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400 COMMONWEALTH DRIVE WARRENDALE PA 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 4071J
Superseding AMS 4071H

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ALUMINUM ALLOY TUBING, HYDRAULIC, SEAMLESS, DRAWN, ROUND
2.5Mg - 0.25Cr (5052-0)
Annealed

UNS A95052

1. SCOPE:

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

1.2 Application: Primarily for parts and assemblies, such as hydraulic systems and fuel and oil lines, operating at pressures up to 1500 psi (105 MPa).

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2203 - Tolerances, Aluminum Alloy Drawn Tubing
AMS 2350 - Standards and Test Methods
AMS 2355 - Quality Assurance Sampling and Testing of Aluminum-Base and Magnesium-Base Alloys, Wrought Products (Except Forgings and Forging Stock) and Flash Welded Rings

2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM E215 - Standardizing Equipment for Electromagnetic Testing of Seamless Aluminum-Alloy Tube

2.3 U.S. Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Military Specifications:

MIL-H-6088 - Heat Treatment of Aluminum Alloys

REAFFIRMED
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Printed in U.S.A.

2.3.2 Military Standards:

MIL-STD-649 - Aluminum and Magnesium Products, Preparation for Shipment and Storage

3. TECHNICAL REQUIREMENTS:

3.1 Composition: Shall conform to the following percentages by weight, determined in accordance with AMS 2355:

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

3.2 Condition: Annealed in accordance with MIL-H-6088.

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 except as specified in 3.4.2.2:

3.3.1 Tensile Properties: Shall be as follows for tubing having nominal wall thickness of 0.010 to 0.450 in. (0.25 to 11.25 mm), inclusive:

Tensile Strength	25,000 - 35,000 psi (170 - 240 MPa)
Yield Strength at 0.2% Offset, min	10,000 psi (70 MPa)

3.3.1.1 Tensile property requirements for tubing having nominal wall thickness under 0.010 in. (0.25 mm) or over 0.450 in. (11.25 mm) shall be as agreed upon by purchaser and vendor.

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 3 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 in. (12.5 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 deg 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: Specimens as in 4.3.1 from tubing with nominal OD of 0.375 in. (9.52 mm) and under shall withstand being double-flared and tubing with nominal OD over 0.375 in. (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 deg included angle to produce a flare having a permanent expanded OD not less than specified in Table I.

TABLE I

Nominal OD Inches	Expanded OD Inches	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 I (SI)

Nominal OD Millimetres	Expanded OD Millimetres	Nominal OD Millimetres	Expanded OD Millimetres
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 I shall take the same percentage flare as shown for the larger of the two sizes.

3.3.3.2 Flarability requirements for tubing having nominal OD under 0.125 in. (3.18 mm) or over 3.000 in. (76.20 mm) shall be as agreed upon by purchaser and vendor.

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

$$P = S \frac{D^2 - d^2}{D^2 + d^2}$$

where, S = Minimum Yield Strength (10,000 psi (70 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 Ø 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 Ø Immersion Test: A tube, immersed in water or other suitable liquid while an air pressure of 250 psig (1725 kPag) is applied to the inside of the tube and held for not less than 5 sec, shall show no leakage as indicated by bubbles in the immersion fluid.

3.4.3.2 Ø Eddy Current Test: Secondary reference standards in accordance with ASTM E215 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 acceptable. Tubes exhibiting eddy current responses equivalent to or greater than those obtained from the d_b holes in the reference standard are not acceptable.

3.5 Tolerances: Unless otherwise specified, tolerances shall conform to all applicable requirements of AMS 2203.

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 performing all Ø required tests. Results of such tests shall be reported to the purchaser as required by 4.4. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the tubing conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to requirements for Ø composition (3.1), tensile properties (3.3.1), leak test (3.4.3) and tolerances (3.5) are classified as acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Tests to determine conformance to requirements for flattening (3.3.2), flarability (3.3.3), and hydraulic strength (3.3.4) are classified as periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling: Shall be in accordance with AMS 2355 and the following:

4.3.1 Specimens for flarability test shall be full tubes or sections cut from tubes. The end of the specimen to be flared shall be cut square, with the cut end smooth and free from burrs but, except for sizes 0.375 in. (9.52 mm) and under, not rounded.

4.4 Reports:

4.4.1 The vendor of tubing shall furnish with each shipment three copies of a report stating that the tubing conforms to the chemical composition and other technical requirements of this specification. This report shall include the purchase order number, AMS 4071J, size, and quantity.

4.4.2 The vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, AMS 4071J, contractor or other direct supplier of tubing, part number, and quantity. When tubing for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of tubing to determine conformance to the requirements of this specification and shall include in the report either a statement that the tubing conforms or copies of laboratory reports showing the results of tests to determine conformance.

4.5 Resampling and Retesting: Shall be in accordance with AMS 2355.

5. PREPARATION FOR DELIVERY:

5.1 Identification: Tubing shall be identified as follows: