

1. Introduction

A diaphragm seal is a device that attaches to the process side of a pressure-measuring instrument to separate the instrument from the process fluid while transmitting pressure across a flexible membrane. The volume enclosed by the diaphragm, the top housing, and the measuring element is completely filled with a pressure transfer fluid. A change in pressure at the process connection causes a displacement of the filling fluid due to deflection of the diaphragm, transferring the change in pressure to the sensing element of the pressure instrument.

2. Safety Information

WARNING: Serious injury or equipment damage can result from failure to properly install, maintain, or operate these components. To assure safe operation and maintenance procedures, read carefully and follow the instructions in this manual.

- Follow all instruction in this document to avoid exposure to pressurized fluid
- Use proper tools and safety equipment in installing or maintaining components
- Assure that process pressure and temperatures are properly monitored and maintained, and the process fluid is appropriate and compatible with the wetted materials of the diaphragm system
- Follow all of your company's safety procedures in the event of a leak or diaphragm seal failure

3. Diaphragm Seal Components

Though the exact components will vary between specific models, most diaphragm seals will share the same essential parts.



3.1 Top Housing/Instrument Connection

The top housing /instrument connection of the diaphragm seal is used to connect to the pressure measurement instrument. The fill port (located on the instrument connection) allows for assemblies to be vacuum filled, then sealed with a ball bearing in a conical seat and secured with a set screw.

3.2 Diaphragm

The diaphragm serves to separate the process fluid from the filling fluid, and as such is a component wetted to the process. Diaphragms can be welded or threaded into the top housing, which in turn can be welded or clamped to a lower housing. Changes in pressure cause the diaphragm to deflect, displacing fill fluid and transmitting pressure to the pressure-measuring instrument. It is important to ensure that a diaphragm has sufficient displacement to operate a pressure-measuring instrument across its entire span. For detailed diaphragm seal and instrument compatibility, see Ashcroft [Pressure and Temperature Guide](#) found at Ashcroft.com

Please scan the QR code to right or click on the link above to go to the Pressure and Temperature Guide



3.3 Lower Housing

The lower housing connects a diaphragm seal to the end user's process, and is also therefore a wetted part. Lower housings are designed to mate with an end user's process and come in a wide variety of flange sizes. Lower housings can optionally be provided with threaded flushing connections which can be used to clean the inside of the seal or to flush out process media.

3.4 Fill Fluid

A filling fluid (sometimes referred to as "system fill," "pressure sensing fluid," or "hydraulic fluid") is required to transmit pressure from the diaphragm membrane to the pressure sensing device. Diaphragm seal assemblies are filled via a vacuum filling process that ensures the system contains no air gaps. Fill fluids are normally selected based on operating conditions; primarily temperature. Though normally not in contact with the process media, a diaphragm failure may bring process media in contact with the fill fluid, so compatibility with the process media should be a consideration.

4. Specifications

4.1 502/503 Seals

Connections	Flanged process connection Flanged process connection with flushing port
Process Connection Sizes	½, ¾, 1, 1.5 NPS
Instrument Connection Sizes	½ NPT female
Pressure Ratings	Per ASME B 16.5
Added Instrument Tolerance	±0.5% typical
Wetted Components	Diaphragm, bottom housing
Non-Wetted Components	Top Housing/Instrument Connection

4.2 Temperature Information

4.2.1 Thermal Dissipation

Seals will dissipate thermal energy, though ambient and process conditions will greatly affect the amount of heat that can be lost through the seal. Accessories designed for dissipating heat, such as siphons or capillaries, should be used whenever dealing with elevated process temperatures.

5. Fill Fluid Specifications

Fill Fluid	Temperature	Viscosity (cSt at RT)	Variation Code	Notes
Glycerin (food grade)	0 °F to 400 °F (-18 °C to 204 °C)	1,300	CG	Direct-mounting only. Not for use with vacuum service
50 cSt Silicone	-40 °F to 500 °F (-40 °C to 260 °C)	50	CK	
10 cSt Silicone	-40 °F to 500 °F (-40 °C to 260 °C)	10	DJ	
Halocarbon® 4.2	-70 °F to 300 °F (-57 °C to 199 °C)	4.2	CF	For use with oxygen/oxidizing process media
Syltherm® 800	-40 °F to 750 °F (-40 °C to 400 °C)	10	HA	High temperature applications
Syltherm® XLT	-150 °F to 500 °F (-100 °C to 260 °C)	1.4	CC	Low temperature applications

6. Installation

6.1 General Information

Instruments attached and filled to diaphragm seals should never be tightened or loosened at the top housing. Doing so will alter the dynamics of the fill fluid and diaphragm movement, causing errors in the reading. Assemblies should ONLY be installed and/or tightened at the diaphragm seal lower housing. 502/503 seals can be purchased with the instrument welded to the top housing of the seal to prevent tampering (XDU).

Diaphragm seals should be installed in accordance with any safety precautions or installation specifications applicable to the end user. That said, the general principles in the following sections still apply.

6.2 Flushing Ports

Use of flushing ports is application-specific – they are often used in cases where process media has the potential to clog inside the lower housing, whether due to process media solidification, suspended solids, polymerization, or other factor. Diaphragm seals with flushing ports must have the flushing ports plugged prior to startup. Flushing ports on type 503 seal have ¼ NPT female connections. Diaphragm seals can be ordered with the flushing ports pre-plugged with the “XPU” variation. **Note that to prevent thread galling or stripping, factory-installed flush plugs may not be fully tightened and should be checked for tightness prior to pressurization.**

6.3 Assembly/Installation

Do not dismantle or alter the filled and calibrated diaphragm seal/pressure measurement instrument system. Do not break the seal on the filling screw. The diaphragm must not be damaged, as scratches or indentations impair function and are also points of attack for corrosion. Capillary lines must not be bent to have sharp edges (minimum bend radius 40 mm), and excess length is to be coiled using a radius of approx. 25 cm. The diaphragm seal must not be supported using the capillary line. Run the capillary line such that it is not exposed to any extreme temperatures and is protected against oscillations. Unless otherwise indicated, the diaphragm seal with capillary line and pressure measurement instrument is calibrated for installation at the same height. In the event of different height levels, the influence of hydrostatic pressure has to be respected, and collapse of the transfer fluid column due to excessive height differences must be avoided (for silicone oil max. 7 m, for Halocarbon max 4m). Run capillary lines for differential pressure measurement instruments parallel as far as possible, to avoid temperature errors. Use only with the mechanical process connection provided with a matching flange seal. Install only with suitable tools; use the designated wrench flats. All installation for flanged assemblies should be done per the ASME B16.5 Standards.

7. Storage and Maintenance

7.1 Storage

Diaphragm seal assemblies should be stored in accordance with the storage requirements for all instruments attached, as well as any temperature limits listed above. Common instrumentation is shown in the table below. Refer to the respective data sheets or maintenance guides for detailed storage requirements for Ashcroft pressure instruments. Note that certain fill fluids may have storage and process temperature limitations narrower than the below data.

7.2 Frequency of Inspection

Inspection frequency is application-specific and depends on the severity of the service and how critical the accuracy of the pressure instrument is. For example, a monthly inspection may be necessary for severe service applications, such as corrosive process media or heavy pulsation and vibration. Annual inspections, or even less frequent schedules, are often employed in non-critical applications.

7.3 Removal from Service

Diaphragm seals should be properly isolated and vented from the process prior to disassembly. Most diaphragms can be inspected by removing the diaphragm seal from the process (either by unthreading or by removing it from the mating flange) and viewing the diaphragm through the lower housing.

7.4 Diaphragm Seal Failures and Troubleshooting

502/503 diaphragm seals are continuous duty as defined by ASME B40.2. Should the pressure instrument fail or be removed accidentally, the diaphragm will seat against a matching surface in the top housing preventing damage to the diaphragm or leakage of the process fluid.

In the event that a diaphragm failure is suspected, the assembly should be immediately isolated from the process and the cause for failure determined. Most diaphragm failures are caused by corrosion, high temperatures, or fill leakage. Process media build-up in the lower housing can also require cleaning or replacement. In the event of a diaphragm failure due to corrosion, it is critical that the wetted materials of the assembly be evaluated for compatibility before it is replaced.

7.4.1 Troubleshooting Guide

Symptom	Possible Cause	Solution
Instrument not responding to pressure	Poor filling process, loss of fill fluid	Refill diaphragm seal and instrument assembly. This should be serviced by an authorized diaphragm seal assembler
	Process media clog or accumulation in lower housing	Clean out lower housing; alternately, use a seal with a flushing port
Process media leaking from process connection	Improper installation	Reinstall flanged seal referencing procedures per ASME B16.5 Pipe Flanges and Flanged Fitting Standards
Rusted top housing/flange	Corrosive atmosphere	In most cases rust will not affect the performance of the seal. Consider more corrosion-resistant non-wetted materials.
Upscale shift on pressure reading	Temperature error – High Temp	Consider a heat dissipation accessory, such as a capillary or MicroTube™ Siphon
	Overfilling	Refill diaphragm seal and instrument assembly
	Diaphragm permeation	Certain process media can permeate the very thin diaphragm material and react with fill fluid. Review wetted material compatibility