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

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 pri-
marily 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 specifica-
tion to the extent referenced herein:

2.2 ASTM Standards:

- B6 Specification for Zinc

B899 Terminology Relating to Non-ferrous Metals and Al-
loys
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:

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

2.4 ISO Standards:

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 docu-
ments:

- 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

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

approved in 1993. Last previous edition approved in 2009 as B833 – 06. DOI:
10.1520/B0833-13

2 Available from American Welding Society (AWS), 550 NW LeJeune Rd.,

3 Available from American National Standards Institute (ANSI), 25 W. 43rd St.,

4 Available from American National Standards Institute (ANSI), 25 W. 43rd St.,

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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 3815-2 or 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 product.

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 wire, 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.

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**TABLE 1 Dimensions, Weights, and Permissible Variations**

<table>
<thead>
<tr>
<th>Nominal Wire Diameter</th>
<th>Permissible Variation</th>
<th>Nominal Weight Per Unit Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm (in.)</td>
<td>mm (in.)</td>
<td>g/m (lb/ft)</td>
</tr>
<tr>
<td>4.763 (0.1875)</td>
<td>+0.0000 (+0.0000)</td>
<td>123.517-126.493 (0.083-0.085)</td>
</tr>
<tr>
<td>3.175 (0.125)</td>
<td>-0.0762 (-0.0030)</td>
<td>55.062-56.550 (0.037-0.039)</td>
</tr>
<tr>
<td>2.311 (0.091)</td>
<td>+0.0000 (+0.0000)</td>
<td>28.275-29.673 (0.019-0.020)</td>
</tr>
<tr>
<td>2.000 (0.079)</td>
<td>-0.0381 (-0.0015)</td>
<td>20.834-22.322 (0.014-0.015)</td>
</tr>
<tr>
<td>1.626 (0.064)</td>
<td>+0.0000 (+0.0000)</td>
<td>13.393-14.882 (0.009-0.010)</td>
</tr>
<tr>
<td>1.448 (0.057)</td>
<td>-0.0381 (-0.0015)</td>
<td>10.417-11.905 (0.007-0.008)</td>
</tr>
</tbody>
</table>
# 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 conformity 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.

<table>
<thead>
<tr>
<th>Composition, % (Weight percent)</th>
<th>Al, max unless noted</th>
<th>Cd, max</th>
<th>Cu, max</th>
<th>Fe, max</th>
<th>Pb, max</th>
<th>Sn, max</th>
<th>Sb, max</th>
<th>Ag, max</th>
<th>Bi, max</th>
<th>As, max</th>
<th>Ni, max</th>
<th>Mg, max</th>
<th>Mo, max</th>
<th>Ti, max</th>
<th>Zn, min</th>
<th>Total Non-ZN+Al, max</th>
<th>Other, Total max</th>
</tr>
</thead>
<tbody>
<tr>
<td>99.99 Zinc(^{\text{a}}) (Z13005)</td>
<td>0.002</td>
<td>0.003</td>
<td>0.005</td>
<td>0.003</td>
<td>0.003</td>
<td>0.001</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>99.99</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>99.9 Zinc(^{\text{b}}) (Z15005)</td>
<td>0.01</td>
<td>0.02</td>
<td>0.02</td>
<td>0.02</td>
<td>0.03</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>99.9</td>
<td>...</td>
<td>0.10</td>
</tr>
<tr>
<td>85 Zn/15 Al(^{\text{b}}) (Z30700)</td>
<td>14.0-16.0</td>
<td>0.005</td>
<td>0.005</td>
<td>0.06</td>
<td>0.005</td>
<td>0.003</td>
<td>0.01</td>
<td>0.015</td>
<td>0.02</td>
<td>0.002</td>
<td>0.005</td>
<td>0.02</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>remainder(^{\text{c}})</td>
<td>...</td>
</tr>
<tr>
<td>99.995 Zinc (Z12004)</td>
<td>0.001</td>
<td>0.003</td>
<td>0.001</td>
<td>0.002</td>
<td>0.003</td>
<td>0.001</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>99.995</td>
<td>...</td>
<td>0.005</td>
<td></td>
</tr>
<tr>
<td>99.95 Zinc (Z14004)</td>
<td>0.01</td>
<td>0.02</td>
<td>0.001</td>
<td>0.02</td>
<td>0.03</td>
<td>0.001</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>99.95</td>
<td>...</td>
<td>0.050</td>
<td></td>
</tr>
<tr>
<td>99 Zinc (Z17000)</td>
<td>0.01</td>
<td>0.005</td>
<td>0.7</td>
<td>0.01</td>
<td>0.005</td>
<td>0.001</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>0.01</td>
<td>0.01</td>
<td>0.18</td>
<td>99</td>
<td>...</td>
<td>1.0</td>
</tr>
<tr>
<td>98Zn/2Al (Z30402)</td>
<td>1.5-2.5</td>
<td>0.005</td>
<td>0.005</td>
<td>0.7</td>
<td>0.01</td>
<td>0.005</td>
<td>0.003</td>
<td>0.10</td>
<td>0.015</td>
<td>0.02</td>
<td>0.002</td>
<td>0.005</td>
<td>0.02</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>remainder (^{\text{c}})</td>
</tr>
<tr>
<td>87Zn/13Al (Z30701)</td>
<td>12.0-14.0</td>
<td>0.005</td>
<td>0.005</td>
<td>0.06</td>
<td>0.005</td>
<td>0.003</td>
<td>0.01</td>
<td>0.015</td>
<td>0.02</td>
<td>0.002</td>
<td>0.005</td>
<td>0.02</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>remainder (^{\text{c}})</td>
<td>0.05</td>
</tr>
</tbody>
</table>

\(^{a}\) 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/cm³ (0.250 to 0.259 lb/in.³). Nominal density is 7.14 g/cm³ (0.258 lb/in.³).

X1.1.2 The nominal density of 85 Zn/15 Al wire is 5.70 g/cm³ (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.

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