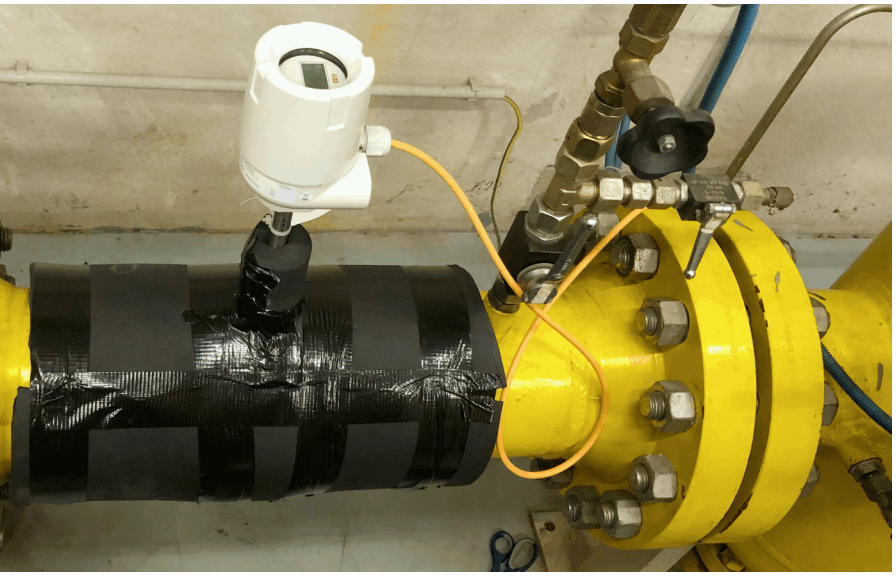
# Temperature measurement for natural gas temperature control

## Use of non-invasive temperature sensors in natural gas transfer and pressure reducing stations



Simple installation of temperature measurement without operational interruption, with outstanding measurement performance

**Measurement made easy**

NINVA TSP341-N

## Introduction

Many municipal utilities in Germany reliably supply their customers with energy. As modern energy service providers, these utilities face the challenges and look for ways to constantly improve the supply - for their customers and for our environment.

Municipal utilities usually operate an extensive and closely meshed gas network to cover their supply areas. At transfer points, the gas is taken from the transmission network of the long-distance gas pipeline operator. From these network coupling points, it is distributed into the networked high, medium and low pressure pipeline systems.

## Additional Information

Additional documentation on TSP341-N is available for download free of charge at www.abb.com/temperature.
Alternatively simply scan this code:

## ABB Performance Predictor

The ABB Performance Predictor for testing your application is included in our digital service tool for measuring devices, called ‘My Measurement Assistant’.

## Challenge

At a regional gas supplier, natural gas is delivered to a transfer point at a volume flow of 11000 $Nm^3/h$ and a pressure of 48 bar. In order for the gas to be delivered to households, it must be expanded to low-pressure mains lines with a pressure of 0.68 bar. Pressure reduction takes place in two stages.

The first stage expands the gas from 48 bar to 27 bar and the second from 27 bar to 0.68 bar.

Heat is extracted from the gas when the pressure is reduced. In order for the natural gas to be fed into the network at approximately the same temperature, it must be heated using a heat exchanger when the pressure is reduced. Temperature measurement and monitoring are essential for this to occur. In the past, conventional temperature sensors with a protection tube were installed in the pipeline.

## Solution

An innovative and non-invasive measuring device is available now, the ABB NINVA TSP341-N temperature sensor. Since any intervention in the pipeline involves considerable effort and disruption to operations, non-invasive measurement has significant advantages. However, it is important to ensure that the measurement results and measurement performance are on a par with classic sensors.

The supplier's engineering manager was immediately enthusiastic about the possibilities offered by the new technology for non-invasive temperature measurement. The NINVA TSP341-N was considered as a solution for some of its measurement points. The alternative to this would be the installation of a contacting, conventional measurement with a correspondingly high cost and interruption of supply. The customer was happy to test the suitability of the non-invasive measurement in the various phases of pressure reduction.

With the ABB Performance predictor, calculation software is available that can determine the expected measurement deviation compared to an invasive temperature measurement based on the operating parameters of a measuring point. Thus, one can estimate in advance whether the installation of the NINVA TSP341-N makes sense and is effective.

### Comparability tests

The test installation in the transfer station of the municipal utility was carried out on the three phases of pressure reduction.

## 1. Phase: High pressure

01

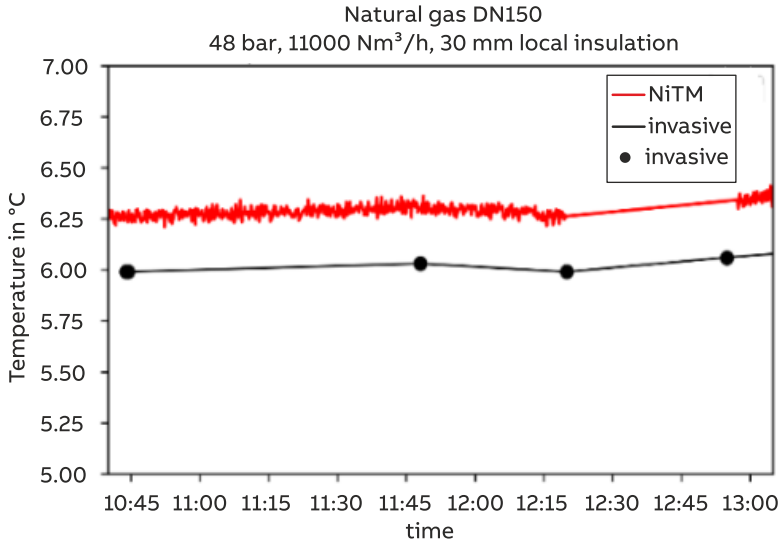
— 01 NINVA TSP341-N on the high pressure gas line

— 02 Comparison of the NINVA TSP341-N non-invasive temperature sensor with an invasive sensor

On the high-pressure side of 48 bar, the natural gas is transferred from the transport network at a temperature of approx. 6 °C.

A theoretical deviation of 0.25 °C for the non-invasive temperature sensor was determined for the measuring point using the ABB performance predictor. In a direct test comparison of the non-invasive temperature sensor NINVA TSP341-N with an invasive sensor, which resulted in the deviation shown in **Figure 02**.

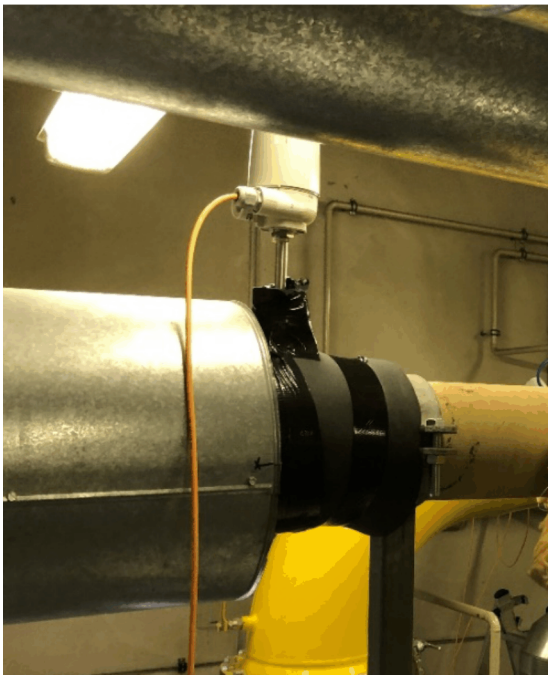
This deviation corresponded exactly to the value calculated with the ABB performance predictor, which also underlines the reliability of the calculated results.




02

# … Solution

## 2. Phase: Medium pressure



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03 NINVA TSP341-N on the medium-pressure gas line, temperature approx. 92 °C

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04 Measurement deviation less than 1 °C
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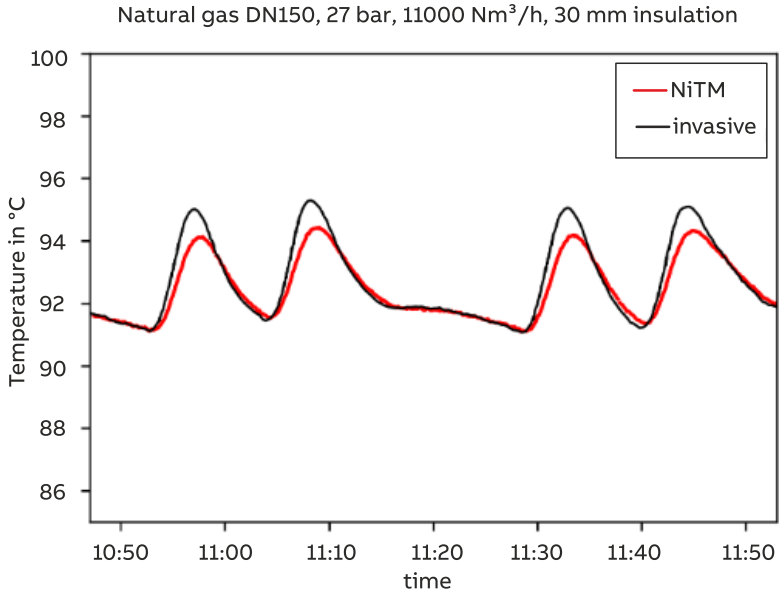
The natural gas, with a pressure of 48 bar, is expanded to a pressure of 27 bar and heated to a temperature of approx. 92 °C using a heater.

Here, too, the theoretical measurement deviation was determined using the ABB performance predictor and compared with the measurement result (see **Figure 04**)

The difference between the invasive and non-invasive measurement is less than 1°C, a very good result, as the technical director also confirmed.




04

05 Measurement deviation less than 6 °C

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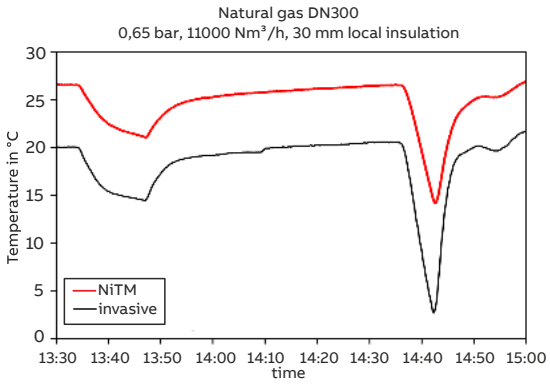
06 Comparison to two non-invasive temperature sensors

### 3. Phase: Low-pressure

In the third phase, the pressure in the natural gas pipeline is then reduced to such an extent that it can be used in households for combustion in central heating systems.

The natural gas is fed into the public grid at a pressure of 0.68 bar. As with the first two phases, the NINVA sensor was mounted on the pipeline and transmitted to the control system. Amazingly, however, the non-invasive measuring point showed a difference of 6 °C, although the ABB performance predictor would allow a mathematical deviation of only 0.25 °C.

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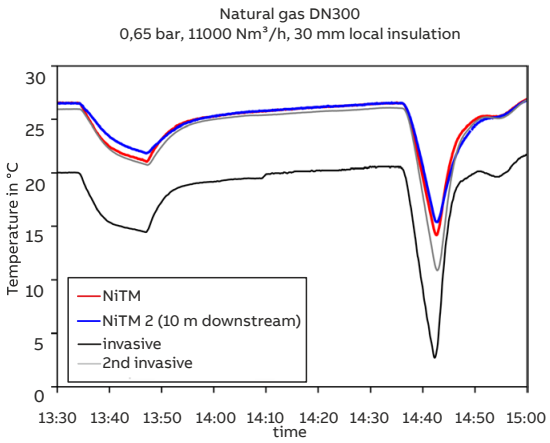
Now which is correct, the touch measurement or the non-invasive measurement via the NINVA TSP341-N?

To investigate the question, a second measuring point with a non-invasive probe was set up. Both non-invasive measuring points showed identical values over the entire course of time.




06

But where does this huge discrepancy come from? It was assumed that the protection tubes of the contacting measurement sensors could cause a drift. To limit the possible error, the measuring insert was checked and evaluated. A defect in the measuring insert could then be ruled out.

The public utilities then checked the entire measurement chain up to the control system. This check revealed a scaling error in the control system. The measuring range set in the temperature transmitter for the 4 to 20 mA signal did not match the scaling in the control system. This error occurs not infrequently, but is difficult to track down.

The non-invasive probe helped the municipal utility to detect a serious error in its invasive temperature measurement. That alone was worth the test operation.

# Areas of use for non-invasive temperature sensors

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07 NINVA TSP341-N non-invasive temperature sensor

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The NINVA TSP341-N non-invasive temperature sensor is characterized by its specific sensor design and a special calculation algorithm that has already won several innovation awards.

Customers is are attracted to the non-invasive sensor for measurement, particularly because of its simple installation, which also allows subsequent installation on existing pipelines.

Time-consuming product selection and extensive planning of measuring points are also a thing of the past.

Temperature measurement accuracy, repeatability and response times are excellent for the non-invasive sensor and the measurement results can be used as a reliable basis

used for plant operation.

ABB's NINVA TSP341-N is the easy-to-install solution for temperature measurements in pressure reducing stations and achieves excellent measurement performance.

| **Process parameters** | **Range** |
|---|---|
| Nominal pipe diameter* | DN 40 to DN 2500 |
| Pipe material | Metals |
| Measuring medium Temperature* | −40 to 400 °C |
| Measured medium | Liquids, gases, steam |
| Measuring medium Density | > 100 Kg/$m^3$ |
| Measuring medium Viscosity | 0.1 to 50 mPas |
| Flow conditions | Reynolds number > 10000 |

* contact ABB for smaller nominal pipe diameter and higher measuring medium temperature.

# Additional information

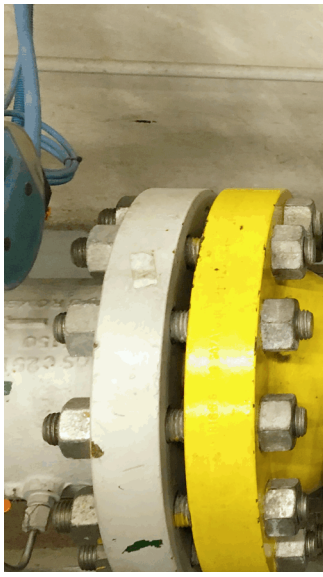
| Link / QR Code | Document |
|---|---|
| | DS/TSP341-N |

| Link / QR Code | |
|---|---|
| | ABB performance predictor |

**ABB Measurement & Analytics**

For your local ABB contact, visit:
**www.abb.com/contacts**

For more product information, visit:
**www.abb.com/temperature**





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