Designation: B 230/B 230M – 07

Standard Specification for Aluminum 1350–H19 Wire for Electrical Purposes[1]

This standard is issued under the fixed designation B 230/B 230M; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification covers aluminum 1350–H19 (extra hard) round wire for electrical purposes.

1.2 The values stated in inch-pound 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 the specification.

1.2.1 For density, resistivity, and temperature, the values stated in SI units are to be regarded as standard.

NOTE 1—Prior to 1975 aluminum 1350 was designated EC aluminum.

NOTE 2—The aluminum and temper designations conform to ANSI H35.1/H35.1M. Aluminum 1350 corresponds to UNS A91350 in accordance with Practice E 527.

NOTE 3—For definitions of terms found in this specification relating to uninsulated electrical conductors see Terminology B 354.

2. Referenced Documents

2.1 The following 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]

B 193 Test Method for Resistivity of Electrical Conductor Materials

B 233 Specification for Aluminum 1350 Drawing Stock for Electrical Purposes

B 354 Terminology Relating to Uninsulated Metallic Electrical Conductors

B 557 Test Methods for Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products

B 557M Test Methods for Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products [Metric]

B 830 Specification for Uniform Test Methods and Frequency

E 527 Practice for Numbering Metals and Alloys (UNS)

2.3 *ANSI Standard:*

ANSI H35.1 American National Standard for Alloy and Temper Designations Systems for Aluminum[3]

ANSI H35.1M American National Standard for Alloy and Temper Systems for Aluminum [Metric][3]

2.4 *NIST Document:*

NBS Handbook 100–Copper Wire Tables[4]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *lot*—a group of production units, up to 30 000 lb [15 000 kg] of mass, of one type and size of wire, which was produced during the same time period, under similar production conditions, and is presented for acceptance at the same time (Explanatory Note 1 and Note 2).

3.1.2 *production unit*—a coil, reel, spool, or other package of wire that represents a single usable length.

3.1.3 *sample*—the production unit or units from which a test specimen or specimens has been removed, and which is considered to have properties representative of the lot.

3.1.4 *specimen*—a length of wire removed for test purposes.

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 size (see 11.1 and Table 1 or Table 2),

4.1.3 Special tension test, if required (see 7.2 and 7.3),

4.1.4 Frequency of bending test (see 8.1 and 14.5),

4.1.5 Special jointing procedures, if permitted (see 12.2),

4.1.6 Place of inspection (see 15.2),

4.1.7 Package size and type (see 16.1), and

4.1.8 Special package marking, if required (see 16.4).

5. Materials and Manufacture

5.1 The aluminum wire shall be made from drawing stock meeting the requirements of Specification B 233.

[1] This specification is under the jurisdiction of ASTM Committee B01 on Electrical Conductors and is the direct responsibility of Subcommittee B01.07 on Conductors of Light Metals.

Current edition approved March 15, 2007. Published March 2007. Originally approved in 1948. Last previous edition approved in 2004 as B 230/B 230M – 99(2004).

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

[4] Available from National Institute of Standards and Technology (NIST), 100 Bureau Dr., Stop 1070, Gaithersburg, MD 20899-1070, http://www.nist.gov.

TABLE 1 Tensile Strength and Elongation Requirements

Diameter, in.	Tensile Strength, min ksi		Elongation in 10 in., min (%)	
	Average for a Lot[A]	Individual Tests	Average for a Lot	Individual Tests
0.0105 to 0.0500	25.0	23.0	. . .	. . .
0.0501 to 0.0600	29.0	27.0	1.4	1.2
0.0601 to 0.0700	28.5	27.0	1.5	1.3
0.0701 to 0.0800	28.0	26.5	1.6	1.4
0.0801 to 0.0900	27.5	26.0	1.6	1.5
0.0901 to 0.1000	27.0	25.5	1.6	1.5
0.1001 to 0.1100	26.0	24.5	1.6	1.5
0.1101 to 0.1200	25.5	24.0	1.7	1.6
0.1201 to 0.1400	25.0	23.5	1.8	1.7
0.1401 to 0.1500	24.5	23.5	1.9	1.8
0.1501 to 0.1800	24.0	23.0	2.0	1.9
0.1801 to 0.2100	24.0	23.0	2.1	2.0
0.2101 to 0.2600	23.5	22.5	2.3	2.2

[A] For wire diameters within 0.0501 to 0.2600 in., the minimum average tensile strength for a lot may be estimated from the following logarithmic equation for process control purposes to meet the requirements of this specification: Tensile strength, ksi = 17.40 – 3.84 × ln (diameter of wire, in.). Requirements stated in the table are to be used for all other purposes.

TABLE 2 Tensile Strength and Elongation Requirements

Diameter, mm	Tensile Strength, min MPa		Elongation in 250 mm, min (%)	
	Average for a Lot[A]	Individual Tests	Average for a Lot	Individual Tests
0.227 to 1.25	170.0	160.0	. . .	. . .
1.26 to 1.50	200.0	185.0	1.4	1.2
1.51 to 1.75	195.0	185.0	1.5	1.3
1.76 to 2.00	195.0	185.0	1.6	1.4
2.01 to 2.25	190.0	180.0	1.6	1.5
2.26 to 2.50	185.0	175.0	1.6	1.5
2.51 to 2.75	180.0	170.0	1.6	1.5
2.76 to 3.00	175.0	165.0	1.7	1.6
3.01 to 3.50	170.0	160.0	1.8	1.7
3.51 to 3.75	170.0	160.0	1.9	1.8
3.76 to 4.50	165.0	160.0	2.0	1.9
4.51 to 5.25	165.0	160.0	2.1	2.0
5.26 to 6.50	160.0	155.0	2.3	2.2

[A] For wire diameters within 1.26 to 6.50 mm the minimum average tensile strength for a lot may be estimated from the following logarithmic equation for process control purposes to meet the requirements of this specification: Tensile Strength, MPa = 205.88 – 27.14 × ln (diameter of wire, mm). Requirements stated in the table are to be used for all other purposes.

6. Workmanship, Finish and Appearance

6.1 The wire shall be free of imperfections not consistent with good commercial practice.

7. Tensile Properties

7.1 *Tensile Strength and Elongation*—The wire shall conform to the tensile strength and elongation requirements set forth in Table 1 or Table 2 (Explanatory Note 3).

7.2 When requested by the purchaser, tension tests shall be made of specimens of wire containing joints made in the drawing stock or in the wire prior to final drawing. Such tests shall indicate tensile strengths not less than 90 % of the values for individual tests shown in Table 1 or Table 2.

7.3 When requested by the purchaser, tension tests of specimens containing joints in the finished wire, or in the final drawing, if permitted, shall be made. Such tests shall indicate tensile strengths to be not less than 11.0 ksi [145 MPa] for electric-butt welded joints, and not less than 21.0 ksi [75 MPa] for cold-pressure welded joints and electric-butt, cold-upset welded joints.

8. Bending Properties

8.1 The wire shall be free of brittleness as evidenced by its ability to be coiled or looped around its own diameter with or without a mandrel. No fracture shall occur. Slight surface checks shall not constitute cause for rejection.

9. Resistivity

9.1 The electrical resistivity shall not exceed the values shown in Table 3 (Explanatory Note 4).

10. Density

10.1 For the purpose of calculating linear density, cross section, and so forth, the density of aluminum 1350 shall be taken as 2705 kg/m^3 [0.0975 lb/in.^{3}] at 20°C [68°F].

11. Diameter

11.1 The diameter of the wire shall be specified in inches to the nearest 0.0001 in. or the diameter of the wire shall be specified in millimetres to the nearest 0.001 mm for wires less than 1.000 mm in diameter, and to the nearest 0.01 mm for wires 1.00 mm in diameter and larger. The actual wire diameter shall not vary from the specified diameter by more than the values shown in Table 4.

12. Joints

12.1 No joints shall be made in the finished wire except as provided in 12.2. Joints may be made in the drawing stock and in the wire prior to final drawing and shall be in accordance with good commercial practice.

12.2 If agreed upon between the manufacturer and the purchaser, joints may be made during the final drawing or in the finished wire by electric-butt welding, cold-pressure welding, or electric-butt, cold-upset welding, subject to the following limitations.

TABLE 3 Electrical Resistivity Requirements at 20°C (68°F) and Equivalent Copper Resistivity[A]

NOTE 1—The values in boldface are standard; other values are for information only.

	Volume Conductivity	Electrical Resistivity					
	%IACS	Volume				Mass	
		Ω·mm^2/m	μΩin.	μΩ·cm	Ω·cmil/ft	Ω·lb/mile^2	Ω·g/m^2
Average for lot	**61.2**	**0.028172**	1.1091	2.8172	16.946	434.81	0.076149
Individual tests	**61.0**	**0.028265**	1.1128	2.8265	17.002	436.23	0.076399
Copper equivalent	100.0	0.017241	0.67879	1.7241	10.371	875.20	0.15328

[A] The equivalent resistivity values for 100 % IACS conductivity were each computed from the fundamental IEC value (1⁄58 Ω·mm^2/m) using conversion factors each accurate to at least seven significant figures. Corresponding values for aluminum conductivities were derived from these by multiplying by the reciprocal of the conductivity ratios and, where applicable, also by the density ratios, both accurate to at least seven significant figures.