

**AEROSPACE
MATERIAL
SPECIFICATION**

MAM 2203

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Revised

**TOLERANCES, METRIC
Aluminum Alloy Drawn Tubing**

1. **SCOPE:** This specification covers established metric manufacturing tolerances applicable to aluminum alloy drawn tubing ordered to metric dimensions. These tolerances apply to all conditions, unless otherwise noted. The term "excl" applies only to the higher figure of the specified range.

2. **DIAMETER, WIDTH, OR DEPTH:**

2.1 **Round:**

TABLE I

Tolerance, Millimetres, Plus and Minus (See Note 2)
Diameter at Any Point (Ovality)
(See Note 3)

Specified OD or ID Millimetres (See Note 1)	Mean Diameter (See Note 4)	Non-Annealed and Non-Heat Treated Tube	Heat Treated Tube (See Note 5)	Annealed Tube
Up to 12.50, incl	0.08	0.08	0.16	0.48
Over 12.50 to 25.00, incl	0.10	0.10	0.20	0.60
Over 25.00 to 50.00, incl	0.13	0.13	0.25	0.75
Over 50.00 to 80.00, incl	0.15	0.15	0.30	0.90
Over 80.00 to 130.00, incl	0.20	0.20	0.41	1.20
Over 130.00 to 150.00, incl	0.25	0.25	0.50	1.50
Over 150.00 to 200.00, incl	0.38	0.38	0.76	2.25
Over 200.00 to 250.00, incl	0.50	0.50	1.00	3.00
Over 250.00 to 300.00, incl	0.64	0.64	1.25	3.75

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2.2 Square, Rectangular, Hexagonal, and Octagonal:

TABLE II

Specified Width or Depth Millimetres (See Note 1)	Tolerance, Millimetres, Plus and Minus (See Note 2)		
	At Corners		Not at Corners (See Notes 3 and 9)
	Square and Rectangular	Square, Hexagonal, and Octagonal	
Up to 12.50, incl	0.08	0.16	The tolerance for the width is the value in the preceding column for a dimension equal to the depth, and conversely, but in no case less than that for its own dimension at the corners (See Note 6).
Over 12.50 to 25.00, incl	0.10	0.20	
Over 25.00 to 50.00, incl	0.13	0.25	
Over 50.00 to 80.00, incl	0.15	0.30	
Over 80.00 to 130.00, incl	0.20	0.40	
Over 130.00 to 150.00, incl	0.25	0.50	
Over 150.00 to 200.00, incl	0.38	0.75	
Over 200.00 to 250.00, incl	0.50	1.00	
Over 250.00 to 300.00, incl	0.64	1.25	

2.3 Streamline, Oval, and Elliptical: The equivalent round diameter is the diameter of a circle having a circumference equal to the perimeter of the tube.

TABLE III

Equivalent Round Diameter Millimetres (See Note 1)	Tolerance, Millimetres			
	Major Axis		Minor Axis	
	Plus	Minus	Plus	Minus
Up to 70.00, incl	1.00	0.64	0.64	0.38
Over 70.00 to 110.00, incl	1.25	0.90	0.90	0.64
Over 110.00 to 150.00, incl	1.80	1.25	1.40	1.00
Over 150.00 to 200.00, incl	2.55	2.15	2.05	1.60
Over 200.00 to 250.00, incl	4.05	3.55	2.90	2.15

3. **WALL THICKNESS:** When the dimensions specified are outside and inside, rather than wall thickness itself, the allowable deviation at any point is $\pm 10\%$ of the mean wall thickness but not less than ± 0.08 millimetre.

TABLE IV

Tolerance, Millimetres, Plus and Minus (See Note 2)			
Wall Thickness at any Point From Specified Wall Thickness (Eccentricity)			
Specified Wall Thickness Millimetres (See Note 1)	Mean Wall Thickness from Specified Wall Thickness (See Note 7)	Round, Non-Heat Treatable (See Note 8)	Round, Heat Treatable; All Tubing Other Than Round; and All Coiled Tubing
Over 0.23 to 0.80, incl	0.05	0.05	
Over 0.80 to 1.20, incl	0.08	0.08	
Over 1.20 to 2.00, incl	0.10	0.10	
Over 2.00 to 3.20, incl	0.13	0.15	
Over 3.20 to 5.00, incl	0.15	0.20	
Over 5.00 to 8.00, incl	0.20	0.30	
Over 8.00 to 10.00, incl	0.38	0.50	
Over 10.00 to 12.50, incl	0.50	0.75	
			10% of specified wall thickness; 0.08 mm, min

4. **LENGTH:**

4.1 **Straight Tubing:**

TABLE V

Tolerance, Millimetres, Plus Only				
Length Ranges, Millimetres				
Specified OD, Width, or Major Axis Millimetres	Up to 5000, incl	Over 5,000 to 10,000, incl	Over 10,000 to 15,000, incl	Over 15,000
Up to 6.30, incl	7	10	13	--
Over 6.30 to 70.00, incl	4	7	10	25
Over 70.00 to 200.00, incl	6	9	11	25
Over 200.00	7	10	13	25

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4.2 Coiled Tubing:

TABLE VI

Specified OD or Width Millimetres	Tolerance, %, Plus and Minus Except as Indicated			
	Length Ranges, Millimetres			
	Up to 30,000, incl	Over 30,000 to 75,000, incl	Over 75,000 to 150,000, incl	Over 150,000
Up to 35.00, incl	-0, +5	10	15	20

5. STRAIGHTNESS:

5.1 Straight Tubing:

TABLE VII

Specified OD or Width Millimetres	Tolerance, Millimetres per metre (See Notes 9 and 10)	
	In total length or in any 300 mm or longer chord segment of total length	
Up to 9.50, excl	42	
9.50 to 150.00, excl	1	
150.00 and over	2	

6. FLATNESS:

6.1 Square, Rectangular, Hexagonal, and Octagonal:

TABLE VIII

Specified Width, Depth or Distance Between Parallel Sides Millimetres	Tolerance, Millimetres (See Note 12)
Up to 12.50, incl	0.08
Over 12.50 to 25.00, incl	0.10
Over 25.00 to 50.00, incl	0.13
Over 50.00 to 80.00, incl	0.15
Over 80.00 to 130.00, incl	0.20
Over 130.00 to 150.00, incl	0.25
Over 150.00 to 200.00, incl	0.38
Over 200.00 to 250.00, incl	0.50
Over 250.00 to 300.00, incl	0.64

7. TWIST:7.1 Square, Rectangular, Hexagonal, and Octagonal:

TABLE IX

Specified Width Millimetres	Tolerance, Degrees, (See Notes 9 and 10) In total length or in any 300 mm or longer chord segment of total length	
Up to 40.00, incl	3/m; 7 max	
Over 40.00 to 80.00, incl	1.5/m; 5 max	
Over 80.00	1/m; 3 max	

8. INSIDE AND OUTSIDE RADII:8.1 Square, Rectangular, Hexagonal, and Octagonal:

TABLE X

Specified Radius Millimetres (See Note 11)	Tolerance
Sharp Corners	+0.5 mm
Over 0.50 to 5.00, incl	+0.5 mm
Over 5.00	+10%

9. ANGULARITY:

9.1 Square, Rectangular, Hexagonal, and Octagonal: The allowable deviation from specified angle is ± 2 degrees.

10. SQUARENESS OF CUT ENDS: Ends shall not deviate from square by more than 1 degree.

11. SURFACE ROUGHNESS (See Note 9): Depth of surface roughness imperfections shall not exceed 10% of the specified (or nominal) wall thickness or 0.13 mm, whichever is smaller.

12. DENTS: Depths of dents shall not exceed twice the applicable ovality tolerance of Table I for the particular tubing size being measured, except for tubing having a wall thickness less than 2-1/2% of the OD in which case the following multipliers apply:

1/2%	to 1%,	excl	5.0 x tolerance
1%	to 1-1/2%,	excl	4.0 x tolerance
1-1/2%	to 2%,	excl	3.0 x tolerance
2%	to 2-1/2%,	excl	2.5 x tolerance