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Standard Specification for ~~High-Strength Zinc–5% Aluminum-Mischmetal Alloy-Coated Steel Core Wire for Aluminum and Aluminum-Alloy Conductors, Steel Reinforced~~High-Strength Zinc–5 % Aluminum-Mischmetal Alloy-Coated Steel Core Wire for Use in Overhead Electrical Conductors[1]

This standard is issued under the fixed designation B 803; 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

~~1.1This specification covers round, high strength, zinc–5% aluminum-mischmetal (Zn–5A1–MM) alloy-coated, steel core wire with Class A Zn–5A1–MM alloy coating used for mechanical reinforcement in the manufacture of special aluminum and aluminum-alloy conductors, steel reinforced.~~

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

~~1.3The 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.~~ *

1.1 This specification covers round, high strength, zinc–5 % aluminum-mischmetal (Zn–5Al–MM) alloy-coated, steel core wire with one class of Zn–5Al–MM coating (MA3) for use in overhead electrical conductors.

1.2 This specification covers wire of diameter from 0.0500 to 0.1900 in. inclusive 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~~Practice for Chemical Analysis of Zinc-5 Aluminum-Mischmetal Alloys by ICP Emission Spectrometry~~[6] 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-1Standard~~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]

[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* ~~, Vol 01.06.~~volume information, refer to the standard's Document Summary page on the ASTM website.

~~[3] Annual Book of ASTM Standards, Vol 01.03.~~

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

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

3. Terminology

3.1 *Abbreviations:Abbreviations:*

3.1.1 *MM*—mischmetal

3.1.2 ~~*Zn–5A1–MM*—zinc–5% aluminum mischmetal~~ Zn–5Al–MM—zinc–5 % aluminum mischmetal alloy

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.

3.2.2 *Product Code*—Defines product coating type, coating class and strength grade. This specification covers only High Strength Class A *Zn–5Al–MM* coated products and identified as product code MA3.

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 or millimeters (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).

4.1.6 Product Code (Paragraph 3.2.2).

4.1.7 Order Example: five multiple lengths of 12 000 ft. each, 0.1327 in. MA3 wire, packaged onto wooden non-returnable reels, with certified test report.

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–5A1–MM~~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.

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.

~~6.3.3A standard practice of X-ray fluorescence spectrometry for determination of cerium and lanthanum in a Zn–5A1–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 E1277~~

6.3.3 *A 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.

7. Tensile Test

7.1 The Zn–5A~~1~~l–MM-coated steel core wire shall conform to the tensile and elongation requirements prescribed in Table 2 or Table 3.

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~~Table 4 or Table 5 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–5A1–MM~~Zn–5Al–MM alloy-coated wire

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

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

TABLE 3 Tensile Requirements (Metric)

Specified Diameter	Stress at 1 % Extension, min	Ultimate Tensile Strength, min	Elongation in 250 mm, min %
mm	MPa	MPa	
1.27 to 2.28, incl	1450	1620	3.0
2.29 to 3.04, incl	1410	1590	3.0
3.05 to 3.55, incl	1380	1550	3.5
3.56 to 4.82, incl	1340	1520	3.5

TABLE ~~3~~ 4 Initial Settings for Determining Stress at 1 % Extension

Specified Diameter	Initial Stress	Initial Setting of Extensometer,		
in.	~~mm~~	in./in. ~~or mm/mm~~	ksi~~MPa~~	
~~0.0500 to 0.0899, incl~~	~~1.270 to 2.283, incl~~	~~14~~	~~97~~	0.0005 (0.05 % Extension)
0.0500 to 0.0899, incl	15	~~14~~	~~97~~	0.0005 (0.05 % Extension)
~~0.0900 to 0.1199, incl~~	~~2.286 to3.045, incl~~	~~28~~	~~193~~	0.0010 (0.10 % Extension)
0.0900 to 0.1199, incl	30	~~28~~	~~193~~	0.0010 (0.10 % Extension)
~~0.1200 to 0.1900, incl~~	~~3.048 to 4.823, incl~~	~~42~~	~~290~~	0.0015 (0.15 % Extension)
0.1200 to 0.1900, incl	~~48 to 4.823, incl~~	~~42~~	~~2906~~	0.0015 (0.15 % Extension)

TABLE 5 Initial Settings for Determining Stress at 1 % Extension (Metric)

Specified Diameter	Initial Stress	Initial Setting of Extensometer,
mm	MPa	mm/mm
1.27 to 2.28, incl	110	0.0005 (0.05 % Extension)
2.29 to 3.04, incl	210	0.0010 (0.10 % Extension)
3.05 to 4.82, incl	320	0.0015 (0.15 % Extension)

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–5A1–MM~~Zn–5Al–MM alloy-coated wire shall conform to the coating requirements prescribed in Table ~~4~~6 or Table 7.

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–5A1–MM~~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~~8 or Table 9, without cracking or flaking the coating to such an extent that any ~~Zn–5A1–MM~~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–5A1–MM~~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.

TABLE 4 6 Zn–5A1l–MM Alloy Coating

Specified Diameter of Coated Wire		Area Density of Zn–5A1l–MM Alloy Coating min of Uncoated Wire Surface, oz/ft^2	
in.	mm	oz/ft^2	g/m^{2}Class A
0.0500 to 0.0599, incl	1.270 to 1.521, incl	0.60183	
0.0500 to 0.0599, incl	0.521, incl	0.60	
0.0600 to 0.0749, incl	1.524 to 1.902, incl	0.65198	
0.0600 to 0.0749, incl	02, incl	0.65	
0.0750 to 0.0899, incl	1.905 to 2.283, incl	0.70214	
0.0750 to 0.0899, incl	0.283, incl	0.70	
0.0900 to 0.1039, incl	2.286 to 2.639, incl	0.75229	
0.0900 to 0.1039, incl	2.286 to 2.639, incl	0.75	
0.1040 to 0.1199, incl	2.642 to 3.045, incl	0.80244	
0.1040 to 0.1199, incl	045, incl	0.80	
0.1200 to 0.1399, incl	3.048 to 3.553, incl	0.85259	
0.1200 to 0.1399, incl	0.553, incl	0.85	
0.1400 to 0.1799, incl	3.556 to 4.569, incl	0.90274	
0.1400 to 0.1799, incl	3.556 to 4.569, incl	0.90	
0.1800 to 0.1900, incl	4.572 to 4.823, incl	1.00305	
0.1800 to 0.1900, incl	4.572 to 4.823, incl	1.00	

TABLE 7 Zn–5Al–MM Alloy Coating (Metric)

Specified Diameter of Coated Wire	Area Density of Zn–5Al–MM Coating, min, of Uncoated Wire Surface, g/m^2
mm	Class A
1.27 to 1.52, incl	183
1.53 to 1.90, incl	198
1.91 to 2.28, incl	214
2.29 to 2.64, incl	229
2.65 to 3.04, incl	244
3.05 to 3.55, incl	259
3.56 to 4.57, incl	274
4.58 to 4.82, incl	305

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–5A1–MM~~Zn–5Al–MM alloy-coated steel wire at 20°C shall be taken as 0.281 lb/in.^{3}(7780 kg/m^3).

12.2 A maximum resistivity of ~~Zn–5A1–MM~~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.