Designation: B 802/B 802M – 08

Standard Specification for Zinc–5 % Aluminum-Mischmetal Alloy-Coated Steel Core Wire for Aluminum Conductors, Steel Reinforced (ACSR)[1]

This standard is issued under the fixed designation B 802/B 802M; 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 round, zinc–5 % aluminum-mischmetal (Zn–5Al–MM) alloy-coated, steel core wire with three classes of Zn–5Al–MM coating used for mechanical reinforcement in the manufacture of aluminum conductors, steel reinforced (ACSR).

1.2 This specification covers wire of diameter from 0.0500 to 0.1900 in. or 1.27 to 4.82 mm, inclusive.

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]

A 90/A 90M Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products

A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products

B 193 Test Method for Resistivity of Electrical Conductor Materials

B 750 Specification for GALFAN (Zinc-5 % Aluminum-Mischmetal) Alloy in Ingot Form for Hot-Dip Coatings

E 47 Test Methods for Chemical Analysis of Zinc Die-Casting Alloys.

E 1277 Test Method for Chemical Analysis of Zinc-5 % Aluminum-Mischmetal Alloys by ICP Emission Spectrometry

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

2.3 *Other Standard:*

GF-1 Standard Practice for Determination of Cerium and Lanthanum Compositions in Galfan Alloy (5 % Al-0.04 % La-0.04 % Ce-Bal SHG Zn)[3]

3. Terminology

3.1 *Abbreviations: Abbreviations:*

3.1.1 *MM*—mischmetal.

3.1.2 *Zn–5Al–MM*—zinc–5 % aluminum mischmetal.

3.2 *Definition:*

3.2.1 *lot*—unless otherwise specified in the contract or order, a lot shall consist of all coils of wire of the same diameter and unit lengths submitted for inspection at the same time.

3.2.2 *Product Code*—Defines product coating type, coating class and strength grade. Two product codes for product produced to this specification: Class A *Zn–5Al–MM* Coated = MA1; and Class C *Zn–5Al–MM* Coated = MC1.

4. Classification

4.1 The wire is furnished in two classes of coating, Class A or Class C, as specified, in conformance with the requirements of Section 10 and Table 1 or Table 2.

5. Ordering Information

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

5.1.1 Quantity of each size,

5.1.2 Wire diameter in inches or millimeters (Section 14),

5.1.3 Product Code (see paragraphs 3.2.2 and 4.1),

5.1.4 Certification, if required (Section 19),

5.1.5 Test report, if required (Section 19), and

5.1.6 Package Size (Section 20).

[1] This specification is under the jurisdiction of ASTM Committee B01 on Electrical Conductors and is the direct responsibility of Subcommittee B01.05 on Conductors of Ferrous Metals.

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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 International Lead Zinc Research Organization (ILZRO), 1822 NC Highway 54 East, Suite 120, Durham NC 27713, http://www.ilzro.org.

***A Summary of Changes section appears at the end of this standard.**

TABLE 1 Zn-5Al-MM Alloy Coating

Specified Diameter of Coated Wire, in.	Area Density of Coating, min, oz/ft² of Uncoated Wire Surface	
	Class A	Class C
0.0500 to 0.0599, incl	0.60	1.80
0.0600 to 0.0749, incl	0.65	1.95
0.0750 to 0.0899, incl	0.70	2.10
0.0900 to 0.1039, incl	0.75	2.25
0.1040 to 0.1199, incl	0.80	2.40
0.1200 to 0.1399, incl	0.85	2.55
0.1400 to 0.1799, incl	0.90	2.70
0.1800 to 0.1900, incl	1.00	3.00

TABLE 2 Zn-5Al-MM Alloy Coating (Metric)

Specified Diameter of Coated Wire, mm	Area Density of Coating, min, g/m² of Uncoated Wire Surface	
	Class A	Class C
1.27 to 1.52, incl	183	549
1.53 to 1.90, incl	198	594
1.91 to 2.28, incl	214	642
2.29 to 2.64, incl	229	687
2.65 to 3.04, incl	244	732
3.05 to 3.55, incl	259	777
3.56 to 4.57, incl	274	822
4.58 to 4.82, incl	305	915

6. Materials and Manufacture

6.1 The base metal shall be steel produced by the open-hearth, electric furnace, or basic oxygen process.

6.2 The wire shall be cold drawn and coated with Zn–5Al–MM alloy to produce the desired properties.

7. Chemical Composition

7.1 The steel shall conform to the requirements prescribed in Table 3.

7.2 Chemical analysis of the steel shall be conducted in accordance with Test Methods, Practices and Terminology A 751.

7.3 The ingot form of zinc-5% aluminum-mischmetal alloy shall conform to Specification B 750.

7.3.1 For a two-step coating operation where the first coating is zinc (hot-dip galvanized or electrogalvanized), the final bath may have an aluminum content of up to 7.2 %, to prevent depletion of the aluminum content of the bath.

7.3.2 *Method of Analysis*—The determination of chemical composition shall be made in accordance with suitable chemical (Test Methods E 47 for Tin), ICP argon plasma spectrometric (Practice E 1277), or other methods. In case of dispute, the results secured by Practice E 1277 shall be the basis of acceptance.

TABLE 3 Chemical Requirements

Element	Composition, %
Carbon	0.50 to 0.88
Manganese	0.50 to 1.10
Phosphorus, max	0.035
Sulfur, max	0.045
Silicon	0.10 to 0.35

7.3.3 *Method of Coating Material Analysis*—Refer to Specification B 750. In case of dispute, the results secured by Practice E 1277 shall be the basis of acceptance.

8. Tensile Test

8.1 The Zn–5Al–MM-coated steel core wire shall conform to the tensile and elongation requirements prescribed in Table 4 or Table 5.

8.2 Tensile tests shall be conducted in accordance with Test Methods and Definitions A 370, using the initial settings for determining stress at 1 % extension given in Table 6 or Table 7 of this specification.

8.3 *Test Specimens*—The test specimens shall be free of bends or kinks other than the curvature resulting from the usual coiling operations. Any hand straightening necessary to permit insertion of the specimen in the jaws of the testing machine shall be performed by drawing between wood blocks or by some other equally satisfactory means.

9. Wrap Test

9.1 The material, as represented by the test specimens, shall not fracture when the Zn–5Al–MM alloy-coated wire is wrapped at a rate not exceeding 15 turns/min in a close helix of at least eight turns around a cylindrical mandrel with a diameter equal to two times the specified diameter of the wire under test, ±5 %.

10. Coating Test

10.1 The material, as represented by the test specimens, shall conform to the coating requirements of Table 1 or Table 2, for the diameter and class of coating specified.

10.2 The coating test shall be conducted in accordance with Test Method A 90/A 90M.

11. Adherence of Coating Test

11.1 The Zn–5Al–MM alloy-coated wire shall be capable of being wrapped in a close helix at a rate not exceeding 15 turns/min around a cylindrical mandrel having a diameter as prescribed in Table 8 or Table 9, without cracking or flaking the coating to such an extent that any Zn–5Al–MM alloy can be removed by rubbing with the bare fingers.

NOTE 1—Loosening or detachment during the adhesion test of superficial, small particles of Zn–5Al–MM alloy formed by mechanical polishing of the surface of the coated wire shall not be considered cause for rejection.

12. Joints

12.1 No joints shall be made in the finished wire.

12.2 Joints may be made at any stage of processing prior to final cold drawing by the electric butt-weld or flash or flash-welding process.

12.3 Welding equipment and procedure shall be such that it can be demonstrated that the ultimate tensile strength of a finished wire specimen containing the welded section shall be not less than 96 % of the specified minimum stress at 1 % extension.

12.4 A welded section shall not be required to meet the stress at 1 % extension, elongation, and wrap tests.

TABLE 4 Tensile Requirements

Specified Diameter, in.	Stress at 1 % Extension, min, Ksi		Ultimate Tensile Strength, min, Ksi		Elongation in 10 in., min, %	
	Class A	Class C	Class A	Class C	Class A	Class C
0.0500 to 0.0899, incl	190	170	210	190	3.0	3.0
0.0900 to 0.1199, incl	185	165	205	185	3.5	3.0
0.1200 to 0.1399, incl	180	160	205	185	4.0	3.0
0.1400 to 0.1900, incl	170	155	200	180	4.0	4.0

TABLE 5 Tensile Requirements (Metric)

Specified Diameter, mm	Stress at 1 % Extension, min, MPa		Ultimate Tensile Strength, min, MPa		Elongation in 250 mm, min, %	
	Class A	Class C	Class A	Class C	Class A	Class C
1.27 to 2.28, incl	1310	1170	1450	1310	3.0	3.0
2.29 to 3.04, incl	1280	1140	1410	1280	3.5	3.0
3.05 to 3.55, incl	1240	1100	1410	1280	4.0	3.0
3.56 to 4.82, incl	1170	1070	1380	1240	4.0	4.0

TABLE 6 Initial Settings for Determining Stress at 1 % Extension

Specified Diameter, in.	Initial Stress, Ksi	Initial Setting of Extensometer, in./in.
0.0500 to 0.0899,incl	14	0.0005 (0.05 % extension)
0.0900 to 0.1199, incl	28	0.0010 (0.10 % extension)
0.1200 to 0.1900, incl	42	0.0015 (0.15 % extension)

TABLE 7 Initial Settings for Determining Stress at 1 % Extension (Metric)

Specified Diameter, mm	Initial Stress, MPa	Initial Setting of Extensometer, mm/mm
1.27 to 2.28, incl	100	0.0005 (0.05 % extension)
2.29 to 3.04, incl	190	0.0010 (0.10 % extension)
3.05 to 4.82, incl	290	0.0015 (0.15 % extension)

TABLE 8 Mandrel Size for Adherence Test

Specified Wire Diameter, in.	Ratio of Mandrel Diameter to Wire Diameter
0.0500 to 0.0899, incl	3
0.0900 to 0.1399, incl	4
0.1400 to 0.1900, incl	5

TABLE 9 Mandrel Size for Adherence Test (Metric)

Specified Wire Diameter, mm	Ratio of Mandrel Diameter to Wire Diameter
1.27 to 2.28, incl	3
2.29 to 3.04, incl	4
3.05 to 4.82, incl	5

13. Density and Resistivity

13.1 For the purpose of calculating mass per unit length, cross sections, etc, the density of Zn–5Al–MM alloy-coated steel wire at 20°C shall be taken as 0.281 lb/in.^{3}(7780 kg/m ^{3}).

13.2 A maximum resistivity of Zn–5Al–MM alloy-coated steel wire is not guaranteed but a typical value of 0.19157 Ωmm ^{2}/m may be used for purpose of calculation. For conversion to other units of conductivity or resistivity, refer to Test Method B 193.

14. Dimensions, Mass, and Permissible Variations

14.1 The specified diameter of the zinc-coated wire shall be expressed in decimal fractions of an inch to four decimal places, or in millimeters to two decimal places.

14.2 To determine the applicable tolerance range from Table 10 or Table 11, round the specified diameter to the nearest 0.001 in. (0.01 mm) in accordance with the rounding method of Practice E 29.

14.3 Measure the largest and smallest diameter taken at the same cross section rounded to the nearest 0.001 in. (0.01 mm) in accordance with the rounding method of Practice E 29. Calculate the average of the two measurements. The calculated value shall not differ from the specified diameter by more than the applicable tolerance range shown in Table 10 or Table 11.

15. Workmanship, Finish, and Appearance

15.1 The Zn–5Al–MM alloy coating shall be reasonably smooth, continuous, of reasonably uniform thickness, and free of imperfections not consistent with good commercial practice.

16. Number of Tests and Retests

16.1 One test specimen shall be taken from each 5000 lb or 2500 kg or fraction thereof in the inspection lot.

TABLE 10 Permissible Variations in Diameter of Zn-5Al-MM Alloy-Coated Steel Wire

NOTE 1—It is recognized that the surface of Zn-5Al-MM alloy coatings, particularly those produced by hot-dip coating, are not perfectly smooth and devoid of irregularities. If the tolerances shown in the table are rigidly applied to such irregularities that are inherent to the product, unjustified rejections of wire that would actually be satisfactory for use could occur. It is intended that these tolerances be used in gaging the wires where there is a minimum of such diameter irregularities due to galvanizing.

Specified Diameter, in.	Permissible Variation, in.	
	Plus	Minus
0.0500 to 0.0749, incl	0.0015	0.001
0.0750 to 0.1199, incl	0.002	0.002
0.1200 to 0.1399, incl	0.003	0.002
0.1400 to 0.1900, incl	0.004	0.003