

Chemical Seals

Technical Information

Uses - Operating Principle - Types

Chemical seals are intended to separate the pressure instrument from the pressure medium whilst allowing pressure variations to be precisely transmitted to the instrument's sensing element. The pressure applied on the diaphragm of the chemical seal is transmitted to the pressure sensing element by means of a suitable liquid.

Chemical seal body and diaphragm are generally made of stainless steel. Also a wide selection of special materials is available to handle almost any exotic pressure fluid. (see table materials)

All WIKA chemical seals are designed to combine with conventional pressure gauges as well as with transmitters or pressure switches. Pressure ranges from 10 mbar to 1600 bar can be handled within a temperature span from -90 °C to +400 °C.

Parameters influencing accuracy and performance of the chemical seal assembly can be very complex, requiring thorough computer calculation and simulation under all aspects. A WIKA Chemical Seal Questionnaire is available to simplify collection of pertaining parameters.

WIKA is able to provide chemical seals with certificate/approval for the Food Industry as well as for use in hazardous zone class 0.

Examples of typical applications

- The pressure medium is **corrosive** to such an extent that it must not enter the interior of a regular pressure sensing element.
- The pressure medium is **highly viscous** and can not pass through a normal pressure gauge entry.
- The pressure medium is **inhomogenous** or contains **suspended matter** which may obstruct the pressure entry or deposit inside the pressure sensing element.
- The pressure medium tends to **crystallise**.
- The pressure medium tends to **polymerise**.
- The **temperature** of the pressure medium does not allow direct measurement. The temperature may be either beyond the capability of existing pressure instruments or the effect of the temperature may cause unacceptable misreading.
- The **pressure tapping point** does not allow direct installation of a pressure reading instrument. A chemical seal with capillary extension may facilitate easy observation of the instrument.
- The **hygienic cleanliness level** of the pressure system must be maintained. A flush mounted chemical seal avoids cavities and dead volumes.
- The pressure medium is **toxic** or the escaping medium may **pollute the environment**. A suitably designed chemical seal will provide protection.
- The pressure system involves **high overpressure** either regularly or at faulty condition. A chemical seal incorporating a contoured diaphragm bed will take up the overpressure and protect the instrument.

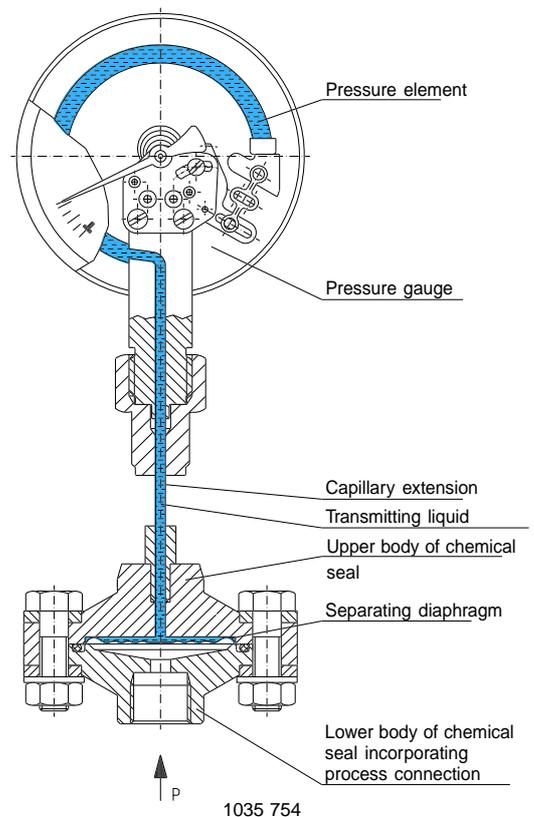
The WIKA chemical seal system combines latest technology of materials and production methods with expertise gained from countless practical solutions of problems in pressure measurement. The initial investment in a chemical seal assembly may soon be recovered by

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

Operating principle

The drawing below highlights the operating principle of a chemical seal assembly. The diaphragm seals the pressure instrument system towards the pressure medium.

The instrument may be a conventional pressure gauge as shown, as well as an electronic pressure transmitter of latest technology. The instrument system is carefully filled with a suitable liquid. Any pressure applied to the diaphragm is hydraulically transmitted to the pressure responsive element of the measuring instrument.



The pressure instrument may be either directly mounted or connected to the chemical seal by means of a capillary extension. Apart from distant reading the capillary also isolates the instrument from hot pressure fluids, however, affects to some extent the response time of the instrument.

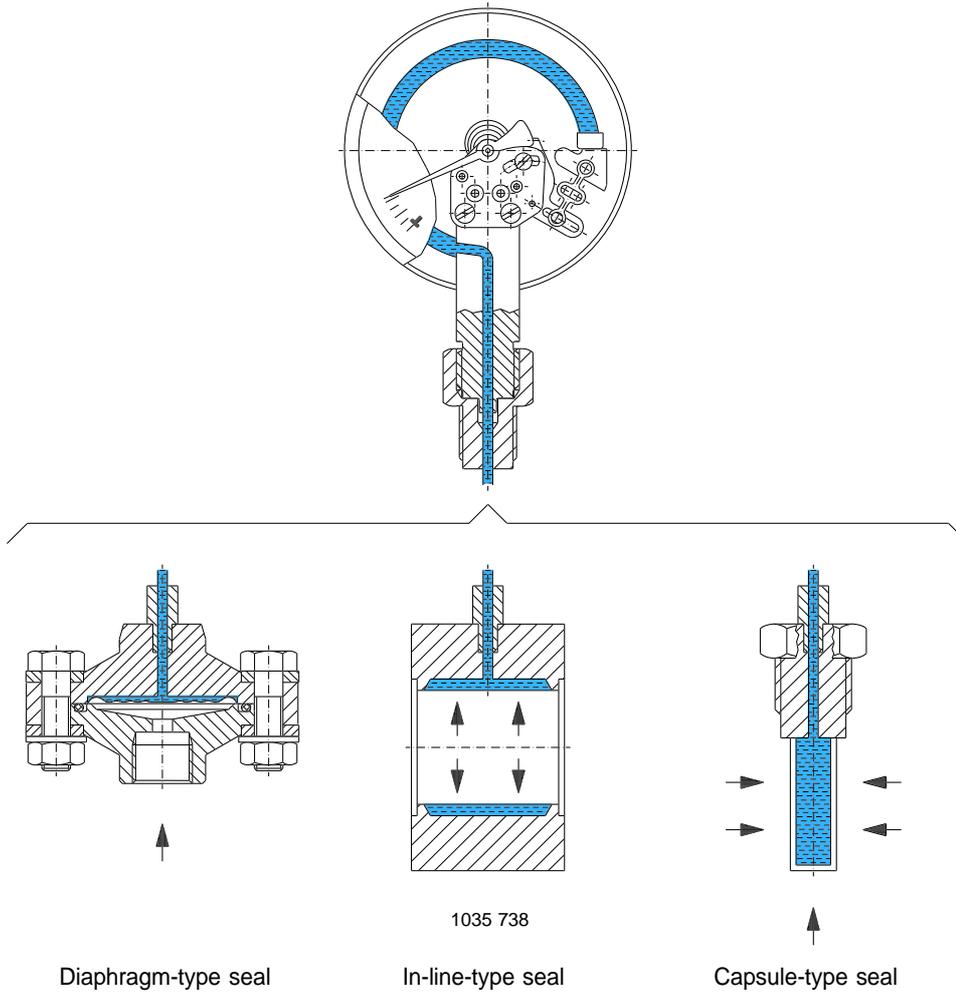
Once filled and calibrated the **hermetically sealed** chemical seal assembly must not be separated.

Diaphragm, lower body and sealing rings where applicable, are exposed to the pressure medium and made of materials suitable to resist pressure, temperature and possible chemical attack of the pressure medium.

The transmitting liquid is normally sealed but may escape into the pressure medium in case of wear or damage of the diaphragm. Hence the liquid should be carefully selected under aspects of compatibility with the pressure medium. This is particularly true where the chemical seal is used in food processing. Available are a variety of filling liquids to handle almost any application. See also the table "Filling liquids" overleaf.

Types of chemical seals

Experience has created three basic types of chemical seals that enable to handle almost any application.



Selection of either one type not only depends on most convenient means of installation but also largely on pressure conditions and requirements of accuracy.

Diaphragm-type seals

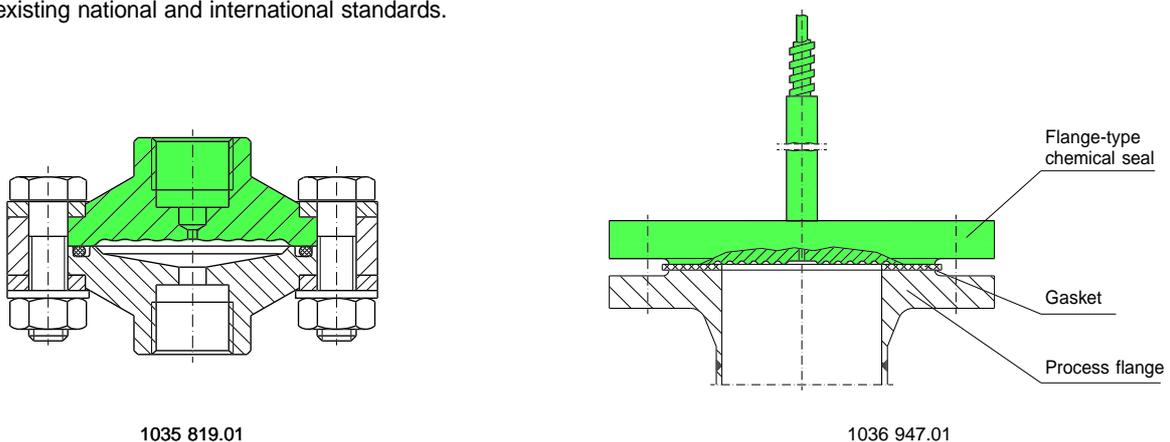
are universally suitable for corrosive, hot and viscous pressure media.

The standard version features screwed process connection or a lower body with flanged connection to handle pressure media that may otherwise deposit underneath the diaphragm. Available are flanges of all existing national and international standards.

Flange-type diaphragm seal

The diaphragm is integral part of a standard flange and flush with the flange sealing face.

This enables simple installation while the diaphragm is fully exposed to the pressure medium.

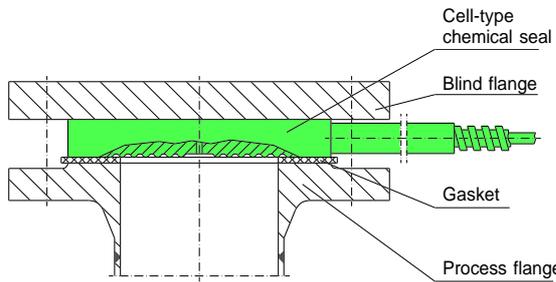


Sandwich-cell type chemical seal

The diaphragm body corresponds to the size of the sealing face of a standard flange.

Upon installation the chemical seal is sandwiched between the process flange and standard blind flange.

The blind flange may be of inferior material since it is not exposed to the pressure medium.

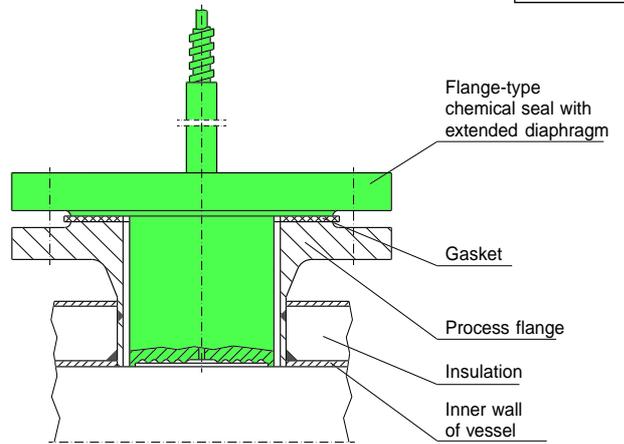


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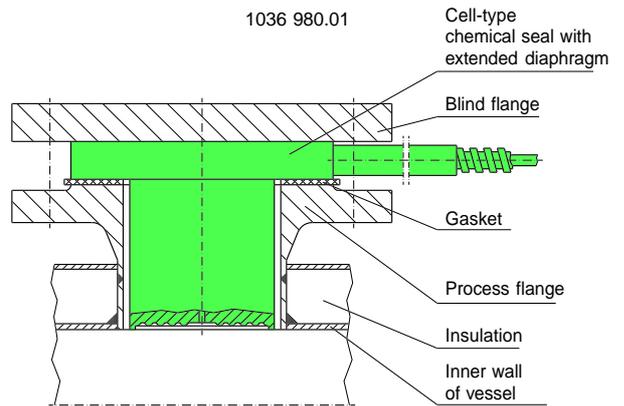
Extended-diaphragm type chemical seal

The tubular extension provides for smooth inner surfaces with thick walled or heavily insulated pressure vessels.

Available are versions incorporating a full flange but also versions to be sandwiched in a similar manner as the cell-type.



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Diaphragm-type chemical seals are available up to 600 bar pressure rating and 400 °C temperature rating.

In-line-type chemical seals

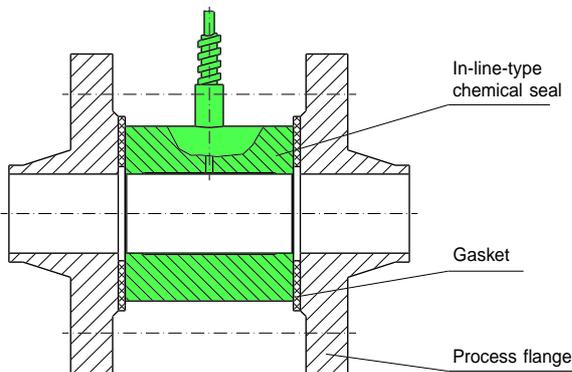
are particularly suited for rapidly flowing pressure media and high viscosity. The seal forms an integral part of the pipe line to allow undisturbed flow of the process medium.

The body comprises of a barrel the diameter of which corresponds to the size of the sealing face of a standard flange.

The chemical seal comprises a cylindrical jacket section in which a thin walled capsule is welded all the way round.

Upon installation the in-line seal is sandwiched between two standard process flanges.

In-line-type chemical seals are available up to 400 bar pressure rating and 400 °C temperature rating.



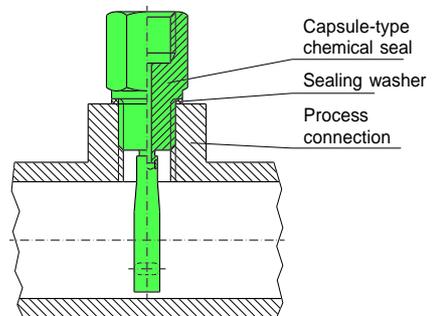
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Capsule-type chemical seals

This type is particularly suitable for flowing, heterogeneous measuring media, since it is immersed directly in the medium. Compared with other chemical seals it takes up extremely little space. The pressure is registered "punctual".

The chemical seal comprises an oval tube as pressure sensor enclosed on the one side and the connection piece welded to it. A support is fitted in the sensor for stabilization. Adaption to the measuring point is with inner and outer thread.

The maximum pressure range is 1600 bar, the normal temperature limit + 400 °C.



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Materials

Below table lists normally available special materials of wetted parts.

Stainless steel	Material no's. 1.4571, 1.4404, 1.4435, 1.4541
Hastelloy B2	Material no. 2.4617
Hastelloy C4	Material no. 2.4610
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
Monel alloy K500	Material no. 2.4375
Nickel	Material no. 2.4066
Tantalum	Ta
Titanium	Material no. 3.7035
Cirkonium	Zr
PTFE	Polytetrafluorethylene

These special materials (except for Ti, Zr, PTFE) are bonded to the main body in a metal-to-metal patented manufacturing process.

Filling liquids

Below table lists normally available filling liquids. Additional special purpose liquids are available.

Common designation	WIKA code-no.	Suitable temperature range		S.G. at temperature		Viscosity at temperature		Notes
		$p_{abs} < 1 \text{ bar}$	$p_{abs} \geq 1 \text{ bar}$	[g/cm ³]	[°C]	[m ² /s·10 ⁻⁶]	[°C]	
Silicon oil	KN 2	–	-20 to +200	0.96	+25	50	+25	Standard
Silicon oil	KN 17	-90 to + 80	-90 to +180	0.914	+20	4	+20	
High temperature oil	KN 3.1	-10 to +100	-20 ¹⁾ to +300	1.07	+20	39	+20	
High temperature oil	KN 3.2	-10 to +200	-20 ¹⁾ to +400	1.07	+20	39	+20	
Halocarbon liquid	KN 21	-40 to + 80	-40 to +175 (max. 160 bar)	1.968	+20	14	+20	Oxygen and chlorine service
Glycerine	KN 7	–	+10 to +230	1.26	+20	1110	+20	Food compatible
Glycerine / water	KN 12	–	-10 to +120	1.22	+20	88	+20	Food compatible
Vegetable oil	KN 13	-10 to +200	-10 to +300	0.94	+15	66	+20	Food compatible

1) -10 °C when used with transmitters



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