

ALUMINUM ALLOY FORGINGS
5.6Zn - 2.5Mg - 1.6Cu - 0.25Cr (7075-T6)

This specification has been declared NONCURRENT by the Nonferrous Alloys Committee, Aerospace Materials Division, as of April 16, 1980. It is recommended that this specification not be specified for new designs.

This cover sheet should be attached to the "G" revision of subject specification.

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REAFFIRMED

10/9/85

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AEROSPACE MATERIAL SPECIFICATION

Society of Automotive Engineers, Inc.
TWO PENNSYLVANIA PLAZA, NEW YORK, N. Y. 10001

AMS 4139G

Superseding AMS 4139F

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ALUMINUM ALLOY FORGINGS 5.6Zn - 2.5Mg - 1.6Cu - 0.25Cr (7075-T6)

1. SCOPE:

- 1.1 Form: This specification covers an aluminum-base alloy in the form of die forgings, hand forgings, and forging stock.
- 1.2 Application: Primarily for structural applications requiring material with high strength in light to medium sections. Certain design and processing procedures may cause this material to be 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 (AMS) and Aerospace Recommended Practices (ARP) 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., Two Pennsylvania Plaza, New York, New York 10001.

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 2645 - Fluorescent Penetrant Inspection
AMS 2808 - Identification, Forgings

2.1.2 Aerospace Recommended Practices:

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

- 2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.

ASTM E8 - Tension Testing of Metallic Materials
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-I-8950 - Inspection, Ultrasonic, Wrought Metals

REAFFIRMED

10/91

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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	--	0.5
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 and Rolled Rings: Solution and precipitation heat treated.

3.2.2 Forging Stock: As ordered by the forging manufacturer.

3.3 Properties:

3.3.1 Tensile Properties: Shall be as follows; test specimens and testing procedures shall be in accordance with ASTM E8:

3.3.1.1 Die Forgings:

3.3.1.1.1 Test Specimens: Test specimens machined from separately forged coupons or from forging stock representing the forgings and in either case heat treated with the forgings, or machined from prolongations on heat treated die forgings shall conform to the following requirements:

Tensile Strength, min	75,000 psi (517MPa)
Yield Strength at 0.2% Offset, min	65,000 psi (448MPa)
Elongation in 2 in. (50.8 mm) or 4D, min	10%

3.3.1.1.2 Die Forgings, With Grain Flow: Test specimens machined from forgings not over 3 in. (76 mm) in thickness with the axis within 15 deg (0.262 rad) of parallel to the forging flow lines in the area of the gage length of the specimen shall conform to the requirements specified in 3.3.1.1.1 except that the elongation may be as low as 7.0%, unless otherwise agreed upon by purchaser and vendor.

3.3.1.1.3 Forgings, Across Grain Flow: Test specimens machined from forgings not over 3 in. (76 mm) in thickness with the axis more than 15 deg (0.262 rad) out of parallel to the forging flow lines shall conform to the following requirements:

Tensile Strength, min	71,000 psi (490MPa)
Yield Strength at 0.2% Offset, min	62,000 psi (427MPa)
Elongation in 2 in. (50.8 mm) or 4D, min	3%

3.3.1.1.3.1 The elongation requirement applies only to test specimens having a gage length diameter not less than 0.25 in. (6.4 mm) and cut so that the length of the specimen is in a plane parallel to the parting plane.

3.3.1.2 Hand Forgings:

3.3.1.2.1 Tensile Properties After Heat Treatment: Hand forgings 3 in. (76 mm) and under in thickness, and test coupons not more than 3 in. (76 mm) in thickness cut before heat treatment from larger hand forgings and then properly solution and precipitation heat treated, shall conform to the requirements shown in Table I, based on the cross-sectional area of the forging before machining. Tensile test specimens shall be taken substantially parallel to and perpendicular to the length of the hand forging in such a manner as to represent the center of the forging.

TABLE I

Ident. Class.	Cross Sectional Area Square Inches	Tensile Strength psi, min			Yield Strength at 0.2% Offset psi, min			Elongation in 2 in. or 4D % min		
		Long		Short	Long		Short	Long		Short
		Longi- tudinal	Trans- verse	Trans- verse	Longi- tudinal	Trans- verse	Trans- verse	Longi- tudinal	Trans- verse	Trans- verse
CL A	Up to 16, incl	75,000	73,000	70,000	63,000	61,000	61,000	9.0	4.0	2.0
CL B	Over 16 to 36, incl	73,000	71,000	68,000	60,000	59,000	59,000	7.0	3.0	2.0
CL C	Over 36 to 144, incl	71,000	69,000	66,000	59,000	57,000	57,000	4.0	2.0	1.0
CL D	Over 144 to 256, incl	70,000	67,000	64,000	58,000	56,000	56,000	4.0	2.0	1.0

TABLE I (SI)

Ident. Class.	Cross Sectional Area Sq. Centimeters	Tensile Strength MPa, min			Yield Strength at 0.2% Offset MPa, min			Elongation in 50.8mm or 4D % min		
		Long		Short	Long		Short	Long		Short
		Longi- tudinal	Trans- verse	Trans- verse	Longi- tudinal	Trans- verse	Trans- verse	Longi- tudinal	Trans- verse	Trans- verse
CL A	103 & under	517	503	483	434	421	421	9.0	4.0	2.0
CL B	Over 103 to 232, incl	503	490	469	414	407	407	7.0	3.0	2.0
CL C	Over 232 to 929, incl	490	476	455	407	393	393	4.0	2.0	1.0
CL D	Over 929 to 1591, incl	483	462	441	400	386	386	4.0	2.0	1.0

3.3.1.3 Special Purpose Forgings: Tensile specimens cut from special purpose forgings or from forgings beyond the size and configuration limits covered by this specification shall conform to the tensile property requirements specified on the drawing or agreed upon by purchaser and vendor.

3.3.1.4 Forging Stock: When a sample of stock is forged to a test coupon and heat treated in the same manner as forgings, a tensile specimen taken from the heat treated coupon shall have properties not lower than those specified in 3.3.1.1.1. If a test specimen taken from the stock after heat treatment in the same manner as forgings has properties not lower than those specified in 3.3.1.1.1, the test shall be accepted as equivalent to tests of a forged coupon.

- 3.3.2 Hardness: Forgings should have hardness not lower than 135 HB/10/500 or 135 HB/14.3/1000 or not lower than 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.
- 3.3.3 Grain Flow: Shall be as specified on the drawing or as agreed upon by purchaser and vendor.
- 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.
- 3.5 Penetrant Inspection: When specified, the forgings shall be subjected to 100% fluorescent penetrant inspection in accordance with AMS 2645.
- 3.6 Ultrasonic Inspection: When specified, the forgings shall be subjected to 100% ultrasonic inspection in accordance with MIL-I-8950. Unless otherwise specified, the acceptance limits shall be as specified for Class B, except that discontinuities in excess of those specified may be allowed, subject to the approval of the purchaser, if it is established that they will be removed by machining or that they are in non-critical areas.
- 3.7 Tolerances: Unless otherwise specified, tolerances for forging stock shall be in accordance with all applicable requirements of AMS 2201.
4. QUALITY ASSURANCE PROVISIONS:
- 4.1 Responsibility for Inspection: The vendor 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 assure that the product conforms to the requirements of this specification.
- 4.2 Classification of Tests:
- 4.2.1 Acceptance Tests: Tests of forgings to determine conformance to all technical requirements of this specification and of forging stock to determine conformance to composition (3.1) requirements of this specification are classified as acceptance or routine control tests.
- 4.2.2 Qualification Tests: Tests of forging stock to determine capability of developing the required properties (3.3.1.4) are classified as qualification or periodic control tests, but the vendor of forging stock shall not be required to perform such tests unless otherwise agreed upon by purchaser and vendor.
- 4.3 Sampling:
- 4.3.1 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 and analyzed to determine conformance to 3.1. Ingots not conforming to this specification shall be rejected. Complete ingot analysis records shall be available to the purchaser.
- 4.3.1.1 Unless compliance with 4.3.1 is established, an analysis shall be made for each 6000 lb (2724 kg) or less of material comprising the lot except that not more than one analysis shall be required per piece.
- 4.3.2 Tensile Properties:
- 4.3.2.1 Die Forgings: At least one separately forged coupon or one forging prolongation heat treated with each lot of forgings shall be tested to determine conformance to 3.3.1.1.1.
- 4.3.2.1.1 In lieu of a prolongation or separately forged coupon, at least one longitudinal and one transverse tensile test specimen shall be cut from one forging representing each lot to determine conformance to 3.3.1.1.2 and 3.3.1.1.3; the test specimens shall be cut from locations specified by the purchaser. A lot shall consist of all forgings of the same part number which are heat treated in the same batch furnace or charged into a continuous furnace consecutively during an 8 hr period.