Chemical glasses and glass coatings for chemical apparatus characteristically have superior acid resistance. This is due to their acidic components and structure. For this reason, acid resistance is their major field of application. Alkali resistance is usually the inherent advantage of metallic and polymeric vessel materials and defines their principal application range. However, decades of Pfaudler research and development have finally broken down these boundaries.

**Pfaudler Standard Glass Coatings**

Pfaudler’s standard glass coatings already have relatively high alkali resistance without compromising their extremely high acid resistance. They are ideal for conventional glass coating applications and are preferred for high acid operations with occasional neutralization and intermediate alkaline operations.

**Pfaudler Type 4300 Glass Coatings**

Type 4300 glass coatings represent a new aspect of this tradition and are designed to bridge a perceived gap in the application range. Pfaudler Type 4300 glass is still an acidic type of glass, but its primary application is based on improved alkali resistance. Pfaudler Type 4300 glass coatings are advisable wherever alkaline conditions prevail during the cycle, or as a result of concentration and temperature, or where concentration and/or temperature conditions exceed permissible limits for conventional glass.

**In addition, Type 4300 glass coatings are advisable where any of the following conditions exist:**

- Protection of alkaline products against metal contamination
- Danger of discoloration of alkaline products due to incorporation of metals
- Stabilization of high-molecular alkalis sensitive to metal contact
- Inadequate redox stability of the vessel material in the alkaline range

Compared to our world renowned standard glass, Type 4300 has three times better alkali resistance. This means that higher process temperatures can be used, or that, under otherwise equal conditions, these glass coatings will have three times the life expectations. The Type 4300 glass does make a slight concession in the area of acid resistance. Although it is adequate for mild service, it is not recommended for aggressive acid conditions. The isocosion curves and thermal limit diagrams for Type 4300 glass appear in the next section.

**Temperature Limits**

Although Type 4300 glass has a high degree of helpful compressive stress in the glass layer, there are definite limits to the level of thermal stress which the glass can withstand without incurring damage.

Only two conditions must be considered when determining the temperature limits:

**A.** Introduction of media into a vessel. The limits are determined from Chart A (located on next page).

**B.** Introduction of media into a jacket. The limits are determined from Chart B (located on next page).

In both cases the safe operating range lies within the polygons as outlined on the charts. The left and right sides on the polygons represent, respectively, the minimum and maximum wall temperatures allowed. The bottom and top on the polygons represent, respectively, the minimum and maximum product temperatures allowed (Chart A) and the minimum and maximum product temperatures allowed (Chart B).
Operating Temperature – Example Exercises

Exercise No. 1.
Determine the maximum and minimum allowable wall temperatures of a vessel when introducing a product at 100°C into the vessel.

Procedure: Since the media is being introduced into the vessel, Chart A applies. Find the product temperature of 100°C on the product temperature axis (ordinate). If you follow this constant temperature along the wall temperature axis (abscissa), you will see it intersects the polygon at wall temperatures of -30°C at the lower temperature end and at 232°C at the upper temperature end.

Answer: Product at 100°C can safely be introduced into a vessel whose wall temperature is between -30 and 232°C.

Exercise No. 2
A vessel with a wall temperature of 100°C is to be heated using hot oil with a heat transfer film coefficient of 1500 W/m²K. What is the maximum temperature oil that can be used?

Procedure: Since the media is being introduced into the jacket, Chart B applies. Find the wall temperature of 100°C along the wall temperature axis (abscissa). If you follow this line along the jacket temperature axis (ordinate), it intersects the oil (1500 W/m²K) polygon at a jacket temperature of 257°C.

Answer: The maximum allowable temperature of a 1500 W/m²K oil introduced into the jacket of a 100°C vessel is 257°C.

Exercise No. 3
A batch has just been completed, and the wall temperature of the vessel is 150°C. What are the upper and lower temperature limits of the product that can be introduced in the vessel for the next batch?

Procedure: Chart A applies. Find the temperature of 150°C on the wall temperature axis. This line intersects the polygon at product temperatures of -5 and 232°C.

Answer: The maximum and minimum temperatures of a product that can be introduced into a vessel with a wall temperature of 150°C are 232 and -5°C respectively.

Exercise No. 4
Steam is being used to heat a product in a vessel. The vessel contents are at 125°C. Can 250°C steam be introduced into the jacket?

Procedure: Chart B applies. The intersection of a wall temperature of 125°C and a jacket temperature of 250°C is outside the steam polygon on the chart.

Answer: Steam at 250°C cannot be introduced safely into a vessel whose contents are at 125°C.

Corrosion Resistance
In the charts that follow, we present the isocorrosion curves for 4300 glass. The curves are for pure acids and bases most commonly used in the chemical industry and take into account technically relevant parameters influencing the rate of corrosion (for example, the volume/surface area into, inhibition effects, concentration, and temperature).

In practical operation these materials are always encountered with liquid additives, dissolved substances or gases which may have positive or negative effects on resistance. We therefore recommend performing corrosion tests or contacting a Pfaudler consultant to assure material suitability for individual processes.
The information contained in this bulletin is believed to be reliable general guidelines for consideration of the products and services described herein. The information is general in nature and should not be considered applicable to any specific process or application.

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Volume to Surface Area Ratio (V/O) applicable to all charts = 20