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

AEROSPACE MATERIAL SPECIFICATION

AMS 4141A
Superseding 4141

Issued 3-15-66
Revised 6-15-75

UNS A97075

ALUMINUM ALLOY DIE FORGINGS
5.6Zn - 2.5Mg - 1.6Cu - 0.26Cr (7075-T73)

1. SCOPE:

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

1.2 Application: 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 Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, Pennsylvania 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 for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 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

2.3 Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 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

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	5.1	6.1
Magnesium	2.1	2.9
Copper	1.2	2.0
Chromium	0.18	0.35
Iron	--	0.50
Silicon	--	0.40
Manganese	--	0.30
Titanium + Zirconium	--	0.25
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 Die Forgings: Solution and precipitation heat treated to develop the required mechanical properties, conductivity, and resistance to stress-corrosion cracking; heat treatment shall be 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 Die 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: Test specimens, machined from forgings not over 6 in. (152 mm) in thickness or from prolongations on such forgings, with the axis of the specimen in the area of the gage length within 15 deg (0.262 rad) of parallel to the forging flow lines, shall have the properties shown in Table I.

TABLE I

Nominal Thickness 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

TABLE I (SI)

Nominal Thickness Millimetres	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 50.8 mm or 4D %, min
Up to 76, incl	455	386	7
Over 76 to 102, incl	441	379	7
Over 102 to 127, incl	427	365	7
Over 127 to 152, incl	421	352	6

3.3.1.1.2 Ø Across Grain Flow: Tensile specimens, machined from forgings not over 6 in. (152 mm) in thickness or from prolongation on such forgings, with the specimen axis deviating more than 15 deg (0.262 rad) from parallel to the forging flow lines, shall have the properties shown in Table II.

TABLE II

Nominal Thickness 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

TABLE II (SI)

Nominal Thickness Millimetres	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 50.8 mm or 4D %, min
Up to 76, incl	427	365	3
Over 76 to 102, incl	421	359	2
Over 102 to 127, incl	407	352	2
Over 127 to 152, incl	400	345	2

3.3.1.2 Ø Hardness: Should be not lower than 125 HB/10/500 or 125 HB/14.3/1000, or not lower than 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 Ø Conductivity: Shall be as follows, determined in accordance with ASTM B342 on each of the specimens of 4.3.2:

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

3.3.1.3.2 If the conductivity is 38 - 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 (82 MPa), 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 (82 MPa), the forgings are suspect.

3.3.1.3.3.1 When forgings are suspect, they may be subjected to additional precipitation heat treatment or a sample of the forgings may be solution heat treated for not less than 30 min. at 870°F ± 10 (465.6°C ± 5.6) and quenched in cold water. Conductivity shall be measured within 15 min. of quenching. If the difference between this measurement and the original measurement is 6% IACS or more, the forgings are satisfactory. 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 unsatisfactory and must be reprocessed regardless of mechanical property level.

3.3.1.4 Resistance to Stress-Corrosion Cracking: A test specimen, cut from a forging, shall show no evidence of stress-corrosion cracking when stressed in a direction perpendicular to flow lines to 75% of the Ø applicable minimum yield strength (parallel to flow lines), held at constant strain in a suitable fixture, and subjected to cyclic immersion for 30 days in a 3-1/2% solution of sodium chloride in accordance with Federal Test Method Standard No. 151, Method 823.

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 test specimens taken from the heat treated coupon shall conform to the requirements of Ø 3.3.1.1.1 and 3.3.1.4. If test 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 shall be uniform in quality and condition, clean, sound, and free from foreign materials and from internal and external imperfections detrimental to fabrication or to performance of parts.

3.4.1 When specified, forgings shall be subjected to fluorescent penetrant inspection in accordance with AMS Ø 2645 and/or to ultrasonic inspection in accordance with AMS 2630. Standards for acceptance shall be as agreed upon by purchaser and vendor.

3.5 Tolerances: Unless otherwise specified, tolerances for forging stock shall conform to all applicable Ø 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 Ø 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 assure 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 and Ø of forgings to determine conformance to tensile property (3.3.1) and conductivity (3.3.1.3) requirements are classified as acceptance or routine control tests.

4.2.2 Periodic Control Tests: Tests of forging stock to determine conformance to stress-corrosion resistance Ø (3.3.1.4) requirements are classified as periodic control tests.

4.2.3 Qualification Tests: Tests of forgings to determine conformance to hardness (3.3.1.2) and stress-corrosion Ø resistance (3.3.1.4) requirements and of forgings to determine ability to develop required properties (3.3.2) are classified as qualification tests.