



Designation: B483/B483M – 13

# Standard Specification for Aluminum and Aluminum-Alloy Drawn Tube and Drawn Pipe for General Purpose Applications<sup>1</sup>

This standard is issued under the fixed designation B483/B483M; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope\*

1.1 This specification covers aluminum and aluminum-alloy drawn tube and drawn pipe in straight lengths and tube in coils for general purpose applications in the alloys (Note 2), and tempers shown in Tables 1 and 2. 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 B210 and B210M, for tubes to be used in condensers and heat exchangers, Specifications B234 and B234M, and for seamless pipe, Specification B241/B241M. For extruded structural tube and pipe, see Specification B429.

NOTE 2—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/H35.1(M). The equivalent Unified Number System alloy designations are those of Table 3 preceded by A9, for example A91060 for aluminum 1060 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 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 may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

<sup>1</sup> 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. 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:<sup>2</sup>

B210 Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes

B210M Specification for Aluminum and Aluminum-Alloy Drawn Seamless 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)

B241/B241M Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube

B429 Specification for Aluminum-Alloy Extruded Structural Pipe and Tube

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)

B660 Practices for Packaging/Packing of Aluminum and Magnesium Products

B666/B666M Practice for Identification Marking of Aluminum and Magnesium Products

B918 Practice for Heat Treatment of Wrought Aluminum Alloys

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

E215 Practice for Standardizing Equipment for Electromagnetic Testing of Seamless Aluminum-Alloy Tube

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

<sup>2</sup> 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



TABLE 1 Tensile Property Limits, Tube<sup>A,B</sup>

ALLOY AND TEMPER	SPECIFIED WALL THICKNESS in. [mm]	TENSILE STRENGTH - ksi [MPa]				Elongation in 2 in. [50 mm] or 4x Diameter, <sup>C</sup> min, % <sup>J</sup>		
		ULTIMATE		YIELD <sup>D</sup> (0.2% Offset), ksi [MPa]		FULL SECTION SPECIMEN <sup>E</sup>	Cut-Out Specimen <sup>F</sup>	
		min.	max.	min.	max.		In 50 mm	In 5x Diameter (5.65 √A) <sup>G</sup>
<b>1060<sup>F,1</sup></b>								
1060-O	0.010-0.500 [0.25-12.50]	8.5 [60]	13.5 [95]	2.5 [15]	.. [.]	..	..	..
1060-H12	0.010-0.500 [0.25-12.50]	10.0 [70]	.. [.]	4.0 [30]	.. [.]	..	..	..
1060-H14	0.010-0.500 [0.25-12.50]	12.0 [85]	.. [.]	10.0 [70]	.. [.]	..	..	..
1060-H18	0.010-0.500 [0.25-12.50]	16.0 [110]	.. [.]	13.0 [90]	.. [.]	..	..	..
1060-H113 <sup>K</sup>	0.010-0.500 [0.25-12.50]	8.5 [60]	.. [.]	2.5 [15]	.. [.]	..	..	..
<b>1100<sup>F,1</sup></b>								
1100-O	0.014-0.500 [0.36-12.50]	11.0 [75]	15.5 [105]	3.5 [25]	.. [.]	..	..	..
1100-H12	0.014-0.500 [0.36-12.50]	14.0 [95]	.. [.]	11.0 [75]	.. [.]	..	..	..
1100-H14	0.014-0.500 [0.36-12.50]	16.0 [110]	.. [.]	14.0 [95]	.. [.]	..	..	..
1100-H16	0.014-0.500 [0.36-12.50]	19.0 [130]	.. [.]	17.0 [115]	.. [.]	..	..	..
1100-H18	0.014-0.500 [0.36-12.50]	22.0 [150]	.. [.]	20.0 [140]	.. [.]	..	..	..
1100-H113 <sup>K</sup>	0.014-0.500 [0.36-12.50]	11.0 [75]	.. [.]	3.5 [25]	.. [.]	..	..	..
<b>3003<sup>F,1</sup></b>								
3003-O	0.010-0.024 [0.25-0.63]	14.0 [95]	19.0 [130]	5.0 [35]	.. [.]	..	..	..
	0.025-0.049 [0.63-1.20]	14.0 [95]	19.0 [130]	5.0 [35]	.. [.]	30	20	..
	0.050-0.259 [1.20-6.30]	14.0 [95]	19.0 [130]	5.0 [35]	.. [.]	35	25	..
	0.260-0.500 [6.30-12.50]	14.0 [95]	19.0 [130]	5.0 [35]	.. [.]	..	30	27
3003-H12	0.010-0.500 [0.25-12.50]	17.0 [115]	.. [.]	12.0 [85]	.. [.]	..	..	..
3003-H14	0.010-0.024 [0.25-0.63]	20.0 [140]	.. [.]	17.0 [115]	.. [.]	3	..	..
	0.025-0.049 [0.63-1.20]	20.0 [140]	.. [.]	17.0 [115]	.. [.]	5	3	..
	0.050-0.259 [1.20-6.30]	20.0 [140]	.. [.]	17.0 [115]	.. [.]	8	4	..
	0.260-0.500 [6.30-12.50]	20.0 [140]	.. [.]	17.0 [115]	.. [.]	..	..	..
3003-H16	0.010-0.024 [0.25-0.63]	24.0 [165]	.. [.]	21.0 [145]	.. [.]	..	..	..
	0.025-0.049 [0.63-1.20]	24.0 [165]	.. [.]	21.0 [145]	.. [.]	3	2	..
	0.050-0.259 [1.20-6.30]	24.0 [165]	.. [.]	21.0 [145]	.. [.]	5	4	..
	0.260-0.500 [6.30-12.50]	24.0 [165]	.. [.]	21.0 [145]	.. [.]	..	..	..
3003-H18	0.010-0.024 [0.25-0.63]	27.0 [185]	.. [.]	24.0 [165]	.. [.]	2	..	..
	0.025-0.049 [0.63-1.20]	27.0 [185]	.. [.]	24.0 [165]	.. [.]	3	2	..
	0.050-0.259 [1.20-6.30]	27.0 [185]	.. [.]	24.0 [165]	.. [.]	5	3	..
	0.260-0.500 [6.30-12.50]	27.0 [185]	.. [.]	24.0 [165]	.. [.]	..	..	..
3003-H113 <sup>K</sup>	0.010-0.500 [0.25-12.50]	14.0 [95]	.. [.]	5.0 [35]	.. [.]	..	..	..
<b>5050<sup>F,1</sup></b>								
5050-O	0.010-0.500 [0.25-12.70]	18.0 [125]	24.0 [165]	6.0 [40]	.. [.]	..	..	..
5050-H32	0.010-0.500 [0.25-12.70]	22.0 [150]	.. [.]	16.0 [110]	.. [.]	..	..	..
5050-H34	0.010-0.500 [0.25-12.70]	25.0 [170]	.. [.]	20.0 [140]	.. [.]	..	..	..
5050-H36	0.010-0.500 [0.25-12.70]	27.0 [185]	.. [.]	22.0 [150]	.. [.]	..	..	..
5050-H38	0.010-0.500 [0.25-12.70]	29.0 [200]	.. [.]	24.0 [165]	.. [.]	..	..	..
<b>5052<sup>F,1</sup></b>								
5052-O	0.010-0.450 [0.25-11.50]	25.0 [170]	35.0 [240]	10.0 [70]	.. [.]	..	..	..
5052-H2	0.010-0.450 [0.25-11.50]	31.0 [215]	.. [.]	23.0 [160]	.. [.]	..	..	..
5052-H34	0.010-0.450 [0.25-11.50]	34.0 [235]	.. [.]	26.0 [180]	.. [.]	..	..	..
5052-H36	0.010-0.450 [0.25-11.50]	37.0 [255]	.. [.]	29.0 [200]	.. [.]	..	..	..
5052-H38	0.010-0.450 [0.25-11.50]	39.0 [270]	.. [.]	31.0 [215]	.. [.]	..	..	..
<b>6061</b>								
6061-O	0.018-0.500 [0.45-12.50]	.. [.]	22.0 [150]	.. [.]	14.0 [95]	15	15	13
6061-T4	0.025-0.049 [0.63-1.20]	30.0 [200]	.. [.]	16.0 [110]	.. [.]	16	14	..
	0.050-0.259 [1.20-6.30]	30.0 [200]	.. [.]	16.0 [110]	.. [.]	18	16	..
	0.260-0.500 [6.30-12.50]	30.0 [200]	.. [.]	16.0 [110]	.. [.]	20	18	16
6061-T42 <sup>G,H</sup>	0.025-0.049 [0.63-1.20]	30.0 [200]	.. [.]	14.0 [110]	.. [.]	16	14	..
	0.050-0.259 [1.20-6.30]	30.0 [200]	.. [.]	14.0 [110]	.. [.]	18	16	..
	0.260-0.500 [6.30-12.50]	30.0 [200]	.. [.]	14.0 [110]	.. [.]	20	18	16
6061-T6 and T62 <sup>G,H</sup>	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
<b>6063</b>								
6063-O	0.018-0.500 [0.45-12.50]	.. [.]	19.0 [130]	.. [.]	.. [.]	..	..	..
6063-T4 and T42 <sup>G,H</sup>	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
6063-T6 and T62 <sup>G,H</sup>	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 [6.30-12.50]	33.0 [230]	.. [.]	28.0 [195]	.. [.]	16	12	10
6063-T83	0.025-0.259 [0.63-6.30]	33.0 [230]	.. [.]	30.0 [205]	.. [.]	5	..	..
6063-T831	0.025-0.259 [0.63-6.30]	28.0 [195]	.. [.]	25.0 [170]	.. [.]	5	..	..

**TABLE 1** *Continued*

ALLOY AND TEMPER	SPECIFIED WALL THICKNESS in. [mm]	TENSILE STRENGTH - ksi [MPa]				Elongation in 2 in. [50 mm] or 4x Diameter, <sup>C</sup> min, % <sup>J</sup>		
		ULTIMATE		YIELD <sup>D</sup> (0.2% Offset), ksi [MPa]		FULL SECTION SPECIMEN <sup>E</sup>	Cut-Out Specimen <sup>F</sup>	
		min.	max.	min.	max.		In 50 mm	In 5x Diameter (5.65 √A) <sup>G</sup>
6063-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	..
	0.051-0.500 [1.30-12.50]	50.0 [345]	.. [.]	45.0 [310]	.. [.]	10	8	..
<b>6262</b>								
6262-T6 and T62 <sup>G,H</sup>	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
6262-T9	0.025-0.375 [0.63-10.00]	48.0 [330]	.. [.]	44.0 [305]	.. [.]	5	4	3

- <sup>A</sup> See **Annex A1**.
- <sup>B</sup> To determine conformance to this specification each value for tensile strength and for yield strength shall be rounded to the nearest 0.1 ksi [MPa] and each value for elongation to the nearest 0.5 %, both in accordance with the rounding method of Practice **E29**.
- <sup>C</sup> Elongation of full-section and cut-out sheet-type specimens is measured in 2 in.; of cut-out round specimens, in 4x specimen diameter.
- <sup>D</sup> Yield strength to be determined only on straight tube.
- <sup>E</sup> Round tube 2 inches or less in outside diameter and square tube 1½ inches or less on a side are tested in full section unless the limitations of the testing machine precludes the use of such a specimen.
- <sup>F</sup> For round tube over 2 inches in diameter, for square tube over 1½ inches on a side, for all sizes of tube other than round and square, or in those cases when a full section specimen cannot be used, a cut-out specimen is used.
- <sup>G</sup> Elongations in 50 mm apply for tube tested in full-section, for sheet type specimens for tubes having a flat wall, and for similar curved specimens for tubes having a curved wall up to a maximum wall thickness of 12.50 mm. Elongations in 5D (5.65 √A), where D and A are diameter and cross-sectional area specimens, respectively, apply to round test specimens machined from wall thickness over 6.30 mm.
- <sup>H</sup> Material in the T42 or T62 tempers is not available from the material producers.
- <sup>I</sup> In this alloy tube other than round is produced only in the F (as drawn) and O tempers. Properties for F temper are not specified or guaranteed.
- <sup>J</sup> For specified wall thickness under 0.025 in. [0.63 mm] elongation is not required.
- <sup>K</sup> The H113 temper applies to other than round tube which is fabricated from annealed round tube.

**TABLE 2 Tensile Property Limits, Drawn Pipe<sup>A,B,C</sup>**

Temper	Pipe Size, Designation	Tensile Strength, ksi [MPa]		Yield Strength <sup>C</sup> (0.2% Offset), ksi [MPa], min	Elongation in 2 in. or 4x Diameter, <sup>D</sup> min, %	Elongation, min, %	
		min	max			In 50 mm	In 5x Diameter (5.65 √A) <sup>E</sup>
<b>Alloy 3003</b>							
H18	Under 1	27.0 [185]	...	24.0 [165]	4	[4]	...
H112	1 and over	14.0 [95]	...	5.0 [35]	25	[25]	[22]

- <sup>A</sup> The basis for establishment of tensile property limits is shown in **Annex A1**.
- <sup>B</sup> 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**.
- <sup>C</sup> Elongation of full-section and cut-out sheet-type specimens is measured in 2 in.; of round specimens, in 4x specimen diameter.
- <sup>D</sup> For purposes of determining conformance with this specification, each value for ultimate strength and yield strength shall be rounded to the nearest 1 MPa, and each value for elongation shall be rounded to the nearest 0.5%, both in accordance with the rounding-off method of Practice **E29**.
- <sup>E</sup> Elongation in 50 mm apply for pipe tested in full-section and to sheet type specimens taken from pipes having a wall up to 12.50 mm thick. Elongation in 5D (5.65 √A) where D and A are diameter and cross-sectional area of the specimens respectively, apply to round test specimens machined from wall thicknesses over 6.30 mm.

[E607 Test Method for Atomic Emission Spectrometric Analysis Aluminum Alloys by the Point to Plane Technique Nitrogen Atmosphere \(Withdrawn 2011\)<sup>3</sup>](#)  
[E716 Practices for Sampling and Sample Preparation of Aluminum and Aluminum Alloys for Determination of Chemical Composition by Spectrochemical Analysis](#)

[E1251 Test Method for Analysis of Aluminum and Aluminum Alloys by Spark Atomic Emission Spectrometry](#)  
 2.3 *ANSI Standards*.<sup>4</sup>  
[H35.1/H35.1\(M\) Alloy and Temper Designation Systems](#)  
[H35.2 Dimensional Tolerances for Aluminum Mill Products](#)

<sup>3</sup> The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).

<sup>4</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

**TABLE 3 Chemical Composition Limits<sup>A,B,C,I</sup>**

Alloy	Composition, %										
	Silicon	Iron	Copper	Manganese	Magnesium	Chromium	Zinc	Titanium	Other Elements <sup>D</sup>		Aluminum
									Each	Total <sup>E</sup>	
1060	0.25	0.35	0.05	0.03	0.03	...	0.05	0.03	0.03 <sup>F</sup>	...	99.60 min <sup>G</sup>
1100	0.95 Si + Fe		0.05–0.20	0.05	...	...	0.10	...	0.05	0.15	99.00 min <sup>G</sup>
3003	0.6	0.7	0.05–0.20	1.0–1.5	...	...	0.10	...	0.05	0.15	remainder
5005	0.30	0.7	0.20	0.20	0.50–1.1	0.10	0.25	...	0.05	0.15	remainder
5050	0.40	0.7	0.20	0.10	1.1–1.8	0.10	0.25	...	0.05	0.15	remainder
5052	0.25	0.40	0.10	0.10	2.2–2.8	0.15–0.35	0.10	...	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
6063	0.20–0.6	0.35	0.10	0.10	0.45–0.9	0.10	0.10	0.10	0.05	0.15	remainder
6262	0.40–0.8	0.7	0.15–0.40	0.15	0.8–1.2	0.04–0.14	0.25	0.15	0.05 <sup>H</sup>	0.15	remainder

<sup>A</sup> Limits are in percent maximum unless shown as a range or otherwise stated.

<sup>B</sup> Analysis shall be made for the elements for which limits are shown in this table.

<sup>C</sup> For 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 method of Practice E29.

<sup>D</sup> *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.

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

<sup>F</sup> Vanadium 0.05 %, maximum.

<sup>G</sup> The 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.

<sup>H</sup> Bismuth and lead each 0.40–0.7 %.

<sup>I</sup> In case there is a discrepancy in the values listed in Table 1 with those listed in the “International Alloy Designations and Chemical Composition Limits for Wrought Aluminum and Wrought Aluminum Alloys” (known as the “Teal Sheets”), the composition limits registered with the Aluminum Association and published in the “Teal Sheets” shall be considered the controlling composition. The “Teal Sheets” are available at <http://www.aluminum.org/tealsheets>.

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

#### 2.4 Military Standard:<sup>5</sup>

#### MIL-STD-129 Marking for Shipment and Storage

#### 2.5 Military Specifications:<sup>5</sup>

#### AMS 2770 Heat Treatment of Wrought Aluminum Alloy Parts

#### AMS 2772 Heat Treatment of Aluminum Alloy Raw Materials

#### 2.6 Federal Standard:<sup>5</sup>

#### Fed. Std. No. 123 Marking for Shipment (Civil Agencies)

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 B597 (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 B660 applies, and if so, the levels of preservation, packaging, and packing required (18.3),

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

4.2.9 Whether threaded ends are required for pipe (14.3), and,

4.2.10 PIN (for Department of Defense only) (Annex A3).

### 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

<sup>5</sup> Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, <http://dodssp.daps.dla.mil>.