

AEROSPACE MATERIAL SPECIFICATION

SAE

AMS-4162

**REV
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Superseding AMS-4162A

ALUMINUM ALLOY EXTRUSIONS

6.3Cu - 0.30Mn - 0.18Zr - 0.10V - 0.06Ti (2219-T8511)

Solution Treated, Stress Relief Stretched, Precipitation Heat Treated

UNS A92219

1. SCOPE:

- 1.1 Form: This specification covers an aluminum alloy in the form of extruded bars, rods, wire, shapes, and tubing.
- 1.2 Application: Primarily for structural parts requiring high strength up to 500°F (260°C). May be welded in the specified condition but properties are improved by reheat treatment after welding. Reheat treatment after welding, however, may reduce resistance to stress-corrosion cracking.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

- 2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

2.1.1 Aerospace Material Specifications:

AMS-2205 - Tolerances, Aluminum Alloy and Magnesium Alloy Extrusions
MAM-2205 - Tolerances, Metric, Aluminum Alloy and Magnesium Alloy Extrusions
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-2630 - Ultrasonic Inspection
AMS-2811 - Identification, Aluminum and Magnesium Alloy Wrought Products

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- 2.2 ASTM Publications: Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM B 117 - Salt Spray (Fog) Testing

ASTM B 660 - Packaging/Packing of Aluminum and Magnesium Products

- 2.3 U.S. Government Publications: Available from Naval Publications and Forms Center, Attn: NPODS, 5801 Tabor Avenue, Philadelphia, PA 19120-5099.

2.3.1 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 in accordance with AMS-2355 or MAM-2355:

	min	max
Copper	5.8	- 6.8
Manganese	0.20	- 0.40
Zirconium	0.10	- 0.25
Vanadium	0.05	- 0.15
Titanium	0.02	- 0.10
Iron	--	0.30
Silicon	--	0.20
Zinc	--	0.10
Magnesium	--	0.02
Other Impurities, each	--	0.05
Other Impurities, total	--	0.15
Aluminum	remainder	

- 3.2 Condition: Solution heat treated, stress relieved by stretching to produce a nominal permanent set of 1-1/2% but not less than 1% nor more than 3%, and precipitation heat treated. Heat treatments shall be performed in accordance with MIL-H-6088.

- 3.2.1 Extrusions, after stretching, may receive minor straightening of an amount necessary to meet the requirements of 3.5.

- 3.2.2 Extrusions shall be supplied with an as-extruded surface finish; light polishing to remove minor surface imperfections is permissible provided such imperfections can be removed within dimensional tolerances.

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

3.3.1 Tensile Properties: Shall be as follows for extrusions under 3.00 inches (76.2 mm) in nominal diameter or least thickness (bars, rods, wire, shapes) or nominal wall thickness (tubing) and 25 square inches (161 cm²) and under in cross-sectional area; tensile property requirements for extrusions 3.00 inches (76.2 mm) and over in nominal diameter or least thickness or over 25 square inches (161 cm²) in cross-sectional area shall be as agreed upon by purchaser and vendor:

3.3.1.1 Longitudinal:

Tensile Strength, minimum	58,000 psi (400 MPa)
Yield Strength at 0.2% Offset, minimum	42,000 psi (290 MPa)
Elongation in 2 Inches (50.8 mm) or 4D, minimum	6%

3.3.1.2 Long-Transverse:

Tensile Strength, minimum	56,000 psi (386 MPa)
Yield Strength at 0.2% Offset, minimum	39,000 psi (269 MPa)
Elongation in 2 Inches (50.8 mm) or 4D, minimum	4%

3.3.1.2.1 Long-transverse tensile requirements apply only to extrusions from which a test specimen not less than 2.50 inches (63.5 mm) in length can be taken.

3.3.2 Hardness: Should be not lower than 115 HB/10/500 or 122 HB/10/1000 but the extrusions shall not be rejected on the basis of hardness if the tensile property requirements are met.

3.3.3 Stress-Corrosion Resistance: Specimens cut from extrusions 0.750 inch (19.05 mm) and over in thickness and stressed in the short-transverse direction to 30,000 psi (207 MPa) shall show no evidence of stress corrosion cracking.

3.4 Quality: Extrusions, 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 extrusions.

3.4.1 When specified, extrusions shall be subjected to ultrasonic inspection in accordance with AMS-2630. Extrusions 0.500 inch (12.70 mm) and over in thickness, up to 600 pounds (273 kg) weight per piece, and having a minimum width-to-thickness ratio of 10 to 1 shall meet discontinuity Class B.

3.4.1.1 Ultrasonic inspection acceptance standards for extrusions that exceed the thickness, weight per piece, or width-to-thickness ratio limits of 3.4.1 shall be as agreed upon by purchaser and vendor.

3.5 Tolerances: Shall conform to all applicable requirements of AMS-2205 or MAM-2205 except that surface roughness tolerances shall be double those specified therein.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of extrusions shall supply all
 0 samples for vendor's tests and shall be responsible for performing all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the extrusions conform to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests for composition (3.1), longitudinal tensile properties (3.3.1.1), ultrasonic inspection when specified (3.4.1), and tolerances (3.5) are acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Tests for long-transverse tensile properties (3.3.1.2), hardness (3.3.2), and stress-corrosion resistance (3.3.3) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing: Shall be in accordance with AMS-2355 or MAM-2355.
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4.4 Reports: The vendor of extrusions shall furnish with each shipment a report stating that the extrusions conform to the technical requirements. This report shall include the purchase order number, lot number, AMS-4162B, size or section identification number, and quantity.

4.5 Resampling and Retesting: Shall be in accordance with AMS-2355 or MAM-2355.

5. PREPARATION FOR DELIVERY:

5.1 Identification: Shall be in accordance with AMS-2811.
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5.2 Packaging:

5.2.1 Extrusions shall be prepared for shipment in accordance with commercial
 0 practice and in compliance with applicable rules and regulations pertaining to the handling, packaging, and transportation of the product to ensure carrier acceptance and safe delivery.

5.2.2 For direct U.S. Military procurement, packaging shall be in accordance
 0 with ASTM B 660, Commercial Level, unless Level A is specified in the request for procurement.

6. ACKNOWLEDGMENT: A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.

7. REJECTIONS: Extrusions not conforming to this specification, or to modifications authorized by purchaser, will be subject to rejection.