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400 Commonwealth Dr., Warrendale, PA 15096

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

AMS 4148B

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Superseding AMS 4148A

ALUMINUM ALLOY DIE FORGINGS
5.6Zn - 2.5Mg - 1.6Cu - 0.23Cr (7175-T66)
Solution and Precipitation Heat Treated

UNS A97175

1. SCOPE:

1.1 Form: This specification covers an aluminum alloy in the form of die forgings.

1.2 Application: Primarily for parts requiring a high level of mechanical properties. Certain design and processing procedures may cause these forgings to become susceptible to stress-corrosion cracking; ARP 823 recommends practices to minimize such conditions.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications and Aerospace Recommended Practices 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
MAM 2355 - Quality Assurance Sampling and Testing of Aluminum Alloys and Magnesium Alloys, Wrought Products (Except Forging Stock) and Flash Welded Rings, Metric (SI) Units
AMS 2375 - Control of Forgings Requiring First-Article Approval
AMS 2645 - Fluorescent Penetrant Inspection
AMS 2808 - Identification, Forgings

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2.1.2 Aerospace Recommended Practices:

ARP 823 - Minimizing Stress Corrosion Cracking in Wrought Heat Treatable Aluminum Alloy Products

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

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, Ø determined in accordance with AMS 2355 or MAM 2355:

	min	max
Zinc	5.1	6.1
Magnesium	2.1	2.9
Copper	1.2	2.0
Chromium	0.18	0.28
Iron	--	0.20
Silicon	--	0.15
Manganese	--	0.10
Titanium	--	0.10
Other Impurities, each	--	0.05
Other Impurities, total	--	0.15
Aluminum	remainder	

3.2 Condition: Solution and precipitation heat treated (See 8.2); furnace Ø surveys and calibration of temperature controllers and recorders shall be in accordance with MIL-H-6088.

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

3.3.1 Tensile Properties: Shall be as follows:

3.3.1.1 With Grain Flow: Specimens, machined from forgings 3 in. (75 mm) and under in nominal thickness or from prolongations on such forgings, with the axis of specimen in the area of gage length varying not more than 15 deg from parallel to the forging flow lines shall have the following properties:

Tensile Strength, min	86,000 psi (595 MPa)
Yield Strength at 0.2% Offset, min	76,000 psi (525 MPa)
Elongation in 2 in. (50 mm) or 4D, min	7%

3.3.1.2 Across Grain Flow: Specimens, machined from forgings 3 in. (75 mm) and under in nominal thickness or from prolongations on such forgings, with the axis of specimen in the area of gage length varying not more than 15 deg from perpendicular to the forging flow lines shall have the following properties. If the configuration of the forging or prolongation cannot accommodate the transverse specimen described, acceptance of the forgings shall be based on testing as in 3.3.1.3.

Tensile Strength, min	77,000 psi (530 MPa)
Yield Strength at 0.2% Offset, min	66,000 psi (455 MPa)
Elongation in 2 in. (50 mm) or 4D, min	4%

3.3.1.3 At Angle to Grain Flow: Specimen, machined from forgings 3 in. (75 mm) and under in nominal thickness or from prolongations on such forgings, with the 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 the forging flow lines, shall have the properties specified in 3.3.1.2. Such tests results shall be identified as neither longitudinal nor transverse tensile properties.

3.3.1.4 Tensile property requirements, with, across, and at an angle to the grain flow for forgings over 3 in. (75 mm) in nominal thickness shall be as agreed upon by purchaser and vendor.

3.3.1.5 Elongation requirements shall not apply to specimens having a gage length diameter less than 0.250 in. (6.25 mm), or located in immediate proximatiy to an abrupt change in section thickness, or located so that any part of the specimen gage length is located within 1/8 in. (3 mm) of the trimmed flash line.

3.3.2 Hardness: Should be not lower than 140 HB/10/500 or 145 HB/10/1000 but forgings shall not be rejected on the basis of hardness if the tensile property requirements are met.

3.3.3 Ø Grain flow in die forgings, except in areas which contain flash-line end grain, 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 Ø 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 that they do not reappear on re-etching and the required section thickness can be maintained are acceptable.

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

3.4.2.1 Forgings 0.500 to 4.000 in. (12.50 to 100.00 mm), incl, in nominal thickness and weighing not over 300 lb (135 kg) shall meet Class B.

3.4.2.2 Acceptance criteria for forgings exceeding the limits of 3.4.2.1 shall be as agreed upon by purchaser and vendor.

3.4.3 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.

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 Ø Acceptance Tests: Tests to determine conformance to requirements for composition (3.1), tensile properties (3.3.1), hardness (3.3.2), surface visual examination (3.4.1), and, when specified, ultrasonic inspection (3.4.2) and fluorescent penetrant inspection (3.4.3) are classified as acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Tests of forgings to determine conformance to requirements for grain flow (3.3.3) 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 Ø 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 approval 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.