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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 4260E

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Superseding AMS 4260D

Submitted for recognition as an American National Standard

ALUMINUM ALLOY, INVESTMENT CASTINGS
7.0Si - 0.32Mg (356.0-T6)
Solution and Precipitation Heat Treated

UNS A03560

1. SCOPE:

1.1 Form:

This specification covers an aluminum alloy in the form of investment castings.

1.2 Application:

These castings have been used typically for small, intricate parts cast to approximately final dimensions, but usage is not limited to such applications.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2360 Room Temperature Tensile Properties of Castings
AMS 2694 Repair Welding of Aerospace Castings
AMS 2771 Heat Treatment of Aluminum Alloy Castings
MAM 2771 Heat Treatment of Aluminum Alloy Castings (Metric)
AMS 2804 Identification, Castings

2.2 ASTM Publications:

Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM B 557	Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products
ASTM B 557M	Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products (Metric)
ASTM B 660	Packaging/Packing of Aluminum and Magnesium Products
ASTM E 18	Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
ASTM E 34	Chemical Analysis of Aluminum and Aluminum Alloys
ASTM E 155	Reference Radiographs for Inspection of Aluminum and Magnesium Castings

2.3 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-STD-453	Radiographic Inspection
MIL-STD-6866	Inspection, Liquid Penetrant

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

Shall conform to the percentages by weight shown in Table 1, determined by wet chemical methods in accordance with ASTM E 34, by spectrochemical methods, or by other analytical methods acceptable to purchaser.

TABLE 1 - Composition

Element	min	max
Silicon	6.5	7.5
Magnesium	0.20	0.45
Iron	--	0.6
Manganese	--	0.35
Zinc	--	0.35
Copper	--	0.25
Titanium	--	0.25
Other Impurities, each (3.1.1)	--	0.05
Other Impurities, total (3.1.1)	--	0.15
Aluminum	remainder	

3.1.1 Determination not required for routine acceptance.

3.2 Condition:

Solution and precipitation heat treated.

3.3 Casting:

Castings shall be poured either from remelted metal from a master heat or directly from a master heat. In either case, metal for casting shall be qualified as in 3.4.

3.3.1 A master heat is refined metal of a single furnace charge or is metal blended as in 3.3.2. Gates, sprues, risers, and rejected castings shall be used only in preparation of master heats; they shall not be remelted directly, without refining, for pouring of castings. Ladle additions of small amounts of grain-refining elements or alloys are permissible.

3.3.2 Metal from two or more master heats may be blended provided that the composition of each master heat to be blended is within the limits of 3.1 and that the total weight of metal blended does not exceed 15,000 pounds (6804 kg). When two or more master heats are blended, the resultant blend shall be considered a master heat.

3.4 Master Heat Qualification:

Each master heat shall be qualified by evaluation of chemical analysis and tensile specimens conforming to 3.4.1 and 3.4.2, respectively. A master heat may be considered conditionally qualified if foundry's test results show conformance to all applicable requirements. However, except when purchaser waives confirmatory testing, final qualification shall be based on purchaser's test results. Conditional qualification of a master heat shall not be construed as a guarantee of acceptance of castings poured therefrom.

3.4.1 Chemical Analysis Specimens: Shall be of any convenient size, shape, and form.

3.4.2 Tensile Specimens: Shall be cast from remelted metal from each master heat except when castings are poured directly from a master heat, the specimens shall also be poured directly from the master heat. Specimens shall be of standard proportions in accordance with ASTM B 557 or ASTM B 557M with 0.250 inch (6.35 mm) at the reduced parallel gage section. They shall be cast to size or shall be cast oversize and subsequently machined to 0.250 inch (6.35 mm) diameter. Center gating may be used.

3.5 Heat Treatment:
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Shall be in accordance with AMS 2771 or MAM 2771 except that the minimum age time shall be three hours. At least one set of tensile specimens shall, during each stage of heat treatment, be put into a batch-type furnace with each load of castings or into a continuous furnace at intervals of not longer than three hours.

3.6 Properties:

Castings, integrally-cast coupons, and representative separately-cast tensile specimens shall conform to the following requirements:

3.6.1 Tensile Properties: Shall be as follows, determined in accordance with ASTM B 557 or ASTM B 557M; conformance to the requirements of 3.6.1.1 shall be used as basis for acceptance of castings except when purchaser specifies that the requirements of 3.6.1.2 apply:

3.6.1.1 Separately-Cast Specimens and Integrally-Cast Coupons: Shall be as shown in Table 2.

TABLE 2 - Minimum Tensile Properties

Property	Value
Tensile Strength	33.0 ksi (228 MPa)
Yield Strength at 0.2% Offset	22.0 ksi (152 MPa)
Elongation in 4D	3%

3.6.1.2 Specimens Cut from Castings: Specimens as in 4.3.5 shall have the properties shown in Table 3.

TABLE 3 - Minimum Tensile Properties

Property	Value
Tensile Strength	25.0 ksi (172 MPa)
Yield Strength at 0.2% Offset	16.5 ksi (114 MPa)
Elongation in 4D	1%

3.6.1.2.1 When properties other than those of 3.6.1.2 are required, tensile specimens as in 4.3.5 taken from locations indicated on the drawing, from a casting or castings chosen at random to represent the lot, shall have the properties indicated on the drawing for such specimens. Property requirements may be designated in accordance with AMS 2360.

3.6.2 Hardness: Castings, except at sprue and riser locations, should have hardness of 27 to 60 HRB, or equivalent, determined in accordance with ASTM E 18, but castings shall not be rejected on the basis of hardness if the tensile property requirements of 3.6.1.2 are met.

3.7 Quality:

3.7.1 Castings, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from imperfections detrimental to usage of the castings.

3.7.1.1 Castings shall have smooth surfaces and shall be sufficiently cleaned to permit fluorescent penetrant inspection.

3.7.2 Castings shall be produced under radiographic control. This control shall consist of radiographic examination of castings in accordance with MIL-STD-453, or other technique acceptable to purchaser, until proper foundry technique, which will produce castings free from harmful imperfections, is established for each part number and of production castings as necessary to ensure maintenance of satisfactory quality.

3.7.3 When specified, castings shall be subjected to fluorescent penetrant inspection in accordance with MIL-STD-6866, or other nondestructive inspection techniques acceptable to purchaser.

3.7.4 Radiographic, fluorescent penetrant, and other quality standards shall be as agreed upon by purchaser and vendor. ASTM E 155 may be used to define radiographic acceptance standards.

3.7.5 Castings shall not be reworked by peening, plugging, welding, or other methods without written permission from purchaser.

3.7.5.1 When permitted in writing by purchaser, defects in castings may be removed and the castings reworked by welding in accordance with AMS 2694.

3.7.6 Castings shall not be impregnated, chemically treated, or coated to prevent leakage, unless specified or allowed by written permission of purchaser designating the method to be used.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of castings shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the product conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Except as specified in 4.2.1.1, tests for composition (3.1), tensile properties of separately-cast specimens (3.6.1.1), hardness (3.6.2), and quality (3.7) are acceptance tests and shall be performed on each master heat.

4.2.1.1 Tensile properties of specimens cut from castings shall be determined only when specified by purchaser or when separately-cast specimens or integrally-cast coupons are not available. Tensile properties of separately-cast specimens or integrally-cast coupons need not be determined when tensile properties of specimens cut from castings are determined.

4.2.2 Preproduction Tests: Tests for all technical requirements are preproduction tests and shall be performed prior to or on the first-article shipment of a casting to a purchaser, when a change in material and/or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.2.1 For direct U.S. Military procurement, substantiating test data and, when requested, preproduction test material shall be submitted to the cognizant agency as directed by the procuring activity, contracting officer, or request for procurement.

4.3 Sampling and Testing:

Shall be in accordance with the following; a lot shall be not more than 800 pounds (363 kg) of cast metal, including gates, sprues, and risers, produced in not more than five consecutive hours from a single master heat and precipitation heat treated in a heat treatment batch:

4.3.1 One chemical analysis specimen in accordance with 3.4.1 from each master heat, a casting from each lot, or both.

4.3.2 One separately-cast tensile specimen in accordance with 3.4.2 representing each lot or one or more integrally-cast coupons from each lot, except when properties of specimens machined from castings are required.

4.3.3 Three hardness specimens in accordance with 3.6.2 from each lot.

4.3.4 Two preproduction castings of each part number; one casting for dimensional evaluation and the other for property and quality evaluation as required for approval as in 4.4.1.

4.3.5 One or more castings from each lot when properties of specimens machined from castings are required. Specimens shall conform to ASTM B 557 or ASTM B 557M and shall be either 0.250 inch (6.35 mm) diameter at the reduced parallel gage section, subsize specimens proportional to the standard, or standard sheet-type specimens. For determining conformance to the requirements of 3.6.1.2, if the number and location of specimens are not shown on the drawing, not less than four tensile specimens, two from the thickest section and two from the thinnest section, shall be cut from a casting or castings from each lot.

4.4 Approval:

4.4.1 Sample castings from new or reworked master patterns and the casting procedure shall be approved by purchaser before castings for production use are supplied, unless such approval be waived by purchaser.

4.4.2 Vendor shall establish, separately for tensile specimens used for master heat qualification and for production of sample castings of each part number, parameters for the process control factors which will produce tensile specimens meeting master heat qualification requirements and acceptable castings; these shall constitute the approved casting procedure and shall be used for producing subsequent master heat qualification specimens and production castings. If necessary to make any change in parameters for the process control factors, vendor shall submit for reapproval a statement of the proposed changes in processing and, when requested by purchaser, test specimens, sample castings, or both. Production castings incorporating the revised operations shall not be shipped prior to receipt of reapproval.

4.4.2.1 Control factors for producing tensile specimens and castings include, but are not limited to, the following:

Type of furnace and its capacity
Type and size of furnace charge
Time molten metal is in furnace
Furnace atmosphere
Fluxing or oxide removal procedure
Number of ladles used in pour
Mold refractory formulation
Mold back-up material
Gating practices
Mold preheat and pouring temperatures; variations of ±25 °F (±14 °C) from established limits are permissible
Solidification and cooling procedures
Solution and precipitation heat treatment cycle
Cleaning operations
Methods of inspection

4.4.2.1.1 Any of the above process control factors for which parameters are considered proprietary by the vendor may be assigned a code designation. Each variation in such parameters shall be assigned a modified code designation.