



Designation: B 234M – 00
METRIC

Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes for Condensers and Heat Exchangers [Metric]¹

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1. Scope *

1.1 This specification covers aluminum-alloy (Note 1) drawn seamless round tube in straight lengths designated as shown in the Table 1, for use in surface condensers, evaporators, and heat exchangers.

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 used in general applications, see Specification B 210M; for extruded tubes see Specification B 221M; for seamless pipe see Specification B 241/B 241M; and for structural pipe and tube see Specification B 429.

NOTE 3—This specification is the metric counterpart of Specification B 234.

1.2 Alloy and temper designations are in accordance with ANSI H35.1M. The equivalent Unified Numbering System alloy designations are those of Table 2 preceded by , for example, A91060 for aluminum 1060, in accordance with Practice E 527.

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

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 557M Test Methods of Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products [Metric]²
- B 597 Practice for Heat Treatment of Aluminum Alloys²
- B 660 Practices for Packaging/Packing of Aluminum and Magnesium Products²
- B 666M Practice for Identification Marking of Aluminum Products [Metric]²
- E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specification³
- E 34 Test Methods for Chemical Analysis of Aluminum and

Aluminum-Base Alloys⁴

- E 55 Practice for Sampling Wrought Nonferrous Metals and Alloys for Determination of Chemical Composition⁴
- E 215 Practice for Standardizing Equipment for Electromagnetic Examination of Seamless Aluminum-Alloy Tube⁵
- E 227 Test Method for Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the Point-to-Plane Technique⁴
- E 527 Practice for Numbering Metals and Alloys (UNS)⁶
- E 607 Test Method for Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the Point-to-Plane Technique, Nitrogen Atmosphere⁷
- E 716 Practices for Sampling Aluminum and Aluminum Alloys for Spectrochemical Analysis⁷
- E 1251 Test Method for Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the Argon Atmosphere, Point-to-Plane, Unipolar Self-Initiating Capacitor Discharge⁷
- 2.3 *ANSI Standards:*
 - H35.1(M) Alloy and Temper Designation Systems for Aluminum²
 - H35.2(M) Dimensional Tolerances for Aluminum Mill Products²
- 2.4 *Federal Standard:*
 - Fed. Std. No. 123 Marking for Shipment (Civil Agencies)⁸
- 2.5 *Military Standard:*
 - MIL-STD-129 Marking for Shipment and Storage⁸
- 2.6 *Military Specification:*
 - MIL-H-6088 Heat Treatment of Aluminum Alloys⁸

3. Terminology

3.1 Definitions:

3.1.1 *tube*—a hollow wrought product that is long in relation to its cross section, which is round, a regular hexagon, a regular octagon, elliptical, or square or rectangular with sharp or rounded corners, and that has uniform wall thickness except

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² *Annual Book of ASTM Standards*, Vol 02.02.

³ *Annual Book of ASTM Standards*, Vol 14.02.

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

⁵ *Annual Book of ASTM Standards*, Vol 03.03.

⁶ *Annual Book of ASTM Standards*, Vol 01.01.

⁷ *Annual Book of ASTM Standards*, Vol 03.06.

⁸ Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

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

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TABLE 1 Tensile Property Limits^{A,B}

Alloy	Temper	Wall Thickness, mm		Tensile Strength, min, MPa	Yield Strength, (0.2 % offset), min, MPa	Elongation in 50 mm min, %	
		Over	Through			Full-Section Specimen	Cut-Out Specimen
1060	H14	0.25	5.00	85	70	...	...
3003	H14	0.25	0.63	140	115	3	...
		0.63	1.20	140	115	5	3
		1.20	5.00	140	115	8	4
	H25	0.25	5.00	150	130	...	...
Alclad 3003	H14	0.25	0.63	135	110	...	...
		0.63	1.20	135	110	5	3
		1.20	5.00	135	110	8	4
	H25	0.25	5.00	145	125	...	...
5052	H32	0.25	5.00	215	160	...	...
	H34	0.25	5.00	235	180	...	...
5454	H32	0.25	1.20	250	180	...	5
		1.20	5.00	250	180	...	8
	H34	0.25	1.20	270	200	...	4
		1.20	5.00	270	200	...	6
6061	T4	0.25	1.20	205	110	16	14
		1.20	5.00	205	110	18	16
	T6	0.25	1.20	290	240	10	8
		1.20	5.00	290	240	12	10

^ATo determine conformance to this specification, each value for tensile strength and for yield strength shall be rounded to the nearest 1 MPa and each value for elongation to the nearest 0.5 %, both in accordance with the rounding-off method of Practice E 29.

^BThe basis for establishment of mechanical property limits is shown in Annex A1.

TABLE 2 Chemical Composition Limits^{A,B,C}

Alloy	Silicon	Iron	Copper	Manganese	Magnesium	Chromium	Zinc	Titanium	Other Elements ^D		Aluminum, min
									Each	Total ^E	
1060	0.25	0.35	0.05	0.03	0.03	...	0.05	0.03	0.03 ^F	...	99.60 ^G
3003	0.6	0.7	0.05–0.20	1.0–1.5	...	...	0.10	...	0.05	0.15	remainder
Alclad 3003	3003 alloy clad with 7072 alloy										
5052	0.25	0.40	0.10	0.10	2.2–2.8	0.15–0.35	0.10	...	0.05	0.15	remainder
5454	0.25	0.40	0.10	0.50–1.0	2.4–3.0	0.05–0.20	0.25	0.20	0.05	0.15	remainder
6061	0.40–0.8	0.7	0.15–0.40	0.15	0.8–1.2	0.04–0.35	0.25	0.15	0.05	0.15	remainder
7072 ^H	0.07 Si + Fe	0.10	0.10	0.10	0.10	...	0.8–1.3	...	0.05	0.15	remainder

^ALimits are in percent maximum unless shown as a range or otherwise stated.

^BAnalysis shall be made for the elements for which limits are shown in this table.

^CFor purposes of determining conformance to these limits, an observed value or a calculated value attained from analysis shall be rounded to the nearest unit in the last right-hand place of figures used in expressing the specified limit, in accordance with the rounding-off method of Practice E 29.

^D*Others* includes listed elements for which no specific limit is shown as well as unlisted metallic elements. The producer may analyze samples for trace elements not specified in this specification. However, such analysis is not required and may not cover all metallic *Others* elements. Should any analysis by the producer or the purchaser establish that an *Others* element exceeds the limit of *Each* or that the aggregate of several *Others* elements exceeds the limit of *Total*, the material shall be considered nonconforming.

^E*Other Elements—Total* shall be the sum of unspecified metallic elements 0.010 % or more, rounded to the second decimal before determining the sum.

^FVanadium 0.05 max.

^GThe aluminum content shall be calculated by subtracting from 100.00 % the sum of all the metallic elements present in amounts of 0.010 % or more, rounded to the second decimal before determining the sum.

^HComposition of cladding alloy as applied during the course of manufacture. The sample from finished tube shall not be required to conform to these limits.

as may be affected by corner radii.

3.1.2 drawn seamless tube—a tube produced from hollow ingot and brought to final dimensions by drawing through a die.

3.1.3 alclad tube—a tube having on either the inside or the outside surface a metallurgically bonded aluminum alloy coating that is anodic to the core alloy to which it is bonded, thus electrolytically protecting the core alloy against corrosion.

3.1.4 heat exchange tube—a tube for use in apparatus in which fluid inside the tube will be heated or cooled by fluid outside the tube. The term usually is not applied to coiled tube or to tube for use in refrigerators or radiators.

3.1.5 producer—the primary manufacturer of the material.

3.1.6 supplier—includes only the category of jobbers and distributors as distinct from producers.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 capable of—the term *capable of* as used in this specification means that the test need not be performed by the producer of the material. However, should testing by the purchaser establish that the material does not meet these requirements, the material shall be subject to rejection.

4. Ordering Information

4.1 Orders for material to this specification shall include the