SAE The Engineering Society For Advancing Mobility Land Sea Air and Space®

400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

MAM 2223A

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Superseding MAM 2223

TOLERANCES, METRIC
Copper and Copper Alloy Seamless Tubing

1. SCOPE: This specification covers established metric manufacturing tolerances applicable to copper and copper alloy seamless tubing ordered to metric (SI) dimensions. These tolerances apply to all conditions, unless otherwise noted.

1.1 AMS 2223, specified in inch/pound units, is the equivalent to this MAM.

2. DIAMETER:
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TABLE I

Specified Diameter Millimetres	Tolerance Applies to	Mean Diameter Tolerance, Millimetre, Plus and Minus	
		Non-Refractory	Refractory
Up to 3, incl	ID	0.05	0.05
Up to 3, incl	OD	0.05	0.06
Over 3 to 16, incl	ID or OD	0.05	0.06
Over 16 to 25, incl	ID or OD	0.06	0.08
Over 25 to 50, incl	ID or OD	0.08	0.10
Over 50 to 75, incl	ID or OD	0.10	0.12
Over 75 to 100, incl	ID or OD	0.12	0.15
Over 100 to 125, incl	ID or OD	0.15	0.20
Over 125 to 150, incl	ID or OD	0.18	0.22
Over 150 to 200, incl	ID or OD	0.20	0.25
Over 200 to 250, incl	ID or OD	0.25	0.32

2.1 Out-of-roundness (difference between the major and minor diameters at any Ø one cross-section) of unannealed tubing in straight lengths shall be not greater than the following; when the tolerance is expressed as a percentage of a specified dimension, the tolerance so calculated shall be rounded to the nearest 0.025 mm to obtain the permissible tolerance:

Ratio of Specified Wall Thickness to Specified Diameter	Roundness Tolerance % of Specified Diameter
0.01 to 0.03, incl	1.5
Over 0.03 to 0.05, incl	1.0
Over 0.05 to 0.10, incl	0.8; 0.05 mm, minimum
Over 0.10	0.7; 0.05 mm, minimum

3. WALL THICKNESS: When the tolerance is expressed as a percentage of a specified dimension, the tolerance so calculated shall be rounded to the nearest 0.025 mm to obtain the permissible tolerance.

3.1 Round; Non-Refractory:
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TABLE II

Wall Tolerance, Millimetre, Plus and Minus
OD Ranges, Millimetres

Specified Wall Thickness Millimetres	0.80 to 3.0, incl	Over 3.0 to 16, incl	Over 16 to 25, incl	Over 25 to 50, incl	Over 50 to 100, incl	Over 100 to 180, incl	Over 180 to 250, incl
Up to 0.40, incl	0.05	0.03	0.04	0.05	--	--	--
0.40 to 0.60, incl	0.08	0.05	0.05	0.06	--	--	--
0.60 to 0.90, incl	0.08	0.06	0.06	0.08	0.10	--	--
0.90 to 1.5, incl	0.08	0.08	0.09	0.09	0.12	0.20	--
1.5 to 2.0, incl	--	0.09	0.10	0.10	0.15	0.20	0.25
2.0 to 3.0, incl	--	0.10	0.12	0.12	0.20	0.20	0.28
3.0 to 4.0, incl	--	0.12	0.15	0.15	0.20	0.25	0.30
4.0 to 5.5, incl	--	0.20	0.20	0.20	0.25	0.30	0.35
5.5 to 7.0, incl	--	--	0.25	0.25	0.30	0.35	0.40
7.0 to 10, incl	--	--	0.30	5%	5%	6%	6%
Over 10	--	--	--	5%	5%	6%	6%

3.2 Round; Refractory:
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TABLE III

Specified Wall Thickness Millimetres	Wall Tolerance, Millimetre, Plus and Minus OD Ranges, Millimetres						
	0.80 to 3.0, incl	Over 3.0 to 16, incl	Over 16 to 25, incl	Over 25 to 50, incl	Over 50 to 100, incl	Over 100 to 180, incl	Over 180 to 250, incl
Up to 0.40, incl	0.06	0.04	0.05	0.06	--	--	--
0.40 to 0.60, incl	0.10	0.06	0.06	0.08	--	--	--
0.60 to 0.90, incl	0.10	0.08	0.08	0.10	0.13	--	--
0.90 to 1.5, incl	0.10	0.10	0.11	0.11	0.16	0.23	--
1.5 to 2.0, incl	--	0.11	0.13	0.13	0.19	0.25	0.33
2.0 to 3.0, incl	--	0.13	0.16	0.16	0.23	0.28	0.35
3.0 to 4.0, incl	--	0.18	0.18	0.19	0.25	0.33	0.38
4.0 to 5.5, incl	--	--	0.23	0.25	0.33	0.38	0.45
5.5 to 7.0, incl	--	--	0.30	0.33	0.38	0.45	0.50
7.0 to 10, incl	--	--	--	0.38	0.45	0.50	0.56
Over 10	--	--	--	6%	6%	8%	8%

4. LENGTH:
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TABLE IV

Specified Diameter Millimetres	Length Tolerance, Millimetres, Plus Only						
	Straight Lengths, Millimetres					Coils, Millimetres	
	150 and Under	Over 150 to 600, incl	Over 600 to 2000, incl	Over 2000 to 4000, incl	Over 4000	15,000 and under	Over 15,000 to 30,000, incl
Up to 25, incl	0.80	1.5	2.5	6.0	12	300	600
Over 25 to 50, incl	1.5	2.5	3.0	6.0	12	300	600
Over 50 to 100, incl	1.6	2.4	3.1	6.2	12	--	--
Over 100	--	3.0	6.0	6.0	12		--

5. STRAIGHTNESS (Unannealed Straight Tubing 6.0 to 100 mm OD):
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TABLE V

Length Millimetres	Maximum Curvature (Depth of Arc) Millimetres
Over 1000 to 2000, incl	5.0
Over 2000 to 2500, incl	8.0
Over 2500 to 3000, incl	12
Over 3000	12 in any 3000 mm of total length