

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

SAE AMS 4131B

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Superseding AMS 4131A

ALUMINUM ALLOY FORGINGS
5.6Zn - 2.5Mg - 1.6Cu - 0.23Cr (7075-T74)
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 hand forgings procured to inch/pound units.
- 1.2 Application: Primarily for parts requiring a combination of good 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 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 2350 - Standards and Test Methods
AMS 2355 - Quality Assurance Sampling and Testing of Aluminum Alloys and Magnesium Alloys, Wrought Products (Except Forging Stock) and Flash Welded Rings
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 for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM B594 - Ultrasonic Inspection of Aluminum-Alloy Products for Aerospace Applications

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

2.3.1 Military Specifications:

MIL-H-6088 - Heat Treatment of Aluminum Alloys

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 in accordance with AMS 2355:

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	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: Solution and precipitation heat treated in accordance with MIL-H-6088.

3.3 Properties: Forgings shall conform to the following requirements, determined in accordance with AMS 2355:

3.3.1 Tensile Properties: Shall be as follows:

3.3.1.1 Die Forgings:

- 3.3.1.1.1 With Grain Flow: Specimens, machined from forgings 6 in. and under in nominal thickness at time of heat treatment 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 forging flow lines, shall have the properties shown in Table I provided the as-forged thickness was 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 4D %, min
Up to 3, incl	76,000	66,000	7
Over 3 to 4, incl	73,000	63,000	7
Over 4 to 5, incl	70,000	61,000	7
Over 5 to 6, incl	68,000	58,000	7

- 3.3.1.1.2 Across Grain Flow: Specimens, machined from forgings 6 in. 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 deg from perpendicular to forging flow lines, shall have the properties shown in Table II provided the as-forged thickness was not more than twice the heat treated thickness. If configuration of the forging or prolongation cannot accommodate the transverse specimen described, acceptance of the forgings shall be based on testing as in 3.3.1.1.3.

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 3, incl	71,000	62,000	4
Over 3 to 4, incl	70,000	60,000	4
Over 4 to 5, incl	68,000	58,000	4
Over 5 to 6, incl	65,000	55,000	4

- 3.3.1.1.2.1 Elongation requirements shall not apply to specimens having a gage length diameter less than 0.250 in. or located in immediate proximity to an abrupt change in thickness or located so that any part of the specimen gage length is located within 1/8 in. of the trimmed flash line.

- 3.3.1.1.3 At Angle to Flow Lines: Specimens, machined from forgings 6 in. 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 more than 15 deg from parallel and also more than 15 deg from perpendicular to forging flow lines, shall have the properties shown in Table II. Such test results shall be identified as neither longitudinal nor transverse tensile results.

- 3.3.1.2 Hand Forgings: Specimens, machined from forgings having an essentially square or rectangular cross section, shall have the properties shown in Table III provided that the as-forged thickness does not exceed 6 inches.

TABLE III

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	73,000	63,000	9
	Long-Trans.	71,000	60,000	5
Over 2 to 3, incl	Longitudinal	73,000	63,000	9
	Long-Trans.	71,000	60,000	5
	Short-Trans.	69,000	60,000	4
Over 3 to 4, incl	Longitudinal	71,000	61,000	9
	Long-Trans.	70,000	58,000	5
	Short-Trans.	68,000	57,000	4
Over 4 to 5, incl	Longitudinal	68,000	57,000	8
	Long-Trans.	67,000	56,000	5
	Short-Trans.	66,000	55,000	4
Over 5 to 6, incl	Longitudinal	65,000	54,000	8
	Long-Trans.	64,000	52,000	5
	Short-Trans.	63,000	52,000	4

- 3.3.1.3 Special Purpose Forgings: Tensile property requirements for specimens cut from special purpose forgings or from forgings beyond the size and configuration limits of 3.3.1.1 and 3.3.1.2 shall be as specified on the drawing or as agreed upon by purchaser and vendor.

- 3.3.2 Hardness: Should be as follows but forgings shall not be rejected on the basis of hardness if the applicable tensile property requirements are met.

- 3.3.2.1 Die Forgings and Hand Forgings 3 In. and Under in Nominal Thickness:
Not lower than 135 HB/10/500 or 140 HB/10/1000.

- 3.3.2.2 Die Forgings and Hand Forgings Over 3 In. in Nominal Thickness: As agreed upon by purchaser and vendor.

- 3.3.3 Conductivity: Shall be as follows:

- 3.3.3.1 If the conductivity is 40% IACS (International Annealed Copper Standard) or higher and tensile properties meet specified requirements, forgings are acceptable.

- 3.3.3.2 If the conductivity is 38.0 - 39.9% IACS, incl, if tensile properties meet the specified requirements, and if the longitudinal yield strength does not exceed the specified minimum by more than 11,900 psi, forgings are acceptable.
- 3.3.3.3 If the conductivity is below 40.0% IACS and the longitudinal 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, forgings meet the requirements of 3.3.1 and 3.3.3.1 or 3.3.3.2, the forgings are acceptable.
- 3.3.3.4 If the conductivity is below 38.0% IACS, the forgings are not acceptable and shall be reprocessed regardless of tensile property level.
- 3.3.4 Stress-Corrosion Resistance: Specimens cut from forgings shall show no evidence of stress-corrosion cracking when stressed in the short-transverse direction (perpendicular to grain flow) to 35,000 psi for forgings 3 in. and under in nominal thickness and to 50% of the longitudinal (parallel to grain flow) yield strength for forgings over 3 in. in nominal thickness.
- 3.3.5 Grain Flow: Except in areas of die forgings which contain flash line end grain, grain flow shall follow the general contour of the forging, showing no evidence of re-entrant flow.
- 3.4 Quality: Forgings, 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 forgings.
- 3.4.1 Die forgings shall be subjected to a caustic etch followed by visual examination of the forging surfaces for defect indications such as seams, laps, bursts, and quench cracks. Surface imperfections which can be removed so they do not reappear on re-etching and the required section thickness can be maintained are acceptable.
- 3.4.2 All forgings shall be subjected to ultrasonic inspection in accordance with ASTM B594 and shall meet the following ultrasonic classes:
- 3.4.2.1 Die Forgings 0.50 to 4.00 In., Incl, in Nominal Thickness and Weighing not Over 300 Lb: Class B.
- 3.4.2.2 Hand Forgings 1.00 to 6.00 In., Incl., in Nominal Thickness and Weighing not Over 600 Lb: Class A.
- 3.4.2.3 Acceptance criteria for forgings exceeding the limits of 3.4.2.1 or 3.4.2.2 shall be as agreed upon by purchaser and vendor.
- 3.4.3 When specified, all forgings shall be subjected to fluorescent penetrant inspection in accordance with AMS 2645. Acceptance standards shall be as agreed upon by purchaser and vendor.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of forgings 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 forgings conform to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to requirements for composition (3.1), tensile properties (3.3.1), conductivity (3.3.3), surface visual examination (3.4.1), ultrasonic inspection (3.4.2), and, when specified, fluorescent penetrant inspection (3.4.3) are classified as acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Tests to determine conformance to requirements for hardness (3.3.2) and stress-corrosion resistance (3.3.4) and for grain flow of die forgings (3.3.5) 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 to determine conformance to all 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, 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, 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 in accordance with AMS 2355 and the following:

4.3.1 Surface Imperfections (3.4.1), Ultrasonic Inspection (3.4.2), and, When Specified, Fluorescent Penetrant Inspection (3.4.3): All forgings:

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

4.5 Reports: