



Designation: B209/B209M – 21a

Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate¹

This standard is issued under the fixed designation B209/B209M; 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 specification² covers aluminum and aluminum-alloy flat sheet, coiled sheet, and plate in the alloys (Note 1) and tempers shown in Tables 2, 3, 4, and 5, 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/H35.1M. The equivalent Unified Numbering System alloy designations are those of Table 1 preceded by A9, for example, A91100 for aluminum 1100 in accordance with Practice E527.

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 Specification 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 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 The following documents of the issue in effect on date of material purchase 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

B557M Test Methods for Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products (Metric)

B594 Practice for Ultrasonic Inspection of Aluminum-Alloy Wrought Products

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/B918M Practice for Heat Treatment of Wrought Aluminum Alloys

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

B947 Practice for Hot Rolling Mill Solution Heat Treatment

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

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 (Withdrawn 2017)⁴

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 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 Spark Atomic Emission Spectrometry

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/H35.1M American National Standard Alloy and Temper Designation Systems for Aluminum

H35.2 American National Standard Dimensional Tolerances for Aluminum Mill Products

H35.2M American National Standard Dimensional Tolerances for Aluminum Mill Products (Metric)

2.4 *ISO Standards*:⁶

ISO 209-1 Wrought aluminium and aluminium alloys – Chemical composition and forms of products – Part 1: Chemical composition

ISO 2107 Aluminium and aluminium alloys – Wrought products – Temper designations

ISO 6361-2 Wrought aluminium and aluminium alloys – Sheets, strips and plates – Part 2: Mechanical properties

2.5 *AMS Specification*:⁷

AMS2772 Heat Treatment of Aluminum Alloy Raw Materials

2.6 *CEN Standard*:⁸

CEN - EN 14242 Aluminium and aluminium alloys – Chemical analysis – Inductively coupled plasma optical

emission spectral analysis

3. Terminology

3.1 *Definitions*:

3.1.1 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**, **Table 3**, **Table 4**, or **Table 5** of this specification or in ANSI H35.2 [H35.2M].

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** or **Table 3**, (H14 or H24) or (H34 or H24), is specifically excluded (**Table 2** and **Table 3**, Footnote C).

4.2.2 Whether heat treatment in accordance with Practice **B918/B918M** 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**, **Table 3**, **Table 4**, and **Table 5**, whether tensile testing should be in a direction other than the direction specified in Test Method **B557** or **B557M** (Subsection 9.4).

⁴ The last approved version of this historical standard is referenced on www.astm.org.

⁵ Available from Aluminum Association, 1400 Crystal Dr., Suite 430, Arlington, VA 22202, <http://www.aluminum.org>.

⁶ Available from International Organization for Standardization (ISO), ISO Central Secretariat, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, <https://www.iso.org>.

⁷ Available from SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096, <http://www.sae.org>.

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



TABLE 1 Chemical Composition Limits^{A,B,C,M}

Table with columns: Alloy, Silicon, Iron, Copper, Manganese, Magnesium, Chromium, Zinc, Titanium, Other Elements (Each, Total), Aluminum. Rows include alloys like 1060, 1100, 1230, 2014, 2024, 2124, 2219, 3003, 3004, 3005, 3105, 5005, 5010, 5050, 5052, 5059, 5083, 5086, 5154, 5252, 5254, 5454, 5456, 5457, 5657, 5754, 6003, 6013, 6061, 7072, 7075.

^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 1 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.

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.

TABLE 2 Mechanical Property Limits for Nonheat-treatable Alloy, Inch-Pound Units^{A,B,G}

Alloy	Temper	Specified Thickness, in.	Tensile Strength, ksi		Yield Strength (0.2 % offset), ksi		Elongation in 2 in. or 4x Diameter, min, %	Bend Diameter Factor, <i>N</i>
			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

**B209/B209M – 21a****TABLE 2** *Continued*

Alloy	Temper	Specified Thickness, in.	Tensile Strength, ksi		Yield Strength (0.2 % offset), ksi		Elongation in 2 in. or 4x Diameter, min, %	Bend Diameter Factor, <i>N</i>
			min	max	min	max		
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

**B209/B209M – 21a****TABLE 2** *Continued*

Alloy	Temper	Specified Thickness, in.	Tensile Strength, ksi		Yield Strength (0.2 % offset), ksi		Elongation in 2 in. or 4x Diameter, min. %	Bend Diameter Factor, <i>N</i>
			min	max	min	max		
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	...

**B209/B209M – 21a****TABLE 2** *Continued*

Alloy	Temper	Specified Thickness, in.	Tensile Strength, ksi		Yield Strength (0.2 % offset), ksi		Elongation in 2 in. or 4x Diameter, min. %	Bend Diameter Factor, <i>N</i>
			min	max	min	max		
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	...

**B209/B209M – 21a****TABLE 2** *Continued*

Alloy	Temper	Specified Thickness, in.	Tensile Strength, ksi		Yield Strength (0.2 % offset), ksi		Elongation in 2 in. or 4x Diameter, min. %	Bend Diameter Factor, <i>N</i>
			min	max	min	max		
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	...

**B209/B209M – 21a****TABLE 2** *Continued*

Alloy	Temper	Specified Thickness, in.	Tensile Strength, ksi		Yield Strength (0.2 % offset), ksi		Elongation in 2 in. or 4x Diameter, min. %	Bend Diameter Factor, <i>N</i>
			min	max	min	max		
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	H111	0.051–1.500	40.0	51.0	18.0	29.0	16	...
5083	H111	1.501–3.000	39.0	50.0	17.0	29.0	16	...
5083	H111	3.001–4.000	38.0	...	16.0	...	16	...
5083	H111	4.001–5.000	38.0	...	16.0	...	14	...
5083	H111	5.001–7.000	37.0	...	15.0	...	14	...
5083	H111	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	...

**B209/B209M – 21a****TABLE 2** *Continued*

Alloy	Temper	Specified Thickness, in.	Tensile Strength, ksi		Yield Strength (0.2 % offset), ksi		Elongation in 2 in. or 4x Diameter, min. %	Bend Diameter Factor, <i>N</i>
			min	max	min	max		
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	...
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	...

TABLE 2 *Continued*

Alloy	Temper	Specified Thickness, in.	Tensile Strength, ksi		Yield Strength (0.2 % offset), ksi		Elongation in 2 in. or 4x Diameter, min, %	Bend Diameter Factor, <i>N</i>
			min	max	min	max		
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	...
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.

^G Mechanical property requirements for product outside the gauge range covered by Table 2 shall be agreed upon between purchaser and producer.

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 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

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.

**B209/B209M – 21a****TABLE 3 Mechanical Property Limits for Nonheat-treatable Alloys, SI Units^{A,B,H}**

Alloy	Temper	Specified Thickness, mm		Tensile Strength, MPa		Yield Strength (0.2 % offset), MPa		Elongation, min, % ^C		Bend Diameter Factor, N
		over	through	min	max	min	max	in 50 mm	in 5x Diameter	
1060	O	0.15	0.32	55	95	15	...	15	...	...
1060	O	0.32	0.63	55	95	15	...	18	...	...
1060	O	0.63	1.20	55	95	15	...	23	...	...
1060	O	1.20	6.30	55	95	15	...	25	...	...
1060	O	6.30	80.00	55	95	15	...	25	22	...
1060	H12 ^E or H22 ^E	0.40	0.63	75	110	60	...	6	...	...
1060	H12 ^E or H22 ^E	0.63	1.20	75	110	60	...	7	...	...
1060	H12 ^E or H22 ^E	1.20	6.30	75	110	60	...	12	...	...
1060	H12 ^E or H22 ^E	6.30	50.00	75	110	60	...	12	10	...
1060	H14 ^E or H24 ^E	0.20	0.32	85	120	70	...	1	...	...
1060	H14 ^E or H24 ^E	0.32	0.63	85	120	70	...	2	...	...
1060	H14 ^E or H24 ^E	0.63	1.20	85	120	70	...	6	...	...
1060	H14 ^E or H24 ^E	1.20	6.30	85	120	70	...	10	...	...
1060	H14 ^E or H24 ^E	6.30	25.00	85	120	70	...	10	9	...
1060	H16 ^E or H26 ^E	0.15	0.32	95	130	75	...	1	...	...
1060	H16 ^E or H26 ^E	0.32	0.63	95	130	75	...	2	...	...
1060	H16 ^E or H26 ^E	0.63	1.20	95	130	75	...	4	...	...
1060	H16 ^E or H26 ^E	1.20	4.00	95	130	75	...	5	...	...
1060	H18 ^E or H28 ^E	0.15	0.32	110	...	85	...	1	...	...
1060	H18 ^E or H28 ^E	0.32	0.63	110	...	85	...	2	...	...
1060	H18 ^E or H28 ^E	0.63	1.20	110	...	85	...	3	...	...
1060	H18 ^E or H28 ^E	1.20	3.20	110	...	85	...	4	...	...
1060	H112	6.30	12.50	75	...	...	...	10	...	...
1060	H112	12.50	40.00	70	...	...	...	...	18	...
1060	H112	40.00	80.00	60	...	...	...	...	22	...
1060	F ^D	6.30	80.00	...	...	...	...	...	...	...
1100	O	0.15	0.32	75	105	25	...	15	...	0
1100	O	0.32	0.63	75	105	25	...	17	...	0
1100	O	0.63	1.20	75	105	25	...	22	...	0
1100	O	1.20	6.30	75	105	25	...	30	...	0
1100	O	6.30	80.00	75	105	25	...	28	25	0
1100	H12 ^E or H22 ^E	0.40	0.63	95	130	75	...	3	...	0
1100	H12 ^E or H22 ^E	0.63	1.20	95	130	75	...	5	...	0
1100	H12 ^E or H22 ^E	1.20	6.30	95	130	75	...	8	...	0
1100	H12 ^E or H22 ^E	6.30	12.50	95	130	75	...	10	9	0
1100	H12 ^E or H22 ^E	12.50	50.00	95	130	75	...	10	9	...
1100	H14 ^E or H24 ^E	0.20	0.32	110	145	95	...	1	...	0
1100	H14 ^E or H24 ^E	0.32	0.63	110	145	95	...	2	...	0
1100	H14 ^E or H24 ^E	0.63	1.20	110	145	95	...	3	...	0
1100	H14 ^E or H24 ^E	1.20	6.30	110	145	95	...	5	...	0
1100	H14 ^E or H24 ^E	6.30	25.00	110	145	95	...	7	6	0
1100	H16 ^E or H26 ^E	0.15	0.32	130	165	115	...	1	...	4
1100	H16 ^E or H26 ^E	0.32	0.63	130	165	115	...	2	...	4
1100	H16 ^E or H26 ^E	0.63	1.20	130	165	115	...	3	...	4
1100	H16 ^E or H26 ^E	1.20	4.00	130	165	115	...	4	...	4
1100	H18 ^E or H28 ^E	0.15	0.32	150	...	...	...	1	...	...
1100	H18 ^E or H28 ^E	0.32	0.63	150	...	...	...	1	...	...
1100	H18 ^E or H28 ^E	0.63	1.20	150	...	...	...	2	...	...
1100	H18 ^E or H28 ^E	1.20	3.20	150	...	...	...	4	...	...
1100	H112	6.30	12.50	90	...	50	...	9	...	...
1100	H112	12.50	40.00	85	...	40	...	...	12	...
1100	H112	40.00	80.00	80	...	30	...	...	18	...
1100	F ^D	6.30	80.00	...	...	...	...	...	...	...
3003	O	0.15	0.20	95	130	35	...	14	...	0
3003	O	0.20	0.32	95	130	35	...	18	...	0
3003	O	0.32	0.63	95	130	35	...	20	...	0
3003	O	0.63	1.20	95	130	35	...	23	...	0
3003	O	1.20	6.30	95	130	35	...	25	...	0
3003	O	6.30	80.00	95	130	35	...	23	21	...
3003	H12 ^E or H22 ^E	0.40	0.63	120	160	85	...	3	...	0
3003	H12 ^E or H22 ^E	0.63	1.20	120	160	85	...	4	...	0
3003	H12 ^E or H22 ^E	1.20	6.30	120	160	85	...	6	...	0
3003	H12 ^E or H22 ^E	6.30	50.00	120	160	85	...	9	8	...
3003	H14 ^E or H24 ^E	0.20	0.32	140	180	115	...	1	...	0
3003	H14 ^E or H24 ^E	0.32	0.63	140	180	115	...	2	...	0
3003	H14 ^E or H24 ^E	0.63	1.20	140	180	115	...	3	...	0
3003	H14 ^E or H24 ^E	1.20	3.20	140	180	115	...	5	...	0
3003	H14 ^E or H24 ^E	3.20	6.30	140	180	115	...	5	...	2

**B209/B209M – 21a****TABLE 3** *Continued*

Alloy	Temper	Specified Thickness, mm		Tensile Strength, MPa		Yield Strength (0.2 % offset), MPa		Elongation, min, % ^C		Bend Diameter Factor, N
		over	through	min	max	min	max	in 50 mm	in 5x Diameter	
3003	H14 ^E or H24 ^E	6.30	25.00	140	180	115	...	8	7	...
3003	H16 ^E or H26 ^E	0.15	0.32	165	205	145	...	1	...	4
3003	H16 ^E or H26 ^E	0.32	0.63	165	205	145	...	2	...	4
3003	H16 ^E or H26 ^E	0.63	1.20	165	205	145	...	3	...	4
3003	H16 ^E or H26 ^E	1.20	4.00	165	205	145	...	4	...	6
3003	H18 ^E or H28 ^E	0.15	0.32	185	...	165	...	1	...	...
3003	H18 ^E or H28 ^E	0.32	0.63	185	...	165	...	1	...	...
3003	H18 ^E or H28 ^E	0.63	1.20	185	...	165	...	2	...	...
3003	H18 ^E or H28 ^E	1.20	3.20	185	...	165	...	4	...	...
3003	H112	6.30	12.50	115	...	70	...	8	...	...
3003	H112	12.50	40.00	105	...	40	...	...	10	...
3003	H112	40.00	80.00	100	...	40	...	...	16	...
3003	F ^F	6.30	80.00	...	...	...	...	...	...	...
Alclad 3003	O	0.15	0.32	90	125	30	...	14	...	...
Alclad 3003	O	0.32	0.63	90	125	30	...	20	...	...
Alclad 3003	O	0.63	1.20	90	125	30	...	22	...	...
Alclad 3003	O	1.20	6.30	90	125	30	...	25	...	...
Alclad 3003	O	6.30	12.50	90	125	30	...	23	...	...
Alclad 3003	O	12.50	80.00	95 ^F	130 ^F	35 ^F	...	...	21	...
Alclad 3003	H12 ^E or H22 ^E	0.40	0.63	115	155	80	...	4	...	...
Alclad 3003	H12 ^E or H22 ^E	0.63	1.20	115	155	80	...	5	...	...
Alclad 3003	H12 ^E or H22 ^E	1.20	6.30	115	155	80	...	6	...	...
Alclad 3003	H12 ^E or H22 ^E	6.30	12.50	115	155	80	...	9	...	...
Alclad 3003	H12 ^E or H22 ^E	12.50	50.00	120 ^F	160 ^F	85 ^F	...	...	8	...
Alclad 3003	H14 ^E or H24 ^E	0.20	0.32	135	175	110	...	1	...	...
Alclad 3003	H14 ^E or H24 ^E	0.32	0.63	135	175	110	...	2	...	...
Alclad 3003	H14 ^E or H24 ^E	0.63	1.20	135	175	110	...	3	...	...
Alclad 3003	H14 ^E or H24 ^E	1.20	6.30	135	175	110	...	5	...	...
Alclad 3003	H14 ^E or H24 ^E	6.30	12.50	135	175	110	...	8	...	...
Alclad 3003	H14 ^E or H24 ^E	12.50	25.00	140 ^F	180 ^F	115 ^F	...	...	7	...
Alclad 3003	H16 ^E or H26 ^E	0.15	0.32	160	200	140	...	1	...	...
Alclad 3003	H16 ^E or H26 ^E	0.32	0.63	160	200	140	...	2	...	...
Alclad 3003	H16 ^E or H26 ^E	0.63	1.20	160	200	140	...	3	...	...
Alclad 3003	H16 ^E or H26 ^E	1.20	4.00	160	200	140	...	4	...	...
Alclad 3003	H18	0.15	0.32	180	...	...	...	1	...	...
Alclad 3003	H18	0.32	0.63	180	...	...	...	1	...	...
Alclad 3003	H18	0.63	1.20	180	...	...	...	2	...	...
Alclad 3003	H18	1.20	3.20	180	...	...	...	4	...	...
Alclad 3003	H112	6.30	12.50	110	...	65	...	8	...	...
Alclad 3003	H112	12.50	40.00	105 ^F	...	40 ^F	...	...	10	...
Alclad 3003	H112	40.00	80.00	100 ^F	...	40 ^F	...	...	16	...
Alclad 3003	F ^D	6.30	80.00	...	...	...	...	...	...	...
3004	O	0.15	0.32	150	200	60	...	9	...	0
3004	O	0.32	0.63	150	200	60	...	12	...	0
3004	O	0.63	1.20	150	200	60	...	15	...	0
3004	O	1.20	6.30	150	200	60	...	18	...	0
3004	O	6.30	80.00	150	200	60	...	16	14	...
3004	H32 ^E or H22 ^E	0.40	0.63	190	240	145	...	1	...	0
3004	H32 ^E or H22 ^E	0.63	1.20	190	240	145	...	3	...	1
3004	H32 ^E or H22 ^E	1.20	3.20	190	240	145	...	5	...	2
3004	H32 ^E or H22 ^E	3.20	6.30	190	240	145	...	5	...	...
3004	H32 ^E or H22 ^E	6.30	50.00	190	240	145	...	6	5	...
3004	H34 ^E or H24 ^E	0.20	0.32	220	265	170	...	1	...	2
3004	H34 ^E or H24 ^E	0.32	0.63	220	265	170	...	2	...	2
3004	H34 ^E or H24 ^E	0.63	1.20	220	265	170	...	3	...	3
3004	H34 ^E or H24 ^E	1.20	3.20	220	265	170	...	4	...	4
3004	H34 ^E or H24 ^E	3.20	6.30	220	265	170	...	4	...	...
3004	H34 ^E or H24 ^E	6.30	25.00	220	265	170	...	5	4	...
3004	H36 ^E or H26 ^E	0.15	0.32	240	285	190	...	1	...	6
3004	H36 ^E or H26 ^E	0.32	0.63	240	285	190	...	2	...	6
3004	H36 ^E or H26 ^E	0.63	1.20	240	285	190	...	3	...	6
3004	H36 ^E or H26 ^E	1.20	4.00	240	285	190	...	4	...	8
3004	H38 ^E or H28 ^E	0.15	0.32	260	...	215	...	...	...	...
3004	H38 ^E or H28 ^E	0.32	0.63	260	...	215	...	1	...	...
3004	H38 ^E or H28 ^E	0.63	1.20	260	...	215	...	2	...	...
3004	H38 ^E or H28 ^E	1.20	3.20	260	...	215	...	4	...	...
3004	H112	6.30	12.50	160	...	60	...	7	...	...
3004	H112	12.50	40.00	160	...	60	...	...	6	...