



Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube¹

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

1. Scope*

1.1 This specification² covers aluminum and aluminum–alloy seamless pipe in the alloys (**Note 1**) and tempers shown in Table 1 [Table 2] and seamless extruded round tube in the alloys and tempers shown in Table 3 [Table 4] intended for pressure applications. The standard sizes for seamless pipe are listed in Table 16.7 of ANSI H35.2 and H35.2(M). Nonstandard alloys, tempers, and sizes of pipe are produced as seamless extruded tube. Also included in this standard are seamless extruded pipe and seamless extruded tube for Oil & Gas Transmission previously covered under Specification B345/B345M.

NOTE 1—Throughout this specification, use of the term *alloy*, in the general sense, includes aluminum as well as aluminum alloy.

NOTE 2—For drawn seamless tubes, see Specifications **B210** and **B210M**; for extruded tubes, Specifications **B221** and **B221M**; for drawn seamless tubes for condensers and heat exchangers, Specifications **B234** and **B234M**; for seamless condenser and heat exchanger tubes with integral fins, Specification **B429/B429M**; and for drawn tube for general purpose applications, Specifications **B483/B483M**.

1.2 Alloy and temper designations are in accordance with ANSI H35.1/H35.1(M). The equivalent Unified Numbering System alloy designations are those of Table 5 preceded by A9, for example, A91100 for aluminum 1100 in accordance with Practice **E527**.

1.3 For acceptance criteria for inclusion of new aluminum and aluminum alloys in this specification, see **Annex A2**.

1.4 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

¹ This specification is under the jurisdiction of ASTM Committee B07 on Light Metals and Alloys and is the direct responsibility of Subcommittee B07.03 on Aluminum Alloy Wrought Products.

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² For ASME Boiler and Pressure Vessel Code applications see related specifications 241/SB241-241M/SB241M in Section II of that code.

1.4.1 The SI units are shown either in brackets or in separate tables.

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:³

B210 Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes

B210M Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes (Metric)

B221 Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

B221M Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)

B234 Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes for Condensers and Heat Exchangers

B234M Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes for Condensers and Heat Exchangers (Metric)

B429/B429M Specification for Aluminum-Alloy Extruded Structural Pipe and Tube

B483/B483M Specification for Aluminum and Aluminum-Alloy Drawn Tube and Drawn Pipe for General Purpose Applications

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)

B594 Practice for Ultrasonic Inspection of Aluminum-Alloy Wrought Products

B647 Test Method for Indentation Hardness of Aluminum Alloys by Means of a Webster Hardness Gage

B648 Test Method for Indentation Hardness of Aluminum

³ 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.

*A Summary of Changes section appears at the end of this standard



- Alloys by Means of a Barcol Impressor
- B660** Practices for Packaging/Packing of Aluminum and Magnesium Products
- B666/B666M** Practice for Identification Marking of Aluminum and Magnesium Products
- B807/B807M** Practice for Extrusion Press Solution Heat Treatment for Aluminum Alloys
- B881** Terminology Relating to Aluminum- and Magnesium-Alloy Products
- B918** Practice for Heat Treatment of Wrought Aluminum Alloys
- B945** Practice for Aluminum Alloy Extrusions Press Cooled from an Elevated Temperature Shaping Process for Production of T1, T2, T5 and T10–Type Tempers
- B985** Practice for Sampling Aluminum Ingots, Billets, Castings and Finished or Semi-Finished Wrought Aluminum Products for Compositional Analysis
- E18** Test Methods for Rockwell Hardness of Metallic Materials
- E29** Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
- E34** Test Methods for Chemical Analysis of Aluminum and Aluminum-Base Alloys
- E527** Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)
- E607** Test Method for Atomic Emission Spectrometric Analysis Aluminum Alloys by the Point to Plane Technique Nitrogen Atmosphere (Withdrawn 2011)⁴
- E716** Practices for Sampling and Sample Preparation of Aluminum and Aluminum Alloys for Determination of Chemical Composition by Spectrochemical Analysis
- E1004** Test Method for Determining Electrical Conductivity Using the Electromagnetic (Eddy-Current) Method
- E1251** Test Method for Analysis of Aluminum and Aluminum Alloys by Spark Atomic Emission Spectrometry
- G47** Test Method for Determining Susceptibility to Stress-Corrosion Cracking of 2XXX and 7XXX Aluminum Alloy Products

2.3 ANSI Standards:

- B2.1** Pipe Threads (except Dryseal)⁵
- B36.10** Wrought Steel and Wrought Iron Pipe⁵
- H35.1/H35.1(M)** Alloy and Temper Designation Systems for Aluminum⁶
- H35.2** Dimensional Tolerances for Aluminum Mill Products⁶
- H35.2(M)** Dimensional Tolerances for Aluminum Mill Products [Metric]⁶

2.4 American Welding Society Standard

- D10.7** Recommended Practices for Gas Shielded Arc Welding of Aluminum and Aluminum-Alloy Pipe⁷

2.5 Federal Standard:

- Fed. Std. No. 123** Marking for Shipment (Civil Agencies)⁸

2.6 Military Standard:

- MIL-STD-129** Marking for Shipment and Storage⁸

2.7 AMS Specification:

- AMS 2772** Heat Treatment of Aluminum Alloy Raw Materials⁹

2.8 CEN EN Standards

- CEN EN 14242** Aluminum and Aluminum Alloys—Chemical Analysis—Inductively Coupled Plasma Optical Emission Spectral Analysis¹⁰

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *alclad seamless pipe or alclad seamless round tube, n*—a composite pipe or tube product composed of a seamless aluminum alloy core having on either the inside or the outside surface a metallurgically bonded aluminum or aluminum-alloy coating that is anodic to the core, thus electrolytically protecting the core against corrosion.

3.1.2 *capable of, adj*—the test need not be performed by the producer of the material. However, should subsequent testing by the purchaser establish that the material does not meet these requirements, the material shall be subject to rejection.

3.1.3 *extruded seamless alclad tube, n*—a composite round tube product composed of an aluminum alloy core having on either the inside or outside surface a metallurgically bonded aluminum or aluminum alloy coating that is anodic to the core, thus electrolytically protecting the core against corrosion.

3.1.4 *extruded seamless pipe, n*—extruded seamless round tube with standardized sizes of outside diameter and wall thickness commonly designated by “Nominal Pipe Sizes” and American National Standards Institute (ANSI) “Schedule Numbers.”

3.1.5 *extruded seamless round tube, n*—a hollow product having a round cross section and a uniform wall thickness, brought to final dimensions by extruding from a hollow cast ingot or mandrel pierced ingot.

3.1.6 *producer, n*—the primary manufacturer of the material.

3.1.7 *seamless pipe, n*—extruded or drawn seamless tube having certain standardized sizes of outside diameter and wall thickness commonly designated by “Nominal Pipe Sizes” and American National Standards Institute (ANSI) “Schedule Numbers.”

3.1.8 *supplier, n*—jobber or distributor as distinct from producer.

3.2 *Other Definitions*—For all other definitions of product terms, refer to Terminology **B881**.

⁴ The last approved version of this historical standard is referenced on www.astm.org.

⁵ Available from American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036.

⁶ Available from Aluminum Association, Inc., 1400 Crystal Dr., Suite 430, Arlington, VA 22202 <http://www.aluminum.org>.

⁷ Available from the American Welding Society, 8669 NW 36th St, Miami, FL 33166.

⁸ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, <http://dodssp.daps.dla.mil>.

⁹ Available from SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, <http://www.sae.org>.

¹⁰ Available from European Committee for Standardization (CEN), 36 Rue de Stassart, B-1050, Brussels, Belgium, <http://www.cenorm.be>.

4. Ordering Information

4.1 Orders for material to this specification shall include the following information:

4.1.1 This specification designation (which includes the number, the year, and the revision letter, if applicable),

NOTE 3—For inch-pound orders specify Specification B241; for metric orders specify Specification B241M. Do not mix units.

4.1.2 Quantity in pieces or pounds [kilograms],

4.1.3 Alloy (Section 7),

4.1.4 Temper (Section 9),

4.1.5 Pipe size and schedule number (Table 12.55 of ANSI H35.2 and H35.2(M)), or outside diameter and wall thickness (tube). Dimensional tolerances for 14, 16, 18, and 20-in. pipe sizes (see Table 4(a)) shall be agreed upon between the producer and purchaser and shall be specified contract or purchase order.

4.1.6 For alloy Alclad 3003, state clad inside or outside (Section 13).

4.1.7 End configuration (Sections 15.4 and 15.5).

4.1.8 Length (Section 14).

4.2 Additionally, orders for material to this specification shall include the following information when required by the purchaser:

4.2.1 Whether solution treatment at the press is unacceptable (8.3),

4.2.2 Whether heat treatment in accordance with Practice B918 is required (8.4),

4.2.3 Whether pipe size under 1 in. (25 mm) shall be extruded only (5.1 and Table 1 [Table 2], Footnote F),

4.2.4 Whether threaded ends are required (see 15.2),

4.2.5 Whether inspection or witness of inspection and tests by the purchaser's representative is required prior to material shipment (Section 16),

4.2.6 Whether Practices B660 applies and, if so, the levels of preservation, packaging, and packing required (20.3),

4.2.7 Whether certification of the material is required (Section 21),

4.2.8 Requirements for tensile property and dimensional tolerance for sizes not specifically covered (9.1.2 and 14.2),

4.2.9 Whether ultrasonic inspection is required (Section 16, Table 6 [Table 7]),

4.2.10 Whether Sections 10 and 11 apply to 6063 and 6061 alloys, and

4.2.11 Whether the term "Seamless" is required in product marking in accordance with Practice B666/B666M.

5. Materials and Manufacture

5.1 The pipe and tube shall be produced from hollow extrusion ingot (cast in hollow form, or drilled, or pierced from solid ingot) and shall be extruded by use of the die and mandrel method.

5.1.1 At the option of the producer, the pipe and tube may be drawn after extrusion, provided all the requirements of this specification are met.

6. Quality Assurance

6.1 *Responsibility for Inspection and Tests*—Unless otherwise specified in the contract or purchase order, the producer is responsible for the performance of all inspection and test

TABLE 1 Tensile Property Limits for Pipe, Inch-Pound Units^{A,B}

Alloy	Temper	Pipe Size, in.	Tensile Strength, min, ksi	Yield Strength (0.2 % Offset), min, ksi	Elongation in 2 in. or 4 × Diameter, min, % ^C
3003	H18	Under 1	27.0	24.0	4
	H112	1 and over	14.0	5.0	25
6005	T1	All	25.0	15.0	16
	T5	All	38.0	35.0	8
6005A	T1	All	25.0	14.5	15
	T5	All	38.0	31.0	7
	T61	Under 0.250	38.0	35.0	8
		0.250–1.000	38.0	35.0	10
6041	T6	All	45.0	40.0	10
6042	T5, T5511	All	38.0	35.0	10
6061	T6 (Extruded)	Under 1	38.0	35.0	8
		1 and over	38.0	35.0	10 ^D
	T6 (Drawn)	Under 1	42.0	35.0	8 ^E
		1 and over	38.0	35.0	10 ^F
6063	T6	All	30.0	25.0	8
6064	T6	All	42.0	38.0	10
6082	T6	All	45.0	38.0	8
6105	T1	All	25.0	15.0	16
	T5	All	38.0	35.0	8
6262	T6	All	38.0	35.0	10
6351	T5	All	38.0	35.0	10 ^D
	T6	All	42.0	37.0	10 ^G

^A The basis for establishment of tensile property limits is shown in Annex A1.

^B For purposes of determining conformance with this specification, each value for tensile strength and yield strength shall be rounded to the nearest 0.1 ksi, and each value for elongation shall be rounded to the nearest 0.5 %, both in accordance with the rounding-off method of Practice E29.

^C Elongation of full-section and cut-out sheet-type specimens is measured in 2 in.; of round specimens, in 4 × specimen diameter.

^D For wall thicknesses less than 0.250 in., the minimum elongation is 8 %.

^E For wall thickness 0.050 to 0.259 in., the minimum elongation is 10 %.

^F For wall thickness 0.260 to 0.500 in., the minimum elongation is 12 %.

^G For wall thickness less than 0.125 in., the minimum elongation is 8 %.