

AEROSPACE MATERIAL SPECIFICATIONS

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

AMS 4165c

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ALUMINUM ALLOY EXTRUSIONS 4.4Cu - 1.5Mg - 0.60Mn (2024-T3511) Stress-Relief Stretched and Straightened

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. May be welded using special techniques. 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 may receive minor straightening after stretching of an amount necessary to meet the requirements of Section 8.

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.