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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 4140G

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Superseding AMS 4140F

Submitted for recognition as an American National Standard

ALUMINUM ALLOY DIE FORGINGS
4.0Cu - 2.0Ni - 0.68Mg (2018-T61)
Solution and Precipitation Heat Treated

UNS A92018

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.

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 2201 Tolerances, Aluminum and Aluminum Alloy Bar, Rod, Wire, and Forging Stock, Rolled or Cold Finished
MAM 2201 Tolerances, Metric, Aluminum and Aluminum Alloy Bar, Rod, Wire, and Forging Stock, Rolled, Drawn, or Cold Finished

2.1 SAE Publications (Continued):

AMS 2355 Quality Assurance Sampling and Testing of Aluminum Alloys and Magnesium Alloys, Wrought Product (Except Forging Stock) and Flash Welded Rings
MAM 2355 Quality Assurance Sampling and Testing of Aluminum Alloys and Magnesium Alloys, Wrought Product (Except Forging Stock) and 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, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM B 594 Ultrasonic Inspection of Aluminum-Alloy Products for Aerospace Applications
ASTM B 660 Packaging/Packing of Aluminum and Magnesium Products

2.3 U.S. Government Publications:

Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-H-6088 Heat Treatment of Aluminum Alloys
MIL-STD-6866 Inspection, Liquid Penetrant

3. TECHNICAL REQUIREMENTS:

3.1 Composition:
(R)

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
Copper	3.5	4.5
Nickel	1.7	2.3
Magnesium	0.45	0.9
Iron	--	1.0
Silicon	--	0.9
Zinc	--	0.25
Manganese	--	0.20
Chromium	--	0.10
Other Impurities, each	--	0.05
Other Impurities, 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 MIL-H-6088.

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 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	55.0 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: Should 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 (R) 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 and 3.3.1.2. 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 and 3.3.1.2, 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 imperfections detrimental to usage of the product.

3.4.1 (R) When specified, forgings shall be subjected to ultrasonic inspection in accordance with ASTM B 594 and/or to fluorescent penetrant inspection in accordance with MIL-STD-6866. Standards for acceptance shall be as agreed upon by purchaser and vendor.

3.4.2 (R) When specified, each forging shall be etched to produce a surface suitable for visual inspection. Surfaces shall be evaluated for defects 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.

3.5 Tolerances:

Forging stock shall conform to all applicable requirements of AMS 2201 or MAM 2201.

4. QUALITY ASSURANCE PROVISIONS:

4.1 (R) Responsibility for Inspection:

The vendor of the product shall supply all samples for vendor's tests and shall be responsible for performing 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 requirements of this specification.

4.2 Classification of Tests:

4.2.1 (R) Acceptance Tests: Tests of the product for composition (3.1) and 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) and etching and visual inspection (3.4.2), are acceptance tests and shall be performed on each lot.