



AEROSPACE MATERIAL SPECIFICATION

AMS4249™**REV. B**

Issued 1992-07
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Revised 2018-04

Superseding AMS4249A

Aluminum Alloy Castings
7.0Si - 0.58Mg - 0.15Ti - 0.06Be (D357.0-T6)
Solution and Precipitation Heat Treated
(Requiring Fatigue and Fracture Toughness Testing)
(Composition similar to UNS A43570)

RATIONALE

AMS4249B revises Composition test method (3.1), Condition terminology reference (3.2), Reports (4.5.1), Retesting (4.6.2.2), 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 castings.

1.2 Application

These castings have been used typically for durability and damage tolerance structural aircraft components (see 8.2) requiring fatigue resistance and fracture toughness, but usage is not limited to such applications.

1.3 Safety - Hazardous Materials

While the material, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

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.

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2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2175	Classification and Inspection of Castings
AMS2360	Room Temperature Tensile Properties of Castings
AMS2694	In-Process Welding of Castings
AMS2771	Heat Treatment of Aluminum Alloy Castings
AMS2804	Identification, Castings
AMS4246	Aluminum Alloy Welding Wire, 7.0Si - 0.52Mg
ARP1917	Clarification of Terms Used in Aerospace Metals Specifications
ARP1947	Dendrite Arm Spacing of Structural Aircraft Quality D357 Aluminum Alloy Castings, Determination and Acceptance of

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 B557	Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products
ASTM B557M	Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products (Metric)
ASTM B660	Packaging/Packing of Aluminum and Magnesium Products
ASTM E10	Brinell Hardness of Metallic Materials
ASTM E29	Using Significant Digits in Test Data to Determine Conformance with Specifications
ASTM E34	Chemical Analysis of Aluminum and Aluminum-Base Alloys
ASTM E155	Reference Radiographs for Inspection of Aluminum and Magnesium Castings
ASTM E466	Conducting Force Controlled Constant Amplitude Axial Fatigue Tests of Metallic Materials
ASTM E607	Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the Point-to-Plane Technique, Nitrogen Atmosphere
ASTM E716	Sampling and Sample Preparation of Aluminum and Aluminum Alloys for Determination of Chemical Composition by Spark Atomic Emission Spectrometry
ASTM E1251	Analysis of Aluminum and Aluminum Alloys by Spark Atomic Emission Spectrometry
ASTM E1304	Plane-Strain (Chevron Notch) Fracture Toughness of Metallic Materials
ASTM E1417/E1417M	Liquid Penetrant Testing
ASTM E1742/E1742M	Radiographic Examination

2.3 ANSI Accredited Publications

Copies of these documents are available online at <http://webstore.ansi.org/>.

ANSI H35.1/H35.1M Standard Alloy and Temper Designation System for Aluminum

2.4 Aluminum Association Publications

Available from the Aluminum Association, Inc., 900 19th Street, N.W., Washington, DC 20006 or www.aluminum.org.

AA-CS-E18 Standards for Aluminum Sand and Permanent Mold Casting – Section E18

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 E34, by spectrochemical methods in accordance with ASTM E607, ASTM E1251, or by other analytical methods acceptable to purchaser (see 3.4.1).

Table 1 - Composition

Element	Min	Max
Silicon	6.5	7.5
Iron	--	0.12
Manganese	--	0.10
Magnesium	0.55	0.6
Titanium	0.10	0.20
Beryllium	0.04	0.07
Other Elements, each	--	0.05
Other Elements, total	--	0.15
Aluminum	remainder	

3.1.1 When permitted by purchaser, strontium or sodium may be used as a silicon particle modifier. When permitted, the maximum percentage by weight shall be 0.014 for strontium or 0.012 for sodium.

3.1.2 Test results may be rounded in accordance with the "rounding off" method of ASTM E29.

3.2 Condition

Solution and precipitation heat treated to T6 condition (refer to ANSI H35.1/H35.1M).

3.3 Casting

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. The method for control of any subsequent additions prior to pouring (i.e., grain refining, correction for magnesium fade, etc.) shall be documented as a control factor (see 4.4.1.2).

3.4 Test Specimens

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 as in 3.1. Spectrochemical sample shall be prepared in accordance with ASTM E716.

3.4.2 Integrally-Cast Coupons

Shall be integrally attached to each casting and tested for tensile, fatigue, and fracture toughness property determination as specified in 3.6.1.1, 3.6.2.1, and 3.6.3, respectively. Unless otherwise specified by purchaser, the following shall apply:

- 3.4.2.1 Each casting shall have at least two integrally-cast tensile coupons. One coupon shall be left attached and used only if repeated heat treatment is necessary. The coupons shall be flat and sufficiently large to permit excision of a sub-size round tensile specimen 0.250 inch (6.35 mm) in diameter with a gage length of 1 inch (25.4 mm) conforming to ASTM B557 or ASTM B557M.
- 3.4.2.2 Each casting shall have at least three integrally-cast fatigue coupons. The coupons shall be sufficiently large to permit excision of a round specimen 0.50 inch (12.7 mm) in diameter, with a minimum gage length of 2.0 inches (50.8 mm), conforming to ASTM E466. All machining marks shall be removed and the gage section shall be polished parallel to the specimen axis. The final polish shall be with Crocus cloth or similar polishing material.
- 3.4.2.3 Each casting shall have at least two integrally-cast fracture toughness coupons. One coupon shall be left attached and used only if repeated heat treatment is necessary. The coupons shall be sufficiently large to permit excision of a specimen conforming to ASTM E1304.
- 3.4.2.4 The radiographic quality of the coupons shall meet the requirements for designated areas shown in Table 2.

Table 2 - Radiographic requirements - Maximum allowable discontinuity severity level

Discontinuity	ASTM E155 Reference Radiograph	Designated Areas	Other Areas
Gas holes	1.1	1	2
Gas porosity (round)	1.21	1	3
Gas porosity (elongated)	1.22	1	3
Shrinkage cavity	2.1	1	2
Shrinkage porosity or sponge	2.2	1	2
Foreign material (less dense)	3.11	1	2
Foreign material (more dense)	3.12	1	2
Segregation	---	none	none
Cracks	---	none	none
Cold shuts	---	none	none
Laps	---	none	none

- 3.4.2.4.1 When two or more types of discontinuities are present to an extent equal to or not better than the acceptance standards for respective discontinuities, the parts shall be rejected.
- 3.4.2.4.2 When two or more types of discontinuities are present and the predominating discontinuity is not better than the acceptance standard, the part shall be reviewed for disposition by the cognizant engineering personnel.
- 3.4.2.4.3 Gas holes or sand spots and inclusions allowed by Table 2 shall be cause for rejection when closer than twice their maximum dimension to an edge or extremity of a casting.

3.4.3 Specimens Cut from Castings

Shall be subsize and proportional to the standard round or sheet-type specimens defined in ASTM B557 or ASTM B557M. For sheet-type specimens, elongation shall be measured based on a gage length of $4.5 \times (\text{cross-sectional area})^{1/2}$.

3.5 Heat Treatment

Shall be in accordance with AMS2771.