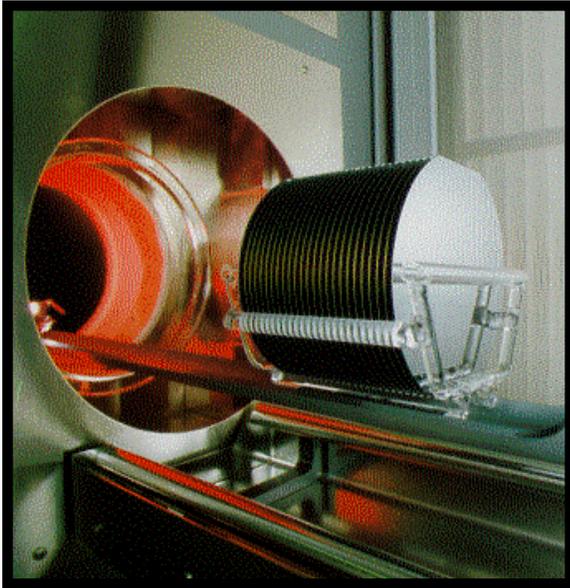




# Semiconductor



In the semiconductor industry, a combination of high purity and excellent high temperature properties make fused quartz tubing an ideal furnace chamber for processing silicon wafers. The material can tolerate the wide temperature gradients and high heat rates of the process. Its high purity creates the low contamination environment required for achieving superior wafer yields.

The stringent requirements of today's advanced semiconductor processes demand continued advancement in materials used in the process chamber. These developments have impacted heavily on quartz producers, requiring both larger tube diameter developments and significantly higher levels of purity. GE Quartz has responded on both counts.

Quartz tubing is available in a full range of sizes, including diameters up to 550mm. Diameter and wall thickness dimensions are tightly controlled. Special heavy wall thicknesses are available on request.

By finding new and better sources of raw material, expanding and modernizing production facilities, and upgrading quality control functions, GE has reduced contaminant levels in its fused quartz tubing to less than 25 ppm, with alkali levels below 1 ppm.

## **Type 214LD**

GE Type 214 LD is the large diameter grade industry standard tubing. For all but highly specialized operations, this low cost tubing offers the levels of purity, sag resistance, furnace life and other properties that diffusion and CVD processes require.

For superior performance at elevated temperatures, GE Type 214 LDH furnace tubing gives process engineers a better balance between the effects of higher temperatures and heavier wafer loads.

## **Description**

Clear fused quartz with the same excellent properties as Type 214 but for large diameter applications.

## **Typical Applications**

Used by the semiconductor industry for diffusion, oxidation and LPCVD processing.



### Type 224LD - Low Alkali Quartz Tubing

As the semiconductor industry moves toward higher density devices, furnace atmosphere contamination becomes an increasingly critical factor in controlling wafer yields. One potential contaminant is sodium, which occurs naturally in the silica sand used to make fused quartz. If not removed, this highly mobile ion can effectively destabilize the electrical characteristics of MOS and bipolar devices.

For these critical applications, GE has developed Type 224 low alkali fused quartz tubing. It is made in a special process that eliminates up to 90% of the naturally occurring alkalis. The process achieves a typical sodium level of 0.1 ppm (vs. a normal 0.7 ppm), greatly reduces potassium, and virtually eliminates lithium.

### Description

Similar to Type 214 with the same exceptional high viscosity and visual standards. Special methods are used to reduce alkali content to the PPB range.

### Typical Applications

Used in critical semiconductor diffusion systems where even trace levels of alkali content can reduce chip yields.

LD (Large Diameter Tubing) (for type 214 / 224 / 244)

Size Range					Common Tolerances								
Inside Diameter (mm)			Common Wall Thickness (mm)		OD		ID	Wall Tolerance		Siding		Bow (mm/ft)	
			Max	Min	Common	Special	Special	Common	Special	Common	Special	Common	Special
					+/-mm	+/-mm	+/-mm	+/-	+/-mm		+/-mm		+/-mm
	Upto	165	7.0	2.5	2.0	Per Request	Per Request	20%	Per Request	15%	Per Request	0.3	Per Request
166	to	190	7.0	3.0	2.0			20%		15%		0.3	
191	to	250	7.0	3.0	2.0			20%		15%		0.3	
251	to	290	7.0	3.5	2.0			20%		15%		0.3	
291	to	350	6.0	3.5	2.0			20%		20%		0.3	
351	to	400	6.0	3.5	3.0			20%		20%		0.3	
401	to	450	6.0	4.0	3.0			20%		20%		0.3	
451	to	500	5.5	4.0	3.0			20%		20%		0.3	

**Large diameter** tubing is made in a process that resizes smaller diameter mother tubes to a larger size. This process controls the OD(outside diameter) and the Wall thickness of the tube. The convention used for specifying tubes is ID(mm) x OD(mm) x Length (in or mm).

**Wall Thicknesses** commonly produced are listed. Thicknesses outside this range are possible. However, since quartz tubes are fragile like any other glass, care should be taken to specify tubes that are robust enough to survive handling.

**OD (Outside Diameter) tolerances** – are controlled by the resizing process. Special tolerances are available on request.

**ID (Inside Diameter) tolerances** – are indirectly controlled by process control of the OD and wall. ID tolerances can be specified by request.

**Wall tolerances** are expressed as a percentage of the nominal wall thickness. For example, a 5mm nominal wall thickness with a 20% tolerances means the wall thickness can range from 4 to 6 mm (5+1mm). Special tolerances are available on request.

**Siding** is the variation in wall thickness from the thickest point to the thinnest point at one cross-section of the tube. Siding is expressed as a percentage of the nominal wall thickness. Special tolerances are available on request.

**This product is a custom made product with many combinations of diameter, wall thickness, tolerance and lengths. Your GE Authorized Distributor-Fabricator or GE representative can help you specify the right product for your need.**



### **Type 244LD Low Alkali/Low Aluminum Quartz Tubing**

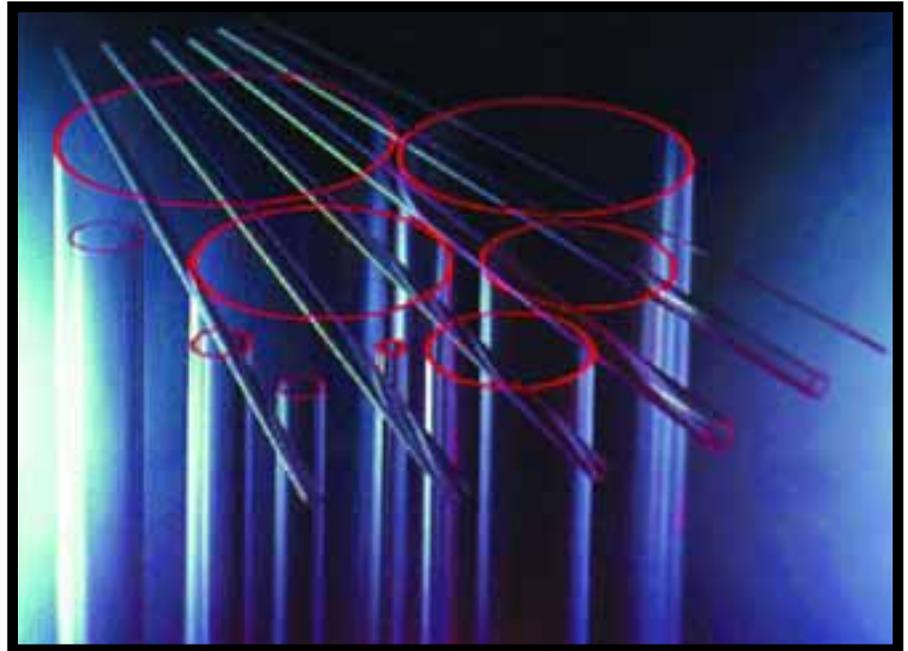
This grade has been specially developed for quartz users concerned about the aluminum level in fused quartz. Type 244 LD has a typical aluminum level of 8 ppm.

### **Type 214 Bell Jar Body**

Certain pieces of semiconductor process equipment require a quartz bell jar for the process chamber. GE makes a selected list of standard bell jar bodies and blanks that can be used by fabricators of finished bell jars. With this bell jar body, fabricators can add a top and bottom flange to make a high quality finished product.

### **Type 514/544 Opaque Rings**

A common practice in fabricating high temperature process chambers is to add a cross-section of opaque quartz to the tube used to form the chamber. The opaque quartz ring used to form the cross-section, blocks IR energy traveling the length of the tube wall (commonly called light piping). Blockage of this IR energy is important to protect the o-ring seal used to seal the chamber.



GE makes opaque rings in standard 514 purity (equivalent to 214 tubing) and 544 purity (equivalent to 244 tubing). These rings make a cost effective alternative to other methods of forming opaque rings. Sizes are generally available for all standard process chambers.

### **Low Hydroxyl (OH)-**

One reason that GE fused quartz tubing can withstand the wide thermal gradients and chemical environments of wafer processing operations is its (OH)- content of less than 10 ppm water in most grades.

Low (OH)-minimizes the sag rate at diffusion temperatures, and effectively retards the progress of devitrification.

Because of its low hydroxyl content, GE Quartz tubing does not require special coatings that could potentially release contaminant's at elevated temperatures.