



Designation:B221–08 Designation: B221 – 12

Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes¹

This standard is issued under the fixed designation B221; 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. Note—Appendix and TableXI.1 updated and the year date was changed on Aug. 8, 2008.

1. Scope*

1.1 This specification² covers aluminum and aluminum-alloy extruded bars, rods, wire, profiles, and tubes in the aluminum alloys (Note 1) and tempers shown in Table 2.

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

NOTE 2—For rolled or cold-finished bar and rod refer to Specification B211, for drawn seamless tube used in pressure applications, Specification B210, for structural pipe and tube, Specification B429/B429M, and for seamless pipe and tube used in pressure applications, Specification B241/B241M.

NOTE 3—Structural pipe and tube produced in accordance with B221 is not intended for fluid-carrying applications involving pressure. Refer to either Specification B210 or B241/B241M, as appropriate, for seamless pipe and tube used in fluid-carrying applications involving pressure.

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 1 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 A complete metric companion to B221 has been developed—B221M; therefore, no metric equivalents are presented in this specification.

2. Referenced Documents

2.1 The following documents of the issue in effect on the date of material purchase, unless otherwise noted, 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

B211 Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire

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

B429/B429M Specification for Aluminum-Alloy Extruded Structural Pipe and Tube

B557 Test Methods for Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products

B594 Practice for Ultrasonic Inspection of Aluminum-Alloy Wrought Products for Aerospace Applications

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

B881 Terminology Relating to Aluminum- and Magnesium-Alloy Products

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 T10Type Tempers

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 E55Practice for Sampling Wrought

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-221 in Section HII of this Code.

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 2 Mechanical Property Limits^{A,B}

NOTE 1—Strength values shown in parentheses are for information only.

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,D}							
			min	max	min	max								
<u>Aluminum 1060^E</u>														
<u>Aluminum 1060^D</u>														
O	all	all	8.5	14.0	2.5	...	25							
H112	all	all	8.5	...	2.5	...	25							
<u>Aluminum 1100^E</u>														
<u>Aluminum 1100^D</u>														
O	all	all	11.0	15.5	3.0	...	25							
H112	all	all	11.0	...	3.0	...	25							
<u>Alloy 2014^E</u>														
<u>Alloy 2014^D</u>														
O	all	all	...	30.0	...	18.0	12							
T4	B0221-08_1	B0221-12_1	all	all	all	35.0	12							
T4510 ^E														
T4510 ^E	all	all	all	50.0	...	35.0	12							
T4511 ^E														
T4511 ^E	all	all	all	50.0	...	29.0	12							
T42 ^G														
T42 ^F	all	all	all	60.0	...	53.0	7							
T6														
T6	B0221-08_3	B0221-12_3	up through 0.499	all	all	60.0	53.0							
T6510 ^E														
T6510 ^E	all	all	up through 0.499	all	all	64.0	58.0							
T6511 ^E														
T6511 ^E	B0221-08_4	B0221-12_4	up through 25	68.0	all	64.0	58.0							
T6511 ^E														
0.750 over 25 through 32	B0221-08_5	B0221-12_5	up through 0.749	all	60.0	53.0	7							
and over														
0.750 and over	B0221-08_6	B0221-12_6	up through 25	all	60.0	53.0	7							
<u>Alloy 2024^E</u>														
<u>Alloy 2024^D</u>														
O	all	all	...	35.0	...	19.0	12							
	B0221-08_7	B0221-12_7	up through 0.249	all	57.0	42.0	12 ^H							
T3														
T3	B0221-08_8	B0221-12_8	0.250–0.749	all	60.0	44.0	12 ^H							
T3510 ^E														
T3510 ^E	0.750–1.499	B0221-08_9	0.250–0.749	all	60.0	44.0	10							
T3510 ^E														
0.750–1.499	B0221-08_9	B0221-12_9	0.750–1.499	all	65.0	46.0	10							

Nonferrous Metals and Alloys for Determination of Chemical Composition

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

TABLE 2 *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,D}
			min	max	min	max	
T3511 ^E	<u>B0221-08_9</u>	up through 25 <u>B0221-12_9</u> up through 25 over 25 through 32	70.0 up 70.0	52.0/ ... 52.0/ ^H	40	10 ...	
	<u>1.500 and over</u>	over 25 through 32	68.0	...	48.0/ ^J	...	8
	<u>1.500 and over</u>	over 25 through 32	68.0	...	48.0/ ^J	...	
	<u>B0221-08_10</u>	up through 0.749 <u>B0221-12_10</u> up through 0.749 0.750–1.499	all up all	57.0 all 57.0	38.0	38.0 ...	12 ...
T42 ^G	<u>1.500 and over</u>	<u>B0221-08_11</u>	up through 25	57.0	38.0	38.0	...
T42 ^F	<u>1.500 and over</u>	<u>B0221-12_11</u>	up through 25 over 25 through 32	57.0 57.0 57.0	38.0 38.0 38.0	38.0 38.0 38.0	10 10 8
T84	<u>B0221-08_12</u>	0.050–0.249 0.050–0.249 <u>B0221-12_12</u> 0.250–1.499	all all all	64.0 64.0 66.0	56.0 56.0 58.0	56.0 56.0 58.0	4 ...
T81				...	...	...	4
T8510 ^E				...	...	...	4
T8510 ^E	0.250–1.499			...	...	...	5
T8511 ^E	<u>1.500 and over</u>	<u>B0221-08_13</u> up through 32	all up 66.0	66.0 66.0	58.0 58.0	58.0 58.0	5
T8511 ^E	<u>1.500 and over</u>	<u>B0221-12_13</u> up through 32	up 66.0	...	58.0	58.0	5

iTEH Standards
(<https://standards.iteh.ai>)

Alloy 2219 ^E							
Alloy 2219 ^D							
O		all	all	...	32.0	...	18.0
T31		all	all	...	32.0	...	12
T3510 ^E	<u>B0221-08_13</u>	up through 0.499	up through 25	42.0 up through 25	26.0	...	14
T3510 ^E	<u>B0221-12_13</u>	up through 0.499	up through 25	42.0	...	26.0	14
T3511 ^E	0.500–2.999		up through 25	45.0	27.0	27.0	14
T3511 ^E	0.500–2.999	up through 25	up through 45.0	...	27.0	...	14
T62 ^G	<u>B0221-08_14</u>	up through 0.999	up through 25	54.0 up through 25	36.0	...	6
T62 ^F	<u>B0221-12_14</u>	up through 0.999	up through 25	54.0	...	36.0	6
T84	1.000 and over		up through 25	54.0	...	36.0	6
T81	<u>B0221-08_15</u>		up through 25	58.0	...	42.0	...
T8510 ^E	<u>B0221-12_15</u>	up through 2.999	up through 25	58.0	...	42.0	6
T8511 ^E				...	...	...	6
T8511 ^E				...	...	...	6

Alloy 3003 ^E							
Alloy 3003 ^D							
O	all	all	14.0	19.0	5.0	...	25
H112	all	all	14.0	...	5.0	...	25
Alloy Alclad 3003 ^E							
Alloy Alclad 3003 ^D							
O	all	all	13.0	18.0	4.5	...	25

TABLE 2 *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,D}
			min	max	min	max	
H112	all	all	13.0	...	4.5 ^K	...	25
H112	all	all	13.0	...	4.5 ^J	...	25
Alloy 3004 ^E							
Alloy 3004 ^D							
O	all	all	23.0	29.0	8.5	...	...
Alloy 3102							
H112 ^L	0.028–0.050	all	11.0	18.0	4.0	...	25
H112 ^K	0.028–0.050	all	11.0	18.0	4.0	...	25
Alloy 5052							
O	all	all	25.0	35.0	10.0	...	...
Alloy 5083 ^E							
Alloy 5083 ^D							
θ	up through 5.000 ^M	up through 32	39.0	51.0	16.0	...	14
O	up through 5.000 ^L	up through 32	39.0	51.0	16.0	...	14
H111	up through 5.000 ^M	up through 32	40.0	...	24.0	...	12
H111	up through 5.000 ^L	up through 32	40.0	...	24.0	...	12
H112	up through 5.000 ^M	up through 32	39.0	...	16.0	...	12
H112	up through 5.000 ^L	up through 32	39.0	...	16.0	...	12
Alloy 5086 ^E							
Alloy 5086 ^D							
θ	up through 5.000 ^M	up through 32	35.0	46.0	14.0	...	14
O	up through 5.000 ^L	up through 32	35.0	46.0	14.0	...	14
H111	up through 5.000 ^M	up through 32	36.0	...	21.0	...	12
H111	up through 5.000 ^L	up through 32	36.0	...	21.0	...	12
H112	up through 5.000 ^M	up through 32	35.0	...	14.0	...	12
H112	up through 5.000 ^L	up through 32	35.0	...	14.0	...	12
Alloy 5154							
O	all	all	30.0	41.0	11.0	...	...
H112	all	all	30.0	30.0	11.0	...	...
Alloy 5454 ^E							
Alloy 5454 ^D							
θ	up through 5.000 ^M	up through 32	31.0	41.0	12.0	...	14
O	up through 5.000 ^L	up through 32	31.0	41.0	12.0	...	14
H111	up through 5.000 ^M	up through 32	33.0	...	19.0	...	12
H111	up through 5.000 ^L	up through 32	33.0	...	19.0	...	12
H112	up through 5.000 ^M	up through 32	31.0	...	12.0	...	12
H112	up through 5.000 ^L	up through 32	31.0	...	12.0	...	12
Alloy 5456 ^E							
Alloy 5456 ^D							
θ	up through 5.000 ^M	up through 32	41.0	53.0	19.0	...	14
O	up through 5.000 ^L	up through 32	41.0	53.0	19.0	...	14
H111	up through 5.000 ^M	up through 32	42.0	...	26.0	...	12
H111	up through 5.000 ^L	up through 32	42.0	...	26.0	...	12
H112	up through 5.000 ^M	up through 32	41.0	...	19.0	...	12
H112	up through 5.000 ^L	up through 32	41.0	...	19.0	...	12
Alloy 6005							
T1	up through 0.500	all	25.0	...	15.0	...	16
T5	up through 0.124	all	38.0	...	35.0	...	8
T5	— { B0221-08_16	up through	all	38.0	...	35.0	...
		{ B0221-12_16	0.124	...	35.0	...	8
	0.125–1.000	all	38.0	...	35.0	...	10
Alloy 6005A							

TABLE 2 *Continued*

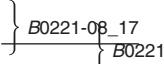
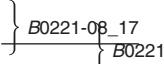
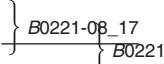
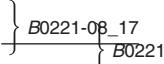
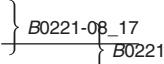
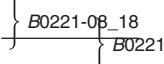
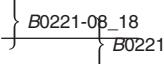
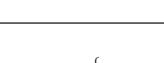
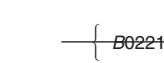
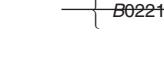
Temper	Specified Section or Wall Thickness, in.	Area, in. ²	Tensile Strength, ksi		Yield Strength (0.2 % offset), ksi		Elongation in 2 in. or 4 × Diameter, min, % ^{C,D}
			min	max	min	max	
T1	up through 0.249	all	25.0	...	14.5	...	15
T5	up through 0.249	all	38.0	...	31.0	...	7
	0.250–0.999	all	38.0	...	31.0	...	9
T61	up through 0.249	all	38.0	...	35.0	...	8
	0.250–0.999	all	38.0	...	35.0	...	10
Alloy 6060							
Alloy 6020							
T51	up through 0.125	all	22.0	...	16.0	...	40
T6511	3.250–6.000	all	38.0	...	35.0	...	10
Alloy 6041							
T6 ^M	0.400–2.000	all	45.0	...	40.0	...	10
T6511 ^M	0.400–2.000	all	45.0	...	40.0	...	10
Alloy 6042							
T5	0.400–0.499	all	38.0	...	35.0	...	10
	0.500–1.800	all	42.0	...	35.0	...	10
T5511	0.400–0.499	all	38.0	...	35.0	...	10
	0.500–1.800	all	42.0	...	35.0	...	10
Alloy 6060							
T51	up through 0.125	all	22.0	...	16.0	...	8
T61	up through 0.124	all	30.0	...	25.0	...	8
	0.125–1.000	all	30.0	...	25.0	...	10
Alloy 6061 ^E							
Alloy 6061 ^D							
O	all	all	...	22.0	...	16.0	16
T1	up through 0.625	all	26.0	...	14.0	...	16
T4	 	all	all	26.0	...	16.0	...
T4		all	26.0	...	16.0	...	16
T4510 ^E	 	all	all	26.0	...	16.0	...
T4510 ^E		all	26.0	...	16.0	...	16
T4511 ^E	 	all	all	26.0	...	16.0	...
T4511 ^E		all	26.0	...	16.0	...	16
T42 ^G	 	all	all	26.0	...	12.0	...
T42 ^F		all	26.0	...	12.0	...	16
T42 ^F	 	all	all	35.0	...	30.0	...
T51		all	35.0	...	30.0	...	8
T6, T62 ^G	 	all	all	38.0	...	35.0	...
T6, T62 ^F		all	38.0	...	35.0	...	8
T6510 ^E	 	all	all	38.0	...	35.0	...
T6511 ^E		all	38.0	...	35.0	...	8
T6511 ^E	0.250 and over	all	38.0	...	35.0	...	10
Alloy 6063							
O	all	all	...	19.0	...	...	18
T4	 	all	all	17.0	...	9.0	...
T1		all	17.0	...	9.0	...	12
T1	0.501–1.000	all	16.0	...	8.0	...	12
T4, T42 ^G	 	all	all	19.0	...	10.0	...
T4, T42 ^F		all	19.0	...	10.0	...	14
T4, T42 ^F	0.501–1.000	all	18.0	...	9.0	...	14
T5	 	all	all	22.0	...	16.0	...
T5		all	22.0	...	16.0	...	8
T5	0.501–1.000	all	21.0	...	15.0	...	8

TABLE 2 *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,D}
			min	max	min	max	
T52	up through 1.000	all	22.0	30.0	16.0	25.0	8
T54	up through 0.124	all	33.0	...	30.0	...	8
T54	<u>{ B0221-12_22</u> <u>up through</u> <u>0.124</u>	<u>all</u>	<u>33.0</u>	<u>...</u>	<u>30.0</u>	<u>...</u>	<u>8</u>
T6, T62 ^G	0.125–0.499	all	33.0	...	30.0	...	10
T6, T62 ^F	<u>{ B0221-08_23</u> <u>up through 0.124</u> <u>{ B0221-12_23</u> <u>up through</u> <u>0.124</u>	<u>all</u>	<u>30.0</u>	<u>...</u>	<u>25.0</u>	<u>...</u>	<u>8</u>
T65	0.125–1.000	all	30.0	...	25.0	...	10
	up through 0.182	all	36.0	...	33.0	...	8
Alloy 6064							
T6 ^M	0.400–2.000	all	38.0	...	35.0	...	10
T6511 ^M	0.400–2.000	all	38.0	...	35.0	...	10
Alloy 6066							
O	all	all	29.0	...	18.0	16	
T4, T4510, T4511 ^E	all	all	40.0	...	25.0	...	14
T4, T4510, T4511 ^E	all	all	40.0	...	25.0	...	14
T42 ^G	all	all	40.0	...	24.0	...	14
T42 ^F	all	all	40.0	...	24.0	...	14
T6, T6510, T6511 ^E	all	all	50.0	...	45.0	...	8
T6, T6510, T6511 ^E	all	all	50.0	...	45.0	...	8
T62 ^G	all	all	50.0	...	42.0	...	8
T62 ^F	all	all	50.0	...	42.0	...	8
Alloy 6070							
T6, T62	up through 2.999	up through 32	48.0	...	45.0	...	6
Alloy 6082							
T6, T6511	<u>{ B0221-08_24</u> <u>0.200–0.750</u>	all	45.0	...	38.0	...	6
T6, T6511	<u>{ B0221-12_24</u> <u>0.200–0.750</u> <u>0.751–6.000</u>	all	45.0	...	38.0	...	6
	6.001–8.000	all	45.0	...	38.0	...	8
Alloy 6105							
T1	up through 0.500	all	25.0	...	15.0	...	16
T5	up through 0.124	all	38.0	...	35.0	...	8
T5	<u>{ B0221-12_25</u> <u>up through</u> <u>0.124</u>	<u>all</u>	<u>38.0</u>	<u>...</u>	<u>35.0</u>	<u>...</u>	<u>8</u>
	0.125–1.000	all	38.0	...	35.0	...	10
Alloy 6162							
T5, T5510, ^F T5511 ^E	up thru 1.000	all	37.0	...	34.0	...	7
T5, T5510, ^E T5511 ^E	up thru 1.000	all	37.0	...	34.0	...	7
T6, T6510, ^F T6511 ^E	up thru 0.249	all	38.0	...	35.0	...	8
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							

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

TABLE 2 *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,D}
			min	max	min	max	
T6							
T6	B0221-08_26 B0221-12_26	all	38.0	...	35.0	...	10
T6510 ^E	B0221-08_27	all	...	38.0	...	35.0	...
T6511 ^E							16
T6510 ^E	B0221-12_27	all	...	38.0	...	35.0	...
T6511 ^E							10
Alloy 6351							
T1	up through 0.499	up through 20	26.0	...	13.0	...	15
T11	up through 0.749	all	26.0	...	16.0	...	16
T4	up through 0.749	all	32.0	...	19.0	...	16
T5	up through 0.249	all	38.0	...	35.0	...	8
	0.250–1.000	all	38.0	...	35.0	...	10
T51	0.125–1.000	all	36.0	...	33.0	...	10
T54	up through 0.500	all	30.0	...	20.0	...	10
	up through 0.124	all	42.0	...	37.0	...	8
	B0221-08_28	up through 0.124	all	42.0	...	37.0	...
T6	0.125–0.749	all	42.0	...	37.0	...	10
Alloy 6360							
T5	up through 0.250	all	22.0	...	16.0	...	8
T6	up through 0.120	all	30.0	...	25.0	...	8
	0.121–0.250	all	30.0	...	25.0	...	10
Alloy 6463							
T1	up through 0.500	up through 20	17.0	...	9.0	...	12
T5	up through 0.500	up through 20	22.0	...	16.0	...	8
T6	up through 0.124	up through 20	30.0	...	25.0	...	8
T6	B0221-08_29	up through 20	30.0	...	25.0	...	8
	B0221-12_29	up through 20	30.0	...	25.0	...	8
	0.125–0.500	up through 20	30.0	...	25.0	...	10
ASTM B221-12							
https://standards.iteh.ai/catalog/standards/sisi/cd80/09b4-324a-432c-b1da-b92361a0a8c4 ASTM B221-12							
Alloy 6560							
T5	0.090–0.125	all	22.0	...	16.0	...	8
T6	0.090–0.125	all	30.0	...	25.0	...	8
Alloy 7005							
T53	up through 0.750	all	50.0	...	44.0	...	10
Alloy 7075 ^E							
Alloy 7075 ^D							
O	all	all	...	40.0	...	24.0	10

E1251 Test Method for Analysis of Aluminum and Aluminum Alloys by Spark Atomic Emission Spectrometry

G34 Test Method for Exfoliation Corrosion Susceptibility in 2XXX and 7XXX Series Aluminum Alloys (EXCO Test)

G47 Test Method for Determining Susceptibility to Stress-Corrosion Cracking of 2XXX and 7XXX Aluminum Alloy Products

Method of Test for Exfoliation Corrosion Susceptibility in 7XXX Series Copper-Containing Aluminum Alloys (EXCO Test) (G 34-72) Test Method for Determining Susceptibility to Stress-Corrosion Cracking of 2XXX and 7XXX Aluminum Alloy Products

2.3 ANSI Standards:⁴

H35.1 ANSI H35.1/H35.1M Alloy and Temper Designation Systems for Aluminum

H35.2 Dimensional Tolerances for Aluminum Mill Products

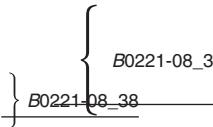
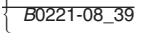
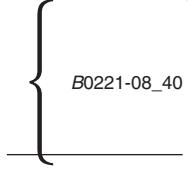
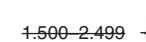
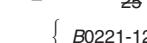
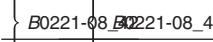
⁴The applicable edition in the use of this specification is G34-72, which is available in the gray pages of the Annual Book of ASTM Standards, Vol 02.02.

⁴ Available from Aluminum Association, Inc., 1525 Wilson Blvd., Suite 600, Arlington, VA 22209, <http://www.aluminum.org>.

TABLE 2 *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,D}	
			min	max	min	max		
T6, T62 ^G	B0221-08_30	up through 0.249	all	78.0	...	70.0	...	7
T6, T62 ^F	B0221-08_31	up through 0.249	all	78.0	...	70.0	...	7
T6510 ^E	0.500–1.499	0.500–1.499	all	81.0	...	73.0	...	7
T6510 ^E	1.500–2.999	0.500–1.499	all	81.0	...	72.0	...	7
T6511 ^E	1.500–2.999	1.500–2.999	all	81.0	...	72.0	...	7
	3.000–4.499	B0221-08_32	up through 20	81.0	...	71.0	...	7
T6511 ^E	3.000–4.499	up through 20	81.0	...	71.0	...	7	7
	3.000–4.499	over 20	78.0	...	70.0	...	6	7
	4.500–5.000	through 32	78.0	...	68.0	...	6	7
	4.500–5.000	up through 32	78.0	...	68.0	...	6	7
T73	B0221-08_33	0.062–0.249	up through 20	68.0	...	58.0	...	7
T73	B0221-08_34	0.062–0.249	up through 20	68.0	...	58.0	...	7
T73510 ^E	B0221-12_33	0.250–1.499	up through 25	70.0	...	61.0	...	8
T73510 ^E	B0221-12_34	0.250–1.499	up through 25	70.0	...	61.0	...	8
T73510 ^E	0.250–1.499	up through 25	70.0	...	61.0	...	8	8
T73511 ^E	1.500–2.999	up through 25	69.0	...	59.0	...	8	8
T73511 ^E	1.500–2.999	up through 25	69.0	...	59.0	...	8	8
	3.000–4.499	up through 20	68.0	...	57.0	...	7	7
	3.000–4.499	over 20 through 32	65.0	...	55.0	...	7	7
T76	B0221-08_35	up through 0.049	all	73.0	...	63.0	...	7
T76	B0221-08_36	up through 0.049	all	73.0	...	63.0	...	7
T76510 ^F	B0221-12_35	0.050–0.124	all	74.0	...	64.0	...	7
T76510 ^F	B0221-12_36	0.050–0.124	all	74.0	...	64.0	...	7
T76510 ^F	0.125–0.249	up through 20	74.0	...	64.0	...	7	7
T76511 ^E	0.250–0.499	up through 20	75.0	...	65.0	...	7	7
T76511 ^E	0.250–0.499	up through 20	75.0	...	65.0	...	7	7
	0.500–1.000	up through 20	75.0	...	65.0	...	7	7
	1.001–2.000	up through 20	75.0	...	65.0	...	7	7
	2.001–3.000	up through 20	74.0	...	64.0	...	7	7
	3.001–4.000	up through 20	74.0	...	63.0	...	7	7
Alloy 7116								
T5	0.125–0.500	all	48.0	...	42.0	...	8	
Alloy 7129								
T5, T6	up through 0.500	all	55.0	...	49.0	...	9	

TABLE 2 *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,D}			
			min	max	min	max				
<u>Alloy 7178^E</u>										
<u>Alloy 7178^D</u>										
O	all	up through 32	...	40.0	...	24.0	10			
		up through 0.061	up through 20	82.0	...	76.0	...			
T6	 B0221-08_38	0.062–0.249 0.062–0.249	up through 20 up through 20	84.0 84.0	...	76.0 76.0	5 5			
T6		0.250–1.499	up through 25	87.0	...	78.0	...			
T6510 ^E					86.0	...	77.0			
T6510 ^E		1.500–2.499	up through 25 up through 25	86.0	...	77.0	...			
T6511 ^E	over 25 through 32	84.0	over 25 through 32 75.0	75.0	...	5				
T6511 ^E			75.0	5						
	2.500–2.999	up through 32	82.0	71.0	...	5				
		up through 0.061	up through 20	79.0 79.0	73.0	73.0	5			
	 B0221-08_40	0.062–0.249 0.062–0.249 0.250–1.499	up through 20 up through 25	82.0 86.0	...	74.0 77.0	...			
T62 ^G		1.500–2.499	 B0221-08_41	86.0	...	77.0	5			
T62 ^F		1.500–2.499	 B0221-12_41	up through 25 up through 25	86.0	...	77.0			
	over 25 through 32	84.0		75.0	...	5				
	2.500–2.999	up through 32	82.0	71.0	...	5				
T76	 B0221-08_43	0.125–0.249 0.125–0.249	up through 20 up through 20	76.0 76.0	66.0	66.0	7			
T76					...	...		
T76510 ^E		0.250–0.499		77.0	...	67.0	7			
T76510 ^E	0.250–0.499	up through 20	77.0	67.0	...	67.0	7			
T76511 ^E	0.500–1.000	up through 20	77.0	67.0	...	67.0	7			
T76511 ^E	0.500–1.000	up through 20	77.0	67.0	...	67.0	7			

^A The basis for establishment of tensile property limits is shown in Annex A1.^B To determine conformance to this specification, each value shall be rounded to the nearest 0.1 ksi for strength and nearest 0.5 % for elongation 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. Elongation of cut-out round specimens is measured in 4× specimen diameter. ^D See 8.1.1 and 8.1.2 for conditions under which measurements are not required.