Innovative non-invasive temperature measurement for hydrogen pipes

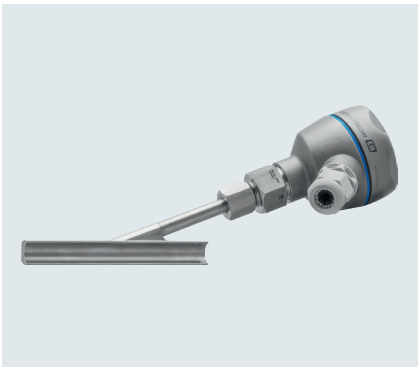
The right solution for small pipe dimensions

Benefits at a glance

- Accurate and quick measurement
- Reduced or eliminated risk of leakages
- Easy installation without opening of the process
- Availability of different communication protocols

Process conditions

- High pressures: 700 bar (10,152 psi)
- Process temperature: -40 to +60 °C (-40 to +140 °F)
- Ambient temperature: -40 to +50 °C (-40 to +122 °F)
- Process medium: hydrogen
- High risk and high impact of leakages



Hydrogen plays a central role in the energy transition and the reduction of greenhouse gas emissions. As a clean energy carrier, hydrogen has the potential to replace fossil fuels in various sectors, particularly in transport, industrial processes, and energy production.

Hydrogen refueling stations are essential to create the infrastructure for the use of fuel cell vehicles. These filling stations enable fast and efficient refueling, comparable to conventional filling stations, and thus promote the acceptance and spread of hydrogen vehicles. The development and expansion of hydrogen filling stations are therefore crucial to realize sustainable and emission-free mobility.

Since the temperature of compressed hydrogen increases with expansion during filling and the usual containers only allow a temperature of approx. +65 °C (+149 °F), temperature measurement is essential at hydrogen filling stations for safety reasons.

The challenge In hydrogen refueling stations, the compressed hydrogen is typically distributed at 350 or 700 bar (4,351 or 10,152 psi). This usually occurs in very small pipelines with an internal diameter of e.g. 8-15 mm (0.31-0.59"). A temperature measurement with a thermowell for 700 bar (101,520 psi) is not possible in these dimensions. Therefore, sensors that are directly in contact with the process are often used, being inserted into the process via T-shaped high-pressure fittings. Due to the short installation length, the sensor usually measures the temperature of the fitting and not that of the medium. Measurement errors of several degrees are not uncommon.

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In addition, the T-shaped fitting leads to three additional potential sources of leakage, which pose a significant risk, especially in hydrogen applications.

Our solution The new and innovative design of the non-invasive temperature sensor iTHERM SurfaceLine TM611 allows adaptation to the small pipe dimensions and accurately and quickly measures the process temperature in the hydrogen pipeline, achieving improved measurement results. Tests with an invasive measurement, installed in a T-shaped high-pressure connection as a reference, mean much higher installation effort and the permanent risk of leaking connections. For efficiency reasons, the pipelines used for hydrogen at a distribution temperature of -40 °C / °F, are insulated against the ambient conditions. Insulation is a precondition for accurate temperature measurement, be it invasive or non-invasive.

Components iTHERM SurfaceLine TM611 is available with different types of sensors like thinfilm / wire-wound Pt100 elements or thermocouple, which are standard and qualified since decades. The combination with the innovative coupling to the process pipe leads to a significantly improved accuracy and response in comparison to traditional non-invasive measurement. TM611 is available with all common communication protocols, making it easy to integrate into existing and new systems.

Result For temperature measurement in small pipe dimensions like in hydrogen refueling stations, iTHERM Surface Line TM611 non-invasive measurement can be a cost effective, maintenance free and accurate substitution of invasive measurement. For handling of hazardous fluids, the eliminated risk of leakages is the decisive advantage of this new solution.

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