



FLOW MEASUREMENT OF NATURAL GAS



Oil & Gas / Downstream Gas transport



Measuring Task

Measurement of the standard volume flow (with NGE functionality) of natural gas on a compressor station

Gas transport means transmission from the production sites to the consumption area to feed gas into the distribution networks there. The gas transport network can be compared to a motorway as it is made up of large axes, while the distribution networks are made up of shorter axes that route the gas directly to the consumer.

At a national level, long-distance pipelines of the gas transport network efficiently connect the storage caverns or aquifers with the distribution networks. A key requirement for the smooth functioning of the infrastructure is information about the gas volumes that flow from one region to another or from one company to another. Compressor and connection stations are located all over the country along the long-distance gas transport pipelines. Border stations ensure the exchange with European partners.

A compressor station in northern France was equipped with a conventional flowmeter. There was no facility for determining gas quality. Instead, a

constant compressibility factor was used to calculate the standard volume flow, which led to significant measurement deviations.

The essential function of the line fitted with the flowmeter is to allow the recirculation of a gas flow between the discharge and suction sides of the compressor. With this recirculation line, the operating range of the gas compressors at the site can be significantly expanded. Since compressors are limited in their operating range, the use of the recirculation line makes it possible to deliver quantities of gas to the transport network that are well below the rated capacities of the compressors. As a result, GRTgaz can achieve transport rates that are far below those that can technically be achieved by the compressor. In addition, instead of loading the compressors in Start & Stop mode, which damages their drive turbines, the compressors are left running continuously to utilize their compressor capacity from 0 to 100%.



Solution

For the correct calculation of the standard volume flow, the pressure, temperature and compressibility of the gas must be known. Pressure and temperature are measured on-site. The compressibility factor z depends on the composition of the gas. In the case of fiscal measurements, these are determined using a chromatograph. Such complex instrumentation was out of the question for the recirculation line.

A dual-channel FLUXUS® G722 NGE (Natural Gas Engine) ultrasonic measuring system now measures the standard volume flow, which has proven to be a suitable solution both in terms of the measurement accuracy achieved and in relation to volume control.

The “Natural Gas Engine” function integrated in the transmitter makes it possible to determine the compressibility factor z without a chromatograph by measuring the speed of sound.

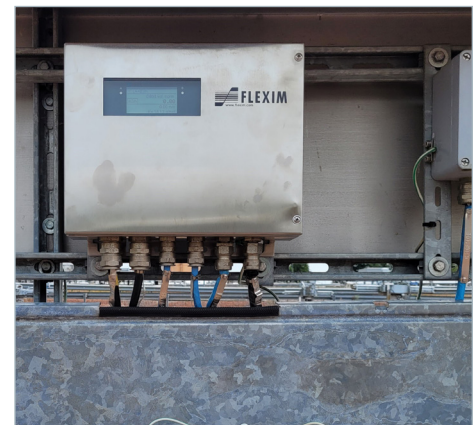
The ultrasonic system simultaneously measures the speed of sound of the gas flowing in the pipe using the same clamp-on ultrasonic transducers that are mounted on the pipe wall and determine the flow rate by measuring the transit time difference. For this purpose, the natural gases were divided into different groups. When correctly assigned to the appropriate fluid class, the Natural Gas Engine can calculate the compressibility and molecular weight of an unknown natural gas with changing composition under operating conditions.

Furthermore, the FLUXUS® G722 has a high-performance processor that enables fast switching between the two measurement channels and their synchronization in the millisecond range. The synchronous dual channel measurement with the FLUXUS® G722 effectively compensates for the strong flow profile disturbance caused by the insufficient straight inlet and outlet lengths on the recirculation line.

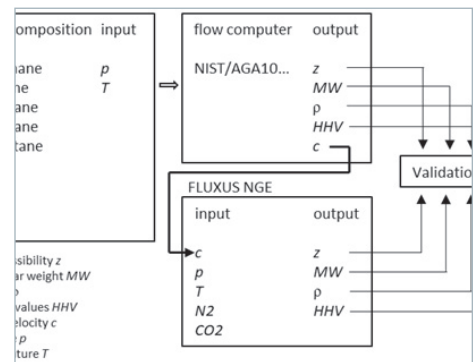
With the non-intrusive flow measurement and the simultaneous determination of gas composition and compressibility, the compressors can now be reliably controlled according to gas quantities and the quantities actually fed into the gas network can be precisely balanced.



Das Gastransportnetz von GRTgaz
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The FLUXUS® G722 with fast channel switching for synchronous dual channel measurement is used as the measuring transducer.



Comparison of the usual method of calculating the standard volume flow using a chromatograph and flow computer with the sound velocity measurement using FLUXUS® NGE

Measuring Points and Instrumentation

Pipeline	24", steel, outer coating PE, wall thickness 0.7"
Medium	natural gas (low-calorific gas)
Measuring Device	stationary ultrasonic FLUXUS® G722 NGE flowmeter (dual channel version, 316L stainless steel body) with two pairs of GLG clamp-on ultrasonic transducers (Lamb wave, ATEX version) mounted in Variofix C sensor mounting rails

Advantages

- Reliable and precise continuous measurement with a very good reproducibility of 0.15% of the measured value ± 0.005 m/s
- High-performance processor with a switching time of 1 ms between the two measuring channels >> no deviations in measured values even with strong turbulence due to the insufficient straight inlet and outlet sections
- Integrated NGE function for real-time determination of the compressibility factor, even under changing operating conditions
- No pipe work in the event of possible maintenance

Customer

GRTgaz, France

GRTgaz is a global expert in gas transmission networks and systems and a leading European gas transmission system operator. In France, GRTgaz owns and operates more than 32,000 km of underground pipelines and 26 compressor stations for transporting gas between suppliers and consumers.

GRTgaz has a public service mission to ensure the security of supply for consumers through its transmission network. With its subsidiaries Elengy, the leading operator of LNG terminals in Europe, and GRTgaz Deutschland, the operator of the MEGAL transport network in Germany, GRTgaz plays a key role in the European gas infrastructure scene.

The company also exports its know-how internationally, in particular thanks to the services developed by its research center, RICE (Research & Innovation Center for Energy).

As a player in the energy transition, GRTgaz, with its 3,852 employees, invests in innovative solutions to accommodate a maximum of renewable gases, including hydrogen, in its network, to support these new production branches and thus contribute to achieving carbon neutrality.



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