

**AEROSPACE
MATERIAL
SPECIFICATION**
AMS 2223E

Superseding AMS 2223D

 Issued 8-1-45
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TOLERANCES

Copper and Copper Alloy Seamless Tubing

1. **SCOPE:** This specification covers established inch/pound manufacturing tolerances applicable to copper and copper alloy seamless tubing ordered to inch/pound dimensions. These tolerances apply to all conditions, unless otherwise noted. The term "excl" is used to apply only to the higher figure of a specified range.

2. **DIAMETER:**

TABLE I

Nominal OD Inches	Tolerance Applies to	Mean Diameter Tolerance Inch, Plus and Minus	
		Non-refractory	Refractory
Up to 0.125, incl	ID	0.002	0.002
Up to 0.125, incl	OD	0.002	0.0025
Over 0.125 to 0.625, incl	ID or OD	0.002	0.0025
Over 0.625 to 1, incl	ID or OD	0.0025	0.003
Over 1 to 2, incl	ID or OD	0.003	0.004
Over 2 to 3, incl	ID or OD	0.004	0.005
Over 3 to 4, incl	ID or OD	0.005	0.006
Over 4 to 5, incl	ID or OD	0.006	0.008
Over 5 to 6, incl	ID or OD	0.007	0.009
Over 6 to 8, incl	ID or OD	0.008	0.010
Over 8 to 10, incl	ID or OD	0.010	0.013

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- 2.1 Cut-of-roundness (difference between the major and minor diameters at any one cross-section) of unannealed tubing in straight lengths shall be not greater than the following; if the tolerance is expressed as a percentage of a nominal dimension, the tolerance so calculated shall be rounded to the nearest 0.001 in. to obtain the permissible tolerance:

Ratio of Nominal Wall Thickness to Nominal OD	Roundness Tolerance % of Nominal OD
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; 0.002 in., min
Over 0.10	0.7; 0.002 in., min

3. WALL THICKNESS: When the tolerance is expressed as a percentage of a nominal dimension, the tolerance so calculated shall be rounded to the nearest 0.001 in. to obtain the permissible tolerance.

- 3.1 Round; Non-Refractory:

TABLE II

Nominal Wall Thickness Inch	Wall Tolerance, Inch, Plus and Minus OD Ranges, Inches						
	Over 0.031 to 0.125, incl	Over 0.125 to 0.625, incl	Over 0.625 to 1, incl	Over 1 to 2, incl	Over 2 to 4, incl	Over 4 to 7, incl	Over 7 to 10, incl
	0.002	0.001	0.0015	0.002	--	--	--
Up to 0.018, excl	0.002	0.001	0.0015	0.002	--	--	--
0.018 to 0.025, excl	0.003	0.002	0.002	0.0025	--	--	--
0.025 to 0.035, excl	0.003	0.0025	0.0025	0.003	0.004	--	--
0.035 to 0.058, excl	0.003	0.003	0.0035	0.0035	0.005	0.007	--
0.058 to 0.083, excl	--	0.0035	0.004	0.004	0.006	0.008	0.010
0.083 to 0.120, excl	--	0.004	0.005	0.005	0.007	0.009	0.011
0.120 to 0.165, excl	--	0.005	0.006	0.006	0.008	0.010	0.012
0.165 to 0.220, excl	--	0.007	0.0075	0.008	0.010	0.012	0.014
0.220 to 0.284, excl	--	--	0.009	0.010	0.012	0.014	0.016
0.284 to 0.380, excl	--	--	0.011	0.012	0.014	0.016	0.018
0.380 and over	--	--	--	5%	5%	6%	6%

3.2 Round; Refractory:

TABLE III

Nominal Wall Thickness Inch	Wall Tolerance, Inch, Plus and Minus OD Ranges, Inches						
	Over 0.031	Over 0.125	Over 0.625	Over 1	Over 2	Over 4	Over 7
	to 0.125, incl	to 0.625, incl	to 1, incl	to 2, incl	to 4, incl	to 7, incl	to 10, incl
Up to 0.018, excl	0.0025	0.0015	0.002	0.0025	--	--	--
0.018 to 0.025, excl	0.004	0.0025	0.0025	0.003	--	--	--
0.025 to 0.035, excl	0.004	0.003	0.003	0.004	0.005	--	--
0.035 to 0.058, excl	0.004	0.004	0.0045	0.0045	0.0065	0.009	--
0.058 to 0.083, excl	--	0.0045	0.005	0.005	0.0075	0.010	0.013
0.083 to 0.120, excl	--	0.005	0.0065	0.0065	0.009	0.011	0.014
0.120 to 0.165, excl	--	0.007	0.007	0.0075	0.010	0.013	0.015
0.165 to 0.220, excl	--	--	0.009	0.010	0.013	0.015	0.018
0.220 to 0.284, excl	--	--	0.012	0.013	0.015	0.018	0.020
0.284 to 0.380, excl	--	--	--	0.015	0.018	0.020	0.023
0.380 and over	--	--	--	6%	6%	8%	8%

4. LENGTH:

TABLE IV

Nominal OD Inches	Length Tolerance, Inch, Plus Only						
	Straight Lengths					Coils	
	6 in. and under	Over 6 in. to 2 ft, incl	Over 2 to 6 ft, incl	Over 6 to 14 ft, incl	Over 14 ft,	50 ft and under	Over 50 to 100 ft, incl
Up to 1, incl	1/32	1/16	3/32	1/4	1/2	12	24
Over 1 to 2, incl	1/16	3/32	1/8	1/4	1/2	12	24
Over 2 to 4, incl	1/16	3/32	1/8	1/4	1/2	--	--
Over 4	--	1/8	1/4	1/4	1/2	--	--