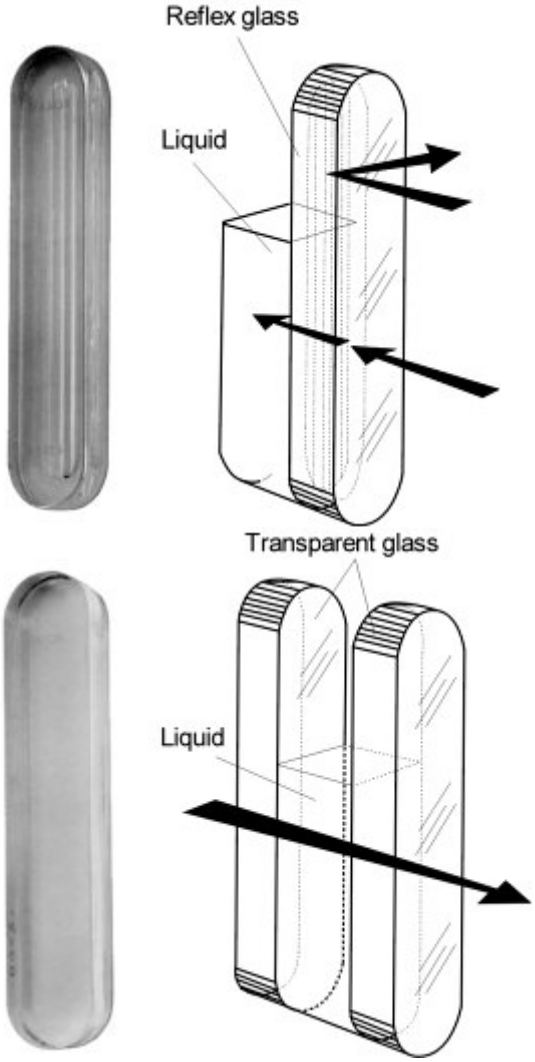


## Reflex and Transparent Gages

Reflex gages have a single vision slot in which light can enter the gage chamber to determine liquid level. Above the liquid level, glass prisms reflect the surrounding light. Below the liquid level the liquid fills the prisms causing the glass to become relatively transparent.

Light striking the area of glass covered by transparent liquid is allowed to pass through to the interior of the gage along the entire length of the covered prism. The light is reflected from the back of the chamber to the observer. Typically the chamber appears dark. An opaque liquid such as milk would directly reflect the light at the surface of the prisms, where it appears as a solid column of white.

Light striking the area of the glass above the liquid level experiences internal reflection. Internal reflection will occur when light attempts to move from a medium having a given index of refraction to one having a lower index of refraction.

When the light attempts to move from a higher index of refraction (glass – 1.47 index of refraction) to a lower index of refraction (air – 1.00 index of refraction through the prism angle), it reflects rather than passes through to the back of the chamber. Except for a focused line of light along the apex of the prism, the surrounding light reflects back to the observer appearing silvery.

The interface between the liquid and gas occurs where the silvery and dark/opaque area intersect.

Transparent gages have a vision slot on both sides of the chamber. Light enters the gage from the side opposite the observer so that both the level of a liquid and its characteristics can be seen. For easier liquid observation in dark environments, illuminators are available for use with transparent gages.
Transparent gages may be used for interface applications

## Armored Gages

Armored flat glass gages give users the ability to visually inspect liquid characteristics (color, particulate, striations, turbulence) and monitor relative fill or drain rates in a variety of applications where vibration, temperature and/or pressure extremes rule out level technologies.

End users interested in establishing a reliable, easy-to-understand level reference often use flat glass gages to verify electronic level device output at plant start-up or routine maintenance (especially pressure vessels).

Other distinct advantages:

- They require no electrical power. Level can be monitored in remote locations where no power is available. In event of a power failure, the flat glass gage is not effected.
- They are not dependent on most liquid properties. Multiple liquids can be processed through the same vessel without concerns for density, surface turbulence, di-electric, conductivity, etc.
- They're suitable for vacuum application.
- They provide a near-unlimited length of measure.
- They're non-intrusive.

## Borosilicate Glass, Aluminosilicate Glass and Quartz

Borosilicate glass is the most common type of optic material used in Penberthy gages. Borosilicate glass offers good resistance to most chemicals at temperatures at or below 600°F [316°C].

Penberthy uses tempered borosilicate glass in its gages to improve thermal shock resistance. The tempering process involves heating the glass to a glassy transition point and rapidly cooling the glass to create compressive stress in the outer 1/6 of thickness.

Aluminosilicate glass has a higher viscosity and a lower thermal expansion coefficient compared to borosilicate glass. Aluminosilicate glass is commonly used where process temperatures are greater than 600°F [316°C] but are at or below 800°F [427°C].

Fused quartz is made from crystalline silica with few impurities (50 ppm by weight). The highest temperature rating, 1000ºF [538ºC], is achieved by using quartz.

Materials other than quartz limit a gage assembly's maximum operating temperature.

Penberthy offers quartz in its model TH only. The physical properties of quartz require an extremely flat seating surface. Flatness tolerance of gasket and cushion seating
surfaces on chambers and covers must be maintained to avoid torsional or point stresses on the quartz.

Shields (e.g., PCTFE, Mica) can be installed to prolong the life of transparent flat glass in corrosive or erosive environments such as hydrofluoric acid, sodium hydroxide or steam.