no relevancy as to whether the land and building are a premises or not. And that status should not change if you don't pay your monthly service bill.

The definition needs to be modified to improve the usability and equal/consistent use of the code and prevent fires and electrical shock. Not encourage loophole shoppers so they can say rules are out of scope or do not apply

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**Committee:** NEC-P16

# Public Input No. 54-NFPA 70-2019 [ New Definition after Definition: Block. ]

**TITLE OF NEW CONTENT**

Cable.

A factory assembly of two or more conductors having an overall covering.

## Statement of Problem and Substantiation for Public Input

The term “cable” appears in more than one article in Chapter 8; consequently it belongs in the general article. See PI 55 for Article 805.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 55-NFPA 70-2019 [Definition: Cable.] | Removes cable definition from Article 805. |
| Public Input No. 55-NFPA 70-2019 [Definition: Cable.] | |

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**Submittal Date:** Fri Nov 08 06:40:28 EST 2019
**Committee:** NEC-P16

## Public Input No. 1765-NFPA 70-2020 [ New Definition after Definition: Communications Circuit. ]

**Communications Service Point.**

The point of connection between the communications service provider's network (Outside Plant) and the premises wiring (Inside Plant). (CMP-XX)

## Statement of Problem and Substantiation for Public Input

This Public Input (PI) was created by a Task Group chartered by the chair of the NEC AAC to consider correlation issues between chapters 7 and 8. TG members included: George Zimmerman - Chair,George Bish, Trevor Bowmer, Tim Cooke, Ernest Gallo, Joel Goergen, Randy Ivans, Steve Johnson, Chad Jones, Alan Manche, and Anthony Tassone. The TG was broad-based and specifically included representation of those with knowledge and experience in telecommunications and members of code panels 3 and 16.
By identifying the communications service point, analogous to the electrical service point, the domain of the communications circuits in chapter 8 become more clearly inspectable. The definition of communications circuit in chapter 8 extends service from the communications utility or service provider, which this definition would do. In civilian telecommunications, outside plant refers to all of the physical cabling and supporting infrastructure (such as conduit, cabinets, tower or poles), and any associated hardware (such as repeaters) located between a demarcation point in a switching facility and a demarcation point in another switching center or customer premises. The term "outside plant communications cable" is also used in 805.48 to distinguish cable coming from the service provider. Depending on the type of communications service, the communications point may take several forms, and the requirements for these are detailed in a proposed new section, in a related PI.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 1764-NFPA 70-2020 [New Section after 800.44] | New article using this added definition |
| Public Input No. 1764-NFPA 70-2020 [New Section after 800.44] | |

## Submitter Information Verification

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**Submittal Date:** Mon Jun 29 17:40:57 EDT 2020
**Committee:** NEC-P16

## Public Input No. 56-NFPA 70-2019 [ New Definition after Definition: Premises. ]

**TITLE OF NEW CONTENT**

Wire.

A factory assembly of one or more insulated conductors without an overall covering.

## Statement of Problem and Substantiation for Public Input

The term “wire” appears in more than one article in Chapter 8; consequently it belongs in the general article.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 57-NFPA 70-2019 [Definition: Wire.] | Deletes definition of wire from Article 805. |
| Public Input No. 57-NFPA 70-2019 [Definition: Wire.] | |

## Submitter Information Verification

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**Submittal Date:** Fri Nov 08 06:49:57 EST 2019
**Committee:** NEC-P16

## Public Input No. 1752-NFPA 70-2020 [ Section No. 800.3 ]

**800.3** Other Articles.

Only those sections of Chapters 1 through 7 referenced in Chapter 8 shall apply to Chapter 8.

**(A)** Hazardous (Classified) Locations.

Circuits and equipment installed in a location that is classified in accordance with 500.5 and 505.5 shall comply with the applicable requirements of Chapter 5.

(B)

~~– Wiring in Ducts for Dust, Loose Stock, or Vapor Removal.~~

~~The requirements of 300.22(A) shall apply~~

Spread of Fire or Products of Combustion.

Installation of communications circuits 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)

~~– Equipment in Other Space Used for Environmental Air. The requirements of 300.22(C)(3) shall apply~~

Ducts, Plenums, and Other Air-Handling Spaces.

Communications circuits installed in ducts, plenums, or other space used for environmental air shall comply with 300.22 .

**(D)** Installation and Use.

The requirements of 110.3(B) shall apply.

**(E)** Optical Fiber Cable.

Where optical fiber cable is used to provide a communications circuit within a building, Article 770 shall apply.

**(F)** Other Communications Systems.

As appropriate for the system involved, communications systems shall also comply with the requirements of the following:

(1) Communications circuits — Article 805

(2) Radio and television equipment — Article 810

(3) Community antenna television and radio distribution systems — Article 820

(4) Network-powered broadband communications systems — Article 830

(5) Premises-powered broadband communications systems — Article 840

**(G)** Reconditioned Equipment.

The requirements of 110.21(A)(2) shall apply.

## Statement of Problem and Substantiation for Public Input

Add the rules on Spread of Fire from 725.3(B) and combined the rules for ducts and plenum spaces like 725.3(C).

## Submitter Information Verification

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**Submittal Date:** Thu Jun 25 20:33:42 EDT 2020
**Committee:** NEC-P16

# Public Input No. 318-NFPA 70-2020 [ Section No. 800.3 ]

**800.3** Other Articles.

Only those sections of Chapters 1 through 7 referenced in Chapter 8 shall apply to Chapter 8. Installations of circuits and equipment shall comply with 800.3(A) through 800.3(G).

**(A)** Hazardous (Classified) Locations.

Circuits and equipment installed in a location that is classified in accordance with 500.5 and 505.5 shall comply with the applicable requirements of Chapter 5.

**(B)** Wiring in Ducts for Dust, Loose Stock, or Vapor Removal.

The requirements of 300.22(A) shall apply.

**(C)** Equipment in Other Space Used for Environmental Air.

The requirements of 300.22(C)(3) shall apply.

**(D)** Installation and Use.

The requirements of 110.3(B) shall apply.

**(E)** Optical Fiber Cable.

Where optical fiber cable is used to provide a communications circuit within a building, Article 770 shall apply.

**(F)** Other Communications Systems.

As appropriate for the system involved, communications systems shall also comply with the requirements of the following:

(1) Communications circuits — Article 805

(2) Radio and television equipment — Article 810

(3) Community antenna television and radio distribution systems — Article 820

(4) Network-powered broadband communications systems — Article 830

(5) Premises-powered broadband communications systems — Article 840

**(G)** Reconditioned Equipment.

The requirements of 110.21(A)(2) shall apply.

## Statement of Problem and Substantiation for Public Input

This is an editorial PI. It introduces parallel text to 800.3 so it reads similarly to 770.3, 820.3, 830.3 and 840.3.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 86-NFPA 70-2019 [Section No. 830.3 [Excluding any Sub-Sections]] | Editorial clarification of 830.3 |
| Public Input No. 87-NFPA 70-2019 [Section No. 820.3 [Excluding any Sub-Sections]] | Editorial clarification of 820.3 |
| Public Input No. 58-NFPA 70-2019 [Section No. 840.3 [Excluding any Sub-Sections]] | Editorial clarification of 840.3 |

## Submitter Information Verification

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**Submittal Date:** Fri Jan 17 16:08:59 EST 2020
**Committee:** NEC-P16

# Public Input No. 3947-NFPA 70-2020 [ Section No. 800.3 ]

**800.3** Other Articles.

Only those sections of Chapters 1 through 7 referenced in Chapter 8 shall apply to Chapter 8.

**(A)** Hazardous (Classified) Locations.

Circuits and equipment installed in a location that is classified in accordance with 500.5 and 505.5 shall comply with the applicable requirements of Chapter 5.

**(B)** Wiring in Ducts for Dust, Loose Stock, or Vapor Removal.

The requirements of 300.22(A) shall apply.

**(C)** Equipment in Other Space Used for Environmental Air.

The requirements of 300.22(C)(3) shall apply.

**(D)** Installation and Use.

The requirements of 110.3(B) shall apply.

**(E)** Optical Fiber Cable.

Where optical fiber cable is used to provide a communications circuit within a building, Article 770 shall apply.

**(F)** Other Communications Systems.

As appropriate for the system involved, communications systems shall also comply with the requirements of the following:

(1) Communications circuits — Article 805

(2) Radio and television equipment — Article 810

(3) Community antenna television and radio distribution systems — Article 820

(4) Network-powered broadband communications systems — Article 830

(5) Premises-powered broadband communications systems — Article 840

**(G)** Reconditioned Equipment.

The requirements of 110.21(A)(2) shall apply.

**(H) Bonding and Grounding of Communication Cable Shields.**

The requirements defined in 250.4 shall apply to all shielded communications cabling as applicable.

## Statement of Problem and Substantiation for Public Input

Armored and other shielded communication cables may be used within buildings as their Listing allows. However, these cables are not required to be bonded or connected to a low-impedance path, creating a potential risk if these cables become energized.

## Submitter Information Verification

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| | |
|---|---|
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| **Submittal Date:** | Wed Sep 09 16:06:00 EDT 2020 |
| **Committee:** | NEC-P16 |

# Public Input No. 2244-NFPA 70-2020 [ New Section after 800.3(G) ]

**(H) Vertical Support for Fire-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.

## Statement of Problem and Substantiation for Public Input

The CI Task Group recommends adding the vertical support language in Chapter 800, similar to the language found in Article 725, 728, 760, and 770 to properly address the spacing and support requirements for circuit integrity cable. 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.

## Submitter Information Verification

**Submitter Full Name:** Richard Holub
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**Submittal Date:** Wed Aug 12 12:10:39 EDT 2020
**Committee:** NEC-P16

## Public Input No. 2246-NFPA 70-2020 [ Section No. 800.24 ]

**800.24** Mechanical Execution of Work.

(A) General.

Circuits and equipment 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 also conform to 300.4 and 300.11. 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 805.170(C).

Informational Note No. 1: Accepted industry practices are described in ANSI/TIA-568.1-D-2015, *Commercial Building Telecommunications Infrastructure Standard;* ANSI/TIA-569-D-2015, *Telecommunications Pathways and Spaces;* ANSI/TIA-570-C-2012, *Residential Telecommunications Infrastructure Standard;* ANSI/TIA-1005-A-2012, *Telecommunications Infrastructure Standard for Industrial Premises;* ANSI/TIA-1179-2010, *Healthcare Facility Telecommunications Infrastructure Standard;* ANSI/TIA-4966-2014, *Telecommunications Infrastructure Standard for Educational Facilities;* and other ANSI-approved installation standards.

Informational Note No. 2: 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. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of wire and cable properties.

(B) Circuit Integrity (CI) Cable.

Circuit integrity (CI) cable shall be supported at a distance not exceeding 610mm (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 intent here is to split this into an (A) General and (B) Circuit Integrity, to correlate with 760.24 (as well as proposed changes in Articles 725, 728, and 770). Circuit Integrity Cable has specific installation requirements which are currently not covered adequately in Chapter 8 and proposals are made to 805.179(C) to address this and point to this mechanical execution of work language.The current language in the NEC(r) is not specific to what building surface the cable may be mounted to. The language proposed here correlates with the other mentioned articles and mirrors the requirements for a circuit protective system installation. Circuit integrity (-CI) cable's support is critical to the survivability of the cable. If the supporting structure doesn't survive the fire for the required time, the critical circuit may not survive as well. 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.

## Submitter Information Verification

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**Committee:** NEC-P16

# Public Input No. 305-NFPA 70-2020 [ Section No. 800.24 ]

**800.24** Mechanical Execution of Work.

Circuits and equipment 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 also conform to 300.4 and 300.11 . Nonmetallic~~ meet the requirements of Section 110.12(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 805.170(C).

Informational Note No. 1: Accepted industry practices are described in ANSI/TIA-568.1-D-2015, *Commercial Building Telecommunications Infrastructure Standard;* ANSI/TIA-569-D-2015, *Telecommunications Pathways and Spaces;* ANSI/TIA-570-C-2012, *Residential Telecommunications Infrastructure Standard;* ANSI/TIA-1005-A-2012, *Telecommunications Infrastructure Standard for Industrial Premises;* ANSI/TIA-1179-2010, *Healthcare Facility Telecommunications Infrastructure Standard;* ANSI/TIA-4966-2014, *Telecommunications Infrastructure Standard for Educational Facilities;* and other ANSI-approved installation standards.

Informational Note No. 2: 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. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of wire and cable properties.~~

## Statement of Problem and Substantiation for Public Input

The general mechanical execution of work requirements, as well as Informational Note No. 1, are now contained in 110.12(C), are redundant here, and may be deleted.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 303-NFPA 70-2020 [Section No. 770.24] | |
| Public Input No. 302-NFPA 70-2020 [Section No. 760.24(A)] | |
| Public Input No. 301-NFPA 70-2020 [Section No. 725.24] | |
| Public Input No. 300-NFPA 70-2020 [Section No. 110.12(C)] | |
| Public Input No. 306-NFPA 70-2020 [Section No. 830.24] | |
| Public Input No. 308-NFPA 70-2020 [Section No. 840.24] | |

## Submitter Information Verification

| | |
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| **Organization:** | Telcordia Technologies (ericss |

| | |
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| **Submittal Date:** | Thu Jan 16 10:54:11 EST 2020 |
| **Committee:** | NEC-P16 |

## Public Input No. 3769-NFPA 70-2020 [ Section No. 800.24 ]

**800.24** Mechanical Execution of Work.

Circuits and equipment 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 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 conform to 300.4 and 300.11. 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 805.170(C).

Informational Note No. 1: Accepted industry practices are described in ANSI/TIA-568.1-D-2015, *Commercial Building Telecommunications Infrastructure Standard;* ANSI/TIA-569-D-2015, *Telecommunications Pathways and Spaces;* ANSI/TIA-570-C-2012, *Residential Telecommunications Infrastructure Standard;* ANSI/TIA-1005-A-2012, *Telecommunications Infrastructure Standard for Industrial Premises;* ANSI/TIA-1179-2010, *Healthcare Facility Telecommunications Infrastructure Standard;* ANSI/TIA-4966-2014, *Telecommunications Infrastructure Standard for Educational Facilities;* and other ANSI-approved installation standards.

Informational Note No. 2: 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. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of wire and 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 optical fiber cable 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 770.24 to ensure the same listing and securement requirement for cable ties also applies to cable ties used to support optical fiber cable. 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 770.24.
Identical public inputs have been submitted for Sections 725.24, 760.24, and 800.24.

## Submitter Information Verification

**Submitter Full Name:** Megan Hayes
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**Submittal Date:** Wed Sep 09 12:12:57 EDT 2020
**Committee:** NEC-P16

## Public Input No. 3929-NFPA 70-2020 [ Section No. 800.24 ]

**800.24** Mechanical Execution of Work.

Circuits and equipment 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 also conform to 300.4 and 300.11. 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 805.170(C).

Informational Note No. 1: Accepted industry practices are described in ANSI/ BICSI N1-2019, *Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure,* ANSI/ TIA-568.1- D-2015, *Commercial Building Telecommunications Infrastructure Standard;* ANSI/TIA-569-D-2015, *Telecommunications Pathways and Spaces;* ANSI/TIA-570-C-2012, *Residential Telecommunications Infrastructure Standard;* ANSI/TIA-1005-A-2012, *Telecommunications Infrastructure Standard for Industrial Premises;* ANSI/ TIA-1179-2010, *Healthcare Facility Telecommunications Infrastructure Standard;* ANSI/TIA-4966-2014, *Telecommunications Infrastructure Standard for Educational Facilities;* and other ANSI-approved installation standards.

Informational Note No. 2: 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. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of wire and cable properties.

## Statement of Problem and Substantiation for Public Input

ANSI/NECA/BICSI 568 served as the ANSI approved installation standard for communications from 2001 to 2019 and was listed within Information Note 1 since 2004. In NFPA 70-2020, the reference was correctly removed as ANSI/NECA/BICSI 568 had been withdrawn and was in process of being replaced by ANSI/BICSI N1-2019.
This proposal is to complete the change in the reference.
As standards placed within Informational Notes should be directly applicable to the article, the purpose of ANSI/BICSI N1-2019 is as follows:
“This standard specifies best practices for installation of telecommunications and information communication cabling used for communication, signaling, network and related applications. These installation practices are intended to
facilitate compliance with applicable codes (e.g., National Electrical Code®, Canadian Electrical Code®) and to follow the recommendations and requirements of applicable standards.”
And the scope of ANSI/BICSI N1 contains the following:
“This standard describes minimum requirements and procedures for installing the infrastructure supporting telecommunication and ICT cabling (e.g., balanced twisted pair copper cabling, optical fiber cabling) used for signal (e.g., voice, data, video) transmission. Installers should always follow applicable codes and manufacturers’ instructions. This standard is intended to be used in describing a “neat and workmanlike manner” as referenced by NFPA 70.”

## Submitter Information Verification

**Submitter Full Name:** Jeff Silveira
**Organization:** BICSI

| | |
|---|---|
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| **Submittal Date:** | Wed Sep 09 15:39:17 EDT 2020 |
| **Committee:** | NEC-P16 |

## Public Input No. 4293-NFPA 70-2020 [ Section No. 800.24 ]

**800.24** Mechanical Execution of Work.

Circuits and equipment 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~~ Hammer driven supports installed over the cable shall not be used. The installation shall also conform to 300.4 and 300.11. 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 805.170(C).

Informational Note No. 1: Accepted industry practices are described in ANSI/TIA-568.1-D-2015, *Commercial Building Telecommunications Infrastructure Standard;* ANSI/TIA-569-D-2015, *Telecommunications Pathways and Spaces;* ANSI/TIA-570-C-2012, *Residential Telecommunications Infrastructure Standard;* ANSI/TIA-1005-A-2012, *Telecommunications Infrastructure Standard for Industrial Premises;* ANSI/TIA-1179-2010, *Healthcare Facility Telecommunications Infrastructure Standard;* ANSI/TIA-4966-2014, *Telecommunications Infrastructure Standard for Educational Facilities;* and other ANSI-approved installation standards.

Informational Note No. 2: 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. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of wire and cable properties.

## Statement of Problem and Substantiation for Public Input

Further explanation needs to be addressed concerning certain fastener installation practices to prevent inadvertent physical damage to these sensitive cables. By inserting the new text we can clearly indicate that we intend to keep the safety of the cable in mind so that “installed so as not to damage the cable” will be adhered to. Article 300.4- “Where subject to physical damage, conductors, raceways, and cables shall be protected. A support that places the cable in line with a hammer swing is quite possibly subject to physical damage.

## Submitter Information Verification

**Submitter Full Name:** Mark Wolff
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**Submittal Date:** Thu Sep 10 09:35:05 EDT 2020
**Committee:** NEC-P16

# Public Input No. 67-NFPA 70-2019 [ Section No. 800.24 ]

**800.24** Mechanical Execution of Work.

Circuits and equipment 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 also conform to 300.4 and 300.11. ~~Nonmetallic~~ Plenum 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 ~~805~~ 800 .170 ~~(C)~~ .

Informational Note No. 1: Accepted industry practices are described in ANSI/TIA-568.1-D-2015, *Commercial Building Telecommunications Infrastructure Standard;* ANSI/TIA-569-D-2015, *Telecommunications Pathways and Spaces;* ANSI/TIA-570-C-2012, *Residential Telecommunications Infrastructure Standard;* ANSI/TIA-1005-A-2012, *Telecommunications Infrastructure Standard for Industrial Premises;* ANSI/TIA-1179-2010, *Healthcare Facility Telecommunications Infrastructure Standard;* ANSI/TIA-4966-2014, *Telecommunications Infrastructure Standard for Educational Facilities;* and other ANSI-approved installation standards.

Informational Note No. 2: 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. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of wire and cable properties.

## Statement of Problem and Substantiation for Public Input

PI 65 and PI 66 move the listing requirements for plenum cable ties from Article 805 to general Article 800. This PI coordinates with PIs 65 & 66.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 66-NFPA 70-2019 [Section No. 805.170(C)] | Deletes listing requirements for plenum cable ties from Article 805 |
| Public Input No. 65-NFPA 70-2019 [New Part after V.] | Moves listing requirements for plenum cable ties to Article 800 |
| Public Input No. 64-NFPA 70-2019 [Section No. 770.24] | Parellel PI for Article 770 |
| Public Input No. 64-NFPA 70-2019 [Section No. 770.24] | |

## Submitter Information Verification

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|---|---|
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| **Submittal Date:** | Fri Nov 08 09:13:08 EST 2019 |
| **Committee:** | NEC-P16 |

# Public Input No. 683-NFPA 70-2020 [ Section No. 800.24 ]

**800.24** Mechanical Execution of Work.

Circuits and equipment 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 also conform to 300.4 and 300.11. 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 805.170(C).

Informational Note No. 1: Accepted industry practices are described in ANSI/TIA-568.1-D-2015, *Commercial Building Telecommunications Infrastructure Standard;* ANSI/TIA-569-D-2015, *Telecommunications Pathways and Spaces;* ANSI/TIA-570-C-2012, *Residential Telecommunications Infrastructure Standard;* ANSI/TIA-1005-A-2012, *Telecommunications Infrastructure Standard for Industrial Premises;* ANSI/TIA-1179-2010, *Healthcare Facility Telecommunications Infrastructure Standard;* ANSI/TIA-4966-2014, *Telecommunications Infrastructure Standard for Educational Facilities;* and other ANSI-approved installation standards.

Informational Note No. 2: See NFPA 90A-~~2018~~ 2021 , *Standard for the Installation of Air-Conditioning and Ventilating Systems*, for discrete combustible components installed in accordance with 300.22(C).

Informational Note No. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of wire and cable properties.

## 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. 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. 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. 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. 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)] | |

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## Public Input No. 881-NFPA 70-2020 [ Section No. 800.24 ]

**800.24** Mechanical Execution of Work.

Circuits and equipment 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 also conform to 300.4 and 300.11. 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 805.170(C).

Informational Note No. 1: Accepted industry practices are described in ANSI/TIA-568.1-~~D~~ E -~~2015~~ 2020 , *Commercial Building Telecommunications Infrastructure Standard;* ANSI/TIA-569-~~D~~ E -~~2015~~ 2019 , *Telecommunications Pathways and Spaces;* ANSI/TIA-570-~~C~~ D -~~2012~~ 2018 , *Residential Telecommunications Infrastructure Standard;* ANSI/TIA-1005-A-2012, *Telecommunications Infrastructure Standard for Industrial Premises;* ANSI/ TIA-1179-~~2010~~ A-2017 , *Healthcare Facility Telecommunications Infrastructure Standard;* ANSI/TIA-4966-2014, *Telecommunications Infrastructure Standard for Educational Facilities;* and other ANSI-approved installation standards.

Informational Note No. 2: 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. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of wire and cable properties.

## Statement of Problem and Substantiation for Public Input

Updating ANSI/TIA references to the latest versions

## Submitter Information Verification

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# Public Input No. 3224-NFPA 70-2020 [ Sections 800.27, Part II., 800.44 ]

**Sections 800.27, Part II., 800.44**

**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.

**Part II.** Wires and Cables Outside and ~~Entering Buildings~~ on the service provider side of the Communication Service Point

**800.44** Overhead (Aerial) Wires and Cables.

Overhead (aerial) wires and cables ~~entering buildings~~ on the service provider side of the Communication Service Point shall comply with 800.44(A) through (D).

Informational Note: For additional information regarding overhead (aerial) wires and cables, see ANSI C2-2017, *National Electrical Safety Code, Part 2 Safety Rules for Overhead Lines.*

**(A)** On Poles and In-Span.

Where wires and cables and electric light or power conductors are supported by the same pole or are run parallel to each other in-span, the conditions described in 800.44(A)(1) through (A)(4) shall be met.

**(1)** Relative Location.

Where practicable, the wires and cables shall be located below the electric light or power conductors.

**(2)** Attachment to Cross-Arms.

Wires and cables shall not be attached to a cross-arm that carries electric light or power conductors.

**(3)** Climbing Space.

The climbing space through wires and cables shall comply with the requirements of 225.14(D).

**(4)** Clearance.

Supply service drops and sets of overhead service conductors of 0 volts to 750 volts running above and parallel to communications and CATV type coaxial service drops shall have a minimum separation of 300 mm (12 in.) at any point in the span, including the point of and at their attachment to the building, provided that the ungrounded conductors are insulated and that a clearance of not less than 1.0 m (40 in.) is maintained between the two services at the pole.

**(B)** Above Roofs.

Communications wires and cables and CATV type coaxial cables shall have a vertical clearance of not less than 2.5 m (8 ft) from all points of roofs above which they pass.

*Exception No. 1: Communications wires and cables and CATV type coaxial cables shall not be required to have a vertical clearance of not less than 2.5 m (8 ft) above auxiliary buildings, such as garages and the like.*

*Exception No. 2: A reduction in clearance above only the overhanging portion of the roof to not less than 450 mm (18 in.) shall be permitted if (1) not more than 1.2 m (4 ft) of communications service-drop conductors pass above the roof overhang and (2) they are terminated at a through- or above-the-roof raceway or approved support.*

*Exception No. 3: Where the roof has a slope of not less than 100 mm in 300 mm (4 in. in 12 in.), a reduction in clearance to not less than 900 mm (3 ft) shall be permitted.*

Informational Note: For additional information regarding overhead (aerial) wires and cables, see ANSI/IEEE C2-2017, *National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines*.

**(C)** On Masts.

Overhead (aerial) communications and CATV type coaxial cables shall be permitted to be attached to an above-the-roof raceway mast that does not enclose or support conductors of electric light or power circuits.

**(D)** Between Buildings.

Communications and CATV type coaxial cables extending between buildings or structures, and also the supports or attachment fixtures, shall be identified and shall have sufficient strength to withstand the loads to which they might be subjected.

*Exception: Where a coaxial cable does not have sufficient strength to be self-supporting, it shall be attached to a supporting messenger cable that, together with the attachment fixtures or supports, shall be acceptable for the purpose and shall have sufficient strength to withstand the loads to which they may be subjected.*

## Additional Proposed Changes

| File Name | Description | Approved |
|---|---|---|
| Chapter_8_-_2020-09-03_CC_Task_Group.pdf | | |

## Statement of Problem and Substantiation for Public Input

This public input is being submitted by a Correlating Committee Task Group to improve the correlation between Chapter 7 and 8. At the present time there are significant correlation issues with regards to what constitutes an installation in Chapter 7 and what constitutes an installation in Chapter 8.

Previously a Correlating Committee Task Group was formed to review Chapter 8 and to make suggested modifications. This Chapter 8 task group has submitted a public input to define Communication Service point and has submitted a public input to determine where the actual service point exists within communication systems. It is very difficult for an AHJ to determine where there inspection authority begins and this work will help provide clarity and usability.

This public input follows up on the work of that specific task group and provides editorial revisions to further improve on that work. Public inputs are being submitted to change Titles and certain wording to reflect what wiring is on the customer side of the Communication Service Point and what wiring is on the communication utility or service provider side of this point.

The Correlating Committee Task Group is a long range planning committee that is seeking to make improvement over the next two to three cycles. The Task Group is made up of the following members: Alan Manche, Donny Cook, Randy Ivans, Ernie Gallo, and Thomas Domitrovich.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 3223-NFPA 70-2020 [Sections Part IV., 805.133] | |
| Public Input No. 3226-NFPA 70-2020 [Section No. 800.154] | |
| Public Input No. 3225-NFPA 70-2020 [Part IV.] | |
| Public Input No. 3227-NFPA 70-2020 [Part II.] | |
| Public Input No. 3229-NFPA 70-2020 [Part V.] | |
| Public Input No. 3230-NFPA 70-2020 [Part II.] | |
| Public Input No. 3231-NFPA 70-2020 [Sections Part V., 830.133] | |
| Public Input No. 3232-NFPA 70-2020 [Sections Part II., 840.47, 840.48, Part III.] | |
| Public Input No. 3233-NFPA 70-2020 [Part V.] | |
| Public Input No. 3223-NFPA 70-2020 [Sections Part IV., 805.133] | |
| Public Input No. 3226-NFPA 70-2020 [Section No. 800.154] | |
| Public Input No. 3227-NFPA 70-2020 [Part II.] | |
| Public Input No. 3230-NFPA 70-2020 [Part II.] | |
| Public Input No. 3232-NFPA 70-2020 [Sections Part II., 840.47, 840.48, Part III.] | |
| Public Input No. 3233-NFPA 70-2020 [Part V.] | |

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## Chapter 8 Communications Systems

# Article 800 General Requirements for Communications Systems

### Part I. General

#### 800.1 Scope.

This article covers general requirements for communications systems. These general requirements apply to communications circuits, community antenna television and radio distribution systems, network-powered broadband communications systems, and premises-powered broadband communications systems, unless modified by Articles 805, 820, 830, or 840.

Informational Note No. 1: See 90.2(B)(4) for installations of circuits and equipment that are not covered.

Informational Note No. 2: For further information for remote control, signaling, and power-limited circuits, see Article 725.

Informational Note No. 3: For further information for fire alarm systems, see Article 760.

#### 800.2 Definitions.

The definitions in Part I of Article 100 shall apply throughout Chapter 8. The definitions in 800.2 shall apply only within Chapter 8.

**Abandoned Cable.**

Cable that is not terminated at equipment or is not identified for future use with a tag.

**Block.**

A square or portion of a city, town, or village enclosed by streets and including the alleys so enclosed, but not any street.

**Cable Sheath.**

A covering over the conductor assembly that may include one or more metallic members, strength members, or jackets.

**Communications Circuit.**

The circuit that extends service from the communications utility or service provider up to and including the customer's communications equipment.

**Communications Service Provider.**

An organization, business, or individual that offers communications service to others.

**Exposed (to Accidental Contact).**

A circuit in such a position that, in case of failure of supports or insulation, contact with another circuit may result.

Informational Note: See Part I of Article 100 for two other definitions of Exposed: *Exposed (as applied to live parts)* and *Exposed (as applied to wiring methods)*.

**Point of Entrance.**

The point within a building at which the wire or cable emerges from an external wall or from a concrete floor slab.

**Premises.**

The land and buildings of a user located on the user side of the utility-user ~~network point of demarcation~~.

#### 800.3 Other Articles.

Only those sections of Chapters 1 through 7 referenced in Chapter 8 shall apply to Chapter 8.

**(A) Hazardous (Classified) Locations.**

Circuits and equipment installed in a location that is classified in accordance with 500.5 and 505.5 shall comply with the applicable requirements of Chapter 5.

**(B) Wiring in Ducts for Dust, Loose Stock, or Vapor Removal.**

The requirements of 300.22(A) shall apply.

**(C) Equipment in Other Space Used for Environmental Air.**

The requirements of 300.22(C)(3) shall apply.

**(D) Installation and Use.**

The requirements of 110.3(B) shall apply.

**(E) Optical Fiber Cable.**

Where optical fiber cable is used to provide a communications circuit within a building, Article 770 shall apply.

**(F) Other Communications Systems.**

As appropriate for the system involved, communications systems shall also comply with the requirements of the following:

1. Communications circuits — Article 805
2. Radio and television equipment — Article 810
3. Community antenna television and radio distribution systems — Article 820
4. Network-powered broadband communications systems — Article 830
5. Premises-powered broadband communications systems — Article 840

**(G) Reconditioned Equipment.**

The requirements of 110.21(A)(2) shall apply.

### 800.21 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.

### 800.24 Mechanical Execution of Work.

Circuits and equipment 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 also conform to 300.4 and 300.11. 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 805.170(C).

Informational Note No. 1: Accepted industry practices are described in ANSI/TIA-568.1- D-2015, *Commercial Building Telecommunications Infrastructure Standard;* ANSI/TIA-569-D-2015, *Telecommunications Pathways and Spaces;* ANSI/TIA-570-C-2012, *Residential Telecommunications Infrastructure Standard;* ANSI/TIA-1005-A-2012, *Telecommunications Infrastructure Standard for Industrial Premises;* ANSI/ TIA-1179-2010, *Healthcare Facility Telecommunications Infrastructure Standard;* ANSI/TIA-4966-2014, *Telecommunications Infrastructure Standard for Educational Facilities;* and other ANSI-approved installation standards.

Informational Note No. 2: 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. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of wire and cable properties.

### 800.25 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.

### 800.26 Spread of Fire or Products of Combustion.

Installations of cables, communications raceways, cable routing assemblies 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 penetrations of cables, communications raceways, and cable routing assemblies 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 800.26 can be found in building codes, fire resistance directories, and product listings.

### 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.

## Part II. Wires and Cables Outside and on the service provider side of the Communication Service Point ~~Entering Buildings~~

### 800.44 Overhead (Aerial) Wires and Cables.

Overhead (aerial) wires and cables on the service provider side of the Communication Service Point ~~entering buildings~~ shall comply with 800.44(A) through (D).

Informational Note: For additional information regarding overhead (aerial) wires and cables, see ANSI C2-2017, *National Electrical Safety Code, Part 2 Safety Rules for Overhead Lines.*

#### (A) On Poles and In-Span.

Where wires and cables and electric light or power conductors are supported by the same pole or are run parallel to each other in-span, the conditions described in 800.44(A)(1) through (A)(4) shall be met.

#### (1) Relative Location.

Where practicable, the wires and cables shall be located below the electric light or power conductors.

#### (2) Attachment to Cross-Arms.

Wires and cables shall not be attached to a cross-arm that carries electric light or power conductors.

#### (3) Climbing Space.

The climbing space through wires and cables shall comply with the requirements of 225.14(D).

#### (4) Clearance.

Supply service drops and sets of overhead service conductors of 0 volts to 750 volts running above and parallel to communications and CATV type coaxial service drops shall have a minimum separation of 300 mm (12 in.) at any point in the span, including the point of and at their attachment to the building, provided that the ungrounded conductors are insulated and that a clearance of not less than 1.0 m (40 in.) is maintained between the two services at the pole.

#### (B) Above Roofs.

Communications wires and cables and CATV type coaxial cables shall have a vertical clearance of not less than 2.5 m (8 ft) from all points of roofs above which they pass.

*Exception No. 1: Communications wires and cables and CATV type coaxial cables shall not be required to have a vertical clearance of not less than 2.5 m (8 ft) above auxiliary buildings, such as garages and the like.*

*Exception No. 2: A reduction in clearance above only the overhanging portion of the roof to not less than 450 mm (18 in.) shall be permitted if (1) not more than 1.2 m (4 ft) of communications service-drop conductors pass above the roof overhang and (2) they are terminated at a through- or above-the-roof raceway or approved support.*

*Exception No. 3: Where the roof has a slope of not less than 100 mm in 300 mm (4 in. in 12 in.), a reduction in clearance to not less than 900 mm (3 ft) shall be permitted.*

Informational Note: For additional information regarding overhead (aerial) wires and cables, see ANSI/IEEE C2-2017, *National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines*.

**(C) On Masts.**

Overhead (aerial) communications and CATV type coaxial cables shall be permitted to be attached to an above-the-roof raceway mast that does not enclose or support conductors of electric light or power circuits.

**(D) Between Buildings.**

Communications and CATV type coaxial cables extending between buildings or structures, and also the supports or attachment fixtures, shall be identified and shall have sufficient strength to withstand the loads to which they might be subjected.

*Exception: Where a coaxial cable does not have sufficient strength to be self-supporting, it shall be attached to a supporting messenger cable that, together with the attachment fixtures or supports, shall be acceptable for the purpose and shall have sufficient strength to withstand the loads to which they may be subjected.*

**800.48 Communication Service Point.** The Communication Service Point shall be at a readily accessible location either outside or inside of a building or structure near to the point of entrance of the conductors in accordance with the one or more of the following:

1. The point of connection at which the communication service provider's network (outside plant) transitions to the premises wiring. The location of this point shall not be located further than 50 feet from the point of entrance.

2. The point of connection in an individual dwelling shall be located so as not to exceed 24 inches from the primary protector on the premises side of the protector.

3. A physical protection point or communications cable exiting the connection enclosure on the individual building side of the enclosure.

4. The point of connection at the Grounding Block, where required.

5. The point where a wireless signal transitions from the antenna or dish through a wired connection to transmitting or receiving equipment. The location of this point shall be permitted to include the ground connection at the antenna discharge unit or coaxial cable connection to the transmitting/receiving station (see 810.21).

6. The point of connection between nonconductive optical fiber cable entering the building and premises optical fiber cable inside the building not to exceed 50 feet from the point of entrance.

7. The Communication Service Point shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC), Electrical metallic tubing (EMT), intermediate metal conduit (IMC), or Rigid polyvinyl chloride conduit (PVC) to the point of emergence (see 770.48, 805.48, 820.48 and 830.48).

Informational Note: The transition and connection points listed above may be co-located. For example, a primary protector may be located inside a network interface unit (item 3) with a connection to an adjacent grounding block (Item 4) within 24 inches, and a connection to the premise wiring (item 2).

### 800.49 Metal Entrance Conduit Grounding.

Metal conduit containing entrance wire or cable shall be connected by a bonding conductor or grounding electrode conductor to a grounding electrode or, where present, the building grounding electrode system in accordance with 800.100(B).

### 800.53 Separation from Lightning Conductors.

Where practicable, a separation of at least 1.8 m (6 ft) shall be maintained between lightning conductors and all communication wires and cables and CATV type coaxial cables on buildings.

Informational Note No. 1: For additional information regarding overhead (aerial) wires and cables, see ANSI C2-2017 *National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines*.

Informational Note No. 2: Specific separation distances may be calculated from the sideflash equation in NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems.*

## Part III. Grounding Methods

### 800.100 Cable and Primary Protector Bonding and Grounding.

#### (A) Bonding Conductor or Grounding Electrode Conductor.

#### (1) Insulation.

The bonding conductor or grounding electrode conductor shall be listed and shall be permitted to be insulated, covered, or bare.

#### (2) Material.

The bonding conductor or grounding electrode conductor shall be copper or other corrosion-resistant conductive material, stranded or solid.

#### (3) Size.

The bonding conductor or grounding electrode conductor shall not be smaller than 14 AWG. The bonding conductor or grounding electrode conductor shall have a current-carrying capacity not less than the grounded metallic cable sheath member of the communications cable, the protected conductor of the communications cable, or the outer sheath of the coaxial cable, as applicable. The bonding conductor or grounding electrode conductor shall not be required to exceed 6 AWG.

#### (4) Length.

The bonding conductor or grounding electrode conductor shall be as short as practicable. In one- and two-family dwellings, the bonding conductor or grounding electrode conductor shall be as short as practicable, not to exceed 6.0 m (20 ft) in length.

Informational Note: Similar bonding conductor or grounding electrode conductor length limitations applied at apartment buildings and commercial buildings help to reduce voltages that may be developed between the building's power and communications systems during lightning events.

*Exception: In one- and two-family dwellings where it is not practicable to achieve an overall maximum bonding conductor or grounding electrode conductor length of 6.0 m (20 ft), a separate ground rod meeting the minimum dimensional criteria of 800.100(B)(3)(2) or (B)(3)(3) shall be driven, the bonding conductor or grounding electrode conductor shall be connected to the ground rod in accordance with 800.100(C), and the ground rod shall be connected to the power grounding electrode system in accordance with 800.100(D).*

#### (5) Run in Straight Line.

The bonding conductor or grounding electrode conductor shall be run in as straight a line as practicable.

#### (6) Physical Protection.

Bonding conductors and grounding electrode conductors shall be protected where exposed to physical damage. Where the bonding conductor or grounding electrode conductor is installed in a metal raceway, both ends of the raceway shall be bonded to the contained conductor or to the same terminal or electrode to which the bonding conductor or grounding electrode conductor is connected.

**(B) Electrode.**

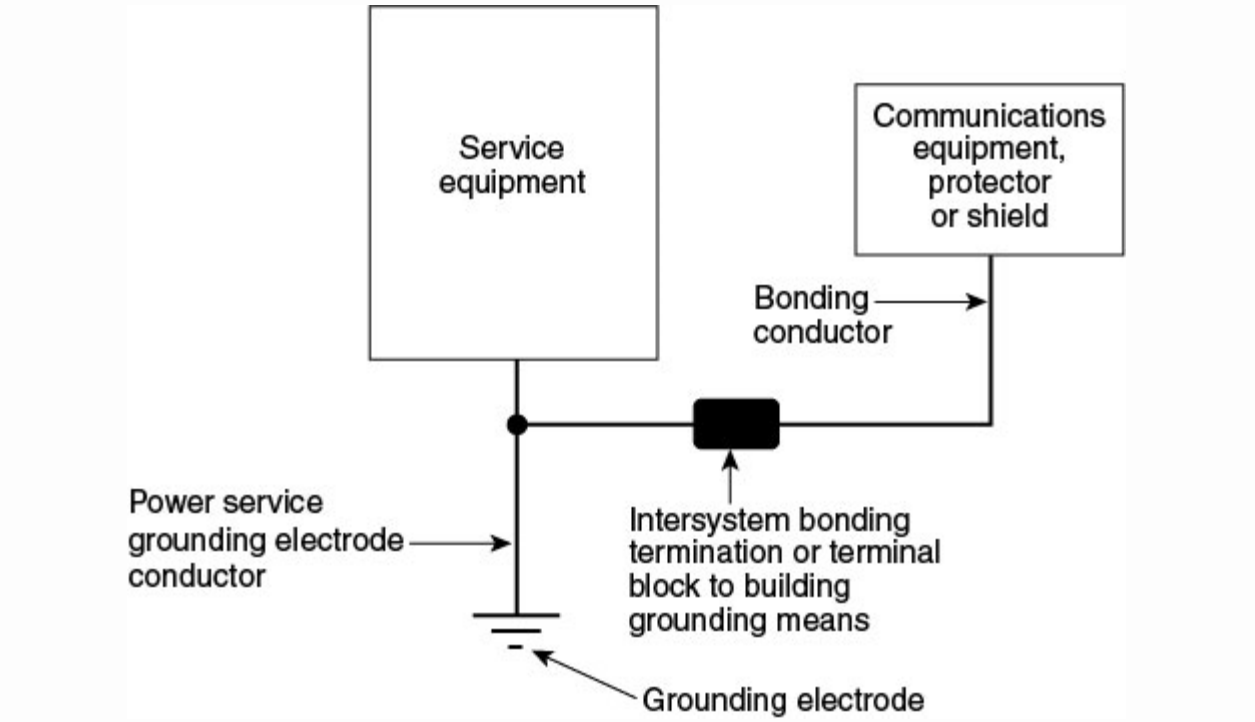
The bonding conductor or grounding electrode conductor shall be connected in accordance with 800.100(B)(1), (B)(2) , or (B)(3).

**(1) In Buildings or Structures with an Intersystem Bonding Termination.**

If the building or structure served has an intersystem bonding termination as required by 250.94, the bonding conductor shall be connected to the intersystem bonding termination.

Informational Note: Informational Note Figure 800.100(B)(1) illustrates the connection of the bonding conductor in buildings or structures equipped with an intersystem bonding termination or a terminal block providing access to the building grounding means.

**Figure Informational Note Figure 800.100(B)(1) Illustration of a Bonding Conductor in a Communications Installation.**




**(2) In Buildings or Structures with Grounding Means.**

If an intersystem bonding termination is established, 250.94(A) shall apply. If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on one of the following:

1. The building or structure grounding electrode system as covered in 250.50
2. The grounded interior metal water piping system, within 1.5 m (5 ft) from its point of entrance to the building, as covered in 250.52
3. The power service accessible means external to enclosures using the options identified in 250.94(A), Exception
4. The nonflexible metal power service raceway
5. The service equipment enclosure

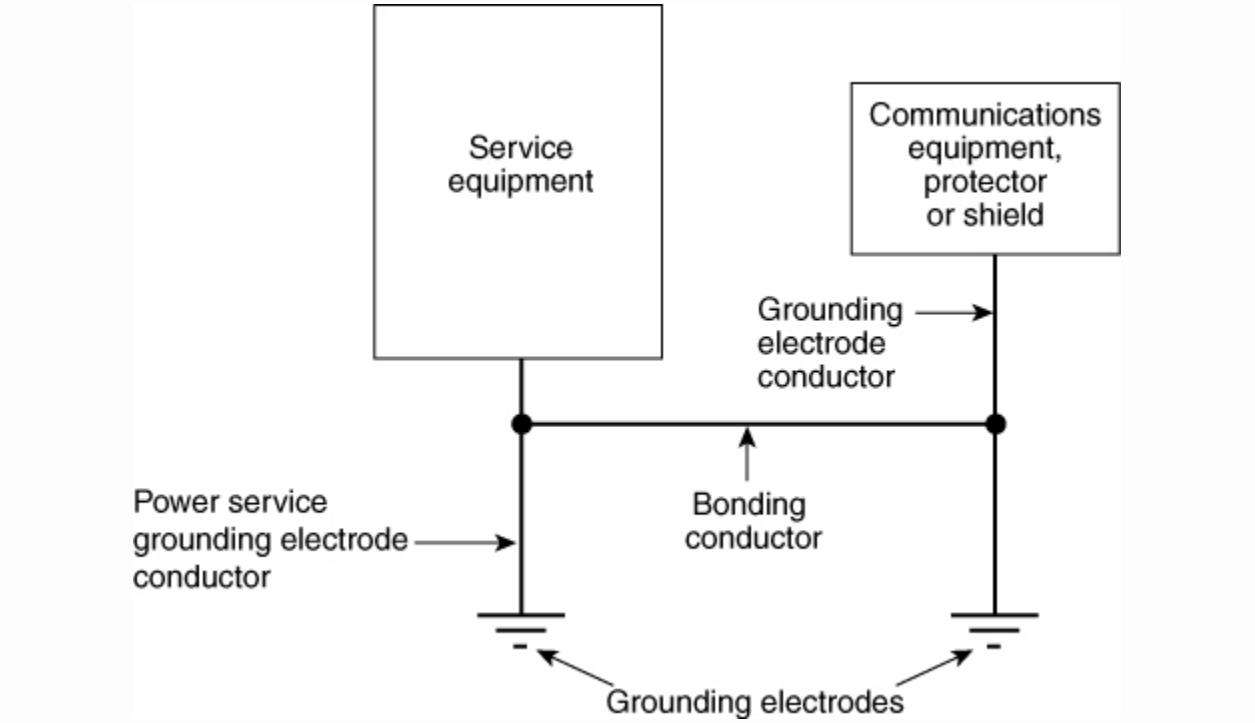
6. The grounding electrode conductor or the grounding electrode conductor metal enclosure of the power service
7. The grounding electrode conductor or the grounding electrode of a building or structure disconnecting means that is connected to a grounding electrode as covered in 250.32

A bonding device intended to provide a termination point for the bonding conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on nonremovable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is nonremovable.

For purposes of this section, the mobile home service equipment or the mobile home disconnecting means located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means connected to an electrode by a grounding electrode conductor in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Informational Note Figure 800.100(B)(2) illustrates the connection of the bonding conductor in buildings or structures not equipped with an intersystem bonding termination or a terminal block providing access to the building grounding means.

**Figure Informational Note Figure 800.100(B)(2) Illustration of a Grounding Electrode Conductor and a Bonding Conductor in a Communications Installation.**




**(3) In Buildings or Structures Without an Intersystem Bonding Termination or Grounding Means.**

If the building or structure served has no intersystem bonding termination or grounding means, as described in 800.100(B)(2), the grounding electrode conductor shall be connected to one of the following:

1. To any one of the individual grounding electrodes described in 250.52(A)(1), (A)(2), (A)(3), or (A)(4)
2. If the building or structure served has no intersystem bonding termination or grounding means, as described in 800.100(B)(2) or (B)(3)(1), to any one of the individual grounding electrodes described in 250.52(A)(5), (A)(7), and (A)(8)

3. For communications circuits covered in Article 805 or network-powered broadband communications systems covered in Article 830, to a ground rod or pipe not less than 1.5 m (5 ft) in length and 12.7 mm (0.5 in.) in diameter, driven, where practicable, into permanently damp earth and separated from lightning protection system conductors, as covered in 800.53, and at least 1.8 m (6 ft) from electrodes of other systems

Steam pipes, hot water pipes, or lightning protection system conductors shall not be employed as grounding electrodes for protectors and grounded metallic members.

**(C) Electrode Connection.**

Connections to grounding electrodes shall comply with 250.70.

**(D) Bonding of Electrodes.**

A bonding jumper not smaller than 6 AWG copper or equivalent shall be connected between the grounding electrode and power grounding electrode system at the building or structure served where separate electrodes are used.

*Exception: At mobile homes as covered in 800.106.*

Informational Note No. 1: See 250.60 for connection to a lightning protection system.

Informational Note No. 2: Bonding together of all separate electrodes limits potential differences between them and between their associated wiring systems.

**800.106 Primary Protector Grounding and Bonding at Mobile Homes.**

**(A) Grounding.**

Grounding shall comply with 800.106(A)(1) and (A)(2).

**(1) Mobile Home Service Equipment.**

Where there is no mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, grounding shall comply with one of the following:

1. The primary protector grounding terminal; the coaxial cable shield ground, or surge arrester grounding terminal; or the network-powered broadband communications cable shield, network-powered broadband communications cable metallic members not used for communications or powering, and network interface unit shall be connected to a grounding electrode conductor or grounding electrode in accordance with 800.100(B)(3).
2. The non-current-carrying metallic members of optical fiber cables shall be connected to a grounding electrode in accordance with 770.106(A)(1). The network terminal, if required to be grounded, shall be connected to a grounding electrode in accordance with 800.106(A)(1)(1). The grounding electrode shall be bonded in accordance with 770.106(B).

**(2) Mobile Home Feeder Disconnecting Means.**

Where there is no mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, grounding shall comply with one of the following:

1. The primary protector grounding terminal; the network-powered broadband communications cable shield, network-powered broadband communications cable metallic members not used for communications or powering, and network interface unit shall be connected to a grounding electrode in accordance with 800.100(B)(3).
2. The non-current-carrying metallic members of optical fiber cables shall be connected to a grounding electrode in accordance with 770.106(A)(2). The network terminal, if required to be grounded, shall be connected to a grounding electrode in accordance with 800.106(A)(2). The grounding electrode shall be bonded in accordance with 770.106(B).

**(B) Bonding.**

The primary protector grounding terminal or grounding electrode, network-powered broadband communications cable grounding terminal, or network interface unit grounding terminal shall be bonded together and connected to the metal frame or available grounding terminal of the mobile home with a copper conductor not smaller than 12 AWG under either of the following conditions:

1. Where there is no mobile home service equipment or disconnecting means as in 800.106(A)
2. Where the mobile home is supplied by cord and plug

**Part IV. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**800.110 Raceways, Cable Routing Assemblies, and Cable Trays.**

**(A) Types of Raceways.**

Wires and cables shall be permitted to be installed in raceways that comply with either 800.110(A)(1) or (A)(2). Medium-power network-powered broadband communications cables shall not be permitted to be installed in raceways that comply with 800.110(A)(2).

**(1) Raceways Recognized in Chapter 3.**

Wires and 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.**

Wires and 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.

**(3) Innerduct for Communications Wires and Cables, Coaxial Cables, or Network-Powered Broadband Communications Cables.**

Listed plenum communications raceways, listed riser communications raceways, and listed general-purpose communications raceways 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.**

The raceway fill requirements of Chapters 3 and 9 shall apply to medium-power network-powered broadband communications cables.

**(C) Cable Routing Assemblies.**

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)(1) and (C)(2) and 800.113.

**(1) Horizontal Support.**

Cable routing assemblies shall be supported where run horizontally at intervals not to exceed 900 mm (3 ft) and at each end or joint, unless listed for other support intervals. In no case shall the distance between supports exceed 3 m (10 ft).

**(2) Vertical Support.**

Vertical runs of cable routing assemblies shall be supported at intervals not exceeding 1.2 m (4 ft), unless listed for other support intervals, and shall not have more than one joint between supports.

**(D) Cable Trays.**

Wires and cables and communications raceways shall be permitted to be installed in metal or listed nonmetallic cable tray systems. Ladder cable trays shall be permitted to support cable routing assemblies.

## 800.113 Installation of Wires, Cables, Cable Routing Assemblies, and Communications Raceways.

Installation of wires, cables, cable routing assemblies, and communications raceways shall comply with 800.113(A) through (L). Installation of cable routing assemblies and communications raceways shall comply also with 800.110.

**(A) Listing.**

Wires, cables, cable routing assemblies, and communications raceways installed in buildings shall be listed.

*Exception: Cables installed in compliance with 805.48 or 820.48 shall not be required to be listed.*

**(B) Ducts Specifically Fabricated for Environmental Air.**

The following wires and 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. Plenum cables up to 1.22 m (4 ft) in length
2. Plenum cables, riser cables, general-purpose cables, and limited-use 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 NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

**(C) Other Spaces Used for Environmental Air (Plenums).**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted in other spaces used for environmental air as described in 300.22(C):

1. Plenum cables
2. Plenum communications raceways
3. Plenum cable routing assemblies
4. Plenum cables installed in plenum communications raceways
5. Plenum cables installed in plenum cable routing assemblies
6. Plenum cables and plenum communications raceways supported by open metal cable tray systems
7. Plenum cables, riser cables, general-purpose cables, limited-use cables, and communications wires installed in raceways that are installed in compliance with 300.22(C)
8. Plenum cables, riser cables, general-purpose cables, limited-use cables, 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)
9. Plenum cables, riser cables, general-purpose cables, and limited-use 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, see NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

**(D) Risers — Cables, Cable Routing Assemblies, and Communications Raceways in Vertical Runs.**

The following cables, cable routing assemblies, and communications raceways shall be permitted in vertical runs penetrating one or more floors and in vertical runs in a shaft:

1. Plenum and riser cables
2. Plenum and riser communications raceways
3. Plenum and riser cable routing assemblies
4. Plenum and riser cables installed in:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) Plenum cable routing assemblies
    d) Riser cable routing assemblies

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**(E) Risers — Cables and Innerducts in Metal Raceways.**

The following cables and innerducts shall be permitted in metal raceways in a riser having firestops at each floor:

1. Plenum cables, riser cables, general-purpose cables, and limited-use cables
2. Plenum, riser, and general-purpose communications raceways
3. Plenum cables, riser cables, general-purpose cables, and limited-use cables installed in:
    a) Plenum communications raceways (innerduct)
    b) Riser communications raceways (innerduct)
    c) General-purpose communications raceways (innerduct)

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**(F) Risers — Cables, Cable Routing Assemblies, and Communications Raceways in Fireproof Shafts.**

The following cables, cable routing assemblies, and communications raceways shall be permitted to be installed in fireproof riser shafts having firestops at each floor:

1. Plenum cables, riser cables, general-purpose cables, and limited-use cables
2. Plenum, riser, and general-purpose communications raceways
3. Plenum, riser, and general-purpose cable routing assemblies
4. Plenum cables, riser cables, general-purpose cables, and limited-use cables installed in:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
    d) Plenum cable routing assemblies
    e) Riser cable routing assemblies
    f) General-purpose cable routing assemblies

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**(G) Risers — One- and Two-Family Dwellings.**

The following cables, cable routing assemblies, and communications raceways shall be permitted in one- and two-family dwellings:

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables less than 6 mm (0.25 in.) in diameter
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Plenum cables, riser cables, and general-purpose cables installed in:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
    d) Plenum cable routing assemblies
    e) Riser cable routing assemblies
    f) General-purpose cable routing assemblies

**(H) Cable Trays.**

The following wires, cables, and communications raceways shall be permitted to be supported by cable trays:

1. Plenum cables, riser cables, and general-purpose cables
2. Plenum, riser, and general-purpose communications raceways
3. Communications wires, plenum cables, riser cables, and general-purpose cables installed in:
    1. Plenum communications raceways
    2. Riser communications raceways
    3. General-purpose communications raceways

**(I) Distributing Frames and Cross-Connect Arrays.**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in distributing frames and cross-connect arrays:

1. Plenum cables, riser cables, general-purpose cables, and communications wires
2. Plenum, riser, and general-purpose communications raceways
3. Plenum, riser, and general-purpose cable routing assemblies
4. Communications wires, plenum cables, riser cables, and general-purpose cables installed in:
    1. Plenum communications raceways
    2. Riser communications raceways
    3. General-purpose communications raceways
    4. Plenum cable routing assemblies
    5. Riser cable routing assemblies
    6. General-purpose cable routing assemblies

**(J) Other Building Locations.**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in building locations other than the locations covered in 800.113(B) through (I):

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables with a maximum of 3 m (10 ft) of exposed length in nonconcealed spaces
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
6. Plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum cable routing assemblies
    b) Riser cable routing assemblies
    c) General-purpose cable routing assemblies
7. Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3
8. Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks

**(K) Multifamily Dwellings.**

The following cables, cable routing assemblies, and communications raceways shall be permitted to be installed in multifamily dwellings in locations other than the locations covered in 800.113(B) through (G):

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables less than 6 mm (0.25 in.) in diameter in nonconcealed spaces
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
6. Plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum cable routing assemblies
    b) Riser cable routing assemblies
    c) General-purpose cable routing assemblies
7. Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3
8. Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks

**(L) One- and Two-Family Dwellings.**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in one- and two-family dwellings in locations other than the locations covered in 800.113(B) through (F):

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables less than 6 mm (0.25 in.) in diameter
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:
   a) Plenum communications raceways
   b) Riser communications raceways
   c) General-purpose communications raceways
6. Plenum cables, riser cables, and general-purpose cables installed in the following
   a) Plenum cable routing assemblies
   b) Riser cable routing assemblies
   c) General-purpose cable routing assemblies
7. Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3
8. Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks
9. Hybrid power and communications cable listed in accordance with 805.179(F)

**800.154 Applications of Listed Communications Wires, Cables, and Raceways, and Listed Cable Routing Assemblies.**

Permitted and nonpermitted applications of listed communications wires, cables, coaxial cables, network-powered broadband communications system cables and raceways, and listed cable routing assemblies, shall be in accordance with one of the following:

1. Listed communications wires and cables as indicated in Table 800.154(a)
2. Listed communications raceways as indicated in Table 800.154(b)
3. Listed cable routing assemblies as indicated in Table 800.154(c)

The permitted applications shall be subject to the installation requirements of 800.110 and 800.113.

**Table 800.154(a) Applications of Listed Communications Wires, Cables, and Network-Powered Broadband Communications System Cables on the customer side of the Communication Service Point ~~Buildings~~**

| Applications | | Wire and Cable Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BMU, BLU | Hybrid Power and Communications Cables | Communications Wires |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | Y | N | N | N | N | N | N | N | N | N |
| | In metal raceway that complies with 300.22(B) | Y | Y | Y | Y | Y | Y | N | N | N | Y |

| Applications | | Wire and Cable Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BMU, BLU | Hybrid Power and Communications Cables | Communications Wires |
| In other spaces used for environmental air (plenums) as described in 300.22(C) | In other spaces used for environmental air | Y | N | N | N | N | N | N | N | N | N |
| | In metal raceway that complies with 300.22(C) | Y | Y | Y | Y | Y | Y | N | N | N | Y |
| | In plenum communications raceways | Y | N | N | N | N | N | N | N | N | N |
| | In plenum cable routing assemblies | Y | N | N | N | N | N | N | N | N | N |
| | Supported by open metal cable trays | Y | N | N | N | N | N | N | N | N | N |
| | Supported by solid bottom metal cable trays with solid metal covers | Y | Y | Y | Y | Y | Y | N | N | N | N |
| In risers | In vertical runs | Y | Y | Y | N | N | N | N | N | N | N |
| | In metal raceways | Y | Y | Y | Y | Y | Y | N | N | N | N |
| | In fireproof shafts | Y | Y | Y | Y | Y | Y | N | N | N | N |
| | In plenum communications raceways | Y | Y | N | N | N | N | N | N | N | N |
| | In plenum cable routing assemblies | Y | Y | N | N | N | N | N | N | N | N |
| | In riser communications raceways | Y | Y | N | N | N | N | N | N | N | N |
| | In riser cable routing assemblies | Y | Y | N | N | N | N | N | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y | Y | Y | Y | N | N | Y | N |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y | Y | Y | Y | N | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y | Y | Y | Y | Y | N | Y | N |
| | In multifamily dwellings | Y | Y | Y | Y | Y | Y | Y | N | N | N |
| | In nonconcealed spaces | Y | Y | Y | Y | Y | Y | Y | N | N | N |
| | Supported by cable trays | Y | Y | Y | Y | Y | N | N | N | N | N |
| | Under carpet, modular flooring, and planks | N | N | N | N | N | N | Y | N | N | N |
| | In distributing frames and cross-connect arrays | Y | Y | N | Y | N | N | N | N | N | Y |
| | In rigid metal conduit (RMC) and intermediate metal conduit (IMC) | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |

| Applications | | Wire and Cable Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BMU, BLU | Hybrid Power and Communications Cables | Communications Wires |
| | In any raceway recognized in Chapter 3 | Y | Y | Y | Y | Y | Y | N | N | N | Y |
| | In plenum communications raceways | Y | Y | N | Y | N | N | N | N | N | Y |
| | In plenum cable routing assemblies | Y | Y | N | Y | N | N | N | N | N | Y |
| | In riser communications raceways | Y | Y | N | Y | N | N | N | N | N | Y |
| | In riser cable routing assemblies | Y | Y | N | Y | N | N | N | N | N | Y |
| | In general-purpose communications raceways | Y | Y | N | Y | N | N | N | N | N | Y |
| | In general-purpose cable routing assemblies | Y | Y | N | Y | N | N | N | N | N | Y |

Note: An "N" in the table indicates that the cable type shall not be permitted to be installed in the application. A "Y" indicates that the cable type shall be permitted to be installed in the application subject to the limitations described in 800.113. The Riser column includes all riser cables except BMR, and the General-Purpose column includes all general-purpose cables except BM.
Informational Note No. 1: Part IV of Article 800 covers wiring on the customer side of the communication service point ~~installation methods within buildings~~. This table covers the applications of listed communications wires, cables, and raceways ~~in buildings~~. See the definition of *Point of Entrance* in 800.2.

Informational Note No. 2: For information on the restrictions to the installation of communications cables in fabricated ducts, see 800.113(B).

### Table 800.154(b) Applications of Listed Communications Raceways on the customer side of the Communication Service Point~~in Buildings~~

| Applications | | Listed Communications Raceway Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | N | N | N |
| | In metal raceway that complies with 300.22(B) | N | N | N |
| In other spaces used for environmental air (plenums) 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 cable routing assemblies | N | 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 cable routing assemblies | N | N | N |
| | In riser cable routing assemblies | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y |
| | In one- and two-family dwellings | Y | Y | Y |
| | In multifamily dwellings | Y | Y | Y |

| Applications | | Listed Communications Raceway Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| | In nonconcealed spaces | Y | Y | Y |
| | Supported by cable trays | Y | Y | Y |
| | Under carpet, modular flooring, and planks | N | N | N |
| | In distributing frames and cross-connect arrays | Y | Y | Y |
| | In any raceway recognized in Chapter 3 | Y | Y | Y |
| | In plenum cable routing assemblies | N | N | N |
| | In riser cable routing assemblies | N | N | N |
| | In general-purpose cable routing assemblies | N | N | N |

Note: An “N” in the table indicates that the communications raceway type shall not be permitted to be installed in the application. A “Y” indicates that the communications raceway type shall be permitted to be installed in the application, subject to the limitations described in 800.110 and 800.113.

## Table 800.154(c) Applications of Listed Cable Routing Assemblies in Buildings

| Applications | | Listed Cable Routing Assembly Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | N | N | N |
| | In metal raceway that complies with 300.22(B) | N | N | N |
| In other spaces used for environmental air (plenums) 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) | N | N | N |
| | In plenum communications raceways | N | N | N |
| | Supported by open metal cable trays | Y | N | N |
| | Supported by solid bottom metal cable trays with solid metal covers | N | N | N |
| In risers | In vertical runs | Y | Y | N |
| | In metal raceways | N | N | N |
| | In fireproof shafts | Y | Y | Y |
| | In plenum communications raceways | N | N | N |
| | In riser communications raceways | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y |
| | In one- and two-family dwellings | Y | Y | Y |
| | In multifamily dwellings | Y | Y | Y |
| | In nonconcealed spaces | Y | Y | Y |
| | Supported by cable trays | Y | Y | Y |
| | Under carpet, modular flooring, and planks | N | N | N |
| | In distributing frames and cross-connect arrays | Y | Y | Y |
| | In any raceway recognized in Chapter 3 | N | N | N |
| | In plenum communications raceways | N | N | N |
| | In riser communications raceways | N | N | N |
| | In general-purpose communications raceways | N | N | N |

Note: An “N” in the table indicates that the cable routing assembly type shall not be permitted to be installed in the application. A “Y” indicates that the cable routing assembly type shall be permitted to be installed in the application subject to the limitations described in 800.113.

### 800.179 Plenum, Riser, General-Purpose, and Limited Use Cables.

Plenum, riser, general-purpose, and limited-use cables shall be listed in accordance with 800.179(A) through (D) and shall have a temperature rating of not less than 60°C (140°F). The temperature rating shall be marked on the jacket of cables that have a temperature rating exceeding 60°C (140°F). The cable voltage rating shall not be marked on the cable.

#### (A) Plenum Cables.

Type CMP communications plenum cables, Type CATVP community antenna television plenum coaxial cables, and Type BLP network-powered broadband communication low-power plenum cables shall be listed as being suitable for use in ducts, plenums, and other spaces 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*.

#### (B) Riser Cables.

Type CMR communications riser cables, Type CATVR community antenna television riser coaxial cables, Type BMR network-powered broadband communications medium-power riser cables, and Type BLR network-powered broadband communications low-power riser cables 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 1666-2011, *Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts.*

#### (C) General-Purpose Cables.

Type CM communications general-purpose cables, Type CATV community antenna television coaxial general-purpose cables, Type BM network-powered broadband communications medium-power general-purpose cables, and Type BL network-powered broadband communications low-power general-purpose cables shall be listed as being suitable for general-purpose use, with the exception of risers and plenums, 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 Flame Tray 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. 0.3-09, *Test Methods for Electrical Wires and Cables*.

#### (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 VW-1 (vertical-wire) flame test in ANSI/UL 1581-2017, *Reference Standard for Electrical Wires, Cables and Flexible Cords*.

## Part V. Listing Requirements

### 800.180 Grounding Devices.

Where bonding or grounding is required, devices used to connect a shield, a sheath, or non-current-carrying metallic members of a cable to a bonding conductor or grounding electrode conductor shall be listed or be part of listed equipment.

### 800.182 Cable Routing Assemblies and Communications Raceways.

Cable routing assemblies and communications raceways shall be listed in accordance with 800.182(A) through (C). Cable routing assemblies shall be marked in accordance with Table 800.182(a). Communications raceways shall be marked in accordance with Table 800.182(b).

Informational Note: For information on listing requirements for both communications raceways and cable routing assemblies, see ANSI/UL 2024-5-2015, *Cable Routing Assemblies and Communications Raceways*.

**Table 800.182(a) Cable Routing Assembly Markings**

| Type | Marking |
|---|---|
| Plenum Cable Routing Assembly | Plenum Cable Routing Assembly |
| Riser Cable Routing Assembly | Riser Cable Routing Assembly |
| General-Purpose Cable Routing Assembly | General-Purpose Cable Routing Assembly |

**Table 800.182(b) Communications Raceway Markings**

| Type | Marking |
|---|---|
| Plenum Communications Raceway | Plenum Communications Raceway |
| Riser Communications Raceway | Riser Communications Raceway |
| General-Purpose Communications Raceway | General-Purpose Communications Raceway |

### (A) Plenum Cable Routing Assemblies and Plenum Communications Raceways.

Plenum cable routing assemblies and plenum communications raceways shall be listed as having adequate fire-resistant and low-smoke-producing characteristics.

Informational Note No. 1: One method of defining cable routing assemblies and communications raceways that have adequate fire-resistant and low-smoke-producing characteristics is that they exhibit a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84-15a, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or ANSI/UL 723-2013, *Standard Test Method for Surface Burning Characteristics of Building Materials*.

Informational Note No. 2: Another method of defining communications raceways that have adequate fire-resistant and low-smoke-producing characteristics is that they exhibit 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 262-2015, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces*.

Informational Note No. 3: See 4.3.11.2.6 or 4.3.11.5.5 of NFPA 90A-2015, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, for information on materials exposed to the airflow in ceiling cavity and raised floor plenums.

### (B) Riser Cable Routing Assemblies and Riser Communications Raceways.

Riser cable routing assemblies and riser communications raceways shall be listed as having adequate 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 cable routing assemblies and communications raceways pass the requirements of ANSI/UL 1666-2011, *Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts*.

### (C) General-Purpose Cable Routing Assemblies and General-Purpose Communications Raceways.

General-purpose cable routing assemblies and general-purpose communications raceways shall 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 cable routing assemblies and communications raceways do not spread fire to the top of the tray in the “UL Flame Exposure, Vertical Flame Tray Test” in ANSI/UL 1685-2011, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*.

## Article 805 Communications Circuits

### Part I. General

### 805.1 Scope.

This article covers communications circuits and equipment.

**805.2 Definitions.**

The definitions in this section shall apply only within Articles 805 and 840.

**Cable.**

A factory assembly of two or more conductors having an overall covering.

**Communications Circuit Integrity (CI) Cable.**

Cable used in communications systems to ensure continued operation of critical circuits during a specified time under fire conditions.

**Wire.**

A factory assembly of one or more insulated conductors without an overall covering.

**805.18 Installation of Equipment.**

Equipment electrically connected to a communications network shall be listed in accordance with 805.170.

*Exception: This listing requirement shall not apply to test equipment that is intended for temporary connection to a telecommunications network by qualified persons during the course of installation, maintenance, or repair of telecommunications equipment or systems.*

**Part II. Wires and Cables Outside and on the service provider side of the Communication Service Point ~~Entering Buildings~~**

**805.47 Underground Communications Wires and Cables ~~Entering Buildings~~.**

Underground communications wires and cables ~~entering buildings~~ shall comply with 805.47(A) and (B). The requirements of 310.10(C) shall not apply to communications wires and cables.

**(A) Underground Systems with Electric Light, Power, Class 1, or Non-Power-Limited Fire Alarm Circuit Conductors.**

Underground communications wires and cables in a raceway, handhole enclosure, or manhole containing electric light, power, Class 1, or non-power-limited fire alarm circuit conductors shall be in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier.

**(B) Underground Block Distribution.**

Where the entire street circuit is run underground and the circuit within the block is placed so as to be free from the likelihood of accidental contact with electric light or power circuits of over 300 volts to ground, the insulation requirements of 805.50(A) and 805.50(C) shall not apply, insulating supports shall not be required for the conductors, and bushings shall not be required where the conductors enter the building.

**805.48 Unlisted Cables on the service provider side of the Communication Service Point ~~Entering Buildings~~.**

Unlisted outside plant communications cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated in an enclosure or on a listed primary protector. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) to the point of emergence.

Informational Note No. 1: Splice cases or terminal boxes, both metallic and plastic types, are typically used as enclosures for splicing or terminating telephone cables.

Informational Note No. 2: This section limits the length of unlisted outside plant cable to 15 m (50 ft), while 805.90(B) requires that the primary protector be located as close as practicable to the point at which the cable enters the building. Therefore, in installations requiring a primary protector, the outside plant cable may not be permitted to extend 15 m (50 ft) into the building if it is practicable to place the primary protector closer than 15 m (50 ft) to the point of entrance.

### 805.50 Circuits Requiring Primary Protectors.

Circuits that require primary protectors as provided in 805.90 shall comply with 805.50(A),805.50(B), and 805.50(C).

#### (A) Insulation, Wires, and Cables.

Communications wires and cables without a metallic shield, running from the last outdoor support to the primary protector, shall be listed in accordance with 805.173.

#### (B) On Buildings.

Communications wires and cables in accordance with 805.50(A) shall be separated at least 100 mm (4 in.) from electric light or power conductors not in a raceway or cable or be permanently separated from conductors of the other systems by a continuous and firmly fixed nonconductor in addition to the insulation on the wires, such as porcelain tubes or flexible tubing. Communications wires and cables in accordance with 805.50(A) exposed to accidental contact with electric light and power conductors operating at over 300 volts to ground and attached to buildings shall be separated from woodwork by being supported on glass, porcelain, or other insulating material.

*Exception: Separation from woodwork shall not be required where fuses are omitted as provided for in 805.90(A)(1), or where conductors are used to extend circuits to a building from a cable having a grounded metal sheath.*

#### (C) Entering Buildings.

Where a primary protector is installed inside the building, the communications wires and cables shall enter the building either through a noncombustible, nonabsorbent insulating bushing or through a metal raceway. The insulating bushing shall not be required where the entering communications wires and cables (1) are in metal-sheathed cable, (2) pass through masonry, (3) meet the requirements of 805.50(A) and fuses are omitted as provided in 805.90(A)(1), or (4) meet the requirements of 805.50(A) and are used to extend circuits to a building from a cable having a grounded metallic sheath. Raceways or bushings shall slope upward from the outside or, where this cannot be done, drip loops shall be formed in the communications wires and cables immediately before they enter the building.

Raceways shall be equipped with an approved service head. More than one communications wire and cable shall be permitted to enter through a single raceway or bushing. Conduits or other metal raceways located ahead of the primary protector shall be grounded.

## Part III. Protection

### 805.90 Protective Devices.

#### (A) Application.

A listed primary protector shall be provided on each circuit run partly or entirely in aerial wire or aerial cable not confined within a block. Also, a listed primary protector shall be provided on each circuit, aerial or underground, located within the block containing the building served so as to be exposed to accidental contact with electric light or power conductors operating at over 300 volts to ground. In addition, where there exists a lightning exposure, each interbuilding circuit on a premises shall be protected by a listed primary protector at each end of the interbuilding circuit. Installation of primary protectors shall also comply with 110.3(B).

Informational Note No. 1: On a circuit not exposed to accidental contact with power conductors, providing a listed primary protector in accordance with this article helps protect against other hazards, such as lightning and above-normal voltages induced by fault currents on power circuits in proximity to the communications circuit.

Informational Note No. 2: Interbuilding circuits are considered to have a lightning exposure unless one or more of the following conditions exist:

1. Circuits in large metropolitan areas where buildings are close together and sufficiently high to intercept lightning.
2. Interbuilding cable runs of 42 m (140 ft) or less, directly buried or in underground conduit, where a continuous metallic cable shield or a continuous metal conduit containing the cable is connected to each building grounding electrode system.

3. Areas having an average of five or fewer thunderstorm days per year and earth resistivity of less than 100 ohm-meters. Such areas are found along the Pacific coast.

Informational Note No. 3: For information on lightning protection systems, see NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems.*

**(1) Fuseless Primary Protectors.**

Fuseless-type primary protectors shall be permitted under any of the conditions given in 805.90(A)(1)(a) through (A)(1)(e).

(a) Where conductors enter a building through a cable with grounded metallic sheath member(s) and where the conductors in the cable safely fuse on all currents greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor

(b) Where insulated conductors in accordance with 805.50(A) are used to extend circuits to a building from a cable with an effectively grounded metallic sheath member(s) and where the conductors in the cable or cable stub, or the connections between the insulated conductors and the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground, safely fuse on all currents greater than the current-carrying capacity of the primary protector, or the associated insulated conductors and of the primary protector bonding conductor or grounding electrode conductor

(c) Where insulated conductors in accordance with 805.50(A) or (B) are used to extend circuits to a building from other than a cable with metallic sheath member(s), where (1) the primary protector is listed as being suitable for this purpose for application with circuits extending from other than a cable with metallic sheath members, and (2) the connections of the insulated conductors to the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground or the conductors of the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground safely fuse on all currents greater than the current-carrying capacity of the primary protector, or associated insulated conductors and of the primary protector bonding conductor or grounding electrode conductor

(d) Where insulated conductors in accordance with 805.50(A) are used to extend circuits aerially to a building from a buried or underground circuit that is unexposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground

(e) Where insulated conductors in accordance with 805.50(A) are used to extend circuits to a building from cable with an effectively grounded metallic sheath member(s), and where (1) the combination of the primary protector and insulated conductors is listed as being suitable for this purpose for application with circuits extending from a cable with an effectively grounded metallic sheath member(s), and (2) the insulated conductors safely fuse on all currents greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor

Informational Note: Section 9 of ANSI/IEEE C2-2012, *National Electrical Safety Code*, provides an example of methods of protective grounding that can achieve effective grounding of communications cable sheaths for cables from which communications circuits are extended.

**(2) Fused Primary Protectors.**

Where the requirements listed under 805.90(A)(1)(a) through (A)(1)(e) are not met, fused-type primary protectors shall be used. Fused-type primary protectors shall consist of an arrester connected between each line conductor and ground, a fuse in series with each line conductor, and an appropriate mounting arrangement. Primary protector terminals shall be marked to indicate line, instrument, and ground, as applicable.

**(B) Location.**

The primary protector shall be located in, on, or immediately adjacent to the structure or building served and as close as practicable to the point of entrance.

For purposes of this section, primary protectors located at mobile home service equipment within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means connected to an electrode by a grounding electrode conductor in accordance with 250.32 and located

within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a primary protector location to achieve the shortest practicable primary protector bonding conductor or grounding electrode conductor helps limit potential differences between communications circuits and other metallic systems.

**(C) Hazardous (Classified) Locations.**

The primary protector shall not be located in any hazardous (classified) locations, as defined in 500.5 and 505.5, or in the vicinity of easily ignitible material.

*Exception: As permitted in 501.150, 502.150, and 503.150.*

**(D) Secondary Protectors.**

Where a secondary protector is installed in series with the indoor communications wire and cable between the primary protector and the equipment, it shall be listed for the purpose in accordance with 805.170(B).

Informational Note: Secondary protectors on circuits exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground are not intended for use without primary protectors.

**805.93 Grounding, Bonding, or Interruption of Non–Current-Carrying Metallic Sheath Members of Communications Cables.**

Communications cables entering the building or terminating on the outside of the building shall comply with 805.93(A) or (B).

**(A) Entering Buildings.**

In installations where the communications cable enters a building, the metallic sheath members of the cable shall be grounded or bonded as specified in 800.100 or interrupted by an insulating joint or equivalent device. The grounding, bonding, or interruption shall be as close as practicable to the point of entrance.

**(B) Terminating on the Outside of Buildings.**

In installations where the communications cable is terminated on the outside of the building, the metallic sheath members of the cable shall be grounded or bonded as specified in 800.100 or interrupted by an insulating joint or equivalent device. The grounding, bonding, or interruption shall be as close as practicable to the point of termination of the cable.

**Part IV. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**805.133 Installation of Communications Wires, Cables, and Equipment.**

Communications wires and cables from the protector to the equipment or, where no protector is required, communications wires and cables attached to the outside or inside of the building shall comply with 805.133(A) and 805.133(B)

**(A) Separation from Other Conductors.**

**(1) In Raceways, Cable Trays, Boxes, Cables, Enclosures, and Cable Routing Assemblies.**

(a) *Other Circuits.* Communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with cables 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. Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770
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

(b) *Class 2 and Class 3 Circuits.* Class 1 circuits shall not be run in the same cable with communications circuits. Class 2 and Class 3 circuit conductors shall be permitted in the same listed communications cable with communications circuits.

(c) *Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm, and Medium-Power Network-Powered Broadband Communications Circuits in Raceways, Compartments, and Boxes.* Communications conductors shall not be placed in any raceway, compartment, outlet box, junction box, or similar fitting with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits.

*Exception No. 1: Section 805.133(A)(1)(c) shall not apply if 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 conductors of communications circuits by a permanent barrier or listed divider.*

*Exception No. 2: Power conductors in outlet boxes, junction boxes, or similar fittings or compartments where such conductors are introduced solely for power supply to communications equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum of 6 mm (¼ in.) separation from the communications circuit conductors.*

*Exception No. 3: As permitted by 620.36.*

**(2) Other Applications.**

Communications wires and cables shall be separated 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.

*Exception No. 1: Section 805.133(A)(2) shall not apply where either (1) all of the conductors of the electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits are in a raceway or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC, or Type UF cables, or (2) all of the conductors of communications circuits are encased in raceway.*

*Exception No. 2: Section 805.133(A)(2) shall not apply where the communications wires and cables are permanently separated from the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B) Support of Communications Wires and Cables.**

Raceways shall be used for their intended purpose. Communications wires and cables shall not be strapped, taped, or attached by any means to the exterior of any raceway as a means of support.

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

**805.154 Substitutions of Listed Communications Wires, Cables, and Raceways, and Listed Cable Routing Assemblies.**

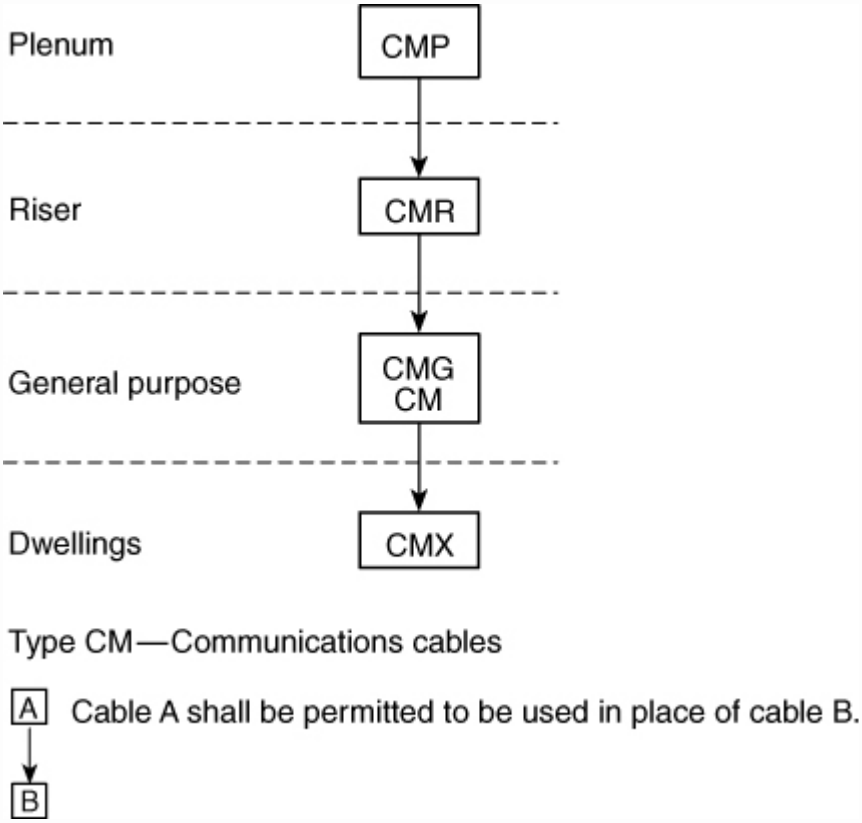
The substitutions for communications cables listed in Table 805.154 and illustrated in Figure 805.154 shall be permitted.

**Table 805.154 Cable Substitutions**

| Cable Type | Permitted Substitutions |
|---|---|
| CMR | CMP |

| Cable Type | Permitted Substitutions |
|---|---|
| CMG, CM | CMP, CMR |
| CMX | CMP, CMR, CMG, CM |

**Figure 805.154 Cable Substitution Hierarchy.**




### 805.156 Dwelling Unit Communications Outlet.

For new construction, a minimum of one communications outlet shall be installed within the dwelling in a readily accessible area and cabled to the service provider demarcation point.

## Part V. Listing Requirements

### 805.170 Equipment.

Communications equipment shall be listed as being suitable for electrical connection to a communications network.

Informational Note No. 1: One way to determine applicable requirements is to refer to ANSI/UL 60950-1-2014, *Standard for Safety of Information Technology Equipment*; ANSI/UL 1863-2012, *Standard for Safety Communications Circuit Accessories*; or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements*.

Informational Note No. 2: Additional information regarding voltages, currents, and power allowed on communications circuits can be found in ANSI/ATIS 0600337-2016, *Requirements for Maximum Voltage, Current, and Power Levels Used in Communications Transport Circuits*.

#### (A) Primary Protectors.

The primary protector shall consist of an arrester connected between each line conductor and ground in an appropriate mounting. Primary protector terminals shall be marked to indicate line and ground as applicable.

Informational Note: One way to determine applicable requirements for a listed primary protector is to refer to ANSI/UL 497-2013, *Standard for Protectors for Paired Conductor Communications Circuits*.

#### (B) Secondary Protectors.

The secondary protector shall be listed as suitable to provide means to safely limit currents to less than the current-carrying capacity of listed indoor communications wire and cable, listed telephone set line cords, and listed communications terminal equipment having ports for external wire line communications circuits. Any overvoltage protection, arresters, or grounding connection shall be connected on the equipment terminals side of the secondary protector current-limiting means.

Informational Note: One way to determine applicable requirements for a listed secondary protector is to refer to ANSI/UL 497A-2012, *Standard for Secondary Protectors for Communications Circuits*.

**(C) Plenum Grade Cable Ties.**

Cable ties intended for use in other space used for environmental air (plenums) shall be listed as having low smoke and heat release properties.

Informational Note: See NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, and ANSI/UL 2043-2013, *Standard for Safety Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces*, for information on listing discrete products as having low smoke and heat release properties.

### 805.173 Drop Wire and Cable.

Communications wires and cables without a metallic shield, running from the last outdoor support to the primary protector, shall be listed as being suitable for the purpose and shall have current-carrying capacity as specified in 805.90(A)(1)(b) or (A)(1)(c).

### 805.179 Communications Wires and Cables.

Communications wires and cables shall be listed in accordance with 805.179(A) through (F) and marked in accordance with Table 805.179 and 805.179(G). Conductors in communications cables, other than in a coaxial cable, shall be copper.

Communications wires and cables shall have a voltage rating of not less than 300 volts. The insulation for the individual conductors, other than the outer conductor of a coaxial cable, shall be rated for 300 volts minimum. The cable voltage rating shall not be marked on the cable or on the under-carpet communications wire.

*Exception: Voltage markings shall be permitted where the cable has multiple listings and 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 805.179 Cable Markings**

| Cable Marking | Type |
|---|---|
| CMP | Communications plenum cable |
| CMR | Communications riser cable |
| CMG | Communications general-purpose cable |
| CM | Communications general-purpose cable |
| CMX | Communications cable, limited use |
| CMUC | Under-carpet communications wire and cable |

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

**(A) General Requirements.**

The general requirements in 805.179 shall apply.

**(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 VW-1 (vertical-wire) flame test in ANSI/UL 1581-2017, *Reference Standard for Electrical Wires, Cables and Flexible Cords*.

### (C) Circuit Integrity (CI) Cable or Electrical Circuit Protective System.

Cables that are used for survivability of critical circuits under fire conditions shall be listed and meet either 805.179(C)(1) or 805.179(C)(2).

Informational Note: The listing organization provides information for circuit integrity (CI) cable and electrical circuit protective systems, including installation requirements required to maintain the fire rating.

### (1) Circuit Integrity (CI) Cables.

Circuit integrity (CI) cables specified in 805.179(A) through (D), and used for survivability of critical circuits, shall have an additional classification using the suffix "CI." In order to maintain its listed fire rating, circuit integrity (CI) cable shall only be installed in free air.

Informational Note: One method of defining circuit integrity (CI) cable is by establishing a minimum 2-hour fire resistance rating for the cable when tested in accordance with ANSI/UL 2196-2017, *Standard for Fire Test for Circuit Integrity of Fire-Resistant Power, Instrumentation, Control, and Data Cables*.

### (2) Fire-Resistive Cables.

Cables specified in 800.179(A) through (D) and 805.179(C)(1), that are part of an electrical circuit protective system, shall be fire-resistive cable identified with the protective system number on the product, or on the smallest unit container in which the product is packaged, and shall be installed in accordance with the listing of the protective system.

Informational Note No. 1: One method of defining an electrical circuit protective system is by establishing a minimum 2-hour fire resistance rating for the system when tested in accordance with UL Subject 1724, *Outline of Investigation for Fire Tests for Electrical Circuit Protective Systems*.

Informational Note No. 2: The listing organization provides information for electrical circuit protective systems (FHIT), including installation requirements for maintaining the fire rating.

### (D) Types CMP-LP, CMR-LP, CMG-LP, and CM-LP Limited Power (LP) Cables.

Types CMP-LP, CMR-LP, CMG-LP, and CM-LP communications limited power 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 XX designates the current limit in amperes per conductor.

Informational Note: An example of the marking on a communications cable with an LP rating is "CMP-LP (0.6A)(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 ampere.

### (E) Communications Wires.

Communications wires, such as distributing frame wire and jumper wire, shall 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 Flame Tray 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. 0.3-09, *Test Methods for Electrical Wires and Cables*.

### (F) Hybrid Power and Communications Cables.

Listed hybrid power and communications cables shall be permitted where the power cable is a listed Type NM or NM-B, conforming to Part III of Article 334, and the communications cable is a listed Type CM, the jackets on the listed NM or NM-B, and listed CM cables are rated for 600 volts minimum, and the hybrid cable is 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 Flame Tray 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. 0.3-09, *Test Methods for Electrical Wires and Cables*.

### (G) Optional Markings.

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.

## Article 810 Radio and Television Equipment

### Part I. General

#### 810.1 Scope.

This article covers antenna systems for radio and television receiving equipment, amateur and citizen band radio transmitting and receiving equipment, and certain features of transmitter safety. This article covers antennas such as wire-strung type, multi-element, vertical rod, flat, or parabolic and also covers the wiring and cabling that connect them to equipment. This article does not cover equipment and antennas used for coupling carrier current to power line conductors.

#### 810.2 Definitions.

The definitions in Part I of Article 100 shall apply.

#### 810.3 Other Articles.

Wiring from the source of power to and between devices connected to the interior wiring system shall comply with Chapters 1 through 4 other than as modified by Parts I and II of Article 640. Wiring for audio signal processing, amplification, and reproduction equipment shall comply with Article 640. Coaxial cables that connect antennas to equipment shall comply with Article 820.

#### 810.4 Community Television Antenna.

The antenna shall comply with this article. The distribution system shall comply with Article 820.

#### 810.5 Radio Noise Suppressors.

Radio interference eliminators, interference capacitors, or noise suppressors connected to power-supply leads shall be of a listed type. They shall not be exposed to physical damage.

#### 810.6 Antenna Lead-In Protectors.

Where an antenna lead-in surge protector is installed, it shall be listed as being suitable for limiting surges on the cable that connects the antenna to the receiver/transmitter electronics and shall be connected between the conductors and the grounded shield or other ground connection. The antenna lead-in protector shall be grounded using a bonding conductor or grounding electrode conductor installed in accordance with 810.21(F).

Informational Note: For requirements covering protectors for antenna lead-in conductors, refer to UL 497E, *Outline of Investigation for Protectors for Antenna Lead-In Conductors*.

#### 810.7 Grounding Devices.

Where bonding or grounding is required, devices used to connect a shield, a sheath, non–current-carrying metallic members of a cable, or metal parts of equipment or antennas to a bonding conductor or grounding electrode conductor shall be listed or be part of listed equipment.

### Part II. Receiving Equipment — Antenna Systems

#### 810.11 Material.

Antennas and lead-in conductors shall be of hard-drawn copper, bronze, aluminum alloy, copper-clad steel, or other high-strength, corrosion-resistant material.

*Exception: Soft-drawn or medium-drawn copper shall be permitted for lead-in conductors where the maximum span between points of support is less than 11 m (35 ft).*

#### 810.12 Supports.

Outdoor antennas and lead-in conductors shall be securely supported. The antennas or lead-in conductors shall not be attached to the electric service mast. They shall not be attached to poles or similar structures carrying open electric light or power wires or trolley wires of over 250 volts between conductors. Insulators supporting the antenna conductors shall have sufficient mechanical strength to safely support the conductors. Lead-in conductors shall be securely attached to the antennas.

### 810.13 Avoidance of Contacts with Conductors of Other Systems.

Outdoor antennas and lead-in conductors from an antenna to a building shall not cross over open conductors of electric light or power circuits and shall be kept well away from all such circuits so as to avoid the possibility of accidental contact. Where proximity to open electric light or power service conductors of less than 250 volts between conductors cannot be avoided, the installation shall be such as to provide a clearance of at least 600 mm (2 ft).

Where practicable, antenna conductors shall be installed so as not to cross under open electric light or power conductors.

### 810.14 Splices.

Splices and joints in antenna spans shall be made mechanically secure with approved splicing devices or by such other means as will not appreciably weaken the conductors.

### 810.15 Grounding.

Masts and metal structures supporting antennas shall be grounded in accordance with 810.21, unless the antenna and its related supporting mast or structure are within a zone of protection defined by a 46 m (150 ft) radius rolling sphere.

Informational Note: See 4.8.3.1 of NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, for the application of the term *rolling sphere*.

### 810.16 Size of Wire-Strung Antenna — Receiving Station.

#### (A) Size of Antenna Conductors.

Outdoor antenna conductors for receiving stations shall be of a size not less than given in Table 810.16(A).

**Table 810.16(A) Size of Receiving Station Outdoor Antenna Conductors**

| Material | Minimum Size of Conductors (AWG) Where Maximum Open Span Length Is | | |
|---|---|---|---|
| | Less Than 11 m (35 ft) | 11 m to 45 m (35 ft to 150 ft) | Over 45 m (150 ft) |
| Aluminum alloy, hard-drawn copper | 19 | 14 | 12 |
| Copper-clad steel, bronze, or other high-strength material | 20 | 17 | 14 |

#### (B) Self-Supporting Antennas.

Outdoor antennas, such as vertical rods and flat, parabolic, or dipole structures, shall be of corrosion-resistant materials and of strength suitable to withstand ice and wind loading conditions and shall be located well away from overhead conductors of electric light and power circuits of over 150 volts to ground, so as to avoid the possibility of the antenna or structure falling into or making accidental contact with such circuits.

### 810.17 Size of Lead-in — Receiving Station.

Lead-in conductors from outside antennas for receiving stations shall, for various maximum open span lengths, be of such size as to have a tensile strength at least as great as that of the conductors for antennas as specified in 810.16. Where the lead-in consists of two or more conductors that are twisted

together, are enclosed in the same covering, or are concentric, the conductor size shall, for various maximum open span lengths, be such that the tensile strength of the combination is at least as great as that of the conductors for antennas as specified in 810.16.

### 810.18 Clearances — Receiving Stations.

#### (A) Outside of Buildings.

Lead-in conductors attached to buildings shall be installed so that they cannot swing closer than 600 mm (2 ft) to the conductors of circuits of 250 volts or less between conductors, or 3.0 m (10 ft) to the conductors of circuits of over 250 volts between conductors, except that in the case of circuits not over 150 volts between conductors, where all conductors involved are supported so as to ensure permanent separation, the clearance shall be permitted to be reduced but shall not be less than 100 mm (4 in.). The clearance between lead-in conductors and any conductor forming a part of a lightning protection system shall not be less than 1.8 m (6 ft). Underground conductors shall be separated at least 300 mm (12 in.) from conductors of any light or power circuits or Class 1 circuits.

*Exception: Where the electric light or power conductors, Class 1 conductors, or lead-in conductors are installed in raceways or metal cable armor.*

Informational Note No. 1: See 250.60 for grounding associated with lightning protection components — strike termination devices. For further information, see NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, which contains detailed information on grounding, bonding, and spacing from lightning protection systems, and the calculation of specific separation distances using the sideflash equation in Section 4.6.

Informational Note No. 2: Metal raceways, enclosures, frames, and other non–current-carrying metal parts of electrical equipment installed on a building equipped with a lightning protection system may require bonding or spacing from the lightning protection conductors in accordance with NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*. Separation from lightning protection conductors is typically 1.8 m (6 ft) through air or 900 mm (3 ft) through dense materials such as concrete, brick, or wood.

#### (B) Antennas and Lead-ins — Indoors.

Indoor antennas and indoor lead-ins shall not be run nearer than 50 mm (2 in.) to conductors of other wiring systems in the premises.

*Exception No. 1: Where such other conductors are in metal raceways or cable armor.*

*Exception No. 2: Where permanently separated from such other conductors by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing.*

#### (C) In Boxes or Other Enclosures.

Indoor antennas and indoor lead-ins shall be permitted to occupy the same box or enclosure with conductors of other wiring systems where separated from such other conductors by an effective permanently installed barrier.

### 810.19 Electrical Supply Circuits Used in Lieu of Antenna — Receiving Stations.

Where an electrical supply circuit is used in lieu of an antenna, the device by which the radio receiving set is connected to the supply circuit shall be listed.

### 810.20 Antenna Discharge Units — Receiving Stations.

#### (A) Where Required.

Each conductor of a lead-in from an outdoor antenna shall be provided with a listed antenna discharge unit.

*Exception: Where the lead-in conductors are enclosed in a continuous metallic shield that either is grounded with a conductor in accordance with 810.21 or is protected by an antenna discharge unit.*

#### (B) Location.

Antenna discharge units shall be located outside the building or inside the building between the point of entrance of the lead-in and the radio set or transformers and as near as practicable to the entrance of the conductors to the building. The antenna discharge unit shall not be located near combustible material or in a hazardous (classified) location as defined in Article 500.

**(C) Grounding.**

The antenna discharge unit shall be grounded in accordance with 810.21.

**810.21 Bonding Conductors and Grounding Electrode Conductors — Receiving Stations.**

Bonding conductors and grounding electrode conductors shall comply with 810.21(A) through 810.21(K).

**(A) Material.**

The bonding conductor or grounding electrode conductor shall be of copper, aluminum, copper-clad steel, copper-clad aluminum, bronze, or similar corrosion-resistant material. Aluminum or copper-clad aluminum bonding conductors or grounding electrode conductors shall not be used where in direct contact with masonry or the earth or where subject to corrosive conditions. Where used outside, aluminum or copper-clad aluminum conductors shall not be installed within 450 mm (18 in.) of the earth.

**(B) Insulation.**

Insulation on bonding conductors or grounding electrode conductors shall not be required.

**(C) Supports.**

The bonding conductor or grounding electrode conductor shall be securely fastened in place and shall be permitted to be directly attached to the surface wired over without the use of insulating supports.

*Exception: Where proper support cannot be provided, the size of the bonding conductors or grounding electrode conductors shall be increased proportionately.*

**(D) Physical Protection.**

Bonding conductors and grounding electrode conductors shall be protected where exposed to physical damage. Where the bonding conductor or grounding electrode conductor is installed in a metal raceway, both ends of the raceway shall be bonded to the contained conductor or to the same terminal or electrode to which the bonding conductor or grounding electrode conductor is connected.

**(E) Run in Straight Line.**

The bonding conductor or grounding electrode conductor for an antenna mast or antenna discharge unit shall be run in as straight a line as practicable.

**(F) Electrode.**

The bonding conductor or grounding electrode conductor shall be connected as required in 810.21(F)(1) through 810.21(F)(3).

**(1) In Buildings or Structures with an Intersystem Bonding Termination.**

If the building or structure served has an intersystem bonding termination as required by 250.94, the bonding conductor shall be connected to the intersystem bonding termination.

**(2) In Buildings or Structures with Grounding Means.**

If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on the following:

1. The building or structure grounding electrode system as covered in 250.50
2. The grounded interior metal water piping systems, within 1.52 m (5 ft) from its point of entrance to the building, as covered in 250.52
3. The power service accessible means external to the building, as covered in 250.94
4. The nonflexible metal power service raceway
5. The service equipment enclosure, or
6. The grounding electrode conductor or the grounding electrode conductor metal enclosures of the power service

A bonding device intended to provide a termination point for the bonding conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on nonremovable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is nonremovable.

**(3) In Buildings or Structures Without an Intersystem Bonding Termination or Grounding Means.**

If the building or structure served has no intersystem bonding termination or grounding means as described in 810.21(F)(2), the grounding electrode conductor shall be connected to a grounding electrode as described in 250.52.

**(G) Inside or Outside Building.**

The bonding conductor or grounding electrode conductor shall be permitted to be run either inside or outside the building.

**(H) Size.**

The bonding conductor or grounding electrode conductor shall not be smaller than 10 AWG copper, 8 AWG aluminum, or 17 AWG copper-clad steel or bronze.

**(I) Common Ground.**

A single bonding conductor or grounding electrode conductor shall be permitted for both protective and operating purposes.

**(J) Bonding of Electrodes.**

A bonding jumper not smaller than 6 AWG copper or equivalent shall be connected between the radio and television equipment grounding electrode and the power grounding electrode system at the building or structure served where separate electrodes are used.

**(K) Electrode Connection.**

Connections to grounding electrodes shall comply with 250.70.

## Part III. Amateur and Citizen Band Transmitting and Receiving Stations — Antenna Systems

### 810.51 Other Sections.

In addition to complying with Part III, antenna systems for amateur and citizen band transmitting and receiving stations shall also comply with 810.11 through 810.15.

### 810.52 Size of Antenna.

Antenna conductors for transmitting and receiving stations shall be of a size not less than given in Table 810.52.

**Table 810.52 Size of Outdoor Antenna Conductors**

| Material | Minimum Size of Conductors (AWG) Where Maximum Open Span Length Is | |
|---|---|---|
| | Less Than 45 m (150 ft) | Over 45 m (150 ft) |
| Hard-drawn copper | 14 | 10 |
| Copper-clad steel, bronze, or other high-strength material | 14 | 12 |

### 810.53 Size of Lead-in Conductors.

Lead-in conductors for transmitting stations shall, for various maximum span lengths, be of a size at least as great as that of conductors for antennas as specified in 810.52.

### 810.54 Clearance on Building.

Antenna conductors for transmitting stations, attached to buildings, shall be firmly mounted at least 75 mm (3 in.) clear of the surface of the building on nonabsorbent insulating supports, such as treated pins or brackets equipped with insulators having not less than 75-mm (3-in.) creepage and airgap distances. Lead-in conductors attached to buildings shall also comply with these requirements.

*Exception: Where the lead-in conductors are enclosed in a continuous metallic shield that is grounded with a conductor in accordance with 810.58, they shall not be required to comply with these requirements. Where grounded, the metallic shield shall also be permitted to be used as a conductor.*

**810.55 Entrance to Building.**

Except where protected with a continuous metallic shield that is grounded with a conductor in accordance with 810.58, lead-in conductors for transmitting stations shall enter buildings by one of the following methods:

1. Through a rigid, noncombustible, nonabsorbent insulating tube or bushing
2. Through an opening provided for the purpose in which the entrance conductors are firmly secured so as to provide a clearance of at least 50 mm (2 in.)
3. Through a drilled window pane

**810.56 Protection Against Accidental Contact.**

Lead-in conductors to radio transmitters shall be located or installed so as to make accidental contact with them difficult.

**810.57 Antenna Discharge Units — Transmitting Stations.**

Each conductor of a lead-in for outdoor antennas shall be provided with an antenna discharge unit or other suitable means that drain static charges from the antenna system.

*Exception No. 1: Where the lead-in is protected by a continuous metallic shield that is grounded with a conductor in accordance with 810.58, an antenna discharge unit or other suitable means shall not be required.*

*Exception No. 2: Where the antenna is grounded with a conductor in accordance with 810.58, an antenna discharge unit or other suitable means shall not be required.*

**810.58 Bonding Conductors and Grounding Electrode Conductors — Amateur and Citizen Band Transmitting and Receiving Stations.**

Bonding conductors and grounding electrode conductors shall comply with 810.58(A) through 810.58(C).

**(A) Other Sections.**

All bonding conductors and grounding electrode conductors for amateur and citizen band transmitting and receiving stations shall comply with 810.21(A) through 810.21(C).

**(B) Size of Protective Bonding Conductor or Grounding Electrode Conductor.**

The protective bonding conductor or grounding electrode conductor for transmitting stations shall be as large as the lead-in but not smaller than 10 AWG copper, bronze, or copper-clad steel.

**(C) Size of Operating Bonding Conductor or Grounding Electrode Conductor.**

The operating bonding conductor or grounding electrode conductor for transmitting stations shall not be less than 14 AWG copper or its equivalent.

**Part IV. Interior Installation — Transmitting Stations**

**810.70 Clearance from Other Conductors.**

All conductors inside the building shall be separated at least 100 mm (4 in.) from the conductors of any electric light, power, or signaling circuit.

*Exception No. 1: As provided in Article 640.*

*Exception No. 2: Where separated from other conductors by raceway or some firmly fixed nonconductor, such as porcelain tubes or flexible tubing.*

### 810.71 General.

Transmitters shall comply with 810.71(A) through (C).

**(A) Enclosing.**

The transmitter shall be enclosed in a metal frame or grille or separated from the operating space by a barrier or other equivalent means, all metallic parts of which are effectively connected to a bonding conductor or grounding electrode conductor.

**(B) Grounding of Controls.**

All external metal handles and controls accessible to the operating personnel shall be effectively connected to an equipment grounding conductor if the transmitter is powered by the premises wiring system or grounded with a conductor in accordance with 810.21.

**(C) Interlocks on Doors.**

All access doors shall be provided with interlocks that disconnect all voltages of over 350 volts between conductors when any access door is opened.

## Article 820 Community Antenna Television and Radio Distribution Systems

### Part I. General

### 820.1 Scope.

This article covers coaxial cable distribution of radio frequency signals typically employed in community antenna television (CATV) systems.

### 820.2 Definitions.

The definitions in this section shall apply only within Articles 820 and 840.

### 820.3 Other Articles.

Circuits and equipment shall comply with 820.3(A)and (B).

**(A) General Requirements.**

The general requirements of Article 800 shall apply.

**(B) Alternate Wiring Methods.**

The wiring methods of Article 830 shall be permitted to substitute for the wiring methods of Article 820.

Informational Note: Use of Article 830 wiring methods will facilitate the upgrading of Article 820 installations to network-powered broadband applications.

### 820.15 Power Limitations.

Coaxial cable shall be permitted to deliver power to equipment that is directly associated with the radio frequency distribution system if the voltage is not over 60 volts and if the current is supplied by a transformer or other device that has power-limiting characteristics.

Power shall be blocked from premises devices on the network that are not intended to be powered via the coaxial cable.

### Part II. Coaxial Cables ~~Outside~~ on the service provider side of the Communication Service Point~~and Entering Buildings~~

### 820.44 Overhead (Aerial) Coaxial Cables.

Overhead (aerial) coaxial cables, prior to the point of grounding, as specified in 820.93, shall comply with 820.44(A) or 800.44.

**(A) On Poles and In-Span, Above Roofs, on Masts, or Between Buildings.**

Where coaxial cables are installed on poles and in-span, above roofs, on masts, or between buildings, they shall comply with 800.44.

**(B) On Buildings.**

Where attached to buildings, coaxial cables shall be securely fastened in such a manner that they will be separated from other conductors in accordance with 820.44(B)(1) and (B)(2).

**(1) Electric Light or Power.**

The coaxial cable shall have a separation of at least 100 mm (4 in.) from electric light, power, Class 1, or non-power-limited fire alarm circuit conductors not in raceway or cable, or shall be permanently separated from conductors of the other system by a continuous and firmly fixed nonconductor in addition to the insulation on the wires.

**(2) Other Communications Systems.**

Coaxial cable shall be installed so that there will be no unnecessary interference in the maintenance of the separate systems. In no case shall the conductors, cables, messenger strand, or equipment of one system cause abrasion to the conductors, cable, messenger strand, or equipment of any other system.

### 820.47 Underground Coaxial Cables Entering Buildings.

Underground coaxial cables entering buildings shall comply with 820.47(A) and 820.47(B).

**(A) Underground Systems with Electric Light, Power, Class 1, or Non–Power-Limited Fire Alarm Circuit Conductors.**

Underground coaxial cables in a duct, pedestal, handhole enclosure, or manhole that contains electric light, power, or Class 1 or non–power-limited fire alarm circuit conductors shall be in a section permanently separated from such conductors by means of a suitable barrier.

**(B) Direct-Buried Cables and Raceways.**

Direct-buried coaxial cable shall be separated at least 300 mm (12 in.) from conductors of any light or power, non–power-limited fire alarm circuit conductors, or Class 1 circuit.

*Exception No. 1: Separation shall not be required where electric service conductors or coaxial cables are installed in raceways or have metal cable armor.*

*Exception No. 2: Separation shall not be required where electric light or power branch-circuit or feeder conductors or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables; or the coaxial cables have metal cable armor or are installed in a raceway.*

### 820.48 Unlisted Cables Entering Buildings.

Unlisted outside plant coaxial cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated at a grounding block. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) to the point of emergence.

## Part III. Protection

### 820.93 Grounding of the Outer Conductive Shield of Coaxial Cables.

Coaxial cables entering buildings or attached to buildings shall comply with 820.93(A) or (B). Where the outer conductive shield of a coaxial cable is grounded, no other protective devices shall be required. For purposes of this section, grounding located at mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a grounding block location to achieve the shortest practicable bonding conductor or grounding electrode conductor helps limit potential differences between CATV and other metallic systems.

**(A) Entering Buildings.**

In installations where the coaxial cable enters the building, the outer conductive shield shall be grounded in accordance with 820.100. The grounding shall be as close as practicable to the point of entrance.

**(B) Terminating Outside of the Building.**

In installations where the coaxial cable is terminated outside of the building, the outer conductive shield shall be grounded in accordance with 820.100. The grounding shall be as close as practicable to the point of attachment or termination.

**(C) Location.**

Where installed, a listed primary protector shall be applied on each community antenna and radio distribution (CATV) cable external to the premises. The listed primary protector shall be located as close as practicable to the entrance point of the cable on either side or integral to the ground block.

**(D) Hazardous (Classified) Locations.**

Where a primary protector or equipment providing the primary protection function is used, it shall not be located in any hazardous (classified) location as defined in 500.5 and 505.5 or in the vicinity of easily ignitible material.

*Exception: As permitted in 501.150, 502.150, and 503.150.*

**Part IV. Grounding Methods**

**820.100 Cable Bonding and Grounding.**

The shield of the coaxial cable shall be bonded or grounded as specified in 820.100(A) and (B).

*Exception: For communications systems using coaxial cable completely contained within the building (i.e., they do not exit the building) or the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere and isolated from outside cable plant, the shield shall be permitted to be grounded by a connection to an equipment grounding conductor as described in 250.118. Connecting to an equipment grounding conductor through a grounded receptacle using a dedicated bonding jumper and a permanently connected listed device shall be permitted. Use of a cord and plug for the connection to an equipment grounding conductor shall not be permitted.*

Informational Note: See 4.8.3.1 of NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems,* for the application of the term *rolling sphere*.

**(A) General Requirements.**

The installation shall be in accordance with 800.100.

**(B) Shield Protection Devices.**

Grounding of a coaxial drop cable shield by means of a protective device that does not interrupt the grounding system within the premises shall be permitted.

**820.103 Equipment Grounding.**

Unpowered equipment and enclosures or equipment powered by the coaxial cable shall be considered grounded where connected to the metallic cable shield.

**Part V. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**820.133 Installation of Coaxial Cables and Equipment.**

Beyond the point of grounding, as defined in 820.93, the coaxial cable installation shall comply with 820.133(A) and (B).

**(A) Separation from Other Conductors.**

**(1) In Raceways, Cable Trays, Boxes, Enclosures, and Cable Routing Assemblies.**

1. *Other Circuits.* Coaxial cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with jacketed cables 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. Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770
4. Communications circuits in compliance with Parts I and IV of Article 805
5. Low-power network-powered broadband communications circuits in compliance with Parts I and V of Article 830

2. *Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm, and Medium-Power Network-Powered Broadband Communications Circuits.* Coaxial cable shall not be placed in any raceway, compartment, outlet box, junction box, or other enclosures with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits.

*Exception No. 1: Coaxial cable shall be permitted to be placed in any raceway, compartment, outlet box, junction box, or other enclosures with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits where 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 coaxial cables by a permanent barrier or listed divider.*

*Exception No. 2: Coaxial cable shall be permitted to be placed in outlet boxes, junction boxes, or similar fittings or compartments with power conductors where such conductors are introduced solely for power supply to the coaxial cable system distribution equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum 6 mm (¼ in.) separation from coaxial cables.*

**(2) Other Applications.**

Coaxial cable shall be separated 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.

*Exception No. 1: Separation shall not be required where either (1) all of the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits are in a raceway, or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC or Type UF cables, or (2) all of the coaxial cables are encased in a raceway.*

*Exception No. 2: Separation shall not be required where the coaxial cables are permanently separated from the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B) Support of Coaxial Cables.**

Raceways shall be used for their intended purpose. Coaxial cables shall not be strapped, taped, or attached by any means to the exterior of any conduit or raceway as a means of support.

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

**820.154 Substitutions of Listed CATV Cables.**

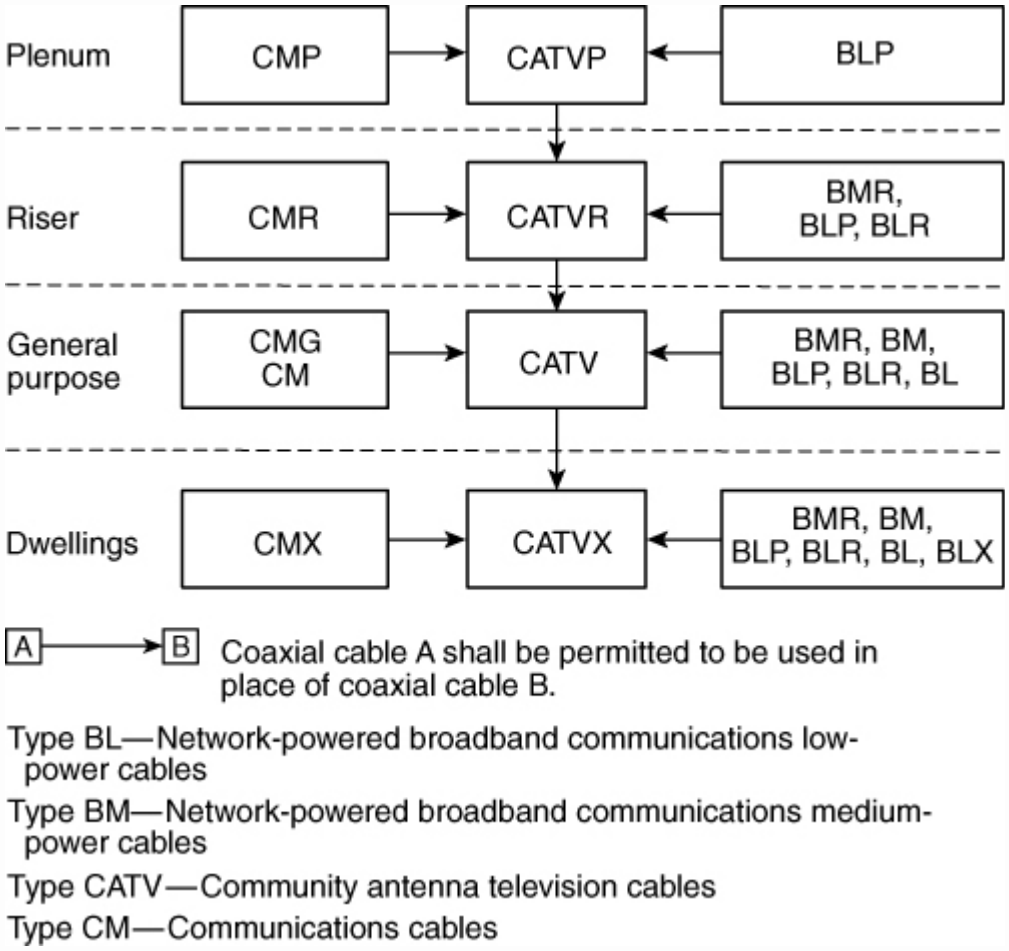
The substitutions for coaxial cables in Table 820.154 and illustrated in Figure 820.154 shall be permitted.

Informational Note: The substitute cables in Table 820.154 and Figure 820.154 are only coaxial-type cables.

**Table 820.154 Coaxial Cable Uses and Permitted Substitutions**

| Cable Type | Permitted Substitutions |
|---|---|
| CATVP | CMP, BLP |
| CATVR | CATVP, CMP, CMR, BMR, BLP, BLR |
| CATV | CATVP, CMP, CATVR, CMR, CMG, CM, BMR, BM, BLP, BLR, BL |
| CATVX | CATVP, CMP, CATVR, CMR, CATV, CMG, CM, BMR, BM, BLP, BLR, BL, BLX |

**Figure 820.154 Cable Substitution Hierarchy.**




## Part VI. Listing Requirements

### 820.179 Coaxial Cables.

Cables shall be listed in accordance with 820.179(A)and marked in accordance with Table 820.179 and 820.179(B). The cable voltage rating shall not be marked on the cable.

Informational Note: Voltage markings on cables could 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.*

**(A) General Requirements.**

The general requirements in 800.179 shall apply.

**(B) Optional Markings.**

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.

**Table 820.179 Coaxial Cable Markings**

| Cable Marking | Type |
|---|---|
| CATVP | CATV plenum cable |
| CATVR | CATV riser cable |
| CATV | CATV cable |
| CATVX | CATV cable, limited use |

# Article 830 Network-Powered Broadband Communications Systems

## Part I. General

### 830.1 Scope.

This article covers network-powered broadband communications systems that provide any combination of voice, audio, video, data, and interactive services through a network interface unit.

Informational Note: A typical basic system configuration includes a cable supplying power and broadband signal to a network interface unit that converts the broadband signal to the component signals. Typical cables are coaxial cable with both broadband signal and power on the center conductor, composite metallic cable with a coaxial member(s) or twisted pair members for the broadband signal and twisted pair members for power, and composite optical fiber cable with a pair of conductors for power. Larger systems may also include network components such as amplifiers that require network power.

### 830.2 Definitions.

The definitions in this section shall apply only within Article 830.

Informational Note: A typical single-family network-powered communications circuit consists of a communications drop or communications service cable and an NIU and includes the communications utility's serving terminal or tap where it is not under the exclusive control of the communications utility.

**Fault Protection Device.**

An electronic device that is intended for the protection of personnel and functions under fault conditions, such as network-powered broadband communications cable short or open circuit, to limit the current or voltage, or both, for a low-power network-powered broadband communications circuit and provide acceptable protection from electric shock.

**Network Interface Unit (NIU).**

A device that converts a broadband signal into component voice, audio, video, data, and interactive services signals and provides isolation between the network power and the premises signal circuits. These devices often contain primary and secondary protectors.

**Network-Powered Broadband Communications Circuit.**

The circuit extending from the communications utility's or service provider's serving terminal or tap up to and including the NIU.

Informational Note: A typical one-family dwelling network-powered communications circuit consists of a communications drop or communications service cable and an NIU and includes the communications utility's serving terminal or tap where it is not under the exclusive control of the communications utility.

### 830.3 Other Articles.

Circuits and equipment shall comply with 830.3(A) through (C).

**(A) General Requirements.**

The general requirements of Article 800 shall apply.

**(B) Output Circuits.**

As appropriate for the services provided, the output circuits derived from the network interface unit shall comply with the requirements of the following:

1. Installations of communications circuits — Part IV of Article 805
2. Installations of community antenna television and radio distribution circuits — Part V of Article 820

   *Exception: Where protection is provided in the output of the NIU 830.90(B)(3) shall apply.*
3. Installations of optical fiber cables — Part V of Article 770
4. Installations of Class 2 and Class 3 circuits — Part III of Article 725
5. Installations of power-limited fire alarm circuits — Part III of Article 760

**(C) Protection Against Physical Damage.**

The requirements of 300.4 shall apply.

**830.15 Power Limitations.**

Network-powered broadband communications systems shall be classified as having low- or medium-power sources as specified in 830.15(1) or (2).

1. Sources shall be classified as defined in Table 830.15.
2. Direct-current power sources exceeding 150 volts to ground, but no more than 200 volts to ground, with the current to ground limited to 10 mA dc, that meet the current and power limitation for medium-power sources in Table 830.15 shall be classified as medium-power sources.

Informational Note: One way to determine compliance with 830.15(2) is listed information technology equipment intended to supply power via a communications network that complies with the requirements for RFT-V circuits as defined in UL 60950-21-2007, *Standard for Safety for Information Technology Equipment — Safety — Part 21: Remote Power Feeding*.

**Table 830.15 Limitations for Network-Powered Broadband Communications Systems**

| Network Power Source | Low | Medium |
|---|---|---|
| Circuit voltage, $V_{max}$ (volts)[1] | 0–100 | 0–150 |
| Power limitation, $VA_{max}$ (volt-amperes)[1] | 250 | 250 |
| Current limitation, $I_{max}$ (amperes)[1] | $1000/V_{max}$ | $1000/V_{max}$ |
| Maximum power rating (volt-amperes) | 100 | 100 |
| Maximum voltage rating (volts) | 100 | 150 |
| Maximum overcurrent protection (amperes)[2] | $100/V_{max}$ | NA |

[1] $V_{max}$, $I_{max}$, and $VA_{max}$ are determined with the current-limiting impedance in the circuit (not bypassed) as follows:

$V_{max}$ — Maximum system voltage regardless of load with rated input applied.

$I_{max}$ — Maximum system current under any noncapacitive load, including short circuit, and with overcurrent protection bypassed if used. $I_{max}$ limits apply after 1 minute of operation.

$VA_{max}$ — Maximum volt-ampere output after 1 minute of operation regardless of load and overcurrent protection bypassed if used.

[2]Overcurrent protection is not required where the current-limiting device provides equivalent current limitation and the current-limiting device does not reset until power or the load is removed.

**830.24 Mechanical Execution of Work.**

The installation shall also conform to 300.4 and 300.11.

**Part II. Cables on the service provider side of the Communication Service Point~~Outside and Entering Buildings~~**

**830.40 Entrance Cables.**

Network-powered broadband communications cables located outside and entering buildings shall comply with 830.40(A) and (B).

**(A) Medium-Power Circuits.**

Medium-power network-powered broadband communications circuits located outside and entering buildings shall be installed using Type BMU, Type BM, or Type BMR network-powered broadband communications medium-power cables.

**(B) Low-Power Circuits.**

Low-power network-powered broadband communications circuits located outside and entering buildings shall be installed using Type BLU or Type BLX low-power network-powered broadband communications cables. Cables shown in Table 830.154 shall be permitted to substitute.

*Exception: Outdoor community antenna television and radio distribution system coaxial cables installed prior to January 1, 2000, and installed in accordance with Article 820, shall be permitted for low-power-type, network-powered broadband communications circuits.*

**830.44 Overhead (Aerial) Cables.**

Overhead (aerial) network-powered broadband communications cables shall comply with 830.44(A) through (F).

**(A) On Poles and In-Span or Above Roofs.**

Where network-powered broadband communications cables are installed on poles and in-span or above roofs, they shall comply with 800.44.

**(B) Clearance from Ground.**

Overhead (aerial) spans of network-powered broadband communications cables shall conform to not less than the following:

1. 2.9 m (9½ ft) — above finished grade, sidewalks, or from any platform or projection from which they might be reached and accessible to pedestrians only
2. 3.5 m (11½ ft) — over residential property and driveways, and those commercial areas not subject to truck traffic
3. 4.7 m (15½ ft) — over public streets, alleys, roads, parking areas subject to truck traffic, driveways on other than residential property, and other land traversed by vehicles such as cultivated, grazing, forest, and orchard

Informational Note: These clearances have been specifically chosen to correlate with ANSI/IEEE C2-2012, *National Electrical Safety Code*, Table 232-1, which provides for clearances of wires, conductors, and cables above ground and roadways, rather than using the clearances referenced in 225.18. Because Article 805 and Article 820 have had no required clearances, the communications industry has used the clearances from the NESC for their installed cable plant.

**(C) Over Pools.**

Clearance of network-powered broadband communications cable in any direction from the water level, edge of pool, base of diving platform, or anchored raft shall comply with those clearances in 680.9.

**(D) Final Spans.**

Final spans of network-powered broadband communications cables without an outer jacket shall be permitted to be attached to the building, but they shall be kept not less than 900 mm (3 ft) from windows that are designed to be opened, doors, porches, balconies, ladders, stairs, fire escapes, or similar locations.

*Exception: Conductors run above the top level of a window shall be permitted to be less than the 900-mm (3-ft) requirement above.*

Overhead (aerial) network-powered broadband communications cables shall not be installed beneath openings through which materials might be moved, such as openings in farm and commercial buildings, and shall not be installed where they obstruct entrance to these building openings.

**(E) Between Buildings.**

Network-powered broadband communications cables extending between buildings or structures, and also the supports or attachment fixtures, shall be identified as suitable for outdoor aerial applications and shall have sufficient strength to withstand the loads to which they may be subjected.

*Exception: Where a network-powered broadband communications cable does not have sufficient strength to be self-supporting, it shall be attached to a supporting messenger cable that, together with the attachment fixtures or supports, shall be acceptable for the purpose and shall have sufficient strength to withstand the loads to which they may be subjected.*

**(F) On Buildings.**

Where attached to buildings, network-powered broadband communications cables shall be securely fastened in such a manner that they are separated from other conductors in accordance with 830.44(F)(1) through (F)(3).

**(1) Electric Light or Power.**

The network-powered broadband communications cable shall have a separation of at least 100 mm (4 in.) from electric light, power, Class 1, or non-power-limited fire alarm circuit conductors not in raceway or cable, or be permanently separated from conductors of the other system by a continuous and firmly fixed nonconductor in addition to the insulation on the wires.

**(2) Other Communications Systems.**

Network-powered broadband communications cables shall be installed so that there will be no unnecessary interference in the maintenance of the separate systems. In no case shall the conductors, cables, messenger strand, or equipment of one system cause abrasion to the conductors, cables, messenger strand, or equipment of any other system.

**(3) Protection from Damage.**

Network-powered broadband communications cables attached to buildings or structures and located within 2.5 m (8 ft) of finished grade shall be protected by enclosures, raceways, or other approved means.

*Exception: A low-power network-powered broadband communications circuit that is equipped with a listed fault protection device, appropriate to the network-powered broadband communications cable used, and located on the network side of the network-powered broadband communications cable shall not be required to be additionally protected by enclosures, raceways, or other approved means.*

**830.47 Underground Network-Powered Broadband Communications Cables Entering Buildings.**

Underground network-powered broadband communications cables entering buildings shall comply with 830.47(A) through 830.47(D).

**(A) Underground Systems with Electric Light and Power, Class 1, or Non–Power-Limited Fire Alarm Circuit Conductors.**

Underground network-powered broadband communications cables in a duct, pedestal, handhole enclosure, or manhole that contains electric light, power conductors, non–power-limited fire alarm circuit

conductors, or Class 1 circuits shall be in a section permanently separated from such conductors by means of a suitable barrier.

**(B) Direct-Buried Cables and Raceways.**

Direct-buried network-powered broadband communications cables shall be separated by at least 300 mm (12 in.) from conductors of any light, power, non–power-limited fire alarm circuit conductors or Class 1 circuit.

*Exception No. 1: Separation shall not be required where electric service conductors or network-powered broadband communications cables are installed in raceways or have metal cable armor.*

*Exception No. 2: Separation shall not be required where electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables; or the network-powered broadband communications cables have metal cable armor or are installed in a raceway.*

**(C) Protection from Physical Damage.**

Direct-buried cable, conduit, or other raceways shall be installed to meet the minimum cover requirements of Table 830.47(C). In addition, direct-buried cables emerging from the ground shall be protected by enclosures, raceways, or other approved means extending from the minimum cover distance required by Table 830.47(C) below grade 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. Types BMU and BLU direct-buried cables emerging from the ground shall be installed in rigid metal conduit (RMC), intermediate metal conduit (IMC), rigid nonmetallic conduit, or other approved means extending from the minimum cover distance required by Table 830.47(C) below grade to the point of entrance.

*Exception: A low-power network-powered broadband communications circuit that is equipped with a listed fault protection device, appropriate to the network-powered broadband communications cable used, and located on the network side of the network-powered broadband communications cable being protected.*

**Table 830.47(C) Network-Powered Broadband Communications Systems Minimum Cover Requirements (*Cover* is the shortest distance measured between a point on the top surface of any direct-buried cable, conduit, or other raceway and the top surface of finished grade, concrete, or similar cover.)**

| Location of Wiring Method or Circuit | Direct Burial Cables | | Rigid Metal Conduit (RMC) or Intermediate Metal Conduit (IMC) | | Nonmetallic Raceways Listed for Direct Burial; Without Concrete Encasement or Other Approved Raceways | |
|---|---|---|---|---|---|---|
| | mm | in. | mm | in. | mm | in. |
| All locations not specified below | 450 | 18 | 150 | 6 | 300 | 12 |
| In trench below 50-mm (2-in.) thick concrete or equivalent | 300 | 12 | 150 | 6 | 150 | 6 |
| Under a building (in raceway only) | 0 | 0 | 0 | 0 | 0 | 0 |
| Under minimum of 100-mm (4-in.) thick concrete exterior slab with no vehicular traffic and the slab extending not less than 150 mm (6 in.) beyond the underground installation | 300 | 12 | 100 | 4 | 100 | 4 |

| Location of Wiring Method or Circuit | Direct Burial Cables | | Rigid Metal Conduit (RMC) or Intermediate Metal Conduit (IMC) | | Nonmetallic Raceways Listed for Direct Burial; Without Concrete Encasement or Other Approved Raceways | |
|---|---|---|---|---|---|---|
| | mm | in. | mm | in. | mm | in. |
| One- and two-family dwelling driveways and outdoor parking areas and used only for dwelling-related purposes | 300 | 12 | 300 | 12 | 300 | 12 |

Notes:

1. Raceways approved for burial only where concrete encased shall require a concrete envelope not less than 50 mm (2 in.) thick.

2. Lesser depths shall be permitted where cables rise for terminations or splices or where access is otherwise required.

3. Where solid rock is encountered, all wiring shall be installed in 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.

4. Low-power network-powered broadband communications circuits using directly buried community antenna television and radio distribution system coaxial cables that were installed outside and entering buildings prior to January 1, 2000, in accordance with Article 820 shall be permitted where buried to a minimum depth of 300 mm (12 in.).

**(D) Pools.**

Cables located under the pool or within the area extending 1.5 m (5 ft) horizontally from the inside wall of the pool shall meet those clearances and requirements specified in 680.11.

**Part III. Protection**

**830.90 Primary Electrical Protection.**

**(A) Application.**

Primary electrical protection shall be provided on all network-powered broadband communications conductors that are neither grounded nor interrupted and are run partly or entirely in aerial cable not confined within a block. Also, primary electrical protection shall be provided on all aerial or underground network-powered broadband communications conductors that are neither grounded nor interrupted and are located within the block containing the building served so as to be exposed to lightning or accidental contact with electric light or power conductors operating at over 300 volts to ground.

*Exception: Primary electrical protection shall not be required on the network-powered broadband communications conductors where electrical protection is provided on the derived circuit(s) (output side of the NIU) in accordance with 830.90(B)(3).*

Informational Note No. 1: On network-powered broadband communications conductors not exposed to lightning or accidental contact with power conductors, providing primary electrical protection in accordance with this article helps protect against other hazards, such as ground potential rise caused by power fault currents, and above-normal voltages induced by fault currents on power circuits in proximity to the network-powered broadband communications conductors.

Informational Note No. 2: Network-powered broadband communications circuits are considered to have a lightning exposure unless one or more of the following conditions exist:

1. Circuits in large metropolitan areas where buildings are close together and sufficiently high to intercept lightning.
2. Areas having an average of five or fewer thunderstorm days each year and earth resistivity of less than 100 ohm-meters. Such areas are found along the Pacific coast.

Informational Note No. 3: For information on lightning protection systems, see NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*.

**(1) Fuseless Primary Protectors.**

Fuseless-type primary protectors shall be permitted where power fault currents on all protected conductors in the cable are safely limited to a value no greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor.

**(2) Fused Primary Protectors.**

Where the requirements listed in 830.90(A)(1) are not met, fused-type primary protectors shall be used. Fused-type primary protectors shall consist of an arrester connected between each conductor to be protected and ground, a fuse in series with each conductor to be protected, and an appropriate mounting arrangement. Fused primary protector terminals shall be marked to indicate line, instrument, and ground, as applicable.

**(B) Location.**

The location of the primary protector, where required, shall comply with 830.90(B)(1), (B)(2), or (B)(3):

1. A listed primary protector shall be applied on each network-powered broadband communications cable external to and on the network side of the network interface unit.
2. The primary protector function shall be an integral part of and contained in the network interface unit. The network interface unit shall be listed as being suitable for application with network-powered broadband communications systems and shall have an external marking indicating that it contains primary electrical protection.
3. The primary protector(s) shall be provided on the derived circuit(s) (output side of the NIU), and the combination of the NIU and the protector(s) shall be listed as being suitable for application with network-powered broadband communications systems.

A primary protector, whether provided integrally or external to the network interface unit, shall be located as close as practicable to the point of entrance.

For purposes of this section, a network interface unit and any externally provided primary protectors located at mobile home service equipment located in sight from and not more than 9.0 m (30 ft) from the exterior wall of the mobile home it serves, or at a mobile home disconnecting means grounded in accordance with 250.32 and located in sight from and not more than 9.0 m (30 ft) from the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a network interface unit and primary protector location to achieve the shortest practicable primary protector bonding conductor or grounding electrode conductor helps limit potential differences between communications circuits and other metallic systems.

**(C) Hazardous (Classified) Locations.**

The primary protector or equipment providing the primary protection function shall not be located in any hazardous (classified) location as defined in 500.5 and 505.5 or in the vicinity of easily ignitible material.

*Exception: As permitted in 501.150, 502.150, and 503.150.*

**Part IV. Grounding Methods**

**830.93 Grounding or Interruption of Metallic Members of Network-Powered Broadband Communications Cables.**

Network-powered communications cables entering buildings or attaching to buildings shall comply with 830.93(A) or (B).

For purposes of this section, grounding located at mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a grounding location to achieve the shortest practicable bonding conductor or grounding electrode conductor helps limit potential differences between the network-powered broadband communications circuits and other metallic systems.

**(A) Entering Buildings.**

In installations where the network-powered communications cable enters the building, the shield shall be grounded in accordance with 800.100, and metallic members of the cable not used for communications or powering shall be grounded in accordance with 800.100 or interrupted by an insulating joint or equivalent device. The grounding or interruption shall be as close as practicable to the point of entrance.

**(B) Terminating Outside of the Building.**

In installations where the network-powered communications cable is terminated outside of the building, the shield shall be grounded in accordance with 800.100, and metallic members of the cable not used for communications or powering shall be grounded in accordance with 800.100 or interrupted by an insulating joint or equivalent device. The grounding or interruption shall be as close as practicable to the point of attachment of the NIU.

**Part V. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**830.133 Installation of Network-Powered Broadband Communications Cables and Equipment.**

Cable and equipment installations within buildings shall comply with 830.133(A) and (B), as applicable.

**(A) Separation of Conductors.**

**(1) In Raceways, Cable Trays, Boxes, Enclosures, and Cable Routing Assemblies.**

1. *Low- and Medium-Power Network-Powered Broadband Communications Circuit Cables.* Low- and medium-power network-powered broadband communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly.

2. *Low-Power Network-Powered Broadband Communications Circuit Cables with Other Circuits.* Low-power network-powered broadband communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with jacketed cables of any of the following circuits:

    1. Class 2 and Class 3 remote-control, signaling, and power-limited circuits in compliance with 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 IV of Article 805
    4. Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770
    5. Community antenna television and radio distribution systems in compliance with Parts I and V of Article 820

3. *Medium-Power Network-Powered Broadband Communications Circuit Cables with Optical Fiber Cables and Other Communications Cables*. Medium-power network-powered broadband communications cables shall not be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with conductors of any of the following circuits:

    1. Communications circuits in compliance with Parts I and IV of Article 805
    2. Conductive optical fiber cables in compliance with Parts I and V of Article 770
    3. Community antenna television and radio distribution systems in compliance with Parts I and V of Article 820

4. *Medium-Power Network-Powered Broadband Communications Circuit Cables with Other Circuits*. Medium-power network-powered broadband communications cables

shall not be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with conductors of any of the following circuits:

1. Class 2 and Class 3 remote-control, signaling, and power-limited circuits in compliance with Parts I and III of Article 725
2. Power-limited fire alarm systems in compliance with Parts I and III of Article 760

5. *Electric Light, Power, Class 1, Non–Powered Broadband Communications Circuit Cables.* Network-powered broadband communications cable shall not be placed in any raceway, cable tray, compartment, outlet box, junction box, or similar fittings with conductors of electric light, power, Class 1, or non–power-limited fire alarm circuit cables.

*Exception No. 1: Where all of the conductors of electric light, power, Class 1, non–power-limited fire alarm circuits are separated from all of the network-powered broadband communications cables by a permanent barrier or listed divider.*

*Exception No. 2: Power circuit conductors in outlet boxes, junction boxes, or similar fittings or compartments where such conductors are introduced solely for power supply to the network-powered broadband communications system distribution equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum 6 mm (¼ in.) separation from network-powered broadband communications cables.*

**(2) Other Applications.**

Network-powered broadband communications cable shall be separated at least 50 mm (2 in.) from conductors of any electric light, power, Class 1, and non–power-limited fire alarm circuits.

*Exception No. 1: Separation shall not be required where: (1) all of the conductors of electric light, power, Class 1, and non–power-limited fire alarm circuits are in a raceway, or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC, or Type UF cables, or (2) all of the network-powered broadband communications cables are encased in a raceway.*

*Exception No. 2: Separation shall not be required where the network-powered broadband communications cables are permanently separated from the conductors of electric light, power, Class 1, and non–power-limited fire alarm circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B) Support of Network-Powered Broadband Communications Cables.**

Raceways shall be used for their intended purpose. Network-powered broadband communications cables shall not be strapped, taped, or attached by any means to the exterior of any conduit or raceway as a means of support.

### 830.154 Substitutions of Network-Powered Broadband Communications System Cables.

The substitutions for network-powered broadband system cables listed in Table 830.154 shall be permitted.

**Table 830.154 Cable Substitutions**

| Cable Type | Permitted Cable Substitutions |
|---|---|
| BM | BMR |
| BLP | CMP, CL3P |
| BLR | CMP, CL3P, CMR, CL3R, BLP, BMR |
| BL | CMP, CMR, CM, CMG, CL3P, CL3R, CL3, BMR, BM, BLP, BLR |
| BLX | CMP, CMR, CM, CMG, CMX, CL3P, CL3R, CL3, CL3X, BMR, BM, BLP, BRP, BL |

### 830.160 Bends.

Bends in network broadband cable shall be made so as not to damage the cable.

## Part VI. Listing Requirements

### 830.179 Network-Powered Broadband Communications Equipment and Cables.

Network-powered broadband communications equipment and cables shall be listed and marked in accordance with 830.179(A) through (D).

*Exception No. 1: This listing requirement shall not apply to community antenna television and radio distribution system coaxial cables that were installed prior to January 1, 2000, in accordance with Article 820 and are used for low-power network-powered broadband communications circuits.*

*Exception No. 2: Substitute cables for network-powered broadband communications cables shall be permitted as shown in Table 830.154.*

**(A) General Requirements.**

The general requirements in 800.179 shall apply.

**(B) Network-Powered Broadband Communications Medium-Power Cables.**

Network-powered broadband communications medium-power cables shall be factory-assembled cables consisting of a jacketed coaxial cable, a jacketed combination of coaxial cable and multiple individual conductors, or a jacketed combination of an optical fiber cable and multiple individual conductors. The insulation for the individual conductors shall be rated for 300 volts minimum. Cables intended for outdoor use shall be listed as suitable for the application. Cables shall be marked in accordance with 310.8. Type BMU cables shall be jacketed and listed as being suitable for outdoor underground use.

**(C) Network-Powered Broadband Communication Low-Power Cables.**

Network-powered broadband communications low-power cables shall be factory-assembled cables consisting of a jacketed coaxial cable, a jacketed combination of coaxial cable and multiple individual conductors, or a jacketed combination of an optical fiber cable and multiple individual conductors. The insulation for the individual conductors shall be rated for 300 volts minimum. Cables intended for outdoor use shall be listed as suitable for the application. Cables shall be marked in accordance with 310.8. Type BLU cables shall be jacketed and listed as being suitable for outdoor underground use.

**(D) Optional Markings.**

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.

# Article 840 Premises-Powered Broadband Communications Systems

## Part I. General

### 840.1 Scope.

This article covers premises-powered broadband communications systems.

Informational Note: A typical basic system configuration consists of an optical fiber, twisted pair, or coaxial cable to the premises supplying a broadband signal to a network terminal that converts the broadband signal into component electrical signals, such as traditional telephone, video, high-speed Internet, and interactive services. Powering for the network terminal and network devices is typically accomplished through a premises power supply that might be built into the network terminal or provided as a separate unit. In order to provide communications in the event of a power interruption, a battery backup unit or an uninterruptible power supply (UPS) is typically part of the powering system.

### 840.2 Definitions.

The definitions in 805.2 and 820.2 shall apply. The definitions in this section shall apply only within Article 840.

**Broadband.**

Wide bandwidth data transmission that transports multiple signals, protocols, and traffic types over various media types.

**Network Terminal.**

A device that converts network-provided signals (optical, electrical, or wireless) into component signals, including voice, audio, video, data, wireless, optical, and interactive services, and is considered a network device on the premises that is connected to a communications service provider and is powered at the premises.

**Premises Communications Circuit.**

The circuit that extends voice, audio, video, data, interactive services, telegraph (except radio), and outside wiring for fire alarm and burglar alarm from the service provider's network terminal to the customer's communications equipment up to and including terminal equipment, such as a telephone, a fax machine, or an answering machine.

**Premises Community Antenna Television (CATV) Circuit.**

The circuit that extends community antenna television (CATV) systems for audio, video, data, and interactive services from the service provider's network terminal to the appropriate customer equipment.

**Premises-Powered.**

Using power provided locally from the premises.

### 840.3 Other Articles.

Circuits and equipment shall comply with 840.3(A) through (C).

**(A) General Requirements.**

The general requirements of Article 800 shall apply.

**(B) Output Circuits.**

As appropriate for the services provided, the output circuits derived from the network terminal shall comply with the requirements of the following:

1. Installations of communications circuits — Part IV of Article 805
2. Installations of premises (within buildings) community antenna television and radio distribution circuits — Part V of Article 820
3. Installations of optical fiber cables — Part V of Article 770
4. Installations of Class 2 and Class 3 circuits — Part III of Article 725

   Informational Note: See 725.121 for information on the classification of information technology equipment circuits.
5. Installations of power-limited fire alarm circuits — Part III of Article 760

**(C) Electrical Classification of Data Circuits and Cables.**

Sections 725.139(D)(1) and 805.133(A)(1)(b) shall apply to the electrical classification of Class 2 and Class 3 circuits in the same cable with communications circuits.

### 840.24 Mechanical Execution of Work.

The requirements of 770.24 and 800.24 shall apply.

### 840.25 Abandoned Cables.

The requirements of 770.25 and 800.25 shall apply.

### 840.26 Spread of Fire or Products of Combustion.

The requirements of 770.26 and 800.26 shall apply.

## Part II. Cables on the service provider side of the Communication Service Point ~~Outside and Entering Buildings~~

### 840.47 Underground Wires and Cables Entering Buildings.

Underground wires and cables entering buildings shall comply with 840.47(A) through (C).

**(A) Optical Fiber Cables.**

**(1) Class 1 or Non–Power-Limited Fire Alarm Circuits.**

Underground conductive optical fiber cables entering buildings with electric light, power, Class 1, or non–power-limited fire alarm circuit conductors in a raceway, handhole enclosure, or manhole shall be located in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier.

**(2) Direct-Buried Cables.**

Direct-buried conductive optical fiber cables shall be separated by at least 300 mm (12 in.) from conductors of any electric light, power, or non–power-limited fire alarm circuit conductors or Class 1 circuit.

*Exception No. 1: Separation shall not be required where the electric service conductors are installed in raceways or have metal cable armor.*

*Exception No. 2: Separation shall not be required where the electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables.*

**(3) Mechanical Protection.**

Direct-buried cable, conduit, or other raceway shall be installed to have a minimum cover of 150 mm (6 in.).

**(B) Communications Wires and Cables.**

Installations of communications wires and multipair communications cables shall comply with 805.47.

**(C) Coaxial Cables.**

Installations of coaxial cables shall comply with 820.47.

### 840.48 Unlisted Wires and Cables Entering Buildings.

Installations of unlisted cables entering buildings shall comply with 840.48(A), (B), or (C), as applicable.

**(A) Optical Fiber Cables.**

Installations of unlisted optical fiber cables entering buildings shall comply with 770.48.

**(B) Communications Wires and Cables.**

Installations of unlisted communications wires and unlisted multipair communications cables entering buildings shall comply with 805.48.

**(C) Coaxial Cables.**

Installations of unlisted coaxial cables entering buildings shall comply with 820.48.

## Part III. Protection

### 840.90 Protective Devices.

The requirements of 805.90 shall apply.

### 840.93 Grounding or Interruption.

Non–current-carrying metallic members of optical fiber cables, communications cables, or coaxial cables entering buildings or attaching to buildings shall comply with 840.93(A), (B), or (C), respectively.

### (A) Non–Current-Carrying Metallic Members of Optical Fiber Cables.

Non–current-carrying metallic members of optical fiber cables entering a building or terminating on the outside of a building shall comply with 770.93(A) or (B).

### (B) Communications Cables.

The grounding or interruption of the metallic sheath of communications cable shall comply with 805.93.

### (C) Coaxial Cables.

Where the network terminal is installed inside or outside of the building, with coaxial cables terminating at the network terminal, and is either entering, exiting, or attached to the outside of the building, 820.93 shall apply.

## 840.94 Premises Circuits Leaving the Building.

Where circuits leave the building to power equipment remote to the building or outside the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere, 805.90 and 805.93 shall apply.

Informational Note: See NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, for the theory of the term *rolling sphere*.

## Part IV. Grounding Methods

## 840.101 Premises Circuits Not Leaving the Building.

Where the network terminal is served by a nonconductive optical fiber cable, or where any non–current-carrying metallic member of a conductive optical fiber cable is interrupted by an insulating joint or equivalent device, and circuits that terminate at the network terminal are completely contained within the building (i.e., they do not exit the building), 840.101(A), (B), or (C) shall apply, as applicable.

### (A) Coaxial Cable Shield Grounding.

The shield of coaxial cable shall be grounded by one of the following:

1. Any of the methods described in 820.100 or 800.106
2. A fixed connection to an equipment grounding conductor as described in 250.118
3. Connection to the network terminal grounding terminal provided that the terminal is connected to ground by one of the methods described in 820.100 or 800.106, or to an equipment grounding conductor through a listed grounding device that will retain the ground connection if the network terminal is unplugged

### (B) Communications Circuit Grounding.

Communications circuits shall not be required to be grounded.

### (C) Network Terminal Grounding.

The network terminal shall not be required to be grounded unless required by its listing. If the coaxial cable shield is separately grounded as described in 840.101(A)(1) or 840.101(A)(2), the use of a cord and plug for the connection to the network terminal grounding connection shall be permitted.

Informational Note: Where required to be grounded, a listed device that extends the equipment grounding conductor from the receptacle to the network terminal equipment grounding terminal is permitted. Sizing of the extended equipment grounding conductor is covered in Table 250.122.

## 840.102 Premises Circuits Leaving the Building.

Where circuits leave the building to power equipment remote to the building or outside the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere, the installation of communications wires and cables shall comply with 800.100 and 800.106, and the installation of coaxial cables shall comply with 820.100 and 800.106.

Informational Note: See NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, for the application of the term *rolling sphere*.

## Part V. Wiring on the service provider side of the Communication Service Point ~~Installation Methods Within Buildings~~

### 840.133 Installation of Optical Fibers and Electrical Conductors.

The requirements of 770.133 shall apply.

## Part VI. Premises Powering of Communications Equipment over Communications Cables

### 840.160 Powering Circuits.

Communications cables listed in accordance with 805.179, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment listed in accordance with 805.170. The power source shall be listed in accordance with 840.170(G). Installation of the listed 4-pair communications cables for a communications circuit or installation where 4-pair communications cables are substituted for Class 2 and Class 3 cables in accordance with 725.154(A) shall comply with 725.144.

*Exception: Installing communications cables in compliance with 725.144 shall not be required for listed 4-pair communications cables where the rated current of the power source does not exceed 0.3 amperes in any conductor 24 AWG or larger.*

Informational Note: A typical communications cable for this application is a 4-pair cable sometimes referred to as Category 5e (or higher) LAN cable or balanced twisted pair cable. These types of cables are often used to provide Ethernet- and Power over Ethernet (PoE)–type services. A large number of such powering cables bundled together can cause overheating of the wiring if not controlled as described in Table 725.144.

## Part VII. Listing Requirements

### 840.170 Equipment and Cables.

Premises-powered broadband communications systems equipment and cables shall comply with 840.170(A) through (H).

#### (A) Network Terminal.

The network terminal and applicable grounding means shall be listed for application with premises-powered broadband communications systems.

Informational Note No. 1: One way to determine applicable requirements is to refer to ANSI/UL 60950-1-2014, *Standard for Safety of Information Technology Equipment*; ANSI/UL 498A-2015, *Current Taps and Adapters*; ANSI/UL 467-2013, *Grounding and Bonding Equipment;* or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements*.

Informational Note No. 2: There are no requirements on the network terminal and its grounding methodologies except for those covered by the listing of the product.

#### (B) Optical Fiber Cables.

Optical fiber cables shall be listed in accordance with 770.179(A) through (D) and shall be marked in accordance with Table 770.179.

#### (C) Communications Equipment.

Communications equipment shall be listed in accordance with 805.170.

#### (D) Cable Routing Assemblies and Communications Raceways.

Cable routing assemblies and communications raceways shall be listed in accordance with 800.182.

#### (E) Premises Communications Wires and Cables.

Communications wires and cable shall be listed and marked in accordance with 805.179.

#### (F) Premises Community Antenna Television (CATV) Circuits.

Premises community antenna television (CATV) coaxial cables connecting to the network terminal shall be listed in accordance with 820.179. Applicable grounding means shall be listed for application with premises-powered broadband communications systems.

#### (G) Power Source.

The power source for circuits intended to provide power over communications cables to remote equipment shall be limited in accordance with Table 11(B) in Chapter 9 for voltage sources up to 60 V dc and be listed as specified in either of the following:

1. A power source shall be listed as specified in 725.121(A)(1), (A)(2), (A)(3), or (A)(4). The power sources shall not have the output connections paralleled or otherwise interconnected unless listed for such interconnection.
2. A power source shall be listed as communications equipment for limited-power circuits.

Informational Note: One way to determine applicable requirements is to refer to ANSI/UL 60950-1-2014, *Standard for Safety of Information Technology Equipment-Safety — Part 1*; or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements*. Typically, such circuits are used to interconnect equipment for the purpose of exchanging information (data).

**(H) Accessory Equipment.**

Communications accessory equipment and/or assemblies shall be listed for application with premises-powered communications systems.

Informational Note: One way to determine applicable requirements is to refer to ANSI/UL 1863-2004, *Communications-Circuit Accessories*.

## Public Input No. 1764-NFPA 70-2020 [ New Section after 800.44 ]

**800.48 Communications Service Point.**

The Communication Service Point shall be at a readily accessible location either outside or inside of a building or structure near to the point of entrance of the conductors in accordance with the one or more of the following:

1. The point of connection at which the communication service provider's network (outside plant) transitions to the premises wiring. The location of this point shall not be located further than 50 feet from the point of entrance.

2. The point of connection in an individual dwelling shall be located so as not to exceed 48 inches from the primary protector on the premises side of the protector.

3. A physical protection point or communications cable exiting the connection enclosure on the individual building side of the enclosure.

4. The point of connection at the Grounding Block, where required.

5. The point where a wireless signal transitions from the antenna or dish through a wired connection to transmitting or receiving equipment. The location of this point shall be permitted to include the ground connection at the antenna discharge unit or coaxial cable connection to the transmitting/receiving station (see 810.21).

6. The point of connection between nonconductive optical fiber cable entering the building and premises optical fiber cable inside the building not to exceed 50 feet from the point of entrance.

7. The Communication Service Point shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC), Electrical metallic tubing (EMT), intermediate metal conduit (IMC), or Rigid polyvinyl chloride conduit (PVC) to the point of emergence (see 770.48, 805.48, 820.48 and 830.48).

Informational Note: The transition and connection points listed above may be co-located. For example, a primary protector may be located inside a network interface unit (item 3) with a connection to an adjacent grounding block (Item 4) within 24 inches, and a connection to the premise wiring (item 2).

## Statement of Problem and Substantiation for Public Input

This Public Input (PI) was created by a Task Group chartered by the chair of the NEC AAC to consider correlation issues between chapters 7 and 8. TG members included: George Zimmerman - Chair, George Bish, Trevor Bowmer, Tim Cooke, Ernest Gallo, Joel Goergen, Randy Ivans, Steve Johnson, Chad Jones, Alan Manche, (Kurt Seeliger-confirm), and Anthony Tassone. The TG was broad-based and specifically included representation of those with knowledge and experience in telecommunications and members of code panels 3 and 16. By identifying the communications service point, analogous to the electrical service point, the domain of the communications circuits in chapter 8 become more clearly inspectable. The definition of communications circuit in chapter 8 extends service from the communications utility or service provider, which this definition would do. In civilian telecommunications, outside plant refers to all of the physical cabling and supporting infrastructure (such as conduit, cabinets, tower or poles), and any associated hardware (such as repeaters) located between a demarcation point in a switching facility and a demarcation point in another switching center or customer premises. The term "outside plant communications cable" is also used in 805.48 to

distinguish cable coming from the service provider. The 50 feet references the outside plant cable entry to the premises in 770.48 and 805.48. The reference to extension of communications point references 770.48(B) and 805.48, where extension in conduit is described. The portion of this infrastructure contained within a building is the inside plant, and the portion of this infrastructure connecting buildings or facilities is the outside plant. Where these two plants meet in a given structure is the Communications service point. The distance of 50 feet permits an unlisted Outside Plant (OSP) cable to enter a building (single family home, apartment block, or commercial building) and to reach a practical transition point to the premises wiring in a cable vault, telecom closet/room, cross connect frame or cabinet, in the vicinity of the main grounding means for the building. It is desirable for this OSP segment be as short as practical. Service drop service communications cables that are Listed are permitted to extend further than 50 feet. The distance of 48 inches is derived from the recommended horizontal separation for equipment boxes on opposite sides of wall, including separation requirements from gas, communications, and power, as well as considerations of providing sufficient working space around equipment closure and for stress--relaxation and drip loops of cables. (see 800.26 IFN - "… An example is the 600 mm (24 in.) minimum horizontal separation that usually applies between boxes installed on opposite sides of the wall……)

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 1765-NFPA 70-2020 [New Definition after Definition: Communications Circuit.] | Related definition |
| Public Input No. 1765-NFPA 70-2020 [New Definition after Definition: Communications Circuit.] | |

## Submitter Information Verification

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**Committee:** NEC-P16

# Public Input No. 3931-NFPA 70-2020 [ New Section after 800.44 ]

**800.48 Unlisted Cables Entering Buildings**

**Unlisted outside plant communications cables, and unlisted outside plant CATV type coaxial cables, shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside, and the unlisted outside plant communications cable is terminated in an enclosure or on a listed primary protector, or the unlisted outside plant CATV type coaxial cable is terminated at a grounding block. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) to the point of emergence.**

**Informational Note No. 1: Splice cases or terminal boxes, both metallic and plastic types, are typically used as enclosures for splicing or terminating communications cables.**

**Informational Note No. 2: This section limits the length of unlisted communications outside plant cables and unlisted outside plant CATV type coaxial cables to 15 m (50 ft), while 805.90(B) and 820.93(A) require that the primary protector or shield grounding be located as close as practicable to the point at which the cable enters the building. Therefore, in installations requiring a primary protector or shield grounding, the outside plant cable may not be permitted to extend 15 m (50 ft) into the building if it is practicable to place the primary protector.**

## Statement of Problem and Substantiation for Public Input

CMP 16 created new Article 800, General Requirements for Communications Systems, in order to consolidate the redundant requirements in Article 800 (old Article 800), Article 820 and Article 830 into one general article.
Redundant requirements that were identical in multiple articles in Chapter 8 were brought into new Article 800. Changes such as this PI were proposed after the direction of Chapter 8 was fully established, but as it was not part of the original proposal, was left for subsequent revisions.

The text and intent of this PI is similar to PI 465 submitted by a different organization.

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**Committee:** NEC-P16

# Public Input No. 3938-NFPA 70-2020 [ New Section after 800.44 ]

**800.47 Underground Communications Wires and Cables Entering Buildings.**

Underground communications wires and cables, CATV type coaxial cables, and network-powered broadband communications cables entering buildings shall comply with 800.47(A) and (B). The requirements of 310.10(C) shall not apply to communications wires and cables, and CATV type coaxial cables.

**800.47(A) Underground Systems with Electric Light, Power, Class 1, or Non-Power-Limited Fire Alarm Circuit Conductors.**

Underground communications wires and cables, CATV type coaxial cables, and network-powered broadband communications cables in a raceway, pedestal, handhole enclosure, or manhole containing electric light, power, Class 1, or non-power-limited fire alarm circuit conductors shall be in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier.

**800.47(B) Direct-Buried Cables and Raceways**

Direct-buried communications wires and cables, direct-buried CATV type coaxial cables, and direct-buried network-powered broadband communications cables, shall be separated at least 300 mm (12 in.) from conductors of any light or power, non – power-limited fire alarm circuit conductors, or Class 1 circuit.

Exception No. 1: Separation shall not be required where electric service conductors or all the direct-buried communications wires and cables, direct-buried CATV type coaxial cables, and direct-buried network-powered broadband communications cables are installed in raceways or have metal cable armor.

Exception No. 2: Separation shall not be required where electric light or power branch-circuit or feeder conductors or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables; or all the direct-buried communications wires and cables, direct-buried CATV type coaxial cables, and direct-buried network-powered .

## Statement of Problem and Substantiation for Public Input

CMP 16 created new Article 800, General Requirements for Communications Systems, in order to consolidate the redundant requirements in Article 800 (old Article 800), Article 820 and Article 830 into one general article.
Redundant requirements that were identical in multiple articles in Chapter 8 were brought into new Article 800. Changes such as this PI were proposed after the direction of Chapter 8 was fully established, but as it was not part of the original proposal, was left for subsequent revisions.
The text and intent of this PI is similar to PI 469 submitted by a different organization.

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| **Submittal Date:** | Wed Sep 09 15:53:11 EDT 2020 |
| **Committee:** | NEC-P16 |

## Public Input No. 465-NFPA 70-2020 [ New Section after 800.44 ]

**800.48 Unlisted Cables Entering Buildings .**

Unlisted outside plant communications cables, and unlisted outside plant CATV type coaxial cables, shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside, and the unlisted outside plant communications cable is terminated in an enclosure or on a listed primary protector, or the unlisted outside plant CATV type coaxial cable is terminated at a grounding block. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) to the point of emergence.

Informational Note No. 1: Splice cases or terminal boxes, both metallic and plastic types, are typically used as enclosures for splicing or terminating communications cables.

Informational Note No. 2: This section limits the length of unlisted communications outside plant cables and unlisted outside plant CATV type coaxial cables to 15 m (50 ft), while 805.90(B) and 820.93(A) require that the primary protector or shield grounding be located as close as practicable to the point at which the cable enters the building. Therefore, in installations requiring a primary protector or shield grounding, the outside plant cable may not be permitted to extend 15 m (50 ft) into the building if it is practicable to place the primary protector or coaxial shield grounding device closer than 15 m (50 ft) to the point of entrance.

## Additional Proposed Changes

| File Name | Description | Approved |
|---|---|---|
| new_800.48.pdf | The attached file shows the recommended text for new section 800.48 along with the related text in 805.48 and 820.48. | |

## Statement of Problem and Substantiation for Public Input

CMP 16 created new Article 800, General Requirements for Communications Systems, in order to consolidate the redundant requirements in Article 800 (old Article 800), Article 820 and Article 830 into one general article. Redundant requirements that were identical in multiple articles in Chapter 8 were brought into new Article 800. The emphasis was on consolidating identical requirements, with similar but not identical requirements left for the next cycle. Simply put, new Article 800 is a work in progress.

This Public Input, and other companion Public Inputs, are intended to continue the development of general Article 800 by consolidating similar but not identical requirements. This consolidation requires an understanding of the technical purpose of the sections being consolidated in order to make editorial changes in the text that retain all the mandatory requirements, albeit with slightly different wording.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|

| | |
|---|---|
| Public Input No. 466-NFPA 70-2020 [Section No. 805.48] | Deletes 805.48 |
| Public Input No. 467-NFPA 70-2020 [Section No. 820.48] | Deletes 820.48 |
| Public Input No. 466-NFPA 70-2020 [Section No. 805.48] | |
| Public Input No. 467-NFPA 70-2020 [Section No. 820.48] | |
| Public Input No. 468-NFPA 70-2020 [Section No. 840.48] | |
| Public Input No. 645-NFPA 70-2020 [Section No. 800.113(A)] | |

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**Committee:** NEC-P16

| PI 465 | PI 466 | PI 467 |
| --- | --- | --- |
| **800.48 Unlisted Cables Entering Buildings**.<br>Unlisted outside plant communications cables, and unlisted outside plant CATV type coaxial cables, shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside, and the unlisted outside plant communications cable is terminated in an enclosure or on a listed primary protector, or the unlisted outside plant CATV type coaxial cable is terminated at a grounding block. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) to the point of emergence.<br><br>Informational Note No. 1: Splice cases or terminal boxes, both metallic and | ~~**805.48 Unlisted Cables Entering Buildings.**~~<br>~~Unlisted outside plant communications cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated in an enclosure or on a listed primary protector. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) to the point of emergence.~~<br><br>~~Informational Note No. 1: Splice cases or terminal boxes, both metallic and plastic types, are typically used as enclosures for splicing or terminating telephone cables.~~<br><br>~~Informational Note No. 2: This section limits the length of unlisted outside~~ | ~~**820.48 Unlisted Cables Entering Buildings.**~~<br>~~Unlisted outside plant coaxial cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated at a grounding block. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) to the point of emergence.~~ |

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|---|---|---|
| plastic types, are typically used as enclosures for splicing or terminating communications cables.<br><br>Informational Note No. 2: This section limits the length of unlisted communications outside plant cables and unlisted outside plant CATV type coaxial cables to 15 m (50 ft), while 805.90(B) and 820.93(A) require that the primary protector or shield grounding be located as close as practicable to the point at which the cable enters the building. Therefore, in installations requiring a primary protector or shield grounding, the outside plant cable may not be permitted to extend 15 m (50 ft) into the building if it is practicable to place the primary protector or coaxial shield grounding device closer than 15 m (50 ft) to the point of entrance. | ~~plant cable to 15 m (50 ft), while 805.90(B) requires that the primary protector be located as close as practicable to the point at which the cable enters the building. Therefore, in installations requiring a primary protector, the outside plant cable may not be permitted to extend 15 m (50 ft) into the building if it is practicable to place the primary protector closer than 15 m (50 ft) to the point of entrance.~~ | |

## Public Input No. 469-NFPA 70-2020 [ New Section after 800.44 ]

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**800.47 Underground Communications Wires and Cables Entering Buildings.** Underground communications wires and cables, CATV type coaxial cables, and network-powered broadband communications cables entering buildings shall comply with 800.47(A) and (B). The requirements of 310.10(C) shall not apply to communications wires and cables, and CATV type coaxial cables.

**800.47(A) Underground Systems with Electric Light, Power, Class 1, or Non-Power-Limited Fire Alarm Circuit Conductors.** Underground communications wires and cables, CATV type coaxial cables, and network-powered broadband communications cables in a raceway, pedestal, handhole enclosure, or manhole containing electric light, power, Class 1, or non-power-limited fire alarm circuit conductors shall be in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier.

**800.47(B) Direct-Buried Cables and Raceways** . Direct-buried communications wires and cables, direct-buried CATV type coaxial cables, and direct-buried network-powered broadband communications cables, shall be separated at least 300 mm (12 in.) from conductors of any light or power, non–power-limited fire alarm circuit conductors, or Class 1 circuit.

Exception No. 1: Separation shall not be required where electric service conductors or all the direct-buried communications wires and cables, direct-buried CATV type coaxial cables, and direct-buried network-powered broadband communications cables are installed in raceways or have metal cable armor.

Exception No. 2: Separation shall not be required where electric light or power branch-circuit or feeder conductors or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables; or all the direct-buried communications wires and cables, direct-buried CATV type coaxial cables, and direct-buried network-powered broadband communications cables, have metal cable armor or are installed in raceway.

## Additional Proposed Changes

| File Name | Description | Approved |
|---|---|---|
| new_800.47.pdf | The attached file shows the recommended text for new section 800.47 along with the related text in 805.47, 820.47 and 830.47. | |

## Statement of Problem and Substantiation for Public Input

CMP 16 created new Article 800, General Requirements for Communications Systems, in order to consolidate the redundant requirements in Article 800 (old Article 800), Article 820 and Article 830 into one general article. Redundant requirements that were identical in multiple articles in Chapter 8 were brought into new Article 800. The emphasis was on consolidating identical requirements, with similar but not identical requirements left for the next cycle. Simply put, new Article 800 is a work in progress.

This Public Input, and other companion Public Inputs, are intended to continue the development of

general Article 800 by consolidating similar but not identical requirements. This consolidation requires an understanding of the technical purpose of the sections being consolidated in order to make editorial changes in the text that retain all the mandatory requirements, albeit with slightly different wording.

This new section 800.47(A), was created by combining parts of 805.47 , all of 820.47, and selected parts of 830.47.
805.47 exempts communications wires and cables from 310.10(C), while 820.47 and 830.47 do not have a parallel exemption. The recommended text for new 800.47 exempts communications wires and cables and CATV type coaxial cables form 310.10(C) since the requirements of 310.10(C) do not recognize that the direct-buried communications and CATV cables are not listed cables.

805.47(A), 820.47(A) and 830.47(A) are nearly identical, but the intent of separating these low power circuits form power circuits is quite clear. 820.47(A) and 830.47(A) refer to installation in a duct while 805.47(A) uses the term raceway. Since raceway includes ducts, we use the term raceway in new 800.47(A). Pedestal is a type of enclosure mentioned in 820.47(A) and 830.47(A) but not in 805.47(A). Pedestals are included in new 800.47(A) because on the clear intent of separating the electric light power circuit from the low power circuits wherever they could be commingled.

805.47 does not have requirements for direct-buried cables and raceways, while 820.47 and 830.47 do have requirements for direct-buried cables and raceways. New 800.47(C) includes communications cables in addition to CATV and network-powered broadband.in order to correct this omission.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 471-NFPA 70-2020 [Section No. 820.47] | Deletes 820.47 |
| Public Input No. 472-NFPA 70-2020 [Section No. 830.47] | Deletes parts of 830.47 |
| Public Input No. 496-NFPA 70-2020 [Section No. 805.47] | Deletes most of 805.47 |
| Public Input No. 471-NFPA 70-2020 [Section No. 820.47] | |
| Public Input No. 472-NFPA 70-2020 [Section No. 830.47] | |
| Public Input No. 496-NFPA 70-2020 [Section No. 805.47] | |

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**Committee:** NEC-P16

| PI 469 | PI 496 | PI 471 | PI 472 |
|---|---|---|---|
| **800.47 Underground Communications Wires and Cables Entering Buildings.** Underground communications wires and cables, CATV type coaxial cables, and network-powered broadband communications cables entering buildings shall comply with 800.47(A) through (C). The requirements of 310.10(C) shall not apply to communications wires and cables, and CATV type coaxial cables. | **805.47 Underground Communications Wires and Cables Entering Buildings.** ~~-~~ Underground communications wires and cables entering buildings shall comply with 805.47(A) and (B). The requirements of 310.10(C) shall not apply to communications wires and cables. | **820.47 Underground Coaxial Cables Entering Buildings.** Underground coaxial cables entering buildings shall comply with 820.47(A) and 820.47(B). | **830.47 Underground Network-Powered Broadband Communications Cables Entering Buildings.** Underground network-powered broadband communications cables entering buildings shall comply with 830.47(A) through and 830.47(DB). |
| **800.47(A) Underground Systems with Electric Light, Power, Class 1, or Non-Power-Limited Fire Alarm Circuit Conductors.** Underground communications wires and cables, CATV type coaxial cables, and network-powered broadband communications cables in a raceway, pedestal, handhole enclosure, or manhole containing electric light, | **805.47(A) Underground Systems with Electric Light, Power, Class 1, or Non-Power-Limited Fire Alarm Circuit Conductors.** Underground communications wires and cables in a raceway, handhole enclosure, or manhole containing electric light, power, Class 1, or non-power-limited fire alarm circuit | **820.47(A) Underground Systems with Electric Light, Power, Class 1, or Non–Power-Limited Fire Alarm Circuit Conductors.** Underground coaxial cables in a duct, pedestal, handhole enclosure, or manhole that contains electric light, power, or Class 1 or non–power-limited fire alarm circuit conductors shall be in a section permanently separated from such | **830.47(A) Underground Systems with Electric Light and Power, Class 1, or Non–Power-Limited Fire Alarm Circuit Conductors.** Underground network-powered broadband communications cables in a duct, pedestal, handhole enclosure, or manhole that contains electric light, power conductors, non–power-limited fire alarm circuit conductors, or Class 1 |

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| power, Class 1, or non-power-limited fire alarm circuit conductors shall be in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier. | ~~conductors shall be in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier.~~ | ~~conductors by means of a suitable barrier.~~ | ~~circuits shall be in a section permanently separated from such conductors by means of a suitable barrier.~~ |
| | ~~805.47(B)~~ **Underground Block Distribution.** Where the entire street circuit is run underground and the circuit within the block is placed so as to be free from the likelihood of accidental contact with electric light or power circuits of over 300 volts to ground, the insulation requirements of 805.50(A) and 805.50(C) shall not apply, insulating supports shall not be required for the conductors, and bushings shall not be required where the conductors enter the building. | ~~**820.47(B) Direct-Buried Cables and Raceways**~~. ~~Direct-buried coaxial cable shall be separated at least 300 mm (12 in.) from conductors of any light or power, non–power-limited fire alarm circuit conductors, or Class 1 circuit.~~<br><br>~~Exception No. 1: Separation shall not be required where electric service conductors or coaxial cables are installed in raceways or have metal cable armor.~~<br><br>~~Exception No. 2: Separation shall not be required where electric light or power branch-circuit or feeder conductors or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type~~ | ~~**830.47(B) Direct-Buried Cables and Raceways.** Direct-buried network-powered broadband communications cables shall be separated by at least 300 mm (12 in.) from conductors of any light, power, non–power-limited fire alarm circuit conductors or Class 1 circuit.~~<br><br>~~Exception No. 1: Separation shall not be required where electric service conductors or network-powered broadband communications cables are installed in raceways or have metal cable armor.~~<br><br>~~Exception No. 2: Separation shall not be required where electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm~~ |

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| | | ~~USE cables; or the coaxial cables have metal cable armor or are installed in a raceway.~~ | ~~circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables; or the network-powered broadband communications cables have metal cable armor or are installed in a raceway.~~ |
| **800.47(B) Direct-Buried Cables and Raceways.** Direct-buried communications wires and cables, direct-buried CATV type coaxial cables, and direct-buried network-powered broadband communications cables, shall be separated at least 300 mm (12 in.) from conductors of any light or power, non–power-limited fire alarm circuit conductors, or Class 1 circuit.<br><br>Exception No. 1: Separation shall not be required where electric service conductors or all the direct-buried communications wires and cables, direct-buried CATV type coaxial cables, and | | | **830.47(~~C~~A) Protection from Physical Damage.** Direct-buried cable, conduit, or other raceways shall be installed to meet the minimum cover requirements of Table 830.47(C). In addition, direct-buried cables emerging from the ground shall be protected by enclosures, raceways, or other approved means extending from the minimum cover distance required by Table 830.47(C) below grade 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. Types BMU and BLU direct-buried cables emerging from the ground shall be installed |

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| direct-buried network-powered broadband communications cables, are installed in raceways or have metal cable armor.<br><br>Exception No. 2: Separation shall not be required where electric light or power branch-circuit or feeder conductors or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables; or all the direct-buried communications wires and cables, direct-buried CATV type coaxial cables, and direct-buried network-powered broadband communications cables, have metal cable armor or are installed in raceway. | | | in rigid metal conduit (RMC), intermediate metal conduit (IMC), rigid nonmetallic conduit, or other approved means extending from the minimum cover distance required by Table 830.47(C) below grade to the point of entrance.<br><br>Exception: A low-power network-powered broadband communications circuit that is equipped with a listed fault protection device, appropriate to the network-powered broadband communications cable used, and located on the network side of the network-powered broadband communications cable being protected. |
| | | | **830.47(~~D~~B) Pools.**<br>Cables located under the pool or within the area extending 1.5 m (5 ft) horizontally from the inside wall of the pool shall meet those clearances and requirements specified in 680.11. |

## Public Input No. 494-NFPA 70-2020 [ Section No. 800.44 ]

**800.44** Overhead (Aerial) Wires and Cables.

Overhead (aerial) communications wires and cables, and CATV type coaxial cables, entering buildings shall comply with 800.44(A) through (~~D~~ E ).

Informational Note: For additional information regarding overhead (aerial) wires and cables, see ANSI C2-2017, *National Electrical Safety Code, Part 2 Safety Rules for Overhead Lines.*

**(A)** On Poles and In-Span, Above Roofs, on Masts, on or Between Buildings .

Where communications wires and cables, and CATV type coaxial cables, and electric light or power conductors are supported by the same pole or are run parallel to each other in-span, the conditions described in 800.44(A)(1) through (A)(4) shall be met.

**(1)** Relative Location.

Where practicable, the communications wires and cables, and the CATV type coaxial cables, shall be located below the electric light or power conductors.

**(2)** Attachment to Cross-Arms.

~~Wires~~ Communications wires and cables, and CATV type coaxial cables, shall not be attached to a cross-arm that carries electric light or power conductors.

**(3)** Climbing Space.

The climbing space through wires and cables shall comply with the requirements of 225.14(D).

**(4)** Clearance.

Supply service drops and sets of overhead service conductors of 0 volts to 750 volts running above and parallel to communications and CATV type coaxial service drops shall have a minimum separation of 300 mm (12 in.) at any point in the span, including the point of and at their attachment to the building, provided that the ungrounded conductors are insulated and that a clearance of not less than 1.0 m (40 in.) is maintained between the two services at the pole.

**(B)** Above Roofs.

Communications wires and cables, and CATV type coaxial cables, shall have a vertical clearance of not less than 2.5 m (8 ft) from all points of roofs above which they pass.

*Exception No. 1: Communications wires and cables, and CATV type coaxial cables, shall not be required to have a vertical clearance of not less than 2.5 m (8 ft) above auxiliary buildings, such as garages and the like.*

*Exception No. 2: A reduction in clearance above only the overhanging portion of the roof to not less than 450 mm (18 in.) shall be permitted if (1) not more than 1.2 m (4 ft) of communications, and CATV type service-drop conductors pass above the roof overhang and (2) they are terminated at a through- or above-the-roof raceway or approved support.*

*Exception No. 3: Where the roof has a slope of not less than 100 mm in 300 mm (4 in. in 12 in.), a reduction in clearance to not less than 900 mm (3 ft) shall be permitted.*

Informational Note: For additional information regarding overhead (aerial) wires and cables, see ANSI/IEEE C2-2017, *National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines*.

**(C)** On Masts.

Overhead (aerial) communications wires and cables, and CATV type coaxial cables, shall be permitted to be attached to an above-the-roof raceway mast that does not enclose or support conductors of electric light or power circuits.

**(D)** Between Buildings.

Communications and CATV type coaxial cables extending between buildings or structures, and also the supports or attachment fixtures, shall be identified and shall have sufficient strength to withstand the loads to which they might be subjected.

*Exception: Where a communications cable, or a CATV type coaxial cable, does not have sufficient strength to be self-supporting, it shall be attached to a supporting messenger cable that, together with the attachment fixtures or supports, shall be acceptable for the purpose and shall have sufficient strength to withstand the loads to which they may be subjected.*

***800.44(E) On Buildings.***

*Where attached to buildings, communications wires and cables, and CATV type coaxial cables shall be securely fastened in such a manner that they will be separated from other conductors in accordance with 820.44(B)(1) and (B)(2).*

***800.44(E)(1) Electric Light or Power.***

*The communications wires and cables, and the CATV type coaxial cables shall have a separation of at least 100 mm (4 in.) from electric light, power, Class 1, or non -power-limited fire alarm circuit conductors not in raceway or cable, or shall be permanently separated from conductors of the other system by a continuous and firmly fixed nonconductor in addition to the insulation on the wires.*

***800.44(E)(2) Other Communications Systems.***

*Communications wires and cables, and CATV type coaxial cables shall be installed so that there will be no unnecessary interference in the maintenance of the separate systems. In no case shall the conductors, cables, messenger strand, or equipment of one system cause abrasion to the conductors, cable, messenger strand, or equipment of any other system.*

## Additional Proposed Changes

| File Name | Description | Approved |
|---|---|---|
| 800.44.pdf | The attached file shows the recommended text for section 800.44 along with the related text in 770.44, 820.44 and 830.48. There is no 805.44 since it was moved into 800.44 in the last code cycle. | |

## Statement of Problem and Substantiation for Public Input

CMP 16 created new Article 800, General Requirements for Communications Systems, in order to consolidate the redundant requirements in Article 800 (old Article 800), Article 820 and Article 830 into one general article. Redundant requirements that were identical in multiple articles in Chapter 8 were brought into new Article 800. The emphasis was on consolidating identical requirements, with similar but not identical requirements left for the next cycle. Simply put, new Article 800 is a work in progress.

This Public Input, and other companion Public Inputs, are intended to continue the development of general Article 800 by consolidating similar but not identical requirements. This consolidation requires an understanding of the technical purpose of the sections being consolidated in order to make editorial changes in the text that retain all the mandatory requirements, albeit with slightly different wording.

CMP 16 in the 2020 NEC consolidated 800.44 from the 2017 NEC and most of 820.44 from the 2017 NEC into section 800.44 in the new general article. The PI completes the task of consolidation the remainder of 820.44 in 800.44. All that was left to consolidate were 820.44(B)(1) “On Buildings” requirements. These requirements, which deal with separation of the Chapter 8 circuit from electric light, power and non-power-limited- fire alarm circuits, clearly should apply to all Chapter 8 low power

circuits, including communications (Article 805) circuits. This PI brings the requirements of 820.44(B)(1) into 800.44(E )(1).

This PI brings the requirements of 820.44(B)(2) into 800.44(E )(2 because the non-interference requirements of 820.44(B)(2) should clearly apply to all Chapter 8 systems.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 495-NFPA 70-2020 [Section No. 820.44] | Deletes 820.44 |
| Public Input No. 495-NFPA 70-2020 [Section No. 820.44] | |

## Submitter Information Verification

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**Submittal Date:** Wed Feb 19 17:27:55 EST 2020
**Committee:** NEC-P16

| | PI 494 | | PI 495 | |
|---|---|---|---|---|
| **770.44 Overhead (Aerial) Optical Fiber Cables.** Overhead optical fiber cables containing a non–current-carrying metallic member entering buildings shall comply with 800.44(A) and (B). | **800.44 Overhead (Aerial) Wires and Cables.** Overhead (aerial) communications wires and cables, and CATV type coaxial cables, entering buildings shall comply with 800.44(A) through (~~D~~E). | | ~~**820.44 Overhead (Aerial) Coaxial Cables.**~~ ~~Overhead (aerial) coaxial cables, prior to the point of grounding, as specified in 820.93, shall comply with 820.44(A) or 800.44.~~ | **830.44 Overhead (Aerial) Cables.** Overhead (aerial) network-powered broadband communications cables shall comply with 830.44(A) through (F). |
| **770.44(A) On Poles and In-Span.** Where outside plant optical fiber cables and electric light or power conductors are supported by the same pole or are run parallel to each other in-span, the conditions described in 770.44(A)(1) through (A)(4) shall be met. | **800.44(A) On Poles and In-Span, Above Roofs, on Masts, on or Between Buildings.** Where communications wires and cables, and CATV type coaxial cables, and electric light or power conductors are supported by the same pole or are run parallel to each other in-span, the conditions described in 800.44(A)(1) through (A)(4) shall be met. | | ~~**820.44(A) On Poles and In-Span, Above Roofs, on Masts, or Between Buildings.**~~ ~~Where coaxial cables are installed on poles and in-span, above roofs, on masts, or between buildings, they shall comply with 800.44.~~ | **830.44(A) On Poles and In-Span or Above Roofs.** Where network-powered broadband communications cables are installed on poles and in-span or above roofs, they shall comply with 800.44. |
| **770.44(A)(1) Relative Location.** Where practicable, the outside plant optical fiber cables shall be located below the electric light or power conductors. | **800.44(A)(1) Relative Location.** Where practicable, the communications wires and cables, and the CATV type coaxial cables, shall be located below the electric light or power conductors. | | | |
| **770.44(A)(2) Attachment to** | **800.44(A)(2) Attachment to** | | | |

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| **Cross-Arms.** Attachment of outside plant optical fiber cables to a cross-arm that carries electric light or power conductors shall not be permitted. | **Cross-Arms.** Communications wires~~Wires~~ and cables, and CATV type coaxial cables, shall not be attached to a cross-arm that carries electric light or power conductors. | | | |
| **770.44(A)(3) Climbing Space.** The climbing space through outside plant optical fiber cables shall comply with the requirements of 225.14(D). | **800.44(A)(3) Climbing Space.** The climbing space through wires and cables shall comply with the requirements of 225.14(D). | | | |
| **770.44(A)(4) Clearance.** Supply service drops and sets of overhead service conductors of 0 to 750 volts running above and parallel to optical fiber cable service drops shall have a minimum separation of 300 mm (12 in.) at any point in the span, including the point of their attachment to the building. Clearance of not less than 1.0 m (40 in.) shall be maintained between the two services at the pole. | **800.44(A)(4) Clearance.** Supply service drops and sets of overhead service conductors of 0 volts to 750 volts running above and parallel to communications, and CATV type coaxial, service drops shall have a minimum separation of 300 mm (12 in.) at any point in the span, including the point of and at their attachment to the building, provided that the ungrounded conductors are insulated and that a clearance of not less than 1.0 m (40 in.) is maintained between the two services at the pole. | | | |
| **770.44(B) Above Roofs.** Outside plant optical fiber cables shall have a vertical clearance of not less than 2.5 m (8 ft) from all points of roofs above which they | **800.44(B) Above Roofs.** Communications wires and cables, and CATV type coaxial cables, shall have a vertical | | ~~**820.44(B) On Buildings.** Where attached to buildings, coaxial cables shall be securely fastened in such a manner that they will be separated from other~~ | **830.44(B) Clearance from Ground.** Overhead (aerial) spans of network-powered broadband |

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| pass.<br><br>Exception No. 1: The requirement of 770.44(B) shall not apply to auxiliary buildings such as garages and the like.<br><br>Exception No. 2: A reduction in clearance above only the overhanging portion of the roof to not less than 450 mm (18 in.) shall be permitted if (a) not more than 1.2 m (4 ft) of optical fiber cable service drop cable passes above the roof overhang, and (b) the cable is terminated at a through- or above-the-roof raceway or approved support.<br><br>Exception No. 3: Where the roof has a slope of not less than 100 mm in 300 mm (4 in. in 12 in.), a reduction in clearance to not less than 900 mm (3 ft) shall be permitted.<br><br>Informational Note: For additional information regarding overhead wires and cables, see ANSI/IEEE C2-2012, *National Electric Safety Code, Part 2, Safety Rules for Overhead* | clearance of not less than 2.5 m (8 ft) from all points of roofs above which they pass.<br><br>Exception No. 1: Communications wires and cables, and CATV type coaxial cables, shall not be required to have a vertical clearance of not less than 2.5 m (8 ft) above auxiliary buildings, such as garages and the like.<br><br>Exception No. 2: A reduction in clearance above only the overhanging portion of the roof to not less than 450 mm (18 in.) shall be permitted if (1) not more than 1.2 m (4 ft) of communications, and CATV type service-drop conductors pass above the roof overhang and (2) they are terminated at a through- or above-the-roof raceway or approved support.<br><br>Exception No. 3: Where the roof has a slope of not less than 100 mm in 300 mm (4 in. in 12 in.), a reduction in clearance to not less than 900 mm (3 ft) shall be permitted. | | ~~conductors in accordance with 820.44(B) (1) and (B)(2).~~ | communications cables shall conform to not less than the following:<br><br>(1) 2.9 m (9½ ft) — above finished grade, sidewalks, or from any platform or projection from which they might be reached and accessible to pedestrians only<br><br>(2) 3.5 m (11½ ft) — over residential property and driveways, and those commercial areas not subject to truck traffic<br><br>(3) 4.7 m (15½ ft) — over public streets, alleys, roads, parking areas subject to truck traffic, driveways on other than residential property, and other land traversed by vehicles such as cultivated, grazing, forest, and orchard<br><br>Informational Note: These clearances have been specifically chosen to correlate with ANSI/IEEE C2-2012, |

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| *Lines*. | Informational Note: For additional information regarding overhead (aerial) wires and cables, see ANSI/IEEE C2-2017, *National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines*. | | | *National Electrical Safety Code*, Table 232-1, which provides for clearances of wires, conductors, and cables above ground and roadways, rather than using the clearances referenced in 225.18. Because Article 805 and Article 820 have had no required clearances, the communications industry has used the clearances from the NESC for their installed cable plant. |
| | | | **~~820.44(B)(1) Electric Light or Power~~**~~.~~<br>~~The coaxial cable shall have a separation of at least 100 mm (4 in.) from electric light, power, Class 1, or non-power-limited fire alarm circuit conductors not in raceway or cable, or shall be permanently separated from conductors of the other system by a continuous and firmly fixed nonconductor in addition to the insulation on the wires.~~ | |
| | | | **~~820.44(B)(2) Other Communications Systems~~**~~.~~<br>~~Coaxial cable shall be installed so that there will be no unnecessary interference in the maintenance of the separate systems. In no case shall the~~ | |

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| | | | ~~conductors, cables, messenger strand, or equipment of one system cause abrasion to the conductors, cable, messenger strand, or equipment of any other system.~~ | |
| | **800.44(C) On Masts.** Overhead (aerial) communications wires and cables, and CATV type coaxial cables, shall be permitted to be attached to an above-the-roof raceway mast that does not enclose or support conductors of electric light or power circuits. | | | **830.44(C) Over Pools.** Clearance of network-powered broadband communications cable in any direction from the water level, edge of pool, base of diving platform, or anchored raft shall comply with those clearances in 680.9. |
| | **800.44(D) Between Buildings.** Communications wires and cables, and CATV type coaxial cables extending between buildings or structures, and also the supports or attachment fixtures, shall be identified and shall have sufficient strength to withstand the loads to which they might be subjected.<br><br>Exception: Where a communications cable, or CATV type coaxial cable, does not have sufficient strength to be self-supporting, it shall be attached to a supporting messenger cable that, together | | | **830.44(D) Final Spans.** Final spans of network-powered broadband communications cables without an outer jacket shall be permitted to be attached to the building, but they shall be kept not less than 900 mm (3 ft) from windows that are designed to be opened, doors, porches, balconies, ladders, stairs, fire escapes, or similar locations.<br><br>Exception: Conductors run above the top level of a window shall be permitted to be less than the 900-mm (3-ft) |

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| | with the attachment fixtures or supports, shall be acceptable for the purpose and shall have sufficient strength to withstand the loads to which they may be subjected. | | | requirement above.<br><br>Overhead (aerial) network-powered broadband communications cables shall not be installed beneath openings through which materials might be moved, such as openings in farm and commercial buildings, and shall not be installed where they obstruct entrance to these building openings. |
| | **800.44(E) On Buildings.**<br>Where attached to buildings, communications wires and cables, and CATV type coaxial cables shall be securely fastened in such a manner that they will be separated from other conductors in accordance with 820.44(B)(1) and (B)(2).<br><br>**800.44(E)(1) Electric Light or Power.**<br>The communications wires and cables, and the CATV type coaxial cables shall have a separation of at least 100 mm (4 in.) from electric light, power, Class 1, or non-power-limited fire alarm circuit conductors not in raceway or cable, or shall be | | | **830.44(E) Between Buildings**. Network-powered broadband communications cables extending between buildings or structures, and also the supports or attachment fixtures, shall be identified as suitable for outdoor aerial applications and shall have sufficient strength to withstand the loads to which they may be subjected.<br><br>Exception: Where a network-powered broadband communications cable does not have sufficient strength to be self-supporting, it shall be attached to a supporting messenger cable that, together with the attachment fixtures or |

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| | permanently separated from conductors of the other system by a continuous and firmly fixed nonconductor in addition to the insulation on the wires.<br><br>**800.44(E)(2) Other Communications Systems.** Communications wires and cables, and CATV type coaxial cables shall be installed so that there will be no unnecessary interference in the maintenance of the separate systems. In no case shall the conductors, cables, messenger strand, or equipment of one system cause abrasion to the conductors, cable, messenger strand, or equipment of any other system. | | | supports, shall be acceptable for the purpose and shall have sufficient strength to withstand the loads to which they may be subjected. |
| | | | | **830.44(F) On Buildings.** Where attached to buildings, network-powered broadband communications cables shall be securely fastened in such a manner that they are separated from other conductors in accordance with 830.44(F)(1) through (F)(3). |
| | | | | **830.44(F)(1) Electric Light or Power.** The network-powered |

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| | | | | broadband communications cable shall have a separation of at least 100 mm (4 in.) from electric light, power, Class 1, or non-power-limited fire alarm circuit conductors not in raceway or cable, or be permanently separated from conductors of the other system by a continuous and firmly fixed nonconductor in addition to the insulation on the wires. |
| | | | | **830.44(F)(2) Other Communications Systems.** Network-powered broadband communications cables shall be installed so that there will be no unnecessary interference in the maintenance of the separate systems. In no case shall the conductors, cables, messenger strand, or equipment of one system cause abrasion to the conductors, cables, messenger strand, or equipment of any other system. |
| | | | | **830.44(F)(3) Protection from Damage.** Network-powered broadband communications cables attached to buildings or structures and located within 2.5 m (8 ft) of finished grade |

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| | | | | shall be protected by enclosures, raceways, or other approved means.<br><br>Exception: A low-power network-powered broadband communications circuit that is equipped with a listed fault protection device, appropriate to the network-powered broadband communications cable used, and located on the network side of the network-powered broadband communications cable shall not be required to be additionally protected by enclosures, raceways, or other approved means. |

## Public Input No. 268-NFPA 70-2020 [ Section No. 800.53 ]

**800.53** Separation from Lightning Conductors.

Where practicable on buildings , a separation of at least 1.8 m (6 ft) shall be maintained between lightning conductors and all communication wires, comminication cables, and CATV coaxial cables ~~and CATV type coaxial cables on buildings~~ .

Informational Note No. 1: For additional information regarding overhead (aerial) wires and cables, see ANSI C2-2017 *National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines*.

Informational Note No. 2: Specific separation distances may be calculated from the sideflash equation in NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems.*

## Statement of Problem and Substantiation for Public Input

The present text is somewhat unclear. Since we are addressing conductors/cables on buildings, that should be stated up front at the beginning of the sentence. Each entity that lightning conductors should be separated from should be clearly delineated, i.e., communication wires, communications cables, CATV coaxial cables. The word "type" is superfluous and may be deleted.

## Submitter Information Verification

| | |
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| **Submittal Date:** | Sat Jan 11 10:26:05 EST 2020 |
| **Committee:** | NEC-P16 |

## Public Input No. 2953-NFPA 70-2020 [ Section No. 800.53 ]

**800.53** Separation from Lightning Conductors.

Where practicable, a separation of at least 1.8 m (6 ft) shall be maintained between lightning conductors and all communication wires and cables and CATV type coaxial cables inside or on buildings.

Informational Note No. 1: For additional information regarding overhead (aerial) wires and cables, see ANSI C2-2017 *National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines*.

Informational Note No. 2: Specific separation distances may be calculated from the sideflash equation in NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems.*

## Additional Proposed Changes

| File Name | Description | Approved |
|---|---|---|
| lightning_utp.pdf | down conductor in proximity 1" from under roof down conductor elementary school in Florida | |

## Statement of Problem and Substantiation for Public Input

As it reads now the distance requirements only cover external down conductor mounted "on buildings" not inside buildings. Many installation to avoid ascetic issues run down conductors under the roof and thus creates a hazard with communication cable proximity. This is unintended by the omission of these interior lightning protection conductors covered in this section. This will clarify separation requirement intended to avoid side flash for all building locations. The attached photo shows an example of an installation that meets the letter of the article but not the spirit. The proposed change will clarify this.

## Submitter Information Verification

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**Committee:** NEC-P16



## Public Input No. 593-NFPA 70-2020 [ Section No. 800.53 ]

**800.53** Separation from Lightning Conductors.

Where practicable, a separation of at least 1.8 m (6 ft) shall be maintained between lightning protection conductors and all communication wires and cables and CATV type coaxial cables on buildings.

Informational Note No. 1: For additional information regarding overhead (aerial) wires and cables, see ANSI C2-2017 *National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines*.

Informational Note No. 2: Specific separation distances may be calculated from the sideflash equation in NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems.*

## Statement of Problem and Substantiation for Public Input

"Lightning protection conductor" is the term used in NFPA 780 (at least, according 250.106 it is).

## Submitter Information Verification

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**Committee:** NEC-P16

# Public Input No. 88-NFPA 70-2019 [ Section No. 800.53 ]

**800.53** Separation from Lightning Conductors.

Where practicable, a separation of at least 1.8 m (6 ft) shall be maintained between lightning conductors and all communication wires and cables and CATV type coaxial cables on buildings.

Informational Note No. 1: For additional information regarding overhead (aerial) wires and cables, see ANSI C2-2017 *National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines*.

Informational Note No. 2: Specific separation distances may be calculated from the sideflash equation in NFPA 780-~~2017~~ 2020 , *Standard for the Installation of Lightning Protection Systems.*

## Statement of Problem and Substantiation for Public Input

The current edition of NFPA 780 is the 2020 edition.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 74-NFPA 70-2019 [Section No. 800.182(A)] | Updates referenced standard |
| Public Input No. 75-NFPA 70-2019 [Section No. 800.182(B)] | Updates referenced standard |
| Public Input No. 76-NFPA 70-2019 [Section No. 800.182(C)] | Updates referenced standard |
| Public Input No. 77-NFPA 70-2019 [Section No. 800.179(B)] | Updates referenced standard |
| Public Input No. 78-NFPA 70-2019 [Section No. 770.179(B)] | Updates referenced standard |
| Public Input No. 79-NFPA 70-2019 [Section No. 770.179(D)] | Updates referenced standard |
| Public Input No. 80-NFPA 70-2019 [Section No. 800.179(C)] | Updates referenced standard |
| Public Input No. 74-NFPA 70-2019 [Section No. 800.182(A)] | |
| Public Input No. 75-NFPA 70-2019 [Section No. 800.182(B)] | |
| Public Input No. 76-NFPA 70-2019 [Section No. 800.182(C)] | |
| Public Input No. 77-NFPA 70-2019 [Section No. 800.179(B)] | |
| Public Input No. 78-NFPA 70-2019 [Section No. 770.179(B)] | |
| Public Input No. 79-NFPA 70-2019 [Section No. 770.179(D)] | |
| Public Input No. 80-NFPA 70-2019 [Section No. 800.179(C)] | |

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**Committee:** NEC-P16

## Public Input No. 269-NFPA 70-2020 [ Section No. 800.100(A)(3) ]

**(3)** Size.

The bonding conductor or grounding electrode conductor shall not be smaller than 14 AWG. The bonding conductor or grounding electrode conductor shall have a current-carrying capacity not less than the aggregate of the grounded ~~metallic cable~~ metal cable sheath member~~ of the communications cable,~~ (s), the metal strength member(s), and the protected conductor(s) of the communications cable, or the outer sheath of the coaxial cable, as applicable. The bonding conductor or grounding electrode conductor shall not be required to exceed 6 AWG.

## Statement of Problem and Substantiation for Public Input

Section 800.100(3) should be phrased to include all the possible current-carrying metal members of the communications cable. Some communications cables include metal strength members, in addition to the metal sheath component and signal-carrying conductors, that may become energized during a power fault or lightning event. Also, we are globally replacing the term “metallic” with the term “metal”.

## Submitter Information Verification

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|---|---|
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| **Submittal Date:** | Sat Jan 11 10:43:51 EST 2020 |
| **Committee:** | NEC-P16 |

## Public Input No. 1621-NFPA 70-2020 [ Section No. 800.100(A)(4) ]

**(4)** Length.

The bonding conductor or grounding electrode conductor shall be as short as practicable. In one- and two-family dwellings, the bonding conductor or grounding electrode conductor shall be as short as practicable, not to exceed 6.0 m (20 ft) in length.

Informational Note: Similar bonding conductor or grounding electrode conductor length limitations applied at apartment buildings and commercial buildings help to reduce voltages that may be developed between the building's power and communications systems during lightning or other events. ANSI/TIA-607-D-2019 Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises includes useful information to reduce such voltages.

*Exception: In one- and two-family dwellings where it is not practicable to achieve an overall maximum bonding conductor or grounding electrode conductor length of 6.0 m (20 ft), a separate ground rod meeting the minimum dimensional criteria of 800.100(B)(3)(2) or (B)(3)(3) shall be driven, the bonding conductor or grounding electrode conductor shall be connected to the ground rod in accordance with 800.100(C), and the ground rod shall be connected to the power grounding electrode system in accordance with 800.100(D).*

## Statement of Problem and Substantiation for Public Input

Voltage differences between the bonding terminal and the power panel can be caused by:
a) lightning events
b) ground potential rise caused by power fault currents
c) transient voltages caused by switching
d) static electricity hazards
e) other fault conditions
Limiting the informational note to only lightning events does not reflect the reality of other events that may occur and decreases the importance of bonding the bonding terminal to the power panel. ANSI/TIA-607-D contains useful information on this subject and adding this to the informational note as a reference will complement the requirements in the code.

## Submitter Information Verification

**Submitter Full Name:** Masood Shariff
**Organization:** Commscope
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**Submittal Date:** Wed Jun 24 13:48:48 EDT 2020
**Committee:** NEC-P16

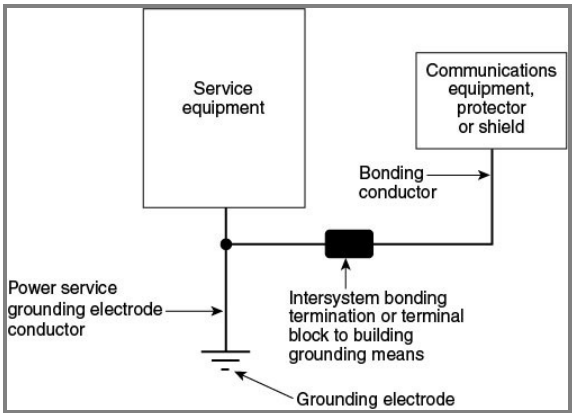
## Public Input No. 231-NFPA 70-2020 [ Section No. 800.100(B)(1) ]

**(1)** In Buildings or Structures with an Intersystem Bonding Termination.

If the building or structure served has an intersystem bonding termination as required by 250.94, the bonding conductor shall be connected to the intersystem bonding termination.

Informational Note: Informational Note Figure 800.100(B)(1) illustrates the connection of the bonding conductor in buildings or structures equipped with an intersystem bonding termination or a terminal block providing access to the building grounding means.

**~~Figure Informational~~ Informational Note Figure 800.100(B)(1) Illustration of a Bonding Conductor in a Communications Installation Equipped With An Intersystem Bonding Terminition or Terminal Block Providing Access To the Building Grounding Means .**




## Statement of Problem and Substantiation for Public Input

The initial word "Figure" in the title "Informational Note Figure 800.100(B)(1)" is redundant and unnecessary. Note that it does not appear in the 2020 NEC paper copy. The title is editorially revised to clarify the contents of the figure and differentiate between Figures 800.100(B)(1) and (B)(2). In Figure 800.100(B)(1) the box that contains the text "Communications equipment, protector or shield" should state "Communications equipment, protector or cable shield" as it is the cable shield that is to be bonded or grounded. Communications equipment, other than cables, is typically not shielded.

## Submitter Information Verification

| | |
|---|---|
| **Submitter Full Name:** | James Brunssen |
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| **Submittal Date:** | Wed Jan 01 11:43:25 EST 2020 |
| **Committee:** | NEC-P16 |

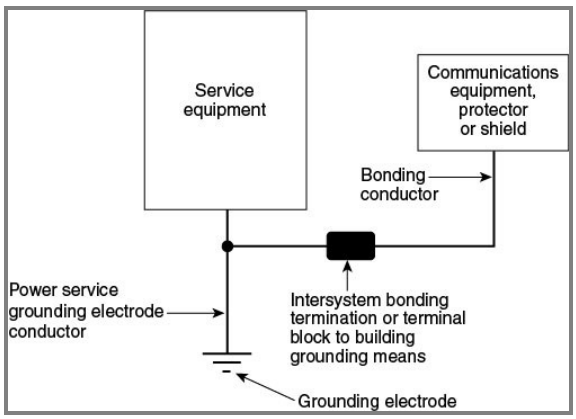
## Public Input No. 324-NFPA 70-2020 [ Section No. 800.100(B)(1) ]

**(1)** In Buildings or Structures with an Intersystem Bonding Termination.

If the building or structure served has an intersystem bonding termination as required by 250.94, the bonding conductor shall be connected to the intersystem bonding termination.

Informational Note: Informational Note Figure 800.100(B)(1) illustrates the connection of ~~the bonding conductor~~ a grounding electrode conductor and a bonding conductor in buildings or structures not equipped with an intersystem bonding termination or a terminal block providing access to the building grounding means.

**Figure Informational Note Figure 800.100(B)(1) Illustration of a ~~Bonding~~ Grounding Electrode Conductor and a Bonding Conductor in a Communications Installation.**




## Statement of Problem and Substantiation for Public Input

This public input supplements the changes in TIA 1479. There are two things missing in the informational note 800.100(B) (2) that are 1) missing a "not" and
2) missing the grounding electrode conductor. TIA 1479 fixes item 1) by adding "not" . Item 2) is not corrected in TIA 1479. This additional change to the informational note is necessary to maintain accuracy and consistency with Figure 800.100(B)(2)
The informational note with both proposed changes is shown below:
800.100(B)(2) … Informational Note:
Informational Note Figure 800.100(B)(2) illustrates the connection of a grounding electrode conductor and a bonding conductor in buildings or structures not equipped with an intersystem bonding termination or a terminal block providing access to the building grounding means.

## Submitter Information Verification

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**Committee:** NEC-P16

## Public Input No. 232-NFPA 70-2020 [ Section No. 800.100(B)(2) ]

**(2)** In Buildings or Structures with Grounding Means.

If an intersystem bonding termination is established, 250.94(A) shall apply. If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on one of the following:

(1) The building or structure grounding electrode system as covered in 250.50

(2) The grounded interior metal water piping system, within 1.5 m (5 ft) from its point of entrance to the building, as covered in 250.52

(3) The power service accessible means external to enclosures using the options identified in 250.94(A), Exception

(4) The nonflexible metal power service raceway

(5) The service equipment enclosure

(6) The grounding electrode conductor or the grounding electrode conductor metal enclosure of the power service

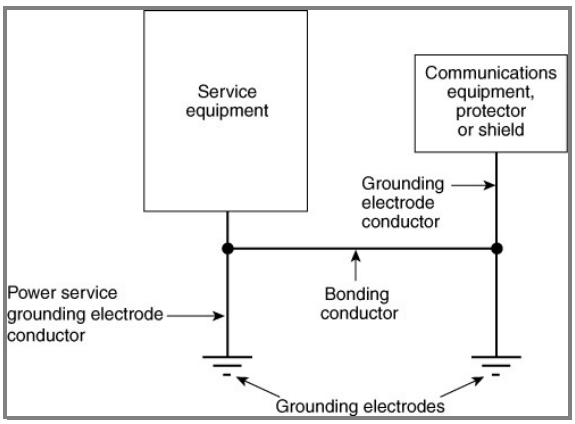
(7) The grounding electrode conductor or the grounding electrode of a building or structure disconnecting means that is connected to a grounding electrode as covered in 250.32

A bonding device intended to provide a termination point for the bonding conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on nonremovable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is nonremovable.

For purposes of this section, the mobile home service equipment or the mobile home disconnecting means located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means connected to an electrode by a grounding electrode conductor in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Informational Note Figure 800.100(B)(2) illustrates the connection of the bonding conductor in buildings or structures not equipped with an intersystem bonding termination or a terminal block providing access to the building grounding means.

**~~Figure Informational~~ Informational Note Figure 800.100(B)(2) Illustration of a Bonding Conductor in a Communications Installation Not Equipped With An Intersystem Bonding Termination or Terminal Block Providing Access To the Building Grounding Means .**




## Statement of Problem and Substantiation for Public Input

The Informational Note is revised to correctly state that Figure 800.100(B)(2) illustrates the condition

where there is no intersystem bonding termination or terminal block providing access to the building grounding means. The initial word "Figure" in the title "Informational Note Figure 800.100(B)(2)" is redundant and unnecessary. Note that it does not appear in the 2020 NEC paper copy. The title is editorially revised to clarify the contents of the figure and differentiate between Figures 800.100(B)(1) and (B)(2). In Figure 800.100(B)(2) the box that contains the text "Communications equipment, protector or shield" should state "Communications equipment, protector or cable shield" as it is the cable shield that is to be bonded or grounded. Communications equipment, other than cables, is typically not shielded.

## Submitter Information Verification

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**Submittal Date:** Wed Jan 01 11:58:30 EST 2020
**Committee:** NEC-P16

## Public Input No. 3156-NFPA 70-2020 [ Section No. 800.100(B)(2) ]

**(2)** In Buildings or Structures with Grounding Means.

If an intersystem bonding termination is established, 250.94(A) shall apply. If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on one of the following:

(1) The building or structure grounding electrode system as covered in 250.50

(2) The ~~grounded interior metal water piping system, within 1.5 m (5 ft) from its point of entrance to the building, as covered in 250.52~~

~~The~~

(3) power service accessible means external to enclosures using the options identified in 250.94(A) , Exception

(4) The nonflexible metal power service raceway

(5) The service equipment enclosure

(6) The grounding electrode conductor or the grounding electrode conductor metal enclosure of the power service

(7) The grounding electrode conductor or the grounding electrode of a building or structure disconnecting means that is connected to a grounding electrode as covered in 250.32

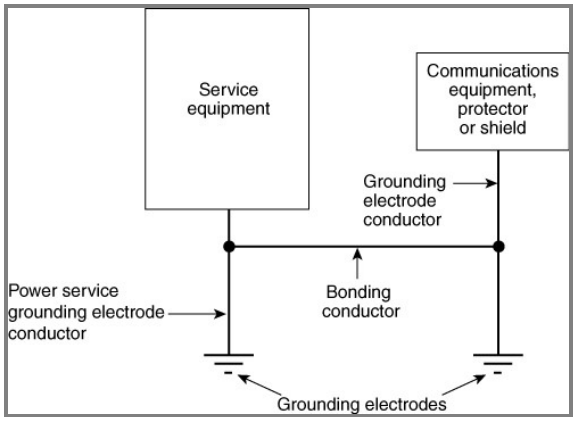
(8) The grounded interior metal water piping systems, within 1.52 m (5 ft) from its point of entrance to the building, as covered in 250.52 providing the continuity of the water pipe to earth (ground) has been verified.

A bonding device intended to provide a termination point for the bonding conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on nonremovable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is nonremovable.

For purposes of this section, the mobile home service equipment or the mobile home disconnecting means located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means connected to an electrode by a grounding electrode conductor in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Informational Note Figure 800.100(B)(2) illustrates the connection of the bonding conductor in buildings or structures not equipped with an intersystem bonding termination or a terminal block providing access to the building grounding means.

**Figure Informational Note Figure 800.100(B)(2) Illustration of a Grounding Electrode Conductor and a Bonding Conductor in a Communications Installation.**




## Statement of Problem and Substantiation for Public Input

The use of the water pipe as a grounding means should be de-emphasized by moving it to the end of the list (making it item 7 and moving items 3 through 7 up one).and adding a qualification to ensure continuity exists.
The use of plastic (non-conductive) pipe for water has become more widespread and therefore water pipe may not be a reliable connection means to ground (earth). The continuity of the metal water pipe needs to be traced and verified that an effective ground connection to earth exists.

The Terraview preview version in legislative text does not quite match the edited version - the intent is for item (2) to be moved to bottom of list (making in item 7) and add a phrase to that item to include a test to verify continuity.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 3155-NFPA 70-2020 [Section No. 770.100(B)(2)] | corresponding change for different rule |
| Public Input No. 3157-NFPA 70-2020 [Section No. 810.21(F)(2)] | corresponding change for different rule |
| Public Input No. 3155-NFPA 70-2020 [Section No. 770.100(B)(2)] | |
| Public Input No. 3157-NFPA 70-2020 [Section No. 810.21(F)(2)] | |

## Submitter Information Verification

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**Submittal Date:** Sat Sep 05 19:42:16 EDT 2020
**Committee:** NEC-P16

## Public Input No. 4656-NFPA 70-2020 [ Section No. 800.100(B)(2) ]

**(2)** In Buildings or Structures with Grounding Means.

If an intersystem bonding termination is established, 250.94(A) shall apply. If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on one of the following:

(1) The building or structure grounding electrode system as covered in 250.50

(2) The grounded interior metal water piping system, within 1.5 m (5 ft) from its point of entrance to the building, as covered in 250.52

(3) The power service accessible means external to enclosures using the options identified in 250.94(A), Exception

(4) The nonflexible metal power service raceway

(5) The service equipment enclosure

(6) The grounding electrode conductor or the grounding electrode conductor metal enclosure of the power service

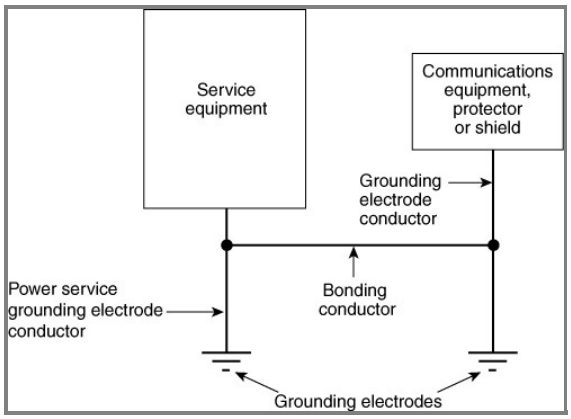
(7) The grounding electrode conductor or the grounding electrode of a building or structure disconnecting means that is connected to a grounding electrode as covered in 250.32

A bonding device intended to provide a termination point for the bonding conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on nonremovable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is nonremovable.

For purposes of this section, the mobile home service equipment or the mobile home disconnecting means located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means connected to an electrode by a grounding electrode conductor in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Informational Note Figure 800.100(B)(2) illustrates the connection of the bonding conductor in buildings or structures not equipped with an intersystem bonding termination or a terminal block providing access to the building grounding means.

**Figure Informational Note Figure 800.100(B)(2) Illustration of a Grounding Electrode Conductor and a Bonding Conductor in a Communications Installation.**



## Additional Proposed Changes

| File Name | Description | Approved |
|---|---|---|
| CMP_16_TIA_1479_issued_TIA_70_20_9.pdf | NEC TIA 20-9 Log No. 1479 | |

## Statement of Problem and Substantiation for Public Input

"NOTE: This public input originates from Tentative Interim Amendment No. 20-9 (Log 1479) issued by the Standards Council on April 1, 2020 and per the NFPA Regs., needs to be reconsidered by the Technical Committee for the next edition of the Document.

Substantiation: The figure 800.100(B)(2) shows a Grounding Electrode Conductor along with a Bonding Conductor for a Communications System Installation. During the revision process the Informational note was duplicated with Figure 800.100(B)(1) which does show a Bonding Conductor only Installation. This change explains that Figure 800.100(B)(2) is showing a Grounding Electrode Conductor along with a Bonding Conductor in a Communications Installation. The Informational Note associated with 800.100(B)(2) is reworded to reflect that there is not intersystem bonding terminal.

Emergency Nature: The standard contains an error or an omission that was overlooked during the regular revision process.

## Submitter Information Verification

**Submitter Full Name:** CMP ON NEC-P16
**Organization:** NEC Code Making Panel 16
**Street Address:**
**City:**
**State:**
**Zip:**
**Submittal Date:** Thu Sep 10 16:21:49 EDT 2020
**Committee:** NEC-P16

Tentative Interim Amendment

# NFPA® 70®

## *National Electrical Code®*

## 2020 Edition

**Reference:** 800.100(B)(2) Informational Note and Informational Note Figure caption
**TIA 20-9**
*(SC 20-4-13 / TIA Log #1479)*

Pursuant to Section 5 of the NFPA *Regulations Governing the Development of NFPA Standards*, the National Fire Protection Association has issued the following Tentative Interim Amendment to NFPA 70, *National Electrical Code*, 2020 edition. The TIA was processed by the National Electrical Code Panel 16 and the NEC Correlating Committee, and was issued by the Standards Council on April 1, 2020, with an effective date of April 21, 2020.

*1. Revise 800.100(B)(2) Informational Note and its associated Figure's caption to read as follows:*

**800.100(B)(2) …**
Informational Note: Informational Note Figure 800.100(B)(2) illustrates the connection of the bonding conductor in buildings or structures not equipped with an intersystem bonding termination or a terminal block providing access to the building grounding means.

**Informational Note Figure 800.100(B)(2) Illustration of a Grounding Electrode Conductor and a Bonding Conductor in a Communications Installation.**

**Issue Date:** April 1, 2020

**Effective Date:** April 21, 2020

**(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. 270-NFPA 70-2020 [ Section No. 800.100(B)(3) ]

**(3)** In Buildings or Structures Without an Intersystem Bonding Termination or Grounding Means.

If the building or structure served has no intersystem bonding termination or grounding means, as described in 800.100(B)(2), the grounding electrode conductor shall be connected to one of the following:

(1) To any one of the individual grounding electrodes described in 250.52(A)(1), (A)(2), (A)(3), or (A)(4)

(2) If the building or structure served has no intersystem bonding termination or grounding means, as described in 800.100(B)(2) or (B)(3)(1), to any one of the individual grounding electrodes described in 250.52(A)(5), (A)(7), and (A)(8)

(3) For communications circuits covered in Article 805 or network-powered broadband communications systems covered in Article 830, to a ground rod or pipe not less than 1.5 m (5 ft) in length and 12.7 mm (0.5 in.) in diameter, driven, where practicable, into permanently damp earth and separated from lightning protection system conductors, as covered in 800.53, and at least 1.8 m (6 ft) from electrodes of other systems

Steam pipes, hot water pipes, or lightning protection system conductors shall not be employed as grounding electrodes or as a bonding or grounding electrode conductor for protectors and grounded metallic members.

## Statement of Problem and Substantiation for Public Input

The text must include a prohibition of the use of steam and hot water pipes not only as grounding electrodes, but as a conductive means to access the grounding electrode. Use as a conductive means to access the grounding electrode could defeat the grounding electrode connection should the pipe be repaired or replaced with non-conductive material.

## Submitter Information Verification

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**Submittal Date:** Sat Jan 11 10:59:20 EST 2020
**Committee:** NEC-P16

## Public Input No. 3023-NFPA 70-2020 [ Section No. 800.106(A)(1) ]

**(1)** Mobile Home Service Equipment.

Where there is no mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, grounding shall comply with one of the following:

(1)

The following components (if present) shall be connected to a grounding electrode in accordance with 800.100(B)(3) -

(a) primary protector grounding terminal

~~; the~~

(b) network interface unit

(c) coaxial cable shield ground

~~, or~~

(d) surge arrester grounding terminal

~~; or the~~

(e) network-powered broadband communications cable shield

~~,~~

(f) network-powered broadband communications cable metallic members not used for communications or powering

~~, and network interface unit shall be connected to a grounding electrode conductor or grounding electrode in accordance with 800.100(B)(3) .~~

(2) The non-current-carrying metallic members of optical fiber cables shall be connected to a grounding electrode in accordance with 770.106(A)(1). The network terminal, if required to be grounded, shall be connected to a grounding electrode in accordance with 800.106(A)(1)(1). The grounding electrode shall be bonded in accordance with 770.106(B).

## Statement of Problem and Substantiation for Public Input

This change is an editorial improvement since the rule is very wordy and confusing with its complex sentence construction, long list, semi-colons and commas. This editorial correction for clarity revises the list to place the key requirement at the begining of the sentence/rule and to eliminate the use of semi-colon, and create a list format for ease of use. .

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 3126-NFPA 70-2020 [Section No. 800.106(A)(2)] | corresponding format change for different rule |
| Public Input No. 3126-NFPA 70-2020 [Section No. 800.106(A)(2)] | |

## Submitter Information Verification

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**Submittal Date:** Fri Sep 04 09:09:13 EDT 2020
**Committee:** NEC-P16

# Public Input No. 3126-NFPA 70-2020 [ Section No. 800.106(A)(2) ]

**(2)** Mobile Home Feeder Disconnecting Means.

Where there is no mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, grounding shall comply with one of the following:

(1)

The following components (if present) shall be connected to a grounding electrode in accordance with 800.100(B)(3) -

(a) primary protector grounding terminal

~~; the network~~

(b) network interface unit

(c) network -powered broadband communications cable shield

~~,~~

(d) network-powered broadband communications cable metallic members not used for communications or powering

~~, and network interface unit shall be connected to a grounding electrode in accordance with 800~~

.

~~100(B)(3).~~

(2) The non-current-carrying metallic members of optical fiber cables shall be connected to a grounding electrode in accordance with 770.106(A)(2). The network terminal, if required to be grounded, shall be connected to a grounding electrode in accordance with 800.106(A)(2). The grounding electrode shall be bonded in accordance with 770.106(B).

## Statement of Problem and Substantiation for Public Input

This proposed editorial change revises the rule to eliminate the complex sentence structure and multiple items separated by commas. .
The revised list moves the key requirement phrase to the front of the section and creates a list for clarity.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 3023-NFPA 70-2020 [Section No. 800.106(A)(1)] | corresponding format change for different rule |
| Public Input No. 3023-NFPA 70-2020 [Section No. 800.106(A)(1)] | |

## Submitter Information Verification

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| **Submittal Date:** | Sat Sep 05 08:03:57 EDT 2020 |
| **Committee:** | NEC-P16 |

## Public Input No. 4117-NFPA 70-2020 [ Section No. 800.110(A)(1) ]

**(1)** Raceways Recognized in Chapter 3.

Wires and 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~~ with Chapter 3.

## Statement of Problem and Substantiation for Public Input

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

## Submitter Information Verification

**Submitter Full Name:** David Williams
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**Zip:**
**Submittal Date:** Wed Sep 09 21:10:59 EDT 2020
**Committee:** NEC-P16

## Public Input No. 969-NFPA 70-2020 [ Section No. 800.110(A)(1) ]

**(1)** Raceways Recognized in Chapter 3.

Wires and 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. Raceways containing conductors and cables for communications systems shall meet the raceways fill requirements in Table 1, Chapter 9 and applicable notes.

Informational Note: Notes (5) and (9) to Table 1 are examples of required raceway fill applications for communications systems cables or conductors.

## Statement of Problem and Substantiation for Public Input

The added sentence and informational note provide clear requirements that address raceway fill for communications cables and conductors installed in conduit, tubing, and other raceways. Item 1 in this section does not appear to address fill requirements for communications cables and conductors nor does Chapter 3.

## Submitter Information Verification

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**Submittal Date:** Wed May 06 10:08:58 EDT 2020
**Committee:** NEC-P16

## Public Input No. 614-NFPA 70-2020 [ New Section after 800.113 ]

**800.133 Installation of Communications Wires and Cables, and CATV Type Coaxial Cables.** Installation of communications wires and cables, from the protector to the equipment or, where no protector is required, communications wires and cables attached to the outside or inside of the building shall comply with 800.133(A) and 800.133(B) . Installation of CATV type coaxial cables, beyond the point of grounding, as defined in 820.93, shall comply with 800.133(A) and (B).

**800.133(A) Separation from Other Conductors.**

**800.133(A)(1) In Raceways, Cable Trays, Boxes, Cables, Enclosures, and Cable Routing Assemblies.**

(a) *Other Circuits.* Communications cables, and CATV type coaxial cables, shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly together and with jacketed cables 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) Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770

(4) Communications circuits in compliance with Parts I and IV of Articles 800 and 805

(5) Community antenna television and radio distribution systems in compliance with Parts I and V of Articles 800 and 820

(5) Low-power network-powered broadband communications circuits in compliance with Parts I and V of Articles 800 and 830

(b) *Class 2 and Class 3 Circuits.* Class 1 circuits shall not be run in the same cable with communications circuits. Class 2 and Class 3 circuit conductors shall be permitted in the same listed communications cable with communications circuits.

(c) *Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm, and Medium-Power Network-Powered Broadband Communications Circuits in Raceways, Compartments, and Boxes.* Communications wires and cables, and CATV type coaxial cables, shall not be placed in any raceway, compartment, outlet box, junction box, or similar fitting with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits.

Exception No. 1: Communications wires and cables, and CATV type coaxial cables, shall be permitted to be placed in any raceway, compartment, outlet box, junction box, or other enclosures with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits where 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 communications wires and cables, and CATV type coaxial cables by a permanent barrier or listed divider.

Exception No. 2: Communications wires and cables, and CATV type coaxial cables, shall be permitted to be placed in outlet boxes, junction boxes, or similar fittings or compartments with power conductors where such conductors are introduced solely for power supply to the communications and coaxial cable system distribution equipment. The power circuit conductors shall be routed within the enclosure to maintain a

**minimum 6 mm (1⁄4 in.) separation from the communications wires and cables, and the CATV type coaxial cables.**

**Exception No. 3: As permitted by 620.36.**

**800.133(A)(2) Other Applications.**

**Communications wires and cables, and CATV type coaxial cables, shall be separated 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.**

**Exception No. 1: Separation shall not be required where either (1) all of the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits are in a raceway, or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC or Type UF cables, or (2) all of the communications wires and cables, and all of the CATV type coaxial cables, are encased in raceway.**

**Exception No. 2: Separation shall not be required where the communications wires and cables, and CATV type coaxial cables, are permanently separated from the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.**

**800.133(B) Support of Communications Wires and Cables and CATV Type Coaxial Cables.**

**Raceways shall be used for their intended purpose. Communications wires and cables, and CATV type coaxial cables, shall not be strapped, taped, or attached by any means to the exterior of any raceway as a means of support.**

**Exception: Overhead (aerial) spans of communications drop wires, communications cables and CATV type coaxial shall be permitted to be attached to the exterior of a raceway-type mast intended for the attachment and support of such wires and cables.**

## Additional Proposed Changes

| File Name | Description | Approved |
|---|---|---|
| 8XX.133.pdf | The attached file shows the recommended text for new section 800.133 along with the related text in 805.133 and 820.133. | |

## Statement of Problem and Substantiation for Public Input

CMP 16 created new Article 800, General Requirements for Communications Systems, in order to consolidate the redundant requirements in Article 800 (old Article 800), Article 820 and Article 830 into one general article. Redundant requirements that were identical in multiple articles in Chapter 8 were brought into new Article 800. The emphasis was on consolidating identical requirements, with similar but not identical requirements left for the next cycle. Simply put, new Article 800 is a work in progress.

This Public Input, and other companion Public Inputs, are intended to continue the development of general Article 800 by consolidating similar but not identical requirements. This consolidation requires an understanding of the technical purpose of the sections being consolidated in order to make editorial changes in the text that retain all the mandatory requirements, albeit with slightly different wording.

This consolidates 805.133 and 820.133 into new 800.133. Companion PIs delete 805.133 and 820.133.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 615-NFPA 70-2020 [Section No. 805.133] | Deletes 805.133 |
| Public Input No. 616-NFPA 70-2020 [Section No. 820.133] | Deletes 820133 |
| Public Input No. 615-NFPA 70-2020 [Section No. 805.133] | |
| Public Input No. 616-NFPA 70-2020 [Section No. 820.133] | |

## Submitter Information Verification

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**Committee:** NEC-P16

| PI 614 | PI 615 | PI 616 |
|---|---|---|
| **800.133(A) Separation from Other Conductors.** | **~~805.133(A) Separation from Other Conductors.~~** | **~~820.133(A) Separation from Other Conductors.~~** |
| **800.133(A)(1) In Raceways, Cable Trays, Boxes, Cables, Enclosures, and Cable Routing Assemblies.**<br><br>(a) *Other Circuits.* Communications cables, and CATV type coaxial cables, shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly together and with jacketed cables of any of the following:<br><br>(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<br><br>(2) Power-limited fire alarm systems in compliance with Parts I and III of Article 760<br><br>(3) Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770<br><br>(4) Communications circuits in | **~~805.133(A)(1) In Raceways, Cable Trays, Boxes, Cables, Enclosures, and Cable Routing Assemblies.~~**<br><br>~~(a) *Other Circuits.* Communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with cables of any of the following:~~<br><br>~~(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~~<br><br>~~(2) Power-limited fire alarm systems in compliance with Parts I and III of Article 760~~<br><br>~~(3) Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770~~<br><br>~~(4) Community antenna television and radio distribution systems in~~ | **~~820.133(A)(1) In Raceways, Cable Trays, Boxes, Enclosures, and Cable Routing Assemblies.~~**<br><br>~~(a) *Other Circuits.* Coaxial cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with jacketed cables of any of the following:~~<br><br>~~(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~~<br><br>~~(2) Power-limited fire alarm systems in compliance with Parts I and III of Article 760~~<br><br>~~(3) Nonconductive and conductive optical fiber~~ |

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|---|---|---|
| compliance with Parts I and IV of Articles 800 and 805<br><br>(5) Community antenna television and radio distribution systems in compliance with Parts I and V of Articles 800 and 820<br><br>(5) Low-power network-powered broadband communications circuits in compliance with Parts I and V of Articles 800 and 830<br><br>(b) *Class 2 and Class 3 Circuits.* Class 1 circuits shall not be run in the same cable with communications circuits. Class 2 and Class 3 circuit conductors shall be permitted in the same listed communications cable with communications circuits.<br><br>(c) *Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm, and Medium-Power Network-Powered Broadband Communications Circuits in Raceways, Compartments, and Boxes.* Communications wires and cables, and CATV type coaxial cables, shall not be placed in any raceway, compartment, outlet box, junction box, or similar fitting with conductors of electric light, power, Class 1, non–power-limited fire alarm, | ~~compliance with Parts I and V of Article 820~~<br><br>~~(5) Low-power network-powered broadband communications circuits in compliance with Parts I and V of Article 830~~<br><br>~~(b) *Class 2 and Class 3 Circuits.* Class 1 circuits shall not be run in the same cable with communications circuits. Class 2 and Class 3 circuit conductors shall be permitted in the same listed communications cable with communications circuits.~~<br><br>~~(c) *Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm, and Medium-Power Network-Powered Broadband Communications Circuits in Raceways, Compartments, and Boxes.* Communications conductors shall not be placed in any raceway, compartment, outlet box, junction box, or similar fitting with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits.~~<br><br>~~Exception No. 1: Section 805.133(A)(1)(c) shall not apply if all of the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power~~ | ~~cables in compliance with Parts I and V of Article 770~~<br><br>~~(4) Communications circuits in compliance with Parts I and IV of Article 805~~<br><br>~~(5) Low-power network-powered broadband communications circuits in compliance with Parts I and V of Article 830~~<br><br>~~(b) *Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm, and Medium-Power Network-Powered Broadband Communications Circuits.* Coaxial cable shall not be placed in any raceway, compartment, outlet box, junction box, or other enclosures with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits.~~<br><br>~~Exception No. 1: Coaxial cable shall be permitted to be placed in any~~ |

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| or medium-power network-powered broadband communications circuits.<br><br>Exception No. 1: Communications wires and cables, and CATV type coaxial cables, shall be permitted to be placed in any raceway, compartment, outlet box, junction box, or other enclosures with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits where 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 communications wires and cables, and CATV type coaxial cables by a permanent barrier or listed divider.<br><br>Exception No. 2: Communications wires and cables, and CATV type coaxial cables, shall be permitted to be placed in outlet boxes, junction boxes, or similar fittings or compartments with power conductors where such conductors are introduced solely for power supply to the communications and coaxial cable system distribution equipment. | ~~network-powered broadband communications circuits are separated from all of the conductors of communications circuits by a permanent barrier or listed divider.~~<br><br>~~Exception No. 2: Power conductors in outlet boxes, junction boxes, or similar fittings or compartments where such conductors are introduced solely for power supply to communications equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum of 6 mm (1⁄4 in.) separation from the communications circuit conductors.~~<br><br>~~Exception No. 3: As permitted by 620.36.~~ | ~~raceway, compartment, outlet box, junction box, or other enclosures with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits where 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 coaxial cables by a permanent barrier or listed divider.~~<br><br>~~Exception No. 2: Coaxial cable shall be permitted to be placed in outlet boxes, junction boxes, or similar fittings or compartments with power conductors where such conductors are introduced solely for power supply to the coaxial cable system distribution equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum 6 mm (1⁄4 in.) separation from coaxial cables.~~ |

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| The power circuit conductors shall be routed within the enclosure to maintain a minimum 6 mm (1⁄4 in.) separation from the communications wires and cables, and the CATV type coaxial cables.<br><br>Exception No. 3: As permitted by 620.36. | | |
| **800.133(A)(2) Other Applications.** Communications wires and cables, and CATV type coaxial cables, shall be separated 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.<br><br>Exception No. 1: Separation shall not be required where either (1) all of the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits are in a raceway, or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC or Type UF cables, or (2) all of the communications wires and cables, | ~~**805.133(A)(2) Other Applications.**~~ ~~Communications wires and cables shall be separated 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.~~<br><br>~~Exception No. 1: Section 805.133(A)(2) shall not apply where either (1) all of the conductors of the electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits are in a raceway or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC, or Type UF cables, or (2) all of the conductors of communications circuits are encased in raceway.~~<br><br>~~Exception No. 2: Section 805.133(A)(2) shall not apply where the communications~~ | ~~**820.133(A)(2) Other Applications.**~~ ~~Coaxial cable shall be separated 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.~~<br><br>~~Exception No. 1: Separation shall not be required where either (1) all of the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits are in a raceway, or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC or Type UF cables, or (2) all of the coaxial cables are encased in a raceway.~~<br><br>~~Exception No. 2: Separation shall not be required where the coaxial cables~~ |

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| and all of the CATV type coaxial cables, are encased in raceway.<br><br>Exception No. 2: Separation shall not be required where the communications wires and cables, and CATV type coaxial cables, are permanently separated from the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits by a continuous and firmly fixed<br><br>nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire. | ~~wires and cables are permanently separated from the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.~~ | ~~are permanently separated from the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.~~ |
| **800.133(B) Support of Communications Wires and Cables and CATV Type Coaxial Cables.** Raceways shall be used for their intended purpose. Communications wires and cables, and CATV type coaxial cables, shall not be strapped, taped, or attached by any means to the exterior of any raceway as a means of support.<br><br>Exception: Overhead (aerial) spans of communications drop wires, communications cables and CATV type coaxial shall be permitted to be attached to the exterior of a raceway- | **~~805.133(B) Support of Communications Wires and Cables.~~** ~~Raceways shall be used for their intended purpose. Communications wires and cables shall not be strapped, taped, or attached by any means to the exterior of any raceway as a means of support.~~<br><br>~~Exception: Overhead (aerial) spans of communications wires and cables shall be permitted to be attached to the exterior of a raceway-type mast intended for the attachment and support of such wires and cables.~~ | **~~820.133(B) Support of Coaxial Cables.~~** ~~Raceways shall be used for their intended purpose. Coaxial cables shall not be strapped, taped, or attached by any means to the exterior of any conduit or raceway as a means of support.~~<br><br>~~Exception: Overhead (aerial) spans of coaxial cables shall be permitted to be attached to the exterior of a raceway-type mast intended for the attachment and support of such cables.~~ |

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| type mast intended for the attachment and support of such wires and cables. | | |

# Public Input No. 2715-NFPA 70-2020 [ Section No. 800.113 ]

**REVISE 800.** ~~113 Installation of Wires, Cables, Cable Routing Assemblies, and Communications Raceways.~~

~~Installation of wires, cables, cable routing assemblies, and communications raceways shall comply with 800.113(A) through (L). Installation of cable routing assemblies and communications raceways shall comply also with 800.110 .~~

~~**(A)** Listing.~~

~~Wires, cables, cable routing assemblies, and communications raceways installed in buildings shall be listed.~~

~~*Exception: Cables installed in compliance with 805.48 or 820.48 shall not be required to be listed.*~~

~~**(B)** Ducts Specifically Fabricated for Environmental Air.~~

~~The following wires and 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) ~~Plenum cables up to 1.22 m (4 ft) in length~~

(2) ~~Plenum cables, riser cables, general-purpose cables, and limited-use 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 NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems* .~~

**(C)** Other Spaces Used for Environmental Air (Plenums).

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted in other spaces used for environmental air as described in 300.22(C) :

(1) Plenum cables

(2) Plenum communications raceways

(3) Plenum cable routing assemblies

(4) Plenum cables installed in plenum communications raceways

(5) Plenum cables installed in plenum cable routing assemblies

(6) Plenum cables and plenum communications raceways supported by open metal cable tray systems

(7) Plenum cables, riser cables, general-purpose cables, limited-use cables, and communications wires installed in raceways that are installed in compliance with 300.22(C)

(8) Plenum cables, riser cables, general-purpose cables, limited-use cables, 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)

(9) Plenum cables, riser cables, general-purpose cables, and limited-use 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, see NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems* .

**(D)** Risers — Cables, Cable Routing Assemblies, and Communications Raceways in Vertical Runs.

The following cables, cable routing assemblies, and communications raceways shall be permitted in vertical runs penetrating one or more floors and in vertical runs in a shaft:

(1) Plenum and riser cables

(2) Plenum and riser communications raceways

(3) Plenum and riser cable routing assemblies

(4) Plenum and riser cables installed in:

(5) Plenum communications raceways

(6) Riser communications raceways

(7) Plenum cable routing assemblies

(8) Riser cable routing assemblies

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**(E)** Risers — Cables and Innerducts in Metal Raceways.

The following cables and innerducts shall be permitted in metal raceways in a riser having firestops at each floor:

(1) Plenum cables, riser cables, general-purpose cables, and limited-use cables

(2) Plenum, riser, and general-purpose communications raceways

(3) Plenum cables, riser cables, general-purpose cables, and limited-use cables installed in:

(4) Plenum communications raceways (innerduct)

(5) Riser communications raceways (innerduct)

(6) General-purpose communications raceways (innerduct)

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**(F)** Risers — Cables, Cable Routing Assemblies, and Communications Raceways in Fireproof Shafts.

The following cables, cable routing assemblies, and communications raceways shall be permitted to be installed in fireproof riser shafts having firestops at each floor:

(1) Plenum cables, riser cables, general-purpose cables, and limited-use cables

(2) Plenum, riser, and general-purpose communications raceways

(3) Plenum, riser, and general-purpose cable routing assemblies

(4) Plenum cables, riser cables, general-purpose cables, and limited-use cables installed in:

(5) Plenum communications raceways

(6) Riser communications raceways

(7) General-purpose communications raceways

(8) Plenum cable routing assemblies

(9) Riser cable routing assemblies

(10) General-purpose cable routing assemblies

Informational Note: See 800.26 for firestop requirements for floor penetrations.

~~**(G)** Risers — One- and Two-Family Dwellings.~~

~~The following cables, cable routing assemblies, and communications raceways shall be permitted in one- and two-family dwellings:~~

(1) ~~Plenum cables, riser cables, and general-purpose cables~~

(2) ~~Limited-use cables less than 6 mm (0.25 in.) in diameter~~

(3) ~~Plenum, riser, and general-purpose communications raceways~~

(4) ~~Plenum, riser, and general-purpose cable routing assemblies~~

(5) ~~Plenum cables, riser cables, and general-purpose cables installed in:~~

(6) ~~Plenum communications raceways~~

(7) ~~Riser communications raceways~~

(8) ~~General-purpose communications raceways~~

(9) ~~Plenum cable routing assemblies~~

(10) ~~Riser cable routing assemblies~~

(11) ~~General-purpose cable routing assemblies~~

~~**(H)** Cable Trays.~~

~~The following wires, cables, and communications raceways shall be permitted to be supported by cable trays:~~

(1) ~~Plenum cables, riser cables, and general-purpose cables~~

(2) ~~Plenum, riser, and general-purpose communications raceways~~

(3) ~~Communications wires, plenum cables, riser cables, and general-purpose cables installed in:~~

(4) ~~Plenum communications raceways~~

(5) ~~Riser communications raceways~~

(6) ~~General-purpose communications raceways~~

~~(l)~~ ~~Distributing Frames and Cross-Connect Arrays.~~

~~The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in distributing frames and cross-connect arrays:~~

(1) ~~Plenum cables, riser cables, general-purpose cables, and communications wires~~

(2) ~~Plenum, riser, and general-purpose communications raceways~~

(3) ~~Plenum, riser, and general-purpose cable routing assemblies~~

(4) ~~Communications wires, plenum cables, riser cables, and general-purpose cables installed in:~~

(5) ~~Plenum communications raceways~~

(6) ~~Riser communications raceways~~

(7) ~~General-purpose communications raceways~~

(8) ~~Plenum cable routing assemblies~~

(9) ~~Riser cable routing assemblies~~

(10) ~~General-purpose cable routing assemblies~~

~~**(J)** Other Building Locations.~~

~~The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in building locations other than the locations covered in 800.113(B) through (I):~~

(1) ~~Plenum cables, riser cables, and general-purpose cables~~

(2) ~~Limited-use cables with a maximum of 3 m (10 ft) of exposed length in nonconcealed spaces~~

(3) ~~Plenum, riser, and general-purpose communications raceways~~

(4) ~~Plenum, riser, and general-purpose cable routing assemblies~~

(5) ~~Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:~~

(6) ~~Plenum communications raceways~~

(7) ~~Riser communications raceways~~

(8) ~~General-purpose communications raceways~~

(9) ~~Plenum cables, riser cables, and general-purpose cables installed in the following:~~

(10) ~~Plenum cable routing assemblies~~

(11) ~~Riser cable routing assemblies~~

(12) ~~General-purpose cable routing assemblies~~

(13) ~~Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3~~

(14) ~~Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks~~

**(K)** Multifamily Dwellings.

The following cables, cable routing assemblies, and communications raceways shall be permitted to be installed in multifamily dwellings in locations other than the locations covered in 800.113(B) through (G):

(1) Plenum cables, riser cables, and general-purpose cables

(2) Limited-use cables less than 6 mm (0.25 in.) in diameter in nonconcealed spaces

(3) Plenum, riser, and general-purpose communications raceways

(4) Plenum, riser, and general-purpose cable routing assemblies

(5) Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:

(6) Plenum communications raceways

(7) Riser communications raceways

(8) General-purpose communications raceways

(9) Plenum cables, riser cables, and general-purpose cables installed in the following:

(10) Plenum cable routing assemblies

(11) Riser cable routing assemblies

(12) General-purpose cable routing assemblies

(13) Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3

(14) Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks

~~(L) One- and Two-Family Dwellings.~~

~~The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in one- and two-family dwellings in locations other than the locations covered in 800.113(B) through (F):~~

(1) ~~Plenum cables, riser cables, and general-purpose cables~~

(2) ~~Limited-use cables less than 6 mm (0.25 in.) in diameter~~

(3) ~~Plenum, riser, and general-purpose communications raceways~~

(4) ~~Plenum, riser, and general-purpose cable routing assemblies~~

(5) ~~Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:~~

(6) ~~Plenum communications raceways~~

(7) ~~Riser communications raceways~~

(8) ~~General-purpose communications raceways~~

(9) ~~Plenum cables, riser cables, and general-purpose cables installed in the following:~~

(10) ~~Plenum cable routing assemblies~~

(11) ~~Riser cable routing assemblies~~

(12) ~~General-purpose cable routing assemblies~~

(13) ~~Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3~~

(14) ~~Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks~~

(15) ~~Hybrid power and communications cable listed in accordance with 805.179(F)~~

**113 AS SHOWN IN THE ATTACHED FILES.**

## Additional Proposed Changes

| File Name | Description | Approved |
|---|---|---|
| PI_2715_text_for_800.113-2.docx | Recommended text for 800.113 in MS Word revisions mode format | |
| PI_2715_text_for_800.113-2-_changes_accepted.pdf | Recommended text for 800.113 with all the changes accepted in PDF format | |

## Statement of Problem and Substantiation for Public Input

This is a companion PI to the PI (PI 2716) to delete Table 800.154(a), Applications of Listed Communications Wires, Cables, and Network-Powered Broadband Communications System Cables in Buildings; Table 800.154(b), Applications of Listed Communications Raceways in Buildings; and Table 800.154(c) Applications of Listed Cable routing Assemblies in Buildings. Most of the entries in the tables are "Y" which indicates that the application is permitted within the limitations of 800.110 and 800.113. If all the "Y" entries were deleted, no mandatory requirements would be lost because they are already in 800.110 and 800.113. The entries that are shown as "N" are equivalent to a "use not permitted". Consequently, if we add the "Uses Not Permitted" to 800.113, Tables 800.154(a), (b) & (c)

become redundant; Tables 800.154(a), (b) & (c) can then be deleted.

This PI adds "Uses Permitted" to the title of the sections showing all the existing permitted uses. This PI also adds "Uses Not Permitted" wherever appropriate. Organizing text into "Uses Permitted" and "Uses Not Permitted" sections is editorially consistent with usage throughout the Code.

This PI also makes several editorial changes to improve clarity and reduce the complexity of 800.113.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 2716-NFPA 70-2020 [Section No. 800.154] | Companion PI that deletes section 800.154 |
| Public Input No. 2716-NFPA 70-2020 [Section No. 800.154] | |

## Submitter Information Verification

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**Committee:** NEC-P16

# PI 2715 Text

**800.113 Installation of ~~Wires,~~ Cables Used for Communications Circuits, Communications Wires, Cable Routing Assemblies, and Communications Raceways.** Installation of ~~wires,~~ cables used for communications circuits, communications wires, cable routing assemblies, and communications raceways shall comply with 800.113(A) through (L). Installation of cable routing assemblies and communications raceways shall comply also with 800.110.

**Table 800.113, Cables Used for Communications Circuits**

| | Listed Cable Types |
|---|---|
| Plenum Cables | CMP, CATVP, BLP, OFNP, OFCP |
| Riser Cables | CMR, CATVR, BMR, BLR, OFNR, OFCR |
| General-Purpose Cables | CMG, CM, CATV, BM, BL, OFNG, OFN, OFCG, OFC |
| Limited-Use Cables | CMX,CATVX, BLX |
| Undercarpet | CMUC |
| Underground | BMU, BLU |

**800.113(A) Listing.** ~~Wires, c~~Cables used for communications circuits, communications wires, cable routing assemblies and communications raceways installed in buildings shall be listed.

Exception: Cables installed in compliance with 805.48 or 820.48 shall not be required to be listed.

**800.113(B) Ducts Specifically Fabricated for Environmental Air.** Installations of cables used for communications circuits, communications wires, cable routing assemblies and communications raceways, in ducts specifically fabricated for environmental air shall be in accordance with 800.113(B)(1) and 800.113(B)(2).

**(B)(1) Uses Permitted.** The following ~~wires and~~ cables and wires 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) Plenum cables up to 1.22 m (4 ft) in length
(2) Plenum, ~~cables,~~ riser, ~~cables,~~ general-purpose, ~~cables,~~ and limited-use cables installed in raceways that are installed in compliance with 300.22(B)

**(B)(2) Uses Not Permitted.** The following cables, wires, cable routing assemblies, and communications raceways shall not be permitted in ducts specifically fabricated for environmental air as described in 300.22(B)

(1) Plenum, riser and general-purpose communications raceways
(2) Plenum, riser and general-purpose cable routing assemblies
(3) Riser, general-purpose and limited-use cables
(4) Type CMUC cables and wires
(5) Types BMU and BLU cables
(6) Communications wires
(7) Hybrid power and communications cables

Informational Note: For information on fire protection of wiring installed in fabricated ducts, see NFPA 90A-2021~~8~~, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

**800.113(C) Other Spaces Used for Environmental Air (Plenums).** Installations of cables used for communications circuits, communications wires, cable routing assemblies, and communications raceways, in other spaces used for environmental air (plenums) shall be in accordance with 800.113(C)(1) and 800.113(C)(2).

**(C)(1) Uses Permitted.** The following ~~wires,~~ cables, wires, cable routing assemblies, and communications raceways shall be permitted in other spaces used for environmental air as described in 300.22(C):

(1) Plenum cables
(2) Plenum communications raceways
(3) Plenum cable routing assemblies
(4) Plenum cables installed in plenum communications raceways
(5) Plenum cables installed in plenum cable routing assemblies
(6) Plenum cables and plenum communications raceways supported by open metal cable tray systems
(7) Plenum, ~~cables,~~ riser, ~~cables,~~ general-purpose, and ~~cables,~~ limited-use cables; ~~,~~ and communications wires installed in raceways that are installed in compliance with 300.22(C)
(8) Plenum, ~~cables,~~ riser, ~~cables,~~ general-purpose, ~~cables~~ and ~~,~~ limited-use cables; ~~,~~ and 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)
(9) Plenum, ~~cables,~~ riser, ~~cables,~~ general-purpose, ~~cables,~~ and limited-use 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)

**(C)(2) Uses Not Permitted.** The following cables, wires, cable routing assemblies, and communications raceways shall not be permitted in other spaces used for environmental air as described in 300.22(C):

(1) Riser, general-purpose and limited-use cables
(2) Riser and general-purpose communications raceways

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(3) Riser and general-purpose cable routing assemblies
(4) Type CMUC cables and wires
(5) Types BMR, BM, BMU and BLU cables
(6) Communications wires
(7) Hybrid power and communications cables

Informational Note: For information on fire protection of wiring installed in other spaces used for environmental air, see NFPA 90A-2021~~8~~, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

**800.113(D) Risers — Cables, Cable Routing Assemblies, and Communications Raceways in Vertical Runs.** Installations of cables used for communications circuits, communications wires, cable routing assemblies, and communications raceways, in risers shall be in accordance with 800.113(D)(1) and 800.113(D)(2).

**(D)(1) Uses Permitted.** The following cables, cable routing assemblies, and communications raceways shall be permitted in vertical runs penetrating one or more floors and in vertical runs in a shaft:

(1) Plenum and riser cables
(2) Plenum and riser communications raceways
(3) Plenum and riser cable routing assemblies
(4) Plenum and riser cables installed in:
  (a) Plenum and riser communications raceways
  ~~(b) Riser communications raceways~~
  ~~(c)~~(b) Plenum and riser cable routing assemblies
  ~~(d) Riser cable routing assemblies~~

**(D)(2) Uses Not Permitted.** The following cables, wires, cable routing assemblies, and communications raceways shall not be permitted in risers:

(1) General-purpose and limited-use cables
(2) General-purpose communications raceways
(3) General-purpose cable routing assemblies
(4) Type CMUC cables and wires
(5) Types BMR, BM, BMU and BLU cables
(6) Communications wires
(7) Hybrid power and communications cables

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**800.113(E) Risers — Cables and Innerducts in Metal Raceways.** Installations of cables used for communications circuits, communications wires, cable routing assemblies, and communications raceways, in metal raceways in a riser shall be in accordance with 800.113(E)(1) and 800.113(E)(2).

**(E)(1) Uses Permittted.** The following cables and innerducts shall be permitted in metal raceways in a riser having firestops at each floor:

(1) Plenum, ~~cables,~~ riser, ~~cables,~~ general-purpose, ~~cables,~~ and limited-use cables
(2) Plenum, riser, and general-purpose communications raceways
(3) Plenum, ~~cables,~~ riser, ~~cables,~~ general-purpose, ~~cables,~~ and limited-use cables installed in:
  (a) Plenum communications raceways (innerduct)
  (b) Riser communications raceways (innerduct)
  (c) General-purpose communications raceways (innerduct)

**(E)(2) Uses Not Permitted.** The following cables, wires, cable routing assemblies, and communications raceways shall not be permitted in metal raceways risers:

(1) Plenum, riser and general-purpose cable routing assemblies
(2) Type CMUC cables and wires
(3) Types BMR, BM, BMU and BLU cables
(4) Communications wires
(5) Hybrid power and communications cables

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**800.113(F) Risers — Cables, Cable Routing Assemblies, and Communications Raceways in Fireproof Shafts. .** Installations of cables used for communications circuits, communications wires, cable routing assemblies, and communications raceways, in fireproof riser shafts shall be in accordance with 800.113(F)(1) and 800.113(F)(2).

**(F)(1) Uses Permitted.** The following cables, cable routing assemblies, and communications raceways shall be permitted to be installed in fireproof riser shafts having firestops at each floor:

(1) Plenum, ~~cables,~~ riser, ~~cables,~~ general-purpose, ~~cables,~~ and limited-use cables
(2) Plenum, riser, and general-purpose communications raceways
(3) Plenum, riser, and general-purpose cable routing assemblies

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(4) Plenum, ~~cables,~~ riser, ~~cables,~~ general-purpose, ~~cables,~~ and limited-use cables installed in:
- (a) Plenum communications raceways
- (b) Riser communications raceways
- (c) General-purpose communications raceways
- (d) Plenum cable routing assemblies
- (e) Riser cable routing assemblies
- (f) General-purpose cable routing assemblies

**(F)(2) Uses Not Permitted.** The following cables, wires, cable routing assemblies, and communications raceways shall not be permitted in metal raceways risers:

(1) Type CMUC cables and wires
(2) Type BMU and BLU cables
(3) Communications wires
(4) Hybrid power and communications cables

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**800.113(G) Risers — One- and Two-Family Dwellings.** Installations of cables used for communications circuits, communications wires, cable routing assemblies, and communications raceways, in risers in one- and two-family dwellings shall be in accordance with 800.113(G)(1) and 800.113(G)(2).

**(G)(1) Uses Permitted.** The following cables, cable routing assemblies, and communications raceways shall be permitted in risers in one- and two-family dwellings:

(1) Plenum, ~~cables,~~ riser, ~~cables,~~ and general-purpose cables
(2) Limited-use cables less than 6 mm (0.25 in.) in diameter
(3) Plenum, riser, and general-purpose communications raceways
(4) Plenum, riser, and general-purpose cable routing assemblies
(5) Plenum, ~~cables,~~ riser, ~~cables,~~ and general-purpose cables installed in:
- (a) Plenum, riser, and general-purpose communications raceways
- ~~(b) Riser communications raceways~~
- ~~(c) General-purpose communications raceways~~
- ~~(d)~~(b) Plenum, riser, and general-purpose cable routing assemblies
- ~~(e) Riser cable routing assemblies~~
- ~~(f) General-purpose cable routing assemblies~~

**(G)(2) Uses Not Permitted.** The following cables and wires shall not be permitted in risers in one- and two-family dwellings:

(1) Type CMUC cables and wires
(2) Type BMU and BLU cables
(3) Communications wires
(4) Hybrid power and communications cables

**800.113(H) Cable Trays.** Installations of cables used for communications circuits, communications wires, cable routing assemblies, and communications raceways, supported by cable trays shall be in accordance with 800.113(H)(1) and 800.113(H)(2).

**(H)(1) Uses Permitted.** The following ~~wires,~~ cables, wires, cable routing assemblies, and communications raceways shall be permitted to be supported by cable trays:

(1) Plenum, ~~cables,~~ riser, ~~cables,~~ and general-purpose cables
(2) Plenum, riser, and general-purpose communications raceways
~~(2)~~(3) Plenum, riser, and general-purpose cable routing assemblies supported by ladder cable trays
~~(3)~~(4) ~~Communications wires, P~~plenum, ~~cables,~~ riser, ~~cables,~~ and general-purpose cables installed in:
- (a) Plenum, riser, and general-purpose communications raceways
- (b) Plenum, r~~R~~iser, and general-purpose cable routing assemblies supported by ladder cable trays ~~communications raceways~~
- ~~(c) General-purpose communications raceways~~

**(H)(2) Uses Not Permitted.** The following cables and wires shall not be permitted to be supported by cable trays:

(1) Limited-use cables
(2 Type CMUC cables and wires
(3) Type BMU and BLU cables
(4) Communications wires
(5) Hybrid power and communications cables

**800.113(I) Distributing Frames and Cross-Connect Arrays.** Installations of cables used for communications circuits,

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communications wires, cable routing assemblies, and communications raceways, in distributing frames and cross-connect arrays shall be in accordance with 800.113(I)(1) and 800.113(I)(2).

**(I)(1) Uses Permitted.** The following ~~wires,~~ cables, wires, cable routing assemblies, and communications raceways shall be permitted to be installed in distributing frames and cross-connect arrays:

(1) Plenum, ~~cables,~~ riser, and ~~cables,~~ general-purpose cables; ~~,~~ and communications wires
(2) Plenum, riser, and general-purpose communications raceways
(3) Plenum, riser, and general-purpose cable routing assemblies
(4) ~~Communications wires, p~~Plenum, ~~cables,~~ riser, ~~cables,~~ and general-purpose cables; and communications wires installed in:
  (a) Plenum, riser and general-purpose communications raceways
  (b) Plenum, r~~R~~iser and general-purpose cable routing assemblies~~communications raceways~~

~~(c) General-purpose communications raceways~~

~~(d) Plenum cable routing assemblies~~

~~(e) Riser cable routing assemblies~~

~~(f) General-purpose cable routing assemblies~~

**(I)(2) Uses Not Permitted.** The following cables and wires shall not be permitted to be installed in distributing frames and cross-connect arrays:

(1) Types BMR, BM, BMU and BLU cables
(2) Limited-use cables
(3) Type CMUC cables and wires
(4) Communications wires
(5) Hybrid power and communications cables

**800.113(J) Other Building Locations.** Installations of cables used for communications circuits, cable communications wires, routing assemblies, and communications raceways, in building locations other than the locations covered in 800.113(B) through (I) shall be in accordance with 800.113(J)(1) and 800.113(J)(2).

**(J)(1) Uses Permitted.** The following ~~wires,~~ cables, wires, cable routing assemblies, and communications raceways shall be permitted to be installed in building locations other than the locations covered in 800.113(B) through (I):

(1) Plenum, ~~cables,~~ riser, ~~cables,~~ and general-purpose cables
(2) Limited-use cables with a maximum of 3 m (10 ft) of exposed length in nonconcealed spaces
(3) Plenum, riser, and general-purpose communications raceways
(4) Plenum, riser, and general-purpose cable routing assemblies
(5) ~~Communications wires, p~~Plenum, ~~cables,~~ riser, ~~cables,~~ and general-purpose cables; and communications wires installed in the following:
  (a) Plenum, riser and general-purpose communications raceways
  ~~(b) Riser communications raceways~~
  ~~(c) General-purpose communications raceways~~
(6) Plenum, ~~cables,~~ riser, ~~cables,~~ and general-purpose cables installed in the following:
  (a) Plenum, riser, and general-purpose cable routing assemblies
  ~~(b) Riser cable routing assemblies~~
  ~~(c) General-purpose cable routing assemblies~~
(7) ~~Communications wires, p~~Plenum, ~~cables,~~ riser, ~~cables,~~ general-purpose, ~~cables~~, and limited-use cables; and communications wires installed in raceways recognized in Chapter 3
(8) Type CMUC under-carpet communications ~~wires and~~ cables and wires installed under carpet, modular flooring, and planks

**(J)(2) Uses Not Permitted.** The following cables, wires, cable routing assemblies, and communications raceways shall not be permitted to be installed in building locations other than the locations covered in 800.113(B) through (I):

(1) Types BMU and BLU cables
(2) Communications wires
(3) Hybrid power and communications cables

**800.113(K) Multifamily Dwellings.** Installations of cables used for communications circuits, communications wires, cable routing assemblies, and communications raceways, in multifamily dwellings shall be in accordance with 800.113(K)(1) and 800.113(K)(2).

**(K)(1) Uses Permitted.** The following cables, cable routing assemblies, and communications raceways shall be permitted to be installed in multifamily dwellings in locations other than the locations covered in 800.113(B) through (G):

(1) Plenum, ~~cables,~~ riser, ~~cables,~~ and general-purpose cables
(2) Limited-use cables less than 6 mm (0.25 in.) in diameter in nonconcealed spaces
(3) Plenum, riser, and general-purpose communications raceways
(4) Plenum, riser, and general-purpose cable routing assemblies
(5) ~~Communications wires, p~~Plenum, ~~cables,~~ ~~riser cables, and~~riser, and general-purpose cables; and communications wires installed in the following:
  (a) Plenum, riser, and general-purpose communications raceways

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(b) Riser communications raceways
(c) General-purpose communications raceways

(6) Plenum, cables, riser, cables, and general-purpose cables installed in the following:
(a) Plenum, riser, and general-purpose cable routing assemblies
(b) Riser cable routing assemblies
(c) General-purpose cable routing assemblies

(7) Communications wires, plenum, cables, riser, cables, general-purpose, cables, and limited-use cables installed in raceways recognized in Chapter 3

**(8)** Type CMUC under-carpet communications wires and cables and wires installed under carpet, modular flooring, and planks

**(K)(2) Uses Not Permitted.** The following cables, cable routing assemblies, and communications raceways shall not be permitted to be installed in multifamily dwellings in locations other than the locations covered in 800.113(B) through (G):

(1) Types BMU and BLU cables
(2) Communications wires
(3) Hybrid power and communications cables

**800.113(L) One- and Two-Family Dwellings.** Installations of cables used for communications circuits, communications wires, cable routing assemblies, and communications raceways, in one- and two-family dwellings in locations other than the locations covered in 800.113(B) through (F) shall be in accordance with 800.113(L)(1) and 800.113(L)(2).

**(L)(1) Uses Permitted.** The following wires, cables, wires, cable routing assemblies, and communications raceways shall be permitted to be installed in one- and two-family dwellings in locations other than the locations covered in 800.113(B) through (F):

(1) Plenum, cables, riser, cables, and general-purpose cables
(2) Limited-use cables less than 6 mm (0.25 in.) in diameter
(3) Plenum, riser, and general-purpose communications raceways
(4) Plenum, riser, and general-purpose cable routing assemblies
(5) Communications wires, pPlenum, cables, riser, cables, and general-purpose cables; and communications wires installed in the following:
(a) Plenum, riser, and general-purpose communications raceways
(b) Riser communications raceways
(c) General-purpose communications raceways
(6) Plenum, cables, riser, cables, and general-purpose cables installed in the following:
(a) Plenum, plenum, riser and general-purpose cable routing assemblies
(b) Riser cable routing assemblies
(c) General-purpose cable routing assemblies
(7) Communications wires, pPlenum, cables, riser, cables, general-purpose, cables, and limited-use cables; and communications wires installed in raceways recognized in Chapter 3
(8) Type CMUC under-carpet communications wires and cables and wires installed under carpet, modular flooring, and planks
**(9)** Hybrid power and communications cable listed in accordance with 805.179(F)

**(L)(2) Uses Not Permitted.** The following cables, wires, cable routing assemblies, and communications raceways shall not be permitted to be installed in one- and two-family dwellings in locations other than the locations covered in 800.113(B) through (F):

(1) Types BMU and BLU cables
(2) Communications wires

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**800.113 Installation of Cables Used for Communications Circuits, Communications Wires, Cable Routing Assemblies, and Communications Raceways.** Installation of cables used for communications circuits, communications wires, cable routing assemblies, and communications raceways shall comply with 800.113(A) through (L). Installation of cable routing assemblies and communications raceways shall comply also with 800.110.

## Table 800.113, Cables Used for Communications Circuits

| | Listed Cable Types |
|---|---|
| Plenum Cables | CMP, CATVP, BLP, OFNP, OFCP |
| Riser Cables | CMR, CATVR, BMR, BLR, OFNR, OFCR |
| General-Purpose Cables | CMG, CM, CATV, BM, BL, OFNG, OFN, OFCG, OFC |
| Limited-Use Cables | CMX,CATVX, BLX |
| Undercarpet | CMUC |
| Underground | BMU, BLU |

**800.113(A) Listing.** Cables used for communications circuits, communications wires, cable routing assemblies and communications raceways installed in buildings shall be listed.

Exception: Cables installed in compliance with 805.48 or 820.48 shall not be required to be listed.

**800.113(B) Ducts Specifically Fabricated for Environmental Air.** Installations of cables used for communications circuits, communications wires, cable routing assemblies and communications raceways, in ducts specifically fabricated for environmental air shall be in accordance with 800.113(B)(1) and 800.113(B)(2).

**(B)(1) Uses Permitted.** The following cables and wires 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) Plenum cables up to 1.22 m (4 ft) in length
(2) Plenum, riser, general-purpose, and limited-use cables installed in raceways that are installed in compliance with 300.22(B)

**(B)(2) Uses Not Permitted.** The following cables, wires, cable routing assemblies, and communications raceways shall not be permitted in ducts specifically fabricated for environmental air as described in 300.22(B)

(1) Plenum, riser and general-purpose communications raceways
(2) Plenum, riser and general-purpose cable routing assemblies
(3) Riser, general-purpose and limited-use cables
(4) Type CMUC cables and wires
(5) Types BMU and BLU cables
(6) Communications wires
(7) Hybrid power and communications cables

Informational Note: For information on fire protection of wiring installed in fabricated ducts, see NFPA 90A-2021, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

**800.113(C) Other Spaces Used for Environmental Air (Plenums).** Installations of cables used for communications circuits, communications wires, cable routing assemblies, and communications raceways, in other spaces used for environmental air (plenums) shall be in accordance with 800.113(C)(1) and 800.113(C)(2).

**(C)(1) Uses Permitted.** The following cables, wires, cable routing assemblies, and communications raceways shall be permitted in other spaces used for environmental air as described in 300.22(C):

(1) Plenum cables
(2) Plenum communications raceways
(3) Plenum cable routing assemblies
(4) Plenum cables installed in plenum communications raceways
(5) Plenum cables installed in plenum cable routing assemblies
(6) Plenum cables and plenum communications raceways supported by open metal cable tray systems
(7) Plenum, riser, general-purpose, and limited-use cables; and communications wires installed in raceways that are installed in compliance with 300.22(C)
(8) Plenum, riser, general-purpose, and limited-use cables; and plenum, riser, 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)
(9) Plenum, riser, general-purpose, and limited-use cables installed in plenum, riser, 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)

(5) Types BMR, BM, BMU and BLU cables
(6) Communications wires
(7) Hybrid power and communications cables

Informational Note: For information on fire protection of wiring installed in other spaces used for environmental air, see NFPA 90A-2021, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

**800.113(D) Risers — Cables, Cable Routing Assemblies, and Communications Raceways in Vertical Runs.** Installations of cables used for communications circuits, communications wires, cable routing assemblies, and communications raceways, in risers shall be in accordance with 800.113(D)(1) and 800.113(D)(2).

**(D)(1) Uses Permitted.** The following cables, cable routing assemblies, and communications raceways shall be permitted in vertical runs penetrating one or more floors and in vertical runs in a shaft:

(1) Plenum and riser cables
(2) Plenum and riser communications raceways
(3) Plenum and riser cable routing assemblies
(4) Plenum and riser cables installed in:
    (a) Plenum and riser communications raceways
    (b) Plenum and riser cable routing assemblies

**(D)(2) Uses Not Permitted.** The following cables, wires, cable routing assemblies, and communications raceways shall not be permitted in risers:

(1) General-purpose and limited-use cables
(2) General-purpose communications raceways
(3) General-purpose cable routing assemblies
(4) Type CMUC cables and wires
(5) Types BMR, BM, BMU and BLU cables
(6) Communications wires
(7) Hybrid power and communications cables

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**800.113(E) Risers — Cables and Innerducts in Metal Raceways.** Installations of cables used for communications circuits, communications wires, cable routing assemblies, and communications raceways, in metal raceways in a riser shall be in accordance with 800.113(E)(1) and 800.113(E)(2).

**(E)(1) Uses Permittted.** The following cables and innerducts shall be permitted in metal raceways in a riser having firestops at each floor:

(1) Plenum, riser, general-purpose, and limited-use cables
(2) Plenum, riser, and general-purpose communications raceways
(3) Plenum, riser, general-purpose, and limited-use cables installed in:
    (a) Plenum communications raceways (innerduct)
    (b) Riser communications raceways (innerduct)
    (c) General-purpose communications raceways (innerduct)

**(E)(2) Uses Not Permitted.** The following cables, wires, cable routing assemblies, and communications raceways shall not be permitted in metal raceways risers:

(1) Plenum, riser and general-purpose cable routing assemblies
(2) Type CMUC cables and wires
(3) Types BMR, BM, BMU and BLU cables
(4) Communications wires
(5) Hybrid power and communications cables

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**800.113(F) Risers — Cables, Cable Routing Assemblies, and Communications Raceways in Fireproof Shafts. .** Installations of cables used for communications circuits, communications wires, cable routing assemblies, and communications raceways, in fireproof riser shafts shall be in accordance with 800.113(F)(1) and 800.113(F)(2).

**(F)(1) Uses Permitted.** The following cables, cable routing assemblies, and communications raceways shall be permitted to be installed in fireproof riser shafts having firestops at each floor:

(d) Plenum cable routing assemblies
(e) Riser cable routing assemblies
(f) General-purpose cable routing assemblies

**(F)(2) Uses Not Permitted.** The following cables, wires, cable routing assemblies, and communications raceways shall not be permitted in metal raceways risers:

(1) Type CMUC cables and wires
(2) Type BMU and BLU cables
(3) Communications wires
(4) Hybrid power and communications cables

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**800.113(G) Risers — One- and Two-Family Dwellings.** Installations of cables used for communications circuits, communications wires, cable routing assemblies, and communications raceways, in risers in one- and two-family dwellings shafts shall be in accordance with 800.113(G)(1) and 800.113(G)(2).

**(G)(1) Uses Permitted.** The following cables, cable routing assemblies, and communications raceways shall be permitted in risers in one- and two-family dwellings:

(1) Plenum, riser, and general-purpose cables
(2) Limited-use cables less than 6 mm (0.25 in.) in diameter
(3) Plenum, riser, and general-purpose communications raceways
(4) Plenum, riser, and general-purpose cable routing assemblies
(5) Plenum, riser, and general-purpose cables installed in:
(a) Plenum, riser, and general-purpose communications raceways
(b) Plenum, riser, and general-purpose cable routing assemblies

**(G)(2) Uses Not Permitted.** The following cables and wires shall not be permitted in risers in one- and two-family dwellings:

(1) Type CMUC cables and wires
(2) Type BMU and BLU cables
(3) Communications wires
(4) Hybrid power and communications cables

**800.113(H) Cable Trays.** Installations of cables used for communications circuits, communications wires, cable routing assemblies, and communications raceways, supported by cable trays shall be in accordance with 800.113(H)(1) and 800.113(H)(2).

**(H)(1) Uses Permitted.** The following cables, wires, cable routing assemblies, and communications raceways shall be permitted to be supported by cable trays:

(1) Plenum, riser, and general-purpose cables
(2) Plenum, riser, and general-purpose communications raceways
(3) Plenum, riser, and general-purpose cable routing assemblies supported by ladder cable trays
(4) Plenum, riser, and general-purpose cables installed in:
(a) Plenum, riser, and general-purpose communications raceways
(b) Plenum, riser, and general-purpose cable routing assemblies supported by ladder cable trays

**(H)(2) Uses Not Permitted.** The following cables and wires shall not be permitted to be supported by cable trays:

(1) Limited-use cables
(2 Type CMUC cables and wires
(3) Type BMU and BLU cables
(4) Communications wires
(5) Hybrid power and communications cables

**800.113(I) Distributing Frames and Cross-Connect Arrays.** Installations of cables used for communications circuits, communications wires, cable routing assemblies, and communications raceways, in distributing frames and cross-connect arrays shall be in accordance with 800.113(I)(1) and 800.113(I)(2).

**(I)(1) Uses Permitted.** The following cables, wires, cable routing assemblies, and communications raceways shall be

**(I)(2) Uses Not Permitted.** The following cables and wires shall not be permitted to be installed in distributing frames and cross-connect arrays:

(1) Types BMR, BM, BMU and BLU cables
(2) Limited-use cables
(3) Type CMUC cables and wires
(4) Communications wires
(5) Hybrid power and communications cables

**800.113(J) Other Building Locations.** Installations of cables used for communications circuits, cable communications wires, routing assemblies, and communications raceways, in building locations other than the locations covered in 800.113(B) through (I) shall be in accordance with 800.113(J)(1) and 800.113(J)(2).

**(J)(1) Uses Permitted.** The following cables, wires, cable routing assemblies, and communications raceways shall be permitted to be installed in building locations other than the locations covered in 800.113(B) through (I):

(1) Plenum, riser, and general-purpose cables
(2) Limited-use cables with a maximum of 3 m (10 ft) of exposed length in nonconcealed spaces
(3) Plenum, riser, and general-purpose communications raceways
(4) Plenum, riser, and general-purpose cable routing assemblies
(5) Plenum, riser, and general-purpose cables; and communications wires installed in the following:
    (a) Plenum, riser and general-purpose communications raceways
(6) Plenum, riser, and general-purpose cables installed in the following:
    (a) Plenum, riser, and general-purpose cable routing assemblies
(7) Plenum, riser, general-purpose, , and limited-use cables; and communications wires installed in raceways recognized in Chapter 3
(8) Type CMUC under-carpet communications cables and wires installed under carpet, modular flooring, and planks

**(J)(2) Uses Not Permitted.** The following cables, wires, cable routing assemblies, and communications raceways shall not be permitted to be installed in building locations other than the locations covered in 800.113(B) through (I):

(1) Types BMU and BLU cables
(2) Communications wires
(3) Hybrid power and communications cables

**800.113(K) Multifamily Dwellings.** Installations of cables used for communications circuits, communications wires, cable routing assemblies, and communications raceways, in multifamily dwellings shall be in accordance with 800.113(K)(1) and 800.113(K)(2).

**(K)(1) Uses Permitted.** The following cables, cable routing assemblies, and communications raceways shall be permitted to be installed in multifamily dwellings in locations other than the locations covered in 800.113(B) through (G):

(1) Plenum, riser, and general-purpose cables
(2) Limited-use cables less than 6 mm (0.25 in.) in diameter in nonconcealed spaces
(3) Plenum, riser, and general-purpose communications raceways
(4) Plenum, riser, and general-purpose cable routing assemblies
(5) Plenum, riser, and general-purpose cables; and communications wires installed in the following:
    (a) Plenum, riser, and general-purpose communications raceways
(6) Plenum, riser, and general-purpose cables installed in the following:
    (a) Plenum, riser, and general-purpose cable routing assemblies
(7) Communications wires, plenum, riser, general-purpose, and limited-use cables installed in raceways recognized in Chapter 3
**(8)** Type CMUC under-carpet communications cables and wires installed under carpet, modular flooring, and planks

**(K)(2) Uses Not Permitted.** The following cables, cable routing assemblies, and communications raceways shall not be permitted to be installed in multifamily dwellings in locations other than the locations covered in 800.113(B) through (G):

(1) Types BMU and BLU cables
(2) Communications wires
(3) Hybrid power and communications cables

**800.113(L) One- and Two-Family Dwellings.** Installations of cables used for communications circuits, communications wires, cable routing assemblies, and communications raceways, in one- and two-family dwellings in locations other than the locations covered in 800.113(B) through (F) shall be in accordance with 800.113(L)(1) and 800.113(L)(2).

(4) Plenum, riser, and general-purpose cable routing assemblies
(5) Plenum, riser, and general-purpose cables; and communications wires installed in the following:
(a) Plenum, riser, and general-purpose communications raceways
(6) Plenum. riser, and general-purpose cables installed in the following:
(a) Plenum, plenum, riser and general-purpose cable routing assemblies
(7) Plenum, riser, general-purpose, and limited-use cables; and communications wires installed in raceways recognized in Chapter 3
(8) Type CMUC under-carpet communications cables and wires installed under carpet, modular flooring, and planks
**(9)** Hybrid power and communications cable listed in accordance with 805.179(F)

**(L)(2) Uses Not Permitted.** The following cables, wires, cable routing assemblies, and communications raceways shall not be permitted to be installed in one- and two-family dwellings in locations other than the locations covered in 800.113(B) through (F):

(1) Types BMU and BLU cables
(2) Communications wires

## Public Input No. 3526-NFPA 70-2020 [ Section No. 800.113(A) ]

**(A)** Listing.

Wires, cables, cable routing assemblies, and communications raceways installed in buildings shall be listed.

~~*Exception: Cables installed in compliance with 805.48 or 820.48 shall not be required to be listed.*~~

## Statement of Problem and Substantiation for Public Input

There is no substantiation that these wiring methods should be exempt from listings. The reference to 805.48 and 820.48 permitting these unlisted wring methods if installed in RMC or IMC makes no sense. It is not cost effective to install RMC or IMC labor and/or material. Like any building wire or method throughout the NEC is required to be listed for many reasons, most notably flame spread and smoke development regardless of installed in RMC or IMC. This installation may have merit on the utility side but not under the scope of the NEC. There are no requirements elsewhere in the NEC to use unlisted methods if protected in a type of raceway and limiting its length. Flame spread and smoke development exist regardless of length.

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## Public Input No. 4059-NFPA 70-2020 [ Section No. 800.113(A) ]

**(A)** Listing.

Wires, cables, cable routing assemblies, and communications raceways installed in buildings shall be listed.

*Exception: Cables installed in compliance with 805.48 ~~or~~ , 820.48 or 840.48 shall not be required to be listed.*

## Statement of Problem and Substantiation for Public Input

840.48 also permits "unlisted" cables just as 805.48 and 820.48 allows "unlisted cables", and needs to be included in this sentence. This appears to simply be an oversight as there seems to be no explanation technically for it not be included here. In addition, these cables in 840.48 are often the exact same cables that have been in place for years or decades, but the equipment at each end has simply changed technology, and the cable would be classified as part of an 840 installation rather than an 800 or 820 installation. In fact these large unlisted entrance cables that can be up to 50' inside the premises could actually have some circuits that are 800 and others that are 840. From the permissible unlisted cables perspective, it does not matter and is part of this exemption.

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## Public Input No. 645-NFPA 70-2020 [ Section No. 800.113(A) ]

**(A)** Listing.

Wires, cables, cable routing assemblies, and communications raceways installed in buildings shall be listed and installed in accordance with the limitations of the listing .

*Exception: Cables installed in compliance with ~~805~~ 800 .48 ~~or 820.48~~ shall not be required to be listed.*

## 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.

The exception for cables installed in accordance with "805.48 or 820.48" has been changed to "800.48" assuming the acceptance of PIs 465, 466 & 467 which consolidate the requirements of 805.48 and 820.48 into (new) 800.48.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 465-NFPA 70-2020 [New Section after 800.44] | Consolidates 805.48 and 820.48 into new 800.48 |
| Public Input No. 466-NFPA 70-2020 [Section No. 805.48] | Deletes 805.48 |
| Public Input No. 467-NFPA 70-2020 [Section No. 820.48] | Deletes 820.48 |
| Public Input No. 646-NFPA 70-2020 [Section No. 725.135(A)] | |
| Public Input No. 647-NFPA 70-2020 [Section No. 760.135(A)] | |

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**Committee:** NEC-P16

## Public Input No. 70-NFPA 70-2019 [ Section No. 800.113(A) ]

**(A)** Listing.

Wires, cables, cable routing assemblies, and communications raceways installed in buildings shall be listed and installed in accordance with the limitations of the listing .

*Exception: Cables installed in compliance with 805.48 or 820.48 shall not be required to be listed.*

## 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.

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**Committee:** NEC-P16

## Public Input No. 684-NFPA 70-2020 [ Section No. 800.113(B) ]

**(B)** Ducts Specifically Fabricated for Environmental Air.

The following wires and 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) Plenum cables up to 1.22 m (4 ft) in length

(2) Plenum cables, riser cables, general-purpose cables, and limited-use 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 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. 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. 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. 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. 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)]

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## Public Input No. 685-NFPA 70-2020 [ Section No. 800.113(C) ]

**(C)** Other Spaces Used for Environmental Air (Plenums).

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted in other spaces used for environmental air as described in 300.22(C):

(1) Plenum cables

(2) Plenum communications raceways

(3) Plenum cable routing assemblies

(4) Plenum cables installed in plenum communications raceways

(5) Plenum cables installed in plenum cable routing assemblies

(6) Plenum cables and plenum communications raceways supported by open metal cable tray systems

(7) Plenum cables, riser cables, general-purpose cables, limited-use cables, and communications wires installed in raceways that are installed in compliance with 300.22(C)

(8) Plenum cables, riser cables, general-purpose cables, limited-use cables, 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)

(9) Plenum cables, riser cables, general-purpose cables, and limited-use 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, see 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. 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. 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. 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. 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)]

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**Committee:** NEC-P16

# Public Input No. 83-NFPA 70-2019 [ New Section after 800.154 ]

**Part V. Listing Requirements**

## Statement of Problem and Substantiation for Public Input

Listing requirements start after 800.154. This PI places Part V. Listing Requirements there.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 82-NFPA 70-2019 [Part V.] | Deletes Part V - in wrong place |
| Public Input No. 82-NFPA 70-2019 [Part V.] | |

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**Committee:** NEC-P16

# Public Input No. 2716-NFPA 70-2020 [ Section No. 800.154 ]

**800.154** Applications of Listed Communications Wires, Cables, and Raceways, and Listed Cable Routing Assemblies.

Permitted and nonpermitted applications of listed communications wires, cables, coaxial cables, network-powered broadband communications system cables and raceways, and listed cable routing assemblies, shall be in accordance with one of the following:

(1) Listed communications wires and cables as indicated in Table 800.154(a)

(2) Listed communications raceways as indicated in Table 800.154(b)

(3) Listed cable routing assemblies as indicated in Table 800.154(c)

The permitted applications shall be subject to the installation requirements of 800.110 and 800.113 .

Table 800.154(a) Applications of Listed Communications Wires, Cables, and Network-Powered Broadband Communications System Cables in Buildings

Applications Wire and Cable Type Plenum Riser BMR General-Purpose BM Limited-Use Undercarpet BMU, BLU Hybrid Power and Communications Cables Communications Wires In ducts specifically fabricated for environmental air as described in 300.22(B) In fabricated ducts Y N N N N N N N N N In metal raceway that complies with 300.22(B) Y Y Y Y Y Y N N N Y In other spaces used for environmental air (plenums) as described in 300.22(C) In other spaces used for environmental air Y N N N N N N N N N In metal raceway that complies with 300.22(C) Y Y Y Y Y Y N N N Y In plenum communications raceways Y N N N N N N N N N In plenum cable routing assemblies Y N N N N N N N N N Supported by open metal cable trays Y N N N N N N N N N Supported by solid bottom metal cable trays with solid metal covers Y Y Y Y Y Y N N N N In risers In vertical runs Y Y Y N N N N N N N In metal raceways Y Y Y Y Y Y N N N N In fireproof shafts Y Y Y Y Y Y Y N N N In plenum communications raceways Y Y N N N N N N N N In plenum cable routing assemblies Y Y N N N N N N N N In riser communications raceways Y Y N N N N N N N N In riser cable routing assemblies Y Y N N N N N N N N In one- and two-family dwellings Y Y Y Y Y Y N N Y N Within buildings in other than air-handling spaces and risers General Y Y Y Y Y Y N N N N In one- and two-family dwellings Y Y Y Y Y Y Y N Y N In multifamily dwellings Y Y Y Y Y Y Y N N N In nonconcealed spaces Y Y Y Y Y Y N N N Supported by cable trays Y Y Y Y Y N N N N N Under carpet, modular flooring, and planks N N N N N N Y N N N In distributing frames and cross-connect arrays Y Y N Y N N N N N Y In rigid metal conduit (RMC) and intermediate metal conduit (IMC) Y Y Y Y Y Y Y Y Y Y In any raceway recognized in Chapter 3 Y Y Y Y Y Y N N N Y In plenum communications raceways Y Y N Y N N N N N Y In plenum cable routing assemblies Y Y N Y N N N N N Y In riser communications raceways Y Y N Y N N N N N Y In riser cable routing assemblies Y Y N Y N N N N N Y In general-purpose communications raceways Y Y N Y N N N N N Y In general-purpose cable routing assemblies Y Y N Y N N N N N Y

Note: An “N” in the table indicates that the cable type shall not be permitted to be installed in the application. A “Y” indicates that the cable type shall be permitted to be installed in the application subject to the limitations described in 800.113. The Riser column includes all riser cables except BMR, and the General-Purpose column includes all general-purpose cables except BM.

Informational Note No. 1: Part IV of Article 800 covers installation methods within buildings. This table covers the applications of listed communications wires, cables, and raceways in buildings. See the definition of *Point of Entrance* in 800.2.

~~Informational Note No. 2: For information on the restrictions to the installation of communications cables in fabricated ducts, see 800.113(B).~~

~~Table 800.154(b) Applications of Listed Communications Raceways in Buildings~~

~~Applications Listed Communications Raceway Type Plenum Riser General-Purpose In ducts specifically fabricated for environmental air as described in 300.22(B) In fabricated ducts N N N In metal raceway that complies with 300.22(B) N N N In other spaces used for environmental air (plenums) 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 cable routing assemblies N 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 cable routing assemblies N N N In riser cable routing assemblies N N N In one- and two-family dwellings Y Y Y Within buildings in other than air-handling spaces and risers General Y Y Y In one- and two-family dwellings Y Y Y In multifamily dwellings Y Y Y In nonconcealed spaces Y Y Y Supported by cable trays Y Y Y Under carpet, modular flooring, and planks N N N In distributing frames and cross-connect arrays Y Y Y In any raceway recognized in Chapter 3 Y Y Y In plenum cable routing assemblies N N N In riser cable routing assemblies N N N In general-purpose cable routing assemblies N N N~~

~~Note: An "N" in the table indicates that the communications raceway type shall not be permitted to be installed in the application. A "Y" indicates that the communications raceway type shall be permitted to be installed in the application, subject to the limitations described in 800.110 and 800.113.~~

~~Table 800.154(c) Applications of Listed Cable Routing Assemblies in Buildings~~

~~Applications Listed Cable Routing Assembly Type Plenum Riser General-Purpose In ducts specifically fabricated for environmental air as described in 300.22(B) In fabricated ducts N N N In metal raceway that complies with 300.22(B) N N N In other spaces used for environmental air (plenums) 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) N N N In plenum communications raceways N N N Supported by open metal cable trays Y N N Supported by solid bottom metal cable trays with solid metal covers N N N In risers In vertical runs Y Y N In metal raceways N N N In fireproof shafts Y Y Y In plenum communications raceways N N N In riser communications raceways N N N In one- and two-family dwellings Y Y Y Within buildings in other than air-handling spaces and risers General Y Y Y In one- and two-family dwellings Y Y Y In multifamily dwellings Y Y Y In nonconcealed spaces Y Y Y Supported by cable trays Y Y Y Under carpet, modular flooring, and planks N N N In distributing frames and cross-connect arrays Y Y Y In any raceway recognized in Chapter 3 N N N In plenum communications raceways N N N In riser communications raceways N N N In general-purpose communications raceways N N N~~

~~Note: An "N" in the table indicates that the cable routing assembly type shall not be permitted to be installed in the application. A "Y" indicates that the cable routing assembly type shall be permitted to be installed in the application subject to the limitations described in 800.113.~~

## Statement of Problem and Substantiation for Public Input

Most of the entries in Table 800.154(a), Applications of Listed Communications Wires, Cables, and Network-Powered Broadband Communications System Cables in Buildings; Table 800.154(b), Applications of Listed Communications Raceways in Buildings; and Table 800.154(c) Applications of Listed Cable Routing Assemblies in Buildings, are "Y" which indicates that the application is permitted within the limitations of 800.110 and 800.113. If all the "Y" entries were deleted, no mandatory requirements would be lost because they are already in 800.110 and 800.113. The entries that are shown as "N" are equivalent to a "use not permitted".

With the changes to 800.113 in PI 2715, Tables 800.154(a), (b) & (c) become redundant and can be deleted.

This PI deletes section 800.154 which includes Tables 800.154(a), (b) & (c).

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 2715-NFPA 70-2020 [Section No. 800.113] | companion PI that revises 800.13 to permit the deletion of 800.154. |
| Public Input No. 2715-NFPA 70-2020 [Section No. 800.113] | |
| Public Input No. 2727-NFPA 70-2020 [Section No. 645.3(B)] | |
| Public Input No. 2728-NFPA 70-2020 [Section No. 645.10(B)] | |
| Public Input No. 2729-NFPA 70-2020 [Section No. 645.3(F)] | |
| Public Input No. 2730-NFPA 70-2020 [Section No. 646.3(B)] | |
| Public Input No. 2731-NFPA 70-2020 [Section No. 646.3(F)] | |
| Public Input No. 2732-NFPA 70-2020 [Section No. 725.3(M)] | |
| Public Input No. 2733-NFPA 70-2020 [Section No. 725.3(N)] | |
| Public Input No. 2734-NFPA 70-2020 [Section No. 760.3(L)] | |
| Public Input No. 2735-NFPA 70-2020 [Section No. 760.3(M)] | |
| Public Input No. 2736-NFPA 70-2020 [Section No. 770.110] | |

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## Public Input No. 3226-NFPA 70-2020 [ Section No. 800.154 ]

**800.154** Applications of Listed Communications Wires, Cables, and Raceways, and Listed Cable Routing Assemblies.

Permitted and nonpermitted applications of listed communications wires, cables, coaxial cables, network-powered broadband communications system cables and raceways, and listed cable routing assemblies, shall be in accordance with one of the following:

(1) Listed communications wires and cables as indicated in Table 800.154(a)

(2) Listed communications raceways as indicated in Table 800.154(b)

(3) Listed cable routing assemblies as indicated in Table 800.154(c)

The permitted applications shall be subject to the installation requirements of 800.110 and 800.113.

Table 800.154(a) Applications of Listed Communications Wires, Cables, and Network-Powered Broadband Communications System Cables ~~in Buildings~~ on the Customer Side of the Communication Service Point

| Applications | | Wire and Cable Type | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BM BL |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | Y | N | N | N | N | N | N | N |
| | In metal raceway that complies with 300.22(B) | Y | Y | Y | Y | Y | Y | N | N |
| In other spaces used for environmental air (plenums) as described in 300.22(C) | In other spaces used for environmental air | Y | N | N | N | N | N | N | N |
| | In metal raceway that complies with 300.22(C) | Y | Y | Y | Y | Y | Y | N | N |
| | In plenum communications raceways | Y | N | N | N | N | N | N | N |
| | In plenum cable routing assemblies | Y | N | N | N | N | N | N | N |
| | Supported by open metal cable trays | Y | N | N | N | N | N | N | N |
| | Supported by solid bottom metal cable trays with solid metal covers | Y | Y | Y | Y | Y | Y | N | N |
| In risers | In vertical runs | Y | Y | Y | N | N | N | N | N |
| | In metal raceways | Y | Y | Y | Y | Y | Y | N | N |

| Applications | | Wire and Cable Type | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BMBL |
| | In fireproof shafts | Y | Y | Y | Y | Y | Y | N | N |
| | In plenum communications raceways | Y | Y | N | N | N | N | N | N |
| | In plenum cable routing assemblies | Y | Y | N | N | N | N | N | N |
| | In riser communications raceways | Y | Y | N | N | N | N | N | N |
| | In riser cable routing assemblies | Y | Y | N | N | N | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y | Y | Y | Y | N | N |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y | Y | Y | Y | N | N |
| | In one- and two-family dwellings | Y | Y | Y | Y | Y | Y | Y | N |
| | In multifamily dwellings | Y | Y | Y | Y | Y | Y | Y | N |
| | In nonconcealed spaces | Y | Y | Y | Y | Y | Y | Y | N |
| | Supported by cable trays | Y | Y | Y | Y | Y | N | N | N |
| | Under carpet, modular flooring, and planks | N | N | N | N | N | N | Y | N |
| | In distributing frames and cross-connect arrays | Y | Y | N | Y | N | N | N | N |
| | In rigid metal conduit (RMC) and intermediate metal conduit (IMC) | Y | Y | Y | Y | Y | Y | Y | Y |
| | In any raceway recognized in Chapter 3 | Y | Y | Y | Y | Y | Y | N | N |
| | In plenum communications raceways | Y | Y | N | Y | N | N | N | N |

| Applications | Wire and Cable Type | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BM BL |
| In plenum cable routing assemblies | Y | Y | N | Y | N | N | N | N |
| In riser communications raceways | Y | Y | N | Y | N | N | N | N |
| In riser cable routing assemblies | Y | Y | N | Y | N | N | N | N |
| In general-purpose communications raceways | Y | Y | N | Y | N | N | N | N |
| In general-purpose cable routing assemblies | Y | Y | N | Y | N | N | N | N |

Note: An “N” in the table indicates that the cable type shall not be permitted to be installed in the application. A “Y” indicates that the cable type shall be permitted to be installed in the application subject to the limitations described in 800.113. The Riser column includes all riser cables except BMR, and the General-Purpose column includes all general-purpose cables except BM.

Informational Note No. 1: Part IV of Article 800 covers ~~installation methods within buildings~~ wiring on the customer side of the communication service point . This table covers the applications of listed communications wires, cables, and raceways ~~in buildings~~ . See the definition of *Point of Entrance* in 800.2.

Informational Note No. 2: For information on the restrictions to the installation of communications cables in fabricated ducts, see 800.113(B).

Table 800.154(b) Applications of Listed Communications Raceways ~~in Buildings~~ on the Customer Side of the Communication Service Point

| Applications | | Listed Communications Raceway Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | N | N | N |
| | In metal raceway that complies with 300.22(B) | N | N | N |
| In other spaces used for environmental air (plenums) 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 cable routing assemblies | N | N | N |
| | Supported by open metal cable trays | Y | N | N |

| Applications | | Listed Communications Raceway Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| | 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 cable routing assemblies | N | N | N |
| | In riser cable routing assemblies | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y |
| | In one- and two-family dwellings | Y | Y | Y |
| | In multifamily dwellings | Y | Y | Y |
| | In nonconcealed spaces | Y | Y | Y |
| | Supported by cable trays | Y | Y | Y |
| | Under carpet, modular flooring, and planks | N | N | N |
| | In distributing frames and cross-connect arrays | Y | Y | Y |
| | In any raceway recognized in Chapter 3 | Y | Y | Y |
| | In plenum cable routing assemblies | N | N | N |
| | In riser cable routing assemblies | N | N | N |
| | In general-purpose cable routing assemblies | N | N | N |

Note: An “N” in the table indicates that the communications raceway type shall not be permitted to be installed in the application. A “Y” indicates that the communications raceway type shall be permitted to be installed in the application, subject to the limitations described in 800.110 and 800.113.

Table 800.154(c) Applications of Listed Cable Routing Assemblies in Buildings

| Applications | | Listed Cable Routing Assembly Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | N | N | N |
| | In metal raceway that complies with 300.22(B) | N | N | N |
| In other spaces used for environmental air (plenums) as | In other spaces used for environmental air | Y | N | N |

| Applications | | Listed Cable Routing Assembly Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| described in 300.22(C) | In metal raceway that complies with 300.22(C) | N | N | N |
| | In plenum communications raceways | N | N | N |
| | Supported by open metal cable trays | Y | N | N |
| | Supported by solid bottom metal cable trays with solid metal covers | N | N | N |
| In risers | In vertical runs | Y | Y | N |
| | In metal raceways | N | N | N |
| | In fireproof shafts | Y | Y | Y |
| | In plenum communications raceways | N | N | N |
| | In riser communications raceways | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y |
| | In one- and two-family dwellings | Y | Y | Y |
| | In multifamily dwellings | Y | Y | Y |
| | In nonconcealed spaces | Y | Y | Y |
| | Supported by cable trays | Y | Y | Y |
| | Under carpet, modular flooring, and planks | N | N | N |
| | In distributing frames and cross-connect arrays | Y | Y | Y |
| | In any raceway recognized in Chapter 3 | N | N | N |
| | In plenum communications raceways | N | N | N |
| | In riser communications raceways | N | N | N |
| | In general-purpose communications raceways | N | N | N |

Note: An “N” in the table indicates that the cable routing assembly type shall not be permitted to be installed in the application. A “Y” indicates that the cable routing assembly type shall be permitted to be installed in the application subject to the limitations described in 800.113.

## Additional Proposed Changes

| File Name | Description | Approved |
|---|---|---|
| Chapter_8_-_2020-09-03_CC_Task_Group.pdf | | |

## Statement of Problem and Substantiation for Public Input

This public input is being submitted by a Correlating Committee Task Group to improve the correlation between Chapter 7 and 8. At the present time there are significant correlation issues with regards to what constitutes an installation in Chapter 7 and what constitutes an installation in Chapter 8.

Previously a Correlating Committee Task Group was formed to review Chapter 8 and to make suggested modifications. This Chapter 8 task group has submitted a public input to define Communication Service point and has submitted a public input to determine where the actual service point exists within communication systems. It is very difficult for an AHJ to determine where there inspection authority begins and this work will help provide clarity and usability.

This public input follows up on the work of that specific task group and provides editorial revisions to further improve on that work. Public inputs are being submitted to change Titles and certain wording to reflect what wiring is on the customer side of the Communication Service Point and what wiring is on the communication utility or service provider side of this point.

The Correlating Committee Task Group is a long range planning committee that is seeking to make improvement over the next two to three cycles. The Task Group is made up of the following members: Alan Manche, Donny Cook, Randy Ivans, Ernie Gallo, and Thomas Domitrovich.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 3223-NFPA 70-2020 [Sections Part IV., 805.133] | |
| Public Input No. 3224-NFPA 70-2020 [Sections 800.27, Part II., 800.44] | |
| Public Input No. 3225-NFPA 70-2020 [Part IV.] | |
| Public Input No. 3227-NFPA 70-2020 [Part II.] | |
| Public Input No. 3229-NFPA 70-2020 [Part V.] | |
| Public Input No. 3230-NFPA 70-2020 [Part II.] | |
| Public Input No. 3231-NFPA 70-2020 [Sections Part V., 830.133] | |
| Public Input No. 3232-NFPA 70-2020 [Sections Part II., 840.47, 840.48, Part III.] | |
| Public Input No. 3233-NFPA 70-2020 [Part V.] | |
| Public Input No. 3223-NFPA 70-2020 [Sections Part IV., 805.133] | |
| Public Input No. 3224-NFPA 70-2020 [Sections 800.27, Part II., 800.44] | |
| Public Input No. 3227-NFPA 70-2020 [Part II.] | |
| Public Input No. 3230-NFPA 70-2020 [Part II.] | |
| Public Input No. 3232-NFPA 70-2020 [Sections Part II., 840.47, 840.48, Part III.] | |
| Public Input No. 3233-NFPA 70-2020 [Part V.] | |

## Submitter Information Verification

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**Committee:** NEC-P16

## Chapter 8 Communications Systems

# Article 800 General Requirements for Communications Systems

### Part I. General

#### 800.1 Scope.

This article covers general requirements for communications systems. These general requirements apply to communications circuits, community antenna television and radio distribution systems, network-powered broadband communications systems, and premises-powered broadband communications systems, unless modified by Articles 805, 820, 830, or 840.

Informational Note No. 1: See 90.2(B)(4) for installations of circuits and equipment that are not covered.

Informational Note No. 2: For further information for remote control, signaling, and power-limited circuits, see Article 725.

Informational Note No. 3: For further information for fire alarm systems, see Article 760.

#### 800.2 Definitions.

The definitions in Part I of Article 100 shall apply throughout Chapter 8. The definitions in 800.2 shall apply only within Chapter 8.

**Abandoned Cable.**

Cable that is not terminated at equipment or is not identified for future use with a tag.

**Block.**

A square or portion of a city, town, or village enclosed by streets and including the alleys so enclosed, but not any street.

**Cable Sheath.**

A covering over the conductor assembly that may include one or more metallic members, strength members, or jackets.

**Communications Circuit.**

The circuit that extends service from the communications utility or service provider up to and including the customer's communications equipment.

**Communications Service Provider.**

An organization, business, or individual that offers communications service to others.

**Exposed (to Accidental Contact).**

A circuit in such a position that, in case of failure of supports or insulation, contact with another circuit may result.

Informational Note: See Part I of Article 100 for two other definitions of Exposed: *Exposed (as applied to live parts)* and *Exposed (as applied to wiring methods)*.

**Point of Entrance.**

The point within a building at which the wire or cable emerges from an external wall or from a concrete floor slab.

**Premises.**

The land and buildings of a user located on the user side of the utility-user ~~network point of demarcation~~.

#### 800.3 Other Articles.

Only those sections of Chapters 1 through 7 referenced in Chapter 8 shall apply to Chapter 8.

**(A) Hazardous (Classified) Locations.**

Circuits and equipment installed in a location that is classified in accordance with 500.5 and 505.5 shall comply with the applicable requirements of Chapter 5.

**(B) Wiring in Ducts for Dust, Loose Stock, or Vapor Removal.**

The requirements of 300.22(A) shall apply.

**(C) Equipment in Other Space Used for Environmental Air.**

The requirements of 300.22(C)(3) shall apply.

**(D) Installation and Use.**

The requirements of 110.3(B) shall apply.

**(E) Optical Fiber Cable.**

Where optical fiber cable is used to provide a communications circuit within a building, Article 770 shall apply.

**(F) Other Communications Systems.**

As appropriate for the system involved, communications systems shall also comply with the requirements of the following:

1. Communications circuits — Article 805
2. Radio and television equipment — Article 810
3. Community antenna television and radio distribution systems — Article 820
4. Network-powered broadband communications systems — Article 830
5. Premises-powered broadband communications systems — Article 840

**(G) Reconditioned Equipment.**

The requirements of 110.21(A)(2) shall apply.

### 800.21 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.

### 800.24 Mechanical Execution of Work.

Circuits and equipment 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 also conform to 300.4 and 300.11. 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 805.170(C).

Informational Note No. 1: Accepted industry practices are described in ANSI/TIA-568.1- D-2015, *Commercial Building Telecommunications Infrastructure Standard;* ANSI/TIA-569-D-2015, *Telecommunications Pathways and Spaces;* ANSI/TIA-570-C-2012, *Residential Telecommunications Infrastructure Standard;* ANSI/TIA-1005-A-2012, *Telecommunications Infrastructure Standard for Industrial Premises;* ANSI/ TIA-1179-2010, *Healthcare Facility Telecommunications Infrastructure Standard;* ANSI/TIA-4966-2014, *Telecommunications Infrastructure Standard for Educational Facilities;* and other ANSI-approved installation standards.

Informational Note No. 2: 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. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of wire and cable properties.

### 800.25 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.

### 800.26 Spread of Fire or Products of Combustion.

Installations of cables, communications raceways, cable routing assemblies 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 penetrations of cables, communications raceways, and cable routing assemblies 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 800.26 can be found in building codes, fire resistance directories, and product listings.

### 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.

## Part II. Wires and Cables Outside and on the service provider side of the Communication Service Point ~~Entering Buildings~~

### 800.44 Overhead (Aerial) Wires and Cables.

Overhead (aerial) wires and cables on the service provider side of the Communication Service Point ~~entering buildings~~ shall comply with 800.44(A) through (D).

Informational Note: For additional information regarding overhead (aerial) wires and cables, see ANSI C2-2017, *National Electrical Safety Code, Part 2 Safety Rules for Overhead Lines.*

#### (A) On Poles and In-Span.

Where wires and cables and electric light or power conductors are supported by the same pole or are run parallel to each other in-span, the conditions described in 800.44(A)(1) through (A)(4) shall be met.

#### (1) Relative Location.

Where practicable, the wires and cables shall be located below the electric light or power conductors.

#### (2) Attachment to Cross-Arms.

Wires and cables shall not be attached to a cross-arm that carries electric light or power conductors.

#### (3) Climbing Space.

The climbing space through wires and cables shall comply with the requirements of 225.14(D).

#### (4) Clearance.

Supply service drops and sets of overhead service conductors of 0 volts to 750 volts running above and parallel to communications and CATV type coaxial service drops shall have a minimum separation of 300 mm (12 in.) at any point in the span, including the point of and at their attachment to the building, provided that the ungrounded conductors are insulated and that a clearance of not less than 1.0 m (40 in.) is maintained between the two services at the pole.

#### (B) Above Roofs.

Communications wires and cables and CATV type coaxial cables shall have a vertical clearance of not less than 2.5 m (8 ft) from all points of roofs above which they pass.

*Exception No. 1: Communications wires and cables and CATV type coaxial cables shall not be required to have a vertical clearance of not less than 2.5 m (8 ft) above auxiliary buildings, such as garages and the like.*

*Exception No. 2: A reduction in clearance above only the overhanging portion of the roof to not less than 450 mm (18 in.) shall be permitted if (1) not more than 1.2 m (4 ft) of communications service-drop conductors pass above the roof overhang and (2) they are terminated at a through- or above-the-roof raceway or approved support.*

*Exception No. 3: Where the roof has a slope of not less than 100 mm in 300 mm (4 in. in 12 in.), a reduction in clearance to not less than 900 mm (3 ft) shall be permitted.*

Informational Note: For additional information regarding overhead (aerial) wires and cables, see ANSI/IEEE C2-2017, *National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines*.

**(C) On Masts.**

Overhead (aerial) communications and CATV type coaxial cables shall be permitted to be attached to an above-the-roof raceway mast that does not enclose or support conductors of electric light or power circuits.

**(D) Between Buildings.**

Communications and CATV type coaxial cables extending between buildings or structures, and also the supports or attachment fixtures, shall be identified and shall have sufficient strength to withstand the loads to which they might be subjected.

*Exception: Where a coaxial cable does not have sufficient strength to be self-supporting, it shall be attached to a supporting messenger cable that, together with the attachment fixtures or supports, shall be acceptable for the purpose and shall have sufficient strength to withstand the loads to which they may be subjected.*

**800.48 Communication Service Point.** The Communication Service Point shall be at a readily accessible location either outside or inside of a building or structure near to the point of entrance of the conductors in accordance with the one or more of the following:

1. The point of connection at which the communication service provider's network (outside plant) transitions to the premises wiring. The location of this point shall not be located further than 50 feet from the point of entrance.

2. The point of connection in an individual dwelling shall be located so as not to exceed 24 inches from the primary protector on the premises side of the protector.

3. A physical protection point or communications cable exiting the connection enclosure on the individual building side of the enclosure.

4. The point of connection at the Grounding Block, where required.

5. The point where a wireless signal transitions from the antenna or dish through a wired connection to transmitting or receiving equipment. The location of this point shall be permitted to include the ground connection at the antenna discharge unit or coaxial cable connection to the transmitting/receiving station (see 810.21).

6. The point of connection between nonconductive optical fiber cable entering the building and premises optical fiber cable inside the building not to exceed 50 feet from the point of entrance.

7. The Communication Service Point shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC), Electrical metallic tubing (EMT), intermediate metal conduit (IMC), or Rigid polyvinyl chloride conduit (PVC) to the point of emergence (see 770.48, 805.48, 820.48 and 830.48).

Informational Note: The transition and connection points listed above may be co-located. For example, a primary protector may be located inside a network interface unit (item 3) with a connection to an adjacent grounding block (Item 4) within 24 inches, and a connection to the premise wiring (item 2).

### 800.49 Metal Entrance Conduit Grounding.

Metal conduit containing entrance wire or cable shall be connected by a bonding conductor or grounding electrode conductor to a grounding electrode or, where present, the building grounding electrode system in accordance with 800.100(B).

### 800.53 Separation from Lightning Conductors.

Where practicable, a separation of at least 1.8 m (6 ft) shall be maintained between lightning conductors and all communication wires and cables and CATV type coaxial cables on buildings.

Informational Note No. 1: For additional information regarding overhead (aerial) wires and cables, see ANSI C2-2017 *National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines*.

Informational Note No. 2: Specific separation distances may be calculated from the sideflash equation in NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems.*

## Part III. Grounding Methods

### 800.100 Cable and Primary Protector Bonding and Grounding.

#### (A) Bonding Conductor or Grounding Electrode Conductor.

#### (1) Insulation.

The bonding conductor or grounding electrode conductor shall be listed and shall be permitted to be insulated, covered, or bare.

#### (2) Material.

The bonding conductor or grounding electrode conductor shall be copper or other corrosion-resistant conductive material, stranded or solid.

#### (3) Size.

The bonding conductor or grounding electrode conductor shall not be smaller than 14 AWG. The bonding conductor or grounding electrode conductor shall have a current-carrying capacity not less than the grounded metallic cable sheath member of the communications cable, the protected conductor of the communications cable, or the outer sheath of the coaxial cable, as applicable. The bonding conductor or grounding electrode conductor shall not be required to exceed 6 AWG.

#### (4) Length.

The bonding conductor or grounding electrode conductor shall be as short as practicable. In one- and two-family dwellings, the bonding conductor or grounding electrode conductor shall be as short as practicable, not to exceed 6.0 m (20 ft) in length.

Informational Note: Similar bonding conductor or grounding electrode conductor length limitations applied at apartment buildings and commercial buildings help to reduce voltages that may be developed between the building's power and communications systems during lightning events.

*Exception: In one- and two-family dwellings where it is not practicable to achieve an overall maximum bonding conductor or grounding electrode conductor length of 6.0 m (20 ft), a separate ground rod meeting the minimum dimensional criteria of 800.100(B)(3)(2) or (B)(3)(3) shall be driven, the bonding conductor or grounding electrode conductor shall be connected to the ground rod in accordance with 800.100(C), and the ground rod shall be connected to the power grounding electrode system in accordance with 800.100(D).*

#### (5) Run in Straight Line.

The bonding conductor or grounding electrode conductor shall be run in as straight a line as practicable.

#### (6) Physical Protection.

Bonding conductors and grounding electrode conductors shall be protected where exposed to physical damage. Where the bonding conductor or grounding electrode conductor is installed in a metal raceway, both ends of the raceway shall be bonded to the contained conductor or to the same terminal or electrode to which the bonding conductor or grounding electrode conductor is connected.

**(B) Electrode.**

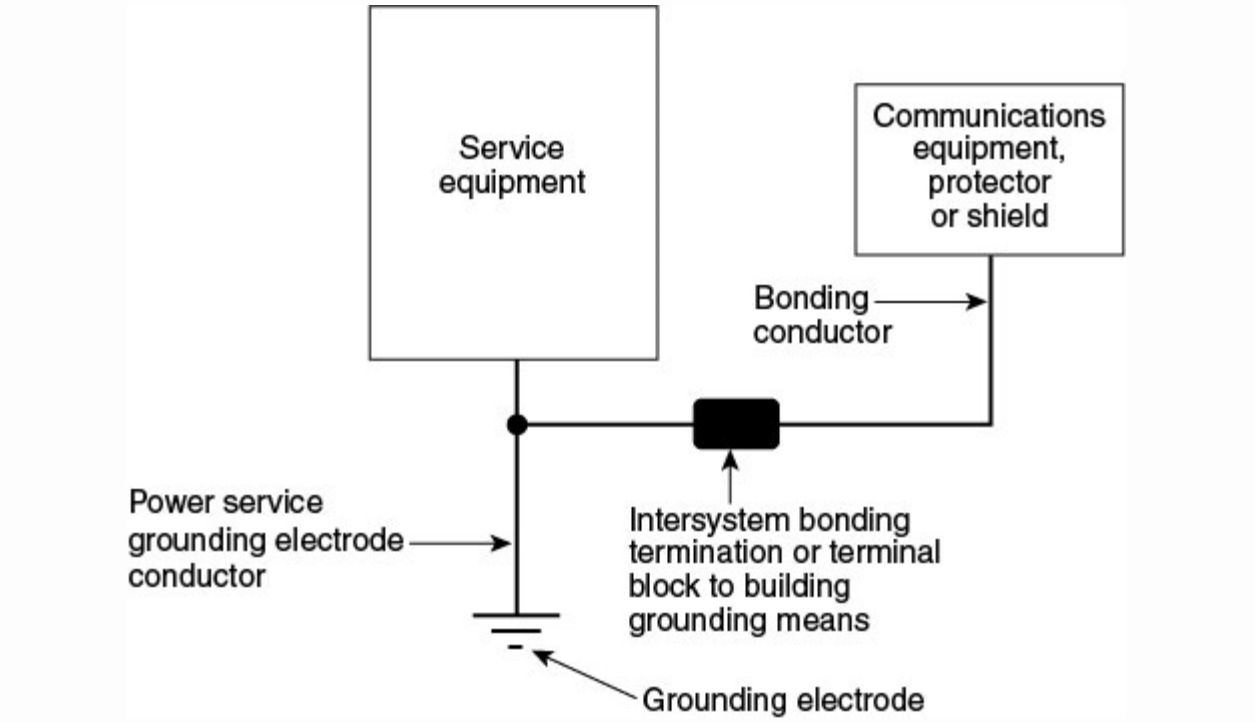
The bonding conductor or grounding electrode conductor shall be connected in accordance with 800.100(B)(1), (B)(2) , or (B)(3).

**(1) In Buildings or Structures with an Intersystem Bonding Termination.**

If the building or structure served has an intersystem bonding termination as required by 250.94, the bonding conductor shall be connected to the intersystem bonding termination.

Informational Note: Informational Note Figure 800.100(B)(1) illustrates the connection of the bonding conductor in buildings or structures equipped with an intersystem bonding termination or a terminal block providing access to the building grounding means.

**Figure Informational Note Figure 800.100(B)(1) Illustration of a Bonding Conductor in a Communications Installation.**




**(2) In Buildings or Structures with Grounding Means.**

If an intersystem bonding termination is established, 250.94(A) shall apply. If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on one of the following:

1. The building or structure grounding electrode system as covered in 250.50
2. The grounded interior metal water piping system, within 1.5 m (5 ft) from its point of entrance to the building, as covered in 250.52
3. The power service accessible means external to enclosures using the options identified in 250.94(A), Exception
4. The nonflexible metal power service raceway
5. The service equipment enclosure

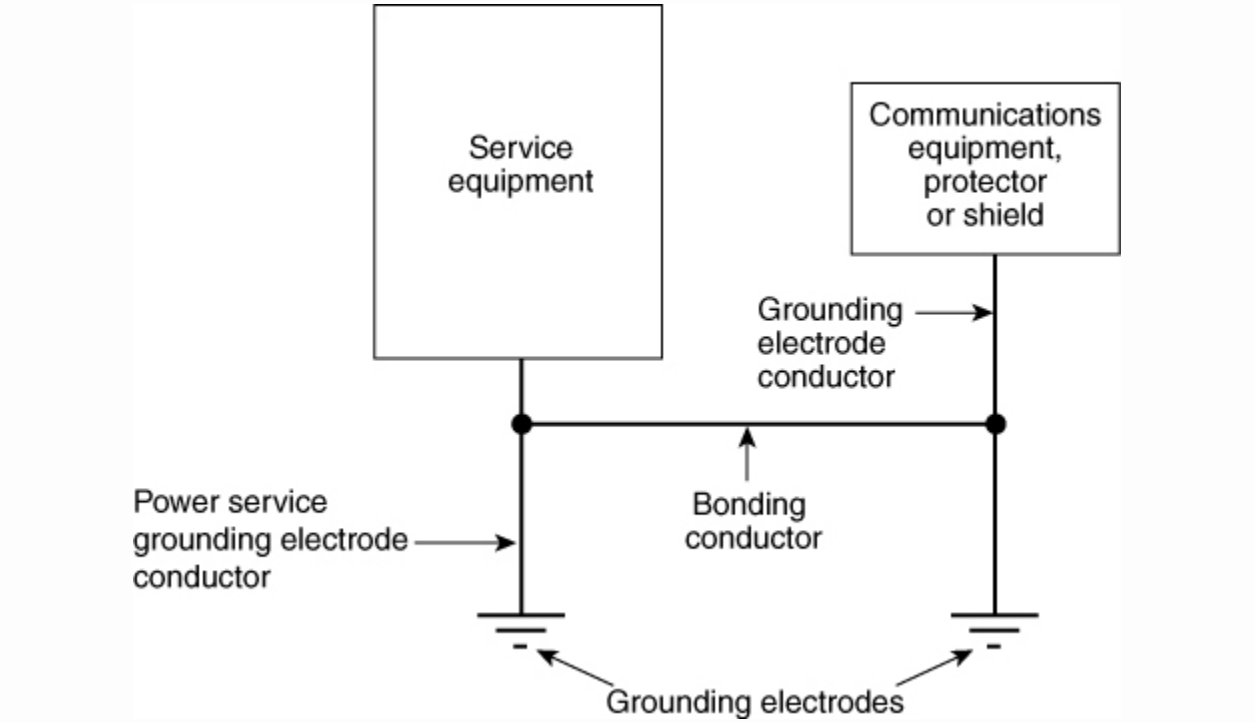
6. The grounding electrode conductor or the grounding electrode conductor metal enclosure of the power service
7. The grounding electrode conductor or the grounding electrode of a building or structure disconnecting means that is connected to a grounding electrode as covered in 250.32

A bonding device intended to provide a termination point for the bonding conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on nonremovable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is nonremovable.

For purposes of this section, the mobile home service equipment or the mobile home disconnecting means located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means connected to an electrode by a grounding electrode conductor in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Informational Note Figure 800.100(B)(2) illustrates the connection of the bonding conductor in buildings or structures not equipped with an intersystem bonding termination or a terminal block providing access to the building grounding means.

**Figure Informational Note Figure 800.100(B)(2) Illustration of a Grounding Electrode Conductor and a Bonding Conductor in a Communications Installation.**




**(3) In Buildings or Structures Without an Intersystem Bonding Termination or Grounding Means.**

If the building or structure served has no intersystem bonding termination or grounding means, as described in 800.100(B)(2), the grounding electrode conductor shall be connected to one of the following:

1. To any one of the individual grounding electrodes described in 250.52(A)(1), (A)(2), (A)(3), or (A)(4)
2. If the building or structure served has no intersystem bonding termination or grounding means, as described in 800.100(B)(2) or (B)(3)(1), to any one of the individual grounding electrodes described in 250.52(A)(5), (A)(7), and (A)(8)

3. For communications circuits covered in Article 805 or network-powered broadband communications systems covered in Article 830, to a ground rod or pipe not less than 1.5 m (5 ft) in length and 12.7 mm (0.5 in.) in diameter, driven, where practicable, into permanently damp earth and separated from lightning protection system conductors, as covered in 800.53, and at least 1.8 m (6 ft) from electrodes of other systems

Steam pipes, hot water pipes, or lightning protection system conductors shall not be employed as grounding electrodes for protectors and grounded metallic members.

**(C) Electrode Connection.**

Connections to grounding electrodes shall comply with 250.70.

**(D) Bonding of Electrodes.**

A bonding jumper not smaller than 6 AWG copper or equivalent shall be connected between the grounding electrode and power grounding electrode system at the building or structure served where separate electrodes are used.

*Exception: At mobile homes as covered in 800.106.*

Informational Note No. 1: See 250.60 for connection to a lightning protection system.

Informational Note No. 2: Bonding together of all separate electrodes limits potential differences between them and between their associated wiring systems.

**800.106 Primary Protector Grounding and Bonding at Mobile Homes.**

**(A) Grounding.**

Grounding shall comply with 800.106(A)(1) and (A)(2).

**(1) Mobile Home Service Equipment.**

Where there is no mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, grounding shall comply with one of the following:

1. The primary protector grounding terminal; the coaxial cable shield ground, or surge arrester grounding terminal; or the network-powered broadband communications cable shield, network-powered broadband communications cable metallic members not used for communications or powering, and network interface unit shall be connected to a grounding electrode conductor or grounding electrode in accordance with 800.100(B)(3).
2. The non-current-carrying metallic members of optical fiber cables shall be connected to a grounding electrode in accordance with 770.106(A)(1). The network terminal, if required to be grounded, shall be connected to a grounding electrode in accordance with 800.106(A)(1)(1). The grounding electrode shall be bonded in accordance with 770.106(B).

**(2) Mobile Home Feeder Disconnecting Means.**

Where there is no mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, grounding shall comply with one of the following:

1. The primary protector grounding terminal; the network-powered broadband communications cable shield, network-powered broadband communications cable metallic members not used for communications or powering, and network interface unit shall be connected to a grounding electrode in accordance with 800.100(B)(3).
2. The non-current-carrying metallic members of optical fiber cables shall be connected to a grounding electrode in accordance with 770.106(A)(2). The network terminal, if required to be grounded, shall be connected to a grounding electrode in accordance with 800.106(A)(2). The grounding electrode shall be bonded in accordance with 770.106(B).

**(B) Bonding.**

The primary protector grounding terminal or grounding electrode, network-powered broadband communications cable grounding terminal, or network interface unit grounding terminal shall be bonded together and connected to the metal frame or available grounding terminal of the mobile home with a copper conductor not smaller than 12 AWG under either of the following conditions:

1. Where there is no mobile home service equipment or disconnecting means as in 800.106(A)
2. Where the mobile home is supplied by cord and plug

**Part IV. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**800.110 Raceways, Cable Routing Assemblies, and Cable Trays.**

**(A) Types of Raceways.**

Wires and cables shall be permitted to be installed in raceways that comply with either 800.110(A)(1) or (A)(2). Medium-power network-powered broadband communications cables shall not be permitted to be installed in raceways that comply with 800.110(A)(2).

**(1) Raceways Recognized in Chapter 3.**

Wires and 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.**

Wires and 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.

**(3) Innerduct for Communications Wires and Cables, Coaxial Cables, or Network-Powered Broadband Communications Cables.**

Listed plenum communications raceways, listed riser communications raceways, and listed general-purpose communications raceways 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.**

The raceway fill requirements of Chapters 3 and 9 shall apply to medium-power network-powered broadband communications cables.

**(C) Cable Routing Assemblies.**

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)(1) and (C)(2) and 800.113.

**(1) Horizontal Support.**

Cable routing assemblies shall be supported where run horizontally at intervals not to exceed 900 mm (3 ft) and at each end or joint, unless listed for other support intervals. In no case shall the distance between supports exceed 3 m (10 ft).

**(2) Vertical Support.**

Vertical runs of cable routing assemblies shall be supported at intervals not exceeding 1.2 m (4 ft), unless listed for other support intervals, and shall not have more than one joint between supports.

**(D) Cable Trays.**

Wires and cables and communications raceways shall be permitted to be installed in metal or listed nonmetallic cable tray systems. Ladder cable trays shall be permitted to support cable routing assemblies.

## 800.113 Installation of Wires, Cables, Cable Routing Assemblies, and Communications Raceways.

Installation of wires, cables, cable routing assemblies, and communications raceways shall comply with 800.113(A) through (L). Installation of cable routing assemblies and communications raceways shall comply also with 800.110.

**(A) Listing.**

Wires, cables, cable routing assemblies, and communications raceways installed in buildings shall be listed.

*Exception: Cables installed in compliance with 805.48 or 820.48 shall not be required to be listed.*

**(B) Ducts Specifically Fabricated for Environmental Air.**

The following wires and 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. Plenum cables up to 1.22 m (4 ft) in length
2. Plenum cables, riser cables, general-purpose cables, and limited-use 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 NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

**(C) Other Spaces Used for Environmental Air (Plenums).**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted in other spaces used for environmental air as described in 300.22(C):

1. Plenum cables
2. Plenum communications raceways
3. Plenum cable routing assemblies
4. Plenum cables installed in plenum communications raceways
5. Plenum cables installed in plenum cable routing assemblies
6. Plenum cables and plenum communications raceways supported by open metal cable tray systems
7. Plenum cables, riser cables, general-purpose cables, limited-use cables, and communications wires installed in raceways that are installed in compliance with 300.22(C)
8. Plenum cables, riser cables, general-purpose cables, limited-use cables, 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)
9. Plenum cables, riser cables, general-purpose cables, and limited-use 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, see NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

**(D) Risers — Cables, Cable Routing Assemblies, and Communications Raceways in Vertical Runs.**

The following cables, cable routing assemblies, and communications raceways shall be permitted in vertical runs penetrating one or more floors and in vertical runs in a shaft:

1. Plenum and riser cables
2. Plenum and riser communications raceways
3. Plenum and riser cable routing assemblies
4. Plenum and riser cables installed in:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) Plenum cable routing assemblies
    d) Riser cable routing assemblies

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**(E) Risers — Cables and Innerducts in Metal Raceways.**

The following cables and innerducts shall be permitted in metal raceways in a riser having firestops at each floor:

1. Plenum cables, riser cables, general-purpose cables, and limited-use cables
2. Plenum, riser, and general-purpose communications raceways
3. Plenum cables, riser cables, general-purpose cables, and limited-use cables installed in:
    a) Plenum communications raceways (innerduct)
    b) Riser communications raceways (innerduct)
    c) General-purpose communications raceways (innerduct)

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**(F) Risers — Cables, Cable Routing Assemblies, and Communications Raceways in Fireproof Shafts.**

The following cables, cable routing assemblies, and communications raceways shall be permitted to be installed in fireproof riser shafts having firestops at each floor:

1. Plenum cables, riser cables, general-purpose cables, and limited-use cables
2. Plenum, riser, and general-purpose communications raceways
3. Plenum, riser, and general-purpose cable routing assemblies
4. Plenum cables, riser cables, general-purpose cables, and limited-use cables installed in:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
    d) Plenum cable routing assemblies
    e) Riser cable routing assemblies
    f) General-purpose cable routing assemblies

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**(G) Risers — One- and Two-Family Dwellings.**

The following cables, cable routing assemblies, and communications raceways shall be permitted in one- and two-family dwellings:

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables less than 6 mm (0.25 in.) in diameter
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Plenum cables, riser cables, and general-purpose cables installed in:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
    d) Plenum cable routing assemblies
    e) Riser cable routing assemblies
    f) General-purpose cable routing assemblies

**(H) Cable Trays.**

The following wires, cables, and communications raceways shall be permitted to be supported by cable trays:

1. Plenum cables, riser cables, and general-purpose cables
2. Plenum, riser, and general-purpose communications raceways
3. Communications wires, plenum cables, riser cables, and general-purpose cables installed in:
    1. Plenum communications raceways
    2. Riser communications raceways
    3. General-purpose communications raceways

**(I) Distributing Frames and Cross-Connect Arrays.**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in distributing frames and cross-connect arrays:

1. Plenum cables, riser cables, general-purpose cables, and communications wires
2. Plenum, riser, and general-purpose communications raceways
3. Plenum, riser, and general-purpose cable routing assemblies
4. Communications wires, plenum cables, riser cables, and general-purpose cables installed in:
    1. Plenum communications raceways
    2. Riser communications raceways
    3. General-purpose communications raceways
    4. Plenum cable routing assemblies
    5. Riser cable routing assemblies
    6. General-purpose cable routing assemblies

**(J) Other Building Locations.**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in building locations other than the locations covered in 800.113(B) through (I):

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables with a maximum of 3 m (10 ft) of exposed length in nonconcealed spaces
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
6. Plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum cable routing assemblies
    b) Riser cable routing assemblies
    c) General-purpose cable routing assemblies
7. Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3
8. Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks

**(K) Multifamily Dwellings.**

The following cables, cable routing assemblies, and communications raceways shall be permitted to be installed in multifamily dwellings in locations other than the locations covered in 800.113(B) through (G):

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables less than 6 mm (0.25 in.) in diameter in nonconcealed spaces
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
6. Plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum cable routing assemblies
    b) Riser cable routing assemblies
    c) General-purpose cable routing assemblies
7. Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3
8. Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks

**(L) One- and Two-Family Dwellings.**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in one- and two-family dwellings in locations other than the locations covered in 800.113(B) through (F):

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables less than 6 mm (0.25 in.) in diameter
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:
   a) Plenum communications raceways
   b) Riser communications raceways
   c) General-purpose communications raceways
6. Plenum cables, riser cables, and general-purpose cables installed in the following
   a) Plenum cable routing assemblies
   b) Riser cable routing assemblies
   c) General-purpose cable routing assemblies
7. Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3
8. Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks
9. Hybrid power and communications cable listed in accordance with 805.179(F)

**800.154 Applications of Listed Communications Wires, Cables, and Raceways, and Listed Cable Routing Assemblies.**

Permitted and nonpermitted applications of listed communications wires, cables, coaxial cables, network-powered broadband communications system cables and raceways, and listed cable routing assemblies, shall be in accordance with one of the following:

1. Listed communications wires and cables as indicated in Table 800.154(a)
2. Listed communications raceways as indicated in Table 800.154(b)
3. Listed cable routing assemblies as indicated in Table 800.154(c)

The permitted applications shall be subject to the installation requirements of 800.110 and 800.113.

**Table 800.154(a) Applications of Listed Communications Wires, Cables, and Network-Powered Broadband Communications System Cables on the customer side of the Communication Service Point ~~Buildings~~**

| Applications | | Wire and Cable Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BMU, BLU | Hybrid Power and Communications Cables | Communications Wires |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | Y | N | N | N | N | N | N | N | N | N |
| | In metal raceway that complies with 300.22(B) | Y | Y | Y | Y | Y | Y | N | N | N | Y |

| Applications | | Wire and Cable Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BMU, BLU | Hybrid Power and Communications Cables | Communications Wires |
| In other spaces used for environmental air (plenums) as described in 300.22(C) | In other spaces used for environmental air | Y | N | N | N | N | N | N | N | N | N |
| | In metal raceway that complies with 300.22(C) | Y | Y | Y | Y | Y | Y | N | N | N | Y |
| | In plenum communications raceways | Y | N | N | N | N | N | N | N | N | N |
| | In plenum cable routing assemblies | Y | N | N | N | N | N | N | N | N | N |
| | Supported by open metal cable trays | Y | N | N | N | N | N | N | N | N | N |
| | Supported by solid bottom metal cable trays with solid metal covers | Y | Y | Y | Y | Y | Y | N | N | N | N |
| In risers | In vertical runs | Y | Y | Y | N | N | N | N | N | N | N |
| | In metal raceways | Y | Y | Y | Y | Y | Y | N | N | N | N |
| | In fireproof shafts | Y | Y | Y | Y | Y | Y | N | N | N | N |
| | In plenum communications raceways | Y | Y | N | N | N | N | N | N | N | N |
| | In plenum cable routing assemblies | Y | Y | N | N | N | N | N | N | N | N |
| | In riser communications raceways | Y | Y | N | N | N | N | N | N | N | N |
| | In riser cable routing assemblies | Y | Y | N | N | N | N | N | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y | Y | Y | Y | N | N | Y | N |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y | Y | Y | Y | N | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y | Y | Y | Y | Y | N | Y | N |
| | In multifamily dwellings | Y | Y | Y | Y | Y | Y | Y | N | N | N |
| | In nonconcealed spaces | Y | Y | Y | Y | Y | Y | Y | N | N | N |
| | Supported by cable trays | Y | Y | Y | Y | Y | N | N | N | N | N |
| | Under carpet, modular flooring, and planks | N | N | N | N | N | N | Y | N | N | N |
| | In distributing frames and cross-connect arrays | Y | Y | N | Y | N | N | N | N | N | Y |
| | In rigid metal conduit (RMC) and intermediate metal conduit (IMC) | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |

| Applications | | Wire and Cable Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BMU, BLU | Hybrid Power and Communications Cables | Communications Wires |
| | In any raceway recognized in Chapter 3 | Y | Y | Y | Y | Y | Y | N | N | N | Y |
| | In plenum communications raceways | Y | Y | N | Y | N | N | N | N | N | Y |
| | In plenum cable routing assemblies | Y | Y | N | Y | N | N | N | N | N | Y |
| | In riser communications raceways | Y | Y | N | Y | N | N | N | N | N | Y |
| | In riser cable routing assemblies | Y | Y | N | Y | N | N | N | N | N | Y |
| | In general-purpose communications raceways | Y | Y | N | Y | N | N | N | N | N | Y |
| | In general-purpose cable routing assemblies | Y | Y | N | Y | N | N | N | N | N | Y |

Note: An "N" in the table indicates that the cable type shall not be permitted to be installed in the application. A "Y" indicates that the cable type shall be permitted to be installed in the application subject to the limitations described in 800.113. The Riser column includes all riser cables except BMR, and the General-Purpose column includes all general-purpose cables except BM.
Informational Note No. 1: Part IV of Article 800 covers wiring on the customer side of the communication service point ~~installation methods within buildings~~. This table covers the applications of listed communications wires, cables, and raceways ~~in buildings~~. See the definition of *Point of Entrance* in 800.2.

Informational Note No. 2: For information on the restrictions to the installation of communications cables in fabricated ducts, see 800.113(B).

### Table 800.154(b) Applications of Listed Communications Raceways on the customer side of the Communication Service Point~~in Buildings~~

| Applications | | Listed Communications Raceway Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | N | N | N |
| | In metal raceway that complies with 300.22(B) | N | N | N |
| In other spaces used for environmental air (plenums) 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 cable routing assemblies | N | 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 cable routing assemblies | N | N | N |
| | In riser cable routing assemblies | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y |
| | In one- and two-family dwellings | Y | Y | Y |
| | In multifamily dwellings | Y | Y | Y |

| Applications | | Listed Communications Raceway Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| | In nonconcealed spaces | Y | Y | Y |
| | Supported by cable trays | Y | Y | Y |
| | Under carpet, modular flooring, and planks | N | N | N |
| | In distributing frames and cross-connect arrays | Y | Y | Y |
| | In any raceway recognized in Chapter 3 | Y | Y | Y |
| | In plenum cable routing assemblies | N | N | N |
| | In riser cable routing assemblies | N | N | N |
| | In general-purpose cable routing assemblies | N | N | N |

Note: An “N” in the table indicates that the communications raceway type shall not be permitted to be installed in the application. A “Y” indicates that the communications raceway type shall be permitted to be installed in the application, subject to the limitations described in 800.110 and 800.113.

## Table 800.154(c) Applications of Listed Cable Routing Assemblies in Buildings

| Applications | | Listed Cable Routing Assembly Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | N | N | N |
| | In metal raceway that complies with 300.22(B) | N | N | N |
| In other spaces used for environmental air (plenums) 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) | N | N | N |
| | In plenum communications raceways | N | N | N |
| | Supported by open metal cable trays | Y | N | N |
| | Supported by solid bottom metal cable trays with solid metal covers | N | N | N |
| In risers | In vertical runs | Y | Y | N |
| | In metal raceways | N | N | N |
| | In fireproof shafts | Y | Y | Y |
| | In plenum communications raceways | N | N | N |
| | In riser communications raceways | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y |
| | In one- and two-family dwellings | Y | Y | Y |
| | In multifamily dwellings | Y | Y | Y |
| | In nonconcealed spaces | Y | Y | Y |
| | Supported by cable trays | Y | Y | Y |
| | Under carpet, modular flooring, and planks | N | N | N |
| | In distributing frames and cross-connect arrays | Y | Y | Y |
| | In any raceway recognized in Chapter 3 | N | N | N |
| | In plenum communications raceways | N | N | N |
| | In riser communications raceways | N | N | N |
| | In general-purpose communications raceways | N | N | N |

Note: An “N” in the table indicates that the cable routing assembly type shall not be permitted to be installed in the application. A “Y” indicates that the cable routing assembly type shall be permitted to be installed in the application subject to the limitations described in 800.113.

### 800.179 Plenum, Riser, General-Purpose, and Limited Use Cables.

Plenum, riser, general-purpose, and limited-use cables shall be listed in accordance with 800.179(A) through (D) and shall have a temperature rating of not less than 60°C (140°F). The temperature rating shall be marked on the jacket of cables that have a temperature rating exceeding 60°C (140°F). The cable voltage rating shall not be marked on the cable.

#### (A) Plenum Cables.

Type CMP communications plenum cables, Type CATVP community antenna television plenum coaxial cables, and Type BLP network-powered broadband communication low-power plenum cables shall be listed as being suitable for use in ducts, plenums, and other spaces 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*.

#### (B) Riser Cables.

Type CMR communications riser cables, Type CATVR community antenna television riser coaxial cables, Type BMR network-powered broadband communications medium-power riser cables, and Type BLR network-powered broadband communications low-power riser cables 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 1666-2011, *Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts.*

#### (C) General-Purpose Cables.

Type CM communications general-purpose cables, Type CATV community antenna television coaxial general-purpose cables, Type BM network-powered broadband communications medium-power general-purpose cables, and Type BL network-powered broadband communications low-power general-purpose cables shall be listed as being suitable for general-purpose use, with the exception of risers and plenums, 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 Flame Tray 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. 0.3-09, *Test Methods for Electrical Wires and Cables*.

#### (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 VW-1 (vertical-wire) flame test in ANSI/UL 1581-2017, *Reference Standard for Electrical Wires, Cables and Flexible Cords*.

## Part V. Listing Requirements

### 800.180 Grounding Devices.

Where bonding or grounding is required, devices used to connect a shield, a sheath, or non-current-carrying metallic members of a cable to a bonding conductor or grounding electrode conductor shall be listed or be part of listed equipment.

### 800.182 Cable Routing Assemblies and Communications Raceways.

Cable routing assemblies and communications raceways shall be listed in accordance with 800.182(A) through (C). Cable routing assemblies shall be marked in accordance with Table 800.182(a). Communications raceways shall be marked in accordance with Table 800.182(b).

Informational Note: For information on listing requirements for both communications raceways and cable routing assemblies, see ANSI/UL 2024-5-2015, *Cable Routing Assemblies and Communications Raceways*.

**Table 800.182(a) Cable Routing Assembly Markings**

| Type | Marking |
|---|---|
| Plenum Cable Routing Assembly | Plenum Cable Routing Assembly |
| Riser Cable Routing Assembly | Riser Cable Routing Assembly |
| General-Purpose Cable Routing Assembly | General-Purpose Cable Routing Assembly |

**Table 800.182(b) Communications Raceway Markings**

| Type | Marking |
|---|---|
| Plenum Communications Raceway | Plenum Communications Raceway |
| Riser Communications Raceway | Riser Communications Raceway |
| General-Purpose Communications Raceway | General-Purpose Communications Raceway |

### (A) Plenum Cable Routing Assemblies and Plenum Communications Raceways.

Plenum cable routing assemblies and plenum communications raceways shall be listed as having adequate fire-resistant and low-smoke-producing characteristics.

Informational Note No. 1: One method of defining cable routing assemblies and communications raceways that have adequate fire-resistant and low-smoke-producing characteristics is that they exhibit a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84-15a, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or ANSI/UL 723-2013, *Standard Test Method for Surface Burning Characteristics of Building Materials*.

Informational Note No. 2: Another method of defining communications raceways that have adequate fire-resistant and low-smoke-producing characteristics is that they exhibit 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 262-2015, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces*.

Informational Note No. 3: See 4.3.11.2.6 or 4.3.11.5.5 of NFPA 90A-2015, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, for information on materials exposed to the airflow in ceiling cavity and raised floor plenums.

### (B) Riser Cable Routing Assemblies and Riser Communications Raceways.

Riser cable routing assemblies and riser communications raceways shall be listed as having adequate 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 cable routing assemblies and communications raceways pass the requirements of ANSI/UL 1666-2011, *Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts*.

### (C) General-Purpose Cable Routing Assemblies and General-Purpose Communications Raceways.

General-purpose cable routing assemblies and general-purpose communications raceways shall 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 cable routing assemblies and communications raceways do not spread fire to the top of the tray in the “UL Flame Exposure, Vertical Flame Tray Test” in ANSI/UL 1685-2011, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*.

## Article 805 Communications Circuits

### Part I. General

### 805.1 Scope.

This article covers communications circuits and equipment.

**805.2 Definitions.**

The definitions in this section shall apply only within Articles 805 and 840.

**Cable.**

A factory assembly of two or more conductors having an overall covering.

**Communications Circuit Integrity (CI) Cable.**

Cable used in communications systems to ensure continued operation of critical circuits during a specified time under fire conditions.

**Wire.**

A factory assembly of one or more insulated conductors without an overall covering.

**805.18 Installation of Equipment.**

Equipment electrically connected to a communications network shall be listed in accordance with 805.170.

*Exception: This listing requirement shall not apply to test equipment that is intended for temporary connection to a telecommunications network by qualified persons during the course of installation, maintenance, or repair of telecommunications equipment or systems.*

**Part II. Wires and Cables Outside and on the service provider side of the Communication Service Point ~~Entering Buildings~~**

**805.47 Underground Communications Wires and Cables ~~Entering Buildings~~.**

Underground communications wires and cables ~~entering buildings~~ shall comply with 805.47(A) and (B). The requirements of 310.10(C) shall not apply to communications wires and cables.

**(A) Underground Systems with Electric Light, Power, Class 1, or Non-Power-Limited Fire Alarm Circuit Conductors.**

Underground communications wires and cables in a raceway, handhole enclosure, or manhole containing electric light, power, Class 1, or non-power-limited fire alarm circuit conductors shall be in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier.

**(B) Underground Block Distribution.**

Where the entire street circuit is run underground and the circuit within the block is placed so as to be free from the likelihood of accidental contact with electric light or power circuits of over 300 volts to ground, the insulation requirements of 805.50(A) and 805.50(C) shall not apply, insulating supports shall not be required for the conductors, and bushings shall not be required where the conductors enter the building.

**805.48 Unlisted Cables on the service provider side of the Communication Service Point ~~Entering Buildings~~.**

Unlisted outside plant communications cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated in an enclosure or on a listed primary protector. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) to the point of emergence.

Informational Note No. 1: Splice cases or terminal boxes, both metallic and plastic types, are typically used as enclosures for splicing or terminating telephone cables.

Informational Note No. 2: This section limits the length of unlisted outside plant cable to 15 m (50 ft), while 805.90(B) requires that the primary protector be located as close as practicable to the point at which the cable enters the building. Therefore, in installations requiring a primary protector, the outside plant cable may not be permitted to extend 15 m (50 ft) into the building if it is practicable to place the primary protector closer than 15 m (50 ft) to the point of entrance.

### 805.50 Circuits Requiring Primary Protectors.

Circuits that require primary protectors as provided in 805.90 shall comply with 805.50(A),805.50(B), and 805.50(C).

#### (A) Insulation, Wires, and Cables.

Communications wires and cables without a metallic shield, running from the last outdoor support to the primary protector, shall be listed in accordance with 805.173.

#### (B) On Buildings.

Communications wires and cables in accordance with 805.50(A) shall be separated at least 100 mm (4 in.) from electric light or power conductors not in a raceway or cable or be permanently separated from conductors of the other systems by a continuous and firmly fixed nonconductor in addition to the insulation on the wires, such as porcelain tubes or flexible tubing. Communications wires and cables in accordance with 805.50(A) exposed to accidental contact with electric light and power conductors operating at over 300 volts to ground and attached to buildings shall be separated from woodwork by being supported on glass, porcelain, or other insulating material.

*Exception: Separation from woodwork shall not be required where fuses are omitted as provided for in 805.90(A)(1), or where conductors are used to extend circuits to a building from a cable having a grounded metal sheath.*

#### (C) Entering Buildings.

Where a primary protector is installed inside the building, the communications wires and cables shall enter the building either through a noncombustible, nonabsorbent insulating bushing or through a metal raceway. The insulating bushing shall not be required where the entering communications wires and cables (1) are in metal-sheathed cable, (2) pass through masonry, (3) meet the requirements of 805.50(A) and fuses are omitted as provided in 805.90(A)(1), or (4) meet the requirements of 805.50(A) and are used to extend circuits to a building from a cable having a grounded metallic sheath. Raceways or bushings shall slope upward from the outside or, where this cannot be done, drip loops shall be formed in the communications wires and cables immediately before they enter the building.

Raceways shall be equipped with an approved service head. More than one communications wire and cable shall be permitted to enter through a single raceway or bushing. Conduits or other metal raceways located ahead of the primary protector shall be grounded.

## Part III. Protection

### 805.90 Protective Devices.

#### (A) Application.

A listed primary protector shall be provided on each circuit run partly or entirely in aerial wire or aerial cable not confined within a block. Also, a listed primary protector shall be provided on each circuit, aerial or underground, located within the block containing the building served so as to be exposed to accidental contact with electric light or power conductors operating at over 300 volts to ground. In addition, where there exists a lightning exposure, each interbuilding circuit on a premises shall be protected by a listed primary protector at each end of the interbuilding circuit. Installation of primary protectors shall also comply with 110.3(B).

Informational Note No. 1: On a circuit not exposed to accidental contact with power conductors, providing a listed primary protector in accordance with this article helps protect against other hazards, such as lightning and above-normal voltages induced by fault currents on power circuits in proximity to the communications circuit.

Informational Note No. 2: Interbuilding circuits are considered to have a lightning exposure unless one or more of the following conditions exist:

1. Circuits in large metropolitan areas where buildings are close together and sufficiently high to intercept lightning.
2. Interbuilding cable runs of 42 m (140 ft) or less, directly buried or in underground conduit, where a continuous metallic cable shield or a continuous metal conduit containing the cable is connected to each building grounding electrode system.

3. Areas having an average of five or fewer thunderstorm days per year and earth resistivity of less than 100 ohm-meters. Such areas are found along the Pacific coast.

Informational Note No. 3: For information on lightning protection systems, see NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems.*

**(1) Fuseless Primary Protectors.**

Fuseless-type primary protectors shall be permitted under any of the conditions given in 805.90(A)(1)(a) through (A)(1)(e).

(a) Where conductors enter a building through a cable with grounded metallic sheath member(s) and where the conductors in the cable safely fuse on all currents greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor

(b) Where insulated conductors in accordance with 805.50(A) are used to extend circuits to a building from a cable with an effectively grounded metallic sheath member(s) and where the conductors in the cable or cable stub, or the connections between the insulated conductors and the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground, safely fuse on all currents greater than the current-carrying capacity of the primary protector, or the associated insulated conductors and of the primary protector bonding conductor or grounding electrode conductor

(c) Where insulated conductors in accordance with 805.50(A) or (B) are used to extend circuits to a building from other than a cable with metallic sheath member(s), where (1) the primary protector is listed as being suitable for this purpose for application with circuits extending from other than a cable with metallic sheath members, and (2) the connections of the insulated conductors to the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground or the conductors of the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground safely fuse on all currents greater than the current-carrying capacity of the primary protector, or associated insulated conductors and of the primary protector bonding conductor or grounding electrode conductor

(d) Where insulated conductors in accordance with 805.50(A) are used to extend circuits aerially to a building from a buried or underground circuit that is unexposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground

(e) Where insulated conductors in accordance with 805.50(A) are used to extend circuits to a building from cable with an effectively grounded metallic sheath member(s), and where (1) the combination of the primary protector and insulated conductors is listed as being suitable for this purpose for application with circuits extending from a cable with an effectively grounded metallic sheath member(s), and (2) the insulated conductors safely fuse on all currents greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor

Informational Note: Section 9 of ANSI/IEEE C2-2012, *National Electrical Safety Code*, provides an example of methods of protective grounding that can achieve effective grounding of communications cable sheaths for cables from which communications circuits are extended.

**(2) Fused Primary Protectors.**

Where the requirements listed under 805.90(A)(1)(a) through (A)(1)(e) are not met, fused-type primary protectors shall be used. Fused-type primary protectors shall consist of an arrester connected between each line conductor and ground, a fuse in series with each line conductor, and an appropriate mounting arrangement. Primary protector terminals shall be marked to indicate line, instrument, and ground, as applicable.

**(B) Location.**

The primary protector shall be located in, on, or immediately adjacent to the structure or building served and as close as practicable to the point of entrance.

For purposes of this section, primary protectors located at mobile home service equipment within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means connected to an electrode by a grounding electrode conductor in accordance with 250.32 and located

within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a primary protector location to achieve the shortest practicable primary protector bonding conductor or grounding electrode conductor helps limit potential differences between communications circuits and other metallic systems.

**(C) Hazardous (Classified) Locations.**

The primary protector shall not be located in any hazardous (classified) locations, as defined in 500.5 and 505.5, or in the vicinity of easily ignitible material.

*Exception: As permitted in 501.150, 502.150, and 503.150.*

**(D) Secondary Protectors.**

Where a secondary protector is installed in series with the indoor communications wire and cable between the primary protector and the equipment, it shall be listed for the purpose in accordance with 805.170(B).

Informational Note: Secondary protectors on circuits exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground are not intended for use without primary protectors.

**805.93 Grounding, Bonding, or Interruption of Non–Current-Carrying Metallic Sheath Members of Communications Cables.**

Communications cables entering the building or terminating on the outside of the building shall comply with 805.93(A) or (B).

**(A) Entering Buildings.**

In installations where the communications cable enters a building, the metallic sheath members of the cable shall be grounded or bonded as specified in 800.100 or interrupted by an insulating joint or equivalent device. The grounding, bonding, or interruption shall be as close as practicable to the point of entrance.

**(B) Terminating on the Outside of Buildings.**

In installations where the communications cable is terminated on the outside of the building, the metallic sheath members of the cable shall be grounded or bonded as specified in 800.100 or interrupted by an insulating joint or equivalent device. The grounding, bonding, or interruption shall be as close as practicable to the point of termination of the cable.

**Part IV. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**805.133 Installation of Communications Wires, Cables, and Equipment.**

Communications wires and cables from the protector to the equipment or, where no protector is required, communications wires and cables attached to the outside or inside of the building shall comply with 805.133(A) and 805.133(B)

**(A) Separation from Other Conductors.**

**(1) In Raceways, Cable Trays, Boxes, Cables, Enclosures, and Cable Routing Assemblies.**

(a) *Other Circuits.* Communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with cables 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. Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770
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

(b) *Class 2 and Class 3 Circuits.* Class 1 circuits shall not be run in the same cable with communications circuits. Class 2 and Class 3 circuit conductors shall be permitted in the same listed communications cable with communications circuits.

(c) *Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm, and Medium-Power Network-Powered Broadband Communications Circuits in Raceways, Compartments, and Boxes.* Communications conductors shall not be placed in any raceway, compartment, outlet box, junction box, or similar fitting with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits.

*Exception No. 1: Section 805.133(A)(1)(c) shall not apply if 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 conductors of communications circuits by a permanent barrier or listed divider.*

*Exception No. 2: Power conductors in outlet boxes, junction boxes, or similar fittings or compartments where such conductors are introduced solely for power supply to communications equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum of 6 mm (¼ in.) separation from the communications circuit conductors.*

*Exception No. 3: As permitted by 620.36.*

**(2) Other Applications.**

Communications wires and cables shall be separated 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.

*Exception No. 1: Section 805.133(A)(2) shall not apply where either (1) all of the conductors of the electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits are in a raceway or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC, or Type UF cables, or (2) all of the conductors of communications circuits are encased in raceway.*

*Exception No. 2: Section 805.133(A)(2) shall not apply where the communications wires and cables are permanently separated from the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B) Support of Communications Wires and Cables.**

Raceways shall be used for their intended purpose. Communications wires and cables shall not be strapped, taped, or attached by any means to the exterior of any raceway as a means of support.

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

**805.154 Substitutions of Listed Communications Wires, Cables, and Raceways, and Listed Cable Routing Assemblies.**

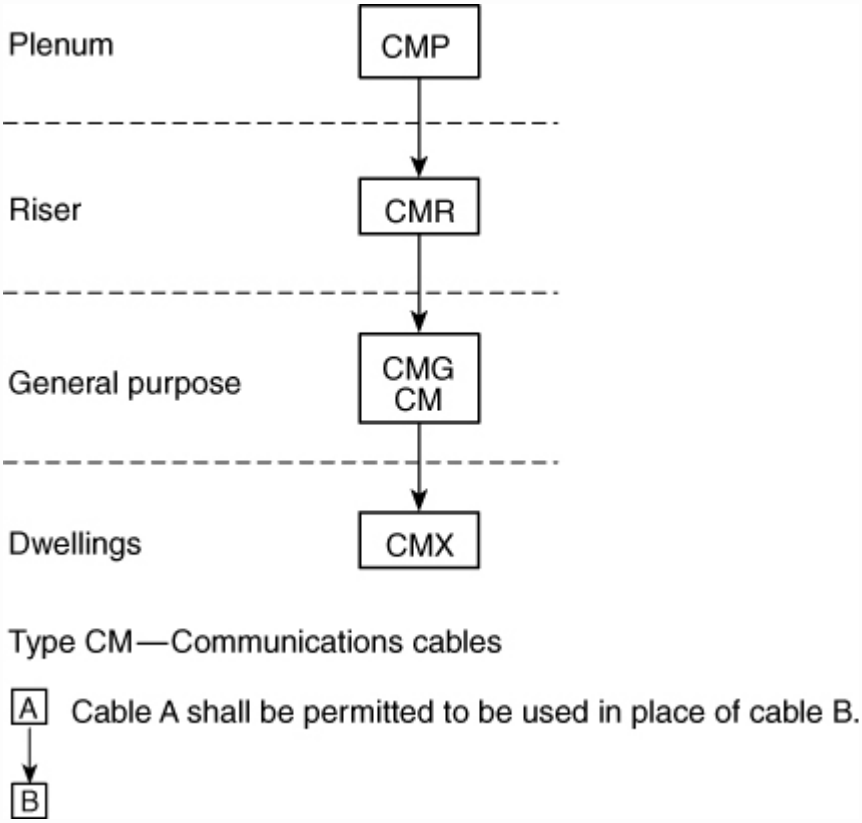
The substitutions for communications cables listed in Table 805.154 and illustrated in Figure 805.154 shall be permitted.

**Table 805.154 Cable Substitutions**

| Cable Type | Permitted Substitutions |
|---|---|
| CMR | CMP |

| Cable Type | Permitted Substitutions |
|---|---|
| CMG, CM | CMP, CMR |
| CMX | CMP, CMR, CMG, CM |

**Figure 805.154 Cable Substitution Hierarchy.**




### 805.156 Dwelling Unit Communications Outlet.

For new construction, a minimum of one communications outlet shall be installed within the dwelling in a readily accessible area and cabled to the service provider demarcation point.

## Part V. Listing Requirements

### 805.170 Equipment.

Communications equipment shall be listed as being suitable for electrical connection to a communications network.

Informational Note No. 1: One way to determine applicable requirements is to refer to ANSI/UL 60950-1-2014, *Standard for Safety of Information Technology Equipment*; ANSI/UL 1863-2012, *Standard for Safety Communications Circuit Accessories*; or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements*.

Informational Note No. 2: Additional information regarding voltages, currents, and power allowed on communications circuits can be found in ANSI/ATIS 0600337-2016, *Requirements for Maximum Voltage, Current, and Power Levels Used in Communications Transport Circuits*.

#### (A) Primary Protectors.

The primary protector shall consist of an arrester connected between each line conductor and ground in an appropriate mounting. Primary protector terminals shall be marked to indicate line and ground as applicable.

Informational Note: One way to determine applicable requirements for a listed primary protector is to refer to ANSI/UL 497-2013, *Standard for Protectors for Paired Conductor Communications Circuits*.

#### (B) Secondary Protectors.

The secondary protector shall be listed as suitable to provide means to safely limit currents to less than the current-carrying capacity of listed indoor communications wire and cable, listed telephone set line cords, and listed communications terminal equipment having ports for external wire line communications circuits. Any overvoltage protection, arresters, or grounding connection shall be connected on the equipment terminals side of the secondary protector current-limiting means.

Informational Note: One way to determine applicable requirements for a listed secondary protector is to refer to ANSI/UL 497A-2012, *Standard for Secondary Protectors for Communications Circuits*.

**(C) Plenum Grade Cable Ties.**

Cable ties intended for use in other space used for environmental air (plenums) shall be listed as having low smoke and heat release properties.

Informational Note: See NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, and ANSI/UL 2043-2013, *Standard for Safety Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces*, for information on listing discrete products as having low smoke and heat release properties.

### 805.173 Drop Wire and Cable.

Communications wires and cables without a metallic shield, running from the last outdoor support to the primary protector, shall be listed as being suitable for the purpose and shall have current-carrying capacity as specified in 805.90(A)(1)(b) or (A)(1)(c).

### 805.179 Communications Wires and Cables.

Communications wires and cables shall be listed in accordance with 805.179(A) through (F) and marked in accordance with Table 805.179 and 805.179(G). Conductors in communications cables, other than in a coaxial cable, shall be copper.

Communications wires and cables shall have a voltage rating of not less than 300 volts. The insulation for the individual conductors, other than the outer conductor of a coaxial cable, shall be rated for 300 volts minimum. The cable voltage rating shall not be marked on the cable or on the under-carpet communications wire.

*Exception: Voltage markings shall be permitted where the cable has multiple listings and 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 805.179 Cable Markings**

| Cable Marking | Type |
|---|---|
| CMP | Communications plenum cable |
| CMR | Communications riser cable |
| CMG | Communications general-purpose cable |
| CM | Communications general-purpose cable |
| CMX | Communications cable, limited use |
| CMUC | Under-carpet communications wire and cable |

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

**(A) General Requirements.**

The general requirements in 805.179 shall apply.

**(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 VW-1 (vertical-wire) flame test in ANSI/UL 1581-2017, *Reference Standard for Electrical Wires, Cables and Flexible Cords*.

### (C) Circuit Integrity (CI) Cable or Electrical Circuit Protective System.

Cables that are used for survivability of critical circuits under fire conditions shall be listed and meet either 805.179(C)(1) or 805.179(C)(2).

Informational Note: The listing organization provides information for circuit integrity (CI) cable and electrical circuit protective systems, including installation requirements required to maintain the fire rating.

### (1) Circuit Integrity (CI) Cables.

Circuit integrity (CI) cables specified in 805.179(A) through (D), and used for survivability of critical circuits, shall have an additional classification using the suffix "CI." In order to maintain its listed fire rating, circuit integrity (CI) cable shall only be installed in free air.

Informational Note: One method of defining circuit integrity (CI) cable is by establishing a minimum 2-hour fire resistance rating for the cable when tested in accordance with ANSI/UL 2196-2017, *Standard for Fire Test for Circuit Integrity of Fire-Resistant Power, Instrumentation, Control, and Data Cables*.

### (2) Fire-Resistive Cables.

Cables specified in 800.179(A) through (D) and 805.179(C)(1), that are part of an electrical circuit protective system, shall be fire-resistive cable identified with the protective system number on the product, or on the smallest unit container in which the product is packaged, and shall be installed in accordance with the listing of the protective system.

Informational Note No. 1: One method of defining an electrical circuit protective system is by establishing a minimum 2-hour fire resistance rating for the system when tested in accordance with UL Subject 1724, *Outline of Investigation for Fire Tests for Electrical Circuit Protective Systems*.

Informational Note No. 2: The listing organization provides information for electrical circuit protective systems (FHIT), including installation requirements for maintaining the fire rating.

### (D) Types CMP-LP, CMR-LP, CMG-LP, and CM-LP Limited Power (LP) Cables.

Types CMP-LP, CMR-LP, CMG-LP, and CM-LP communications limited power 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 XX designates the current limit in amperes per conductor.

Informational Note: An example of the marking on a communications cable with an LP rating is "CMP-LP (0.6A)(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 ampere.

### (E) Communications Wires.

Communications wires, such as distributing frame wire and jumper wire, shall 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 Flame Tray 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. 0.3-09, *Test Methods for Electrical Wires and Cables*.

### (F) Hybrid Power and Communications Cables.

Listed hybrid power and communications cables shall be permitted where the power cable is a listed Type NM or NM-B, conforming to Part III of Article 334, and the communications cable is a listed Type CM, the jackets on the listed NM or NM-B, and listed CM cables are rated for 600 volts minimum, and the hybrid cable is 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 Flame Tray 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. 0.3-09, *Test Methods for Electrical Wires and Cables*.

### (G) Optional Markings.

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.

## Article 810 Radio and Television Equipment

### Part I. General

#### 810.1 Scope.

This article covers antenna systems for radio and television receiving equipment, amateur and citizen band radio transmitting and receiving equipment, and certain features of transmitter safety. This article covers antennas such as wire-strung type, multi-element, vertical rod, flat, or parabolic and also covers the wiring and cabling that connect them to equipment. This article does not cover equipment and antennas used for coupling carrier current to power line conductors.

#### 810.2 Definitions.

The definitions in Part I of Article 100 shall apply.

#### 810.3 Other Articles.

Wiring from the source of power to and between devices connected to the interior wiring system shall comply with Chapters 1 through 4 other than as modified by Parts I and II of Article 640. Wiring for audio signal processing, amplification, and reproduction equipment shall comply with Article 640. Coaxial cables that connect antennas to equipment shall comply with Article 820.

#### 810.4 Community Television Antenna.

The antenna shall comply with this article. The distribution system shall comply with Article 820.

#### 810.5 Radio Noise Suppressors.

Radio interference eliminators, interference capacitors, or noise suppressors connected to power-supply leads shall be of a listed type. They shall not be exposed to physical damage.

#### 810.6 Antenna Lead-In Protectors.

Where an antenna lead-in surge protector is installed, it shall be listed as being suitable for limiting surges on the cable that connects the antenna to the receiver/transmitter electronics and shall be connected between the conductors and the grounded shield or other ground connection. The antenna lead-in protector shall be grounded using a bonding conductor or grounding electrode conductor installed in accordance with 810.21(F).

Informational Note: For requirements covering protectors for antenna lead-in conductors, refer to UL 497E, *Outline of Investigation for Protectors for Antenna Lead-In Conductors*.

#### 810.7 Grounding Devices.

Where bonding or grounding is required, devices used to connect a shield, a sheath, non–current-carrying metallic members of a cable, or metal parts of equipment or antennas to a bonding conductor or grounding electrode conductor shall be listed or be part of listed equipment.

### Part II. Receiving Equipment — Antenna Systems

#### 810.11 Material.

Antennas and lead-in conductors shall be of hard-drawn copper, bronze, aluminum alloy, copper-clad steel, or other high-strength, corrosion-resistant material.

*Exception: Soft-drawn or medium-drawn copper shall be permitted for lead-in conductors where the maximum span between points of support is less than 11 m (35 ft).*

#### 810.12 Supports.

Outdoor antennas and lead-in conductors shall be securely supported. The antennas or lead-in conductors shall not be attached to the electric service mast. They shall not be attached to poles or similar structures carrying open electric light or power wires or trolley wires of over 250 volts between conductors. Insulators supporting the antenna conductors shall have sufficient mechanical strength to safely support the conductors. Lead-in conductors shall be securely attached to the antennas.

### 810.13 Avoidance of Contacts with Conductors of Other Systems.

Outdoor antennas and lead-in conductors from an antenna to a building shall not cross over open conductors of electric light or power circuits and shall be kept well away from all such circuits so as to avoid the possibility of accidental contact. Where proximity to open electric light or power service conductors of less than 250 volts between conductors cannot be avoided, the installation shall be such as to provide a clearance of at least 600 mm (2 ft).

Where practicable, antenna conductors shall be installed so as not to cross under open electric light or power conductors.

### 810.14 Splices.

Splices and joints in antenna spans shall be made mechanically secure with approved splicing devices or by such other means as will not appreciably weaken the conductors.

### 810.15 Grounding.

Masts and metal structures supporting antennas shall be grounded in accordance with 810.21, unless the antenna and its related supporting mast or structure are within a zone of protection defined by a 46 m (150 ft) radius rolling sphere.

Informational Note: See 4.8.3.1 of NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, for the application of the term *rolling sphere*.

### 810.16 Size of Wire-Strung Antenna — Receiving Station.

#### (A) Size of Antenna Conductors.

Outdoor antenna conductors for receiving stations shall be of a size not less than given in Table 810.16(A).

**Table 810.16(A) Size of Receiving Station Outdoor Antenna Conductors**

| Material | Minimum Size of Conductors (AWG) Where Maximum Open Span Length Is | | |
|---|---|---|---|
| | Less Than 11 m (35 ft) | 11 m to 45 m (35 ft to 150 ft) | Over 45 m (150 ft) |
| Aluminum alloy, hard-drawn copper | 19 | 14 | 12 |
| Copper-clad steel, bronze, or other high-strength material | 20 | 17 | 14 |

#### (B) Self-Supporting Antennas.

Outdoor antennas, such as vertical rods and flat, parabolic, or dipole structures, shall be of corrosion-resistant materials and of strength suitable to withstand ice and wind loading conditions and shall be located well away from overhead conductors of electric light and power circuits of over 150 volts to ground, so as to avoid the possibility of the antenna or structure falling into or making accidental contact with such circuits.

### 810.17 Size of Lead-in — Receiving Station.

Lead-in conductors from outside antennas for receiving stations shall, for various maximum open span lengths, be of such size as to have a tensile strength at least as great as that of the conductors for antennas as specified in 810.16. Where the lead-in consists of two or more conductors that are twisted

together, are enclosed in the same covering, or are concentric, the conductor size shall, for various maximum open span lengths, be such that the tensile strength of the combination is at least as great as that of the conductors for antennas as specified in 810.16.

### 810.18 Clearances — Receiving Stations.

#### (A) Outside of Buildings.

Lead-in conductors attached to buildings shall be installed so that they cannot swing closer than 600 mm (2 ft) to the conductors of circuits of 250 volts or less between conductors, or 3.0 m (10 ft) to the conductors of circuits of over 250 volts between conductors, except that in the case of circuits not over 150 volts between conductors, where all conductors involved are supported so as to ensure permanent separation, the clearance shall be permitted to be reduced but shall not be less than 100 mm (4 in.). The clearance between lead-in conductors and any conductor forming a part of a lightning protection system shall not be less than 1.8 m (6 ft). Underground conductors shall be separated at least 300 mm (12 in.) from conductors of any light or power circuits or Class 1 circuits.

*Exception: Where the electric light or power conductors, Class 1 conductors, or lead-in conductors are installed in raceways or metal cable armor.*

Informational Note No. 1: See 250.60 for grounding associated with lightning protection components — strike termination devices. For further information, see NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, which contains detailed information on grounding, bonding, and spacing from lightning protection systems, and the calculation of specific separation distances using the sideflash equation in Section 4.6.

Informational Note No. 2: Metal raceways, enclosures, frames, and other non–current-carrying metal parts of electrical equipment installed on a building equipped with a lightning protection system may require bonding or spacing from the lightning protection conductors in accordance with NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*. Separation from lightning protection conductors is typically 1.8 m (6 ft) through air or 900 mm (3 ft) through dense materials such as concrete, brick, or wood.

#### (B) Antennas and Lead-ins — Indoors.

Indoor antennas and indoor lead-ins shall not be run nearer than 50 mm (2 in.) to conductors of other wiring systems in the premises.

*Exception No. 1: Where such other conductors are in metal raceways or cable armor.*

*Exception No. 2: Where permanently separated from such other conductors by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing.*

#### (C) In Boxes or Other Enclosures.

Indoor antennas and indoor lead-ins shall be permitted to occupy the same box or enclosure with conductors of other wiring systems where separated from such other conductors by an effective permanently installed barrier.

### 810.19 Electrical Supply Circuits Used in Lieu of Antenna — Receiving Stations.

Where an electrical supply circuit is used in lieu of an antenna, the device by which the radio receiving set is connected to the supply circuit shall be listed.

### 810.20 Antenna Discharge Units — Receiving Stations.

#### (A) Where Required.

Each conductor of a lead-in from an outdoor antenna shall be provided with a listed antenna discharge unit.

*Exception: Where the lead-in conductors are enclosed in a continuous metallic shield that either is grounded with a conductor in accordance with 810.21 or is protected by an antenna discharge unit.*

#### (B) Location.

Antenna discharge units shall be located outside the building or inside the building between the point of entrance of the lead-in and the radio set or transformers and as near as practicable to the entrance of the conductors to the building. The antenna discharge unit shall not be located near combustible material or in a hazardous (classified) location as defined in Article 500.

**(C) Grounding.**

The antenna discharge unit shall be grounded in accordance with 810.21.

**810.21 Bonding Conductors and Grounding Electrode Conductors — Receiving Stations.**

Bonding conductors and grounding electrode conductors shall comply with 810.21(A) through 810.21(K).

**(A) Material.**

The bonding conductor or grounding electrode conductor shall be of copper, aluminum, copper-clad steel, copper-clad aluminum, bronze, or similar corrosion-resistant material. Aluminum or copper-clad aluminum bonding conductors or grounding electrode conductors shall not be used where in direct contact with masonry or the earth or where subject to corrosive conditions. Where used outside, aluminum or copper-clad aluminum conductors shall not be installed within 450 mm (18 in.) of the earth.

**(B) Insulation.**

Insulation on bonding conductors or grounding electrode conductors shall not be required.

**(C) Supports.**

The bonding conductor or grounding electrode conductor shall be securely fastened in place and shall be permitted to be directly attached to the surface wired over without the use of insulating supports.

*Exception: Where proper support cannot be provided, the size of the bonding conductors or grounding electrode conductors shall be increased proportionately.*

**(D) Physical Protection.**

Bonding conductors and grounding electrode conductors shall be protected where exposed to physical damage. Where the bonding conductor or grounding electrode conductor is installed in a metal raceway, both ends of the raceway shall be bonded to the contained conductor or to the same terminal or electrode to which the bonding conductor or grounding electrode conductor is connected.

**(E) Run in Straight Line.**

The bonding conductor or grounding electrode conductor for an antenna mast or antenna discharge unit shall be run in as straight a line as practicable.

**(F) Electrode.**

The bonding conductor or grounding electrode conductor shall be connected as required in 810.21(F)(1) through 810.21(F)(3).

**(1) In Buildings or Structures with an Intersystem Bonding Termination.**

If the building or structure served has an intersystem bonding termination as required by 250.94, the bonding conductor shall be connected to the intersystem bonding termination.

**(2) In Buildings or Structures with Grounding Means.**

If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on the following:

1. The building or structure grounding electrode system as covered in 250.50
2. The grounded interior metal water piping systems, within 1.52 m (5 ft) from its point of entrance to the building, as covered in 250.52
3. The power service accessible means external to the building, as covered in 250.94
4. The nonflexible metal power service raceway
5. The service equipment enclosure, or
6. The grounding electrode conductor or the grounding electrode conductor metal enclosures of the power service

A bonding device intended to provide a termination point for the bonding conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on nonremovable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is nonremovable.

**(3) In Buildings or Structures Without an Intersystem Bonding Termination or Grounding Means.**

If the building or structure served has no intersystem bonding termination or grounding means as described in 810.21(F)(2), the grounding electrode conductor shall be connected to a grounding electrode as described in 250.52.

**(G) Inside or Outside Building.**

The bonding conductor or grounding electrode conductor shall be permitted to be run either inside or outside the building.

**(H) Size.**

The bonding conductor or grounding electrode conductor shall not be smaller than 10 AWG copper, 8 AWG aluminum, or 17 AWG copper-clad steel or bronze.

**(I) Common Ground.**

A single bonding conductor or grounding electrode conductor shall be permitted for both protective and operating purposes.

**(J) Bonding of Electrodes.**

A bonding jumper not smaller than 6 AWG copper or equivalent shall be connected between the radio and television equipment grounding electrode and the power grounding electrode system at the building or structure served where separate electrodes are used.

**(K) Electrode Connection.**

Connections to grounding electrodes shall comply with 250.70.

## Part III. Amateur and Citizen Band Transmitting and Receiving Stations — Antenna Systems

### 810.51 Other Sections.

In addition to complying with Part III, antenna systems for amateur and citizen band transmitting and receiving stations shall also comply with 810.11 through 810.15.

### 810.52 Size of Antenna.

Antenna conductors for transmitting and receiving stations shall be of a size not less than given in Table 810.52.

**Table 810.52 Size of Outdoor Antenna Conductors**

| Material | Minimum Size of Conductors (AWG) Where Maximum Open Span Length Is | |
|---|---|---|
| | Less Than 45 m (150 ft) | Over 45 m (150 ft) |
| Hard-drawn copper | 14 | 10 |
| Copper-clad steel, bronze, or other high-strength material | 14 | 12 |

### 810.53 Size of Lead-in Conductors.

Lead-in conductors for transmitting stations shall, for various maximum span lengths, be of a size at least as great as that of conductors for antennas as specified in 810.52.

### 810.54 Clearance on Building.

Antenna conductors for transmitting stations, attached to buildings, shall be firmly mounted at least 75 mm (3 in.) clear of the surface of the building on nonabsorbent insulating supports, such as treated pins or brackets equipped with insulators having not less than 75-mm (3-in.) creepage and airgap distances. Lead-in conductors attached to buildings shall also comply with these requirements.

*Exception: Where the lead-in conductors are enclosed in a continuous metallic shield that is grounded with a conductor in accordance with 810.58, they shall not be required to comply with these requirements. Where grounded, the metallic shield shall also be permitted to be used as a conductor.*

**810.55 Entrance to Building.**

Except where protected with a continuous metallic shield that is grounded with a conductor in accordance with 810.58, lead-in conductors for transmitting stations shall enter buildings by one of the following methods:

1. Through a rigid, noncombustible, nonabsorbent insulating tube or bushing
2. Through an opening provided for the purpose in which the entrance conductors are firmly secured so as to provide a clearance of at least 50 mm (2 in.)
3. Through a drilled window pane

**810.56 Protection Against Accidental Contact.**

Lead-in conductors to radio transmitters shall be located or installed so as to make accidental contact with them difficult.

**810.57 Antenna Discharge Units — Transmitting Stations.**

Each conductor of a lead-in for outdoor antennas shall be provided with an antenna discharge unit or other suitable means that drain static charges from the antenna system.

*Exception No. 1: Where the lead-in is protected by a continuous metallic shield that is grounded with a conductor in accordance with 810.58, an antenna discharge unit or other suitable means shall not be required.*

*Exception No. 2: Where the antenna is grounded with a conductor in accordance with 810.58, an antenna discharge unit or other suitable means shall not be required.*

**810.58 Bonding Conductors and Grounding Electrode Conductors — Amateur and Citizen Band Transmitting and Receiving Stations.**

Bonding conductors and grounding electrode conductors shall comply with 810.58(A) through 810.58(C).

**(A) Other Sections.**

All bonding conductors and grounding electrode conductors for amateur and citizen band transmitting and receiving stations shall comply with 810.21(A) through 810.21(C).

**(B) Size of Protective Bonding Conductor or Grounding Electrode Conductor.**

The protective bonding conductor or grounding electrode conductor for transmitting stations shall be as large as the lead-in but not smaller than 10 AWG copper, bronze, or copper-clad steel.

**(C) Size of Operating Bonding Conductor or Grounding Electrode Conductor.**

The operating bonding conductor or grounding electrode conductor for transmitting stations shall not be less than 14 AWG copper or its equivalent.

**Part IV. Interior Installation — Transmitting Stations**

**810.70 Clearance from Other Conductors.**

All conductors inside the building shall be separated at least 100 mm (4 in.) from the conductors of any electric light, power, or signaling circuit.

*Exception No. 1: As provided in Article 640.*

*Exception No. 2: Where separated from other conductors by raceway or some firmly fixed nonconductor, such as porcelain tubes or flexible tubing.*

### 810.71 General.

Transmitters shall comply with 810.71(A) through (C).

**(A) Enclosing.**

The transmitter shall be enclosed in a metal frame or grille or separated from the operating space by a barrier or other equivalent means, all metallic parts of which are effectively connected to a bonding conductor or grounding electrode conductor.

**(B) Grounding of Controls.**

All external metal handles and controls accessible to the operating personnel shall be effectively connected to an equipment grounding conductor if the transmitter is powered by the premises wiring system or grounded with a conductor in accordance with 810.21.

**(C) Interlocks on Doors.**

All access doors shall be provided with interlocks that disconnect all voltages of over 350 volts between conductors when any access door is opened.

## Article 820 Community Antenna Television and Radio Distribution Systems

### Part I. General

### 820.1 Scope.

This article covers coaxial cable distribution of radio frequency signals typically employed in community antenna television (CATV) systems.

### 820.2 Definitions.

The definitions in this section shall apply only within Articles 820 and 840.

### 820.3 Other Articles.

Circuits and equipment shall comply with 820.3(A)and (B).

**(A) General Requirements.**

The general requirements of Article 800 shall apply.

**(B) Alternate Wiring Methods.**

The wiring methods of Article 830 shall be permitted to substitute for the wiring methods of Article 820.

Informational Note: Use of Article 830 wiring methods will facilitate the upgrading of Article 820 installations to network-powered broadband applications.

### 820.15 Power Limitations.

Coaxial cable shall be permitted to deliver power to equipment that is directly associated with the radio frequency distribution system if the voltage is not over 60 volts and if the current is supplied by a transformer or other device that has power-limiting characteristics.

Power shall be blocked from premises devices on the network that are not intended to be powered via the coaxial cable.

### Part II. Coaxial Cables ~~Outside~~ on the service provider side of the Communication Service Point~~and Entering Buildings~~

### 820.44 Overhead (Aerial) Coaxial Cables.

Overhead (aerial) coaxial cables, prior to the point of grounding, as specified in 820.93, shall comply with 820.44(A) or 800.44.

**(A) On Poles and In-Span, Above Roofs, on Masts, or Between Buildings.**

Where coaxial cables are installed on poles and in-span, above roofs, on masts, or between buildings, they shall comply with 800.44.

**(B) On Buildings.**

Where attached to buildings, coaxial cables shall be securely fastened in such a manner that they will be separated from other conductors in accordance with 820.44(B)(1) and (B)(2).

**(1) Electric Light or Power.**

The coaxial cable shall have a separation of at least 100 mm (4 in.) from electric light, power, Class 1, or non-power-limited fire alarm circuit conductors not in raceway or cable, or shall be permanently separated from conductors of the other system by a continuous and firmly fixed nonconductor in addition to the insulation on the wires.

**(2) Other Communications Systems.**

Coaxial cable shall be installed so that there will be no unnecessary interference in the maintenance of the separate systems. In no case shall the conductors, cables, messenger strand, or equipment of one system cause abrasion to the conductors, cable, messenger strand, or equipment of any other system.

### 820.47 Underground Coaxial Cables Entering Buildings.

Underground coaxial cables entering buildings shall comply with 820.47(A) and 820.47(B).

**(A) Underground Systems with Electric Light, Power, Class 1, or Non–Power-Limited Fire Alarm Circuit Conductors.**

Underground coaxial cables in a duct, pedestal, handhole enclosure, or manhole that contains electric light, power, or Class 1 or non–power-limited fire alarm circuit conductors shall be in a section permanently separated from such conductors by means of a suitable barrier.

**(B) Direct-Buried Cables and Raceways.**

Direct-buried coaxial cable shall be separated at least 300 mm (12 in.) from conductors of any light or power, non–power-limited fire alarm circuit conductors, or Class 1 circuit.

*Exception No. 1: Separation shall not be required where electric service conductors or coaxial cables are installed in raceways or have metal cable armor.*

*Exception No. 2: Separation shall not be required where electric light or power branch-circuit or feeder conductors or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables; or the coaxial cables have metal cable armor or are installed in a raceway.*

### 820.48 Unlisted Cables Entering Buildings.

Unlisted outside plant coaxial cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated at a grounding block. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) to the point of emergence.

## Part III. Protection

### 820.93 Grounding of the Outer Conductive Shield of Coaxial Cables.

Coaxial cables entering buildings or attached to buildings shall comply with 820.93(A) or (B). Where the outer conductive shield of a coaxial cable is grounded, no other protective devices shall be required. For purposes of this section, grounding located at mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a grounding block location to achieve the shortest practicable bonding conductor or grounding electrode conductor helps limit potential differences between CATV and other metallic systems.

**(A) Entering Buildings.**

In installations where the coaxial cable enters the building, the outer conductive shield shall be grounded in accordance with 820.100. The grounding shall be as close as practicable to the point of entrance.

**(B) Terminating Outside of the Building.**

In installations where the coaxial cable is terminated outside of the building, the outer conductive shield shall be grounded in accordance with 820.100. The grounding shall be as close as practicable to the point of attachment or termination.

**(C) Location.**

Where installed, a listed primary protector shall be applied on each community antenna and radio distribution (CATV) cable external to the premises. The listed primary protector shall be located as close as practicable to the entrance point of the cable on either side or integral to the ground block.

**(D) Hazardous (Classified) Locations.**

Where a primary protector or equipment providing the primary protection function is used, it shall not be located in any hazardous (classified) location as defined in 500.5 and 505.5 or in the vicinity of easily ignitible material.

*Exception: As permitted in 501.150, 502.150, and 503.150.*

**Part IV. Grounding Methods**

**820.100 Cable Bonding and Grounding.**

The shield of the coaxial cable shall be bonded or grounded as specified in 820.100(A) and (B).

*Exception: For communications systems using coaxial cable completely contained within the building (i.e., they do not exit the building) or the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere and isolated from outside cable plant, the shield shall be permitted to be grounded by a connection to an equipment grounding conductor as described in 250.118. Connecting to an equipment grounding conductor through a grounded receptacle using a dedicated bonding jumper and a permanently connected listed device shall be permitted. Use of a cord and plug for the connection to an equipment grounding conductor shall not be permitted.*

Informational Note: See 4.8.3.1 of NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems,* for the application of the term *rolling sphere*.

**(A) General Requirements.**

The installation shall be in accordance with 800.100.

**(B) Shield Protection Devices.**

Grounding of a coaxial drop cable shield by means of a protective device that does not interrupt the grounding system within the premises shall be permitted.

**820.103 Equipment Grounding.**

Unpowered equipment and enclosures or equipment powered by the coaxial cable shall be considered grounded where connected to the metallic cable shield.

**Part V. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**820.133 Installation of Coaxial Cables and Equipment.**

Beyond the point of grounding, as defined in 820.93, the coaxial cable installation shall comply with 820.133(A) and (B).

**(A) Separation from Other Conductors.**

**(1) In Raceways, Cable Trays, Boxes, Enclosures, and Cable Routing Assemblies.**

1. *Other Circuits.* Coaxial cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with jacketed cables 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. Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770
4. Communications circuits in compliance with Parts I and IV of Article 805
5. Low-power network-powered broadband communications circuits in compliance with Parts I and V of Article 830

2. *Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm, and Medium-Power Network-Powered Broadband Communications Circuits.* Coaxial cable shall not be placed in any raceway, compartment, outlet box, junction box, or other enclosures with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits.

*Exception No. 1: Coaxial cable shall be permitted to be placed in any raceway, compartment, outlet box, junction box, or other enclosures with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits where 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 coaxial cables by a permanent barrier or listed divider.*

*Exception No. 2: Coaxial cable shall be permitted to be placed in outlet boxes, junction boxes, or similar fittings or compartments with power conductors where such conductors are introduced solely for power supply to the coaxial cable system distribution equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum 6 mm (¼ in.) separation from coaxial cables.*

**(2) Other Applications.**

Coaxial cable shall be separated 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.

*Exception No. 1: Separation shall not be required where either (1) all of the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits are in a raceway, or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC or Type UF cables, or (2) all of the coaxial cables are encased in a raceway.*

*Exception No. 2: Separation shall not be required where the coaxial cables are permanently separated from the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B) Support of Coaxial Cables.**

Raceways shall be used for their intended purpose. Coaxial cables shall not be strapped, taped, or attached by any means to the exterior of any conduit or raceway as a means of support.

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

**820.154 Substitutions of Listed CATV Cables.**

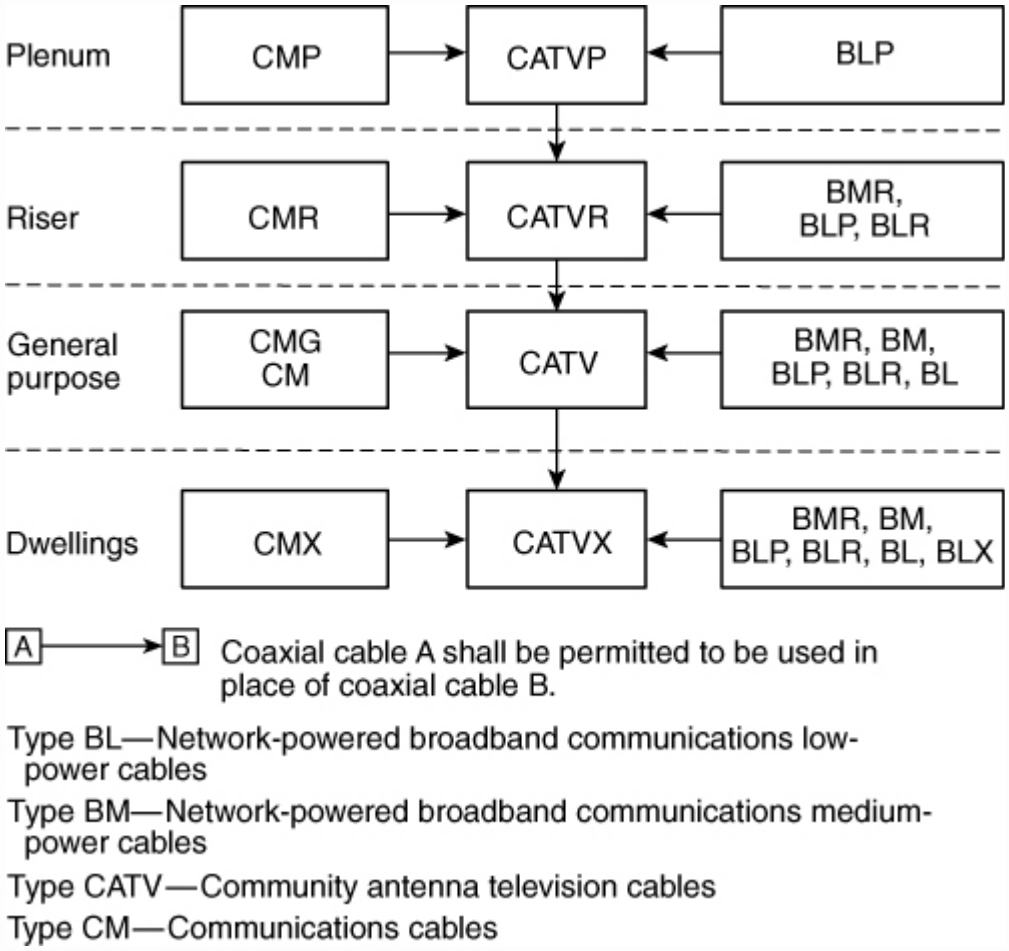
The substitutions for coaxial cables in Table 820.154 and illustrated in Figure 820.154 shall be permitted.

Informational Note: The substitute cables in Table 820.154 and Figure 820.154 are only coaxial-type cables.

**Table 820.154 Coaxial Cable Uses and Permitted Substitutions**

| Cable Type | Permitted Substitutions |
|---|---|
| CATVP | CMP, BLP |
| CATVR | CATVP, CMP, CMR, BMR, BLP, BLR |
| CATV | CATVP, CMP, CATVR, CMR, CMG, CM, BMR, BM, BLP, BLR, BL |
| CATVX | CATVP, CMP, CATVR, CMR, CATV, CMG, CM, BMR, BM, BLP, BLR, BL, BLX |

**Figure 820.154 Cable Substitution Hierarchy.**




## Part VI. Listing Requirements

### 820.179 Coaxial Cables.

Cables shall be listed in accordance with 820.179(A)and marked in accordance with Table 820.179 and 820.179(B). The cable voltage rating shall not be marked on the cable.

Informational Note: Voltage markings on cables could 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.*

**(A) General Requirements.**

The general requirements in 800.179 shall apply.

**(B) Optional Markings.**

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.

**Table 820.179 Coaxial Cable Markings**

| Cable Marking | Type |
|---|---|
| CATVP | CATV plenum cable |
| CATVR | CATV riser cable |
| CATV | CATV cable |
| CATVX | CATV cable, limited use |

# Article 830 Network-Powered Broadband Communications Systems

## Part I. General

### 830.1 Scope.

This article covers network-powered broadband communications systems that provide any combination of voice, audio, video, data, and interactive services through a network interface unit.

Informational Note: A typical basic system configuration includes a cable supplying power and broadband signal to a network interface unit that converts the broadband signal to the component signals. Typical cables are coaxial cable with both broadband signal and power on the center conductor, composite metallic cable with a coaxial member(s) or twisted pair members for the broadband signal and twisted pair members for power, and composite optical fiber cable with a pair of conductors for power. Larger systems may also include network components such as amplifiers that require network power.

### 830.2 Definitions.

The definitions in this section shall apply only within Article 830.

Informational Note: A typical single-family network-powered communications circuit consists of a communications drop or communications service cable and an NIU and includes the communications utility's serving terminal or tap where it is not under the exclusive control of the communications utility.

**Fault Protection Device.**

An electronic device that is intended for the protection of personnel and functions under fault conditions, such as network-powered broadband communications cable short or open circuit, to limit the current or voltage, or both, for a low-power network-powered broadband communications circuit and provide acceptable protection from electric shock.

**Network Interface Unit (NIU).**

A device that converts a broadband signal into component voice, audio, video, data, and interactive services signals and provides isolation between the network power and the premises signal circuits. These devices often contain primary and secondary protectors.

**Network-Powered Broadband Communications Circuit.**

The circuit extending from the communications utility's or service provider's serving terminal or tap up to and including the NIU.

Informational Note: A typical one-family dwelling network-powered communications circuit consists of a communications drop or communications service cable and an NIU and includes the communications utility's serving terminal or tap where it is not under the exclusive control of the communications utility.

### 830.3 Other Articles.

Circuits and equipment shall comply with 830.3(A) through (C).

**(A) General Requirements.**

The general requirements of Article 800 shall apply.

**(B) Output Circuits.**

As appropriate for the services provided, the output circuits derived from the network interface unit shall comply with the requirements of the following:

1. Installations of communications circuits — Part IV of Article 805
2. Installations of community antenna television and radio distribution circuits — Part V of Article 820

   *Exception: Where protection is provided in the output of the NIU 830.90(B)(3) shall apply.*
3. Installations of optical fiber cables — Part V of Article 770
4. Installations of Class 2 and Class 3 circuits — Part III of Article 725
5. Installations of power-limited fire alarm circuits — Part III of Article 760

**(C) Protection Against Physical Damage.**

The requirements of 300.4 shall apply.

**830.15 Power Limitations.**

Network-powered broadband communications systems shall be classified as having low- or medium-power sources as specified in 830.15(1) or (2).

1. Sources shall be classified as defined in Table 830.15.
2. Direct-current power sources exceeding 150 volts to ground, but no more than 200 volts to ground, with the current to ground limited to 10 mA dc, that meet the current and power limitation for medium-power sources in Table 830.15 shall be classified as medium-power sources.

Informational Note: One way to determine compliance with 830.15(2) is listed information technology equipment intended to supply power via a communications network that complies with the requirements for RFT-V circuits as defined in UL 60950-21-2007, *Standard for Safety for Information Technology Equipment — Safety — Part 21: Remote Power Feeding*.

**Table 830.15 Limitations for Network-Powered Broadband Communications Systems**

| Network Power Source | Low | Medium |
|---|---|---|
| Circuit voltage, $V_{max}$ (volts)[1] | 0–100 | 0–150 |
| Power limitation, $VA_{max}$ (volt-amperes)[1] | 250 | 250 |
| Current limitation, $I_{max}$ (amperes)[1] | $1000/V_{max}$ | $1000/V_{max}$ |
| Maximum power rating (volt-amperes) | 100 | 100 |
| Maximum voltage rating (volts) | 100 | 150 |
| Maximum overcurrent protection (amperes)[2] | $100/V_{max}$ | NA |

[1] $V_{max}$, $I_{max}$, and $VA_{max}$ are determined with the current-limiting impedance in the circuit (not bypassed) as follows:

$V_{max}$ — Maximum system voltage regardless of load with rated input applied.

$I_{max}$ — Maximum system current under any noncapacitive load, including short circuit, and with overcurrent protection bypassed if used. $I_{max}$ limits apply after 1 minute of operation.

$VA_{max}$ — Maximum volt-ampere output after 1 minute of operation regardless of load and overcurrent protection bypassed if used.

[2]Overcurrent protection is not required where the current-limiting device provides equivalent current limitation and the current-limiting device does not reset until power or the load is removed.

**830.24 Mechanical Execution of Work.**

The installation shall also conform to 300.4 and 300.11.

**Part II. Cables on the service provider side of the Communication Service Point~~Outside and Entering Buildings~~**

**830.40 Entrance Cables.**

Network-powered broadband communications cables located outside and entering buildings shall comply with 830.40(A) and (B).

**(A) Medium-Power Circuits.**

Medium-power network-powered broadband communications circuits located outside and entering buildings shall be installed using Type BMU, Type BM, or Type BMR network-powered broadband communications medium-power cables.

**(B) Low-Power Circuits.**

Low-power network-powered broadband communications circuits located outside and entering buildings shall be installed using Type BLU or Type BLX low-power network-powered broadband communications cables. Cables shown in Table 830.154 shall be permitted to substitute.

*Exception: Outdoor community antenna television and radio distribution system coaxial cables installed prior to January 1, 2000, and installed in accordance with Article 820, shall be permitted for low-power-type, network-powered broadband communications circuits.*

**830.44 Overhead (Aerial) Cables.**

Overhead (aerial) network-powered broadband communications cables shall comply with 830.44(A) through (F).

**(A) On Poles and In-Span or Above Roofs.**

Where network-powered broadband communications cables are installed on poles and in-span or above roofs, they shall comply with 800.44.

**(B) Clearance from Ground.**

Overhead (aerial) spans of network-powered broadband communications cables shall conform to not less than the following:

1. 2.9 m (9½ ft) — above finished grade, sidewalks, or from any platform or projection from which they might be reached and accessible to pedestrians only
2. 3.5 m (11½ ft) — over residential property and driveways, and those commercial areas not subject to truck traffic
3. 4.7 m (15½ ft) — over public streets, alleys, roads, parking areas subject to truck traffic, driveways on other than residential property, and other land traversed by vehicles such as cultivated, grazing, forest, and orchard

Informational Note: These clearances have been specifically chosen to correlate with ANSI/IEEE C2-2012, *National Electrical Safety Code*, Table 232-1, which provides for clearances of wires, conductors, and cables above ground and roadways, rather than using the clearances referenced in 225.18. Because Article 805 and Article 820 have had no required clearances, the communications industry has used the clearances from the NESC for their installed cable plant.

**(C) Over Pools.**

Clearance of network-powered broadband communications cable in any direction from the water level, edge of pool, base of diving platform, or anchored raft shall comply with those clearances in 680.9.

**(D) Final Spans.**

Final spans of network-powered broadband communications cables without an outer jacket shall be permitted to be attached to the building, but they shall be kept not less than 900 mm (3 ft) from windows that are designed to be opened, doors, porches, balconies, ladders, stairs, fire escapes, or similar locations.

*Exception: Conductors run above the top level of a window shall be permitted to be less than the 900-mm (3-ft) requirement above.*

Overhead (aerial) network-powered broadband communications cables shall not be installed beneath openings through which materials might be moved, such as openings in farm and commercial buildings, and shall not be installed where they obstruct entrance to these building openings.

**(E) Between Buildings.**

Network-powered broadband communications cables extending between buildings or structures, and also the supports or attachment fixtures, shall be identified as suitable for outdoor aerial applications and shall have sufficient strength to withstand the loads to which they may be subjected.

*Exception: Where a network-powered broadband communications cable does not have sufficient strength to be self-supporting, it shall be attached to a supporting messenger cable that, together with the attachment fixtures or supports, shall be acceptable for the purpose and shall have sufficient strength to withstand the loads to which they may be subjected.*

**(F) On Buildings.**

Where attached to buildings, network-powered broadband communications cables shall be securely fastened in such a manner that they are separated from other conductors in accordance with 830.44(F)(1) through (F)(3).

**(1) Electric Light or Power.**

The network-powered broadband communications cable shall have a separation of at least 100 mm (4 in.) from electric light, power, Class 1, or non-power-limited fire alarm circuit conductors not in raceway or cable, or be permanently separated from conductors of the other system by a continuous and firmly fixed nonconductor in addition to the insulation on the wires.

**(2) Other Communications Systems.**

Network-powered broadband communications cables shall be installed so that there will be no unnecessary interference in the maintenance of the separate systems. In no case shall the conductors, cables, messenger strand, or equipment of one system cause abrasion to the conductors, cables, messenger strand, or equipment of any other system.

**(3) Protection from Damage.**

Network-powered broadband communications cables attached to buildings or structures and located within 2.5 m (8 ft) of finished grade shall be protected by enclosures, raceways, or other approved means.

*Exception: A low-power network-powered broadband communications circuit that is equipped with a listed fault protection device, appropriate to the network-powered broadband communications cable used, and located on the network side of the network-powered broadband communications cable shall not be required to be additionally protected by enclosures, raceways, or other approved means.*

**830.47 Underground Network-Powered Broadband Communications Cables Entering Buildings.**

Underground network-powered broadband communications cables entering buildings shall comply with 830.47(A) through 830.47(D).

**(A) Underground Systems with Electric Light and Power, Class 1, or Non–Power-Limited Fire Alarm Circuit Conductors.**

Underground network-powered broadband communications cables in a duct, pedestal, handhole enclosure, or manhole that contains electric light, power conductors, non–power-limited fire alarm circuit

conductors, or Class 1 circuits shall be in a section permanently separated from such conductors by means of a suitable barrier.

**(B) Direct-Buried Cables and Raceways.**

Direct-buried network-powered broadband communications cables shall be separated by at least 300 mm (12 in.) from conductors of any light, power, non–power-limited fire alarm circuit conductors or Class 1 circuit.

*Exception No. 1: Separation shall not be required where electric service conductors or network-powered broadband communications cables are installed in raceways or have metal cable armor.*

*Exception No. 2: Separation shall not be required where electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables; or the network-powered broadband communications cables have metal cable armor or are installed in a raceway.*

**(C) Protection from Physical Damage.**

Direct-buried cable, conduit, or other raceways shall be installed to meet the minimum cover requirements of Table 830.47(C). In addition, direct-buried cables emerging from the ground shall be protected by enclosures, raceways, or other approved means extending from the minimum cover distance required by Table 830.47(C) below grade 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. Types BMU and BLU direct-buried cables emerging from the ground shall be installed in rigid metal conduit (RMC), intermediate metal conduit (IMC), rigid nonmetallic conduit, or other approved means extending from the minimum cover distance required by Table 830.47(C) below grade to the point of entrance.

*Exception: A low-power network-powered broadband communications circuit that is equipped with a listed fault protection device, appropriate to the network-powered broadband communications cable used, and located on the network side of the network-powered broadband communications cable being protected.*

**Table 830.47(C) Network-Powered Broadband Communications Systems Minimum Cover Requirements (*Cover* is the shortest distance measured between a point on the top surface of any direct-buried cable, conduit, or other raceway and the top surface of finished grade, concrete, or similar cover.)**

| Location of Wiring Method or Circuit | Direct Burial Cables | | Rigid Metal Conduit (RMC) or Intermediate Metal Conduit (IMC) | | Nonmetallic Raceways Listed for Direct Burial; Without Concrete Encasement or Other Approved Raceways | |
|---|---|---|---|---|---|---|
| | mm | in. | mm | in. | mm | in. |
| All locations not specified below | 450 | 18 | 150 | 6 | 300 | 12 |
| In trench below 50-mm (2-in.) thick concrete or equivalent | 300 | 12 | 150 | 6 | 150 | 6 |
| Under a building (in raceway only) | 0 | 0 | 0 | 0 | 0 | 0 |
| Under minimum of 100-mm (4-in.) thick concrete exterior slab with no vehicular traffic and the slab extending not less than 150 mm (6 in.) beyond the underground installation | 300 | 12 | 100 | 4 | 100 | 4 |

| Location of Wiring Method or Circuit | Direct Burial Cables | | Rigid Metal Conduit (RMC) or Intermediate Metal Conduit (IMC) | | Nonmetallic Raceways Listed for Direct Burial; Without Concrete Encasement or Other Approved Raceways | |
|---|---|---|---|---|---|---|
| | mm | in. | mm | in. | mm | in. |
| One- and two-family dwelling driveways and outdoor parking areas and used only for dwelling-related purposes | 300 | 12 | 300 | 12 | 300 | 12 |

Notes:

1. Raceways approved for burial only where concrete encased shall require a concrete envelope not less than 50 mm (2 in.) thick.

2. Lesser depths shall be permitted where cables rise for terminations or splices or where access is otherwise required.

3. Where solid rock is encountered, all wiring shall be installed in 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.

4. Low-power network-powered broadband communications circuits using directly buried community antenna television and radio distribution system coaxial cables that were installed outside and entering buildings prior to January 1, 2000, in accordance with Article 820 shall be permitted where buried to a minimum depth of 300 mm (12 in.).

**(D) Pools.**

Cables located under the pool or within the area extending 1.5 m (5 ft) horizontally from the inside wall of the pool shall meet those clearances and requirements specified in 680.11.

**Part III. Protection**

**830.90 Primary Electrical Protection.**

**(A) Application.**

Primary electrical protection shall be provided on all network-powered broadband communications conductors that are neither grounded nor interrupted and are run partly or entirely in aerial cable not confined within a block. Also, primary electrical protection shall be provided on all aerial or underground network-powered broadband communications conductors that are neither grounded nor interrupted and are located within the block containing the building served so as to be exposed to lightning or accidental contact with electric light or power conductors operating at over 300 volts to ground.

*Exception: Primary electrical protection shall not be required on the network-powered broadband communications conductors where electrical protection is provided on the derived circuit(s) (output side of the NIU) in accordance with 830.90(B)(3).*

Informational Note No. 1: On network-powered broadband communications conductors not exposed to lightning or accidental contact with power conductors, providing primary electrical protection in accordance with this article helps protect against other hazards, such as ground potential rise caused by power fault currents, and above-normal voltages induced by fault currents on power circuits in proximity to the network-powered broadband communications conductors.

Informational Note No. 2: Network-powered broadband communications circuits are considered to have a lightning exposure unless one or more of the following conditions exist:

1. Circuits in large metropolitan areas where buildings are close together and sufficiently high to intercept lightning.
2. Areas having an average of five or fewer thunderstorm days each year and earth resistivity of less than 100 ohm-meters. Such areas are found along the Pacific coast.

Informational Note No. 3: For information on lightning protection systems, see NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*.

**(1) Fuseless Primary Protectors.**

Fuseless-type primary protectors shall be permitted where power fault currents on all protected conductors in the cable are safely limited to a value no greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor.

**(2) Fused Primary Protectors.**

Where the requirements listed in 830.90(A)(1) are not met, fused-type primary protectors shall be used. Fused-type primary protectors shall consist of an arrester connected between each conductor to be protected and ground, a fuse in series with each conductor to be protected, and an appropriate mounting arrangement. Fused primary protector terminals shall be marked to indicate line, instrument, and ground, as applicable.

**(B) Location.**

The location of the primary protector, where required, shall comply with 830.90(B)(1), (B)(2), or (B)(3):

1. A listed primary protector shall be applied on each network-powered broadband communications cable external to and on the network side of the network interface unit.
2. The primary protector function shall be an integral part of and contained in the network interface unit. The network interface unit shall be listed as being suitable for application with network-powered broadband communications systems and shall have an external marking indicating that it contains primary electrical protection.
3. The primary protector(s) shall be provided on the derived circuit(s) (output side of the NIU), and the combination of the NIU and the protector(s) shall be listed as being suitable for application with network-powered broadband communications systems.

A primary protector, whether provided integrally or external to the network interface unit, shall be located as close as practicable to the point of entrance.

For purposes of this section, a network interface unit and any externally provided primary protectors located at mobile home service equipment located in sight from and not more than 9.0 m (30 ft) from the exterior wall of the mobile home it serves, or at a mobile home disconnecting means grounded in accordance with 250.32 and located in sight from and not more than 9.0 m (30 ft) from the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a network interface unit and primary protector location to achieve the shortest practicable primary protector bonding conductor or grounding electrode conductor helps limit potential differences between communications circuits and other metallic systems.

**(C) Hazardous (Classified) Locations.**

The primary protector or equipment providing the primary protection function shall not be located in any hazardous (classified) location as defined in 500.5 and 505.5 or in the vicinity of easily ignitible material.

*Exception: As permitted in 501.150, 502.150, and 503.150.*

**Part IV. Grounding Methods**

**830.93 Grounding or Interruption of Metallic Members of Network-Powered Broadband Communications Cables.**

Network-powered communications cables entering buildings or attaching to buildings shall comply with 830.93(A) or (B).

For purposes of this section, grounding located at mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a grounding location to achieve the shortest practicable bonding conductor or grounding electrode conductor helps limit potential differences between the network-powered broadband communications circuits and other metallic systems.

**(A) Entering Buildings.**

In installations where the network-powered communications cable enters the building, the shield shall be grounded in accordance with 800.100, and metallic members of the cable not used for communications or powering shall be grounded in accordance with 800.100 or interrupted by an insulating joint or equivalent device. The grounding or interruption shall be as close as practicable to the point of entrance.

**(B) Terminating Outside of the Building.**

In installations where the network-powered communications cable is terminated outside of the building, the shield shall be grounded in accordance with 800.100, and metallic members of the cable not used for communications or powering shall be grounded in accordance with 800.100 or interrupted by an insulating joint or equivalent device. The grounding or interruption shall be as close as practicable to the point of attachment of the NIU.

**Part V. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**830.133 Installation of Network-Powered Broadband Communications Cables and Equipment.**

Cable and equipment installations within buildings shall comply with 830.133(A) and (B), as applicable.

**(A) Separation of Conductors.**

**(1) In Raceways, Cable Trays, Boxes, Enclosures, and Cable Routing Assemblies.**

1. *Low- and Medium-Power Network-Powered Broadband Communications Circuit Cables.* Low- and medium-power network-powered broadband communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly.

2. *Low-Power Network-Powered Broadband Communications Circuit Cables with Other Circuits.* Low-power network-powered broadband communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with jacketed cables of any of the following circuits:

    1. Class 2 and Class 3 remote-control, signaling, and power-limited circuits in compliance with 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 IV of Article 805
    4. Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770
    5. Community antenna television and radio distribution systems in compliance with Parts I and V of Article 820

3. *Medium-Power Network-Powered Broadband Communications Circuit Cables with Optical Fiber Cables and Other Communications Cables*. Medium-power network-powered broadband communications cables shall not be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with conductors of any of the following circuits:

    1. Communications circuits in compliance with Parts I and IV of Article 805
    2. Conductive optical fiber cables in compliance with Parts I and V of Article 770
    3. Community antenna television and radio distribution systems in compliance with Parts I and V of Article 820

4. *Medium-Power Network-Powered Broadband Communications Circuit Cables with Other Circuits*. Medium-power network-powered broadband communications cables

shall not be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with conductors of any of the following circuits:

1. Class 2 and Class 3 remote-control, signaling, and power-limited circuits in compliance with Parts I and III of Article 725
2. Power-limited fire alarm systems in compliance with Parts I and III of Article 760

5. *Electric Light, Power, Class 1, Non–Powered Broadband Communications Circuit Cables.* Network-powered broadband communications cable shall not be placed in any raceway, cable tray, compartment, outlet box, junction box, or similar fittings with conductors of electric light, power, Class 1, or non–power-limited fire alarm circuit cables.

*Exception No. 1: Where all of the conductors of electric light, power, Class 1, non–power-limited fire alarm circuits are separated from all of the network-powered broadband communications cables by a permanent barrier or listed divider.*

*Exception No. 2: Power circuit conductors in outlet boxes, junction boxes, or similar fittings or compartments where such conductors are introduced solely for power supply to the network-powered broadband communications system distribution equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum 6 mm (¼ in.) separation from network-powered broadband communications cables.*

**(2) Other Applications.**

Network-powered broadband communications cable shall be separated at least 50 mm (2 in.) from conductors of any electric light, power, Class 1, and non–power-limited fire alarm circuits.

*Exception No. 1: Separation shall not be required where: (1) all of the conductors of electric light, power, Class 1, and non–power-limited fire alarm circuits are in a raceway, or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC, or Type UF cables, or (2) all of the network-powered broadband communications cables are encased in a raceway.*

*Exception No. 2: Separation shall not be required where the network-powered broadband communications cables are permanently separated from the conductors of electric light, power, Class 1, and non–power-limited fire alarm circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B) Support of Network-Powered Broadband Communications Cables.**

Raceways shall be used for their intended purpose. Network-powered broadband communications cables shall not be strapped, taped, or attached by any means to the exterior of any conduit or raceway as a means of support.

### 830.154 Substitutions of Network-Powered Broadband Communications System Cables.

The substitutions for network-powered broadband system cables listed in Table 830.154 shall be permitted.

**Table 830.154 Cable Substitutions**

| Cable Type | Permitted Cable Substitutions |
|---|---|
| BM | BMR |
| BLP | CMP, CL3P |
| BLR | CMP, CL3P, CMR, CL3R, BLP, BMR |
| BL | CMP, CMR, CM, CMG, CL3P, CL3R, CL3, BMR, BM, BLP, BLR |
| BLX | CMP, CMR, CM, CMG, CMX, CL3P, CL3R, CL3, CL3X, BMR, BM, BLP, BRP, BL |

### 830.160 Bends.

Bends in network broadband cable shall be made so as not to damage the cable.

## Part VI. Listing Requirements

### 830.179 Network-Powered Broadband Communications Equipment and Cables.

Network-powered broadband communications equipment and cables shall be listed and marked in accordance with 830.179(A) through (D).

*Exception No. 1: This listing requirement shall not apply to community antenna television and radio distribution system coaxial cables that were installed prior to January 1, 2000, in accordance with Article 820 and are used for low-power network-powered broadband communications circuits.*

*Exception No. 2: Substitute cables for network-powered broadband communications cables shall be permitted as shown in Table 830.154.*

**(A) General Requirements.**

The general requirements in 800.179 shall apply.

**(B) Network-Powered Broadband Communications Medium-Power Cables.**

Network-powered broadband communications medium-power cables shall be factory-assembled cables consisting of a jacketed coaxial cable, a jacketed combination of coaxial cable and multiple individual conductors, or a jacketed combination of an optical fiber cable and multiple individual conductors. The insulation for the individual conductors shall be rated for 300 volts minimum. Cables intended for outdoor use shall be listed as suitable for the application. Cables shall be marked in accordance with 310.8. Type BMU cables shall be jacketed and listed as being suitable for outdoor underground use.

**(C) Network-Powered Broadband Communication Low-Power Cables.**

Network-powered broadband communications low-power cables shall be factory-assembled cables consisting of a jacketed coaxial cable, a jacketed combination of coaxial cable and multiple individual conductors, or a jacketed combination of an optical fiber cable and multiple individual conductors. The insulation for the individual conductors shall be rated for 300 volts minimum. Cables intended for outdoor use shall be listed as suitable for the application. Cables shall be marked in accordance with 310.8. Type BLU cables shall be jacketed and listed as being suitable for outdoor underground use.

**(D) Optional Markings.**

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.

# Article 840 Premises-Powered Broadband Communications Systems

## Part I. General

### 840.1 Scope.

This article covers premises-powered broadband communications systems.

Informational Note: A typical basic system configuration consists of an optical fiber, twisted pair, or coaxial cable to the premises supplying a broadband signal to a network terminal that converts the broadband signal into component electrical signals, such as traditional telephone, video, high-speed Internet, and interactive services. Powering for the network terminal and network devices is typically accomplished through a premises power supply that might be built into the network terminal or provided as a separate unit. In order to provide communications in the event of a power interruption, a battery backup unit or an uninterruptible power supply (UPS) is typically part of the powering system.

### 840.2 Definitions.

The definitions in 805.2 and 820.2 shall apply. The definitions in this section shall apply only within Article 840.

**Broadband.**

Wide bandwidth data transmission that transports multiple signals, protocols, and traffic types over various media types.

**Network Terminal.**

A device that converts network-provided signals (optical, electrical, or wireless) into component signals, including voice, audio, video, data, wireless, optical, and interactive services, and is considered a network device on the premises that is connected to a communications service provider and is powered at the premises.

**Premises Communications Circuit.**

The circuit that extends voice, audio, video, data, interactive services, telegraph (except radio), and outside wiring for fire alarm and burglar alarm from the service provider's network terminal to the customer's communications equipment up to and including terminal equipment, such as a telephone, a fax machine, or an answering machine.

**Premises Community Antenna Television (CATV) Circuit.**

The circuit that extends community antenna television (CATV) systems for audio, video, data, and interactive services from the service provider's network terminal to the appropriate customer equipment.

**Premises-Powered.**

Using power provided locally from the premises.

### 840.3 Other Articles.

Circuits and equipment shall comply with 840.3(A) through (C).

**(A) General Requirements.**

The general requirements of Article 800 shall apply.

**(B) Output Circuits.**

As appropriate for the services provided, the output circuits derived from the network terminal shall comply with the requirements of the following:

1. Installations of communications circuits — Part IV of Article 805
2. Installations of premises (within buildings) community antenna television and radio distribution circuits — Part V of Article 820
3. Installations of optical fiber cables — Part V of Article 770
4. Installations of Class 2 and Class 3 circuits — Part III of Article 725

   Informational Note: See 725.121 for information on the classification of information technology equipment circuits.
5. Installations of power-limited fire alarm circuits — Part III of Article 760

**(C) Electrical Classification of Data Circuits and Cables.**

Sections 725.139(D)(1) and 805.133(A)(1)(b) shall apply to the electrical classification of Class 2 and Class 3 circuits in the same cable with communications circuits.

### 840.24 Mechanical Execution of Work.

The requirements of 770.24 and 800.24 shall apply.

### 840.25 Abandoned Cables.

The requirements of 770.25 and 800.25 shall apply.

### 840.26 Spread of Fire or Products of Combustion.

The requirements of 770.26 and 800.26 shall apply.

## Part II. Cables on the service provider side of the Communication Service Point ~~Outside and Entering Buildings~~

### 840.47 Underground Wires and Cables Entering Buildings.

Underground wires and cables entering buildings shall comply with 840.47(A) through (C).

**(A) Optical Fiber Cables.**

**(1) Class 1 or Non–Power-Limited Fire Alarm Circuits.**

Underground conductive optical fiber cables entering buildings with electric light, power, Class 1, or non–power-limited fire alarm circuit conductors in a raceway, handhole enclosure, or manhole shall be located in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier.

**(2) Direct-Buried Cables.**

Direct-buried conductive optical fiber cables shall be separated by at least 300 mm (12 in.) from conductors of any electric light, power, or non–power-limited fire alarm circuit conductors or Class 1 circuit.

*Exception No. 1: Separation shall not be required where the electric service conductors are installed in raceways or have metal cable armor.*

*Exception No. 2: Separation shall not be required where the electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables.*

**(3) Mechanical Protection.**

Direct-buried cable, conduit, or other raceway shall be installed to have a minimum cover of 150 mm (6 in.).

**(B) Communications Wires and Cables.**

Installations of communications wires and multipair communications cables shall comply with 805.47.

**(C) Coaxial Cables.**

Installations of coaxial cables shall comply with 820.47.

### 840.48 Unlisted Wires and Cables Entering Buildings.

Installations of unlisted cables entering buildings shall comply with 840.48(A), (B), or (C), as applicable.

**(A) Optical Fiber Cables.**

Installations of unlisted optical fiber cables entering buildings shall comply with 770.48.

**(B) Communications Wires and Cables.**

Installations of unlisted communications wires and unlisted multipair communications cables entering buildings shall comply with 805.48.

**(C) Coaxial Cables.**

Installations of unlisted coaxial cables entering buildings shall comply with 820.48.

## Part III. Protection

### 840.90 Protective Devices.

The requirements of 805.90 shall apply.

### 840.93 Grounding or Interruption.

Non–current-carrying metallic members of optical fiber cables, communications cables, or coaxial cables entering buildings or attaching to buildings shall comply with 840.93(A), (B), or (C), respectively.

### (A) Non–Current-Carrying Metallic Members of Optical Fiber Cables.

Non–current-carrying metallic members of optical fiber cables entering a building or terminating on the outside of a building shall comply with 770.93(A) or (B).

### (B) Communications Cables.

The grounding or interruption of the metallic sheath of communications cable shall comply with 805.93.

### (C) Coaxial Cables.

Where the network terminal is installed inside or outside of the building, with coaxial cables terminating at the network terminal, and is either entering, exiting, or attached to the outside of the building, 820.93 shall apply.

## 840.94 Premises Circuits Leaving the Building.

Where circuits leave the building to power equipment remote to the building or outside the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere, 805.90 and 805.93 shall apply.

Informational Note: See NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, for the theory of the term *rolling sphere*.

## Part IV. Grounding Methods

## 840.101 Premises Circuits Not Leaving the Building.

Where the network terminal is served by a nonconductive optical fiber cable, or where any non–current-carrying metallic member of a conductive optical fiber cable is interrupted by an insulating joint or equivalent device, and circuits that terminate at the network terminal are completely contained within the building (i.e., they do not exit the building), 840.101(A), (B), or (C) shall apply, as applicable.

### (A) Coaxial Cable Shield Grounding.

The shield of coaxial cable shall be grounded by one of the following:

1. Any of the methods described in 820.100 or 800.106
2. A fixed connection to an equipment grounding conductor as described in 250.118
3. Connection to the network terminal grounding terminal provided that the terminal is connected to ground by one of the methods described in 820.100 or 800.106, or to an equipment grounding conductor through a listed grounding device that will retain the ground connection if the network terminal is unplugged

### (B) Communications Circuit Grounding.

Communications circuits shall not be required to be grounded.

### (C) Network Terminal Grounding.

The network terminal shall not be required to be grounded unless required by its listing. If the coaxial cable shield is separately grounded as described in 840.101(A)(1) or 840.101(A)(2), the use of a cord and plug for the connection to the network terminal grounding connection shall be permitted.

Informational Note: Where required to be grounded, a listed device that extends the equipment grounding conductor from the receptacle to the network terminal equipment grounding terminal is permitted. Sizing of the extended equipment grounding conductor is covered in Table 250.122.

## 840.102 Premises Circuits Leaving the Building.

Where circuits leave the building to power equipment remote to the building or outside the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere, the installation of communications wires and cables shall comply with 800.100 and 800.106, and the installation of coaxial cables shall comply with 820.100 and 800.106.

Informational Note: See NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, for the application of the term *rolling sphere*.

## Part V. Wiring on the service provider side of the Communication Service Point ~~Installation Methods Within Buildings~~

### 840.133 Installation of Optical Fibers and Electrical Conductors.

The requirements of 770.133 shall apply.

## Part VI. Premises Powering of Communications Equipment over Communications Cables

### 840.160 Powering Circuits.

Communications cables listed in accordance with 805.179, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment listed in accordance with 805.170. The power source shall be listed in accordance with 840.170(G). Installation of the listed 4-pair communications cables for a communications circuit or installation where 4-pair communications cables are substituted for Class 2 and Class 3 cables in accordance with 725.154(A) shall comply with 725.144.

*Exception: Installing communications cables in compliance with 725.144 shall not be required for listed 4-pair communications cables where the rated current of the power source does not exceed 0.3 amperes in any conductor 24 AWG or larger.*

Informational Note: A typical communications cable for this application is a 4-pair cable sometimes referred to as Category 5e (or higher) LAN cable or balanced twisted pair cable. These types of cables are often used to provide Ethernet- and Power over Ethernet (PoE)–type services. A large number of such powering cables bundled together can cause overheating of the wiring if not controlled as described in Table 725.144.

## Part VII. Listing Requirements

### 840.170 Equipment and Cables.

Premises-powered broadband communications systems equipment and cables shall comply with 840.170(A) through (H).

#### (A) Network Terminal.

The network terminal and applicable grounding means shall be listed for application with premises-powered broadband communications systems.

Informational Note No. 1: One way to determine applicable requirements is to refer to ANSI/UL 60950-1-2014, *Standard for Safety of Information Technology Equipment*; ANSI/UL 498A-2015, *Current Taps and Adapters*; ANSI/UL 467-2013, *Grounding and Bonding Equipment;* or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements*.

Informational Note No. 2: There are no requirements on the network terminal and its grounding methodologies except for those covered by the listing of the product.

#### (B) Optical Fiber Cables.

Optical fiber cables shall be listed in accordance with 770.179(A) through (D) and shall be marked in accordance with Table 770.179.

#### (C) Communications Equipment.

Communications equipment shall be listed in accordance with 805.170.

#### (D) Cable Routing Assemblies and Communications Raceways.

Cable routing assemblies and communications raceways shall be listed in accordance with 800.182.

#### (E) Premises Communications Wires and Cables.

Communications wires and cable shall be listed and marked in accordance with 805.179.

#### (F) Premises Community Antenna Television (CATV) Circuits.

Premises community antenna television (CATV) coaxial cables connecting to the network terminal shall be listed in accordance with 820.179. Applicable grounding means shall be listed for application with premises-powered broadband communications systems.

#### (G) Power Source.

The power source for circuits intended to provide power over communications cables to remote equipment shall be limited in accordance with Table 11(B) in Chapter 9 for voltage sources up to 60 V dc and be listed as specified in either of the following:

1. A power source shall be listed as specified in 725.121(A)(1), (A)(2), (A)(3), or (A)(4). The power sources shall not have the output connections paralleled or otherwise interconnected unless listed for such interconnection.
2. A power source shall be listed as communications equipment for limited-power circuits.

Informational Note: One way to determine applicable requirements is to refer to ANSI/UL 60950-1-2014, *Standard for Safety of Information Technology Equipment-Safety — Part 1*; or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements*. Typically, such circuits are used to interconnect equipment for the purpose of exchanging information (data).

**(H) Accessory Equipment.**

Communications accessory equipment and/or assemblies shall be listed for application with premises-powered communications systems.

Informational Note: One way to determine applicable requirements is to refer to ANSI/UL 1863-2004, *Communications-Circuit Accessories*.

## Public Input No. 210-NFPA 70-2019 [ Section No. 800.179 ]

**800.179** ~~Plenum, Riser, General-Purpose, and Limited Use~~ Communications Wires and Cables.

~~Plenum, riser, general-purpose, and limited-use~~ Communications wires and cables shall be listed in accordance with 800.179(A) through (~~D~~ I ) and shall have a temperature rating of not less than 60°C (140°F). The temperature rating shall be marked on the jacket of cables that have a temperature rating exceeding 60°C (140°F). Conductors in communications cables, other than in a coaxial cable, shall be copper. Cables shall be permitted to contain optical fibers. Cables containing optical fibers shall be marked with the suffix -OF.

Communications wires and cables shall have a voltage rating of not less than 300 volts. The insulation for the individual conductors, other than the outer conductor of a coaxial cable , shall be rated for 300 volts minimum. The cable voltage rating shall not be marked on the cable or on the under-carpet communications wire .

Exception: Voltage markings shall be permitted where the cable has multiple listings and 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.

**(A)** Plenum Cables.

Type CMP communications plenum cables, Type CATVP community antenna television plenum coaxial cables, and Type BLP network-powered broadband communication low-power plenum cables shall be listed as being suitable for use in ducts, plenums, and other spaces 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*.

**(B)** Riser Cables.

Type CMR communications riser cables, Type CATVR community antenna television riser coaxial cables, Type BMR network-powered broadband communications medium-power riser cables, and Type BLR network-powered broadband communications low-power riser cables 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-~~2011~~ 2017 , *Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts.*

**(C)** General-Purpose Cables.

**(1) Type CMG.**

Type CMG communications general-purpose cables shall be listed as being suitable for general-purpose use, with the exception of risers and plenums, 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 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. 0.3-09 (R2019), *Test Methods for Electrical Wires and Cables*.

**(2)Types CM , CATV, BM and BL.**

Type CM communications general-purpose cables, Type CATV community antenna television coaxial general-purpose cables, Type BM network-powered broadband communications medium-power general-purpose cables, and Type BL network-powered broadband communications low-power general-purpose cables shall be listed as being suitable for general-purpose use, with the exception of risers and plenums, 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 Flame Tray 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 *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. 0.3-09, *Test Methods for Electrical Wires and Cables*.

**(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 VW-1 (vertical-wire) flame test in ANSI/UL 1581-2017, *Reference Standard for Electrical Wires, Cables and Flexible Cords*.

**(E) Circuit Integrity (CI) Cable or Electrical Circuit Protective System.**

Cables that are used for survivability of critical circuits under fire conditions shall be listed and meet either 800.179(C)(1) or 800.179(C)(2) .

Informational Note: The listing organization provides information for circuit integrity (CI) cable and electrical circuit protective systems, including installation requirements required to maintain the fire rating.

**(1) Circuit Integrity (CI) Cables.**

Circuit integrity (CI) cables specified in 800.179(A) through (C), and used for survivability of critical circuits, shall have an additional classification using the suffix “CI.” In order to maintain its listed fire rating, circuit integrity (CI) cable shall only be installed in free air.

Informational Note: One method of defining circuit integrity (CI) cable is by establishing a minimum 2-hour fire resistance rating for the cable when tested in accordance with ANSI/UL 2196-2017, *Standard for Fire Test for Circuit Integrity of Fire-Resistant Power, Instrumentation, Control, and Data Cables* .

**(2) Fire-Resistive Cables.**

Cables specified in 800.179(A) through (C) and 800.179(E)(1), that are part of an electrical circuit protective system, shall be fire-resistive cable identified with the protective system number on the product, or on the smallest unit container in which the product is packaged, and shall be installed in accordance with the listing of the protective system.

Informational Note No. 1: One method of defining an electrical circuit protective system is by establishing a minimum 2-hour fire resistance rating for the system when tested in accordance with UL Subject 1724, *Outline of Investigation for Fire Tests for Electrical Circuit Protective Systems* .

Informational Note No. 2: The listing organization provides information for electrical circuit protective systems (FHIT), including installation requirements for maintaining the fire rating.

**(F) Types CMP-LP, CMR-LP, CMG-LP, and CM-LP Limited Power (LP) Cables.**

Types CMP-LP, CMR-LP, CMG-LP, and CM-LP communications limited power 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 XX designates the current limit in amperes per conductor.

Informational Note: An example of the marking on a communications cable with an LP rating is "CMP-LP (0.6A)(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

ampere.

**(G) 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 VW-1 (vertical-wire) flame test in ANSI/UL 1581-2017, *Reference Standard for Electrical Wires, Cables and Flexible Cords* .

**(H) Communications Wires.**

Communications wires, such as distributing frame wire and jumper wire, shall 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 Flame Tray 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. 0.3-09 (R2019), *Test Methods for Electrical Wires and Cables* .

**(I) Optional Markings.**

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.

## Statement of Problem and Substantiation for Public Input

When Article 800 was introduced into the 2020 Code, the listing requirements for plenum , riser , general-purpose, and limited-use cables were moved into Article 800.

One of the purposes of this PI is to correct an omission concerning Type CMG cables. The listing requirements for CMG cables were deleted from Article 805 but not moved into Article 800. This PI corrects that omission and updates the reference to the CSA test in the informational note.

In addition to correcting an omission, this PI moves the listing requirements for circuit integrity cables. limited-power cables, undercarpert wires and cables, and communications wires into Article 800 because they all have applications in Articles other than Article 800 and therefore should be in the general article.

Another purpose of this PI is to explicitly permit communications type cables to contain optical fibers to acknowledge that some communications type 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. 209-NFPA 70-2019 [Section No. 770.179(C)] | Updates reference to the CSA test |
| Public Input No. 211-NFPA 70-2019 [Section No. 805.179] | Coordinating PI for Article 805 |
| Public Input No. 212-NFPA 70-2019 [Section No. 830.179] | Coordinating PI for Article 830 |
| Public Input No. 214-NFPA 70-2019 [Section No. 820.179] | Coordinating PI for Article 820 |
| Public Input No. 313-NFPA 70-2020 [Section No. 725.179] | Deals with optical fibers in cables |
| Public Input No. 315-NFPA 70-2020 [Section No. 760.176] | Deals with optical fibers in cables |
| Public Input No. 299-NFPA 70-2020 [Section No. 760.179] | Deals with optical fibers in cables |
| Public Input No. 314-NFPA 70-2020 [Section No. 770.133(C)] | Deals with optical fibers in cables |
| Public Input No. 209-NFPA 70-2019 [Section No. 770.179(C)] | |
| Public Input No. 211-NFPA 70-2019 [Section No. 805.179] | |
| Public Input No. 212-NFPA 70-2019 [Section No. 830.179] | |
| Public Input No. 214-NFPA 70-2019 [Section No. 820.179] | |
| 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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**Committee:** NEC-P16

## Public Input No. 77-NFPA 70-2019 [ Section No. 800.179(B) ]

**(B)** Riser Cables.

Type CMR communications riser cables, Type CATVR community antenna television riser coaxial cables, Type BMR network-powered broadband communications medium-power riser cables, and Type BLR network-powered broadband communications low-power riser cables 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-~~2011~~ 2017 , *Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts.*

## Statement of Problem and Substantiation for Public Input

This PI updates the referenced standard.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 75-NFPA 70-2019 [Section No. 800.182(B)] | Updates referenced standard |
| Public Input No. 74-NFPA 70-2019 [Section No. 800.182(A)] | Updates referenced standard |
| Public Input No. 76-NFPA 70-2019 [Section No. 800.182(C)] | Updates referenced standard |
| Public Input No. 78-NFPA 70-2019 [Section No. 770.179(B)] | Updates referenced standard |
| Public Input No. 79-NFPA 70-2019 [Section No. 770.179(D)] | Updates referenced standard |
| Public Input No. 80-NFPA 70-2019 [Section No. 800.179(C)] | Updates referenced standard |
| Public Input No. 88-NFPA 70-2019 [Section No. 800.53] | Updates referenced standard |
| Public Input No. 74-NFPA 70-2019 [Section No. 800.182(A)] | |
| Public Input No. 75-NFPA 70-2019 [Section No. 800.182(B)] | |
| Public Input No. 76-NFPA 70-2019 [Section No. 800.182(C)] | |
| Public Input No. 78-NFPA 70-2019 [Section No. 770.179(B)] | |
| Public Input No. 79-NFPA 70-2019 [Section No. 770.179(D)] | |
| Public Input No. 80-NFPA 70-2019 [Section No. 800.179(C)] | |
| Public Input No. 88-NFPA 70-2019 [Section No. 800.53] | |

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## Public Input No. 80-NFPA 70-2019 [ Section No. 800.179(C) ]

**(C)** General-Purpose Cables.

Type CM communications general-purpose cables, Type CATV community antenna television coaxial general-purpose cables, Type BM network-powered broadband communications medium-power general-purpose cables, and Type BL network-powered broadband communications low-power general-purpose cables shall be listed as being suitable for general-purpose use, with the exception of risers and plenums, 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 Flame Tray 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 *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. 0.3-09, *Test Methods for Electrical Wires and Cables*.

## Statement of Problem and Substantiation for Public Input

This PI updates the referenced standard.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 79-NFPA 70-2019 [Section No. 770.179(D)] | Updates referenced standard |
| Public Input No. 74-NFPA 70-2019 [Section No. 800.182(A)] | Updates referenced standard |
| Public Input No. 75-NFPA 70-2019 [Section No. 800.182(B)] | Updates referenced standard |
| Public Input No. 76-NFPA 70-2019 [Section No. 800.182(C)] | Updates referenced standard |
| Public Input No. 77-NFPA 70-2019 [Section No. 800.179(B)] | Updates referenced standard |
| Public Input No. 78-NFPA 70-2019 [Section No. 770.179(B)] | Updates referenced standard |
| Public Input No. 88-NFPA 70-2019 [Section No. 800.53] | Updates referenced standard |
| Public Input No. 74-NFPA 70-2019 [Section No. 800.182(A)] | |
| Public Input No. 75-NFPA 70-2019 [Section No. 800.182(B)] | |
| Public Input No. 76-NFPA 70-2019 [Section No. 800.182(C)] | |
| Public Input No. 77-NFPA 70-2019 [Section No. 800.179(B)] | |
| Public Input No. 78-NFPA 70-2019 [Section No. 770.179(B)] | |
| Public Input No. 79-NFPA 70-2019 [Section No. 770.179(D)] | |
| Public Input No. 88-NFPA 70-2019 [Section No. 800.53] | |

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## Public Input No. 341-NFPA 70-2020 [ Section No. 800.179 [Excluding any Sub-Sections] ]

Plenum, riser, general-purpose, and limited-use cables shall be listed in accordance with 800.179(A) through (D) and shall have a temperature rating of not less than 60°C (140°F). The temperature rating shall be marked on the jacket of cables that have a temperature rating exceeding 60°C (140°F). The cable voltage rating shall not be marked on the cable.

Informational Note No. 1: For information on communications cables see *UL 444, Communications Cables* , 2017.

Informational Note No. 2: For information on Community-Antenna Television cables see *UL 1655, Standard for Community-Antenna Television Cables* , 2009.

## 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. 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. 345-NFPA 70-2020 [Section No. 760.176 [Excluding any Sub-Sections]] | Similar PI for 760.176 |
| 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]] | |
| Public Input No. 345-NFPA 70-2020 [Section No. 760.176 [Excluding any Sub-Sections]] | |

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## Public Input No. 686-NFPA 70-2020 [ Section No. 800.182(A) ]

**(A)** Plenum Cable Routing Assemblies and Plenum Communications Raceways.

Plenum cable routing assemblies and plenum communications raceways shall be listed as having adequate fire-resistant and low-smoke-producing characteristics.

Informational Note No. 1: One method of defining cable routing assemblies and communications raceways that have adequate fire-resistant and low-smoke-producing characteristics is that they exhibit a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84-15a, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or ANSI/UL 723-2013, *Standard Test Method for Surface Burning Characteristics of Building Materials*.

Informational Note No. 2: Another method of defining communications raceways that have adequate fire-resistant and low-smoke-producing characteristics is that they exhibit 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 262-2015, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces*.

Informational Note No. 3: See 4.3.11.2.6 or 4.3.11.5.5 of NFPA 90A-~~2015~~ 2021 , *Standard for the Installation of Air-Conditioning and Ventilating Systems*, for information on materials exposed to the airflow in ceiling cavity and raised floor plenums.

### Statement of Problem and Substantiation for Public Input

Update issue date of NFPA 90A.

### Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 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. 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. 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. 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. 687-NFPA 70-2020 [Section No. 805.170(C)]

Public Input No. 688-NFPA 70-2020 [Section No. 770.113(B)]

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**Committee:** NEC-P16

## Public Input No. 74-NFPA 70-2019 [ Section No. 800.182(A) ]

**(A)** Plenum Cable Routing Assemblies and Plenum Communications Raceways.

Plenum cable routing assemblies and plenum communications raceways shall be listed as having adequate fire-resistant and low-smoke-producing characteristics.

Informational Note No. 1: One method of defining cable routing assemblies and communications raceways that have adequate fire-resistant and low-smoke-producing characteristics is that they exhibit a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84-~~15a~~ 19b , *Standard Test Method for Surface Burning Characteristics of Building Materials*, or ANSI/UL 723-~~2013~~ 2018 , *Standard Test Method for Surface Burning Characteristics of Building Materials*.

Informational Note No. 2: Another method of defining communications raceways that have adequate fire-resistant and low-smoke-producing characteristics is that they exhibit 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-~~2015~~ 2019 , *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces*.

Informational Note No. 3: See 4.3.11.2.6 or 4.3.11.5.5 of NFPA 90A-~~2015~~ 2018 , *Standard for the Installation of Air-Conditioning and Ventilating Systems*, for information on materials exposed to the airflow in ceiling cavity and raised floor plenums.

## Statement of Problem and Substantiation for Public Input

This PI updates the referenced standards.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 75-NFPA 70-2019 [Section No. 800.182(B)] | Updates referenced standard |
| Public Input No. 76-NFPA 70-2019 [Section No. 800.182(C)] | Updates referenced standard |
| Public Input No. 77-NFPA 70-2019 [Section No. 800.179(B)] | Updates referenced standard |
| Public Input No. 78-NFPA 70-2019 [Section No. 770.179(B)] | Updates referenced standard |
| Public Input No. 79-NFPA 70-2019 [Section No. 770.179(D)] | Updates referenced standard |
| Public Input No. 80-NFPA 70-2019 [Section No. 800.179(C)] | Updates referenced standard |
| Public Input No. 88-NFPA 70-2019 [Section No. 800.53] | Updates referenced standard |
| Public Input No. 75-NFPA 70-2019 [Section No. 800.182(B)] | |
| Public Input No. 76-NFPA 70-2019 [Section No. 800.182(C)] | |
| Public Input No. 77-NFPA 70-2019 [Section No. 800.179(B)] | |
| Public Input No. 80-NFPA 70-2019 [Section No. 800.179(C)] | |
| Public Input No. 88-NFPA 70-2019 [Section No. 800.53] | |

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| **Submittal Date:** | Sat Nov 09 06:30:57 EST 2019 |
| **Committee:** | NEC-P16 |

# Public Input No. 75-NFPA 70-2019 [ Section No. 800.182(B) ]

**(B)** Riser Cable Routing Assemblies and Riser Communications Raceways.

Riser cable routing assemblies and riser communications raceways shall be listed as having adequate 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 cable routing assemblies and communications raceways pass the requirements of ANSI/UL 1666-~~2011~~ 2017 , *Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts*.

## Statement of Problem and Substantiation for Public Input

This PI updates the referenced standard.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 74-NFPA 70-2019 [Section No. 800.182(A)] | Updates referenced standard |
| Public Input No. 76-NFPA 70-2019 [Section No. 800.182(C)] | Updates referenced standard |
| Public Input No. 77-NFPA 70-2019 [Section No. 800.179(B)] | Updates referenced standard |
| Public Input No. 78-NFPA 70-2019 [Section No. 770.179(B)] | Updates referenced standard |
| Public Input No. 79-NFPA 70-2019 [Section No. 770.179(D)] | Updates referenced standard |
| Public Input No. 80-NFPA 70-2019 [Section No. 800.179(C)] | Updates referenced standard |
| Public Input No. 88-NFPA 70-2019 [Section No. 800.53] | Updates referenced standard |
| Public Input No. 74-NFPA 70-2019 [Section No. 800.182(A)] | |
| Public Input No. 76-NFPA 70-2019 [Section No. 800.182(C)] | |
| Public Input No. 77-NFPA 70-2019 [Section No. 800.179(B)] | |
| Public Input No. 78-NFPA 70-2019 [Section No. 770.179(B)] | |
| Public Input No. 79-NFPA 70-2019 [Section No. 770.179(D)] | |
| Public Input No. 80-NFPA 70-2019 [Section No. 800.179(C)] | |
| Public Input No. 88-NFPA 70-2019 [Section No. 800.53] | |

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**Committee:** NEC-P16

## Public Input No. 76-NFPA 70-2019 [ Section No. 800.182(C) ]

**(C)** General-Purpose Cable Routing Assemblies and General-Purpose Communications Raceways.

General-purpose cable routing assemblies and general-purpose communications raceways shall 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 cable routing assemblies and communications raceways do not spread fire to the top of the tray in the "UL Flame Exposure, Vertical Flame Tray Test" in ANSI/UL 1685-~~2011~~ 2015 , *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*.

## Statement of Problem and Substantiation for Public Input

This PI updates the referenced standard.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 74-NFPA 70-2019 [Section No. 800.182(A)] | Updates referenced standard |
| Public Input No. 75-NFPA 70-2019 [Section No. 800.182(B)] | Updates referenced standard |
| Public Input No. 77-NFPA 70-2019 [Section No. 800.179(B)] | Updates referenced standard |
| Public Input No. 78-NFPA 70-2019 [Section No. 770.179(B)] | Updates referenced standard |
| Public Input No. 79-NFPA 70-2019 [Section No. 770.179(D)] | Updates referenced standard |
| Public Input No. 80-NFPA 70-2019 [Section No. 800.179(C)] | Updates referenced standard |
| Public Input No. 88-NFPA 70-2019 [Section No. 800.53] | Updates referenced standard |
| Public Input No. 74-NFPA 70-2019 [Section No. 800.182(A)] | |
| Public Input No. 75-NFPA 70-2019 [Section No. 800.182(B)] | |
| Public Input No. 77-NFPA 70-2019 [Section No. 800.179(B)] | |
| Public Input No. 78-NFPA 70-2019 [Section No. 770.179(B)] | |
| Public Input No. 79-NFPA 70-2019 [Section No. 770.179(D)] | |
| Public Input No. 80-NFPA 70-2019 [Section No. 800.179(C)] | |
| Public Input No. 88-NFPA 70-2019 [Section No. 800.53] | |

## Submitter Information Verification

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**Submittal Date:** Sat Nov 09 06:42:58 EST 2019
**Committee:** NEC-P16

## Public Input No. 3970-NFPA 70-2020 [ Section No. 805.2 ]

(Relocate all definitions in the 805. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

**805. 2** Definitions.

The definitions in this section shall apply only within Articles 805 and 840.

**Cable.**

A factory assembly of two or more conductors having an overall covering.

**Communications Circuit Integrity (CI) Cable.**

Cable used in communications systems to ensure continued operation of critical circuits during a specified time under fire conditions.

**Wire.**

A factory assembly of one or more insulated conductors without an overall covering.

## 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-P16

# Public Input No. 55-NFPA 70-2019 [ Definition: Cable. ]

~~**Cable.**~~

~~A factory assembly of two or more conductors having an overall covering.~~

## Statement of Problem and Substantiation for Public Input

The term “cable” appears in more than one article in Chapter 8, consequently it belongs in the general article. See PI 54 for Article 800.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 54-NFPA 70-2019 [New Definition after Definition: Block.] | Adds cable definition to Article 800 |
| Public Input No. 54-NFPA 70-2019 [New Definition after Definition: Block.] | |

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**Submittal Date:** Fri Nov 08 06:43:40 EST 2019
**Committee:** NEC-P16

# Public Input No. 57-NFPA 70-2019 [ Definition: Wire. ]

~~**Wire.**~~

~~A factory assembly of one or more insulated conductors without an overall covering.~~

## Statement of Problem and Substantiation for Public Input

The term “wire” appears in more than one article in Chapter 8, consequently it belongs in the general article. See PI 56.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 56-NFPA 70-2019 [New Definition after Definition: Premises.] | Adds definition of wire to Article 800. |
| Public Input No. 56-NFPA 70-2019 [New Definition after Definition: Premises.] | |

## Submitter Information Verification

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**Submittal Date:** Fri Nov 08 06:52:43 EST 2019
**Committee:** NEC-P16

# Public Input No. 911-NFPA 70-2020 [ New Definition after Definition: Communications Circuit Int... ]

**Critical Communication Wiring**

Other necessary communication wiring (other than CI cable) that requires continuous operation to ensure safety of the building or structure and occupants.

## Statement of Problem and Substantiation for Public Input

"Communications Circuit Integrity (CI) Cable" definition deals with the circuit wiring only. We don't yet have a definition for other (associated) emergency wiring which may need to have some degree of fire protection. I feel that this is needed and that the correct place for this IMO would be Article 805.

I took the definition of Critical Circuit from the 2018 International Building Code and changed it. This is how the language reads in the 2018 IBC:
"Critical Circuit - A circuit that requires continuous operation to ensure safety of the structure and occupants."

This is necessary because certain communication systems including but not limited to dispatching systems, telephone systems, public reporting systems, and one-way and two-way radio systems, require 2-hour fire protection for the power or riser circuit only. Under current NEC codes, associated wiring such as fiber optic cable (necessary for the emergency communication) or backbone wiring or transmission lines (coaxial cable run inside buildings) may not incorporate any fire protection. The level of fire protection should really first be established in Article 805 before sending the user off to other Chapters of NEC. So we first need a definition for "other" critical communication wiring in order to apply any new requirements. Please see associated PI for further substantiation.

It is ironic that this is Public Input 911.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 912-NFPA 70-2020 [New Section after 805.179(G)] | |
| Public Input No. 912-NFPA 70-2020 [New Section after 805.179(G)] | |

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**Committee:** NEC-P16

# Public Input No. 84-NFPA 70-2019 [ New Definition after Definition: Wire. ]

**805.3 Other Articles.**

**The general requirements of Article 800 shall apply.**

..

## Statement of Problem and Substantiation for Public Input

A reference to general Article 800 was omitted in the 2020 edition of the NEC. This PI corrects that omission.

## Submitter Information Verification

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**Submittal Date:** Sat Nov 09 09:02:43 EST 2019
**Committee:** NEC-P16

# Public Input No. 496-NFPA 70-2020 [ Section No. 805.47 ]

~~**(B)** Underground~~

**805.47** Underground Communications Wires and Cables Entering Buildings.

~~Underground communications wires and cables entering buildings shall comply with 805.47(A) and (B). The requirements of 310.10(C) shall not apply to communications wires and cables.~~

~~**(A)** Underground Systems with Electric Light, Power, Class 1, or Non-Power-Limited Fire Alarm Circuit Conductors.~~

~~Underground communications wires and cables in a raceway, handhole enclosure, or manhole containing electric light, power, Class 1, or non-power-limited fire alarm circuit conductors shall be in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier.~~

~~-~~ Underground Block Distribution.

Where the entire street circuit is run underground and the circuit within the block is placed so as to be free from the likelihood of accidental contact with electric light or power circuits of over 300 volts to ground, the insulation requirements of 805.50(A) and 805.50(C) shall not apply, insulating supports shall not be required for the conductors, and bushings shall not be required where the conductors enter the building.

## Statement of Problem and Substantiation for Public Input

This is a companion PI to PI 469 which moved most of 805.47 to new 800.47. The requirements for underground block distribution are unique to Article 805 and this PI retains those requirements in Article 805.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 469-NFPA 70-2020 [New Section after 800.44] | Creates new 800.47 |
| Public Input No. 471-NFPA 70-2020 [Section No. 820.47] | Deletes 820.47 |
| Public Input No. 472-NFPA 70-2020 [Section No. 830.47] | Deletes part of 830.47 |
| Public Input No. 469-NFPA 70-2020 [New Section after 800.44] | |
| Public Input No. 472-NFPA 70-2020 [Section No. 830.47] | |

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**Submittal Date:** Thu Feb 20 08:45:48 EST 2020
**Committee:** NEC-P16

## Public Input No. 1442-NFPA 70-2020 [ Section No. 805.47 [Excluding any Sub-Sections] ]

Underground communications wires and cables entering buildings shall comply with 805.47(A) and (B). The requirements of 310.10(C)(3) shall ~~not~~ apply to communications wires and cables.

## Statement of Problem and Substantiation for Public Input

Time and need has caught up to not requiring low voltage cabling to be listed for Direct burial or "wet location" The industry may realize that Belden cable does not make a cable listed for a wet location therefor the time allowance may be needed. I believe precedent has been set in many articles to give the industry a full 3 years to get the technology. IE... NEC 240.67 for fused arc energy reduction, light fixtures requiring disconnecting means 410.130(G). The point is that low voltage has high performance installations and should be afforded the same restrictions as 120v or 24v fire alarm

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**Committee:** NEC-P16

## Public Input No. 3530-NFPA 70-2020 [ Section No. 805.47 [Excluding any Sub-Sections] ]

Underground communications wires and cables entering buildings shall comply with 805.47(A) and (B). The requirements of 310.10(C) shall ~~not~~ apply to communications wires and cables.

## Statement of Problem and Substantiation for Public Input

Time and need has caught up to not requiring low voltage cabling to be listed for direct burial or "wet location" The industry may realize that Belden cable does not make a cable listed for a wet location therefor the time allowance may be needed. I believe precedent has been set in many articles to give the industry a full 3 years to get the technology. IE... NEC 240.67 for fused arc energy reduction, lluminaires requiring disconnecting means 410.130(G). The point is that low voltage has high performance installations and should be afforded the same restrictions as 120 volt or 24 volt fire alarm requirements in NEC 760.3(D).

## Submitter Information Verification

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**Committee:** NEC-P16

# Public Input No. 466-NFPA 70-2020 [ Section No. 805.48 ]

~~**805.48** Unlisted Cables Entering Buildings.~~

~~Unlisted outside plant communications cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated in an enclosure or on a listed primary protector. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) to the point of emergence.~~

~~Informational Note No. 1: Splice cases or terminal boxes, both metallic and plastic types, are typically used as enclosures for splicing or terminating telephone cables.~~

~~Informational Note No. 2: This section limits the length of unlisted outside plant cable to 15 m (50 ft), while 805.90(B) requires that the primary protector be located as close as practicable to the point at which the cable enters the building. Therefore, in installations requiring a primary protector, the outside plant cable may not be permitted to extend 15 m (50 ft) into the building if it is practicable to place the primary protector closer than 15 m (50 ft) to the point of entrance.~~

## Statement of Problem and Substantiation for Public Input

The PI is a companion Public Input to PI No. 465 which consolidates 805.48 and 820.48 into new 800.48. If PI No. 465 is accepted, then this PI needs to be accepted too.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 465-NFPA 70-2020 [New Section after 800.44] | Creates 800.48 |
| Public Input No. 467-NFPA 70-2020 [Section No. 820.48] | Deletes 820.48 |
| Public Input No. 468-NFPA 70-2020 [Section No. 840.48] | Deletes 840.48 |
| Public Input No. 465-NFPA 70-2020 [New Section after 800.44] | |
| Public Input No. 467-NFPA 70-2020 [Section No. 820.48] | |
| Public Input No. 468-NFPA 70-2020 [Section No. 840.48] | |
| Public Input No. 645-NFPA 70-2020 [Section No. 800.113(A)] | |

## Submitter Information Verification

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**Committee:** NEC-P16

## Public Input No. 3127-NFPA 70-2020 [ Section No. 805.90(A)(1) ]

**(1)** Fuseless Primary Protectors.

Fuseless-type primary protectors shall be permitted under any of the conditions given in 805.90(A)(1)(a) through (A)(1)(e).

(a) Where conductors enter a building through a cable with grounded metallic sheath member(s) and where the conductors in the cable safely fuse on all currents greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor

(b) Where insulated conductors in accordance with 805.50(A) are used to extend circuits to a building from a cable with an effectively grounded metallic sheath member(s) and where the conductors in the cable or cable stub, or the connections between the insulated conductors and the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground, safely fuse on all currents greater than the current-carrying capacity of the primary protector, or the associated insulated conductors and of the primary protector bonding conductor or grounding electrode conductor

(c) Where insulated conductors in accordance with 805.50(A) or (B) are used to extend circuits to a building from other than a cable with metallic sheath member(s), where (1) the primary protector is listed as being suitable for this purpose for application with circuits extending from other than a cable with metallic sheath members, and (2) the connections of the insulated conductors to the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground or the conductors of the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground safely fuse on all currents greater than the current-carrying capacity of the primary protector, or associated insulated conductors and of the primary protector bonding conductor or grounding electrode conductor

(d) Where insulated conductors in accordance with 805.50(A) are used to extend circuits aerially to a building from a buried or underground circuit that is unexposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground

(e) Where insulated conductors in accordance with 805.50(A) are used to extend circuits to a building from cable with an effectively grounded metallic sheath member(s), and where (1) the combination of the primary protector and insulated conductors is listed as being suitable for this purpose for application with circuits extending from a cable with an effectively grounded metallic sheath member(s), and (2) the insulated conductors safely fuse on all currents greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor

Informational Note: ~~Section 9~~ Section 09 of ANSI/IEEE C2-~~2012~~ 2017 , *National Electrical Safety Code*, provides an example of methods of protective grounding that can achieve effective grounding of communications cable sheaths for cables from which communications circuits are extended.

## Statement of Problem and Substantiation for Public Input

This change updates the reference to NESC to the latest published edition of 2017 and corrects the reference to "Section 9" to "Section 09".

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|

| | |
|---|---|
| Public Input No. 3132-NFPA 70-2020 [Section No. 830.44(B)] | similar update to NESC edition date for different rule |
| Public Input No. 3132-NFPA 70-2020 [Section No. 830.44(B)] | |

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**Committee:** NEC-P16

## Public Input No. 3135-NFPA 70-2020 [ Section No. 805.90(C) ]

**(C)** Hazardous (Classified) Locations.

The ~~primary protector shall not be located in any hazardous (classified) locations, as defined in 500.5 and 505.5 , or in the vicinity of easily ignitible material.~~

~~*Exception: As permitted in 501.150 , 502.150 , and 503.150 .*~~

requirements of 800.90 shall apply

## Statement of Problem and Substantiation for Public Input

As part of the consolidation of requirements into the new Article 800 for the 2020 code, this requirement should be moved to a common rule under a new 800.90 (as proposed under PI 3133) and replaced with a reference here in this 805.90(C).

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 3133-NFPA 70-2020 [New Part after III.] | adding a new rule in 800 to move requirements of 805.90(C) to. |
| Public Input No. 3136-NFPA 70-2020 [Section No. 820.93(D)] | moving similar rule in 820.93(D) to newly created 800.90 |
| Public Input No. 3137-NFPA 70-2020 [Section No. 830.90(C)] | moving similar rule in 830.90(C) to newly created 800.90 |
| Public Input No. 3133-NFPA 70-2020 [New Part after III.] | |
| Public Input No. 3136-NFPA 70-2020 [Section No. 820.93(D)] | |
| Public Input No. 3137-NFPA 70-2020 [Section No. 830.90(C)] | |

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**Committee:** NEC-P16

# Public Input No. 615-NFPA 70-2020 [ Section No. 805.133 ]

**805.133** Installation of Communications Wires, Cables, and Equipment.

Communications wires and cables from the protector to the equipment or, where no protector is required, communications wires and cables attached to the outside or inside of the building shall comply with 805.133(A) and 805.133(B)

**(A)** Separation from Other Conductors.

**(1)** In Raceways, Cable Trays, Boxes, Cables, Enclosures, and Cable Routing Assemblies.

(a) *Other Circuits.* Communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with cables 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) Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770

(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

(b) *Class 2 and Class 3 Circuits.* Class 1 circuits shall not be run in the same cable with communications circuits. Class 2 and Class 3 circuit conductors shall be permitted in the same listed communications cable with communications circuits.

(c) *Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm, and Medium-Power Network-Powered Broadband Communications Circuits in Raceways, Compartments, and Boxes.* Communications conductors shall not be placed in any raceway, compartment, outlet box, junction box, or similar fitting with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits.

*Exception No. 1:* *Section 805.133(A)(1) (c) shall not apply if 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 conductors of communications circuits by a permanent barrier or listed divider.*

*Exception No. 2:* *Power conductors in outlet boxes, junction boxes, or similar fittings or compartments where such conductors are introduced solely for power supply to communications equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum of 6 mm ( 1/4 in.) separation from the communications circuit conductors.*

*Exception No. 3:* *As permitted by 620.36 .*

~~**(2)** Other Applications.~~

~~Communications wires and cables shall be separated 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.~~

~~*Exception No. 1: Section 805.133(A)(2) shall not apply where either (1) all of the conductors of the electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits are in a raceway or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC, or Type UF cables, or (2) all of the conductors of communications circuits are encased in raceway.*~~

~~*Exception No. 2: Section 805.133(A)(2) shall not apply where the communications wires and cables are permanently separated from the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*~~

~~**(B)** Support of Communications Wires and Cables.~~

~~Raceways shall be used for their intended purpose. Communications wires and cables shall not be strapped, taped, or attached by any means to the exterior of any raceway as a means of support.~~

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

## Statement of Problem and Substantiation for Public Input

CMP 16 created new Article 800, General Requirements for Communications Systems, in order to consolidate the redundant requirements in Article 800 (old Article 800), Article 820 and Article 830 into one general article. Redundant requirements that were identical in multiple articles in Chapter 8 were brought into new Article 800. The emphasis was on consolidating identical requirements, with similar but not identical requirements left for the next cycle. Simply put, new Article 800 is a work in progress.

This Public Input, and other companion Public Inputs, are intended to continue the development of general Article 800 by consolidating similar but not identical requirements. This consolidation requires an understanding of the technical purpose of the sections being consolidated in order to make editorial changes in the text that retain all the mandatory requirements, albeit with slightly different wording.

The PI is a companion Public Input to PI No. 614 which consolidates 805.133 and 820.133 into new 800.133. If PI No. 614 is accepted, then this PI needs to be accepted too.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 614-NFPA 70-2020 [New Section after 800.113] | Creates 800.133 |
| Public Input No. 616-NFPA 70-2020 [Section No. 820.133] | Deletes 820.133 |
| Public Input No. 614-NFPA 70-2020 [New Section after 800.113] | |
| Public Input No. 616-NFPA 70-2020 [Section No. 820.133] | |

## Submitter Information Verification

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| **Zip:** | |
| **Submittal Date:** | Sun Mar 08 05:15:48 EDT 2020 |
| **Committee:** | NEC-P16 |

## Public Input No. 3762-NFPA 70-2020 [ Section No. 805.133(A)(1) ]

**(1)** In Raceways, Cable Trays, Boxes, Cables, Enclosures, and Cable Routing Assemblies.

(a) *Other Circuits.* Communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with cables of any of the following:

(1) Class 2, Class 3 and ~~Class 3~~ Class 4 remote-control, signaling, and power-limited circuits in compliance with Article 645 or Parts I and III of Article 725 or 726 as applicable.

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

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

(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

(b) *Class 2 and Class 3 Circuits.* Class 1 circuits shall not be run in the same cable with communications circuits. Class 2 ~~and Class 3 circuit~~ , Class 3 and Class 4 circuits conductors shall be permitted in the same listed communications cable with communications circuits.

(c) *Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm, and Medium-Power Network-Powered Broadband Communications Circuits in Raceways, Compartments, and Boxes.* Communications conductors shall not be placed in any raceway, compartment, outlet box, junction box, or similar fitting with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits.

*Exception No. 1: Section 805.133(A)(1)(c) shall not apply if 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 conductors of communications circuits by a permanent barrier or listed divider.*

*Exception No. 2: Power conductors in outlet boxes, junction boxes, or similar fittings or compartments where such conductors are introduced solely for power supply to communications equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum of 6 mm (¼ in.) separation from the communications circuit conductors.*

*Exception No. 3: As permitted by 620.36.*

## Statement of Problem and Substantiation for Public Input

Added New Class 4 and Article 726 to correlate with Public Input 3740 Article 726 Class 4

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| **Committee:** | NEC-P16 |

# Public Input No. 89-NFPA 70-2019 [ Section No. 805.154 ]

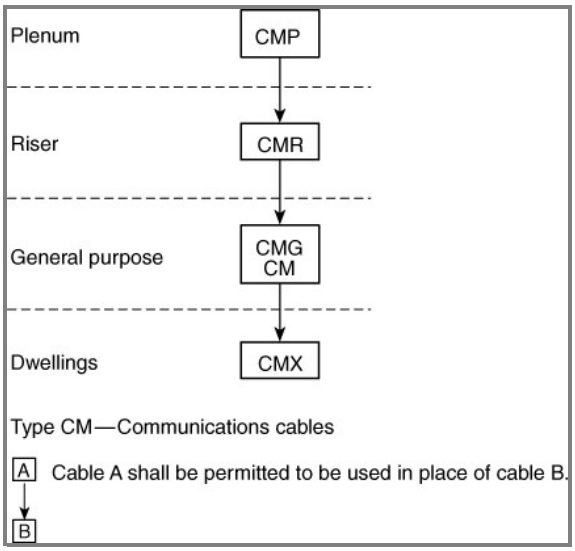
**805.154** Substitutions of Listed Communications Wires ~~, Cables, and Raceways, and Listed Cable Routing Assemblies~~ and Cables .

The substitutions for communications cables listed in Table 805.154 and illustrated in Figure 805.154 shall be permitted.

Table 805.154 Cable Substitutions

| Cable Type | Permitted Substitutions |
|---|---|
| CMR | CMP |
| CMG, CM | CMP, CMR |
| CMX | CMP, CMR, CMG, CM |

**Figure 805.154 Cable Substitution Hierarchy.**




## Statement of Problem and Substantiation for Public Input

This section only deals with wires and cables. The requirements for cable routing assemblies and communications raceways are in general Article 800.

## Submitter Information Verification

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## Public Input No. 272-NFPA 70-2020 [ Section No. 805.170(A) ]

**(A)** Primary Protectors.

The primary protector shall be listed and shall consist of an arrester connected between each line conductor and ground in an appropriate mounting. Primary protector terminals shall be marked to indicate line and ground as applicable.

Informational Note: One way to determine applicable requirements for a listed primary protector is to refer to ANSI/UL 497-2013, *Standard for Protectors for Paired Conductor Communications Circuits*.

## Statement of Problem and Substantiation for Public Input

Section 805.170 covers listing of communications equipment, but does not mention protectors. Will the NEC user assume that the protector is considered communications equipment? Section 805.170(A) does not mention that the protector shall be listed. However, the Informational Note to 805.170(A) directs the reader to the UL standard for listing requirements. Unfortunately, Informational Notes are not enforceable as Code.

## Submitter Information Verification

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| **Committee:** | NEC-P16 |

## Public Input No. 66-NFPA 70-2019 [ Section No. 805.170(C) ]

~~**(C)** Plenum Grade Cable Ties.~~

~~Cable ties intended for use in other space used for environmental air (plenums) shall be listed as having low smoke and heat release properties.~~

~~Informational Note: See NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems* , and ANSI/UL 2043-2013, *Standard for Safety Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces* , for information on listing discrete products as having low smoke and heat release properties.~~

## Statement of Problem and Substantiation for Public Input

The listing requirements for plenum cable ties belong in general Article 800 because cable ties are used in multiple articles. See PI 65.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 65-NFPA 70-2019 [New Part after V.] | Moves listing requirements for cable ties to Article 800. |
| Public Input No. 64-NFPA 70-2019 [Section No. 770.24] | |
| Public Input No. 65-NFPA 70-2019 [New Part after V.] | |
| Public Input No. 67-NFPA 70-2019 [Section No. 800.24] | |

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**Committee:** NEC-P16

## Public Input No. 687-NFPA 70-2020 [ Section No. 805.170(C) ]

**(C)** Plenum Grade Cable Ties.

Cable ties intended for use in other space used for environmental air (plenums) shall be listed as having low smoke and heat release properties.

Informational Note: See NFPA 90A ~~2018~~ 2021 , *Standard for the Installation of Air-Conditioning and Ventilating Systems*, and ANSI/UL 2043-2013, *Standard for Safety Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces*, for information on listing discrete products as having low smoke and heat release properties.

### 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. 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. 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. 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. 688-NFPA 70-2020 [Section No. 770.113(B)]

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**Committee:** NEC-P16

## Public Input No. 4706-NFPA 70-2020 [ Section No. 805.170 [Excluding any Sub-Sections] ]

Communications equipment shall be listed as being suitable for electrical connection to a communications network.

Informational Note No. 1: One way to determine applicable requirements is to refer to ANSI/UL 62368-1-2014, or ANSI/UL 62368-1-2018 *Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements* . ANSI/ UL 60950-1-2014, *Standard for Safety of Information Technology Equipment*; ANSI/UL 1863-2012, *Standard for Safety Communications Circuit Accessories*; ~~or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements*~~ is no longer permitted for NEW Listings as of 12/20/2020, however existing products can continue to bear the 60950-1 Listing as long as permitted by the Listing agency .

Informational Note No. 2: Additional information regarding voltages, currents, and power allowed on communications circuits can be found in ANSI/ATIS 0600337-~~2016~~ 2019 , *Requirements for Maximum Voltage, Current, and Power Levels Used in Communications ~~Transport~~ Circuits*.

### Statement of Problem and Substantiation for Public Input

I am on the the STP and THC for the ICT Listing standards and these are editorial updates to reflect the latest available information. I am also the editor of the referenced ATIS standard and am providing that updated date

UL 62368-1-2014 2nd edition is currently in force with no stated withdrawal or sunset date
UL 62368-1-2018 3rd edition is currently also in force as an option
UL 60950-1 will only be permitted for new Listings until 12/20/2020, however NRTL's are permitted to continue to allow existing products or products that have not undergone a design change to continue to be Listed based on each NRTL's policy. Currently all NRTL's will allow Listings to be retained to 60950-1 indefinitley.
IEC 62368-1 4th edition is in final development and may not be published by this code cycle end date so not included. Anticipated publication date is 2022 or early 2023.
ATIS 0600337 was updated and re-published in 2019.

### Submitter Information Verification

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**Committee:** NEC-P16

# Public Input No. 211-NFPA 70-2019 [ Section No. 805.179 ]

**805.179** Communications Wires and Cables.

Communications wires and cables shall be listed in accordance with 805.179(A) ~~through~~ and (~~F~~ B ) and marked in accordance with Table 805.179 ~~and 805~~ . ~~179(G). Conductors in communications cables, other than in a coaxial cable, shall be copper.~~

~~Communications wires and cables shall have a voltage rating of not less than 300 volts. The insulation for the individual conductors, other than the outer conductor of a coaxial cable, shall be rated for 300 volts minimum. The cable voltage rating shall not be marked on the cable or on the under-carpet communications wire.~~

~~Exception: _ _ Voltage markings shall be permitted where the cable has multiple listings and 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 805.179 Cable Markings

| Cable Marking | Type |
|---|---|
| CMP | Communications plenum cable |
| CMR | Communications riser cable |
| CMG | Communications general-purpose cable |
| CM | Communications general-purpose cable |
| CMX | Communications cable, limited use |
| CMUC | Under-carpet communications wire and cable |

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

**(A)** General Requirements.

The general requirements in ~~805~~ 800 .179 shall apply.

~~**(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 VW-1 (vertical-wire) flame test in ANSI/UL 1581-2017, *Reference Standard for Electrical Wires, Cables and Flexible Cords* .~~

~~**(C)** Circuit Integrity (CI) Cable or Electrical Circuit Protective System.~~

~~Cables that are used for survivability of critical circuits under fire conditions shall be listed and meet either 805.179(C)(1) or 805.179(C)(2) .~~

~~Informational Note: The listing organization provides information for circuit integrity (CI) cable and electrical circuit protective systems, including installation requirements required to maintain the fire rating.~~

**(1)** Circuit Integrity (CI) Cables.

Circuit integrity (CI) cables specified in 805.179(A) through (D), and used for survivability of critical circuits, shall have an additional classification using the suffix "CI." In order to maintain its listed fire rating, circuit integrity (CI) cable shall only be installed in free air.

Informational Note: One method of defining circuit integrity (CI) cable is by establishing a minimum 2-hour fire resistance rating for the cable when tested in accordance with ANSI/UL 2196-2017, *Standard for Fire Test for Circuit Integrity of Fire-Resistant Power, Instrumentation, Control, and Data Cables* .

**(2)** Fire-Resistive Cables.

Cables specified in 800.179(A) through (D) and 805.179(C)(1) , that are part of an electrical circuit protective system, shall be fire-resistive cable identified with the protective system number on the product, or on the smallest unit container in which the product is packaged, and shall be installed in accordance with the listing of the protective system.

Informational Note No. 1: One method of defining an electrical circuit protective system is by establishing a minimum 2-hour fire resistance rating for the system when tested in accordance with UL Subject 1724, *Outline of Investigation for Fire Tests for Electrical Circuit Protective Systems* .

Informational Note No. 2: The listing organization provides information for electrical circuit protective systems (FHIT), including installation requirements for maintaining the fire rating.

**(D)** Types CMP-LP, CMR-LP, CMG-LP, and CM-LP Limited Power (LP) Cables.

Types CMP-LP, CMR-LP, CMG-LP, and CM-LP communications limited power 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 XX designates the current limit in amperes per conductor.

Informational Note: An example of the marking on a communications cable with an LP rating is "CMP-LP (0.6A)(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 ampere.

**(E)** Communications Wires.

Communications wires, such as distributing frame wire and jumper wire, shall 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 Flame Tray 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. 0.3-09, *Test Methods for Electrical Wires and Cables* .

~~**(F)**~~

**(B)** Hybrid Power and Communications Cables.

Listed hybrid power and communications cables shall be permitted where the power cable is a listed Type NM or NM-B, conforming to Part III of Article 334, and the communications cable is a listed Type CM, the jackets on the listed NM or NM-B, and listed CM cables are rated for 600 volts minimum, and the hybrid cable is 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 Flame Tray 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 *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. 0.3-09, *Test Methods for Electrical Wires and Cables* .

~~**(G)** Optional Markings.~~

~~Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.~~

~~Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.~~

## Statement of Problem and Substantiation for Public Input

This PI coordinates with PI 210 by deleting the listing requirements from Article 805 that PI 210 moves to Article 800.

This PI also updates the reference to UL 1685.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 210-NFPA 70-2019 [Section No. 800.179] | Moves listing requirements to Article 800. |
| Public Input No. 212-NFPA 70-2019 [Section No. 830.179] | Coordinating PI for Article 830 |
| Public Input No. 210-NFPA 70-2019 [Section No. 800.179] | |
| Public Input No. 212-NFPA 70-2019 [Section No. 830.179] | |
| Public Input No. 214-NFPA 70-2019 [Section No. 820.179] | |

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| **Submittal Date:** | Fri Dec 27 10:02:49 EST 2019 |
| **Committee:** | NEC-P16 |

## Public Input No. 3128-NFPA 70-2020 [ Section No. 805.179(A) ]

**(A)** General Requirements.

The general requirements in ~~805~~ 800 . ~~179 shall~~ 179 shall apply.

## Statement of Problem and Substantiation for Public Input

One objective of the consolidation into Article 800 was that all common listing requirements will be contained in sections such as 800.179. This reference in 805.179 should be to 800.179.

## Submitter Information Verification

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## Public Input No. 4572-NFPA 70-2020 [ Section No. 805.179(A) ]

**(A)** General Requirements.

The general requirements in ~~805~~ 800 .179 shall apply.

## Statement of Problem and Substantiation for Public Input

This section needs a back-reference to the generic tables and descriptions in 800.179; A good confirming example of this is the corresponding provision in 820.179(A). This reference to 805.179 is unnecessary because the reader is already in that section, and appears to be an error.

## Submitter Information Verification

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**Committee:** NEC-P16

## Public Input No. 81-NFPA 70-2019 [ Section No. 805.179(A) ]

**(A)** General Requirements.

The general requirements in ~~805~~ 800 .179 shall apply.

## Statement of Problem and Substantiation for Public Input

This PI corrects an error. The general requirements are in Article 800 not 805.

## Submitter Information Verification

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**Submittal Date:** Sat Nov 09 08:36:05 EST 2019
**Committee:** NEC-P16

## Public Input No. 2247-NFPA 70-2020 [ Section No. 805.179(C) ]

**(C)** 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 805.179(C)(1) ~~or 805.179~~ , (C)(2) or (C)(3) .

Informational Note: The listing organization provides information for circuit integrity (CI) cable and electrical circuit protective systems, including installation requirements required to maintain the fire rating.

**(1)** Circuit Integrity (CI) Cables.

Circuit integrity (CI) cables specified in 805.179(A) through (D), 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 800 .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 800.179(C)(2).

Informational Note: One method of defining circuit integrity (CI) cable is by establishing ~~a minimum 2-hour fire resistance~~ fire-resistive rating for the cable when tested in accordance with ~~ANSI/~~ UL 2196~~-2017~~ , ~~*Standard for*~~ *Fire Test for Circuit Integrity of Fire-~~Resistant~~ Resistive Power, Instrumentation, Control ~~,~~ and Data Cables* as specified in UL 444 ,*Communication Cables* . UL *Guide Information for Communications Cable (DUZX)* contains information to identify the cable and its installation limitations to maintain the fire-resistive rating.

**(2)** Fire-Resistive ~~Cables~~ Cable Systems .

~~Cables~~ Fire-resistive cables specified in 800.179(A) through (D) and 805.179(C)(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 the outer jacket of the cable and installed in accordance with the listing of the system.

Informational Note: One method of defining a fire-cable system is by establishing a rating when tested in accordance with UL2196, *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 Systems.

Protectants for cables specified in 800.179(A) through (D), which are part of an electrical circuit protective system, shall be

~~fire-resistive cable~~

identified with the protective system

~~number~~

identifier and hourly rating marked on the

~~product,~~

protectant or

~~on~~

the smallest unit container

~~in which the product is packaged,~~

and

~~shall be~~

installed in accordance with the listing of the

~~protective~~

system.

Informational Note ~~No. 1~~ : One method of defining an electrical circuit protective system is by establishing a ~~minimum 2-hour fire resistance~~ rating ~~for the system~~ when tested in accordance with ~~UL Subject 1724, Outline of Investigation for~~ UL1724 *Fire Tests for Electrical Circuit Protective Systems* . ~~Informational Note No. 2: The listing organization provides information for electrical circuit protective systems (FHIT), including installation requirements for maintaining the fire~~ 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 intent here is to mirror language used in Articles 725, 728, 760, and 770 all regarding the installation of Circuit
Integrity Systems, Fire-Resistive Cable Systems, and Electrical Circuit Protective Systems. There are three distinct
methods to provide survivability and they need to be properly identified here with their installation requirements
documented accordingly. The prior reference to "minimum 2-hour fire-resistance" in the informational notes was deleted
to avoid the appearance of a requirement in an informational note and to align with text proposed for the other sections
to correlate. 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-P16

## Public Input No. 4037-NFPA 70-2020 [ Section No. 805.179(D) ]

**(D)** Types CMP-LP, CMR-LP, CMG-LP, and CM-LP Limited Power (LP) Cables.

Types CMP-LP, CMR-LP, CMG-LP, and CM-LP communications limited power cables shall be listed

~~as~~
a suitable for

~~carrying~~
suppling 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.~~
to equipment. When installed in bundles of 192 or less cables 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 marked on the cable, located immediately following the suffix “-LP”. These cables may also be installed using the ampacity values and bundle size limits given in Table 725.144. For ambient temperatures above 30°C (86°F), the correction factors of Table 310.15(B)(1) or Equation 310.15(B) must be applied to the ampacity values given in table 725.144 as well as the rated current limit marked on the cable.

The cables shall be marked in accordance with table 805.179 and the suffix “-

~~LP~~
LP (

~~XXA~~
XXA@ 30°C ),” where XX designates the current limit in amperes per conductor at 30°C (86°F) . The temperature rating of the cable shall also be marked on the jacket of cables that have a temperature rating exceeding 60°C (140°F).

Informational Note:

~~An~~
An example of the

~~marking~~
markings on a

~~communications cable with an LP rating is "CMP-LP (0.6A)(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 ampere~~

23 gauge Plenum, limited power (LP) cable having a rated current of 0.5 amperes per conductor at 30°C (86°F), and a temperature rating of 75°C are “CMP-LP(0.5A@30°C) 75°C 23 AWG” .

## Statement of Problem and Substantiation for Public Input

Rational: The proposed text clarifies the methods by which may be installed in regards to bundle size and current capacity. Also clarifies the required cable markings and adds “@30°C” to the markings 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 and not only up to 30C. This could 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.

## Submitter Information Verification

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**Committee:** NEC-P16

## Public Input No. 919-NFPA 70-2020 [ Section No. 805.179(D) ]

**(D)** Types CMP-LP, CMR-LP, CMG-LP, and CM-LP Limited Power (LP) Cables.

Types CMP-LP, CMR-LP, CMG-LP, and CM-LP communications limited power 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 805.179 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 XX designates the current limit in amperes per conductor.

Informational Note: An example of the marking on a communications cable with an LP rating is "CMP-LP (0.6A)(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 ampere.

## Statement of Problem and Substantiation for Public Input

Referencing the article 805.179 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 805.179(D) for accuracy and consistency with the marking requirements. This change will also be consistent with the example in the informational note in article 805.179(D) where the temperature rating of (75°C) is included in the marking "CMP-LP (0.6A)(75°C) 23 AWG 4 pair,".

Informational Note: An example of the marking on a communications cable with an LP rating is "CMP-LP (0.6A)(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 ampere.

## Submitter Information Verification

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**Submittal Date:** Thu Apr 30 18:57:25 EDT 2020
**Committee:** NEC-P16

## Public Input No. 912-NFPA 70-2020 [ New Section after 805.179(G) ]

**805.179(H)Critical Communication Wiring**

Critical Communication Wiring shall be protected using one of the following methods:

(1) Cables shall be listed to UL 2196 and have a fire resistance rating of not less than 1-hour.

(2) Electrical circuit protective systems having a fire resistance rating of not less than 1-hour. Electrical circuit protective systems must be installed in accordance with the listing.

(3) Routing the wiring through areas having a fire resistance rating of not less than 1-hour.

(4) Routing the wiring only through sections of the building or structure that are sprinkled, where a fire sprinkler system(s) is installed in accordance with NFPA-13, Standard for the Installation of Sprinkler Systems. Where the critical communication wiring passes from an area of sprinkler protection to an area that is not protected, the wiring shall employ protection as listed in (1), (2), or (3) above.

## Statement of Problem and Substantiation for Public Input

The substantiation for this addition to NEC is to protect other wiring that may need some degree of fire protection. Should a coaxial cable for a 911 system fail, for example, it could compromise the system. Should a fiber optic cable for an emergency two-way system fail, for example, it could compromise the system.

Every code and standard seems to dictate that at least 1-hour rating is necessary. Yet for fiber optic (emergency) transmission for example, we send the user to 770 which does not definitively require this rating. This is an example of the real-life problem. "Plenum rated" fiber-optic cable is distinctly different from fiber optic cable with a 1-hour fire rating (or 1-hour method of protection). "Flame resistance" is not necessarily linked to functional integrity. The fire-protection standards for all emergency communication wiring first needs to be established in Article 805, before sending the user to other sections of the code that may also apply.

This proposed change would integrate seamlessly with NFPA-1221. NFPA-1221 Section 5.10 states that, “All pathways shall comply with NFPA-70.” So the applicable standard already points back to NEC.

This idea was taken in part from the 2018 International Building Code, Section 2702.3 "Critical circuits," (a new section). This new section requires at least 1-hour for a critical circuit. This proposed change is also in line with NFPA-72, which permits Level 1 protection for buildings (or parts thereof) constructed of less than 2-hour rated construction (see Exception in 24.3.13.7 2016 NFPA-72). I'm not advocating for a reduction in protection as currently required by 805.179(C)(1) and (C)(2). Rather this change would apply to other wiring that is necessary to make the system work.

This proposed change would also encourage cable manufacturers to fabricate additional 1-hour rated cable types. I see this change as being good for all parties, and to help ensure safety of the public during emergencies.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 911-NFPA 70-2020 [New Definition after Definition: Communications Circuit Int...] | |

Public Input No. 911-NFPA 70-2020 [New Definition after Definition: Communications Circuit Int...]

## Submitter Information Verification

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**Committee:** NEC-P16

# Public Input No. 2780-NFPA 70-2020 [ Article 810 ]

~~**Article 810** Radio and Television Equipment~~ Article 810 Antenna Systems

**Part I.** General

**810.1** Scope.

This article covers antenna systems for radio and television receiving equipment, amateur and citizen band radio transmitting and receiving equipment, and certain features of transmitter safety. This article covers antennas such as wire-strung type, multi-element, vertical rod, flat, or parabolic and also covers the wiring and cabling that connect them to equipment. This article does not cover equipment and antennas used for coupling carrier current to power line conductors.

**810.2** Definitions.

The definitions in Part I of Article 100 shall apply.

**810.3** Other Articles.

Wiring from the source of power to and between devices connected to the interior wiring system shall comply with Chapters 1 through 4 other than as modified by Parts I and II of Article 640. Wiring for audio signal processing, amplification, and reproduction equipment shall comply with Article 640. Coaxial cables that connect antennas to equipment shall comply with Article 820.

**810.4** Community Television Antenna.

The antenna shall comply with this article. The distribution system shall comply with Article 820.

**810.5** Radio Noise Suppressors.

Radio interference eliminators, interference capacitors, or noise suppressors connected to power-supply leads shall be of a listed type. They shall not be exposed to physical damage.

**810.6** Antenna Lead-In Protectors.

Where an antenna lead-in surge protector is installed, it shall be listed as being suitable for limiting surges on the cable that connects the antenna to the receiver/transmitter electronics and shall be connected between the conductors and the grounded shield or other ground connection. The antenna lead-in protector shall be grounded using a bonding conductor or grounding electrode conductor installed in accordance with 810.21(F).

> Informational Note: For requirements covering protectors for antenna lead-in conductors, refer to UL 497E, *Outline of Investigation for Protectors for Antenna Lead-In Conductors*.

**810.7** Grounding Devices.

Where bonding or grounding is required, devices used to connect a shield, a sheath, non–current-carrying metallic members of a cable, or metal parts of equipment or antennas to a bonding conductor or grounding electrode conductor shall be listed or be part of listed equipment.

**Part II.** Receiving Equipment — Antenna Systems

**810.11** Material.

Antennas and lead-in conductors shall be of hard-drawn copper, bronze, aluminum alloy, copper-clad steel, or other high-strength, corrosion-resistant material.

*Exception: Soft-drawn or medium-drawn copper shall be permitted for lead-in conductors where the maximum span between points of support is less than 11 m (35 ft).*

**810.12** Supports.

Outdoor antennas and lead-in conductors shall be securely supported. The antennas or lead-in conductors shall not be attached to the electric service mast. They shall not be attached to poles or similar structures carrying open electric light or power wires or trolley wires of over 250 volts between conductors. Insulators supporting the antenna conductors shall have sufficient mechanical strength to safely support the conductors. Lead-in conductors shall be securely attached to the antennas.

**810.13** Avoidance of Contacts with Conductors of Other Systems.

Outdoor antennas and lead-in conductors from an antenna to a building shall not cross over open conductors of electric light or power circuits and shall be kept well away from all such circuits so as to avoid the possibility of accidental contact. Where proximity to open electric light or power service conductors of less than 250 volts between conductors cannot be avoided, the installation shall be such as to provide a clearance of at least 600 mm (2 ft).

Where practicable, antenna conductors shall be installed so as not to cross under open electric light or power conductors.

**810.14** Splices.

Splices and joints in antenna spans shall be made mechanically secure with approved splicing devices or by such other means as will not appreciably weaken the conductors.

**810.15** Grounding.

Masts and metal structures supporting antennas shall be grounded in accordance with 810.21, unless the antenna and its related supporting mast or structure are within a zone of protection defined by a 46 m (150 ft) radius rolling sphere.

Informational Note: See 4.8.3.1 of NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, for the application of the term *rolling sphere*.

**810.16** Size of Wire-Strung Antenna — Receiving Station.

**(A)** Size of Antenna Conductors.

Outdoor antenna conductors for receiving stations shall be of a size not less than given in Table 810.16(A).

Table 810.16(A) Size of Receiving Station Outdoor Antenna Conductors

| Material | Minimum Size of Conductors (AWG) Where Maximum Open Span Length Is | | |
|---|---|---|---|
| | Less Than 11 m (35 ft) | 11 m to 45 m (35 ft to 150 ft) | Over 45 m (150 ft) |
| Aluminum alloy, hard-drawn copper | 19 | 14 | 12 |
| Copper-clad steel, bronze, or other high-strength material | 20 | 17 | 14 |

**(B)** Self-Supporting Antennas.

Outdoor antennas, such as vertical rods and flat, parabolic, or dipole structures, shall be of corrosion-resistant materials and of strength suitable to withstand ice and wind loading conditions and shall be located well away from overhead conductors of electric light and power circuits of over 150 volts to ground, so as to avoid the possibility of the antenna or structure falling into or making accidental contact with such circuits.

**810.17** Size of Lead-in — Receiving Station.

Lead-in conductors from outside antennas for receiving stations shall, for various maximum open span lengths, be of such size as to have a tensile strength at least as great as that of the conductors for antennas as specified in 810.16. Where the lead-in consists of two or more conductors that are twisted together, are enclosed in the same covering, or are concentric, the conductor size shall, for various maximum open span lengths, be such that the tensile strength of the combination is at least as great as that of the conductors for antennas as specified in 810.16.

**810.18** Clearances — Receiving Stations.

**(A)** Outside of Buildings.

Lead-in conductors attached to buildings shall be installed so that they cannot swing closer than 600 mm (2 ft) to the conductors of circuits of 250 volts or less between conductors, or 3.0 m (10 ft) to the conductors of circuits of over 250 volts between conductors, except that in the case of circuits not over 150 volts between conductors, where all conductors involved are supported so as to ensure permanent separation, the clearance shall be permitted to be reduced but shall not be less than 100 mm (4 in.). The clearance between lead-in conductors and any conductor forming a part of a lightning protection system shall not be less than 1.8 m (6 ft). Underground conductors shall be separated at least 300 mm (12 in.) from conductors of any light or power circuits or Class 1 circuits.

*Exception: Where the electric light or power conductors, Class 1 conductors, or lead-in conductors are installed in raceways or metal cable armor.*

Informational Note No. 1: See 250.60 for grounding associated with lightning protection components — strike termination devices. For further information, see NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, which contains detailed information on grounding, bonding, and spacing from lightning protection systems, and the calculation of specific separation distances using the sideflash equation in Section 4.6.

Informational Note No. 2: Metal raceways, enclosures, frames, and other non–current-carrying metal parts of electrical equipment installed on a building equipped with a lightning protection system may require bonding or spacing from the lightning protection conductors in accordance with NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*. Separation from lightning protection conductors is typically 1.8 m (6 ft) through air or 900 mm (3 ft) through dense materials such as concrete, brick, or wood.

**(B)** Antennas and Lead-ins — Indoors.

Indoor antennas and indoor lead-ins shall not be run nearer than 50 mm (2 in.) to conductors of other wiring systems in the premises.

*Exception No. 1: Where such other conductors are in metal raceways or cable armor.*

*Exception No. 2: Where permanently separated from such other conductors by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing.*

**(C)** In Boxes or Other Enclosures.

Indoor antennas and indoor lead-ins shall be permitted to occupy the same box or enclosure with conductors of other wiring systems where separated from such other conductors by an effective permanently installed barrier.

**810.19** Electrical Supply Circuits Used in Lieu of Antenna — Receiving Stations.

Where an electrical supply circuit is used in lieu of an antenna, the device by which the radio receiving set is connected to the supply circuit shall be listed.

**810.20** Antenna Discharge Units — Receiving Stations.

**(A)** Where Required.

Each conductor of a lead-in from an outdoor antenna shall be provided with a listed antenna discharge unit.

*Exception: Where the lead-in conductors are enclosed in a continuous metallic shield that either is grounded with a conductor in accordance with 810.21 or is protected by an antenna discharge unit.*

**(B)** Location.

Antenna discharge units shall be located outside the building or inside the building between the point of entrance of the lead-in and the radio set or transformers and as near as practicable to the entrance of the conductors to the building. The antenna discharge unit shall not be located near combustible material or in a hazardous (classified) location as defined in Article 500.

**(C)** Grounding.

The antenna discharge unit shall be grounded in accordance with 810.21.

**810.21** Bonding Conductors and Grounding Electrode Conductors — Receiving Stations.

Bonding conductors and grounding electrode conductors shall comply with 810.21(A) through 810.21(K).

**(A)** Material.

The bonding conductor or grounding electrode conductor shall be of copper, aluminum, copper-clad steel, copper-clad aluminum, bronze, or similar corrosion-resistant material. Aluminum or copper-clad aluminum bonding conductors or grounding electrode conductors shall not be used where in direct contact with masonry or the earth or where subject to corrosive conditions. Where used outside, aluminum or copper-clad aluminum conductors shall not be installed within 450 mm (18 in.) of the earth.

**(B)** Insulation.

Insulation on bonding conductors or grounding electrode conductors shall not be required.

**(C)** Supports.

The bonding conductor or grounding electrode conductor shall be securely fastened in place and shall be permitted to be directly attached to the surface wired over without the use of insulating supports.

*Exception: Where proper support cannot be provided, the size of the bonding conductors or grounding electrode conductors shall be increased proportionately.*

**(D)** Physical Protection.

Bonding conductors and grounding electrode conductors shall be protected where exposed to physical damage. Where the bonding conductor or grounding electrode conductor is installed in a metal raceway, both ends of the raceway shall be bonded to the contained conductor or to the same terminal or electrode to which the bonding conductor or grounding electrode conductor is connected.

**(E)** Run in Straight Line.

The bonding conductor or grounding electrode conductor for an antenna mast or antenna discharge unit shall be run in as straight a line as practicable.

**(F)** Electrode.

The bonding conductor or grounding electrode conductor shall be connected as required in 810.21(F)(1) through 810.21(F)(3).

**(1)** In Buildings or Structures with an Intersystem Bonding Termination.

If the building or structure served has an intersystem bonding termination as required by 250.94, the bonding conductor shall be connected to the intersystem bonding termination.

**(2)** In Buildings or Structures with Grounding Means.

If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on the following:

(1) The building or structure grounding electrode system as covered in 250.50

(2) The grounded interior metal water piping systems, within 1.52 m (5 ft) from its point of entrance to the building, as covered in 250.52

(3) The power service accessible means external to the building, as covered in 250.94

(4) The nonflexible metal power service raceway

(5) The service equipment enclosure, or

(6) The grounding electrode conductor or the grounding electrode conductor metal enclosures of the power service

A bonding device intended to provide a termination point for the bonding conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on nonremovable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is nonremovable.

**(3)** In Buildings or Structures Without an Intersystem Bonding Termination or Grounding Means.

If the building or structure served has no intersystem bonding termination or grounding means as described in 810.21(F)(2), the grounding electrode conductor shall be connected to a grounding electrode as described in 250.52.

**(G)** Inside or Outside Building.

The bonding conductor or grounding electrode conductor shall be permitted to be run either inside or outside the building.

**(H)** Size.

The bonding conductor or grounding electrode conductor shall not be smaller than 10 AWG copper, 8 AWG aluminum, or 17 AWG copper-clad steel or bronze.

**(I)** Common Ground.

A single bonding conductor or grounding electrode conductor shall be permitted for both protective and operating purposes.

**(J)** Bonding of Electrodes.

A bonding jumper not smaller than 6 AWG copper or equivalent shall be connected between the radio and television equipment grounding electrode and the power grounding electrode system at the building or structure served where separate electrodes are used.

**(K)** Electrode Connection.

Connections to grounding electrodes shall comply with 250.70.

**Part III.** Amateur and Citizen Band Transmitting and Receiving Stations — Antenna Systems

**810.51** Other Sections.

In addition to complying with Part III, antenna systems for amateur and citizen band transmitting and receiving stations shall also comply with 810.11 through 810.15.

**810.52** Size of Antenna.

Antenna conductors for transmitting and receiving stations shall be of a size not less than given in Table 810.52.

Table 810.52 Size of Outdoor Antenna Conductors

| Material | Minimum Size of Conductors (AWG) Where Maximum Open Span Length Is | |
|---|---|---|
| | Less Than 45 m (150 ft) | Over 45 m (150 ft) |
| Hard-drawn copper | 14 | 10 |
| Copper-clad steel, bronze, or other high-strength material | 14 | 12 |

**810.53** Size of Lead-in Conductors.

Lead-in conductors for transmitting stations shall, for various maximum span lengths, be of a size at least as great as that of conductors for antennas as specified in 810.52.

**810.54** Clearance on Building.

Antenna conductors for transmitting stations, attached to buildings, shall be firmly mounted at least 75 mm (3 in.) clear of the surface of the building on nonabsorbent insulating supports, such as treated pins or brackets equipped with insulators having not less than 75-mm (3-in.) creepage and airgap distances. Lead-in conductors attached to buildings shall also comply with these requirements.

*Exception: Where the lead-in conductors are enclosed in a continuous metallic shield that is grounded with a conductor in accordance with 810.58, they shall not be required to comply with these requirements. Where grounded, the metallic shield shall also be permitted to be used as a conductor.*

**810.55** Entrance to Building.

Except where protected with a continuous metallic shield that is grounded with a conductor in accordance with 810.58, lead-in conductors for transmitting stations shall enter buildings by one of the following methods:

(1) Through a rigid, noncombustible, nonabsorbent insulating tube or bushing

(2) Through an opening provided for the purpose in which the entrance conductors are firmly secured so as to provide a clearance of at least 50 mm (2 in.)

(3) Through a drilled window pane

**810.56** Protection Against Accidental Contact.

Lead-in conductors to radio transmitters shall be located or installed so as to make accidental contact with them difficult.

**810.57** Antenna Discharge Units — Transmitting Stations.

Each conductor of a lead-in for outdoor antennas shall be provided with an antenna discharge unit or other suitable means that drain static charges from the antenna system.

*Exception No. 1: Where the lead-in is protected by a continuous metallic shield that is grounded with a conductor in accordance with 810.58, an antenna discharge unit or other suitable means shall not be required.*

*Exception No. 2: Where the antenna is grounded with a conductor in accordance with 810.58, an antenna discharge unit or other suitable means shall not be required.*

**810.58** Bonding Conductors and Grounding Electrode Conductors — Amateur and Citizen Band Transmitting and Receiving Stations.

Bonding conductors and grounding electrode conductors shall comply with 810.58(A) through 810.58(C).

**(A)** Other Sections.

All bonding conductors and grounding electrode conductors for amateur and citizen band transmitting and receiving stations shall comply with 810.21(A) through 810.21(C).

**(B)** Size of Protective Bonding Conductor or Grounding Electrode Conductor.

The protective bonding conductor or grounding electrode conductor for transmitting stations shall be as large as the lead-in but not smaller than 10 AWG copper, bronze, or copper-clad steel.

**(C)** Size of Operating Bonding Conductor or Grounding Electrode Conductor.

The operating bonding conductor or grounding electrode conductor for transmitting stations shall not be less than 14 AWG copper or its equivalent.

**Part IV.** Interior Installation — Transmitting Stations

**810.70** Clearance from Other Conductors.

All conductors inside the building shall be separated at least 100 mm (4 in.) from the conductors of any electric light, power, or signaling circuit.

*Exception No. 1: As provided in Article 640.*

*Exception No. 2: Where separated from other conductors by raceway or some firmly fixed nonconductor, such as porcelain tubes or flexible tubing.*

**810.71** General.

Transmitters shall comply with 810.71(A) through (C).

**(A)** Enclosing.

The transmitter shall be enclosed in a metal frame or grille or separated from the operating space by a barrier or other equivalent means, all metallic parts of which are effectively connected to a bonding conductor or grounding electrode conductor.

**(B)** Grounding of Controls.

All external metal handles and controls accessible to the operating personnel shall be effectively connected to an equipment grounding conductor if the transmitter is powered by the premises wiring system or grounded with a conductor in accordance with 810.21.

**(C)** Interlocks on Doors.

All access doors shall be provided with interlocks that disconnect all voltages of over 350 volts between conductors when any access door is opened.

## Statement of Problem and Substantiation for Public Input

The title of the article does not match up with the scope of the article. The scope of the article is antenna systems and not radio and television equipment. The article only applies to the antenna systems for that and other types of transmitting and receiving equipment. The title needs to match the scope.

## Submitter Information Verification

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|---|---|
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| **Submittal Date:** | Mon Aug 31 18:12:15 EDT 2020 |
| **Committee:** | NEC-P16 |

## Public Input No. 3973-NFPA 70-2020 [ Section No. 810.2 ]

(All definitions have been to Article 100, arranged in alphabetical order and without any subdivisions, This section will need to be modified.)

**810.2** Definitions.

The definitions in Part I of Article 100 shall apply.

## Statement of Problem and Substantiation for Public Input

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

## Submitter Information Verification

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**Committee:** NEC-P16

## Public Input No. 1246-NFPA 70-2020 [ Section No. 810.3 ]

**810.3** Other Articles.

Wiring from the source of power to and between devices connected to the interior wiring system shall comply with Chapters 1 through 4 other than as modified by Parts I and II of Article 640. Wiring for audio signal processing, amplification, and reproduction equipment shall comply with Article 640. Coaxial cables that connect antennas to equipment shall comply with Article 820.

314.22- When a surface extension is made from the cover of a box make compliance with 314.22 exception a requirement.

## Statement of Problem and Substantiation for Public Input

When a surface extension is made from the cover of a box make compliance with 314.22 exception a requirement. Some installers attach an LB (from a ridged raceway) for example to the cover of a box. This makes accessing the box difficult and often results in a broken mechanical connection between the LB and box cover and/or damage to the rigid raceway.

## Submitter Information Verification

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**Committee:** NEC-P16

## Public Input No. 1707-NFPA 70-2020 [ Section No. 810.3 ]

**810.3** Other Articles.

Wiring from the source of power to and between devices connected to the interior wiring system shall comply with Chapters 1 through 4 other than as modified by Parts I and II of Article 640. Wiring for audio signal processing, amplification, and reproduction equipment shall comply with Article 640. Coaxial cables that connect antennas to equipment shall comply with Article 820. Wiring and equipment installed in hazardous (classified) locations shall comply with the appropriate requirements in Chapter 5.

## Statement of Problem and Substantiation for Public Input

Because of the independence of Chapter 8, it is necessary to have a reference in Article 810 to the hazardous locations requirements of chapter 5.

## Submitter Information Verification

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**Committee:** NEC-P16

## Public Input No. 3129-NFPA 70-2020 [ Section No. 810.5 ]

**810.5** Radio Noise ~~Suppressors~~ Suppression .

Radio interference eliminators, interference capacitors, or noise suppressors connected to power-supply leads shall be of a listed type. They shall not be exposed to physical damage.

## Statement of Problem and Substantiation for Public Input

Editorial correction
Change the title to "Radio Noise Suppression" so that the title covers all the components listed in the rule - radio interference eliminators, interference capacitors, and noise suppressors - not just the noise suppressors.

## Submitter Information Verification

**Submitter Full Name:** Trevor Bowmer
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**Committee:** NEC-P16

## Public Input No. 1624-NFPA 70-2020 [ Section No. 810.14 ]

**810.14** Splices.

Splices and joints in antenna spans shall be made mechanically secure with approved splicing devices or by such other means ~~as will not appreciably weaken the~~ that provide equivalent tensile strength as the antenna conductors.

## Statement of Problem and Substantiation for Public Input

The original "shall statement" coupled with the words "other means as will not appreciably weaken the conductors." is not consistent with itself, not measurable in the lab or the field. Providing a pro-active measurable alternative reinforces the shall statement and can be easily implemented, inspected.

## Submitter Information Verification

**Submitter Full Name:** Masood Shariff
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**Submittal Date:** Wed Jun 24 14:49:46 EDT 2020
**Committee:** NEC-P16

## Public Input No. 1381-NFPA 70-2020 [ Section No. 810.15 ]

**810.15** Grounding or Bonding .

Masts and metal structures supporting antennas shall be grounded or bonded in accordance with 810.21, unless the antenna and its related supporting mast or structure are within a zone of protection defined by a 46 m (150 ft) radius rolling sphere.

Informational Note: See 4.8.3.1 of NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, for the application of the term *rolling sphere*.

## Statement of Problem and Substantiation for Public Input

The antenna mast is “bonded” when the bonding jumper terminates to the intersystem bonding termination device, and “grounded” when the grounding conductor terminates to the grounding electrode system when there is not intersystem bonding system device present. So, adding “bonding” to the title and text makes it complete.

## Submitter Information Verification

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**Submittal Date:** Mon Jun 01 21:00:42 EDT 2020
**Committee:** NEC-P16

## Public Input No. 1383-NFPA 70-2020 [ Section No. 810.20(A) ]

**(A)** Where Required.

Each conductor of a lead-in from an outdoor antenna shall be provided with a listed antenna discharge unit.

*Exception: Where the lead-in conductors are enclosed in a continuous metallic shield that either is bonded or grounded with a conductor in accordance with 810.21 or is protected by an antenna discharge unit.*

## Statement of Problem and Substantiation for Public Input

When the intersystem bonding termination device is used, then the term 'bonding' applies, so it should be included in the exception.

## Submitter Information Verification

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**Submittal Date:** Mon Jun 01 21:05:51 EDT 2020
**Committee:** NEC-P16

## Public Input No. 1382-NFPA 70-2020 [ Section No. 810.20(C) ]

**(C)** Grounding or Bonding .

The antenna discharge unit shall be grounded or bonded in accordance with 810.21.

### Statement of Problem and Substantiation for Public Input

When a intersystem bonding termination device is present, the discharge unit is 'bonded', when no intersystem bonding termination device is present, then the discharge unit is 'grounded' to the premises electrode. My revised text simply makes the rule complete.

### Submitter Information Verification

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**Committee:** NEC-P16

# Public Input No. 3157-NFPA 70-2020 [ Section No. 810.21(F)(2) ]

**(2)** In Buildings or Structures with Grounding Means.

If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on the following:

(1) The building or structure grounding electrode system as covered in 250.50

(2) The ~~grounded interior metal water piping systems, within 1.52 m (5 ft) from its point of entrance to the building, as covered in 250.52~~

~~The~~

(3) power service accessible means external to the building, as covered in 250.94

(4) The nonflexible metal power service raceway

(5) The service equipment enclosure, or

(6) The grounding electrode conductor or the grounding electrode conductor metal enclosures of the power service

(7) The grounded interior metal water piping systems, within 1.52 m (5 ft) from its point of entrance to the building, as covered in 250.52 providing the continuity of the water pipe to earth (ground) has been verified.

A bonding device intended to provide a termination point for the bonding conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on nonremovable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is nonremovable.

## Statement of Problem and Substantiation for Public Input

The use of the water pipe as a grounding means should be de-emphasized by moving it to the end of the list (making it item 7 and moving items 3 through 7 up one).and adding a qualification to ensure continuity exists.
The use of plastic (non-conductive) pipe for water has become more widespread and therefore water pipe may not be a reliable connection means to ground (earth). The continuity of the metal water pipe needs to be traced and verified that an effective ground connection to earth exists.

The Terraview preview version in legislative text does not quite match the edited version - the intent is for item (2) to be moved to bottom of list (making in item 7) and add a phrase to that item to include a test for continuity.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 3155-NFPA 70-2020 [Section No. 770.100(B)(2)] | corresponding change in different rule |
| Public Input No. 3156-NFPA 70-2020 [Section No. 800.100(B)(2)] | corresponding change in different rule |
| Public Input No. 3155-NFPA 70-2020 [Section No. 770.100(B)(2)] | |
| Public Input No. 3156-NFPA 70-2020 [Section No. 800.100(B)(2)] | |

## Submitter Information Verification

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**Committee:** NEC-P16

## Public Input No. 3131-NFPA 70-2020 [ Section No. 810.52 ]

**810.52** Size of Antenna Conductors .

Antenna conductors for transmitting and receiving stations shall be of a size not less than given in Table 810.52.

Table 810.52 Size of Outdoor Antenna Conductors

| Material | Minimum Size of Conductors (AWG) Where Maximum Open Span Length Is | |
|---|---|---|
| | Less Than 45 m (150 ft) | Over 45 m (150 ft) |
| Hard-drawn copper | 14 | 10 |
| Copper-clad steel, bronze, or other high-strength material | 14 | 12 |

## Statement of Problem and Substantiation for Public Input

Editorial Change
Correct the title to match the content of the rule which is about size of conductors and not about the size of the antenna.

## Submitter Information Verification

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**Committee:** NEC-P16

## Public Input No. 1380-NFPA 70-2020 [ Section No. 810.57 ]

**810.57** Antenna Discharge Units — Transmitting Stations.

Each conductor of a lead-in for outdoor antennas shall be provided with an antenna discharge unit or other suitable means that drain static charges from the antenna system.

*Exception No. 1: Where the lead-in is protected by a continuous metallic shield that is grounded with a conductor in accordance with 810.58, an antenna discharge unit or other suitable means shall not be required.*

*Exception No. 2: Where the antenna is bonded or grounded with a conductor in accordance with 810.58, an antenna discharge unit or other suitable means shall not be required.*

## Statement of Problem and Substantiation for Public Input

The discharge unit is either 'bonded' or 'grounded' so it would be appropiate to have both terms in this exception. It references 800.58, which covers bonding and grounding.

## Submitter Information Verification

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**Committee:** NEC-P16

## Public Input No. 266-NFPA 70-2020 [ Section No. 820.1 ]

**820.1** Scope.

This article covers coaxial cable distribution ~~of radio frequency signals~~ systems typically employed in community antenna television (CATV) systems.

## Statement of Problem and Substantiation for Public Input

The word “systems” is added for consistency with the other Articles 8xx.1 and because the Article addresses the cable/equipment used for the distribution of CATV signals, not the actual signals themselves. The text “of radio frequency signals” is deleted as these systems may carry more than radio frequency signals.

## Submitter Information Verification

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| **Committee:** | NEC-P16 |

## Public Input No. 3975-NFPA 70-2020 [ Section No. 820.2 ]

(All definitions have been to Article 100, arranged in alphabetical order and without any subdivisions, This section will need to be modified.)

**820.2** Definitions.

The definitions in this section shall apply only within Articles 820 and 840.

## 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. 51-NFPA 70-2019 [ Section No. 820.2 ]

~~**820.2** Definitions.~~

~~The definitions in this section shall apply only within Articles 820 and 840.~~

### Statement of Problem and Substantiation for Public Input

There are no definitions in Article 820.

### Submitter Information Verification

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**Submittal Date:** Fri Nov 08 06:21:23 EST 2019
**Committee:** NEC-P16

## Public Input No. 87-NFPA 70-2019 [ Section No. 820.3 [Excluding any Sub-Sections] ]

~~Circuits~~ The installaton of circuits and equipment shall comply with 820.3(A)and (B).

## Statement of Problem and Substantiation for Public Input

Code usability is improved by explicitly stating that this section deals with installations. The recommended text complies with the NEC Style Manual section 3.3.5. See the parallel requirement in 770.3.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 86-NFPA 70-2019 [Section No. 830.3 [Excluding any Sub-Sections]] | Parallel PI for Article 830 |
| Public Input No. 58-NFPA 70-2019 [Section No. 840.3 [Excluding any Sub-Sections]] | Parallel PI for Article 840 |
| Public Input No. 58-NFPA 70-2019 [Section No. 840.3 [Excluding any Sub-Sections]] | |
| Public Input No. 86-NFPA 70-2019 [Section No. 830.3 [Excluding any Sub-Sections]] | |
| Public Input No. 318-NFPA 70-2020 [Section No. 800.3] | |

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**Committee:** NEC-P16

# Public Input No. 495-NFPA 70-2020 [ Section No. 820.44 ]

~~**820.44** Overhead (Aerial) Coaxial Cables.~~

~~Overhead (aerial) coaxial cables, prior to the point of grounding, as specified in 820.93 , shall comply with 820.44(A) or 800.44 .~~

~~**(A)** On Poles and In-Span, Above Roofs, on Masts, or Between Buildings.~~

~~Where coaxial cables are installed on poles and in-span, above roofs, on masts, or between buildings, they shall comply with 800.44 .~~

~~**(B)** On Buildings.~~

~~Where attached to buildings, coaxial cables shall be securely fastened in such a manner that they will be separated from other conductors in accordance with 820.44(B)(1) and (B)(2).~~

~~**(1)** Electric Light or Power.~~

~~The coaxial cable shall have a separation of at least 100 mm (4 in.) from electric light, power, Class 1, or non-power-limited fire alarm circuit conductors not in raceway or cable, or shall be permanently separated from conductors of the other system by a continuous and firmly fixed nonconductor in addition to the insulation on the wires.~~

~~**(2)** Other Communications Systems.~~

~~Coaxial cable shall be installed so that there will be no unnecessary interference in the maintenance of the separate systems. In no case shall the conductors, cables, messenger strand, or equipment of one system cause abrasion to the conductors, cable, messenger strand, or equipment of any other system.~~

## Statement of Problem and Substantiation for Public Input

This is a companion Public Input to PI 494 which consolidates all the requirements of 820.44 into 800.44.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 494-NFPA 70-2020 [Section No. 800.44] | Merges 820.44 into 800.44 |
| Public Input No. 494-NFPA 70-2020 [Section No. 800.44] | |

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**Committee:** NEC-P16

# Public Input No. 471-NFPA 70-2020 [ Section No. 820.47 ]

~~**820.47** Underground Coaxial Cables Entering Buildings.~~

~~Underground coaxial cables entering buildings shall comply with 820.47(A) and 820.47(B) .~~

~~**(A)** Underground Systems with Electric Light, Power, Class 1, or Non–Power-Limited Fire Alarm Circuit Conductors.~~

~~Underground coaxial cables in a duct, pedestal, handhole enclosure, or manhole that contains electric light, power, or Class 1 or non–power-limited fire alarm circuit conductors shall be in a section permanently separated from such conductors by means of a suitable barrier.~~

~~**(B)** Direct-Buried Cables and Raceways.~~

~~Direct-buried coaxial cable shall be separated at least 300 mm (12 in.) from conductors of any light or power, non–power-limited fire alarm circuit conductors, or Class 1 circuit.~~

~~*Exception No. 1: Separation shall not be required where electric service conductors or coaxial cables are installed in raceways or have metal cable armor.*~~

~~*Exception No. 2: Separation shall not be required where electric light or power branch-circuit or feeder conductors or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables; or the coaxial cables have metal cable armor or are installed in a raceway.*~~

## Statement of Problem and Substantiation for Public Input

The PI is a companion Public Input to PI No. 469 which consolidates 805.47, 820.47 and parts of 830.47 into new 800.47. If PI No. 469 is accepted, then this PI needs to be accepted too.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 469-NFPA 70-2020 [New Section after 800.44] | Creates 800.47 |
| Public Input No. 470-NFPA 70-2020 [Section No. 805.47] | Deletes 805.47 |
| Public Input No. 472-NFPA 70-2020 [Section No. 830.47] | Deletes part of 830.47 |
| Public Input No. 469-NFPA 70-2020 [New Section after 800.44] | |
| Public Input No. 472-NFPA 70-2020 [Section No. 830.47] | |
| Public Input No. 475-NFPA 70-2020 [Section No. 840.47] | |
| Public Input No. 496-NFPA 70-2020 [Section No. 805.47] | |

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**Committee:** NEC-P16

# Public Input No. 467-NFPA 70-2020 [ Section No. 820.48 ]

~~**820.48** Unlisted Cables Entering Buildings.~~

~~Unlisted outside plant coaxial cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated at a grounding block. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) to the point of emergence.~~

## Statement of Problem and Substantiation for Public Input

The PI is a companion Public Input to PI No. 465 which consolidates 805.48 and 820.48 into new 800.48. If PI No. 465 is accepted, then this PI needs to be accepted too.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 465-NFPA 70-2020 [New Section after 800.44] | Creates 800.48 |
| Public Input No. 466-NFPA 70-2020 [Section No. 805.48] | Deletes 805.48 |
| Public Input No. 468-NFPA 70-2020 [Section No. 840.48] | Deletes 840.48 |
| Public Input No. 465-NFPA 70-2020 [New Section after 800.44] | |
| Public Input No. 466-NFPA 70-2020 [Section No. 805.48] | |
| Public Input No. 468-NFPA 70-2020 [Section No. 840.48] | |
| Public Input No. 645-NFPA 70-2020 [Section No. 800.113(A)] | |

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**Committee:** NEC-P16

# Public Input No. 3136-NFPA 70-2020 [ Section No. 820.93(D) ]

**(D)** Hazardous (Classified) Locations.

~~Where a primary protector or equipment providing the primary protection function is used, it shall not be located in any hazardous (classified) location as defined in 500.5 and 505.5 or in the vicinity of easily ignitible material.~~

~~*Exception: As permitted in 501.150 , 502.150 , and 503.150 .*~~

The requirements of 800.90 shall apply.

## Statement of Problem and Substantiation for Public Input

As part of the consolidation of requirements into the new Article 800 for the 2020 code, this requirement should be moved to a common rule under a new 800.90 (as proposed under PI 3133) and replaced with a reference here in this 820.93(D).

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 3133-NFPA 70-2020 [New Part after III.] | adding a new rule in 800.90 to move common requirements of 820.93(D) to |
| Public Input No. 3135-NFPA 70-2020 [Section No. 805.90(C)] | moving related common requirements from 805.90(C) to newly created 800.90 |
| Public Input No. 3137-NFPA 70-2020 [Section No. 830.90(C)] | moving related common requirements from 830.90(C) to newly created 800.90 |
| Public Input No. 3133-NFPA 70-2020 [New Part after III.] | |
| Public Input No. 3135-NFPA 70-2020 [Section No. 805.90(C)] | |
| Public Input No. 3137-NFPA 70-2020 [Section No. 830.90(C)] | |

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**Committee:** NEC-P16

## Public Input No. 616-NFPA 70-2020 [ Section No. 820.133 ]

**820.133** Installation of Coaxial Cables and Equipment.

Beyond the point of grounding, as defined in 820.93 , the coaxial cable installation shall comply with 820.133(A) and (B).

**(A)** Separation from Other Conductors.

**(1)** In Raceways, Cable Trays, Boxes, Enclosures, and Cable Routing Assemblies.

(a) *Other Circuits.* Coaxial cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with jacketed cables of any of the following:

(2) 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

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

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

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

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

(g) *Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm, and Medium-Power Network-Powered Broadband Communications Circuits.* Coaxial cable shall not be placed in any raceway, compartment, outlet box, junction box, or other enclosures with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits.

*Exception No. 1:* *Coaxial cable shall be permitted to be placed in any raceway, compartment, outlet box, junction box, or other enclosures with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits where 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 coaxial cables by a permanent barrier or listed divider.*

*Exception No. 2:* *Coaxial cable shall be permitted to be placed in outlet boxes, junction boxes, or similar fittings or compartments with power conductors where such conductors are introduced solely for power supply to the coaxial cable system distribution equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum 6 mm ($\frac{1}{4}$ in.) separation from coaxial cables.*

~~**(2)** Other Applications.~~

~~Coaxial cable shall be separated 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.~~

~~*Exception No. 1:* Separation shall not be required where either (1) all of the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits are in a raceway, or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC or Type UF cables, or (2) all of the coaxial cables are encased in a raceway.~~

~~*Exception No. 2:* Separation shall not be required where the coaxial cables are permanently separated from the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.~~

~~**(B)** Support of Coaxial Cables.~~

~~Raceways shall be used for their intended purpose. Coaxial cables shall not be strapped, taped, or attached by any means to the exterior of any conduit or raceway as a means of support.~~

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

## Statement of Problem and Substantiation for Public Input

CMP 16 created new Article 800, General Requirements for Communications Systems, in order to consolidate the redundant requirements in Article 800 (old Article 800), Article 820 and Article 830 into one general article. Redundant requirements that were identical in multiple articles in Chapter 8 were brought into new Article 800. The emphasis was on consolidating identical requirements, with similar but not identical requirements left for the next cycle. Simply put, new Article 800 is a work in progress.

This Public Input, and other companion Public Inputs, are intended to continue the development of general Article 800 by consolidating similar but not identical requirements. This consolidation requires an understanding of the technical purpose of the sections being consolidated in order to make editorial changes in the text that retain all the mandatory requirements, albeit with slightly different wording.

The PI is a companion Public Input to PI No. 614 which consolidates 805.133 and 820.133 into new 800.133. If PI No. 614 is accepted, then this PI needs to be accepted too.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 614-NFPA 70-2020 [New Section after 800.113] | Creates 800.133 |
| Public Input No. 615-NFPA 70-2020 [Section No. 805.133] | Deletes 805.133 |
| Public Input No. 614-NFPA 70-2020 [New Section after 800.113] | |
| Public Input No. 615-NFPA 70-2020 [Section No. 805.133] | |

## Submitter Information Verification

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| **Submittal Date:** | Sun Mar 08 05:17:36 EDT 2020 |
| **Committee:** | NEC-P16 |

# Public Input No. 90-NFPA 70-2019 [ Section No. 820.154 ]

**820.154** Substitutions of Listed CATV Cables.

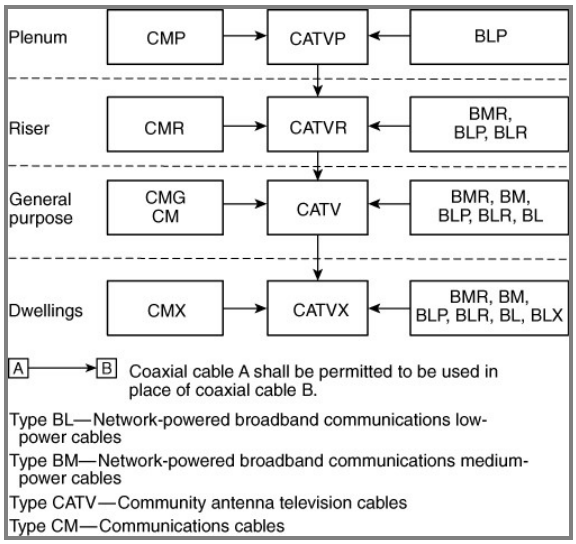
The substitutions for coaxial cables in Table 820.154 and illustrated in Figure 820.154 shall be permitted.

Informational Note: The substitute cables in Table 820.154 and Figure 820.154 are only coaxial-type cables.

Table 820.154 Coaxial Cable Uses and Permitted Substitutions

| Cable Type | Permitted Substitutions |
|---|---|
| CATVP | CMP, BLP |
| CATVR | CATVP, CMP, CMR, BMR, BLP, BLR |
| CATV | CATVP, CMP, CATVR, CMR, CMG, CM, BMR, BM, BLP, BLR, BL |
| CATVX | CATVP, CMP, CATVR, CMR, CATV, CMG, CM, BMR, BM, BLP, BLR, BL, BLX |

**Figure 820.~~154 Cable~~ 154 Coaxial Cable Substitution Hierarchy.**




## Statement of Problem and Substantiation for Public Input

The figure deals with coaxial cables only.

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**Committee:** NEC-P16

# Public Input No. 214-NFPA 70-2019 [ Section No. 820.179 ]

**820.179** Coaxial Cables.

Cables shall be listed in accordance with 820.179(A)and marked in accordance with Table 820.179~~ and 820~~ . ~~179(B). The cable voltage rating shall not be marked on the cable.~~

~~Informational Note: Voltage markings on cables could 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.*~~

**(A)** General Requirements.

The general requirements in 800.179 shall apply.

~~**(B)** Optional Markings.~~

~~Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.~~

~~Informational Note: _ These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.~~

Table 820.179 Coaxial Cable Markings

| Cable Marking | Type |
|---|---|
| CATVP | CATV plenum cable |
| CATVR | CATV riser cable |
| CATV | CATV cable |
| CATVX | CATV cable, limited use |

## Statement of Problem and Substantiation for Public Input

PI 210 moves the optional marking requirements into the general article (Article 800). Consequently, the optional marking requirements in 820.179(B) are redundant, and should be deleted.
The requirements dealing with voltage marking in 820.179 are covered in 800.179 and are therefore redundant and should be deleted.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 210-NFPA 70-2019 [Section No. 800.179] | Moves optional marking to Article 800 |
| Public Input No. 212-NFPA 70-2019 [Section No. 830.179] | Coordinating PI for Artle 830. |
| Public Input No. 211-NFPA 70-2019 [Section No. 805.179] | Coordinating PI for Article 805. |
| Public Input No. 210-NFPA 70-2019 [Section No. 800.179] | |

## Submitter Information Verification

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| **Submittal Date:** | Fri Dec 27 14:50:39 EST 2019 |
| **Committee:** | NEC-P16 |

## Public Input No. 419-NFPA 70-2020 [ Section No. 830.1 ]

**830.1** Scope.

This article covers network-powered broadband communications systems that provide any combination of voice, audio, video, data, and interactive services through a network interface unit.

Informational Note: A typical basic system configuration includes a cable supplying power and broadband signal to a network interface unit that converts the broadband signal to the component signals. Typical cables are coaxial cable with both broadband signal and power on the center conductor, composite metallic cable with a coaxial member(s) or twisted pair members for the broadband signal and twisted pair members for power, and ~~composite~~ hybrid optical fiber cable with a pair of conductors for power. Larger systems may also include network components such as amplifiers that require network power.

## Statement of Problem and Substantiation for Public Input

Public Input No. 416 proposes to change “composite optical fiber cable” to “hybrid optical fiber cable” in order to align the NEC with current U.S and international definitions. Acceptance of PI 416 necessitates changing “composite optical fiber cable” to “hybrid optical fiber cable” throughout the NEC. This is a coordinating Public Input to PI 416.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 416-NFPA 70-2020 [Definition: Cable, Optical Fiber, Composite.] | Changes definition of composite optical fiber cable to hybrid optical fiber cable |
| Public Input No. 417-NFPA 70-2020 [Section No. 770.3(C)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 418-NFPA 70-2020 [Section No. 770.133(B)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 420-NFPA 70-2020 [Section No. 500.8(F)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 421-NFPA 70-2020 [Section No. 505.9(F)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 422-NFPA 70-2020 [Section No. 506.9(F)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 423-NFPA 70-2020 [Section No. 640.21(B)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 424-NFPA 70-2020 [Section No. 640.21(C)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 425-NFPA 70-2020 [Section No. 640.42(B)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 426-NFPA 70-2020 [Section No. 640.42(C)] | Coordinates with the change of composite optical fiber cable to hybrid optical fiber cable in PI 416 |
| Public Input No. 416-NFPA 70-2020 [Definition: Cable, Optical Fiber, Composite.] | |

Public Input No. 417-NFPA 70-2020 [Section No. 770.3(C)]

Public Input No. 418-NFPA 70-2020 [Section No. 770.133(B)]

Public Input No. 420-NFPA 70-2020 [Section No. 500.8(F)]

Public Input No. 421-NFPA 70-2020 [Section No. 505.9(F)]

Public Input No. 422-NFPA 70-2020 [Section No. 506.9(F)]

Public Input No. 423-NFPA 70-2020 [Section No. 640.21(B)]

Public Input No. 424-NFPA 70-2020 [Section No. 640.21(C)]

Public Input No. 425-NFPA 70-2020 [Section No. 640.42(B)]

Public Input No. 426-NFPA 70-2020 [Section No. 640.42(C)]

## Submitter Information Verification

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**Submittal Date:** Tue Feb 04 12:56:52 EST 2020
**Committee:** NEC-P16

# Public Input No. 3976-NFPA 70-2020 [ Section No. 830.2 ]

(Relocate all definitions in the 830. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

**830. 2** Definitions.

The definitions in this section shall apply only within Article 830.

Informational Note: A typical single-family network-powered communications circuit consists of a communications drop or communications service cable and an NIU and includes the communications utility's serving terminal or tap where it is not under the exclusive control of the communications utility.

**Fault Protection Device.**

An electronic device that is intended for the protection of personnel and functions under fault conditions, such as network-powered broadband communications cable short or open circuit, to limit the current or voltage, or both, for a low-power network-powered broadband communications circuit and provide acceptable protection from electric shock.

**Network Interface Unit (NIU).**

A device that converts a broadband signal into component voice, audio, video, data, and interactive services signals and provides isolation between the network power and the premises signal circuits. These devices often contain primary and secondary protectors.

**Network-Powered Broadband Communications Circuit.**

The circuit extending from the communications utility's or service provider's serving terminal or tap up to and including the NIU.

Informational Note: A typical one-family dwelling network-powered communications circuit consists of a communications drop or communications service cable and an NIU and includes the communications utility's serving terminal or tap where it is not under the exclusive control of the communications utility.

## Statement of Problem and Substantiation for Public Input

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

## Submitter Information Verification

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**Committee:** NEC-P16

## Public Input No. 52-NFPA 70-2019 [ Section No. 830.2 [Excluding any Sub-Sections] ]

The definitions in this section shall apply only within Article 830.

~~Informational Note: A typical single-family network-powered communications circuit consists of a communications drop or communications service cable and an NIU and includes the communications utility's serving terminal or tap where it is not under the exclusive control of the communications utility.~~

## Statement of Problem and Substantiation for Public Input

The informational note is redundant. See the definition of a Network-Powered Broadband Communications Circuit.

## Submitter Information Verification

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**Submittal Date:** Fri Nov 08 06:25:57 EST 2019
**Committee:** NEC-P16

## Public Input No. 273-NFPA 70-2020 [ Section No. 830.3(C) ]

~~(C) Protection Against Physical Damage.~~

~~The requirements of 300.4 shall apply.~~

### Statement of Problem and Substantiation for Public Input

The requirement of 830.3(C) is redundant and may be deleted as it is now covered in 800.24.

### Submitter Information Verification

| | |
|---|---|
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| **Submittal Date:** | Sat Jan 11 11:54:25 EST 2020 |
| **Committee:** | NEC-P16 |

## Public Input No. 85-NFPA 70-2019 [ Section No. 830.3(C) ]

~~(C) Protection Against Physical Damage.~~

~~The requirements of 300.4 shall apply.~~

### Statement of Problem and Substantiation for Public Input

The deleted text is redundant. It repeats a requirement in general Article 800.

### Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 86-NFPA 70-2019 [Section No. 830.3 [Excluding any Sub-Sections]] | Renumbers to coordinate with PI 85 |
| Public Input No. 86-NFPA 70-2019 [Section No. 830.3 [Excluding any Sub-Sections]] | |

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**Committee:** NEC-P16

## Public Input No. 86-NFPA 70-2019 [ Section No. 830.3 [Excluding any Sub-Sections] ]

~~Circuits~~ The installation of circuits and equipment shall comply with 830.3(A)~~ through~~ and (~~C~~ B ).

## Statement of Problem and Substantiation for Public Input

PI 85 eliminates the redundant requirement in 830.3C).

Code usability is improved by explicitly stating that this section deals with installations. See 830.3(B) which uses the term “installations” multiple times. The recommended text complies with the NEC Style Manual section 3.3.5. See the parallel requirement in 770.3.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 85-NFPA 70-2019 [Section No. 830.3(C)] | Delete redundant text |
| Public Input No. 58-NFPA 70-2019 [Section No. 840.3 [Excluding any Sub-Sections]] | Parallel PI in Article 840 |
| Public Input No. 87-NFPA 70-2019 [Section No. 820.3 [Excluding any Sub-Sections]] | Parallel PI in Article 820 |
| Public Input No. 58-NFPA 70-2019 [Section No. 840.3 [Excluding any Sub-Sections]] | |
| Public Input No. 85-NFPA 70-2019 [Section No. 830.3(C)] | |
| Public Input No. 87-NFPA 70-2019 [Section No. 820.3 [Excluding any Sub-Sections]] | |
| Public Input No. 318-NFPA 70-2020 [Section No. 800.3] | |

## Submitter Information Verification

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**Submittal Date:** Sun Nov 10 06:49:20 EST 2019
**Committee:** NEC-P16

# Public Input No. 306-NFPA 70-2020 [ Section No. 830.24 ]

~~**830.24** Mechanical Execution of Work.~~

~~The installation shall also conform to 300.4 and 300.11 .~~

## Statement of Problem and Substantiation for Public Input

Section 830.24 may be deleted as the information is now covered in 800.24 and 110.12(C) and is redundant here.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 300-NFPA 70-2020 [Section No. 110.12(C)] | |
| Public Input No. 305-NFPA 70-2020 [Section No. 800.24] | |

## Submitter Information Verification

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| **Organization:** | Telcordia Technologies (ericss |
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| **Submittal Date:** | Thu Jan 16 11:04:09 EST 2020 |
| **Committee:** | NEC-P16 |

# Public Input No. 61-NFPA 70-2019 [ Section No. 830.24 ]

~~**830.24** Mechanical Execution of Work.~~

~~The installation shall also conform to 300.4 and 300.11 .~~

## Statement of Problem and Substantiation for Public Input

The deleted text is redundant. It repeats a requirement in general Article 800.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 60-NFPA 70-2019 [Section No. 840.24] | Deletes redundant text |
| Public Input No. 62-NFPA 70-2019 [Section No. 840.25] | Deletes redundant text |
| Public Input No. 63-NFPA 70-2019 [Section No. 840.26] | Deletes redundant text |
| Public Input No. 71-NFPA 70-2019 [Section No. 840.133] | Deletes redundant text |
| Public Input No. 60-NFPA 70-2019 [Section No. 840.24] | |
| Public Input No. 62-NFPA 70-2019 [Section No. 840.25] | |
| Public Input No. 63-NFPA 70-2019 [Section No. 840.26] | |
| Public Input No. 71-NFPA 70-2019 [Section No. 840.133] | |

## Submitter Information Verification

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**Submittal Date:** Fri Nov 08 08:33:38 EST 2019
**Committee:** NEC-P16

## Public Input No. 3132-NFPA 70-2020 [ Section No. 830.44(B) ]

**(B)** Clearance from Ground.

Overhead (aerial) spans of network-powered broadband communications cables shall conform to not less than the following:

(1) 2.9 m (9½ ft) — above finished grade, sidewalks, or from any platform or projection from which they might be reached and accessible to pedestrians only

(2) 3.5 m (11½ ft) — over residential property and driveways, and those commercial areas not subject to truck traffic

(3) 4.7 m (15½ ft) — over public streets, alleys, roads, parking areas subject to truck traffic, driveways on other than residential property, and other land traversed by vehicles such as cultivated, grazing, forest, and orchard

Informational Note: These clearances have been specifically chosen to correlate with ANSI/IEEE C2-~~2012~~ 2017 , *National Electrical Safety Code*, Table 232-1, which provides for clearances of wires, conductors, and cables above ground and roadways, rather than using the clearances referenced in 225.18. Because Article 805 and Article 820 have had no required clearances, the communications industry has used the clearances from the NESC for their installed cable plant.

## Statement of Problem and Substantiation for Public Input

Update the reference to the NESC to the latest edition which is the 2017 edition.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 3127-NFPA 70-2020 [Section No. 805.90(A)(1)] | similar update to NESC edition date to 2017 edition |
| Public Input No. 3127-NFPA 70-2020 [Section No. 805.90(A)(1)] | |

## Submitter Information Verification

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**Committee:** NEC-P16

# Public Input No. 472-NFPA 70-2020 [ Section No. 830.47 ]

**830.47** Underground Network-Powered Broadband Communications Cables Entering Buildings.

~~(~~

Underground network-powered broadband communications cables entering buildings shall comply with 830.47(A)~~ through~~ and 830.47(~~D~~) ~~.~~

~~**(A)** Underground Systems with Electric Light and Power, Class 1, or Non–Power-Limited Fire Alarm Circuit Conductors.~~

~~Underground network-powered broadband communications cables in a duct, pedestal, handhole enclosure, or manhole that contains electric light, power conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuits shall be in a section permanently separated from such conductors by means of a suitable barrier.~~

B)

~~Direct-Buried Cables and Raceways~~

.

~~Direct-buried network-powered broadband communications cables shall be separated by at least 300 mm (12 in~~

.

~~) from conductors of any light, power, non–power-limited fire alarm circuit conductors or Class 1 circuit.~~

~~*Exception No. 1:* Separation shall not be required where electric service conductors or network-powered broadband communications cables are installed in raceways or have metal cable armor.~~

~~*Exception No. 2:* Separation shall not be required where electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables; or the network-powered broadband communications cables have metal cable armor or are installed in a raceway.~~

(C

**(A )_** Protection from Physical Damage.

Direct-buried cable, conduit, or other raceways shall be installed to meet the minimum cover requirements of Table 830.47(C) . In addition, direct-buried cables emerging from the ground shall be protected by enclosures, raceways, or other approved means extending from the minimum cover distance required by Table 830.47(C) below grade 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. Types BMU and BLU direct-buried cables emerging from the ground shall be installed in rigid metal conduit (RMC), intermediate metal conduit (IMC), rigid nonmetallic conduit, or other approved means extending from the minimum cover distance required by Table 830.47(C) below grade to the point of entrance.

*Exception: A low-power network-powered broadband communications circuit that is equipped with a listed fault protection device, appropriate to the network-powered broadband communications cable used, and located on the network side of the network-powered broadband communications cable being protected.*

Table 830.47(C) Network-Powered Broadband Communications Systems Minimum Cover Requirements ( *Cover* is the shortest distance measured between a point on the top surface of any direct-buried cable, conduit, or other raceway and the top surface of finished grade, concrete, or similar cover.)

| Location of Wiring Method or Circuit | Direct Burial Cables | | | |
|---|---|---|---|---|
| | | | | |
| Rigid Metal Conduit (RMC) or Intermediate Metal Conduit (IMC) | | | | |
| | | | | |
| Nonmetallic Raceways Listed for Direct Burial; Without Concrete Encasement or Other Approved Raceways | | | | |
| mm | | in. | | |
| | | | | |
| | mm | | in. | |
| | | | | |
| | | | mm | in. |
| All locations not specified below | | | 450 | 18 |
| | | | | |
| 150 | | 6 | | |
| | | | | |
| | | | 300 | 12 |
| In trench below 50-mm (2-in.) thick concrete or equivalent | | | 300 | 12 |
| | | | | |
| 150 | | 6 | | |

| | | | |
|---|---|---|---|
| Under a building (in raceway only) | 150<br>0 | 6<br>0 | |
| 0 | 0 | | |
| Under minimum of 100-mm (4-in.) thick concrete exterior slab with no vehicular traffic and the slab extending not less than 150 mm (6 in.) beyond the underground installation | 0<br>300 | 0<br>12 | |
| 100 | 4 | | |
| One- and two-family dwelling driveways and outdoor parking areas and used only for dwelling-related purposes | 100<br>300 | 4<br>12 | |
| 300 | 12 | | |
| 300 | 12 | | |

Notes:

1. Raceways approved for burial only where concrete encased shall require a concrete envelope not less than 50 mm (2 in.) thick.

2. Lesser depths shall be permitted where cables rise for terminations or splices or where access is otherwise required.

3. Where solid rock is encountered, all wiring shall be installed in 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.

4. Low-power network-powered broadband communications circuits using directly buried community antenna television and radio distribution system coaxial cables that were installed outside and entering buildings prior to January 1, 2000, in accordance with Article 820 shall be permitted where buried to a minimum depth of 300 mm (12 in.).

**(**

~~D~~

**B )_** Pools.

Cables located under the pool or within the area extending 1.5 m (5 ft) horizontally from the inside wall of the pool shall meet those clearances and requirements specified in 680.11 .

## Statement of Problem and Substantiation for Public Input

The PI is a companion Public Input to PI No. 469 which consolidates 805.47, 820.47 and parts of 830.47 into new 800.47. If PI No. 469 is accepted, then this PI needs to be accepted too.

This PI re-letters 830.47 (C) to 803.47(A), and also re-letters 803.47(D) to 830.47(B).. It deletes the other sub-sections.

No changes were made to the table.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 471-NFPA 70-2020 [Section No. 820.47] | Deletes 820.47 |
| Public Input No. 496-NFPA 70-2020 [Section No. 805.47] | Deletes part of 805.47 |
| Public Input No. 469-NFPA 70-2020 [New Section after 800.44] | Creates 800.47 |
| Public Input No. 469-NFPA 70-2020 [New Section after 800.44] | |
| Public Input No. 471-NFPA 70-2020 [Section No. 820.47] | |
| Public Input No. 496-NFPA 70-2020 [Section No. 805.47] | |

## Submitter Information Verification

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**Submittal Date:** Mon Feb 17 09:24:43 EST 2020
**Committee:** NEC-P16

## Public Input No. 4587-NFPA 70-2020 [ Section No. 830.47(C) ]

**(C)** Protection from Physical Damage.

Direct-buried cable, conduit, or other raceways shall be installed to meet the minimum cover requirements of Table 830.47(C). In addition, direct-buried cables emerging from the ground shall be protected by enclosures, raceways, or other approved means extending from the minimum cover distance required by Table 830.47(C) below grade 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. Types BMU and BLU direct-buried cables emerging from the ground shall be installed in rigid metal conduit (RMC), intermediate metal conduit (IMC), rigid nonmetallic conduit, or other approved means extending from the minimum cover distance required by Table 830.47(C) below grade to the point of entrance.

*Exception: A low-power network-powered broadband communications circuit that is equipped with a listed fault protection device, appropriate to the network-powered broadband communications cable used, and located on the network side of the network-powered broadband communications cable ~~being protected.~~ shall not be required to be additionally protected by enclosures, raceways, or other approved means.*

Table 830.47(C) Network-Powered Broadband Communications Systems Minimum Cover Requirements (*Cover* is the shortest distance measured between a point on the top surface of any direct-buried cable, conduit, or other raceway and the top surface of finished grade, concrete, or similar cover.)

| Location of Wiring Method or Circuit | Direct Burial Cables | | Rigid Metal Conduit (RMC) or Intermediate Metal Conduit (IMC) | | Nonmetallic Raceways Listed for Direct Burial; Without Concrete Encasement or Other Approved Raceways | |
|---|---|---|---|---|---|---|
| | mm | in. | mm | in. | mm | in. |
| All locations not specified below | 450 | 18 | 150 | 6 | 300 | 12 |
| In trench below 50-mm (2-in.) thick concrete or equivalent | 300 | 12 | 150 | 6 | 150 | 6 |
| Under a building (in raceway only) | 0 | 0 | 0 | 0 | 0 | 0 |
| Under minimum of 100-mm (4-in.) thick concrete exterior slab with no vehicular traffic and the slab extending not less than 150 mm (6 in.) beyond the underground installation | 300 | 12 | 100 | 4 | 100 | 4 |
| One- and two-family dwelling driveways and outdoor parking areas and used only for dwelling-related purposes | 300 | 12 | 300 | 12 | 300 | 12 |

Notes:

1. Raceways approved for burial only where concrete encased shall require a concrete envelope not less than 50 mm (2 in.) thick.

2. Lesser depths shall be permitted where cables rise for terminations or splices or where access is otherwise required.

3. Where solid rock is encountered, all wiring shall be installed in 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.

4. Low-power network-powered broadband communications circuits using directly buried

community antenna television and radio distribution system coaxial cables that were installed outside and entering buildings prior to January 1, 2000, in accordance with Article 820 shall be permitted where buried to a minimum depth of 300 mm (12 in.).

## Statement of Problem and Substantiation for Public Input

The existing wording of the exception is not a complete sentence because it lacks a predicate in violation of the NEC Style Manual at 3.1.4.1. It fails to say what is being allowed to happen. Fortunately, there is an exact model for the apparently intended allowance in 800.44(F)(3) Exception, that is a complete sentence. This PI uses that as a model to complete the wording in this location.

## Submitter Information Verification

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**Submittal Date:** Thu Sep 10 15:29:15 EDT 2020
**Committee:** NEC-P16

## Public Input No. 3137-NFPA 70-2020 [ Section No. 830.90(C) ]

**(C)** Hazardous (Classified) Locations.

The ~~primary protector or equipment providing the primary protection function shall not be located in any hazardous (classified) location as defined in 500.5 and 505.5 or in the vicinity of easily ignitible material.~~

~~*Exception: As permitted in 501.150 , 502.150 , and 503.150 .*~~

requirements of 800.90 shall apply.

## Statement of Problem and Substantiation for Public Input

As part of the consolidation of requirements into the new Article 800 for the 2020 code, this requirement should be moved to a common rule under a new 800.90 (as proposed under PI 3133) and replaced with a reference here in 830.90(C).

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 3136-NFPA 70-2020 [Section No. 820.93(D)] | moving related common requirements from 820.93(D) to the newly created 800.90 |
| Public Input No. 3133-NFPA 70-2020 [New Part after III.] | adding a new rule in 800.90 to move common requirements of 830.90 (C) to |
| Public Input No. 3135-NFPA 70-2020 [Section No. 805.90(C)] | moving related common requirements from 805.90(C) to the newly created 800.90 |
| Public Input No. 3133-NFPA 70-2020 [New Part after III.] | |
| Public Input No. 3135-NFPA 70-2020 [Section No. 805.90(C)] | |
| Public Input No. 3136-NFPA 70-2020 [Section No. 820.93(D)] | |

## Submitter Information Verification

**Submitter Full Name:** Trevor Bowmer
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**Submittal Date:** Sat Sep 05 09:36:15 EDT 2020
**Committee:** NEC-P16

## Public Input No. 4648-NFPA 70-2020 [ Section No. 830.133 ]

**830.133** Installation of Network-Powered Broadband Communications Cables and Equipment.

Cable and equipment installations within buildings shall comply with 830.133(A) ~~and~~ thru (~~B~~ C ), as applicable.

**(A)** Separation of Conductors.

**(1)** In Raceways, Cable Trays, Boxes, Enclosures, and Cable Routing Assemblies.

(a) *Low- and Medium-Power Network-Powered Broadband Communications Circuit Cables.* Low- and medium-power network-powered broadband communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly.

(b) *Low-Power Network-Powered Broadband Communications Circuit Cables with Other Circuits.* Low-power network-powered broadband communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with jacketed cables of any of the following circuits:

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

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

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

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

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

(h) *Medium-Power Network-Powered Broadband Communications Circuit Cables with Optical Fiber Cables and Other Communications Cables*. Medium-power network-powered broadband communications cables shall not be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with conductors of any of the following circuits:

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

(10) Conductive optical fiber cables in compliance with Parts I and V of Article 770

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

(l) *Medium-Power Network-Powered Broadband Communications Circuit Cables with Other Circuits*. Medium-power network-powered broadband communications cables shall not be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with conductors of any of the following circuits:

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

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

(o) *Electric Light, Power, Class 1, Non–Powered Broadband Communications Circuit Cables.* Network-powered broadband communications cable shall not be placed in any raceway, cable tray, compartment, outlet box, junction box, or similar fittings with conductors of electric light, power, Class 1, or non–power-limited fire alarm circuit cables.

*Exception No. 1: Where all of the conductors of electric light, power, Class 1, non–power-limited fire alarm circuits are separated from all of the network-powered broadband communications cables by a permanent barrier or listed divider.*

*Exception No. 2: Power circuit conductors in outlet boxes, junction boxes, or similar fittings or compartments where such conductors are introduced solely for power supply to the network-powered broadband communications system distribution equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum 6 mm (¼ in.) separation from network-powered broadband communications cables.*

**(2)** Other Applications.

Network-powered broadband communications cable shall be separated at least 50 mm (2 in.) from conductors of any electric light, power, Class 1, and non–power-limited fire alarm circuits.

*Exception No. 1: Separation shall not be required where: (1) all of the conductors of electric light, power, Class 1, and non–power-limited fire alarm circuits are in a raceway, or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC, or Type UF cables, or (2) all of the network-powered broadband communications cables are encased in a raceway.*

*Exception No. 2: Separation shall not be required where the network-powered broadband communications cables are permanently separated from the conductors of electric light, power, Class 1, and non–power-limited fire alarm circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B)** Support of Network-Powered Broadband Communications Cables.

Raceways shall be used for their intended purpose. Network-powered broadband communications cables shall not be strapped, taped, or attached by any means to the exterior of any conduit or raceway as a means of support.

**(C)** Network-Powered Broadband Communications Cables Splicing.

**Where a cable is spliced or extended, a listed junction box with accessibility or listed patch panel equipment shall be used.**

## Statement of Problem and Substantiation for Public Input

It is becoming frequent to see broadband coax spliced in an attic resting against wood or insulation. With cable equipment now powering from the home into the street, the splice point should be protected.

## Submitter Information Verification

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**Affiliation:** Cisco Systems, Inc.
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**State:**
**Zip:**
**Submittal Date:** Thu Sep 10 16:16:08 EDT 2020
**Committee:** NEC-P16

## Public Input No. 1606-NFPA 70-2020 [ Section No. 830.160 ]

**830.160** Bends.

Bends in network broadband cable shall be made so as not to damage the cable.The radius of the curve of

the inner edge of any bend shall not be less than ten times the diameter of the cable.

Informational note: One additional source to maintain acceptable bend radius of network broadband cable during different types of installation conditions is ANSI/TIA-568.0-E Generic Telecommunications Cabling for Customer Premises.

## Statement of Problem and Substantiation for Public Input

Bending radius is an important installation requirement to maintain reliable transmission performance of network broadband cables. It is specified for other cable types in the code and should also be specified for coaxial network broadband cables. The existing requirement to avoid damage is not proactive and cannot be verified. Internal damage is not visible on the outside of the cable ( e.g. shield opening or splitting) leading to adverse consequences on the reliability of critical network elements.

## Submitter Information Verification

**Submitter Full Name:** Masood Shariff
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**Affiliation:** Telecommunications Industry Association
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**Zip:**
**Submittal Date:** Tue Jun 23 18:24:31 EDT 2020
**Committee:** NEC-P16

## Public Input No. 212-NFPA 70-2019 [ Section No. 830.179 ]

**830.179** Network-Powered Broadband Communications Equipment and Cables.

Network-powered broadband communications equipment and cables shall be listed and marked in accordance with 830.179(A) through (~~D~~ C ).

*Exception No. 1: This listing requirement shall not apply to community antenna television and radio distribution system coaxial cables that were installed prior to January 1, 2000, in accordance with Article 820 and are used for low-power network-powered broadband communications circuits.*

*Exception No. 2: Substitute cables for network-powered broadband communications cables shall be permitted as shown in Table 830.154.*

**(A)** General Requirements.

The general requirements in 800.179 shall apply.

**(B)** Network-Powered Broadband Communications Medium-Power Cables.

Network-powered broadband communications medium-power cables shall be factory-assembled cables consisting of a jacketed coaxial cable, a jacketed combination of coaxial cable and multiple individual conductors, or a jacketed combination of an optical fiber cable and multiple individual conductors. The insulation for the individual conductors shall be rated for 300 volts minimum. Cables intended for outdoor use shall be listed as suitable for the application. Cables shall be marked in accordance with 310.8. Type BMU cables shall be jacketed and listed as being suitable for outdoor underground use.

**(C)** Network-Powered Broadband Communication Low-Power Cables.

Network-powered broadband communications low-power cables shall be factory-assembled cables consisting of a jacketed coaxial cable, a jacketed combination of coaxial cable and multiple individual conductors, or a jacketed combination of an optical fiber cable and multiple individual conductors. The insulation for the individual conductors shall be rated for 300 volts minimum. Cables intended for outdoor use shall be listed as suitable for the application. Cables shall be marked in accordance with 310.8. Type BLU cables shall be jacketed and listed as being suitable for outdoor underground use.

~~**(D)** Optional Markings.~~

~~Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.~~

~~Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.~~

## Statement of Problem and Substantiation for Public Input

PI 210 moves optional markings to the general article (Article 800). They would be redundant if left in Article 830.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 210-NFPA 70-2019 [Section No. 800.179] | Moves listing requirements to Article 800. |
| Public Input No. 211-NFPA 70-2019 [Section No. 805.179] | Coordinating PI for Article 805 |

Public Input No. 210-NFPA 70-2019 [Section No. 800.179]

Public Input No. 211-NFPA 70-2019 [Section No. 805.179]

Public Input No. 214-NFPA 70-2019 [Section No. 820.179]

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**Committee:** NEC-P16

## Public Input No. 2935-NFPA 70-2020 [ Section No. 840.1 ]

**840.1** Scope.

This article covers the premises-powered broadband communications ~~systems~~ system's network terminal .

Informational Note: A typical basic system configuration consists of an optical fiber, twisted pair, or coaxial cable to the premises supplying a broadband signal to a network terminal that converts the broadband signal into component electrical signals, such as traditional telephone, video, high-speed Internet, and interactive services. Powering for the network terminal and network devices is typically accomplished through a premises power supply that might be built into the network terminal or provided as a separate unit. In order to provide communications in the event of a power interruption, a battery backup unit or an uninterruptible power supply (UPS) is typically part of the powering system.

## Statement of Problem and Substantiation for Public Input

The current scope of this article must change as it has led a great many people in the computer networking side of the industry to believe that this is the only article that they must follow. I have been watching the evolution of this article over the last several Code cycles and has clearly been a moving target, but with the current wording it remains easy for one to misinterpret the intent. I both understand and appreciate the intent of 840 as it currently exists, but I have had far too many conversations with “Code experts” at electrical contractors that insist 840 is the only article that has to be followed for the entire system as long as there is a connection to a service provider. This change would make it clear that the intent of this article is not to cover the entire system, but rather that it should only cover the network terminal and its directly connected cables.

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**Committee:** NEC-P16

## Public Input No. 920-NFPA 70-2020 [ Section No. 840.1 ]

**840.1** Scope.

This article covers premises-powered broadband communications systems.

Informational Note: A typical basic system configuration consists of an optical fiber, twisted pair, or coaxial cable to the premises supplying a broadband signal to a network terminal that converts the broadband signal into ~~component electrical signals~~ component signals , such as traditional telephone, video, high-speed Internet, and interactive services. Powering for the network terminal and network devices is typically accomplished through a premises power supply that might be built into the network terminal or provided as a separate unit. In order to provide communications in the event of a power interruption, a battery backup unit or an uninterruptible power supply (UPS) is typically part of the powering system.

## Statement of Problem and Substantiation for Public Input

This PI removes unnecessary text and is consistent with the approach in other parts of the code. There is no need to limit component signals to electrical only. It is possible that the signals could be optical signals.

## Submitter Information Verification

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**Committee:** NEC-P16

# Public Input No. 3979-NFPA 70-2020 [ Section No. 840.2 ]

(Relocate all definitions in the 840. 2 to Article 100, arrange them in alphabetical order and without any subdivisions.)

**840. 2** Definitions.

The definitions in 805.2 and 820.2 shall apply. The definitions in this section shall apply only within Article 840.

**Broadband.**

Wide bandwidth data transmission that transports multiple signals, protocols, and traffic types over various media types.

**Network Terminal.**

A device that converts network-provided signals (optical, electrical, or wireless) into component signals, including voice, audio, video, data, wireless, optical, and interactive services, and is considered a network device on the premises that is connected to a communications service provider and is powered at the premises.

**Premises Communications Circuit.**

The circuit that extends voice, audio, video, data, interactive services, telegraph (except radio), and outside wiring for fire alarm and burglar alarm from the service provider's network terminal to the customer's communications equipment up to and including terminal equipment, such as a telephone, a fax machine, or an answering machine.

**Premises Community Antenna Television (CATV) Circuit.**

The circuit that extends community antenna television (CATV) systems for audio, video, data, and interactive services from the service provider's network terminal to the appropriate customer equipment.

**Premises-Powered.**

Using power provided locally from the premises.

## 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-P16

## Public Input No. 921-NFPA 70-2020 [ Definition: Premises Communications Circuit. ]

**Premises Communications Circuit.**

The circuit that extends voice, audio, video, data, interactive services, telegraph (except radio), and outside wiring for fire alarm and burglar alarm from the service provider's network terminal to the customer's communications equipment up to and including terminal equipment~~, such as a telephone, a fax machine, or an answering machine~~ .

## Statement of Problem and Substantiation for Public Input

This PI deletes text that does not add any value to the definition of a circuit. Definitions should be simple, succinct, and sufficient. Going beyond terminal equipment with legacy examples of devices like answering machines is not a good reflection of the real world in 2023, which the code in intended to reflect and serve effectively.

## Submitter Information Verification

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**Committee:** NEC-P16

# Public Input No. 59-NFPA 70-2019 [ Section No. 840.3(C) ]

~~(C) – Electrical Classification of Data Circuits and Cables.~~

~~Sections 725.139(D)(1) and 805.133(A)(1) (b) shall apply to the electrical classification of Class 2 and Class 3 circuits in the same cable with communications circuits~~

**Optical Fiber Cable.**

Installations of optical fiber cables shall comply with the requirements of Parts I, II, III, IV & V of Article 770 .

## Statement of Problem and Substantiation for Public Input

The deleted text refers to text that was in the 2017 NEC but deleted from the 2020 NEC.

Adding a requirement to have installations of optical fiber cable comply with the installation rules in Article 770 will simplify Article 840 because the multiple references to sections of Article 770 can then be deleted just like the multiple references to sections of Article 800 (general requirements) can be deleted by simply referring to Article 800.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 60-NFPA 70-2019 [Section No. 840.24] | |
| Public Input No. 62-NFPA 70-2019 [Section No. 840.25] | |
| Public Input No. 63-NFPA 70-2019 [Section No. 840.26] | |
| Public Input No. 71-NFPA 70-2019 [Section No. 840.133] | |
| Public Input No. 323-NFPA 70-2020 [Section No. 840.48(A)] | |

## Submitter Information Verification

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## Public Input No. 58-NFPA 70-2019 [ Section No. 840.3 [Excluding any Sub-Sections] ]

~~Circuits~~ Installations of circuits and equipment shall comply with 840.3(A) through (C).

## Statement of Problem and Substantiation for Public Input

Code usability is improved by explicitly stating that this section deals with installations. See 840.3(B) which uses the term “installations” multiple times. The recommended text complies with the NEC Style Manual section 3.3.5. See the parallel requirement in 770.3.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 86-NFPA 70-2019 [Section No. 830.3 [Excluding any Sub-Sections]] | Parallel PI for Article 830 |
| Public Input No. 87-NFPA 70-2019 [Section No. 820.3 [Excluding any Sub-Sections]] | Parallel PI for Article 820 |
| Public Input No. 86-NFPA 70-2019 [Section No. 830.3 [Excluding any Sub-Sections]] | |
| Public Input No. 87-NFPA 70-2019 [Section No. 820.3 [Excluding any Sub-Sections]] | |
| Public Input No. 318-NFPA 70-2020 [Section No. 800.3] | |

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**Committee:** NEC-P16

# Public Input No. 308-NFPA 70-2020 [ Section No. 840.24 ]

~~**840.24** Mechanical Execution of Work.~~

~~The requirements of 770.24 and 800.24 shall apply.~~

## Statement of Problem and Substantiation for Public Input

This information is now covered in 110.112(C), 800.24 and 770.24, is redundant here and may be deleted. The NEC Correlating Committee (CC) accepted the action of Panel 16 to create a new Chapter 8 general article in response to Public Input from the CC-appointed Task Group to address redundant requirements in Chapter 8 (PI 2858) and accepted First Revision FR 7512 by Panel 16 resulting in new general Article 800.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 305-NFPA 70-2020 [Section No. 800.24] | |
| Public Input No. 300-NFPA 70-2020 [Section No. 110.12(C)] | |
| Public Input No. 303-NFPA 70-2020 [Section No. 770.24] | |

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| **Committee:** | NEC-P16 |

# Public Input No. 60-NFPA 70-2019 [ Section No. 840.24 ]

~~**840.24** Mechanical Execution of Work.~~

~~The requirements of 770.24 and 800.24 shall apply.~~

## Statement of Problem and Substantiation for Public Input

The references to sections of Articles 770 become redundant with the acceptance of PI 59 which refers to virtually the entire Article 770. The references to sections of Article 800 are redundant because of the requirement in 840.3(A) to comply with the general requirements in Article 800.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 59-NFPA 70-2019 [Section No. 840.3(C)] | Adds requirement to comply with Article 770 |
| Public Input No. 61-NFPA 70-2019 [Section No. 830.24] | Deletes redundant text |
| Public Input No. 62-NFPA 70-2019 [Section No. 840.25] | Deletes redundant text |
| Public Input No. 63-NFPA 70-2019 [Section No. 840.26] | Deletes redundant text |
| Public Input No. 71-NFPA 70-2019 [Section No. 840.133] | Deletes redundant text |
| Public Input No. 61-NFPA 70-2019 [Section No. 830.24] | |
| Public Input No. 62-NFPA 70-2019 [Section No. 840.25] | |
| Public Input No. 63-NFPA 70-2019 [Section No. 840.26] | |
| Public Input No. 71-NFPA 70-2019 [Section No. 840.133] | |
| Public Input No. 323-NFPA 70-2020 [Section No. 840.48(A)] | |

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**Committee:** NEC-P16

# Public Input No. 62-NFPA 70-2019 [ Section No. 840.25 ]

~~**840.25** Abandoned Cables.~~

~~The requirements of 770.25 and 800.25 shall apply.~~

## Statement of Problem and Substantiation for Public Input

The references to sections of Articles 770 become redundant with the acceptance of PI 59 which refers to virtually the entire Article 770. The references to sections of Article 800 are redundant because of the requirement in 840.3(A) to comply with the general requirements in Article 800.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 60-NFPA 70-2019 [Section No. 840.24] | Deletes redundant text |
| Public Input No. 61-NFPA 70-2019 [Section No. 830.24] | Deletes redundant text |
| Public Input No. 63-NFPA 70-2019 [Section No. 840.26] | Deletes redundant text |
| Public Input No. 71-NFPA 70-2019 [Section No. 840.133] | Deletes redundant text |
| Public Input No. 59-NFPA 70-2019 [Section No. 840.3(C)] | References Article 770 |
| Public Input No. 60-NFPA 70-2019 [Section No. 840.24] | |
| Public Input No. 61-NFPA 70-2019 [Section No. 830.24] | |
| Public Input No. 63-NFPA 70-2019 [Section No. 840.26] | |
| Public Input No. 71-NFPA 70-2019 [Section No. 840.133] | |
| Public Input No. 323-NFPA 70-2020 [Section No. 840.48(A)] | |

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**Committee:** NEC-P16

# Public Input No. 63-NFPA 70-2019 [ Section No. 840.26 ]

~~**840.26** Spread of Fire or Products of Combustion.~~

~~The requirements of 770.26 and 800.26 shall apply.~~

## Statement of Problem and Substantiation for Public Input

The references to sections of Articles 770 become redundant with the acceptance of PI 59 which refers to virtually the entire Article 770. The references to sections of Article 800 are redundant because of the requirement in 840.3(A) to comply with the general requirements in Article 800.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 62-NFPA 70-2019 [Section No. 840.25] | Deletes redundant text |
| Public Input No. 60-NFPA 70-2019 [Section No. 840.24] | Deletes redundant text |
| Public Input No. 59-NFPA 70-2019 [Section No. 840.3(C)] | References Article 770 |
| Public Input No. 61-NFPA 70-2019 [Section No. 830.24] | Deletes redundant text |
| Public Input No. 71-NFPA 70-2019 [Section No. 840.133] | Deletes redundant text |
| Public Input No. 60-NFPA 70-2019 [Section No. 840.24] | |
| Public Input No. 61-NFPA 70-2019 [Section No. 830.24] | |
| Public Input No. 62-NFPA 70-2019 [Section No. 840.25] | |
| Public Input No. 71-NFPA 70-2019 [Section No. 840.133] | |
| Public Input No. 323-NFPA 70-2020 [Section No. 840.48(A)] | |

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**Committee:** NEC-P16

## Public Input No. 475-NFPA 70-2020 [ Section No. 840.47 ]

**840.47** Underground ~~Wires and~~ Optical Fiber Cables Entering Buildings.

~~Underground wires and cables entering buildings shall comply with 840.47(A) through (C).~~

~~**(A)** Optical Fiber Cables.~~

~~**(1)** Class 1 or Non–Power-Limited Fire Alarm Circuits.~~

~~Underground conductive optical fiber cables entering buildings with electric light, power, Class 1, or non–power-limited fire alarm circuit conductors in a raceway, handhole enclosure, or manhole shall be located in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier.~~

~~**(2)**~~

Direct-

~~Buried Cables.Direct-~~

buried

~~conductive~~

optical

~~fiber cables shall be separated by at least 300 mm (12 in.) from conductors of any electric light, power, or non–power-limited fire alarm circuit conductors or Class 1 circuit.~~

~~*Exception No. 1: Separation shall not be required where the electric service conductors are installed in raceways or have metal cable armor.*~~

~~*Exception No. 2: Separation shall not be required where the electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables.*~~

~~**(3)** Mechanical Protection.~~

~~Direct-buried cable, conduit, or other raceway shall be installed~~

fiber cables shall be installed to have a minimum cover of 150 mm (6 in.).

~~**(B)** Communications Wires and Cables.~~

~~Installations of communications wires and multipair communications cables shall comply with 805.47 .~~

~~**(C)** Coaxial Cables.~~

~~Installations of coaxial cables shall comply with 820.47 .~~

## Statement of Problem and Substantiation for Public Input

The references to sections of Article 800 are redundant because of the requirement in 840.3(A) to comply with the general requirements in Article 800. References to 805.47 and 820.47 become redundant with the acceptance of PIs 470 and 471 which move the requirements of 805.47 and 820.47 into (new) 800.47. The references to sections of Article 770 become redundant with the acceptance of PI 59 which refers to virtually the entire Article 770. After all the superfluous references ae deleted we are left with 840.47(A)(3) which has a burial depth requirements for optical fiber cables which is retained in the text. The burial depth requirement for raceways is deleted because we have a general reference to Article 770, and 770.110(A)(1) requires that these raceways be installed in accordance with the requirements of Chapter 3.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 470-NFPA 70-2020 [Section No. 805.47] | Deletes 805.47 |
| Public Input No. 471-NFPA 70-2020 [Section No. 820.47] | Deletes 820.47 |

## Submitter Information Verification

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**Submittal Date:** Tue Feb 18 08:07:36 EST 2020
**Committee:** NEC-P16

# Public Input No. 468-NFPA 70-2020 [ Section No. 840.48 ]

~~**840.48** Unlisted Wires and Cables Entering Buildings.~~

~~Installations of unlisted cables entering buildings shall comply with 840.48(A) , (B), or (C), as applicable.~~

~~**(A)** Optical Fiber Cables.~~

~~Installations of unlisted optical fiber cables entering buildings shall comply with 770.48 .~~

~~**(B)** Communications Wires and Cables.~~

~~Installations of unlisted communications wires and unlisted multipair communications cables entering buildings shall comply with 805.48 .~~

~~**(C)** Coaxial Cables.~~

~~Installations of unlisted coaxial cables entering buildings shall comply with 820.48 .~~

## Statement of Problem and Substantiation for Public Input

The references to sections of Article 770 become redundant with the acceptance of PI 59 which refers to virtually the entire Article 770.

References to 805.48 and 820.48 become redundant with the acceptance of PIs 465, 466 and 467 which move the requirements of 805.48 and 820.48 into (new) 800.48. Section 840.3(A) requires compliance with Article 800.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 465-NFPA 70-2020 [New Section after 800.44] | Creates 800.48 |
| Public Input No. 466-NFPA 70-2020 [Section No. 805.48] | Deletes 805.48 |
| Public Input No. 467-NFPA 70-2020 [Section No. 820.48] | Deletes 820.48 |
| Public Input No. 466-NFPA 70-2020 [Section No. 805.48] | |
| Public Input No. 467-NFPA 70-2020 [Section No. 820.48] | |

## Submitter Information Verification

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**Committee:** NEC-P16

## Public Input No. 323-NFPA 70-2020 [ Section No. 840.48(A) ]

~~(A) Optical Fiber Cables.~~

~~Installations of unlisted optical fiber cables entering buildings shall comply with 770.48 .~~

### Statement of Problem and Substantiation for Public Input

The references to sections of Articles 770 become redundant with the acceptance of PI 59 which refers to virtually the entire Article 770.

### Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 59-NFPA 70-2019 [Section No. 840.3(C)] | References Article 770 |
| Public Input No. 60-NFPA 70-2019 [Section No. 840.24] | Deletes redundant text |
| Public Input No. 62-NFPA 70-2019 [Section No. 840.25] | Deletes redundant text |
| Public Input No. 63-NFPA 70-2019 [Section No. 840.26] | Deletes redundant text |
| Public Input No. 71-NFPA 70-2019 [Section No. 840.133] | Deletes redundant text |

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**Submittal Date:** Mon Jan 20 09:07:14 EST 2020
**Committee:** NEC-P16

## Public Input No. 71-NFPA 70-2019 [ Section No. 840.133 ]

~~**840.133** Installation of Optical Fibers and Electrical Conductors.~~

~~The requirements of 770.133 shall apply.~~

## Statement of Problem and Substantiation for Public Input

The references to sections of Article 770 become redundant with the acceptance of PI 59 which refers to virtually the entire Article 770

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 59-NFPA 70-2019 [Section No. 840.3(C)] | References Article 770 |
| Public Input No. 60-NFPA 70-2019 [Section No. 840.24] | Deletes redundant text |
| Public Input No. 61-NFPA 70-2019 [Section No. 830.24] | Deletes redundant text |
| Public Input No. 62-NFPA 70-2019 [Section No. 840.25] | Deletes redundant text |
| Public Input No. 63-NFPA 70-2019 [Section No. 840.26] | Deletes redundant text |
| Public Input No. 60-NFPA 70-2019 [Section No. 840.24] | |
| Public Input No. 61-NFPA 70-2019 [Section No. 830.24] | |
| Public Input No. 62-NFPA 70-2019 [Section No. 840.25] | |
| Public Input No. 63-NFPA 70-2019 [Section No. 840.26] | |
| Public Input No. 323-NFPA 70-2020 [Section No. 840.48(A)] | |

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**Committee:** NEC-P16

## Public Input No. 926-NFPA 70-2020 [ Section No. 840.160 ]

**840.160** Powering Circuits.

Communications cables listed in accordance with 805.179, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment listed in accordance with 805.170. The power source shall be listed in accordance with 840.170(G). Installation of the listed 4-pair communications cables for a communications circuit or installation where 4-pair communications cables are substituted for Class 2 and Class 3 cables in accordance with 725.154(A) shall comply with 725.144.

*Exception: Installing communications cables in compliance with 725.144 shall not be required for listed 4-pair communications cables where the rated current of the power source does not exceed 0.3 amperes in any conductor 24 AWG or larger.*

Informational Note: A typical communications cable for this application is a 4-pair cable sometimes referred to as Category 5e (or higher) LAN cable or balanced twisted pair cable. These types of cables are often used to provide Ethernet- and Power over Ethernet (PoE)–type services. ~~A large number of such powering cables bundled together can cause overheating of the wiring if not controlled as described in Table~~ 725.144 provides requirements to manage the temperature rise in bundles of cables providing power .

## Statement of Problem and Substantiation for Public Input

This PI modifies the last sentence to make it consistent with the body of 840.160. The reference to the full article 725.144 is sufficient and complete in all respects and should not be qualified in any way to form other opinions or perspectives.

## Submitter Information Verification

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**Submittal Date:** Fri May 01 11:23:36 EDT 2020
**Committee:** NEC-P16

## Public Input No. 1617-NFPA 70-2020 [ Section No. 840.170(E) ]

**(E)** Premises Communications Wires and Cables.

Communications wires and ~~cable~~ cables shall be listed and marked in accordance with 805.179.

## Statement of Problem and Substantiation for Public Input

Consistency with usage. This is an editorial change.

## Submitter Information Verification

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**Submittal Date:** Wed Jun 24 13:17:33 EDT 2020
**Committee:** NEC-P16

## Public Input No. 72-NFPA 70-2019 [ Section No. 840.170(E) ]

**(E)** Premises Communications Wires and Cables.

Communications wires and ~~cable~~ cables shall be listed and marked in accordance with 800.179 and 805.179.

## Statement of Problem and Substantiation for Public Input

Listing requirements for communications wires and cables are in two Articles, 800 and 805.

## Submitter Information Verification

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**Committee:** NEC-P16

## Public Input No. 73-NFPA 70-2019 [ Section No. 840.170(F) ]

**(F)** Premises Community Antenna Television (CATV) Circuits.

Premises community antenna television (CATV) coaxial cables connecting to the network terminal shall be listed in accordance with ~~820~~ 800 .179. Applicable grounding means shall be listed for application with premises-powered broadband communications systems.

## Statement of Problem and Substantiation for Public Input

Listing requirements for CATV coaxial cables are in Article 800.

## Submitter Information Verification

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**Committee:** NEC-P16

## Public Input No. 2617-NFPA 70-2020 [ Section No. 80.21(C) ]

**(C)** Responsibility of the Authority Having Jurisdiction.

It shall be the responsibility of the authority having jurisdiction to promulgate rules that cover the following:

(1) Review of construction documents and drawings shall be completed within established time frames for the purpose of acceptance or to provide reasons for nonacceptance.

(2) Review and approval by the authority having jurisdiction shall not relieve the applicant of the responsibility of compliance with this *Code*.

(3) Where field conditions necessitate any substantial change from the approved plan, the authority having jurisdiction shall be permitted to require that the corrected plans be submitted for approval.

(4) The authority having jurisdiction shall be permitted to determine the scope of electrical power system rehabilitation.

## Statement of Problem and Substantiation for Public Input

This is a revision of the P.I. submitted last cycle. The education industry is the largest non-residential building construction market in the United States; building and renovating campus square footage at a clip of about $80 billion per year. Construction activity at the University of Michigan alone (with 36 million square feet under management and the largest campus in the US in terms of building square-footage) runs at an annual rate of $600 million to $ 1.2 billion annually so the evolution of electrical systems is in plain sight on a daily basis. This proposal is intended to generate discussion about the degree to which the scope of electrical distribution system rehabilitation shall be permitted to be scaled according the site specific conditions that govern safety and economy. For example, many building codes may require that a 50% change in the square footage affected by a rehabilitation/renovation project may require a corresponding change in the electrical system. That change may or may not be justified on the basis of safety considerations alone. Conversely, the 50% criterion may not be a sufficient threshold to guarantee safety. While this model language for electrical administration may always be subordinate to the building codes, some model language that has been vetted through ANSI processes; that makes scalability a possibility would be welcomed from the standpoint of both both safety and economy

## Submitter Information Verification

| | |
|---|---|
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| **Committee:** | NEC-P16 |

# Public Input No. 3227-NFPA 70-2020 [ Part II. ]

**Part II.** ~~– Coaxial Cables Outside and Entering Buildings~~ Wiring on the Customer Side of the Communication Service Point

## Additional Proposed Changes

| File Name | Description | Approved |
|---|---|---|
| Chapter_8_-_2020-09-03_CC_Task_Group.pdf | | |

## Statement of Problem and Substantiation for Public Input

This public input is being submitted by a Correlating Committee Task Group to improve the correlation between Chapter 7 and 8. At the present time there are significant correlation issues with regards to what constitutes an installation in Chapter 7 and what constitutes an installation in Chapter 8.

Previously a Correlating Committee Task Group was formed to review Chapter 8 and to make suggested modifications. This Chapter 8 task group has submitted a public input to define Communication Service point and has submitted a public input to determine where the actual service point exists within communication systems. It is very difficult for an AHJ to determine where there inspection authority begins and this work will help provide clarity and usability.

This public input follows up on the work of that specific task group and provides editorial revisions to further improve on that work. Public inputs are being submitted to change Titles and certain wording to reflect what wiring is on the customer side of the Communication Service Point and what wiring is on the communication utility or service provider side of this point.

The Correlating Committee Task Group is a long range planning committee that is seeking to make improvement over the next two to three cycles. The Task Group is made up of the following members: Alan Manche, Donny Cook, Randy Ivans, Ernie Gallo, and Thomas Domitrovich.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 3224-NFPA 70-2020 [Sections 800.27, Part II., 800.44] | |
| Public Input No. 3225-NFPA 70-2020 [Part IV.] | |
| Public Input No. 3226-NFPA 70-2020 [Section No. 800.154] | |
| Public Input No. 3229-NFPA 70-2020 [Part V.] | |
| Public Input No. 3230-NFPA 70-2020 [Part II.] | |
| Public Input No. 3231-NFPA 70-2020 [Sections Part V., 830.133] | |
| Public Input No. 3232-NFPA 70-2020 [Sections Part II., 840.47, 840.48, Part III.] | |
| Public Input No. 3233-NFPA 70-2020 [Part V.] | |
| Public Input No. 3223-NFPA 70-2020 [Sections Part IV., 805.133] | |
| Public Input No. 3223-NFPA 70-2020 [Sections Part IV., 805.133] | |
| Public Input No. 3224-NFPA 70-2020 [Sections 800.27, Part II., 800.44] | |
| Public Input No. 3226-NFPA 70-2020 [Section No. 800.154] | |
| Public Input No. 3230-NFPA 70-2020 [Part II.] | |

Public Input No. 3232-NFPA 70-2020 [Sections Part II., 840.47, 840.48, Part III.]

Public Input No. 3233-NFPA 70-2020 [Part V.]

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**Committee:** NEC-P16

## Chapter 8 Communications Systems

# Article 800 General Requirements for Communications Systems

### Part I. General

#### 800.1 Scope.

This article covers general requirements for communications systems. These general requirements apply to communications circuits, community antenna television and radio distribution systems, network-powered broadband communications systems, and premises-powered broadband communications systems, unless modified by Articles 805, 820, 830, or 840.

Informational Note No. 1: See 90.2(B)(4) for installations of circuits and equipment that are not covered.

Informational Note No. 2: For further information for remote control, signaling, and power-limited circuits, see Article 725.

Informational Note No. 3: For further information for fire alarm systems, see Article 760.

#### 800.2 Definitions.

The definitions in Part I of Article 100 shall apply throughout Chapter 8. The definitions in 800.2 shall apply only within Chapter 8.

**Abandoned Cable.**

Cable that is not terminated at equipment or is not identified for future use with a tag.

**Block.**

A square or portion of a city, town, or village enclosed by streets and including the alleys so enclosed, but not any street.

**Cable Sheath.**

A covering over the conductor assembly that may include one or more metallic members, strength members, or jackets.

**Communications Circuit.**

The circuit that extends service from the communications utility or service provider up to and including the customer's communications equipment.

**Communications Service Provider.**

An organization, business, or individual that offers communications service to others.

**Exposed (to Accidental Contact).**

A circuit in such a position that, in case of failure of supports or insulation, contact with another circuit may result.

Informational Note: See Part I of Article 100 for two other definitions of Exposed: *Exposed (as applied to live parts)* and *Exposed (as applied to wiring methods)*.

**Point of Entrance.**

The point within a building at which the wire or cable emerges from an external wall or from a concrete floor slab.

**Premises.**

The land and buildings of a user located on the user side of the utility-user ~~network point of demarcation~~.

#### 800.3 Other Articles.

Only those sections of Chapters 1 through 7 referenced in Chapter 8 shall apply to Chapter 8.

**(A) Hazardous (Classified) Locations.**

Circuits and equipment installed in a location that is classified in accordance with 500.5 and 505.5 shall comply with the applicable requirements of Chapter 5.

**(B) Wiring in Ducts for Dust, Loose Stock, or Vapor Removal.**

The requirements of 300.22(A) shall apply.

**(C) Equipment in Other Space Used for Environmental Air.**

The requirements of 300.22(C)(3) shall apply.

**(D) Installation and Use.**

The requirements of 110.3(B) shall apply.

**(E) Optical Fiber Cable.**

Where optical fiber cable is used to provide a communications circuit within a building, Article 770 shall apply.

**(F) Other Communications Systems.**

As appropriate for the system involved, communications systems shall also comply with the requirements of the following:

1. Communications circuits — Article 805
2. Radio and television equipment — Article 810
3. Community antenna television and radio distribution systems — Article 820
4. Network-powered broadband communications systems — Article 830
5. Premises-powered broadband communications systems — Article 840

**(G) Reconditioned Equipment.**

The requirements of 110.21(A)(2) shall apply.

### 800.21 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.

### 800.24 Mechanical Execution of Work.

Circuits and equipment 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 also conform to 300.4 and 300.11. 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 805.170(C).

Informational Note No. 1: Accepted industry practices are described in ANSI/TIA-568.1- D-2015, *Commercial Building Telecommunications Infrastructure Standard;* ANSI/TIA-569-D-2015, *Telecommunications Pathways and Spaces;* ANSI/TIA-570-C-2012, *Residential Telecommunications Infrastructure Standard;* ANSI/TIA-1005-A-2012, *Telecommunications Infrastructure Standard for Industrial Premises;* ANSI/ TIA-1179-2010, *Healthcare Facility Telecommunications Infrastructure Standard;* ANSI/TIA-4966-2014, *Telecommunications Infrastructure Standard for Educational Facilities;* and other ANSI-approved installation standards.

Informational Note No. 2: 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. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of wire and cable properties.

### 800.25 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.

### 800.26 Spread of Fire or Products of Combustion.

Installations of cables, communications raceways, cable routing assemblies 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 penetrations of cables, communications raceways, and cable routing assemblies 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 800.26 can be found in building codes, fire resistance directories, and product listings.

### 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.

## Part II. Wires and Cables Outside and on the service provider side of the Communication Service Point ~~Entering Buildings~~

### 800.44 Overhead (Aerial) Wires and Cables.

Overhead (aerial) wires and cables on the service provider side of the Communication Service Point ~~entering buildings~~ shall comply with 800.44(A) through (D).

Informational Note: For additional information regarding overhead (aerial) wires and cables, see ANSI C2-2017, *National Electrical Safety Code, Part 2 Safety Rules for Overhead Lines.*

#### (A) On Poles and In-Span.

Where wires and cables and electric light or power conductors are supported by the same pole or are run parallel to each other in-span, the conditions described in 800.44(A)(1) through (A)(4) shall be met.

#### (1) Relative Location.

Where practicable, the wires and cables shall be located below the electric light or power conductors.

#### (2) Attachment to Cross-Arms.

Wires and cables shall not be attached to a cross-arm that carries electric light or power conductors.

#### (3) Climbing Space.

The climbing space through wires and cables shall comply with the requirements of 225.14(D).

#### (4) Clearance.

Supply service drops and sets of overhead service conductors of 0 volts to 750 volts running above and parallel to communications and CATV type coaxial service drops shall have a minimum separation of 300 mm (12 in.) at any point in the span, including the point of and at their attachment to the building, provided that the ungrounded conductors are insulated and that a clearance of not less than 1.0 m (40 in.) is maintained between the two services at the pole.

#### (B) Above Roofs.

Communications wires and cables and CATV type coaxial cables shall have a vertical clearance of not less than 2.5 m (8 ft) from all points of roofs above which they pass.

*Exception No. 1: Communications wires and cables and CATV type coaxial cables shall not be required to have a vertical clearance of not less than 2.5 m (8 ft) above auxiliary buildings, such as garages and the like.*

*Exception No. 2: A reduction in clearance above only the overhanging portion of the roof to not less than 450 mm (18 in.) shall be permitted if (1) not more than 1.2 m (4 ft) of communications service-drop conductors pass above the roof overhang and (2) they are terminated at a through- or above-the-roof raceway or approved support.*

*Exception No. 3: Where the roof has a slope of not less than 100 mm in 300 mm (4 in. in 12 in.), a reduction in clearance to not less than 900 mm (3 ft) shall be permitted.*

Informational Note: For additional information regarding overhead (aerial) wires and cables, see ANSI/IEEE C2-2017, *National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines*.

**(C) On Masts.**

Overhead (aerial) communications and CATV type coaxial cables shall be permitted to be attached to an above-the-roof raceway mast that does not enclose or support conductors of electric light or power circuits.

**(D) Between Buildings.**

Communications and CATV type coaxial cables extending between buildings or structures, and also the supports or attachment fixtures, shall be identified and shall have sufficient strength to withstand the loads to which they might be subjected.

*Exception: Where a coaxial cable does not have sufficient strength to be self-supporting, it shall be attached to a supporting messenger cable that, together with the attachment fixtures or supports, shall be acceptable for the purpose and shall have sufficient strength to withstand the loads to which they may be subjected.*

**800.48 Communication Service Point.** The Communication Service Point shall be at a readily accessible location either outside or inside of a building or structure near to the point of entrance of the conductors in accordance with the one or more of the following:

1. The point of connection at which the communication service provider's network (outside plant) transitions to the premises wiring. The location of this point shall not be located further than 50 feet from the point of entrance.

2. The point of connection in an individual dwelling shall be located so as not to exceed 24 inches from the primary protector on the premises side of the protector.

3. A physical protection point or communications cable exiting the connection enclosure on the individual building side of the enclosure.

4. The point of connection at the Grounding Block, where required.

5. The point where a wireless signal transitions from the antenna or dish through a wired connection to transmitting or receiving equipment. The location of this point shall be permitted to include the ground connection at the antenna discharge unit or coaxial cable connection to the transmitting/receiving station (see 810.21).

6. The point of connection between nonconductive optical fiber cable entering the building and premises optical fiber cable inside the building not to exceed 50 feet from the point of entrance.

7. The Communication Service Point shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC), Electrical metallic tubing (EMT), intermediate metal conduit (IMC), or Rigid polyvinyl chloride conduit (PVC) to the point of emergence (see 770.48, 805.48, 820.48 and 830.48).

Informational Note: The transition and connection points listed above may be co-located. For example, a primary protector may be located inside a network interface unit (item 3) with a connection to an adjacent grounding block (Item 4) within 24 inches, and a connection to the premise wiring (item 2).

### 800.49 Metal Entrance Conduit Grounding.

Metal conduit containing entrance wire or cable shall be connected by a bonding conductor or grounding electrode conductor to a grounding electrode or, where present, the building grounding electrode system in accordance with 800.100(B).

### 800.53 Separation from Lightning Conductors.

Where practicable, a separation of at least 1.8 m (6 ft) shall be maintained between lightning conductors and all communication wires and cables and CATV type coaxial cables on buildings.

Informational Note No. 1: For additional information regarding overhead (aerial) wires and cables, see ANSI C2-2017 *National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines*.

Informational Note No. 2: Specific separation distances may be calculated from the sideflash equation in NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems.*

## Part III. Grounding Methods

### 800.100 Cable and Primary Protector Bonding and Grounding.

#### (A) Bonding Conductor or Grounding Electrode Conductor.

#### (1) Insulation.

The bonding conductor or grounding electrode conductor shall be listed and shall be permitted to be insulated, covered, or bare.

#### (2) Material.

The bonding conductor or grounding electrode conductor shall be copper or other corrosion-resistant conductive material, stranded or solid.

#### (3) Size.

The bonding conductor or grounding electrode conductor shall not be smaller than 14 AWG. The bonding conductor or grounding electrode conductor shall have a current-carrying capacity not less than the grounded metallic cable sheath member of the communications cable, the protected conductor of the communications cable, or the outer sheath of the coaxial cable, as applicable. The bonding conductor or grounding electrode conductor shall not be required to exceed 6 AWG.

#### (4) Length.

The bonding conductor or grounding electrode conductor shall be as short as practicable. In one- and two-family dwellings, the bonding conductor or grounding electrode conductor shall be as short as practicable, not to exceed 6.0 m (20 ft) in length.

Informational Note: Similar bonding conductor or grounding electrode conductor length limitations applied at apartment buildings and commercial buildings help to reduce voltages that may be developed between the building's power and communications systems during lightning events.

*Exception: In one- and two-family dwellings where it is not practicable to achieve an overall maximum bonding conductor or grounding electrode conductor length of 6.0 m (20 ft), a separate ground rod meeting the minimum dimensional criteria of 800.100(B)(3)(2) or (B)(3)(3) shall be driven, the bonding conductor or grounding electrode conductor shall be connected to the ground rod in accordance with 800.100(C), and the ground rod shall be connected to the power grounding electrode system in accordance with 800.100(D).*

#### (5) Run in Straight Line.

The bonding conductor or grounding electrode conductor shall be run in as straight a line as practicable.

#### (6) Physical Protection.

Bonding conductors and grounding electrode conductors shall be protected where exposed to physical damage. Where the bonding conductor or grounding electrode conductor is installed in a metal raceway, both ends of the raceway shall be bonded to the contained conductor or to the same terminal or electrode to which the bonding conductor or grounding electrode conductor is connected.

**(B) Electrode.**

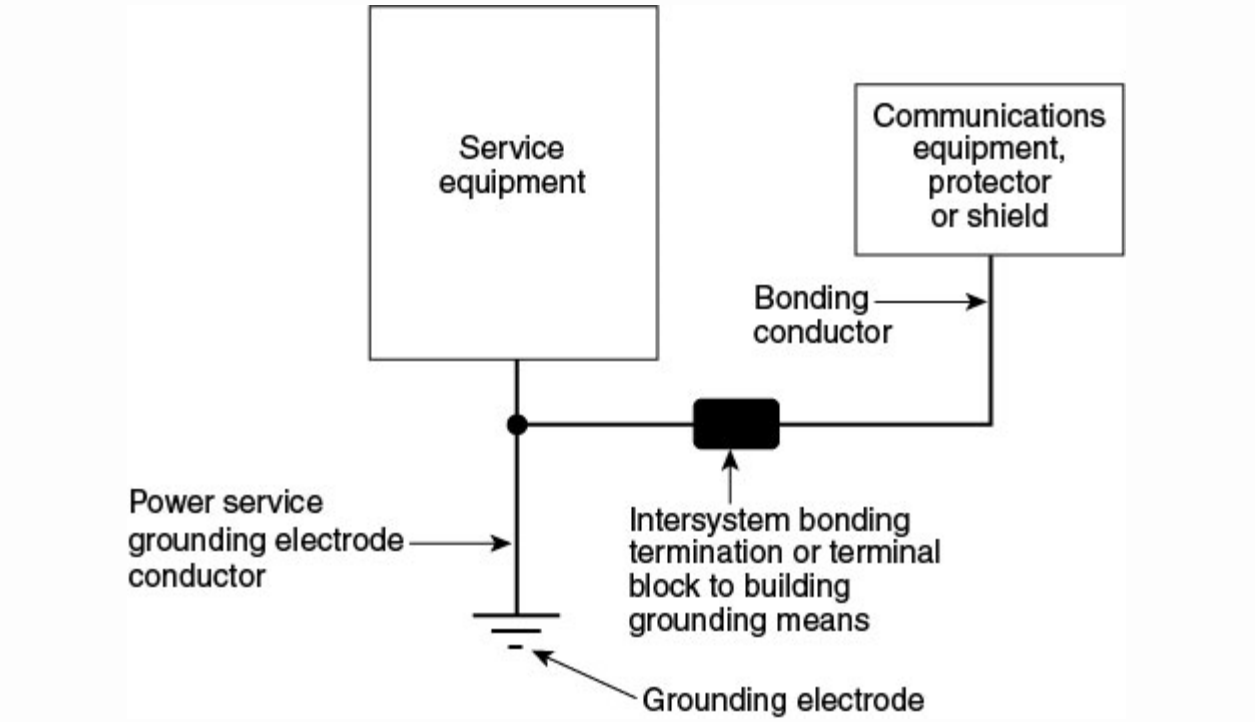
The bonding conductor or grounding electrode conductor shall be connected in accordance with 800.100(B)(1), (B)(2) , or (B)(3).

**(1) In Buildings or Structures with an Intersystem Bonding Termination.**

If the building or structure served has an intersystem bonding termination as required by 250.94, the bonding conductor shall be connected to the intersystem bonding termination.

Informational Note: Informational Note Figure 800.100(B)(1) illustrates the connection of the bonding conductor in buildings or structures equipped with an intersystem bonding termination or a terminal block providing access to the building grounding means.

**Figure Informational Note Figure 800.100(B)(1) Illustration of a Bonding Conductor in a Communications Installation.**




**(2) In Buildings or Structures with Grounding Means.**

If an intersystem bonding termination is established, 250.94(A) shall apply. If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on one of the following:

1. The building or structure grounding electrode system as covered in 250.50
2. The grounded interior metal water piping system, within 1.5 m (5 ft) from its point of entrance to the building, as covered in 250.52
3. The power service accessible means external to enclosures using the options identified in 250.94(A), Exception
4. The nonflexible metal power service raceway
5. The service equipment enclosure

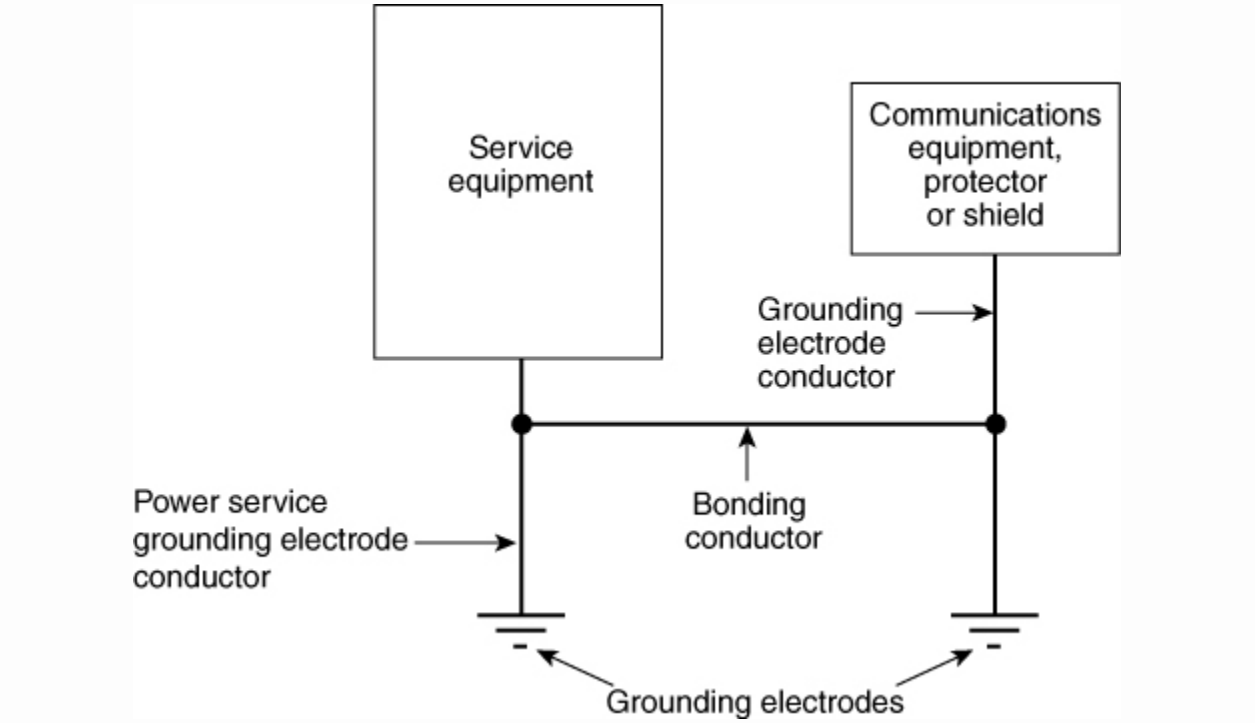
6. The grounding electrode conductor or the grounding electrode conductor metal enclosure of the power service
7. The grounding electrode conductor or the grounding electrode of a building or structure disconnecting means that is connected to a grounding electrode as covered in 250.32

A bonding device intended to provide a termination point for the bonding conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on nonremovable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is nonremovable.

For purposes of this section, the mobile home service equipment or the mobile home disconnecting means located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means connected to an electrode by a grounding electrode conductor in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Informational Note Figure 800.100(B)(2) illustrates the connection of the bonding conductor in buildings or structures not equipped with an intersystem bonding termination or a terminal block providing access to the building grounding means.

**Figure Informational Note Figure 800.100(B)(2) Illustration of a Grounding Electrode Conductor and a Bonding Conductor in a Communications Installation.**




**(3) In Buildings or Structures Without an Intersystem Bonding Termination or Grounding Means.**

If the building or structure served has no intersystem bonding termination or grounding means, as described in 800.100(B)(2), the grounding electrode conductor shall be connected to one of the following:

1. To any one of the individual grounding electrodes described in 250.52(A)(1), (A)(2), (A)(3), or (A)(4)
2. If the building or structure served has no intersystem bonding termination or grounding means, as described in 800.100(B)(2) or (B)(3)(1), to any one of the individual grounding electrodes described in 250.52(A)(5), (A)(7), and (A)(8)

3. For communications circuits covered in Article 805 or network-powered broadband communications systems covered in Article 830, to a ground rod or pipe not less than 1.5 m (5 ft) in length and 12.7 mm (0.5 in.) in diameter, driven, where practicable, into permanently damp earth and separated from lightning protection system conductors, as covered in 800.53, and at least 1.8 m (6 ft) from electrodes of other systems

Steam pipes, hot water pipes, or lightning protection system conductors shall not be employed as grounding electrodes for protectors and grounded metallic members.

**(C) Electrode Connection.**

Connections to grounding electrodes shall comply with 250.70.

**(D) Bonding of Electrodes.**

A bonding jumper not smaller than 6 AWG copper or equivalent shall be connected between the grounding electrode and power grounding electrode system at the building or structure served where separate electrodes are used.

*Exception: At mobile homes as covered in 800.106.*

Informational Note No. 1: See 250.60 for connection to a lightning protection system.

Informational Note No. 2: Bonding together of all separate electrodes limits potential differences between them and between their associated wiring systems.

**800.106 Primary Protector Grounding and Bonding at Mobile Homes.**

**(A) Grounding.**

Grounding shall comply with 800.106(A)(1) and (A)(2).

**(1) Mobile Home Service Equipment.**

Where there is no mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, grounding shall comply with one of the following:

1. The primary protector grounding terminal; the coaxial cable shield ground, or surge arrester grounding terminal; or the network-powered broadband communications cable shield, network-powered broadband communications cable metallic members not used for communications or powering, and network interface unit shall be connected to a grounding electrode conductor or grounding electrode in accordance with 800.100(B)(3).
2. The non-current-carrying metallic members of optical fiber cables shall be connected to a grounding electrode in accordance with 770.106(A)(1). The network terminal, if required to be grounded, shall be connected to a grounding electrode in accordance with 800.106(A)(1)(1). The grounding electrode shall be bonded in accordance with 770.106(B).

**(2) Mobile Home Feeder Disconnecting Means.**

Where there is no mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, grounding shall comply with one of the following:

1. The primary protector grounding terminal; the network-powered broadband communications cable shield, network-powered broadband communications cable metallic members not used for communications or powering, and network interface unit shall be connected to a grounding electrode in accordance with 800.100(B)(3).
2. The non-current-carrying metallic members of optical fiber cables shall be connected to a grounding electrode in accordance with 770.106(A)(2). The network terminal, if required to be grounded, shall be connected to a grounding electrode in accordance with 800.106(A)(2). The grounding electrode shall be bonded in accordance with 770.106(B).

**(B) Bonding.**

The primary protector grounding terminal or grounding electrode, network-powered broadband communications cable grounding terminal, or network interface unit grounding terminal shall be bonded together and connected to the metal frame or available grounding terminal of the mobile home with a copper conductor not smaller than 12 AWG under either of the following conditions:

1. Where there is no mobile home service equipment or disconnecting means as in 800.106(A)
2. Where the mobile home is supplied by cord and plug

**Part IV. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**800.110 Raceways, Cable Routing Assemblies, and Cable Trays.**

**(A) Types of Raceways.**

Wires and cables shall be permitted to be installed in raceways that comply with either 800.110(A)(1) or (A)(2). Medium-power network-powered broadband communications cables shall not be permitted to be installed in raceways that comply with 800.110(A)(2).

**(1) Raceways Recognized in Chapter 3.**

Wires and 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.**

Wires and 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.

**(3) Innerduct for Communications Wires and Cables, Coaxial Cables, or Network-Powered Broadband Communications Cables.**

Listed plenum communications raceways, listed riser communications raceways, and listed general-purpose communications raceways 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.**

The raceway fill requirements of Chapters 3 and 9 shall apply to medium-power network-powered broadband communications cables.

**(C) Cable Routing Assemblies.**

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)(1) and (C)(2) and 800.113.

**(1) Horizontal Support.**

Cable routing assemblies shall be supported where run horizontally at intervals not to exceed 900 mm (3 ft) and at each end or joint, unless listed for other support intervals. In no case shall the distance between supports exceed 3 m (10 ft).

**(2) Vertical Support.**

Vertical runs of cable routing assemblies shall be supported at intervals not exceeding 1.2 m (4 ft), unless listed for other support intervals, and shall not have more than one joint between supports.

**(D) Cable Trays.**

Wires and cables and communications raceways shall be permitted to be installed in metal or listed nonmetallic cable tray systems. Ladder cable trays shall be permitted to support cable routing assemblies.

## 800.113 Installation of Wires, Cables, Cable Routing Assemblies, and Communications Raceways.

Installation of wires, cables, cable routing assemblies, and communications raceways shall comply with 800.113(A) through (L). Installation of cable routing assemblies and communications raceways shall comply also with 800.110.

**(A) Listing.**

Wires, cables, cable routing assemblies, and communications raceways installed in buildings shall be listed.

*Exception: Cables installed in compliance with 805.48 or 820.48 shall not be required to be listed.*

**(B) Ducts Specifically Fabricated for Environmental Air.**

The following wires and 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. Plenum cables up to 1.22 m (4 ft) in length
2. Plenum cables, riser cables, general-purpose cables, and limited-use 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 NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

**(C) Other Spaces Used for Environmental Air (Plenums).**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted in other spaces used for environmental air as described in 300.22(C):

1. Plenum cables
2. Plenum communications raceways
3. Plenum cable routing assemblies
4. Plenum cables installed in plenum communications raceways
5. Plenum cables installed in plenum cable routing assemblies
6. Plenum cables and plenum communications raceways supported by open metal cable tray systems
7. Plenum cables, riser cables, general-purpose cables, limited-use cables, and communications wires installed in raceways that are installed in compliance with 300.22(C)
8. Plenum cables, riser cables, general-purpose cables, limited-use cables, 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)
9. Plenum cables, riser cables, general-purpose cables, and limited-use 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, see NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

**(D) Risers — Cables, Cable Routing Assemblies, and Communications Raceways in Vertical Runs.**

The following cables, cable routing assemblies, and communications raceways shall be permitted in vertical runs penetrating one or more floors and in vertical runs in a shaft:

1. Plenum and riser cables
2. Plenum and riser communications raceways
3. Plenum and riser cable routing assemblies
4. Plenum and riser cables installed in:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) Plenum cable routing assemblies
    d) Riser cable routing assemblies

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**(E) Risers — Cables and Innerducts in Metal Raceways.**

The following cables and innerducts shall be permitted in metal raceways in a riser having firestops at each floor:

1. Plenum cables, riser cables, general-purpose cables, and limited-use cables
2. Plenum, riser, and general-purpose communications raceways
3. Plenum cables, riser cables, general-purpose cables, and limited-use cables installed in:
    a) Plenum communications raceways (innerduct)
    b) Riser communications raceways (innerduct)
    c) General-purpose communications raceways (innerduct)

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**(F) Risers — Cables, Cable Routing Assemblies, and Communications Raceways in Fireproof Shafts.**

The following cables, cable routing assemblies, and communications raceways shall be permitted to be installed in fireproof riser shafts having firestops at each floor:

1. Plenum cables, riser cables, general-purpose cables, and limited-use cables
2. Plenum, riser, and general-purpose communications raceways
3. Plenum, riser, and general-purpose cable routing assemblies
4. Plenum cables, riser cables, general-purpose cables, and limited-use cables installed in:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
    d) Plenum cable routing assemblies
    e) Riser cable routing assemblies
    f) General-purpose cable routing assemblies

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**(G) Risers — One- and Two-Family Dwellings.**

The following cables, cable routing assemblies, and communications raceways shall be permitted in one- and two-family dwellings:

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables less than 6 mm (0.25 in.) in diameter
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Plenum cables, riser cables, and general-purpose cables installed in:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
    d) Plenum cable routing assemblies
    e) Riser cable routing assemblies
    f) General-purpose cable routing assemblies

**(H) Cable Trays.**

The following wires, cables, and communications raceways shall be permitted to be supported by cable trays:

1. Plenum cables, riser cables, and general-purpose cables
2. Plenum, riser, and general-purpose communications raceways
3. Communications wires, plenum cables, riser cables, and general-purpose cables installed in:
    1. Plenum communications raceways
    2. Riser communications raceways
    3. General-purpose communications raceways

**(I) Distributing Frames and Cross-Connect Arrays.**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in distributing frames and cross-connect arrays:

1. Plenum cables, riser cables, general-purpose cables, and communications wires
2. Plenum, riser, and general-purpose communications raceways
3. Plenum, riser, and general-purpose cable routing assemblies
4. Communications wires, plenum cables, riser cables, and general-purpose cables installed in:
    1. Plenum communications raceways
    2. Riser communications raceways
    3. General-purpose communications raceways
    4. Plenum cable routing assemblies
    5. Riser cable routing assemblies
    6. General-purpose cable routing assemblies

**(J) Other Building Locations.**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in building locations other than the locations covered in 800.113(B) through (I):

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables with a maximum of 3 m (10 ft) of exposed length in nonconcealed spaces
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
6. Plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum cable routing assemblies
    b) Riser cable routing assemblies
    c) General-purpose cable routing assemblies
7. Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3
8. Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks

**(K) Multifamily Dwellings.**

The following cables, cable routing assemblies, and communications raceways shall be permitted to be installed in multifamily dwellings in locations other than the locations covered in 800.113(B) through (G):

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables less than 6 mm (0.25 in.) in diameter in nonconcealed spaces
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
6. Plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum cable routing assemblies
    b) Riser cable routing assemblies
    c) General-purpose cable routing assemblies
7. Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3
8. Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks

**(L) One- and Two-Family Dwellings.**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in one- and two-family dwellings in locations other than the locations covered in 800.113(B) through (F):

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables less than 6 mm (0.25 in.) in diameter
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:
   a) Plenum communications raceways
   b) Riser communications raceways
   c) General-purpose communications raceways
6. Plenum cables, riser cables, and general-purpose cables installed in the following
   a) Plenum cable routing assemblies
   b) Riser cable routing assemblies
   c) General-purpose cable routing assemblies
7. Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3
8. Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks
9. Hybrid power and communications cable listed in accordance with 805.179(F)

**800.154 Applications of Listed Communications Wires, Cables, and Raceways, and Listed Cable Routing Assemblies.**

Permitted and nonpermitted applications of listed communications wires, cables, coaxial cables, network-powered broadband communications system cables and raceways, and listed cable routing assemblies, shall be in accordance with one of the following:

1. Listed communications wires and cables as indicated in Table 800.154(a)
2. Listed communications raceways as indicated in Table 800.154(b)
3. Listed cable routing assemblies as indicated in Table 800.154(c)

The permitted applications shall be subject to the installation requirements of 800.110 and 800.113.

**Table 800.154(a) Applications of Listed Communications Wires, Cables, and Network-Powered Broadband Communications System Cables on the customer side of the Communication Service Point ~~Buildings~~**

| Applications | | Wire and Cable Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BMU, BLU | Hybrid Power and Communications Cables | Communications Wires |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | Y | N | N | N | N | N | N | N | N | N |
| | In metal raceway that complies with 300.22(B) | Y | Y | Y | Y | Y | Y | N | N | N | Y |

| Applications | | Wire and Cable Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BMU, BLU | Hybrid Power and Communications Cables | Communications Wires |
| In other spaces used for environmental air (plenums) as described in 300.22(C) | In other spaces used for environmental air | Y | N | N | N | N | N | N | N | N | N |
| | In metal raceway that complies with 300.22(C) | Y | Y | Y | Y | Y | Y | N | N | N | Y |
| | In plenum communications raceways | Y | N | N | N | N | N | N | N | N | N |
| | In plenum cable routing assemblies | Y | N | N | N | N | N | N | N | N | N |
| | Supported by open metal cable trays | Y | N | N | N | N | N | N | N | N | N |
| | Supported by solid bottom metal cable trays with solid metal covers | Y | Y | Y | Y | Y | Y | N | N | N | N |
| In risers | In vertical runs | Y | Y | Y | N | N | N | N | N | N | N |
| | In metal raceways | Y | Y | Y | Y | Y | Y | N | N | N | N |
| | In fireproof shafts | Y | Y | Y | Y | Y | Y | N | N | N | N |
| | In plenum communications raceways | Y | Y | N | N | N | N | N | N | N | N |
| | In plenum cable routing assemblies | Y | Y | N | N | N | N | N | N | N | N |
| | In riser communications raceways | Y | Y | N | N | N | N | N | N | N | N |
| | In riser cable routing assemblies | Y | Y | N | N | N | N | N | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y | Y | Y | Y | N | N | Y | N |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y | Y | Y | Y | N | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y | Y | Y | Y | Y | N | Y | N |
| | In multifamily dwellings | Y | Y | Y | Y | Y | Y | Y | N | N | N |
| | In nonconcealed spaces | Y | Y | Y | Y | Y | Y | Y | N | N | N |
| | Supported by cable trays | Y | Y | Y | Y | Y | N | N | N | N | N |
| | Under carpet, modular flooring, and planks | N | N | N | N | N | N | Y | N | N | N |
| | In distributing frames and cross-connect arrays | Y | Y | N | Y | N | N | N | N | N | Y |
| | In rigid metal conduit (RMC) and intermediate metal conduit (IMC) | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |

| Applications | | Wire and Cable Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BMU, BLU | Hybrid Power and Communications Cables | Communications Wires |
| | In any raceway recognized in Chapter 3 | Y | Y | Y | Y | Y | Y | N | N | N | Y |
| | In plenum communications raceways | Y | Y | N | Y | N | N | N | N | N | Y |
| | In plenum cable routing assemblies | Y | Y | N | Y | N | N | N | N | N | Y |
| | In riser communications raceways | Y | Y | N | Y | N | N | N | N | N | Y |
| | In riser cable routing assemblies | Y | Y | N | Y | N | N | N | N | N | Y |
| | In general-purpose communications raceways | Y | Y | N | Y | N | N | N | N | N | Y |
| | In general-purpose cable routing assemblies | Y | Y | N | Y | N | N | N | N | N | Y |

Note: An "N" in the table indicates that the cable type shall not be permitted to be installed in the application. A "Y" indicates that the cable type shall be permitted to be installed in the application subject to the limitations described in 800.113. The Riser column includes all riser cables except BMR, and the General-Purpose column includes all general-purpose cables except BM.
Informational Note No. 1: Part IV of Article 800 covers wiring on the customer side of the communication service point ~~installation methods within buildings~~. This table covers the applications of listed communications wires, cables, and raceways ~~in buildings~~. See the definition of *Point of Entrance* in 800.2.

Informational Note No. 2: For information on the restrictions to the installation of communications cables in fabricated ducts, see 800.113(B).

### Table 800.154(b) Applications of Listed Communications Raceways on the customer side of the Communication Service Point~~in Buildings~~

| Applications | | Listed Communications Raceway Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | N | N | N |
| | In metal raceway that complies with 300.22(B) | N | N | N |
| In other spaces used for environmental air (plenums) 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 cable routing assemblies | N | 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 cable routing assemblies | N | N | N |
| | In riser cable routing assemblies | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y |
| | In one- and two-family dwellings | Y | Y | Y |
| | In multifamily dwellings | Y | Y | Y |

| Applications | | Listed Communications Raceway Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| | In nonconcealed spaces | Y | Y | Y |
| | Supported by cable trays | Y | Y | Y |
| | Under carpet, modular flooring, and planks | N | N | N |
| | In distributing frames and cross-connect arrays | Y | Y | Y |
| | In any raceway recognized in Chapter 3 | Y | Y | Y |
| | In plenum cable routing assemblies | N | N | N |
| | In riser cable routing assemblies | N | N | N |
| | In general-purpose cable routing assemblies | N | N | N |

Note: An “N” in the table indicates that the communications raceway type shall not be permitted to be installed in the application. A “Y” indicates that the communications raceway type shall be permitted to be installed in the application, subject to the limitations described in 800.110 and 800.113.

## Table 800.154(c) Applications of Listed Cable Routing Assemblies in Buildings

| Applications | | Listed Cable Routing Assembly Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | N | N | N |
| | In metal raceway that complies with 300.22(B) | N | N | N |
| In other spaces used for environmental air (plenums) 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) | N | N | N |
| | In plenum communications raceways | N | N | N |
| | Supported by open metal cable trays | Y | N | N |
| | Supported by solid bottom metal cable trays with solid metal covers | N | N | N |
| In risers | In vertical runs | Y | Y | N |
| | In metal raceways | N | N | N |
| | In fireproof shafts | Y | Y | Y |
| | In plenum communications raceways | N | N | N |
| | In riser communications raceways | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y |
| | In one- and two-family dwellings | Y | Y | Y |
| | In multifamily dwellings | Y | Y | Y |
| | In nonconcealed spaces | Y | Y | Y |
| | Supported by cable trays | Y | Y | Y |
| | Under carpet, modular flooring, and planks | N | N | N |
| | In distributing frames and cross-connect arrays | Y | Y | Y |
| | In any raceway recognized in Chapter 3 | N | N | N |
| | In plenum communications raceways | N | N | N |
| | In riser communications raceways | N | N | N |
| | In general-purpose communications raceways | N | N | N |

Note: An “N” in the table indicates that the cable routing assembly type shall not be permitted to be installed in the application. A “Y” indicates that the cable routing assembly type shall be permitted to be installed in the application subject to the limitations described in 800.113.

### 800.179 Plenum, Riser, General-Purpose, and Limited Use Cables.

Plenum, riser, general-purpose, and limited-use cables shall be listed in accordance with 800.179(A) through (D) and shall have a temperature rating of not less than 60°C (140°F). The temperature rating shall be marked on the jacket of cables that have a temperature rating exceeding 60°C (140°F). The cable voltage rating shall not be marked on the cable.

#### (A) Plenum Cables.

Type CMP communications plenum cables, Type CATVP community antenna television plenum coaxial cables, and Type BLP network-powered broadband communication low-power plenum cables shall be listed as being suitable for use in ducts, plenums, and other spaces 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*.

#### (B) Riser Cables.

Type CMR communications riser cables, Type CATVR community antenna television riser coaxial cables, Type BMR network-powered broadband communications medium-power riser cables, and Type BLR network-powered broadband communications low-power riser cables 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 1666-2011, *Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts.*

#### (C) General-Purpose Cables.

Type CM communications general-purpose cables, Type CATV community antenna television coaxial general-purpose cables, Type BM network-powered broadband communications medium-power general-purpose cables, and Type BL network-powered broadband communications low-power general-purpose cables shall be listed as being suitable for general-purpose use, with the exception of risers and plenums, 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 Flame Tray 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. 0.3-09, *Test Methods for Electrical Wires and Cables*.

#### (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 VW-1 (vertical-wire) flame test in ANSI/UL 1581-2017, *Reference Standard for Electrical Wires, Cables and Flexible Cords*.

## Part V. Listing Requirements

### 800.180 Grounding Devices.

Where bonding or grounding is required, devices used to connect a shield, a sheath, or non-current-carrying metallic members of a cable to a bonding conductor or grounding electrode conductor shall be listed or be part of listed equipment.

### 800.182 Cable Routing Assemblies and Communications Raceways.

Cable routing assemblies and communications raceways shall be listed in accordance with 800.182(A) through (C). Cable routing assemblies shall be marked in accordance with Table 800.182(a). Communications raceways shall be marked in accordance with Table 800.182(b).

Informational Note: For information on listing requirements for both communications raceways and cable routing assemblies, see ANSI/UL 2024-5-2015, *Cable Routing Assemblies and Communications Raceways*.

**Table 800.182(a) Cable Routing Assembly Markings**

| Type | Marking |
|---|---|
| Plenum Cable Routing Assembly | Plenum Cable Routing Assembly |
| Riser Cable Routing Assembly | Riser Cable Routing Assembly |
| General-Purpose Cable Routing Assembly | General-Purpose Cable Routing Assembly |

**Table 800.182(b) Communications Raceway Markings**

| Type | Marking |
|---|---|
| Plenum Communications Raceway | Plenum Communications Raceway |
| Riser Communications Raceway | Riser Communications Raceway |
| General-Purpose Communications Raceway | General-Purpose Communications Raceway |

### (A) Plenum Cable Routing Assemblies and Plenum Communications Raceways.

Plenum cable routing assemblies and plenum communications raceways shall be listed as having adequate fire-resistant and low-smoke-producing characteristics.

Informational Note No. 1: One method of defining cable routing assemblies and communications raceways that have adequate fire-resistant and low-smoke-producing characteristics is that they exhibit a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84-15a, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or ANSI/UL 723-2013, *Standard Test Method for Surface Burning Characteristics of Building Materials*.

Informational Note No. 2: Another method of defining communications raceways that have adequate fire-resistant and low-smoke-producing characteristics is that they exhibit 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 262-2015, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces*.

Informational Note No. 3: See 4.3.11.2.6 or 4.3.11.5.5 of NFPA 90A-2015, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, for information on materials exposed to the airflow in ceiling cavity and raised floor plenums.

### (B) Riser Cable Routing Assemblies and Riser Communications Raceways.

Riser cable routing assemblies and riser communications raceways shall be listed as having adequate 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 cable routing assemblies and communications raceways pass the requirements of ANSI/UL 1666-2011, *Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts*.

### (C) General-Purpose Cable Routing Assemblies and General-Purpose Communications Raceways.

General-purpose cable routing assemblies and general-purpose communications raceways shall 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 cable routing assemblies and communications raceways do not spread fire to the top of the tray in the “UL Flame Exposure, Vertical Flame Tray Test” in ANSI/UL 1685-2011, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*.

## Article 805 Communications Circuits

### Part I. General

### 805.1 Scope.

This article covers communications circuits and equipment.

**805.2 Definitions.**

The definitions in this section shall apply only within Articles 805 and 840.

**Cable.**

A factory assembly of two or more conductors having an overall covering.

**Communications Circuit Integrity (CI) Cable.**

Cable used in communications systems to ensure continued operation of critical circuits during a specified time under fire conditions.

**Wire.**

A factory assembly of one or more insulated conductors without an overall covering.

**805.18 Installation of Equipment.**

Equipment electrically connected to a communications network shall be listed in accordance with 805.170.

*Exception: This listing requirement shall not apply to test equipment that is intended for temporary connection to a telecommunications network by qualified persons during the course of installation, maintenance, or repair of telecommunications equipment or systems.*

**Part II. Wires and Cables Outside and on the service provider side of the Communication Service Point ~~Entering Buildings~~**

**805.47 Underground Communications Wires and Cables ~~Entering Buildings~~.**

Underground communications wires and cables ~~entering buildings~~ shall comply with 805.47(A) and (B). The requirements of 310.10(C) shall not apply to communications wires and cables.

**(A) Underground Systems with Electric Light, Power, Class 1, or Non-Power-Limited Fire Alarm Circuit Conductors.**

Underground communications wires and cables in a raceway, handhole enclosure, or manhole containing electric light, power, Class 1, or non-power-limited fire alarm circuit conductors shall be in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier.

**(B) Underground Block Distribution.**

Where the entire street circuit is run underground and the circuit within the block is placed so as to be free from the likelihood of accidental contact with electric light or power circuits of over 300 volts to ground, the insulation requirements of 805.50(A) and 805.50(C) shall not apply, insulating supports shall not be required for the conductors, and bushings shall not be required where the conductors enter the building.

**805.48 Unlisted Cables on the service provider side of the Communication Service Point ~~Entering Buildings~~.**

Unlisted outside plant communications cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated in an enclosure or on a listed primary protector. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) to the point of emergence.

Informational Note No. 1: Splice cases or terminal boxes, both metallic and plastic types, are typically used as enclosures for splicing or terminating telephone cables.

Informational Note No. 2: This section limits the length of unlisted outside plant cable to 15 m (50 ft), while 805.90(B) requires that the primary protector be located as close as practicable to the point at which the cable enters the building. Therefore, in installations requiring a primary protector, the outside plant cable may not be permitted to extend 15 m (50 ft) into the building if it is practicable to place the primary protector closer than 15 m (50 ft) to the point of entrance.

### 805.50 Circuits Requiring Primary Protectors.

Circuits that require primary protectors as provided in 805.90 shall comply with 805.50(A),805.50(B), and 805.50(C).

#### (A) Insulation, Wires, and Cables.

Communications wires and cables without a metallic shield, running from the last outdoor support to the primary protector, shall be listed in accordance with 805.173.

#### (B) On Buildings.

Communications wires and cables in accordance with 805.50(A) shall be separated at least 100 mm (4 in.) from electric light or power conductors not in a raceway or cable or be permanently separated from conductors of the other systems by a continuous and firmly fixed nonconductor in addition to the insulation on the wires, such as porcelain tubes or flexible tubing. Communications wires and cables in accordance with 805.50(A) exposed to accidental contact with electric light and power conductors operating at over 300 volts to ground and attached to buildings shall be separated from woodwork by being supported on glass, porcelain, or other insulating material.

*Exception: Separation from woodwork shall not be required where fuses are omitted as provided for in 805.90(A)(1), or where conductors are used to extend circuits to a building from a cable having a grounded metal sheath.*

#### (C) Entering Buildings.

Where a primary protector is installed inside the building, the communications wires and cables shall enter the building either through a noncombustible, nonabsorbent insulating bushing or through a metal raceway. The insulating bushing shall not be required where the entering communications wires and cables (1) are in metal-sheathed cable, (2) pass through masonry, (3) meet the requirements of 805.50(A) and fuses are omitted as provided in 805.90(A)(1), or (4) meet the requirements of 805.50(A) and are used to extend circuits to a building from a cable having a grounded metallic sheath. Raceways or bushings shall slope upward from the outside or, where this cannot be done, drip loops shall be formed in the communications wires and cables immediately before they enter the building.

Raceways shall be equipped with an approved service head. More than one communications wire and cable shall be permitted to enter through a single raceway or bushing. Conduits or other metal raceways located ahead of the primary protector shall be grounded.

## Part III. Protection

### 805.90 Protective Devices.

#### (A) Application.

A listed primary protector shall be provided on each circuit run partly or entirely in aerial wire or aerial cable not confined within a block. Also, a listed primary protector shall be provided on each circuit, aerial or underground, located within the block containing the building served so as to be exposed to accidental contact with electric light or power conductors operating at over 300 volts to ground. In addition, where there exists a lightning exposure, each interbuilding circuit on a premises shall be protected by a listed primary protector at each end of the interbuilding circuit. Installation of primary protectors shall also comply with 110.3(B).

Informational Note No. 1: On a circuit not exposed to accidental contact with power conductors, providing a listed primary protector in accordance with this article helps protect against other hazards, such as lightning and above-normal voltages induced by fault currents on power circuits in proximity to the communications circuit.

Informational Note No. 2: Interbuilding circuits are considered to have a lightning exposure unless one or more of the following conditions exist:

1. Circuits in large metropolitan areas where buildings are close together and sufficiently high to intercept lightning.
2. Interbuilding cable runs of 42 m (140 ft) or less, directly buried or in underground conduit, where a continuous metallic cable shield or a continuous metal conduit containing the cable is connected to each building grounding electrode system.

3. Areas having an average of five or fewer thunderstorm days per year and earth resistivity of less than 100 ohm-meters. Such areas are found along the Pacific coast.

Informational Note No. 3: For information on lightning protection systems, see NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems.*

**(1) Fuseless Primary Protectors.**

Fuseless-type primary protectors shall be permitted under any of the conditions given in 805.90(A)(1)(a) through (A)(1)(e).

(a) Where conductors enter a building through a cable with grounded metallic sheath member(s) and where the conductors in the cable safely fuse on all currents greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor

(b) Where insulated conductors in accordance with 805.50(A) are used to extend circuits to a building from a cable with an effectively grounded metallic sheath member(s) and where the conductors in the cable or cable stub, or the connections between the insulated conductors and the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground, safely fuse on all currents greater than the current-carrying capacity of the primary protector, or the associated insulated conductors and of the primary protector bonding conductor or grounding electrode conductor

(c) Where insulated conductors in accordance with 805.50(A) or (B) are used to extend circuits to a building from other than a cable with metallic sheath member(s), where (1) the primary protector is listed as being suitable for this purpose for application with circuits extending from other than a cable with metallic sheath members, and (2) the connections of the insulated conductors to the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground or the conductors of the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground safely fuse on all currents greater than the current-carrying capacity of the primary protector, or associated insulated conductors and of the primary protector bonding conductor or grounding electrode conductor

(d) Where insulated conductors in accordance with 805.50(A) are used to extend circuits aerially to a building from a buried or underground circuit that is unexposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground

(e) Where insulated conductors in accordance with 805.50(A) are used to extend circuits to a building from cable with an effectively grounded metallic sheath member(s), and where (1) the combination of the primary protector and insulated conductors is listed as being suitable for this purpose for application with circuits extending from a cable with an effectively grounded metallic sheath member(s), and (2) the insulated conductors safely fuse on all currents greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor

Informational Note: Section 9 of ANSI/IEEE C2-2012, *National Electrical Safety Code*, provides an example of methods of protective grounding that can achieve effective grounding of communications cable sheaths for cables from which communications circuits are extended.

**(2) Fused Primary Protectors.**

Where the requirements listed under 805.90(A)(1)(a) through (A)(1)(e) are not met, fused-type primary protectors shall be used. Fused-type primary protectors shall consist of an arrester connected between each line conductor and ground, a fuse in series with each line conductor, and an appropriate mounting arrangement. Primary protector terminals shall be marked to indicate line, instrument, and ground, as applicable.

**(B) Location.**

The primary protector shall be located in, on, or immediately adjacent to the structure or building served and as close as practicable to the point of entrance.

For purposes of this section, primary protectors located at mobile home service equipment within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means connected to an electrode by a grounding electrode conductor in accordance with 250.32 and located

within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a primary protector location to achieve the shortest practicable primary protector bonding conductor or grounding electrode conductor helps limit potential differences between communications circuits and other metallic systems.

**(C) Hazardous (Classified) Locations.**

The primary protector shall not be located in any hazardous (classified) locations, as defined in 500.5 and 505.5, or in the vicinity of easily ignitible material.

*Exception: As permitted in 501.150, 502.150, and 503.150.*

**(D) Secondary Protectors.**

Where a secondary protector is installed in series with the indoor communications wire and cable between the primary protector and the equipment, it shall be listed for the purpose in accordance with 805.170(B).

Informational Note: Secondary protectors on circuits exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground are not intended for use without primary protectors.

**805.93 Grounding, Bonding, or Interruption of Non–Current-Carrying Metallic Sheath Members of Communications Cables.**

Communications cables entering the building or terminating on the outside of the building shall comply with 805.93(A) or (B).

**(A) Entering Buildings.**

In installations where the communications cable enters a building, the metallic sheath members of the cable shall be grounded or bonded as specified in 800.100 or interrupted by an insulating joint or equivalent device. The grounding, bonding, or interruption shall be as close as practicable to the point of entrance.

**(B) Terminating on the Outside of Buildings.**

In installations where the communications cable is terminated on the outside of the building, the metallic sheath members of the cable shall be grounded or bonded as specified in 800.100 or interrupted by an insulating joint or equivalent device. The grounding, bonding, or interruption shall be as close as practicable to the point of termination of the cable.

**Part IV. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**805.133 Installation of Communications Wires, Cables, and Equipment.**

Communications wires and cables from the protector to the equipment or, where no protector is required, communications wires and cables attached to the outside or inside of the building shall comply with 805.133(A) and 805.133(B)

**(A) Separation from Other Conductors.**

**(1) In Raceways, Cable Trays, Boxes, Cables, Enclosures, and Cable Routing Assemblies.**

(a) *Other Circuits.* Communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with cables 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. Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770
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

(b) *Class 2 and Class 3 Circuits.* Class 1 circuits shall not be run in the same cable with communications circuits. Class 2 and Class 3 circuit conductors shall be permitted in the same listed communications cable with communications circuits.

(c) *Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm, and Medium-Power Network-Powered Broadband Communications Circuits in Raceways, Compartments, and Boxes.* Communications conductors shall not be placed in any raceway, compartment, outlet box, junction box, or similar fitting with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits.

*Exception No. 1: Section 805.133(A)(1)(c) shall not apply if 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 conductors of communications circuits by a permanent barrier or listed divider.*

*Exception No. 2: Power conductors in outlet boxes, junction boxes, or similar fittings or compartments where such conductors are introduced solely for power supply to communications equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum of 6 mm (¼ in.) separation from the communications circuit conductors.*

*Exception No. 3: As permitted by 620.36.*

**(2) Other Applications.**

Communications wires and cables shall be separated 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.

*Exception No. 1: Section 805.133(A)(2) shall not apply where either (1) all of the conductors of the electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits are in a raceway or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC, or Type UF cables, or (2) all of the conductors of communications circuits are encased in raceway.*

*Exception No. 2: Section 805.133(A)(2) shall not apply where the communications wires and cables are permanently separated from the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B) Support of Communications Wires and Cables.**

Raceways shall be used for their intended purpose. Communications wires and cables shall not be strapped, taped, or attached by any means to the exterior of any raceway as a means of support.

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

**805.154 Substitutions of Listed Communications Wires, Cables, and Raceways, and Listed Cable Routing Assemblies.**

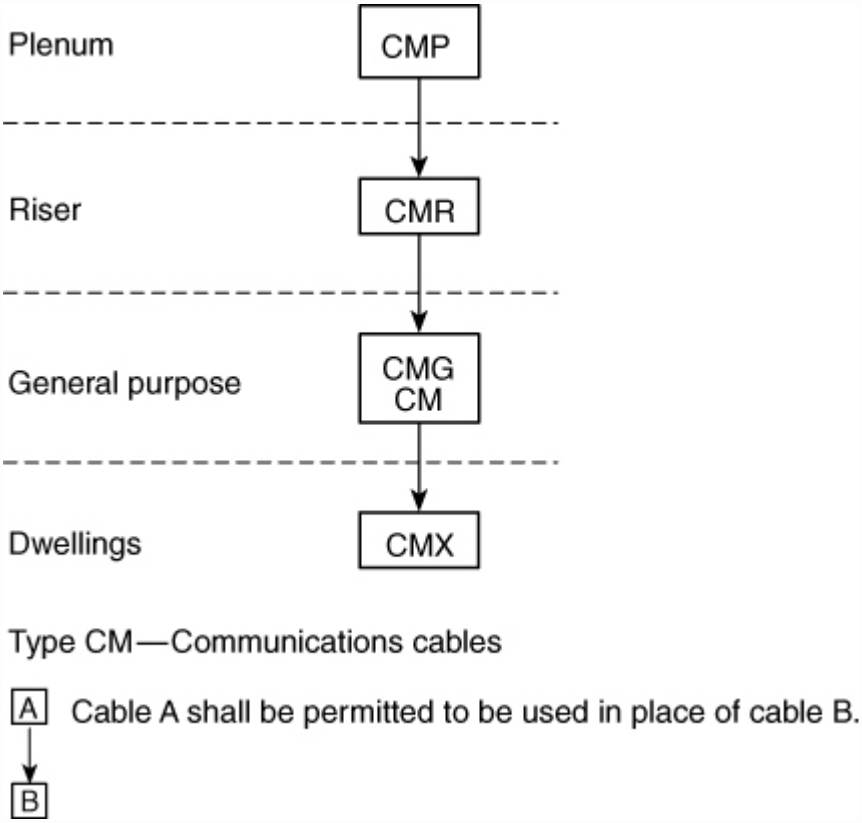
The substitutions for communications cables listed in Table 805.154 and illustrated in Figure 805.154 shall be permitted.

**Table 805.154 Cable Substitutions**

| Cable Type | Permitted Substitutions |
|---|---|
| CMR | CMP |

| Cable Type | Permitted Substitutions |
|---|---|
| CMG, CM | CMP, CMR |
| CMX | CMP, CMR, CMG, CM |

**Figure 805.154 Cable Substitution Hierarchy.**




### 805.156 Dwelling Unit Communications Outlet.

For new construction, a minimum of one communications outlet shall be installed within the dwelling in a readily accessible area and cabled to the service provider demarcation point.

## Part V. Listing Requirements

### 805.170 Equipment.

Communications equipment shall be listed as being suitable for electrical connection to a communications network.

Informational Note No. 1: One way to determine applicable requirements is to refer to ANSI/UL 60950-1-2014, *Standard for Safety of Information Technology Equipment*; ANSI/UL 1863-2012, *Standard for Safety Communications Circuit Accessories*; or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements*.

Informational Note No. 2: Additional information regarding voltages, currents, and power allowed on communications circuits can be found in ANSI/ATIS 0600337-2016, *Requirements for Maximum Voltage, Current, and Power Levels Used in Communications Transport Circuits*.

#### (A) Primary Protectors.

The primary protector shall consist of an arrester connected between each line conductor and ground in an appropriate mounting. Primary protector terminals shall be marked to indicate line and ground as applicable.

Informational Note: One way to determine applicable requirements for a listed primary protector is to refer to ANSI/UL 497-2013, *Standard for Protectors for Paired Conductor Communications Circuits*.

#### (B) Secondary Protectors.

The secondary protector shall be listed as suitable to provide means to safely limit currents to less than the current-carrying capacity of listed indoor communications wire and cable, listed telephone set line cords, and listed communications terminal equipment having ports for external wire line communications circuits. Any overvoltage protection, arresters, or grounding connection shall be connected on the equipment terminals side of the secondary protector current-limiting means.

Informational Note: One way to determine applicable requirements for a listed secondary protector is to refer to ANSI/UL 497A-2012, *Standard for Secondary Protectors for Communications Circuits*.

**(C) Plenum Grade Cable Ties.**

Cable ties intended for use in other space used for environmental air (plenums) shall be listed as having low smoke and heat release properties.

Informational Note: See NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, and ANSI/UL 2043-2013, *Standard for Safety Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces*, for information on listing discrete products as having low smoke and heat release properties.

### 805.173 Drop Wire and Cable.

Communications wires and cables without a metallic shield, running from the last outdoor support to the primary protector, shall be listed as being suitable for the purpose and shall have current-carrying capacity as specified in 805.90(A)(1)(b) or (A)(1)(c).

### 805.179 Communications Wires and Cables.

Communications wires and cables shall be listed in accordance with 805.179(A) through (F) and marked in accordance with Table 805.179 and 805.179(G). Conductors in communications cables, other than in a coaxial cable, shall be copper.

Communications wires and cables shall have a voltage rating of not less than 300 volts. The insulation for the individual conductors, other than the outer conductor of a coaxial cable, shall be rated for 300 volts minimum. The cable voltage rating shall not be marked on the cable or on the under-carpet communications wire.

*Exception: Voltage markings shall be permitted where the cable has multiple listings and 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 805.179 Cable Markings**

| Cable Marking | Type |
|---|---|
| CMP | Communications plenum cable |
| CMR | Communications riser cable |
| CMG | Communications general-purpose cable |
| CM | Communications general-purpose cable |
| CMX | Communications cable, limited use |
| CMUC | Under-carpet communications wire and cable |

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

**(A) General Requirements.**

The general requirements in 805.179 shall apply.

**(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 VW-1 (vertical-wire) flame test in ANSI/UL 1581-2017, *Reference Standard for Electrical Wires, Cables and Flexible Cords*.

### (C) Circuit Integrity (CI) Cable or Electrical Circuit Protective System.

Cables that are used for survivability of critical circuits under fire conditions shall be listed and meet either 805.179(C)(1) or 805.179(C)(2).

Informational Note: The listing organization provides information for circuit integrity (CI) cable and electrical circuit protective systems, including installation requirements required to maintain the fire rating.

### (1) Circuit Integrity (CI) Cables.

Circuit integrity (CI) cables specified in 805.179(A) through (D), and used for survivability of critical circuits, shall have an additional classification using the suffix "CI." In order to maintain its listed fire rating, circuit integrity (CI) cable shall only be installed in free air.

Informational Note: One method of defining circuit integrity (CI) cable is by establishing a minimum 2-hour fire resistance rating for the cable when tested in accordance with ANSI/UL 2196-2017, *Standard for Fire Test for Circuit Integrity of Fire-Resistant Power, Instrumentation, Control, and Data Cables*.

### (2) Fire-Resistive Cables.

Cables specified in 800.179(A) through (D) and 805.179(C)(1), that are part of an electrical circuit protective system, shall be fire-resistive cable identified with the protective system number on the product, or on the smallest unit container in which the product is packaged, and shall be installed in accordance with the listing of the protective system.

Informational Note No. 1: One method of defining an electrical circuit protective system is by establishing a minimum 2-hour fire resistance rating for the system when tested in accordance with UL Subject 1724, *Outline of Investigation for Fire Tests for Electrical Circuit Protective Systems*.

Informational Note No. 2: The listing organization provides information for electrical circuit protective systems (FHIT), including installation requirements for maintaining the fire rating.

### (D) Types CMP-LP, CMR-LP, CMG-LP, and CM-LP Limited Power (LP) Cables.

Types CMP-LP, CMR-LP, CMG-LP, and CM-LP communications limited power 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 XX designates the current limit in amperes per conductor.

Informational Note: An example of the marking on a communications cable with an LP rating is "CMP-LP (0.6A)(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 ampere.

### (E) Communications Wires.

Communications wires, such as distributing frame wire and jumper wire, shall 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 Flame Tray 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. 0.3-09, *Test Methods for Electrical Wires and Cables*.

### (F) Hybrid Power and Communications Cables.

Listed hybrid power and communications cables shall be permitted where the power cable is a listed Type NM or NM-B, conforming to Part III of Article 334, and the communications cable is a listed Type CM, the jackets on the listed NM or NM-B, and listed CM cables are rated for 600 volts minimum, and the hybrid cable is 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 Flame Tray 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. 0.3-09, *Test Methods for Electrical Wires and Cables*.

### (G) Optional Markings.

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.

## Article 810 Radio and Television Equipment

### Part I. General

#### 810.1 Scope.

This article covers antenna systems for radio and television receiving equipment, amateur and citizen band radio transmitting and receiving equipment, and certain features of transmitter safety. This article covers antennas such as wire-strung type, multi-element, vertical rod, flat, or parabolic and also covers the wiring and cabling that connect them to equipment. This article does not cover equipment and antennas used for coupling carrier current to power line conductors.

#### 810.2 Definitions.

The definitions in Part I of Article 100 shall apply.

#### 810.3 Other Articles.

Wiring from the source of power to and between devices connected to the interior wiring system shall comply with Chapters 1 through 4 other than as modified by Parts I and II of Article 640. Wiring for audio signal processing, amplification, and reproduction equipment shall comply with Article 640. Coaxial cables that connect antennas to equipment shall comply with Article 820.

#### 810.4 Community Television Antenna.

The antenna shall comply with this article. The distribution system shall comply with Article 820.

#### 810.5 Radio Noise Suppressors.

Radio interference eliminators, interference capacitors, or noise suppressors connected to power-supply leads shall be of a listed type. They shall not be exposed to physical damage.

#### 810.6 Antenna Lead-In Protectors.

Where an antenna lead-in surge protector is installed, it shall be listed as being suitable for limiting surges on the cable that connects the antenna to the receiver/transmitter electronics and shall be connected between the conductors and the grounded shield or other ground connection. The antenna lead-in protector shall be grounded using a bonding conductor or grounding electrode conductor installed in accordance with 810.21(F).

Informational Note: For requirements covering protectors for antenna lead-in conductors, refer to UL 497E, *Outline of Investigation for Protectors for Antenna Lead-In Conductors*.

#### 810.7 Grounding Devices.

Where bonding or grounding is required, devices used to connect a shield, a sheath, non–current-carrying metallic members of a cable, or metal parts of equipment or antennas to a bonding conductor or grounding electrode conductor shall be listed or be part of listed equipment.

### Part II. Receiving Equipment — Antenna Systems

#### 810.11 Material.

Antennas and lead-in conductors shall be of hard-drawn copper, bronze, aluminum alloy, copper-clad steel, or other high-strength, corrosion-resistant material.

*Exception: Soft-drawn or medium-drawn copper shall be permitted for lead-in conductors where the maximum span between points of support is less than 11 m (35 ft).*

#### 810.12 Supports.

Outdoor antennas and lead-in conductors shall be securely supported. The antennas or lead-in conductors shall not be attached to the electric service mast. They shall not be attached to poles or similar structures carrying open electric light or power wires or trolley wires of over 250 volts between conductors. Insulators supporting the antenna conductors shall have sufficient mechanical strength to safely support the conductors. Lead-in conductors shall be securely attached to the antennas.

### 810.13 Avoidance of Contacts with Conductors of Other Systems.

Outdoor antennas and lead-in conductors from an antenna to a building shall not cross over open conductors of electric light or power circuits and shall be kept well away from all such circuits so as to avoid the possibility of accidental contact. Where proximity to open electric light or power service conductors of less than 250 volts between conductors cannot be avoided, the installation shall be such as to provide a clearance of at least 600 mm (2 ft).

Where practicable, antenna conductors shall be installed so as not to cross under open electric light or power conductors.

### 810.14 Splices.

Splices and joints in antenna spans shall be made mechanically secure with approved splicing devices or by such other means as will not appreciably weaken the conductors.

### 810.15 Grounding.

Masts and metal structures supporting antennas shall be grounded in accordance with 810.21, unless the antenna and its related supporting mast or structure are within a zone of protection defined by a 46 m (150 ft) radius rolling sphere.

Informational Note: See 4.8.3.1 of NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, for the application of the term *rolling sphere*.

### 810.16 Size of Wire-Strung Antenna — Receiving Station.

#### (A) Size of Antenna Conductors.

Outdoor antenna conductors for receiving stations shall be of a size not less than given in Table 810.16(A).

**Table 810.16(A) Size of Receiving Station Outdoor Antenna Conductors**

| Material | Minimum Size of Conductors (AWG) Where Maximum Open Span Length Is | | |
|---|---|---|---|
| | Less Than 11 m (35 ft) | 11 m to 45 m (35 ft to 150 ft) | Over 45 m (150 ft) |
| Aluminum alloy, hard-drawn copper | 19 | 14 | 12 |
| Copper-clad steel, bronze, or other high-strength material | 20 | 17 | 14 |

#### (B) Self-Supporting Antennas.

Outdoor antennas, such as vertical rods and flat, parabolic, or dipole structures, shall be of corrosion-resistant materials and of strength suitable to withstand ice and wind loading conditions and shall be located well away from overhead conductors of electric light and power circuits of over 150 volts to ground, so as to avoid the possibility of the antenna or structure falling into or making accidental contact with such circuits.

### 810.17 Size of Lead-in — Receiving Station.

Lead-in conductors from outside antennas for receiving stations shall, for various maximum open span lengths, be of such size as to have a tensile strength at least as great as that of the conductors for antennas as specified in 810.16. Where the lead-in consists of two or more conductors that are twisted

together, are enclosed in the same covering, or are concentric, the conductor size shall, for various maximum open span lengths, be such that the tensile strength of the combination is at least as great as that of the conductors for antennas as specified in 810.16.

### 810.18 Clearances — Receiving Stations.

#### (A) Outside of Buildings.

Lead-in conductors attached to buildings shall be installed so that they cannot swing closer than 600 mm (2 ft) to the conductors of circuits of 250 volts or less between conductors, or 3.0 m (10 ft) to the conductors of circuits of over 250 volts between conductors, except that in the case of circuits not over 150 volts between conductors, where all conductors involved are supported so as to ensure permanent separation, the clearance shall be permitted to be reduced but shall not be less than 100 mm (4 in.). The clearance between lead-in conductors and any conductor forming a part of a lightning protection system shall not be less than 1.8 m (6 ft). Underground conductors shall be separated at least 300 mm (12 in.) from conductors of any light or power circuits or Class 1 circuits.

*Exception: Where the electric light or power conductors, Class 1 conductors, or lead-in conductors are installed in raceways or metal cable armor.*

Informational Note No. 1: See 250.60 for grounding associated with lightning protection components — strike termination devices. For further information, see NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, which contains detailed information on grounding, bonding, and spacing from lightning protection systems, and the calculation of specific separation distances using the sideflash equation in Section 4.6.

Informational Note No. 2: Metal raceways, enclosures, frames, and other non–current-carrying metal parts of electrical equipment installed on a building equipped with a lightning protection system may require bonding or spacing from the lightning protection conductors in accordance with NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*. Separation from lightning protection conductors is typically 1.8 m (6 ft) through air or 900 mm (3 ft) through dense materials such as concrete, brick, or wood.

#### (B) Antennas and Lead-ins — Indoors.

Indoor antennas and indoor lead-ins shall not be run nearer than 50 mm (2 in.) to conductors of other wiring systems in the premises.

*Exception No. 1: Where such other conductors are in metal raceways or cable armor.*

*Exception No. 2: Where permanently separated from such other conductors by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing.*

#### (C) In Boxes or Other Enclosures.

Indoor antennas and indoor lead-ins shall be permitted to occupy the same box or enclosure with conductors of other wiring systems where separated from such other conductors by an effective permanently installed barrier.

### 810.19 Electrical Supply Circuits Used in Lieu of Antenna — Receiving Stations.

Where an electrical supply circuit is used in lieu of an antenna, the device by which the radio receiving set is connected to the supply circuit shall be listed.

### 810.20 Antenna Discharge Units — Receiving Stations.

#### (A) Where Required.

Each conductor of a lead-in from an outdoor antenna shall be provided with a listed antenna discharge unit.

*Exception: Where the lead-in conductors are enclosed in a continuous metallic shield that either is grounded with a conductor in accordance with 810.21 or is protected by an antenna discharge unit.*

#### (B) Location.

Antenna discharge units shall be located outside the building or inside the building between the point of entrance of the lead-in and the radio set or transformers and as near as practicable to the entrance of the conductors to the building. The antenna discharge unit shall not be located near combustible material or in a hazardous (classified) location as defined in Article 500.

**(C) Grounding.**

The antenna discharge unit shall be grounded in accordance with 810.21.

**810.21 Bonding Conductors and Grounding Electrode Conductors — Receiving Stations.**

Bonding conductors and grounding electrode conductors shall comply with 810.21(A) through 810.21(K).

**(A) Material.**

The bonding conductor or grounding electrode conductor shall be of copper, aluminum, copper-clad steel, copper-clad aluminum, bronze, or similar corrosion-resistant material. Aluminum or copper-clad aluminum bonding conductors or grounding electrode conductors shall not be used where in direct contact with masonry or the earth or where subject to corrosive conditions. Where used outside, aluminum or copper-clad aluminum conductors shall not be installed within 450 mm (18 in.) of the earth.

**(B) Insulation.**

Insulation on bonding conductors or grounding electrode conductors shall not be required.

**(C) Supports.**

The bonding conductor or grounding electrode conductor shall be securely fastened in place and shall be permitted to be directly attached to the surface wired over without the use of insulating supports.

*Exception: Where proper support cannot be provided, the size of the bonding conductors or grounding electrode conductors shall be increased proportionately.*

**(D) Physical Protection.**

Bonding conductors and grounding electrode conductors shall be protected where exposed to physical damage. Where the bonding conductor or grounding electrode conductor is installed in a metal raceway, both ends of the raceway shall be bonded to the contained conductor or to the same terminal or electrode to which the bonding conductor or grounding electrode conductor is connected.

**(E) Run in Straight Line.**

The bonding conductor or grounding electrode conductor for an antenna mast or antenna discharge unit shall be run in as straight a line as practicable.

**(F) Electrode.**

The bonding conductor or grounding electrode conductor shall be connected as required in 810.21(F)(1) through 810.21(F)(3).

**(1) In Buildings or Structures with an Intersystem Bonding Termination.**

If the building or structure served has an intersystem bonding termination as required by 250.94, the bonding conductor shall be connected to the intersystem bonding termination.

**(2) In Buildings or Structures with Grounding Means.**

If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on the following:

1. The building or structure grounding electrode system as covered in 250.50
2. The grounded interior metal water piping systems, within 1.52 m (5 ft) from its point of entrance to the building, as covered in 250.52
3. The power service accessible means external to the building, as covered in 250.94
4. The nonflexible metal power service raceway
5. The service equipment enclosure, or
6. The grounding electrode conductor or the grounding electrode conductor metal enclosures of the power service

A bonding device intended to provide a termination point for the bonding conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on nonremovable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is nonremovable.

**(3) In Buildings or Structures Without an Intersystem Bonding Termination or Grounding Means.**

If the building or structure served has no intersystem bonding termination or grounding means as described in 810.21(F)(2), the grounding electrode conductor shall be connected to a grounding electrode as described in 250.52.

**(G) Inside or Outside Building.**

The bonding conductor or grounding electrode conductor shall be permitted to be run either inside or outside the building.

**(H) Size.**

The bonding conductor or grounding electrode conductor shall not be smaller than 10 AWG copper, 8 AWG aluminum, or 17 AWG copper-clad steel or bronze.

**(I) Common Ground.**

A single bonding conductor or grounding electrode conductor shall be permitted for both protective and operating purposes.

**(J) Bonding of Electrodes.**

A bonding jumper not smaller than 6 AWG copper or equivalent shall be connected between the radio and television equipment grounding electrode and the power grounding electrode system at the building or structure served where separate electrodes are used.

**(K) Electrode Connection.**

Connections to grounding electrodes shall comply with 250.70.

## Part III. Amateur and Citizen Band Transmitting and Receiving Stations — Antenna Systems

### 810.51 Other Sections.

In addition to complying with Part III, antenna systems for amateur and citizen band transmitting and receiving stations shall also comply with 810.11 through 810.15.

### 810.52 Size of Antenna.

Antenna conductors for transmitting and receiving stations shall be of a size not less than given in Table 810.52.

**Table 810.52 Size of Outdoor Antenna Conductors**

| Material | Minimum Size of Conductors (AWG) Where Maximum Open Span Length Is | |
|---|---|---|
| | Less Than 45 m (150 ft) | Over 45 m (150 ft) |
| Hard-drawn copper | 14 | 10 |
| Copper-clad steel, bronze, or other high-strength material | 14 | 12 |

### 810.53 Size of Lead-in Conductors.

Lead-in conductors for transmitting stations shall, for various maximum span lengths, be of a size at least as great as that of conductors for antennas as specified in 810.52.

### 810.54 Clearance on Building.

Antenna conductors for transmitting stations, attached to buildings, shall be firmly mounted at least 75 mm (3 in.) clear of the surface of the building on nonabsorbent insulating supports, such as treated pins or brackets equipped with insulators having not less than 75-mm (3-in.) creepage and airgap distances. Lead-in conductors attached to buildings shall also comply with these requirements.

*Exception: Where the lead-in conductors are enclosed in a continuous metallic shield that is grounded with a conductor in accordance with 810.58, they shall not be required to comply with these requirements. Where grounded, the metallic shield shall also be permitted to be used as a conductor.*

**810.55 Entrance to Building.**

Except where protected with a continuous metallic shield that is grounded with a conductor in accordance with 810.58, lead-in conductors for transmitting stations shall enter buildings by one of the following methods:

1. Through a rigid, noncombustible, nonabsorbent insulating tube or bushing
2. Through an opening provided for the purpose in which the entrance conductors are firmly secured so as to provide a clearance of at least 50 mm (2 in.)
3. Through a drilled window pane

**810.56 Protection Against Accidental Contact.**

Lead-in conductors to radio transmitters shall be located or installed so as to make accidental contact with them difficult.

**810.57 Antenna Discharge Units — Transmitting Stations.**

Each conductor of a lead-in for outdoor antennas shall be provided with an antenna discharge unit or other suitable means that drain static charges from the antenna system.

*Exception No. 1: Where the lead-in is protected by a continuous metallic shield that is grounded with a conductor in accordance with 810.58, an antenna discharge unit or other suitable means shall not be required.*

*Exception No. 2: Where the antenna is grounded with a conductor in accordance with 810.58, an antenna discharge unit or other suitable means shall not be required.*

**810.58 Bonding Conductors and Grounding Electrode Conductors — Amateur and Citizen Band Transmitting and Receiving Stations.**

Bonding conductors and grounding electrode conductors shall comply with 810.58(A) through 810.58(C).

**(A) Other Sections.**

All bonding conductors and grounding electrode conductors for amateur and citizen band transmitting and receiving stations shall comply with 810.21(A) through 810.21(C).

**(B) Size of Protective Bonding Conductor or Grounding Electrode Conductor.**

The protective bonding conductor or grounding electrode conductor for transmitting stations shall be as large as the lead-in but not smaller than 10 AWG copper, bronze, or copper-clad steel.

**(C) Size of Operating Bonding Conductor or Grounding Electrode Conductor.**

The operating bonding conductor or grounding electrode conductor for transmitting stations shall not be less than 14 AWG copper or its equivalent.

**Part IV. Interior Installation — Transmitting Stations**

**810.70 Clearance from Other Conductors.**

All conductors inside the building shall be separated at least 100 mm (4 in.) from the conductors of any electric light, power, or signaling circuit.

*Exception No. 1: As provided in Article 640.*

*Exception No. 2: Where separated from other conductors by raceway or some firmly fixed nonconductor, such as porcelain tubes or flexible tubing.*

### 810.71 General.

Transmitters shall comply with 810.71(A) through (C).

**(A) Enclosing.**

The transmitter shall be enclosed in a metal frame or grille or separated from the operating space by a barrier or other equivalent means, all metallic parts of which are effectively connected to a bonding conductor or grounding electrode conductor.

**(B) Grounding of Controls.**

All external metal handles and controls accessible to the operating personnel shall be effectively connected to an equipment grounding conductor if the transmitter is powered by the premises wiring system or grounded with a conductor in accordance with 810.21.

**(C) Interlocks on Doors.**

All access doors shall be provided with interlocks that disconnect all voltages of over 350 volts between conductors when any access door is opened.

## Article 820 Community Antenna Television and Radio Distribution Systems

### Part I. General

### 820.1 Scope.

This article covers coaxial cable distribution of radio frequency signals typically employed in community antenna television (CATV) systems.

### 820.2 Definitions.

The definitions in this section shall apply only within Articles 820 and 840.

### 820.3 Other Articles.

Circuits and equipment shall comply with 820.3(A)and (B).

**(A) General Requirements.**

The general requirements of Article 800 shall apply.

**(B) Alternate Wiring Methods.**

The wiring methods of Article 830 shall be permitted to substitute for the wiring methods of Article 820.

Informational Note: Use of Article 830 wiring methods will facilitate the upgrading of Article 820 installations to network-powered broadband applications.

### 820.15 Power Limitations.

Coaxial cable shall be permitted to deliver power to equipment that is directly associated with the radio frequency distribution system if the voltage is not over 60 volts and if the current is supplied by a transformer or other device that has power-limiting characteristics.

Power shall be blocked from premises devices on the network that are not intended to be powered via the coaxial cable.

### Part II. Coaxial Cables ~~Outside~~ on the service provider side of the Communication Service Point~~and Entering Buildings~~

### 820.44 Overhead (Aerial) Coaxial Cables.

Overhead (aerial) coaxial cables, prior to the point of grounding, as specified in 820.93, shall comply with 820.44(A) or 800.44.

**(A) On Poles and In-Span, Above Roofs, on Masts, or Between Buildings.**

Where coaxial cables are installed on poles and in-span, above roofs, on masts, or between buildings, they shall comply with 800.44.

**(B) On Buildings.**

Where attached to buildings, coaxial cables shall be securely fastened in such a manner that they will be separated from other conductors in accordance with 820.44(B)(1) and (B)(2).

**(1) Electric Light or Power.**

The coaxial cable shall have a separation of at least 100 mm (4 in.) from electric light, power, Class 1, or non-power-limited fire alarm circuit conductors not in raceway or cable, or shall be permanently separated from conductors of the other system by a continuous and firmly fixed nonconductor in addition to the insulation on the wires.

**(2) Other Communications Systems.**

Coaxial cable shall be installed so that there will be no unnecessary interference in the maintenance of the separate systems. In no case shall the conductors, cables, messenger strand, or equipment of one system cause abrasion to the conductors, cable, messenger strand, or equipment of any other system.

### 820.47 Underground Coaxial Cables Entering Buildings.

Underground coaxial cables entering buildings shall comply with 820.47(A) and 820.47(B).

**(A) Underground Systems with Electric Light, Power, Class 1, or Non–Power-Limited Fire Alarm Circuit Conductors.**

Underground coaxial cables in a duct, pedestal, handhole enclosure, or manhole that contains electric light, power, or Class 1 or non–power-limited fire alarm circuit conductors shall be in a section permanently separated from such conductors by means of a suitable barrier.

**(B) Direct-Buried Cables and Raceways.**

Direct-buried coaxial cable shall be separated at least 300 mm (12 in.) from conductors of any light or power, non–power-limited fire alarm circuit conductors, or Class 1 circuit.

*Exception No. 1: Separation shall not be required where electric service conductors or coaxial cables are installed in raceways or have metal cable armor.*

*Exception No. 2: Separation shall not be required where electric light or power branch-circuit or feeder conductors or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables; or the coaxial cables have metal cable armor or are installed in a raceway.*

### 820.48 Unlisted Cables Entering Buildings.

Unlisted outside plant coaxial cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated at a grounding block. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) to the point of emergence.

## Part III. Protection

### 820.93 Grounding of the Outer Conductive Shield of Coaxial Cables.

Coaxial cables entering buildings or attached to buildings shall comply with 820.93(A) or (B). Where the outer conductive shield of a coaxial cable is grounded, no other protective devices shall be required. For purposes of this section, grounding located at mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a grounding block location to achieve the shortest practicable bonding conductor or grounding electrode conductor helps limit potential differences between CATV and other metallic systems.

**(A) Entering Buildings.**

In installations where the coaxial cable enters the building, the outer conductive shield shall be grounded in accordance with 820.100. The grounding shall be as close as practicable to the point of entrance.

**(B) Terminating Outside of the Building.**

In installations where the coaxial cable is terminated outside of the building, the outer conductive shield shall be grounded in accordance with 820.100. The grounding shall be as close as practicable to the point of attachment or termination.

**(C) Location.**

Where installed, a listed primary protector shall be applied on each community antenna and radio distribution (CATV) cable external to the premises. The listed primary protector shall be located as close as practicable to the entrance point of the cable on either side or integral to the ground block.

**(D) Hazardous (Classified) Locations.**

Where a primary protector or equipment providing the primary protection function is used, it shall not be located in any hazardous (classified) location as defined in 500.5 and 505.5 or in the vicinity of easily ignitible material.

*Exception: As permitted in 501.150, 502.150, and 503.150.*

**Part IV. Grounding Methods**

**820.100 Cable Bonding and Grounding.**

The shield of the coaxial cable shall be bonded or grounded as specified in 820.100(A) and (B).

*Exception: For communications systems using coaxial cable completely contained within the building (i.e., they do not exit the building) or the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere and isolated from outside cable plant, the shield shall be permitted to be grounded by a connection to an equipment grounding conductor as described in 250.118. Connecting to an equipment grounding conductor through a grounded receptacle using a dedicated bonding jumper and a permanently connected listed device shall be permitted. Use of a cord and plug for the connection to an equipment grounding conductor shall not be permitted.*

Informational Note: See 4.8.3.1 of NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems,* for the application of the term *rolling sphere*.

**(A) General Requirements.**

The installation shall be in accordance with 800.100.

**(B) Shield Protection Devices.**

Grounding of a coaxial drop cable shield by means of a protective device that does not interrupt the grounding system within the premises shall be permitted.

**820.103 Equipment Grounding.**

Unpowered equipment and enclosures or equipment powered by the coaxial cable shall be considered grounded where connected to the metallic cable shield.

**Part V. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**820.133 Installation of Coaxial Cables and Equipment.**

Beyond the point of grounding, as defined in 820.93, the coaxial cable installation shall comply with 820.133(A) and (B).

**(A) Separation from Other Conductors.**

**(1) In Raceways, Cable Trays, Boxes, Enclosures, and Cable Routing Assemblies.**

1. *Other Circuits.* Coaxial cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with jacketed cables 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. Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770
4. Communications circuits in compliance with Parts I and IV of Article 805
5. Low-power network-powered broadband communications circuits in compliance with Parts I and V of Article 830

2. *Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm, and Medium-Power Network-Powered Broadband Communications Circuits.* Coaxial cable shall not be placed in any raceway, compartment, outlet box, junction box, or other enclosures with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits.

*Exception No. 1: Coaxial cable shall be permitted to be placed in any raceway, compartment, outlet box, junction box, or other enclosures with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits where 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 coaxial cables by a permanent barrier or listed divider.*

*Exception No. 2: Coaxial cable shall be permitted to be placed in outlet boxes, junction boxes, or similar fittings or compartments with power conductors where such conductors are introduced solely for power supply to the coaxial cable system distribution equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum 6 mm (¼ in.) separation from coaxial cables.*

**(2) Other Applications.**

Coaxial cable shall be separated 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.

*Exception No. 1: Separation shall not be required where either (1) all of the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits are in a raceway, or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC or Type UF cables, or (2) all of the coaxial cables are encased in a raceway.*

*Exception No. 2: Separation shall not be required where the coaxial cables are permanently separated from the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B) Support of Coaxial Cables.**

Raceways shall be used for their intended purpose. Coaxial cables shall not be strapped, taped, or attached by any means to the exterior of any conduit or raceway as a means of support.

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

**820.154 Substitutions of Listed CATV Cables.**

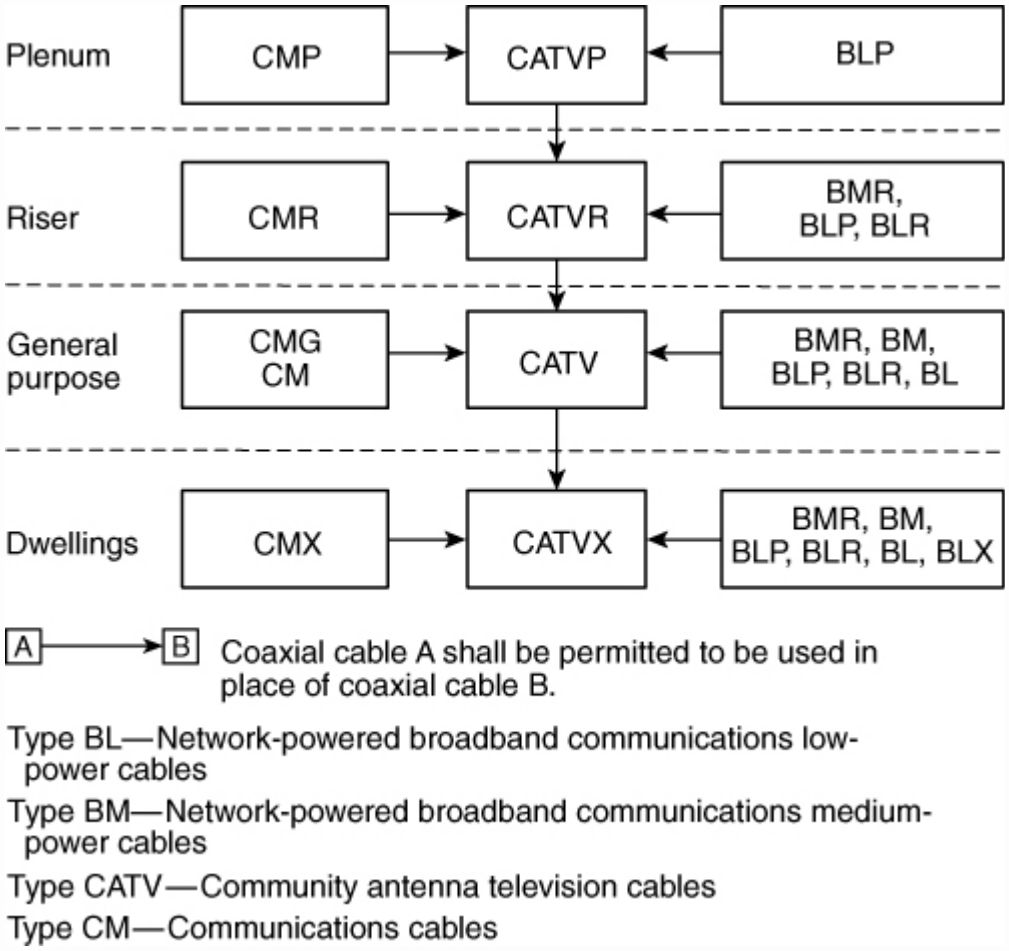
The substitutions for coaxial cables in Table 820.154 and illustrated in Figure 820.154 shall be permitted.

Informational Note: The substitute cables in Table 820.154 and Figure 820.154 are only coaxial-type cables.

**Table 820.154 Coaxial Cable Uses and Permitted Substitutions**

| Cable Type | Permitted Substitutions |
|---|---|
| CATVP | CMP, BLP |
| CATVR | CATVP, CMP, CMR, BMR, BLP, BLR |
| CATV | CATVP, CMP, CATVR, CMR, CMG, CM, BMR, BM, BLP, BLR, BL |
| CATVX | CATVP, CMP, CATVR, CMR, CATV, CMG, CM, BMR, BM, BLP, BLR, BL, BLX |

**Figure 820.154 Cable Substitution Hierarchy.**




## Part VI. Listing Requirements

### 820.179 Coaxial Cables.

Cables shall be listed in accordance with 820.179(A)and marked in accordance with Table 820.179 and 820.179(B). The cable voltage rating shall not be marked on the cable.

Informational Note: Voltage markings on cables could 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.*

**(A) General Requirements.**

The general requirements in 800.179 shall apply.

**(B) Optional Markings.**

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.

**Table 820.179 Coaxial Cable Markings**

| Cable Marking | Type |
|---|---|
| CATVP | CATV plenum cable |
| CATVR | CATV riser cable |
| CATV | CATV cable |
| CATVX | CATV cable, limited use |

# Article 830 Network-Powered Broadband Communications Systems

## Part I. General

### 830.1 Scope.

This article covers network-powered broadband communications systems that provide any combination of voice, audio, video, data, and interactive services through a network interface unit.

Informational Note: A typical basic system configuration includes a cable supplying power and broadband signal to a network interface unit that converts the broadband signal to the component signals. Typical cables are coaxial cable with both broadband signal and power on the center conductor, composite metallic cable with a coaxial member(s) or twisted pair members for the broadband signal and twisted pair members for power, and composite optical fiber cable with a pair of conductors for power. Larger systems may also include network components such as amplifiers that require network power.

### 830.2 Definitions.

The definitions in this section shall apply only within Article 830.

Informational Note: A typical single-family network-powered communications circuit consists of a communications drop or communications service cable and an NIU and includes the communications utility's serving terminal or tap where it is not under the exclusive control of the communications utility.

**Fault Protection Device.**

An electronic device that is intended for the protection of personnel and functions under fault conditions, such as network-powered broadband communications cable short or open circuit, to limit the current or voltage, or both, for a low-power network-powered broadband communications circuit and provide acceptable protection from electric shock.

**Network Interface Unit (NIU).**

A device that converts a broadband signal into component voice, audio, video, data, and interactive services signals and provides isolation between the network power and the premises signal circuits. These devices often contain primary and secondary protectors.

**Network-Powered Broadband Communications Circuit.**

The circuit extending from the communications utility's or service provider's serving terminal or tap up to and including the NIU.

Informational Note: A typical one-family dwelling network-powered communications circuit consists of a communications drop or communications service cable and an NIU and includes the communications utility's serving terminal or tap where it is not under the exclusive control of the communications utility.

### 830.3 Other Articles.

Circuits and equipment shall comply with 830.3(A) through (C).

**(A) General Requirements.**

The general requirements of Article 800 shall apply.

**(B) Output Circuits.**

As appropriate for the services provided, the output circuits derived from the network interface unit shall comply with the requirements of the following:

1. Installations of communications circuits — Part IV of Article 805
2. Installations of community antenna television and radio distribution circuits — Part V of Article 820

   *Exception: Where protection is provided in the output of the NIU 830.90(B)(3) shall apply.*
3. Installations of optical fiber cables — Part V of Article 770
4. Installations of Class 2 and Class 3 circuits — Part III of Article 725
5. Installations of power-limited fire alarm circuits — Part III of Article 760

**(C) Protection Against Physical Damage.**

The requirements of 300.4 shall apply.

**830.15 Power Limitations.**

Network-powered broadband communications systems shall be classified as having low- or medium-power sources as specified in 830.15(1) or (2).

1. Sources shall be classified as defined in Table 830.15.
2. Direct-current power sources exceeding 150 volts to ground, but no more than 200 volts to ground, with the current to ground limited to 10 mA dc, that meet the current and power limitation for medium-power sources in Table 830.15 shall be classified as medium-power sources.

Informational Note: One way to determine compliance with 830.15(2) is listed information technology equipment intended to supply power via a communications network that complies with the requirements for RFT-V circuits as defined in UL 60950-21-2007, *Standard for Safety for Information Technology Equipment — Safety — Part 21: Remote Power Feeding*.

**Table 830.15 Limitations for Network-Powered Broadband Communications Systems**

| Network Power Source | Low | Medium |
|---|---|---|
| Circuit voltage, $V_{max}$ (volts)[1] | 0–100 | 0–150 |
| Power limitation, $VA_{max}$ (volt-amperes)[1] | 250 | 250 |
| Current limitation, $I_{max}$ (amperes)[1] | $1000/V_{max}$ | $1000/V_{max}$ |
| Maximum power rating (volt-amperes) | 100 | 100 |
| Maximum voltage rating (volts) | 100 | 150 |
| Maximum overcurrent protection (amperes)[2] | $100/V_{max}$ | NA |

[1] $V_{max}$, $I_{max}$, and $VA_{max}$ are determined with the current-limiting impedance in the circuit (not bypassed) as follows:

$V_{max}$ — Maximum system voltage regardless of load with rated input applied.

$I_{max}$ — Maximum system current under any noncapacitive load, including short circuit, and with overcurrent protection bypassed if used. $I_{max}$ limits apply after 1 minute of operation.

$VA_{max}$ — Maximum volt-ampere output after 1 minute of operation regardless of load and overcurrent protection bypassed if used.

[2]Overcurrent protection is not required where the current-limiting device provides equivalent current limitation and the current-limiting device does not reset until power or the load is removed.

**830.24 Mechanical Execution of Work.**

The installation shall also conform to 300.4 and 300.11.

**Part II. Cables on the service provider side of the Communication Service Point~~Outside and Entering Buildings~~**

**830.40 Entrance Cables.**

Network-powered broadband communications cables located outside and entering buildings shall comply with 830.40(A) and (B).

**(A) Medium-Power Circuits.**

Medium-power network-powered broadband communications circuits located outside and entering buildings shall be installed using Type BMU, Type BM, or Type BMR network-powered broadband communications medium-power cables.

**(B) Low-Power Circuits.**

Low-power network-powered broadband communications circuits located outside and entering buildings shall be installed using Type BLU or Type BLX low-power network-powered broadband communications cables. Cables shown in Table 830.154 shall be permitted to substitute.

*Exception: Outdoor community antenna television and radio distribution system coaxial cables installed prior to January 1, 2000, and installed in accordance with Article 820, shall be permitted for low-power-type, network-powered broadband communications circuits.*

**830.44 Overhead (Aerial) Cables.**

Overhead (aerial) network-powered broadband communications cables shall comply with 830.44(A) through (F).

**(A) On Poles and In-Span or Above Roofs.**

Where network-powered broadband communications cables are installed on poles and in-span or above roofs, they shall comply with 800.44.

**(B) Clearance from Ground.**

Overhead (aerial) spans of network-powered broadband communications cables shall conform to not less than the following:

1. 2.9 m (9½ ft) — above finished grade, sidewalks, or from any platform or projection from which they might be reached and accessible to pedestrians only
2. 3.5 m (11½ ft) — over residential property and driveways, and those commercial areas not subject to truck traffic
3. 4.7 m (15½ ft) — over public streets, alleys, roads, parking areas subject to truck traffic, driveways on other than residential property, and other land traversed by vehicles such as cultivated, grazing, forest, and orchard

Informational Note: These clearances have been specifically chosen to correlate with ANSI/IEEE C2-2012, *National Electrical Safety Code*, Table 232-1, which provides for clearances of wires, conductors, and cables above ground and roadways, rather than using the clearances referenced in 225.18. Because Article 805 and Article 820 have had no required clearances, the communications industry has used the clearances from the NESC for their installed cable plant.

**(C) Over Pools.**

Clearance of network-powered broadband communications cable in any direction from the water level, edge of pool, base of diving platform, or anchored raft shall comply with those clearances in 680.9.

**(D) Final Spans.**

Final spans of network-powered broadband communications cables without an outer jacket shall be permitted to be attached to the building, but they shall be kept not less than 900 mm (3 ft) from windows that are designed to be opened, doors, porches, balconies, ladders, stairs, fire escapes, or similar locations.

*Exception: Conductors run above the top level of a window shall be permitted to be less than the 900-mm (3-ft) requirement above.*

Overhead (aerial) network-powered broadband communications cables shall not be installed beneath openings through which materials might be moved, such as openings in farm and commercial buildings, and shall not be installed where they obstruct entrance to these building openings.

**(E) Between Buildings.**

Network-powered broadband communications cables extending between buildings or structures, and also the supports or attachment fixtures, shall be identified as suitable for outdoor aerial applications and shall have sufficient strength to withstand the loads to which they may be subjected.

*Exception: Where a network-powered broadband communications cable does not have sufficient strength to be self-supporting, it shall be attached to a supporting messenger cable that, together with the attachment fixtures or supports, shall be acceptable for the purpose and shall have sufficient strength to withstand the loads to which they may be subjected.*

**(F) On Buildings.**

Where attached to buildings, network-powered broadband communications cables shall be securely fastened in such a manner that they are separated from other conductors in accordance with 830.44(F)(1) through (F)(3).

**(1) Electric Light or Power.**

The network-powered broadband communications cable shall have a separation of at least 100 mm (4 in.) from electric light, power, Class 1, or non-power-limited fire alarm circuit conductors not in raceway or cable, or be permanently separated from conductors of the other system by a continuous and firmly fixed nonconductor in addition to the insulation on the wires.

**(2) Other Communications Systems.**

Network-powered broadband communications cables shall be installed so that there will be no unnecessary interference in the maintenance of the separate systems. In no case shall the conductors, cables, messenger strand, or equipment of one system cause abrasion to the conductors, cables, messenger strand, or equipment of any other system.

**(3) Protection from Damage.**

Network-powered broadband communications cables attached to buildings or structures and located within 2.5 m (8 ft) of finished grade shall be protected by enclosures, raceways, or other approved means.

*Exception: A low-power network-powered broadband communications circuit that is equipped with a listed fault protection device, appropriate to the network-powered broadband communications cable used, and located on the network side of the network-powered broadband communications cable shall not be required to be additionally protected by enclosures, raceways, or other approved means.*

**830.47 Underground Network-Powered Broadband Communications Cables Entering Buildings.**

Underground network-powered broadband communications cables entering buildings shall comply with 830.47(A) through 830.47(D).

**(A) Underground Systems with Electric Light and Power, Class 1, or Non–Power-Limited Fire Alarm Circuit Conductors.**

Underground network-powered broadband communications cables in a duct, pedestal, handhole enclosure, or manhole that contains electric light, power conductors, non–power-limited fire alarm circuit

conductors, or Class 1 circuits shall be in a section permanently separated from such conductors by means of a suitable barrier.

**(B) Direct-Buried Cables and Raceways.**

Direct-buried network-powered broadband communications cables shall be separated by at least 300 mm (12 in.) from conductors of any light, power, non–power-limited fire alarm circuit conductors or Class 1 circuit.

*Exception No. 1: Separation shall not be required where electric service conductors or network-powered broadband communications cables are installed in raceways or have metal cable armor.*

*Exception No. 2: Separation shall not be required where electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables; or the network-powered broadband communications cables have metal cable armor or are installed in a raceway.*

**(C) Protection from Physical Damage.**

Direct-buried cable, conduit, or other raceways shall be installed to meet the minimum cover requirements of Table 830.47(C). In addition, direct-buried cables emerging from the ground shall be protected by enclosures, raceways, or other approved means extending from the minimum cover distance required by Table 830.47(C) below grade 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. Types BMU and BLU direct-buried cables emerging from the ground shall be installed in rigid metal conduit (RMC), intermediate metal conduit (IMC), rigid nonmetallic conduit, or other approved means extending from the minimum cover distance required by Table 830.47(C) below grade to the point of entrance.

*Exception: A low-power network-powered broadband communications circuit that is equipped with a listed fault protection device, appropriate to the network-powered broadband communications cable used, and located on the network side of the network-powered broadband communications cable being protected.*

**Table 830.47(C) Network-Powered Broadband Communications Systems Minimum Cover Requirements (*Cover* is the shortest distance measured between a point on the top surface of any direct-buried cable, conduit, or other raceway and the top surface of finished grade, concrete, or similar cover.)**

| Location of Wiring Method or Circuit | Direct Burial Cables | | Rigid Metal Conduit (RMC) or Intermediate Metal Conduit (IMC) | | Nonmetallic Raceways Listed for Direct Burial; Without Concrete Encasement or Other Approved Raceways | |
|---|---|---|---|---|---|---|
| | mm | in. | mm | in. | mm | in. |
| All locations not specified below | 450 | 18 | 150 | 6 | 300 | 12 |
| In trench below 50-mm (2-in.) thick concrete or equivalent | 300 | 12 | 150 | 6 | 150 | 6 |
| Under a building (in raceway only) | 0 | 0 | 0 | 0 | 0 | 0 |
| Under minimum of 100-mm (4-in.) thick concrete exterior slab with no vehicular traffic and the slab extending not less than 150 mm (6 in.) beyond the underground installation | 300 | 12 | 100 | 4 | 100 | 4 |

| Location of Wiring Method or Circuit | Direct Burial Cables | | Rigid Metal Conduit (RMC) or Intermediate Metal Conduit (IMC) | | Nonmetallic Raceways Listed for Direct Burial; Without Concrete Encasement or Other Approved Raceways | |
|---|---|---|---|---|---|---|
| | mm | in. | mm | in. | mm | in. |
| One- and two-family dwelling driveways and outdoor parking areas and used only for dwelling-related purposes | 300 | 12 | 300 | 12 | 300 | 12 |

Notes:

1. Raceways approved for burial only where concrete encased shall require a concrete envelope not less than 50 mm (2 in.) thick.

2. Lesser depths shall be permitted where cables rise for terminations or splices or where access is otherwise required.

3. Where solid rock is encountered, all wiring shall be installed in 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.

4. Low-power network-powered broadband communications circuits using directly buried community antenna television and radio distribution system coaxial cables that were installed outside and entering buildings prior to January 1, 2000, in accordance with Article 820 shall be permitted where buried to a minimum depth of 300 mm (12 in.).

**(D) Pools.**

Cables located under the pool or within the area extending 1.5 m (5 ft) horizontally from the inside wall of the pool shall meet those clearances and requirements specified in 680.11.

**Part III. Protection**

**830.90 Primary Electrical Protection.**

**(A) Application.**

Primary electrical protection shall be provided on all network-powered broadband communications conductors that are neither grounded nor interrupted and are run partly or entirely in aerial cable not confined within a block. Also, primary electrical protection shall be provided on all aerial or underground network-powered broadband communications conductors that are neither grounded nor interrupted and are located within the block containing the building served so as to be exposed to lightning or accidental contact with electric light or power conductors operating at over 300 volts to ground.

*Exception: Primary electrical protection shall not be required on the network-powered broadband communications conductors where electrical protection is provided on the derived circuit(s) (output side of the NIU) in accordance with 830.90(B)(3).*

Informational Note No. 1: On network-powered broadband communications conductors not exposed to lightning or accidental contact with power conductors, providing primary electrical protection in accordance with this article helps protect against other hazards, such as ground potential rise caused by power fault currents, and above-normal voltages induced by fault currents on power circuits in proximity to the network-powered broadband communications conductors.

Informational Note No. 2: Network-powered broadband communications circuits are considered to have a lightning exposure unless one or more of the following conditions exist:

1. Circuits in large metropolitan areas where buildings are close together and sufficiently high to intercept lightning.
2. Areas having an average of five or fewer thunderstorm days each year and earth resistivity of less than 100 ohm-meters. Such areas are found along the Pacific coast.

Informational Note No. 3: For information on lightning protection systems, see NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*.

**(1) Fuseless Primary Protectors.**

Fuseless-type primary protectors shall be permitted where power fault currents on all protected conductors in the cable are safely limited to a value no greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor.

**(2) Fused Primary Protectors.**

Where the requirements listed in 830.90(A)(1) are not met, fused-type primary protectors shall be used. Fused-type primary protectors shall consist of an arrester connected between each conductor to be protected and ground, a fuse in series with each conductor to be protected, and an appropriate mounting arrangement. Fused primary protector terminals shall be marked to indicate line, instrument, and ground, as applicable.

**(B) Location.**

The location of the primary protector, where required, shall comply with 830.90(B)(1), (B)(2), or (B)(3):

1. A listed primary protector shall be applied on each network-powered broadband communications cable external to and on the network side of the network interface unit.
2. The primary protector function shall be an integral part of and contained in the network interface unit. The network interface unit shall be listed as being suitable for application with network-powered broadband communications systems and shall have an external marking indicating that it contains primary electrical protection.
3. The primary protector(s) shall be provided on the derived circuit(s) (output side of the NIU), and the combination of the NIU and the protector(s) shall be listed as being suitable for application with network-powered broadband communications systems.

A primary protector, whether provided integrally or external to the network interface unit, shall be located as close as practicable to the point of entrance.

For purposes of this section, a network interface unit and any externally provided primary protectors located at mobile home service equipment located in sight from and not more than 9.0 m (30 ft) from the exterior wall of the mobile home it serves, or at a mobile home disconnecting means grounded in accordance with 250.32 and located in sight from and not more than 9.0 m (30 ft) from the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a network interface unit and primary protector location to achieve the shortest practicable primary protector bonding conductor or grounding electrode conductor helps limit potential differences between communications circuits and other metallic systems.

**(C) Hazardous (Classified) Locations.**

The primary protector or equipment providing the primary protection function shall not be located in any hazardous (classified) location as defined in 500.5 and 505.5 or in the vicinity of easily ignitible material.

*Exception: As permitted in 501.150, 502.150, and 503.150.*

**Part IV. Grounding Methods**

**830.93 Grounding or Interruption of Metallic Members of Network-Powered Broadband Communications Cables.**

Network-powered communications cables entering buildings or attaching to buildings shall comply with 830.93(A) or (B).

For purposes of this section, grounding located at mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a grounding location to achieve the shortest practicable bonding conductor or grounding electrode conductor helps limit potential differences between the network-powered broadband communications circuits and other metallic systems.

**(A) Entering Buildings.**

In installations where the network-powered communications cable enters the building, the shield shall be grounded in accordance with 800.100, and metallic members of the cable not used for communications or powering shall be grounded in accordance with 800.100 or interrupted by an insulating joint or equivalent device. The grounding or interruption shall be as close as practicable to the point of entrance.

**(B) Terminating Outside of the Building.**

In installations where the network-powered communications cable is terminated outside of the building, the shield shall be grounded in accordance with 800.100, and metallic members of the cable not used for communications or powering shall be grounded in accordance with 800.100 or interrupted by an insulating joint or equivalent device. The grounding or interruption shall be as close as practicable to the point of attachment of the NIU.

**Part V. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**830.133 Installation of Network-Powered Broadband Communications Cables and Equipment.**

Cable and equipment installations within buildings shall comply with 830.133(A) and (B), as applicable.

**(A) Separation of Conductors.**

**(1) In Raceways, Cable Trays, Boxes, Enclosures, and Cable Routing Assemblies.**

1. *Low- and Medium-Power Network-Powered Broadband Communications Circuit Cables.* Low- and medium-power network-powered broadband communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly.

2. *Low-Power Network-Powered Broadband Communications Circuit Cables with Other Circuits.* Low-power network-powered broadband communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with jacketed cables of any of the following circuits:

    1. Class 2 and Class 3 remote-control, signaling, and power-limited circuits in compliance with 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 IV of Article 805
    4. Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770
    5. Community antenna television and radio distribution systems in compliance with Parts I and V of Article 820

3. *Medium-Power Network-Powered Broadband Communications Circuit Cables with Optical Fiber Cables and Other Communications Cables*. Medium-power network-powered broadband communications cables shall not be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with conductors of any of the following circuits:

    1. Communications circuits in compliance with Parts I and IV of Article 805
    2. Conductive optical fiber cables in compliance with Parts I and V of Article 770
    3. Community antenna television and radio distribution systems in compliance with Parts I and V of Article 820

4. *Medium-Power Network-Powered Broadband Communications Circuit Cables with Other Circuits*. Medium-power network-powered broadband communications cables

shall not be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with conductors of any of the following circuits:

1. Class 2 and Class 3 remote-control, signaling, and power-limited circuits in compliance with Parts I and III of Article 725
2. Power-limited fire alarm systems in compliance with Parts I and III of Article 760

5. *Electric Light, Power, Class 1, Non–Powered Broadband Communications Circuit Cables.* Network-powered broadband communications cable shall not be placed in any raceway, cable tray, compartment, outlet box, junction box, or similar fittings with conductors of electric light, power, Class 1, or non–power-limited fire alarm circuit cables.

*Exception No. 1: Where all of the conductors of electric light, power, Class 1, non–power-limited fire alarm circuits are separated from all of the network-powered broadband communications cables by a permanent barrier or listed divider.*

*Exception No. 2: Power circuit conductors in outlet boxes, junction boxes, or similar fittings or compartments where such conductors are introduced solely for power supply to the network-powered broadband communications system distribution equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum 6 mm (¼ in.) separation from network-powered broadband communications cables.*

**(2) Other Applications.**

Network-powered broadband communications cable shall be separated at least 50 mm (2 in.) from conductors of any electric light, power, Class 1, and non–power-limited fire alarm circuits.

*Exception No. 1: Separation shall not be required where: (1) all of the conductors of electric light, power, Class 1, and non–power-limited fire alarm circuits are in a raceway, or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC, or Type UF cables, or (2) all of the network-powered broadband communications cables are encased in a raceway.*

*Exception No. 2: Separation shall not be required where the network-powered broadband communications cables are permanently separated from the conductors of electric light, power, Class 1, and non–power-limited fire alarm circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B) Support of Network-Powered Broadband Communications Cables.**

Raceways shall be used for their intended purpose. Network-powered broadband communications cables shall not be strapped, taped, or attached by any means to the exterior of any conduit or raceway as a means of support.

### 830.154 Substitutions of Network-Powered Broadband Communications System Cables.

The substitutions for network-powered broadband system cables listed in Table 830.154 shall be permitted.

**Table 830.154 Cable Substitutions**

| Cable Type | Permitted Cable Substitutions |
|---|---|
| BM | BMR |
| BLP | CMP, CL3P |
| BLR | CMP, CL3P, CMR, CL3R, BLP, BMR |
| BL | CMP, CMR, CM, CMG, CL3P, CL3R, CL3, BMR, BM, BLP, BLR |
| BLX | CMP, CMR, CM, CMG, CMX, CL3P, CL3R, CL3, CL3X, BMR, BM, BLP, BRP, BL |

### 830.160 Bends.

Bends in network broadband cable shall be made so as not to damage the cable.

## Part VI. Listing Requirements

### 830.179 Network-Powered Broadband Communications Equipment and Cables.

Network-powered broadband communications equipment and cables shall be listed and marked in accordance with 830.179(A) through (D).

*Exception No. 1: This listing requirement shall not apply to community antenna television and radio distribution system coaxial cables that were installed prior to January 1, 2000, in accordance with Article 820 and are used for low-power network-powered broadband communications circuits.*

*Exception No. 2: Substitute cables for network-powered broadband communications cables shall be permitted as shown in Table 830.154.*

**(A) General Requirements.**

The general requirements in 800.179 shall apply.

**(B) Network-Powered Broadband Communications Medium-Power Cables.**

Network-powered broadband communications medium-power cables shall be factory-assembled cables consisting of a jacketed coaxial cable, a jacketed combination of coaxial cable and multiple individual conductors, or a jacketed combination of an optical fiber cable and multiple individual conductors. The insulation for the individual conductors shall be rated for 300 volts minimum. Cables intended for outdoor use shall be listed as suitable for the application. Cables shall be marked in accordance with 310.8. Type BMU cables shall be jacketed and listed as being suitable for outdoor underground use.

**(C) Network-Powered Broadband Communication Low-Power Cables.**

Network-powered broadband communications low-power cables shall be factory-assembled cables consisting of a jacketed coaxial cable, a jacketed combination of coaxial cable and multiple individual conductors, or a jacketed combination of an optical fiber cable and multiple individual conductors. The insulation for the individual conductors shall be rated for 300 volts minimum. Cables intended for outdoor use shall be listed as suitable for the application. Cables shall be marked in accordance with 310.8. Type BLU cables shall be jacketed and listed as being suitable for outdoor underground use.

**(D) Optional Markings.**

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.

# Article 840 Premises-Powered Broadband Communications Systems

## Part I. General

### 840.1 Scope.

This article covers premises-powered broadband communications systems.

Informational Note: A typical basic system configuration consists of an optical fiber, twisted pair, or coaxial cable to the premises supplying a broadband signal to a network terminal that converts the broadband signal into component electrical signals, such as traditional telephone, video, high-speed Internet, and interactive services. Powering for the network terminal and network devices is typically accomplished through a premises power supply that might be built into the network terminal or provided as a separate unit. In order to provide communications in the event of a power interruption, a battery backup unit or an uninterruptible power supply (UPS) is typically part of the powering system.

### 840.2 Definitions.

The definitions in 805.2 and 820.2 shall apply. The definitions in this section shall apply only within Article 840.

**Broadband.**

Wide bandwidth data transmission that transports multiple signals, protocols, and traffic types over various media types.

**Network Terminal.**

A device that converts network-provided signals (optical, electrical, or wireless) into component signals, including voice, audio, video, data, wireless, optical, and interactive services, and is considered a network device on the premises that is connected to a communications service provider and is powered at the premises.

**Premises Communications Circuit.**

The circuit that extends voice, audio, video, data, interactive services, telegraph (except radio), and outside wiring for fire alarm and burglar alarm from the service provider's network terminal to the customer's communications equipment up to and including terminal equipment, such as a telephone, a fax machine, or an answering machine.

**Premises Community Antenna Television (CATV) Circuit.**

The circuit that extends community antenna television (CATV) systems for audio, video, data, and interactive services from the service provider's network terminal to the appropriate customer equipment.

**Premises-Powered.**

Using power provided locally from the premises.

### 840.3 Other Articles.

Circuits and equipment shall comply with 840.3(A) through (C).

**(A) General Requirements.**

The general requirements of Article 800 shall apply.

**(B) Output Circuits.**

As appropriate for the services provided, the output circuits derived from the network terminal shall comply with the requirements of the following:

1. Installations of communications circuits — Part IV of Article 805
2. Installations of premises (within buildings) community antenna television and radio distribution circuits — Part V of Article 820
3. Installations of optical fiber cables — Part V of Article 770
4. Installations of Class 2 and Class 3 circuits — Part III of Article 725

   Informational Note: See 725.121 for information on the classification of information technology equipment circuits.
5. Installations of power-limited fire alarm circuits — Part III of Article 760

**(C) Electrical Classification of Data Circuits and Cables.**

Sections 725.139(D)(1) and 805.133(A)(1)(b) shall apply to the electrical classification of Class 2 and Class 3 circuits in the same cable with communications circuits.

### 840.24 Mechanical Execution of Work.

The requirements of 770.24 and 800.24 shall apply.

### 840.25 Abandoned Cables.

The requirements of 770.25 and 800.25 shall apply.

### 840.26 Spread of Fire or Products of Combustion.

The requirements of 770.26 and 800.26 shall apply.

## Part II. Cables on the service provider side of the Communication Service Point ~~Outside and Entering Buildings~~

### 840.47 Underground Wires and Cables Entering Buildings.

Underground wires and cables entering buildings shall comply with 840.47(A) through (C).

**(A) Optical Fiber Cables.**

**(1) Class 1 or Non–Power-Limited Fire Alarm Circuits.**

Underground conductive optical fiber cables entering buildings with electric light, power, Class 1, or non–power-limited fire alarm circuit conductors in a raceway, handhole enclosure, or manhole shall be located in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier.

**(2) Direct-Buried Cables.**

Direct-buried conductive optical fiber cables shall be separated by at least 300 mm (12 in.) from conductors of any electric light, power, or non–power-limited fire alarm circuit conductors or Class 1 circuit.

*Exception No. 1: Separation shall not be required where the electric service conductors are installed in raceways or have metal cable armor.*

*Exception No. 2: Separation shall not be required where the electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables.*

**(3) Mechanical Protection.**

Direct-buried cable, conduit, or other raceway shall be installed to have a minimum cover of 150 mm (6 in.).

**(B) Communications Wires and Cables.**

Installations of communications wires and multipair communications cables shall comply with 805.47.

**(C) Coaxial Cables.**

Installations of coaxial cables shall comply with 820.47.

### 840.48 Unlisted Wires and Cables Entering Buildings.

Installations of unlisted cables entering buildings shall comply with 840.48(A), (B), or (C), as applicable.

**(A) Optical Fiber Cables.**

Installations of unlisted optical fiber cables entering buildings shall comply with 770.48.

**(B) Communications Wires and Cables.**

Installations of unlisted communications wires and unlisted multipair communications cables entering buildings shall comply with 805.48.

**(C) Coaxial Cables.**

Installations of unlisted coaxial cables entering buildings shall comply with 820.48.

## Part III. Protection

### 840.90 Protective Devices.

The requirements of 805.90 shall apply.

### 840.93 Grounding or Interruption.

Non–current-carrying metallic members of optical fiber cables, communications cables, or coaxial cables entering buildings or attaching to buildings shall comply with 840.93(A), (B), or (C), respectively.

### (A) Non–Current-Carrying Metallic Members of Optical Fiber Cables.

Non–current-carrying metallic members of optical fiber cables entering a building or terminating on the outside of a building shall comply with 770.93(A) or (B).

### (B) Communications Cables.

The grounding or interruption of the metallic sheath of communications cable shall comply with 805.93.

### (C) Coaxial Cables.

Where the network terminal is installed inside or outside of the building, with coaxial cables terminating at the network terminal, and is either entering, exiting, or attached to the outside of the building, 820.93 shall apply.

## 840.94 Premises Circuits Leaving the Building.

Where circuits leave the building to power equipment remote to the building or outside the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere, 805.90 and 805.93 shall apply.

Informational Note: See NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, for the theory of the term *rolling sphere*.

## Part IV. Grounding Methods

## 840.101 Premises Circuits Not Leaving the Building.

Where the network terminal is served by a nonconductive optical fiber cable, or where any non–current-carrying metallic member of a conductive optical fiber cable is interrupted by an insulating joint or equivalent device, and circuits that terminate at the network terminal are completely contained within the building (i.e., they do not exit the building), 840.101(A), (B), or (C) shall apply, as applicable.

### (A) Coaxial Cable Shield Grounding.

The shield of coaxial cable shall be grounded by one of the following:

1. Any of the methods described in 820.100 or 800.106
2. A fixed connection to an equipment grounding conductor as described in 250.118
3. Connection to the network terminal grounding terminal provided that the terminal is connected to ground by one of the methods described in 820.100 or 800.106, or to an equipment grounding conductor through a listed grounding device that will retain the ground connection if the network terminal is unplugged

### (B) Communications Circuit Grounding.

Communications circuits shall not be required to be grounded.

### (C) Network Terminal Grounding.

The network terminal shall not be required to be grounded unless required by its listing. If the coaxial cable shield is separately grounded as described in 840.101(A)(1) or 840.101(A)(2), the use of a cord and plug for the connection to the network terminal grounding connection shall be permitted.

Informational Note: Where required to be grounded, a listed device that extends the equipment grounding conductor from the receptacle to the network terminal equipment grounding terminal is permitted. Sizing of the extended equipment grounding conductor is covered in Table 250.122.

## 840.102 Premises Circuits Leaving the Building.

Where circuits leave the building to power equipment remote to the building or outside the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere, the installation of communications wires and cables shall comply with 800.100 and 800.106, and the installation of coaxial cables shall comply with 820.100 and 800.106.

Informational Note: See NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, for the application of the term *rolling sphere*.

## Part V. Wiring on the service provider side of the Communication Service Point ~~Installation Methods Within Buildings~~

### 840.133 Installation of Optical Fibers and Electrical Conductors.

The requirements of 770.133 shall apply.

## Part VI. Premises Powering of Communications Equipment over Communications Cables

### 840.160 Powering Circuits.

Communications cables listed in accordance with 805.179, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment listed in accordance with 805.170. The power source shall be listed in accordance with 840.170(G). Installation of the listed 4-pair communications cables for a communications circuit or installation where 4-pair communications cables are substituted for Class 2 and Class 3 cables in accordance with 725.154(A) shall comply with 725.144.

*Exception: Installing communications cables in compliance with 725.144 shall not be required for listed 4-pair communications cables where the rated current of the power source does not exceed 0.3 amperes in any conductor 24 AWG or larger.*

Informational Note: A typical communications cable for this application is a 4-pair cable sometimes referred to as Category 5e (or higher) LAN cable or balanced twisted pair cable. These types of cables are often used to provide Ethernet- and Power over Ethernet (PoE)–type services. A large number of such powering cables bundled together can cause overheating of the wiring if not controlled as described in Table 725.144.

## Part VII. Listing Requirements

### 840.170 Equipment and Cables.

Premises-powered broadband communications systems equipment and cables shall comply with 840.170(A) through (H).

#### (A) Network Terminal.

The network terminal and applicable grounding means shall be listed for application with premises-powered broadband communications systems.

Informational Note No. 1: One way to determine applicable requirements is to refer to ANSI/UL 60950-1-2014, *Standard for Safety of Information Technology Equipment*; ANSI/UL 498A-2015, *Current Taps and Adapters*; ANSI/UL 467-2013, *Grounding and Bonding Equipment;* or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements*.

Informational Note No. 2: There are no requirements on the network terminal and its grounding methodologies except for those covered by the listing of the product.

#### (B) Optical Fiber Cables.

Optical fiber cables shall be listed in accordance with 770.179(A) through (D) and shall be marked in accordance with Table 770.179.

#### (C) Communications Equipment.

Communications equipment shall be listed in accordance with 805.170.

#### (D) Cable Routing Assemblies and Communications Raceways.

Cable routing assemblies and communications raceways shall be listed in accordance with 800.182.

#### (E) Premises Communications Wires and Cables.

Communications wires and cable shall be listed and marked in accordance with 805.179.

#### (F) Premises Community Antenna Television (CATV) Circuits.

Premises community antenna television (CATV) coaxial cables connecting to the network terminal shall be listed in accordance with 820.179. Applicable grounding means shall be listed for application with premises-powered broadband communications systems.

#### (G) Power Source.

The power source for circuits intended to provide power over communications cables to remote equipment shall be limited in accordance with Table 11(B) in Chapter 9 for voltage sources up to 60 V dc and be listed as specified in either of the following:

1. A power source shall be listed as specified in 725.121(A)(1), (A)(2), (A)(3), or (A)(4). The power sources shall not have the output connections paralleled or otherwise interconnected unless listed for such interconnection.
2. A power source shall be listed as communications equipment for limited-power circuits.

Informational Note: One way to determine applicable requirements is to refer to ANSI/UL 60950-1-2014, *Standard for Safety of Information Technology Equipment-Safety — Part 1*; or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements*. Typically, such circuits are used to interconnect equipment for the purpose of exchanging information (data).

**(H) Accessory Equipment.**

Communications accessory equipment and/or assemblies shall be listed for application with premises-powered communications systems.

Informational Note: One way to determine applicable requirements is to refer to ANSI/UL 1863-2004, *Communications-Circuit Accessories*.

# Public Input No. 3230-NFPA 70-2020 [ Part II. ]

**Part II.** Cables ~~Outside and Entering Buildings~~ on the Communication Utility or Service Provider Side of the Communicaiton Service Point

## Additional Proposed Changes

| File Name | Description | Approved |
|---|---|---|
| Chapter_8_-_2020-09-03_CC_Task_Group.pdf | | |

## Statement of Problem and Substantiation for Public Input

This public input is being submitted by a Correlating Committee Task Group to improve the correlation between Chapter 7 and 8. At the present time there are significant correlation issues with regards to what constitutes an installation in Chapter 7 and what constitutes an installation in Chapter 8.

Previously a Correlating Committee Task Group was formed to review Chapter 8 and to make suggested modifications. This Chapter 8 task group has submitted a public input to define Communication Service point and has submitted a public input to determine where the actual service point exists within communication systems. It is very difficult for an AHJ to determine where there inspection authority begins and this work will help provide clarity and usability.

This public input follows up on the work of that specific task group and provides editorial revisions to further improve on that work. Public inputs are being submitted to change Titles and certain wording to reflect what wiring is on the customer side of the Communication Service Point and what wiring is on the communication utility or service provider side of this point.

The Correlating Committee Task Group is a long range planning committee that is seeking to make improvement over the next two to three cycles. The Task Group is made up of the following members: Alan Manche, Donny Cook, Randy Ivans, Ernie Gallo, and Thomas Domitrovich.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 3223-NFPA 70-2020 [Sections Part IV., 805.133] | |
| Public Input No. 3224-NFPA 70-2020 [Sections 800.27, Part II., 800.44] | |
| Public Input No. 3225-NFPA 70-2020 [Part IV.] | |
| Public Input No. 3226-NFPA 70-2020 [Section No. 800.154] | |
| Public Input No. 3227-NFPA 70-2020 [Part II.] | |
| Public Input No. 3229-NFPA 70-2020 [Part V.] | |
| Public Input No. 3231-NFPA 70-2020 [Sections Part V., 830.133] | |
| Public Input No. 3232-NFPA 70-2020 [Sections Part II., 840.47, 840.48, Part III.] | |
| Public Input No. 3233-NFPA 70-2020 [Part V.] | |
| Public Input No. 3223-NFPA 70-2020 [Sections Part IV., 805.133] | |
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| Public Input No. 3226-NFPA 70-2020 [Section No. 800.154] | |
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**Committee:** NEC-P16

## Chapter 8 Communications Systems

# Article 800 General Requirements for Communications Systems

### Part I. General

#### 800.1 Scope.

This article covers general requirements for communications systems. These general requirements apply to communications circuits, community antenna television and radio distribution systems, network-powered broadband communications systems, and premises-powered broadband communications systems, unless modified by Articles 805, 820, 830, or 840.

Informational Note No. 1: See 90.2(B)(4) for installations of circuits and equipment that are not covered.

Informational Note No. 2: For further information for remote control, signaling, and power-limited circuits, see Article 725.

Informational Note No. 3: For further information for fire alarm systems, see Article 760.

#### 800.2 Definitions.

The definitions in Part I of Article 100 shall apply throughout Chapter 8. The definitions in 800.2 shall apply only within Chapter 8.

**Abandoned Cable.**

Cable that is not terminated at equipment or is not identified for future use with a tag.

**Block.**

A square or portion of a city, town, or village enclosed by streets and including the alleys so enclosed, but not any street.

**Cable Sheath.**

A covering over the conductor assembly that may include one or more metallic members, strength members, or jackets.

**Communications Circuit.**

The circuit that extends service from the communications utility or service provider up to and including the customer's communications equipment.

**Communications Service Provider.**

An organization, business, or individual that offers communications service to others.

**Exposed (to Accidental Contact).**

A circuit in such a position that, in case of failure of supports or insulation, contact with another circuit may result.

Informational Note: See Part I of Article 100 for two other definitions of Exposed: *Exposed (as applied to live parts)* and *Exposed (as applied to wiring methods)*.

**Point of Entrance.**

The point within a building at which the wire or cable emerges from an external wall or from a concrete floor slab.

**Premises.**

The land and buildings of a user located on the user side of the utility-user ~~network point of demarcation~~.

#### 800.3 Other Articles.

Only those sections of Chapters 1 through 7 referenced in Chapter 8 shall apply to Chapter 8.

**(A) Hazardous (Classified) Locations.**

Circuits and equipment installed in a location that is classified in accordance with 500.5 and 505.5 shall comply with the applicable requirements of Chapter 5.

**(B) Wiring in Ducts for Dust, Loose Stock, or Vapor Removal.**

The requirements of 300.22(A) shall apply.

**(C) Equipment in Other Space Used for Environmental Air.**

The requirements of 300.22(C)(3) shall apply.

**(D) Installation and Use.**

The requirements of 110.3(B) shall apply.

**(E) Optical Fiber Cable.**

Where optical fiber cable is used to provide a communications circuit within a building, Article 770 shall apply.

**(F) Other Communications Systems.**

As appropriate for the system involved, communications systems shall also comply with the requirements of the following:

1. Communications circuits — Article 805
2. Radio and television equipment — Article 810
3. Community antenna television and radio distribution systems — Article 820
4. Network-powered broadband communications systems — Article 830
5. Premises-powered broadband communications systems — Article 840

**(G) Reconditioned Equipment.**

The requirements of 110.21(A)(2) shall apply.

### 800.21 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.

### 800.24 Mechanical Execution of Work.

Circuits and equipment 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 also conform to 300.4 and 300.11. 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 805.170(C).

Informational Note No. 1: Accepted industry practices are described in ANSI/TIA-568.1- D-2015, *Commercial Building Telecommunications Infrastructure Standard;* ANSI/TIA-569-D-2015, *Telecommunications Pathways and Spaces;* ANSI/TIA-570-C-2012, *Residential Telecommunications Infrastructure Standard;* ANSI/TIA-1005-A-2012, *Telecommunications Infrastructure Standard for Industrial Premises;* ANSI/ TIA-1179-2010, *Healthcare Facility Telecommunications Infrastructure Standard;* ANSI/TIA-4966-2014, *Telecommunications Infrastructure Standard for Educational Facilities;* and other ANSI-approved installation standards.

Informational Note No. 2: 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. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of wire and cable properties.

### 800.25 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.

### 800.26 Spread of Fire or Products of Combustion.

Installations of cables, communications raceways, cable routing assemblies 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 penetrations of cables, communications raceways, and cable routing assemblies 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 800.26 can be found in building codes, fire resistance directories, and product listings.

### 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.

## Part II. Wires and Cables Outside and on the service provider side of the Communication Service Point ~~Entering Buildings~~

### 800.44 Overhead (Aerial) Wires and Cables.

Overhead (aerial) wires and cables on the service provider side of the Communication Service Point ~~entering buildings~~ shall comply with 800.44(A) through (D).

Informational Note: For additional information regarding overhead (aerial) wires and cables, see ANSI C2-2017, *National Electrical Safety Code, Part 2 Safety Rules for Overhead Lines.*

#### (A) On Poles and In-Span.

Where wires and cables and electric light or power conductors are supported by the same pole or are run parallel to each other in-span, the conditions described in 800.44(A)(1) through (A)(4) shall be met.

#### (1) Relative Location.

Where practicable, the wires and cables shall be located below the electric light or power conductors.

#### (2) Attachment to Cross-Arms.

Wires and cables shall not be attached to a cross-arm that carries electric light or power conductors.

#### (3) Climbing Space.

The climbing space through wires and cables shall comply with the requirements of 225.14(D).

#### (4) Clearance.

Supply service drops and sets of overhead service conductors of 0 volts to 750 volts running above and parallel to communications and CATV type coaxial service drops shall have a minimum separation of 300 mm (12 in.) at any point in the span, including the point of and at their attachment to the building, provided that the ungrounded conductors are insulated and that a clearance of not less than 1.0 m (40 in.) is maintained between the two services at the pole.

#### (B) Above Roofs.

Communications wires and cables and CATV type coaxial cables shall have a vertical clearance of not less than 2.5 m (8 ft) from all points of roofs above which they pass.

*Exception No. 1: Communications wires and cables and CATV type coaxial cables shall not be required to have a vertical clearance of not less than 2.5 m (8 ft) above auxiliary buildings, such as garages and the like.*

*Exception No. 2: A reduction in clearance above only the overhanging portion of the roof to not less than 450 mm (18 in.) shall be permitted if (1) not more than 1.2 m (4 ft) of communications service-drop conductors pass above the roof overhang and (2) they are terminated at a through- or above-the-roof raceway or approved support.*

*Exception No. 3: Where the roof has a slope of not less than 100 mm in 300 mm (4 in. in 12 in.), a reduction in clearance to not less than 900 mm (3 ft) shall be permitted.*

Informational Note: For additional information regarding overhead (aerial) wires and cables, see ANSI/IEEE C2-2017, *National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines*.

**(C) On Masts.**

Overhead (aerial) communications and CATV type coaxial cables shall be permitted to be attached to an above-the-roof raceway mast that does not enclose or support conductors of electric light or power circuits.

**(D) Between Buildings.**

Communications and CATV type coaxial cables extending between buildings or structures, and also the supports or attachment fixtures, shall be identified and shall have sufficient strength to withstand the loads to which they might be subjected.

*Exception: Where a coaxial cable does not have sufficient strength to be self-supporting, it shall be attached to a supporting messenger cable that, together with the attachment fixtures or supports, shall be acceptable for the purpose and shall have sufficient strength to withstand the loads to which they may be subjected.*

**800.48 Communication Service Point.** The Communication Service Point shall be at a readily accessible location either outside or inside of a building or structure near to the point of entrance of the conductors in accordance with the one or more of the following:

1. The point of connection at which the communication service provider's network (outside plant) transitions to the premises wiring. The location of this point shall not be located further than 50 feet from the point of entrance.

2. The point of connection in an individual dwelling shall be located so as not to exceed 24 inches from the primary protector on the premises side of the protector.

3. A physical protection point or communications cable exiting the connection enclosure on the individual building side of the enclosure.

4. The point of connection at the Grounding Block, where required.

5. The point where a wireless signal transitions from the antenna or dish through a wired connection to transmitting or receiving equipment. The location of this point shall be permitted to include the ground connection at the antenna discharge unit or coaxial cable connection to the transmitting/receiving station (see 810.21).

6. The point of connection between nonconductive optical fiber cable entering the building and premises optical fiber cable inside the building not to exceed 50 feet from the point of entrance.

7. The Communication Service Point shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC), Electrical metallic tubing (EMT), intermediate metal conduit (IMC), or Rigid polyvinyl chloride conduit (PVC) to the point of emergence (see 770.48, 805.48, 820.48 and 830.48).

Informational Note: The transition and connection points listed above may be co-located. For example, a primary protector may be located inside a network interface unit (item 3) with a connection to an adjacent grounding block (Item 4) within 24 inches, and a connection to the premise wiring (item 2).

### 800.49 Metal Entrance Conduit Grounding.

Metal conduit containing entrance wire or cable shall be connected by a bonding conductor or grounding electrode conductor to a grounding electrode or, where present, the building grounding electrode system in accordance with 800.100(B).

### 800.53 Separation from Lightning Conductors.

Where practicable, a separation of at least 1.8 m (6 ft) shall be maintained between lightning conductors and all communication wires and cables and CATV type coaxial cables on buildings.

Informational Note No. 1: For additional information regarding overhead (aerial) wires and cables, see ANSI C2-2017 *National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines*.

Informational Note No. 2: Specific separation distances may be calculated from the sideflash equation in NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems.*

## Part III. Grounding Methods

### 800.100 Cable and Primary Protector Bonding and Grounding.

#### (A) Bonding Conductor or Grounding Electrode Conductor.

#### (1) Insulation.

The bonding conductor or grounding electrode conductor shall be listed and shall be permitted to be insulated, covered, or bare.

#### (2) Material.

The bonding conductor or grounding electrode conductor shall be copper or other corrosion-resistant conductive material, stranded or solid.

#### (3) Size.

The bonding conductor or grounding electrode conductor shall not be smaller than 14 AWG. The bonding conductor or grounding electrode conductor shall have a current-carrying capacity not less than the grounded metallic cable sheath member of the communications cable, the protected conductor of the communications cable, or the outer sheath of the coaxial cable, as applicable. The bonding conductor or grounding electrode conductor shall not be required to exceed 6 AWG.

#### (4) Length.

The bonding conductor or grounding electrode conductor shall be as short as practicable. In one- and two-family dwellings, the bonding conductor or grounding electrode conductor shall be as short as practicable, not to exceed 6.0 m (20 ft) in length.

Informational Note: Similar bonding conductor or grounding electrode conductor length limitations applied at apartment buildings and commercial buildings help to reduce voltages that may be developed between the building's power and communications systems during lightning events.

*Exception: In one- and two-family dwellings where it is not practicable to achieve an overall maximum bonding conductor or grounding electrode conductor length of 6.0 m (20 ft), a separate ground rod meeting the minimum dimensional criteria of 800.100(B)(3)(2) or (B)(3)(3) shall be driven, the bonding conductor or grounding electrode conductor shall be connected to the ground rod in accordance with 800.100(C), and the ground rod shall be connected to the power grounding electrode system in accordance with 800.100(D).*

#### (5) Run in Straight Line.

The bonding conductor or grounding electrode conductor shall be run in as straight a line as practicable.

#### (6) Physical Protection.

Bonding conductors and grounding electrode conductors shall be protected where exposed to physical damage. Where the bonding conductor or grounding electrode conductor is installed in a metal raceway, both ends of the raceway shall be bonded to the contained conductor or to the same terminal or electrode to which the bonding conductor or grounding electrode conductor is connected.

**(B) Electrode.**

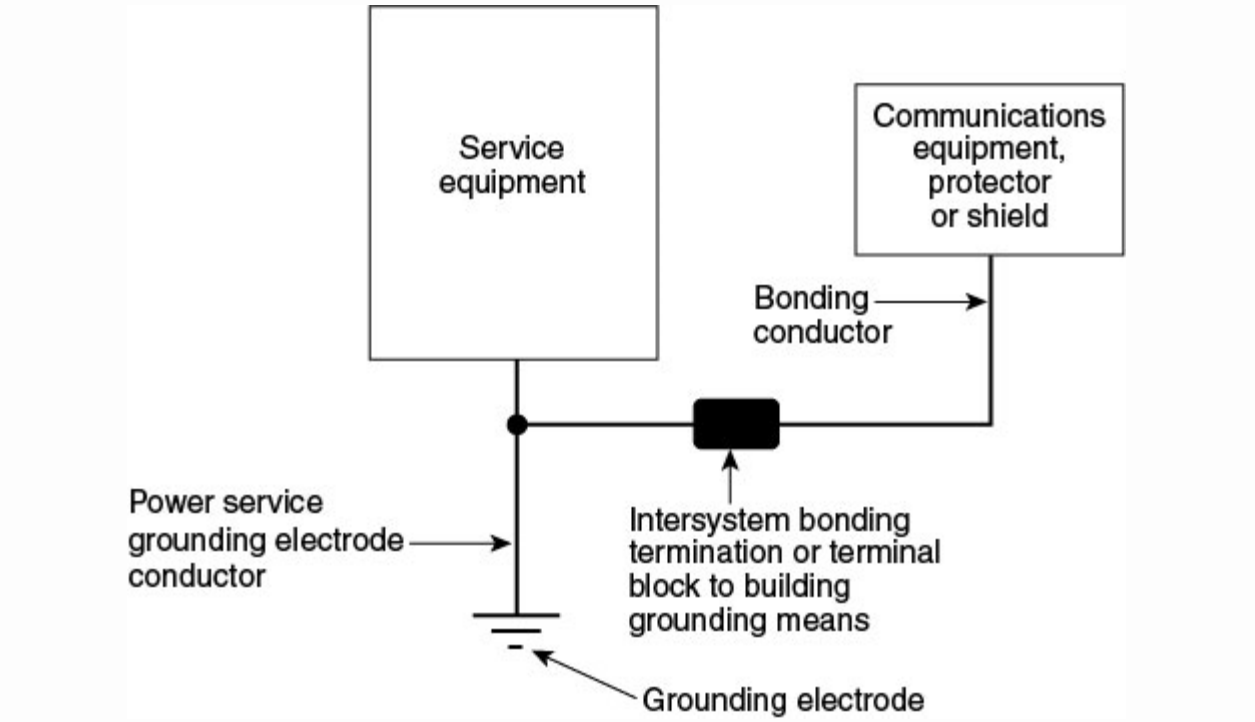
The bonding conductor or grounding electrode conductor shall be connected in accordance with 800.100(B)(1), (B)(2) , or (B)(3).

**(1) In Buildings or Structures with an Intersystem Bonding Termination.**

If the building or structure served has an intersystem bonding termination as required by 250.94, the bonding conductor shall be connected to the intersystem bonding termination.

Informational Note: Informational Note Figure 800.100(B)(1) illustrates the connection of the bonding conductor in buildings or structures equipped with an intersystem bonding termination or a terminal block providing access to the building grounding means.

**Figure Informational Note Figure 800.100(B)(1) Illustration of a Bonding Conductor in a Communications Installation.**




**(2) In Buildings or Structures with Grounding Means.**

If an intersystem bonding termination is established, 250.94(A) shall apply. If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on one of the following:

1. The building or structure grounding electrode system as covered in 250.50
2. The grounded interior metal water piping system, within 1.5 m (5 ft) from its point of entrance to the building, as covered in 250.52
3. The power service accessible means external to enclosures using the options identified in 250.94(A), Exception
4. The nonflexible metal power service raceway
5. The service equipment enclosure

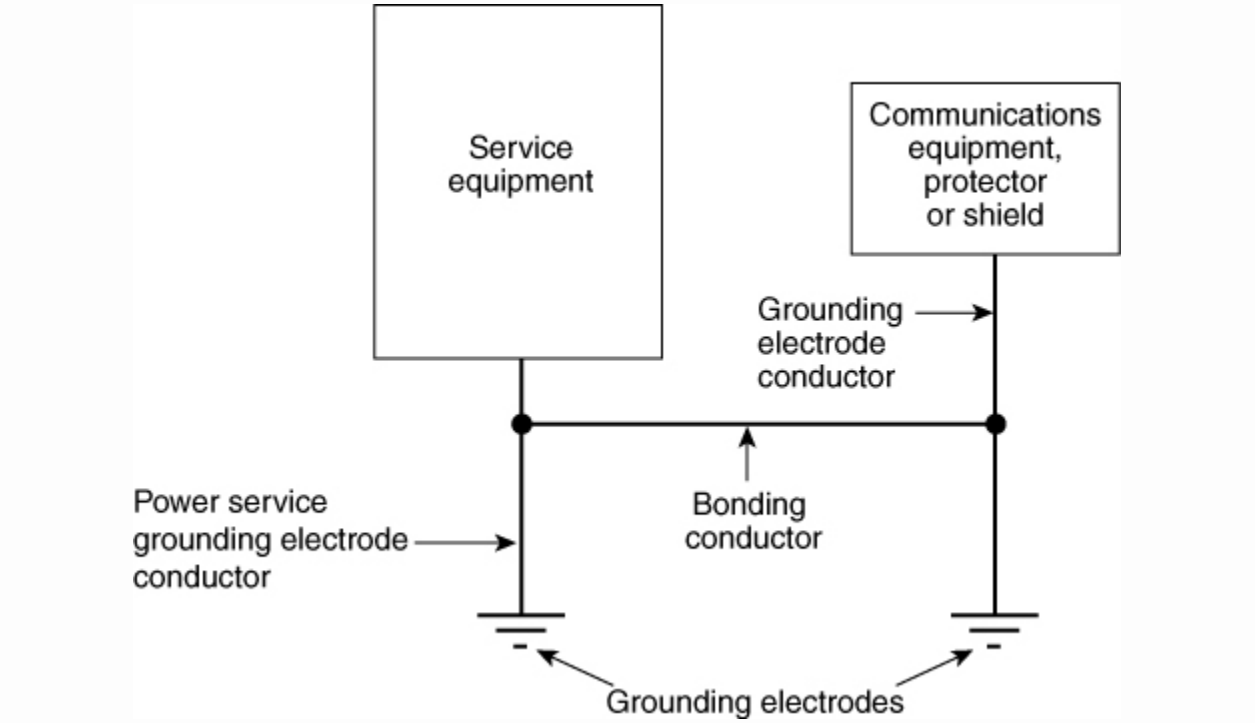
6. The grounding electrode conductor or the grounding electrode conductor metal enclosure of the power service
7. The grounding electrode conductor or the grounding electrode of a building or structure disconnecting means that is connected to a grounding electrode as covered in 250.32

A bonding device intended to provide a termination point for the bonding conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on nonremovable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is nonremovable.

For purposes of this section, the mobile home service equipment or the mobile home disconnecting means located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means connected to an electrode by a grounding electrode conductor in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Informational Note Figure 800.100(B)(2) illustrates the connection of the bonding conductor in buildings or structures not equipped with an intersystem bonding termination or a terminal block providing access to the building grounding means.

**Figure Informational Note Figure 800.100(B)(2) Illustration of a Grounding Electrode Conductor and a Bonding Conductor in a Communications Installation.**




**(3) In Buildings or Structures Without an Intersystem Bonding Termination or Grounding Means.**

If the building or structure served has no intersystem bonding termination or grounding means, as described in 800.100(B)(2), the grounding electrode conductor shall be connected to one of the following:

1. To any one of the individual grounding electrodes described in 250.52(A)(1), (A)(2), (A)(3), or (A)(4)
2. If the building or structure served has no intersystem bonding termination or grounding means, as described in 800.100(B)(2) or (B)(3)(1), to any one of the individual grounding electrodes described in 250.52(A)(5), (A)(7), and (A)(8)

3. For communications circuits covered in Article 805 or network-powered broadband communications systems covered in Article 830, to a ground rod or pipe not less than 1.5 m (5 ft) in length and 12.7 mm (0.5 in.) in diameter, driven, where practicable, into permanently damp earth and separated from lightning protection system conductors, as covered in 800.53, and at least 1.8 m (6 ft) from electrodes of other systems

Steam pipes, hot water pipes, or lightning protection system conductors shall not be employed as grounding electrodes for protectors and grounded metallic members.

**(C) Electrode Connection.**

Connections to grounding electrodes shall comply with 250.70.

**(D) Bonding of Electrodes.**

A bonding jumper not smaller than 6 AWG copper or equivalent shall be connected between the grounding electrode and power grounding electrode system at the building or structure served where separate electrodes are used.

*Exception: At mobile homes as covered in 800.106.*

Informational Note No. 1: See 250.60 for connection to a lightning protection system.

Informational Note No. 2: Bonding together of all separate electrodes limits potential differences between them and between their associated wiring systems.

**800.106 Primary Protector Grounding and Bonding at Mobile Homes.**

**(A) Grounding.**

Grounding shall comply with 800.106(A)(1) and (A)(2).

**(1) Mobile Home Service Equipment.**

Where there is no mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, grounding shall comply with one of the following:

1. The primary protector grounding terminal; the coaxial cable shield ground, or surge arrester grounding terminal; or the network-powered broadband communications cable shield, network-powered broadband communications cable metallic members not used for communications or powering, and network interface unit shall be connected to a grounding electrode conductor or grounding electrode in accordance with 800.100(B)(3).
2. The non-current-carrying metallic members of optical fiber cables shall be connected to a grounding electrode in accordance with 770.106(A)(1). The network terminal, if required to be grounded, shall be connected to a grounding electrode in accordance with 800.106(A)(1)(1). The grounding electrode shall be bonded in accordance with 770.106(B).

**(2) Mobile Home Feeder Disconnecting Means.**

Where there is no mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, grounding shall comply with one of the following:

1. The primary protector grounding terminal; the network-powered broadband communications cable shield, network-powered broadband communications cable metallic members not used for communications or powering, and network interface unit shall be connected to a grounding electrode in accordance with 800.100(B)(3).
2. The non-current-carrying metallic members of optical fiber cables shall be connected to a grounding electrode in accordance with 770.106(A)(2). The network terminal, if required to be grounded, shall be connected to a grounding electrode in accordance with 800.106(A)(2). The grounding electrode shall be bonded in accordance with 770.106(B).

**(B) Bonding.**

The primary protector grounding terminal or grounding electrode, network-powered broadband communications cable grounding terminal, or network interface unit grounding terminal shall be bonded together and connected to the metal frame or available grounding terminal of the mobile home with a copper conductor not smaller than 12 AWG under either of the following conditions:

1. Where there is no mobile home service equipment or disconnecting means as in 800.106(A)
2. Where the mobile home is supplied by cord and plug

**Part IV. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**800.110 Raceways, Cable Routing Assemblies, and Cable Trays.**

**(A) Types of Raceways.**

Wires and cables shall be permitted to be installed in raceways that comply with either 800.110(A)(1) or (A)(2). Medium-power network-powered broadband communications cables shall not be permitted to be installed in raceways that comply with 800.110(A)(2).

**(1) Raceways Recognized in Chapter 3.**

Wires and 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.**

Wires and 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.

**(3) Innerduct for Communications Wires and Cables, Coaxial Cables, or Network-Powered Broadband Communications Cables.**

Listed plenum communications raceways, listed riser communications raceways, and listed general-purpose communications raceways 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.**

The raceway fill requirements of Chapters 3 and 9 shall apply to medium-power network-powered broadband communications cables.

**(C) Cable Routing Assemblies.**

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)(1) and (C)(2) and 800.113.

**(1) Horizontal Support.**

Cable routing assemblies shall be supported where run horizontally at intervals not to exceed 900 mm (3 ft) and at each end or joint, unless listed for other support intervals. In no case shall the distance between supports exceed 3 m (10 ft).

**(2) Vertical Support.**

Vertical runs of cable routing assemblies shall be supported at intervals not exceeding 1.2 m (4 ft), unless listed for other support intervals, and shall not have more than one joint between supports.

**(D) Cable Trays.**

Wires and cables and communications raceways shall be permitted to be installed in metal or listed nonmetallic cable tray systems. Ladder cable trays shall be permitted to support cable routing assemblies.

## 800.113 Installation of Wires, Cables, Cable Routing Assemblies, and Communications Raceways.

Installation of wires, cables, cable routing assemblies, and communications raceways shall comply with 800.113(A) through (L). Installation of cable routing assemblies and communications raceways shall comply also with 800.110.

**(A) Listing.**

Wires, cables, cable routing assemblies, and communications raceways installed in buildings shall be listed.

*Exception: Cables installed in compliance with 805.48 or 820.48 shall not be required to be listed.*

**(B) Ducts Specifically Fabricated for Environmental Air.**

The following wires and 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. Plenum cables up to 1.22 m (4 ft) in length
2. Plenum cables, riser cables, general-purpose cables, and limited-use 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 NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

**(C) Other Spaces Used for Environmental Air (Plenums).**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted in other spaces used for environmental air as described in 300.22(C):

1. Plenum cables
2. Plenum communications raceways
3. Plenum cable routing assemblies
4. Plenum cables installed in plenum communications raceways
5. Plenum cables installed in plenum cable routing assemblies
6. Plenum cables and plenum communications raceways supported by open metal cable tray systems
7. Plenum cables, riser cables, general-purpose cables, limited-use cables, and communications wires installed in raceways that are installed in compliance with 300.22(C)
8. Plenum cables, riser cables, general-purpose cables, limited-use cables, 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)
9. Plenum cables, riser cables, general-purpose cables, and limited-use 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, see NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

**(D) Risers — Cables, Cable Routing Assemblies, and Communications Raceways in Vertical Runs.**

The following cables, cable routing assemblies, and communications raceways shall be permitted in vertical runs penetrating one or more floors and in vertical runs in a shaft:

1. Plenum and riser cables
2. Plenum and riser communications raceways
3. Plenum and riser cable routing assemblies
4. Plenum and riser cables installed in:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) Plenum cable routing assemblies
    d) Riser cable routing assemblies

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**(E) Risers — Cables and Innerducts in Metal Raceways.**

The following cables and innerducts shall be permitted in metal raceways in a riser having firestops at each floor:

1. Plenum cables, riser cables, general-purpose cables, and limited-use cables
2. Plenum, riser, and general-purpose communications raceways
3. Plenum cables, riser cables, general-purpose cables, and limited-use cables installed in:
    a) Plenum communications raceways (innerduct)
    b) Riser communications raceways (innerduct)
    c) General-purpose communications raceways (innerduct)

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**(F) Risers — Cables, Cable Routing Assemblies, and Communications Raceways in Fireproof Shafts.**

The following cables, cable routing assemblies, and communications raceways shall be permitted to be installed in fireproof riser shafts having firestops at each floor:

1. Plenum cables, riser cables, general-purpose cables, and limited-use cables
2. Plenum, riser, and general-purpose communications raceways
3. Plenum, riser, and general-purpose cable routing assemblies
4. Plenum cables, riser cables, general-purpose cables, and limited-use cables installed in:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
    d) Plenum cable routing assemblies
    e) Riser cable routing assemblies
    f) General-purpose cable routing assemblies

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**(G) Risers — One- and Two-Family Dwellings.**

The following cables, cable routing assemblies, and communications raceways shall be permitted in one- and two-family dwellings:

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables less than 6 mm (0.25 in.) in diameter
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Plenum cables, riser cables, and general-purpose cables installed in:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
    d) Plenum cable routing assemblies
    e) Riser cable routing assemblies
    f) General-purpose cable routing assemblies

**(H) Cable Trays.**

The following wires, cables, and communications raceways shall be permitted to be supported by cable trays:

1. Plenum cables, riser cables, and general-purpose cables
2. Plenum, riser, and general-purpose communications raceways
3. Communications wires, plenum cables, riser cables, and general-purpose cables installed in:
    1. Plenum communications raceways
    2. Riser communications raceways
    3. General-purpose communications raceways

**(I) Distributing Frames and Cross-Connect Arrays.**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in distributing frames and cross-connect arrays:

1. Plenum cables, riser cables, general-purpose cables, and communications wires
2. Plenum, riser, and general-purpose communications raceways
3. Plenum, riser, and general-purpose cable routing assemblies
4. Communications wires, plenum cables, riser cables, and general-purpose cables installed in:
    1. Plenum communications raceways
    2. Riser communications raceways
    3. General-purpose communications raceways
    4. Plenum cable routing assemblies
    5. Riser cable routing assemblies
    6. General-purpose cable routing assemblies

**(J) Other Building Locations.**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in building locations other than the locations covered in 800.113(B) through (I):

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables with a maximum of 3 m (10 ft) of exposed length in nonconcealed spaces
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
6. Plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum cable routing assemblies
    b) Riser cable routing assemblies
    c) General-purpose cable routing assemblies
7. Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3
8. Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks

**(K) Multifamily Dwellings.**

The following cables, cable routing assemblies, and communications raceways shall be permitted to be installed in multifamily dwellings in locations other than the locations covered in 800.113(B) through (G):

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables less than 6 mm (0.25 in.) in diameter in nonconcealed spaces
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
6. Plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum cable routing assemblies
    b) Riser cable routing assemblies
    c) General-purpose cable routing assemblies
7. Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3
8. Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks

**(L) One- and Two-Family Dwellings.**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in one- and two-family dwellings in locations other than the locations covered in 800.113(B) through (F):

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables less than 6 mm (0.25 in.) in diameter
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:
   a) Plenum communications raceways
   b) Riser communications raceways
   c) General-purpose communications raceways
6. Plenum cables, riser cables, and general-purpose cables installed in the following
   a) Plenum cable routing assemblies
   b) Riser cable routing assemblies
   c) General-purpose cable routing assemblies
7. Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3
8. Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks
9. Hybrid power and communications cable listed in accordance with 805.179(F)

**800.154 Applications of Listed Communications Wires, Cables, and Raceways, and Listed Cable Routing Assemblies.**

Permitted and nonpermitted applications of listed communications wires, cables, coaxial cables, network-powered broadband communications system cables and raceways, and listed cable routing assemblies, shall be in accordance with one of the following:

1. Listed communications wires and cables as indicated in Table 800.154(a)
2. Listed communications raceways as indicated in Table 800.154(b)
3. Listed cable routing assemblies as indicated in Table 800.154(c)

The permitted applications shall be subject to the installation requirements of 800.110 and 800.113.

**Table 800.154(a) Applications of Listed Communications Wires, Cables, and Network-Powered Broadband Communications System Cables on the customer side of the Communication Service Point ~~Buildings~~**

| Applications | | Wire and Cable Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BMU, BLU | Hybrid Power and Communications Cables | Communications Wires |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | Y | N | N | N | N | N | N | N | N | N |
| | In metal raceway that complies with 300.22(B) | Y | Y | Y | Y | Y | Y | N | N | N | Y |

| Applications | | Wire and Cable Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BMU, BLU | Hybrid Power and Communications Cables | Communications Wires |
| In other spaces used for environmental air (plenums) as described in 300.22(C) | In other spaces used for environmental air | Y | N | N | N | N | N | N | N | N | N |
| | In metal raceway that complies with 300.22(C) | Y | Y | Y | Y | Y | Y | N | N | N | Y |
| | In plenum communications raceways | Y | N | N | N | N | N | N | N | N | N |
| | In plenum cable routing assemblies | Y | N | N | N | N | N | N | N | N | N |
| | Supported by open metal cable trays | Y | N | N | N | N | N | N | N | N | N |
| | Supported by solid bottom metal cable trays with solid metal covers | Y | Y | Y | Y | Y | Y | N | N | N | N |
| In risers | In vertical runs | Y | Y | Y | N | N | N | N | N | N | N |
| | In metal raceways | Y | Y | Y | Y | Y | Y | N | N | N | N |
| | In fireproof shafts | Y | Y | Y | Y | Y | Y | N | N | N | N |
| | In plenum communications raceways | Y | Y | N | N | N | N | N | N | N | N |
| | In plenum cable routing assemblies | Y | Y | N | N | N | N | N | N | N | N |
| | In riser communications raceways | Y | Y | N | N | N | N | N | N | N | N |
| | In riser cable routing assemblies | Y | Y | N | N | N | N | N | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y | Y | Y | Y | N | N | Y | N |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y | Y | Y | Y | N | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y | Y | Y | Y | Y | N | Y | N |
| | In multifamily dwellings | Y | Y | Y | Y | Y | Y | Y | N | N | N |
| | In nonconcealed spaces | Y | Y | Y | Y | Y | Y | Y | N | N | N |
| | Supported by cable trays | Y | Y | Y | Y | Y | N | N | N | N | N |
| | Under carpet, modular flooring, and planks | N | N | N | N | N | N | Y | N | N | N |
| | In distributing frames and cross-connect arrays | Y | Y | N | Y | N | N | N | N | N | Y |
| | In rigid metal conduit (RMC) and intermediate metal conduit (IMC) | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |

| Applications | | Wire and Cable Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BMU, BLU | Hybrid Power and Communications Cables | Communications Wires |
| | In any raceway recognized in Chapter 3 | Y | Y | Y | Y | Y | Y | N | N | N | Y |
| | In plenum communications raceways | Y | Y | N | Y | N | N | N | N | N | Y |
| | In plenum cable routing assemblies | Y | Y | N | Y | N | N | N | N | N | Y |
| | In riser communications raceways | Y | Y | N | Y | N | N | N | N | N | Y |
| | In riser cable routing assemblies | Y | Y | N | Y | N | N | N | N | N | Y |
| | In general-purpose communications raceways | Y | Y | N | Y | N | N | N | N | N | Y |
| | In general-purpose cable routing assemblies | Y | Y | N | Y | N | N | N | N | N | Y |

Note: An "N" in the table indicates that the cable type shall not be permitted to be installed in the application. A "Y" indicates that the cable type shall be permitted to be installed in the application subject to the limitations described in 800.113. The Riser column includes all riser cables except BMR, and the General-Purpose column includes all general-purpose cables except BM.
Informational Note No. 1: Part IV of Article 800 covers wiring on the customer side of the communication service point ~~installation methods within buildings~~. This table covers the applications of listed communications wires, cables, and raceways ~~in buildings~~. See the definition of *Point of Entrance* in 800.2.

Informational Note No. 2: For information on the restrictions to the installation of communications cables in fabricated ducts, see 800.113(B).

### Table 800.154(b) Applications of Listed Communications Raceways on the customer side of the Communication Service Point~~in Buildings~~

| Applications | | Listed Communications Raceway Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | N | N | N |
| | In metal raceway that complies with 300.22(B) | N | N | N |
| In other spaces used for environmental air (plenums) 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 cable routing assemblies | N | 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 cable routing assemblies | N | N | N |
| | In riser cable routing assemblies | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y |
| | In one- and two-family dwellings | Y | Y | Y |
| | In multifamily dwellings | Y | Y | Y |

| Applications | | Listed Communications Raceway Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| | In nonconcealed spaces | Y | Y | Y |
| | Supported by cable trays | Y | Y | Y |
| | Under carpet, modular flooring, and planks | N | N | N |
| | In distributing frames and cross-connect arrays | Y | Y | Y |
| | In any raceway recognized in Chapter 3 | Y | Y | Y |
| | In plenum cable routing assemblies | N | N | N |
| | In riser cable routing assemblies | N | N | N |
| | In general-purpose cable routing assemblies | N | N | N |

Note: An “N” in the table indicates that the communications raceway type shall not be permitted to be installed in the application. A “Y” indicates that the communications raceway type shall be permitted to be installed in the application, subject to the limitations described in 800.110 and 800.113.

## Table 800.154(c) Applications of Listed Cable Routing Assemblies in Buildings

| Applications | | Listed Cable Routing Assembly Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | N | N | N |
| | In metal raceway that complies with 300.22(B) | N | N | N |
| In other spaces used for environmental air (plenums) 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) | N | N | N |
| | In plenum communications raceways | N | N | N |
| | Supported by open metal cable trays | Y | N | N |
| | Supported by solid bottom metal cable trays with solid metal covers | N | N | N |
| In risers | In vertical runs | Y | Y | N |
| | In metal raceways | N | N | N |
| | In fireproof shafts | Y | Y | Y |
| | In plenum communications raceways | N | N | N |
| | In riser communications raceways | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y |
| | In one- and two-family dwellings | Y | Y | Y |
| | In multifamily dwellings | Y | Y | Y |
| | In nonconcealed spaces | Y | Y | Y |
| | Supported by cable trays | Y | Y | Y |
| | Under carpet, modular flooring, and planks | N | N | N |
| | In distributing frames and cross-connect arrays | Y | Y | Y |
| | In any raceway recognized in Chapter 3 | N | N | N |
| | In plenum communications raceways | N | N | N |
| | In riser communications raceways | N | N | N |
| | In general-purpose communications raceways | N | N | N |

Note: An “N” in the table indicates that the cable routing assembly type shall not be permitted to be installed in the application. A “Y” indicates that the cable routing assembly type shall be permitted to be installed in the application subject to the limitations described in 800.113.

### 800.179 Plenum, Riser, General-Purpose, and Limited Use Cables.

Plenum, riser, general-purpose, and limited-use cables shall be listed in accordance with 800.179(A) through (D) and shall have a temperature rating of not less than 60°C (140°F). The temperature rating shall be marked on the jacket of cables that have a temperature rating exceeding 60°C (140°F). The cable voltage rating shall not be marked on the cable.

#### (A) Plenum Cables.

Type CMP communications plenum cables, Type CATVP community antenna television plenum coaxial cables, and Type BLP network-powered broadband communication low-power plenum cables shall be listed as being suitable for use in ducts, plenums, and other spaces 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*.

#### (B) Riser Cables.

Type CMR communications riser cables, Type CATVR community antenna television riser coaxial cables, Type BMR network-powered broadband communications medium-power riser cables, and Type BLR network-powered broadband communications low-power riser cables 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 1666-2011, *Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts.*

#### (C) General-Purpose Cables.

Type CM communications general-purpose cables, Type CATV community antenna television coaxial general-purpose cables, Type BM network-powered broadband communications medium-power general-purpose cables, and Type BL network-powered broadband communications low-power general-purpose cables shall be listed as being suitable for general-purpose use, with the exception of risers and plenums, 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 Flame Tray 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. 0.3-09, *Test Methods for Electrical Wires and Cables*.

#### (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 VW-1 (vertical-wire) flame test in ANSI/UL 1581-2017, *Reference Standard for Electrical Wires, Cables and Flexible Cords*.

## Part V. Listing Requirements

### 800.180 Grounding Devices.

Where bonding or grounding is required, devices used to connect a shield, a sheath, or non-current-carrying metallic members of a cable to a bonding conductor or grounding electrode conductor shall be listed or be part of listed equipment.

### 800.182 Cable Routing Assemblies and Communications Raceways.

Cable routing assemblies and communications raceways shall be listed in accordance with 800.182(A) through (C). Cable routing assemblies shall be marked in accordance with Table 800.182(a). Communications raceways shall be marked in accordance with Table 800.182(b).

Informational Note: For information on listing requirements for both communications raceways and cable routing assemblies, see ANSI/UL 2024-5-2015, *Cable Routing Assemblies and Communications Raceways*.

**Table 800.182(a) Cable Routing Assembly Markings**

| Type | Marking |
|---|---|
| Plenum Cable Routing Assembly | Plenum Cable Routing Assembly |
| Riser Cable Routing Assembly | Riser Cable Routing Assembly |
| General-Purpose Cable Routing Assembly | General-Purpose Cable Routing Assembly |

**Table 800.182(b) Communications Raceway Markings**

| Type | Marking |
|---|---|
| Plenum Communications Raceway | Plenum Communications Raceway |
| Riser Communications Raceway | Riser Communications Raceway |
| General-Purpose Communications Raceway | General-Purpose Communications Raceway |

### (A) Plenum Cable Routing Assemblies and Plenum Communications Raceways.

Plenum cable routing assemblies and plenum communications raceways shall be listed as having adequate fire-resistant and low-smoke-producing characteristics.

Informational Note No. 1: One method of defining cable routing assemblies and communications raceways that have adequate fire-resistant and low-smoke-producing characteristics is that they exhibit a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84-15a, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or ANSI/UL 723-2013, *Standard Test Method for Surface Burning Characteristics of Building Materials*.

Informational Note No. 2: Another method of defining communications raceways that have adequate fire-resistant and low-smoke-producing characteristics is that they exhibit 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 262-2015, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces*.

Informational Note No. 3: See 4.3.11.2.6 or 4.3.11.5.5 of NFPA 90A-2015, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, for information on materials exposed to the airflow in ceiling cavity and raised floor plenums.

### (B) Riser Cable Routing Assemblies and Riser Communications Raceways.

Riser cable routing assemblies and riser communications raceways shall be listed as having adequate 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 cable routing assemblies and communications raceways pass the requirements of ANSI/UL 1666-2011, *Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts*.

### (C) General-Purpose Cable Routing Assemblies and General-Purpose Communications Raceways.

General-purpose cable routing assemblies and general-purpose communications raceways shall 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 cable routing assemblies and communications raceways do not spread fire to the top of the tray in the “UL Flame Exposure, Vertical Flame Tray Test” in ANSI/UL 1685-2011, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*.

## Article 805 Communications Circuits

### Part I. General

### 805.1 Scope.

This article covers communications circuits and equipment.

**805.2 Definitions.**

The definitions in this section shall apply only within Articles 805 and 840.

**Cable.**

A factory assembly of two or more conductors having an overall covering.

**Communications Circuit Integrity (CI) Cable.**

Cable used in communications systems to ensure continued operation of critical circuits during a specified time under fire conditions.

**Wire.**

A factory assembly of one or more insulated conductors without an overall covering.

**805.18 Installation of Equipment.**

Equipment electrically connected to a communications network shall be listed in accordance with 805.170.

*Exception: This listing requirement shall not apply to test equipment that is intended for temporary connection to a telecommunications network by qualified persons during the course of installation, maintenance, or repair of telecommunications equipment or systems.*

**Part II. Wires and Cables Outside and on the service provider side of the Communication Service Point ~~Entering Buildings~~**

**805.47 Underground Communications Wires and Cables ~~Entering Buildings~~.**

Underground communications wires and cables ~~entering buildings~~ shall comply with 805.47(A) and (B). The requirements of 310.10(C) shall not apply to communications wires and cables.

**(A) Underground Systems with Electric Light, Power, Class 1, or Non-Power-Limited Fire Alarm Circuit Conductors.**

Underground communications wires and cables in a raceway, handhole enclosure, or manhole containing electric light, power, Class 1, or non-power-limited fire alarm circuit conductors shall be in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier.

**(B) Underground Block Distribution.**

Where the entire street circuit is run underground and the circuit within the block is placed so as to be free from the likelihood of accidental contact with electric light or power circuits of over 300 volts to ground, the insulation requirements of 805.50(A) and 805.50(C) shall not apply, insulating supports shall not be required for the conductors, and bushings shall not be required where the conductors enter the building.

**805.48 Unlisted Cables on the service provider side of the Communication Service Point ~~Entering Buildings~~.**

Unlisted outside plant communications cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated in an enclosure or on a listed primary protector. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) to the point of emergence.

Informational Note No. 1: Splice cases or terminal boxes, both metallic and plastic types, are typically used as enclosures for splicing or terminating telephone cables.

Informational Note No. 2: This section limits the length of unlisted outside plant cable to 15 m (50 ft), while 805.90(B) requires that the primary protector be located as close as practicable to the point at which the cable enters the building. Therefore, in installations requiring a primary protector, the outside plant cable may not be permitted to extend 15 m (50 ft) into the building if it is practicable to place the primary protector closer than 15 m (50 ft) to the point of entrance.

### 805.50 Circuits Requiring Primary Protectors.

Circuits that require primary protectors as provided in 805.90 shall comply with 805.50(A),805.50(B), and 805.50(C).

#### (A) Insulation, Wires, and Cables.

Communications wires and cables without a metallic shield, running from the last outdoor support to the primary protector, shall be listed in accordance with 805.173.

#### (B) On Buildings.

Communications wires and cables in accordance with 805.50(A) shall be separated at least 100 mm (4 in.) from electric light or power conductors not in a raceway or cable or be permanently separated from conductors of the other systems by a continuous and firmly fixed nonconductor in addition to the insulation on the wires, such as porcelain tubes or flexible tubing. Communications wires and cables in accordance with 805.50(A) exposed to accidental contact with electric light and power conductors operating at over 300 volts to ground and attached to buildings shall be separated from woodwork by being supported on glass, porcelain, or other insulating material.

*Exception: Separation from woodwork shall not be required where fuses are omitted as provided for in 805.90(A)(1), or where conductors are used to extend circuits to a building from a cable having a grounded metal sheath.*

#### (C) Entering Buildings.

Where a primary protector is installed inside the building, the communications wires and cables shall enter the building either through a noncombustible, nonabsorbent insulating bushing or through a metal raceway. The insulating bushing shall not be required where the entering communications wires and cables (1) are in metal-sheathed cable, (2) pass through masonry, (3) meet the requirements of 805.50(A) and fuses are omitted as provided in 805.90(A)(1), or (4) meet the requirements of 805.50(A) and are used to extend circuits to a building from a cable having a grounded metallic sheath. Raceways or bushings shall slope upward from the outside or, where this cannot be done, drip loops shall be formed in the communications wires and cables immediately before they enter the building.

Raceways shall be equipped with an approved service head. More than one communications wire and cable shall be permitted to enter through a single raceway or bushing. Conduits or other metal raceways located ahead of the primary protector shall be grounded.

## Part III. Protection

### 805.90 Protective Devices.

#### (A) Application.

A listed primary protector shall be provided on each circuit run partly or entirely in aerial wire or aerial cable not confined within a block. Also, a listed primary protector shall be provided on each circuit, aerial or underground, located within the block containing the building served so as to be exposed to accidental contact with electric light or power conductors operating at over 300 volts to ground. In addition, where there exists a lightning exposure, each interbuilding circuit on a premises shall be protected by a listed primary protector at each end of the interbuilding circuit. Installation of primary protectors shall also comply with 110.3(B).

Informational Note No. 1: On a circuit not exposed to accidental contact with power conductors, providing a listed primary protector in accordance with this article helps protect against other hazards, such as lightning and above-normal voltages induced by fault currents on power circuits in proximity to the communications circuit.

Informational Note No. 2: Interbuilding circuits are considered to have a lightning exposure unless one or more of the following conditions exist:

1. Circuits in large metropolitan areas where buildings are close together and sufficiently high to intercept lightning.
2. Interbuilding cable runs of 42 m (140 ft) or less, directly buried or in underground conduit, where a continuous metallic cable shield or a continuous metal conduit containing the cable is connected to each building grounding electrode system.

3. Areas having an average of five or fewer thunderstorm days per year and earth resistivity of less than 100 ohm-meters. Such areas are found along the Pacific coast.

Informational Note No. 3: For information on lightning protection systems, see NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems.*

**(1) Fuseless Primary Protectors.**

Fuseless-type primary protectors shall be permitted under any of the conditions given in 805.90(A)(1)(a) through (A)(1)(e).

(a) Where conductors enter a building through a cable with grounded metallic sheath member(s) and where the conductors in the cable safely fuse on all currents greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor

(b) Where insulated conductors in accordance with 805.50(A) are used to extend circuits to a building from a cable with an effectively grounded metallic sheath member(s) and where the conductors in the cable or cable stub, or the connections between the insulated conductors and the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground, safely fuse on all currents greater than the current-carrying capacity of the primary protector, or the associated insulated conductors and of the primary protector bonding conductor or grounding electrode conductor

(c) Where insulated conductors in accordance with 805.50(A) or (B) are used to extend circuits to a building from other than a cable with metallic sheath member(s), where (1) the primary protector is listed as being suitable for this purpose for application with circuits extending from other than a cable with metallic sheath members, and (2) the connections of the insulated conductors to the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground or the conductors of the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground safely fuse on all currents greater than the current-carrying capacity of the primary protector, or associated insulated conductors and of the primary protector bonding conductor or grounding electrode conductor

(d) Where insulated conductors in accordance with 805.50(A) are used to extend circuits aerially to a building from a buried or underground circuit that is unexposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground

(e) Where insulated conductors in accordance with 805.50(A) are used to extend circuits to a building from cable with an effectively grounded metallic sheath member(s), and where (1) the combination of the primary protector and insulated conductors is listed as being suitable for this purpose for application with circuits extending from a cable with an effectively grounded metallic sheath member(s), and (2) the insulated conductors safely fuse on all currents greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor

Informational Note: Section 9 of ANSI/IEEE C2-2012, *National Electrical Safety Code*, provides an example of methods of protective grounding that can achieve effective grounding of communications cable sheaths for cables from which communications circuits are extended.

**(2) Fused Primary Protectors.**

Where the requirements listed under 805.90(A)(1)(a) through (A)(1)(e) are not met, fused-type primary protectors shall be used. Fused-type primary protectors shall consist of an arrester connected between each line conductor and ground, a fuse in series with each line conductor, and an appropriate mounting arrangement. Primary protector terminals shall be marked to indicate line, instrument, and ground, as applicable.

**(B) Location.**

The primary protector shall be located in, on, or immediately adjacent to the structure or building served and as close as practicable to the point of entrance.

For purposes of this section, primary protectors located at mobile home service equipment within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means connected to an electrode by a grounding electrode conductor in accordance with 250.32 and located

within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a primary protector location to achieve the shortest practicable primary protector bonding conductor or grounding electrode conductor helps limit potential differences between communications circuits and other metallic systems.

**(C) Hazardous (Classified) Locations.**

The primary protector shall not be located in any hazardous (classified) locations, as defined in 500.5 and 505.5, or in the vicinity of easily ignitible material.

*Exception: As permitted in 501.150, 502.150, and 503.150.*

**(D) Secondary Protectors.**

Where a secondary protector is installed in series with the indoor communications wire and cable between the primary protector and the equipment, it shall be listed for the purpose in accordance with 805.170(B).

Informational Note: Secondary protectors on circuits exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground are not intended for use without primary protectors.

**805.93 Grounding, Bonding, or Interruption of Non–Current-Carrying Metallic Sheath Members of Communications Cables.**

Communications cables entering the building or terminating on the outside of the building shall comply with 805.93(A) or (B).

**(A) Entering Buildings.**

In installations where the communications cable enters a building, the metallic sheath members of the cable shall be grounded or bonded as specified in 800.100 or interrupted by an insulating joint or equivalent device. The grounding, bonding, or interruption shall be as close as practicable to the point of entrance.

**(B) Terminating on the Outside of Buildings.**

In installations where the communications cable is terminated on the outside of the building, the metallic sheath members of the cable shall be grounded or bonded as specified in 800.100 or interrupted by an insulating joint or equivalent device. The grounding, bonding, or interruption shall be as close as practicable to the point of termination of the cable.

**Part IV. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**805.133 Installation of Communications Wires, Cables, and Equipment.**

Communications wires and cables from the protector to the equipment or, where no protector is required, communications wires and cables attached to the outside or inside of the building shall comply with 805.133(A) and 805.133(B)

**(A) Separation from Other Conductors.**

**(1) In Raceways, Cable Trays, Boxes, Cables, Enclosures, and Cable Routing Assemblies.**

(a) *Other Circuits.* Communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with cables 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. Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770
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

(b) *Class 2 and Class 3 Circuits.* Class 1 circuits shall not be run in the same cable with communications circuits. Class 2 and Class 3 circuit conductors shall be permitted in the same listed communications cable with communications circuits.

(c) *Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm, and Medium-Power Network-Powered Broadband Communications Circuits in Raceways, Compartments, and Boxes.* Communications conductors shall not be placed in any raceway, compartment, outlet box, junction box, or similar fitting with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits.

*Exception No. 1: Section 805.133(A)(1)(c) shall not apply if 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 conductors of communications circuits by a permanent barrier or listed divider.*

*Exception No. 2: Power conductors in outlet boxes, junction boxes, or similar fittings or compartments where such conductors are introduced solely for power supply to communications equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum of 6 mm (¼ in.) separation from the communications circuit conductors.*

*Exception No. 3: As permitted by 620.36.*

**(2) Other Applications.**

Communications wires and cables shall be separated 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.

*Exception No. 1: Section 805.133(A)(2) shall not apply where either (1) all of the conductors of the electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits are in a raceway or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC, or Type UF cables, or (2) all of the conductors of communications circuits are encased in raceway.*

*Exception No. 2: Section 805.133(A)(2) shall not apply where the communications wires and cables are permanently separated from the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B) Support of Communications Wires and Cables.**

Raceways shall be used for their intended purpose. Communications wires and cables shall not be strapped, taped, or attached by any means to the exterior of any raceway as a means of support.

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

**805.154 Substitutions of Listed Communications Wires, Cables, and Raceways, and Listed Cable Routing Assemblies.**

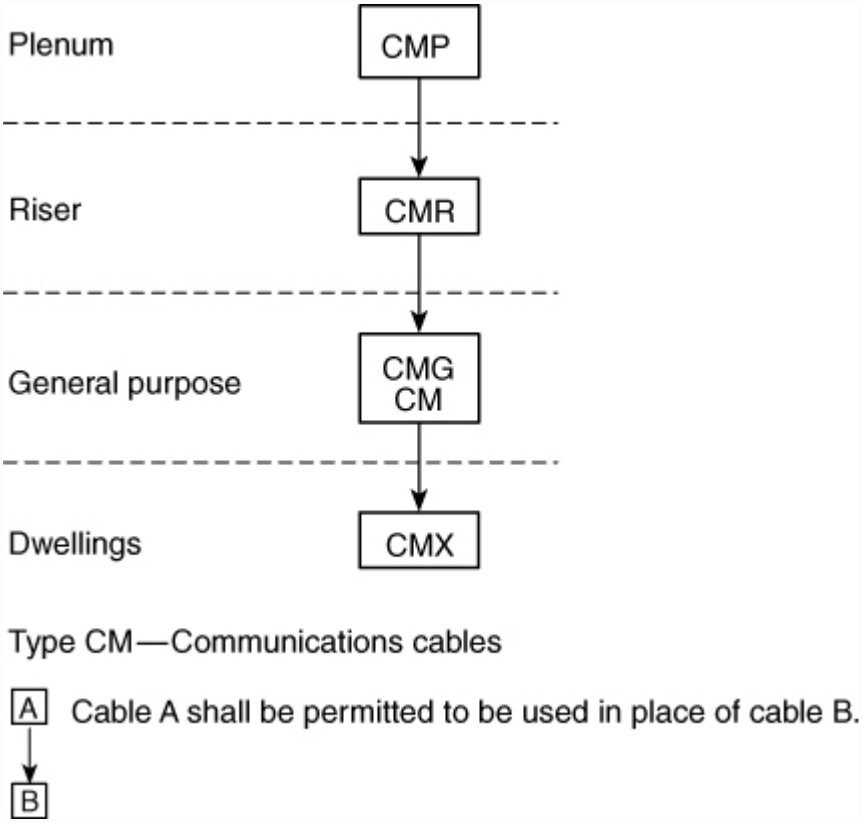
The substitutions for communications cables listed in Table 805.154 and illustrated in Figure 805.154 shall be permitted.

**Table 805.154 Cable Substitutions**

| Cable Type | Permitted Substitutions |
|---|---|
| CMR | CMP |

| Cable Type | Permitted Substitutions |
|---|---|
| CMG, CM | CMP, CMR |
| CMX | CMP, CMR, CMG, CM |

**Figure 805.154 Cable Substitution Hierarchy.**




### 805.156 Dwelling Unit Communications Outlet.

For new construction, a minimum of one communications outlet shall be installed within the dwelling in a readily accessible area and cabled to the service provider demarcation point.

## Part V. Listing Requirements

### 805.170 Equipment.

Communications equipment shall be listed as being suitable for electrical connection to a communications network.

Informational Note No. 1: One way to determine applicable requirements is to refer to ANSI/UL 60950-1-2014, *Standard for Safety of Information Technology Equipment*; ANSI/UL 1863-2012, *Standard for Safety Communications Circuit Accessories*; or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements*.

Informational Note No. 2: Additional information regarding voltages, currents, and power allowed on communications circuits can be found in ANSI/ATIS 0600337-2016, *Requirements for Maximum Voltage, Current, and Power Levels Used in Communications Transport Circuits*.

#### (A) Primary Protectors.

The primary protector shall consist of an arrester connected between each line conductor and ground in an appropriate mounting. Primary protector terminals shall be marked to indicate line and ground as applicable.

Informational Note: One way to determine applicable requirements for a listed primary protector is to refer to ANSI/UL 497-2013, *Standard for Protectors for Paired Conductor Communications Circuits*.

#### (B) Secondary Protectors.

The secondary protector shall be listed as suitable to provide means to safely limit currents to less than the current-carrying capacity of listed indoor communications wire and cable, listed telephone set line cords, and listed communications terminal equipment having ports for external wire line communications circuits. Any overvoltage protection, arresters, or grounding connection shall be connected on the equipment terminals side of the secondary protector current-limiting means.

Informational Note: One way to determine applicable requirements for a listed secondary protector is to refer to ANSI/UL 497A-2012, *Standard for Secondary Protectors for Communications Circuits*.

**(C) Plenum Grade Cable Ties.**

Cable ties intended for use in other space used for environmental air (plenums) shall be listed as having low smoke and heat release properties.

Informational Note: See NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, and ANSI/UL 2043-2013, *Standard for Safety Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces*, for information on listing discrete products as having low smoke and heat release properties.

### 805.173 Drop Wire and Cable.

Communications wires and cables without a metallic shield, running from the last outdoor support to the primary protector, shall be listed as being suitable for the purpose and shall have current-carrying capacity as specified in 805.90(A)(1)(b) or (A)(1)(c).

### 805.179 Communications Wires and Cables.

Communications wires and cables shall be listed in accordance with 805.179(A) through (F) and marked in accordance with Table 805.179 and 805.179(G). Conductors in communications cables, other than in a coaxial cable, shall be copper.

Communications wires and cables shall have a voltage rating of not less than 300 volts. The insulation for the individual conductors, other than the outer conductor of a coaxial cable, shall be rated for 300 volts minimum. The cable voltage rating shall not be marked on the cable or on the under-carpet communications wire.

*Exception: Voltage markings shall be permitted where the cable has multiple listings and 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 805.179 Cable Markings**

| Cable Marking | Type |
|---|---|
| CMP | Communications plenum cable |
| CMR | Communications riser cable |
| CMG | Communications general-purpose cable |
| CM | Communications general-purpose cable |
| CMX | Communications cable, limited use |
| CMUC | Under-carpet communications wire and cable |

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

**(A) General Requirements.**

The general requirements in 805.179 shall apply.

**(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 VW-1 (vertical-wire) flame test in ANSI/UL 1581-2017, *Reference Standard for Electrical Wires, Cables and Flexible Cords*.

### (C) Circuit Integrity (CI) Cable or Electrical Circuit Protective System.

Cables that are used for survivability of critical circuits under fire conditions shall be listed and meet either 805.179(C)(1) or 805.179(C)(2).

Informational Note: The listing organization provides information for circuit integrity (CI) cable and electrical circuit protective systems, including installation requirements required to maintain the fire rating.

### (1) Circuit Integrity (CI) Cables.

Circuit integrity (CI) cables specified in 805.179(A) through (D), and used for survivability of critical circuits, shall have an additional classification using the suffix "CI." In order to maintain its listed fire rating, circuit integrity (CI) cable shall only be installed in free air.

Informational Note: One method of defining circuit integrity (CI) cable is by establishing a minimum 2-hour fire resistance rating for the cable when tested in accordance with ANSI/UL 2196-2017, *Standard for Fire Test for Circuit Integrity of Fire-Resistant Power, Instrumentation, Control, and Data Cables*.

### (2) Fire-Resistive Cables.

Cables specified in 800.179(A) through (D) and 805.179(C)(1), that are part of an electrical circuit protective system, shall be fire-resistive cable identified with the protective system number on the product, or on the smallest unit container in which the product is packaged, and shall be installed in accordance with the listing of the protective system.

Informational Note No. 1: One method of defining an electrical circuit protective system is by establishing a minimum 2-hour fire resistance rating for the system when tested in accordance with UL Subject 1724, *Outline of Investigation for Fire Tests for Electrical Circuit Protective Systems*.

Informational Note No. 2: The listing organization provides information for electrical circuit protective systems (FHIT), including installation requirements for maintaining the fire rating.

### (D) Types CMP-LP, CMR-LP, CMG-LP, and CM-LP Limited Power (LP) Cables.

Types CMP-LP, CMR-LP, CMG-LP, and CM-LP communications limited power 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 XX designates the current limit in amperes per conductor.

Informational Note: An example of the marking on a communications cable with an LP rating is "CMP-LP (0.6A)(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 ampere.

### (E) Communications Wires.

Communications wires, such as distributing frame wire and jumper wire, shall 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 Flame Tray 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. 0.3-09, *Test Methods for Electrical Wires and Cables*.

### (F) Hybrid Power and Communications Cables.

Listed hybrid power and communications cables shall be permitted where the power cable is a listed Type NM or NM-B, conforming to Part III of Article 334, and the communications cable is a listed Type CM, the jackets on the listed NM or NM-B, and listed CM cables are rated for 600 volts minimum, and the hybrid cable is 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 Flame Tray 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. 0.3-09, *Test Methods for Electrical Wires and Cables*.

### (G) Optional Markings.

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.

## Article 810 Radio and Television Equipment

### Part I. General

#### 810.1 Scope.

This article covers antenna systems for radio and television receiving equipment, amateur and citizen band radio transmitting and receiving equipment, and certain features of transmitter safety. This article covers antennas such as wire-strung type, multi-element, vertical rod, flat, or parabolic and also covers the wiring and cabling that connect them to equipment. This article does not cover equipment and antennas used for coupling carrier current to power line conductors.

#### 810.2 Definitions.

The definitions in Part I of Article 100 shall apply.

#### 810.3 Other Articles.

Wiring from the source of power to and between devices connected to the interior wiring system shall comply with Chapters 1 through 4 other than as modified by Parts I and II of Article 640. Wiring for audio signal processing, amplification, and reproduction equipment shall comply with Article 640. Coaxial cables that connect antennas to equipment shall comply with Article 820.

#### 810.4 Community Television Antenna.

The antenna shall comply with this article. The distribution system shall comply with Article 820.

#### 810.5 Radio Noise Suppressors.

Radio interference eliminators, interference capacitors, or noise suppressors connected to power-supply leads shall be of a listed type. They shall not be exposed to physical damage.

#### 810.6 Antenna Lead-In Protectors.

Where an antenna lead-in surge protector is installed, it shall be listed as being suitable for limiting surges on the cable that connects the antenna to the receiver/transmitter electronics and shall be connected between the conductors and the grounded shield or other ground connection. The antenna lead-in protector shall be grounded using a bonding conductor or grounding electrode conductor installed in accordance with 810.21(F).

Informational Note: For requirements covering protectors for antenna lead-in conductors, refer to UL 497E, *Outline of Investigation for Protectors for Antenna Lead-In Conductors*.

#### 810.7 Grounding Devices.

Where bonding or grounding is required, devices used to connect a shield, a sheath, non–current-carrying metallic members of a cable, or metal parts of equipment or antennas to a bonding conductor or grounding electrode conductor shall be listed or be part of listed equipment.

### Part II. Receiving Equipment — Antenna Systems

#### 810.11 Material.

Antennas and lead-in conductors shall be of hard-drawn copper, bronze, aluminum alloy, copper-clad steel, or other high-strength, corrosion-resistant material.

*Exception: Soft-drawn or medium-drawn copper shall be permitted for lead-in conductors where the maximum span between points of support is less than 11 m (35 ft).*

#### 810.12 Supports.

Outdoor antennas and lead-in conductors shall be securely supported. The antennas or lead-in conductors shall not be attached to the electric service mast. They shall not be attached to poles or similar structures carrying open electric light or power wires or trolley wires of over 250 volts between conductors. Insulators supporting the antenna conductors shall have sufficient mechanical strength to safely support the conductors. Lead-in conductors shall be securely attached to the antennas.

### 810.13 Avoidance of Contacts with Conductors of Other Systems.

Outdoor antennas and lead-in conductors from an antenna to a building shall not cross over open conductors of electric light or power circuits and shall be kept well away from all such circuits so as to avoid the possibility of accidental contact. Where proximity to open electric light or power service conductors of less than 250 volts between conductors cannot be avoided, the installation shall be such as to provide a clearance of at least 600 mm (2 ft).

Where practicable, antenna conductors shall be installed so as not to cross under open electric light or power conductors.

### 810.14 Splices.

Splices and joints in antenna spans shall be made mechanically secure with approved splicing devices or by such other means as will not appreciably weaken the conductors.

### 810.15 Grounding.

Masts and metal structures supporting antennas shall be grounded in accordance with 810.21, unless the antenna and its related supporting mast or structure are within a zone of protection defined by a 46 m (150 ft) radius rolling sphere.

Informational Note: See 4.8.3.1 of NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, for the application of the term *rolling sphere*.

### 810.16 Size of Wire-Strung Antenna — Receiving Station.

#### (A) Size of Antenna Conductors.

Outdoor antenna conductors for receiving stations shall be of a size not less than given in Table 810.16(A).

**Table 810.16(A) Size of Receiving Station Outdoor Antenna Conductors**

| Material | Minimum Size of Conductors (AWG) Where Maximum Open Span Length Is | | |
|---|---|---|---|
| | Less Than 11 m (35 ft) | 11 m to 45 m (35 ft to 150 ft) | Over 45 m (150 ft) |
| Aluminum alloy, hard-drawn copper | 19 | 14 | 12 |
| Copper-clad steel, bronze, or other high-strength material | 20 | 17 | 14 |

#### (B) Self-Supporting Antennas.

Outdoor antennas, such as vertical rods and flat, parabolic, or dipole structures, shall be of corrosion-resistant materials and of strength suitable to withstand ice and wind loading conditions and shall be located well away from overhead conductors of electric light and power circuits of over 150 volts to ground, so as to avoid the possibility of the antenna or structure falling into or making accidental contact with such circuits.

### 810.17 Size of Lead-in — Receiving Station.

Lead-in conductors from outside antennas for receiving stations shall, for various maximum open span lengths, be of such size as to have a tensile strength at least as great as that of the conductors for antennas as specified in 810.16. Where the lead-in consists of two or more conductors that are twisted

together, are enclosed in the same covering, or are concentric, the conductor size shall, for various maximum open span lengths, be such that the tensile strength of the combination is at least as great as that of the conductors for antennas as specified in 810.16.

### 810.18 Clearances — Receiving Stations.

#### (A) Outside of Buildings.

Lead-in conductors attached to buildings shall be installed so that they cannot swing closer than 600 mm (2 ft) to the conductors of circuits of 250 volts or less between conductors, or 3.0 m (10 ft) to the conductors of circuits of over 250 volts between conductors, except that in the case of circuits not over 150 volts between conductors, where all conductors involved are supported so as to ensure permanent separation, the clearance shall be permitted to be reduced but shall not be less than 100 mm (4 in.). The clearance between lead-in conductors and any conductor forming a part of a lightning protection system shall not be less than 1.8 m (6 ft). Underground conductors shall be separated at least 300 mm (12 in.) from conductors of any light or power circuits or Class 1 circuits.

*Exception: Where the electric light or power conductors, Class 1 conductors, or lead-in conductors are installed in raceways or metal cable armor.*

Informational Note No. 1: See 250.60 for grounding associated with lightning protection components — strike termination devices. For further information, see NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, which contains detailed information on grounding, bonding, and spacing from lightning protection systems, and the calculation of specific separation distances using the sideflash equation in Section 4.6.

Informational Note No. 2: Metal raceways, enclosures, frames, and other non–current-carrying metal parts of electrical equipment installed on a building equipped with a lightning protection system may require bonding or spacing from the lightning protection conductors in accordance with NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*. Separation from lightning protection conductors is typically 1.8 m (6 ft) through air or 900 mm (3 ft) through dense materials such as concrete, brick, or wood.

#### (B) Antennas and Lead-ins — Indoors.

Indoor antennas and indoor lead-ins shall not be run nearer than 50 mm (2 in.) to conductors of other wiring systems in the premises.

*Exception No. 1: Where such other conductors are in metal raceways or cable armor.*

*Exception No. 2: Where permanently separated from such other conductors by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing.*

#### (C) In Boxes or Other Enclosures.

Indoor antennas and indoor lead-ins shall be permitted to occupy the same box or enclosure with conductors of other wiring systems where separated from such other conductors by an effective permanently installed barrier.

### 810.19 Electrical Supply Circuits Used in Lieu of Antenna — Receiving Stations.

Where an electrical supply circuit is used in lieu of an antenna, the device by which the radio receiving set is connected to the supply circuit shall be listed.

### 810.20 Antenna Discharge Units — Receiving Stations.

#### (A) Where Required.

Each conductor of a lead-in from an outdoor antenna shall be provided with a listed antenna discharge unit.

*Exception: Where the lead-in conductors are enclosed in a continuous metallic shield that either is grounded with a conductor in accordance with 810.21 or is protected by an antenna discharge unit.*

#### (B) Location.

Antenna discharge units shall be located outside the building or inside the building between the point of entrance of the lead-in and the radio set or transformers and as near as practicable to the entrance of the conductors to the building. The antenna discharge unit shall not be located near combustible material or in a hazardous (classified) location as defined in Article 500.

**(C) Grounding.**

The antenna discharge unit shall be grounded in accordance with 810.21.

**810.21 Bonding Conductors and Grounding Electrode Conductors — Receiving Stations.**

Bonding conductors and grounding electrode conductors shall comply with 810.21(A) through 810.21(K).

**(A) Material.**

The bonding conductor or grounding electrode conductor shall be of copper, aluminum, copper-clad steel, copper-clad aluminum, bronze, or similar corrosion-resistant material. Aluminum or copper-clad aluminum bonding conductors or grounding electrode conductors shall not be used where in direct contact with masonry or the earth or where subject to corrosive conditions. Where used outside, aluminum or copper-clad aluminum conductors shall not be installed within 450 mm (18 in.) of the earth.

**(B) Insulation.**

Insulation on bonding conductors or grounding electrode conductors shall not be required.

**(C) Supports.**

The bonding conductor or grounding electrode conductor shall be securely fastened in place and shall be permitted to be directly attached to the surface wired over without the use of insulating supports.

*Exception: Where proper support cannot be provided, the size of the bonding conductors or grounding electrode conductors shall be increased proportionately.*

**(D) Physical Protection.**

Bonding conductors and grounding electrode conductors shall be protected where exposed to physical damage. Where the bonding conductor or grounding electrode conductor is installed in a metal raceway, both ends of the raceway shall be bonded to the contained conductor or to the same terminal or electrode to which the bonding conductor or grounding electrode conductor is connected.

**(E) Run in Straight Line.**

The bonding conductor or grounding electrode conductor for an antenna mast or antenna discharge unit shall be run in as straight a line as practicable.

**(F) Electrode.**

The bonding conductor or grounding electrode conductor shall be connected as required in 810.21(F)(1) through 810.21(F)(3).

**(1) In Buildings or Structures with an Intersystem Bonding Termination.**

If the building or structure served has an intersystem bonding termination as required by 250.94, the bonding conductor shall be connected to the intersystem bonding termination.

**(2) In Buildings or Structures with Grounding Means.**

If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on the following:

1. The building or structure grounding electrode system as covered in 250.50
2. The grounded interior metal water piping systems, within 1.52 m (5 ft) from its point of entrance to the building, as covered in 250.52
3. The power service accessible means external to the building, as covered in 250.94
4. The nonflexible metal power service raceway
5. The service equipment enclosure, or
6. The grounding electrode conductor or the grounding electrode conductor metal enclosures of the power service

A bonding device intended to provide a termination point for the bonding conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on nonremovable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is nonremovable.

**(3) In Buildings or Structures Without an Intersystem Bonding Termination or Grounding Means.**

If the building or structure served has no intersystem bonding termination or grounding means as described in 810.21(F)(2), the grounding electrode conductor shall be connected to a grounding electrode as described in 250.52.

**(G) Inside or Outside Building.**

The bonding conductor or grounding electrode conductor shall be permitted to be run either inside or outside the building.

**(H) Size.**

The bonding conductor or grounding electrode conductor shall not be smaller than 10 AWG copper, 8 AWG aluminum, or 17 AWG copper-clad steel or bronze.

**(I) Common Ground.**

A single bonding conductor or grounding electrode conductor shall be permitted for both protective and operating purposes.

**(J) Bonding of Electrodes.**

A bonding jumper not smaller than 6 AWG copper or equivalent shall be connected between the radio and television equipment grounding electrode and the power grounding electrode system at the building or structure served where separate electrodes are used.

**(K) Electrode Connection.**

Connections to grounding electrodes shall comply with 250.70.

## Part III. Amateur and Citizen Band Transmitting and Receiving Stations — Antenna Systems

### 810.51 Other Sections.

In addition to complying with Part III, antenna systems for amateur and citizen band transmitting and receiving stations shall also comply with 810.11 through 810.15.

### 810.52 Size of Antenna.

Antenna conductors for transmitting and receiving stations shall be of a size not less than given in Table 810.52.

**Table 810.52 Size of Outdoor Antenna Conductors**

| Material | Minimum Size of Conductors (AWG) Where Maximum Open Span Length Is | |
|---|---|---|
| | Less Than 45 m (150 ft) | Over 45 m (150 ft) |
| Hard-drawn copper | 14 | 10 |
| Copper-clad steel, bronze, or other high-strength material | 14 | 12 |

### 810.53 Size of Lead-in Conductors.

Lead-in conductors for transmitting stations shall, for various maximum span lengths, be of a size at least as great as that of conductors for antennas as specified in 810.52.

### 810.54 Clearance on Building.

Antenna conductors for transmitting stations, attached to buildings, shall be firmly mounted at least 75 mm (3 in.) clear of the surface of the building on nonabsorbent insulating supports, such as treated pins or brackets equipped with insulators having not less than 75-mm (3-in.) creepage and airgap distances. Lead-in conductors attached to buildings shall also comply with these requirements.

*Exception: Where the lead-in conductors are enclosed in a continuous metallic shield that is grounded with a conductor in accordance with 810.58, they shall not be required to comply with these requirements. Where grounded, the metallic shield shall also be permitted to be used as a conductor.*

**810.55 Entrance to Building.**

Except where protected with a continuous metallic shield that is grounded with a conductor in accordance with 810.58, lead-in conductors for transmitting stations shall enter buildings by one of the following methods:

1. Through a rigid, noncombustible, nonabsorbent insulating tube or bushing
2. Through an opening provided for the purpose in which the entrance conductors are firmly secured so as to provide a clearance of at least 50 mm (2 in.)
3. Through a drilled window pane

**810.56 Protection Against Accidental Contact.**

Lead-in conductors to radio transmitters shall be located or installed so as to make accidental contact with them difficult.

**810.57 Antenna Discharge Units — Transmitting Stations.**

Each conductor of a lead-in for outdoor antennas shall be provided with an antenna discharge unit or other suitable means that drain static charges from the antenna system.

*Exception No. 1: Where the lead-in is protected by a continuous metallic shield that is grounded with a conductor in accordance with 810.58, an antenna discharge unit or other suitable means shall not be required.*

*Exception No. 2: Where the antenna is grounded with a conductor in accordance with 810.58, an antenna discharge unit or other suitable means shall not be required.*

**810.58 Bonding Conductors and Grounding Electrode Conductors — Amateur and Citizen Band Transmitting and Receiving Stations.**

Bonding conductors and grounding electrode conductors shall comply with 810.58(A) through 810.58(C).

**(A) Other Sections.**

All bonding conductors and grounding electrode conductors for amateur and citizen band transmitting and receiving stations shall comply with 810.21(A) through 810.21(C).

**(B) Size of Protective Bonding Conductor or Grounding Electrode Conductor.**

The protective bonding conductor or grounding electrode conductor for transmitting stations shall be as large as the lead-in but not smaller than 10 AWG copper, bronze, or copper-clad steel.

**(C) Size of Operating Bonding Conductor or Grounding Electrode Conductor.**

The operating bonding conductor or grounding electrode conductor for transmitting stations shall not be less than 14 AWG copper or its equivalent.

**Part IV. Interior Installation — Transmitting Stations**

**810.70 Clearance from Other Conductors.**

All conductors inside the building shall be separated at least 100 mm (4 in.) from the conductors of any electric light, power, or signaling circuit.

*Exception No. 1: As provided in Article 640.*

*Exception No. 2: Where separated from other conductors by raceway or some firmly fixed nonconductor, such as porcelain tubes or flexible tubing.*

### 810.71 General.

Transmitters shall comply with 810.71(A) through (C).

**(A) Enclosing.**

The transmitter shall be enclosed in a metal frame or grille or separated from the operating space by a barrier or other equivalent means, all metallic parts of which are effectively connected to a bonding conductor or grounding electrode conductor.

**(B) Grounding of Controls.**

All external metal handles and controls accessible to the operating personnel shall be effectively connected to an equipment grounding conductor if the transmitter is powered by the premises wiring system or grounded with a conductor in accordance with 810.21.

**(C) Interlocks on Doors.**

All access doors shall be provided with interlocks that disconnect all voltages of over 350 volts between conductors when any access door is opened.

## Article 820 Community Antenna Television and Radio Distribution Systems

### Part I. General

### 820.1 Scope.

This article covers coaxial cable distribution of radio frequency signals typically employed in community antenna television (CATV) systems.

### 820.2 Definitions.

The definitions in this section shall apply only within Articles 820 and 840.

### 820.3 Other Articles.

Circuits and equipment shall comply with 820.3(A)and (B).

**(A) General Requirements.**

The general requirements of Article 800 shall apply.

**(B) Alternate Wiring Methods.**

The wiring methods of Article 830 shall be permitted to substitute for the wiring methods of Article 820.

Informational Note: Use of Article 830 wiring methods will facilitate the upgrading of Article 820 installations to network-powered broadband applications.

### 820.15 Power Limitations.

Coaxial cable shall be permitted to deliver power to equipment that is directly associated with the radio frequency distribution system if the voltage is not over 60 volts and if the current is supplied by a transformer or other device that has power-limiting characteristics.

Power shall be blocked from premises devices on the network that are not intended to be powered via the coaxial cable.

### Part II. Coaxial Cables ~~Outside~~ on the service provider side of the Communication Service Point~~and Entering Buildings~~

### 820.44 Overhead (Aerial) Coaxial Cables.

Overhead (aerial) coaxial cables, prior to the point of grounding, as specified in 820.93, shall comply with 820.44(A) or 800.44.

**(A) On Poles and In-Span, Above Roofs, on Masts, or Between Buildings.**

Where coaxial cables are installed on poles and in-span, above roofs, on masts, or between buildings, they shall comply with 800.44.

**(B) On Buildings.**

Where attached to buildings, coaxial cables shall be securely fastened in such a manner that they will be separated from other conductors in accordance with 820.44(B)(1) and (B)(2).

**(1) Electric Light or Power.**

The coaxial cable shall have a separation of at least 100 mm (4 in.) from electric light, power, Class 1, or non-power-limited fire alarm circuit conductors not in raceway or cable, or shall be permanently separated from conductors of the other system by a continuous and firmly fixed nonconductor in addition to the insulation on the wires.

**(2) Other Communications Systems.**

Coaxial cable shall be installed so that there will be no unnecessary interference in the maintenance of the separate systems. In no case shall the conductors, cables, messenger strand, or equipment of one system cause abrasion to the conductors, cable, messenger strand, or equipment of any other system.

### 820.47 Underground Coaxial Cables Entering Buildings.

Underground coaxial cables entering buildings shall comply with 820.47(A) and 820.47(B).

**(A) Underground Systems with Electric Light, Power, Class 1, or Non–Power-Limited Fire Alarm Circuit Conductors.**

Underground coaxial cables in a duct, pedestal, handhole enclosure, or manhole that contains electric light, power, or Class 1 or non–power-limited fire alarm circuit conductors shall be in a section permanently separated from such conductors by means of a suitable barrier.

**(B) Direct-Buried Cables and Raceways.**

Direct-buried coaxial cable shall be separated at least 300 mm (12 in.) from conductors of any light or power, non–power-limited fire alarm circuit conductors, or Class 1 circuit.

*Exception No. 1: Separation shall not be required where electric service conductors or coaxial cables are installed in raceways or have metal cable armor.*

*Exception No. 2: Separation shall not be required where electric light or power branch-circuit or feeder conductors or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables; or the coaxial cables have metal cable armor or are installed in a raceway.*

### 820.48 Unlisted Cables Entering Buildings.

Unlisted outside plant coaxial cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated at a grounding block. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) to the point of emergence.

## Part III. Protection

### 820.93 Grounding of the Outer Conductive Shield of Coaxial Cables.

Coaxial cables entering buildings or attached to buildings shall comply with 820.93(A) or (B). Where the outer conductive shield of a coaxial cable is grounded, no other protective devices shall be required. For purposes of this section, grounding located at mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a grounding block location to achieve the shortest practicable bonding conductor or grounding electrode conductor helps limit potential differences between CATV and other metallic systems.

**(A) Entering Buildings.**

In installations where the coaxial cable enters the building, the outer conductive shield shall be grounded in accordance with 820.100. The grounding shall be as close as practicable to the point of entrance.

**(B) Terminating Outside of the Building.**

In installations where the coaxial cable is terminated outside of the building, the outer conductive shield shall be grounded in accordance with 820.100. The grounding shall be as close as practicable to the point of attachment or termination.

**(C) Location.**

Where installed, a listed primary protector shall be applied on each community antenna and radio distribution (CATV) cable external to the premises. The listed primary protector shall be located as close as practicable to the entrance point of the cable on either side or integral to the ground block.

**(D) Hazardous (Classified) Locations.**

Where a primary protector or equipment providing the primary protection function is used, it shall not be located in any hazardous (classified) location as defined in 500.5 and 505.5 or in the vicinity of easily ignitible material.

*Exception: As permitted in 501.150, 502.150, and 503.150.*

**Part IV. Grounding Methods**

**820.100 Cable Bonding and Grounding.**

The shield of the coaxial cable shall be bonded or grounded as specified in 820.100(A) and (B).

*Exception: For communications systems using coaxial cable completely contained within the building (i.e., they do not exit the building) or the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere and isolated from outside cable plant, the shield shall be permitted to be grounded by a connection to an equipment grounding conductor as described in 250.118. Connecting to an equipment grounding conductor through a grounded receptacle using a dedicated bonding jumper and a permanently connected listed device shall be permitted. Use of a cord and plug for the connection to an equipment grounding conductor shall not be permitted.*

Informational Note: See 4.8.3.1 of NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems,* for the application of the term *rolling sphere*.

**(A) General Requirements.**

The installation shall be in accordance with 800.100.

**(B) Shield Protection Devices.**

Grounding of a coaxial drop cable shield by means of a protective device that does not interrupt the grounding system within the premises shall be permitted.

**820.103 Equipment Grounding.**

Unpowered equipment and enclosures or equipment powered by the coaxial cable shall be considered grounded where connected to the metallic cable shield.

**Part V. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**820.133 Installation of Coaxial Cables and Equipment.**

Beyond the point of grounding, as defined in 820.93, the coaxial cable installation shall comply with 820.133(A) and (B).

**(A) Separation from Other Conductors.**

**(1) In Raceways, Cable Trays, Boxes, Enclosures, and Cable Routing Assemblies.**

1. *Other Circuits.* Coaxial cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with jacketed cables 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. Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770
4. Communications circuits in compliance with Parts I and IV of Article 805
5. Low-power network-powered broadband communications circuits in compliance with Parts I and V of Article 830

2. *Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm, and Medium-Power Network-Powered Broadband Communications Circuits.* Coaxial cable shall not be placed in any raceway, compartment, outlet box, junction box, or other enclosures with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits.

*Exception No. 1: Coaxial cable shall be permitted to be placed in any raceway, compartment, outlet box, junction box, or other enclosures with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits where 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 coaxial cables by a permanent barrier or listed divider.*

*Exception No. 2: Coaxial cable shall be permitted to be placed in outlet boxes, junction boxes, or similar fittings or compartments with power conductors where such conductors are introduced solely for power supply to the coaxial cable system distribution equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum 6 mm (¼ in.) separation from coaxial cables.*

**(2) Other Applications.**

Coaxial cable shall be separated 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.

*Exception No. 1: Separation shall not be required where either (1) all of the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits are in a raceway, or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC or Type UF cables, or (2) all of the coaxial cables are encased in a raceway.*

*Exception No. 2: Separation shall not be required where the coaxial cables are permanently separated from the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B) Support of Coaxial Cables.**

Raceways shall be used for their intended purpose. Coaxial cables shall not be strapped, taped, or attached by any means to the exterior of any conduit or raceway as a means of support.

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

**820.154 Substitutions of Listed CATV Cables.**

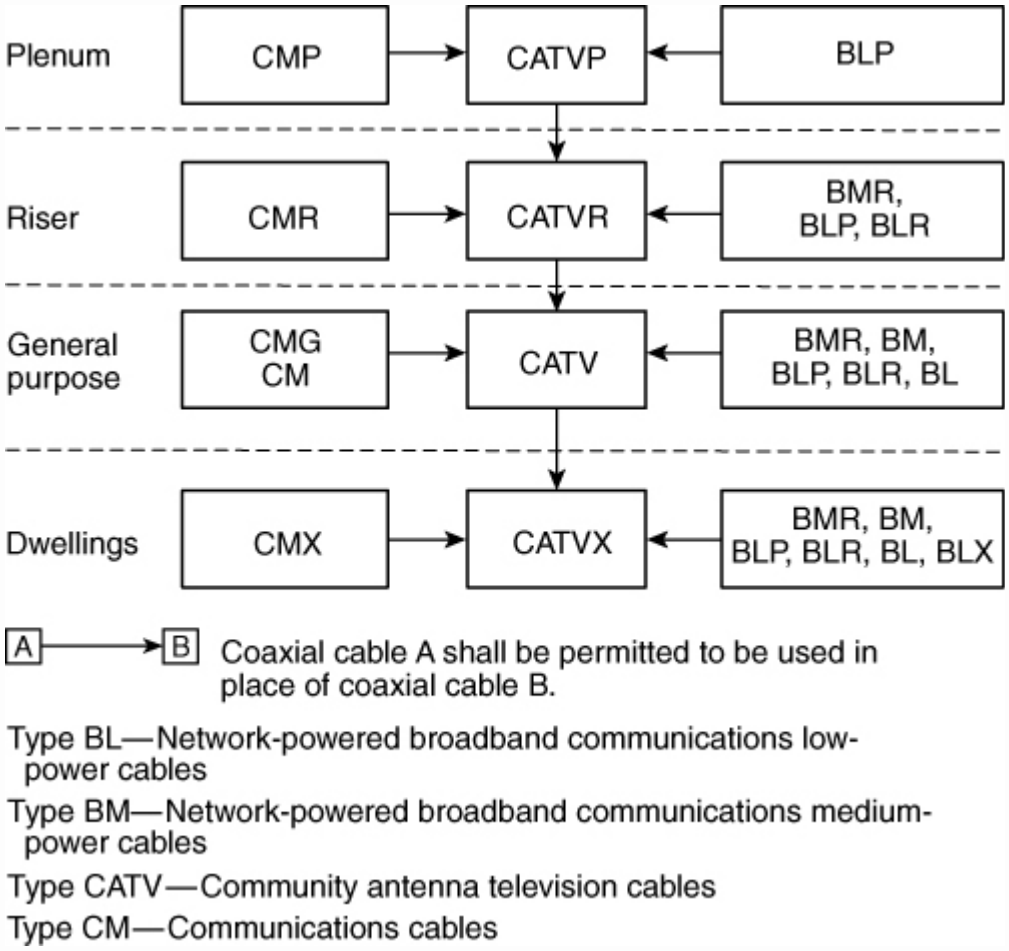
The substitutions for coaxial cables in Table 820.154 and illustrated in Figure 820.154 shall be permitted.

Informational Note: The substitute cables in Table 820.154 and Figure 820.154 are only coaxial-type cables.

**Table 820.154 Coaxial Cable Uses and Permitted Substitutions**

| Cable Type | Permitted Substitutions |
|---|---|
| CATVP | CMP, BLP |
| CATVR | CATVP, CMP, CMR, BMR, BLP, BLR |
| CATV | CATVP, CMP, CATVR, CMR, CMG, CM, BMR, BM, BLP, BLR, BL |
| CATVX | CATVP, CMP, CATVR, CMR, CATV, CMG, CM, BMR, BM, BLP, BLR, BL, BLX |

**Figure 820.154 Cable Substitution Hierarchy.**




## Part VI. Listing Requirements

### 820.179 Coaxial Cables.

Cables shall be listed in accordance with 820.179(A)and marked in accordance with Table 820.179 and 820.179(B). The cable voltage rating shall not be marked on the cable.

Informational Note: Voltage markings on cables could 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.*

**(A) General Requirements.**

The general requirements in 800.179 shall apply.

**(B) Optional Markings.**

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.

**Table 820.179 Coaxial Cable Markings**

| Cable Marking | Type |
|---|---|
| CATVP | CATV plenum cable |
| CATVR | CATV riser cable |
| CATV | CATV cable |
| CATVX | CATV cable, limited use |

# Article 830 Network-Powered Broadband Communications Systems

## Part I. General

### 830.1 Scope.

This article covers network-powered broadband communications systems that provide any combination of voice, audio, video, data, and interactive services through a network interface unit.

Informational Note: A typical basic system configuration includes a cable supplying power and broadband signal to a network interface unit that converts the broadband signal to the component signals. Typical cables are coaxial cable with both broadband signal and power on the center conductor, composite metallic cable with a coaxial member(s) or twisted pair members for the broadband signal and twisted pair members for power, and composite optical fiber cable with a pair of conductors for power. Larger systems may also include network components such as amplifiers that require network power.

### 830.2 Definitions.

The definitions in this section shall apply only within Article 830.

Informational Note: A typical single-family network-powered communications circuit consists of a communications drop or communications service cable and an NIU and includes the communications utility's serving terminal or tap where it is not under the exclusive control of the communications utility.

**Fault Protection Device.**

An electronic device that is intended for the protection of personnel and functions under fault conditions, such as network-powered broadband communications cable short or open circuit, to limit the current or voltage, or both, for a low-power network-powered broadband communications circuit and provide acceptable protection from electric shock.

**Network Interface Unit (NIU).**

A device that converts a broadband signal into component voice, audio, video, data, and interactive services signals and provides isolation between the network power and the premises signal circuits. These devices often contain primary and secondary protectors.

**Network-Powered Broadband Communications Circuit.**

The circuit extending from the communications utility's or service provider's serving terminal or tap up to and including the NIU.

Informational Note: A typical one-family dwelling network-powered communications circuit consists of a communications drop or communications service cable and an NIU and includes the communications utility's serving terminal or tap where it is not under the exclusive control of the communications utility.

### 830.3 Other Articles.

Circuits and equipment shall comply with 830.3(A) through (C).

**(A) General Requirements.**

The general requirements of Article 800 shall apply.

**(B) Output Circuits.**

As appropriate for the services provided, the output circuits derived from the network interface unit shall comply with the requirements of the following:

1. Installations of communications circuits — Part IV of Article 805
2. Installations of community antenna television and radio distribution circuits — Part V of Article 820

   *Exception: Where protection is provided in the output of the NIU 830.90(B)(3) shall apply.*
3. Installations of optical fiber cables — Part V of Article 770
4. Installations of Class 2 and Class 3 circuits — Part III of Article 725
5. Installations of power-limited fire alarm circuits — Part III of Article 760

**(C) Protection Against Physical Damage.**

The requirements of 300.4 shall apply.

**830.15 Power Limitations.**

Network-powered broadband communications systems shall be classified as having low- or medium-power sources as specified in 830.15(1) or (2).

1. Sources shall be classified as defined in Table 830.15.
2. Direct-current power sources exceeding 150 volts to ground, but no more than 200 volts to ground, with the current to ground limited to 10 mA dc, that meet the current and power limitation for medium-power sources in Table 830.15 shall be classified as medium-power sources.

Informational Note: One way to determine compliance with 830.15(2) is listed information technology equipment intended to supply power via a communications network that complies with the requirements for RFT-V circuits as defined in UL 60950-21-2007, *Standard for Safety for Information Technology Equipment — Safety — Part 21: Remote Power Feeding*.

**Table 830.15 Limitations for Network-Powered Broadband Communications Systems**

| Network Power Source | Low | Medium |
|---|---|---|
| Circuit voltage, $V_{max}$ (volts)[1] | 0–100 | 0–150 |
| Power limitation, $VA_{max}$ (volt-amperes)[1] | 250 | 250 |
| Current limitation, $I_{max}$ (amperes)[1] | $1000/V_{max}$ | $1000/V_{max}$ |
| Maximum power rating (volt-amperes) | 100 | 100 |
| Maximum voltage rating (volts) | 100 | 150 |
| Maximum overcurrent protection (amperes)[2] | $100/V_{max}$ | NA |

[1] $V_{max}$, $I_{max}$, and $VA_{max}$ are determined with the current-limiting impedance in the circuit (not bypassed) as follows:

$V_{max}$ — Maximum system voltage regardless of load with rated input applied.

$I_{max}$ — Maximum system current under any noncapacitive load, including short circuit, and with overcurrent protection bypassed if used. $I_{max}$ limits apply after 1 minute of operation.

$VA_{max}$ — Maximum volt-ampere output after 1 minute of operation regardless of load and overcurrent protection bypassed if used.

[2]Overcurrent protection is not required where the current-limiting device provides equivalent current limitation and the current-limiting device does not reset until power or the load is removed.

**830.24 Mechanical Execution of Work.**

The installation shall also conform to 300.4 and 300.11.

**Part II. Cables on the service provider side of the Communication Service Point~~Outside and Entering Buildings~~**

**830.40 Entrance Cables.**

Network-powered broadband communications cables located outside and entering buildings shall comply with 830.40(A) and (B).

**(A) Medium-Power Circuits.**

Medium-power network-powered broadband communications circuits located outside and entering buildings shall be installed using Type BMU, Type BM, or Type BMR network-powered broadband communications medium-power cables.

**(B) Low-Power Circuits.**

Low-power network-powered broadband communications circuits located outside and entering buildings shall be installed using Type BLU or Type BLX low-power network-powered broadband communications cables. Cables shown in Table 830.154 shall be permitted to substitute.

*Exception: Outdoor community antenna television and radio distribution system coaxial cables installed prior to January 1, 2000, and installed in accordance with Article 820, shall be permitted for low-power-type, network-powered broadband communications circuits.*

**830.44 Overhead (Aerial) Cables.**

Overhead (aerial) network-powered broadband communications cables shall comply with 830.44(A) through (F).

**(A) On Poles and In-Span or Above Roofs.**

Where network-powered broadband communications cables are installed on poles and in-span or above roofs, they shall comply with 800.44.

**(B) Clearance from Ground.**

Overhead (aerial) spans of network-powered broadband communications cables shall conform to not less than the following:

1. 2.9 m (9½ ft) — above finished grade, sidewalks, or from any platform or projection from which they might be reached and accessible to pedestrians only
2. 3.5 m (11½ ft) — over residential property and driveways, and those commercial areas not subject to truck traffic
3. 4.7 m (15½ ft) — over public streets, alleys, roads, parking areas subject to truck traffic, driveways on other than residential property, and other land traversed by vehicles such as cultivated, grazing, forest, and orchard

Informational Note: These clearances have been specifically chosen to correlate with ANSI/IEEE C2-2012, *National Electrical Safety Code*, Table 232-1, which provides for clearances of wires, conductors, and cables above ground and roadways, rather than using the clearances referenced in 225.18. Because Article 805 and Article 820 have had no required clearances, the communications industry has used the clearances from the NESC for their installed cable plant.

**(C) Over Pools.**

Clearance of network-powered broadband communications cable in any direction from the water level, edge of pool, base of diving platform, or anchored raft shall comply with those clearances in 680.9.

**(D) Final Spans.**

Final spans of network-powered broadband communications cables without an outer jacket shall be permitted to be attached to the building, but they shall be kept not less than 900 mm (3 ft) from windows that are designed to be opened, doors, porches, balconies, ladders, stairs, fire escapes, or similar locations.

*Exception: Conductors run above the top level of a window shall be permitted to be less than the 900-mm (3-ft) requirement above.*

Overhead (aerial) network-powered broadband communications cables shall not be installed beneath openings through which materials might be moved, such as openings in farm and commercial buildings, and shall not be installed where they obstruct entrance to these building openings.

**(E) Between Buildings.**

Network-powered broadband communications cables extending between buildings or structures, and also the supports or attachment fixtures, shall be identified as suitable for outdoor aerial applications and shall have sufficient strength to withstand the loads to which they may be subjected.

*Exception: Where a network-powered broadband communications cable does not have sufficient strength to be self-supporting, it shall be attached to a supporting messenger cable that, together with the attachment fixtures or supports, shall be acceptable for the purpose and shall have sufficient strength to withstand the loads to which they may be subjected.*

**(F) On Buildings.**

Where attached to buildings, network-powered broadband communications cables shall be securely fastened in such a manner that they are separated from other conductors in accordance with 830.44(F)(1) through (F)(3).

**(1) Electric Light or Power.**

The network-powered broadband communications cable shall have a separation of at least 100 mm (4 in.) from electric light, power, Class 1, or non-power-limited fire alarm circuit conductors not in raceway or cable, or be permanently separated from conductors of the other system by a continuous and firmly fixed nonconductor in addition to the insulation on the wires.

**(2) Other Communications Systems.**

Network-powered broadband communications cables shall be installed so that there will be no unnecessary interference in the maintenance of the separate systems. In no case shall the conductors, cables, messenger strand, or equipment of one system cause abrasion to the conductors, cables, messenger strand, or equipment of any other system.

**(3) Protection from Damage.**

Network-powered broadband communications cables attached to buildings or structures and located within 2.5 m (8 ft) of finished grade shall be protected by enclosures, raceways, or other approved means.

*Exception: A low-power network-powered broadband communications circuit that is equipped with a listed fault protection device, appropriate to the network-powered broadband communications cable used, and located on the network side of the network-powered broadband communications cable shall not be required to be additionally protected by enclosures, raceways, or other approved means.*

**830.47 Underground Network-Powered Broadband Communications Cables Entering Buildings.**

Underground network-powered broadband communications cables entering buildings shall comply with 830.47(A) through 830.47(D).

**(A) Underground Systems with Electric Light and Power, Class 1, or Non–Power-Limited Fire Alarm Circuit Conductors.**

Underground network-powered broadband communications cables in a duct, pedestal, handhole enclosure, or manhole that contains electric light, power conductors, non–power-limited fire alarm circuit

conductors, or Class 1 circuits shall be in a section permanently separated from such conductors by means of a suitable barrier.

**(B) Direct-Buried Cables and Raceways.**

Direct-buried network-powered broadband communications cables shall be separated by at least 300 mm (12 in.) from conductors of any light, power, non–power-limited fire alarm circuit conductors or Class 1 circuit.

*Exception No. 1: Separation shall not be required where electric service conductors or network-powered broadband communications cables are installed in raceways or have metal cable armor.*

*Exception No. 2: Separation shall not be required where electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables; or the network-powered broadband communications cables have metal cable armor or are installed in a raceway.*

**(C) Protection from Physical Damage.**

Direct-buried cable, conduit, or other raceways shall be installed to meet the minimum cover requirements of Table 830.47(C). In addition, direct-buried cables emerging from the ground shall be protected by enclosures, raceways, or other approved means extending from the minimum cover distance required by Table 830.47(C) below grade 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. Types BMU and BLU direct-buried cables emerging from the ground shall be installed in rigid metal conduit (RMC), intermediate metal conduit (IMC), rigid nonmetallic conduit, or other approved means extending from the minimum cover distance required by Table 830.47(C) below grade to the point of entrance.

*Exception: A low-power network-powered broadband communications circuit that is equipped with a listed fault protection device, appropriate to the network-powered broadband communications cable used, and located on the network side of the network-powered broadband communications cable being protected.*

**Table 830.47(C) Network-Powered Broadband Communications Systems Minimum Cover Requirements (*Cover* is the shortest distance measured between a point on the top surface of any direct-buried cable, conduit, or other raceway and the top surface of finished grade, concrete, or similar cover.)**

| Location of Wiring Method or Circuit | Direct Burial Cables | | Rigid Metal Conduit (RMC) or Intermediate Metal Conduit (IMC) | | Nonmetallic Raceways Listed for Direct Burial; Without Concrete Encasement or Other Approved Raceways | |
|---|---|---|---|---|---|---|
| | mm | in. | mm | in. | mm | in. |
| All locations not specified below | 450 | 18 | 150 | 6 | 300 | 12 |
| In trench below 50-mm (2-in.) thick concrete or equivalent | 300 | 12 | 150 | 6 | 150 | 6 |
| Under a building (in raceway only) | 0 | 0 | 0 | 0 | 0 | 0 |
| Under minimum of 100-mm (4-in.) thick concrete exterior slab with no vehicular traffic and the slab extending not less than 150 mm (6 in.) beyond the underground installation | 300 | 12 | 100 | 4 | 100 | 4 |

| Location of Wiring Method or Circuit | Direct Burial Cables | | Rigid Metal Conduit (RMC) or Intermediate Metal Conduit (IMC) | | Nonmetallic Raceways Listed for Direct Burial; Without Concrete Encasement or Other Approved Raceways | |
|---|---|---|---|---|---|---|
| | mm | in. | mm | in. | mm | in. |
| One- and two-family dwelling driveways and outdoor parking areas and used only for dwelling-related purposes | 300 | 12 | 300 | 12 | 300 | 12 |

Notes:

1. Raceways approved for burial only where concrete encased shall require a concrete envelope not less than 50 mm (2 in.) thick.

2. Lesser depths shall be permitted where cables rise for terminations or splices or where access is otherwise required.

3. Where solid rock is encountered, all wiring shall be installed in 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.

4. Low-power network-powered broadband communications circuits using directly buried community antenna television and radio distribution system coaxial cables that were installed outside and entering buildings prior to January 1, 2000, in accordance with Article 820 shall be permitted where buried to a minimum depth of 300 mm (12 in.).

**(D) Pools.**

Cables located under the pool or within the area extending 1.5 m (5 ft) horizontally from the inside wall of the pool shall meet those clearances and requirements specified in 680.11.

**Part III. Protection**

**830.90 Primary Electrical Protection.**

**(A) Application.**

Primary electrical protection shall be provided on all network-powered broadband communications conductors that are neither grounded nor interrupted and are run partly or entirely in aerial cable not confined within a block. Also, primary electrical protection shall be provided on all aerial or underground network-powered broadband communications conductors that are neither grounded nor interrupted and are located within the block containing the building served so as to be exposed to lightning or accidental contact with electric light or power conductors operating at over 300 volts to ground.

*Exception: Primary electrical protection shall not be required on the network-powered broadband communications conductors where electrical protection is provided on the derived circuit(s) (output side of the NIU) in accordance with 830.90(B)(3).*

Informational Note No. 1: On network-powered broadband communications conductors not exposed to lightning or accidental contact with power conductors, providing primary electrical protection in accordance with this article helps protect against other hazards, such as ground potential rise caused by power fault currents, and above-normal voltages induced by fault currents on power circuits in proximity to the network-powered broadband communications conductors.

Informational Note No. 2: Network-powered broadband communications circuits are considered to have a lightning exposure unless one or more of the following conditions exist:

1. Circuits in large metropolitan areas where buildings are close together and sufficiently high to intercept lightning.
2. Areas having an average of five or fewer thunderstorm days each year and earth resistivity of less than 100 ohm-meters. Such areas are found along the Pacific coast.

Informational Note No. 3: For information on lightning protection systems, see NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*.

**(1) Fuseless Primary Protectors.**

Fuseless-type primary protectors shall be permitted where power fault currents on all protected conductors in the cable are safely limited to a value no greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor.

**(2) Fused Primary Protectors.**

Where the requirements listed in 830.90(A)(1) are not met, fused-type primary protectors shall be used. Fused-type primary protectors shall consist of an arrester connected between each conductor to be protected and ground, a fuse in series with each conductor to be protected, and an appropriate mounting arrangement. Fused primary protector terminals shall be marked to indicate line, instrument, and ground, as applicable.

**(B) Location.**

The location of the primary protector, where required, shall comply with 830.90(B)(1), (B)(2), or (B)(3):

1. A listed primary protector shall be applied on each network-powered broadband communications cable external to and on the network side of the network interface unit.
2. The primary protector function shall be an integral part of and contained in the network interface unit. The network interface unit shall be listed as being suitable for application with network-powered broadband communications systems and shall have an external marking indicating that it contains primary electrical protection.
3. The primary protector(s) shall be provided on the derived circuit(s) (output side of the NIU), and the combination of the NIU and the protector(s) shall be listed as being suitable for application with network-powered broadband communications systems.

A primary protector, whether provided integrally or external to the network interface unit, shall be located as close as practicable to the point of entrance.

For purposes of this section, a network interface unit and any externally provided primary protectors located at mobile home service equipment located in sight from and not more than 9.0 m (30 ft) from the exterior wall of the mobile home it serves, or at a mobile home disconnecting means grounded in accordance with 250.32 and located in sight from and not more than 9.0 m (30 ft) from the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a network interface unit and primary protector location to achieve the shortest practicable primary protector bonding conductor or grounding electrode conductor helps limit potential differences between communications circuits and other metallic systems.

**(C) Hazardous (Classified) Locations.**

The primary protector or equipment providing the primary protection function shall not be located in any hazardous (classified) location as defined in 500.5 and 505.5 or in the vicinity of easily ignitible material.

*Exception: As permitted in 501.150, 502.150, and 503.150.*

**Part IV. Grounding Methods**

**830.93 Grounding or Interruption of Metallic Members of Network-Powered Broadband Communications Cables.**

Network-powered communications cables entering buildings or attaching to buildings shall comply with 830.93(A) or (B).

For purposes of this section, grounding located at mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a grounding location to achieve the shortest practicable bonding conductor or grounding electrode conductor helps limit potential differences between the network-powered broadband communications circuits and other metallic systems.

**(A) Entering Buildings.**

In installations where the network-powered communications cable enters the building, the shield shall be grounded in accordance with 800.100, and metallic members of the cable not used for communications or powering shall be grounded in accordance with 800.100 or interrupted by an insulating joint or equivalent device. The grounding or interruption shall be as close as practicable to the point of entrance.

**(B) Terminating Outside of the Building.**

In installations where the network-powered communications cable is terminated outside of the building, the shield shall be grounded in accordance with 800.100, and metallic members of the cable not used for communications or powering shall be grounded in accordance with 800.100 or interrupted by an insulating joint or equivalent device. The grounding or interruption shall be as close as practicable to the point of attachment of the NIU.

**Part V. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**830.133 Installation of Network-Powered Broadband Communications Cables and Equipment.**

Cable and equipment installations within buildings shall comply with 830.133(A) and (B), as applicable.

**(A) Separation of Conductors.**

**(1) In Raceways, Cable Trays, Boxes, Enclosures, and Cable Routing Assemblies.**

1. *Low- and Medium-Power Network-Powered Broadband Communications Circuit Cables.* Low- and medium-power network-powered broadband communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly.

2. *Low-Power Network-Powered Broadband Communications Circuit Cables with Other Circuits.* Low-power network-powered broadband communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with jacketed cables of any of the following circuits:

    1. Class 2 and Class 3 remote-control, signaling, and power-limited circuits in compliance with 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 IV of Article 805
    4. Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770
    5. Community antenna television and radio distribution systems in compliance with Parts I and V of Article 820

3. *Medium-Power Network-Powered Broadband Communications Circuit Cables with Optical Fiber Cables and Other Communications Cables*. Medium-power network-powered broadband communications cables shall not be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with conductors of any of the following circuits:

    1. Communications circuits in compliance with Parts I and IV of Article 805
    2. Conductive optical fiber cables in compliance with Parts I and V of Article 770
    3. Community antenna television and radio distribution systems in compliance with Parts I and V of Article 820

4. *Medium-Power Network-Powered Broadband Communications Circuit Cables with Other Circuits*. Medium-power network-powered broadband communications cables

shall not be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with conductors of any of the following circuits:

1. Class 2 and Class 3 remote-control, signaling, and power-limited circuits in compliance with Parts I and III of Article 725
2. Power-limited fire alarm systems in compliance with Parts I and III of Article 760

5. *Electric Light, Power, Class 1, Non–Powered Broadband Communications Circuit Cables.* Network-powered broadband communications cable shall not be placed in any raceway, cable tray, compartment, outlet box, junction box, or similar fittings with conductors of electric light, power, Class 1, or non–power-limited fire alarm circuit cables.

*Exception No. 1: Where all of the conductors of electric light, power, Class 1, non–power-limited fire alarm circuits are separated from all of the network-powered broadband communications cables by a permanent barrier or listed divider.*

*Exception No. 2: Power circuit conductors in outlet boxes, junction boxes, or similar fittings or compartments where such conductors are introduced solely for power supply to the network-powered broadband communications system distribution equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum 6 mm (¼ in.) separation from network-powered broadband communications cables.*

**(2) Other Applications.**

Network-powered broadband communications cable shall be separated at least 50 mm (2 in.) from conductors of any electric light, power, Class 1, and non–power-limited fire alarm circuits.

*Exception No. 1: Separation shall not be required where: (1) all of the conductors of electric light, power, Class 1, and non–power-limited fire alarm circuits are in a raceway, or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC, or Type UF cables, or (2) all of the network-powered broadband communications cables are encased in a raceway.*

*Exception No. 2: Separation shall not be required where the network-powered broadband communications cables are permanently separated from the conductors of electric light, power, Class 1, and non–power-limited fire alarm circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B) Support of Network-Powered Broadband Communications Cables.**

Raceways shall be used for their intended purpose. Network-powered broadband communications cables shall not be strapped, taped, or attached by any means to the exterior of any conduit or raceway as a means of support.

### 830.154 Substitutions of Network-Powered Broadband Communications System Cables.

The substitutions for network-powered broadband system cables listed in Table 830.154 shall be permitted.

**Table 830.154 Cable Substitutions**

| Cable Type | Permitted Cable Substitutions |
|---|---|
| BM | BMR |
| BLP | CMP, CL3P |
| BLR | CMP, CL3P, CMR, CL3R, BLP, BMR |
| BL | CMP, CMR, CM, CMG, CL3P, CL3R, CL3, BMR, BM, BLP, BLR |
| BLX | CMP, CMR, CM, CMG, CMX, CL3P, CL3R, CL3, CL3X, BMR, BM, BLP, BRP, BL |

### 830.160 Bends.

Bends in network broadband cable shall be made so as not to damage the cable.

## Part VI. Listing Requirements

### 830.179 Network-Powered Broadband Communications Equipment and Cables.

Network-powered broadband communications equipment and cables shall be listed and marked in accordance with 830.179(A) through (D).

*Exception No. 1: This listing requirement shall not apply to community antenna television and radio distribution system coaxial cables that were installed prior to January 1, 2000, in accordance with Article 820 and are used for low-power network-powered broadband communications circuits.*

*Exception No. 2: Substitute cables for network-powered broadband communications cables shall be permitted as shown in Table 830.154.*

**(A) General Requirements.**

The general requirements in 800.179 shall apply.

**(B) Network-Powered Broadband Communications Medium-Power Cables.**

Network-powered broadband communications medium-power cables shall be factory-assembled cables consisting of a jacketed coaxial cable, a jacketed combination of coaxial cable and multiple individual conductors, or a jacketed combination of an optical fiber cable and multiple individual conductors. The insulation for the individual conductors shall be rated for 300 volts minimum. Cables intended for outdoor use shall be listed as suitable for the application. Cables shall be marked in accordance with 310.8. Type BMU cables shall be jacketed and listed as being suitable for outdoor underground use.

**(C) Network-Powered Broadband Communication Low-Power Cables.**

Network-powered broadband communications low-power cables shall be factory-assembled cables consisting of a jacketed coaxial cable, a jacketed combination of coaxial cable and multiple individual conductors, or a jacketed combination of an optical fiber cable and multiple individual conductors. The insulation for the individual conductors shall be rated for 300 volts minimum. Cables intended for outdoor use shall be listed as suitable for the application. Cables shall be marked in accordance with 310.8. Type BLU cables shall be jacketed and listed as being suitable for outdoor underground use.

**(D) Optional Markings.**

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.

# Article 840 Premises-Powered Broadband Communications Systems

## Part I. General

### 840.1 Scope.

This article covers premises-powered broadband communications systems.

Informational Note: A typical basic system configuration consists of an optical fiber, twisted pair, or coaxial cable to the premises supplying a broadband signal to a network terminal that converts the broadband signal into component electrical signals, such as traditional telephone, video, high-speed Internet, and interactive services. Powering for the network terminal and network devices is typically accomplished through a premises power supply that might be built into the network terminal or provided as a separate unit. In order to provide communications in the event of a power interruption, a battery backup unit or an uninterruptible power supply (UPS) is typically part of the powering system.

### 840.2 Definitions.

The definitions in 805.2 and 820.2 shall apply. The definitions in this section shall apply only within Article 840.

**Broadband.**

Wide bandwidth data transmission that transports multiple signals, protocols, and traffic types over various media types.

**Network Terminal.**

A device that converts network-provided signals (optical, electrical, or wireless) into component signals, including voice, audio, video, data, wireless, optical, and interactive services, and is considered a network device on the premises that is connected to a communications service provider and is powered at the premises.

**Premises Communications Circuit.**

The circuit that extends voice, audio, video, data, interactive services, telegraph (except radio), and outside wiring for fire alarm and burglar alarm from the service provider's network terminal to the customer's communications equipment up to and including terminal equipment, such as a telephone, a fax machine, or an answering machine.

**Premises Community Antenna Television (CATV) Circuit.**

The circuit that extends community antenna television (CATV) systems for audio, video, data, and interactive services from the service provider's network terminal to the appropriate customer equipment.

**Premises-Powered.**

Using power provided locally from the premises.

### 840.3 Other Articles.

Circuits and equipment shall comply with 840.3(A) through (C).

**(A) General Requirements.**

The general requirements of Article 800 shall apply.

**(B) Output Circuits.**

As appropriate for the services provided, the output circuits derived from the network terminal shall comply with the requirements of the following:

1. Installations of communications circuits — Part IV of Article 805
2. Installations of premises (within buildings) community antenna television and radio distribution circuits — Part V of Article 820
3. Installations of optical fiber cables — Part V of Article 770
4. Installations of Class 2 and Class 3 circuits — Part III of Article 725

   Informational Note: See 725.121 for information on the classification of information technology equipment circuits.
5. Installations of power-limited fire alarm circuits — Part III of Article 760

**(C) Electrical Classification of Data Circuits and Cables.**

Sections 725.139(D)(1) and 805.133(A)(1)(b) shall apply to the electrical classification of Class 2 and Class 3 circuits in the same cable with communications circuits.

### 840.24 Mechanical Execution of Work.

The requirements of 770.24 and 800.24 shall apply.

### 840.25 Abandoned Cables.

The requirements of 770.25 and 800.25 shall apply.

### 840.26 Spread of Fire or Products of Combustion.

The requirements of 770.26 and 800.26 shall apply.

## Part II. Cables on the service provider side of the Communication Service Point ~~Outside and Entering Buildings~~

### 840.47 Underground Wires and Cables Entering Buildings.

Underground wires and cables entering buildings shall comply with 840.47(A) through (C).

**(A) Optical Fiber Cables.**

**(1) Class 1 or Non–Power-Limited Fire Alarm Circuits.**

Underground conductive optical fiber cables entering buildings with electric light, power, Class 1, or non–power-limited fire alarm circuit conductors in a raceway, handhole enclosure, or manhole shall be located in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier.

**(2) Direct-Buried Cables.**

Direct-buried conductive optical fiber cables shall be separated by at least 300 mm (12 in.) from conductors of any electric light, power, or non–power-limited fire alarm circuit conductors or Class 1 circuit.

*Exception No. 1: Separation shall not be required where the electric service conductors are installed in raceways or have metal cable armor.*

*Exception No. 2: Separation shall not be required where the electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables.*

**(3) Mechanical Protection.**

Direct-buried cable, conduit, or other raceway shall be installed to have a minimum cover of 150 mm (6 in.).

**(B) Communications Wires and Cables.**

Installations of communications wires and multipair communications cables shall comply with 805.47.

**(C) Coaxial Cables.**

Installations of coaxial cables shall comply with 820.47.

### 840.48 Unlisted Wires and Cables Entering Buildings.

Installations of unlisted cables entering buildings shall comply with 840.48(A), (B), or (C), as applicable.

**(A) Optical Fiber Cables.**

Installations of unlisted optical fiber cables entering buildings shall comply with 770.48.

**(B) Communications Wires and Cables.**

Installations of unlisted communications wires and unlisted multipair communications cables entering buildings shall comply with 805.48.

**(C) Coaxial Cables.**

Installations of unlisted coaxial cables entering buildings shall comply with 820.48.

## Part III. Protection

### 840.90 Protective Devices.

The requirements of 805.90 shall apply.

### 840.93 Grounding or Interruption.

Non–current-carrying metallic members of optical fiber cables, communications cables, or coaxial cables entering buildings or attaching to buildings shall comply with 840.93(A), (B), or (C), respectively.

### (A) Non–Current-Carrying Metallic Members of Optical Fiber Cables.

Non–current-carrying metallic members of optical fiber cables entering a building or terminating on the outside of a building shall comply with 770.93(A) or (B).

### (B) Communications Cables.

The grounding or interruption of the metallic sheath of communications cable shall comply with 805.93.

### (C) Coaxial Cables.

Where the network terminal is installed inside or outside of the building, with coaxial cables terminating at the network terminal, and is either entering, exiting, or attached to the outside of the building, 820.93 shall apply.

## 840.94 Premises Circuits Leaving the Building.

Where circuits leave the building to power equipment remote to the building or outside the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere, 805.90 and 805.93 shall apply.

Informational Note: See NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, for the theory of the term *rolling sphere*.

## Part IV. Grounding Methods

## 840.101 Premises Circuits Not Leaving the Building.

Where the network terminal is served by a nonconductive optical fiber cable, or where any non–current-carrying metallic member of a conductive optical fiber cable is interrupted by an insulating joint or equivalent device, and circuits that terminate at the network terminal are completely contained within the building (i.e., they do not exit the building), 840.101(A), (B), or (C) shall apply, as applicable.

### (A) Coaxial Cable Shield Grounding.

The shield of coaxial cable shall be grounded by one of the following:

1. Any of the methods described in 820.100 or 800.106
2. A fixed connection to an equipment grounding conductor as described in 250.118
3. Connection to the network terminal grounding terminal provided that the terminal is connected to ground by one of the methods described in 820.100 or 800.106, or to an equipment grounding conductor through a listed grounding device that will retain the ground connection if the network terminal is unplugged

### (B) Communications Circuit Grounding.

Communications circuits shall not be required to be grounded.

### (C) Network Terminal Grounding.

The network terminal shall not be required to be grounded unless required by its listing. If the coaxial cable shield is separately grounded as described in 840.101(A)(1) or 840.101(A)(2), the use of a cord and plug for the connection to the network terminal grounding connection shall be permitted.

Informational Note: Where required to be grounded, a listed device that extends the equipment grounding conductor from the receptacle to the network terminal equipment grounding terminal is permitted. Sizing of the extended equipment grounding conductor is covered in Table 250.122.

## 840.102 Premises Circuits Leaving the Building.

Where circuits leave the building to power equipment remote to the building or outside the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere, the installation of communications wires and cables shall comply with 800.100 and 800.106, and the installation of coaxial cables shall comply with 820.100 and 800.106.

Informational Note: See NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, for the application of the term *rolling sphere*.

## Part V. Wiring on the service provider side of the Communication Service Point ~~Installation Methods Within Buildings~~

### 840.133 Installation of Optical Fibers and Electrical Conductors.

The requirements of 770.133 shall apply.

## Part VI. Premises Powering of Communications Equipment over Communications Cables

### 840.160 Powering Circuits.

Communications cables listed in accordance with 805.179, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment listed in accordance with 805.170. The power source shall be listed in accordance with 840.170(G). Installation of the listed 4-pair communications cables for a communications circuit or installation where 4-pair communications cables are substituted for Class 2 and Class 3 cables in accordance with 725.154(A) shall comply with 725.144.

*Exception: Installing communications cables in compliance with 725.144 shall not be required for listed 4-pair communications cables where the rated current of the power source does not exceed 0.3 amperes in any conductor 24 AWG or larger.*

Informational Note: A typical communications cable for this application is a 4-pair cable sometimes referred to as Category 5e (or higher) LAN cable or balanced twisted pair cable. These types of cables are often used to provide Ethernet- and Power over Ethernet (PoE)–type services. A large number of such powering cables bundled together can cause overheating of the wiring if not controlled as described in Table 725.144.

## Part VII. Listing Requirements

### 840.170 Equipment and Cables.

Premises-powered broadband communications systems equipment and cables shall comply with 840.170(A) through (H).

#### (A) Network Terminal.

The network terminal and applicable grounding means shall be listed for application with premises-powered broadband communications systems.

Informational Note No. 1: One way to determine applicable requirements is to refer to ANSI/UL 60950-1-2014, *Standard for Safety of Information Technology Equipment*; ANSI/UL 498A-2015, *Current Taps and Adapters*; ANSI/UL 467-2013, *Grounding and Bonding Equipment;* or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements*.

Informational Note No. 2: There are no requirements on the network terminal and its grounding methodologies except for those covered by the listing of the product.

#### (B) Optical Fiber Cables.

Optical fiber cables shall be listed in accordance with 770.179(A) through (D) and shall be marked in accordance with Table 770.179.

#### (C) Communications Equipment.

Communications equipment shall be listed in accordance with 805.170.

#### (D) Cable Routing Assemblies and Communications Raceways.

Cable routing assemblies and communications raceways shall be listed in accordance with 800.182.

#### (E) Premises Communications Wires and Cables.

Communications wires and cable shall be listed and marked in accordance with 805.179.

#### (F) Premises Community Antenna Television (CATV) Circuits.

Premises community antenna television (CATV) coaxial cables connecting to the network terminal shall be listed in accordance with 820.179. Applicable grounding means shall be listed for application with premises-powered broadband communications systems.

#### (G) Power Source.

The power source for circuits intended to provide power over communications cables to remote equipment shall be limited in accordance with Table 11(B) in Chapter 9 for voltage sources up to 60 V dc and be listed as specified in either of the following:

1. A power source shall be listed as specified in 725.121(A)(1), (A)(2), (A)(3), or (A)(4). The power sources shall not have the output connections paralleled or otherwise interconnected unless listed for such interconnection.
2. A power source shall be listed as communications equipment for limited-power circuits.

Informational Note: One way to determine applicable requirements is to refer to ANSI/UL 60950-1-2014, *Standard for Safety of Information Technology Equipment-Safety — Part 1*; or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements*. Typically, such circuits are used to interconnect equipment for the purpose of exchanging information (data).

**(H) Accessory Equipment.**

Communications accessory equipment and/or assemblies shall be listed for application with premises-powered communications systems.

Informational Note: One way to determine applicable requirements is to refer to ANSI/UL 1863-2004, *Communications-Circuit Accessories*.

## Public Input No. 3232-NFPA 70-2020 [ Sections Part II., 840.47, 840.48, Part III. ]

**Sections Part II., 840.47, 840.48, Part III.**

**Part II.** Cables ~~Outside and Entering Buildings~~ on the Service Provider Side of the Communication Service Point

**840.47** Underground Wires and Cables Entering Buildings.

Underground wires and cables ~~entering buildings~~ on the Service Provider Side shall comply with 840.47(A) through (C).

**(A)** Optical Fiber Cables.

**(1)** Class 1 or Non–Power-Limited Fire Alarm Circuits.

Underground conductive optical fiber cables entering buildings with electric light, power, Class 1, or non–power-limited fire alarm circuit conductors in a raceway, handhole enclosure, or manhole shall be located in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier.

**(2)** Direct-Buried Cables.

Direct-buried conductive optical fiber cables shall be separated by at least 300 mm (12 in.) from conductors of any electric light, power, or non–power-limited fire alarm circuit conductors or Class 1 circuit.

*Exception No. 1: Separation shall not be required where the electric service conductors are installed in raceways or have metal cable armor.*

*Exception No. 2: Separation shall not be required where the electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables.*

**(3)** Mechanical Protection.

Direct-buried cable, conduit, or other raceway shall be installed to have a minimum cover of 150 mm (6 in.).

**(B)** Communications Wires and Cables.

Installations of communications wires and multipair communications cables shall comply with 805.47.

**(C)** Coaxial Cables.

Installations of coaxial cables shall comply with 820.47.

**840.48** Unlisted Wires and Cables Entering Buildings.

Installations of unlisted cables entering buildings shall comply with 840.48(A), (B), or (C), as applicable.

**(A)** Optical Fiber Cables.

Installations of unlisted optical fiber cables entering buildings shall comply with 770.48.

**(B)** Communications Wires and Cables.

Installations of unlisted communications wires and unlisted multipair communications cables entering buildings shall comply with 805.48.

**(C)** Coaxial Cables.

Installations of unlisted coaxial cables entering buildings shall comply with 820.48.

**Part III.** Protection

## Additional Proposed Changes

| File Name | Description | Approved |
|---|---|---|
| Chapter_8_-_2020-09-03_CC_Task_Group.pdf | | |

## Statement of Problem and Substantiation for Public Input

This public input is being submitted by a Correlating Committee Task Group to improve the correlation between Chapter 7 and 8. At the present time there are significant correlation issues with regards to what constitutes an installation in Chapter 7 and what constitutes an installation in Chapter 8.

Previously a Correlating Committee Task Group was formed to review Chapter 8 and to make suggested modifications. This Chapter 8 task group has submitted a public input to define Communication Service point and has submitted a public input to determine where the actual service point exists within communication systems. It is very difficult for an AHJ to determine where there inspection authority begins and this work will help provide clarity and usability.

This public input follows up on the work of that specific task group and provides editorial revisions to further improve on that work. Public inputs are being submitted to change Titles and certain wording to reflect what wiring is on the customer side of the Communication Service Point and what wiring is on the communication utility or service provider side of this point.

The Correlating Committee Task Group is a long range planning committee that is seeking to make improvement over the next two to three cycles. The Task Group is made up of the following members: Alan Manche, Donny Cook, Randy Ivans, Ernie Gallo, and Thomas Domitrovich.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 3223-NFPA 70-2020 [Sections Part IV., 805.133] | |
| Public Input No. 3224-NFPA 70-2020 [Sections 800.27, Part II., 800.44] | |
| Public Input No. 3225-NFPA 70-2020 [Part IV.] | |
| Public Input No. 3226-NFPA 70-2020 [Section No. 800.154] | |
| Public Input No. 3227-NFPA 70-2020 [Part II.] | |
| Public Input No. 3229-NFPA 70-2020 [Part V.] | |
| Public Input No. 3230-NFPA 70-2020 [Part II.] | |
| Public Input No. 3231-NFPA 70-2020 [Sections Part V., 830.133] | |
| Public Input No. 3233-NFPA 70-2020 [Part V.] | |
| Public Input No. 3223-NFPA 70-2020 [Sections Part IV., 805.133] | |
| Public Input No. 3224-NFPA 70-2020 [Sections 800.27, Part II., 800.44] | |
| Public Input No. 3226-NFPA 70-2020 [Section No. 800.154] | |
| Public Input No. 3227-NFPA 70-2020 [Part II.] | |
| Public Input No. 3230-NFPA 70-2020 [Part II.] | |
| Public Input No. 3233-NFPA 70-2020 [Part V.] | |

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## Chapter 8 Communications Systems

# Article 800 General Requirements for Communications Systems

### Part I. General

#### 800.1 Scope.

This article covers general requirements for communications systems. These general requirements apply to communications circuits, community antenna television and radio distribution systems, network-powered broadband communications systems, and premises-powered broadband communications systems, unless modified by Articles 805, 820, 830, or 840.

Informational Note No. 1: See 90.2(B)(4) for installations of circuits and equipment that are not covered.

Informational Note No. 2: For further information for remote control, signaling, and power-limited circuits, see Article 725.

Informational Note No. 3: For further information for fire alarm systems, see Article 760.

#### 800.2 Definitions.

The definitions in Part I of Article 100 shall apply throughout Chapter 8. The definitions in 800.2 shall apply only within Chapter 8.

**Abandoned Cable.**

Cable that is not terminated at equipment or is not identified for future use with a tag.

**Block.**

A square or portion of a city, town, or village enclosed by streets and including the alleys so enclosed, but not any street.

**Cable Sheath.**

A covering over the conductor assembly that may include one or more metallic members, strength members, or jackets.

**Communications Circuit.**

The circuit that extends service from the communications utility or service provider up to and including the customer's communications equipment.

**Communications Service Provider.**

An organization, business, or individual that offers communications service to others.

**Exposed (to Accidental Contact).**

A circuit in such a position that, in case of failure of supports or insulation, contact with another circuit may result.

Informational Note: See Part I of Article 100 for two other definitions of Exposed: *Exposed (as applied to live parts)* and *Exposed (as applied to wiring methods)*.

**Point of Entrance.**

The point within a building at which the wire or cable emerges from an external wall or from a concrete floor slab.

**Premises.**

The land and buildings of a user located on the user side of the utility-user ~~network point of demarcation~~.

#### 800.3 Other Articles.

Only those sections of Chapters 1 through 7 referenced in Chapter 8 shall apply to Chapter 8.

**(A) Hazardous (Classified) Locations.**

Circuits and equipment installed in a location that is classified in accordance with 500.5 and 505.5 shall comply with the applicable requirements of Chapter 5.

**(B) Wiring in Ducts for Dust, Loose Stock, or Vapor Removal.**

The requirements of 300.22(A) shall apply.

**(C) Equipment in Other Space Used for Environmental Air.**

The requirements of 300.22(C)(3) shall apply.

**(D) Installation and Use.**

The requirements of 110.3(B) shall apply.

**(E) Optical Fiber Cable.**

Where optical fiber cable is used to provide a communications circuit within a building, Article 770 shall apply.

**(F) Other Communications Systems.**

As appropriate for the system involved, communications systems shall also comply with the requirements of the following:

1. Communications circuits — Article 805
2. Radio and television equipment — Article 810
3. Community antenna television and radio distribution systems — Article 820
4. Network-powered broadband communications systems — Article 830
5. Premises-powered broadband communications systems — Article 840

**(G) Reconditioned Equipment.**

The requirements of 110.21(A)(2) shall apply.

### 800.21 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.

### 800.24 Mechanical Execution of Work.

Circuits and equipment 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 also conform to 300.4 and 300.11. 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 805.170(C).

Informational Note No. 1: Accepted industry practices are described in ANSI/TIA-568.1- D-2015, *Commercial Building Telecommunications Infrastructure Standard;* ANSI/TIA-569-D-2015, *Telecommunications Pathways and Spaces;* ANSI/TIA-570-C-2012, *Residential Telecommunications Infrastructure Standard;* ANSI/TIA-1005-A-2012, *Telecommunications Infrastructure Standard for Industrial Premises;* ANSI/ TIA-1179-2010, *Healthcare Facility Telecommunications Infrastructure Standard;* ANSI/TIA-4966-2014, *Telecommunications Infrastructure Standard for Educational Facilities;* and other ANSI-approved installation standards.

Informational Note No. 2: 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. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of wire and cable properties.

### 800.25 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.

### 800.26 Spread of Fire or Products of Combustion.

Installations of cables, communications raceways, cable routing assemblies 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 penetrations of cables, communications raceways, and cable routing assemblies 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 800.26 can be found in building codes, fire resistance directories, and product listings.

### 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.

## Part II. Wires and Cables Outside and on the service provider side of the Communication Service Point ~~Entering Buildings~~

### 800.44 Overhead (Aerial) Wires and Cables.

Overhead (aerial) wires and cables on the service provider side of the Communication Service Point ~~entering buildings~~ shall comply with 800.44(A) through (D).

Informational Note: For additional information regarding overhead (aerial) wires and cables, see ANSI C2-2017, *National Electrical Safety Code, Part 2 Safety Rules for Overhead Lines.*

#### (A) On Poles and In-Span.

Where wires and cables and electric light or power conductors are supported by the same pole or are run parallel to each other in-span, the conditions described in 800.44(A)(1) through (A)(4) shall be met.

#### (1) Relative Location.

Where practicable, the wires and cables shall be located below the electric light or power conductors.

#### (2) Attachment to Cross-Arms.

Wires and cables shall not be attached to a cross-arm that carries electric light or power conductors.

#### (3) Climbing Space.

The climbing space through wires and cables shall comply with the requirements of 225.14(D).

#### (4) Clearance.

Supply service drops and sets of overhead service conductors of 0 volts to 750 volts running above and parallel to communications and CATV type coaxial service drops shall have a minimum separation of 300 mm (12 in.) at any point in the span, including the point of and at their attachment to the building, provided that the ungrounded conductors are insulated and that a clearance of not less than 1.0 m (40 in.) is maintained between the two services at the pole.

#### (B) Above Roofs.

Communications wires and cables and CATV type coaxial cables shall have a vertical clearance of not less than 2.5 m (8 ft) from all points of roofs above which they pass.

*Exception No. 1: Communications wires and cables and CATV type coaxial cables shall not be required to have a vertical clearance of not less than 2.5 m (8 ft) above auxiliary buildings, such as garages and the like.*

*Exception No. 2: A reduction in clearance above only the overhanging portion of the roof to not less than 450 mm (18 in.) shall be permitted if (1) not more than 1.2 m (4 ft) of communications service-drop conductors pass above the roof overhang and (2) they are terminated at a through- or above-the-roof raceway or approved support.*

*Exception No. 3: Where the roof has a slope of not less than 100 mm in 300 mm (4 in. in 12 in.), a reduction in clearance to not less than 900 mm (3 ft) shall be permitted.*

Informational Note: For additional information regarding overhead (aerial) wires and cables, see ANSI/IEEE C2-2017, *National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines*.

**(C) On Masts.**

Overhead (aerial) communications and CATV type coaxial cables shall be permitted to be attached to an above-the-roof raceway mast that does not enclose or support conductors of electric light or power circuits.

**(D) Between Buildings.**

Communications and CATV type coaxial cables extending between buildings or structures, and also the supports or attachment fixtures, shall be identified and shall have sufficient strength to withstand the loads to which they might be subjected.

*Exception: Where a coaxial cable does not have sufficient strength to be self-supporting, it shall be attached to a supporting messenger cable that, together with the attachment fixtures or supports, shall be acceptable for the purpose and shall have sufficient strength to withstand the loads to which they may be subjected.*

**800.48 Communication Service Point.** The Communication Service Point shall be at a readily accessible location either outside or inside of a building or structure near to the point of entrance of the conductors in accordance with the one or more of the following:

1. The point of connection at which the communication service provider's network (outside plant) transitions to the premises wiring. The location of this point shall not be located further than 50 feet from the point of entrance.

2. The point of connection in an individual dwelling shall be located so as not to exceed 24 inches from the primary protector on the premises side of the protector.

3. A physical protection point or communications cable exiting the connection enclosure on the individual building side of the enclosure.

4. The point of connection at the Grounding Block, where required.

5. The point where a wireless signal transitions from the antenna or dish through a wired connection to transmitting or receiving equipment. The location of this point shall be permitted to include the ground connection at the antenna discharge unit or coaxial cable connection to the transmitting/receiving station (see 810.21).

6. The point of connection between nonconductive optical fiber cable entering the building and premises optical fiber cable inside the building not to exceed 50 feet from the point of entrance.

7. The Communication Service Point shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC), Electrical metallic tubing (EMT), intermediate metal conduit (IMC), or Rigid polyvinyl chloride conduit (PVC) to the point of emergence (see 770.48, 805.48, 820.48 and 830.48).

Informational Note: The transition and connection points listed above may be co-located. For example, a primary protector may be located inside a network interface unit (item 3) with a connection to an adjacent grounding block (Item 4) within 24 inches, and a connection to the premise wiring (item 2).

### 800.49 Metal Entrance Conduit Grounding.

Metal conduit containing entrance wire or cable shall be connected by a bonding conductor or grounding electrode conductor to a grounding electrode or, where present, the building grounding electrode system in accordance with 800.100(B).

### 800.53 Separation from Lightning Conductors.

Where practicable, a separation of at least 1.8 m (6 ft) shall be maintained between lightning conductors and all communication wires and cables and CATV type coaxial cables on buildings.

Informational Note No. 1: For additional information regarding overhead (aerial) wires and cables, see ANSI C2-2017 *National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines*.

Informational Note No. 2: Specific separation distances may be calculated from the sideflash equation in NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems.*

## Part III. Grounding Methods

### 800.100 Cable and Primary Protector Bonding and Grounding.

#### (A) Bonding Conductor or Grounding Electrode Conductor.

#### (1) Insulation.

The bonding conductor or grounding electrode conductor shall be listed and shall be permitted to be insulated, covered, or bare.

#### (2) Material.

The bonding conductor or grounding electrode conductor shall be copper or other corrosion-resistant conductive material, stranded or solid.

#### (3) Size.

The bonding conductor or grounding electrode conductor shall not be smaller than 14 AWG. The bonding conductor or grounding electrode conductor shall have a current-carrying capacity not less than the grounded metallic cable sheath member of the communications cable, the protected conductor of the communications cable, or the outer sheath of the coaxial cable, as applicable. The bonding conductor or grounding electrode conductor shall not be required to exceed 6 AWG.

#### (4) Length.

The bonding conductor or grounding electrode conductor shall be as short as practicable. In one- and two-family dwellings, the bonding conductor or grounding electrode conductor shall be as short as practicable, not to exceed 6.0 m (20 ft) in length.

Informational Note: Similar bonding conductor or grounding electrode conductor length limitations applied at apartment buildings and commercial buildings help to reduce voltages that may be developed between the building's power and communications systems during lightning events.

*Exception: In one- and two-family dwellings where it is not practicable to achieve an overall maximum bonding conductor or grounding electrode conductor length of 6.0 m (20 ft), a separate ground rod meeting the minimum dimensional criteria of 800.100(B)(3)(2) or (B)(3)(3) shall be driven, the bonding conductor or grounding electrode conductor shall be connected to the ground rod in accordance with 800.100(C), and the ground rod shall be connected to the power grounding electrode system in accordance with 800.100(D).*

#### (5) Run in Straight Line.

The bonding conductor or grounding electrode conductor shall be run in as straight a line as practicable.

#### (6) Physical Protection.

Bonding conductors and grounding electrode conductors shall be protected where exposed to physical damage. Where the bonding conductor or grounding electrode conductor is installed in a metal raceway, both ends of the raceway shall be bonded to the contained conductor or to the same terminal or electrode to which the bonding conductor or grounding electrode conductor is connected.

**(B) Electrode.**

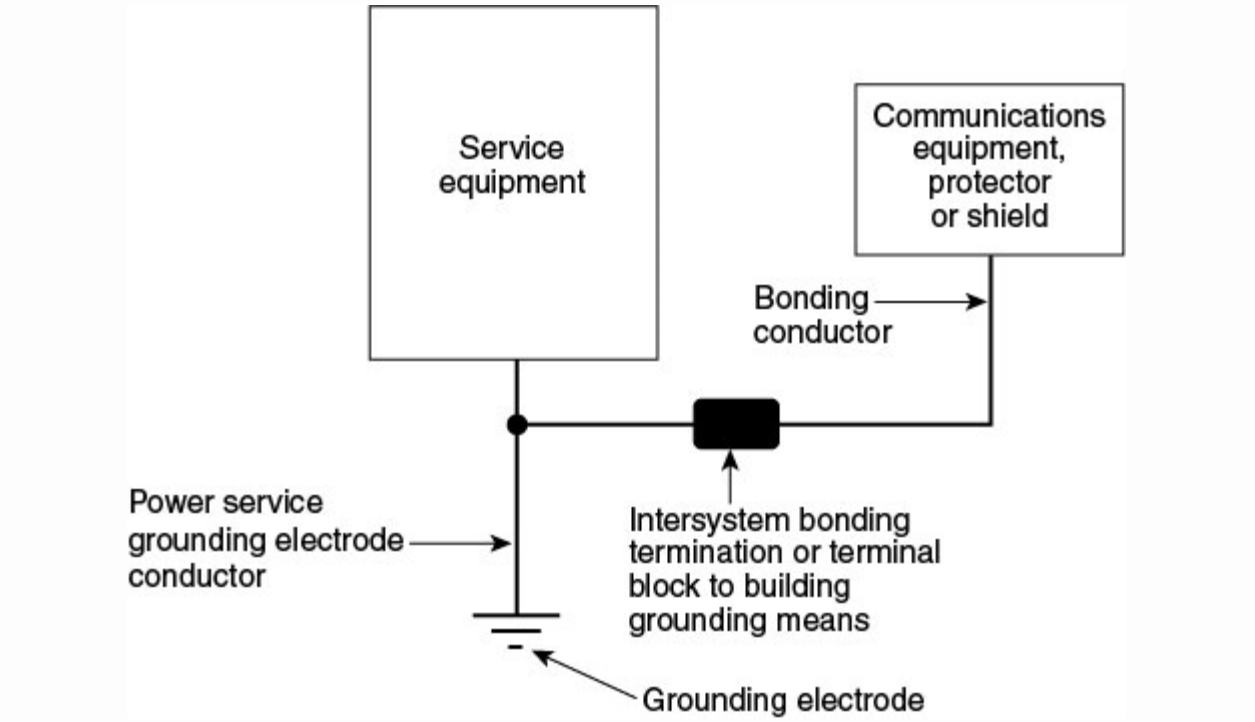
The bonding conductor or grounding electrode conductor shall be connected in accordance with 800.100(B)(1), (B)(2) , or (B)(3).

**(1) In Buildings or Structures with an Intersystem Bonding Termination.**

If the building or structure served has an intersystem bonding termination as required by 250.94, the bonding conductor shall be connected to the intersystem bonding termination.

Informational Note: Informational Note Figure 800.100(B)(1) illustrates the connection of the bonding conductor in buildings or structures equipped with an intersystem bonding termination or a terminal block providing access to the building grounding means.

**Figure Informational Note Figure 800.100(B)(1) Illustration of a Bonding Conductor in a Communications Installation.**




**(2) In Buildings or Structures with Grounding Means.**

If an intersystem bonding termination is established, 250.94(A) shall apply. If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on one of the following:

1. The building or structure grounding electrode system as covered in 250.50
2. The grounded interior metal water piping system, within 1.5 m (5 ft) from its point of entrance to the building, as covered in 250.52
3. The power service accessible means external to enclosures using the options identified in 250.94(A), Exception
4. The nonflexible metal power service raceway
5. The service equipment enclosure

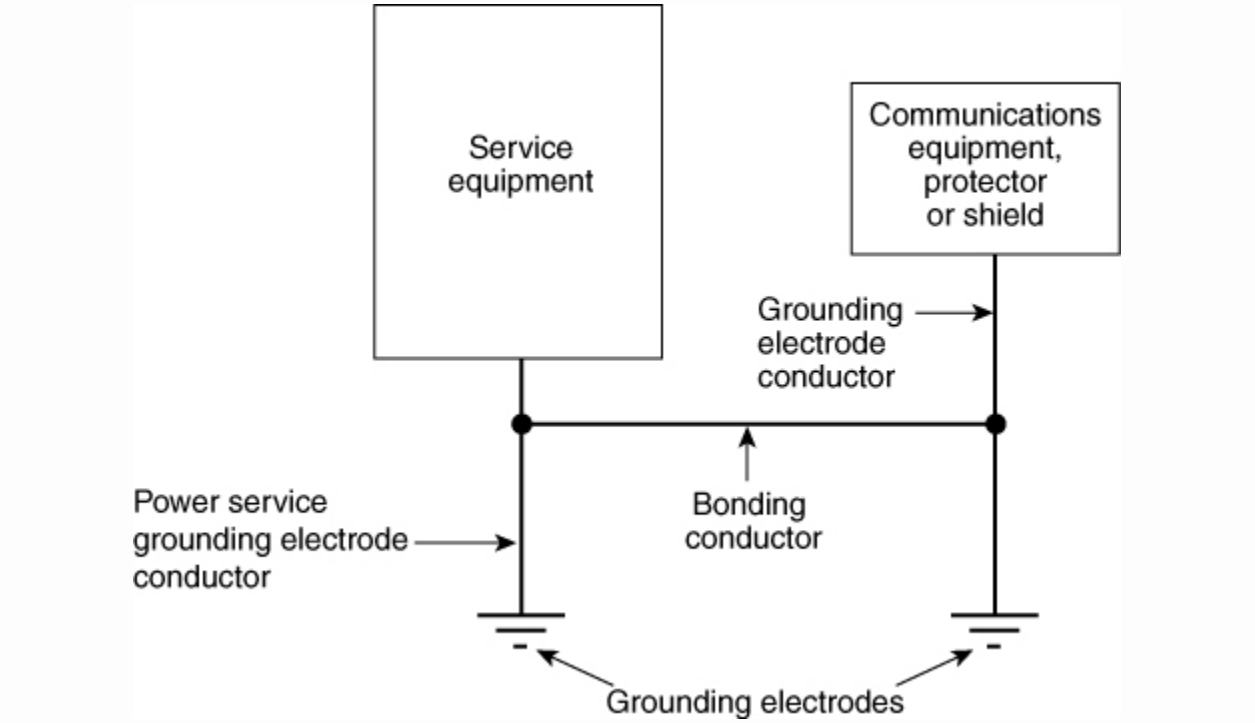
6. The grounding electrode conductor or the grounding electrode conductor metal enclosure of the power service
7. The grounding electrode conductor or the grounding electrode of a building or structure disconnecting means that is connected to a grounding electrode as covered in 250.32

A bonding device intended to provide a termination point for the bonding conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on nonremovable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is nonremovable.

For purposes of this section, the mobile home service equipment or the mobile home disconnecting means located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means connected to an electrode by a grounding electrode conductor in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Informational Note Figure 800.100(B)(2) illustrates the connection of the bonding conductor in buildings or structures not equipped with an intersystem bonding termination or a terminal block providing access to the building grounding means.

**Figure Informational Note Figure 800.100(B)(2) Illustration of a Grounding Electrode Conductor and a Bonding Conductor in a Communications Installation.**




**(3) In Buildings or Structures Without an Intersystem Bonding Termination or Grounding Means.**

If the building or structure served has no intersystem bonding termination or grounding means, as described in 800.100(B)(2), the grounding electrode conductor shall be connected to one of the following:

1. To any one of the individual grounding electrodes described in 250.52(A)(1), (A)(2), (A)(3), or (A)(4)
2. If the building or structure served has no intersystem bonding termination or grounding means, as described in 800.100(B)(2) or (B)(3)(1), to any one of the individual grounding electrodes described in 250.52(A)(5), (A)(7), and (A)(8)

3. For communications circuits covered in Article 805 or network-powered broadband communications systems covered in Article 830, to a ground rod or pipe not less than 1.5 m (5 ft) in length and 12.7 mm (0.5 in.) in diameter, driven, where practicable, into permanently damp earth and separated from lightning protection system conductors, as covered in 800.53, and at least 1.8 m (6 ft) from electrodes of other systems

Steam pipes, hot water pipes, or lightning protection system conductors shall not be employed as grounding electrodes for protectors and grounded metallic members.

**(C) Electrode Connection.**

Connections to grounding electrodes shall comply with 250.70.

**(D) Bonding of Electrodes.**

A bonding jumper not smaller than 6 AWG copper or equivalent shall be connected between the grounding electrode and power grounding electrode system at the building or structure served where separate electrodes are used.

*Exception: At mobile homes as covered in 800.106.*

Informational Note No. 1: See 250.60 for connection to a lightning protection system.

Informational Note No. 2: Bonding together of all separate electrodes limits potential differences between them and between their associated wiring systems.

**800.106 Primary Protector Grounding and Bonding at Mobile Homes.**

**(A) Grounding.**

Grounding shall comply with 800.106(A)(1) and (A)(2).

**(1) Mobile Home Service Equipment.**

Where there is no mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, grounding shall comply with one of the following:

1. The primary protector grounding terminal; the coaxial cable shield ground, or surge arrester grounding terminal; or the network-powered broadband communications cable shield, network-powered broadband communications cable metallic members not used for communications or powering, and network interface unit shall be connected to a grounding electrode conductor or grounding electrode in accordance with 800.100(B)(3).
2. The non-current-carrying metallic members of optical fiber cables shall be connected to a grounding electrode in accordance with 770.106(A)(1). The network terminal, if required to be grounded, shall be connected to a grounding electrode in accordance with 800.106(A)(1)(1). The grounding electrode shall be bonded in accordance with 770.106(B).

**(2) Mobile Home Feeder Disconnecting Means.**

Where there is no mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, grounding shall comply with one of the following:

1. The primary protector grounding terminal; the network-powered broadband communications cable shield, network-powered broadband communications cable metallic members not used for communications or powering, and network interface unit shall be connected to a grounding electrode in accordance with 800.100(B)(3).
2. The non-current-carrying metallic members of optical fiber cables shall be connected to a grounding electrode in accordance with 770.106(A)(2). The network terminal, if required to be grounded, shall be connected to a grounding electrode in accordance with 800.106(A)(2). The grounding electrode shall be bonded in accordance with 770.106(B).

**(B) Bonding.**

The primary protector grounding terminal or grounding electrode, network-powered broadband communications cable grounding terminal, or network interface unit grounding terminal shall be bonded together and connected to the metal frame or available grounding terminal of the mobile home with a copper conductor not smaller than 12 AWG under either of the following conditions:

1. Where there is no mobile home service equipment or disconnecting means as in 800.106(A)
2. Where the mobile home is supplied by cord and plug

**Part IV. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**800.110 Raceways, Cable Routing Assemblies, and Cable Trays.**

**(A) Types of Raceways.**

Wires and cables shall be permitted to be installed in raceways that comply with either 800.110(A)(1) or (A)(2). Medium-power network-powered broadband communications cables shall not be permitted to be installed in raceways that comply with 800.110(A)(2).

**(1) Raceways Recognized in Chapter 3.**

Wires and 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.**

Wires and 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.

**(3) Innerduct for Communications Wires and Cables, Coaxial Cables, or Network-Powered Broadband Communications Cables.**

Listed plenum communications raceways, listed riser communications raceways, and listed general-purpose communications raceways 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.**

The raceway fill requirements of Chapters 3 and 9 shall apply to medium-power network-powered broadband communications cables.

**(C) Cable Routing Assemblies.**

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)(1) and (C)(2) and 800.113.

**(1) Horizontal Support.**

Cable routing assemblies shall be supported where run horizontally at intervals not to exceed 900 mm (3 ft) and at each end or joint, unless listed for other support intervals. In no case shall the distance between supports exceed 3 m (10 ft).

**(2) Vertical Support.**

Vertical runs of cable routing assemblies shall be supported at intervals not exceeding 1.2 m (4 ft), unless listed for other support intervals, and shall not have more than one joint between supports.

**(D) Cable Trays.**

Wires and cables and communications raceways shall be permitted to be installed in metal or listed nonmetallic cable tray systems. Ladder cable trays shall be permitted to support cable routing assemblies.

## 800.113 Installation of Wires, Cables, Cable Routing Assemblies, and Communications Raceways.

Installation of wires, cables, cable routing assemblies, and communications raceways shall comply with 800.113(A) through (L). Installation of cable routing assemblies and communications raceways shall comply also with 800.110.

**(A) Listing.**

Wires, cables, cable routing assemblies, and communications raceways installed in buildings shall be listed.

*Exception: Cables installed in compliance with 805.48 or 820.48 shall not be required to be listed.*

**(B) Ducts Specifically Fabricated for Environmental Air.**

The following wires and 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. Plenum cables up to 1.22 m (4 ft) in length
2. Plenum cables, riser cables, general-purpose cables, and limited-use 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 NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

**(C) Other Spaces Used for Environmental Air (Plenums).**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted in other spaces used for environmental air as described in 300.22(C):

1. Plenum cables
2. Plenum communications raceways
3. Plenum cable routing assemblies
4. Plenum cables installed in plenum communications raceways
5. Plenum cables installed in plenum cable routing assemblies
6. Plenum cables and plenum communications raceways supported by open metal cable tray systems
7. Plenum cables, riser cables, general-purpose cables, limited-use cables, and communications wires installed in raceways that are installed in compliance with 300.22(C)
8. Plenum cables, riser cables, general-purpose cables, limited-use cables, 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)
9. Plenum cables, riser cables, general-purpose cables, and limited-use 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, see NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

**(D) Risers — Cables, Cable Routing Assemblies, and Communications Raceways in Vertical Runs.**

The following cables, cable routing assemblies, and communications raceways shall be permitted in vertical runs penetrating one or more floors and in vertical runs in a shaft:

1. Plenum and riser cables
2. Plenum and riser communications raceways
3. Plenum and riser cable routing assemblies
4. Plenum and riser cables installed in:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) Plenum cable routing assemblies
    d) Riser cable routing assemblies

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**(E) Risers — Cables and Innerducts in Metal Raceways.**

The following cables and innerducts shall be permitted in metal raceways in a riser having firestops at each floor:

1. Plenum cables, riser cables, general-purpose cables, and limited-use cables
2. Plenum, riser, and general-purpose communications raceways
3. Plenum cables, riser cables, general-purpose cables, and limited-use cables installed in:
    a) Plenum communications raceways (innerduct)
    b) Riser communications raceways (innerduct)
    c) General-purpose communications raceways (innerduct)

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**(F) Risers — Cables, Cable Routing Assemblies, and Communications Raceways in Fireproof Shafts.**

The following cables, cable routing assemblies, and communications raceways shall be permitted to be installed in fireproof riser shafts having firestops at each floor:

1. Plenum cables, riser cables, general-purpose cables, and limited-use cables
2. Plenum, riser, and general-purpose communications raceways
3. Plenum, riser, and general-purpose cable routing assemblies
4. Plenum cables, riser cables, general-purpose cables, and limited-use cables installed in:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
    d) Plenum cable routing assemblies
    e) Riser cable routing assemblies
    f) General-purpose cable routing assemblies

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**(G) Risers — One- and Two-Family Dwellings.**

The following cables, cable routing assemblies, and communications raceways shall be permitted in one- and two-family dwellings:

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables less than 6 mm (0.25 in.) in diameter
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Plenum cables, riser cables, and general-purpose cables installed in:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
    d) Plenum cable routing assemblies
    e) Riser cable routing assemblies
    f) General-purpose cable routing assemblies

**(H) Cable Trays.**

The following wires, cables, and communications raceways shall be permitted to be supported by cable trays:

1. Plenum cables, riser cables, and general-purpose cables
2. Plenum, riser, and general-purpose communications raceways
3. Communications wires, plenum cables, riser cables, and general-purpose cables installed in:
    1. Plenum communications raceways
    2. Riser communications raceways
    3. General-purpose communications raceways

**(I) Distributing Frames and Cross-Connect Arrays.**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in distributing frames and cross-connect arrays:

1. Plenum cables, riser cables, general-purpose cables, and communications wires
2. Plenum, riser, and general-purpose communications raceways
3. Plenum, riser, and general-purpose cable routing assemblies
4. Communications wires, plenum cables, riser cables, and general-purpose cables installed in:
    1. Plenum communications raceways
    2. Riser communications raceways
    3. General-purpose communications raceways
    4. Plenum cable routing assemblies
    5. Riser cable routing assemblies
    6. General-purpose cable routing assemblies

**(J) Other Building Locations.**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in building locations other than the locations covered in 800.113(B) through (I):

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables with a maximum of 3 m (10 ft) of exposed length in nonconcealed spaces
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
6. Plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum cable routing assemblies
    b) Riser cable routing assemblies
    c) General-purpose cable routing assemblies
7. Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3
8. Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks

**(K) Multifamily Dwellings.**

The following cables, cable routing assemblies, and communications raceways shall be permitted to be installed in multifamily dwellings in locations other than the locations covered in 800.113(B) through (G):

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables less than 6 mm (0.25 in.) in diameter in nonconcealed spaces
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
6. Plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum cable routing assemblies
    b) Riser cable routing assemblies
    c) General-purpose cable routing assemblies
7. Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3
8. Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks

**(L) One- and Two-Family Dwellings.**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in one- and two-family dwellings in locations other than the locations covered in 800.113(B) through (F):

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables less than 6 mm (0.25 in.) in diameter
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:
   a) Plenum communications raceways
   b) Riser communications raceways
   c) General-purpose communications raceways
6. Plenum cables, riser cables, and general-purpose cables installed in the following
   a) Plenum cable routing assemblies
   b) Riser cable routing assemblies
   c) General-purpose cable routing assemblies
7. Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3
8. Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks
9. Hybrid power and communications cable listed in accordance with 805.179(F)

**800.154 Applications of Listed Communications Wires, Cables, and Raceways, and Listed Cable Routing Assemblies.**

Permitted and nonpermitted applications of listed communications wires, cables, coaxial cables, network-powered broadband communications system cables and raceways, and listed cable routing assemblies, shall be in accordance with one of the following:

1. Listed communications wires and cables as indicated in Table 800.154(a)
2. Listed communications raceways as indicated in Table 800.154(b)
3. Listed cable routing assemblies as indicated in Table 800.154(c)

The permitted applications shall be subject to the installation requirements of 800.110 and 800.113.

**Table 800.154(a) Applications of Listed Communications Wires, Cables, and Network-Powered Broadband Communications System Cables on the customer side of the Communication Service Point ~~Buildings~~**

| Applications | | Wire and Cable Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BMU, BLU | Hybrid Power and Communications Cables | Communications Wires |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | Y | N | N | N | N | N | N | N | N | N |
| | In metal raceway that complies with 300.22(B) | Y | Y | Y | Y | Y | Y | N | N | N | Y |

| Applications | | Wire and Cable Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BMU, BLU | Hybrid Power and Communications Cables | Communications Wires |
| In other spaces used for environmental air (plenums) as described in 300.22(C) | In other spaces used for environmental air | Y | N | N | N | N | N | N | N | N | N |
| | In metal raceway that complies with 300.22(C) | Y | Y | Y | Y | Y | Y | N | N | N | Y |
| | In plenum communications raceways | Y | N | N | N | N | N | N | N | N | N |
| | In plenum cable routing assemblies | Y | N | N | N | N | N | N | N | N | N |
| | Supported by open metal cable trays | Y | N | N | N | N | N | N | N | N | N |
| | Supported by solid bottom metal cable trays with solid metal covers | Y | Y | Y | Y | Y | Y | N | N | N | N |
| In risers | In vertical runs | Y | Y | Y | N | N | N | N | N | N | N |
| | In metal raceways | Y | Y | Y | Y | Y | Y | N | N | N | N |
| | In fireproof shafts | Y | Y | Y | Y | Y | Y | N | N | N | N |
| | In plenum communications raceways | Y | Y | N | N | N | N | N | N | N | N |
| | In plenum cable routing assemblies | Y | Y | N | N | N | N | N | N | N | N |
| | In riser communications raceways | Y | Y | N | N | N | N | N | N | N | N |
| | In riser cable routing assemblies | Y | Y | N | N | N | N | N | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y | Y | Y | Y | N | N | Y | N |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y | Y | Y | Y | N | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y | Y | Y | Y | Y | N | Y | N |
| | In multifamily dwellings | Y | Y | Y | Y | Y | Y | Y | N | N | N |
| | In nonconcealed spaces | Y | Y | Y | Y | Y | Y | Y | N | N | N |
| | Supported by cable trays | Y | Y | Y | Y | Y | N | N | N | N | N |
| | Under carpet, modular flooring, and planks | N | N | N | N | N | N | Y | N | N | N |
| | In distributing frames and cross-connect arrays | Y | Y | N | Y | N | N | N | N | N | Y |
| | In rigid metal conduit (RMC) and intermediate metal conduit (IMC) | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |

| Applications | | Wire and Cable Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BMU, BLU | Hybrid Power and Communications Cables | Communications Wires |
| | In any raceway recognized in Chapter 3 | Y | Y | Y | Y | Y | Y | N | N | N | Y |
| | In plenum communications raceways | Y | Y | N | Y | N | N | N | N | N | Y |
| | In plenum cable routing assemblies | Y | Y | N | Y | N | N | N | N | N | Y |
| | In riser communications raceways | Y | Y | N | Y | N | N | N | N | N | Y |
| | In riser cable routing assemblies | Y | Y | N | Y | N | N | N | N | N | Y |
| | In general-purpose communications raceways | Y | Y | N | Y | N | N | N | N | N | Y |
| | In general-purpose cable routing assemblies | Y | Y | N | Y | N | N | N | N | N | Y |

Note: An "N" in the table indicates that the cable type shall not be permitted to be installed in the application. A "Y" indicates that the cable type shall be permitted to be installed in the application subject to the limitations described in 800.113. The Riser column includes all riser cables except BMR, and the General-Purpose column includes all general-purpose cables except BM.
Informational Note No. 1: Part IV of Article 800 covers wiring on the customer side of the communication service point ~~installation methods within buildings~~. This table covers the applications of listed communications wires, cables, and raceways ~~in buildings~~. See the definition of *Point of Entrance* in 800.2.

Informational Note No. 2: For information on the restrictions to the installation of communications cables in fabricated ducts, see 800.113(B).

### Table 800.154(b) Applications of Listed Communications Raceways on the customer side of the Communication Service Point~~in Buildings~~

| Applications | | Listed Communications Raceway Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | N | N | N |
| | In metal raceway that complies with 300.22(B) | N | N | N |
| In other spaces used for environmental air (plenums) 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 cable routing assemblies | N | 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 cable routing assemblies | N | N | N |
| | In riser cable routing assemblies | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y |
| | In one- and two-family dwellings | Y | Y | Y |
| | In multifamily dwellings | Y | Y | Y |

| Applications | | Listed Communications Raceway Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| | In nonconcealed spaces | Y | Y | Y |
| | Supported by cable trays | Y | Y | Y |
| | Under carpet, modular flooring, and planks | N | N | N |
| | In distributing frames and cross-connect arrays | Y | Y | Y |
| | In any raceway recognized in Chapter 3 | Y | Y | Y |
| | In plenum cable routing assemblies | N | N | N |
| | In riser cable routing assemblies | N | N | N |
| | In general-purpose cable routing assemblies | N | N | N |

Note: An “N” in the table indicates that the communications raceway type shall not be permitted to be installed in the application. A “Y” indicates that the communications raceway type shall be permitted to be installed in the application, subject to the limitations described in 800.110 and 800.113.

## Table 800.154(c) Applications of Listed Cable Routing Assemblies in Buildings

| Applications | | Listed Cable Routing Assembly Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | N | N | N |
| | In metal raceway that complies with 300.22(B) | N | N | N |
| In other spaces used for environmental air (plenums) 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) | N | N | N |
| | In plenum communications raceways | N | N | N |
| | Supported by open metal cable trays | Y | N | N |
| | Supported by solid bottom metal cable trays with solid metal covers | N | N | N |
| In risers | In vertical runs | Y | Y | N |
| | In metal raceways | N | N | N |
| | In fireproof shafts | Y | Y | Y |
| | In plenum communications raceways | N | N | N |
| | In riser communications raceways | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y |
| | In one- and two-family dwellings | Y | Y | Y |
| | In multifamily dwellings | Y | Y | Y |
| | In nonconcealed spaces | Y | Y | Y |
| | Supported by cable trays | Y | Y | Y |
| | Under carpet, modular flooring, and planks | N | N | N |
| | In distributing frames and cross-connect arrays | Y | Y | Y |
| | In any raceway recognized in Chapter 3 | N | N | N |
| | In plenum communications raceways | N | N | N |
| | In riser communications raceways | N | N | N |
| | In general-purpose communications raceways | N | N | N |

Note: An “N” in the table indicates that the cable routing assembly type shall not be permitted to be installed in the application. A “Y” indicates that the cable routing assembly type shall be permitted to be installed in the application subject to the limitations described in 800.113.

### 800.179 Plenum, Riser, General-Purpose, and Limited Use Cables.

Plenum, riser, general-purpose, and limited-use cables shall be listed in accordance with 800.179(A) through (D) and shall have a temperature rating of not less than 60°C (140°F). The temperature rating shall be marked on the jacket of cables that have a temperature rating exceeding 60°C (140°F). The cable voltage rating shall not be marked on the cable.

#### (A) Plenum Cables.

Type CMP communications plenum cables, Type CATVP community antenna television plenum coaxial cables, and Type BLP network-powered broadband communication low-power plenum cables shall be listed as being suitable for use in ducts, plenums, and other spaces 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*.

#### (B) Riser Cables.

Type CMR communications riser cables, Type CATVR community antenna television riser coaxial cables, Type BMR network-powered broadband communications medium-power riser cables, and Type BLR network-powered broadband communications low-power riser cables 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 1666-2011, *Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts.*

#### (C) General-Purpose Cables.

Type CM communications general-purpose cables, Type CATV community antenna television coaxial general-purpose cables, Type BM network-powered broadband communications medium-power general-purpose cables, and Type BL network-powered broadband communications low-power general-purpose cables shall be listed as being suitable for general-purpose use, with the exception of risers and plenums, 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 Flame Tray 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. 0.3-09, *Test Methods for Electrical Wires and Cables*.

#### (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 VW-1 (vertical-wire) flame test in ANSI/UL 1581-2017, *Reference Standard for Electrical Wires, Cables and Flexible Cords*.

## Part V. Listing Requirements

### 800.180 Grounding Devices.

Where bonding or grounding is required, devices used to connect a shield, a sheath, or non-current-carrying metallic members of a cable to a bonding conductor or grounding electrode conductor shall be listed or be part of listed equipment.

### 800.182 Cable Routing Assemblies and Communications Raceways.

Cable routing assemblies and communications raceways shall be listed in accordance with 800.182(A) through (C). Cable routing assemblies shall be marked in accordance with Table 800.182(a). Communications raceways shall be marked in accordance with Table 800.182(b).

Informational Note: For information on listing requirements for both communications raceways and cable routing assemblies, see ANSI/UL 2024-5-2015, *Cable Routing Assemblies and Communications Raceways*.

**Table 800.182(a) Cable Routing Assembly Markings**

| Type | Marking |
|---|---|
| Plenum Cable Routing Assembly | Plenum Cable Routing Assembly |
| Riser Cable Routing Assembly | Riser Cable Routing Assembly |
| General-Purpose Cable Routing Assembly | General-Purpose Cable Routing Assembly |

**Table 800.182(b) Communications Raceway Markings**

| Type | Marking |
|---|---|
| Plenum Communications Raceway | Plenum Communications Raceway |
| Riser Communications Raceway | Riser Communications Raceway |
| General-Purpose Communications Raceway | General-Purpose Communications Raceway |

### (A) Plenum Cable Routing Assemblies and Plenum Communications Raceways.

Plenum cable routing assemblies and plenum communications raceways shall be listed as having adequate fire-resistant and low-smoke-producing characteristics.

Informational Note No. 1: One method of defining cable routing assemblies and communications raceways that have adequate fire-resistant and low-smoke-producing characteristics is that they exhibit a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84-15a, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or ANSI/UL 723-2013, *Standard Test Method for Surface Burning Characteristics of Building Materials*.

Informational Note No. 2: Another method of defining communications raceways that have adequate fire-resistant and low-smoke-producing characteristics is that they exhibit 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 262-2015, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces*.

Informational Note No. 3: See 4.3.11.2.6 or 4.3.11.5.5 of NFPA 90A-2015, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, for information on materials exposed to the airflow in ceiling cavity and raised floor plenums.

### (B) Riser Cable Routing Assemblies and Riser Communications Raceways.

Riser cable routing assemblies and riser communications raceways shall be listed as having adequate 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 cable routing assemblies and communications raceways pass the requirements of ANSI/UL 1666-2011, *Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts*.

### (C) General-Purpose Cable Routing Assemblies and General-Purpose Communications Raceways.

General-purpose cable routing assemblies and general-purpose communications raceways shall 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 cable routing assemblies and communications raceways do not spread fire to the top of the tray in the “UL Flame Exposure, Vertical Flame Tray Test” in ANSI/UL 1685-2011, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*.

## Article 805 Communications Circuits

### Part I. General

### 805.1 Scope.

This article covers communications circuits and equipment.

**805.2 Definitions.**

The definitions in this section shall apply only within Articles 805 and 840.

**Cable.**

A factory assembly of two or more conductors having an overall covering.

**Communications Circuit Integrity (CI) Cable.**

Cable used in communications systems to ensure continued operation of critical circuits during a specified time under fire conditions.

**Wire.**

A factory assembly of one or more insulated conductors without an overall covering.

**805.18 Installation of Equipment.**

Equipment electrically connected to a communications network shall be listed in accordance with 805.170.

*Exception: This listing requirement shall not apply to test equipment that is intended for temporary connection to a telecommunications network by qualified persons during the course of installation, maintenance, or repair of telecommunications equipment or systems.*

**Part II. Wires and Cables Outside and on the service provider side of the Communication Service Point ~~Entering Buildings~~**

**805.47 Underground Communications Wires and Cables ~~Entering Buildings~~.**

Underground communications wires and cables ~~entering buildings~~ shall comply with 805.47(A) and (B). The requirements of 310.10(C) shall not apply to communications wires and cables.

**(A) Underground Systems with Electric Light, Power, Class 1, or Non-Power-Limited Fire Alarm Circuit Conductors.**

Underground communications wires and cables in a raceway, handhole enclosure, or manhole containing electric light, power, Class 1, or non-power-limited fire alarm circuit conductors shall be in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier.

**(B) Underground Block Distribution.**

Where the entire street circuit is run underground and the circuit within the block is placed so as to be free from the likelihood of accidental contact with electric light or power circuits of over 300 volts to ground, the insulation requirements of 805.50(A) and 805.50(C) shall not apply, insulating supports shall not be required for the conductors, and bushings shall not be required where the conductors enter the building.

**805.48 Unlisted Cables on the service provider side of the Communication Service Point ~~Entering Buildings~~.**

Unlisted outside plant communications cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated in an enclosure or on a listed primary protector. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) to the point of emergence.

Informational Note No. 1: Splice cases or terminal boxes, both metallic and plastic types, are typically used as enclosures for splicing or terminating telephone cables.

Informational Note No. 2: This section limits the length of unlisted outside plant cable to 15 m (50 ft), while 805.90(B) requires that the primary protector be located as close as practicable to the point at which the cable enters the building. Therefore, in installations requiring a primary protector, the outside plant cable may not be permitted to extend 15 m (50 ft) into the building if it is practicable to place the primary protector closer than 15 m (50 ft) to the point of entrance.

### 805.50 Circuits Requiring Primary Protectors.

Circuits that require primary protectors as provided in 805.90 shall comply with 805.50(A),805.50(B), and 805.50(C).

#### (A) Insulation, Wires, and Cables.

Communications wires and cables without a metallic shield, running from the last outdoor support to the primary protector, shall be listed in accordance with 805.173.

#### (B) On Buildings.

Communications wires and cables in accordance with 805.50(A) shall be separated at least 100 mm (4 in.) from electric light or power conductors not in a raceway or cable or be permanently separated from conductors of the other systems by a continuous and firmly fixed nonconductor in addition to the insulation on the wires, such as porcelain tubes or flexible tubing. Communications wires and cables in accordance with 805.50(A) exposed to accidental contact with electric light and power conductors operating at over 300 volts to ground and attached to buildings shall be separated from woodwork by being supported on glass, porcelain, or other insulating material.

*Exception: Separation from woodwork shall not be required where fuses are omitted as provided for in 805.90(A)(1), or where conductors are used to extend circuits to a building from a cable having a grounded metal sheath.*

#### (C) Entering Buildings.

Where a primary protector is installed inside the building, the communications wires and cables shall enter the building either through a noncombustible, nonabsorbent insulating bushing or through a metal raceway. The insulating bushing shall not be required where the entering communications wires and cables (1) are in metal-sheathed cable, (2) pass through masonry, (3) meet the requirements of 805.50(A) and fuses are omitted as provided in 805.90(A)(1), or (4) meet the requirements of 805.50(A) and are used to extend circuits to a building from a cable having a grounded metallic sheath. Raceways or bushings shall slope upward from the outside or, where this cannot be done, drip loops shall be formed in the communications wires and cables immediately before they enter the building.

Raceways shall be equipped with an approved service head. More than one communications wire and cable shall be permitted to enter through a single raceway or bushing. Conduits or other metal raceways located ahead of the primary protector shall be grounded.

## Part III. Protection

### 805.90 Protective Devices.

#### (A) Application.

A listed primary protector shall be provided on each circuit run partly or entirely in aerial wire or aerial cable not confined within a block. Also, a listed primary protector shall be provided on each circuit, aerial or underground, located within the block containing the building served so as to be exposed to accidental contact with electric light or power conductors operating at over 300 volts to ground. In addition, where there exists a lightning exposure, each interbuilding circuit on a premises shall be protected by a listed primary protector at each end of the interbuilding circuit. Installation of primary protectors shall also comply with 110.3(B).

Informational Note No. 1: On a circuit not exposed to accidental contact with power conductors, providing a listed primary protector in accordance with this article helps protect against other hazards, such as lightning and above-normal voltages induced by fault currents on power circuits in proximity to the communications circuit.

Informational Note No. 2: Interbuilding circuits are considered to have a lightning exposure unless one or more of the following conditions exist:

1. Circuits in large metropolitan areas where buildings are close together and sufficiently high to intercept lightning.
2. Interbuilding cable runs of 42 m (140 ft) or less, directly buried or in underground conduit, where a continuous metallic cable shield or a continuous metal conduit containing the cable is connected to each building grounding electrode system.

3. Areas having an average of five or fewer thunderstorm days per year and earth resistivity of less than 100 ohm-meters. Such areas are found along the Pacific coast.

Informational Note No. 3: For information on lightning protection systems, see NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems.*

**(1) Fuseless Primary Protectors.**

Fuseless-type primary protectors shall be permitted under any of the conditions given in 805.90(A)(1)(a) through (A)(1)(e).

(a) Where conductors enter a building through a cable with grounded metallic sheath member(s) and where the conductors in the cable safely fuse on all currents greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor

(b) Where insulated conductors in accordance with 805.50(A) are used to extend circuits to a building from a cable with an effectively grounded metallic sheath member(s) and where the conductors in the cable or cable stub, or the connections between the insulated conductors and the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground, safely fuse on all currents greater than the current-carrying capacity of the primary protector, or the associated insulated conductors and of the primary protector bonding conductor or grounding electrode conductor

(c) Where insulated conductors in accordance with 805.50(A) or (B) are used to extend circuits to a building from other than a cable with metallic sheath member(s), where (1) the primary protector is listed as being suitable for this purpose for application with circuits extending from other than a cable with metallic sheath members, and (2) the connections of the insulated conductors to the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground or the conductors of the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground safely fuse on all currents greater than the current-carrying capacity of the primary protector, or associated insulated conductors and of the primary protector bonding conductor or grounding electrode conductor

(d) Where insulated conductors in accordance with 805.50(A) are used to extend circuits aerially to a building from a buried or underground circuit that is unexposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground

(e) Where insulated conductors in accordance with 805.50(A) are used to extend circuits to a building from cable with an effectively grounded metallic sheath member(s), and where (1) the combination of the primary protector and insulated conductors is listed as being suitable for this purpose for application with circuits extending from a cable with an effectively grounded metallic sheath member(s), and (2) the insulated conductors safely fuse on all currents greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor

Informational Note: Section 9 of ANSI/IEEE C2-2012, *National Electrical Safety Code*, provides an example of methods of protective grounding that can achieve effective grounding of communications cable sheaths for cables from which communications circuits are extended.

**(2) Fused Primary Protectors.**

Where the requirements listed under 805.90(A)(1)(a) through (A)(1)(e) are not met, fused-type primary protectors shall be used. Fused-type primary protectors shall consist of an arrester connected between each line conductor and ground, a fuse in series with each line conductor, and an appropriate mounting arrangement. Primary protector terminals shall be marked to indicate line, instrument, and ground, as applicable.

**(B) Location.**

The primary protector shall be located in, on, or immediately adjacent to the structure or building served and as close as practicable to the point of entrance.

For purposes of this section, primary protectors located at mobile home service equipment within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means connected to an electrode by a grounding electrode conductor in accordance with 250.32 and located

within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a primary protector location to achieve the shortest practicable primary protector bonding conductor or grounding electrode conductor helps limit potential differences between communications circuits and other metallic systems.

**(C) Hazardous (Classified) Locations.**

The primary protector shall not be located in any hazardous (classified) locations, as defined in 500.5 and 505.5, or in the vicinity of easily ignitible material.

*Exception: As permitted in 501.150, 502.150, and 503.150.*

**(D) Secondary Protectors.**

Where a secondary protector is installed in series with the indoor communications wire and cable between the primary protector and the equipment, it shall be listed for the purpose in accordance with 805.170(B).

Informational Note: Secondary protectors on circuits exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground are not intended for use without primary protectors.

**805.93 Grounding, Bonding, or Interruption of Non–Current-Carrying Metallic Sheath Members of Communications Cables.**

Communications cables entering the building or terminating on the outside of the building shall comply with 805.93(A) or (B).

**(A) Entering Buildings.**

In installations where the communications cable enters a building, the metallic sheath members of the cable shall be grounded or bonded as specified in 800.100 or interrupted by an insulating joint or equivalent device. The grounding, bonding, or interruption shall be as close as practicable to the point of entrance.

**(B) Terminating on the Outside of Buildings.**

In installations where the communications cable is terminated on the outside of the building, the metallic sheath members of the cable shall be grounded or bonded as specified in 800.100 or interrupted by an insulating joint or equivalent device. The grounding, bonding, or interruption shall be as close as practicable to the point of termination of the cable.

**Part IV. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**805.133 Installation of Communications Wires, Cables, and Equipment.**

Communications wires and cables from the protector to the equipment or, where no protector is required, communications wires and cables attached to the outside or inside of the building shall comply with 805.133(A) and 805.133(B)

**(A) Separation from Other Conductors.**

**(1) In Raceways, Cable Trays, Boxes, Cables, Enclosures, and Cable Routing Assemblies.**

(a) *Other Circuits.* Communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with cables 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. Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770
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

(b) *Class 2 and Class 3 Circuits.* Class 1 circuits shall not be run in the same cable with communications circuits. Class 2 and Class 3 circuit conductors shall be permitted in the same listed communications cable with communications circuits.

(c) *Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm, and Medium-Power Network-Powered Broadband Communications Circuits in Raceways, Compartments, and Boxes.* Communications conductors shall not be placed in any raceway, compartment, outlet box, junction box, or similar fitting with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits.

*Exception No. 1: Section 805.133(A)(1)(c) shall not apply if 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 conductors of communications circuits by a permanent barrier or listed divider.*

*Exception No. 2: Power conductors in outlet boxes, junction boxes, or similar fittings or compartments where such conductors are introduced solely for power supply to communications equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum of 6 mm (¼ in.) separation from the communications circuit conductors.*

*Exception No. 3: As permitted by 620.36.*

**(2) Other Applications.**

Communications wires and cables shall be separated 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.

*Exception No. 1: Section 805.133(A)(2) shall not apply where either (1) all of the conductors of the electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits are in a raceway or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC, or Type UF cables, or (2) all of the conductors of communications circuits are encased in raceway.*

*Exception No. 2: Section 805.133(A)(2) shall not apply where the communications wires and cables are permanently separated from the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B) Support of Communications Wires and Cables.**

Raceways shall be used for their intended purpose. Communications wires and cables shall not be strapped, taped, or attached by any means to the exterior of any raceway as a means of support.

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

**805.154 Substitutions of Listed Communications Wires, Cables, and Raceways, and Listed Cable Routing Assemblies.**

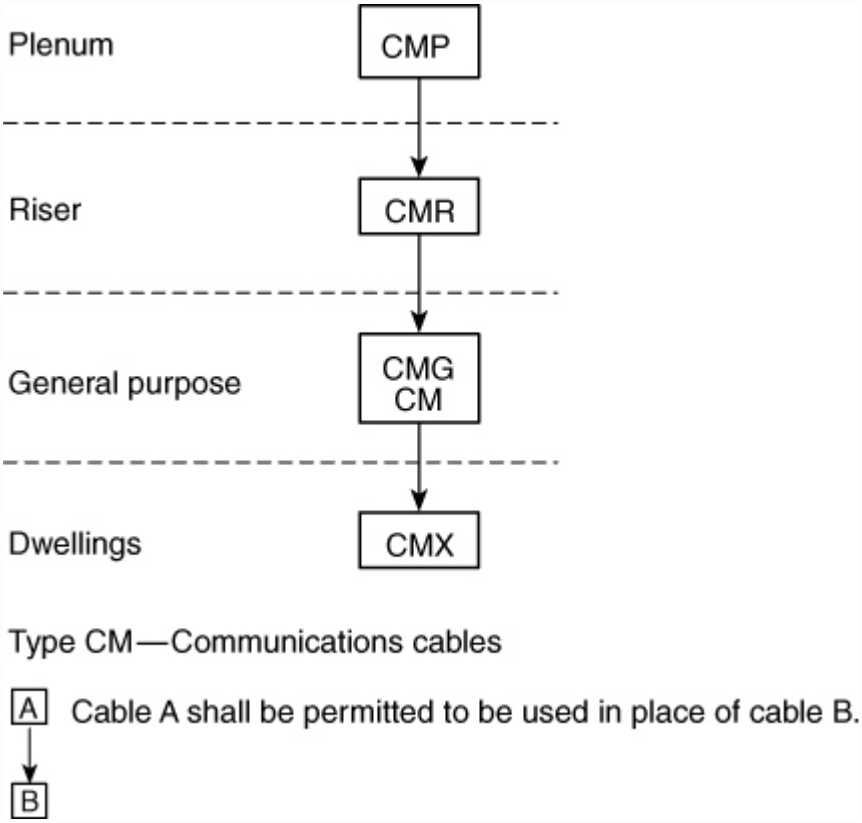
The substitutions for communications cables listed in Table 805.154 and illustrated in Figure 805.154 shall be permitted.

**Table 805.154 Cable Substitutions**

| Cable Type | Permitted Substitutions |
|---|---|
| CMR | CMP |

| Cable Type | Permitted Substitutions |
|---|---|
| CMG, CM | CMP, CMR |
| CMX | CMP, CMR, CMG, CM |

**Figure 805.154 Cable Substitution Hierarchy.**




### 805.156 Dwelling Unit Communications Outlet.

For new construction, a minimum of one communications outlet shall be installed within the dwelling in a readily accessible area and cabled to the service provider demarcation point.

## Part V. Listing Requirements

### 805.170 Equipment.

Communications equipment shall be listed as being suitable for electrical connection to a communications network.

Informational Note No. 1: One way to determine applicable requirements is to refer to ANSI/UL 60950-1-2014, *Standard for Safety of Information Technology Equipment*; ANSI/UL 1863-2012, *Standard for Safety Communications Circuit Accessories*; or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements*.

Informational Note No. 2: Additional information regarding voltages, currents, and power allowed on communications circuits can be found in ANSI/ATIS 0600337-2016, *Requirements for Maximum Voltage, Current, and Power Levels Used in Communications Transport Circuits*.

#### (A) Primary Protectors.

The primary protector shall consist of an arrester connected between each line conductor and ground in an appropriate mounting. Primary protector terminals shall be marked to indicate line and ground as applicable.

Informational Note: One way to determine applicable requirements for a listed primary protector is to refer to ANSI/UL 497-2013, *Standard for Protectors for Paired Conductor Communications Circuits*.

#### (B) Secondary Protectors.

The secondary protector shall be listed as suitable to provide means to safely limit currents to less than the current-carrying capacity of listed indoor communications wire and cable, listed telephone set line cords, and listed communications terminal equipment having ports for external wire line communications circuits. Any overvoltage protection, arresters, or grounding connection shall be connected on the equipment terminals side of the secondary protector current-limiting means.

Informational Note: One way to determine applicable requirements for a listed secondary protector is to refer to ANSI/UL 497A-2012, *Standard for Secondary Protectors for Communications Circuits*.

**(C) Plenum Grade Cable Ties.**

Cable ties intended for use in other space used for environmental air (plenums) shall be listed as having low smoke and heat release properties.

Informational Note: See NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, and ANSI/UL 2043-2013, *Standard for Safety Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces*, for information on listing discrete products as having low smoke and heat release properties.

### 805.173 Drop Wire and Cable.

Communications wires and cables without a metallic shield, running from the last outdoor support to the primary protector, shall be listed as being suitable for the purpose and shall have current-carrying capacity as specified in 805.90(A)(1)(b) or (A)(1)(c).

### 805.179 Communications Wires and Cables.

Communications wires and cables shall be listed in accordance with 805.179(A) through (F) and marked in accordance with Table 805.179 and 805.179(G). Conductors in communications cables, other than in a coaxial cable, shall be copper.

Communications wires and cables shall have a voltage rating of not less than 300 volts. The insulation for the individual conductors, other than the outer conductor of a coaxial cable, shall be rated for 300 volts minimum. The cable voltage rating shall not be marked on the cable or on the under-carpet communications wire.

*Exception: Voltage markings shall be permitted where the cable has multiple listings and 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 805.179 Cable Markings**

| Cable Marking | Type |
|---|---|
| CMP | Communications plenum cable |
| CMR | Communications riser cable |
| CMG | Communications general-purpose cable |
| CM | Communications general-purpose cable |
| CMX | Communications cable, limited use |
| CMUC | Under-carpet communications wire and cable |

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

**(A) General Requirements.**

The general requirements in 805.179 shall apply.

**(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 VW-1 (vertical-wire) flame test in ANSI/UL 1581-2017, *Reference Standard for Electrical Wires, Cables and Flexible Cords*.

### (C) Circuit Integrity (CI) Cable or Electrical Circuit Protective System.

Cables that are used for survivability of critical circuits under fire conditions shall be listed and meet either 805.179(C)(1) or 805.179(C)(2).

Informational Note: The listing organization provides information for circuit integrity (CI) cable and electrical circuit protective systems, including installation requirements required to maintain the fire rating.

### (1) Circuit Integrity (CI) Cables.

Circuit integrity (CI) cables specified in 805.179(A) through (D), and used for survivability of critical circuits, shall have an additional classification using the suffix "CI." In order to maintain its listed fire rating, circuit integrity (CI) cable shall only be installed in free air.

Informational Note: One method of defining circuit integrity (CI) cable is by establishing a minimum 2-hour fire resistance rating for the cable when tested in accordance with ANSI/UL 2196-2017, *Standard for Fire Test for Circuit Integrity of Fire-Resistant Power, Instrumentation, Control, and Data Cables*.

### (2) Fire-Resistive Cables.

Cables specified in 800.179(A) through (D) and 805.179(C)(1), that are part of an electrical circuit protective system, shall be fire-resistive cable identified with the protective system number on the product, or on the smallest unit container in which the product is packaged, and shall be installed in accordance with the listing of the protective system.

Informational Note No. 1: One method of defining an electrical circuit protective system is by establishing a minimum 2-hour fire resistance rating for the system when tested in accordance with UL Subject 1724, *Outline of Investigation for Fire Tests for Electrical Circuit Protective Systems*.

Informational Note No. 2: The listing organization provides information for electrical circuit protective systems (FHIT), including installation requirements for maintaining the fire rating.

### (D) Types CMP-LP, CMR-LP, CMG-LP, and CM-LP Limited Power (LP) Cables.

Types CMP-LP, CMR-LP, CMG-LP, and CM-LP communications limited power 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 XX designates the current limit in amperes per conductor.

Informational Note: An example of the marking on a communications cable with an LP rating is "CMP-LP (0.6A)(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 ampere.

### (E) Communications Wires.

Communications wires, such as distributing frame wire and jumper wire, shall 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 Flame Tray 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. 0.3-09, *Test Methods for Electrical Wires and Cables*.

### (F) Hybrid Power and Communications Cables.

Listed hybrid power and communications cables shall be permitted where the power cable is a listed Type NM or NM-B, conforming to Part III of Article 334, and the communications cable is a listed Type CM, the jackets on the listed NM or NM-B, and listed CM cables are rated for 600 volts minimum, and the hybrid cable is 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 Flame Tray 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. 0.3-09, *Test Methods for Electrical Wires and Cables*.

### (G) Optional Markings.

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.

## Article 810 Radio and Television Equipment

### Part I. General

#### 810.1 Scope.

This article covers antenna systems for radio and television receiving equipment, amateur and citizen band radio transmitting and receiving equipment, and certain features of transmitter safety. This article covers antennas such as wire-strung type, multi-element, vertical rod, flat, or parabolic and also covers the wiring and cabling that connect them to equipment. This article does not cover equipment and antennas used for coupling carrier current to power line conductors.

#### 810.2 Definitions.

The definitions in Part I of Article 100 shall apply.

#### 810.3 Other Articles.

Wiring from the source of power to and between devices connected to the interior wiring system shall comply with Chapters 1 through 4 other than as modified by Parts I and II of Article 640. Wiring for audio signal processing, amplification, and reproduction equipment shall comply with Article 640. Coaxial cables that connect antennas to equipment shall comply with Article 820.

#### 810.4 Community Television Antenna.

The antenna shall comply with this article. The distribution system shall comply with Article 820.

#### 810.5 Radio Noise Suppressors.

Radio interference eliminators, interference capacitors, or noise suppressors connected to power-supply leads shall be of a listed type. They shall not be exposed to physical damage.

#### 810.6 Antenna Lead-In Protectors.

Where an antenna lead-in surge protector is installed, it shall be listed as being suitable for limiting surges on the cable that connects the antenna to the receiver/transmitter electronics and shall be connected between the conductors and the grounded shield or other ground connection. The antenna lead-in protector shall be grounded using a bonding conductor or grounding electrode conductor installed in accordance with 810.21(F).

Informational Note: For requirements covering protectors for antenna lead-in conductors, refer to UL 497E, *Outline of Investigation for Protectors for Antenna Lead-In Conductors*.

#### 810.7 Grounding Devices.

Where bonding or grounding is required, devices used to connect a shield, a sheath, non–current-carrying metallic members of a cable, or metal parts of equipment or antennas to a bonding conductor or grounding electrode conductor shall be listed or be part of listed equipment.

### Part II. Receiving Equipment — Antenna Systems

#### 810.11 Material.

Antennas and lead-in conductors shall be of hard-drawn copper, bronze, aluminum alloy, copper-clad steel, or other high-strength, corrosion-resistant material.

*Exception: Soft-drawn or medium-drawn copper shall be permitted for lead-in conductors where the maximum span between points of support is less than 11 m (35 ft).*

#### 810.12 Supports.

Outdoor antennas and lead-in conductors shall be securely supported. The antennas or lead-in conductors shall not be attached to the electric service mast. They shall not be attached to poles or similar structures carrying open electric light or power wires or trolley wires of over 250 volts between conductors. Insulators supporting the antenna conductors shall have sufficient mechanical strength to safely support the conductors. Lead-in conductors shall be securely attached to the antennas.

### 810.13 Avoidance of Contacts with Conductors of Other Systems.

Outdoor antennas and lead-in conductors from an antenna to a building shall not cross over open conductors of electric light or power circuits and shall be kept well away from all such circuits so as to avoid the possibility of accidental contact. Where proximity to open electric light or power service conductors of less than 250 volts between conductors cannot be avoided, the installation shall be such as to provide a clearance of at least 600 mm (2 ft).

Where practicable, antenna conductors shall be installed so as not to cross under open electric light or power conductors.

### 810.14 Splices.

Splices and joints in antenna spans shall be made mechanically secure with approved splicing devices or by such other means as will not appreciably weaken the conductors.

### 810.15 Grounding.

Masts and metal structures supporting antennas shall be grounded in accordance with 810.21, unless the antenna and its related supporting mast or structure are within a zone of protection defined by a 46 m (150 ft) radius rolling sphere.

Informational Note: See 4.8.3.1 of NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, for the application of the term *rolling sphere*.

### 810.16 Size of Wire-Strung Antenna — Receiving Station.

#### (A) Size of Antenna Conductors.

Outdoor antenna conductors for receiving stations shall be of a size not less than given in Table 810.16(A).

**Table 810.16(A) Size of Receiving Station Outdoor Antenna Conductors**

| Material | Minimum Size of Conductors (AWG) Where Maximum Open Span Length Is | | |
|---|---|---|---|
| | Less Than 11 m (35 ft) | 11 m to 45 m (35 ft to 150 ft) | Over 45 m (150 ft) |
| Aluminum alloy, hard-drawn copper | 19 | 14 | 12 |
| Copper-clad steel, bronze, or other high-strength material | 20 | 17 | 14 |

#### (B) Self-Supporting Antennas.

Outdoor antennas, such as vertical rods and flat, parabolic, or dipole structures, shall be of corrosion-resistant materials and of strength suitable to withstand ice and wind loading conditions and shall be located well away from overhead conductors of electric light and power circuits of over 150 volts to ground, so as to avoid the possibility of the antenna or structure falling into or making accidental contact with such circuits.

### 810.17 Size of Lead-in — Receiving Station.

Lead-in conductors from outside antennas for receiving stations shall, for various maximum open span lengths, be of such size as to have a tensile strength at least as great as that of the conductors for antennas as specified in 810.16. Where the lead-in consists of two or more conductors that are twisted

together, are enclosed in the same covering, or are concentric, the conductor size shall, for various maximum open span lengths, be such that the tensile strength of the combination is at least as great as that of the conductors for antennas as specified in 810.16.

### 810.18 Clearances — Receiving Stations.

#### (A) Outside of Buildings.

Lead-in conductors attached to buildings shall be installed so that they cannot swing closer than 600 mm (2 ft) to the conductors of circuits of 250 volts or less between conductors, or 3.0 m (10 ft) to the conductors of circuits of over 250 volts between conductors, except that in the case of circuits not over 150 volts between conductors, where all conductors involved are supported so as to ensure permanent separation, the clearance shall be permitted to be reduced but shall not be less than 100 mm (4 in.). The clearance between lead-in conductors and any conductor forming a part of a lightning protection system shall not be less than 1.8 m (6 ft). Underground conductors shall be separated at least 300 mm (12 in.) from conductors of any light or power circuits or Class 1 circuits.

*Exception: Where the electric light or power conductors, Class 1 conductors, or lead-in conductors are installed in raceways or metal cable armor.*

Informational Note No. 1: See 250.60 for grounding associated with lightning protection components — strike termination devices. For further information, see NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, which contains detailed information on grounding, bonding, and spacing from lightning protection systems, and the calculation of specific separation distances using the sideflash equation in Section 4.6.

Informational Note No. 2: Metal raceways, enclosures, frames, and other non–current-carrying metal parts of electrical equipment installed on a building equipped with a lightning protection system may require bonding or spacing from the lightning protection conductors in accordance with NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*. Separation from lightning protection conductors is typically 1.8 m (6 ft) through air or 900 mm (3 ft) through dense materials such as concrete, brick, or wood.

#### (B) Antennas and Lead-ins — Indoors.

Indoor antennas and indoor lead-ins shall not be run nearer than 50 mm (2 in.) to conductors of other wiring systems in the premises.

*Exception No. 1: Where such other conductors are in metal raceways or cable armor.*

*Exception No. 2: Where permanently separated from such other conductors by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing.*

#### (C) In Boxes or Other Enclosures.

Indoor antennas and indoor lead-ins shall be permitted to occupy the same box or enclosure with conductors of other wiring systems where separated from such other conductors by an effective permanently installed barrier.

### 810.19 Electrical Supply Circuits Used in Lieu of Antenna — Receiving Stations.

Where an electrical supply circuit is used in lieu of an antenna, the device by which the radio receiving set is connected to the supply circuit shall be listed.

### 810.20 Antenna Discharge Units — Receiving Stations.

#### (A) Where Required.

Each conductor of a lead-in from an outdoor antenna shall be provided with a listed antenna discharge unit.

*Exception: Where the lead-in conductors are enclosed in a continuous metallic shield that either is grounded with a conductor in accordance with 810.21 or is protected by an antenna discharge unit.*

#### (B) Location.

Antenna discharge units shall be located outside the building or inside the building between the point of entrance of the lead-in and the radio set or transformers and as near as practicable to the entrance of the conductors to the building. The antenna discharge unit shall not be located near combustible material or in a hazardous (classified) location as defined in Article 500.

**(C) Grounding.**

The antenna discharge unit shall be grounded in accordance with 810.21.

**810.21 Bonding Conductors and Grounding Electrode Conductors — Receiving Stations.**

Bonding conductors and grounding electrode conductors shall comply with 810.21(A) through 810.21(K).

**(A) Material.**

The bonding conductor or grounding electrode conductor shall be of copper, aluminum, copper-clad steel, copper-clad aluminum, bronze, or similar corrosion-resistant material. Aluminum or copper-clad aluminum bonding conductors or grounding electrode conductors shall not be used where in direct contact with masonry or the earth or where subject to corrosive conditions. Where used outside, aluminum or copper-clad aluminum conductors shall not be installed within 450 mm (18 in.) of the earth.

**(B) Insulation.**

Insulation on bonding conductors or grounding electrode conductors shall not be required.

**(C) Supports.**

The bonding conductor or grounding electrode conductor shall be securely fastened in place and shall be permitted to be directly attached to the surface wired over without the use of insulating supports.

*Exception: Where proper support cannot be provided, the size of the bonding conductors or grounding electrode conductors shall be increased proportionately.*

**(D) Physical Protection.**

Bonding conductors and grounding electrode conductors shall be protected where exposed to physical damage. Where the bonding conductor or grounding electrode conductor is installed in a metal raceway, both ends of the raceway shall be bonded to the contained conductor or to the same terminal or electrode to which the bonding conductor or grounding electrode conductor is connected.

**(E) Run in Straight Line.**

The bonding conductor or grounding electrode conductor for an antenna mast or antenna discharge unit shall be run in as straight a line as practicable.

**(F) Electrode.**

The bonding conductor or grounding electrode conductor shall be connected as required in 810.21(F)(1) through 810.21(F)(3).

**(1) In Buildings or Structures with an Intersystem Bonding Termination.**

If the building or structure served has an intersystem bonding termination as required by 250.94, the bonding conductor shall be connected to the intersystem bonding termination.

**(2) In Buildings or Structures with Grounding Means.**

If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on the following:

1. The building or structure grounding electrode system as covered in 250.50
2. The grounded interior metal water piping systems, within 1.52 m (5 ft) from its point of entrance to the building, as covered in 250.52
3. The power service accessible means external to the building, as covered in 250.94
4. The nonflexible metal power service raceway
5. The service equipment enclosure, or
6. The grounding electrode conductor or the grounding electrode conductor metal enclosures of the power service

A bonding device intended to provide a termination point for the bonding conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on nonremovable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is nonremovable.

**(3) In Buildings or Structures Without an Intersystem Bonding Termination or Grounding Means.**

If the building or structure served has no intersystem bonding termination or grounding means as described in 810.21(F)(2), the grounding electrode conductor shall be connected to a grounding electrode as described in 250.52.

**(G) Inside or Outside Building.**

The bonding conductor or grounding electrode conductor shall be permitted to be run either inside or outside the building.

**(H) Size.**

The bonding conductor or grounding electrode conductor shall not be smaller than 10 AWG copper, 8 AWG aluminum, or 17 AWG copper-clad steel or bronze.

**(I) Common Ground.**

A single bonding conductor or grounding electrode conductor shall be permitted for both protective and operating purposes.

**(J) Bonding of Electrodes.**

A bonding jumper not smaller than 6 AWG copper or equivalent shall be connected between the radio and television equipment grounding electrode and the power grounding electrode system at the building or structure served where separate electrodes are used.

**(K) Electrode Connection.**

Connections to grounding electrodes shall comply with 250.70.

## Part III. Amateur and Citizen Band Transmitting and Receiving Stations — Antenna Systems

### 810.51 Other Sections.

In addition to complying with Part III, antenna systems for amateur and citizen band transmitting and receiving stations shall also comply with 810.11 through 810.15.

### 810.52 Size of Antenna.

Antenna conductors for transmitting and receiving stations shall be of a size not less than given in Table 810.52.

**Table 810.52 Size of Outdoor Antenna Conductors**

| Material | Minimum Size of Conductors (AWG) Where Maximum Open Span Length Is | |
|---|---|---|
| | Less Than 45 m (150 ft) | Over 45 m (150 ft) |
| Hard-drawn copper | 14 | 10 |
| Copper-clad steel, bronze, or other high-strength material | 14 | 12 |

### 810.53 Size of Lead-in Conductors.

Lead-in conductors for transmitting stations shall, for various maximum span lengths, be of a size at least as great as that of conductors for antennas as specified in 810.52.

### 810.54 Clearance on Building.

Antenna conductors for transmitting stations, attached to buildings, shall be firmly mounted at least 75 mm (3 in.) clear of the surface of the building on nonabsorbent insulating supports, such as treated pins or brackets equipped with insulators having not less than 75-mm (3-in.) creepage and airgap distances. Lead-in conductors attached to buildings shall also comply with these requirements.

*Exception: Where the lead-in conductors are enclosed in a continuous metallic shield that is grounded with a conductor in accordance with 810.58, they shall not be required to comply with these requirements. Where grounded, the metallic shield shall also be permitted to be used as a conductor.*

**810.55 Entrance to Building.**

Except where protected with a continuous metallic shield that is grounded with a conductor in accordance with 810.58, lead-in conductors for transmitting stations shall enter buildings by one of the following methods:

1. Through a rigid, noncombustible, nonabsorbent insulating tube or bushing
2. Through an opening provided for the purpose in which the entrance conductors are firmly secured so as to provide a clearance of at least 50 mm (2 in.)
3. Through a drilled window pane

**810.56 Protection Against Accidental Contact.**

Lead-in conductors to radio transmitters shall be located or installed so as to make accidental contact with them difficult.

**810.57 Antenna Discharge Units — Transmitting Stations.**

Each conductor of a lead-in for outdoor antennas shall be provided with an antenna discharge unit or other suitable means that drain static charges from the antenna system.

*Exception No. 1: Where the lead-in is protected by a continuous metallic shield that is grounded with a conductor in accordance with 810.58, an antenna discharge unit or other suitable means shall not be required.*

*Exception No. 2: Where the antenna is grounded with a conductor in accordance with 810.58, an antenna discharge unit or other suitable means shall not be required.*

**810.58 Bonding Conductors and Grounding Electrode Conductors — Amateur and Citizen Band Transmitting and Receiving Stations.**

Bonding conductors and grounding electrode conductors shall comply with 810.58(A) through 810.58(C).

**(A) Other Sections.**

All bonding conductors and grounding electrode conductors for amateur and citizen band transmitting and receiving stations shall comply with 810.21(A) through 810.21(C).

**(B) Size of Protective Bonding Conductor or Grounding Electrode Conductor.**

The protective bonding conductor or grounding electrode conductor for transmitting stations shall be as large as the lead-in but not smaller than 10 AWG copper, bronze, or copper-clad steel.

**(C) Size of Operating Bonding Conductor or Grounding Electrode Conductor.**

The operating bonding conductor or grounding electrode conductor for transmitting stations shall not be less than 14 AWG copper or its equivalent.

**Part IV. Interior Installation — Transmitting Stations**

**810.70 Clearance from Other Conductors.**

All conductors inside the building shall be separated at least 100 mm (4 in.) from the conductors of any electric light, power, or signaling circuit.

*Exception No. 1: As provided in Article 640.*

*Exception No. 2: Where separated from other conductors by raceway or some firmly fixed nonconductor, such as porcelain tubes or flexible tubing.*

### 810.71 General.

Transmitters shall comply with 810.71(A) through (C).

**(A) Enclosing.**

The transmitter shall be enclosed in a metal frame or grille or separated from the operating space by a barrier or other equivalent means, all metallic parts of which are effectively connected to a bonding conductor or grounding electrode conductor.

**(B) Grounding of Controls.**

All external metal handles and controls accessible to the operating personnel shall be effectively connected to an equipment grounding conductor if the transmitter is powered by the premises wiring system or grounded with a conductor in accordance with 810.21.

**(C) Interlocks on Doors.**

All access doors shall be provided with interlocks that disconnect all voltages of over 350 volts between conductors when any access door is opened.

## Article 820 Community Antenna Television and Radio Distribution Systems

### Part I. General

### 820.1 Scope.

This article covers coaxial cable distribution of radio frequency signals typically employed in community antenna television (CATV) systems.

### 820.2 Definitions.

The definitions in this section shall apply only within Articles 820 and 840.

### 820.3 Other Articles.

Circuits and equipment shall comply with 820.3(A)and (B).

**(A) General Requirements.**

The general requirements of Article 800 shall apply.

**(B) Alternate Wiring Methods.**

The wiring methods of Article 830 shall be permitted to substitute for the wiring methods of Article 820.

Informational Note: Use of Article 830 wiring methods will facilitate the upgrading of Article 820 installations to network-powered broadband applications.

### 820.15 Power Limitations.

Coaxial cable shall be permitted to deliver power to equipment that is directly associated with the radio frequency distribution system if the voltage is not over 60 volts and if the current is supplied by a transformer or other device that has power-limiting characteristics.

Power shall be blocked from premises devices on the network that are not intended to be powered via the coaxial cable.

### Part II. Coaxial Cables ~~Outside~~ on the service provider side of the Communication Service Point~~and Entering Buildings~~

### 820.44 Overhead (Aerial) Coaxial Cables.

Overhead (aerial) coaxial cables, prior to the point of grounding, as specified in 820.93, shall comply with 820.44(A) or 800.44.

**(A) On Poles and In-Span, Above Roofs, on Masts, or Between Buildings.**

Where coaxial cables are installed on poles and in-span, above roofs, on masts, or between buildings, they shall comply with 800.44.

**(B) On Buildings.**

Where attached to buildings, coaxial cables shall be securely fastened in such a manner that they will be separated from other conductors in accordance with 820.44(B)(1) and (B)(2).

**(1) Electric Light or Power.**

The coaxial cable shall have a separation of at least 100 mm (4 in.) from electric light, power, Class 1, or non-power-limited fire alarm circuit conductors not in raceway or cable, or shall be permanently separated from conductors of the other system by a continuous and firmly fixed nonconductor in addition to the insulation on the wires.

**(2) Other Communications Systems.**

Coaxial cable shall be installed so that there will be no unnecessary interference in the maintenance of the separate systems. In no case shall the conductors, cables, messenger strand, or equipment of one system cause abrasion to the conductors, cable, messenger strand, or equipment of any other system.

### 820.47 Underground Coaxial Cables Entering Buildings.

Underground coaxial cables entering buildings shall comply with 820.47(A) and 820.47(B).

**(A) Underground Systems with Electric Light, Power, Class 1, or Non–Power-Limited Fire Alarm Circuit Conductors.**

Underground coaxial cables in a duct, pedestal, handhole enclosure, or manhole that contains electric light, power, or Class 1 or non–power-limited fire alarm circuit conductors shall be in a section permanently separated from such conductors by means of a suitable barrier.

**(B) Direct-Buried Cables and Raceways.**

Direct-buried coaxial cable shall be separated at least 300 mm (12 in.) from conductors of any light or power, non–power-limited fire alarm circuit conductors, or Class 1 circuit.

*Exception No. 1: Separation shall not be required where electric service conductors or coaxial cables are installed in raceways or have metal cable armor.*

*Exception No. 2: Separation shall not be required where electric light or power branch-circuit or feeder conductors or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables; or the coaxial cables have metal cable armor or are installed in a raceway.*

### 820.48 Unlisted Cables Entering Buildings.

Unlisted outside plant coaxial cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated at a grounding block. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) to the point of emergence.

## Part III. Protection

### 820.93 Grounding of the Outer Conductive Shield of Coaxial Cables.

Coaxial cables entering buildings or attached to buildings shall comply with 820.93(A) or (B). Where the outer conductive shield of a coaxial cable is grounded, no other protective devices shall be required. For purposes of this section, grounding located at mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a grounding block location to achieve the shortest practicable bonding conductor or grounding electrode conductor helps limit potential differences between CATV and other metallic systems.

**(A) Entering Buildings.**

In installations where the coaxial cable enters the building, the outer conductive shield shall be grounded in accordance with 820.100. The grounding shall be as close as practicable to the point of entrance.

**(B) Terminating Outside of the Building.**

In installations where the coaxial cable is terminated outside of the building, the outer conductive shield shall be grounded in accordance with 820.100. The grounding shall be as close as practicable to the point of attachment or termination.

**(C) Location.**

Where installed, a listed primary protector shall be applied on each community antenna and radio distribution (CATV) cable external to the premises. The listed primary protector shall be located as close as practicable to the entrance point of the cable on either side or integral to the ground block.

**(D) Hazardous (Classified) Locations.**

Where a primary protector or equipment providing the primary protection function is used, it shall not be located in any hazardous (classified) location as defined in 500.5 and 505.5 or in the vicinity of easily ignitible material.

*Exception: As permitted in 501.150, 502.150, and 503.150.*

**Part IV. Grounding Methods**

**820.100 Cable Bonding and Grounding.**

The shield of the coaxial cable shall be bonded or grounded as specified in 820.100(A) and (B).

*Exception: For communications systems using coaxial cable completely contained within the building (i.e., they do not exit the building) or the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere and isolated from outside cable plant, the shield shall be permitted to be grounded by a connection to an equipment grounding conductor as described in 250.118. Connecting to an equipment grounding conductor through a grounded receptacle using a dedicated bonding jumper and a permanently connected listed device shall be permitted. Use of a cord and plug for the connection to an equipment grounding conductor shall not be permitted.*

Informational Note: See 4.8.3.1 of NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems,* for the application of the term *rolling sphere*.

**(A) General Requirements.**

The installation shall be in accordance with 800.100.

**(B) Shield Protection Devices.**

Grounding of a coaxial drop cable shield by means of a protective device that does not interrupt the grounding system within the premises shall be permitted.

**820.103 Equipment Grounding.**

Unpowered equipment and enclosures or equipment powered by the coaxial cable shall be considered grounded where connected to the metallic cable shield.

**Part V. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**820.133 Installation of Coaxial Cables and Equipment.**

Beyond the point of grounding, as defined in 820.93, the coaxial cable installation shall comply with 820.133(A) and (B).

**(A) Separation from Other Conductors.**

**(1) In Raceways, Cable Trays, Boxes, Enclosures, and Cable Routing Assemblies.**

1. *Other Circuits.* Coaxial cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with jacketed cables 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. Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770
4. Communications circuits in compliance with Parts I and IV of Article 805
5. Low-power network-powered broadband communications circuits in compliance with Parts I and V of Article 830

2. *Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm, and Medium-Power Network-Powered Broadband Communications Circuits.* Coaxial cable shall not be placed in any raceway, compartment, outlet box, junction box, or other enclosures with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits.

*Exception No. 1: Coaxial cable shall be permitted to be placed in any raceway, compartment, outlet box, junction box, or other enclosures with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits where 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 coaxial cables by a permanent barrier or listed divider.*

*Exception No. 2: Coaxial cable shall be permitted to be placed in outlet boxes, junction boxes, or similar fittings or compartments with power conductors where such conductors are introduced solely for power supply to the coaxial cable system distribution equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum 6 mm (¼ in.) separation from coaxial cables.*

**(2) Other Applications.**

Coaxial cable shall be separated 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.

*Exception No. 1: Separation shall not be required where either (1) all of the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits are in a raceway, or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC or Type UF cables, or (2) all of the coaxial cables are encased in a raceway.*

*Exception No. 2: Separation shall not be required where the coaxial cables are permanently separated from the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B) Support of Coaxial Cables.**

Raceways shall be used for their intended purpose. Coaxial cables shall not be strapped, taped, or attached by any means to the exterior of any conduit or raceway as a means of support.

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

**820.154 Substitutions of Listed CATV Cables.**

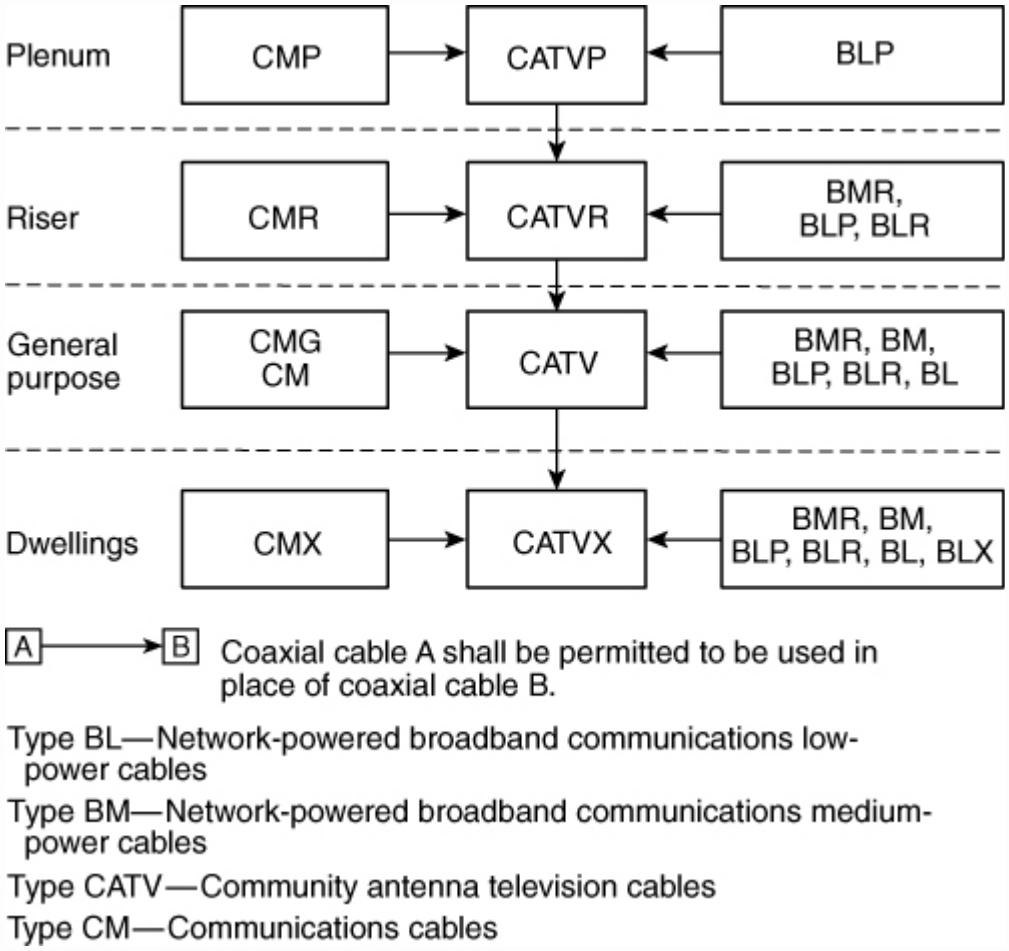
The substitutions for coaxial cables in Table 820.154 and illustrated in Figure 820.154 shall be permitted.

Informational Note: The substitute cables in Table 820.154 and Figure 820.154 are only coaxial-type cables.

**Table 820.154 Coaxial Cable Uses and Permitted Substitutions**

| Cable Type | Permitted Substitutions |
|---|---|
| CATVP | CMP, BLP |
| CATVR | CATVP, CMP, CMR, BMR, BLP, BLR |
| CATV | CATVP, CMP, CATVR, CMR, CMG, CM, BMR, BM, BLP, BLR, BL |
| CATVX | CATVP, CMP, CATVR, CMR, CATV, CMG, CM, BMR, BM, BLP, BLR, BL, BLX |

**Figure 820.154 Cable Substitution Hierarchy.**




## Part VI. Listing Requirements

### 820.179 Coaxial Cables.

Cables shall be listed in accordance with 820.179(A)and marked in accordance with Table 820.179 and 820.179(B). The cable voltage rating shall not be marked on the cable.

Informational Note: Voltage markings on cables could 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.*

**(A) General Requirements.**

The general requirements in 800.179 shall apply.

**(B) Optional Markings.**

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.

**Table 820.179 Coaxial Cable Markings**

| Cable Marking | Type |
|---|---|
| CATVP | CATV plenum cable |
| CATVR | CATV riser cable |
| CATV | CATV cable |
| CATVX | CATV cable, limited use |

# Article 830 Network-Powered Broadband Communications Systems

## Part I. General

### 830.1 Scope.

This article covers network-powered broadband communications systems that provide any combination of voice, audio, video, data, and interactive services through a network interface unit.

Informational Note: A typical basic system configuration includes a cable supplying power and broadband signal to a network interface unit that converts the broadband signal to the component signals. Typical cables are coaxial cable with both broadband signal and power on the center conductor, composite metallic cable with a coaxial member(s) or twisted pair members for the broadband signal and twisted pair members for power, and composite optical fiber cable with a pair of conductors for power. Larger systems may also include network components such as amplifiers that require network power.

### 830.2 Definitions.

The definitions in this section shall apply only within Article 830.

Informational Note: A typical single-family network-powered communications circuit consists of a communications drop or communications service cable and an NIU and includes the communications utility's serving terminal or tap where it is not under the exclusive control of the communications utility.

**Fault Protection Device.**

An electronic device that is intended for the protection of personnel and functions under fault conditions, such as network-powered broadband communications cable short or open circuit, to limit the current or voltage, or both, for a low-power network-powered broadband communications circuit and provide acceptable protection from electric shock.

**Network Interface Unit (NIU).**

A device that converts a broadband signal into component voice, audio, video, data, and interactive services signals and provides isolation between the network power and the premises signal circuits. These devices often contain primary and secondary protectors.

**Network-Powered Broadband Communications Circuit.**

The circuit extending from the communications utility's or service provider's serving terminal or tap up to and including the NIU.

Informational Note: A typical one-family dwelling network-powered communications circuit consists of a communications drop or communications service cable and an NIU and includes the communications utility's serving terminal or tap where it is not under the exclusive control of the communications utility.

### 830.3 Other Articles.

Circuits and equipment shall comply with 830.3(A) through (C).

**(A) General Requirements.**

The general requirements of Article 800 shall apply.

**(B) Output Circuits.**

As appropriate for the services provided, the output circuits derived from the network interface unit shall comply with the requirements of the following:

1. Installations of communications circuits — Part IV of Article 805
2. Installations of community antenna television and radio distribution circuits — Part V of Article 820

   *Exception: Where protection is provided in the output of the NIU 830.90(B)(3) shall apply.*
3. Installations of optical fiber cables — Part V of Article 770
4. Installations of Class 2 and Class 3 circuits — Part III of Article 725
5. Installations of power-limited fire alarm circuits — Part III of Article 760

**(C) Protection Against Physical Damage.**

The requirements of 300.4 shall apply.

**830.15 Power Limitations.**

Network-powered broadband communications systems shall be classified as having low- or medium-power sources as specified in 830.15(1) or (2).

1. Sources shall be classified as defined in Table 830.15.
2. Direct-current power sources exceeding 150 volts to ground, but no more than 200 volts to ground, with the current to ground limited to 10 mA dc, that meet the current and power limitation for medium-power sources in Table 830.15 shall be classified as medium-power sources.

Informational Note: One way to determine compliance with 830.15(2) is listed information technology equipment intended to supply power via a communications network that complies with the requirements for RFT-V circuits as defined in UL 60950-21-2007, *Standard for Safety for Information Technology Equipment — Safety — Part 21: Remote Power Feeding*.

**Table 830.15 Limitations for Network-Powered Broadband Communications Systems**

| Network Power Source | Low | Medium |
|---|---|---|
| Circuit voltage, $V_{max}$ (volts)[1] | 0–100 | 0–150 |
| Power limitation, $VA_{max}$ (volt-amperes)[1] | 250 | 250 |
| Current limitation, $I_{max}$ (amperes)[1] | $1000/V_{max}$ | $1000/V_{max}$ |
| Maximum power rating (volt-amperes) | 100 | 100 |
| Maximum voltage rating (volts) | 100 | 150 |
| Maximum overcurrent protection (amperes)[2] | $100/V_{max}$ | NA |

[1] $V_{max}$, $I_{max}$, and $VA_{max}$ are determined with the current-limiting impedance in the circuit (not bypassed) as follows:

$V_{max}$ — Maximum system voltage regardless of load with rated input applied.

$I_{max}$ — Maximum system current under any noncapacitive load, including short circuit, and with overcurrent protection bypassed if used. $I_{max}$ limits apply after 1 minute of operation.

$VA_{max}$ — Maximum volt-ampere output after 1 minute of operation regardless of load and overcurrent protection bypassed if used.

[2]Overcurrent protection is not required where the current-limiting device provides equivalent current limitation and the current-limiting device does not reset until power or the load is removed.

**830.24 Mechanical Execution of Work.**

The installation shall also conform to 300.4 and 300.11.

**Part II. Cables on the service provider side of the Communication Service Point~~Outside and Entering Buildings~~**

**830.40 Entrance Cables.**

Network-powered broadband communications cables located outside and entering buildings shall comply with 830.40(A) and (B).

**(A) Medium-Power Circuits.**

Medium-power network-powered broadband communications circuits located outside and entering buildings shall be installed using Type BMU, Type BM, or Type BMR network-powered broadband communications medium-power cables.

**(B) Low-Power Circuits.**

Low-power network-powered broadband communications circuits located outside and entering buildings shall be installed using Type BLU or Type BLX low-power network-powered broadband communications cables. Cables shown in Table 830.154 shall be permitted to substitute.

*Exception: Outdoor community antenna television and radio distribution system coaxial cables installed prior to January 1, 2000, and installed in accordance with Article 820, shall be permitted for low-power-type, network-powered broadband communications circuits.*

**830.44 Overhead (Aerial) Cables.**

Overhead (aerial) network-powered broadband communications cables shall comply with 830.44(A) through (F).

**(A) On Poles and In-Span or Above Roofs.**

Where network-powered broadband communications cables are installed on poles and in-span or above roofs, they shall comply with 800.44.

**(B) Clearance from Ground.**

Overhead (aerial) spans of network-powered broadband communications cables shall conform to not less than the following:

1. 2.9 m (9½ ft) — above finished grade, sidewalks, or from any platform or projection from which they might be reached and accessible to pedestrians only
2. 3.5 m (11½ ft) — over residential property and driveways, and those commercial areas not subject to truck traffic
3. 4.7 m (15½ ft) — over public streets, alleys, roads, parking areas subject to truck traffic, driveways on other than residential property, and other land traversed by vehicles such as cultivated, grazing, forest, and orchard

Informational Note: These clearances have been specifically chosen to correlate with ANSI/IEEE C2-2012, *National Electrical Safety Code*, Table 232-1, which provides for clearances of wires, conductors, and cables above ground and roadways, rather than using the clearances referenced in 225.18. Because Article 805 and Article 820 have had no required clearances, the communications industry has used the clearances from the NESC for their installed cable plant.

**(C) Over Pools.**

Clearance of network-powered broadband communications cable in any direction from the water level, edge of pool, base of diving platform, or anchored raft shall comply with those clearances in 680.9.

**(D) Final Spans.**

Final spans of network-powered broadband communications cables without an outer jacket shall be permitted to be attached to the building, but they shall be kept not less than 900 mm (3 ft) from windows that are designed to be opened, doors, porches, balconies, ladders, stairs, fire escapes, or similar locations.

*Exception: Conductors run above the top level of a window shall be permitted to be less than the 900-mm (3-ft) requirement above.*

Overhead (aerial) network-powered broadband communications cables shall not be installed beneath openings through which materials might be moved, such as openings in farm and commercial buildings, and shall not be installed where they obstruct entrance to these building openings.

**(E) Between Buildings.**

Network-powered broadband communications cables extending between buildings or structures, and also the supports or attachment fixtures, shall be identified as suitable for outdoor aerial applications and shall have sufficient strength to withstand the loads to which they may be subjected.

*Exception: Where a network-powered broadband communications cable does not have sufficient strength to be self-supporting, it shall be attached to a supporting messenger cable that, together with the attachment fixtures or supports, shall be acceptable for the purpose and shall have sufficient strength to withstand the loads to which they may be subjected.*

**(F) On Buildings.**

Where attached to buildings, network-powered broadband communications cables shall be securely fastened in such a manner that they are separated from other conductors in accordance with 830.44(F)(1) through (F)(3).

**(1) Electric Light or Power.**

The network-powered broadband communications cable shall have a separation of at least 100 mm (4 in.) from electric light, power, Class 1, or non-power-limited fire alarm circuit conductors not in raceway or cable, or be permanently separated from conductors of the other system by a continuous and firmly fixed nonconductor in addition to the insulation on the wires.

**(2) Other Communications Systems.**

Network-powered broadband communications cables shall be installed so that there will be no unnecessary interference in the maintenance of the separate systems. In no case shall the conductors, cables, messenger strand, or equipment of one system cause abrasion to the conductors, cables, messenger strand, or equipment of any other system.

**(3) Protection from Damage.**

Network-powered broadband communications cables attached to buildings or structures and located within 2.5 m (8 ft) of finished grade shall be protected by enclosures, raceways, or other approved means.

*Exception: A low-power network-powered broadband communications circuit that is equipped with a listed fault protection device, appropriate to the network-powered broadband communications cable used, and located on the network side of the network-powered broadband communications cable shall not be required to be additionally protected by enclosures, raceways, or other approved means.*

**830.47 Underground Network-Powered Broadband Communications Cables Entering Buildings.**

Underground network-powered broadband communications cables entering buildings shall comply with 830.47(A) through 830.47(D).

**(A) Underground Systems with Electric Light and Power, Class 1, or Non–Power-Limited Fire Alarm Circuit Conductors.**

Underground network-powered broadband communications cables in a duct, pedestal, handhole enclosure, or manhole that contains electric light, power conductors, non–power-limited fire alarm circuit

conductors, or Class 1 circuits shall be in a section permanently separated from such conductors by means of a suitable barrier.

**(B) Direct-Buried Cables and Raceways.**

Direct-buried network-powered broadband communications cables shall be separated by at least 300 mm (12 in.) from conductors of any light, power, non–power-limited fire alarm circuit conductors or Class 1 circuit.

*Exception No. 1: Separation shall not be required where electric service conductors or network-powered broadband communications cables are installed in raceways or have metal cable armor.*

*Exception No. 2: Separation shall not be required where electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables; or the network-powered broadband communications cables have metal cable armor or are installed in a raceway.*

**(C) Protection from Physical Damage.**

Direct-buried cable, conduit, or other raceways shall be installed to meet the minimum cover requirements of Table 830.47(C). In addition, direct-buried cables emerging from the ground shall be protected by enclosures, raceways, or other approved means extending from the minimum cover distance required by Table 830.47(C) below grade 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. Types BMU and BLU direct-buried cables emerging from the ground shall be installed in rigid metal conduit (RMC), intermediate metal conduit (IMC), rigid nonmetallic conduit, or other approved means extending from the minimum cover distance required by Table 830.47(C) below grade to the point of entrance.

*Exception: A low-power network-powered broadband communications circuit that is equipped with a listed fault protection device, appropriate to the network-powered broadband communications cable used, and located on the network side of the network-powered broadband communications cable being protected.*

**Table 830.47(C) Network-Powered Broadband Communications Systems Minimum Cover Requirements (*Cover* is the shortest distance measured between a point on the top surface of any direct-buried cable, conduit, or other raceway and the top surface of finished grade, concrete, or similar cover.)**

| Location of Wiring Method or Circuit | Direct Burial Cables | | Rigid Metal Conduit (RMC) or Intermediate Metal Conduit (IMC) | | Nonmetallic Raceways Listed for Direct Burial; Without Concrete Encasement or Other Approved Raceways | |
|---|---|---|---|---|---|---|
| | mm | in. | mm | in. | mm | in. |
| All locations not specified below | 450 | 18 | 150 | 6 | 300 | 12 |
| In trench below 50-mm (2-in.) thick concrete or equivalent | 300 | 12 | 150 | 6 | 150 | 6 |
| Under a building (in raceway only) | 0 | 0 | 0 | 0 | 0 | 0 |
| Under minimum of 100-mm (4-in.) thick concrete exterior slab with no vehicular traffic and the slab extending not less than 150 mm (6 in.) beyond the underground installation | 300 | 12 | 100 | 4 | 100 | 4 |

| Location of Wiring Method or Circuit | Direct Burial Cables | | Rigid Metal Conduit (RMC) or Intermediate Metal Conduit (IMC) | | Nonmetallic Raceways Listed for Direct Burial; Without Concrete Encasement or Other Approved Raceways | |
|---|---|---|---|---|---|---|
| | mm | in. | mm | in. | mm | in. |
| One- and two-family dwelling driveways and outdoor parking areas and used only for dwelling-related purposes | 300 | 12 | 300 | 12 | 300 | 12 |

Notes:

1. Raceways approved for burial only where concrete encased shall require a concrete envelope not less than 50 mm (2 in.) thick.

2. Lesser depths shall be permitted where cables rise for terminations or splices or where access is otherwise required.

3. Where solid rock is encountered, all wiring shall be installed in 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.

4. Low-power network-powered broadband communications circuits using directly buried community antenna television and radio distribution system coaxial cables that were installed outside and entering buildings prior to January 1, 2000, in accordance with Article 820 shall be permitted where buried to a minimum depth of 300 mm (12 in.).

**(D) Pools.**

Cables located under the pool or within the area extending 1.5 m (5 ft) horizontally from the inside wall of the pool shall meet those clearances and requirements specified in 680.11.

**Part III. Protection**

**830.90 Primary Electrical Protection.**

**(A) Application.**

Primary electrical protection shall be provided on all network-powered broadband communications conductors that are neither grounded nor interrupted and are run partly or entirely in aerial cable not confined within a block. Also, primary electrical protection shall be provided on all aerial or underground network-powered broadband communications conductors that are neither grounded nor interrupted and are located within the block containing the building served so as to be exposed to lightning or accidental contact with electric light or power conductors operating at over 300 volts to ground.

*Exception: Primary electrical protection shall not be required on the network-powered broadband communications conductors where electrical protection is provided on the derived circuit(s) (output side of the NIU) in accordance with 830.90(B)(3).*

Informational Note No. 1: On network-powered broadband communications conductors not exposed to lightning or accidental contact with power conductors, providing primary electrical protection in accordance with this article helps protect against other hazards, such as ground potential rise caused by power fault currents, and above-normal voltages induced by fault currents on power circuits in proximity to the network-powered broadband communications conductors.

Informational Note No. 2: Network-powered broadband communications circuits are considered to have a lightning exposure unless one or more of the following conditions exist:

1. Circuits in large metropolitan areas where buildings are close together and sufficiently high to intercept lightning.
2. Areas having an average of five or fewer thunderstorm days each year and earth resistivity of less than 100 ohm-meters. Such areas are found along the Pacific coast.

Informational Note No. 3: For information on lightning protection systems, see NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*.

**(1) Fuseless Primary Protectors.**

Fuseless-type primary protectors shall be permitted where power fault currents on all protected conductors in the cable are safely limited to a value no greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor.

**(2) Fused Primary Protectors.**

Where the requirements listed in 830.90(A)(1) are not met, fused-type primary protectors shall be used. Fused-type primary protectors shall consist of an arrester connected between each conductor to be protected and ground, a fuse in series with each conductor to be protected, and an appropriate mounting arrangement. Fused primary protector terminals shall be marked to indicate line, instrument, and ground, as applicable.

**(B) Location.**

The location of the primary protector, where required, shall comply with 830.90(B)(1), (B)(2), or (B)(3):

1. A listed primary protector shall be applied on each network-powered broadband communications cable external to and on the network side of the network interface unit.
2. The primary protector function shall be an integral part of and contained in the network interface unit. The network interface unit shall be listed as being suitable for application with network-powered broadband communications systems and shall have an external marking indicating that it contains primary electrical protection.
3. The primary protector(s) shall be provided on the derived circuit(s) (output side of the NIU), and the combination of the NIU and the protector(s) shall be listed as being suitable for application with network-powered broadband communications systems.

A primary protector, whether provided integrally or external to the network interface unit, shall be located as close as practicable to the point of entrance.

For purposes of this section, a network interface unit and any externally provided primary protectors located at mobile home service equipment located in sight from and not more than 9.0 m (30 ft) from the exterior wall of the mobile home it serves, or at a mobile home disconnecting means grounded in accordance with 250.32 and located in sight from and not more than 9.0 m (30 ft) from the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a network interface unit and primary protector location to achieve the shortest practicable primary protector bonding conductor or grounding electrode conductor helps limit potential differences between communications circuits and other metallic systems.

**(C) Hazardous (Classified) Locations.**

The primary protector or equipment providing the primary protection function shall not be located in any hazardous (classified) location as defined in 500.5 and 505.5 or in the vicinity of easily ignitible material.

*Exception: As permitted in 501.150, 502.150, and 503.150.*

**Part IV. Grounding Methods**

**830.93 Grounding or Interruption of Metallic Members of Network-Powered Broadband Communications Cables.**

Network-powered communications cables entering buildings or attaching to buildings shall comply with 830.93(A) or (B).

For purposes of this section, grounding located at mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a grounding location to achieve the shortest practicable bonding conductor or grounding electrode conductor helps limit potential differences between the network-powered broadband communications circuits and other metallic systems.

**(A) Entering Buildings.**

In installations where the network-powered communications cable enters the building, the shield shall be grounded in accordance with 800.100, and metallic members of the cable not used for communications or powering shall be grounded in accordance with 800.100 or interrupted by an insulating joint or equivalent device. The grounding or interruption shall be as close as practicable to the point of entrance.

**(B) Terminating Outside of the Building.**

In installations where the network-powered communications cable is terminated outside of the building, the shield shall be grounded in accordance with 800.100, and metallic members of the cable not used for communications or powering shall be grounded in accordance with 800.100 or interrupted by an insulating joint or equivalent device. The grounding or interruption shall be as close as practicable to the point of attachment of the NIU.

**Part V. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**830.133 Installation of Network-Powered Broadband Communications Cables and Equipment.**

Cable and equipment installations within buildings shall comply with 830.133(A) and (B), as applicable.

**(A) Separation of Conductors.**

**(1) In Raceways, Cable Trays, Boxes, Enclosures, and Cable Routing Assemblies.**

1. *Low- and Medium-Power Network-Powered Broadband Communications Circuit Cables.* Low- and medium-power network-powered broadband communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly.

2. *Low-Power Network-Powered Broadband Communications Circuit Cables with Other Circuits.* Low-power network-powered broadband communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with jacketed cables of any of the following circuits:

    1. Class 2 and Class 3 remote-control, signaling, and power-limited circuits in compliance with 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 IV of Article 805
    4. Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770
    5. Community antenna television and radio distribution systems in compliance with Parts I and V of Article 820

3. *Medium-Power Network-Powered Broadband Communications Circuit Cables with Optical Fiber Cables and Other Communications Cables*. Medium-power network-powered broadband communications cables shall not be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with conductors of any of the following circuits:

    1. Communications circuits in compliance with Parts I and IV of Article 805
    2. Conductive optical fiber cables in compliance with Parts I and V of Article 770
    3. Community antenna television and radio distribution systems in compliance with Parts I and V of Article 820

4. *Medium-Power Network-Powered Broadband Communications Circuit Cables with Other Circuits*. Medium-power network-powered broadband communications cables

shall not be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with conductors of any of the following circuits:

1. Class 2 and Class 3 remote-control, signaling, and power-limited circuits in compliance with Parts I and III of Article 725
2. Power-limited fire alarm systems in compliance with Parts I and III of Article 760

5. *Electric Light, Power, Class 1, Non–Powered Broadband Communications Circuit Cables.* Network-powered broadband communications cable shall not be placed in any raceway, cable tray, compartment, outlet box, junction box, or similar fittings with conductors of electric light, power, Class 1, or non–power-limited fire alarm circuit cables.

*Exception No. 1: Where all of the conductors of electric light, power, Class 1, non–power-limited fire alarm circuits are separated from all of the network-powered broadband communications cables by a permanent barrier or listed divider.*

*Exception No. 2: Power circuit conductors in outlet boxes, junction boxes, or similar fittings or compartments where such conductors are introduced solely for power supply to the network-powered broadband communications system distribution equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum 6 mm (¼ in.) separation from network-powered broadband communications cables.*

**(2) Other Applications.**

Network-powered broadband communications cable shall be separated at least 50 mm (2 in.) from conductors of any electric light, power, Class 1, and non–power-limited fire alarm circuits.

*Exception No. 1: Separation shall not be required where: (1) all of the conductors of electric light, power, Class 1, and non–power-limited fire alarm circuits are in a raceway, or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC, or Type UF cables, or (2) all of the network-powered broadband communications cables are encased in a raceway.*

*Exception No. 2: Separation shall not be required where the network-powered broadband communications cables are permanently separated from the conductors of electric light, power, Class 1, and non–power-limited fire alarm circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B) Support of Network-Powered Broadband Communications Cables.**

Raceways shall be used for their intended purpose. Network-powered broadband communications cables shall not be strapped, taped, or attached by any means to the exterior of any conduit or raceway as a means of support.

### 830.154 Substitutions of Network-Powered Broadband Communications System Cables.

The substitutions for network-powered broadband system cables listed in Table 830.154 shall be permitted.

**Table 830.154 Cable Substitutions**

| Cable Type | Permitted Cable Substitutions |
|---|---|
| BM | BMR |
| BLP | CMP, CL3P |
| BLR | CMP, CL3P, CMR, CL3R, BLP, BMR |
| BL | CMP, CMR, CM, CMG, CL3P, CL3R, CL3, BMR, BM, BLP, BLR |
| BLX | CMP, CMR, CM, CMG, CMX, CL3P, CL3R, CL3, CL3X, BMR, BM, BLP, BRP, BL |

### 830.160 Bends.

Bends in network broadband cable shall be made so as not to damage the cable.

## Part VI. Listing Requirements

### 830.179 Network-Powered Broadband Communications Equipment and Cables.

Network-powered broadband communications equipment and cables shall be listed and marked in accordance with 830.179(A) through (D).

*Exception No. 1: This listing requirement shall not apply to community antenna television and radio distribution system coaxial cables that were installed prior to January 1, 2000, in accordance with Article 820 and are used for low-power network-powered broadband communications circuits.*

*Exception No. 2: Substitute cables for network-powered broadband communications cables shall be permitted as shown in Table 830.154.*

**(A) General Requirements.**

The general requirements in 800.179 shall apply.

**(B) Network-Powered Broadband Communications Medium-Power Cables.**

Network-powered broadband communications medium-power cables shall be factory-assembled cables consisting of a jacketed coaxial cable, a jacketed combination of coaxial cable and multiple individual conductors, or a jacketed combination of an optical fiber cable and multiple individual conductors. The insulation for the individual conductors shall be rated for 300 volts minimum. Cables intended for outdoor use shall be listed as suitable for the application. Cables shall be marked in accordance with 310.8. Type BMU cables shall be jacketed and listed as being suitable for outdoor underground use.

**(C) Network-Powered Broadband Communication Low-Power Cables.**

Network-powered broadband communications low-power cables shall be factory-assembled cables consisting of a jacketed coaxial cable, a jacketed combination of coaxial cable and multiple individual conductors, or a jacketed combination of an optical fiber cable and multiple individual conductors. The insulation for the individual conductors shall be rated for 300 volts minimum. Cables intended for outdoor use shall be listed as suitable for the application. Cables shall be marked in accordance with 310.8. Type BLU cables shall be jacketed and listed as being suitable for outdoor underground use.

**(D) Optional Markings.**

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.

# Article 840 Premises-Powered Broadband Communications Systems

## Part I. General

### 840.1 Scope.

This article covers premises-powered broadband communications systems.

Informational Note: A typical basic system configuration consists of an optical fiber, twisted pair, or coaxial cable to the premises supplying a broadband signal to a network terminal that converts the broadband signal into component electrical signals, such as traditional telephone, video, high-speed Internet, and interactive services. Powering for the network terminal and network devices is typically accomplished through a premises power supply that might be built into the network terminal or provided as a separate unit. In order to provide communications in the event of a power interruption, a battery backup unit or an uninterruptible power supply (UPS) is typically part of the powering system.

### 840.2 Definitions.

The definitions in 805.2 and 820.2 shall apply. The definitions in this section shall apply only within Article 840.

**Broadband.**

Wide bandwidth data transmission that transports multiple signals, protocols, and traffic types over various media types.

**Network Terminal.**

A device that converts network-provided signals (optical, electrical, or wireless) into component signals, including voice, audio, video, data, wireless, optical, and interactive services, and is considered a network device on the premises that is connected to a communications service provider and is powered at the premises.

**Premises Communications Circuit.**

The circuit that extends voice, audio, video, data, interactive services, telegraph (except radio), and outside wiring for fire alarm and burglar alarm from the service provider's network terminal to the customer's communications equipment up to and including terminal equipment, such as a telephone, a fax machine, or an answering machine.

**Premises Community Antenna Television (CATV) Circuit.**

The circuit that extends community antenna television (CATV) systems for audio, video, data, and interactive services from the service provider's network terminal to the appropriate customer equipment.

**Premises-Powered.**

Using power provided locally from the premises.

### 840.3 Other Articles.

Circuits and equipment shall comply with 840.3(A) through (C).

**(A) General Requirements.**

The general requirements of Article 800 shall apply.

**(B) Output Circuits.**

As appropriate for the services provided, the output circuits derived from the network terminal shall comply with the requirements of the following:

1. Installations of communications circuits — Part IV of Article 805
2. Installations of premises (within buildings) community antenna television and radio distribution circuits — Part V of Article 820
3. Installations of optical fiber cables — Part V of Article 770
4. Installations of Class 2 and Class 3 circuits — Part III of Article 725

   Informational Note: See 725.121 for information on the classification of information technology equipment circuits.
5. Installations of power-limited fire alarm circuits — Part III of Article 760

**(C) Electrical Classification of Data Circuits and Cables.**

Sections 725.139(D)(1) and 805.133(A)(1)(b) shall apply to the electrical classification of Class 2 and Class 3 circuits in the same cable with communications circuits.

### 840.24 Mechanical Execution of Work.

The requirements of 770.24 and 800.24 shall apply.

### 840.25 Abandoned Cables.

The requirements of 770.25 and 800.25 shall apply.

### 840.26 Spread of Fire or Products of Combustion.

The requirements of 770.26 and 800.26 shall apply.

## Part II. Cables on the service provider side of the Communication Service Point ~~Outside and Entering Buildings~~

### 840.47 Underground Wires and Cables Entering Buildings.

Underground wires and cables entering buildings shall comply with 840.47(A) through (C).

**(A) Optical Fiber Cables.**

**(1) Class 1 or Non–Power-Limited Fire Alarm Circuits.**

Underground conductive optical fiber cables entering buildings with electric light, power, Class 1, or non–power-limited fire alarm circuit conductors in a raceway, handhole enclosure, or manhole shall be located in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier.

**(2) Direct-Buried Cables.**

Direct-buried conductive optical fiber cables shall be separated by at least 300 mm (12 in.) from conductors of any electric light, power, or non–power-limited fire alarm circuit conductors or Class 1 circuit.

*Exception No. 1: Separation shall not be required where the electric service conductors are installed in raceways or have metal cable armor.*

*Exception No. 2: Separation shall not be required where the electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables.*

**(3) Mechanical Protection.**

Direct-buried cable, conduit, or other raceway shall be installed to have a minimum cover of 150 mm (6 in.).

**(B) Communications Wires and Cables.**

Installations of communications wires and multipair communications cables shall comply with 805.47.

**(C) Coaxial Cables.**

Installations of coaxial cables shall comply with 820.47.

### 840.48 Unlisted Wires and Cables Entering Buildings.

Installations of unlisted cables entering buildings shall comply with 840.48(A), (B), or (C), as applicable.

**(A) Optical Fiber Cables.**

Installations of unlisted optical fiber cables entering buildings shall comply with 770.48.

**(B) Communications Wires and Cables.**

Installations of unlisted communications wires and unlisted multipair communications cables entering buildings shall comply with 805.48.

**(C) Coaxial Cables.**

Installations of unlisted coaxial cables entering buildings shall comply with 820.48.

## Part III. Protection

### 840.90 Protective Devices.

The requirements of 805.90 shall apply.

### 840.93 Grounding or Interruption.

Non–current-carrying metallic members of optical fiber cables, communications cables, or coaxial cables entering buildings or attaching to buildings shall comply with 840.93(A), (B), or (C), respectively.

### (A) Non–Current-Carrying Metallic Members of Optical Fiber Cables.

Non–current-carrying metallic members of optical fiber cables entering a building or terminating on the outside of a building shall comply with 770.93(A) or (B).

### (B) Communications Cables.

The grounding or interruption of the metallic sheath of communications cable shall comply with 805.93.

### (C) Coaxial Cables.

Where the network terminal is installed inside or outside of the building, with coaxial cables terminating at the network terminal, and is either entering, exiting, or attached to the outside of the building, 820.93 shall apply.

## 840.94 Premises Circuits Leaving the Building.

Where circuits leave the building to power equipment remote to the building or outside the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere, 805.90 and 805.93 shall apply.

Informational Note: See NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, for the theory of the term *rolling sphere*.

## Part IV. Grounding Methods

## 840.101 Premises Circuits Not Leaving the Building.

Where the network terminal is served by a nonconductive optical fiber cable, or where any non–current-carrying metallic member of a conductive optical fiber cable is interrupted by an insulating joint or equivalent device, and circuits that terminate at the network terminal are completely contained within the building (i.e., they do not exit the building), 840.101(A), (B), or (C) shall apply, as applicable.

### (A) Coaxial Cable Shield Grounding.

The shield of coaxial cable shall be grounded by one of the following:

1. Any of the methods described in 820.100 or 800.106
2. A fixed connection to an equipment grounding conductor as described in 250.118
3. Connection to the network terminal grounding terminal provided that the terminal is connected to ground by one of the methods described in 820.100 or 800.106, or to an equipment grounding conductor through a listed grounding device that will retain the ground connection if the network terminal is unplugged

### (B) Communications Circuit Grounding.

Communications circuits shall not be required to be grounded.

### (C) Network Terminal Grounding.

The network terminal shall not be required to be grounded unless required by its listing. If the coaxial cable shield is separately grounded as described in 840.101(A)(1) or 840.101(A)(2), the use of a cord and plug for the connection to the network terminal grounding connection shall be permitted.

Informational Note: Where required to be grounded, a listed device that extends the equipment grounding conductor from the receptacle to the network terminal equipment grounding terminal is permitted. Sizing of the extended equipment grounding conductor is covered in Table 250.122.

## 840.102 Premises Circuits Leaving the Building.

Where circuits leave the building to power equipment remote to the building or outside the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere, the installation of communications wires and cables shall comply with 800.100 and 800.106, and the installation of coaxial cables shall comply with 820.100 and 800.106.

Informational Note: See NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, for the application of the term *rolling sphere*.

## Part V. Wiring on the service provider side of the Communication Service Point ~~Installation Methods Within Buildings~~

### 840.133 Installation of Optical Fibers and Electrical Conductors.

The requirements of 770.133 shall apply.

## Part VI. Premises Powering of Communications Equipment over Communications Cables

### 840.160 Powering Circuits.

Communications cables listed in accordance with 805.179, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment listed in accordance with 805.170. The power source shall be listed in accordance with 840.170(G). Installation of the listed 4-pair communications cables for a communications circuit or installation where 4-pair communications cables are substituted for Class 2 and Class 3 cables in accordance with 725.154(A) shall comply with 725.144.

*Exception: Installing communications cables in compliance with 725.144 shall not be required for listed 4-pair communications cables where the rated current of the power source does not exceed 0.3 amperes in any conductor 24 AWG or larger.*

Informational Note: A typical communications cable for this application is a 4-pair cable sometimes referred to as Category 5e (or higher) LAN cable or balanced twisted pair cable. These types of cables are often used to provide Ethernet- and Power over Ethernet (PoE)–type services. A large number of such powering cables bundled together can cause overheating of the wiring if not controlled as described in Table 725.144.

## Part VII. Listing Requirements

### 840.170 Equipment and Cables.

Premises-powered broadband communications systems equipment and cables shall comply with 840.170(A) through (H).

#### (A) Network Terminal.

The network terminal and applicable grounding means shall be listed for application with premises-powered broadband communications systems.

Informational Note No. 1: One way to determine applicable requirements is to refer to ANSI/UL 60950-1-2014, *Standard for Safety of Information Technology Equipment*; ANSI/UL 498A-2015, *Current Taps and Adapters*; ANSI/UL 467-2013, *Grounding and Bonding Equipment;* or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements*.

Informational Note No. 2: There are no requirements on the network terminal and its grounding methodologies except for those covered by the listing of the product.

#### (B) Optical Fiber Cables.

Optical fiber cables shall be listed in accordance with 770.179(A) through (D) and shall be marked in accordance with Table 770.179.

#### (C) Communications Equipment.

Communications equipment shall be listed in accordance with 805.170.

#### (D) Cable Routing Assemblies and Communications Raceways.

Cable routing assemblies and communications raceways shall be listed in accordance with 800.182.

#### (E) Premises Communications Wires and Cables.

Communications wires and cable shall be listed and marked in accordance with 805.179.

#### (F) Premises Community Antenna Television (CATV) Circuits.

Premises community antenna television (CATV) coaxial cables connecting to the network terminal shall be listed in accordance with 820.179. Applicable grounding means shall be listed for application with premises-powered broadband communications systems.

#### (G) Power Source.

The power source for circuits intended to provide power over communications cables to remote equipment shall be limited in accordance with Table 11(B) in Chapter 9 for voltage sources up to 60 V dc and be listed as specified in either of the following:

1. A power source shall be listed as specified in 725.121(A)(1), (A)(2), (A)(3), or (A)(4). The power sources shall not have the output connections paralleled or otherwise interconnected unless listed for such interconnection.
2. A power source shall be listed as communications equipment for limited-power circuits.

Informational Note: One way to determine applicable requirements is to refer to ANSI/UL 60950-1-2014, *Standard for Safety of Information Technology Equipment-Safety — Part 1*; or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements*. Typically, such circuits are used to interconnect equipment for the purpose of exchanging information (data).

**(H) Accessory Equipment.**

Communications accessory equipment and/or assemblies shall be listed for application with premises-powered communications systems.

Informational Note: One way to determine applicable requirements is to refer to ANSI/UL 1863-2004, *Communications-Circuit Accessories*.

# Public Input No. 3133-NFPA 70-2020 [ New Part after III. ]

**800.90 Hazardous (Classified) Locations**

The primary protector or equipment providing the primary protection function shall not be located in any hazardous (classified) location as defined in 500.5 and 505.5 or in the vicinity of easily ignitable material.

*Exception: As permitted in 501.150 , 502.150 , and 503.150 .*

## Statement of Problem and Substantiation for Public Input

As part of the consolidation effort of common requirements into new Article 800, the requirements of 805.90(C), 820.93(D), 830.90(C) can be moved under a new 800.90 protection location rule.
Related PIs are submitted to replace the sections noted above - 805.90(C), 820.93(D) and 830.90(C) with a reference to this new 800.90 section.
This new section should be numbered 800.90 to correlate with the related numbered sections in the other articles of Chapter 8.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 3137-NFPA 70-2020 [Section No. 830.90(C)] | moving common requirements from 830.90(C) to this newly created 800.90 |
| Public Input No. 3136-NFPA 70-2020 [Section No. 820.93(D)] | moving related common requirements from 820.93(D) to this newly created 800.90 |
| Public Input No. 3135-NFPA 70-2020 [Section No. 805.90(C)] | moving related common requirements from 805.90(C) to this newly created 800.90 |
| Public Input No. 3135-NFPA 70-2020 [Section No. 805.90(C)] | |
| Public Input No. 3136-NFPA 70-2020 [Section No. 820.93(D)] | |
| Public Input No. 3137-NFPA 70-2020 [Section No. 830.90(C)] | |

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**Committee:** NEC-P16

# Public Input No. 3225-NFPA 70-2020 [ Part IV. ]

**Part IV.** ~~Installation Methods Within Buildings~~ Wiring on the customer side of the Communication Service Point

## Additional Proposed Changes

| File Name | Description | Approved |
|---|---|---|
| Chapter_8_-_2020-09-03_CC_Task_Group.pdf | | |

## Statement of Problem and Substantiation for Public Input

This public input is being submitted by a Correlating Committee Task Group to improve the correlation between Chapter 7 and 8. At the present time there are significant correlation issues with regards to what constitutes an installation in Chapter 7 and what constitutes an installation in Chapter 8.

Previously a Correlating Committee Task Group was formed to review Chapter 8 and to make suggested modifications. This Chapter 8 task group has submitted a public input to define Communication Service point and has submitted a public input to determine where the actual service point exists within communication systems. It is very difficult for an AHJ to determine where there inspection authority begins and this work will help provide clarity and usability.

This public input follows up on the work of that specific task group and provides editorial revisions to further improve on that work. Public inputs are being submitted to change Titles and certain wording to reflect what wiring is on the customer side of the Communication Service Point and what wiring is on the communication utility or service provider side of this point.

The Correlating Committee Task Group is a long range planning committee that is seeking to make improvement over the next two to three cycles. The Task Group is made up of the following members: Alan Manche, Donny Cook, Randy Ivans, Ernie Gallo, and Thomas Domitrovich.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 3223-NFPA 70-2020 [Sections Part IV., 805.133] | |
| Public Input No. 3224-NFPA 70-2020 [Sections 800.27, Part II., 800.44] | |
| Public Input No. 3226-NFPA 70-2020 [Section No. 800.154] | |
| Public Input No. 3227-NFPA 70-2020 [Part II.] | |
| Public Input No. 3230-NFPA 70-2020 [Part II.] | |
| Public Input No. 3232-NFPA 70-2020 [Sections Part II., 840.47, 840.48, Part III.] | |
| Public Input No. 3233-NFPA 70-2020 [Part V.] | |

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## Chapter 8 Communications Systems

# Article 800 General Requirements for Communications Systems

### Part I. General

#### 800.1 Scope.

This article covers general requirements for communications systems. These general requirements apply to communications circuits, community antenna television and radio distribution systems, network-powered broadband communications systems, and premises-powered broadband communications systems, unless modified by Articles 805, 820, 830, or 840.

Informational Note No. 1: See 90.2(B)(4) for installations of circuits and equipment that are not covered.

Informational Note No. 2: For further information for remote control, signaling, and power-limited circuits, see Article 725.

Informational Note No. 3: For further information for fire alarm systems, see Article 760.

#### 800.2 Definitions.

The definitions in Part I of Article 100 shall apply throughout Chapter 8. The definitions in 800.2 shall apply only within Chapter 8.

**Abandoned Cable.**

Cable that is not terminated at equipment or is not identified for future use with a tag.

**Block.**

A square or portion of a city, town, or village enclosed by streets and including the alleys so enclosed, but not any street.

**Cable Sheath.**

A covering over the conductor assembly that may include one or more metallic members, strength members, or jackets.

**Communications Circuit.**

The circuit that extends service from the communications utility or service provider up to and including the customer's communications equipment.

**Communications Service Provider.**

An organization, business, or individual that offers communications service to others.

**Exposed (to Accidental Contact).**

A circuit in such a position that, in case of failure of supports or insulation, contact with another circuit may result.

Informational Note: See Part I of Article 100 for two other definitions of Exposed: *Exposed (as applied to live parts)* and *Exposed (as applied to wiring methods)*.

**Point of Entrance.**

The point within a building at which the wire or cable emerges from an external wall or from a concrete floor slab.

**Premises.**

The land and buildings of a user located on the user side of the utility-user ~~network point of demarcation~~.

#### 800.3 Other Articles.

Only those sections of Chapters 1 through 7 referenced in Chapter 8 shall apply to Chapter 8.

**(A) Hazardous (Classified) Locations.**

Circuits and equipment installed in a location that is classified in accordance with 500.5 and 505.5 shall comply with the applicable requirements of Chapter 5.

**(B) Wiring in Ducts for Dust, Loose Stock, or Vapor Removal.**

The requirements of 300.22(A) shall apply.

**(C) Equipment in Other Space Used for Environmental Air.**

The requirements of 300.22(C)(3) shall apply.

**(D) Installation and Use.**

The requirements of 110.3(B) shall apply.

**(E) Optical Fiber Cable.**

Where optical fiber cable is used to provide a communications circuit within a building, Article 770 shall apply.

**(F) Other Communications Systems.**

As appropriate for the system involved, communications systems shall also comply with the requirements of the following:

1. Communications circuits — Article 805
2. Radio and television equipment — Article 810
3. Community antenna television and radio distribution systems — Article 820
4. Network-powered broadband communications systems — Article 830
5. Premises-powered broadband communications systems — Article 840

**(G) Reconditioned Equipment.**

The requirements of 110.21(A)(2) shall apply.

### 800.21 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.

### 800.24 Mechanical Execution of Work.

Circuits and equipment 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 also conform to 300.4 and 300.11. 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 805.170(C).

Informational Note No. 1: Accepted industry practices are described in ANSI/TIA-568.1- D-2015, *Commercial Building Telecommunications Infrastructure Standard;* ANSI/TIA-569-D-2015, *Telecommunications Pathways and Spaces;* ANSI/TIA-570-C-2012, *Residential Telecommunications Infrastructure Standard;* ANSI/TIA-1005-A-2012, *Telecommunications Infrastructure Standard for Industrial Premises;* ANSI/ TIA-1179-2010, *Healthcare Facility Telecommunications Infrastructure Standard;* ANSI/TIA-4966-2014, *Telecommunications Infrastructure Standard for Educational Facilities;* and other ANSI-approved installation standards.

Informational Note No. 2: 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. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of wire and cable properties.

### 800.25 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.

### 800.26 Spread of Fire or Products of Combustion.

Installations of cables, communications raceways, cable routing assemblies 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 penetrations of cables, communications raceways, and cable routing assemblies 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 800.26 can be found in building codes, fire resistance directories, and product listings.

### 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.

## Part II. Wires and Cables Outside and on the service provider side of the Communication Service Point ~~Entering Buildings~~

### 800.44 Overhead (Aerial) Wires and Cables.

Overhead (aerial) wires and cables on the service provider side of the Communication Service Point ~~entering buildings~~ shall comply with 800.44(A) through (D).

Informational Note: For additional information regarding overhead (aerial) wires and cables, see ANSI C2-2017, *National Electrical Safety Code, Part 2 Safety Rules for Overhead Lines.*

#### (A) On Poles and In-Span.

Where wires and cables and electric light or power conductors are supported by the same pole or are run parallel to each other in-span, the conditions described in 800.44(A)(1) through (A)(4) shall be met.

#### (1) Relative Location.

Where practicable, the wires and cables shall be located below the electric light or power conductors.

#### (2) Attachment to Cross-Arms.

Wires and cables shall not be attached to a cross-arm that carries electric light or power conductors.

#### (3) Climbing Space.

The climbing space through wires and cables shall comply with the requirements of 225.14(D).

#### (4) Clearance.

Supply service drops and sets of overhead service conductors of 0 volts to 750 volts running above and parallel to communications and CATV type coaxial service drops shall have a minimum separation of 300 mm (12 in.) at any point in the span, including the point of and at their attachment to the building, provided that the ungrounded conductors are insulated and that a clearance of not less than 1.0 m (40 in.) is maintained between the two services at the pole.

#### (B) Above Roofs.

Communications wires and cables and CATV type coaxial cables shall have a vertical clearance of not less than 2.5 m (8 ft) from all points of roofs above which they pass.

*Exception No. 1: Communications wires and cables and CATV type coaxial cables shall not be required to have a vertical clearance of not less than 2.5 m (8 ft) above auxiliary buildings, such as garages and the like.*

*Exception No. 2: A reduction in clearance above only the overhanging portion of the roof to not less than 450 mm (18 in.) shall be permitted if (1) not more than 1.2 m (4 ft) of communications service-drop conductors pass above the roof overhang and (2) they are terminated at a through- or above-the-roof raceway or approved support.*

*Exception No. 3: Where the roof has a slope of not less than 100 mm in 300 mm (4 in. in 12 in.), a reduction in clearance to not less than 900 mm (3 ft) shall be permitted.*

Informational Note: For additional information regarding overhead (aerial) wires and cables, see ANSI/IEEE C2-2017, *National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines*.

**(C) On Masts.**

Overhead (aerial) communications and CATV type coaxial cables shall be permitted to be attached to an above-the-roof raceway mast that does not enclose or support conductors of electric light or power circuits.

**(D) Between Buildings.**

Communications and CATV type coaxial cables extending between buildings or structures, and also the supports or attachment fixtures, shall be identified and shall have sufficient strength to withstand the loads to which they might be subjected.

*Exception: Where a coaxial cable does not have sufficient strength to be self-supporting, it shall be attached to a supporting messenger cable that, together with the attachment fixtures or supports, shall be acceptable for the purpose and shall have sufficient strength to withstand the loads to which they may be subjected.*

**800.48 Communication Service Point.** The Communication Service Point shall be at a readily accessible location either outside or inside of a building or structure near to the point of entrance of the conductors in accordance with the one or more of the following:

1. The point of connection at which the communication service provider's network (outside plant) transitions to the premises wiring. The location of this point shall not be located further than 50 feet from the point of entrance.

2. The point of connection in an individual dwelling shall be located so as not to exceed 24 inches from the primary protector on the premises side of the protector.

3. A physical protection point or communications cable exiting the connection enclosure on the individual building side of the enclosure.

4. The point of connection at the Grounding Block, where required.

5. The point where a wireless signal transitions from the antenna or dish through a wired connection to transmitting or receiving equipment. The location of this point shall be permitted to include the ground connection at the antenna discharge unit or coaxial cable connection to the transmitting/receiving station (see 810.21).

6. The point of connection between nonconductive optical fiber cable entering the building and premises optical fiber cable inside the building not to exceed 50 feet from the point of entrance.

7. The Communication Service Point shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC), Electrical metallic tubing (EMT), intermediate metal conduit (IMC), or Rigid polyvinyl chloride conduit (PVC) to the point of emergence (see 770.48, 805.48, 820.48 and 830.48).

Informational Note: The transition and connection points listed above may be co-located. For example, a primary protector may be located inside a network interface unit (item 3) with a connection to an adjacent grounding block (Item 4) within 24 inches, and a connection to the premise wiring (item 2).

### 800.49 Metal Entrance Conduit Grounding.

Metal conduit containing entrance wire or cable shall be connected by a bonding conductor or grounding electrode conductor to a grounding electrode or, where present, the building grounding electrode system in accordance with 800.100(B).

### 800.53 Separation from Lightning Conductors.

Where practicable, a separation of at least 1.8 m (6 ft) shall be maintained between lightning conductors and all communication wires and cables and CATV type coaxial cables on buildings.

Informational Note No. 1: For additional information regarding overhead (aerial) wires and cables, see ANSI C2-2017 *National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines*.

Informational Note No. 2: Specific separation distances may be calculated from the sideflash equation in NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems.*

## Part III. Grounding Methods

### 800.100 Cable and Primary Protector Bonding and Grounding.

#### (A) Bonding Conductor or Grounding Electrode Conductor.

#### (1) Insulation.

The bonding conductor or grounding electrode conductor shall be listed and shall be permitted to be insulated, covered, or bare.

#### (2) Material.

The bonding conductor or grounding electrode conductor shall be copper or other corrosion-resistant conductive material, stranded or solid.

#### (3) Size.

The bonding conductor or grounding electrode conductor shall not be smaller than 14 AWG. The bonding conductor or grounding electrode conductor shall have a current-carrying capacity not less than the grounded metallic cable sheath member of the communications cable, the protected conductor of the communications cable, or the outer sheath of the coaxial cable, as applicable. The bonding conductor or grounding electrode conductor shall not be required to exceed 6 AWG.

#### (4) Length.

The bonding conductor or grounding electrode conductor shall be as short as practicable. In one- and two-family dwellings, the bonding conductor or grounding electrode conductor shall be as short as practicable, not to exceed 6.0 m (20 ft) in length.

Informational Note: Similar bonding conductor or grounding electrode conductor length limitations applied at apartment buildings and commercial buildings help to reduce voltages that may be developed between the building's power and communications systems during lightning events.

*Exception: In one- and two-family dwellings where it is not practicable to achieve an overall maximum bonding conductor or grounding electrode conductor length of 6.0 m (20 ft), a separate ground rod meeting the minimum dimensional criteria of 800.100(B)(3)(2) or (B)(3)(3) shall be driven, the bonding conductor or grounding electrode conductor shall be connected to the ground rod in accordance with 800.100(C), and the ground rod shall be connected to the power grounding electrode system in accordance with 800.100(D).*

#### (5) Run in Straight Line.

The bonding conductor or grounding electrode conductor shall be run in as straight a line as practicable.

#### (6) Physical Protection.

Bonding conductors and grounding electrode conductors shall be protected where exposed to physical damage. Where the bonding conductor or grounding electrode conductor is installed in a metal raceway, both ends of the raceway shall be bonded to the contained conductor or to the same terminal or electrode to which the bonding conductor or grounding electrode conductor is connected.

**(B) Electrode.**

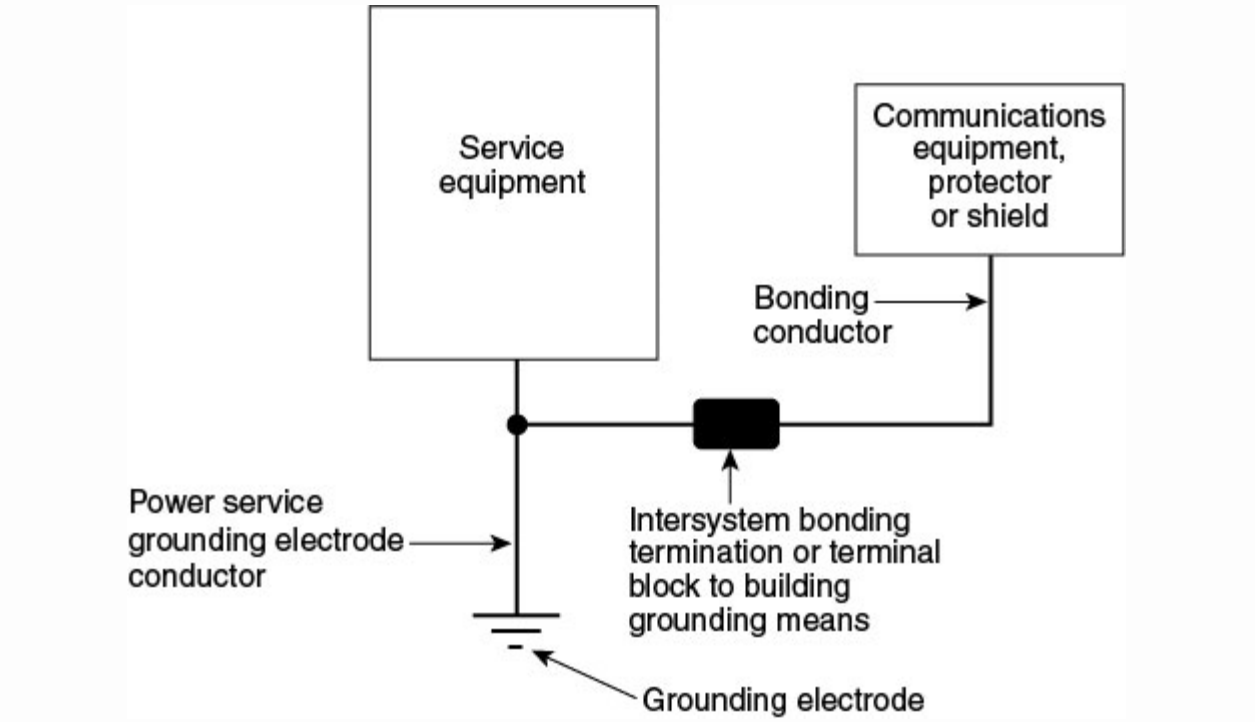
The bonding conductor or grounding electrode conductor shall be connected in accordance with 800.100(B)(1), (B)(2) , or (B)(3).

**(1) In Buildings or Structures with an Intersystem Bonding Termination.**

If the building or structure served has an intersystem bonding termination as required by 250.94, the bonding conductor shall be connected to the intersystem bonding termination.

Informational Note: Informational Note Figure 800.100(B)(1) illustrates the connection of the bonding conductor in buildings or structures equipped with an intersystem bonding termination or a terminal block providing access to the building grounding means.

**Figure Informational Note Figure 800.100(B)(1) Illustration of a Bonding Conductor in a Communications Installation.**




**(2) In Buildings or Structures with Grounding Means.**

If an intersystem bonding termination is established, 250.94(A) shall apply. If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on one of the following:

1. The building or structure grounding electrode system as covered in 250.50
2. The grounded interior metal water piping system, within 1.5 m (5 ft) from its point of entrance to the building, as covered in 250.52
3. The power service accessible means external to enclosures using the options identified in 250.94(A), Exception
4. The nonflexible metal power service raceway
5. The service equipment enclosure

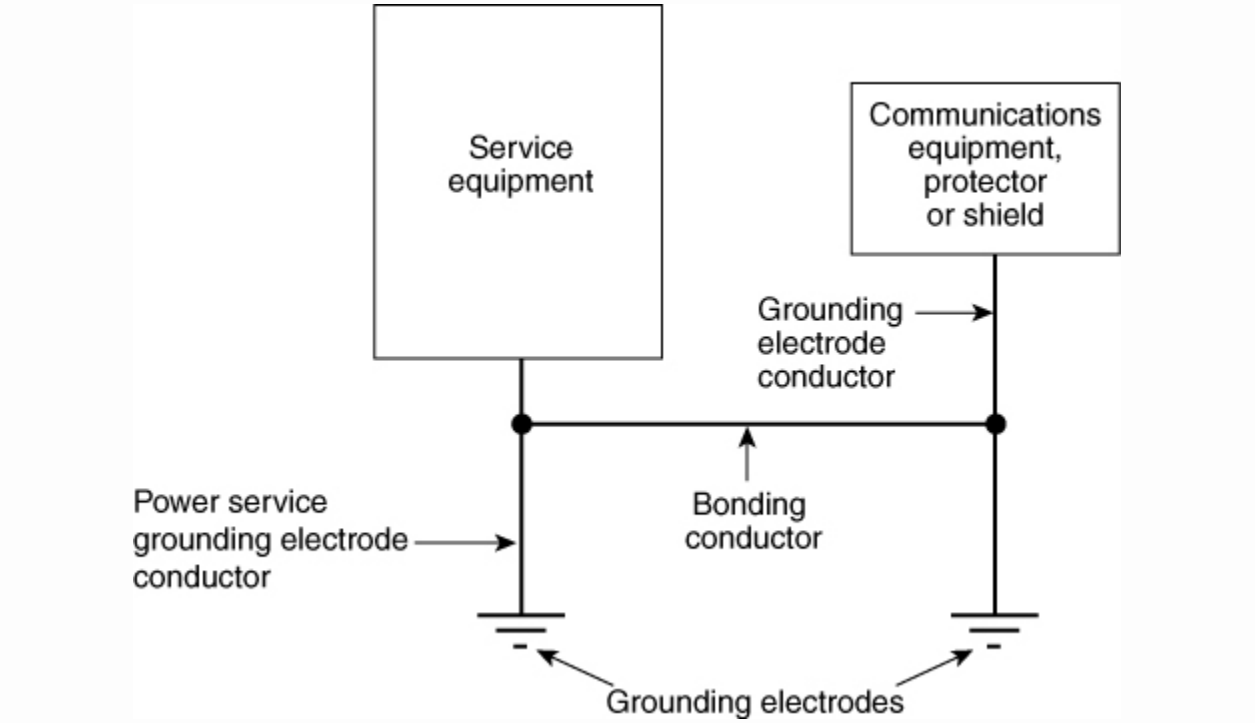
6. The grounding electrode conductor or the grounding electrode conductor metal enclosure of the power service
7. The grounding electrode conductor or the grounding electrode of a building or structure disconnecting means that is connected to a grounding electrode as covered in 250.32

A bonding device intended to provide a termination point for the bonding conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on nonremovable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is nonremovable.

For purposes of this section, the mobile home service equipment or the mobile home disconnecting means located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means connected to an electrode by a grounding electrode conductor in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Informational Note Figure 800.100(B)(2) illustrates the connection of the bonding conductor in buildings or structures not equipped with an intersystem bonding termination or a terminal block providing access to the building grounding means.

**Figure Informational Note Figure 800.100(B)(2) Illustration of a Grounding Electrode Conductor and a Bonding Conductor in a Communications Installation.**




**(3) In Buildings or Structures Without an Intersystem Bonding Termination or Grounding Means.**

If the building or structure served has no intersystem bonding termination or grounding means, as described in 800.100(B)(2), the grounding electrode conductor shall be connected to one of the following:

1. To any one of the individual grounding electrodes described in 250.52(A)(1), (A)(2), (A)(3), or (A)(4)
2. If the building or structure served has no intersystem bonding termination or grounding means, as described in 800.100(B)(2) or (B)(3)(1), to any one of the individual grounding electrodes described in 250.52(A)(5), (A)(7), and (A)(8)

3. For communications circuits covered in Article 805 or network-powered broadband communications systems covered in Article 830, to a ground rod or pipe not less than 1.5 m (5 ft) in length and 12.7 mm (0.5 in.) in diameter, driven, where practicable, into permanently damp earth and separated from lightning protection system conductors, as covered in 800.53, and at least 1.8 m (6 ft) from electrodes of other systems

Steam pipes, hot water pipes, or lightning protection system conductors shall not be employed as grounding electrodes for protectors and grounded metallic members.

**(C) Electrode Connection.**

Connections to grounding electrodes shall comply with 250.70.

**(D) Bonding of Electrodes.**

A bonding jumper not smaller than 6 AWG copper or equivalent shall be connected between the grounding electrode and power grounding electrode system at the building or structure served where separate electrodes are used.

*Exception: At mobile homes as covered in 800.106.*

Informational Note No. 1: See 250.60 for connection to a lightning protection system.

Informational Note No. 2: Bonding together of all separate electrodes limits potential differences between them and between their associated wiring systems.

**800.106 Primary Protector Grounding and Bonding at Mobile Homes.**

**(A) Grounding.**

Grounding shall comply with 800.106(A)(1) and (A)(2).

**(1) Mobile Home Service Equipment.**

Where there is no mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, grounding shall comply with one of the following:

1. The primary protector grounding terminal; the coaxial cable shield ground, or surge arrester grounding terminal; or the network-powered broadband communications cable shield, network-powered broadband communications cable metallic members not used for communications or powering, and network interface unit shall be connected to a grounding electrode conductor or grounding electrode in accordance with 800.100(B)(3).
2. The non-current-carrying metallic members of optical fiber cables shall be connected to a grounding electrode in accordance with 770.106(A)(1). The network terminal, if required to be grounded, shall be connected to a grounding electrode in accordance with 800.106(A)(1)(1). The grounding electrode shall be bonded in accordance with 770.106(B).

**(2) Mobile Home Feeder Disconnecting Means.**

Where there is no mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, grounding shall comply with one of the following:

1. The primary protector grounding terminal; the network-powered broadband communications cable shield, network-powered broadband communications cable metallic members not used for communications or powering, and network interface unit shall be connected to a grounding electrode in accordance with 800.100(B)(3).
2. The non-current-carrying metallic members of optical fiber cables shall be connected to a grounding electrode in accordance with 770.106(A)(2). The network terminal, if required to be grounded, shall be connected to a grounding electrode in accordance with 800.106(A)(2). The grounding electrode shall be bonded in accordance with 770.106(B).

**(B) Bonding.**

The primary protector grounding terminal or grounding electrode, network-powered broadband communications cable grounding terminal, or network interface unit grounding terminal shall be bonded together and connected to the metal frame or available grounding terminal of the mobile home with a copper conductor not smaller than 12 AWG under either of the following conditions:

1. Where there is no mobile home service equipment or disconnecting means as in 800.106(A)
2. Where the mobile home is supplied by cord and plug

**Part IV. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**800.110 Raceways, Cable Routing Assemblies, and Cable Trays.**

**(A) Types of Raceways.**

Wires and cables shall be permitted to be installed in raceways that comply with either 800.110(A)(1) or (A)(2). Medium-power network-powered broadband communications cables shall not be permitted to be installed in raceways that comply with 800.110(A)(2).

**(1) Raceways Recognized in Chapter 3.**

Wires and 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.**

Wires and 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.

**(3) Innerduct for Communications Wires and Cables, Coaxial Cables, or Network-Powered Broadband Communications Cables.**

Listed plenum communications raceways, listed riser communications raceways, and listed general-purpose communications raceways 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.**

The raceway fill requirements of Chapters 3 and 9 shall apply to medium-power network-powered broadband communications cables.

**(C) Cable Routing Assemblies.**

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)(1) and (C)(2) and 800.113.

**(1) Horizontal Support.**

Cable routing assemblies shall be supported where run horizontally at intervals not to exceed 900 mm (3 ft) and at each end or joint, unless listed for other support intervals. In no case shall the distance between supports exceed 3 m (10 ft).

**(2) Vertical Support.**

Vertical runs of cable routing assemblies shall be supported at intervals not exceeding 1.2 m (4 ft), unless listed for other support intervals, and shall not have more than one joint between supports.

**(D) Cable Trays.**

Wires and cables and communications raceways shall be permitted to be installed in metal or listed nonmetallic cable tray systems. Ladder cable trays shall be permitted to support cable routing assemblies.

## 800.113 Installation of Wires, Cables, Cable Routing Assemblies, and Communications Raceways.

Installation of wires, cables, cable routing assemblies, and communications raceways shall comply with 800.113(A) through (L). Installation of cable routing assemblies and communications raceways shall comply also with 800.110.

**(A) Listing.**

Wires, cables, cable routing assemblies, and communications raceways installed in buildings shall be listed.

*Exception: Cables installed in compliance with 805.48 or 820.48 shall not be required to be listed.*

**(B) Ducts Specifically Fabricated for Environmental Air.**

The following wires and 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. Plenum cables up to 1.22 m (4 ft) in length
2. Plenum cables, riser cables, general-purpose cables, and limited-use 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 NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

**(C) Other Spaces Used for Environmental Air (Plenums).**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted in other spaces used for environmental air as described in 300.22(C):

1. Plenum cables
2. Plenum communications raceways
3. Plenum cable routing assemblies
4. Plenum cables installed in plenum communications raceways
5. Plenum cables installed in plenum cable routing assemblies
6. Plenum cables and plenum communications raceways supported by open metal cable tray systems
7. Plenum cables, riser cables, general-purpose cables, limited-use cables, and communications wires installed in raceways that are installed in compliance with 300.22(C)
8. Plenum cables, riser cables, general-purpose cables, limited-use cables, 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)
9. Plenum cables, riser cables, general-purpose cables, and limited-use 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, see NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

**(D) Risers — Cables, Cable Routing Assemblies, and Communications Raceways in Vertical Runs.**

The following cables, cable routing assemblies, and communications raceways shall be permitted in vertical runs penetrating one or more floors and in vertical runs in a shaft:

1. Plenum and riser cables
2. Plenum and riser communications raceways
3. Plenum and riser cable routing assemblies
4. Plenum and riser cables installed in:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) Plenum cable routing assemblies
    d) Riser cable routing assemblies

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**(E) Risers — Cables and Innerducts in Metal Raceways.**

The following cables and innerducts shall be permitted in metal raceways in a riser having firestops at each floor:

1. Plenum cables, riser cables, general-purpose cables, and limited-use cables
2. Plenum, riser, and general-purpose communications raceways
3. Plenum cables, riser cables, general-purpose cables, and limited-use cables installed in:
    a) Plenum communications raceways (innerduct)
    b) Riser communications raceways (innerduct)
    c) General-purpose communications raceways (innerduct)

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**(F) Risers — Cables, Cable Routing Assemblies, and Communications Raceways in Fireproof Shafts.**

The following cables, cable routing assemblies, and communications raceways shall be permitted to be installed in fireproof riser shafts having firestops at each floor:

1. Plenum cables, riser cables, general-purpose cables, and limited-use cables
2. Plenum, riser, and general-purpose communications raceways
3. Plenum, riser, and general-purpose cable routing assemblies
4. Plenum cables, riser cables, general-purpose cables, and limited-use cables installed in:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
    d) Plenum cable routing assemblies
    e) Riser cable routing assemblies
    f) General-purpose cable routing assemblies

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**(G) Risers — One- and Two-Family Dwellings.**

The following cables, cable routing assemblies, and communications raceways shall be permitted in one- and two-family dwellings:

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables less than 6 mm (0.25 in.) in diameter
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Plenum cables, riser cables, and general-purpose cables installed in:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
    d) Plenum cable routing assemblies
    e) Riser cable routing assemblies
    f) General-purpose cable routing assemblies

**(H) Cable Trays.**

The following wires, cables, and communications raceways shall be permitted to be supported by cable trays:

1. Plenum cables, riser cables, and general-purpose cables
2. Plenum, riser, and general-purpose communications raceways
3. Communications wires, plenum cables, riser cables, and general-purpose cables installed in:
    1. Plenum communications raceways
    2. Riser communications raceways
    3. General-purpose communications raceways

**(I) Distributing Frames and Cross-Connect Arrays.**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in distributing frames and cross-connect arrays:

1. Plenum cables, riser cables, general-purpose cables, and communications wires
2. Plenum, riser, and general-purpose communications raceways
3. Plenum, riser, and general-purpose cable routing assemblies
4. Communications wires, plenum cables, riser cables, and general-purpose cables installed in:
    1. Plenum communications raceways
    2. Riser communications raceways
    3. General-purpose communications raceways
    4. Plenum cable routing assemblies
    5. Riser cable routing assemblies
    6. General-purpose cable routing assemblies

**(J) Other Building Locations.**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in building locations other than the locations covered in 800.113(B) through (I):

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables with a maximum of 3 m (10 ft) of exposed length in nonconcealed spaces
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
6. Plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum cable routing assemblies
    b) Riser cable routing assemblies
    c) General-purpose cable routing assemblies
7. Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3
8. Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks

**(K) Multifamily Dwellings.**

The following cables, cable routing assemblies, and communications raceways shall be permitted to be installed in multifamily dwellings in locations other than the locations covered in 800.113(B) through (G):

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables less than 6 mm (0.25 in.) in diameter in nonconcealed spaces
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
6. Plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum cable routing assemblies
    b) Riser cable routing assemblies
    c) General-purpose cable routing assemblies
7. Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3
8. Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks

**(L) One- and Two-Family Dwellings.**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in one- and two-family dwellings in locations other than the locations covered in 800.113(B) through (F):

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables less than 6 mm (0.25 in.) in diameter
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:
   a) Plenum communications raceways
   b) Riser communications raceways
   c) General-purpose communications raceways
6. Plenum cables, riser cables, and general-purpose cables installed in the following
   a) Plenum cable routing assemblies
   b) Riser cable routing assemblies
   c) General-purpose cable routing assemblies
7. Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3
8. Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks
9. Hybrid power and communications cable listed in accordance with 805.179(F)

**800.154 Applications of Listed Communications Wires, Cables, and Raceways, and Listed Cable Routing Assemblies.**

Permitted and nonpermitted applications of listed communications wires, cables, coaxial cables, network-powered broadband communications system cables and raceways, and listed cable routing assemblies, shall be in accordance with one of the following:

1. Listed communications wires and cables as indicated in Table 800.154(a)
2. Listed communications raceways as indicated in Table 800.154(b)
3. Listed cable routing assemblies as indicated in Table 800.154(c)

The permitted applications shall be subject to the installation requirements of 800.110 and 800.113.

**Table 800.154(a) Applications of Listed Communications Wires, Cables, and Network-Powered Broadband Communications System Cables on the customer side of the Communication Service Point ~~Buildings~~**

| Applications | | Wire and Cable Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BMU, BLU | Hybrid Power and Communications Cables | Communications Wires |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | Y | N | N | N | N | N | N | N | N | N |
| | In metal raceway that complies with 300.22(B) | Y | Y | Y | Y | Y | Y | N | N | N | Y |

| Applications | | Wire and Cable Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BMU, BLU | Hybrid Power and Communications Cables | Communications Wires |
| In other spaces used for environmental air (plenums) as described in 300.22(C) | In other spaces used for environmental air | Y | N | N | N | N | N | N | N | N | N |
| | In metal raceway that complies with 300.22(C) | Y | Y | Y | Y | Y | Y | N | N | N | Y |
| | In plenum communications raceways | Y | N | N | N | N | N | N | N | N | N |
| | In plenum cable routing assemblies | Y | N | N | N | N | N | N | N | N | N |
| | Supported by open metal cable trays | Y | N | N | N | N | N | N | N | N | N |
| | Supported by solid bottom metal cable trays with solid metal covers | Y | Y | Y | Y | Y | Y | N | N | N | N |
| In risers | In vertical runs | Y | Y | Y | N | N | N | N | N | N | N |
| | In metal raceways | Y | Y | Y | Y | Y | Y | N | N | N | N |
| | In fireproof shafts | Y | Y | Y | Y | Y | Y | N | N | N | N |
| | In plenum communications raceways | Y | Y | N | N | N | N | N | N | N | N |
| | In plenum cable routing assemblies | Y | Y | N | N | N | N | N | N | N | N |
| | In riser communications raceways | Y | Y | N | N | N | N | N | N | N | N |
| | In riser cable routing assemblies | Y | Y | N | N | N | N | N | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y | Y | Y | Y | N | N | Y | N |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y | Y | Y | Y | N | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y | Y | Y | Y | Y | N | Y | N |
| | In multifamily dwellings | Y | Y | Y | Y | Y | Y | Y | N | N | N |
| | In nonconcealed spaces | Y | Y | Y | Y | Y | Y | Y | N | N | N |
| | Supported by cable trays | Y | Y | Y | Y | Y | N | N | N | N | N |
| | Under carpet, modular flooring, and planks | N | N | N | N | N | N | Y | N | N | N |
| | In distributing frames and cross-connect arrays | Y | Y | N | Y | N | N | N | N | N | Y |
| | In rigid metal conduit (RMC) and intermediate metal conduit (IMC) | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |

| Applications | | Wire and Cable Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BMU, BLU | Hybrid Power and Communications Cables | Communications Wires |
| | In any raceway recognized in Chapter 3 | Y | Y | Y | Y | Y | Y | N | N | N | Y |
| | In plenum communications raceways | Y | Y | N | Y | N | N | N | N | N | Y |
| | In plenum cable routing assemblies | Y | Y | N | Y | N | N | N | N | N | Y |
| | In riser communications raceways | Y | Y | N | Y | N | N | N | N | N | Y |
| | In riser cable routing assemblies | Y | Y | N | Y | N | N | N | N | N | Y |
| | In general-purpose communications raceways | Y | Y | N | Y | N | N | N | N | N | Y |
| | In general-purpose cable routing assemblies | Y | Y | N | Y | N | N | N | N | N | Y |

Note: An "N" in the table indicates that the cable type shall not be permitted to be installed in the application. A "Y" indicates that the cable type shall be permitted to be installed in the application subject to the limitations described in 800.113. The Riser column includes all riser cables except BMR, and the General-Purpose column includes all general-purpose cables except BM.
Informational Note No. 1: Part IV of Article 800 covers wiring on the customer side of the communication service point ~~installation methods within buildings~~. This table covers the applications of listed communications wires, cables, and raceways ~~in buildings~~. See the definition of *Point of Entrance* in 800.2.

Informational Note No. 2: For information on the restrictions to the installation of communications cables in fabricated ducts, see 800.113(B).

### Table 800.154(b) Applications of Listed Communications Raceways on the customer side of the Communication Service Point~~in Buildings~~

| Applications | | Listed Communications Raceway Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | N | N | N |
| | In metal raceway that complies with 300.22(B) | N | N | N |
| In other spaces used for environmental air (plenums) 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 cable routing assemblies | N | 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 cable routing assemblies | N | N | N |
| | In riser cable routing assemblies | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y |
| | In one- and two-family dwellings | Y | Y | Y |
| | In multifamily dwellings | Y | Y | Y |

| Applications | | Listed Communications Raceway Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| | In nonconcealed spaces | Y | Y | Y |
| | Supported by cable trays | Y | Y | Y |
| | Under carpet, modular flooring, and planks | N | N | N |
| | In distributing frames and cross-connect arrays | Y | Y | Y |
| | In any raceway recognized in Chapter 3 | Y | Y | Y |
| | In plenum cable routing assemblies | N | N | N |
| | In riser cable routing assemblies | N | N | N |
| | In general-purpose cable routing assemblies | N | N | N |

Note: An “N” in the table indicates that the communications raceway type shall not be permitted to be installed in the application. A “Y” indicates that the communications raceway type shall be permitted to be installed in the application, subject to the limitations described in 800.110 and 800.113.

## Table 800.154(c) Applications of Listed Cable Routing Assemblies in Buildings

| Applications | | Listed Cable Routing Assembly Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | N | N | N |
| | In metal raceway that complies with 300.22(B) | N | N | N |
| In other spaces used for environmental air (plenums) 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) | N | N | N |
| | In plenum communications raceways | N | N | N |
| | Supported by open metal cable trays | Y | N | N |
| | Supported by solid bottom metal cable trays with solid metal covers | N | N | N |
| In risers | In vertical runs | Y | Y | N |
| | In metal raceways | N | N | N |
| | In fireproof shafts | Y | Y | Y |
| | In plenum communications raceways | N | N | N |
| | In riser communications raceways | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y |
| | In one- and two-family dwellings | Y | Y | Y |
| | In multifamily dwellings | Y | Y | Y |
| | In nonconcealed spaces | Y | Y | Y |
| | Supported by cable trays | Y | Y | Y |
| | Under carpet, modular flooring, and planks | N | N | N |
| | In distributing frames and cross-connect arrays | Y | Y | Y |
| | In any raceway recognized in Chapter 3 | N | N | N |
| | In plenum communications raceways | N | N | N |
| | In riser communications raceways | N | N | N |
| | In general-purpose communications raceways | N | N | N |

Note: An “N” in the table indicates that the cable routing assembly type shall not be permitted to be installed in the application. A “Y” indicates that the cable routing assembly type shall be permitted to be installed in the application subject to the limitations described in 800.113.

### 800.179 Plenum, Riser, General-Purpose, and Limited Use Cables.

Plenum, riser, general-purpose, and limited-use cables shall be listed in accordance with 800.179(A) through (D) and shall have a temperature rating of not less than 60°C (140°F). The temperature rating shall be marked on the jacket of cables that have a temperature rating exceeding 60°C (140°F). The cable voltage rating shall not be marked on the cable.

#### (A) Plenum Cables.

Type CMP communications plenum cables, Type CATVP community antenna television plenum coaxial cables, and Type BLP network-powered broadband communication low-power plenum cables shall be listed as being suitable for use in ducts, plenums, and other spaces 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*.

#### (B) Riser Cables.

Type CMR communications riser cables, Type CATVR community antenna television riser coaxial cables, Type BMR network-powered broadband communications medium-power riser cables, and Type BLR network-powered broadband communications low-power riser cables 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 1666-2011, *Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts.*

#### (C) General-Purpose Cables.

Type CM communications general-purpose cables, Type CATV community antenna television coaxial general-purpose cables, Type BM network-powered broadband communications medium-power general-purpose cables, and Type BL network-powered broadband communications low-power general-purpose cables shall be listed as being suitable for general-purpose use, with the exception of risers and plenums, 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 Flame Tray 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. 0.3-09, *Test Methods for Electrical Wires and Cables*.

#### (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 VW-1 (vertical-wire) flame test in ANSI/UL 1581-2017, *Reference Standard for Electrical Wires, Cables and Flexible Cords*.

## Part V. Listing Requirements

### 800.180 Grounding Devices.

Where bonding or grounding is required, devices used to connect a shield, a sheath, or non-current-carrying metallic members of a cable to a bonding conductor or grounding electrode conductor shall be listed or be part of listed equipment.

### 800.182 Cable Routing Assemblies and Communications Raceways.

Cable routing assemblies and communications raceways shall be listed in accordance with 800.182(A) through (C). Cable routing assemblies shall be marked in accordance with Table 800.182(a). Communications raceways shall be marked in accordance with Table 800.182(b).

Informational Note: For information on listing requirements for both communications raceways and cable routing assemblies, see ANSI/UL 2024-5-2015, *Cable Routing Assemblies and Communications Raceways*.

**Table 800.182(a) Cable Routing Assembly Markings**

| Type | Marking |
|---|---|
| Plenum Cable Routing Assembly | Plenum Cable Routing Assembly |
| Riser Cable Routing Assembly | Riser Cable Routing Assembly |
| General-Purpose Cable Routing Assembly | General-Purpose Cable Routing Assembly |

**Table 800.182(b) Communications Raceway Markings**

| Type | Marking |
|---|---|
| Plenum Communications Raceway | Plenum Communications Raceway |
| Riser Communications Raceway | Riser Communications Raceway |
| General-Purpose Communications Raceway | General-Purpose Communications Raceway |

### (A) Plenum Cable Routing Assemblies and Plenum Communications Raceways.

Plenum cable routing assemblies and plenum communications raceways shall be listed as having adequate fire-resistant and low-smoke-producing characteristics.

Informational Note No. 1: One method of defining cable routing assemblies and communications raceways that have adequate fire-resistant and low-smoke-producing characteristics is that they exhibit a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84-15a, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or ANSI/UL 723-2013, *Standard Test Method for Surface Burning Characteristics of Building Materials*.

Informational Note No. 2: Another method of defining communications raceways that have adequate fire-resistant and low-smoke-producing characteristics is that they exhibit 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 262-2015, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces*.

Informational Note No. 3: See 4.3.11.2.6 or 4.3.11.5.5 of NFPA 90A-2015, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, for information on materials exposed to the airflow in ceiling cavity and raised floor plenums.

### (B) Riser Cable Routing Assemblies and Riser Communications Raceways.

Riser cable routing assemblies and riser communications raceways shall be listed as having adequate 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 cable routing assemblies and communications raceways pass the requirements of ANSI/UL 1666-2011, *Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts*.

### (C) General-Purpose Cable Routing Assemblies and General-Purpose Communications Raceways.

General-purpose cable routing assemblies and general-purpose communications raceways shall 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 cable routing assemblies and communications raceways do not spread fire to the top of the tray in the “UL Flame Exposure, Vertical Flame Tray Test” in ANSI/UL 1685-2011, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*.

## Article 805 Communications Circuits

### Part I. General

### 805.1 Scope.

This article covers communications circuits and equipment.

**805.2 Definitions.**

The definitions in this section shall apply only within Articles 805 and 840.

**Cable.**

A factory assembly of two or more conductors having an overall covering.

**Communications Circuit Integrity (CI) Cable.**

Cable used in communications systems to ensure continued operation of critical circuits during a specified time under fire conditions.

**Wire.**

A factory assembly of one or more insulated conductors without an overall covering.

**805.18 Installation of Equipment.**

Equipment electrically connected to a communications network shall be listed in accordance with 805.170.

*Exception: This listing requirement shall not apply to test equipment that is intended for temporary connection to a telecommunications network by qualified persons during the course of installation, maintenance, or repair of telecommunications equipment or systems.*

**Part II. Wires and Cables Outside and on the service provider side of the Communication Service Point ~~Entering Buildings~~**

**805.47 Underground Communications Wires and Cables ~~Entering Buildings~~.**

Underground communications wires and cables ~~entering buildings~~ shall comply with 805.47(A) and (B). The requirements of 310.10(C) shall not apply to communications wires and cables.

**(A) Underground Systems with Electric Light, Power, Class 1, or Non-Power-Limited Fire Alarm Circuit Conductors.**

Underground communications wires and cables in a raceway, handhole enclosure, or manhole containing electric light, power, Class 1, or non-power-limited fire alarm circuit conductors shall be in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier.

**(B) Underground Block Distribution.**

Where the entire street circuit is run underground and the circuit within the block is placed so as to be free from the likelihood of accidental contact with electric light or power circuits of over 300 volts to ground, the insulation requirements of 805.50(A) and 805.50(C) shall not apply, insulating supports shall not be required for the conductors, and bushings shall not be required where the conductors enter the building.

**805.48 Unlisted Cables on the service provider side of the Communication Service Point ~~Entering Buildings~~.**

Unlisted outside plant communications cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated in an enclosure or on a listed primary protector. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) to the point of emergence.

Informational Note No. 1: Splice cases or terminal boxes, both metallic and plastic types, are typically used as enclosures for splicing or terminating telephone cables.

Informational Note No. 2: This section limits the length of unlisted outside plant cable to 15 m (50 ft), while 805.90(B) requires that the primary protector be located as close as practicable to the point at which the cable enters the building. Therefore, in installations requiring a primary protector, the outside plant cable may not be permitted to extend 15 m (50 ft) into the building if it is practicable to place the primary protector closer than 15 m (50 ft) to the point of entrance.

### 805.50 Circuits Requiring Primary Protectors.

Circuits that require primary protectors as provided in 805.90 shall comply with 805.50(A),805.50(B), and 805.50(C).

#### (A) Insulation, Wires, and Cables.

Communications wires and cables without a metallic shield, running from the last outdoor support to the primary protector, shall be listed in accordance with 805.173.

#### (B) On Buildings.

Communications wires and cables in accordance with 805.50(A) shall be separated at least 100 mm (4 in.) from electric light or power conductors not in a raceway or cable or be permanently separated from conductors of the other systems by a continuous and firmly fixed nonconductor in addition to the insulation on the wires, such as porcelain tubes or flexible tubing. Communications wires and cables in accordance with 805.50(A) exposed to accidental contact with electric light and power conductors operating at over 300 volts to ground and attached to buildings shall be separated from woodwork by being supported on glass, porcelain, or other insulating material.

*Exception: Separation from woodwork shall not be required where fuses are omitted as provided for in 805.90(A)(1), or where conductors are used to extend circuits to a building from a cable having a grounded metal sheath.*

#### (C) Entering Buildings.

Where a primary protector is installed inside the building, the communications wires and cables shall enter the building either through a noncombustible, nonabsorbent insulating bushing or through a metal raceway. The insulating bushing shall not be required where the entering communications wires and cables (1) are in metal-sheathed cable, (2) pass through masonry, (3) meet the requirements of 805.50(A) and fuses are omitted as provided in 805.90(A)(1), or (4) meet the requirements of 805.50(A) and are used to extend circuits to a building from a cable having a grounded metallic sheath. Raceways or bushings shall slope upward from the outside or, where this cannot be done, drip loops shall be formed in the communications wires and cables immediately before they enter the building.

Raceways shall be equipped with an approved service head. More than one communications wire and cable shall be permitted to enter through a single raceway or bushing. Conduits or other metal raceways located ahead of the primary protector shall be grounded.

## Part III. Protection

### 805.90 Protective Devices.

#### (A) Application.

A listed primary protector shall be provided on each circuit run partly or entirely in aerial wire or aerial cable not confined within a block. Also, a listed primary protector shall be provided on each circuit, aerial or underground, located within the block containing the building served so as to be exposed to accidental contact with electric light or power conductors operating at over 300 volts to ground. In addition, where there exists a lightning exposure, each interbuilding circuit on a premises shall be protected by a listed primary protector at each end of the interbuilding circuit. Installation of primary protectors shall also comply with 110.3(B).

Informational Note No. 1: On a circuit not exposed to accidental contact with power conductors, providing a listed primary protector in accordance with this article helps protect against other hazards, such as lightning and above-normal voltages induced by fault currents on power circuits in proximity to the communications circuit.

Informational Note No. 2: Interbuilding circuits are considered to have a lightning exposure unless one or more of the following conditions exist:

1. Circuits in large metropolitan areas where buildings are close together and sufficiently high to intercept lightning.
2. Interbuilding cable runs of 42 m (140 ft) or less, directly buried or in underground conduit, where a continuous metallic cable shield or a continuous metal conduit containing the cable is connected to each building grounding electrode system.

3. Areas having an average of five or fewer thunderstorm days per year and earth resistivity of less than 100 ohm-meters. Such areas are found along the Pacific coast.

Informational Note No. 3: For information on lightning protection systems, see NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems.*

**(1) Fuseless Primary Protectors.**

Fuseless-type primary protectors shall be permitted under any of the conditions given in 805.90(A)(1)(a) through (A)(1)(e).

(a) Where conductors enter a building through a cable with grounded metallic sheath member(s) and where the conductors in the cable safely fuse on all currents greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor

(b) Where insulated conductors in accordance with 805.50(A) are used to extend circuits to a building from a cable with an effectively grounded metallic sheath member(s) and where the conductors in the cable or cable stub, or the connections between the insulated conductors and the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground, safely fuse on all currents greater than the current-carrying capacity of the primary protector, or the associated insulated conductors and of the primary protector bonding conductor or grounding electrode conductor

(c) Where insulated conductors in accordance with 805.50(A) or (B) are used to extend circuits to a building from other than a cable with metallic sheath member(s), where (1) the primary protector is listed as being suitable for this purpose for application with circuits extending from other than a cable with metallic sheath members, and (2) the connections of the insulated conductors to the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground or the conductors of the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground safely fuse on all currents greater than the current-carrying capacity of the primary protector, or associated insulated conductors and of the primary protector bonding conductor or grounding electrode conductor

(d) Where insulated conductors in accordance with 805.50(A) are used to extend circuits aerially to a building from a buried or underground circuit that is unexposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground

(e) Where insulated conductors in accordance with 805.50(A) are used to extend circuits to a building from cable with an effectively grounded metallic sheath member(s), and where (1) the combination of the primary protector and insulated conductors is listed as being suitable for this purpose for application with circuits extending from a cable with an effectively grounded metallic sheath member(s), and (2) the insulated conductors safely fuse on all currents greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor

Informational Note: Section 9 of ANSI/IEEE C2-2012, *National Electrical Safety Code*, provides an example of methods of protective grounding that can achieve effective grounding of communications cable sheaths for cables from which communications circuits are extended.

**(2) Fused Primary Protectors.**

Where the requirements listed under 805.90(A)(1)(a) through (A)(1)(e) are not met, fused-type primary protectors shall be used. Fused-type primary protectors shall consist of an arrester connected between each line conductor and ground, a fuse in series with each line conductor, and an appropriate mounting arrangement. Primary protector terminals shall be marked to indicate line, instrument, and ground, as applicable.

**(B) Location.**

The primary protector shall be located in, on, or immediately adjacent to the structure or building served and as close as practicable to the point of entrance.

For purposes of this section, primary protectors located at mobile home service equipment within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means connected to an electrode by a grounding electrode conductor in accordance with 250.32 and located

within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a primary protector location to achieve the shortest practicable primary protector bonding conductor or grounding electrode conductor helps limit potential differences between communications circuits and other metallic systems.

**(C) Hazardous (Classified) Locations.**

The primary protector shall not be located in any hazardous (classified) locations, as defined in 500.5 and 505.5, or in the vicinity of easily ignitible material.

*Exception: As permitted in 501.150, 502.150, and 503.150.*

**(D) Secondary Protectors.**

Where a secondary protector is installed in series with the indoor communications wire and cable between the primary protector and the equipment, it shall be listed for the purpose in accordance with 805.170(B).

Informational Note: Secondary protectors on circuits exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground are not intended for use without primary protectors.

**805.93 Grounding, Bonding, or Interruption of Non–Current-Carrying Metallic Sheath Members of Communications Cables.**

Communications cables entering the building or terminating on the outside of the building shall comply with 805.93(A) or (B).

**(A) Entering Buildings.**

In installations where the communications cable enters a building, the metallic sheath members of the cable shall be grounded or bonded as specified in 800.100 or interrupted by an insulating joint or equivalent device. The grounding, bonding, or interruption shall be as close as practicable to the point of entrance.

**(B) Terminating on the Outside of Buildings.**

In installations where the communications cable is terminated on the outside of the building, the metallic sheath members of the cable shall be grounded or bonded as specified in 800.100 or interrupted by an insulating joint or equivalent device. The grounding, bonding, or interruption shall be as close as practicable to the point of termination of the cable.

**Part IV. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**805.133 Installation of Communications Wires, Cables, and Equipment.**

Communications wires and cables from the protector to the equipment or, where no protector is required, communications wires and cables attached to the outside or inside of the building shall comply with 805.133(A) and 805.133(B)

**(A) Separation from Other Conductors.**

**(1) In Raceways, Cable Trays, Boxes, Cables, Enclosures, and Cable Routing Assemblies.**

(a) *Other Circuits.* Communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with cables 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. Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770
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

(b) *Class 2 and Class 3 Circuits.* Class 1 circuits shall not be run in the same cable with communications circuits. Class 2 and Class 3 circuit conductors shall be permitted in the same listed communications cable with communications circuits.

(c) *Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm, and Medium-Power Network-Powered Broadband Communications Circuits in Raceways, Compartments, and Boxes.* Communications conductors shall not be placed in any raceway, compartment, outlet box, junction box, or similar fitting with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits.

*Exception No. 1: Section 805.133(A)(1)(c) shall not apply if 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 conductors of communications circuits by a permanent barrier or listed divider.*

*Exception No. 2: Power conductors in outlet boxes, junction boxes, or similar fittings or compartments where such conductors are introduced solely for power supply to communications equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum of 6 mm (¼ in.) separation from the communications circuit conductors.*

*Exception No. 3: As permitted by 620.36.*

**(2) Other Applications.**

Communications wires and cables shall be separated 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.

*Exception No. 1: Section 805.133(A)(2) shall not apply where either (1) all of the conductors of the electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits are in a raceway or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC, or Type UF cables, or (2) all of the conductors of communications circuits are encased in raceway.*

*Exception No. 2: Section 805.133(A)(2) shall not apply where the communications wires and cables are permanently separated from the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B) Support of Communications Wires and Cables.**

Raceways shall be used for their intended purpose. Communications wires and cables shall not be strapped, taped, or attached by any means to the exterior of any raceway as a means of support.

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

**805.154 Substitutions of Listed Communications Wires, Cables, and Raceways, and Listed Cable Routing Assemblies.**

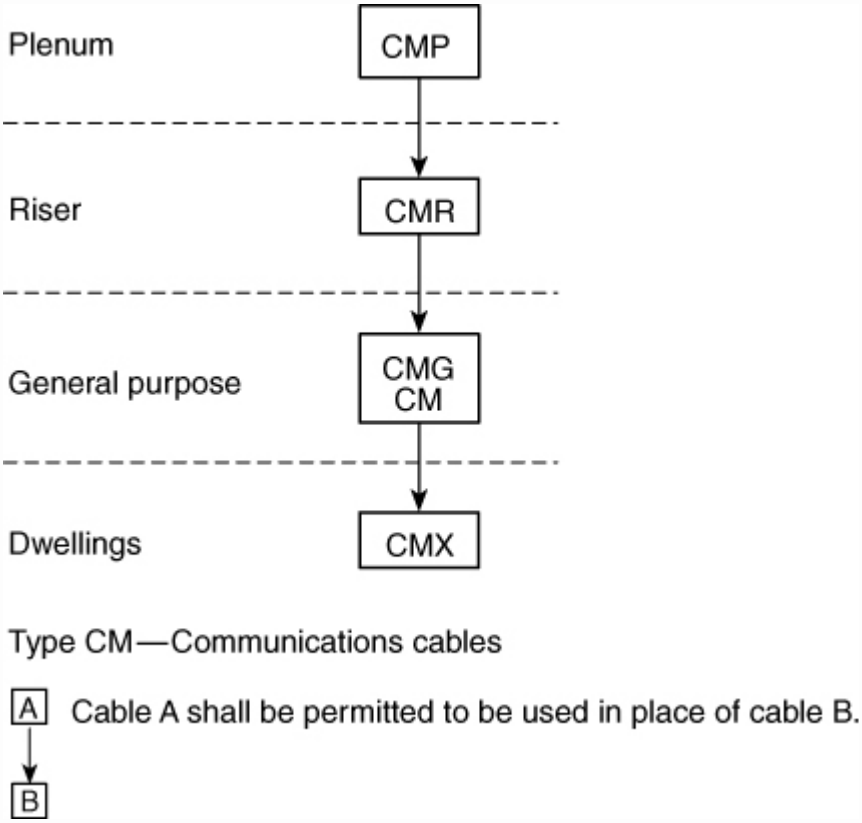
The substitutions for communications cables listed in Table 805.154 and illustrated in Figure 805.154 shall be permitted.

**Table 805.154 Cable Substitutions**

| Cable Type | Permitted Substitutions |
|---|---|
| CMR | CMP |

| Cable Type | Permitted Substitutions |
|---|---|
| CMG, CM | CMP, CMR |
| CMX | CMP, CMR, CMG, CM |

**Figure 805.154 Cable Substitution Hierarchy.**




### 805.156 Dwelling Unit Communications Outlet.

For new construction, a minimum of one communications outlet shall be installed within the dwelling in a readily accessible area and cabled to the service provider demarcation point.

## Part V. Listing Requirements

### 805.170 Equipment.

Communications equipment shall be listed as being suitable for electrical connection to a communications network.

Informational Note No. 1: One way to determine applicable requirements is to refer to ANSI/UL 60950-1-2014, *Standard for Safety of Information Technology Equipment*; ANSI/UL 1863-2012, *Standard for Safety Communications Circuit Accessories*; or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements*.

Informational Note No. 2: Additional information regarding voltages, currents, and power allowed on communications circuits can be found in ANSI/ATIS 0600337-2016, *Requirements for Maximum Voltage, Current, and Power Levels Used in Communications Transport Circuits*.

#### (A) Primary Protectors.

The primary protector shall consist of an arrester connected between each line conductor and ground in an appropriate mounting. Primary protector terminals shall be marked to indicate line and ground as applicable.

Informational Note: One way to determine applicable requirements for a listed primary protector is to refer to ANSI/UL 497-2013, *Standard for Protectors for Paired Conductor Communications Circuits*.

#### (B) Secondary Protectors.

The secondary protector shall be listed as suitable to provide means to safely limit currents to less than the current-carrying capacity of listed indoor communications wire and cable, listed telephone set line cords, and listed communications terminal equipment having ports for external wire line communications circuits. Any overvoltage protection, arresters, or grounding connection shall be connected on the equipment terminals side of the secondary protector current-limiting means.

Informational Note: One way to determine applicable requirements for a listed secondary protector is to refer to ANSI/UL 497A-2012, *Standard for Secondary Protectors for Communications Circuits*.

**(C) Plenum Grade Cable Ties.**

Cable ties intended for use in other space used for environmental air (plenums) shall be listed as having low smoke and heat release properties.

Informational Note: See NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, and ANSI/UL 2043-2013, *Standard for Safety Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces*, for information on listing discrete products as having low smoke and heat release properties.

### 805.173 Drop Wire and Cable.

Communications wires and cables without a metallic shield, running from the last outdoor support to the primary protector, shall be listed as being suitable for the purpose and shall have current-carrying capacity as specified in 805.90(A)(1)(b) or (A)(1)(c).

### 805.179 Communications Wires and Cables.

Communications wires and cables shall be listed in accordance with 805.179(A) through (F) and marked in accordance with Table 805.179 and 805.179(G). Conductors in communications cables, other than in a coaxial cable, shall be copper.

Communications wires and cables shall have a voltage rating of not less than 300 volts. The insulation for the individual conductors, other than the outer conductor of a coaxial cable, shall be rated for 300 volts minimum. The cable voltage rating shall not be marked on the cable or on the under-carpet communications wire.

*Exception: Voltage markings shall be permitted where the cable has multiple listings and 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 805.179 Cable Markings**

| Cable Marking | Type |
|---|---|
| CMP | Communications plenum cable |
| CMR | Communications riser cable |
| CMG | Communications general-purpose cable |
| CM | Communications general-purpose cable |
| CMX | Communications cable, limited use |
| CMUC | Under-carpet communications wire and cable |

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

**(A) General Requirements.**

The general requirements in 805.179 shall apply.

**(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 VW-1 (vertical-wire) flame test in ANSI/UL 1581-2017, *Reference Standard for Electrical Wires, Cables and Flexible Cords*.

### (C) Circuit Integrity (CI) Cable or Electrical Circuit Protective System.

Cables that are used for survivability of critical circuits under fire conditions shall be listed and meet either 805.179(C)(1) or 805.179(C)(2).

Informational Note: The listing organization provides information for circuit integrity (CI) cable and electrical circuit protective systems, including installation requirements required to maintain the fire rating.

### (1) Circuit Integrity (CI) Cables.

Circuit integrity (CI) cables specified in 805.179(A) through (D), and used for survivability of critical circuits, shall have an additional classification using the suffix "CI." In order to maintain its listed fire rating, circuit integrity (CI) cable shall only be installed in free air.

Informational Note: One method of defining circuit integrity (CI) cable is by establishing a minimum 2-hour fire resistance rating for the cable when tested in accordance with ANSI/UL 2196-2017, *Standard for Fire Test for Circuit Integrity of Fire-Resistant Power, Instrumentation, Control, and Data Cables*.

### (2) Fire-Resistive Cables.

Cables specified in 800.179(A) through (D) and 805.179(C)(1), that are part of an electrical circuit protective system, shall be fire-resistive cable identified with the protective system number on the product, or on the smallest unit container in which the product is packaged, and shall be installed in accordance with the listing of the protective system.

Informational Note No. 1: One method of defining an electrical circuit protective system is by establishing a minimum 2-hour fire resistance rating for the system when tested in accordance with UL Subject 1724, *Outline of Investigation for Fire Tests for Electrical Circuit Protective Systems*.

Informational Note No. 2: The listing organization provides information for electrical circuit protective systems (FHIT), including installation requirements for maintaining the fire rating.

### (D) Types CMP-LP, CMR-LP, CMG-LP, and CM-LP Limited Power (LP) Cables.

Types CMP-LP, CMR-LP, CMG-LP, and CM-LP communications limited power 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 XX designates the current limit in amperes per conductor.

Informational Note: An example of the marking on a communications cable with an LP rating is "CMP-LP (0.6A)(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 ampere.

### (E) Communications Wires.

Communications wires, such as distributing frame wire and jumper wire, shall 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 Flame Tray 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. 0.3-09, *Test Methods for Electrical Wires and Cables*.

### (F) Hybrid Power and Communications Cables.

Listed hybrid power and communications cables shall be permitted where the power cable is a listed Type NM or NM-B, conforming to Part III of Article 334, and the communications cable is a listed Type CM, the jackets on the listed NM or NM-B, and listed CM cables are rated for 600 volts minimum, and the hybrid cable is 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 Flame Tray 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. 0.3-09, *Test Methods for Electrical Wires and Cables*.

### (G) Optional Markings.

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.

## Article 810 Radio and Television Equipment

### Part I. General

#### 810.1 Scope.

This article covers antenna systems for radio and television receiving equipment, amateur and citizen band radio transmitting and receiving equipment, and certain features of transmitter safety. This article covers antennas such as wire-strung type, multi-element, vertical rod, flat, or parabolic and also covers the wiring and cabling that connect them to equipment. This article does not cover equipment and antennas used for coupling carrier current to power line conductors.

#### 810.2 Definitions.

The definitions in Part I of Article 100 shall apply.

#### 810.3 Other Articles.

Wiring from the source of power to and between devices connected to the interior wiring system shall comply with Chapters 1 through 4 other than as modified by Parts I and II of Article 640. Wiring for audio signal processing, amplification, and reproduction equipment shall comply with Article 640. Coaxial cables that connect antennas to equipment shall comply with Article 820.

#### 810.4 Community Television Antenna.

The antenna shall comply with this article. The distribution system shall comply with Article 820.

#### 810.5 Radio Noise Suppressors.

Radio interference eliminators, interference capacitors, or noise suppressors connected to power-supply leads shall be of a listed type. They shall not be exposed to physical damage.

#### 810.6 Antenna Lead-In Protectors.

Where an antenna lead-in surge protector is installed, it shall be listed as being suitable for limiting surges on the cable that connects the antenna to the receiver/transmitter electronics and shall be connected between the conductors and the grounded shield or other ground connection. The antenna lead-in protector shall be grounded using a bonding conductor or grounding electrode conductor installed in accordance with 810.21(F).

Informational Note: For requirements covering protectors for antenna lead-in conductors, refer to UL 497E, *Outline of Investigation for Protectors for Antenna Lead-In Conductors*.

#### 810.7 Grounding Devices.

Where bonding or grounding is required, devices used to connect a shield, a sheath, non–current-carrying metallic members of a cable, or metal parts of equipment or antennas to a bonding conductor or grounding electrode conductor shall be listed or be part of listed equipment.

### Part II. Receiving Equipment — Antenna Systems

#### 810.11 Material.

Antennas and lead-in conductors shall be of hard-drawn copper, bronze, aluminum alloy, copper-clad steel, or other high-strength, corrosion-resistant material.

*Exception: Soft-drawn or medium-drawn copper shall be permitted for lead-in conductors where the maximum span between points of support is less than 11 m (35 ft).*

#### 810.12 Supports.

Outdoor antennas and lead-in conductors shall be securely supported. The antennas or lead-in conductors shall not be attached to the electric service mast. They shall not be attached to poles or similar structures carrying open electric light or power wires or trolley wires of over 250 volts between conductors. Insulators supporting the antenna conductors shall have sufficient mechanical strength to safely support the conductors. Lead-in conductors shall be securely attached to the antennas.

### 810.13 Avoidance of Contacts with Conductors of Other Systems.

Outdoor antennas and lead-in conductors from an antenna to a building shall not cross over open conductors of electric light or power circuits and shall be kept well away from all such circuits so as to avoid the possibility of accidental contact. Where proximity to open electric light or power service conductors of less than 250 volts between conductors cannot be avoided, the installation shall be such as to provide a clearance of at least 600 mm (2 ft).

Where practicable, antenna conductors shall be installed so as not to cross under open electric light or power conductors.

### 810.14 Splices.

Splices and joints in antenna spans shall be made mechanically secure with approved splicing devices or by such other means as will not appreciably weaken the conductors.

### 810.15 Grounding.

Masts and metal structures supporting antennas shall be grounded in accordance with 810.21, unless the antenna and its related supporting mast or structure are within a zone of protection defined by a 46 m (150 ft) radius rolling sphere.

Informational Note: See 4.8.3.1 of NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, for the application of the term *rolling sphere*.

### 810.16 Size of Wire-Strung Antenna — Receiving Station.

#### (A) Size of Antenna Conductors.

Outdoor antenna conductors for receiving stations shall be of a size not less than given in Table 810.16(A).

**Table 810.16(A) Size of Receiving Station Outdoor Antenna Conductors**

| Material | Minimum Size of Conductors (AWG) Where Maximum Open Span Length Is | | |
|---|---|---|---|
| | Less Than 11 m (35 ft) | 11 m to 45 m (35 ft to 150 ft) | Over 45 m (150 ft) |
| Aluminum alloy, hard-drawn copper | 19 | 14 | 12 |
| Copper-clad steel, bronze, or other high-strength material | 20 | 17 | 14 |

#### (B) Self-Supporting Antennas.

Outdoor antennas, such as vertical rods and flat, parabolic, or dipole structures, shall be of corrosion-resistant materials and of strength suitable to withstand ice and wind loading conditions and shall be located well away from overhead conductors of electric light and power circuits of over 150 volts to ground, so as to avoid the possibility of the antenna or structure falling into or making accidental contact with such circuits.

### 810.17 Size of Lead-in — Receiving Station.

Lead-in conductors from outside antennas for receiving stations shall, for various maximum open span lengths, be of such size as to have a tensile strength at least as great as that of the conductors for antennas as specified in 810.16. Where the lead-in consists of two or more conductors that are twisted

together, are enclosed in the same covering, or are concentric, the conductor size shall, for various maximum open span lengths, be such that the tensile strength of the combination is at least as great as that of the conductors for antennas as specified in 810.16.

### 810.18 Clearances — Receiving Stations.

#### (A) Outside of Buildings.

Lead-in conductors attached to buildings shall be installed so that they cannot swing closer than 600 mm (2 ft) to the conductors of circuits of 250 volts or less between conductors, or 3.0 m (10 ft) to the conductors of circuits of over 250 volts between conductors, except that in the case of circuits not over 150 volts between conductors, where all conductors involved are supported so as to ensure permanent separation, the clearance shall be permitted to be reduced but shall not be less than 100 mm (4 in.). The clearance between lead-in conductors and any conductor forming a part of a lightning protection system shall not be less than 1.8 m (6 ft). Underground conductors shall be separated at least 300 mm (12 in.) from conductors of any light or power circuits or Class 1 circuits.

*Exception: Where the electric light or power conductors, Class 1 conductors, or lead-in conductors are installed in raceways or metal cable armor.*

Informational Note No. 1: See 250.60 for grounding associated with lightning protection components — strike termination devices. For further information, see NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, which contains detailed information on grounding, bonding, and spacing from lightning protection systems, and the calculation of specific separation distances using the sideflash equation in Section 4.6.

Informational Note No. 2: Metal raceways, enclosures, frames, and other non–current-carrying metal parts of electrical equipment installed on a building equipped with a lightning protection system may require bonding or spacing from the lightning protection conductors in accordance with NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*. Separation from lightning protection conductors is typically 1.8 m (6 ft) through air or 900 mm (3 ft) through dense materials such as concrete, brick, or wood.

#### (B) Antennas and Lead-ins — Indoors.

Indoor antennas and indoor lead-ins shall not be run nearer than 50 mm (2 in.) to conductors of other wiring systems in the premises.

*Exception No. 1: Where such other conductors are in metal raceways or cable armor.*

*Exception No. 2: Where permanently separated from such other conductors by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing.*

#### (C) In Boxes or Other Enclosures.

Indoor antennas and indoor lead-ins shall be permitted to occupy the same box or enclosure with conductors of other wiring systems where separated from such other conductors by an effective permanently installed barrier.

### 810.19 Electrical Supply Circuits Used in Lieu of Antenna — Receiving Stations.

Where an electrical supply circuit is used in lieu of an antenna, the device by which the radio receiving set is connected to the supply circuit shall be listed.

### 810.20 Antenna Discharge Units — Receiving Stations.

#### (A) Where Required.

Each conductor of a lead-in from an outdoor antenna shall be provided with a listed antenna discharge unit.

*Exception: Where the lead-in conductors are enclosed in a continuous metallic shield that either is grounded with a conductor in accordance with 810.21 or is protected by an antenna discharge unit.*

#### (B) Location.

Antenna discharge units shall be located outside the building or inside the building between the point of entrance of the lead-in and the radio set or transformers and as near as practicable to the entrance of the conductors to the building. The antenna discharge unit shall not be located near combustible material or in a hazardous (classified) location as defined in Article 500.

**(C) Grounding.**

The antenna discharge unit shall be grounded in accordance with 810.21.

**810.21 Bonding Conductors and Grounding Electrode Conductors — Receiving Stations.**

Bonding conductors and grounding electrode conductors shall comply with 810.21(A) through 810.21(K).

**(A) Material.**

The bonding conductor or grounding electrode conductor shall be of copper, aluminum, copper-clad steel, copper-clad aluminum, bronze, or similar corrosion-resistant material. Aluminum or copper-clad aluminum bonding conductors or grounding electrode conductors shall not be used where in direct contact with masonry or the earth or where subject to corrosive conditions. Where used outside, aluminum or copper-clad aluminum conductors shall not be installed within 450 mm (18 in.) of the earth.

**(B) Insulation.**

Insulation on bonding conductors or grounding electrode conductors shall not be required.

**(C) Supports.**

The bonding conductor or grounding electrode conductor shall be securely fastened in place and shall be permitted to be directly attached to the surface wired over without the use of insulating supports.

*Exception: Where proper support cannot be provided, the size of the bonding conductors or grounding electrode conductors shall be increased proportionately.*

**(D) Physical Protection.**

Bonding conductors and grounding electrode conductors shall be protected where exposed to physical damage. Where the bonding conductor or grounding electrode conductor is installed in a metal raceway, both ends of the raceway shall be bonded to the contained conductor or to the same terminal or electrode to which the bonding conductor or grounding electrode conductor is connected.

**(E) Run in Straight Line.**

The bonding conductor or grounding electrode conductor for an antenna mast or antenna discharge unit shall be run in as straight a line as practicable.

**(F) Electrode.**

The bonding conductor or grounding electrode conductor shall be connected as required in 810.21(F)(1) through 810.21(F)(3).

**(1) In Buildings or Structures with an Intersystem Bonding Termination.**

If the building or structure served has an intersystem bonding termination as required by 250.94, the bonding conductor shall be connected to the intersystem bonding termination.

**(2) In Buildings or Structures with Grounding Means.**

If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on the following:

1. The building or structure grounding electrode system as covered in 250.50
2. The grounded interior metal water piping systems, within 1.52 m (5 ft) from its point of entrance to the building, as covered in 250.52
3. The power service accessible means external to the building, as covered in 250.94
4. The nonflexible metal power service raceway
5. The service equipment enclosure, or
6. The grounding electrode conductor or the grounding electrode conductor metal enclosures of the power service

A bonding device intended to provide a termination point for the bonding conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on nonremovable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is nonremovable.

**(3) In Buildings or Structures Without an Intersystem Bonding Termination or Grounding Means.**

If the building or structure served has no intersystem bonding termination or grounding means as described in 810.21(F)(2), the grounding electrode conductor shall be connected to a grounding electrode as described in 250.52.

**(G) Inside or Outside Building.**

The bonding conductor or grounding electrode conductor shall be permitted to be run either inside or outside the building.

**(H) Size.**

The bonding conductor or grounding electrode conductor shall not be smaller than 10 AWG copper, 8 AWG aluminum, or 17 AWG copper-clad steel or bronze.

**(I) Common Ground.**

A single bonding conductor or grounding electrode conductor shall be permitted for both protective and operating purposes.

**(J) Bonding of Electrodes.**

A bonding jumper not smaller than 6 AWG copper or equivalent shall be connected between the radio and television equipment grounding electrode and the power grounding electrode system at the building or structure served where separate electrodes are used.

**(K) Electrode Connection.**

Connections to grounding electrodes shall comply with 250.70.

## Part III. Amateur and Citizen Band Transmitting and Receiving Stations — Antenna Systems

### 810.51 Other Sections.

In addition to complying with Part III, antenna systems for amateur and citizen band transmitting and receiving stations shall also comply with 810.11 through 810.15.

### 810.52 Size of Antenna.

Antenna conductors for transmitting and receiving stations shall be of a size not less than given in Table 810.52.

**Table 810.52 Size of Outdoor Antenna Conductors**

| Material | Minimum Size of Conductors (AWG) Where Maximum Open Span Length Is | |
|---|---|---|
| | Less Than 45 m (150 ft) | Over 45 m (150 ft) |
| Hard-drawn copper | 14 | 10 |
| Copper-clad steel, bronze, or other high-strength material | 14 | 12 |

### 810.53 Size of Lead-in Conductors.

Lead-in conductors for transmitting stations shall, for various maximum span lengths, be of a size at least as great as that of conductors for antennas as specified in 810.52.

### 810.54 Clearance on Building.

Antenna conductors for transmitting stations, attached to buildings, shall be firmly mounted at least 75 mm (3 in.) clear of the surface of the building on nonabsorbent insulating supports, such as treated pins or brackets equipped with insulators having not less than 75-mm (3-in.) creepage and airgap distances. Lead-in conductors attached to buildings shall also comply with these requirements.

*Exception: Where the lead-in conductors are enclosed in a continuous metallic shield that is grounded with a conductor in accordance with 810.58, they shall not be required to comply with these requirements. Where grounded, the metallic shield shall also be permitted to be used as a conductor.*

**810.55 Entrance to Building.**

Except where protected with a continuous metallic shield that is grounded with a conductor in accordance with 810.58, lead-in conductors for transmitting stations shall enter buildings by one of the following methods:

1. Through a rigid, noncombustible, nonabsorbent insulating tube or bushing
2. Through an opening provided for the purpose in which the entrance conductors are firmly secured so as to provide a clearance of at least 50 mm (2 in.)
3. Through a drilled window pane

**810.56 Protection Against Accidental Contact.**

Lead-in conductors to radio transmitters shall be located or installed so as to make accidental contact with them difficult.

**810.57 Antenna Discharge Units — Transmitting Stations.**

Each conductor of a lead-in for outdoor antennas shall be provided with an antenna discharge unit or other suitable means that drain static charges from the antenna system.

*Exception No. 1: Where the lead-in is protected by a continuous metallic shield that is grounded with a conductor in accordance with 810.58, an antenna discharge unit or other suitable means shall not be required.*

*Exception No. 2: Where the antenna is grounded with a conductor in accordance with 810.58, an antenna discharge unit or other suitable means shall not be required.*

**810.58 Bonding Conductors and Grounding Electrode Conductors — Amateur and Citizen Band Transmitting and Receiving Stations.**

Bonding conductors and grounding electrode conductors shall comply with 810.58(A) through 810.58(C).

**(A) Other Sections.**

All bonding conductors and grounding electrode conductors for amateur and citizen band transmitting and receiving stations shall comply with 810.21(A) through 810.21(C).

**(B) Size of Protective Bonding Conductor or Grounding Electrode Conductor.**

The protective bonding conductor or grounding electrode conductor for transmitting stations shall be as large as the lead-in but not smaller than 10 AWG copper, bronze, or copper-clad steel.

**(C) Size of Operating Bonding Conductor or Grounding Electrode Conductor.**

The operating bonding conductor or grounding electrode conductor for transmitting stations shall not be less than 14 AWG copper or its equivalent.

**Part IV. Interior Installation — Transmitting Stations**

**810.70 Clearance from Other Conductors.**

All conductors inside the building shall be separated at least 100 mm (4 in.) from the conductors of any electric light, power, or signaling circuit.

*Exception No. 1: As provided in Article 640.*

*Exception No. 2: Where separated from other conductors by raceway or some firmly fixed nonconductor, such as porcelain tubes or flexible tubing.*

### 810.71 General.

Transmitters shall comply with 810.71(A) through (C).

**(A) Enclosing.**

The transmitter shall be enclosed in a metal frame or grille or separated from the operating space by a barrier or other equivalent means, all metallic parts of which are effectively connected to a bonding conductor or grounding electrode conductor.

**(B) Grounding of Controls.**

All external metal handles and controls accessible to the operating personnel shall be effectively connected to an equipment grounding conductor if the transmitter is powered by the premises wiring system or grounded with a conductor in accordance with 810.21.

**(C) Interlocks on Doors.**

All access doors shall be provided with interlocks that disconnect all voltages of over 350 volts between conductors when any access door is opened.

## Article 820 Community Antenna Television and Radio Distribution Systems

### Part I. General

### 820.1 Scope.

This article covers coaxial cable distribution of radio frequency signals typically employed in community antenna television (CATV) systems.

### 820.2 Definitions.

The definitions in this section shall apply only within Articles 820 and 840.

### 820.3 Other Articles.

Circuits and equipment shall comply with 820.3(A)and (B).

**(A) General Requirements.**

The general requirements of Article 800 shall apply.

**(B) Alternate Wiring Methods.**

The wiring methods of Article 830 shall be permitted to substitute for the wiring methods of Article 820.

Informational Note: Use of Article 830 wiring methods will facilitate the upgrading of Article 820 installations to network-powered broadband applications.

### 820.15 Power Limitations.

Coaxial cable shall be permitted to deliver power to equipment that is directly associated with the radio frequency distribution system if the voltage is not over 60 volts and if the current is supplied by a transformer or other device that has power-limiting characteristics.

Power shall be blocked from premises devices on the network that are not intended to be powered via the coaxial cable.

### Part II. Coaxial Cables ~~Outside~~ on the service provider side of the Communication Service Point~~and Entering Buildings~~

### 820.44 Overhead (Aerial) Coaxial Cables.

Overhead (aerial) coaxial cables, prior to the point of grounding, as specified in 820.93, shall comply with 820.44(A) or 800.44.

**(A) On Poles and In-Span, Above Roofs, on Masts, or Between Buildings.**

Where coaxial cables are installed on poles and in-span, above roofs, on masts, or between buildings, they shall comply with 800.44.

**(B) On Buildings.**

Where attached to buildings, coaxial cables shall be securely fastened in such a manner that they will be separated from other conductors in accordance with 820.44(B)(1) and (B)(2).

**(1) Electric Light or Power.**

The coaxial cable shall have a separation of at least 100 mm (4 in.) from electric light, power, Class 1, or non-power-limited fire alarm circuit conductors not in raceway or cable, or shall be permanently separated from conductors of the other system by a continuous and firmly fixed nonconductor in addition to the insulation on the wires.

**(2) Other Communications Systems.**

Coaxial cable shall be installed so that there will be no unnecessary interference in the maintenance of the separate systems. In no case shall the conductors, cables, messenger strand, or equipment of one system cause abrasion to the conductors, cable, messenger strand, or equipment of any other system.

### 820.47 Underground Coaxial Cables Entering Buildings.

Underground coaxial cables entering buildings shall comply with 820.47(A) and 820.47(B).

**(A) Underground Systems with Electric Light, Power, Class 1, or Non–Power-Limited Fire Alarm Circuit Conductors.**

Underground coaxial cables in a duct, pedestal, handhole enclosure, or manhole that contains electric light, power, or Class 1 or non–power-limited fire alarm circuit conductors shall be in a section permanently separated from such conductors by means of a suitable barrier.

**(B) Direct-Buried Cables and Raceways.**

Direct-buried coaxial cable shall be separated at least 300 mm (12 in.) from conductors of any light or power, non–power-limited fire alarm circuit conductors, or Class 1 circuit.

*Exception No. 1: Separation shall not be required where electric service conductors or coaxial cables are installed in raceways or have metal cable armor.*

*Exception No. 2: Separation shall not be required where electric light or power branch-circuit or feeder conductors or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables; or the coaxial cables have metal cable armor or are installed in a raceway.*

### 820.48 Unlisted Cables Entering Buildings.

Unlisted outside plant coaxial cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated at a grounding block. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) to the point of emergence.

## Part III. Protection

### 820.93 Grounding of the Outer Conductive Shield of Coaxial Cables.

Coaxial cables entering buildings or attached to buildings shall comply with 820.93(A) or (B). Where the outer conductive shield of a coaxial cable is grounded, no other protective devices shall be required. For purposes of this section, grounding located at mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a grounding block location to achieve the shortest practicable bonding conductor or grounding electrode conductor helps limit potential differences between CATV and other metallic systems.

**(A) Entering Buildings.**

In installations where the coaxial cable enters the building, the outer conductive shield shall be grounded in accordance with 820.100. The grounding shall be as close as practicable to the point of entrance.

**(B) Terminating Outside of the Building.**

In installations where the coaxial cable is terminated outside of the building, the outer conductive shield shall be grounded in accordance with 820.100. The grounding shall be as close as practicable to the point of attachment or termination.

**(C) Location.**

Where installed, a listed primary protector shall be applied on each community antenna and radio distribution (CATV) cable external to the premises. The listed primary protector shall be located as close as practicable to the entrance point of the cable on either side or integral to the ground block.

**(D) Hazardous (Classified) Locations.**

Where a primary protector or equipment providing the primary protection function is used, it shall not be located in any hazardous (classified) location as defined in 500.5 and 505.5 or in the vicinity of easily ignitible material.

*Exception: As permitted in 501.150, 502.150, and 503.150.*

**Part IV. Grounding Methods**

**820.100 Cable Bonding and Grounding.**

The shield of the coaxial cable shall be bonded or grounded as specified in 820.100(A) and (B).

*Exception: For communications systems using coaxial cable completely contained within the building (i.e., they do not exit the building) or the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere and isolated from outside cable plant, the shield shall be permitted to be grounded by a connection to an equipment grounding conductor as described in 250.118. Connecting to an equipment grounding conductor through a grounded receptacle using a dedicated bonding jumper and a permanently connected listed device shall be permitted. Use of a cord and plug for the connection to an equipment grounding conductor shall not be permitted.*

Informational Note: See 4.8.3.1 of NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems,* for the application of the term *rolling sphere*.

**(A) General Requirements.**

The installation shall be in accordance with 800.100.

**(B) Shield Protection Devices.**

Grounding of a coaxial drop cable shield by means of a protective device that does not interrupt the grounding system within the premises shall be permitted.

**820.103 Equipment Grounding.**

Unpowered equipment and enclosures or equipment powered by the coaxial cable shall be considered grounded where connected to the metallic cable shield.

**Part V. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**820.133 Installation of Coaxial Cables and Equipment.**

Beyond the point of grounding, as defined in 820.93, the coaxial cable installation shall comply with 820.133(A) and (B).

**(A) Separation from Other Conductors.**

**(1) In Raceways, Cable Trays, Boxes, Enclosures, and Cable Routing Assemblies.**

1. *Other Circuits.* Coaxial cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with jacketed cables 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. Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770
4. Communications circuits in compliance with Parts I and IV of Article 805
5. Low-power network-powered broadband communications circuits in compliance with Parts I and V of Article 830

2. *Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm, and Medium-Power Network-Powered Broadband Communications Circuits.* Coaxial cable shall not be placed in any raceway, compartment, outlet box, junction box, or other enclosures with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits.

*Exception No. 1: Coaxial cable shall be permitted to be placed in any raceway, compartment, outlet box, junction box, or other enclosures with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits where 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 coaxial cables by a permanent barrier or listed divider.*

*Exception No. 2: Coaxial cable shall be permitted to be placed in outlet boxes, junction boxes, or similar fittings or compartments with power conductors where such conductors are introduced solely for power supply to the coaxial cable system distribution equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum 6 mm (¼ in.) separation from coaxial cables.*

**(2) Other Applications.**

Coaxial cable shall be separated 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.

*Exception No. 1: Separation shall not be required where either (1) all of the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits are in a raceway, or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC or Type UF cables, or (2) all of the coaxial cables are encased in a raceway.*

*Exception No. 2: Separation shall not be required where the coaxial cables are permanently separated from the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B) Support of Coaxial Cables.**

Raceways shall be used for their intended purpose. Coaxial cables shall not be strapped, taped, or attached by any means to the exterior of any conduit or raceway as a means of support.

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

**820.154 Substitutions of Listed CATV Cables.**

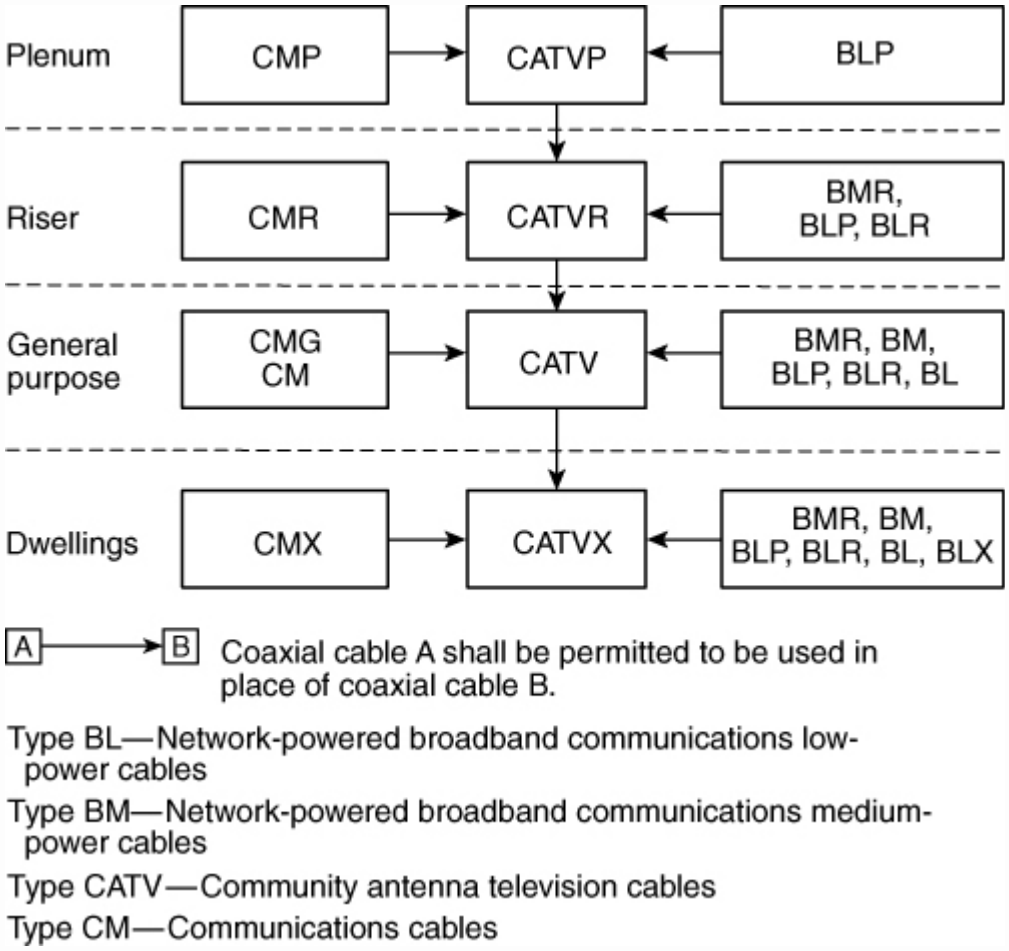
The substitutions for coaxial cables in Table 820.154 and illustrated in Figure 820.154 shall be permitted.

Informational Note: The substitute cables in Table 820.154 and Figure 820.154 are only coaxial-type cables.

**Table 820.154 Coaxial Cable Uses and Permitted Substitutions**

| Cable Type | Permitted Substitutions |
|---|---|
| CATVP | CMP, BLP |
| CATVR | CATVP, CMP, CMR, BMR, BLP, BLR |
| CATV | CATVP, CMP, CATVR, CMR, CMG, CM, BMR, BM, BLP, BLR, BL |
| CATVX | CATVP, CMP, CATVR, CMR, CATV, CMG, CM, BMR, BM, BLP, BLR, BL, BLX |

**Figure 820.154 Cable Substitution Hierarchy.**




## Part VI. Listing Requirements

### 820.179 Coaxial Cables.

Cables shall be listed in accordance with 820.179(A)and marked in accordance with Table 820.179 and 820.179(B). The cable voltage rating shall not be marked on the cable.

Informational Note: Voltage markings on cables could 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.*

**(A) General Requirements.**

The general requirements in 800.179 shall apply.

**(B) Optional Markings.**

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.

**Table 820.179 Coaxial Cable Markings**

| Cable Marking | Type |
|---|---|
| CATVP | CATV plenum cable |
| CATVR | CATV riser cable |
| CATV | CATV cable |
| CATVX | CATV cable, limited use |

# Article 830 Network-Powered Broadband Communications Systems

## Part I. General

### 830.1 Scope.

This article covers network-powered broadband communications systems that provide any combination of voice, audio, video, data, and interactive services through a network interface unit.

Informational Note: A typical basic system configuration includes a cable supplying power and broadband signal to a network interface unit that converts the broadband signal to the component signals. Typical cables are coaxial cable with both broadband signal and power on the center conductor, composite metallic cable with a coaxial member(s) or twisted pair members for the broadband signal and twisted pair members for power, and composite optical fiber cable with a pair of conductors for power. Larger systems may also include network components such as amplifiers that require network power.

### 830.2 Definitions.

The definitions in this section shall apply only within Article 830.

Informational Note: A typical single-family network-powered communications circuit consists of a communications drop or communications service cable and an NIU and includes the communications utility's serving terminal or tap where it is not under the exclusive control of the communications utility.

**Fault Protection Device.**

An electronic device that is intended for the protection of personnel and functions under fault conditions, such as network-powered broadband communications cable short or open circuit, to limit the current or voltage, or both, for a low-power network-powered broadband communications circuit and provide acceptable protection from electric shock.

**Network Interface Unit (NIU).**

A device that converts a broadband signal into component voice, audio, video, data, and interactive services signals and provides isolation between the network power and the premises signal circuits. These devices often contain primary and secondary protectors.

**Network-Powered Broadband Communications Circuit.**

The circuit extending from the communications utility's or service provider's serving terminal or tap up to and including the NIU.

Informational Note: A typical one-family dwelling network-powered communications circuit consists of a communications drop or communications service cable and an NIU and includes the communications utility's serving terminal or tap where it is not under the exclusive control of the communications utility.

### 830.3 Other Articles.

Circuits and equipment shall comply with 830.3(A) through (C).

**(A) General Requirements.**

The general requirements of Article 800 shall apply.

**(B) Output Circuits.**

As appropriate for the services provided, the output circuits derived from the network interface unit shall comply with the requirements of the following:

1. Installations of communications circuits — Part IV of Article 805
2. Installations of community antenna television and radio distribution circuits — Part V of Article 820

   *Exception: Where protection is provided in the output of the NIU 830.90(B)(3) shall apply.*
3. Installations of optical fiber cables — Part V of Article 770
4. Installations of Class 2 and Class 3 circuits — Part III of Article 725
5. Installations of power-limited fire alarm circuits — Part III of Article 760

**(C) Protection Against Physical Damage.**

The requirements of 300.4 shall apply.

**830.15 Power Limitations.**

Network-powered broadband communications systems shall be classified as having low- or medium-power sources as specified in 830.15(1) or (2).

1. Sources shall be classified as defined in Table 830.15.
2. Direct-current power sources exceeding 150 volts to ground, but no more than 200 volts to ground, with the current to ground limited to 10 mA dc, that meet the current and power limitation for medium-power sources in Table 830.15 shall be classified as medium-power sources.

Informational Note: One way to determine compliance with 830.15(2) is listed information technology equipment intended to supply power via a communications network that complies with the requirements for RFT-V circuits as defined in UL 60950-21-2007, *Standard for Safety for Information Technology Equipment — Safety — Part 21: Remote Power Feeding*.

**Table 830.15 Limitations for Network-Powered Broadband Communications Systems**

| Network Power Source | Low | Medium |
|---|---|---|
| Circuit voltage, $V_{max}$ (volts)[1] | 0–100 | 0–150 |
| Power limitation, $VA_{max}$ (volt-amperes)[1] | 250 | 250 |
| Current limitation, $I_{max}$ (amperes)[1] | $1000/V_{max}$ | $1000/V_{max}$ |
| Maximum power rating (volt-amperes) | 100 | 100 |
| Maximum voltage rating (volts) | 100 | 150 |
| Maximum overcurrent protection (amperes)[2] | $100/V_{max}$ | NA |

[1] $V_{max}$, $I_{max}$, and $VA_{max}$ are determined with the current-limiting impedance in the circuit (not bypassed) as follows:

$V_{max}$ — Maximum system voltage regardless of load with rated input applied.

$I_{max}$ — Maximum system current under any noncapacitive load, including short circuit, and with overcurrent protection bypassed if used. $I_{max}$ limits apply after 1 minute of operation.

$VA_{max}$ — Maximum volt-ampere output after 1 minute of operation regardless of load and overcurrent protection bypassed if used.

[2]Overcurrent protection is not required where the current-limiting device provides equivalent current limitation and the current-limiting device does not reset until power or the load is removed.

**830.24 Mechanical Execution of Work.**

The installation shall also conform to 300.4 and 300.11.

**Part II. Cables on the service provider side of the Communication Service Point~~Outside and Entering Buildings~~**

**830.40 Entrance Cables.**

Network-powered broadband communications cables located outside and entering buildings shall comply with 830.40(A) and (B).

**(A) Medium-Power Circuits.**

Medium-power network-powered broadband communications circuits located outside and entering buildings shall be installed using Type BMU, Type BM, or Type BMR network-powered broadband communications medium-power cables.

**(B) Low-Power Circuits.**

Low-power network-powered broadband communications circuits located outside and entering buildings shall be installed using Type BLU or Type BLX low-power network-powered broadband communications cables. Cables shown in Table 830.154 shall be permitted to substitute.

*Exception: Outdoor community antenna television and radio distribution system coaxial cables installed prior to January 1, 2000, and installed in accordance with Article 820, shall be permitted for low-power-type, network-powered broadband communications circuits.*

**830.44 Overhead (Aerial) Cables.**

Overhead (aerial) network-powered broadband communications cables shall comply with 830.44(A) through (F).

**(A) On Poles and In-Span or Above Roofs.**

Where network-powered broadband communications cables are installed on poles and in-span or above roofs, they shall comply with 800.44.

**(B) Clearance from Ground.**

Overhead (aerial) spans of network-powered broadband communications cables shall conform to not less than the following:

1. 2.9 m (9½ ft) — above finished grade, sidewalks, or from any platform or projection from which they might be reached and accessible to pedestrians only
2. 3.5 m (11½ ft) — over residential property and driveways, and those commercial areas not subject to truck traffic
3. 4.7 m (15½ ft) — over public streets, alleys, roads, parking areas subject to truck traffic, driveways on other than residential property, and other land traversed by vehicles such as cultivated, grazing, forest, and orchard

Informational Note: These clearances have been specifically chosen to correlate with ANSI/IEEE C2-2012, *National Electrical Safety Code*, Table 232-1, which provides for clearances of wires, conductors, and cables above ground and roadways, rather than using the clearances referenced in 225.18. Because Article 805 and Article 820 have had no required clearances, the communications industry has used the clearances from the NESC for their installed cable plant.

**(C) Over Pools.**

Clearance of network-powered broadband communications cable in any direction from the water level, edge of pool, base of diving platform, or anchored raft shall comply with those clearances in 680.9.

**(D) Final Spans.**

Final spans of network-powered broadband communications cables without an outer jacket shall be permitted to be attached to the building, but they shall be kept not less than 900 mm (3 ft) from windows that are designed to be opened, doors, porches, balconies, ladders, stairs, fire escapes, or similar locations.

*Exception: Conductors run above the top level of a window shall be permitted to be less than the 900-mm (3-ft) requirement above.*

Overhead (aerial) network-powered broadband communications cables shall not be installed beneath openings through which materials might be moved, such as openings in farm and commercial buildings, and shall not be installed where they obstruct entrance to these building openings.

**(E) Between Buildings.**

Network-powered broadband communications cables extending between buildings or structures, and also the supports or attachment fixtures, shall be identified as suitable for outdoor aerial applications and shall have sufficient strength to withstand the loads to which they may be subjected.

*Exception: Where a network-powered broadband communications cable does not have sufficient strength to be self-supporting, it shall be attached to a supporting messenger cable that, together with the attachment fixtures or supports, shall be acceptable for the purpose and shall have sufficient strength to withstand the loads to which they may be subjected.*

**(F) On Buildings.**

Where attached to buildings, network-powered broadband communications cables shall be securely fastened in such a manner that they are separated from other conductors in accordance with 830.44(F)(1) through (F)(3).

**(1) Electric Light or Power.**

The network-powered broadband communications cable shall have a separation of at least 100 mm (4 in.) from electric light, power, Class 1, or non-power-limited fire alarm circuit conductors not in raceway or cable, or be permanently separated from conductors of the other system by a continuous and firmly fixed nonconductor in addition to the insulation on the wires.

**(2) Other Communications Systems.**

Network-powered broadband communications cables shall be installed so that there will be no unnecessary interference in the maintenance of the separate systems. In no case shall the conductors, cables, messenger strand, or equipment of one system cause abrasion to the conductors, cables, messenger strand, or equipment of any other system.

**(3) Protection from Damage.**

Network-powered broadband communications cables attached to buildings or structures and located within 2.5 m (8 ft) of finished grade shall be protected by enclosures, raceways, or other approved means.

*Exception: A low-power network-powered broadband communications circuit that is equipped with a listed fault protection device, appropriate to the network-powered broadband communications cable used, and located on the network side of the network-powered broadband communications cable shall not be required to be additionally protected by enclosures, raceways, or other approved means.*

**830.47 Underground Network-Powered Broadband Communications Cables Entering Buildings.**

Underground network-powered broadband communications cables entering buildings shall comply with 830.47(A) through 830.47(D).

**(A) Underground Systems with Electric Light and Power, Class 1, or Non–Power-Limited Fire Alarm Circuit Conductors.**

Underground network-powered broadband communications cables in a duct, pedestal, handhole enclosure, or manhole that contains electric light, power conductors, non–power-limited fire alarm circuit

conductors, or Class 1 circuits shall be in a section permanently separated from such conductors by means of a suitable barrier.

**(B) Direct-Buried Cables and Raceways.**

Direct-buried network-powered broadband communications cables shall be separated by at least 300 mm (12 in.) from conductors of any light, power, non–power-limited fire alarm circuit conductors or Class 1 circuit.

*Exception No. 1: Separation shall not be required where electric service conductors or network-powered broadband communications cables are installed in raceways or have metal cable armor.*

*Exception No. 2: Separation shall not be required where electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables; or the network-powered broadband communications cables have metal cable armor or are installed in a raceway.*

**(C) Protection from Physical Damage.**

Direct-buried cable, conduit, or other raceways shall be installed to meet the minimum cover requirements of Table 830.47(C). In addition, direct-buried cables emerging from the ground shall be protected by enclosures, raceways, or other approved means extending from the minimum cover distance required by Table 830.47(C) below grade 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. Types BMU and BLU direct-buried cables emerging from the ground shall be installed in rigid metal conduit (RMC), intermediate metal conduit (IMC), rigid nonmetallic conduit, or other approved means extending from the minimum cover distance required by Table 830.47(C) below grade to the point of entrance.

*Exception: A low-power network-powered broadband communications circuit that is equipped with a listed fault protection device, appropriate to the network-powered broadband communications cable used, and located on the network side of the network-powered broadband communications cable being protected.*

**Table 830.47(C) Network-Powered Broadband Communications Systems Minimum Cover Requirements (*Cover* is the shortest distance measured between a point on the top surface of any direct-buried cable, conduit, or other raceway and the top surface of finished grade, concrete, or similar cover.)**

| Location of Wiring Method or Circuit | Direct Burial Cables | | Rigid Metal Conduit (RMC) or Intermediate Metal Conduit (IMC) | | Nonmetallic Raceways Listed for Direct Burial; Without Concrete Encasement or Other Approved Raceways | |
|---|---|---|---|---|---|---|
| | mm | in. | mm | in. | mm | in. |
| All locations not specified below | 450 | 18 | 150 | 6 | 300 | 12 |
| In trench below 50-mm (2-in.) thick concrete or equivalent | 300 | 12 | 150 | 6 | 150 | 6 |
| Under a building (in raceway only) | 0 | 0 | 0 | 0 | 0 | 0 |
| Under minimum of 100-mm (4-in.) thick concrete exterior slab with no vehicular traffic and the slab extending not less than 150 mm (6 in.) beyond the underground installation | 300 | 12 | 100 | 4 | 100 | 4 |

| Location of Wiring Method or Circuit | Direct Burial Cables | | Rigid Metal Conduit (RMC) or Intermediate Metal Conduit (IMC) | | Nonmetallic Raceways Listed for Direct Burial; Without Concrete Encasement or Other Approved Raceways | |
|---|---|---|---|---|---|---|
| | mm | in. | mm | in. | mm | in. |
| One- and two-family dwelling driveways and outdoor parking areas and used only for dwelling-related purposes | 300 | 12 | 300 | 12 | 300 | 12 |

Notes:

1. Raceways approved for burial only where concrete encased shall require a concrete envelope not less than 50 mm (2 in.) thick.

2. Lesser depths shall be permitted where cables rise for terminations or splices or where access is otherwise required.

3. Where solid rock is encountered, all wiring shall be installed in 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.

4. Low-power network-powered broadband communications circuits using directly buried community antenna television and radio distribution system coaxial cables that were installed outside and entering buildings prior to January 1, 2000, in accordance with Article 820 shall be permitted where buried to a minimum depth of 300 mm (12 in.).

**(D) Pools.**

Cables located under the pool or within the area extending 1.5 m (5 ft) horizontally from the inside wall of the pool shall meet those clearances and requirements specified in 680.11.

**Part III. Protection**

**830.90 Primary Electrical Protection.**

**(A) Application.**

Primary electrical protection shall be provided on all network-powered broadband communications conductors that are neither grounded nor interrupted and are run partly or entirely in aerial cable not confined within a block. Also, primary electrical protection shall be provided on all aerial or underground network-powered broadband communications conductors that are neither grounded nor interrupted and are located within the block containing the building served so as to be exposed to lightning or accidental contact with electric light or power conductors operating at over 300 volts to ground.

*Exception: Primary electrical protection shall not be required on the network-powered broadband communications conductors where electrical protection is provided on the derived circuit(s) (output side of the NIU) in accordance with 830.90(B)(3).*

Informational Note No. 1: On network-powered broadband communications conductors not exposed to lightning or accidental contact with power conductors, providing primary electrical protection in accordance with this article helps protect against other hazards, such as ground potential rise caused by power fault currents, and above-normal voltages induced by fault currents on power circuits in proximity to the network-powered broadband communications conductors.

Informational Note No. 2: Network-powered broadband communications circuits are considered to have a lightning exposure unless one or more of the following conditions exist:

1. Circuits in large metropolitan areas where buildings are close together and sufficiently high to intercept lightning.
2. Areas having an average of five or fewer thunderstorm days each year and earth resistivity of less than 100 ohm-meters. Such areas are found along the Pacific coast.

Informational Note No. 3: For information on lightning protection systems, see NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*.

**(1) Fuseless Primary Protectors.**

Fuseless-type primary protectors shall be permitted where power fault currents on all protected conductors in the cable are safely limited to a value no greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor.

**(2) Fused Primary Protectors.**

Where the requirements listed in 830.90(A)(1) are not met, fused-type primary protectors shall be used. Fused-type primary protectors shall consist of an arrester connected between each conductor to be protected and ground, a fuse in series with each conductor to be protected, and an appropriate mounting arrangement. Fused primary protector terminals shall be marked to indicate line, instrument, and ground, as applicable.

**(B) Location.**

The location of the primary protector, where required, shall comply with 830.90(B)(1), (B)(2), or (B)(3):

1. A listed primary protector shall be applied on each network-powered broadband communications cable external to and on the network side of the network interface unit.
2. The primary protector function shall be an integral part of and contained in the network interface unit. The network interface unit shall be listed as being suitable for application with network-powered broadband communications systems and shall have an external marking indicating that it contains primary electrical protection.
3. The primary protector(s) shall be provided on the derived circuit(s) (output side of the NIU), and the combination of the NIU and the protector(s) shall be listed as being suitable for application with network-powered broadband communications systems.

A primary protector, whether provided integrally or external to the network interface unit, shall be located as close as practicable to the point of entrance.

For purposes of this section, a network interface unit and any externally provided primary protectors located at mobile home service equipment located in sight from and not more than 9.0 m (30 ft) from the exterior wall of the mobile home it serves, or at a mobile home disconnecting means grounded in accordance with 250.32 and located in sight from and not more than 9.0 m (30 ft) from the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a network interface unit and primary protector location to achieve the shortest practicable primary protector bonding conductor or grounding electrode conductor helps limit potential differences between communications circuits and other metallic systems.

**(C) Hazardous (Classified) Locations.**

The primary protector or equipment providing the primary protection function shall not be located in any hazardous (classified) location as defined in 500.5 and 505.5 or in the vicinity of easily ignitible material.

*Exception: As permitted in 501.150, 502.150, and 503.150.*

**Part IV. Grounding Methods**

**830.93 Grounding or Interruption of Metallic Members of Network-Powered Broadband Communications Cables.**

Network-powered communications cables entering buildings or attaching to buildings shall comply with 830.93(A) or (B).

For purposes of this section, grounding located at mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a grounding location to achieve the shortest practicable bonding conductor or grounding electrode conductor helps limit potential differences between the network-powered broadband communications circuits and other metallic systems.

**(A) Entering Buildings.**

In installations where the network-powered communications cable enters the building, the shield shall be grounded in accordance with 800.100, and metallic members of the cable not used for communications or powering shall be grounded in accordance with 800.100 or interrupted by an insulating joint or equivalent device. The grounding or interruption shall be as close as practicable to the point of entrance.

**(B) Terminating Outside of the Building.**

In installations where the network-powered communications cable is terminated outside of the building, the shield shall be grounded in accordance with 800.100, and metallic members of the cable not used for communications or powering shall be grounded in accordance with 800.100 or interrupted by an insulating joint or equivalent device. The grounding or interruption shall be as close as practicable to the point of attachment of the NIU.

**Part V. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**830.133 Installation of Network-Powered Broadband Communications Cables and Equipment.**

Cable and equipment installations within buildings shall comply with 830.133(A) and (B), as applicable.

**(A) Separation of Conductors.**

**(1) In Raceways, Cable Trays, Boxes, Enclosures, and Cable Routing Assemblies.**

1. *Low- and Medium-Power Network-Powered Broadband Communications Circuit Cables.* Low- and medium-power network-powered broadband communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly.

2. *Low-Power Network-Powered Broadband Communications Circuit Cables with Other Circuits.* Low-power network-powered broadband communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with jacketed cables of any of the following circuits:

    1. Class 2 and Class 3 remote-control, signaling, and power-limited circuits in compliance with 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 IV of Article 805
    4. Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770
    5. Community antenna television and radio distribution systems in compliance with Parts I and V of Article 820

3. *Medium-Power Network-Powered Broadband Communications Circuit Cables with Optical Fiber Cables and Other Communications Cables*. Medium-power network-powered broadband communications cables shall not be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with conductors of any of the following circuits:

    1. Communications circuits in compliance with Parts I and IV of Article 805
    2. Conductive optical fiber cables in compliance with Parts I and V of Article 770
    3. Community antenna television and radio distribution systems in compliance with Parts I and V of Article 820

4. *Medium-Power Network-Powered Broadband Communications Circuit Cables with Other Circuits*. Medium-power network-powered broadband communications cables

shall not be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with conductors of any of the following circuits:

1. Class 2 and Class 3 remote-control, signaling, and power-limited circuits in compliance with Parts I and III of Article 725
2. Power-limited fire alarm systems in compliance with Parts I and III of Article 760

5. *Electric Light, Power, Class 1, Non–Powered Broadband Communications Circuit Cables.* Network-powered broadband communications cable shall not be placed in any raceway, cable tray, compartment, outlet box, junction box, or similar fittings with conductors of electric light, power, Class 1, or non–power-limited fire alarm circuit cables.

*Exception No. 1: Where all of the conductors of electric light, power, Class 1, non–power-limited fire alarm circuits are separated from all of the network-powered broadband communications cables by a permanent barrier or listed divider.*

*Exception No. 2: Power circuit conductors in outlet boxes, junction boxes, or similar fittings or compartments where such conductors are introduced solely for power supply to the network-powered broadband communications system distribution equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum 6 mm (¼ in.) separation from network-powered broadband communications cables.*

**(2) Other Applications.**

Network-powered broadband communications cable shall be separated at least 50 mm (2 in.) from conductors of any electric light, power, Class 1, and non–power-limited fire alarm circuits.

*Exception No. 1: Separation shall not be required where: (1) all of the conductors of electric light, power, Class 1, and non–power-limited fire alarm circuits are in a raceway, or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC, or Type UF cables, or (2) all of the network-powered broadband communications cables are encased in a raceway.*

*Exception No. 2: Separation shall not be required where the network-powered broadband communications cables are permanently separated from the conductors of electric light, power, Class 1, and non–power-limited fire alarm circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B) Support of Network-Powered Broadband Communications Cables.**

Raceways shall be used for their intended purpose. Network-powered broadband communications cables shall not be strapped, taped, or attached by any means to the exterior of any conduit or raceway as a means of support.

### 830.154 Substitutions of Network-Powered Broadband Communications System Cables.

The substitutions for network-powered broadband system cables listed in Table 830.154 shall be permitted.

**Table 830.154 Cable Substitutions**

| Cable Type | Permitted Cable Substitutions |
|---|---|
| BM | BMR |
| BLP | CMP, CL3P |
| BLR | CMP, CL3P, CMR, CL3R, BLP, BMR |
| BL | CMP, CMR, CM, CMG, CL3P, CL3R, CL3, BMR, BM, BLP, BLR |
| BLX | CMP, CMR, CM, CMG, CMX, CL3P, CL3R, CL3, CL3X, BMR, BM, BLP, BRP, BL |

### 830.160 Bends.

Bends in network broadband cable shall be made so as not to damage the cable.

## Part VI. Listing Requirements

### 830.179 Network-Powered Broadband Communications Equipment and Cables.

Network-powered broadband communications equipment and cables shall be listed and marked in accordance with 830.179(A) through (D).

*Exception No. 1: This listing requirement shall not apply to community antenna television and radio distribution system coaxial cables that were installed prior to January 1, 2000, in accordance with Article 820 and are used for low-power network-powered broadband communications circuits.*

*Exception No. 2: Substitute cables for network-powered broadband communications cables shall be permitted as shown in Table 830.154.*

**(A) General Requirements.**

The general requirements in 800.179 shall apply.

**(B) Network-Powered Broadband Communications Medium-Power Cables.**

Network-powered broadband communications medium-power cables shall be factory-assembled cables consisting of a jacketed coaxial cable, a jacketed combination of coaxial cable and multiple individual conductors, or a jacketed combination of an optical fiber cable and multiple individual conductors. The insulation for the individual conductors shall be rated for 300 volts minimum. Cables intended for outdoor use shall be listed as suitable for the application. Cables shall be marked in accordance with 310.8. Type BMU cables shall be jacketed and listed as being suitable for outdoor underground use.

**(C) Network-Powered Broadband Communication Low-Power Cables.**

Network-powered broadband communications low-power cables shall be factory-assembled cables consisting of a jacketed coaxial cable, a jacketed combination of coaxial cable and multiple individual conductors, or a jacketed combination of an optical fiber cable and multiple individual conductors. The insulation for the individual conductors shall be rated for 300 volts minimum. Cables intended for outdoor use shall be listed as suitable for the application. Cables shall be marked in accordance with 310.8. Type BLU cables shall be jacketed and listed as being suitable for outdoor underground use.

**(D) Optional Markings.**

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.

# Article 840 Premises-Powered Broadband Communications Systems

## Part I. General

### 840.1 Scope.

This article covers premises-powered broadband communications systems.

Informational Note: A typical basic system configuration consists of an optical fiber, twisted pair, or coaxial cable to the premises supplying a broadband signal to a network terminal that converts the broadband signal into component electrical signals, such as traditional telephone, video, high-speed Internet, and interactive services. Powering for the network terminal and network devices is typically accomplished through a premises power supply that might be built into the network terminal or provided as a separate unit. In order to provide communications in the event of a power interruption, a battery backup unit or an uninterruptible power supply (UPS) is typically part of the powering system.

### 840.2 Definitions.

The definitions in 805.2 and 820.2 shall apply. The definitions in this section shall apply only within Article 840.

**Broadband.**

Wide bandwidth data transmission that transports multiple signals, protocols, and traffic types over various media types.

**Network Terminal.**

A device that converts network-provided signals (optical, electrical, or wireless) into component signals, including voice, audio, video, data, wireless, optical, and interactive services, and is considered a network device on the premises that is connected to a communications service provider and is powered at the premises.

**Premises Communications Circuit.**

The circuit that extends voice, audio, video, data, interactive services, telegraph (except radio), and outside wiring for fire alarm and burglar alarm from the service provider's network terminal to the customer's communications equipment up to and including terminal equipment, such as a telephone, a fax machine, or an answering machine.

**Premises Community Antenna Television (CATV) Circuit.**

The circuit that extends community antenna television (CATV) systems for audio, video, data, and interactive services from the service provider's network terminal to the appropriate customer equipment.

**Premises-Powered.**

Using power provided locally from the premises.

### 840.3 Other Articles.

Circuits and equipment shall comply with 840.3(A) through (C).

**(A) General Requirements.**

The general requirements of Article 800 shall apply.

**(B) Output Circuits.**

As appropriate for the services provided, the output circuits derived from the network terminal shall comply with the requirements of the following:

1. Installations of communications circuits — Part IV of Article 805
2. Installations of premises (within buildings) community antenna television and radio distribution circuits — Part V of Article 820
3. Installations of optical fiber cables — Part V of Article 770
4. Installations of Class 2 and Class 3 circuits — Part III of Article 725

   Informational Note: See 725.121 for information on the classification of information technology equipment circuits.
5. Installations of power-limited fire alarm circuits — Part III of Article 760

**(C) Electrical Classification of Data Circuits and Cables.**

Sections 725.139(D)(1) and 805.133(A)(1)(b) shall apply to the electrical classification of Class 2 and Class 3 circuits in the same cable with communications circuits.

### 840.24 Mechanical Execution of Work.

The requirements of 770.24 and 800.24 shall apply.

### 840.25 Abandoned Cables.

The requirements of 770.25 and 800.25 shall apply.

### 840.26 Spread of Fire or Products of Combustion.

The requirements of 770.26 and 800.26 shall apply.

## Part II. Cables on the service provider side of the Communication Service Point ~~Outside and Entering Buildings~~

### 840.47 Underground Wires and Cables Entering Buildings.

Underground wires and cables entering buildings shall comply with 840.47(A) through (C).

**(A) Optical Fiber Cables.**

**(1) Class 1 or Non–Power-Limited Fire Alarm Circuits.**

Underground conductive optical fiber cables entering buildings with electric light, power, Class 1, or non–power-limited fire alarm circuit conductors in a raceway, handhole enclosure, or manhole shall be located in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier.

**(2) Direct-Buried Cables.**

Direct-buried conductive optical fiber cables shall be separated by at least 300 mm (12 in.) from conductors of any electric light, power, or non–power-limited fire alarm circuit conductors or Class 1 circuit.

*Exception No. 1: Separation shall not be required where the electric service conductors are installed in raceways or have metal cable armor.*

*Exception No. 2: Separation shall not be required where the electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables.*

**(3) Mechanical Protection.**

Direct-buried cable, conduit, or other raceway shall be installed to have a minimum cover of 150 mm (6 in.).

**(B) Communications Wires and Cables.**

Installations of communications wires and multipair communications cables shall comply with 805.47.

**(C) Coaxial Cables.**

Installations of coaxial cables shall comply with 820.47.

### 840.48 Unlisted Wires and Cables Entering Buildings.

Installations of unlisted cables entering buildings shall comply with 840.48(A), (B), or (C), as applicable.

**(A) Optical Fiber Cables.**

Installations of unlisted optical fiber cables entering buildings shall comply with 770.48.

**(B) Communications Wires and Cables.**

Installations of unlisted communications wires and unlisted multipair communications cables entering buildings shall comply with 805.48.

**(C) Coaxial Cables.**

Installations of unlisted coaxial cables entering buildings shall comply with 820.48.

## Part III. Protection

### 840.90 Protective Devices.

The requirements of 805.90 shall apply.

### 840.93 Grounding or Interruption.

Non–current-carrying metallic members of optical fiber cables, communications cables, or coaxial cables entering buildings or attaching to buildings shall comply with 840.93(A), (B), or (C), respectively.

### (A) Non–Current-Carrying Metallic Members of Optical Fiber Cables.

Non–current-carrying metallic members of optical fiber cables entering a building or terminating on the outside of a building shall comply with 770.93(A) or (B).

### (B) Communications Cables.

The grounding or interruption of the metallic sheath of communications cable shall comply with 805.93.

### (C) Coaxial Cables.

Where the network terminal is installed inside or outside of the building, with coaxial cables terminating at the network terminal, and is either entering, exiting, or attached to the outside of the building, 820.93 shall apply.

## 840.94 Premises Circuits Leaving the Building.

Where circuits leave the building to power equipment remote to the building or outside the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere, 805.90 and 805.93 shall apply.

Informational Note: See NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, for the theory of the term *rolling sphere*.

## Part IV. Grounding Methods

## 840.101 Premises Circuits Not Leaving the Building.

Where the network terminal is served by a nonconductive optical fiber cable, or where any non–current-carrying metallic member of a conductive optical fiber cable is interrupted by an insulating joint or equivalent device, and circuits that terminate at the network terminal are completely contained within the building (i.e., they do not exit the building), 840.101(A), (B), or (C) shall apply, as applicable.

### (A) Coaxial Cable Shield Grounding.

The shield of coaxial cable shall be grounded by one of the following:

1. Any of the methods described in 820.100 or 800.106
2. A fixed connection to an equipment grounding conductor as described in 250.118
3. Connection to the network terminal grounding terminal provided that the terminal is connected to ground by one of the methods described in 820.100 or 800.106, or to an equipment grounding conductor through a listed grounding device that will retain the ground connection if the network terminal is unplugged

### (B) Communications Circuit Grounding.

Communications circuits shall not be required to be grounded.

### (C) Network Terminal Grounding.

The network terminal shall not be required to be grounded unless required by its listing. If the coaxial cable shield is separately grounded as described in 840.101(A)(1) or 840.101(A)(2), the use of a cord and plug for the connection to the network terminal grounding connection shall be permitted.

Informational Note: Where required to be grounded, a listed device that extends the equipment grounding conductor from the receptacle to the network terminal equipment grounding terminal is permitted. Sizing of the extended equipment grounding conductor is covered in Table 250.122.

## 840.102 Premises Circuits Leaving the Building.

Where circuits leave the building to power equipment remote to the building or outside the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere, the installation of communications wires and cables shall comply with 800.100 and 800.106, and the installation of coaxial cables shall comply with 820.100 and 800.106.

Informational Note: See NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, for the application of the term *rolling sphere*.

## Part V. Wiring on the service provider side of the Communication Service Point ~~Installation Methods Within Buildings~~

### 840.133 Installation of Optical Fibers and Electrical Conductors.

The requirements of 770.133 shall apply.

## Part VI. Premises Powering of Communications Equipment over Communications Cables

### 840.160 Powering Circuits.

Communications cables listed in accordance with 805.179, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment listed in accordance with 805.170. The power source shall be listed in accordance with 840.170(G). Installation of the listed 4-pair communications cables for a communications circuit or installation where 4-pair communications cables are substituted for Class 2 and Class 3 cables in accordance with 725.154(A) shall comply with 725.144.

*Exception: Installing communications cables in compliance with 725.144 shall not be required for listed 4-pair communications cables where the rated current of the power source does not exceed 0.3 amperes in any conductor 24 AWG or larger.*

Informational Note: A typical communications cable for this application is a 4-pair cable sometimes referred to as Category 5e (or higher) LAN cable or balanced twisted pair cable. These types of cables are often used to provide Ethernet- and Power over Ethernet (PoE)–type services. A large number of such powering cables bundled together can cause overheating of the wiring if not controlled as described in Table 725.144.

## Part VII. Listing Requirements

### 840.170 Equipment and Cables.

Premises-powered broadband communications systems equipment and cables shall comply with 840.170(A) through (H).

#### (A) Network Terminal.

The network terminal and applicable grounding means shall be listed for application with premises-powered broadband communications systems.

Informational Note No. 1: One way to determine applicable requirements is to refer to ANSI/UL 60950-1-2014, *Standard for Safety of Information Technology Equipment*; ANSI/UL 498A-2015, *Current Taps and Adapters*; ANSI/UL 467-2013, *Grounding and Bonding Equipment;* or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements*.

Informational Note No. 2: There are no requirements on the network terminal and its grounding methodologies except for those covered by the listing of the product.

#### (B) Optical Fiber Cables.

Optical fiber cables shall be listed in accordance with 770.179(A) through (D) and shall be marked in accordance with Table 770.179.

#### (C) Communications Equipment.

Communications equipment shall be listed in accordance with 805.170.

#### (D) Cable Routing Assemblies and Communications Raceways.

Cable routing assemblies and communications raceways shall be listed in accordance with 800.182.

#### (E) Premises Communications Wires and Cables.

Communications wires and cable shall be listed and marked in accordance with 805.179.

#### (F) Premises Community Antenna Television (CATV) Circuits.

Premises community antenna television (CATV) coaxial cables connecting to the network terminal shall be listed in accordance with 820.179. Applicable grounding means shall be listed for application with premises-powered broadband communications systems.

#### (G) Power Source.

The power source for circuits intended to provide power over communications cables to remote equipment shall be limited in accordance with Table 11(B) in Chapter 9 for voltage sources up to 60 V dc and be listed as specified in either of the following:

1. A power source shall be listed as specified in 725.121(A)(1), (A)(2), (A)(3), or (A)(4). The power sources shall not have the output connections paralleled or otherwise interconnected unless listed for such interconnection.
2. A power source shall be listed as communications equipment for limited-power circuits.

Informational Note: One way to determine applicable requirements is to refer to ANSI/UL 60950-1-2014, *Standard for Safety of Information Technology Equipment-Safety — Part 1*; or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements*. Typically, such circuits are used to interconnect equipment for the purpose of exchanging information (data).

**(H) Accessory Equipment.**

Communications accessory equipment and/or assemblies shall be listed for application with premises-powered communications systems.

Informational Note: One way to determine applicable requirements is to refer to ANSI/UL 1863-2004, *Communications-Circuit Accessories*.

# Public Input No. 3223-NFPA 70-2020 [ Sections Part IV., 805.133 ]

**Sections Part IV., 805.133**

**Part IV.** ~~Installation Methods Within Buildings~~ Wiring on the customer side of the Communication Service Point

**805.133** Installation of Communications Wires, Cables, and Equipment.

Communications wires and cables from the protector to the equipment or, where no protector is required, communications wires and cables attached to the outside or inside of the building shall comply with 805.133(A) and 805.133(B)

**(A)** Separation from Other Conductors.

**(1)** In Raceways, Cable Trays, Boxes, Cables, Enclosures, and Cable Routing Assemblies.

(a) *Other Circuits.* Communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with cables 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) Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770

(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

(b) *Class 2 and Class 3 Circuits.* Class 1 circuits shall not be run in the same cable with communications circuits. Class 2 and Class 3 circuit conductors shall be permitted in the same listed communications cable with communications circuits.

(c) *Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm, and Medium-Power Network-Powered Broadband Communications Circuits in Raceways, Compartments, and Boxes.* Communications conductors shall not be placed in any raceway, compartment, outlet box, junction box, or similar fitting with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits.

*Exception No. 1: Section 805.133(A)(1)(c) shall not apply if 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 conductors of communications circuits by a permanent barrier or listed divider.*

*Exception No. 2: Power conductors in outlet boxes, junction boxes, or similar fittings or compartments where such conductors are introduced solely for power supply to communications equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum of 6 mm (¼ in.) separation from the communications circuit conductors.*

*Exception No. 3: As permitted by 620.36.*

**(2)** Other Applications.

Communications wires and cables shall be separated 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.

*Exception No. 1: Section 805.133(A)(2) shall not apply where either (1) all of the conductors of the electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits are in a raceway or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC, or Type UF cables, or (2) all of the conductors of communications circuits are encased in raceway.*

*Exception No. 2: Section 805.133(A)(2) shall not apply where the communications wires and cables are permanently separated from the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B)** Support of Communications Wires and Cables.

Raceways shall be used for their intended purpose. Communications wires and cables shall not be strapped, taped, or attached by any means to the exterior of any raceway as a means of support.

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

## Statement of Problem and Substantiation for Public Input

This public input is being submitted by a Correlating Committee Task Group to improve the correlation between Chapter 7 and 8. At the present time there are significant correlation issues with regards to what constitutes an installation in Chapter 7 and what constitutes an installation in Chapter 8. Previously a Correlating Committee Task Group was formed to review Chapter 8 and to make suggested modifications. This Chapter 8 task group has submitted a public input to define Communication Service point and has submitted a public input to determine where the actual service point exists within communication systems. It is very difficult for an AHJ to determine where there inspection authority begins and this work will help provide clarity and usability.
This public input follows up on the work of that specific task group and provides editorial revisions to further improve on that work. Public inputs are being submitted to change Titles and certain wording to reflect what wiring is on the customer side of the Communication Service Point and what wiring is on the communication utility or service provider side of this point.
The Correlating Committee Task Group is a long range planning committee that is seeking to make improvement over the next two to three cycles. The Task Group is made up of the following members: Alan Manche, Donny Cook, Randy Ivans, Ernie Gallo, and Thomas Domitrovich.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 3224-NFPA 70-2020 [Sections 800.27, Part II., 800.44] | |
| Public Input No. 3225-NFPA 70-2020 [Part IV.] | |
| Public Input No. 3226-NFPA 70-2020 [Section No. 800.154] | |
| Public Input No. 3227-NFPA 70-2020 [Part II.] | |
| Public Input No. 3229-NFPA 70-2020 [Part V.] | |
| Public Input No. 3230-NFPA 70-2020 [Part II.] | |
| Public Input No. 3231-NFPA 70-2020 [Sections Part V., 830.133] | |
| Public Input No. 3232-NFPA 70-2020 [Sections Part II., 840.47, 840.48, Part III.] | |
| Public Input No. 3233-NFPA 70-2020 [Part V.] | |

Public Input No. 3224-NFPA 70-2020 [Sections 800.27, Part II., 800.44]

Public Input No. 3226-NFPA 70-2020 [Section No. 800.154]

Public Input No. 3227-NFPA 70-2020 [Part II.]

Public Input No. 3230-NFPA 70-2020 [Part II.]

Public Input No. 3232-NFPA 70-2020 [Sections Part II., 840.47, 840.48, Part III.]

Public Input No. 3233-NFPA 70-2020 [Part V.]

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**Committee:** NEC-P16

# Public Input No. 65-NFPA 70-2019 [ New Part after V. ]

**800.170 Plenum Cable Ties. Cable ties intended for use in other space used for environmental air (plenums) shall be listed as having low smoke and heat release properties.**

**Informational Note: See NFPA 90A -2018, Standard for the Installation of Air-Conditioning and Ventilating Systems, and ANSI/UL 2043-2013, Standard for Safety Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces, for information on listing discrete products as having low smoke and heat release properties.**

## Statement of Problem and Substantiation for Public Input

The listing requirements for plenum cable ties belong in Article 800 because cable ties are used in multiple articles. The name of these cable ties was changed from “Plenum Grade Cable Ties” to “Plenum Cable Ties” to be consistent with the names of plenum cables.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 66-NFPA 70-2019 [Section No. 805.170(C)] | Deletes listing requirements for cable ties from Article 805 |
| Public Input No. 64-NFPA 70-2019 [Section No. 770.24] | |
| Public Input No. 66-NFPA 70-2019 [Section No. 805.170(C)] | |
| Public Input No. 67-NFPA 70-2019 [Section No. 800.24] | |

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**Committee:** NEC-P16

# Public Input No. 3229-NFPA 70-2020 [ Part V. ]

**Part V.** ~~– Installation Methods Within Buildings~~ Wiring on the Customer Service Side of the Communication Service Point

## Additional Proposed Changes

| File Name | Description | Approved |
|---|---|---|
| Chapter_8_-_2020-09-03_CC_Task_Group.pdf | | |

## Statement of Problem and Substantiation for Public Input

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## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 3223-NFPA 70-2020 [Sections Part IV., 805.133] | |
| Public Input No. 3224-NFPA 70-2020 [Sections 800.27, Part II., 800.44] | |
| Public Input No. 3226-NFPA 70-2020 [Section No. 800.154] | |
| Public Input No. 3227-NFPA 70-2020 [Part II.] | |
| Public Input No. 3230-NFPA 70-2020 [Part II.] | |
| Public Input No. 3232-NFPA 70-2020 [Sections Part II., 840.47, 840.48, Part III.] | |
| Public Input No. 3233-NFPA 70-2020 [Part V.] | |

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| **Zip:** | |
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## Chapter 8 Communications Systems

# Article 800 General Requirements for Communications Systems

### Part I. General

#### 800.1 Scope.

This article covers general requirements for communications systems. These general requirements apply to communications circuits, community antenna television and radio distribution systems, network-powered broadband communications systems, and premises-powered broadband communications systems, unless modified by Articles 805, 820, 830, or 840.

Informational Note No. 1: See 90.2(B)(4) for installations of circuits and equipment that are not covered.

Informational Note No. 2: For further information for remote control, signaling, and power-limited circuits, see Article 725.

Informational Note No. 3: For further information for fire alarm systems, see Article 760.

#### 800.2 Definitions.

The definitions in Part I of Article 100 shall apply throughout Chapter 8. The definitions in 800.2 shall apply only within Chapter 8.

**Abandoned Cable.**

Cable that is not terminated at equipment or is not identified for future use with a tag.

**Block.**

A square or portion of a city, town, or village enclosed by streets and including the alleys so enclosed, but not any street.

**Cable Sheath.**

A covering over the conductor assembly that may include one or more metallic members, strength members, or jackets.

**Communications Circuit.**

The circuit that extends service from the communications utility or service provider up to and including the customer's communications equipment.

**Communications Service Provider.**

An organization, business, or individual that offers communications service to others.

**Exposed (to Accidental Contact).**

A circuit in such a position that, in case of failure of supports or insulation, contact with another circuit may result.

Informational Note: See Part I of Article 100 for two other definitions of Exposed: *Exposed (as applied to live parts)* and *Exposed (as applied to wiring methods)*.

**Point of Entrance.**

The point within a building at which the wire or cable emerges from an external wall or from a concrete floor slab.

**Premises.**

The land and buildings of a user located on the user side of the utility-user ~~network point of demarcation~~.

#### 800.3 Other Articles.

Only those sections of Chapters 1 through 7 referenced in Chapter 8 shall apply to Chapter 8.

**(A) Hazardous (Classified) Locations.**

Circuits and equipment installed in a location that is classified in accordance with 500.5 and 505.5 shall comply with the applicable requirements of Chapter 5.

**(B) Wiring in Ducts for Dust, Loose Stock, or Vapor Removal.**

The requirements of 300.22(A) shall apply.

**(C) Equipment in Other Space Used for Environmental Air.**

The requirements of 300.22(C)(3) shall apply.

**(D) Installation and Use.**

The requirements of 110.3(B) shall apply.

**(E) Optical Fiber Cable.**

Where optical fiber cable is used to provide a communications circuit within a building, Article 770 shall apply.

**(F) Other Communications Systems.**

As appropriate for the system involved, communications systems shall also comply with the requirements of the following:

1. Communications circuits — Article 805
2. Radio and television equipment — Article 810
3. Community antenna television and radio distribution systems — Article 820
4. Network-powered broadband communications systems — Article 830
5. Premises-powered broadband communications systems — Article 840

**(G) Reconditioned Equipment.**

The requirements of 110.21(A)(2) shall apply.

### 800.21 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.

### 800.24 Mechanical Execution of Work.

Circuits and equipment 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 also conform to 300.4 and 300.11. 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 805.170(C).

Informational Note No. 1: Accepted industry practices are described in ANSI/TIA-568.1- D-2015, *Commercial Building Telecommunications Infrastructure Standard;* ANSI/TIA-569-D-2015, *Telecommunications Pathways and Spaces;* ANSI/TIA-570-C-2012, *Residential Telecommunications Infrastructure Standard;* ANSI/TIA-1005-A-2012, *Telecommunications Infrastructure Standard for Industrial Premises;* ANSI/ TIA-1179-2010, *Healthcare Facility Telecommunications Infrastructure Standard;* ANSI/TIA-4966-2014, *Telecommunications Infrastructure Standard for Educational Facilities;* and other ANSI-approved installation standards.

Informational Note No. 2: 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. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of wire and cable properties.

### 800.25 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.

### 800.26 Spread of Fire or Products of Combustion.

Installations of cables, communications raceways, cable routing assemblies 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 penetrations of cables, communications raceways, and cable routing assemblies 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 800.26 can be found in building codes, fire resistance directories, and product listings.

### 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.

## Part II. Wires and Cables Outside and on the service provider side of the Communication Service Point ~~Entering Buildings~~

### 800.44 Overhead (Aerial) Wires and Cables.

Overhead (aerial) wires and cables on the service provider side of the Communication Service Point ~~entering buildings~~ shall comply with 800.44(A) through (D).

Informational Note: For additional information regarding overhead (aerial) wires and cables, see ANSI C2-2017, *National Electrical Safety Code, Part 2 Safety Rules for Overhead Lines.*

#### (A) On Poles and In-Span.

Where wires and cables and electric light or power conductors are supported by the same pole or are run parallel to each other in-span, the conditions described in 800.44(A)(1) through (A)(4) shall be met.

#### (1) Relative Location.

Where practicable, the wires and cables shall be located below the electric light or power conductors.

#### (2) Attachment to Cross-Arms.

Wires and cables shall not be attached to a cross-arm that carries electric light or power conductors.

#### (3) Climbing Space.

The climbing space through wires and cables shall comply with the requirements of 225.14(D).

#### (4) Clearance.

Supply service drops and sets of overhead service conductors of 0 volts to 750 volts running above and parallel to communications and CATV type coaxial service drops shall have a minimum separation of 300 mm (12 in.) at any point in the span, including the point of and at their attachment to the building, provided that the ungrounded conductors are insulated and that a clearance of not less than 1.0 m (40 in.) is maintained between the two services at the pole.

#### (B) Above Roofs.

Communications wires and cables and CATV type coaxial cables shall have a vertical clearance of not less than 2.5 m (8 ft) from all points of roofs above which they pass.

*Exception No. 1: Communications wires and cables and CATV type coaxial cables shall not be required to have a vertical clearance of not less than 2.5 m (8 ft) above auxiliary buildings, such as garages and the like.*

*Exception No. 2: A reduction in clearance above only the overhanging portion of the roof to not less than 450 mm (18 in.) shall be permitted if (1) not more than 1.2 m (4 ft) of communications service-drop conductors pass above the roof overhang and (2) they are terminated at a through- or above-the-roof raceway or approved support.*

*Exception No. 3: Where the roof has a slope of not less than 100 mm in 300 mm (4 in. in 12 in.), a reduction in clearance to not less than 900 mm (3 ft) shall be permitted.*

Informational Note: For additional information regarding overhead (aerial) wires and cables, see ANSI/IEEE C2-2017, *National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines*.

**(C) On Masts.**

Overhead (aerial) communications and CATV type coaxial cables shall be permitted to be attached to an above-the-roof raceway mast that does not enclose or support conductors of electric light or power circuits.

**(D) Between Buildings.**

Communications and CATV type coaxial cables extending between buildings or structures, and also the supports or attachment fixtures, shall be identified and shall have sufficient strength to withstand the loads to which they might be subjected.

*Exception: Where a coaxial cable does not have sufficient strength to be self-supporting, it shall be attached to a supporting messenger cable that, together with the attachment fixtures or supports, shall be acceptable for the purpose and shall have sufficient strength to withstand the loads to which they may be subjected.*

**800.48 Communication Service Point.** The Communication Service Point shall be at a readily accessible location either outside or inside of a building or structure near to the point of entrance of the conductors in accordance with the one or more of the following:

1. The point of connection at which the communication service provider's network (outside plant) transitions to the premises wiring. The location of this point shall not be located further than 50 feet from the point of entrance.

2. The point of connection in an individual dwelling shall be located so as not to exceed 24 inches from the primary protector on the premises side of the protector.

3. A physical protection point or communications cable exiting the connection enclosure on the individual building side of the enclosure.

4. The point of connection at the Grounding Block, where required.

5. The point where a wireless signal transitions from the antenna or dish through a wired connection to transmitting or receiving equipment. The location of this point shall be permitted to include the ground connection at the antenna discharge unit or coaxial cable connection to the transmitting/receiving station (see 810.21).

6. The point of connection between nonconductive optical fiber cable entering the building and premises optical fiber cable inside the building not to exceed 50 feet from the point of entrance.

7. The Communication Service Point shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC), Electrical metallic tubing (EMT), intermediate metal conduit (IMC), or Rigid polyvinyl chloride conduit (PVC) to the point of emergence (see 770.48, 805.48, 820.48 and 830.48).

Informational Note: The transition and connection points listed above may be co-located. For example, a primary protector may be located inside a network interface unit (item 3) with a connection to an adjacent grounding block (Item 4) within 24 inches, and a connection to the premise wiring (item 2).

### 800.49 Metal Entrance Conduit Grounding.

Metal conduit containing entrance wire or cable shall be connected by a bonding conductor or grounding electrode conductor to a grounding electrode or, where present, the building grounding electrode system in accordance with 800.100(B).

### 800.53 Separation from Lightning Conductors.

Where practicable, a separation of at least 1.8 m (6 ft) shall be maintained between lightning conductors and all communication wires and cables and CATV type coaxial cables on buildings.

Informational Note No. 1: For additional information regarding overhead (aerial) wires and cables, see ANSI C2-2017 *National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines*.

Informational Note No. 2: Specific separation distances may be calculated from the sideflash equation in NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems.*

## Part III. Grounding Methods

### 800.100 Cable and Primary Protector Bonding and Grounding.

#### (A) Bonding Conductor or Grounding Electrode Conductor.

#### (1) Insulation.

The bonding conductor or grounding electrode conductor shall be listed and shall be permitted to be insulated, covered, or bare.

#### (2) Material.

The bonding conductor or grounding electrode conductor shall be copper or other corrosion-resistant conductive material, stranded or solid.

#### (3) Size.

The bonding conductor or grounding electrode conductor shall not be smaller than 14 AWG. The bonding conductor or grounding electrode conductor shall have a current-carrying capacity not less than the grounded metallic cable sheath member of the communications cable, the protected conductor of the communications cable, or the outer sheath of the coaxial cable, as applicable. The bonding conductor or grounding electrode conductor shall not be required to exceed 6 AWG.

#### (4) Length.

The bonding conductor or grounding electrode conductor shall be as short as practicable. In one- and two-family dwellings, the bonding conductor or grounding electrode conductor shall be as short as practicable, not to exceed 6.0 m (20 ft) in length.

Informational Note: Similar bonding conductor or grounding electrode conductor length limitations applied at apartment buildings and commercial buildings help to reduce voltages that may be developed between the building's power and communications systems during lightning events.

*Exception: In one- and two-family dwellings where it is not practicable to achieve an overall maximum bonding conductor or grounding electrode conductor length of 6.0 m (20 ft), a separate ground rod meeting the minimum dimensional criteria of 800.100(B)(3)(2) or (B)(3)(3) shall be driven, the bonding conductor or grounding electrode conductor shall be connected to the ground rod in accordance with 800.100(C), and the ground rod shall be connected to the power grounding electrode system in accordance with 800.100(D).*

#### (5) Run in Straight Line.

The bonding conductor or grounding electrode conductor shall be run in as straight a line as practicable.

#### (6) Physical Protection.

Bonding conductors and grounding electrode conductors shall be protected where exposed to physical damage. Where the bonding conductor or grounding electrode conductor is installed in a metal raceway, both ends of the raceway shall be bonded to the contained conductor or to the same terminal or electrode to which the bonding conductor or grounding electrode conductor is connected.

**(B) Electrode.**

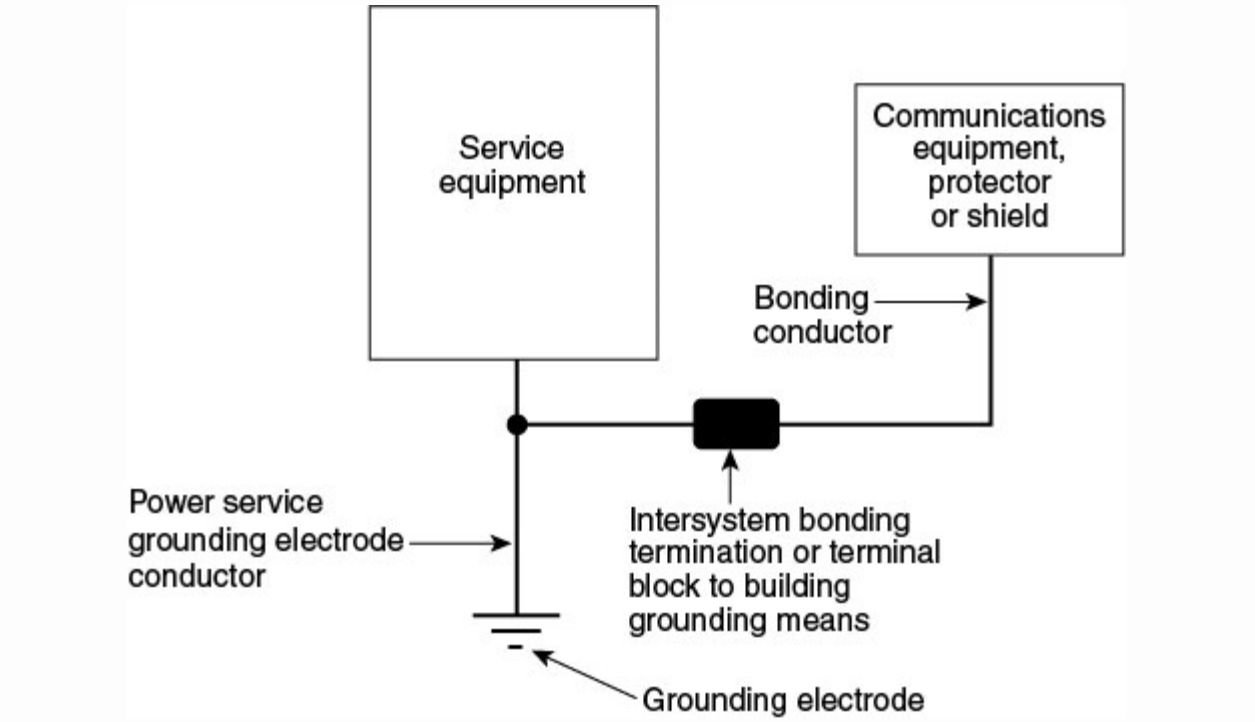
The bonding conductor or grounding electrode conductor shall be connected in accordance with 800.100(B)(1), (B)(2) , or (B)(3).

**(1) In Buildings or Structures with an Intersystem Bonding Termination.**

If the building or structure served has an intersystem bonding termination as required by 250.94, the bonding conductor shall be connected to the intersystem bonding termination.

Informational Note: Informational Note Figure 800.100(B)(1) illustrates the connection of the bonding conductor in buildings or structures equipped with an intersystem bonding termination or a terminal block providing access to the building grounding means.

**Figure Informational Note Figure 800.100(B)(1) Illustration of a Bonding Conductor in a Communications Installation.**




**(2) In Buildings or Structures with Grounding Means.**

If an intersystem bonding termination is established, 250.94(A) shall apply. If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on one of the following:

1. The building or structure grounding electrode system as covered in 250.50
2. The grounded interior metal water piping system, within 1.5 m (5 ft) from its point of entrance to the building, as covered in 250.52
3. The power service accessible means external to enclosures using the options identified in 250.94(A), Exception
4. The nonflexible metal power service raceway
5. The service equipment enclosure

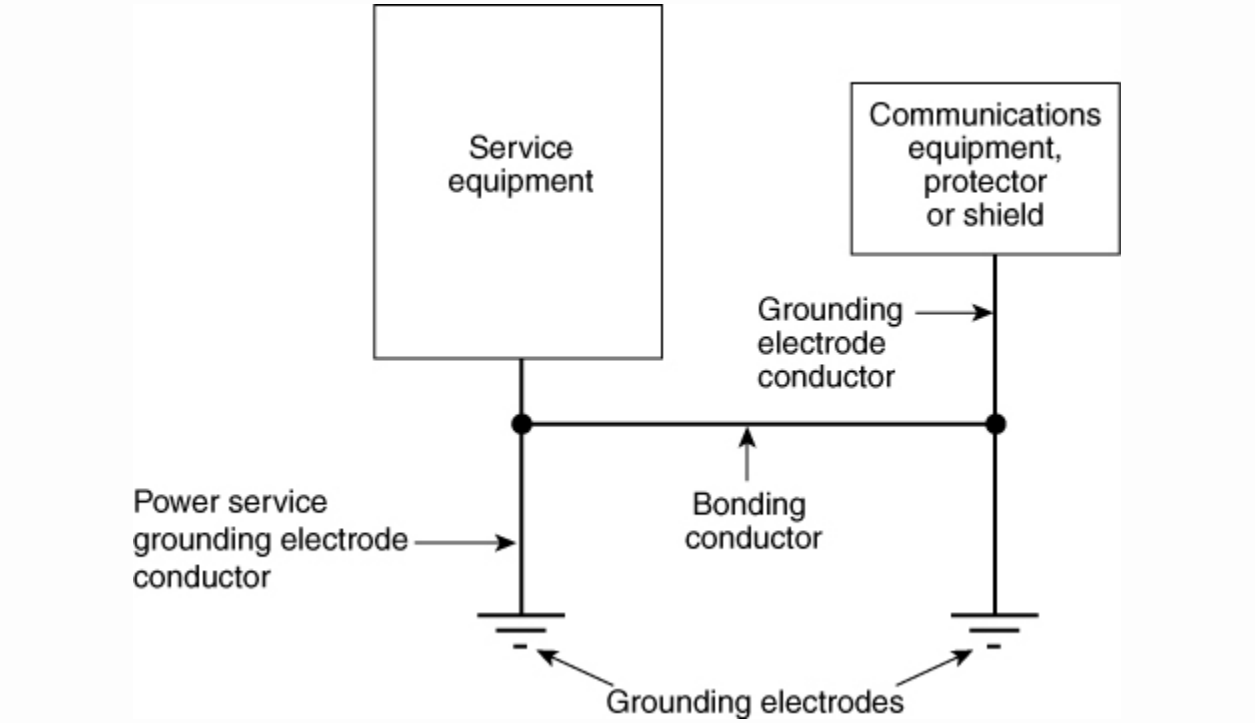
6. The grounding electrode conductor or the grounding electrode conductor metal enclosure of the power service
7. The grounding electrode conductor or the grounding electrode of a building or structure disconnecting means that is connected to a grounding electrode as covered in 250.32

A bonding device intended to provide a termination point for the bonding conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on nonremovable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is nonremovable.

For purposes of this section, the mobile home service equipment or the mobile home disconnecting means located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means connected to an electrode by a grounding electrode conductor in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Informational Note Figure 800.100(B)(2) illustrates the connection of the bonding conductor in buildings or structures not equipped with an intersystem bonding termination or a terminal block providing access to the building grounding means.

**Figure Informational Note Figure 800.100(B)(2) Illustration of a Grounding Electrode Conductor and a Bonding Conductor in a Communications Installation.**




**(3) In Buildings or Structures Without an Intersystem Bonding Termination or Grounding Means.**

If the building or structure served has no intersystem bonding termination or grounding means, as described in 800.100(B)(2), the grounding electrode conductor shall be connected to one of the following:

1. To any one of the individual grounding electrodes described in 250.52(A)(1), (A)(2), (A)(3), or (A)(4)
2. If the building or structure served has no intersystem bonding termination or grounding means, as described in 800.100(B)(2) or (B)(3)(1), to any one of the individual grounding electrodes described in 250.52(A)(5), (A)(7), and (A)(8)

3. For communications circuits covered in Article 805 or network-powered broadband communications systems covered in Article 830, to a ground rod or pipe not less than 1.5 m (5 ft) in length and 12.7 mm (0.5 in.) in diameter, driven, where practicable, into permanently damp earth and separated from lightning protection system conductors, as covered in 800.53, and at least 1.8 m (6 ft) from electrodes of other systems

Steam pipes, hot water pipes, or lightning protection system conductors shall not be employed as grounding electrodes for protectors and grounded metallic members.

**(C) Electrode Connection.**

Connections to grounding electrodes shall comply with 250.70.

**(D) Bonding of Electrodes.**

A bonding jumper not smaller than 6 AWG copper or equivalent shall be connected between the grounding electrode and power grounding electrode system at the building or structure served where separate electrodes are used.

*Exception: At mobile homes as covered in 800.106.*

Informational Note No. 1: See 250.60 for connection to a lightning protection system.

Informational Note No. 2: Bonding together of all separate electrodes limits potential differences between them and between their associated wiring systems.

**800.106 Primary Protector Grounding and Bonding at Mobile Homes.**

**(A) Grounding.**

Grounding shall comply with 800.106(A)(1) and (A)(2).

**(1) Mobile Home Service Equipment.**

Where there is no mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, grounding shall comply with one of the following:

1. The primary protector grounding terminal; the coaxial cable shield ground, or surge arrester grounding terminal; or the network-powered broadband communications cable shield, network-powered broadband communications cable metallic members not used for communications or powering, and network interface unit shall be connected to a grounding electrode conductor or grounding electrode in accordance with 800.100(B)(3).
2. The non-current-carrying metallic members of optical fiber cables shall be connected to a grounding electrode in accordance with 770.106(A)(1). The network terminal, if required to be grounded, shall be connected to a grounding electrode in accordance with 800.106(A)(1)(1). The grounding electrode shall be bonded in accordance with 770.106(B).

**(2) Mobile Home Feeder Disconnecting Means.**

Where there is no mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, grounding shall comply with one of the following:

1. The primary protector grounding terminal; the network-powered broadband communications cable shield, network-powered broadband communications cable metallic members not used for communications or powering, and network interface unit shall be connected to a grounding electrode in accordance with 800.100(B)(3).
2. The non-current-carrying metallic members of optical fiber cables shall be connected to a grounding electrode in accordance with 770.106(A)(2). The network terminal, if required to be grounded, shall be connected to a grounding electrode in accordance with 800.106(A)(2). The grounding electrode shall be bonded in accordance with 770.106(B).

**(B) Bonding.**

The primary protector grounding terminal or grounding electrode, network-powered broadband communications cable grounding terminal, or network interface unit grounding terminal shall be bonded together and connected to the metal frame or available grounding terminal of the mobile home with a copper conductor not smaller than 12 AWG under either of the following conditions:

1. Where there is no mobile home service equipment or disconnecting means as in 800.106(A)
2. Where the mobile home is supplied by cord and plug

**Part IV. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**800.110 Raceways, Cable Routing Assemblies, and Cable Trays.**

**(A) Types of Raceways.**

Wires and cables shall be permitted to be installed in raceways that comply with either 800.110(A)(1) or (A)(2). Medium-power network-powered broadband communications cables shall not be permitted to be installed in raceways that comply with 800.110(A)(2).

**(1) Raceways Recognized in Chapter 3.**

Wires and 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.**

Wires and 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.

**(3) Innerduct for Communications Wires and Cables, Coaxial Cables, or Network-Powered Broadband Communications Cables.**

Listed plenum communications raceways, listed riser communications raceways, and listed general-purpose communications raceways 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.**

The raceway fill requirements of Chapters 3 and 9 shall apply to medium-power network-powered broadband communications cables.

**(C) Cable Routing Assemblies.**

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)(1) and (C)(2) and 800.113.

**(1) Horizontal Support.**

Cable routing assemblies shall be supported where run horizontally at intervals not to exceed 900 mm (3 ft) and at each end or joint, unless listed for other support intervals. In no case shall the distance between supports exceed 3 m (10 ft).

**(2) Vertical Support.**

Vertical runs of cable routing assemblies shall be supported at intervals not exceeding 1.2 m (4 ft), unless listed for other support intervals, and shall not have more than one joint between supports.

**(D) Cable Trays.**

Wires and cables and communications raceways shall be permitted to be installed in metal or listed nonmetallic cable tray systems. Ladder cable trays shall be permitted to support cable routing assemblies.

## 800.113 Installation of Wires, Cables, Cable Routing Assemblies, and Communications Raceways.

Installation of wires, cables, cable routing assemblies, and communications raceways shall comply with 800.113(A) through (L). Installation of cable routing assemblies and communications raceways shall comply also with 800.110.

**(A) Listing.**

Wires, cables, cable routing assemblies, and communications raceways installed in buildings shall be listed.

*Exception: Cables installed in compliance with 805.48 or 820.48 shall not be required to be listed.*

**(B) Ducts Specifically Fabricated for Environmental Air.**

The following wires and 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. Plenum cables up to 1.22 m (4 ft) in length
2. Plenum cables, riser cables, general-purpose cables, and limited-use 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 NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

**(C) Other Spaces Used for Environmental Air (Plenums).**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted in other spaces used for environmental air as described in 300.22(C):

1. Plenum cables
2. Plenum communications raceways
3. Plenum cable routing assemblies
4. Plenum cables installed in plenum communications raceways
5. Plenum cables installed in plenum cable routing assemblies
6. Plenum cables and plenum communications raceways supported by open metal cable tray systems
7. Plenum cables, riser cables, general-purpose cables, limited-use cables, and communications wires installed in raceways that are installed in compliance with 300.22(C)
8. Plenum cables, riser cables, general-purpose cables, limited-use cables, 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)
9. Plenum cables, riser cables, general-purpose cables, and limited-use 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, see NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

**(D) Risers — Cables, Cable Routing Assemblies, and Communications Raceways in Vertical Runs.**

The following cables, cable routing assemblies, and communications raceways shall be permitted in vertical runs penetrating one or more floors and in vertical runs in a shaft:

1. Plenum and riser cables
2. Plenum and riser communications raceways
3. Plenum and riser cable routing assemblies
4. Plenum and riser cables installed in:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) Plenum cable routing assemblies
    d) Riser cable routing assemblies

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**(E) Risers — Cables and Innerducts in Metal Raceways.**

The following cables and innerducts shall be permitted in metal raceways in a riser having firestops at each floor:

1. Plenum cables, riser cables, general-purpose cables, and limited-use cables
2. Plenum, riser, and general-purpose communications raceways
3. Plenum cables, riser cables, general-purpose cables, and limited-use cables installed in:
    a) Plenum communications raceways (innerduct)
    b) Riser communications raceways (innerduct)
    c) General-purpose communications raceways (innerduct)

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**(F) Risers — Cables, Cable Routing Assemblies, and Communications Raceways in Fireproof Shafts.**

The following cables, cable routing assemblies, and communications raceways shall be permitted to be installed in fireproof riser shafts having firestops at each floor:

1. Plenum cables, riser cables, general-purpose cables, and limited-use cables
2. Plenum, riser, and general-purpose communications raceways
3. Plenum, riser, and general-purpose cable routing assemblies
4. Plenum cables, riser cables, general-purpose cables, and limited-use cables installed in:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
    d) Plenum cable routing assemblies
    e) Riser cable routing assemblies
    f) General-purpose cable routing assemblies

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**(G) Risers — One- and Two-Family Dwellings.**

The following cables, cable routing assemblies, and communications raceways shall be permitted in one- and two-family dwellings:

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables less than 6 mm (0.25 in.) in diameter
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Plenum cables, riser cables, and general-purpose cables installed in:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
    d) Plenum cable routing assemblies
    e) Riser cable routing assemblies
    f) General-purpose cable routing assemblies

**(H) Cable Trays.**

The following wires, cables, and communications raceways shall be permitted to be supported by cable trays:

1. Plenum cables, riser cables, and general-purpose cables
2. Plenum, riser, and general-purpose communications raceways
3. Communications wires, plenum cables, riser cables, and general-purpose cables installed in:
    1. Plenum communications raceways
    2. Riser communications raceways
    3. General-purpose communications raceways

**(I) Distributing Frames and Cross-Connect Arrays.**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in distributing frames and cross-connect arrays:

1. Plenum cables, riser cables, general-purpose cables, and communications wires
2. Plenum, riser, and general-purpose communications raceways
3. Plenum, riser, and general-purpose cable routing assemblies
4. Communications wires, plenum cables, riser cables, and general-purpose cables installed in:
    1. Plenum communications raceways
    2. Riser communications raceways
    3. General-purpose communications raceways
    4. Plenum cable routing assemblies
    5. Riser cable routing assemblies
    6. General-purpose cable routing assemblies

**(J) Other Building Locations.**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in building locations other than the locations covered in 800.113(B) through (I):

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables with a maximum of 3 m (10 ft) of exposed length in nonconcealed spaces
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
6. Plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum cable routing assemblies
    b) Riser cable routing assemblies
    c) General-purpose cable routing assemblies
7. Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3
8. Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks

**(K) Multifamily Dwellings.**

The following cables, cable routing assemblies, and communications raceways shall be permitted to be installed in multifamily dwellings in locations other than the locations covered in 800.113(B) through (G):

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables less than 6 mm (0.25 in.) in diameter in nonconcealed spaces
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
6. Plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum cable routing assemblies
    b) Riser cable routing assemblies
    c) General-purpose cable routing assemblies
7. Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3
8. Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks

**(L) One- and Two-Family Dwellings.**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in one- and two-family dwellings in locations other than the locations covered in 800.113(B) through (F):

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables less than 6 mm (0.25 in.) in diameter
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:
   a) Plenum communications raceways
   b) Riser communications raceways
   c) General-purpose communications raceways
6. Plenum cables, riser cables, and general-purpose cables installed in the following
   a) Plenum cable routing assemblies
   b) Riser cable routing assemblies
   c) General-purpose cable routing assemblies
7. Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3
8. Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks
9. Hybrid power and communications cable listed in accordance with 805.179(F)

**800.154 Applications of Listed Communications Wires, Cables, and Raceways, and Listed Cable Routing Assemblies.**

Permitted and nonpermitted applications of listed communications wires, cables, coaxial cables, network-powered broadband communications system cables and raceways, and listed cable routing assemblies, shall be in accordance with one of the following:

1. Listed communications wires and cables as indicated in Table 800.154(a)
2. Listed communications raceways as indicated in Table 800.154(b)
3. Listed cable routing assemblies as indicated in Table 800.154(c)

The permitted applications shall be subject to the installation requirements of 800.110 and 800.113.

**Table 800.154(a) Applications of Listed Communications Wires, Cables, and Network-Powered Broadband Communications System Cables on the customer side of the Communication Service Point ~~Buildings~~**

| Applications | | Wire and Cable Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BMU, BLU | Hybrid Power and Communications Cables | Communications Wires |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | Y | N | N | N | N | N | N | N | N | N |
| | In metal raceway that complies with 300.22(B) | Y | Y | Y | Y | Y | Y | N | N | N | Y |

| Applications | | Wire and Cable Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BMU, BLU | Hybrid Power and Communications Cables | Communications Wires |
| In other spaces used for environmental air (plenums) as described in 300.22(C) | In other spaces used for environmental air | Y | N | N | N | N | N | N | N | N | N |
| | In metal raceway that complies with 300.22(C) | Y | Y | Y | Y | Y | Y | N | N | N | Y |
| | In plenum communications raceways | Y | N | N | N | N | N | N | N | N | N |
| | In plenum cable routing assemblies | Y | N | N | N | N | N | N | N | N | N |
| | Supported by open metal cable trays | Y | N | N | N | N | N | N | N | N | N |
| | Supported by solid bottom metal cable trays with solid metal covers | Y | Y | Y | Y | Y | Y | N | N | N | N |
| In risers | In vertical runs | Y | Y | Y | N | N | N | N | N | N | N |
| | In metal raceways | Y | Y | Y | Y | Y | Y | N | N | N | N |
| | In fireproof shafts | Y | Y | Y | Y | Y | Y | N | N | N | N |
| | In plenum communications raceways | Y | Y | N | N | N | N | N | N | N | N |
| | In plenum cable routing assemblies | Y | Y | N | N | N | N | N | N | N | N |
| | In riser communications raceways | Y | Y | N | N | N | N | N | N | N | N |
| | In riser cable routing assemblies | Y | Y | N | N | N | N | N | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y | Y | Y | Y | N | N | Y | N |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y | Y | Y | Y | N | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y | Y | Y | Y | Y | N | Y | N |
| | In multifamily dwellings | Y | Y | Y | Y | Y | Y | Y | N | N | N |
| | In nonconcealed spaces | Y | Y | Y | Y | Y | Y | Y | N | N | N |
| | Supported by cable trays | Y | Y | Y | Y | Y | N | N | N | N | N |
| | Under carpet, modular flooring, and planks | N | N | N | N | N | N | Y | N | N | N |
| | In distributing frames and cross-connect arrays | Y | Y | N | Y | N | N | N | N | N | Y |
| | In rigid metal conduit (RMC) and intermediate metal conduit (IMC) | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |

| Applications | | Wire and Cable Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BMU, BLU | Hybrid Power and Communications Cables | Communications Wires |
| | In any raceway recognized in Chapter 3 | Y | Y | Y | Y | Y | Y | N | N | N | Y |
| | In plenum communications raceways | Y | Y | N | Y | N | N | N | N | N | Y |
| | In plenum cable routing assemblies | Y | Y | N | Y | N | N | N | N | N | Y |
| | In riser communications raceways | Y | Y | N | Y | N | N | N | N | N | Y |
| | In riser cable routing assemblies | Y | Y | N | Y | N | N | N | N | N | Y |
| | In general-purpose communications raceways | Y | Y | N | Y | N | N | N | N | N | Y |
| | In general-purpose cable routing assemblies | Y | Y | N | Y | N | N | N | N | N | Y |

Note: An "N" in the table indicates that the cable type shall not be permitted to be installed in the application. A "Y" indicates that the cable type shall be permitted to be installed in the application subject to the limitations described in 800.113. The Riser column includes all riser cables except BMR, and the General-Purpose column includes all general-purpose cables except BM.
Informational Note No. 1: Part IV of Article 800 covers wiring on the customer side of the communication service point ~~installation methods within buildings~~. This table covers the applications of listed communications wires, cables, and raceways ~~in buildings~~. See the definition of *Point of Entrance* in 800.2.

Informational Note No. 2: For information on the restrictions to the installation of communications cables in fabricated ducts, see 800.113(B).

### Table 800.154(b) Applications of Listed Communications Raceways on the customer side of the Communication Service Point~~in Buildings~~

| Applications | | Listed Communications Raceway Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | N | N | N |
| | In metal raceway that complies with 300.22(B) | N | N | N |
| In other spaces used for environmental air (plenums) 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 cable routing assemblies | N | 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 cable routing assemblies | N | N | N |
| | In riser cable routing assemblies | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y |
| | In one- and two-family dwellings | Y | Y | Y |
| | In multifamily dwellings | Y | Y | Y |

| Applications | | Listed Communications Raceway Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| | In nonconcealed spaces | Y | Y | Y |
| | Supported by cable trays | Y | Y | Y |
| | Under carpet, modular flooring, and planks | N | N | N |
| | In distributing frames and cross-connect arrays | Y | Y | Y |
| | In any raceway recognized in Chapter 3 | Y | Y | Y |
| | In plenum cable routing assemblies | N | N | N |
| | In riser cable routing assemblies | N | N | N |
| | In general-purpose cable routing assemblies | N | N | N |

Note: An “N” in the table indicates that the communications raceway type shall not be permitted to be installed in the application. A “Y” indicates that the communications raceway type shall be permitted to be installed in the application, subject to the limitations described in 800.110 and 800.113.

## Table 800.154(c) Applications of Listed Cable Routing Assemblies in Buildings

| Applications | | Listed Cable Routing Assembly Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | N | N | N |
| | In metal raceway that complies with 300.22(B) | N | N | N |
| In other spaces used for environmental air (plenums) 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) | N | N | N |
| | In plenum communications raceways | N | N | N |
| | Supported by open metal cable trays | Y | N | N |
| | Supported by solid bottom metal cable trays with solid metal covers | N | N | N |
| In risers | In vertical runs | Y | Y | N |
| | In metal raceways | N | N | N |
| | In fireproof shafts | Y | Y | Y |
| | In plenum communications raceways | N | N | N |
| | In riser communications raceways | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y |
| | In one- and two-family dwellings | Y | Y | Y |
| | In multifamily dwellings | Y | Y | Y |
| | In nonconcealed spaces | Y | Y | Y |
| | Supported by cable trays | Y | Y | Y |
| | Under carpet, modular flooring, and planks | N | N | N |
| | In distributing frames and cross-connect arrays | Y | Y | Y |
| | In any raceway recognized in Chapter 3 | N | N | N |
| | In plenum communications raceways | N | N | N |
| | In riser communications raceways | N | N | N |
| | In general-purpose communications raceways | N | N | N |

Note: An “N” in the table indicates that the cable routing assembly type shall not be permitted to be installed in the application. A “Y” indicates that the cable routing assembly type shall be permitted to be installed in the application subject to the limitations described in 800.113.

### 800.179 Plenum, Riser, General-Purpose, and Limited Use Cables.

Plenum, riser, general-purpose, and limited-use cables shall be listed in accordance with 800.179(A) through (D) and shall have a temperature rating of not less than 60°C (140°F). The temperature rating shall be marked on the jacket of cables that have a temperature rating exceeding 60°C (140°F). The cable voltage rating shall not be marked on the cable.

#### (A) Plenum Cables.

Type CMP communications plenum cables, Type CATVP community antenna television plenum coaxial cables, and Type BLP network-powered broadband communication low-power plenum cables shall be listed as being suitable for use in ducts, plenums, and other spaces 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*.

#### (B) Riser Cables.

Type CMR communications riser cables, Type CATVR community antenna television riser coaxial cables, Type BMR network-powered broadband communications medium-power riser cables, and Type BLR network-powered broadband communications low-power riser cables 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 1666-2011, *Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts.*

#### (C) General-Purpose Cables.

Type CM communications general-purpose cables, Type CATV community antenna television coaxial general-purpose cables, Type BM network-powered broadband communications medium-power general-purpose cables, and Type BL network-powered broadband communications low-power general-purpose cables shall be listed as being suitable for general-purpose use, with the exception of risers and plenums, 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 Flame Tray 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. 0.3-09, *Test Methods for Electrical Wires and Cables*.

#### (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 VW-1 (vertical-wire) flame test in ANSI/UL 1581-2017, *Reference Standard for Electrical Wires, Cables and Flexible Cords*.

## Part V. Listing Requirements

### 800.180 Grounding Devices.

Where bonding or grounding is required, devices used to connect a shield, a sheath, or non-current-carrying metallic members of a cable to a bonding conductor or grounding electrode conductor shall be listed or be part of listed equipment.

### 800.182 Cable Routing Assemblies and Communications Raceways.

Cable routing assemblies and communications raceways shall be listed in accordance with 800.182(A) through (C). Cable routing assemblies shall be marked in accordance with Table 800.182(a). Communications raceways shall be marked in accordance with Table 800.182(b).

Informational Note: For information on listing requirements for both communications raceways and cable routing assemblies, see ANSI/UL 2024-5-2015, *Cable Routing Assemblies and Communications Raceways*.

**Table 800.182(a) Cable Routing Assembly Markings**

| Type | Marking |
|---|---|
| Plenum Cable Routing Assembly | Plenum Cable Routing Assembly |
| Riser Cable Routing Assembly | Riser Cable Routing Assembly |
| General-Purpose Cable Routing Assembly | General-Purpose Cable Routing Assembly |

**Table 800.182(b) Communications Raceway Markings**

| Type | Marking |
|---|---|
| Plenum Communications Raceway | Plenum Communications Raceway |
| Riser Communications Raceway | Riser Communications Raceway |
| General-Purpose Communications Raceway | General-Purpose Communications Raceway |

### (A) Plenum Cable Routing Assemblies and Plenum Communications Raceways.

Plenum cable routing assemblies and plenum communications raceways shall be listed as having adequate fire-resistant and low-smoke-producing characteristics.

Informational Note No. 1: One method of defining cable routing assemblies and communications raceways that have adequate fire-resistant and low-smoke-producing characteristics is that they exhibit a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84-15a, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or ANSI/UL 723-2013, *Standard Test Method for Surface Burning Characteristics of Building Materials*.

Informational Note No. 2: Another method of defining communications raceways that have adequate fire-resistant and low-smoke-producing characteristics is that they exhibit 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 262-2015, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces*.

Informational Note No. 3: See 4.3.11.2.6 or 4.3.11.5.5 of NFPA 90A-2015, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, for information on materials exposed to the airflow in ceiling cavity and raised floor plenums.

### (B) Riser Cable Routing Assemblies and Riser Communications Raceways.

Riser cable routing assemblies and riser communications raceways shall be listed as having adequate 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 cable routing assemblies and communications raceways pass the requirements of ANSI/UL 1666-2011, *Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts*.

### (C) General-Purpose Cable Routing Assemblies and General-Purpose Communications Raceways.

General-purpose cable routing assemblies and general-purpose communications raceways shall 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 cable routing assemblies and communications raceways do not spread fire to the top of the tray in the “UL Flame Exposure, Vertical Flame Tray Test” in ANSI/UL 1685-2011, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*.

## Article 805 Communications Circuits

### Part I. General

### 805.1 Scope.

This article covers communications circuits and equipment.

**805.2 Definitions.**

The definitions in this section shall apply only within Articles 805 and 840.

**Cable.**

A factory assembly of two or more conductors having an overall covering.

**Communications Circuit Integrity (CI) Cable.**

Cable used in communications systems to ensure continued operation of critical circuits during a specified time under fire conditions.

**Wire.**

A factory assembly of one or more insulated conductors without an overall covering.

**805.18 Installation of Equipment.**

Equipment electrically connected to a communications network shall be listed in accordance with 805.170.

*Exception: This listing requirement shall not apply to test equipment that is intended for temporary connection to a telecommunications network by qualified persons during the course of installation, maintenance, or repair of telecommunications equipment or systems.*

**Part II. Wires and Cables Outside and on the service provider side of the Communication Service Point ~~Entering Buildings~~**

**805.47 Underground Communications Wires and Cables ~~Entering Buildings~~.**

Underground communications wires and cables ~~entering buildings~~ shall comply with 805.47(A) and (B). The requirements of 310.10(C) shall not apply to communications wires and cables.

**(A) Underground Systems with Electric Light, Power, Class 1, or Non-Power-Limited Fire Alarm Circuit Conductors.**

Underground communications wires and cables in a raceway, handhole enclosure, or manhole containing electric light, power, Class 1, or non-power-limited fire alarm circuit conductors shall be in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier.

**(B) Underground Block Distribution.**

Where the entire street circuit is run underground and the circuit within the block is placed so as to be free from the likelihood of accidental contact with electric light or power circuits of over 300 volts to ground, the insulation requirements of 805.50(A) and 805.50(C) shall not apply, insulating supports shall not be required for the conductors, and bushings shall not be required where the conductors enter the building.

**805.48 Unlisted Cables on the service provider side of the Communication Service Point ~~Entering Buildings~~.**

Unlisted outside plant communications cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated in an enclosure or on a listed primary protector. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) to the point of emergence.

Informational Note No. 1: Splice cases or terminal boxes, both metallic and plastic types, are typically used as enclosures for splicing or terminating telephone cables.

Informational Note No. 2: This section limits the length of unlisted outside plant cable to 15 m (50 ft), while 805.90(B) requires that the primary protector be located as close as practicable to the point at which the cable enters the building. Therefore, in installations requiring a primary protector, the outside plant cable may not be permitted to extend 15 m (50 ft) into the building if it is practicable to place the primary protector closer than 15 m (50 ft) to the point of entrance.

### 805.50 Circuits Requiring Primary Protectors.

Circuits that require primary protectors as provided in 805.90 shall comply with 805.50(A),805.50(B), and 805.50(C).

#### (A) Insulation, Wires, and Cables.

Communications wires and cables without a metallic shield, running from the last outdoor support to the primary protector, shall be listed in accordance with 805.173.

#### (B) On Buildings.

Communications wires and cables in accordance with 805.50(A) shall be separated at least 100 mm (4 in.) from electric light or power conductors not in a raceway or cable or be permanently separated from conductors of the other systems by a continuous and firmly fixed nonconductor in addition to the insulation on the wires, such as porcelain tubes or flexible tubing. Communications wires and cables in accordance with 805.50(A) exposed to accidental contact with electric light and power conductors operating at over 300 volts to ground and attached to buildings shall be separated from woodwork by being supported on glass, porcelain, or other insulating material.

*Exception: Separation from woodwork shall not be required where fuses are omitted as provided for in 805.90(A)(1), or where conductors are used to extend circuits to a building from a cable having a grounded metal sheath.*

#### (C) Entering Buildings.

Where a primary protector is installed inside the building, the communications wires and cables shall enter the building either through a noncombustible, nonabsorbent insulating bushing or through a metal raceway. The insulating bushing shall not be required where the entering communications wires and cables (1) are in metal-sheathed cable, (2) pass through masonry, (3) meet the requirements of 805.50(A) and fuses are omitted as provided in 805.90(A)(1), or (4) meet the requirements of 805.50(A) and are used to extend circuits to a building from a cable having a grounded metallic sheath. Raceways or bushings shall slope upward from the outside or, where this cannot be done, drip loops shall be formed in the communications wires and cables immediately before they enter the building.

Raceways shall be equipped with an approved service head. More than one communications wire and cable shall be permitted to enter through a single raceway or bushing. Conduits or other metal raceways located ahead of the primary protector shall be grounded.

## Part III. Protection

### 805.90 Protective Devices.

#### (A) Application.

A listed primary protector shall be provided on each circuit run partly or entirely in aerial wire or aerial cable not confined within a block. Also, a listed primary protector shall be provided on each circuit, aerial or underground, located within the block containing the building served so as to be exposed to accidental contact with electric light or power conductors operating at over 300 volts to ground. In addition, where there exists a lightning exposure, each interbuilding circuit on a premises shall be protected by a listed primary protector at each end of the interbuilding circuit. Installation of primary protectors shall also comply with 110.3(B).

Informational Note No. 1: On a circuit not exposed to accidental contact with power conductors, providing a listed primary protector in accordance with this article helps protect against other hazards, such as lightning and above-normal voltages induced by fault currents on power circuits in proximity to the communications circuit.

Informational Note No. 2: Interbuilding circuits are considered to have a lightning exposure unless one or more of the following conditions exist:

1. Circuits in large metropolitan areas where buildings are close together and sufficiently high to intercept lightning.
2. Interbuilding cable runs of 42 m (140 ft) or less, directly buried or in underground conduit, where a continuous metallic cable shield or a continuous metal conduit containing the cable is connected to each building grounding electrode system.

3. Areas having an average of five or fewer thunderstorm days per year and earth resistivity of less than 100 ohm-meters. Such areas are found along the Pacific coast.

Informational Note No. 3: For information on lightning protection systems, see NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems.*

**(1) Fuseless Primary Protectors.**

Fuseless-type primary protectors shall be permitted under any of the conditions given in 805.90(A)(1)(a) through (A)(1)(e).

(a) Where conductors enter a building through a cable with grounded metallic sheath member(s) and where the conductors in the cable safely fuse on all currents greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor

(b) Where insulated conductors in accordance with 805.50(A) are used to extend circuits to a building from a cable with an effectively grounded metallic sheath member(s) and where the conductors in the cable or cable stub, or the connections between the insulated conductors and the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground, safely fuse on all currents greater than the current-carrying capacity of the primary protector, or the associated insulated conductors and of the primary protector bonding conductor or grounding electrode conductor

(c) Where insulated conductors in accordance with 805.50(A) or (B) are used to extend circuits to a building from other than a cable with metallic sheath member(s), where (1) the primary protector is listed as being suitable for this purpose for application with circuits extending from other than a cable with metallic sheath members, and (2) the connections of the insulated conductors to the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground or the conductors of the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground safely fuse on all currents greater than the current-carrying capacity of the primary protector, or associated insulated conductors and of the primary protector bonding conductor or grounding electrode conductor

(d) Where insulated conductors in accordance with 805.50(A) are used to extend circuits aerially to a building from a buried or underground circuit that is unexposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground

(e) Where insulated conductors in accordance with 805.50(A) are used to extend circuits to a building from cable with an effectively grounded metallic sheath member(s), and where (1) the combination of the primary protector and insulated conductors is listed as being suitable for this purpose for application with circuits extending from a cable with an effectively grounded metallic sheath member(s), and (2) the insulated conductors safely fuse on all currents greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor

Informational Note: Section 9 of ANSI/IEEE C2-2012, *National Electrical Safety Code*, provides an example of methods of protective grounding that can achieve effective grounding of communications cable sheaths for cables from which communications circuits are extended.

**(2) Fused Primary Protectors.**

Where the requirements listed under 805.90(A)(1)(a) through (A)(1)(e) are not met, fused-type primary protectors shall be used. Fused-type primary protectors shall consist of an arrester connected between each line conductor and ground, a fuse in series with each line conductor, and an appropriate mounting arrangement. Primary protector terminals shall be marked to indicate line, instrument, and ground, as applicable.

**(B) Location.**

The primary protector shall be located in, on, or immediately adjacent to the structure or building served and as close as practicable to the point of entrance.

For purposes of this section, primary protectors located at mobile home service equipment within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means connected to an electrode by a grounding electrode conductor in accordance with 250.32 and located

within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a primary protector location to achieve the shortest practicable primary protector bonding conductor or grounding electrode conductor helps limit potential differences between communications circuits and other metallic systems.

**(C) Hazardous (Classified) Locations.**

The primary protector shall not be located in any hazardous (classified) locations, as defined in 500.5 and 505.5, or in the vicinity of easily ignitible material.

*Exception: As permitted in 501.150, 502.150, and 503.150.*

**(D) Secondary Protectors.**

Where a secondary protector is installed in series with the indoor communications wire and cable between the primary protector and the equipment, it shall be listed for the purpose in accordance with 805.170(B).

Informational Note: Secondary protectors on circuits exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground are not intended for use without primary protectors.

**805.93 Grounding, Bonding, or Interruption of Non–Current-Carrying Metallic Sheath Members of Communications Cables.**

Communications cables entering the building or terminating on the outside of the building shall comply with 805.93(A) or (B).

**(A) Entering Buildings.**

In installations where the communications cable enters a building, the metallic sheath members of the cable shall be grounded or bonded as specified in 800.100 or interrupted by an insulating joint or equivalent device. The grounding, bonding, or interruption shall be as close as practicable to the point of entrance.

**(B) Terminating on the Outside of Buildings.**

In installations where the communications cable is terminated on the outside of the building, the metallic sheath members of the cable shall be grounded or bonded as specified in 800.100 or interrupted by an insulating joint or equivalent device. The grounding, bonding, or interruption shall be as close as practicable to the point of termination of the cable.

**Part IV. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**805.133 Installation of Communications Wires, Cables, and Equipment.**

Communications wires and cables from the protector to the equipment or, where no protector is required, communications wires and cables attached to the outside or inside of the building shall comply with 805.133(A) and 805.133(B)

**(A) Separation from Other Conductors.**

**(1) In Raceways, Cable Trays, Boxes, Cables, Enclosures, and Cable Routing Assemblies.**

(a) *Other Circuits.* Communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with cables 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. Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770
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

(b) *Class 2 and Class 3 Circuits.* Class 1 circuits shall not be run in the same cable with communications circuits. Class 2 and Class 3 circuit conductors shall be permitted in the same listed communications cable with communications circuits.

(c) *Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm, and Medium-Power Network-Powered Broadband Communications Circuits in Raceways, Compartments, and Boxes.* Communications conductors shall not be placed in any raceway, compartment, outlet box, junction box, or similar fitting with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits.

*Exception No. 1: Section 805.133(A)(1)(c) shall not apply if 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 conductors of communications circuits by a permanent barrier or listed divider.*

*Exception No. 2: Power conductors in outlet boxes, junction boxes, or similar fittings or compartments where such conductors are introduced solely for power supply to communications equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum of 6 mm (¼ in.) separation from the communications circuit conductors.*

*Exception No. 3: As permitted by 620.36.*

**(2) Other Applications.**

Communications wires and cables shall be separated 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.

*Exception No. 1: Section 805.133(A)(2) shall not apply where either (1) all of the conductors of the electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits are in a raceway or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC, or Type UF cables, or (2) all of the conductors of communications circuits are encased in raceway.*

*Exception No. 2: Section 805.133(A)(2) shall not apply where the communications wires and cables are permanently separated from the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B) Support of Communications Wires and Cables.**

Raceways shall be used for their intended purpose. Communications wires and cables shall not be strapped, taped, or attached by any means to the exterior of any raceway as a means of support.

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

**805.154 Substitutions of Listed Communications Wires, Cables, and Raceways, and Listed Cable Routing Assemblies.**

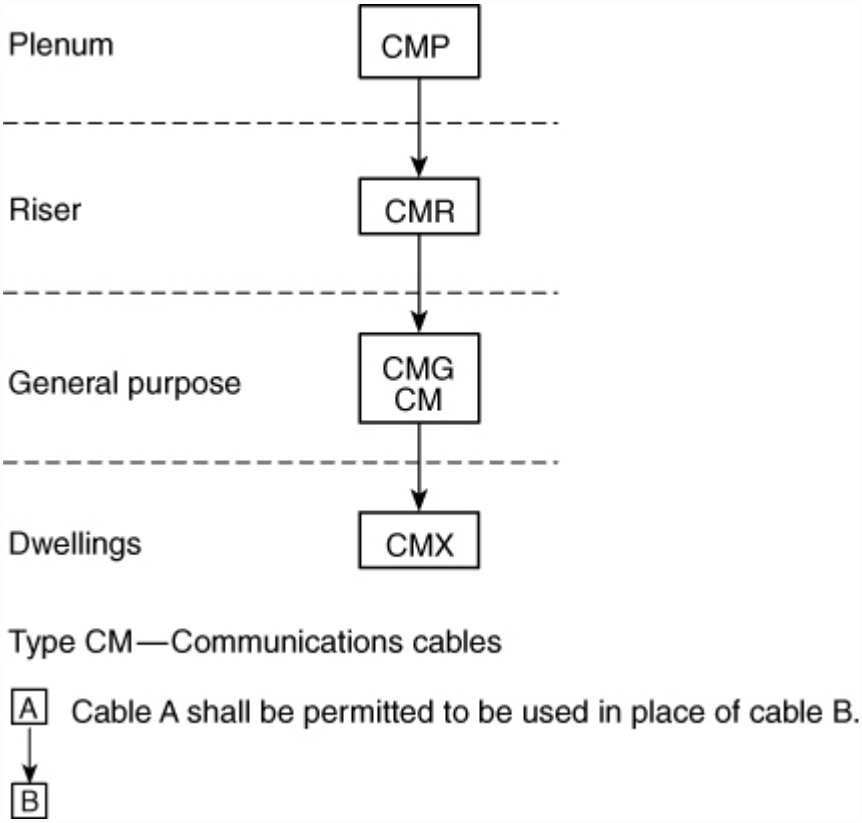
The substitutions for communications cables listed in Table 805.154 and illustrated in Figure 805.154 shall be permitted.

**Table 805.154 Cable Substitutions**

| Cable Type | Permitted Substitutions |
|---|---|
| CMR | CMP |

| Cable Type | Permitted Substitutions |
|---|---|
| CMG, CM | CMP, CMR |
| CMX | CMP, CMR, CMG, CM |

**Figure 805.154 Cable Substitution Hierarchy.**




### 805.156 Dwelling Unit Communications Outlet.

For new construction, a minimum of one communications outlet shall be installed within the dwelling in a readily accessible area and cabled to the service provider demarcation point.

## Part V. Listing Requirements

### 805.170 Equipment.

Communications equipment shall be listed as being suitable for electrical connection to a communications network.

Informational Note No. 1: One way to determine applicable requirements is to refer to ANSI/UL 60950-1-2014, *Standard for Safety of Information Technology Equipment*; ANSI/UL 1863-2012, *Standard for Safety Communications Circuit Accessories*; or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements*.

Informational Note No. 2: Additional information regarding voltages, currents, and power allowed on communications circuits can be found in ANSI/ATIS 0600337-2016, *Requirements for Maximum Voltage, Current, and Power Levels Used in Communications Transport Circuits*.

#### (A) Primary Protectors.

The primary protector shall consist of an arrester connected between each line conductor and ground in an appropriate mounting. Primary protector terminals shall be marked to indicate line and ground as applicable.

Informational Note: One way to determine applicable requirements for a listed primary protector is to refer to ANSI/UL 497-2013, *Standard for Protectors for Paired Conductor Communications Circuits*.

#### (B) Secondary Protectors.

The secondary protector shall be listed as suitable to provide means to safely limit currents to less than the current-carrying capacity of listed indoor communications wire and cable, listed telephone set line cords, and listed communications terminal equipment having ports for external wire line communications circuits. Any overvoltage protection, arresters, or grounding connection shall be connected on the equipment terminals side of the secondary protector current-limiting means.

Informational Note: One way to determine applicable requirements for a listed secondary protector is to refer to ANSI/UL 497A-2012, *Standard for Secondary Protectors for Communications Circuits*.

**(C) Plenum Grade Cable Ties.**

Cable ties intended for use in other space used for environmental air (plenums) shall be listed as having low smoke and heat release properties.

Informational Note: See NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, and ANSI/UL 2043-2013, *Standard for Safety Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces*, for information on listing discrete products as having low smoke and heat release properties.

### 805.173 Drop Wire and Cable.

Communications wires and cables without a metallic shield, running from the last outdoor support to the primary protector, shall be listed as being suitable for the purpose and shall have current-carrying capacity as specified in 805.90(A)(1)(b) or (A)(1)(c).

### 805.179 Communications Wires and Cables.

Communications wires and cables shall be listed in accordance with 805.179(A) through (F) and marked in accordance with Table 805.179 and 805.179(G). Conductors in communications cables, other than in a coaxial cable, shall be copper.

Communications wires and cables shall have a voltage rating of not less than 300 volts. The insulation for the individual conductors, other than the outer conductor of a coaxial cable, shall be rated for 300 volts minimum. The cable voltage rating shall not be marked on the cable or on the under-carpet communications wire.

*Exception: Voltage markings shall be permitted where the cable has multiple listings and 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 805.179 Cable Markings**

| Cable Marking | Type |
|---|---|
| CMP | Communications plenum cable |
| CMR | Communications riser cable |
| CMG | Communications general-purpose cable |
| CM | Communications general-purpose cable |
| CMX | Communications cable, limited use |
| CMUC | Under-carpet communications wire and cable |

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

**(A) General Requirements.**

The general requirements in 805.179 shall apply.

**(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 VW-1 (vertical-wire) flame test in ANSI/UL 1581-2017, *Reference Standard for Electrical Wires, Cables and Flexible Cords*.

### (C) Circuit Integrity (CI) Cable or Electrical Circuit Protective System.

Cables that are used for survivability of critical circuits under fire conditions shall be listed and meet either 805.179(C)(1) or 805.179(C)(2).

Informational Note: The listing organization provides information for circuit integrity (CI) cable and electrical circuit protective systems, including installation requirements required to maintain the fire rating.

### (1) Circuit Integrity (CI) Cables.

Circuit integrity (CI) cables specified in 805.179(A) through (D), and used for survivability of critical circuits, shall have an additional classification using the suffix "CI." In order to maintain its listed fire rating, circuit integrity (CI) cable shall only be installed in free air.

Informational Note: One method of defining circuit integrity (CI) cable is by establishing a minimum 2-hour fire resistance rating for the cable when tested in accordance with ANSI/UL 2196-2017, *Standard for Fire Test for Circuit Integrity of Fire-Resistant Power, Instrumentation, Control, and Data Cables*.

### (2) Fire-Resistive Cables.

Cables specified in 800.179(A) through (D) and 805.179(C)(1), that are part of an electrical circuit protective system, shall be fire-resistive cable identified with the protective system number on the product, or on the smallest unit container in which the product is packaged, and shall be installed in accordance with the listing of the protective system.

Informational Note No. 1: One method of defining an electrical circuit protective system is by establishing a minimum 2-hour fire resistance rating for the system when tested in accordance with UL Subject 1724, *Outline of Investigation for Fire Tests for Electrical Circuit Protective Systems*.

Informational Note No. 2: The listing organization provides information for electrical circuit protective systems (FHIT), including installation requirements for maintaining the fire rating.

### (D) Types CMP-LP, CMR-LP, CMG-LP, and CM-LP Limited Power (LP) Cables.

Types CMP-LP, CMR-LP, CMG-LP, and CM-LP communications limited power 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 XX designates the current limit in amperes per conductor.

Informational Note: An example of the marking on a communications cable with an LP rating is "CMP-LP (0.6A)(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 ampere.

### (E) Communications Wires.

Communications wires, such as distributing frame wire and jumper wire, shall 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 Flame Tray 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. 0.3-09, *Test Methods for Electrical Wires and Cables*.

### (F) Hybrid Power and Communications Cables.

Listed hybrid power and communications cables shall be permitted where the power cable is a listed Type NM or NM-B, conforming to Part III of Article 334, and the communications cable is a listed Type CM, the jackets on the listed NM or NM-B, and listed CM cables are rated for 600 volts minimum, and the hybrid cable is 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 Flame Tray 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. 0.3-09, *Test Methods for Electrical Wires and Cables*.

### (G) Optional Markings.

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.

## Article 810 Radio and Television Equipment

### Part I. General

#### 810.1 Scope.

This article covers antenna systems for radio and television receiving equipment, amateur and citizen band radio transmitting and receiving equipment, and certain features of transmitter safety. This article covers antennas such as wire-strung type, multi-element, vertical rod, flat, or parabolic and also covers the wiring and cabling that connect them to equipment. This article does not cover equipment and antennas used for coupling carrier current to power line conductors.

#### 810.2 Definitions.

The definitions in Part I of Article 100 shall apply.

#### 810.3 Other Articles.

Wiring from the source of power to and between devices connected to the interior wiring system shall comply with Chapters 1 through 4 other than as modified by Parts I and II of Article 640. Wiring for audio signal processing, amplification, and reproduction equipment shall comply with Article 640. Coaxial cables that connect antennas to equipment shall comply with Article 820.

#### 810.4 Community Television Antenna.

The antenna shall comply with this article. The distribution system shall comply with Article 820.

#### 810.5 Radio Noise Suppressors.

Radio interference eliminators, interference capacitors, or noise suppressors connected to power-supply leads shall be of a listed type. They shall not be exposed to physical damage.

#### 810.6 Antenna Lead-In Protectors.

Where an antenna lead-in surge protector is installed, it shall be listed as being suitable for limiting surges on the cable that connects the antenna to the receiver/transmitter electronics and shall be connected between the conductors and the grounded shield or other ground connection. The antenna lead-in protector shall be grounded using a bonding conductor or grounding electrode conductor installed in accordance with 810.21(F).

Informational Note: For requirements covering protectors for antenna lead-in conductors, refer to UL 497E, *Outline of Investigation for Protectors for Antenna Lead-In Conductors*.

#### 810.7 Grounding Devices.

Where bonding or grounding is required, devices used to connect a shield, a sheath, non–current-carrying metallic members of a cable, or metal parts of equipment or antennas to a bonding conductor or grounding electrode conductor shall be listed or be part of listed equipment.

### Part II. Receiving Equipment — Antenna Systems

#### 810.11 Material.

Antennas and lead-in conductors shall be of hard-drawn copper, bronze, aluminum alloy, copper-clad steel, or other high-strength, corrosion-resistant material.

*Exception: Soft-drawn or medium-drawn copper shall be permitted for lead-in conductors where the maximum span between points of support is less than 11 m (35 ft).*

#### 810.12 Supports.

Outdoor antennas and lead-in conductors shall be securely supported. The antennas or lead-in conductors shall not be attached to the electric service mast. They shall not be attached to poles or similar structures carrying open electric light or power wires or trolley wires of over 250 volts between conductors. Insulators supporting the antenna conductors shall have sufficient mechanical strength to safely support the conductors. Lead-in conductors shall be securely attached to the antennas.

### 810.13 Avoidance of Contacts with Conductors of Other Systems.

Outdoor antennas and lead-in conductors from an antenna to a building shall not cross over open conductors of electric light or power circuits and shall be kept well away from all such circuits so as to avoid the possibility of accidental contact. Where proximity to open electric light or power service conductors of less than 250 volts between conductors cannot be avoided, the installation shall be such as to provide a clearance of at least 600 mm (2 ft).

Where practicable, antenna conductors shall be installed so as not to cross under open electric light or power conductors.

### 810.14 Splices.

Splices and joints in antenna spans shall be made mechanically secure with approved splicing devices or by such other means as will not appreciably weaken the conductors.

### 810.15 Grounding.

Masts and metal structures supporting antennas shall be grounded in accordance with 810.21, unless the antenna and its related supporting mast or structure are within a zone of protection defined by a 46 m (150 ft) radius rolling sphere.

Informational Note: See 4.8.3.1 of NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, for the application of the term *rolling sphere*.

### 810.16 Size of Wire-Strung Antenna — Receiving Station.

#### (A) Size of Antenna Conductors.

Outdoor antenna conductors for receiving stations shall be of a size not less than given in Table 810.16(A).

**Table 810.16(A) Size of Receiving Station Outdoor Antenna Conductors**

| Material | Minimum Size of Conductors (AWG) Where Maximum Open Span Length Is | | |
|---|---|---|---|
| | Less Than 11 m (35 ft) | 11 m to 45 m (35 ft to 150 ft) | Over 45 m (150 ft) |
| Aluminum alloy, hard-drawn copper | 19 | 14 | 12 |
| Copper-clad steel, bronze, or other high-strength material | 20 | 17 | 14 |

#### (B) Self-Supporting Antennas.

Outdoor antennas, such as vertical rods and flat, parabolic, or dipole structures, shall be of corrosion-resistant materials and of strength suitable to withstand ice and wind loading conditions and shall be located well away from overhead conductors of electric light and power circuits of over 150 volts to ground, so as to avoid the possibility of the antenna or structure falling into or making accidental contact with such circuits.

### 810.17 Size of Lead-in — Receiving Station.

Lead-in conductors from outside antennas for receiving stations shall, for various maximum open span lengths, be of such size as to have a tensile strength at least as great as that of the conductors for antennas as specified in 810.16. Where the lead-in consists of two or more conductors that are twisted

together, are enclosed in the same covering, or are concentric, the conductor size shall, for various maximum open span lengths, be such that the tensile strength of the combination is at least as great as that of the conductors for antennas as specified in 810.16.

### 810.18 Clearances — Receiving Stations.

#### (A) Outside of Buildings.

Lead-in conductors attached to buildings shall be installed so that they cannot swing closer than 600 mm (2 ft) to the conductors of circuits of 250 volts or less between conductors, or 3.0 m (10 ft) to the conductors of circuits of over 250 volts between conductors, except that in the case of circuits not over 150 volts between conductors, where all conductors involved are supported so as to ensure permanent separation, the clearance shall be permitted to be reduced but shall not be less than 100 mm (4 in.). The clearance between lead-in conductors and any conductor forming a part of a lightning protection system shall not be less than 1.8 m (6 ft). Underground conductors shall be separated at least 300 mm (12 in.) from conductors of any light or power circuits or Class 1 circuits.

*Exception: Where the electric light or power conductors, Class 1 conductors, or lead-in conductors are installed in raceways or metal cable armor.*

Informational Note No. 1: See 250.60 for grounding associated with lightning protection components — strike termination devices. For further information, see NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, which contains detailed information on grounding, bonding, and spacing from lightning protection systems, and the calculation of specific separation distances using the sideflash equation in Section 4.6.

Informational Note No. 2: Metal raceways, enclosures, frames, and other non–current-carrying metal parts of electrical equipment installed on a building equipped with a lightning protection system may require bonding or spacing from the lightning protection conductors in accordance with NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*. Separation from lightning protection conductors is typically 1.8 m (6 ft) through air or 900 mm (3 ft) through dense materials such as concrete, brick, or wood.

#### (B) Antennas and Lead-ins — Indoors.

Indoor antennas and indoor lead-ins shall not be run nearer than 50 mm (2 in.) to conductors of other wiring systems in the premises.

*Exception No. 1: Where such other conductors are in metal raceways or cable armor.*

*Exception No. 2: Where permanently separated from such other conductors by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing.*

#### (C) In Boxes or Other Enclosures.

Indoor antennas and indoor lead-ins shall be permitted to occupy the same box or enclosure with conductors of other wiring systems where separated from such other conductors by an effective permanently installed barrier.

### 810.19 Electrical Supply Circuits Used in Lieu of Antenna — Receiving Stations.

Where an electrical supply circuit is used in lieu of an antenna, the device by which the radio receiving set is connected to the supply circuit shall be listed.

### 810.20 Antenna Discharge Units — Receiving Stations.

#### (A) Where Required.

Each conductor of a lead-in from an outdoor antenna shall be provided with a listed antenna discharge unit.

*Exception: Where the lead-in conductors are enclosed in a continuous metallic shield that either is grounded with a conductor in accordance with 810.21 or is protected by an antenna discharge unit.*

#### (B) Location.

Antenna discharge units shall be located outside the building or inside the building between the point of entrance of the lead-in and the radio set or transformers and as near as practicable to the entrance of the conductors to the building. The antenna discharge unit shall not be located near combustible material or in a hazardous (classified) location as defined in Article 500.

**(C) Grounding.**

The antenna discharge unit shall be grounded in accordance with 810.21.

**810.21 Bonding Conductors and Grounding Electrode Conductors — Receiving Stations.**

Bonding conductors and grounding electrode conductors shall comply with 810.21(A) through 810.21(K).

**(A) Material.**

The bonding conductor or grounding electrode conductor shall be of copper, aluminum, copper-clad steel, copper-clad aluminum, bronze, or similar corrosion-resistant material. Aluminum or copper-clad aluminum bonding conductors or grounding electrode conductors shall not be used where in direct contact with masonry or the earth or where subject to corrosive conditions. Where used outside, aluminum or copper-clad aluminum conductors shall not be installed within 450 mm (18 in.) of the earth.

**(B) Insulation.**

Insulation on bonding conductors or grounding electrode conductors shall not be required.

**(C) Supports.**

The bonding conductor or grounding electrode conductor shall be securely fastened in place and shall be permitted to be directly attached to the surface wired over without the use of insulating supports.

*Exception: Where proper support cannot be provided, the size of the bonding conductors or grounding electrode conductors shall be increased proportionately.*

**(D) Physical Protection.**

Bonding conductors and grounding electrode conductors shall be protected where exposed to physical damage. Where the bonding conductor or grounding electrode conductor is installed in a metal raceway, both ends of the raceway shall be bonded to the contained conductor or to the same terminal or electrode to which the bonding conductor or grounding electrode conductor is connected.

**(E) Run in Straight Line.**

The bonding conductor or grounding electrode conductor for an antenna mast or antenna discharge unit shall be run in as straight a line as practicable.

**(F) Electrode.**

The bonding conductor or grounding electrode conductor shall be connected as required in 810.21(F)(1) through 810.21(F)(3).

**(1) In Buildings or Structures with an Intersystem Bonding Termination.**

If the building or structure served has an intersystem bonding termination as required by 250.94, the bonding conductor shall be connected to the intersystem bonding termination.

**(2) In Buildings or Structures with Grounding Means.**

If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on the following:

1. The building or structure grounding electrode system as covered in 250.50
2. The grounded interior metal water piping systems, within 1.52 m (5 ft) from its point of entrance to the building, as covered in 250.52
3. The power service accessible means external to the building, as covered in 250.94
4. The nonflexible metal power service raceway
5. The service equipment enclosure, or
6. The grounding electrode conductor or the grounding electrode conductor metal enclosures of the power service

A bonding device intended to provide a termination point for the bonding conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on nonremovable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is nonremovable.

**(3) In Buildings or Structures Without an Intersystem Bonding Termination or Grounding Means.**

If the building or structure served has no intersystem bonding termination or grounding means as described in 810.21(F)(2), the grounding electrode conductor shall be connected to a grounding electrode as described in 250.52.

**(G) Inside or Outside Building.**

The bonding conductor or grounding electrode conductor shall be permitted to be run either inside or outside the building.

**(H) Size.**

The bonding conductor or grounding electrode conductor shall not be smaller than 10 AWG copper, 8 AWG aluminum, or 17 AWG copper-clad steel or bronze.

**(I) Common Ground.**

A single bonding conductor or grounding electrode conductor shall be permitted for both protective and operating purposes.

**(J) Bonding of Electrodes.**

A bonding jumper not smaller than 6 AWG copper or equivalent shall be connected between the radio and television equipment grounding electrode and the power grounding electrode system at the building or structure served where separate electrodes are used.

**(K) Electrode Connection.**

Connections to grounding electrodes shall comply with 250.70.

## Part III. Amateur and Citizen Band Transmitting and Receiving Stations — Antenna Systems

### 810.51 Other Sections.

In addition to complying with Part III, antenna systems for amateur and citizen band transmitting and receiving stations shall also comply with 810.11 through 810.15.

### 810.52 Size of Antenna.

Antenna conductors for transmitting and receiving stations shall be of a size not less than given in Table 810.52.

**Table 810.52 Size of Outdoor Antenna Conductors**

| Material | Minimum Size of Conductors (AWG) Where Maximum Open Span Length Is | |
|---|---|---|
| | Less Than 45 m (150 ft) | Over 45 m (150 ft) |
| Hard-drawn copper | 14 | 10 |
| Copper-clad steel, bronze, or other high-strength material | 14 | 12 |

### 810.53 Size of Lead-in Conductors.

Lead-in conductors for transmitting stations shall, for various maximum span lengths, be of a size at least as great as that of conductors for antennas as specified in 810.52.

### 810.54 Clearance on Building.

Antenna conductors for transmitting stations, attached to buildings, shall be firmly mounted at least 75 mm (3 in.) clear of the surface of the building on nonabsorbent insulating supports, such as treated pins or brackets equipped with insulators having not less than 75-mm (3-in.) creepage and airgap distances. Lead-in conductors attached to buildings shall also comply with these requirements.

*Exception: Where the lead-in conductors are enclosed in a continuous metallic shield that is grounded with a conductor in accordance with 810.58, they shall not be required to comply with these requirements. Where grounded, the metallic shield shall also be permitted to be used as a conductor.*

**810.55 Entrance to Building.**

Except where protected with a continuous metallic shield that is grounded with a conductor in accordance with 810.58, lead-in conductors for transmitting stations shall enter buildings by one of the following methods:

1. Through a rigid, noncombustible, nonabsorbent insulating tube or bushing
2. Through an opening provided for the purpose in which the entrance conductors are firmly secured so as to provide a clearance of at least 50 mm (2 in.)
3. Through a drilled window pane

**810.56 Protection Against Accidental Contact.**

Lead-in conductors to radio transmitters shall be located or installed so as to make accidental contact with them difficult.

**810.57 Antenna Discharge Units — Transmitting Stations.**

Each conductor of a lead-in for outdoor antennas shall be provided with an antenna discharge unit or other suitable means that drain static charges from the antenna system.

*Exception No. 1: Where the lead-in is protected by a continuous metallic shield that is grounded with a conductor in accordance with 810.58, an antenna discharge unit or other suitable means shall not be required.*

*Exception No. 2: Where the antenna is grounded with a conductor in accordance with 810.58, an antenna discharge unit or other suitable means shall not be required.*

**810.58 Bonding Conductors and Grounding Electrode Conductors — Amateur and Citizen Band Transmitting and Receiving Stations.**

Bonding conductors and grounding electrode conductors shall comply with 810.58(A) through 810.58(C).

**(A) Other Sections.**

All bonding conductors and grounding electrode conductors for amateur and citizen band transmitting and receiving stations shall comply with 810.21(A) through 810.21(C).

**(B) Size of Protective Bonding Conductor or Grounding Electrode Conductor.**

The protective bonding conductor or grounding electrode conductor for transmitting stations shall be as large as the lead-in but not smaller than 10 AWG copper, bronze, or copper-clad steel.

**(C) Size of Operating Bonding Conductor or Grounding Electrode Conductor.**

The operating bonding conductor or grounding electrode conductor for transmitting stations shall not be less than 14 AWG copper or its equivalent.

**Part IV. Interior Installation — Transmitting Stations**

**810.70 Clearance from Other Conductors.**

All conductors inside the building shall be separated at least 100 mm (4 in.) from the conductors of any electric light, power, or signaling circuit.

*Exception No. 1: As provided in Article 640.*

*Exception No. 2: Where separated from other conductors by raceway or some firmly fixed nonconductor, such as porcelain tubes or flexible tubing.*

### 810.71 General.

Transmitters shall comply with 810.71(A) through (C).

**(A) Enclosing.**

The transmitter shall be enclosed in a metal frame or grille or separated from the operating space by a barrier or other equivalent means, all metallic parts of which are effectively connected to a bonding conductor or grounding electrode conductor.

**(B) Grounding of Controls.**

All external metal handles and controls accessible to the operating personnel shall be effectively connected to an equipment grounding conductor if the transmitter is powered by the premises wiring system or grounded with a conductor in accordance with 810.21.

**(C) Interlocks on Doors.**

All access doors shall be provided with interlocks that disconnect all voltages of over 350 volts between conductors when any access door is opened.

## Article 820 Community Antenna Television and Radio Distribution Systems

### Part I. General

### 820.1 Scope.

This article covers coaxial cable distribution of radio frequency signals typically employed in community antenna television (CATV) systems.

### 820.2 Definitions.

The definitions in this section shall apply only within Articles 820 and 840.

### 820.3 Other Articles.

Circuits and equipment shall comply with 820.3(A)and (B).

**(A) General Requirements.**

The general requirements of Article 800 shall apply.

**(B) Alternate Wiring Methods.**

The wiring methods of Article 830 shall be permitted to substitute for the wiring methods of Article 820.

Informational Note: Use of Article 830 wiring methods will facilitate the upgrading of Article 820 installations to network-powered broadband applications.

### 820.15 Power Limitations.

Coaxial cable shall be permitted to deliver power to equipment that is directly associated with the radio frequency distribution system if the voltage is not over 60 volts and if the current is supplied by a transformer or other device that has power-limiting characteristics.

Power shall be blocked from premises devices on the network that are not intended to be powered via the coaxial cable.

### Part II. Coaxial Cables ~~Outside~~ on the service provider side of the Communication Service Point~~and Entering Buildings~~

### 820.44 Overhead (Aerial) Coaxial Cables.

Overhead (aerial) coaxial cables, prior to the point of grounding, as specified in 820.93, shall comply with 820.44(A) or 800.44.

**(A) On Poles and In-Span, Above Roofs, on Masts, or Between Buildings.**

Where coaxial cables are installed on poles and in-span, above roofs, on masts, or between buildings, they shall comply with 800.44.

**(B) On Buildings.**

Where attached to buildings, coaxial cables shall be securely fastened in such a manner that they will be separated from other conductors in accordance with 820.44(B)(1) and (B)(2).

**(1) Electric Light or Power.**

The coaxial cable shall have a separation of at least 100 mm (4 in.) from electric light, power, Class 1, or non-power-limited fire alarm circuit conductors not in raceway or cable, or shall be permanently separated from conductors of the other system by a continuous and firmly fixed nonconductor in addition to the insulation on the wires.

**(2) Other Communications Systems.**

Coaxial cable shall be installed so that there will be no unnecessary interference in the maintenance of the separate systems. In no case shall the conductors, cables, messenger strand, or equipment of one system cause abrasion to the conductors, cable, messenger strand, or equipment of any other system.

### 820.47 Underground Coaxial Cables Entering Buildings.

Underground coaxial cables entering buildings shall comply with 820.47(A) and 820.47(B).

**(A) Underground Systems with Electric Light, Power, Class 1, or Non–Power-Limited Fire Alarm Circuit Conductors.**

Underground coaxial cables in a duct, pedestal, handhole enclosure, or manhole that contains electric light, power, or Class 1 or non–power-limited fire alarm circuit conductors shall be in a section permanently separated from such conductors by means of a suitable barrier.

**(B) Direct-Buried Cables and Raceways.**

Direct-buried coaxial cable shall be separated at least 300 mm (12 in.) from conductors of any light or power, non–power-limited fire alarm circuit conductors, or Class 1 circuit.

*Exception No. 1: Separation shall not be required where electric service conductors or coaxial cables are installed in raceways or have metal cable armor.*

*Exception No. 2: Separation shall not be required where electric light or power branch-circuit or feeder conductors or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables; or the coaxial cables have metal cable armor or are installed in a raceway.*

### 820.48 Unlisted Cables Entering Buildings.

Unlisted outside plant coaxial cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated at a grounding block. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) to the point of emergence.

## Part III. Protection

### 820.93 Grounding of the Outer Conductive Shield of Coaxial Cables.

Coaxial cables entering buildings or attached to buildings shall comply with 820.93(A) or (B). Where the outer conductive shield of a coaxial cable is grounded, no other protective devices shall be required. For purposes of this section, grounding located at mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a grounding block location to achieve the shortest practicable bonding conductor or grounding electrode conductor helps limit potential differences between CATV and other metallic systems.

**(A) Entering Buildings.**

In installations where the coaxial cable enters the building, the outer conductive shield shall be grounded in accordance with 820.100. The grounding shall be as close as practicable to the point of entrance.

**(B) Terminating Outside of the Building.**

In installations where the coaxial cable is terminated outside of the building, the outer conductive shield shall be grounded in accordance with 820.100. The grounding shall be as close as practicable to the point of attachment or termination.

**(C) Location.**

Where installed, a listed primary protector shall be applied on each community antenna and radio distribution (CATV) cable external to the premises. The listed primary protector shall be located as close as practicable to the entrance point of the cable on either side or integral to the ground block.

**(D) Hazardous (Classified) Locations.**

Where a primary protector or equipment providing the primary protection function is used, it shall not be located in any hazardous (classified) location as defined in 500.5 and 505.5 or in the vicinity of easily ignitible material.

*Exception: As permitted in 501.150, 502.150, and 503.150.*

**Part IV. Grounding Methods**

**820.100 Cable Bonding and Grounding.**

The shield of the coaxial cable shall be bonded or grounded as specified in 820.100(A) and (B).

*Exception: For communications systems using coaxial cable completely contained within the building (i.e., they do not exit the building) or the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere and isolated from outside cable plant, the shield shall be permitted to be grounded by a connection to an equipment grounding conductor as described in 250.118. Connecting to an equipment grounding conductor through a grounded receptacle using a dedicated bonding jumper and a permanently connected listed device shall be permitted. Use of a cord and plug for the connection to an equipment grounding conductor shall not be permitted.*

Informational Note: See 4.8.3.1 of NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems,* for the application of the term *rolling sphere*.

**(A) General Requirements.**

The installation shall be in accordance with 800.100.

**(B) Shield Protection Devices.**

Grounding of a coaxial drop cable shield by means of a protective device that does not interrupt the grounding system within the premises shall be permitted.

**820.103 Equipment Grounding.**

Unpowered equipment and enclosures or equipment powered by the coaxial cable shall be considered grounded where connected to the metallic cable shield.

**Part V. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**820.133 Installation of Coaxial Cables and Equipment.**

Beyond the point of grounding, as defined in 820.93, the coaxial cable installation shall comply with 820.133(A) and (B).

**(A) Separation from Other Conductors.**

**(1) In Raceways, Cable Trays, Boxes, Enclosures, and Cable Routing Assemblies.**

1. *Other Circuits.* Coaxial cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with jacketed cables 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. Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770
4. Communications circuits in compliance with Parts I and IV of Article 805
5. Low-power network-powered broadband communications circuits in compliance with Parts I and V of Article 830

2. *Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm, and Medium-Power Network-Powered Broadband Communications Circuits.* Coaxial cable shall not be placed in any raceway, compartment, outlet box, junction box, or other enclosures with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits.

*Exception No. 1: Coaxial cable shall be permitted to be placed in any raceway, compartment, outlet box, junction box, or other enclosures with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits where 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 coaxial cables by a permanent barrier or listed divider.*

*Exception No. 2: Coaxial cable shall be permitted to be placed in outlet boxes, junction boxes, or similar fittings or compartments with power conductors where such conductors are introduced solely for power supply to the coaxial cable system distribution equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum 6 mm (¼ in.) separation from coaxial cables.*

**(2) Other Applications.**

Coaxial cable shall be separated 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.

*Exception No. 1: Separation shall not be required where either (1) all of the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits are in a raceway, or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC or Type UF cables, or (2) all of the coaxial cables are encased in a raceway.*

*Exception No. 2: Separation shall not be required where the coaxial cables are permanently separated from the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B) Support of Coaxial Cables.**

Raceways shall be used for their intended purpose. Coaxial cables shall not be strapped, taped, or attached by any means to the exterior of any conduit or raceway as a means of support.

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

**820.154 Substitutions of Listed CATV Cables.**

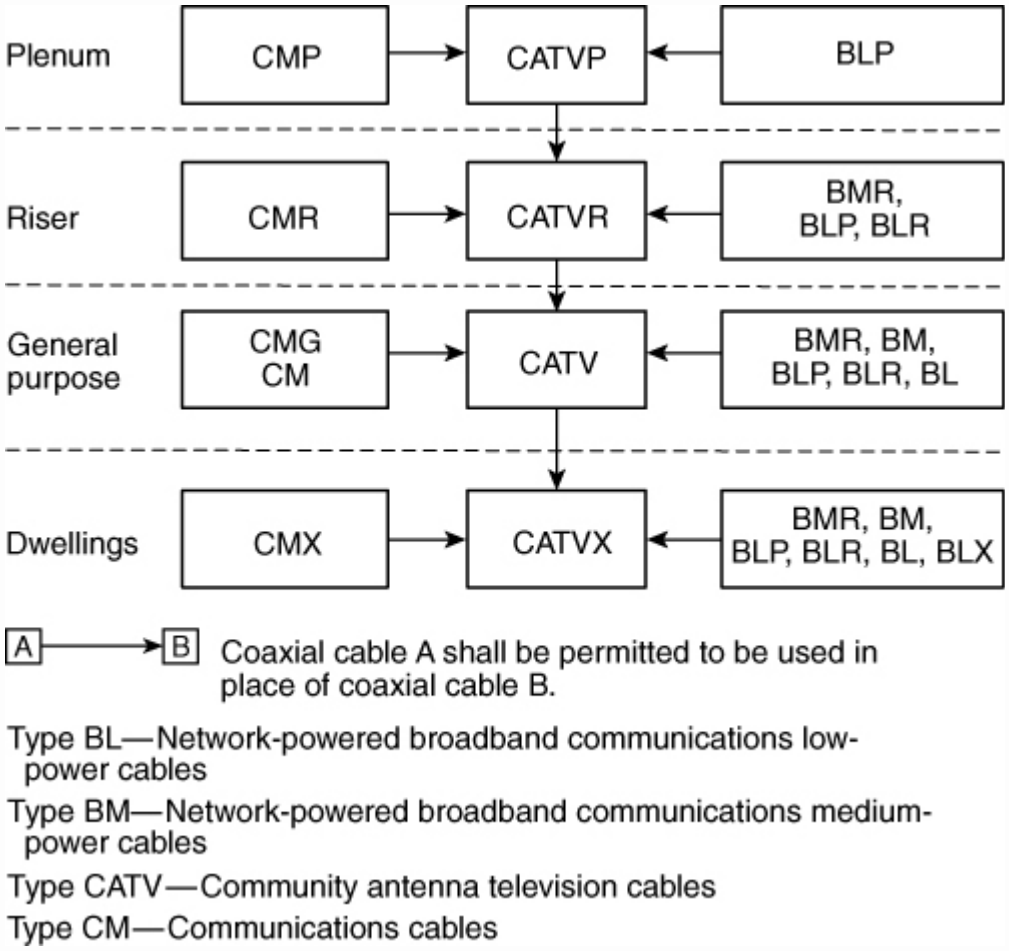
The substitutions for coaxial cables in Table 820.154 and illustrated in Figure 820.154 shall be permitted.

Informational Note: The substitute cables in Table 820.154 and Figure 820.154 are only coaxial-type cables.

**Table 820.154 Coaxial Cable Uses and Permitted Substitutions**

| Cable Type | Permitted Substitutions |
|---|---|
| CATVP | CMP, BLP |
| CATVR | CATVP, CMP, CMR, BMR, BLP, BLR |
| CATV | CATVP, CMP, CATVR, CMR, CMG, CM, BMR, BM, BLP, BLR, BL |
| CATVX | CATVP, CMP, CATVR, CMR, CATV, CMG, CM, BMR, BM, BLP, BLR, BL, BLX |

**Figure 820.154 Cable Substitution Hierarchy.**




## Part VI. Listing Requirements

### 820.179 Coaxial Cables.

Cables shall be listed in accordance with 820.179(A)and marked in accordance with Table 820.179 and 820.179(B). The cable voltage rating shall not be marked on the cable.

Informational Note: Voltage markings on cables could 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.*

**(A) General Requirements.**

The general requirements in 800.179 shall apply.

**(B) Optional Markings.**

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.

**Table 820.179 Coaxial Cable Markings**

| Cable Marking | Type |
|---|---|
| CATVP | CATV plenum cable |
| CATVR | CATV riser cable |
| CATV | CATV cable |
| CATVX | CATV cable, limited use |

# Article 830 Network-Powered Broadband Communications Systems

## Part I. General

### 830.1 Scope.

This article covers network-powered broadband communications systems that provide any combination of voice, audio, video, data, and interactive services through a network interface unit.

Informational Note: A typical basic system configuration includes a cable supplying power and broadband signal to a network interface unit that converts the broadband signal to the component signals. Typical cables are coaxial cable with both broadband signal and power on the center conductor, composite metallic cable with a coaxial member(s) or twisted pair members for the broadband signal and twisted pair members for power, and composite optical fiber cable with a pair of conductors for power. Larger systems may also include network components such as amplifiers that require network power.

### 830.2 Definitions.

The definitions in this section shall apply only within Article 830.

Informational Note: A typical single-family network-powered communications circuit consists of a communications drop or communications service cable and an NIU and includes the communications utility's serving terminal or tap where it is not under the exclusive control of the communications utility.

**Fault Protection Device.**

An electronic device that is intended for the protection of personnel and functions under fault conditions, such as network-powered broadband communications cable short or open circuit, to limit the current or voltage, or both, for a low-power network-powered broadband communications circuit and provide acceptable protection from electric shock.

**Network Interface Unit (NIU).**

A device that converts a broadband signal into component voice, audio, video, data, and interactive services signals and provides isolation between the network power and the premises signal circuits. These devices often contain primary and secondary protectors.

**Network-Powered Broadband Communications Circuit.**

The circuit extending from the communications utility's or service provider's serving terminal or tap up to and including the NIU.

Informational Note: A typical one-family dwelling network-powered communications circuit consists of a communications drop or communications service cable and an NIU and includes the communications utility's serving terminal or tap where it is not under the exclusive control of the communications utility.

### 830.3 Other Articles.

Circuits and equipment shall comply with 830.3(A) through (C).

**(A) General Requirements.**

The general requirements of Article 800 shall apply.

**(B) Output Circuits.**

As appropriate for the services provided, the output circuits derived from the network interface unit shall comply with the requirements of the following:

1. Installations of communications circuits — Part IV of Article 805
2. Installations of community antenna television and radio distribution circuits — Part V of Article 820

   *Exception: Where protection is provided in the output of the NIU 830.90(B)(3) shall apply.*
3. Installations of optical fiber cables — Part V of Article 770
4. Installations of Class 2 and Class 3 circuits — Part III of Article 725
5. Installations of power-limited fire alarm circuits — Part III of Article 760

**(C) Protection Against Physical Damage.**

The requirements of 300.4 shall apply.

**830.15 Power Limitations.**

Network-powered broadband communications systems shall be classified as having low- or medium-power sources as specified in 830.15(1) or (2).

1. Sources shall be classified as defined in Table 830.15.
2. Direct-current power sources exceeding 150 volts to ground, but no more than 200 volts to ground, with the current to ground limited to 10 mA dc, that meet the current and power limitation for medium-power sources in Table 830.15 shall be classified as medium-power sources.

Informational Note: One way to determine compliance with 830.15(2) is listed information technology equipment intended to supply power via a communications network that complies with the requirements for RFT-V circuits as defined in UL 60950-21-2007, *Standard for Safety for Information Technology Equipment — Safety — Part 21: Remote Power Feeding*.

**Table 830.15 Limitations for Network-Powered Broadband Communications Systems**

| Network Power Source | Low | Medium |
|---|---|---|
| Circuit voltage, $V_{max}$ (volts)[1] | 0–100 | 0–150 |
| Power limitation, $VA_{max}$ (volt-amperes)[1] | 250 | 250 |
| Current limitation, $I_{max}$ (amperes)[1] | $1000/V_{max}$ | $1000/V_{max}$ |
| Maximum power rating (volt-amperes) | 100 | 100 |
| Maximum voltage rating (volts) | 100 | 150 |
| Maximum overcurrent protection (amperes)[2] | $100/V_{max}$ | NA |

[1] $V_{max}$, $I_{max}$, and $VA_{max}$ are determined with the current-limiting impedance in the circuit (not bypassed) as follows:

$V_{max}$ — Maximum system voltage regardless of load with rated input applied.

$I_{max}$ — Maximum system current under any noncapacitive load, including short circuit, and with overcurrent protection bypassed if used. $I_{max}$ limits apply after 1 minute of operation.

$VA_{max}$ — Maximum volt-ampere output after 1 minute of operation regardless of load and overcurrent protection bypassed if used.

[2]Overcurrent protection is not required where the current-limiting device provides equivalent current limitation and the current-limiting device does not reset until power or the load is removed.

**830.24 Mechanical Execution of Work.**

The installation shall also conform to 300.4 and 300.11.

**Part II. Cables on the service provider side of the Communication Service Point~~Outside and Entering Buildings~~**

**830.40 Entrance Cables.**

Network-powered broadband communications cables located outside and entering buildings shall comply with 830.40(A) and (B).

**(A) Medium-Power Circuits.**

Medium-power network-powered broadband communications circuits located outside and entering buildings shall be installed using Type BMU, Type BM, or Type BMR network-powered broadband communications medium-power cables.

**(B) Low-Power Circuits.**

Low-power network-powered broadband communications circuits located outside and entering buildings shall be installed using Type BLU or Type BLX low-power network-powered broadband communications cables. Cables shown in Table 830.154 shall be permitted to substitute.

*Exception: Outdoor community antenna television and radio distribution system coaxial cables installed prior to January 1, 2000, and installed in accordance with Article 820, shall be permitted for low-power-type, network-powered broadband communications circuits.*

**830.44 Overhead (Aerial) Cables.**

Overhead (aerial) network-powered broadband communications cables shall comply with 830.44(A) through (F).

**(A) On Poles and In-Span or Above Roofs.**

Where network-powered broadband communications cables are installed on poles and in-span or above roofs, they shall comply with 800.44.

**(B) Clearance from Ground.**

Overhead (aerial) spans of network-powered broadband communications cables shall conform to not less than the following:

1. 2.9 m (9½ ft) — above finished grade, sidewalks, or from any platform or projection from which they might be reached and accessible to pedestrians only
2. 3.5 m (11½ ft) — over residential property and driveways, and those commercial areas not subject to truck traffic
3. 4.7 m (15½ ft) — over public streets, alleys, roads, parking areas subject to truck traffic, driveways on other than residential property, and other land traversed by vehicles such as cultivated, grazing, forest, and orchard

Informational Note: These clearances have been specifically chosen to correlate with ANSI/IEEE C2-2012, *National Electrical Safety Code*, Table 232-1, which provides for clearances of wires, conductors, and cables above ground and roadways, rather than using the clearances referenced in 225.18. Because Article 805 and Article 820 have had no required clearances, the communications industry has used the clearances from the NESC for their installed cable plant.

**(C) Over Pools.**

Clearance of network-powered broadband communications cable in any direction from the water level, edge of pool, base of diving platform, or anchored raft shall comply with those clearances in 680.9.

**(D) Final Spans.**

Final spans of network-powered broadband communications cables without an outer jacket shall be permitted to be attached to the building, but they shall be kept not less than 900 mm (3 ft) from windows that are designed to be opened, doors, porches, balconies, ladders, stairs, fire escapes, or similar locations.

*Exception: Conductors run above the top level of a window shall be permitted to be less than the 900-mm (3-ft) requirement above.*

Overhead (aerial) network-powered broadband communications cables shall not be installed beneath openings through which materials might be moved, such as openings in farm and commercial buildings, and shall not be installed where they obstruct entrance to these building openings.

**(E) Between Buildings.**

Network-powered broadband communications cables extending between buildings or structures, and also the supports or attachment fixtures, shall be identified as suitable for outdoor aerial applications and shall have sufficient strength to withstand the loads to which they may be subjected.

*Exception: Where a network-powered broadband communications cable does not have sufficient strength to be self-supporting, it shall be attached to a supporting messenger cable that, together with the attachment fixtures or supports, shall be acceptable for the purpose and shall have sufficient strength to withstand the loads to which they may be subjected.*

**(F) On Buildings.**

Where attached to buildings, network-powered broadband communications cables shall be securely fastened in such a manner that they are separated from other conductors in accordance with 830.44(F)(1) through (F)(3).

**(1) Electric Light or Power.**

The network-powered broadband communications cable shall have a separation of at least 100 mm (4 in.) from electric light, power, Class 1, or non-power-limited fire alarm circuit conductors not in raceway or cable, or be permanently separated from conductors of the other system by a continuous and firmly fixed nonconductor in addition to the insulation on the wires.

**(2) Other Communications Systems.**

Network-powered broadband communications cables shall be installed so that there will be no unnecessary interference in the maintenance of the separate systems. In no case shall the conductors, cables, messenger strand, or equipment of one system cause abrasion to the conductors, cables, messenger strand, or equipment of any other system.

**(3) Protection from Damage.**

Network-powered broadband communications cables attached to buildings or structures and located within 2.5 m (8 ft) of finished grade shall be protected by enclosures, raceways, or other approved means.

*Exception: A low-power network-powered broadband communications circuit that is equipped with a listed fault protection device, appropriate to the network-powered broadband communications cable used, and located on the network side of the network-powered broadband communications cable shall not be required to be additionally protected by enclosures, raceways, or other approved means.*

**830.47 Underground Network-Powered Broadband Communications Cables Entering Buildings.**

Underground network-powered broadband communications cables entering buildings shall comply with 830.47(A) through 830.47(D).

**(A) Underground Systems with Electric Light and Power, Class 1, or Non–Power-Limited Fire Alarm Circuit Conductors.**

Underground network-powered broadband communications cables in a duct, pedestal, handhole enclosure, or manhole that contains electric light, power conductors, non–power-limited fire alarm circuit

conductors, or Class 1 circuits shall be in a section permanently separated from such conductors by means of a suitable barrier.

**(B) Direct-Buried Cables and Raceways.**

Direct-buried network-powered broadband communications cables shall be separated by at least 300 mm (12 in.) from conductors of any light, power, non–power-limited fire alarm circuit conductors or Class 1 circuit.

*Exception No. 1: Separation shall not be required where electric service conductors or network-powered broadband communications cables are installed in raceways or have metal cable armor.*

*Exception No. 2: Separation shall not be required where electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables; or the network-powered broadband communications cables have metal cable armor or are installed in a raceway.*

**(C) Protection from Physical Damage.**

Direct-buried cable, conduit, or other raceways shall be installed to meet the minimum cover requirements of Table 830.47(C). In addition, direct-buried cables emerging from the ground shall be protected by enclosures, raceways, or other approved means extending from the minimum cover distance required by Table 830.47(C) below grade 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. Types BMU and BLU direct-buried cables emerging from the ground shall be installed in rigid metal conduit (RMC), intermediate metal conduit (IMC), rigid nonmetallic conduit, or other approved means extending from the minimum cover distance required by Table 830.47(C) below grade to the point of entrance.

*Exception: A low-power network-powered broadband communications circuit that is equipped with a listed fault protection device, appropriate to the network-powered broadband communications cable used, and located on the network side of the network-powered broadband communications cable being protected.*

**Table 830.47(C) Network-Powered Broadband Communications Systems Minimum Cover Requirements (*Cover* is the shortest distance measured between a point on the top surface of any direct-buried cable, conduit, or other raceway and the top surface of finished grade, concrete, or similar cover.)**

| Location of Wiring Method or Circuit | Direct Burial Cables | | Rigid Metal Conduit (RMC) or Intermediate Metal Conduit (IMC) | | Nonmetallic Raceways Listed for Direct Burial; Without Concrete Encasement or Other Approved Raceways | |
|---|---|---|---|---|---|---|
| | mm | in. | mm | in. | mm | in. |
| All locations not specified below | 450 | 18 | 150 | 6 | 300 | 12 |
| In trench below 50-mm (2-in.) thick concrete or equivalent | 300 | 12 | 150 | 6 | 150 | 6 |
| Under a building (in raceway only) | 0 | 0 | 0 | 0 | 0 | 0 |
| Under minimum of 100-mm (4-in.) thick concrete exterior slab with no vehicular traffic and the slab extending not less than 150 mm (6 in.) beyond the underground installation | 300 | 12 | 100 | 4 | 100 | 4 |

| Location of Wiring Method or Circuit | Direct Burial Cables | | Rigid Metal Conduit (RMC) or Intermediate Metal Conduit (IMC) | | Nonmetallic Raceways Listed for Direct Burial; Without Concrete Encasement or Other Approved Raceways | |
|---|---|---|---|---|---|---|
| | mm | in. | mm | in. | mm | in. |
| One- and two-family dwelling driveways and outdoor parking areas and used only for dwelling-related purposes | 300 | 12 | 300 | 12 | 300 | 12 |

Notes:

1. Raceways approved for burial only where concrete encased shall require a concrete envelope not less than 50 mm (2 in.) thick.

2. Lesser depths shall be permitted where cables rise for terminations or splices or where access is otherwise required.

3. Where solid rock is encountered, all wiring shall be installed in 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.

4. Low-power network-powered broadband communications circuits using directly buried community antenna television and radio distribution system coaxial cables that were installed outside and entering buildings prior to January 1, 2000, in accordance with Article 820 shall be permitted where buried to a minimum depth of 300 mm (12 in.).

**(D) Pools.**

Cables located under the pool or within the area extending 1.5 m (5 ft) horizontally from the inside wall of the pool shall meet those clearances and requirements specified in 680.11.

**Part III. Protection**

**830.90 Primary Electrical Protection.**

**(A) Application.**

Primary electrical protection shall be provided on all network-powered broadband communications conductors that are neither grounded nor interrupted and are run partly or entirely in aerial cable not confined within a block. Also, primary electrical protection shall be provided on all aerial or underground network-powered broadband communications conductors that are neither grounded nor interrupted and are located within the block containing the building served so as to be exposed to lightning or accidental contact with electric light or power conductors operating at over 300 volts to ground.

*Exception: Primary electrical protection shall not be required on the network-powered broadband communications conductors where electrical protection is provided on the derived circuit(s) (output side of the NIU) in accordance with 830.90(B)(3).*

Informational Note No. 1: On network-powered broadband communications conductors not exposed to lightning or accidental contact with power conductors, providing primary electrical protection in accordance with this article helps protect against other hazards, such as ground potential rise caused by power fault currents, and above-normal voltages induced by fault currents on power circuits in proximity to the network-powered broadband communications conductors.

Informational Note No. 2: Network-powered broadband communications circuits are considered to have a lightning exposure unless one or more of the following conditions exist:

1. Circuits in large metropolitan areas where buildings are close together and sufficiently high to intercept lightning.
2. Areas having an average of five or fewer thunderstorm days each year and earth resistivity of less than 100 ohm-meters. Such areas are found along the Pacific coast.

Informational Note No. 3: For information on lightning protection systems, see NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*.

**(1) Fuseless Primary Protectors.**

Fuseless-type primary protectors shall be permitted where power fault currents on all protected conductors in the cable are safely limited to a value no greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor.

**(2) Fused Primary Protectors.**

Where the requirements listed in 830.90(A)(1) are not met, fused-type primary protectors shall be used. Fused-type primary protectors shall consist of an arrester connected between each conductor to be protected and ground, a fuse in series with each conductor to be protected, and an appropriate mounting arrangement. Fused primary protector terminals shall be marked to indicate line, instrument, and ground, as applicable.

**(B) Location.**

The location of the primary protector, where required, shall comply with 830.90(B)(1), (B)(2), or (B)(3):

1. A listed primary protector shall be applied on each network-powered broadband communications cable external to and on the network side of the network interface unit.
2. The primary protector function shall be an integral part of and contained in the network interface unit. The network interface unit shall be listed as being suitable for application with network-powered broadband communications systems and shall have an external marking indicating that it contains primary electrical protection.
3. The primary protector(s) shall be provided on the derived circuit(s) (output side of the NIU), and the combination of the NIU and the protector(s) shall be listed as being suitable for application with network-powered broadband communications systems.

A primary protector, whether provided integrally or external to the network interface unit, shall be located as close as practicable to the point of entrance.

For purposes of this section, a network interface unit and any externally provided primary protectors located at mobile home service equipment located in sight from and not more than 9.0 m (30 ft) from the exterior wall of the mobile home it serves, or at a mobile home disconnecting means grounded in accordance with 250.32 and located in sight from and not more than 9.0 m (30 ft) from the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a network interface unit and primary protector location to achieve the shortest practicable primary protector bonding conductor or grounding electrode conductor helps limit potential differences between communications circuits and other metallic systems.

**(C) Hazardous (Classified) Locations.**

The primary protector or equipment providing the primary protection function shall not be located in any hazardous (classified) location as defined in 500.5 and 505.5 or in the vicinity of easily ignitible material.

*Exception: As permitted in 501.150, 502.150, and 503.150.*

**Part IV. Grounding Methods**

**830.93 Grounding or Interruption of Metallic Members of Network-Powered Broadband Communications Cables.**

Network-powered communications cables entering buildings or attaching to buildings shall comply with 830.93(A) or (B).

For purposes of this section, grounding located at mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a grounding location to achieve the shortest practicable bonding conductor or grounding electrode conductor helps limit potential differences between the network-powered broadband communications circuits and other metallic systems.

**(A) Entering Buildings.**

In installations where the network-powered communications cable enters the building, the shield shall be grounded in accordance with 800.100, and metallic members of the cable not used for communications or powering shall be grounded in accordance with 800.100 or interrupted by an insulating joint or equivalent device. The grounding or interruption shall be as close as practicable to the point of entrance.

**(B) Terminating Outside of the Building.**

In installations where the network-powered communications cable is terminated outside of the building, the shield shall be grounded in accordance with 800.100, and metallic members of the cable not used for communications or powering shall be grounded in accordance with 800.100 or interrupted by an insulating joint or equivalent device. The grounding or interruption shall be as close as practicable to the point of attachment of the NIU.

**Part V. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**830.133 Installation of Network-Powered Broadband Communications Cables and Equipment.**

Cable and equipment installations within buildings shall comply with 830.133(A) and (B), as applicable.

**(A) Separation of Conductors.**

**(1) In Raceways, Cable Trays, Boxes, Enclosures, and Cable Routing Assemblies.**

1. *Low- and Medium-Power Network-Powered Broadband Communications Circuit Cables.* Low- and medium-power network-powered broadband communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly.

2. *Low-Power Network-Powered Broadband Communications Circuit Cables with Other Circuits.* Low-power network-powered broadband communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with jacketed cables of any of the following circuits:

    1. Class 2 and Class 3 remote-control, signaling, and power-limited circuits in compliance with 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 IV of Article 805
    4. Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770
    5. Community antenna television and radio distribution systems in compliance with Parts I and V of Article 820

3. *Medium-Power Network-Powered Broadband Communications Circuit Cables with Optical Fiber Cables and Other Communications Cables*. Medium-power network-powered broadband communications cables shall not be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with conductors of any of the following circuits:

    1. Communications circuits in compliance with Parts I and IV of Article 805
    2. Conductive optical fiber cables in compliance with Parts I and V of Article 770
    3. Community antenna television and radio distribution systems in compliance with Parts I and V of Article 820

4. *Medium-Power Network-Powered Broadband Communications Circuit Cables with Other Circuits*. Medium-power network-powered broadband communications cables

shall not be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with conductors of any of the following circuits:

1. Class 2 and Class 3 remote-control, signaling, and power-limited circuits in compliance with Parts I and III of Article 725
2. Power-limited fire alarm systems in compliance with Parts I and III of Article 760

5. *Electric Light, Power, Class 1, Non–Powered Broadband Communications Circuit Cables.* Network-powered broadband communications cable shall not be placed in any raceway, cable tray, compartment, outlet box, junction box, or similar fittings with conductors of electric light, power, Class 1, or non–power-limited fire alarm circuit cables.

*Exception No. 1: Where all of the conductors of electric light, power, Class 1, non–power-limited fire alarm circuits are separated from all of the network-powered broadband communications cables by a permanent barrier or listed divider.*

*Exception No. 2: Power circuit conductors in outlet boxes, junction boxes, or similar fittings or compartments where such conductors are introduced solely for power supply to the network-powered broadband communications system distribution equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum 6 mm (¼ in.) separation from network-powered broadband communications cables.*

**(2) Other Applications.**

Network-powered broadband communications cable shall be separated at least 50 mm (2 in.) from conductors of any electric light, power, Class 1, and non–power-limited fire alarm circuits.

*Exception No. 1: Separation shall not be required where: (1) all of the conductors of electric light, power, Class 1, and non–power-limited fire alarm circuits are in a raceway, or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC, or Type UF cables, or (2) all of the network-powered broadband communications cables are encased in a raceway.*

*Exception No. 2: Separation shall not be required where the network-powered broadband communications cables are permanently separated from the conductors of electric light, power, Class 1, and non–power-limited fire alarm circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B) Support of Network-Powered Broadband Communications Cables.**

Raceways shall be used for their intended purpose. Network-powered broadband communications cables shall not be strapped, taped, or attached by any means to the exterior of any conduit or raceway as a means of support.

### 830.154 Substitutions of Network-Powered Broadband Communications System Cables.

The substitutions for network-powered broadband system cables listed in Table 830.154 shall be permitted.

**Table 830.154 Cable Substitutions**

| Cable Type | Permitted Cable Substitutions |
|---|---|
| BM | BMR |
| BLP | CMP, CL3P |
| BLR | CMP, CL3P, CMR, CL3R, BLP, BMR |
| BL | CMP, CMR, CM, CMG, CL3P, CL3R, CL3, BMR, BM, BLP, BLR |
| BLX | CMP, CMR, CM, CMG, CMX, CL3P, CL3R, CL3, CL3X, BMR, BM, BLP, BRP, BL |

### 830.160 Bends.

Bends in network broadband cable shall be made so as not to damage the cable.

## Part VI. Listing Requirements

### 830.179 Network-Powered Broadband Communications Equipment and Cables.

Network-powered broadband communications equipment and cables shall be listed and marked in accordance with 830.179(A) through (D).

*Exception No. 1: This listing requirement shall not apply to community antenna television and radio distribution system coaxial cables that were installed prior to January 1, 2000, in accordance with Article 820 and are used for low-power network-powered broadband communications circuits.*

*Exception No. 2: Substitute cables for network-powered broadband communications cables shall be permitted as shown in Table 830.154.*

**(A) General Requirements.**

The general requirements in 800.179 shall apply.

**(B) Network-Powered Broadband Communications Medium-Power Cables.**

Network-powered broadband communications medium-power cables shall be factory-assembled cables consisting of a jacketed coaxial cable, a jacketed combination of coaxial cable and multiple individual conductors, or a jacketed combination of an optical fiber cable and multiple individual conductors. The insulation for the individual conductors shall be rated for 300 volts minimum. Cables intended for outdoor use shall be listed as suitable for the application. Cables shall be marked in accordance with 310.8. Type BMU cables shall be jacketed and listed as being suitable for outdoor underground use.

**(C) Network-Powered Broadband Communication Low-Power Cables.**

Network-powered broadband communications low-power cables shall be factory-assembled cables consisting of a jacketed coaxial cable, a jacketed combination of coaxial cable and multiple individual conductors, or a jacketed combination of an optical fiber cable and multiple individual conductors. The insulation for the individual conductors shall be rated for 300 volts minimum. Cables intended for outdoor use shall be listed as suitable for the application. Cables shall be marked in accordance with 310.8. Type BLU cables shall be jacketed and listed as being suitable for outdoor underground use.

**(D) Optional Markings.**

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.

# Article 840 Premises-Powered Broadband Communications Systems

## Part I. General

### 840.1 Scope.

This article covers premises-powered broadband communications systems.

Informational Note: A typical basic system configuration consists of an optical fiber, twisted pair, or coaxial cable to the premises supplying a broadband signal to a network terminal that converts the broadband signal into component electrical signals, such as traditional telephone, video, high-speed Internet, and interactive services. Powering for the network terminal and network devices is typically accomplished through a premises power supply that might be built into the network terminal or provided as a separate unit. In order to provide communications in the event of a power interruption, a battery backup unit or an uninterruptible power supply (UPS) is typically part of the powering system.

### 840.2 Definitions.

The definitions in 805.2 and 820.2 shall apply. The definitions in this section shall apply only within Article 840.

**Broadband.**

Wide bandwidth data transmission that transports multiple signals, protocols, and traffic types over various media types.

**Network Terminal.**

A device that converts network-provided signals (optical, electrical, or wireless) into component signals, including voice, audio, video, data, wireless, optical, and interactive services, and is considered a network device on the premises that is connected to a communications service provider and is powered at the premises.

**Premises Communications Circuit.**

The circuit that extends voice, audio, video, data, interactive services, telegraph (except radio), and outside wiring for fire alarm and burglar alarm from the service provider's network terminal to the customer's communications equipment up to and including terminal equipment, such as a telephone, a fax machine, or an answering machine.

**Premises Community Antenna Television (CATV) Circuit.**

The circuit that extends community antenna television (CATV) systems for audio, video, data, and interactive services from the service provider's network terminal to the appropriate customer equipment.

**Premises-Powered.**

Using power provided locally from the premises.

### 840.3 Other Articles.

Circuits and equipment shall comply with 840.3(A) through (C).

**(A) General Requirements.**

The general requirements of Article 800 shall apply.

**(B) Output Circuits.**

As appropriate for the services provided, the output circuits derived from the network terminal shall comply with the requirements of the following:

1. Installations of communications circuits — Part IV of Article 805
2. Installations of premises (within buildings) community antenna television and radio distribution circuits — Part V of Article 820
3. Installations of optical fiber cables — Part V of Article 770
4. Installations of Class 2 and Class 3 circuits — Part III of Article 725

   Informational Note: See 725.121 for information on the classification of information technology equipment circuits.
5. Installations of power-limited fire alarm circuits — Part III of Article 760

**(C) Electrical Classification of Data Circuits and Cables.**

Sections 725.139(D)(1) and 805.133(A)(1)(b) shall apply to the electrical classification of Class 2 and Class 3 circuits in the same cable with communications circuits.

### 840.24 Mechanical Execution of Work.

The requirements of 770.24 and 800.24 shall apply.

### 840.25 Abandoned Cables.

The requirements of 770.25 and 800.25 shall apply.

### 840.26 Spread of Fire or Products of Combustion.

The requirements of 770.26 and 800.26 shall apply.

## Part II. Cables on the service provider side of the Communication Service Point ~~Outside and Entering Buildings~~

### 840.47 Underground Wires and Cables Entering Buildings.

Underground wires and cables entering buildings shall comply with 840.47(A) through (C).

**(A) Optical Fiber Cables.**

**(1) Class 1 or Non–Power-Limited Fire Alarm Circuits.**

Underground conductive optical fiber cables entering buildings with electric light, power, Class 1, or non–power-limited fire alarm circuit conductors in a raceway, handhole enclosure, or manhole shall be located in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier.

**(2) Direct-Buried Cables.**

Direct-buried conductive optical fiber cables shall be separated by at least 300 mm (12 in.) from conductors of any electric light, power, or non–power-limited fire alarm circuit conductors or Class 1 circuit.

*Exception No. 1: Separation shall not be required where the electric service conductors are installed in raceways or have metal cable armor.*

*Exception No. 2: Separation shall not be required where the electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables.*

**(3) Mechanical Protection.**

Direct-buried cable, conduit, or other raceway shall be installed to have a minimum cover of 150 mm (6 in.).

**(B) Communications Wires and Cables.**

Installations of communications wires and multipair communications cables shall comply with 805.47.

**(C) Coaxial Cables.**

Installations of coaxial cables shall comply with 820.47.

### 840.48 Unlisted Wires and Cables Entering Buildings.

Installations of unlisted cables entering buildings shall comply with 840.48(A), (B), or (C), as applicable.

**(A) Optical Fiber Cables.**

Installations of unlisted optical fiber cables entering buildings shall comply with 770.48.

**(B) Communications Wires and Cables.**

Installations of unlisted communications wires and unlisted multipair communications cables entering buildings shall comply with 805.48.

**(C) Coaxial Cables.**

Installations of unlisted coaxial cables entering buildings shall comply with 820.48.

## Part III. Protection

### 840.90 Protective Devices.

The requirements of 805.90 shall apply.

### 840.93 Grounding or Interruption.

Non–current-carrying metallic members of optical fiber cables, communications cables, or coaxial cables entering buildings or attaching to buildings shall comply with 840.93(A), (B), or (C), respectively.

### (A) Non–Current-Carrying Metallic Members of Optical Fiber Cables.

Non–current-carrying metallic members of optical fiber cables entering a building or terminating on the outside of a building shall comply with 770.93(A) or (B).

### (B) Communications Cables.

The grounding or interruption of the metallic sheath of communications cable shall comply with 805.93.

### (C) Coaxial Cables.

Where the network terminal is installed inside or outside of the building, with coaxial cables terminating at the network terminal, and is either entering, exiting, or attached to the outside of the building, 820.93 shall apply.

## 840.94 Premises Circuits Leaving the Building.

Where circuits leave the building to power equipment remote to the building or outside the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere, 805.90 and 805.93 shall apply.

Informational Note: See NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, for the theory of the term *rolling sphere*.

## Part IV. Grounding Methods

## 840.101 Premises Circuits Not Leaving the Building.

Where the network terminal is served by a nonconductive optical fiber cable, or where any non–current-carrying metallic member of a conductive optical fiber cable is interrupted by an insulating joint or equivalent device, and circuits that terminate at the network terminal are completely contained within the building (i.e., they do not exit the building), 840.101(A), (B), or (C) shall apply, as applicable.

### (A) Coaxial Cable Shield Grounding.

The shield of coaxial cable shall be grounded by one of the following:

1. Any of the methods described in 820.100 or 800.106
2. A fixed connection to an equipment grounding conductor as described in 250.118
3. Connection to the network terminal grounding terminal provided that the terminal is connected to ground by one of the methods described in 820.100 or 800.106, or to an equipment grounding conductor through a listed grounding device that will retain the ground connection if the network terminal is unplugged

### (B) Communications Circuit Grounding.

Communications circuits shall not be required to be grounded.

### (C) Network Terminal Grounding.

The network terminal shall not be required to be grounded unless required by its listing. If the coaxial cable shield is separately grounded as described in 840.101(A)(1) or 840.101(A)(2), the use of a cord and plug for the connection to the network terminal grounding connection shall be permitted.

Informational Note: Where required to be grounded, a listed device that extends the equipment grounding conductor from the receptacle to the network terminal equipment grounding terminal is permitted. Sizing of the extended equipment grounding conductor is covered in Table 250.122.

## 840.102 Premises Circuits Leaving the Building.

Where circuits leave the building to power equipment remote to the building or outside the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere, the installation of communications wires and cables shall comply with 800.100 and 800.106, and the installation of coaxial cables shall comply with 820.100 and 800.106.

Informational Note: See NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, for the application of the term *rolling sphere*.

## Part V. Wiring on the service provider side of the Communication Service Point ~~Installation Methods Within Buildings~~

### 840.133 Installation of Optical Fibers and Electrical Conductors.

The requirements of 770.133 shall apply.

## Part VI. Premises Powering of Communications Equipment over Communications Cables

### 840.160 Powering Circuits.

Communications cables listed in accordance with 805.179, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment listed in accordance with 805.170. The power source shall be listed in accordance with 840.170(G). Installation of the listed 4-pair communications cables for a communications circuit or installation where 4-pair communications cables are substituted for Class 2 and Class 3 cables in accordance with 725.154(A) shall comply with 725.144.

*Exception: Installing communications cables in compliance with 725.144 shall not be required for listed 4-pair communications cables where the rated current of the power source does not exceed 0.3 amperes in any conductor 24 AWG or larger.*

Informational Note: A typical communications cable for this application is a 4-pair cable sometimes referred to as Category 5e (or higher) LAN cable or balanced twisted pair cable. These types of cables are often used to provide Ethernet- and Power over Ethernet (PoE)–type services. A large number of such powering cables bundled together can cause overheating of the wiring if not controlled as described in Table 725.144.

## Part VII. Listing Requirements

### 840.170 Equipment and Cables.

Premises-powered broadband communications systems equipment and cables shall comply with 840.170(A) through (H).

#### (A) Network Terminal.

The network terminal and applicable grounding means shall be listed for application with premises-powered broadband communications systems.

Informational Note No. 1: One way to determine applicable requirements is to refer to ANSI/UL 60950-1-2014, *Standard for Safety of Information Technology Equipment*; ANSI/UL 498A-2015, *Current Taps and Adapters*; ANSI/UL 467-2013, *Grounding and Bonding Equipment;* or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements*.

Informational Note No. 2: There are no requirements on the network terminal and its grounding methodologies except for those covered by the listing of the product.

#### (B) Optical Fiber Cables.

Optical fiber cables shall be listed in accordance with 770.179(A) through (D) and shall be marked in accordance with Table 770.179.

#### (C) Communications Equipment.

Communications equipment shall be listed in accordance with 805.170.

#### (D) Cable Routing Assemblies and Communications Raceways.

Cable routing assemblies and communications raceways shall be listed in accordance with 800.182.

#### (E) Premises Communications Wires and Cables.

Communications wires and cable shall be listed and marked in accordance with 805.179.

#### (F) Premises Community Antenna Television (CATV) Circuits.

Premises community antenna television (CATV) coaxial cables connecting to the network terminal shall be listed in accordance with 820.179. Applicable grounding means shall be listed for application with premises-powered broadband communications systems.

#### (G) Power Source.

The power source for circuits intended to provide power over communications cables to remote equipment shall be limited in accordance with Table 11(B) in Chapter 9 for voltage sources up to 60 V dc and be listed as specified in either of the following:

1. A power source shall be listed as specified in 725.121(A)(1), (A)(2), (A)(3), or (A)(4). The power sources shall not have the output connections paralleled or otherwise interconnected unless listed for such interconnection.
2. A power source shall be listed as communications equipment for limited-power circuits.

Informational Note: One way to determine applicable requirements is to refer to ANSI/UL 60950-1-2014, *Standard for Safety of Information Technology Equipment-Safety — Part 1*; or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements*. Typically, such circuits are used to interconnect equipment for the purpose of exchanging information (data).

**(H) Accessory Equipment.**

Communications accessory equipment and/or assemblies shall be listed for application with premises-powered communications systems.

Informational Note: One way to determine applicable requirements is to refer to ANSI/UL 1863-2004, *Communications-Circuit Accessories*.

# Public Input No. 3233-NFPA 70-2020 [ Part V. ]

**Part V.** ~~– Installation Methods Within Buildings~~ Wiring on the Customer Side of the Communication Service Point

## Additional Proposed Changes

| File Name | Description | Approved |
|---|---|---|
| Chapter_8_-_2020-09-03_CC_Task_Group.pdf | | |

## Statement of Problem and Substantiation for Public Input

This public input is being submitted by a Correlating Committee Task Group to improve the correlation between Chapter 7 and 8. At the present time there are significant correlation issues with regards to what constitutes an installation in Chapter 7 and what constitutes an installation in Chapter 8.

Previously a Correlating Committee Task Group was formed to review Chapter 8 and to make suggested modifications. This Chapter 8 task group has submitted a public input to define Communication Service point and has submitted a public input to determine where the actual service point exists within communication systems. It is very difficult for an AHJ to determine where there inspection authority begins and this work will help provide clarity and usability.

This public input follows up on the work of that specific task group and provides editorial revisions to further improve on that work. Public inputs are being submitted to change Titles and certain wording to reflect what wiring is on the customer side of the Communication Service Point and what wiring is on the communication utility or service provider side of this point.

The Correlating Committee Task Group is a long range planning committee that is seeking to make improvement over the next two to three cycles. The Task Group is made up of the following members: Alan Manche, Donny Cook, Randy Ivans, Ernie Gallo, and Thomas Domitrovich.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 3223-NFPA 70-2020 [Sections Part IV., 805.133] | |
| Public Input No. 3224-NFPA 70-2020 [Sections 800.27, Part II., 800.44] | |
| Public Input No. 3225-NFPA 70-2020 [Part IV.] | |
| Public Input No. 3226-NFPA 70-2020 [Section No. 800.154] | |
| Public Input No. 3227-NFPA 70-2020 [Part II.] | |
| Public Input No. 3229-NFPA 70-2020 [Part V.] | |
| Public Input No. 3230-NFPA 70-2020 [Part II.] | |
| Public Input No. 3231-NFPA 70-2020 [Sections Part V., 830.133] | |
| Public Input No. 3232-NFPA 70-2020 [Sections Part II., 840.47, 840.48, Part III.] | |
| Public Input No. 3223-NFPA 70-2020 [Sections Part IV., 805.133] | |
| Public Input No. 3224-NFPA 70-2020 [Sections 800.27, Part II., 800.44] | |
| Public Input No. 3226-NFPA 70-2020 [Section No. 800.154] | |
| Public Input No. 3227-NFPA 70-2020 [Part II.] | |

Public Input No. 3230-NFPA 70-2020 [Part II.]

Public Input No. 3232-NFPA 70-2020 [Sections Part II., 840.47, 840.48, Part III.]

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## Chapter 8 Communications Systems

# Article 800 General Requirements for Communications Systems

### Part I. General

#### 800.1 Scope.

This article covers general requirements for communications systems. These general requirements apply to communications circuits, community antenna television and radio distribution systems, network-powered broadband communications systems, and premises-powered broadband communications systems, unless modified by Articles 805, 820, 830, or 840.

Informational Note No. 1: See 90.2(B)(4) for installations of circuits and equipment that are not covered.

Informational Note No. 2: For further information for remote control, signaling, and power-limited circuits, see Article 725.

Informational Note No. 3: For further information for fire alarm systems, see Article 760.

#### 800.2 Definitions.

The definitions in Part I of Article 100 shall apply throughout Chapter 8. The definitions in 800.2 shall apply only within Chapter 8.

**Abandoned Cable.**

Cable that is not terminated at equipment or is not identified for future use with a tag.

**Block.**

A square or portion of a city, town, or village enclosed by streets and including the alleys so enclosed, but not any street.

**Cable Sheath.**

A covering over the conductor assembly that may include one or more metallic members, strength members, or jackets.

**Communications Circuit.**

The circuit that extends service from the communications utility or service provider up to and including the customer's communications equipment.

**Communications Service Provider.**

An organization, business, or individual that offers communications service to others.

**Exposed (to Accidental Contact).**

A circuit in such a position that, in case of failure of supports or insulation, contact with another circuit may result.

Informational Note: See Part I of Article 100 for two other definitions of Exposed: *Exposed (as applied to live parts)* and *Exposed (as applied to wiring methods)*.

**Point of Entrance.**

The point within a building at which the wire or cable emerges from an external wall or from a concrete floor slab.

**Premises.**

The land and buildings of a user located on the user side of the utility-user ~~network point of demarcation~~.

#### 800.3 Other Articles.

Only those sections of Chapters 1 through 7 referenced in Chapter 8 shall apply to Chapter 8.

**(A) Hazardous (Classified) Locations.**

Circuits and equipment installed in a location that is classified in accordance with 500.5 and 505.5 shall comply with the applicable requirements of Chapter 5.

**(B) Wiring in Ducts for Dust, Loose Stock, or Vapor Removal.**

The requirements of 300.22(A) shall apply.

**(C) Equipment in Other Space Used for Environmental Air.**

The requirements of 300.22(C)(3) shall apply.

**(D) Installation and Use.**

The requirements of 110.3(B) shall apply.

**(E) Optical Fiber Cable.**

Where optical fiber cable is used to provide a communications circuit within a building, Article 770 shall apply.

**(F) Other Communications Systems.**

As appropriate for the system involved, communications systems shall also comply with the requirements of the following:

1. Communications circuits — Article 805
2. Radio and television equipment — Article 810
3. Community antenna television and radio distribution systems — Article 820
4. Network-powered broadband communications systems — Article 830
5. Premises-powered broadband communications systems — Article 840

**(G) Reconditioned Equipment.**

The requirements of 110.21(A)(2) shall apply.

### 800.21 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.

### 800.24 Mechanical Execution of Work.

Circuits and equipment 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 also conform to 300.4 and 300.11. 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 805.170(C).

Informational Note No. 1: Accepted industry practices are described in ANSI/TIA-568.1- D-2015, *Commercial Building Telecommunications Infrastructure Standard;* ANSI/TIA-569-D-2015, *Telecommunications Pathways and Spaces;* ANSI/TIA-570-C-2012, *Residential Telecommunications Infrastructure Standard;* ANSI/TIA-1005-A-2012, *Telecommunications Infrastructure Standard for Industrial Premises;* ANSI/ TIA-1179-2010, *Healthcare Facility Telecommunications Infrastructure Standard;* ANSI/TIA-4966-2014, *Telecommunications Infrastructure Standard for Educational Facilities;* and other ANSI-approved installation standards.

Informational Note No. 2: 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. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of wire and cable properties.

### 800.25 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.

### 800.26 Spread of Fire or Products of Combustion.

Installations of cables, communications raceways, cable routing assemblies 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 penetrations of cables, communications raceways, and cable routing assemblies 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 800.26 can be found in building codes, fire resistance directories, and product listings.

### 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.

## Part II. Wires and Cables Outside and on the service provider side of the Communication Service Point ~~Entering Buildings~~

### 800.44 Overhead (Aerial) Wires and Cables.

Overhead (aerial) wires and cables on the service provider side of the Communication Service Point ~~entering buildings~~ shall comply with 800.44(A) through (D).

Informational Note: For additional information regarding overhead (aerial) wires and cables, see ANSI C2-2017, *National Electrical Safety Code, Part 2 Safety Rules for Overhead Lines.*

#### (A) On Poles and In-Span.

Where wires and cables and electric light or power conductors are supported by the same pole or are run parallel to each other in-span, the conditions described in 800.44(A)(1) through (A)(4) shall be met.

#### (1) Relative Location.

Where practicable, the wires and cables shall be located below the electric light or power conductors.

#### (2) Attachment to Cross-Arms.

Wires and cables shall not be attached to a cross-arm that carries electric light or power conductors.

#### (3) Climbing Space.

The climbing space through wires and cables shall comply with the requirements of 225.14(D).

#### (4) Clearance.

Supply service drops and sets of overhead service conductors of 0 volts to 750 volts running above and parallel to communications and CATV type coaxial service drops shall have a minimum separation of 300 mm (12 in.) at any point in the span, including the point of and at their attachment to the building, provided that the ungrounded conductors are insulated and that a clearance of not less than 1.0 m (40 in.) is maintained between the two services at the pole.

#### (B) Above Roofs.

Communications wires and cables and CATV type coaxial cables shall have a vertical clearance of not less than 2.5 m (8 ft) from all points of roofs above which they pass.

*Exception No. 1: Communications wires and cables and CATV type coaxial cables shall not be required to have a vertical clearance of not less than 2.5 m (8 ft) above auxiliary buildings, such as garages and the like.*

*Exception No. 2: A reduction in clearance above only the overhanging portion of the roof to not less than 450 mm (18 in.) shall be permitted if (1) not more than 1.2 m (4 ft) of communications service-drop conductors pass above the roof overhang and (2) they are terminated at a through- or above-the-roof raceway or approved support.*

*Exception No. 3: Where the roof has a slope of not less than 100 mm in 300 mm (4 in. in 12 in.), a reduction in clearance to not less than 900 mm (3 ft) shall be permitted.*

Informational Note: For additional information regarding overhead (aerial) wires and cables, see ANSI/IEEE C2-2017, *National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines*.

**(C) On Masts.**

Overhead (aerial) communications and CATV type coaxial cables shall be permitted to be attached to an above-the-roof raceway mast that does not enclose or support conductors of electric light or power circuits.

**(D) Between Buildings.**

Communications and CATV type coaxial cables extending between buildings or structures, and also the supports or attachment fixtures, shall be identified and shall have sufficient strength to withstand the loads to which they might be subjected.

*Exception: Where a coaxial cable does not have sufficient strength to be self-supporting, it shall be attached to a supporting messenger cable that, together with the attachment fixtures or supports, shall be acceptable for the purpose and shall have sufficient strength to withstand the loads to which they may be subjected.*

**800.48 Communication Service Point.** The Communication Service Point shall be at a readily accessible location either outside or inside of a building or structure near to the point of entrance of the conductors in accordance with the one or more of the following:

1. The point of connection at which the communication service provider's network (outside plant) transitions to the premises wiring. The location of this point shall not be located further than 50 feet from the point of entrance.

2. The point of connection in an individual dwelling shall be located so as not to exceed 24 inches from the primary protector on the premises side of the protector.

3. A physical protection point or communications cable exiting the connection enclosure on the individual building side of the enclosure.

4. The point of connection at the Grounding Block, where required.

5. The point where a wireless signal transitions from the antenna or dish through a wired connection to transmitting or receiving equipment. The location of this point shall be permitted to include the ground connection at the antenna discharge unit or coaxial cable connection to the transmitting/receiving station (see 810.21).

6. The point of connection between nonconductive optical fiber cable entering the building and premises optical fiber cable inside the building not to exceed 50 feet from the point of entrance.

7. The Communication Service Point shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC), Electrical metallic tubing (EMT), intermediate metal conduit (IMC), or Rigid polyvinyl chloride conduit (PVC) to the point of emergence (see 770.48, 805.48, 820.48 and 830.48).

Informational Note: The transition and connection points listed above may be co-located. For example, a primary protector may be located inside a network interface unit (item 3) with a connection to an adjacent grounding block (Item 4) within 24 inches, and a connection to the premise wiring (item 2).

### 800.49 Metal Entrance Conduit Grounding.

Metal conduit containing entrance wire or cable shall be connected by a bonding conductor or grounding electrode conductor to a grounding electrode or, where present, the building grounding electrode system in accordance with 800.100(B).

### 800.53 Separation from Lightning Conductors.

Where practicable, a separation of at least 1.8 m (6 ft) shall be maintained between lightning conductors and all communication wires and cables and CATV type coaxial cables on buildings.

Informational Note No. 1: For additional information regarding overhead (aerial) wires and cables, see ANSI C2-2017 *National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines*.

Informational Note No. 2: Specific separation distances may be calculated from the sideflash equation in NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems.*

## Part III. Grounding Methods

### 800.100 Cable and Primary Protector Bonding and Grounding.

#### (A) Bonding Conductor or Grounding Electrode Conductor.

#### (1) Insulation.

The bonding conductor or grounding electrode conductor shall be listed and shall be permitted to be insulated, covered, or bare.

#### (2) Material.

The bonding conductor or grounding electrode conductor shall be copper or other corrosion-resistant conductive material, stranded or solid.

#### (3) Size.

The bonding conductor or grounding electrode conductor shall not be smaller than 14 AWG. The bonding conductor or grounding electrode conductor shall have a current-carrying capacity not less than the grounded metallic cable sheath member of the communications cable, the protected conductor of the communications cable, or the outer sheath of the coaxial cable, as applicable. The bonding conductor or grounding electrode conductor shall not be required to exceed 6 AWG.

#### (4) Length.

The bonding conductor or grounding electrode conductor shall be as short as practicable. In one- and two-family dwellings, the bonding conductor or grounding electrode conductor shall be as short as practicable, not to exceed 6.0 m (20 ft) in length.

Informational Note: Similar bonding conductor or grounding electrode conductor length limitations applied at apartment buildings and commercial buildings help to reduce voltages that may be developed between the building's power and communications systems during lightning events.

*Exception: In one- and two-family dwellings where it is not practicable to achieve an overall maximum bonding conductor or grounding electrode conductor length of 6.0 m (20 ft), a separate ground rod meeting the minimum dimensional criteria of 800.100(B)(3)(2) or (B)(3)(3) shall be driven, the bonding conductor or grounding electrode conductor shall be connected to the ground rod in accordance with 800.100(C), and the ground rod shall be connected to the power grounding electrode system in accordance with 800.100(D).*

#### (5) Run in Straight Line.

The bonding conductor or grounding electrode conductor shall be run in as straight a line as practicable.

#### (6) Physical Protection.

Bonding conductors and grounding electrode conductors shall be protected where exposed to physical damage. Where the bonding conductor or grounding electrode conductor is installed in a metal raceway, both ends of the raceway shall be bonded to the contained conductor or to the same terminal or electrode to which the bonding conductor or grounding electrode conductor is connected.

**(B) Electrode.**

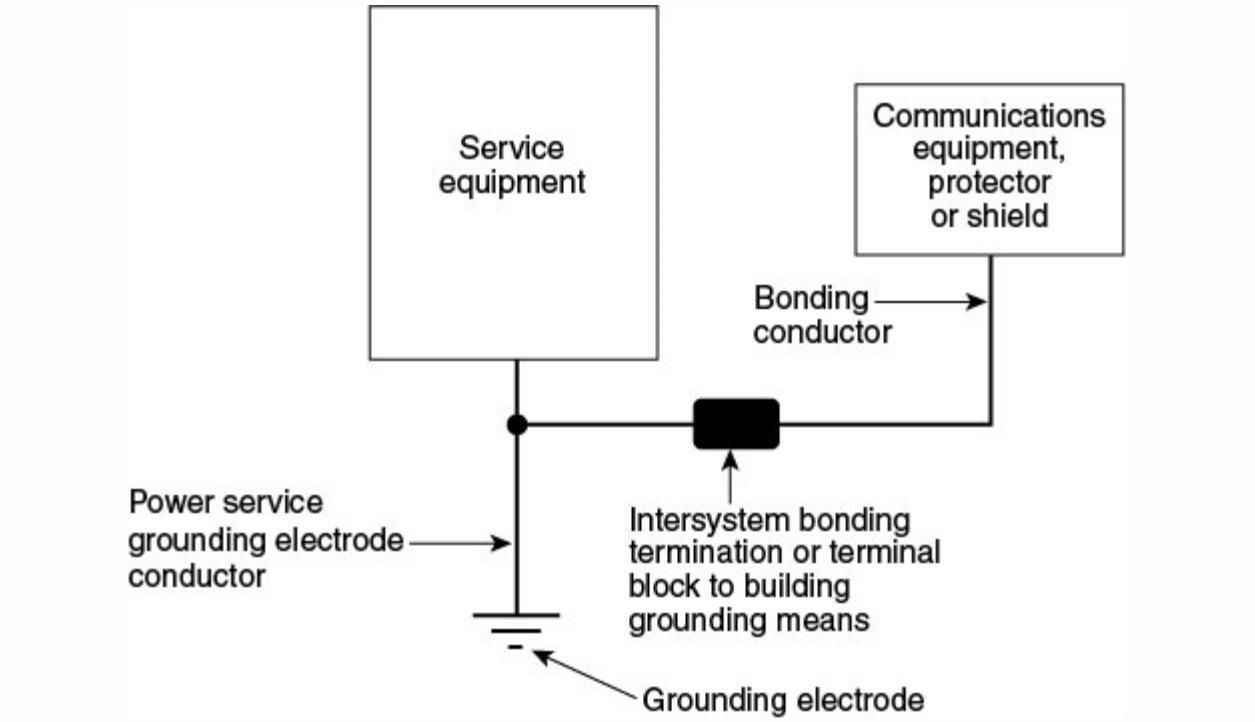
The bonding conductor or grounding electrode conductor shall be connected in accordance with 800.100(B)(1), (B)(2) , or (B)(3).

**(1) In Buildings or Structures with an Intersystem Bonding Termination.**

If the building or structure served has an intersystem bonding termination as required by 250.94, the bonding conductor shall be connected to the intersystem bonding termination.

Informational Note: Informational Note Figure 800.100(B)(1) illustrates the connection of the bonding conductor in buildings or structures equipped with an intersystem bonding termination or a terminal block providing access to the building grounding means.

**Figure Informational Note Figure 800.100(B)(1) Illustration of a Bonding Conductor in a Communications Installation.**




**(2) In Buildings or Structures with Grounding Means.**

If an intersystem bonding termination is established, 250.94(A) shall apply. If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on one of the following:

1. The building or structure grounding electrode system as covered in 250.50
2. The grounded interior metal water piping system, within 1.5 m (5 ft) from its point of entrance to the building, as covered in 250.52
3. The power service accessible means external to enclosures using the options identified in 250.94(A), Exception
4. The nonflexible metal power service raceway
5. The service equipment enclosure

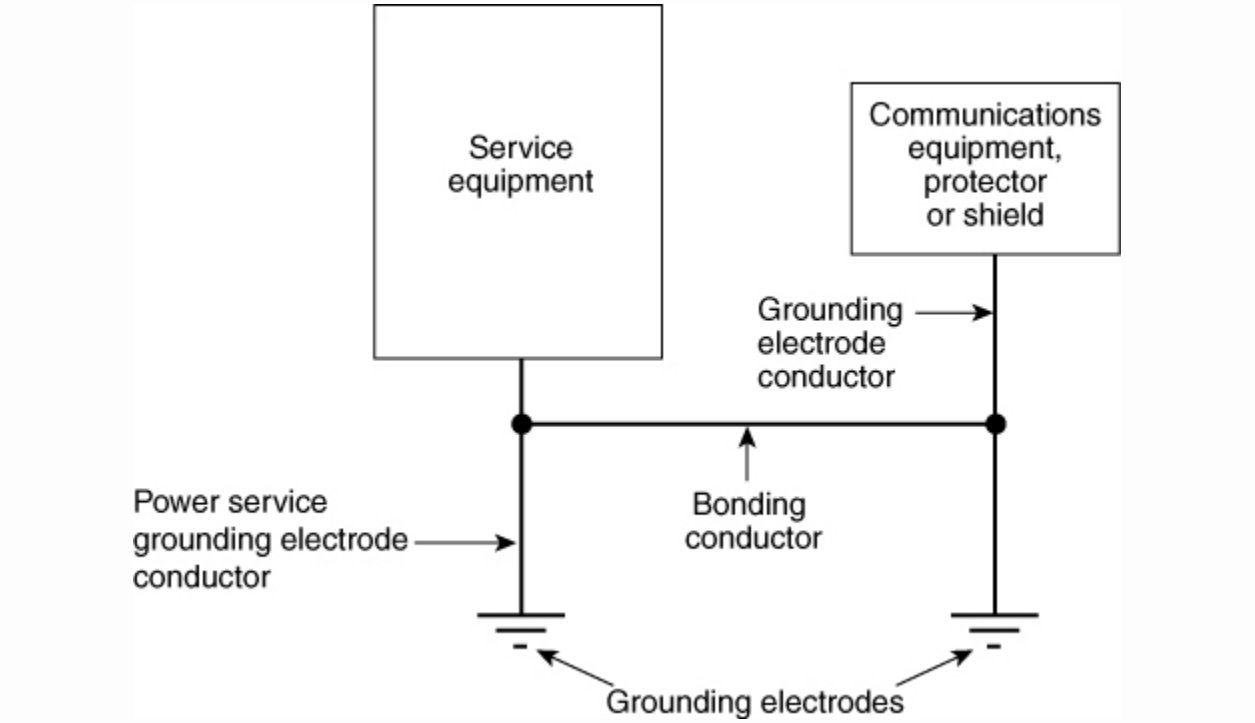
6. The grounding electrode conductor or the grounding electrode conductor metal enclosure of the power service
7. The grounding electrode conductor or the grounding electrode of a building or structure disconnecting means that is connected to a grounding electrode as covered in 250.32

A bonding device intended to provide a termination point for the bonding conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on nonremovable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is nonremovable.

For purposes of this section, the mobile home service equipment or the mobile home disconnecting means located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means connected to an electrode by a grounding electrode conductor in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Informational Note Figure 800.100(B)(2) illustrates the connection of the bonding conductor in buildings or structures not equipped with an intersystem bonding termination or a terminal block providing access to the building grounding means.

**Figure Informational Note Figure 800.100(B)(2) Illustration of a Grounding Electrode Conductor and a Bonding Conductor in a Communications Installation.**




**(3) In Buildings or Structures Without an Intersystem Bonding Termination or Grounding Means.**

If the building or structure served has no intersystem bonding termination or grounding means, as described in 800.100(B)(2), the grounding electrode conductor shall be connected to one of the following:

1. To any one of the individual grounding electrodes described in 250.52(A)(1), (A)(2), (A)(3), or (A)(4)
2. If the building or structure served has no intersystem bonding termination or grounding means, as described in 800.100(B)(2) or (B)(3)(1), to any one of the individual grounding electrodes described in 250.52(A)(5), (A)(7), and (A)(8)

3. For communications circuits covered in Article 805 or network-powered broadband communications systems covered in Article 830, to a ground rod or pipe not less than 1.5 m (5 ft) in length and 12.7 mm (0.5 in.) in diameter, driven, where practicable, into permanently damp earth and separated from lightning protection system conductors, as covered in 800.53, and at least 1.8 m (6 ft) from electrodes of other systems

Steam pipes, hot water pipes, or lightning protection system conductors shall not be employed as grounding electrodes for protectors and grounded metallic members.

**(C) Electrode Connection.**

Connections to grounding electrodes shall comply with 250.70.

**(D) Bonding of Electrodes.**

A bonding jumper not smaller than 6 AWG copper or equivalent shall be connected between the grounding electrode and power grounding electrode system at the building or structure served where separate electrodes are used.

*Exception: At mobile homes as covered in 800.106.*

Informational Note No. 1: See 250.60 for connection to a lightning protection system.

Informational Note No. 2: Bonding together of all separate electrodes limits potential differences between them and between their associated wiring systems.

**800.106 Primary Protector Grounding and Bonding at Mobile Homes.**

**(A) Grounding.**

Grounding shall comply with 800.106(A)(1) and (A)(2).

**(1) Mobile Home Service Equipment.**

Where there is no mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, grounding shall comply with one of the following:

1. The primary protector grounding terminal; the coaxial cable shield ground, or surge arrester grounding terminal; or the network-powered broadband communications cable shield, network-powered broadband communications cable metallic members not used for communications or powering, and network interface unit shall be connected to a grounding electrode conductor or grounding electrode in accordance with 800.100(B)(3).
2. The non-current-carrying metallic members of optical fiber cables shall be connected to a grounding electrode in accordance with 770.106(A)(1). The network terminal, if required to be grounded, shall be connected to a grounding electrode in accordance with 800.106(A)(1)(1). The grounding electrode shall be bonded in accordance with 770.106(B).

**(2) Mobile Home Feeder Disconnecting Means.**

Where there is no mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, grounding shall comply with one of the following:

1. The primary protector grounding terminal; the network-powered broadband communications cable shield, network-powered broadband communications cable metallic members not used for communications or powering, and network interface unit shall be connected to a grounding electrode in accordance with 800.100(B)(3).
2. The non-current-carrying metallic members of optical fiber cables shall be connected to a grounding electrode in accordance with 770.106(A)(2). The network terminal, if required to be grounded, shall be connected to a grounding electrode in accordance with 800.106(A)(2). The grounding electrode shall be bonded in accordance with 770.106(B).

**(B) Bonding.**

The primary protector grounding terminal or grounding electrode, network-powered broadband communications cable grounding terminal, or network interface unit grounding terminal shall be bonded together and connected to the metal frame or available grounding terminal of the mobile home with a copper conductor not smaller than 12 AWG under either of the following conditions:

1. Where there is no mobile home service equipment or disconnecting means as in 800.106(A)
2. Where the mobile home is supplied by cord and plug

**Part IV. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**800.110 Raceways, Cable Routing Assemblies, and Cable Trays.**

**(A) Types of Raceways.**

Wires and cables shall be permitted to be installed in raceways that comply with either 800.110(A)(1) or (A)(2). Medium-power network-powered broadband communications cables shall not be permitted to be installed in raceways that comply with 800.110(A)(2).

**(1) Raceways Recognized in Chapter 3.**

Wires and 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.**

Wires and 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.

**(3) Innerduct for Communications Wires and Cables, Coaxial Cables, or Network-Powered Broadband Communications Cables.**

Listed plenum communications raceways, listed riser communications raceways, and listed general-purpose communications raceways 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.**

The raceway fill requirements of Chapters 3 and 9 shall apply to medium-power network-powered broadband communications cables.

**(C) Cable Routing Assemblies.**

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)(1) and (C)(2) and 800.113.

**(1) Horizontal Support.**

Cable routing assemblies shall be supported where run horizontally at intervals not to exceed 900 mm (3 ft) and at each end or joint, unless listed for other support intervals. In no case shall the distance between supports exceed 3 m (10 ft).

**(2) Vertical Support.**

Vertical runs of cable routing assemblies shall be supported at intervals not exceeding 1.2 m (4 ft), unless listed for other support intervals, and shall not have more than one joint between supports.

**(D) Cable Trays.**

Wires and cables and communications raceways shall be permitted to be installed in metal or listed nonmetallic cable tray systems. Ladder cable trays shall be permitted to support cable routing assemblies.

## 800.113 Installation of Wires, Cables, Cable Routing Assemblies, and Communications Raceways.

Installation of wires, cables, cable routing assemblies, and communications raceways shall comply with 800.113(A) through (L). Installation of cable routing assemblies and communications raceways shall comply also with 800.110.

**(A) Listing.**

Wires, cables, cable routing assemblies, and communications raceways installed in buildings shall be listed.

*Exception: Cables installed in compliance with 805.48 or 820.48 shall not be required to be listed.*

**(B) Ducts Specifically Fabricated for Environmental Air.**

The following wires and 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. Plenum cables up to 1.22 m (4 ft) in length
2. Plenum cables, riser cables, general-purpose cables, and limited-use 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 NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

**(C) Other Spaces Used for Environmental Air (Plenums).**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted in other spaces used for environmental air as described in 300.22(C):

1. Plenum cables
2. Plenum communications raceways
3. Plenum cable routing assemblies
4. Plenum cables installed in plenum communications raceways
5. Plenum cables installed in plenum cable routing assemblies
6. Plenum cables and plenum communications raceways supported by open metal cable tray systems
7. Plenum cables, riser cables, general-purpose cables, limited-use cables, and communications wires installed in raceways that are installed in compliance with 300.22(C)
8. Plenum cables, riser cables, general-purpose cables, limited-use cables, 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)
9. Plenum cables, riser cables, general-purpose cables, and limited-use 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, see NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

**(D) Risers — Cables, Cable Routing Assemblies, and Communications Raceways in Vertical Runs.**

The following cables, cable routing assemblies, and communications raceways shall be permitted in vertical runs penetrating one or more floors and in vertical runs in a shaft:

1. Plenum and riser cables
2. Plenum and riser communications raceways
3. Plenum and riser cable routing assemblies
4. Plenum and riser cables installed in:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) Plenum cable routing assemblies
    d) Riser cable routing assemblies

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**(E) Risers — Cables and Innerducts in Metal Raceways.**

The following cables and innerducts shall be permitted in metal raceways in a riser having firestops at each floor:

1. Plenum cables, riser cables, general-purpose cables, and limited-use cables
2. Plenum, riser, and general-purpose communications raceways
3. Plenum cables, riser cables, general-purpose cables, and limited-use cables installed in:
    a) Plenum communications raceways (innerduct)
    b) Riser communications raceways (innerduct)
    c) General-purpose communications raceways (innerduct)

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**(F) Risers — Cables, Cable Routing Assemblies, and Communications Raceways in Fireproof Shafts.**

The following cables, cable routing assemblies, and communications raceways shall be permitted to be installed in fireproof riser shafts having firestops at each floor:

1. Plenum cables, riser cables, general-purpose cables, and limited-use cables
2. Plenum, riser, and general-purpose communications raceways
3. Plenum, riser, and general-purpose cable routing assemblies
4. Plenum cables, riser cables, general-purpose cables, and limited-use cables installed in:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
    d) Plenum cable routing assemblies
    e) Riser cable routing assemblies
    f) General-purpose cable routing assemblies

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**(G) Risers — One- and Two-Family Dwellings.**

The following cables, cable routing assemblies, and communications raceways shall be permitted in one- and two-family dwellings:

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables less than 6 mm (0.25 in.) in diameter
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Plenum cables, riser cables, and general-purpose cables installed in:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
    d) Plenum cable routing assemblies
    e) Riser cable routing assemblies
    f) General-purpose cable routing assemblies

**(H) Cable Trays.**

The following wires, cables, and communications raceways shall be permitted to be supported by cable trays:

1. Plenum cables, riser cables, and general-purpose cables
2. Plenum, riser, and general-purpose communications raceways
3. Communications wires, plenum cables, riser cables, and general-purpose cables installed in:
    1. Plenum communications raceways
    2. Riser communications raceways
    3. General-purpose communications raceways

**(I) Distributing Frames and Cross-Connect Arrays.**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in distributing frames and cross-connect arrays:

1. Plenum cables, riser cables, general-purpose cables, and communications wires
2. Plenum, riser, and general-purpose communications raceways
3. Plenum, riser, and general-purpose cable routing assemblies
4. Communications wires, plenum cables, riser cables, and general-purpose cables installed in:
    1. Plenum communications raceways
    2. Riser communications raceways
    3. General-purpose communications raceways
    4. Plenum cable routing assemblies
    5. Riser cable routing assemblies
    6. General-purpose cable routing assemblies

**(J) Other Building Locations.**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in building locations other than the locations covered in 800.113(B) through (I):

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables with a maximum of 3 m (10 ft) of exposed length in nonconcealed spaces
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
6. Plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum cable routing assemblies
    b) Riser cable routing assemblies
    c) General-purpose cable routing assemblies
7. Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3
8. Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks

**(K) Multifamily Dwellings.**

The following cables, cable routing assemblies, and communications raceways shall be permitted to be installed in multifamily dwellings in locations other than the locations covered in 800.113(B) through (G):

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables less than 6 mm (0.25 in.) in diameter in nonconcealed spaces
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
6. Plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum cable routing assemblies
    b) Riser cable routing assemblies
    c) General-purpose cable routing assemblies
7. Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3
8. Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks

**(L) One- and Two-Family Dwellings.**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in one- and two-family dwellings in locations other than the locations covered in 800.113(B) through (F):

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables less than 6 mm (0.25 in.) in diameter
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:
   a) Plenum communications raceways
   b) Riser communications raceways
   c) General-purpose communications raceways
6. Plenum cables, riser cables, and general-purpose cables installed in the following
   a) Plenum cable routing assemblies
   b) Riser cable routing assemblies
   c) General-purpose cable routing assemblies
7. Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3
8. Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks
9. Hybrid power and communications cable listed in accordance with 805.179(F)

**800.154 Applications of Listed Communications Wires, Cables, and Raceways, and Listed Cable Routing Assemblies.**

Permitted and nonpermitted applications of listed communications wires, cables, coaxial cables, network-powered broadband communications system cables and raceways, and listed cable routing assemblies, shall be in accordance with one of the following:

1. Listed communications wires and cables as indicated in Table 800.154(a)
2. Listed communications raceways as indicated in Table 800.154(b)
3. Listed cable routing assemblies as indicated in Table 800.154(c)

The permitted applications shall be subject to the installation requirements of 800.110 and 800.113.

**Table 800.154(a) Applications of Listed Communications Wires, Cables, and Network-Powered Broadband Communications System Cables on the customer side of the Communication Service Point ~~Buildings~~**

| Applications | | Wire and Cable Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BMU, BLU | Hybrid Power and Communications Cables | Communications Wires |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | Y | N | N | N | N | N | N | N | N | N |
| | In metal raceway that complies with 300.22(B) | Y | Y | Y | Y | Y | Y | N | N | N | Y |

| Applications | | Wire and Cable Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BMU, BLU | Hybrid Power and Communications Cables | Communications Wires |
| In other spaces used for environmental air (plenums) as described in 300.22(C) | In other spaces used for environmental air | Y | N | N | N | N | N | N | N | N | N |
| | In metal raceway that complies with 300.22(C) | Y | Y | Y | Y | Y | Y | N | N | N | Y |
| | In plenum communications raceways | Y | N | N | N | N | N | N | N | N | N |
| | In plenum cable routing assemblies | Y | N | N | N | N | N | N | N | N | N |
| | Supported by open metal cable trays | Y | N | N | N | N | N | N | N | N | N |
| | Supported by solid bottom metal cable trays with solid metal covers | Y | Y | Y | Y | Y | Y | N | N | N | N |
| In risers | In vertical runs | Y | Y | Y | N | N | N | N | N | N | N |
| | In metal raceways | Y | Y | Y | Y | Y | Y | N | N | N | N |
| | In fireproof shafts | Y | Y | Y | Y | Y | Y | N | N | N | N |
| | In plenum communications raceways | Y | Y | N | N | N | N | N | N | N | N |
| | In plenum cable routing assemblies | Y | Y | N | N | N | N | N | N | N | N |
| | In riser communications raceways | Y | Y | N | N | N | N | N | N | N | N |
| | In riser cable routing assemblies | Y | Y | N | N | N | N | N | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y | Y | Y | Y | N | N | Y | N |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y | Y | Y | Y | N | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y | Y | Y | Y | Y | N | Y | N |
| | In multifamily dwellings | Y | Y | Y | Y | Y | Y | Y | N | N | N |
| | In nonconcealed spaces | Y | Y | Y | Y | Y | Y | Y | N | N | N |
| | Supported by cable trays | Y | Y | Y | Y | Y | N | N | N | N | N |
| | Under carpet, modular flooring, and planks | N | N | N | N | N | N | Y | N | N | N |
| | In distributing frames and cross-connect arrays | Y | Y | N | Y | N | N | N | N | N | Y |
| | In rigid metal conduit (RMC) and intermediate metal conduit (IMC) | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |

| Applications | | Wire and Cable Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BMU, BLU | Hybrid Power and Communications Cables | Communications Wires |
| | In any raceway recognized in Chapter 3 | Y | Y | Y | Y | Y | Y | N | N | N | Y |
| | In plenum communications raceways | Y | Y | N | Y | N | N | N | N | N | Y |
| | In plenum cable routing assemblies | Y | Y | N | Y | N | N | N | N | N | Y |
| | In riser communications raceways | Y | Y | N | Y | N | N | N | N | N | Y |
| | In riser cable routing assemblies | Y | Y | N | Y | N | N | N | N | N | Y |
| | In general-purpose communications raceways | Y | Y | N | Y | N | N | N | N | N | Y |
| | In general-purpose cable routing assemblies | Y | Y | N | Y | N | N | N | N | N | Y |

Note: An "N" in the table indicates that the cable type shall not be permitted to be installed in the application. A "Y" indicates that the cable type shall be permitted to be installed in the application subject to the limitations described in 800.113. The Riser column includes all riser cables except BMR, and the General-Purpose column includes all general-purpose cables except BM.
Informational Note No. 1: Part IV of Article 800 covers wiring on the customer side of the communication service point ~~installation methods within buildings~~. This table covers the applications of listed communications wires, cables, and raceways ~~in buildings~~. See the definition of *Point of Entrance* in 800.2.

Informational Note No. 2: For information on the restrictions to the installation of communications cables in fabricated ducts, see 800.113(B).

### Table 800.154(b) Applications of Listed Communications Raceways on the customer side of the Communication Service Point~~in Buildings~~

| Applications | | Listed Communications Raceway Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | N | N | N |
| | In metal raceway that complies with 300.22(B) | N | N | N |
| In other spaces used for environmental air (plenums) 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 cable routing assemblies | N | 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 cable routing assemblies | N | N | N |
| | In riser cable routing assemblies | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y |
| | In one- and two-family dwellings | Y | Y | Y |
| | In multifamily dwellings | Y | Y | Y |

| Applications | | Listed Communications Raceway Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| | In nonconcealed spaces | Y | Y | Y |
| | Supported by cable trays | Y | Y | Y |
| | Under carpet, modular flooring, and planks | N | N | N |
| | In distributing frames and cross-connect arrays | Y | Y | Y |
| | In any raceway recognized in Chapter 3 | Y | Y | Y |
| | In plenum cable routing assemblies | N | N | N |
| | In riser cable routing assemblies | N | N | N |
| | In general-purpose cable routing assemblies | N | N | N |

Note: An “N” in the table indicates that the communications raceway type shall not be permitted to be installed in the application. A “Y” indicates that the communications raceway type shall be permitted to be installed in the application, subject to the limitations described in 800.110 and 800.113.

## Table 800.154(c) Applications of Listed Cable Routing Assemblies in Buildings

| Applications | | Listed Cable Routing Assembly Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | N | N | N |
| | In metal raceway that complies with 300.22(B) | N | N | N |
| In other spaces used for environmental air (plenums) 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) | N | N | N |
| | In plenum communications raceways | N | N | N |
| | Supported by open metal cable trays | Y | N | N |
| | Supported by solid bottom metal cable trays with solid metal covers | N | N | N |
| In risers | In vertical runs | Y | Y | N |
| | In metal raceways | N | N | N |
| | In fireproof shafts | Y | Y | Y |
| | In plenum communications raceways | N | N | N |
| | In riser communications raceways | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y |
| | In one- and two-family dwellings | Y | Y | Y |
| | In multifamily dwellings | Y | Y | Y |
| | In nonconcealed spaces | Y | Y | Y |
| | Supported by cable trays | Y | Y | Y |
| | Under carpet, modular flooring, and planks | N | N | N |
| | In distributing frames and cross-connect arrays | Y | Y | Y |
| | In any raceway recognized in Chapter 3 | N | N | N |
| | In plenum communications raceways | N | N | N |
| | In riser communications raceways | N | N | N |
| | In general-purpose communications raceways | N | N | N |

Note: An “N” in the table indicates that the cable routing assembly type shall not be permitted to be installed in the application. A “Y” indicates that the cable routing assembly type shall be permitted to be installed in the application subject to the limitations described in 800.113.

### 800.179 Plenum, Riser, General-Purpose, and Limited Use Cables.

Plenum, riser, general-purpose, and limited-use cables shall be listed in accordance with 800.179(A) through (D) and shall have a temperature rating of not less than 60°C (140°F). The temperature rating shall be marked on the jacket of cables that have a temperature rating exceeding 60°C (140°F). The cable voltage rating shall not be marked on the cable.

#### (A) Plenum Cables.

Type CMP communications plenum cables, Type CATVP community antenna television plenum coaxial cables, and Type BLP network-powered broadband communication low-power plenum cables shall be listed as being suitable for use in ducts, plenums, and other spaces 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*.

#### (B) Riser Cables.

Type CMR communications riser cables, Type CATVR community antenna television riser coaxial cables, Type BMR network-powered broadband communications medium-power riser cables, and Type BLR network-powered broadband communications low-power riser cables 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 1666-2011, *Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts.*

#### (C) General-Purpose Cables.

Type CM communications general-purpose cables, Type CATV community antenna television coaxial general-purpose cables, Type BM network-powered broadband communications medium-power general-purpose cables, and Type BL network-powered broadband communications low-power general-purpose cables shall be listed as being suitable for general-purpose use, with the exception of risers and plenums, 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 Flame Tray 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. 0.3-09, *Test Methods for Electrical Wires and Cables*.

#### (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 VW-1 (vertical-wire) flame test in ANSI/UL 1581-2017, *Reference Standard for Electrical Wires, Cables and Flexible Cords*.

## Part V. Listing Requirements

### 800.180 Grounding Devices.

Where bonding or grounding is required, devices used to connect a shield, a sheath, or non-current-carrying metallic members of a cable to a bonding conductor or grounding electrode conductor shall be listed or be part of listed equipment.

### 800.182 Cable Routing Assemblies and Communications Raceways.

Cable routing assemblies and communications raceways shall be listed in accordance with 800.182(A) through (C). Cable routing assemblies shall be marked in accordance with Table 800.182(a). Communications raceways shall be marked in accordance with Table 800.182(b).

Informational Note: For information on listing requirements for both communications raceways and cable routing assemblies, see ANSI/UL 2024-5-2015, *Cable Routing Assemblies and Communications Raceways*.

**Table 800.182(a) Cable Routing Assembly Markings**

| Type | Marking |
|---|---|
| Plenum Cable Routing Assembly | Plenum Cable Routing Assembly |
| Riser Cable Routing Assembly | Riser Cable Routing Assembly |
| General-Purpose Cable Routing Assembly | General-Purpose Cable Routing Assembly |

**Table 800.182(b) Communications Raceway Markings**

| Type | Marking |
|---|---|
| Plenum Communications Raceway | Plenum Communications Raceway |
| Riser Communications Raceway | Riser Communications Raceway |
| General-Purpose Communications Raceway | General-Purpose Communications Raceway |

### (A) Plenum Cable Routing Assemblies and Plenum Communications Raceways.

Plenum cable routing assemblies and plenum communications raceways shall be listed as having adequate fire-resistant and low-smoke-producing characteristics.

Informational Note No. 1: One method of defining cable routing assemblies and communications raceways that have adequate fire-resistant and low-smoke-producing characteristics is that they exhibit a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84-15a, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or ANSI/UL 723-2013, *Standard Test Method for Surface Burning Characteristics of Building Materials*.

Informational Note No. 2: Another method of defining communications raceways that have adequate fire-resistant and low-smoke-producing characteristics is that they exhibit 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 262-2015, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces*.

Informational Note No. 3: See 4.3.11.2.6 or 4.3.11.5.5 of NFPA 90A-2015, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, for information on materials exposed to the airflow in ceiling cavity and raised floor plenums.

### (B) Riser Cable Routing Assemblies and Riser Communications Raceways.

Riser cable routing assemblies and riser communications raceways shall be listed as having adequate 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 cable routing assemblies and communications raceways pass the requirements of ANSI/UL 1666-2011, *Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts*.

### (C) General-Purpose Cable Routing Assemblies and General-Purpose Communications Raceways.

General-purpose cable routing assemblies and general-purpose communications raceways shall 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 cable routing assemblies and communications raceways do not spread fire to the top of the tray in the “UL Flame Exposure, Vertical Flame Tray Test” in ANSI/UL 1685-2011, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*.

## Article 805 Communications Circuits

### Part I. General

### 805.1 Scope.

This article covers communications circuits and equipment.

**805.2 Definitions.**

The definitions in this section shall apply only within Articles 805 and 840.

**Cable.**

A factory assembly of two or more conductors having an overall covering.

**Communications Circuit Integrity (CI) Cable.**

Cable used in communications systems to ensure continued operation of critical circuits during a specified time under fire conditions.

**Wire.**

A factory assembly of one or more insulated conductors without an overall covering.

**805.18 Installation of Equipment.**

Equipment electrically connected to a communications network shall be listed in accordance with 805.170.

*Exception: This listing requirement shall not apply to test equipment that is intended for temporary connection to a telecommunications network by qualified persons during the course of installation, maintenance, or repair of telecommunications equipment or systems.*

**Part II. Wires and Cables Outside and on the service provider side of the Communication Service Point ~~Entering Buildings~~**

**805.47 Underground Communications Wires and Cables ~~Entering Buildings~~.**

Underground communications wires and cables ~~entering buildings~~ shall comply with 805.47(A) and (B). The requirements of 310.10(C) shall not apply to communications wires and cables.

**(A) Underground Systems with Electric Light, Power, Class 1, or Non-Power-Limited Fire Alarm Circuit Conductors.**

Underground communications wires and cables in a raceway, handhole enclosure, or manhole containing electric light, power, Class 1, or non-power-limited fire alarm circuit conductors shall be in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier.

**(B) Underground Block Distribution.**

Where the entire street circuit is run underground and the circuit within the block is placed so as to be free from the likelihood of accidental contact with electric light or power circuits of over 300 volts to ground, the insulation requirements of 805.50(A) and 805.50(C) shall not apply, insulating supports shall not be required for the conductors, and bushings shall not be required where the conductors enter the building.

**805.48 Unlisted Cables on the service provider side of the Communication Service Point ~~Entering Buildings~~.**

Unlisted outside plant communications cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated in an enclosure or on a listed primary protector. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) to the point of emergence.

Informational Note No. 1: Splice cases or terminal boxes, both metallic and plastic types, are typically used as enclosures for splicing or terminating telephone cables.

Informational Note No. 2: This section limits the length of unlisted outside plant cable to 15 m (50 ft), while 805.90(B) requires that the primary protector be located as close as practicable to the point at which the cable enters the building. Therefore, in installations requiring a primary protector, the outside plant cable may not be permitted to extend 15 m (50 ft) into the building if it is practicable to place the primary protector closer than 15 m (50 ft) to the point of entrance.

### 805.50 Circuits Requiring Primary Protectors.

Circuits that require primary protectors as provided in 805.90 shall comply with 805.50(A),805.50(B), and 805.50(C).

#### (A) Insulation, Wires, and Cables.

Communications wires and cables without a metallic shield, running from the last outdoor support to the primary protector, shall be listed in accordance with 805.173.

#### (B) On Buildings.

Communications wires and cables in accordance with 805.50(A) shall be separated at least 100 mm (4 in.) from electric light or power conductors not in a raceway or cable or be permanently separated from conductors of the other systems by a continuous and firmly fixed nonconductor in addition to the insulation on the wires, such as porcelain tubes or flexible tubing. Communications wires and cables in accordance with 805.50(A) exposed to accidental contact with electric light and power conductors operating at over 300 volts to ground and attached to buildings shall be separated from woodwork by being supported on glass, porcelain, or other insulating material.

*Exception: Separation from woodwork shall not be required where fuses are omitted as provided for in 805.90(A)(1), or where conductors are used to extend circuits to a building from a cable having a grounded metal sheath.*

#### (C) Entering Buildings.

Where a primary protector is installed inside the building, the communications wires and cables shall enter the building either through a noncombustible, nonabsorbent insulating bushing or through a metal raceway. The insulating bushing shall not be required where the entering communications wires and cables (1) are in metal-sheathed cable, (2) pass through masonry, (3) meet the requirements of 805.50(A) and fuses are omitted as provided in 805.90(A)(1), or (4) meet the requirements of 805.50(A) and are used to extend circuits to a building from a cable having a grounded metallic sheath. Raceways or bushings shall slope upward from the outside or, where this cannot be done, drip loops shall be formed in the communications wires and cables immediately before they enter the building.

Raceways shall be equipped with an approved service head. More than one communications wire and cable shall be permitted to enter through a single raceway or bushing. Conduits or other metal raceways located ahead of the primary protector shall be grounded.

## Part III. Protection

### 805.90 Protective Devices.

#### (A) Application.

A listed primary protector shall be provided on each circuit run partly or entirely in aerial wire or aerial cable not confined within a block. Also, a listed primary protector shall be provided on each circuit, aerial or underground, located within the block containing the building served so as to be exposed to accidental contact with electric light or power conductors operating at over 300 volts to ground. In addition, where there exists a lightning exposure, each interbuilding circuit on a premises shall be protected by a listed primary protector at each end of the interbuilding circuit. Installation of primary protectors shall also comply with 110.3(B).

Informational Note No. 1: On a circuit not exposed to accidental contact with power conductors, providing a listed primary protector in accordance with this article helps protect against other hazards, such as lightning and above-normal voltages induced by fault currents on power circuits in proximity to the communications circuit.

Informational Note No. 2: Interbuilding circuits are considered to have a lightning exposure unless one or more of the following conditions exist:

1. Circuits in large metropolitan areas where buildings are close together and sufficiently high to intercept lightning.
2. Interbuilding cable runs of 42 m (140 ft) or less, directly buried or in underground conduit, where a continuous metallic cable shield or a continuous metal conduit containing the cable is connected to each building grounding electrode system.

3. Areas having an average of five or fewer thunderstorm days per year and earth resistivity of less than 100 ohm-meters. Such areas are found along the Pacific coast.

Informational Note No. 3: For information on lightning protection systems, see NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems.*

**(1) Fuseless Primary Protectors.**

Fuseless-type primary protectors shall be permitted under any of the conditions given in 805.90(A)(1)(a) through (A)(1)(e).

(a) Where conductors enter a building through a cable with grounded metallic sheath member(s) and where the conductors in the cable safely fuse on all currents greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor

(b) Where insulated conductors in accordance with 805.50(A) are used to extend circuits to a building from a cable with an effectively grounded metallic sheath member(s) and where the conductors in the cable or cable stub, or the connections between the insulated conductors and the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground, safely fuse on all currents greater than the current-carrying capacity of the primary protector, or the associated insulated conductors and of the primary protector bonding conductor or grounding electrode conductor

(c) Where insulated conductors in accordance with 805.50(A) or (B) are used to extend circuits to a building from other than a cable with metallic sheath member(s), where (1) the primary protector is listed as being suitable for this purpose for application with circuits extending from other than a cable with metallic sheath members, and (2) the connections of the insulated conductors to the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground or the conductors of the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground safely fuse on all currents greater than the current-carrying capacity of the primary protector, or associated insulated conductors and of the primary protector bonding conductor or grounding electrode conductor

(d) Where insulated conductors in accordance with 805.50(A) are used to extend circuits aerially to a building from a buried or underground circuit that is unexposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground

(e) Where insulated conductors in accordance with 805.50(A) are used to extend circuits to a building from cable with an effectively grounded metallic sheath member(s), and where (1) the combination of the primary protector and insulated conductors is listed as being suitable for this purpose for application with circuits extending from a cable with an effectively grounded metallic sheath member(s), and (2) the insulated conductors safely fuse on all currents greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor

Informational Note: Section 9 of ANSI/IEEE C2-2012, *National Electrical Safety Code*, provides an example of methods of protective grounding that can achieve effective grounding of communications cable sheaths for cables from which communications circuits are extended.

**(2) Fused Primary Protectors.**

Where the requirements listed under 805.90(A)(1)(a) through (A)(1)(e) are not met, fused-type primary protectors shall be used. Fused-type primary protectors shall consist of an arrester connected between each line conductor and ground, a fuse in series with each line conductor, and an appropriate mounting arrangement. Primary protector terminals shall be marked to indicate line, instrument, and ground, as applicable.

**(B) Location.**

The primary protector shall be located in, on, or immediately adjacent to the structure or building served and as close as practicable to the point of entrance.

For purposes of this section, primary protectors located at mobile home service equipment within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means connected to an electrode by a grounding electrode conductor in accordance with 250.32 and located

within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a primary protector location to achieve the shortest practicable primary protector bonding conductor or grounding electrode conductor helps limit potential differences between communications circuits and other metallic systems.

**(C) Hazardous (Classified) Locations.**

The primary protector shall not be located in any hazardous (classified) locations, as defined in 500.5 and 505.5, or in the vicinity of easily ignitible material.

*Exception: As permitted in 501.150, 502.150, and 503.150.*

**(D) Secondary Protectors.**

Where a secondary protector is installed in series with the indoor communications wire and cable between the primary protector and the equipment, it shall be listed for the purpose in accordance with 805.170(B).

Informational Note: Secondary protectors on circuits exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground are not intended for use without primary protectors.

**805.93 Grounding, Bonding, or Interruption of Non–Current-Carrying Metallic Sheath Members of Communications Cables.**

Communications cables entering the building or terminating on the outside of the building shall comply with 805.93(A) or (B).

**(A) Entering Buildings.**

In installations where the communications cable enters a building, the metallic sheath members of the cable shall be grounded or bonded as specified in 800.100 or interrupted by an insulating joint or equivalent device. The grounding, bonding, or interruption shall be as close as practicable to the point of entrance.

**(B) Terminating on the Outside of Buildings.**

In installations where the communications cable is terminated on the outside of the building, the metallic sheath members of the cable shall be grounded or bonded as specified in 800.100 or interrupted by an insulating joint or equivalent device. The grounding, bonding, or interruption shall be as close as practicable to the point of termination of the cable.

**Part IV. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**805.133 Installation of Communications Wires, Cables, and Equipment.**

Communications wires and cables from the protector to the equipment or, where no protector is required, communications wires and cables attached to the outside or inside of the building shall comply with 805.133(A) and 805.133(B)

**(A) Separation from Other Conductors.**

**(1) In Raceways, Cable Trays, Boxes, Cables, Enclosures, and Cable Routing Assemblies.**

(a) *Other Circuits.* Communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with cables 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. Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770
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

(b) *Class 2 and Class 3 Circuits.* Class 1 circuits shall not be run in the same cable with communications circuits. Class 2 and Class 3 circuit conductors shall be permitted in the same listed communications cable with communications circuits.

(c) *Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm, and Medium-Power Network-Powered Broadband Communications Circuits in Raceways, Compartments, and Boxes.* Communications conductors shall not be placed in any raceway, compartment, outlet box, junction box, or similar fitting with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits.

*Exception No. 1: Section 805.133(A)(1)(c) shall not apply if 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 conductors of communications circuits by a permanent barrier or listed divider.*

*Exception No. 2: Power conductors in outlet boxes, junction boxes, or similar fittings or compartments where such conductors are introduced solely for power supply to communications equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum of 6 mm (¼ in.) separation from the communications circuit conductors.*

*Exception No. 3: As permitted by 620.36.*

**(2) Other Applications.**

Communications wires and cables shall be separated 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.

*Exception No. 1: Section 805.133(A)(2) shall not apply where either (1) all of the conductors of the electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits are in a raceway or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC, or Type UF cables, or (2) all of the conductors of communications circuits are encased in raceway.*

*Exception No. 2: Section 805.133(A)(2) shall not apply where the communications wires and cables are permanently separated from the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B) Support of Communications Wires and Cables.**

Raceways shall be used for their intended purpose. Communications wires and cables shall not be strapped, taped, or attached by any means to the exterior of any raceway as a means of support.

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

**805.154 Substitutions of Listed Communications Wires, Cables, and Raceways, and Listed Cable Routing Assemblies.**

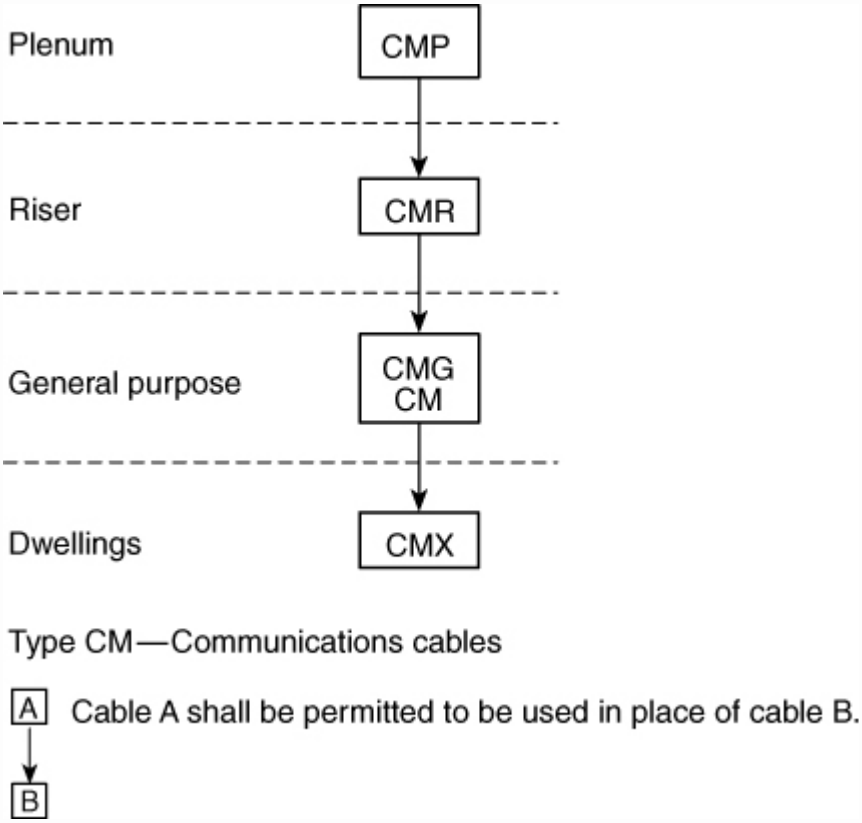
The substitutions for communications cables listed in Table 805.154 and illustrated in Figure 805.154 shall be permitted.

**Table 805.154 Cable Substitutions**

| Cable Type | Permitted Substitutions |
|---|---|
| CMR | CMP |

| Cable Type | Permitted Substitutions |
|---|---|
| CMG, CM | CMP, CMR |
| CMX | CMP, CMR, CMG, CM |

**Figure 805.154 Cable Substitution Hierarchy.**




### 805.156 Dwelling Unit Communications Outlet.

For new construction, a minimum of one communications outlet shall be installed within the dwelling in a readily accessible area and cabled to the service provider demarcation point.

## Part V. Listing Requirements

### 805.170 Equipment.

Communications equipment shall be listed as being suitable for electrical connection to a communications network.

Informational Note No. 1: One way to determine applicable requirements is to refer to ANSI/UL 60950-1-2014, *Standard for Safety of Information Technology Equipment*; ANSI/UL 1863-2012, *Standard for Safety Communications Circuit Accessories*; or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements*.

Informational Note No. 2: Additional information regarding voltages, currents, and power allowed on communications circuits can be found in ANSI/ATIS 0600337-2016, *Requirements for Maximum Voltage, Current, and Power Levels Used in Communications Transport Circuits*.

#### (A) Primary Protectors.

The primary protector shall consist of an arrester connected between each line conductor and ground in an appropriate mounting. Primary protector terminals shall be marked to indicate line and ground as applicable.

Informational Note: One way to determine applicable requirements for a listed primary protector is to refer to ANSI/UL 497-2013, *Standard for Protectors for Paired Conductor Communications Circuits*.

#### (B) Secondary Protectors.

The secondary protector shall be listed as suitable to provide means to safely limit currents to less than the current-carrying capacity of listed indoor communications wire and cable, listed telephone set line cords, and listed communications terminal equipment having ports for external wire line communications circuits. Any overvoltage protection, arresters, or grounding connection shall be connected on the equipment terminals side of the secondary protector current-limiting means.

Informational Note: One way to determine applicable requirements for a listed secondary protector is to refer to ANSI/UL 497A-2012, *Standard for Secondary Protectors for Communications Circuits*.

**(C) Plenum Grade Cable Ties.**

Cable ties intended for use in other space used for environmental air (plenums) shall be listed as having low smoke and heat release properties.

Informational Note: See NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, and ANSI/UL 2043-2013, *Standard for Safety Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces*, for information on listing discrete products as having low smoke and heat release properties.

### 805.173 Drop Wire and Cable.

Communications wires and cables without a metallic shield, running from the last outdoor support to the primary protector, shall be listed as being suitable for the purpose and shall have current-carrying capacity as specified in 805.90(A)(1)(b) or (A)(1)(c).

### 805.179 Communications Wires and Cables.

Communications wires and cables shall be listed in accordance with 805.179(A) through (F) and marked in accordance with Table 805.179 and 805.179(G). Conductors in communications cables, other than in a coaxial cable, shall be copper.

Communications wires and cables shall have a voltage rating of not less than 300 volts. The insulation for the individual conductors, other than the outer conductor of a coaxial cable, shall be rated for 300 volts minimum. The cable voltage rating shall not be marked on the cable or on the under-carpet communications wire.

*Exception: Voltage markings shall be permitted where the cable has multiple listings and 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 805.179 Cable Markings**

| Cable Marking | Type |
|---|---|
| CMP | Communications plenum cable |
| CMR | Communications riser cable |
| CMG | Communications general-purpose cable |
| CM | Communications general-purpose cable |
| CMX | Communications cable, limited use |
| CMUC | Under-carpet communications wire and cable |

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

**(A) General Requirements.**

The general requirements in 805.179 shall apply.

**(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 VW-1 (vertical-wire) flame test in ANSI/UL 1581-2017, *Reference Standard for Electrical Wires, Cables and Flexible Cords*.

### (C) Circuit Integrity (CI) Cable or Electrical Circuit Protective System.

Cables that are used for survivability of critical circuits under fire conditions shall be listed and meet either 805.179(C)(1) or 805.179(C)(2).

Informational Note: The listing organization provides information for circuit integrity (CI) cable and electrical circuit protective systems, including installation requirements required to maintain the fire rating.

### (1) Circuit Integrity (CI) Cables.

Circuit integrity (CI) cables specified in 805.179(A) through (D), and used for survivability of critical circuits, shall have an additional classification using the suffix "CI." In order to maintain its listed fire rating, circuit integrity (CI) cable shall only be installed in free air.

Informational Note: One method of defining circuit integrity (CI) cable is by establishing a minimum 2-hour fire resistance rating for the cable when tested in accordance with ANSI/UL 2196-2017, *Standard for Fire Test for Circuit Integrity of Fire-Resistant Power, Instrumentation, Control, and Data Cables*.

### (2) Fire-Resistive Cables.

Cables specified in 800.179(A) through (D) and 805.179(C)(1), that are part of an electrical circuit protective system, shall be fire-resistive cable identified with the protective system number on the product, or on the smallest unit container in which the product is packaged, and shall be installed in accordance with the listing of the protective system.

Informational Note No. 1: One method of defining an electrical circuit protective system is by establishing a minimum 2-hour fire resistance rating for the system when tested in accordance with UL Subject 1724, *Outline of Investigation for Fire Tests for Electrical Circuit Protective Systems*.

Informational Note No. 2: The listing organization provides information for electrical circuit protective systems (FHIT), including installation requirements for maintaining the fire rating.

### (D) Types CMP-LP, CMR-LP, CMG-LP, and CM-LP Limited Power (LP) Cables.

Types CMP-LP, CMR-LP, CMG-LP, and CM-LP communications limited power 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 XX designates the current limit in amperes per conductor.

Informational Note: An example of the marking on a communications cable with an LP rating is "CMP-LP (0.6A)(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 ampere.

### (E) Communications Wires.

Communications wires, such as distributing frame wire and jumper wire, shall 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 Flame Tray 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. 0.3-09, *Test Methods for Electrical Wires and Cables*.

### (F) Hybrid Power and Communications Cables.

Listed hybrid power and communications cables shall be permitted where the power cable is a listed Type NM or NM-B, conforming to Part III of Article 334, and the communications cable is a listed Type CM, the jackets on the listed NM or NM-B, and listed CM cables are rated for 600 volts minimum, and the hybrid cable is 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 Flame Tray 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. 0.3-09, *Test Methods for Electrical Wires and Cables*.

### (G) Optional Markings.

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.

## Article 810 Radio and Television Equipment

### Part I. General

#### 810.1 Scope.

This article covers antenna systems for radio and television receiving equipment, amateur and citizen band radio transmitting and receiving equipment, and certain features of transmitter safety. This article covers antennas such as wire-strung type, multi-element, vertical rod, flat, or parabolic and also covers the wiring and cabling that connect them to equipment. This article does not cover equipment and antennas used for coupling carrier current to power line conductors.

#### 810.2 Definitions.

The definitions in Part I of Article 100 shall apply.

#### 810.3 Other Articles.

Wiring from the source of power to and between devices connected to the interior wiring system shall comply with Chapters 1 through 4 other than as modified by Parts I and II of Article 640. Wiring for audio signal processing, amplification, and reproduction equipment shall comply with Article 640. Coaxial cables that connect antennas to equipment shall comply with Article 820.

#### 810.4 Community Television Antenna.

The antenna shall comply with this article. The distribution system shall comply with Article 820.

#### 810.5 Radio Noise Suppressors.

Radio interference eliminators, interference capacitors, or noise suppressors connected to power-supply leads shall be of a listed type. They shall not be exposed to physical damage.

#### 810.6 Antenna Lead-In Protectors.

Where an antenna lead-in surge protector is installed, it shall be listed as being suitable for limiting surges on the cable that connects the antenna to the receiver/transmitter electronics and shall be connected between the conductors and the grounded shield or other ground connection. The antenna lead-in protector shall be grounded using a bonding conductor or grounding electrode conductor installed in accordance with 810.21(F).

Informational Note: For requirements covering protectors for antenna lead-in conductors, refer to UL 497E, *Outline of Investigation for Protectors for Antenna Lead-In Conductors*.

#### 810.7 Grounding Devices.

Where bonding or grounding is required, devices used to connect a shield, a sheath, non–current-carrying metallic members of a cable, or metal parts of equipment or antennas to a bonding conductor or grounding electrode conductor shall be listed or be part of listed equipment.

### Part II. Receiving Equipment — Antenna Systems

#### 810.11 Material.

Antennas and lead-in conductors shall be of hard-drawn copper, bronze, aluminum alloy, copper-clad steel, or other high-strength, corrosion-resistant material.

*Exception: Soft-drawn or medium-drawn copper shall be permitted for lead-in conductors where the maximum span between points of support is less than 11 m (35 ft).*

#### 810.12 Supports.

Outdoor antennas and lead-in conductors shall be securely supported. The antennas or lead-in conductors shall not be attached to the electric service mast. They shall not be attached to poles or similar structures carrying open electric light or power wires or trolley wires of over 250 volts between conductors. Insulators supporting the antenna conductors shall have sufficient mechanical strength to safely support the conductors. Lead-in conductors shall be securely attached to the antennas.

### 810.13 Avoidance of Contacts with Conductors of Other Systems.

Outdoor antennas and lead-in conductors from an antenna to a building shall not cross over open conductors of electric light or power circuits and shall be kept well away from all such circuits so as to avoid the possibility of accidental contact. Where proximity to open electric light or power service conductors of less than 250 volts between conductors cannot be avoided, the installation shall be such as to provide a clearance of at least 600 mm (2 ft).

Where practicable, antenna conductors shall be installed so as not to cross under open electric light or power conductors.

### 810.14 Splices.

Splices and joints in antenna spans shall be made mechanically secure with approved splicing devices or by such other means as will not appreciably weaken the conductors.

### 810.15 Grounding.

Masts and metal structures supporting antennas shall be grounded in accordance with 810.21, unless the antenna and its related supporting mast or structure are within a zone of protection defined by a 46 m (150 ft) radius rolling sphere.

Informational Note: See 4.8.3.1 of NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, for the application of the term *rolling sphere*.

### 810.16 Size of Wire-Strung Antenna — Receiving Station.

#### (A) Size of Antenna Conductors.

Outdoor antenna conductors for receiving stations shall be of a size not less than given in Table 810.16(A).

**Table 810.16(A) Size of Receiving Station Outdoor Antenna Conductors**

| Material | Minimum Size of Conductors (AWG) Where Maximum Open Span Length Is | | |
|---|---|---|---|
| | Less Than 11 m (35 ft) | 11 m to 45 m (35 ft to 150 ft) | Over 45 m (150 ft) |
| Aluminum alloy, hard-drawn copper | 19 | 14 | 12 |
| Copper-clad steel, bronze, or other high-strength material | 20 | 17 | 14 |

#### (B) Self-Supporting Antennas.

Outdoor antennas, such as vertical rods and flat, parabolic, or dipole structures, shall be of corrosion-resistant materials and of strength suitable to withstand ice and wind loading conditions and shall be located well away from overhead conductors of electric light and power circuits of over 150 volts to ground, so as to avoid the possibility of the antenna or structure falling into or making accidental contact with such circuits.

### 810.17 Size of Lead-in — Receiving Station.

Lead-in conductors from outside antennas for receiving stations shall, for various maximum open span lengths, be of such size as to have a tensile strength at least as great as that of the conductors for antennas as specified in 810.16. Where the lead-in consists of two or more conductors that are twisted

together, are enclosed in the same covering, or are concentric, the conductor size shall, for various maximum open span lengths, be such that the tensile strength of the combination is at least as great as that of the conductors for antennas as specified in 810.16.

### 810.18 Clearances — Receiving Stations.

#### (A) Outside of Buildings.

Lead-in conductors attached to buildings shall be installed so that they cannot swing closer than 600 mm (2 ft) to the conductors of circuits of 250 volts or less between conductors, or 3.0 m (10 ft) to the conductors of circuits of over 250 volts between conductors, except that in the case of circuits not over 150 volts between conductors, where all conductors involved are supported so as to ensure permanent separation, the clearance shall be permitted to be reduced but shall not be less than 100 mm (4 in.). The clearance between lead-in conductors and any conductor forming a part of a lightning protection system shall not be less than 1.8 m (6 ft). Underground conductors shall be separated at least 300 mm (12 in.) from conductors of any light or power circuits or Class 1 circuits.

*Exception: Where the electric light or power conductors, Class 1 conductors, or lead-in conductors are installed in raceways or metal cable armor.*

Informational Note No. 1: See 250.60 for grounding associated with lightning protection components — strike termination devices. For further information, see NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, which contains detailed information on grounding, bonding, and spacing from lightning protection systems, and the calculation of specific separation distances using the sideflash equation in Section 4.6.

Informational Note No. 2: Metal raceways, enclosures, frames, and other non–current-carrying metal parts of electrical equipment installed on a building equipped with a lightning protection system may require bonding or spacing from the lightning protection conductors in accordance with NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*. Separation from lightning protection conductors is typically 1.8 m (6 ft) through air or 900 mm (3 ft) through dense materials such as concrete, brick, or wood.

#### (B) Antennas and Lead-ins — Indoors.

Indoor antennas and indoor lead-ins shall not be run nearer than 50 mm (2 in.) to conductors of other wiring systems in the premises.

*Exception No. 1: Where such other conductors are in metal raceways or cable armor.*

*Exception No. 2: Where permanently separated from such other conductors by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing.*

#### (C) In Boxes or Other Enclosures.

Indoor antennas and indoor lead-ins shall be permitted to occupy the same box or enclosure with conductors of other wiring systems where separated from such other conductors by an effective permanently installed barrier.

### 810.19 Electrical Supply Circuits Used in Lieu of Antenna — Receiving Stations.

Where an electrical supply circuit is used in lieu of an antenna, the device by which the radio receiving set is connected to the supply circuit shall be listed.

### 810.20 Antenna Discharge Units — Receiving Stations.

#### (A) Where Required.

Each conductor of a lead-in from an outdoor antenna shall be provided with a listed antenna discharge unit.

*Exception: Where the lead-in conductors are enclosed in a continuous metallic shield that either is grounded with a conductor in accordance with 810.21 or is protected by an antenna discharge unit.*

#### (B) Location.

Antenna discharge units shall be located outside the building or inside the building between the point of entrance of the lead-in and the radio set or transformers and as near as practicable to the entrance of the conductors to the building. The antenna discharge unit shall not be located near combustible material or in a hazardous (classified) location as defined in Article 500.

**(C) Grounding.**

The antenna discharge unit shall be grounded in accordance with 810.21.

**810.21 Bonding Conductors and Grounding Electrode Conductors — Receiving Stations.**

Bonding conductors and grounding electrode conductors shall comply with 810.21(A) through 810.21(K).

**(A) Material.**

The bonding conductor or grounding electrode conductor shall be of copper, aluminum, copper-clad steel, copper-clad aluminum, bronze, or similar corrosion-resistant material. Aluminum or copper-clad aluminum bonding conductors or grounding electrode conductors shall not be used where in direct contact with masonry or the earth or where subject to corrosive conditions. Where used outside, aluminum or copper-clad aluminum conductors shall not be installed within 450 mm (18 in.) of the earth.

**(B) Insulation.**

Insulation on bonding conductors or grounding electrode conductors shall not be required.

**(C) Supports.**

The bonding conductor or grounding electrode conductor shall be securely fastened in place and shall be permitted to be directly attached to the surface wired over without the use of insulating supports.

*Exception: Where proper support cannot be provided, the size of the bonding conductors or grounding electrode conductors shall be increased proportionately.*

**(D) Physical Protection.**

Bonding conductors and grounding electrode conductors shall be protected where exposed to physical damage. Where the bonding conductor or grounding electrode conductor is installed in a metal raceway, both ends of the raceway shall be bonded to the contained conductor or to the same terminal or electrode to which the bonding conductor or grounding electrode conductor is connected.

**(E) Run in Straight Line.**

The bonding conductor or grounding electrode conductor for an antenna mast or antenna discharge unit shall be run in as straight a line as practicable.

**(F) Electrode.**

The bonding conductor or grounding electrode conductor shall be connected as required in 810.21(F)(1) through 810.21(F)(3).

**(1) In Buildings or Structures with an Intersystem Bonding Termination.**

If the building or structure served has an intersystem bonding termination as required by 250.94, the bonding conductor shall be connected to the intersystem bonding termination.

**(2) In Buildings or Structures with Grounding Means.**

If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on the following:

1. The building or structure grounding electrode system as covered in 250.50
2. The grounded interior metal water piping systems, within 1.52 m (5 ft) from its point of entrance to the building, as covered in 250.52
3. The power service accessible means external to the building, as covered in 250.94
4. The nonflexible metal power service raceway
5. The service equipment enclosure, or
6. The grounding electrode conductor or the grounding electrode conductor metal enclosures of the power service

A bonding device intended to provide a termination point for the bonding conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on nonremovable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is nonremovable.

**(3) In Buildings or Structures Without an Intersystem Bonding Termination or Grounding Means.**

If the building or structure served has no intersystem bonding termination or grounding means as described in 810.21(F)(2), the grounding electrode conductor shall be connected to a grounding electrode as described in 250.52.

**(G) Inside or Outside Building.**

The bonding conductor or grounding electrode conductor shall be permitted to be run either inside or outside the building.

**(H) Size.**

The bonding conductor or grounding electrode conductor shall not be smaller than 10 AWG copper, 8 AWG aluminum, or 17 AWG copper-clad steel or bronze.

**(I) Common Ground.**

A single bonding conductor or grounding electrode conductor shall be permitted for both protective and operating purposes.

**(J) Bonding of Electrodes.**

A bonding jumper not smaller than 6 AWG copper or equivalent shall be connected between the radio and television equipment grounding electrode and the power grounding electrode system at the building or structure served where separate electrodes are used.

**(K) Electrode Connection.**

Connections to grounding electrodes shall comply with 250.70.

## Part III. Amateur and Citizen Band Transmitting and Receiving Stations — Antenna Systems

### 810.51 Other Sections.

In addition to complying with Part III, antenna systems for amateur and citizen band transmitting and receiving stations shall also comply with 810.11 through 810.15.

### 810.52 Size of Antenna.

Antenna conductors for transmitting and receiving stations shall be of a size not less than given in Table 810.52.

**Table 810.52 Size of Outdoor Antenna Conductors**

| Material | Minimum Size of Conductors (AWG) Where Maximum Open Span Length Is | |
|---|---|---|
| | Less Than 45 m (150 ft) | Over 45 m (150 ft) |
| Hard-drawn copper | 14 | 10 |
| Copper-clad steel, bronze, or other high-strength material | 14 | 12 |

### 810.53 Size of Lead-in Conductors.

Lead-in conductors for transmitting stations shall, for various maximum span lengths, be of a size at least as great as that of conductors for antennas as specified in 810.52.

### 810.54 Clearance on Building.

Antenna conductors for transmitting stations, attached to buildings, shall be firmly mounted at least 75 mm (3 in.) clear of the surface of the building on nonabsorbent insulating supports, such as treated pins or brackets equipped with insulators having not less than 75-mm (3-in.) creepage and airgap distances. Lead-in conductors attached to buildings shall also comply with these requirements.

*Exception: Where the lead-in conductors are enclosed in a continuous metallic shield that is grounded with a conductor in accordance with 810.58, they shall not be required to comply with these requirements. Where grounded, the metallic shield shall also be permitted to be used as a conductor.*

**810.55 Entrance to Building.**

Except where protected with a continuous metallic shield that is grounded with a conductor in accordance with 810.58, lead-in conductors for transmitting stations shall enter buildings by one of the following methods:

1. Through a rigid, noncombustible, nonabsorbent insulating tube or bushing
2. Through an opening provided for the purpose in which the entrance conductors are firmly secured so as to provide a clearance of at least 50 mm (2 in.)
3. Through a drilled window pane

**810.56 Protection Against Accidental Contact.**

Lead-in conductors to radio transmitters shall be located or installed so as to make accidental contact with them difficult.

**810.57 Antenna Discharge Units — Transmitting Stations.**

Each conductor of a lead-in for outdoor antennas shall be provided with an antenna discharge unit or other suitable means that drain static charges from the antenna system.

*Exception No. 1: Where the lead-in is protected by a continuous metallic shield that is grounded with a conductor in accordance with 810.58, an antenna discharge unit or other suitable means shall not be required.*

*Exception No. 2: Where the antenna is grounded with a conductor in accordance with 810.58, an antenna discharge unit or other suitable means shall not be required.*

**810.58 Bonding Conductors and Grounding Electrode Conductors — Amateur and Citizen Band Transmitting and Receiving Stations.**

Bonding conductors and grounding electrode conductors shall comply with 810.58(A) through 810.58(C).

**(A) Other Sections.**

All bonding conductors and grounding electrode conductors for amateur and citizen band transmitting and receiving stations shall comply with 810.21(A) through 810.21(C).

**(B) Size of Protective Bonding Conductor or Grounding Electrode Conductor.**

The protective bonding conductor or grounding electrode conductor for transmitting stations shall be as large as the lead-in but not smaller than 10 AWG copper, bronze, or copper-clad steel.

**(C) Size of Operating Bonding Conductor or Grounding Electrode Conductor.**

The operating bonding conductor or grounding electrode conductor for transmitting stations shall not be less than 14 AWG copper or its equivalent.

**Part IV. Interior Installation — Transmitting Stations**

**810.70 Clearance from Other Conductors.**

All conductors inside the building shall be separated at least 100 mm (4 in.) from the conductors of any electric light, power, or signaling circuit.

*Exception No. 1: As provided in Article 640.*

*Exception No. 2: Where separated from other conductors by raceway or some firmly fixed nonconductor, such as porcelain tubes or flexible tubing.*

### 810.71 General.

Transmitters shall comply with 810.71(A) through (C).

**(A) Enclosing.**

The transmitter shall be enclosed in a metal frame or grille or separated from the operating space by a barrier or other equivalent means, all metallic parts of which are effectively connected to a bonding conductor or grounding electrode conductor.

**(B) Grounding of Controls.**

All external metal handles and controls accessible to the operating personnel shall be effectively connected to an equipment grounding conductor if the transmitter is powered by the premises wiring system or grounded with a conductor in accordance with 810.21.

**(C) Interlocks on Doors.**

All access doors shall be provided with interlocks that disconnect all voltages of over 350 volts between conductors when any access door is opened.

## Article 820 Community Antenna Television and Radio Distribution Systems

### Part I. General

### 820.1 Scope.

This article covers coaxial cable distribution of radio frequency signals typically employed in community antenna television (CATV) systems.

### 820.2 Definitions.

The definitions in this section shall apply only within Articles 820 and 840.

### 820.3 Other Articles.

Circuits and equipment shall comply with 820.3(A)and (B).

**(A) General Requirements.**

The general requirements of Article 800 shall apply.

**(B) Alternate Wiring Methods.**

The wiring methods of Article 830 shall be permitted to substitute for the wiring methods of Article 820.

Informational Note: Use of Article 830 wiring methods will facilitate the upgrading of Article 820 installations to network-powered broadband applications.

### 820.15 Power Limitations.

Coaxial cable shall be permitted to deliver power to equipment that is directly associated with the radio frequency distribution system if the voltage is not over 60 volts and if the current is supplied by a transformer or other device that has power-limiting characteristics.

Power shall be blocked from premises devices on the network that are not intended to be powered via the coaxial cable.

### Part II. Coaxial Cables ~~Outside~~ on the service provider side of the Communication Service Point~~and Entering Buildings~~

### 820.44 Overhead (Aerial) Coaxial Cables.

Overhead (aerial) coaxial cables, prior to the point of grounding, as specified in 820.93, shall comply with 820.44(A) or 800.44.

**(A) On Poles and In-Span, Above Roofs, on Masts, or Between Buildings.**

Where coaxial cables are installed on poles and in-span, above roofs, on masts, or between buildings, they shall comply with 800.44.

**(B) On Buildings.**

Where attached to buildings, coaxial cables shall be securely fastened in such a manner that they will be separated from other conductors in accordance with 820.44(B)(1) and (B)(2).

**(1) Electric Light or Power.**

The coaxial cable shall have a separation of at least 100 mm (4 in.) from electric light, power, Class 1, or non-power-limited fire alarm circuit conductors not in raceway or cable, or shall be permanently separated from conductors of the other system by a continuous and firmly fixed nonconductor in addition to the insulation on the wires.

**(2) Other Communications Systems.**

Coaxial cable shall be installed so that there will be no unnecessary interference in the maintenance of the separate systems. In no case shall the conductors, cables, messenger strand, or equipment of one system cause abrasion to the conductors, cable, messenger strand, or equipment of any other system.

### 820.47 Underground Coaxial Cables Entering Buildings.

Underground coaxial cables entering buildings shall comply with 820.47(A) and 820.47(B).

**(A) Underground Systems with Electric Light, Power, Class 1, or Non–Power-Limited Fire Alarm Circuit Conductors.**

Underground coaxial cables in a duct, pedestal, handhole enclosure, or manhole that contains electric light, power, or Class 1 or non–power-limited fire alarm circuit conductors shall be in a section permanently separated from such conductors by means of a suitable barrier.

**(B) Direct-Buried Cables and Raceways.**

Direct-buried coaxial cable shall be separated at least 300 mm (12 in.) from conductors of any light or power, non–power-limited fire alarm circuit conductors, or Class 1 circuit.

*Exception No. 1: Separation shall not be required where electric service conductors or coaxial cables are installed in raceways or have metal cable armor.*

*Exception No. 2: Separation shall not be required where electric light or power branch-circuit or feeder conductors or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables; or the coaxial cables have metal cable armor or are installed in a raceway.*

### 820.48 Unlisted Cables Entering Buildings.

Unlisted outside plant coaxial cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated at a grounding block. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) to the point of emergence.

## Part III. Protection

### 820.93 Grounding of the Outer Conductive Shield of Coaxial Cables.

Coaxial cables entering buildings or attached to buildings shall comply with 820.93(A) or (B). Where the outer conductive shield of a coaxial cable is grounded, no other protective devices shall be required. For purposes of this section, grounding located at mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a grounding block location to achieve the shortest practicable bonding conductor or grounding electrode conductor helps limit potential differences between CATV and other metallic systems.

**(A) Entering Buildings.**

In installations where the coaxial cable enters the building, the outer conductive shield shall be grounded in accordance with 820.100. The grounding shall be as close as practicable to the point of entrance.

**(B) Terminating Outside of the Building.**

In installations where the coaxial cable is terminated outside of the building, the outer conductive shield shall be grounded in accordance with 820.100. The grounding shall be as close as practicable to the point of attachment or termination.

**(C) Location.**

Where installed, a listed primary protector shall be applied on each community antenna and radio distribution (CATV) cable external to the premises. The listed primary protector shall be located as close as practicable to the entrance point of the cable on either side or integral to the ground block.

**(D) Hazardous (Classified) Locations.**

Where a primary protector or equipment providing the primary protection function is used, it shall not be located in any hazardous (classified) location as defined in 500.5 and 505.5 or in the vicinity of easily ignitible material.

*Exception: As permitted in 501.150, 502.150, and 503.150.*

**Part IV. Grounding Methods**

**820.100 Cable Bonding and Grounding.**

The shield of the coaxial cable shall be bonded or grounded as specified in 820.100(A) and (B).

*Exception: For communications systems using coaxial cable completely contained within the building (i.e., they do not exit the building) or the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere and isolated from outside cable plant, the shield shall be permitted to be grounded by a connection to an equipment grounding conductor as described in 250.118. Connecting to an equipment grounding conductor through a grounded receptacle using a dedicated bonding jumper and a permanently connected listed device shall be permitted. Use of a cord and plug for the connection to an equipment grounding conductor shall not be permitted.*

Informational Note: See 4.8.3.1 of NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems,* for the application of the term *rolling sphere*.

**(A) General Requirements.**

The installation shall be in accordance with 800.100.

**(B) Shield Protection Devices.**

Grounding of a coaxial drop cable shield by means of a protective device that does not interrupt the grounding system within the premises shall be permitted.

**820.103 Equipment Grounding.**

Unpowered equipment and enclosures or equipment powered by the coaxial cable shall be considered grounded where connected to the metallic cable shield.

**Part V. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**820.133 Installation of Coaxial Cables and Equipment.**

Beyond the point of grounding, as defined in 820.93, the coaxial cable installation shall comply with 820.133(A) and (B).

**(A) Separation from Other Conductors.**

**(1) In Raceways, Cable Trays, Boxes, Enclosures, and Cable Routing Assemblies.**

1. *Other Circuits.* Coaxial cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with jacketed cables 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. Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770
4. Communications circuits in compliance with Parts I and IV of Article 805
5. Low-power network-powered broadband communications circuits in compliance with Parts I and V of Article 830

2. *Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm, and Medium-Power Network-Powered Broadband Communications Circuits.* Coaxial cable shall not be placed in any raceway, compartment, outlet box, junction box, or other enclosures with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits.

*Exception No. 1: Coaxial cable shall be permitted to be placed in any raceway, compartment, outlet box, junction box, or other enclosures with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits where 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 coaxial cables by a permanent barrier or listed divider.*

*Exception No. 2: Coaxial cable shall be permitted to be placed in outlet boxes, junction boxes, or similar fittings or compartments with power conductors where such conductors are introduced solely for power supply to the coaxial cable system distribution equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum 6 mm (¼ in.) separation from coaxial cables.*

**(2) Other Applications.**

Coaxial cable shall be separated 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.

*Exception No. 1: Separation shall not be required where either (1) all of the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits are in a raceway, or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC or Type UF cables, or (2) all of the coaxial cables are encased in a raceway.*

*Exception No. 2: Separation shall not be required where the coaxial cables are permanently separated from the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B) Support of Coaxial Cables.**

Raceways shall be used for their intended purpose. Coaxial cables shall not be strapped, taped, or attached by any means to the exterior of any conduit or raceway as a means of support.

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

**820.154 Substitutions of Listed CATV Cables.**

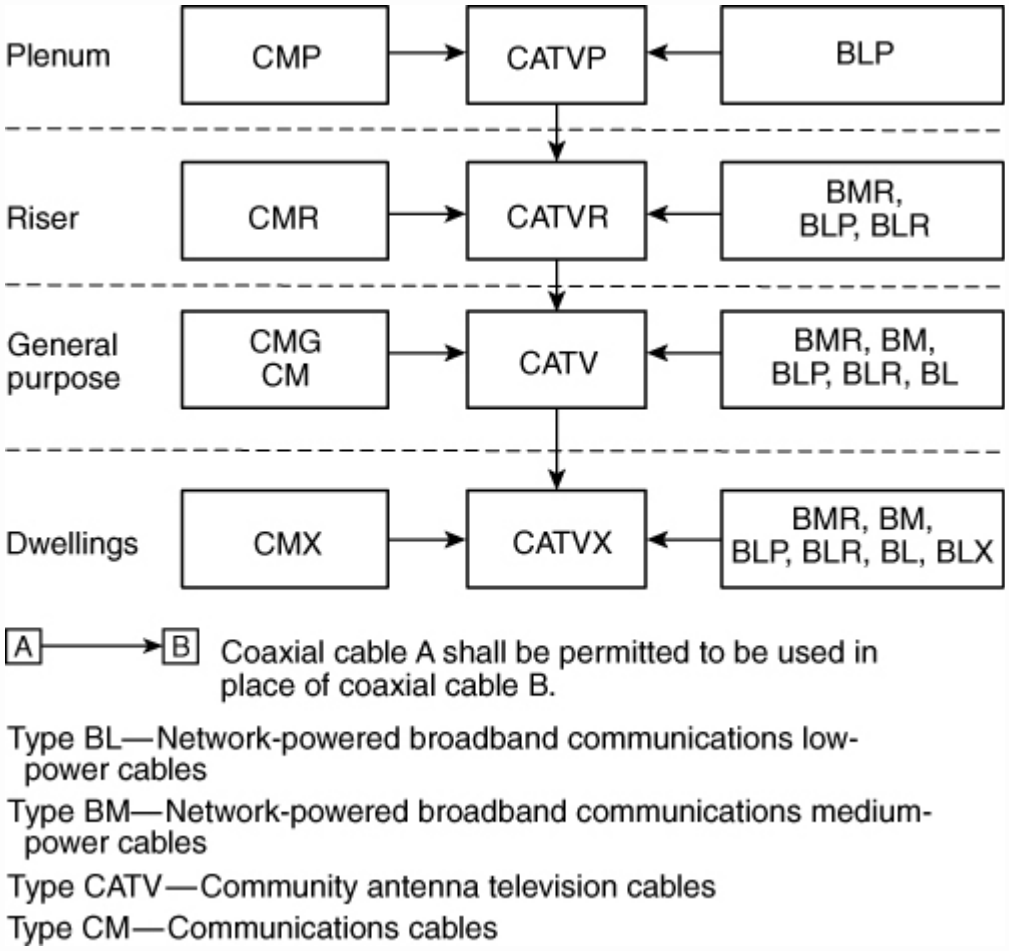
The substitutions for coaxial cables in Table 820.154 and illustrated in Figure 820.154 shall be permitted.

Informational Note: The substitute cables in Table 820.154 and Figure 820.154 are only coaxial-type cables.

**Table 820.154 Coaxial Cable Uses and Permitted Substitutions**

| Cable Type | Permitted Substitutions |
|---|---|
| CATVP | CMP, BLP |
| CATVR | CATVP, CMP, CMR, BMR, BLP, BLR |
| CATV | CATVP, CMP, CATVR, CMR, CMG, CM, BMR, BM, BLP, BLR, BL |
| CATVX | CATVP, CMP, CATVR, CMR, CATV, CMG, CM, BMR, BM, BLP, BLR, BL, BLX |

**Figure 820.154 Cable Substitution Hierarchy.**




## Part VI. Listing Requirements

### 820.179 Coaxial Cables.

Cables shall be listed in accordance with 820.179(A)and marked in accordance with Table 820.179 and 820.179(B). The cable voltage rating shall not be marked on the cable.

Informational Note: Voltage markings on cables could 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.*

**(A) General Requirements.**

The general requirements in 800.179 shall apply.

**(B) Optional Markings.**

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.

**Table 820.179 Coaxial Cable Markings**

| Cable Marking | Type |
|---|---|
| CATVP | CATV plenum cable |
| CATVR | CATV riser cable |
| CATV | CATV cable |
| CATVX | CATV cable, limited use |

# Article 830 Network-Powered Broadband Communications Systems

## Part I. General

### 830.1 Scope.

This article covers network-powered broadband communications systems that provide any combination of voice, audio, video, data, and interactive services through a network interface unit.

Informational Note: A typical basic system configuration includes a cable supplying power and broadband signal to a network interface unit that converts the broadband signal to the component signals. Typical cables are coaxial cable with both broadband signal and power on the center conductor, composite metallic cable with a coaxial member(s) or twisted pair members for the broadband signal and twisted pair members for power, and composite optical fiber cable with a pair of conductors for power. Larger systems may also include network components such as amplifiers that require network power.

### 830.2 Definitions.

The definitions in this section shall apply only within Article 830.

Informational Note: A typical single-family network-powered communications circuit consists of a communications drop or communications service cable and an NIU and includes the communications utility's serving terminal or tap where it is not under the exclusive control of the communications utility.

**Fault Protection Device.**

An electronic device that is intended for the protection of personnel and functions under fault conditions, such as network-powered broadband communications cable short or open circuit, to limit the current or voltage, or both, for a low-power network-powered broadband communications circuit and provide acceptable protection from electric shock.

**Network Interface Unit (NIU).**

A device that converts a broadband signal into component voice, audio, video, data, and interactive services signals and provides isolation between the network power and the premises signal circuits. These devices often contain primary and secondary protectors.

**Network-Powered Broadband Communications Circuit.**

The circuit extending from the communications utility's or service provider's serving terminal or tap up to and including the NIU.

Informational Note: A typical one-family dwelling network-powered communications circuit consists of a communications drop or communications service cable and an NIU and includes the communications utility's serving terminal or tap where it is not under the exclusive control of the communications utility.

### 830.3 Other Articles.

Circuits and equipment shall comply with 830.3(A) through (C).

**(A) General Requirements.**

The general requirements of Article 800 shall apply.

**(B) Output Circuits.**

As appropriate for the services provided, the output circuits derived from the network interface unit shall comply with the requirements of the following:

1. Installations of communications circuits — Part IV of Article 805
2. Installations of community antenna television and radio distribution circuits — Part V of Article 820

   *Exception: Where protection is provided in the output of the NIU 830.90(B)(3) shall apply.*
3. Installations of optical fiber cables — Part V of Article 770
4. Installations of Class 2 and Class 3 circuits — Part III of Article 725
5. Installations of power-limited fire alarm circuits — Part III of Article 760

**(C) Protection Against Physical Damage.**

The requirements of 300.4 shall apply.

**830.15 Power Limitations.**

Network-powered broadband communications systems shall be classified as having low- or medium-power sources as specified in 830.15(1) or (2).

1. Sources shall be classified as defined in Table 830.15.
2. Direct-current power sources exceeding 150 volts to ground, but no more than 200 volts to ground, with the current to ground limited to 10 mA dc, that meet the current and power limitation for medium-power sources in Table 830.15 shall be classified as medium-power sources.

Informational Note: One way to determine compliance with 830.15(2) is listed information technology equipment intended to supply power via a communications network that complies with the requirements for RFT-V circuits as defined in UL 60950-21-2007, *Standard for Safety for Information Technology Equipment — Safety — Part 21: Remote Power Feeding*.

**Table 830.15 Limitations for Network-Powered Broadband Communications Systems**

| Network Power Source | Low | Medium |
|---|---|---|
| Circuit voltage, $V_{max}$ (volts)[1] | 0–100 | 0–150 |
| Power limitation, $VA_{max}$ (volt-amperes)[1] | 250 | 250 |
| Current limitation, $I_{max}$ (amperes)[1] | $1000/V_{max}$ | $1000/V_{max}$ |
| Maximum power rating (volt-amperes) | 100 | 100 |
| Maximum voltage rating (volts) | 100 | 150 |
| Maximum overcurrent protection (amperes)[2] | $100/V_{max}$ | NA |

[1] $V_{max}$, $I_{max}$, and $VA_{max}$ are determined with the current-limiting impedance in the circuit (not bypassed) as follows:

$V_{max}$ — Maximum system voltage regardless of load with rated input applied.

$I_{max}$ — Maximum system current under any noncapacitive load, including short circuit, and with overcurrent protection bypassed if used. $I_{max}$ limits apply after 1 minute of operation.

$VA_{max}$ — Maximum volt-ampere output after 1 minute of operation regardless of load and overcurrent protection bypassed if used.

[2]Overcurrent protection is not required where the current-limiting device provides equivalent current limitation and the current-limiting device does not reset until power or the load is removed.

**830.24 Mechanical Execution of Work.**

The installation shall also conform to 300.4 and 300.11.

**Part II. Cables on the service provider side of the Communication Service Point~~Outside and Entering Buildings~~**

**830.40 Entrance Cables.**

Network-powered broadband communications cables located outside and entering buildings shall comply with 830.40(A) and (B).

**(A) Medium-Power Circuits.**

Medium-power network-powered broadband communications circuits located outside and entering buildings shall be installed using Type BMU, Type BM, or Type BMR network-powered broadband communications medium-power cables.

**(B) Low-Power Circuits.**

Low-power network-powered broadband communications circuits located outside and entering buildings shall be installed using Type BLU or Type BLX low-power network-powered broadband communications cables. Cables shown in Table 830.154 shall be permitted to substitute.

*Exception: Outdoor community antenna television and radio distribution system coaxial cables installed prior to January 1, 2000, and installed in accordance with Article 820, shall be permitted for low-power-type, network-powered broadband communications circuits.*

**830.44 Overhead (Aerial) Cables.**

Overhead (aerial) network-powered broadband communications cables shall comply with 830.44(A) through (F).

**(A) On Poles and In-Span or Above Roofs.**

Where network-powered broadband communications cables are installed on poles and in-span or above roofs, they shall comply with 800.44.

**(B) Clearance from Ground.**

Overhead (aerial) spans of network-powered broadband communications cables shall conform to not less than the following:

1. 2.9 m (9½ ft) — above finished grade, sidewalks, or from any platform or projection from which they might be reached and accessible to pedestrians only
2. 3.5 m (11½ ft) — over residential property and driveways, and those commercial areas not subject to truck traffic
3. 4.7 m (15½ ft) — over public streets, alleys, roads, parking areas subject to truck traffic, driveways on other than residential property, and other land traversed by vehicles such as cultivated, grazing, forest, and orchard

Informational Note: These clearances have been specifically chosen to correlate with ANSI/IEEE C2-2012, *National Electrical Safety Code*, Table 232-1, which provides for clearances of wires, conductors, and cables above ground and roadways, rather than using the clearances referenced in 225.18. Because Article 805 and Article 820 have had no required clearances, the communications industry has used the clearances from the NESC for their installed cable plant.

**(C) Over Pools.**

Clearance of network-powered broadband communications cable in any direction from the water level, edge of pool, base of diving platform, or anchored raft shall comply with those clearances in 680.9.

**(D) Final Spans.**

Final spans of network-powered broadband communications cables without an outer jacket shall be permitted to be attached to the building, but they shall be kept not less than 900 mm (3 ft) from windows that are designed to be opened, doors, porches, balconies, ladders, stairs, fire escapes, or similar locations.

*Exception: Conductors run above the top level of a window shall be permitted to be less than the 900-mm (3-ft) requirement above.*

Overhead (aerial) network-powered broadband communications cables shall not be installed beneath openings through which materials might be moved, such as openings in farm and commercial buildings, and shall not be installed where they obstruct entrance to these building openings.

**(E) Between Buildings.**

Network-powered broadband communications cables extending between buildings or structures, and also the supports or attachment fixtures, shall be identified as suitable for outdoor aerial applications and shall have sufficient strength to withstand the loads to which they may be subjected.

*Exception: Where a network-powered broadband communications cable does not have sufficient strength to be self-supporting, it shall be attached to a supporting messenger cable that, together with the attachment fixtures or supports, shall be acceptable for the purpose and shall have sufficient strength to withstand the loads to which they may be subjected.*

**(F) On Buildings.**

Where attached to buildings, network-powered broadband communications cables shall be securely fastened in such a manner that they are separated from other conductors in accordance with 830.44(F)(1) through (F)(3).

**(1) Electric Light or Power.**

The network-powered broadband communications cable shall have a separation of at least 100 mm (4 in.) from electric light, power, Class 1, or non-power-limited fire alarm circuit conductors not in raceway or cable, or be permanently separated from conductors of the other system by a continuous and firmly fixed nonconductor in addition to the insulation on the wires.

**(2) Other Communications Systems.**

Network-powered broadband communications cables shall be installed so that there will be no unnecessary interference in the maintenance of the separate systems. In no case shall the conductors, cables, messenger strand, or equipment of one system cause abrasion to the conductors, cables, messenger strand, or equipment of any other system.

**(3) Protection from Damage.**

Network-powered broadband communications cables attached to buildings or structures and located within 2.5 m (8 ft) of finished grade shall be protected by enclosures, raceways, or other approved means.

*Exception: A low-power network-powered broadband communications circuit that is equipped with a listed fault protection device, appropriate to the network-powered broadband communications cable used, and located on the network side of the network-powered broadband communications cable shall not be required to be additionally protected by enclosures, raceways, or other approved means.*

**830.47 Underground Network-Powered Broadband Communications Cables Entering Buildings.**

Underground network-powered broadband communications cables entering buildings shall comply with 830.47(A) through 830.47(D).

**(A) Underground Systems with Electric Light and Power, Class 1, or Non–Power-Limited Fire Alarm Circuit Conductors.**

Underground network-powered broadband communications cables in a duct, pedestal, handhole enclosure, or manhole that contains electric light, power conductors, non–power-limited fire alarm circuit

conductors, or Class 1 circuits shall be in a section permanently separated from such conductors by means of a suitable barrier.

**(B) Direct-Buried Cables and Raceways.**

Direct-buried network-powered broadband communications cables shall be separated by at least 300 mm (12 in.) from conductors of any light, power, non–power-limited fire alarm circuit conductors or Class 1 circuit.

*Exception No. 1: Separation shall not be required where electric service conductors or network-powered broadband communications cables are installed in raceways or have metal cable armor.*

*Exception No. 2: Separation shall not be required where electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables; or the network-powered broadband communications cables have metal cable armor or are installed in a raceway.*

**(C) Protection from Physical Damage.**

Direct-buried cable, conduit, or other raceways shall be installed to meet the minimum cover requirements of Table 830.47(C). In addition, direct-buried cables emerging from the ground shall be protected by enclosures, raceways, or other approved means extending from the minimum cover distance required by Table 830.47(C) below grade 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. Types BMU and BLU direct-buried cables emerging from the ground shall be installed in rigid metal conduit (RMC), intermediate metal conduit (IMC), rigid nonmetallic conduit, or other approved means extending from the minimum cover distance required by Table 830.47(C) below grade to the point of entrance.

*Exception: A low-power network-powered broadband communications circuit that is equipped with a listed fault protection device, appropriate to the network-powered broadband communications cable used, and located on the network side of the network-powered broadband communications cable being protected.*

**Table 830.47(C) Network-Powered Broadband Communications Systems Minimum Cover Requirements (*Cover* is the shortest distance measured between a point on the top surface of any direct-buried cable, conduit, or other raceway and the top surface of finished grade, concrete, or similar cover.)**

| Location of Wiring Method or Circuit | Direct Burial Cables | | Rigid Metal Conduit (RMC) or Intermediate Metal Conduit (IMC) | | Nonmetallic Raceways Listed for Direct Burial; Without Concrete Encasement or Other Approved Raceways | |
|---|---|---|---|---|---|---|
| | mm | in. | mm | in. | mm | in. |
| All locations not specified below | 450 | 18 | 150 | 6 | 300 | 12 |
| In trench below 50-mm (2-in.) thick concrete or equivalent | 300 | 12 | 150 | 6 | 150 | 6 |
| Under a building (in raceway only) | 0 | 0 | 0 | 0 | 0 | 0 |
| Under minimum of 100-mm (4-in.) thick concrete exterior slab with no vehicular traffic and the slab extending not less than 150 mm (6 in.) beyond the underground installation | 300 | 12 | 100 | 4 | 100 | 4 |

| Location of Wiring Method or Circuit | Direct Burial Cables | | Rigid Metal Conduit (RMC) or Intermediate Metal Conduit (IMC) | | Nonmetallic Raceways Listed for Direct Burial; Without Concrete Encasement or Other Approved Raceways | |
|---|---|---|---|---|---|---|
| | mm | in. | mm | in. | mm | in. |
| One- and two-family dwelling driveways and outdoor parking areas and used only for dwelling-related purposes | 300 | 12 | 300 | 12 | 300 | 12 |

Notes:

1. Raceways approved for burial only where concrete encased shall require a concrete envelope not less than 50 mm (2 in.) thick.

2. Lesser depths shall be permitted where cables rise for terminations or splices or where access is otherwise required.

3. Where solid rock is encountered, all wiring shall be installed in 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.

4. Low-power network-powered broadband communications circuits using directly buried community antenna television and radio distribution system coaxial cables that were installed outside and entering buildings prior to January 1, 2000, in accordance with Article 820 shall be permitted where buried to a minimum depth of 300 mm (12 in.).

**(D) Pools.**

Cables located under the pool or within the area extending 1.5 m (5 ft) horizontally from the inside wall of the pool shall meet those clearances and requirements specified in 680.11.

**Part III. Protection**

**830.90 Primary Electrical Protection.**

**(A) Application.**

Primary electrical protection shall be provided on all network-powered broadband communications conductors that are neither grounded nor interrupted and are run partly or entirely in aerial cable not confined within a block. Also, primary electrical protection shall be provided on all aerial or underground network-powered broadband communications conductors that are neither grounded nor interrupted and are located within the block containing the building served so as to be exposed to lightning or accidental contact with electric light or power conductors operating at over 300 volts to ground.

*Exception: Primary electrical protection shall not be required on the network-powered broadband communications conductors where electrical protection is provided on the derived circuit(s) (output side of the NIU) in accordance with 830.90(B)(3).*

Informational Note No. 1: On network-powered broadband communications conductors not exposed to lightning or accidental contact with power conductors, providing primary electrical protection in accordance with this article helps protect against other hazards, such as ground potential rise caused by power fault currents, and above-normal voltages induced by fault currents on power circuits in proximity to the network-powered broadband communications conductors.

Informational Note No. 2: Network-powered broadband communications circuits are considered to have a lightning exposure unless one or more of the following conditions exist:

1. Circuits in large metropolitan areas where buildings are close together and sufficiently high to intercept lightning.
2. Areas having an average of five or fewer thunderstorm days each year and earth resistivity of less than 100 ohm-meters. Such areas are found along the Pacific coast.

Informational Note No. 3: For information on lightning protection systems, see NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*.

**(1) Fuseless Primary Protectors.**

Fuseless-type primary protectors shall be permitted where power fault currents on all protected conductors in the cable are safely limited to a value no greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor.

**(2) Fused Primary Protectors.**

Where the requirements listed in 830.90(A)(1) are not met, fused-type primary protectors shall be used. Fused-type primary protectors shall consist of an arrester connected between each conductor to be protected and ground, a fuse in series with each conductor to be protected, and an appropriate mounting arrangement. Fused primary protector terminals shall be marked to indicate line, instrument, and ground, as applicable.

**(B) Location.**

The location of the primary protector, where required, shall comply with 830.90(B)(1), (B)(2), or (B)(3):

1. A listed primary protector shall be applied on each network-powered broadband communications cable external to and on the network side of the network interface unit.
2. The primary protector function shall be an integral part of and contained in the network interface unit. The network interface unit shall be listed as being suitable for application with network-powered broadband communications systems and shall have an external marking indicating that it contains primary electrical protection.
3. The primary protector(s) shall be provided on the derived circuit(s) (output side of the NIU), and the combination of the NIU and the protector(s) shall be listed as being suitable for application with network-powered broadband communications systems.

A primary protector, whether provided integrally or external to the network interface unit, shall be located as close as practicable to the point of entrance.

For purposes of this section, a network interface unit and any externally provided primary protectors located at mobile home service equipment located in sight from and not more than 9.0 m (30 ft) from the exterior wall of the mobile home it serves, or at a mobile home disconnecting means grounded in accordance with 250.32 and located in sight from and not more than 9.0 m (30 ft) from the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a network interface unit and primary protector location to achieve the shortest practicable primary protector bonding conductor or grounding electrode conductor helps limit potential differences between communications circuits and other metallic systems.

**(C) Hazardous (Classified) Locations.**

The primary protector or equipment providing the primary protection function shall not be located in any hazardous (classified) location as defined in 500.5 and 505.5 or in the vicinity of easily ignitible material.

*Exception: As permitted in 501.150, 502.150, and 503.150.*

**Part IV. Grounding Methods**

**830.93 Grounding or Interruption of Metallic Members of Network-Powered Broadband Communications Cables.**

Network-powered communications cables entering buildings or attaching to buildings shall comply with 830.93(A) or (B).

For purposes of this section, grounding located at mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a grounding location to achieve the shortest practicable bonding conductor or grounding electrode conductor helps limit potential differences between the network-powered broadband communications circuits and other metallic systems.

**(A) Entering Buildings.**

In installations where the network-powered communications cable enters the building, the shield shall be grounded in accordance with 800.100, and metallic members of the cable not used for communications or powering shall be grounded in accordance with 800.100 or interrupted by an insulating joint or equivalent device. The grounding or interruption shall be as close as practicable to the point of entrance.

**(B) Terminating Outside of the Building.**

In installations where the network-powered communications cable is terminated outside of the building, the shield shall be grounded in accordance with 800.100, and metallic members of the cable not used for communications or powering shall be grounded in accordance with 800.100 or interrupted by an insulating joint or equivalent device. The grounding or interruption shall be as close as practicable to the point of attachment of the NIU.

**Part V. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**830.133 Installation of Network-Powered Broadband Communications Cables and Equipment.**

Cable and equipment installations within buildings shall comply with 830.133(A) and (B), as applicable.

**(A) Separation of Conductors.**

**(1) In Raceways, Cable Trays, Boxes, Enclosures, and Cable Routing Assemblies.**

1. *Low- and Medium-Power Network-Powered Broadband Communications Circuit Cables.* Low- and medium-power network-powered broadband communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly.

2. *Low-Power Network-Powered Broadband Communications Circuit Cables with Other Circuits.* Low-power network-powered broadband communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with jacketed cables of any of the following circuits:

    1. Class 2 and Class 3 remote-control, signaling, and power-limited circuits in compliance with 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 IV of Article 805
    4. Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770
    5. Community antenna television and radio distribution systems in compliance with Parts I and V of Article 820

3. *Medium-Power Network-Powered Broadband Communications Circuit Cables with Optical Fiber Cables and Other Communications Cables*. Medium-power network-powered broadband communications cables shall not be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with conductors of any of the following circuits:

    1. Communications circuits in compliance with Parts I and IV of Article 805
    2. Conductive optical fiber cables in compliance with Parts I and V of Article 770
    3. Community antenna television and radio distribution systems in compliance with Parts I and V of Article 820

4. *Medium-Power Network-Powered Broadband Communications Circuit Cables with Other Circuits*. Medium-power network-powered broadband communications cables

shall not be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with conductors of any of the following circuits:

1. Class 2 and Class 3 remote-control, signaling, and power-limited circuits in compliance with Parts I and III of Article 725
2. Power-limited fire alarm systems in compliance with Parts I and III of Article 760

5. *Electric Light, Power, Class 1, Non–Powered Broadband Communications Circuit Cables.* Network-powered broadband communications cable shall not be placed in any raceway, cable tray, compartment, outlet box, junction box, or similar fittings with conductors of electric light, power, Class 1, or non–power-limited fire alarm circuit cables.

*Exception No. 1: Where all of the conductors of electric light, power, Class 1, non–power-limited fire alarm circuits are separated from all of the network-powered broadband communications cables by a permanent barrier or listed divider.*

*Exception No. 2: Power circuit conductors in outlet boxes, junction boxes, or similar fittings or compartments where such conductors are introduced solely for power supply to the network-powered broadband communications system distribution equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum 6 mm (¼ in.) separation from network-powered broadband communications cables.*

**(2) Other Applications.**

Network-powered broadband communications cable shall be separated at least 50 mm (2 in.) from conductors of any electric light, power, Class 1, and non–power-limited fire alarm circuits.

*Exception No. 1: Separation shall not be required where: (1) all of the conductors of electric light, power, Class 1, and non–power-limited fire alarm circuits are in a raceway, or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC, or Type UF cables, or (2) all of the network-powered broadband communications cables are encased in a raceway.*

*Exception No. 2: Separation shall not be required where the network-powered broadband communications cables are permanently separated from the conductors of electric light, power, Class 1, and non–power-limited fire alarm circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B) Support of Network-Powered Broadband Communications Cables.**

Raceways shall be used for their intended purpose. Network-powered broadband communications cables shall not be strapped, taped, or attached by any means to the exterior of any conduit or raceway as a means of support.

### 830.154 Substitutions of Network-Powered Broadband Communications System Cables.

The substitutions for network-powered broadband system cables listed in Table 830.154 shall be permitted.

**Table 830.154 Cable Substitutions**

| Cable Type | Permitted Cable Substitutions |
|---|---|
| BM | BMR |
| BLP | CMP, CL3P |
| BLR | CMP, CL3P, CMR, CL3R, BLP, BMR |
| BL | CMP, CMR, CM, CMG, CL3P, CL3R, CL3, BMR, BM, BLP, BLR |
| BLX | CMP, CMR, CM, CMG, CMX, CL3P, CL3R, CL3, CL3X, BMR, BM, BLP, BRP, BL |

### 830.160 Bends.

Bends in network broadband cable shall be made so as not to damage the cable.

## Part VI. Listing Requirements

### 830.179 Network-Powered Broadband Communications Equipment and Cables.

Network-powered broadband communications equipment and cables shall be listed and marked in accordance with 830.179(A) through (D).

*Exception No. 1: This listing requirement shall not apply to community antenna television and radio distribution system coaxial cables that were installed prior to January 1, 2000, in accordance with Article 820 and are used for low-power network-powered broadband communications circuits.*

*Exception No. 2: Substitute cables for network-powered broadband communications cables shall be permitted as shown in Table 830.154.*

**(A) General Requirements.**

The general requirements in 800.179 shall apply.

**(B) Network-Powered Broadband Communications Medium-Power Cables.**

Network-powered broadband communications medium-power cables shall be factory-assembled cables consisting of a jacketed coaxial cable, a jacketed combination of coaxial cable and multiple individual conductors, or a jacketed combination of an optical fiber cable and multiple individual conductors. The insulation for the individual conductors shall be rated for 300 volts minimum. Cables intended for outdoor use shall be listed as suitable for the application. Cables shall be marked in accordance with 310.8. Type BMU cables shall be jacketed and listed as being suitable for outdoor underground use.

**(C) Network-Powered Broadband Communication Low-Power Cables.**

Network-powered broadband communications low-power cables shall be factory-assembled cables consisting of a jacketed coaxial cable, a jacketed combination of coaxial cable and multiple individual conductors, or a jacketed combination of an optical fiber cable and multiple individual conductors. The insulation for the individual conductors shall be rated for 300 volts minimum. Cables intended for outdoor use shall be listed as suitable for the application. Cables shall be marked in accordance with 310.8. Type BLU cables shall be jacketed and listed as being suitable for outdoor underground use.

**(D) Optional Markings.**

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.

# Article 840 Premises-Powered Broadband Communications Systems

## Part I. General

### 840.1 Scope.

This article covers premises-powered broadband communications systems.

Informational Note: A typical basic system configuration consists of an optical fiber, twisted pair, or coaxial cable to the premises supplying a broadband signal to a network terminal that converts the broadband signal into component electrical signals, such as traditional telephone, video, high-speed Internet, and interactive services. Powering for the network terminal and network devices is typically accomplished through a premises power supply that might be built into the network terminal or provided as a separate unit. In order to provide communications in the event of a power interruption, a battery backup unit or an uninterruptible power supply (UPS) is typically part of the powering system.

### 840.2 Definitions.

The definitions in 805.2 and 820.2 shall apply. The definitions in this section shall apply only within Article 840.

**Broadband.**

Wide bandwidth data transmission that transports multiple signals, protocols, and traffic types over various media types.

**Network Terminal.**

A device that converts network-provided signals (optical, electrical, or wireless) into component signals, including voice, audio, video, data, wireless, optical, and interactive services, and is considered a network device on the premises that is connected to a communications service provider and is powered at the premises.

**Premises Communications Circuit.**

The circuit that extends voice, audio, video, data, interactive services, telegraph (except radio), and outside wiring for fire alarm and burglar alarm from the service provider's network terminal to the customer's communications equipment up to and including terminal equipment, such as a telephone, a fax machine, or an answering machine.

**Premises Community Antenna Television (CATV) Circuit.**

The circuit that extends community antenna television (CATV) systems for audio, video, data, and interactive services from the service provider's network terminal to the appropriate customer equipment.

**Premises-Powered.**

Using power provided locally from the premises.

### 840.3 Other Articles.

Circuits and equipment shall comply with 840.3(A) through (C).

**(A) General Requirements.**

The general requirements of Article 800 shall apply.

**(B) Output Circuits.**

As appropriate for the services provided, the output circuits derived from the network terminal shall comply with the requirements of the following:

1. Installations of communications circuits — Part IV of Article 805
2. Installations of premises (within buildings) community antenna television and radio distribution circuits — Part V of Article 820
3. Installations of optical fiber cables — Part V of Article 770
4. Installations of Class 2 and Class 3 circuits — Part III of Article 725

   Informational Note: See 725.121 for information on the classification of information technology equipment circuits.
5. Installations of power-limited fire alarm circuits — Part III of Article 760

**(C) Electrical Classification of Data Circuits and Cables.**

Sections 725.139(D)(1) and 805.133(A)(1)(b) shall apply to the electrical classification of Class 2 and Class 3 circuits in the same cable with communications circuits.

### 840.24 Mechanical Execution of Work.

The requirements of 770.24 and 800.24 shall apply.

### 840.25 Abandoned Cables.

The requirements of 770.25 and 800.25 shall apply.

### 840.26 Spread of Fire or Products of Combustion.

The requirements of 770.26 and 800.26 shall apply.

## Part II. Cables on the service provider side of the Communication Service Point ~~Outside and Entering Buildings~~

### 840.47 Underground Wires and Cables Entering Buildings.

Underground wires and cables entering buildings shall comply with 840.47(A) through (C).

**(A) Optical Fiber Cables.**

**(1) Class 1 or Non–Power-Limited Fire Alarm Circuits.**

Underground conductive optical fiber cables entering buildings with electric light, power, Class 1, or non–power-limited fire alarm circuit conductors in a raceway, handhole enclosure, or manhole shall be located in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier.

**(2) Direct-Buried Cables.**

Direct-buried conductive optical fiber cables shall be separated by at least 300 mm (12 in.) from conductors of any electric light, power, or non–power-limited fire alarm circuit conductors or Class 1 circuit.

*Exception No. 1: Separation shall not be required where the electric service conductors are installed in raceways or have metal cable armor.*

*Exception No. 2: Separation shall not be required where the electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables.*

**(3) Mechanical Protection.**

Direct-buried cable, conduit, or other raceway shall be installed to have a minimum cover of 150 mm (6 in.).

**(B) Communications Wires and Cables.**

Installations of communications wires and multipair communications cables shall comply with 805.47.

**(C) Coaxial Cables.**

Installations of coaxial cables shall comply with 820.47.

### 840.48 Unlisted Wires and Cables Entering Buildings.

Installations of unlisted cables entering buildings shall comply with 840.48(A), (B), or (C), as applicable.

**(A) Optical Fiber Cables.**

Installations of unlisted optical fiber cables entering buildings shall comply with 770.48.

**(B) Communications Wires and Cables.**

Installations of unlisted communications wires and unlisted multipair communications cables entering buildings shall comply with 805.48.

**(C) Coaxial Cables.**

Installations of unlisted coaxial cables entering buildings shall comply with 820.48.

## Part III. Protection

### 840.90 Protective Devices.

The requirements of 805.90 shall apply.

### 840.93 Grounding or Interruption.

Non–current-carrying metallic members of optical fiber cables, communications cables, or coaxial cables entering buildings or attaching to buildings shall comply with 840.93(A), (B), or (C), respectively.

### (A) Non–Current-Carrying Metallic Members of Optical Fiber Cables.

Non–current-carrying metallic members of optical fiber cables entering a building or terminating on the outside of a building shall comply with 770.93(A) or (B).

### (B) Communications Cables.

The grounding or interruption of the metallic sheath of communications cable shall comply with 805.93.

### (C) Coaxial Cables.

Where the network terminal is installed inside or outside of the building, with coaxial cables terminating at the network terminal, and is either entering, exiting, or attached to the outside of the building, 820.93 shall apply.

## 840.94 Premises Circuits Leaving the Building.

Where circuits leave the building to power equipment remote to the building or outside the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere, 805.90 and 805.93 shall apply.

Informational Note: See NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, for the theory of the term *rolling sphere*.

## Part IV. Grounding Methods

## 840.101 Premises Circuits Not Leaving the Building.

Where the network terminal is served by a nonconductive optical fiber cable, or where any non–current-carrying metallic member of a conductive optical fiber cable is interrupted by an insulating joint or equivalent device, and circuits that terminate at the network terminal are completely contained within the building (i.e., they do not exit the building), 840.101(A), (B), or (C) shall apply, as applicable.

### (A) Coaxial Cable Shield Grounding.

The shield of coaxial cable shall be grounded by one of the following:

1. Any of the methods described in 820.100 or 800.106
2. A fixed connection to an equipment grounding conductor as described in 250.118
3. Connection to the network terminal grounding terminal provided that the terminal is connected to ground by one of the methods described in 820.100 or 800.106, or to an equipment grounding conductor through a listed grounding device that will retain the ground connection if the network terminal is unplugged

### (B) Communications Circuit Grounding.

Communications circuits shall not be required to be grounded.

### (C) Network Terminal Grounding.

The network terminal shall not be required to be grounded unless required by its listing. If the coaxial cable shield is separately grounded as described in 840.101(A)(1) or 840.101(A)(2), the use of a cord and plug for the connection to the network terminal grounding connection shall be permitted.

Informational Note: Where required to be grounded, a listed device that extends the equipment grounding conductor from the receptacle to the network terminal equipment grounding terminal is permitted. Sizing of the extended equipment grounding conductor is covered in Table 250.122.

## 840.102 Premises Circuits Leaving the Building.

Where circuits leave the building to power equipment remote to the building or outside the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere, the installation of communications wires and cables shall comply with 800.100 and 800.106, and the installation of coaxial cables shall comply with 820.100 and 800.106.

Informational Note: See NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, for the application of the term *rolling sphere*.

## Part V. Wiring on the service provider side of the Communication Service Point ~~Installation Methods Within Buildings~~

### 840.133 Installation of Optical Fibers and Electrical Conductors.

The requirements of 770.133 shall apply.

## Part VI. Premises Powering of Communications Equipment over Communications Cables

### 840.160 Powering Circuits.

Communications cables listed in accordance with 805.179, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment listed in accordance with 805.170. The power source shall be listed in accordance with 840.170(G). Installation of the listed 4-pair communications cables for a communications circuit or installation where 4-pair communications cables are substituted for Class 2 and Class 3 cables in accordance with 725.154(A) shall comply with 725.144.

*Exception: Installing communications cables in compliance with 725.144 shall not be required for listed 4-pair communications cables where the rated current of the power source does not exceed 0.3 amperes in any conductor 24 AWG or larger.*

Informational Note: A typical communications cable for this application is a 4-pair cable sometimes referred to as Category 5e (or higher) LAN cable or balanced twisted pair cable. These types of cables are often used to provide Ethernet- and Power over Ethernet (PoE)–type services. A large number of such powering cables bundled together can cause overheating of the wiring if not controlled as described in Table 725.144.

## Part VII. Listing Requirements

### 840.170 Equipment and Cables.

Premises-powered broadband communications systems equipment and cables shall comply with 840.170(A) through (H).

#### (A) Network Terminal.

The network terminal and applicable grounding means shall be listed for application with premises-powered broadband communications systems.

Informational Note No. 1: One way to determine applicable requirements is to refer to ANSI/UL 60950-1-2014, *Standard for Safety of Information Technology Equipment*; ANSI/UL 498A-2015, *Current Taps and Adapters*; ANSI/UL 467-2013, *Grounding and Bonding Equipment;* or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements*.

Informational Note No. 2: There are no requirements on the network terminal and its grounding methodologies except for those covered by the listing of the product.

#### (B) Optical Fiber Cables.

Optical fiber cables shall be listed in accordance with 770.179(A) through (D) and shall be marked in accordance with Table 770.179.

#### (C) Communications Equipment.

Communications equipment shall be listed in accordance with 805.170.

#### (D) Cable Routing Assemblies and Communications Raceways.

Cable routing assemblies and communications raceways shall be listed in accordance with 800.182.

#### (E) Premises Communications Wires and Cables.

Communications wires and cable shall be listed and marked in accordance with 805.179.

#### (F) Premises Community Antenna Television (CATV) Circuits.

Premises community antenna television (CATV) coaxial cables connecting to the network terminal shall be listed in accordance with 820.179. Applicable grounding means shall be listed for application with premises-powered broadband communications systems.

#### (G) Power Source.

The power source for circuits intended to provide power over communications cables to remote equipment shall be limited in accordance with Table 11(B) in Chapter 9 for voltage sources up to 60 V dc and be listed as specified in either of the following:

1. A power source shall be listed as specified in 725.121(A)(1), (A)(2), (A)(3), or (A)(4). The power sources shall not have the output connections paralleled or otherwise interconnected unless listed for such interconnection.
2. A power source shall be listed as communications equipment for limited-power circuits.

Informational Note: One way to determine applicable requirements is to refer to ANSI/UL 60950-1-2014, *Standard for Safety of Information Technology Equipment-Safety — Part 1*; or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements*. Typically, such circuits are used to interconnect equipment for the purpose of exchanging information (data).

**(H) Accessory Equipment.**

Communications accessory equipment and/or assemblies shall be listed for application with premises-powered communications systems.

Informational Note: One way to determine applicable requirements is to refer to ANSI/UL 1863-2004, *Communications-Circuit Accessories*.

# Public Input No. 82-NFPA 70-2019 [ Part V. ]

~~**Part V.** Listing Requirements~~

## Statement of Problem and Substantiation for Public Input

Part V is in the wrong place. It should be after 800.154

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 83-NFPA 70-2019 [New Section after 800.154] | Moves Part V to the right place |
| Public Input No. 83-NFPA 70-2019 [New Section after 800.154] | |

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# Public Input No. 3231-NFPA 70-2020 [ Sections Part V., 830.133 ]

**Sections Part V., 830.133**

**Part V.** ~~Installation Methods Within Buildings~~ Wiring on the Customer side of the Communication Service Point

**830.133** Installation of Network-Powered Broadband Communications Cables and Equipment.

Cable and equipment installations ~~within buildings~~ on the customer side of the Communication Service Point shall comply with 830.133(A) and (B), as applicable.

**(A)** Separation of Conductors.

**(1)** In Raceways, Cable Trays, Boxes, Enclosures, and Cable Routing Assemblies.

(a) *Low- and Medium-Power Network-Powered Broadband Communications Circuit Cables.* Low- and medium-power network-powered broadband communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly.

(b) *Low-Power Network-Powered Broadband Communications Circuit Cables with Other Circuits.* Low-power network-powered broadband communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with jacketed cables of any of the following circuits:

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

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

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

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

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

(h) *Medium-Power Network-Powered Broadband Communications Circuit Cables with Optical Fiber Cables and Other Communications Cables*. Medium-power network-powered broadband communications cables shall not be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with conductors of any of the following circuits:

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

(10) Conductive optical fiber cables in compliance with Parts I and V of Article 770

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

(l) *Medium-Power Network-Powered Broadband Communications Circuit Cables with Other Circuits*. Medium-power network-powered broadband communications cables shall not be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with conductors of any of the following circuits:

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

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

(o) *Electric Light, Power, Class 1, Non–Powered Broadband Communications Circuit Cables.* Network-powered broadband communications cable shall not be placed in any raceway, cable tray, compartment, outlet box, junction box, or similar fittings with conductors of electric light, power, Class 1, or non–power-limited fire alarm circuit cables.

*Exception No. 1: Where all of the conductors of electric light, power, Class 1, non–power-limited fire alarm circuits are separated from all of the network-powered broadband communications cables by a permanent barrier or listed divider.*

*Exception No. 2: Power circuit conductors in outlet boxes, junction boxes, or similar fittings or compartments where such conductors are introduced solely for power supply to the network-powered broadband communications system distribution equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum 6 mm (¼ in.) separation from network-powered broadband communications cables.*

**(2)** Other Applications.

Network-powered broadband communications cable shall be separated at least 50 mm (2 in.) from conductors of any electric light, power, Class 1, and non–power-limited fire alarm circuits.

*Exception No. 1: Separation shall not be required where: (1) all of the conductors of electric light, power, Class 1, and non–power-limited fire alarm circuits are in a raceway, or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC, or Type UF cables, or (2) all of the network-powered broadband communications cables are encased in a raceway.*

*Exception No. 2: Separation shall not be required where the network-powered broadband communications cables are permanently separated from the conductors of electric light, power, Class 1, and non–power-limited fire alarm circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B)** Support of Network-Powered Broadband Communications Cables.

Raceways shall be used for their intended purpose. Network-powered broadband communications cables shall not be strapped, taped, or attached by any means to the exterior of any conduit or raceway as a means of support.

## Additional Proposed Changes

| File Name | Description | Approved |
|---|---|---|
| Chapter_8_-_2020-09-03_CC_Task_Group.pdf | | |

## Statement of Problem and Substantiation for Public Input

The only changes in this section are changes to the Title of Part V and the changes to the first sentences after 830.133.

This public input is being submitted by a Correlating Committee Task Group to improve the correlation between Chapter 7 and 8. At the present time there are significant correlation issues with regards to what constitutes an installation in Chapter 7 and what constitutes an installation in Chapter 8.

Previously a Correlating Committee Task Group was formed to review Chapter 8 and to make suggested modifications. This Chapter 8 task group has submitted a public input to define Communication Service point and has submitted a public input to determine where the actual service point exists within communication systems. It is very difficult for an AHJ to determine where there inspection authority begins and this work will help provide clarity and usability.

This public input follows up on the work of that specific task group and provides editorial revisions to further improve on that work. Public inputs are being submitted to change Titles and certain wording to reflect what wiring is on the customer side of the Communication Service Point and what wiring is on the communication utility or service provider side of this point.

The Correlating Committee Task Group is a long range planning committee that is seeking to make improvement over the next two to three cycles. The Task Group is made up of the following members: Alan Manche, Donny Cook, Randy Ivans, Ernie Gallo, and Thomas Domitrovich.

## Related Public Inputs for This Document

| Related Input | Relationship |
|---|---|
| Public Input No. 3223-NFPA 70-2020 [Sections Part IV., 805.133] | |
| Public Input No. 3224-NFPA 70-2020 [Sections 800.27, Part II., 800.44] | |
| Public Input No. 3226-NFPA 70-2020 [Section No. 800.154] | |
| Public Input No. 3227-NFPA 70-2020 [Part II.] | |
| Public Input No. 3230-NFPA 70-2020 [Part II.] | |

Public Input No. 3232-NFPA 70-2020 [Sections Part II., 840.47, 840.48, Part III.]

Public Input No. 3233-NFPA 70-2020 [Part V.]

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## Chapter 8 Communications Systems

# Article 800 General Requirements for Communications Systems

### Part I. General

#### 800.1 Scope.

This article covers general requirements for communications systems. These general requirements apply to communications circuits, community antenna television and radio distribution systems, network-powered broadband communications systems, and premises-powered broadband communications systems, unless modified by Articles 805, 820, 830, or 840.

Informational Note No. 1: See 90.2(B)(4) for installations of circuits and equipment that are not covered.

Informational Note No. 2: For further information for remote control, signaling, and power-limited circuits, see Article 725.

Informational Note No. 3: For further information for fire alarm systems, see Article 760.

#### 800.2 Definitions.

The definitions in Part I of Article 100 shall apply throughout Chapter 8. The definitions in 800.2 shall apply only within Chapter 8.

**Abandoned Cable.**

Cable that is not terminated at equipment or is not identified for future use with a tag.

**Block.**

A square or portion of a city, town, or village enclosed by streets and including the alleys so enclosed, but not any street.

**Cable Sheath.**

A covering over the conductor assembly that may include one or more metallic members, strength members, or jackets.

**Communications Circuit.**

The circuit that extends service from the communications utility or service provider up to and including the customer's communications equipment.

**Communications Service Provider.**

An organization, business, or individual that offers communications service to others.

**Exposed (to Accidental Contact).**

A circuit in such a position that, in case of failure of supports or insulation, contact with another circuit may result.

Informational Note: See Part I of Article 100 for two other definitions of Exposed: *Exposed (as applied to live parts)* and *Exposed (as applied to wiring methods)*.

**Point of Entrance.**

The point within a building at which the wire or cable emerges from an external wall or from a concrete floor slab.

**Premises.**

The land and buildings of a user located on the user side of the utility-user ~~network point of demarcation~~.

#### 800.3 Other Articles.

Only those sections of Chapters 1 through 7 referenced in Chapter 8 shall apply to Chapter 8.

**(A) Hazardous (Classified) Locations.**

Circuits and equipment installed in a location that is classified in accordance with 500.5 and 505.5 shall comply with the applicable requirements of Chapter 5.

**(B) Wiring in Ducts for Dust, Loose Stock, or Vapor Removal.**

The requirements of 300.22(A) shall apply.

**(C) Equipment in Other Space Used for Environmental Air.**

The requirements of 300.22(C)(3) shall apply.

**(D) Installation and Use.**

The requirements of 110.3(B) shall apply.

**(E) Optical Fiber Cable.**

Where optical fiber cable is used to provide a communications circuit within a building, Article 770 shall apply.

**(F) Other Communications Systems.**

As appropriate for the system involved, communications systems shall also comply with the requirements of the following:

1. Communications circuits — Article 805
2. Radio and television equipment — Article 810
3. Community antenna television and radio distribution systems — Article 820
4. Network-powered broadband communications systems — Article 830
5. Premises-powered broadband communications systems — Article 840

**(G) Reconditioned Equipment.**

The requirements of 110.21(A)(2) shall apply.

### 800.21 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.

### 800.24 Mechanical Execution of Work.

Circuits and equipment 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 also conform to 300.4 and 300.11. 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 805.170(C).

Informational Note No. 1: Accepted industry practices are described in ANSI/TIA-568.1- D-2015, *Commercial Building Telecommunications Infrastructure Standard;* ANSI/TIA-569-D-2015, *Telecommunications Pathways and Spaces;* ANSI/TIA-570-C-2012, *Residential Telecommunications Infrastructure Standard;* ANSI/TIA-1005-A-2012, *Telecommunications Infrastructure Standard for Industrial Premises;* ANSI/ TIA-1179-2010, *Healthcare Facility Telecommunications Infrastructure Standard;* ANSI/TIA-4966-2014, *Telecommunications Infrastructure Standard for Educational Facilities;* and other ANSI-approved installation standards.

Informational Note No. 2: 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. 3: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants may result in an undetermined alteration of wire and cable properties.

### 800.25 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.

### 800.26 Spread of Fire or Products of Combustion.

Installations of cables, communications raceways, cable routing assemblies 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 penetrations of cables, communications raceways, and cable routing assemblies 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 800.26 can be found in building codes, fire resistance directories, and product listings.

### 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.

## Part II. Wires and Cables Outside and on the service provider side of the Communication Service Point ~~Entering Buildings~~

### 800.44 Overhead (Aerial) Wires and Cables.

Overhead (aerial) wires and cables on the service provider side of the Communication Service Point ~~entering buildings~~ shall comply with 800.44(A) through (D).

Informational Note: For additional information regarding overhead (aerial) wires and cables, see ANSI C2-2017, *National Electrical Safety Code, Part 2 Safety Rules for Overhead Lines.*

#### (A) On Poles and In-Span.

Where wires and cables and electric light or power conductors are supported by the same pole or are run parallel to each other in-span, the conditions described in 800.44(A)(1) through (A)(4) shall be met.

#### (1) Relative Location.

Where practicable, the wires and cables shall be located below the electric light or power conductors.

#### (2) Attachment to Cross-Arms.

Wires and cables shall not be attached to a cross-arm that carries electric light or power conductors.

#### (3) Climbing Space.

The climbing space through wires and cables shall comply with the requirements of 225.14(D).

#### (4) Clearance.

Supply service drops and sets of overhead service conductors of 0 volts to 750 volts running above and parallel to communications and CATV type coaxial service drops shall have a minimum separation of 300 mm (12 in.) at any point in the span, including the point of and at their attachment to the building, provided that the ungrounded conductors are insulated and that a clearance of not less than 1.0 m (40 in.) is maintained between the two services at the pole.

#### (B) Above Roofs.

Communications wires and cables and CATV type coaxial cables shall have a vertical clearance of not less than 2.5 m (8 ft) from all points of roofs above which they pass.

*Exception No. 1: Communications wires and cables and CATV type coaxial cables shall not be required to have a vertical clearance of not less than 2.5 m (8 ft) above auxiliary buildings, such as garages and the like.*

*Exception No. 2: A reduction in clearance above only the overhanging portion of the roof to not less than 450 mm (18 in.) shall be permitted if (1) not more than 1.2 m (4 ft) of communications service-drop conductors pass above the roof overhang and (2) they are terminated at a through- or above-the-roof raceway or approved support.*

*Exception No. 3: Where the roof has a slope of not less than 100 mm in 300 mm (4 in. in 12 in.), a reduction in clearance to not less than 900 mm (3 ft) shall be permitted.*

Informational Note: For additional information regarding overhead (aerial) wires and cables, see ANSI/IEEE C2-2017, *National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines*.

**(C) On Masts.**

Overhead (aerial) communications and CATV type coaxial cables shall be permitted to be attached to an above-the-roof raceway mast that does not enclose or support conductors of electric light or power circuits.

**(D) Between Buildings.**

Communications and CATV type coaxial cables extending between buildings or structures, and also the supports or attachment fixtures, shall be identified and shall have sufficient strength to withstand the loads to which they might be subjected.

*Exception: Where a coaxial cable does not have sufficient strength to be self-supporting, it shall be attached to a supporting messenger cable that, together with the attachment fixtures or supports, shall be acceptable for the purpose and shall have sufficient strength to withstand the loads to which they may be subjected.*

**800.48 Communication Service Point.** The Communication Service Point shall be at a readily accessible location either outside or inside of a building or structure near to the point of entrance of the conductors in accordance with the one or more of the following:

1. The point of connection at which the communication service provider's network (outside plant) transitions to the premises wiring. The location of this point shall not be located further than 50 feet from the point of entrance.

2. The point of connection in an individual dwelling shall be located so as not to exceed 24 inches from the primary protector on the premises side of the protector.

3. A physical protection point or communications cable exiting the connection enclosure on the individual building side of the enclosure.

4. The point of connection at the Grounding Block, where required.

5. The point where a wireless signal transitions from the antenna or dish through a wired connection to transmitting or receiving equipment. The location of this point shall be permitted to include the ground connection at the antenna discharge unit or coaxial cable connection to the transmitting/receiving station (see 810.21).

6. The point of connection between nonconductive optical fiber cable entering the building and premises optical fiber cable inside the building not to exceed 50 feet from the point of entrance.

7. The Communication Service Point shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC), Electrical metallic tubing (EMT), intermediate metal conduit (IMC), or Rigid polyvinyl chloride conduit (PVC) to the point of emergence (see 770.48, 805.48, 820.48 and 830.48).

Informational Note: The transition and connection points listed above may be co-located. For example, a primary protector may be located inside a network interface unit (item 3) with a connection to an adjacent grounding block (Item 4) within 24 inches, and a connection to the premise wiring (item 2).

### 800.49 Metal Entrance Conduit Grounding.

Metal conduit containing entrance wire or cable shall be connected by a bonding conductor or grounding electrode conductor to a grounding electrode or, where present, the building grounding electrode system in accordance with 800.100(B).

### 800.53 Separation from Lightning Conductors.

Where practicable, a separation of at least 1.8 m (6 ft) shall be maintained between lightning conductors and all communication wires and cables and CATV type coaxial cables on buildings.

Informational Note No. 1: For additional information regarding overhead (aerial) wires and cables, see ANSI C2-2017 *National Electrical Safety Code, Part 2, Safety Rules for Overhead Lines*.

Informational Note No. 2: Specific separation distances may be calculated from the sideflash equation in NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems.*

## Part III. Grounding Methods

### 800.100 Cable and Primary Protector Bonding and Grounding.

#### (A) Bonding Conductor or Grounding Electrode Conductor.

#### (1) Insulation.

The bonding conductor or grounding electrode conductor shall be listed and shall be permitted to be insulated, covered, or bare.

#### (2) Material.

The bonding conductor or grounding electrode conductor shall be copper or other corrosion-resistant conductive material, stranded or solid.

#### (3) Size.

The bonding conductor or grounding electrode conductor shall not be smaller than 14 AWG. The bonding conductor or grounding electrode conductor shall have a current-carrying capacity not less than the grounded metallic cable sheath member of the communications cable, the protected conductor of the communications cable, or the outer sheath of the coaxial cable, as applicable. The bonding conductor or grounding electrode conductor shall not be required to exceed 6 AWG.

#### (4) Length.

The bonding conductor or grounding electrode conductor shall be as short as practicable. In one- and two-family dwellings, the bonding conductor or grounding electrode conductor shall be as short as practicable, not to exceed 6.0 m (20 ft) in length.

Informational Note: Similar bonding conductor or grounding electrode conductor length limitations applied at apartment buildings and commercial buildings help to reduce voltages that may be developed between the building's power and communications systems during lightning events.

*Exception: In one- and two-family dwellings where it is not practicable to achieve an overall maximum bonding conductor or grounding electrode conductor length of 6.0 m (20 ft), a separate ground rod meeting the minimum dimensional criteria of 800.100(B)(3)(2) or (B)(3)(3) shall be driven, the bonding conductor or grounding electrode conductor shall be connected to the ground rod in accordance with 800.100(C), and the ground rod shall be connected to the power grounding electrode system in accordance with 800.100(D).*

#### (5) Run in Straight Line.

The bonding conductor or grounding electrode conductor shall be run in as straight a line as practicable.

#### (6) Physical Protection.

Bonding conductors and grounding electrode conductors shall be protected where exposed to physical damage. Where the bonding conductor or grounding electrode conductor is installed in a metal raceway, both ends of the raceway shall be bonded to the contained conductor or to the same terminal or electrode to which the bonding conductor or grounding electrode conductor is connected.

**(B) Electrode.**

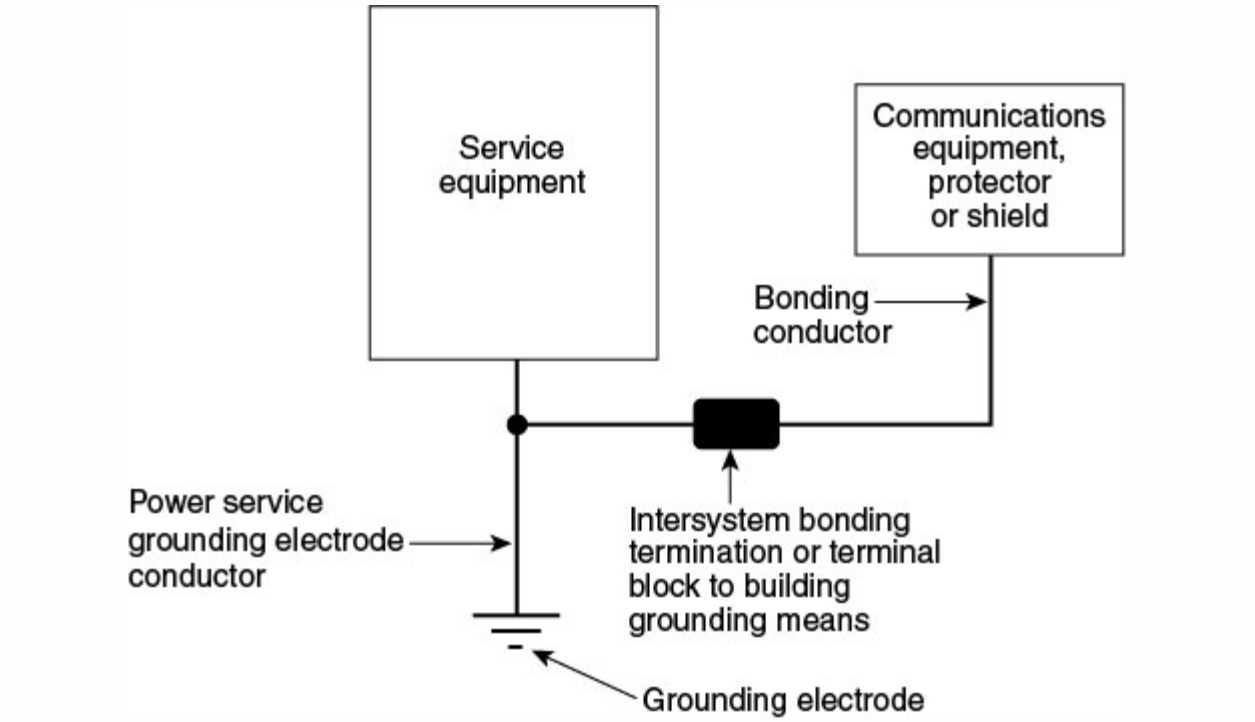
The bonding conductor or grounding electrode conductor shall be connected in accordance with 800.100(B)(1), (B)(2) , or (B)(3).

**(1) In Buildings or Structures with an Intersystem Bonding Termination.**

If the building or structure served has an intersystem bonding termination as required by 250.94, the bonding conductor shall be connected to the intersystem bonding termination.

Informational Note: Informational Note Figure 800.100(B)(1) illustrates the connection of the bonding conductor in buildings or structures equipped with an intersystem bonding termination or a terminal block providing access to the building grounding means.

**Figure Informational Note Figure 800.100(B)(1) Illustration of a Bonding Conductor in a Communications Installation.**




**(2) In Buildings or Structures with Grounding Means.**

If an intersystem bonding termination is established, 250.94(A) shall apply. If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on one of the following:

1. The building or structure grounding electrode system as covered in 250.50
2. The grounded interior metal water piping system, within 1.5 m (5 ft) from its point of entrance to the building, as covered in 250.52
3. The power service accessible means external to enclosures using the options identified in 250.94(A), Exception
4. The nonflexible metal power service raceway
5. The service equipment enclosure

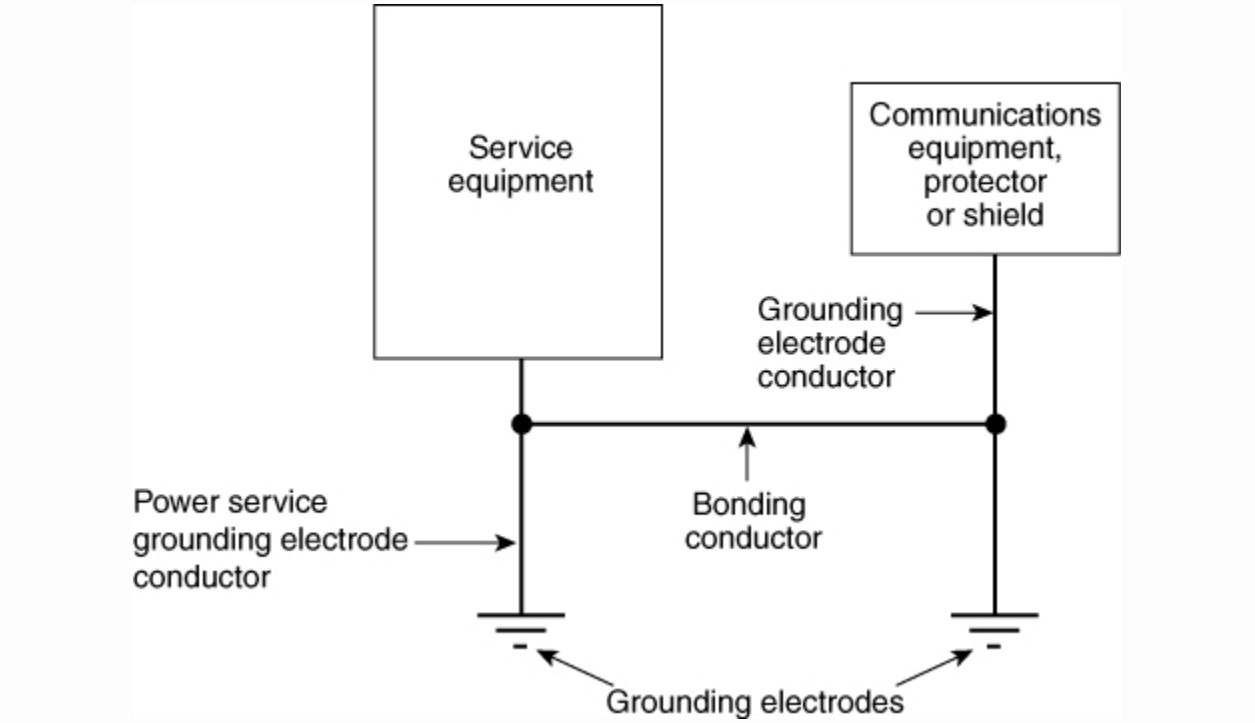
6. The grounding electrode conductor or the grounding electrode conductor metal enclosure of the power service
7. The grounding electrode conductor or the grounding electrode of a building or structure disconnecting means that is connected to a grounding electrode as covered in 250.32

A bonding device intended to provide a termination point for the bonding conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on nonremovable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is nonremovable.

For purposes of this section, the mobile home service equipment or the mobile home disconnecting means located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means connected to an electrode by a grounding electrode conductor in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Informational Note Figure 800.100(B)(2) illustrates the connection of the bonding conductor in buildings or structures not equipped with an intersystem bonding termination or a terminal block providing access to the building grounding means.

**Figure Informational Note Figure 800.100(B)(2) Illustration of a Grounding Electrode Conductor and a Bonding Conductor in a Communications Installation.**




**(3) In Buildings or Structures Without an Intersystem Bonding Termination or Grounding Means.**

If the building or structure served has no intersystem bonding termination or grounding means, as described in 800.100(B)(2), the grounding electrode conductor shall be connected to one of the following:

1. To any one of the individual grounding electrodes described in 250.52(A)(1), (A)(2), (A)(3), or (A)(4)
2. If the building or structure served has no intersystem bonding termination or grounding means, as described in 800.100(B)(2) or (B)(3)(1), to any one of the individual grounding electrodes described in 250.52(A)(5), (A)(7), and (A)(8)

3. For communications circuits covered in Article 805 or network-powered broadband communications systems covered in Article 830, to a ground rod or pipe not less than 1.5 m (5 ft) in length and 12.7 mm (0.5 in.) in diameter, driven, where practicable, into permanently damp earth and separated from lightning protection system conductors, as covered in 800.53, and at least 1.8 m (6 ft) from electrodes of other systems

Steam pipes, hot water pipes, or lightning protection system conductors shall not be employed as grounding electrodes for protectors and grounded metallic members.

**(C) Electrode Connection.**

Connections to grounding electrodes shall comply with 250.70.

**(D) Bonding of Electrodes.**

A bonding jumper not smaller than 6 AWG copper or equivalent shall be connected between the grounding electrode and power grounding electrode system at the building or structure served where separate electrodes are used.

*Exception: At mobile homes as covered in 800.106.*

Informational Note No. 1: See 250.60 for connection to a lightning protection system.

Informational Note No. 2: Bonding together of all separate electrodes limits potential differences between them and between their associated wiring systems.

**800.106 Primary Protector Grounding and Bonding at Mobile Homes.**

**(A) Grounding.**

Grounding shall comply with 800.106(A)(1) and (A)(2).

**(1) Mobile Home Service Equipment.**

Where there is no mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, grounding shall comply with one of the following:

1. The primary protector grounding terminal; the coaxial cable shield ground, or surge arrester grounding terminal; or the network-powered broadband communications cable shield, network-powered broadband communications cable metallic members not used for communications or powering, and network interface unit shall be connected to a grounding electrode conductor or grounding electrode in accordance with 800.100(B)(3).
2. The non-current-carrying metallic members of optical fiber cables shall be connected to a grounding electrode in accordance with 770.106(A)(1). The network terminal, if required to be grounded, shall be connected to a grounding electrode in accordance with 800.106(A)(1)(1). The grounding electrode shall be bonded in accordance with 770.106(B).

**(2) Mobile Home Feeder Disconnecting Means.**

Where there is no mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, grounding shall comply with one of the following:

1. The primary protector grounding terminal; the network-powered broadband communications cable shield, network-powered broadband communications cable metallic members not used for communications or powering, and network interface unit shall be connected to a grounding electrode in accordance with 800.100(B)(3).
2. The non-current-carrying metallic members of optical fiber cables shall be connected to a grounding electrode in accordance with 770.106(A)(2). The network terminal, if required to be grounded, shall be connected to a grounding electrode in accordance with 800.106(A)(2). The grounding electrode shall be bonded in accordance with 770.106(B).

**(B) Bonding.**

The primary protector grounding terminal or grounding electrode, network-powered broadband communications cable grounding terminal, or network interface unit grounding terminal shall be bonded together and connected to the metal frame or available grounding terminal of the mobile home with a copper conductor not smaller than 12 AWG under either of the following conditions:

1. Where there is no mobile home service equipment or disconnecting means as in 800.106(A)
2. Where the mobile home is supplied by cord and plug

**Part IV. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**800.110 Raceways, Cable Routing Assemblies, and Cable Trays.**

**(A) Types of Raceways.**

Wires and cables shall be permitted to be installed in raceways that comply with either 800.110(A)(1) or (A)(2). Medium-power network-powered broadband communications cables shall not be permitted to be installed in raceways that comply with 800.110(A)(2).

**(1) Raceways Recognized in Chapter 3.**

Wires and 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.**

Wires and 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.

**(3) Innerduct for Communications Wires and Cables, Coaxial Cables, or Network-Powered Broadband Communications Cables.**

Listed plenum communications raceways, listed riser communications raceways, and listed general-purpose communications raceways 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.**

The raceway fill requirements of Chapters 3 and 9 shall apply to medium-power network-powered broadband communications cables.

**(C) Cable Routing Assemblies.**

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)(1) and (C)(2) and 800.113.

**(1) Horizontal Support.**

Cable routing assemblies shall be supported where run horizontally at intervals not to exceed 900 mm (3 ft) and at each end or joint, unless listed for other support intervals. In no case shall the distance between supports exceed 3 m (10 ft).

**(2) Vertical Support.**

Vertical runs of cable routing assemblies shall be supported at intervals not exceeding 1.2 m (4 ft), unless listed for other support intervals, and shall not have more than one joint between supports.

**(D) Cable Trays.**

Wires and cables and communications raceways shall be permitted to be installed in metal or listed nonmetallic cable tray systems. Ladder cable trays shall be permitted to support cable routing assemblies.

## 800.113 Installation of Wires, Cables, Cable Routing Assemblies, and Communications Raceways.

Installation of wires, cables, cable routing assemblies, and communications raceways shall comply with 800.113(A) through (L). Installation of cable routing assemblies and communications raceways shall comply also with 800.110.

**(A) Listing.**

Wires, cables, cable routing assemblies, and communications raceways installed in buildings shall be listed.

*Exception: Cables installed in compliance with 805.48 or 820.48 shall not be required to be listed.*

**(B) Ducts Specifically Fabricated for Environmental Air.**

The following wires and 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. Plenum cables up to 1.22 m (4 ft) in length
2. Plenum cables, riser cables, general-purpose cables, and limited-use 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 NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

**(C) Other Spaces Used for Environmental Air (Plenums).**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted in other spaces used for environmental air as described in 300.22(C):

1. Plenum cables
2. Plenum communications raceways
3. Plenum cable routing assemblies
4. Plenum cables installed in plenum communications raceways
5. Plenum cables installed in plenum cable routing assemblies
6. Plenum cables and plenum communications raceways supported by open metal cable tray systems
7. Plenum cables, riser cables, general-purpose cables, limited-use cables, and communications wires installed in raceways that are installed in compliance with 300.22(C)
8. Plenum cables, riser cables, general-purpose cables, limited-use cables, 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)
9. Plenum cables, riser cables, general-purpose cables, and limited-use 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, see NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

**(D) Risers — Cables, Cable Routing Assemblies, and Communications Raceways in Vertical Runs.**

The following cables, cable routing assemblies, and communications raceways shall be permitted in vertical runs penetrating one or more floors and in vertical runs in a shaft:

1. Plenum and riser cables
2. Plenum and riser communications raceways
3. Plenum and riser cable routing assemblies
4. Plenum and riser cables installed in:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) Plenum cable routing assemblies
    d) Riser cable routing assemblies

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**(E) Risers — Cables and Innerducts in Metal Raceways.**

The following cables and innerducts shall be permitted in metal raceways in a riser having firestops at each floor:

1. Plenum cables, riser cables, general-purpose cables, and limited-use cables
2. Plenum, riser, and general-purpose communications raceways
3. Plenum cables, riser cables, general-purpose cables, and limited-use cables installed in:
    a) Plenum communications raceways (innerduct)
    b) Riser communications raceways (innerduct)
    c) General-purpose communications raceways (innerduct)

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**(F) Risers — Cables, Cable Routing Assemblies, and Communications Raceways in Fireproof Shafts.**

The following cables, cable routing assemblies, and communications raceways shall be permitted to be installed in fireproof riser shafts having firestops at each floor:

1. Plenum cables, riser cables, general-purpose cables, and limited-use cables
2. Plenum, riser, and general-purpose communications raceways
3. Plenum, riser, and general-purpose cable routing assemblies
4. Plenum cables, riser cables, general-purpose cables, and limited-use cables installed in:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
    d) Plenum cable routing assemblies
    e) Riser cable routing assemblies
    f) General-purpose cable routing assemblies

Informational Note: See 800.26 for firestop requirements for floor penetrations.

**(G) Risers — One- and Two-Family Dwellings.**

The following cables, cable routing assemblies, and communications raceways shall be permitted in one- and two-family dwellings:

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables less than 6 mm (0.25 in.) in diameter
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Plenum cables, riser cables, and general-purpose cables installed in:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
    d) Plenum cable routing assemblies
    e) Riser cable routing assemblies
    f) General-purpose cable routing assemblies

**(H) Cable Trays.**

The following wires, cables, and communications raceways shall be permitted to be supported by cable trays:

1. Plenum cables, riser cables, and general-purpose cables
2. Plenum, riser, and general-purpose communications raceways
3. Communications wires, plenum cables, riser cables, and general-purpose cables installed in:
    1. Plenum communications raceways
    2. Riser communications raceways
    3. General-purpose communications raceways

**(I) Distributing Frames and Cross-Connect Arrays.**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in distributing frames and cross-connect arrays:

1. Plenum cables, riser cables, general-purpose cables, and communications wires
2. Plenum, riser, and general-purpose communications raceways
3. Plenum, riser, and general-purpose cable routing assemblies
4. Communications wires, plenum cables, riser cables, and general-purpose cables installed in:
    1. Plenum communications raceways
    2. Riser communications raceways
    3. General-purpose communications raceways
    4. Plenum cable routing assemblies
    5. Riser cable routing assemblies
    6. General-purpose cable routing assemblies

**(J) Other Building Locations.**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in building locations other than the locations covered in 800.113(B) through (I):

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables with a maximum of 3 m (10 ft) of exposed length in nonconcealed spaces
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
6. Plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum cable routing assemblies
    b) Riser cable routing assemblies
    c) General-purpose cable routing assemblies
7. Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3
8. Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks

**(K) Multifamily Dwellings.**

The following cables, cable routing assemblies, and communications raceways shall be permitted to be installed in multifamily dwellings in locations other than the locations covered in 800.113(B) through (G):

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables less than 6 mm (0.25 in.) in diameter in nonconcealed spaces
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum communications raceways
    b) Riser communications raceways
    c) General-purpose communications raceways
6. Plenum cables, riser cables, and general-purpose cables installed in the following:
    a) Plenum cable routing assemblies
    b) Riser cable routing assemblies
    c) General-purpose cable routing assemblies
7. Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3
8. Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks

**(L) One- and Two-Family Dwellings.**

The following wires, cables, cable routing assemblies, and communications raceways shall be permitted to be installed in one- and two-family dwellings in locations other than the locations covered in 800.113(B) through (F):

1. Plenum cables, riser cables, and general-purpose cables
2. Limited-use cables less than 6 mm (0.25 in.) in diameter
3. Plenum, riser, and general-purpose communications raceways
4. Plenum, riser, and general-purpose cable routing assemblies
5. Communications wires, plenum cables, riser cables, and general-purpose cables installed in the following:
   a) Plenum communications raceways
   b) Riser communications raceways
   c) General-purpose communications raceways
6. Plenum cables, riser cables, and general-purpose cables installed in the following
   a) Plenum cable routing assemblies
   b) Riser cable routing assemblies
   c) General-purpose cable routing assemblies
7. Communications wires, plenum cables, riser cables, general-purpose cables, and limited-use cables installed in raceways recognized in Chapter 3
8. Type CMUC under-carpet communications wires and cables installed under carpet, modular flooring, and planks
9. Hybrid power and communications cable listed in accordance with 805.179(F)

**800.154 Applications of Listed Communications Wires, Cables, and Raceways, and Listed Cable Routing Assemblies.**

Permitted and nonpermitted applications of listed communications wires, cables, coaxial cables, network-powered broadband communications system cables and raceways, and listed cable routing assemblies, shall be in accordance with one of the following:

1. Listed communications wires and cables as indicated in Table 800.154(a)
2. Listed communications raceways as indicated in Table 800.154(b)
3. Listed cable routing assemblies as indicated in Table 800.154(c)

The permitted applications shall be subject to the installation requirements of 800.110 and 800.113.

**Table 800.154(a) Applications of Listed Communications Wires, Cables, and Network-Powered Broadband Communications System Cables on the customer side of the Communication Service Point ~~Buildings~~**

| Applications | | Wire and Cable Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BMU, BLU | Hybrid Power and Communications Cables | Communications Wires |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | Y | N | N | N | N | N | N | N | N | N |
| | In metal raceway that complies with 300.22(B) | Y | Y | Y | Y | Y | Y | N | N | N | Y |

| Applications | | Wire and Cable Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BMU, BLU | Hybrid Power and Communications Cables | Communications Wires |
| In other spaces used for environmental air (plenums) as described in 300.22(C) | In other spaces used for environmental air | Y | N | N | N | N | N | N | N | N | N |
| | In metal raceway that complies with 300.22(C) | Y | Y | Y | Y | Y | Y | N | N | N | Y |
| | In plenum communications raceways | Y | N | N | N | N | N | N | N | N | N |
| | In plenum cable routing assemblies | Y | N | N | N | N | N | N | N | N | N |
| | Supported by open metal cable trays | Y | N | N | N | N | N | N | N | N | N |
| | Supported by solid bottom metal cable trays with solid metal covers | Y | Y | Y | Y | Y | Y | N | N | N | N |
| In risers | In vertical runs | Y | Y | Y | N | N | N | N | N | N | N |
| | In metal raceways | Y | Y | Y | Y | Y | Y | N | N | N | N |
| | In fireproof shafts | Y | Y | Y | Y | Y | Y | N | N | N | N |
| | In plenum communications raceways | Y | Y | N | N | N | N | N | N | N | N |
| | In plenum cable routing assemblies | Y | Y | N | N | N | N | N | N | N | N |
| | In riser communications raceways | Y | Y | N | N | N | N | N | N | N | N |
| | In riser cable routing assemblies | Y | Y | N | N | N | N | N | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y | Y | Y | Y | N | N | Y | N |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y | Y | Y | Y | N | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y | Y | Y | Y | Y | N | Y | N |
| | In multifamily dwellings | Y | Y | Y | Y | Y | Y | Y | N | N | N |
| | In nonconcealed spaces | Y | Y | Y | Y | Y | Y | Y | N | N | N |
| | Supported by cable trays | Y | Y | Y | Y | Y | N | N | N | N | N |
| | Under carpet, modular flooring, and planks | N | N | N | N | N | N | Y | N | N | N |
| | In distributing frames and cross-connect arrays | Y | Y | N | Y | N | N | N | N | N | Y |
| | In rigid metal conduit (RMC) and intermediate metal conduit (IMC) | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y |

| Applications | | Wire and Cable Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Plenum | Riser | BMR | General-Purpose | BM | Limited-Use | Undercarpet | BMU, BLU | Hybrid Power and Communications Cables | Communications Wires |
| | In any raceway recognized in Chapter 3 | Y | Y | Y | Y | Y | Y | N | N | N | Y |
| | In plenum communications raceways | Y | Y | N | Y | N | N | N | N | N | Y |
| | In plenum cable routing assemblies | Y | Y | N | Y | N | N | N | N | N | Y |
| | In riser communications raceways | Y | Y | N | Y | N | N | N | N | N | Y |
| | In riser cable routing assemblies | Y | Y | N | Y | N | N | N | N | N | Y |
| | In general-purpose communications raceways | Y | Y | N | Y | N | N | N | N | N | Y |
| | In general-purpose cable routing assemblies | Y | Y | N | Y | N | N | N | N | N | Y |

Note: An "N" in the table indicates that the cable type shall not be permitted to be installed in the application. A "Y" indicates that the cable type shall be permitted to be installed in the application subject to the limitations described in 800.113. The Riser column includes all riser cables except BMR, and the General-Purpose column includes all general-purpose cables except BM.
Informational Note No. 1: Part IV of Article 800 covers wiring on the customer side of the communication service point ~~installation methods within buildings~~. This table covers the applications of listed communications wires, cables, and raceways ~~in buildings~~. See the definition of *Point of Entrance* in 800.2.

Informational Note No. 2: For information on the restrictions to the installation of communications cables in fabricated ducts, see 800.113(B).

### Table 800.154(b) Applications of Listed Communications Raceways on the customer side of the Communication Service Point~~in Buildings~~

| Applications | | Listed Communications Raceway Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | N | N | N |
| | In metal raceway that complies with 300.22(B) | N | N | N |
| In other spaces used for environmental air (plenums) 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 cable routing assemblies | N | 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 cable routing assemblies | N | N | N |
| | In riser cable routing assemblies | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y |
| | In one- and two-family dwellings | Y | Y | Y |
| | In multifamily dwellings | Y | Y | Y |

| Applications | | Listed Communications Raceway Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| | In nonconcealed spaces | Y | Y | Y |
| | Supported by cable trays | Y | Y | Y |
| | Under carpet, modular flooring, and planks | N | N | N |
| | In distributing frames and cross-connect arrays | Y | Y | Y |
| | In any raceway recognized in Chapter 3 | Y | Y | Y |
| | In plenum cable routing assemblies | N | N | N |
| | In riser cable routing assemblies | N | N | N |
| | In general-purpose cable routing assemblies | N | N | N |

Note: An “N” in the table indicates that the communications raceway type shall not be permitted to be installed in the application. A “Y” indicates that the communications raceway type shall be permitted to be installed in the application, subject to the limitations described in 800.110 and 800.113.

## Table 800.154(c) Applications of Listed Cable Routing Assemblies in Buildings

| Applications | | Listed Cable Routing Assembly Type | | |
|---|---|---|---|---|
| | | Plenum | Riser | General-Purpose |
| In ducts specifically fabricated for environmental air as described in 300.22(B) | In fabricated ducts | N | N | N |
| | In metal raceway that complies with 300.22(B) | N | N | N |
| In other spaces used for environmental air (plenums) 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) | N | N | N |
| | In plenum communications raceways | N | N | N |
| | Supported by open metal cable trays | Y | N | N |
| | Supported by solid bottom metal cable trays with solid metal covers | N | N | N |
| In risers | In vertical runs | Y | Y | N |
| | In metal raceways | N | N | N |
| | In fireproof shafts | Y | Y | Y |
| | In plenum communications raceways | N | N | N |
| | In riser communications raceways | N | N | N |
| | In one- and two-family dwellings | Y | Y | Y |
| Within buildings in other than air-handling spaces and risers | General | Y | Y | Y |
| | In one- and two-family dwellings | Y | Y | Y |
| | In multifamily dwellings | Y | Y | Y |
| | In nonconcealed spaces | Y | Y | Y |
| | Supported by cable trays | Y | Y | Y |
| | Under carpet, modular flooring, and planks | N | N | N |
| | In distributing frames and cross-connect arrays | Y | Y | Y |
| | In any raceway recognized in Chapter 3 | N | N | N |
| | In plenum communications raceways | N | N | N |
| | In riser communications raceways | N | N | N |
| | In general-purpose communications raceways | N | N | N |

Note: An “N” in the table indicates that the cable routing assembly type shall not be permitted to be installed in the application. A “Y” indicates that the cable routing assembly type shall be permitted to be installed in the application subject to the limitations described in 800.113.

### 800.179 Plenum, Riser, General-Purpose, and Limited Use Cables.

Plenum, riser, general-purpose, and limited-use cables shall be listed in accordance with 800.179(A) through (D) and shall have a temperature rating of not less than 60°C (140°F). The temperature rating shall be marked on the jacket of cables that have a temperature rating exceeding 60°C (140°F). The cable voltage rating shall not be marked on the cable.

#### (A) Plenum Cables.

Type CMP communications plenum cables, Type CATVP community antenna television plenum coaxial cables, and Type BLP network-powered broadband communication low-power plenum cables shall be listed as being suitable for use in ducts, plenums, and other spaces 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*.

#### (B) Riser Cables.

Type CMR communications riser cables, Type CATVR community antenna television riser coaxial cables, Type BMR network-powered broadband communications medium-power riser cables, and Type BLR network-powered broadband communications low-power riser cables 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 1666-2011, *Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts.*

#### (C) General-Purpose Cables.

Type CM communications general-purpose cables, Type CATV community antenna television coaxial general-purpose cables, Type BM network-powered broadband communications medium-power general-purpose cables, and Type BL network-powered broadband communications low-power general-purpose cables shall be listed as being suitable for general-purpose use, with the exception of risers and plenums, 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 Flame Tray 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. 0.3-09, *Test Methods for Electrical Wires and Cables*.

#### (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 VW-1 (vertical-wire) flame test in ANSI/UL 1581-2017, *Reference Standard for Electrical Wires, Cables and Flexible Cords*.

## Part V. Listing Requirements

### 800.180 Grounding Devices.

Where bonding or grounding is required, devices used to connect a shield, a sheath, or non-current-carrying metallic members of a cable to a bonding conductor or grounding electrode conductor shall be listed or be part of listed equipment.

### 800.182 Cable Routing Assemblies and Communications Raceways.

Cable routing assemblies and communications raceways shall be listed in accordance with 800.182(A) through (C). Cable routing assemblies shall be marked in accordance with Table 800.182(a). Communications raceways shall be marked in accordance with Table 800.182(b).

Informational Note: For information on listing requirements for both communications raceways and cable routing assemblies, see ANSI/UL 2024-5-2015, *Cable Routing Assemblies and Communications Raceways*.

**Table 800.182(a) Cable Routing Assembly Markings**

| Type | Marking |
|---|---|
| Plenum Cable Routing Assembly | Plenum Cable Routing Assembly |
| Riser Cable Routing Assembly | Riser Cable Routing Assembly |
| General-Purpose Cable Routing Assembly | General-Purpose Cable Routing Assembly |

**Table 800.182(b) Communications Raceway Markings**

| Type | Marking |
|---|---|
| Plenum Communications Raceway | Plenum Communications Raceway |
| Riser Communications Raceway | Riser Communications Raceway |
| General-Purpose Communications Raceway | General-Purpose Communications Raceway |

### (A) Plenum Cable Routing Assemblies and Plenum Communications Raceways.

Plenum cable routing assemblies and plenum communications raceways shall be listed as having adequate fire-resistant and low-smoke-producing characteristics.

Informational Note No. 1: One method of defining cable routing assemblies and communications raceways that have adequate fire-resistant and low-smoke-producing characteristics is that they exhibit a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84-15a, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or ANSI/UL 723-2013, *Standard Test Method for Surface Burning Characteristics of Building Materials*.

Informational Note No. 2: Another method of defining communications raceways that have adequate fire-resistant and low-smoke-producing characteristics is that they exhibit 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 262-2015, *Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces*.

Informational Note No. 3: See 4.3.11.2.6 or 4.3.11.5.5 of NFPA 90A-2015, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, for information on materials exposed to the airflow in ceiling cavity and raised floor plenums.

### (B) Riser Cable Routing Assemblies and Riser Communications Raceways.

Riser cable routing assemblies and riser communications raceways shall be listed as having adequate 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 cable routing assemblies and communications raceways pass the requirements of ANSI/UL 1666-2011, *Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cable Installed Vertically in Shafts*.

### (C) General-Purpose Cable Routing Assemblies and General-Purpose Communications Raceways.

General-purpose cable routing assemblies and general-purpose communications raceways shall 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 cable routing assemblies and communications raceways do not spread fire to the top of the tray in the “UL Flame Exposure, Vertical Flame Tray Test” in ANSI/UL 1685-2011, *Standard for Safety for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables*.

## Article 805 Communications Circuits

### Part I. General

### 805.1 Scope.

This article covers communications circuits and equipment.

**805.2 Definitions.**

The definitions in this section shall apply only within Articles 805 and 840.

**Cable.**

A factory assembly of two or more conductors having an overall covering.

**Communications Circuit Integrity (CI) Cable.**

Cable used in communications systems to ensure continued operation of critical circuits during a specified time under fire conditions.

**Wire.**

A factory assembly of one or more insulated conductors without an overall covering.

**805.18 Installation of Equipment.**

Equipment electrically connected to a communications network shall be listed in accordance with 805.170.

*Exception: This listing requirement shall not apply to test equipment that is intended for temporary connection to a telecommunications network by qualified persons during the course of installation, maintenance, or repair of telecommunications equipment or systems.*

**Part II. Wires and Cables Outside and on the service provider side of the Communication Service Point ~~Entering Buildings~~**

**805.47 Underground Communications Wires and Cables ~~Entering Buildings~~.**

Underground communications wires and cables ~~entering buildings~~ shall comply with 805.47(A) and (B). The requirements of 310.10(C) shall not apply to communications wires and cables.

**(A) Underground Systems with Electric Light, Power, Class 1, or Non-Power-Limited Fire Alarm Circuit Conductors.**

Underground communications wires and cables in a raceway, handhole enclosure, or manhole containing electric light, power, Class 1, or non-power-limited fire alarm circuit conductors shall be in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier.

**(B) Underground Block Distribution.**

Where the entire street circuit is run underground and the circuit within the block is placed so as to be free from the likelihood of accidental contact with electric light or power circuits of over 300 volts to ground, the insulation requirements of 805.50(A) and 805.50(C) shall not apply, insulating supports shall not be required for the conductors, and bushings shall not be required where the conductors enter the building.

**805.48 Unlisted Cables on the service provider side of the Communication Service Point ~~Entering Buildings~~.**

Unlisted outside plant communications cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated in an enclosure or on a listed primary protector. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) to the point of emergence.

Informational Note No. 1: Splice cases or terminal boxes, both metallic and plastic types, are typically used as enclosures for splicing or terminating telephone cables.

Informational Note No. 2: This section limits the length of unlisted outside plant cable to 15 m (50 ft), while 805.90(B) requires that the primary protector be located as close as practicable to the point at which the cable enters the building. Therefore, in installations requiring a primary protector, the outside plant cable may not be permitted to extend 15 m (50 ft) into the building if it is practicable to place the primary protector closer than 15 m (50 ft) to the point of entrance.

### 805.50 Circuits Requiring Primary Protectors.

Circuits that require primary protectors as provided in 805.90 shall comply with 805.50(A),805.50(B), and 805.50(C).

#### (A) Insulation, Wires, and Cables.

Communications wires and cables without a metallic shield, running from the last outdoor support to the primary protector, shall be listed in accordance with 805.173.

#### (B) On Buildings.

Communications wires and cables in accordance with 805.50(A) shall be separated at least 100 mm (4 in.) from electric light or power conductors not in a raceway or cable or be permanently separated from conductors of the other systems by a continuous and firmly fixed nonconductor in addition to the insulation on the wires, such as porcelain tubes or flexible tubing. Communications wires and cables in accordance with 805.50(A) exposed to accidental contact with electric light and power conductors operating at over 300 volts to ground and attached to buildings shall be separated from woodwork by being supported on glass, porcelain, or other insulating material.

*Exception: Separation from woodwork shall not be required where fuses are omitted as provided for in 805.90(A)(1), or where conductors are used to extend circuits to a building from a cable having a grounded metal sheath.*

#### (C) Entering Buildings.

Where a primary protector is installed inside the building, the communications wires and cables shall enter the building either through a noncombustible, nonabsorbent insulating bushing or through a metal raceway. The insulating bushing shall not be required where the entering communications wires and cables (1) are in metal-sheathed cable, (2) pass through masonry, (3) meet the requirements of 805.50(A) and fuses are omitted as provided in 805.90(A)(1), or (4) meet the requirements of 805.50(A) and are used to extend circuits to a building from a cable having a grounded metallic sheath. Raceways or bushings shall slope upward from the outside or, where this cannot be done, drip loops shall be formed in the communications wires and cables immediately before they enter the building.

Raceways shall be equipped with an approved service head. More than one communications wire and cable shall be permitted to enter through a single raceway or bushing. Conduits or other metal raceways located ahead of the primary protector shall be grounded.

## Part III. Protection

### 805.90 Protective Devices.

#### (A) Application.

A listed primary protector shall be provided on each circuit run partly or entirely in aerial wire or aerial cable not confined within a block. Also, a listed primary protector shall be provided on each circuit, aerial or underground, located within the block containing the building served so as to be exposed to accidental contact with electric light or power conductors operating at over 300 volts to ground. In addition, where there exists a lightning exposure, each interbuilding circuit on a premises shall be protected by a listed primary protector at each end of the interbuilding circuit. Installation of primary protectors shall also comply with 110.3(B).

Informational Note No. 1: On a circuit not exposed to accidental contact with power conductors, providing a listed primary protector in accordance with this article helps protect against other hazards, such as lightning and above-normal voltages induced by fault currents on power circuits in proximity to the communications circuit.

Informational Note No. 2: Interbuilding circuits are considered to have a lightning exposure unless one or more of the following conditions exist:

1. Circuits in large metropolitan areas where buildings are close together and sufficiently high to intercept lightning.
2. Interbuilding cable runs of 42 m (140 ft) or less, directly buried or in underground conduit, where a continuous metallic cable shield or a continuous metal conduit containing the cable is connected to each building grounding electrode system.

3. Areas having an average of five or fewer thunderstorm days per year and earth resistivity of less than 100 ohm-meters. Such areas are found along the Pacific coast.

Informational Note No. 3: For information on lightning protection systems, see NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems.*

**(1) Fuseless Primary Protectors.**

Fuseless-type primary protectors shall be permitted under any of the conditions given in 805.90(A)(1)(a) through (A)(1)(e).

(a) Where conductors enter a building through a cable with grounded metallic sheath member(s) and where the conductors in the cable safely fuse on all currents greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor

(b) Where insulated conductors in accordance with 805.50(A) are used to extend circuits to a building from a cable with an effectively grounded metallic sheath member(s) and where the conductors in the cable or cable stub, or the connections between the insulated conductors and the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground, safely fuse on all currents greater than the current-carrying capacity of the primary protector, or the associated insulated conductors and of the primary protector bonding conductor or grounding electrode conductor

(c) Where insulated conductors in accordance with 805.50(A) or (B) are used to extend circuits to a building from other than a cable with metallic sheath member(s), where (1) the primary protector is listed as being suitable for this purpose for application with circuits extending from other than a cable with metallic sheath members, and (2) the connections of the insulated conductors to the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground or the conductors of the plant exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground safely fuse on all currents greater than the current-carrying capacity of the primary protector, or associated insulated conductors and of the primary protector bonding conductor or grounding electrode conductor

(d) Where insulated conductors in accordance with 805.50(A) are used to extend circuits aerially to a building from a buried or underground circuit that is unexposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground

(e) Where insulated conductors in accordance with 805.50(A) are used to extend circuits to a building from cable with an effectively grounded metallic sheath member(s), and where (1) the combination of the primary protector and insulated conductors is listed as being suitable for this purpose for application with circuits extending from a cable with an effectively grounded metallic sheath member(s), and (2) the insulated conductors safely fuse on all currents greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor

Informational Note: Section 9 of ANSI/IEEE C2-2012, *National Electrical Safety Code*, provides an example of methods of protective grounding that can achieve effective grounding of communications cable sheaths for cables from which communications circuits are extended.

**(2) Fused Primary Protectors.**

Where the requirements listed under 805.90(A)(1)(a) through (A)(1)(e) are not met, fused-type primary protectors shall be used. Fused-type primary protectors shall consist of an arrester connected between each line conductor and ground, a fuse in series with each line conductor, and an appropriate mounting arrangement. Primary protector terminals shall be marked to indicate line, instrument, and ground, as applicable.

**(B) Location.**

The primary protector shall be located in, on, or immediately adjacent to the structure or building served and as close as practicable to the point of entrance.

For purposes of this section, primary protectors located at mobile home service equipment within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means connected to an electrode by a grounding electrode conductor in accordance with 250.32 and located

within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a primary protector location to achieve the shortest practicable primary protector bonding conductor or grounding electrode conductor helps limit potential differences between communications circuits and other metallic systems.

**(C) Hazardous (Classified) Locations.**

The primary protector shall not be located in any hazardous (classified) locations, as defined in 500.5 and 505.5, or in the vicinity of easily ignitible material.

*Exception: As permitted in 501.150, 502.150, and 503.150.*

**(D) Secondary Protectors.**

Where a secondary protector is installed in series with the indoor communications wire and cable between the primary protector and the equipment, it shall be listed for the purpose in accordance with 805.170(B).

Informational Note: Secondary protectors on circuits exposed to accidental contact with electric light or power conductors operating at greater than 300 volts to ground are not intended for use without primary protectors.

**805.93 Grounding, Bonding, or Interruption of Non–Current-Carrying Metallic Sheath Members of Communications Cables.**

Communications cables entering the building or terminating on the outside of the building shall comply with 805.93(A) or (B).

**(A) Entering Buildings.**

In installations where the communications cable enters a building, the metallic sheath members of the cable shall be grounded or bonded as specified in 800.100 or interrupted by an insulating joint or equivalent device. The grounding, bonding, or interruption shall be as close as practicable to the point of entrance.

**(B) Terminating on the Outside of Buildings.**

In installations where the communications cable is terminated on the outside of the building, the metallic sheath members of the cable shall be grounded or bonded as specified in 800.100 or interrupted by an insulating joint or equivalent device. The grounding, bonding, or interruption shall be as close as practicable to the point of termination of the cable.

**Part IV. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**805.133 Installation of Communications Wires, Cables, and Equipment.**

Communications wires and cables from the protector to the equipment or, where no protector is required, communications wires and cables attached to the outside or inside of the building shall comply with 805.133(A) and 805.133(B)

**(A) Separation from Other Conductors.**

**(1) In Raceways, Cable Trays, Boxes, Cables, Enclosures, and Cable Routing Assemblies.**

(a) *Other Circuits.* Communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with cables 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. Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770
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

(b) *Class 2 and Class 3 Circuits.* Class 1 circuits shall not be run in the same cable with communications circuits. Class 2 and Class 3 circuit conductors shall be permitted in the same listed communications cable with communications circuits.

(c) *Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm, and Medium-Power Network-Powered Broadband Communications Circuits in Raceways, Compartments, and Boxes.* Communications conductors shall not be placed in any raceway, compartment, outlet box, junction box, or similar fitting with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits.

*Exception No. 1: Section 805.133(A)(1)(c) shall not apply if 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 conductors of communications circuits by a permanent barrier or listed divider.*

*Exception No. 2: Power conductors in outlet boxes, junction boxes, or similar fittings or compartments where such conductors are introduced solely for power supply to communications equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum of 6 mm (¼ in.) separation from the communications circuit conductors.*

*Exception No. 3: As permitted by 620.36.*

**(2) Other Applications.**

Communications wires and cables shall be separated 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.

*Exception No. 1: Section 805.133(A)(2) shall not apply where either (1) all of the conductors of the electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits are in a raceway or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC, or Type UF cables, or (2) all of the conductors of communications circuits are encased in raceway.*

*Exception No. 2: Section 805.133(A)(2) shall not apply where the communications wires and cables are permanently separated from the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B) Support of Communications Wires and Cables.**

Raceways shall be used for their intended purpose. Communications wires and cables shall not be strapped, taped, or attached by any means to the exterior of any raceway as a means of support.

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

**805.154 Substitutions of Listed Communications Wires, Cables, and Raceways, and Listed Cable Routing Assemblies.**

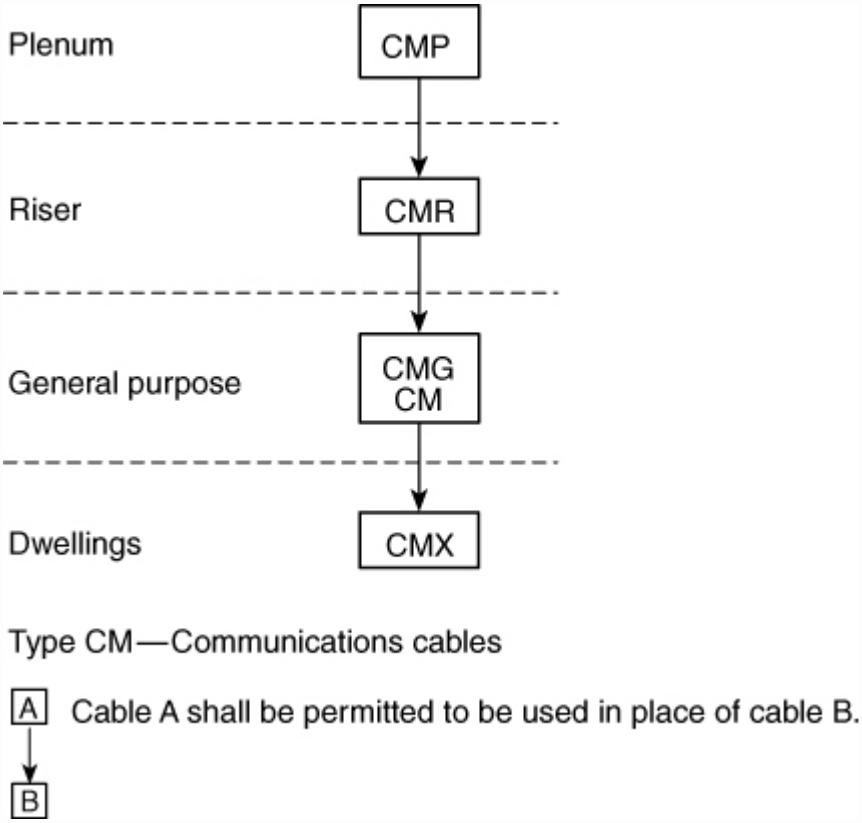
The substitutions for communications cables listed in Table 805.154 and illustrated in Figure 805.154 shall be permitted.

**Table 805.154 Cable Substitutions**

| Cable Type | Permitted Substitutions |
|---|---|
| CMR | CMP |

| Cable Type | Permitted Substitutions |
|---|---|
| CMG, CM | CMP, CMR |
| CMX | CMP, CMR, CMG, CM |

**Figure 805.154 Cable Substitution Hierarchy.**




### 805.156 Dwelling Unit Communications Outlet.

For new construction, a minimum of one communications outlet shall be installed within the dwelling in a readily accessible area and cabled to the service provider demarcation point.

## Part V. Listing Requirements

### 805.170 Equipment.

Communications equipment shall be listed as being suitable for electrical connection to a communications network.

Informational Note No. 1: One way to determine applicable requirements is to refer to ANSI/UL 60950-1-2014, *Standard for Safety of Information Technology Equipment*; ANSI/UL 1863-2012, *Standard for Safety Communications Circuit Accessories*; or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements*.

Informational Note No. 2: Additional information regarding voltages, currents, and power allowed on communications circuits can be found in ANSI/ATIS 0600337-2016, *Requirements for Maximum Voltage, Current, and Power Levels Used in Communications Transport Circuits*.

#### (A) Primary Protectors.

The primary protector shall consist of an arrester connected between each line conductor and ground in an appropriate mounting. Primary protector terminals shall be marked to indicate line and ground as applicable.

Informational Note: One way to determine applicable requirements for a listed primary protector is to refer to ANSI/UL 497-2013, *Standard for Protectors for Paired Conductor Communications Circuits*.

#### (B) Secondary Protectors.

The secondary protector shall be listed as suitable to provide means to safely limit currents to less than the current-carrying capacity of listed indoor communications wire and cable, listed telephone set line cords, and listed communications terminal equipment having ports for external wire line communications circuits. Any overvoltage protection, arresters, or grounding connection shall be connected on the equipment terminals side of the secondary protector current-limiting means.

Informational Note: One way to determine applicable requirements for a listed secondary protector is to refer to ANSI/UL 497A-2012, *Standard for Secondary Protectors for Communications Circuits*.

**(C) Plenum Grade Cable Ties.**

Cable ties intended for use in other space used for environmental air (plenums) shall be listed as having low smoke and heat release properties.

Informational Note: See NFPA 90A-2018, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, and ANSI/UL 2043-2013, *Standard for Safety Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces*, for information on listing discrete products as having low smoke and heat release properties.

### 805.173 Drop Wire and Cable.

Communications wires and cables without a metallic shield, running from the last outdoor support to the primary protector, shall be listed as being suitable for the purpose and shall have current-carrying capacity as specified in 805.90(A)(1)(b) or (A)(1)(c).

### 805.179 Communications Wires and Cables.

Communications wires and cables shall be listed in accordance with 805.179(A) through (F) and marked in accordance with Table 805.179 and 805.179(G). Conductors in communications cables, other than in a coaxial cable, shall be copper.

Communications wires and cables shall have a voltage rating of not less than 300 volts. The insulation for the individual conductors, other than the outer conductor of a coaxial cable, shall be rated for 300 volts minimum. The cable voltage rating shall not be marked on the cable or on the under-carpet communications wire.

*Exception: Voltage markings shall be permitted where the cable has multiple listings and 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 805.179 Cable Markings**

| Cable Marking | Type |
|---|---|
| CMP | Communications plenum cable |
| CMR | Communications riser cable |
| CMG | Communications general-purpose cable |
| CM | Communications general-purpose cable |
| CMX | Communications cable, limited use |
| CMUC | Under-carpet communications wire and cable |

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

**(A) General Requirements.**

The general requirements in 805.179 shall apply.

**(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 VW-1 (vertical-wire) flame test in ANSI/UL 1581-2017, *Reference Standard for Electrical Wires, Cables and Flexible Cords*.

### (C) Circuit Integrity (CI) Cable or Electrical Circuit Protective System.

Cables that are used for survivability of critical circuits under fire conditions shall be listed and meet either 805.179(C)(1) or 805.179(C)(2).

Informational Note: The listing organization provides information for circuit integrity (CI) cable and electrical circuit protective systems, including installation requirements required to maintain the fire rating.

### (1) Circuit Integrity (CI) Cables.

Circuit integrity (CI) cables specified in 805.179(A) through (D), and used for survivability of critical circuits, shall have an additional classification using the suffix "CI." In order to maintain its listed fire rating, circuit integrity (CI) cable shall only be installed in free air.

Informational Note: One method of defining circuit integrity (CI) cable is by establishing a minimum 2-hour fire resistance rating for the cable when tested in accordance with ANSI/UL 2196-2017, *Standard for Fire Test for Circuit Integrity of Fire-Resistant Power, Instrumentation, Control, and Data Cables*.

### (2) Fire-Resistive Cables.

Cables specified in 800.179(A) through (D) and 805.179(C)(1), that are part of an electrical circuit protective system, shall be fire-resistive cable identified with the protective system number on the product, or on the smallest unit container in which the product is packaged, and shall be installed in accordance with the listing of the protective system.

Informational Note No. 1: One method of defining an electrical circuit protective system is by establishing a minimum 2-hour fire resistance rating for the system when tested in accordance with UL Subject 1724, *Outline of Investigation for Fire Tests for Electrical Circuit Protective Systems*.

Informational Note No. 2: The listing organization provides information for electrical circuit protective systems (FHIT), including installation requirements for maintaining the fire rating.

### (D) Types CMP-LP, CMR-LP, CMG-LP, and CM-LP Limited Power (LP) Cables.

Types CMP-LP, CMR-LP, CMG-LP, and CM-LP communications limited power 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 XX designates the current limit in amperes per conductor.

Informational Note: An example of the marking on a communications cable with an LP rating is "CMP-LP (0.6A)(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 ampere.

### (E) Communications Wires.

Communications wires, such as distributing frame wire and jumper wire, shall 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 Flame Tray 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. 0.3-09, *Test Methods for Electrical Wires and Cables*.

### (F) Hybrid Power and Communications Cables.

Listed hybrid power and communications cables shall be permitted where the power cable is a listed Type NM or NM-B, conforming to Part III of Article 334, and the communications cable is a listed Type CM, the jackets on the listed NM or NM-B, and listed CM cables are rated for 600 volts minimum, and the hybrid cable is 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 Flame Tray 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. 0.3-09, *Test Methods for Electrical Wires and Cables*.

### (G) Optional Markings.

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.

## Article 810 Radio and Television Equipment

### Part I. General

#### 810.1 Scope.

This article covers antenna systems for radio and television receiving equipment, amateur and citizen band radio transmitting and receiving equipment, and certain features of transmitter safety. This article covers antennas such as wire-strung type, multi-element, vertical rod, flat, or parabolic and also covers the wiring and cabling that connect them to equipment. This article does not cover equipment and antennas used for coupling carrier current to power line conductors.

#### 810.2 Definitions.

The definitions in Part I of Article 100 shall apply.

#### 810.3 Other Articles.

Wiring from the source of power to and between devices connected to the interior wiring system shall comply with Chapters 1 through 4 other than as modified by Parts I and II of Article 640. Wiring for audio signal processing, amplification, and reproduction equipment shall comply with Article 640. Coaxial cables that connect antennas to equipment shall comply with Article 820.

#### 810.4 Community Television Antenna.

The antenna shall comply with this article. The distribution system shall comply with Article 820.

#### 810.5 Radio Noise Suppressors.

Radio interference eliminators, interference capacitors, or noise suppressors connected to power-supply leads shall be of a listed type. They shall not be exposed to physical damage.

#### 810.6 Antenna Lead-In Protectors.

Where an antenna lead-in surge protector is installed, it shall be listed as being suitable for limiting surges on the cable that connects the antenna to the receiver/transmitter electronics and shall be connected between the conductors and the grounded shield or other ground connection. The antenna lead-in protector shall be grounded using a bonding conductor or grounding electrode conductor installed in accordance with 810.21(F).

Informational Note: For requirements covering protectors for antenna lead-in conductors, refer to UL 497E, *Outline of Investigation for Protectors for Antenna Lead-In Conductors*.

#### 810.7 Grounding Devices.

Where bonding or grounding is required, devices used to connect a shield, a sheath, non–current-carrying metallic members of a cable, or metal parts of equipment or antennas to a bonding conductor or grounding electrode conductor shall be listed or be part of listed equipment.

### Part II. Receiving Equipment — Antenna Systems

#### 810.11 Material.

Antennas and lead-in conductors shall be of hard-drawn copper, bronze, aluminum alloy, copper-clad steel, or other high-strength, corrosion-resistant material.

*Exception: Soft-drawn or medium-drawn copper shall be permitted for lead-in conductors where the maximum span between points of support is less than 11 m (35 ft).*

#### 810.12 Supports.

Outdoor antennas and lead-in conductors shall be securely supported. The antennas or lead-in conductors shall not be attached to the electric service mast. They shall not be attached to poles or similar structures carrying open electric light or power wires or trolley wires of over 250 volts between conductors. Insulators supporting the antenna conductors shall have sufficient mechanical strength to safely support the conductors. Lead-in conductors shall be securely attached to the antennas.

### 810.13 Avoidance of Contacts with Conductors of Other Systems.

Outdoor antennas and lead-in conductors from an antenna to a building shall not cross over open conductors of electric light or power circuits and shall be kept well away from all such circuits so as to avoid the possibility of accidental contact. Where proximity to open electric light or power service conductors of less than 250 volts between conductors cannot be avoided, the installation shall be such as to provide a clearance of at least 600 mm (2 ft).

Where practicable, antenna conductors shall be installed so as not to cross under open electric light or power conductors.

### 810.14 Splices.

Splices and joints in antenna spans shall be made mechanically secure with approved splicing devices or by such other means as will not appreciably weaken the conductors.

### 810.15 Grounding.

Masts and metal structures supporting antennas shall be grounded in accordance with 810.21, unless the antenna and its related supporting mast or structure are within a zone of protection defined by a 46 m (150 ft) radius rolling sphere.

Informational Note: See 4.8.3.1 of NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, for the application of the term *rolling sphere*.

### 810.16 Size of Wire-Strung Antenna — Receiving Station.

#### (A) Size of Antenna Conductors.

Outdoor antenna conductors for receiving stations shall be of a size not less than given in Table 810.16(A).

**Table 810.16(A) Size of Receiving Station Outdoor Antenna Conductors**

| Material | Minimum Size of Conductors (AWG) Where Maximum Open Span Length Is | | |
|---|---|---|---|
| | Less Than 11 m (35 ft) | 11 m to 45 m (35 ft to 150 ft) | Over 45 m (150 ft) |
| Aluminum alloy, hard-drawn copper | 19 | 14 | 12 |
| Copper-clad steel, bronze, or other high-strength material | 20 | 17 | 14 |

#### (B) Self-Supporting Antennas.

Outdoor antennas, such as vertical rods and flat, parabolic, or dipole structures, shall be of corrosion-resistant materials and of strength suitable to withstand ice and wind loading conditions and shall be located well away from overhead conductors of electric light and power circuits of over 150 volts to ground, so as to avoid the possibility of the antenna or structure falling into or making accidental contact with such circuits.

### 810.17 Size of Lead-in — Receiving Station.

Lead-in conductors from outside antennas for receiving stations shall, for various maximum open span lengths, be of such size as to have a tensile strength at least as great as that of the conductors for antennas as specified in 810.16. Where the lead-in consists of two or more conductors that are twisted

together, are enclosed in the same covering, or are concentric, the conductor size shall, for various maximum open span lengths, be such that the tensile strength of the combination is at least as great as that of the conductors for antennas as specified in 810.16.

### 810.18 Clearances — Receiving Stations.

#### (A) Outside of Buildings.

Lead-in conductors attached to buildings shall be installed so that they cannot swing closer than 600 mm (2 ft) to the conductors of circuits of 250 volts or less between conductors, or 3.0 m (10 ft) to the conductors of circuits of over 250 volts between conductors, except that in the case of circuits not over 150 volts between conductors, where all conductors involved are supported so as to ensure permanent separation, the clearance shall be permitted to be reduced but shall not be less than 100 mm (4 in.). The clearance between lead-in conductors and any conductor forming a part of a lightning protection system shall not be less than 1.8 m (6 ft). Underground conductors shall be separated at least 300 mm (12 in.) from conductors of any light or power circuits or Class 1 circuits.

*Exception: Where the electric light or power conductors, Class 1 conductors, or lead-in conductors are installed in raceways or metal cable armor.*

Informational Note No. 1: See 250.60 for grounding associated with lightning protection components — strike termination devices. For further information, see NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, which contains detailed information on grounding, bonding, and spacing from lightning protection systems, and the calculation of specific separation distances using the sideflash equation in Section 4.6.

Informational Note No. 2: Metal raceways, enclosures, frames, and other non–current-carrying metal parts of electrical equipment installed on a building equipped with a lightning protection system may require bonding or spacing from the lightning protection conductors in accordance with NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*. Separation from lightning protection conductors is typically 1.8 m (6 ft) through air or 900 mm (3 ft) through dense materials such as concrete, brick, or wood.

#### (B) Antennas and Lead-ins — Indoors.

Indoor antennas and indoor lead-ins shall not be run nearer than 50 mm (2 in.) to conductors of other wiring systems in the premises.

*Exception No. 1: Where such other conductors are in metal raceways or cable armor.*

*Exception No. 2: Where permanently separated from such other conductors by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing.*

#### (C) In Boxes or Other Enclosures.

Indoor antennas and indoor lead-ins shall be permitted to occupy the same box or enclosure with conductors of other wiring systems where separated from such other conductors by an effective permanently installed barrier.

### 810.19 Electrical Supply Circuits Used in Lieu of Antenna — Receiving Stations.

Where an electrical supply circuit is used in lieu of an antenna, the device by which the radio receiving set is connected to the supply circuit shall be listed.

### 810.20 Antenna Discharge Units — Receiving Stations.

#### (A) Where Required.

Each conductor of a lead-in from an outdoor antenna shall be provided with a listed antenna discharge unit.

*Exception: Where the lead-in conductors are enclosed in a continuous metallic shield that either is grounded with a conductor in accordance with 810.21 or is protected by an antenna discharge unit.*

#### (B) Location.

Antenna discharge units shall be located outside the building or inside the building between the point of entrance of the lead-in and the radio set or transformers and as near as practicable to the entrance of the conductors to the building. The antenna discharge unit shall not be located near combustible material or in a hazardous (classified) location as defined in Article 500.

**(C) Grounding.**

The antenna discharge unit shall be grounded in accordance with 810.21.

**810.21 Bonding Conductors and Grounding Electrode Conductors — Receiving Stations.**

Bonding conductors and grounding electrode conductors shall comply with 810.21(A) through 810.21(K).

**(A) Material.**

The bonding conductor or grounding electrode conductor shall be of copper, aluminum, copper-clad steel, copper-clad aluminum, bronze, or similar corrosion-resistant material. Aluminum or copper-clad aluminum bonding conductors or grounding electrode conductors shall not be used where in direct contact with masonry or the earth or where subject to corrosive conditions. Where used outside, aluminum or copper-clad aluminum conductors shall not be installed within 450 mm (18 in.) of the earth.

**(B) Insulation.**

Insulation on bonding conductors or grounding electrode conductors shall not be required.

**(C) Supports.**

The bonding conductor or grounding electrode conductor shall be securely fastened in place and shall be permitted to be directly attached to the surface wired over without the use of insulating supports.

*Exception: Where proper support cannot be provided, the size of the bonding conductors or grounding electrode conductors shall be increased proportionately.*

**(D) Physical Protection.**

Bonding conductors and grounding electrode conductors shall be protected where exposed to physical damage. Where the bonding conductor or grounding electrode conductor is installed in a metal raceway, both ends of the raceway shall be bonded to the contained conductor or to the same terminal or electrode to which the bonding conductor or grounding electrode conductor is connected.

**(E) Run in Straight Line.**

The bonding conductor or grounding electrode conductor for an antenna mast or antenna discharge unit shall be run in as straight a line as practicable.

**(F) Electrode.**

The bonding conductor or grounding electrode conductor shall be connected as required in 810.21(F)(1) through 810.21(F)(3).

**(1) In Buildings or Structures with an Intersystem Bonding Termination.**

If the building or structure served has an intersystem bonding termination as required by 250.94, the bonding conductor shall be connected to the intersystem bonding termination.

**(2) In Buildings or Structures with Grounding Means.**

If the building or structure served has no intersystem bonding termination, the bonding conductor or grounding electrode conductor shall be connected to the nearest accessible location on the following:

1. The building or structure grounding electrode system as covered in 250.50
2. The grounded interior metal water piping systems, within 1.52 m (5 ft) from its point of entrance to the building, as covered in 250.52
3. The power service accessible means external to the building, as covered in 250.94
4. The nonflexible metal power service raceway
5. The service equipment enclosure, or
6. The grounding electrode conductor or the grounding electrode conductor metal enclosures of the power service

A bonding device intended to provide a termination point for the bonding conductor (intersystem bonding) shall not interfere with the opening of an equipment enclosure. A bonding device shall be mounted on nonremovable parts. A bonding device shall not be mounted on a door or cover even if the door or cover is nonremovable.

**(3) In Buildings or Structures Without an Intersystem Bonding Termination or Grounding Means.**

If the building or structure served has no intersystem bonding termination or grounding means as described in 810.21(F)(2), the grounding electrode conductor shall be connected to a grounding electrode as described in 250.52.

**(G) Inside or Outside Building.**

The bonding conductor or grounding electrode conductor shall be permitted to be run either inside or outside the building.

**(H) Size.**

The bonding conductor or grounding electrode conductor shall not be smaller than 10 AWG copper, 8 AWG aluminum, or 17 AWG copper-clad steel or bronze.

**(I) Common Ground.**

A single bonding conductor or grounding electrode conductor shall be permitted for both protective and operating purposes.

**(J) Bonding of Electrodes.**

A bonding jumper not smaller than 6 AWG copper or equivalent shall be connected between the radio and television equipment grounding electrode and the power grounding electrode system at the building or structure served where separate electrodes are used.

**(K) Electrode Connection.**

Connections to grounding electrodes shall comply with 250.70.

## Part III. Amateur and Citizen Band Transmitting and Receiving Stations — Antenna Systems

### 810.51 Other Sections.

In addition to complying with Part III, antenna systems for amateur and citizen band transmitting and receiving stations shall also comply with 810.11 through 810.15.

### 810.52 Size of Antenna.

Antenna conductors for transmitting and receiving stations shall be of a size not less than given in Table 810.52.

**Table 810.52 Size of Outdoor Antenna Conductors**

| Material | Minimum Size of Conductors (AWG) Where Maximum Open Span Length Is | |
|---|---|---|
| | Less Than 45 m (150 ft) | Over 45 m (150 ft) |
| Hard-drawn copper | 14 | 10 |
| Copper-clad steel, bronze, or other high-strength material | 14 | 12 |

### 810.53 Size of Lead-in Conductors.

Lead-in conductors for transmitting stations shall, for various maximum span lengths, be of a size at least as great as that of conductors for antennas as specified in 810.52.

### 810.54 Clearance on Building.

Antenna conductors for transmitting stations, attached to buildings, shall be firmly mounted at least 75 mm (3 in.) clear of the surface of the building on nonabsorbent insulating supports, such as treated pins or brackets equipped with insulators having not less than 75-mm (3-in.) creepage and airgap distances. Lead-in conductors attached to buildings shall also comply with these requirements.

*Exception: Where the lead-in conductors are enclosed in a continuous metallic shield that is grounded with a conductor in accordance with 810.58, they shall not be required to comply with these requirements. Where grounded, the metallic shield shall also be permitted to be used as a conductor.*

**810.55 Entrance to Building.**

Except where protected with a continuous metallic shield that is grounded with a conductor in accordance with 810.58, lead-in conductors for transmitting stations shall enter buildings by one of the following methods:

1. Through a rigid, noncombustible, nonabsorbent insulating tube or bushing
2. Through an opening provided for the purpose in which the entrance conductors are firmly secured so as to provide a clearance of at least 50 mm (2 in.)
3. Through a drilled window pane

**810.56 Protection Against Accidental Contact.**

Lead-in conductors to radio transmitters shall be located or installed so as to make accidental contact with them difficult.

**810.57 Antenna Discharge Units — Transmitting Stations.**

Each conductor of a lead-in for outdoor antennas shall be provided with an antenna discharge unit or other suitable means that drain static charges from the antenna system.

*Exception No. 1: Where the lead-in is protected by a continuous metallic shield that is grounded with a conductor in accordance with 810.58, an antenna discharge unit or other suitable means shall not be required.*

*Exception No. 2: Where the antenna is grounded with a conductor in accordance with 810.58, an antenna discharge unit or other suitable means shall not be required.*

**810.58 Bonding Conductors and Grounding Electrode Conductors — Amateur and Citizen Band Transmitting and Receiving Stations.**

Bonding conductors and grounding electrode conductors shall comply with 810.58(A) through 810.58(C).

**(A) Other Sections.**

All bonding conductors and grounding electrode conductors for amateur and citizen band transmitting and receiving stations shall comply with 810.21(A) through 810.21(C).

**(B) Size of Protective Bonding Conductor or Grounding Electrode Conductor.**

The protective bonding conductor or grounding electrode conductor for transmitting stations shall be as large as the lead-in but not smaller than 10 AWG copper, bronze, or copper-clad steel.

**(C) Size of Operating Bonding Conductor or Grounding Electrode Conductor.**

The operating bonding conductor or grounding electrode conductor for transmitting stations shall not be less than 14 AWG copper or its equivalent.

**Part IV. Interior Installation — Transmitting Stations**

**810.70 Clearance from Other Conductors.**

All conductors inside the building shall be separated at least 100 mm (4 in.) from the conductors of any electric light, power, or signaling circuit.

*Exception No. 1: As provided in Article 640.*

*Exception No. 2: Where separated from other conductors by raceway or some firmly fixed nonconductor, such as porcelain tubes or flexible tubing.*

### 810.71 General.

Transmitters shall comply with 810.71(A) through (C).

**(A) Enclosing.**

The transmitter shall be enclosed in a metal frame or grille or separated from the operating space by a barrier or other equivalent means, all metallic parts of which are effectively connected to a bonding conductor or grounding electrode conductor.

**(B) Grounding of Controls.**

All external metal handles and controls accessible to the operating personnel shall be effectively connected to an equipment grounding conductor if the transmitter is powered by the premises wiring system or grounded with a conductor in accordance with 810.21.

**(C) Interlocks on Doors.**

All access doors shall be provided with interlocks that disconnect all voltages of over 350 volts between conductors when any access door is opened.

## Article 820 Community Antenna Television and Radio Distribution Systems

### Part I. General

### 820.1 Scope.

This article covers coaxial cable distribution of radio frequency signals typically employed in community antenna television (CATV) systems.

### 820.2 Definitions.

The definitions in this section shall apply only within Articles 820 and 840.

### 820.3 Other Articles.

Circuits and equipment shall comply with 820.3(A)and (B).

**(A) General Requirements.**

The general requirements of Article 800 shall apply.

**(B) Alternate Wiring Methods.**

The wiring methods of Article 830 shall be permitted to substitute for the wiring methods of Article 820.

Informational Note: Use of Article 830 wiring methods will facilitate the upgrading of Article 820 installations to network-powered broadband applications.

### 820.15 Power Limitations.

Coaxial cable shall be permitted to deliver power to equipment that is directly associated with the radio frequency distribution system if the voltage is not over 60 volts and if the current is supplied by a transformer or other device that has power-limiting characteristics.

Power shall be blocked from premises devices on the network that are not intended to be powered via the coaxial cable.

### Part II. Coaxial Cables ~~Outside~~ on the service provider side of the Communication Service Point~~and Entering Buildings~~

### 820.44 Overhead (Aerial) Coaxial Cables.

Overhead (aerial) coaxial cables, prior to the point of grounding, as specified in 820.93, shall comply with 820.44(A) or 800.44.

**(A) On Poles and In-Span, Above Roofs, on Masts, or Between Buildings.**

Where coaxial cables are installed on poles and in-span, above roofs, on masts, or between buildings, they shall comply with 800.44.

**(B) On Buildings.**

Where attached to buildings, coaxial cables shall be securely fastened in such a manner that they will be separated from other conductors in accordance with 820.44(B)(1) and (B)(2).

**(1) Electric Light or Power.**

The coaxial cable shall have a separation of at least 100 mm (4 in.) from electric light, power, Class 1, or non-power-limited fire alarm circuit conductors not in raceway or cable, or shall be permanently separated from conductors of the other system by a continuous and firmly fixed nonconductor in addition to the insulation on the wires.

**(2) Other Communications Systems.**

Coaxial cable shall be installed so that there will be no unnecessary interference in the maintenance of the separate systems. In no case shall the conductors, cables, messenger strand, or equipment of one system cause abrasion to the conductors, cable, messenger strand, or equipment of any other system.

### 820.47 Underground Coaxial Cables Entering Buildings.

Underground coaxial cables entering buildings shall comply with 820.47(A) and 820.47(B).

**(A) Underground Systems with Electric Light, Power, Class 1, or Non–Power-Limited Fire Alarm Circuit Conductors.**

Underground coaxial cables in a duct, pedestal, handhole enclosure, or manhole that contains electric light, power, or Class 1 or non–power-limited fire alarm circuit conductors shall be in a section permanently separated from such conductors by means of a suitable barrier.

**(B) Direct-Buried Cables and Raceways.**

Direct-buried coaxial cable shall be separated at least 300 mm (12 in.) from conductors of any light or power, non–power-limited fire alarm circuit conductors, or Class 1 circuit.

*Exception No. 1: Separation shall not be required where electric service conductors or coaxial cables are installed in raceways or have metal cable armor.*

*Exception No. 2: Separation shall not be required where electric light or power branch-circuit or feeder conductors or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables; or the coaxial cables have metal cable armor or are installed in a raceway.*

### 820.48 Unlisted Cables Entering Buildings.

Unlisted outside plant coaxial cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air, where the length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft) and the cable enters the building from the outside and is terminated at a grounding block. The point of entrance shall be permitted to be extended from the penetration of the external wall or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) to the point of emergence.

## Part III. Protection

### 820.93 Grounding of the Outer Conductive Shield of Coaxial Cables.

Coaxial cables entering buildings or attached to buildings shall comply with 820.93(A) or (B). Where the outer conductive shield of a coaxial cable is grounded, no other protective devices shall be required. For purposes of this section, grounding located at mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a grounding block location to achieve the shortest practicable bonding conductor or grounding electrode conductor helps limit potential differences between CATV and other metallic systems.

**(A) Entering Buildings.**

In installations where the coaxial cable enters the building, the outer conductive shield shall be grounded in accordance with 820.100. The grounding shall be as close as practicable to the point of entrance.

**(B) Terminating Outside of the Building.**

In installations where the coaxial cable is terminated outside of the building, the outer conductive shield shall be grounded in accordance with 820.100. The grounding shall be as close as practicable to the point of attachment or termination.

**(C) Location.**

Where installed, a listed primary protector shall be applied on each community antenna and radio distribution (CATV) cable external to the premises. The listed primary protector shall be located as close as practicable to the entrance point of the cable on either side or integral to the ground block.

**(D) Hazardous (Classified) Locations.**

Where a primary protector or equipment providing the primary protection function is used, it shall not be located in any hazardous (classified) location as defined in 500.5 and 505.5 or in the vicinity of easily ignitible material.

*Exception: As permitted in 501.150, 502.150, and 503.150.*

**Part IV. Grounding Methods**

**820.100 Cable Bonding and Grounding.**

The shield of the coaxial cable shall be bonded or grounded as specified in 820.100(A) and (B).

*Exception: For communications systems using coaxial cable completely contained within the building (i.e., they do not exit the building) or the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere and isolated from outside cable plant, the shield shall be permitted to be grounded by a connection to an equipment grounding conductor as described in 250.118. Connecting to an equipment grounding conductor through a grounded receptacle using a dedicated bonding jumper and a permanently connected listed device shall be permitted. Use of a cord and plug for the connection to an equipment grounding conductor shall not be permitted.*

Informational Note: See 4.8.3.1 of NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems,* for the application of the term *rolling sphere*.

**(A) General Requirements.**

The installation shall be in accordance with 800.100.

**(B) Shield Protection Devices.**

Grounding of a coaxial drop cable shield by means of a protective device that does not interrupt the grounding system within the premises shall be permitted.

**820.103 Equipment Grounding.**

Unpowered equipment and enclosures or equipment powered by the coaxial cable shall be considered grounded where connected to the metallic cable shield.

**Part V. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**820.133 Installation of Coaxial Cables and Equipment.**

Beyond the point of grounding, as defined in 820.93, the coaxial cable installation shall comply with 820.133(A) and (B).

**(A) Separation from Other Conductors.**

**(1) In Raceways, Cable Trays, Boxes, Enclosures, and Cable Routing Assemblies.**

1. *Other Circuits.* Coaxial cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with jacketed cables 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. Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770
4. Communications circuits in compliance with Parts I and IV of Article 805
5. Low-power network-powered broadband communications circuits in compliance with Parts I and V of Article 830

2. *Electric Light, Power, Class 1, Non–Power-Limited Fire Alarm, and Medium-Power Network-Powered Broadband Communications Circuits.* Coaxial cable shall not be placed in any raceway, compartment, outlet box, junction box, or other enclosures with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits.

*Exception No. 1: Coaxial cable shall be permitted to be placed in any raceway, compartment, outlet box, junction box, or other enclosures with conductors of electric light, power, Class 1, non–power-limited fire alarm, or medium-power network-powered broadband communications circuits where 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 coaxial cables by a permanent barrier or listed divider.*

*Exception No. 2: Coaxial cable shall be permitted to be placed in outlet boxes, junction boxes, or similar fittings or compartments with power conductors where such conductors are introduced solely for power supply to the coaxial cable system distribution equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum 6 mm (¼ in.) separation from coaxial cables.*

**(2) Other Applications.**

Coaxial cable shall be separated 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.

*Exception No. 1: Separation shall not be required where either (1) all of the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits are in a raceway, or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC or Type UF cables, or (2) all of the coaxial cables are encased in a raceway.*

*Exception No. 2: Separation shall not be required where the coaxial cables are permanently separated from the conductors of electric light, power, Class 1, non–power-limited fire alarm, and medium-power network-powered broadband communications circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B) Support of Coaxial Cables.**

Raceways shall be used for their intended purpose. Coaxial cables shall not be strapped, taped, or attached by any means to the exterior of any conduit or raceway as a means of support.

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

**820.154 Substitutions of Listed CATV Cables.**

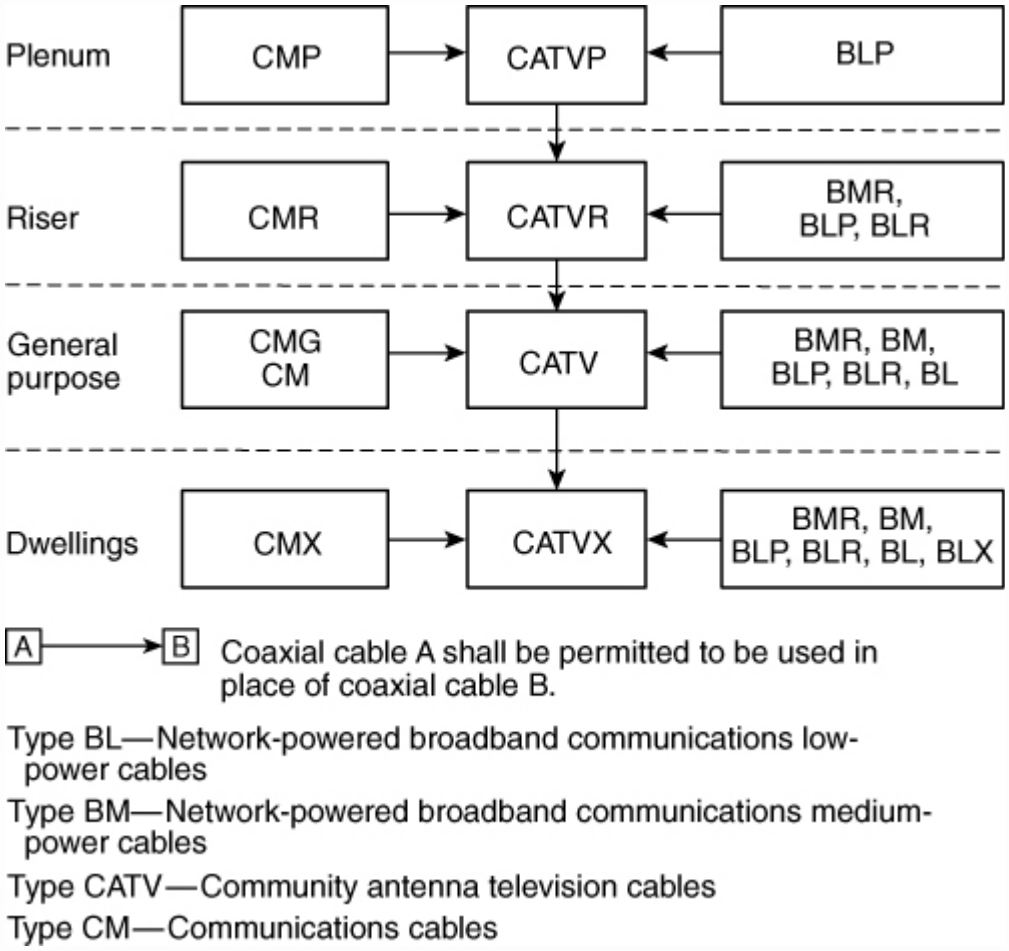
The substitutions for coaxial cables in Table 820.154 and illustrated in Figure 820.154 shall be permitted.

Informational Note: The substitute cables in Table 820.154 and Figure 820.154 are only coaxial-type cables.

**Table 820.154 Coaxial Cable Uses and Permitted Substitutions**

| Cable Type | Permitted Substitutions |
|---|---|
| CATVP | CMP, BLP |
| CATVR | CATVP, CMP, CMR, BMR, BLP, BLR |
| CATV | CATVP, CMP, CATVR, CMR, CMG, CM, BMR, BM, BLP, BLR, BL |
| CATVX | CATVP, CMP, CATVR, CMR, CATV, CMG, CM, BMR, BM, BLP, BLR, BL, BLX |

**Figure 820.154 Cable Substitution Hierarchy.**




## Part VI. Listing Requirements

### 820.179 Coaxial Cables.

Cables shall be listed in accordance with 820.179(A)and marked in accordance with Table 820.179 and 820.179(B). The cable voltage rating shall not be marked on the cable.

Informational Note: Voltage markings on cables could 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.*

**(A) General Requirements.**

The general requirements in 800.179 shall apply.

**(B) Optional Markings.**

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.

**Table 820.179 Coaxial Cable Markings**

| Cable Marking | Type |
|---|---|
| CATVP | CATV plenum cable |
| CATVR | CATV riser cable |
| CATV | CATV cable |
| CATVX | CATV cable, limited use |

# Article 830 Network-Powered Broadband Communications Systems

## Part I. General

### 830.1 Scope.

This article covers network-powered broadband communications systems that provide any combination of voice, audio, video, data, and interactive services through a network interface unit.

Informational Note: A typical basic system configuration includes a cable supplying power and broadband signal to a network interface unit that converts the broadband signal to the component signals. Typical cables are coaxial cable with both broadband signal and power on the center conductor, composite metallic cable with a coaxial member(s) or twisted pair members for the broadband signal and twisted pair members for power, and composite optical fiber cable with a pair of conductors for power. Larger systems may also include network components such as amplifiers that require network power.

### 830.2 Definitions.

The definitions in this section shall apply only within Article 830.

Informational Note: A typical single-family network-powered communications circuit consists of a communications drop or communications service cable and an NIU and includes the communications utility's serving terminal or tap where it is not under the exclusive control of the communications utility.

**Fault Protection Device.**

An electronic device that is intended for the protection of personnel and functions under fault conditions, such as network-powered broadband communications cable short or open circuit, to limit the current or voltage, or both, for a low-power network-powered broadband communications circuit and provide acceptable protection from electric shock.

**Network Interface Unit (NIU).**

A device that converts a broadband signal into component voice, audio, video, data, and interactive services signals and provides isolation between the network power and the premises signal circuits. These devices often contain primary and secondary protectors.

**Network-Powered Broadband Communications Circuit.**

The circuit extending from the communications utility's or service provider's serving terminal or tap up to and including the NIU.

Informational Note: A typical one-family dwelling network-powered communications circuit consists of a communications drop or communications service cable and an NIU and includes the communications utility's serving terminal or tap where it is not under the exclusive control of the communications utility.

### 830.3 Other Articles.

Circuits and equipment shall comply with 830.3(A) through (C).

**(A) General Requirements.**

The general requirements of Article 800 shall apply.

**(B) Output Circuits.**

As appropriate for the services provided, the output circuits derived from the network interface unit shall comply with the requirements of the following:

1. Installations of communications circuits — Part IV of Article 805
2. Installations of community antenna television and radio distribution circuits — Part V of Article 820

   *Exception: Where protection is provided in the output of the NIU 830.90(B)(3) shall apply.*
3. Installations of optical fiber cables — Part V of Article 770
4. Installations of Class 2 and Class 3 circuits — Part III of Article 725
5. Installations of power-limited fire alarm circuits — Part III of Article 760

**(C) Protection Against Physical Damage.**

The requirements of 300.4 shall apply.

**830.15 Power Limitations.**

Network-powered broadband communications systems shall be classified as having low- or medium-power sources as specified in 830.15(1) or (2).

1. Sources shall be classified as defined in Table 830.15.
2. Direct-current power sources exceeding 150 volts to ground, but no more than 200 volts to ground, with the current to ground limited to 10 mA dc, that meet the current and power limitation for medium-power sources in Table 830.15 shall be classified as medium-power sources.

Informational Note: One way to determine compliance with 830.15(2) is listed information technology equipment intended to supply power via a communications network that complies with the requirements for RFT-V circuits as defined in UL 60950-21-2007, *Standard for Safety for Information Technology Equipment — Safety — Part 21: Remote Power Feeding*.

**Table 830.15 Limitations for Network-Powered Broadband Communications Systems**

| Network Power Source | Low | Medium |
|---|---|---|
| Circuit voltage, $V_{max}$ (volts)[1] | 0–100 | 0–150 |
| Power limitation, $VA_{max}$ (volt-amperes)[1] | 250 | 250 |
| Current limitation, $I_{max}$ (amperes)[1] | $1000/V_{max}$ | $1000/V_{max}$ |
| Maximum power rating (volt-amperes) | 100 | 100 |
| Maximum voltage rating (volts) | 100 | 150 |
| Maximum overcurrent protection (amperes)[2] | $100/V_{max}$ | NA |

[1] $V_{max}$, $I_{max}$, and $VA_{max}$ are determined with the current-limiting impedance in the circuit (not bypassed) as follows:

$V_{max}$ — Maximum system voltage regardless of load with rated input applied.

$I_{max}$ — Maximum system current under any noncapacitive load, including short circuit, and with overcurrent protection bypassed if used. $I_{max}$ limits apply after 1 minute of operation.

$VA_{max}$ — Maximum volt-ampere output after 1 minute of operation regardless of load and overcurrent protection bypassed if used.

[2]Overcurrent protection is not required where the current-limiting device provides equivalent current limitation and the current-limiting device does not reset until power or the load is removed.

**830.24 Mechanical Execution of Work.**

The installation shall also conform to 300.4 and 300.11.

**Part II. Cables on the service provider side of the Communication Service Point~~Outside and Entering Buildings~~**

**830.40 Entrance Cables.**

Network-powered broadband communications cables located outside and entering buildings shall comply with 830.40(A) and (B).

**(A) Medium-Power Circuits.**

Medium-power network-powered broadband communications circuits located outside and entering buildings shall be installed using Type BMU, Type BM, or Type BMR network-powered broadband communications medium-power cables.

**(B) Low-Power Circuits.**

Low-power network-powered broadband communications circuits located outside and entering buildings shall be installed using Type BLU or Type BLX low-power network-powered broadband communications cables. Cables shown in Table 830.154 shall be permitted to substitute.

*Exception: Outdoor community antenna television and radio distribution system coaxial cables installed prior to January 1, 2000, and installed in accordance with Article 820, shall be permitted for low-power-type, network-powered broadband communications circuits.*

**830.44 Overhead (Aerial) Cables.**

Overhead (aerial) network-powered broadband communications cables shall comply with 830.44(A) through (F).

**(A) On Poles and In-Span or Above Roofs.**

Where network-powered broadband communications cables are installed on poles and in-span or above roofs, they shall comply with 800.44.

**(B) Clearance from Ground.**

Overhead (aerial) spans of network-powered broadband communications cables shall conform to not less than the following:

1. 2.9 m (9½ ft) — above finished grade, sidewalks, or from any platform or projection from which they might be reached and accessible to pedestrians only
2. 3.5 m (11½ ft) — over residential property and driveways, and those commercial areas not subject to truck traffic
3. 4.7 m (15½ ft) — over public streets, alleys, roads, parking areas subject to truck traffic, driveways on other than residential property, and other land traversed by vehicles such as cultivated, grazing, forest, and orchard

Informational Note: These clearances have been specifically chosen to correlate with ANSI/IEEE C2-2012, *National Electrical Safety Code*, Table 232-1, which provides for clearances of wires, conductors, and cables above ground and roadways, rather than using the clearances referenced in 225.18. Because Article 805 and Article 820 have had no required clearances, the communications industry has used the clearances from the NESC for their installed cable plant.

**(C) Over Pools.**

Clearance of network-powered broadband communications cable in any direction from the water level, edge of pool, base of diving platform, or anchored raft shall comply with those clearances in 680.9.

**(D) Final Spans.**

Final spans of network-powered broadband communications cables without an outer jacket shall be permitted to be attached to the building, but they shall be kept not less than 900 mm (3 ft) from windows that are designed to be opened, doors, porches, balconies, ladders, stairs, fire escapes, or similar locations.

*Exception: Conductors run above the top level of a window shall be permitted to be less than the 900-mm (3-ft) requirement above.*

Overhead (aerial) network-powered broadband communications cables shall not be installed beneath openings through which materials might be moved, such as openings in farm and commercial buildings, and shall not be installed where they obstruct entrance to these building openings.

**(E) Between Buildings.**

Network-powered broadband communications cables extending between buildings or structures, and also the supports or attachment fixtures, shall be identified as suitable for outdoor aerial applications and shall have sufficient strength to withstand the loads to which they may be subjected.

*Exception: Where a network-powered broadband communications cable does not have sufficient strength to be self-supporting, it shall be attached to a supporting messenger cable that, together with the attachment fixtures or supports, shall be acceptable for the purpose and shall have sufficient strength to withstand the loads to which they may be subjected.*

**(F) On Buildings.**

Where attached to buildings, network-powered broadband communications cables shall be securely fastened in such a manner that they are separated from other conductors in accordance with 830.44(F)(1) through (F)(3).

**(1) Electric Light or Power.**

The network-powered broadband communications cable shall have a separation of at least 100 mm (4 in.) from electric light, power, Class 1, or non-power-limited fire alarm circuit conductors not in raceway or cable, or be permanently separated from conductors of the other system by a continuous and firmly fixed nonconductor in addition to the insulation on the wires.

**(2) Other Communications Systems.**

Network-powered broadband communications cables shall be installed so that there will be no unnecessary interference in the maintenance of the separate systems. In no case shall the conductors, cables, messenger strand, or equipment of one system cause abrasion to the conductors, cables, messenger strand, or equipment of any other system.

**(3) Protection from Damage.**

Network-powered broadband communications cables attached to buildings or structures and located within 2.5 m (8 ft) of finished grade shall be protected by enclosures, raceways, or other approved means.

*Exception: A low-power network-powered broadband communications circuit that is equipped with a listed fault protection device, appropriate to the network-powered broadband communications cable used, and located on the network side of the network-powered broadband communications cable shall not be required to be additionally protected by enclosures, raceways, or other approved means.*

**830.47 Underground Network-Powered Broadband Communications Cables Entering Buildings.**

Underground network-powered broadband communications cables entering buildings shall comply with 830.47(A) through 830.47(D).

**(A) Underground Systems with Electric Light and Power, Class 1, or Non–Power-Limited Fire Alarm Circuit Conductors.**

Underground network-powered broadband communications cables in a duct, pedestal, handhole enclosure, or manhole that contains electric light, power conductors, non–power-limited fire alarm circuit

conductors, or Class 1 circuits shall be in a section permanently separated from such conductors by means of a suitable barrier.

**(B) Direct-Buried Cables and Raceways.**

Direct-buried network-powered broadband communications cables shall be separated by at least 300 mm (12 in.) from conductors of any light, power, non–power-limited fire alarm circuit conductors or Class 1 circuit.

*Exception No. 1: Separation shall not be required where electric service conductors or network-powered broadband communications cables are installed in raceways or have metal cable armor.*

*Exception No. 2: Separation shall not be required where electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables; or the network-powered broadband communications cables have metal cable armor or are installed in a raceway.*

**(C) Protection from Physical Damage.**

Direct-buried cable, conduit, or other raceways shall be installed to meet the minimum cover requirements of Table 830.47(C). In addition, direct-buried cables emerging from the ground shall be protected by enclosures, raceways, or other approved means extending from the minimum cover distance required by Table 830.47(C) below grade 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. Types BMU and BLU direct-buried cables emerging from the ground shall be installed in rigid metal conduit (RMC), intermediate metal conduit (IMC), rigid nonmetallic conduit, or other approved means extending from the minimum cover distance required by Table 830.47(C) below grade to the point of entrance.

*Exception: A low-power network-powered broadband communications circuit that is equipped with a listed fault protection device, appropriate to the network-powered broadband communications cable used, and located on the network side of the network-powered broadband communications cable being protected.*

**Table 830.47(C) Network-Powered Broadband Communications Systems Minimum Cover Requirements (*Cover* is the shortest distance measured between a point on the top surface of any direct-buried cable, conduit, or other raceway and the top surface of finished grade, concrete, or similar cover.)**

| Location of Wiring Method or Circuit | Direct Burial Cables | | Rigid Metal Conduit (RMC) or Intermediate Metal Conduit (IMC) | | Nonmetallic Raceways Listed for Direct Burial; Without Concrete Encasement or Other Approved Raceways | |
|---|---|---|---|---|---|---|
| | mm | in. | mm | in. | mm | in. |
| All locations not specified below | 450 | 18 | 150 | 6 | 300 | 12 |
| In trench below 50-mm (2-in.) thick concrete or equivalent | 300 | 12 | 150 | 6 | 150 | 6 |
| Under a building (in raceway only) | 0 | 0 | 0 | 0 | 0 | 0 |
| Under minimum of 100-mm (4-in.) thick concrete exterior slab with no vehicular traffic and the slab extending not less than 150 mm (6 in.) beyond the underground installation | 300 | 12 | 100 | 4 | 100 | 4 |

| Location of Wiring Method or Circuit | Direct Burial Cables | | Rigid Metal Conduit (RMC) or Intermediate Metal Conduit (IMC) | | Nonmetallic Raceways Listed for Direct Burial; Without Concrete Encasement or Other Approved Raceways | |
|---|---|---|---|---|---|---|
| | mm | in. | mm | in. | mm | in. |
| One- and two-family dwelling driveways and outdoor parking areas and used only for dwelling-related purposes | 300 | 12 | 300 | 12 | 300 | 12 |

Notes:

1. Raceways approved for burial only where concrete encased shall require a concrete envelope not less than 50 mm (2 in.) thick.

2. Lesser depths shall be permitted where cables rise for terminations or splices or where access is otherwise required.

3. Where solid rock is encountered, all wiring shall be installed in 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.

4. Low-power network-powered broadband communications circuits using directly buried community antenna television and radio distribution system coaxial cables that were installed outside and entering buildings prior to January 1, 2000, in accordance with Article 820 shall be permitted where buried to a minimum depth of 300 mm (12 in.).

**(D) Pools.**

Cables located under the pool or within the area extending 1.5 m (5 ft) horizontally from the inside wall of the pool shall meet those clearances and requirements specified in 680.11.

**Part III. Protection**

**830.90 Primary Electrical Protection.**

**(A) Application.**

Primary electrical protection shall be provided on all network-powered broadband communications conductors that are neither grounded nor interrupted and are run partly or entirely in aerial cable not confined within a block. Also, primary electrical protection shall be provided on all aerial or underground network-powered broadband communications conductors that are neither grounded nor interrupted and are located within the block containing the building served so as to be exposed to lightning or accidental contact with electric light or power conductors operating at over 300 volts to ground.

*Exception: Primary electrical protection shall not be required on the network-powered broadband communications conductors where electrical protection is provided on the derived circuit(s) (output side of the NIU) in accordance with 830.90(B)(3).*

Informational Note No. 1: On network-powered broadband communications conductors not exposed to lightning or accidental contact with power conductors, providing primary electrical protection in accordance with this article helps protect against other hazards, such as ground potential rise caused by power fault currents, and above-normal voltages induced by fault currents on power circuits in proximity to the network-powered broadband communications conductors.

Informational Note No. 2: Network-powered broadband communications circuits are considered to have a lightning exposure unless one or more of the following conditions exist:

1. Circuits in large metropolitan areas where buildings are close together and sufficiently high to intercept lightning.
2. Areas having an average of five or fewer thunderstorm days each year and earth resistivity of less than 100 ohm-meters. Such areas are found along the Pacific coast.

Informational Note No. 3: For information on lightning protection systems, see NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*.

**(1) Fuseless Primary Protectors.**

Fuseless-type primary protectors shall be permitted where power fault currents on all protected conductors in the cable are safely limited to a value no greater than the current-carrying capacity of the primary protector and of the primary protector bonding conductor or grounding electrode conductor.

**(2) Fused Primary Protectors.**

Where the requirements listed in 830.90(A)(1) are not met, fused-type primary protectors shall be used. Fused-type primary protectors shall consist of an arrester connected between each conductor to be protected and ground, a fuse in series with each conductor to be protected, and an appropriate mounting arrangement. Fused primary protector terminals shall be marked to indicate line, instrument, and ground, as applicable.

**(B) Location.**

The location of the primary protector, where required, shall comply with 830.90(B)(1), (B)(2), or (B)(3):

1. A listed primary protector shall be applied on each network-powered broadband communications cable external to and on the network side of the network interface unit.
2. The primary protector function shall be an integral part of and contained in the network interface unit. The network interface unit shall be listed as being suitable for application with network-powered broadband communications systems and shall have an external marking indicating that it contains primary electrical protection.
3. The primary protector(s) shall be provided on the derived circuit(s) (output side of the NIU), and the combination of the NIU and the protector(s) shall be listed as being suitable for application with network-powered broadband communications systems.

A primary protector, whether provided integrally or external to the network interface unit, shall be located as close as practicable to the point of entrance.

For purposes of this section, a network interface unit and any externally provided primary protectors located at mobile home service equipment located in sight from and not more than 9.0 m (30 ft) from the exterior wall of the mobile home it serves, or at a mobile home disconnecting means grounded in accordance with 250.32 and located in sight from and not more than 9.0 m (30 ft) from the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a network interface unit and primary protector location to achieve the shortest practicable primary protector bonding conductor or grounding electrode conductor helps limit potential differences between communications circuits and other metallic systems.

**(C) Hazardous (Classified) Locations.**

The primary protector or equipment providing the primary protection function shall not be located in any hazardous (classified) location as defined in 500.5 and 505.5 or in the vicinity of easily ignitible material.

*Exception: As permitted in 501.150, 502.150, and 503.150.*

**Part IV. Grounding Methods**

**830.93 Grounding or Interruption of Metallic Members of Network-Powered Broadband Communications Cables.**

Network-powered communications cables entering buildings or attaching to buildings shall comply with 830.93(A) or (B).

For purposes of this section, grounding located at mobile home service equipment located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, or at a mobile home disconnecting means grounded in accordance with 250.32 and located within 9.0 m (30 ft) of the exterior wall of the mobile home it serves, shall be considered to meet the requirements of this section.

Informational Note: Selecting a grounding location to achieve the shortest practicable bonding conductor or grounding electrode conductor helps limit potential differences between the network-powered broadband communications circuits and other metallic systems.

**(A) Entering Buildings.**

In installations where the network-powered communications cable enters the building, the shield shall be grounded in accordance with 800.100, and metallic members of the cable not used for communications or powering shall be grounded in accordance with 800.100 or interrupted by an insulating joint or equivalent device. The grounding or interruption shall be as close as practicable to the point of entrance.

**(B) Terminating Outside of the Building.**

In installations where the network-powered communications cable is terminated outside of the building, the shield shall be grounded in accordance with 800.100, and metallic members of the cable not used for communications or powering shall be grounded in accordance with 800.100 or interrupted by an insulating joint or equivalent device. The grounding or interruption shall be as close as practicable to the point of attachment of the NIU.

**Part V. Wiring on the customer side of the Communication Service Point ~~Installation Methods Within Buildings~~**

**830.133 Installation of Network-Powered Broadband Communications Cables and Equipment.**

Cable and equipment installations within buildings shall comply with 830.133(A) and (B), as applicable.

**(A) Separation of Conductors.**

**(1) In Raceways, Cable Trays, Boxes, Enclosures, and Cable Routing Assemblies.**

1. *Low- and Medium-Power Network-Powered Broadband Communications Circuit Cables.* Low- and medium-power network-powered broadband communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly.

2. *Low-Power Network-Powered Broadband Communications Circuit Cables with Other Circuits.* Low-power network-powered broadband communications cables shall be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with jacketed cables of any of the following circuits:

    1. Class 2 and Class 3 remote-control, signaling, and power-limited circuits in compliance with 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 IV of Article 805
    4. Nonconductive and conductive optical fiber cables in compliance with Parts I and V of Article 770
    5. Community antenna television and radio distribution systems in compliance with Parts I and V of Article 820

3. *Medium-Power Network-Powered Broadband Communications Circuit Cables with Optical Fiber Cables and Other Communications Cables*. Medium-power network-powered broadband communications cables shall not be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with conductors of any of the following circuits:

    1. Communications circuits in compliance with Parts I and IV of Article 805
    2. Conductive optical fiber cables in compliance with Parts I and V of Article 770
    3. Community antenna television and radio distribution systems in compliance with Parts I and V of Article 820

4. *Medium-Power Network-Powered Broadband Communications Circuit Cables with Other Circuits*. Medium-power network-powered broadband communications cables

shall not be permitted in the same raceway, cable tray, box, enclosure, or cable routing assembly with conductors of any of the following circuits:

1. Class 2 and Class 3 remote-control, signaling, and power-limited circuits in compliance with Parts I and III of Article 725
2. Power-limited fire alarm systems in compliance with Parts I and III of Article 760

5. *Electric Light, Power, Class 1, Non–Powered Broadband Communications Circuit Cables.* Network-powered broadband communications cable shall not be placed in any raceway, cable tray, compartment, outlet box, junction box, or similar fittings with conductors of electric light, power, Class 1, or non–power-limited fire alarm circuit cables.

*Exception No. 1: Where all of the conductors of electric light, power, Class 1, non–power-limited fire alarm circuits are separated from all of the network-powered broadband communications cables by a permanent barrier or listed divider.*

*Exception No. 2: Power circuit conductors in outlet boxes, junction boxes, or similar fittings or compartments where such conductors are introduced solely for power supply to the network-powered broadband communications system distribution equipment. The power circuit conductors shall be routed within the enclosure to maintain a minimum 6 mm (¼ in.) separation from network-powered broadband communications cables.*

**(2) Other Applications.**

Network-powered broadband communications cable shall be separated at least 50 mm (2 in.) from conductors of any electric light, power, Class 1, and non–power-limited fire alarm circuits.

*Exception No. 1: Separation shall not be required where: (1) all of the conductors of electric light, power, Class 1, and non–power-limited fire alarm circuits are in a raceway, or in metal-sheathed, metal-clad, nonmetallic-sheathed, Type AC, or Type UF cables, or (2) all of the network-powered broadband communications cables are encased in a raceway.*

*Exception No. 2: Separation shall not be required where the network-powered broadband communications cables are permanently separated from the conductors of electric light, power, Class 1, and non–power-limited fire alarm circuits by a continuous and firmly fixed nonconductor, such as porcelain tubes or flexible tubing, in addition to the insulation on the wire.*

**(B) Support of Network-Powered Broadband Communications Cables.**

Raceways shall be used for their intended purpose. Network-powered broadband communications cables shall not be strapped, taped, or attached by any means to the exterior of any conduit or raceway as a means of support.

### 830.154 Substitutions of Network-Powered Broadband Communications System Cables.

The substitutions for network-powered broadband system cables listed in Table 830.154 shall be permitted.

**Table 830.154 Cable Substitutions**

| Cable Type | Permitted Cable Substitutions |
|---|---|
| BM | BMR |
| BLP | CMP, CL3P |
| BLR | CMP, CL3P, CMR, CL3R, BLP, BMR |
| BL | CMP, CMR, CM, CMG, CL3P, CL3R, CL3, BMR, BM, BLP, BLR |
| BLX | CMP, CMR, CM, CMG, CMX, CL3P, CL3R, CL3, CL3X, BMR, BM, BLP, BRP, BL |

### 830.160 Bends.

Bends in network broadband cable shall be made so as not to damage the cable.

## Part VI. Listing Requirements

### 830.179 Network-Powered Broadband Communications Equipment and Cables.

Network-powered broadband communications equipment and cables shall be listed and marked in accordance with 830.179(A) through (D).

*Exception No. 1: This listing requirement shall not apply to community antenna television and radio distribution system coaxial cables that were installed prior to January 1, 2000, in accordance with Article 820 and are used for low-power network-powered broadband communications circuits.*

*Exception No. 2: Substitute cables for network-powered broadband communications cables shall be permitted as shown in Table 830.154.*

**(A) General Requirements.**

The general requirements in 800.179 shall apply.

**(B) Network-Powered Broadband Communications Medium-Power Cables.**

Network-powered broadband communications medium-power cables shall be factory-assembled cables consisting of a jacketed coaxial cable, a jacketed combination of coaxial cable and multiple individual conductors, or a jacketed combination of an optical fiber cable and multiple individual conductors. The insulation for the individual conductors shall be rated for 300 volts minimum. Cables intended for outdoor use shall be listed as suitable for the application. Cables shall be marked in accordance with 310.8. Type BMU cables shall be jacketed and listed as being suitable for outdoor underground use.

**(C) Network-Powered Broadband Communication Low-Power Cables.**

Network-powered broadband communications low-power cables shall be factory-assembled cables consisting of a jacketed coaxial cable, a jacketed combination of coaxial cable and multiple individual conductors, or a jacketed combination of an optical fiber cable and multiple individual conductors. The insulation for the individual conductors shall be rated for 300 volts minimum. Cables intended for outdoor use shall be listed as suitable for the application. Cables shall be marked in accordance with 310.8. Type BLU cables shall be jacketed and listed as being suitable for outdoor underground use.

**(D) Optional Markings.**

Cables shall be permitted to be surface marked to indicate special characteristics of the cable materials.

Informational Note: These markings can include, but are not limited to, markings for limited-smoke, halogen-free, low-smoke halogen-free, and sunlight resistance.

# Article 840 Premises-Powered Broadband Communications Systems

## Part I. General

### 840.1 Scope.

This article covers premises-powered broadband communications systems.

Informational Note: A typical basic system configuration consists of an optical fiber, twisted pair, or coaxial cable to the premises supplying a broadband signal to a network terminal that converts the broadband signal into component electrical signals, such as traditional telephone, video, high-speed Internet, and interactive services. Powering for the network terminal and network devices is typically accomplished through a premises power supply that might be built into the network terminal or provided as a separate unit. In order to provide communications in the event of a power interruption, a battery backup unit or an uninterruptible power supply (UPS) is typically part of the powering system.

### 840.2 Definitions.

The definitions in 805.2 and 820.2 shall apply. The definitions in this section shall apply only within Article 840.

**Broadband.**

Wide bandwidth data transmission that transports multiple signals, protocols, and traffic types over various media types.

**Network Terminal.**

A device that converts network-provided signals (optical, electrical, or wireless) into component signals, including voice, audio, video, data, wireless, optical, and interactive services, and is considered a network device on the premises that is connected to a communications service provider and is powered at the premises.

**Premises Communications Circuit.**

The circuit that extends voice, audio, video, data, interactive services, telegraph (except radio), and outside wiring for fire alarm and burglar alarm from the service provider's network terminal to the customer's communications equipment up to and including terminal equipment, such as a telephone, a fax machine, or an answering machine.

**Premises Community Antenna Television (CATV) Circuit.**

The circuit that extends community antenna television (CATV) systems for audio, video, data, and interactive services from the service provider's network terminal to the appropriate customer equipment.

**Premises-Powered.**

Using power provided locally from the premises.

### 840.3 Other Articles.

Circuits and equipment shall comply with 840.3(A) through (C).

**(A) General Requirements.**

The general requirements of Article 800 shall apply.

**(B) Output Circuits.**

As appropriate for the services provided, the output circuits derived from the network terminal shall comply with the requirements of the following:

1. Installations of communications circuits — Part IV of Article 805
2. Installations of premises (within buildings) community antenna television and radio distribution circuits — Part V of Article 820
3. Installations of optical fiber cables — Part V of Article 770
4. Installations of Class 2 and Class 3 circuits — Part III of Article 725

   Informational Note: See 725.121 for information on the classification of information technology equipment circuits.
5. Installations of power-limited fire alarm circuits — Part III of Article 760

**(C) Electrical Classification of Data Circuits and Cables.**

Sections 725.139(D)(1) and 805.133(A)(1)(b) shall apply to the electrical classification of Class 2 and Class 3 circuits in the same cable with communications circuits.

### 840.24 Mechanical Execution of Work.

The requirements of 770.24 and 800.24 shall apply.

### 840.25 Abandoned Cables.

The requirements of 770.25 and 800.25 shall apply.

### 840.26 Spread of Fire or Products of Combustion.

The requirements of 770.26 and 800.26 shall apply.

## Part II. Cables on the service provider side of the Communication Service Point ~~Outside and Entering Buildings~~

### 840.47 Underground Wires and Cables Entering Buildings.

Underground wires and cables entering buildings shall comply with 840.47(A) through (C).

**(A) Optical Fiber Cables.**

**(1) Class 1 or Non–Power-Limited Fire Alarm Circuits.**

Underground conductive optical fiber cables entering buildings with electric light, power, Class 1, or non–power-limited fire alarm circuit conductors in a raceway, handhole enclosure, or manhole shall be located in a section separated from such conductors by means of brick, concrete, or tile partitions or by means of a suitable barrier.

**(2) Direct-Buried Cables.**

Direct-buried conductive optical fiber cables shall be separated by at least 300 mm (12 in.) from conductors of any electric light, power, or non–power-limited fire alarm circuit conductors or Class 1 circuit.

*Exception No. 1: Separation shall not be required where the electric service conductors are installed in raceways or have metal cable armor.*

*Exception No. 2: Separation shall not be required where the electric light or power branch-circuit or feeder conductors, non–power-limited fire alarm circuit conductors, or Class 1 circuit conductors are installed in a raceway or in metal-sheathed, metal-clad, or Type UF or Type USE cables.*

**(3) Mechanical Protection.**

Direct-buried cable, conduit, or other raceway shall be installed to have a minimum cover of 150 mm (6 in.).

**(B) Communications Wires and Cables.**

Installations of communications wires and multipair communications cables shall comply with 805.47.

**(C) Coaxial Cables.**

Installations of coaxial cables shall comply with 820.47.

### 840.48 Unlisted Wires and Cables Entering Buildings.

Installations of unlisted cables entering buildings shall comply with 840.48(A), (B), or (C), as applicable.

**(A) Optical Fiber Cables.**

Installations of unlisted optical fiber cables entering buildings shall comply with 770.48.

**(B) Communications Wires and Cables.**

Installations of unlisted communications wires and unlisted multipair communications cables entering buildings shall comply with 805.48.

**(C) Coaxial Cables.**

Installations of unlisted coaxial cables entering buildings shall comply with 820.48.

## Part III. Protection

### 840.90 Protective Devices.

The requirements of 805.90 shall apply.

### 840.93 Grounding or Interruption.

Non–current-carrying metallic members of optical fiber cables, communications cables, or coaxial cables entering buildings or attaching to buildings shall comply with 840.93(A), (B), or (C), respectively.

### (A) Non–Current-Carrying Metallic Members of Optical Fiber Cables.

Non–current-carrying metallic members of optical fiber cables entering a building or terminating on the outside of a building shall comply with 770.93(A) or (B).

### (B) Communications Cables.

The grounding or interruption of the metallic sheath of communications cable shall comply with 805.93.

### (C) Coaxial Cables.

Where the network terminal is installed inside or outside of the building, with coaxial cables terminating at the network terminal, and is either entering, exiting, or attached to the outside of the building, 820.93 shall apply.

## 840.94 Premises Circuits Leaving the Building.

Where circuits leave the building to power equipment remote to the building or outside the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere, 805.90 and 805.93 shall apply.

Informational Note: See NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, for the theory of the term *rolling sphere*.

## Part IV. Grounding Methods

## 840.101 Premises Circuits Not Leaving the Building.

Where the network terminal is served by a nonconductive optical fiber cable, or where any non–current-carrying metallic member of a conductive optical fiber cable is interrupted by an insulating joint or equivalent device, and circuits that terminate at the network terminal are completely contained within the building (i.e., they do not exit the building), 840.101(A), (B), or (C) shall apply, as applicable.

### (A) Coaxial Cable Shield Grounding.

The shield of coaxial cable shall be grounded by one of the following:

1. Any of the methods described in 820.100 or 800.106
2. A fixed connection to an equipment grounding conductor as described in 250.118
3. Connection to the network terminal grounding terminal provided that the terminal is connected to ground by one of the methods described in 820.100 or 800.106, or to an equipment grounding conductor through a listed grounding device that will retain the ground connection if the network terminal is unplugged

### (B) Communications Circuit Grounding.

Communications circuits shall not be required to be grounded.

### (C) Network Terminal Grounding.

The network terminal shall not be required to be grounded unless required by its listing. If the coaxial cable shield is separately grounded as described in 840.101(A)(1) or 840.101(A)(2), the use of a cord and plug for the connection to the network terminal grounding connection shall be permitted.

Informational Note: Where required to be grounded, a listed device that extends the equipment grounding conductor from the receptacle to the network terminal equipment grounding terminal is permitted. Sizing of the extended equipment grounding conductor is covered in Table 250.122.

## 840.102 Premises Circuits Leaving the Building.

Where circuits leave the building to power equipment remote to the building or outside the exterior zone of protection defined by a 46 m (150 ft) radius rolling sphere, the installation of communications wires and cables shall comply with 800.100 and 800.106, and the installation of coaxial cables shall comply with 820.100 and 800.106.

Informational Note: See NFPA 780-2017, *Standard for the Installation of Lightning Protection Systems*, for the application of the term *rolling sphere*.

## Part V. Wiring on the service provider side of the Communication Service Point ~~Installation Methods Within Buildings~~

### 840.133 Installation of Optical Fibers and Electrical Conductors.

The requirements of 770.133 shall apply.

## Part VI. Premises Powering of Communications Equipment over Communications Cables

### 840.160 Powering Circuits.

Communications cables listed in accordance with 805.179, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment listed in accordance with 805.170. The power source shall be listed in accordance with 840.170(G). Installation of the listed 4-pair communications cables for a communications circuit or installation where 4-pair communications cables are substituted for Class 2 and Class 3 cables in accordance with 725.154(A) shall comply with 725.144.

*Exception: Installing communications cables in compliance with 725.144 shall not be required for listed 4-pair communications cables where the rated current of the power source does not exceed 0.3 amperes in any conductor 24 AWG or larger.*

Informational Note: A typical communications cable for this application is a 4-pair cable sometimes referred to as Category 5e (or higher) LAN cable or balanced twisted pair cable. These types of cables are often used to provide Ethernet- and Power over Ethernet (PoE)–type services. A large number of such powering cables bundled together can cause overheating of the wiring if not controlled as described in Table 725.144.

## Part VII. Listing Requirements

### 840.170 Equipment and Cables.

Premises-powered broadband communications systems equipment and cables shall comply with 840.170(A) through (H).

#### (A) Network Terminal.

The network terminal and applicable grounding means shall be listed for application with premises-powered broadband communications systems.

Informational Note No. 1: One way to determine applicable requirements is to refer to ANSI/UL 60950-1-2014, *Standard for Safety of Information Technology Equipment*; ANSI/UL 498A-2015, *Current Taps and Adapters*; ANSI/UL 467-2013, *Grounding and Bonding Equipment;* or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements*.

Informational Note No. 2: There are no requirements on the network terminal and its grounding methodologies except for those covered by the listing of the product.

#### (B) Optical Fiber Cables.

Optical fiber cables shall be listed in accordance with 770.179(A) through (D) and shall be marked in accordance with Table 770.179.

#### (C) Communications Equipment.

Communications equipment shall be listed in accordance with 805.170.

#### (D) Cable Routing Assemblies and Communications Raceways.

Cable routing assemblies and communications raceways shall be listed in accordance with 800.182.

#### (E) Premises Communications Wires and Cables.

Communications wires and cable shall be listed and marked in accordance with 805.179.

#### (F) Premises Community Antenna Television (CATV) Circuits.

Premises community antenna television (CATV) coaxial cables connecting to the network terminal shall be listed in accordance with 820.179. Applicable grounding means shall be listed for application with premises-powered broadband communications systems.

#### (G) Power Source.

The power source for circuits intended to provide power over communications cables to remote equipment shall be limited in accordance with Table 11(B) in Chapter 9 for voltage sources up to 60 V dc and be listed as specified in either of the following:

1. A power source shall be listed as specified in 725.121(A)(1), (A)(2), (A)(3), or (A)(4). The power sources shall not have the output connections paralleled or otherwise interconnected unless listed for such interconnection.
2. A power source shall be listed as communications equipment for limited-power circuits.

Informational Note: One way to determine applicable requirements is to refer to ANSI/UL 60950-1-2014, *Standard for Safety of Information Technology Equipment-Safety — Part 1*; or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements*. Typically, such circuits are used to interconnect equipment for the purpose of exchanging information (data).

**(H) Accessory Equipment.**

Communications accessory equipment and/or assemblies shall be listed for application with premises-powered communications systems.

Informational Note: One way to determine applicable requirements is to refer to ANSI/UL 1863-2004, *Communications-Circuit Accessories*.

# Public Input No. 3277-NFPA 70-2020 [ Sections Part VII., 840.170 ]

**Sections Part VII., 840.170**

**Part VII.** Listing Requirements

**840.170** Equipment and Cables.

Premises-powered broadband communications systems equipment and cables shall comply with 840.170(A) through (~~H~~ B ).

**(A)** Network Terminal.

The network terminal and applicable grounding means shall be listed for application with premises-powered broadband communications systems.

Informational Note No. 1: One way to determine applicable requirements is to refer to ANSI/UL 60950-1-2014, *Standard for Safety of Information Technology Equipment*; ANSI/UL 498A-2015, *Current Taps and Adapters*; ANSI/UL 467-2013, *Grounding and Bonding Equipment;* or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements*.

Informational Note No. 2: There are no requirements on the network terminal and its grounding methodologies except for those covered by the listing of the product.

~~**(H)**~~

**(B)** ~~Optical Fiber Cables.~~

~~Optical fiber cables shall be listed in accordance with 770.179(A) through (D) and shall be marked in accordance with Table 770.179 .~~

~~**(C)** Communications Equipment.~~

~~Communications equipment shall be listed in accordance with 805.170 .~~

~~**(D)** Cable Routing Assemblies and Communications Raceways.~~

~~Cable routing assemblies and communications raceways shall be listed in accordance with 800.182 .~~

~~**(E)** Premises Communications Wires and Cables.~~

~~Communications wires and cable shall be listed and marked in accordance with 805.179 .~~

~~**(F)** Premises Community Antenna Television (CATV) Circuits.~~

~~Premises community antenna television (CATV) coaxial cables connecting to the network terminal shall be listed in accordance with 820.179 . Applicable grounding means shall be listed for application with premises-powered broadband communications systems.~~

~~**(G)** Power Source.~~

~~The power source for circuits intended to provide power over communications cables to remote equipment shall be limited in accordance with Table 11(B) in Chapter 9 for voltage sources up to 60 V dc and be listed as specified in either of the following:~~

(1) ~~A power source shall be listed as specified in 725.121(A)(1) , (A)(2), (A)(3), or (A)(4). The power sources shall not have the output connections paralleled or otherwise interconnected unless listed for such interconnection.~~

(2) ~~A power source shall be listed as communications equipment for limited-power circuits.~~

~~Informational Note: One way to determine applicable requirements is to refer to ANSI/UL 60950-1-2014, *Standard for Safety of Information Technology Equipment-Safety — Part 1* ; or ANSI/UL 62368-1-2014, *Audio/Video, Information and Communication Technology Equipment — Part 1: Safety Requirements* . Typically, such circuits are used to interconnect equipment for the purpose of exchanging information (data).~~

**Accessory Equipment.**

Communications accessory equipment and/or assemblies shall be listed for application with premises-powered communications systems.

Informational Note: One way to determine applicable requirements is to refer to ANSI/UL 1863-2004, *Communications-Circuit Accessories*.

## Statement of Problem and Substantiation for Public Input

This public input is being submitted by a Correlating Committee Task Group to improve the correlation between Chapter 7 and 8.

At the present time there are significant correlation issues with regards to what constitutes an installation in Chapter 7 and what constitutes an installation in Chapter 8. This public input seeks to remove duplicated material in Chapter 7 and Chapter 8. This proposal would relocate all duplicated material in Part V of Article 840. The NEC Style Manual also requires that duplicated material be removed.

The NEC strongly needs to correlate these Chapters since much of the technological advancement in the electrical industry is occurring in this limited energy world. The Correlating Committee seeks to remove correlation and duplication issues to make the NEC more clear, concise and usable in both Chapters 7 and 8.
The Correlating Committee Task Group is a long range planning committee that is seeking to make improvement over the next two to three cycles. The Task Group is made up of the following members: Alan Manche, Donny Cook, Randy Ivans, George Zimmerman and Thomas Domitrovich.

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