

GE 124 QUARTZ

Mechanical properties:

Compressive strength: 1.9×10^8 Pa (160,000 psi).

Tensile strength: 4.8×10^7 Pa (7000 psi).

Permeability (at 700° C):

Helium: 2.1×10^{-8} cc/sec/cm²/mm/cm Hg

Hydrogen: 2.1×10^{-9} cc/sec/cm²/mm/cm Hg

Deuterium: 1.7×10^{-9} cc/sec/cm²/mm/cm Hg

Neon: 9.5×10^{-10} cc/sec/cm²/mm/cm Hg

Typical Physical Properties:

Density: 2.2×10^3 kg/m³

Hardness: 5.5 - 6.5 Mohs Scale 570 KHN

Design Tensile Strength: 4.8×10^7 Pa (N/m²), 160,000 psi

Design Compressive Strength: Greater than 1.1×10^8 Pa (160,000 psi)

Bulk Modulus: 3.1×10^{10} Pa (5.3×10^3 psi)

Poissons ratio: 0.17 Coefficient of thermal expansion (20 - 320° C): 5.5×10^{-7} cm/cm °C.

Thermal conductivity: 1.4 W/m° C

Specific heat: (20° C) 670 J/kg °C

Softening point: 1683° C

Annealing point: 1215° C

Strain point: 1120° C

Electrical resistivity (350° C): 7×10^7 ohm cm

Index of refraction: 1.4585

Constringence (Nu value): 67.56

Empirical Annealing Rates:

Cooling from two sides:

Rate °C/minute: $4274.7 \times$ residual stress Pa/(thickness, mm)₂

Cooling from one side:

Rate °C/minute: $4274.7 \times$ residual stress Pa/(2 x thickness, mm)₂.

Residual stress: 1.7×10^7 to 20.4×10^7 Pa (25-300 psi).

(As a general rule, it is possible to cool up to 100° C/hour for sections less than 25 mm thick.)



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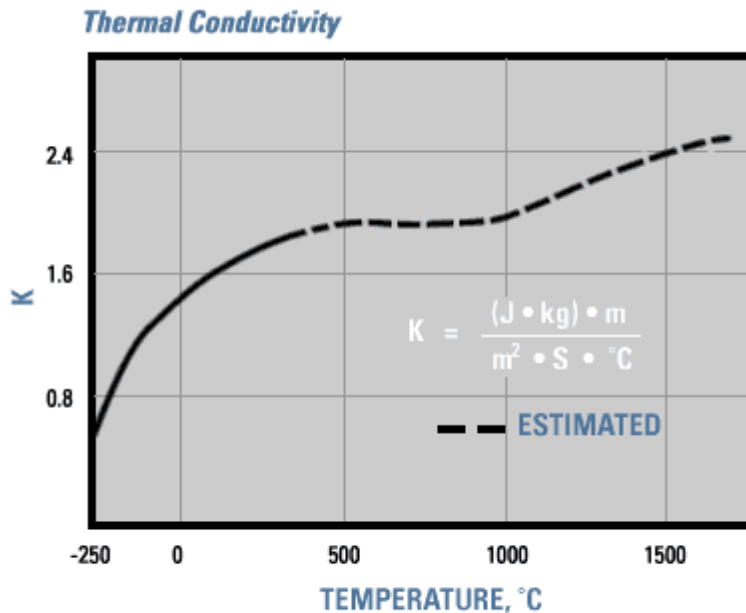
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Typical Trace Element Composition (ppm by weight):

Al	14
As	<0.002
B	<0.02
Ca	0.4
Cd	<0.01
Cr	<0.05
Cu	<0.05
Fe	0.2
K	0.6
Li	0.6
Mg	0.1
Mn	<0.05
Na	0.7
Ni	<0.1
P	<0.2
Sb	<0.003
Ti	1.1
Zr	0.8
OH	<5

Thermal properties:

One of the most important properties of fused quartz is its extremely low coefficient of expansion (20-320° C): $5.5 \times 10^{-7} \text{ mm}^\circ \text{C}$. Its coefficient is 1/34 that of copper and only 1/7 of borosilicate glass. Thermal conductivity information is given below as a function of temperature:



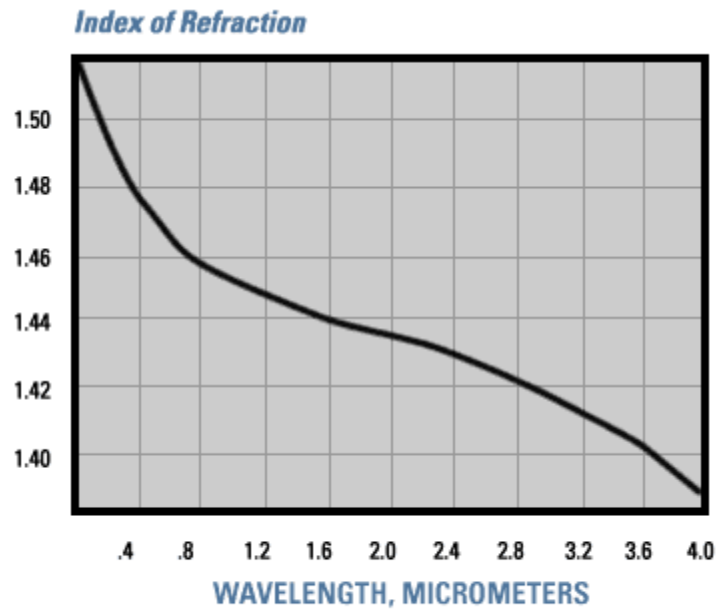
Representative thermal conductivity of fused quartz.
Source: Published manufacturer's data.



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Index of refraction:



Index of refraction of fused quartz.
Source: *Journal of the Optical Society of America*,
Sept. 1954.



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