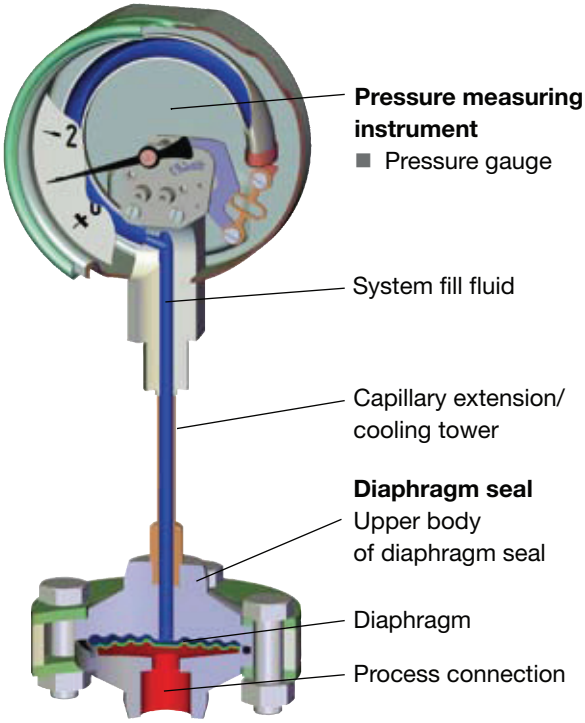
LENZ
Fluid Power Specialist

Diaphragm Seals, Chemical Seals Applications - Operating Principle - Designs



Diaphragm seals, also known as chemical seals or remote seals, are used when the pressure measuring instrument's sensing element should not come in contact with the process medium.

A diaphragm seal has two primary tasks:

1. **Separate the pressure measuring instrument from the process medium**
2. **Transfer the pressure to the pressure measuring instrument**

Operating principle of diaphragm seals

The operating principle of a diaphragm seal (using the example of a diaphragm seal) is shown in the picture on the right.

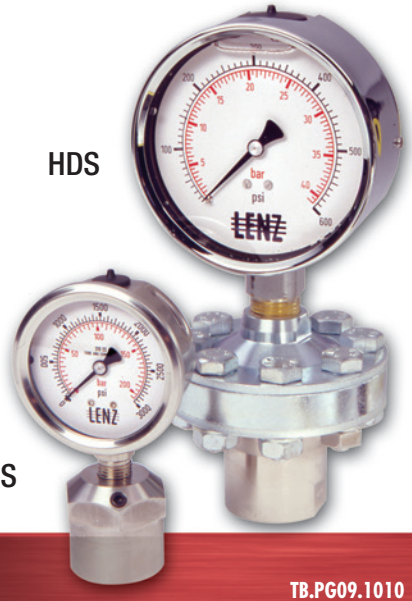
Operating principle

A diaphragm made of the appropriate material separates the pressure medium from the pressure instrument, while a suitable liquid transmits the pressure to the instrument's sensing element. The inner cavity between the diaphragm and the pressure measuring instrument is completely filled with a system fill fluid. The process pressure is transmitted by the elastic diaphragm via the transmitting fluid and from there to the measuring element, i.e. to a pressure gauge or transmitter.

In many cases, a capillary between diaphragm seal and pressure measuring instrument is used, for example to eliminate or minimize the hot temperature effects on the pressure measuring instrument. The capillary affects the response time of the complete assembly.

Diaphragm seal, capillary and pressure measuring instrument together form a hermetically closed system. For this reason, the sealed filling screws on the diaphragm seal and/or pressure measuring instrument should not be opened, since loss of fill fluid will impair the system's performance.

The diaphragm and the mounting flange are part of the system which comes in contact with the process medium. Therefore, the material from which they are manufactured, must meet the corresponding temperature and corrosion resistance requirements. If the diaphragm is punctured, the system fill fluid can enter the process media. For food processing applications, this system fill fluid must be approved for food contact. When selecting a system fill fluid, factors such as compatibility and temperature are of extreme importance. There are many different system fill fluids available, suitable for temperature ranges from –130 °F up to +752 °F (see table "Standard system fill fluids").



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When to use diaphragm seals

Diaphragm seals are used to protect pressure measuring instruments from the harshest of conditions.

Examples of typical applications

- The pressure medium is corrosive and would damage the measuring element. A diaphragm seal allows the use of different materials to either eliminate or reduce damage caused by corrosive media.
- The pressure medium is highly viscous or contains suspended matter which may obstruct the pressure entry or deposit inside the pressure sensing element.
- The pressure medium tends to crystallise or polymerise.
- The pressure medium temperature is very high and exceeds the temperature limit of the pressure measuring instrument or the temperature effect may cause inaccurate measurement.
- The pressure measuring point does not allow direct installation of a pressure measuring instrument. A diaphragm seal with capillary (remote mounting) may facilitate easy observation of the instrument.
- The application requires sanitary connections. A flush mounted diaphragm seal avoids cavities and dead volumes.
- The pressure medium is toxic or the escaping medium may pollute the environment. A suitably designed diaphragm seal will provide protection.

The Lenz diaphragm seal system combines innovative of materials and production methods with expertise gained from countless practical solutions of problems in pressure measurement.

Diaphragm seals improve the performance of the operations and processes through:

- extended service life of the instrument
- reduced cost of installation
- reduced or even eliminated costs of maintenance

Combination possibilities

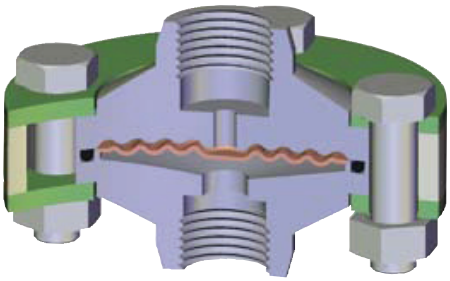
Assembly of the diaphragm seal and measuring instrument may be made via a “rigid” direct connection. The “rigid” assembly is made either by directly screwing or welding the measuring instruments to the diaphragm seal or through a gauge adapter. The configuration of the combination of pressure measuring instruments and diaphragm seals depends, among other things, on the application conditions in which the assembly must work.

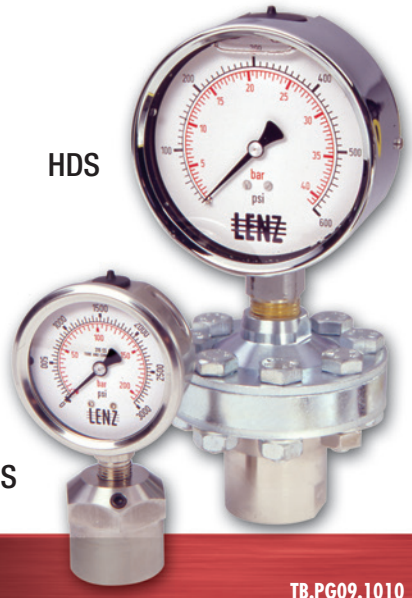
Direct assembly

Diaphragm seals

Diaphragm seals are mounted to existing fittings. Generally the fittings are T-pieces (which are integrated into a pipeline) or welding sockets (which are then welded onto a pipe, process vessel or tank).

This diaphragm seal type offers the advantage that the “contact surface” between pressure medium and diaphragm is relatively large, thus ensuring accurate pressure measurement. The fact that they can be easily dismounted (e.g. for cleaning or calibration purposes) is a further advantage.





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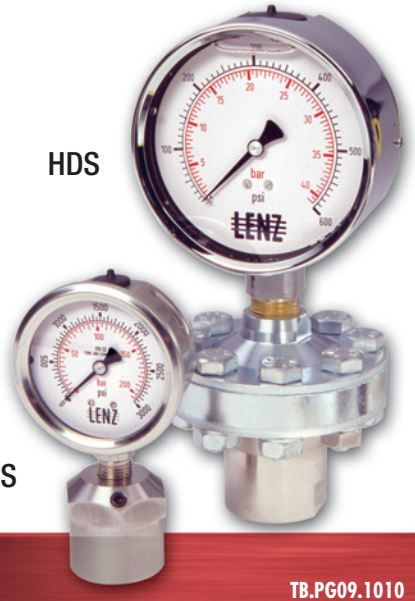
Material	Code Designation
Stainless Steel	Mat no's. 316L, 1.4571, 1.4404, 1.4435, 1.4541, 1.4542, 1.4539
Duplex 2205	Material no. 1.4462
Hastelloy B2	Material no. 2.4617
Hastelloy C4	Material no. 2.4610
Hastelloy C22	Material no. 2.4602
Hastelloy C276	Material no. 2.4819
Incoloy alloy 825	Material no. 2.4858
Inconel alloy 600	Material no. 2.4816
Monel alloy 400	Material no. 2.4360

Material	Code Designation
Nickel	Material no. 2.4066 / 2.4068
Platinum	Pt
Tantalum	Ta
Titanium	Material no. 3.7035
Zirconium	Zr
Ceramic	wikaramic®
Polytetrafluorethylene	PTFE
Perfluoralkoxy	PFA
Copolymer of Ethene and Chlortrifluorethene	ECTFE (Halar®)

Common designation	LENZ code-no. KN	Suitable temperage range P ≥15psi abs	P < 15psi [1] abs	S.G. at temperature [g/cm³]	[°F]	Viscosity at temperature [m2/s 10⁻⁶]	[°F]	Notes
Silicone oil	KN 2	-4 ... +392 °F	-	0.96	+77	50	+77	Standard
Silicone oil	KN 2.2	-40 ... +572 °F	-40 ... +202 °F	0.96	+77	55	+68	
Silicone oil	KN 17	-130 ... +356 °F	-130 ... +176 °F	0.914	+68	4	+68	
Silicone oil	KN 68	-40 ... +392 °F	-40 ... +250 °F	0.934	+77	10	+77	Standard
High temperature oil	KN 3.1	-42) ... +572 °F	-14 ... +212 °F	1.07	+68	39	+68	
High temperature oil	KN 3.2	-42) ... +752 °F	-14 ... +392 °F	1.07	+68	39	+68	
Halocarbon liquid	KN 21	-40 ... +347 °F (max. 2300 psi)	-40 ... +176 °F	1.968	+68	14	+68	for oxygen and chlorine, BAM4) tested
Glycerine	KN 7	+63[3]) ... +446 °F	-	1.26	+68	1110	+68	Food and beverage
Neobee® M-20	KN 59	-4 ... +392 °F	-4 ... +392 °F	0.92	+68	10.1	+77	Food and beverage
Medicinal white mineral oil	KN 92	-14 ... +500 °F	-14 ... +320 °F	0.85	+68	23	+104	Food and beverage
Food grade	KN 93	-0 ... +572 °F	-	0.97	+77	350	+77	Food and beverage



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