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400 COMMONWEALTH DRIVE WARRENDALE PA 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 4108B
Superseding AMS 4108A

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ALUMINUM ALLOY HAND FORGINGS
6.2Zn - 2.3Cu - 2.2Mg - 0.12Zr (7050-T7452) (formerly -T73652)
Solution Heat Treated, Compression Stress-Relieved, and Overaged

UNS A97050

1. SCOPE:

1.1 Form: This specification covers an aluminum alloy in the form of hand forgings with thicknesses up to 8 in. (200 mm) and of forging stock.

1.2 Application: Primarily for machined structural parts subject to warpage during machining and 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

2.2 ASTM Publications: Available from American Society of 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 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, stress-relieved by compressing to produce 1 - 5% permanent set, and overaged.

3.2.2 Forging Stock: As ordered by the forging manufacturer.

3.3 Heat Treatment: Solution heat treatment and overaging shall be performed in Ø accordance with MIL-H-6088.

3.4 Properties: The product shall conform to the following requirements:

3.4.1 Forgings:

3.4.1.1 Tensile Properties: Shall be as follows, determined in accordance with ASTM B557. Specimens as in 4.3.1.2 machined from forgings having essentially a rectangular or square section, heat treated in the Ø indicated thickness, shall have properties as specified in Table I provided that the as-forged thickness does not exceed 8.0 in. (200 mm). The long-transverse direction for squares shall be identified by the vendor.

TABLE I

Nominal Thickness At Time Of Heat Treatment Inches	Specimen Orientation	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 4D %, min
Up to 2, incl	Longitudinal	72,000	63,000	9
	Long-Trans.	71,000	61,000	5
Over 2 to 3, incl	Longitudinal	72,000	62,000	9
	Long-Trans.	70,000	60,000	5
	Short-Trans.	67,000	55,000	4
Over 3 to 4, incl	Longitudinal	71,000	61,000	9
	Long-Trans.	70,000	59,000	5
	Short-Trans.	67,000	55,000	4
Over 4 to 5, incl	Longitudinal	70,000	60,000	9
	Long-Trans.	69,000	58,000	4
	Short-Trans.	66,000	54,000	3
Over 5 to 6, incl	Longitudinal	69,000	59,000	9
	Long-Trans.	68,000	56,000	4
	Short-Trans.	66,000	53,000	3
Over 6 to 7, incl	Longitudinal	68,000	58,000	9
	Long-Trans.	67,000	54,000	4
	Short-Trans.	65,000	51,000	3
Over 7 to 8, incl	Longitudinal	67,000	57,000	9
	Long-Trans.	66,000	52,000	4
	Short-Trans.	64,000	50,000	3

TABLE I (SI)

Nominal Thickness At Time Of Heat Treatment Millimetres	Specimen Orientation	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 5D %, min
Up to 50, incl	Longitudinal	495	435	8
	Long-Trans.	490	420	5
Over 50 to 75, incl	Longitudinal	495	425	8
	Long-Trans.	485	415	5
	Short-Trans.	460	380	4
Over 75 to 100, incl	Longitudinal	490	420	8
	Long-Trans.	485	405	5
	Short-Trans.	460	380	4
Over 100 to 125, incl	Longitudinal	485	415	8
	Long-Trans.	475	400	4
	Short-Trans.	455	370	3
Over 125 to 150, incl	Longitudinal	475	405	8
	Long-Trans.	470	385	4
	Short-Trans.	455	365	3
Over 150 to 175, incl	Longitudinal	470	400	8
	Long-Trans.	460	370	4
	Short-Trans.	450	350	3
Over 175 to 200, incl	Longitudinal	460	395	8
	Long-Trans.	455	360	4
	Short-Trans.	440	345	3

3.4.1.1.1 Special Purpose Forgings: Tensile specimens cut from special purpose forgings or forgings beyond the size and configuration limits of 3.4.1.1 shall have tensile properties as specified on the drawing or as agreed upon by purchaser and vendor.

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

3.4.1.3 Corrosion Resistance: Resistance to stress-corrosion cracking and to Ø exfoliation-corrosion is acceptable if the conditions of 3.4.1.3.1 and 3.4.1.3.2 are met.

3.4.1.3.1 Electrical Conductivity: Shall be not lower than 38.0% IACS Ø (International Annealed Copper Standard) (22.0 MS/m), determined in accordance with MIL-STD-1537.

3.4.1.3.2 Stress-Corrosion Susceptibility Factor (SCF): Shall be not greater Ø. 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:

Inch/Pound Units	72.0 ksi - 38.5% IACS = 33.5	Unacceptable
	68.0 ksi - 40.2% IACS = 27.8	Acceptable
SI Units	495 MPa - 12 X 22.3 MS/m = 228.4	Unacceptable
	469 MPa - 12 X 23.3 MS/m = 189.4	Acceptable

3.4.1.3.3 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, 3.4.1.3.1 and 3.4.1.3.2.

3.4.1.4 Exfoliation-Corrosion Resistance: Specimens cut from forgings shall Ø 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.

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

3.4.2 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 3.4.1.1. If specimens Ø taken from the stock after heat treatment in the same manner as forgings conform to the requirements of 3.4.1.1, 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.

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

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

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

3.5.2.1 Forgings with nominal section thicknesses from 1.000 to 8.000 in. (25.00 to 200.00 mm) and weights per piece up to 600 lb (300 kg) shall meet Ø ultrasonic Class A. The ultrasonic class for nominal thicknesses greater than 3.000 in. (200.00 mm) or for weights heavier than 600 lb (300 kg) shall be as agreed upon by purchaser and vendor.

3.6 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 Ø 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 Ø requirements are classified as acceptance tests and shall be performed on each lot:

4.2.1.1 Composition (3.1) of the product.
Ø

4.2.1.2 Tensile properties (3.4.1.1), hardness (3.4.1.2), corrosion resistance Ø (3.4.1.3) and, when specified, fluorescent penetrant inspection (3.5.1) and ultrasonic soundness (3.5.2) of each lot of forgings.

4.2.1.3 Tolerances (3.6) of forging stock.
Ø

4.2.2 Periodic Tests: Tests of forgings to determine conformance to requirements for exfoliation-corrosion resistance (3.4.1.4) and stress- Ø corrosion resistance (3.4.1.5) and of forging stock to demonstrate ability to develop required properties (3.4.2) are classified as periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.2.3 Preproduction Tests: Tests of forgings to determine conformance to all applicable technical requirements of this specification when AMS 2375 is Ø 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 not more than 6000 lb Ø (2700 kg) of forgings of the same configuration or part number heat treated in the same batch-furnace load or charged into a continuous furnace consecutively during an 8-hr period.

4.3.1 For Acceptance Tests:
Ø

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

4.3.1.1.1 Unless compliance with 4.3.1.1 is established, an analysis shall be Ø 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: Tensile specimens shall be taken from not less than Ø one forging or one forging prolongation heat treated with each lot of forgings. Not less than one tensile specimen shall be cut in the longitudinal direction and one in the long-transverse direction.

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

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

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

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

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

4.5 Reports: