Diaphragm Seals

For Pressure Products

For Pressure Products

Barksdale
CONTROL PRODUCTS
CRANE Barksdale, Inc./Barksdale GmbH
A Subsidiary of Crane Co.

Diaphragm Seals

Product Overview

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

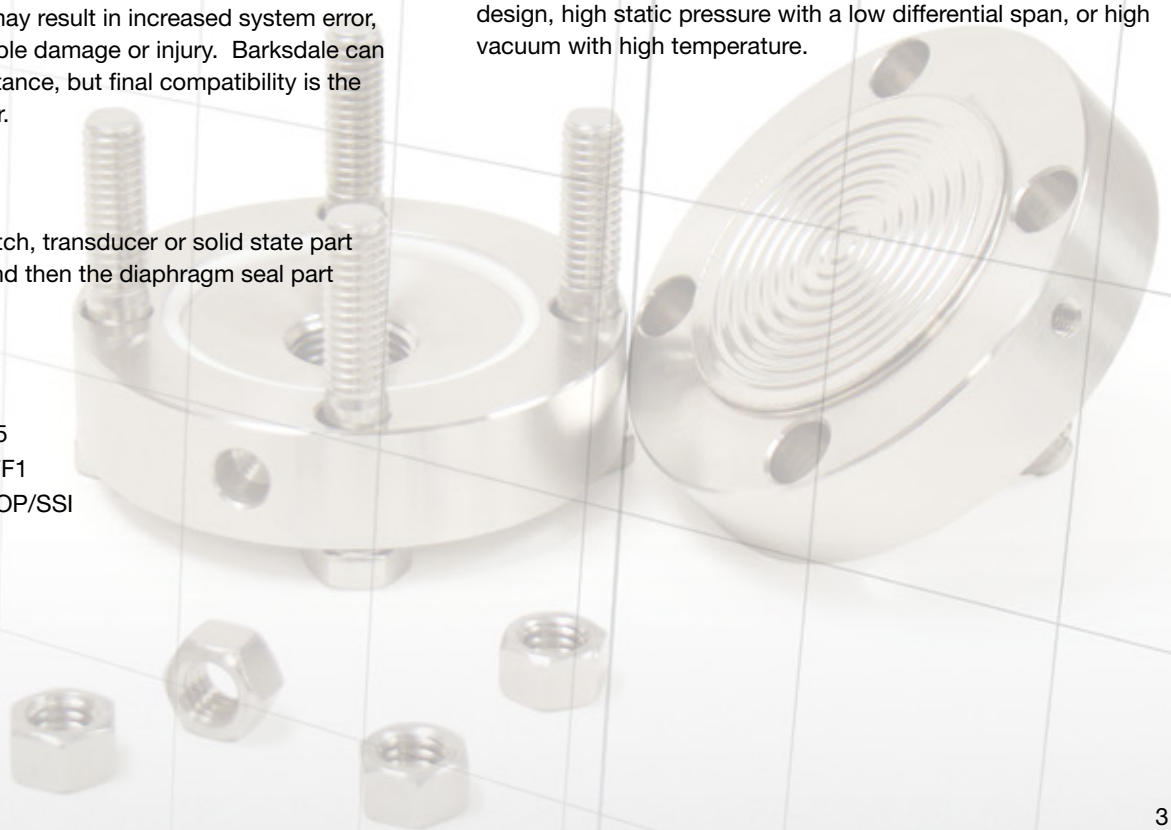
Threaded Off-line Seals:
Threaded off-line and flanged off-line seals are commonly used in a variety of applications. These have a standard cleanout feature, allowing removal of the process flange or lower housing without losing the fill. Mounted on a nipple off the line or using a standard ANSI flange.

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.



Diaphragm Seals *Applicable Mechanical Switch Products*

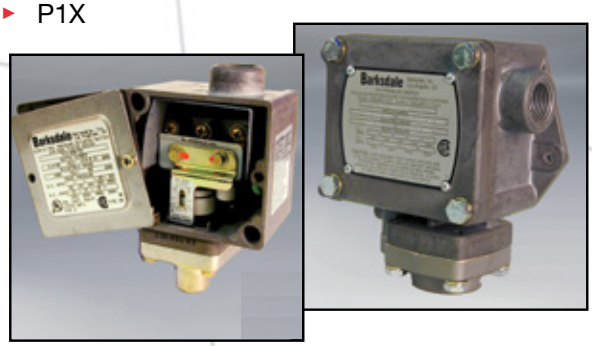
The following Barksdale pressure switches are approved for use with diaphragm seals.

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.

Dia-Seal Piston

Dia-Seal Piston
Explosion Proof Dia-Seal Piston

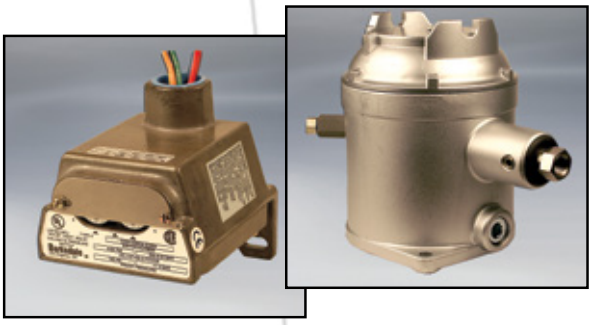
- E1H
- P1H
- P1X



Diaphragm

Diaphragm Switches
Explosion Proof Diaphragm Switch

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

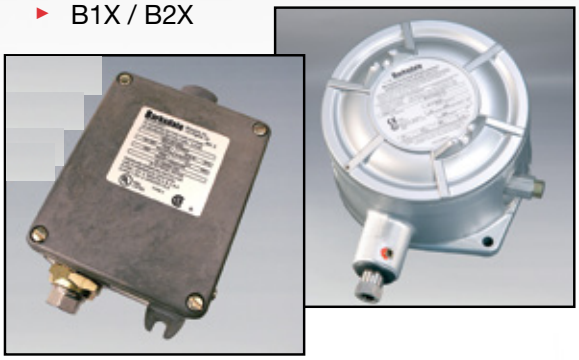


NOTE
Adding a diaphragm seal to Barksdale's pressure instruments will affect some of the product's performance and accuracy - the degree of variability depends on the environmental, installation, service, and/or measurement methods and conditions. The end user should determine the final overall product suitability and acceptability in the specific application.

Bourdon Tube

Bourdon Tube
Explosion Proof Bourdon Tube

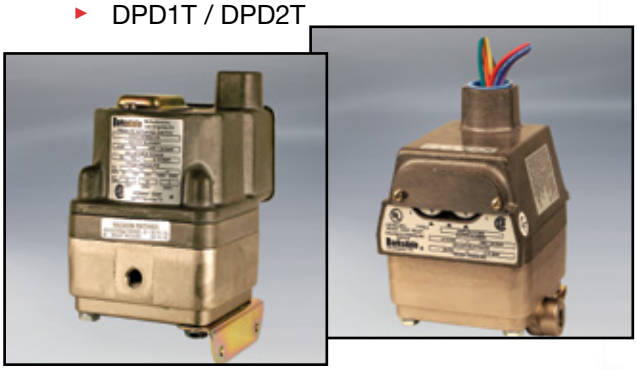
- B1T / B2T
- B1X / B2X



Differential

Differential Pressure Switches

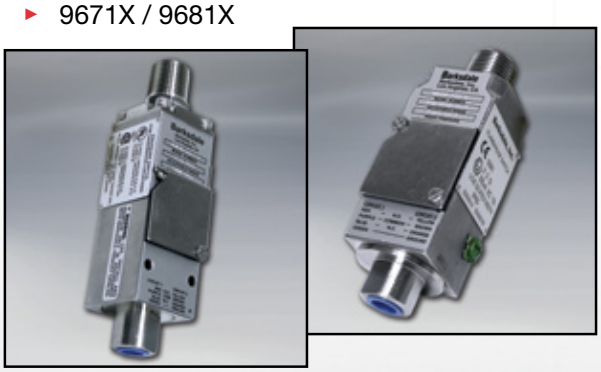
- CDPD1H / CDPD2H
- DPD1T / DPD2T



Compact

Explosion Proof Compact Switch

- 9671X / 9681X



Diaphragm Seals

Applicable Electronic Products

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

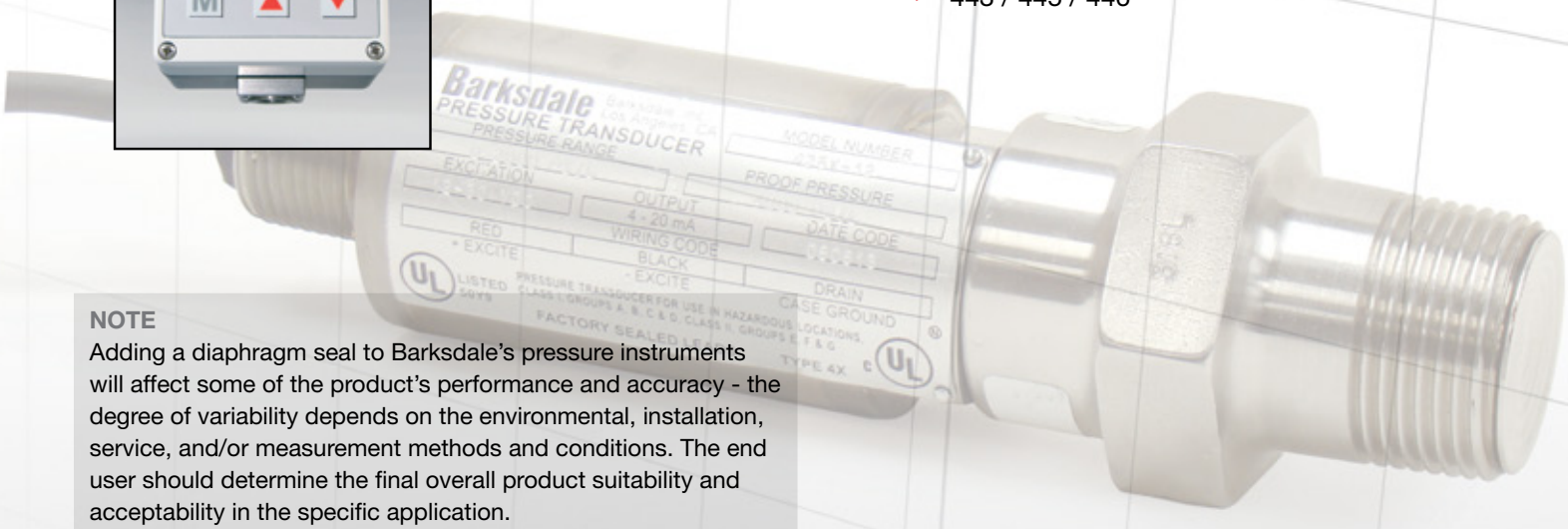
Solid State Products
Electronic Pressure Switches

- SW2000
- BPS3000
- UDS3

Transducers

General Industrial Transducers
Explosion Proof Transducers

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

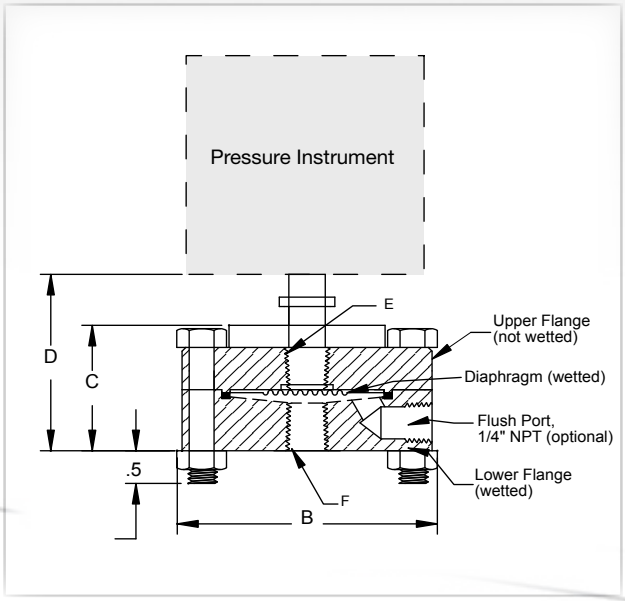


NOTE
Adding a diaphragm seal to Barksdale's pressure instruments will affect some of the product's performance and accuracy - the degree of variability depends on the environmental, installation, service, and/or measurement methods and conditions. The end user should determine the final overall product suitability and acceptability in the specific application.

Threaded Off-Line Diaphragm Seals

Series TS & TC

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.



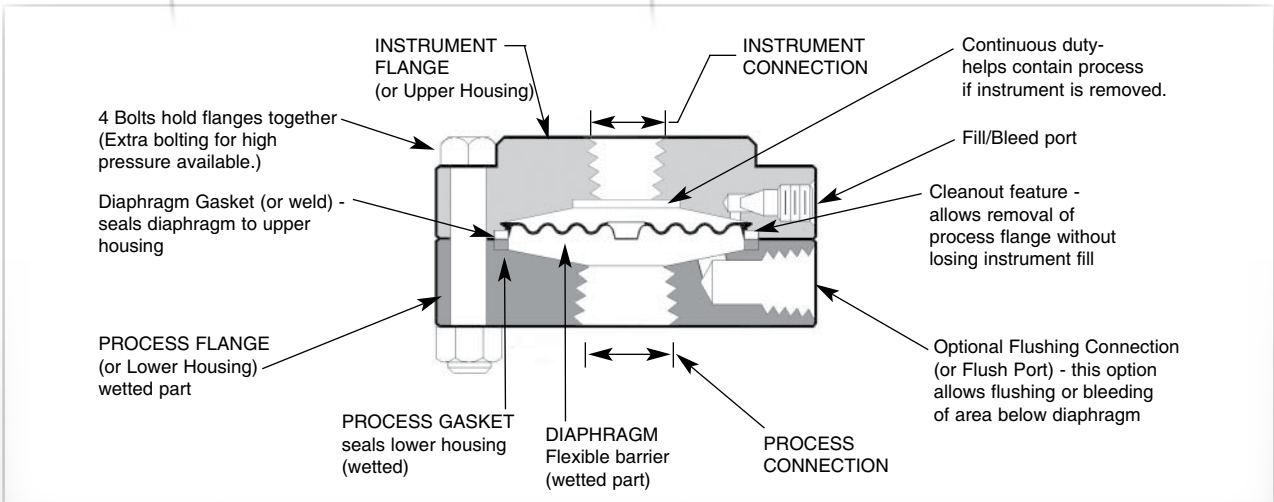
Diaphragm Size	B	C	D	Instrument Connection E (NPTF)	Process Connection F (NPTF)
5	3.5" max	1.8" max	3.0" max	1/4"	1/4", 1/2"
6	4-1/8" max	1.9" max	3.1" max	1/4"	1/4", 1/2"

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
- Welded 316 SS diaphragm
- 1/4" NPTF instrument connection
- DC 200 silicone fill fluid (-50 to 450°F operating range)

Diaphragm Size	Upper Housing Material[9]	Process Connection (NPTF)[8]	Flush Port Configuration[6]	Part #
5 (2-1/4" ∅ diaphragm)	Carbon Steel	1/4"	With flush port	TC1
			Without flush port	TC2
		1/2"	With flush port	TC3
			Without flush port	TC4
		Flanged (specify pipe size and rating)	With flush port	C/F
			Without flush port	C/F
6 (3" ∅ diaphragm)		1/4"	With flush port	TC5
			Without flush port	TC6
		1/2"	With flush port	TC7
			Without flush port	TC8
		Flanged (specify pipe size and rating)	With flush port	C/F
			Without flush port	C/F
5 (2-1/4" ∅ diaphragm)	316 S.S.	1/4"	With flush port	TS1
			Without flush port	TS2
		1/2"	With flush port	TS3
			Without flush port	TS4
		Flanged (specify pipe size and rating)	With flush port	C/F
			Without flush port	C/F
6 (3" ∅ diaphragm)		1/4"	With flush port	TS5
			Without flush port	TS6
		1/2"	With flush port	TS7
			Without flush port	TS8
		Flanged (specify pipe size and rating)	With flush port	C/F
			Without flush port	C/F

Recommended Control Device[7]:	**Transducer series[1]:** 423/425/426, 423N1/425N1/426N1, 423X/425X/426X, 433/435/436, 443/445/446 **Solid State[1]:** SW2000, BPS3000, UDS3 **Bourdon Tube:** B1T/B2T, B1X/B2X **Diaphragm Switches[3,4,5]:** 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)

Maximum Temperature	Diaphragm Material	Lower Housing
650°F	Welded metal[10]	Metal
450°F	Teflon option[10]	Metal
300°F	Viton option[10]	Metal
140°F	-	Nonmetal

Pressure Limits[2] (for reference)

	psi	Lower Housing	
Maximum Working Pressure[9]	1,500	metal, with ss bolting	(at 100°F)
	2,500	metal, std bolting	(at 100°F)
	5,000	metal, hi-press bolting	(at 100°F)
	per flange rating	ASA flange	(per flange spec)
	300	non-metallic	(at 140°F)

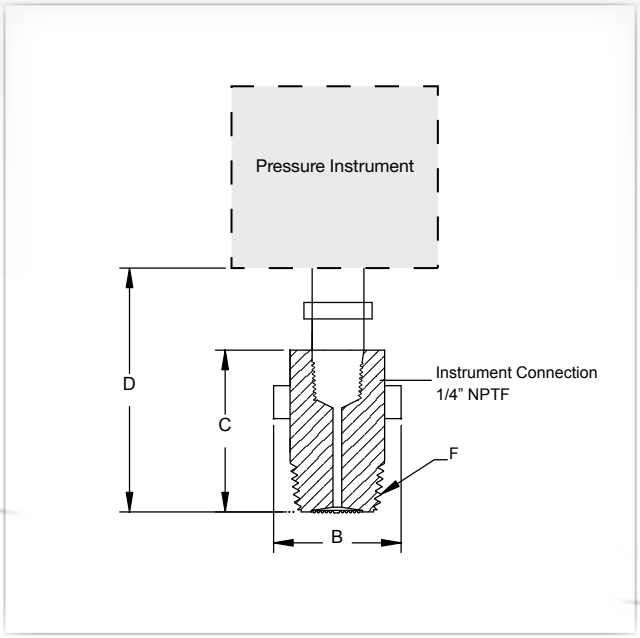
	Diaphragm	Size 5 Seal	Size 6 Seal
Minimum Working Pressure	Metal[10]	25 psi	10 psi
	Teflon option[10]	20 psi	5 psi
	Viton option[10]	3 psi	n/a
Vacuum Limits	Metal[10]	-21" Hg	-24" Hg
	Teflon option[10]	-23" Hg	-26" Hg
	Viton option[10]	-29" Hg	n/a

[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] Diaphragm differential pressure switches will require two seals and two capillaries for remote mounting. Consult Factory.
[4] Do not use diaphragm switches in the -2SS pressure range.
[5] Use the size 6 switch with diaphragm switches.
[6] Cleanout style configuration: the lower housing can be removed without losing the fill.
[7] Recommend selecting brass or stainless steel process fittings only for pressure switch or transducer.
[8] 3/4" NPTF and 1" NPTF also available. Consult factory.
[9] Standard steel bolting is rated at 2500 psi maximum pressure.
[10] 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

Series FF

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



F Process Connection	B	C	D	Max. Pressure @ 100°F [2]	Min. Pressure Range (Mechanical)	Min. Pressure Range (Electrical)
1/2" NPT	1.1" max	1.4" max	2.6" max	5000 psi	100 psi	100 psi
3/4" NPT	2.1" max	2.5" max	3.7" max	2500 psi	100 psi	15 psi
1" NPT	2.1" max	2.7" max	3.9" max	1500 psi	100 psi	30 psi

Seal Specifications

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

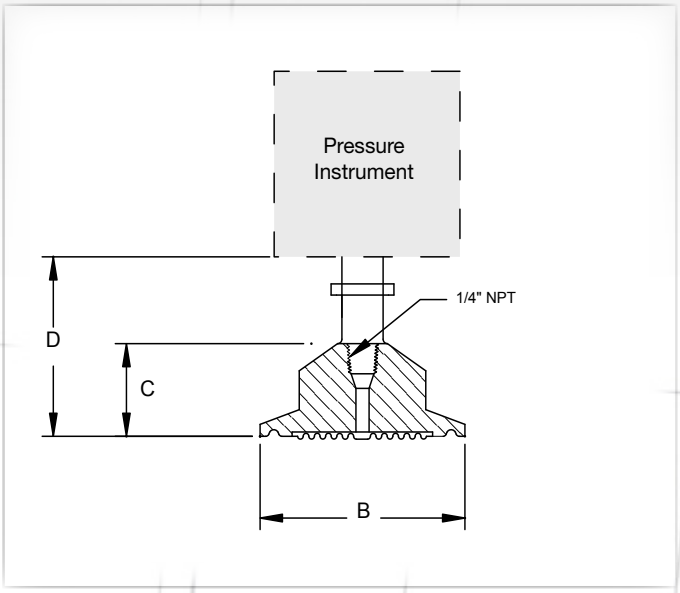
Diaphragm Size	Process Connection (NPTM)	Part #
Same as Process Connection	1"	FF1
	1/2"	FF2[4]
	3/4"	FF3
Recommended Control Device[7]:	**Transducer series[1]:** 423/425/426, 423N1/425N1/426N1, 423X/425X/426X, 433/435/436, 443/445/446 **Solid State[1]:** SW2000, BPS3000, UDS3 **Bourdon Tube:** B1T/B2T, B1X/B2X **Dia-Seal Piston:** E1H[3], P1H[5], P1X (Recommend 1.5 connection / Consult factory) **Compact Explosion Proof:** 9681X[6]	

[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.



Process Connection	B	C	D	Max. Pressure @ 100°F [2, 5]	Min. Range
Size 1-1/2”	2.0” max	1.2” max	2.4” max	600 psi	60 psi
Size 2”	2.5” max	1.3” max	2.5” max	600 psi	60 psi

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

Process Connection	Part #
1 1/2” Tri-clamp	SS1
2” Tri-clamp	SS2
3/4” Tri-clamp	C/F

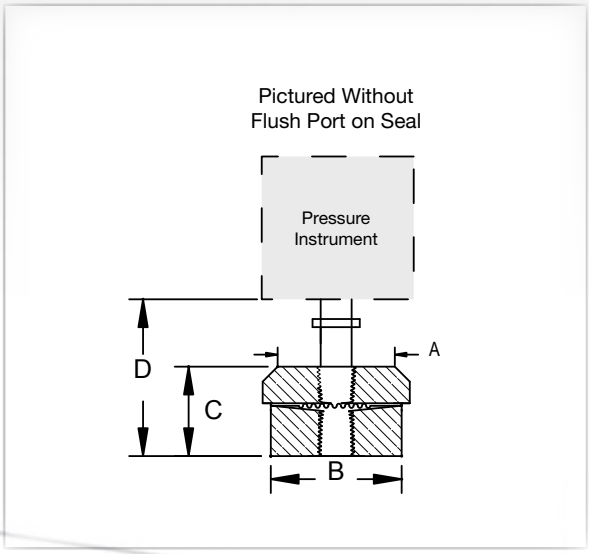
Recommended Control Device[6]:	**Transducer series[1]:** 423/425/426, 423N1/425N1/426N1, 423X/425X/426X, 433/435/436, 443/445/446 **Solid State[1]:** SW2000, BPS3000, UDS3 **Bourdon Tube:** B1T/B2T, B1X/B2X **Dia-Seal Piston:** E1H[3], P1H[4], P1X **Compact Explosion Proof:** 9681X

[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 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

Series MS

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 Size	A	B	C	D	Max. Pressure @ 100°F [2]	Min. Range
4G	1.73” max	1.5” max	1.5” max	2.7” max	2000 psi	100 psi
6G	2.25” max	1.95” max	1.6” max	2.8” max	1000 psi	15 psi

Seal Specifications

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

Seal Size	Process Connection (NPTF)	Flush Port Configuration	Part #
4G	1/4”	With flush port	MS1
		Without flush port	MS2
	1/2”	With flush port	MS3
		Without flush port	MS4
6G	1/4”	With flush port	MS5
		Without flush port	MS6
	1/2”	With flush port	MS7
		Without flush port	MS8
Recommended Control Device[4]:	**Transducer series[1]:** 423/425/426, 423N1/425N1/426N1, 423X/425X/426X, 433/435/436, 443/445/446 **Solid State[1]:** SW2000, BPS3000, UDS3 **Compact Explosion Proof:** 9681X[3]		

[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 _____ Diaphragm _____

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)

2. PROCESS INFORMATION:

	Maximum	Working	Minimum	Setpoint
Process Pressure (psi)				
Process Temperature (°F)				N/A

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

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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.

Barksdale, Inc.
3211 Fruitland Avenue, Los Angeles, CA 90058
TEL: (323) 589-6181, FAX: (323) 583-6209
www.barksdale.com

Barksdale Inc.
3211 Fruitland Ave.
Los Angeles, CA 90058-0843
U.S.A.
Phone: (866) 832-6278
Fax: (323) 583-6209
Email: sales@barksdale.com
www.barksdale.com

Barksdale GmbH
Dorn-Assenheimer Strasse 27
61203 Reichelsheim, Germany
Phone: +49 6035-949-0 (main office)
+49 6035-949-204 (sales)
Fax: +49 6035-949-111/-113
Email: info@barksdale.de
www.barksdale.de

Barksdale China
33F Huaihai Plaza
1045 Central Huaihai Road
Shanghai 200031, P.R. China
Phone: +86 21 6127-3000
Fax: +86 21 6473-3298
Email: ChinaSales@barksdale.com
www.barksdaleChina.com

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