AERONAUTICAL MATERIAL SPECIFICATION

Society of Automotive Engineers, Inc.
29 West 39th Street
New York City

AMS 4083C

Issued 11-1-48
Revised 2-15-53

ALUMINUM ALLOY TUBING, HYDRAULIC
1.0Mg - 0.6Si - 0.25Cu - 0.25Cr (61S-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 lines 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	0.20 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 OD Inch	Nominal Wall Thickness Inch	Tensile Strength psi, min	Yield Strength at 0.2% Offset or at Extension Indicated (E = 9,900,000) psi, min	Extension Under Load, in. in 2 in.	Elongation % in 2 in. min Full Tube	Elongation % in 2 in. min Strip
0.25 - 2, incl	0.049 and under	42,000	35,000	0.0111	10	8
0.25 - 2, incl	Over 0.049 - 0.259, incl	42,000	35,000	0.0111	12	10
0.25 - 2, incl	Over 0.259 - 0.500, incl	42,000	35,000	0.0111	14	12

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:

5.3.1 Tubing having nominal wall thickness less than 10% of the nominal outside diameter shall be capable of being flattened sideways under a gradually applied load, without cracking, to an outside dimension 8 times the nominal wall thickness, while under load.

5.3.1.1 If tubing does not pass the flattening test of 5.3.1, a section of the tubing not less than 1/2 in. in length and embracing 1/3 to 1/2 the circumference of the tube shall be capable of being bent around a mandrel having a diameter equal to 6 times the nominal wall thickness, without cracking, until the specimen encloses at least 180 degrees of the pin circumference. The test shall be made with the axis of bend parallel to the axis of the 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-degree included angle, to produce a flare having the permanent expanded OD specified in the following table:

Nominal OD Inch	Expanded OD Inch, min	Nominal OD Inch	Expanded OD Inch, 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
0.626	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. 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%:

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

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 defects 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. Diameter and wall thickness tolerances shall be as specified below:

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

7.2 Wall Thickness: Table II, 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 chemical composition and tensile properties of the product conform to the requirements specified. This report shall include the purchase order number, material specification number, size, and quantity. When material is government source inspected, reports will not be required.