Designation: B 233 – 97

Standard Specification for Aluminum 1350 Drawing Stock for Electrical Purposes[1]

This standard is issued under the fixed designation B 233; 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 aluminum 1350 drawing stock 0.375 in. (9.52 mm) to 1.000 in. (25.40 mm) in diameter, in the tempers shown in Table 1, for drawing into wire for electrical conductors (Explanatory Note 1 and Note 2).

1.2 The SI values of density and resistivity are to be regarded as the standard. For all other properties the inch-pound values are to be regarded as standard and the SI units may be approximate.

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

NOTE 2—The aluminum and temper designations conform to ANSI H35.1. Aluminum 1350 corresponds to unified numbering system A91350 in accordance with Practice E 527.Table 1Table 2Table 3Table 4Table 5

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:*

B 193 Test Method for Resistivity of Electrical Conductor Materials[2]

B 354 Terminology Relating to Uninsulated Metallic Electrical Conductors[2]

B 557 Test Methods of Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products[3]

B 830 Specification for Uniform Test Methods and Frequency[2]

E 34 Test Methods for Chemical Analysis of Aluminum and Aluminum-Base Alloys[4]

E 55 Practice for Sampling Wrought Nonferrous Metals and Alloys for Determination of Chemical Composition[4]

E 227 Test Method for Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the Point-to-Plane Technique[4]

E 527 Practice for Numbering Metals and Alloys (UNS)[5]

2.3 *American National Standard:*

ANSI H35.1 Alloy and Temper Designation Systems for Aluminum[6]

2.4 *National Bureau of Standards:*

Handbook *100, Copper Wire Tables*[7]

TABLE 1 Tensile Property Limits[A]

Temper	Tensile Strength	
	ksi	MPa
1350-O	8.5–14.0	59–97
1350-H12 and -H22	12.0–17.0	83–117
1350-H14 and -H24	15.0–20.0[A]	103–138
1350-H16 and -H26	17.0–22.0[A]	117–152

[A] Applicable to stock sizes through 0.500-in. (12.70-mm) diameter. The values to apply for larger sizes in these tempers shall be negotiated at time of inquiry.

3. Ordering Information

3.1 Orders for material under this specification shall include

[6] Available from American National Standard Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

[7] Available from the National Technical Information Service, 5285 Port Royal Rd., Springfield, VA 22161.

TABLE 2 Chemical Requirements[A]

Element	Composition, %
Silicon, max	0.10
Iron, max	0.40
Copper, max	0.05
Manganese, max	0.01
Chromium, max	0.01
Zinc, max	0.05
Boron, max	0.05
Gallium, max	0.03
Vanadium plus titanium, total, max	0.02
Other elements, each, max	0.03
Other elements, total, max	0.10
Aluminum, min	99.50

[A] Analysis shall regularly be made only for the elements specified in this table. If, however, the presence of other elements is suspected or indicated in amounts greater than the specified limits, further analysis shall be made to determine that these elements are not present in amounts in excess of the specified limits.

TABLE 3 Electrical Resistivity Limits

Temper	Resistivity, Ω·mm²/m, max	Equivalent Volume Conductivity, % IACS, min
1350-O	0.027899	61.8
1350-H12 and -H22	0.028035	61.5
1350-H14 and -H24	0.028080	61.4
1350-H16 and -H26	0.028126	61.3

[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.

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

[3] *Annual Book of ASTM Standards*, Vol 02.02.

[4] *Annual Book of ASTM Standards*, Vol 03.05.

[5] *Annual Book of ASTM Standards*, Vol 01.01.

TABLE 4 Equivalent Resistivity Values at 20°C[A]

Material	Volume Conductivity, % IACS	Resistivity Constants, Volume			
		Ω·mm²/m	Ω·cmil/ft	μΩ·in.	μΩ·cm
Copper	100	0.017241	10.371	0.67879	1.7241
Aluminum	61.3	0.028126	16.919	1.1073	2.8126
	61.4	0.028080	16.891	1.1055	2.8080
	61.5	0.028035	16.864	1.1037	2.8035
	61.8	0.027899	16.782	1.0984	2.7899

[A] The equivalent resistivity values for 100 % IACS conductivity were each computed from the fundamental IEC value (1 / 58 Ω·mm²/m) using conversion factors each accurate to at least seven significant figures. Corresponding values for other conductivities (aluminum) were derived from these by multiplying by the reciprocal of the conductivity ratios accurate to at least seven significant figures.

TABLE 5 Diameter Tolerances

Specified Diameter, in. (mm)	Tolerance, in. (mm), Plus or Minus	
	Deviation of Mean[A] Diameter from Specified Diameter	Deviation at Any Point from Specified Diameter
0.375–0.500 (9.52–12.70)	0.020 (0.51)	0.030 (0.76)
0.501–1.00 (12.73–25.40)	0.025 (0.64)	0.035 (0.89)

[A] For this specification, mean diameter is the average of the maximum diameter and the minimum diameter measured in the same transverse plane along the length.

the following information:

3.1.1 Quantity,

3.1.2 Diameter (see 11.1),

3.1.3 Temper (see Table 1 and Explanatory Note 1 and Note 2),

3.1.4 Whether joints are permitted (see 8.1),

3.1.5 Whether tests of joints are required and number of specimens (see 8.2),

3.1.6 Coil size and weight (see 14.2),

3.1.7 Whether wrapping of coils is required (see 14.3),

3.1.8 Special marking on tags, if required (see 14.4), and

3.1.9 Whether inspection or witness of inspection and tests by purchaser's representative is required prior to shipment (see Section 13).

4. Manufacture

4.1 Unless otherwise agreed upon at the time of placing the order, the manufacturer shall have the option of producing the stock from either individually cast ingots or continuously cast bars. Only one method of production shall be used on any given order.

4.2 Unless otherwise specified, the manufacturer shall have the option of supplying stock in the H2X temper when H1X is specified, and of supplying stock in the H1X temper when H2X is specified. Only one temper shall be supplied in any given order (see Explanatory Note 1 and ANSI H35.1).

5. Chemical Composition

5.1 The stock shall conform to the requirements of Table 2 as to chemical composition. Conformance shall be determined by the manufacturer by analyzing samples taken at the time the ingots or continuously cast bars are poured, or samples taken from the finished or semifinished product. If the manufacturer has determined the chemical composition of the material during the course of manufacture, he shall not be required to sample and analyze the finished product.

5.2 *Number of Samples*—The number of samples taken for determination of chemical composition shall be as follows:

5.2.1 When samples are taken at the time the ingots are poured, at least one sample shall be taken to represent each group of ingots poured simultaneously from the same source of molten metal.

5.2.2 When samples are taken at the time continuously cast bars are poured, at least one sample shall be taken to represent the continuously cast length poured from each furnace load of molten metal.

5.2.3 When samples are taken from the finished or semifinished product, a sample shall be taken to represent each 5000 lb (2300 kg) or fraction thereof of material in the shipment, except that no more than one sample shall be required per continuous unjointed coil.

5.3 *Methods of Sampling*—Samples for determination of chemical composition shall be taken in accordance with one of the following methods:

5.3.1 Samples for chemical analysis shall be taken from the material by drilling, sawing, milling, turning, or clipping a representative piece or pieces to obtain a weight of prepared sample not less than 75 g. Sampling shall be in accordance with Practice E 55.

5.3.2 Samples for spectrochemical and other methods of analysis shall be suitable for the form of material being analyzed and the type of analytical method used.

5.4 *Methods of Analysis*—The determination of chemical composition shall be made in accordance with suitable chemical (Test Methods E 34), spectrochemical (Test Method E 227), or other methods.

6. Workmanship

6.1 The stock shall be uniform in quality and temper and shall be suitable for drawing into wire.

6.2 The stock shall be clean, sound, smooth, and free of pipes, laps, cracks, kinks, twists, seams, damaged ends, excessive oil, and other injurious defects within the limits of good commercial practice.

7. Tensile Requirements

7.1 *Limits*:

7.1.1 The tensile strength of the respective tempers of stock shall conform to the requirements specified in Table 1. All tensile test results shall be reported.

7.1.2 The tensile strength of joints made in the finished stock shall be not less than 8500 psi (59 MPa) for 1350-O and not less than 11 000 psi (76 MPa) for the other tempers.

7.2 *Number of Specimens*—One specimen shall be taken from each 5000-lb (2300-kg) coil.

7.2.1 Tests to demonstrate conformance with 7.1.2 are not required unless agreed upon at time of ordering. The number of specimens shall be as negotiated (see 8.2).

7.3 *Type of Specimens*—Tension test specimens shall be the full section of the stock, or specimens machined from it. Machined specimens shall conform to Fig. 8 of Test Methods B 557. In case of dispute, tension test specimens shall be full section.

7.4 *Test Method*— Tension tests shall be made in accordance with Test Methods B 557. When tested in full section,