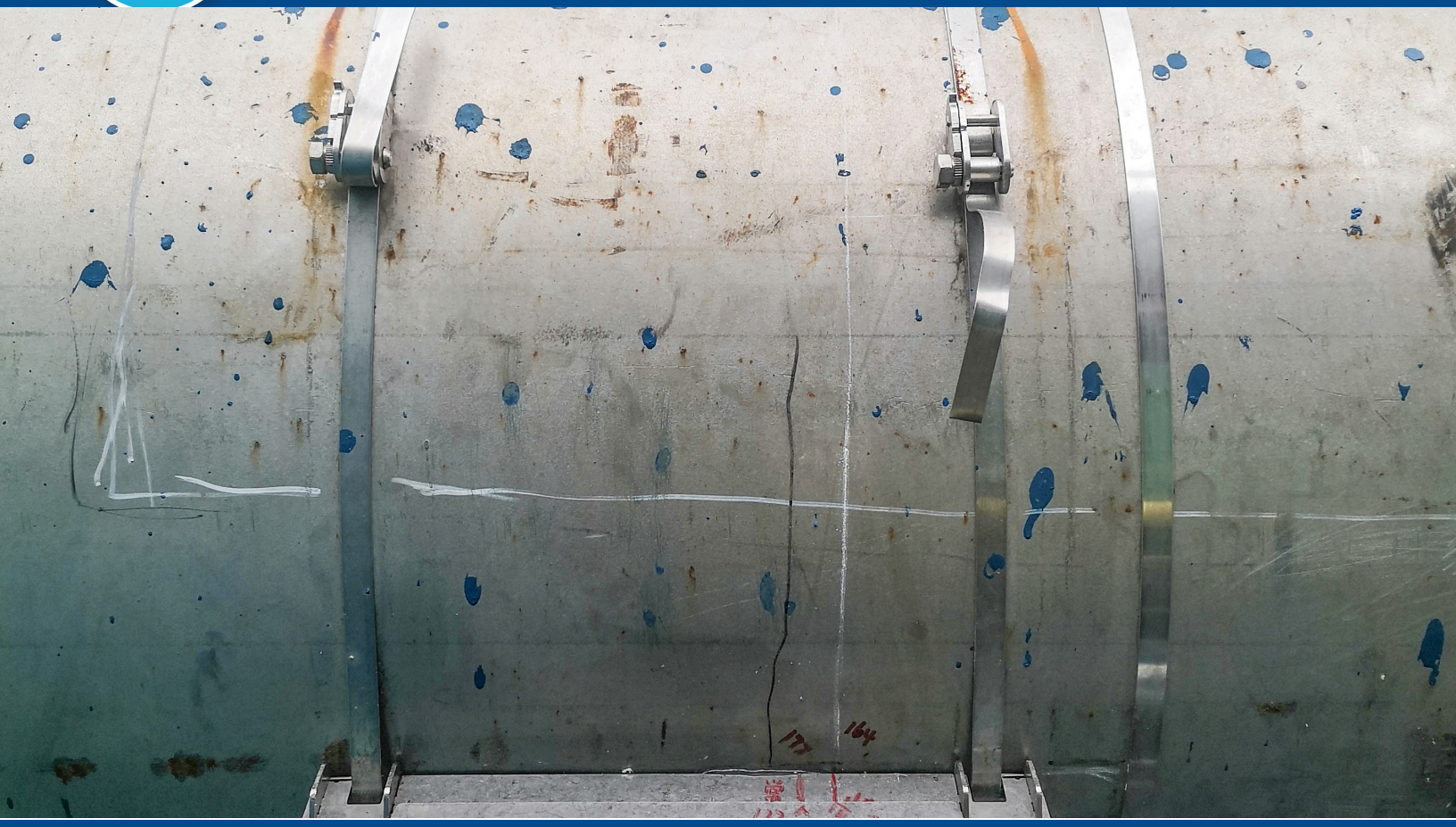
APPLICATION REPORT

SULFURIC ACID CONCENTRATION AND FLOW MEASUREMENT



Chemical Industry / Fertilizer

"Non-intrusive measurement of both flow and concentration of hot sulfuric acid is the best solution for us. Because the ultrasonic transducers do not come into contact with the corrosive medium, they suffer no wear and tear and require no maintenance."

Li Yang,
Expert for Field Instrumentation,
Yihua Group.

Measuring Task

Non-intrusive measurement of the concentration and flow of sulfuric acid at the outlets of the four heat recovery systems in Hubei Yihua's fertilizer plant.

Sulfuric acid is one of the most important base chemicals and an indispensable agent in the fabrication of fertilizers. In its chemical and fertilizer complex in Yichang City, Yihua operates two sulfuric acid plants with an overall annual production capacity of 1.2 million tons.

The production process for sulfuric acid is exothermic. Hubei Yihua's sulfuric acid plants are equipped with four heat recovery systems where the produced thermal energy is used to generate steam. Highly concentrated 99.6%m sulphuric acid enters the heat recovery system at a temperature of over 390 °F. To ensure safe and efficient operation, both concentration and flow rate need to be monitored. The measured value for flow is used to control the inflow of boiler feed water. Differences between the measured values for concentration between the inlet and the outlet of the heat recovery system indicate that there might be a leakage in the steam generator.

The concentration is determined by conductivity measurements in the inflow and outflow of the heat recovery systems. While these measurements

always worked without any problems, the plant operators were not satisfied with the performance of their flowmeters. These differential pressure (Δp) measurements never worked sufficiently to ensure automatic control of the water valves. Therefore, the operators searched for a better solution.

Solution

Obviously, Flexim 's non-intrusive measuring technology offers the ideal solution to replace the old Δp meters – without any need to open the pipe. As clamp-on ultrasonic transducers are simply mounted onto the outside of the pipe, their installation does not impair in any way normal plant operation. Moreover, as they do not come into direct contact with the highly corrosive medium flowing inside and they are not subject to wear and tear. Therefore, Yihua's process engineers decided to equip each of the four heat recovery units with a FLUXUS® F704AN flowmeter from Flexim . The measuring points are located at the respective outlets where the sulfuric acid still has a temperature of ~ 377 °F.

Yihua's engineers became very curious when they learned that the same measuring device would also be able to determine concentration. Flexim 's ultrasonic flowmeter systems FLUXUS® work according to the transit-time-difference principle: The transit time of an ultrasonic signal sent in the direction of the flow is shorter than against it; their difference corresponds to the mean flow velocity. With the same arrangement, FLUXUS® simultaneously determines the speed of sound propagation in the fluid. Acoustic velocity is a characteristic physical property of a medium, varying with temperature. In the case of highly concentrated sulfuric acid, there is a clear and easily measurable correlation between concentration and the speed of sound.

One of the advantages of Flexim 's non-intrusive measuring technology is that it can be tested thoroughly with no risk. As it was only necessary to upload the specific media data set to the transmitters and to activate their temperature inputs, Yihua decided to try to evaluate the concentration functionality of their new flowmeters in daily operation. Their experience was extremely positive. The operators are happy that they have replaced their unreliable Δp flowmeters, and now also have a non-intrusive concentration measurement that is not subject to wear and tear and therefore requires virtually no maintenance.

Overview of Hubei Yihua's chemical and fertilizer complex on the right bank of Yangtze river

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One of the two sulfuric acid plants at Hubei Yihua

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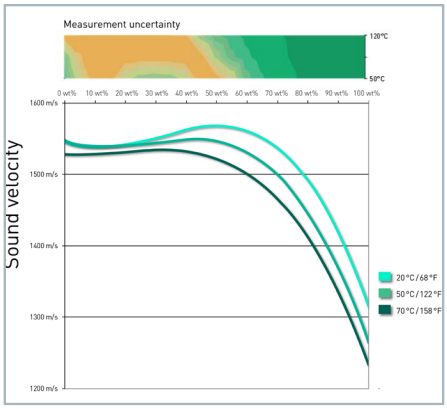

At higher concentrations, there is a clear and easily measurable relationship between the concentration of sulfuric acid and the sound velocity.

Stationary FLUXUS® F704AN ultrasonic measuring systems are used as transmitters.

Measuring Points and Instrumentation

Pipelines	16” to 28”, stainless steel
Medium	99.6%m sulphuric acid
Temperature	~ 377 °F
Devices used	4 stationary FLUXUS® F704AN ultrasonic measuring systems 4 pairs of CDM high temperature clamp-on ultrasonic transducers, installed in VARIOFIX L mounting rails

Advantages

- Precise and long-term stable flow measurement from the outside of the pipe
- Simultaneous equally non-intrusive concentration measurement
- No wear and tear from the corrosive medium flowing inside
- Increase of occupational and operational safety through significant reduction of maintenance effort

Customer

Hubei Yihua Chemical Industry Co. Ltd, Yichang City, Hubei province, China

Hubei Yihua Group Co., Ltd, located in Yichang City, was established in 1977. It is a state-controlled listed company and a core subsidiary of Hubei Yihua Group. The company covers an area of 25,000 hectares on the right bank of the Yangtze river and employs more than 2,800 people.

The company consists of three independent legal entities: Hubei Yihua Chemical Company Limited, Yichang Yihua Pacific Thermal Power Company Limited and Hubei Yihua Fertilizer Company Limited.

The company is mainly engaged in fertiliser and chemical products. Its existing production capacity of leading products are: 350,000 tons of synthetic ammonia, 100,000 tons of caustic soda, 100,000 tons of pentaerythritol, 660,000 tons of diammonium phosphate, 1.2 million tons of sulphuric acid, 300,000 tons of phosphoric acid, 100,000 tons of caustic soda and 120,000 tons of PVC.

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