SAE Aerospace
An SAE International Group

AEROSPACE MATERIAL SPECIFICATION

SAE AMS4242 | REV. B

Issued 1986-07
Revised 2007-07
Reaffirmed 2012-09

Superseding AMS4242A

Aluminum Alloy, Castings
4.7Cu - 0.60Ag - 0.35Mn - 0.25Mg - 0.25Ti (B201.0-T7)
Solution Heat Treated and Overaged
(Composition similar to UNS A02010)

RATIONALE

AMS4242B has been reaffirmed to comply with the SAE five-year review policy.

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 aircraft components requiring high strength and reliability, both at room and elevated temperatures, but usage is not limited to such applications.

1.3 Alloy B201.0, the alloy designated in this specification, has restricted composition within the limits of alloy A201.0.

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.

AMS 2175	Casting, Classification and Inspection of
AMS 2360	Room Temperature Tensile Properties of Castings
AMS 2644	Inspection Material, Penetrant
AMS 2694	Repair Welding of Aerospace Castings
AMS 2771	Heat Treatment of Aluminum Alloy Castings
AMS 2804	Identification, Castings
AS1990	Aluminum Alloy Tempers

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
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/AMS4242B

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 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 101	Spectrographic Analysis of Aluminum and Aluminum Alloys by the Point-to-Plane Technique
ASTM E 155	Reference Radiographs for Inspection of Aluminum and Magnesium Castings
ASTM E 227	Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the Point-to-Plane Technique
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 1251	Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by Argon Atmosphere, Point-to-Plane, Unipolar Self-Initiating Capacitor Discharge
ASTM E 1417	Liquid Penetrant Examination
ASTM E1742	Radiographic Examination
ASTM G 44	Exposure of Metals and Alloys by Alternate Immersion in Neutral 3.5% Sodium Chloride Solution

2.3 U.S. Government Publications

Available from the Document Automation and Production Service (DAPS), Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6257, http://assist.daps.dla.mil/quicksearch/.

MIL-STD-1537	Electrical Conductivity Test for Measurement of Heat Treatment of Aluminum Alloys, Eddy Current Method

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

TABLE 1 – COMPOSITION

Element	min	max
Silicon	--	0.05
Iron	--	0.05
Copper	4.5	5.0
Manganese	0.20	0.50
Magnesium	0.20	0.30
Titanium	0.15	0.35
Silver	0.40	0.8
Other Elements, each	--	0.05
Other Elements, total	--	0.15
Aluminum	remainder	

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

3.2 Condition

Solution heat treated and overaged to T7 temper (See AS1990).

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.

3.4 Test Specimens

3.4.1 Chemical Analysis Specimen

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

3.4.2 Tensile Specimens

Shall be cut from integrally-cast coupons. Each casting shall have two integrally-cast coupons to be removed after heat treatment, except as permitted in 3.4.2.1. One coupon shall remain with the casting in case reheat treatment and retesting are necessary. 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, as required by 3.6.1.

3.4.2.1 Integrally-cast coupons may be removed prior to heat treatment only if documented procedures ensure that the coupons are marked with identification traceable to the casting and are heat treated with the corresponding casting.

3.5 Heat Treatment: Shall be in accordance with AMS 2771, except as follows:

Castings and integrally-cast coupons shall be solution heat treated and overaged in such a manner as to ensure conformance to the requirements of 3.6. A step solution treatment of 945 to 965 °F (507 to 518 °C) for not less than 2 hours then raised to 970 to 990 °F (521 to 532 °C) for not less than 14 hours is recommended. Precipitation heat treatment at 365 to 375 °F (185 to 191 °C) for not less than 5 hours is required.

3.6 Properties

Castings and integrally-cast coupons 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.

3.6.1.1 Integrally-Cast Coupons

Shall have the properties shown in Table 2.

TABLE 2 - MINIMUM TENSILE PROPERTIES

Property	Value
Tensile Strength	62.0 ksi (427 MPa)
Yield Strength at 0.2% Offset	55.0 ksi (379 MPa)
Elongation in 4D	5%

3.6.1.2 Specimens Cut from Castings

Tensile properties of specimens cut from a casting or castings shall be as shown in Tables 3 and 4.

TABLE 3 - MINIMUM TENSILE PROPERTIES FOR DESIGNATED CASTING AREAS

Property	Value
Tensile Strength	60.0 ksi (414 MPa)
Yield Strength at 0.2% Offset	50.0 ksi (345 MPa)
Elongation in 4D	3%

TABLE 4 - MINIMUM TENSILE PROPERTIES FOR CASTING AREAS OTHER THAN DESIGNATED AREAS

Property	Value
Tensile Strength	56.0 ksi (386 MPa)
Yield Strength at 0.2% Offset	48.0 ksi (331 MPa)
Elongation in 4D	2%

3.6.1.2.1 When properties other than those of Table 3 or Table 4 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.

3.6.2 Electrical Conductivity

Casting shall exhibit a minimum electrical conductivity of 31% IACS [International Annealed Copper Standard] (18 MS/m), determined by the procedure of MIL-STD-1537.

3.6.3 Stress-Corrosion Resistance

A specimen as in 4.3.2.1, cut from the designated area of the casting or from an integrally-cast coupon, shall show no evidence of stress-corrosion cracking when tested for 30 days in accordance with ASTM G 44 at a stress of 37.5 ksi (259 MPa) (See 8.3).

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.

3.7.2 Radiographic inspection of each casting shall be performed in accordance with ASTM E 1742 or other method specified by purchaser. ASTM E 155 shall be used to define radiographic acceptance standards in accordance with Table 5.

TABLE 5 - RADIOGRAPHIC ACCEPTANCE CRITERIA (1) (2) (3) (4)

Defect Indications	Radiograph Reference	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

NOTES:
(1) Maximum permissible radiograph in accordance with ASTM E 155.
(2) When two or more types of defects are indicated to an extent equal to or not significantly better than the acceptance standards for respective defects, the parts shall be rejected.
(3) When two or more types of defects are indicated and the predominating defect is not significantly better than the acceptance standard, the part shall be considered borderline and shall be reviewed for disposition by the cognizant engineering personnel.
(4) Discrete indications of 0.015 inch (0.38 mm) or larger in maximum dimension are not acceptable when closer than twice their maximum dimension to an edge or extremity of a casting in a designated area, or when closer than their maximum dimension to an edge or extremity in an undesignated area.

3.7.3 Each casting shall be subjected to fluorescent penetrant inspection in accordance with ASTM E 1417.

3.7.3.1 The fluorescent penetrant shall have a sensitivity greater than or equal to Level 2 in accordance with AMS 2644.

3.7.3.2 Unless otherwise specified by purchaser, the following acceptance criteria shall apply:

3.7.3.2.1 Linear indications, cold shuts, cracks, and seams are not acceptable.

3.7.3.2.2 Surface porosity is not acceptable if the individual pores are closer than twice their maximum dimension to an edge or extremity of the casting or the pores form a linear indication; i.e., three or more are in a line and the distance between each indication is less than twice the maximum dimension of either adjacent indication.

3.7.3.2.3 Any individual indication which is five times longer than it is wide shall be considered a linear indication and is not acceptable.

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

3.7.4.1 When authorized by purchaser, welding in accordance with AMS 2694 or other welding program approved by purchaser may be used.

3.7.5 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 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

Composition (3.1), tensile properties (3.6.1), electrical conductivity (3.6.2), and quality (3.7) are acceptance tests and shall be performed to represent each melt, or lot as applicable.

4.2.2 Periodic Tests

Stress-corrosion resistance (3.6.3) 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 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.

4.3 Sampling and Testing

Shall be in accordance with the following:

4.3.1 For Acceptance Tests

4.3.1.1 One chemical analysis specimen in accordance with 3.4.1 from each melt for conformance to 3.1.

4.3.1.2 The destructive testing of castings for the evaluation of excised tensile specimen shall occur at the following frequency:

4.3.1.2.1 First 30 Castings Received

One casting from each 10 production castings shall be selected for destructive testing in accordance with the requirements of 3.6.1.2.

4.3.1.2.2 Castings Received Thereafter

If no failure occurs in 4.3.1.2.1, one casting from each 25 production castings consecutively received thereafter. If a failure occurs, the test frequency shall revert to one from each 10 production castings from the next 30 castings received.

4.3.1.3 An integrally-cast coupon from each casting for tensile testing in accordance with 3.6.1.1.

4.3.1.4 Each casting for radiographic and fluorescent penetrant inspection in accordance with Section 3.7.

4.3.1.5 An integrally-cast coupon from each casting for electrical conductivity testing in accordance with 3.6.2.

4.3.2 For Periodic Tests and Preproduction Tests

As agreed upon by purchaser and vendor and the following:

4.3.2.1 Specimens for stress-corrosion tests shall be round specimens, not less than 0.250 inch (6.35 mm) in diameter in the reduced section. Whenever practicable, specimens shall be taken from the designated areas of the casting as shown on the engineering drawing. Specimens from integrally-cast coupons are acceptable if size of the casting does not permit excision of a 0.250 inch (6.35 mm) diameter specimen.

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. 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, integrally-cast coupons and/or sample castings. 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, the following. Supplier's procedures shall identify tolerances, ranges, and/or control limits, as applicable:

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
Solidification and cooling procedures
Melt hold time
Solution and precipitation heat treat cycles
Cleaning operations
Straightening procedure, when applicable
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 showing the results of tests for composition of each melt, tensile properties of attached specimens representing each casting and of specimens cut from casting, if applicable, and fluorescent penetrant and radiographic inspection of each casting by serial number. This report shall include the purchase order number, inspection lot number, AMS 4242B, part number, and quantity.

4.6 Resampling and Retesting

4.6.1 Cast Coupons

4.6.1.1 Replacement testing and retesting of tensile specimens machined from integrally-cast coupons shall be in accordance with ASTM B 557 or ASTM B 557M.