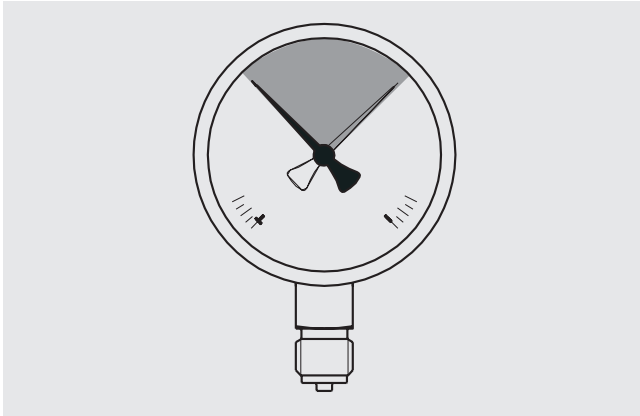


Selection, installation, handling and operation of pressure gauges

WIKA data sheet IN 00.05

General information

The user must ensure that the appropriate pressure gauge has been selected in terms of scale range and design. The scale range is optimally selected when the operating pressure lies in the middle third of the scale range.



The pressure gauge must be mounted free from vibration and should be aligned so that it is easy to read.

The process connection must be sealed properly.

For zero point checking or the exchange of the instrument during operation, the installation of a shut-off device between pressure tapping and pressure gauge is recommended.

Case designs

For operational safety and the protection of personnel who find themselves in the vicinity of the measuring location, the EN 837-2 user standard requires different safety levels for cases.

Safety levels for cases per EN 837

- "S1" with blow-out device in case back
- "S2" for NS 40 ... NS 80 with blow-out device in case back or blow-out back
- "S3" for NS 40 ... NS 250 with solid baffle wall ① (Solidfront) and blow-out back ②

Exploded diagram of safety level "S3"



For non-hazardous, liquid media < 25 bar without case filling, no safety level is required. For gaseous or vaporous media from an operating pressure of 25 bar, in accordance with EN 837-2, a pressure gauge with safety level "S3" is recommended. Furthermore, in accordance with EN 837-2, further criteria are specified for the selection of the appropriate safety level for specific fields of application and instrument versions.

Instrument fixing

If the line to the instrument is not rigid enough for a vibration-free installation, the gauge should be mounted by means of appropriate fastening elements for wall or pipe mounting - if necessary, through the insertion of a capillary.

Measuring system dampening

If vibrations cannot be avoided by means of suitable installation, instruments with a liquid case filling should be used.

Shut-off devices

Depending on the intended use, stopcocks or shut-off valves are fitted upstream of the pressure gauge.

Stopcock and shut-off valve

Stopcocks have up to 4 functions:

- **Vent** The supply line is shut and the pressure element is connected to the atmosphere. The zero point can be checked.
- **Operation** The supply line is open, the pressure element is pressurised.
- **Blow out** The supply line is open, the medium escapes into the atmosphere.
- **Testing** The supply line is open and, in addition to the working pressure gauge, a test pressure gauge can be installed if a test connection is available.

Shut-off valves with or without test connection in accordance with DIN 16270 or DIN 16271 have a vent screw between the valve seat and instrument connection. If the vent screw is loosened, the venting can be controlled through the thread.

In specific applications (e.g. steam boilers) the shut-off devices must have a test connection, so that the pressure gauge can be tested without being dismantled. With shut-off valves in accordance with DIN 16272, the test connection can be isolated separately. In the process industry, the block-and-bleed valve is used for this functionality.

Due to their one-piece design, monoflanges can withstand high overpressures. Through this, the robust and compact mounting of the measuring instrument directly to the process flange is possible.

Temperature load

When mounting the pressure gauge it must be ensured that, taking into consideration the influence of convection and heat radiation, no deviation above or below the permissible ambient and media temperatures can occur. Thus the instrument and the shut-off device must be protected by sufficiently long measuring lines or syphons. The influence of temperature on the indication accuracy must be observed.

Diaphragm seals/Separators

In the case of aggressive, hot, highly viscous, contaminated or crystallising media, which must not penetrate into the pressure element, diaphragm seals must be provided as separators.

To transmit the pressure to the pressure element, a neutral system fill fluid is used, which must be selected to correspond to the measuring range, temperature and compatibility with the medium. The connection between instrument and diaphragm seal must not be disconnected under any circumstances.

Protection of the pressure elements from overpressure

If the medium is subject to rapid changes in pressure, or pressure surges are expected, then these must not act directly on the pressure element. The action of the pressure surges must be dampened, for example with the fitting of a throttle section (reduction in cross-section in the pressure port) or through the addition of an adjustable snubber. If, to favour a higher display resolution, the measuring range selected is smaller than the maximum pressures that occur for short times, the pressure element must be protected against damage. For this purpose, an overpressure protector must be connected upstream (external protection); this closes immediately in the event of a pressure surge, and only gradually if the pressure rises slowly. The closing pressure to be set thus depends on the pressure profile over time. A further possibility is the use of a pressure gauge with high overload safety (internal protection).

Pressure tapping

The pressure tapping should be arranged with as large a bore as possible (≥ 6 mm) via a shut-off device, so that the pressure tap is not distorted by any flow in the medium. The measuring line between the pressure tapping and the pressure gauge should have a large enough inner diameter and no sharp bends to prevent blockage and lag in the pressure transmission. Its installation with a steady slope of approx. 1:15 is recommended.

Measuring line

The measuring line should be designed and installed so that the loads occurring due to expansion, vibration and thermal effects can be absorbed.

With gaseous media, a drain should be provided at the lowest point; with liquid media, a vent should be provided at the highest point.

For particle-laden gases or liquids, separators must be provided which can be isolated from the plant during operation, using shut-off devices, and emptied. If the instrument needs to be mounted either higher or lower than the pressure tapping, the measuring range shifts if the medium in the measuring line does not have the same density as the ambient air.

The shift, Δp , is derived from the density difference ($\rho_M - \rho_L$) and the height difference, Δh , in accordance with the formula:

$$\Delta p = (\rho_M - \rho_L) \cdot g \cdot \Delta h \cdot 10^{-5} \text{ (bar)}$$

Shift in the measuring range

ρ_M = Density of the medium (kg/m^3)

ρ_L = Density of the ambient air (kg/m^3)
(1.205 kg/m^3 at 20 °C)

Δh = Height difference (m)

g = Gravitational acceleration (m/s^2)
(average gravitational acceleration = 9.81 m/s^2)

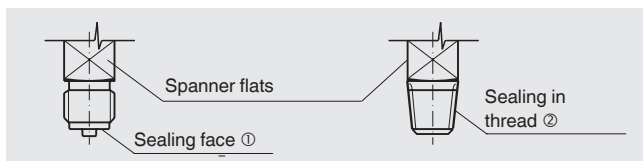
The display decreases by Δp , if the pressure gauge is higher; it increases by Δp , if the pressure measuring instrument is lower than the pressure tapping.

Usually, a pressure gauge is mounted with its dial vertical. With any deviation, the position indicator on the dial must be observed.

Mounting and commissioning

For process connections with parallel threads, use flat gaskets, lens-type sealing rings or WIKA profile sealings at the sealing face ①. The tightening torque is dependent upon the process connection, the material and the sealing. With tapered threads (e.g. NPT threads), sealing is made in the threads, ② using a suitable sealing material (EN 837-2).

Parallel and tapered thread connection



In order to orientate the instrument so that it can be read as well as possible, a connection with LH-RH union or union nut should be used.

When screwing the instruments in, the force required for sealing must not be applied through the case, but only through the spanner flats provided for this purpose, and using a suitable tool.

If the instrument is located below the pressure tapping, the measuring line must be flushed thoroughly before installation to remove any foreign bodies.

Some instrument models have a vent valve with the inscription CLOSE and OPEN for internal pressure compensation. In the condition at time of supply, this vent valve is closed (lever to setting CLOSE). Before checking and/or after installation and before commissioning, these instruments must be vented, i.e. the lever set to OPEN.

When pressure testing or blowing through pipes or vessels, the pressure gauge must not be subjected to a higher load than indicated by the identifying mark ▼ on the dial (EN 837-1 and EN 837-3). Otherwise the pressure gauge must either be protected by a shut-off device or dismantled.

Before the dismantling of a pressure gauge, it must be ensured that it is no longer pressurised. If necessary, the measuring line must have strain relief.

For diaphragm pressure gauges, the clamping bolts of the upper and lower flange must not be loosened.

Liquid media with the property of changing the volume during solidification can damage the measuring system (e.g. water if it falls below the freezing point).

Residual media in dismantled pressure gauges can result in a risk to persons, the environment and equipment. Sufficient precautionary measures must be taken.

Operation

In order to prevent any pressure surges, shut-off devices must only be opened slowly.

The maximum pressure for static load is indicated by the identifying mark ▼ on the dial (EN 837-1 and EN 837-3). Lower values apply for alternating loads.

For a zero point check during operation, the shut-off device must be closed and the pressure element vented. The pointer must then be within the range marked h at the zero point.

If the pointer is outside the transverse bar, it can generally be assumed that the pressure element is permanently deformed, which would have to be subjected to closer inspection in order to avoid measuring errors or accidents.

To check the display during operation, the pressure gauge must be separated from the process, via the shut-off device with test connection, and loaded with a test pressure. For instruments in accordance with EN 837-1 and EN 837-3, the permissible error limits are defined.

Improper handling with hazardous media, such as, for example, oxygen, acetylene, flammable or toxic substances, as well as in refrigeration systems, compressors etc., can cause dangerous or harmful media to escape into the environment, which can lead to damage or injury. For these media, in addition to all standard regulations, the appropriate existing codes or regulations must also be followed.

Storage

To avoid damage, the following points must be observed when storing the pressure gauges until installation:

- Leave the instruments in their original packaging and store them protected from damage by external influences.
- Following any possible removal of the instruments, e.g. for testing, the instrument should again be stored in its original packaging.
- Storage temperature range: $-40 \dots +70 \text{ }^{\circ}\text{C}$
Deviating storage temperatures are possible. The permissible temperature range can be taken from the respective data sheet.
- Protect the instruments from moisture and dust.

Reference documents

Quoted standards

EN 837-1

Bourdon tube pressure gauges - part 1:
Dimensions, metrology, requirements and testing

EN 837-2

Pressure gauges - part 2:
Selection and installation recommendations for pressure gauges

EN 837-3

Diaphragm and capsule pressure gauges - part 3:
Dimensions, metrology, requirements and testing

DIN 16270

PN 250 and PN 400 valves without test connection for pressure gauges

DIN 16271

PN 250 and PN 400 valves with test connection for pressure gauges

DIN 16272

PN 250 and PN 400 valves with blocking test connection for pressure gauges

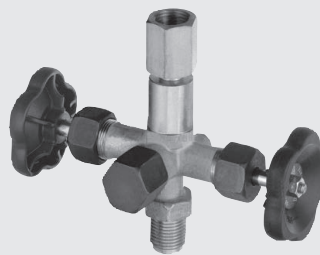
Shut-off devices



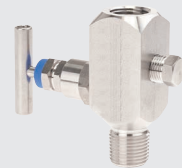
Stopcock



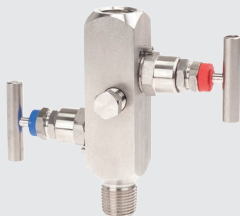
Shut-off valve



Shut-off valve with separately isolatable test connection



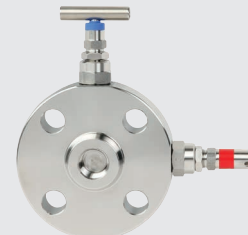
Needle valve with vent connection



Block-and-bleed valve



Double-block-and-bleed valve manifold



Monoflange

Mounting accessories



LH-RH union

Adjustable snubber

Adapter piece for instrument mounting bracket

Instrument mounting bracket

Syphon, compact form

Syphon, trumpet form

Syphon, U-form

Overpressure protector

Measuring arrangement

Proven measuring assemblies for various types of media.

Filling of the measuring line	Liquid media			Gaseous media		
	Liquid	Liquid with vapour	Completely vapourised	Gaseous	Partially condensed (damp)	Completely condensed
Examples	Condensate	Boiling liquids	"Liquid gases"	Dry air	Moist air Flue gases	Steam
Pressure gauge above the pressure tapping						
Pressure gauge below the pressure tapping						

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