



National Fire Protection Association

1 Batterymarch Park, Quincy, MA 02169-7471
Phone: 617-770-3000 • Fax: 617-770-0700 • www.nfpa.org

WORKING DRAFT OF NEC[®] CODE MAKING PANEL 6 MEETING OUTPUT

**CONTENT NOT FINAL –SUBJECT TO REVISION
PRIOR TO LETTER BALLOT AND PUBLICATION OF
SECOND DRAFT REPORT**

Document: National Electrical Code[®]

Revision Cycle: A2019

Meeting Dates: October 22 – 27, 2018

Committee Activity: Comment Stage

This is a working draft, prepared by NFPA staff, to record the output generated at the Code-Making Panels Second Draft Meetings. It includes draft copies of the Second Revisions and any Global Revisions.

It is being made available to Committee members for the purpose of facilitating early review, particularly for those Committee members who may be seeking input from their respective organizations in preparation for the Letter Ballot of the Committee.

**Second Revision No. 7745-NFPA 70-2018 [Detail]**

Change title to read:

Article 334 Nonmetallic-Sheath Cable: Tyypes NM, and NMC

Submitter Information Verification

Committee: NEC-P06

Submittal Date: Wed Oct 24 16:04:12 EDT 2018

Committee Statement

Committee Statement: The title of Article 334 is being revised to reflect the First Revisions FR 8045, FR 8047 and FR 8048 where Type NMS cable was deleted from the Article.

Response Message: SR-7745-NFPA 70-2018

[Public Comment No. 899-NFPA 70-2018 \[Section No. 334.6\]](#)

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Second Revision No. 7572-NFPA 70-2018 [Definition: Free Air (as applied to conductors).]

100. Free Air (as applied to conductors).

Open or ventilated environment that allows for air- ~~heat dissipation and air~~ flow around an installed conductor- ~~with no other conductors closer than one cable diameter and no insulation or building materials in contact with the conductor insulation for more than 75 mm (3 in .) for every 3 m (10 ft) of conductor.~~ (CMP6)

Submitter Information Verification

Committee: NEC-P06

Submittal Date: Mon Oct 22 14:42:19 EDT 2018

Committee Statement

Committee Statement: Requirements were removed per PC 1742 edits and now only define "free air."

Removing the definition of "free air" does not help define a condition for the user in conductor application or selection. (CMP6)

Response Message: SR-7572-NFPA 70-2018

[Public Comment No. 1315-NFPA 70-2018 \[Definition: Free Air \(as applied to conductors\). \]](#)

[Public Comment No. 735-NFPA 70-2018 \[Definition: Free Air \(as applied to conductors\). \]](#)

[Public Comment No. 1217-NFPA 70-2018 \[Definition: Free Air \(as applied to conductors\). \]](#)

[Public Comment No. 1742-NFPA 70-2018 \[Definition: Free Air \(as applied to conductors\). \]](#)

**Second Revision No. 7573-NFPA 70-2018 [Definition: Messenger or Messenger Wire.]****100. Messenger or Messenger Wire.**

A wire that is run along with or integral with
or parallel to

a cable or conductor to provide mechanical support for the cable or conductor. (CMP-6)

Submitter Information Verification

Committee: NEC-P06

Submittal Date: Mon Oct 22 14:58:17 EDT 2018

Committee Statement

Committee Statement: The revision will insure that the definition does not cause confusion with the term "parallel conductors". (CMP-6)

Response Message: SR-7573-NFPA 70-2018

Public Comment No. 2002-NFPA 70-2018 [Definition: Messenger or Messenger Wire.]

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SUBJECT TO REVISION - NOT FOR PUBLICATION



Second Revision No. 7730-NFPA 70-2018 [Section No. 310.4]

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SUBJECT TO REVISION - NOT FOR PUBLICATION

310.4 Conductor Constructions and Applications.

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Insulated conductors shall comply with Table 310.4(A) and Table 310.4(B).

Informational Note: Thermoplastic insulation may stiffen at temperatures lower than -10°C ($+14^{\circ}\text{F}$). Thermoplastic insulation may also be deformed at normal temperatures where subjected to pressure, such as at points of support.

Table 310.4(A) Conductor Applications and Insulations Rated 600 Volts¹

Trade Name	Type Letter	Maximum Operating Temperature	Application Provisions	Insulation	Thickness of Insulation			Conductor Construction
					AWG or kcmil	mm	mils	
Fluorinated ethylene propylene	FEP or FEPB	90°C (194°F)	Dry and damp locations	Fluorinated ethylene propylene	14–10	0.51	20	Non
					8–2	0.76	30	-
		200°C	Dry locations — special applications ³	Fluorinated ethylene propylene	14–8	0.36	14	Glas
		(392°F)			6–2	0.36	14	Glas othe suita braic mate
Mineral insulation (metal sheathed)	MI	90°C (194°F)	Dry and wet locations	Magnesium oxide	18–16 ⁴	0.58	23	Cop alloy
		250°C (482°F)	For special applications ³		16–10	0.91	36	
					9–4	1.27	50	
					3–500	1.40	55	
Moisture-, heat-, and oil-resistant thermoplastic	MTW	60°C (140°F)	Machine tool wiring in wet locations	Flame-retardant, moisture-, heat-, and oil-resistant thermoplastic	-		(A) (B) (A)	
		90°C (194°F)	Machine tool wiring in dry locations		22–12	0.76	0.38 30 15	
					10	0.76	0.51 30 20	
					-	8	1.14 0.76 45	
					-	6	1.52 0.76 60	
					-	4–2	1.52 1.02 60	
					-	1–4/0	2.03 1.27 80	
					-	213–500	2.41 1.52 95	
					-	501–1000	2.79 1.78 110	
					Informational Note: See NFPA 79.			
Paper	-	85°C (185°F)	For underground service conductors, or by special permission	Paper	-	-	-	
Perfluoro-alkoxy	PFA	90°C (194°F)	Dry and damp locations	Perfluoro-alkoxy	14–10	0.51	20	Non
					8–2	0.76	30	
		200°C	Dry locations — special applications ³		1–4/0	1.14	45	
		(392°F)			-	-	-	
Perfluoro-alkoxy	PFAH	250°C	Dry locations only. Only for leads within apparatus or within raceways connected to apparatus (nickel or nickel-coated copper only)	Perfluoro-alkoxy	14–10	0.51	20	Non
		(482°F)			8–2	0.76	30	

WORKING DRAFT OF CMP 6 MEETING OUTPUT - NATIONAL ELECTRICAL CODE - NFPA 70
OCTOBER 22 - 27, 2018 - SUBJECT TO REVISION - NOT FOR PUBLICATION

Trade Name	Type Letter	Maximum Operating Temperature	Application Provisions	Insulation	Thickness of Insulation				Conductor Size
					AWG or kcmil	mm		mils	
					1–4/0	1.14		45	
Thermoset	RHH	90°C (194°F)	Dry and damp locations			14–10	1.14		4
						8–2	1.52		6
						1–4/0	2.03		8
						213–500	2.41		9
						501–1000	2.79		11
						1001–2000	3.18		12
Moisture-resistant thermoset	RHW	75°C (167°F)	Dry and wet locations	Flame-retardant, moisture-resistant thermoset	14–10	1.14	45	Mois resis flam retar noni cove	
					8–2	1.52	60		
					1–4/0	2.03	80		
	RHW-2	90°C (194°F)				213–500	2.41		95
						501–1000	2.79		110
						1001–2000	3.18		125
Silicone	SA	90°C (194°F)	Dry and damp locations	Silicone rubber	14–10	1.14	45	Glas othe suite brai mate	
		200°C (392°F)			For special application ³	8–2	1.52		60
					1–4/0	2.03	80		
					213–500	2.41	95		
					501–1000	2.79	110		
					1001–2000	3.18	125		
Thermoset	SIS	90°C (194°F)	Switchboard and switchgear wiring only	Flame-retardant thermoset	14–10	0.76	30	Non	
					8–2	1.14	45		
					1–4/0	2.03	55		
Thermoplastic and fibrous outer braid	TBS	90°C (194°F)	Switchboard and switchgear wiring only	Thermoplastic	14–10	0.76	30	Flam retar noni cove	
					8	1.14	45		
					6–2	1.52	60		
					1–4/0	2.03	80		
Extended polytetrafluoroethylene	TFE	250°C (482°F)	Dry locations only. Only for leads within apparatus or within raceways connected to apparatus, or as open wiring (nickel or nickel-coated copper only)	Extruded polytetrafluoroethylene	14–10	0.51	20	Non	
					8–2	0.76	30		
					1–4/0	1.14	45		
Heat-resistant thermoplastic	THHN	90°C (194°F)	Dry and damp locations	Flame-retardant, heat-resistant thermoplastic	14–12	0.38	15	Nylc jack equi	
					10	0.51	20		
					8–6	0.76	30		
					4–2	1.02	40		
					1–4/0	1.27	50		
					250–500	1.52	60		
					501–1000	1.78	70		
Moisture- and heat-resistant thermoplastic	THHW	75°C (167°F)	Wet location	Flame-retardant, moisture- and	14–10	0.76	30	Non	
					8	1.14	45		
					6–2	1.52	60		

WORKING DRAFT OF CMP 6 MEETING OUTPUT - NATIONAL ELECTRICAL CODE - NFPA 70
OCTOBER 22 - 27, 2018 - SUBJECT TO REVISION - NOT FOR PUBLICATION

Trade Name	Type Letter	Maximum Operating Temperature	Application Provisions	Insulation	Thickness of Insulation			Cov
					AWG or kcmil	mm	mils	
		90°C (194°F)	Dry location	heat-resistant thermoplastic	1-4/0 213-500 501-1000 1001-2000	2.03 2.41 2.79 3.18	80 95 110 125	
Moisture- and heat-resistant thermoplastic	THW	75°C (167°F) 90°C (194°F)	Dry and wet locations Special applications within electric discharge lighting equipment. Limited to 1000 open-circuit volts or less. (Size 14-8 only as permitted in 410.68.)	Flame-retardant, moisture- and heat-resistant thermoplastic	14-10 8 6-2 1-4/0 213-500 501-1000 1001-2000	0.76 1.14 1.52 2.03 2.41 2.79 3.18	30 45 60 80 95 110 125	Non
		THW-2	90°C (194°F)	Dry and wet locations	-	-	-	
Moisture- and heat-resistant thermoplastic	THWN	75°C (167°F)	Dry and wet locations	Flame-retardant, moisture- and heat-resistant thermoplastic	14-12 10 8-6 4-2	0.38 0.51 0.76 1.02	15 20 30 40	Nylon jacket equipment
	THWN-2	90°C (194°F)			1-4/0 250-500 501-1000	1.27 1.52 1.78	50 60 70	
Moisture-resistant thermoplastic	TW	60°C (140°F)			14-10 8 6-2 1-4/0 213-500 501-1000 1001-2000	0.76 1.14 1.52 2.03 2.41 2.79 3.18	30 45 60 80 95 110 125	Non
Underground feeder and branch-circuit cable — single conductor (for Type UF cable employing more than one conductor, see Article 340).	UF	60°C (140°F) 75°C (167°F) ⁵		Moisture-resistant	14-10 8-2 1-4/0	1.52 2.03 2.41	60 ⁶ 80 ⁶ 95 ⁶	Inter with insu
Underground service-	USE	75°C (167°F) ⁵	See Article 338.	Heat- and moisture-	14-10 8-2	1.14 1.52	45 60	Mois resis

WORKING DRAFT OF CMP 6 MEETING OUTPUT - NATIONAL ELECTRICAL CODE - NFPA 70
OCTOBER 22 - 27, 2018 - SUBJECT TO REVISION - NOT FOR PUBLICATION

Trade Name	Type Letter	Maximum Operating Temperature	Application Provisions	Insulation	Thickness of Insulation			Cover
					AWG or kcmil	mm	mils	
entrance cable — single conductor (for Type USE cable employing more than one conductor, see Article 338).	USE-2	90°C (194°F)	Dry and wet locations	resistant	1–4/0	2.03	80	non-covered (See 338.10)
					213–500	2.41	95	
					501–1000	2.79	110	
					1001–2000	3.18	125	
Thermoset	XHH	90°C (194°F)	Dry and damp locations	Flame-retardant thermoset	14–10	0.76	30	None
					8–2	1.14	45	
					1–4/0	1.40	55	
					213–500	1.65	65	
					501–1000	2.03	80	
					1001–2000	2.41	95	
Thermoset	XHHN	90°C (194°F)	Dry and damp locations	Flame-retardant thermoset	14–12	0.38	15	Nylon jacket equipment
					10	0.51	20	
					8–6	0.76	30	
					4–2	1.02	40	
					1–4/0	1.27	50	
					250–500	1.52	60	
					501–1000	1.78	70	
					Moisture-resistant thermoset	XHHW	90°C (194°F)	
75°C (167°F)	Wet locations	8–2	1.14	45				
		1–4/0	1.40	55				
		213–500	1.65	65				
		501–1000	2.03	80				
		1001–2000	2.41	95				
Moisture-resistant thermoset	XHHW-2	90°C (194°F)	Dry and wet locations	Flame-retardant, moisture-resistant thermoset	14–10	0.76	30	None
					8–2	1.14	45	
					1–4/0	1.40	55	
					213–500	1.65	65	
					501–1000	2.03	80	
					1001–2000	2.41	95	
Moisture-resistant thermoset	XHWN	75°C (167°F)	Dry and wet locations	Flame-retardant, moisture-resistant thermoset	14–12	0.38	15	Nylon jacket equipment
					10	0.51	20	
					8–6	0.76	30	
					4–2	1.02	40	
	XHWN-2	90°C (194°F)			1–4/0	1.27	50	
					250–500	1.52	60	
					501–1000	1.78	70	
Modified ethylene tetrafluoro-ethylene	Z	90°C (194°F)	Dry and damp locations	Modified ethylene tetrafluoro-ethylene	14–12	0.38	15	None
		150°C	Dry locations		10	0.51	20	
					8–4	0.64	25	

WORKING DRAFT OF CMP 6 MEETING OUTPUT - NATIONAL ELECTRICAL CODE - NFPA 70
OCTOBER 22 - 27, 2018 - SUBJECT TO REVISION - NOT FOR PUBLICATION

Trade Name	Type Letter	Maximum Operating Temperature	Application Provisions	Insulation	Thickness of Insulation			Covering
		(302°F)	— special applications ³		AWG or kcmil	mm	mils	
Modified ethylene tetrafluoro-ethylene	ZW	75°C (167°F)	Wet locations	Modified ethylene tetrafluoro-ethylene	3–1	0.89	35	Non
		90°C (194°F)	Dry and damp locations		1/0–4/0	1.14	45	
		150°C (302°F)	Dry locations — special applications ³		14–10	0.76	30	
					8–2	1.14	45	
	ZW-2	90°C (194°F)	Dry and wet locations					

¹Conductors shall be permitted to be rated up to 1000 volts if listed and marked.

²Outer coverings shall not be required where listed without a covering.

³~~Where~~ Higher temperature rated constructions shall be permitted where design conditions require maximum conductor operating temperatures above 90°C (194°F).

⁴~~For~~ Conductor sizes shall be permitted for signaling circuits permitting 300-volt insulation.

⁵~~For ampacity limitation, see~~ The ampacity of Type UF cable shall be limited in accordance with 340.80.

⁶~~Includes~~ Type UF insulation thickness shall include the integral jacket.

⁷Insulation thickness shall be permitted to be 2.03 mm (80 mils) for listed Type USE conductors that have been subjected to special investigations. The nonmetallic covering over individual rubber-covered conductors of aluminum-sheathed cable and of lead-sheathed or multiconductor cable shall not be required to be flame retardant. ~~For Type MC cable, see 330.104. For nonmetallic-sheathed cable, see Article 334, Part III. For Type UF cable, see Article 340, Part III.~~

Table 310.4(B) Thickness of Insulation for Nonshielded Types RHH and RHW Solid Dielectric Insulated Conductors Rated 2000 Volts

Conductor Size (AWG or kcmil)		Column A ¹			Column B ²	
		mm	mils		mm	mils
14–10	-	2.03	80	-	1.52	60
8	-	2.03	80	-	1.78	70
6–2	-	2.41	95	-	1.78	70
1–2/0	-	2.79	110	-	2.29	90
3/0–4/0	-	2.79	110	-	2.29	90
213–500	-	3.18	125	-	2.67	105
501–1000	-	3.56	140	-	3.05	120
1001–2000	-	3.56	140	-	3.56	140

¹Column A insulations shall be limited to natural, SBR, and butyl rubbers.

²Column B insulations shall be materials such as cross-linked polyethylene, ethylene propylene rubber, and composites thereof.

Supplemental Information

File Name	Description	Approved
70-Article_310_For_NFPA_use.docx	310.4 - Attached word doc for clarity of change. Staff use only.	

Submitter Information Verification**Committee:** NEC-P06**Submittal Date:** Tue Oct 23 21:28:12 EDT 2018**Committee Statement**

Committee Statement: The mm equivalent of 55 mils for SIS cable was corrected from 2.41 to 1.40. The notes at the bottom of the table were edited to mandatory language for compliance to the Style Manual. Note 4 was not deleted. It is rewritten in mandatory language.

Response Message: SR-7730-NFPA 70-2018

Public Comment No. 1721-NFPA 70-2018 [Section No. 310.4]

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**Second Revision No. 7612-NFPA 70-2018 [Section No. 310.6(C)]****(C) Ungrounded Conductors.**

Conductors that are intended for use as ungrounded conductors, whether used as a single conductor or in multiconductor cables, shall be finished to be clearly distinguishable from grounded ~~-, and equipment~~ grounding ~~-, and bonding~~ conductors. Distinguishing markings shall not conflict in any manner with the surface markings required by 310.8(B)(1). Branch-circuit ungrounded conductors shall be identified in accordance with 210.5(C). Feeders shall be identified in accordance with 215.12.

Exception: Conductor identification shall be permitted in accordance with ~~with~~ 200.7.

Submitter Information Verification

Committee: NEC-P06

Submittal Date: Mon Oct 22 17:57:45 EDT 2018

Committee Statement

Committee Statement: Equipment grounding conductors have specific color requirements in the NEC. Other grounding and bonding conductors may not have specific color requirements.

Response Message: SR-7612-NFPA 70-2018

[Public Comment No. 455-NFPA 70-2018 \[Section No. 310.6\(C\)\]](#)

[Public Comment No. 575-NFPA 70-2018 \[Section No. 310.6\(C\)\]](#)

**Second Revision No. 7633-NFPA 70-2018 [Section No. 310.8(B)(1)]****(1) Surface Marking.**

The following conductors and cables shall be durably marked on the surface. ~~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) Single-conductor and multiconductor ~~rubber~~ thermoset - and thermoplastic-insulated wire and cable
- (2) Nonmetallic-sheathed cable
- (3) Service-entrance cable
- (4) Underground feeder and branch-circuit cable
- (5) Tray cable
- (6) Irrigation cable
- (7) Power-limited tray cable
- (8) Instrumentation tray cable

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.).

Submitter Information Verification

Committee: NEC-P06

Submittal Date: Mon Oct 22 18:23:52 EDT 2018

Committee Statement

Committee Statement: Rubber was changed to thermoset to harmonize with changes made elsewhere in the NEC. Two sentences were moved after the list for clarity.

Response Message: SR-7633-NFPA 70-2018

[Public Comment No. 1724-NFPA 70-2018 \[Section No. 310.8\(B\)\(1\)\]](#)

[Public Comment No. 1227-NFPA 70-2018 \[Section No. 310.8\(B\)\(1\)\]](#)

**Second Revision No. 7636-NFPA 70-2018 [Section No. 310.8(B)(2)]****(2) Marker Tape.**

Metal-covered multiconductor cables shall employ a marker tape located within the cable and running for its complete length.

Exception No. 1: Type MI cable shall not require a marker tape .

Exception No. 2: Type AC cable shall not require a marker tape .

Exception No. 3: The information required in 310.8(A) shall be permitted to be durably marked on the outer nonmetallic covering of Type MC, Type ITC, or Type PLTC cables at intervals not exceeding 1.0 m (40 in.).

Exception No. 4: The information required in 310.8(A) shall be permitted to be durably marked on a nonmetallic covering under the metallic sheath of Type ITC or Type PLTC cable at intervals not exceeding 1.0 m (40 in.).

Informational Note: Included in the group of metal-covered cables are Type AC cable (Article 320), Type MC cable (Article 330), and lead-sheathed cable.

Submitter Information Verification

Committee: NEC-P06

Submittal Date: Mon Oct 22 18:29:20 EDT 2018

Committee Statement

Committee Statement: Exception No. 1 and Exception No. 2 are rewritten as complete sentences and in permissive text in accordance with the NEC® Style Manual.

Response Message: SR-7636-NFPA 70-2018

Public Comment No. 1229-NFPA 70-2018 [Section No. 310.8(B)(2)]



Second Revision No. 7638-NFPA 70-2018 [Section No. 310.12]

310.12 Single-Phase Dwelling Services and Feeders.

For one-family dwellings and the individual dwelling units of two-family and multifamily dwellings, service and feeder conductors supplied by a single-phase, 120/240-volt system shall be permitted to be sized in accordance with 310.12(A) through (D).

For one-family dwellings and the individual dwelling units of two-family and multifamily dwellings, single-phase feeder conductors consisting of 2 ungrounded conductors and the neutral conductor from a 208Y/120 volt system shall be permitted to be sized in accordance with 310.12(A) through (D).

(A)– Services.

For a service rated 100 amperes through 400 amperes, the service conductors supplying the entire load associated with a one-family dwelling, or the service conductors supplying the entire load associated with an individual dwelling unit in a two-family or multifamily dwelling, shall be permitted to have an ampacity not less than 83 percent of the service rating. If no adjustment or correction factors are required, Table 310.12 shall be permitted to be applied.

(B)– Feeders.

For a feeder rated 100 amperes through 400 amperes, the feeder conductors supplying the entire load associated with a one-family dwelling, or the feeder conductors supplying the entire load associated with an individual dwelling unit in a two-family or multifamily dwelling, shall be permitted to have an ampacity not less than 83 percent of the feeder rating. If no adjustment or correction factors are required, Table 310.12 shall be permitted to be applied.

(C)– Feeder Ampacities.

In no case shall a feeder for an individual dwelling unit be required to have an ampacity greater than that specified in 310.12(A) or (B).

(D)– Grounded Conductors.

Grounded conductors shall be permitted to be sized smaller than the ungrounded conductors, if the requirements of 220.61 and 230.42 for service conductors or the requirements of 215.2 and 220.61 for feeder conductors are met.

Where correction or adjustment factors are required by 310.15(B) or (C), they shall be permitted to be applied to the ampacity associated with the temperature rating of the conductor.

Informational Note No. 1: The service or feeder ratings addressed by this section are based on the standard ampere ratings for fuses and inverse time circuit breakers from 240.6(A).

Informational Note No. 2: See Example D7 in Annex D.

Table 310.12 Single-Phase Dwelling Services and Feeders

<u>Service or Feeder Rating(Amperes)</u>	<u>Conductor (AWG or kcmil)</u>	
	<u>Copper</u>	<u>Aluminum or Copper-Clad Aluminum</u>
100	4	2
110	3	1
125	2	1/0
150	1	2/0
175	1/0	3/0
200	2/0	4/0
225	3/0	250
250	4/0	300
300	250	350
350	350	500
400	400	600

Note: If no adjustment or correction factors are required, this table shall be permitted to be applied.

Submitter Information Verification**Committee:** NEC-P06**Submittal Date:** Mon Oct 22 18:42:13 EDT 2018**Committee Statement****Committee Statement:** Updated format to comply with the NEC® Style Manual. Cited reference is corrected.**Response Message:** SR-7638-NFPA 70-2018[Public Comment No. 1727-NFPA 70-2018 \[Section No. 310.12 \[Excluding any Sub-Sections\]\]](#)[Public Comment No. 1242-NFPA 70-2018 \[Section No. 310.12\]](#)[Public Comment No. 677-NFPA 70-2018 \[Section No. 310.12 \[Excluding any Sub-Sections\]\]](#)FOR CODE-MAKING PANEL USE ONLY
SUBJECT TO REVISION - NOT FOR PUBLICATION

**Second Revision No. 7650-NFPA 70-2018 [Section No. 310.15]****310.15 Ampacity Tables.****(A) General.**

Ampacities for conductors rated 0 volts to 2000 volts shall be as specified in the Ampacity Table 310.16 through Table 310.21, as modified by 310.15(A) through (F) and 310.12. Under engineering supervision, ampacities of sizes not shown in ampacity tables for conductors meeting the general wiring requirements shall be permitted to be determined by interpolation of the adjacent conductors based on the conductor's area.

The temperature correction and adjustment factors shall be permitted to be applied to the ampacity for the temperature rating of the conductor, if the corrected and adjusted ampacity does not exceed the ampacity for the temperature rating of the termination in accordance with the provisions of 110.14(C).

Informational Note No. 1: Table 310.16 through Table 310.19 are application tables for use in determining conductor sizes on loads calculated in accordance with Article 220. Ampacities result from consideration of one or more of the following:

- (1) Temperature compatibility with connected equipment, especially the connection points.
- (2) Coordination with circuit and system overcurrent protection.
- (3) Compliance with the requirements of product listings or certifications. See 110.3(B).
- (4) Preservation of the safety benefits of established industry practices and standardized procedures.

Informational Note No. 2: For conductor area see Chapter 9, Table 8, Conductor Properties. Interpolation is based on the conductor area and not the conductor overall area.

Informational Note No. 3: For the ampacities of flexible cords and cables, see 400.5. For the ampacities of fixture wires, see 402.5.

(A) General.

Informational Note No. 4: For explanation of type letters used in tables and for recognized sizes of conductors for the various conductor insulations, see Table 310.4(A) and Table 310.4(B). For installation requirements, see 310.1 through 310.14 and the various articles of this Code. For flexible cords, see Table 400.4, Table 400.5(A)(a), and Table 400.5(A)(b).

(B)_ Ambient Temperature Correction Factors.

(1) General.

FOR CODE-MAKING PANEL USE ONLY
SUBJECT TO REVISION - NOT FOR PUBLICATION

Ampacities for ambient temperatures other than those shown in the ampacity tables shall be corrected in accordance with Table 310.15(B)(1) or Table 310.15(B)(2), or shall be permitted to be calculated using Equation 310.15(B).

$$I' = I \sqrt{\frac{T_c - T_a'}{T_c - T_a}} \quad [310.15(B)]$$

where:

I' = ampacity corrected for ambient temperature

I = ampacity shown in the tables

T_c = temperature rating of conductor (°C)

T_a' = new ambient temperature (°C)

T_a = ambient temperature used in the table (°C)

Raceways- (2) . Rooftop.

For raceways or cables exposed to direct sunlight on or above rooftops, where the distance above the roof to the bottom of the raceway or cable is less than 23 mm ($\frac{7}{8}$ in.), a temperature adder of 33°C (60°F) shall be added to the outdoor temperature to determine the applicable ambient temperature for application of the correction factors in Table 310.15(B)(1) or Table 310.15(B)(2).

Exception: Type XHHW-2 insulated conductors shall not be subject to this ampacity adjustment.

Informational Note: One source for the ambient temperatures in various locations is the ASHRAE Handbook - Fundamentals.

Table 310.15(B)(1) Ambient Temperature Correction Factors Based on 30°C (86°F)

For ambient temperatures other than 30°C (86°F), multiply the allowable ampacities specified in the ampacity tables by the appropriate correction factor shown below.

Ambient Temperature (°C)	Temperature Rating of Conductor			Ambient Temperature (°F)
	60°C	75°C	90°C	
10 or less	1.29	1.20	1.15	50 or less
11–15	1.22	1.15	1.12	51–59
16–20	1.15	1.11	1.08	60–68
21–25	1.08	1.05	1.04	69–77
26–30	1.00	1.00	1.00	78–86
31–35	0.91	0.94	0.96	87–95
36–40	0.82	0.88	0.91	96–104
41–45	0.71	0.82	0.87	105–113
46–50	0.58	0.75	0.82	114–122
51–55	0.41	0.67	0.76	123–131
56–60	—	0.58	0.71	132–140
61–65	—	0.47	0.65	141–149
66–70	—	0.33	0.58	150–158
71–75	—	—	0.50	159–167
76–80	—	—	0.41	168–176
81–85	—	—	0.29	177–185

Table 310.15(B)(2) Ambient Temperature Correction Factors Based on 40°C (104°F)

For ambient temperatures other than 40°C (104°F), multiply the allowable ampacities specified in the ampacity tables by the appropriate correction factor shown below.

Ambient Temperature (°C)	Temperature Rating of Conductor						Ambient Temperature (°F)
	60°C	75°C	90°C	150°C	200°C	250°C	
10 or less	1.58	1.36	1.26	1.13	1.09	1.07	50 or less
11–15	1.50	1.31	1.22	1.11	1.08	1.06	51–59

For ambient temperatures other than 40°C (104°F), multiply the allowable ampacities specified in the ampacity tables by the appropriate correction factor shown below.

Ambient Temperature (°C)	Temperature Rating of Conductor						Ambient Temperature (°F)
	60°C	75°C	90°C	150°C	200°C	250°C	
16–20	1.41	1.25	1.18	1.09	1.06	1.05	60–68
21–25	1.32	1.2	1.14	1.07	1.05	1.04	69–77
26–30	1.22	1.13	1.10	1.04	1.03	1.02	78–86
31–35	1.12	1.07	1.05	1.02	1.02	1.01	87–95
36–40	1.00	1.00	1.00	1.00	1.00	1.00	96–104
41–45	0.87	0.93	0.95	0.98	0.98	0.99	105–113
46–50	0.71	0.85	0.89	0.95	0.97	0.98	114–122
51–55	0.50	0.76	0.84	0.93	0.95	0.96	123–131
56–60	—	0.65	0.77	0.90	0.94	0.95	132–140
61–65	—	0.53	0.71	0.88	0.92	0.94	141–149
66–70	—	0.38	0.63	0.85	0.90	0.93	150–158
71–75	—	—	0.55	0.83	0.88	0.91	159–167
76–80	—	—	0.45	0.80	0.87	0.90	168–176
81–90	—	—	—	0.74	0.83	0.87	177–194
91–100	—	—	—	0.67	0.79	0.85	195–212
101–110	—	—	—	0.60	0.75	0.82	213–230
111–120	—	—	—	0.52	0.71	0.79	231–248
121–130	—	—	—	0.43	0.66	0.76	249–266
131–140	—	—	—	0.30	0.61	0.72	267–284
141–160	—	—	—	—	0.50	0.65	285–320
161–180	—	—	—	—	0.35	0.58	321–356
181–200	—	—	—	—	—	0.49	357–392
201–225	—	—	—	—	—	0.35	393–437

(C) Adjustment Factors.

(1) More than Three Current-Carrying Conductors.

The ampacity of each conductor shall be reduced as shown in Table 310.15(C)(1) where the number of current-carrying conductors in a raceway or cable exceeds three, or where single conductors or multiconductor cables not installed in raceways are installed without maintaining spacing for a continuous length longer than 600 mm (24 in.). Each current-carrying conductor of a paralleled set of conductors shall be counted as a current-carrying conductor.

Table 310.15(C)(1) Adjustment Factors for More Than Three Current-Carrying Conductors

<u>Number of Conductors</u> *	<u>Percent of Values in Table 310.16 Through Table 310.19 as Adjusted for Ambient Temperature if Necessary</u>
4–6	80
7–9	70
10–20	50
21–30	45
31–40	40
41 and above	35

* Number of conductors is the total number of conductors in the raceway or cable, including spare conductors. The count shall be adjusted in accordance with 310.15(E) and (F). The count shall not include conductors that are connected to electrical components that cannot be simultaneously energized.

Note:

Spacing between raceways shall be maintained.

Exception: Type XHHW-2 insulated conductors shall not be subject to this ampacity adjustment.

Informational Note: One source for the ambient temperatures in various locations is the ASHRAE Handbook—Fundamentals.

Where conductors of different systems, as provided in 300.3, are installed in a common raceway or cable, the adjustment factors shown in Table 310.15(C)(1) shall apply only to the number of power and lighting conductors (Articles 210, 215, 220, and 230).

Informational Note No. 1: See Annex B for adjustment factors for more than three current-carrying conductors in a raceway or cable with load diversity.

Informational Note No. 2: See 366.23 for adjustment factors for conductors and ampacity for bare copper and aluminum bars in auxiliary gutters and 376.22(B) for adjustment factors for conductors in metal wireways.

(a) Where conductors are installed in cable trays, the provisions of 392.80 shall apply.

(b) Adjustment factors shall not apply to conductors in raceways having a length not exceeding 600 mm (24 in.).

(c) Adjustment factors shall not apply to underground conductors entering or leaving an outdoor trench if those conductors have physical protection in the form of rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride conduit (PVC), or reinforced thermosetting resin conduit (RTRC) having a length not exceeding 3.05 m (10 ft), and if the number of conductors does not exceed four.

(d) Adjustment factors shall not apply to Type AC cable or to Type MC cable under the following conditions:

(5) The cables do not have an overall outer jacket.

(6) Each cable has not more than three current-carrying conductors.

(7) The conductors are 12 AWG copper.

(8) Not more than 20 current-carrying conductors are installed without maintaining spacing, are stacked, or are supported on “bridle rings.”

Exception to (4): If cables meeting the requirements in 310.15(C)(1)(d)(1) through (C)(1)(d)(3) with more than 20 current-carrying conductors are installed longer than 600 mm (24 in.) without maintaining spacing, are stacked, or are supported on bridle rings, a 60 percent adjustment factor shall be applied.

(2) Raceway Spacing. Spacing between raceways shall be maintained.

(D) Bare or Covered Conductors.

Where bare or covered conductors are installed with insulated conductors, the temperature rating of the bare or covered conductor shall be equal to the lowest temperature rating of the insulated conductors for the purpose of determining ampacity.

(E) Neutral Conductor.

Neutral conductors shall be considered current carrying in accordance with any of the following:

- (1) A neutral conductor that carries only the unbalanced current from other conductors of the same circuit shall not be required to be counted when applying the provisions of 310.15(C)(1).
- (2) In a 3-wire circuit consisting of two phase conductors and the neutral conductor of a 4-wire, 3-phase, wye-connected system, a common conductor carries approximately the same current as the line-to-neutral load currents of the other conductors and shall be counted when applying the provisions of 310.15(C)(1).
- (3) On a 4-wire, 3-phase wye circuit where the major portion of the load consists of nonlinear loads, harmonic currents are present in the neutral conductor; the neutral conductor shall therefore be considered a current-carrying conductor.

(F) Grounding or Bonding Conductor.

A grounding or bonding conductor shall not be counted when applying the provisions of 310.15(C)(1).

Supplemental Information

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
70-Article_310_For_NFPA_use.docx	310.15 - Attached word doc for clarity of change. Staff use only.	

Submitter Information Verification

Committee: NEC-P06

Submittal Date: Mon Oct 22 20:49:29 EDT 2018

Committee Statement

Committee Statement: Clarification for conductor area is included in the informational note rather than the main text.

Information was relocated to correct location. The requirement for raceway spacing was incorrectly located as a note, so it was deleted and then added as list item (C)(2).

Exception and informational note were moved to the correct location.

Editorial change was made to make text into a complete sentence.

Removed the word "allowable" to correlate with the removal of allowable from the ampacity tables.

Response Message: SR-7650-NFPA 70-2018

[Public Comment No. 1731-NFPA 70-2018 \[Section No. 310.15\(C\)\]](#)

[Public Comment No. 390-NFPA 70-2018 \[Section No. 310.15\(C\)\(1\)\]](#)

[Public Comment No. 1729-NFPA 70-2018 \[Section No. 310.15\(B\)\]](#)

[Public Comment No. 389-NFPA 70-2018 \[Section No. 310.15\(B\)\]](#)

[Public Comment No. 464-NFPA 70-2018 \[Section No. 310.15\(B\)\]](#)

[Public Comment No. 579-NFPA 70-2018 \[Section No. 310.15 \[Excluding any Sub-Sections\]\]](#)

[Public Comment No. 1976-NFPA 70-2018 \[New Section after 310.15\(B\)\]](#)

[Public Comment No. 1422-NFPA 70-2018 \[Section No. 310.15\(C\)\(1\)\]](#)

**Second Revision No. 7651-NFPA 70-2018 [Sections 310.16, 310.17, 310.18, 310.19, 310.20, 310.21]****Sections 310.16, 310.17, 310.18, 310.19, 310.20, 310.21****310.16 Allowable** Ampacities of Insulated Conductors in Raceway, Cable, or Earth (Directly Buried).

The maximum ~~allowable~~ ampacities shall be as specified in Table 310.16 where all of the following conditions apply:

- (1) Conductors are rated 0 volts ~~to~~ through 2000 volts.
- (2) Conductors are rated 60°C (140°F), 75°C (167°F), or 90°C (194°F).
- (3) Wiring is installed in a 30°C (86°F) ambient temperature.
- (4) There are not more than three current-carrying conductors.

310.17 Allowable Ampacities of Single-Insulated Conductors in Free Air.

The maximum ~~allowable~~ ampacities shall be as specified in Table 310.17 where all of the following conditions apply:

- (1) Conductors are rated 0 volts ~~to~~ through 2000 volts.
- (2) Conductors are rated 60°C (140°F), 75°C (167°F), or 90°C (194°F).
- (3) Wiring is installed in a 30°C (86°F) ambient temperature.

310.18 Allowable Ampacities of Insulated Conductors in Raceway or Cable.

The maximum ~~allowable~~ ampacities shall be as specified in Table 310.18 where all of the following conditions apply:

- (1) Conductors are rated 0 volts ~~to~~ through 2000 volts.
- (2) Conductors are rated 150°C (302°F), 200°C (392°F), or 250°C (482°F).
- (3) Wiring is installed in a 40°C (86°F 104°F) ambient temperature.
- (4) There are not more than three current-carrying conductors.

310.19 Allowable Ampacities of Single-Insulated Conductors in Free Air.

The maximum ~~allowable~~ ampacities shall be as specified in Table 310.19 where all of the following conditions apply:

- (1) Conductors are rated 0 volts ~~to~~ through 2000 volts.
- (2) Conductors are rated up to 250°C (482°F).
- (3) Wiring is installed in a 40°C (86°F 104°F) ambient temperature.

310.20 Ampacities of Conductors Supported on a Messenger.

The maximum ampacities shall be as specified in Table 310.20 where all of the following conditions apply:

- (1) Conductors are rated 0 volts ~~to~~ through 2000 volts.
- (2) Conductors are rated 75°C (167°F) or 90°C (194°F).
- (3) Wiring is installed in a 40°C (86°F 104°F) ambient temperature.
- (4) There are not more than three single-insulated conductors.

310.21 Ampacities of Bare or Covered Conductors in Free Air.

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The maximum ampacities shall be as specified in Table 310.21 where all of the following conditions apply:

- (1) Wind velocity is 610 mm/sec (2 ft/sec).
- (2) Conductors are 80°C (176°F) total conductor temperature.
- (3) Wiring is installed in a 40°C (86°F 104°F) ambient temperature.

Table 310.16 (16. Ampacities of Insulated Conductors with Not More Than Three Current-Carrying Conductors in Raceway, Cable, or Earth (Directly Buried)

Size AWG or kcmil	Temperature Rating of Conductor [See Table 310.4(A)]						Size AWG or kcmil
	60°C (140°F)	75°C (167°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	90°C (194°F)	
	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, XHWN, USE, ZW	Types TBS, SA, SIS, FEP, FEPB, MI, PFA, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, XHWN, XHWN-2, XHHN, Z, ZW-2	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, XHWN, USE	Types TBS, SA, SIS, THHN, THHW, THW-2, THWN-2, RHH, RHW-2, USE-2, XHH, XHHW, XHHW-2, XHWN, XHWN-2, ZW-2 XHHN	
	COPPER			ALUMINUM OR COPPER-CLAD ALUMINUM			
18**	—	—	14	—	—	—	—
16**	—	—	18	—	—	—	—
14**	15	20	25	—	—	—	—
12**	20	25	30	15	20	25	12**
10**	30	35	40	25	30	35	10**
8	40	50	55	35	40	45	8
6	55	65	75	40	50	55	6
4	70	85	95	55	65	75	4
3	85	100	115	65	75	85	3
2	95	115	130	75	90	100	2
1	110	130	145	85	100	115	1
1/0	125	150	170	100	120	135	1/0
2/0	145	175	195	115	135	150	2/0
3/0	165	200	225	130	155	175	3/0
4/0	195	230	260	150	180	205	4/0
250	215	255	290	170	205	230	250
300	240	285	320	195	230	260	300
350	260	310	350	210	250	280	350
400	280	335	380	225	270	305	400
500	320	380	430	260	310	350	500
600	350	420	475	285	340	385	600
700	385	460	520	315	375	425	700
750	400	475	535	320	385	435	750
800	410	490	555	330	395	445	800
900	435	520	585	355	425	480	900
1000	455	545	615	375	445	500	1000
1250	495	590	665	405	485	545	1250
1500	525	625	705	435	520	585	1500
1750	545	650	735	455	545	615	1750
2000	555	665	750	470	560	630	2000

Notes:

1. Section 310.16 shall be referenced for conditions of use.

* 2. Section 310.15(B) shall be referenced for the ampacity correction factors where the ambient temperature is other than 30°C (86°F).

** 3. Section 310.15(C)(1) shall be referenced for more than three current-carrying conductors.

** Refer to Section 240.4(D) shall be referenced for conductor overcurrent protection limitations, except as modified elsewhere in the Code.

Table 310.17 Ampacities of Single-Insulated Conductors in Free Air

Size AWG or kcmil	Temperature Rating of Conductor [See Table 310.4(A)]						Size AWG or kcmil
	60°C (140°F)	75°C (167°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	90°C (194°F)	
	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, XHWN, ZW	Types TBS, SA, SIS, FEP, FEPB, MI, PFA, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, XHWN, XHWN-2, XHHN, Z, ZW-2	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, XHWN	Types TBS, SA, SIS, THHN, THHW, THW-2, THWN-2, RHH, RHW-2, USE-2, XHH, XHHW, XHHW-2, XHWN, XHWN-2, ZW-2 XHHN	
	COPPER			ALUMINUM OR COPPER-CLAD ALUMINUM			
18	—	—	18	—	—	—	—
16	—	—	24	—	—	—	—
14**	25	30	35	—	—	—	—
12**	30	35	40	25	30	35	12**
10**	40	50	55	35	40	45	10**
8	60	70	80	45	55	60	8
6	80	95	105	60	75	85	6
4	105	125	140	80	100	115	4
3	120	145	165	95	115	130	3
2	140	170	190	110	135	150	2
1	165	195	220	130	155	175	1
1/0	195	230	260	150	180	205	1/0
2/0	225	265	300	175	210	235	2/0
3/0	260	310	350	200	240	270	3/0
4/0	300	360	405	235	280	315	4/0
250	340	405	455	265	315	355	250
300	375	445	500	290	350	395	300
350	420	505	570	330	395	445	350
400	455	545	615	355	425	480	400
500	515	620	700	405	485	545	500
600	575	690	780	455	545	615	600
700	630	755	850	500	595	670	700
750	655	785	885	515	620	700	750
800	680	815	920	535	645	725	800
900	730	870	980	580	700	790	900
1000	780	935	1055	625	750	845	1000
1250	890	1065	1200	710	855	965	1250
1500	980	1175	1325	795	950	1070	1500
1750	1070	1280	1445	875	1050	1185	1750

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OCTOBER 22 - 27, 2018 - SUBJECT TO REVISION - NOT FOR PUBLICATION

Size AWG or kcmil	Temperature Rating of Conductor [See Table 310.4(A)]						Size AWG or kcmil
	60°C (140°F)	75°C (167°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	90°C (194°F)	
	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, XHWN, ZW	Types TBS, SA, SIS, FEP, FEPB, MI, PFA, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, XHWN, XHWN-2, XHHN, Z, ZW-2	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, XHWN	Types TBS, SA, SIS, THHN, THHW, THW-2, THWN-2, RHH, RHW-2, USE-2, XHH, XHHW, XHHW-2, XHWN, XHWN-2, ZW-2 XHHN	
	COPPER			ALUMINUM OR COPPER-CLAD ALUMINUM			
2000	1155	1385	1560	960	1150	1295	2000

Notes:

1. Section 310.17 shall be referenced for conditions of use.

* 2. Section 310.15(B) shall be referenced for the ampacity correction factors where the ambient temperature is other than 30°C (86°F).

** Section 240.4(D) shall be referenced for conductor overcurrent protection limitations, except as modified elsewhere in the Code.

Table 310.18 Ampacities of Insulated Conductors with Not More Than Three Current-Carrying Conductors in Raceway or Cable

Size AWG or kcmil	Temperature Rating of Conductor [See Table 310.4(A)]				Size AWG or kcmil
	150°C (302°F)	200°C (392°F)	250°C (482°F)	150°C (302°F)	
	Type Z	Types FEP, FEPB, PFA, SA	Types PFAH, TFE	Type Z	
	COPPER		NICKEL OR NICKEL- COATED COPPER	ALUMINUM OR COPPER-CLAD ALUMINUM	
14	34	36	39	—	14
12	43	45	54	30	12
10	55	60	73	44	10
8	76	83	93	57	8
6	96	110	117	75	6
4	120	125	148	94	4
3	143	152	166	109	3
2	160	171	191	124	2
1	186	197	215	145	1
1/0	215	229	244	169	1/0
2/0	251	260	273	198	2/0
3/0	288	297	308	227	3/0
4/0	332	346	361	260	4/0

Notes:

1. Section 310.18 shall be referenced for conditions of use.

2. Section 310.15(C)(1) shall be referenced for more than three current-carrying conductors.

* 3. Section 310.15(B) shall be referenced for the ampacity correction factors where the ambient temperature is other than 40°C (104°F).

Table 310.19 Ampacities of Single-Insulated Conductors in Free Air

<u>Size AWG or kcmil</u>	<u>Temperature Rating of Conductor [See Table 310.4(A)]</u>				<u>Size AWG or kcmil</u>
	<u>150°C (302°F)</u>	<u>200°C (392°F)</u>	<u>250°C (482°F)</u>	<u>150°C (302°F)</u>	
	<u>Type Z</u>	<u>Types FEP, FEPB, PFA, SA</u>	<u>Types PFAH, TFE</u>	<u>Type Z</u>	
	<u>COPPER</u>		<u>NICKEL, OR NICKEL- COATED COPPER</u>	<u>ALUMINUM OR COPPER-CLAD ALUMINUM</u>	
14	46	54	59	—	14
12	60	68	78	47	12
10	80	90	107	63	10
8	106	124	142	83	8
6	155	165	205	112	6
4	190	220	278	148	4
3	214	252	327	170	3
2	255	293	381	198	2
1	293	344	440	228	1
1/0	339	399	532	263	1/0
2/0	390	467	591	305	2/0
3/0	451	546	708	351	3/0
4/0	529	629	830	411	4/0

Notes:

1. Section 310.19 shall be referenced for conditions of use.

* 2. Section 310.15(B) shall be referenced for the ampacity correction factors where the ambient temperature is other than 40°C (104°F).

Table 310.20 Ampacities of Conductors on a Messenger

Size AWG or kcmil	Temperature Rating of Conductor [See Table 310.4(A)]				Size AWG or kcmil
	75°C (167°F)	90°C (194°F)	75°C (167°F)	90°C (194°F)	
	Types RHW, THHW, THW, THWN, XHHW, XHWN, ZW	Types MI, THHN, THHW, THW-2, THWN-2, RHH, RHW-2, USE-2, XHHW, XHHW-2, XHWN, XHWN-2, ZW-2	Types RHW, THW, THWN, THHW, XHHW, XHWN	Types THHN, THHW, RHH, XHHW, RHW-2, XHHW-2, THW-2, THWN-2, XHWN, XHWN-2, USE-2, ZW-2	
	COPPER		ALUMINUM OR COPPER-CLAD ALUMINUM		
8	57	66	44	51	8
6	76	89	59	69	6
4	101	117	78	91	4
3	118	138	92	107	3
2	135	158	106	123	2
1	158	185	123	144	1
1/0	183	214	143	167	1/0
2/0	212	247	165	193	2/0
3/0	245	287	192	224	3/0
4/0	287	335	224	262	4/0
250	320	374	251	292	250
300	359	419	282	328	300
350	397	464	312	364	350
400	430	503	339	395	400

<u>Size AWG or kcmil</u>	<u>Temperature Rating of Conductor [See Table 310.4(A)]</u>				<u>Size AWG or kcmil</u>
	<u>75°C (167°F)</u>	<u>90°C (194°F)</u>	<u>75°C (167°F)</u>	<u>90°C (194°F)</u>	
	<u>Types RHW, THHW, THW, THWN, XHHW, XHWN, ZW</u>	<u>Types MI, THHN, THHW, THW-2, THWN-2, RHH, RHW-2, USE-2, XHHW, XHHW-2, XHWN, XHWN-2, ZW-2</u>	<u>Types RHW, THW, THWN, THHW, XHHW, XHWN</u>	<u>Types THHN, THHW, RHH, XHHW, RHW-2, XHHW-2, THW-2, THWN-2, XHWN, XHWN-2, USE-2, ZW-2</u>	
	<u>COPPER</u>		<u>ALUMINUM OR COPPER-CLAD ALUMINUM</u>		
500	496	580	392	458	500
600	553	647	440	514	600
700	610	714	488	570	700
750	638	747	512	598	750
800	660	773	532	622	800
900	704	826	572	669	900
1000	748	879	612	716	1000

Notes:

1. Section 310.20 shall be referenced for conditions of use.

* 2. Section 310.15(B) shall be referenced for the ampacity correction factors where the ambient temperature is other than 40°C (104°F).

3. Section 310.15(C)(1) shall be referenced for more than three current-carrying conductors.

Table 310.21 Ampacities of Bare or Covered Conductors in Free Air

<u>Copper Conductors</u>				<u>AAC Aluminum Conductors</u>			
<u>Bare</u>		<u>Covered</u>		<u>Bare</u>		<u>Covered</u>	
<u>AWG or kcmil</u>	<u>Amperes</u>	<u>AWG or kcmil</u>	<u>Amperes</u>	<u>AWG or kcmil</u>	<u>Amperes</u>	<u>AWG or kcmil</u>	<u>Amperes</u>
8	98	8	103	8	76	8	80
6	124	6	130	6	96	6	101
4	155	4	163	4	121	4	127
2	209	2	219	2	163	2	171
1/0	282	1/0	297	1/0	220	1/0	231
2/0	329	2/0	344	2/0	255	2/0	268
3/0	382	3/0	401	3/0	297	3/0	312
4/0	444	4/0	466	4/0	346	4/0	364
250	494	250	519	266.8	403	266.8	423
300	556	300	584	336.4	468	336.4	492
500	773	500	812	397.5	522	397.5	548
750	1000	750	1050	477.0	588	477.0	617
1000	1193	1000	1253	556.5	650	556.5	682
—	—	—	—	636.0	709	636.0	744
—	—	—	—	795.0	819	795.0	860
—	—	—	—	954.0	920	—	—
—	—	—	—	1033.5	968	1033.5	1017
—	—	—	—	1272	1103	1272	1201
—	—	—	—	1590	1267	1590	1381
—	—	—	—	2000	1454	2000	1527

Note: Section 310.20-21 shall be referenced for conditions of use.

Supplemental Information

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
70-Article_310_For_NFPA_use.docx	310.16 through 310.21 - Attached word doc for clarity of change. Staff use only.	

Submitter Information Verification

Committee: NEC-P06

Submittal Date: Tue Oct 23 10:46:21 EDT 2018

Committee Statement

Committee Statement: [for PC 1434]: Added PFA, XHHN and Z to 90C copper. Only XHHN was added to 90C aluminum based on UL Product Category [Wire] Thermoplastic-insulated Wire, ZLGR showing PFA, Z and ZW-2 only in copper. MTW was not added based on reference to NFPA 79. ZW-2 was removed from the aluminum column based on UL Category ZLGR showing it is made in copper only.

[for PCs 1733, 467, 632, 1734, 468, 636, 1736, 469, 1737 and 470]: Deleted "allowable" based on Ampacity Task Group Pls.

[for PCs 624, 626, 627, 628, 629 and 630]: Editorial correction for temperature conversion and clarifies that 2000 volts is included in voltage rating.

[for PC 1739]: Editorial changes made to make the notes into mandatory text, provide consistent numbering for the notes (except for the asterisk for the 240.4(D) references), and add words to clarify certain phrases.

[for PCs 631 and 633]: Corrected temperature conversion for 40°C from 86°F to 104°F.

Response Message: SR-7651-NFPA 70-2018

[Public Comment No. 1739-NFPA 70-2018 \[Section No. 310.21\]](#)

[Public Comment No. 633-NFPA 70-2018 \[Section No. 310.21\]](#)

[Public Comment No. 1434-NFPA 70-2018 \[New Section after 310.16\]](#)

[Public Comment No. 467-NFPA 70-2018 \[Section No. 310.16\]](#)

[Public Comment No. 1734-NFPA 70-2018 \[Section No. 310.17\]](#)

[Public Comment No. 629-NFPA 70-2018 \[Section No. 310.20\]](#)

[Public Comment No. 1737-NFPA 70-2018 \[Section No. 310.19\]](#)

[Public Comment No. 470-NFPA 70-2018 \[Section No. 310.19\]](#)

[Public Comment No. 626-NFPA 70-2018 \[Section No. 310.18\]](#)

[Public Comment No. 469-NFPA 70-2018 \[Section No. 310.18\]](#)

[Public Comment No. 636-NFPA 70-2018 \[Section No. 310.17\]](#)

[Public Comment No. 624-NFPA 70-2018 \[Section No. 310.18\]](#)

[Public Comment No. 1736-NFPA 70-2018 \[Section No. 310.18\]](#)

[Public Comment No. 468-NFPA 70-2018 \[Section No. 310.17\]](#)

[Public Comment No. 628-NFPA 70-2018 \[Section No. 310.19\]](#)

[Public Comment No. 631-NFPA 70-2018 \[Section No. 310.21\]](#)

[Public Comment No. 630-NFPA 70-2018 \[Section No. 310.20\]](#)

[Public Comment No. 1733-NFPA 70-2018 \[Section No. 310.16\]](#)

[Public Comment No. 627-NFPA 70-2018 \[Section No. 310.19\]](#)

[Public Comment No. 632-NFPA 70-2018 \[Section No. 310.16\]](#)

**Second Revision No. 7577-NFPA 70-2018 [Section No. 311.1]****311.1 Scope.**

This article covers the use, installation, construction specifications, and ampacities for Type MV medium voltage conductors and cable, Type MV. ~~These requirements do not apply to conductors that form an integral part of equipment, such as motors, motor controllers, and similar equipment, or to conductors specifically provided for elsewhere in this Code.~~

Submitter Information Verification**Committee:** NEC-P06**Submittal Date:** Mon Oct 22 15:40:10 EDT 2018**Committee Statement****Committee Statement:** This is an editorial activity, the following edits are in accordance with the style manual as recommended by PC 830.**Response Message:** SR-7577-NFPA 70-2018[Public Comment No. 830-NFPA 70-2018 \[Global Input\]](#)

**Second Revision No. 7574-NFPA 70-2018 [Section No. 311.10]****311.10** Constructions and Applications.

Type MV cables shall comply with the applicable provisions in 311.10(A) through (C).

(A) Conductor Application and Insulation.

Conductor application and insulation shall comply with Table 311.10(A).

(B) Thickness of Insulation and Jacket for Nonshielded Insulated Conductors.

Thickness of insulation and jacket for nonshielded solid dielectric insulated conductors rated 2001 volts to 5000 volts shall comply with Table 311.10(B).

(C) Thickness of Insulation for Shielded Insulated Conductors.

Thickness of insulation for shielded solid dielectric insulated conductors rated 2001 volts to 35,000 volts shall comply with Table 311.10(C) and 311.10(C)(1) through (C)(3).

(1) 100 Percent Insulation Level.

~~Cables in this category shall be permitted to be applied where the system is provided with relay protection such that ground faults will be cleared as rapidly as possible but, in any case, within 1 minute. While these~~ These cables are applicable to the great majority of cable installations that are on grounded systems, they ~~and~~ shall be permitted to be used also on other systems for which the application of cables is acceptable, ~~provided the systems provided the~~ above clearing requirements are met in completely de-energizing the faulted section.

(2) 133 Percent Insulation Level.

~~This insulation level corresponds to that formerly designated for ungrounded systems. Cables in this category shall be permitted to be applied in situations where the clearing time requirements of the 100 percent level category cannot be met and yet there is adequate assurance that the faulted section will be de-energized in a time not exceeding 1 hour. Also, they~~ Cable shall be permitted to be used in 100 percent insulation level applications where the installation requires additional insulation ~~is desirable~~.

(3) 173 Percent Insulation Level.

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Cables in this category shall be permitted to be applied under all of the following conditions:

- (1) In industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons service the installation
- (2) Where the fault clearing time requirements of the 133 percent level category cannot be met
- (3) Where an orderly shutdown is ~~essential~~ required to protect equipment and personnel
- (4) Where there is ~~adequate assurance that~~ the faulted section will be de-energized in an orderly shutdown

Also, ~~cables with this insulation thickness~~ Cables shall be permitted to be used in 100 percent or 133 percent insulation level applications where the installation requires additional insulation ~~strength is desirable~~.

Table 311.10(A) Conductor Application and Insulation Rated 2001 Volts and Higher

<u>Trade Name</u>	<u>Type Letter</u>	<u>Maximum Operating Temperature</u>	<u>Application Provision</u>	<u>Insulation</u>	<u>Outer Covering</u>
Medium voltage solid dielectric	MV-90	90°C	Dry or wet locations	Thermoplastic or thermosetting	Jacket, sheath, or armor
	MV-105*	105°C			

*Where design conditions require maximum conductor temperatures above 90°C.

Table 311.10(B) Thickness of Insulation and Jacket for Nonshielded Solid Dielectric Insulated Conductors Rated 2001 Volts to 5000 Volts

<u>Conductor Size (AWG or kcmil)</u>	<u>Dry Locations, Single Conductor</u>								<u>Wet or Dry Locations</u>								<u>Multiconductor Insulation*</u>
	<u>Without Jacket Insulation</u>				<u>With Jacket</u>				<u>Single Conductor</u>								
	<u>mm</u>	<u>mils</u>			<u>mm</u>	<u>mils</u>			<u>mm</u>	<u>mils</u>			<u>mm</u>	<u>mils</u>			
8	2.79	110	-	2.29	90	-	0.76 30	-	3.18	125	-	2.03	80	-		2.29	
6	2.79	110	-	2.29	90	-	0.76 30	-	3.18	125	-	2.03	80	-		2.29	
4–2	2.79	110	-	2.29	90	-	1.14 45	-	3.18	125	-	2.03	80	-		2.29	
1–2/0	2.79	110	-	2.29	90	-	1.14 45	-	3.18	125	-	2.03	80	-		2.29	
3/0–4/0	2.79	110	-	2.29	90	-	1.65 65	-	3.18	125	-	2.41	95	-		2.29	
213–500	3.05	120	-	2.29	90	-	1.65 65	-	3.56	140	-	2.79	110	-		2.29	
501–750	3.30	130	-	2.29	90	-	1.65 65	-	3.94	155	-	3.18	125	-		2.29	
751–1000	3.30	130	-	2.29	90	-	1.65 65	-	3.94	155	-	3.18	125	-		2.29	
1001–1250	3.56	140	-	2.92	115	-	1.65 65	-	4.32	170	-	3.56	140	-		2.92	
1251–1500	3.56	140	-	2.92	115	-	2.03 80	-	4.32	170	-	3.56	140	-		2.92	
1501–2000	3.56	140	-	2.92	115	-	2.03 80	-	4.32	170	-	3.94	155	-		3.56	

*Under a common overall covering such as a jacket, sheath, or armor.

Table 311.10(C) Thickness of Insulation for Shielded Solid Dielectric Insulated Conductors Rated 2001 Volts to 35,000 Volts

<u>Conductor Size (AWG or kcmil)</u>	<u>2001–5000 Volts</u>				<u>5001–8000 Volts</u>				<u>8001–15,000 Volts</u>								
	<u>100 Percent Insulation Level</u>				<u>100 Percent Insulation Level</u>				<u>133 Percent Insulation Level</u>				<u>100 Percent Insulation Level</u>		<u>133 Percent Insulation Level</u>		
	<u>mm</u>	<u>mils</u>			<u>mm</u>	<u>mils</u>			<u>mm</u>	<u>mils</u>			<u>mm</u>	<u>mils</u>			
8	2.29	90	-	—	—	-	—	—	-	—	—	-	—	—	-	—	—
6–4	2.29	90	-	2.92	115	-	3.56	140	-	4.45	175	-	—	—	-	—	—
2	2.29	90	-	2.92	115	-	3.56	140	-	4.45	175	-	4.45	175	-	5.59	220
1	2.29	90	-	2.92	115	-	3.56	140	-	4.45	175	-	4.45	175	-	5.59	220

<u>Conductor Size (AWG or kcmil)</u>	<u>2001–5000 Volts</u>			<u>5001–8000 Volts</u>			<u>8001–15,000 Volts</u>		
	<u>100 Percent Insulation Level</u>			<u>100 Percent Insulation Level</u>			<u>100 Percent Insulation Level</u>		
	<u>mm</u> <u>mils</u>			<u>mm</u> <u>mils</u>			<u>mm</u> <u>mils</u>		
1/0–2000	2.29	90	-	2.92	115	-	3.56	140	-
							4.45	175	-
							4.45	175	-
							5.59	220	-
	<u>25,001–28,000 Volts</u>			<u>28,001–35,000 Volts</u>					
	<u>100 Percent Insulation Level</u>			<u>133 Percent Insulation Level</u>			<u>100 Percent Insulation Level</u>		
	<u>mm</u> <u>mils</u>			<u>mm</u> <u>mils</u>			<u>mm</u> <u>mils</u>		
1	7.11	280	-	8.76	345	-	11.30	445	-
1/0–2000	7.11	280	-	8.76	345	-	11.30	445	-
							8.76	345	-
							10.67	420	-
							14.73	580	-

Submitter Information Verification**Committee:** NEC-P06**Submittal Date:** Mon Oct 22 15:23:10 EDT 2018**Committee Statement**

Committee Statement: This is an editorial activity, the following edits are in accordance with the style manual as recommended by PC 830.

Response Message: SR-7574-NFPA 70-2018

**Second Revision No. 7576-NFPA 70-2018 [Section No. 311.16(C)]****(C) Optional Markings.**

Cables shall be permitted to be marked to indicate special characteristics of the cable materials. ~~These markings include, but are not limited to, markings for~~ , such as , limited smoke and sunlight resistant resistance .

Submitter Information Verification**Committee:** NEC-P06**Submittal Date:** Mon Oct 22 15:36:56 EDT 2018**Committee Statement****Committee Statement:** This is an editorial activity, the following edits are in accordance with the style manual as recommended by PC 830.**Response Message:** SR-7576-NFPA 70-2018

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**Second Revision No. 7578-NFPA 70-2018 [Section No. 311.32]****311.32 Uses Permitted.**

Type MV cable shall be permitted for use on power systems rated up to and including 35,000 volts, nominal, as follows:

- (1) In wet or dry locations.
- (2) In raceways.
- (3) In cable trays, where identified for the use, in accordance with 392.10, 392.20(B), (C), and (D), 392.22(C), 392.30(B)(1), 392.46, 392.56, and 392.60. Type MV cable that has an overall metallic sheath or armor, complies with the requirements for Type MC cable, and is identified as "MV or MC" shall be permitted to be installed in cable trays in accordance with 392.10(B)(2).
- (4) In messenger-supported wiring in accordance with Part II of Article 396.
- (5) As exposed runs in accordance with 300.37. Type MV cable that has an overall metallic sheath or armor, complies with the requirements for Type MC cable, and is identified as "MV or MC" shall be permitted to be installed as exposed runs of metal-clad cable in accordance with 300.37.
- (6) Corrosive conditions where exposed to oils, greases, vapors, gases, fumes, liquids, or other substances having a deleterious effect on the conductor or insulation shall be of a type suitable for the application.
- (7) Conductors in parallel in accordance with 310.10(H).
- (8) Type MV cable used where exposed to direct sunlight shall be identified for the use.

Informational Note: The "uses permitted" in 311.32 is permitted is not an all-inclusive list.

Submitter Information Verification

Committee: NEC-P06

Submittal Date: Mon Oct 22 15:44:41 EDT 2018

Committee Statement

Committee Statement: This is an editorial activity, the following edits are in accordance with the style manual as recommended by PC 830.

Response Message: SR-7578-NFPA 70-2018

**Second Revision No. 7579-NFPA 70-2018 [Section No. 311.36]****311.36 Direct-Burial Conductors.**

Type MV conductors and cables used for direct burial applications shall be ~~of a type identified shielded, identified~~ for such use and installed in accordance with 300.50.

~~Cables rated above 2000 volts shall be shielded.~~

Exception No. 1: Nonshielded multiconductor cables rated 2001 volts to 2400 volts shall be permitted if the cable has an overall metallic sheath or armor.

The metallic shield, sheath, or armor shall be connected to a grounding electrode conductor, a grounding busbar, or a grounding electrode.

Exception No. 2: Airfield lighting cable used in series circuits that are rated up to 5000 volts and are powered by regulators shall be permitted to be nonshielded.

Informational Note to Exception No. 2: Federal Aviation Administration (FAA) Advisory Circulars (ACs) provide additional practices and methods for airport lighting.

Submitter Information Verification

Committee: NEC-P06

Submittal Date: Mon Oct 22 15:46:51 EDT 2018

Committee Statement

Committee Statement: This is an editorial activity, the following edits are in accordance with the style manual as recommended by PC 830.

Response Message: SR-7579-NFPA 70-2018

**Second Revision No. 7598-NFPA 70-2018 [Section No. 324.60]****324.60** Grounding and Bonding .

All metal shields, boxes, receptacle housings, and self-contained devices shall be electrically continuous to the equipment grounding conductor of the supplying branch circuit. All such electrical connections shall be made with connectors identified for this use. The electrical resistivity of such shield system shall not be more than that of one conductor of the Type FCC cable used in the installation.

Submitter Information Verification**Committee:** NEC-P06**Submittal Date:** Mon Oct 22 16:52:57 EDT 2018**Committee Statement**

Committee Statement: The existing wording "electrically continuous" is used within 324.60. The terms grounded and bonded are used extensively in the code and CMP6 is not aware of confusion with its application. The term "Grounding and Bonding" is better understood rather than "electrically continuous" as the title.

Response Message: SR-7598-NFPA 70-2018

[Public Comment No. 343-NFPA 70-2018 \[Section No. 324.60\]](#)

**Second Revision No. 7742-NFPA 70-2018 [Section No. 330.80(B)]****(B) Single Type MC Conductors Grouped Together.**

Where single Type MC conductors are grouped together in a triangular or square configuration and installed on a messenger or exposed with a maintained free airspace of not less than 2.15 times one conductor diameter ($2.15 \times \text{O.D.}$) of the largest conductor contained within the configuration and adjacent conductor configurations or cables, the ampacity of the conductors shall not exceed the allowable ampacities in the following tables:

- (1) Table 310.20 for conductors rated 0 volts through 2000 volts
- (2) Table 310.311 .60(C)(67) and Table 310.311 .60(C)(68) for conductors rated over 2000 volts

Submitter Information Verification

Committee: NEC-P06

Submittal Date: Wed Oct 24 15:42:32 EDT 2018

Committee Statement

Committee Statement: Editorial per PC#2211.

Response Message: SR-7742-NFPA 70-2018

**Second Revision No. 7736-NFPA 70-2018 [Section No. 330.104]****330.104** Conductors.

Conductors

For ungrounded, grounded and equipment grounding conductors, the minimum conductor sizes shall be of

14 AWG copper,

aluminum, copper-clad aluminum,

nickel or nickel-coated copper

, solid or stranded. The minimum conductor size shall be 18 AWG

and 12 AWG aluminum or copper-clad aluminum.

For control and signal conductors, the minimum conductor sizes shall be 18 AWG copper, nickel or nickel-coated copper,

or 12 AWG aluminum or

14 AWG copper-clad aluminum , and 12 AWG aluminum .

Submitter Information Verification

Committee: NEC-P06

Submittal Date: Wed Oct 24 12:37:11 EDT 2018

Committee Statement

Committee Statement: The minimum size copper-clad aluminum conductor size was reduced to 14 AWG for control and signal conductors based on data submitted to the panel.

The test data provided in support of the public input and comment addresses temperature considerations only. For other applications, a fact-finding investigation is needed that specifically develops a test program and develops test data that supports the proposed change in the NEC based on the specific code language being proposed. This would include overcurrent protection, compatibility with wiring devices and equipment and other correlation within the code where the 14 AWG CCA could be used.

Response Message: SR-7736-NFPA 70-2018

Public Comment No. 1407-NFPA 70-2018 [Section No. 330.104]

**Second Revision No. 7590-NFPA 70-2018 [Section No. 330.130]****330.130–**

~~Where used in Class I, Division 1 or Zone 1 locations, the cable shall be listed and~~

130 Hazardous (Classified) Locations.

~~Where required to be marked MC-HL- and shall , the cable shall be listed and shall have a gas/vapor tight continuous corrugated metallic sheath or an interlocked metallic sheath , an overall jacket of suitable polymeric material, and a separate equipment grounding conductor.~~

Submitter Information Verification

Committee: NEC-P06

Submittal Date: Mon Oct 22 16:31:37 EDT 2018

Committee Statement

Committee Statement: Interlock armor was added to correlate changes to Article 501.

Response Message: SR-7590-NFPA 70-2018

Public Comment No. 1335-NFPA 70-2018 [Section No. 330.130]

**Second Revision No. 7727-NFPA 70-2018 [Section No. 334.12(A)]****(A) Types NM and NMC.**

Types NM and NMC cables shall not be permitted as follows:

- (1) In any dwelling or structure not specifically permitted in 334.10(1), (2), (3), and (5)
- (2) Exposed within a dropped or suspended ceiling cavity in other than one- and two-family and multifamily dwellings
- (3) As service-entrance cable
- (4) In commercial garages having hazardous (classified) locations as defined in 511.3
- (5) In theaters and similar locations, except where permitted in 518.4(B)
- (6) In motion picture studios
- (7) In storage battery rooms
- (8) In hoistways or on elevators or escalators
- (9) Embedded in poured cement, concrete, or aggregate
- (10) In hazardous (classified) locations, except where specifically permitted by other articles in this *Code*
- (11) Where subject to physical damage

Submitter Information Verification

Committee: NEC-P06

Submittal Date: Tue Oct 23 20:48:19 EDT 2018

Committee Statement

Committee Statement: "Where subject to physical damage" was added so this rule will be similar to 320.13, 330.12, 336.12, 338.12, 340.12, 340.12. NM cable is restricted from use where subject to physical damage as covered in 300.4. Including it in 334.12 improves usability.

Response Message: SR-7727-NFPA 70-2018

Public Comment No. 403-NFPA 70-2018 [Section No. 334.12(A)]

**Second Revision No. 7728-NFPA 70-2018 [Section No. 334.30 [Excluding any Sub-Sections]]**

Nonmetallic-sheathed cable shall be supported and secured by staples, cable ties listed and identified for securement and support, or straps, hangers, or similar fittings designed and installed so as not to damage the cable, at intervals not exceeding 1.4 m (4½ ft) and within 300 mm (12 in.) of every cable ~~measured no more than 450 mm (18 in.) along the cable sheath,~~ entry into enclosures such as outlet boxes, junction boxes, cabinets, or fittings. The cable length between the cable entry and the closest cable support shall not exceed 450 mm (18 in.). Flat cables shall not be stapled on edge.

Sections of cable protected from physical damage by raceway shall not be required to be secured within the raceway.

Submitter Information Verification

Committee: NEC-P06

Submittal Date: Tue Oct 23 20:52:32 EDT 2018

Committee Statement

Committee Statement: The term measured along the cable sheath was removed and replaced with a sentence indicating that the cable length between the last cable support and the junction box enclosure would not exceed 18 in. total.

Response Message: SR-7728-NFPA 70-2018

[Public Comment No. 1264-NFPA 70-2018 \[Section No. 334.30 \[Excluding any Sub-Sections\]\]](#)

[Public Comment No. 596-NFPA 70-2018 \[Section No. 334.30 \[Excluding any Sub-Sections\]\]](#)

[Public Comment No. 915-NFPA 70-2018 \[Section No. 334.30\]](#)



Second Revision No. 7689-NFPA 70-2018 [Section No. 336.10]

FOR CODE-MAKING PANEL USE ONLY
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336.10 Uses Permitted.

Type TC cable shall be permitted to be used as follows:

- (1) For power, lighting, control, and signal circuits.
- (2) In cable trays, including those with mechanically discontinuous segments up to 300 mm (1 ft).
- (3) In raceways.
- (4) In outdoor locations supported by a messenger wire.
- (5) For Class 1 circuits as permitted in Parts II and III of Article 725.
- (6) For non-power-limited fire alarm circuits if conductors comply with the requirements of 760.49.
- (7) Between a cable tray and the utilization equipment or device(s), provided all of the following apply:
 - (8) The cable is Type TC-ER.
 - (9) The cable is installed in industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons service the installation.
 - (10) The cable is continuously supported and protected against physical damage using mechanical protection such as struts, angles, or channels.
 - (11) The cable complies with the crush and impact requirements of Type MC cable and is identified with the marking "TC-ER."
 - (12) The cable is secured at intervals not exceeding 1.8 m (6 ft).
 - (13) Equipment grounding for the utilization equipment is provided by an equipment grounding conductor within the cable. In cables containing conductors sized 6 AWG or smaller, the equipment grounding conductor

must

- a. shall be provided within the cable or, at the time of installation, one or more insulated conductors

must

- a. shall be permanently identified as an equipment grounding conductor in accordance with 250.119(B) .

Exception to (7): Where not subject to physical damage, Type TC-ER shall be permitted to transition between cable trays and between cable trays and utilization equipment or devices for a distance not to exceed 1.8 m (6 ft) without continuous support. The cable shall be mechanically supported where exiting the cable tray to ensure that the minimum bending radius is not exceeded.

- (14) ~~Where installed in wet locations, Type TC cable shall also be resistant to moisture and corrosive agents where installed in wet locations .~~
- (15) In one- and two-family dwelling units, Type TC-ER - JP cable containing both power and control conductors that is ~~identified for pulling through structural members~~ shall be permitted for branch circuits and feeders. Type TC-ER - JP cable used as interior wiring shall be installed per the requirements of Part II of Article 334 and where installed as exterior wiring shall be installed per the requirements of Part II of Article 340.

Exception: Where used to connect a generator and associated equipment having terminals rated 75°C (140°F) or higher, the cable shall not be limited in ampacity by 334.80 or 340.80.

~~Informational Note No. 1 : TC-ER cable that is suitable for pulling through structural members is marked "JP."~~ ~~Informational Note No. 2: See 725.136 for limitations on Class 2 or 3 circuits contained within the same cable with conductors of electric light, power, or Class 1 circuits.~~

- (16) Direct buried, where identified for such use.
- (17) In hazardous (classified) locations where specifically permitted by other articles in this Code.

Informational Note: See 310.14(A)(3) for temperature limitation of conductors.

Supplemental Information

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
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Section_336.10_-
_Track_Changes.docx

See attached word doc for clarity of changes made to list items
in section 336.10

Submitter Information Verification

Committee: NEC-P06

Submittal Date: Tue Oct 23 14:22:13 EDT 2018

Committee Statement

Committee Statement: The designation "TC-ER-JP" was added to the mandatory language and the informational note was deleted. Cable suitable for pulling through structural members in accordance with NEC 336.10(9) is surface marked with the suffix "-JP" after the type designation "TC-ER." Therefore, cable is required to be marked "TC-ER-JP" in order to eliminate any confusion between AHJ's and installers as well as fall in line with the marking requirements of applicable product standard.

The exception is no longer limited to utilization equipment.

Response Message: SR-7689-NFPA 70-2018

[Public Comment No. 1625-NFPA 70-2018 \[Section No. 336.10\]](#)

[Public Comment No. 180-NFPA 70-2018 \[Section No. 336.10\]](#)

FOR CODE-MAKING PANEL USE ONLY
SUBJECT TO REVISION - NOT FOR PUBLICATION

**Second Revision No. 7689-NFPA 70-2018 [Section No. 336.10]****336.10 Uses Permitted.**

Type TC cable shall be permitted to be used as follows:

- (1) For power, lighting, control, and signal circuits.
- (2) In cable trays, including those with mechanically discontinuous segments up to 300 mm (1 ft).
- (3) In raceways.
- (4) In outdoor locations supported by a messenger wire.
- (5) For Class 1 circuits as permitted in Parts II and III of Article 725.
- (6) For non-power-limited fire alarm circuits if conductors comply with the requirements of 760.49.
- (7) Between a cable tray and the utilization equipment or device(s), provided all of the following apply:
 - (8) The cable is Type TC-ER.
 - (9) The cable is installed in industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons service the installation.
 - (10) The cable is continuously supported and protected against physical damage using mechanical protection such as struts, angles, or channels.
 - (11) The cable complies with the crush and impact requirements of Type MC cable and is identified with the marking "TC-ER."
 - (12) The cable is secured at intervals not exceeding 1.8 m (6 ft).
 - (13) Equipment grounding for the utilization equipment is provided by an equipment grounding conductor within the cable. In cables containing conductors sized 6 AWG or smaller, the equipment grounding conductor

must

- a. shall be provided within the cable or, at the time of installation, one or more insulated conductors

must

- a. shall be permanently identified as an equipment grounding conductor in accordance with 250.119(B).

Exception to (7): Where not subject to physical damage, Type TC-ER shall be permitted to transition between cable trays and between cable trays and utilization equipment or devices for a distance not to exceed 1.8 m (6 ft) without continuous support. The cable shall be mechanically supported where exiting the cable tray to ensure that the minimum bending radius is not exceeded.

- (14) ~~Where installed in wet locations,~~ Type TC cable shall also be resistant to moisture and corrosive agents ~~where installed in wet locations.~~
- (15) In one- and two-family dwelling units, Type TC-ER - JP cable containing both power and control conductors ~~that is identified for pulling through structural members~~ shall be permitted for branch circuits and feeders. Type TC-ER - JP cable used as interior wiring shall be installed per the requirements of Part II of Article 334 and where installed as exterior wiring shall be installed per the requirements of Part II of Article 340.

Exception: Where used to connect a generator and associated equipment having terminals rated 75°C (140°F) or higher, the cable shall not be limited in ampacity by 334.80 or 340.80.

~~Informational Note No. 1: TC-ER cable that is suitable for pulling through structural members is marked "JP."~~ Informational Note No. 2: See 725.136 for limitations on Class 2 or 3 circuits contained within the same cable with conductors of electric light, power, or Class 1 circuits.

- (16) Direct buried, where identified for such use.
- (17) In hazardous (classified) locations where specifically permitted by other articles in this Code.

Informational Note: See 310.14(A)(3) for temperature limitation of conductors.

Supplemental Information

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
Section_336.10_-_Track_Changes.docx	See attached word doc for clarity of changes made to list items in section 336.10	✓

Submitter Information Verification

Committee: NEC-P06

Submittal Date: Tue Oct 23 14:22:13 EDT 2018

Committee Statement and Meeting Notes

Committee Statement: The designation "TC-ER-JP" was added to the mandatory language and the informational note was deleted. Cable suitable for pulling through structural members in accordance with NEC 336.10(9) is surface marked with the suffix "-JP" after the type designation "TC-ER." Therefore, cable is required to be marked "TC-ER-JP" in order to eliminate any confusion between AHJ's and installers as well as fall in line with the marking requirements of applicable product standard.

The exception is no longer limited to utilization equipment.

Response Message: SR-7689-NFPA 70-2018

Committee Notes:

<u>Date</u>	<u>Submitted By</u>	
Oct 23, 2018	Chad Duffy	See attached word doc for clarity of changes made to list items in section 336.10

[Public Comment No. 1625-NFPA 70-2018 \[Section No. 336.10\]](#)

[Public Comment No. 180-NFPA 70-2018 \[Section No. 336.10\]](#)

Editorial Comment

[Click here](#)



Second Revision No. 7739-NFPA 70-2018 [Section No. 336.104 [Excluding any Sub-Sections]]

~~The insulated conductors of Type TC cables shall be in sizes 18 AWG to~~

~~For ungrounded, grounded and equipment grounding conductors, the conductor sizes shall be 14 AWG through 1000 kcmil copper, nickel~~

~~or nickel-coated copper~~

~~and~~
~~sizes 12 AWG~~

~~12 AWG through 1000 kcmil aluminum or copper-clad aluminum.~~

~~Insulated conductors of sizes 14 AWG, and larger copper, nickel, or nickel-coated copper, and sizes 12 AWG through 1000 kcmil aluminum or copper-clad aluminum~~

~~Insulation types shall be one of the types listed in Table 310.~~

~~104~~

~~4 (A) or Table 310.~~

~~104~~

~~4 (B) that is suitable for branch circuit and feeder circuits or one that is identified for such use.~~

~~For control and signal conductors, the minimum conductor sizes shall be 18 AWG copper, nickel or nickel-coated copper, 14 AWG copper-clad aluminum, and 12 AWG aluminum.~~

Submitter Information Verification

Committee: NEC-P06

Submittal Date: Wed Oct 24 14:13:51 EDT 2018

Committee Statement

Committee Statement: The minimum size copper-clad aluminum conductor size was reduced to 14 AWG for control and signal conductors based on data submitted to the panel.

The test data provided in support of the public input and comment addresses temperature considerations only. For other applications, a fact-finding investigation is needed that specifically develops a test program and develops test data that supports the proposed change in the NEC based on the specific code language being proposed. This would include overcurrent protection, compatibility with wiring devices and equipment and other correlation within the code where the 14 AWG CCA could be used.

Response Message: SR-7739-NFPA 70-2018

Public Comment No. 1411-NFPA 70-2018 [Section No. 336.104 [Excluding any Sub-Sections]]

**Second Revision No. 7674-NFPA 70-2018 [Section No. 336.130]****336.130** Hazardous (Classified) Location Cable.

Cable listed and marked Type TC-ER-HL shall comply with the following:

- (1) The overall nonmetallic jacket shall be suitable for the environment.
- (2) The overall cable construction shall be essentially circular in cross-section.
- (3) The ~~overall~~ overall nonmetallic jacket shall be continuous and gas/vapor tight.
- (4) For construction greater than 25.4 mm (1 in.) in diameter, the following shall apply:
 - (5) The equipment grounding conductor shall be bare.
 - (6) A

metallic

- a. metallic shield shall be included over all conductors under the

outer

- a. outer jacket.

Supplemental Information

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
Section_336.130_-_Track_Changes.docx	Word document for editing use. Clarifies the revisions in the list	

Submitter Information Verification

Committee: NEC-P06

Submittal Date: Tue Oct 23 13:07:00 EDT 2018

Committee Statement

Committee Statement: The word "essentially" was not deleted since it would make the requirement less enforceable. The reality is that cable is not perfectly circular. Two words in the final list item were corrected for spelling. The spelling of the word "overall" was corrected.

Response Message: SR-7674-NFPA 70-2018

[Public Comment No. 916-NFPA 70-2018 \[Section No. 336.120\]](#)

[Public Comment No. 1912-NFPA 70-2018 \[Section No. 336.130\]](#)

336.130 Hazardous (Classified) Location Cable.

Cable listed and marked Type TC-ER-HL shall comply with the following:

- (1) The overall nonmetallic jacket shall be suitable for the environment.
- (2) The overall cable construction shall be essentially circular in cross-section.
- (3) The overall nonmetallic jacket shall be continuous and gas/vapor tight.
- (4) For construction greater than 25.4 mm (1 in.) in diameter, the following shall apply:
 - a. The equipment grounding conductor shall be bare.
 - b. A metallic shield shall be included over all conductors under the outer jacket.

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**Second Revision No. 7729-NFPA 70-2018 [Article 337]****Article 337** Type P Cable**Part I.** General**337.1** Scope.

This article covers the use, installation, and construction specifications for 600 up through 2000 volt Type P cable (armored and unarmored), ~~for use in hazardous (classified) locations as permitted in this Code .~~

337.2 Definition.

The definition in this section shall apply within this article and throughout the *Code*.

Type P Cable .

A factory assembly of ~~two~~ one or more insulated flexible tinned copper conductors, with associated ~~bare or covered grounding conductors, impervious sheath, braided metallic armored or unarmored cable. See Part III. equipment grounding conductor(s), with or without a braided metallic armor and with an overall nonmetallic jacket.~~

337.6 Listing Requirements.

Type P cables and associated fittings shall be listed.

Part II. Installation

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337.10 Uses Permitted.

In industrial locations under engineering supervision where the conditions of maintenance and supervision ensure that only qualified persons service the installation, Type P cable shall be permitted

for use in hazardous (classified) locations and to transition between a hazardous (classified) location and a non-hazardous (classified) location as follows:

- For services, feeders, and branch circuits
- For power, lighting, control, and signal circuits
- Indoors
- Outdoors where identified for such use
- Exposed or concealed
- For direct burial where identified for such use
- In cable tray where identified for such use
- In any raceway
- In wet locations

Between a cable tray and the utilization equipment or device(s), provided all of the following apply: The cable is installed in industrial establishments where the to be used:

1) Under engineering supervision in industrial installations where conditions of maintenance and supervision ensure that only qualified persons monitor and service the installation system .

- The cable is continuously supported and protected against physical damage using mechanical protection such as struts, angles, or channels.
- The cable is secured at intervals not exceeding 1.4 m (4.5 ft).
- Equipment grounding for the utilization equipment is provided by a bare equipment grounding conductor within the cable.

Exception to (10): *Where not subject to physical damage, Type P 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) In hazardous (classified) locations where specifically permitted by other articles in this Code .

337.12 Uses Not Permitted.

Type P cable shall not be installed or used where :

- 1) Where it will be exposed to physical damage.
- 2) Where not specifically permitted by other articles in the Code

337.24 Bending Radius.

Bends in Type P cable shall be made such that the cable will not be damaged. The radius of the curve of the inner edge of any bend shall not be less than required in 337.24(A) through (B).

(A) Unarmored Cable.

- (1) Four times the overall diameter for cables 25 mm (1 in.) or less in diameter
- (2) Five times the overall diameter for cables larger than 25 mm (1 in.) but not more than 50 mm (2 in.) in diameter
- (3) Six times the overall diameter for cables larger than 50 mm (2 in.) in diameter

(B) Armored Cable.

- (1) Ten times the external diameter of the metallic armor for cable not more than 19 mm ($\frac{3}{4}$ in.) in external diameter
- (2) Twelve times the external diameter of the metallic armor for cable more than 19 mm ($\frac{3}{4}$ in.) in external diameter

The minimum bending radii during installations and handling in service shall be adequate to prevent damage to the cable.

337.30 Securing and Supporting.

Type P cable shall be supported and secured by cable ties listed and identified for securement and support; straps, hangers, or similar fittings; or other approved means designed and installed so as not to damage the cable.

(A) Securing.

Unless otherwise provided, cables shall be secured at intervals not exceeding 1.4 m (4.5 ft). Cables containing four or fewer conductors sized no larger than 10 AWG shall be secured within 300 mm (12 in.) of every box, cabinet, fitting, or other cable termination. In vertical installations, cables with ungrounded conductors 250 kcmil and larger shall be permitted to be secured at intervals not exceeding 3 m (10 ft).

(B) Supporting.

Unless otherwise provided, cables shall be supported at intervals not exceeding 1.4 m (4.5 ft). Horizontal runs of Type P cable installed in wooden or metal framing members or similar supporting means shall be considered supported and secured where such support does not exceed 1.4 m (4.5 ft) intervals.

(C) Unsupported Cables.

Type P cable shall be permitted to be unsupported and unsecured where the cable complies with any of the following:

- (1) Is fished between access points through concealed spaces in finished buildings or structures and supporting is impractical
- (2) Is not more than 1.4 m (4.5 ft) in length from the last point of cable support to the point of connection to luminaires or other electrical equipment and the cable and point of connection are within an accessible ceiling
- (3) Is in lengths not exceeding 900 mm (3 ft) from the last point where it is securely fastened and is used to connect equipment where flexibility is necessary to minimize the transmission of vibration from equipment or to provide flexibility for equipment that requires movement after installation

337.31 Single Conductors.

Where single-conductor cables are used, the installation shall comply with 300.20.

337.80 Ampacity.

The ampacity of Type P cable shall be determined in accordance with 310.15 14(A) or (B) for 14 AWG and larger conductors. For 18 AWG and 16 AWG conductors the ampacities shall be determined in accordance with Table 402.5 for 18 AWG and 16 AWG conductors. When installed in cable tray, the ampacities shall be permitted to be determined in accordance with 392.80. The installation shall not exceed the temperature ratings of terminations and equipment.

Part III. Construction Specifications**337.104 Conductors.**

Conductors shall be of tinned copper. Conductors shall employ flexible stranding. The minimum conductor size shall be 18 AWG.

337.108 Equipment Grounding Conductor.

An equipment grounding conductor complying with 250.122 shall be provided within the cable.

~~An uninsulated equipment grounding conductor shall be provided in cable marked Type P-HL.~~

337.112 Insulation.

~~Insulated conductors shall comply with 337.112(A) or (B). Insulated conductors in sizes 18 AWG and 16 AWG shall be Type FFHH-2 as listed in Table 402.3. Conductors larger than 16 AWG shall be Type XHHW or XHHW-2 as listed in Table 310.4(A) be a thermoset type identified for use in Type P cable. All conductors shall be suitable for wet locations. The minimum wall thickness shall be 0.76 mm (30 mils).~~

~~337.~~

~~116 Sheath.~~

~~The sheath or outer covering shall comply with 337.116(A) or (B).~~

~~(A) Armored.~~

~~An overall nonmetallic jacket impervious to moisture and corrosion-resistant shall be provided over the armor. The 114 Shield.~~

~~Metallic shield(s) shall be permitted over a single conductor or groups of conductors.~~

~~337.115 Jacket.~~

~~Single conductor cables and multiconductor cables shall have an overall nonmetallic jacket that is impervious to moisture, corrosion-resistant, and sunlight resistant.~~

~~337.116 Armor.~~

~~Armor shall be permitted over the jacket. If provided, the armor or metallic covering shall be a braided basket weave type consisting of wire laid closely together, flat and parallel, and forming a basket weave that shall firmly grip the cable. The wire shall be commercial bronze. The armor shall not be used as a current-carrying conductor.~~

~~(B) Unarmored.~~

~~An overall flame-retardant, nonmetallic material impervious to moisture and corrosion-resistant shall be provided over the cable core. A metallic sheath or armor as defined in 337.116 shall not be permitted either under or over the nonmetallic jacket. Metallic shield(s) shall be permitted over groups of conductors, under the outer jacket, or both, as an equipment grounding conductor. A nonmetallic jacket that conforms to 337.115 shall be provided over the armor.~~

~~337.120 Marking.~~

~~Type P cable shall be marked in accordance with 310.8. Armored When an armor is provided, the cable shall be marked as Type P-HL accordingly.~~

Submitter Information Verification

Committee: NEC-P06

Submittal Date: Tue Oct 23 20:57:46 EDT 2018

Committee Statement

Committee Statement: Article 337 was developed based on industry need for the limited use of Type P cable in land based drilling rigs.

[1969, 1445 and 1448] The language does not restrict the use of Type P to hazardous locations.

[2043] The definition was revised to permit single conductor Type P cables.

[1460] An EGC that complies with 250.122 is required. It is not limited to an insulated conductor.

[2049] The armor is not permitted as the EGC in 337.116.

[1457 and 2056] Unnecessary reference to 337.112(A) and (B) were deleted.

[1481 and 2058] The reference to Type P-HL was deleted.

[792, 794, and 795] CMP-6 has purview over wiring methods and Type P cable is a wiring method and shall stay in Chapter 3 where general wiring methods reside. The title of the article has been revised to "Type P Cable" per the request of the correlating committee. Article 337 has been edited to align with the style manual.

Response SR-7729-NFPA 70-2018
Message:

[Public Comment No. 1969-NFPA 70-2018 \[Section No. 337.1\]](#)

[Public Comment No. 2056-NFPA 70-2018 \[Section No. 337.112\]](#)

[Public Comment No. 1460-NFPA 70-2018 \[Section No. 337.108\]](#)

[Public Comment No. 1445-NFPA 70-2018 \[Section No. 337.1\]](#)

[Public Comment No. 2049-NFPA 70-2018 \[Section No. 337.108\]](#)

[Public Comment No. 1448-NFPA 70-2018 \[Section No. 337.10\]](#)

[Public Comment No. 1481-NFPA 70-2018 \[Section No. 337.120\]](#)

[Public Comment No. 1457-NFPA 70-2018 \[Section No. 337.112\]](#)

[Public Comment No. 2043-NFPA 70-2018 \[Definition: Type P.\]](#)

[Public Comment No. 2058-NFPA 70-2018 \[Section No. 337.120\]](#)

[Public Comment No. 792-NFPA 70-2018 \[Global Input\]](#)

[Public Comment No. 794-NFPA 70-2018 \[Global Input\]](#)

[Public Comment No. 795-NFPA 70-2018 \[Global Input\]](#)

FOR CODE-MAKING PANEL USE ONLY
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Second Revision No. 7682-NFPA 70-2018 [Definition: Service-Entrance Conductor Assembly.]

338.2. Service-Entrance Conductor Assembly Assembly.

Multiple single-insulated conductors twisted together without an overall covering, other than an optional binder intended only to keep the conductors together.

Submitter Information Verification

Committee: NEC-P06

Submittal Date: Tue Oct 23 13:36:20 EDT 2018

Committee Statement

Committee Statement: Editorial.

Response Message: SR-7682-NFPA 70-2018

FOR CODE-MAKING PANEL USE ONLY
SUBJECT TO REVISION - NOT FOR PUBLICATION



Second Revision No. 7678-NFPA 70-2018 [Section No. 338.10(B)(4)]

(4) Installation Methods for Branch Circuits and Feeders.

Informational Note No. 1: See 310.15(A)(3) for temperature limitation of conductors.

Informational Note No. 2: For the installation of main power feeder conductors in dwelling units refer to 310.12.

(a) Interior Installations.

- (2) In addition to the provisions of this article, Type SE service-entrance cable used for interior wiring shall comply with the installation requirements of Part II of Article 334, excluding 334.80.
- (3) Where more than two Type SE cables containing two or more current-carrying conductors in each cable are installed in contact with thermal

insulations

- (1) insulation, caulk, or sealing foam without maintaining spacing between cables, the ampacity of each conductor shall be adjusted in accordance with Table 310.15(C)(1).
- (2) For Type SE cable with ungrounded conductor sizes 10 AWG and smaller, where installed in contact with thermal insulation, the ampacity shall be in accordance with 60°C (140°F) conductor temperature rating. The maximum conductor temperature rating shall be permitted to be used for ampacity adjustment and correction purposes, if the final ampacity does not exceed that for a 60°C (140°F) rated conductor.

(d) Exterior Installations.

- (5) In addition to the provisions of this article, service-entrance cable used for feeders or branch circuits, where installed as exterior wiring, shall be installed in accordance with Part I of Article 225. The cable shall be supported in accordance with 334.30.
- (6) Type USE cable installed as underground feeder and branch circuit cable shall comply with Part II of Article 340.

Exception: Single-conductor Type USE and multi-rated USE conductors shall not be subject to the ampacity limitations of Part II of Article 340.

Supplemental Information

File Name	Description	Approved
Section_338.10_B_4_-_Track_Changes.docx	See attached word doc for clarity of editorial changes to list items of section 338.10(B)(4)--for staff use	

Submitter Information Verification

Committee: NEC-P06

Submittal Date: Tue Oct 23 13:30:33 EDT 2018

Committee Statement

Committee Statement: The only changes were correcting a reference in IN 1 and deleting an "s" at the end of insulation.

Response Message: SR-7678-NFPA 70-2018

Public Comment No. 1914-NFPA 70-2018 [Section No. 338.10(B)(4)]

WORKING DRAFT OF CMP 6 MEETING OUTPUT - NATIONAL ELECTRICAL CODE - NFPA 70
OCTOBER 22 - 27, 2018 - SUBJECT TO REVISION - NOT FOR PUBLICATION

FOR CODE-MAKING PANEL USE ONLY
SUBJECT TO REVISION - NOT FOR PUBLICATION

**Second Revision No. 7680-NFPA 70-2018 [Section No. 338.100]****338.100 Construction.****(A)– Assemblies.**

Cabled assemblies of multiple single-conductor Type USE conductors shall be permitted for direct burial. All conductors shall be insulated.

Informational Note: The term “cabled” refers to a manufacturing process of twisting single conductors together and may also be referred to as “plexed.”

(B)– Uninsulated Conductor.

Type SE or USE cable with an overall covering containing two or more conductors shall be permitted to have one conductor uninsulated.

Submitter Information Verification

Committee: NEC-P06

Submittal Date: Tue Oct 23 13:32:56 EDT 2018

Committee Statement

Committee Statement: Editorial.

Response Message: SR-7680-NFPA 70-2018

[Public Comment No. 1918-NFPA 70-2018 \[Section No. 338.100\(A\)\]](#)

[Public Comment No. 1922-NFPA 70-2018 \[Section No. 338.100\(B\)\]](#)

[Public Comment No. 917-NFPA 70-2018 \[Section No. 338.100\]](#)

**Second Revision No. 7732-NFPA 70-2018 [Section No. 400.12]****400.12 Uses Not Permitted.**

Unless specifically permitted in 400.10, flexible cords, flexible cables, cord sets, and power supply cords shall not be used for the following:

- (1) As a substitute for the fixed wiring of a structure
- (2) Where run through holes in walls, structural ceilings, suspended ceilings, dropped ceilings, or floors
- (3) Where run through doorways, windows, or similar openings
- (4) Where attached to building surfaces

Exception to (4): Flexible cord and flexible cable shall be permitted to be attached to building surfaces in accordance with 368.56(B) and 590.4.

- (5) Where concealed by walls, floors, or ceilings or located above suspended or dropped ceilings

Exception to (5): Flexible cord and flexible cable shall ~~be~~ cords, flexible cables, and power supply cords shall be permitted if contained within an enclosure for use in other spaces used for environmental air as permitted by 300.22(C)(3).

- (6) Where installed in raceways, except as otherwise permitted in this Code
- (7) Where subject to physical damage

Informational Note: For proper application see UL 817, *Cord Sets and Power-Supply Cords*, and UL 62, *Flexible Cords and Cables*.

Submitter Information Verification

Committee: NEC-P06

Submittal Date: Wed Oct 24 11:37:15 EDT 2018

Committee Statement

Committee Statement: Edited to include power supply cord in the exception.

Response Message: SR-7732-NFPA 70-2018

Public Comment No. 391-NFPA 70-2018 [Section No. 400.12]



Second Revision No. 7743-NFPA 70-2018 [Section No. B.7]

FOR CODE-MAKING PANEL USE ONLY
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B.7 Examples Showing Use of Figure B.310.15(B)(2)(1) for Electrical Duct Bank Ampacity Modifications.

FOR CODE-MAKING PANEL USE ONLY
SUBJECT TO REVISION - NOT FOR PUBLICATION

Figure B.310.15(B)(2)(1) is used for interpolation or extrapolation for values of Rho and load factor for cables installed in electrical ducts. The upper family of curves shows the variation in ampacity and Rho at unity load factor in terms of I_1 , the ampacity for Rho = 60, and 50 percent load factor. Each curve is designated for a particular ratio I_2/I_1 , where I_2 is the ampacity at Rho = 120 and 100 percent load factor.

The lower family of curves shows the relationship between Rho and load factor that will give substantially the same ampacity as the indicated value of Rho at 100 percent load factor.

As an example, to find the ampacity of a 500-kcmil copper cable circuit for six electrical ducts as shown in Table B.310.15(B)(2)(5): At the Rho = 60, LF = 50, $I_1 = 583$; for Rho = 120 and LF = 100, $I_2 = 400$. The ratio $I_2/I_1 = 0.686$. Locate Rho = 90 at the bottom of the chart and follow the 90 Rho line to the intersection with 100 percent load factor where the equivalent Rho = 90. Then follow the 90 Rho line to I_2/I_1 ratio of 0.686 where $F = 0.74$. The desired ampacity = $0.74 \times 583 = 431$, which agrees with the table for Rho = 90, LF = 100.

To determine the ampacity for the same circuit where Rho = 80 and LF = 75, using Figure B.310.15(B)(2)(1), the equivalent Rho = 43, $F = 0.855$, and the desired ampacity = $0.855 \times 583 = 498$ amperes. Values for using Figure B.310.15(B)(2)(1) are found in the electrical duct bank ampacity tables of this informative annex.

Where the load factor is less than 100 percent and can be verified by measurement or calculation, the ampacity of electrical duct bank installations can be modified as shown. Different values of Rho can be accommodated in the same manner.

Table B.310.15(B)(2)(1) Ampacities of Two or Three Insulated Conductors, Rated 0 Through 2000 Volts, Within an Overall Covering (Multiconductor Cable), in Raceway in Free Air Based on Ambient Air Temperature of 30°C (86°F)*

Size (AWG or kcmil)	Temperature Rating of Conductor. [See Table 310.104.4 (A) .]						Size (AWG or kcmil)
	60°C(140°F)	75°C(167°F)	90°C(194°F)	60°C(140°F)	75°C(167°F)	90°C(194°F)	
	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, ZW	Types THHN, THHW, THW-2, THWN-2, RHH, RWH-2, USE-2, XHHW, XHHW-2, ZW-2	Type TW	Types RHW, THHW, THW, THWN, XHHW	Types THHN, THHW, THW-2, THWN-2, RHH, RWH-2, USE-2, XHHW, XHHW-2, ZW-2	
COPPER				ALUMINUM OR COPPER-CLAD ALUMINUM			
14**	16	18	21	—	—	—	14
12**	20	24	27	16	18	21	12
10**	27	33	36	21	25	28	10
8	36	43	48	28	33	37	8
6	48	58	65	38	45	51	6
4	66	79	89	51	61	69	4
3	76	90	102	59	70	79	3
2	88	105	119	69	83	93	2
1	102	121	137	80	95	106	1
1/0	121	145	163	94	113	127	1/0
2/0	138	166	186	108	129	146	2/0
3/0	158	189	214	124	147	167	3/0
4/0	187	223	253	147	176	197	4/0
250	205	245	276	160	192	217	250
300	234	281	317	185	221	250	300
350	255	305	345	202	242	273	350
400	274	328	371	218	261	295	400

WORKING DRAFT OF CMP 6 MEETING OUTPUT - NATIONAL ELECTRICAL CODE - NFPA 70
OCTOBER 22 - 27, 2018 - SUBJECT TO REVISION - NOT FOR PUBLICATION

<u>Size (AWG or kcmil)</u>	<u>Temperature Rating of Conductor. [See Table 310. 104 4 (A) .]</u>						<u>Size (AWG or kcmil)</u>
	<u>60°C(140°F)</u>	<u>75°C(167°F)</u>	<u>90°C(194°F)</u>	<u>60°C(140°F)</u>	<u>75°C(167°F)</u>	<u>90°C(194°F)</u>	
	<u>Types TW, UF</u>	<u>Types RHW, THHW, THW, THWN, XHHW, ZW</u>	<u>Types THHN, THHW, THW-2, THWN-2, RHH, RWH-2, USE-2, XHHW, XHHW-2, ZW-2</u>	<u>Type TW</u>	<u>Types RHW, THHW, THW, THWN, XHHW</u>	<u>Types THHN, THHW, THW-2, THWN-2, RHH, RWH-2, USE-2, XHHW, XHHW-2, ZW-2</u>	
	<u>COPPER</u>			<u>ALUMINUM OR COPPER-CLAD ALUMINUM</u>			
500	315	378	427	254	303	342	500
600	343	413	468	279	335	378	600
700	376	452	514	310	371	420	700
750	387	466	529	321	384	435	750
800	397	479	543	331	397	450	800
900	415	500	570	350	421	477	900
1000	448	542	617	382	460	521	1000

*Refer to 310.15(B)(2) for the ampacity correction factors where the ambient temperature is other than 30°C (86°F).

**Refer to 240.4(D) for conductor overcurrent protection limitations.

Table B.310.15(B)(2)(3) Ampacities of Multiconductor Cables with Not More Than Three Insulated Conductors, Rated 0 Through 2000 Volts, in Free Air Based on Ambient Air Temperature of 40°C (104°F) (for Types TC, MC, MI, UF, and USE Cables)*

Size (AWG or kcmil)	Temperature Rating of Conductor. [See Table 310. 104 4 (A) .]								Size (AWG or kcmil)
	60°C (140°F)	75°C (167°F)	85°C (185°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	85°C (185°F)	90°C (194°F)	
	COPPER				ALUMINUM OR COPPER-CLAD ALUMINUM				
18	—	—	—	11	—	—	—	—	18
16	—	—	—	16	—	—	—	—	16
14**	18	21	24	25	—	—	—	—	14
12**	21	28	30	32	18	21	24	25	12
10**	28	36	41	43	21	28	30	32	10
8	39	50	56	59	30	39	44	46	8
6	52	68	75	79	41	53	59	61	6
4	69	89	100	104	54	70	78	81	4
3	81	104	116	121	63	81	91	95	3
2	92	118	132	138	72	92	103	108	2
1	107	138	154	161	84	108	120	126	1
1/0	124	160	178	186	97	125	139	145	1/0
2/0	143	184	206	215	111	144	160	168	2/0
3/0	165	213	238	249	129	166	185	194	3/0
4/0	190	245	274	287	149	192	214	224	4/0
250	212	274	305	320	166	214	239	250	250
300	237	306	341	357	186	240	268	280	300
350	261	337	377	394	205	265	296	309	350
400	281	363	406	425	222	287	317	334	400

WORKING DRAFT OF CMP 6 MEETING OUTPUT - NATIONAL ELECTRICAL CODE - NFPA 70
OCTOBER 22 - 27, 2018 - SUBJECT TO REVISION - NOT FOR PUBLICATION

Size (AWG or kcmil)	Temperature Rating of Conductor. [See Table 310.104.4 (A).]								Size (AWG or kcmil)
	60°C (140°F)	75°C (167°F)	85°C (185°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	85°C (185°F)	90°C (194°F)	
	COPPER				ALUMINUM OR COPPER-CLAD ALUMINUM				
500	321	416	465	487	255	330	368	385	500
600	354	459	513	538	284	368	410	429	600
700	387	502	562	589	306	405	462	473	700
750	404	523	586	615	328	424	473	495	750
800	415	539	604	633	339	439	490	513	800
900	438	570	639	670	362	469	514	548	900
1000	461	601	674	707	385	499	558	584	1000

*Refer to 310.15(B)(2) for the ampacity correction factors where the ambient temperature is other than 40°C (104°F).

**Refer to 240.4(D) for conductor overcurrent protection limitations.

Table B.310.15(B)(2)(5) Ampacities of Single Insulated Conductors, Rated 0 Through 2000 Volts, in Nonmagnetic Underground Electrical Ducts (One Conductor per Electrical Duct), Based on Ambient Earth Temperature of 20°C (68°F), Electrical Duct Arrangement in Accordance with Figure B.310.15(B)(2)(2), Conductor Temperature 75°C (167°F)

Size (kcmil)	3 Electrical Ducts [Fig. B.310.15(B) (2)(2), Detail 2]			6 Electrical Ducts [Fig. B.310.15(B) (2)(2), Detail 3]			9 Electrical Ducts [Fig. B.310.15(B) (2)(2), Detail 4]			3 Electrical Ducts [Fig. B.310.15(B) (2)(2), Detail 2]			6 Electrical Ducts [Fig. B.310.15(B) (2)(2), Detail 3]			B
	Types RHW, THHW, THW, THWN, XHHW, USE			Types RHW, THHW, THW, THWN, XHHW, USE			Types RHW, THHW, THW, THWN, XHHW, USE			Types RHW, THHW, THW, THWN, XHHW, USE			Types RHW, THHW, THW, THWN, XHHW, USE			
	COPPER						ALUMINUM OR COPPER-CLAD ALUM									
	RHO	RHO	RHO	RHO	RHO	RHO	RHO	RHO	RHO	RHO	RHO	RHO	RHO	RHO	RHO	
	60	90	120	60	90	120	60	90	120	60	90	120	60	90	120	60
	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF
	50	100	100	50	100	100	50	100	100	50	100	100	50	100	100	50
250	410	344	327	386	295	275	369	270	252	320	269	256	302	230	214	288
350	503	418	396	472	355	330	446	322	299	393	327	310	369	277	258	350
500	624	511	484	583	431	400	545	387	360	489	401	379	457	337	313	430
750	794	640	603	736	534	494	674	469	434	626	505	475	581	421	389	538
1000	936	745	700	864	617	570	776	533	493	744	593	557	687	491	453	629
1250	1055	832	781	970	686	632	854	581	536	848	668	627	779	551	508	703
1500	1160	907	849	1063	744	685	918	619	571	941	736	689	863	604	556	767
1750	1250	970	907	1142	793	729	975	651	599	1026	796	745	937	651	598	823
2000	1332	1027	959	1213	836	768	1030	683	628	1103	850	794	1005	693	636	877
AmbientTemp.(°C)	Correction Factors															
6–10	1.09			1.09			1.09			1.09			1.09			
11–15	1.04			1.04			1.04			1.04			1.04			
16–20	1.00			1.00			1.00			1.00			1.00			
21–25	0.95			0.95			0.95			0.95			0.95			
26–30	0.90			0.90			0.90			0.90			0.90			

WORKING DRAFT OF CMP 6 MEETING OUTPUT - NATIONAL ELECTRICAL CODE - NFPA 70
OCTOBER 22 - 27, 2018 - SUBJECT TO REVISION - NOT FOR PUBLICATION

Table B.310.15(B)(2)(6) Ampacities of Three Insulated Conductors, Rated 0 Through 2000 Volts, Within an Overall Covering (Three-Conductor Cable) in Underground Electrical Ducts (One Cable per Electrical Duct) Based on Ambient Earth Temperature of 20°C (68°F), Electrical Duct Arrangement in Accordance with Figure B.310.15(B)(2)(2), Conductor Temperature 75°C (167°F)

Size (AWG or kcmil)	1 Electrical Duct [Fig. B.310.15(B) (2)(2), Detail 1]			3 Electrical Ducts [Fig. B.310.15(B) (2)(2), Detail 2]			6 Electrical Ducts [Fig. B.310.15(B) (2)(2), Detail 3]			1 Electrical Duct [Fig. B.310.15(B) (2)(2), Detail 1]			3 Electrical Ducts [Fig. B.310.15(B) (2)(2), Detail 2]			6 Elect Ducts [Fig. B.310.1 (2)(2), D 3]		
	Types RHW, THHW, THW, THWN, XHHW, USE			Types RHW, THHW, THW, THWN, XHHW, USE			Types RHW, THHW, THW, THWN, XHHW, USE			Types RHW, THHW, THW, THWN, XHHW, USE			Types RHW, THHW, THW, THWN, XHHW, USE			Types R THHW, THW, THWN, XHHW, USE		
	COPPER									ALUMINUM OR COPPER-CLAD ALUMINUM								
	-	RHO	RHO	RHO	RHO	RHO	RHO	RHO	RHO	RHO	RHO	RHO	RHO	RHO	RHO	RHO	RHO	
	-	60	90	120	60	90	120	60	90	120	60	90	120	60	90	120	60	
	-	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	
	-	50	100	100	50	100	100	50	100	100	50	100	100	50	100	100	50	
8		58	54	53	56	48	46	53	42	39	45	42	41	43	37	36	41	32
6		77	71	69	74	63	60	70	54	51	60	55	54	57	49	47	54	42
4		101	93	91	96	81	77	91	69	65	78	72	71	75	63	60	71	54
2		132	121	118	126	105	100	119	89	83	103	94	92	98	82	78	92	70
1		154	140	136	146	121	114	137	102	95	120	109	106	114	94	89	107	79
1/0		177	160	156	168	137	130	157	116	107	138	125	122	131	107	101	122	90
2/0		203	183	178	192	156	147	179	131	121	158	143	139	150	122	115	140	102
3/0		233	210	204	221	178	158	205	148	137	182	164	159	172	139	131	160	116
4/0		268	240	232	253	202	190	234	168	155	209	187	182	198	158	149	183	131
250		297	265	256	280	222	209	258	184	169	233	207	201	219	174	163	202	144
350		363	321	310	340	267	250	312	219	202	285	252	244	267	209	196	245	172
500		444	389	375	414	320	299	377	261	240	352	308	297	328	254	237	299	207
750		552	478	459	511	388	362	462	314	288	446	386	372	413	314	293	374	254
1000		628	539	518	579	435	405	522	351	321	521	447	430	480	361	336	433	291
Ambient Temp.(°C)	Correction Factors																	
6–10	1.09			1.09			1.09			1.09			1.09			1.09		
11–15	1.04			1.04			1.04			1.04			1.04			1.04		
16–20	1.00			1.00			1.00			1.00			1.00			1.00		
21–25	0.95			0.95			0.95			0.95			0.95			0.95		
26–30	0.90			0.90			0.90			0.90			0.90			0.90		

Table B.310.15(B)(2)(7) Ampacities of Three Single Insulated Conductors, Rated 0 Through 2000 Volts, in Underground Electrical Ducts (Three Conductors per Electrical Duct) Based on Ambient Earth Temperature of 20°C (68°F), Electrical Duct Arrangement in Accordance with Figure B.310.15(B)(2)(2), Conductor Temperature 75°C (167°F)

Size (AWG or kcmil)	-	<u>1 Electrical Duct [Fig. B.310.15(B)(2)(2), Detail 1]</u>		<u>3 Electrical Ducts [Fig. B.310.15(B)(2)(2), Detail 2]</u>		<u>6 Electrical Ducts [Fig. B.310.15(B)(2)(2), Detail 3]</u>		<u>1 Electrical Duct [Fig. B.310.15(B)(2)(2), Detail 1]</u>		<u>3 Electrical Ducts [Fig. B.310.15(B)(2)(2), Detail 2]</u>		<u>6 Electrical Ducts [Fig. B.310.15(B)(2)(2), Detail 3]</u>	
		<u>Types RHW, THHW, THW, THWN, XHHW, USE</u>		<u>Types RHW, THHW, THW, THWN, XHHW, USE</u>		<u>Types RHW, THHW, THW, THWN, XHHW, USE</u>		<u>Types RHW, THHW, THW, THWN, XHHW, USE</u>		<u>Types RHW, THHW, THW, THWN, XHHW, USE</u>		<u>Types RHW, THHW, THW, THWN, XHHW, USE</u>	
		<u>COPPER</u>						<u>ALUMINUM OR COPPER-CLAD ALUMINUM</u>					
		RHO RHO RHO RHO RHO RHO RHO RHO RHO RHO RHO RHO RHO RHO RHO RHO											

Size (AWG or kcmil)	1 Electrical Duct [Fig. B.310.15(B)(2)(2), Detail 1]			3 Electrical Ducts [Fig. B.310.15(B)(2)(2), Detail 2]			6 Electrical Ducts [Fig. B.310.15(B)(2)(2), Detail 3]			1 Electrical Duct [Fig. B.310.15(B)(2)(2), Detail 1]			3 Electrical Ducts [Fig. B.310.15(B)(2)(2), Detail 2]			6 Electrical Ducts [Fig. B.310.15(B)(2)(2), Detail 3]		
	Types RHW, THHW, THW, THWN, XHHW, USE			Types RHW, THHW, THW, THWN, XHHW, USE			Types RHW, THHW, THW, THWN, XHHW, USE			Types RHW, THHW, THW, THWN, XHHW, USE			Types RHW, THHW, THW, THWN, XHHW, USE			Types RHW, THHW, THW, THWN, XHHW, USE		
	COPPER									ALUMINUM OR COPPER-CLAD ALUMINUM								
	60	90	120	60	90	120	60	90	120	60	90	120	60	90	120	60	90	
	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	LF	
	50	100	100	50	100	100	50	100	100	50	100	100	50	100	100	50	100	
8	63	58	57	61	51	49	57	44	41	49	45	44	47	40	38	45	34	
6	84	77	75	80	67	63	75	56	53	66	60	58	63	52	49	59	44	
4	111	100	98	105	86	81	98	73	67	86	78	76	79	67	63	77	57	
3	129	116	113	122	99	94	113	83	77	101	91	89	83	77	73	84	65	
2	147	132	128	139	112	106	129	93	86	115	103	100	108	87	82	101	73	
1	171	153	148	161	128	121	149	106	98	133	119	115	126	100	94	116	83	
1/0	197	175	169	185	146	137	170	121	111	153	136	132	144	114	107	133	94	
2/0	226	200	193	212	166	156	194	136	126	176	156	151	165	130	121	151	106	
3/0	260	228	220	243	189	177	222	154	142	203	178	172	189	147	138	173	121	
4/0	301	263	253	280	215	201	255	175	161	235	205	198	219	168	157	199	137	
250	334	290	279	310	236	220	281	192	176	261	227	218	242	185	172	220	150	
300	373	321	308	344	260	242	310	210	192	293	252	242	272	204	190	245	165	
350	409	351	337	377	283	264	340	228	209	321	276	265	296	222	207	266	179	
400	442	376	361	394	302	280	368	243	223	349	297	284	321	238	220	288	191	
500	503	427	409	460	341	316	412	273	249	397	338	323	364	270	250	326	216	
600	552	468	447	511	371	343	457	296	270	446	373	356	408	296	274	365	236	
700	602	509	486	553	402	371	492	319	291	488	408	389	443	321	297	394	255	
750	632	529	505	574	417	385	509	330	301	508	425	405	461	334	309	409	265	
800	654	544	520	597	428	395	527	338	308	530	439	418	481	344	318	427	273	
900	692	575	549	628	450	415	554	355	323	563	466	444	510	365	337	450	288	
1000	730	605	576	659	472	435	581	372	338	597	494	471	538	385	355	475	304	
Ambient Temp.(°C)																		
Correction Factors																		
6–10	1.09			1.09			1.09			1.09			1.09			1.09		
11–15	1.04			1.04			1.04			1.04			1.04			1.04		
16–20	1.00			1.00			1.00			1.00			1.00			1.00		
21–25	0.95			0.95			0.95			0.95			0.95			0.95		
26–30	0.90			0.90			0.90			0.90			0.90			0.90		

Table B.310.15(B)(2)(8) Ampacities of Two or Three Insulated Conductors, Rated 0 Through 2000 Volts, Cabled Within an Overall (Two- or Three-Conductor) Covering, Directly Buried in Earth, Based on Ambient Earth Temperature of 20°C (68°F), Electrical Duct Arrangement in Accordance with Figure B.310.15(B)(2)(2), 100 Percent Load Factor, Thermal Resistance (Rho) of 90

Size (AWG or kcmil)	1 Cable [Fig. B.310.15(B)(2)(2), Detail 5]		2 Cables [Fig. B.310.15(B)(2)(2), Detail 6]		1 Cable [Fig. B.310.15(B)(2)(2), Detail 5]		2 Cables [Fig. B.310.15(B)(2)(2), Detail 6]		Size (AWG or kcmil)
	60°C (140°F)	75°C (167°F)	60°C (140°F)	75°C (167°F)	60°C (140°F)	75°C (167°F)	60°C (140°F)	75°C (167°F)	
	TYPES				TYPES				

WORKING DRAFT OF CMP 6 MEETING OUTPUT - NATIONAL ELECTRICAL CODE - NFPA 70
OCTOBER 22 - 27, 2018 - SUBJECT TO REVISION - NOT FOR PUBLICATION

	<u>UF</u>	<u>RHW, THHW, THW, THWN, XHHW, USE</u>	<u>UF</u>	<u>RHW, THHW, THW, THWN, XHHW, USE</u>	<u>UF</u>	<u>RHW, THHW, THW, THWN, XHHW, USE</u>	<u>UF</u>	<u>RHW, THHW, THW, THWN, XHHW, USE</u>	
	<u>COPPER</u>				<u>ALUMINUM OR COPPER-CLAD ALUMINUM</u>				
8	64	75	60	70	51	59	47	55	8
6	85	100	81	95	68	75	60	70	6
4	107	125	100	117	83	97	78	91	4
2	137	161	128	150	107	126	110	117	2
1	155	182	145	170	121	142	113	132	1
1/0	177	208	165	193	138	162	129	151	1/0
2/0	201	236	188	220	157	184	146	171	2/0
3/0	229	269	213	250	179	210	166	195	3/0
4/0	259	304	241	282	203	238	188	220	4/0
250	—	333	—	308	—	261	—	241	250
350	—	401	—	370	—	315	—	290	350
500	—	481	—	442	—	381	—	350	500
750	—	585	—	535	—	473	—	433	750
1000	—	657	—	600	—	545	—	497	1000
Ambient Temp.(°C)	Correction Factors								Ambient Temp.(°F)
6–10	1.12	1.09	1.12	1.09	1.12	1.09	1.12	1.09	43–50
11–15	1.06	1.04	1.06	1.04	1.06	1.04	1.06	1.04	52–59
16–20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	61–68
21–25	0.94	0.95	0.94	0.95	0.94	0.95	0.94	0.95	70–77
26–30	0.87	0.90	0.87	0.90	0.87	0.90	0.87	0.90	79–86

Note: For ampacities of Type UF cable in underground electrical ducts, multiply the ampacities shown in the table by 0.74.

Table B.310.15(B)(2)(9) Ampacities of Three Triplexed Single Insulated Conductors, Rated 0 Through 2000 Volts, Directly Buried in Earth Based on Ambient Earth Temperature of 20°C (68°F), Electrical Duct Arrangement in Accordance with Figure B.310.15(B)(2)(2), 100 Percent Load Factor, Thermal Resistance (Rho) of 90

<u>Size (AWG or kcmil)</u>	<u>See Fig. B.310.15(B) (2)(2), Detail 7</u>		<u>See Fig. B.310.15(B) (2)(2), Detail 8</u>		<u>See Fig. B.310.15(B) (2)(2), Detail 7</u>		<u>See Fig. B.310.15(B) (2)(2), Detail 7</u>	
	<u>60°C(140°F)</u>	<u>75°C(167°F)</u>	<u>60°C(140°F)</u>	<u>75°C(167°F)</u>	<u>60°C(140°F)</u>	<u>75°C(167°F)</u>	<u>60°C(140°F)</u>	<u>75°C(167°F)</u>
	<u>TYPES</u>				<u>TYPES</u>			
	<u>UF</u>	<u>USE</u>	<u>UF</u>	<u>USE</u>	<u>UF</u>	<u>USE</u>	<u>UF</u>	<u>USE</u>
	<u>COPPER</u>				<u>ALUMINUM OR COPPER-CLAD ALUMINUM</u>			
8	72	84	66	77	55	65	51	60
6	91	107	84	99	72	84	66	77
4	119	139	109	128	92	108	85	100
2	153	179	140	164	119	139	109	128
1	173	203	159	186	135	158	124	147
1/0	197	231	181	212	154	180	141	168
2/0	223	262	205	240	175	205	159	188
3/0	254	298	232	272	199	233	181	214
4/0	289	339	263	308	226	265	206	241

WORKING DRAFT OF CMP 6 MEETING OUTPUT - NATIONAL ELECTRICAL CODE - NFPA 70
OCTOBER 22 - 27, 2018 - SUBJECT TO REVISION - NOT FOR PUBLICATION

Size (AWG or kcmil)	See Fig. B.310.15(B) (2)(2), Detail 7		See Fig. B.310.15(B) (2)(2), Detail 8		See Fig. B.310.15(B) (2)(2), Detail 7		See Fig. B.310.15(B) (2)(2), Detail 7	
	60°C(140°F)	75°C(167°F)	60°C(140°F)	75°C(167°F)	60°C(140°F)	75°C(167°F)	60°C(140°F)	75°C(167°F)
	TYPES				TYPES			
	UF	USE	UF	USE	UF	USE	UF	USE
	COPPER				ALUMINUM OR COPPER-CLAD ALUMINUM			
250	—	370	—	336	—	289	—	260
350	—	445	—	403	—	349	—	315
500	—	536	—	483	—	424	—	385
750	—	654	—	587	—	525	—	475
1000	—	744	—	665	—	608	—	545
Ambient Temp.(°C)	Correction Factors							
6–10	1.12	1.09	1.12	1.09	1.12	1.09	1.12	1.09
11–15	1.06	1.04	1.06	1.04	1.06	1.04	1.06	1.04
16–20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21–25	0.94	0.95	0.94	0.95	0.94	0.95	0.94	0.95
26–30	0.87	0.90	0.87	0.90	0.87	0.90	0.87	0.90

Table B.310.15(B)(2)(10) Ampacities of Three Single Insulated Conductors, Rated 0 Through 2000 Volts, Directly Buried in Earth Based on Ambient Earth Temperature of 20°C (68°F), Electrical Duct Arrangement in Accordance with Figure B.310.15(B)(2)(2), 100 Percent Load Factor, Thermal Resistance (Rho) of 90

Size (AWG or kcmil)	See Fig. B.310.15(B) (2)(2), Detail 9		See Fig. B.310.15(B) (2)(2), Detail 10		See Fig. B.310.15(B) (2)(2), Detail 9		See Fig. B.310.15(B) (2)(2), Detail 9	
	60°C(140°F)	75°C(167°F)	60°C(140°F)	75°C(167°F)	60°C(140°F)	75°C(167°F)	60°C(140°F)	75°C(167°F)
	TYPES				TYPES			
	UF	USE	UF	USE	UF	USE	UF	USE
	COPPER				ALUMINUM OR COPPER-CLAD ALUMINUM			
8	84	98	78	92	66	77	61	72
6	107	126	101	118	84	98	78	92
4	139	163	130	152	108	127	101	118
2	178	209	165	194	139	163	129	152
1	201	236	187	219	157	184	146	172
1/0	230	270	212	249	179	210	165	195
2/0	261	306	241	283	204	239	188	222
3/0	297	348	274	321	232	272	213	252
4/0	336	394	309	362	262	307	241	288
250	—	429	—	394	—	335	—	300
350	—	516	—	474	—	403	—	365
500	—	626	—	572	—	490	—	440
750	—	767	—	700	—	605	—	545
1000	—	887	—	808	—	706	—	640
1250	—	979	—	891	—	787	—	710
1500	—	1063	—	965	—	862	—	780
1750	—	1133	—	1027	—	930	—	840
2000	—	1195	—	1082	—	990	—	890
Ambient Temp.(°C)	Correction Factors							
6–10	1.12	1.09	1.12	1.09	1.12	1.09	1.12	1.09
11–15	1.06	1.04	1.06	1.04	1.06	1.04	1.06	1.04

Size (AWG or kcmil)	See Fig. B.310.15(B) (2)(2), Detail 9		See Fig. B.310.15(B) (2)(2), Detail 10		See Fig. B.310.15(B) (2)(2), Detail 9		See Fig. B.3 (2)(2), De
	60°C(140°F)	75°C(167°F)	60°C(140°F)	75°C(167°F)	60°C(140°F)	75°C(167°F)	60°C(140°F) 7
	TYPES				TYPES		
	UF	USE	UF	USE	UF	USE	UF
	COPPER				ALUMINUM OR COPPER-CLAD ALU		
16–20	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21–25	0.94	0.95	0.94	0.95	0.94	0.95	0.94
26–30	0.87	0.90	0.87	0.90	0.87	0.90	0.87

Table B.310.15(B)(2)(11) Adjustment Factors for More Than Three Current-Carrying Conductors in a Raceway or Cable with Load Diversity

Number of Conductors*	Percent of Values in Tables as Adjusted for Ambient Temperature if Necessary
4–6	80
7–9	70
10–24	70**
25–42	60**
43–85	50**

*Number of conductors is the total number of conductors in the raceway or cable adjusted in accordance with 310.15(B)(4) and (5).

**These factors include the effects of a load diversity of 50 percent.

Informational Note: The ampacity limit for 10 through 85 current-carrying conductors is based on the following equation. For more than 85 conductors, special calculations are required that are beyond the scope of this table.

$$A_2 = \left[\sqrt{\frac{0.5N}{E}} \times (A_1) \right] \text{ or } A_1, \text{ whichever is less} \quad [\text{B.310.15(B)(2)(11)}]$$

where:

A_1 = ampacity from Table 310.16, Table 310.18, Table B.310.15(B)(2)(1), Table B.310.15(B)(2)(6), or Table B.310.15(B)(2)(7) multiplied by the appropriate adjustment factor from Table B.310.15(B)(2)(11).

N = total number of conductors used to select adjustment factor from Table B.310.15(B)(2)(11)

E = number of conductors carrying current simultaneously in the raceway or cable

A_2 = ampacity limit for the current-carrying conductors in the raceway or cable

Example 1

Calculate the ampacity limit for twelve 14 AWG THWN current-carrying conductors (75°C) in a raceway that contains 24 conductors that may, at different times, be current-carrying.

$$\begin{aligned} A_2 &= \sqrt{\frac{(0.5)(24)}{12}} \times 20(0.7) \\ &= 14 \text{ amperes (i.e., 50 percent diversity)} \end{aligned} \quad [\text{B.310.15(B)(2)(11)}]$$

Example 2

Calculate the ampacity limit for eighteen 14 AWG THWN current-carrying conductors (75°C) in a raceway that contains 24 conductors that may, at different times, be current-carrying.

$$A_2 = \sqrt{\frac{(0.5)(24)}{18}} \times 20(0.7) = 11.5 \text{ amperes} \quad [\text{B.310.15(B)(2)(11)}]$$

Figure B.310.15(B)(2)(1) Interpolation Chart for Cables in a Duct Bank. I_1 = ampacity for Rho = 60, 50 LF; I_2 = ampacity for Rho = 120, 100 LF (load factor); desired ampacity = $F \times I_1$.

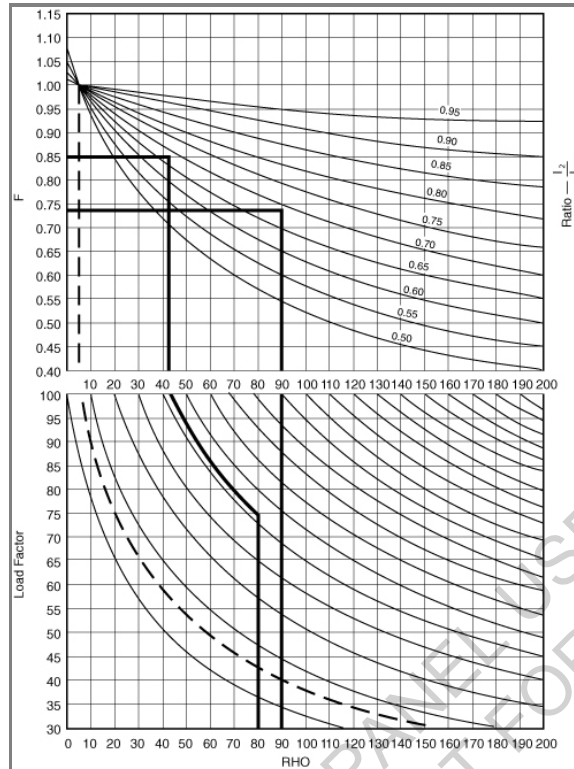


Figure B.310.15(B)(2)(2) Cable Installation Dimensions for Use with Table B.310.15(B)(2)(5) Through Table B.310.15(B)(2)(10).

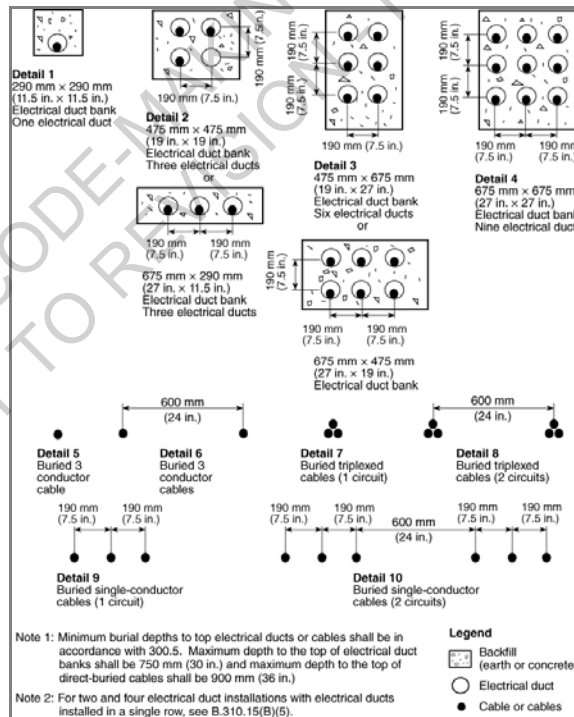


Figure Informational Note Figure B.310.15(B)(2)(3) Ampacities of Single Insulated Conductors Rated 0 Through 5000 Volts in Underground Electrical Ducts (Three Conductors per Electrical Duct), Nine Single-Conductor Cables per Phase Based on Ambient Earth Temperature of 20°C (68°F), Conductor Temperature 75°C (167°F).

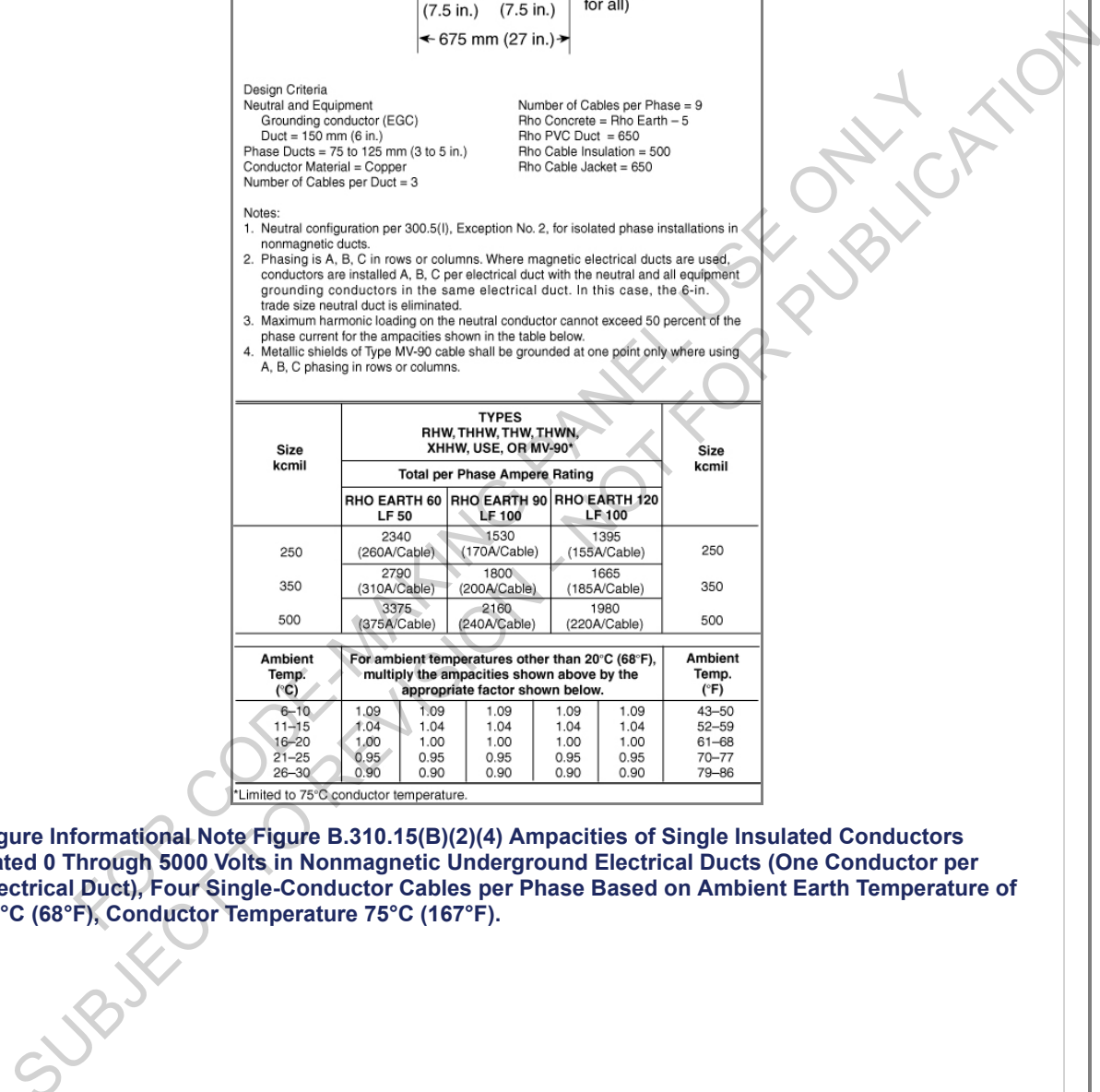


Figure Informational Note Figure B.310.15(B)(2)(4) Ampacities of Single Insulated Conductors Rated 0 Through 5000 Volts in Nonmagnetic Underground Electrical Ducts (One Conductor per Electrical Duct), Four Single-Conductor Cables per Phase Based on Ambient Earth Temperature of 20°C (68°F), Conductor Temperature 75°C (167°F).

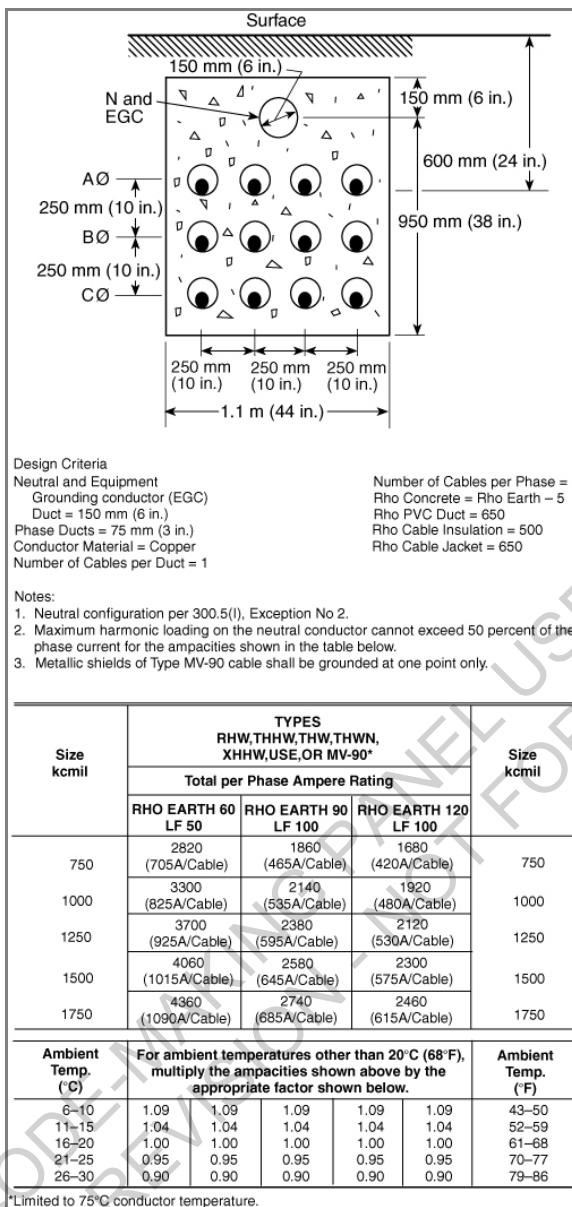
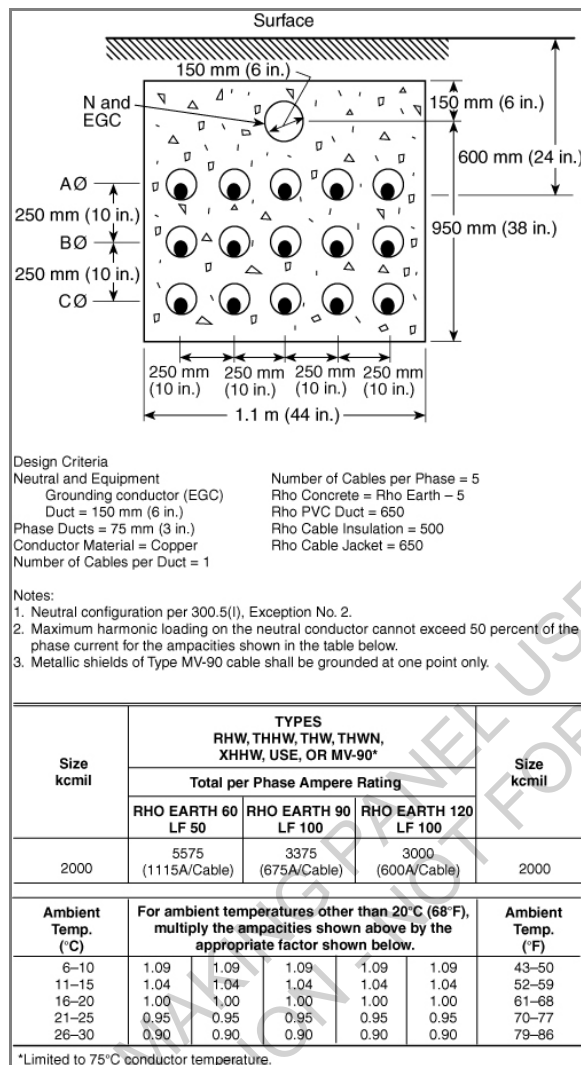


Figure Informational Note Figure B.310.15(B)(2)(5) Ampacities of Single Insulated Conductors Rated 0 Through 5000 Volts in Nonmagnetic Underground Electrical Ducts (One Conductor per Electrical Duct), Five Single-Conductor Cables per Phase Based on Ambient Earth Temperature of 20°C (68°F), Conductor Temperature 75°C (167°F).

WORKING DRAFT OF CMP 6 MEETING OUTPUT - NATIONAL ELECTRICAL CODE - NFPA 70
OCTOBER 22 - 27, 2018 - SUBJECT TO REVISION - NOT FOR PUBLICATION**Submitter Information Verification****Committee:** NEC-P06**Submittal Date:** Wed Oct 24 15:46:45 EDT 2018**Committee Statement****Committee Statement:** Editorial per PC#2211.**Response Message:** SR-7743-NFPA 70-2018