

**Data sheet and material properties**

**Introduction**

Quartz glass is one of the most demanding of all glasses for use in technical applications. The single-component glass consists of pure, amorphous silicon dioxide (SiO<sub>2</sub>). Natural or synthetical produced raw materials are used as the starting material, which are melted at over 2000 °C to form amorphous quartz glass. In contrast to crystalline quartz, amorphous quartz glass is not harmful to health and is completely harmless to the environment. Above all due to its extraordinarily high resistance to heat, low thermal expansion and excellent thermal shock resistance, quartz glass is used wherever other glass materials reach their limits.

**Chemical composition**

The chemical composition of quartz glass (typical) in % by weight is as follows:

SiO<sub>2</sub> > 99.7 %

**Physical properties of quartz glass**

Coeff. of thermal expansion	5.5 x 10 <sup>-7</sup> K <sup>-1</sup> (20 °C - 300 °C)
Specific heat capacity	1.1 x 10 <sup>3</sup> J/kg K (20 °C)
Thermal conductivity	1.38 W/m K (20 °C)
Transition temperature (T <sub>g</sub> )	1130 °C
Max. service temperature permanent	1100 °C
short-term	1300 °C
Density	2.2 x 10 <sup>3</sup> kg/m <sup>3</sup>
Poisson constant	0.17 (25 °C - 400 °C)
Young's modulus	75 x 10 <sup>3</sup> N/mm <sup>2</sup> (20 °C)
Mohs hardness	5.5 - 6.5
Compressive strength	1150 N/mm <sup>2</sup>
Tensile strength	50 N/mm <sup>2</sup>
Bending tensile strength	68 N/mm <sup>2</sup>

\* Deviations in individual characteristic values are possible with porous materials.

**Pharmaceutical properties**

The properties described in the pharmacopoeias (DAB10, EurAB, USP XXIII) for pharmaceutical primary packaging and glassware require the hydrolytic resistance according to glass type I. Quartz glass meets these requirements.

**Thermal properties**

The linear thermal expansion coefficient is one of the characteristic properties of glass and is defined as the change in length in relation to temperature. The thermal expansion of quartz glass is 5.5 x 10<sup>-7</sup> · K<sup>-1</sup> (20°C - 300°C) with a permissible tolerance of ± 0.1 x 10<sup>-7</sup> · K<sup>-1</sup>.

**Maximum operating temperatures**

The stress relief limit (1054 °C) is usually considered as the maximum permissible service temperature for quartz glass. Depending on the product and application, quartz glass can withstand a maximum service temperature of up to 1300 °C for a short time, but this increases the risk of deformation and a changing pore structure.

**Drying**

Moist glass filters are dried at room temperature or in a drying cabinet at no more than 100 °C.

**Occupational health and safety**

Working with glass requires protection against shards and splinters. For pressure and vacuum filtration, the use of protective screens, curtains or hoods or working in a fume cupboard is recommended. Protective goggles and gloves should be worn. The possible leakage of reagents used must be taken into account. Please observe these instructions in conjunction with the applicable regulations for working in the laboratory.



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**Viscosity**

Although the glass does not have a defined softening point there are four defined viscosity/temperature points (ISO 7884-2/-3/-4):

Strain point 1054 °C	
Viscosity ( $\eta$ )	$10^{14.5}$ dPa · s
Annealing point 1204 °C	
Viscosity ( $\eta$ )	$10^{13.0}$ dPa · s
Softening point ~ 1730 °C	
Viscosity ( $\eta$ )	$10^{7.6}$ dPa · s
Working point 1700-2100 °C	
Viscosity ( $\eta$ )	$10^{4.0}$ dPa · s

**Chemical resistance**

The chemical resistance of glass, especially quartz glass, is better than that of other known materials. It is resistant to water, acids and alkalis, salts and organic substances. Hydrofluoric acid and concentrated phosphoric acid attack the glass surface with increasing temperature and concentration. The following results were determined in accordance with internationally recognized standards:

Hydrolytic resistance*	HGB 1	(ISO 719, DIN 12111)
*Na <sub>2</sub> O - weight loss	≤ 0.01 µg	(Grieß 300-500µm bei 98 °C)
Hydrolytic resistance	HGA 1	(ISO 720 Grieß bei 121 °C)
Pharma - glass type	1	(USP23, DAB10, EurAB)
Acid resistance*	1	(DIN 12116)
*Na <sub>2</sub> O - weight loss	≤ 100 µg	(ISO 1776)
Alkali resistance	A1	(ISO 695, DIN 52322)



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