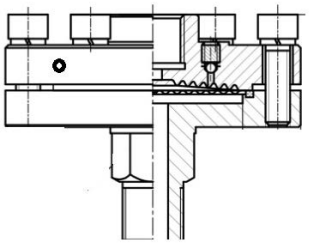
1. **Introduction**

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 instructions 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 seal
- 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

The top housing of the diaphragm seal is used to connect to the pressure measurement instrument. The fill port 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

3.3 PTFE Gasket

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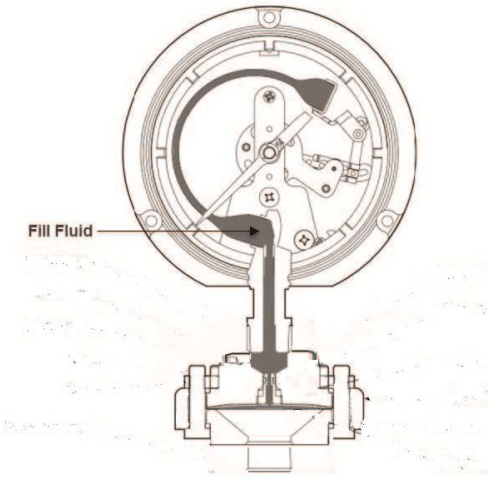
All F60- and F77-series seals are supplied with a single- use PTFE skirted gasket. Refer to Section 4.2.3 for process considerations related to these gaskets.

3.4 Lower Housing

The lower housing connects a diaphragm seal to the user's process, and is therefore a wetted part. Lower housings are designed to mate with the process They are avaiable in a wide variety of thread 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.

3.5 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 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 F60/F77-Series Seals

Connections	threaded process connection
Process Connection Sizes	¼ to 1/2 NPT female ¼ to 1/2 NPT male
Instrument Connection Sizes	G1/2 ,1/2 NPT male
Pressure Ratings	2,500 psi
Added Instrument Tolerance	±0.5% typical
Wetted Components	Diaphragm, bottom housing, PTFE gasket
Non-Wetted Components	Top Housing, clamp rings, assembly hardware

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.

4.2.2 Elastomers and Polymeric materials

Seals made with elastomeric or polymeric wetted components will have lower pressure ratings than those made from metallic components. Refer to the applicable data sheet for temperature and pressure ratings for seals with non-metallic diaphragms or bottom housings.

4.2.3 PTFE Gasketing

The highest acceptable process temperature for PTFE gaskets is 500F. The lowest acceptable temperature is limited by the fill fluid, the lowest of which is Syltherm XLT, rated to -150ºF.

For process temperatures below -150ºF or exceeding 500ºF, consider a temperature dissipating device, such as capillary or a a microTube ™ or siphon. For processes that are not compatible with PTFE, consider an all-welded diaphragm seal.

5. **Fill Fluid Specifications**

Fill Fluid	Temperature	Viscosity (cSt at RT)
Glycerin (food grade)	0°F to 400°F (-18°C to 204°C)	1,300
50 cSt Silicone	-40°F to 500°F (-40°C to 260°C)	50
10 cSt Silicone	-40°F to 500°F (-40°C to 260°C)	10

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. Most diaphragm seals can be purchased with either a locking device (XLD) or 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 and are often used when process media has the potential to clog inside the lower housing, whether due to process media solidification, suspended solids, polymerization, or other factors. Diaphragm seals with flushing ports must have the flushing ports plugged prior to startup.

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 Threaded Seals

Note: Torque should never be applied to the pressure instrument when installing the diaphragm seal. Most seals are supplied with either wrench flats or spanner holes to be used when installing the seal into process piping. Threaded seals are most commonly supplied with NPT threads per ASME B1.20.1. NPT threads require the use of a suitable thread sealant, such as pipe dope or PTFE tape, and must be tightened securely to prevent galled threads and to ensure a leak-tight seal. Torque values will vary by connection size, though 2-3 full turns past finger-tight is often used as a guideline.

7. **Maintenence**

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 (e.g., distilled water) 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. If additional inspection is needed, F60- and F77-series diaphragm seals can be disassembled by removing the clamping screws and separating the top housing and diaphragm from the lower housing. Note that the PTFE wetted gaskets on certain seals are single use, and must be replaced anytime the compression is lost.

7.4 Diaphragm Seal Failures and Troubleshooting

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.

Troubleshooting Guide

Symptom	Possible Cause	Solution
Instrument not responding to pressure	Poor filling process, loss of fill fluid	Refill diaphragm seal and instrument assembly
	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	Threaded seals: Inadequate thread sealing	Check that the seal has been properly torqued and that the threads have been sealed with pipe dope or PTFE tape
Rusted bolts/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