ACTIVE COMPENSATION OF THE TEMPERATURE SENSOR WITH DIAPHRAGM SEAL SYSTEMS

INTRODUCTION

Diaphragm seals are frequently used in the process industry for pressure measurements to protect the measuring device against aggressive media or for example in the pharmaceutical industry, to create a gap-free process connection. The process is separated from the measuring device by means of a thin metal diaphragm. A pressure transmission fluid behind the diaphragm transmits the process pressure to the actual pressure sensor.

A solution can be found for almost any pressure measurement task using diaphragm seal systems.

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CHALLENGE

Dr. Thomas Köster, Head of R&D at Labom, explains: "A big challenge is that the diaphragm seal is not completely non-reactive. A measurement error caused by the influence of the process temperature can occur depending on the design. The pressure transmission fluid expands as a result of the process heat and deflects the separating diaphragm. This generates a restoring force depending on the rigidity of the latter, which is received as an error in the pressure measurement."

The extent to which you can accurately restore the force is most dependent upon the thickness, diameter and contours of the diaphragm. It's a requisite that the diaphragm have a certain minimum thickness because of the mechanical resistance demanded. Optimised diaphragm contours tend to be used to reduce the rigidity and the limits of what is feasible are quickly reached especially with small diaphragm seals. It's imperative that a correctly sized diaphragm seal for critical pressure measurements is used to ensure that the error caused by process temperature changes remains acceptable.

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SOLUTION

Labom has been working hard to eradicate certain elements of the existing process. As Dr. Köster explains: "The temperature of the pressure transmission fluid is recorded with an additional temperature sensor with the Active Temperature Compensation (ATC technology)."

This sensor (a Pt100 element) is placed as close as possible to the separating diaphragm and is able to record the temperature of the liquid behind the separating diaphragm with accuracy. Dr. Köster continues: "This measurement method is much quicker in its response time compared to the pressure sensor temperature. The resulting measurement errors can therefore also be mathematically corrected much faster. The method is also much more hardy against changes in the ambient conditions because the temperatures of the significant amounts of fluid in the system (behind the diaphragm and in front of the sensor) are known. The correction can therefore be set so that the measuring error is fully compensated in a stationary state."

RESULT

In conclusion big steps have been made with these developments. Dr Köster concludes: "The example of a real measurement with individual correction factors shows the potential of ATC technology. A level measurement was simulated with a temperature-controlled water tank. The correction factors were determined for a very small diaphragm seal (3/4" clamp) and then a temperature ramp was run. The temperature error was almost completely eliminated in its stationary state. There were minimal deviations from the nominal value during the heating and cooling phases."

With such large developments in the temperature stability of diaphragm seals with its innovative ATC Technology, Labom has changed the landscape of this technology. High-precision pressure measurements can therefore be carried out together with the high accuracy of the pressure measuring device.

EQUIPMENT SUPPLIED

- **Various Labom diaphragm seals**

***Credit to Author:** Dr. Thomas Köster, Head of R&D

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