



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.

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.

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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 Pipe for General Purpose Applications (Withdrawn 2012)⁴

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 for Aerospace Applications

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

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.

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

*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 ^D	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 ^E
	T6 (Drawn)	Under 1	42.0	35.0	8 ^F
		1 and over	38.0	35.0	10 ^G
6063	T6	All	30.0	25.0	8
6064 ^D	T6	All	38.0	35.0	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 ^E
	T6	All	42.0	37.0	10 ^H

^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 Tentative—Properties subject to revision.

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

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

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

^H 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	...
				260	240	8
6041 ^D	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 ^E	9
	T6 (Drawn)	Under 1	290	240	8 ^F	...
		1 and over	260	240	10 ^G	9
6063	T6	All	205	170	8	7
6064 ^D	T6	All	260	240	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 ^E	9
	T6	All	290	255	10 ^H	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 √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 Tentative, are subject to modification.

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

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

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

^H 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	50.0	...	35.0	...	12
T4510 ^E							
T4511 ^E							
T42	all	all	50.0	...	29.0	...	12
T6	}	up thru 0.499	60.0	...	53.0	...	7
T6510 ^E							
T6511 ^E							
	}	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	60.0	...	53.0	...	7
	}	0.750 and over	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	}	up thru 0.249	57.0	...	42.0	...	10
T3510 ^E							
T3511 ^E							
	}	0.250–0.749	60.0	...	44.0	...	10
	}	0.750–1.499	65.0	...	46.0	...	10
		1.500 and over	70.0	...	48.0	...	10
		over 25 thru 32	68.0	...	46.0	...	8
T42	}	up thru 0.749	57.0	...	38.0	...	12
	}	0.750–1.499	57.0	...	38.0	...	10
	}	1.500 and over	57.0	...	38.0	...	10
		over 25 thru 32	57.0	...	38.0	...	8
T81	}	0.050–0.249	64.0	...	56.0	...	4
T8510 ^E							
T8511 ^E							
	}	0.250–1.499	66.0	...	58.0	...	5
		1.500 and over	66.0	...	58.0	...	5
F ^D	all	all	...	...	...	...	...
Alloy 2219							
O	all	all	...	32.0	...	18.0	12
T31	}	up thru 0.499	42.0	...	26.0	...	14
T3510 ^E							
T3511 ^E	}	0.500–2.999	45.0	...	27.0	...	14
T62	}	Up thru 0.999	54.0	...	36.0	...	6
		1.000 and over	54.0	...	36.0	...	6

**B241/B241M – 10****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		
T81 T8510 ^E T8511 ^E	} up thru 2.999	up thru 25	58.0	...	42.0	...	6	
F ^D			all	all
Alloy 3003								
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 6041								
T6, T6511 ^F	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	

**B241/B241M – 10****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	
T4 T4510 ^E T4511 ^E	all	all	26.0	...	16.0	...	16
T42		all	26.0	...	12.0	...	16
T51		up thru 0.625	all	35.0	...	30.0	...	8
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 ^G	up thru 0.500	all	17.0	...	9.0	...	12
	0.501–1.000	all	16.0	...	8.0	...	12
T4, T42	up through 0.500	all	19.0	...	10.0	...	14
	0.501–1.000	all	18.0	...	9.0	...	14
T5	up thru 0.500	all	22.0	...	16.0	...	8
	0.501–1.000	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	all	30.0	...	25.0	...	8
	0.125–1.000	all	30.0	...	25.0	...	10
F ^D	all	all	...	...	...	...	...
Alloy 6064							
T6 T6511 ^F	0.400–2.000	all	38.0	...	35.0	...	10
Alloy 6066							
O	all	all	...	29.0	...	18.0	16
T4, T4510 ^E T4511 ^E	all	all	40.0	...	25.0	...	14
T42	all	all	40.0	...	24.0	...	14
T6, T6510, ^E T6511 ^E	all	all	50.0	...	45.0	...	8
T62	all	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 ^F	up thru 1.000	all	37.0	...	34.0	...	7
T6, T6510 ^E T6511 ^E	up thru 0.249	all	38.0	...	35.0	...	8
	0.250–0.499	all	38.0	...	35.0	...	10
Alloy 6262							

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, 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	...	42.0	...	37.0	...	8
	0.125–0749	...	42.0	...	37.0	...	10
Alloy 7075							
O	all	...	...	40.0	...	24.0	10
T6, T62	up through 0.249 0.250–0.499 0.500–1.499 1.500–2.999	all	78.0	...	70.0	...	7
T6510 ^E		all	81.0	...	73.0	...	7
T6511 ^E		all	81.0	...	72.0	...	7
		all	81.0	...	72.0	...	7
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 1.500–2.499 2.500–2.999	all	82.0	...	76.0	...	...
		up thru 20	84.0	...	76.0	...	5
		up thru 25	87.0	...	78.0	...	5
		up thru 25	86.0	...	77.0	...	5
		over 25 thru 32	84.0	...	75.0	...	5
		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 2.500–2.999	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	
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.

^FTentative, Properties subject to revision.

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

B945 Practice for Aluminum Alloy Extrusions Press Cooled from an Elevated Temperature Shaping Process for Production of T1, T2, T5 and T10–Type Tempers

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

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	all	all	60	95	15	...	25	22
H112	all	all	all	all	60	...	15	...	25	22
F ^D	all	all	all	all	...	...	...	...	...	...
Aluminum 1100										
O	all	all	all	all	75	105	20	...	25	22
H112	all	all	all	all	75	...	20	...	25	22
F ^D	all	all	all	all	...	...	...	...	...	...
Alloy 2014										
O	all	all	all	all	...	205	...	125	12	10
T4	}	all	all	all	345	...	240	...	12	10
T4510 ^E										
T4511 ^E										
T42 ^F	all	all	all	all	345	...	200	...	12	10
T6	}	}	}	}	}	}	}	}	}	}
T6510 ^E										
T6511 ^E										
T62 ^F										
F ^D	all	all	all	all	...	...	...	...	...	...
Alloy 2024										
O	all	all	all	all	...	240	...	130	12	10
T3	}	}	}	}	}	}	}	}	}	}
T3510 ^E										
T3511 ^E										
T42 ^F										
T81										
T8510 ^E										
T8511 ^E										
F ^D	all	all	all	all	...	...	...	...	...	...
Alloy 2219										
O	all	all	all	all	...	220	...	125	12	10
T31	}	}	}	}	}	}	}	}	}	}
T3510 ^E										
T3511 ^E										
T62 ^F	all	all	all	all	...	...	...	...	...	...
T81	}	}	}	}	}	}	}	}	}	}
T8510 ^E										
T8511 ^E										
F ^D	all	all	all	all	...	...	...	...	...	...
Alloy 3003										
O	all	...	all	all	95	130	35	...	25	22
H112	...	1.60	all	all	95	...	35	...	...	...
F ^D	all	...	all	all	95	...	35	...	25	22
Alclad Alloy 3003										
O	all	...	all	all	90	125	30	...	25	22
H112	all	...	all	all	90	...	30	...	25	22
F ^D	all	...	all	all	...	...	...	...	...	...

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)
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 6041										
T6, T6511 G	10.00	50.00	...		310 ^G	...	275	...	10	9
Alloy 6042										
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 T4510 ^E T4511 ^E	all		all		180	...	110	...	16	14
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



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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	12.50	25.00	all		125	...	60	...	...	12
	...	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		...	...	...	...	...	...
<i>Alloy 6064</i>											
T6, T6511 G	10.00	50.00			260		240		10	9	
<i>Alloy 6066</i>											
O	all		all		...	200	...	125	16	14	
T4, T4510 ^E T4511 ^E	}	all	all		275	...	170	...	14	12	
T42		all	all		275	...	165	...	14	12	
T6, T6510 ^E T6511 ^E		}	all	all		345	...	310	...	8	7
T62	all		all		345	...	290	...	8	7	
<i>Alloy 6082</i>											
T6	5.00	25.00			310		260		8	10 ^H	
<i>Alloy 6105</i>											
T1	...	12.50	all		170	...	105	...	16	14	
T5	...	12.50	all		260	...	240	...	8	7	
<i>Alloy 6162</i>											
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
<i>Alloy 6262</i>											
T6, T6511	all		all		260	...	240	...	10	9	
<i>Alloy 6351</i>											
T4	...	20.00	all		220	...	130	...	16	14	
T6	...	3.20	...		290	...	255	...	8	...	
	3.20	25.00	...		290	...	255	...	10	9	
<i>Alloy 7075</i>											
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 T73511 ^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	
F ^D	all		all		...	...	...	...	...
<i>Alloy 7178</i>											
O	all		...	20 000	...	275	...	165	10	9	
T6 T6510 ^E T6511 ^E	}	...	1.60	all	565	...	525	...	...	...
		1.60	6.30	...	13 000	580	...	525	...	5	...
		6.30	35.00	...	16 000	600	...	540	...	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

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)
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](#).

^CElongation in 50 mm apply for shapes tested in full section and for sheet-type specimens machined from material up through 12.5 mm in thickness having parallel surfaces. Elongations in 5 D ($5.65\sqrt{A}$), where D and A are diameter and cross-sectional area of the specimen respectively, apply to round test specimens machined from thicknesses over 6.30. See [9.1.1](#) for conditions under which measurements are not required.

^DNo mechanical properties are specified or guaranteed.

^EFor stress-relieved tempers (T3510, T3511, T4510, T4511, T5510, T5511, T6510, T6511, T73510, T73511, T76510, T76511, T8510, T8511), characteristics and properties offer than those specified may differ somewhat from the corresponding characteristics and properties of material in the basic tempers.

^FMaterial in the T42 and T62 tempers is not available from the material producers.

^GTentative, Properties subject to revision.

^HFor Table 12.1 in both ASD and ASD(M):

For purposes of harmonization, the 5D and 50 mm elongation limits were established to match extruded tube elongation values previously published in EN 755-2 [1997]. The relationship among the US customary and metric elongation values does not comply with the conversion rules of the Aluminum Association.

[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 Aluminum](#)⁵

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

[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 Storage](#)⁶

2.6 *AMS Specification:*

[AMS 2772 Heat Treatment of Aluminum Alloy Raw Materials](#)⁷

2.7 *CEN EN Standards*

[CEN EN 14242 Aluminum and Aluminum Alloys. Chemical analysis. Inductively coupled plasma optical emission spectral analysis](#)⁸

3. Terminology

3.1 *Definitions:*

3.1.1 *alclad seamless pipe or alclad seamless tube*—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 *extruded seamless round tube*—an extruded hollow product having a round cross section and a uniform wall thickness, which does not contain any line junctures resulting from method of manufacture.

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

3.1.4 *seamless pipe*—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.

3.1.5 *supplier*—jobber or distributor as distinct from producer.

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>.

⁷ Available from SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, <http://www.sae.org>.

⁸ Available from European Committee for Standardization (CEN), 36 rue de Stassart, B-1050, Brussels, Belgium, <http://www.cenorm.be>.