



Standard Specification for Rope-Lay-Stranded Copper Conductors Having Concentric-Stranded Members, for Electrical Conductors¹

This standard is issued under the fixed designation B 173; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification covers bare rope-lay-stranded conductors having concentric-stranded members made from round copper wires, either uncoated or coated with tin, lead, or lead-alloy for use as electrical conductors (Explanatory Note 1 and Note 2).

1.2 Coated wires shall include only those wires with finished diameters and densities substantially equal to the respective diameters and densities of uncoated wires.

1.3 The SI values for density are regarded as the standard. For all other properties the inch-pound values are to be regarded as standard and the SI units may be approximate.

2. Referenced Documents

2.1 The following documents of the issue in effect at the time of reference form a part of this specification to the extent referenced herein:

2.2 ASTM Standards:

- B 3 Specification for Soft or Annealed Copper Wire²
- B 8 Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft²
- B 33 Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes²
- B 172 Specification for Rope-Lay-Stranded Copper Conductors Having Bunch-Stranded Members, for Electrical Conductors²
- B 189 Specification for Lead-Coated and Lead-Alloy-Coated Soft Copper Wire for Electrical Purposes²
- B 263 Test Method for Determination of Cross-Sectional Area of Stranded Conductors²
- B 354 Terminology Relating to Uninsulated Metallic Electrical Conductors²

2.3 American National Standard:

- ANSI C42.35 Definitions of Electrical Terms³

¹ This specification is under the jurisdiction of ASTM Committee B-1 on Electrical Conductors and is the direct responsibility of Subcommittee B01.04 on Conductors of Copper and Copper Alloys.

Current edition approved July 15, 1995. Published September 1995. Originally issued 1942 to replace portions of B 158 – 41 T. Last previous edition B 173 – 90.

² *Annual Book of ASTM Standards*, Vol 02.03.

³ Available from American National Standards Institute, 11 West 42nd St., 13th Floor, New York, NY 10036.

3. Classification

3.1 For the purpose of this specification rope-lay-stranded conductors having concentric-stranded members are classified as follows:

3.1.1 *Class G*—Conductors consisting of 7 to 61 rope-lay-stranded members, each of which consists of 7 to 19 concentric-stranded wires, with total conductor sizes ranging from No. 14 AWG (2.08 mm²) to 5 000 000 cmil (2534 mm²). (Typical use is for rubber-sheathed conductor, apparatus conductor, portable conductor, and similar applications.)

3.1.2 *Class H*—Conductors consisting of 19 to 91 rope-lay-stranded members, each of which consists of 7 to 19 concentric-stranded wires, with total conductor sizes ranging from No. 9 AWG (6.63 mm²) to 5 000 000 cmil (2534 mm²). Class K construction produces a conductor with greater flexibility than class G. (Typical use is for rubber-sheathed cord and applications where flexibility is required such as on take-up reels over sheaves and extra-flexible apparatus conductor.)

4. Ordering Information

4.1 Orders for material under this specification shall include the following information:

- 4.1.1 Quantity of each size and class,
- 4.1.2 Conductor size: circular-mil area or AWG (Section 7),
- 4.1.3 Class (Section 3 and Table 1),
- 4.1.4 Whether coated or uncoated; if coated, designate type of coating (see 11.1),
- 4.1.5 Details of special-purpose lays, if required (see 6.2 and 6.3) and (Explanatory Note 3),
- 4.1.6 Package size (see 14.1),
- 4.1.7 Special package marking, if required (Section 15),
- 4.1.8 Lagging, if required (see 14.2), and
- 4.1.9 Place of inspection (Section 13).
- 4.1.10 In addition, Supplementary Requirements shall apply only when specified by the purchaser in the inquiry, contract, or purchase order for direct procurement by agencies of the U. S. Government (S1, S2, and S3).

5. Joints

5.1 Necessary joints in wires or in groups of wires shall be made in accordance with accepted commercial practice, taking

TABLE 1 Construction Requirements of Rope-Lay Stranded Copper Conductors Having Concentric-Stranded Members^A

Area of Cross Section		Class G										Class H							
		Size AWG	Number of Wires	Diameter of Wires		Number of Wires in Each Member	Completed Conductor ^B				Number of Wires	Diameter of Wires		Number of Wires in Each Member	Completed Conductor ^B				
				in.	mm		in.	mm	lb/1000 ft.	kg/km		in.	mm		in.	mm	lb/1000 ft.	kg/km	
cmil	mm																		
5 000 000	2534	...	1159	0.0657	1.67	19	2.957	75.1	16 052	23 888	1729	0.0538	1.37	19	2.959	75.2	16 057	23 896	
4 500 000	2280	...	1159	0.0623	1.58	19	2.804	71.2	14 433	21 479	1729	0.0510	1.30	19	2.805	71.2	14 429	21 473	
4 000 000	2027	...	1159	0.0587	1.49	19	2.642	67.1	12 814	19 069	1729	0.0481	1.22	19	2.646	67.2	12 835	19 101	
3 500 000	1773	...	1159	0.0550	1.40	19	2.475	62.9	11 249	16 741	1729	0.0450	1.14	19	2.475	62.9	11 234	16 718	
3 000 000	1520	...	1159	0.0509	1.29	19	2.291	58.2	9635	14 338	1729	0.0417	1.06	19	2.294	58.3	9647	14 356	
2 500 000	1267	...	703	0.0596	1.51	19	2.086	53.0	8012	11 924	1159	0.0464	1.18	19	2.088	53.0	8006	11 915	
2 000 000	1013	...	703	0.0533	1.35	19	1.866	47.4	6408	9536	1159	0.0415	1.05	19	1.868	47.4	6405	9531	
1 900 000	963	...	703	0.0520	1.32	19	1.820	46.2	6099	9077	1159	0.0405	1.03	19	1.823	46.3	6100	9077	
1 800 000	912	...	703	0.0506	1.29	19	1.771	45.0	5775	8594	1159	0.0394	1.00	19	1.773	45.0	5773	8591	
1 750 000	887	...	703	0.0499	1.27	19	1.747	44.4	5617	8358	1159	0.0389	0.99	19	1.751	44.5	5627	8374	
1 700 000	861	...	703	0.0492	1.25	19	1.722	43.7	5460	8125	1159	0.0383	0.97	19	1.724	43.8	5455	8118	
1 600 000	811	...	703	0.0477	1.21	19	1.670	42.4	5132	7638	1159	0.0372	0.94	19	1.674	42.5	5146	7658	
1 500 000	760	...	427	0.0593	1.51	7	1.601	40.7	4772	7102	703	0.0462	1.17	19	1.617	41.1	4815	7165	
1 400 000	709	...	427	0.0573	1.46	7	1.547	39.3	4456	6631	703	0.0446	1.13	19	1.561	39.6	4487	6677	
1 300 000	659	...	427	0.0552	1.40	7	1.490	37.8	4135	6154	703	0.0430	1.09	19	1.505	38.2	4171	6207	
1 250 000	633	...	427	0.0541	1.37	7	1.461	37.1	3972	5911	703	0.0422	1.07	19	1.477	37.5	4017	5978	
1 200 000	608	...	427	0.0530	1.35	7	1.431	36.3	3812	5673	703	0.0413	1.05	19	1.446	36.7	3847	5726	
1 100 000	557	...	427	0.0508	1.29	7	1.372	34.8	3502	5212	703	0.0396	1.01	19	1.386	35.2	3537	5264	
1 000 000	507	...	427	0.0484	1.23	7	1.307	33.2	3179	4731	703	0.0377	0.96	19	1.320	33.5	3206	4771	
900 000	456	...	427	0.0459	1.17	7	1.239	31.5	2859	4255	703	0.0358	0.91	19	1.253	31.8	2891	4302	
800 000	405	...	427	0.0433	1.10	7	1.169	29.7	2544	3787	703	0.0337	0.86	19	1.180	30.0	2562	3812	
750 000	380	...	427	0.0419	1.06	7	1.131	28.7	2383	3546	703	0.0327	0.83	19	1.145	29.1	2412	3589	
700 000	355	...	427	0.0405	1.03	7	1.094	27.8	2226	3313	703	0.0316	0.80	19	1.106	28.1	2252	3352	
650 000	329	...	427	0.0390	0.99	7	1.053	26.7	2064	3072	703	0.0304	0.77	19	1.064	27.0	2085	3102	
600 000	304	...	427	0.0375	0.95	7	1.013	25.7	1908	2840	703	0.0292	0.74	19	1.022	26.0	1923	2862	
550 000	279	...	427	0.0359	0.91	7	0.969	24.6	1749	2603	703	0.0280	0.71	19	0.980	24.9	1768	2632	
500 000	253	...	259	0.0439	1.12	7	0.922	23.4	1579	2350	427	0.0342	0.87	7	0.923	23.4	1587	2362	
450 000	228	...	259	0.0417	1.06	7	0.876	22.3	1425	2120	427	0.0325	0.83	7	0.878	22.3	1433	2133	
400 000	203	...	259	0.0393	1.00	7	0.825	21.0	1265	1883	427	0.0306	0.78	7	0.826	21.0	1271	1891	
350 000	177	...	259	0.0368	0.93	7	0.773	19.6	1109	1651	427	0.0286	0.73	7	0.772	19.6	1110	1652	
300 000	152	...	259	0.0340	0.86	7	0.714	18.1	947	1409	427	0.0265	0.67	7	0.716	18.2	953	1418	
250 000	127	...	259	0.0311	0.79	7	0.653	16.6	792	1179	427	0.0242	0.61	7	0.653	16.6	795	1183	
211 600	107	0000	133	0.0399	1.01	7	0.599	15.2	667	992	259	0.0286	0.73	7	0.601	15.3	670	997	
167 800	85.0	000	133	0.0355	0.90	7	0.533	13.5	528	785	259	0.0255	0.65	7	0.536	13.6	533	793	
133 100	67.4	00	133	0.0316	0.80	7	0.474	12.0	418	622	259	0.0227	0.58	7	0.477	12.1	422	628	
105 600	53.5	0	133	0.0282	0.72	7	0.423	10.7	333	495	259	0.0202	0.51	7	0.424	10.8	334	497	
83 690	42.4	1	133	0.0251	0.64	7	0.377	9.58	264	393	259	0.0180	0.46	7	0.378	9.60	265	395	
66 360	33.6	2	49	0.0368	0.93	7	0.331	8.41	207	308	259	0.0160	0.41	7	0.335	8.51	210	312	
52 620	26.7	3	49	0.0328	0.83	7	0.295	7.49	164	245	133	0.0199	0.51	7	0.299	7.59	166	247	
41 740	21.1	4	49	0.0292	0.74	7	0.263	6.68	130	194	133	0.0177	0.45	7	0.266	6.76	131	195	
33 090	16.8	5	49	0.0260	0.66	7	0.234	5.94	103	154	133	0.0158	0.40	7	0.237	6.02	105	156	
26 240	13.3	6	49	0.0231	0.59	7	0.208	5.28	81.5	121	133	0.0140	0.36	7	0.210	5.33	82.1	122	
20 820	10.5	7	49	0.0206	0.52	7	0.185	4.70	64.8	96.5	133	0.0125	0.32	7	0.188	4.78	65.4	97.4	
16 510	8.37	8	49	0.0184	0.47	7	0.166	4.22	51.7	77.0	133	0.0111	0.28	7	0.167	4.24	51.6	76.8	
13 090	6.63	9	49	0.0163	0.41	7	0.148	3.76	40.6	60.4	133	0.0099	0.25	7	0.149	3.78	41.0	61.1	
10 380	5.26	10	49	0.0146	0.37	7	0.131	3.33	32.6	48.5									
6530	3.31	12	49	0.0115	0.29	7	0.104	2.64	20.2	30.1									
4110	2.08	14	49	0.0092	0.23	7	0.083	2.11	12.9	19.2									

^A The constructions shown in this table are typical of those used in the industry. It is not intended that this table preclude other constructions using the same total number of wires which may be desirable for specific applications. The constructions shown provide for a finished, non-covered, stranded conductor approximately of the area indicated. When specified by the purchaser, the number or size of wires may be increased to provide additional area to compensate for draw-down during subsequent processing.

^B Values for the nominal diameter and mass of the completed conductor are approximate. The mass values are based upon the standard stranding increments listed in Explanatory Note 6.

into account the size of the wire or group of wires as related to the size of the entire conductor.

5.2 Concentric-stranded members forming the completed conductor may be joined as a unit by soldering, brazing, or welding.

5.3 Joints shall be so constructed and so disposed throughout the conductor that the diameter or configuration of the completed conductor is not substantially affected, and so that the flexibility of the completed conductor is not adversely affected.

6. Lay (Explanatory Note 3)

6.1 Conductors of the same size and description furnished on one order shall have the same lay.

6.2 The length of lay of the outer layer of the rope-laystranded conductor shall be not less than 8 nor more than 16 times the outside diameter of the completed conductor. The length of lay of the other layers shall be at the option of the manufacturer unless specifically agreed upon. The direction of lay of the outer layer shall be left-hand, unless the direction of