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Standard Specification for Extra-High-Strength and Ultra-High-Strength Zinc-Coated (Galvanized) Steel Core Wire for Overhead Electrical Conductors¹

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1. Scope

1.1 This specification covers round, extra-high-strength and ultra-high-strength, Class A zinc-coated (galvanized), steel core wire used 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.

1.4 *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 establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

- 2.1 *ASTM Standards*:²
- A90/A90M Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings
 - A370 Test Methods and Definitions for Mechanical Testing of Steel Products
 - A751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products
 - B6 Specification for Zinc
 - B193 Test Method for Resistivity of Electrical Conductor Materials
 - E29 Practice for Using Significant Digits in Test Data to

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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.

Determine Conformance with Specifications

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *Lot, n*—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.

3.1.2 *Product Code, n*—Defines product coating type, coating class and strength grade.

3.1.2.1 *Extra High Strength Grade Zinc, Class A Coated*—use Code GA4.

3.1.2.2 *Ultra High Strength Grade Zinc, Class A Coated*—use Code GA5.

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 millimeter (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 Strength Grade.

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 zinc to produce the desired properties.

5.3 The slab zinc used for coating shall be high grade or better, conforming to Specification B6.

6. Chemical Composition

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

6.2 Chemical analysis shall be conducted in accordance with Test Methods, Practices, and Terminology A751.

TABLE 1 Chemical Requirements

Element	Composition, %
Carbon	0.50 to 1.00
Manganese	0.30 to 1.30
Phosphorus, max	0.035
Sulfur, max	0.045
Silicon	0.15 to 1.20

TABLE 3 Grade 4 Extra-High-Strength Tensile Requirements [Metric]

Specified Diameter, mm	Stress at 1% Extension, min, MPa	Ultimate Tensile Strength, min, MPa	Elongation in 250 mm, min %
1.27 to 2.28, incl	1550	1825	3.0
2.29 to 3.04, incl	1515	1790	3.0
3.05 to 3.55, incl	1480	1760	3.5
3.56 to 4.82, incl	1450	1725	3.5

TABLE 4 Grade 5 Ultra-High-Strength Tensile Requirements

Specified Diameter, in.	Stress at 1% Extension, min, kpsi	Ultimate Tensile Strength, min, kpsi	Elongation in 10 in. min %
0.0500 to 0.0899, incl	230	285	3.0
0.0900 to 0.1199, incl	225	275	3.0
0.1200 to 0.1399, incl	220	270	3.5
0.1400 to 0.1900, incl	215	265	3.5

TABLE 5 Grade 5 Ultra-High-Strength Tensile Requirements [Metric]

Specified Diameter, mm	Stress at 1% Extension, min, MPa	Ultimate Tensile Strength, min, MPa	Elongation in 250 mm, min %
1.27 to 2.28, incl	1580	1965	3.0
2.29 to 3.04, incl	1550	1900	3.0
3.05 to 3.55, incl	1515	1860	3.5
3.56 to 4.82, incl	1480	1825	3.5

TABLE 6 Initial Settings for Determining Stress at 1% Extension

Specified Diameter, in.	Initial Stress, kpsi	Initial Setting of Extensometer, in./in.
0.0500 to 0.0899, incl	18	0.0005 (0.05 % extension)
0.0900 to 0.1199, incl	36	0.0010 (0.10 % extension)
0.1200 to 0.1900, incl	54	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	124	0.0005 (0.05 % extension)
2.29 to 3.04, incl	248	0.0010 (0.10 % extension)
3.05 to 4.82, incl	372	0.0015 (0.15 % extension)

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-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, and wrap tests.

7. Tensile Test

7.1 The zinc-coated steel core wire shall conform to the tensile and elongation requirements prescribed in [Table 2](#), [Table 3](#), [Table 4](#), or [Table 5](#) depending on the strength grade and unit base ordered.

7.2 Tensile tests shall be conducted in accordance with Test Methods and Definitions [A370](#), using the initial settings for determining stress at 1 % extension given in [Table 6](#) or [Table 7](#) 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.

7.4 The nominal diameter requested shall be used to determine the applicable strength specification.

8. Wrap Test

8.1 The material, as represented by the test specimens, shall not fracture when the galvanized 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 four times the specified diameter of the wire under test, $\pm 5\%$.

9. Coating Test

9.1 The zinc-coated wire shall conform to the coating requirements prescribed in [Table 8](#) or [Table 9](#).

9.2 The coating test shall be conducted in accordance with Test Method [A90/A90M](#).

10. Adherence of Coating Test

10.1 The zinc-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 10](#) or [Table 11](#), without cracking or flaking the zinc coating to such an extent that any zinc can be removed by rubbing with the bare fingers.

TABLE 2 Grade 4 Extra-High-Strength Tensile Requirements

Specified Diameter, in.	Stress at 1% Extension, min, kpsi	Ultimate Tensile Strength, min, kpsi	Elongation in 10 in., min %
0.0500 to 0.0899, incl	225	265	3.0
0.0900 to 0.1199, incl	220	260	3.0
0.1200 to 0.1399, incl	215	255	3.5
0.1400 to 0.1900, incl	210	250	3.5