Diaphragm Seals

For Pressure Products
Introduction
Diaphragm Seals (or Chemical Seals) use a flexible barrier, or diaphragm, to isolate a pressure sensor (switch or transducer) from adverse effects of the process fluid.

Diaphragm seals are useful to:

- Protect the sensor from the process media (corrosive, abrasive, viscous, crystallizing media, or high process temperature)
- Protect the process from the contaminants (sanitary process requiring clean-out, or high purity media).

HOW IT WORKS
A diaphragm seal, when properly mounted to a sensor and filled, will accurately transmit process pressure to the instrument. The pressure applied by the process media is hydraulically transmitted from the flexible diaphragm, through the fill fluid between the diaphragm and the instrument, to the pressure element, thus engaging the switch or transducer.

TARGET MARKETS & APPLICATIONS

- Oil, gas & petrochemical refining
- Food & beverage processing
- Waste water facilities
- Pharmaceutical
- Pulp & paper
- Chemical
- Sanitary/High Purity applications
- Power generation
- Automotive/Paint
Application Considerations

The following should be considered when choosing a diaphragm seal:

- **Process Characteristics:** Pressure, temperature, chemical compatibility, and viscosity.
- **Seal Mounting:** Connection to process (threaded, flanged, clamped, or remote) and connection to instrument (usually NPT).
- **Ambient Characteristics:** Temperature, corrosive atmosphere, etc.
- **Instrument Considerations:** Sufficient fluid displacement is required to drive instrument through its full range. This means, for example, you can't put an instrument with a large displacement on a seal with a small displacement. Remote instrument placement requires a capillary connecting instrument to seal.
- **Vacuum Considerations:** High vacuums (over 25” Hg) or vacuums with high temperatures require special fill selection, preparation, and procedures, as well as careful diaphragm selection.

**NOTE**

Improper seal selection may result in increased system error, system failure, and possible damage or injury. Barksdale can provide application assistance, but final compatibility is the responsibility of the buyer.

**HOW TO ORDER**

Follow the Barksdale switch, transducer or solid state part number with a slash (/) and then the diaphragm seal part number.

*Examples:*

D1H-H18SS/TS5  
E1H-H250-BR/FF1  
BPS34NVM01SOP/SSI  
425X-03/MS6

**SEAL TYPES**

**Threaded Off-line Seals:**
Threaded off-line and flanged off-line seals are commonly used in a variety of applications. These have a standard cleanout feature, allowing removal of the process flange or lower housing without losing the fill. Mounted on a nipple off the line or using a standard ANSI flange.

**Flush Face Seals:**
Designed for low displacement applications where a build-up of solids across the diaphragm is a concern. Threaded process connection.

**Sanitary Seals:**
Designed for food, pharmaceutical and other sanitary applications. Available to fit most standard piping systems with “Tri-clamp” connection. Standard fill is food grade glycerin.

**Mini-Seals:**
Designed for low displacement applications where size or economy are the primary considerations.

**Special Designs:**
Barksdale is ready to work with you on any high-performance diaphragm seal application, (that might exceed the stated limits) such as high vacuum, high temperature, high sterility, custom design, high static pressure with a low differential span, or high vacuum with high temperature.
The following Barksdale pressure switches are approved for use with diaphragm seals.

Barksdale’s electro-mechanical switches use a sensor such as a diaphragm, dia-seal piston, or bourdon tube which actuates an electro-mechanical limit switch that opens or closes a circuit. Mechanical switches do not require any power input to operate, and thus make excellent fail-safe devices.

**Diaghragram Seals**

**Applicable Mechanical Switch Products**

**Dia-Seal Piston**

**Explosion Proof Dia-Seal Piston**

- E1H
- P1H
- P1X

**Differential**

**Diaphragm Switches**

**Explosion Proof Diaphragm Switch**

- D1H / D2H
- D1T / D2T
- D1X / D2X
- CD1H / CD2H

**Bourdon Tube**

**Explosion Proof Bourdon Tube**

- B1T / B2T
- B1X / B2X

**Compact**

**Explosion Proof Compact Switch**

- 9671X / 9681X

**NOTE**

Adding a diaphragm seal to Barksdale’s pressure instruments will affect some of the product’s performance and accuracy - the degree of variability depends on the environmental, installation, service, and/or measurement methods and conditions. The end user should determine the final overall product suitability and acceptability in the specific application.
The following Barksdale transducer and solid state products are approved for use with diaphragm seals.

Barksdale’s electronic switches use a piezo-resistive pressure sensing technology that transmits a voltage or current signal proportional to the system pressure or vacuum. These switches provide added functionality to any system they are used in.

## Solid States

### Solid State Products

- Electronic Pressure Switches
  - SW2000
  - BPS3000
  - UDS3

### General Industrial Transducers

- Explosion Proof Transducers
  - 423 / 425 / 426
  - 423N1 / 425N1 / 426N1
  - 423X / 425X / 426X
  - 433 / 435 / 436
  - 443 / 445 / 446

## Diaphragm Seals

**Applicable Electronic Products**

NOTE

Adding a diaphragm seal to Barksdale’s pressure instruments will affect some of the product’s performance and accuracy - the degree of variability depends on the environmental, installation, service, and/or measurement methods and conditions. The end user should determine the final overall product suitability and acceptability in the specific application.
Threaded Off Line Diaphragm Seals are a popular choice for most applications. The flush port is recommended for applications where there may be a build up of solids and requires a simple means of cleaning. These seals are available in all stainless steel construction, as well as a carbon steel upper flange for a more economical choice.

**Materials**

**Lower housings:** 316SS standard. Other materials available for custom applications.

**Diaphragms:** Standard metal diaphragms are convoluted and made of 316SS. Other materials (such as Teflon or tantalum) are available for corrosion resistance or extra sensitivity.

**Gaskets:** Standard Teflon gaskets are on the process side of diaphragm (grafoil for high temperature.) Other materials are available.
**Threaded Off-Line Diaphragm Seals**

**Series TS & TC**

### Seal Specifications

- 316 SS lower housing
- 1/" NPTF instrument connection
- Welded 316 SS diaphragm
- DC 200 silicone fill fluid (-50 to 450°F operating range)

<table>
<thead>
<tr>
<th>Diaphragm Size</th>
<th>Upper Housing Material</th>
<th>Process Connection (NPTF)</th>
<th>Flush Port Configuration</th>
<th>Part #</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 (2-1/4&quot; Ø diaphragm)</td>
<td>Carbon Steel</td>
<td>1/4&quot;</td>
<td>Without flush port</td>
<td>TC1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1/2&quot;</td>
<td>Without flush port</td>
<td>TC2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flanged (specify pipe size and rating)</td>
<td>Without flush port</td>
<td>C/F</td>
</tr>
<tr>
<td>6 (3&quot; Ø diaphragm)</td>
<td>316 S.S.</td>
<td>1/4&quot;</td>
<td>Without flush port</td>
<td>TS1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1/2&quot;</td>
<td>Without flush port</td>
<td>TS2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flanged (specify pipe size and rating)</td>
<td>Without flush port</td>
<td>C/F</td>
</tr>
</tbody>
</table>


**Solid State**: SW2000, BPS3000, UDS3

**Bourdon Tube**: B1T/B2T, B1X/B2X

**Diaphragm Switches**: D1H/D2H, D1T/D2T, D1X/D2X, CD1H/CD2H, DPD1T/DPD2T, CDPD1H/CDPD2H

**Dia-Seal Piston**: E1H, P1H, P1X

**Compact Explosion Proof**: 9681X

**Recommended Control Device**:

- Solid State: SW2000, BPS3000, UDS3
- Bourdon Tube: B1T/B2T, B1X/B2X
- Diaphragm Switches: D1H/D2H, D1T/D2T, D1X/D2X, CD1H/CD2H, DPD1T/DPD2T, CDPD1H/CDPD2H
- Dia-Seal Piston: E1H, P1H, P1X
- Compact Explosion Proof: 9681X

**Temperature Limits (for reference)**

<table>
<thead>
<tr>
<th>Maximum</th>
<th>Diaphragm Material</th>
<th>Lower Housing</th>
</tr>
</thead>
<tbody>
<tr>
<td>650°F</td>
<td>Welded metal</td>
<td>Metal</td>
</tr>
<tr>
<td>450°F</td>
<td>Teflon option</td>
<td>Metal</td>
</tr>
<tr>
<td>300°F</td>
<td>Viton option</td>
<td>Metal</td>
</tr>
<tr>
<td>140°F</td>
<td>Nonmetal</td>
<td></td>
</tr>
</tbody>
</table>

**Pressure Limits (for reference)**

<table>
<thead>
<tr>
<th>Lower Housing</th>
<th>Metal, with ss bolting</th>
<th>Metal, std bolting</th>
<th>Metal, hi-press bolting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(at 100°F)</td>
<td>(at 100°F)</td>
<td>(at 100°F)</td>
</tr>
<tr>
<td>1,500 psi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,500 psi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5,000 psi</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maximum</th>
<th>ASA flange (per flange spec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 psi</td>
<td>non-metallic (at 140°F)</td>
</tr>
</tbody>
</table>

**Vacuum Limits**

<table>
<thead>
<tr>
<th>Metal</th>
<th>-21&quot; Hg</th>
<th>-24&quot; Hg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teflon option</td>
<td>-23&quot; Hg</td>
<td>-26&quot; Hg</td>
</tr>
<tr>
<td>Viton option</td>
<td>-29&quot; Hg</td>
<td>n/a</td>
</tr>
</tbody>
</table>

*Seals not recommended for transducers and solid state devices with ranges lower than 15 psi. Use higher pressure ranges, or absolute ranges.

*The maximum working pressure is the lower of the maximum seal working pressure and the maximum adjustable range of the switch.

*Diaphragm differential pressure switches will require two seals and two capillaries for remote mounting. Consult Factory.

*Do not use diaphragm switches in the -2SS pressure range.

*Use the 6 switch with diaphragm switches.

*Cleanout style configuration: the lower housing can be removed without losing the fill.

*Recommend selecting brass or stainless steel process fittings only for pressure switch or transducer.

*Seals have standard 316 SS diaphragm. Pressure and temperature limits for metal diaphragms apply. Other metals such as hastelloy, tantalum, as well as viton and Teflon diaphragms are available for customized applications. Please consult factory.
Flush Face Diaphragm Seals

Flush Face Diaphragm Seals are useful in applications where a continuous flow of process media across the diaphragm is required to prevent solids buildup.

Seal Specifications

- All 316 SS construction
- Welded 316 SS diaphragm
- DC200 silicone fill fluid
- 1/4" NPT instrument connection

<table>
<thead>
<tr>
<th>Diaphragm Size</th>
<th>Process Connection (NPTM)</th>
<th>Part #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Same as Process Connection</td>
<td>1&quot;</td>
<td>FF1</td>
</tr>
<tr>
<td></td>
<td>1/2&quot;</td>
<td>FF2*</td>
</tr>
<tr>
<td></td>
<td>3/4&quot;</td>
<td>FF3</td>
</tr>
</tbody>
</table>

Recommended Control Device:

| Solid State¹: SW2000, BPS3000, UDS3
| Bourdon Tube: B1T/B2T, B1X/B2X
| Dia-Seal Piston: E1H*, P1H*, P1X (Recommend 1.5 connection / Consult factory)
| Compact Explosion Proof: 9681X⁰ |

¹ Seals not recommended for transducers and solid state devices with ranges lower than 15 psi. Use higher pressure ranges, or absolute ranges.
² The maximum working pressure is the lower of the maximum seal working pressure and the maximum adjustable range of the switch.
³ Do not use E1H pressure range 15 with flush face seal.
⁴ FF2 only recommended for high pressure applications.
⁵ Use only FF1 seal with P1H / P1X pressure range 30.
⁶ Do not use 9681X with FF2 seal.
⁷ Recommend selecting brass or stainless steel process fittings only for pressure switch or transducer.
Sanitary Diaphragm Seals Series SS

Sanitary Diaphragm Seals are specially designed to meet the demanding sanitary requirements of food, dairy, beverage, pharmaceutical, and biotech applications.

Seal Specifications

- All 316 SS welded diaphragm construction
- Certified for 3A sanitary standards
- Food grade glycerin fill
- Weld mount control device to seal
- 1/4” NPT instrument connection

Sanitary Diaphragm Seals Series SS

- All 316 SS welded diaphragm construction
- Certified for 3A sanitary standards
- Food grade glycerin fill
- Weld mount control device to seal
- 1/4” NPT instrument connection

Recommended Control Device:

- **Solid State**: SW2000, BPS3000, UDS3
- **Bourdon Tube**: B1T/B2T, B1X/B2X
- **Dia-Seal Piston**: E1H, P1H, P1X
- **Compact Explosion Proof**: 9681X

### Process Connection

<table>
<thead>
<tr>
<th>Process Connection</th>
<th>Part #</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1/2” Tri-clamp</td>
<td>SS1</td>
</tr>
<tr>
<td>2” Tri-clamp</td>
<td>SS2</td>
</tr>
<tr>
<td>3/4” Tri-clamp</td>
<td>C/F</td>
</tr>
</tbody>
</table>

### Max. Pressure @ 100°F

<table>
<thead>
<tr>
<th>Size 1-1/2”</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Max. Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0” max</td>
<td>1.2” max</td>
<td>2.4” max</td>
<td>600 psi</td>
<td>60 psi</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Size 2”</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Max. Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5” max</td>
<td>1.3” max</td>
<td>2.5” max</td>
<td>600 psi</td>
<td>60 psi</td>
</tr>
</tbody>
</table>

1. Seals not recommended for transducers and solid state devices with ranges lower than 15 psi. Use higher pressure ranges, or absolute ranges.
2. The maximum working pressure is the lower of the maximum seal working pressure and the maximum adjustable range of the switch.
3. Do not use E1H pressure range 15 with seal SS1.
4. Do not use P1H / P1X pressure range 30 with seal SS1.
5. 1000 psi maximum pressure with customer supplied heavy duty clamp. Not to exceed the instrument pressure rating.
6. Recommend selecting brass or stainless steel process fittings only for pressure switch or transducer.
Mini Diaphragm Seals

Mini-Seals are all-welded, gasketless, threaded off-line seals. The mini-seal is an economical choice for isolation of smaller instruments, or where high sensitivity is not required.

Seal Specifications

- All welded, gasketless, 316 SS construction
- 1/4" NPT instrument connection
- DC200 silicone fill fluid

<table>
<thead>
<tr>
<th>Seal Size</th>
<th>Process Connection (NPTF)</th>
<th>Flush Port Configuration</th>
<th>Part #</th>
</tr>
</thead>
<tbody>
<tr>
<td>4G</td>
<td>1/4&quot;</td>
<td>With flush port</td>
<td>MS1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Without flush port</td>
<td>MS2</td>
</tr>
<tr>
<td></td>
<td>1/2&quot;</td>
<td>With flush port</td>
<td>MS3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Without flush port</td>
<td>MS4</td>
</tr>
<tr>
<td>6G</td>
<td>1/4&quot;</td>
<td>With flush port</td>
<td>MS5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Without flush port</td>
<td>MS6</td>
</tr>
<tr>
<td></td>
<td>1/2&quot;</td>
<td>With flush port</td>
<td>MS7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Without flush port</td>
<td>MS8</td>
</tr>
</tbody>
</table>

Recommended Control Device:
- Solid State: SW2000, BPS3000, UDS3
- Compact Explosion Proof: 9681X

1 Seals not recommended for transducers and solid state devices with ranges lower than 15 psi. Use higher pressure ranges, or absolute ranges.
2 The maximum working pressure is the lower of the maximum seal working pressure and the maximum adjustable range of the switch.
3 Do not use 9681X pressure range 1 with MS1, MS2, MS3, MS4 seals.
4 Recommend selecting brass or stainless steel process fittings for pressure switch or transducer.
Diaphragm Seals

Application Worksheet

1. SEAL INFORMATION:
Description (or Model) of Seal Requested:

Process Connection:

☐ Threaded:   ☐ 1/4” NPT   ☐ 1/2” NPT
☐ Flanged: _______ inches _______ lbs.
☐ Sanitary Tri-clamp connection:   ☐ 1-1/2”   ☐ 2”   ☐ 3/4”
☐ Capillary (remote mount): _________ feet
☐ Other __________________________

Seal Materials: Upper __________________________ Lower __________________________

2. PROCESS INFORMATION:

<table>
<thead>
<tr>
<th>Maximum</th>
<th>Working</th>
<th>Minimum</th>
<th>Setpoint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process Pressure (psi)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process Temperature (°F)</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Process Fluid: __________________________

Process Pulsation: ☐ Yes   ☐ No   If yes, specify __________________________

Vibration: ☐ Yes   ☐ No   If yes, specify __________________________

3. SENSOR INFORMATION:

☐ Switch
☐ Transducer
☐ Solid State

Barksdale part number or family: __________________________

Adjustable pressure range: __________________________

Other: __________________________

4. AMBIENT CONDITIONS:

Temperature Range: High _________ Low _________

Check where applicable:
☐ Indoor   ☐ Outdoor
☐ Sunny   ☐ Shaded
☐ Wet   ☐ Dry
☐ Corrosive

5. APPLICATION DESCRIPTION:

________________________________________________________________________________________________________________________

________________________________________________________________________________________________________________________

6. OTHER INFORMATION, SPECIAL NEEDS, AND NOTES:

________________________________________________________________________________________________________________________

________________________________________________________________________________________________________________________

**NOTE: Barksdale Inc. is glad to provide applications assistance, based on limited information, but final compatibility is the responsibility of the buyer.**

For Office Use Only

Quotation #: __________________________

Order #: __________________________

Fill Fluid:

☐ Standard DC 200 silicone (-50°F to 450°F)
☐ Food grade glycerin 30°F to 300°F
☐ High temperature (>450°F)

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Standard DC 200 silicone (-50°F to 450°F)
Food grade glycerin 30°F to 300°F
High temperature (>450°F)