

INTRODUCTION

In today’s process industry there are many processes that operate with very low pressures, < 100 mbar. An example of such a process is Nitrogen blanketing which is a commonly used technique to prevent process gases entering the atmosphere. To obtain this, a small nitrogen overpressure of approximately 10 mbar is applied on a vessel with these gases. Accurate measurement of this small overpressure is necessary to minimise or even avoid interference with the process in the vessel. Besides that a significant cost reduction is achieved by limiting the consumption of nitrogen to an absolute minimum.



LOW PRESSURE MEASUREMENT WITH DIAPHRAGM SEALS

Difficulties arise when this technique is applied in a corrosive environment. In these circumstances it is often mandatory to use pressure measurement devices equipped with Diaphragm Seals. However, the use of a standard Diaphragm Seal in combination with the very low overpressure ranges implies relative high temperature effects. These high temperature effects, and especially ambient temperature effects, result in unstable, unreliable and inaccurate pressure measurement. And this subsequently results in poor control of the process.

SOLUTION DEVELOPED

After thorough analysis of the process data and requirements, Badotherm developed a Diaphragm Seal for low pressure GP applications. This solution is referred to as LGP and can be used in combination with several seal types. Test results obtained by measuring low gauge pressures showed that the minimum GP range reduces from 80 mbar with a standard Diaphragm Seal to only 5

mbar with the LGP Diaphragm Seal. Similarly the ambient temperature effect reduces from 0.4 mbar per 10°C to 0.03 mbar, while the process temperature effect reduces from 0.39 to 0.09 mbar.

Besides the accurate measuring of low pressure and limiting the consumption of nitrogen two other issues were solved. Firstly, the way of mounting the transmitter to the vessels has no effect on the zero and span adjustments of the transmitter. Secondly, there is no effect on the performance by a change in density of the fill fluid caused by ambient temperature fluctuations.

TECHNICAL SPECIFICATIONS

The Diaphragm Seal type LGP is standard manufactured in AISI316(L). It can also be supplied with all kinds of exotic materials as wetted parts. The LGP solution needs to be mounted on a DP transmitter.

	STD 3"	LGP 3"
Min. GP range (mbar)	80	5
Min. Capillary length (mtr)	direct	0.5
Ambient temp. effect (mbar)		
Capillary (per mtr)	0.4 /10°C	0.03 /10°C
Transmitter	0.19 /10°C	0.02 /10°C
Process temp. effect (mbar)		
Diaphragm Seal	0.39 /10°C	0.09 /10°C

CALCULATION EXAMPLE

Below a calculation example with the above mentioned specifications is presented.

	BF 3"	BF-LGP 3"
Process Pressure (mbar)	80	80
Capillary length (mtr)	5	5
Fill fluid	BSO-22	BSO-22
Temp. at calibration	20°C	20°C
Ambient temp.	40°C	40°C
Process temp.	140°C	140°C
Temp. effect (mbar)		
Diaphragm Seal	4.68	1.08
Capillary	4	0.3
Transmitter	0.38	0.04
Total temp. effect (mbar)	9.06	1.42
Total Probable Error (TPE)	11.3%	1.8%



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