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

AEROSPACE MATERIAL SPECIFICATION

AMS 4163

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Revised

ALUMINUM ALLOY EXTRUSIONS
6.3Cu - 0.30Mn - 0.18Zr - 0.10V - 0.06Ti (2219-T3511)
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 temperatures up to 500 F (260 C), after proper precipitation heat treatment. May be welded. Certain design and fabricating procedures may cause this material to be susceptible to stress corrosion cracking; ARP 823 recommends practices to minimize such conditions.

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 and stress-relieved by stretching.

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 Tensile Properties: The following requirements apply to material in the sizes shown but having cross-sectional area not over 25 sq inches:

Nominal Diameter or Thickness, Inches	Tensile Strength psi, min	Yield Strength at 0.2% Offset or at Extension Indicated (E = 10,500,000) psi, min	Extension Under Load in. in 2 in.	Elongation % in 2 in. or 4D, min
Up to 0.499, incl	42,000	26,000	0.0090	14
Over 0.499 to 2.999, incl	45,000	27,000	0.0091	14

6.1.1 For sizes other than those shown above, the tensile properties 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 Hardness: Material should have hardness not lower than Brinell 77 using 500 kg load and 10 mm ball or 1000 kg load and 9/16 in. ball, or not lower than Brinell 82 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.

6.3 Properties After Precipitation Heat Treatment: Material after proper precipitation heat treatment shall conform to the following requirements:

6.3.1 Longitudinal Tensile Properties: The following requirements apply to material 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

6.3.2 Long Transverse Tensile Properties: When tested, rod, bar, 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

6.3.3 For sizes other than those shown, tensile property requirements shall be as agreed upon by purchaser and vendor.

6.3.4 When a dispute occurs between purchaser and vendor over yield strength values, yield strength determined by the offset method shall apply.

6.3.5 Stress-Corrosion Cracking Test: Material after proper precipitation heat treatment shall be capable of showing no stress-corrosion cracking when subjected to the following test:

6.3.5.1 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.