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SPECIAL PRINT

Seat Leakage Detection

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Precise Seat Leakage Detection in Control Valves

If a valve's tight shut-off is impaired, the seat leakage does not become visible on the outside. Yet, it can be a problem on the inside. If the seat and plug do not shut off properly, an unacceptable amount of the process medium continues to flow through the valve even though it is supposed to be fully closed. The medium always finds a way between the seat and plug. An immediate consequence is that the control accuracy deteriorates. In the long run, the valve's service life is shortened. By connecting a sensor to the Series 3730 Positioners with integrated diagnostics, SAMSON has found a way to reliably detect and indicate leakage inside the valve.

Seat leakage

In a valve, the plug position determines the cross-sectional area of flow between the seat and plug, and thus the flow rate through the valve. When the valve is closed, the plug rests on the seat and, ideally, leaves no space for the process medium to flow through. The actual leakage rate of a valve depends on the valve design, particularly on the shape of the plug and the sealing at the seat. Further determining factors are the positioning force of the actuator and the pressure drop that exists between the valve inlet and outlet. Through the course of a valve's service life, the medium flow through the seat and plug when the valve is closed increases due to progressing erosion at the plug caused by abrasive media, cavitation or flashing. As a result, the valve no longer complies with the specifications for which it was sized originally. In practice, a small seat leakage rate is tolerated in most control applications. In shut-off valves, however, even the smallest amount of unwanted medium flow can cause severe damage, for example when toxic, highly reactive or highly flammable media get into the process without being properly controlled. In such cases, it is vital that signs of wear on the plug are detected at an early stage.

Flow-induced sound

Even the smallest medium flow creates sound of a measurable level. SAMSON uses this phenomenon to detect valve leakage at an early stage. A leakage sensor mounted on a pneumatic control valve can reveal and indicate impaired valve shut-off with the help of the EXPERTplus valve diagnostics integrated into the posi-

tioner. As a result, the combination of leakage sensor and positioner with diagnostic functions allows operators to precisely monitor their valves for seat leakage. Monitoring the leakage rate is indispensable particularly in safety-instrumented systems where valves must shut off on demand, reliably and without leakage. In such applications, plant operators must be alerted when unacceptable amounts of the medium flow through a closed valve.

So far, mainly flow meters have been used for seat leakage monitoring. To detect minimal leakage rates, however, it makes sense to supplement the flow meters with leakage sensors, which require neither an additional power supply nor a connection to the process control system. Mr. Marcel Richter, product manager at SAMSON for positioners, the integrated EXPERTplus valve diagnostics and leakage sensors, sees the main benefit for customers in the fact that the positioner-leakage sensor combination can be integrated seamlessly into existing systems: "The leakage sensor is powered and linked to the process control system simply by being connected to the positioner. Whether the measured sound pressure level is transmitted to the control system using the HART® or FOUNDATION™ fieldbus protocol depends on the selected positioner. This also means that only one leakage sensor version is required for the different communication protocols employed by the positioners."

Prime valve performance

A valve setup matching the actual conditions in a plant has been installed on the test bench at SAMSON's Frankfurt

headquarters to show how well the unit comprising a control valve with positioner, integrated diagnostics and leakage sensor works in the field. One of the visitors impressed by the setup was Mr. Rolf Ohrndorf, head of SAMSON's Cologne engineering and sales office: "For those of us interacting directly with the customers, this is a good opportunity to see the leakage sensor firsthand and learn how it works. I was particularly impressed by the low threshold that caused the leakage rate to be indicated in the valve diagnostics." Mr. Ohrndorf considers the test bench setup a valuable presentation for SAMSON staff and customers alike, even though the focus is on the sensor's functioning. Other benefits become evident nonetheless, for example that the solution with a leakage sensor is cost-effective and easy to install.

Mounting the leakage sensor to the valve is simple. It is screwed onto the valve and connected to the positioner. That is all it takes before the first measurements can be performed. The leakage sensor measures the sound pressure level created by the medium flowing through the valve every time the valve is fully closed. The assessment necessary for leakage detection is done by the positioner, or more precisely the EXPERTplus valve diagnostics integrated into the positioner. They save and analyze the transmitted sound pressure level. Based on a reference measurement performed when the valve was closed, the positioner generates an alarm every time the valve is closed tightly and the customizable alarm limits for the leakage rate are exceeded. The urgency of the alarm can also be defined by the operator. The color-coded classification is

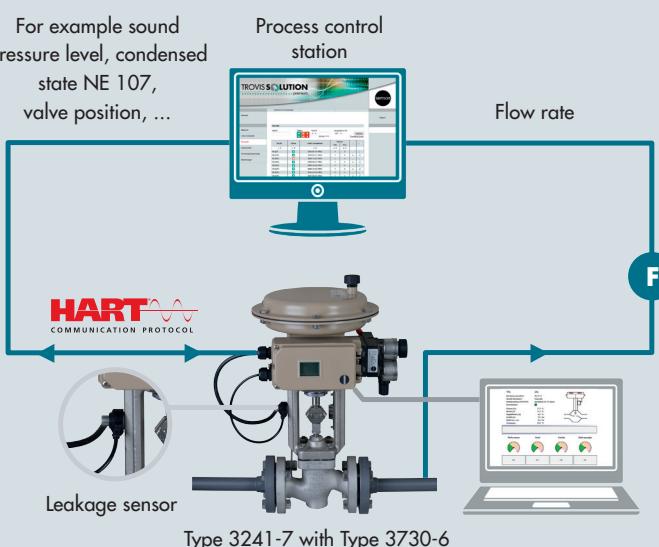
based on NAMUR Recommendation NE 107 and indicates the valve's diagnostic status as either green (no message), yellow (out of specification) or red (failure) depending on the settings adjusted by the operator. After his visit to the Frankfurt test bench, it was clear to Mr. Ohrndorf that the leakage sensor presented a cost-effective solution for plant operators to detect impaired valve shut-off: "I think our customers will recognize the potential offered by the sensor, particularly for safety-instrumented systems where downstream flow meters may reach their measuring limits."

Supported by diagnostics

On the test bench, the leakage sensor is currently used with the latest positioner from the Series 3730. The Type 3730-6 communicates with the process control system using the HART® protocol. Two of the four HART® variables can be used to permanently transmit the sound pressure level and the status of EXPERTplus. In this way, the valve's shut-off is properly monitored at all times. The leakage sensor further enhances safety-instrumented shut-off valves that are operated very rarely but expected to either close or open on demand (fail-close or fail-open applications). In fail-open applications, the valve is closed during normal operation, which means that the leakage sensor monitors the leakage rate constantly. In fail-close applications, the valve is open during normal operation. In such applications, the leakage sensor is mainly needed to perform the mandatory functional tests at regular intervals.

As part of these mandatory proof tests, the valve is moved through its entire travel range from its normal operating position (open) to its fail-safe position (closed) while key data, such as the breakaway and closing times, are recorded. A leakage sensor additionally provides information on whether the valve is still able to shut off reliably and tightly after remaining in the open position for longer periods of time.

Mr. Richter is convinced that, with the positioner and leakage sensor, SAMSON has introduced a high-quality product to the market that complies with the latest technical requirements. "Visitors of the test bench can see for themselves. For our international staff as well as our customers who do not have the chance to see the leakage sensor at work firsthand, we have uploaded a product video to the Internet. It shows how precisely the leakage sensor works."





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