

AERONAUTICAL MATERIAL SPECIFICATION

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TOLERANCES Corrosion and Heat Resistant Steel Tubing

1. **PURPOSE:** To publish established manufacturing tolerances.
2. **APPLICATION:** Tolerances shown herein apply, unless otherwise agreed upon by purchaser and vendor. These tolerances apply to all conditions and are based on individual measurements, unless otherwise noted. The term "excl" is used to apply only to the higher figure of the specified range. Ovality is the difference between the maximum and minimum diameters of any one section of a tube.
3. **DIAMETER:**
 - 3.1 **Seamless Cold Finished:**

TABLE I

Nominal OD Inch	Nominal Wall Thickness Inch	Tolerance, Inch		
		Cold Drawn	Annealed or Solution Heat Treated(1)	
		OD Plus and Minus	Mean OD (2) Plus and Minus	Ovality
Under 0.500	Under 0.015	0.004	0.004	0.008
Under 0.500	0.015 and over	0.004	0.004	0.004
0.500 to 1.500, excl	Under 0.065	0.005	0.005	0.010
0.500 to 1.500, excl	0.065 and over	0.005	0.005	0.005
1.500 to 3.500, excl	Under 0.095	0.010	0.010	0.020
1.500 to 3.500, excl	0.095 and over	0.010	0.010	0.010
3.500 to 5.500, excl	Under 0.150	0.015	0.015	0.030
3.500 to 5.500, excl	0.150 and over	0.015	0.015	0.015
5.500 to 8.000, excl	Under 0.240	0.030	0.030	0.060
5.500 to 8.000, excl	0.240 and over	0.030	0.030	0.030

Notes: (1) Special Tolerance Tubing: Up to 1.500 in. OD, when special tolerance tubing is required by specification, drawing or purchase order, tolerances for cold drawn tubing shall apply.

(2) Mean diameter is the average of two measurements taken at right angles to each other.

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3.2 Seamless Hot Finished:

TABLE II

Nominal OD Inches	Nominal Wall Thickness Inch	OD Tolerance, Inch Plus and Minus
1.50 to 3.00, excl	Over 0.094	0.023
3.00 to 3.25, excl	Over 0.094	0.031
⊕ 3.25 to 5.50, excl	3% of OD or more	0.031
5.50 to 8.00, excl	3% of OD or more	0.047
8.00 to 10.75, incl	5% of OD or more	0.047
8.00 to 10.75, incl	Under 5% of OD	0.063

Note: When specified on the purchase order, OD tolerances in Tables I and II shall apply to the ID instead, but not to both ID and OD of the same lot of tubing.

3.3 Welded:

TABLE III

⊕ Nominal OD Inches	Nominal Wall Thickness Inch	Tolerance, Inch		
		OD Plus and Minus	ID Plus and Minus	Ovality
Over 0.625 to 0.875, incl	0.025 to 0.065, incl	0.004	0.006	0.007
Over 0.625 to 0.875, incl	Over 0.065 to 0.095, incl	0.004	0.006	0.005
Over 0.875 to 1.500, incl	0.025 to 0.058, incl	0.005	0.007	0.009
Over 0.875 to 1.500, incl	Over 0.058 to 0.134, incl	0.005	0.007	0.007
Over 1.500 to 2.000, incl	0.025 to 0.058, incl	0.006	0.008	0.010
Over 1.500 to 2.000, incl	Over 0.058 to 0.134, incl	0.006	0.008	0.008
Over 2.000 to 2.500, incl	0.032 to 0.072, incl	0.007	0.010	0.012
Over 2.000 to 2.500, incl	Over 0.072 to 0.134, incl	0.007	0.010	0.010
Over 2.500 to 3.000, incl	0.035 to 0.072, incl	0.010	0.012	0.018
Over 2.500 to 3.000, incl	Over 0.072 to 0.134, incl	0.010	0.012	0.015
Over 3.000 to 4.000, incl	0.049 to 0.083, incl	0.012	0.014	0.024
Over 3.000 to 4.000, incl	Over 0.083 to 0.134, incl	0.012	0.014	0.020
Over 4.000 to 5.000, incl	0.065 to 0.134, incl	0.016	0.020	0.030
Over 5.000 to 6.000, incl	0.065 to 0.134, incl	0.020	0.030	0.035

Notes: (1) For nominal OD 0.625 in. and under, diameter tolerances of seamless tubing apply.

(2) OD and ID tolerances shall not both apply to the same lot of tubing.

4. WALL THICKNESS:4.1 Seamless, Cold Finished:

4.1.1 Wall thickness of all tubes except those sizes in 4.1.2 shall not vary more than plus and minus 10%.

4.1.2 Wall thickness may vary plus and minus 12.5% for the following sizes:

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4.1.2.1 Wall thickness over 25% of the nominal OD.

4.1.2.2 Wall thickness over 1.25 inches.

4.2 Seamless, Hot Finished:

TABLE IV

Nominal Wall Thickness Inch	Wall Thickness Tolerance, % Plus and Minus
0.109 and under	16.5
Over 0.109 to 0.172, incl	15.0
Over 0.172 to 0.203, incl	14.0
Over 0.203	12.5

4.3 Welded:

TABLE V

Nominal Wall Thickness Inch	Wall Thickness Tolerance, Inch OD Ranges, Inches			
	Over 0.625 to 0.875, incl	Over 0.875 to 1.875, incl	Over 1.875 to 3.75, incl	Over 3.75 to 6.00, incl
0.025 and under	+0.000 -0.003	+0.002 -0.003		
Over 0.025 to 0.028, incl	+0.000 -0.003	+0.002 -0.003		
Over 0.028 to 0.032, incl	+0.002 -0.003	+0.003 -0.003	+0.004 -0.003	
Over 0.032 to 0.035, incl	+0.003 -0.003	+0.004 -0.003	+0.005 -0.003	+0.006 -0.003
Over 0.035 to 0.049, incl	+0.000 -0.006	+0.001 -0.006	+0.001 -0.007	+0.004 -0.007
Over 0.049 to 0.058, incl	+0.000 -0.006	+0.001 -0.006	+0.001 -0.007	+0.004 -0.007
Over 0.058 to 0.065, incl	+0.000 -0.006	+0.002 -0.006	+0.002 -0.006	+0.004 -0.007
Over 0.065 to 0.072, incl	+0.000 -0.006	+0.003 -0.006	+0.002 -0.007	+0.004 -0.007
Over 0.072 to 0.095, incl	+0.000 -0.006	+0.003 -0.006	+0.001 -0.008	+0.001 -0.010
Over 0.095 to 0.120, incl	+0.000 -0.006	+0.003 -0.006	+0.003 -0.008	+0.003 -0.010
Over 0.120 to 0.134, incl			+0.003 -0.008	+0.003 -0.010

Note: For nominal OD 0.625 in. and under, wall thickness tolerances of seamless tubing apply.