Designation: B232/B232M – 09

Standard Specification for Concentric-Lay-Stranded Aluminum Conductors, Coated-Steel Reinforced (ACSR)[1]

This standard is issued under the fixed designation B232/B232M; 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 concentric-lay-stranded conductors made from round aluminum 1350-H19 (extra hard) wires and round, coated steel core wire(s) for use as overhead electrical conductors (Explanatory Note 1 and Explanatory Note 2).

1.2 ACSR covered by this specification has nine types of coated steel core wire which are designated by abbreviations as follows (Explanatory Note 2):

1.2.1 *ACSR/GA or ACSR/GA2—ACSR* using Class A zinc-coated steel wire,

1.2.2 *ACSR/GC or ACSR/GC2—ACSR* using Class C zinc-coated steel wire,

1.2.3 *ACSR/MA or ACSR/MA2—ACSR* using Class A Zn-5A1-MM coated steel wire,

1.2.4 *ACSR/HS or ACSR/GA3—ACSR* using Class A zinc-coated high-strength steel wires,

1.2.5 *ACSR/MS or ACSR/MA3—ACSR* using Class A Zn-5A1-MM coated high-strength steel wires,

1.2.6 *ACSR/GA4—ACSR* using Class A zinc-coated extra-high-strength steel wires,

1.2.7 *ACSR/MA4—ACSR* using Class A Zn-5A1-MM coated extra-high-strength steel wires,

1.2.8 *ACSR/GA5—ACSR* using Class A zinc-coated ultra-high-strength steel wires,

1.2.9 *ACSR/MA5—ACSR* using Class A Zn-5Al-MM coated ultra-high-strength steel wires.

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

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:*[2]

B230/B230M Specification for Aluminum 1350–H19 Wire for Electrical Purposes

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

B354 Terminology Relating to Uninsulated Metallic Electrical Conductors

B498/B498M Specification for Zinc-Coated (Galvanized) Steel Core Wire for Use in Overhead Electrical Conductors

B500/B500M Specification for Metallic Coated Stranded Steel Core for Use in Overhead Electrical Conductors

B606 Specification for High-Strength Zinc-Coated (Galvanized) Steel Core Wire for Aluminum and Aluminum-Alloy Conductors, Steel Reinforced

B802/B802M Specification for Zinc–5 % Aluminum-Mischmetal Alloy-Coated Steel Core Wire for Aluminum Conductors, Steel Reinforced (ACSR)

B803 Specification for High-Strength Zinc–5 % Aluminum-Mischmetal Alloy-Coated Steel Core Wire for Use in Overhead Electrical Conductors

B957 Specification for Extra-High-Strength and Ultra-High-Strength Zinc-Coated (Galvanized) Steel Core Wire for Overhead Electrical Conductors

B958 Specification for Extra-High-Strength and Ultra-High-Strength Class A Zinc–5% Aluminum-Mischmetal Alloy-Coated Steel Core Wire for Use in Overhead Electrical Conductors

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

E527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)

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

Current edition approved Aug. 1, 2009. Published September 2009. Originally approved in 1948. Last previous edition approved in 2002 as B232/B232M – 01 $^{\varepsilon 1}$. DOI: 10.1520/B0232_B0232M-09.

[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.

2.3 *ANSI Documents:*

ANSI H35.1 American National Standard Alloy and Temper Designation Systems for Aluminum[3]

ANSI H35.1M American National Standard for Alloy and Temper Designations Systems for Aluminum [Metric][3]

2.4 *NIST Document:*

NBS Handbook 100—Copper Wire Tables[4]

2.5 *Aluminum Association Document:*

Publication 50, Code Words for Overhead Aluminum Electrical Conductors[5]

3. Terminology

3.1 *Definitions*:

3.1.1 *Galvanized*—zinc coated.

3.1.2 *Aluminized*—aluminum coated.

3.2 *Abbreviations:Abbreviations:*

3.2.1 *Zn-5A1-MM*—zinc-5 % aluminum-mischmetal alloy.

3.2.2 *ACSR*—aluminum conductor, steel reinforced.

3.2.3 *ACSR/GA or ACSR/GA2*—reinforced with galvanized steel core wire, coating Class A in accordance with Specification B498/B498M.

3.2.4 *ACSR/GC or ACSR/GC2*—reinforced with galvanized steel core wire, coating Class C in accordance with Specification B498/B498M.

3.2.5 *ACSR/HS or ACSR/GA3*—reinforced with high-strength galvanized steel core wire in accordance with Specification B606.

3.2.6 *ACSR/MA or ACSR/MA2*—reinforced with Zn-5A1-MM coated steel core wire, coating Class A in accordance with Specification B802/B802M.

3.2.7 *ACSR/MS or ACSR/MA3*—reinforced with high-strength Zn-5A1-MM coated steel core wire in accordance with Specification B803.

3.2.8 *ACSR//MA4*—reinforced with extra-high-strength Zn-5A1-MM coated steel core wire in accordance with Specification B958.

3.2.9 *ACSR/GA4*—reinforced with extra-high-strength galvanized steel core wire in accordance with Specification B957.

3.2.10 *ACSR/MA5*—reinforced with ultra-high-strength Zn-5A1-MM coated steel core wire in accordance with Specification B958.

3.2.11 *ACSR/GA5*—reinforced with ultra-high-strength galvanized steel core wire in accordance with Specification B957.

4. Classification

4.1 For the purpose of this specification conductors are classified as follows (Explanatory Notes 1 and 2):

4.1.1 *Class AA*—For bare conductors usually used in over-head lines. These conductors are divided into two types as follows:

4.1.1.1 Conductors used for regular over-head line construction, and

4.1.1.2 Conductors having a high ratio of mechanical strength to current-carrying capacity used for overhead ground wires and for extra-long span construction. These are denoted under the Class column in Table 1 and Table 2 as "(HS)" for High Strength.

4.1.2 *Class A*—For conductors to be covered with weather-resistant materials.

5. Ordering Information

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

5.1.1 Quantity of each size, stranding, and class,

5.1.2 Conductor size, circular-mil area or AWG (Section 9 and Table 1),

5.1.3 Number of wires, aluminum and steel (see Tables 1-5),

5.1.4 Type of steel core wire and type and area density (if applicable) of coating (see 6.2),

5.1.5 Direction of lay of outer layer of aluminum wires if other than right-hand (see 8.2),

5.1.6 Special tension test, if desired (see 15.3),

5.1.7 Place of inspection (Section 16),

5.1.8 Package size and type (see 17.1),

5.1.9 Heavy wood lagging, if required (see 17.3), and

5.1.10 Special package marking, if required (see 17.4).

6. Requirement for Wires

6.1 Before stranding, the aluminum wire used shall meet the requirements of Specification B230/B230M.

6.2 Before stranding, the steel core wire used shall meet the requirements of Specification B498/B498M, B606, B802/B802M, B803, B957, or B958, whichever is applicable.

7. Joints

7.1 Electric-butt welds, cold-pressure welds, and electric-butt, cold-upset welds in the finished individual aluminum wires composing the conductor may be made during the stranding process. No weld shall occur within 50 ft [15 m] of a weld in the same wire or in any other wire of the completed conductor (Explanatory Note 3).

7.2 There shall be no joints of any kind made in the finished zinc-coated or zinc-5% aluminum-mischmetal alloy coated steel wires.

8. Lay

8.1 The length of lay of the various layers of wires in a conductor shall conform to Table 5 (see Explanatory Note 4).

8.2 The direction of lay of the outside layer of aluminum wires shall be right hand unless otherwise specified in the purchaser order. The direction of lay of the aluminum and steel wires shall be reversed in successive layers.

9. Construction

9.1 *ACSR* may be constructed using steel core wire with any one of two types of protective coatings. The acceptable core wires are:

9.1.1 Galvanized steel core wires, with coating Classes A or C in accordance with Specification B498/B498M;

9.1.2 High-strength galvanized steel core wire, coating Class A in accordance with Specification B606;

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

[4] Available from National Institute of Standards and Technology (NIST), 100 Bureau Dr., Stop 1070, Gaithersburg, MD 20899-1070, http://www.nist.gov.

[5] Available from Aluminum Association, Inc., 1525 Wilson Blvd., Suite 600, Arlington, VA 22209, http://www.aluminum.org.

TABLE 1 Construction Requirements of Aluminum Conductors, Steel Reinforced (ACSR)

Size		Code Words[A]	Class	Stranding Design Aluminum/ Steel	Stranding: Aluminum Wires			Stranding: Steel Wires			Nominal O.D. of Conductors, in.	Mass, lb/1000 ft
cmil	AWG				Number	Diameter, in.	Layers	Number	Diameter, in.	Layers		
2 312 000	. . .	Thrasher	AA	76/19	76	0.1744	4	19	0.0814	2	1.802	2523
2 167 000	. . .	Kiwi	AA	72/7	72	0.1735	4	7	0.1157	1	1.735	2301
2 156 000	. . .	Bluebird	AA	84/19	84	0.1602	4	19	0.0961	2	1.762	2508
1 780 000	. . .	Chukar	AA	84/19	84	0.1456	4	19	0.0874	2	1.602	2072
1 590 000	. . .	Falcon	AA	54/19	54	0.1716	3	19	0.1030	2	1.545	2042
1 590 000	. . .	Lapwing	AA	45/7	45	0.1880	3	7	0.1253	1	1.504	1790
1 510 500	. . .	Parrot	AA	54/19	54	0.1672	3	19	0.1003	2	1.505	1938
1 510 500	. . .	Nuthatch	AA	45/7	45	0.1832	3	7	0.1221	1	1.466	1700
1 431 000	. . .	Plover	AA	54/19	54	0.1628	3	19	0.0977	2	1.465	1838
1 431 000	. . .	Bobolink	AA	45/7	45	0.1783	3	7	0.1189	1	1.427	1611
1 351 500	. . .	Martin	AA	54/19	54	0.1582	3	19	0.0949	2	1.424	1735
1 351 500	. . .	Dipper	AA	45/7	45	0.1733	3	7	0.1155	1	1.386	1521
1 272 000	. . .	Pheasant	AA	54/19	54	0.1535	3	19	0.0921	2	1.382	1634
1 272 000	. . .	Bittern	AA	45/7	45	0.1681	3	7	0.1121	1	1.345	1432
1 272 000	. . .	Skylark	AA	36/1	36	0.1880	3	1	0.1880	0	1.316	1286
1 192 500	. . .	Grackle	AA	54/19	54	0.1486	3	19	0.0892	2	1.338	1531
1 192 500	. . .	Bunting	AA	45/7	45	0.1628	3	7	0.1085	1	1.302	1342
1 113 000	. . .	Finch	AA	54/19	54	0.1436	3	19	0.0862	2	1.293	1430
1 113 000	. . .	Bluejay	AA	45/7	45	0.1573	3	7	0.1049	1	1.259	1254
1 033 500	. . .	Curlew	AA	54/7	54	0.1383	3	7	0.1383	1	1.245	1329
1 033 500	. . .	Ortolan	AA	45/7	45	0.1515	3	7	0.1010	1	1.212	1163
1 033 500	. . .	Tanager	AA	36/1	36	0.1694	3	1	0.1694	0	1.186	1044
954 000	. . .	Cardinal	AA	54/7	54	0.1329	3	7	0.1329	1	1.196	1227.1
954 000	. . .	Rail	AA	45/7	45	0.1456	3	7	0.0971	1	1.165	1074
954 000	. . .	Catbird	AA	36/1	36	0.1628	3	1	0.1628	0	1.140	964
900 000	. . .	Canary	AA	54/7	54	0.1291	3	7	0.1291	1	1.162	1158
900 000	. . .	Ruddy	AA	45/7	45	0.1414	3	7	0.0943	1	1.131	1013
795 000	. . .	Mallard	AA	30/19	30	0.1628	2	19	0.0977	2	1.140	1233.9
795 000	. . .	Condor	AA	54/7	54	0.1213	3	7	0.1213	1	1.092	1022
795 000	. . .	Tern	AA	45/7	45	0.1329	3	7	0.0886	1	1.063	895
795 000	. . .	Drake	AA	26/7	26	0.1749	2	7	0.1360	1	1.108	1093
795 000	. . .	Cuckoo	AA	24/7	24	0.1820	2	7	0.1213	1	1.092	1023
795 000	. . .	Coot	AA	36/1	36	0.1486	3	1	0.1486	0	1.040	803.6
715 500	. . .	Redwing	AA	30/19	30	0.1544	2	19	0.0926	2	1.081	1109.3
715 500	. . .	Starling	AA	26/7	26	0.1659	2	7	0.1290	1	1.051	983.7
715 500	. . .	Stilt	AA	24/7	24	0.1727	2	7	0.1151	1	1.036	921
666 600	. . .	Gannet	AA	26/7	26	0.1601	2	7	0.1245	1	1.014	916.2
666 600	. . .	Flamingo	AA	24/7	24	0.1667	2	7	0.1111	1	1.000	857.9
636 000	. . .	Egret	AA	30/19	30	0.1456	2	19	0.0874	2	1.019	987.2
636 000	. . .	Scoter	AA	30/7	30	0.1456	2	7	0.1456	1	1.019	995.1
636 000	. . .	Grosbeak	AA	26/7	26	0.1564	2	7	0.1216	1	0.990	874.2
636 000	. . .	Rook	AA	24/7	24	0.1628	2	7	0.1085	1	0.977	818.2
636 000	. . .	Swift	AA	36/1	36	0.1329	3	1	0.1329	0	0.930	642.8
636 000	. . .	Kingbird	AA	18/1	18	0.1880	2	1	0.1880	0	0.940	689.9
605 000	. . .	Teal	AA	30/19	30	0.1420	2	19	0.0852	2	0.994	938.6
605 000	. . .	Wood Duck	AA	30/7	30	0.1420	2	7	0.1420	1	0.994	946.5
605 000	. . .	Squab	AA	26/7	26	0.1525	2	7	0.1186	1	0.966	831.3
605 000	. . .	Peacock	AA	24/7	24	0.1588	2	7	0.1059	1	0.953	778.8
556 500	. . .	Eagle	AA	30/7	30	0.1362	2	7	0.1362	1	0.953	870.7
556 500	. . .	Dove	AA	26/7	26	0.1463	2	7	0.1138	1	0.927	765.2
556 500	. . .	Parakeet	AA	24/7	24	0.1523	2	7	0.1015	1	0.914	716.1
556 500	. . .	Osprey	AA	18/1	18	0.1758	2	1	0.1758	0	0.879	603.3
477 000	. . .	Hen	AA	30/7	30	0.1261	2	7	0.1261	1	0.883	746.4
477 000	. . .	Hawk	AA	26/7	26	0.1354	2	7	0.1053	1	0.858	655.3
477 000	. . .	Flicker	AA	24/7	24	0.1410	2	7	0.0940	1	0.846	613.9
477 000	. . .	Pelican	AA	18/1	18	0.1628	2	1	0.1628	0	0.814	517.3
397 500	. . .	Lark	AA	30/7	30	0.1151	2	7	0.1151	1	0.806	621.8
397 500	. . .	Ibis	AA	26/7	26	0.1236	2	7	0.0961	1	0.783	546.0
397 500	. . .	Brant	AA	24/7	24	0.1287	2	7	0.0858	1	0.772	511.4
397 500	. . .	Chickadee	AA	18/1	18	0.1486	2	1	0.1486	0	0.743	431.0
336 400	. . .	Oriole	AA	30/7	30	0.1059	2	7	0.1059	1	0.741	526.4
336 400	. . .	Linnet	AA	26/7	26	0.1137	2	7	0.0884	1	0.720	462.0
336 400	. . .	Merlin	AA	18/1	18	0.1367	2	1	0.1367	0	0.684	364.8
300 000	. . .	Ostrich	AA	26/7	26	0.1074	2	7	0.0835	1	0.680	412.2
266 800	. . .	Partridge	AA	26/7	26	0.1013	2	7	0.0788	1	0.642	366.9
266 800	. . .	Waxwing	AA	18/1	18	0.1217	2	1	0.1217	0	0.609	289.1
211 600	0000	Penguin	AA, A	6/1	6	0.1878	1	1	0.1878	0	0.563	290.8
211 300	. . .	Cochin	AA (HS)	12/7	12	0.1327	1	7	0.1327	1	0.664	526.8
203 200	. . .	Brahma	AA (HS)	16/19	16	0.1127	1	19	0.0977	2	0.714	674.6
190 800	. . .	Dorking	AA (HS)	12/7	12	0.1261	1	7	0.1261	1	0.631	475.7

TABLE 1 *Continued*

Size		Code Words[A]	Class	Stranding Design Aluminum/ Steel	Stranding						Nominal O.D. of Conductors, in.	Mass, lb/1000 ft
					Aluminum Wires			Steel Wires				
cmil	AWG				Number	Diameter, in.	Layers	Number	Diameter, in.	Layers		
176 900	. . .	Dotterel	AA (HS)	12/7	12	0.1214	1	7	0.1214	1	0.607	440.9
167 800	000	Pigeon	AA, A	6/1	6	0.1672	1	1	0.1672	0	0.502	230.5
159 000	. . .	Guinea	AA (HS)	12/7	12	0.1151	1	7	0.1151	1	0.576	396.3
134 600	. . .	Leghorn	AA (HS)	12/7	12	0.1059	1	7	0.1059	1	0.530	335.5
133 100	00	Quail	AA, A	6/1	6	0.1489	1	1	0.1489	0	0.447	182.8
110 800	. . .	Minorca	AA (HS)	12/7	12	0.0961	1	7	0.0961	1	0.481	276.3
105 600	0	Raven	AA, A	6/1	6	0.1327	1	1	0.1327	0	0.398	145.2
101 800	. . .	Petrel	AA (HS)	12/7	12	0.0921	1	7	0.0921	1	0.461	253.8
83 690	1	Robin	AA, A	6/1	6	0.1181	1	1	0.1181	0	0.354	115.0
80 000	. . .	Grouse	AA (HS)	8/1	8	0.1000	1	1	0.1670	0	0.367	148.8
66 360	2	Sparate	AA, A	7/1	7	0.0974	1	1	0.1299	0	0.325	106.63
66 360	2	Sparrow	AA, A	6/1	6	0.1052	1	1	0.1052	0	0.316	91.2
41 740	4	Swanate	AA, A	7/1	7	0.0772	1	1	0.1029	0	0.257	66.95
41 740	4	Swan	AA, A	6/1	6	0.0834	1	1	0.0834	0	0.250	57.35
33 090	5	. . .	A	6/1	6	0.0743	1	1	0.0743	0	0.223	45.51
26 240	6	Turkey	AA, A	6/1	6	0.0661	1	1	0.0661	0	0.198	36.02

[A] Code words shown are provided here for information only. These code names apply to Class AA Bare Aluminum Conductors, Steel Reinforced (ACSR) as shown above. They do not apply to Class A products shown in the above table.

Conversion factors:
1 cmil = 5.067 E – 0.4 mm^2
1 in. = 2.54 E + 01 mm
1 lb/1000ft = 1.488 E + 00 kg/km
1 ft = 3.048 E – 01 m
1 lb = 4.536 E – 01 kg
1 lbf = 4.448 E – 03 kN

9.1.3 Zn-5A1-MM coated steel core wire, coating Class A, in accordance with Specification B802/B802M;

9.1.4 High-strength Zn-5A1-MM coated steel core wire, coating Class A in accordance with Specification B803;

9.1.5 Extra-high-strength galvanized steel core wire coating Class A in accordance with Specification B957;

9.1.6 Extra-high-strength Zn-5Al-MM coated steel core wire, coating Class A in accordance with Specification B958;

9.1.7 Ultra-high-strength galvanized steel core wire coating Class A in accordance with Specification B957; or

9.1.8 Ultra-high-strength Zn-5Al-MM coated steel core wire, coating Class A in accordance with Specification B958.

9.2 The number and diameter of aluminum and steel wires and the area of cross section of aluminum wires shall conform to the requirements prescribed in Tables 1-5.

9.3 Where compressed stranding is required in order to insulate the conductor properly, one or more aluminum layers of any stranded conductor consisting of 7 wires or more may be slightly compressed. The nominal diameter of the compressed conductor is 3 % below the nominal diameter of noncompressed conductor and the area of cross section after compressing is in accordance with Section 13.

9.4 For "HS" (High Strength) type conductors as denoted in Table 1 and Table 2, unless specified by the customer, the default strength of steel shall be regular strength Type GA2 to Specification B498/B498M or MA2 to Specification B802/B802M.

9.5 All steel wires shall lie naturally in their position in the stranded core, and where the core is cut, the wire ends shall remain in position or be readily replaced by hand and then remain approximately in position. This requirement also applies to the outer layer of aluminum wires of a conductor.

9.6 The stranded steel core shall be free from waviness and kinks.

9.7 Before stranding, aluminum and steel wires shall have approximately uniform temperatures.

9.8 The diameter of the finished conductor shall be not less than 99 % nor more than 101 % of that shown in Table 1 and Table 2 when measured with a diameter tape between the closing die(s) and the capstan of the strander.

10. A Rated Strength of Conductor

10.1 The rated strength of a completed conductor shall be taken as the aggregate strength of the aluminum and steel components, calculated as follows. The strength contribution of the aluminum wires shall be taken as the percentage, indicated in Table 6, of the sum of the strengths of the 1350-H19 wires, calculated from their specified nominal wire diameter and the appropriate specified minimum average tensile strength given in Specification B230/B230M. The strength contribution of the steel core wires shall be taken as the percentage, according to the number of layers of steel wires, indicated in Table 6, of the sum of the strengths of the steel wires, calculated from their specified nominal wire diameter and the appropriate specified minimum stress at 1 % extension given in Specification B498/B498M, B606, B802/B802M, or B803, whichever is applicable.

10.2 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 E29.

10.3 Rated strength of various constructions are given in Table 3 or Table 4.

TABLE 2 Construction Requirements—Aluminum Conductors, Steel Reinforced (ACSR)

Size, mm²	Class	Stranding Design	Stranding						Nominal Outside Diameter of Conductors, mm	Mass, kg/km
			Aluminum Wires			Steel Wires				
			Number	Diameter, mm	Layers	Number	Diameter, mm	Layers		
1250	AA	84/19	84	4.35	4	19	2.61	2	47.85	4274
1250	AA	76/19	76	4.58	4	19	2.14	2	47.34	4023
1250	AA	72/7	72	4.70	4	7	3.13	1	46.99	3901
1120	AA	84/19	84	4.12	4	19	2.47	2	45.31	3833
1120	AA	76/19	76	4.33	4	19	2.02	2	44.74	3595
1120	AA	72/7	72	4.45	4	7	2.97	1	44.51	3499
1000	AA	84/19	84	3.89	4	19	2.33	2	42.77	3416
1000	AA	72/7	72	4.21	4	7	2.81	1	42.11	3132
900	AA	84/19	84	3.69	4	19	2.21	2	40.57	3073
900	AA	72/7	72	3.99	4	7	2.66	1	39.9	2812
800	AA	54/19	54	4.34	3	19	2.60	2	39.04	3015
800	AA	45/7	45	4.76	3	7	3.17	1	38.07	2652
710	AA	54/19	54	4.09	3	19	2.45	2	36.79	2678
710	AA	45/7	45	4.48	3	7	2.99	1	35.85	2351
630	AA	54/19	54	3.85	3	19	2.31	2	34.65	2375
630	AA	45/7	45	4.22	3	7	2.81	1	33.75	2084
560	AA	54/19	54	3.63	3	19	2.18	2	32.68	2112
560	AA	45/7	45	3.98	3	7	2.65	1	31.83	1854
500	AA	54/7	54	3.43	3	7	3.43	1	30.87	1889
500	AA	45/7	45	3.76	3	7	2.51	1	30.09	1656
450	AA	54/7	54	3.26	3	7	3.26	1	29.34	1706
450	AA	45/7	45	3.57	3	7	2.38	1	28.56	1492
400	AA	30/19	30	4.12	2	19	2.47	2	28.83	1824
400	AA	26/7	26	4.43	2	7	3.45	1	28.07	1622
400	AA	24/7	24	4.61	2	7	3.07	1	27.65	1515
355	AA	30/19	30	3.88	2	19	2.33	2	27.17	1620
355	AA	26/7	26	4.17	2	7	3.24	1	26.4	1435
355	AA	24/7	24	4.34	2	7	2.89	1	26.03	1343
315	AA	30/19	30	3.66	2	19	2.20	2	25.64	1443
315	AA	26/7	26	3.93	2	7	3.06	1	24.9	1277
315	AA	24/7	24	4.09	2	7	2.73	1	24.55	1194
315	AA	18/1	18	4.72	2	1	4.72	0	23.6	1014
280	AA	30/7	30	3.45	2	7	3.45	1	24.15	1291
280	AA	26/7	26	3.70	2	7	2.88	1	23.44	1131
280	AA	24/7	24	3.85	2	7	2.57	1	23.11	1058
280	AA	18/1	18	4.45	2	1	4.45	0	22.25	901.0
250	AA	30/7	30	3.26	2	7	3.26	1	22.82	1152
250	AA	26/7	26	3.50	2	7	2.72	1	22.16	1011
250	AA	24/7	24	3.64	2	7	2.43	1	21.85	946.0
250	AA	18/1	18	4.21	2	1	4.21	0	21.05	806.4
224	AA	30/7	30	3.08	2	7	3.08	1	21.56	1029
224	AA	26/7	26	3.31	2	7	2.57	1	20.95	904.0
224	AA	24/7	24	3.45	2	7	2.30	1	20.7	849.2
224	AA	18/1	18	3.98	2	1	3.98	0	19.9	720.7
200	AA	30/7	30	2.91	2	7	2.91	1	20.37	918.2
200	AA	26/7	26	3.13	2	7	2.43	1	19.81	808.3
200	AA	24/7	24	3.26	2	7	2.17	1	19.55	757.6
200	AA	18/1	18	3.76	2	1	3.76	0	18.8	643.2
180	AA	30/7	30	2.76	2	7	2.76	1	19.32	826.0
180	AA	26/7	26	2.97	2	7	2.31	1	18.81	728.6
180	AA	24/7	24	3.09	2	7	2.06	1	18.54	681.2
180	AA	18/1	18	3.57	2	1	3.57	0	17.85	579.9
160	AA	30/7	30	2.61	2	7	2.61	1	18.27	738.6
160	AA	26/7	26	2.80	2	7	2.18	1	17.74	648.0
160	AA	24/7	24	2.91	2	7	1.94	1	17.46	604.2
160	AA	18/1	18	3.36	2	1	3.36	0	16.8	513.7
140	AA	26/7	26	2.62	2	7	2.04	1	16.6	567.4

TABLE 2 *Continued*

Size, mm²	Class	Stranding Design	Stranding						Nominal Outside Diameter of Conductors, mm	Mass, kg/km
			Aluminum Wires			Steel Wires				
			Number	Diameter, mm	Layers	Number	Diameter, mm	Layers		
140	AA	24/7	24	2.73	2	7	1.82	1	16.38	531.8
140	AA	18/1	18	3.15	2	1	3.15	0	15.75	451.5
125	AA	26/7	26	2.47	2	7	1.92	1	15.64	503.7
125	AA	24/7	24	2.58	2	7	1.72	1	15.48	474.9
125	AA	18/1	18	2.97	2	1	2.97	0	14.85	401.3
100	AA (HS)	16/19	16	2.82	1	19	2.44	2	17.84	972.4
100	AA (HS)	12/7	12	3.26	1	7	3.26	1	16.3	734.1
100	AA, A	6/1	6	4.61	1	1	4.61	0	13.83	404.8
90	AA (HS)	12/7	12	3.09	1	7	3.09	1	15.45	659.5
80	AA (HS)	12/7	12	2.91	1	7	2.91	1	14.55	584.9
80	AA, A	6/1	6	4.12	1	1	4.12	0	12.36	323.3
71	AA (HS)	12/7	12	2.74	1	7	2.74	1	13.7	518.6
63	AA (HS)	12/7	12	2.59	1	7	2.59	1	12.95	463.4
63	AA, A	6/1	6	3.66	1	1	3.66	0	10.98	255.2
56	AA (HS)	12/7	12	2.44	1	7	2.44	1	12.2	411.2
50	AA (HS)	12/7	12	2.30	1	7	2.30	1	11.5	365.4
50	AA, A	6/1	6	3.26	1	1	3.26	0	9.78	202.4
40	AA (HS)	8/1	8	2.52	1	1	4.20	0	9.24	217.9
40	AA, A	6/1	6	2.91	1	1	2.91	0	8.73	161.3
31.5	AA, A	7/1	7	2.39	1	1	3.19	0	7.97	148.4
31.5	AA, A	6/1	6	2.59	1	1	2.59	0	7.77	127.8
25	AA, A	7/1	7	2.13	1	1	2.84	0	7.1	117.8
25	AA, A	6/1	6	2.30	1	1	2.30	0	6.9	100.8
20	AA, A	7/1	7	1.91	1	1	2.55	0	6.37	94.80
20	AA, A	6/1	6	2.06	1	1	2.06	0	6.18	80.83
16	AA, A	6/1	6	1.84	1	1	1.84	0	5.52	64.49
12.5	AA, A	6/1	6	1.63	1	1	1.63	0	4.89	50.61

11. Density

11.1 For the purpose of calculating mass per unit length, cross sections, etc., the density of aluminum 1350 shall be taken as 2705 kg/m^3 [0.0975 lb/in.^{3}] at 20°C (Explanatory Note 5).

11.2 For the purpose of calculating mass per unit length, cross sections, etc., the density of galvanized or aluminized steel wire shall be taken as 7780 kg/m^3 [0.281 lb/in.^{3}] at 20°C.

12. Mass Per Unit Length and Electrical Resistance

12.1 The mass per unit length 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 the standard increments shown in Table 6. When greater accuracy is desired, the increment based on the specific lay of the conductor may be calculated (Explanatory Note 6).

12.2 In the calculation of the electrical resistance of a conductor, the zinc-coated or Zn-5A1-MM coated steel core wires may be included.

13. Variation in Area

13.1 The area of cross section of the aluminum wires of a conductor shall be not less than 98 % of the area specified. Unless otherwise specified by the purchaser, the manufacturer may have the option of determining the cross-sectional area by either of the following methods, except that in case of question regarding area compliance, the method of 13.1.2 shall be used:

13.1.1 The area of cross section may be determined by calculations from diameter measurements, expressed to four decimal places, of the component aluminum wires at any point when measured perpendicularly to their axes.

13.1.2 The area of cross section of the aluminum wires of a conductor may be determined by Test Method B263. In applying that test method the increment in mass per unit length resulting from stranding may be the applicable value specified in 12.1 or may be calculated from the measured component dimensions of the sample under test. In case of question regarding area compliance, the actual mass per unit length increment due to stranding shall be calculated.

14. Workmanship, Finish and Appearance

14.1 The conductor shall be clean and free of imperfections not consistent with good commercial practice.

15. Mechanical and Electrical Tests

15.1 Tests for mechanical and electrical properties of aluminum wires shall be made before stranding (Explanatory Note 7).

15.2 All aluminum wires composing the conductors shall be capable of meeting the bending properties stated in Specification B230/B230M after stranding.