Designation: B 801 – 99

AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation[1]

This standard is issued under the fixed designation B 801; 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.

1. Scope

1.1 This specification covers aluminum alloys in the 8000 series cited in B 800 in tempers "0" and H1X or H2X bare compact-round, compressed and conventional concentric-lay-stranded conductors made from round or shaped wires used as covered or insulated electrical conductors. These conductors shall be composed of a central core surrounded by one or more compacted, compressed or conventional layers of helically applied wires (Explanatory Note 1 and Note 2).

1.2 The SI values for resistivity are regarded as standard. For all other properties, the inch-pound units are regarded as standard and the SI units may be approximate.

NOTE 1—Sealed conductors that are intended to prevent longitudinal water propagation are also permitted within the guidelines of this specification.

2. Referenced Documents

2.1 The following documents of the issue in effect on date of material purchase form a part of this specification to the extent referenced herein.

2.2 *ASTM Standards:*

B 193 Test Method for Resistivity of Electrical Conductor Materials[2]

B 263 Test Method for Determination of Cross-Sectional Area of Stranded Conductors[2]

B 354 Terminology Relating to Uninsulated Metallic Electrical Conductors[2]

B 800 Specification for 8000 Series Aluminum Alloy Wire for Electric Purposes—Annealed and Intermediate Tempers[2]

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications[3]

2.3 *ANSI Standard:*

ANSI H35.1 Alloy and Temper Designation Systems for Aluminum[4]

2.4 *National Bureau of Standards:*

NBS Handbook 100—Copper Wire Tables[5]

3. Classification

3.1 For the purpose of this specification, conductors are classified as follows:

3.1.1 *Class A*—For conductors to be covered with weather/resistant materials.

3.1.2 *Class B*—For conductors to be insulated with various materials such as rubber, paper, varnished cloth, etc., and for the conductors indicated under Class A where greater flexibility is required.

3.1.3 *Class C and D*—For conductors where greater flexibility is required than is provided by Class B 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 (Table 1).

4.1.2 Conductor size; circular-mil area or Awg (Section 7),

4.1.3 Class (See 3.1),

4.1.4 Temper (Section 12),

4.1.5 Lay direction if nonstandard (See 6.3 and 6.4), reversed or unidirectional (See 6.3) or special (See 6.4),

4.1.6 Special tension test, if required (See 8.2),

4.1.7 Packaging (Section 19),

4.1.8 Special package marking (Section 19), and

4.1.9 Place of inspection (Section 18).

4.2 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 Joints may be made in any of the wires of any stranding by electric-butt welding, cold-pressure welding, or electric-butt, cold-upset welding.

5.2 Joints in the individual wires in a finished conductor shall be not closer together than 1 ft (0.3 m) for conductors of 19 wires or less, or closer than 1 ft in a layer for conductors of more than 19 wires.

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[1] This specification is under the jurisdiction of Committee B-1 on Electrical Conductors and is the direct responsibility of Subcommittee B01.07 on Conductors of Light Metals.

Current edition approved April 10, 1999. Published June 1999. Originally published as B 801 – 88. Last previous edition B 801 – 95.

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

[3] *Annual Book of ASTM Standards*, Vol 14.02.

[4] Available from American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036.

[5] Available from National Technical Information Service, 5285 Port Royal Rd., Springfield, VA 22161.

5.3 No joint or splice shall be made in a stranded conductor as a whole.

6. Lay

6.1 The length of lay for all classes shall be not less than 8 nor more than 16 times the outside diameter of that layer, except that for conductors composed of 37 wires or more, this requirement shall apply only to the two outer layers. The lay of the layers other than the two outer layers shall be at the option of the manufacturer, unless otherwise agreed upon.

6.1.1 For conductors to be used in covered or insulated wires or cables, the lay length of the wires shall be not less than 8 nor more than 16 times the outer diameter of the finished conductor. For conductors of 37 wires or more, this requirement shall apply to the wires in the outer two layers. The lay of the layers other than the two outer layers shall be at the option of the manufacturer, unless otherwise agreed upon.

6.2 The direction of lay for Class A conductors shall be right-hand.

TABLE 1 Construction Requirements for Aluminum Conductors in the 8000 Series Alloys

Conductor Size			Class	Number[A] of Wires	Nominal Conductor Diameter						Compact		Nominal Mass		Nominal d-c resistance[B] at 20°C	
					Conventional		Reverse Concentric Compressed		Unilay Compressed							
Cmil	AWG	mm^2			in.	mm	in.	mm	in.	mm.	in	mm	lbs/1000 ft	kg/km	Ω/1000 ft	Ω/km
1000000		507	D	127	1.153	29.3	1.119	28.4			1.060	26.9	941	1400	0.0173	0.0568
1000000		507	C	91	1.153	29.3	1.118	28.4	1.084	27.5	1.060	26.9	941	1400	0.0173	0.0568
1000000		507	B, A	61	1.152	29.3	1.117	28.4			1.060	26.9	941	1400	0.0173	0.0568
900000		456	D	127	1.095	27.8	1.062	27.0			0.999	25.4	847	1260	0.0193	0.0633
900000		456	C	91	1.093	27.8	1.060	26.9	1.028	26.1	0.999	25.4	847	1260	0.0193	0.0633
900000		456	B, A	61	1.093	27.8	1.060	26.9			0.999	25.4	847	1260	0.0193	0.0633
800000		405	D	127	1.032	26.2	1.001	25.4			0.938	23.8	753	1120	0.0217	0.0712
800000		405	C	91	1.032	26.2	1.001	25.4	0.969	24.6	0.938	23.8	753	1120	0.0217	0.0712
800000		405	B, A	61	1.031	26.2	1.000	25.4			0.938	23.8	753	1120	0.0217	0.0712
750000		380	D	127	0.998	25.3	0.968	24.6			0.908	23.1	706	1050	0.0231	0.0758
750000		380	C	91	0.999	25.4	0.969	24.6	0.939	23.9	0.908	23.1	706	1050	0.0231	0.0758
750000		380	B, A	61	0.998	25.3	0.968	24.6			0.908	23.1	706	1050	0.0231	0.0758
700000		355	D	127	0.965	24.5	0.936	23.8			0.877	22.3	659	981	0.0248	0.0814
700000		355	C	91	0.965	24.5	0.936	23.8	0.907	23.0	0.877	22.3	659	981	0.0248	0.0814
700000		355	B, A	61	0.964	24.5	0.935	23.7			0.877	22.3	659	981	0.0248	0.0814
650000		329	D	127	0.930	23.6	0.902	22.9			0.845	21.5	612	911	0.0267	0.0876
650000		329	C	91	0.930	23.6	0.902	22.9	0.874	22.2	0.845	21.5	612	911	0.0267	0.0876
650000		329	B	61	0.929	23.6	0.901	22.9			0.845	21.5	612	911	0.0267	0.0876
650000		329	A	37	0.928	23.6	0.900	22.9			0.845	21.5	612	911	0.0267	0.0876
600000		304	D	127	0.893	22.7	0.866	22.0			0.813	20.7	565	841	0.0289	0.0948
600000		304	C	91	0.893	22.7	0.866	22.0	0.840	21.3	0.813	20.7	565	841	0.0289	0.0948
600000		304	B	61	0.893	22.7	0.866	22.0			0.813	20.7	565	841	0.0289	0.0948
600000		304	A	37	0.891	22.6	0.864	21.9			0.813	20.7	565	841	0.0289	0.0948
556500		282	D	127	0.861	21.9	0.835	21.2			0.780	19.8	524	780	0.0312	0.1024
556500		282	C	91	0.860	21.8	0.834	21.2			0.780	19.8	524	780	0.0312	0.1024
556500		282	B	61	0.860	21.8	0.834	21.2			0.780	19.8	524	780	0.0312	0.1024
556500		282	A	37	0.858	21.8	0.832	21.1			0.780	19.8	524	780	0.0312	0.1024
550000		279	D	127	0.855	21.7	0.829	21.1			0.775	19.7	518	771	0.0315	0.1034
550000		279	C	91	0.855	21.7	0.829	21.1			0.775	19.7	518	771	0.0315	0.1034
550000		279	B	61	0.855	21.7	0.829	21.1	0.804	20.4	0.775	19.7	518	771	0.0315	0.1034
550000		279	A	37	0.853	21.7	0.827	21.0			0.775	19.7	518	771	0.0315	0.1034
500000		253	D	91	0.815	20.7	0.791	20.1			0.736	18.7	471	701	0.0347	0.1139
500000		253	C	61	0.815	20.7	0.791	20.1	0.766	19.5	0.736	18.7	471	701	0.0347	0.1139
500000		253	B, A	37	0.813	20.7	0.789	20.0			0.736	18.7	471	701	0.0347	0.1139
477000		242	D	91	0.796	20.2	0.772	19.6			0.722	18.3	449	668	0.0364	0.1194
477000		242	C	61	0.796	20.2	0.772	19.6			0.722	18.3	449	668	0.0364	0.1194
477000		242	B, A	37	0.795	20.2	0.771	19.6			0.722	18.3	449	668	0.0364	0.1194
450000		228	D	91	0.773	19.6	0.750	19.0			0.700	17.8	424	631	0.0385	0.1263
450000		228	C	61	0.773	19.6	0.750	19.0	0.727	18.5	0.700	17.8	424	631	0.0385	0.1263
450000		228	B, A	37	0.772	19.6	0.749	19.0			0.700	17.8	424	631	0.0385	0.1263
400000		203	D	91	0.729	18.5	0.707	18.0			0.659	16.7	376	559	0.0434	0.1424
400000		203	C	61	0.729	18.5	0.707	18.0	0.685	17.4	0.659	16.7	376	559	0.0434	0.1424
400000		203	B, A	37	0.728	18.5	0.706	17.9			0.659	16.7	376	559	0.0434	0.1424
397500		201	D	91	0.727	18.5	0.705	17.9			0.659	16.7	374	557	0.0436	0.1431
397500		201	C	61	0.726	18.4	0.704	17.9			0.659	16.7	374	557	0.0436	0.1431
397500		201	B	37	0.725	18.4	0.703	17.9			0.659	16.7	374	557	0.0436	0.1431
397500		201	A	19	0.724	18.4	0.702	17.8			0.659	16.7	374	557	0.0436	0.1431
350000		177	D	91	0.682	17.3	0.661	16.8			0.616	15.6	329	490	0.0495	0.1624
350000		177	C	61	0.681	17.3	0.661	16.8	0.641	16.3	0.616	15.6	329	490	0.0495	0.1624
350000		177	B	37	0.681	17.3	0.661	16.8			0.616	15.6	329	490	0.0495	0.1624
350000		177	A	19	0.679	17.2	0.659	16.7			0.616	15.6	329	490	0.0495	0.1624
336400		170	C	61	0.669	17.0	0.649	16.5			0.603	15.3	317	472	0.0516	0.1693

TABLE 1 *Continued*

Conductor Size			Class	Number[A] of Wires	Nominal Conductor Diameter						Compact		Nominal Mass		Nominal d-c resistance[B] at 20°C	
					Conventional		Reverse Concentric Compressed		Unilay Compressed							
Cmil	AWG	mm^2			in.	mm	in.	mm	in.	mm.	in	mm	lbs/1000 ft	kg/km	Ω/1000 ft	Ω/km
336400		170	B	37	0.668	17.0	0.648	16.5			0.603	15.3	317	472	0.0516	0.1693
336400		170	A	19	0.666	16.9	0.646	16.4			0.603	15.3	317	472	0.0516	0.1693
300000		152	C	61	0.631	16.0	0.612	15.5			0.570	14.5	282	420	0.0578	0.1896
300000		152	B	37	0.630	16.0	0.611	15.5	0.594	15.1	0.570	14.5	282	420	0.0578	0.1896
300000		152	A	19	0.629	16.0	0.610	15.5			0.576	14.5	282	420	0.0578	0.1896
266800		135	C	61	0.595	15.1	0.577	14.7			0.537	13.6	251	373	0.0650	0.2133
266800		135	B	37	0.594	15.1	0.576	14.6			0.537	13.6	251	373	0.0650	0.2133
266800		135	A	19	0.593	15.0	0.575	14.6			0.537	13.6	251	373	0.0650	0.2133
250000		127	C	61	0.576	14.6	0.559	14.2			0.520	13.2	235	350	0.0694	0.2277
250000		127	B	37	0.575	14.6	0.558	14.2	0.542	13.8	0.520	13.2	235	350	0.0694	0.2277
250000		127	A	19	0.574	14.6	0.557	14.1			0.520	13.2	235	350	0.0694	0.2277
211600	0000	107	C	37	0.529	13.4	0.513	13.0			0.475	12.1	199	296	0.0820	0.2690
211600	0000	107	B	19	0.528	13.4	0.512	13.0	0.498	12.6	0.475	12.1	199	296	0.0820	0.2690
211600	0000	107	A	7	0.522	13.3	0.506	13.0			0.475	12.1	199	296	0.0820	0.2690
167800	000	85.0	C	37	0.471	12.0	0.457	11.6			0.423	10.7	158	235	0.1033	0.3389
167800	000	85.0	B	19	0.470	11.9	0.456	11.6	0.443	11.3	0.423	10.7	158	235	0.1033	0.3389
167800	000	85.0	A	7	0.464	11.8	0.450	11.4			0.423	10.7	158	235	0.1033	0.3389
133100	00	67.4	B	19	0.419	10.6	0.406	10.3	0.395	10.0	0.376	9.55	125	186	0.1303	0.4275
133100	00	67.4	A	7	0.414	10.5	0.402	10.2			0.376	9.55	125	186	0.1303	0.4275
105600	0	53.5	B	19	0.373	9.46	0.362	9.19			0.336	8.53	99.4	148	0.1642	0.5387
105600	0	53.5	A	7	0.368	9.36	0.357	9.07	0.352	8.94	0.336	8.53	99.4	148	0.1642	0.5387
83690	1	42.4	B	19	0.332	8.43	0.322	8.18	0.313	7.95	0.299	7.59	78.8	117	0.2072	0.6798
66360	2	33.6	B, A	7	0.292	7.42	0.283	7.19			0.268	6.81	62.5	93.0	0.2613	0.8573
52620	3	26.7	B, A	7	0.260	6.61	0.252	6.41			0.238	6.05	49.5	73.7	0.3296	1.0814
41740	4	21.2	B, A	7	0.232	5.88	0.225	5.72			0.213	5.41	39.3	58.5	0.4155	1.3633
26240	6	13.3	B, A	7	0.184	4.66	0.178	4.53			0.169	4.29	24.7	36.8	0.6609	2.1684
16510	8	8.37	B, A	7	0.146	3.70	0.142	3.60			0.134	3.40	15.5	23.1	1.0504	3.4464

[A] For compact-stranded constructions, the number of wires may be reduced as follows:

19-Wire Constructions—18 Wires Minimum
37-Wire Constructions—35 Wires Minimum
61-Wire Constructions—58 Wires Minimum
91-Wire Constructions—87 Wires Minimum
127-Wire Constructions—122 Wires Minimum

[B] Nominal d-c resistance is based on 61.0 % IACS conductivity (17.002 Ω/cmil/ft). See Explanatory Note 3.

6.3 The direction of lay of the outer layer shall be left-hand for all other classes, unless the direction is specified otherwise by the purchaser.

6.4 The direction of lay shall be reversed in successive layers in conventional and compressed constructions. In compact constructions, the lay of the successive layers may be either reversed or unidirectional.

6.4.1 For conductors to be used in covered or insulated wires or cables, the direction of lay of the outer layer shall be left-hand and may be reversed or unidirectional/unilay in successive layers, unless otherwise agreed upon with the purchaser.

6.5 The maximum length of lay for compact conductors AWG 2 and smaller shall be 17.5 times the outside diameter of that layer.

6.6 Other lay requirements may be furnished by special agreement between the manufacturer and the purchaser.

7. Construction

7.1 The construction of the conductors shall be as shown in Table 1 as to number of wires and cross-sectional area of the completed conductor, and the lay shall be in accordance with Section 6.

7.2 Wire used in the fabrication of conductor shall be of such dimensions as to produce a finished conductor having a nominal cross-sectional area and diameter as prescribed in Table 1.

7.3 Where compressed stranding is required in order to insulate the conductor properly, one or more layers of any stranded conductor consisting of seven wires or more may be slightly compressed, thereby reducing the outside diameter of the conductor by not more than 3 %, provided that the area of cross-section after compressing is in accordance with Section 15.

NOTE 2—The user's attention is called to the claim that certain compressed strand constructions may be subject to patent rights, for example U.S. Patents 3,383,704 and 3,444,684.

8. Mechanical and Electrical Tests of Conductors in 8000 Series Alloys in "0" Temper, H1X or H2X Wire and Not Annealed After Stranding

8.1 Tests for the mechanical and electrical properties of wire composing the conductor shall be made before, but not after stranding, unless otherwise agreed upon between the manufacturer and the purchaser as provided in 8.2 (Explanatory Note 4).

8.2 At the option of the purchaser, at the time of placing the order, tension and elongation tests of wire before stranding may be waived, and the completed conductor may be tested as a unit. The minimum breaking strength of conductors so tested shall be not less than the minimum rated strength of 8000 Series Aluminum Alloys "0" Temper or H1X and H2X conductors, whichever is applicable. If failure occurs in the free length at least 1 in. (25 mm) beyond the end of either gripping device, the minimum breaking strength shall be not less than 95 % of the rated or minimum rated strength if failure occurs inside, or within 1 in. of the end of either gripping device. The maximum breaking strength of 8000 Series Aluminum Alloys "0" Temper or H1X and H2X conductors, whichever is applicable, shall be not greater than their maximum rated strengths. The free length between grips of the test specimen shall be not less than 24 in. (600 mm) and care shall be taken to ensure that the wires in the conductor are evenly gripped during the test (Section 13 and Explanatory Note 5).

9. Mechanical and Electrical Tests of Conductors Fabricated from Wires Other Than 8000-H2X and Annealed After Stranding to Meet 8000 "0" Temper or H2X Requirements

9.1 At the option of the manufacturer, mechanical and electrical tests may be performed in accordance with either paragraph 9.1.1 or 9.1.2.

9.1.1 The completed conductor shall be tested as a unit. The minimum breaking strength of bare conductors shall be not less than minimum rated strength if failure occurs in the free length at least 1 in. (25 mm) beyond the end of either gripping device, or shall be not less than 95 % of the minimum rated strength if failure occurs inside, or within 1 in. of the end of either gripping device. The maximum breaking strength of 8000 "0" Temper, or H2X conductors shall be not greater than their maximum rated strengths. The free length between grips of the test specimen shall be not less than 24 in. (600 mm), and care shall be taken to ensure that the wires in the conductor are evenly gripped during the test (Section 13 and Explanatory Note 5).

9.1.1.1 The d-c resistance of the completed conductor in Ω/1000 ft shall conform to Table 1. The maximum d-c resistance for any conductor shall be taken as nominal + 2 %.

9.1.2 When wires removed from the stranded conductor are tested, intermediate temper (−H2X) wire shall have tensile strengths not less than 95 % of the minimum tensile strength nor more than 105 % of the maximum tensile strength prescribed in Specification B 800.

9.1.3 When electrical testing is conducted on wires removed from the stranded conductor, the resistivity shall conform to Specification B 800.

10. Mass and Electrical Resistance

10.1 The mass and electrical resistance of a unit length of stranded conductor are a function of the length of lay. The approximate mass and electrical resistance may be determined using an increment of 2 %. When greater accuracy is desired, the increment based on the specific lay of the conductor may be calculated (Explanatory Note 6).

10.2 The maximum electrical resistance of a unit length of stranded conductor shall not exceed the nominal d-c resistance (Table 1) + 2 %. (See Explanatory Note 6).

10.2.1 When the d-c resistance is measured at other than 20°C, it is to be corrected by using the multiplying factor given in Table 2.

10.3 For conductors to be used in covered or insulated wires or cables, direct current (D-C) resistance measurement may be used instead of the method outlined in Section 15 to determine compliance with this specification.

11. Workmanship, Finish, and Appearance

11.1 The conductor shall be clean and free from imperfections not consistent with good commercial practice.

12. Requirements of Wires

12.1 Wires annealed before stranding shall meet the requirements of Specification B 800.

12.2 Wires shaped before stranding are not required to meet a specific dimension or area tolerance. The area tolerances for shaped wire of all tempers shall be such that the finished conductor conforms to Section 15. The tensile requirements shall be the same as those for round wires of equal nominal area.

13. Rated Strength of Conductor

13.1 Calculations for rated strengths of 8000 "0" Temper, H1X, and H2X conductors shall be made on the basis of the strengths of the component wires using the nominal wire diameter for the noncompacted construction and the specified maximum and minimum tensile strengths for the appropriate temper of the respective component wires given in Specification B 800. The minimum rated strengths of the conductors shall be taken as the sum of the calculated minimum strengths of the component wires multiplied by the rating factor given in Table 3. The maximum rated strength of the conductors shall be taken as the sum of the calculated maximum strengths of the component wires.

TABLE 2 Temperature Correction Factors for Conductor Resistance

Temperature,° C	Multiplying Factor for Conversion to 20°C
0	1.088
5	1.064
10	1.042
15	1.020
20	1.000
25	0.980
30	0.961
35	0.943
40	0.925
45	0.908
50	0.892
55	0.876
60	0.861
65	0.846
70	0.832
75	0.818
80	0.805
85	0.792
90	0.780

TABLE 3 Rating Factors

NOTE 1— For compact-stranded construction minimum see Footnotes A through E.

Stranding		Rating Factor,%
Number of Wires in Conductor	Number of Layers	
7	1	96
19[A]	2	93
37[B]	3	91
61[C]	4	90
91[D]	5	90
127[E]	6	90

[A] 18 wires minimum.
[B] 35 wires minimum.
[C] 58 wires minimum.
[D] 87 wires minimum.
[E] 122 wires minimum.

TABLE 4 Conductor Rated Strengths

Conductor Size			Number[A] of Wires	8000 Series Alloys − "0" Temper				8000 Series Alloys H12X, H22X			
				min		max		min		max	
Cmil	AWG	mm^2		lbf	N	lbf	N	lbf	N	lbf	N
1000000		507	127	6010	26700	12600	56000	10600	47100	17300	77000
1000000		507	91	6010	26700	12600	56000	10600	47100	17300	77000
1000000		507	61	6010	26700	12600	56000	10600	47100	17300	77000
900000		456	127	5400	24000	11300	50300	9540	42400	15500	68900
900000		456	91	5400	24000	11300	50300	9540	42400	15500	68900
900000		456	61	5400	24000	11300	50300	9540	42400	15500	68900
800000		405	127	4800	21400	10000	44500	8480	37700	13800	61400
800000		405	91	4800	21400	10000	44500	8480	37700	13800	61400
800000		405	61	4800	21400	10000	44500	8480	37700	13800	61400
750000		380	127	4500	20000	9420	41900	7950	35400	13000	57800
750000		380	91	4500	20000	9420	41900	7950	35400	13000	57800
750000		380	61	4500	20000	9420	41900	7950	35400	13000	57800
700000		355	127	4200	18700	8790	39100	7420	33000	12100	53800
700000		355	91	4200	18700	8790	39100	7420	33000	12100	53800
700000		355	61	4200	18700	8790	39100	7420	33000	12100	53800
650000		329	127	3900	17300	8160	36300	6890	30600	11200	49800
650000		329	91	3900	17300	8160	36300	6890	30600	11200	49800
650000		329	61	3900	17300	8160	36300	6890	30600	11200	49800
650000		329	37	3950	17600	8160	36300	6960	31000	11200	49800
600000		304	127	3600	16000	7540	33500	6360	28300	10400	46300
600000		304	91	3600	16000	7540	33500	6360	28300	10400	46300
600000		304	61	3600	16000	7540	33500	6360	28300	10400	46300
600000		304	37	3640	16200	7540	33500	6430	28600	10400	46300
556500		282	127	3340	14900	6990	31100	5900	26200	9610	42700
556500		282	91	3340	14900	6990	31100	5900	26200	9610	42700
556500		282	61	3340	14900	6990	31100	5900	26200	9610	42700
556500		282	37	3380	15000	6990	31100	5960	26500	9610	42700
550000		279	127	3300	14700	6910	30700	5830	25900	9500	42300
550000		279	91	3300	14700	6910	30700	5830	25900	9500	42300
550000		279	61	3300	14700	6910	30700	5830	25900	9500	42300
550000		279	37	3340	14900	6910	30700	5890	26200	9500	42300
500000		253	91	3000	13300	6280	27900	5300	23600	8640	38400
500000		253	61	3000	13300	6280	27900	5300	23600	8640	38400
500000		253	37	3040	13500	6280	27900	5360	23800	8640	38400
477000		242	91	2860	12700	5990	26600	5060	22500	8240	36700
477000		242	61	2860	12700	5990	26600	5060	22500	8240	36700
477000		242	37	2900	12900	5990	26600	5110	22700	8240	36700
450000		228	91	2700	12000	5650	25100	4770	21200	7770	34600
450000		228	61	2700	12000	5650	25100	4770	21200	7770	34600
450000		228	37	2730	12100	5650	25100	4820	21400	7770	34600
400000		203	91	2400	10700	5020	22300	4240	18900	6910	30700
400000		203	61	2400	10700	5020	22300	4240	18900	6910	30700
400000		203	37	2430	10800	5020	22300	4290	19100	6910	30700
397500		201	91	2390	10600	4990	22200	4210	18700	6860	30500
397500		201	61	2390	10600	4990	22200	4210	18700	6860	30500
397500		201	37	2410	10700	4990	22200	4260	18900	6860	30500
397500		201	19	2470	11000	4990	22200	4350	19300	6860	30500
350000		177	91	2100	9340	4400	19600	3710	16500	6040	26900
350000		177	61	2100	9340	4400	19600	3710	16500	6040	26900

TABLE 4 *Continued*

Conductor Size			Number[A] of Wires	8000 Series Alloys − "0" Temper				8000 Series Alloys H12X, H22X			
				min		max		min		max	
Cmil	AWG	mm²		lbf	N	lbf	N	lbf	N	lbf	N
350000		177	37	2130	9470	4400	19600	3750	16700	6040	26900
350000		177	19	2170	9650	4400	19600	3830	17000	6040	26900
336400		170	61	2020	8980	4230	18800	3560	15800	5810	25800
336400		170	37	2040	9070	4230	18800	3600	16000	5810	25800
336400		170	19	2090	9300	4230	18800	3680	16400	5810	25800
300000		152	61	1800	8010	3770	16800	3180	14100	5180	23000
300000		152	37	1820	8100	3770	16800	3210	14300	5180	23000
300000		152	19	1860	8270	3770	16800	3290	14600	5180	23000
266800		135	61	1600	7120	3350	14900	2830	12600	4610	20500
266800		135	37	1620	7210	3350	14900	2860	12700	4610	20500
266800		135	19	1660	7380	3350	14900	2920	13000	4610	20500
250000		127	61	1500	6670	3140	14000	2650	11800	4320	19200
250000		127	37	1520	6760	3140	14000	2680	11900	4320	19200
250000		127	19	1550	6890	3140	14000	2740	12200	4320	19200
211600	0000	107	37	1280	5690	2660	11800	2270	10100	3650	16200
211600	0000	107	19	1310	5830	2660	11800	2320	10300	3650	16200
211600	0000	107	7	1360	6050	2660	11800	2390	10600	3650	16200
167800	000	85.0	37	1020	4540	2110	9390	1800	8010	2900	12900
167800	000	85.0	19	1040	4630	2110	9390	1840	8180	2900	12900
167800	000	85.0	7	1070	4760	2110	9390	1900	8450	2900	12900
133100	00	67.4	19	826	3670	1670	7430	1460	6490	2300	10200
133100	00	67.4	7	853	3790	1670	7430	1500	6670	2300	10200
105600	0	53.5	19	655	2910	1330	5920	1160	5160	1820	8100
105600	0	53.5	7	676	3010	1330	5920	1190	5290	1820	8100
83690	1	42.4	19	519	2310	1050	4670	916	4070	1450	6450
66360	2	33.6	7	425	1890	833	3710	750	3340	1150	5120
52620	3	26.7	7	337	1500	661	2940	595	2650	909	4040
41740	4	21.2	7	267	1190	524	2330	472	2100	721	3210
26240	6	13.3	7	168	747	330	1470	297	1320	453	2010
16510	8	8.37	7	106	471	207	921	187	832	285	1270

[A] For Compact-stranded Constructions, the number of wires may be reduced as follows:

19-Wire Constructions— 18 Wires Minimum
37-Wire Constructions— 35 Wires Minimum
61-Wire Constructions— 58 Wires Minimum
91-Wire Constructions— 87 Wires Minimum
127-Wire Constructions—122 Wires Minimum

13.2 Rated-strength and breaking-strength values shall be rounded to three significant figures, in the final value only in accordance with the rounding method of Practice E 29.

13.3 Rated strengths of "0" Temper, H12X and H22X conductors are given in Table 4.

14. Density

14.1 For the purpose of calculating mass, (2.1.1) cross sections, etc., the density of 8000 series Aluminum Alloys shall be taken as 0.098 lb/in.^{3}(2.710 g/cm^3) at 20°C.

15. Variation in Area

15.1 The cross-sectional area of the conductor shall be not less than 98 % of the cross-sectional area as specified in Column 1 of Table 1.

15.2 The manufacturer shall determine the cross-sectional area by Test Method B 263. In applying this method, the increment in mass resulting from stranding may be the applicable value specified in 10.1 or it may be calculated from the measured dimensions of the sample under test. In case of question regarding area compliance, the actual weight increment due to stranding shall be calculated.

16. Variation in Diameter

16.1 The average diameter of compact conductors shall vary by not more than + 1 or − 2 % from the diameter specified in Table 1 except that compact construction sizes No. 1/0 (53.5 mm^2) through No. 4/0 (107 mm^2) composed of 18 or 19 wires shall vary by not more than + 1½ or − 2½ % from the average diameter specified in Table 1. The diameters for conventional and compressed constructions are given for information purposes only.

17. Sampling

17.1 The aluminum cross-sectional area (Section 15) and the diameter (Section 16) shall be measured on a sample of the completed conductor. At least one sample shall be tested on each size of conductor on each order of quantities from 5000 to 100 000 ft (1500 to 30 000 m), and one additional sample tested from each 100 000 ft thereafter.

18. Inspection

18.1 All tests and inspection shall be made at the place of manufacture unless otherwise especially agreed upon betweeen the manufacturer and the purchaser at the time of purchase. The manufacturer shall afford the inspector representing the purchaser all reasonable facilities to satisfy him that the material is being furnished in accordance with this specification.

19. Packaging and Package Marking

19.1 Package sizes for conductors shall be agreed upon between the manufacturer and the purchaser in the placing of individual orders.

19.2 There shall be only one length of conductor on a reel unless otherwise agreed upon between the manufacturer and purchaser at time of placing order.

19.3 The net weight, length (and number of lengths, if more than one length is included in the package), size, kind of conductor, purchase order number, and any other marks required by the purchase order shall be marked on a tag attached to the end of the conductor inside of the package. The same information, together with the manufacturer's serial number (if any) and all shipping marks required by the purchaser, shall appear on the outside of each package.

EXPLANATORY NOTES

NOTE 1—In this specification compact, compressed and conventional round concentric-lay-stranded conductor constructions are specifically designated. Constructions not included in this specification should be specifically agreed upon between the manufacturer and the purchaser when placing the order.

NOTE 2—For definitions of terms relating to conductors, reference should be made to Terminology B 354.

NOTE 3—The d-c resistance on a given construction shall be calculated using the following formula:

$$R = (k/100 + 1)\rho/A$$

where:

R = conductor resistance in Ω/1000 ft,
k = increment due to stranding of 2 % and Explanatory Note 6,
ρ = volume resistivity in ohms-cmil/ft, determined in accordance with Test Method B 193, and
A = cross-sectional area of conductor in kcmil determined in accordance with Section 15 of this specification.

NOTE 4—When wires are annealed before stranding, individual wires should not be unlaid from compact round or compressed conductors for testing purposes. Some physical properties of the individual compacted or compressed wires may be altered by the deformation brought about by compacting, compressing, unlaying, and straightening for test.

NOTE 5—To test stranded conductors for breaking strength successfully as a unit requires adequate means of gripping the ends of the test specimen without causing damage that may result in a failure below the actual strength of the conductor. Various means are available, such as compression sleeves, split sleeves, and preformed grips, but ordinary jaws or clamping devices usually are not suitable.

NOTE 6—The increment of mass or electrical resistance of a completed concentric-lay-stranded conductor (k) in percent is as follows:

$$k = 100\,(m - 1)$$

where m is the stranding factor, and is also the ratio of the linear density or electrical resistance of a unit length of stranded conductor to that of a solid conductor of the same cross-sectional area or of a stranded conductor with infinite length of lay, that is, all wires parallel to the conductor axis. The stranding factor m for the completed stranded conductor is the numerical average of the stranding factors for each of the individual wires in the conductor, including the straight core wire, if any (for which the lay factor is unity). The stranding factor (M_{ind}) for any given wire in a concentric-lay-stranded conductor is:

$$M_{ind} = \sqrt{1 + (9.8696/n^2)}$$

where:

$$n = \frac{\text{length of lay}}{\text{diameter of helical path of the wire}}$$

The derivation of the above as given in *NBS Handbook 100* is based on round wire constructions which are applicable to compacted and compressed wire constructions.

SUPPLEMENTARY REQUIREMENTS

The following supplementary requirements shall apply only when specified by the purchaser in the inquiry, contract, or order, for agencies of the U.S. Government.

S1. Referenced Documents

S1.1 The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

S1.2 *Military Specifications:*[6]

MIL-C-12000 Cable, Cord, and Wire, Electric; Packaging of

S2. Inspection

S2.1 The government shall have the right to perform any of the inspections and tests set forth in this specification when such tests are deemed necessary to ensure that the material conforms to the prescribed requirements.

S3. Packaging

S3.1 Packaging shall be in accordance with MIL-C-12000.

[6] Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.