New Ultrasonic Flowmeter

Technology boosts critical accuracy of subsea, low-flow chemical injection.

By David Simpson, Cameron, a Schlumberger company

The accuracy of injection rate is the key component in delivery of cost-efficient, effective low-flow chemical injection. Historically, achieving critical accuracy has not been a simple task. Traditional flow measurement technologies used in subsea chemical injection metering valves for low-dose inhibitors (LDI) typically use either Venturi-type flow measurement (whereby a pressure drop is measured across a precision orifice) or a positive displacement flow measurement technique that employs a rotating or stroking piston to measure volumetric flow rate.

Accuracy with these techniques can be heavily influenced by the properties of the injected chemicals, requiring project-specific chemical calibration during manufacture of these chemical injection metering valves (CIMVs). However, CIMV system designers are often not provided with critical chemical data while the CIMV is in the design stage. Inaccuracies in flow measurement can also stem from particulate contamination and blockage in the CIMV.

These events can result in potential CIMV system under-performance. Blockage happens because of particulate contamination of chemicals being injected through the CIMV, blocking onboard filters or tightly fitting moving parts or orifices used for flow measurement.

Deepwater long step-out projects utilizing subsea distributed chemical injection are dependent on CIMV technology that demonstrates maximum particulate tolerance; consistent high accuracy of reading; independence to changes in chemical properties, such as viscosity; and increased reliability in measuring chemical flow rate.

Criticality of inhibitor dosage

Costly under- or overdosing is often tied to chemical injection metering valve accuracy, which can be heavily influenced by the flowmeter design and properties of the injected chemicals. Under-injection can result in scale or wax buildup in production strings or pipelines, for example, lowering the production rate.

Should the scale or wax exist in the line for an extended period, the well may have to be shut in to undergo a batch treatment, incurring deferred production and intervention costs. In the case of corrosion inhibitors, SURF (subsea, umbilicals, risers and flowline) facilities may have to be taken offline until failed components are replaced.

Revolutionary flowmeter concept

Cameron, a Schlumberger company, has introduced the microbore, nonintrusive PULSE LF low-flow ultrasonic chemical injection metering valve for injection rate control of LDIs, offering a highly reliable, debris-tolerant CIMV with best-in-class injection rate accuracy. This flowmeter addresses the key limitation of present LDI chemical injection technology (sensitivity to blockage) by having capability to accurately and reliably meter chemical inhibitors without the need for filtration.

The microbore ultrasonic flowmeter at the heart of the PULSE LF CIMV delivers nonintrusive, debris-tolerant flow measurement (based on the "delta T" time-of-flight measurement technique) with no moving parts, is chemical independent with a very low native pressure drop and does not require any subsea filtration.

This single, retrievable unit offers an injection range from 0.25 to 600 l/h (achieving a turndown ratio of 2,400:1) with an injection rate accuracy of better than 2% of reading above 2 l/h compared to the Venturi-type, low-flow chemical flowmeter technology that may only deliver accuracy of 5% to 10% full scale.

The PULSE CIMV system architecture combines the ultrasonic flowmeter with an electrically actuated needle-and-seat throttling valve in closed-loop control. Flow rate monitoring and valve actuation via the onboard closed-loop control algorithm, along with external communications, are managed by the electronic control module that streams back operational performance data to the operator via the master control station.

Real-time feedback from the flowmeter is used to autonomously control the throttling valve, maintaining a user-defined injection rate set point indefinitely regardless of up- or downstream system disturbances. ■

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