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AEROSPACE MATERIAL SPECIFICATION

AMS 4141C
Superseding AMS 4141B

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UNS A97075

ALUMINUM ALLOY DIE FORGINGS
5.6Zn - 2.5Mg - 1.6Cu - 0.23Cr (7075-T73)
Solution and Precipitation Heat Treated

1. SCOPE:

1.1 Form: This specification covers an aluminum alloy in the form of die forgings and forging stock ordered to inch/pound units.

1.2 Applications: Primarily for parts requiring good resistance to stress-corrosion cracking but with lower strength than AMS 4139.

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 Drawn
AMS 2350 - Standards and Test Methods
AMS 2375 - Control of Forgings Requiring First Article Approval
AMS 2630 - Ultrasonic Inspection
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 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 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

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	5.1	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: The product shall be supplied in the following condition:

3.2.1 Forgings: Solution and precipitation heat treated 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:

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 6 in. and under in nominal thickness at time of heat treatment or from prolongations on such forgings, with the axis of the specimen in the area of the gage length varying not more than 15 deg from parallel to the forging flow lines, shall have properties specified in Table I provided the as-forged thickness is 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 2 in. or 4D %, min
Up to 3, incl	66,000	56,000	7
Over 3 to 4, incl	64,000	55,000	7
Over 4 to 5, incl	62,000	53,000	7
Over 5 to 6, incl	61,000	51,000	6

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 the axis of the specimen in the area of gage length varying not more than 15 deg from perpendicular to the forging flow lines, shall have properties as specified in Table II provided the as-forged thickness is not more than twice the heat treated thickness.

TABLE II

Nominal Thickness at Time of Heat Treatment Inches	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 2 in. or 4D %, min
Up to 3, incl	62,000	53,000	3
Over 3 to 4, incl	61,000	52,000	2
Over 4 to 5, incl	59,000	51,000	2
Over 5 to 6, incl	58,000	50,000	2

3.3.1.1.3 Tensile property requirements for specimens cut from forgings over 6 in. in nominal thickness at time of heat treatment shall be as specified on the drawing or as agreed upon by purchaser and vendor.

3.3.1.2 Hardness: Should be not lower than 125 HB/10/500 or 130 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 Conductivity: Shall be as follows, determined in accordance with ASTM B342 on the surface of the sample:

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

3.3.1.3.2 If the conductivity is 38.0 - 39.9% IACS, incl, if the tensile properties meet specified requirements, and if the yield strength parallel to grain flow does not exceed the specified minimum by more than 11,900 psi, the forgings are acceptable.

3.3.1.3.3 If the conductivity is below 40% IACS and the yield strength parallel to grain flow exceeds the specified minimum by more than 11,900 psi, the forgings are suspect.

3.3.1.3.3.1 When forgings are suspect, they may be reprocessed or a sample of the forgings may be treated for not less than 30 min. at 870°F ± 10 and quenched in cold water. Conductivity shall be measured within 15 min. of quenching. If the difference between this measurement and the original measurement on the forgings is 6% IACS or more, the forgings are acceptable. If the difference is less than 6% IACS, the forgings shall be reprocessed.

3.3.1.3.4 If the conductivity is below 38% IACS, the forgings are not acceptable and shall be reprocessed regardless of tensile property level.

3.3.1.4 Stress-Corrosion Resistance: Specimens, cut from forgings 0.750 in. and over in nominal thickness and processed to meet the requirements of Ø 3.3.1.1 and 3.3.1.3 and stressed in the short-transverse (perpendicular to grain flow) direction to 75% of the specified minimum longitudinal (parallel to grain flow) yield strength and held at constant strain, shall meet the requirements of ASTM G47.

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, tensile specimens taken from the heat treated coupon shall conform to the requirements of 3.3.1.1.1 and 3.3.1.4. If specimens taken from the stock after heat treatment in the same manner as forgings conform to the requirements of 3.3.1.1.1 and 3.3.1.4, 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 and/or to ultrasonic inspection in Ø accordance with AMS 2630. Standards for acceptance shall be as agreed upon by purchaser and vendor. If ultrasonic inspection standards are not agreed upon by purchaser and vendor, forgings 0.500 to 4.00 in., incl, in nominal section thickness and weighing not over 300 lb shall meet Class B requirements of AMS 2630.

3.5 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 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.

4.2.1.2 Tensile properties (3.3.1.1) and conductivity (3.3.1.3) 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 hardness (3.3.1.2) and stress-corrosion resistance (3.3.1.4) and of forging stock to determine ability to develop required properties (3.3.2) Ø 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 specified are classified as preproduction tests and shall be performed Ø on the first-article shipment of a forging to a purchaser, when a change in material and/or processing 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 nominal cross-section and configuration heat treated in the same batch-furnace load or quenched from a continuous furnace consecutively during an 8-hr period. For forgings heat treated in a continuous furnace, the maximum lot size shall be 6000 lb of forgings.

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 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 or less of material comprising a lot except that not more than one analysis shall be required per piece.

4.3.1.2 Tensile Properties and Conductivity: At least one longitudinal and one short-transverse tensile specimen shall be cut from a forging, or a prolongation of a forging, representing each lot; conductivity shall be determined on the longitudinal tensile specimen blank prior to final machining.

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

4.3.2.1 Stress-Corrosion: Specimens not less than 0.750 in. cube, shall be cut from a forging, when size permits, so that the axis of the specimen varies not more than 15 deg from perpendicular to the forging flow lines. One specimen shall be cut each month representing each combination of forging thickness range and precipitation heat treatment furnace used during the month.

4.3.3 For Preproduction Tests: Shall be 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: