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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS-4087 REV F

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Superseding AMS-4087E

Submitted for recognition as an American National Standard

ALUMINUM ALLOY TUBING, SEAMLESS, DRAWN
4.4Cu - 1.5Mg - 0.60Mn (2024-O)
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 following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

2.1.1 Aerospace Material Specifications:

AMS-2203 - Tolerances, Aluminum Alloy Drawn Tubing
MAM-2203 - Tolerances, Metric, Aluminum Alloy Drawn Tubing
AMS-2355 - Quality Assurance Sampling and Testing of Aluminum Alloys and Magnesium Alloys, Wrought Products (Except Forging Stock) and Flash Welded Rings
MAM-2355 - Quality Assurance Sampling and Testing of Aluminum Alloys and Magnesium Alloys, Wrought Products (Except Forging Stock) and Flash Welded Rings, Metric (SI) Units
AMS-2770 - Heat Treatment of Wrought Aluminum Alloy Parts
AMS-2811 - Identification, Aluminum and Magnesium Alloy Wrought Products

2.2 ASTM Publications: Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM B 660 - Packaging/Packing of Aluminum and Magnesium Products

3. TECHNICAL REQUIREMENTS:

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

	min	max
Copper	3.8	4.9
Magnesium	1.2	1.8
Manganese	0.30	0.9
Iron	--	0.50
Silicon	--	0.50
Zinc	--	0.25
Titanium	--	0.15
Chromium	--	0.10
Other Impurities, each	--	0.05
Other Impurities, 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.

3.3.1 As Annealed:

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

Tensile Strength, maximum	32,000 psi (221 MPa)
Yield Strength at 0.2% Offset, maximum	15,000 psi (103 MPa)

3.3.1.1.1 Tensile property requirements for tubing under 0.018 inch (0.46 mm) or over 0.500 inch (12.70 mm) in nominal wall thickness shall be as agreed upon by purchaser and vendor.

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 times the nominal wall thickness.

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

3.3.1.2.1 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 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.

Nominal Wall Thickness		Bend Factor
Inch	Millimetres	
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 1.

TABLE I

Nominal OD Inches	Expanded OD Inches	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 I (SI)

Nominal OD Millimetres	Expanded OD Millimetres	Nominal OD Millimetres	Expanded OD Millimetres
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.

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

3.3.2 After Solution Heat Treatment and Aging: Tubing as received by purchaser, after solution heat treatment in accordance with AMS-2770 and aging for not less than 4 days at room temperature, shall have the following properties:

3.3.2.1 Tensile Properties: Shall be as specified in Table II and 3.3.2.1.1.

TABLE II

Nominal Wall Thickness Inch	Tensile Strength psi, min	Yield Strength at 0.2% Offset psi, min	Elongation in 2 Inches or 4D %, min	
			Strip	Full Section
0.018 to 0.024, incl	64,000	40,000	--	10
Over 0.024 to 0.049, incl	64,000	40,000	10	12
Over 0.049 to 0.259, incl	64,000	40,000	10	14
Over 0.259 to 0.500, incl	64,000	40,000	12	16

TABLE II (SI)

Nominal Wall Thickness Millimetres	Tensile Strength MPa, min	Yield Strength at 0.2% Offset MPa, min	Elongation in 50.8 mm or 4D %, min	
			Strip	Full Section
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

3.3.2.1.1 Tensile property requirements for tubing under 0.018 inch (0.46 mm) or over 0.500 inch (12.70 mm) in nominal wall thickness shall be as agreed upon by purchaser and vendor.

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.