Designation: B 483/B 483M – 00

Standard Specification for Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications[1]

This standard is issued under the fixed designation B 483/B 483M; 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 and aluminum-alloy drawn tubes in straight lengths and coils for general purpose applications in the alloys (Note 2), and tempers shown in Table 1. Coiled tubes are generally available only as round tubes with a wall thickness not exceeding 0.083 in. [2.00 mm] and only in non-heat-treatable alloys.

NOTE 1—For drawn seamless tubes, see Specifications B 210 and B 210M, for tubes to be used in condensers and heat exchangers, Specifications B 234 and B 234M, and for seamless pipe, Specification B 241/B 241M.

NOTE 2—Throughout this specification use of the term *alloy* in the general sense includes aluminum as well as aluminum alloy.

1.2 Alloy and temper designations are in accordance with ANSI H35.1 and H35.1M. The equivalent Unified Number System alloy designations are those of Table 2 preceded by A9, 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.

1.4 The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated 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.

2. Referenced Documents

2.1 The following documents of the issue in effect on date of order acceptance form a part of this specification to the extent referenced herein:

2.2 *ASTM Standards:*

B 557 Test Methods for Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products[2]

B 557M Test Methods for Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products [Metric][2]

B 597 Practice for Heat Treatment of Aluminum Alloys[2]

B 660 Practices for Packaging/Packing of Aluminum and Magnesium Products[2]

B 666/B 666M Practice for Identification Marking of Aluminum and Magnesium Products[2]

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications[3]

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 215 Practice for Standardizing Equipment for Electromagnetic Testing of Seamless Aluminum-Alloy Tube[5]

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)[6]

E 607 Test Method for Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the Point-to-Plane Technique, Nitrogen Atmosphere[7]

E 716 Practices for Sampling Aluminum and Aluminum Alloys for Spectrochemical Analysis[7]

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 Discharge[7]

2.3 *ANSI Standards:*

H35.1 Alloy and Temper Designation Systems for Aluminum[2]

H35.1M Alloy and Temper Designation Systems for Aluminum [Metric][2]

H35.2 Dimensional Tolerances for Aluminum Mill Products[2]

H35.2M Dimensional Tolerances for Aluminum Mill Products [Metric][2]

2.4 *Military 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] *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.

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

MIL-STD-129 Marking for Shipment and Storage[8]

2.5 *Military Specification:*

MIL-H-6088 Heat Treatment of Aluminum Alloys[8]

2.6 *Federal Standard:*

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)[8]

3. Terminology

3.1 *Definitions:*

3.1.1 *tube*—a hollow wrought product that is long in relation to its cross section, that 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 as may be affected by corner radii.

3.1.2 *drawn tube*—a tube brought to final dimensions by drawing through a die.

3.1.3 *producer*—the primary manufacturer of the material.

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

3.2 *Definition of Term 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 following information:

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

4.1.2 Quantity in pieces or pounds,

4.1.3 Alloy (7.1),

4.1.4 Temper (8.1),

4.1.5 Cross-sectional dimensions (outside diameter and wall thickness, or inside diameter and wall thickness for round tube; for tube other than round, square, rectangular, hexagonal, or octagonal with sharp corners, a drawing is required),

4.1.6 Length (straight or coiled),

4.1.7 Nominal inside diameter of coils and weight or maximum outside diameter, if applicable,

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

4.2.1 Whether heat treatment shall be in accordance with Practice B 597 (9.2),

4.2.2 Whether testing for leaks is required (11.1),

4.2.3 Whether specified number of leaks are allowed, and the manner of marking leaks (11.1.3.2),

4.2.4 Whether inside cleanliness test is required on coiled tubes (12.2), and frequency of testing required,

4.2.5 Whether inspection or witness of inspection and tests by the purchaser's representative is required prior to material shipment (15.1),

4.2.6 Whether marking for identification is required (17.1),

4.2.7 Whether Practices B 660 applies, and if so, the levels of preservation, packaging, and packing required (18.3), and,

4.2.8 Whether certification of the material by the producer is required (Section 19).

5. Manufacture

5.1 The tube may be produced by drawing tube stock produced by extrusion through a bridge-type die or by die and mandrel methods, at the option of the producer, provided that the production method results in material that meets all requirements of this specification.

5.2 The ends of coils shall be crimped or otherwise sealed to avoid contamination during shipment.

6. Responsibility For 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 requirements specified herein. Except as otherwise specified in the contract or order, the producer may use his own or any other suitable facilities for the performance of the inspection and test requirements specified herein, unless disapproved by the purchaser. The purchaser shall have the right to perform any of the inspections and tests set forth in this specification where such inspections are deemed necessary to assure that material conforms to prescribed requirements.

6.2 *Lot Definition*—An inspection lot shall be defined as follows:

6.2.1 For heat-treated tempers, an inspection lot shall consist of an identifiable quantity of material of the same alloy, temper, and nominal dimensions, traceable to a heat-treat lot or lots, and subjected to inspection at one time.

6.2.2 For nonheat-treated tempers, an inspection lot shall consist of an identifiable quantity of material of the same mill form, alloy, temper, and nominal dimensions subjected to inspection at one time.

7. Chemical Composition

7.1 *Limits*—The tubes shall conform to the composition in Table 2. Conformance shall be determined by the producer by analyzing samples taken at the time the ingots are poured, or samples taken from the finished or semifinished product. If the producer has determined the composition of the material during the course of manufacture, he shall not be required to sample and analyze the finished product.

NOTE 3—It is standard practice in the United States aluminum industry to determine conformance to the composition limits prior to further processing of ingots into wrought products. Due to the continuous nature of the process, it is not practical to keep a specific ingot analysis identified with a specific quantity of finished material.

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

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

7.2.2 When samples are taken from the finished or semifinished product, a sample shall be taken to represent each 4000 lb [2000 kg] or fraction thereof of material in the lot, except that no more than one sample shall be required per piece.

7.3 *Methods of Sampling*—Samples for determination of

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

chemical composition shall be taken in accordance with one of the following methods:

7.3.1 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 prepared sample of not less than 75 g. Sampling shall be in accordance with Practice E 55.

7.3.2 Sampling for spectrochemical analysis shall be in accordance with Practices E 716. Samples for other methods of analysis shall be suitable for the form of material being analyzed and the type of analytical method used.

7.4 *Methods of Analysis*—The determination of chemical composition shall be made in accordance with suitable chemical (Test Methods E 34), or spectrochemical (Test Methods E 227, E 607, and E 1251), methods. Other methods may be used only when no published ASTM method is available. In case of dispute, the methods of analysis shall be agreed upon between the producer and purchaser.

8. Tensile Properties

8.1 *Limits*—Tube shall conform to the tensile properties in Table 1.

8.2 *Number of Specimens*:

8.2.1 For tubes having a nominal weight of less than 1 lb/linear ft [1.7 kg/linear m], one tension test specimen shall be taken for each 1000 lb [500 kg] or fraction thereof in a lot.

8.2.2 For tubes having a nominal weight of 1 lb [1.7 kg] or more/linear ft [m], one tension test specimen shall be taken for each 1000 ft [300 m] or fraction thereof in a lot.

8.3 *Test Specimens*—Geometry of test specimens and the location in the product from which they are taken shall be as specified in Test Methods B 557 and B 557M.

8.4 *Test Methods*—The tension tests shall be made in accordance with Test Methods B 557 and B 557M.

9. Heat Treatment

9.1 Unless specified in 9.2, producer or supplier heat treatment for the applicable tempers in Table 1 shall be in accordance with MIL-H-6088.

9.2 When specified, heat treatment of applicable tempers in Table 1 shall be in accordance with Practice B 597.

10. Heat Treatment and Reheat Treatment Capability

10.1 As-received material in the O or F temper and in alloys 6061 and 6063 (within the size limitations specified in Table 1 and without the imposition of cold work) shall, after proper solution heat treatment and natural aging for not less than 4 days at room temperature, conform to the properties specified in Table 1 for T42 temper material.

10.2 Material in alloy and tempers 6063-T4 and T6 shall, after proper resolution heat treatment and natural aging for not less than 4 days at room temperature, conform to the properties specified in Table 1 for the T42 temper.

NOTE 4—6061-T4 and T6 are excluded from this paragraph because experience has shown the reheat treated material may develop large recrystallized grains and may fail to develop the tensile properties shown in Table 1.

10.3 Material in T4 and T42 tempers shall, after proper precipitation heat treatment, conform to the properties specified in Table 1 for the T6 and T62 tempers, respectively.

TABLE 1 Tensile Property Limits[A,B]

Temper	Specified Wall Thickness,[C] in. [mm]	Tensile Strength, ksi [MPa]		Yield Strength[D] (0.2% Offset), ksi [MPa], min	Elongation in 2 in. [50 mm] or 4× Diameter,[E] min, %		
		min	max		Full-Section Specimen	Cut-Out Specimen	
						in 50 mm	In 5 × Diameter ($5.65\sqrt{A}$)[F]
Aluminum 1060							
O	0.018–0.500 [0.45–12.50]	8.5 [60]	13.5 [95]	2.5 [15]	...	...	...
H12	0.018–0.500 [0.45–12.50]	10.0 [70]	... [...]	4.0 [30]	...	...	...
H14	0.018–0.500 [0.45–12.50]	12.0 [85]	... [...]	10.0 [70]	...	...	...
H18	0.018–0.500 [0.45–12.50]	16.0 [110]	... [...]	13.0 [90]	...	...	...
H113[G]	0.018–0.500 [0.45–12.50]	8.5 [60]	... [...]	2.5 [15]	...	...	...
Aluminum 1100							
O	0.018–0.500 [0.45–12.50]	11.0 [75]	15.5 [105]	3.5 [25]	...	...	...
H12	0.018–0.500 [0.45–12.50]	14.0 [95]	... [...]	11.0 [75]	...	...	...
H14	0.018–0.500 [0.45–12.50]	16.0 [110]	... [...]	14.0 [85]	...	...	...
H16	0.018–0.500 [0.45–12.50]	19.0 [130]	... [...]	17.0 [115]	...	...	...
H18	0.018–0.500 [0.45–12.50]	22.0 [150]	... [...]	20.0 [140]	...	...	...
H113[G]	0.018–0.500 [0.45–12.50]	11.0 [75]	... [...]	3.5 [25]	...	...	...
Aluminum 1435[H]							
O	0.018–0.500 [0.45–12.50]	9.5 [65]	14.0 [100]	3.0 [20]	...	...	...
H12	0.018–0.500 [0.45–12.50]	12.0 [85]	... [...]	7.0 [50]	...	...	...
H14	0.018–0.500 [0.45–12.50]	14.0 [95]	... [...]	12.0 [85]	...	...	...
H16	0.018–0.500 [0.45–12.50]	16.0 [110]	... [...]	14.0 [95]	...	...	...
H18	0.018–0.500 [0.45–12.50]	19.0 [135]	... [...]	16.0 [110]	...	...	...
Alloy 3003							

TABLE 1 *Continued*

Temper	Specified Wall Thickness,[C] in. [mm]	Tensile Strength, ksi [MPa]		Yield Strength[D] (0.2% Offset), ksi [MPa], min	Elongation in 2 in. [50 mm] or 4× Diameter,[E] min, %		
		min	max		Full-Section Specimen	Cut-Out Specimen	
						in 50 mm	In 5 × Diameter ($5.65\sqrt{A}$)[F]
O	0.018–0.500 [0.45–12.50]	14.0 [95]	19.0 [130]	5.0 [35]	...	...	...
H12	0.018–0.500 [0.45–12.50]	17.0 [120]	... [...]	12.0 [85]	...	...	...
H14	0.018–0.500 [0.45–12.50]	20.0 [140]	... [...]	17.0 [115]	...	...	...
H16	0.018–0.500 [0.45–12.50]	24.0 [165]	... [...]	21.0 [145]	...	...	...
H18	0.018–0.500 [0.45–12.50]	27.0 [185]	... [...]	24.0 [165]	...	...	...
H113[G]	0.018–0.500 [0.45–12.50]	14.0 [95]	... [...]	5.0 [35]	...	...	...
			Alloy 3102[H]				
O	0.018–0.049 [0.63–1.20]	11.0 [75]	17.0 [115]	3.5 [25]	30[I]	20[I]	
	0.050–0.065 [1.20–1.70]	11.0 [75]	17.0 [115]	3.5 [25]	35	25	
						...	
						...	
			Alloy 5005[H]				
O	0.018–0.500 [0.45–12.50]	15.0 [105]	21.0 [145]	5.0 [35]	...	...	...
			Alloy 5050[H]				
O	0.018–0.500 [0.45–12.50]	18.0 [125]	24.0 [165]	6.0 [40]	...	...	...
H32	0.018–0.500 [0.45–12.50]	22.0 [150]	... [...]	16.0 [110]	...	...	...
H34	0.018–0.500 [0.45–12.50]	25.0 [170]	... [...]	20.0 [140]	...	...	...
H36	0.018–0.500 [0.45–12.50]	27.0 [185]	... [...]	22.0 [150]	...	...	...
H38	0.018–0.500 [0.45–12.50]	29.0 [200]	... [...]	24.0 [165]	...	...	...
			Alloy 5052[H]				
O	0.018–0.450 [0.45–11.50]	25.0 [170]	35.0 [240]	10.0 [70]	...	...	
H32	0.018–0.450 [0.45–11.50]	31.0 [215]	... [...]	23.0 [160]	...	...	
H34	0.018–0.450 [0.45–11.50]	34.0 [235]	... [...]	26.0 [180]	...	...	
H36	0.018–0.450 [0.45–11.50]	37.0 [355]	... [...]	29.0 [200]	...	...	
H38	0.018–0.450 [0.45–11.50]	39.0 [270]	... [...]	31.0 [215]	...	...	
			Alloy 6061				
O	0.018–0.500 [0.45–12.50]	... ...	22.0 [150]	14.0 [95] max	15	15	13
T4	0.025–0.049 [0.63–1.20]	30.0 [205]	... [...]	16.0 [110]	16	14	...
	0.050–0.259 [1.20–6.30]	30.0 [205]	... [...]	16.0 [110]	18	16	...
	0.260–0.500 [6.30–12.50]	30.0 [205]	... [...]	16.0 [110]	20	18	16
T42[J]	0.025–0.049 [0.63–1.20]	30.0 [205]	... [...]	14.0 [95]	16	14	...
	0.050–0.259 [1.20–6.30]	30.0 [205]	... [...]	14.0 [95]	18	16	...
	0.260–0.500 [6.30–12.50]	30.0 [205]	... [...]	14.0 [95]	20	18	16
T6, T62[J]	0.025–0.049 [0.63–1.20]	42.0 [290]	... [...]	35.0 [240]	10	8	...
	0.050–0.259 [1.20–6.30]	42.0 [290]	... [...]	35.0 [240]	12	10	...
	0.260–0.500 [6.30–12.50]	42.0 [290]	... [...]	35.0 [240]	14	12	10
			Alloy 6063				
O	0.018–0.500 [0.45–12.50]	... [...]	19.0 [130]	... [...]	...	...	...
T4, T42[J]	0.025–0.049 [0.63–1.20]	22.0 [150]	... [...]	10.0 [70]	16	14	...
	0.050–0.259 [1.20–6.30]	22.0 [150]	... [...]	10.0 [70]	18	16	...
	0.260–0.500 [6.30–12.50]	22.0 [150]	... [...]	10.0 [70]	20	18	16
T6, T62[J]	0.025–0.049 [0.63–1.20]	33.0 [230]	... [...]	28.0 [195]	12	8	...
	0.050–0.259 [1.20–6.30]	33.0 [230]	... [...]	28.0 [195]	14	10	...
	0.260–0.500 [6.30–2.50]	33.0 [230]	... [...]	28.0 [195]	16	12	10
T83	0.025–0.259 [0.63–6.30]	33.0 [230]	... [...]	30.0 [205]	5	...	...
T831	0.025–0.259 [0.63–6.30]	28.0 [195]	... [...]	25.0 [170]	5	...	...
T832	0.025–0.049 [0.63–1.20]	41.0 [285]	... [...]	36.0 [250]	8	5	...
	0.050–0.259 [1.20–6.30]	40.0 [275]	... [...]	35.0 [240]	8	5	...
			Alloy 6262				
T6, T62[J]	0.025–0.049 [0.63–1.20]	42.0 [290]	... [...]	35.0 [240]	10	8	...
	0.050–0.259 [1.20–6.30]	42.0 [290]	... [...]	35.0 [240]	12	10	...
	0.260–0.500 [6.30–12.50]	42.0 [290]	... [...]	35.0 [240]	14	12	10
T9	0.025–0.375 [0.63–10.00]	48.0 [330]	... [...]	44.0 [305]	5	4	3

[A] See Annex A1.