

Diaphragm seals and diaphragm seal systems

Application - Functionality - Design

WIKA data sheet IN 00.06

Definition

Diaphragm seals are used for pressure measurements when the process medium should not come into contact with the pressurised parts of the measuring instrument.

A diaphragm seal has two primary tasks:

1. Separation of the measuring instrument from the process medium
2. Transfer of the pressure to the measuring instrument

Functionality of a diaphragm seal

The functionality of a diaphragm seal is illustrated in the figure on the right.

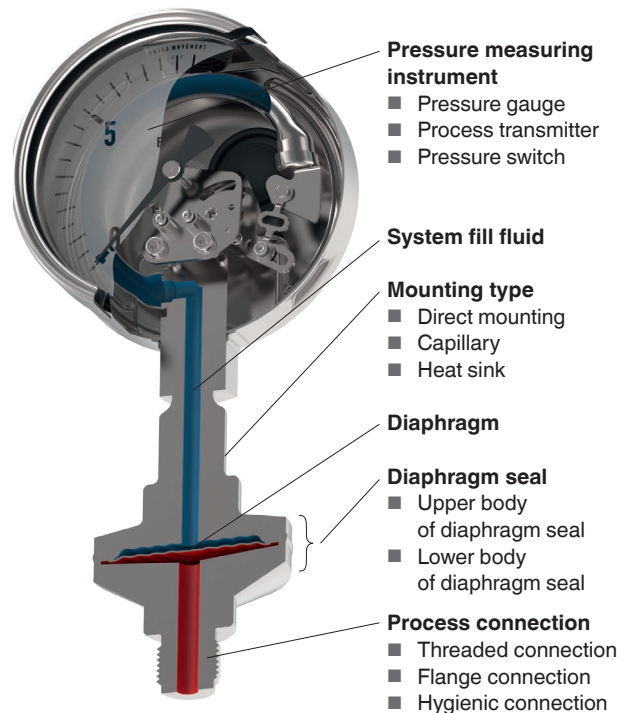
Principle

The process side of the seal is isolated by a flexible diaphragm. The internal space between this diaphragm and the pressure measuring instrument is completely filled with a system fill fluid. The process pressure is transmitted by the elastic diaphragm into the fluid and from there to the measuring element of the pressure measuring instrument.

In many cases, between the diaphragm seal and pressure measuring instrument, a capillary is connected in order (for example) to eliminate or to minimise temperature effects from the hot fluid to the measuring instrument. The capillary affects the response time of the overall system.

Diaphragm seal, capillary and measuring instrument form a closed system. The sealed filling screws on the diaphragm seal and the measuring instrument must therefore never be opened, since the function of the system is affected following any escape of fill fluid!

The diaphragm and the process connection are the elements of the system which come into contact with the medium. Therefore, the material from which they are made must meet the relevant requirements in terms of temperature and corrosion resistance.



Installation example of a diaphragm seal system

If the diaphragm is leaking, the system fill fluid can enter the medium. For applications in the food industry, it must be approved for contact with food. In selecting the fill fluid, the factors of compatibility, temperature and pressure conditions in the medium are of crucial importance. Customer-specific solutions can be realised for the different operating conditions of the applications.

Diaphragm seal systems are capable of withstanding extreme temperatures of $-130 \dots +450 \text{ }^{\circ}\text{C}$ [$-202 \dots +842 \text{ }^{\circ}\text{F}$] and pressures of 35 mbar ... 3,600 bar [0.5 ... 52,200 psi].

Fields of application

The use of diaphragm seals enables the user to employ a large number of pressure measuring instruments for the most difficult process conditions.

Examples

- The medium is corrosive and the pressure measuring instrument itself (e.g. the interior of a Bourdon tube) cannot be sufficiently protected against it.
- The medium is highly viscous and fibrous, thus causing measuring problems due to dead spaces and constrictions in the bores of the pressure measuring instrument (pressure ports, Bourdon tubes).
- The medium has a tendency towards crystallisation or polymerisation.
- The medium has a very high temperature. As a result, the pressure measuring instrument is strongly heated. This heating leads to a large temperature error in the measurement on the pressure measuring instrument. The increased temperature can also lead to the upper limits for the thermal loading of the measuring instrument components being exceeded.
- The measuring location is not favourably located. For reasons of space, the pressure measuring instrument can either not be mounted or cannot be read or can only be read with difficulty. By installing a diaphragm seal and using a longer capillary, the pressure measuring instrument can be installed in a location where it can be easily viewed.

- In the manufacture of the product, and in the production plant, hygienic requirements must be followed. For this reason, dead spaces and undercuts in the wetted parts must be avoided.
- The medium is toxic or harmful to the environment. It cannot be allowed to escape into the atmosphere or environment through leakage. On the grounds of safety and environmental protection, the appropriate protective measures must therefore be taken.

Thanks to its many years of experience, WIKA is able to turn challenging tasks into solutions with a technological edge.

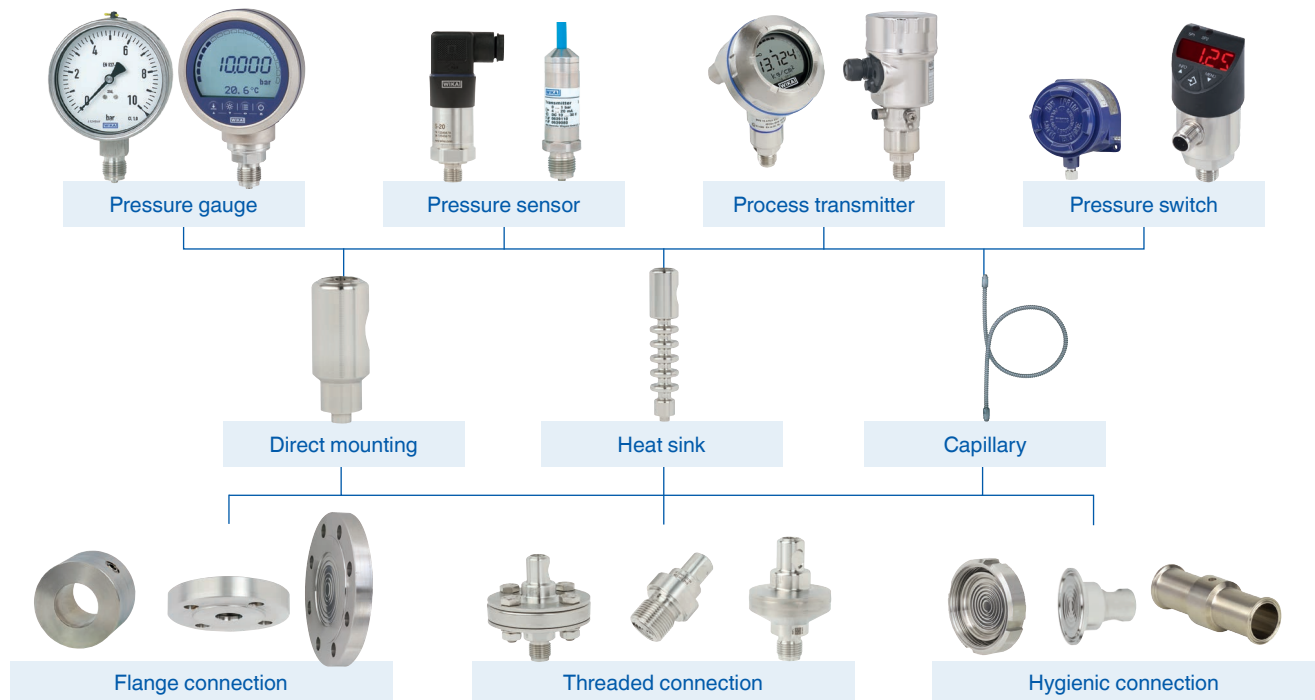
Advantages from using diaphragm seals

- Long service life of the measuring assembly
- Reduced installation effort
- Elimination of maintenance

Combinations for diaphragm seal systems

A diaphragm seal system is defined with the pressure measuring instrument, the mounting type and the diaphragm seal with process connection.

The optimal diaphragm seal designs, materials, system fill fluids and accessories are available for each application.



Mounting types

The required mounting type for pressure measuring instruments with diaphragm seals depends, among other things, on the operating conditions of the diaphragm seal system. The choice is between direct mounting, flexible capillary or heat sink. This makes the diaphragm seal system adaptable to customer-specific conditions. When selecting the mounting type, influences on the measuring capability of the diaphragm seal system must be taken into account. Mounting via a capillary or a heat sink results in a longer response time than direct mounting, for example.

Direct mounting

Direct mounting is achieved by welding the measuring instrument directly to the diaphragm seal via a connection adapter.

Direct mounting via axial connection adapter



Capillary

The capillary is a flexible connecting piece between the measuring instrument and the diaphragm seal, which typically consists of a tube, a capillary protection hose and, optionally, a further jacket. Capillaries are used where the process media are at high temperatures, as these are cooled down through the connecting line. Furthermore, this mounting type is suitable for decoupling strong vibrations, or if the measuring instrument cannot be mounted at the measuring location or is easier to read at another location.

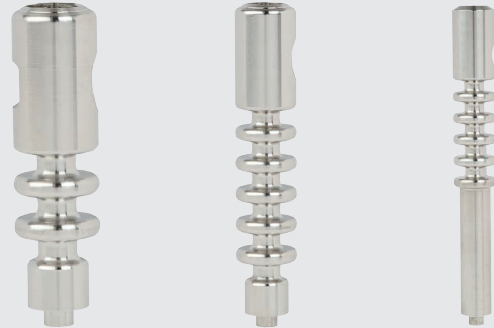
Capillary (example)



Heat sink

With hot media, the heat sink ensures that the system fill fluid cools down sufficiently to guarantee precise measurement.

Heat sink (examples)



Process connection and design

Diaphragm seal systems are used in demanding applications in a wide range of industries. The optimal process connections and designs are available for each application.

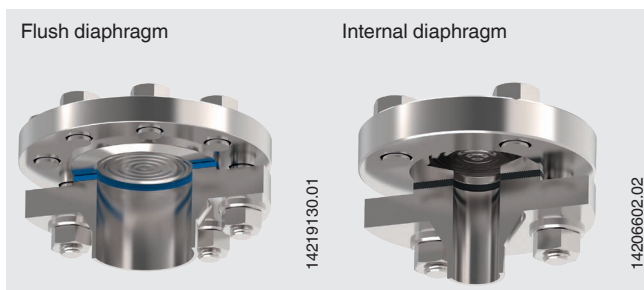
The decision for the right diaphragm seal depends on both the specifications as well as the installation options and requirements of each specific measuring task.

Classification of the process connections

- Flange connection
- Threaded connection
- Hygienic connection

Flange connection

Diaphragm seals with flange connection can be used for processes with aggressive, adhesive, corrosive, highly viscous, environmentally hazardous or toxic media. Diaphragm seals with flange connections are available with dimensions for all common standard flanges. The sealing face is flush and the diaphragm is designed to be either flush or internal.



Cell-type

The cell-type is a specific variant of diaphragm seal with flange connection. It consists of a cylindrical plate, whose diameter is matched to the sealing face area of corresponding standard flanges. The diaphragm is flush and matched to the nominal width.

A blind flange is used to mount the cell-type, available for all common flange standards.



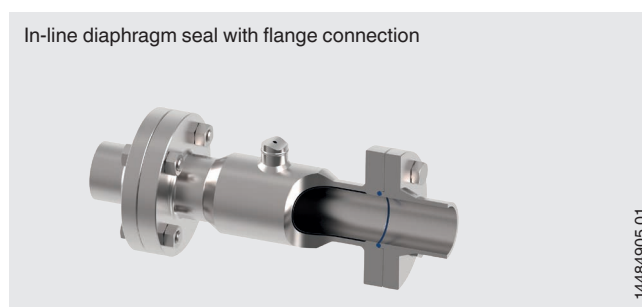
Extended-diaphragm version

Diaphragm seals with extended diaphragm are used, among other things, on thick-walled and/or insulated product lines, vessel walls, etc. The version with extended diaphragm is available for flange- and cell-type designs.



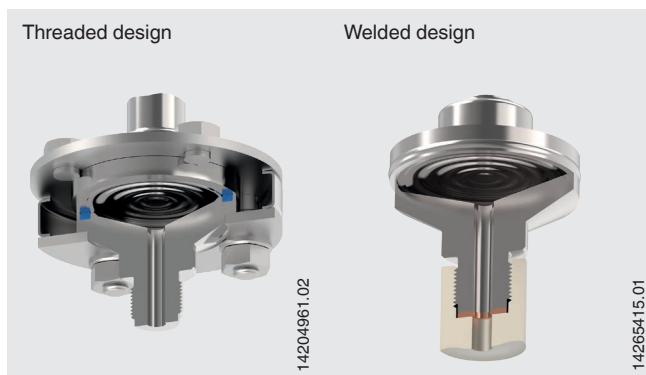
In-line diaphragm seal with flange connection

These diaphragm seals are exceptionally suitable for the measurement of flowing media. The in-line diaphragm seal is clamped directly into the pipeline using flanges at both ends. This integration into the process line prevents disturbing turbulences, as this design has no corners, dead spaces or other obstructions in the flow direction. Different nominal widths allow the in-line diaphragm seals to be adapted to any pipeline cross-section. The in-line diaphragm seals are also available in a cell-type design.



Threaded connection

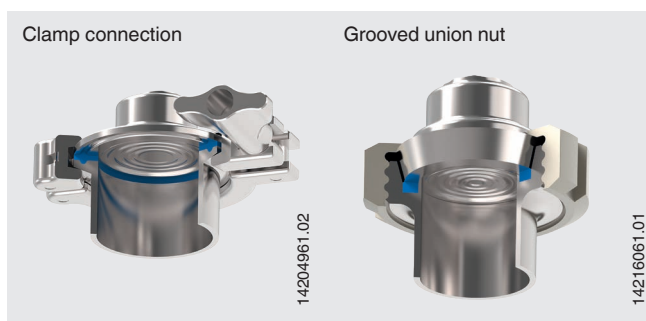
Diaphragm seals with threaded connection can be used for processes with aggressive, adhesive, corrosive, highly viscous, environmentally hazardous or toxic media. The connection of the upper and lower bodies of the diaphragm seal is available in either a threaded or a welded design. These diaphragm seals are available with female or male thread in their basic design. The wide variety of available process connections enables many different adaptations without any problems. The material of the upper body of the diaphragm seal and the lower body of the diaphragm seal can be the same or be different.



Hygienic connection

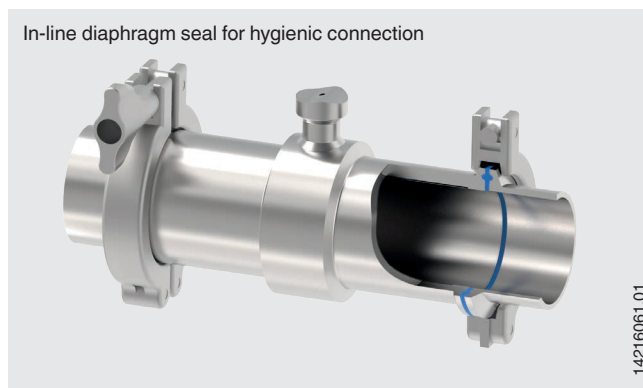
Diaphragm seals in hygienic design can be used for processes with gases, compressed air or vapour and also with liquid, pasty, powdery and crystallising media. The diaphragm seals resist the temperatures that occur and meet the requirements for sterile connections. The flush diaphragm can be integrated hygienically into all applications thanks to the various process connections.

SIP and CIP criteria, which are an essential requirement for sanitary applications, are met by using WIKA diaphragm seals.



In-line diaphragm seal for hygienic connection

The in-line diaphragm seal is perfectly suited for use with flowing media. With the seal being completely integrated into the process line, measurements do not cause any disturbing turbulences, corners, dead spaces or other obstructions in the flow direction. The in-line diaphragm seal is clamped directly into the pipeline. With in-line diaphragm seals, the medium flows through unhindered and effects the self-cleaning of the measuring chamber. Different nominal widths allow the in-line diaphragm seals to be adapted to any pipeline cross-section.



Materials and coatings

The predominant material for diaphragm seals is stainless steel 316L. For the wetted parts, a wide range of special materials and coatings are available for specific areas of application. WIKA offers this variety of different materials in order to be able to find the best possible solution for the demands of the measuring location.

The material selection for diaphragm seals is strongly dependent upon the operating conditions. In addition to the pressure load, the requirements for the temperature and also the resistance against the medium must be known. Then the material selection for the diaphragm seal can be made. The selection can be designed with different materials for the base body, the sealing face and the diaphragm, as these are not equally wetted in every design.

Material combinations and coatings

Especially when using special materials, high costs and long delivery times can occur.

Such circumstance can be resolved by intelligent selection of material combinations or coatings. A cost-effective base material is used for the load-bearing parts, for example, and only the wetted parts are made of a special material or have a coating. The joining and connection technology play an important role here, as different materials cannot always be welded. Regardless of the type of connection technology, these diaphragm seals can withstand extreme operating conditions.

Material	Unified numbering system (UNS)
Stainless steel 316L (1.4404 or 1.4435)	S31603
Stainless steel 904L (1.4539)	N08904
Stainless steel 321 (1.4541)	S32100
Stainless steel 316Ti (1.4571)	S31635
Stainless steel 1.4466 (urea grade)	S31050
Duplex 2205 (1.4462)	S31803
Superduplex 1.4410	S32750
Tantalum (also lining)	R05200
Hastelloy C276 (2.4819)	N01276
Hastelloy C22 (2.4602)	N06022
Inconel 600 (2.4816)	N06600
Incoloy 825 (2.4858)	N08825
Inconel 625 (2.485)	N06625
Monel 400 (2.4360)	N04400
Nickel 200 (2.4066)	N02200
Nickel 201 (2.4068)	N02201
Titanium 3.7035 (class 2)	R50400
Titanium 3.7235 (class 7)	R52400
Zirconium GR702	R60702

The maximum permissible process temperature is limited by the joining method and the system fill fluid. The maximum process temperature can be found in the data sheet for the diaphragm seal.

Coatings

Stainless steel with ECTFE coating
Stainless steel with PFA (FDA; 21 CFR 177.1550 and 21 CFR 177.2440)
Stainless steel with PFA, anti-static (suitable for Ex applications)
Stainless steel with gold plating
Stainless steel with gold-rhodium
Stainless steel with Wikaramic®

System fill fluids

When selecting the system fill fluid for diaphragm seals, factors such as medium compatibility as well as temperature and pressure conditions at the measuring location are of critical importance in order to avoid endangering the process. Depending on the system fill fluid, the appropriate minimum and maximum operating temperature range must be observed. In addition, the change in volume of the system fill fluid at extreme application temperatures must be taken into account.

Highly flammable applications, such as oxygen and chlorine applications, and the high demands within both sanitary applications and the semiconductor industry are also crucial in choosing the right fluid.

The properties of the system fill fluids affect the permissible operating temperature of the diaphragm seal system. Since the parameters of the individual system fill fluids vary, WIKA offers a wide range to cover different applications.

FDA approval

The FDA ("Food and Drug Administration") is a US authority under the Department of Health. It is responsible for the monitoring of foodstuffs and pharmaceuticals and serves to protect public health in the United States.

Liquids that could find their way into the end product in the event of a failure must be FDA-compliant.

Designation	Identi- fication number	Solidi- fication point	Boiling/ degradation point	Density at 25 °C	Kin. Viscosity at 25 °C	Remark
	KN	°C	°C	g/cm ³	cSt	
Silicone oil	2	-45	+300	0.96	54.5	Universal application
Glycerine	7	-35	+240	1.26	759.6	FDA 21 CFR 182.1320
Silicone oil	17	-90	+200	0.92	4.4	Low temperatures
Halocarbon	21	-60	+175	1.89	10.6	Oxygen ¹⁾ and chlorine
Methylcyclopentane	30	-130	+60	0.74	0.7	For very low temperatures
High-temperature silicone oil	32	-25	+400	1.06	47.1	For high temperatures
Neobee® M-20	59	-35	+260	0.92	10.0	FDA 21 CFR 172.856, 21 CFR 174.5
DI water	64	+4	+85	1.00	0.9	For ultrapure media
Silicone oil	68	-75	+250	0.93	10.3	
DI water/propanol mixture	75	-30	+60	0.92	3.6	For ultrapure media
Medicinal white mineral oil	92	-15	+260	0.85	45.3	FDA 21 CFR 172.878, 21 CFR 178.3620(a); USP, EP, SP

Other system fill fluids on request

Note:

- The stated lower temperature limit is a purely physical characteristic of the system fill fluid. The resulting response time has to be calculated and evaluated separately.
- The upper temperature limit for a diaphragm seal system is further restricted by the operating pressure and the diaphragm. To determine the upper temperature limit for the individual diaphragm seal system, a calculation is required.

1) For oxygen applications the following values per BAM test (Federal Institute for Materials Research and Testing) apply:

Maximum temperature	Maximum oxygen pressure
to 60 °C	50 bar
> 60 °C to 100 °C	30 bar
> 100 °C to 175 °C	25 bar

Influencing factors on the measurement

Response time

A combination of the individual components generally causes a delay in the output of the measured value. This delay is referred to as the response time and varies depending on the assembly.

Factors such as the control volume of the measuring instrument as well as the capillary length and its associated cross-section are included in the calculation. It can therefore be concluded that the response time increases with a large control volume or a long capillary. This effect can be counteracted by selecting a measuring instrument with a smaller control volume, a shorter capillary or a capillary with a larger cross-section.

In addition to the geometric variables of the diaphragm seal system, the viscosity of the fill fluid, among other things, must also be taken into account. The higher the viscosity value, the more viscous the medium. An optimisation of the response time can thus be realised through the selection of a fill fluid with a lower viscosity.

Furthermore, the temperatures applied influence the physical properties of the system fill fluid. If the temperature increases, then the medium becomes less viscous and the response time shortens. Conversely, the response time of the measuring instrument increases as the temperature drops due to the increasing viscosity.

Temperature effect

Diaphragm seal systems are generally filled at room temperature. If there are now temperature changes in the environment or in the process, these have a negative effect on the output values of the measuring instrument. The reason is due to the change in the physical properties of the system fill fluid. If the measuring system experiences an increase in temperature, there is an increase in volume which leads to a deflection of the diaphragm in the direction of the process. The restoring force of the diaphragm simultaneously ensures a positive zero point offset on the measuring instrument.

To counteract this error, large diaphragm diameters should be chosen due to their low rigidity. Other factors that counteract the zero point offset are a lower dead volume of the entire system and a lower thermal expansion coefficient of the fill fluid.

The opposite effect is seen when the temperature drops. The decrease in volume now causes the diaphragm to deflect in the direction of the diaphragm bed. The temperature reduction causes a negative zero point offset due to the restoring force of the diaphragm.

Height difference

Any height difference between the pressure measuring instrument and the diaphragm seal (this applies especially when using capillaries) affects the measurement. This is due to the hydrostatic pressure of the liquid column in the capillary. The display is reduced when the pressure measuring instrument is positioned higher than the diaphragm seal. It is increased when the pressure measuring instrument is positioned lower. This height difference must be known when designing the entire system at the factory so that it can be taken into account accordingly.

Note: After mounting, a zero point test and, if necessary, a zero point correction is recommended.



Information on process connections

WIKA data sheet IN 00.14

Applications

- For the definition of the process connections for WIKA pressure measuring instruments

Scope

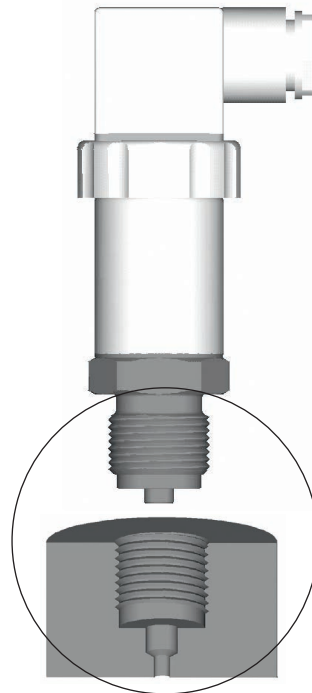
- Pressure sensors
- Electronic pressure switches
- UHP transducer

Contents

- Mounting at the process connection
- Dimensions of the process connections
- Max. measuring ranges and overpressure limits depending on the process connections

Description

WIKA offers pressure measuring instruments with a variety of process connections in order to meet diverse customer-specific application requirements.



Mounting

The following notes relate to process connections with specified geometric and functional features in accordance with technical regulations.

Requirements for the mounting point

The mounting point must meet the following conditions:

- Keep the sealing faces at the pressure sensor and the measuring location clean and free from scratches.
- Remove the protective cap and/or the Mylar or protective foil not until shortly before installation.
- Observe the permissible ambient temperatures. Do not exceed the performance limits of the measuring instrument specified by the manufacturer. Consider possible restrictions on the ambient temperature range due to the mating connectors used.

Mechanical mounting

Carry out the mounting in accordance with the following steps:

1. Prior to commissioning, subject the instrument to a visual inspection.
→ Leaking liquid is indicative of damage.
2. Depressurise the container, pipeline or system.
3. Ensure that the sealing faces are clean and do not show any mechanical damage.
4. Seal the sealing face, see [„Sealing variants“](#).
5. At the mounting point, screw the instrument in hand-tight.
→ Make sure not to cross the threads.
6. For force transmission, use only the defined spanner flats, see [„Spanner flats“](#).
→ The case must not be subjected to mechanical load. Never use the case as a working surface.
7. Tighten the instrument with a torque wrench using the spanner flats.



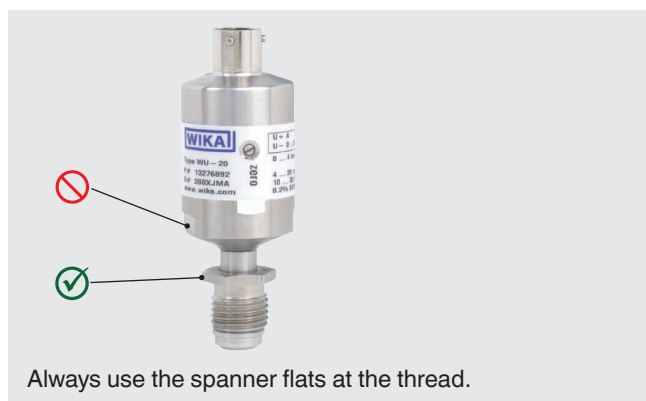
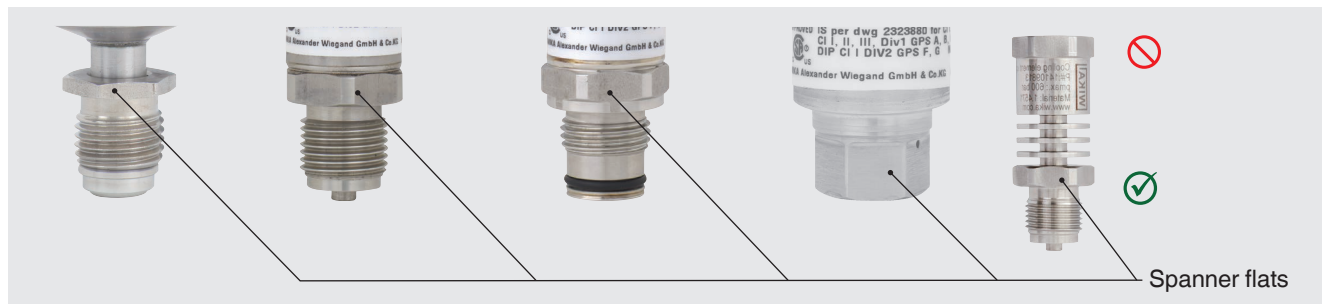
The correct torque depends on the mounting point (e.g. material and shape).

Only use the instrument if it is in perfect condition with respect to safety.

Only use original accessories. For accessories, see data sheet for the respective pressure sensor or pressure switch.

Spanner flats

To avoid damage to the instrument, always use the correct spanner flats.

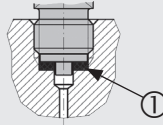


Sealing variants

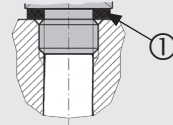
To meet the diverse requirements and operating conditions in different applications, seal the process connections as follows:

Parallel threads

For sealing, use flat gaskets, lens-type sealing rings or WIKA profile sealings at the sealing face ①.



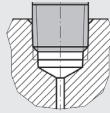
per EN 837



per DIN EN ISO 1179-2
(formerly DIN 3852-E)

Tapered threads

For sealing, the thread is wound with additional sealing material, e.g. PTFE tape.



NPT, R and PT

→ For notes on seals, see WIKA data sheet AC 09.08 at www.wika.com.

Additional notes for special process connections

In certain applications, process connections with special geometric or functional properties are used. This section describes the relevant deviations, technical requirements and notes on the safe and compliant use of such connections.

Cooling element

Cooling elements must not be insulated.

The cooling elements are crucial for regulating the temperature of the pressure measuring instrument. Insulation would impede heat dissipation and could cause the instrument to overheat. This impairs the measurement accuracy and shortens the service life of the pressure measuring instrument.

Flush process connections

Diaphragms must be undamaged.

The diaphragm is the direct interface between the medium and the measuring instrument and is crucial for the following aspects:

- Measurement accuracy: An intact diaphragm ensures correct pressure transmission without errors.
- Prevention of blockages: Especially with viscous, crystalline or abrasive media, an undamaged diaphragm prevents blockages and damage to the pressure port.
- Protection of the measuring instrument: The diaphragm protects the measuring instrument from aggressive or adhesive media.
- Hygiene and cleaning: An undamaged diaphragm makes cleaning easier and prevents contamination, which is particularly important in hygienic applications.

Hygienic process connections

The following notes must be observed when using hygienic process connections:

- Never loosen sealed filling screws on the measuring instrument. Loosening of the filling screws can lead to leakage and contamination.
- For mounting, use the appropriate fastenings. In accordance with the fittings and flange standards, suitable screws, nuts or clamps must be used to ensure a secure and leak-tight connection.
- Only use seals with a sufficiently large inner diameter. The seal must be inserted centrally to prevent contact with the diaphragm, which could lead to measuring deviations.
- Position the welding socket correctly. Position the welding socket so that the bore for leakage detection points downwards. The nozzle must be welded flush with the inner wall of the vessel and ground smooth. The surface roughness of the ground surfaces must be $Ra \leq 0.8 \mu m$.
- Observe the seal manufacturer's instructions. When using soft or PTFE seals, observe the instructions of the seal manufacturer, particularly with regard to tightening torque and load cycles.

UHP process connections

The following notes must be observed when using UHP process connections:

- Complete the weld seam. The weld seam must be fully welded to ensure a secure and leak-tight connection.
- Observe the minimum current and heat input. To avoid damage, ensure that the current and heat input during the welding process are as low as possible.
- Cool the argon flow during the welding process. To improve the quality of the weld seam, cool the flow of argon during welding.
- Perform test welds in advance. Test welds help to prevent welding errors and improve the quality of the weld.
- Clean the connection components. Clean the connection components (such as cable glands, seals and connectors) with pure/filtered gas.



Observe the specifications and notes. Observe the specifications and notes of all components and manufacturers.

Note on VCR®-compatible connections

For VCR®-compatible connections, the union nut/male nut or fitting must be tightened beyond the hand-tight position (depending on the seals used) using a 1/8 or 1/4 turn. Excessive tightening can damage the sealing lips and lead to possible leakage. Do not scratch the sealing lips.

VCR® is a registered trademark of Swagelok

Notes on rework

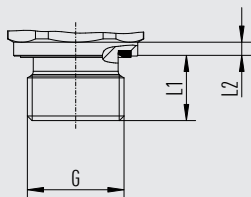
The following rework steps are required for UHP products:

- Set the zero point. A zero point is required; see the operating instructions for the respective instrument.
- Check for leak tightness. Check the UHP connections (threaded connections, welds) for leak tightness using a suitable test (e.g. helium leak test).
- Check the gas flow. Switch the gas flow on and off at least 10 times to remove any particles that may have entered during installation. The flow rate of the gas should correspond to the subsequent process flow.

Dimensions in mm [in]

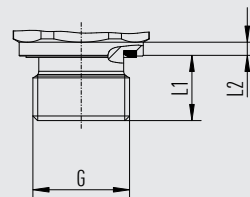
Threaded connections

DIN EN ISO 1179-2



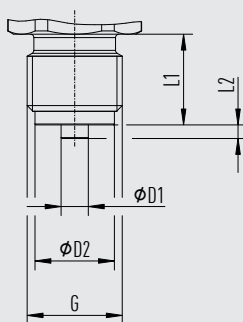
G	L1	L2
G ⅜ A	8 [0.31]	1.5 [0.059]
G ¼ A	12 [0.47]	2 [0.08]
G ½ A	14 [0.55]	3 [0.12]

DIN EN ISO 9974-2



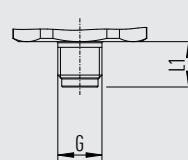
G	L1	L2
M10 x 1.0	8 [0.31]	1.5 [0.059]
M14 x 1.5	12 [0.47]	2 [0.08]

EN 837



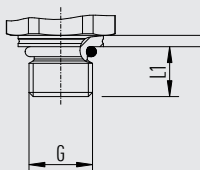
G	L1	L2	D1	D2
G ¼ B	13 [0.51]	2 [0.08]	5 [0.19]	9.5 [0.374]
G ⅝ B	16 [0.63]	3 [0.12]	5.5 [0.22]	13 [0.512]
G ½ B	20 [0.79]	3 [0.12]	6 [0.24]	17.5 [0.689]

EN 837



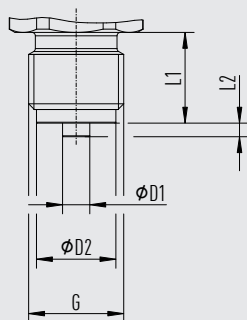
G	L1
G ⅝	10 [0.39]

ISO 6149-2



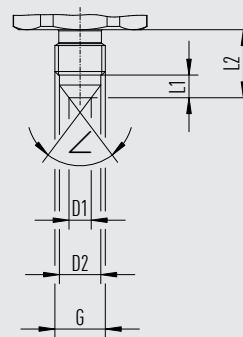
G	L1
M14 x 1.5	11 [0.43]

DIN 16288



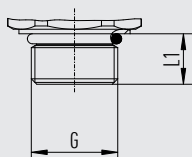
G	L1	L2	D1	D2
M12 x 1.5	13 [0.51]	2 [0.08]	5 [0.19]	9.5 [0.374]
M20 x 1.5	20 [0.79]	3 [0.12]	6 [0.24]	17.5 [0.689]

SAE J514, sealing cone



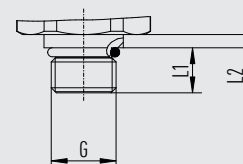
G	L1	L2	D1	D2	∠
7/16-20 UNF-2A	5 [0.2]	15 [0.59]	4.9 [0.193]	9.12 [0.359]	74°

SAE J514, O-ring BOSS



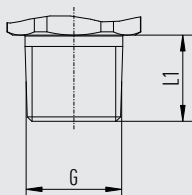
G	L1
3/4-16 UNF-2A, O-ring BOSS	11.13 [0.4382]

SAE J514, O-ring BOSS



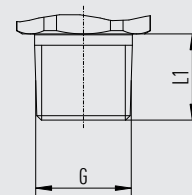
G	L1	L2
7/16-20 UNF-2A, O-ring BOSS	9.14 [0.3598]	2.92 [0.1149]
9/16-18 UNF-2A, O-ring BOSS	9.93 [0.3909]	2.92 [0.1149]

ANSI/ASME B1.20.1



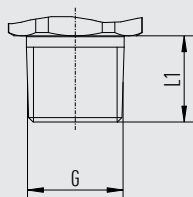
G	L1
1/8 NPT	10 [0.39]
1/4 NPT	13 [0.51]
1/2 NPT	19 [0.75]

KS B 0222



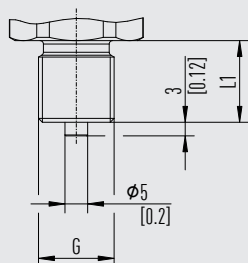
G	L1
PT 1/4	13 [0.51]
PT 3/8	15 [0.59]
PT 1/2	19 [0.75]

ISO 7



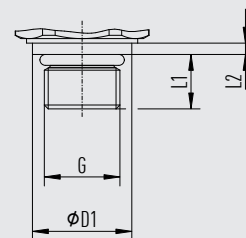
G	L1
R ¼	13 [0.51]
R ⅜	15 [0.59]
R ½	19 [0.75]

JIS B 7505-76



G	L
G ¼ B	16 [0.63]

JIS B 2351-1

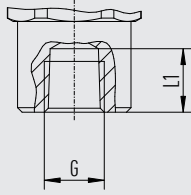


G	D1	L1	L2
G ¼ FORM O with collar	19 [0.75]	10 [0.39] ¹⁾	2 [0.08]
G ⅜ FORM O with collar	21.9 [0.962] ¹⁾	12 [0.47]	2.5 [0.098]

1) Not in accordance with standard

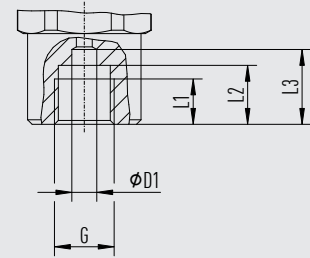
Connections with female thread

ANSI/ASME B1.20.1



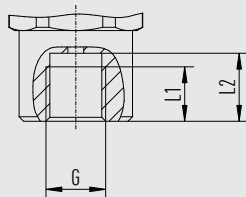
G	L1
¼ NPT	14 [0.55]

EN 837



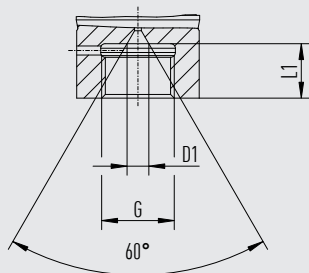
G	L1	L2	L3	D1
G ¼	10 [0.39]	13 [0.51]	16.5 [0.65]	5.5 [0.217]

ISO 8434-1



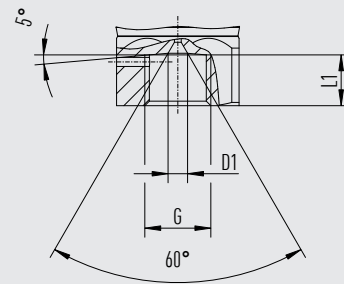
G	L1	L2
G ¼ (compatible with bite-type fittings)	12 [0.47]	15 [0.59]

Metric threads



G	L1	D1
M16 x 1.5, with sealing cone	12 [0.47]	4.8 [0.189]
M20 x 1.5, with sealing cone	15 [0.59]	4.8 [0.189]

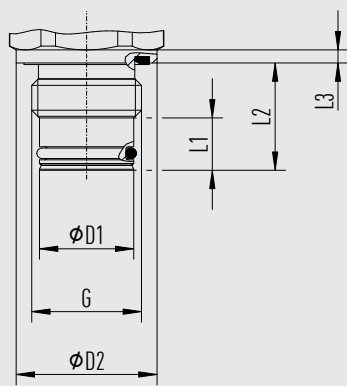
UNF thread



G	L1	D1
9/16-18 UNF-2B (F250-C)	11.2 [0.441]	4.3 [0.169]

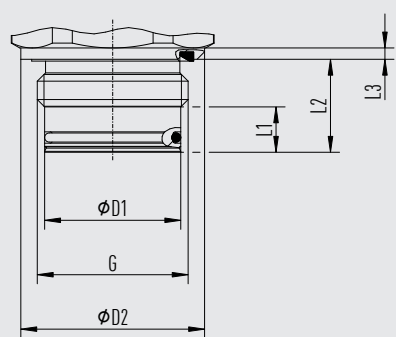
Flush threaded connections

G ½ B flush



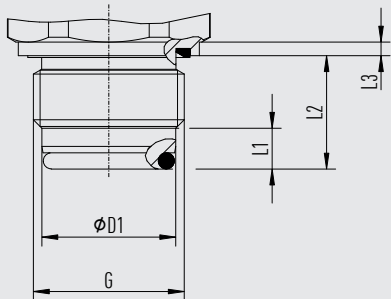
G	L1	L2	L3	D1	D2
G ½ B	10 [0.39]	20.5 [0.807]	3 [0.12]	18 [0.71]	26.9 [1.059]

G 1 B flush



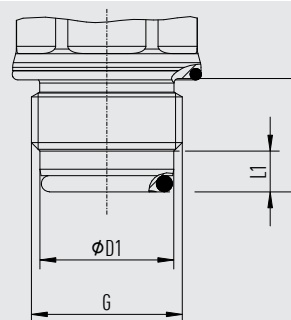
G	L1	L2	L3	D1	D2
G 1 B	10 [0.39]	20.5 [0.807]	2.5 [0.098]	30 [1.18]	40.5 [1.595]

G 1 B hygienic



G	L1	L2	L3	D1
G 1 B	9 [0.35]	25 [0.98]	3 [0.12]	29.5 [1.161]

G 1 B hygienic 3A

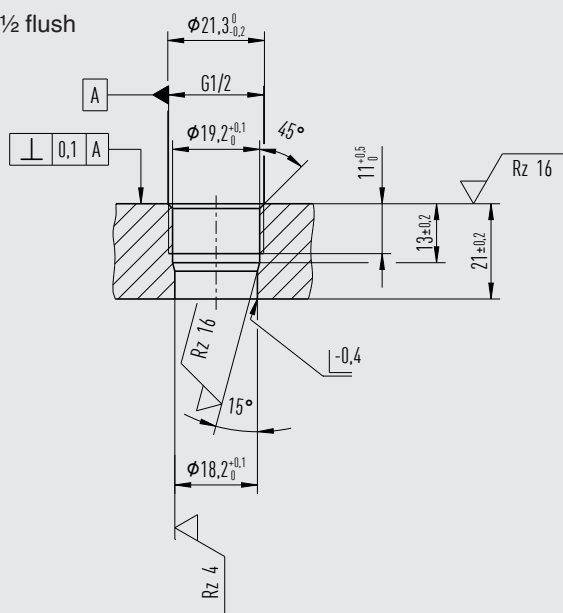


G	L1	D1
G 1 B	9 [0.35]	29.5 [1.161]

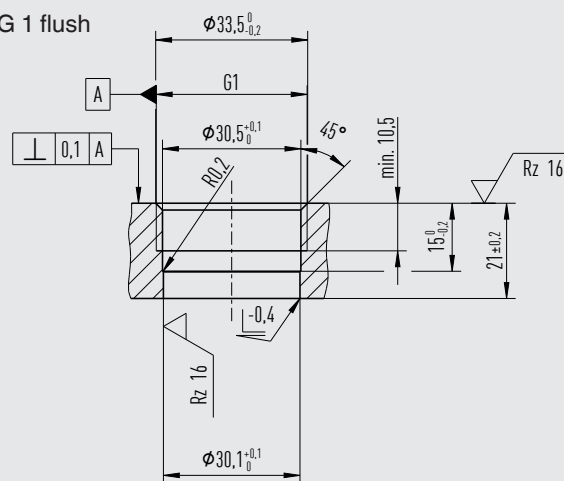
Tapped holes in mm

Tapped holes are only shown for WIKA-specific threads. For all other tapped holes, observe the applicable standards.

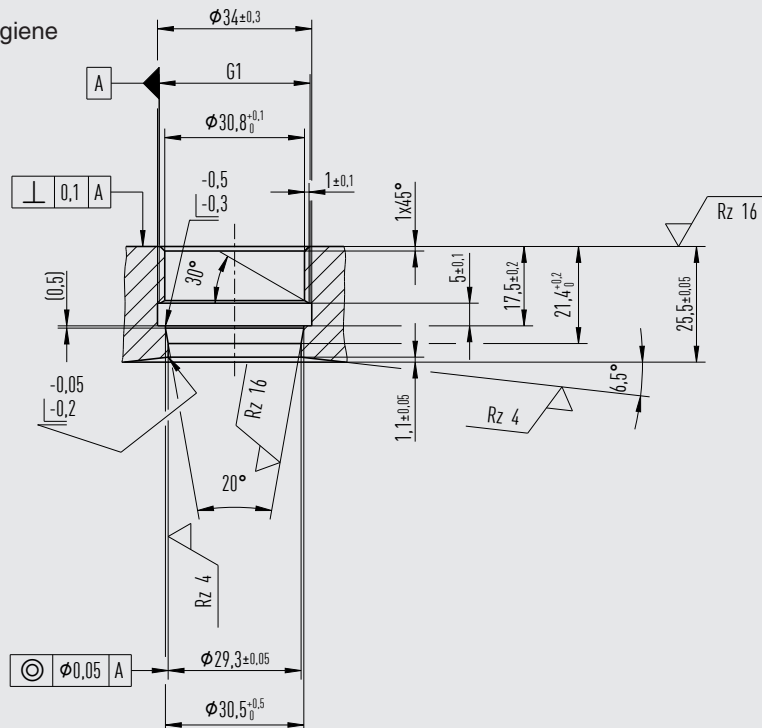
G 1/2 flush



G 1 flush

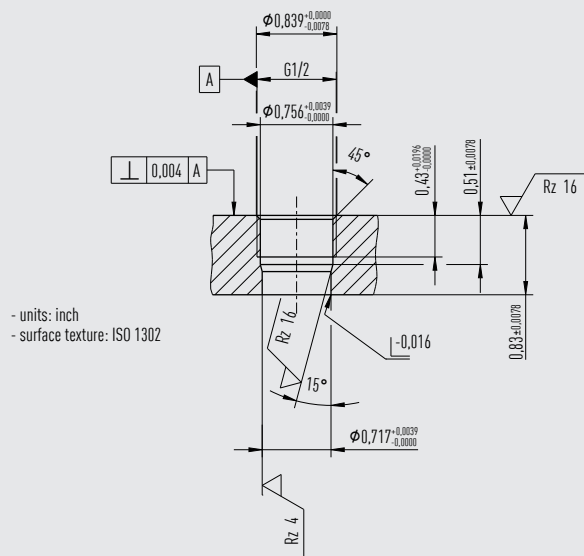


G 1 flush hygiene

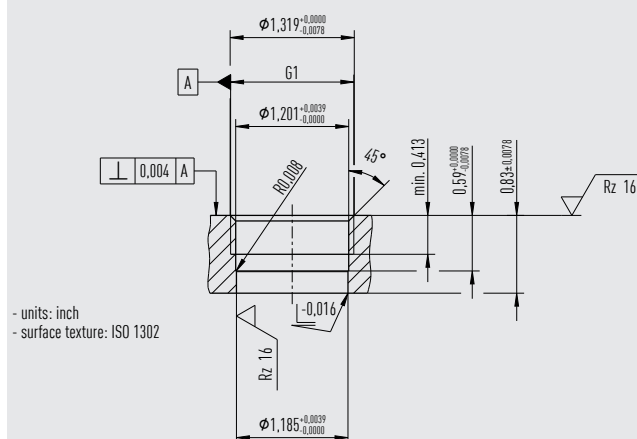


Tapped holes in inch

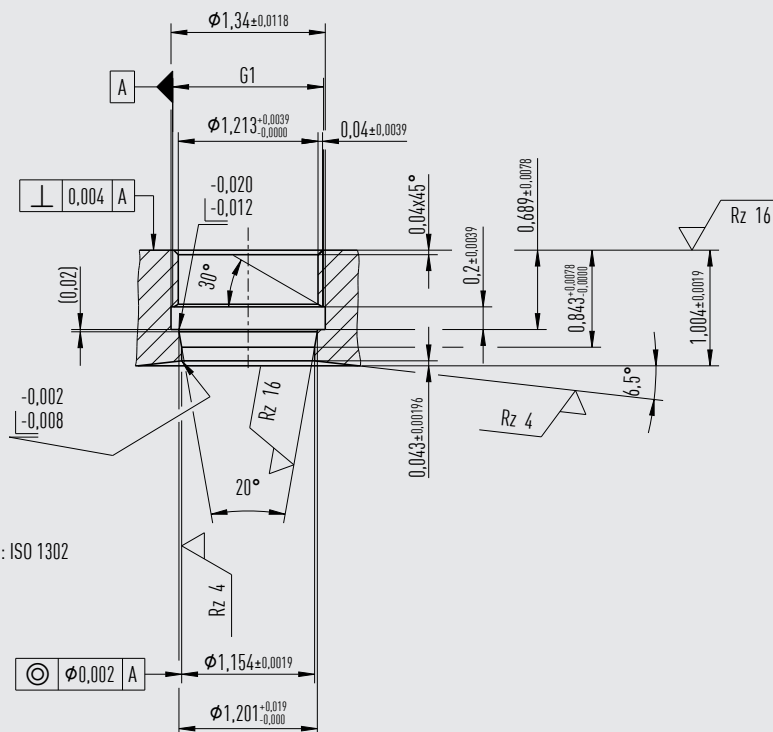
G 1/2 flash



G 1 flash



G 1 flush hygiene



Max. measuring ranges and overpressure limits depending on the process connections

Thread size	Seal	Max. measuring range in bar [psi]	Overpressure limit in bar [psi]
EN 837			
G 3/8 B, male	WIKA seal ¹⁾	1,035 [15,000]	1,480 [21,500]
G 1/8 B, male	WIKA seal ¹⁾	400 [5,800]	572 [8,200]
G 1/4 B, male	WIKA seal ¹⁾	1,035 [15,000]	1,480 [21,500]
G 1/4, female	WIKA seal ¹⁾	1,035 [15,000]	1,480 [21,500]
G 1/2 B, male	WIKA seal ¹⁾	1,035 [15,000]	1,480 [21,500]
G 1/2 B, male ³⁾	Without (from ≥ 1,000 bar ⁴⁾)	1,600 [23,200]	2,288 [33,185]
DIN EN ISO 1179-2			
G 1/8 A, male	Elastomer seal ²⁾	250 [3,600]	358 [3,700]
G 1/4 A, male	Elastomer seal ²⁾	600 [8,700]	858 [12,400]
G 1/4 A, male	Elastomer seal (item no. 14045531)	1,035 [15,000]	1,480 [21,500]
G 1/2 A, male	Elastomer seal ²⁾	600 [8,700]	858 [12,400]
DIN EN ISO 9974-2			
M10 x 1.0, male	Elastomer seal ²⁾	250 [3,600]	358 [3,700]
M14 x 1.5, male	Elastomer seal ²⁾	600 [8,700]	858 [12,400]
ANSI/ASME B1.20.1			
1/8 NPT, male	Self-sealing	400 [5,800]	572 [8,300]
1/4 NPT, male	Self-sealing	1,035 [15,000]	1,480 [21,500]
1/4 NPT, female	Self-sealing	1,035 [15,000]	1,480 [21,500]
1/2 NPT, male	Self-sealing	1,035 [15,000]	1,480 [21,500]
1/2 NPT, male ³⁾	Self-sealing	1,600 [23,200]	2,288 [33,185]
ISO 7			
R 3/8, male	WIKA seal ¹⁾	1,035 [15,000]	1,480 [21,500]
R 1/4, male	WIKA seal ¹⁾	1,035 [15,000]	1,480 [21,500]
R 1/2, male	WIKA seal ¹⁾	1,035 [15,000]	1,480 [21,500]
SAE J514			
3/4-16 UNF-2A SAE J514 O-ring BOSS	Elastomer seal ²⁾	600 [8,700]	858 [12,400]
7/16-20 UNF-2A SAE J514 O-ring BOSS	Elastomer seal ²⁾	600 [8,700]	858 [12,400]
7/16-20 UNF-2A SAE J514 74°	Self-sealing	800 [11,600]	1,144 [16,600]
9/16-18 UNF-2A SAE J514 O-ring BOSS	Elastomer seal ²⁾	600 [8,700]	858 [12,400]
JIS B2351-1			
G 3/8, male, form O with collar	Elastomer seal ²⁾	600 [8,700]	858 [12,400]
G 1/4 x 10, male, form O with collar	Elastomer seal ²⁾	600 [8,700]	858 [12,400]
DIN 16288			
M20 x 1.5, male	WIKA seal ¹⁾	1,035 [15,000]	1,480 [21,500]
M20 x 1.5, male ³⁾	Without (from ≥ 1000 bar ⁴⁾)	1,600 [23,200]	2,288 [33,185]
DIN 16288 (similar to EN 837)			
M12 x 1.5, male (similar to EN 837)	WIKA seal ¹⁾	1,035 [15,000]	1,480 [21,500]
M12 x 1.5, male (similar to EN 837) ³⁾	Without (from ≥ 1000 bar ⁴⁾)	1,600 [23,200]	2,288 [33,185]
JIS B7505-76			
G 1/4 B, male	WIKA seal ¹⁾	1,035 [15,000]	1,480 [21,500]
ISO 6149-2			

Thread size	Seal	Max. measuring range in bar [psi]	Overpressure limit in bar [psi]
M14 x 1.5	Elastomer seal ²⁾	600 [8,700]	858 [12,400]
ISO 8434-1			
G 1/4, female (compatible with bite-type fittings)	Without ⁴⁾	1,035 [15,000]	1,480 [21,500]
KS B 0222			
PT 3/8, male	self-sealing	1,035 [15,000]	1,480 [21,500]
PT 1/4, male	self-sealing	1,035 [15,000]	1,480 [21,500]
PT 1/2, male	self-sealing	1,035 [15,000]	1,480 [21,500]
Without			
G 1/2, flush	NBR, up to 120 °C	600 [8,700]	1,200 [17,400]
G 1/2, flush	FKM, up to 100 °C	420 [6,100]	600 [8,700]
G 1/2, flush	EPDM, up to 150 °C	280 [4,100]	400 [5,800]
G 1/2, flush	FFKM, up to 150 °C	600 [8,700]	1,200 [17,400]
M16 x 1.5 female with sealing cone	Without ⁴⁾	7,000 [101,500]	8,000 [116,000]
M20 x 1.5 female with sealing cone	Without ⁴⁾	15,000 [217,600]	16,000 [232,100]
9/16-18 UNF, female F250-C	Without ⁴⁾	7,000 [101,500]	8,000 [116,000]
G 1 B hygienic 3A	Elastomer seal ²⁾	Not required ⁵⁾	Not required ⁵⁾
G 1 B hygienic	Elastomer seal ²⁾	Not required ⁵⁾	Not required ⁵⁾
G 1 B, flush	Elastomer seal ²⁾	Not required ⁵⁾	Not required ⁵⁾

1) Per DS AC 09.08 (materials only Cu and 1.4571)

2) Per section "Spare parts" of the respective DS

3) Process connection from CrNiMo steel 1.4542

4) The information on the maximum measuring range and overpressure limit refers to the process connection.

Depending on the selected process connection and the seal, restrictions in overpressure limit can result.

5) It is not necessary to specify the maximum measuring range and overpressure limit, as the thread is only used for significantly lower measuring ranges.

Details must be tested separately in the respective application. The specified values for the overpressure limit serve only as a rough orientation. The values depend on the temperature, the seal used, the selected torque, the type and the material of the mating thread and the prevailing operating conditions.

→ Other customised process connections on request

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We reserve the right to make modifications to the specifications and materials.



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Hydrogen applications with electronic pressure measurement

WIKA data sheet IN 00.40

Description

Due to hydrogen diffusion into the sensor structures, signal drift can occur over time. The time until the occurrence of a relevant signal drift and the size of the signal drift depend mainly on the following factors:

- The temperature of the hydrogen
- The pressure of the hydrogen
- The hydrogen content in the medium

The user shall test the selected product version for suitability in the specific application environment.

Sensor technologies for electronic pressure measurement:

Thin-film measuring cell	Without oil filling
For pressure ranges $\geq 0 \dots 25$ bar [$\geq 0 \dots 360$ psi] or $\geq 0 \dots 60$ bar [$\geq 0 \dots 870$ psi]	
Piezo measuring cell	With oil filling
Pressure ranges from $0 \dots 0.4$ bar [$0 \dots 5.8$ psi] to $0 \dots 25$ bar [$0 \dots 360$ psi]	

Wetted parts

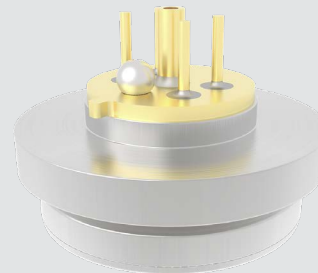
For wetted parts, only those materials are used which are suitable for permanent hydrogen pressure measurement.

Leak test

The models listed here are subjected to a leak test with a leakage rate of max. 1×10^{-6} mbar·l/s during production.



Thin-film measuring cell



Piezo measuring cell

Scope: thin-film measuring cell

Supplement to the following data sheets with the corresponding restrictions with respect to the measuring range:

Data sheet	Model	Material (wetted)	Measuring ranges
PE 81.61	S-20 ¹⁾	Austenitic steel, 2.4711	0 ... 25 to 0 ... 1,000 bar [0 ... 400 to 0 ... 15,000 psi]
PE 86.05	UPT-20	Austenitic steel, 2.4711	0 ... 60 to 0 ... 1,000 bar [0 ... 700 to 0 ... 15,000 psi]
PE 86.06	IPT-20	Austenitic steel, 2.4711	

1) During configuration, select the suitability for hydrogen.

→ Other measuring ranges on request.

Representation



Long-term drift (per IEC 61298-2)

Deviating from the specifications in the respective data sheet, a higher long-term drift can occur.

Typical: ≤ 1 % of span/year

Maximum: ≤ 3 % of span/year

Valid at a temperature of up to 30 °C [86 °F].

For higher temperatures, the sensor must be tested by the user for suitability for the application.

Scope: piezo measuring cell

Supplement to the following data sheet with the corresponding restrictions with respect to the measuring range:

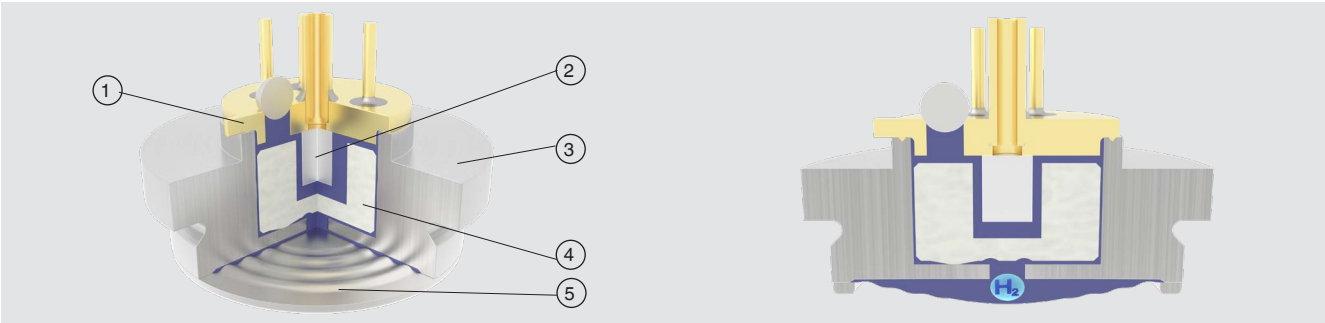
Data sheet	Model	Material (wetted)	Gauge pressure measuring ranges
PE 81.61	S-20	Stainless steel 316L	0 ... 0.4 to 0 ... 25 bar [0 ... 5 to 0 ... 400 psi]

- During configuration, select the suitability for hydrogen.
- Other measuring ranges on request.



Absolute pressure measuring ranges do not fall within the scope of this document.

Design



- ① Header
- ② MEMS chip with glass base
- ③ Case
- ④ Volume displacer
- ⑤ Diaphragm

The permeation (penetration) of hydrogen into the oil filling of the sensor can cause a gas bubble to form there. This bubble creates internal pressure in the measuring cell, leading to a signal offset (zero point offset).
→ This theory has been checked in tests.

Test

Test conditions	
Medium	Hydrogen 3.0
Measuring range	1 bar gauge pressure
Duration	6,000 h and ongoing
Temperature	125 °C [257°F]
Material (wetted)	316L
→ After every 1,000 hours, a mechanical pulse was applied to release any gas that may have dissolved in the oil.	

Result

Even after 6,000 hours, the devices under test showed no hydrogen-induced signal drift.
→ Taking into account the test conditions, a gauge pressure piezo measuring cell can also be used to measure hydrogen.

Pressure signals should be monitored regularly.

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Electrical mounting of pressure sensors and electronic pressure switches

WIKA data sheet IN 00.50

Applications

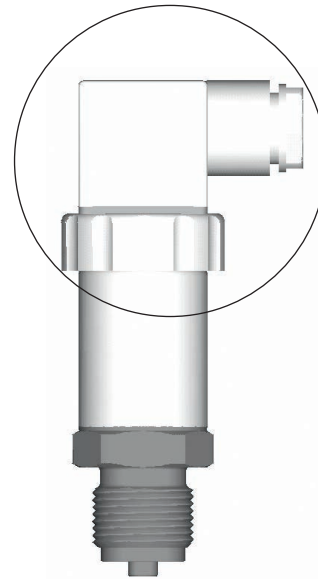
- For determining the electrical connections for WIKA pressure measuring instruments

Scope

- Pressure sensors
- Electronic pressure switches
- UHP transducers

Content

- Making the electrical connection
- Connection types
- Ingress protection overview (IP code)



Description

WIKA offers pressure measuring instruments with a variety of electrical connections in order to meet diverse customer-specific application requirements.

Making the electrical connection

Requirements for the mounting point

The mounting point must meet the following conditions:

- Humidity $\leq 80\%$ relative humidity
- Non-condensing
- Protected from weather influences
- Sufficient space for a safe electrical installation
- Permissible ambient temperatures must remain within the performance limits of the measuring instrument.
- Consider possible restrictions on the ambient temperature range due to the mating connectors used.

Preparation:

- Only use original accessories.
 - To connect the instrument, the mating connector or cable outlet must be assembled in advance.
 - Only use cables with suitable characteristics for the respective operating conditions.
 - Select a cable diameter that matches the cable bushing of the connector.
- For accessories, see data sheet for the respective instrument.

Electrical mounting:

Mating connector

1. Make the connection to the mating connector, see ["2-wire connection"](#).
2. Make sure that the cable gland of the mounted connector has a tight fit.
3. Check existing seals for damage.
4. Establish the plug connection. Tighten any cable glands and check the correct seating of the seal, if available, to ensure the ingress protection.



Only the correct combination of connector and mating connector will ensure the desired IP ingress protection.

Cable outlet

1. Select the mounting option.
2. Cables with ventilation tubes must be vented to atmosphere.
3. If specified, with cable versions, attach strain relief.
4. Make sure that no moisture enters at the lead end.

Fitting a DIN 175301-803 angular connector

1. Loosen the screw (1).
2. Loosen the cable gland (2).
3. Disconnect the angular connector (5) + (6) from the instrument.
- 4.



CAUTION!

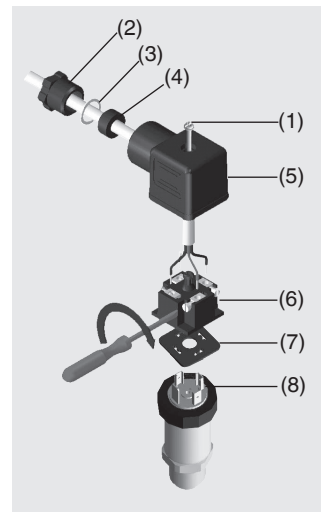
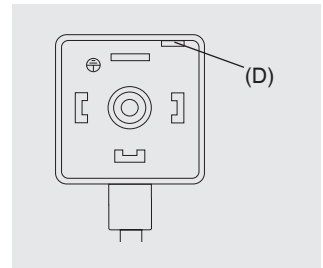
Improper mounting

The seal of the angle housing will be damaged.

- Do not try to push the terminal block (6) out using the screw hole (1) or the cable gland (2).

Via the mounting hole (D), lever the terminal block (6) out of the angle housing (5).

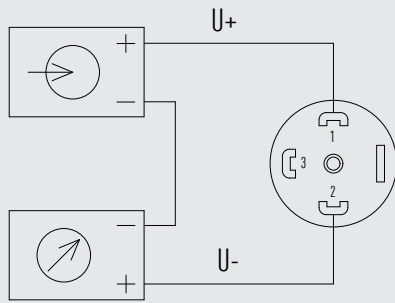
5. Slide the cable through the cable gland (2), the ring (3), the seal (4) and the angle housing (5).
6. Connect the cable ends to the terminal block (6) in accordance with the connection diagram.
7. Press the angle housing (5) onto the terminal block (6).
8. Make sure that the seals are not damaged and that the cable gland and seals are correctly seated in order to ensure ingress protection.
9. Tighten the cable gland (2) around the cable.
10. Place the flat gasket (7) over the instrument's connection pins.
11. Push the angular connector (5) + (6) onto the instrument.
12. Tighten the screw (1).



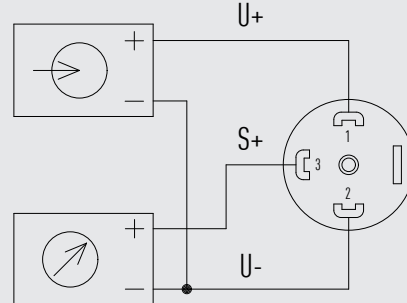
Connection types: example of M12 and DIN-A connector

Angular connector, DIN 175301-803 A

2-wire connection

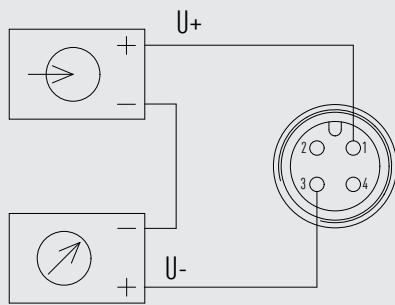


3-wire connection

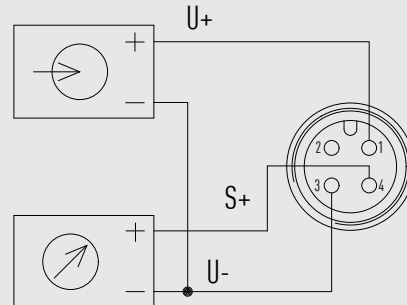


Circular connector, M12 x 1, 4-pin

2-wire connection



3-wire connection



Legend

- U₊ Positive power supply terminal
- U₋ Negative power supply terminal
- S₊ Analogue output
-  Voltage supply
-  Load

→ The pin assignment can be found on the respective product label.

Ingress protection (IP code) per electrical connection

Electrical connection	Ingress protection (IP code) per IEC 60529	Note
Angular connector DIN 175301-803 A	IP65	-
Angular connector DIN 175301-803 C	IP65	-
Circular connector M12 x 1 (4-pin)	IP67	-
Deutsch connector DT04	IP67	-
Delphi connector Metri-Pack series 150 (3-pin)	IP67	-
Bayonet connector (6-pin)	IP67	-
Cable outlet	IP67	Only with cable outlets: ■ Unshielded with models A-10, O-10 ■ Shielded with model O-10 ■ OEM version with model A-10 ■ ½ NPT, conduit with model S-20
Cable outlet IP67	IP67	-
Cable outlet IP68	IP68	-
Cable outlet IP69K	IP69K	-
Cable outlet IP6K9K	IP6K9K	-
Field case	IP6K9K	-
AMP Superseal connector 1.5 (3-pin)	IP67	-
VW connector, code I (4-pin)	IP67	-
USB connector type A	IP67 (instrument)	-
	IP20 (connector)	

In the event of any discrepancies or contradictions between this technical information and the information in the item name or in the operating instructions, solely the information in the item name or in the operating instructions shall be binding and take precedence.

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