



friedrich & dimmock, inc.

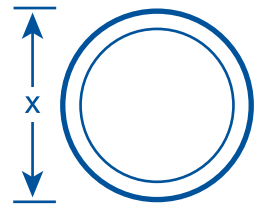
PRECISION GLASS & QUARTZ COMPONENTS FOR INDUSTRY • SCIENCE • RESEARCH • OPTICS
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Custom Glass Specifications HOW TO SPECIFY GLASS TUBING BY CLASSES

Standard Tubing

Available in a variety of sizes and wall weights.

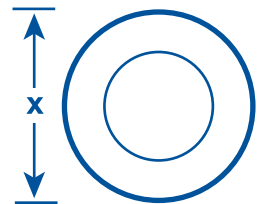
Standard tubing of any glass formulation is tubing cut to workable lengths exactly as it was drawn from the tank. It is produced in a variety of wall weights from numbered grades to standard, medium, and heavy wall classifications. Standard tubing is generally the lowest cost product.



Redrawn Tubing

Multiple shapes are available.

Redrawn or resized tubing is an excellent choice for a wide variety of applications at a much lower cost than precision bore tubing. Many precision bore tubing applications, from micron sizes to 6 - 8 mm size range, can be economically satisfied using redrawn tubing. Friedrich & Dimmock, Inc. is the leader in the production of precision redrawn tubing. Redrawn tubing has become the method of choice for the production of microbore capillaries, microelectrodes, and ultra-micro medical apparatus. The redrawing or resizing of glass tubing involves heating it to its softening temperature and redrawing the tubing under controlled conditions to precise tolerances. Redrawn tubing is an excellent choice for most instrumentation applications. Please call to discuss your special requirements.

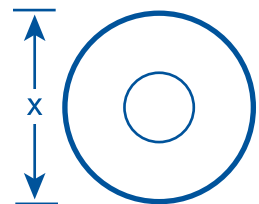


Shapes

Multiple shapes are available.

Tolerances dependent on mandrel and sorting.

Tubing can be reshaped into square, rectangular, triangular, hexagonal, or other configurations. Requests for your special needs are invited.



Precision Bore Tubing

Multiple shapes are available.

Tolerances dependent on mandrel.

Precision bore tubing offers the tightest I.D. tolerances under most conditions, and permits engineers to specify precise I.D.'s over an extended length. Precision bore tubing, or "PB", is fabricated by placing a piece of tubing (usually selected bore) over a metal mandrel that has been machined and polished to the complementary O.D. size, taper, or shape for the I.D. configuration. The glass is then heated to its softening temperature while the annular space between the tubing and mandrel is connected to a vacuum source. As the softening burner or heater travels along the length of tubing, the vacuum draws the softened glass to the surface of the mandrel. Precalculated differential expansion/contraction coefficients between the mandrel and the glass assist in the removal of the formed glass part from the mandrel after cooling occurs. Mandrel life is variable dependent upon the amount of heat required, surface finish, care and handling.



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Custom Glass Specifications

NON-STANDARD (*Special*) TUBING POLICY

33 Expansion Borosilicate Tubing & Rod

Minimum Order: 1,100 lbs.

Shipping Policy:

33 Expansion Special Tubing and Rod orders will be held no longer than 6 months. Customer must supply release dates with the original order.

51 Expansion Borosilicate Tubing

Minimum Order: 1,100 lbs.

Shipping Policy:

51 Expansion Special Tubing orders will be held no longer than 6 months. Customer must supply release dates with the original order.

ENGINEERING CONSIDERATIONS

Friedrich & Dimmock, Inc. has been fabricating precision glass components since 1919. Engineering staff is available to assist you at every stage—from design concept and working prototype to mass producing your product. Professional craftsmen in our onsite machine shop will render the tooling required to quickly and precisely produce your designs.

Unlike metal or plastic tubing, glass tubing is not normally extruded through dies to produce close tolerance wall weights and consistent I.D. to O.D. ratios. Glass tubing is

drawn, horizontally or vertically from tanks of molten glass and the rate of draw is a major determinant of tubing size, wall weight, and tolerances. Therefore, standard glass tubing will have tolerances much different than those to which engineers are accustomed.

The properties of glass are such that it is often used in areas of high corrosion, vacuum, flow and optical transmission applications, etc. Before design engineers can work with glass, it is essential that they be aware of the characteristics of this amazing liquid/solid, so that the glass can be specified for applications where it will give superior service.

CUSTOM ORDER POLICY

Custom orders must be prepaid prior to the start of manufacturing. Returns on custom orders will be accepted if product is out of specification and subject to our standard return policy.

Redrawn Tubing & Noncircular Tubing

Minimum Order:

Determined by manufacturing yield

Shipping Policy:

All orders will be manufactured on a make and ship basis unless other arrangements are made prior to manufacture.

Any exception to the above policy must be at the approval of Friedrich & Dimmock, Inc. and be authorized in writing.

All special items will have a 10% over or underrun factor.