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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS-4141 REV D

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Superseding AMS-4141C

Submitted for recognition as an American National Standard

ALUMINUM ALLOY DIE FORGINGS
5.6Zn - 2.5Mg - 1.6Cu - 0.23Cr (7075-T73)
Solution and Precipitation Heat Treated

UNS A97075

1. SCOPE:

1.1 Form: This specification covers an aluminum alloy in the form of die forgings and forging stock ordered to inch/pound units.

1.1.1 MAM-4141A is the metric version of this AMS.

1.2 Application: Primarily for parts requiring good resistance to stress-corrosion cracking but with lower strength than AMS-4139.

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.

2.1.1 Aerospace Material Specification:

AMS-2201 - Tolerances, Aluminum and Aluminum Alloy Bar, Rod, Wire, and Forging Stock, Rolled or Drawn
AMS-2355 - Quality Assurance Sampling and Testing of Aluminum Alloys and Magnesium Alloys, Wrought Product (Except Forging Stock) and Flash Welded Rings
AMS-2630 - Ultrasonic Inspection
AMS-2645 - Fluorescent Penetrant Inspection
AMS-2808 - Identification, Forgings

2.2 ASTM Publications: Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

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.

2.3.1 Military Specifications:

MIL-H-6088 - Heat Treatment of Aluminum Alloys

2.3.2 Military Standards:

MIL-STD-2154 - Inspection, Ultrasonic, Wrought Metals, Process for

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, Ø determined in accordance with AMS-2355:

	min	max
Zinc	5.1	6.1
Magnesium	2.1	2.9
Copper	1.2	2.0
Chromium	0.18	0.28
Iron	--	0.50
Silicon	--	0.40
Manganese	--	0.30
Titanium	--	0.20
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 precipation 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, Ø determined in accordance with AMS-2355.

3.3.1 Forgings:

3.3.1.1 Tensile Properties: Shall be as follows:
Ø

3.3.1.1.1 With Grain Flow: Specimens, machined from forgings 6 inches and under in nominal thickness at time of heat treatment or from prolongations on such forgings, with axis of specimen in the area of gage length varying not more than 15 degrees from parallel to the forging flow lines, shall have properties specified in Table I provided the as-forged thickness is not more than twice the heat treated thickness.

TABLE I

Nominal Thickness at Time of Heat Treatment Inches	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 2 Inches or 4D %, min
Up to 3, incl	66,000	56,000	7
Over 3 to 4, incl	64,000	55,000	7
Over 4 to 5, incl	62,000	53,000	7
Over 5 to 6, incl	61,000	51,000	6

3.3.1.1.2 Across Grain Flow: Specimens, machined from forgings 6 inches and Ø under in nominal thickness at time of heat treatment or from prolongations on such forgings, with axis of specimen in the area of gage length varying not more than 15 degrees from perpendicular to the forging flow lines, shall have properties as specified in Table II provided the as-forged thickness is not more than twice the heat treated thickness. If configuration of the forging or prolongation cannot accommodate the transverse specimen described, properties of the forgings shall be as agreed upon by purchaser and vendor.

TABLE II

Nominal Thickness at Time of Heat Treatment Inches	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 2 Inches or 4D %, min
Up to 3, incl	62,000	53,000	3
Over 3 to 4, incl	61,000	52.000	2
Over 4 to 5, incl	59,000	51,000	2
Over 5 to 6, incl	58,000	50,000	2

3.3.1.1.3 Tensile property requirements for specimens cut from forgings over 6 inches in nominal thickness at time of heat treatment shall be as specified on the drawing or as agreed upon by purchaser and vendor.

3.3.1.2 Hardness: Should be not lower than 124 HB/10/500 but forgings shall not be rejected on the basis of hardness if the applicable tensile property requirements are met.

3.3.1.3 Stress-Corrosion Resistance: Forgings shall meet the conductivity test of 3.3.1.3.1 and shall exhibit no evidence of stress-corrosion cracking when tested in accordance with 3.3.1.3.2. The test of 3.3.1.3.2 need not be performed on forgings meeting the requirements of 3.3.1.3.1.1, 3.3.1.3.1.2, and 3.3.1.3.1.3.

3.3.1.3.1 Conductivity: Shall be as follows, determined on the surface of the sample:

3.3.1.3.1.1 If the conductivity is 40.0% IACS (International Annealed Copper Standard) or higher and longitudinal (with grain flow) tensile properties meet specified requirements, the forgings are acceptable.

3.3.1.3.1.2 If the conductivity is between 38.0 - 39.9% IACS, inclusive, if the longitudinal (with grain flow) tensile properties meet specified properties, and if the longitudinal yield strength does not exceed the specified minimum by more than 11,900 psi, the forgings are acceptable.

3.3.1.3.1.3 Ø If the conductivity is between 38.0 - 39.9% IACS, inclusive, and longitudinal (with grain flow) yield strength exceeds the specified minimum value by more than 11,900 psi, the forgings shall be given additional precipitation heat treatment. If, after such treatment, the forgings meet the requirements of 3.3.1.3 and 3.3.1.3.1.1 or 3.3.1.3.1.2, the forgings are acceptable.

3.3.1.3.1.4 Ø If the conductivity is below 38.0% IACS, the forgings are not acceptable but may be re-heat treated or given additional precipitation heat treatment to meet the specified requirements.

3.3.1.3.2 Ø Stress-Corrosion Cracking Resistance: Specimens, cut from forgings 0.750 inch and over in nominal thickness, shall exhibit no evidence of stress-corrosion cracking when stressed in the short-transverse (across grain flow) direction to 75% of the specified minimum longitudinal (with grain flow) yield strength.

3.3.2 Ø Forging Stock: When a sample of stock is forged to a test coupon, with a degree of mechanical working not greater than that of the forgings, and heat treated in the same manner as forgings, tensile 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 When specified, forgings shall be etched to produce a surface suitable for Ø 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.

3.4.2 When specified, die forgings shall be ultrasonically inspected in Ø accordance with MIL-STD-2154 or other method acceptable to purchaser and shall meet Class B requirements of MIL-STD-2154.

3.4.3 When specified, forgings shall be subjected to fluorescent penetrant inspection in accordance with AMS-2645 or other method acceptable to purchaser. Standards for acceptance shall be as agreed upon by purchaser and vendor.

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

3.5 Tolerances: Forging stock shall conform to all applicable requirements of AMS-2201.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of the product shall supply all Ø 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 Acceptance Tests: Tests for the following requirements are acceptance tests and shall be performed on each lot:

4.2.1.1 Composition (3.1).

4.2.1.2 Tensile properties (3.3.1.1), stress-corrosion resistance (3.3.1.3), Ø surface visual examination (3.4.1), and when specified, ultrasonic inspection (3.4.2) and fluorescent penetrant inspection (3.4.3).

4.2.1.3 Tolerances (3.5) of forging stock.

4.2.2 Periodic Tests: Tests of forgings for hardness (3.3.1.2), Ø stress-corrosion cracking resistance (3.3.1.3.2), and grain flow (3.4.4) 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 and 4.3.1. Ø