Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 4108A
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UNS A97050

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

1. SCOPE:

1.1 Form: This specification covers an aluminum alloy in the form of high-strength hand forgings with thicknesses up to 8 in. (203 mm) and of forging stock.

1.2 Application: Primarily for structural, machined 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 Society of Automotive Engineers, Inc., 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 Drawn
AMS 2350 - Standards and Test Methods
AMS 2375 - Approval and Control of Critical Forgings
AMS 2630 - Ultrasonic Inspection
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 B342 - Electrical Conductivity by Use of Eddy Currents
ASTM B557 - Tension Testing Wrought and Cast Aluminum and Magnesium Alloy Products
ASTM E10 - Brinell Hardness of Metallic Materials
ASTM E34 - Chemical Analysis of Aluminum and Aluminum-Base Alloys
ASTM G47 - Determining Susceptibility to Stress-Corrosion Cracking of High Strength 7XXX Aluminum Alloy Products

2.3 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 Standards:

MIL-STD-649 - Aluminum and Magnesium Products, Preparation for Shipment and Storage

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 approved analytical methods:

	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, and precipitation heat treated.

3.2.2 Forging Stock: As ordered by the forging manufacturer.

3.3 Heat Treatment: Forgings shall be solution heat treated by heating to 890°F ± 10 (477°C ± 6), holding at heat for a time commensurate with section thickness but not less than 60 min., and quenching in water at 140° - 160°F (60° - 71°C), stress-relieved by compressing to produce a permanent set of 1-5%, and precipitation heat treated by heating to 250°F ± 10 (121°C ± 6), holding at heat for 24 hr ± 1, heating to 350°F ± 10 (177°C ± 6), holding at heat for 8 hr ± 1, and cooling in air.

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. Test specimens machined from forgings having essentially a rectangular or square section heat treated in the indicated thickness shall have properties as specified in Table I, provided that the as-forged thickness does not exceed 8.0 in. (203 mm). The long transverse direction for squares shall be as 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 2 in. or 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 50.8 mm or 4D %, min
Up to 51, incl	Longitudinal	496	434	9
	Long Trans.	490	421	5
Over 51 to 76, incl	Longitudinal	496	427	9
	Long Trans.	483	414	5
	Short Trans.	462	379	4
Over 76 to 102, incl	Longitudinal	490	421	9
	Long Trans.	483	407	5
	Short Trans.	462	379	4
Over 102 to 127, incl	Longitudinal	483	414	9
	Long Trans.	476	400	4
	Short Trans.	455	372	3
Over 127 to 152, incl	Longitudinal	476	407	9
	Long Trans.	469	386	4
	Short Trans.	455	365	3
Over 152 to 178, incl	Longitudinal	469	400	9
	Long Trans.	462	372	4
	Short Trans.	448	352	3
Over 178 to 203, incl	Longitudinal	462	393	9
	Long. Trans.	455	359	4
	Short Trans.	441	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 covered by this specification shall meet the tensile property requirements specified on the drawing or agreed upon by purchaser and vendor.

3.4.1.2 Hardness: Should be not lower than 135 HB/10/500, 135 HB/14.3/1000, 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.

3.4.1.3 Conductivity: Shall be as follows, determined in accordance with ASTM B342:

3.4.1.3.1 ø If the conductivity is 40% IACS (International Annealed Copper Standard) or higher and the yield strength in the parallel grain direction does not exceed 72,000 psi (496 MPa), the forgings are acceptable.

3.4.1.3.2 ø If the conductivity is 40% IACS or higher and the yield strength in the parallel grain direction exceeds 72,000 psi (496 MPa), the forgings shall be subjected to additional precipitation heat treatment to meet the requirements of 3.4.1.3.1.

3.4.1.3.3 If the conductivity is below 40% IACS, the forgings are unsatisfactory and shall be reprocessed regardless of mechanical property level.

3.4.1.4 Stress-Corrosion Resistance: Specimens, cut from forgings processed to meet the requirements Ø of 3.4.1.3 and stressed in the short transverse (perpendicular to grain flow) direction to 50% of the specified minimum longitudinal (parallel to grain flow) yield strength for thicknesses up to 3.000 in. (76 mm), incl, and to 35,000 psi (241 MPa) for thicknesses over 3.000 in. (76 mm), shall meet the requirements of ASTM G47.

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, tensile test specimens taken from the heat treated coupon shall conform to the requirements of 3.4.1.1. If specimens 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 the purchaser, shall be uniform in quality and condition, sound, Ø 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 inspection in accordance with AMS 2645 and/or to ultrasonic inspection in accordance with AMS 2630. Standards for acceptance 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.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of the product shall supply all samples 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 perform such confirmatory testing as he deems necessary to ensure that the product conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests of the product to determine conformance to composition (3.1) requirements; of forgings to determine conformance to tensile property (3.4.1.1), hardness (3.4.1.2), and conductivity (3.4.1.3) requirements; and of forging stock to determine conformance to tolerance (3.6) requirements are classified as acceptance tests.

4.2.2 Periodic Tests: Tests of forgings to determine conformance to stress-corrosion resistance (3.4.1.4) Ø requirements and of forging stock to determine ability to develop required properties (3.4.2) are classified as periodic tests.

4.2.3 Preproduction Tests: Tests to determine conformance to all technical requirements of this specifi- Ø cation are classified as preproduction tests.

4.2.3.1 For direct U.S. Military procurement of forgings, substantiating test data and, when requested, Ø 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 (2724 kg) of forgings of the same size and shape heat treated in the same batch furnace load or charged into a continuous furnace consecutively during an 8-hr period.

Ø 4.3.1 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.