Designation: B 221M – 02

METRIC

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

This standard is issued under the fixed designation B 221M; 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 bar, rod, wire, profile, and tube 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 B 211M, for drawn tube to Specification B 210M, for structural pipe and tube to Specification B 429M, and for seamless pipe and tube to Specification B 241/B 241M.

1.2 Alloy and temper designations are in accordance with ANSI 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 E 527.

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 B 221.

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:*

B 210M Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes [Metric][2]

B 211M Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire [Metric][2]

B 241/B 241M Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube [Metric][2]

B 429M Specification for Aluminum-Alloy Extruded Structural Pipe and Tube [Metric][2]

B 557M Test Methods of Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products [Metric][2]

B 594 Practice for Ultrasonic Inspection of Aluminum-Alloy Wrought Products for Aerospace Applications[2]

B 660 Practices for Packaging/Packing of Aluminum and Magnesium Products[2]

B 666/B 666M Practice for Identification Marking of Aluminum and Magnesium Products[2]

B 807 Practice for Extrusion Press Solution Heat Treatment of Aluminum Alloys[2]

B 918 Practice for Heat Treatment of Wrought Aluminum Alloys[2]

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications[3]

E 34 Test Methods for Chemical Analysis of Aluminum and Aluminum-Base Alloys[4]

E 55 Practice for Sampling Wrought Nonferrous Metals and Alloys for Determination of Chemical Composition[4]

E 227 Test Method for Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the Point-to-Plane Technique[4]

E 527 Practice for Numbering Metals and Alloys (UNS)[5]

E 607 Test Method for Atomic Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the Point-to-Plane Technique, Nitrogen Atmosphere[4]

E 716 Practices for Sampling Aluminum and Aluminum Alloys for Spectrochemical Analysis[4]

E 1004 Practice for Determining Electrical Conductivity Using the Electromagnetic (Eddy-Current) Method[6]

E 1251 Test Method for Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the Argon Atmosphere, Point-to-Plane, Unipolar Self-Initiating Capacitor Discharge[4]

[1] This specification is under the jurisdiction of ASTM Committee B07 on Light Metals and Alloys and is the direct responsibility of Subcommittee B07.03 on Aluminum Alloy Wrought Products.

Current edition approved Oct. 10, 2002. Published January 2002. Originally approved in 1979. Last previous edition approved in 2000 as B 221M–00.

[2] *Annual Book of ASTM Standards*, Vol 02.02.

[3] *Annual Book of ASTM Standards*, Vol 14.02.

[4] *Annual Book of ASTM Standards*, Vol 03.05.

[5] *Annual Book of ASTM Standards*, Vol 01.01.

[6] *Annual Book of ASTM Standards*, Vol 03.03.

***A Summary of Changes section appears at the end of this standard.**

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

Alloy	Silicon	Iron	Copper	Manganese	Magnesium	Chromium	Zinc	Vanadium		Titanium	Other Elements[D]		Aluminum
											Each	Total[E]	
1060	0.25	0.35	0.05	0.03	0.03	...	0.05	0.05	...	0.03	0.03	...	99.60 min[F]
1100	0.95 Si + Fe		0.05–0.20	0.05	...	...	0.10	...	...	...	0.05	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	0.05	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	0.05	0.15	remainder
2219	0.20	0.30	5.8–6.8	0.30–0.40	0.02	...	0.10	0.05–0.15	0.10–0.25 Zr	0.02–0.10	0.05	0.15	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[G]	0.40–0.7	0.30[G]	0.20	...	...	0.10	0.05	0.15	remainder
6060	0.30–0.6	0.10–0.30	0.10	0.10	0.35–0.6	0.05	0.15	...	...	0.10	0.05	0.15	remainder
6061	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
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
6105	0.6–1.0	0.35	0.10	0.10	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	...	...[H]	0.15	0.05	0.15	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
6463	0.20–0.6	0.15	0.20	0.05	0.45–0.9	...	0.05	...	...	...	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	...	0.08–0.20 Zr	0.01–0.06	0.05	0.15	remainder
7072[I]	0.7 Si + Fe		0.10	0.10	0.10	...	0.8–1.3	...	...	...	0.05	0.15	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	0.05	0.15	remainder
7116	0.15	0.30	0.50–1.1	0.05	0.8–1.4	...	4.2–5.2	0.05	0.03Ga	0.05	0.05	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	0.03Ga	0.05	0.05	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 mass 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 limits, in accordance with the rounding-off method of Practice E 29.

[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] Manganese plus chromium shall total 0.12–0.50.

[H] Bismuth and lead shall be 0.40–0.7 % each.

[I] Composition of cladding alloy applied during the course of manufacture. Samples from finished tube shall not be required to conform to these limits.

G 47 Test Method for Determining Susceptibility to Stress-Corrosion Cracking of 2xxx and 7xxx Aluminum Alloy Products[7]

Method of Test for Exfoliation Corrosion Susceptibility in 7xxx Series Copper-Containing Aluminum Alloys (EXCO Test) (G34-72)[8]

2.3 *ANSI Standards:*[2]

H35.1(M) Alloy and Temper Designation Systems for Aluminum

H35.2(M) Dimensional Tolerances for Aluminum Mill Products

2.4 *ISO Standards:*[9]

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:*[10]

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

2.6 *Military Standard:*[10]

MIL-STD-129 Marking for Shipment and Storage

2.7 *AMS Specification:*[11]

[7] *Annual Book of ASTM Standards*, Vol 03.02.

[8] The applicable edition in the use of this specification is G 34–72, which is available in the gray pages of the *Annual Book of ASTM Standards*, Vol 02.02.

[9] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

[10] Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

[11] Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001.

AMS 2772 Heat Treatment of Aluminum Alloy Raw Materials

3. Terminology

3.1 *Definitions:*

3.1.1 *extruded bar*—an extruded solid section, long in relation to its cross-sectional dimensions, having asymmetrical cross section that is square or rectangular with sharp or rounded corners or edges, or is a regular hexagon or octagon, and whose width or greatest distance between parallel faces is over 10 mm.

3.1.2 *extruded rod*—an extruded round section, long in relation to its diameter, whose diameter is over 10 mm.

3.1.3 *extruded profile*—a hollow or solid extruded section, long in relation to its cross-sectional dimensions, whose cross section is other than that of wire, rod, bar, or tube.

3.1.4 *extruded tube*—an extruded hollow section, long in relation to its cross-sectional dimensions, which is symmetrical and is round, square, rectangular, hexagonal, octagonal, or elliptical with sharp or rounded corners, and has a uniform wall thickness except as affected by corner radii.

3.1.5 *alclad tube*—tube having on the inside surface a metallurgically bonded aluminum or aluminum-alloy coating that is anodic to the core alloy to which it is bonded, thus electrolytically protecting the core alloy against corrosion.

3.1.6 *wire*—a solid section long in relation to its cross-sectional dimensions, having a cross section that is round, hexagonal, or octagonal and whose diameter, width, or greatest distance between parallel faces is up through 10 mm, or having a symmetrical cross section that is square or rectangular (excluding flattened wire) with sharp or rounded corners or edges.

3.1.7 *producer*—the primary manufacturer of a material.

3.1.8 *supplier*—includes only the category of jobbers and distributors as distinct from producer.

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.

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, T4510[E], T4511[E]	all		all		345	. . .	240	. . .	12	10
T42[F]	all		all		345	. . .	200	. . .	12	10
T6, T6510[E], T6511[E]	. . .	12.50	all		415	. . .	365	. . .	7	6
	12.50	18.00	all	16 000	440	. . .	400	. . .	. . .	6
	18.00	. . .	. . .	20 000	470	. . .	415	. . .	. . .	6
	18.00	. . .	16 000		470	. . .	400	. . .	. . .	5
T62[F]	. . .	18.00	all	. . .	415	. . .	365	. . .	7	6
	18.00	. . .	. . .	16 000	415	. . .	365	. . .	. . .	6
	18.00	. . .	16 000	20 000	415	. . .	365	. . .	. . .	5
F[D]	all		all	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Alloy 2024										
O	all		all		. . .	240	. . .	130	12	10
T3, T3510[E], T3511[E]	. . .	6.30	all		395	. . .	290	. . .	12[G]	. . .
	6.30	18.00	all		415	. . .	305	. . .	12[G]	10[G]
	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, T8510[E], T8511[E]	1.20	6.30	all		440	. . .	385	. . .	4	. . .
	6.30	35.00	all		455	. . .	400	. . .	5	4
	35.00	. . .	. . .	20 000	455	. . .	400	. . .	. . .	4

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 $\sqrt{A}$)
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] T8511[E]	...	80.00	...	16 000	400	...	290	...	6	5
F[D]	all		all		...	...	...	...	...	...
Alloy 3003										
O	all		all		95	130	35	...	25	22
H112	all		all		90	...	30	...	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
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	...

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 $\sqrt{A}$)
	6.30	25.00	all		260	. . .	215	. . .	9	8
					Alloy 6060					
T51	. . .	3.20	all		150	. . .	110	. . .	8	. . .
					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]	. . .	6.30	all		260	. . .	240	. . .	8	. . .
T6510[E], T6511[E]	6.30	. . .	all		260	. . .	240	. . .	10	9
F[D]	all		all		. . .	. . .	. . .	. . .	. . .	. . .
					Alloy 6063					
O	all		all		. . .	130	. . .	. . .	18	16
T1	. . .	12.50	all	. . .	115	. . .	60	. . .	12	10
	12.50	25.00	all	. . .	110	. . .	55	. . .	. . .	10
T4,T42[F]	. . .	12.50	all		130	. . .	70	. . .	14	12
	12.50	25.00	all		125	. . .	60	. . .	. . .	12
T5	. . .	12.50	all		150	. . .	110	. . .	8	7
	12.50	25.00	all		145	. . .	105	. . .	. . .	7
T52	. . .	25.00	all		150	205	110	170	8	7
T6, T62[K]	. . .	3.20	all		205	. . .	170	. . .	8	. . .
	3.20	25.00	all		205	. . .	170	. . .	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
T6			all		345	. . .	310	. . .	8	7
T6510[E], T6511[E]	all									
T62[F]	all		all		345	. . .	290	. . .	8	7
					Alloy 6070					
T6, T62	. . .	80.00	. . .	20 000	330	. . .	310	. . .	6	5
					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	. . .	19.00	all		180	. . .	110	. . .	16	14
T4	. . .	19.00	all		220	. . .	130	. . .	16	14
T5	. . .	6.30	all		260	. . .	240	. . .	8	. . .

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 $\sqrt{A}$)
	6.30	25.00	all		260	. . .	240	. . .	10	9
T51	3.20	25.00	all		250	. . .	230	. . .	10	7
T54	. . .	12.50	all		205	. . .	140	. . .	10	9
T6	. . .	3.20	all		290	. . .	255	. . .	8	. . .
	3.20	18.00	all		290	. . .	255	. . .	10	9
				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 7005						
T53	3.20	25.00	. . .	16 000	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
T6	. . .	6.30	all		540	. . .	485	. . .	7	. . .
T62[F]	6.30	12.50	all		560	. . .	505	. . .	7	6
T6510[E]	12.50	70.00	all		560	. . .	495	. . .	. . .	6
T6511[E]	70.00	110.00	. . .	13 000	560	. . .	490	. . .	. . .	6
	70.00	110.00[L]	13 000	20 000	540	. . .	485	. . .	. . .	5
	110.00	130.00[L]	. . .	20 000	540	. . .	470	. . .	. . .	5
T73	1.60	6.30	. . .	13 000	470	. . .	400	. . .	7	. . .
T3510[E]	6.30	35.00	. . .	16 000	485	. . .	420	. . .	8	7
T3511[E]	35.00	70.00	. . .	18 000	475	. . .	405	. . .	. . .	7
	70.00	110.00[L]	. . .	13 000	470	. . .	395	. . .	. . .	6
	70.00	110.00[L]	13 000	20 000	450	. . .	380	. . .	. . .	6
	. . .	1.25	all		500	. . .	435	. . .	7	. . .
	1.25	3.20	all		510	. . .	440	. . .	7	. . .
T76	3.20	6.30	. . .	13 000	510	. . .	440	. . .	7	. . .
T76510[E]	6.30	12.50	. . .	13 000	515	. . .	450	. . .	7	6
T76511[E]	12.50	25.00	. . .	13 000	515	. . .	450	. . .	. . .	6
	25.00	50.00	. . .	13 000	515	. . .	450	. . .	7	6
	50.00	75.00	. . .	13 000	510	. . .	440	. . .	7	6
	75.00	100.00	. . .	13 000	510	. . .	435	. . .	7	6
F[D]	all		all		. . .	. . .	. . .	. . .	. . .	. . .
				Alloy 7178						
O	all		. . .	20 000	. . .	275	. . .	165	10	9
	. . .	1.60	. . .	13 000	565	. . .	525	. . .	. . .	. . .
	1.60	6.30	. . .	13 000	580	. . .	525	. . .	5	. . .
T6	6.30	35.00	. . .	16 000	600	. . .	540	. . .	5	4
T6510[E]	35.00	60.00	. . .	16 000	595	. . .	530	. . .	. . .	4
T6511[E]	35.00	60.00	16 000	20 000	580	. . .	515	. . .	. . .	4
	60.00	80.00	. . .	20 000	565	. . .	490	. . .	. . .	4
	. . .	1.60	. . .	13 000	545	. . .	505	. . .	. . .	. . .
	1.60	6.30	. . .	13 000	565	. . .	510	. . .	5	. . .
	6.30	35.00	. . .	16 000	595	. . .	530	. . .	5	4
T62[F]	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
T76	3.20	6.30	. . .	13 000	525	. . .	455	. . .	7	. . .
T76510[E]	6.30	12.50	. . .	13 000	530	. . .	460	. . .	7	6
T76511[E]	12.50	25.00	. . .	13 000	530	. . .	460	. . .	. . .	6
F[D]	all		all		. . .	. . .	. . .	. . .	. . .	. . .

[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 1 MPa for strength and the nearest 0.5 % for elongation, in accordance with the rounding-off method of Practice E 29.

[C] Elongations 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 × diameter (5.65 $\sqrt{A}$), where *D* and *A* are diameter and cross-sectional area of the specimen respectively, apply to round test specimens