



<b>AEROSPACE MATERIAL SPECIFICATION</b>	<b>AMS4071™</b>	<b>REV. P</b>
	Issued 1945-05 Reaffirmed 2011-08 Revised 2023-05	
Superseding AMS4071N		
Aluminum Alloy, Drawn, Round, Seamless Hydraulic Tubing 2.5Mg - 0.25Cr (5052-O) Annealed (Composition similar to UNS A95052)		

### RATIONALE

AMS4071P results from a Five-Year Review and update of this specification with changes to prohibit unauthorized exceptions (3.3.1.1, 3.6, 4.4.1, 5.1.1, and 8.4), relocate definitions (2.4), update applicable documents (Section 2), sampling and testing for flarability (4.3.1), and ordering information (8.5), and allow the use of the immediate prior specification revision (8.3).

#### 1. SCOPE

##### 1.1 Form

This specification covers an aluminum alloy in the form of drawn, round seamless tubing having a wall thickness of 0.010 to 0.450 inch (0.25 to 11.43 mm), inclusive, and nominal outside diameters of 0.125 to 3.000 inch (3.18 to 76.2 mm), inclusive (see 8.5).

##### 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 cancelled and no superseding document has been specified, the last published issue of that document shall apply.

##### 2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), [www.sae.org](http://www.sae.org).

**AMS2355** Quality Assurance, Sampling and Testing, Aluminum Alloys and Magnesium Alloy, Wrought Products (Except Forging Stock), and Rolled, Forged, or Flash Welded Rings

**AS4330** Tubing, Flared, Standard Dimensions for, Design Standard

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<https://www.sae.org/standards/content/AMS4071P/>

AS33583 Tubing End, Double Flare, Standard Dimensions for

AS7766 Terms Used in Aerospace Metals Specifications

## 2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, [www.astm.org](http://www.astm.org).

ASTM B660 Packaging/Packing of Aluminum and Magnesium Products

ASTM B666/B666M Identification Marking of Aluminum and Magnesium Alloy Products

ASTM E215 Standardizing Equipment and Electromagnetic Examination of Seamless Aluminum-Alloy Tube

## 2.3 ANSI Publications

Copies of these documents are available online at <https://webstore.ansi.org/>.

ANSI H35.2 Dimensional Tolerances for Aluminum Mill Products

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

## 2.4 Definitions

Terms used in AMS are defined in AS7766.

2.4.1 A double flare is similar to a standard single flare except that the flare is folded back on itself such that the cut edge is inside the flare near the ID of the tube. Definitions and illustration of single flaring are shown in AS4330; double flaring is defined and illustrated in AS33583.

## 3. TECHNICAL REQUIREMENTS

### 3.1 Composition

Shall conform to the percentages by weight shown in Table 1, determined in accordance with AMS2355.

**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 AMS2355 on the mill produced size:

#### 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, minimum	10.0 ksi (68.9 MPa)

3.3.1.1 Mechanical property requirements for product outside of the ranges covered by 3.3.1 shall be agreed upon between the purchaser and producer and reported per 4.4.1 (see 8.5).

#### 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, 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 (see 2.4.1).

**Table 3A - Minimum flarability, inch/pound units**

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 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%.

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

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 the 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 detrimental imperfections 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. The requirements of 3.5 shall be met after any sanding.

### 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 producer unless the purchaser specifies the method of test (see 8.5).

#### 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 E215 shall be used to set threshold levels.

3.4.3.2.1 If Method A of ASTM E215 is used to establish secondary standards, tubes exhibiting eddy current responses smaller than those obtained from the db holes are acceptable. Tubes exhibiting eddy current responses equivalent to or greater than those obtained from the db holes in the reference standard are not acceptable.

3.4.3.2.2 If Method B of ASTM E215 is used to establish secondary standards, and the alarm level is set as specified in ASTM E215, Method B, tubes exhibiting eddy current responses which trigger the alarm are not acceptable.

3.4.3.2.3 Reference standard dimensions and acceptance criteria for tubes outside the dimensions specified in ASTM E215 shall be agreed upon between the purchaser and producer (see 8.5).

### 3.5 Tolerances

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

### 3.6 Exceptions

Any exceptions shall be authorized by the purchaser and reported as in 4.4.1.

## 4. QUALITY ASSURANCE PROVISIONS

### 4.1 Responsibility for Inspection

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

### 4.2 Classification of Tests

#### 4.2.1 Acceptance Tests

Composition (3.1), tensile properties (3.3.1), leak test (3.4.3), and tolerances (3.5) are acceptance tests and, except for composition, shall be performed on each inspection lot.

#### 4.2.2 Periodic Tests

Flattening (3.3.2), flarability (3.3.3), and hydraulic strength (3.3.4) are periodic tests and shall be performed at a frequency selected by the producer unless frequency of testing is specified by the purchaser.

### 4.3 Sampling and Testing

Shall be in accordance with AMS2355 and the following:

4.3.1 Specimens for flarability test shall be full tubes or sections cut from a tube. For sizes over 0.375 inch (9.52 mm) in nominal diameter, the end of the specimen to be single-flared shall be cut square, with the cut end smooth and free from burrs but not rounded. For sizes 0.375 inch (9.52 mm) and under in nominal diameter, the end of the specimen to be double-flared shall be cut square, with the cut smooth and free from burrs (see 3.3.3).

### 4.4 Reports

The producer of tubing shall furnish with each shipment a report stating that the tubing conforms to the composition and showing the numerical results of tests to determine conformance to the other acceptance test requirements. This report shall include the purchase order number, inspection lot number, AMS4071P, size, and quantity. The report shall also include the producer and the size of the mill product.