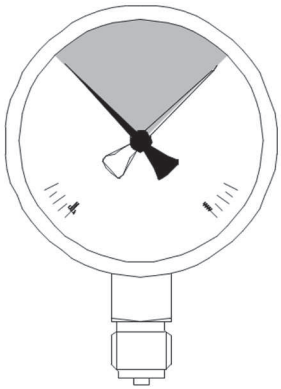
Selection, Installation, Handling and Operation

of Elastic Element Pressure Gauges

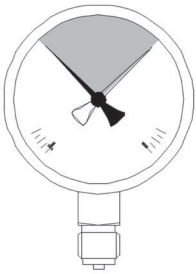


tecsis GmbH
Carl-Legien-Str. 40 D-63073 Offenbach Phone: +49 69 5806 0
Fax: Sales national +49 69 5806 170 Sales international +49 69 5806 177
E-Mail: info@tecsis.de http://www.tecsis.de

BE 200 d

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.

Chemical seals

Chemical seals may be employed to separate the pressure gauge from a pressure medium that must not enter the elastic pressure element. Chemical 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 chemical 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 (³ 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.

$\Delta p = (\rho_M - \rho_L) \cdot g \cdot \Delta h \cdot 10^{-5}$ (bar) = where Δh = Level difference in metres (m)

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

g = Gravity acceleration in (m/s²) (standard value= 9,81 m/s²)

ρ_L = S.G. of ambient air in (kg/m³) (1,205 kg/m³ at 20 °C)

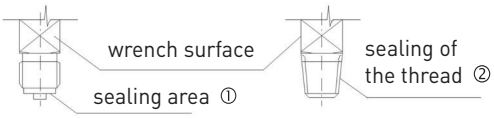
The corresponding indication will be lower by the value of Dp if the gauge is mounted above, but higher by the value of Dp if the gauge is mounted below the pressure tapping point.

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, uitable sealing ring, sealing washer or tecsis 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



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 lockup 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 t (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 lowerdiaphragm 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 tecsis 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 in DIN and EN Standards

DIN EN 837-1

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

DIN EN 837-2

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

DIN 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

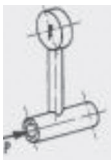
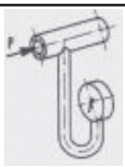
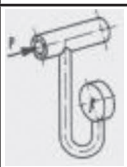
DIN 16 272

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

	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						

The tecsis Product range

Mechanical pressure gauges
Pressure gauges for over-, absolut- and differential pressure with bourdon tube, capsule and diaphragm. Normal ranges from 6 mbar to 6000 bar. Display accuracies 2.5% up to 0.1%. Equippable with mechanical, electrical and electronic additional devices; combinably with chemical seals of most diverse execution forms. Pneumatic and hydraulic pressure calibration devices with accuracies from 0.02% to 0.008%.

Diaphragm-, In-line-type and capsule-type chemical seals
for the adjustment of pressure gauges, load cells, pressure transducers etc. to difficult measuring functions. Application at extreme temperatures, with aggressive, corrosive, heterogeneous, toxic measuring materials within the range of -90 °C to 400 °C and pressure from 16 mbar to 1600 bar.

Electronic pressure gauges
Load cells, pressure switches and pressure transducers for over-, absolute- and differential pressure with piezoresistive, magnetic field-independent and inductive sensors, as well as sensors in thinfilm technology. Digital and analogue sensors.

Mechanical temperature gauges
Mechanical temperature gauges according to the principle of the bimetal or gas expansion with normal ranges from -200 °C to 700 °C. Bimetal thermometers and gas pressure thermometers are also available with electrical alarm contacts, transmitters, as well as thermowells and appropriate accessories.

Electronic temperature gauges
Devices for electronic temperature measurement, like thermocouples, resistance thermometers, similar and digital temperature transmitters, dataloggers, contactless temperature measurement with infrared devices.

Mechanical load cells
Hydraulic load cells for compression forces of 0.2 kN to 2 500 kN in very durable execution. Here the most diverse mechanical or electronic pressure gauges can be attached.

Electronic load cells
Devices for electronic tension- and compression-force measurement are available in the most different constructional remarks. Depending upon type measuring ranges are determined of 10 N to 3 000 kN.

Service
tecsis GmbH is recognized calibration department for pressure in the German calibration service (DKD). We calibrate pressure measuring devices manufactured at the tecsis as well as devices of other manufacturers within the pressure range from -1000 mbar to 10 kbar with a measuring uncertainty smaller than 0.02%.