SAE Aerospace
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AEROSPACE MATERIAL SPECIFICATION

SAE AMS 4291G

Issued OCT 1943
Revised AUG 2005

Superseding AMS 4291F

Aluminum Alloy, Die Castings
8.5Si - 3.5Cu (A380.0-F) (See AS1990)
As Cast

(Composition similar to UNS A13800)

1. SCOPE:

1.1 Form:

This specification covers an aluminum alloy in the form of die castings.

1.2 Application:

These castings have been used typically for components of intricate shape, but not having thin sections, but usage is not limited to such applications. This alloy has good casting characteristics by cold-chamber die casting and fair resistance to corrosion.

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, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or www.sae.org.

AMS 2694	Repair Welding of Aerospace Castings
AMS 2804	Identification, Castings
AS1990	Aluminum Alloy Tempers

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

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2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959 or www.astm.org.

ASTM B 660	Packaging/Packing of Aluminum and Magnesium Products
ASTM E 29	Practice for 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 505	Reference Radiographs for Inspection of Aluminum and Magnesium Die Castings
ASTM E 607	Atomic Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the Point-to-Plane Technique, Nitrogen Atmosphere
ASTM E 716	Sampling of Aluminum and Aluminum Alloys for Spectrochemical Analysis
ASTM E 1251	Optical Emission Spectometric 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, 8.2).

TABLE 1 - Composition

Element	min	max
Silicon	7.5	9.5
Iron	--	1.3
Copper	3.0	4.0
Manganese	--	0.50
Magnesium	--	0.10
Nickel	--	0.50
Zinc	--	3.0
Tin	--	0.35
Other Elements, total	--	0.50
Aluminum	remainder	

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

3.2 Condition:

As cast.

3.3 Castings:

Castings shall be produced from metal conforming to 3.1, determined by analysis of a specimen (3.4) cast after the last melt addition.

3.4 Chemical Analysis Specimen:

Shall be cast 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.

3.5 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.

3.5.1 Radiographic, liquid penetrant, and other quality standards shall be as agreed upon by purchaser and vendor. When acceptance standards are not specified for radiographic inspection, the requirements of Table 2 shall apply, utilizing the reference radiographs of ASTM E 505.

TABLE 2 - Default Radiographic Acceptance Standards Using ASTM E 505

Category of Discontinuity	Maximum Acceptable Level of Discontinuity Section Thickness 1/8 inch (3.2 mm)	Maximum Acceptable Level of Discontinuity Section Thickness 5/8 inch (15.9 mm)
Category A (Porosity)	#2	#2
Category B (Cold Fill)	#2	#3 per 1/8 inch (3.2 mm) Reference
Category C (Shrinkage)	N/A	
Category D (Foreign Material)	Not greater than reference standard for 1/8 inch (3.2 mm) section thicknesses	Not greater than reference standard for 5/8 inch (15.9 mm) section thicknesses

3.5.2 Methods of inspection and frequency of inspection shall be as agreed upon by purchaser and vendor. A “Casting Classification” of AMS 2175 may be selected to specify the method and frequency of inspection.

3.5.3 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.

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

3.5.4 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.

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

3.5.5.1 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: All technical requirements except radiographic inspection (3.5.3) are acceptance tests and shall be performed on each lot (See 4.2.2).

4.2.2 Periodic Tests: Radiographic inspection (3.5.3) following establishment of process control (See 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 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 At least one chemical analysis specimen from each melt for conformance to 3.1 unless another sampling frequency is agreed upon by purchaser and vendor.

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

4.4 Approval:

4.4.1 Sample castings from new or reworked dies 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 process control factors which will produce acceptable castings and, when requested, sample castings and/or radiographic results; these shall constitute the approved casting procedure and shall be used for producing production castings. If necessary to make any change in parameters for process control factors, vendor shall submit for reapproval, a statement of the proposed change in processing and, when requested, sample casting. 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:

Type of furnace
Furnace atmosphere
Alloy additions, fluxing, deoxidation, and gas removal procedures
Location and number of gates
Location and number of knockout pins
Mold temperature and tolerances
Injection pressure and tolerances
Metal injection temperature; variation of ±50 °F (±28 °C) from the established limit is permissible
Solidification and cooling procedures
Straightening procedure, when applicable
Cleaning operations
Methods of inspection
Radiographic inspection sampling plan, if used