



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

This standard is issued under the fixed designation B241/B241M; 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.

^{ε1} NOTE—Sections 9.1.1.1 and 9.3 were corrected editorially in August 2013.

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 H35.2M. Nonstandard alloys, tempers, and sizes of pipe are produced as seamless extruded tube.

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

NOTE 2—For other seamless drawn tubes, see Specification B210 or Specification B483/B483M. For extruded tube see Specification B221, and for structural pipe and tube see Specification B429/B429M.

1.2 Alloy and temper designations are in accordance with ANSI H35.1/H35.1M. 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.

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

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.

Current edition approved Nov. 1, 2012. Published December 2012. Originally approved in 1949. Last previous edition approved in 2010 as B241/B241M–10. DOI: 10.1520/B0241_B0241M-12E01.

² For ASME Boiler and Pressure Vessel Code applications see related Specification SB-241/SB-241M in Section II of that Code.

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

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

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 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

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

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

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 %.

TABLE 2 Tensile Property Limits for Pipe [SI Units]^{A,B}

Alloy	Temper (Product)	Pipe Size, Designation	Tensile Strength, min, MPa	Yield Strength (0.2 % Offset), min, MPa	Elongation, ^C min, %	
					in 50 mm	in 5 × Diameter (5.65 √A)
3003	H18	Under 1	185	165	4	...
	H112	1 and over	95	35	25	22
6005	T1	All	170	105	16	14
	T5	All	260	240	8	...
6005A	T1	All	170	100	15	...
	T5	All	260	215	7	6
	T61	All	260	240	8	...
		1 and over	260	240	10 ^D	9
6041	T6	All	310	275	10	9
6042	T5, T5511	All	260	240	10	9
6061	T6 (Extruded)	Under 1	260	240	8	...
		1 and over	260	240	10 ^D	9
	T6 (Drawn)	Under 1	290	240	8 ^E	...
		1 and over	260	240	10 ^F	9
6063	T6	All	205	170	8	7
6064	T6	All	290	260	10	9
6082	T6	All	310	260	10	8
6105	T5	All	260	240	8	7
	T6	All	290	255	10	9
6262	T6	All	260	240	10	9
6351	T5	All	260	240	10 ^D	9
	T6	All	290	255	10 ^G	9

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

^B 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.

^C Elongations 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. Elongations in 5D

$$(5.65 \sqrt{A}),$$

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.

^D For wall thicknesses up through 6.30 mm the minimum elongation is 8 %.

^E For wall thicknesses over 1.25 through 6.60 mm, the minimum elongation is 10 %.

^F For wall thicknesses over 6.60 through 12.50 mm, the minimum elongation is 12 %.

^G For wall thicknesses up through 3.20 mm the minimum elongation is 8 %.

TABLE 3 Tensile Property Limits for Extruded Tube, Inch-Pound Units^{A,B}

Temper	Specified Section or Wall Thickness, in.		Area, in. ²	Tensile Strength, ksi		Yield Strength (0.2 % Offset), ksi		Elongation in 2 in. or 4 × Diameter, min, % ^C
				Min	Max	Min	Max	
Aluminum 1060								
O	all	all		8.5	14.0	2.5	...	25
H112	all	all		8.5	...	2.5	...	25
F ^D	all	all		...	...	...	...	...
Aluminum 1100								
O	all	all		11.0	15.5	3.0	...	25
H112	all	all		11.0	...	3.0	...	25
F ^D	all	all		...	...	...	...	...
Alloy 2014								
O	all	all		...	30.0	...	18.0	12
T4	}	all	all	50.0	...	35.0	...	12
T4510 ^E								
T4511 ^E								
T42	all	all		50.0	...	29.0	...	12
T6	}	}	all	60.0	...	53.0	...	7
T6510 ^E								
T6511 ^E								
			up thru 0.499	60.0	...	53.0	...	7
			0.500–0.749	64.0	...	58.0	...	7
			0.750 and over	68.0	...	60.0	...	7
			over 25 thru 32	68.0	...	58.0	...	6
T62	up thru 0.749	all		60.0	...	53.0	...	7
	0.750 and over	up thru 25		60.0	...	53.0	...	7
		over 25 thru 32		60.0	...	53.0	...	6
F ^D	all	all		...	...	...	...	...
Alloy 2024								
O	all	all		...	35.0	...	19.0	12
T3	}	}	all	57.0	...	42.0	...	10
T3510 ^E								
T3511 ^E								
			up thru 0.249	60.0	...	44.0	...	10
			0.250–0.749	65.0	...	46.0	...	10
			0.750–1.499	...	...	...	...	10
			1.500 and over	70.0	...	48.0	...	10
			up thru 25	68.0	...	46.0	...	8
			over 25 thru 32	...	...	...	...	...
T42	up thru 0.749	all		57.0	...	38.0	...	12
	0.750–1.499	all		57.0	...	38.0	...	10
	1.500 and over	up thru 25		57.0	...	38.0	...	10
		over 25 thru 32		57.0	...	38.0	...	8
T81	0.050–0.249	all		64.0	...	56.0	...	4
T8510 ^E	}	}	all	66.0	...	58.0	...	5
T8511 ^E								
			up thru 32	66.0	...	58.0	...	5
F ^D	all	all		...	...	...	...	...
Alloy 2219								
O	all	all		...	32.0	...	18.0	12
T31	}	}	up thru 25	42.0	...	26.0	...	14
T3510 ^E								
T3511 ^E								
			up thru 25	45.0	...	27.0	...	14
T62	Up thru 0.999	up thru 25		54.0	...	36.0	...	6
	1.000 and over	up thru 25		54.0	...	36.0	...	6
T81	}	}	up thru 25	58.0	...	42.0	...	6
T8510 ^E								
T8511 ^E								
F ^D	all	all		...	...	...	...	...
Alloy 3003								

TABLE 3 *Continued*

Temper	Specified Section or Wall Thickness, in.	Area, in. ²	Tensile Strength, ksi		Yield Strength (0.2 % Offset), ksi		Elongation in 2 in. or 4 × Diameter, min, % ^C							
			Min	Max	Min	Max								
O	all	all	14.0	19.0	5.0	...	25							
H112	all	all	14.0	...	5.0	...	25							
F ^D	all	all	...	...	...	...	...		
Alclad Alloy 3003														
O	all	all	13.0	18.0	4.5	...	25							
H112	all	all	13.0	...	4.5	...	25							
F ^D	all	all	...	...	...	...	...		
Alloy 5052														
O	all	all	25.0	35.0	10.0	...	...					
F ^D	all	all	...	...	...	...	...		
Alloy 5083														
O	all	up thru 32	39.0	51.0	16.0	...	14							
H111	all	up thru 32	40.0	...	24.0	...	12							
H112	all	up thru 32	39.0	...	16.0	...	12							
F ^D	all	all	...	...	...	...	...		
Alloy 5086														
O	all	up thru 32	35.0	46.0	14.0	...	14							
H111	all	up thru 32	36.0	...	21.0	...	12							
H112	all	up thru 32	35.0	...	14.0	...	12							
F ^D	all	all	...	...	...	...	...		
Alloy 5154														
O	all	all	30.0	41.0	11.0	...	...					
H112	all	all	30.0	...	11.0	...	...					
Alloy 5454														
O	all	up thru 32	31.0	41.0	12.0	...	14							
H111	all	up thru 32	33.0	...	19.0	...	12							
H112	all	up thru 32	31.0	...	12.0	...	12							
F ^D	all	all	...	...	...	...	...		
Alloy 5456														
O	all	up thru 32	41.0	53.0	19.0	...	14							
H111	all	up thru 32	42.0	...	26.0	...	12							
H112	all	up thru 32	41.0	...	19.0	...	12							
F ^D	all	all	...	...	...	...	...		
Alloy 6005														
T1	Up thru 0.500	all	25.0	...	15.0	...	16							
T5	Up thru 0.124	all	38.0	...	35.0	...	8							
	0.125–1.000	all	38.0	...	35.0	...	10							
Alloy 6005A														
T1	Up thru 0.249	all	25.0	...	14.5	...	15							
T5	Up thru 0.249	all	38.0	...	31.0	...	7							
	0.250–0.999	all	38.0	...	31.0	...	9							
T61	Up thru 0.249	all	38.0	...	35.0	...	8							
	0.250–1.000	all	38.0	...	35.0	...	10							
Alloy 6013														
T6, T6511	0.200-0.499	all	49.0	...	46.0	...	8							
	0.500-0.749	all	49.0	...	46.0	...	8							
	0.750-2.000	all	49.0	...	45.0	...	8							
Alloy 6041														
T6, T6511	0.400–2.000	all	45.0	...	40.0	...	10							
Alloy 6042														
T5, T5511	0.400–0.499	all	38.0	...	35.0	...	10							
	0.500–1.800	all	42.0	...	35.0	...	10							
Alloy 6061														
O	all	all	...	22.0	...	16.0	16							
T1	up thru 0.625	all	26.0	...	14.0	...	16							
T4 T4510 ^E T4511 ^E	} all	all	26.0	...	16.0	...	16							
T42								all	all	26.0	...	12.0	...	16
T51								up thru 0.625	all	35.0	...	30.0	...	8

TABLE 3 *Continued*

Temper	Specified Section or Wall Thickness, in.	Area, in. ²	Tensile Strength, ksi		Yield Strength (0.2 % Offset), ksi		Elongation in 2 in. or 4 × Diameter, min, % ^C
			Min	Max	Min	Max	
T6, T62 T6510 ^E T6511 ^E	} up thru 0.249 0.250 and over	all	38.0	...	35.0	...	8
		all	38.0	...	35.0	...	10
F ^D	all	all	...	...	...	...	...
Alloy 6063							
O	all	all	...	19.0	...	...	18
T1 ^F	up thru 0.500 0.501–1.000	all	17.0	...	9.0	...	12
		all	16.0	...	8.0	...	12
T4, T42	up through 0.500 0.501–1.000	all	19.0	...	10.0	...	14
		all	18.0	...	9.0	...	14
T5	up thru 0.500 0.501–1.000	all	22.0	...	16.0	...	8
		all	21.0	...	15.0	...	8
T52	up thru 1.000	all	22.0	30.0	16.0	25.0	8
T6, T62	up thru 0.124 0.125–1.000	all	30.0	...	25.0	...	8
		all	30.0	...	25.0	...	10
F ^D	all	all	...	...	...	...	...
Alloy 6064							
T6, T6511	0.400–2.000	all	42.0	...	38.0	...	10
Alloy 6066							
O	all	all	...	29.0	...	18.0	16
T4, T4510 ^E T4511 ^E	} all	all	40.0	...	25.0	...	14
		all	40.0	...	24.0	...	14
T6, T6510, ^E T6511 ^E	} all	all	50.0	...	45.0	...	8
		all	50.0	...	42.0	...	8
Alloy 6082							
T6	0.200–1.000	all	45.0	...	38.0	...	8
Alloy 6105							
T1	Up thru 0.500	all	25.0	...	15.0	...	16
T5	Up thru 0.500	all	38.0	...	35.0	...	8
Alloy 6162							
T5, T5510 ^F T5511 ^E	up thru 1.000	all	37.0	...	34.0	...	7
T6, T6510 ^E T6511 ^E	up thru 0.249 0.250–0.499	all	38.0	...	35.0	...	8
		all	38.0	...	35.0	...	10
Alloy 6262							
T6, T6511	all	all	38.0	...	35.0	...	10
Alloy 6351							
T4	up thru 0.749	all	32.0	...	19.0	...	16
T6	up thru 0.124 0.125–0749	...	42.0	...	37.0	...	8
		...	42.0	...	37.0	...	10
Alloy 7075							
O	all	...	...	40.0	...	24.0	10
T6, T62 T6510 ^E T6511 ^E	} { up through 0.249 0.250–0.499 0.500–1.499 1.500–2.999	all	78.0	...	70.0	...	7
		all	81.0	...	73.0	...	7
		all	81.0	...	72.0	...	7
		all	81.0	...	72.0	...	7

TABLE 3 *Continued*

Temper	Specified Section or Wall Thickness, in.	Area, in. ²	Tensile Strength, ksi		Yield Strength (0.2 % Offset), ksi		Elongation in 2 in. or 4 × Diameter, min, % ^C
			Min	Max	Min	Max	
T73	0.062–0.249 0.250–1.499 1.500–2.999	all	68.0	...	58.0	...	7
T73510		up thru 25	70.0	...	61.0	...	8
T73511		up thru 25	69.0	...	59.0	...	8
F ^D	all	all	...	...	...	...	...
Alloy 7178							
O	all	up thru 32	...	40.0	...	24.0	10
T6	up through 0.061 0.062–0.249 0.250–1.499	all	82.0	...	76.0	...	...
		up thru 20	84.0	...	76.0	...	5
		up thru 25	87.0	...	78.0	...	5
T6510 ^E	1.500–2.499	up thru 25	86.0	...	77.0	...	5
T6511 ^E		over 25 thru 32	84.0	...	75.0	...	5
	2.500–2.999	up thru 32	82.0	...	71.0	...	5
T62	up thru 0.061 0.062–0.249 0.250–1.499 1.500–2.499	all	79.0	...	73.0	...	...
		up thru 20	82.0	...	74.0	...	5
		up thru 25	86.0	...	77.0	...	5
		up thru 25	86.0	...	77.0	...	5
		over 25 thru 32	84.0	...	75.0	...	5
	2.500–2.999	up through 32	82.0	...	71.0	...	7
F ^D	all	all	...	...	...	...	...

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

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

^CElongation of full-section and cut-out sheet-type specimens is measured in 2 in.; of round specimens, in 4 × specimen diameter. See 9.1.1 for conditions under which measurements are not required.

^DTests for tensile properties in the F temper are not required.

^EFor stress relieved tempers (T3510, T3511, T4510, T4511, T5510, T5511, T6510, T6511, T73510, T73511, T8510, T8511), characteristics and properties other than those specified may differ somewhat from the corresponding characteristics and properties of material in the basic tempers.

^FFormerly designated T42 temper. When properly aged (precipitation heat-treated) 6063-T1 extruded products are designated T5.

[ASTM B241/B241M-12e1](https://standards.iteh.ai/catalog/standards/sist/b428a6ed-39b7-46fb-90b8-c145ce89b6ce/astm-b241-b241m-12e1)

<https://standards.iteh.ai/catalog/standards/sist/b428a6ed-39b7-46fb-90b8-c145ce89b6ce/astm-b241-b241m-12e1>

[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](#)

[E227 Test Method for Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the Point-to-Plane Technique \(Withdrawn 2002\)⁴](#)

[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:*

[H35.1/H35.1\(M\) Alloy and Temper Designation Systems for Aluminum⁵](#)

[H35.2 Dimensional Tolerances for Aluminum Mill Products⁵](#)

[H35.2\(M\) Dimensional Tolerances for Aluminum Mill Products \[Metric\]⁵](#)

2.4 *Federal Standard:*

[Fed. Std. No. 123 Marking for Shipment \(Civil Agencies\)⁶](#)

2.5 *Military Standard:*

[MIL-STD-129 Marking for Shipment and Storage⁶](#)

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

⁵ Available from Aluminum Association, Inc., 1525 Wilson Blvd., Suite 600, Arlington, VA 22209, <http://www.aluminum.org>.

⁶ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, <http://dodssp.daps.dla.mil>.

TABLE 4 Tensile Property Limits for Extruded Tube [SI Units]^{A,B}

Temper	Specified Section or Wall Thickness, mm		Area, mm ²		Tensile Strength, MPa		Yield Strength (0.2 % offset), MPa		Elongation, ^C %, min		
	over	through	over	through	min	max	min	max	in 50 mm	in 5 × diameter (5.65√A)	
Aluminum 1060											
O	all		all		60	95	15	...	25	22	
H112	all		all		60	...	15	...	25	22	
F ^D	all		all		...	...	...	...	...	...
Aluminum 1100											
O	all		all		75	105	20	...	25	22	
H112	all		all		75	...	20	...	25	22	
F ^D	all		all		...	...	...	...	...	...
Alloy 2014											
O	all		all		...	205	...	125	12	10	
T4	}		all		345	...	240	...	12	10	
T4510 ^E											
T4511 ^E											
T42 ^F	all		all		345	...	200	...	12	10	
T6	}	...	12.50	all		415	...	365	...	7	6
T6510 ^E		12.50	18.00	all		440	...	400	...	...	6
T6511 ^E		18.00	...	...	16 000	470	...	415	...	...	6
		18.00	...	16 000	20 000	470	...	400	...	...	5
T62 ^F	}	...	18.00	all	...	415	...	365	...	7	6
		18.00	...	...	16 000	415	...	365	...	...	6
		18.00	...	16 000	20 000	415	...	365	...	...	5
F ^D	all		all		...	...	...	...	...	...
Alloy 2024											
O	all		all		...	240	...	130	12	10	
T3	}	...	6.30	all		395	...	290	...	10	...
T3510 ^E		6.30	18.00	all		415	...	305	...	10	9 ^H
T3511 ^E		18.00	35.00	all		450	...	315	...	...	9
		35.00	...	...	16 000	485	...	330	...	...	9
		35.00	...	16 000	20 000	470	...	315	...	...	7
T42 ^F	}	...	18.00	all	...	395	...	260	...	12	10
		18.00	35.00	all		395	...	260	...	...	9
		35.00	...	...	16 000	395	...	260	...	...	9
		35.00	...	16 000	20 000	395	...	260	...	...	7
T81	}	1.20	6.30	all		440	...	385	...	4	...
T8510 ^E		6.30	35.00	all		455	...	400	...	5	4
T8511 ^E		35.00	...	...	20 000	455	...	400	...	...	4
F ^D	all		all		...	...	...	...	...	...
Alloy 2219											
O	all		all		...	220	...	125	12	10	
T31	}	...	12.50	...	16 000	290	...	180	...	14	12
T3510 ^E		12.50	80.00	...	16 000	310	...	185	...	...	12
T3511 ^E											

TABLE 4 *Continued*

Temper	Specified Section or Wall Thickness, mm		Area, mm ²		Tensile Strength, MPa		Yield Strength (0.2 % offset), MPa		Elongation, ^C %, min	
	over	through	over	through	min	max	min	max	in 50 mm	in 5 × diameter (5.65√ <i>A</i>)
T62 ^F	...	25.00	...	16 000	370	...	250	...	6	5
	25.00		...	20 000	370	...	250	...	...	5
T81	}	80.00	...	16 000	400	...	290	...	6	5
T8510 ^E										
T8511 ^E										
F ^D	all		all		...	...	...	...	...	...
Alloy 3003										
O	all	...	all		95	130	35	...	25	22
H112	...	1.60	all		95	...	35	...	...	...
F ^D	1.60	...	all		95	...	35	...	25	22
F ^D	all		all		...	...	...	...	...	...
Alclad Alloy 3003										
O	all		all		90	125	30	...	25	22
H112	all		all		90	...	30	...	25	22
F ^D	all		all		...	...	...	...	...	...
Alloy 5052										
O	all		all		170	240	70	...	...	...
F ^D	all		all		...	...	...	...	...	...
Alloy 5083										
O	all		...	20 000	270	350	110	...	14	12
H111	all		...	20 000	275	...	165	...	12	10
H112	all		...	20 000	270	...	110	...	12	10
F ^D	all		all		...	...	...	...	...	...
Alloy 5086										
O	all		...	20 000	240	315	95	...	14	12
H111	all		...	20 000	250	...	145	...	12	10
H112	all		...	20 000	240	...	95	...	12	10
F ^D	all		all		...	...	...	...	...	...
Alloy 5154										
O	all		all		205	285	75	...	...	...
H112	all		all		205	...	75	...	...	...
Alloy 5454										
O	all		...	20 000	215	285	85	...	14	12
H111	all		...	20 000	230	...	130	...	12	10
H112	all		...	20 000	215	...	85	...	12	10
F ^D	all		all		...	...	...	...	...	...
Alloy 5456										
O	all		...	20 000	285	365	130	...	14	12
H111	all		...	20 000	290	...	180	...	12	10
H112	all		...	20 000	285	...	130	...	12	10
F ^D	all		all		...	...	...	...	...	...
Alloy 6005										
T1	...	12.50	all		170	...	105	...	16	14
T5	...	3.20			260	...	240	...	8	...
	3.20	25.00			260	...	240	...	10	9
Alloy 6005A										
T1	...	6.30	all		170	...	100	...	15	
T5	...	6.30	all		260	...	215	...	7	
	6.30	25.00	all		260	...	215	...	9	8
T61	...	6.30	all		260	...	240	...	8	
	6.30	25.00	all		260	...	240	...	10	9
Alloy 6013										
T6, T6511	5.00	12.50	all		340		315		8	...
	12.50	20.00	all		340		315		...	7
	20.00	50.00			340		310		...	7
Alloy 6041										
T6, T6511	10.00	50.00			310	...	275	...	10	9
Alloy 6042										

TABLE 4 *Continued*

Temper	Specified Section or Wall Thickness, mm		Area, mm ²		Tensile Strength, MPa		Yield Strength (0.2 % offset), MPa		Elongation, ^C %, min		
	over	through	over	through	min	max	min	max	in 50 mm	in 5 × diameter (5.65√A)	
T5, T5511	10.00	12.50	all		260	...	240	...	10		
	12.50	50.00	all		290	...	240	...		9	
Alloy 6061											
O	all		all		...	150	...	110	16	14	
T1	...	16.00	all		180	...	95	...	16	14	
T4	}		all		180	...	110	...	16	14	
T4510 ^E		all									
T4511 ^E											
T42 ^F	all		all		180	...	85	...	16	14	
T51	...	16.00	all		240	...	205	...	8	7	
T6, T62 ^F T6510 ^E T6511 ^E	}	...	6.30	all		260	...	240	...	8	...
		6.30	...	all		260	...	240	...	10	9
F ^D	all		all		...	...	...	...	...	...
Alloy 6063											
O	all		all		...	130	...	...	18	16
T1	...	12.50	all		115	...	60	...	12	10	
	12.50	25.00	all		110	...	55	...	...	10
T4, T42 ^F	...	12.50	all		130	...	70	...	14	12	
	12.50	25.00	all		125	...	60	...	...	12
T5	...	12.50	all		150	...	110	...	8	7	
	12.50	25.00	all		145	...	105	...	...	7
T52	...	25.00	all		150	205	110	170	8	7	
T6	...	3.20	all		205	...	170	...	8	...	
	3.20	25.00	all		205	...	170	...	10	9	
F ^D	all		all		...	...	...	...	...	...
Alloy 6064											
T6, T6511	10.00	50.00			290		240		10	9	
Alloy 6066											
O	all		all		...	200	...	125	16	14	
T4, T4510 ^E T4511 ^E	}		all		275	...	170	...	14	12	
T42		all			275	...	165	...	14	12	
T6, T6510 ^E T6511 ^E			all			345	...	310	...	8	7
T62	all	all		345	...	290	...	8	7		
Alloy 6082											
T6	5.00	25.00			310		260		8	10 ^G	
Alloy 6105											
T1	...	12.50	all		170	...	105	...	16	14	
T5	...	12.50	all		260	...	240	...	8	7	
Alloy 6162											

TABLE 4 *Continued*

Temper	Specified Section or Wall Thickness, mm		Area, mm ²		Tensile Strength, MPa		Yield Strength (0.2 % offset), MPa		Elongation, ^C %, min	
	over	through	over	through	min	max	min	max	in 50 mm	in 5 × diameter (5.65√A)
T5, T5510 ^E T5511 ^E	...	25.00	all		255	...	235	...	7	6
T6, T6510 ^E T6511 ^E	...	6.30	all		260	...	240	...	8	...
	6.30	12.50	all		260	...	240	...	10	9
Alloy 6262										
T6, T6511	all		all		260	...	240	...	10	9
Alloy 6351										
T4	...	20.00	all		220	...	130	...	16	14
T6	...	3.20	...		290	...	255	...	8	...
	3.20	25.00	...		290	...	255	...	10	9
Alloy 7075										
O	all		all		...	275	...	165	10	9
T6, T62 ^F T62510 ^E T6511 ^E	...	6.30	all		540	...	485	...	7	...
	6.30	12.50	all		560	...	505	...	7	6
	12.50	70.00	all		560	...	495	...	...	6
T73 T73510 ^E	1.60	6.30	all	13 000	470	...	400	...	7	...
	6.30	35.00	...	16 000	485	...	420	...	8	7
	35.00	70.00	...	16 000	475	...	405	...	...	7
T73511 ^E F ^D	all		all		...	...	...	...	...	...
Alloy 7178										
O	all		...	20 000	...	275	...	165	10	9
T6	...	1.60	all	...	565	...	525	...	...	...
	1.60	6.30	...	13 000	580	...	525	...	5	...
T6510 ^E	6.30	35.00	...	16 000	600	...	540	...	5	4
T6511 ^E	35.00	60.00	...	16 000	595	...	530	...	...	4
	35.00	60.00	16 000	20 000	580	...	515	...	...	4
	60.00	80.00	...	20 000	565	...	490	...	...	4
T62 ^F	...	1.60	all	13 000	545	...	505	...	...	...
	1.60	6.30	...	13 000	565	...	510	...	5	...
	6.30	35.00	...	16 000	595	...	530	...	5	4
	35.00	60.00	...	16 000	595	...	530	...	...	4
	35.00	60.00	16 000	20 000	580	...	515	...	...	4
	60.00	80.00	...	20 000	565	...	490	...	...	4
F ^D	all		all	...	...	...	...	...	...	...

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

^BTo determine conformance to this specification, each value for tensile strength and 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 E29.