

QUARTZ SLEEVES

Technical Data, Real World Use and Video Links

GE Type 214 clear fused quartz tubing is high-purity, high UVC transmittance, high temperature material with a low hydroxyl (OH)- content. They are used to protect Ultraviolet lamps from water and wastewater and allow the lamp to maintain a consistent temperature range within the air-gap.

UV lamps are manufactured using **GE Type 219**, also known as “ozone free” or “germicidal quartz tubing”. Type 219 transmits visible and near UV radiation. It cuts off below 250 nm to block wavelengths that cause ozone generation. It transmits the 254 nm disinfection wavelengths.

Features – key issues

- GE Type 214 / Fused Quartz
- 99.9% silicon dioxide
- 254 nm UVC light passes
- Isolates lamp from water
- Open / Closed - “domed” ends
- Can become dirty aka fouled
- Requires maintenance
- 5 to 10 year life



Applications, Installations and Operational Tips

Quartz sleeves protect the UV lamp from the water, wastewater or liquid that is being treated. They are used in various wastewater and clean water disinfection systems and are similar in appearance to test-tubes.

The UV lamp slides into the quartz sleeve. The quartz sleeve allows the UVC light in the 254 nm (germicidal) wavelength to pass through and reach the intended microorganisms. The sleeve also creates an air-gap envelope that allows the UV lamp to work at an optimal temperature, which is important for certain lamp technologies.

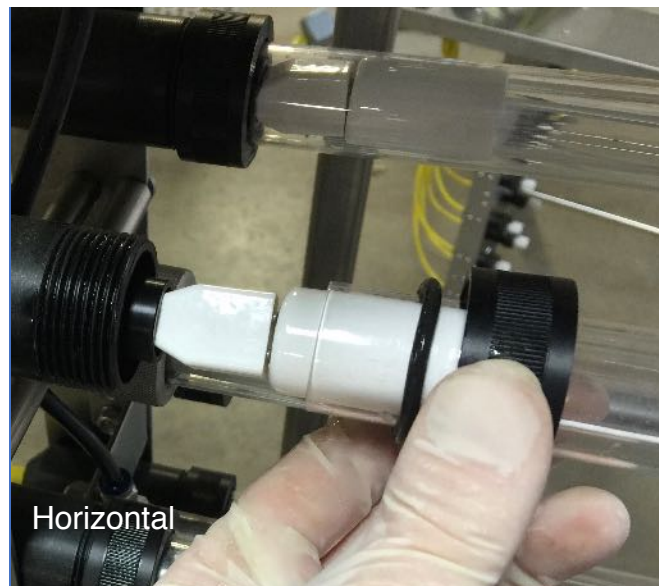
Quartz sleeves need to be sealed from the water in order to protect them lamp from water damage. Chambers (pressure vessels) and open channel wastewater systems use different forms of compression fittings.

A 6" laboratory unit provides a good visual. The "domed" sleeve is inserted into vessel, an o-ring / washer is compressed, creating a watertight envelope for lamp

Some systems require that the quartz be removed for lamp change.



Vertical



Horizontal



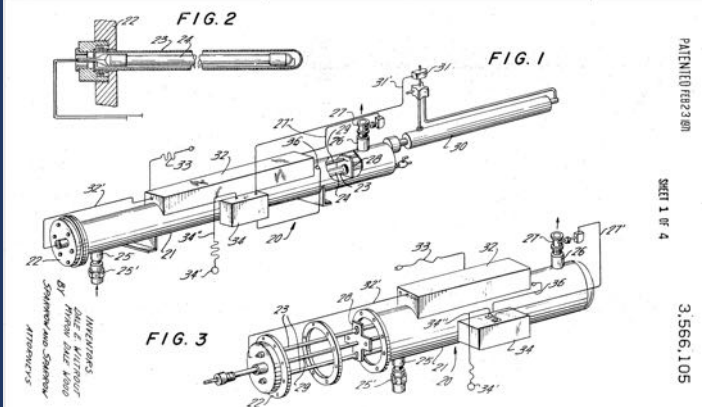
Chamber

Need to Know - Engineers & Operators

Our Experience First used in 1966

Engineers and System Designers

"Lamp sleeves shall be type GE TYPE 214 clear fused quartz circular tubing. Sleeves shall be rated for transmission of 94% or more and sleeves shall not be subject to solarization over the length of their life."



Some existing specification language is from a time when quartz sleeve quality varied. Today, manufacturers use the highest quality materials. Sleeves are fire polished and held to strict tolerances. When designing a system, year-end quartz fouling factor is applied (typically 85-95%). Systems that are biologically tested, these fouling factors are consistent.

Quartz are prone to fouling. Water impurities (minerals and solids) can settle on, and then “plate” or “coat”. Once this scaling adheres to the quartz, it prevents proper UV light transmission.

System fouling and quartz cleaning options need to be discussed. Many systems have automatic mechanical quartz cleaning systems that prevent build-up. Frequency is based on water quality and system type. Options includes pneumatic, electric, hydraulic and gears.

Operation and Ownership

Quartz-based UV systems require maintenance. Lamps need to be changed after a year. The quartz sleeves will require cleaning. Basic systems need “hand” cleaning (requires removing them, and scrubbing with chemicals). Some have mechanical wiping and or chemical cleaning dip tanks.

Cleaning frequency depends on effluent conditions, type of UV system and the cleaning system.

Quartz life is 5 to 10 years. Some systems require the quartz sleeves to be removed to change lamps (primarily horizontal type).

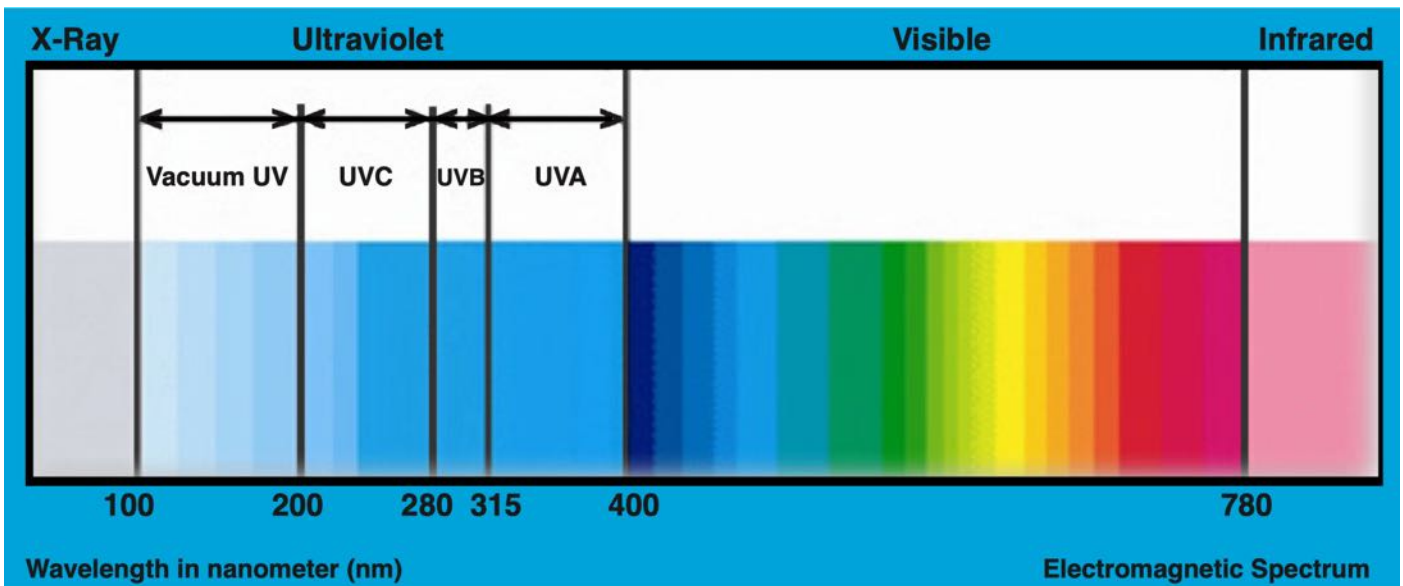


Transmission Range

As the curve shows, **Type 214** fused quartz has a UV cutoff (1 mm thickness) at < 160 nm, small absorption at 245 nm and no appreciable absorption due to hydroxyl ions.

UV lamp tubing (**Type 219**), which contains approximately 100 ppm Ti, has a UV cutoff at ~ 230 nm for a 1 mm thick sample. This blocks lower ozone wavelengths.

The chart details the percent transmittance for **Types 214** and **219** fused quartz, including the losses caused by reflections at both surfaces.



Material Properties

The quartz material used for UV disinfection applications is generically referred to as GE Type 214.

This is considered the worldwide standard for clear fused quartz lamp tubing. GE 214 is high purity, high transmittance, high temperature material with a low hydroxyl (OH)- content and is suitable for protecting UV lamps and allowing the maximum amount of UVC light to penetrate.

Available available sizes (lengths, diameters and end seals). Quartz has excellent visual, thermal and mechanical properties with low hydroxyl content and tight dimensional tolerances. The sleeves are 99.9% silicon dioxide in construction.

Property	Value	Property	Value
Density	2.2 x 10 ³ kg/m ³	Dielectric Properties (20 °C, 1 MHz)	
Hardness	5.5 - 6.5 Mohs' Scale - 570 KHN 100	Constant	3.75
		Strength	5 x 10 ⁷ V/m
Design Tensile Strength	4.8 x 10 ⁷ Pa (N/m ²) (7,000 psi)	Loss Factor	< 4 x 10 ⁻⁴
Design Compressive Strength	> 1.1 x 10 ⁹ Pa (160,000 psi)	Dissipation Factor	< 1 x 10 ⁻⁴
Bulk Modulus	3.7 x 10 ¹⁰ Pa (5.3 x 10 ⁶ psi)		
Rigidity Modulus	3.1 x 10 ¹⁰ Pa (4.5 x 10 ⁶ psi)	Index of Refraction	1.4585
Young's Modulus	7.2 x 10 ¹⁰ Pa (10.5 x 10 ⁶ psi)	Constringence (Nu value)	67.56
Poisson's Ratio	0.17		
Coefficient of Thermal Expansion (20 °C - 320 °C)	5.5 x 10 ⁻⁷ cm/cm • °C	Velocity of Sound-Shear Wave	3.75 x 10 ³ m/s
		Velocity of Sound/Compression Wave	5.90 x 10 ³ m/s
Thermal Conductivity at 20°C	1.4 W/m • °C	Sonic Attenuation	<11 db/m MHz
Specific Heat at 20 °C	670 J/kg • °C	Permeability Constants at 700 °C	(cm ³ mm/cm ² sec cm Hg)
Softening Point	1683 °C	Helium	210 x 10 ⁻¹⁰
Annealing Point	1215 °C	Hydrogen	21 x 10 ⁻¹⁰
Strain Point	1120 °C	Deuterium	17 x 10 ⁻¹⁰
Electrical Resistivity at (350 °C)	7 x 10 ⁷ Ω • cm	Neon	9.5 x 10 ⁻¹⁰

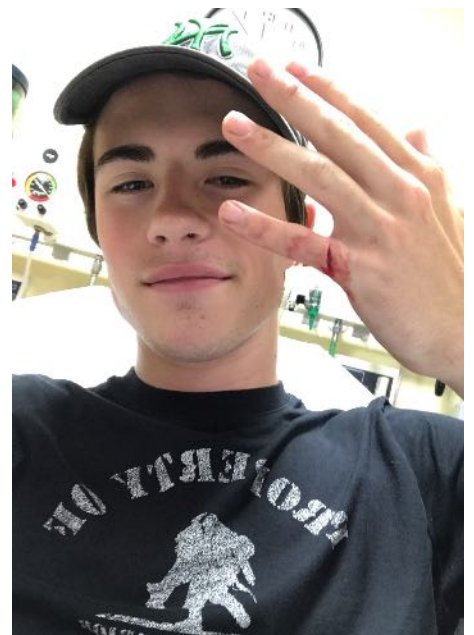
Additional Information

Quartz sleeves are fragile and can break. An unattended module may tip over or an operator may accidentally drop or bang an end. It happens. The most important issue is safety. Quartz are razor sharp when broken.

Quartz sleeves can become fouled with skin oils or other impurities. Wear rubber gloves or protective work gloves. When servicing older equipment, we recommend leather gloves, protective sleeves and eye protection in case of a shattered sleeve.

Quartz sleeves should be disposed of in a manner that protects everyone including trash collectors.

Quartz sleeves can be cleaned with a Scotch-Brite® and products like Lime-A-Way® or CLR® calcium, lime and rust removers.



Broken quartz injury – requiring stitches
4th Generation family member

Mission: Data sheet information has been provided to help understand quartz sleeves and their use in various UV systems. If you have suggestions for improvement, please contact us.

Owners represent the 4th Generation of UV equipment manufacturers. UV since 1965
Manufacturing history starting in 1920 in New York City.