

**AEROSPACE
MATERIAL
SPECIFICATION**

AMS 4138B

Issued AUG 1955
Noncurrent OCT 1980
Cancelled SEP 2006

Superseding AMS 4138A

Aluminum Alloy Forgings
4.3Zn - 3.3Mg - 0.60Cu - 0.20 Mn - 0.18Cr (7079-T6)

RATIONALE

AMS 4138B places this specification in cancelled status.

CANCELLATION NOTICE

This specification has been declared "CANCELLED" by the Aerospace Materials Division, SAE, as of September, 2006. By this action, this document will remain listed in the Numerical Section of the Index of Aerospace Material Specifications indicating that it has been "CANCELLED".

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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 medium to heavy 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

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	3.8	4.8
Magnesium	2.9	3.7
Copper	0.40	0.8
Manganese	0.10	0.30
Chromium	0.10	0.25
Iron	--	0.40
Silicon	--	0.30
Titanium	--	0.10
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	74,000 psi (510MPa)
Yield Strength at 0.2% Offset, min	64,000 psi (441MPa)
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 7 in. (178 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 Die Forgings, Across Grain Flow: Test specimens machined from forgings not over 7 in. (178 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	72,000 psi (496MPa)
Yield Strength at 0.2% Offset, min	61,000 psi (421MPa)
Elongation, in 2 in. (50.8 mm) or 4D, min	4%

3.3.1.1.3.1 The elongation requirement shall not apply to test specimens having a gage length diameter less than 0.25 in. (6.4 mm) or located in immediate proximity to an abrupt change in section thickness or located in such a way that any surface of the gage length has been prepared from material located within 1/8 in. (3.18 mm) of the trimmed flash line.

- 3.3.1.2 **Hand Forgings:** Tensile test specimens prepared as specified in 3.3.1.2.1 and 3.3.1.2.2 from hand forgings not greater than 72 sq in. (464 cm²) in cross-sectional area shall have tensile properties as specified in Table I; tensile test specimens taken from hand forgings over 72 sq in. (464 cm²) in cross-sectional area shall have tensile properties as agreed upon by purchaser and vendor. 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

Test Direction	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 2 in. or 4D %, min
Longitudinal	73,000	62,000	9
Long Transverse	70,000	60,000	6
Short Transverse	65,000	54,000	4

TABLE I (SI)

Test Direction	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 50.8 mm or 4D %, min
Longitudinal	503	427	9
Long Transverse	483	414	6
Short Transverse	448	372	4

- 3.3.1.2.1 **Forgings 7 In. (178 mm) and Under Thick:** Tensile test specimens shall be cut from the forging after proper solution and precipitation heat treatment.
- 3.3.1.2.2 **Forgings Over 7 In. (178 mm) Thick:** Coupons not over 7 in. (178 mm) thick shall be cut from the forging before heat treatment and then properly solution and precipitation heat treated. Tensile test specimens shall be cut from the heat treated coupons.
- 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 or 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.