



Designation: B 606 – 9802

# Standard Specification for High-Strength Zinc-Coated (Galvanized) Steel Core Wire for Aluminum and Aluminum-Alloy Conductors, Steel Reinforced<sup>1</sup>

This standard is issued under the fixed designation B 606; 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 reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee B-1 B01 on Electrical Conductors and is the direct responsibility of Subcommittee B01.05 on Conductors of Ferrous Metals.

Current edition approved Sept. 10, 1998; 2002. Published November 1998; October 2002. Originally published as B 606 – 75. Last previous edition B 606 – 938.

## 1. Scope

1.1 This specification covers round, high-strength, zinc-coated (galvanized), steel core wire with Class A zinc 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 the standard, with the exception of resistivity. The values given in parentheses 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/A 90M Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings<sup>2</sup>

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products<sup>3</sup>

A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products<sup>3</sup>

B 6 Specification for Zinc<sup>4</sup>

B 193 Test Method for Resistivity of Electrical Conductor Materials<sup>5</sup>

## 3. Terminology

### 3.1 Definitions:

3.1.1 *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 zinc to produce the desired properties.

<sup>2</sup> Annual Book of ASTM Standards, Vol 01.06.

<sup>3</sup> Annual Book of ASTM Standards, Vol 01.03.

<sup>4</sup> Annual Book of ASTM Standards, Vol 02.04.

<sup>5</sup> Annual Book of ASTM Standards, Vol 02.03.

5.3 The slab zinc used for coating shall be high grade or better, conforming to Specification B 6.

## 6. Chemical Composition

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

**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

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

## 7. Tensile Test

7.1 The zinc-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 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 three 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 4.

**TABLE 4 Zinc Coating**

Specified Diameter of Coated Wire		Area Density of Zinc Coating, min of Uncoated Wire Surface	
in.	mm	oz/ft <sup>2</sup>	g/m <sup>2</sup>
0.0500 to 0.0599 incl	1.270 to 1.521 incl	0.60	183
0.0600 to 0.0749 incl	1.524 to 1.902 incl	0.65	198
0.0750 to 0.0899 incl	1.905 to 2.283 incl	0.70	214
0.0900 to 0.1039 incl	2.286 to 2.639 incl	0.75	229
0.1040 to 0.1199 incl	2.642 to 3.045 incl	0.80	244
0.1200 to 0.1399 incl	3.048 to 3.553 incl	0.85	259
0.1400 to 0.1799 incl	3.556 to 4.569 incl	0.90	274
0.1800 to 0.1900 incl	4.572 to 4.823 incl	1.00	305

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 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 5, 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 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 Initial Settings for Determining Stress at 1 % Extension**

Specified Diameter		Initial Stress		Initial Setting of Extensometer
in.	mm	ksi	MPa	in./in. or mm/mm
0.0500 to 0.0899, incl	1.270 to 2.283, incl	14	97	0.0005 (0.05 % extension)
0.0900 to 0.1199, incl	2.286 to 3.045, incl	28	193	0.0010 (0.10 % extension)
0.1200 to 0.1900, incl	3.048 to 4.832, incl	42	290	0.0015 (0.15 % extension)

**TABLE 5 Mandrel Size for Adherence Test**

Specified Wire Diameter		Ratio of Mandrel Diameter to Wire Diameter
in.	mm	
0.0500 to 0.0899, incl	1.270 to 2.283, incl	3
0.0900 to 0.1399, incl	2.286 to 3.553, incl	4
0.1400 to 0.1900, incl	3.556 to 4.823, incl	5

NOTE 1—Loosening or detachment during the adhesion test of superficial, small particles of zinc formed by mechanical polishing of the surface of the zinc-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-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.

## 12. Density and Resistivity

12.1 For the purpose of calculating mass per unit length, cross sections, and so forth, the density of galvanized steel wire at 20°C shall be taken as 0.281 lb/in.<sup>3</sup> (7.780 kg/cm<sup>3</sup>).

12.2 A maximum resistivity of galvanized steel wire is not guaranteed but a typical value of 0.19157 Ω·mm<sup>2</sup>/m may be used for calculating purposes. 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 zinc-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. (0.013 mm).

13.3 The average of the largest and smallest diameter readings, each to the nearest 0.001 in. (0.025 mm) taken at the same cross section, shall not differ from the specified diameter by more than the tolerances shown in Table 6.

## 14. Workmanship, Finish, and Appearance

14.1 The zinc coating shall be reasonably smooth, continuous, of reasonably uniform thickness, and free of imperfections not consistent with good commercial practice.

## 15. Number of Tests and Retests

15.1 One test specimen shall be taken from each 5000 lb (23500 kg) or fraction thereof in the inspection lot.

**TABLE 6 Permissible Variations in Diameter of Zinc-Coated Steel Wire**

NOTE 1—It is recognized that the surface of zinc coatings, particularly those produced by the hot-dip method of coating, are not perfectly smooth and devoid of irregularities. If the tolerances shown in the table are rigidly applied to such irregularities that are inherent to the product, unjustified rejections of wire that would actually be satisfactory for use could occur. It is intended that these tolerances be used in gaging the wires where there is a minimum of such diameter irregularities due to galvanizing.

Specified Diameter		Permissible Variation			
in.	mm	in.		mm	
		Plus	Minus	Plus	Minus
0.0500 to 0.0749, incl	1.270 to 1.902, incl	0.0015	0.001	0.038	0.025
0.0750 to 0.1199, incl	1.905 to 3.045, incl	0.002	0.002	0.051	0.051
0.1200 to 0.1399, incl	3.048 to 3.553, incl	0.003	0.002	0.076	0.051
0.1400 to 0.1900, incl	3.556 to 4.823, incl	0.004	0.003	0.102	0.076

15.2 Each specimen shall be tested for compliance with Sections 7, 8, 10, and 13. At least half of the specimens shall be tested for compliance with Section 9.

15.3 Should one or more of the test specimens fail any of the tests specified, the nonconforming coil or coils may be removed and the balance of the lot subjected to retests. For retest purposes, two additional coils for each 5000 lbs (2500 kg) in the lot shall be sampled and tested for the property in which the original sample failed to comply.

15.4 Should any of the retest specimens fail to meet the properties specified, the lot represented by the test specimens shall be rejected.

15.5 Instead of rejecting the entire lot as provided in 15.4, the producer may test specimens from every coil in the lot for the property in which failure occurred and reject only the nonconforming coils.

## 16. Inspection

16.1 Unless otherwise specified in the contract or purchase order, the manufacturer shall be responsible for the performance of all inspection and test requirements specified.

16.2 All inspections and tests shall be made at the place of manufacture unless otherwise especially agreed upon between the manufacturer and the purchaser at the time of the purchase.

16.3 The manufacturer shall afford the inspector representing the purchaser all reasonable manufacturer's facilities to satisfy him that the material is being furnished in accordance with this specification.

## 17. Rejection and Rehearing

17.1 Material that fails to conform to the requirements of this specification shall be rejected. Rejection should be reported to the producer or supplier promptly and in writing. In case of dissatisfaction with the results of the test, the producer or supplier may make claim for a rehearing.

## 18. Certification

18.1 When specified in the purchase order or contract, a producer's or supplier's certification shall be furnished to the purchaser showing that the material was manufactured, sampled, tested and inspected in accordance with this specification and has been found to meet the requirements. When specified in the purchase order or contract, a report of the test results shall be furnished.

## 19. Packaging and Package Marking

19.1 The unit lengths shall be as specified in the contract or order. Length tolerances shall be  $\pm 2\%$  unless otherwise specified by the purchaser.

19.2 Package dimensions, kind of package (coils, reels, or reelless coils), and quantity of wire in each package shall be agreed upon between the manufacturer and the purchaser.

19.3 A durable tag shall be securely attached to each package showing the nominal wire diameter, length, approximate weight, purchaser's order number, and manufacturer's name.

19.4 The starting end shall be identified.

19.5 In case there is more than one piece in a package, the length and position of each piece shall be shown on the tag.

## 20. Keywords

20.1 coated steel wire; high strength steel wire; steel core wire; steel wire; zinc-coated steel wire

*ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.*

*This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.*

*This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org).*