IN 00.05

Selection, Installation, Handling and Operation

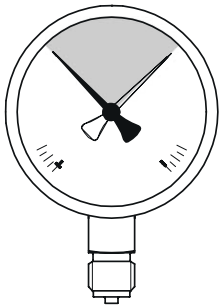
Technical Information

of Elastic Element Pressure Gauges

In general
The user must ensure that the appropriate pressure gauge with regard to scale range and performance is selected.

The optimum selection of the scale range is given if the operating pressure is in the middle third of the scale range.

See sketch



The pressure gauge should be installed such as to avoid exposure to heat and vibration and to enable easy observation of the dial indication.

The pressure connections have to be sealed.

It is common practise to install the pressure gauge by means of an isolating device to facilitate replacement while the system is pressurised and to set the gauge inoperative when reading is not required.

Isolating devices
The isolating device may be either a pressure gauge cock or a pressure gauge valve, depending on operating conditions and requirements.

Pressure gauge cocks. The handle features 3 positions:

OFF The pressure medium is barred and the pressure element is open to the atmosphere.

ON The pressure gauge is connected to the pressure medium.

VENT The pressure gauge is isolated but the pressure system is vented and the medium can escape into the atmosphere.

Pressure gauge valves without or with test connector (DIN 16 270 or 16 271 resp.) are equipped with a venting plug between valve body and pressure connection. Release of the venting plug enables controlled venting through the thread.

Local safety codes such as for pressure or steam vessels may specify isolating devices enabling on-site testing of the pressure gauge. The test connector of the pressure gauge valve according to DIN 16 272 can be closed with an additional shut-off device.

Pressure gauge mounting provisions
If the pressure system or tail pipe is not sufficiently rigid to accept the weight of the gauge, particularly where vibration exists, the gauge should be mounted by means of a mounting device for surface or pipe mounting, if necessary with capillary extension.

Damping of vibration
If the pressure gauge is exposed to vibration or pulsating pressure or both, then a liquid filled pressure gauge may provide considerably better performance and readability.

Effects of temperature
The operating temperature of the pressure gauge, resulting from the effects of pressure medium, ambient temperature and possibly heat radiation must not exceed the temperature span the pressure gauge is intended for. Suitably shaped tailpipes or syphons with water filling may be used to separate the pressure gauge and its isolating device from hot pressure media.

Diaphragm seals
Diaphragm seals may be employed to separate the pressure gauge from a pressure medium that must not enter the elastic pressure element.
Diaphragm seal and pressure element are filled with an inert liquid that acts as a pressure transmitting agent.
Once assembled and filled the pressure instrument must not be dismantled from the diaphragm seal.

Overload protection for pressure elements
Should the measuring media be subject to rapid fluctuations in pressure, or pressure surges have to be taken into account, these must not be allowed to act directly on the pressure element.

The pressure surges must be restricted in their effect, for example, by fitting integral restrictor screws (to reduce the cross-section in the canal) or by using adjustable snubber devices.

In cases where it is necessary to select a range less than the maximum pressure which could occur in the system, in order to obtain a high reading resolution, the pressure element must be protected against damage. Some pressure gauges are provided with in-built over pressure safety to high pressures.

If the pressure gauge does not have the capability to withstand high overpressures a separate overpressure protection valve must be fitted.

The valve will immediately isolate the system in the event of sudden surges in pressure, or gradually close in the event of slow pressure increases. The setting for the valve must be adjusted according to its anticipated usage.

Pressure tapping points
To ensure correct operation the gauge should be located at a point of undisturbed and continuous flow, and it should be fitted via an isolating device.

Tail pipes
The tail pipe, that is the connecting line between pressure tapping point and pressure gauge, should be of sufficiently large diameter (≥ 6 mm) to avoid clogging by possibly suspended matter. Horizontal lines of considerable length should be sloped (recommended inclination 1:15). With gaseous pressure media the line should feature a draining provision at its lowest point, whereas the line of a liquid medium should feature an air bleeding provision at its highest point. A filter or separator that enables cleaning without being removed should be provided where the pressure medium contains suspended matter.

Generally, the **line** should be dimensioned and fastened such as to withstand mechanical vibration or thermal expansion and provide safe operation under normal service conditions.

If a static head of liquid is acting on the gauge, then this causes a zero offset Δp, where Δp is the pressure resulting from specific gravity and height of the liquid head.

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

where

ρ_M = S.G. of pressure medium in kg/m³

ρ_L = S.G. of ambient air in kg/m³ (standard value 1.205 kg/m³ at 20 °C)

Δh = Level difference in metres

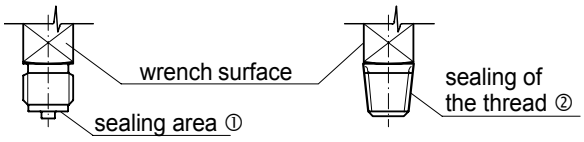
g = Gravity acceleration in m/s² (standard value 9.81 m/s²)

The corresponding indication will be lower by the value of Δp if the gauge is mounted above, but higher by the value of Δp if the gauge is mounted below the pressure tapping point.

Normal gauge position will have the dial facia in its vertical plane. Calibration of the gauge in a position other than vertical will be indicated by a corresponding symbol on the dial.

Installation and commissioning
Correct sealing of pressure gauge connections with parallel thread shall be means of a ① suitable sealing ring, sealing washer or WIKA profile seals.
The sealing of tapered threads (e.g. NPT threads) is made by providing the thread ② with additional sealing material like, for example, PTFE tape (EN 837-2).

① parallel and ② tapered thread connection



The torque depends on the seal used. With standard G-type pipe thread, gauge connection by means of a union nut or a LH-RH adjusting nut is recommended to simplify correct orientation of the gauge.
The tightening or loosening torque applied to the connection should be by means of the spanner flats provided on the stem and should not be by means of grasping the case as this may damage the gauge.

The connecting tail pipe should be thoroughly cleaned prior to fitting of the gauge.

For internal pressure compensation, some pressure gauges types are provided with lock-up pressure vent with the inscription CLOSE and OPEN. This pressure vent is closed at time of supply (lever in CLOSE position).
Prior to inspection and/or after installation and prior to initial operation, the gauges have to be vented (lever in OPEN position).

No pressure higher than indicated by the working pressure symbol ▼ (final value) must be applied to the gauge during hydrostatic pressure test of the system (EN 837-1 and EN 837-3). Otherwise the gauge must be isolated or removed during this operation.

In the case of diaphragm gauges, care should be taken not to accidentally loosen the bolts that retain upper and lower diaphragm housing.

No attempts should be made to remove a pressurised gauge. The pressure system must be totally vented if the gauge can not be otherwise isolated.

Process medium remaining in the pressure element may be hazardous or toxic. This must be considered when handling or storing a gauge which has been removed from the process.

Pressure gauges in service
Always open isolating devices gently, never abruptly, since this may generate sudden pressure surges that may damage the gauge.

The maximum working pressure for which the pressure gauge is suitable, or also the minimum working pressure in the case of vacuum or compound gauges, is indicated on the dial by corresponding symbols (EN 837-1 and EN 837-3). Fluctuating pressure always reduces the maximum working pressure of the gauge. Consult the data sheet pertaining to the pressure gauge model.

Correct zeroing may be checked by closing the isolating device and relieving the gauge from pressure. The pointer must fall within the thickened portion of the zero mark ┼. Unless the gauge temperature is considerably higher or lower than 20 °C, a pointer not returning to zero may indicate serious damage of the gauge.

On-site testing of the pressure gauge is feasible by means of special isolating devices enabling connection of a test gauge together with a suitable pressure source.

Pressure gauge safety
Pressure media such as
Oxygen
Acetylene
Flammable gases or liquids
Toxic gases or liquids
Steam
Ammonia and other refrigerants

as well as portable or stationary pressure systems such as

Air compressors	Welding equipment
Pressure vessels and boilers	Life support equipment

may require pressure gauges of a construction complying with national standards and/or local safety codes. This must be considered and clearly specified when placing an order for such gauges. Your WIKA contact will be pleased to assist in selecting a suitable pressure gauge model.

Storage
The pressure gauge should remain in its original packing until installation. The gauge should be protected from external damage during storage.

Storage temperature should not exceed - 40 °C or + 60 °C unless specified otherwise. Consult the data sheet pertaining to the pressure gauge model.

Pressure gauges removed from service should be protected from dust and humidity, preferably by using the original packing material. Remainder of the pressure medium contained in the pressure element may be susceptible to frost. This should be considered when storing the removed pressure gauge.

Reference documents
DIN and EN Standards

EN 837-1
Pressure gauges; part 1: Bourdon tube pressure gauges; Dimensions, metrology, requirements and testing

EN 837-2
Pressure gauges; part 2: Selection and installation recommendation for pressure gauges

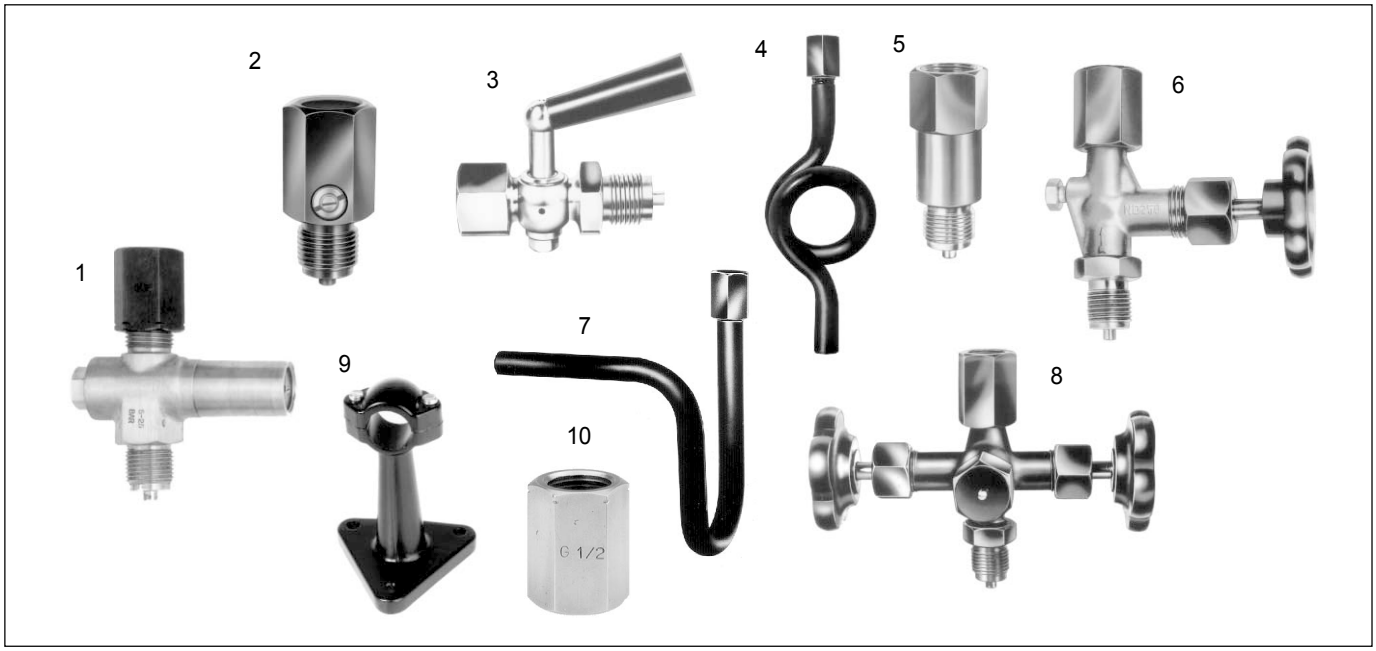
EN 837-3
Pressure gauges; part 3: Diaphragm and capsule pressure gauges; Dimensions, metrology, requirements and testing

DIN 16 270
PN 250 and PN 400 valves without test connection for pressure gauges

DIN 16 271
PN 250 and PN 400 valves with test connection for pressure gauges

DIN 16 272
PN 250 and PN 400 valves with blocking test connection for pressure gauges

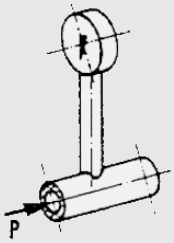
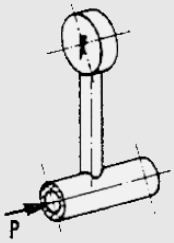
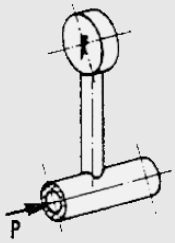
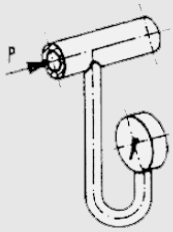
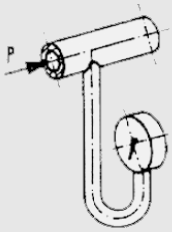
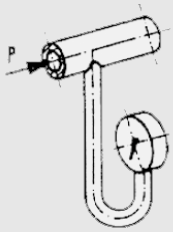
Accessories for pressure gauges



1. Overpressure protector
2. Adjustable snubber
3. Pressure gauge cock
4. Trumpet-form syphon
5. Adaptor for surface mounting bracket
6. Pressure gauge valve
7. U-form syphon
8. Pressure gauge valve with extra valve for test connector
9. Surface mounting bracket
10. LH-RH adjusting nut

Arrangements for pressure measurement

Recommended measuring arrangements for various types of process fluid

	Liquid media			Gaseous media		
Contents of tail pipe	Liquid	Liquid with vapour	Vapour only	Gas only	Wet gas	Liquid gas condensate
Typically	Condensate	Boiling liquid	LPG	Dry air	Moist air Flue gas	Steam
Pressure instrument higher than tapping point						
Pressure instrument lower than tapping point						

WIKA Product lines

The WIKA programme covers six product lines for various fields of application.

Mechanical pressure measuring instruments

Indicating instruments for gauge, absolute and differential pressure with bourdon tube, diaphragm or capsule pressure element have been tested millions of times over. These instruments, which cover pressure ranges from 0 ... 2.5 mbar to 0 ... 4,000 bar and accuracies of up to 0.1 %, can also be equipped with mechanical, electrical and electronic accessories and combined with a variety of diaphragm seal solutions.

Diaphragm seals

Our know-how on the subject of diaphragm seal systems is appreciated and recognised internationally. In combination with diaphragm seals, which are available in many different designs and special materials, pressure gauges, pressure transducers, pressure transmitters and pressure switches can be used even under extreme conditions.
Thanks to the diaphragm seals the measuring instruments are suited to extreme temperatures as well as aggressive, corrosive, heterogeneous, abrasive, highly viscous or toxic media.
In addition, diaphragm seals also enable a hygienic connection of measuring instruments to the process.

Electronic pressure measuring instruments

WIKA offers a complete range of electronic pressure measuring instruments: pressure sensors, pressure switches, pressure transmitters and transmitters with Turn down (UniTrans) for the measurement of gauge, absolute and differential pressure.
Our pressure gauges are available in the measuring ranges 0 ... 0.6 mbar to 0 ... 8,000 bar.
These instruments come supplied with standardized current or voltage output signals, interfaces and protocols for various types of field buses.
Whether ceramic thick-film, metal thin-film or piezo-resistive, WIKA is the only manufacturer worldwide that produces the full range of essential sensor technologies possible today in-house.

Mechanical temperature measuring instruments

Our mechanical temperature measuring instruments work on the bimetal or gas actuation principle and cover temperature ranges from -200 °C to +700 °C.
A large variety of thermowells are available for the thermometers, so that they can even be used under extreme process conditions. The thermowells can also be ordered in special materials, e.g. hastelloy or titanium, or with special coatings of tantalum, teflon etc.
As an engineering service we offer thermowell calculations in accordance with Dittrich/Klotter or ASME/ANSI PTC 19.3.

Electrical temperature measuring instruments

Our range of products includes thermocouples, resistance thermometers, analogue and digital temperature transmitters, digital indicators, controllers and calibrators for temperature ranges from -200 °C to +1,800 °C.

Testing and calibration technology

WIKA maintains DKD (German calibration service) calibration laboratories for pressure, temperature and mass as measurement variables. We not only calibrate instruments manufactured by WIKA, but also instruments from other manufacturers on customer request in pressure ranges from -1 bar to 10,000 bar with the smallest possible measurement increments and in temperature ranges from -80 °C to +1,200 °C with measurement increments from 2 mK to 4.5 mK. Due to a multilateral agreement by the European co-operation for Accreditation (EA) DKD calibration certificates are recognized in 16 European member countries. Worldwide the number of countries that accept the DKD is showing an increasing tendency for continuous growth.

Detailed literature is available on all product lines.

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