

## General information

### Designation

Quartz fused silica glass

### Typical uses

High temperature glass applications, envelopes for high wattage lamps

## Composition overview

### Compositional summary

SiO<sub>2</sub> (99.9%)

Material family	Glass
Base material	Oxide

### Composition detail (metals, ceramics and glasses)

SiO <sub>2</sub> (silica)	99.9	%
Other	0.1	%

### Price

Price	* 4.8	-	8	GBP/kg
Price per unit volume	* 1.04e4	-	1.78e4	GBP/m <sup>3</sup>

### Physical properties

Density	2.17e3	-	2.22e3	kg/m <sup>3</sup>
Porosity (closed)	0			%
Porosity (open)	0			%

### Mechanical properties

Young's modulus	72	-	74	GPa
Specific stiffness	32.7	-	33.9	MN.m/kg
Yield strength (elastic limit)	* 45.7	-	50.4	MPa
Tensile strength	45.7	-	50.4	MPa
Specific strength	* 20.8	-	23	kN.m/kg
Elongation	* 0.06	-	0.07	% strain
Compressive strength	* 1.05e3	-	1.16e3	MPa
Flexural modulus	* 72	-	74	GPa
Flexural strength (modulus of rupture)	105	-	116	MPa
Shear modulus	* 31	-	31.8	GPa
Bulk modulus	* 35.3	-	36.2	GPa
Poisson's ratio	0.15	-	0.16	
Shape factor	15			
Hardness - Vickers	952	-	1.05e3	HV
Elastic stored energy (springs)	* 14.3	-	17.4	kJ/m <sup>3</sup>
Fatigue strength at 10 <sup>7</sup> cycles	* 43.3	-	47.9	MPa

### Impact & fracture properties

Fracture toughness	* 0.6	-	0.8	MPa.m <sup>0.5</sup>
Toughness (G)	0.00502	-	0.00861	kJ/m <sup>2</sup>
Ductility index	6e-6	-	7e-6	µm

### Thermal properties

Glass temperature	* 1.56e3	-	1.96e3	°C
Maximum service temperature	1.1e3	-	1.4e3	°C
Minimum service temperature	-273			°C
Thermal conductivity	1.4	-	1.5	W/m.°C
Specific heat capacity	670	-	740	J/kg.°C
Thermal expansion coefficient	0.48	-	0.52	µstrain/°C
Thermal shock resistance	* 1.23e3	-	1.4e3	°C
Thermal distortion resistance	* 2.75	-	3.06	MW/m

### Electrical properties

Electrical resistivity	* 3.16e24	-	1e26	µohm.cm
Electrical conductivity	1.72e-24	-	5.46e-23	%IACS
Dielectric constant (relative permittivity)	3.8	-	4.2	
Dissipation factor (dielectric loss tangent)	1e-4	-	0.001	
Dielectric strength (dielectric breakdown)	25	-	40	MV/m

### Magnetic properties

Magnetic type	Non-magnetic
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### Optical, aesthetic and acoustic properties

Color	Clear
Refractive index	1.45 - 1.47
Transparency	Transparent
Softness to touch	6.01 - 6.16
Warmth to touch	64.8 - 68.9
Acoustic velocity	5.72e3 - 5.82e3 m/s
Mechanical loss coefficient (tan delta)	* 5e-6 - 1e-5

### Healthcare & food

Food contact	Yes
Guidance for MRI Safety	No Interaction - MR Safe

### Restricted substances risk indicators

RoHS 2 (EU) compliant grades?	✓
REACH Candidate List indicator (0-1, 1 = high risk)	0
SIN List indicator (0-1, 1 = high risk)	0

### Durability

Water (fresh)	Excellent
Water (salt)	Excellent
Weak acids	Excellent
Strong acids	Excellent
Weak alkalis	Excellent
Strong alkalis	Acceptable
Organic solvents	Excellent
Oxidation at 500C	Excellent
UV radiation (sunlight)	Excellent
Halogens	Acceptable

Metals	Limited use		
Flammability	Non-flammable		
Oxygen index	100		%


## Primary production energy, CO2 and water

Embodied energy, primary production	* 37.4	- 41.4	MJ/kg
CO2 footprint, primary production	* 2.2	- 2.43	kg/kg
Water usage	* 1.33	- 1.47	l/kg

## Processing energy, CO2 footprint & water

Glass molding energy	* 20.7	- 22.8	MJ/kg
Glass molding CO2	* 1.66	- 1.82	kg/kg
Glass molding water	* 6.15	- 9.22	l/kg
Grinding energy (per unit wt removed)	* 96	- 106	MJ/kg
Grinding CO2 (per unit wt removed)	* 7.2	- 7.96	kg/kg

## Recycling and end of life

Recycle			
Embodied energy, recycling	* 30.7	- 33.9	MJ/kg
CO2 footprint, recycling	* 1.54	- 1.7	kg/kg
Recycle fraction in current supply	23.8	- 26.3	%
Downcycle			
Combust for energy recovery			
Landfill			
Biodegrade			

## Notes

### Warning

Susceptible to attack by HF

### Other notes

Quartz fused silica has similar properties to silica, but is harder and not as strong.

## Links

ProcessUniverse

Producers

Reference

Senvol Database additive manufactured grades

Shape