

AEROSPACE MATERIAL SPECIFICATION



AMS 4087G

Issued NOV 1945
Revised JUL 2000

Superseding AMS 4087F

Aluminum Alloy Tubing, Seamless, Drawn (2024-0) Reinstate Composition Annealed

UNS A92024

1. SCOPE:

1.1 Form:

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

1.2 Application:

Primarily for parts requiring a high-strength, non-weldable alloy. Parts are usually solution heat treated and aged before use.

2. APPLICABLE DOCUMENTS:

The issue of the following documents in effect on the date of the purchase order form 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.

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
AMS 2772	Heat Treatment of Aluminum Alloy Raw Materials

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2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM B 660 Packaging/Packing of Aluminum and Magnesium Product

ASTM B 666/B 666M Identification Marking of Aluminum Products

2.3 ANSI Publications:

Available from ANSI, 11 West 42nd 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	--	0.50
Iron	--	0.50
Copper	3.8	4.9
Manganese	0.30	0.9
Magnesium	1.2	1.8
Chromium	--	0.10
Zinc	--	0.25
Titanium	--	0.15
Other Elements, each	--	0.05
Other Elements, total	--	0.15
Aluminum	Remainder	

3.2 Condition:

Annealed.

3.3 Properties:

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

3.3.1 As Annealed:

3.3.1.1 Tensile Properties: Shall be as shown in Table 2 for tubing having nominal wall thickness of 0.18 to 0.500 inch (0.46 to 12.70 mm) inclusive.

TABLE 2 - As Annealed, Maximum Tensile Properties

Property	Value
Tensile Strength	32.0 ksi (221 MPa)
Yield Strength at 0.2% Offset	15.0 ksi (103 MPa)

3.3.1.2 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 the flattening factor shown in Table 3 times the nominal wall thickness.

TABLE 3 - Flattening Factor

Nominal Wall Thickness Inch	Nominal Wall Thickness Millimeters	Factor
Up to 0.049, incl	Up to 1.24, incl	3
Over 0.049	Over 1.24	4

3.3.1.2.1 Retesting Procedure: If tubing does not pass the flattening test of 3.3.1.2, a section of tube not less than 1/2 inch (12.7 mm) in length and including 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 bend factor shown in Table 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.

TABLE 4 - Bending Factor

Nominal Wall Thickness Inch	Nominal Wall Thickness Millimeters	Factor
Up to 0.049, incl	Up to 1.24, incl	1
Over 0.049	Over 1.24	2

- 3.3.1.3 Flarability: Tubing of 0.375 inch (9.52 mm) and under in nominal OD shall withstand double-flaring and tubing over 0.375 inch (9.52 mm) in nominal OD shall withstand single-flaring 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 5. (See 8.2.1.)

TABLE 5A - Flarability, Inch/Pound Units

Nominal OD Inch	Expanded OD Inch	Nominal OD Inches	Expanded OD Inches
0.125	0.200	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	2.500	2.856
		3.000	3.356

TABLE 5B - Flarability, SI Units

Nominal OD Millimeters	Expanded OD Millimeters	Nominal OD Millimeters	Expanded OD Millimeters
3.18	5.08	19.05	23.80
4.78	7.67	25.40	30.15
6.35	9.12	31.75	38.10
7.92	10.69	38.10	43.71
9.52	12.29	44.45	53.49
12.70	16.66	50.80	59.84
15.88	19.84	63.50	72.54
		76.20	85.24

- 3.3.1.3.1 Tubing with nominal OD between any two standard sizes shown in 3.3.1.3 shall take the same percentage flare as shown for the larger of the two sizes.

- 3.3.2 After Solution Heat Treatment and Aging: Tubing as received by purchaser, after solution heat treatment in accordance with AMS 2772 and aging for not less than 4 days at room temperature to the T42 Temper, shall have the following properties:

3.3.2.1 Tensile Properties: Shall be as specified in Table 6.

TABLE 6A - Minimum Tensile Properties, Inch/Pound Units

Nominal Wall Thickness Inch	Tensile Strength ksi	Yield Strength at 0.2% Offset ksi	Elongation in 2 Inches or 4D % Cut Out Specimen	Elongation in 2 Inches or 4D % Full Section Specimen
0.018 to 0.024, incl	64.0	40.0	--	10
Over 0.024 to 0.049, incl	64.0	40.0	10	12
Over 0.049 to 0.259, incl	64.0	40.0	10	14
Over 0.259 to 0.500, incl	64.0	40.0	12	16

TABLE 6B - Minimum Tensile Properties, SI Units

Nominal Wall Thickness Millimeters	Tensile Strength MPa	Yield Strength at 0.2% Offset MPa	Elongation in 50.8 mm or 4D % Cut Out Specimen	Elongation in 50.8 mm or 4D % Full Section Specimen
0.46 to 0.61, incl	441	276	--	10
Over 0.61 to 1.24, incl	441	276	10	12
Over 1.24 to 6.58, incl	441	276	10	14
Over 6.58 to 12.70, incl	441	276	12	16

3.4 Quality:

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

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

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.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Composition (3.1), tensile properties as annealed (3.3.1.1) and after solution heat treatment and aging (3.3.2.1), quality (3.4), and tolerances (3.5) are acceptance tests and, except for composition, shall be performed on each lot of tubing.

4.2.2 Periodic Tests: Tests for flattening (3.3.1.2) and flarability (3.3.1.3) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing:

Shall be in accordance with AMS 2355 or MAM 2355 and the following:

4.3.1 Specimens for flarability test (3.3.1.3) shall be full tubes or sections cut from a tube. 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 inch (9.52 mm) and under in nominal diameter, not rounded.

4.4 Reports:

The vendor of tubing shall furnish with each shipment a report stating that the tubing conforms to the chemical composition and tolerances (and NDT inspection, when required); and showing the numerical results of tests on each inspection lot to determine conformance to the other acceptance test requirements and periodic test requirements when performed. This report shall include the purchase order number, inspection lot number(s), AMS 4087G, size, and quantity. The report shall also identify the producer, the product form, and the size of the mill product.

4.5 Resampling and Retesting:

Shall be in accordance with AMS 2355 or MAM 2355.