Designation: B221M – 12

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

This standard is issued under the fixed designation B221M; 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 specification covers aluminum and aluminum-alloy extruded bars, rods, wires, 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 bars and rods refer to Specification B211M, for drawn seamless tube used in pressure applications, Specification B210M, 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 this specification is not intended for fluid-carrying applications involving pressure. Refer to either Specification B210M 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 This specification is the metric counterpart of Specification B221.

1.5 The values stated in SI are to be regarded as standard. No other units of measurement are included in this specification.

2. Referenced Documents

2.1 The following documents of the issue in effect on the date of material purchase form a part of this specification to the extent referenced herein:

2.2 *ASTM Standards:*[2]

B210M Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes (Metric)

B211M Specification for Aluminum and Aluminum-Alloy Rolled or Cold-Finished Bar, Rod, and Wire (Metric)

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

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

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 Analysis Aluminum Alloys by the Point to Plane Technique Nitrogen Atmosphere (Withdrawn 2011)[3]

[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 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.

[3] 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 Chemical Composition Limits [A,B,C]

NOTE 1—In case of a discrepancy between the values listed in Table 1 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	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
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-.040 %,
[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.

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:*[4]
H35.1/H35.1(M) Alloy and Temper Designation Systems for Aluminum
H35.2(M) Dimensional Tolerances for Aluminum Mill Products

2.4 *ISO Standards:*[4]
ISO 209-1 Wrought Aluminum and Aluminum Alloys-Chemical Composition and Forms of Product
ISO 2107 Aluminum, Magnesium and their Alloys-Temper Designation
ISO 6362-2 Wrought Aluminum and Aluminum Alloy Extruded Rod/Bar, Tube, and Profile—Mechanical Properties

2.5 *Federal Standard:*[5]
Fed. Std. No. 123 Marking for Shipment (Civil Agencies)

2.6 *Military Standard:*[5]
MIL-STD-129 Marking for Shipment and Storage

2.7 *AMS Specification:*[6]
AMS 2772 Heat Treatment of Aluminum Alloy Raw Materials

2.8 *Other Standards:*
CEN EN 14242 Aluminium and Aluminium Alloys–Chemical Analysis–Inductively Coupled Plasma Optical Emission Spectral Analysis[7]

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

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

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

[7] Available from European Committee for Standardization, Central Secretariat (CEN), rue de Stassart 36, B1050 Brussels, Belgium. http://www.cen.eu/esearch.

TABLE 2 Tensile Property Limits[A,B]

Temper	Specified Section or Wall Thickness, mm		Area, mm²		Tensile Strength, MPa		Yield Strength (0.2 % offset), MPa		Elongation,[C] %, min	
	over	incl	over	incl	min	max	min	max	in 50 mm	in 5 × Diameter ($5.65\sqrt{A}$)
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		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

TABLE 2 *Continued*

Temper	Specified Section or Wall Thickness, mm		Area, mm^2		Tensile Strength, MPa		Yield Strength (0.2 % offset), MPa		Elongation,[C] %, min	
	over	incl	over	incl	min	max	min	max	in 50 mm	in 5 × Diameter ($5.65\sqrt{A}$)
T3	. . .	6.30	all		395	. . .	290	. . .	12[G]	. . .
T3510[E]	6.30	18.00	all		415	. . .	305	. . .	12[G]	10[G]
T3511[E]	18.00	35.00	all		450	. . .	315	. . .	. . .	9
	35.00	. . .	. . .	16 000	485	. . .	360[H]	. . .	. . .	9
	35.00	. . .	16 000	20 000	470	. . .	330[I]	. . .	. . .	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
T62[F]	. . .	25.00	. . .	16 000	370	. . .	250	. . .	6	5
	25.00		. . .	20 000	370	. . .	250	. . .	. . .	5
T81										
T8510[E]	. . .	80.00	. . .	16 000	400	. . .	290	. . .	6	5
T8511[E]										
F[D]	all		all		. . .	. . .	. . .	. . .	. . .	. . .
Alloy 3003										
O	all		all		95	130	35	. . .	25	22
H112	all		all		95	. . .	35	. . .	25	22
F[D]	all		all		. . .	. . .	. . .	. . .	. . .	. . .
Alclad Alloy 3003										
O	all	all	all		90	125	30	. . .	25	. . .
H112	all				90	. . .	30[J]	. . .	25	. . .
Alloy 3004										
O	all		all		160	200	60	. . .	. . .	. . .
F[D]	all		all		. . .	. . .	. . .	. . .	. . .	. . .
Alloy 3102										
H112[K]	0.70	1.30	all		75	125	30	. . .	25	. . .
Alloy 5052										
O	all		all		170	240	70	. . .	. . .	. . .
Alloy 5083										
O	. . .	130.00[L]	. . .	20 000	270	350	110	. . .	14	12
H111	. . .	130.00[L]	. . .	20 000	275	. . .	165	. . .	12	10
H112	. . .	130.00[L]	. . .	20 000	270	. . .	110	. . .	12	10
F[D]	all		all		. . .	. . .	. . .	. . .	. . .	. . .
Alloy 5086										
O	. . .	130.00[L]	. . .	20 000	240	315	95	. . .	14	12
H111	. . .	130.00[L]	. . .	20 000	250	. . .	145	. . .	12	10
H112	. . .	130.00[L]	. . .	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	. . .	130.00[L]	. . .	20 000	215	285	85	. . .	14	12
H111	. . .	130.00[L]	. . .	20 000	230	. . .	130	. . .	12	10
H112	. . .	130.00[L]	. . .	20 000	215	. . .	85	. . .	12	10
F[D]	all		all		. . .	. . .	. . .	. . .	. . .	. . .
Alloy 5456										
O	. . .	130.00[L]	. . .	20 000	285	365	130	. . .	14	12
H111	. . .	130.00[L]	. . .	20 000	290	. . .	180	. . .	12	10

TABLE 2 *Continued*

Temper	Specified Section or Wall Thickness, mm		Area, mm^2		Tensile Strength, MPa		Yield Strength (0.2 % offset), MPa		Elongation,[C] %, min	
	over	incl	over	incl	min	max	min	max	in 50 mm	in 5 × Diameter ($5.65\sqrt{A}$)
H112	. . .	130.00[L]	. . .	20 000	285	. . .	130	. . .	12	10
F[D]	all		all		. . .	. . .	. . .	. . .	. . .	. . .
Alloy 6005										
T1	. . .	12.50	all		170	. . .	105	. . .	16	14
T5	. . .	3.20	all		260	. . .	240	. . .	8	. . .
	3.20	25.00	all		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 6020										
T6511	80.00	160.00	all		260	. . .	240	. . .	. . .	9
Alloy 6041										
T6[M]	10.00	50.00	all		310	. . .	275	. . .	10	9
T6511[M]	10.00	50.00	all		310	. . .	275	. . .	10	9
Alloy 6042										
T5	10.00	12.50	all		260	. . .	240	. . .	10	. . .
	12.50	50.00	all		290	. . .	240	. . .	. . .	9
T551	10.00	12.50	all		260	. . .	240	. . .	10	. . .
	12.50	50.00	all		290	. . .	240	. . .	. . .	9
Alloy 6060										
T51	. . .	3.20	all		150	. . .	110	. . .	8	. . .
T61	. . .	3.20	all		205	. . .	170	. . .	8	. . .
	3.20	25.00	all		205	. . .	170	. . .	10	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], T4511[E]	all									
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
T54	. . .	3.20	all		225	. . .	205	. . .	8	. . .
	3.20	12.50	all		225	. . .	205	. . .	10	. . .
T6, T62[K,F]	. . .	3.20	all		205	. . .	170	. . .	8	. . .
	3.20	25.00	all		205	. . .	170	. . .	10	9
T65	. . .	5.00	all		250	. . .	230	. . .	7	. . .
Alloy 6064										
T6[M]	10.00	50.00	all		260	. . .	240	. . .	10	9
T6511[M]	10.00	50.00	all		260	. . .	240	. . .	10	9
Alloy 6066										
O	all		all		. . .	200	. . .	125	16	14
T4			all		275	. . .	170	. . .	14	12
T4510[E], T4511[E]	all									
T42[F]	all		all		275	. . .	165	. . .	14	12

TABLE 2 *Continued*

Temper	Specified Section or Wall Thickness, mm		Area, mm^2		Tensile Strength, MPa		Yield Strength (0.2 % offset), MPa		Elongation,[C] %, min	
	over	incl	over	incl	min	max	min	max	in 50 mm	in 5 × Diameter ($5.65\sqrt{A}$)
T6			all		345	. . .	310	. . .	8	7
T6510[E]	all									
T6511[E]										
T62[F]	all		all		345	. . .	290	. . .	8	7
Alloy 6070										
T6, T62[F]	. . .	80.00	. . .	20 000	330	. . .	310	. . .	6	5
Alloy 6082										
T6	5.00	20.00	all		310	...	260	...	6	8
T6511	20.00	150.00	all		310	...	260	...		8
	150.00	200.00	all		280	...	240	...		8
Alloy 6105										
T1	. . .	12.5	all		170	. . .	105	. . .	16	14
T5	. . .	3.20	all		250	. . .	240	. . .	8	. . .
	3.20	25.00	all		250	. . .	240	. . .	10	9
Alloy 6162										
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 T6510[E] T6511[E]	all		all		260	. . .	240	. . .	10	9
Alloy 6351										
T1	. . .	12.50	. . .	13 000	180	. . .	90	. . .	15	13
T11	. . .	20.00	all		180	. . .	110	. . .	16	14
T4	. . .	20.00	all		220	. . .	130	. . .	16	14
T5	. . .	6.30	all		260	. . .	240	. . .	8	. . .
	6.30	25.00	all		260	. . .	240	. . .	10	9
T51	3.20	25.00	. . .	13 000	250	. . .	230	. . .	10	7
T54	. . .	12.50	. . .	13 000	205	. . .	140	. . .	10	9
T6	. . .	3.20	all		290	. . .	255	. . .	8	. . .
	3.20	20.00	all		290	. . .	255	. . .	10	9
Alloy 6360										
T5	. . .	6.30	all		150	. . .	110	. . .	8	. . .
T6	. . .	3.20	all		205	. . .	170	. . .	8	. . .
	3.20	6.30	all		205	. . .	170	. . .	10	. . .
Alloy 6463										
T1	. . .	12.50	. . .	13 000	115	. . .	60	. . .	12	10
T5	. . .	12.50	. . .	13 000	150	. . .	110	. . .	8	7
T6,T62[F]	. . .	3.20	. . .	13 000	205	. . .	170	. . .	8	. . .
	3.20	12.50	. . .	13 000	205	. . .	170	. . .	10	9
Alloy 6560										
T5	2.50	3.20	all		150	...	110	...	8	...
T6	2.50	3.20	all		205	...	170	...	8	...
Alloy 7005										
T53		20.00	all		345	. . .	305	. . .	10	9
Alloy 7116										
T5	3.20	12.50	all		330	. . .	290	. . .	8	7
Alloy 7129										
T5, T6	. . .	12.50	all		380	. . .	340	. . .	9	8
Alloy 7075										
O	all		all		. . .	275	. . .	165	10	9