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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 4285C

Issued MAY 1954
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Reaffirmed APR 2006

Superseding AMS 4285B

(R)

Aluminum Alloy Castings, Centrifugal
7.0Si - 0.30Mg (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 centrifugal castings.

1.2 Application:

These castings have been used typically for intricate castings with thin walls or sections used at relatively high stresses, but usage is not limited to such applications.

2. APPLICABLE DOCUMENTS:

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been canceled and no superseding document has been specified, the last published issue of that document shall apply.

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

QUESTIONS REGARDING THIS DOCUMENT: (724) 772-7161 FAX: (724) 776-0243
TO PLACE A DOCUMENT ORDER: (724) 776-4970 FAX: (724) 776-0790

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

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 29	Using Significant Digits in Test Data to Determine Conformance with Specifications
ASTM E 34	Chemical Analysis of Aluminum- and Aluminum-Base Alloys
ASTM E 227	Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the Point-to-Plane Technique
ASTM E 607	Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the Point-to-Plane Technique, Nitrogen Atmosphere
ASTM E 716	Sampling Aluminum and Aluminum Alloys for Spectrochemical Analysis
ASTM E 1251	Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the Argon Atmosphere, Point-to-Plane, Unipolar Self-Initiating Capacitor Discharge
ASTM E 1417	Liquid Penetrant Examination
ASTM E 1742	Radiographic Examination

2.3 U.S. Government Publications:

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

MIL-STD-2175	Casting, Classification and Inspection of

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 in accordance with ASTM E 227, ASTM E 607, or ASTM E 1251, or by other analytical methods acceptable to purchaser (See 3.4.1).

TABLE 1 - Composition

Element (3.1.1)	min	max
Silicon	6.5	7.5
Iron	--	0.6
Copper	--	0.25
Manganese	--	0.35
Magnesium	0.20	0.40
Zinc	--	0.35
Titanium	--	0.25
Other Elements, each	--	0.05
Other Elements, total	--	0.15
Aluminum	remainder	

3.1.1 Test results may be rounded by the "rounding off" method of ASTM E 29.

3.2 Condition:

Solution and precipitation heat treated to the -T6 temper.

3.3 Castings:

Castings shall be produced from metal conforming to 3.1, determined by analysis of a specimen (3.4.1) cast after the last melt addition.

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 after the last melt addition and shall be tested to qualify the melt lot as in 3.1. Spectrochemical sample shall be prepared in accordance with ASTM E 716.

3.4.2 Tensile Specimens:

3.4.2.1 Unless specimens cut from a casting are specified by purchaser, separately-cast specimens conforming to ASTM B 557 or ASTM B 557M shall be cast from each melt after the last melt addition. Specimens shall be cast in molds representing the mold used for castings. Chills are not permitted on test specimen cavity except on the end face of the specimen when approved in accordance with 4.4.2. Tensile specimens shall be processed with each heat treat lot and tested for conformance to 3.6.1.

3.4.2.2 When purchaser specifies specimens cut from a casting or from integrally-cast coupons, such specimens shall be removed after heat treatment, 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, as required by 3.6.1.

3.5 Heat Treatment:

Shall be in accordance with AMS 2771 or MAM 2771. Unless specimens cut from a casting are specified, one or more sets of separately-cast 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 and 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 the basis for acceptance of castings except when purchaser specifies that 3.6.1.2 applies:

3.6.1.1 Separately-Cast Specimens: Specimens as in 4.3.2 shall have the properties shown in Table 2.

TABLE 2 - Minimum Tensile Properties for Separately-Cast Specimens

Property	Value
Tensile Strength	33.0 ksi (228 MPa)
Yield Strength at 0.2% Offset	22.0 ksi (152 MPa)
Elongation in 4D	3.0%

3.6.1.2 Specimens Cut from Castings: Specimens as in 4.3.4 shall have the properties shown in Table 3.

TABLE 3 - Minimum Tensile Properties for Specimens Cut from Castings

Property	Value
Tensile Strength	24.8 ksi (171 MPa)
Yield Strength at 0.2% Offset	16.5 ksi (114 MPa)
Elongation in 4D	1.0%

3.6.1.2.1 When properties other than those of 3.6.1.2 are required, tensile 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.

3.7 Quality:

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 When acceptance standards are not specified, Grade C of MIL-STD-2175 shall apply.

3.7.2 Methods of inspection and frequency of inspection shall be as agreed upon by purchaser and vendor. A "Casting Class" of MIL-STD-2175 may be selected to specify the method and frequency of inspection.

3.7.3 Castings shall be produced under radiographic control. This control shall consist of 100% radiographic inspection of castings until process control factors (See 4.4.2) have been established to ensure production of acceptable castings. Unless otherwise specified by purchaser, continued radiographic inspection of production castings shall be performed at a frequency determined by the vendor to ensure continued maintenance of internal quality.

3.7.4 Radiographic inspection shall be conducted in accordance with ASTM E 1742, unless otherwise specified by purchaser.

3.7.5 When specified by purchaser, castings shall be fluorescent penetrant inspected using a method specified by purchaser, or, if not specified, a method in accordance with ASTM E 1417.

3.7.6 Castings shall not be peened, plugged, impregnated, or welded unless authorized by purchaser.

3.7.6.1 When authorized by purchaser, welding in accordance with AMS 2694 or other welding program approved by purchaser may 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 the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the castings conform to specified requirements.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Except as specified in 4.2.1.1, composition (3.1), tensile properties of separately-cast specimens (3.6.1.1), and quality (3.7) are acceptance tests and shall be performed to represent each melt or heat treat lot as applicable.

4.2.1.1 Tensile properties of specimens cut from castings shall be determined 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 Periodic Tests: Radiographic inspection (3.7.3) following the establishment of process control (4.4.2) is a periodic test and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

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

4.3 Sampling and Testing:

Shall be in accordance with the following:

4.3.1 At least one chemical analysis specimen in accordance with 3.4.1 from each melt for conformance to 3.1.

4.3.2 One or more separately-cast tensile specimens in accordance with 3.4.2 from each heat treat lot except when purchaser specifies specimens cut from a casting as in 4.3.4.

4.3.3 One or more preproduction castings in accordance with 4.4.1 of each part number.

4.3.4 One or more castings from each heat treat lot when properties are required from specimens cut from castings. For determining conformance to the requirements of 3.6.1.2, if specimen locations are not shown on the drawing, two specimens from the thickest section and two specimens from the thinnest section, shall be cut from a casting or castings from each heat treat lot.

4.4 Approval:

4.4.1 Sample castings from new or reworked molds and the casting procedure and sample castings, when specified, 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. Vendor shall also establish control factors for producing separately cast tensile specimens, but these control factors need not be identical to those used for production of castings. Method for production of separately-cast tensile specimens shall be consistent for all cast material. 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 tensile specimens and castings include, but are not limited to, the following. Supplier's procedures shall identify tolerances, ranges, and/or control limits, as applicable. Control factors for separately-cast tensile specimens must generally represent, but need not be identical to, those factors used for castings:

Type of furnace
Furnace atmosphere
Alloy additions, fluxing, deoxidation, and gas removal procedures
Gating and risering practices
Mold composition and molding practice
Mold setup
Mold rotational speed
Core composition and fabrication method, when applicable
Metal pouring temperature; variation of 50 °F (28 °C) from the established limit is permissible
Solidification and cooling procedures
Stabilization/precipitation heat treat cycle
Straightening procedure, when applicable
Cleaning operations
Methods of inspection
Radiographic inspection sampling plan, if used.

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 showing the results of tests for chemical composition of each melt and the results of tests for tensile properties of separately-cast specimens representing each heat treat lot or of specimens cut from a casting from each heat treat lot, and stating that the castings conform to the other technical requirements. This report shall include the purchase order number, melt and heat treat lot numbers, AMS 4285C, part number, and quantity.

4.6 Resampling and Retesting:

If any specimen used in the above tests fails to meet specified requirements, disposition of the castings may be based on the results of testing two additional specimens for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the castings represented. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Identification:

Shall be in accordance with AMS 2804.