AEROSPACE MATERIAL SPECIFICATION

AMS4140	REV. K

Issued	1942-01
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Noncurrent	2009-08
Stabilized	2014-12

Superseding AMS4140J

Aluminum Alloy Die Forgings
4.0Cu - 2.0Ni - 0.68Mg (2018-T61)
Solution and Precipitation Heat Treated
(Composition similar to UNS A92018)

RATIONALE

AMS4140K stabilizes this document because it contains mature technology that is not expected to change and thus no further revisions are anticipated.

STABILIZED NOTICE

AMS4140K has been declared "STABILIZED" by AMS Committee D. This document will no longer be updated and may no longer represent standard industry practice. This document was stabilized because this document contains mature technology that is not expected to change and thus no further revisions are anticipated. Previously this document was Noncurrent. The last technical update of this document occurred in June, 2001. Users of this document should refer to the cognizant engineering organization for disposition of any issues with reports/certifications to this specification; including exceptions listed on the certification. NOTE: In many cases, the purchaser may represent a sub tier supplier and not the cognizant engineering organization.

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
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1. SCOPE:

1.1 Form:

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

1.2 Application:

This product has been used typically for small, forged parts for aircraft engines, 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 canceled 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 http://www.sae.org.

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 2772	Heat Treatment of Aluminum Alloy Raw Materials
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 B 660	Packaging/Packing of Aluminum and Magnesium Products
ASTM E 1417	Liquid Penetrant Examination

2.3 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	--	0.9
Iron	--	1.0
Copper	3.5	4.5
Manganese	--	0.20
Magnesium	0.45	0.9
Chromium	--	0.10
Nickel	1.7	2.3
Zinc	--	0.25
Other Elements, each	--	0.05
Other Elements, total	--	0.15
Aluminum	remainder	

3.2 Condition:

The product shall be supplied in the following condition:

3.2.1 Forgings: Solution and precipitation heat treated in accordance with AMS 2772 to the T61 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 on the mill produced size and as specified herein.

3.3.1 Forgings:

3.3.1.1 Tensile Properties: Shall be as follows:

3.3.1.1.1 Test Specimens: Specimens, machined from separately-forged coupons or from forging stock representing the forgings and, in either case, heat treated with the forgings or machined from prolongations on heat treated forgings, shall have the properties shown in Table 2:

TABLE 2 - Minimum Tensile Properties

Property	Value
Tensile Strength	55 ksi (379 MPa)
Yield Strength at 0.2% Offset	40.0 ksi (276 MPa)
Elongation in 4D	10%

3.3.1.1.2 Forgings With Grain Flow: Specimens, machined from 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 properties as specified in Table 2.

3.3.1.2 Hardness: Shall be not lower than 100 HB/10/500 or 106 HB/10/1000, or equivalent, but forgings shall not be rejected on the basis of hardness if the tensile property requirements are met. Piston forgings shall also meet the requirements of 3.3.1.2.1.

3.3.1.2.1 Piston forgings shall retain hardness not lower than 90 HB/10/500 or 93 HB/10/1000, or equivalent, after being heated to 450 °F ± 10 (232 °C ± 6), held at heat for 5 hours ± 0.2, and cooled in air.

3.3.1.3 Grain Flow: Except in areas of forgings which contain flash-line end grain, grain flow shall follow the general contour of the forging 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 3.3.1.1.1. If specimens taken from the stock after heat treatment in the same manner as forgings conform to the requirements of 3.3.1.1.1, the tests shall be accepted as equivalent to tests of a forged coupon.

3.4 Quality:

The product, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from conditions detrimental to usage of the product.

3.4.1 When specified, forgings shall be subjected to ultrasonic inspection in accordance with ASTM B 594 and/or to fluorescent penetrant inspection in accordance with ASTM E 1417. Standards for acceptance shall be as agreed upon by purchaser and vendor.

3.4.2 When specified, each forging shall be etched to produce a surface suitable for visual inspection. Surfaces shall be evaluated for conditions such as seams, laps, bursts, and quench cracks. Surface conditions which can be removed so that they do not reappear on re-etching and the required section thickness can be maintained are acceptable.

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 conforms to the specified requirements.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Composition 3.1) and testing of forgings for tensile properties (3.3.1.1), hardness (3.3.1.2), quality (3.4) and, when specified, ultrasonic and/or fluorescent penetrant inspection (3.4.1), etching and visual inspection (3.4.2), are acceptance tests and, except for composition, shall be performed on each lot.

4.2.2 Periodic Tests: Tests of forgings for grain flow (3.3.1.3) and, when applicable, hardness retention (3.3.1.2.1) and 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 Ultrasonic and Fluorescent Penetrant Inspection (3.4.1): All die forgings, when specified.

4.3.2 Surface Conditions (3.4.2): All die forgings, when specified.