Designation: B398/B398M – 02(Reapproved 2013)

Standard Specification for Aluminum-Alloy 6201-T81 Wire for Electrical Purposes[1]

This standard is issued under the fixed designation B398/B398M; 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-alloy 6201-T81 (hard: solution heat-treated, cold worked, and artificially aged) round wire for electrical purposes.

NOTE 1—The alloy and temper designations conform to ANSI H35.1 and H35.1M. Aluminum-alloy 6201 corresponds to unified numbering system alloy A96201 in accordance with Practice E527.

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.

2. Referenced Documents

2.1 The following documents of this issue in effect on date of material purchase form a part of this specification to the extent referenced herein.

2.2 *ASTM Standards:*[2]

B193 Test Method for Resistivity of Electrical Conductor Materials

B557 Test Methods for Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products

B557M Test Methods for Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products (Metric)

B830 Specification for Uniform Test Methods and Frequency

E527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)

2.3 *ANSI Standard:*[3]

ANSI H35.1 American National Standard for Alloy and Temper Designation Systems for Aluminum

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

2.4 *NIST Standard:*[4]

Handbook 100 *Copper Wire Tables*

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 metric tons] 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 Notes 1 and 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: diameter in inches or in millimetres (see 11.1),

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

4.1.4 Frequency of bending test (see 8.2),

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. Material and Manufacture

5.1 The aluminum alloy used shall be of such quality that wire produced from it can comply with the requirements as to chemical composition, tensile and elongation properties, bending properties, and electrical resistivity prescribed in this specification.

[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] 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 Technical Information Service (NTIS), 5285 Port Royal Rd., Springfield, VA 22161, http://www.ntis.gov.

6. Chemical Composition

6.1 The wire shall be made from aluminum alloy 6201 as designated in ANSI H35.1 and H35.1M. The material shall conform to the chemical composition prescribed in Table 1.

7. Tensile Properties

7.1 The heat-treated, drawn, and artificially aged wire when sampled in accordance with Section 14 of this specification and tested in accordance with Test Methods B557 and B557M shall conform to the tensile requirements prescribed in Table 2 (Explanatory Note 3).

7.2 When requested by the purchaser, tension tests shall be made on specimens of heat-treated, drawn, and artificially aged wire containing joints made in the wire after heat treatment and prior to final drawing. Such tests shall show not less than 90 % of the minimum strength specified in Table 2 for individual test.

7.3 When requested by the purchaser, tension tests shall be made on specimens of heat-treated, drawn, and artificially aged wire containing joints made in the finished wire or during the final drawing as permitted in 12.2. Such tests shall show the tensile strength to be not less than 42 ksi (290 MPa) for cold-pressure welds and for electric-butt, cold-upset welds and not less than 15 ksi (100 MPa) for electric-butt welds. Electric-butt welds in addition shall show a minimum elongation of 6 % in 10 in. (250 mm).

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 either with or without a mandrel. No fracture shall occur. Slight surface checks shall not constitute cause for rejection.

8.2 Any coil or reel may be tested in accordance with 8.1, but the frequency of production sampling and testing shall be by agreement between the manufacturer and the purchaser.

9. Resistivity

9.1 Electrical resistivity, determined on samples selected in accordance with Section 14 of this specification and tested in accordance with Test Method B193, shall not exceed 0.032841 Ω·mm^2/m at 20°C (68°F) (Explanatory Note 2 and Table 3).

TABLE 1 Chemical Requirements[A]

Element	Composition, %
Copper, max	0.10
Iron, max	0.50
Silicon	0.50–0.9
Manganese, max	0.03
Magnesium	0.6–0.9
Zinc, max	0.10
Chromium, max	0.03
Boron, max	0.06
Other elements, each, max	0.03
Other elements, total, max	0.10
Aluminum	remainder

[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 for other elements.

TABLE 2 Tensile Requirements

Diameter, in. (mm)		Tensile Strength, min		Elongation in 10 in. (250 mm) for Individual Tests, min, %
		Average for a lot	Individual Tests	
Over	Through	ksi (MPa)	ksi (MPa)	
0.1280 (3.25)	0.1878 (4.75)	46 (315)	44 (305)	3.0
0.0610 (1.50)	0.1280 (3.25)	48 (330)	46 (315)	3.0

TABLE 3 Equivalent Resistivity Values at 20°C (68°F)[A]

Material	Volume Conductivity % IACS	Resistivity Constants[A] Volume
		Ω·cmil/ft (Ω·mm^2/m)
Copper	100	10.371 (0.017241)
Aluminum	61.0	17.002 (0.028265)
	53.5	19.385 (0.032227)
	52.5	19.755 (0.032841)

[A] The equivalent resistivity values for 100 % IACS (soft copper) 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 other conductivities (aluminum) were derived from these by multiplying by the reciprocal of the conductivity ratios accurate to at least seven significant figures.

10. Density

10.1 For the purpose of calculating mass, mass per unit length, mass cross sections, etc., the density of aluminum-alloy 6201 shall be taken as 2690 kg/m^3 (0.097 lb/in.^{3}) at 20°C.

11. Diameter and Permissible Variations

11.1 The diameter of the wire shall be expressed in decimal fractions of an inch using four places of decimals or in millimetres using two places of decimals.

11.2 Ten percent, but not less than five coils or spools (or all if the lot is less than five) from any lot of wire shall be gaged at three places. If the material is in coil form, one gaging shall be made near each end and one near the middle.

11.3 The permissible variations in diameter are as follows:

Specified Diameter, in. (mm)	Permissible Variations of Mean Diameter from Specified Diameter, plus and minus
0.1878 to 0.1000 (4.75 to 2.55), incl	1 %
Under 0.1000 to 0.0612 (2.55 to 1.50), incl	0.0010 in. (0.03 mm)

12. Joints

12.1 Unless otherwise specified at the time of placing the order, wire shall be supplied in one continuous length of reel, coil, or spool. Joints may be made in the drawing stock or wire after heat treatment and prior to final drawing by electric-butt welding, by cold-pressure welding, or by electric-butt, cold-upset welding in accordance with good commercial practice. Unless otherwise specified, no joints shall be made during final drawing or in the finished wire.

12.2 If agreed upon between the manufacturer and the purchaser, joints may be made during final drawing or in the finished wire by cold-pressure welding, by electric-butt, cold-upset welding, or by electric-butt welding. Following welding, electric-butt welds shall be annealed for a distance of at least 6 in. (150 mm) on each side of the weld. Not more than 10 % of the reels, coils, or spools shall contain such joints and no joint