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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS-4280 REV G

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Superseding AMS-4280F

Submitted for recognition as an American National Standard

ALUMINUM ALLOY CASTINGS, PERMANENT MOLD
5.0Si - 1.2Cu - 0.5Mg (355.0-T71)
Solution Heat Treated and Overaged

UNS A03550

1 SCOPE:

1.1 Form: This specification covers an aluminum alloy in the form of permanent mold castings.

1.2 Application: Primarily for components requiring moderate strength up to 300°F (149°C).

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.

2.1.1 Aerospace Material Specifications:

AMS-2360 - Room Temperature Tensile Properties of Castings
AMS-2635 - Radiographic Inspection
AMS-2645 - Fluorescent Penetrant Inspection
AMS-2646 - Contrast Dye Penetrant Inspection
AMS-2694 - Repair Welding of Aerospace Castings
AMS-2771 - Heat Treatment of Aluminum Alloy Castings
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 10 - Brinell 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

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E 34, by spectrochemical methods, or by other analytical methods acceptable to purchaser:

	min	max
Silicon	4.5	5.5
Copper	1.0	1.5
Magnesium	0.40	0.6
Iron (3.1.1)	--	0.6
Manganese (3.1.1)	--	0.50
Zinc	--	0.35
Titanium	--	0.25
Chromium	--	0.25
Other Impurities, each	--	0.05
Other Impurities, total	--	0.15
Aluminum	remainder	

3.1.1 If iron content exceeds 0.45, manganese content shall be not less than one-half the iron content.

3.2 Condition: Solution heat treated and overaged.

3.3 Casting: Castings shall be produced in lots from metal conforming to 3.1. Metal remelted from previously analyzed ingot may be poured directly into castings. Furnace or ladle additions of grain-refining elements or alloys are permissible. Molten metal taken from alloying furnaces, with or without additions of foundry operating scrap (gates, sprues, risers, and rejected castings), shall not be poured into castings unless first converted to ingot, analyzed, and remelted or unless the composition of a sample taken after the last addition to the melt conforms to 3.1.

3.3.1 A melt shall be the metal withdrawn from a batch furnace charge of 2000 pounds (907 kg) or less as melted for pouring castings or, when permitted by purchaser, a melt shall be 4000 pounds (1814 kg) or less of metal withdrawn from one continous furnace in not more than eight consecutive hours.

3.3.2 A lot shall be all castings poured from a single melt in not more than eight consecutive hours and solution heat treated and overaged in the same heat treat batch. Ø

3.4 Cast Test Specimens: Chemical analysis specimens and tensile specimens shall be cast as follows:

3.4.1 Chemical Analysis Specimens: Shall be cast from each melt and shall be of any suitable size and shape. Ø

3.4.2 Tensile Specimens: Shall be cast with each lot of castings, shall of standard proportions conforming to ASTM B 557 or ASTM B 557M with 0.500 inch (12.70 mm) diameter at the reduced parallel gage section, and shall be cast to size in permanent molds. Metal for the specimens shall be part of the melt which is used for the castings. If the metal for castings is given any treatment, such as fluxing or cooling and reheating, the metal for the specimens shall be a portion of the metal so treated and, during such treatment, shall be heated to the same maximum temperature and held for approximately the same time as the molten metal for the castings. The temperature of the metal during pouring of the specimens shall be not lower than that during pouring of the castings. Ø

3.5 Heat Treatment: All castings and separately-cast tensile specimens shall be solution heat treated in accordance with AMS-2771 and overaged in accordance with 3.5.1; at least one set of 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. Ø

3.5.1 Castings and separately-cast tensile specimens shall, after solution heat treatment, be overaged by heating to 475°F ± 10 (246°C ± 6), holding at heat for not less than five hours, and cooling in air.

3.6 Properties: Castings and separately-cast tensile specimens produced in accordance with 3.4.2 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 the basis for acceptance of castings except when purchaser specifies that 3.6.1.2 applies: Ø

3.6.1.1 Separately-Cast Specimens:

Tensile Strength, minimum	34,000 psi (234 MPa)
Yield Strength at 0.2% Offset, minimum	27,000 psi (186 MPa)
Elongation in 4D, minimum	1%

3.6.1.2 Specimens Cut From Castings: Shall be as follows, determined on specimens Ø as in 4.3.4:

Tensile Strength, minimum	25,500 psi (176 MPa)
Yield Strength at 0.2% Offset, minimum	20,000 psi (138 MPa)

3.6.1.2.1 When properties other than those of 3.6.1.2 are required, tensile Ø specimens 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 70 - 95 HB/10/500 or 75 - 100 HB/10/1000, determined in accordance with ASTM E 10, but the 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 well cleaned.

3.7.2 Castings shall be produced under radiographic control. This control shall consist of radiographic examination of castings in accordance with AMS-2635 until proper foundry technique, which will produce castings free from harmful internal 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 AMS-2645, to contrast dye penetrant inspection in accordance with AMS-2646, or to both.

3.7.4 Radiographic, fluorescent penetrant, contrast dye 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, imperfections in castings may be Ø 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 Ø 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 castings conform to the requirements of this specification.

4.2 Classification of Tests: Except as specified in 4.2.1, tests for all technical Ø requirements are acceptance tests and preproduction tests and shall be performed prior to or on the first-article shipment of a casting to a purchaser, on each melt or lot as applicable, when a change in ingredients and/or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

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

4.2.2 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: Ø

4.3.1 At least one chemical analysis specimen in accordance with 3.4.1 from each Ø melt, a casting from each lot, or both.

4.3.2 Three separately-cast specimens in accordance with 3.4.2 representing each Ø lot except when properties are required from specimens cut from castings.

4.3.3 Two preproduction castings in accordance with 4.4.1 of each part number.

4.3.4 One or more castings from each lot when properties are required from specimens machined from castings. Specimens shall conform to ASTM B 557 or ASTM B 557M and shall be either 0.500 inch (12.70 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 specimen locations 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 molds 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, for production of sample castings of each part number, parameters for the process control factors which will produce acceptable castings; these shall constitute the approved casting procedure and shall be used for producing 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, 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 castings include, but are not limited to, Ø the following:

Type of furnace
Furnace atmosphere
Gating and risering practices
Fluxing or deoxidation procedure
Metal pouring temperature; variation of ±50°F (±28°C) from the established limit is permissible
Solidification and cooling procedures
Solution heat treatment and overaging cycles
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.

4.5 Reports: The vendor of castings shall furnish with each shipment a report Ø showing the results of tests for chemical composition of at least one casting or of a separately-cast specimen from each melt, the results of tests for tensile properties of separately-cast specimens representing each lot or of specimens cut from castings from each lot, and the results of tests for hardness of castings from each lot. This report shall include the purchase order number, lot number, AMS-4280G, part number, and quantity.