

# AEROSPACE MATERIAL SPECIFICATIONS

## AMS 4164c

SOCIETY OF AUTOMOTIVE ENGINEERS, Inc. 485 Lexington Ave., New York 17, N.Y.

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### ALUMINUM ALLOY EXTRUSIONS 4.4Cu - 1.5Mg - 0.60Mn (2024-T3510) Stress-Relief Stretched, Unstraightened

1. **ACKNOWLEDGMENT:** A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.
2. **FORM:** Bars, rods, shapes, and round tubing.
3. **APPLICATION:** Primarily for parts subject to excessive warpage during machining due to residual stresses, and for parts requiring good strength and whose fabrication does not involve welding. Certain design and processing 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	3.8	4.9
Magnesium	1.2	1.8
Manganese	0.30	0.9
Iron	--	0.50
Silicon	--	0.50
Zinc	--	0.25
Chromium	--	0.10
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 heat treated condition to produce a nominal permanent set of 1.5%, but not less than 1% nor more than 3%.
  - 5.3 Material shall receive no straightening after stretching.

Section 8.3 of the SAE Technical Board rules provides that: "All technical reports, including standards approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no agreement to adhere to any SAE standard or recommended practice, and no commitment to conform to or be guided by any technical report in formulating and issuing technical reports. The Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the reports are responsible for protecting themselves against liability for infringement of patents."

6. TECHNICAL REQUIREMENTS:

6.1 Tensile Properties:

6.1.1 Bars, Rods, and Shapes:

Nominal Diameter or Thickness, and Area Inches	Tensile Strength psi, min	Yield Strength at 0.2% Offset or at Extension Indicated (E = 10,500,000)		Elongation % in 2 in. or 4D min
		psi, min	Extension Under Load in. in 2 in.	
0.050 to 0.249, incl, all areas	57,000	42,000	0.0120	12
Over 0.249 to 0.749, incl, all areas	60,000	44,000	0.0124	12
Over 0.749 to 1.499, incl, all areas	65,000	46,000	0.0128	10
Over 1.499				
Area 25 sq in. and under	70,000	52,000	0.0139	10
Area over 25 to 32 sq in., incl	68,000	48,000	0.0131	8

6.1.1.1 For material of such thickness that a standard specimen cannot be taken, or for material thinner than 0.062 in., the test for elongation is not required.

6.1.1.2 The tensile property requirements shall be based on the thickness of the portion of the extrusion from which the tensile test specimens are taken. Specimens from sections over 1.5 in. in diameter or thickness shall be taken midway between center and surface.

6.1.2 Round Tubing:

Nominal Wall Thickness, and Area Inches	Tensile Strength psi, min	Yield Strength at 0.2% Offset or at Extension Indicated (E = 10,500,000)		Elongation % in 2 in. or 4D(a) min
		psi, min	Extension Under Load in. in 2 in.	
Up to 0.249 in., incl, all areas	57,000	42,000	0.0120	10
Over 0.249 to 0.749 in., incl, all areas	60,000	44,000	0.0124	10
∅ Over 0.749 to 1.499 in., incl, all areas	65,000	46,000	0.0128	10
Over 1.499 in.				
Area 25 sq in., incl, and under	70,000	48,000	0.0131	10
Area over 25 to 32 sq in., incl	68,000	46,000	0.0128	8

(a) Elongation of full section and cut-out sheet type specimens shall be measured on a 2 in. gage length; for cut-out round specimens, elongation shall be measured on a gage length of 4D where D represents diameter of specimen.