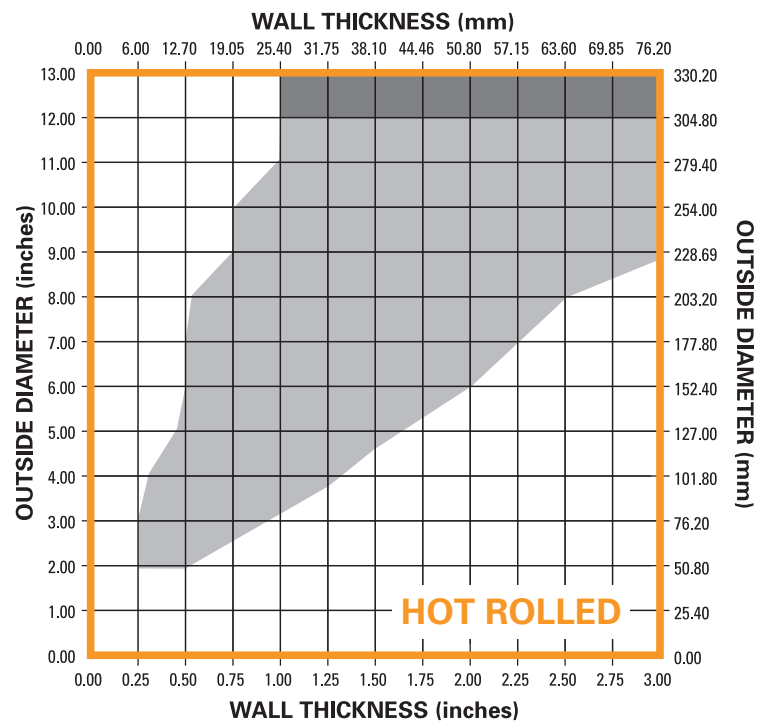
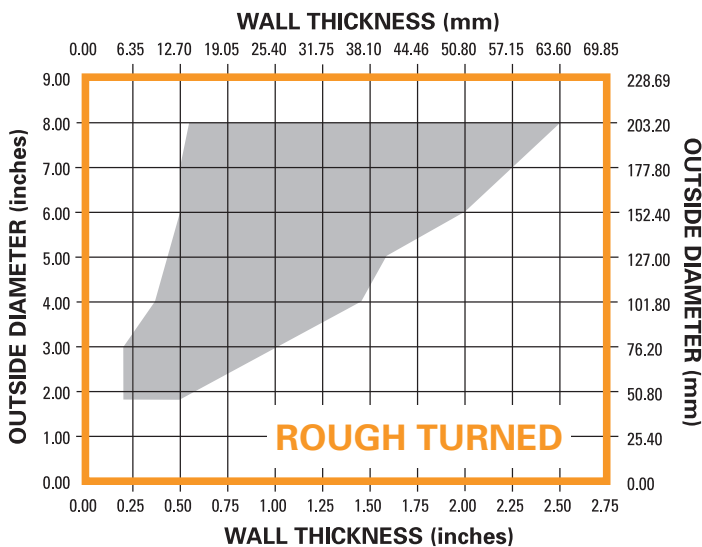
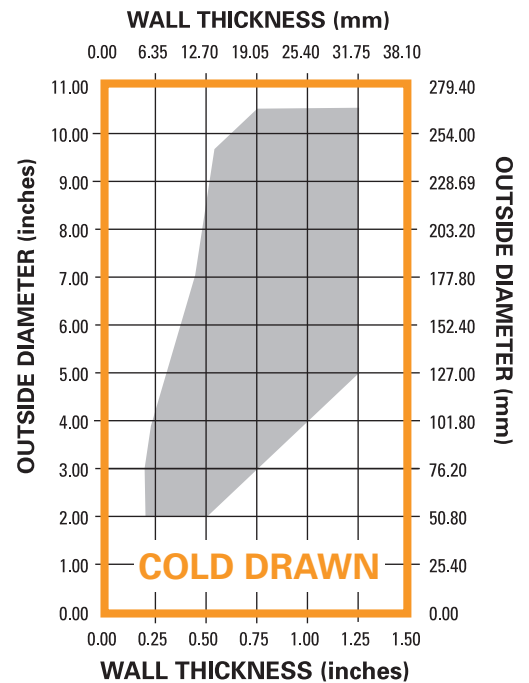


## TIMKEN® MECHANICAL SEAMLESS STEEL TUBING

The Timken Company is a leading manufacturer of seamless mechanical tubing. The tubing is produced in most carbon and alloy grades. It may be purchased in sizes recommended to clean up at finished part dimensions. This allows for optimum material utilization.

Sizes with tube ODs greater than 12 inches (305 mm) are available only in low- and medium-carbon grades and in OD and wall increments of 1/4 inch (0.250 inch or 6.35 mm).

These capability charts apply to common grades of carbon, alloy and bearing steels up to 1.00 percent carbon content. Our ability to produce higher carbon steels or special grades more than 3.5 percent alloy content, alloy pressure tubing and stainless tubing is subject to review on an inquiry basis.



# TOLERANCES

<b>TIMKEN TUBING TOLERANCES</b>	<b>As Hot Rolled/Rough Turned or Single Thermal Treatment; As Cold Drawn</b>	<b>Cold Drawn and Single Thermal Treatment Tempered or Normalized Rough Turned When Straightened and/or Tempered (Stress Relieved) After Rough Turning</b>
<b>HOT ROLLED ROUND*</b>	inches $T_{OD} = \pm (.0045 \text{ OD} + .005) \text{ or } \pm .015 \text{ min.}$ mm $T_{OD} = \pm (.0045 \text{ OD} + .13) \text{ or } \pm .38 \text{ min.}$ Over 10.75 inches (273 mm) thru 12.0 inches (305 mm) inches $T_{OD} = \pm .095$ mm $T_{OD} = 2.41$ Greater than 12.0 inches (305 mm) - $T_{OD} = \pm 1\%$	
<b>COLD DRAWN, ROUND†</b>	inches $T_{OD/ID} = \pm (.0023 \text{ OD} - .003) \text{ or } \pm .004 \text{ min.}$ mm $T_{OD} = \pm (.0023 \text{ OD} - .08) \text{ or } \pm .10 \text{ min.}$	inches $T_{OD/ID} = \pm 1.8 (.0023 \text{ OD} - .003) \text{ or } \pm .007 \text{ min.}$ mm $T_{OD} = \pm 1.8 (.0023 \text{ OD} - .08) \text{ or } \pm .18 \text{ min.}$
<b>ROUGH TURNED, ROUND</b>	Under 6.75 inches (171.5 mm) inches $T_{OD} = \pm .005$ mm $T_{OD} = \pm .13$ 6.75 inches (171.5 mm) and over inches $T_{OD} = \pm .010$ mm $T_{OD} = \pm .25$	inches $T_{OD} = \pm .010$ mm $T_{OD} = \pm .25$

## SPECIAL PROCESSED TUBING TOLERANCES

<b>COLD DRAWN, SHAPED</b> Square, Rectangular or Oval	inches $T_{OD/ID} = \pm .005 \text{ OD or } \pm .020 \text{ min.}$ mm $T_{OD/ID} = \pm .005 \text{ OD or } \pm .51 \text{ min.}$
<b>COLD DRAWN, SHAPED‡</b> Dissimilar OD and ID Configuration	inches $T_{OD/ID} = \pm .005 \text{ OD or } \pm .010 \text{ min.}$ mm $T_{OD} = \pm .005 \text{ OD or } \pm .25 \text{ min.}$

**OD – Outside Diameter ID – Inside Diameter T – Tolerance W – Wall Thickness**

\* Hot rolled and rough turned tubes can be purchased to outside diameter (OD) and wall thickness (W) only.

† Tubes with a nominal finish wall size greater than 1.250 inches (31.75 mm) will have a hot rolled ID and will be produced to cold drawn OD tolerances and hot rolled wall tolerances.

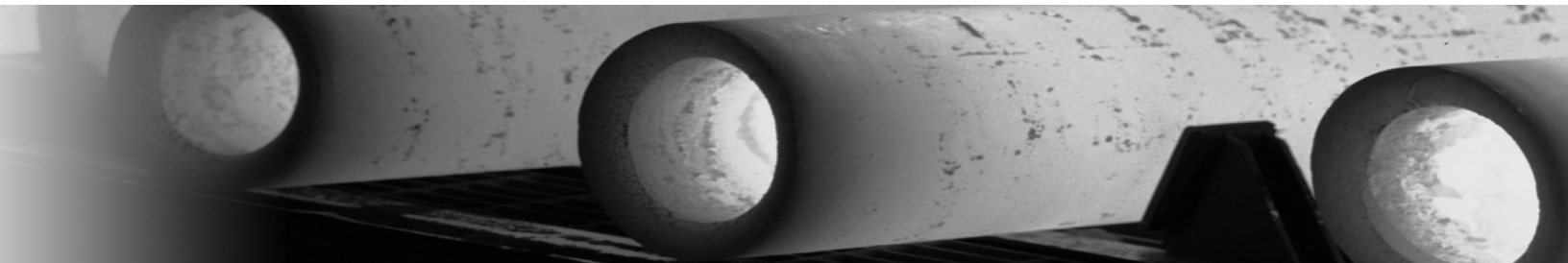
‡ When corner radii and twist are important, they must be reviewed by our mill before we accept the order.

ASTMA - 519 tolerances are acceptable except for cold finished sizes smaller than 2.500 inches (63.50 mm) diameter, where Timken Company tolerances apply.

Timken Company guaranteed tube sizes are calculated using Timken Company tolerances.

Quenched and Tempered or Normalized and Tempered (OD & Wall or ID & Wall Dimensions Only)	Quenched and Tempered or Normalized and Tempered (OD & ID Dimensions Only)	Wall Tolerances All Thermal Conditions
inches $T_{OD} = \pm 1.5 (.0045 \text{ OD} + .005) \text{ or } \pm .023 \text{ min.}$ mm $T_{OD} = \pm 1.5 (.0045 \text{ OD} + .13) \text{ or } \pm .58 \text{ min.}$ Over 10.75 inches (273 mm) thru 12.0 inches (305 mm) inches $T_{OD} = \pm .113$ mm $T_{OD} = \pm 2.87$ Greater than 12.0 inches (305 mm) - $T_{OD} = \pm 1\%$		OD to wall ratio over 10:1 or over 10.75 to 12.0 inch (305 mm) OD (all OD to wall ratios) $\pm 10\%$ OD to wall ratio of 10:1 or less..... $\pm 7.5\%$ Minimum wall tolerance is $\pm .020 \text{ inch (.51 mm)}$ Greater than 12.0 inch (305 mm) to 13.0 inch (330 mm): Wall less than 1.5 inch (38 mm)..... $\pm 12.5\%$ Wall 1.5 inch (38 mm) and greater..... $\pm 10.0\%$
inches $T_{OD/ID} = \pm 2.5 (.0023 \text{ OD} - .003) \text{ or } \pm .010 \text{ min.}$ mm $T_{OD/ID} = \pm 2.5 (.0023 \text{ OD} - .08) \text{ or } \pm .25 \text{ min.}$	inches $T_{OD/ID} = \pm 3.75 (.0023 \text{ OD} - .003) \text{ or } \pm .015 \text{ min.}$ mm $T_{OD/ID} = \pm 3.75 (.0023 \text{ OD} - .08) \text{ or } \pm .38 \text{ min.}$	OD to wall ratio over 10:1 ..... $\pm 7.5\%$ OD to wall ratio over 10:1 to 4:1..... $\pm 6\%$ OD to wall ratio under 4:1..... $\pm 7.5\%$ (1) Minimum wall tolerance is $\pm 0.12 \text{ inch (.30 mm)}$ (2) When ID is under 1.000 inch (25.4 mm), inquiry basis (3) Walls 6% of OD and lighter, inquiry basis (4) When OD & ID dimensions, use $\pm 7.5\%$ wall
Under 6.75 inches (171.5 mm) Heat Treated Before Rough Turned $T_{OD} = \pm .010 \text{ inches } (\pm .25 \text{ mm})$ Heat Treated After Rough Turned $T_{OD} = \pm .015 \text{ inches } (\pm .38 \text{ mm})$ 6.75 inches (171.5 mm) and over Heat Treated Before Rough Turned $T_{OD} = \pm .020 \text{ inches } (\pm .51 \text{ mm})$ Heat Treated After Rough Turned $T_{OD} = \pm .030 \text{ inches } (\pm .76 \text{ mm})$		OD to wall ratio over 10:1..... $\pm 12.5\%$ OD to wall ratio of 10:1 or less ..... $\pm 10\%$ Minimum wall tolerance is $\pm .020 \text{ inch (.51 mm)}$

inches $T_{OD/ID} = \pm .01 \text{ OD } \pm .040 \text{ min.}$ mm $T_{OD/ID} = \pm .01 \text{ OD } \pm 1.02 \text{ min.}$	All wall thickness $\pm 10\%$ at center of flats
inches $T_{OD/ID} = \pm .01 \text{ OD } \pm .020 \text{ min.}$ mm $T_{OD/ID} = \pm .01 \text{ OD } \pm .51 \text{ min.}$	All wall thickness $\pm 10\%$ at center of flats



## CUSTOMERS TURN TO TIMKEN FOR QUALITY AND INNOVATION

Companies around the world turn to Timken for alloy steel. We're known for metallurgy and advanced manufacturing processes that produce some of the cleanest, highest performance steel in the world.

In addition, we offer value-added solutions that help customers reduce costs and test new technology. An example is Timken's machining capabilities at Timken Boring Specialties in Houston, Texas, which provides precision-machined IDs and ODs if tighter tolerances are required.

Contact Timken to create solutions for you.

For more information on Timken® steel and other value-added services or products, call:

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2.5M 2-11-29 Order No. 4263