



Standard Specification for Aluminum-Alloy Rolled Tread Plate¹

This standard is issued under the fixed designation B632/B632M; 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 covers aluminum-alloy rolled flat tread plate, mill-finish, with a raised pattern on one side, in the alloy, tempers, and thicknesses shown in [Table 1](#) and [Table 2](#) [[Table 3](#)].

1.2 Alloy and temper designation are in accordance with ANSI H35.1/H35.1M. The equivalent Unified Numbering System alloy designation are those of [Table 1](#) preceded by A9, which is A96061 for alloy 6061 and A93003 for Alloy 3003 in accordance with Practice [E527](#).

1.3 For acceptance criteria for inclusion of new aluminum and aluminum alloys in this specification, see [Annex A2](#).

1.4 The values stated in either inch-pound or SI units are to be regarded separately as standard. The SI units are shown either in brackets or in separate tables. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other. Combining values from the two systems will result in nonconformance with the specification.

2. Referenced Documents

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

2.2 ASTM Standards:²

- [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)
- [B660](#) Practices for Packaging/Packing of Aluminum and Magnesium Products

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

Current edition approved Oct. 1, 2015. Published October 2015. Originally approved in 1978. Last previous edition approved in 2008 as B632/B632M – 08. DOI: 10.1520/B0632_B0632M-15.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[B666/B666M](#) Practice for Identification Marking of Aluminum and Magnesium Products

[B881](#) Terminology Relating to Aluminum- and Magnesium-Alloy Products

[B985](#) Practice for Sampling Aluminum Ingots, Billets, Castings and Finished or Semi-Finished Wrought Aluminum Products for Compositional Analysis

[B918](#) Practice for Heat Treatment of Wrought Aluminum Alloys

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

[E716](#) Practices for Sampling and Sample Preparation of Aluminum and Aluminum Alloys for Determination of Chemical Composition by Spectrochemical Analysis

[E1251](#) Test Method for Analysis of Aluminum and Aluminum Alloys by Spark Atomic Emission Spectrometry

2.3 ANSI Standards:⁴

[H35.1/H35.1M](#) Alloy and Temper Designation Systems for Aluminum

[H35.2](#) Dimensional Tolerances for Aluminum Mill Products

[H35.2M](#) Dimensional Tolerances for Aluminum Mill Products [Metric]

2.4 Other Standards

[CEN EN 14242](#) Aluminum and Aluminum Alloys. Chemical Analysis. Inductively Coupled Plasma Optical Emission Spectral Analysis⁵

³ The last approved version of this historical standard is referenced on www.astm.org.

⁴ Available from Aluminum Association, Inc., 1400 Crystal Drive, Suite 430 Arlington, VA 22202 (<http://www.aluminum.org>).

⁵ Available from European Committee for Standardization, Central Secretariat (CEN), Rue de Stassart 36, B1050 Brussels, Belgium (<http://www.cen.eu/eseach>).

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

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

| Alloy | Silicon | Iron | Copper | Manganese | Magnesium | Chromium | Zinc | Titanium | Other Elements ^D | | Aluminum |
|-------|----------|------|-----------|-----------|-----------|-----------|------|----------|-----------------------------|--------------------|-----------|
| | | | | | | | | | Each | Total ^E | |
| 3003 | 0.6 | 0.7 | 0.05-0.20 | 1.0-1.5 | --- | --- | 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 |

^A Limits in weight percent maximum unless shown as a range or minimum

^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 obtained from analysis shall be rounded to the nearest unit in the last right-hand place of figures used in expressing the specified limit, in accordance with the rounding off method of Practice E29.

^D Others includes listed elements for which no specific limit is shown as well as unlisted metallic elements. The producer may analyze samples for trace elements not specified in the specification. However, such analysis is not required and may not cover all metallic Others elements. Should any analysis by the producer or purchaser establish that an Others element exceed the limit of Each or that the aggregate of several Others elements exceeds the limit of Total, the material shall be considered non-conforming.

^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 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>.

TABLE 2 Tensile Properties, Inch-Pound Units^{A,B}

| Alloy and Temper | Specified Thickness ^C , in. | Tensile Strength, ksi | | Yield Strength (0.2 % Offset), ksi | | Elongation in 2 in. or 4 ^D min, % |
|------------------------------|--|-----------------------|------|------------------------------------|------|--|
| | | min | max | min | max | |
| 3003-H231 | 0.100-0.113 | 19.0 | ... | 15.0 | ... | 5 |
| | 0.114-0.161 | 19.0 | ... | 15.0 | ... | 6 |
| | 0.162-0.188 | 19.0 | ... | 15.0 | ... | 7 |
| 6061-O | 0.100-0.128 | ... | 22.0 | ... | 12.0 | 16 |
| | 0.129-0.499 | ... | 22.0 | ... | 12.0 | 18 |
| | 0.500-0.625 | ... | 22.0 | ... | ... | 18 |
| 6061-T4 | 0.100-0.249 | 30.0 | ... | 16.0 | ... | 14 |
| | 0.250-0.625 | 30.0 | ... | 16.0 | ... | 16 |
| 6061-T42 ^E | 0.100-0.249 | 30.0 | ... | 14.0 | ... | 14 |
| | 0.250-0.625 | 30.0 | ... | 14.0 | ... | 16 |
| 6061-T6 and T62 ^E | 0.100-0.188 | 42.0 | ... | 35.0 | ... | 6 |
| | 0.189-0.249 | 42.0 | ... | 35.0 | ... | 8 |
| | 0.250-0.499 | 42.0 | ... | 35.0 | ... | 10 |
| 6061-F | 0.500-0.625 | 42.0 | ... | 35.0 | ... | 9 |
| | 0.100-0.625 | no requirements | | | | |

^A To determine conformance to this specification, each value for tensile strength and for 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-off method of Practice E29.

^B See Annex A1 for the basis for establishment of mechanical property limits.

^C For sheet and plate under ½ in. in thickness, the standard ½ in. wide rectangular tension test specimen shall be used.

^D The specimen diameter is represented by D.

^E This temper is not available from the material producer.

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 tests need not be performed. 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 under 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),

NOTE 1—For inch-pound orders, specify Specification B632; for metric orders, specify Specification B632M. Do not mix units.

4.1.2 Quantity in pieces or pounds [kilograms],

4.1.3 Alloy (7.1),

4.1.4 Temper (9.1),

4.1.5 Dimensions (thickness, width, and length),

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

4.2.1 Whether tension test specimens that retain the pattern are unacceptable (Table 2, footnote C).

4.2.2 Whether bend tests are required (10.1),

4.2.3 Whether inspection or witness of inspection and tests by the purchaser's representative is required prior to material shipment (13.1),

4.2.4 Whether certification of the material by the producer or supplier is required (17.1),

4.2.5 Whether marking is required (15.1), and

4.2.6 Whether Practices B660 applies and, if so, the levels of preservation, packaging, and packing required (16.3).

TABLE 3 Tensile Properties [SI Units]^{A,B}

| Alloy and Temper | Specified Thickness, ^C mm | | Tensile Strength, MPa | | Yield Strength (0.2 % Offset), MPa | | Elongation, min, % | |
|------------------------------|---|---------|--------------------------|-----|---------------------------------------|-----|-----------------------|-----------------|
| | Over | Through | min | max | min | max | in 50 mm | 5D ^D |
| 3003-H231 | 2.50 | 3.20 | 130 | ... | 105 | ... | 5 | ... |
| | 3.20 | 4.00 | 130 | ... | 105 | ... | 6 | ... |
| | 4.00 | 5.00 | 130 | ... | 105 | ... | 7 | ... |
| 6061-O | 2.49 | 3.20 | ... | 150 | ... | 85 | 16 | ... |
| | 3.20 | 12.50 | ... | 150 | ... | 85 | 18 | ... |
| | 12.50 | 16.00 | ... | 150 | ... | ... | ... | 16 |
| 6061-T4 | 2.49 | 6.30 | 205 | ... | 110 | ... | 14 | ... |
| | 6.30 | 12.50 | 205 | ... | 110 | ... | 16 | ... |
| | 12.50 | 16.00 | 205 | ... | 110 | ... | ... | 14 |
| 6061-T42 ^E | 2.49 | 6.30 | 205 | ... | 95 | ... | 14 | ... |
| | 6.30 | 12.50 | 205 | ... | 95 | ... | 16 | ... |
| | 12.50 | 16.00 | 205 | ... | 95 | ... | ... | 14 |
| 6061-T6 and T62 ^E | 2.49 | 5.00 | 290 | ... | 240 | ... | 6 | ... |
| | 5.00 | 6.30 | 290 | ... | 240 | ... | 8 | ... |
| | 6.30 | 12.50 | 290 | ... | 240 | ... | 10 | ... |
| 6061-F | 12.50 | 16.00 | 290 | ... | 240 | ... | ... | 8 |
| | 2.49 | 16.00 | no requirements | | | | | |

^A To determine conformance to this specification, each value for tensile strength and for yield strength shall be rounded to the nearest 1 MPa and each value for elongation to the nearest 0.5 %, both in accordance with the rounding-off method of Practice E29.

^B See Annex A1 for the basis for establishment of mechanical property limits.

^C For sheet and plate through 12.50 mm in thickness, the standard 12.50-mm wide tension rectangular test specimen shall be used.

^D The specimen diameter is represented by *D*.

^E This temper is not available from the material producer.

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 his own or any other suitable facilities for the performance of the inspection and test requirements specified herein, unless disapproved by the purchaser in the order or at the time of contract signing. The purchaser shall have the right to perform any of the inspections and tests set forth in this specification where such inspections are deemed necessary to assure 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 non-heat-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, all tread plate shall be supplied in the mill finish and shall be uniform as defined by the requirements of this specification and shall be commercially sound. Any requirement not so covered is subject to negotiation between the producer and the purchaser.

6.2 Each piece shall be examined to determine conformance to this specification with respect to general quality and identi-

fication marking. On approval of the purchaser, however, a system of statistical quality control may be used for such examinations.

7. Chemical Composition

7.1 *Limits*—The tread plate shall conform to the chemical composition limits specified in Table 1. Conformance shall be determined by the producer by taking samples in accordance with Practices E716 when the ingots are poured and analyzing those samples in accordance with Test Methods E34, E607, E1251, or EN14242. 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 2—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 tread 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, E1251, or EN14242.

8. Heat Treatment

8.1 Producer or supplier heat treatment for the applicable tempers of alloy 6061 in Table 2 [Table 3] shall be in accordance with Practice B918.



9. Tensile Properties of Materials as Supplied

9.1 *Limits*—The tread plate shall conform to the tensile properties specified in Table 2 [Table 3].

9.2 *Number of Specimens*—One specimen shall be taken from a randomly selected piece representing the following quantities of tread plate in a lot:

| Thickness, in. [mm] | Quantity |
|---------------------------------------|---------------------------|
| 0.100–0.249 [over 2.49 through 6.30] | 2000 lb or less [1000 kg] |
| 0.250–0.625 [over 6.30 through 16.00] | 4000 lb or less [2000 kg] |

Other procedures for selecting samples may be employed if approved by the 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 Methods B557 [B557M]. Unless specified by agreement between the producer and purchaser, the producer may test specimens without the removal of the raised pattern or after the raised figures of the pattern are machined off.

9.4 *Test Methods*—The tension test shall be made in accordance with Test Methods B557 [B557M].

10. Bend Properties

10.1 *Limits*—Tread 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 4 for the specified tempers and thicknesses. The test need not be conducted unless specified on the purchaser order.

10.2 *Number of Specimens*—The number of specimens from each lot of material to be tested shall be as specified in 9.2.

10.3 *Test Specimens*—When bend tests are made, the specimens shall be the full thickness of the material, approximately ¾ in. [20 mm] in width, and when practical, at least 6 in. [150 mm] in length. Such specimens may be taken in any direction and their edges may be rounded to a radius of approximately 1/16 in. [2 mm] if desired. The pattern side of the product shall be on the outside of the bend.

10.4 *Test Methods*—The bend tests shall be made in accordance with Test Method E290 except as stated otherwise in 10.3.

TABLE 4 Bend Diameter Factors^A

| Thickness, in. [mm] | Factor, <i>N</i> | | | |
|------------------------|------------------------|---------------------|----------------------------|----------------------------|
| | 3003 Temper H231 | 6061 Temper O | 6061 Tempers T4, T42 | 6061 Tempers T6, T62 |
| 0.100 [2.50] | 2 | 2 | 4 | 7 |
| 0.125 [3.20] | 2 | 2 | 4 | 7 |
| 0.156 [4.00] | 2 | 2 | 4 | 7 |
| 0.188 [5.00] | 2 ^B | 2 | 4 | 7 |
| 0.250 [6.00] | | 4 | 5 | 8 |
| ... [8.00] | | 4 | 6 | 8 |
| 0.375 [10.00] | | 4 | 6 | 8 |
| 0.500 [12.00] | | 4 | 6 | 8 |
| 0.625 [16.00] | | 4 | 6 | 8 |

^A See 10.1.

^B The 3003-H231 product at this thickness is capable of the 2t bend but bending may produce an objectionable surface condition

11. Producer Confirmation of Heat-Treat Response for 6061

11.1 In addition to the requirements of 9.1 and 10.1, mill-produced 6061 material in the O or F temper (without the subsequent imposition of cold work or forming operations) shall be capable, upon proper solution heat treatment and natural aging at room temperature, of developing the properties specified in Table 2 [Table 3] and Table 4 for T42 temper material. The natural aging period at room temperature shall be not less than 4 days, but samples of material may be tested prior to 4 days aging, and if the material fails to conform to the requirements of T42 temper material, the tests may be repeated without prejudice after completion of 4 days aging.

11.2 Alloy 6061 material in the T4 and T42 tempers shall, after proper precipitation heat treatment, be capable of attaining the properties specified in Table 2 [Table 3] and Table 4 for the T6 and T62 tempers respectively.

11.3 *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 11.1 and 11.2 shall be as specified in 9.2.

12. Tolerances

12.1 *Weight [Mass]*—The allowable deviation from nominal weight as shown in Table 5 [Table 6] shall not exceed 8 %. The minimum weight [mass] is controlled by thickness tolerance and minimum pattern height.

12.2 *Pattern*—The minimum height of the raised pattern figures is 0.040 in. [1.00 mm]. (The pattern figure height is the difference in thickness between the maximum thickness reading to the top of the figure and the thickness of an adjacent nonfigured area.) The top of the raised figure may be rounded with sloping sides. A definite line of demarcation between the figure top and sides is not required. The pattern orientation shall conform to Fig. 1.

12.3 *Width, Length, Pattern Line Camber, Lateral Bow, and Squareness*—Tread plate shall not vary in width, length, pattern line camber, lateral bow, or squareness by more than the permissible variations prescribed in the following tables of ANSI H35.2 [H35.2M]:

| Table No. | Title |
|-----------|------------------------|
| 7.38 | Width |
| 7.39 | Length |
| 7.41 | Camber of Pattern Line |
| 7.42 | Lateral Bow |
| 7.43 | Squareness |

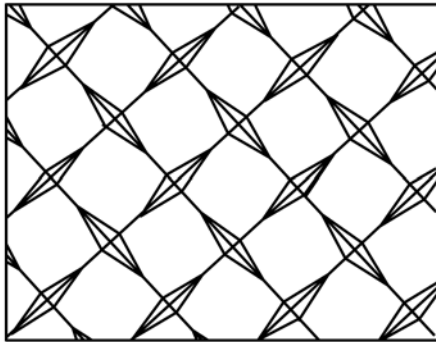
TABLE 5 Nominal Weights per Square Foot

| Specified Thickness Inches | Nominal Weight —lb/ft. ² | |
|-------------------------------|-------------------------------------|------|
| | 3003 | 6061 |
| 0.100 | 1.57 | 1.55 |
| 0.125 | 1.92 | 1.90 |
| 0.156 | 2.36 | 2.34 |
| 0.188 | 2.82 | 2.79 |
| 0.250 | --- | 3.67 |
| 0.313 | --- | 4.56 |
| 0.375 | --- | 5.43 |
| 0.500 | --- | 7.20 |
| 0.625 | --- | 8.96 |

**TABLE 6 Nominal Mass per Square Meter**

NOTE 1—Length of diamond: $1\frac{3}{16}$ in. [31 mm] maximum. Width of diamond: $\frac{1}{32}$ in. [9 mm] maximum.

| Specified Thickness | Nominal Weight —kg/m ² | |
|---------------------|-----------------------------------|------|
| mm | 3003 | 6061 |
| 2.50 | 7.4 | 7.4 |
| 3.20 | 9.3 | 9.3 |
| 4.00 | 11.5 | 11.5 |
| 5.00 | 14.2 | 14.2 |
| 6.00 | --- | 16.9 |
| 8.00 | --- | 22.3 |
| 10.00 | --- | 27.7 |
| 12.00 | --- | 33.1 |
| 16.00 | --- | 43.9 |



Rolling
Direction

NOTE 1—Length of diamond: $1\frac{3}{16}$ in. [31 mm] maximum. Width of diamond: $\frac{1}{32}$ in. [9 mm] maximum.

FIG. 1 Pattern Orientation of Raised Figures (Previously Known as Pattern B)

12.4 *Thickness*—The thickness shall be that permitted by the respective tolerances shown in **Table 7** [Table 8].

12.5 *Sampling for Inspection*—Examination for dimensional conformance shall be made to ensure conformance to the tolerance specified. On approval of the purchaser, a system of statistical quality control for such sampling and examinations may be used.

13. Source Inspection

13.1 If the purchaser desires that his 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.

TABLE 7 Thickness Tolerances

| Specified Thickness ^A | 3003 Tolerance Inches | | 6061 Tolerance Inches | |
|----------------------------------|-----------------------|-------|-----------------------|-------|
| Inches | Plus | Minus | Plus ^B | Minus |
| 0.100 | 0.006 | 0.006 | 0.008 | 0.012 |
| 0.125 | 0.009 | 0.009 | 0.010 | 0.015 |
| 0.156 | 0.010 | 0.010 | 0.011 | 0.019 |
| 0.188 | 0.010 | 0.010 | 0.013 | 0.023 |
| 0.250 | --- | --- | 0.018 | 0.030 |
| 0.313 | --- | --- | --- | --- |
| 0.375 | --- | --- | 0.025 | 0.045 |
| 0.500 | --- | --- | 0.035 | 0.060 |
| 0.625 | --- | --- | 0.044 | 0.075 |

^A Specified thickness does not include height of pattern.

^B In case of dispute, allowed plus tolerance shall be determined by weight.

TABLE 8 Thickness Tolerances

| Specified Thickness ^A | 3003 Tolerance mm | | 6061 Tolerance mm | |
|----------------------------------|-------------------|-------|-------------------|-------|
| mm | Plus | Minus | Plus ^B | Minus |
| 2.50 | 0.15 | 0.15 | 0.20 | 0.30 |
| 3.20 | 0.21 | 0.21 | 0.26 | 0.38 |
| 4.00 | 0.26 | 0.26 | 0.28 | 0.48 |
| 5.00 | 0.26 | 0.26 | 0.35 | 0.60 |
| 6.00 | --- | --- | 0.42 | 0.72 |
| 8.00 | --- | --- | 0.56 | 0.96 |
| 10.00 | --- | --- | 0.70 | 1.20 |
| 12.00 | --- | --- | 0.84 | 1.40 |
| 16.00 | --- | --- | 1.10 | 1.90 |

^A Specified thickness does not include height of pattern.

^B In case of dispute, allowed plus tolerance shall be determined by weight.

13.2 When such inspection or witness of inspection and testing is agreed upon, the purchaser's representative shall be afforded 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.

14. Retest and Rejection

14.1 If any material fails to conform to all of the applicable requirements of this specification, it shall be cause for rejection of the inspection lot.

14.2 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.

14.3 Material in which non conforming conditions are discovered subsequent to inspection may be rejected.

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

15. Identification Marking of Product

15.1 Identification marking of this product is normally not required. When marking is necessary and when specified on the purchase order or contract, all sheet and plate shall be marked on the back side in accordance with Practice **B666/B666M** or by identifying each sheet or plate near one end on the back side with the producer's name or trademark, alloy, temper, thickness, and this specification number.

16. Packaging and Package Marking

16.1 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 [mass] of containers shall, unless otherwise agreed upon, 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.

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

16.3 When specified in the contract or purchase order, material shall be preserved, packaged, and packed in accordance with the requirements of Practices **B660**.

17. Certification

17.1 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.

ANNEXES

(Mandatory Information)

A1. BASIS FOR INCLUSION OF PROPERTY LIMITS

A1.1 Mechanical property limits are established in accordance 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/H35.1M. The Aluminum Association⁴ 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/H35.1M. 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., etc. |
| (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; (see **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.

SUMMARY OF CHANGES

Committee **B07** has identified the location of selected changes to this standard since the last issue (B632/B632M – 08) that may impact the use of this standard. (Approved Oct. 1, 2015.)

- (1) Updated address information for the Aluminum Association in **2.3**, Footnote 4.
- (2) Added Footnote F to **Table 1**.
- (3) Added references to Practice **B985** in **2.2** and **7.2.1**.
- (4) Deleted references to E55.
- (5) Added references to CEN EN 14242 in **2.4**, **7.1**, and Footnote 5 in **Table 1**.
- (6) Revised Section **7** to replace sampling and analysis information with references to Practice **B985**.
- (7) Revised **A1.1**.

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