SAE The Engineering Resource For Advancing Mobility

400 Commonwealth Dr., Warrendale, PA 15096

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

SAE AMS 4107C

Issued 6-15-75
Revised 7-1-86

Superseding AMS 4107B

ALUMINUM ALLOY DIE FORGINGS
6.2Zn - 2.3Cu - 2.2Mg - 0.12Zr (7050-T74) (Formerly -T736)
Solution Heat Treated and Overaged UNS A97050

1. SCOPE:

1.1 Form: This specification covers an aluminum alloy in the form of high-strength die forgings and of forging stock.

1.2 Application: Primarily for structural applications requiring superior strength and resistance to stress-corrosion cracking.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

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 or Cold Finished
AMS 2350 - Standards and Test Methods
AMS 2375 - Control of Forgings Requiring First Article Approval
AMS 2645 - Fluorescent Penetrant Inspection
AMS 2808 - Identification, Forgings

REAFFIRMED 10/91

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM B557 - Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products
ASTM B594 - Ultrasonic Inspection of Aluminum-Alloy Products for Aerospace Applications
ASTM E10 - Brinell Hardness of Metallic Materials
ASTM E34 - Chemical Analysis of Aluminum and Aluminum Alloys
ASTM G34 - Exfoliation Corrosion Susceptibility in 2xxx and 7xxx Series Aluminum Alloys (EXCO Test)
ASTM G47 - Determining Susceptibility to Stress-Corrosion Cracking of High-Strength Aluminum Alloy Products

2.3 U.S. Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Federal Standards:

Federal Test Method Standard No. 151 - Metals; Test Methods

2.3.2 Military Specifications:

MIL-H-6088 - Heat Treatment of Aluminum Alloys

2.3.3 Military Standards:

MIL-STD-649 - Aluminum and Magnesium Products, Preparation for Shipment and Storage
MIL-STD-1537 - Electrical Conductivity Test for Measurement of Heat Treatment of Aluminum Alloys, Eddy Current Method

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, determined by wet chemical methods in accordance with ASTM E34, by spectrographic methods in accordance with Federal Test Method Standard No. 151, Method 112, or by other analytical methods approved by purchaser:

	min	max
Zinc	5.7	6.7
Copper	2.0	2.6
Magnesium	1.9	2.6
Zirconium	0.08	0.15
Iron	--	0.15
Silicon	--	0.12
Manganese	--	0.10
Titanium	--	0.06
Chromium	--	0.04
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 heat treated and overaged 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:

3.3.1 Forgings: The following requirements apply to forgings having an as-forged thickness not more than twice the nominal thickness at time of heat treatment:

3.3.1.1 Tensile Properties: Shall be as follows, determined in accordance with ASTM B557:

3.3.1.1.1 With Grain Flow: Specimens, machined from forgings or from prolongations on such forgings with axis of specimen in the area of the gage length varying not more than 15 deg from parallel to the forging flow lines, shall have the properties specified in Table I.

TABLE I

Nominal Thickness At Time Of Heat Treatment Inches	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 4D %, min
Up to 2, incl	72,000	62,000	7
Over 2 to 4, incl	71,000	61,000	7
Over 4 to 5, incl	70,000	60,000	7
Over 5 to 6, incl	70,000	59,000	7

TABLE I (SI)

Nominal Thickness At Time Of Heat Treatment Millimetres	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 5D %, min
Up to 50, incl	495	425	6
Over 50 to 100, incl	490	420	6
Over 100 to 125, incl	485	415	6
Over 125 to 150, incl	485	405	6

3.3.1.1.2 Across Grain Flow: Specimens, machined from forgings or from prolongations on such forgings with the axis of specimen in the area of the gage length varying not more than 15 deg from perpendicular to the forging flow line, shall have the properties specified in Table II.

TABLE II

Nominal Thickness At Time Of Heat Treatment Inches	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 4D %, min
Up to 2, incl	68,000	56,000	5
Over 2 to 4, incl	67,000	55,000	4
Over 4 to 6, incl	66,000	54,000	3

TABLE II (SI)

Nominal Thickness At Time Of Heat Treatment Millimetres	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 5D %, min
Up to 50, incl	470	385	5
Over 50 to 100, incl	460	380	4
Over 100 to 150, incl	455	370	3

3.3.1.1.3 Special Purpose Forgings: Tensile specimens cut from special purpose forgings or from forgings beyond the size and configuration limits of 3.3.1.1.1 or 3.3.1.1.2 shall meet the tensile property requirements specified on the drawing or as agreed upon by purchaser and vendor.

3.3.1.2 Hardness: Should be not lower than 135 HB/10/500 or 140 HB/10/1000, determined in accordance with ASTM E10, but forgings shall not be rejected on the basis of hardness if the tensile property requirements are met.

3.3.1.3 Corrosion Resistance: Resistance to stress-corrosion cracking and to exfoliation-corrosion is acceptable if the conditions of 3.3.1.3.1 and 3.3.1.3.2 are met.

3.3.1.3.1 Electrical conductivity, determined in accordance with MIL-STD-1537, shall be not lower than 38.0% IACS (International Annealed Copper Standard) (22.0 MS/m) and yield strength parallel to grain flow shall not exceed 72,000 psi (495 MPa).

3.3.1.3.2 Stress-Corrosion Susceptibility Factor (SCF): Shall be not greater than 32.0 (220), determined by subtracting the electrical conductivity, AA.A% IACS (12 times BB.B MS/m) from the longitudinal yield strength, XX.X ksi (YYY MPa).

Examples: 72.0 ksi - 38.5% IACS = 33.5 Unacceptable
68.0 ksi - 40.2% IACS = 27.8 Acceptable

(SI) 495 MPa - 12 X 22.3 MS/m = 228.4 Unacceptable
469 MPa - 12 X 23.3 MS/m = 189.4 Acceptable

3.3.1.3.3 Forgings not conforming to 3.4.1.3.1 and 3.4.1.3.2 may be given Ø additional overaging and retested to determine conformance to 3.4.1.1 and 3.4.1.3.

3.3.1.4 Exfoliation-Corrosion Resistance: Specimens cut from forgings shall show a level of exfoliation-corrosion less than that pictured in Photo B, Fig 2, of ASTM G34-72 at any plane, determined in accordance with ASTM G34.

3.3.1.5 Stress-Corrosion Resistance: Specimens as in 4.3.2.1 cut from forgings shall meet the requirements of ASTM G47 when stressed at 35,000 psi (240 MPa) in the short-transverse direction.

3.3.2 Forging Stock: When a sample of stock is forged to a test coupon 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. The forging stock supplier, however, shall not be required to conduct such tests.

3.4 Quality: The product, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from internal and external imperfections detrimental to usage of the product.

3.4.1 When specified, forgings shall be subjected to fluorescent penetrant inspection in accordance with AMS 2645. Standards for acceptance shall be as agreed upon by purchaser and vendor.

3.4.2 When specified, forgings shall be subjected to ultrasonic inspection in accordance with ASTM B594 and shall meet the following requirements:

3.4.2.1 Forgings with nominal section thicknesses from 0.500 to 4.000 in. (12.50 to 100.00 mm) and weights per piece up to 300 lb (150 kg) shall meet ultrasonic Class B. The ultrasonic class for nominal thicknesses greater than 4.000 in. (100.00 mm) or for weights heavier than 300 lb (150 kg) shall be as agreed upon by purchaser and vendor.

3.5 Tolerances: Unless otherwise specified, tolerances for forging stock shall conform to all applicable requirements of AMS 2201 or MAM 2201.

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 performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.5. 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 to determine conformance to the following requirements are classified as acceptance tests and shall be performed on each lot:

4.2.1.1 Composition (3.1) of the product.

4.2.1.2 Tensile properties (3.3.1.1), hardness (3.3.1.2), corrosion resistance (3.3.1.3) and, when specified, fluorescent penetrant inspection (3.4.1) and ultrasonic soundness (3.4.2) of each lot of forgings.

4.2.1.3 Tolerances (3.5) of forging stock.

4.2.2 Periodic Tests: Tests of forgings to determine conformance to requirements for exfoliation-corrosion resistance (3.3.1.4) and stress-corrosion resistance (3.3.1.5) and of forging stock to demonstrate ability to develop required properties (3.3.2) are classified as periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing specified by purchaser.

4.2.3 For Preproduction Tests: Tests of forgings to determine conformance to all applicable technical requirements of this specification when AMS 2375 is specified are classified as preproduction tests and shall be performed prior to or on the first-article shipment of a forging to a purchaser, when a change in material or processing, or both, requires reapproval as in 4.4, and when purchaser deems confirmatory testing to be required.

4.2.3.1 For direct U.S. Military procurement of forgings, substantiating test data and, when requested, preproduction forgings shall be submitted to the cognizant agency as directed by the procuring activity, the contracting officer, or the request for procurement.

4.3 Sampling: Shall be as follows; a lot shall be all forgings of the same configuration or part number heat treated in the same batch furnace load or in a continuous furnace consecutively during an 8-hr period. The maximum lot size for forgings heat treated in a continuous furnace and charged consecutively during continuous furnace operation shall be 2000 lb (900 kg) for forgings weighing 5 lb (2.5 kg) and under and shall be 6000 lb (2700 kg) for forgings weighing over 5 lb (2.5 kg).

4.3.1 For Acceptance Tests:

4.3.1.1 Composition: At least one sample shall be taken by the producer from each group of ingots poured simultaneously from the same source of molten metal. Complete ingot analysis records shall be available to the purchaser at the producer's facility.

4.3.1.1.1 Unless compliance with 4.3.1.1 is established, an analysis shall be made for each 6000 lb (2700 kg) or less of alloy comprising the lot except that not more than one analysis shall be required per piece.

4.3.1.2 Tensile Properties: Not less than one forging or one forging prolongation heat treated with each lot of forgings. Not less than one tensile specimen shall be cut with the grain flow and one tensile specimen across the grain flow.

4.3.1.3 Conductivity: Shall be the longitudinal (with grain flow) tensile

4.3.2 For Periodic Tests: Shall be as agreed upon by purchaser and vendor and as follows:

4.3.2.1 Stress-Corrosion Resistance: Samples shall be taken from a forging or forging prolongation. Specimens shall be not less than a 0.750 in. (19 mm) cube.

4.3.3 For Preproduction Tests: As agreed upon by purchaser and vendor.

4.4 Approval: When specified, approval and control of forgings shall be in accordance with AMS 2375.

4.5 Reports:

4.5.1 The vendor of forgings shall furnish with each shipment a report stating that the chemical composition conforms to the requirements of this specification and showing the results of tests on each lot to determine conformance to the other acceptance test requirements and, when performed, to the periodic test requirements. This report shall include the purchase order number, AMS 4107C, lot number, size or part number, and quantity.

4.5.2 The vendor of forging stock shall furnish with each shipment a report stating that the chemical composition of the stock conforms to the requirements of this specification. This report shall include the purchase order number, AMS 4107C, size, and quantity.

4.5.3 The vendor of finished or semi-finished parts shall furnish with each shipment a report showing the purchase order number, AMS 4107C, contractor or other direct supplier of forgings, part number, and quantity. When forgings for making parts are produced or purchased by the parts vendor, that vendor shall inspect each lot of forgings to determine conformance to the requirements of this specification and shall include in the report either a statement that the forgings conform or copies of laboratory reports showing the results of tests to determine conformance.