

## Borosilicate Glass Properties

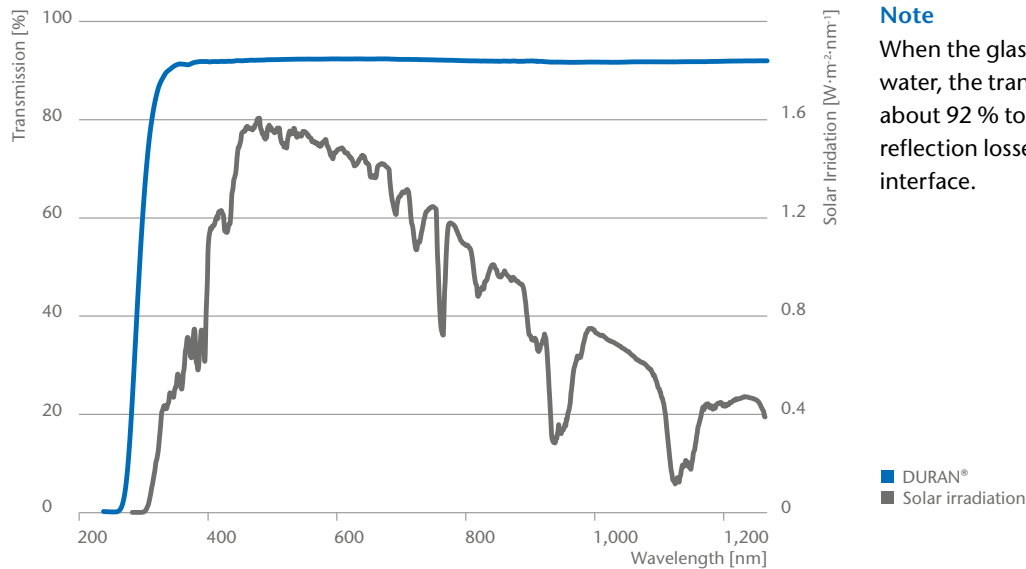
	Metric	US
Coefficient of mean linear thermal expansion $\alpha$ acc. to DIN ISO 7991	$3.3 \cdot 10^{-6} \text{ K}^{-1}$ (20 °C; 300 °C)	$3.3 \cdot 10^{-6} \text{ K}^{-1}$ (68 °F; 572 °F)
Transformation temperature $T_g$	525 °C	977 °F
Density $\rho$ at 25 °C	2.23 g · cm <sup>-3</sup>	139.2 lb · ft <sup>-3</sup>
Modulus of elasticity E (Young's modulus)	$63 \cdot 10^3 \text{ N} \cdot \text{mm}^{-2}$	$91 \cdot 10^5 \text{ lb} \cdot \text{in}^{-2}$ (psi)
Poisson's ratio $\mu$	0.20	0.20
Thermal conductivity $\lambda_w$ at 90 °C	$1.2 \text{ W} \cdot \text{m}^{-1} \cdot \text{K}^{-1}$	$0.69 \text{ Btu} \cdot \text{hr}^{-1} \cdot \text{ft}^{-1} \cdot \text{°F}^{-1}$
Refractive index ( $\lambda = 587.6 \text{ nm}$ ) $n_d$	1.473	1.473
Stress-optical coefficient (DIN 52 314) K	$4.0 \cdot 10^{-6} \text{ mm}^2 \cdot \text{N}^{-1}$	$4.0 \cdot 10^{-6} \text{ mm}^2 \cdot \text{N}^{-1}$

Chemical Composition			
SiO <sub>2</sub>	B <sub>2</sub> O <sub>3</sub>	Na <sub>2</sub> O + K <sub>2</sub> O	Al <sub>2</sub> O <sub>3</sub>
81	13	4	2

main components in approx. weight %

Chemical Resistance	
Hydrolytic Class (DIN ISO 719)	HGB 1
Acid Class (DIN 12116)	Class S 1
Alkali Class (DIN ISO 695)	Class A 2

## Transmission



Transmission of DURAN® glass (d=2.2mm) in configuration air/glass/air.

## Pressure Resistance of Tubing made of Borosilicate Glass

The following formulas apply to stress free, pristine tubing and cylindrical hollow bodies with a circular profile, uniform wall thickness with open ends, free from thermal load, under internal positive pressure.

### Estimation of the maximum pressure resistance (p)

$$p = \frac{WT \cdot 140 \text{ bar}}{OD - WT}$$

OD = Outside Diameter in [mm]  
WT = Wall Thickness in [mm]  
p = Pressure Resistance in [bar]

### Estimation of the minimum wall thickness (WT)

$$WT = \frac{OD \cdot p}{140 \text{ bar} + p}$$

#### Other points to be considered:

- AD 2000-leaflet N 4, edition 2000-10: Pressure vessels made of glass, with encl. 1, edition 2000-10: Evaluation of faults in walls of glass pressure containers
- AD 2000-leaflet B 1, edition 2000-10: Cylindrical and spherical shells under internal pressure overload

$\frac{K}{S} = 70 \text{ bar}$  permissible load referring to standard DIN EN 1595: Pressure Equipment made from Borosilicate Glass 3.3 General Rules for Design, Manufacture and Testing

According to DIN EN 1595 "Pressure Equipment made from Borosilicate Glass 3.3 – General Rules for Design, Manufacture and Testing", DURAN® is an approved material and may be used for the construction of pressure equipment.