AEROSPACE MATERIAL SPECIFICATION

AMS4214	REV. J

Issued 1941-09
Revised 2008-06
Reaffirmed 2013-12

Superseding AMS4214H

Castings, Aluminum Alloy Sand
5.0Si - 1.2Cu - 0.50Mg (355.0-T71)
Solution Heat Treated and Overaged
(Composition similar to UNS A03550)

RATIONALE

AMS4214J 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 sand castings.

1.2 Application

These castings have been used typically for components requiring strength up to 450 °F (232 °C), 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
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/AMS4214J

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 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

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	min	max
Silicon	4.5	5.5
Iron (3.1.1)	--	0.6
Copper	1.0	1.5
Manganese (3.1.1)	--	0.50
Magnesium	0.40	0.6
Chromium	--	0.25
Zinc	--	0.35
Titanium	--	0.25
Other Elements, each	--	0.05
Other Elements, 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.

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

3.2 Condition

Solution heat treated and overaged.

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 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

Unless specimens cut from castings 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. A tensile specimen shall be processed with each heat treat lot and tested for conformance to 3.6.1.1.

3.4.2.1 When purchaser specifies specimens cut from castings, such specimens shall be machined to 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 3.6.1.2.

3.5 Heat Treatment

Castings and representative tensile specimens (3.4.2) shall be solution heat treated and overaged in accordance with AMS2771 except that set temperature and soak time shall be 465 to 485 °F (240 to 252 °C) for 4 to 6 hours. Test specimens shall be put into a batch furnace with each load of castings or into a continuous furnace at intervals of not longer than three hours.

3.6 Properties

Castings and representative 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 basis for acceptance of castings except when purchaser specifies that the requirements of 3.6.1.2 apply:

3.6.1.1 Separately-Cast Specimens

Shall have the properties shown in Table 2.

TABLE 2 - MINIMUM TENSILE PROPERTIES

Property	Value
Tensile Strength	30.0 ksi (207 MPa)
Yield Strength at 0.2% Offset	22.0 ksi (152 MPa)
Elongation in 4D	1.0%

3.6.1.2 Specimens Cut from Castings

When specified by purchaser, specimens cut from castings (See 4.3.4.1) shall have the properties shown in Table 3.

TABLE 3 - MINIMUM TENSILE PROPERTIES

Property	Value
Tensile Strength	22.5 ksi (155 MPa)
Elongation in 4D	0.25%

3.6.1.3 Specimens Cut from Designated Casting Areas

When specified by purchaser, specimens taken from locations indicated on the drawing, shall meet tensile property requirements specified on the drawing. 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 (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.

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

3.7.4 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.

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

3.7.5.1 When authorized by purchaser, welding in accordance with AMS2694 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

Composition (3.1) and tensile properties (3.6.1) are acceptance tests and shall be performed to represent each melt or heat treat lot as applicable.

4.2.2 Periodic Tests

Radiographic inspection (3.7.3) following establishment of process control (4.4.2) is a periodic test and shall be performed at a frequency determined by the vendor to ensure continued maintenance of internal quality 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 One chemical analysis specimen 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 unless purchaser specifies that specimens be cut from castings.

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

4.3.4 When purchaser specifies that specimens be cut from castings, one or more castings from each heat treat lot shall conform to 3.6.1.2.

4.3.4.1 For determining conformance to 3.6.1.2, when specimen locations are not shown on the drawing, not less than four, preferably ten, tensile specimens shall be cut from thick and thin sections and tested.

4.4 Approval

4.4.1 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 material cast to this specification. Control factors for producing separately-cast tensile specimens need not be the same as those used for production of 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.