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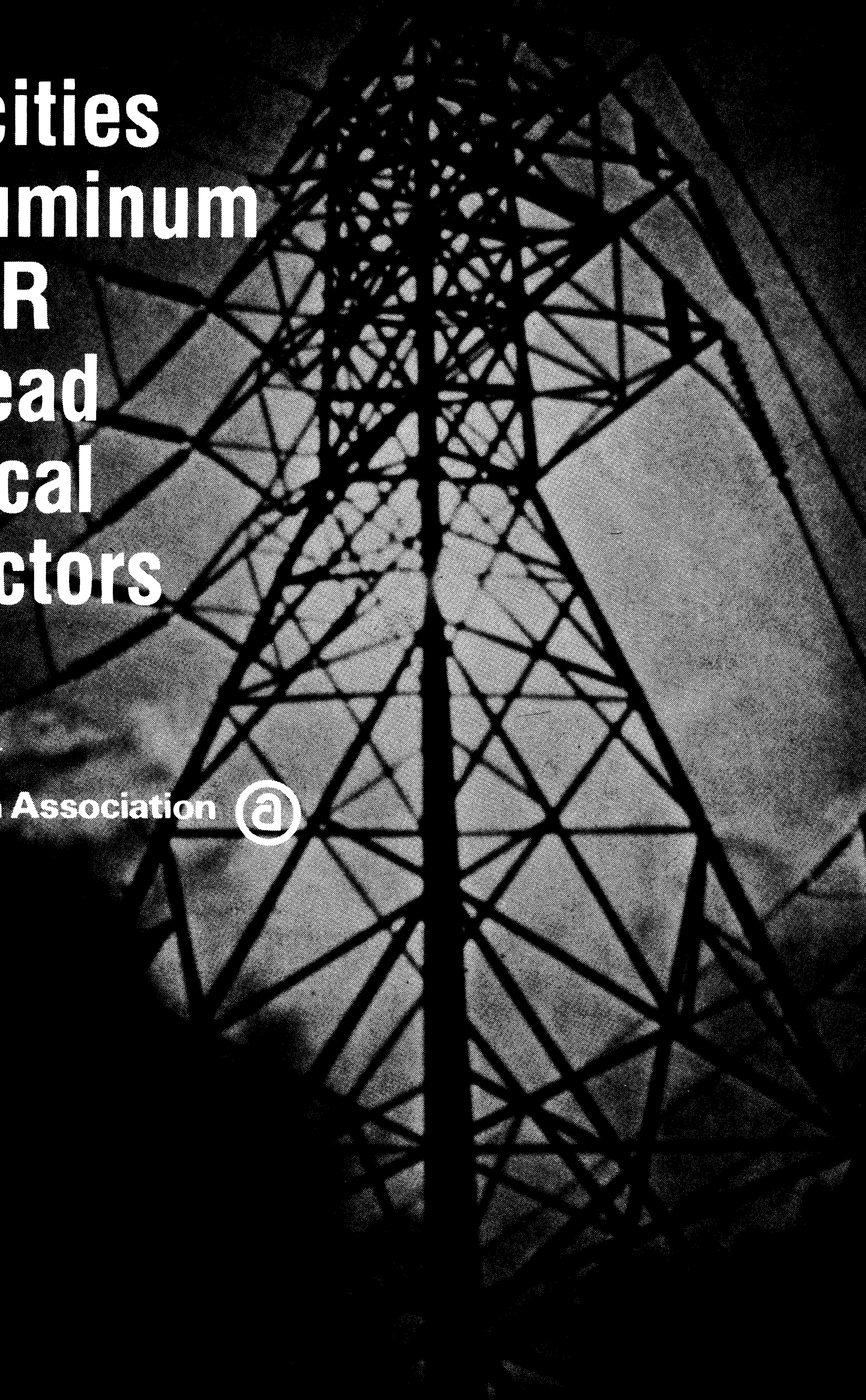
Ampacities for Aluminum & ACSR Overhead Electrical Conductors



the Aluminum Association
Incorporated

Ampacities for Aluminum & ACSR Overhead Electrical Conductors

$6.00

About the Aluminum Association

The Aluminum Association is an industry-wide trade organization representing over 82 companies including all the primary producers of aluminum in the United States, leading manufacturers of semi-fabricated aluminum products and principal foundries and smelters.

The Association's aims are to increase public and industrial understanding of aluminum and the aluminum industry and—through its technical, statistical and informational activities—to serve industries, consumers, financial analysts, educators, students, government agencies and the public generally.

For the aluminum industry and those industries that use aluminum, the Association helps develop standards and designation systems, helps prepare codes and specifications involving aluminum products and studies technical problems of the industry.

The Association maintains and periodically issues industry-wide statistics and records which are used as an authoritative source.

Association members also join together on a number of commodity and end-market committees to conduct industry-wide market development programs.

Use of the Information

All Aluminum Association publications are reviewed at least every five years and revised, reaffirmed or withdrawn. If in doubt, users are advised to contact the Aluminum Association to ascertain whether any information presented here has been superseded.

Ampacities for Aluminum and ACSR Overhead Electrical Conductors

Contents

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Foreword

This publication deals exclusively with overhead aluminum electrical conductors. It includes bare aluminum, aluminum alloys and ACSR, covered aluminum and ACSR and neutral supported secondary and service drop cable.

All tables give ampacity (current carrying capacity) values at normal operating temperatures under four sets of weather conditions. It will be noted that the 75 °C operating temperature is only exceeded in the case of mutiplex cables where the conductors are not under tension.

The ampacity values given are designated solely as a guide to the normal current carrying capacities of the conductors listed under the conditions as specified. In the case of bare and covered conductors, the relevant resistance and reactance values have also been included.

The basic conditions on which all the ampacity tables have been calculated are:

1. Conductivity, 1350-61.2%, 6201-52.5%, 5005-53.5% IACS; ACSR: 1350-61.2%, Steel 8% IACS, Aluminum clad steel 20.3%.
2. Thermal resistivity, 375 °C•cm/watt for both polyethylene and cross-linked polyethylene.
3. Conductor temperature, 75 °C (except XLP insulated duplex, triplex and quadruplex· also includes 90 °C).
4. Ambient temperature, 25 °C and 40 °C.
5. Wind velocity 2 ft/s.
6. Solar absorption, bare 0.5, covered or insulated 0.91.
7. Sun altitude at 12:00 noon, 83 °.
8. Azimuth of line, 270 °.
9. East-west line at latitude 30 ° N.
10. Elevation, sea level.
11. Azimuth of sun, 180 °.
12. Emissivity, bare 0.5, covered or insulated 0.91.

The values shown in the tables were based on the following reference works:

a. ''Standard for Calculation of Bare Overhead Conductor Temperature and Ampacity Under Steady-State Conditions'' ANSI/IEEE Std. 738-1986.
b. ''The Resistance and Reaction of ACSR'' by Lewis and Tuttle A.I.E.E. Transactions, Vol. 77, Part III, 1958.

TABLE 1 — AMPACITY FOR BARE 1350 ALUMINUM CONDUCTORS

			AMPACITY-amperes								RESISTANCE Ohms/Mile		REACTANCE AT 1' SPACING 60 Hz	
			25°C AMBIENT				40°C AMBIENT							
CODE WORD	SIZE AWG/kcmil	STRANDS	SUN NO WIND	NO SUN NO WIND	SUN WIND	NO SUN WIND	SUN NO WIND	NO SUN NO WIND	SUN WIND	NO SUN WIND	DC 20°C	AC 75°C	INDUCTIVE Ohms/Mile	CAPACITIVE Megohms-Mile
Peachbell	6	7	60	65	105	110	45	55	85	90	3.481	4.26	0.630	0.145
Rose	4	7	80	90	140	145	60	75	115	120	2.188	2.67	0.602	0.138
Ibis	2	7	110	125	185	195	85	105	150	165	1.374	1.68	0.574	0.131
Pansy	1	7	130	150	215	225	100	125	175	190	1.091	1.33	0.560	0.127
Poppy	1/0	7	155	175	245	260	115	145	200	220	0.8646	1.06	0.546	0.124
Aster	2/0	7	180	210	285	305	135	170	235	255	0.6856	0.838	0.532	0.120
Phlox	3/0	7	215	245	330	350	160	200	270	295	0.5441	0.665	0.518	0.117
Oxlip	4/0	7	250	290	380	410	185	235	310	345	0.4311	0.528	0.504	0.114
Sunflower	4/0	19	250	290	385	410	190	240	315	345	0.4316	0.528	0.497	0.113
Sneezewort	250	7	280	325	425	455	210	265	345	380	0.3650	0.447	0.493	0.111
Valerian	250	19	280	325	425	455	210	265	345	385	0.3651	0.447	0.487	0.111
Daisy	266.8	7	295	340	440	475	220	280	360	400	0.3418	0.419	0.489	0.110
Laurel	266.8	19	295	340	445	475	220	280	360	400	0.3421	0.419	0.483	0.110
Peony	300	19	320	370	480	515	240	305	390	430	0.3040	0.372	0.476	0.108
Tulip	336.4	19	345	400	515	555	260	330	415	465	0.2711	0.332	0.469	0.106
Daffodil	350	19	355	415	525	565	265	340	425	475	0.2609	0.320	0.466	0.106
Canna	397.5	19	385	450	570	615	290	370	460	515	0.2294	0.282	0.459	0.104
Goldentuft	450	19	420	495	615	665	315	405	500	560	0.2028	0.249	0.451	0.102
Cosmos	477	19	440	515	640	690	325	420	520	580	0.1914	0.235	0.448	0.101
Syringa	477	37	440	515	640	695	325	420	520	585	0.1915	0.235	0.446	0.101
Zinnia	500	19	455	530	655	710	335	435	530	600	0.1826	0.225	0.445	0.101
Hyacinth	500	37	455	530	655	715	335	435	530	600	0.1827	0.225	0.443	0.100
Dahlia	556.5	19	490	570	705	765	360	470	570	645	0.1641	0.202	0.438	0.0989
Mistletoe	556.5	37	490	575	705	765	365	470	570	645	0.1641	0.202	0.436	0.0988
Meadowsweet	600	37	515	605	735	800	380	495	595	675	0.1522	0.188	0.432	0.0977
Orchid	636	37	535	630	765	835	395	515	620	700	0.1435	0.177	0.428	0.0968
Hauchera	650	37	545	640	775	845	405	525	625	710	0.1405	0.173	0.427	0.0965
Verbena	700	37	570	675	810	885	425	555	655	745	0.1305	0.161	0.422	0.0954
Flag	700	61	570	675	810	885	425	555	655	745	0.1304	0.161	0.421	0.0954
Violet	715.5	37	580	685	820	900	430	560	665	755	0.1275	0.158	0.421	0.0951
Nasturtium	715.5	61	580	685	820	900	430	560	665	755	0.1276	0.158	0.420	0.0950
Petunia	750	37	600	705	845	925	445	580	685	780	0.1216	0.151	0.418	0.0944
Cattail	750	61	600	705	845	925	445	580	685	780	0.1217	0.151	0.417	0.0943
Arbutus	795	37	625	735	880	960	460	605	710	810	0.1148	0.142	0.415	0.0935
Lilac	795	61	625	735	880	960	460	605	710	810	0.1147	0.142	0.414	0.0935
Cockscomb	900	37	680	800	950	1040	500	660	765	875	0.1014	0.126	0.407	0.0917
Snapdragon	900	61	680	800	950	1040	500	660	765	875	0.1014	0.126	0.406	0.0916
Magnolia	954	37	700	830	980	1075	520	685	790	905	0.09563	0.120	0.403	0.0908
Goldenrod	954	61	705	835	985	1080	520	685	795	910	0.09560	0.119	0.403	0.0908
Hawkweed	1000	37	725	860	1010	1110	535	710	815	935	0.09126	0.114	0.401	0.0901
Camellia	1000	61	730	860	1010	1110	540	710	815	935	0.09132	0.114	0.400	0.0901
Bluebell	1033.5	37	740	880	1030	1130	550	725	830	955	0.08823	0.111	0.399	0.0896
Larkspur	1033.5	61	740	880	1030	1135	550	725	830	955	0.08826	0.111	0.398	0.0896
Marigold	1113	61	780	925	1080	1190	575	765	870	1000	0.08197	0.103	0.393	0.0885
Hawthorn	1192.5	61	815	970	1125	1240	600	800	905	1045	0.07655	0.0968	0.389	0.0875
Narcissus	1272	61	850	1015	1170	1290	630	835	940	1085	0.07175	0.0911	0.385	0.0865
Columbine	1351.5	61	885	1055	1210	1340	655	870	970	1130	0.06748	0.0861	0.381	0.0856
Carnation	1431	61	920	1095	1255	1390	680	905	1005	1170	0.06375	0.0817	0.378	0.0847
Gladiolus	1510.5	61	955	1135	1295	1435	700	935	1035	1210	0.06039	0.0778	0.375	0.0839
Coreopsis	1590	61	985	1175	1330	1480	725	970	1070	1245	0.05736	0.0743	0.372	0.0832
Jessamine	1750	61	1045	1250	1405	1565	770	1030	1125	1320	0.05214	0.0683	0.366	0.0818
Cowslip	2000	91	1135	1365	1515	1695	835	1125	1215	1425	0.04566	0.0609	0.357	0.0798
Sagebrush	2250	91	1215	1460	1610	1805	890	1205	1285	1520	0.04098	0.0557	0.350	0.0780
Lupine	2500	91	1295	1560	1705	1910	945	1285	1360	1610	0.03689	0.0512	0.344	0.0765
Bitterroot	2750	91	1370	1650	1790	2015	1000	1360	1430	1700	0.03353	0.0475	0.338	0.0750
Trillium	3000	127	1440	1735	1875	2110	1050	1430	1490	1780	0.03072	0.0445	0.332	0.0737
Bluebonnet	3500	127	1560	1890	2015	2280	1135	1555	1600	1920	0.02659	0.0402	0.323	0.0715

TABLE 2 — AMPACITY FOR BARE STRANDED 5005 ALUMINUM ALLOY CONDUCTORS

DESCRIPTION	AMBIENT TEMP. °C	AMPACITY Amperes				RESISTANCE Ohms/Mile		REACTANCE AT 1′ SPACING, 60 Hz	
		SUN NO WIND	NO SUN NO WIND	SUN WIND	NO SUN WIND	DC 20°C	AC 75°C	INDUCTIVE Ohms/Mile	CAPACITIVE Megohms-Mile
30.58 kcmil 7 Strand Kazoo	25	60	70	105	110	3.414	4.08	0.621	0.142
	40	45	55	90	95				
48.69 kcmil 7 Strand Kaki	25	85	95	145	150	2.144	2.56	0.593	0.135
	40	65	80	120	125				
77.47 kcmil 7 Strand Kench	25	120	135	190	205	1.348	1.61	0.564	0.128
	40	90	110	160	170				
123.3 kcmil 7 Strand Kibe	25	165	185	260	275	0.8470	1.01	0.536	0.122
	40	125	155	210	230				
155.4 kcmil 7 Strand Kayak	25	190	220	300	315	0.6718	0.803	0.522	0.118
	40	145	180	245	265				
195.7 kcmil 7 Strand Kopeck	25	225	260	345	370	0.5335	0.638	0.508	0.115
	40	170	210	280	310				
246.9 kcmil 7 Strand Kittle	25	265	305	400	425	0.4229	0.506	0.494	0.111
	40	195	250	325	360				
281.4 kcmil 19 Strand Ratch	25	290	335	435	465	0.3710	0.444	0.480	0.109
	40	215	275	355	390				
312.8 kcmil 19 Strand Ramie	25	310	360	465	500	0.3338	0.399	0.473	0.107
	40	230	295	375	420				
355.1 kcmil 19 Strand Radar	25	340	395	500	540	0.2940	0.352	0.465	0.106
	40	255	325	410	455				
394.5 kcmil 19 Strand Radian	25	365	425	535	580	0.2646	0.317	0.459	0.104
	40	270	350	435	485				
419.6 kcmil 19 Strand Rede	25	380	445	560	605	0.2488	0.296	0.455	0.103
	40	285	365	450	505				
465.4 kcmil 19 Strand Ragout	25	410	480	595	645	0.2244	0.269	0.449	0.101
	40	305	390	480	540				
503.6 kcmil 19 Strand Rex	25	430	505	625	680	0.2073	0.249	0.444	0.100
	40	320	415	505	570				
559.5 kcmil 19 Strand Remex	25	465	545	670	725	0.1866	0.224	0.438	0.0988
	40	345	445	540	610				
587.2 kcmil 19 Strand Ruble	25	480	560	690	750	0.1778	0.214	0.435	0.0981
	40	355	460	555	630				
652.4 kcmil 19 Strand Rune	25	515	605	735	800	0.1600	0.193	0.429	0.0965
	40	380	495	595	675				
740.8 kcmil 37 Strand Spar	25	560	665	795	870	0.1409	0.170	0.419	0.0946
	40	415	545	645	730				
927.2 kcmil 37 Strand Solar	25	655	775	915	1000	0.1126	0.137	0.405	0.0912
	40	485	635	735	845				

TABLE 3 — AMPACITIES FOR BARE STRANDED 6201 ALUMINUM ALLOY CONDUCTORS

DESCRIPTION	AMBIENT TEMP. °C	AMPACITY Amperes				RESISTANCE Ohms/Mile		REACTANCE AT 1′ SPACING, 60 Hz	
		SUN NO WIND	NO SUN NO WIND	SUN WIND	NO SUN WIND	DC 20°C	AC 75°C	INDUCTIVE Ohms/Mile	CAPACITIVE Megohms-Mile
30.58 kcmil 7 Strand Akron	25	60	70	105	110	3.479	4.14	0.621	0.142
	40	45	55	90	95				
48.69 kcmil 7 Strand Alton	25	85	95	145	150	2.185	2.60	0.593	0.135
	40	65	80	115	125				
77.47 kcmil 7 Strand Ames	25	115	135	190	200	1.373	1.64	0.564	0.128
	40	90	110	155	170				
123.3 kcmil 7 Strand Azusa	25	160	185	255	270	0.8631	1.03	0.536	0.122
	40	120	150	210	225				
155.4 kcmil 7 Strand Anaheim	25	190	220	295	315	0.6846	0.816	0.522	0.118
	40	140	180	240	265				
195.7 kcmil 7 Strand Amherst	25	220	255	340	365	0.5437	0.648	0.508	0.115
	40	165	210	280	305				
246.9 kcmil 7 Strand Alliance	25	260	300	395	425	0.4309	0.514	0.494	0.111
	40	195	245	320	355				
281.4 kcmil 19 Strand Alliance	25	285	335	430	460	0.3781	0.451	0.480	0.109
	40	215	275	350	390				
312.8 kcmil 19 Strand Butte	25	310	360	460	495	0.3402	0.406	0.473	0.107
	40	230	295	375	415				
355.1 kcmil 19 Strand Butte	25	335	390	500	535	0.2996	0.358	0.465	0.106
	40	250	320	405	450				
394.5 kcmil 19 Strand Canton	25	360	420	530	575	0.2697	0.322	0.459	0.104
	40	270	345	430	485				
419.6 kcmil 19 Strand Canton	25	375	440	555	600	0.2536	0.303	0.455	0.103
	40	280	360	450	505				
465.4 kcmil 19 Strand Cairo	25	405	475	590	640	0.2286	0.273	0.449	0.101
	40	300	390	480	540				
503.6 kcmil 19 Strand Cairo	25	425	500	620	670	0.2113	0.253	0.444	0.100
	40	320	410	500	565				
559.5 kcmil 19 Strand Darien	25	460	540	660	720	0.1902	0.228	0.438	0.0988
	40	340	445	535	605				
587.2 kcmil 19 Strand Darien	25	475	560	685	745	0.1812	0.217	0.435	0.0981
	40	355	460	550	625				
652.4 kcmil 19 Strand Elgin	25	510	600	730	795	0.1631	0.196	0.429	0.0965
	40	380	495	590	670				
740.8 kcmil 37 Strand Flint	25	555	655	790	860	0.1436	0.173	0.419	0.0946
	40	415	540	635	725				
927.2 kcmil 37 Strand Greely	25	650	770	905	995	0.1148	0.139	0.405	0.0912
	40	480	630	730	840				

TABLE 4 — AMPACITY FOR BARE ACSR CONDUCTORS

CODE WORD	SIZE AWG/kcmil	STRANDS AL/STEEL	AMPACITY-amperes, 25°C AMBIENT: SUN NO WIND	25°C AMBIENT: NO SUN NO WIND	25°C AMBIENT: SUN WIND	25°C AMBIENT: NO SUN WIND	40°C AMBIENT: SUN NO WIND	40°C AMBIENT: NO SUN NO WIND	40°C AMBIENT: SUN WIND	40°C AMBIENT: NO SUN WIND	RESISTANCE Ohms/Mile: DC 20°C	RESISTANCE Ohms/Mile: AC* 75°C	REACTANCE AT 1' SPACING 60 Hz: INDUCTIVE* Ohms/Mile	REACTANCE AT 1' SPACING 60 Hz: CAPACITIVE Megohms-Mile
Turkey	6	6/1	60	70	105	110	45	55	85	90	3.389	4.32	0.776	0.142
Swan	4	6/1	80	95	140	145	65	75	115	120	2.129	2.76	0.723	0.135
Swanate	4	7/1	85	95	140	145	65	75	115	120	2.108	2.80	0.744	0.135
Sparrow	2	6/1	110	130	185	195	85	105	150	160	1.338	1.78	0.670	0.129
Sparate	2	7/1	115	130	185	195	85	105	150	160	1.323	1.80	0.681	0.128
Robin	1	6/1	130	150	210	225	100	120	170	185	1.062	1.43	0.644	0.125
Raven	1/0	6/1	155	175	240	255	115	145	200	215	0.8410	1.15	0.623	0.122
Quail	2/0	6/1	175	205	275	295	135	165	225	245	0.6679	0.935	0.601	0.118
Pigeon	3/0	6/1	205	235	315	340	155	195	260	285	0.5297	0.755	0.580	0.115
Penguin	4/0	6/1	240	275	360	385	180	225	295	325	0.4199	0.618	0.554	0.111
Waxwing	266.8	18/1	300	345	450	480	225	285	365	405	0.3398	0.416	0.477	0.109
Partridge	266.8	26/7	305	355	455	490	230	290	370	415	0.3364	0.411	0.465	0.107
Ostrich	300	26/7	330	385	490	530	250	315	400	445	0.2993	0.366	0.458	0.106
Merlin	336.4	18/1	350	410	520	560	260	335	420	470	0.2693	0.330	0.463	0.106
Linnet	336.4	26/7	360	420	530	570	265	345	430	480	0.2671	0.327	0.451	0.104
Oriole	336.4	26/7	365	425	535	580	270	350	435	485	0.2650	0.324	0.445	0.103
Chickadee	397.5	18/1	395	460	575	625	295	375	470	525	0.2279	0.279	0.452	0.103
Brant	397.5	24/7	400	465	585	630	300	385	475	530	0.2268	0.278	0.444	0.102
Ibis	397.5	26/7	405	470	585	635	300	385	475	535	0.2260	0.277	0.441	0.102
Lark	397.5	30/7	410	480	595	645	305	395	480	540	0.2243	0.274	0.435	0.101
Pelican	477	18/1	445	520	645	700	330	430	525	590	0.1899	0.233	0.441	0.100
Flicker	477	24/7	455	530	655	710	335	435	530	600	0.1889	0.232	0.432	0.0992
Hawk	477	26/7	455	535	660	715	340	440	530	600	0.1883	0.231	0.430	0.0988
Hen	477	30/7	465	545	665	725	345	445	540	610	0.1869	0.299	0.424	0.0980
Osprey	556.5	18/1	495	580	710	775	370	480	575	650	0.1629	0.200	0.432	0.0981
Parakeet	556.5	24/7	505	590	720	785	375	485	580	660	0.1620	0.199	0.423	0.0969
Dove	556.5	26/7	510	595	725	790	375	490	585	665	0.1613	0.198	0.420	0.0965
Eagle	556.5	30/7	515	605	735	800	385	500	595	675	0.1602	0.196	0.415	0.0957
Peacock	605	24/7	535	630	760	830	395	515	615	700	0.1490	0.183	0.418	0.0957
Squab	605	26/7	540	635	765	835	400	520	615	700	0.1485	0.182	0.415	0.0953
Wood Duck	605	30/7	545	645	770	845	405	530	625	710	0.1474	0.181	0.410	0.0944
Teal	605	30/19	545	645	770	845	405	530	625	710	0.1475	0.181	0.410	0.0944
Kingbird	636	18/1	545	640	775	845	405	525	625	710	0.1424	0.175	0.424	0.0961
Rook	636	24/7	555	650	785	855	410	535	635	720	0.1417	0.174	0.415	0.0950
Grosbeak	636	26/7	555	655	790	860	415	540	635	725	0.1411	0.173	0.412	0.0946
Scoter	636	30/7	565	665	795	870	420	550	645	735	0.1402	0.172	0.406	0.0937
Egret	636	30/19	565	665	795	870	420	550	645	735	0.1403	0.172	0.406	0.0937
Swift	636	36/1	540	635	770	840	400	520	620	705	0.1430	0.176	0.425	0.0964
Flamingo	666	24/7	570	675	810	885	425	555	650	745	0.1352	0.166	0.412	0.0943
Gannet	666.6	26/7	575	680	815	890	425	560	655	750	0.1347	0.165	0.409	0.0939
Stilt	715.5	24/7	600	705	845	925	445	580	680	775	0.1260	0.155	0.408	0.0932
Starling	715.5	26/7	605	715	850	930	445	585	685	785	0.1254	0.154	0.405	0.0928
Redwing	715.5	30/19	615	725	860	940	455	595	690	795	0.1248	0.153	0.399	0.0920
Cuckoo	795	24/7	645	760	900	985	475	625	725	830	0.1134	0.140	0.402	0.0917
Drake	795	26/7	650	770	905	995	480	630	730	840	0.1129	0.139	0.399	0.0912
Mallard	795	30/19	660	780	915	1005	485	640	740	850	0.1122	0.138	0.393	0.0904
Coot	795	36/1	625	740	880	965	465	610	710	815	0.1144	0.142	0.411	0.0931
Tern	795	45/7	630	745	885	970	465	615	715	820	0.1143	0.141	0.406	0.0925
Condor	795	54/7	640	755	895	980	475	625	720	825	0.1135	0.140	0.401	0.0917
Ruddy	900	45/7	685	815	955	1050	510	670	770	885	0.1010	0.125	0.399	0.0906
Canary	900	54/7	695	825	965	1065	515	680	780	895	0.1002	0.124	0.393	0.0898
Catbird	954	36/1	710	840	985	1085	525	690	795	915	0.09530	0.119	0.400	0.0904
Rail	954	45/7	715	845	990	1090	530	695	800	920	0.09520	0.118	0.395	0.0897
Cardinal	954	54/7	725	860	1005	1105	535	710	810	930	0.09452	0.117	0.389	0.0890
Tanager	1033.5	36/1	750	890	1040	1140	555	730	835	960	0.08802	0.110	0.395	0.0892
Ortolan	1033.5	45/7	750	890	1040	1145	555	735	835	965	0.08798	0.110	0.390	0.0886
Curlew	1033.5	54/7	765	910	1055	1165	565	750	850	980	0.08728	0.108	0.385	0.0878
Bluejay	1113	45/7	790	940	1090	1200	585	775	875	1015	0.08161	0.102	0.386	0.0874
Finch	1113	54/19	805	955	1100	1220	595	785	885	1025	0.08138	0.101	0.380	0.0867
Bunting	1192.5	45/7	830	985	1135	1255	610	810	915	1060	0.07619	0.0954	0.382	0.0864
Grackle	1192.5	54/19	840	1000	1150	1270	620	825	925	1070	0.07600	0.0947	0.376	0.0856
Skylark	1272	36/1	860	1025	1175	1300	635	840	945	1095	0.07146	0.0904	0.383	0.0861
Bittern	1272	45/7	865	1030	1180	1305	640	850	950	1100	0.07146	0.0898	0.378	0.0855
Pheasant	1272	54/19	880	1050	1195	1325	645	860	960	1115	0.07122	0.0890	0.372	0.0847
Dipper	1351.5	45/7	900	1075	1225	1360	665	885	985	1145	0.06724	0.0848	0.374	0.0846
Martin	1351.5	54/19	915	1090	1240	1375	675	900	995	1160	0.06706	0.0840	0.368	0.0838
Bobolink	1431	45/7	935	1115	1270	1405	690	920	1020	1185	0.06352	0.0804	0.371	0.0837
Plover	1431	54/19	950	1135	1285	1425	700	935	1030	1200	0.06332	0.0796	0.365	0.0829
Nuthatch	1510.5	45/7	970	1160	1310	1455	715	955	1050	1225	0.06017	0.0765	0.367	0.0829
Parrot	1510.5	54/19	985	1175	1325	1475	725	970	1060	1245	0.06003	0.0757	0.362	0.0821
Lapwing	1590	45/7	1005	1200	1350	1500	740	990	1080	1265	0.05714	0.0729	0.364	0.0822
Falcon	1590	54/19	1020	1220	1370	1525	750	1005	1095	1285	0.05699	0.0721	0.358	0.0814
Chukar	1780	84/19	1085	1300	1455	1620	795	1070	1160	1365	0.05119	0.0658	0.355	0.0803
Bluebird	2156	84/19	1225	1475	1620	1815	900	1215	1295	1530	0.04229	0.0555	0.344	0.0775
Kiwi	2167	72/7	1215	1455	1605	1795	890	1200	1280	1515	0.04228	0.0562	0.348	0.0779
Thrasher	2312	76/19	1270	1525	1670	1875	930	1255	1335	1580	0.03958	0.0529	0.342	0.0768
Joree	2515	76/19	1335	1610	1750	1970	975	1325	1395	1660	0.03638	0.0493	0.337	0.0755

* AC Resistance and Inductance of single layer ACSR is given for 25°C ambient ampacity with no sun and no wind.
AC Resistance of three layer ACSR is with no correction for current density.

TABLE 5 — AMPACITY FOR BARE ACSR/AW CONDUCTORS

CODE WORD	SIZE AWG/kcmil	STRANDS AL/AW	AMPACITY-amperes 25°C AMBIENT SUN NO WIND	NO SUN NO WIND	SUN WIND	NO SUN WIND	40°C AMBIENT SUN NO WIND	NO SUN NO WIND	SUN WIND	NO SUN WIND	RESISTANCE Ohms/Mile DC 20°C	AC* 75°C	REACTANCE AT 1' SPACING 60 Hz INDUCTIVE Ohms/Mile	CAPACITIVE Megohms-Mile
Waxwing/AW	266.8	18/1	300	350	450	485	225	285	365	405	0.3360	0.411	0.477	0.109
Partridge/AW	266.8	26/7	310	360	465	500	230	295	380	420	0.3257	0.398	0.465	0.107
Ostrich/AW	300	26/7	335	395	500	540	250	320	405	455	0.2898	0.354	0.458	0.106
Merlin/AW	336.4	18/1	350	410	520	565	265	335	425	475	0.2663	0.326	0.463	0.106
Linnet/AW	336.4	26/7	365	425	535	580	270	350	435	490	0.2586	0.316	0.451	0.104
Oriole/AW	336.4	26/7	375	435	545	590	280	360	445	500	0.2532	0.309	0.445	0.103
Chicadee/AW	397.5	18/1	395	460	580	625	295	380	470	525	0.2254	0.276	0.452	0.103
Brant/AW	397.5	24/7	405	475	590	640	300	390	480	540	0.2210	0.271	0.444	0.102
Ibis/AW	397.5	26/7	410	480	595	645	305	395	485	545	0.2188	0.268	0.441	0.102
Lark/AW	397.5	30/7	420	490	605	660	310	400	490	555	0.2143	0.262	0.435	0.101
Pelican/AW	477	18/1	450	525	650	705	335	430	530	595	0.1878	0.229	0.441	0.100
Flicker/AW	477	24/7	460	540	660	720	340	440	535	605	0.1841	0.226	0.432	0.0992
Hawk/AW	477	26/7	465	545	670	725	345	450	540	610	0.1823	0.223	0.430	0.0988
Hen/AW	477	30/7	475	555	680	740	350	455	550	625	0.1786	0.219	0.424	0.0980
Osprey/AW	556.5	18/1	500	585	715	780	370	480	580	655	0.1610	0.198	0.432	0.0981
Parakeet/AW	556.5	24/7	510	600	730	795	380	495	590	670	0.1578	0.194	0.423	0.0969
Dove/AW	556.5	26/7	515	605	735	800	385	500	595	675	0.1562	0.192	0.420	0.0965
Eagle/AW	556.5	30/7	525	620	750	820	390	510	605	690	0.1531	0.188	0.415	0.0957
Peacock/AW	605	24/7	540	635	770	840	400	525	620	705	0.1451	0.178	0.418	0.0957
Squab/AW	605	26/7	545	645	775	850	405	530	630	715	0.1464	0.176	0.415	0.0953
Wood Duck/AW	605	30/7	560	660	790	865	415	540	640	725	0.1408	0.173	0.410	0.0944
Teal/AW	605	30/19	560	660	790	865	415	540	640	725	0.1411	0.173	0.410	0.0944
Kingbird/AW	636	18/1	545	640	775	845	405	525	625	710	0.1408	0.174	0.424	0.0961
Rook/AW	636	24/7	560	660	795	865	415	540	640	730	0.1381	0.170	0.415	0.0950
Grosbeak/AW	636	26/7	565	665	800	875	420	550	645	735	0.1366	0.168	0.412	0.0946
Scoter/AW	636	30/7	580	685	815	895	430	560	660	750	0.1339	0.164	0.406	0.0937
Egret/AW	636	30/19	575	680	815	890	425	560	655	750	0.1342	0.165	0.406	0.0937
Swift/AW	636	36/1	540	635	770	840	400	525	625	710	0.1422	0.175	0.425	0.0964
Flamingo/AW	666	24/7	580	680	815	895	430	560	660	750	0.1317	0.162	0.412	0.0943
Gannet/AW	666.6	26/7	585	690	825	905	435	565	665	760	0.1304	0.160	0.409	0.0939
Stilt/AW	715.5	24/7	605	715	855	935	450	590	690	790	0.1227	0.151	0.408	0.0932
Starling/AW	715.5	26/7	615	725	865	945	455	595	695	795	0.1215	0.149	0.405	0.0928
Redwing/AW	715.5	30/19	625	740	875	960	465	610	705	810	0.1193	0.147	0.399	0.0920
Cuckoo/AW	795	24/7	655	770	915	1000	485	635	735	845	0.1105	0.136	0.402	0.0917
Drake/AW	795	26/7	660	780	920	1010	485	640	740	850	0.1093	0.135	0.399	0.0912
Mallard/AW	795	30/19	675	795	935	1030	500	655	755	865	0.1073	0.132	0.393	0.0904
Coot/AW	795	36/1	630	745	885	970	465	610	715	815	0.1137	0.141	0.411	0.0931
Tern/AW	795	45/7	635	750	890	980	470	620	720	825	0.1127	0.139	0.406	0.0925
Condor/AW	795	54/7	650	770	910	995	480	630	735	840	0.1104	0.136	0.401	0.0917
Ruddy/AW	900	45/7	690	820	965	1060	510	675	775	890	0.09958	0.123	0.399	0.0906
Canary/AW	900	54/7	705	835	980	1075	520	685	790	905	0.09763	0.121	0.393	0.0898
Catbird/AW	954	36/1	710	845	990	1090	525	695	800	915	0.09476	0.118	0.400	0.0904
Rail/AW	954	45/7	720	850	995	1095	530	700	805	925	0.09393	0.117	0.395	0.0897
Cardinal/AW	954	54/7	735	870	1015	1120	545	715	820	945	0.09208	0.114	0.389	0.0890
Tanager/AW	1033.5	36/1	750	890	1040	1145	555	735	840	965	0.08752	0.109	0.395	0.0892
Ortolan/AW	1033.5	45/7	760	900	1050	1155	560	740	845	975	0.08664	0.108	0.390	0.0886
Curlew/AW	1033.5	54/7	780	925	1070	1180	575	760	860	995	0.08496	0.105	0.385	0.0878
Bluejay/AW	1113	45/7	795	945	1095	1210	585	780	880	1020	0.08047	0.101	0.386	0.0874
Finch/AW	1113	54/19	815	965	1115	1230	600	795	895	1040	0.07936	0.0987	0.380	0.0867
Bunting/AW	1192.5	45/7	835	995	1145	1265	615	815	920	1065	0.07513	0.0942	0.382	0.0864
Grackle/AW	1192.5	54/19	850	1015	1165	1285	630	835	935	1085	0.07408	0.0924	0.376	0.0856
Skylark/AW	1272	36/1	860	1025	1180	1305	635	845	950	1100	0.07106	0.0899	0.383	0.0861
Bittern/AW	1272	45/7	870	1040	1190	1315	640	855	955	1110	0.07049	0.0886	0.378	0.0855
Pheasant/AW	1272	54/19	890	1060	1210	1340	655	870	970	1130	0.06943	0.0870	0.372	0.0847
Dipper/AW	1351.5	45/7	910	1080	1235	1365	670	890	990	1150	0.06632	0.0837	0.374	0.0846
Martin/AW	1351.5	54/19	925	1105	1255	1390	680	910	1005	1175	0.06537	0.0821	0.368	0.0838
Bobolink/AW	1431	45/7	940	1125	1275	1415	695	925	1025	1195	0.06262	0.0794	0.371	0.0837
Plover/AW	1431	54/19	960	1150	1300	1445	710	945	1040	1215	0.06172	0.0777	0.365	0.0829
Nuthatch/AW	1510.5	45/7	975	1165	1320	1465	720	960	1055	1235	0.05935	0.0755	0.367	0.0829
Parrot/AW	1510.5	54/19	1000	1195	1345	1495	735	985	1075	1260	0.05834	0.0737	0.362	0.0821
Lapwing/AW	1590	45/7	1010	1205	1360	1510	740	995	1090	1275	0.05644	0.0721	0.364	0.0822
Falcon/AW	1590	54/19	1030	1235	1385	1540	760	1015	1110	1300	0.05555	0.0704	0.358	0.0814
Chukar/AW	1780	84/19	1095	1310	1465	1630	805	1080	1170	1375	0.05036	0.0649	0.355	0.0803
Bluebird/AW	2156	84/19	1235	1485	1635	1830	905	1225	1305	1540	0.04160	0.0548	0.344	0.0775
Kiwi/AW	2167	72/7	1215	1460	1610	1805	890	1205	1285	1520	0.04190	0.0558	0.348	0.0779
Thrasher/AW	2312	76/19	1275	1525	1680	1885	930	1265	1340	1590	0.03914	0.0524	0.342	0.0768
Joree/AW	2515	76/19	1340	1615	1760	1975	980	1330	1400	1665	0.03598	0.0489	0.337	0.0755

*AC Resistance of three layer ACSR/AW is with no correction for current density.

TABLE 6 — AMPACITIES FOR POLYETHYLENE COVERED 1350 ALUMINUM CONDUCTORS — 75 DEG C OPERATION

CODE WORD	SIZE AND STRANDING AWG/kcmil	COVERING THICKNESS (Inches)	AMPACITY (Amperes) 25°C AMBIENT SUN NO WIND	25°C AMBIENT NO SUN NO WIND	25°C AMBIENT SUN WIND	25°C AMBIENT NO SUN WIND	40°C AMBIENT SUN NO WIND	40°C AMBIENT NO SUN NO WIND	40°C AMBIENT SUN WIND	40°C AMBIENT NO SUN WIND	RESISTANCE Ohms/Mile DC 20°C	RESISTANCE Ohms/Mile AC 75°C
Apple	6-1	0.030	65	75	105	110	45	65	85	95	3.409	4.17
Pear	4-1	0.030	85	105	135	150	60	85	110	125	2.144	2.63
Cherry	2-1	0.045	115	145	180	200	85	120	145	170	1.348	1.65
Plum	6-7	0.030	65	80	105	115	45	65	85	95	3.481	4.26
Apricot	4-7	0.030	85	105	140	150	65	90	110	125	2.188	2.67
Peach	2-7	0.045	120	150	185	200	85	125	145	170	1.374	1.68
Nectarine	1-7	0.045	140	175	210	235	100	145	170	195	1.091	1.33
Quince	1/0-7	0.060	165	205	240	270	115	170	195	225	0.8646	1.06
Orange	2/0-7	0.060	190	240	280	315	135	200	225	265	0.6856	0.838
Fig	3/0-7	0.060	220	280	320	365	155	235	255	305	0.5441	0.665
Olive	4/0-7	0.060	260	330	370	420	185	270	295	355	0.4311	0.528
Pomegranate	4/0-19	0.060	260	330	375	420	185	275	295	355	0.4316	0.528
Mulberry	266.8-19	0.060	305	385	430	490	215	320	340	415	0.3421	0.419
Anona	336.4-19	0.060	355	450	500	570	250	375	395	480	0.2711	0.332
Molles	397.5-19	0.080	395	505	545	630	275	425	430	530	0.2294	0.282
Huckleberry	477-37	0.080	445	575	615	710	310	480	480	600	0.1915	0.235
Paw Paw	556.5-37	0.080	495	640	675	780	345	530	530	660	0.1641	0.202
Dreadfruit	636-61	0.095	540	700	725	845	375	585	570	715	0.1435	0.177
Persimmon	795-61	0.095	625	815	835	980	435	680	650	830	0.1147	0.142
Grapefruit	1033.5-61	0.095	740	970	980	1155	510	810	760	975	0.08826	0.111
Mango	1590-61	0.110	970	1285	1255	1500	665	1075	965	1270	0.05736	0.0743

TABLE 7 — AMPACITIES FOR XLP COVERED 1350 ALUMINUM CONDUCTORS — 90 DEG C OPERATION

CODE WORD	SIZE AND STRANDING AWG/kcmil	COVERING THICKNESS (Inches)	AMPACITY (Amperes) 25°C AMBIENT SUN NO WIND	25°C AMBIENT NO SUN NO WIND	25°C AMBIENT SUN WIND	25°C AMBIENT NO SUN WIND	40°C AMBIENT SUN NO WIND	40°C AMBIENT NO SUN NO WIND	40°C AMBIENT SUN WIND	40°C AMBIENT NO SUN WIND	RESISTANCE Ohms/mile DC 20°C	RESISTANCE Ohms/mile AC 90°C
Apple/XLP	6-1	0.030	75	90	120	125	65	75	100	110	3.409	4.37
Pear/XLP	4-1	0.030	105	120	155	165	85	105	135	145	2.144	2.75
Cherry/XLP	2-1	0.045	145	165	210	225	120	145	180	195	1.348	1.73
Plum/XLP	6-7	0.030	80	90	120	125	65	80	105	110	3.481	4.47
Apricot/XLP	4-7	0.030	105	120	160	170	90	105	135	150	2.188	2.81
Peach/XLP	2-7	0.045	145	170	210	225	120	150	180	200	1.374	1.76
Nectarine/XLP	1-7	0.045	170	200	245	260	140	175	210	230	1.091	1.40
Quince/XLP	1/0-7	0.060	200	235	280	300	165	205	240	265	0.8646	1.11
Orange/XLP	2/0-7	0.060	235	275	325	350	195	240	280	310	0.6856	0.880
Fig/XLP	3/0-7	0.060	275	320	375	405	225	280	320	360	0.5441	0.698
Olive/XLP	4/0-7	0.060	320	375	430	470	265	330	370	415	0.4311	0.554
Pomegranate/XLP	4/0-19	0.060	320	375	430	475	265	330	370	420	0.4316	0.554
Mulberry/XLP	266.8-19	0.060	375	440	500	550	310	385	430	485	0.3421	0.439
Anona/XLP	336.4-19	0.060	440	520	580	640	360	455	495	565	0.2711	0.349
Molles/XLP	397.5-19	0.080	490	580	635	705	405	510	545	625	0.2294	0.295
Huckleberry/XLP	477-37	0.080	555	660	715	795	455	580	610	700	0.1915	0.247
Paw Paw/XLP	556.5-37	0.080	615	730	785	875	505	640	675	775	0.1641	0.212
Dreadfruit/XLP	636-61	0.095	675	800	850	950	555	705	725	840	0.1435	0.186
Persimmon/XLP	795-61	0.095	780	930	980	1100	640	820	835	975	0.1147	0.149
Grapefruit/XLP	1033.5-61	0.095	930	1110	1150	1300	765	975	985	1150	0.08826	0.116
Mango/XLP	1590-61	0.110	1225	1475	1485	1690	1005	1295	1265	1500	0.05736	0.0776

TABLE 8 — AMPACITIES FOR POLYETHYLENE-COVERED ACSR CONDUCTORS

CODE WORD	SIZE AND STRANDING AWG or kcmil	COVERING THICKNESS (Inches)	AMBIENT TEMP. DEG C	AMPACITY (Amperes)				RESISTANCE Ohms/Mile		INDUCTIVE REACTANCE AT 1 FT Ohms/Mile
				SUN NO WIND	NO SUN NO WIND	SUN WIND	NO SUN WIND	DC 20°C	AC* 75°C	
Walnut	6-6/1	0.030	25	65	80	105	115	3.387	4.26	0.650
			40	50	65	85	95		4.22	
Butternut	4-6/1	0.030	25	90	110	140	155	2.129	2.72	0.638
			40	65	90	115	130		2.70	
Hickory	4-7/1	0.030	25	90	110	140	155	2.105	2.74	0.656
			40	65	90	115	130		2.71	
Pignut	2-6/1	0.045	25	120	150	185	200	1.339	1.75	0.630
			40	85	125	145	170		1.75	
Beech	2-7/1	0.045	25	120	150	180	200	1.324	1.79	0.657
			40	85	125	145	170		1.76	
Chestnut	1-6/1	0.045	25	140	175	210	230	1.062	1.41	0.628
			40	100	145	170	195		1.41	
Almond	1/0-6/1	0.060	25	160	205	240	265	0.8415	1.14	0.627
			40	115	170	190	225		1.15	
Pecan	2/0-6/1	0.060	25	185	235	270	305	0.6677	0.931	0.627
			40	130	195	215	255		0.936	
Filbert	3/0-6/1	0.060	25	215	270	305	345	0.5296	0.762	0.628
			40	150	225	245	290		0.767	
Buckeye	4/0-6/1	0.060	25	245	310	350	395	0.4200	0.628	0.631
			40	170	255	275	330		0.633	
Hackberry	266.8-18/1	0.060	25	305	390	435	495	0.3396	0.416	0.480
			40	215	325	345	420		0.416	

Note: The above values are also applicable to H.M. and H.D. Polyethylene and XLP

*AC Resistance and Inductance for single layer ACSR is given for 25°C ambient ampacity with no sun and wind.

TABLE 9 — AMPACITIES FOR DUPLEX AND TRIPLEX — NEUTRAL SUPPORTED SECONDARY POLYETHYLENE INSULATED — 75 DEG C OPERATION

SIZE AND STRANDING	INSULATION THICKNESS (Inches)	AMPACITY (Amperes) 25°C AMBIENT SUN NO WIND	25°C NO SUN NO WIND	25°C SUN WIND	25°C NO SUN WIND	40°C AMBIENT SUN NO WIND	40°C NO SUN NO WIND	40°C SUN WIND	40°C NO SUN WIND
6-7	0.045	55	70	85	95	40	60	70	80
4-7	0.045	75	95	115	130	55	80	90	110
2-7	0.045	105	130	150	170	75	110	120	145
1/0-7	0.060	140	180	200	230	100	150	160	195
2/0-7	0.060	165	215	230	265	115	175	180	225
4/0-7	0.060	225	290	310	360	155	240	240	300

TABLE 10 — AMPACITIES FOR DUPLEX AND TRIPLEX — NEUTRAL SUPPORTED SECONDARY XLP INSULATED — 90 DEG C OPERATION

SIZE AND STRANDING	INSULATION THICKNESS (Inches)	AMPACITY (Amperes) 25°C AMBIENT SUN NO WIND	25°C NO SUN NO WIND	25°C SUN WIND	25°C NO SUN WIND	40°C AMBIENT SUN NO WIND	40°C NO SUN NO WIND	40°C SUN WIND	40°C NO SUN WIND
6-7	0.045	70	80	100	105	60	70	85	95
4-7	0.045	95	110	130	145	80	95	115	125
2-7	0.045	130	150	175	190	105	130	150	170
1/0-7	0.060	175	210	235	255	145	185	200	230
2/0-7	0.060	205	245	270	300	170	215	230	265
3/0-7	0.060	240	285	310	345	200	250	265	305
4/0-7	0.060	280	335	360	400	230	295	310	355

TABLE 11 — AMPACITIES FOR QUADRUPLEX — NEUTRAL SUPPORTED SECONDARY POLYETHYLENE INSULATED — 75 DEG C OPERATION

SIZE AND STRANDING	INSULATION THICKNESS (Inches)	AMPACITY (Amperes) 25°C AMBIENT SUN NO WIND	25°C NO SUN NO WIND	25°C SUN WIND	25°C NO SUN WIND	40°C AMBIENT SUN NO WIND	40°C NO SUN NO WIND	40°C SUN WIND	40°C NO SUN WIND
6-7	0.045	55	65	75	85	40	55	60	75
4-7	0.045	70	90	100	115	50	75	80	100
2-7	0.045	95	125	135	155	65	105	105	130
1/0-7	0.060	130	170	180	210	90	145	140	180
2/0-7	0.060	155	200	210	245	105	170	165	205
3/0-7	0.060	180	235	240	285	125	195	185	240
4/0-7	0.060	210	275	275	330	145	230	215	280

TABLE 12 — AMPACITIES FOR QUADRUPLEX — NEUTRAL SUPPORTED SECONDARY XLP INSULATED — 90 DEG C OPERATION

SIZE AND STRANDING	INSULATION THICKNESS (Inches)	AMPACITY (Amperes) 25°C AMBIENT SUN NO WIND	25°C NO SUN NO WIND	25°C SUN WIND	25°C NO SUN WIND	40°C AMBIENT SUN NO WIND	40°C NO SUN NO WIND	40°C SUN WIND	40°C NO SUN WIND
6-7	0.045	65	75	90	100	55	70	75	85
4-7	0.045	90	105	120	130	75	90	100	115
2-7	0.045	120	140	160	175	100	125	135	155
1/0-7	0.060	165	195	210	235	135	175	180	210
2/0-7	0.060	195	230	245	275	160	205	210	245
3/0-7	0.060	225	270	285	320	185	235	240	280
4/0-7	0.060	265	315	325	370	215	275	280	325

Appendix

The values shown in the foregoing tables were based on the use of the following formulae.

D.C. RESISTANCE

$$R = \frac{\rho k \times 5280}{CM}$$

Where: R = Nominal DC resistance at 20°C, ohms/mile
ρ = Resistivity of wire material at 20°C, ohm-cmil/ft.
k = Stranding increment from ASTM Specification.
CM = Nominal area of conductor, circular mils.

$$R_t = R[1 + \alpha(t - 20)]$$

Where: R_t = Nominal DC resistance at operating temperature t, ohms/mile
α = Temperature coefficient of resistance at 20°C from ASTM Specification B 193
t = operating temperature of conductor, degrees C.

The resistance for each material of a composite conductor is calculated separately and then paralleled at the operating temperature.

A.C. RESISTANCE

$$R_{ac} = y\, R_{dc}$$

Where: R_{ac} = is nominal AC resistance, ohms/mile
R_{dc} = nominal DC resistance, ohms/mile
$y = \frac{ac}{dc}$ resistance ratio

The $\frac{ac}{dc}$ resistance ratio may be obtained from curves or calculated from equations derived from H. B. Dwight's equations using Bessel Functions.

The AIEE paper by Lewis and Tuttle "The Resistance and Reactance of Aluminum Conductors, Steel Reinforced" published in *AIEE Transactions* Vol. 77, Part III, Power Apparatus and Systems, 1958, pages 1189 thru 1215, provides details of the calculation of the AC resistance of ACSR. The topic is covered and curves provided in Chapter 3 of the Aluminum Association Electrical Conductor Handbook. Though there are variations for shortcuts or computer programming which have proven useful, the calculations for these tables were based on the Lewis and Tuttle method.

For those wishing to make calculations for single layer ACSR the following R_{ac} values will be helpful. Since the actual resistance and inductance are dependent on current, the values should be considered as approximations.

SIZE AWG	STRANDING	Ohms/Mile at		
		25°C	50°C	75°C
6	6/1	3.46	3.96	4.32
4	6/1	2.18	2.52	2.76
	7/1	2.15	2.52	2.79
2	6/1	1.37	1.63	1.79
	7/1	1.35	1.63	1.80

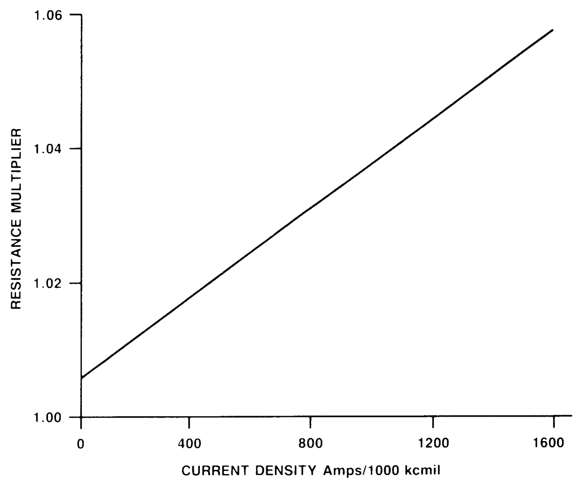
SIZE AWG	STRANDING	Ohms/Mile at		
		25°C	50°C	75°C
1	6/1 6/1	1.08	1.32	1.43
1/0	6/1 6/1	0.866	1.05	1.15
2/0	6/1 6/1	0.686	0.853	0.935
3/0	6/1 6/1	0.544	0.693	0.754
4/0	6/1	0.434	0.560	0.618

Magnetic core loss in three layer, multi-strand core wire ACSR is included in the ampacity calculations as recommended in "AC Resistance of ACSR—Magnetic and Temperature Effects" IEEE Paper 84 SM 700 − 1. This resistance correction equation is as follows and shown on the curve.

$$Y = 1.006 + (3.18 \times 10^{-5}) \bullet (X)$$

Where: Y = resistance multiplier
X = current density, amperes/1000 kcmil

RESISTANCE MULTIPLIER FOR THREE LAYER ACSR



GEOMETRIC MEAN RADIUS

$$GMR = \frac{OD}{24} \times K_g$$

Where: GMR = Geometric Mean Radius of conductor, feet.
K_g = Obtained from Table V.
OD = Overall diameter, inches.

INDUCTIVE REACTANCE

$$X_a = 0.2794 \frac{f}{60} \log_{10} \frac{1}{GMR} \text{ ohms/mile.}$$

Where: X_a = Inductive reactance, at one foot spacing.
f = Frequency, hertz.
GMR = Geometric Mean Radius, feet.

CAPACITIVE REACTANCE

$$X_c = 0.0683 \frac{60}{f} \log \frac{1}{r} \text{ megohm-miles.}$$

Where: X_c = Capacitive reactance, at one foot spacing.
f = Frequency, hertz.
r = Conductor radius, feet.

AMPACITY

$$I = \sqrt{\frac{q_c + q_r - q_s}{R_{ac-t}}}$$

I = Ampacity (current carrying capacity), amperes.
q_c = Convected heat loss, watts/ft.
q_r = Radiated heat loss, watts/ft.
q_s = Heat gain from sun, watts/ft.
R_{ac-t} = Nominal AC resistance at operating temperature t, ohms/ft.

convected heat loss (q_c):

Natural convection (no wind).

At sea level
$q_c = 0.072\, D^{0.75} (t_c - t_a)^{1.25}$.

At high altitudes (10,000 feet and above)
$q_c = 0.283\, \rho_f^{0.5} D^{0.75} (t_c - t_a)^{1.25}$.

Forced convection (wind).

$$q_c = \left[1.01 + 0.371 \left(\frac{D\rho_f V}{\mu_f} \right)^{0.52} \right] K_f (t_c - t_a).$$

$$q_c = 0.1695 \left[\frac{D\rho_f V}{\mu_f} \right]^{0.6} K_f (t_c - t_a).$$

The maximum value of q_c obtained from the above two equations is used in the calculation.

D = conductor diameter, in.
t_c = conductor operating temperature, degrees C.
t_a = ambient temperature, degree C.
ρ_f = air density at t_f, lb/cu ft.*
V = air velocity, ft/hr.
μ_f = absolute viscosity of air at t_f, lb/(hr)(ft).*
K_f = thermal conductivity of air at t_f, watts/(sq. ft.)(°C).*

*From Table I.

$$t_f = \frac{t_c + t_a}{2}$$

radiated heat loss (q_r):

$$q_r = 0.138 D \epsilon \left[\left(\frac{K_c}{100} \right)^4 - \left(\frac{K_a}{100} \right)^4 \right]$$

ϵ = coefficient of emissivity (0.91 for black conductors, 0.23 for new conductor, and 0.5 for average oxidized conductor).
K_c = conductor operating temperature, degrees Kelvin.
K_a = ambient temperature, degrees Kelvin.

solar heat gain (q_s):

$q_s = {}_aQ_s (\sin \theta) A$.
$\theta = \cos^{-1} [(\cos H_c) \cos (Z_c - Z_e)]$.
a = coefficient of solar absorption (0.95 for black conductor, 0.23 for new conductor, and 0.5 for average oxidized conductor).
Q_s = total solar and sky radiated heat, watts/ft.^{2} (From Table III of House & Tuttle AIEE Paper)**(Table III).
θ = effective angle of incidence of sun's rays.
A = projected area of conductor, sq. ft. per lineal ft. = D/12.
H_c = altitude of sun, degrees.*
Z_c = azimuth of sun, degrees.*
Z_e = azimuth of line, degrees [Z_e = 270° for E-W line, Z_e = 180° for N-S line.]

* From Table IV.
**"Current Carrying Capacity of Aluminum Conductors, Steel Reinforced" by House and Tuttle *AIEE Transactions*, Vol. 77, Part III 1958.

SINGLE OR MULTIPLEX COVERED

For single or multiplex covered conductors the above equations for Ampacity are modified by substituting $(t_c - t_1)$ for t_c. A similar substitution is made for K_c.

$$t_1 = I^2R_{ac} \times 1.202 \times 10^{-2} \times \sigma\,(\log_{10} D/d)$$

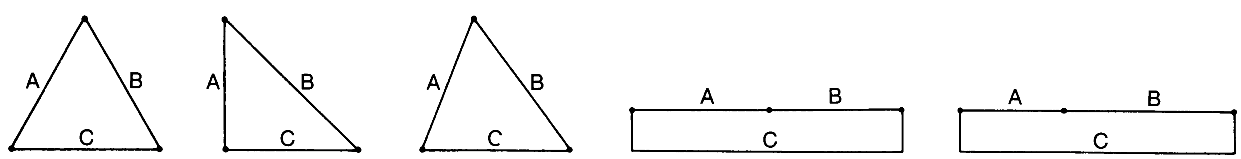
Where: t_1 = Temperature drop through the covering or insulation, degrees C
I = Total current, amperes
R_{ac} = Cable ac resistance, ohm per foot
σ = Thermal resistivity of the covering or insulation material
= 375°C · cm/watt for polyethylene or cross-linked polyethylene
D = Diameter over the covered or insulated conductor, inches
d = Diameter over the bare phase conductor, inches

For multiplex an equivalent diameter is substituted for D in the above equation for Ampacity calculations as follows:

For Duplex and Triplex: $1.64 \times OD$
For Quadruplex: $2.27 \times OD$
Where OD = Diameter over the covered or insulated conductor, inches

G.M.D.

GMD can be obtained from the formula where A, B, & C are the distances between the phase conductors of a three-phase system as shown below.



Symmetrical triangular spacing	Right triangular spacing A = C	Unequal triangular spacing	Symmetrical flat spacing A = B	Unsymmetrical flat spacing
GMD = A = B = C	GMD = 1.123A	GMD = $\sqrt[3]{A \times B \times C}$	GMD = 1.26A	GMD = $\sqrt[3]{A \times B \times C}$

TEMPERATURE CHANGE

An approximation for ampacity at a different temperature can be obtained to within 3% accuracy by use of the formula (from E. Hazan AIEE paper No. 59-897):

$$I_2 = I_1 \sqrt{\frac{\Delta t_2}{\Delta t_1}}$$

Where: I_2 = Ampacity at required new temperature.
I_1 = Ampacity at known temperature.
Δt_2 = Difference between conductor and ambient temperature for new conditions.
Δt_1 = Difference between conductor and ambient temperature for known conditions.

TABLE I. VISCOSITY, DENSITY AT SEA LEVEL TO 15,000 FT, AND THERMAL CONDUCTIVITY OF AIR

TEMPERATURE			$\frac{K^4}{100}$	ABSOLUTE VISCOSITY, μ_f	DENSITY, ϱ_f				THERMAL CONDUCTIVITY, k_f
°F	°C	°K			SEA LEVEL	5,000 FT	10,000 FT	15,000 FT	
32	0	273	55.55	0.0415	0.0807	0.0671	0.0554	0.0455	0.00739
41	5	278	59.73	0.0421	0.0793	0.0660	0.0545	0.0447	0.00750
50	10	283	64.14	0.0427	0.0779	0.0648	0.0535	0.0439	0.00762
59	15	288	68.80	0.0433	0.0765	0.0636	0.0526	0.0431	0.00773
68	20	293	73.70	0.0439	0.0752	0.0626	0.0517	0.0424	0.00784
77	25	298	78.86	0.0444	0.0740	0.0616	0.0508	0.0417	0.00795
86	30	303	84.29	0.0450	0.0728	0.0606	0.0500	0.0411	0.00807
95	35	308	89.99	0.0456	0.0716	0.0596	0.0492	0.0404	0.00818
104	40	313	95.98	0.0461	0.0704	0.0586	0.0484	0.0397	0.00830
113	45	318	102.26	0.0467	0.0693	0.0577	0.0476	0.0391	0.00841
122	50	323	108.85	0.0473	0.0683	0.0568	0.0469	0.0385	0.00852
131	55	328	115.74	0.0478	0.0672	0.0559	0.0462	0.0379	0.00864
140	60	333	122.96	0.0484	0.0661	0.0550	0.0454	0.0373	0.00875
149	65	338	130.52	0.0489	0.0652	0.0542	0.0448	0.0367	0.00886
158	70	343	138.41	0.0494	0.0643	0.0535	0.0442	0.0363	0.00898
167	75	348	146.66	0.0500	0.0634	0.0527	0.0436	0.0358	0.00909
176	80	353	155.27	0.0505	0.0627	0.0522	0.0431	0.0354	0.00921
185	85	358	164.26	0.0510	0.0616	0.0513	0.0423	0.0347	0.00932
194	90	363	173.63	0.0515	0.0608	0.0506	0.0418	0.0343	0.00943
203	95	368	183.40	0.0521	0.0599	0.0498	0.0412	0.0338	0.00952
212	100	373	193.57	0.0526	0.0591	0.0492	0.0406	0.0333	0.00966

μ_f = absolute viscosity, lb/(hr)(ft).
ϱ_f = density, lb of air/ft^3.
k_f = thermal conductivity of air, watts/(sq ft)(C) at $t_f = (t_c + t_a)/2$.
t_a = ambient temperature, °C.
t_c = conductor temperature, °C.

TABLE II. HEAT-TRANSMISSION FACTOR FOR ALTITUDES ABOVE SEA LEVEL

ELEVATION ABOVE SEA LEVEL, FT	MULTIPLIER FOR VALUES IN TABLE III
0	1.00
5,000	1.15
10,000	1.25
15,000	1.30

TABLE III. TOTAL HEAT RECEIVED BY SURFACE AT SEA LEVEL NORMAL TO SUN'S RAYS

SOLAR ALTITUDE, H_c, DEGREES	Q_s, WATTS/SQ FT	
	CLEAR ATMOSPHERE	INDUSTRIAL ATMOSPHERE
5	21.7	12.6
10	40.2	22.3
15	54.2	30.5
20	64.4	39.2
25	71.5	46.6
30	77.0	53.0
35	81.5	57.5
40	84.8	61.5
45	87.4	64.5
50	90.0	67.5
60	92.9	71.6
70	95.0	75.2
80	95.8	77.4
90	96.4	78.9

TABLE IV. ALTITUDE AND AZIMUTH IN DEGREES OF SUN AT VARIOUS LATITUDES AT DECLINATION OF 23.0 DEGREES, NORTHERN HEMISPHERE, JUNE 10 AND JULY 3

DEGREES NORTH LATITUDE	LOCAL SUN TIME					
	10:00 A.M.		12:00 NOON		2:00 P.M.	
	H_c	Z_c	H_c	Z_c	H_c	Z_c
20	62	78	87	0	62	282
25	62	88	88	180	62	272
30	62	98	83	180	62	262
35	61	107	78	180	61	253
40	60	115	73	180	60	245
45	57	122	68	180	57	238
50	54	128	63	180	54	232
60	47	137	53	180	47	223
70	40	143	43	180	40	217

TABLE V. INTERNAL SELF-REACTANCE CHARACTERISTICS FOR STRANDED CONDUCTORS

SINGLE-LAYER TUBULAR CONDUCTOR

Number of Strands	k_g	$-\log_{10} k_g$	X_{ir} Ohms/Mile at 60 Hz
1	0.7788	0.10857	0.0303
3	0.6778	0.16889	0.0472
5	0.7406	0.13041	0.0364
6	0.7680	0.11467	0.0320
7	0.7902	0.10225	0.0286
8	0.8087	0.09224	0.0258
9	0.8242	0.08399	0.0235
10	0.8374	0.07709	0.0215
11	0.8487	0.07123	0.0199
12	0.8586	0.06620	0.0185
13	0.8673	0.06183	0.0173
14	0.8750	0.05800	0.0162
15	0.8818	0.05461	0.0153
16	0.8880	0.05160	0.0144
17	0.8935	0.04890	0.0137
18	0.8985	0.04647	0.0130
19	0.9031	0.04427	0.0124
20	0.9072	0.04227	0.0118
21	0.9111	0.04044	0.0113
22	0.9146	0.03876	0.0108
23	0.9179	0.03722	0.0104
24	0.9209	0.03580	0.0100
25	0.9237	0.03448	0.0096
26	0.9263	0.03325	0.0093
27	0.9287	0.03211	0.0090
28	0.9310	0.03104	0.0087
29	0.9332	0.03004	0.0084
30	0.9352	0.02911	0.0081
31	0.9371	0.02823	0.0079
32	0.9389	0.02740	0.0077
33	0.9405	0.02662	0.0074
34	0.9421	0.02588	0.0072
35	0.9437	0.02519	0.0070
36	0.9451	0.02452	0.0068

TWO-LAYER TUBULAR CONDUCTOR

Number of Strands: Total	Number of Strands: In Outer Layer n	k_g	$-\log_{10} k_g$	X_{ir} Ohms/Mile at 60 Hz
7_α	6	0.7256	0.13932	0.0389
12_β	9	0.7605	0.11888	0.0332
16	11	0.7671	0.11512	0.0322
18	12	0.7765	0.10988	0.0307
20	13	0.7858	0.10468	0.0292
22	14	0.7949	0.09971	0.0279
24	15	0.8035	0.09502	0.0266
26	16	0.8116	0.09065	0.0253
28	17	0.8192	0.08660	0.0242
30	18	0.8264	0.08284	0.0231
32	19	0.8330	0.07935	0.0222
34	20	0.8392	0.07612	0.0213
36	21	0.8450	0.07312	0.0204
38	22	0.8505	0.07034	0.0196
40	23	0.8556	0.06774	0.0189
42	24	0.8603	0.06533	0.0182
44	25	0.8648	0.06307	0.0176
46	26	0.8690	0.06095	0.0170
48	27	0.8730	0.05897	0.0165
50	28	0.8768	0.05711	0.0160
52	29	0.8803	0.05536	0.0155
54	30	0.8837	0.05371	0.0150
56	31	0.8868	0.05216	0.0146
58	32	0.8898	0.05068	0.0142
60	33	0.8927	0.04929	0.0138
62	34	0.8954	0.04798	0.0134
64	35	0.8980	0.04673	0.0131
66	36	0.9005	0.04554	0.0127

THREE-LAYER TUBULAR CONDUCTOR

Number of Strands: Total	Number of Strands: In Outer Layer n	k_g	$-\log_{10} k_g$	X_{ir} Ohms/Mile at 60 Hz
19_α	12	0.7577	0.12053	0.0337
27_β	15	0.7733	0.11168	0.0312
33	17	0.7732	0.11172	0.0312
36	18	0.7779	0.10909	0.0305
39	19	0.7830	0.10622	0.0297
42	20	0.7884	0.10324	0.0288
45	21	0.7939	0.10024	0.0280
48	22	0.7993	0.09728	0.0272
51	23	0.8047	0.09438	0.0264
54	24	0.8099	0.09158	0.0256
57	25	0.8149	0.08889	0.0248
60	26	0.8198	0.08630	0.0241
63	27	0.8245	0.08383	0.0234
66	28	0.8290	0.08147	0.0228
69	29	0.8333	0.07921	0.0221
72	30	0.8374	0.07706	0.0215
75	31	0.8414	0.07501	0.0210
78	32	0.8452	0.07305	0.0204
81	33	0.8488	0.07118	0.0199
84	34	0.8523	0.06940	0.0194
87	35	0.8557	0.06769	0.0189
90	36	0.8589	0.06606	0.0185

FOUR-LAYER TUBULAR CONDUCTOR

Number of Strands: Total	Number of Strands: In Outer Layer n	k_g	$-\log_{10} k_g$	X_{ir} Ohms/Mile at 60 Hz
37_α	18	0.7678	0.11476	0.0321
48_β	21	0.7772	0.10957	0.0306
56	23	0.7755	0.11040	0.0308
60	24	0.7783	0.10883	0.0304
64	25	0.7816	0.10704	0.0299
68	26	0.7851	0.10508	0.0294
72	27	0.7889	0.10300	0.0288
76	28	0.7928	0.10085	0.0282
80	29	0.7967	0.09871	0.0276
84	30	0.8005	0.09661	0.0270
88	31	0.8044	0.09451	0.0264
92	32	0.8084	0.09239	0.0258
96	33	0.8121	0.09037	0.0252
100	34	0.8158	0.08842	0.0247
104	35	0.8194	0.08652	0.0242
108	36	0.8229	0.08465	0.0236

CONCENTRIC-STRANDED CONDUCTORS

Total Strands	Layers Around Core	K_g	$-\log_{10} k_g$	X_{ir} Ohms/Mile at 60 Hz
1	0	0.7788	0.10857	0.0303
7	1	0.7256	0.13932	0.0389
19	2	0.7577	0.12053	0.0337
37	3	0.7678	0.11476	0.0321
61	4	0.7722	0.11234	0.0314
91	5	0.7743	0.11110	0.0310
127	6	0.7756	0.11038	0.0308

Notes:

$X_i = -0.0046566\, f \log_{10} k_g$ (ohms/mile)

$X_a = 0.0046566\, f \log_{10} \frac{1}{r_n} + X_{ir}$ (ohms/mile)

$k_g = \frac{d_{qq}}{r_n}$ (ratio of radii)

X_i = internal reactance at frequency f

X_a = conductor component of reactance

d_{qq} = geometric-mean radius of conductor, feet

r_n = outer radius of conductor, feet

α = denotes concentric-stranded conductor with single-strand core

β = denotes concentric-stranded conductor with 3-strand core

Other Aluminum Association Electrical Publications

Aluminum Electrical Conductor Handbook (ECH-56) 1982
Comprehensive handbook on the electrical uses of aluminum. It puts together in one place essential information compiled through more than four decades of electrical experience.

Code Words For Underground Distribution Cables (CCW-49) 1977
This publication lists more than 400 code words used to identify aluminum underground distribution (UD) cables. Code words are used in catalogs, orders, invoices and other sales and production records to provide brief identification in place of a long detailed description for each cable construction. This booklet also describes the code word system and outlines the procedure for registering new code words.

Aluminum Underground Distribution Reference Book (UDB-52) 1982
A reference book with information on design, installation and maintenance of underground cable, it includes tables listing ampacities, dimensions, and weights for various aluminum underground constructions.

Packaging Standards for Aluminum Conductor and ACSR (PEC-53) 1981
This publication lists dimensions of reels and coils for stranded aluminum conductor and ACSR (aluminum conductor steel reinforced) and covered conductors, as well as neutral supported secondary and service drop cable.

Guide To Specification Of Electrical Installations Employing Aluminum Conductors (SEI-59) 1983
This guide was developed for use by electrical systems designers. In standard section 16-A job-specification format, it covers system components from primary cable to wiring devices.

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