Hydrogen applications with electronic pressure measurement

Description

Due to hydrogen diffusion into the sensor structures, signal drift can occur over time. The time until the occurrence of a relevant signal drift and the size of the signal drift depend mainly on the following factors:

- The temperature of the hydrogen
- The pressure of the hydrogen
- The hydrogen content in the medium

The user shall test the selected product version for suitability in the specific application environment.

Sensor technologies for electronic pressure measurement:	
Thin-film measuring cell	**Without oil filling**
For pressure ranges ≥ 0 ... 25 bar [≥ 0 ... 360 psi] or ≥ 0 ... 60 bar [≥ 0 ... 870 psi]	
Piezo measuring cell	**With oil filling**
Pressure ranges from 0 ... 0.4 bar [0 ... 5.8 psi] to 0 ... 25 bar [0 ... 360 psi]	

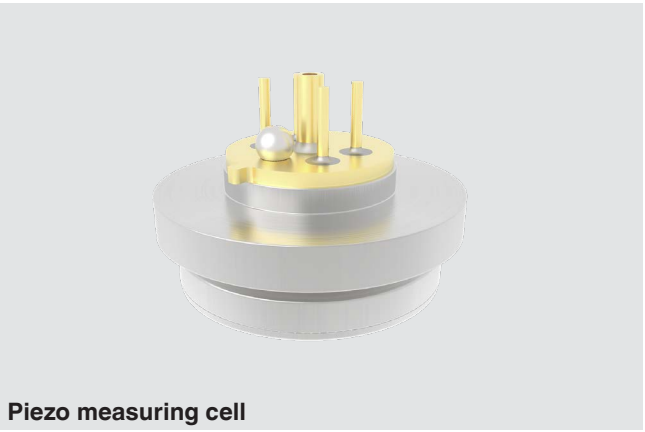
Wetted parts

For wetted parts, only those materials are used which are suitable for permanent hydrogen pressure measurement.

Leak test

The models listed here are subjected to a leak test with a leakage rate of max. 1 x10^{-6} mbar*l/s during production.

Thin-film measuring cell



Piezo measuring cell

Scope: thin-film measuring cell

Supplement to the following data sheets with the corresponding restrictions with respect to the measuring range:

Data sheet	Model	Material (wetted)	Measuring ranges
PE 81.61	S-20 [1)]	Austenitic steel, 2.4711	0 ... 25 to 0 ... 1,000 bar [0 ... 400 to 0 ... 15,000 psi]
PE 86.05	UPT-20	Austenitic steel, 2.4711	0 ... 60 to 0 ... 1,000 bar [0 ... 700 to 0 ... 15,000 psi]
PE 86.06	IPT-20	Austenitic steel, 2.4711	

1) During configuration, select the suitability for hydrogen.

→ Other measuring ranges on request.

Representation

Long-term drift (per IEC 61298-2)

Deviating from the specifications in the respective data sheet, a higher long-term drift can occur.
Typical: ≤ 1 % of span/year
Maximum: ≤ 3 % of span/year

Valid at a temperature of up to 30 °C [86 °F].
For higher temperatures, the sensor must be tested by the user for suitability for the application.

Scope: piezo measuring cell

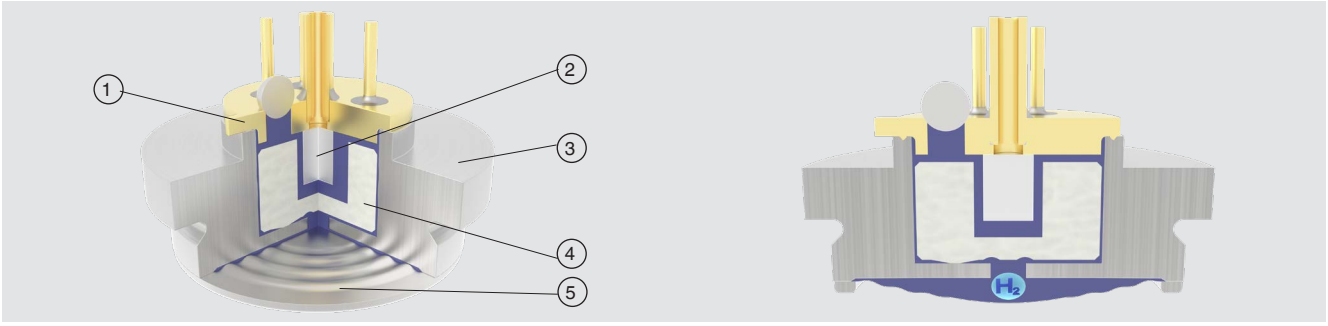
Supplement to the following data sheet with the corresponding restrictions with respect to the measuring range:

Data sheet	Model	Material (wetted)	Gauge pressure measuring ranges
PE 81.61	S-20	Stainless steel 316L	0 ... 0.4 to 0 ... 25 bar [0 ... 5 to 0 ... 400 psi]

→ During configuration, select the suitability for hydrogen.
→ Other measuring ranges on request.

Absolute pressure measuring ranges do not fall within the scope of this document.

Design



1. Header
2. MEMS chip with glass base
3. Case
4. Volume displacer
5. Diaphragm

The permeation (penetration) of hydrogen into the oil filling of the sensor can cause a gas bubble to form there.
This bubble creates internal pressure in the measuring cell, leading to a signal offset (zero point offset).
→ This theory has been checked in tests.

Test

Test conditions	
Medium	Hydrogen 3.0
Measuring range	1 bar gauge pressure
Duration	6,000 h and ongoing
Temperature	125 °C [257°F]
Material (wetted)	316L
→ After every 1,000 hours, a mechanical pulse was applied to release any gas that may have dissolved in the oil.	

Result

Even after 6,000 hours, the devices under test showed no hydrogen-induced signal drift.
→ Taking into account the test conditions, a gauge pressure piezo measuring cell can also be used to measure hydrogen.

Pressure signals should be monitored regularly.

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