TABLE 7b. Wall Thickness Tolerance for Round Cold-Worked Tubing

Wall Thickness Range as % of Outside Diameter	Wall Thickness Tolerance, Over and Under Nominal, %	
	Up to 1.499 in., ID	1.500 in. and Over
25 and under	10.0	7.5
Over 25	12.5	10.0

Wall Thickness Tolerance for Round Hot Finished Tubing

Wall Thickness Range as Percent Outside Diameter	Wall Thickness Tolerance,[a] percent Over and Under		
	Outside Diameter 2.999 in.(76.19 mm) and smaller	Outside Diameter 3.000 in.(76.20 mm) to 5.999 in.(152.37 mm)	Outside Diameter 6.000 in.(152.40 mm) to 10.750 in.(273.05 mm)
Under 15	12.5	10.0	10.0
15 and over	10.0	7.5	10.0

[a] Wall thickness tolerances may not be applicable to walls 0.199 in. (5.05 mm) and less; consult manufacturer for wall tolerances on such tube sizes.

Straightness Tolerances for Seamless Round Mechanical Tubing

NOTE 1 — The straightness variation for any 3 ft. (0.9 m) of length is measured with a 3-ft. straightedge and the use of a feeler gage. The total variation, that is the maximum curvature at any point in the total length of the tube, is determined by rolling the tube on a surface plate and measuring the concavity with a feeler gage.

NOTE 2 — The tolerances apply generally to unannealed, finish-annealed and medium-annealed cold-finished or hot-finished tubes. When straightening stresses would interfere with the use of the end product, the straightness tolerances shown do not apply when tubing is specified "not to be straightened after furnace treatment." These straightness tolerances do not apply to soft-annealed or quenched and tempered tubes.

Size Limits	Maximum Curvature in any 3 ft. in. (mm)	Maximum Curvature in Total Lengths, in. (mm)	Maximum Curvature for Lengths under 3 ft. or 1 m
OD 5 in.(127.0mm) and smaller. Wall thickness, over 3% of OD but not over 0.5 in. (12.7 mm)	0.030 (0.83)	0.030 x (no. of ft of length/3) (0.83 x no. of m of length)	ratio of 0.010 in./ft or 0.83 mm/m
OD over 5 to 8 in. (127.0 mm to 203.2 mm), incl. -Wall thickness, over 4% of OD but not over 0.75 in. (19.0 mm)	0.045 (1.25)	0.045 x (no. of ft of length/3) (1.25 x no. of m of length)	ratio of 0.015 in./ft or 1.25 mm/m
OD over 8 to 12½ in. (203.2 to 323.8 mm), incl. -Wall thickness, over 4% of OD but not over 1 in. (25.4 mm)	0.045 (1.25)	0.045 x (no. of ft of length/3) (1.25 x no. of m of length)	ratio of 0.015 in./ft or 1.25 mm/m

Length Tolerance for Round Hot-Finished or Cold-Finished Tubing

NOTE 1 — The producer should be consulted for length tolerances for tubes produced by liquid- or air-quenching heat treatment.

Length, ft (mm)	Outside Diameter, in. (mm)	Tolerance, in. (mm)	
		Over	Under
4 (1.2) and under	up to 2 (50.8), incl.	1/16 (1.6)	0
4 (1.2) and under	over 2 to 4 (50.8 to 101.6), incl.	3/32 (2.4)	0
4 (1.2) and under	over 4 (101.6)	1/8 (3.2)	0
Over 4 to 10 (1.2 to 3.0), incl.	over 2 (50.8), incl.	3/32 (2.4)	0
Over 4 to 10 (1.2 to 3.0), incl.	over 2 (50.8)	1/8 (3.2)	0
Over 10 to 24 (3.0 to 7.3), incl.	all sizes	3/16 (4.8)	0
Over 24 (7.3)	all sizes	3/16 + 1/2 (4.8 + 12.7) for each 10 ft (3.0 m) or fraction over 24 ft (7.3 m)	0

TUBING SPECIFIED TO O.D. AND I.D. DIMENSIONS IS RECOMMENDED FOR MACHINING AND OTHER APPLICATIONS REQUIRING AN ACCURATE INSIDE DIAMETER

Example: Tubing specified to O.D. and I.D. dimensions 4½" O.D. x 4" I.D.
O.D. 4.500/4.513" I.D. 3.987/4.000"
Wall ± 7.5% of .250/.263" or .231/.283"

Tubing specified to O.D. and Wall Dimensions 4½" O.D. x ¼" wall.
O.D. 4.500/4.513" I.D. 3.962/4.051"
Wall ± 7.5% of .250 or .231/.269"

MACHINING ALLOWANCES FOR TUBING FROM WAREHOUSE STOCK

The following procedure may be used to determine the proper warehouse stock size (O.D. and wall thickness) of Cold Drawn Seamless of Buttweld Steel Tubing with sufficient allowance for machining, based on chucking true to O.D.

A = Machined O.D. (Maximum)

B = Machined O.D. (Maximum) or I.D.

Under 1½" O.D.	.020"
1½" to 3" Excel.	.040"
3" to 5½" Excel.	.060"
5½" to 8" Excel.	.080"

C = Camber in length of part. ration per foot

Under 5" O.D.	.020"
5" to 8" Excel.	.030"
8" to 10¼" Excel.	.040"

D = Machined I.D. (Minimum)

E = Outside Diameter Tolerance

F = Percent of Wall Thickness Tolerance

Calculated O.D. = A + B + C

Stock Size O.D. — When the calculated O.D. is not shown as available in the stock list, use the stock size O.D. listed which is next larger than the calculated O.D.

Calculated I.D. = D – (B + C)

Calculated Wall Thickness =

$$\frac{\text{(Stock Size O.D. + E – Calculated I.D.) (1.00 + F)}}{2}$$

Stock Size Wall Thickness — When the calculated wall thickness is not shown as available in the stock size O.D. above, use the stock size wall thickness listed which is next heavier

Notes:
If the machined part is less than 4" long or the maximum machined O.D. and minimum machined I.D. is within 4" of the chuck, camber may be ignored. Also, the formula assumes that tolerances, surface defects, eccentricity and camber are all at the permissible maximum at the same time. Since this condition is extremely unlikely, a stock size slightly under either the calculated O.D. or wall may sometimes be used to advantage with the risk off-set by the savings in material cost.

AVERAGE PHYSICAL PROPERTIES OF C.D.S.M

C-1018	
Minimum Yield Point	**65,000 PSI**
Minimum Tensile Strength	**75,000 PSI**
Minimum Elongation in 2"	**5%**
Rockwell "B"	**80**
C-1020	
Minimum Yield Point	**60,000 PSI**
Minimum Tensile Strength	**70,000 PSI**
Minimum Elongation in 2"	**5%**
Rockwell "B"	**75**
C-1026	
Minimum Yield Point	**70,000 PSI**
Minimum Tensile Strength	**80,000 PSI**
Minimum Elongation in 2"	**5%**
Rockwell "B"	**83**