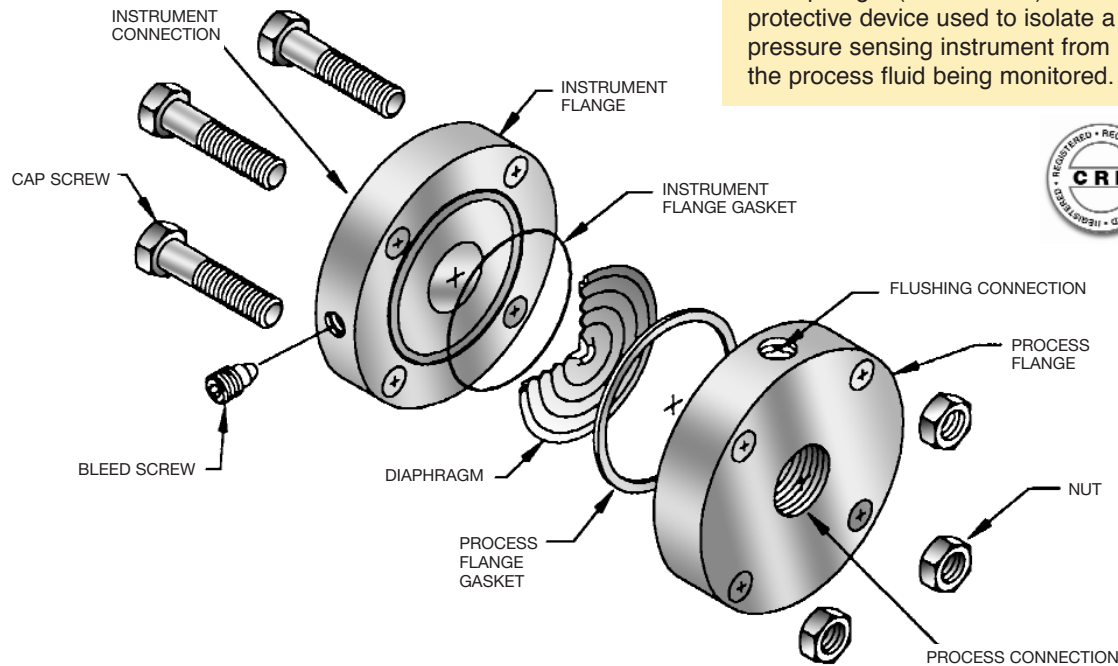


Diaphragm Seals

DESIGN & OPERATION

DIAPHRAGM SEALS



Description

A Diaphragm (or Chemical) Seal is a protective device used to isolate a pressure sensing instrument from the process fluid being monitored.

Principles of Operation

A Diaphragm Seal is a device consisting of a diaphragm clamped between two suitable housings that are properly gasketed to prevent leakage of liquid or gas. The diaphragm (a dividing membrane or thin partition) acts as a barrier to isolate and protect the sensing element of a pressure instrument from potentially destructive process media. Without such a barrier, the process media might clog or corrode the pressure instrument, causing failure or inaccurate response. The sensing element of the pressure instrument, as well as the space above the diaphragm of the seal, is evacuated and then filled with an incompressible liquid. When force (process media) is applied to the diaphragm seal, the internal diaphragm will flex and the displaced liquid fill will then transmit the force to the sensing element of the pressure instrument, resulting in a pressure measurement.

Features

Continuous Seal Operation

Trerice Diaphragm Seals (except Mini Seals and Sanitary Seals) are designed for continuous seal operation. A diaphragm stop plate, located within the instrument housing, enables the diaphragm to assist in containing the process media should the pressure instrument be damaged or removed. This allows the process to continue to operate until it can be shut down to repair or replace the instrument or seal. This safety feature is especially important where the process media is corrosive or harmful.

Various Diaphragm Sizes

Trerice Diaphragm Seals are available in a variety of diaphragm sizes: Mini (Series 2), Compact (Series 3), Sanitary (Series 4), Standard (Series 5) and Large (Series 6). Mini and Compact diaphragm sizes are designed to provide economical protection for pressure gauges (Contractor/Commercial/Utility) with a dial face size of 4 1/2" or smaller. Sanitary Diaphragm Seals are designed for use with Tri-Clamp process connections. Standard and Large diaphragm sizes are the most versatile, with a variety of available materials and connections. The Large diaphragm size has twice the diaphragm surface area of the Standard diaphragm size and is therefore more sensitive and better suited for low pressure applications.

Fill Port

Terice Diaphragm Seals are furnished standard with a fill port in the side of the instrument housing. This port provides access to the fill area above the diaphragm. An adapter fitting can be connected so that the assembly can be evacuated and completely filled with liquid without entrapping air, thereby maintaining the integrity of the system. A bleed screw is inserted after filling to plug the port and provide a means to bleed excess fill during the instrument calibration process.

Clean-out Design

Most Terice Diaphragm Seals are of the Clean-out design, utilizing a snap-in or welded style diaphragm, with an o-ring gasket between the diaphragm and instrument housing. This allows the bolts to be removed and the housings separated to permit inspection, cleaning or installation of the process housing without loss of the liquid fill fluid in the instrument housing.

Note: Should the bolts of a Non Clean-out design diaphragm seal (Styles 05, 10 and 11) be loosened or removed, loss of the liquid fill will result.

Flushing Connection

Most Terice Diaphragm Seals can be ordered with a 1/4 NPT Flushing Connection (located in the side of the process housing), which enables periodic back flushing of solids from the system.

Selecting A Diaphragm Seal

In choosing the appropriate diaphragm seal, it is essential to have an understanding of the pressure instrument to be isolated, the process medium, and any temperature or pressure considerations. The process housing (or adapter ring), diaphragm, and process housing gasket are “wetted” parts which come in contact with the process medium, making proper material selection critical. The instrument housing, instrument housing gasket, nuts and bolts, and liquid fill fluid do not come into contact with the process medium and therefore are “non-wetted” parts. External environmental considerations, such as atmospheric conditions or extreme temperatures, may influence material and design selection.

All Terice Diaphragm Seals should be carefully selected to meet the demands of the particular application. The information contained in this catalog is offered only as a guide to assist in making the proper selection. Selection of the proper diaphragm seal, as well as the liquid fill fluid, is the sole responsibility of the user. Improper application may cause failure of the seal, resulting in possible personal injury or property damage. For correct use and application of all diaphragm seals, please refer to Diaphragm Seal Standard ASME B40.2. This document may be obtained from the American Society of Mechanical Engineers (ASME), United Engineering Center, 345 East 42nd Street, New York, NY 10017.

Process Housing or Adapter Ring

Generally, the material chosen is identical to that used in the piping system. Many different metal alloys, as well as nonmetallic materials, are available. A unique, patented Teflon-lined process housing is offered for use with Teflon-lined piping systems. The Teflon-lined steel housing can safely withstand high pressures and temperatures without leakage. Diaphragm seals supplied with nonmetallic process housings are furnished with a steel pressure plate under the fasteners, which spreads the bolting pressure over a large area and prevents the nuts or bolts from imbedding themselves into the process housing.

Diaphragm Seals

DESIGN & OPERATION

Diaphragm

Both welded and removable metal diaphragms are available, as are Teflon and Viton diaphragm materials. Trerice metal diaphragms have both radial and spoke corrugations, resulting in an extremely flexible diaphragm. This flexibility increases the diaphragm's ability to displace fill fluid into the pressure instrument, providing excellent accuracy at low pressures. Trerice Teflon diaphragms provide greater sensitivity than metal diaphragms and are compatible with many caustic process media. Trerice Viton diaphragms are extremely pliable and offer optimum sensitivity at low pressures.

Type W (Welded Metal)

- ▶ Diaphragm is welded at its outer edge directly to the instrument housing.
- ▶ Ensures no leakage of the fill fluid.
- ▶ Best choice for high temperature applications.
- ▶ Economically priced.
- ▶ Diaphragm and instrument housing must be replaced as a complete assembly.
- ▶ Clean-out design.

Type M (Removable Metal)

- ▶ Diaphragm is replaceable if worn or damaged.
- ▶ Can be rebuilt many times to "like new" condition.
- ▶ Very cost effective.
- ▶ Available in Clean-out or Non Clean-out design.

Type T (Teflon)

- ▶ Offers excellent compatibility with most process media.
- ▶ Greater sensitivity than metal diaphragms.
- ▶ Best choice for abrasive fluid applications.
- ▶ Available in Clean-out or Non Clean-out design.

Type V (Viton)

- ▶ Compatible with most process media.
- ▶ Most sensitive diaphragm material available.
- ▶ Ideal for low pressure applications.
- ▶ Available in Clean-out or Non Clean-out design.

For Viton diaphragm applications that also require pulsation damping, a .040 orifice should be specified. Standard porous stones are not recommended. Please consult factory.

Process Housing Gasket

Process housing gaskets are installed in all seals (except Mini Seals and Sanitary Seals). They seat into a recessed area of the process housing, eliminating the possibility of causing damage to the gasket by over-tightening the bolts. The process housing gasket is self-energized (utilizing process pressure to seat the gasket), reducing the possibility of leakage. Process housing gaskets are normally made of Teflon for applications up to 500°F, but can be supplied in Grafoil for temperature requirements up to 800°F. Consult factory for availability.

Instrument Housing

The instrument housing is isolated from the process media by the diaphragm and is normally furnished in nickel plated, carbon steel. For severe environmental conditions, a 316 stainless steel housing with stainless steel nuts and bolts is also available. For other material requirements, consult factory.

Instrument Housing Gasket

Viton instrument housing gaskets are used in Type M (Removable Metal) and Type T (Teflon) seals, and have a 500°F temperature limit. No instrument housing gasket is required on Type V (Viton) seals as the diaphragm provides a "self-gasketed" seal.

Nuts and Bolts

Bolts are normally hexagonal head, heat treated alloy steel, while nuts are hexagonal type stainless steel. Stainless steel bolts are furnished with stainless steel instrument housings and are also available with standard nickel plated, carbon steel instrument housings. Special materials are also available; consult factory. (Mini Seals and Sanitary Seals are of welded construction and, therefore, nuts and bolts are not required for assembly.)

Liquid Fill Fluids

The liquid fill fluid transmits the process pressure acting upon the diaphragm to the sensing element of the pressure instrument. Because fill fluids may freeze at low temperatures, vaporize at high temperatures, or react chemically with process media or other materials, caution must be exercised when selecting the liquid fill fluid. Please consult the table below for liquid fill temperature limits. Other fill fluids may be available; consult factory.

Liquid Fill Fluid Temperature Limits		Fill Fluid Pressure Limits	
Standard Instrument Oil	10°F to 300°F	Standard Instrument Oil	Vacuum/Pressure
Glycerine	0°F to 210°F	Glycerine	Pressure Only
High Temperature Silicone	-60°F to 500°F	Silicone	Vacuum/Pressure
Halocarbon	-50°F to 500°F	Halocarbon	Vacuum/Pressure

Temperature and Pressure Limitations

Temperature and Operating Range Limitations				
Diaphragm Size	Diaphragm Type	Maximum Temperature*	Minimum Pressure Gauge Range	Maximum Readable Vacuum (30" Hg to 0 Range)
Series 6	M, W	500°F	0 to 30 psi	24" Hg
	T	500°F	0 to 30 psi	26" Hg
Series 5	M, W	500°F	0 to 60 psi	21" Hg
	T	500°F	0 to 60 psi	23" Hg
	V	350°F	0 to 5 psi	29" Hg
Series 4	W472	500°F	Range Dependent**	Not Recommended
Series 3	W305	500°F	0 to 100 psi	Not Recommended
Series 2	W205	500°F	0 to 100 psi	Not Recommended

* Choice of fill fluids may affect maximum temperature. Please refer to Liquid Fill Fluid Temperature Limits above.

** See Sanitary Gauge product data page for minimum operating pressures.

Maximum Working Pressure	
Style	Maximum Pressure
Pipe-Mounted	2500 psi @ 100°F (5000 psi @ 100°F – optionally available – consult factory)
Flanged	ASA flange pressure rating
In-Line Flow-Thru	600 psi @ 100°F**
Saddle-Welded	600 psi @ 100°F**
Drop-In Welded	600 psi @ 100°F**
Mini Diaphragm	2000 psi @ 100°F
Compact Diaphragm	1000 psi @ 100°F
Sanitary	1000 psi @ 100°F

** Should not exceed pressure rating of pipe being used.

For applications other than those listed, please consult factory. The above temperature, pressure, and vacuum limits apply only when diaphragm seals are properly mounted, installed, operated and maintained.

The accuracy of a pressure instrument may be affected when mounted to a diaphragm seal, especially in ranges of 100 psi or below. Please consult factory for further information.

Seals with a polypropylene, PVC or Teflon process housing have a maximum working pressure of 300 psi at a maximum temperature of 140°F.