## 1. General:

RQ 500 is an electrically fused, transparent quartz glass. This material specification describes the chemical and physical properties of RQ 500, produced by Raesch Quarz (Germany) GmbH.

## 2. Chemical Properties:

### 2.1 Chemical Composition:

RQ 500 has a purity of at least 99.99% $SiO_2$, it contains the following impurities in ppm:

| **Elements** | Al | Ca | Cr | Cu | Fe | K | Li | Mg | Mn | Na | Ni | Ti |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Typical** | 15 | 0.6 | 0.01 | 0.02 | 0.15 | 0.2 | 0.7 | 0.03 | < 0.05 | 0.2 | < 0.01 | 1.3 |
| **Maximal** | 18 | 1 | 0.04 | 0.05 | 0.3 | 1.5 | 1.1 | 0.2 | 0.05 | 0.5 | 0.04 | 1.9 |

### 2.2 OH-Content:

RQ 500, in its untreated state directly after tube drawing, has an OH content of approximately 120 ppm. Through vacuum annealing, the OH content can be reduced to less than 1 ppm, depending on the wall thickness and annealing duration.

### 2.3 Chemical Resistance:

Quartz glass exhibits exceptionally high inertness to chemical reagents. It is classified as Class 1 for water, alkali, and acid resistance. This chemical durability remains effective even at high concentrations and temperatures. Exceptions include hydrofluoric acid and concentrated phosphoric acid.

### 2.4 Gas Permeability:

At room temperature, quartz glass is virtually impermeable to gases. Depending on their respective diffusion coefficients, helium becomes noticeably permeable at around 180°C, hydrogen at around 300°C, light gases at 600°C, and neon, nitrogen, oxygen, and air at around 1000°C.

## 3. Physical Properties:

### 3.1 Mechanical Properties:

| | | |
|---|---|---|
| Density | [g/cm$^3$] | 2.203 |
| Poisson's ratio | [1] | 0.17 |
| Hardness | [Mohs] | 5.5 - 6.5 |
| Compressive Strength | [N/mm$^2$] | 1150 |
| Tensile Strength | [N/mm$^2$] | 50 |
| Bending Strength | [N/mm$^2$] | 68 |
| Modulus of Elasticity at 20 °C | [N/mm$^2$] | 75000 |

* The mechanical properties are significantly influenced by the shape, surface texture, and internal stresses. The table lists typical values

### 3.2 Thermal Properties:

| | | | | |
|---|---|---|---|---|
| Strain Point | [dPas] | $10^{14.7}$ | [°C] | 1167 |
| Annealing Point | [dPas] | $10^{13.2}$ | [°C] | 1255 |
| Softening Point | [dPas] | $10^{7.6}$ | [°C] | 1760 |
| Working Point | [dPas] | $10^{4}$ | [°C] | 1700 - 2100 |
| Transformation Temperature | | | [°C] | approx. 1200 |
| Boiling Point | | | [°C] | approx. 2230 |

| | | |
|---|---|---|
| Max. working temperature: continuous | [°C] | Up to 1160 |
| Max. working temperature: short-term | [°C] | Up to 1300 |
| Devitrification Range | [°C] | 1000 - 1700 |

| | | |
|---|---|---|
| Linear Thermal Expansion Coefficient (at 25 - 300°C) | [1/K] | $0.54 \times 10^{-6}$ |
| Thermal Conductivity (at 20°C) | [1/Wm*K] | 1.4 |
| Specific Heat (at 50°C) | [J/kg*K] | 775 |

## 3.3 Electrical Properties:

| | | | | |
|---|---|---|---|---|
| Electrical resistivity | [°C] | 20 | [Ω*m] | $1 \times 10^{18}$ |
| | [°C] | 400 | [Ω*m] | $1 \times 10^{10}$ |
| | [°C] | 800 | [Ω*m] | $6.3 \times 10^{6}$ |
| | [°C] | 1200 | [Ω*m] | $1.3 \times 10^{5}$ |

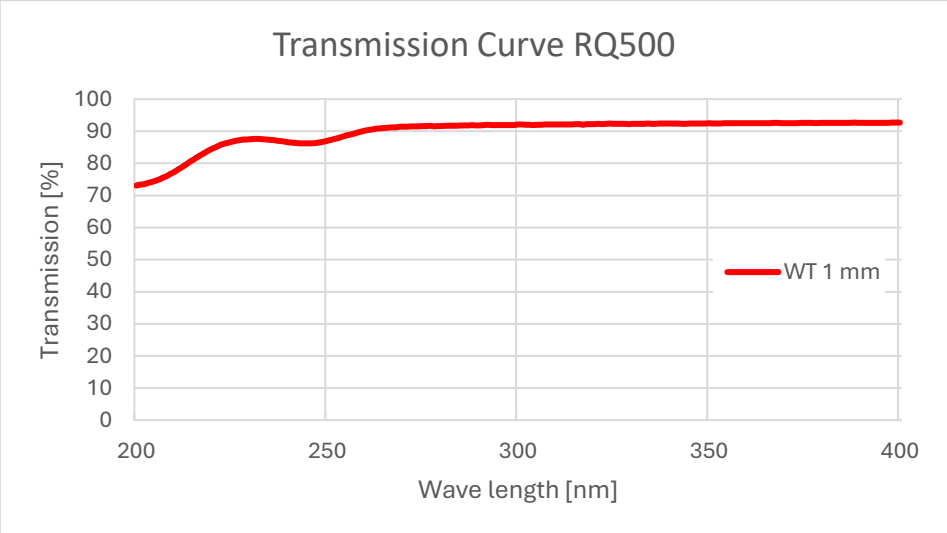
| | | | | |
|---|---|---|---|---|
| Dielectric Strength | [°C] | 20 | [kV/mm] | 25 ... 40 |
| | [°C] | 500 | [kV/mm] | 4 ... 5 |

| | | |
|---|---|---|
| Dielectric Constant ε (at 20°C, 1 MHz) | [1] | 3.7 |
| Dielectric Loss Factor tg δ (at 20°C, 1 MHz) | [1] | $1 \times 10^{-4}$ |

## 3.4 Optical Properties:

| | | |
|---|---|---|
| Optical Refractive Index (at λ = 589.3 nm) | [1] | 1.459 |

| Required Transmission Values at 1 [mm] Wall Thickness: | | | | | |
|---|---|---|---|---|---|
| Wave length λ [nm] | 200 | 250 | 254 | 360 | 400 |
| Transmission T [%] | > 65 | > 85 | > 87 | > 90 | > 91 |



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**Relevant Documents:**
Product Specification RQ 500

| Change History | | |
|---|---|---|
| **Rev.** | **Date** | **Change description** |
| 0 | 01.04.2019 | • New Document |
| 1 | 17.04.2024 | • New Logo & Layout |