

Designation: $B26/B26M - 14 B26/B26M - 14^{\epsilon 1}$

Standard Specification for Aluminum-Alloy Sand Castings¹

This standard is issued under the fixed designation B26/B26M; 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 (\$\epsilon\$) 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.

ε¹ NOTE—Table 1 was updated in February 2015 to include footnotes E, F, and G.

1. Scope*

- 1.1 This specification² covers aluminum-alloy sand castings designated as shown in Table 1.
- 1.2 This specification is for aluminum-alloy sand castings used in general purpose applications. It may not address the mechanical properties, integrity testing, and verification required for highly loaded or safety critical applications.
- 1.3 Alloy and temper designations are in accordance with ANSI H35.1/H35.1M. Unified Numbering System alloy designations are in accordance with Practice E527.
 - 1.4 Unless the order specifies the "M" specification designation, the material shall be furnished to the inch-pound units.
- 1.5 For acceptance criteria for inclusion of new aluminum and aluminum alloys and their properties in this specification, see Annex A1 and Annex A2.
- 1.6 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.
- 1.7 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. Referenced Documents

- 2.1 The following documents 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
 - B179 Specification for Aluminum Alloys in Ingot and Molten Forms for Castings from All Casting Processes
 - B275 Practice for Codification of Certain Zinc, Tin and Lead Die Castings
 - 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
 - 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
 - B917/B917M Practice for Heat Treatment of Aluminum-Alloy Castings from All Processes
 - D3951 Practice for Commercial Packaging
 - 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

¹ This specification is under the jurisdiction of ASTM Committee B07 on Light Metals and Alloys and is the direct responsibility of Subcommittee B07.01 on Aluminum Alloy Ingots and Castings.

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² For ASME Boiler and Pressure Vessel Code applications see related Specification SB-26/SB-26M 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.

TABLE 1 Chemical Composition Limits

Note 1-When single units are shown, these indicate the maximum amounts permitted.

Note 2—Analysis shall be made for the elements for which limits are shown in this table.

Note 3—The following applies to all specified limits in this table: 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 method of Practice E29.

Alloy			Composition, (Values in Weight Percent)								Oth	Others ^F		
ANSI <u>E</u>	UNS	Aluminum	Silicon	Iron	Copper	Man- ganese	Magne- sium	Chromium	Nickel	Zinc	Tin	Titanium	Each	Total ^G
201.0	A02010	remainder	0.10	0.15	4.0-5.2	0.20-0.50	0.15-0.55					0.15-0.35	0.05 ^A	0.10
204.0	A02040	remainder	0.20	0.35	4.2-5.0	0.10	0.15-0.35		0.05	0.10	0.05	0.15-0.30	0.05	0.15
242.0	A02420	remainder	0.7	1.0	3.7-4.5	0.35	1.2-1.8	0.25	1.7-2.3	0.35		0.25	0.05	0.15
A242.0	A12420	remainder	0.6	8.0	3.7-4.5	0.10	1.2-1.7	0.15-0.25	1.8-2.3	0.10		0.07-0.20	0.05	0.15
295.0	A02950	remainder	0.7-1.5	1.0	4.0-5.0	0.35	0.03			0.35		0.25	0.05	0.15
319.0	A03190	remainder	5.5-6.5	1.0	3.0-4.0	0.50	0.10		0.35	1.0		0.25		0.50
328.0	A03280	remainder	7.5-8.5	1.0	1.0-2.0	0.20-0.6	0.20-0.6	0.35	0.25	1.5		0.25		0.50
355.0	A03550	remainder	4.5-5.5	0.6^{B}	1.0-1.5	0.50^{B}	0.40-0.6	0.25		0.35		0.25	0.05	0.15
C355.0	A33550	remainder	4.5-5.5	0.20	1.0-1.5	0.10	0.40-0.6			0.10		0.20	0.05	0.15
356.0	A03560	remainder	6.5-7.5	0.6^{B}	0.25	0.35^{B}	0.20-0.45			0.35		0.25	0.05	0.15
A356.0	A13560	remainder	6.5-7.5	0.20	0.20	0.10	0.25-0.45			0.10		0.20	0.05	0.15
443.0	A04430	remainder	4.5-6.0	8.0	0.6	0.50	0.05	0.25		0.50		0.25		0.35
B443.0	A24430	remainder	4.5-6.0	8.0	0.15	0.35	0.05			0.35		0.25	0.05	0.15
512.0	A05120	remainder	1.4-2.2	0.6	0.35	0.8	3.5-4.5	0.25		0.35		0.25	0.05	0.15
514.0	A05140	remainder	0.35	0.50	0.15	0.35	3.5-4.5			0.15		0.25	0.05	0.15
520.0	A05200	remainder	0.25	0.30	0.25	0.15	9.5-10.6			0.15		0.25	0.05	0.15
535.0	A05350	remainder	0.15	0.15	0.05	0.10-0.25	6.2 - 7.5					0.10-0.25	0.05^{C}	0.15
705.0	A07050	remainder	0.20	8.0	0.20	0.40 - 0.6	1.4-1.8	0.20 - 0.40		2.7 - 3.3		0.25	0.05	0.15
707.0	A07070	remainder	0.20	8.0	0.20	0.40 - 0.6	1.8-2.4	0.20 - 0.40		4.0-4.5		0.25	0.05	0.15
710.0^{D}	A07100	remainder	0.15	0.50	0.35-0.65	0.05	0.6-0.8			6.0 - 7.0		0.25	0.05	0.15
712.0^{D}	A07120	remainder	0.30	0.50	0.25	0.10	0.50-0.65	0.40-0.6	-an	5.0-6.5		0.15-0.25	0.05	0.20
713.0	A07130	remainder	0.25	1.1	0.40-1.0	0.6	0.20-0.50	0.35	0.15	7.0-8.0		0.25	0.10	0.25
771.0	A07710	remainder	0.15	0.15	0.10	0.10	0.8-1.0	0.06-0.20		6.5 - 7.5		0.10-0.20	0.05	0.15
850.0	A08500	remainder	0.7	0.7	0.7 - 1.3	0.10	0.10		0.7 - 1.3	•	5.5-7.0	0.20		0.30
851.0 ^D	A08510	remainder	2.0-3.0	0.7	0.7-1.3	0.10	0.10		0.30-0.7	211	5.5-7.0	0.20		0.30
852.0^{D}	A08520	remainder	0.40	0.7	1.7-2.3	0.10	0.6-0.9		0.9-1.5		5.5-7.0	0.20		0.30

 $^{^{\}it A}$ Contains silver 0.40–1.0 %.

E94 Guide for Radiographic Examination

E155 Reference Radiographs for Inspection of Aluminum and Magnesium Castings

E165 Practice for Liquid Penetrant Examination for General Industry

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 Spectrochemical Analysis

E1251 Test Method for Analysis of Aluminum and Aluminum Alloys by Spark Atomic Emission Spectrometry

E2422 Digital Reference Images for Inspection of Aluminum Castings

IEEE/ASTM SI 10 Standard for Use of the International System of Units (SI): The Modern Metric System

2.3 AMS Standard:⁵

AMS 2771 Heat Treatment of Aluminum Alloy Castings

2.4 American National Standards:⁶

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

^B If iron exceeds 0.45 %, manganese content shall not be less than one half of the iron content.

^C Contains beryllium 0.003-0.007 %, boron 0.005 % max.

^D 710.0 formerly A712.0, 712.0 formerly D712.0, 851.0 formerly A850.0, 852.0 formerly B850.0.

^E ASTM alloy designations are recorded in Practice B275.

F "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.

G Other Elements-Total shall be the sum of unspecified metallic elements 0.010 % or more, rounded to the second decimal before determining the sum.

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

⁵ Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, http://www.sae.org.

⁶ Available from Aluminum Association, Inc., 1525 Wilson Blvd., Suite 600, Arlington, VA 22209, http://www.aluminum.org/bookstore.



2.5 Military Standards:⁷

MIL-STD-129 Marking for Shipment and Storage

MIL-STD-276 Impregnation of Porous Nonferrous Metal Castings

NAVSEA Technical Publication S9074-AR-GIB-010/278

2.6 Federal Standard:⁷

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

2.7 Other Standards:⁸

EN 14242 Aluminum and Aluminum Alloys — Chemical Analysis — Inductively Coupled Plasma Optical Emission Spectral Analysis

3. Terminology

- 3.1 Definitions—Refer to Terminology B881 for definitions of product terms used in this specification.
- 3.2 sand casting—a metal object produced by pouring molten metal into a sand mold and allowing it to solidify.

4. Ordering Information

- 4.1 Orders for material under this specification shall include the following information (1.4 and 1.5):
- 4.1.1 This specification designation (which includes the number, year, and revision letter, if applicable),

Note 1—For inch-pound application, specify Specification B26 and for metric application specify Specification B26M. Do not mix units.

- 4.1.2 The quantity in either pieces or pounds [kilograms],
- 4.1.3 Alloy (Section 7 and Table 1),
- 4.1.4 Temper (Section 10 and Table 2), and
- 4.1.5 Applicable drawing or part number,
- 4.2 Additionally, orders for material to this specification shall include the following information when required by the purchaser:
 - 4.2.1 Whether chemical analysis and tensile property reports are required (Table 1 and Table 2),
- 4.2.2 Whether castings or test bars, or both, may be artificially aged for Alloys 705.0-T5, 707.0-T5, 712.0-T5, and 713.0-T5 (10.2) and whether yield strength tests are required for these alloys;
- 4.2.3 Whether test specimens cut from castings are required in addition to, or instead of, separately cast specimens (Sections 10 and 13);
 - 4.2.4 Whether heat treatment is to be performed in accordance with AMS 2771 (see Section 15),
 - 4.2.5 Whether repairs are permissible (16.1),
 - 4.2.6 Whether inspection is required at the producer's works (Section 18);
 - 4.2.7 Whether certification is required (21.1);
- 4.2.8 Whether surface requirements shall be checked against observational standards where such standards are established (19.1);
 - 4.2.9 Whether liquid penetrant inspection is required (19.2);
 - 4.2.10 Whether radiographic inspection is required and, if so, the radiographic grade of casting required (19.3, Table 3);
 - 4.2.11 Whether foundry control is required (Section 9); and
 - 4.2.12 Whether Practice B660 applies and, if so, the levels of preservation, packaging, and packing required (23.4).

5. Quality Assurance

5.1 Unless otherwise specified in the contract or purchase order, the producer shall be responsible for the performance of all inspections and test requirements specified herein. Unless disapproved by the purchaser, the producer may use his own or any other suitable facilities for the performance of the inspection and test requirements specified herein. 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 confirm that the material conforms to prescribed requirements.

6. Manufacture

6.1 The responsibility of furnishing castings that can be laid out and machined to the finished dimensions within the permissible variations specified, as shown on the blueprints or drawings, shall rest with the producer, except where pattern equipment is furnished by the purchaser.

7. Chemical Composition

7.1 The Product shall conform to the chemical composition limits prescribed in Table 1. Conformance shall be determined by the producer by taking samples at the time castings are poured in accordance with Practice E716 and analyzed in accordance with

Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, http://www.dodssp.daps.mil.

⁸ Available from European Committee for Standardization (CEN), 36 rue de Stassart, B-1050, Brussels, Belgium, http://www.cenorm.be.



TABLE 2 Tensile Requirements^A (Inch-Pound Units)

Note 1—For purposes of determining conformance with this specification, each value for tensile strength and yield strength shall be rounded to the nearest 0.1 ksi and each value for elongation shall be rounded to the nearest 0.5 %, both in accordance with the rounding method of Practice E29.

ANSIP UNS min, ksi			Yield Strength	Elongation in	Typical Brinell Hard-	
204.0 A022040 T4 45.0 28.0 6.0 242.0 A02420 OF 23.0 F F F F F F F F F F F F F F F F F F F	NS		(0.2 % offset), min, ksi	2 in. or 4 x diameter, min, %	ness, ^C 500 kgf, 10 mm	
242.0	010	D2010 T7 60.0	50.0			
242.0	040)2040 T4 45.0	28.0	6.0		
T61 32.0 20.0 F 295.0 A02950 T4 299.0 F 1.0 295.0 A02950 T4 299.0 F 1.0 295.0 A02950 T4 299.0 T3.0 6.0 T6 32.0 20.0 3.0 T7 29.0 16.0 3.0 T7 29.0 16.0 3.0 319.0 A03190 F 25.0 T6 31.0 20.0 1.5 T5 25.0 F T6 31.0 20.0 1.5 328.0 A03280 F 25.0 14.0 1.0 355.0 A03550 T6 34.0 21.0 1.0 355.0 A03550 T6 32.0 20.0 22.0 T51 25.0 18.0 F T71 30.0 22.0 F C355.0 A33550 T6 36.0 25.0 25.5 366.0 A03560 F 16 30.0 22.0 F T71 30.0 22.0 F T6 30.0 3.0 T7 31.0 F T51 23.0 16.0 F T71 30.0 22.0 F A356.0 A03560 F 16 30.0 25.0 25.0 25.5 366.0 A03560 F 16 30.0 20.0 3.0 T6 30.0 20.0 3.0 T6 30.0 20.0 3.0 T7 31.0 F F T51 23.0 16.0 F T71 25.0 18.0 3.0 A356.0 A13560 T6 34.0 24.0 3.5 T61 35.0 26.0 1.0 A356.0 A13560 F T61 35.0 26.0 1.0 A356.0 A13560 F T71 25.0 18.0 3.0 A356.0 A04430 F T61 35.0 26.0 1.0 A43.0 A04430 F T61 35.0 26.0 1.0 A43.0 A04430 F T61 35.0 26.0 1.0 A356.0 A05350 F T71 25.0 18.0 3.0 B443.0 A04430 F T61 35.0 26.0 1.0 A05120 F T71 7.0 10.0 T61 35.0 26.0 1.0 A05120 F T70 170 10.0 T61 35.0 26.0 1.0 A05120 F T70 37.0 A05120 F T71 37.0 A07120 T5 A0713.0 A07130 T5 A0710 T5 A07110	420)2420 O ^E 23.0	F	F	70	
295.0 A02950 T4 29.0 13.0 6.0 16 32.0 20.0 3.0 177 29.0 16.0 3.0 319.0 A03190 F 23.0 13.0 1.5 15 25.0 F F 16 31.0 20.0 15.0 175 25.0 F F 176 31.0 20.0 1.5 328.0 A03280 F 25.0 14.0 1.0 355.0 A03550 T6 32.0 20.0 20.0 2.0 171 30.0 22.0 F 171 30.0 3.0 3.0 366.0 A03560 F 19.0 9.5 2.0 16 36.0 25.0 2.5 366.0 A03560 F 19.0 9.5 2.0 17 31.0 F F 17 31.0 F F 17 31.0 F F 18 30.0 3.0 A356.0 A1360 T6 34.0 24.0 3.5 16 30.0 20.0 3.0 17 31.0 F F 17 31.0 A05140 F F 17.0 10.0 514.0 A05140 F 7 22.0 9.0 6.0 520.0 A0520 F 7 37.0 9.0 6.0 520.0 A0520 F 7 37.0 9.0 6.0 520.0 A0530 F 9 30.0 17.0 9.0 6.0 520.0 A0520 F 15 30.0 17.0 9.0 6.0 520.0 A0520 F 15 30.0 17.0 9.0 9.0 705.0 A07050 T5 30.0 17.0 9.0 707.0 A07070 T7 710.0 A07100 T5 32.0 22.0 30.0 771.0 F A07120 T5 32.0 22.0 30.0 771.0 A07110 T5 32.0 22.0 30.0 771.0 A07110 T5 32.0 22.0 30.0 771.0 A07110 T5 32.0 22.0 30.0 771.0 A07710 T5 32.0 35.0 772.0 35.0 35.0 35.0 35.0 773.0 35.0 35.0 35.0 35.0 35.0 35.0			20.0	F	105	
T6 32.0 20.0 3.0 76 76 76 77 29.0 16.0 3.0 3.0 15.5 25.0 76 76 77 29.0 16.0 3.0 1.5 75 25.0 76 76 31.0 20.0 15.5 328.0 A03280 F 25.0 14.0 1.0 355.0 A03550 T6 32.0 20.0 2.0 76 35.0 A03560 F 35.0 A03560 F 36 36.0 25.0 2.5 356.0 A03560 F 371 25.0 18.0 76 34.0 22.0 3.0 77 31.0 76 34.0 24.0 3.5 3.5 3.5 3.5 3.5 3.5 3.5 3.5 3.5 3.5	420	12420 T75 29.0	F	1.0	75	
T62 36.0 28.0 F T77 29.0 16.0 3.0 319.0 A03190 F 29.0 15.0 3.0 T5 25.0 F F T6 31.0 20.0 15.5 328.0 A03280 F 25.0 14.0 1.0 T6 34.0 21.0 1.0 355.0 A03550 T6 32.0 20.0 2.0 T51 25.0 18.0 F T71 30.0 22.0 F T71 30.0 22.0 F C355.0 A33550 T6 36.0 25.0 18.0 F T71 30.0 22.0 F T71 31.0 F F T71 31.0 F T71 25.0 18.0 F T71 31.0 F T71 25.0 18.0 S A356.0 A13560 F 19.0 9.5 2.0 A356.0 A13560 T6 36.0 25.0 3.0 T6 30.0 20.0 3.0 T7 31.0 F T7 31.0 F T51 29.0 18.0 3.0 A356.0 A13560 T6 34.0 24.0 3.5 T61 35.0 26.0 1.0 A356.0 A13560 F 17.0 7.0 3.0 B443.0 A04430 F 17.0 7.0 3.0 B443.0 A04430 F 17.0 7.0 3.0 B443.0 A0450 F 17.0 17.0 7.0 3.0 B443.0 A0450 F 17.0 17.0 10.0 512.0 A05120 F 17.0 17.0 10.0 514.0 A05140 F 22.0 9.0 6.0 520.0 A05200 F 35.0 35.0 18.0 9.0 705.0 A07050 T5 30.0 17.0 9.0 9.0 707.0 A07070 T7 37.0 30.0 12.0 712.0" A07120 T5 32.0 22.0 30.0 713.0 A07130 T5 32.0 22.0 30.0 771.0 A07710 T5 32.0 55.0 55.0	950)2950 T4 29.0	13.0	6.0	60	
T77 29.0 16.0 3.0 T77 29.0 16.0 3.0 T5 25.0 F T6 31.0 20.0 1.5 328.0 A03280 F T6 34.0 21.0 1.0 355.0 A03550 T6 32.0 20.0 2.0 T71 30.0 22.0 F T71 31.0 F T71 31.0 F T71 25.0 18.0 F T71 31.0 F T71 25.0 18.0 S T71 31.0 F T71 31.0 F T71 25.0 18.0 S T71 25.0 18.0 S T71 25.0 18.0 S T71 31.0 F T72 31.0 F T73 31.0 F T74 31.0 F T75 25.0 18.0 S T6 30.0 20.0 3.0 T75 20.0 3.0 S T77 31.0 F T71 25.0 18.0 S T71 25.0 S T71 35.0 S T71 35.		T6 32.0	20.0	3.0	75	
319.0 A03190 F 25.0 F F F F 75		T62 36.0	28.0	F	95	
T5		T7 29.0	16.0	3.0	70	
T6 31.0 20.0 1.5 328.0 A03280 F 25.0 14.0 1.0 355.0 A03550 T6 32.0 20.0 2.0 T51 25.0 18.0 F T71 30.0 22.0 F C355.0 A33550 T6 36.0 22.0 F C355.0 A03560 F 19.0 9.5 2.0 T6 30.0 20.0 3.0 T7 31.0 F F T71 25.0 18.0 F T71 25.0 18.0 3.0 A366.0 A13660 F 34.0 20.0 3.0 T6 34.0 24.0 3.5 T61 35.0 26.0 1.0 A356.0 A1360 T6 34.0 24.0 3.5 T61 35.0 26.0 1.0 A356.0 A1360 F 17.0 6.0 3.0 B443.0 A24430 F 17.0 6.0 3.0 S12.0 A05120 F 17.0 6.0 3.0 S12.0 A05120 F 17.0 10.0 S14.0 A05140 F 22.0 9.0 6.0 S20.0 A05200 F 35.0 35.0 18.0 9.0 T62.0 A05200 F 35.0 35.0 18.0 9.0 T635.0 A05350 F 36.0 17.0 10.0 T64 30.0 17.0 10.0 T77.0 10.0 10.0 T77.0 10.0 10.0 T79.0 30.0 170.0 10.0 10.0 T19.0 42.0 10.0 10.0 10.0 10.0 10.0 T19.0 42.0 10.0 10.0 10.0 10.0 T19.0 40.0 10.0 15.0 10.0 10.0 10.0 10.0 T19.0 40.0 10.0 15.0 10.0 10.0 10.0 10.0 T19.0 40.0 10.0 15.0 10.0 10.0 10.0 10.0 10.0 1	190	03190 F 23.0	13.0	1.5	70	
328.0		T5 25.0			80	
T6 34.0 21.0 1.0 355.0 A03550 T6 32.0 20.0 2.0 T51 25.0 18.0 F T71 30.0 22.0 F C355.0 A33550 T6 36.0 25.0 2.5 356.0 A03560 F 19.0 9.5 2.0 T6 30.0 20.0 3.0 T7 31.0 F F T51 23.0 16.0 F T71 25.0 18.0 3.0 A356.0 A13560 T6 34.0 20.0 3.0 A356.0 A13560 T6 34.0 24.0 3.5 T61 35.0 26.0 1.0 443.0 A04430 F 17.0 7.0 3.0 B443.0 A04430 F 17.0 7.0 3.0 B443.0 A05120 F 17.0 10.0 514.0 A05120 F 17.0 10.0 514.0 A05140 F 22.0 9.0 6.0 520.0 A05200 T4 42.0 22.0 12.0 535.0 A05350 F 35.0 18.0 9.0 707.0 A07050 T5 30.0 17.0 30.0 9.0 707.0 A07050 T5 30.0 17.0 30.0 9.0 710.0 A07100 T5 32.0 20.0 20.0 20.0 711.0 A07110 T5 32.0 20.0 30.0 1.5 T51 ASTMBB 32.0 22.0 30.0 1.5 T51 ASTMBB 32.0 22.0 30.0 1.5 T51 ASTMBB 32.0 22.0 30.0 30.0 1.5 T51 ASTMBB 32.0 22.0 30.0 30.0 1.5 T51 ASTMBB 32.0 30.0 35.0 1.5 T51 ASTMBB 32.0 30.0 35.0 35.0 35.0 35.0 35.0 35.0 35		T6 31.0	20.0	1.5	80	
355.0	280	03280 F 25.0	14.0	1.0	60	
T51		T6 34.0	21.0	1.0	80	
C355.0 A33550 T6 36.0 22.0 F C356.0 A03560 F 19.0 9.5 2.0 T6 30.0 20.0 3.0 T7 31.0 F T51 23.0 16.0 F T71 25.0 18.0 3.0 A356.0 A13560 F 34.0 24.0 3.5 T61 35.0 26.0 1.0 443.0 A04430 F 17.0 6.0 3.0 B443.0 A24430 F 17.0 6.0 3.0 B443.0 A05120 F 17.0 10.0 514.0 A05140 F 22.0 9.0 6.0 520.0 A05200 F 35.0 A05350 T6 30.0 17.0 30.0 T7 37.0 30.0 17.0 5.0 T8 30.0 17.0 5.0 T8 30.0 17.0 5.0 T9 30.0 17.0 5.0 T1 30.	550	D3550 T6 32.0	20.0	2.0	80	
C355.0		T51 25.0	18.0	F	65	
356.0 A03560 F 19.0 9.5 2.0 3.0 T6 30.0 20.0 3.0 T7 31.0 F F F F T51 23.0 16.0 F F T51 25.0 18.0 3.0 A0450 F T61 35.0 26.0 1.0 A05120 F 17.0 6.0 3.0 512.0 A05140 F 22.0 9.0 6.0 520.0 A05200 F 35.0 A05350 F 35.0 A05350 F 35.0 A05350 F 35.0 A05350 F 35.0 A07050 T5 30.0 17.0 A07070 T7 A0710 H A07100 T5 A07120 T5 32.0 20.0 30.0 A07130 T5 32.0 20.0 30.0 A07130 T5 32.0 22.0 30.0 A07130 T5 32.0 22.0 30.0 A07130 T5 32.0 A07130 T5 32.0 A07140 38.0 1.5 T51 A5TM B 32.0 A0540 S 15.5 tm-b26		T71 30.0	22.0	F	75	
T6 30.0 20.0 3.0 F F T11 25.0 18.0 3.0 A356.0 A13560 T6 34.0 24.0 3.5 T61 35.0 26.0 1.0 A43.0 A24430 F T17.0 A243.0 A2430 F T17.0 A2430 F T17.0 A243.0 A2430 F T17.0 A243.0 A2430 F T17.0 A2430 F	550		25.0	2.5		
T7	560	D3560 F 19.0	9.5	2.0	55	
T51 23.0 16.0 F T71 25.0 18.0 3.0 A356.0 A13560 T6 34.0 24.0 3.5 T61 35.0 26.0 1.0 443.0 A04430 F T6 17.0 7.0 3.0 B443.0 A05120 F 17.0 10.0 514.0 A05140 F 22.0 9.0 6.0 520.0 A05200 F 22.0 9.0 6.0 520.0 A05200 F 35.0 18.0 9.0 705.0 A07050 T5 30.0 17.0 30.0 707.0 A07070 T7 707.0 A07070 T7 710.0 A07100 T5 32.0 P 25.0 30.0 713.0 A07130 T5 32.0 25.0 38.0 1.5 T51 ASTMB 42.0 36.0 36.0 30.0 30.0 30.0 30.0 30.0 30		T6 30.0	20.0	3.0	70	
T71 25.0 18.0 3.0 A356.0 A13560 T6 34.0 24.0 3.5 T61 35.0 26.0 1.0 443.0 A04430 F T6 17.0 7.0 3.0 B443.0 A24430 F 17.0 10.0 512.0 A05120 F 17.0 10.0 514.0 A05140 F 22.0 9.0 6.0 520.0 A05200 T4 2.0 22.0 9.0 6.0 520.0 A05200 F 35.0 18.0 9.0 705.0 A07050 T5 30.0 17.0 5.0 707.0 A07070 T7 37.0 P 37.0 30.0 20.0 712.0 A07120 T5 34.0 25.0 40.0 713.0 A07130 T5 32.0 22.0 3.0 771.0 A07710 T5 32.0 22.0 3.0 771.0 A07710 T5 32.0 22.0 3.0 T51 32.0 32.0 33.0 15.5 T61 32.0 33.0 15.5 T61 32.0 33.0 30.0 30.0 30.0 30.0 30.0 30.0		T7 31.0	F		75	
A356.0 A13560 T6 34.0 24.0 3.5 T61 35.0 26.0 1.0 443.0 A04430 F T6 17.0 7.0 3.0 B443.0 A24430 F T7.0 10.0 6.0 3.0 512.0 A05120 F 17.0 10.0 514.0 A05140 F 22.0 9.0 6.0 520.0 A05200 T4 \$2.0 \$2.0 \$12.0 535.0 A05350 F 35.0 \$18.0 \$9.0 705.0 A07050 T5 30.0 \$17.0^6\$ 5.0 707.0 A07070 T7 710.0 ^H A07100 T5 32.0 20.0 20.0 712.0 ^H A07120 T5 34.0 25.0 ^G 4.0 713.0 A07130 T5 32.0 22.0 3.0 771.0 A07710 T5 42.0 38.0 1.5 T51 ASTM 20.0 40.0 35.0 \$1.5 T61 ASTM 20.0 40.0 35.0 \$1.5 T62 A36.0 40.0 35.0 \$1.5 T63 A36.0 40.0 35.0 \$1.5 T642.0 38.0 1.5 T65 32.0 42.0 35.0 \$1.5 T76 42.0 35.0 \$1.5 T77 42.0 42.0 \$1.5 T78 42.0 35.0 \$1.5 T78 42.0 \$		T51 23.0	16.0	F	60	
T61 35.0 26.0 1.0 443.0 A04430 F TC 17.0 7.0 3.0 B443.0 A24430 F TC 17.0 10.0 512.0 A05120 F 17.0 10.0 514.0 A05140 F 22.0 9.0 6.0 520.0 A05200 T4 22.0 12.0 535.0 A05350 F 35.0 12.0 12.0 705.0 A07050 T5 30.0 17.0 5.0 707.0 A07070 T7 37.0 30.0 17.0 5.0 710.0 A07100 T5 32.0 20.0 20.0 712.0 A07120 T5 34.0 25.0 40.0 713.0 A07130 T5 32.0 22.0 3.0 771.0 A07710 T5 42.0 38.0 1.5 T61 ASTM 20.0 M-14c1 27.0 3.0 110 35.0 1.5 110 35.0 1		T71 25.0	18.0	3.0	60	
443.0 A04430 F TCh 17.0 7.0 3.0 B443.0 A24430 F TCh 17.0 G.0 3.0 512.0 A05120 F 17.0 10.0 514.0 A05140 F 22.0 9.0 6.0 520.0 A05200 T4 42.0 12.0 12.0 535.0 A05350 F 35.0 18.0 9.0 705.0 A07050 T5 30.0 17.0 5.0 707.0 A07070 T7 37.0 30.0 17.0 5.0 710.0 A07100 T5 32.0 20.0 20.0 712.0 A07120 T5 34.0 25.0 40.0 713.0 A07130 T5 32.0 22.0 3.0 771.0 A07710 T5 32.0 32.0 30.0 1.5 T61 ASTM B 32.0 M-14cl 27.0 3.0 115 32.0 35.0 30.0 35.0 35.0 35.0	560	13560 T6 34.0	24.0	3.5	80	
512.0 A05120 F 17.0 10.0 514.0 A05140 F 22.0 9.0 6.0 520.0 A05200 T4 42.0 22.0 12.0 535.0 A05350 F 35.0 18.0 9.0 705.0 A07050 T5 30.0 17.0° 5.0 707.0 A07070 T7 37.0 30.0° 1.0 710.0H A07100 T5 32.0 20.0 2.0 713.0 A07130 T5 32.0 22.0 3.0 771.0 A07710 T5 42.0 38.0 1.5 T51 T51 32.0 27.0 3.0 155 32.0 22.0 3.0 771.0 A07710 T5 42.0 38.0 1.5 T51 T6 42.0 30.0 30.0 35.0 1ttps://standards.itch.ai/catalog/staff 752 42.0 35.0 35.0 5.0			26.0	1.0		
512.0 A05120 F 17.0 10.0 514.0 A05140 F 22.0 9.0 6.0 520.0 A05200 T4 22.0 9.0 6.0 535.0 A05350 F 35.0 18.0 9.0 705.0 A07050 T5 30.0 17.0° 5.0 707.0 A07070 T7 37.0 30.0° 1.0 710.0 ^H A07100 T5 32.0 20.0 2.0 712.0 ^H A07120 T5 34.0 25.0° 4.0 713.0 A07130 T5 32.0 22.0 3.0 771.0 A07710 T5 42.0 38.0 1.5 T51 T52 36.0 27.0 3.0 1tps://standards.itch.ai/catalog/staff 752 36.0 30.0 35.0 1tps://standards.itch.ai/catalog/staff 752 36.0 35.0 35.0 5.0		04430 F 17.0			40	
514.0 A05140 F 22.0 9.0 6.0 520.0 A05200 T4 42.0 22.0 12.0 535.0 A05350 T5 35.0 18.0 9.0 705.0 A07050 T5 30.0 17.0° 5.0 707.0 A07070 T7 37.0 1.0 20.0 2.0 710.0H A07100 T5 32.0 20.0 2.0 713.0 A07130 T5 32.0 22.0 3.0 771.0 A07710 T5 42.0 38.0 1.5 751 ASTM B2 32.0 27.0 3.0 1ttps://standards.iteh.ai/catalog/star/T6 42.0 36.0 42.0 35.0 5.0	430			3.0	40	
520.0 A05200 T4 \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	120	** := * : : : : : : : : : : : : : : : :			50	
705.0 A07050 T5 30.0 17.0 5.0 10.0 17.0 5.0 10.0 17.0 6 5.0 17.0 6 10.0 17.0 6 10.0 17.0 6 10.0 17.0 6 10.0 17.0 6 10.0 17.0 6 10.0 17.0 6 10.0 17.0 6 10.0 17.0 6 10.0 17.0 6 10.0 17.0 6 10.0 17.0 17.0 17.0 17.0 17.0 17.0 17.0	140	05140 F 22.0	9.0	6.0	50	
705.0 A07050 T5 30.0 17.0 5.0 10.0 707.0 A07070 T7 OCUME 37.0 20.0 20.0 2.0 710.0 407100 T5 32.0 25.0 6 4.0 713.0 A07130 T5 32.0 22.0 3.0 771.0 A07710 T5 42.0 38.0 1.5 T51 ASTM B2 32.0 6M-14e1 27.0 3.0 11.5 11.5 11.5 11.5 11.5 11.5 11.5 11		05200 T4 C 42.0 C	22.0		75	
707.0 A07070 T7 OCUME 37.0 20.0 2.0 2.0 2.0 712.0 A07100 T5 32.0 PCV 30.0 2.0 2.0 712.0 A07120 T5 34.0 25.0 4.0 32.0 22.0 3.0 713.0 A07130 T5 32.0 22.0 3.0 771.0 A07710 T5 42.0 38.0 1.5 T51 ASTM B 32.0 6M-14e1 27.0 3.0 1.5 T51 ASTM B 32.0 6M-14e1 27.0 3.0 1.5 T51 ASTM B 32.0 6M-14e1 27.0 3.0 1.5 T51 ASTM B 32.0 6M-14e1 37.0 3.0 3.0 3.0 3.0 3.0 3.0 3.0 3.0 3.0 3		05350 F 35.0	18.0		70	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	050	07050 T5 30.0	17.0 ^G	5.0	65	
712.0 ^H A07120 T5 34.0 25.0 ^G 4.0 713.0 A07130 T5 32.0 22.0 3.0 771.0 A07710 T5 42.0 38.0 1.5 T51 ASTM B2 32.0 26M-14e1 27.0 3.0 1ttps://standards.iteh.ai/catalog/stan T52 rds/sist/0640124 36.0 42.0 55-4168-808 30.0 1081995a35 1.5 5.0 5tm-b26	070	07070 T7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	30.0^{G}	1.0	80	
713.0 A07130 T5 32.0 22.0 3.0 771.0 A07710 T5 42.0 38.0 1.5 T51 ASTM B2 32.0 26M-14e1 27.0 3.0 1.5 1ttps://standards.iteh.ai/catalog/stan ^{T52} rds/sist/0640f24 36.0 55-4f68-808 30.0 108f995a35 5.0 stm-b26	100	07100 T5 0 32.0		2.0	75	
771.0 A07710 T5 ASTM B2 42.0 26M-14e1 38.0 1.5 3.0 30.0 1.5 3.0 30.0 30.0 30.0 30.0 30.0 30.0 30.	120)7120 T5 34.0	25.0 ^G	4.0	75	
T51 <u>AS I W B2 32 0 26 M - 14 e 1</u> 27.0 3.0 https://standards.iteh.ai/catalog/stan ^{T52} rds/sist/0640124_36.0 b5-4168-808_35.0 1081995a35_5.0 stm-b26	130			3.0	75	
nttps://standards.iteh.ai/catalog/stan ^{T52} rds/sist/0640f24 ^{236.0} 2b5-4f68-808 ^{30.0} 35.0 108f995a35 ^{1.5} 5.0 stm-b26	710	07710 T5 42.0	38.0	1.5	100	
				3.0	85	
		iteh.ai/catalog/stan T52 rds/sist/0640f24 36.0 b5-4f68-8	08 30.0 108 5	995a35c ^{1.5} stm-b	26-b26r ⁸⁵ 14e1	
17 1 40.0 40.0 2.0					120	
850.0 A08500 T5 16.0 F 5.0	500		45.0 F		45	
851.0 ^H A08510 T5 17.0 F 3.0					45 45	
852.0 ^H A08520 T5 24.0 18.0 ^F				ა.u F	45 60	

A If agreed upon between the manufacturer and the purchaser, other mechanical properties may be obtained by other heat treatments such as annealing, aging, or stress relieving.

Test Methods E607, E1251, or E34, or EN 14242. If the producer has determined the composition of the material during casting, they shall not be required to sample and analyze the finished product.

- 7.1.1 A sample for determination of chemical composition shall be taken to represent one of the following:
- 7.1.2 Not more than 4000 lb [2000 kg] of clean castings or a single casting poured from one furnace. The maximum elapsed time between determinations shall be established for each alloy, but in any case the maximum elapsed time shall not exceed 8 h.
- 7.1.3 The maximum elapsed time between determinations shall be established for each alloy, but in any case the maximum elapsed time shall not exceed 8 h.
- 7.2 If it becomes necessary to analyze castings for conformance to chemical composition limits, the method used to sample castings for the determination of chemical composition shall be in accordance with Practice B985. Analysis shall be performed in accordance with Practice E716, Test Methods E34, E607, or E1251, or EN 14242 (ICP method).

^B Refer to ANSI H35.1/H35.1M, or both, for description of tempers.

 $^{^{\}it C}\,{\rm For}$ information only, not required for acceptance.

^D ASTM alloy designations are recorded in Practice B275.

 $^{^{\}it E}$ Formerly designated as 222.0-T2 and 242.0-T21.

F Not required.

^G Yield strength to be determined only when specified in the contract or purchase order.

 $^{^{\}it H}$ 710.0 formerly A712.0, 712.0 formerly D712.0, 851.0 formerly A850.0, 852.0 formerly B850.0.

TABLE 3 Discontinuity-Level Requirements for Aluminum Castings in Accordance with Film Reference Radiographs E155 or Digital Reference Radiographs E2422

		Section Thickness in. [mm]								
Discontinuity		Grade A ^A		Grade B		Grade C		Grade D		
	_	1/4 [6.4]	3/4 [19.0]	1/4 [6.4]	3/4 [19.0]	1/4 [6.4]	3/4 [19.0]	1/4 [6.4]	3/4 [19.0]	
Gas holes	1.1	none		1	1	2	2	5	5	
Gas porosity (round)	1.21	none		1	1	3	3	7	7	
Gas porosity (elongated)	1.22	none		1	1	3	4	5	5	
Shrinkage cavity	2.1	no	one	1	В	2	В	3	В	
Shrinkage porosity or sponge	2.2	no	one	1	1	2	2	4	3	
Foreign material (less dense material)	3.11	no	one	1	1	2	2	4	4	
Foreign material (more dense material)	3.12	none		1	1	2	1	4	3	
Segregation	3.2	none		none		none		none		
Cracks .		none		none		none		none		
Cold shuts		none		none		none		no	none	
Surface irregularity					r	not to exceed	drawing toleran	ice		
Core shift				not to exceed drawing tolerance						

^A Caution should be exercised in requesting Grade A.

8. Material Requirements—Castings Produced for Governmental and Military Agencies

- 8.1 Unless otherwise specified, only aluminum alloy conforming to the requirements of Specification B179 or producer's foundry scrap (identified as being made from alloy conforming to Specification B179) shall be used in the remelting furnace from which molten metal is taken for pouring directly into castings. Additions of small amounts of modifiers and grain refining elements or alloys are permitted.
- 8.1.1 Pure materials, recycled materials, and master alloys may be used to make alloys conforming to this specification, provided chemical analysis can be taken and adjusted to conform to Table 1 prior to pouring any castings.

9. Foundry Control—Castings Produced for Governmental or Military Agencies, or Both

9.1 When specified, castings shall be produced under foundry control approved by the purchaser. Foundry control shall consist of examination of castings by radiographic or other approved methods for determining internal discontinuities until the gating, pouring, and other foundry practices have been established to produce castings meeting the quality standards furnished by the purchaser or agreed upon between the purchaser and the producer. When foundry practices have been so established, the production method shall not be significantly changed without demonstrating to the satisfaction of the purchaser that the change does not adversely affect the quality of the castings. Minor changes in pouring temperature of $\pm 50^{\circ}$ F [$\pm 28^{\circ}$ C] from the established nominal temperature are permissible.

10. Tensile Properties

- 10.1 The separately cast test specimens representing the castings shall meet the mechanical properties prescribed in Table 2.
- 10.2 Although Alloys 705.0, 707.0, 712.0, and 713.0 are most frequently used in the naturally aged condition, by agreement between the producer and the purchaser, the castings may be artificially aged to the T5 temper. The producer and the purchaser may also agree to base the acceptance of castings on artificially aged test bars. The conditions of artificial aging shown in Practice B917/B917M shall be employed unless other conditions are accepted by mutual consent.
- 10.3 When specified, the tensile strength, yield strength, and elongation values of specimens cut from castings shall be not less than 75 % of the tensile and yield strength values and not less than 25 % of the elongation values specified in Table 2 [Table 4]. The measurement of the elongation is not required for test specimens cut from castings if 25 % of the specified minimum elongation value published in Table 2 [Table 4] is 0.5 % or less. If grade D quality castings as described in Table 3 are specified, no tensile tests shall be specified nor tensile requirements be met on specimens cut from castings.

11. Workmanship, Finish, and Appearance

11.1 The finished castings shall be uniform in composition and free of blowholes, cracks, shrinks, and other discontinuities except as designated and agreed upon as acceptable by the purchaser.

12. Number of Tests and Retests

- 12.1 Unless otherwise agreed upon between the purchaser and producer, a minimum of two tension test specimens shall be separately cast and tested to represent the following:
 - 12.1.1 Not more than 4000 lb [2000 kg] of clean castings (gates and risers removed) or a single casting poured from one furnace.
 - 12.1.2 The castings poured continuously from one furnace in not more than eight consecutive hours.

^B Not available.



TABLE 4 Tensile Requirements (SI Units)—[Metric]^A

Note 1—For purposes of determining conformance with this specification, each value for tensile strength and yield strength shall be rounded to the nearest 1 MPa and each value for elongation shall be rounded to the nearest 0.5 %, both in accordance with the rounding method of Practice E29.

Alloy		T B	Tensile Strength,	Yield Strength	Elongation in	Typical Brinell	
ANSI ^E	UNS	— Temper ^B	min, MPa ^Č	(0.2 % offset), min, MPa ^C	5× diameter, min %	Hardness, ^D 500 kgf, 10 mm	
201.0	A02010	T7	415	345	3.0		
204.0	A02040	T4	310	195	6.0		
242.0	A02420	O^{F}	160	G	G	70	
		T61	220	140	G	105	
A242.0	A12420	T75	200	G	1.0	75	
295.0	A02950	T4	200	90	6.0	60	
		T6	220	140	3.0	75	
		T62	250	195	G	95	
		T7	200	110	3.0	70	
319.0	A03190	F	160	90	1.5	70	
		T5	170	G	G	80	
		T6	215	140	1.5	80	
328.0	A03280	F	170	95	1.0	60	
		T6	235	145	1.0	80	
355.0	A03550	T6	220	140	2.0	80	
000.0	7100000	T51	170	125	G	65	
		T71	205	150	G	75	
C355.0	A33550	T6	250	170	2.5		
356.0	A03560	F	130	65	2.0	55	
000.0	7100000	T6	205	140	3.0	70	
		T7	215	G	G.0	75	
		T51	160	110	G	60	
		T71	170	125	3.0	60	
A356.0	A13560	T6	235	165	3.5	80	
A000.0	A10000	T61	245	180	1.0		
443.0	A04430	F	115	50	3.0	 40	
B443.0	A24430	F I (h S 115 n 1 2	30	3.0	40	
512.0	A05120	F	115	70		50	
514.0	A05120 A05140	, F ,	150	60	6.0	50	
520.0	A05140 A05200	(h 1111) c • /		150	12.0	75	
535.0	A05200 A05350	(11111,12).//	S12 1 290 240	125	9.0	75 70	
705.0	A05350 A07050	T5	205	115 ^H	5.0	65	
705.0	A07050 A07070	T7		205 ^H	1.0	80	
707.0 710.0 ⁷	A07070 A07100	T5 0 C	255	140	2.0	75	
				170 ^H			
712.0 ⁷	A07120	T5	235		4.0	75 75	
713.0	A07130	T5	220	150	3.0	75	
771.0	A07710	T5	STM R2 290	4e1 260	1.5	100	
		T51 =	15 1 W B Z 220 Z 0 W - 1	185	3.0	85	
		atalog/star ^{T52} rds/sist	/0640f244 <mark>250</mark> eb5-4f6	08-808 205 d 08 f 9 9	5a35c ^{1.5} stm-b2	6-b26m ₉₀ ⁸⁵ 4e1	
		T71	330	310	2.0	120	
850.0	A08500	T5	110	G	5.0	45	
851.0 ⁷	A08500 A08510	T5	115	G	3.0	45	
852.0 ¹	A08510 A08520	T5	165	125	G.0	60	
002.0	AUODZU	10	100	120		00	

All fagreed upon between the manufacturer and the purchaser, other mechanical properties may be obtained by other heat treatments such as annealing, aging, or stress relieving.

Additional digits, the first of which shall not be zero, may be added to designation T1 through T10 to indicate a variation in treatment that significantly alters the characteristics of the product.

12.2 When tensile properties from castings are to be determined, one per melt-heat combination shall be tested unless otherwise shown on the drawing or specified in the purchase order.

^B Temper designations:

F As fabricated.

O Annealed.

T1 Cooled from an elevated temperature shaping process and naturally aged to a substantially stable condition.

T4 Solution heat-treated and naturally aged to a substantially stable condition.

T5 Cooled from an elevated temperature shaping process and then artificially aged.

T6 Solution heat-treated and then artificially aged.

T7 Solution heat-treated and stabilized.

^C For explanation of the SI unit "MPa" see Appendix X2.

^D For information only, not required for acceptance.

^E ASTM alloy designations are recorded in Practice B275.

^F Formerly designated as 222.0-T2 and 242.0-T21.

G Not required.

HYield strength to be determined only when specified in the contract or purchase order.

¹ 710.0 formerly A712.0, 712.0 formerly D712.0, 851.0 formerly A850.0, 852.0 formerly B850.0.