This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

Designation: B172 – 17

Standard Specification for Rope-Lay-Stranded Copper Conductors Having Bunch-Stranded Members, for Electrical Conductors[1]

This standard is issued under the fixed designation B172; 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 U.S. Department of Defense.

1. Scope

1.1 This specification covers bare rope-lay-stranded conductors having bunch-stranded members made from round copper wires, either uncoated or coated with tin, lead, or lead-alloy for use as electrical conductors (Explanatory Notes 1 and 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 values stated in inch-pound or SI units are to be regarded separately as standard. Each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the specification. For conductor sizes designated by AWG or kcmil, the requirements in SI units have been numerically converted from corresponding values, stated or derived, in inch-pound units. For conductor sizes designated by SI units only, the requirements are stated or derived in SI units.

1.3.1 For density, resistivity, and temperature, the values stated in SI units are to be regarded as standard.

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

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:*[2]

B3 Specification for Soft or Annealed Copper Wire

B33 Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes

B173 Specification for Rope-Lay-Stranded Copper Conductors Having Concentric-Stranded Members, for Electrical Conductors

B189 Specification for Lead-Coated and Lead-Alloy-Coated Soft Copper Wire for Electrical Purposes

B193 Test Method for Resistivity of Electrical Conductor Materials

B263 Test Method for Determination of Cross-Sectional Area of Stranded Conductors

B354 Terminology Relating to Uninsulated Metallic Electrical Conductors

2.3 *American National Standard:*

ANSI C42.35 Definitions of Electrical Terms[3]

3. Classification

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

3.1.1 *Class I*—Conductors consisting of wires 0.0201-in. (0.511-mm) diameter (No. 24 AWG) to produce rope-lay-stranded conductors up to 2 000 000 cmil (1013 mm^2) in total cross-sectional area. (Typical use is for special apparatus conductor.)

3.1.2 *Class K*—Conductors consisting of wires 0.0100-in. (0.254-mm) diameter (No. 30 AWG) to produce rope-lay-stranded conductors up to 1 000 000 cmil (507 mm^2) in total cross-sectional area. (Typical use is for special portable cord and conductors.)

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

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

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3.1.3 *Class M*—Conductors consisting of wires 0.0063-in. (0.160-mm) diameter (No. 34 AWG) to produce rope-lay-stranded conductors up to 1 000 000 cmil (507 mm^2) in total cross-sectional area. (Typical use is for welding conductors.)

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 (see 7.1),

4.1.3 Class (Section 4 and Tables 1-3),

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, 6.3, and Explanatory Note 3),

4.1.6 Package size (see 15.1),

4.1.7 Special package marking, if required (Section 14),

4.1.8 Lagging, if required (see 15.2), and

4.1.9 Place of inspection (Section 13).

5. Joints

5.1 Necessary joints in wires or in groups of wires shall be made in accordance with accepted commercial practice, taking into account the size of the wire or group of wires as related to the size of the entire conductor.

TABLE 1 Construction Requirements of Class I Rope-Lay Stranded Copper Conductors Having Bunch Stranded Members[A]

Area of Cross Section			Wire Diameter 0.0201 in. (0.511 mm)		Approximate Mass[B]		Uncoated Copper				Coated Copper			
							Nominal dc resistance @ 20°C		Maximum dc resistance @ 20°C		Nominal dc resistance @ 20°C		Maximum dc resistance @ 20°C	
cmil	mm^2	Size AWG	Nominal Number of Wires	Strand Construction A by B by C[C]	lb/ 1000 ft.	kg/ km	Ohm / kft	Ohm / km	Ohm / kft	Ohm / km	Ohm / kft	Ohm / km	Ohm / kft	Ohm / km
2 000 000	1013	. . .	4921	19 by 7 by 37	6439	9583	0.00555	0.0182	0.00566	0.0186	0.00577	0.0189	0.00589	0.0193
1 900 000	963	. . .	4788	19 by 7 by 36	6265	9324	0.00584	0.0192	0.00596	0.0196	0.00607	0.0199	0.00619	0.0203
1 800 000	912	. . .	4522	19 by 7 by 34	5917	8806	0.00616	0.0202	0.00628	0.0206	0.00641	0.0210	0.00654	0.0214
1 750 000	887	. . .	4389	19 by 7 by 33	5743	8547	0.00634	0.0208	0.00647	0.0212	0.00659	0.0216	0.00672	0.0220
1 700 000	861	. . .	4256	19 by 7 by 32	5569	8288	0.00653	0.0214	0.00666	0.0218	0.00679	0.0223	0.00693	0.0227
1 600 000	811	. . .	3990	19 by 7 by 30	5221	7770	0.00694	0.0228	0.00708	0.0233	0.00721	0.0237	0.00735	0.0242
1 500 000	760	. . .	3724	19 by 7 by 28	4873	7252	0.00740	0.0243	0.00755	0.0248	0.00769	0.0252	0.00784	0.0257
1 400 000	709	. . .	3458	19 by 7 by 26	4525	6734	0.00793	0.0260	0.00809	0.0265	0.00824	0.0270	0.00840	0.0275
1 300 000	659	. . .	3192	19 by 7 by 24	4177	6216	0.00854	0.0280	0.00871	0.0286	0.00888	0.0291	0.00906	0.0297
1 250 000	633	. . .	3059	19 by 7 by 23	4003	5957	0.00888	0.0291	0.00906	0.0297	0.00923	0.0303	0.00941	0.0309
1 200 000	608	. . .	2926	19 by 7 by 22	3829	5698	0.00925	0.0303	0.00944	0.0309	0.00962	0.0316	0.00981	0.0322
1 100 000	557	. . .	2793	19 by 7 by 21	3655	5439	0.0101	0.0331	0.0103	0.0338	0.0105	0.0344	0.0107	0.0351
1 000 000	507	. . .	2527	19 by 7 by 19	3307	4921	0.0111	0.0364	0.0113	0.0371	0.0115	0.0379	0.0117	0.0387
900 000	456	. . .	2261	19 by 7 by 17	2959	4403	0.0123	0.0405	0.0125	0.0413	0.0128	0.0421	0.0131	0.0429
800 000	405	. . .	1995	19 by 7 by 15	2611	3885	0.0139	0.0455	0.0142	0.0464	0.0144	0.0473	0.0147	0.0482
750 000	380	. . .	1862	19 by 7 by 14	2436	3626	0.0148	0.0485	0.0151	0.0495	0.0154	0.0505	0.0157	0.0515
700 000	355	. . .	1729	19 by 7 by 13	2262	3367	0.0159	0.0520	0.0162	0.0530	0.0165	0.0541	0.0168	0.0552
650 000	329	. . .	1596	19 by 7 by 12	2088	3108	0.0171	0.0560	0.0174	0.0571	0.0178	0.0583	0.0182	0.0594
600 000	304	. . .	1470	7 by 7 by 30	1906	2836	0.0183	0.0601	0.0187	0.0613	0.0191	0.0625	0.0195	0.0638
550 000	279	. . .	1372	7 by 7 by 28	1779	2647	0.0200	0.0656	0.0204	0.0669	0.0208	0.0682	0.0212	0.0696
500 000	253	. . .	1225	7 by 7 by 25	1588	2363	0.0220	0.0721	0.0224	0.0735	0.0229	0.0750	0.0234	0.0765
450 000	228	. . .	1127	7 by 7 by 23	1461	2174	0.0244	0.0802	0.0249	0.0817	0.0254	0.0834	0.0259	0.0850
400 000	203	. . .	980	7 by 7 by 20	1270	1891	0.0275	0.0902	0.0281	0.0920	0.0286	0.0938	0.0292	0.0957
350 000	177	. . .	882	7 by 7 by 18	1143	1701	0.0314	0.103	0.0320	0.105	0.0327	0.107	0.0334	0.109
300 000	152	. . .	735	7 by 7 by 15	953	1418	0.0366	0.120	0.0373	0.122	0.0381	0.125	0.0389	0.128
250 000	127	. . .	637	7 by 7 by 13	826	1229	0.0440	0.144	0.0449	0.147	0.0457	0.150	0.0466	0.153
211 600	107	0000	532	19 by 28	683	1017	0.0515	0.169	0.0525	0.172	0.0536	0.176	0.0546	0.180
167 800	85	000	418	19 by 22	537	799	0.0649	0.213	0.0662	0.217	0.0675	0.221	0.0689	0.225
133 100	67.4	00	342	19 by 18	439	654	0.0818	0.268	0.0834	0.273	0.0851	0.279	0.0868	0.285
105 600	53.5	0	266	19 by 14	342	508	0.103	0.338	0.105	0.345	0.107	0.352	0.109	0.359
83 690	42.4	1	210	7 by 30	267	397	0.129	0.423	0.132	0.431	0.134	0.440	0.137	0.449
66 360	33.6	2	161	7 by 23	205	305	0.163	0.533	0.166	0.544	0.169	0.555	0.172	0.566
52 620	26.7	3	133	7 by 19	169	252	0.205	0.673	0.209	0.686	0.213	0.699	0.217	0.713
41 740	21.1	4	105	7 by 15	134	199	0.258	0.848	0.263	0.865	0.269	0.882	0.274	0.900
33 090	16.8	5	84	7 by 12	107	159	0.326	1.07	0.333	1.09	0.339	1.11	0.346	1.13
26 240	13.3	6	63	7 by 9	80	119	0.411	1.35	0.419	1.38	0.427	1.40	0.436	1.43

[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 which may be desirable for specific applications. The constructions shown provide for finished, covered or non-covered, stranded conductor approximately of the area indicated. When specified by the purchaser, the number of strands may be increased to provide additional area to compensate for draw-down during subsequent processing.

[B] Values for the mass of the completed conductor are approximate. The mass values are based upon the standard stranding increments listed in Explanatory Note 6.

[C] Strand Construction—#A by #B by #C: where #C is the number of wires in each bunch-stranded member; #B is the number of bunch stranded members which make-up each rope-stranded member; and #A (where used) is the number of rope-stranded members in the conductor. Where #A is not given, the conductor consists of one rope-stranded member. For example, 19 by 7 by 32 indicates a construction consisting of 19 rope-stranded members, each of which consists of 7 bunch-stranded members with 32 wires each.

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TABLE 2 Construction Requirements of Class K Rope-Lay Stranded Copper Conductors Having Bunch Stranded Members[A]

Area of Cross Section			Wire Diameter 0.0100 In. (0.254 mm)		Approximate Mass[B]		Uncoated Copper				Coated Copper			
cmil	mm²	Size AWG	Nominal Number of Wires	Strand Construction A by B by C[C]	Lb/1000 ft	Kg/km	Nominal dc resistance @ 20°C		Maximum dc resistance @ 20°C		Nominal dc resistance @ 20°C		Maximum dc resistance @ 20°C	
1,000,000	507	.....	10101	37 by 7 by 39	3272	4869	0.0111	0.0364	0.0113	0.0371	0.0119	0.0391	0.0121	0.0399
900,000	456	.....	9065	37 by 7 by 35	2936	4369	0.0123	0.0405	0.0125	0.0413	0.0132	0.0434	0.0135	0.0443
800,000	405	.....	7980	19 by 7 by 60	2585	3846	0.0139	0.0455	0.0142	0.0464	0.0149	0.0489	0.0152	0.0499
750,000	380	.....	7581	19 by 7 by 57	2455	3654	0.0148	0.0485	0.0151	0.0495	0.0159	0.0521	0.0162	0.0531
700,000	355	.....	6916	19 by 7 by 52	2240	3333	0.0159	0.0520	0.0162	0.0530	0.0170	0.0558	0.0173	0.0569
650,000	329	.....	6517	19 by 7 by 49	2111	3141	0.0171	0.0560	0.0174	0.0571	0.0183	0.0601	0.0187	0.0613
600,000	304	.....	5985	19 by 7 by 45	1938	2885	0.0185	0.0607	0.0189	0.0619	0.0199	0.0651	0.0203	0.0664
550,000	279	.....	5453	19 by 7 by 41	1766	2628	0.0202	0.0662	0.0206	0.0675	0.0217	0.0711	0.0221	0.0725
500,000	253	.....	5054	19 by 7 by 38	1637	2436	0.0222	0.0728	0.0226	0.0743	0.0238	0.0782	0.0243	0.0798
450,000	228	.....	4522	19 by 7 by 34	1465	2180	0.0247	0.0809	0.0252	0.0825	0.0265	0.0869	0.0270	0.0886
400,000	203	.....	3990	19 by 7 by 30	1292	1923	0.0277	0.0910	0.0283	0.0928	0.0298	0.0977	0.0304	0.0997
350,000	177	.....	3458	19 by 7 by 26	1120	1667	0.0317	0.104	0.0323	0.106	0.0340	0.112	0.0347	0.114
300,000	152	.....	2989	7 by 7 by 61	959	1427	0.0366	0.120	0.0373	0.122	0.0393	0.129	0.0401	0.132
250,000	127	.....	2499	7 by 7 by 51	802	1193	0.0440	0.144	0.0449	0.147	0.0472	0.155	0.0481	0.158
211,600	107	0000	2107	7 by 7 by 43	676	1006	0.0520	0.171	0.0530	0.174	0.0558	0.183	0.0569	0.187
167,800	85	000	1666	7 by 7 by 34	535	795	0.0655	0.215	0.0668	0.219	0.0703	0.231	0.0717	0.236
133,100	67.4	00	1323	7 by 7 by 27	424	632	0.0826	0.271	0.0843	0.276	0.0887	0.291	0.0905	0.297
105,600	53.5	0	1064	19 by 56	338	503	0.103	0.338	0.105	0.345	0.111	0.363	0.113	0.370
83,690	42.4	1	836	19 by 44	266	395	0.130	0.427	0.133	0.435	0.140	0.458	0.142	0.467
66,360	33.6	2	665	19 by 35	211	315	0.164	0.538	0.167	0.549	0.176	0.578	0.180	0.590
52,620	26.7	3	532	19 by 28	169	252	0.207	0.679	0.211	0.693	0.222	0.729	0.227	0.744
41,740	21.1	4	420	7 by 60	132	197	0.258	0.848	0.264	0.865	0.277	0.910	0.283	0.928
33,090	16.8	5	336	7 by 48	106	157	0.326	1.07	0.333	1.09	0.350	1.15	0.357	1.17
26,240	13.3	6	266	7 by 38	84	125	0.411	1.35	0.419	1.38	0.441	1.45	0.450	1.48
20,820	10.5	7	210	7 by 30	66	98	0.518	1.70	0.528	1.73	0.556	1.82	0.567	1.86
16,510	8.37	8	168	7 by 24	53	79	0.653	2.14	0.666	2.19	0.701	2.30	0.715	2.35
13,090	6.63	9	133	7 by 19	42	62	0.824	2.70	0.840	2.76	0.885	2.90	0.902	2.96

[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 which may be desirable for specific applications. The constructions shown provide for finished covered or non-covered stranded conductor approximately of the area indicated. When specified by the purchaser, the number of strands may be increased to provide additional area to compensate for draw-down during subsequent processing.

[B] Values for the mass of the completed conductor are approximate. The mass values are based upon the standard stranding increments listed in Explanatory Note 6.

[C] Strand construction – A by B by C where C is the number of wires in each bunch-stranded member, B is the number of bunch-stranded members which make up each rope stranded member, and A (where used) is the number of rope-stranded members in the conductor. Where A is not given, the conductor consists of one rope-stranded member. For example, 19 by 7 by 32 indicates a construction consisting of 19 rope-stranded members each of which consist of 7 bunch-stranded members with 32 wires each.

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