Designation: B 341/B 341M – 02

Standard Specification for Aluminum-Coated (Aluminized) Steel Core Wire for Aluminum Conductors, Steel Reinforced (ACSR/AZ)[1]

This standard is issued under the fixed designation B 341/B 341M; 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 round, aluminum-coated steel core wire used for mechanical reinforcement in the manufacture of aluminum conductors, steel reinforced (ACSR).

1.2 This specification covers wire of diameter from 0.0500 to 0.1900 in. or 1.60 to 4.80 mm, inclusive.

1.3 The 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.

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 370 Test Methods and Definitions for Mechanical Testing of Steel Products[2]

A 428/A 428M Test Method for Weight [Mass] of Coating on Aluminum-Coated Iron or Steel Articles[3]

A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products[2]

B 193 Test Method for Resistivity of Electrical Conductor Materials[4]

3. Terminology

3.1 *Definition*:

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.

TABLE 1 Chemical Requirements

Element	Composition,%
Carbon	0.50 to 0.95
Manganese	0.50 to 1.30
Phosphorus, max	0.040
Sulfur, max	0.050
Silicon	0.10 to 0.35

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 millimetres (see 1.2, 13.1),

4.1.3 Certification, if required (Section 19),

4.1.4 Test report, if required (Section19), and

4.1.5 Package size (Section 20).

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 aluminum to produce the desired properties.

5.3 The ingot or pig aluminum used for coating shall conform to the following impurity limits:

Copper, max, % 0.10

Iron, max, % 0.50

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 A 751.

7. Tensile Test

7.1 The material, as represented by the test specimens, shall conform to the tensile properties 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 4 or Table 5 of this specification.

[1] This specification is under the jurisdiction of Committee B01 on Electrical Conductors and is the direct responsibility of Subcommittee B01.05 on Conductors of Ferrous Metals.

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[2] *Annual Book of ASTM Standards*, Vol 01.03.

[3] *Annual Book of ASTM Standards*, Vol 01.06.

[4] *Annual Book of ASTM Standards*, Vol 02.03.

TABLE 2 Tensile Requirements

Specified Diameter	Stress at 1 % Extension, min	Tensile Strength, min	Elongation, min % in 10 in. or 250 mm
in.	ksi	ksi	
0.0500 to 0.0899, incl	170	185	3.0
0.0900 to 0.1199, incl	160	180	3.5
0.1200 to 0.1384, incl	150	175	4.0
0.1385 to 0.1489, incl	145	170	4.0
0.1490 to 0.1900, incl	135	165	4.0

TABLE 3 Tensile Requirements

Specified Diameter, mm	Stress at 1 % Extension, min, mPa	Tensile Strength, min, mPa	Elongation, in 250 mm, min, %
1.60 to 2.30, incl	1170	1280	3.0
Over 2.30 to 3.05, incl	1100	1240	3.5
Over 3.05 to 3.50, incl	1030	1210	4.0
Over 3.50 to 3.80, incl	1000	1170	4.0
Over 3.80 to 4.80, incl	930	1140	4.0

TABLE 4 Initial Settings for Determining Stress at 1 % Extension

Specified Diameter, in.	Initial Stress, Ksi	Initial Setting of Extensometer, in./in.
0.0500 to 0.0899, incl	14	0.0005 (0.05 % extension)
0.0900 to 0.1199, incl	28	0.0010 (0.10 % extension)
0.1200 to 0.1900, incl	42	0.0015 (0.15 % extension)

TABLE 5 Initial Settings for Determining Stress at 1 % Extension

Specified Diameter, mm	Initial Stress, MPa	Initial Setting of Extensometer, mm/mm
1.60 to 2.30, incl	100	0.0005 (0.05 % extension)
Over 2.30 to 3.05, incl	190	0.0010 (0.10 % extension)
Over 3.05 to 4.80, incl	290	0.0015 (0.15 % extension)

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 aluminized 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 two times the specified diameter of the wire under test, ±5 %.

9. Coating Test

9.1 The material, as represented by the test specimens, shall conform to the coating requirements of Table 6 or Table 7, for the diameter specified.

9.2 The coating test shall be conducted in accordance with Test Method A 428/A 428M.

10. Adherence of Coating Test

10.1 The material, as represented by the samples, 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 8 or Table 9, without cracking or flaking the aluminum coating to such an extent that any aluminum can be removed by rubbing with the bare fingers.

NOTE 1—Loosening or detachment during the adhesion test of superficial, small particles of aluminum formed by mechanical polishing of the surface of aluminum-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 tensile strength of a finished wire specimen containing the welded section shall not be 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 purposes of calculating mass per unit length, cross-sections, etc., the density of aluminized steel wire shall be taken as 0.281 lb/in.^{3}(7780 kg/m^3).

TABLE 6 Aluminum Coating

Specified Diameter of Coated Wire, in.	Area Density Of Coating, min, oz/ft^2 of Uncoated Wire Surface
0.0500 to 0.0599, incl	0.23
0.0600 to 0.0749, incl	0.25
0.0750 to 0.0899, incl	0.26
0.0900 to 0.1039, incl	0.28
0.1040 to 0.1199, incl	0.30
0.1200 to 0.1399, incl	0.32
0.1400 to 0.1799, incl	0.34
0.1800 to 0.1900, incl	0.38

TABLE 7 Aluminum Coating

Specified Diameter of Coated Wire, mm	Area Density of Coating, Minimum g/m^2 of Uncoated Wire Surface
1.60 to 2.00, incl	76
Over 2.00 to 2.30, incl	92
Over 2.30 to 2.70, incl	98
Over 2.70 to 3.80, incl	107
Over 3.80 to 4.80, incl	122

TABLE 8 Mandrel Size for Adherence Test

Specified Wire Diameter, in.	Ratio of Mandrel Diameter to Wire Diameter
0.0500 to 0.0899, incl	3
0.0900 to 0.1399, incl	4
0.1400 to 0.1900, incl	5

TABLE 9 Mandrel Size for Adherence Test

Specified Wire Diameter, mm	Ratio of Mandrel Diameter to Wire Diameter
1.60 to 2.30, incl	3
Over 2.30 to 3.05, incl	4
Over 3.05 to 4.80, incl	5

12.2 A maximum resistivity of aluminized steel wire is not guaranteed, but a typical value of 0.19157 $\Omega \cdot mm^2/m$ may be used for purposes of calculation. For conversion to other units of conductivity or resistivity, see Test Method B 193.

13. Dimensions and Permissible Variations

13.1 The specified diameter shall be expressed in decimal fractions of an inch to four decimal places or in millimetres and decimal fractions of a millimetre to two decimal places.

13.2 For diameter measurements and diameter tolerances, specified diameters shall be rounded to the closest 0.0005 in. or 0.01 mm.

13.3 Determine the greatest and the least diameters each to the nearest 0.001 in. or 0.01 mm, at the same cross section. The average of these two diameters shall not differ from the specified diameter by more than the tolerances shown in Table 10 or Table 11.

14. Workmanship, Finish, and Appearance

14.1 The aluminum 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 or 2500 kg or fraction thereof in a lot.

15.2 Each specimen shall be tested for compliance with Section 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 lb or 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.

TABLE 10 Permissible Variations In Diameter Of Aluminum-Coated Wire

NOTE 1—It is recognized that the surface of aluminum coatings, particularly those produced by hot-dip aluminizing, are not perfectly smooth and devoid of irregularities. If the tolerances shown in this 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. Therefore, it is intended that these tolerances be used in gaging only the uniform areas of the aluminized wire.

Specified Diameter, in.	Permissible Variation in.	
	Plus	Minus
0.0500 to 0.0749, incl	0.0015	0.001
0.0750 to 0.1199, incl	0.002	0.002
0.1200 to 0.1399, incl	0.003	0.002
0.1400 to 0.1900, incl	0.004	0.003

TABLE 11 Permissible Variations In Diameter Of Aluminum-Coated Wire

NOTE 1—It is recognized that the surface of aluminum coatings, particularly those produced by hot-dip aluminizing, are not perfectly smooth and devoid of irregularities. If the tolerances shown in this 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. Therefore, it is intended that these tolerances be used in gaging only the uniform areas of the aluminized wire.

Specified Diameter, mm	Permissible Variation mm	
	Plus	Minus
1.60 to 2.30, incl	0.04	0.03
Over 2.30 to 3.05, incl	0.05	0.05
Over 3.05 to 3.60, incl	0.08	0.05
Over 3.60 to 4.80, incl	0.10	0.08

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 shall 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 ± 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 purchaser.

19.3 A durable tag shall be securely attached to each package showing the specified diameter of wire, specified 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 aluminum-coated steel wire; coated steel wire; steel core wire; steel wire