Designation: B632/B632M – 18

Standard Specification for Aluminum-Alloy Rolled Tread Plate[1]

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.

1.5 *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 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

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/B918M 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 (Withdrawn 2017)[3]

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 Spark Atomic Emission Spectrometry

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]

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

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

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

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

***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*[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
	0.500–0.625	42.0	. . .	35.0	. . .	9
6061-F	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.

2.4 *AMS Specification*[5]

AMS2772 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[6]

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),

[5] Available from SAE International, 400 Commonwealth Dr., Warrendale, PA 15096 (http://www.sae.org).
[6] Available from European Committee for Standardization, Central Secretariat (CEN), Rue de Stassart 36, B1050 Brussels, Belgium (http://www.cen.eu/esearch).

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	. . .
	12.50	16.00	290	. . .	240	. . .	. . .	8
6061-F	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.

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).

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 identification 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.