

Wire Ampacity and Calculations according to the 2014 NEC

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Ampacity. The **MAXIMUM** Current in amperes, that a conductor can carry continuously under the conditions of use without exceeding its temperature rating

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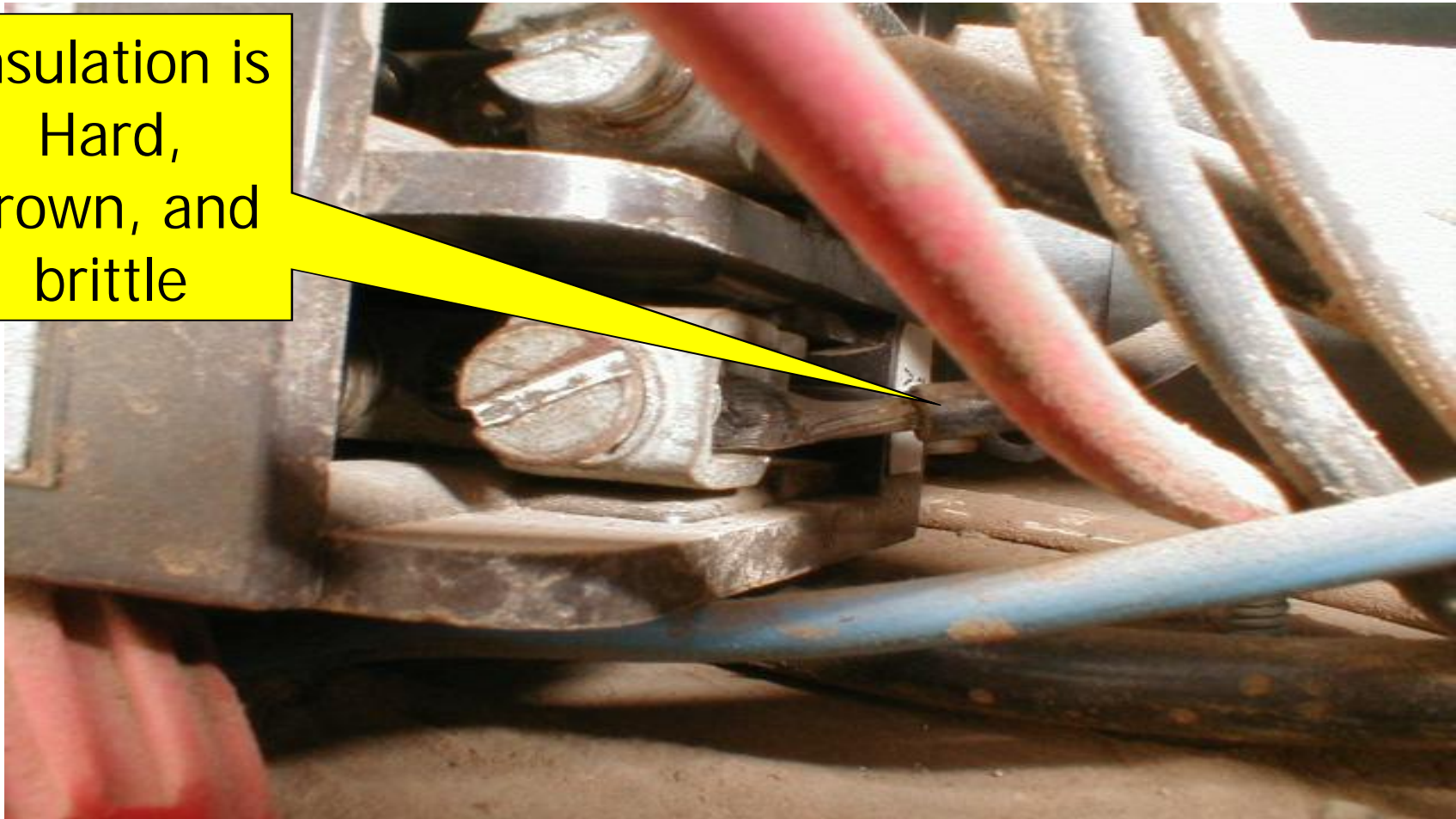
310.15(A)(3) Temp. Limitations of Conductors

No conductor shall be used in such a manner that its operating temperature will exceed that designated for the type of insulated conductor involved.

FPN talks about ‘Serious Degradation**’.**

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Insulation is
Hard,
brown, and
brittle



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Romex – NM, NMC, NMS

334.80 Ampacity

The ampacity of Types NM, NMC, and NMS cable shall be determined in accordance with 310.15. The allowable ampacity shall not exceed that of a 60°C (140°F) rated conductor. The 90°C (194°F) rating shall be permitted to be used for ampacity adjustment and correction calculations, provided the final derated ampacity does not exceed that of a 60°C (140°F) rated conductor. The ampacity of Types NM, NMC, and NMS cable installed in cable tray shall be determined in accordance with 392.80(A).

90° for
DERATING

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NEC 2014 Article 110.14

(C) Temperature Limitations. The temperature rating associated with the ampacity of a conductor shall be selected and coordinated so as not to exceed the lowest temperature rating of any connected termination, conductor, or device. Conductors with temperature ratings higher than specified for terminations shall be permitted to be used for ampacity adjustment, correction, or both.

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NEC 2014 Article 110.14

(1) Equipment Provisions. The determination of termination provisions of equipment shall be based on 110.14(C)(1) (a) or (C)(1)(b). Unless the equipment is listed and marked otherwise, conductor ampacities used in determining equipment termination provisions shall be based on Table 310.15(B)(16) as appropriately modified by 310.15(B)(7).

(a) Termination provisions of equipment for circuits rated **100 amperes or less**, or marked for **14 AWG through 1 AWG** conductors, shall be used only for one of the following:

(1) **Conductors rated 60°C (140°F).**

(2) **Conductors with higher temperature ratings, provided the ampacity of such conductors is determined based on the 60°C (140°F) ampacity of the conductor size used.**

(3) **Conductors with higher temperature ratings if the equipment is listed and identified for use with such conductors.**

(4) For **motors** marked with design letters **B, C, or D**, conductors having an insulation rating of **75°C (167°F)** or higher shall be permitted to be used, provided the ampacity of such conductors does not exceed the **75°C (167°F)** ampacity.

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NEC 2014 Article 110.14

(b) Termination provisions of **equipment for circuits rated over 100 amperes, or marked for conductors larger than 1 AWG**, shall be used only for one of the following:

(1) **Conductors rated 75°C (167°F)**

(2) Conductors with higher temperature ratings, provided the ampacity of such conductors **does not exceed the 75°C (167°F)** ampacity of the conductor size used, or up to their ampacity if the equipment is listed and identified for use with such conductors

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110.14 (c) (1), & (2)

- Temperature Limitations of Conductors
 - #14 thru #1 or 100 amps or less
 - Shall use the ampacity from the 60 ° C Column
 - Larger than #1 or over 100 amps
 - Shall use the ampacity from the 75 ° C Column
 - The 90 ° C ampacity can be used for corrections only.
 - Ambient Temperature
 - Number of Conductors

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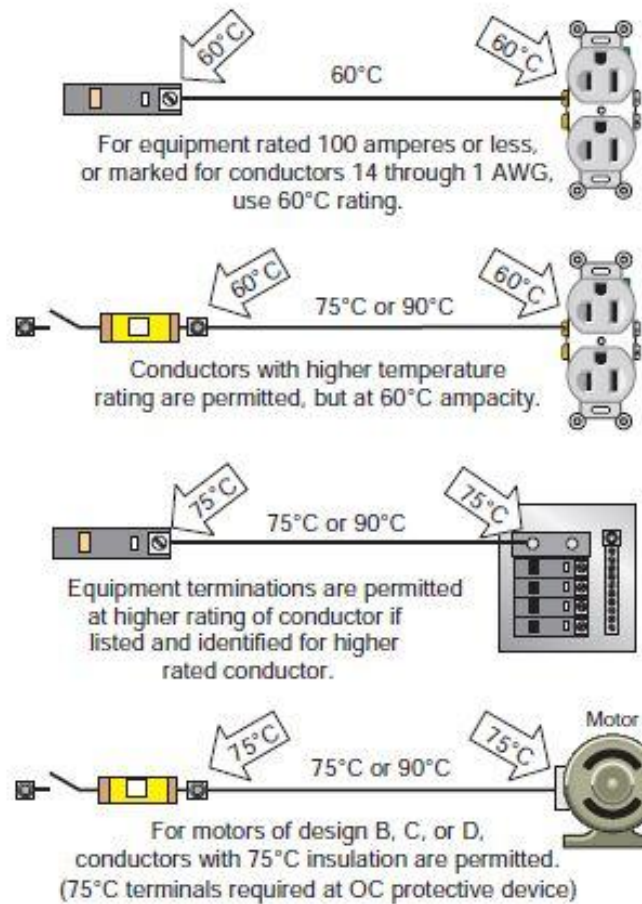


FIGURE 8-2 Temperature limitation of terminals for conductors sized 14 through 1 AWG or for overcurrent protective devices rated 100 amperes or lower. (Delmar/Cengage Learning)

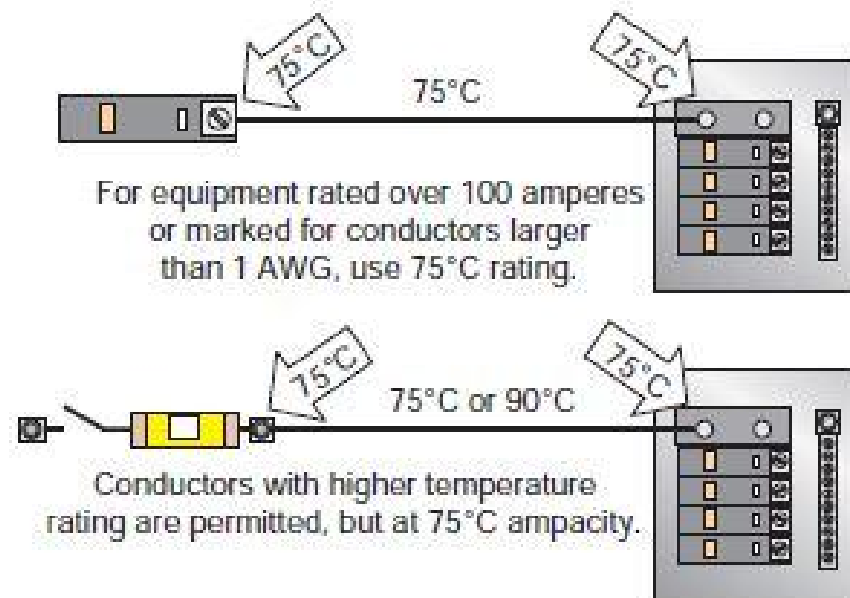


FIGURE 8-3 Temperature limitation of terminals for conductors sized larger than 1 AWG or for overcurrent protective devices rated greater than 100 amperes. (*Delmar/Cengage Learning*)

TABLE 310.15(B)(16) (formerly Table 310.16) Allowable Ampacities of Insulated Conductors Rated Up to and Including 2000 Volts, 60°C Through 90°C (140°F Through 194°F), Not More Than Three Current-Carrying Conductors in Raceway, Cable, or Earth (Directly Buried), Based on Ambient Temperature of 30°C (86°F)*

Size AWG or kcmil	Temperature Rating of Conductor [See Table 310.104(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, USE, ZW	Types TBS, SA, SIS, FEP, FEPB, MI, RHH, RHW- 2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE	Types TBS, SA, SIS, THHN, THHW, THW-2, THWN-2, RHH, RHW-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	
	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

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Table 310.15(B)(16) Parameters

- **Not more than 3 current-carrying conductors**
- **Ambient temperature not exceeding 30° Centigrade or 86° Farenheight**

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T. 310.15(B)(16) Corrections

- Ambient Temperature
 - Above 30° C
 - Below 30 ° C
- Number of Conductors
 - More than 3 current carrying conductors

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Neutral Conductor

- **Grounded Conductor**
 - **Carries unbalanced load**
 - **Is not counted if it only carries the unbalanced load.**
 - **Must be counted as a current carrying conductor if load consists of fluorescent lighting or other harmonic loads.**

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Ampacity Calculations #1

What is the Maximum allowed ampacity for a single #2 THHN Conductor installed in a circuit.

Step 1. 110.14(c) (#14 thru #1)

Step 2. Table 310.15(B)(16) (60°C Column)

Step 3. Read Ampacity

95 Amps

T.310.15(b)(16)

240.6

110.14

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Ampacity Calculations #1

What is the Maximum allowed ampacity for a single #2 THHN Conductor not installed in a circuit.

Step 1. Table 310.15(B)(16) (90°C Column)

Step 3. Read Ampacity

130 Amps

T.310.15(b)(16)

240.6

110.14

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Ampacity Calculations #2

What is the Maximum allowed ampacity for a single # 500 Kcmil THHN Conductor installed in a circuit with both 75° and 90° lugs.

- Step 1. 110.14(c) (Larger than #1)**
- Step 2. Table 310.15(B)(16) (75°C Column)**
- Step 3. Read Ampacity**

380 Amps

T.310.15(b)(16)

240.6

110.14

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TABLE 310.15(B)(2)(A) 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

T.310.15(b)(16) 240.6 110.14

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Adjustment Factors

TABLE 310.15(B)(3)(a) Adjustment Factors for More Than Three Current-Carrying Conductors in a Raceway or Cable

Number of Conductors¹	Percent of Values in Table 310.15(B)(16) through Table 310.15(B)(19) as Adjusted for Ambient Temperature if Necessary
4–6	80
7–9	70
10–20	50
21–30	45
31–40	40
41 and above	35

¹Number of conductors is the total number of conductors in the raceway or cable adjusted in accordance with 310.15(B)(5) and (6).

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Ambient Temperature

measured from bottom of conduit to roof

New Table 310.15(B)(2)(c) for adjusting temperature to be applied for derating of conductors installed in conduits or tubing that are in direct sunlight on roofs

Distance above roof to bottom of conduit	Temperature added degrees C	Temperature added degrees F
0 to ½ inch	33	60
½ to 3 ½ inches	22	40
3 ½ to 12 inches	17	30
Above 12 inches	14	25

T.310.15(b)(16)

240.6

110.14

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TABLE 310.104(A) Conductor Applications and Insulations Rated 600 Volts

Trade Name	Type Letter	Maximum Operating Temperature	Application Provisions	Insulation	Thickness of Insulation			Outer Covering ¹
					AWG or kcmil	mm	mils	
Fluorinated ethylene propylene	FEP or FEPB	90°C 194°F 200°C 392°F	Dry and damp locations Dry locations — special applications ²	Fluorinated ethylene propylene Fluorinated ethylene propylene	14–10	0.51	20	None
					8–2	0.76	30	
					14–8	0.36	14	
Mineral insulation (metal sheathed)	MI	90°C 194°F 250°C 482°F	Dry and wet locations For special applications ²	Magnesium oxide	18–16 ³	0.58	23	Copper or alloy steel
					16–10	0.91	36	
					9–4	1.27	50	
Moisture-, heat-, and oil-resistant thermoplastic	MTW	60°C 140°F 90°C 194°F	Machine tool wiring in wet locations Machine tool wiring in dry locations. Informational Note: See NFPA 79.	Flame-retardant, moisture-, heat-, and oil-resistant thermoplastic	6–2	0.36	14	(A) None (B) Nylon jacket or equivalent
					22–12	(A) 0.76 (B) 0.38	(A) 30 (B) 15	
					10	0.76 0.51	30 20	
Paper		85°C 185°F	For underground service conductors, or by special permission	Paper	8	1.14	45	Lead sheath
					6	1.52	60	
					4–2	1.52	60	
					1–4/0	2.03	80	
					213–500	2.41	95	
					501–1000	2.79	110	
					501–1000	2.79	110	
Perfluoro-alkoxy	PFA	90°C 194°F 200°C 392°F	Dry and damp locations Dry locations — special applications ²	Perfluoro-alkoxy	14–10	0.51	20	None
					8–2	0.76	30	
					1–4/0	1.14	45	
Perfluoro-alkoxy	PFAH	250°C 482°F	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	None
					8–2	0.76	30	
					1–4/0	1.14	45	
Thermoset •	RHH	90°C 194°F	Dry and damp locations		14–10	1.14	45	Moisture-resistant, flame-retardant, non-metallic covering ¹
					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	
Moisture-resistant thermoset •	RHW	75°C 167°F	Dry and wet locations	Flame-retardant, moisture-resistant thermoset	14–10	1.14	45	Moisture-resistant, flame-retardant, non-metallic covering
					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	Dry and damp locations	Silicone rubber	14–10	1.14	45	Glass or other suitable

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TABLE 310.104(A) Continued

Trade Name	Type Letter	Maximum Operating Temperature	Application Provisions	Insulation	Thickness of Insulation			Outer Covering ¹
Heat-resistant thermoplastic	THHN	90°C 194°F	Dry and damp locations	Flame-retardant, heat-resistant thermoplastic	14-12	0.38	15	Nylon jacket or equivalent
					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 heat-resistant thermoplastic	14-10	0.76	30	None
					8	1.14	45	
					6-2	1.52	60	
		90°C 194°F	Dry location		1-4/0	2.03	80	
					213-500	2.41	95	
					501-1000	2.79	110	
1001-2000	3.18	125						
Moisture- and heat-resistant thermoplastic	THW	75°C 167°F 90°C 194°F	Dry and wet locations	Flame-retardant, moisture- and heat-resistant thermoplastic	14-10	0.76	30	None
					8	1.14	45	
	Special applications within electric discharge lighting equipment. Limited to 1000 open-circuit volts or less. (size 14-8 only as permitted in 410.68)	6-2	1.52		60			
		1-4/0	2.03		80			
		213-500	2.41		95			
		501-1000	2.79		110			
THW-2	90°C 194°F	Dry and wet locations	1001-2000	3.18	125			
Moisture- and heat-resistant thermoplastic	THWN	75°C 167°F	Dry and wet locations	Flame-retardant, moisture- and heat-resistant thermoplastic	14-12	0.38	15	Nylon jacket or equivalent
					10	0.51	20	
	THWN-2	90°C 194°F			8-6	0.76	30	
					4-2	1.02	40	
Moisture-resistant thermoplastic	TW	60°C 140°F	Dry and wet locations	Flame-retardant, moisture-resistant thermoplastic	14-10	0.76	30	None
					8	1.14	45	
					6-2	1.52	60	
					1-4/0	2.03	80	
					213-500	2.41	95	
					501-1000	2.79	110	
1001-2000	3.18	125						
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	See Article 340.	Moisture-resistant	14-10	1.52	60 ⁴	Integral with insulation
					8-2	2.03	80 ⁴	
		75°C 167°F ⁵		1-4/0	2.41	95 ⁴		
Underground service-	USE	75°C	See Article 338.	Heat- and moisture-	14-10	1.14	45	Moisture-resistant

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Ampacity Calculations #3

What is the Maximum allowed ampacity for a single # 500 Kcmil THHN Conductor in a 56°C environment and terminated ?

Step 1. **110.14(c)** (Larger than #1)

Step 2. **Table 310.15(B)(16)** (90°C Column)

Step 3. 430 Amps X .71 Correction Factor = **305.3 Amps**

Step 4. Look at 75°C column (**Cannot exceed 380A**)

305 Amps

T.310.15(b)(16) **240.6** **110.14**

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Ampacity Calculations #4

What is the Maximum allowed ampacity for a six # 4/0 Kcmil THW Conductors in a 143°F environment ?

Step 1. **110.14(c)** (Larger than #1)

Step 2. **Table 310.15(B)(16)** (75°C Column) (THW insulation)

Step 3. 230 Amps X .47 (T) = **108.1 Amps**

Step 4. 108.1 Amps X .80 (# Cond.) = **86.48 Amps**

86 Amps

T.310.15(b)(16) **240.6** **110.14**

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Ampacity Calculations #5

What is the minimum size THHN conductor required for the branch circuit conductors for a circuit of 120 volts, with a 10,000 watt load operating for 3.5 hours , located in a 68° C environment with 3 ungrounded conductors, 1 grounded conductor, and 1 grounding conductor in conduit, connected to 75° C terminations and devices ?

Existing load is fluorescent lighting

T.310.15(b)(16)

240.6

110.14

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Keywords in question

What is the **minimum size THHN conductor** required for the **branch circuit conductors** for a circuit of **120 volts**, with a **10,000 watt load operating for 3.5 hours**, located in a **68° C environment** with **3 ungrounded conductors**, **1 grounded conductor**, and **1 grounding conductor** in conduit, connected to **75° C terminations** and devices ?

Existing load is fluorescent lighting

T.310.15(b)(16)

240.6

110.14

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Solution to Question #5

§ Step 1: Get Current = watts / volts = 10,000/120 = **83.3 amps**

§ Step 2: Continuous = 125% = 83.3 X 125% = **104.125 Amps**

§ Definition of Continuous and Article **210.19**

§ Step 3: Get Multiplier = .80 X .58 = **.464**

§ **T.310.15(b)(2)(a)** = .80 (4-6 conductors)

§ **T.310.15(B)(16)** = .58 (68 degrees C, 90 C Column)

§ Step 4: Get Wire Ampacity = 104.125 / .464 = **224.407 amps**

§ Minimum Ampacity Required

§ Step 5: Select Wire (**310.15(B)(16)** & **110.14**) = **#4/0 THHN (75° C)**

– Since all connections are stated at 75 degrees C

#4/0 THHN

T.310.15(b)(16)

240.6

110.14

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Ampacity Test Questions

10 Questions

30 Minutes

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240.6 Standard Ampere Ratings.

(A) Fuses and Fixed-Trip Circuit Breakers. The standard ampere ratings for fuses and inverse time circuit breakers shall be considered 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100, 110, 125, 150, 175, 200, 225, 250, 300, 350, 400, 450, 500, 600, 700, 800, 1000, 1200, 1600, 2000, 2500, 3000, 4000, 5000, and 6000 amperes. Additional standard ampere ratings for fuses shall be 1, 3, 6, 10, and 601. The use of fuses and inverse time circuit breakers with nonstandard ampere ratings shall be permitted.



**Table 310.16 Allowable Ampacities of Insulated Conductors Rated 0 Through 600 Volts, Single-Phase, AC Systems
Current-Carrying Conductors in Raceway, Cable, or Earth (Direct Buried)**

Size AWG or kcmil	Temperature Rating of Conductor		
	60°C (140°F) Types TW, UF	75°C (167°F) Types RHW, THHW, THW, THWN, XHHW, USE, ZW	90°C (194°F) Types TBS, SA, SIS, FEP, FEPB, MI, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, ZW-2
	COPPER		
12*	25	25	30
10*	30	35	40
8	40	50	55
6	55	65	75
4	70	85	95
3	85	100	110
2	95	115	130
1	110	130	150
1/0	125	150	170
2/0	145	175	195
3/0	165	200	225
4/0	195	230	260
250	215	255	290
300	240	285	320
350	260	310	350
400	280	335	380
500	320	380	430
600	355	420	475



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Table 250.122 Minimum Size Equipment Grounding Conductors for Grounding Raceway and Equipment

Rating or Setting of Automatic Overcurrent Device in Circuit Ahead of Equipment, Conduit, etc., Not Exceeding (Amperes)	Size (AWG or kcmil)	
	Copper	Aluminum or Copper-Clad Aluminum*
20	12	10
30	10	8
40	10	8
60	10	8
100	8	6
200	6	4
300	4	2
400	3	1
500	2	1/0
600	1	2/0
800	1/0	3/0
1000	2/0	4/0
1200	3/0	250
1600	4/0	350
2000	250	400
2500	350	600
3000	400	600
4000	500	800
5000	700	1200
6000	800	1200

Note: Where necessary to comply with [250.4\(A\)\(5\)](#) or [\(B\)\(4\)](#), the equipment grounding conductor shall be sized larger than given in this table.

*See installation restrictions in [250.120](#).



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(1) Equipment Provisions The determination of termination provisions of equipment shall be based on 110.14(C)(1)(a) or (C)(1)(b). Unless the equipment is listed and marked otherwise, conductor ampacities used in determining equipment termination provisions shall be based on Table 310.16 as appropriately modified by 310.15(B)(6).

(a) Termination provisions of equipment for circuits rated 100 amperes or less, or marked for 14 AWG through 1 AWG conductors, shall be used only for one of the following:

- (1) Conductors rated 60°C (140°F).
- (2) Conductors with higher temperature ratings, provided the ampacity of such conductors is determined based on the 60°C (140°F) ampacity of the conductor size used.
- (3) Conductors with higher temperature ratings if the equipment is listed and identified for use with such conductors.
- (4) For motors marked with design letters B, C, or D, conductors having an insulation rating of 75°C (167°F) or higher shall be permitted to be used, provided the ampacity of such conductors does not exceed the 75°C (167°F) ampacity.

(b) Termination provisions of equipment for circuits rated over 100 amperes, or marked for conductors larger than 1 AWG, shall be used only for one of the following:

- (1) Conductors rated 75°C (167°F)
- (2) Conductors with higher temperature ratings, provided the ampacity of such conductors does not exceed the 75°C (167°F) ampacity of the conductor size used, or up to their ampacity if the equipment is listed and identified for use with such conductors

