SAE Aerospace
An SAE International Group

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 4148 REV. E

Issued 1971-05
Revised 1999-01
Noncurrent 2006-08
Reaf. Noncur. 2011-11

Superseding AMS 4148D

Aluminum Alloy Die Forgings
(7175-T66)
Solution and Precipitation Heat Treated

A97175

RATIONALE

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

NONCURRENT NOTICE

This specification has been declared “NONCURRENT” by the Aerospace Materials Division, SAE, as of August, 2006. It is recommended, therefore, that this specification not be specified for new designs.

“NONCURRENT” refers to those specifications which have previously been widely used and which may be required for production or processing of existing designs in the future. The Aerospace Materials Division, however, does not recommend these specifications for future use in new designs. “NONCURRENT” specifications are available from SAE upon request.

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/AMS4148E

1. SCOPE:

1.1 Form:

This specification covers an aluminum alloy in the form of die forgings and forging stock.

1.2 Application:

These forgings have been used typically for parts requiring a high level of mechanical properties, but usage is not limited to such applications.

1.2.1 Certain design and processing procedures may cause these forgings to become susceptible to stress-corrosion cracking; ARP823 recommends practices to minimize such conditions.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2355	Quality Assurance Sampling and Testing, Aluminum Alloys and Magnesium Alloys, Wrought Products, Except Forging Stock, and Rolled, Forged, or Flash Welded Rings
MAM 2355	Quality Assurance Sampling and Testing, Aluminum Alloys and Magnesium Alloys, Wrought Products, Except Forging Stock, and Rolled, Forged, or Flash Welded Rings, Metric (SI) Units
AMS 2808	Identification, Forgings
ARP823	Minimizing Stress-Corrosion Cracking in Wrought Heat-Treatable Aluminum Alloy Products

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM B 594	Ultrasonic Inspection of Aluminum-Alloy Products for Aerospace Applications
ASTM E 1417	Liquid Penetrant Examination

2.3 U.S. Government Publications:

Available from DODSSP Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-H-6088 Heat Treatment of Aluminum Alloys

2.4 ANSI Publications:

Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ANSI H35.2 Dimensional Tolerances for Aluminum Mill Products
ANSI H35.2M Dimensional Tolerances for Aluminum Mill Products (Metric)

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

Shall conform to the percentages by weight shown in Table 1, determined in accordance with AMS 2355 or MAM 2355.

TABLE 1 - Composition

Element	min	max
Silicon	--	0.15
Iron	--	0.20
Copper	1.2	2.0
Manganese	--	0.10
Magnesium	2.1	2.9
Chromium	0.18	0.28
Zinc	5.1	6.1
Titanium	--	0.10
Other Elements, each	--	0.05
Other Elements, total	--	0.15
Aluminum	remainder	

3.2 Condition:

Shall be as follows:

3.2.1 Forgings: Solution and precipitation heat treated in accordance with MIL-H-6088 to the -T66 temper.

3.2.2 Forging Stock: As ordered by the forging manufacturer.

3.3 Properties:

The product shall conform to the following requirements, determined in accordance with AMS 2355 or MAM 2355:

3.3.1 Forgings:

3.3.1.1 Tensile Properties: Shall be as follows:

3.3.1.1.1 With Grain Flow: Specimens, machined from forgings 3 inches (76 mm) and under in nominal thickness or from prolongations on such forgings, with axis of specimen in area of gage length varying not more than 15 degrees from parallel to the forging flow lines, shall have the properties shown in Table 2.

TABLE 2 - Minimum Tensile Properties

Property	Value
Tensile Strength	86.0 ksi (593 MPa)
Yield Strength at 0.2% Offset	76.0 ksi (524 MPa)
Elongation in 2 Inches (50.8 mm) or 4D	7%

3.3.1.1.2 Across Grain Flow: Specimens, machined from forgings 3 inches (76 mm) and under in nominal thickness or from prolongations on such forgings, with axis of specimen in area of gage length varying not more than 15 degrees from perpendicular to the forging flow lines shall have the properties shown in Table 3. If the configuration of the forging or prolongation cannot accommodate the transverse specimen described, acceptance of the forgings shall be based on testing as in 3.3.1.1.3.

TABLE 3 - Minimum Tensile Properties

Property	Value
Tensile Strength	77.0 ksi (531 MPa)
Yield Strength at 0.2% Offset	66.0 ksi (455 MPa)
Elongation in 2 Inches (50.8 mm) or 4D	4%

3.3.1.1.3 At Angle to Grain Flow: Specimens, machined from forgings 3 inches (76 mm) and under in nominal thickness or from prolongations on such forgings, with axis of specimen in area of gage length varying more than 15 degrees from parallel and also more than 15 degrees from perpendicular to the forging flow lines, shall have the properties specified in 3.3.1.1.2. Such test results shall be identified as neither longitudinal nor transverse tensile properties.

3.3.1.1.4 Elongation requirements shall not apply to specimens having a gage length diameter under 0.250 inch (6.35 mm), or located in immediate proximity to an abrupt change in section thickness, or located so that any part of the specimen gage length is located within 1/8 inch (3.2 mm) of the trimmed flash line.

3.3.1.2 Grain flow of die forgings, except in areas which contain flash-line end grain, shall follow the general contour of the forgings showing no evidence of re-entrant grain flow.

3.3.2 Forging Stock: When a sample of stock is forged to a test coupon having a degree of mechanical working not greater than the forging and heat treated in the same manner as forgings, specimens taken from the heat treated coupon shall conform to the requirements of 3.3.1.1. If specimens taken from the stock after heat treatment in the same manner as forgings conform to the requirements of 3.3.1.1, the tests shall be accepted as equivalent to tests of a forged coupon.

3.4 Quality:

Forgings, 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 forgings.

3.4.1 Forgings shall be subjected to a caustic etch followed by visual examination of the forging surfaces for defect indications such as seams, laps, bursts, and quench cracks. Surface imperfections which can be removed so that they do not reappear on re-etching and the required section thickness can be maintained are acceptable.

3.4.1.1 When approved by purchaser, a sampling plan may be used in lieu of etching each forging.

3.4.2 When specified, forgings shall be subjected to ultrasonic inspection in accordance with ASTM B 594 and shall meet the following requirements of that specification:

3.4.2.1 Forgings 0.500 to 4.000 inches (12.70 to 101.6 mm), inclusive, in nominal thickness and weighing not over 300 pounds (136 kg) shall meet Class B.

3.4.2.2 Acceptance criteria for forgings exceeding the limits of 3.4.2.1 shall be as agreed upon by purchaser and vendor.

3.4.3 When specified, forgings shall be subjected to fluorescent penetrant inspection in accordance with ASTM E 1417. Standards for acceptance shall be established by the cognizant engineering organization.

3.5 Tolerances:

Forging stock shall conform to all applicable requirements of ANSI H35.2 or ANSI H35.2M.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of the product 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 product conform to specified requirements.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Composition (3.1), tensile properties (3.3.1.1), surface visual examination (3.4.1), tolerances (3.5) and, when specified, ultrasonic inspection (3.4.2) and fluorescent penetrant inspection (3.4.3) are acceptance tests and except for composition shall be performed on each inspection lot.

4.2.2 Periodic Tests: Grain flow (3.3.1.3) and tests of forging stock to determine ability to develop required properties (3.3.2) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing:

Shall be in accordance with AMS 2355 or MAM 2355 and the following:

4.3.1 Surface Imperfections (3.4.2): All die forgings.

4.3.2 When specified, all forgings shall be subjected to ultrasonic inspection and/or fluorescent penetrant inspection.

4.4 Reports:

4.4.1 The vendor of forgings shall furnish with each shipment a report stating that the forgings conform to the chemical composition, tolerances and NDT inspection, when required, and showing numerical results of tests for the other acceptance test requirements and periodic test requirements when performed. This report shall include the purchase order number, inspection lot number(s), AMS 4148D, size or part number, and quantity.

4.4.2 The vendor of forging stock shall furnish with each shipment a report stating that the chemical composition of the stock conforms to specified requirements. This report shall include the purchase order number, inspection lot number, AMS 4148C, size, and quantity.

4.5 Resampling and Retesting:

Shall be in accordance with AMS 2355 or MAM 2355.