APPLICATION REPORT

Chemical

Flow control of well water for rapid decarbonisation

BASF
We create chemistry

- Decarbonisation using fast reactors in the production of demineralised water
- Use of a smart meter valve to precisely increase the raw water quantities
- Improved control quality thanks to automated workflows; no more manual intervention required
- Reduced maintenance and operating costs thanks to redundancy and extended valve test times

1. Background

The chemical company BASF operates several demineralised water plants at its site in Ludwigshafen, Germany, to produce deionised water using raw water drawn from deep wells. A key process in this production is decarbonisation (softening), which occurs before the ion exchange stage using fast reactors.

2. Control requirements

Rapid decarbonisation is a floating bed process. In this process, raw water is enriched with calcium hydroxide [lime milk, ($Ca(OH)_2$)] as an alkaline solution. This neutralises hydrogen carbonate ions and carbon dioxide, precipitating them out of the water as calcium carbonate ($CaCO_3$). The softened water then rises and is transported out of the reactor through the outlet zone.

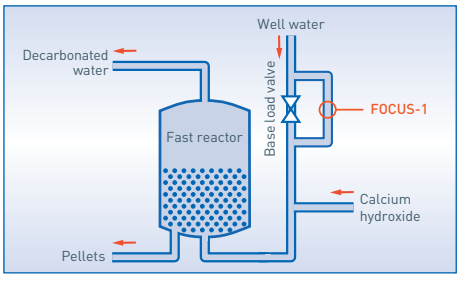
During the start-up phase of a fast reactor, the water supply must be increased by 2 m^3/h every two hours over an extended period and kept stable. Previously, the raw water volume was controlled by a base-load valve, while additional water was added manually through a valve in a bypass line. The flow rate for this increase was measured by a compact orifice plate in the main pipe (DN300 / ~12"). However, this manual process required significant effort, and the orifice plate flowmeter had a limited measuring span. Its accuracy was also insufficient to achieve the desired level of control. The customer sought an alternative measurement setup to enable fully automated increases in throughput without manual intervention. They also aimed to improve the accuracy of the underlying flow measurement.

KROHNE

3. KROHNE solution

The chemical company decided on the FOCUS-1 smart meter valve. The multifunctional device combines a control valve, a flowmeter, pressure and temperature sensors and extensive computing power in a single device.

In this setup, the customer uses the meter valve to control flow in the bypass line, where the flow rate is constantly increased during the start-up phase. The integrated ultrasonic flow measurement of FOCUS-1 offers a significantly larger measuring span than the previously used differential pressure transmitter, and FOCUS-1 controls the flow autonomously. It only receives the desired setpoint from the PLC and continuously sends the actual flow rate back to the PLC via a 4...20 mA signal. In the future, the system operator also plans to use additional data provided by FOCUS-1 — such as pressure, temperature, and valve position information communicated via HART® — for further analysis in the control room.



Simplified process scheme for flow control with the FOCUS-1

In addition to the ultrasonic flow measurement, the integrated differential pressure and temperature measurement provides a wealth of additional data for comprehensive diagnostics. Its sophisticated algorithms enable the smart meter valve to create a "digital twin", for example. The measured data is modelled so that, in the unlikely event of an ultrasonic transducer failure, the instrument can continue functioning without requiring an immediate process interruption.

4. Customer benefits

With FOCUS-1 the customer can now match the actual water quantity much closer to the target amount, allowing for much more efficient and accurate control of the decarbonisation process. Throughput adjustments are now fully automated, eliminating the need for manual intervention. This freed up labour resources, which can be allocated to more productive tasks.

The multi-parameter measurement provides redundancy and a high level of diagnostic coverage, enabling real-time monitoring of valve status, among other parameters. This allows wear on the valve seat — and any resulting leakage issues — to be detected immediately. As a result, the smart meter valve does not need to be removed and tested at standard maintenance intervals like a conventional valve. Extending the inspection intervals helps reduce maintenance and operating costs for the customer.

The combination of enhanced control quality, lower maintenance and operating costs, and reduced procurement and installation expenses compared to a setup with individual components convinced the customer. Additional fast reactors are planned to be equipped with the FOCUS-1 in the future.

5. Product used

FOCUS-1

- Smart meter valve for flow, pressure and process control
- Integrated control valve, flowmeter, pressure and temperature sensors combined with extensive computing power in one single device
- Seamless integration into all automation systems, e.g. 4...20 mA, HART®, PROFINET, Ethernet or Wi-Fi

Contact
Would you like further information about these or other applications?
Do you require technical advice for your application?
application@krohne.com

Please visit our website for a current list of all KROHNE contacts and addresses.

www.krohne.com