SAE Aerospace
An SAE International Group

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 4071L

Issued MAY 1945
Revised MAR 2002
Reaffirmed OCT 2006

Superseding AMS 4071K

Aluminum Alloy, Drawn, Round, Seamless Hydraulic Tubing
2.5Mg - 0.25Cr (5052-0)
Annealed

(Composition similar to UNS A95052)

RATIONALE

This document has been reaffirmed to comply with the SAE 5-year Review policy.

1. SCOPE:

1.1 Form:

This specification covers an aluminum alloy in the form of drawn, round seamless tubing.

1.2 Application:

This tubing has been used typically for parts, such as hydraulic systems and fuel and oil lines, but usage is not limited to such applications.

2. APPLICABLE DOCUMENTS:

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been canceled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or www.sae.org.

AMS 2355	Quality Assurance Sampling and Testing, Aluminum Alloys and Magnesium Alloys, Wrought Products, Except Forging Stock, and Rolled, Forged, or Flash Welded Rings
MAM 2355	Quality Assurance Sampling and Testing, Aluminum Alloys and Magnesium Alloys, Wrought Products, Except Forging Stock, and Rolled, Forged, or Flash Welded Rings, Metric (SI) Units

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or www.astm.org.

ASTM E 215	Standardizing Equipment for Electromagnetic Testing of Seamless Aluminum-Alloy Tube
ASTM B 660	Packaging/Packing of Aluminum and Magnesium Products
ASTM B 666/B 666M	Identification of Aluminum and Magnesium Alloy Products

2.3 ANSI Publications:

Available from American National Standards Institute, Inc., 25 West 43rd Street, New York, NY 10036-8002.

ANSI H35.2	Dimensional Tolerances for Aluminum Mill Products
ANSI H35.2M	Dimensional Tolerances for Aluminum Mill Products (Metric)

3. TECHNICAL REQUIREMENTS:

3.1 Composition:

Shall conform to the percentages by weight shown in Table 1, determined in accordance with AMS 2355 or MAM 2355.

TABLE 1 - Composition

Element	min	max
Silicon	--	0.25
Iron	--	0.40
Copper	--	0.10
Manganese	--	0.10
Magnesium	2.2	2.8
Chromium	0.15	0.35
Zinc	--	0.10
Other Elements, each	--	0.05
Other Elements, total	--	0.15
Aluminum	remainder	

3.2 Condition:

Annealed.

3.2.1 Tubing shall be supplied unground with an as-drawn surface finish, unless otherwise specified.

3.3 Properties:

Tubing shall conform to the following requirements, determined in accordance with AMS 2355 or MAM 2355.

3.3.1 Tensile Properties: Shall be as shown in Table 2 for tubing having nominal wall thickness of 0.010 to 0.450 inch (0.25 to 11.43 mm), inclusive.

TABLE 2 - Tensile Properties

Property	Value
Tensile Strength	25.0 to 35.0 ksi (172 to 241 MPa)
Yield Strength at 0.2% Offset, min	10.0 ksi (68.9 MPa)

3.3.2 Flattening: Tubing having nominal wall thickness less than 10% of the nominal OD shall withstand, without cracking, flattening sideways under a load applied gradually at room temperature until the outside dimension under load is equal to three times the nominal wall thickness.

3.3.2.1 If tubing does not pass the flattening test of 3.3.2, a section of tube not less than 1/2 inch (12.7 mm) in length and embracing one-third to one-half the circumference of the tube shall withstand, without cracking, bending at room temperature through an angle of 180 degrees around a diameter equal to 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.

3.3.3 Flarability: Tubing with a nominal OD of 0.125 to 0.312 inch (3.18 to 7.92 mm) and wall thickness up to 0.035 inch (0.89 mm) and tubing with a nominal OD of 0.313 to 0.375 inch (7.95 to 9.52 mm) and nominal wall thickness not greater than 0.049 inch (1.24 mm) shall withstand being double-flared (See 8.3), and tubing with nominal OD over 0.375 inch (9.52 mm) shall withstand being single-flared without formation of cracks or other visible defects by being forced axially, at room temperature, with steady pressure over a hardened and polished tapered steel pin having a 74-degree included angle to produce a flare having a permanent expanded OD not less than specified in Table 3.

TABLE 3A - Minimum Flarability, Inch/Pound Units

Nominal OD Inch	Expanded OD Inch	Nominal OD Inches	Expanded OD Inches
0.125	0.224	1.000	1.187
0.188	0.302	1.250	1.500
0.250	0.359	1.500	1.721
0.312	0.421	1.750	2.106
0.375	0.484	2.000	2.356
0.500	0.656	2.500	2.856
0.625	0.781	3.000	3.356
0.750	0.937		

TABLE 3B - Minimum Flarability, SI Units

Nominal OD Millimeters	Expanded OD Millimeters	Nominal OD Millimeters	Expanded OD Millimeters
3.18	5.69	25.40	30.15
4.78	7.67	31.75	38.10
6.35	9.12	38.10	43.71
7.92	10.69	44.45	53.49
9.52	12.29	50.80	59.84
12.70	16.66	63.50	72.54
15.88	19.84	76.20	85.24
19.05	23.80		

3.3.3.1 Tubing with nominal OD between any two standard sizes shown in Table 3 shall take the same percentage flare as shown for the larger of the two sizes.

3.3.4 Hydraulic Strength: Tubing shall withstand an internal hydrostatic pressure (P), based on Equation 1, without developing leaks and without an increase in mean diameter of more than 0.2%:

$$P = S\frac{D^2 - d^2}{D^2 + d^2} \qquad \text{(Eq. 1)}$$

where:

S = Minimum Yield Strength (10.0 ksi (68.9 MPa))
D = Maximum OD (nominal OD plus tolerance)
d = Maximum ID (D minus twice the minimum wall thickness)

3.3.4.1 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.

3.4 Quality:

Tubing, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from internal and external imperfections detrimental to usage of the tubing.

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

3.4.2 Detrimental imperfections include, but are not limited to, cracks, splits, seams, inclusions, or severe cross-hatching (surface breaks) that cannot be removed by light hand-sanding, using 180 grit or finer sandpaper.

3.4.3 Leak Test: Each length of tubing shall be tested for leaks in accordance with either 3.4.3.1 or 3.4.3.2; the method of test shall be at the option of the vendor unless purchaser specifies the method of test.

3.4.3.1 Immersion Test: A tube, immersed in water or other suitable liquid while an air pressure of 250 psi (1724 kPa) is applied to the inside of the tube and held for not less than 5 seconds, shall show no leakage as indicated by bubbles in the immersion fluid.

3.4.3.2 Eddy Current Test: Secondary reference standards in accordance with ASTM E 215 shall be used to set threshold levels. Tubes exhibiting eddy current responses equivalent to or smaller than those obtained from the d_a holes are automatically acceptable. Tubes with responses equivalent to or greater than d_b holes are automatically not acceptable. Indications between the d_a and d_b hole sizes shall be reviewed by the cognizant authority for disposition.

3.5 Tolerances:

Shall conform to all applicable requirements of ANSI H35.2 or ANSI H35.2M.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of tubing shall supply all samples for vendor's tests and shall be responsible for the performance of all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the tubing conforms to the specified requirements.