



Designation: B 803 – 02

Standard Specification for High-Strength Zinc–5 % Aluminum-Mischmetal Alloy-Coated Steel Core Wire for Aluminum and Aluminum-Alloy Conductors, Steel Reinforced¹

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1. Scope

1.1 This specification covers round, high strength, zinc–5 % aluminum-mischmetal (Zn–5Al–MM) alloy-coated, steel core wire with Class A Zn–5Al–MM alloy coating used for mechanical reinforcement in the manufacture of special aluminum and aluminum-alloy conductors, steel reinforced.

1.2 This specification covers wire of diameter from 0.0500 to 0.1900 in. inclusive.

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

A 90/A90M Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings²

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products³

A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products³

B 193 Test Method for Resistivity of Electrical Conductor Materials⁴

B 750 Specification for Zinc–5 % Aluminum-Mischmetal Alloy in Ingot Form for Hot-Dip Coatings⁵

E 47 Test Methods for Chemical Analysis of Zinc Die-Casting Alloys⁶

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 Annual Book of ASTM Standards, Vol 01.06.

³ Annual Book of ASTM Standards, Vol 01.03.

⁴ Annual Book of ASTM Standards, Vol 02.03.

⁵ Annual Book of ASTM Standards, Vol 02.04.

⁶ Annual Book of ASTM Standards, Vol 03.05.

E 1277 Practice for Chemical Analysis of Zinc-5 Aluminum-Mischmetal Alloys by ICP Emission Spectrometry⁶

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)⁷

3. Terminology

3.1 Abbreviations: Abbreviations:

3.1.1 MM—mischmetal

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

3.2 Definitions:

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.

4. Ordering Information

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

4.1.1 Quantity of each size,

4.1.2 Wire diameter in inches (Section 13),

4.1.3 Certification, if required (Section 18),

4.1.4 Test report, if required (Section 18), and

4.1.5 Package Size (Section 19).

5. Materials and Manufacture

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

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

6. Chemical Composition

6.1 The steel shall conform to the requirements prescribed in Table 1.

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

⁷ Available from International Lead Zinc Research Organization, 2525 Meridian Parkway, P.O. Box 12036, Research Triangle Park, NC 27709-2036

TABLE 1 Chemical Requirements

| Element | Composition, % |
|-----------------|----------------|
| Carbon | 0.50 to 0.88 |
| Manganese | 0.50 to 1.30 |
| Phosphorus, max | 0.035 |
| Sulfur, max | 0.045 |
| Silicon | 0.10 to 0.35 |

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

6.3.1 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.

6.3.2 *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.

6.3.3 A standard practice of X-ray fluorescence spectrometry for determination of cerium and lanthanum in a Zn-5Al-MM alloy has been established by the International Lead Zinc Research Organization (Standard Practice GF-1). In case of dispute, the results secured by Practice E 1277 shall be the basis of acceptance.

7. Tensile Test

7.1 The Zn-5Al-MM-coated steel core wire shall conform to the tensile and elongation requirements prescribed in Table 2.

7.2 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 3 of this specification.

7.3 *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.

8. Wrap Test

8.1 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 three times the specified diameter of the wire under test, ± 5 %.

9. Coating Test

9.1 The Zn-5Al-MM alloy-coated wire shall conform to the coating requirements prescribed in Table 4.

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

10. Adherence of Coating Test

10.1 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 5, 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.

11. Joints

11.1 No joints shall be made in the finished wire.

11.2 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.

11.3 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.

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

12. Density and Resistivity

12.1 For the purpose of calculating mass per unit length, cross sections, and so forth, the density of Zn-5Al-MM alloy-coated steel wire at 20°C shall be taken as 0.281 lb/in.³ (7780 kg/m³).

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

13. Dimensions and Permissible Variations

13.1 The specified diameter of the Zn-5Al-MM alloy-coated wire shall be expressed in decimal fractions of an inch to four decimal places, or in millimetres to three decimal places.

13.2 For diameter measurements and diameter tolerance, specified diameters shall be rounded to the closest 0.0005 in. (0.01 mm).

TABLE 2 Tensile Requirements

| Specified Diameter | | Stress at 1 % Extension, min | | Ultimate Tensile Strength, min | | Elongation in 10 in. or 250 mm, min % |
|------------------------|----------------------|------------------------------|------|--------------------------------|------|---------------------------------------|
| in. | mm | ksi | MPa | ksi | MPa | |
| 0.0500 to 0.0899, incl | 1.270 to 2.283, incl | 210 | 1450 | 235 | 1620 | 3.0 |
| 0.0900 to 0.1199, incl | 2.286 to 3.045, incl | 205 | 1410 | 230 | 1590 | 3.0 |
| 0.1200 to 0.1399, incl | 3.048 to 3.553, incl | 200 | 1380 | 225 | 1550 | 3.5 |
| 0.1400 to 0.1900, incl | 3.556 to 4.823, incl | 195 | 1340 | 220 | 1520 | 3.5 |