

White Paper

Step-by-Step Guide to Sight Glass Selection

Sight glass components allow operators to safely observe processes inside tanks, pipes, reactors and vessels. When it comes to selecting a sight glass, a wide variety of factors should be considered in order to ensure optimal performance. The guidelines that follow give tips and step-by-step advice on how to best select the ideal sight glass for a specific application.

Start by defining the process to be observed, with considerations given to temperature, pressure, impact, physical characteristics of the process media, flow, and whether or not the process has sanitary requirements. With these factors in mind, one can begin the process of selecting the type of sight glass that best suits the needs of the process.

There are two distinct styles of sight glasses:

Sight glass window. This type of sight glass is used on a process vessel or tank. It is a window that allows operators to inspect the process media, observe reactions, observe the functioning of mixing equipment, verify the presence or absence of media, see liquid level, etc. It consists of metal, glass and gasket components.



Sight flow indicator. A sight flow indicator is used in process pipelines to observe the flow of liquid, powder or gas. It is comprised of a body with one or more viewing windows, usually with gaskets, and a way to mount the indicator to the pipeline. It is installed in a pipe to provide a visual means of verifying flow for direction and approximate rate of the process media. Through the sight flow indicator, operators can easily observe the color, clarity and flow of the medium passing through the window.



There are different selection considerations for each style.

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Sight Glass Windows

Step 1

Consider the viewing requirements:

- What does the operator need to see? Is it simply how much product is in a vessel? Or does the character of the process media need to be examined? How much of the tank needs to be viewed – a small area near the sight glass or the entire tank?
- Is there enough ambient light to clearly see through the sight glass or should a light (also called a luminaire) be installed to increase visibility within tank or vessel interiors?
- A sight glass with a viewing area of 4 inches or larger should provide sufficient room to add a light.
- Would installing two sight glasses – one for viewing and one for a light – better serve your needs? Often an additional sight glass with its own light better illuminates the interior of a vessel. (Imagine looking through a small opening with a flashlight. Illumination from an angle is more effective.)
- Would installation of a camera be beneficial? Sight glass ports may be fitted with video cameras that allow for remote monitoring as well as recording.

Step 2

What size viewing area do you need?

- The minimum area of glass for viewing is four inches in diameter. (Imagine peering into a vessel; four inches give just enough room to use both eyes.) Smaller areas of glass can be used for sight glasses that are specifically for lights and cameras.

Step 3

How will the sight glass window be mounted?

- **Weld-on.** If the sight glass will be welded on, consider the following:
 - What will be the temperature and pressure inside the vessel? Sight glasses are rated for maximum temperature and pressure.
 - If the sight glass is going to be welded into place, the vessel onto which it will be welded likely hasn't been created yet. The size of the hole for the sight glass should be specified before the vessel is made.
- **Bolt-on.** When your sight glass is mounted to an existing flange, bear in mind the following:

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- Bolt-on sight glasses come with existing bolt holes. Be sure to let the sight glass supplier know the size of the flange to which the sight glass will be connected so that the bolt holes match up.
- There are pressure limitations depending on the type of flange used. Bolt-on sight glasses are generally specified as 1) good to 15 lbs. psi or 2) for anything over 15 lbs. psi. Sizes should follow DIN28120 specification guidelines and materials should follow ASME standards.
- **Clamp-on.** The pharmaceutical industry uses clamp-on sight glasses so that all components can be easily disassembled for cleaning.

Step 4

Next, determine the type of materials that should be used in your sight glass device, bearing in mind compatibility of the components. A sight glass unit is generally comprised of metal, gaskets and glass.

Metal

- Carbon steel and stainless steel are the two most common materials used.
- Stainless steel offers better corrosion resistance and is used in pharmaceutical applications.

Gaskets

- Be sure that the gasket material used is compatible with the product with which it will come in contact.
- Standard gaskets for most industry applications are made of an enhanced PF material or Teflon. Gasket integrity is crucial to successful sight glass performance.

Glass

- Standard soda glass is typically used when temperatures are less than 300° F.
- For temperatures between 300° – 500° F, borosilicate is typically used. It is more resistant to thermal shock than soda glass, and should be specified in areas where hot equipment may experience washdowns with cool water, even for temperatures below 300° F.
- Quartz or sapphire glass is recommended for temperatures greater than 500° F, such as in high temperature steam applications.
- Glass can come as a conventional glass disc or as a glass disc fused to a metal ring during manufacturing. Fused sight glass windows hold the glass in concentric compression that makes the glass resistant to bending stresses that would otherwise

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cause cracks or failure. They are used when high pressure ratings, impact resistance and high safety margins are needed.

- Such fused glass sight glasses are popular in pharmaceutical and food industries, in which case it is attached with a clamp.
- For use with caustic or acidic chemicals, borosilicate glass is less likely to experience clouding and erosion than soda lime glass.
- In some conditions, soda lime glass may leach into the process media. In contrast, borosilicate glass meets the requirements of USP Type 1 and may be used with non-parenteral process media.
- Soda lime glass discs should be replaced and not be reused after maintenance (disassembly) of the sight glass, because tiny fractures may occur during mounting that are not visible to the naked eye. Borosilicate glass discs are tougher and usually they may be reused if they pass close visual inspection. If the sight glass is of the type where the glass is fused to its metal frame, then reuse is no problem, because the metal ring takes the stress of mounting.

Sight Flow Indicators

Step 1

If you have determined you need a sight flow indicator, then you have two types from which to choose:

360° view flow indicator. Also called full view, cylindrical- or tube-style flow indicator, this type of flow indicator passes fluid through a glass cylinder that is visible from all angles. This allows ample ambient light to illuminate the flow. It is ideal for the observation of process fluid for clarity, color, foam, and other conditions, and for the presence of moisture. It is not appropriate for high temperatures or high pressures.



View-through flow indicator. This type of flow indicator has two opposing windows so that an operator can see the intervening flow of fluid lighted from behind, either by ambient light or with an attached luminaire. Unlike 360-degree full-view flow indicators, this design is suited for ANSI pressure classes, high temperature, and harsh fluid applications.



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Step 2

Now narrow down the specific function of the indicator. Sometimes you may need more than just a clear glass indicator. A number of different indicators are available that can help you easily gauge direction and speed of flow of the process material:

Flapper flow indicator. Flow indicators may be fitted with a hinged flapper or flag visible through the sight glass. The flapper is deflected toward the flow direction. Because the position of the flapper changes in relationship to the force of flow, it provides operators with an approximate gauge of flow.

Visual flow meters. Flapper-style sight flow indicators are available in which the flapper has a reset spring. The force of the spring is overcome by the relative flow of the process fluid. A graduated scale is marked on the glass so that the flow volume is indicated. In simple applications this may be used as an alternative to an expensive flow meter.

Rotary flow indicator. Flow indicators may be fitted with rotors or impellers that are turned by the flow of liquid or gas. The rotors are mounted in the window view so operators can observe the direction and approximate speed of flow. This is particularly useful for clear gases and fluids, though the rotor is visible with dark fluids as well.

Drip indicator. Drip indicators may be models designed for drip observation or conventional flow indicators installed with a drip tube. Drips and low-volume intermittent flows may be observed in applications such as distillation. Because gravity is utilized, drip indicators are normally applied in vertical pipes with a downward flow.

Ball Flow Indicator. Flow moves a ball from the bottom of the indicator housing to a position at the top of the sight window. The ball is visible through the window so that flow may be observed easily at a glance. The suspension of the ball by the fluid indicates the presence of flow. Because gravity returns the ball to its rest position, this style of indicator must be applied in vertical pipes with upward flow. Generally this is used with slow moving fluids or gases, and not with high-rate or turbulent flows.

Flutter Indicator. The mechanisms for standard flappers and rotors cannot be Teflon[®] coated, so for observing gases and liquids in Teflon-lined flow indicators a flutter style indicator is a good choice. The movement of a thin ribbon of tough, non-reactive material such as Teflon may be observed through the sight glass window. The intensity of the flutter indicates the relative speed of the flow.

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Step 3

Choose a mounting type.

- Bolt-on (flanged)
- Threaded-on (typically used for smaller sizes)
- Sanitary clamp (used in pharmaceutical applications for easy cleaning)

Step 4

Next, determine the type of materials that should be used in your sight glass device, bearing in mind compatibility of the components. A sight glass unit is generally comprised of metal, gaskets and glass.

Metal

- Carbon steel and stainless steel are the two most common materials used.
- Stainless steel offers better corrosion resistance and is used in pharmaceutical applications.
- Iron, bronze and PVC can also be used. However, PVC is rarely used for industrial and chemical processing.

Gaskets

- Be sure that the gasket material used is compatible with the product with which it will come in contact.
- Standard gaskets for most industry applications are made of an enhanced PF material or Teflon. Gasket integrity is crucial to successful sight glass performance.

Glass

- Standard soda glass is typically used when temperatures are less than 300° F.
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By giving careful consideration to the items outlined above, you should easily and successfully navigate the sight glass specification process.

For more information on the selection and application of sight flow indicators in process applications, L.J. Star offers its Sight Flow Indicators Handbook online:

<http://www.ljstar.com/publications/pdf/SightFlowIndicatorsHB.pdf>

For more information on sight glass considerations such as temperature, thermal shock, corrosion, abrasion, pressure and impact, download the L.J. Star White Paper “6 Tips for Critical Sight Glass Applications” at <http://www2.ljstar.com/1/12112/2012-04-04/h5q2>

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