Designation: B232/B232M – 24

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.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *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 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/B263M 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 or Aluminum Clad Stranded Steel Core for Use in Overhead Electrical Conductors

B606/B606M Specification for High-Strength Zinc-Coated (Galvanized) Steel Core Wire for Use in Overhead Electrical Conductors

B802/B802M Specification for Zinc–5 % Aluminum-Mischmetal Alloy-Coated Steel Core Wire for Use in Overhead Electrical Conductors

B803/B803M Specification for High-Strength Zinc–5 % Aluminum-Mischmetal Alloy-Coated Steel Core Wire for Use in Overhead Electrical Conductors

B957/B957M Specification for Extra-High-Strength and

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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.

Ultra-High-Strength Zinc-Coated (Galvanized) Steel Core Wire for Use in Overhead Electrical Conductors
B958/B958M 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)

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, adj*—zinc coated.

3.2 *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/B606M.

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/B803M.

3.2.8 *ACSR//MA4*—reinforced with extra-high-strength Zn-5A1-MM coated steel core wire in accordance with Specification B958/B958M.

3.2.9 *ACSR/GA4*—reinforced with extra-high-strength galvanized steel core wire in accordance with Specification B957/B957M.

3.2.10 *ACSR/MA5*—reinforced with ultra-high-strength Zn-5A1-MM coated steel core wire in accordance with Specification B958/B958M.

3.2.11 *ACSR/GA5*—reinforced with ultra-high-strength galvanized steel core wire in accordance with Specification B957/B957M.

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 overhead 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 8.3),

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/B606M, B802/B802M, B803/B803M, B957/B957M, or B958/B958M, 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.

[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						Nominal O.D. of Conductors, in.	Mass, lb/1000 ft
					Aluminum Wires			Steel Wires				
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
176 900	. . .	Dotterel	AA (HS)	12/7	12	0.1214	1	7	0.1214	1	0.607	440.9