Technical Paper

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Heated sampling probe enables reliable pressure measurements in natural gas storage facilities:

Integrated ball valve for a safe primary shut-off

Nordheim (Germany) - 18 September 2014 - To be able to reliably supply all households and businesses in Germany year-round with natural gas, the energy companies rely on huge storage facilities. In the underground reservoirs, however, moisture often forms. Through the formation of hydrates, outages occur making the measurement of pressure and differential pressure impossible. A leading natural gas storage operator has solved this problem using a heatable sampling probe - with an integrated ball valve by AS-Schneider - one of the leading manufacturers of Industrial Valves.

Natural gas is, after oil and coal, the third most important energy source in Germany - and the trend is rising. Households and businesses consume about one trillion kilowatt hours per year - mainly for heating or as a heat supplier to industry. In addition, power plant operators are using more and more natural gas for power generation. In the automotive industry, the fuel is used as alternative propulsion to petrol and diesel engines. With this, Germany is the fourth largest natural gas consumer in the world.

The European countries can only cover a fraction of their natural gas consumption through their own extraction. Therefore, they import most of the gas. Because the demand in summer is much lower than in winter, utilities store the gas in underground temporary storage facilities. These also help stave off daytime-dependent fluctuations - many households require the most gas mornings and evenings while companies need gas during their operating hours.

In Germany, there are about 40 underground gas storage facilities with a capacity of almost 20 billion cubic meters. Artificially created cavities in disused salt domes or already depleted gas reservoirs usually serve as storage areas. To store gas in the least possible space, the gas is compressed to up to 250 bar. The storage operators monitor and control the plants using constant pressure and differential pressure measurements. At various measuring points, impulse lines output the static pressure of the gas to a measuring gauge. For safety, these can be shut off using a ball valve.

The Challenge: Hydrate formation at withdrawal

If the gas is supplied into the pipeline network from a storage facility, the pressure reduces to about 84 bar and the gas expands. This reduces its temperature and condensate is formed in the pipe system. In the transport lines, this hydrate formation is countered through additives, such as glycerol. These remove humidity from the gas. This does not function in the measurement lines, however, since there is no flow here. The moisture clogs the lines and affects the function of the measuring instruments. The result: Errors in pressure and flow measurements; sometimes they fail completely.

Depending on the composition of the gas, hydrates form in the lines at temperatures of less than 24 degrees Celsius. So that the gas does not fall below this temperature limit there, the storage operators try to heat the measuring points. However, this is not an easy task, because the transition between the transport and impulse line consists mostly of thick-walled pipes or are even flanged. This makes it extremely complicated to transfer heat from the outside to the gas. Especially at low outdoor temperatures, this method is very inefficient, because it consumes a lot of energy. In addition, it cannot always be ensured that the heat penetrates into the interior of the pipe.

Heatable probe for accurate measurement readings

To meet this challenge, one of the leading operators of natural gas storage facilities in Europe developed a special solution: a heatable sampling probe. This transfers the heat specifically from the inside to the appropriate measurement point. The probe consists of a copper block with an absorber pipe which is threaded into the dispensing nozzle for the measurement. The copper pipe which extends to the inner wall of the transport piping, heats the gas in the line thus preventing the formation of hydrates. An electric heater block bolted onto the housing heats the probe with conduction heat. This block controls its temperature independently as needed and is therefore extremely safe and energy efficient. Moreover, the probe unrestrictedly transfers the static pressure of the gas on thus ensuring accurate results.

The probe prototypes were still produced by the company for its own use. However, the company was not equipped for professional series production. Another difficulty was the interface between the transport and impulse lines: Using the sampling probe, the power company could not continue to use the ball valves that were installed previously as the primary shut-off at the measuring points. However, a reliable primary shut-off when dealing with gas is absolutely imperative, especially at such high pressures. Therefore, the storage operator was looking for a partner who would not only take over the manufacturing but also design a matching primary shut-off for the sampling probe. AS-Schneider ultimately received the contract for the project. The family company based near Heilbronn is one of the market leaders of Instrumentation Valves, Manifolds and Accessories and has extensive expertise in the development of customised special solutions for special customer requirements.

The ball valve by AS-Schneider provides the primary shut-off

AS-Schneider integrated a ball valve in the sampling probe. This maintains a pressure of up to 250 bar and is therefore ideal as a primary

shut-off for natural gas pipelines. Two independent sealing systems ensure that no gas can escape from the ball valve. The ball seats made of plastic PTFE take over the primary seal and O-rings on the spindle take over the secondary seal. "We chose a soft-seated ball valve, because these can open and close easily even under high pressure," explains Stefan Heine, who works in the AS-Schneider Sales Department and was responsible for the project. "In addition, the plastic seals are especially resistant to dirt. That is a great advantage under these extreme conditions."

The experts of AS-Schneider paid special attention to safety. The blow-off-proof switching shaft of the ball valve is manufactured in a special anti-static design. "This is to protect against gas explosions," says Heine. Because even one spark could ignite the highly compressed gas and cause a disaster. A relief hole in the ball also prevents stresses due to different thermal expansion. This ensures that the ball valve operates reliably even under extreme temperature fluctuations. The ergonomic oval handle can be locked if necessary to prevent tampering.

Proven in the field

The storage operators were delighted by the AS-Schneider solution. The integrated ball valve offers enormous advantages in practical use. For example, it greatly simplifies installation since all the components are accommodated in one housing. The size of the sampling probe could also be reduced in this way. The probes have since been successfully used in the many storage facilities of several well-known companies where they reliably prevent hydrate formation in the measuring lines.

Scope: 7,293 characters including spaces

Captions:

Picture 1: The heatable sampling probe consists of a copper block with an absorber pipe, a bolted-on heating block and an integrated ball valve.

Picture 2: The integrated AS-Schneider ball valve provides a reliable primary shut-off.

Picture 3: The sampling probe is successfully used in the numerous storage facilities of many well-known operators.

Bild 4: Stefan Heine (author), Sales Engineer at AS-Schneider, was in charge of that project.

Pictures by: Armaturenfabrik Franz Schneider GmbH + Co. KG

About Stefan Heine

Stefan Heine, born in 1966 in Esslingen a. N., studied Mechanical Engineering at the University of Applied Sciences in Berlin following his apprenticeship to become a toolmaker. He has been employed at AS-Schneider for more than 20 years. After short intervals in Construction Design, Production and Quality Assurance, he transferred to the Sales Department in Field Service. He assists and advises our customers in the area of instrumentation for pressure and differential pressure measurement. He brings with him a great deal of experience in the search for customer solutions through his many years of work at AS-Schneider.

About AS-Schneider

The family-run company, AS-Schneider, was founded in 1875 and with over 350 employees, is one of the leading manufacturers of Instrumentation Valves and Manifolds worldwide. In the market segment for Large-Bore Diesel Engine Valves such as those used in marine propulsion and the generation of electricity, AS-Schneider is even the world market leader. With our own subsidiaries in Romania, Singapore, Dubai (UAE) and Houston (USA) and professional partners in more than 20 countries worldwide, we are located everywhere our customers need us.

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