

svonavec-SR EE-period 5-8 - offsite learning packet day 8

SENIOR ELECTRICITY

SIZING WIRE AND CONDUIT AND BREAKER SIZES

Name _____

Date _____

- 1) Given a continuous load of 115 amps @ 480 VAC 3 PH what would be the appropriate amperage rating of the OCPD. _____
- 2) What wire size would be required using THHN copper conductors with no more than three current carrying conductors and in an ambient temp of 30 degrees C? _____
- 3) What would be the sufficient equipment grounding conductor size _____
- 4) What pipe size using IMC would be adequate to pull these wires in? _____
- 5) Given a non-continuous load of 65 amps @ 208 VAC 3 PH what would be the appropriate amperage rating of the OCPD. _____
- 6) What wire size would be required using THHN copper conductors in a pipe with 9 current carrying conductors? _____
- 7) What would be the sufficient equipment grounding conductor size _____
- 8) What pipe size using IMC would be adequate to pull these wires in? _____
- 9) Given a continuous load of 43.5 amps @ 208 VAC 3 Ph what would be the appropriate amperage rating of the OCPD. _____
- 10) What wire size would be required using THHN copper conductors with no more than three current carrying conductors and in an ambient temp of 45 degrees C? _____
- 11) What would be the sufficient equipment grounding conductor size _____
- 12) What pipe size using EMT would be adequate to pull these wires in? _____

Table 310.15(B)(16) (formerly Table 310.16) Allowable Ampacities of Insulated Conductors Rated Up to and Including 2000 Volts, 60 C (140 F) Through 90 C (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 310.15(B)(7)]						Size AWG or kcmil
	60 C (140 F)		75 C (167 F)		90 C (194 F)		
	Types TW, UF	Types RHW, THHN, THHW, THWN, XHHW, USE, ZW	Types RHW, THHN, THHW, THWN, XHHW, USE, ZW	Types RHW, THHN, THHW, THWN, XHHW, USE, ZW	Types RHW, THHN, THHW, THWN, XHHW, USE, ZW	Types RHW, THHN, THHW, THWN, XHHW, USE, ZW	
	COPPER			ALUMINUM OR COPPER-CLAD ALUMINUM			
18	—	—	14	—	—	—	
16	—	—	15	—	—	—	
14**	15	20	24	15	20	25	12**
12**	20	25	30	25	30	35	16**
10**	30	35	40	35	40	45	
8	40	50	55	45	50	55	
6	55	65	70	60	65	70	6
4	70	85	90	75	80	85	4
2	95	110	115	90	95	100	2
1	110	130	135	105	110	115	1
1/2	—	—	—	—	—	—	—
1/4	125	150	170	100	120	135	1/2
3/8	145	175	195	115	135	150	3/8
1/2	165	200	220	130	155	175	1/2
3/4	190	230	250	150	180	205	3/4
1	220	270	290	170	205	230	1
1 1/4	260	320	340	200	240	270	1 1/4
1 1/2	290	360	380	220	260	290	1 1/2
2	330	410	430	250	300	330	2
3	380	470	490	290	340	370	3
4	430	530	550	330	390	420	4
5	480	590	610	370	440	470	5
6	530	650	670	410	490	520	6
8	630	770	800	490	590	630	8
10	730	890	930	570	690	730	10
12	830	1010	1060	650	790	830	12
14	930	1130	1190	730	890	930	14
16	1030	1260	1330	810	990	1030	16
18	1130	1390	1470	890	1090	1130	18
20	1230	1520	1610	970	1190	1230	20
25	1530	1880	2000	1230	1510	1530	25
30	1830	2280	2430	1530	1840	1830	30
35	2130	2680	2860	1830	2210	2130	35
40	2430	3080	3290	2130	2610	2430	40
50	2930	3680	3930	2630	3210	2930	50
60	3430	4280	4570	3130	3810	3430	60
75	4130	5180	5510	3830	4710	4130	75
90	4830	6080	6460	4530	5610	4830	90
110	5630	7080	7510	5330	6510	5630	110
125	6130	7780	8260	5830	7210	6130	125
150	7130	9180	9760	6830	8410	7130	150
175	8130	10580	11260	7830	9610	8130	175
200	9130	11980	12760	8830	10810	9130	200

*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 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

Trade size in inches		Wire sizes (THWN, THHN) conductor size AWG/kcmil																				
		14	12	10	8	6	4	3	2	1	1/0	2/0	3/0	4/0	250	300	350	400	500	600	700	750
1/2	EMT	12	9	5	3	2	1	1	1	1												
	IMC	14	10	6	3	2	1	1	1	1	1											
	GALV	13	9	6	3	2	1	1	1	1												
3/4	EMT	22	16	10	6	4	2	1	1	1	1	1	1									
	IMC	24	17	11	6	4	3	2	1	1	1	1	1									
	GALV	22	16	10	6	4	2	1	1	1	1	1	1									
1	EMT	35	29	16	9	7	4	3	3	1	1	1	1	1	1	1	1					
	IMC	39	26	18	10	7	4	4	3	2	1	1	1	1	1	1	1					
	GALV	36	29	17	9	7	4	3	3	1	1	1	1	1	1	1	1					
1 1/4	EMT	61	45	28	16	12	7	6	5	4	3	3	2	1	1	1	1	1	1	1	1	1
	IMC	68	49	31	18	13	8	6	5	4	3	3	2	1	1	1	1	1	1	1	1	1
	GALV	63	46	29	16	12	7	6	5	4	3	2	1	1	1	1	1	1	1	1	1	1
1 1/2	EMT	84	61	38	22	16	10	8	7	5	4	3	3	2	1	1	1	1	1	1	1	1
	IMC	91	67	42	24	17	11	9	7	5	4	4	3	2	1	1	1	1	1	1	1	1
	GALV	85	62	39	22	16	10	8	7	5	4	3	3	2	1	1	1	1	1	1	1	1
2	EMT	138	101	63	36	26	16	13	11	7	6	5	4	3	3	2	1	1	1	1	1	1
	IMC	149	109	69	39	28	17	15	12	8	6	5	4	3	3	2	2	1	1	1	1	1
	GALV	140	102	64	37	27	16	14	11	7	6	5	4	3	3	2	2	1	1	1	1	1
2 1/2	EMT	241	176	111	64	46	28	24	20	15	12	10	8	7	6	5	4	4	3	3	2	1
	IMC	211	154	97	56	40	25	21	17	13	11	9	7	6	5	4	3	3	2	1	1	1
	GALV	200	146	92	53	38	23	20	17	12	10	8	7	6	5	4	3	3	2	1	1	1
3	EMT	364	266	167	96	69	43	36	30	22	19	16	13	11	9	7	6	6	5	4	3	3
	IMC	326	238	150	86	62	38	32	27	20	17	14	12	9	8	7	6	5	4	3	3	3
	GALV	309	225	142	87	59	36	31	26	19	16	13	11	9	7	6	5	5	4	3	3	3
3 1/2	EMT	476	347	219	126	91	56	47	40	29	25	20	17	14	11	10	9	8	7	6	5	4
	IMC	436	318	200	115	83	51	43	36	27	23	19	16	13	10	9	8	7	6	5	4	4
	GALV	412	301	189	109	79	48	41	34	25	21	18	15	12	10	8	7	7	5	4	4	4
4	EMT	608	443	279	161	116	71	60	51	37	32	26	22	18	15	13	11	10	8	7	6	5
	IMC	562	410	258	149	107	66	56	47	35	29	24	20	17	13	12	10	9	7	6	5	5
	GALV	531	387	244	140	101	62	53	44	33	27	23	19	16	13	11	10	8	7	6	5	5

Table 310.15(B)(2)(g) Adjustment Factors for More Than Three Current-Carrying Conductors in a Raceway or Cable

Number of Current-Carrying Conductors	Percent of Values in Tables 310.16 through 310.19 as Adjusted for Ambient Temperature if Necessary
1-3	80
4-6	70
7-9	50
10-20	40
21-30	30
31-40	20
41 and above	15

TABLE 250.122: SIZING EQUIPMENT GROUNDING CONDUCTOR	
Overcurrent Device Rating	Copper Conductor
15A	14 AWG
20A	12 AWG
25A to 60A	10 AWG
75A to 100A	8 AWG
115A to 200A	6 AWG
225A to 300A	4 AWG
350A to 600A	3 AWG
600A to 800A	2 AWG
900A	1 AWG
100A to 1100A	1/0 AWG
1200A	2/0 AWG

Standard Ampere Ratings for Fuses and

Inverse Time Circuit Breakers

[Table 240.6(A)]

Standard Ampere Ratings				
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	6000	—	—	—

Calculating branch circuits, breaker size and wire size for continuous loads

Typical breaker Overcurrent Ratings . Overcurrent protection has provisions for opening a circuit to protect conductors and its related equipment from excessive heat [240-1 FPN]. If the current flowing through the protection device exceeds the device setting for a significant period, the protection device will open. The overcurrent rating of an overcurrent protection device is the actual ampere; such as 15, 20, or 30 ampere and the National Electrical Code list the standard sizes in Section 240-6(a). They include, but are not limited to: 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

1) Determine Full load or ampacity of circuit to be sized:

(EXAMPLE: 100 Amp continuous load)

2) Size OCPD(overcurrent protective device) to 125% of the calculated load Per article 210.20 (A)

(EXAMPLE: 100 Amps x 1.25 = 125 amps) This allows for a typical rise in current due to long run times

3) Determine appropriate size OCPD based on typical ratings per table 240.6 (A)

(EXAMPLE: 125 Amp OCPD per article 240.6 (A)

Even if using a typical 80 % rated breaker The 125 amp OCPD is still loaded within the 80% given a 100 Amp load (Example: $.80 \times 125 = 100$)

4) Determine appropriate wire size: we must size our wire based on the ampere rating of the OCPD. Use article 310.15.b.16 to look up conductor ampacity ratings

(EXAMPLE Using the 90 degree C column: #2 THHN rated to 130 amps)

Using the 75 degree C column: #1 THwn rated to 130 amps

Wire ampacity May exceed ampere rating of OCPD

