INSULATED CONDUCTORS

Information

Allowable Ampacities - Not More Than Three Conductors in Raceway or Cable or Direct Burial (Base on Ambient Temperature of 30°C, 86°F)

	Copper Conductors				Aluminum Conductors Copper-Clad Aluminum Conductors				
Size AWG/ MCM	60°C (140°F) Types RUW T TW UF*	75°C (167°F) Types FEPW RH RHW RUH THW THWN XHHW USE ZW*	85°C (185°F) Types V MI	90°C (194°F) Types TA, TBS SA, AVB SIS FEP FEPB RHH THHN XHHW†	60°C (140°F) Types RUW T TW UF	75°C (167°F) Types RH RHW RUH THW THWN XHHW USE*	85°C (185°F) Types V MI	90°C (194°F) Types TA, TBS SA, AVB SIS RHH THHN XHHW‡	Size AWG/ MCM
18	...	...	...	14	...	...	...	...	...
16	...	...	18	18	...	...	...	...	...
14	20*	20*	25	25*	...	...	...	...	...
12	25*	25*	30	30*	20*	20*	25	25*	12
10	30	35*	40	40*	25	30*	30	35*	10
8	40	50	55	55	30	40	40	45	8
6	55	65	70	75	40	50	55	60	6
4	70	85	95	95	55	65	75	75	4
3	85	100	110	110	65	75	85	85	3
2	95	115	125	130	75	90	100	100	2
1	110	130	145	150	85	100	110	115	1
0	125	150	165	170	100	120	130	135	0
00	145	175	190	195	115	135	145	150	00
000	165	200	215	225	130	155	170	175	000
0000	195	230	250	260	150	180	195	205	0000
250	215	255	275	290	170	205	220	230	250
300	240	285	310	320	190	230	250	255	300
350	260	310	340	350	210	250	270	280	350
400	280	335	365	380	225	270	295	305	400
500	320	380	415	430	260	310	335	350	500
600	355	420	460	475	285	340	370	385	600
700	385	460	500	520	310	375	405	420	700
750	400	475	515	535	320	385	420	435	750
800	410	490	535	555	330	395	430†	450	800
900	435	520	565	585	355	425	465	480	900
1000	455	545	590	615	375	445	485	500	1000
1250	495	590	640	665	405	485	525	545	1250
1500	520	625	680	705	435	520	565	585	1500
1750	545	650	705	735	455	545	595	615	1750
2000	560	665	725	750	470	560	610	630	2000

*Load current rating and overcurrent protection for conductor types shall not exceed 15A for 14 AWG, 20A for 12 AWG, 30A for 10 AWG copper; 15A for 12 AWG, 25A for 10 AWG aluminum and copper-clad aluminum.

†For FEP, FEPB, RHH, THHN, XHHW, load current rating and overcurrent protection for conductor types shall not exceed 15A for 14 AWG, 20A for 12 AWG, 30A for 10 AWG copper; 15A for 12 AWG, 25A for 10 AWG aluminum and copper-clad aluminum. XHHW for dry locations only. See 75°C for wet locations.

‡For RHH, THHN, XHHW, load current rating and overcurrent protection for conductor types shall not exceed 15A for 14 AWG, 20A for 12 AWG, 30A for 10 AWG copper; 15A for 12 AWG, 25A for 10 AWG aluminum and copper-clad aluminum. XHHW for dry locations only. See 75°C for wet locations.

Correction Factors For Ambient Temp. Over 30°C (86°F)

Temp. °C	Correction Factors	Correction Factors	Correction Factors	Correction Factors	Correction Factors	Correction Factors	Correction Factors	Correction Factors	Temp. °F
31-40	.85	.88	.90	.91	.82	.88	.90	.91	87-104
41-45	.71	.82	.85	.87	.71	.82	.85	.87	105-113
46-50	.58	.75	.80	.82	.58	.75	.80	.82	114-122
51-60		.58	.67	.71	...	.58	.67	.71	123-141
61-70		.35	.52	.58	...	.35	.52	.58	142-158
71-80			.30	.41	...	...	.30	.41	159-176

Complete Information Available on Request.

AC INDUCTION MOTORS

Three Phase - Information

hp	208V FLA	230V FLA	460V FLA	575V FLA
¼	1.11	.96	.48	.38
⅓	1.34	1.18	.59	.47
½	2.20	2.00	1.00	.80
¾	3.10	2.80	1.40	1.10
1	4.00	3.60	1.80	1.40
1½	5.70	5.20	2.60	2.10
2	7.50	6.80	3.40	2.70
3	10.60	9.60	4.80	3.90
5	16.70	15.20	7.60	6.10

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hp	208V FLA	230V FLA	460V FLA	575V FLA
7½	24.00	22.00	11.00	9.00
10	31.00	28.00	14.00	11.00
15	46.00	42.00	21.00	17.00
20	59.00	54.00	27.00	22.00
25	75.00	68.00	34.00	27.00
30	88.00	80.00	40.00	32.00
40	114.00	104.00	52.00	41.00
50	143.00	130.00	65.00	52.00
60	169.00	154.00	77.00	62.00
75	211.00	192.00	96.00	77.00
100	273.00	240.00	124.00	99.00
125	343.00	312.00	156.00	125.00
150	396.00	360.00	180.00	144.00
200		480.00	240.00	192.00
250		602.00	301.00	242.00
300			362.00	288.00
350			413.00	337.00
400			477.00	382.00
500			590.00	472.00

Complete Information Available on Request.

AC MOTORS

Single Phase - Information

hp	115V FLA	230V FLA
⅛	4.4	2.2
¼	5.8	2.9
⅓	7.2	3.6
½	9.8	4.9
¾	13.8	6.9
1	16.0	8.0
1½	20.0	10.0
2	24.0	12.0
3	34.0	17.0
5	56.0	28.0
7½	80.0	40.0
10	100.0	50.0

Complete Information Available on Request.

MOTORS

DC - Information

For full-load currents.

hp	120V FLA	240V FLA
¼	3.1	1.6
⅓	4.1	2.0
½	5.4	2.7
¾	7.6	3.8
1	9.5	4.7
1½	13.2	6.6
2	17.0	8.5
3	25.0	12.2
5	40.0	20.0
7½	48.0	29.0
10	76.0	38.0

Complete Information Available on Request.

MOTOR TRANSFORMERS

Information

kVA	120V FLA	240V FLA	480V FLA	600V FLA	2400V FLA	4160V FLA	4800V FLA
			Single Phase				
.25	2.08	1.04	.522	.417			
.50	4.17	2.08	1.040	.833			
.75	6.25	3.12	1.560	1.250			
1.00	8.33	4.17	2.080	1.670			
1.50	12.50	6.25	3.120	2.500			
2.00	16.66	8.33	4.170	3.330			

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kVA	120V FLA	240V FLA	480V FLA	600V FLA	2400V FLA	4160V FLA	4800V FLA
3.00	25.00	12.50	6.250	5.000	1.250	.722	.625
5.00	41.70	20.80	10.400	8.330	2.080	1.205	1.040
7.50	62.50	31.20	15.600	12.500	3.120	1.805	1.560
10.00	83.30	41.70	20.800	16.700	4.170	2.410	2.080
15.00	125.00	62.50	31.200	25.000	6.250	3.610	3.120
25.00	208.00	104.00	52.000	41.700	10.400	6.020	5.200
37.50	313.00	156.00	78.200	62.500	15.600	9.020	7.820
50.00	417.00	208.00	104.000	83.300	20.800	12.050	10.400
75.00	625.00	312.00	156.000	125.000	31.200	18.050	15.600
100.00	833.00	417.00	208.000	167.000	41.700	24.100	20.800
167.00	1390.00	695.00	348.000	278.500	69.500	40.200	34.800
200.00	1666.00	833.00	417.000	333.000	83.300	48.200	41.700
250.00	2080.00	1040.00	520.000	417.000	104.000	60.200	52.000
333.00	2770.00	1385.00	693.000	555.000	138.500	80.000	69.300
500.00	4160.00	2080.00	1040.000	833.000	208.000	120.400	104.000
			Three Phase				
3.00	8.33	7.22	3.610	2.810	.722	.417	.361
6.00	16.67	14.44	7.220	5.620	1.444	.833	.722
9.00	25.00	21.60	10.800	8.660	2.160	1.250	1.080
10.00	27.70	24.04	12.020	9.620	2.404	1.380	1.202
15.00	41.70	36.10	18.050	14.440	3.610	2.082	1.805
20.00	55.50	48.08	24.040	19.240	4.808	2.760	2.404
25.00	69.50	60.02	30.010	24.100	6.002	3.470	3.001
30.00	83.30	72.20	36.100	28.880	7.220	4.164	3.610
45.00	125.00	108.20	54.100	43.300	10.820	6.250	5.410
50.00	138.80	120.04	60.020	48.200	12.004	6.940	6.002
75.00	208.00	180.20	90.100	72.200	18.020	10.420	9.010
100.00	277.00	240.08	120.040	96.400	24.008	13.880	12.004
112.50	313.00	270.80	135.400	108.200	27.080	15.600	13.540
150.00	417.00	361.00	180.500	144.400	36.100	20.820	18.050
225.00	625.00	542.00	271.000	206.200	54.200	31.220	27.100
300.00	833.00	722.00	361.000	288.800	72.200	41.640	36.100
400.00	1110.00	960.00	480.000	385.000	96.000	55.500	48.000
500.00	1388.00	1200.40	600.200	482.000	120.040	69.400	60.020
750.00	2080.00	1802.00	901.000	722.000	180.200	104.200	90.100
1000.00	2770.00	2400.80	1200.400	964.000	240.080	138.800	120.040
1500.00	4170.00	3610.00	1805.000	1444.000	361.000	208.200	180.500

Complete Information Available on Request.

COPPER WIRE

Information

Minimum Size Copper Wire Required to Allow Not More Than 2% Voltage Drop On 110V Circuits for Distances Shown

Cap.	Length of Circuit in Feet (One Way)																	
Amps	20	30	40	50	60	70	80	90	100	120	140	160	180	200	240	280	320	360
1	..	...	...	...	...	...	...	...	...	...	...	...	...	...	14	14	14	14
1.5	..	...	...	...	...	...	...	...	...	...	...	14	14	14	14	14	12	12
2	..	...	...	...	...	...	...	...	...	14	14	14	14	14	12	12	12	10
3	..	...	...	...	...	...	14	14	14	14	14	12	12	12	10	10	10	8
4	..	...	...	...	14	14	14	14	14	12	12	12	10	10	10	8	8	8
5	..	...	...	14	14	14	14	12	12	12	10	10	10	10	8	8	8	6
6	..	...	14	14	14	14	12	12	12	10	10	10	8	8	8	8	6	6
7	..	14	14	14	14	12	12	12	10	10	10	8	8	8	6	6	6	6
8	..	14	14	14	12	12	12	10	10	10	8	8	8	8	6	6	6	5
9	...	14	14	12	12	12	10	10	10	8	8	8	8	6	6	6	5	5
10	14	14	14	12	12	10	10	10	10	8	8	8	6	6	6	5	5	4
12	14	14	12	12	10	10	10	8	8	8	8	6	6	6	5	5	4	4
14	14	14	12	12	10	10	10	8	8	8	8	6	6	6	5	5	4	4
16	14	12	12	10	10	8	8	8	8	6	6	6	5	5	4	3	3	2
18	12	12	10	10	8	8	8	8	6	6	6	5	5	4	4	3	2	2
20	12	12	10	10	8	8	8	6	6	6	5	5	4	4	3	2	2	1
25	10	10	10	8	8	6	6	6	6	5	4	4	3	3	2	1	1	0
30	8	8	8	8	6	6	6	6	5	4	4	3	3	2	1	1	0	0
35	8	8	8	6	6	6	5	5	4	4	3	2	2	1	1	0	00	00
40	6	6	6	6	6	5	5	4	4	3	2	2	1	1	0	00	00	00
45	6	6	6	6	6	5	4	4	3	3	2	1	1	0	00	00	000	000
50	6	6	6	6	5	4	4	3	3	2	1	1	0	0	00	000	000	0000
60	4	4	4	4	4	4	3	3	2	1	1	0	0	00	000	000	0000	0000
70	4	4	4	4	4	3	2	2	1	1	0	00	00	000	000	0000	0000	
80	3	3	3	3	3	2	2	1	1	0	00	00	000	000	0000	0000	.	
90	2	2	2	2	2	2	1	1	0	00	00	000	000	0000	0000	...	.	
100	1	1	1	1	1	1	1	0	0	00	000	000	0000	0000	...	...	.	

Minimum Size Copper Wire Required to Allow Not More Than 2% Voltage Drop On 220V Circuits for Distances Shown

Cap.	Length of Circuit in Feet (One Way)																	
Amps	20	30	40	50	60	70	80	90	100	120	140	160	180	200	240	280	320	360
1																	...	...
1.5															...	...	14	14
2												...	...	...	14	14	14	12
3										...	...	14	14	14	14	14	12	12
4										14	14	14	14	14	12	12	12	12
5										14	14	14	12	12	12	10	10	10

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Cap.	Length of Circuit in Feet (One Way)																	
Amps	20	30	40	50	60	70	80	90	100	120	140	160	180	200	240	280	320	360
6	...	...	...	...	...	...	14	14	14	14	14	12	12	12	10	10	10	8
7	...	...	...	...	...	14	14	14	14	14	12	12	12	10	10	10	8	8
8	...	...	...	...	14	14	14	14	14	12	12	12	10	10	10	8	8	8
9	...	...	...	...	14	14	14	14	12	12	12	10	10	10	8	8	8	8
10	...	...	...	14	14	14	14	12	12	12	10	10	10	10	8	8	8	8
12	...	...	14	14	14	14	12	12	12	10	10	10	8	8	8	8	6	6
14	...	14	14	14	14	12	12	12	10	10	10	8	8	8	6	6	6	6
16	...	12	12	12	12	12	12	10	10	10	8	8	8	8	6	6	6	6
18	...	12	12	12	12	12	10	10	10	8	8	8	8	6	6	6	5	5
20	12	12	12	12	12	10	10	10	10	8	8	8	6	6	6	5	5	4
25	10	10	10	10	10	10	10	8	8	8	6	6	6	6	5	4	4	3
30	8	8	8	8	8	8	8	8	8	6	6	6	6	5	4	4	3	3
35	8	8	8	8	8	8	8	8	6	6	6	5	5	4	4	3	2	2
40	6	6	6	6	6	6	6	6	6	6	5	5	4	4	3	2	2	1
45	6	6	6	6	6	6	6	6	6	6	5	4	4	3	3	2	1	1
50	6	6	6	6	6	6	6	6	6	5	4	4	3	3	2	1	1	0
60	4	4	4	4	4	4	4	4	4	4	4	3	3	2	1	1	0	0
70	4	4	4	4	4	4	4	4	4	4	3	2	2	1	1	0	00	00
80	3	3	3	3	3	3	3	3	3	3	2	2	1	1	0	00	00	000
90	2	2	2	2	2	2	2	2	2	2	2	1	1	0	00	00	000	000
100	1	1	1	1	1	1	1	1	1	1	1	1	0	0	00	000	000	0000

Complete Information Available on Request.

FLEXIBLE CORD

Round - Information

Sizes of Round Flexible Cord Types SO & SJO

AWG	Super-Cord-X	Amer-Clad	Security-Flex	Cornish	Plastic Wire	Tirex	Master	Bronco
				2 Conductors				
18 SO	.430	.390	.390	.390	.390	.390	.390	.390
18 SJO	.300	...	.310	.305	...	.310	.310	.300
16 SO	.460	.405	.410	.405	.400	.410	.410	.405
16 SJO	.330	.330	.330	.330	...	.330	.330	.330
14 SO	.590	.530	.530	.530	.530	.530	.550	.530
12 SO	.670	.605	.610	.600	.600	.600	.610	.605
10 SO	.710	.640	.660	.640	.650	.640	.650	.640
8 SO			.810	.800	.830			.810
6 SO			.930	.945	.940			.930
				3 Conductors				
18 SO	.450	.405	.410	.405	.400	.410	.410	.405
18 SJO	.330	...	.330	.335	...	.340	.340	.330
16 SO	.480	.430	.430	.430	.430	.430	.430	.430
16 SJO	.360	...	.360	.360	...	.360	.360	.360
14 SO	.610	.560	.560	.560	.560	.560	.580	.560
12 SO	.700	.635	.640	.635	.630	.640	.650	.640
10 SO	.750	.690	.700	.690	.690	.690	.700	.695
8 SO			.910	.850	.870			.910
6 SO			1.010	1.010	.990			1.010
				4 Conductors				
18 SO	.480	.435	.440	.435	.430	.440	.440	.435
18 SJO	...	...	.360	.360	...	.360	.370	.360
16 SO	.500	.485	.490	.485	.480	.490	.490	.485
16 SJO	...	...	.390	.390	...	.390	.410	.390
14 SO	.660	.605	.610	.605	.600	.610	.620	.605
12 SO	.760	.665	.690	.665	.680	.670	.690	.670
10 SO	.810	.745	.760	.745	.750	.750	.750	.750
8 SO			.990	.960	.980			.970
6 SO			1.100	1.130	1.110			1.100
				5 Conductors				
18 SO		.480	.500	.495	.480	.480	.500	.495
18 SJO		...	...	...	...	...	...	...
16 SO		.520	.530	.525	.510	.520	.540	.525
16 SJO		...	...	...	...	...	...	...
14 SO		.680	.690	.685	.640	.680	.710	.685
12 SO		.750	.750	.745	.730	.750	.790	.730
10 SO		.820	.820	.815	.790	.820	.830	.815
8 SO					1.040			1.080
6 SO					1.160			1.200

Complete Information Available on Request.

HEAVY WALL CONDUIT

Information

Nom. Trade Size In.	Nom. ID In.	Nom. OD In.	Nom. Wall Thick. In.	Lgth. w/o Couplings	Wt. Lbs.*
¼	.364	.540	.088	9′ 11½″	38.5
⅜	.493	.675	.091	9′ 11½″	51.5
½	.622	.840	.109	9′ 11¼″	79.0
¾	.824	1.050	.113	9′ 11¼″	105.0
1	1.049	1.315	.133	9′ 11″	153.0
1¼	1.380	1.660	.140	9′ 11″	201.0
1½	1.610	1.900	.145	9′ 11″	249.0
2	2.067	2.375	.154	9′ 11″	334.0
2½	2.469	2.875	.203	9′ 10½″	527.0
3	3.068	3.500	.216	9′ 10½″	690.0
3½	3.548	4.000	.226	9′ 10¼″	831.0
4	4.026	4.500	.237	9′ 10¼″	982.0
5	5.047	5.563	.258	9′ 10″	1344.0
6	6.065	6.625	.280	9′ 10″	1770.0

*Min. weight of 10 unit lengths with couplings attached.

Complete Information Available on Request.

TUBING

EMT - Information

Furnished in 10′ lengths. Applicable length tolerance - length ±¼″.

Trade Size In.	OD In.	Nom. ID In.	Nom. Wall Thick. In.	Nom. Wt./ 100′ Lbs.	Ft./ Bundle	Standard Lifts Ft.	Standard Lifts Wt. Lbs.
⅜	.577	.493	.042	23	200	....	....
½*	.706	.622	.042	30	100	7000	2100
¾*	.922	.824	.049	47	100	4000	1880
1*	1.163	1.049	.057	68	100	3000	2040
1¼†	1.510	1.380	.065	100	50	2000	2000
1½	1.740	1.610	.065	114	50	1750	1995
2	2.197	2.037	.065	147	30	1350	1985
2½‡	2.875	2.731	.072	230		450	1035
3‡	3.500	3.356	.072	270		380	1026
3½‡	4.000	3.834	.083	365		270	985
4‡	4.500	4.334	.083	400		220	880

*Furnished with knurled inside finish, INCH-MARKED and GUIDE-LINED.
†INCH-MARKED and GUIDE-LINED.
‡OD Size same as corresponding trade sizes of rigid conduit.

Complete Information Available on Request.

ELBOWS

EMT - Information

Elbow Size In.	Min. Rad. To Center Tubing In.	Nom. Offset In.	Min. Straight Lgth. In.*	Wt./ 100 Lbs.	Pkg. Qty.
		45°			
1	5.000	6.3125	5.250	92.5	25
1¼	5.500	6.8175	5.500	128.0	25
1½	6.875	6.9375	5.125	151.0	20
2	8.000	7.4375	6.000	231.0	10
2½	10.500	8.0249	7.000	410.0	1
3	13.000	9.1107	7.500	550.0	1
4	16.000	11.0500	9.000	980.0	
		90°			
1	5.750	7.8120	2.062	84.0	25
1¼	7.370	9.3750	2.000	144.0	25
1½	8.625	10.6250	2.000	195.0	20
2	9.500	12.3750	2.875	290.0	10
2½†	10.500	17.5000	7.000	540.0	1
3†	13.000	20.5000	7.500	790.0	1
4†	16.000	25.0000	9.000	1410.0	

*Ls at each end.
†Bent to same standards as in UL 6 for rigid conduit.

Complete Information Available on Request.

EXPANDED-END ELBOWS

EMT - Information

1/pkg.

Elbow Size In.	Min. Radius to Center Tubing In.	Nom. Offset In.	Min. Straight Lgth. In.*	Wt./ 100 Lbs.
		45°		
2½	10.5	8.0299	6.875	410
3	13.0	9.1107	7.375	550
4	16.0	11.0500	8.875	980
		90°		
2½	10.5	17.5000	6.875	540
3	13.0	20.5000	7.375	790
4	16.0	25.0000	8.875	1410

*Ls at each end.

Complete Information Available on Request.

FITTINGS

EMT

Include setscrews.

No.	UPC	Trade Size In.	Desc.	Nom. Lgth. In.	Nom. OD In.*	Nom. Wt./ 100 Lbs.	Pkg. Qty.
CG-250	.....	2½	Couing	8	3	163	5
CN-250	.....	2½	Connector	6	3 1/16	244	5
CG-300	.....	3	Coupling	9	3 21/32	216	5
CN-300	.....	3	Connector	6½	3 27/32	300	5
CG-400	.....	4	Coupling	11	4 1/16	328	1
CN-400	.....	4	Connector	7½	4 27/32	494	1

*For maximum clearance add ¼" for setscrew.

ENCLOSURES

Industry Standards - For Nonhazardous Locations - Information

National Electrical Manufacturers Association (NEMA Standard 250)

NEMA Type 1. Enclosures are intended for indoor use primarily to provide a degree of protection against contact with the enclosed equipment or locations where unusual service conditions do not exist.

NEMA Type 2. Enclosures are intended for indoor use primarily to provide a degree of protection against limited amounts of falling water and dirt.

NEMA Type 3. Enclosures are intended for outdoor use primarily to provide a degree of protection against windblown dust, rain, and sleet; undamaged by the formation of ice on the enclosure.

NEMA Type 3R. Enclosures are intended for outdoor use primarily to provide a degree of protection against falling rain and sleet; undamaged by the formation of ice on the enclosure.

NEMA Type 4. Enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against windblown dust and rain, splashing water, and hose-directed water; undamaged by the formation of ice on the enclosure.

NEMA Type 4X. Enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water, and hose-directed water; undamaged by the formation of ice on the enclosure.

NEMA Type 5. No NEMA equivalent.

NEMA Type 6. Enclosures are intended for use indoors or outdoors where occasional submersion is encountered.

NEMA Type 12. Enclosures are intended for indoor use primarily to provide a degree of protection against dust, falling dirt, and dripping noncorrosive liquids.

NEMA Type 13. Enclosures are intended for indoor use primarily to provide a degree of protection against dust, spraying of water, oil, and noncorrosive coolant.

Underwriters Laboratories Inc. (UL 50 and UL 508)

UL Type 1. Indoor use primarily to provide protection against contact with enclosed equipment and against limited amount of falling dirt.

UL Type 2. Indoor use to provide degree of protection against limited amounts of falling water and dirt.

UL Type 3. Outdoor use to provide a degree of protection against windblown dust and windblown rain; undamaged by the formation of ice on the enclosure.

UL Type 3R. Outdoor use to provide a degree of protection against falling rain; undamaged by the formation of ice on the enclosure.

UL Type 4. Either indoor or outdoor use to provide a degree of protection against falling rain, splashing water, and hose-directed water; undamaged by the formation of ice on the enclosure.

UL Type 4X. Either indoor or outdoor use to provide a degree of protection against falling rain, splashing water, and hose-directed water; undamaged by the formation of ice on the enclosure; resists corrosion.

UL Type 5. No UL equivalent.

UL Type 6. Indoor or outdoor use to provide a degree of protection against entry of water during temporary submersion at a limited depth; undamaged by the formation of ice on the enclosure.

UL Type 12. Indoor use to provide a degree of protection against dust, dirt fiber flyings, dripping water, and external condensation of noncorrosive liquids.

UL Type 13. Indoor use to provide a degree of protection against lint, dust seepage, external condensation and spraying of water, oil, and noncorrosive liquids.

Canadian Standards Association (Standard C22.2 Nos. 14, 40 and 94)

CSA Type 1. General purpose enclosure. Protects against accidental contact parts.

CSA Type 2. Indoor use and so constructed or protected that exposure to falling moisture will not impair the effectiveness of the enclosed equipment.

CSA Type 3. Outdoor use and so constructed or protected that exposure to the weather, to falling moisture, or to external splashing, will not impair the effectiveness of the enclosed equipment.

CSA Type 3R. No CSA equivalent.

CSA Type 4. Indoor or outdoor use and so constructed that a stream of water from a hose will not result in water entering the enclosing case.

CSA Type 4X. No CSA equivalent.

CSA Type 5. Indoor use and so constructed that dust cannot enter the enclosure; and accumulated dust will not result in temperatures exceeding specified values.

CSA Type 6. No CSA equivalent.

CSA Type 12. No CSA equivalent.

CSA Type 13. No CSA equivalent.

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Complete Information Available on Request.

MOTOR ENCLOSURES

Information

For Indoor Nonhazardous Locations

Environmental Condition	Type 1	Type 2	Type 4	Type 4X	Type 5	Type 6	Type 6P	Type 11	Type 12	Type 12K	Type 13
Incidental Contact w/Enclosure Equipment	X	X	X	X	X	X	X	X	X	X	X
Falling Dirt	X	X	X	X	X	X	X	X	X	X	X
Falling Liquids and Light Splashing		X	X	X	...	X	X	X	X	X	X
Dust, Lint, and Fibers		...	X	X	X	X	X		X	X	X
Hosedown and Splashing Water		...	X	X	...	X	X		...	...	...
Oil and Coolant Seepage									X	X	X
Oil or Coolant Spraying and Splashing				..			..	..			X
Corrosive Agents				X			X	X			
Occasional Temporary Submersion						X	X				
Occasional Prolonged Submersion							X				

For Outdoor Nonhazardous Locations

Environmental Condition	Type 3	Type 3R	Type 3S	Type 4	Type 4X	Type 6	Type 6P
Incidental Contact w/Enclosure Equipment	X	X	X	X	X	X	X
Rain, Snow, and Sleet*	X	X	X	X	X	X	X
Sleet†	...	...	X	...	...	...	...
Windblown Dust	X	...	X	X	X	X	X
Hosedown	...	...	...	X	X	X	X
Corrosive Agents	...	...	...	...	X	...	X
Occasional Temporary Submersion	...	...	...	...	...	X	X
Occasional Prolonged Submersion	...	...	...	...	...	...	X

*External operating mechanisms are not required to be operable for ice covered enclosures.

†External operating mechanisms are operable for ice covered enclosures.

Type 9 NEMA. Intended for use in indoor locations Class II, Groups E or G.

Type 9 UL. Intended for use in indoor locations Class II, Groups E or G.

Type 9 CSA. Intended for electrical equipment other than lighting fixtures. Use for hazardous locations Class II, Groups E, F and G.

For Hazardous Locations - NEMA/UL/IEC Compliance

Index of Protect. Rating	NEMA Encl. Type 1	NEMA Encl. Type 2	NEMA Encl. Type 3	NEMA Encl. Type 3R	NEMA Encl. Type 3S	NEMA Encl. Type 4	NEMA Encl. Type 4X	NEMA Encl. Type 6	NEMA Encl. Type 12	NEMA Encl. Type 13
IP10	X	X	X	X	X	X	X	X	X	X
IP20	X	X	X	X	X	X	X	X	X	X
IP21	X	X	X	X	X	X	X	X	X	X
IP22	X	X	X	X	X	X	X	X	X	X
IP23	X	X	X	X	X	X	X	X	X	X
IP30	...	X	X	X	X	X	X	X	X	X
IP31	...	...	X	X	X	X	X	X	X	X
IP32	...	...	X	X	X	X	X	X	X	X
IP33	...	...	X	...	X	X	X	X	X	X
IP40	...	...	X	...	X	X	X	X	X	X
IP41	...	...	X	...	X	X	X	X	X	X
IP42	...	...	X	...	X	X	X	X	X	X
IP43	...	...	X	...	X	X	X	X	X	X
IP50	...	...	X	...	X	X	X	X	X	X
IP51	...	...	X	...	X	X	X	X	X	X
IP52	...	...	X	...	X	X	X	X	X	X
IP53	...	...	X	...	X	X	X	X	X	X
IP54	...	...	X	...	X	X	X	X	X	X
IP55	...	...	X	...	X	X	X	X	X	X
IP58	...	...	X	...	X	X	X	X	X	X
IP60	...	...	X	...	X	X	X	X	X	X
IP61	...	...	X	...	X	X	X	X	X	X
IP62	...	...	X	...	X	X	X	X	X	X
IP63	...	...	X	...	X	X	X	X	X	X
IP64	...	...	X	...	X	X	X	X	X	X
IP65	...	...	...	...	...	X	X	X	X	X
IP66	...	...	...	...	...	X	X	X	.	
IP67	...	...	...	...	...	...	...	X	.	

Complete Information Available on Request.

HAZARDOUS LOCATIONS

Information

Hazardous locations are those areas where a potential for explosion and fire exist because of flammable gases, vapors or finely pulverized dusts in the atmosphere, or because of the presence of easily ignitable fibers or flyings. Hazardous locations may result from the normal processing of certain volatile chemicals, gases, grains, etc., or they may result from accidental failure of storage systems for these materials. It is also possible that a hazardous location may be created when volatile solvents or fluids, used in a normal maintenance routine, vaporize to form an explosive atmosphere.

Regardless of the cause of a hazardous location it is necessary that every precaution be taken to guard against ignition of the atmosphere.

Electrical Sources of Ignition. Energy required to touch off an explosion in a hazardous location atmosphere. Electrical equipment can be a source of this ignition energy. The normal operation of switches, circuit breakers, motor starters, contactors and plugs and receptacles release this energy in the form of arcs and sparks as contact open and close; making and breaking circuits. Electrical equipment such as lighting fixtures and motors are classified as heat producing, and they will become a source of ignition if they reach a surface temperature which exceeds the ignition temperature of the particular gas, vapor or dust in the atmosphere. It is also possible that an abnormality or failure in an electrical system could provide a source of ignition. A loose termination in a splice box or a loose lamp in a socket can be the source of both arcing and heat. The failure of insulation from cuts, nicks or aging can also act as an ignition source again from sparking, arcing and heat.

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Hazardous Locations and the National Electrical Code. The National Electrical Code treats installations in hazardous locations in articles 500 through 517. Each hazardous location can be classified by the definitions in the NEC. Following are interpretations of these classifications and applications.

Class I Locations. Flammable gases or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures.

Class I, Division 1. Hazardous atmosphere is expected to be present during normal operations. It may be present continuously, intermittently, periodically or during normal repair or maintenance operations. Division 1 locations are also those locations where a breakdown in the operation of processing equipment results in the release of hazardous vapors and the simultaneous failure of electrical equipment.

Class I, Division 2. Volatile flammable liquids or gases are handled, processed or used, but in which they will normally be confined within closed containers or closed systems from which they can escape only in the case of accidental rupture or breakdown of the containers or systems. The hazardous conditions will occur only under abnormal condition.

Class II Locations. Hazardous because of the presence of combustible dust.

Class II, Division 1. Combustible dust may be in suspension in the air under normal conditions in sufficient quantities to produce explosive or ignitable mixtures. This may occur continuously, intermittently or periodically. Division 1 locations also exist where failure or malfunction of machinery or equipment might cause a hazardous location to exist while providing a source of ignition with the simultaneous failure of electrical equipment. Included also are locations in which combustible dust of an electrically conductive nature may be present.

Class II, Division 2. Combustible dust will not normally be in suspension in the air and normal operations will not put the dust in suspension, but where accumulation of the dust may interfere with the safe dissipation of heat from electrical equipment or where accumulations near electrical equipment may be ignited by arcs, sparks or burning material from the equipment.

Class III Locations. Hazardous because of the presence of easily ignitable fibers or flyings, but in which the fibers or flyings are not likely to be in suspension in the air in quantities sufficient to produce ignitable mixtures.

Class III, Division 1. Easily ignitable fibers or materials producing combustible flyings are handled, manufactured or used.

Class III, Division 2. Easily ignitable fibers are stored or handled.

Complete Information Available on Request.

NATIONAL ELECTRICAL CODE

Information

Article 370 of the National Electrical Code® covers the installation and use of boxes. The Article includes table references that guide the electrician in the selection of proper size boxes necessary to safely accommodate electrical service requirements. The box capacity table is reproduced in part from the N.E.Code as a quick reference and guide. The N.E.Code should be consulted for complete details.

370-6. Number of Conductors in Switch, Outlet, Receptacle, Device, and Junction Boxes. Boxes shall be of sufficient size to provide free space for all conductors enclosed in the box.

The provisions of this section shall not apply to terminal housings supplied with motors. Boxes and conduit bodies containing conductors, size No. 4 or larger, shall also comply with the provisions of Section 370-18.

Metal Boxes

Box Dimension, In.	Cap.	Max. Number of Conductors				
Trade Size or Type	Cu. In.	No. 14	No. 12	No. 10	No. 8	No. 6
4×1¼ Round or Octagonal	12.5	6	5	5	4	0
4×1½ Round or Octagonal	15.5	7	6	6	5	0
4×2⅛ Round or Octagonal	21.5	10	9	8	7	0
4×1¼ Square	18.0	8	8	7	6	0
4×1½ Square	21.0	10	9	8	7	0
4×2⅛ Square	30.3	15	13	12	10	6*
4 11/16×1¼ Square	25.5	12	11	10	8	0
4 11/16×1½ Square	29.5	14	13	11	9	0
4 11/16×2⅛ Square	42.0	21	18	16	14	0
3×2×1½ Device	7.5	3	3	3	2	0
3×2×2 Device	10.0	5	4	4	3	0
3×2×2¼ Device	10.5	5	4	4	3	0
3×2×2½ Device	12.5	6	5	5	4	0
3×2×2¾ Device	14.0	7	6	5	4	0
3×2×3½ Device	18.0	9	8	7	6	0
4×2⅛×1½ Device	10.3	5	4	4	3	0
4×2⅛×1⅞ Device	13.0	6	5	5	4	0
4×2⅛×2⅛ Device	14.5	7	6	5	4	0
3¾×2×2½ Masonry Box/Gang	14.0	7	6	5	4	0
3¾×2×3½ Masonry Box/Gang	21.0	10	9	8	7	0
FS - Minimum Internal Depth 1¾ Single Cover/Gang	13.5	6	6	5	4	0
FD - Minimum Internal Depth 2⅜ Single Cover/Gang	18.0	9	8	7	6	3
FS - Minimum Internal Depth 1¾ Multiple Cover/Gang	18.0	9	8	7	6	0
FD - Minimum Internal Depth 2⅜ Multiple Cover/Gang	24.0	12	10	9	8	4

*Not to be used as a pull box. For termination only.

Volume Required per Conductor

Size of Conductor	Free Space Within Box for Each Conductor
No. 14	2 Cubic In.
No. 12	2.25 Cubic In.
No. 10	2.5 Cubic In.
No. 8	3 Cubic In.
No. 6	5 Cubic In.

Complete Information Available on Request.

ELECTRICAL SYMBOLS & ABBREVIATIONS

Information

In Accordance with American Standards Associations

CEILING WALL

GENERAL OUTLETS

- Outlet.
- Blanked Outlet.
- Drop Cord.
- Electrical Outlet; for use only when circle used alone might be confused with columns, plumbing symbols, etc.
- Fan Outlet.
- Junction Box.
- Lamp Holder.
- Lamp Holder with Pull Switch.
- Pull Switch.
- Outlet for Vapor Discharge Lamp.
- Exit Light Outlet.
- Clock Outlet. (Specify Voltage)

CONVENIENCE OUTLETS

- Duplex Convenience Outlet.
- Convenience Outlet other than Duplex. 1 = Single, 3 = Triplex, etc.
- Weatherproof convenience Outlet.
- Range Outlet.
- Switch and Convenience Outlet.
- Radio and Convenience Outlet.
- Special Purpose Outlet. (Des. in Spec.)
- Floor Outlet.

SWITCH OUTLETS

- S Single Pole Switch.
- S_2 Double Pole Switch.
- S_3 Three Way Switch.
- S_4 Four Way Switch.
- S_D Automatic Door Switch.
- S_E Electrolier Switch.
- S_K Key Operated Switch.
- S_P Switch and Pilot Lamp.
- S_{CB} Circuit Breaker.
- S_{WCB} Weatherproof Circuit Breaker.
- S_{MC} Momentary Contact Switch.
- S_{RC} Remote Control Switch.
- S_{WP} Weatherproof Switch.
- S_F Fused Switch.
- S_{WF} Weatherproof Fused Switch.

SPECIAL OUTLETS

$O_{a,b,c,etc}$
$\ominus_{a,b,c,etc}$
$S_{a,b,c,etc}$

Any Standard Symbol as given above with; the addition of a lower case subscript letter may be used to designate some special variation of Standard Equipment of particular interest in a specific set of Architectural Plans.

When used they must be listed in the key of Symbols on each drawing and if necessary further described in the specifications.

PANELS, CIRCUITS AND MISCELLANEOUS

- Lighting Panel.
- Power Panels.
- Branch Circuit; Concealed in Ceiling or Wall.
- Branch Circuit; Concealed in Floor.
- Branch Circuit; Exposed.
- Home Run to Panel Board. Indicate number of Circuits by number of arrows.
  Note: Any circuit without further designation indicates a two-wire circuit. For greater number of wires indicate as follows: ——— (3 wires), ——— (4 wires), etc.
- Feeders. Note: Use heavy lines and designate by number corresponding to listing in Feeder Schedule.
- Underfloor Duct and Junction Box. Triple System.
  Note: For double or single systems eliminate one or two lines. This symbol is equally adaptable to auxiliary system layouts.
- Generator.
- Motor.
- Instrument.
- Power Transformer. (Or draw to scale.)
- Controller.
- Isolating Switch.

AUXILIARY SYSTEMS

- Push Button.
- Buzzer.
- Bell.
- Annunciator.
- Outside Telephone.
- Interconnecting Telephone.
- Telephone Switchboard.
- Bell Ringing Transformer.
- Electric Door Opener.
- Fire Alarm Bell.
- Fire Alarm Station.
- City Fire Alarm Station.
- Fire Alarm Central Station.
- Automatic Fire Alarm Device.
- Watchman's Station.
- Watchman's Central Station.
- Horn.
- Nurse's Signal Plug.
- Maid's Signal Plug.
- Radio Outlet.
- Signal Central Station.
- Interconnection Box.
- Battery.
- Auxiliary System Circuits.
  Note: Any line without further designation indicates a 2-Wire System. For a greater number of wires designate with numerals in manner similar to — · — 12-No. 18 W-¾" C., or designate by number corresponding to listing in Schedule.
- $\square_{a,b,c}$ Special Auxiliary Outlets.
  Subscript letters refer to notes on plans or detailed description in specifications.

These symbols have been prepared by the American Standards Association Sectional Committee on Graphical Symbols and Abbreviations for Use on Drawings.

Complete Information Available on Request.

CIRCUIT PROTECTORS

Glossary of Terms - Information

Ampere. The measurement of intensity or rate of flow of electrons in an electric circuit. An ampere is the amount of current that will flow through a resistance of one ohm under a pressure or potential of one volt.

Ampere Rating. The current carrying capacity of a fuse. When a fuse is subjected to a current above its ampere rating, it will open the circuit after a predetermined period of time.

Ampere Squared Seconds, I^2t. The measure of heat energy developed within a circuit during the fuse's clearing. It can be expressed as "melting I^2t", "arcing I^2t" or the sum of them as "Clearing I^2t". "I" stands for effective let-through current (RMS), which is squared, and "t" stands for time of opening in seconds.

Arcing Time. The amount of time from the instant the fuse link has melted until the overcurrent is interrupted or cleared.

Cartridge Fuse. A fuse consisting of a current responsive element inside a fuse tube with terminal on both ends.

Class CC Fuses. 600V, 200,000 ampere interrupting rating, branch circuit fuses with overall dimensions of 13/32"×1½". Their design incorporates rejection

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feature that allows them to be inserted into rejection fuse holders and fuse blocks that reject all lower voltage, lower interrupting rating 13/32"x1½" fuses. They are available from 1/10 amp thru 30 amps.

Class G Fuses. 300V, 100,000 ampere interrupting rating branch circuit fuses that are size rejecting to eliminate overfusing. The fuse diameter is 13/32" while the length varies from 1 5/16" to 2¼". These are available in ratings from 1 amp thru 60 amps.

Class H Fuses. 250V and 600V, 10,000 ampere interrupting rating branch circuit fuses that may be renewable or nonrenewable. These are available in ampere ratings of 1 amp thru 600 amps. (See One-Time and Renewable fuses).

Class J Fuses. These fuses are rated to interrupt 200,000 amperes AC. They are UL Labelled as "Current Limiting", are rated for 600 volts AC and are not interchangeable with other classes.

Class K Fuses. These are fuses listed by UL as K-1, K-5 or K-9 fuses. Each subclass has designated I^2t and Ip maximums. These are dimensionally the same as Class H fuses, (NEC Dimensions) and they can have interrupting ratings of 50,000, 100,000 or 200,000 amps. These fuses are current limiting; however, they are not marked "current limiting" on their label since they do not have a rejection feature.

Class L Fuses. These fuses are rated for 601 through 6000 amperes, and are rated to interrupt 200,000 amperes, AC. They are labelled "Current Limiting" and are rated for 600 volts AC. They are intended to be bolted into their mounting and are not normally used in clips. Some Class L fuses have designed in time-delay features for all purpose use.

Class R Fuses. These are high performance ruses rated 1/10-600 amps in 250 volt and 600 volt ratings. All are marked "Current Limiting" on their label and all have a 200,000 amp interrupting rating. They have identical outline dimensions with the NEC fuses (Class H) but have a rejection feature which prevents the user from mounting a fuse of lesser capabilities (lower interrupting capacity) when used with special Class R clips. Class R fuses will fit into either rejection or nonrejection clips.

Class T Fuses. A UL Classification of fuses in 300 volt and 600 volt ratings from 1 amp through 1200 amps. They are physically very small and can be applied where space is at a premium. They are fast acting fuses, with an interrupting rating of 200,000 amps RMS.

Clearing Time. The total time between the beginning of the overcurrent and the final opening of the circuit at rated voltage by an overcurrent protective device. Clearing time is the total of the melting time and the arcing time.

Component Short Circuit Withstand Rating. The maximum short circuit current that a component or device is capable of carrying without requiring replacement because of extensive damage. (FPN): This definition shall not apply to overcurrent protective devices which are normally replaced after the performance of their duty.

Current Limitation. A fuse operation relating to short circuits only. When a fuse operates in its current limiting range, it will clear a short circuit in less than ½ cycle. Also, it will limit the instantaneous peak let-thru current to a value substantially less than that obtainable in the same circuit if that fuse were replaced with a solid conductor of equal impedance.

Dual Element Fuse. Fuse with a special design that utilizes two individual elements in series inside the fuse tube. One element, the spring actuated trigger assembly, operates on overloads up to 5-6 times the fuse current rating. The other element, the short circuit section, operates on short circuits up to their interrupting rating.

Electrical Load. That part of the electrical system which actually uses the energy or does the work required.

Fast Acting Fuse. A fuse which opens on overloads and short circuits very quickly. This type of fuse is not designed to withstand temporary overload currents associated with some electrical loads (inductive loads).

Fuse. An overcurrent protective device with a fusible link that operates and opens the circuit on an overcurrent condition.

High Speed Fuses. Fuses with no intentional time-delay in the overload range and designed to open as quickly as possible in the short circuit range. These fuses are often used to protect solid state devices.

Inductive Load. An electrical load which pulls a large amount of current--an inrush current--when first energized. After a few cycles or seconds the current "settles down" to the full load running current.

Interrupting Capacity. See Interrupting Rating.

Interrupting Rating. The rating which defines a fuse's ability to *safely* interrupt and clear short circuits. This rating is much greater than the ampere rating of a fuse. The NEC defines "Interrupting Rating" as "The highest current at rated voltage that a device is intended to interrupt under standard test conditions."

Melting Time. The amount of time required to melt the fuse link during a specified overcurrent. (See Arcing Time and Clearing Time).

NEC Dimensions. These are dimensions once referenced in the National Electric Code. They are common to Class H and K fuses and provide interchangeability between manufacturers for fuses and fusible equipment of given ampere and voltage ratings.

Ohm. The unit of measure for electric resistance. An ohm is the amount of resistance that will allow one ampere to flow under a pressure of one volt.

Ohm's Law. The relationship between electrical pressure, resistance and current flow in a circuit. E=IR.

One Time Fuses. Generic term used to describe a Class H nonrenewable cartridge fuse, with a single element.

Overcurrent. A condition which exists on an electrical circuit when the normal load current is exceeded. Overcurrents take on two separate characteristics--overloads and short circuits.

Overload. Can be classified as an overcurrent which exceeds the normal full load current of a circuit. Also characteristic of this type of overcurrent is that it does not leave the normal current carrying path of the circuit--that is, it flows from the source, through the conductors, through the load, back through the conductors, to the source again.

Peak Let-Thru Current, Ip. The instantaneous value of peak current let-thru by a current limiting fuse, when it operates in its current limiting range.

Renewable Fuse (600V & below). A fuse in which the element, typically a zinc link, may be replaced after the fuse has opened, and then reused. Renewable fuses are made to Class H standards.

Resistive Load. An electrical load which is characteristic of not having any significant inrush current. When a resistive load is energized, the current rises instantly to its steady state value, without first rising to a higher value.

R.M.S. Current. The effective value of an alternating current size wave which is calculated as the square root of the average of the squares of all the instantaneous values of the current throughout one cycle. R.M.S. alternating current is that value of an alternating current which produces the same heating effect as a given direct current value.

Semiconductor Fuses. Fuses used to protect solid state devices. See "High Speed Fuses".

Short Circuit. Can be classified as an overcurrent which exceeds the normal full load current of a circuit by a factor many times (tens, hundreds or thousands greater). Also characteristic of this type of overcurrent is that it leaves the normal current carrying path of the circuit--it takes a "short cut" around the load and back to the source.

Single Phasing. That condition which occurs when one phase of a three phase system opens, either in a low voltage (secondary) or high voltage (primary) distribution system. Primary or secondary single phasing can be caused by any number of events. This condition results in unbalanced loads in polyphase motors and, unless protective measures are taken, causes overheating and failure.

Threshold Current. The symmetrical R.M.S. available current at the threshold of the current limiting range, where the fuse becomes current limiting when tested to the UL Standard. This value can be read off of a peak let-thru chart where the fuse curve intersects the A-B line. A threshold ratio is the relationship of the threshold current to the fuse's continuous current rating.

Time-Delay Fuse. A fuse with a built in delay that allows temporary and harmless inrush currents to pass without opening, but is so designed to open on sustained overloads and short circuits.

UL Classes. Underwriter's Laboratories has developed basic physical specifications and electrical performance requirements for fuses with voltage ratings of 600 volts or less. These are known as UL Standards. If a type of fuse meets the requirements of a standard, it can fall into that UL Class. Typical UL Classes are K, RK1, RK5, G, L, H, T, CC, J.

Voltage Rating. The maximum value of system voltage in which a fuse can be used, yet safely interrupt an overcurrent. Exceeding the voltage rating of a fuse impairs its ability to clear an overload or short circuit safely.

Complete Information Available on Request.