

AERONAUTICAL MATERIAL SPECIFICATIONS

AMS 4083D

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

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ALUMINUM ALLOY TUBING, HYDRAULIC, SEAMLESS, DRAWN
1Mg - 0.6Si - 0.25Cu - 0.25Cr (6061-T6)

1. ACKNOWLEDGMENT: A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.
2. APPLICATION: Primarily for parts and assemblies, operating under high pressure, such as hydraulic systems, fuel and oil lines, where high quality is required.

3. COMPOSITION:

| | | |
|-------------------------|------|-----------|
| Magnesium | 0.8 | - 1.2 |
| Silicon | 0.40 | - 0.8 |
| Copper | 0.15 | - 0.40 |
| Chromium | 0.15 | - 0.35 |
| Iron | 0.7 | max |
| Zinc | 0.25 | max |
| Manganese | 0.15 | max |
| Titanium | 0.15 | max |
| Other Impurities, each | 0.05 | max |
| Other Impurities, total | 0.15 | max |
| Aluminum | | remainder |

4. CONDITION: Solution and precipitation heat treated.

4.1 Unless otherwise specified, tubing shall be supplied unground.

5. TECHNICAL REQUIREMENTS:

5.1 Tensile Properties:

| Nominal Wall Thickness Inch | Tensile Strength psi, min | Yield Strength at 0.2% Offset or at Extension Indicated (E = 9,900,000) | | Elongation % in 2 in. min | |
|-----------------------------------|---------------------------------|--|--------------|---------------------------------|-----------------|
| | | psi, min | in. in 2 in. | Strip | Full Section |
| 0.025 to 0.049, incl | 42,000 | 35,000 | 0.0111 | 8 | 10 |
| Over 0.049 to 0.259, incl | 42,000 | 35,000 | 0.0111 | 10 | 12 |
| Over 0.259 to 0.500, incl | 42,000 | 35,000 | 0.0111 | 12 | 14 |

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

Section 7C 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 obligation to conform to or be guided by any technical report, in formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against liability for infringement of patents."

- 5.2 Hardness: Tubing should have hardness not lower than Rockwell B 50 or equivalent, but shall not be rejected on the basis of hardness if the tensile property requirements are met.
- 5.3 Flattening: Tubing having nominal wall thickness less than 10% of the nominal OD shall be capable of withstanding, without cracking, flattening sideways under a load applied gradually at room temperature until the outside dimension under load is equal to 8 times the nominal wall thickness.
- 5.3.1 If tubing does not pass the flattening test of 5.3, a section of the tube not less than 1/2 in. in length and embracing 1/3 to 1/2 the circumference of the tube shall be capable of withstanding, without cracking, bending at room temperature through an angle of 180 deg around a diameter equal to 4 times the nominal wall thickness of the tubing with axis of bend parallel to axis of tube and with inside of tube on inside of bend.
- 5.4 Flarability: Tubing with nominal OD of 0.375 in. and under shall be capable of being double-flared and tubing with nominal OD over 0.375 in. shall be capable of being single-flared without formation of cracks or other visible defects. Specimens for flaring may be cut from any portion of the tube, or an entire tube may be used as a specimen. The end of the specimen to be flared shall be cut square, with the cut end smooth and free from burrs, but not rounded except for sizes 0.375 in. and under. The specimen shall, at room temperature, be forced axially with steady pressure over a hardened and polished tapered steel pin having a 74 deg included angle, to produce a flare having the permanent expanded OD specified in the following table:

| Nominal OD Inches | Expanded OD Inches, min | Nominal OD Inches | Expanded OD Inches, min |
|----------------------|----------------------------|----------------------|----------------------------|
| 0.125 | 0.224 | 0.750 | 0.937 |
| 0.188 | 0.302 | 1.000 | 1.187 |
| 0.250 | 0.359 | 1.250 | 1.500 |
| 0.312 | 0.421 | 1.500 | 1.721 |
| 0.375 | 0.484 | 1.750 | 2.106 |
| 0.500 | 0.656 | 2.000 | 2.356 |
| 0.625 | 0.781 | | |

- 5.4.1 Tubing with intermediate nominal OD shall take the same percentage flare as that for the next larger OD.
- 5.4.2 Tubing with nominal OD greater than 2.00 in. or less than 0.125 in. shall have flarability as agreed upon by purchaser and vendor.
- 5.5 Hydraulic Strength: Each length of tubing shall be capable of withstanding an internal hydrostatic pressure (P), calculated according to the following formula, without developing leaks and without an increase in mean diameter of more than 0.2%:

$$P = \frac{1.9tS}{D-t}$$

5.5 (contd.)

Where:

P = Test pressure in psi.

t = Minimum wall thickness (nominal wall thickness minus maximum negative tolerance) in inches.

S = Yield strength from 5.1.

D = Nominal OD of tube in inches.

5.5.1 Mean diameter is the average of two diameters at right angles to each other in the same transverse plane; measurements before and after testing should be taken at substantially the same location.

6. QUALITY:

6.1 Tubing 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. A polished and etched cross-section of a tube shall show no evidence of cracks, seams, or folds when examined at a magnification of 100 diameters.

6.2 Cleanliness of Tubing: Tubing shall be free from grease or other foreign matter and shall have a good workmanlike finish. No metallic flakes or particles shall be collected by a clean white cloth when it is drawn through the length of the bore of a test sample. The presence of metallic flakes or particles on the cloth will be cause for rejection. Discoloration of the cloth, without the presence of flakes or grit, will not be cause for rejection.

7. TOLERANCES: Unless otherwise specified, tolerances shall conform to the latest issue of AMS 2203 as applicable and as specified below:

7.1 Diameter: Table 1, columns headed "Mean Diameter", and "Diameter at any Point" for Heat Treatable Alloys.

7.2 Wall Thickness: Table 11, columns headed "Mean Wall Thickness", and "Wall Thickness at any Point" for Heat Treatable Alloys.

8. REPORTS:

8.1 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, size, and quantity.

8.2 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.