



COPPERCLAD STEEL WIRE

Solution for Grounding Wire for Power Applications

Product Catalog

Founded in 1984, AFL is an international manufacturer providing end-to-end solutions to the energy, service provider, enterprise, hyperscale and industrial markets as well as several emerging markets.

AFL's products are in use in over 130 countries and include fiber optic cable and hardware, transmission and substation accessories, outside plant equipment, connectivity, test and inspection equipment, fusion splicers and training.

AFL also offers a wide variety of services supporting data center, enterprise, wireless and outside plant applications.

AFL is dedicated to bringing our customers a quality product as well as delivering superior value.




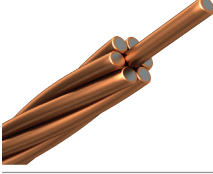
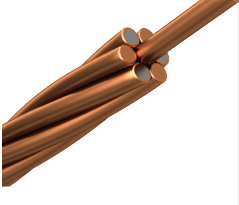
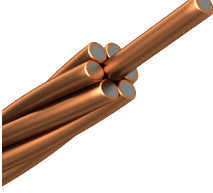


**COMPANY WITH
QUALITY SYSTEM
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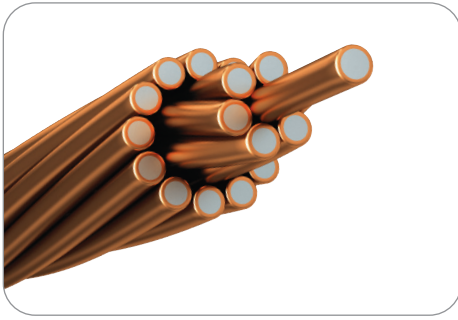
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Copperclad Steel Wire Products

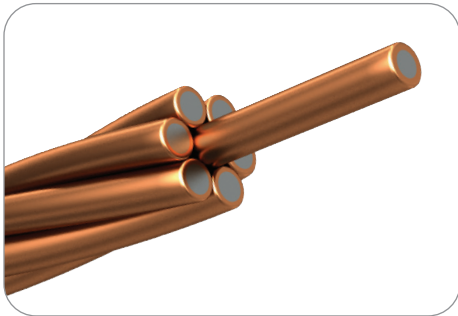
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	Pg. 3	Copperclad Dead Soft Annealed (DSA)—for 19, 7, 3 and single strand
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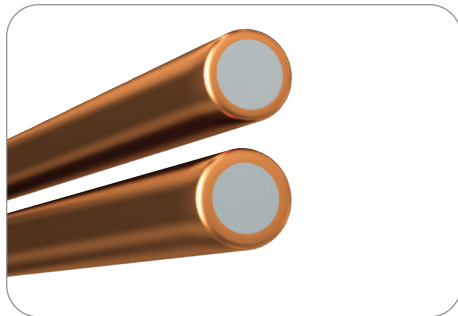
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19-strand Copperclad Steel Wire



7-strand Copperclad Steel Wire

Single strand Copperclad Steel Wire
in large and small diameters

OnyxCCS® Copperclad Steel Wire

Copperclad Steel Wire

AFL's Copperclad Steel Wire is the ideal solution for grounding wire for power type applications. Composed of a steel core with coppercladding, the steel wire gives the wire its strength and the consistent layer of copper provides electrical conductivity and resistance to corrosion.

To manufacture Copperclad Steel Wire, carbon steel (low, high strength and extra high strength) is bonded with a uniform layer of oxygen-free coppercladding to achieve 30% and 40% IACS (International Annealed Copper Standard) conductivities. The material is available in a single wire, 3, 7 and 19 cable strands with some sizes jacketed to give the wire a different appearance to copper.

Features

- Demonstrates the same corrosion-resistant properties as copper while maintaining the high strength of steel
- Reduces damage caused during installation or fatigue from vibration or bending
- Special heat treat process results in a very malleable wire called Dead Soft Annealed (DSA)
- Copper permanently bonded to the steel core prevents corrosion of the steel core.
- Very little scrap value, discouraging theft and leaving the grounding system intact
- Compliant with IEEE 80
- Manufactured in accordance with ASTM specifications (B258, B910/B910M, B229, B228, B227)

Dead Soft Annealed Copperclad Steel Wire

Copperclad Steel Wire is a strong, non-rusting, efficient grounding conductor. It is composed of Coppercladding that is permanently bonded to the central steel core of each wire. Copperclad provides the same conductivity and corrosion resistance as copper while maintaining the high strength of steel. Dead Soft Annealed (DSA) Copperclad Steel Wire is very flexible for easy preparation and installation.

When compared to solid copper, Copperclad Steel Wire has faster impedance to ground for better protection of lines and equipment plus a higher resistance to thermal expansion failures. It also reduces the fatigue damage caused by more than 10 times that of annealed solid copper.

Copperclad Steel Wire is an excellent solution for areas with high rates of copper theft as the amount of copper used in the bonding process is minimal—6% to 10% depending on the conductivity. When Copperclad Steel Wire is used in place of copper, the grounding conductor is far less likely to be stolen. This feature is important not only from an economic standpoint, but also from the standpoint of safety and reliability. Often, the fact that a copper downlead has been removed is not evident until a surge current causes a failure in the system.

OnyxCCS® Copperclad Steel Wire

OnyxCCS offers the same benefits as standard Copperclad Steel (CCS) while protecting against copper theft. In addition to the inherent strength of a CCS product, OnyxCCS has a chemically-etched surface treatment which permanently darkens the standard CCS. This process discourages theft of a utility's copper infrastructure and does not compromise mechanical nor electrical properties.

OnyxCCS is offered in all sizes of the AFL Copperclad product line. To order OnyxCCS, the part number pre-fix "CCX" replaces "CCS". EX: **CCX**07074DR1000F



AFL's Swage Grounding Coupler compressed onto 19-strand Copperclad Steel Wire

Selecting the Right Size for the Application

When selecting a conductor for a ground grid, it must meet the maximum fault current for the identified duration and meet a minimum breaking load as required by the substation design (typically 5,000 pounds). The key to properly sizing copperclad steel wire is the actual fault current requirement. Often copper is physically oversized to gain the physical strength needed in the application. With Copperclad, the physical strength is inherent to the product so the primary consideration is electrical. Table below compares the ampacity ratings of copper and Copperclad Steel Wire which allows the user to visually select the Copperclad equivalent. For example:

Requirements: The equivalent to 4/0 copper per the IEEE Fusing Chart is 19#9 40%. A typical maximum fault current for a distribution substation is ~18 kA at 30 cycles. Most engineers upsize to 4/0 copper in order to meet the mechanical strength requirement.

AFL solution: A 2/0 copper or 7#6 Copperclad Steel Wire conductor will meet this requirement instead of the larger size 4/0 copper commonly used for ground grids. The conductor safety margin for 7#6 Copperclad Steel Wire is 30% and meets the fault current and mechanical strength requirements.

40% CCS Overview

CONDUCTOR SIZE	STRANDS	STRAND DIAMETER		OVERALL DIAMETER		AREA		FAULT CURRENT	WEIGHT/LENGTH		WIRE RESISTANCE		MIN. BREAK LOAD	
		In.	MM	In.	MM	cmil	(mm ²)		Amps at 0.5 Sec.	lbs/kft	kg/km	Ω/kft	Ω/kM	lbf
19#4	19	0.2043	5.19	1.022	25.95	793,000	401.8	107.28	2251.7	3350.9	0.0338	0.1110	21755	9868
19#5	19	0.1819	4.62	0.910	23.10	628,700	318.6	85.05	1785.0	2656.3	0.0427	0.1400	17246	7823
19#6	19	0.1620	4.11	0.810	20.57	498,600	252.6	67.46	1415.8	2106.9	0.0538	0.1765	13679	6205
19#7	19	0.1443	3.67	0.722	18.33	395,600	200.5	53.52	1123.3	1671.7	0.0678	0.2224	10853	4923
19#8	19	0.1285	3.26	0.643	16.32	313,700	159.0	42.44	890.8	1325.6	0.0855	0.2805	8606	3904
19#9	19	0.1144	2.91	0.572	14.53	248,700	126.0	33.64	706.0	1050.7	0.1079	0.3539	6821	3094
4/0	19	0.1055	2.68	0.528	13.40	211,500	107.2	28.61	600.4	893.6	0.1268	0.4161	5801	2631
19#10	19	0.1019	2.59	0.510	12.94	197,300	100.0	26.69	560.2	833.6	0.1359	0.4460	5412	2455
7#4	7	0.2043	5.19	0.613	15.57	292,200	148.1	39.53	826.3	1229.7	0.0914	0.3000	8015	3635
7#5	7	0.1819	4.62	0.546	13.86	231,600	117.4	31.33	655.0	974.8	0.1153	0.3784	6354	2882
7#6	7	0.1620	4.11	0.486	12.34	183,700	93.1	24.85	519.6	773.2	0.1454	0.4771	5040	2286
7#7	7	0.1443	3.67	0.433	11.00	145,800	73.9	19.72	412.2	613.5	0.1833	0.6013	3998	1814
2/0	7	0.1379	3.50	0.414	10.51	133,100	67.4	18.01	376.5	560.2	0.2007	0.6584	3652	1656
7#8	7	0.1285	3.26	0.386	9.79	115,600	58.6	15.64	326.9	486.5	0.2311	0.7583	3171	1438
1/0	7	0.1228	3.12	0.368	9.35	105,600	53.5	14.28	298.5	444.3	0.2531	0.8303	2896	1313
7#9	7	0.1144	2.91	0.343	8.72	91,610	46.4	12.39	259.1	385.6	0.2916	0.9567	2513	1140
7#10	7	0.1019	2.59	0.306	7.76	72,690	36.8	9.83	205.6	305.9	0.3675	1.2058	1994	904
3#4	3	0.2043	5.19	0.440	11.18	125,200	63.4	16.94	353.4	526.0	0.2129	0.6986	3626	1645
3#5	3	0.1819	4.62	0.392	9.96	99,260	50.3	13.43	280.2	416.9	0.2686	0.8812	2874	1304
3#6	3	0.1620	4.11	0.349	8.86	78,730	39.9	10.65	222.2	330.7	0.3386	1.1110	2280	1034
3#7	3	0.1443	3.67	0.311	7.90	62,470	31.7	8.45	176.3	262.4	0.4268	1.4003	1809	820
3#8	3	0.1285	3.26	0.277	7.04	49,540	25.1	6.70	139.8	208.1	0.5382	1.7658	1434	651
3#9	3	0.1144	2.91	0.247	6.27	39,260	19.9	5.31	110.8	164.9	0.6791	2.2279	1137	516
3#10	3	0.1019	2.59	0.220	5.59	31,150	15.8	4.21	87.9	130.8	0.8559	2.8080	902	409
#2 AWG	7	0.0860	2.18	0.258	6.55	51,770	26.2	7.00	146.4	217.9	0.5160	1.6929	1435	651
#4 AWG	7	0.0680	1.73	0.204	5.18	32,370	16.4	4.38	91.5	136.2	0.8253	2.7078	897	407
#2 AWG	1	0.2576	6.54	0.258	6.54	66,370	33.6	8.98	185.8	276.6	0.3985	1.3075	2023	918
#4 AWG	1	0.2043	5.19	0.204	5.19	41,740	21.2	5.65	116.9	173.9	0.6337	2.0791	1272	577
#6 AWG	1	0.1620	4.12	0.162	4.12	26,250	13.3	3.55	73.5	109.4	1.0076	3.3058	800	363
#8 AWG	1	0.1285	3.26	0.129	3.26	16,510	8.4	2.23	46.2	68.8	1.6018	5.2554	503	228
#9 AWG	1	0.1144	2.91	0.114	2.91	13,090	6.6	1.77	36.6	54.5	2.0210	6.6307	399	181
#10 AWG	1	0.1019	2.59	0.102	2.59	10,380	5.3	1.40	29.1	43.3	2.5473	8.3572	316	144

30% CCS Overview

CONDUCTOR SIZE	STRANDS	STRAND DIAMETER		OVERALL DIAMETER		AREA		FAULT CURRENT	WEIGHT/LENGTH		WIRE RESISTANCE		MIN. BREAK LOAD	
		In.	MM	In.	MM	cmil	(mm ²)	Amps at 0.5 Sec.	lbs/kft	kg/km	Ω/kft	Ω/kM	lbf	kgf
19#4	19	0.2043	5.19	1.022	25.95	793,000	401.8	92.96	2231.3	3320.5	0.0451	0.1479	24474	11101
19#5	19	0.1819	4.62	0.910	23.10	628,700	318.6	73.70	1768.8	2632.3	0.0569	0.1866	19402	8800
19#6	19	0.1620	4.11	0.810	20.57	498,600	252.6	58.45	1403.0	2087.9	0.0717	0.2352	15389	6980
19#7	19	0.1443	3.67	0.722	18.33	395,600	200.5	46.38	1113.2	1656.6	0.0904	0.2965	12210	5538
19#8	19	0.1285	3.26	0.643	16.32	313,700	159.0	36.78	882.7	1313.6	0.1140	0.3739	9682	4392
19#9	19	0.1144	2.91	0.572	14.53	248,700	126.0	29.15	699.6	1041.2	0.1438	0.4717	7674	3481
4/0	19	0.1055	2.68	0.528	13.40	211,500	107.2	24.79	595.0	885.5	0.1691	0.5547	6526	2960
19#10	19	0.1019	2.59	0.510	12.94	197,300	100.0	23.13	555.1	826.1	0.1812	0.5946	6089	2762
7#4	7	0.2043	5.19	0.613	15.57	292,200	148.1	34.25	818.8	1218.5	0.1219	0.3999	9017	4090
7#5	7	0.1819	4.62	0.546	13.86	231,600	117.4	27.15	649.1	966.0	0.1538	0.5045	7148	3242
7#6	7	0.1620	4.11	0.486	12.34	183,700	93.1	21.54	514.9	766.2	0.1939	0.6360	5670	2572
7#7	7	0.1443	3.67	0.433	11.00	145,800	73.9	17.09	408.5	607.9	0.2443	0.8016	4498	2040
2/0	7	0.1379	3.50	0.414	10.51	133,100	67.4	15.60	373.1	555.2	0.2675	0.8777	4108	1863
7#8	7	0.1285	3.26	0.386	9.79	115,600	58.6	13.55	323.9	482.1	0.3081	1.0108	3567	1618
1/0	7	0.1228	3.12	0.368	9.35	105,600	53.5	12.37	295.8	440.2	0.3374	1.1069	3258	1478
7#9	7	0.1144	2.91	0.343	8.72	91,610	46.4	10.74	256.7	382.1	0.3887	1.2754	2827	1282
7#10	7	0.1019	2.59	0.306	7.76	72,690	36.8	8.52	203.7	303.1	0.4900	1.6075	2243	1017
3#4	3	0.2043	5.19	0.440	11.18	125,200	63.4	14.68	350.2	521.2	0.2838	0.9313	4079	1850
3#5	3	0.1819	4.62	0.392	9.96	99,260	50.3	11.64	277.6	413.2	0.3581	1.1747	3234	1467
3#6	3	0.1620	4.11	0.349	8.86	78,730	39.9	9.23	220.2	327.7	0.4514	1.4811	2565	1163
3#7	3	0.1443	3.67	0.311	7.90	62,470	31.7	7.32	174.7	260.0	0.5690	1.8667	2035	923
3#8	3	0.1285	3.26	0.277	7.04	49,540	25.1	5.81	138.6	206.2	0.7175	2.3540	1614	732
3#9	3	0.1144	2.91	0.247	6.27	39,260	19.9	4.60	109.8	163.4	0.9053	2.9700	1279	580
3#10	3	0.1019	2.59	0.220	5.59	31,150	15.8	3.65	87.1	129.7	1.1410	3.7433	1015	460
#2 AWG	7	0.0860	2.18	0.258	6.55	51,770	26.2	6.07	145.1	215.9	0.6879	2.2568	1614	732
#4 AWG	7	0.0680	1.73	0.204	5.18	32,370	16.4	3.79	90.7	135.0	1.1002	3.6097	1009	458
#2 AWG	1	0.2576	6.54	0.258	6.54	66,370	33.6	7.78	184.2	274.1	0.5313	1.7430	2276	1032
#4 AWG	1	0.2043	5.19	0.204	5.19	41,740	21.2	4.89	115.8	172.4	0.8448	2.7716	1431	649
#6 AWG	1	0.1620	4.12	0.162	4.12	26,250	13.3	3.08	72.8	108.4	1.3432	4.4069	900	408
#8 AWG	1	0.1285	3.26	0.129	3.26	16,510	8.4	1.94	45.8	68.2	2.1354	7.0059	566	257
#9 AWG	1	0.1144	2.91	0.114	2.91	13,090	6.6	1.53	36.3	54.0	2.6942	8.8393	449	204

DSA Copperclad Steel Wire for Grounding Applications

Wire Specifications

40% CONDUCTIVITY										
CONDUCTOR SIZE	STRANDS	AFL NO.	I2T	NOM. DC RESISTANCE	FAULT CURRENT					
					3 CYCLES	6 CYCLES	9 CYCLES	30 CYCLES	60 CYCLES	120 CYCLES
AWG			kA2s	ohm/kft	0.05S	0.10S	0.15S	0.50S	1.00S	2.00S
19#4	19	CCS19044D	5755.00	0.0331	339.26	239.90	195.87	107.28	75.86	53.64
19#5	19	CCS19054D	3616.62	0.0418	268.95	190.17	155.28	85.05	60.14	42.52
19#6	19	CCS19064D	2275.27	0.0527	213.32	150.84	123.16	67.46	47.70	33.73
19#7	19	CCS19074D	1432.31	0.0664	169.25	119.68	97.72	53.52	37.85	26.76
19#8	19	CCS19084D	900.71	0.0837	134.22	94.91	77.49	42.44	30.01	21.22
19#9	19	CCS19094D	565.82	0.1057	106.38	75.22	61.42	33.64	23.79	16.82
4/0	19	CCS4/04D	409.24	0.1242	90.47	63.97	52.23	28.61	20.23	14.30
19#10	19	CCS19104D	356.18	0.1332	84.40	59.68	48.73	26.69	18.87	13.35
7#4	7	CCS07044D	781.15	0.0896	124.99	88.38	72.16	39.53	27.95	19.76
7#5	7	CCS07054D	490.90	0.1130	99.09	70.06	57.21	31.33	22.16	15.67
7#6	7	CCS07064D	308.83	0.1424	78.59	55.57	45.37	24.85	17.57	12.43
7#7	7	CCS07074D	194.41	0.1795	62.36	44.09	36.00	19.72	13.94	9.86
2/0	7	CCS2/04D	162.15	0.1966	56.95	40.27	32.88	18.01	12.73	9.00
7#8	7	CCS07084D	122.26	0.2264	49.45	34.97	28.55	15.64	11.06	7.82
1/0	7	CCS1/04D	101.97	0.2479	45.16	31.93	26.07	14.28	10.10	7.14
7#9	7	CCS07094D	76.80	0.2856	39.19	27.71	22.63	12.39	8.76	6.20
7#10	7	CCS07104D	48.35	0.3600	31.10	21.99	17.95	9.83	6.95	4.92
3#4	3	CCS03044D	143.48	0.2086	53.57	37.88	30.93	16.94	11.98	8.47
3#5	3	CCS03054D	90.17	0.2631	42.47	30.03	24.52	13.43	9.50	6.71
3#6	3	CCS03064D	56.72	0.3317	33.68	23.82	19.45	10.65	7.53	5.33
3#7	3	CCS03074D	35.71	0.4181	26.72	18.90	15.43	8.45	5.98	4.23
3#8	3	CCS03084D	22.46	0.5272	21.19	14.99	12.24	6.70	4.74	3.35
3#9	3	CCS03094D	14.11	0.6652	16.80	11.88	9.70	5.31	3.76	2.66
3#10	3	CCS03104D	8.88	0.8384	13.33	9.42	7.69	4.21	2.98	2.11
#2 AWG	7	CCS02STR4D	24.53	0.5054	22.15	15.66	12.79	7.00	4.95	3.50
#4 AWG	7	CCS04STR4D	9.59	0.8085	13.85	9.79	7.99	4.38	3.10	2.19
#2 AWG	1	CCS01024D	40.31	0.3904	28.39	20.08	16.39	8.98	6.35	4.49
#4 AWG	1	CCS01044D	15.94	0.6207	17.86	12.63	10.31	5.65	3.99	2.82
#6 AWG	1	CCS01064D	6.31	0.9870	11.23	7.94	6.48	3.55	2.51	1.78
#8 AWG	1	CCS01084D	2.50	1.5691	7.06	5.00	4.08	2.23	1.58	1.12
#9 AWG	1	CCS01094D	1.57	1.9797	5.60	3.96	3.23	1.77	1.25	0.89
#10 AWG	1	CCS01104D	0.99	2.4952	4.44	3.14	2.56	1.40	0.99	0.70

DSA Copperclad Steel Wire for Grounding Applications (cont.)

Wire Specifications

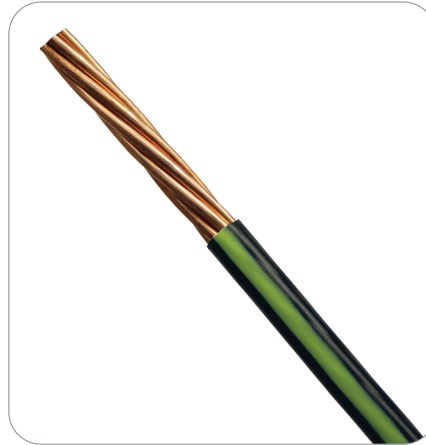
30% CONDUCTIVITY										
CONDUCTOR SIZE	STRANDS	AFL NO.	I2T	NOM. DC RESISTANCE	FAULT CURRENT					
					3 CYCLES	6 CYCLES	9 CYCLES	30 CYCLES	60 CYCLES	120 CYCLES
AWG			kA2s	ohm/kft	0.05S	0.10S	0.15S	0.50S	1.00S	2.00S
19#4	19	CCS19043D	4321.16	0.0442	293.98	207.87	169.73	92.96	65.74	46.48
19#5	19	CCS19053D	2715.55	0.0558	233.05	164.79	134.55	73.70	52.11	36.85
19#6	19	CCS19063D	1708.39	0.0703	184.85	130.71	106.72	58.45	41.33	29.23
19#7	19	CCS19073D	1075.46	0.0886	146.66	103.70	84.67	46.38	32.79	23.19
19#8	19	CCS19083D	676.30	0.1118	116.30	82.24	67.15	36.78	26.01	18.39
19#9	19	CCS19093D	424.85	0.1410	92.18	65.18	53.22	29.15	20.61	14.57
4/0	19	CCS4/03D	307.28	0.1658	78.39	55.43	45.26	24.79	17.53	12.40
19#10	19	CCS19103D	267.44	0.1777	73.14	51.71	42.22	23.13	16.35	11.56
7#4	7	CCS07043D	586.53	0.1195	108.31	76.59	62.53	34.25	24.22	17.12
7#5	7	CCS07053D	368.59	0.1508	85.86	60.71	49.57	27.15	19.20	13.58
7#6	7	CCS07063D	231.89	0.1901	68.10	48.15	39.32	21.54	15.23	10.77
7#7	7	CCS07073D	145.98	0.2396	54.03	38.21	31.20	17.09	12.08	8.54
2/0	7	CCS2/03D	121.75	0.2624	49.35	34.89	28.49	15.60	11.03	7.80
7#8	7	CCS07083D	91.80	0.3021	42.85	30.30	24.74	13.55	9.58	6.77
1/0	7	CCS1/03D	76.56	0.3308	39.13	27.67	22.59	12.37	8.75	6.19
7#9	7	CCS07093D	57.67	0.3812	33.96	24.01	19.61	10.74	7.59	5.37
7#10	7	CCS07103D	36.30	0.4805	26.94	19.05	15.56	8.52	6.02	4.26
3#4	3	CCS03043D	107.73	0.2784	46.42	32.82	26.80	14.68	10.38	7.34
3#5	3	CCS03053D	67.70	0.3511	36.80	26.02	21.24	11.64	8.23	5.82
3#6	3	CCS03063D	42.59	0.4427	29.19	20.64	16.85	9.23	6.53	4.61
3#7	3	CCS03073D	26.81	0.5580	23.16	16.37	13.37	7.32	5.18	3.66
3#8	3	CCS03083D	16.86	0.7036	18.36	12.98	10.60	5.81	4.11	2.90
3#9	3	CCS03093D	10.59	0.8877	14.55	10.29	8.40	4.60	3.25	2.30
3#10	3	CCS03103D	6.67	1.1189	11.55	8.17	6.67	3.65	2.58	1.83
#2 AWG	7	CCS02STR3D	18.42	0.6746	19.19	13.57	11.08	6.07	4.29	3.03
#4 AWG	7	CCS04STR3D	7.20	1.0790	12.00	8.48	6.93	3.79	2.68	1.90
#2 AWG	1	CCS01023D	30.26	0.5210	24.60	17.40	14.20	7.78	5.50	3.89
#4 AWG	1	CCS01043D	11.97	0.8284	15.47	10.94	8.93	4.89	3.46	2.45
#6 AWG	1	CCS01063D	4.73	1.3172	9.73	6.88	5.62	3.08	2.18	1.54
#8 AWG	1	CCS01083D	1.87	2.0941	6.12	4.33	3.53	1.94	1.37	0.97
#9 AWG	1	CCS01093D	1.18	2.6421	4.85	3.43	2.80	1.53	1.08	0.77
#10 AWG	1	CCS01103D	0.74	3.3301	3.85	2.72	2.22	1.22	0.86	0.61

DSA Copperclad Steel Wire Jacketed Material

Copperclad Steel Wire from AFL can be jacketed to further reduce copper theft and is available in black with green stripe or grey. Available sizes are shown in the chart below, Table 1. Please contact AFL for larger sizes not shown.



6 AWG Solid with grey PVC Jacket

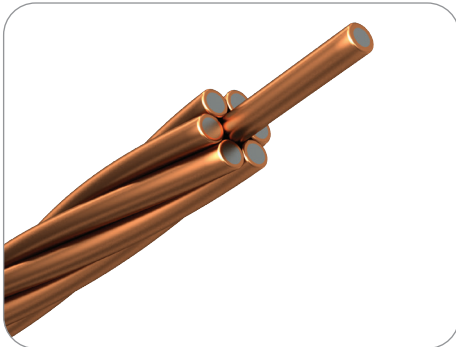


7#7 AWG with black with green stripe PVC jacket

Table 1—Physical and Electrical Characteristics of Copperclad Jacketed DSA Conductors

CONDUCTOR SIZE	CONDUCTOR OVERALL DIAMETER		AFL NO.		WEIGHT/LENGTH PVC		MIN BREAKING LOAD	
			GREY PVC	BLACK WITH GREEN TRACER PVC				
(AWG)	(in.)	(mm)	0.030 in.	0.030 in.	(lbs/kft)	(kg/km)	lbf	(kgf)
7#9	0.343	8.72	CCS07094DJV	CCS07094DBLK	279.7	416.2	2513	1140
7#10	0.306	7.76	CCS07104DJV	CCS07104DBLK	224.1	333.5	1994	904
#2 Str	0.258	6.55	CCS2STR4DJV	CCS2STR4DBLK	162.3	241.5	1435	651
#4 Str	0.204	5.18	CCS4STR4DJV	CCS4STR4DBLK	104.4	155.4	897	407
#2 Solid	0.258	6.54	CCS01024DJV	CCS01024DBLK	201.7	300.2	2023	918
#4 Solid	0.204	5.19	CCS01044DJV	CCS01044DBLK	129.8	193.2	1272	577
#6 Solid	0.162	4.12	CCS01064DJV	CCS01064DBLK	84.1	125.1	800	363

Copperclad Steel Wire—High Strength/Extra High Strength



7-strand Copperclad Steel Wire

High Strength (HS) and Extra High Strength (EHS) copperclad steel wire provides the same conductivity and corrosion resistance as copper while maintaining the high strength of steel. Frequently used for overhead ground wire and messenger wire, HS and EHS copperclad Steel Wire can resist mechanical damage caused during installation plus electrical damage during a fault condition. The core carbon steel is bonded with a uniform layer of oxygen-free coppercladding to ensure that the copper will not flake, crack or peel when the wire is twisted, installed or buried.

Specifications and Ordering Information

30% CONDUCTIVITY—HIGH STRENGTH

CONDUCTOR SIZE AWG	STRANDS	AFL NO.	OVERALL DIAMETER		AREA		MIN. BREAKING LOAD		WEIGHT/LENGTH		NOM. DC RESISTANCE	
			in.	mm	cmil	(mm ²)	lbf	kgf	lbs/kft	kg/km	Ω/kft	Ω/kM
19#4	19	CCS19043H	1.022	25.95	793,000	401.8	65264	29603	2231.3	3320.5	0.0442	0.1451
19#5	19	CCS19053H	0.910	23.10	628,700	318.6	53893	24445	1768.8	2632.3	0.0558	0.1830
19#6	19	CCS19063H	0.810	20.57	498,600	252.6	44456	20165	1403.0	2087.9	0.0703	0.2307
19#7	19	CCS19073H	0.722	18.33	395,600	200.5	36629	16615	1113.2	1656.6	0.0886	0.2908
19#8	19	CCS19083H	0.643	16.32	313,700	159.0	30123	13663	882.7	1313.6	0.1118	0.3667
19#9	19	CCS19093H	0.572	14.53	248,700	126.0	24727	11216	699.6	1041.2	0.1410	0.4626
4/0	19	CCS4/03H	0.528	13.40	211,500	107.2	21030	9539	595.0	885.5	0.1658	0.5440
19#10	19	CCS19103H	0.510	12.94	197,300	100.0	20431	9267	555.1	826.1	0.1777	0.5831
7#4	7	CCS07043H	0.613	15.57	292,200	148.1	24045	10906	818.8	1218.5	0.1195	0.3922
7#5	7	CCS07053H	0.546	13.86	231,600	117.4	19855	9006	649.1	966.0	0.1508	0.4947
7#6	7	CCS07063H	0.486	12.34	183,700	93.1	16379	7429	514.9	766.2	0.1901	0.6237
7#7	7	CCS07073H	0.433	11.00	145,800	73.9	13495	6121	408.5	607.9	0.2396	0.7861
2/0	7	CCS2/03H	0.414	10.51	133,100	67.4	12324	5590	373.1	555.2	0.2624	0.8608
7#8	7	CCS07083H	0.386	9.79	115,600	58.6	11098	5034	323.9	482.1	0.3021	0.9913
1/0	7	CCS1/03H	0.368	9.35	105,600	53.5	10135	4597	295.8	440.2	0.3308	1.0855
7#9	7	CCS07093H	0.343	8.72	91,610	46.4	9110	4132	256.7	382.1	0.3812	1.2507
7#10	7	CCS07103H	0.306	7.76	72,690	36.8	7527	3414	203.7	303.1	0.4805	1.5764
3#4	3	CCS03043H	0.440	11.18	125,200	63.4	10877	4934	350.2	521.2	0.2784	0.9132
3#5	3	CCS03053H	0.392	9.96	99,260	50.3	8982	4074	277.6	413.2	0.3511	1.1520
3#6	3	CCS03063H	0.349	8.86	78,730	39.9	7409	3361	220.2	327.7	0.4427	1.4524
3#7	3	CCS03073H	0.311	7.90	62,470	31.7	6105	2769	174.7	260.0	0.5580	1.8306
3#8	3	CCS03083H	0.277	7.04	49,540	25.1	5020	2277	138.6	206.2	0.7036	2.3084
3#9	3	CCS03093H	0.247	6.27	39,260	19.9	4121	1869	109.8	163.4	0.8877	2.9126
3#10	3	CCS03103H	0.220	5.59	31,150	15.8	3405	1545	87.1	129.7	1.1189	3.6709
#2 AWG	7	CCS02STR3H	0.258	6.55	51,770	26.2	5416	2457	145.1	215.9	0.6746	2.2132
#4 AWG	7	CCS04STR3H	0.204	5.18	32,370	16.4	2691	1221	90.7	135.0	1.0790	3.5399
#2 AWG	1	CCS01023H	0.258	6.54	66,370	33.6	6069	2753	184.2	274.1	0.5210	1.7093
#4 AWG	1	CCS01043H	0.204	5.19	41,740	21.2	3817	1731	115.8	172.4	0.8284	2.7180
#6 AWG	1	CCS01063H	0.162	4.12	26,250	13.3	2600	1180	72.8	108.4	1.3172	4.3216
#8 AWG	1	CCS01083H	0.129	3.26	16,510	8.4	1762	799	45.8	68.2	2.0941	6.8704
#9 AWG	1	CCS01093H	0.114	2.91	13,090	6.6	1446	656	36.3	54.0	2.6421	8.6683
#10 AWG	1	CCS01103H	0.102	2.59	10,380	5.3	1195	542	28.8	42.9	3.3301	10.9254

Copperclad Steel Wire—High Strength (cont.)

Specifications and Ordering Information

40% CONDUCTIVITY—HIGH STRENGTH												
CONDUCTOR SIZE AWG	STRANDS	AFL NO.	OVERALL DIAMETER		AREA		MIN. BREAKING LOAD		WEIGHT/LENGTH		NOM. DC RESISTANCE	
			in.	mm	cmil	(mm ²)	lbf	kgf	lbs/kft	kg/km	Ω/kft	Ω/kM
19#4	19	CCS19044H	1.022	25.95	793,000	401.8	58738	26643	2251.7	3350.9	0.0331	0.1087
19#5	19	CCS19054H	0.910	23.10	628,700	318.6	48719	22099	1785.0	2656.3	0.0418	0.1371
19#6	19	CCS19064H	0.810	20.57	498,600	252.6	40353	18303	1415.8	2106.9	0.0527	0.1729
19#7	19	CCS19074H	0.722	18.33	395,600	200.5	33373	15138	1123.3	1671.7	0.0664	0.2179
19#8	19	CCS19084H	0.643	16.32	313,700	159.0	27541	12492	890.8	1325.6	0.0837	0.2747
19#9	19	CCS19094H	0.572	14.53	248,700	126.0	22681	10288	706.0	1050.7	0.1057	0.3466
4/0	19	CCS4/04H	0.528	13.40	211,500	107.2	19289	8749	600.4	893.6	0.1242	0.4076
19#10	19	CCS19104H	0.510	12.94	197,300	100.0	18753	8506	560.2	833.6	0.1332	0.4369
7#4	7	CCS07044H	0.613	15.57	292,200	148.1	21640	9816	826.3	1229.7	0.0896	0.2938
7#5	7	CCS07054H	0.546	13.86	231,600	117.4	17949	8142	655.0	974.8	0.1130	0.3707
7#6	7	CCS07064H	0.486	12.34	183,700	93.1	14867	6743	519.6	773.2	0.1424	0.4673
7#7	7	CCS07074H	0.433	11.00	145,800	73.9	12295	5577	412.2	613.5	0.1795	0.5890
2/0	7	CCS2/04H	0.414	10.51	133,100	67.4	11229	5093	376.5	560.2	0.1966	0.6450
7#8	7	CCS07084H	0.386	9.79	115,600	58.6	10147	4602	326.9	486.5	0.2264	0.7428
1/0	7	CCS1/04H	0.368	9.35	105,600	53.5	9266	4203	298.5	444.3	0.2479	0.8133
7#9	7	CCS07094H	0.343	8.72	91,610	46.4	8356	3790	259.1	385.6	0.2856	0.9371
7#10	7	CCS07104H	0.306	7.76	72,690	36.8	6909	3134	205.6	305.9	0.3600	1.1812
3#4	3	CCS03044H	0.440	11.18	125,200	63.4	9790	4440	353.4	526.0	0.2086	0.6843
3#5	3	CCS03054H	0.392	9.96	99,260	50.3	8120	3683	280.2	416.9	0.2631	0.8632
3#6	3	CCS03064H	0.349	8.86	78,730	39.9	6725	3051	222.2	330.7	0.3317	1.0883
3#7	3	CCS03074H	0.311	7.90	62,470	31.7	5562	2523	176.3	262.4	0.4181	1.3716
3#8	3	CCS03084H	0.277	7.04	49,540	25.1	4590	2082	139.8	208.1	0.5272	1.7297
3#9	3	CCS03094H	0.247	6.27	39,260	19.9	3780	1715	110.8	164.9	0.6652	2.1823
3#10	3	CCS03104H	0.220	5.59	31,150	15.8	3125	1418	87.9	130.8	0.8384	2.7506
#2 AWG	7	CCS02STR4H	0.258	6.55	51,770	26.2	4971	2255	146.4	217.9	0.5054	1.6583
#4 AWG	7	CCS04STR4H	0.204	5.18	32,370	16.4	2579	1170	91.5	136.2	0.8085	2.6524
#2 AWG	1	CCS01024H	0.258	6.54	66,370	33.6	5462	2477	185.8	276.6	0.3904	1.2808
#4 AWG	1	CCS01044H	0.204	5.19	41,740	21.2	3435	1558	116.9	173.9	0.6207	2.0366
#6 AWG	1	CCS01064H	0.162	4.12	26,250	13.3	2360	1071	73.5	109.4	0.9870	3.2382
#8 AWG	1	CCS01084H	0.129	3.26	16,510	8.4	1611	731	46.2	68.8	1.5691	5.1479
#9 AWG	1	CCS01094H	0.114	2.91	13,090	6.6	1326	602	36.6	54.5	1.9797	6.4951
#10 AWG	1	CCS01104H	0.102	2.59	10,380	5.3	1097	497	29.1	43.3	2.4952	8.1863

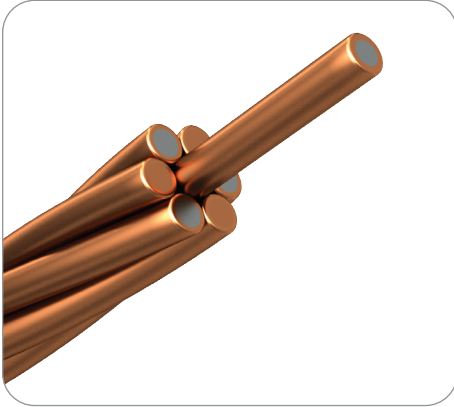
Copperclad Steel Wire—Extra High Strength

Specifications and Ordering Information

30% CONDUCTIVITY—EXTRA HIGH STRENGTH

CONDUCTOR SIZE AWG	STRANDS	AFL NO.	OVERALL DIAMETER		AREA		MIN. BREAKING LOAD		WEIGHT/LENGTH		NOM. DC RESISTANCE	
			in.	mm	cmil	(mm ²)	lbf	kgf	lbs/kft	kg/km	Ω/kft	Ω/kM
19#4	19	CCS19043E	1.022	25.95	793,000	401.8	77501	35154	2231.3	3320.5	0.0442	0.1451
19#5	19	CCS19053E	0.910	23.10	628,700	318.6	64887	29432	1768.8	2632.3	0.0558	0.1830
19#6	19	CCS19063E	0.810	20.57	498,600	252.6	53860	24431	1403.0	2087.9	0.0703	0.2307
19#7	19	CCS19073E	0.722	18.33	395,600	200.5	44497	20184	1113.2	1656.6	0.0886	0.2908
19#8	19	CCS19083E	0.643	16.32	313,700	159.0	36577	16591	882.7	1313.6	0.1118	0.3667
19#9	19	CCS19093E	0.572	14.53	248,700	126.0	29690	13467	699.6	1041.2	0.1410	0.4626
4/0	19	CCS4/03E	0.528	13.40	211,500	107.2	25250	11453	595.0	885.5	0.1658	0.5440
19#10	19	CCS19103E	0.510	12.94	197,300	100.0	24219	10986	555.1	826.1	0.1777	0.5831
7#4	7	CCS07043E	0.613	15.57	292,200	148.1	28553	12951	818.8	1218.5	0.1195	0.3922
7#5	7	CCS07053E	0.546	13.86	231,600	117.4	23906	10843	649.1	966.0	0.1508	0.4947
7#6	7	CCS07063E	0.486	12.34	183,700	93.1	19843	9001	514.9	766.2	0.1901	0.6237
7#7	7	CCS07073E	0.433	11.00	145,800	73.9	16394	7436	408.5	607.9	0.2396	0.7861
2/0	7	CCS2/03E	0.414	10.51	133,100	67.4	14972	6791	373.1	555.2	0.2624	0.8608
7#8	7	CCS07083E	0.386	9.79	115,600	58.6	13476	6113	323.9	482.1	0.3021	0.9913
1/0	7	CCS1/03E	0.368	9.35	105,600	53.5	12307	5582	295.8	440.2	0.3308	1.0855
7#9	7	CCS07093E	0.343	8.72	91,610	46.4	10938	4962	256.7	382.1	0.3812	1.2507
7#10	7	CCS07103E	0.306	7.76	72,690	36.8	8923	4047	203.7	303.1	0.4805	1.5764
3#4	3	CCS03043E	0.440	11.18	125,200	63.4	12917	5859	350.2	521.2	0.2784	0.9132
3#5	3	CCS03053E	0.392	9.96	99,260	50.3	10815	4905	277.6	413.2	0.3511	1.1520
3#6	3	CCS03063E	0.349	8.86	78,730	39.9	8977	4072	220.2	327.7	0.4427	1.4524
3#7	3	CCS03073E	0.311	7.90	62,470	31.7	7416	3364	174.7	260.0	0.5580	1.8306
3#8	3	CCS03083E	0.277	7.04	49,540	25.1	6096	2765	138.6	206.2	0.7036	2.3084
3#9	3	CCS03093E	0.247	6.27	39,260	19.9	4948	2245	109.8	163.4	0.8877	2.9126
3#10	3	CCS03103E	0.220	5.59	31,150	15.8	4037	1831	87.1	129.7	1.1189	3.6709
#2 AWG	7	CCS02STR3E	0.258	6.55	51,770	26.2	6420	2912	145.1	215.9	0.6746	2.2132
#4 AWG	7	CCS04STR3E	0.204	5.18	32,370	16.4	4014	1821	90.7	135.0	1.0790	3.5399
#2 AWG	1	CCS01023E	0.258	6.54	66,370	33.6	7207	3269	184.2	274.1	0.5210	1.7093
#4 AWG	1	CCS01043E	0.204	5.19	41,740	21.2	4532	2056	115.8	172.4	0.8284	2.7180
#6 AWG	1	CCS01063E	0.162	4.12	26,250	13.3	3151	1429	72.8	108.4	1.3172	4.3216
#8 AWG	1	CCS01083E	0.129	3.26	16,510	8.4	2139	970	45.8	68.2	2.0941	6.8704
#9 AWG	1	CCS01093E	0.114	2.91	13,090	6.6	1736	788	36.3	54.0	2.6421	8.6683
#10 AWG	1	CCS01103E	0.102	2.59	10,380	5.3	1416	642	28.8	42.9	3.3301	10.9254

Copperclad Composite (CCC) Conductors



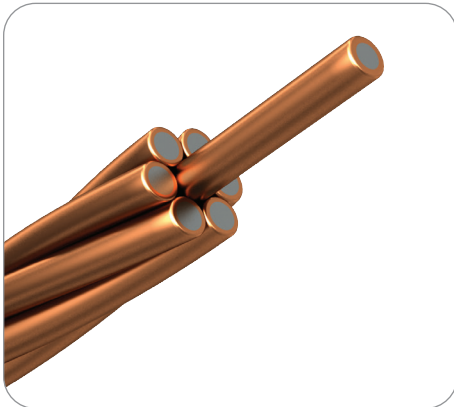
*Type K—4 Copperclad Steel Wires
and 3 Copper Wires*

Copperclad Composite (CCC) Conductors provide strength and conductivity by combining hard drawn copper with 30% conductivity EHS Copperclad Steel Wire. With its steel component, the CCC conductor achieves a higher tensile strength.

CCC conductors feature a higher ampacity for the same wire size as standard Copperclad Steel Wire.

Ordering Information

Contact AFL for detailed specifications not shown.



7-strand Copperclad Steel Wire

Copperclad Type M Guy Wire

Copperclad Type M guy wire is an economical, corrosion-resistant guying material for use on overhead lines. The coppercladding that is bonded on each wire protects the high-strength steel core from rusting and subsequent loss of strength.

Ordering Information

Contact AFL for detailed specifications.

For additional information on Copperclad Composite Conductors, contact AFL.

Copperclad Part Number Nomenclature

Ordering Information

Step 1: Determine Catalog Number.

Step 2: Determine Package Code.

Step 3: Assemble complete part number—Catalog Number + Package Code

- Example: For a 2,000 ft. reel of 40% and 7#8 DSA, the complete part number is CCS07084DR2000F.

Step 1—Catalog Number

CATALOG NUMBER (NOT ALL SIZES LISTED)		
CONDUCTOR CONFIGURATION	30% CONDUCTIVITY	40% CONDUCTIVITY
#6 Jacketed		CCS01064D-JV*
#4 Jacketed		CCS01044D-JV*
#2 Jacketed		CCS01024D-JV*
#4 Stranded Jacketed		CCS4STR4D-JV*
#2 Stranded Jacketed		CCS2STR4D-JV*
#2 Stranded		CCS2STR4D
#4 Stranded		CCS4STR4D
#2	CCS01023D	CCS01024D
#4	CCS01043D	CCS01044D
#6	CCS01063D	CCS01064D
3#5	CCS03053D	CCS03054D
3#6	CCS03063D	CCS03064D
3#7	CCS03073D	CCS03074D
3#8	CCS03083D	CCS03084D
3#9	CCS03093D	CCS03094D
3#10	CCS03103D	CCS03104D
7#5	CCS07053D	CCS07054D
7#6	CCS07063D	CCS07064D
7#7	CCS07073D	CCS07074D
7#8	CCS07083D	CCS07084D
7#9	CCS07093D	CCS07094D
7#10	CCS07103D	CCS07104D
19#5	CCS19053D	CCS19054D
19#6	CCS19063D	CCS19064D
19#7	CCS19073D	CCS19074D
19#8	CCS19083D	CCS19084D
19#9	CCS19093D	CCS19094D

* See Jacket detail sheet for alternate jacketing configurations and part numbers.

Step 2—Package Code

Select preference of packaging type.

COILS		REELS		SPOOLS	
CODE (LBS)	CODE (FT)	CODE (LBS)	CODE (FT)	CODE (LBS)	CODE (FT)
C50P	C334F	R500P	R500F	S25P	S318F
C100P		R1000P	R1000F		
C200P		R2000P	R2000F		
		R3521P	R3521F		

Not all sizes listed.

Step 3—Assemble Complete Part Number



Explanation of Copperclad Part Numbers

CCS	0707	4	D	R	1000	F
Copperclad Steel (CCX = Onyx)	Stranding of #7 0707 = 7 Strands of #7 0102 = Single Strand of #2	Conductivity (IACS Int'l Annealed Copper) 3 = 30% 4 = 40%	Material Type D = DSA (Dead Soft Annealed) H = High Strength E = Extra High Strength	Package Type R = Reel S = Spool C = Coil	Package Quantity	Unit of Measure F = Feet (ft) P = Pounds (lbs)

Recommended Maximum Footage per Reel

19 Strands

REEL SIZE	19#4	19#5	19#6	19#7	19#8	19#9	4/0	19#10
4	—	—	—	—	—	575	675	725
5	—	—	—	—	575	750	875	950
6	—	—	600	775	975	1,200	1,450	1,550
7.5	575	725	925	1,150	1,450	1,850	2,200	2,350
8	775	975	1,200	1,550	1,950	2,450	2,900	3,100
9	1,200	1,550	1,950	2,450	3,100	3,950	4,650	4,950
10	1,550	1,950	2,450	3,100	3,900	4,950	5,800	6,200
11	2,050	2,600	3,300	4,150	5,250	6,650	7,850	8,400
12	3,150	4,000	5,000	6,350	8,000	10,100	11,800	12,700

7 Strands

REEL SIZE	7#4	7#5	7#6	7#7	2/0	7#8	1/0	7#9	7#10	#2 STR	#4 STR
4	475	600	775	975	1,050	1,200	1,350	1,550	1,950	2,750	4,450
5	625	800	1,000	1,250	1,400	1,600	1,750	2,050	2,550	3,600	5,800
6	1,050	1,300	1,650	2,100	2,300	2,650	2,950	3,400	4,250	6,000	9,600
7.5	1,600	2,000	2,550	3,200	3,500	4,050	4,450	5,100	6,450	9,100	14,500
8	2,100	2,650	3,350	4,250	4,650	5,350	5,850	6,750	8,500	11,900	—
9	3,350	4,250	5,350	6,750	7,400	8,550	9,350	10,800	13,600	—	—
10	4,200	5,300	6,700	8,450	9,250	10,700	11,700	13,500	—	—	—
11	5,700	7,200	9,050	11,400	12,500	14,400	15,800	—	—	—	—
12	8,600	10,900	13,700	—	—	—	—	—	—	—	—

3 Strands

REEL SIZE	3#5	3#6	3#7	3#8	3#9	3#10
4	1,450	1,800	2,300	2,900	3,650	4,600
5	1,900	2,400	3,000	3,800	4,800	6,050
6	3,100	3,950	5,000	6,300	7,950	10,000
7.5	4,750	6,000	7,550	9,500	12,000	15,100
8	6,250	7,850	9,900	12,500	15,800	19,900
9	9,950	12,500	15,800	20,000	—	—
10	12,400	15,700	19,800	—	—	—
11	16,800	21,200	—	—	—	—
12	—	—	—	—	—	—

Single Strand

REEL SIZE	#2	#4	#6
4	2,150	3,450	5,500
5	2,850	4,550	7,250
6	4,700	7,500	11,900
7.5	7,150	11,400	18,100
8	—	—	—
9	—	—	—
10	—	—	—
11	—	—	—
12	—	—	—

Reel Specifications

REEL NO.	OD (in.)	ID (in.)	WIDTH (in.)	MAX CAPACITY (lbs)
4	24.0	12.0	13.0	407
5	24.0	12.0	16.9	533
6	28.0	12.0	17.9	881
8	36.0	17.9	21.1	1,751
9	40.0	17.1	29.5	2,797
10	41.9	13.8	29.5	3,496
11	48.0	26.0	30.0	5,070
12	54.0	36.0	30.0	7,140

Green Spool Specifications



Spool of Copperclad Steel Wire with PVC jacketed material. For spool sizes and specifications, see page 14.

SIZE	ARBOR HOLE SIZE*	WEIGHT	SPOOL DIMENSIONS (inches)	DSA	JACKET TYPE	WIRE LENGTH (ft.)
#6 Bare Solid	2 inch	25	12 x 4 x 5	40	—	338
#6 Solid Jacketed	2 inch	29	13 x 4 x 5	40	Vinyl	338
#4 Bare Solid	2 inch	25	12 x 4 x 5	40	—	214
#4 Solid Jacketed	2 inch	29	12 x 4 x 5	40	Vinyl	214
#4 Stranded	2 inch	20	12 x 4 x 5	40	—	214
#4 Stranded Jacketed	2 inch	22	12 x 4 x 5	40	Vinyl	214
#2 Bare Solid	2 inch	25	12 x 4 x 5	40	—	134
#2 Solid Jacketed	2 inch	27	12 x 4 x 5	40	Vinyl	134
#2 Stranded	2 inch	20	12 x 4 x 5	40	—	134
#2 Stranded Jacketed	2 inch	23	12 x 4 x 5	40	Vinyl	134

* Special arbor hole sizes available upon request.

Please contact your AFL Sales Representative for information about our other products or services.

**FIBER OPTIC CABLE
(OPGW, ADSS, Loose Tube)**



**FIBER OPTIC CABLE
ACCESSORIES**

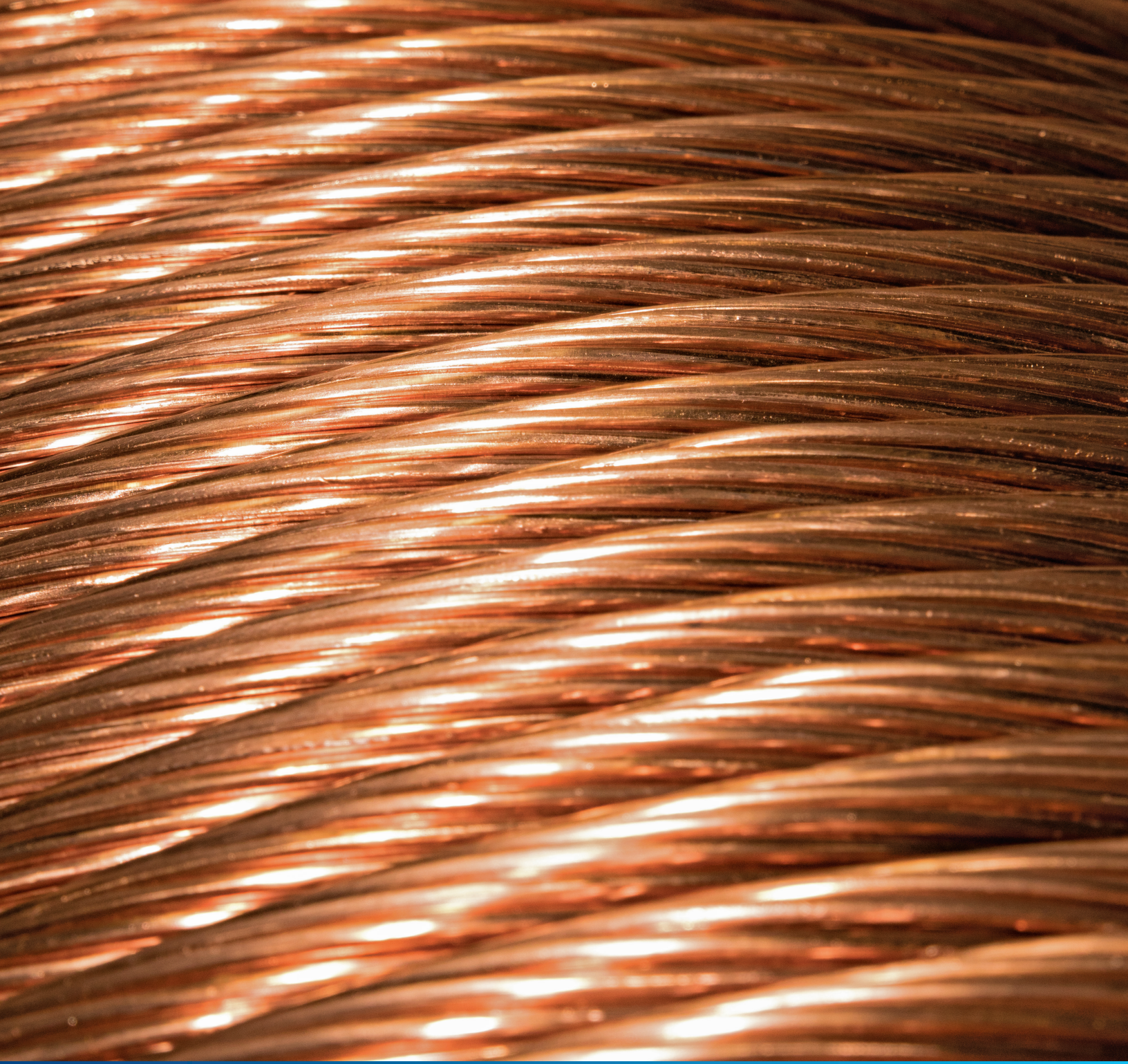


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