SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS4261 REV. F

Issued 1964-06
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Superseding AMS4261E

Aluminum Alloy Castings, Investment
7.0Si - 0.32Mg (356.0-T51)
Precipitation Heat Treated

(Composition similar to UNS A03560)

RATIONALE

AMS4261F revises referenced documents, tensile specimen requirements (3.4.2.2) and results from a Five Year Review and update of this specification.

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 components requiring low weight, moderate strength and soundness, 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 cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AMS2175 Casting, Classification and Inspection of
AMS2360 Room Temperature Tensile Properties of Castings
AMS2694 Repair Welding of Aerospace Castings
AMS2771 Heat Treatment of Aluminum Alloy Castings
AMS2804 Identification, Castings

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
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SAE WEB ADDRESS: **http://www.sae.org**

SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/AMS4261F

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

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 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 607 Atomic 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 1417 Liquid Penetrant Testing
ASTM E 1742 Radiographic Examination

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 607, or by other analytical methods acceptable to purchaser (See 3.4.1).

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 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

Precipitation heat treated from the as-cast condition.

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 formulation 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 integrally cast specimens or specimens cut from a casting, such specimens shall conform to ASTM B 557 or ASTM B 557M, and shall be either round or rectangular, of standard size or subsize proportional to the standard, heat treated with the castings represented, and tested for conformance to 3.6.1.

3.5 Heat Treatment

Shall be in accordance with AMS2771. Unless specimens cut from a casting are specified, one or more separately-cast 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 not longer than three hours.

3.6 Properties

Castings, integrally-cast coupons, 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 basis for acceptance of castings except when purchaser specifies that 3.6.1.2 applies.

3.6.1.1 Separately-Cast Specimens and Integrally-Cast Coupons

Shall have the properties shown in Table 2.

TABLE 2 - MINIMUM TENSILE PROPERTIES

Property	Value
Tensile Strength	23.0 ksi (159 MPa)
Yield Strength at 0.2% Offset	16.0 ksi (110 MPa)
Elongation in 4D	3%

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

Property	Value
Tensile Strength	17.5 ksi (121 MPa)
Yield Strength at 0.2% Offset	12.0 ksi (83 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 4.3.4 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 AMS2360.

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 AMS2175 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 AMS2175 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 tested 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, castings may be repaired by welding in accordance with AMS2694 or other welding program approved by purchaser.

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 a casting or from integrally-cast coupons 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 a casting or from integrally-cast coupons 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 material 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 One chemical analysis specimen in accordance with 3.4.1 from each melt for conformance to 3.1.

4.3.2 A tensile specimen in accordance with 3.4.2 from each heat treat lot, except when purchaser specifies use of 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 machined from a casting. 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.

4.3.4.1 When permitted by purchaser, tensile specimens conforming to ASTM B 557 or ASTM B 557M excised from integrally-cast coupons may be used in lieu of separately-cast specimens (4.3.2) or specimens cut from a casting or castings (4.3.4). Size, number, and location of integrally-cast coupons shall be as specified by purchaser.

4.4 Approval

4.4.1 Sample castings from new or reworked tooling (i.e. patterns, molds, dies, etc) 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. Vendor shall also establish a procedure for production of separately-cast tensile specimens. 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
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 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.