

TABLE 12.20 Diameter—Drawn Round Tube

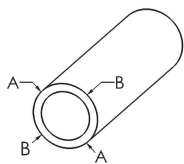
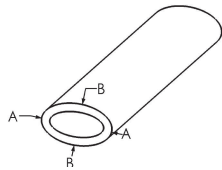
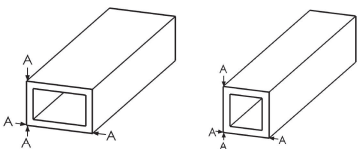
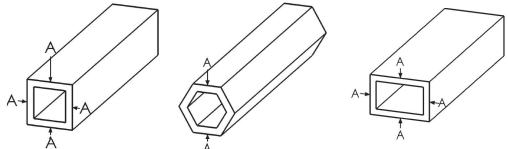
SPECIFIED DIAMETER in.	TOLERANCE—in. plus and minus			
	ALLOWABLE DEVIATION OF MEAN DIAMETER ③ FROM SPECIFIED DIAMETER (Size)  Difference between ½ (AA + BB) and specified diameter	ALLOWABLE DEVIATION OF DIAMETER AT ANY POINT FROM SPECIFIED DIAMETER ④  Difference between AA or BB and specified diameter		
		NON-ANNEALED AND NON-HEAT-TREATED TUBE	HEAT-TREATED TUBE ⑤	ANNEALED TUBE
Col. 1	Col. 2	Col. 3	Col. 4	Col. 5
Up thru 0.500	0.003	0.003	0.006	0.018
0.501–1.000	0.004	0.004	0.008	0.024
1.001–2.000	0.005	0.005	0.010	0.030
2.001–3.000	0.006	0.006	0.012	0.036
3.001–5.000	0.008	0.008	0.016	0.048
5.001–6.000	0.010	0.010	0.020	0.060
6.001–8.000	0.015	0.015	0.030	0.090
8.001–10.000	0.020	0.020	0.040	0.120
10.001–12.000	0.025	0.025	0.050	0.150

TABLE 12.21 Width and Depth—Drawn Square, Rectangular, Hexagonal and Octagonal Tube

SPECIFIED WIDTH OR DEPTH ① in.	TOLERANCE—in. plus and minus		
	ALLOWABLE DEVIATION OF WIDTH OR DEPTH AT CORNERS FROM SPECIFIED WIDTH OR DEPTH  Difference between AA and specified width or depth	ALLOWABLE DEVIATION OF WIDTH OR DEPTH NOT AT CORNERS FROM SPECIFIED WIDTH OR DEPTH ④ ⑦  Difference between AA and specified width, depth, or distance across flats	
		SQUARE, RECTANGULAR	SQUARE, HEXAGONAL, OCTAGONAL	RECTANGULAR
Col. 1	Col. 2	Col. 3	Col. 4
Up thru 0.500	0.003	0.006	The tolerance for the width is the value in Col. 3 for the dimension equal to the depth, and conversely, but in no case is the tolerance less than at the corners. ⑥
0.501–1.000	0.004	0.008	
1.001–2.000	0.005	0.010	
2.001–3.000	0.006	0.012	
3.001–5.000	0.008	0.016	
5.001–6.000	0.010	0.020	
6.001–8.000	0.015	0.030	
8.001–10.000	0.020	0.040	
10.001–12.000	0.025	0.050	

Footnotes for Tables 12.20 and 12.21

- ① When outside diameter, inside diameter, and wall thickness (or their equivalent dimensions in other than round tube) are all specified, standard tolerances are applicable to any two of these dimensions, but not to all three. When both outside and inside diameters or inside diameter and wall thickness are specified, the tolerance applicable to the specified or calculated O.D. dimension shall also apply to the I.D. dimension.
- ② Footnote is inactive.
- ③ Mean diameter is the average of two diameter measurements taken at right angles to each other at the same longitudinal location on the tube.
- ④ Not applicable to coiled tube or tube having a wall thickness less than 2½ percent of the specified outside diameter. The tolerance for tube with wall thick-

- ness less than 2½ percent of the specified outside diameter is determined by multiplying the applicable tolerance in columns 3 thru 5 as follows:
 2% to 2½% exclusive—1.5 × tolerance
 1½% to 2% exclusive—2.0 × tolerance
 1% to 1½% exclusive—3.0 × tolerance
 ½% to 1% exclusive—4.0 × tolerance
- ⑤ For the T8 tempers of 6063 the tolerance in Column 3 apply.
- ⑥ Example: The width tolerance of 1 × 3 inch rectangular tube is plus and minus 0.008 inch, and the depth tolerance is plus and minus 0.012 in.
- ⑦ Not applicable to annealed (O temper) tube.

TABLE 12.22 Diameter - Drawn Oval, Elliptical and Streamline Tube

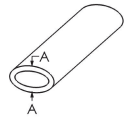
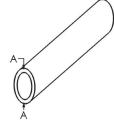
EQUIVALENT ROUND DIAMETER ^⑤ in.	TOLERANCE ^① -in.			
	LENGTH OF MAJOR AXIS, in.  Difference between AA and specified length		LENGTH OF MAJOR AXIS, in.  Difference between AA and specified length	
Col. 1	Col. 2		Col. 3	
Up thru 2.500	+0.040	-0.025	+0.025	-0.015
2.501-4.250	+0.050	-0.035	+0.035	-0.025
4.251-6.000	+0.070	-0.050	+0.055	-0.040
6.001-8.000	+0.100	-0.085	+0.080	-0.060
8.001-10.000	+0.160	-0.140	+0.115	-0.085

TABLE 12.23 Corner Radii—Drawn Tube

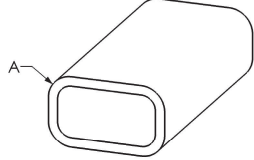
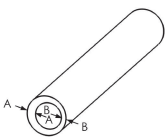
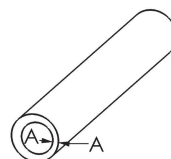
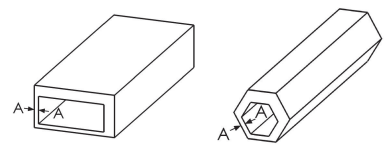
SPECIFIED ^⑦ RADIUS in.	TOLERANCE—in.
	ALLOWABLE DEVIATION FROM SPECIFIED RADIUS  Difference between radius A and specified radius
Sharp Corners	+1/64
0.016-0.187	±1/64
0.188 and over	±10%

TABLE 12.24 Wall Thickness—Drawn Round and Other-Than-Round Tube

SPECIFIED THICKNESS ^④ in.	TOLERANCE ^① -in. plus and minus		
	ALLOWABLE DEVIATION OF MEAN WALL THICKNESS ^③ FROM SPECIFIED WALL THICKNESS  Difference between 1/2 (AA+BB) and specified wall thickness	ALLOWABLE DEVIATION OF WALL THICKNESS AT ANY POINT FROM SPECIFIED WALL THICKNESS (Eccentricity)	
		ROUND, NON-HEAT-TREATABLE ALLOYS ^⑥ 	ROUND, HEAT-TREATABLE ALLOYS AND OTHER THAN ROUND, ALL ALLOYS 
Col. 1	Col. 2	Col. 3	Col. 4
0.010-0.035	0.002	0.002	Plus and minus 10% of specified wall thickness, min ±0.003
0.036-0.049	0.003	0.003	
0.050-0.083	0.004	0.004	
0.084-0.120	0.005	0.006	
0.121-0.203	0.006	0.008	
0.204-0.300	0.008	0.012	
0.301-0.375	0.015	0.020	
0.376-0.500	0.020	0.030	

Footnotes for Tables 12.22 Through 12.24

- ① When outside diameter, inside diameter, and wall thickness (or their equivalent dimensions in other-than-round tube) are all specified, standard tolerances are applicable to any two of these dimensions, but not to all three. When both outside and inside diameters or inside diameter and wall thickness are specified, the tolerance applicable to the specified or calculated O.D. dimension shall also apply to the I.D. dimension.
- ② Footnote is inactive.
- ③ Mean wall thickness is the average of the largest and the smallest wall thickness of tube measured in the same plane perpendicular to the longitudinal axis of the tube.
- ④ When dimensions specified are outside and inside, rather than wall

- thickness itself, allowable deviation at any point (eccentricity) is plus and minus 10 percent of the mean wall thickness but not less than ±0.003 inch.
- ⑤ Equivalent round diameter is the diameter of the circle having a circumference equal to the perimeter of the tube.
- ⑥ For coiled tube, values in Column 4 apply.
- ⑦ If unspecified, the radius shall be 1/32 in. maximum including tolerances.

TABLE 12.25 Straightness—Drawn Tube

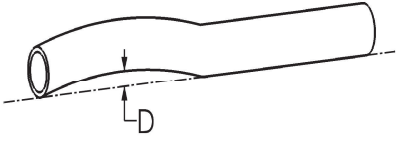
SPECIFIED OUTSIDE DIAMETER OR WIDTH in.	TOLERANCE ①—in.
	ALLOWABLE DEVIATION FROM STRAIGHT
	 <p>D(Max)</p>
	IN TOTAL LENGTH OR IN ANY MEASURED SEGMENT OF ONE FT. OR MORE OF TOTAL LENGTH
Up thru 0.374	0.500 × Measured length, ft.
0.375–5.999	0.010 × Measured length, ft.
6.000 and over	0.020 × Measured length, ft.

TABLE 12.26 Twist ④—Drawn Tube

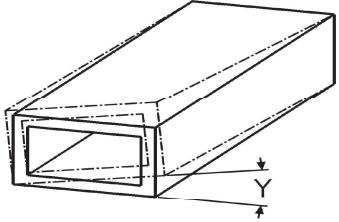
SPECIFIED WIDTH in.	TOLERANCE ① ②—Degree	
	ALLOWABLE DEVIATION FROM STRAIGHT	
	 <p>Y</p>	Y (max) in degrees
	IN TOTAL LENGTH OR IN ANY MEASURED SEGMENT OF ONE FT. OR MORE OF TOTAL LENGTH	MAXIMUM FOR TOTAL LENGTH
Up thru 1.499	1 × Measured length, ft.	7
1.500–2.999	1/2 × Measured length, ft.	5
3.000 and over	1/4 × Measured length, ft.	3

TABLE 12.27 Length—Drawn Tube

SPECIFIED OUTSIDE DIAMETER OR WIDTH in.	TOLERANCE—in. plus except as noted							
	ALLOWABLE DEVIATION FROM SPECIFIED LENGTH							
	STRAIGHT				COILED			
	SPECIFIED LENGTH—ft.							
	Up thru 12	Over 12 thru 30	Over 30 thru 50	Over 50	Up thru 100	Over 100 to 250	250 to 500	500 and over
Up thru 0.249	1/4	3/8	1/2	..	+5%, -0%	±10%	±15%	±20%
0.250-1.249	1/8	1/4	3/8	1	+5%, -0%	±10%	±15%	±20%
1.250-2.999	1/8	1/4	3/8	1	..	..	..	..
3.000-7.999	3/8	5/16	7/16	1	..	..	..	..
8.000 and over	1/4	3/8	1/2	1	..	..	..	..

For all numbered footnotes, see page 12-18.

drawn tube/standard tolerances

**TABLE 12.28 Flatness (Flat Surfaces)
Other-Than-Round Drawn Tube**

SPECIFIED WIDTH OR DEPTH in.	TOLERANCE ③—in.	
	ALLOWABLE DEVIATION FROM FLAT	
	Maximum allowable distance Y	
Up thru 0.500	0.003	
0.501-1.000	0.004	
1.001-2.000	0.005	
2.001-3.000	0.006	
3.001-5.000	0.008	
5.001-6.000	0.010	
6.001-8.000	0.015	
8.001-10.000	0.020	
10.001-12.000	0.025	

**TABLE 12.31 Surface Roughness-
Drawn Tube ②**

Depth of surface conditions shall not exceed 10% of the smaller (or nominal) wall thickness or 0.005 inch, whichever is smaller.

② Not applicable to annealed (O Temper) tube.

TABLE 12.32 Dents-Drawn Tube

SPECIFIED DIAMETER in.	TOLERANCES—in.		
	NON-ANNEALED AND NON-HEAT-TREATED TUBE	HEAT-TREATED TUBE ⑤	ANNEALED TUBE
Col. 1	Col. 2	Col. 3	Col. 4
Up thru 0.500	0.006	0.012	0.036
0.501-1.000	0.008	0.016	0.048
1.001-2.000	0.010	0.020	0.060
2.001-3.000	0.012	0.024	0.072
3.001-5.000	0.016	0.032	0.096
5.001-6.000	0.020	0.040	0.120
6.001-8.000	0.030	0.060	0.180
8.001-10.000	0.040	0.080	0.240
10.001-12.000	0.050	0.100	0.300

For tube having a wall thickness less than 2½ percent of the outside diameter, the following multipliers of the above tolerances apply.

Percent of Wall Thickness

- 2% to 2.5% exclusive—1.25 × tolerance (max.)
- 1.5% to 2% exclusive—1.50 × tolerance (max.)
- 1% to 1.5% exclusive—2.0 × tolerance (max.)
- 0.5% to 1% exclusive—2.5 × tolerance (max.)

⑤ For the T8 tempers of 6063 the tolerances of Column 2 apply.

**TABLE 12.29 Squareness of Cut Ends—
Drawn Tube**

Allowable deviation from square: 1 degree

TABLE 12.30 Angularity—Drawn Tube

Allowable deviation from specified angle: ±2 degrees

Footnotes for Tables 12.25 Through 12.30

- ① Tolerance is applicable when weight of tube on flat surface minimizes deviation.
- ② Not applicable to annealed (O temper) tube.
- ③ Not applicable to annealed (O temper) tube, coiled tube, or tube having a wall thickness less than 0.020 inch or less than 2½% of the equivalent round diameter. Equivalent round diameter is the diameter of a circle having a circumference equal to the perimeter of the tube.
- ④ Twist is normally measured by placing the drawn tube on a flat surface and at any point along its length measuring the maximum distance between the bottom surface of the drawn tube and the flat surface. From this measurement, the actual deviation from straightness of the drawn tube at that point is subtracted. The remainder is the twist. To convert the standard twist tolerance (degrees) to an equivalent linear value, the sine of the standard tolerance is multiplied by the width of the surface of the section that is on the flat surface. The following values are used to convert angular tolerances to linear deviation:

Tolerance, degrees	Maximum allowable linear deviation inch per inch of width
¼	0.004
½	0.009
1	0.017
1½	0.026
3	0.052
5	0.087
7	0.122
9	0.156
15	0.259
21	0.358

For all numbered footnotes, TABLE 12.31 thru 12.32, see page 12-19.