

Connection and Separation Rolled into One

Why pressure sensors with in-line diaphragm seals are a good choice for hygienic applications

When specifying pressure measurement systems one of the most important aspects is the pressure gauge or transducer itself. If the process requires sterile connections measuring elements with a diaphragm seal should definitely be considered.

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Many standard pressure sensors and gauges have crevices and dead spaces which make them unsuitable for hygienic applications. They may also be damaged by the high temperature of the steam used for sterilization in place. In such cases, a diaphragm seal not only provides a safe and sterile connection between the medium and the measuring instrument, but also allows simple cleaning between batches.

A diaphragm seal separates the pressure gauge, transmitter or switch from the medium being measured and ensures a process connection in which dead spaces are minimized or eliminated. Isolation is achieved by means of a flexible diaphragm, with the internal space between the diaphragm and the pressure measuring instrument completely filled with fluid. The elastic diaphragm transmits the process pressure to the incompressible fill fluid and hence to the measuring instrument. The link between the diaphragm seal and the measuring instrument may take the form of a direct connection or a capillary. For high temperatures a cooling section can also be fitted between the seal and the instrument.

The choice of fill fluid is important. The fluid needs to be compatible with the process medium, for safety in the rare event that the diaphragm ruptures. For sanitary applications it is important to choose an FDA-approved fill

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Picture: Sartorius Stedim Biotech

One of the applications for pressure sensors with in-line diaphragms: measuring pressure drop across cartridge filters.

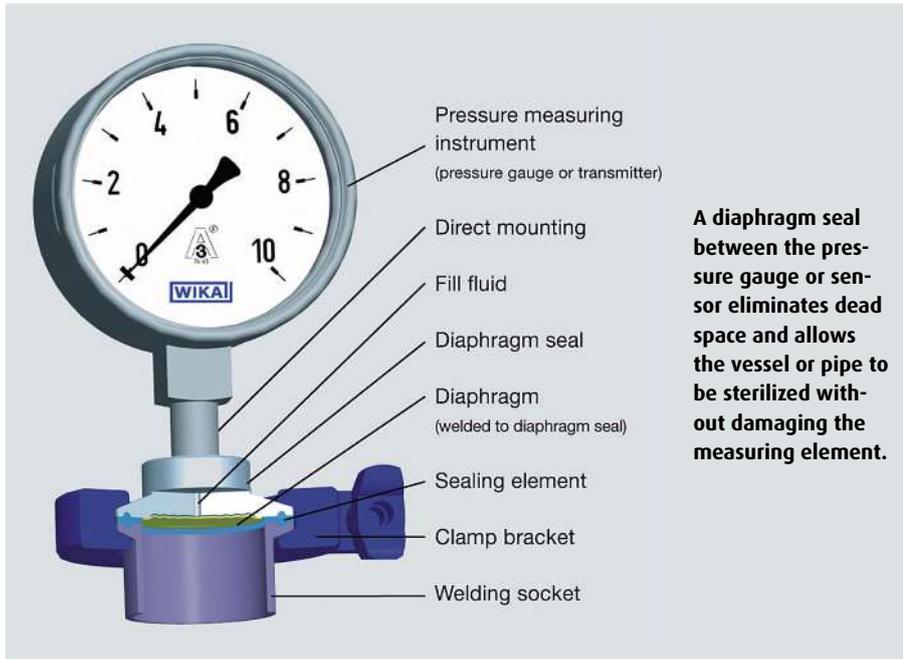
fluid, and further approvals—such as listing in the relevant national pharmacopoeia—may be necessary to ensure compliance with cGMP requirements.

In-line Advantages

To meet the demand for hygiene in pressure measurement, in-line instruments may be used to avoid dead space and promote cleanability. The patented in-line diaphragm seal design from Wika functions in exactly the same way as a conventional diaphragm

seal, except that the diaphragm is cylindrical instead of flat. As with other diaphragm instruments, in-line diaphragm seals are available with either gauges or pressure transmitters.

In contrast to designs with beads or deviating geometry, the process medium flows unhindered through the measuring chamber of an in-line diaphragm instrument. The chamber is self-draining regardless of the orientation at which it is installed. Cleaning and sterilization in place (CIP and SIP) is



A diaphragm seal between the pressure gauge or sensor eliminates dead space and allows the vessel or pipe to be sterilized without damaging the measuring element.



In sanitary applications it is important to make sure that the fill fluid behind the diaphragm is compatible with the process fluid, in case the diaphragm is damaged.

easily achieved because there are no dead spaces or crevices in which products can settle or biofilms form.

In-line diaphragm seals are also available with built-in resistance thermometers, allowing them to measure temperature as well as pressure. In this case the temperature sensor is fixed to the inner wall of the diaphragm. This compact arrangement features the same excellent hygienic performance as the basic in-line diaphragm pressure sensor, and has the advantage of requiring fewer seals or welds than if two separate fittings were used for temperature and pressure.

Sanitary Standards

Pressure measuring instruments with diaphragm seals are supplied in a range of diameters to suit all standard pipe sizes. They are available with weld stubs for direct orbital welding, and also with a variety of clamp, flange and screw connections to match systems such as the DIN 11864 aseptic standard, DIN 11851 (as used in the dairy industry), Variline from GEA Tuchenhausen,

and Neumo's BioControl range. Careful matching between the internal diameter of the diaphragm and that of the neighbouring pipe eliminates even small variations in diameter that can create flow restrictions or contamination traps.

Advantages of the standardized approach through in-line housings include lower costs for spares stockholding, less chance of error during plant construction, and flexibility during design and operation: a pressure gauge can easily be replaced by a transmitter, or a temperature sensor added, with the minimum of disturbance to the process.

The surface finish of standard Wika in-line diaphragm seals easily meets the minimum hygienic quality requirement of $Ra < 0.8 \mu\text{m}$, and even higher specifications—electropolish and cleanability tests—can be supplied on request. The instruments are therefore suitable for the most demanding requirements in both Europe and the USA.

For instance, they not only meet the standards laid down by the European Hygienic

Equipment Design Group (EHEDG) for the food industry, but even form part of the EHEDG test equipment operated by TU Munich's Faculty for Machine and Apparatus Studies in Weihenstephan. All Wika in-line diaphragm seals with hygienic fittings are also independently certified as meeting standard 74-03 from 3-A Sanitary Standards, which governs the design of instrumentation for hygienic applications in the US market, and can be supplied with the 3-A logo.

Conclusion

In-line diaphragm pressure gauges have a lot of advantages compared to conventional pressure transmitters or diaphragm gauges: The in-line setup is well suited for continuous processes and cleaning in place techniques. Its crevice free designs without kinks or sharp bends reduces the risk of sediments or deposits in the pipework. Complying to recent hygiene standards, in-line diaphragm pressure gauges can be a good choice for clean and hygienic processes in spite of their slightly more elaborate construction. ●

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DIAPHRAGM SEALS

3-A: The American Way of Standards

Standard 74-03 by the 3-A Sanitary Standards governs the design of sensor and measuring instrument components in contact with the medium for the US market. Proof of adherence to the design regulations is provided by a Third Party Verification. The manufacturer of measuring instruments may affix the 3-A logo to his instruments only after successful completion of this audit. Machines and system components for sanitary applications certified with a 3-A logo are therefore easier to export to the US.