Designation: B221 – 14

Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes[1]

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 U.S. Department of Defense.

1. Scope*

1.1 This specification[2] 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—Pipe and tube products listed in this specification are intended for general purpose applications. This specification may not address the manufacturing processes, integrity testing, and verification required for fluid-carrying applications involving pressure. See Specifications B210 or B241/B241M, or both as appropriate, for seamless pipe and tube used in fluid-carrying applications involving pressure. See Specification B234, as appropriate, for use in surface condensers, evaporators, and heat exchangers.

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 Specification B221 has been developed—Specification 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

B234 Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes for Condensers and Heat Exchangers

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

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 T10–Type 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

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

E607 Test Method for Atomic Emission Spectrometric

[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 II 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**

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
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

2.3 *ANSI Standards:*[5]

ANSI H35.1/H35.1M Alloy and Temper Designation Systems for Aluminum
ANSI H35.2 Dimensional Tolerances for Aluminum Mill Products

2.4 *Federal Standard:*[6]

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

2.5 *Military Standard:*[6]

MIL-STD-129 Marking for Shipment and Storage

2.6 *AMS Specification:*[7]

AMS 2772 Heat Treatment of Aluminum Alloy Raw Materials

2.7 *CEN Standard:*[8]

EN 14242 Aluminium and Aluminium Alloys—Chemical Analysis—Inductively Coupled Plasma Optical Emission Spectral Analysis

3. Terminology

3.1 *Definitions*—Refer to Terminology B881 for definitions of product terms used in this specification.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *capable of*—The term *capable of* as used in this specification means that the test need not be performed by the producer of the material. However, should subsequent testing by the purchaser establish that the material does not meet these requirements, the material shall be subject to rejection.

4. Ordering Information

4.1 Orders for material to this specification shall include the following information:

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

4.1.2 Quantity in pieces or pounds.

4.1.3 Alloy (Section 7 and Table 1).

4.1.4 Temper (Section 8 and Table 2).

4.1.5 Nominal cross-sectional dimensions as follows:

4.1.5.1 For rod and round wire: diameter.

4.1.5.2 For square-cornered bar and wire: depth and width.

4.1.5.3 For sharp-cornered hexagonal or octagonal bar and wire: distance across flats.

4.1.5.4 For round tube: outside or inside diameter and wall thickness.

4.1.5.5 For square or sharp-cornered tube other than round: distance across flats and wall thickness.

4.1.5.6 For round-cornered bars, profiles, tube other than round, square, rectangular, hexagonal, or octagonal with sharp corners: drawing required.

4.1.6 Length.

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

4.2.1 Whether solution treatment at the press is unacceptable (9.3).

4.2.2 Whether heat treatment in accordance with Practice B918 is required (9.4).

4.2.3 Whether ultrasonic inspection is required (Section 17, Table 3).

4.2.4 Whether inspection or witness of inspection and tests by the purchaser's representative is required prior to material shipment (Section 18).

4.2.5 Whether certification is required (Section 22).

4.2.6 Whether marking for identification is required in accordance with Practice B666/B666M, Section 20.

4.2.7 Whether Practice B660 applies and, if so, the levels of preservation, packaging, and packing required (21.3).

4.2.8 Requirements for tensile property and dimensional tolerance for sizes not specifically covered (8.1.3 and 15.1.1).

4.2.9 Whether Titanium and Zirconium algorithm is allowed as shown in Table 1 (Footnote G), when ordering 2014 or 2024.

4.2.10 Whether Titanium and Zirconium algorithm is allowed as shown in Table 1 (Footnote N), when ordering 7075.

5. Materials and Manufacture

5.1 The products covered by this specification shall be produced by the hot extrusion method or by similar methods at the option of the producer, provided that the resulting products comply with the requirements in this specification.

6. Quality Assurance

6.1 *Responsibility for Inspection and Tests*—Unless otherwise specified in the contract or purchase order, the producer is responsible for the performance of all inspection and test requirements specified herein. The producer may use his own or any other suitable facilities for the performance of the inspection and test requirements specified herein, unless disapproved by the purchaser in the order or at the time of contract signing. The purchaser shall have the right to perform any of the inspections and tests set forth in this specification where such inspections are deemed necessary to ensure that material conforms to prescribed requirements.

[4] The 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://www.dodssp.daps.mil.

[7] Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, http://www.sae.org.

[8] Available from European Committee for Standardization (CEN), Avenue Marnix 17, B-1000, Brussels, Belgium, http://www.cen.eu.

TABLE 1 Chemical Composition Limits [A,B,C]

NOTE 1—In case of a discrepancy between the values listed in Table 2 and 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" should be considered the controlling composition. The "Teal Sheets" are available at http://www.aluminum.org/tealsheets.

Alloy	Silicon	Iron	Copper	Manganese	Magnesium	Chromium	Zinc	Titanium	Vanadium	Other Elements[D]		Aluminum
										Each	Total[E]	
1060	0.25	0.35	0.05	0.03	0.03	...	0.05	0.03	0.05	0.03	...	99.60 min[F]
1100	0.95 Si + Fe		0.05–0.20	0.05	...	...	0.10	...	...	0.05[G]	0.15	99.00 min[F]
2014	0.50–1.2	0.7	3.9–5.0	0.40–1.2	0.20–0.8	0.10	0.25	0.15[H]	...	0.05[H]	0.15	remainder
2024	0.50	0.50	3.8–4.9	0.30–0.9	1.2–1.8	0.10	0.25	0.15[H]	...	0.05[H]	0.15	remainder
2219	0.20	0.30	5.8–6.8	0.20–0.40	0.02	...	0.10	0.02–0.10	0.05–0.15	0.05[I]	0.15[I]	remainder
3003	0.6	0.7	0.05–0.20	1.0–1.5	...	...	0.10	...	...	0.05	0.15	remainder
Alclad 3003	...	3003 Clad with 7072 alloy		...	...	...	...	...	...	...	...	...
3004	0.30	0.7	0.25	1.0–1.5	0.8–1.3	...	0.25	...	...	0.05	0.15	remainder
3102	0.40	0.7	0.10	0.05–0.40	...	...	0.30	0.10	...	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
5083	0.40	0.40	0.10	0.40–1.0	4.0–4.9	0.05–0.25	0.25	0.15	...	0.05	0.15	remainder
5086	0.40	0.50	0.10	0.20–0.7	3.5–4.5	0.05–0.25	0.25	0.15	...	0.05	0.15	remainder
5154	0.25	0.40	0.10	0.10	3.1–3.9	0.15–0.35	0.20	0.20	...	0.05[G]	0.15	remainder
5454	0.25	0.40	0.10	0.50–1.0	2.4–3.0	0.05–0.20	0.25	0.20	...	0.05	0.15	remainder
5456	0.25	0.40	0.10	0.50–1.0	4.7–5.5	0.05–0.20	0.25	0.20	...	0.05	0.15	remainder
6005	0.6–0.9	0.35	0.10	0.10	0.40–0.6	0.10	0.10	0.10	...	0.05	0.15	remainder
6005A	0.50–0.9	0.35	0.30	0.50[J]	0.40–0.7	0.30[J]	0.20	0.10	...	0.05	0.15	remainder
6013	0.6-1.0	0.50	0.6-1.1	0.20-0.8	0.8-1.2	0.10	0.25	0.10	...	0.05	0.15	remainder
6020[K]	0.40-0.9	0.50	0.30-0.9	0.35	0.6-1.2	0.15	0.20	0.15	...	0.05	0.15	remainder
6041[L]	0.50-0.9	0.15-0.7	0.15-0.6	0.05-0.20	0.8-1.2	0.05-0.15	0.25	0.15	...	0.05	0.15	remainder
6042[M]	0.50-1.2	0.7	0.20-0.6	0.40	0.7-1.2	0.04-0.35	0.25	0.15	...	0.05	0.15	remainder
6060	0.30–0.6	0.10–0.30	0.10	0.10	0.35–0.6	0.5	0.15	0.10	...	0.05	0.15	remainder
6061[N]	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
6064[O]	0.40-0.8	0.7	0.15-0.40	0.15	0.8-1.2	0.05-0.14	0.25	0.15	...	0.05	0.15	remainder
6066	0.9–1.8	0.50	0.7–1.2	0.6–1.1	0.8–1.4	0.40	0.25	0.20	...	0.05	0.15	remainder
6070	1.0–1.7	0.50	0.15–0.40	0.40–1.0	0.50–1.2	0.10	0.25	0.15	...	0.05	0.15	remainder
6082	0.7–1.3	0.50	0.10	0.40–1.0	0.6–1.2	0.25	0.20	0.10	...	0.05	0.15	remainder
6105	0.6–1.0	0.35	0.10	0.15	0.45–0.8	0.10	0.10	0.10	...	0.05	0.15	remainder
6162	0.40–0.8	0.50	0.20	0.10	0.7–1.1	0.10	0.25	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[P]	0.15[P]	remainder
6351	0.7–1.3	0.50	0.10	0.40–0.8	0.40–0.8	...	0.20	0.20	...	0.05	0.15	remainder
6360	0.35-0.8	0.10-0.30	0.15	0.02-0.15	0.25-0.45	0.05	0.10	0.10	...	0.05	0.15	remainder
6463	0.20–0.6	0.15	0.20	0.05	0.45–0.9	...	0.05	...	...	0.05	0.15	remainder
6560	0.30–0.7	0.10–0.30	0.05–0.20	0.20	0.20–0.6	0.05	0.15	0.10	...	0.05	0.15	remainder
7005	0.35	0.40	0.10	0.20–0.7	1.0–1.8	0.06–0.20	4.0–5.0	0.01–0.06	...	0.05[Q]	0.15[Q]	remainder
7072[R]	0.7 Si + Fe		0.10	0.10	0.10	...	0.8–1.3	...	...			remainder
7075	0.40	0.50	1.2–2.0	0.30	2.1–2.9	0.18–0.28	5.1–6.1	0.20[S]	...	0.05[S]	0.15	remainder
7116	0.15	0.30	0.50–1.1	0.05	0.8–1.4	...	4.2–5.2	0.05	0.05	0.05[T]	0.15	remainder
7129	0.15	0.30	0.50–0.9	0.10	1.3–2.0	0.10	4.2–5.2	0.05	0.05	0.05[T]	0.15	remainder
7178	0.40	0.50	1.6–2.4	0.30	2.4–3.1	0.18–0.28	6.3–7.3	0.20	...	0.05	0.15	remainder

[A] Limits are in weight percent maximum unless shown as a range, or stated otherwise.
[B] Analysis shall be made for the elements for which limits are shown in this table.
[C] For the purpose of determining conformance to these limits, an observed value or a calculated value obtained from analysis shall be rounded to the nearest unit in the last right-hand place of the figures used in expressing the specified limit, in accordance with the rounding-off method of Practice E29.
[D] *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 the 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.
[E] *Other Elements*—Total shall be the sum of unspecified metallic elements 0.010 % or more, rounded to the second decimal before determining the sum.
[F] The aluminum content shall be calculated by subtracting from 100.00 % the sum of all metallic elements present in amounts of 0.010 % or more each, rounded to the second decimal before determining the sum.
[G] Be 0.0003 max for welding electrode, welding rod, and filler wire.
[H] Upon agreement between the purchaser and the producer or supplier, a Zr + Ti limit of 0.20 % max is permitted. Properties in Specification (Table 2) are not based on the Zirconium and Titanium algorithm.
[I] Zirconium, 0.10–0.25 %. The total for other elements does not include zirconium.
[J] Manganese plus chromium shall total 0.12–0.50.
[K] Lead 0.05 % max, Tin 0.9-1.5 %.
[L] Bismuth 0.30-0.9 %, Tin 0.35-1.2 %.
[M] Bismuth 0.20-0.8 % Lead 0.15-0.40 %.
[N] In 1965 the requirements for 6062 were combined with those for 6061 by revising the minimum chromium from "0.15 %" to" 0.04 %." This action cancelled alloy 6062.
[O] Bismuth 0.50-0.7 %, Lead 0.20-0.40 %,
[P] Bismuth and lead shall be 0.40–0.7 % each.
[Q] Zirconium 0.08–0.20 %. The total for other elements does not include zirconium.
[R] Composition of cladding alloy applied during the course of manufacture. Samples from finished tube shall not be required to conform to these limits.
[S] Upon agreement between the purchaser and the producer or supplier, a Zr + Ti limit of 0.25 % max is permitted. Properties in Specification (Table 2) are not based on the Zirconium and Titanium algorithm.
[T] Gallium 0.03 % max.

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]
			min	max	min	max	
Aluminum 1060[D]							
O	all	all	8.5	14.0	2.5	. . .	25
H112	all	all	8.5	. . .	2.5	. . .	25
Aluminum 1100[D]							
O	all	all	11.0	15.5	3.0	. . .	25
H112	all	all	11.0	. . .	3.0	. . .	25
Alloy 2014[D]							
O	all	all	. . .	30.0	. . .	18.0	12
T4 T4510[E] T4511[E]	all	all	50.0	. . .	35.0	. . .	12
T42[F]	all	all	50.0	. . .	29.0	. . .	12
T6	up through 0.499	all	60.0	. . .	53.0	. . .	7
T6510[E]	0.500–0.749	all	64.0	. . .	58.0	. . .	7
T6511[E]	0.750 and over	up through 25	68.0	. . .	60.0	. . .	7
		over 25 through 32	68.0	. . .	58.0	. . .	6
T62[F]	up through 0.749	all	60.0	. . .	53.0	. . .	7
	0.750 and over	up through 25	60.0	. . .	53.0	. . .	7
		over 25 through 32	60.0	. . .	53.0	. . .	6
Alloy 2024[D]							
O	all	all	. . .	35.0	. . .	19.0	12
T3	up through 0.249	all	57.0	. . .	42.0	. . .	12[G]
T3510[E]	0.250–0.749	all	60.0	. . .	44.0	. . .	12[G]
T3511[E]	0.750–1.499	all	65.0	. . .	46.0	. . .	10
		up through 25	70.0	. . .	52.0[H]	. . .	10
	1.500 and over	over 25 through 32	68.0	. . .	48.0[I]	. . .	8
T42[F]	up through 0.749	all	57.0	. . .	38.0	. . .	12
	0.750–1.499	all	57.0	. . .	38.0	. . .	10
	1.500 and over	up through 25	57.0	. . .	38.0	. . .	10
		over 25 through 32	57.0	. . .	38.0	. . .	8
T81	0.050–0.249	all	64.0	. . .	56.0	. . .	4
T8510[E]	0.250–1.499	all	66.0	. . .	58.0	. . .	5
T8511[E]	1.500 and over	up through 32	66.0	. . .	58.0	. . .	5
Alloy 2219[D]							
O	all	all	. . .	32.0	. . .	18.0	12
T31 T3510[E] T3511[E]	up through 0.499	up through 25	42.0	. . .	26.0	. . .	14
	0.500–2.999	up through 25	45.0	. . .	27.0	. . .	14
T62[F]	up through 0.999	up through 25	54.0	. . .	36.0	. . .	6
	1.000 and over	up through 25	54.0	. . .	36.0	. . .	6

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}
			min	max	min	max	
T81 T8510^E T8511^E	up through 2.999	up through 25	58.0	. . .	42.0	. . .	6
		Alloy 3003^D					
O	all	all	14.0	19.0	5.0	. . .	25
H112	all	all	14.0	. . .	5.0	. . .	25
		Alloy Alclad 3003^D					
O	all	all	13.0	18.0	4.5	. . .	25
H112	all	all	13.0	. . .	4.5^J	. . .	25
		Alloy 3004^D					
O	all	all	23.0	29.0	8.5	. . .	. . .
		Alloy 3102					
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^D					
O	up through 5.000^L	up through 32	39.0	51.0	16.0	. . .	14
H111	up through 5.000^L	up through 32	40.0	. . .	24.0	. . .	12
H112	up through 5.000^L	up through 32	39.0	. . .	16.0	. . .	12
		Alloy 5086^D					
O	up through 5.000^L	up through 32	35.0	46.0	14.0	. . .	14
H111	up through 5.000^L	up through 32	36.0	. . .	21.0	. . .	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	. . .	11.0	. . .	. . .
		Alloy 5454^D					
O	up through 5.000^L	up through 32	31.0	41.0	12.0	. . .	14
H111	up through 5.000^L	up through 32	33.0	. . .	19.0	. . .	12
H112	up through 5.000^L	up through 32	31.0	. . .	12.0	. . .	12
		Alloy 5456^D					
O	up through 5.000^L	up through 32	41.0	53.0	19.0	. . .	14
H111	up through 5.000^L	up through 32	42.0	. . .	26.0	. . .	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
	0.125–1.000	all	38.0	. . .	35.0	. . .	10
		Alloy 6005A					
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
	0.250–1.000	all	38.0	. . .	35.0	. . .	10
		Alloy 6013					
T6	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
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 6020					
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		30.0	...	25.0	...	8
	0.125–1.000		30.0	...	25.0	...	10

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}
			min	max	min	max	
		Alloy 6061^D					
O	all	all	. . .	22.0	. . .	16.0	16
T1	up through 0.625	all	26.0	. . .	14.0	. . .	16
T4 T4510^E T4511^E	all	all	26.0	. . .	16.0	. . .	16
T42^F	all	all	26.0	. . .	12.0	. . .	16
T51	up through 0.625	all	35.0	. . .	30.0	. . .	8
T6, T62^F T6510^E	up through 0.249	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
T1	up through 0.500	all	17.0	. . .	9.0	. . .	12
	0.501–1.000	all	16.0	. . .	8.0	. . .	12
T4, T42^F	up through 0.500	all	19.0	. . .	10.0	. . .	14
	0.501–1.000	all	18.0	. . .	9.0	. . .	14
T5	up through 0.500	all	22.0	. . .	16.0	. . .	8
	0.501–1.000	all	21.0	. . .	15.0	. . .	8
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
	0.125–0.499	all	33.0	...	30.0	...	10
T6, T62^F	up through 0.124	all	30.0	. . .	25.0	. . .	8
	0.125–1.000	all	30.0	. . .	25.0	. . .	10
T65	up through 0.182	all	36.0	. . .	33.0	. . .	8
		Alloy 6064					
T6	0.180-3.250	all	42.0	. . .	38.0	. . .	10
T6511	0.180-3.250	all	42.0	. . .	38.0	. . .	10
		Alloy 6066					
O	all	all		29.0	. . .	18.0	16
T4, T4510, T4511^E	all	all	40.0	. . .	25.0	. . .	14
T42^F	all	all	40.0	. . .	24.0	. . .	14
T6, T6510, T6511^E	all	all	50.0	. . .	45.0	. . .	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	0.200–0.750	all	45.0	...	38.0	...	6
	0.751–6.000	all	45.0	....	38.0	....	8
	6.001–8.000	all	41.0	...	35.0	...	6
		Alloy 6105					
T1	up through 0.500	all	25.0	. . .	15.0	. . .	16
T5	up through 0.124	all	38.0	. . .	35.0	. . .	8
	0.125–1.000	all	38.0	. . .	35.0	. . .	10
		Alloy 6162					
T5, T5510,^{E} T5511^E	up thru 1.000	all	37.0	. . .	34.0	. . .	7