



AEROSPACE MATERIAL SPECIFICATION

Society of Automotive Engineers, Inc.
485 LEXINGTON AVENUE, NEW YORK, N. Y. 10017

AMS 4162

Issued 5-1-68
Revised

ALUMINUM, ALLOY EXTRUSIONS 6.3Cu - 0.30Mn - 0.18Zr - 0.10V - 0.06Ti (2219-T8511) Stress Relief Stretched and Straightened

1. ACKNOWLEDGMENT: A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.
2. FORM: Bars, rods, tubing, and shapes.
3. APPLICATION: Primarily for structural machined parts requiring high strength at elevated temperature up to 500 F (260 C). May be welded in this condition, but properties are improved by reheat treatment after welding. Reheat treatment after welding may reduce resistance to stress corrosion cracking.
4. COMPOSITION:

	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	

5. CONDITION: Solution heat treated, stress-relieved by stretching, and precipitation heat treated.
 - 5.1 Unless otherwise specified, 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 the dimensional tolerances.
 - 5.2 Material shall be stretched in the solution treated condition to produce a nominal permanent set of 1-1/2% but not less than 1% nor more than 3%.
 - 5.3 Material may receive minor straightening after stretching of an amount necessary to meet the requirements of Section 8.
6. TECHNICAL REQUIREMENTS: The product shall conform to the following requirements; tensile properties shall be determined in accordance with the latest issue of AMS 2355.
 - 6.1 Longitudinal Tensile Properties: The following requirements apply to sections under 3.000 in. in diameter or thickness and not greater than 25 sq in. in cross-sectional area:

Tensile Strength, psi	58,000 min
Yield Strength at 0.2% Offset or at 0.0120 in.	
in 2 in. Extension Under Load (E = 10,500,000), psi	42,000 min
Elongation, % in 2 in. or 4D	6 min

- 6.1.1 For sizes other than those shown, tensile property requirements shall be as agreed upon by purchaser and vendor.
- 6.1.2 When a dispute occurs between purchaser and vendor over the yield strength values, yield strength determined by the offset method shall apply.

6.2 Long Transverse Tensile Properties: When tested, rods, bars, and shapes of sections under 3.000 in. in diameter or thickness and not greater than 25 sq in. in cross-sectional area shall be capable of meeting the following requirements:

Tensile Strength, psi	56,000 min
Yield Strength at 0.2% Offset or at 0.0116 in. in 2 in. Extension Under Load (E = 10,500,000), psi	39,000 min
Elongation, % in 2 in. or 4D	4 min

6.3 Hardness: Material should have hardness not lower than Brinell 115 using 500 kg load and 10 mm ball or 1000 kg load and 9/16 in. ball, or not lower than Brinell 122 using 1000 kg load and 10 mm ball, but shall not be rejected on the basis of hardness if the tensile property requirements are met.

6.4 Stress-Corrosion Cracking Test: Material shall be capable of showing no evidence of stress-corrosion cracking when subjected to the following test:

6.4.1 A suitable test specimen, cut from the material so that the axis of loading of the specimen is parallel to the short transverse direction of the material, shall be stressed to 30,000 psi and held at a constant strain in a suitable fixture. The stressed specimen shall be subjected to cyclic immersion for 30 days in a 3-1/2% solution of sodium chloride conforming to the purity and pH requirements of the issue of ASTM B117 listed in the latest issue of AMS 2350, and maintained at room temperature; each cycle shall consist of 10 min. immersion in the solution and 50 min. out of the solution. Specimens shall be dried prior to each immersion.

7. QUALITY: Material 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.

8. TOLERANCES: Unless otherwise specified, tolerances shall conform to all applicable requirements of the latest issue of AMS 2205.

9. REPORTS:

9.1 Unless otherwise specified, the vendor of the product shall furnish with each shipment three copies of a report stating that the product conforms to the chemical composition and technical requirements of this specification. This report shall include the purchase order number, material specification number, inspection lot number, size or section identification number, and quantity.

9.2 Unless otherwise specified, the vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number, contractor, or other direct supplier of material, part number, and quantity. When material for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of material to determine conformance to the requirements of this specification, and shall include in the report a statement that the material conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.

10. IDENTIFICATION: Unless otherwise specified, the product shall be identified as follows: