Designation: B209 – 14

Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate[1]

This standard is issued under the fixed designation B209; 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 flat sheet, coiled sheet, and plate in the alloys (Note 1) and tempers shown in Tables 2 and 3, and in the following finishes:

1.1.1 Plate in all alloys and sheet in heat-treatable alloys: mill finish.

1.1.2 Sheet in nonheat-treatable alloys: mill finish, one-side bright mill finish, standard one-side bright finish, and standard two-sides bright finish.

1.2 Alloy and temper designations are in accordance with ANSI H35.1/H35.1(M). 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.

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

NOTE 2—See Specification B632/B632M for tread plate.

NOTE 3—See Specification B928/B928M for 5xxx-H116 and 5xxx-H321 aluminum alloys containing 3 % or more nominal magnesium and intended for marine service and similar environments. Other alloy-temper products listed in this specification, which do not require the additional corrosion testing/capability called out in ASTM B928/B928M, may be suitable for marine and similar environment applications.

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 inch-pound companion to Specification B209M; therefore, no SI equivalents are presented in the specification.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 The following documents form a part of this specification to the extent referenced herein:

2.2 *ASTM Standards:*[3]

B548 Test Method for Ultrasonic Inspection of Aluminum-Alloy Plate for Pressure Vessels

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

B594 Practice for Ultrasonic Inspection of Aluminum-Alloy Wrought Products

B632/B632M Specification for Aluminum-Alloy Rolled Tread Plate

B660 Practices for Packaging/Packing of Aluminum and Magnesium Products

B666/B666M Practice for Identification Marking of Aluminum and Magnesium Products

B881 Terminology Relating to Aluminum- and Magnesium-Alloy Products

B918 Practice for Heat Treatment of Wrought Aluminum Alloys

B928/B928M Specification for High Magnesium Aluminum-Alloy Sheet and Plate for Marine Service and Similar Environments

B947 Practice for Hot Rolling Mill Solution Heat Treatment for Aluminum Alloy Plate

B985 Practice for Sampling Aluminum Ingots, Billets, Castings and Finished or Semi-Finished Wrought Aluminum Products for Compositional Analysis

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

E290 Test Methods for Bend Testing of Material for Ductility

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-209 in Section II of that 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]
H35.1/H35.1(M) Alloy and Temper Designation Systems for Aluminum
H35.2 Dimensional Tolerances for Aluminum Mill Products

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

2.5 *Other Standards:*
CEN EN 14242 Aluminum and Aluminum 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 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 (7.1).

4.1.4 Temper (9.1).

4.1.5 Finish for sheet in nonheat-treatable alloys (Section 1).

4.1.6 For sheet, whether flat or coiled.

4.1.7 Dimensions (thickness, width, and length or coil size).

4.1.8 Tensile property limits and dimensional tolerances for sizes not covered in Table 2 or Table 3 of this specification and in ANSI H35.2, respectively.

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

4.2.1 Whether a supply of one of the pairs of tempers where shown in Table 2, (H14 or H24) or (H34 or H24), is specifically excluded (Table 2, Footnote *C*).

4.2.2 Whether heat treatment in accordance with Practice B918 is required (8.2).

4.2.3 Whether solution heat treatment using the hot rolling mill is acceptable (8.3).

4.2.4 Whether bend tests are required (12.1).

4.2.5 Whether testing for stress-corrosion cracking resistance of alloy 2124-T851, 2219-T851, or 2219-T87 is required (13.1).

4.2.6 Whether ultrasonic inspection for aerospace or pressure vessels applications is required (Section 17).

4.2.7 Whether inspection or witness of inspection and tests by the purchaser's representative is required prior to material shipment (18.1).

4.2.8 Whether certification is required (Section 22).

4.2.9 Whether there are exceptions to identification marking as provided in B666/B666M (20.1).

4.2.10 Whether Practices B660 apply and, if so, the levels of preservation, packaging, and packing required (21.3).

4.2.11 For sheet and plate with tensile properties having more than one test direction shown in Table 2 and Table 3, whether tensile testing should be in a direction other than the direction specified in Test Method B557 (Section 9.4).

5. Responsibility for Quality Assurance

5.1 *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 their 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.

5.2 *Lot Definition*—An inspection lot shall be defined as follows:

5.2.1 For heat-treated tempers, an inspection lot shall consist of an identifiable quantity of material of the same mill form, alloy, temper, and thickness traceable to a heat-treat lot or lots, and subjected to inspection at one time.

5.2.2 For nonheat-treated tempers, an inspection lot shall consist of an identifiable quantity of material of the same mill form, alloy, temper, and thickness subjected to inspection at one time.

6. General Quality

6.1 Unless otherwise specified, the material shall be supplied in the mill finish, shall be uniform as defined by the

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

[7] Available from European Committee for Standardization (CEN), 36 Rue de Stassart, B-1050, Brussels, Belgium, http://www.cenorm.be.

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

Alloy	Silicon	Iron	Copper	Manganese	Magnesium	Chromium	Zinc	Titanium	Other Elements[D]		Aluminum
									Each	Total[E]	
1060	0.25	0.35	0.05	0.03	0.03	...	0.05	0.03	0.03[F]	...	99.60 min[G]
1100	0.95 Si + Fe		0.05–0.20	0.05	...	...	0.10	...	0.05	0.15	99.00 min[G]
1230[H]	0.70 Si + Fe		0.10	0.05	0.05	...	0.10	0.03	0.03[F]	...	99.30 min[G]
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
Alclad 2014						2014 clad with 6003					
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
Alclad 2024						2024 clad with 1230					
2124	0.20	0.30	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	0.20–0.40	0.02	...	0.10	0.02–0.10	0.05[I]	0.15[I]	remainder
Alclad 2219						2219 clad with 7072					
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					
3004	0.30	0.7	0.25	1.0–1.5	0.8–1.3	...	0.25	...	0.05	0.15	remainder
Alclad 3004						3004 clad with 7072					
3005	0.6	0.7	0.30	1.0–1.5	0.20–0.6	0.10	0.25	0.10	0.05	0.15	remainder
3105	0.6	0.7	0.30	0.30–0.8	0.20–0.8	0.20	0.40	0.10	0.05	0.15	remainder
5005	0.30	0.7	0.20	0.20	0.50–1.1	0.10	0.25	...	0.05	0.15	remainder
5010	0.40	0.7	0.25	0.10–0.30	0.20–0.6	0.15	0.30	0.10	0.05	0.15	remainder
5050	0.40	0.7	0.20	0.10	1.1–1.8	0.10	0.25	...	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
5059	0.45	0.50	0.25	0.6–1.2	5.0–6.0	0.25	0.40–0.9	0.20	0.05[J]	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
5252	0.08	0.10	0.10	0.10	2.2–2.8	...	0.05	...	0.03[F]	0.10[F]	remainder
5254	0.45 Si + Fe		0.05	0.01	3.1–3.9	0.15–0.35	0.20	0.05	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
5457	0.08	0.10	0.20	0.15–0.45	0.8–1.2	...	0.05	...	0.03[F]	0.10[F]	remainder
5657	0.08	0.10	0.10	0.03	0.6–1.0	...	0.05	...	0.02[K]	0.05[K]	remainder
5754	0.40	0.40	0.10	0.50[L]	2.6-3.6	0.30[L]	0.20	0.15	0.05	0.15	remainder
6003[H]	0.35–1.0	0.6	0.10	0.8	0.8–1.5	0.35	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
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
Alclad 6061						6061 clad with 7072					
7072[H]	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
Alclad 7075						7075 clad with 7072					

[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 purposes of determining conformance to these limits, an observed value or a calculated value attained from analysis shall be rounded to the nearest unit in the last righthand place of figures used in expressing the specified limit, in accordance with the Rounding 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. The Total for Other Elements does not include elements shown in the footnotes with specific composition limits.
[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] Vanadium 0.05 max.
[G] 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.
[H] Composition of cladding alloy as applied during the course of manufacture. Samples from finished sheet or plate shall not be required to conform to these limits.
[I] Vanadium 0.05–0.15, zirconium 0.10–0.25.
[J] 0.05–0.25 Zr
[K] Gallium 0.03 max, vanadium 0.05 max.
[L] 0.10–0.6 Mn + Cr.
[M] In case there is a discrepancy in the values listed in Table 2 with 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" shall be considered the controlling composition. The "Teal Sheets" are available at http://www.aluminum.org/tealsheets.

requirements of this specification, and shall be commercially sound. Any requirement not covered is subject to negotiation between producer and purchaser.

6.2 Each sheet and plate shall be examined to determine conformance to this specification with respect to general quality and identification marking. On approval of the purchaser, however, the producer may use a system of statistical quality control for such examinations.

7. Chemical Composition

7.1 *Limits*—The sheet and plate shall conform to the chemical composition limits specified in Table 1. Conformance shall be determined by the producer by analyzing samples taken at the time the ingots are poured in accordance with Practices E716 and analyzed in accordance with Test Methods E34, E607, or E1251, or with EN 14242. At least one sample shall be taken for each group of ingots poured simultaneously from

TABLE 2 Mechanical Property Limits for Nonheat-Treatable Alloy[A,B]

Alloy	Temper	Specified Thickness, in.	Tensile Strength, ksi		Yield Strength (0.2 % offset), ksi		Elongation in 2 in. or 4× Diameter, min, %	Bend Diameter Factor, *N*
			min	max	min	max		
1060	O	0.006–0.019	8.0	14.0	2.5	....	15	...
1060	O	0.020–0.050	8.0	14.0	2.5	...	22	...
1060	O	0.051–3.000	8.0	14.0	2.5	...	25	...
1060	H12[C] or H22[C]	0.017–0.050	11.0	16.0	9.0	...	6	...
1060	H12[C] or H22[C]	0.051–2.000	11.0	16.0	9.0	...	12	...
1060	H14[C] or H24[C]	0.009–0.019	12.0	17.0	10.0	...	1	...
1060	H14[C] or H24[C]	0.020–0.050	12.0	17.0	10.0	...	5	..
1060	H14[C] or H24[C]	0.051–1.000	12.0	17.0	10.0	...	10	...
1060	H16[C] or H26[C]	0.006–0.019	14.0	19.0	11.0	...	1	...
1060	H16[C] or H26[C]	0.020–0.050	14.0	19.0	11.0	...	4	...
1060	H16[C] or H26[C]	0.051–0.162	14.0	19.0	11.0	...	5	...
1060	H18[C] or H28[C]	0.006–0.019	16.0	...	12.0	...	1	...
1060	H18[C] or H28[C]	0.020–0.050	16.0	...	12.0	...	3	...
1060	H18[C] or H28[C]	0.051–0.128	16.0	...	12.0	...	4	...
1060	H112	0.250–0.499	11.0	...	7.0	...	10	...
1060	H112	0.500–1.000	10.0	...	5.0	...	20	...
1060	H112	1.001–3.000	9.0	...	4.0	...	25	...
1060	F	0.250–3.000	...	...	...	...	...	...
1100	O	0.006–0.019	11.0	15.5	3.5	...	15	0
1100	O	0.020–0.031	11.0	15.5	3.5	...	20	0
1100	O	0.032–0.050	11.0	15.5	3.5	...	25	0
1100	O	0.051–0.249	11.0	15.5	3.5	...	30	0
1100	O	0.250–3.000	11.0	15.5	3.5	...	28	0
1100	H12[C] or H22[C]	0.017–0.019	14.0	19.0	11.0	...	3	0
1100	H12[C] or H22[C]	0.020–0.031	14.0	19.0	11.0	...	4	0
1100	H12[C] or H22[C]	0.032–0.050	14.0	19.0	11.0	...	6	0
1100	H12[C] or H22[C]	0.051–0.113	14.0	19.0	11.0	...	8	0
1100	H12[C] or H22[C]	0.114–0.499	14.0	19.0	11.0	...	9	0
1100	H12[C] or H22[C]	0.500–2.000	14.0	19.0	11.0	...	12	0
1100	H14[C] or H24[C]	0.009–0.012	16.0	21.0	14.0	...	1	0
1100	H14[C] or H24[C]	0.013–0.019	16.0	21.0	14.0	...	2	0
1100	H14[C] or H24[C]	0.020–0.031	16.0	21.0	14.0	...	3	0
1100	H14[C] or H24[C]	0.032–0.050	16.0	21.0	14.0	...	4	0
1100	H14[C] or H24[C]	0.051–0.113	16.0	21.0	14.0	...	5	0
1100	H14[C] or H24[C]	0.114–0.499	16.0	21.0	14.0	...	6	0
1100	H14[C] or H24[C]	0.500–1.000	16.0	21.0	14.0	...	10	0
1100	H16[C] or H26[C]	0.006–0.019	19.0	24.0	17.0	...	1	4
1100	H16[C] or H26[C]	0.020–0.031	19.0	24.0	17.0	...	2	4
1100	H16[C] or H26[C]	0.032–0.050	19.0	24.0	17.0	...	3	4
1100	H16[C] or H26[C]	0.051–0.162	19.0	24.0	17.0	...	4	4
1100	H18[C] or H28[C]	0.006–0.019	22.0	...	...	...	1	...
1100	H18[C] or H28[C]	0.020–0.031	22.0	...	...	...	2	...
1100	H18[C] or H28[C]	0.032–0.050	22.0	...	...	...	3	...
1100	H18[C] or H28[C]	0.051–0.128	22.0	...	...	...	4	...
1100	H112	0.250–0.499	13.0		7.0	...	9	...
1100	H112	0.500–2.000	12.0	...	5.0	...	14	...
1100	H112	2.001–3.000	11.5	...	4.0	...	20	...
1100	F[D]	0.250–3.000	...	...	...	...	...	...
3003	O	0.006–0.007	14.0	19.0	5.0	...	14	0
3003	O	0.008–0.012	14.0	19.0	5.0	...	18	0
3003	O	0.013–0.031	14.0	19.0	5.0	...	20	0
3003	O	0.032–0.050	14.0	19.0	5.0	...	23	0
3003	O	0.051–0.249	14.0	19.0	5.0	...	25	0
3003	O	0.250–3.000	14.0	19.0	5.0	...	23	...
3003	H12[C] or H22[C]	0.017–0.019	17.0	23.0	12.0	...	3	0
3003	H12[C] or H22[C]	0.020–0.031	17.0	23.0	12.0	...	4	0
3003	H12[C] or H22[C]	0.032–0.050	17.0	23.0	12.0	...	5	0
3003	H12[C] or H22[C]	0.051–0.113	17.0	23.0	12.0	...	6	0
3003	H12[C] or H22[C]	0.114–0.161	17.0	23.0	12.0	...	7	0
3003	H12[C] or H22[C]	0.162–0.249	17.0	23.0	12.0	...	8	0
3003	H12[C] or H22[C]	0.250–0.499	17.0	23.0	12.0	...	9	...
3003	H12[C] or H22[C]	0.500–2.000	17.0	23.0	12.0	...	10	...
3003	H14[C] or H24[C]	0.009–0.012	20.0	26.0	17.0	...	1	0
3003	H14[C] or H24[C]	0.013–0.019	20.0	26.0	17.0	...	2	0
3003	H14[C] or H24[C]	0.020–0.031	20.0	26.0	17.0	...	3	0
3003	H14[C] or H24[C]	0.032–0.050	20.0	26.0	17.0	...	4	0
3003	H14[C] or H24[C]	0.051–0.113	20.0	26.0	17.0	...	5	0
3003	H14[C] or H24[C]	0.114–0.161	20.0	26.0	17.0	...	6	2

TABLE 2 *Continued*

Alloy	Temper	Specified Thickness, in.	Tensile Strength, ksi min	Tensile Strength, ksi max	Yield Strength (0.2 % offset), ksi min	Yield Strength (0.2 % offset), ksi max	Elongation in 2 in. or 4× Diameter, min, %	Bend Diameter Factor, *N*
3003	H14[C] or H24[C]	0.162–0.249	20.0	26.0	17.0	...	7	2
3003	H14[C] or H24[C]	0.250–0.499	20.0	26.0	17.0	...	8	...
3003	H14[C] or H24[C]	0.500–1.000	20.0	26.0	17.0	...	10	...
3003	H16[C] or H26[C]	0.006–0.019	24.0	30.0	21.0	...	1	4
3003	H16[C] or H26[C]	0.020–0.031	24.0	30.0	21.0	...	2	4
3003	H16[C] or H26[C]	0.032–0.050	24.0	30.0	21.0	...	3	4
3003	H16[C] or H26[C]	0.051–0.162	24.0	30.0	21.0	...	4	6
3003	H18[C] or H28[C]	0.006–0.019	27.0	...	24.0	...	1	...
3003	H18[C] or H28[C]	0.020–0.031	27.0	...	24.0	...	2	...
3003	H18[C] or H28[C]	0.032–0.050	27.0	...	24.0	...	3	...
3003	H18[C] or H28[C]	0.051–0.128	27.0	...	24.0	...	4	...
3003	H112	0.250–0.499	17.0	...	10.0	...	8	...
3003	H112	0.500–2.000	15.0	...	6.0	...	12	...
3003	H112	2.001–3.000	14.5	...	6.0	...	18	...
3003	F[D]	0.250–3.000	...	...	...	...	...	...
Alclad 3003	O	0.006–0.007	13.0	18.0	4.5	...	14	...
Alclad 3003	O	0.008–0.012	13.0	18.0	4.5	...	18	...
Alclad 3003	O	0.013–0.031	13.0	18.0	4.5	...	20	...
Alclad 3003	O	0.032–0.050	13.0	18.0	4.5	...	23	...
Alclad 3003	O	0.051–0.249	13.0	18.0	4.5	...	25	...
Alclad 3003	O	0.250–0.499	13.0	18.0	4.5	...	23	...
Alclad 3003	O	0.500–3.000	14.0[E]	19.0[E]	5.0[E]	...	23	...
Alclad 3003	H12[C] or H22[C]	0.017–0.031	16.0	22.0	11.0	...	4	...
Alclad 3003	H12[C] or H22[C]	0.032–0.050	16.0	22.0	11.0	...	5	...
Alclad 3003	H12[C] or H22[C]	0.051–0.113	16.0	22.0	11.0	...	6	...
Alclad 3003	H12[C] or H22[C]	0.114–0.161	16.0	22.0	11.0	...	7	...
Alclad 3003	H12[C] or H22[C]	0.162–0.249	16.0	22.0	11.0	...	8	...
Alclad 3003	H12[C] or H22[C]	0.250–0.499	16.0	22.0	11.0	...	9	...
Alclad 3003	H12[C] or H22[C]	0.500–2.000	17.0[E]	23.0[E]	12.0[E]	...	10	...
Alclad 3003	H14[C] or H24[C]	0.009–0.012	19.0	25.0	16.0	...	1	...
Alclad 3003	H14[C] or H24[C]	0.013–0.019	19.0	25.0	16.0	...	2	...
Alclad 3003	H14[C] or H24[C]	0.020–0.031	19.0	25.0	16.0	...	3	...
Alclad 3003	H14[C] or H24[C]	0.032–0.050	19.0	25.0	16.0	...	4	...
Alclad 3003	H14[C] or H24[C]	0.051–0.113	19.0	25.0	16.0	...	5	...
Alclad 3003	H14[C] or H24[C]	0.114–0.161	19.0	25.0	16.0	...	6	...
Alclad 3003	H14[C] or H24[C]	0.162–0.249	19.0	25.0	16.0	...	7	...
Alclad 3003	H14[C] or H24[C]	0.250–0.499	19.0	25.0	16.0	...	8	...
Alclad 3003	H14[C] or H24[C]	0.500–1.000	20.0[E]	26.0[E]	17.0[E]	...	10	...
Alclad 3003	H16[C] or H26[C]	0.006–0.019	23.0	29.0	20.0	...	1	...
Alclad 3003	H16[C] or H26[C]	0.020–0.031	23.0	29.0	20.0	...	2	...
Alclad 3003	H16[C] or H26[C]	0.032–0.050	23.0	29.0	20.0	...	3	...
Alclad 3003	H16[C] or H26[C]	0.051–0.162	23.0	29.0	20.0	...	4	...
Alclad 3003	H18	0.006–0.019	26.0	...	...	...	1	...
Alclad 3003	H18	0.020–0.031	26.0	...	...	...	2	...
Alclad 3003	H18	0.032–0.050	26.0	...	...	...	3	...
Alclad 3003	H18	0.051–0.128	26.0	...	...	...	4	...
Alclad 3003	H112	0.250–0.499	16.0	...	9.0	...	8	...
Alclad 3003	H112	0.500–2.000	15.0[E]	...	6.0[E]	...	12	...
Alclad 3003	H112	2.001–3.000	14.5[E]	...	6.0[E]	...	18	...
Alclad 3003	F[D]	0.250–3.000	...	...	...	...	...	...
3004	O	0.006–0.007	22.0	29.0	8.5	...	...	...
3004	O	0.008– 0.019	22.0	29.0	8.5	...	10	0
3004	O	0.020–0.031	22.0	29.0	8.5	...	14	0
3004	O	0.032–0.050	22.0	29.0	8.5	...	16	0
3004	O	0.051–0.249	22.0	29.0	8.5	...	18	0
3004	O	0.250–3.000	22.0	29.0	8.5	...	16	...
3004	H32[C] or H22[C]	0.017–0.019	28.0	35.0	21.0	...	1	0
3004	H32[C] or H22[C]	0.020–0.031	28.0	35.0	21.0	...	3	1
3004	H32[C] or H22[C]	0.032–0.050	28.0	35.0	21.0	...	4	1
3004	H32[C] or H22[C]	0.051–0.113	28.0	35.0	21.0	...	5	2
3004	H32[C] or H22[C]	0.114–2.000	28.0	35.0	21.0	...	6	...
3004	H34[C] or H24[C]	0.009–0.019	32.0	38.0	25.0	...	1	2
3004	H34[C] or H24[C]	0.020–0.050	32.0	38.0	25.0	...	3	3
3004	H34[C] or H24[C]	0.051–0.113	32.0	38.0	25.0	...	4	4
3004	H34[C] or H24[C]	0.114–1.000	32.0	38.0	25.0	...	5	...
3004	H36[C] or H26[C]	0.006–0.007	35.0	41.0	28.0	...	...	...
3004	H36[C] or H26[C]	0.008–0.019	35.0	41.0	28.0	...	1	6
3004	H36[C] or H26[C]	0.020–0.031	35.0	41.0	28.0	...	2	6

TABLE 2 *Continued*

Alloy	Temper	Specified Thickness, in.	Tensile Strength, ksi min	Tensile Strength, ksi max	Yield Strength (0.2 % offset), ksi min	Yield Strength (0.2 % offset), ksi max	Elongation in 2 in. or 4× Diameter, min, %	Bend Diameter Factor, *N*
3004	H36[C] or H26[C]	0.032–0.050	35.0	41.0	28.0	...	3	6
3004	H36[C] or H26[C]	0.051–0.162	35.0	41.0	28.0	...	4	8
3004	H38[C] or H28[C]	0.006–0.007	38.0	...	31.0	...	...	...
3004	H38[C] or H28[C]	0.008–0.019	38.0	...	31.0	...	1	...
3004	H38[C] or H28[C]	0.020–0.031	38.0	...	31.0	...	2	...
3004	H38[C] or H28[C]	0.032–0.050	38.0	...	31.0	...	3	...
3004	H38[C] or H28[C]	0.051–0.128	38.0	...	31.0	...	4	...
3004	H112	0.250–3.000	23.0	...	9.0	...	7	...
3004	F[D]	0.250–3.000	...	...	...	...	...	...
Alclad 3004	O	0.006–0.007	21.0	28.0	8.0	...	...	...
Alclad 3004	O	0.008–0.019	21.0	28.0	8.0	...	10	...
Alclad 3004	O	0.020–0.031	21.0	28.0	8.0	...	14	...
Alclad 3004	O	0.032–0.050	21.0	28.0	8.0	...	16	...
Alclad 3004	O	0.051–0.249	21.0	28.0	8.0	...	18	...
Alclad 3004	O	0.250–0.499	21.0	28.0	8.0	...	16	...
Alclad 3004	O	0.500–3.000	22.0[E]	29.0[E]	8.5[E]	...	16	...
Alclad 3004	H32[C] or H22[C]	0.017–0.019	27.0	34.0	20.0	...	1	...
Alclad 3004	H32[C] or H22[C]	0.020–0.031	27.0	34.0	20.0	...	3	...
Alclad 3004	H32[C] or H22[C]	0.032–0.050	27.0	34.0	20.0	...	4	...
Alclad 3004	H32[C] or H22[C]	0.051–0.113	27.0	34.0	20.0	...	5	...
Alclad 3004	H32[C] or H22[C]	0.114–0.249	27.0	34.0	20.0	...	6	...
Alclad 3004	H32[C] or H22[C]	0.250–0.499	27.0	34.0	20.0	...	6	...
Alclad 3004	H32[C] or H22[C]	0.500–2.000	28.0[E]	35.0[E]	21.0[E]	...	6	...
Alclad 3004	H34[C] or H24[C]	0.009–0.019	31.0	37.0	24.0	...	1	...
Alclad 3004	H34[C] or H24[C]	0.020–0.050	31.0	37.0	24.0	...	3	...
Alclad 3004	H34[C] or H24[C]	0.051–0.113	31.0	37.0	24.0	...	4	...
Alclad 3004	H34[C] or H24[C]	0.114–0.249	31.0	37.0	24.0	...	5	...
Alclad 3004	H34[C] or H24[C]	0.250–0.499	31.0	37.0	24.0	...	5	...
Alclad 3004	H34[C] or H24[C]	0.500–1.000	32.0[E]	38.0[E]	25.0[E]	...	5	...
Alclad 3004	H36[C] or H26[C]	0.006–0.007	34.0	40.0	27.0	...	...	...
Alclad 3004	H36[C] or H26[C]	0.008–0.019	34.0	40.0	27.0	...	1	...
Alclad 3004	H36[C] or H26[C]	0.020–0.031	34.0	40.0	27.0	...	2	...
Alclad 3004	H36[C] or H26[C]	0.032–0.050	34.0	40.0	27.0	...	3	...
Alclad 3004	H36[C] or H26[C]	0.051–0.162	34.0	40.0	27.0	...	4	...
Alclad 3004	H38	0.006–0.007	37.0	...	...	...	...	...
Alclad 3004	H38	0.008–0.019	37.0	...	...	...	1	...
Alclad 3004	H38	0.020–0.031	37.0	...	...	...	2	...
Alclad 3004	H38	0.032–0.050	37.0	...	...	...	3	...
Alclad 3004	H38	0.051–0.128	37.0	...	...	...	4	...
Alclad 3004	H112	0.250–0.499	22.0	...	8.5	...	7	...
Alclad 3004	H112	0.500–3.000	23.0[E]	...	9.0[E]	...	7	...
Alclad 3004	F[D]	0.250–3.000	...	...	...	...	...	...
3005	O	0.006–0.007	17.0	24.0	6.5	...	10	...
3005	O	0.008–0.012	17.0	24.0	6.5	...	12	...
3005	O	0.013–0.019	17.0	24.0	6.5	...	14	...
3005	O	0.020–0.031	17.0	24.0	6.5	...	16	...
3005	O	0.032–0.050	17.0	24.0	6.5	...	18	...
3005	O	0.051–0.249	17.0	24.0	6.5	...	20	...
3005	H12	0.017–0.019	20.0	27.0	17.0	...	1	...
3005	H12	0.020–0.050	20.0	27.0	17.0	...	2	...
3005	H12	0.051–0.113	20.0	27.0	17.0	...	3	...
3005	H12	0.114–0.161	20.0	27.0	17.0	...	4	...
3005	H12	0.162–0.249	20.0	27.0	17.0	...	5	...
3005	H14	0.009–0.031	24.0	31.0	21.0	...	1	...
3005	H14	0.032–0.050	24.0	31.0	21.0	...	2	...
3005	H14	0.051–0.113	24.0	31.0	21.0	...	3	...
3005	H14	0.114–0.249	24.0	31.0	21.0	...	4	...
3005	H16	0.006–0.031	28.0	35.0	25.0	...	1	...
3005	H16	0.032–0.113	28.0	35.0	25.0	...	2	...
3005	H16	0.114–0.162	28.0	35.0	25.0	...	3	...
3005	H18	0.006–0.031	32.0	...	29.0	....	1	...
3005	H18	0.032–0.128	32.0	...	29.0	...	2	...
3005	H19	0.006–0.012	34.0	...	...	...	...	...
3005	H19	0.013–0.063	34.0	...	...	...	1	...
3005	H25	0.016–0.019	26.0	34.0	22.0	...	1	...
3005	H25	0.020–0.031	26.0	34.0	22.0	...	2	...
3005	H25	0.032–0.050	26.0	34.0	22.0	...	3	...
3005	H25	0.051–0.080	26.0	34.0	22.0	...	4	...

TABLE 2 *Continued*

Alloy	Temper	Specified Thickness, in.	Tensile Strength, ksi min	Tensile Strength, ksi max	Yield Strength (0.2 % offset), ksi min	Yield Strength (0.2 % offset), ksi max	Elongation in 2 in. or 4× Diameter, min, %	Bend Diameter Factor, *N*
3005	H27	0.016–0.019	29.5	37.5	25.5	...	1	...
3005	H27	0.020–0.031	29.5	37.5	25.5	...	2	...
3005	H27	0.032–0.050	29.5	37.5	25.5	...	3	...
3005	H27	0.051–0.080	29.5	37.5	25.5	...	4	...
3005	H28	0.016–0.019	31.0	...	27.0	...	1	...
3005	H28	0.020–0.031	31.0	...	27.0	...	2	...
3005	H28	0.032–0.050	31.0	...	27.0	...	3	...
3005	H28	0.051–0.080	31.0	...	27.0	...	4	...
3105	O	0.013–0.019	14.0	21.0	5.0	...	16	...
3105	O	0.020–0.031	14.0	21.0	5.0	...	18	...
3105	O	0.032–0.080	14.0	21.0	5.0	...	20	...
3105	H12	0.017–0.019	19.0	26.0	15.0	...	1	...
3105	H12	0.020–0.031	19.0	26.0	15.0	...	1	...
3105	H12	0.032–0.050	19.0	26.0	15.0	...	2	...
3105	H12	0.051–0.080	19.0	26.0	15.0	...	3	...
3105	H14	0.013–0.019	22.0	29.0	18.0	...	1	...
3105	H14	0.020–0.031	22.0	29.0	18.0	...	1	...
3105	H14	0.032–0.050	22.0	29.0	18.0	...	2	...
3105	H14	0.051–0.080	22.0	29.0	18.0	...	2	...
3105	H16	0.013–0.031	25.0	32.0	21.0	...	1	...
3105	H16	0.032–0.050	25.0	32.0	21.0	...	2	...
3105	H16	0.051–0.080	25.0	32.0	21.0	...	2	...
3105	H18	0.013–0.031	28.0	...	24.0	...	1	...
3105	H18	0.032–0.050	28.0	...	24.0	...	1	...
3105	H18	0.051–0.080	28.0	,,,	24.0	...	2	...
3105	H22	0.013–0.019	19.0	...	15.0	...	3	...
3105	H22	0.020–0.031	19.0	...	15.0	...	4	...
3105	H22	0.032–0.050	19.0	...	15.0	...	5	...
3105	H22	0.051–0.080	19.0	...	15.0	...	6	...
3105	H24	0.013–0.019	22.0	...	18.0	...	2	...
3105	H24	0.020–0.031	22.0	...	18.0	...	3	...
3105	H24	0.032–0.050	22.0	...	18.0	...	4	...
3105	H24	0.051–0.080	22.0	...	18.0	...	6	...
3105	H25	0.013–0.019	23.0	...	19.0	...	2	...
3105	H25	0.020–0.031	23.0	...	19.0	...	3	...
3105	H25	0.032–0.050	23.0	...	19.0	...	4	...
3105	H25	0.051–0.080	23.0	...	19.0	...	6	...
3105	H26	0.013–0.031	25.0	...	21.0	.....	3	...
3105	H26	0.032–0.050	25.0	...	21.0	...	4	...
3105	H26	0.051–0.080	25.0	...	21.0	...	5	...
3105	H28	0.013–0.031	28.0	...	24.0	...	2	...
3105	H28	0.032–0.050	28.0	...	24.0	...	3	...
3105	H28	0.051–0.080	28.0	...	24.0	...	4	...
5005	O	0.006–0.007	15.0	21.0	5.0	...	12	...
5005	O	0.008–0.012	15.0	21.0	5.0	...	14	...
5005	O	0.013–0.019	15.0	21.0	5.0	...	16	...
5005	O	0.020–0.031	15.0	21.0	5.0	...	18	...
5005	O	0.032–0.050	15.0	21.0	5.0	...	20	...
5005	O	0.051–0.113	15.0	21.0	5.0	...	21	...
5005	O	0.114–0.249	15.0	21.0	5.0	...	22	...
5005	O	0.250–3.000	15.0	21.0	5.0	...	22	...
5005	H12	0.017–0.019	18.0	24.0	14.0	...	2	...
5005	H12	0.020–0.031	18.0	24.0	14.0	...	3	...
5005	H12	0.032–0.050	18.0	24.0	14.0	...	4	...
5005	H12	0.051–0.113	18.0	24.0	14.0	...	6	...
5005	H12	0.114–0.161	18.0	24.0	14.0	...	7	...
5005	H12	0.162–0.249	18.0	24.0	14.0	...	8	...
5005	H12	0.250–0.499	18.0	24.0	14.0	...	9	...
5005	H12	0.500–2.000	18.0	24.0	14.0	...	10	...
5005	H14	0.009–0.031	21.0	27.0	17.0	...	1	...
5005	H14	0.032–0.050	21.0	27.0	17.0	...	2	...
5005	H14	0.051–0.113	21.0	27.0	17.0	...	3	...
5005	H14	0.114–0.161	21.0	27.0	17.0	...	5	...
5005	H14	0.162–0.249	21.0	27.0	17.0	...	6	...
5005	H14	0.250–0.499	21.0	27.0	17.0	...	8	...
5005	H14	0.500–1.000	21.0	27.0	17.0	...	10	...
5005	H16	0.006–0.031	24.0	30.0	20.0	...	1	...
5005	H16	0.032–0.050	24.0	30.0	20.0	...	2	...

TABLE 2 *Continued*

Alloy	Temper	Specified Thickness, in.	Tensile Strength, ksi min	Tensile Strength, ksi max	Yield Strength (0.2 % offset), ksi min	Yield Strength (0.2 % offset), ksi max	Elongation in 2 in. or 4× Diameter, min, %	Bend Diameter Factor, *N*
5005	H16	0.051–0.162	24.0	30.0	20.0	...	3	...
5005	H18	0.006–0.031	27.0	...	...	...	1	...
5005	H18	0.032–0.050	27.0	...	...	...	2	...
5005	H18	0.051–0.128	27.0	...	...	...	3	...
5005	H32[C] or H22[C]	0.017–0.019	17.0	23.0	12.0	...	3	...
5005	H32[C] or H22[C]	0.020–0.031	17.0	23.0	12.0	...	4	...
5005	H32[C] or H22[C]	0.032–0.050	17.0	23.0	12.0	...	5	...
5005	H32[C] or H22[C]	0.051–0.113	17.0	23.0	12.0	...	7	...
5005	H32[C] or H22[C]	0.114–0.161	17.0	23.0	12.0	...	8	...
5005	H32[C] or H22[C]	0.162–0.249	17.0	23.0	12.0	...	9	...
5005	H32[C] or H22[C]	0.250–2.000	17.0	23.0	12.0	...	10	...
5005	H34[C] or H24[C]	0.009–0.012	20.0	26.0	15.0	...	2	...
5005	H34[C] or H24[C]	0.013–0.031	20.0	26.0	15.0	...	3	...
5005	H34[C] or H24[C]	0.032–0.050	20.0	26.0	15.0	...	4	...
5005	H34[C] or H24[C]	0.051–0.113	20.0	26.0	15.0	...	5	...
5005	H34[C] or H24[C]	0.114–0.161	20.0	26.0	15.0	...	6	...
5005	H34[C] or H24[C]	0.162–0.249	20.0	26.0	15.0	...	7	...
5005	H34[C] or H24[C]	0.250–0.499	20.0	26.0	15.0	...	8	...
5005	H34[C] or H24[C]	0.500–1.000	20.0	26.0	15.0	...	10	...
5005	H36[C] or H26[C]	0.006–0.007	23.0	29.0	18.0	...	1	...
5005	H36[C] or H26[C]	0.008–0.019	23.0	29.0	18.0	...	2	...
5005	H36[C] or H26[C]	0.020–0.031	23.0	29.0	18.0	...	3	...
5005	H36[C] or H26[C]	0.032–0.162	23.0	29.0	18.0	...	4	...
5005	H38	0.006–0.012	26.0	...	...	...	1	...
5005	H38	0.013–0.019	26.0	...	...	...	2	...
5005	H38	0.020–0.031	26.0	...	...	...	3	...
5005	H38	0.032–0.128	26.0	...	...	...	4	...
5005	H112	0.250–0.499	17.0	...	...	...	8	...
5005	H112	0.500–2.000	15.0	...	...	...	12	...
5005	H112	2.001–3.000	14.5	...	...	...	18	...
5005	F[D]	0.250–3.000	...	...	...	...	...	...
5010	O	0.010–0.070	15.0	21.0	5.0	...	3	...
5010	H22	0.010–0.070	17.0	23.0	14.0	...	2	...
5010	H24	0.010–0.070	20.0	26.0	17.0	...	1	...
5010	H26	0.010–0.070	23.0	29.0	21.0	...	1	...
5010	H28	0.010–0.070	26.0	...	...	...	...	...
5050	O	0.006–0.007	18.0	24.0	6.0	...	...	0
5050	O	0.008–0.019	18.0	24.0	6.0	...	16	0
5050	O	0.020–0.031	18.0	24.0	6.0	...	18	0
5050	O	0.032–0.113	18.0	24.0	6.0	...	20	0
5050	O	0.114–0.249	18.0	24.0	6.0	...	22	0
5050	O	0.250–3.000	18.0	24.0	6.0	...	20	2
5050	H32[C] or H22[C]	0.017–0.050	22.0	28.0	16.0	...	4	1
5050	H32[C] or H22[C]	0.051–0.249	22.0	28.0	16.0	...	6	2
5050	H34[C] or H24[C]	0.009–0.031	25.0	31.0	20.0	...	3	1
5050	H34[C] or H24[C]	0.032–0.050	25.0	31.0	20.0	...	4	1
5050	H34[C] or H24[C]	0.051–0.249	25.0	31.0	20.0	...	5	3
5050	H36[C] or H26[C]	0.006–0.019	27.0	33.0	22.0	...	2	3
5050	H36[C] or H26[C]	0.020–0.050	27.0	33.0	22.0	...	3	3
5050	H36[C] or H26[C]	0.051–0.162	27.0	33.0	22.0	...	4	4
5050	H38	0.006–0.007	29.0	...	...	...	...	...
5050	H38	0.008–0.031	29.0	...	...	...	2	...
5050	H38	0.032–0.050	29.0	...	...	...	3	...
5050	H38	0.051–0.128	29.0	...	...	...	4	...
5050	H112	0.250–3.000	20.0	...	8.0	...	12	...
5050	F[D]	0.250–3.000	...	...	...	...	...	...
5052	O	0.006–0.007	25.0	31.0	9.5	...	...	0
5052	O	0.008–0.012	25.0	31.0	9.5	...	14	0
5052	O	0.013–0.019	25.0	31.0	9.5	...	15	0
5052	O	0.020–0.031	25.0	31.0	9.5	...	16	0
5052	O	0.032–0.050	25.0	31.0	9.5	...	18	0
5052	O	0.051–0.113	25.0	31.0	9.5	...	19	0
5052	O	0.114–0.249	25.0	31.0	9.5	...	20	0
5052	O	0.250–3.000	25.0	31.0	9.5	...	18	...
5052	H141	0.090-0.174	35.5	...	24.0	...	6	...
5052	H141	0.175-0.300	34.0	...	24.0	...	8	...

TABLE 2 *Continued*

Alloy	Temper	Specified Thickness, in.	Tensile Strength, ksi min	Tensile Strength, ksi max	Yield Strength (0.2 % offset), ksi min	Yield Strength (0.2 % offset), ksi max	Elongation in 2 in. or 4× Diameter, min, %	Bend Diameter Factor, *N*
5052	H32[C] or H22[C]	0.017–0.019	31.0	38.0	23.0	...	4	0
5052	H32[C] or H22[C]	0.020–0.050	31.0	38.0	23.0	...	5	1
5052	H32[C] or H22[C]	0.051–0.113	31.0	38.0	23.0	...	7	2
5052	H32[C] or H22[C]	0.114–0.249	31.0	38.0	23.0	...	9	3
5052	H32[C] or H22[C]	0.250–0.499	31.0	38.0	23.0	...	11	...
5052	H32[C] or H22[C]	0.500–2.000	31.0	38.0	23.0	...	12	...
5052	H34[C] or H24[C]	0.009–0.019	34.0	41.0	26.0	...	3	1
5052	H34[C] or H24[C]	0.020–0.050	34.0	41.0	26.0	...	4	2
5052	H34[C] or H24[C]	0.051–0.113	34.0	41.0	26.0	...	6	3
5052	H34[C] or H24[C]	0.114–0.249	34.0	41.0	26.0	...	7	4
5052	H34[C] or H24[C]	0.250–1.000	34.0	41.0	26.0	...	10	...
5052	H36[C] or H26[C]	0.006–0.007	37.0	44.0	29.0	...	2	4
5052	H36[C] or H26[C]	0.008–0.031	37.0	44.0	29.0	...	3	4
5052	H36[C] or H26[C]	0.032–0.162	37.0	44.0	29.0	...	4	5
5052	H38[C] or H28[C]	0.006–0.007	39.0	...	32.0	...	2	...
5052	H38[C] or H28[C]	0.008–0.031	39.0	...	32.0	...	3	...
5052	H38[C] or H28[C]	0.032–0.128	39.0	...	32.0	...	4	...
5052	H112	0.250–0.499	28.0	...	16.0	...	7	...
5052	H112	0.500–2.000	25.0	...	9.5	...	12	...
5052	H112	2.001–3.000	25.0	...	9.5	...	16	...
5052	H322	0.020–0.050	31.0	35.0	21.0	...	5	...
5052	H322	0.051–0.113	31.0	35.0	21.0	...	7	...
5052	H322	0.114–0.125	31.0	35.0	21.0	...	9	...
5052	F[D]	0.250–3.000	...	...	...	...	...	...
5059	O	0.078–0.249	48.0	...	23.0	...	24	...
5059	O	0.250–0.787	48.0	...	23.0	...	24	...
5059	O	0.788–1.575	48.0	...	23.0	...	20	...
5059	O	1.576–7.000	44.0	...	21.0	...	17	...
5059	H111	0.078–0.249	48.0	...	23.0	...	24	...
5059	H111	0.250–0.787	48.0	...	23.0	...	24	...
5059	H111	0.788–1.575	48.0	...	23.0	...	20	...
5059	H111	1.576–7.000	44.0	...	21.0	...	17	...
5083	O	0.051–1.500	40.0	51.0	18.0	29.0	16	...
5083	O	1.501–3.000	39.0	50.0	17.0	29.0	16	...
5083	O	3.001–4.000	38.0	...	16.0	...	16	...
5083	O	4.001–5.000	38.0	...	16.0	...	14	...
5083	O	5.001–7.000	37.0	...	15.0	...	14	...
5083	O	7.001–8.000	36.0	...	14.0	...	12	...
5083	H32	0.125–0.187	44.0	56.0	31.0	...	10	...
5083	H32	0.188–1.500	44.0	56.0	31.0	...	12	...
5083	H32	1.501–3.000	41.0	56.0	29.0	...	12	...
5083	H112	0.250–1.500	40.0	...	18.0	...	12	...
5083	H112	1.501–3.000	39.0	...	17.0	...	12	...
5083	F[D]	0.250–8.000	...	...	...	...	...	...
5086	O	0.020–0.050	35.0	44.0	14.0	...	15	...
5086	O	0.051–0.249	35.0	44.0	14.0	...	18	...
5086	O	0.250–2.000	35.0	44.0	14.0	...	16	...
5086	H32[C] or H22[C]	0.020–0.050	40.0	47.0	28.0	...	6	...
5086	H32[C] or H22[C]	0.051–0.249	40.0	47.0	28.0	...	8	...
5086	H32[C] or H22[C]	0.250–2.000	40.0	47.0	28.0	...	12	...
5086	H34[C] or H24[C]	0.009–0.019	44.0	51.0	34.0	...	4	...
5086	H34[C] or H24[C]	0.020–0.050	44.0	51.0	34.0	...	5	...
5086	H34[C] or H24[C]	0.051–0.249	44.0	51.0	34.0	...	6	...
5086	H34[C] or H24[C]	0.250–1.000	44.0	51.0	34.0	...	10	...
5086	H36[C] or H26[C]	0.006–0.019	47.0	54.0	38.0	...	3	...
5086	H36[C] or H26[C]	0.020–0.050	47.0	54.0	38.0	...	4	...
5086	H36[C] or H26[C]	0.051–0.162	47.0	54.0	38.0	...	6	...
5086	H38[C] or H28[C]	0.006–0.020	50.0	...	41.0	...	3	...
5086	H112	0.188–0.499	36.0	...	18.0	...	8	...
5086	H112	0.500–1.000	35.0	...	16.0	...	10	...
5086	H112	1.001–2.000	35.0	...	14.0	...	14	...
5086	H112	2.001–3.000	34.0	...	14.0	...	14	...
5086	F[D]	0.250–3.000	...	...	...	...	...	...
5154	O	0.020–0.031	30.0	41.0	11.0	...	12	...

TABLE 2 *Continued*

Alloy	Temper	Specified Thickness, in.	Tensile Strength, ksi min	Tensile Strength, ksi max	Yield Strength (0.2 % offset), ksi min	Yield Strength (0.2 % offset), ksi max	Elongation in 2 in. or 4× Diameter, min, %	Bend Diameter Factor, *N*
5154	O	0.032–0.050	30.0	41.0	11.0	...	14	...
5154	O	0.051–0.113	30.0	41.0	11.0	...	16	...
5154	O	0.114–3.000	30.0	41.0	11.0	...	18	...
5154	H32[C] or H22[C]	0.020–0.050	36.0	43.0	26.0	...	5	...
5154	H32[C] or H22[C]	0.051–0.249	36.0	43.0	26.0	...	8	...
5154	H32[C] or H22[C]	0.250–2.000	36.0	43.0	26.0	...	12	...
5154	H34[C] or H24[C]	0.009–0.050	39.0	46.0	29.0	...	4	...
5154	H34[C] or H24[C]	0.051–0.161	39.0	46.0	29.0	...	6	...
5154	H34[C] or H24[C]	0.162–0.249	39.0	46.0	29.0	...	7	...
5154	H34[C] or H24[C]	0.250–1.000	39.0	46.0	29.0	...	10	...
5154	H36[C] or H26[C]	0.006–0.050	42.0	49.0	32.0	...	3	...
5154	H36[C] or H26[C]	0.051–0.113	42.0	49.0	32.0	...	4	...
5154	H36[C] or H26[C]	0.114–0.162	42.0	49.0	32.0	...	5	...
5154	H38[C] or H28[C]	0.006–0.050	45.0	...	35.0	...	3	...
5154	H38[C] or H28[C]	0.051–0.113	45.0	...	35.0	...	4	...
5154	H38[C] or H28[C]	0.114–0.128	45.0	...	35.0	...	5	...
5154	H112	0.250–0.499	32.0	...	18.0	...	8	...
5154	H112	0.500–2.000	30.0	...	11.0	...	11	...
5154	H112	2.001–3.000	30.0	...	11.0	...	15	...
5154	F[D]	0.250–3.000	...	...	...	...	...	...
5252	H24	0.030–0.090	30.0	38.0	...	...	10	...
5252	H25	0.030–0.090	31.0	39.0	...	...	9	...
5252	H28	0.030–0.090	38.0	...	...	...	3	...
5254	O	0.051–0.113	30.0	41.0	11.0	...	16	...
5254	O	0.114–3.000	30.0	41.0	11.0	...	18	...
5254	H32[C] or H22[C]	0.051–0.249	36.0	43.0	26.0	...	8	....
5254	H32[C] or H22[C]	0.250–2.000	36.0	43.0	26.0	...	12	...
5254	H34[C] or H24[C]	0.051–0.161	39.0	46.0	29.0	...	6	...
5254	H34[C] or H24[C]	0.162–0.249	39.0	46.0	29.0	...	7	...
5254	H34[C] or H24[C]	0.250–1.000	39.0	46.0	29.0	...	10	...
5254	H36[C] or H26[C]	0.051–0.113	42.0	49.0	32.0	...	4	...
5254	H36[C] or H26[C]	0.114–0.162	42.0	49.0	32.0	...	5	...
5254	H38[C] or H28[C]	0.051–0.113	45.0	...	35.0	...	4	...
5254	H38[C] or H28[C]	0.114–0.128	45.0	...	35.0	...	5	...
5254	H112	0.250–0.499	32.0	...	18.0	...	8	...
5254	H112	0.500–2.000	30.0	...	11.0	...	11	...
5254	H112	2.001–3.000	30.0	...	11.0	...	15	...
5254	F[D]	0.250–3.000	...	...	...	...	...	...
5454	O	0.020–0.031	31.0	41.0	12.0	...	12	...
5454	O	0.032–0.050	31.0	41.0	12.0	...	14	...
5454	O	0.051–0.113	31.0	41.0	12.0	...	16	...
5454	O	0.114–3.000	31.0	41.0	12.0	...	18	...
5454	H32[C] or H22[C]	0.020–0.050	36.0	44.0	26.0	...	5	...
5454	H32[C] or H22[C]	0.051–0.249	36.0	44.0	26.0	...	8	...
5454	H32[C] or H22[C]	0.250–2.000	36.0	44.0	26.0	...	12	...
5454	H34[C] or H24[C]	0.020–0.050	39.0	47.0	29.0	...	4	...
5454	H34[C] or H24[C]	0.051–0.161	39.0	47.0	29.0	...	6	...
5454	H34[C] or H24[C]	0.162–0.249	39.0	47.0	29.0	...	7	...
5454	H34[C] or H24[C]	0.250–1.000	39.0	47.0	29.0	...	10	...
5454	H112	0.250–0.499	32.0	...	18.0	...	8	...
5454	H112	0.500–2.000	31.0	...	12.0	...	11	...
5454	H112	2.001–3.000	31.0	...	12.0	...	15	...
5454	F[D]	0.250–3.000	...	...	...	...	...	...
5754	O	0.030–0.055	29.0	39.0	12.0	...	17	...
5754	O	0.056–0.087	29.0	39.0	12.0	...	18	...
5754	O	0.088–0.138	29.0	39.0	12.0	...	19	...
5456	O	0.051–1.500	42.0	53.0	19.0	30.0	16	...
5456	O	1.501–3.000	41.0	52.0	18.0	30.0	16	...
5456	O	3.001–5.000	40.0	...	17.0	...	14	...
5456	O	5.001–7.000	39.0	...	16.0	...	14	...
5456	O	7.001–8.000	38.0	...	15.0	...	12	...
5456	H32	0.188–0.499	46.0	59.0	33.0	...	12	...

TABLE 2 *Continued*

Alloy	Temper	Specified Thickness, in.	Tensile Strength, ksi min	Tensile Strength, ksi max	Yield Strength (0.2 % offset), ksi min	Yield Strength (0.2 % offset), ksi max	Elongation in 2 in. or 4× Diameter, min, %	Bend Diameter Factor, *N*
5456	H32	0.500–1.500	44.0	56.0	31.0	...	12	...
5456	H32	1.501–3.000	41.0	54.0	29.0	...	12	...
5456	H112	0.250–1.500	42.0	...	19.0	...	12	...
5456	H112	1.501–3.000	41.0	...	18.0	...	12	...
5456	F[D]	0.250–8.000	...	...	...	...	...	...
5457	O	0.030–0.090	16.0	22.0	...	...	20	...
5657	H241[F]	0.030–0.090	18.0	26.0	...	...	13	...
5657	H25	0.030–0.090	20.0	28.0	...	...	8	...
5657	H26	0.030–0.090	22.0	30.0	...	...	7	...
5657	H28	0.030–0.090	25.0	...	...	...	5	...

[A] To determine conformance to this specification each value for tensile strength and yield strength shall be rounded to the nearest 0.1 ksi and each value for elongation to the nearest 0.5 %, both in accordance with the Rounding Method of Practice E29.
[B] The basis for establishment of mechanical property limits is shown in Annex A1.
[C] Material in either of these tempers (H32 or H22), (H34 or H24), (H36 or H26), (H38 or H28), (H12 or H22), (H14 or H24), (H16 or H26), (H18 or H28), may be supplied at the option of the supplier, unless one is specifically excluded by the contract or purchase order. When ordered as H2x tempers, the maximum tensile strength and minimum yield strength do not apply. When H2x tempers are supplied instead of ordered H1x or H3x tempers, the supplied H2x temper material shall meet the respective H1x or H3x temper tensile property limits.
[D] Tests of F temper plate for tensile properties are not required.
[E] The tension test specimen from plate 0.500 in. and thicker is machined from the core and does not include the cladding alloy.
[F] This material is subject to some recrystallization and an attendant loss of brightness.

the same source of molten metal. If the producer has determined the chemical composition during pouring of the ingots, they shall not be required to sample and analyze the finished product.

NOTE 4—It is standard practice in the United States aluminum industry to determine conformance to the chemical composition limits prior to further processing of ingots into wrought products. Due to the continuous nature of the process, it is not practical to keep a specific ingot analysis identified with a specific quantity of finished material.

7.2 If it becomes necessary to analyze sheet and plate for conformance to chemical composition limits, the methods of sampling and methods of analysis shall be as provided in the following:

7.2.1 *Methods of Sampling*—Samples for chemical analysis shall be taken in accordance with Practice B985.

7.2.2 *Methods of Analysis*—Analysis shall be performed in accordance with Test Methods E34, E607, or E1251, or with EN 14242.

NOTE 5—It is difficult to obtain a reliable analysis of each of the components of clad materials using material in its finished state. A reasonably accurate determination of the core composition can be made if the cladding is substantially removed prior to analysis. The cladding composition is more difficult to determine because of the relatively thin layer and because of diffusion of core elements to the cladding. The correctness of cladding alloy used can usually be verified by a combination of metallographic examination and spectrochemical analysis of the surface at several widely separated points.

8. Heat Treatment

8.1 Unless specified in 8.2 or as noted in 8.3, producer or supplier heat treatment for the applicable tempers in Table 3 shall be in accordance with AMS 2772.

8.2 When specified (4.2.2), heat treatment of applicable tempers in Table 3 shall be in accordance with Practice B918.

8.3 When specified (4.2.3), alloy 6061 plate may be produced using hot rolling mill solution heat treatment in accordance with Practice B947, when aged in accordance with Practice B918 for the production of T651 tempers, as applicable.

9. Tensile Properties of Material as Supplied

9.1 *Limits*—The sheet and plate shall conform to the requirements for tensile properties as specified in Table 2 and Table 3 for nonheat-treatable and heat-treatable alloys, respectively.

9.1.1 Tensile property limits for sizes not covered in Table 2 or Table 3 shall be as agreed upon between the producer and purchaser and shall be so specified in the contract or purchase order.

9.2 *Number of Samples*—One sample shall be taken from each end of each parent coil, or parent plate, but no more than one sample per 2000 lb of sheet or 4000 lb of plate, or part thereof, in a lot shall be required. Other procedures for selecting samples may be employed if agreed upon between the producer and purchaser.

9.3 *Test Specimens*—Geometry of test specimens and the location in the product from which they are taken shall be as specified in Test Method B557.

9.4 *Test Direction*—Unless otherwise specified, tensile testing shall be in the direction specified in Test Method B557. When a direction other than specified in Test Method B557 is tested, the tensile testing direction shall be noted on all documentation.

9.5 *Test Methods*—The tension test shall be made in accordance with Test Method B557.

TABLE 3 Tensile Property Limits for Heat-Treatable Alloys[A,B]

Alloy	Temper	Specified Thickness, in.	Axis of Test Specimen[C]	Tensile Strength, ksi		Yield Strength (0.2 % offset), ksi		Elongation in 2 in. or 4× Diameter, min, %	Bend Diameter Factor, *N*
				min	max	min	max		
2014	O	0.020–0.124	...	...	32.0	...	16.0	16	0
2014	O	0.125–0.249	...	...	32.0	...	16.0	16	1
2014	O	0.250–0.499	...	...	32.0	...	16.0	16	2
2014	T3	0.020–0.039	...	59.0	...	35.0	...	14	3
2014	T3	0.040–0.124	...	59.0	...	36.0	...	14	3
2014	T3	0.125–0.249	...	59.0	...	36.0	...	14	4
2014	T4[D]	0.020–0.124	...	59.0	...	35.0	...	14	3
2014	T4[D]	0.125–0.249	...	59.0	...	35.0	...	14	4
2014	T42[E]	0.020–0.124	...	58.0	...	34.0	...	14	3
2014	T42[E]	0.125–0.249	...	58.0	...	34.0	...	14	4
2014	T42[E]	0.250–0.499	...	58.0	...	34.0	...	14	5
2014	T42[E]	0.500–1.000	...	58.0	...	34.0	...	14	...
2014	T451[F]	0.250–1.000	...	58.0	...	36.0	...	14	....
2014	T451[F]	1.001–2.000	...	58.0	...	36.0	...	12	...
2014	T451[F]	2.001–3.000	...	57.0	...	36.0	...	8	...
2014	T6, T62[E]	0.020–0.039	...	64.0	...	57.0	...	6	4
2014	T6, T62[E]	0.040–0.050	...	66.0	...	58.0	...	7	5
2014	T6, T62[E]	0.051–0.124	...	66.0	...	58.0	...	7	6
2014	T6, T62[E]	0.125–0.249	...	66.0	...	58.0	...	7	8
2014	T62[E] , T651[F]	0.250–0.499	...	67.0	...	59.0	...	7	10
2014	T62[E] , T651[F]	0.500–1.000	...	67.0	...	59.0	...	6	...
2014	T62[E] , T651[F]	1.001–2.000	...	67.0	...	59.0	...	4	...
2014	T62[E] , T651[F]	2.001–2.500	...	65.0	...	58.0	...	2	...
2014	T62[E] , T651[F]	2.501–3.000	...	63.0	...	57.0	...	2	...
2014	T62[E] , T651[F]	3.001–4.000	...	59.0	...	55.0	...	1	...
2014	F[G]	0.250–1.000	...	...	...	...	...	...	...
Alclad 2014	O	0.020–0.499	...	...	30.0	...	14.0	16	...
Alclad 2014	O	0.500–1.000	...	...	32.0[H]	...	...	10	...
Alclad 2014	T3	0.020–0.024	...	54.0	...	33.0	...	14	...
Alclad 2014	T3	0.025–0.039	...	55.0	...	34.0	...	14	...
Alclad 2014	T3	0.040–0.249	...	57.0	...	35.0	...	15	...
Alclad 2014	T4[D]	0.020–0.024	...	54.0	...	31.0	...	14	...
Alclad 2014	T4[D]	0.025–0.039	...	55.0	...	32.0	...	14	...
Alclad 2014	T4[D]	0.040–0.249	...	57.0	...	34.0	...	15	...
Alclad 2014	T42[E]	0.020–0.024	...	54.0	...	31.0	...	14	...
Alclad 2014	T42[E]	0.025–0.039	...	55.0	...	32.0	...	14	...
Alclad 2014	T42[E]	0.040–0.499	...	57.0	...	34.0	...	15	...
Alclad 2014	T42[E]	0.500–1.000	...	58.0[H]	...	34.0[H]	...	14	...
Alclad 2014	T451[F]	0.250–0.499	...	57.0	...	36.0	...	15	...
Alclad 2014	T451[F]	0.500–1.000	...	58.0[H]	...	36.0[H]	...	14	...
Alclad 2014	T451[F]	1.001–2.000	...	58.0[H]	...	36.0[H]	...	12	...
Alclad 2014	T451[F]	2.001–3.000	...	57.0[H]	...	36.0[H]	...	8	...
Alclad 2014	T6, T62[E]	0.020–0.024	...	62.0	...	54.0	...	7	...
Alclad 2014	T6, T62[E]	0.025–0.039	...	63.0	...	55.0	...	7	...
Alclad 2014	T6, T62[E]	0.040–0.249	...	64.0	...	57.0	...	8	...
Alclad 2014	T62[E] , T651[F]	0.250–0.499	...	64.0	...	57.0	...	8	...
Alclad 2014	T62[E] , T651[F]	0.500–1.000	...	67.0[H]	...	59.0[H]	...	6	...
Alclad 2014	T62[E] , T651[F]	1.001–2.000	...	67.0[H]	...	59.0[H]	...	4	...
Alclad 2014	T62[E] , T651[F]	2.001–2.500	...	65.0[H]	...	58.0[H]	...	2	...
Alclad 2014	T62[E] , T651[F]	2.501–3.000	...	63.0[H]	...	57.0[H]	...	2	...
Alclad 2014	T62[E] , T651[F]	3.001–4.000	...	59.0[H]	...	55.0[H]	...	1	...
Alclad 2014	F[G]	0.250–1.000	...	...	...	...	...	...	...
2024	O	0.010–0.032	...	...	32.0	...	14.0	12	0
2024	O	0.033–0.063	...	...	32.0	...	14.0	12	1
2024	O	0.064–0.128	...	...	32.0	...	14.0	12	4
2024	O	0.129–0.499	...	...	32.0	...	14.0	12	6
2024	T3	0.008–0.009	...	63.0	...	42.0	...	10	4
2024	T3	0.010–0.020	...	63.0	...	42.0	...	12	4
2024	T3	0.021–0.051	...	63.0	...	42.0	...	15	5
2024	T3	0.052–0.128	...	63.0	...	42.0	...	15	6
2024	T3	0.129–0.249	...	64.0	...	42.0	...	15	8
2024	T351[F]	0.250–0.499	...	64.0	...	42.0	...	12	...
2024	T351[F]	0.500–1.000	...	63.0	...	42.0	...	8	...
2024	T351[F]	1.001–1.500	...	62.0	...	42.0	...	7	...
2024	T351[F]	1.501–2.000	...	62.0	...	42.0	...	6	...

TABLE 3 *Continued*

Alloy	Temper	Specified Thickness, in.	Axis of Test Specimen[C]	Tensile Strength, ksi		Yield Strength (0.2 % offset), ksi		Elongation in 2 in. or 4× Diameter, min, %	Bend Diameter Factor, *N*
				min	max	min	max		
2024	T351[F]	2.001–3.000	...	60.0	...	42.0	...	4	...
2024	T351[F]	3.001–4.000	...	57.0	...	41.0	...	4	
2024	T361[I]	0.020–0.051	...	67.0	...	50.0	...	8	4
2024	T361[I]	0.052–0.062	...	67.0	...	50.0	...	8	8
2024	T361[I]	0.063–0.249	...	68.0	...	51.0	...	9	8
2024	T361[I]	0.250–0.499	...	66.0	...	49.0	...	9	...
2024	T361[I]	0.500	...	66.0	...	49.0	...	10	...
2024	T4[D]	0.010–0.020	...	62.0	...	40.0	...	12	4
2024	T4[D]	0.021–0.051	...	62.0	...	40.0	...	15	5
2024	T4[D]	0.052–0.128	...	62.0	...	40.0	...	15	6
2024	T4[D]	0.129–0.249	...	62.0	...	40.0	...	15	8
2024	T42[E]	0.010–0.020	...	62.0	...	38.0	...	12	4
2024	T42[E]	0.021–0.051	...	62.0	...	38.0	...	15	5
2024	T42[E]	0.052–0.128	...	62.0	...	38.0	...	15	6
2024	T42[E]	0.129–0.249	...	62.0	...	38.0	...	15	8
2024	T42[E]	0.250–0.499	...	62.0	...	38.0	...	12	10
2024	T42[E]	0.500–1.000	...	61.0	...	38.0	...	8	...
2024	T42[E]	1.001–1.500	...	60.0	...	38.0	...	7	...
2024	T42[E]	1.501–2.000	...	60.0	...	38.0	...	6	...
2024	T42[E]	2.001–3.000	...	58.0	...	38.0	...	4	...
2024	T62[E]	0.010–0.499	...	64.0	...	50.0	...	5	...
2024	T62[E]	0.500–3.000	...	63.0	...	50.0	...	5	...
2024	T72[E,J]	0.010–0.249	...	60.0	...	46.0	...	5	...
2024	T81	0.010–0.249	...	67.0	...	58.0	...	5	...
2024	T851[F]	0.250–0.499	...	67.0	...	58.0	...	5	...
2024	T851[F]	0.500–1.000	...	66.0	...	58.0	...	5	...
2024	T851[F]	1.001–1.499	...	66.0	...	57.0	...	5	...
2024	T861[I]	0.020–0.062	...	70.0	...	62.0	...	3	...
2024	T861[I]	0.063–0.249	...	71.0	...	66.0	...	4	...
2024	T861[I]	0.250–0.499	...	70.0	...	64.0	...	4	...
2024	T861[I]	0.500	...	70.0	...	64.0	...	4	...
2024	F[G]	0.250–3.000	...	...	...	...	.. .	...	...
Alclad 2024	O	0.008–0.009	...	...	30.0	...	14.0	10	0
Alclad 2024	O	0.010–0.032	...	...	30.0	...	14.0	12	0
Alclad 2024	O	0.033–0.062	...	...	30.0	...	14.0	12	1
Alclad 2024	O	0.063–0.249	...	...	32.0	...	14.0	12	2
Alclad 2024	O	0.250–0.499	...	...	32.0	...	14.0	12	3
Alclad 2024	O	0.500–1.750	...	...	32.0[H]	...	...	12	...
Alclad 2024	T3	0.008–0.009	...	58.0	...	39.0	...	10	4
Alclad 2024	T3	0.010–0.020	...	59.0	...	39.0	...	12	4
Alclad 2024	T3	0.021–0.040	...	59.0	...	39.0	...	15	4
Alclad 2024	T3	0.041–0.062	...	59.0	...	39.0	...	15	5
Alclad 2024	T3	0.063–0.128	...	61.0	...	40.0	...	15	5
Alclad 2024	T3	0.129–0.249	...	62.0	...	40.0	...	15	8
Alclad 2024	T351[F]	0.250–0.499	...	62.0	...	40.0	...	12	...
Alclad 2024	T351[F]	0.500–1.000	...	63.0[H]	...	42.0[H]	...	8	...
Alclad 2024	T351[F]	1.001–1.500	...	62.0[H]	...	42.0[H]	...	7	...
Alclad 2024	T351[F]	1.501–2.000	...	62.0[H]	...	42.0[H]	...	6	...
Alclad 2024	T351[F]	2.001–3.000	...	60.0[H]	...	42.0[H]	...	4	...
Alclad 2024	T351[F]	3.001–4.000	...	57.0[H]	...	41.0[H]	...	4	...
Alclad 2024	T361[I]	0.020–0.062	...	61.0	...	47.0	...	8	4
Alclad 2024	T361[I]	0.063–0.187	...	64.0	...	48.0	...	9	6
Alclad 2024	T361[I]	0.188–0.249	...	64.0	...	48.0	...	9	8
Alclad 2024	T361[I]	0.250–0.499	...	64.0	...	48.0	...	9	...
Alclad 2024	T361[I]	0.500	...	66.0[H]	...	49.0[H]	...	10	...
Alclad 2024	T4[D]	0.010–0.020	...	58.0	...	36.0	...	12	4
Alclad 2024	T4[D]	0.021–0.040	...	58.0	...	36.0	...	15	4
Alclad 2024	T4[D]	0.041–0.062	...	58.0	...	36.0	...	15	5
Alclad 2024	T4[D]	0.063–0.128	...	61.0	...	38.0	...	15	5
Alclad 2024	T42[E]	0.008–0.009	...	55.0	...	34.0	...	10	4
Alclad 2024	T42[E]	0.010–0.020	...	57.0	...	34.0	...	12	4
Alclad 2024	T42[E]	0.021–0.040	...	57.0	...	34.0	...	15	4
Alclad 2024	T42[E]	0.041–0.062	...	57.0	...	34.0	...	15	5
Alclad 2024	T42[E]	0.063–0.128	...	60.0	...	36.0	...	15	5
Alclad 2024	T42[E]	0.129–0.187	...	60.0	...	36.0	...	15	8
Alclad 2024	T42[E]	0.188–0.249	...	60.0	...	36.0	...	15	8
Alclad 2024	T42[E]	0.250–0.499	...	60.0	...	36.0	...	12	10

TABLE 3 *Continued*

Alloy	Temper	Specified Thickness, in.	Axis of Test Specimen[C]	Tensile Strength, ksi		Yield Strength (0.2 % offset), ksi		Elongation in 2 in. or 4× Diameter, min, %	Bend Diameter Factor, *N*
				min	max	min	max		
Alclad 2024	T42[E]	0.500–1.000	...	61.0[H]	...	38.0[H]	...	8	...
Alclad 2024	T42[E]	1.001–1.500	...	60.0[H]	...	38.0[H]	...	7	...
Alclad 2024	T42[E]	1.501–2.000	...	60.0[H]	...	38.0[H]	...	6	...
Alclad 2024	T42[E]	2.001–3.000	...	58.0[H]	...	38.0[H]	...	4	...
Alclad 2024	T62[E]	0.010–0.062	...	60.0	...	47.0	...	5	...
Alclad 2024	T62[E]	0.063–0.499	...	62.0	...	49.0	...	5	...
Alclad 2024	T72[E,J]	0.010–0.062	...	56.0	...	43.0	...	5	...
Alclad 2024	T72[E,J]	0.063–0.249	...	58.0	...	45.0	...	5	...
Alclad 2024	T81	0.010–0.062	...	62.0	...	54.0	...	5	...
Alclad 2024	T81	0.063–0.249	...	65.0	...	56.0	...	5	...
Alclad 2024	T851[F]	0.250–0.499	...	65.0	...	56.0	...	5	...
Alclad 2024	T851[F]	0.500–1.000	...	66.0[H]	...	58.0[H]	...	5	...
Alclad 2024	T861[I]	0.020–0.062	...	64.0	...	58.0	...	3	...
Alclad 2024	T861[I]	0.063–0.187	...	69.0	...	64.0	...	4	...
Alclad 2024	T861[I]	0.188–0.249	...	69.0	...	64.0	...	4	...
Alclad 2024	T861[I]	0.250–0.499	...	68.0	...	62.0	...	4	...
Alclad 2024	T861[I]	0.500	...	70.0[H]	...	64.0[H]	...	4	...
Alclad 2024	F[G]	0.250–3.000	...	...	...	...	...	...	...
1½ % Alclad 2024	O	0.188–0.499	...	...	32.0	...	14.0	12	...
1½ % Alclad 2024	O	0.500–1.750	...	...	32.0[H]	...	...	12	...
1½ % Alclad 2024	T3	0.188–0.249	...	63.0	...	41.0	...	15	...
1½ % Alclad 2024	T361	0.188–0.249	...	65.0	...	49.0	...	9	...
1½ % Alclad 2024	T361	0.250–0.499	...	65.0	...	48.0	...	9	...
1½ % Alclad 2024	T361	0.500	...	66.0[H]	...	49.0[H]	...	10	...
1½ % Alclad 2024	T351[F]	0.250–0.499	...	63.0	...	41.0	...	12	...
1½ % Alclad 2024	T351[F]	0.500–1.000	...	63.0[H]	...	42.0[H]	...	8	...
1½ % Alclad 2024	T351[F]	1.001–1.500	...	62.0[H]	...	42.0[H]	...	7	...
1½ % Alclad 2024	T351[F]	1.501–2.000	...	62.0[H]	...	42.0[H]	...	6	...
1½ % Alclad 2024	T351[F]	2.001–3.000	...	60.0[H]	...	42.0[H]	...	4	...
1½ % Alclad 2024	T351[F]	3.001–4.000	...	57.0[H]	...	41.0[H]	...	4	...
1½ % Alclad 2024	T42[E]	0.188–0.249	...	61.0	...	37.0	...	15	...
1½ % Alclad 2024	T42[E]	0.250–0.499	...	61.0	...	37.0	...	12	...
1½ % Alclad 2024	T42[E]	0.500–1.000	...	61.0[H]	...	38.0[H]	...	8	...
1½ % Alclad 2024	T42[E]	1.001–1.500	...	60.0[H]	...	38.0[H]	...	7	...
1½ % Alclad 2024	T42[E]	1.501–2.000	...	60.0[H]	...	38.0[H]	...	6	...
1½ % Alclad 2024	T42[E]	2.001–3.000	...	58.0[H]	...	38.0[H]	...	4	...
1½ % Alclad 2024	T62[E]	0.188–0.499	...	62.0	...	49.0	...	5	...
1½ % Alclad 2024	T72[E, J]	0.188–0.249	...	59.0	...	45.0	...	5	...
1½ % Alclad 2024	T81	0.188–0.249	...	66.0	...	57.0	...	5	...
1½ % Alclad 2024	T851[F]	0.250–0.499	...	66.0	...	57.0	...	5	...
1½ % Alclad 2024	T851[F]	0.500–1.000	...	66.0[H]	...	58.0[H]	...	5	...
1½ % Alclad 2024	T861	0.188–0.249	...	70.0	...	65.0	...	4	...
1½ % Alclad 2024	T861	0.250–0.499	...	69.0	...	63.0	...	4	...
1½ % Alclad 2024	T861	0.500	...	70.0[H]	...	64.0[H]	...	4	...
1½ % Alclad 2024	F[G]	0.250–3.000	...	...	...	...	...	...	...
Alclad 1-Side 2024	O	0.008–0.009	...	...	31.0	...	14.0	10	...
Alclad 1-Side 2024	O	0.010–0.062	...	...	31.0	...	14.0	12	...
Alclad 1-Side 2024	O	0.063–0.499	...	...	32.0	...	14.0	12	...
Alclad 1-Side 2024	T3	0.010–0.020	...	61.0	...	40.0	...	12	...
Alclad 1-Side 2024	T3	0.021–0.062	...	61.0	...	40.0	...	15	...
Alclad 1-Side 2024	T3	0.063–0.128	...	62.0	...	41.0	...	15	...
Alclad 1-Side 2024	T3	0.129–0.249	...	63.0	...	41.0	...	15	...
Alclad 1-Side 2024	T351[F]	0.250–0.499	...	63.0	...	41.0	...	12	...
Alclad 1-Side 2024	T361	0.020–0.062	...	64.0	...	48.0	...	8	...
Alclad 1-Side 2024	T361	0.063–0.249	...	66.0	...	49.0	...	9	...
Alclad 1-Side 2024	T361	0.250–0.499	...	65.0	...	48.0	...	9	...
Alclad 1-Side 2024	T42[E]	0.010–0.020	...	59.0	...	35.0	...	12	...
Alclad 1-Side 2024	T42[E]	0.021–0.062	...	59.0	...	36.0	...	15	...
Alclad 1-Side 2024	T42[E]	0.063–0.249	...	61.0	...	37.0	...	15	...
Alclad 1-Side 2024	T42[E]	0.250–0.499	...	61.0	...	37.0	...	12	...
Alclad 1-Side 2024	T62[E]	0.010–0.062	...	62.0	...	48.0	...	5	...
Alclad 1-Side 2024	T62[E]	0.063–0.499	...	63.0	...	49.0	...	5	...
Alclad 1-Side 2024	T72[E,J]	0.010–0.062	...	58.0	...	44.0	...	5	...
Alclad 1-Side 2024	T72[E,J]	0.063–0.249	...	59.0	...	45.0	...	5	...
Alclad 1-Side 2024	T81	0.010–0.062	...	64.0	...	56.0	...	5	...

TABLE 3 *Continued*

Alloy	Temper	Specified Thickness, in.	Axis of Test Specimen[C]	Tensile Strength, ksi		Yield Strength (0.2 % offset), ksi		Elongation in 2 in. or 4× Diameter, min, %	Bend Diameter Factor, *N*
				min	max	min	max		
Alclad 1-Side 2024	T81	0.063–0.249	...	66.0	...	57.0	...	5	...
Alclad 1-Side 2024	T851[F]	0.250–0.499	...	66.0	...	57.0	...	5	...
Alclad 1-Side 2024	T861	0.020–0.062	...	67.0	...	60.0	...	3	...
Alclad 1-Side 2024	T861	0.063–0.249	...	70.0	...	65.0	...	4	...
Alclad 1-Side 2024	T861	0.250–0.499	...	69.0	...	63.0	...	4	...
Alclad 1-Side 2024	F[G]	0.250–0.499	...	...	...	...	...	...	...
1½ % Alclad 1-Side 2024	O	0.188–0.499	...	...	32.0	...	14.0	12	...
1½ % Alclad 1-Side 2024	T3	0.188–0.249	...	63.0	...	41.0	...	15	...
1½ % Alclad 1-Side 2024	T351[F]	0.250–0.499	...	63.0	...	41.0	...	12	...
1½ % Alclad 1-Side 2024	T361	0.188–0.249	...	66.0	...	49.0	...	9	...
1½ % Alclad 1-Side 2024	T361	0.250–0.499	...	65.0	...	48.0	...	9	...
1½ % Alclad 1-Side 2024	T42[E]	0.188–0.249	...	61.0	...	37.0	...	15	...
1½ % Alclad 1-Side 2024	T42[E]	0.250–0.499	...	61.0	...	37.0	...	12	...
1½ % Alclad 1-Side 2024	T62[E]	0.188–0.499	...	63.0	...	49.0	...	5	...
1½ % Alclad 1-Side 2024	T72[E,J]	0.188–0.249	...	59.0	...	45.0	...	5	...
1½ % Alclad 1-Side 2024	T81	0.188–0.249	...	66.0	...	57.0	...	5	...
1½ % Alclad 1-Side 2024	T851[F]	0.250–0.499	...	66.0	...	57.0	...	5	...
1½ % Alclad 1-Side 2024	T861	0.188–0.249	...	70.0	...	65.0	...	4	...
1½ % Alclad 1-Side 2024	T861	0.250–0.499	...	69.0	...	63.0	...	4	...
1½ % Alclad 1-Side 2024	F[G]	0.250–0.499	...	...	...	...	...	...	...
2124	T851[F]	1.000–2.000[K]	longitudinal	66.0	...	57.0	...	6	...
2124	T851[F]	1.000–2.000[K]	long transverse	66.0	...	57.0	...	5	...
2124	T851[F]	1.000–2.000[K]	short transverse	64.0	...	55.0	...	1.5	...
2124	T851[F]	2.001–3.000	longitudinal	65.0	...	57.0	...	6	...
2124	T851[F]	2.001–3.000	long transverse	65.0	...	57.0	...	4	...
2124	T851[F]	2.001–3.000	short transverse	63.0	...	55.0	...	1.5	...
2124	T851[F]	3.001–4.000	longitudinal	65.0	...	56.0	...	5	...
2124	T851[F]	3.001–4.000	long transverse	65.0	...	56.0	...	4	...
2124	T851[F]	3.001–4.000	short transverse	62.0	...	54.0	...	1.5	...
2124	T851[F]	4.001–5.000	longitudinal	64.0	...	55.0	...	5	...
2124	T851[F]	4.001–5.000	long transverse	64.0	...	55.0	...	4	...
2124	T851[F]	4.001–5.000	short transverse	61.0	...	53.0	...	1.5	...
2124	T851[F]	5.001–6.000	longitudinal	63.0	...	54.0	...	5	...
2124	T851[F]	5.001–6.000	long transverse	63.0	...	54.0	...	4	...
2124	T851[F]	5.001–6.000	short transverse	58.0	...	51.0	...	1.5	...
2219	O	0.020–0.250	...	...	32.0	...	16.0	12	4
2219	O	0.251–0.750	...	...	32.0	...	16.0	12	6
2219	O	0.751–1.000	...	...	32.0	...	16.0	12	8
2219	O	1.001–2.000	...	...	32.0	...	16.0	12	...

TABLE 3 *Continued*

Alloy	Temper	Specified Thickness, in.	Axis of Test Specimen[C]	Tensile Strength, ksi		Yield Strength (0.2 % offset), ksi		Elongation in 2 in. or 4× Diameter, min, %	Bend Diameter Factor, *N*
				min	max	min	max		
2219	T31[L] (flat sheet)	0.020–0.039	...	46.0	...	29.0	...	8	...
2219	T31[L] (flat sheet)	0.040–0.249	...	46.0	...	28.0	...	10	...
2219	T351[F,L] plate (formerly T31 plate)	0.250–2.000	...	46.0	...	28.0	...	10	...
2219	T351[F,L] plate (formerly T31 plate)	2.001–3.000	...	44.0	...	28.0	...	10	...
2219	T351[F,L] plate (formerly T31 plate)	3.001–4.000	...	42.0	...	27.0	...	9	...
2219	T351[F,L] plate (formerly T31 plate)	4.001–5.000	...	40.0	...	26.0	...	9	...
2219	T351[F,L] plate (formerly T31 plate)	5.001–6.000	...	39.0	...	25.0	...	8	...
2219	T37[L]	0.020–0.039	...	49.0	...	38.0	...	6	...
2219	T37[L]	0.040–2.500	...	49.0	...	37.0	...	6	...
2219	T37[L]	2.501–3.000	...	47.0	...	36.0	...	6	...
2219	T37[L]	3.001–4.000	...	45.0	...	35.0	...	5	...
2219	T37[L]	4.001–5.000	...	43.0	...	34.0	...	4	...
2219	T62[E]	0.020–0.039	...	54.0	...	36.0	...	6	...
2219	T62[E]	0.040–0.249	...	54.0	...	36.0	...	7	...
2219	T62[E]	0.250–1.000	...	54.0	...	36.0	...	8	...
2219	T62[E]	1.001–2.000	...	54.0	...	36.0	...	7	...
2219	T81 sheet	0.020–0.039	...	62.0	...	46.0	...	6	...
2219	T81 sheet	0.040–0.249	...	62.0	...	46.0	...	7	...
2219	T851[F] plate (formerly T81 plate)	0.250–1.000	...	62.0	...	46.0	...	8	...
2219	T851[F] plate (formerly T81 plate)	1.001–2.000	...	62.0	...	46.0	...	7	...
2219	T851[F] plate (formerly T81 plate)	2.001–3.000	...	62.0	...	45.0	...	6	...
2219	T851[F] plate (formerly T81 plate)	3.001–4.000	...	60.0	...	44.0	...	5	...
2219	T851[F] plate (formerly T81 plate)	4.001–5.000	...	59.0	...	43.0	...	5	...
2219	T851[F] plate (formerly T81 plate)	5.001–6.000	...	57.0	...	42.0	...	4	...
2219	T87	0.020–0.039	...	64.0	...	52.0	...	5	...
2219	T87	0.040–0.249	...	64.0	...	52.0	...	6	...
2219	T87	0.250–1.000	...	64.0	...	51.0	...	7	...
2219	T87	1.001–2.000	...	64.0	...	51.0	...	6	...
2219	T87	2.001–3.000	...	64.0	...	51.0	...	6	...
2219	T87	3.001–4.000	...	62.0	...	50.0	...	4	...
2219	T87	4.001–5.000	...	61.0	...	49.0	...	3	...
2219	F[G]	0.250–2.000	...	...	...	...	...	...	...
Alclad 2219	O	0.020–0.499	...	...	32.0	...	16.0	12	...
Alclad 2219	O	0.500–2.000	...	...	32.0[H]	...	16.0[H]	...	...
Alclad 2219	T31[L] (flat sheet)	0.040–0.099	...	42.0	...	25.0	...	10	...
Alclad 2219	T31[L] (flat sheet)	0.100–0.249	...	44.0	...	26.0	...	10	...
Alclad 2219	T351[F,L] plate (formerly T31 plate)	0.250–0.499	...	44.0	...	26.0	...	10	...
Alclad 2219	T37[L]	0.040–0.099	...	45.0		34.0	...	6	...
Alclad 2219	T37[L]	0.100–0.499	...	47.0	...	35.0	...	6	...
Alclad 2219	T62[E]	0.020–0.039	...	44.0	...	29.0	...	6	...
Alclad 2219	T62[E]	0.040–0.099	...	49.0	...	32.0	...	7	...
Alclad 2219	T62[E]	0.100–0.249	...	51.0	...	34.0	...	7	...
Alclad 2219	T62[E]	0.250–0.499	...	51.0	...	34.0	...	8	...
Alclad 2219	T62[E]	0.500–1.000	...	54.0[H]	...	36.0[H]	...	8	...
Alclad 2219	T62[E]	1.001–2.000	...	54.0[H]	...	36.0[H]	...	7	...
Alclad 2219	T81 (flat sheet)	0.020–0.039	...	49.0	...	37.0	...	6	...
Alclad 2219	T81 (flat sheet)	0.040–0.099		55.0	...	41.0	...	7	...
Alclad 2219	T81 (flat sheet)	0.100–0.249		58.0	...	43.0	...	7	...
Alclad 2219	T851[F] plate (formerly T81 plate)	0.250–0.499	...	58.0	...	42.0	...	8	...
Alclad 2219	T87	0.040–0.099	...	57.0	...	46.0	...	6	...
Alclad 2219	T87	0.100–0.249	...	60.0	...	48.0	...	6	...
Alclad 2219	T87	0.250–0.499	...	60.0	...	48.0	...	7	...
Alclad 2219	F[G]	0.250–2.000	...	...	...	...	...	...	...
6013	T4	0.020–0.249	...	40.0	...	21.0	...	20	...

TABLE 3 *Continued*

Alloy	Temper	Specified Thickness, in.	Axis of Test Specimen[C]	Tensile Strength, ksi		Yield Strength (0.2 % offset), ksi		Elongation in 2 in. or 4× Diameter, min, %	Bend Diameter Factor, *N*
				min	max	min	max		
6013	T6	0.020–0.249	...	52.0	...	46.0	...	8	...
6013	T651	0.250–1.500	...	53.0	...	44.0	...	5	...
6013	T651	1.501–3.000	...	54.0	...	47.0	...	5	...
6013	T651	3.001–6.000	...	55.0	...	47.0	...	4	...
6061	O	0.006–0.007	...	...	22.0	...	12.0	10	0
6061	O	0.008–0.009	...	...	22.0	...	12.0	12	0
6061	O	0.010–0.020	...	...	22.0	...	12.0	14	0
6061	O	0.021–0.128	...	...	22.0	...	12.0	16	1
6061	O	0.129–0.249	...	...	22.0	...	12.0	18	2
6061	O	0.250–0.499	...	...	22.0	...	12.0	18	3
6061	O	0.500–1.000	...	...	22.0	...	...	18	...
6061	O	1.001–3.000	...	...	22.0	...	...	16	...
6061	T4	0.006–0.007	...	30.0	...	16.0	...	10	2
6061	T4	0.008–0.009	...	30.0	...	16.0	...	12	2
6061	T4	0.010–0.020	...	30.0	...	16.0	...	14	2
6061	T4	0.021–0.249	...	30.0	...	16.0	...	16	3
6061	T451[F]	0.250–0.499	...	30.0	...	16.0	...	18	4
6061	T451[F]	0.500–1.000	...	30.0	...	16.0	...	18	...
6061	T451[F]	1.001–3.000	...	30.0	...	16.0	...	16	...
6061	T42[E]	0.006–0.007	...	30.0	...	14.0	...	10	2
6061	T42[E]	0.008–0.009	...	30.0	...	14.0	...	12	2
6061	T42[E]	0.010–0.020	...	30.0	...	14.0	...	14	2
6061	T42[E]	0.021–0.249	...	30.0	...	14.0	...	16	3
6061	T42[E]	0.250–0.499	...	30.0	...	14.0	...	18	4
6061	T42[E]	0.500–1.000	...	30.0	...	14.0	...	18	...
6061	T42[E]	1.001–3.000	...	30.0	...	14.0	...	16	...
6061	T6, T62[E]	0.006–0.007	...	42.0	...	35.0	...	4	2
6061	T6, T62[E]	0.008–0.009	...	42.0	...	35.0	...	6	2
6061	T6, T62[E]	0.010–0.020	...	42.0	...	35.0	...	8	2
6061	T6, T62[E]	0.021–0.036	...	42.0	...	35.0	...	10	3
6061	T6, T62[E]	0.037–0.064	...	42.0	...	35.0	...	10	4
6061	T6, T62[E]	0.065–0.128	...	42.0	...	35.0	...	10	5
6061	T6, T62[E]	0.129–0.249	...	42.0	...	35.0	...	10	6
6061	T62[E] , T651[F]	0.250–0.499	...	42.0	...	35.0	...	10	7
6061	T62[E] , T651[F]	0.500–1.000	...	42.0	...	35.0	...	9	...
6061	T62[E] , T651[F]	1.001–2.000	...	42.0	...	35.0	...	8	...
6061	T62[E] , T651[F]	2.001–4.000	...	42.0	...	35.0	...	6	...
6061	T62[E] , T651[F]	4.001–6.000[M]	...	40.0	...	35.0	...	6	...
6061	F[G]	0.250–3.000	...	...	...	...	...	...	...
Alclad 6061	O	0.010–0.020	...	...	20.0	...	12.0	14	...
Alclad 6061	O	0.021–0.128	...	...	20.0	...	12.0	16	...
Alclad 6061	O	0.129–0.499	...	...	20.0	...	12.0	18	...
Alclad 6061	O	0.500–1.000	...	...	22.0[H]	...	...	18	...
Alclad 6061	O	1.001–3.000	...	...	22.0[H]	...	...	16	...
Alclad 6061	T4	0.010–0.020	...	27.0	...	14.0	...	14	...
Alclad 6061	T4	0.021–0.249	...	27.0	...	14.0	...	16	...
Alclad 6061	T451[F]	0.250–0.499	...	27.0	...	14.0	...	18	...
Alclad 6061	T451[F]	0.500–1.000	...	30.0[H]	...	16.0[H]	...	18	...
Alclad 6061	T451[F]	1.001–3.000	...	30.0[H]	...	16.0[H]	...	16	...
Alclad 6061	T42[E]	0.010–0.020	...	27.0	...	12.0	...	14	...
Alclad 6061	T42[E]	0.021–0.249	...	27.0	...	12.0	...	16	...
Alclad 6061	T42[E]	0.250–0.499	...	27.0	...	12.0	...	18	...
Alclad 6061	T42[E]	0.500–1.000	...	30.0[H]	...	14.0[H]	...	18	...
Alclad 6061	T42[E]	1.001–3.000	...	30.0[H]	...	14.0[H]	...	16	...
Alclad 6061	T6, T62[E]	0.010–0.020	...	38.0	...	32.0	...	8	...
Alclad 6061	T6, T62[E]	0.021–0.249	...	38.0	...	32.0	...	10	...
Alclad 6061	T62[E] , T651[F]	0.250–0.499	...	38.0	...	32.0	...	10	...
Alclad 6061	T62[E] , T651[F]	0.500–1.000	...	42.0[H]	...	35.0[H]	...	9	...
Alclad 6061	T62[E] , T651[F]	1.001–2.000	...	42.0[H]	...	35.0[H]	...	8	...
Alclad 6061	T62[E] , T651[F]	2.001–4.000	...	42.0[H]	...	35.0[H]	...	6	...
Alclad 6061	T62[E] , T651[F]	4.001–5.000	...	40.0[H]	...	35.0[H]	...	6	...
Alclad 6061	F[G]	0.250–3.000	...	...	...	...	...	...	...
7075	O	0.015–0.020	...	...	40.0	...	21.0	10	1

TABLE 3 *Continued*

Alloy	Temper	Specified Thickness, in.	Axis of Test Specimen[C]	Tensile Strength, ksi		Yield Strength (0.2 % offset), ksi		Elongation in 2 in. or 4× Diameter, min, %	Bend Diameter Factor, *N*
				min	max	min	max		
7075	O	0.021–0.062	...	...	40.0	...	21.0	10	2
7075	O	0.063–0.091	...	...	40.0	...	21.0	10	3
7075	O	0.092–0.125	...	...	40.0	...	21.0	10	4
7075	O	0.126–0.249	...	...	40.0	...	21.0	10	5
7075	O	0.250–0.499	...	...	40.0	...	21.0	10	6
7075	O	0.500–2.000	...	...	40.0	...	...	10	...
7075	T6, T62[E]	0.008–0.011	...	74.0	...	63.0	...	5	7
7075	T6, T62[E]	0.012–0.020	...	76.0	...	67.0	...	8	7
7075	T6, T62[E]	0.021–0.039	...	76.0	...	67.0	...	8	8
7075	T6, T62[E]	0.040–0.062	...	78.0	...	68.0	...	9	8
7075	T6, T62[E]	0.063–0.091	...	78.0	...	68.0	...	9	9
7075	T6, T62[E]	0.092–0.125	...	78.0	...	68.0	...	9	10
7075	T6, T62[E]	0.126–0.187	...	79.0	...	69.0	...	9	11
7075	T6, T62[E]	0.188–0.249	...	80.0	...	69.0	...	9	11
7075	T62[E] , T651[F]	0.250–0.499	...	78.0	...	67.0	...	9	14
7075	T62[E] , T651[F]	0.500–1.000	...	78.0	...	68.0	...	7	...
7075	T62[E] , T651[F]	1.001–2.000	...	77.0	...	67.0	...	6	...
7075	T62[E] , T651[F]	2.001–2.500	...	76.0	...	64.0	...	5	...
7075	T62[E] , T651[F]	2.501–3.000	...	72.0	...	61.0	...	5	...
7075	T62[E] , T651[F]	3.001–3.500	...	71.0	...	58.0	...	5	...
7075	T62[E] , T651[F]	3.501–4.000	...	67.0	...	54.0	...	3	...
7075	T73 sheet	0.040–0.249	...	67.0	...	56.0	...	8	...
7075	T7351[F] plate	0.250–1.000	...	69.0	...	57.0	...	7	...
7075	T7351[F] plate	1.001–2.000	...	69.0	...	57.0	...	6	...
7075	T7351[F] plate	2.001–2.500	...	66.0	...	52.0	...	6	...
7075	T7351[F] plate	2.501–3.000	...	64.0	...	49.0	...	6	...
7075	T7351[F] plate	3.001–3.500	...	63.0	...	49.0	...	6	...
7075	T7351[F] plate	3.501–4.000	...	61.0	...	48.0	...	6	...
7075	T76 sheet	0.063–0.125	...	73.0	...	62.0	...	8	...
7075	T76 sheet	0.126–0.249	...	73.0	...	62.0	...	8	...
7075	T7651 plate[F]	0.250–0.499	...	72.0	...	61.0	...	8	...
7075	T7651 plate[F]	0.500–1.000	...	71.0	...	60.0	...	6	...
7075	T7651 plate[F]	1.001–2.000	...	71.0	...	60.0	...	5	...
7075	F[G]	0.250–4.000	...	...	...	...	...	...	...
Alclad 7075	O	0.008–0.014	...	...	36.0	...	20.0	9	1
Alclad 7075	O	0.015–0.032	...	...	36.0	...	20.0	10	1
Alclad 7075	O	0.033–0.062	...	...	36.0	...	20.0	10	2
Alclad 7075	O	0.063–0.125	...	...	38.0	...	20.0	10	3
Alclad 7075	O	0.126–0.187	...	...	38.0	...	20.0	10	4
Alclad 7075	O	0.188–0.249	...	...	39.0	...	21.0	10	4
Alclad 7075	O	0.250–0.499	...	...	39.0	...	21.0	10	6
Alclad 7075	O	0.500–1.000	...	...	40.0[H]	...	...	10	...
Alclad 7075	T6, T62[E]	0.008–0.011	...	68.0	...	58.0	...	5	6
Alclad 7075	T6, T62[E]	0.012–0.020	...	71.0	...	61.0	...	8	6
Alclad 7075	T6, T62[E]	0.021–0.039	...	71.0	...	61.0	...	8	7
Alclad 7075	T6, T62[E]	0.040–0.062	...	72.0	...	62.0	...	9	7
Alclad 7075	T6, T62[E]	0.063–0.091	...	74.0	...	64.0	...	9	8
Alclad 7075	T6, T62[E]	0.092–0.125	...	74.0	...	64.0	...	9	9
Alclad 7075	T6, T62[E]	0.126–0.187	...	74.0	...	64.0	...	9	10
Alclad 7075	T6, T62[E]	0.188–0.249	...	76.0	...	65.0	...	9	10
Alclad 7075	T62[E] ,T651[F]	0.250–0.499	...	75.0	...	65.0	...	9	12
Alclad 7075	T62[E] ,T651[F]	0.500–1.000	...	78.0[H]	...	68.0[H]	...	7	...
Alclad 7075	T62[E] ,T651[F]	1.001–2.000	...	77.0[H]	...	67.0[H]	...	6	...
Alclad 7075	T62[E] ,T651[F]	2.001–2.500	...	76.0[H]	...	64.0[H]	...	5	...
Alclad 7075	T62[E] ,T651[F]	2.501–3.000	...	72.0[H]	...	61.0[H]	...	5	...
Alclad 7075	T62[E] ,T651[F]	3.001–3.500	...	71.0[H]	...	58.0[H]	...	5	...
Alclad 7075	T62[E] ,T651[F]	3.501–4.000	...	67.0[H]	...	54.0[H]	...	3	...
Alclad 7075	T76 sheet	0.040–0.062	...	67.0	...	56.0	...	8	...
Alclad 7075	T76 sheet	0.063–0.125	...	68.0	...	57.0	...	8	...
Alclad 7075	T76 sheet	0.126–0.187	...	68.0	...	57.0	...	8	...
Alclad 7075	T76 sheet	0.188–0.249		70.0	...	59.0	...	8	...
Alclad 7075	T7651[F] plate	0.250–0.499	...	69.0	...	58.0	...	8	...
Alclad 7075	T7651[F] plate	0.500–1.000	...	71.0[H]	...	60.0[H]	...	6	...
Alclad 7075	F[G]	0.250–4.000	...	...	...	...	...	...	...
Alclad 1-Side 7075	O	0.015–0.032	...	...	38.0	...	21.0	10	1

TABLE 3 *Continued*

Alloy	Temper	Specified Thickness, in.	Axis of Test Specimen[C]	Tensile Strength, ksi		Yield Strength (0.2 % offset), ksi		Elongation in 2 in. or 4× Diameter, min, %	Bend Diameter Factor, *N*
				min	max	min	max		
Alclad 1-Side 7075	O	0.033–0.062	...	...	38.0	...	21.0	10	2
Alclad 1-Side 7075	O	0.063–0.091	...	...	39.0	...	21.0	10	3
Alclad 1-Side 7075	O	0.092–0.125	...	...	39.0	...	21.0	10	4
Alclad 1-Side 7075	O	0.126–0.187	...	...	39.0	...	21.0	10	5
Alclad 1-Side 7075	O	0.188–0.249	...	...	39.0	...	21.0	10	5
Alclad 1-Side 7075	O	0.250–0.499	...	...	39.0	...	21.0	10	6
Alclad 1-Side 7075	O	0.500–1.000	...	...	40.0[H]	...	...	10	...
Alclad 1-Side 7075	T6, T62[E]	0.008–0.011	...	71.0	...	60.0	...	5	...
Alclad 1-Side 7075	T6, T62[E]	0.012–0.014	...	74.0	...	64.0	...	8	...
Alclad 1-Side 7075	T6, T62[E]	0.015–0.032	...	74.0	...	64.0	...	8	7
Alclad 1-Side 7075	T6, T62[E]	0.033–0.039	...	74.0	...	64.0	...	8	8
Alclad 1-Side 7075	T6, T62[E]	0.040–0.062	...	75.0	...	65.0	...	9	8
Alclad 1-Side 7075	T6, T62[E]	0.063–0.091	...	76.0	...	66.0	...	9	9
Alclad 1-Side 7075	T6, T62[E]	0.092–0.125	...	76.0	...	66.0	...	9	10
Alclad 1-Side 7075	T6, T62[E]	0.126–0.187	...	77.0	...	67.0	...	9	11
Alclad 1-Side 7075	T6, T62[E]	0.188–0.249	...	78.0	...	67.0	...	9	11
Alclad 1-Side 7075	T62[E], T651[F]	0.250–0.499	...	76.0	...	66.0	...	9	13
Alclad 1-Side 7075	T62[E], T651[F]	0.500–1.000		78.0[H]	...	68.0[H]	...	7	...
Alclad 1-Side 7075	T62[E], T651[F]	1.001–2.000		77.0[H]	...	67.0[H]	...	6	...
Alclad 1-Side 7075	F[G]	0.250–2.000	...	...	...	...	...	...	...

[A] To determine conformance to this specification, each value for tensile strength and yield strength shall be rounded to the nearest 0.1 ksi and each value for elongation to the nearest 0.5 %, both in accordance with the Rounding Method of Practice E29.
[B] The basis for establishment of mechanical property limits is shown in Annex A1.
[C] Long transverse unless otherwise noted.
[D] Coiled sheet.
[E] Material in the T42, T62, and T72 tempers is not available from the material producer.
[F] For stress-relieved tempers (T351, T451, T651, T7351, T7651, and T851), characteristics and properties other than those specified may differ somewhat from the corresponding characteristics and properties of material in the basic temper.
[G] Test for tensile properties in the F temper are not required.
[H] The tension test specimen from plate 0.500 in. and thicker is machined from the core and does not include the cladding.
[I] Applicable to flat sheet and plate only.
[J] The T72 temper is applicable only to Alloys 2024 and Alclad 2024 sheet solution heat treated and artificially overaged by the user to develop increased resistance to stress-corrosion cracking.
[K] Short transverse tensile property limits are not applicable to material less than 1.500 in. in thickness.
[L] Use of Alloys 2219 and Alclad 2219 in the T31, T351, and T37 tempers for finished products is not recommended.
[M] The properties for this thickness apply only to the T651 temper.

10. Producer Confirmation of Heat-Treat Response

10.1 In addition to the requirements of 9.1, material in the O or F temper of alloys 2014, Alclad 2014, 2024, Alclad 2024, 1½ % Alclad 2024, Alclad one-side 2024, 1½ % Alclad one-side 2024, 6061, and Alclad 6061 shall, upon proper solution heat treatment and natural aging at room temperature, develop the properties specified in Table 3 for T42 temper material. The natural aging period at room temperature shall be not less than four days, but samples of material may be tested prior to four days aging, and if the material fails to conform to the requirements of T42 temper material, the tests may be repeated after completion of four days aging without prejudice.

10.2 Also, material in the O or F temper of alloys 2219, Alclad 2219, 6061, 7075, Alclad 7075, and Alclad one-side 7075 shall, upon proper solution heat treatment and precipitation heat treatment, develop the properties specified in Table 3 for T62 temper material.

10.3 *Number of Specimens*—The number of specimens from each lot of O temper material and F temper material to be tested to verify conformance with 10.1 and 10.2 shall be as specified in 9.2.

11. Heat Treatment and Reheat-Treatment Capability

11.1 Mill-produced material in the O or F temper of alloys 2014, Alclad 2014, 2024, Alclad 2024, 1½ % Alclad 2024, Alclad one-side 2024, 1½ % Alclad one-side 2024, 6061, and Alclad 6061 (without the subsequent imposition of cold work or forming operations) shall, upon proper solution heat treatment and natural aging at room temperature, develop the properties specified in Table 3 for T42 temper material. The natural aging period at room temperature shall be not less than four days, but samples of material may be tested prior to four days aging, and if the material fails to conform to the requirements of T42 temper material, the tests may be repeated after completion of four days aging without prejudice.

11.2 Mill-produced material in the O or F temper of alloys 2219, Alclad 2219, 6061, 7075, Alclad 7075, and Alclad one-side 7075 (without the subsequent imposition of cold work or forming operations) shall, upon proper solution heat treatment and precipitation heat treatment, develop the properties specified in Table 3 for T62 temper material.

11.3 Mill-produced material in the following alloys and tempers shall, after proper resolution heat treatment and natural

aging for four days at room temperature, be capable of attaining the properties specified in Table 3 for the T42 temper.

Alloys	Tempers
2014 and Alclad 2014	T3, T4, T451, T6, T651
2024 and Alclad 2024	T3, T4, T351, T81, T851
1½ % Alclad 2024, Alclad 1-Side 2024 and 1½ % Alclad 1-Side 2024	T3, T351, T81, T851

NOTE 6—Beginning with the 1974 revision, 6061 and Alclad 6061 T4, T451, T6, and T651 were deleted from this paragraph because experience has shown that reheat-treated material may develop large recrystallized grains and may fail to develop the tensile properties shown in Table 3.

11.4 Mill-produced material in the following alloys and tempers shall, after proper resolution heat treatment and precipitation heat treatment, be capable of attaining the properties specified in Table 3 for the T62 temper.

Alloys	Tempers
2219 and Alclad 2219	T31, T351, T81, T851
7075	T6, T651, T73, T7351, T76, T7651
Alclad 7075	T6, T651, T76, T7651
Alclad 1-Side 7075	T6, T651

11.5 Mill-produced material in the following alloys and tempers and T42 temper material shall, after proper precipitation heat treatment, be capable of attaining the properties specified in Table 3 for the aged tempers listed below.

Alloy and Temper	Temper after Aging
2014 and Alclad 2014-T3, T4, T42, T451	T6, T6, T62, T651, respectively
2024, Alclad 2024, 1 ½ % Alclad 2024, Alclad 1-Side 2024 and 1½ % Alclad one side 2024-T3, T351, T361, T42	T81, T851, T861, T62, or T72, respectively
2219 and Alclad 2219-T31, T351, T37	T81, T851, T87, respectively
6061 and Alclad 6061-T4, T451, T42	T6, T651, T62, respectively

12. Bend Properties

12.1 *Limits*—Sheet and plate shall be capable of being bent cold through an angle of 180° around a pin having a diameter equal to *N* times the thickness of the sheet or plate without cracking, the value of *N* being as prescribed in Table 2 and Table 3 for the different alloys, tempers, and thicknesses. The test need not be conducted unless specified on the purchase order.

12.2 *Test Specimens*—When bend tests are made, the specimens for sheet shall be the full thickness of the material, approximately ¾ in. in width, and when practical, at least 6 in. in length. Such specimens may be taken in any direction and their edges may be rounded to a radius of approximately 1/16 in. if desired. For sheet less than ¾ in. in width, the specimens should be the full width of the material.

12.3 *Test Methods*—The bend tests shall be made in accordance with Test Method E290 except as stated otherwise in 12.2.

13. Stress-Corrosion Resistance

13.1 When specified on the purchase order or contract, alloys 2124-T851, 2219-T851, and 2219-T87 plate shall be subjected to the test specified in 13.3 and shall exhibit no evidence of stress-corrosion cracking. One sample shall be taken from each parent plate in each lot and a minimum of three adjacent replicate specimens from this sample shall be tested. The producer shall maintain records of all lot acceptance test results and make them available for examination at the producer's facility.

13.2 Alloy 7075 in the T73-type and T76-type tempers, and Alclad 7075 in the T76-type tempers, shall be capable of exhibiting no evidence of stress-corrosion cracking when subjected to the test specified in 13.3.

13.2.1 For lot-acceptance purposes, resistance to stress-corrosion cracking for each lot of material shall be established by testing the previously selected tension-test samples to the criteria shown in Table 4.

13.2.2 For surveillance purposes, each month the producer shall perform at least one test for stress-corrosion resistance in accordance with 13.3 on each applicable alloy-temper for each thickness range 0.750 in. and over listed in Table 3, produced that month. Each sample shall be taken from material considered acceptable in accordance with lot-acceptance criteria of Table 4. A minimum of three adjacent replicate specimens shall be taken from each sample and tested. The producer shall maintain records of all lots so tested and make them available for examination at the producer's facility.

13.3 The stress-corrosion cracking test shall be performed on plate 0.750 in. and over in thickness as follows:

13.3.1 Specimens shall be stressed in tension in the short transverse direction with respect to grain flow and held at constant strain. For alloy 2124-T851, the stress levels shall be 50 % of the specified minimum long transverse yield strength. For alloy 2219-T851 and T87, the stress levels shall be 75 % of the specified minimum long transverse yield strength. For alloy 7075 in the T73-type tempers, the stress level shall be 75 % of the specified minimum yield strength, and for alloy 7075 and Alclad 7075 in the T76-type, it shall be 25 ksi.

13.3.2 The stress-corrosion test shall be made in accordance with Test Method G47.

13.3.3 There shall be no visual evidence of stress-corrosion cracking in any specimen, except that the retest provisions of 19.2 shall apply.

14. Exfoliation-Corrosion Resistance

14.1 Alloys 7075 and Alclad 7075, in the T76-type tempers, shall be capable of exhibiting no evidence of exfoliation corrosion equivalent to or in excess of that illustrated by Photo EB in Fig. 2 of Test Method G34 when subjected to the test in 14.2.

14.1.1 For lot-acceptance purposes, resistance to exfoliation corrosion for each lot of material in the alloys and tempers listed in 14.1 shall be established by testing the previously selected tension-test samples to the criteria shown in Table 4.

14.1.2 For surveillance purposes, each month the producer shall perform at least one test for exfoliation-corrosion resistance on each applicable alloy-temper for each thickness range listed in Table 3, produced that month. The samples for test shall be selected at random from material considered acceptable in accordance with the lot-acceptance criteria of Table 4. The producer shall maintain records of all surveillance test results and make them available for examination.

TABLE 4 Lot Acceptance Criteria for Resistance to Stress Corrosion and Exfoliation Corrosion

Alloy and Temper	Lot Acceptance Criteria		Lot Acceptance Status
	Electrical Conductivity,[A] %, IACS	Level of Mechanical Properties	
7075–T73 and T7351	40.0 or greater	per specified requirements	acceptable
	38.0 through 39.9	per specified requirements but yield strength does not exceed minimum by more than 11.9 ksi	acceptable
	38.0 through 39.9	per specified requirements but yield strength exceeds minimum by 12.0 ksi or more	unacceptable[B]
	less than 38.0	any level	unacceptable[B]
7075 – T76 and T7651 Alclad 7075 – T76 and T7651	38.0 or greater	per specified requirements	acceptable
	36.0 through 37.9	per specified requirements	suspect[C]
	less than 36.0	any level	unacceptable[B]

[A] The electrical conductivity shall be determined in accordance with Practice E1004 in the locations specified below.
[B] When material is found to be unacceptable, it shall be reprocessed (additional precipitation heat treatment or re-solution heat treatment, stress relieving and precipitation heat treatment, when applicable).
[C] When material in these tempers is found to be suspect it is either tested for exfoliation corrosion resistance per ASTM G34 or it is reprocessed (additional precipitation heat treatment or resolution heat treatment and precipitation heat treatment). Favorable exfoliation corrosion test results must never be used as an acceptance criteria for stress corrosion resistance.

Alloy-Temper	Thickness, in.	Location
7075–T73 and T7351	all	surface of tension-test sample
7075–T76 and T7651	up through 0.100	surface of tension-test sample
	0.101 and over	sub-surface after removal of approximately 10 % of the thickness

For alclad products, the cladding shall be removed and the electrical conductivity determined on the core alloy.

14.2 The test for exfoliation-corrosion resistance shall be made in accordance with Test Method G34 and the following:

14.2.1 The specimens shall be a minimum of 2 by 4 in. with the 4-in. dimension in a plane parallel to the direction of final rolling. They shall be full-section thickness specimens of the material except that for material 0.101 in. or more in thickness, 10 % of the thickness shall be removed by machining one surface. The cladding of alclad sheet of any thickness shall be removed by machining the test surface; the cladding on the back side (nontest surface) of the specimen for any thickness of alclad material shall also either be removed or masked off. For machined specimens, the machined surface shall be evaluated by exposure to the test solution.

15. Cladding

15.1 Preparatory to rolling alclad sheet and plate to the specified thickness, the aluminum or aluminum-alloy plates which are bonded to the alloy ingot or slab shall be of the composition shown in Table 1 and shall each have a thickness not less than that shown in Table 5 for the alloy specified.

15.2 When the thickness of the cladding is to be determined on finished material, not less than one transverse sample approximately ¾ in. in length shall be taken from each edge and from the center width of the material. Samples shall be mounted to expose a transverse cross section and shall be polished for examination with a metallurgical microscope. Using 100× magnification, the maximum and minimum cladding thickness on each surface shall be measured in each of five fields approximately 0.1 in. apart for each sample. The average of the ten values (five minima plus five maxima) on each sample surface is the average cladding thickness and shall meet the minimum average and, when applicable, the maximum average specified in Table 5.

16. Dimensional Tolerances

16.1 *Thickness*—The thickness of flat sheet, coiled sheet, and plate shall not vary from that specified by more than the respective permissible variations prescribed in Tables 7.7a, 7.7b, 7.26, 7.31, and 8.2 of ANSI H35.2. Permissible variations in thickness of plate specified in thicknesses exceeding 6 in. shall be the subject of agreement between the purchaser and the producer or the supplier at the time the order is placed.

16.2 *Length, Width, Lateral Bow, Squareness, and Flatness*—Coiled sheet shall not vary in width or in lateral bow from that specified by more than the permissible variations prescribed in Tables 7.11 and 7.12, respectively, of ANSI H35.2. Flat sheet and plate shall not vary in width, length, lateral bow, squareness, or flatness by more than the permissible variations prescribed in the following tables of ANSI H35.2 except that where the tolerances for sizes ordered are not covered by this specification, the permissible variations shall be the subject of agreement between the purchaser and the producer or the supplier at the time the order is placed:

Table No.	Title
7.8	Width, Sheared Flat Sheet and Plate
7.9	Length, Sheared Flat Sheet and Plate
7.10	Width and Length, Sawed Flat Sheet and Plate
7.13	Lateral Bow, Flat Sheet and Plate
7.14	Squareness, Flat Sheet and Plate
7.17	Flatness, Flat Sheet
7.18	Flatness, Sawed or Sheared Plate

TABLE 5 Components of Clad Products

Alloy	Component Alloys[A]		Total Composite Thickness of Finished Sheet and Plate, in.	Sides Clad	Cladding Thickness per Side, percent of Composite Thickness		
	Core	Cladding			Nominal	Average[B]	
						min	max
Alclad 2014	2014	6003	up through 0.024	both	10	8	...
			0.025–0.039	both	7.5	6	...
			0.040–0.099	both	5	4	...
			0.100 and over	both	2.5	2	3[C]
Alclad 2024	2024	1230	up through 0.062	both	5	4	...
			0.063 and over	both	2.5	2	3[C]
1½ % Alclad 2024	2024	1230	0.188 and over	both	1.5	1.2	3[D]
Alclad one-side 2024	2024	1230	up through 0.062	one	5	4	...
			0.063 and over	one	2.5	2	3[C]
1½ % Alclad one-side 2024	2024	1230	0.188 and over	one	1.5	1.2	3[D]
Alclad 2219	2219	7072	up through 0.039	both	10	8	...
			0.040–0.099	both	5	4	...
			0.100 and over	both	2.5	2	3[C]
Alclad 3003	3003	7072	all	both	5	4	6[C]
Alclad 3004	3004	7072	all	both	5	4	6[C]
Alclad 6061	6061	7072	all	both	5	4	6[C]
Alclad 7075	7075	7072	up through 0.062	both	4	3.2	...
			0.063–0.187	both	2.5	2	...
			0.188 and over	both	1.5	1.2	3[D]
Alclad one-side 7075	7075	7072	up through 0.062	one	4	3.2	...
			0.063–0.187	one	2.5	2	...
			0.188 and over	one	1.5	1.2	3[D]

[A] Cladding composition is applicable only to the aluminum alloy bonded to the alloy ingot or slab preparatory to rolling to the specified composite product. The composition of the cladding may be altered subsequently by diffusion between the core and cladding due to thermal treatment.
[B] Average thickness per side as determined by averaging cladding thickness measurements when determined in accordance with the procedure specified in 15.2.
[C] Applicable for thicknesses of 0.500 in. and greater.
[D] For thicknesses of 0.500 in. and over with 1.5 % of nominal cladding thickness, the average maximum thickness of cladding per side after rolling to the specified thickness of plate shall be 3 % of the thickness of the plate as determined by averaging cladding thickness measurements taken at a magnification of 100 diameters on the cross section of a transverse sample polished and etched for examination with a metallurgical microscope.

16.3 Dimensional tolerances for sizes not covered in ANSI H35.2 shall be as agreed upon between the producer and purchaser and shall be specified in the contract or purchase order.

16.4 *Sampling for Inspection*—Examination for dimensional conformance shall be made to ensure conformance to the tolerance specified.

17. Internal Quality

17.1 When specified by the purchaser at the time of placing the order, plate 0.500 to 4.500 in. in thickness and up to 2000 lb in maximum weight in alloys 2014, 2024, 2124, 2219, and 7075, both bare and Alclad where applicable, shall be tested in accordance with Practice B594 to the discontinuity acceptance limits of Table 6.

TABLE 6 Ultrasonic Discontinuity Limits for Plate[A]

Alloy	Thickness, in.	Maximum Weight Per Piece, lb[B]	Discontinuity Class[C]
2014[D] 2024[D] 2124 2219[D] 7075[D]	0.500–1.499	2000	B
	1.500–3.000	2000	A
	3.001–6.000	2000	B

[A] Discontinuities in excess of those listed in this table shall be allowed if it is established that they will be removed by machining or that they are in noncritical areas.
[B] The maximum weight is either the ordered weight of a plate of rectangular shape or the planned weight of a rectangular plate prior to removing metal to produce a part or plate shape to a drawing.
[C] The discontinuity class limits are defined in Section 11 of Practice B594.
[D] Also applies for alclad plate.

17.2 When specified by the purchaser at the time of placing the order, plate 0.500 in. in thickness and greater for ASME pressure vessel applications in alloys 1060, 1100, 3003, Alclad 3003, 3004, Alclad 3004, 5052, 5083, 5086, 5154, 5254, 5454, 5456, 6061, and Alclad 6061 shall be tested in accordance with Test Method B548. In such cases, the material will be subject to rejection if the following limits are exceeded unless it is determined by the purchaser that the area of the plate containing significant discontinuities will be removed during the subsequent fabrication process or that the plate may be repaired by welding:

17.2.1 If the longest dimension of the marked area representing a discontinuity causing a complete loss of back reflection (95 % or greater) exceeds 1.0 in.

17.2.2 If the length of the marked area representing a discontinuity causing an isolated ultrasonic indication without a complete loss of back reflection (95 % or greater) exceeds 3.0 in.

17.2.3 If each of two marked areas representing two adjacent discontinuities causing isolated ultrasonic indications without a complete loss of back reflection (95 % or greater) is longer than 1.0 in., and if they are located within 3.0 in. of each other.

18. Source Inspection

18.1 If the purchaser desires that their representative inspect or witness the inspection and testing of the material prior to shipment, such agreement shall be made by the purchaser and producer as part of the purchase contract.

18.2 When such inspection or witness of inspection and testing is agreed upon, the producer shall afford the purchaser's representative all reasonable facilities to satisfy him that the material meets the requirements of this specification. Inspection and tests shall be conducted so there is no unnecessary interference with the producer's operations.

19. Retest and Rejection

19.1 If any material fails to conform to all of the applicable requirements of this specification, the inspection lot shall be rejected.

19.2 When there is evidence that a failed specimen was not representative of the inspection lot and when no other sampling plan is provided or approved by the purchaser through the contract or purchase order, at least two additional specimens shall be selected to replace each test specimen that failed. All specimens so selected for retest shall meet the requirements of the specification or the lot shall be subject to rejection.

19.3 Material which is determined to be non-conforming subsequent to inspection may be rejected.

19.4 If material is rejected by the purchaser, the producer or supplier is responsible only for replacement of material to the purchaser. As much as possible of the rejected material shall be returned to the producer or supplier by the purchaser.

20. Identification Marking of Product

20.1 All sheet and plate shall be marked in accordance with Practice B666/B666M, unless otherwise specified.

20.2 The requirements specified in 20.1 are minimum; marking systems that involve added information, larger characters, and greater frequencies are acceptable under this specification.

21. Packaging and Package Marking

21.1 The material shall be packaged to provide adequate protection during normal handling and transportation and each package shall contain only one size, alloy, and temper of material unless otherwise agreed. The type of packaging and gross weight of containers shall, unless otherwise agreed, be at the producer's or supplier's discretion, provided that they are such as to ensure acceptance by common or other carriers for safe transportation at the lowest rate to the delivery point.

21.2 Each shipping container shall be marked with the purchase order number, material size, specification number, alloy and temper, gross and net weights, and the producer's name or trademark.

21.3 When specified in the contract or purchase order, material shall be preserved, packaged, and packed in accordance with the requirements of Practices B660. The applicable levels shall be as specified in the contract or order.

22. Certification

22.1 The producer or supplier shall, on request, furnish to the purchaser a certificate stating that each lot has been sampled, tested, and inspected in accordance with this specification, and has met the requirements.

23. Keywords

23.1 aluminum alloy; aluminum-alloy plate; aluminum-alloy sheet

ANNEXES

(Mandatory Information)

A1. BASIS FOR INCLUSION OF PROPERTY LIMITS

A1.1 Mechanical property limits are established in accord with Section 6, Standards Section, of the most current edition of the Aluminum Standards and Data and the latest edition of the Aluminum Association publication "Tempers for Aluminum and Aluminum Alloy Products (Yellow and Tan Sheets)".

Limits are based on a statistical evaluation of the data indicating that at least 99 % of the population obtained from all standard material meets the limit with 95 % confidence. For the products described, mechanical property limits are based on the statistical analyses of at least 100 tests from at least five cast lots of standard production material with no more than ten observations from a given heat treat or inspection lot. Mechanical properties limits for press solution heat treated products have specific additional requirements which are provided in the "Tempers for Aluminum and Aluminum Alloy Products".

Limits denoted as "Tentative" by the Aluminum Association may be included. Requirements for tentative property registrations are defined in the latest edition of the Aluminum Association publication "Tempers for Aluminum and Aluminum Alloy Products." Tentative property limits are established at levels at which at least 99 % of the data conform at a confidence level of 95 %. Tentative property limits, which are subject to revision, shall be based on a statistical analysis of at least 30 tests from at least three cast lots of standard production material with no more than ten observations from a given heat treat or inspection lot. Where tentative property limits are listed, they shall be shown in italics and footnoted as Tentative in the standard.

All tests are performed in accordance with the appropriate ASTM test methods.

A2. ACCEPTANCE CRITERIA FOR INCLUSION OF NEW ALUMINUM AND ALUMINUM ALLOYS IN THIS SPECIFICATION

A2.1 Prior to acceptance for inclusion in this specification, the composition of wrought or cast aluminum or aluminum alloy shall be registered in accordance with ANSI H35.1/H35.1(M). The Aluminum Association[8] holds the Secretariat of ANSI H35 Committee and administers the criteria and procedures for registration.

A2.2 If it is documented that the Aluminum Association could not or would not register a given composition, an alternative procedure and the criteria for acceptance shall be as follows:

A2.2.1 The designation submitted for inclusion does not utilize the same designation system as described in ANSI H35.1/H35.1(M). A designation not in conflict with other designation systems or a trade name is acceptable.

A2.2.2 The aluminum or aluminum alloy has been offered for sale in commercial quantities within the prior twelve months to at least three identifiable users.

A2.2.3 The complete chemical composition limits are submitted.

A2.2.4 The composition is, in the judgment of the responsible subcommittee, significantly different from that of any other aluminum or aluminum alloy already in the specification.

A2.2.5 For codification purposes, an alloying element is any element intentionally added for any purpose other than grain refinement and for which minimum and maximum limits are specified. Unalloyed aluminum contains a minimum of 99.00 % aluminum.

A2.2.6 Standard limits for alloying elements and impurities are expressed to the following decimal places:

Less than 0.001 %	0.000X
0.001 to but less than 0.01 %	0.00X
0.01 to but less than 0.10 %	
Unalloyed aluminum made by a refining process	0.0XX
Alloys and unalloyed aluminum not made by a refining process	0.0X
0.10 through 0.55 %	0.XX
(It is customary to express limits of 0.30 through 0.55 % as 0.X0 or 0.X5.)	
Over 0.55 %	0.X, X.X, and so forth
(except that combined Si + Fe limits for 99.00 % minimum aluminum must be expressed as 0.XX or 1.XX)	

A2.2.7 Standard limits for alloying elements and impurities are expressed in the following sequence: Silicon; Iron; Copper; Manganese; Magnesium; Chromium; Nickel; Zinc; Titanium; (Note A2.1); Other Elements, Each; Other Elements, Total; Aluminum (Note A2.2).

NOTE A2.1—Additional specified elements having limits are inserted in alphabetical order of their chemical symbols between Titanium and Other Elements, Each, or are specified in footnotes.

NOTE A2.2—Aluminum is specified as *minimum* for unalloyed aluminum and as a *remainder* for aluminum alloys.

[8] Available from Aluminum Association, Inc., 1525 Wilson Blvd., Suite 600, Arlington, VA 22209, http://www.aluminum.org.

SUMMARY OF CHANGES

Committee B07 has identified the location of selected changes to this standard since the last issue (B209 – 10) that may impact the use of this standard. (Approved in Nov. 1, 2014.)

(1) Revised Table 1; the reference to the Teal Sheet was made into a footnote, and "should" was changed to "shall."
(2) Revised Table 2; Footnote G, which was inadvertently dropped from 5657-H241 in the last revision, was added.
(3) Practice B985 was added to subsection 2.2.
(4) Subsection 4.2.3 was added to the Ordering Information, and subsequent items were renumbered.
(5) Revised Section 7 to provide for sampling of semi-finished and finished products as defined in Practice B985.
(6) Revised Section 8.