Designation: B833 – 13

Standard Specification for Zinc and Zinc Alloy Wire for Thermal Spraying (Metallizing) for the Corrosion Protection of Steel[1]

This standard is issued under the fixed designation B833; 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 zinc and zinc alloy wire used to deposit zinc coatings by thermal spraying (metallizing) for the corrosion protection of steel and iron. Zinc and zinc alloy wire provided under this specification is intended for use in oxy-fuel and electric arc thermal spraying equipment. Additional zinc alloy compositions used in thermal spraying primarily for electronic applications are found in Specification B943.

1.2 Zinc alloy wire compositions used in thermal spraying primarily for electronic applications are found in Specification B943.

1.3 Zinc alloy wire compositions used as solders are found in Specification B907.

1.4 The values stated in SI units are to be regarded as the standard. The values in parentheses are for information only.

1.5 *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 become familiar with all hazards including those identified in the appropriate Material Safety Data Sheet (MSDS) for this product/material as provided by the manufacturer, to establish appropriate safety and health practices, and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 The following ASTM documents of the issue in effect on the date of material purchase form a part of this specification to the extent referenced herein:

2.2 *ASTM Standards:*[2]

B6 Specification for Zinc

B899 Terminology Relating to Non-ferrous Metals and Alloys

B907 Specification for Zinc, Tin and Cadmium Base Alloys Used as Solders

B943 Specification for Zinc and Tin Alloy Wire Used in Thermal Spraying for Electronic Applications

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)

E536 Test Methods for Chemical Analysis of Zinc and Zinc Alloys

2.3 *ANSI/AWS Standard:*[3]

ANSI/AWS A5.33 Specification for Solid and Ceramic Wires and Ceramic Rods for Thermal Spraying

2.4 *ISO Standards:*[4]

ISO 3815-1 Zinc and zinc alloys — Part 1: Analysis of solid samples by optical emission spectrometry

ISO 3815-2 Zinc and zinc alloys — Part 2: Analysis by inductively coupled plasma optical emission spectrometry

3. Terminology

3.1 Terms shall be defined in accordance with Terminology B899.

4. Ordering Information

4.1 In order to make the application of this specification complete, the purchaser shall supply the following information to the seller in the purchase order or other governing documents:

4.1.1 Name, designation, and date of issue of this specification,

4.1.2 Quantity (mass(weight) in kilograms (pounds)),

4.1.3 Diameter (see Table 1),

4.1.4 Acceptance tests if other than specified (see Section 10),

4.1.5 Certification (see Section 11),

4.1.6 Packaging and packing materials (see Section 12), and

[1] This specification is under the jurisdiction of ASTM Committee B02 on Nonferrous Metals and Alloysand is the direct responsibility of Subcommittee B02.04 on Zinc and Cadmium.

Current edition approved Feb. 1, 2013. Published March 2013. Originally approved in 1993. Last previous edition approved in 2009 as B833 – 06. DOI: 10.1520/B0833-13.

[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 American Welding Society (AWS), 550 NW LeJeune Rd., Miami, FL 33126, http://www.aws.org.

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

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

TABLE 1 Dimensions, Weights, and Permissible Variations

Nominal Wire Diameter		Permissible Variation		Nominal Weight Per Unit Length	
mm	(in.)	mm	(in.)	g/m	(lb/ft)
4.763	(0.1875)	+0.0000 -0.0762	(+0.0000) (-0.0030)	123.517-126.493	(0.083-0.085)
3.175	(0.125)	+0.0000 -0.0508	(+0.0000) (-0.0020)	55.062-56.550	(0.037-0.038)
2.311	(0.091)	+0.0000 -0.0381	(+0.0000) (-0.0015)	28.275-29.673	(0.019-0.020)
2.000	(0.079)	+0.0000 -0.0381	(+0.0000) (-0.0015)	20.834-22.322	(0.014-0.015)
1.626	(0.064)	+0.0000 -0.0381	(+0.0000) (-0.0015)	13.393-14.882	(0.009-0.010)
1.448	(0.057)	+0.0000 -0.0381	(+0.0000) (-0.0015)	10.417-11.905	(0.007-0.008)

4.1.7 Supplementary requirements, if applicable.

5. Materials and Manufacture

5.1 The zinc used to manufacture the wire shall conform to the requirements for High Grade Zinc (Z15001) or Special High Grade Zinc (Z13001) as specified in Specification B6.

6. Chemical Composition

6.1 The wire shall conform to the requirements prescribed in Table 2.

7. Physical Properties and Mechanical Properties

7.1 Appendix X1 shows typical physical properties for zinc and zinc alloy wire and does not constitute a part of this specification but is provided for informational purposes only.

7.2 Appendix X2 shows typical mechanical properties for zinc and zinc alloy wire and does not constitute a part of this specification but is provided for informational purposes only.

7.2.1 Mechanical properties are important so the wire can be fed into a thermal spray gun without breaking or jamming.

7.2.2 Mechanical properties of zinc and zinc alloy wire will vary depending upon the wire diameter and processing factors.

8. Dimensions, Weights, and Permissible Variations

8.1 The wire shall conform to the sizes, tolerances, and weights per unit length listed in Table 1.

9. Workmanship, Finish, and Appearance

9.1 The wire shall be clean and free of corrosion, adhering foreign material, scale, seams, nicks, burrs, and other defects which would interfere with the operation of thermal spraying equipment. The wire shall uncoil readily and be free of bends or kinks that would prevent its passage through the thermal spray gun.

9.2 the wire shall be a continuous length per spool, coil, or drum. Splices or welds are permitted, provided that they do not interfere with the thermal spray equipment or coating process.

9.3 The starting end of each coil shall be tagged to indicate winding direction and to be readily identifiable with ASTM designation.

10. Acceptance Tests

10.1 The seller shall provide, at the buyer's option, either a certification or a manufacturer's declaration that the raw material used to manufacture the wire met the requirements of composition specified in 5.1.

10.2 Selection of samples of wire shall be agreed upon between the purchaser and the supplier. Agreement may also include requirements of the number of tests and retests.

10.3 *Chemical Composition:*

10.3.1 The manufacturer shall perform chemical analyses as directed in Test Methods E536, ISO 3815-1, ISO 3815-2or by other methods of at least equal accuracy to confirm that the wire conforms to the requirements of composition. In case of dispute, analysis by Test Methods E536, ISO 3815-1, or ISO 3815-2 shall be accepted. Analysis of alloy wires not covered by the above cited test methods shall be agreed upon between the manufacturer and the purchaser.

10.3.2 Analysis may be performed on finished wire, on material selected when the wire is cast, or on samples taken from semi-finished wire.

10.3.3 If analysis is performed on finished wire, the number and selection of samples shall be agreed upon by the buyer and seller.

10.3.4 If the analysis is performed on material selected while the wire is being cast, at least one sample shall be selected for each source of molten metal.

10.3.5 If the analysis is performed on samples taken from semi-finished product, at least one sample shall be analyzed for each 4500 kg (10 000 lbs) or fraction thereof.

10.4 The manufacturer shall determine the diameter of the wire at the end and the beginning of each continuous wire in a production pack, coil, or spool of wire. Each determination shall be the result of at least three measurements.

10.5 The buyer reserves the right to reject wire that, during use, is found to be defective.

10.5.1 Unless otherwise specified, any rejection based on tests made in accordance with this specification shall be reported to the seller within 30 working days from receipt of the material by the purchaser.

10.5.2 The buyer reserves the right to set aside wire that, while during use, is found to be defective. The seller, however, is to be notified and given the opportunity to inspect the allegedly defective material prior to removal from the buyer's premises.

TABLE 2 Chemical Composition Requirements for Zinc and Zinc Alloy Wires

NOTE 1—The following applies to all specified limits in this table. For the purposes of determining conformance with this specification, an observed value obtained from analysis shall be rounded off to the nearest unit in the last right-hand place of figures used in expressing the limiting value, in accordance with the rounding method of Practice E29.

	Composition, % (Weight percent)																
Common Name (UNS)[A]	Al, max unless noted	Cd, max	Cu, max	Fe, max	Pb, max	Sn, max	Sb, max	Ag, max	Bi, max	As, max	Ni, max	Mg, max	Mo, max	Ti, max	Zn, min	Total Non-ZN+Al, max	Other, Total max
99.99 Zinc[B] (Z13005)	0.002	0.003	0.005	0.003	0.003	0.001	...	...	...	...	...	...	...	...	99.99	...	...
							...	...	...	...	...	...	...	...	...	...	...
99.9 Zinc[B] (Z15005)	0.01	0.02	0.02	0.02	0.03	...	...	...	...	...	...	...	...	...	99.9	...	0.10 total non-Zn
						...	...	...	...	...	...	...	...	...	...	...	
85 Zn/15 Al[B] (Z30700)	14.0-16.0	0.005	0.005	0.06	0.005	0.003	0.01	0.015	0.02	0.002	0.005	0.02	...	...	remain-der[C]	...	0.05 total non Zn+Al
99.995 Zinc (Z12004)	0.001	0.003	0.001	0.002	0.003	0.001	...	...	...	...	...	...	...	...	99.995	...	0.005
99.95 Zinc (Z14004)	0.01	0.02	0.001	0.02	0.03	0.001	...	...	...	...	...	...	...	...	99.95	...	0.050
99 Zinc (Z17000)	0.01	0.005	0.7	0.01	0.005	0.001	...	...	...	...	...	0.01	0.01	0.18	99	...	1.0
98Zn/2Al (Z30402)	1.5-2.5	0.005	0.005	0.02	0.005	0.003	0.10	0.015	0.02	0.002	0.005	0.02	...	...	remain-der	...	...
87Zn/13Al (Z30701)	12.0-14.0	0.005	0.005	0.06	0.005	0.003	0.01	0.015	0.02	0.002	0.005	0.02	...	...	remain-der	0.05	...

[A] UNS designations were established in accordance with Recommended Practice E527.
[B] In accordance with ANSI/AWS A5.33.
[C] Remainder determined arithmetically by difference.

11. Certification

11.1 When specified in the purchase order or contract, the purchaser shall be furnished certification that samples representing each lot have been tested or inspected as directed in this specification and the requirements have been met. When specified in the purchase order to contract, a report of the test results shall be furnished.

11.2 An inspection lot shall be defined as a collection of material of the same kind that has been produced to the same specification from the same heat by a single supplier at one time under essentially identical conditions and that are submitted for acceptance or retest as a group.

12. Packaging and Packaging Materials

12.1 The material shall be separated by size and prepared for shipment in such a matter as to ensure acceptance by common carrier and to afford protection from the normal hazards of transport.

12.2 Packaging materials for electric arc spray wire shall be nonconductive.

12.3 *Size(s) of Packaging:*

12.3.1 Coil inside diameter may range from 30 to 56 cm (12 to 22 in.).

12.3.2 Coil weight shall be approximately 20 to 25 kg (45 to 55 lbs).

12.3.3 Production pack drums shall measure approximately 56 cm (22 in.) in diameter and approximately 81 cm (32 in.) high. Each drum shall contain a continuous wire, which is coiled around a central core.

12.3.4 Net weight per drum shall be 205 to 250 kg (450 to 550 lbs).

12.3.5 If special packaging is required, it shall be negotiated between the supplier and the purchaser.

12.4 Each shipping unit shall be legibly marked with the purchase order number, size, gross, tare, net weights, and the name of the supplier. The specification number shall be shown when required.

13. Keywords

13.1 corrosion protection applications; metallizing; thermal spray; wire; zinc; zinc-aluminum alloys

SUPPLEMENTARY REQUIREMENTS

The following supplementary requirements apply for all agencies of the United States Government or only when specified by the purchaser as part of the purchase order or contract.

S1. Responsibility for Inspection

S1.1 The producer or supplier shall be responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein unless disapproved by the purchaser. The purchaser retains the right to perform any of the inspections and tests set forth in this specification, where such inspections and tests are deemed necessary, to ensure that the supplies and services conform to the prescribed requirements.

APPENDIXES

(Nonmandatory Information)

X1. PHYSICAL PROPERTIES

X1.1 *Density:*

X1.1.1 The density of 99.99 and 99.9 Zinc wire ranges from 6.92 to 7.16 g/cm^3 (0.250 to 0.259 lb/in.^{3}). Nominal density is 7.14 g/cm^3 (0.258 lb/in.^{3}).

X1.1.2 The nominal density of 85 Zn/15 Al wire is 5.70 g/cm^3 (0.206 lb/in.^{3}).

X1.2 *Melting Point:*

X1.2.1 The melting point of 99.99 and 99.9 Zinc wire is 420°C (788°F).

X1.2.2 The melting range of 85 Zn/15 Al wire is 382-460°C (720-860°F).

X2. MECHANICAL PROPERTIES

X2.1 *Ultimate Tensile Strength:*

X2.1.1 The ultimate tensile strength of 99.99 and 99.9 Zinc wire ranges from 90 to 130 MPA (13 000 to 19 000 psi). The nominal ultimate tensile strength is 103 MPA (15 000 psi).

X2.1.2 The ultimate tensile strength of 85 Zn/15 Al wire ranges from 152 to 234 MPA (22 000 to 34 000 psi). The nominal ultimate tensile strength is 200 MPA (29 000 psi).

X2.2 *Elongation:*

X2.2.1 The nominal tensile elongation of 99.99 and 99.9 Zinc wire under load is 50 %.

X2.2.2 The tensile elongation of 85 Zn/15 Al wire under load ranges from 75 % to 150 %. The nominal tensile elongation of 85 Zn/15 Al wire under load is 100 %.

SUMMARY OF CHANGES

Committee B02 has identified the location of selected changes to this standard since the last issue (B833 – 09) that may impact the use of this standard. (Approved February 2013.)

(1) UNS numbers were added.