



STEAM MEASUREMENT IN A COMBINED HEAT AND POWER PLANT



Power Plants

“For us, the key advantage of Flexim’s measuring technology is that the pipeline does not have to be opened. When installing a wetted measuring system, the effort involved in emptying the pipeline, the installation, and then carrying out the safety check quickly exceeds the investment costs.”

*Dr. Kordula Mawick,
Head of production support and
operating documentation for CHP
plants, Stadtwerke Düsseldorf.*



Measuring Task

Flow measurement of 930 °F hot high-pressure steam in the inflow to the Flingern CHP plant of Stadtwerke Düsseldorf AG

Flingern is the cradle of Düsseldorf’s electricity supply. Electricity has been generated here since 1891. In the vicinity of the historic site, Stadtwerke Düsseldorf has been operating a waste incineration plant since 1965. It supplies the most important raw material for the Flingern CHP plant via a 2,600 ft long pipe bridge: steam. Over 440,000 tons of waste are incinerated in the Flingern waste incineration plant every year. Stadtwerke Düsseldorf uses the heat generated in the boilers to generate more than a million tons of steam per year. In the CHP plant in Flingern, a highly efficient turbine generates up to 55 MW of electricity based on the principle of combined heat and power, and 100 MW of district heating is also extracted. This covers around 11 percent of the electricity consumed in Düsseldorf’s private households and approx. 20 percent of the district heating requirements of the Düsseldorf city center network.

The waste incineration plant accounts for the amount of steam produced and delivered to the CHP plant. A measuring orifice is installed in each of the two 12” and 10” high-pressure steam lines to record the quantity. However, the measuring orifice in the 12” pipeline is located behind an outlet line

through which steam can be drawn to preheat the other connection line if necessary. As a result, parts of the amount of steam drawn remain undetected due to operating conditions. The operators were therefore looking for a way to retrofit the line with a suitable measuring system at a point before the outlet with as little effort as possible and without disrupting operation.



Solution

Whenever it comes to solving demanding measurement tasks as simply as possible, Axel Dickfeld is a sought-after contact. As a sales engineer in the field, he supplies industrial companies on the Rhine and Ruhr with measurement technology from Flexim. Axel Dickfeld is at home in Düsseldorf and a welcome guest at the public utility company. He has already effortlessly fitted the large hot water lines of the district heating supply with clamp-on FLUXUS® ultrasonic flowmeters from Flexim, as well as compressed air lines in the power plants. Only when it came to the question of non-intrusive steam measurement did he always have to pass: "We are working on it" was his motto for a long time.

In the meantime, however, the situation has changed. The persistent work of the research and development department at Flexim finally led to success and the proud development engineers were dying to provide a customer with the high-temperature steam measurement they had devised to solve their measuring task. Now it was up to Axel Dickfeld to find people who were interested in non-intrusive steam measurement technology. Engineers at Stadtwerke showed definite interest, so a test measurement was arranged. A fundamental advantage of Flexim's non-intrusive measurement technology is that its suitability for the measurement task can be tested without any impairment of operation before purchase. The agreement that was reached was as simple as it was clear: the measuring system will only be purchased if it works to complete satisfaction. Clearly, a win-win situation. With the steam line on the 2,600 ft long pipe bridge, the development engineers from Flexim were given a perfect place to work, while Stadtwerke Düsseldorf had the prospect of a non-intrusive solution to their measurement problem.

The Flingern waste incineration plant produces and supplies steam at a temperature of almost 930 °F and a pressure of 940 to 1,160 psi. Flexim developed the new steam measurement technology for exactly this type of application. The larger of the two steam lines was selected for the test measurement. Because of the high temperature, the ultrasonic transducers were mounted on Flexim's patented WaveInjector® transducer mounting device.

The new superheated steam flowmeters FLUXUS® ST-HT from Flexim measure according to the cross-correlation method. Two pairs of ultrasonic transducers are mounted on the pipe at a defined distance from each other, thereby forming two acoustic measurement barriers. The ultrasonic signals radiated into the pipe are modulated by the vortices of the turbulently flowing fluid. Since the vortices are carried along by the flow, they pass through the two measurement barriers with a time delay. By cross-correlating the modulation signals over time, FLUXUS® ST-HT determines



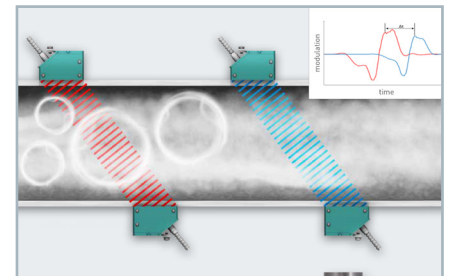
Flingern CHP plant
© Stadtwerke Düsseldorf



Flingern waste incineration plant
© Stadtwerke Düsseldorf



Axel Dickfeld has a good laugh: with Flexim's clamp-on ultrasonic technology, steam can now also be measured non-invasively.



Schematic diagram of non-intrusive flow measurement using the cross-correlation method

the flow velocity of the steam and calculates the mass flow based on the geometry of the measuring point and the physical parameters.

Flexim's development engineers made the best of the field trial. The non-intrusive measuring technology allows installation without any effect on normal system operation and the measuring device can also be modified and optimized afterward as desired. The developers optimized the measurement in close cooperation with their own service people on site and the operating staff of Stadtwerke Düsseldorf.

Stadtwerke Düsseldorf has long since acquired the measuring system. Due to the positive experience with the new steam measuring technology from Flexim, the other 10" pipeline is to be fitted with a clamp-on ultrasonic measuring system from Flexim.



Installation of the high-temperature Wave-Injector® transducer mounting devices on a hot pipe. The insulation only needs to be removed temporarily from the pipe to install the ultrasonic transducers.



The stationary FLUXUS® G722 ST-HT ultrasonic system is used as a measuring transmitter.



Advantages

- Reliable measurement from outside
- Simple retrofitting without opening the pressure pipeline
- No pressure loss
- No energy loss
- No risk of leakage
- No pressure equipment directive testing required

Measuring Points and Instrumentation

Pipelines	steel 12", wall thickness 0.5"
Medium	superheated live steam, temperature ~ 900 °F – 935 °F, pressure 940 – 1,160 psi
1 stationary clamp-on ultrasonic FLUXUS® G722 ST-HT flowmeter for superheated steam 2 pairs of GDM2E52 clamp-on ultrasonic transducers 2 pairs of high-temperature WaveInjector® transducer mounting devices	



Customer

Stadtwerke Düsseldorf AG, Düsseldorf, Germany

Stadtwerke Düsseldorf AG provides the energy and drinking water supply as well as the municipal district heating supply for the North Rhine-Westphalia state capital. The company also operates a waste incineration plant and offers electromobility services.

Founded in 1866, Stadtwerke Düsseldorf is now one of the largest municipal utility companies in Germany with 2,500 employees and a turnover of around EUR 2.1 billion.

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