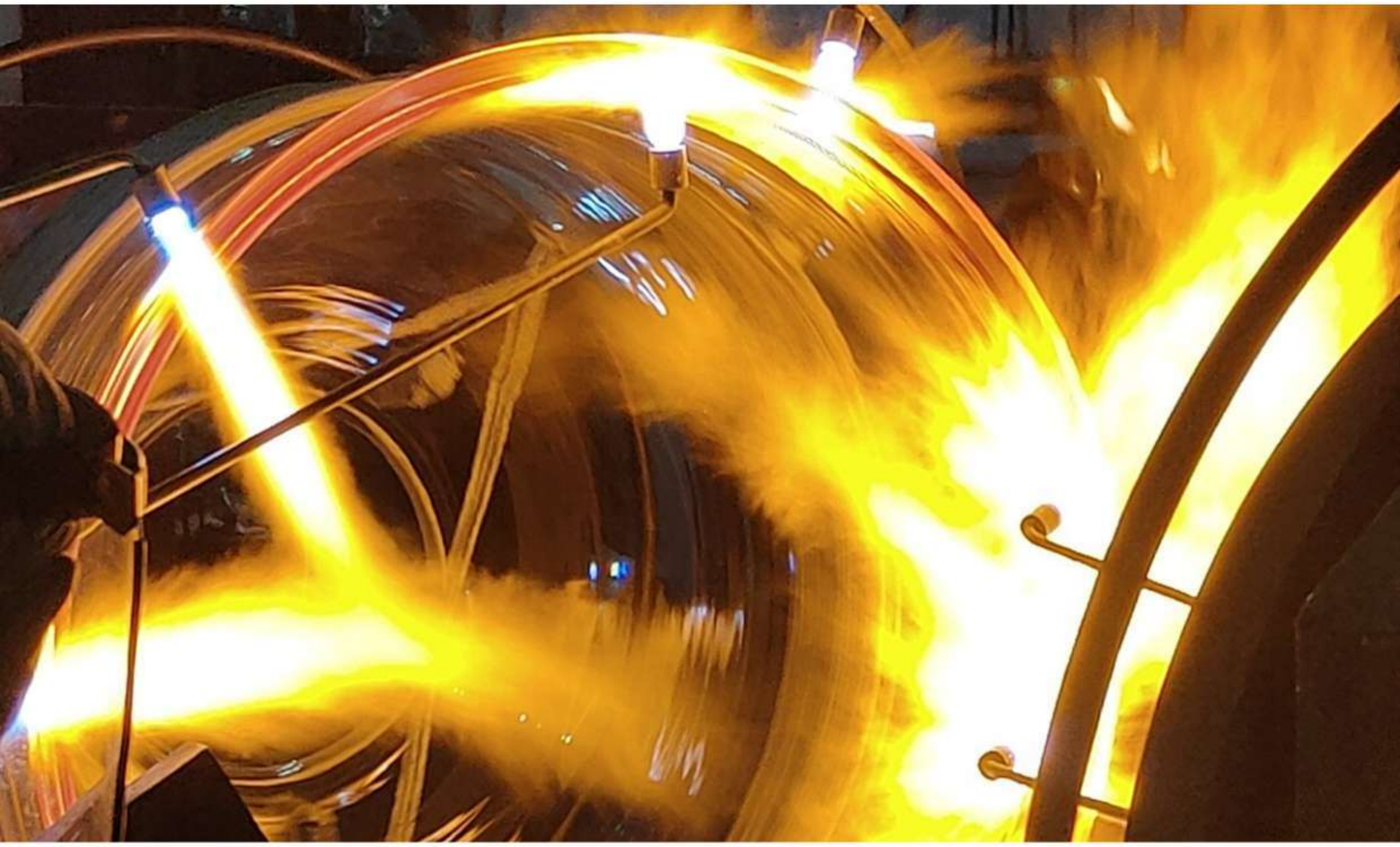
PRODUCT CATALOG



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TECHNICAL INFORMATION

Borosilicate glass is a highly preferred material for constructing plants and piping systems across various industries, including chemical, dyestuff, food, pharmaceutical, and petrochemical sectors. Its increasing popularity is attributed to its numerous advantages compared to traditional materials

-Outstanding corrosion resistance	**- Catalytic intertness.**
-Smooth pore free surface	**- No effect on taste and odour**
- Transparency.	**- Physiological intertness**

Borosilicate glass is selected for its distinct chemical and physical characteristics. It primarily consists of oxides, including silica (SiO2), magnesia (MgO), and lead oxide (PbO), which act as the main modifiers or fluxes in its composition.

The chemical and physical properties of any glass depends on a varying degree on chemical composition of glass.

CHEMICAL COMPOSITION

The chemical composition of borosilicate glass used for chemical plants has following approximate composition.

SiO2 - 80.6%	**B2O2 - 12.5%**
Na2O - 4.2%	**Al2 O3 - 2.2%**
Others - 0.5%	

CHEMICAL RESISTANT

Borosilicate glass 3.3 offers exceptional resistance to chemical attack from most substances, providing broader protection than many other commonly used materials. It demonstrates high resistance to water, saline solutions, organic compounds, halogens like chlorine and bromine, as well as many acids. However, a few chemicals, such as hydrofluoric acid, concentrated phosphoric acid, and strong caustic solutions at elevated temperatures, can cause significant corrosion to its surface. Hydrofluoric acid poses the greatest risk to borosilicate glass, even in very low concentrations (parts per million). Phosphoric acid and caustic solutions are generally harmless at lower temperatures, but corrosion can occur as the temperature rises. Caustic solutions with concentrations up to 30% can be safely managed at ambient temperatures.

In real-world applications, factors like turbulence and the presence of trace chemicals in the solution can influence the rate of corrosion. Therefore, it is challenging to provide precise corrosion rates for caustic solutions under varying conditions.

TECHNICAL INFORMATION

THERMAL PROPERTIES

Linear coefficient of thermal expansion

Borosilicate glass has a thermal expansion coefficient of 3.3×10^{-6} /°C over the temperature range of 0-300°C. This value is significantly lower compared to other types of glass and metals, which is why borosilicate glass is often referred to as low expansion borosilicate glass.

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Specific heat

Specific heat between 25°C and 300°C is average to be 0.233Kcal/Kg, °C

Thermal Conductivity

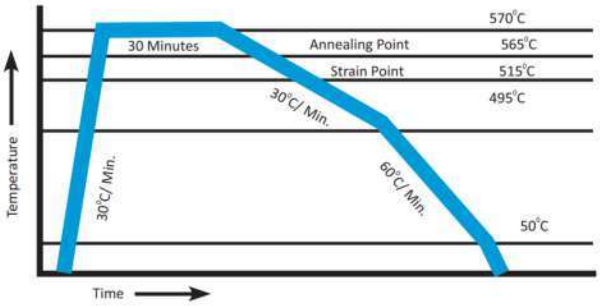
The thermal conductivity of the material is 1.0 Kcal/hr·m°C within the allowable operating temperature range.

Mean Specific Heat

Mean Specific Heat between 20°C and 200°C is 0.98KJ/Kg K

ANNEALING

Annealing of glass is the process where the glass is heated and kept for a defined period of time to relive internal stresses. Careful cooling under controlled conditions is essential to ensure that no stresses are reintroduced by chilling/cooling.



RESHAPEING

In the below given table, it shows characteristic temperature at a determined viscosity, essential for glass reshape.

Lower cooling temperature	10^{24}poise	515°C
Upper cooling temperature	10^{13}poise	565°C
Softening point	10^{7}poise	795°C
Reshaping point	10^{4}poise	120°C

TECHNICAL INFORMATION

MECHANICAL PROPERTIES

The inherent brittleness of glass means it cannot redistribute stresses at points of local irregularities or flaws, leading to significant variation in its breaking strength around an average value. Typically, breakage occurs at a tensile strength of approximately 700 kg/cm². To account for this variability in breaking stress, a substantial safety factor is used when calculating the required wall thickness, ensuring safe operation within the specified working pressure limits.

OPTICAL PROPERTIES

Borosilicate glass 3.3 does not significantly absorb light in the visible spectrum, resulting in its clear and colorless appearance.

For processes involving photosensitive substances, it is advisable to use Amber-coated borosilicate glass 3.3. This coating effectively minimizes UV light transmission by shifting the absorption limit to around 500 nm. Additionally, Sectrans-coated glass components, with an absorption limit near 380 nm, are also well-suited for such applications.

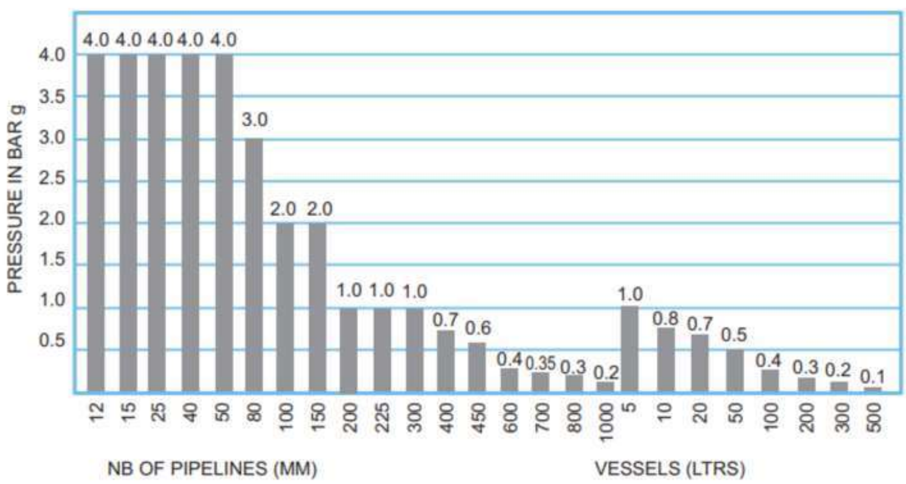
PERMISSIBLE OPERATING CONDITIONS

Working Pressure For Glass Pipelines & Vessels

The allowable internal operating pressure of glass components is determined by their nominal diameter and the working temperature.

For systems that include multiple components such as vessels, filters, and heat exchangers, the overall permissible internal gauge pressure is dictated by the component with the lowest allowable operating pressure. All components are designed to withstand full vacuum conditions.

Pressure values are given in bar, which measures absolute pressure. The maximum recommended working pressure represents the pressure above atmospheric levels.



Working Temperature

Borosilicate glass maintains its mechanical strength and only begins to deform at temperatures approaching its strain point. However, the practical upper operating temperature is much lower and is primarily influenced by temperature differentials in the glass, which depend on the relative temperatures of the contents and the external environment. As long as borosilicate glass is not exposed to rapid temperature changes that could cause thermal shock, it can be safely used at temperatures up to 250°C.

In complete systems that include materials other than borosilicate glass, such as PTFE, the recommended maximum operating temperature is 200°C. Operating temperatures may need to be adjusted to account for factors like pressure, thermal cycling, and rapid heating or cooling.

The ability of borosilicate glass to withstand thermal shock, typically defined as sudden cooling or heating, depends on several factors, including operational stresses, support-related stresses, and glass wall thickness. While it is generally advisable to avoid sudden temperature changes, temperature differences of up to 120°C can be managed.

At sub-zero temperatures, the tensile strength of borosilicate glass increases, allowing it to be safely used at temperatures as low as -70°C. Restrictions may occur because of combination with PTFE components, which may become brittle at low temperature.

The working conditions of jacketed items are described separately

COMPOSITE MATERIALS

The last two decades have seen the new or further developments of particularly corrosion resistant plant construction materials. Typical examples of these are PTFE, tantalum, titanium, graphite and of course, Borosilicate 3.3 Glass.

The combination of different corrosion resistant materials with the utilization of the specific advantages of each permits both safe and economic construction.

Borosilicate glass/PTFE

Borosilicate Glass with PTFE is of particularly decisive importance for construction of glass installation for example. in Seals, Bellows, Stirrers, Pumps, Heat Exchangers, Column Inserts etc.

PTFE is used with Glass because of its excellent mechanical & thermal properties. They have near universal fluid compatibility. Wear life when compared with others is very low. Particularly PTFE is maintenance free and have cryogenic stability with non-wetting property.

Service temperature of PTFE is considered as - 50°C to + 200°C