Non-intrusive Liquid and Gas Flow Measurement – Water / Steam Phase Detection

Energetic production is a diverse industry. The common thread in the industry is productivity. Forced outages and high maintenance costs are a major problem in all types of power applications.

Why choose FLEXIM?
FLEXIM is the leader in Ultrasonic flow measurement technology. The flexibility to clamp-on to the outside of the pipe and accurately measure what is going through it helps our business partners increase availability and decrease maintenance costs.

FLEXIM meters.
FLEXIM provides a method for measuring liquid and gas that is easy and comprehensive.

FLEXIM meters can significantly improve downtime.
Detection of water in parts of the boiler during startup can prevent premature tube failures in HRSG applications.

FLEXIM meters are perfectly suited for maintenance applications.
FLEXIM meters are portable as well as permanent and can be easily installed under flowing conditions. They can provide information before and during purges and are equally as useful for troubleshooting problems.

FLEXIM meters turn your data into information you can use.
Our FluxDiag historian software makes data retrieval a snap. View, and export flow measurements into useful information quickly and easily.

FLEXIM has experience on applications where others can not operate.
FLEXIM meters have highly advanced technology that enables the meter to start up and operate where other ultrasonic meters have not been successful.

Combined Cycle power plants are highly efficient means of generating electric power and steam as well as heated water that can be used for adjacent production processes. Moreover, such plants are considered very clean and ideal for high frequency cycling support of renewable power plants when needed.

The natural gas turbines of the CC plant are used as the primary power producer. Further, the hot exhaust from the turbine is used to heat water in the Heat Recovery Steam Generator, generating steam which is then used to turn a steam turbine generator. Excess steam can also be used in production applications.

FLEXIM Solution for overcoming Tube Failures
One of the most difficult problems with HRSGs occurs during warm, pressurized startup of the unit. During pre-start purge of the gas path, water vapor in the superheater and reheater sections of the HRSG will condense. When the gas turbines is fired it heats the superheater and reheater tubes. Any undrained water will be pushed by steam into the hot tubes and causing thermal fatigue damage and eventual tube failures.

Tube failures cause decreases in availability, increased maintenance costs, and forced outages. FLEXIM has provided the solution. Using FLEXIM’s non-intrusive ultrasonic flow metering technology along with the patented WaveInjector technology, we are able to detect water and allow drainage before any damage can occur in the heater tubes. Drain line valves can optionally be controlled to monitor the water level under water level control of steam.

FLEXIM has offices located throughout North America. Please have a look for your local representative at: www.flexim.com or call us at: 1-888-852-PIPE

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The superior metering solution at extreme pipe temperatures

Non-intrusive ultrasonic flow measurement with the Wavelinjet®

Reliable - Safe - Efficient

The Wavelinjet® has been specifically engineered for high-temperature applications. Using patented technology, the Wavelinjet® thermally separates the ultrasonic transducers from the hot pipe, allowing operation at process temperatures up to 600 °C and beyond.

Unique measuring technology

With the Wavelinjet®, FLEXIM provides a metrological alternative, which offers fundamental advantages over known wetted-sensor ultrasonic applications worldwide. Without the need for pipe work or process shut-downs, the Wavelinjet® is scanned to the outer surface of the pipe. Rigged mounting fixtures provide long-term stable measurement even over pipes with extreme vibration.

A wide range of ultrasonic transducers and transmitters guarantee the ideal adaptation to the individual measurement task, independent of pipe materials, wall thickness and measurement range - even within hazardous areas (FM Class 1, Div. 1 and 2, ATEX/IECEx Zone 1 and 2).

FLEXIM Capability is put to the test in a CCP

The Electric Power Research Institute (EPRI), a combined cycle plant in the South of the US and FLEXIM agreed to conduct some tests on the superheater of one of CCP’s HRSG units in 2012. The test was conducted by Robert Anderson from the Boiler Water/Steam Group of the EPRI. FLEXIM was requested to perform a high-temperature clamp-on ultrasonic flow metering system for the test, as the temperature of the steam system exceeded 320 °C.

The tests were conducted on the superheater drain pipes of the CCP. FLEXIM utilized its patented Wavelinjet® high-temperature clamp-on system in the test, as temperatures in the steam system exceeded 320 °C.

The idea behind the test is to demonstrate that FLEXIM’s leading edge technology can indicate a phase change from liquid to steam in the superheater drain pipe to facilitate automatic control of the superheater drain valves.

During startup of the HRSG, condensate water can be trapped in the superheater, and reheater. This can be avoided before the boiler has steam introduced to avoid damage to the boiler tubes.

The Wavelinjet® was installed on a 3” mild steel Alloy Steel pipe. As seen in the graph below, the value of the measured Water / Steam Phase Line is the determining factor in the test. Liquid values below a certain threshold indicate that liquid is in the tube. By knowing this, the drain valves can be opened to allow the draining of liquid and then closed to prevent undesirable escape of steam.

Other Applications in HRSG

Along with the ability to detect phase changes in the boiler tubes of a HRSG, there are several other opportunities for Clamp-On Ultrasonic Flow Measurement:

- Make-up Water Metering
- Cooling Tower Water Metering
- High performance measurement
- Water Treatment
- Natural Gas Measurement
- Gas Measurement
- Liquid Measurement

Unrivalled advantages of the non-intrusive flow measurement with FLEXIM in HRSG applications:

- No need for pipe work or process shut-downs
- Safe for personnel
- No intrusive measurement
- High operational safety with no risk
- Independent of pipe material, diameter, wall thickness and internal pressure
- Accurate and repeatable measurement readings - even at high turndown ratios
- Highly cost efficient in comparison to traditional methods

FLEXIM's leading edge technology offers a metrological solution to the fluid dynamics in harsh, high-temperature applications, setting new standards for efficiency and reliability in the measurement of liquid and gas flows.

Unique features of the FLEXIM® flow meters:

- Engineered for the reliable detection of water and steam phases at extremely high temperatures and pressures, ensuring the measurement of liquid and gas flows.
- Accurate and reliable metering even at partial blockage of gas lines or steam lines - due to its built-in FLEXIM® technology.
- Virtually free of wear and tear, with no maintenance required due to measurement outside the pipe wall.
- Every measurement system is pre-calibrated in house. Traceable to national standards, delivered with a calibration certificate.
- Matched transducers, integrated temperature compensation (according to IEC, ANSI, EN 1434), robust design (IP68 / NEMA 6P), digital signal processing guaranteeing a high zero point and flow measurement stability.
- Permanent coupling with unique coupling pads. Reducing the occurring measurement features guarantees direct control pressure data also in heavily vibrating pipes.

Technical facts

- Temperature ranges:
  - Liq: -40 °C to +100 °C (-40 °C to +40 °C)
  - Gaseous media: up to 400 °C
- Flow rates:
  - Liquids: ± 1.2% of reading ± 0.01 m/s
  - Gaseous media: ± 1,5% of reading ± 0.01 m/s
- Communication protocols:...
The superior metering solution at extreme pipe temperatures

Non-intrusive ultrasonic flow measurement with the Wavelinker®

Reliable - Safe - Efficient

The Wavelinker® has been specifically engineered for high-temperature applications. Using patented technology, the Wavelinker® thereby separates the ultrasonic transducers from the hot pipe, allowing operation at process temperatures up to 600 °C and beyond.

Unique measuring technology

With the Wavelinker® FLUXUS provides a metrological alternative, which offers fundamental advantages and has proven in numerous successful applications worldwide. Without the need for pipe work or process shut-downs, the Wavelinker® is returned to the outer surface of the pipe. Rugged mounting brackets provide long-term stable measurement even under extremely vibrating conditions. The wide range of ultrasonic transducers and transmitters guarantees the ideal adaptation to the individual measurement task, independent of pipe materials, wall thickness and measurement range - even within hazardous areas (FM Class I, Div. 1 and 2; ATEX 00c Zone 1 and 2).

FLEXIM Capability is put to the test in a CCP

The Electric Power Research Institute (EPRI) has been specifically engineered for high-temperature HRSG applications. The tests were conducted on the superheater drain system of the unit. FLEXIM utilized its patented Wavelinker® high-temperature clamp-on system in the test, as the system in the stream exceeded 360 °C. The idea behind the test was to demonstrate that FLEXIM's leading edge technology can indicate a phase change from liquid to steam in the superheater drain pipe to facilitate automated control of the superheater drain valve.

The Wavelinker® was installed on 3” XXS wall Alloy Steel pipes. As seen in the graph, below the value of the measured Water / Steam Phase Signal is the determining factor in test. Signal values below a certain threshold indicate that liquid is in the tube. By knowing this, the drain values can be opened to allow the draining of liquid and then closed to prevent undesirable escape of steam.

- Unrivalled advantages of the non-intrusive flow measurement with FLEXIM in HRSG applications:
  - No process shut-downs or interfering with the process
  - Close identification of Water / Steam Phases
  - Certified for operation within extremely high temperatures (EN 13445, TEMA, ASME)
  - Fast measuring dynamics, also capturing highly fluctuating flows

Make-Up Water Metering

All boiler, including HRSG, use make-up water during operation. FLEXIM Ultrasonic Meters can be utilized to ensure accurate measurement of the Make-Up.

Cooling Tower Water Metering

Most HRSG plants utilize cooling towers for the demineralized water supply of the plant. Cooling Tower Flows are key measurement parameters for operation and efficiency. FLEXIM has great experience in measuring these kind of flows.

Natural Gas Measurement

Natural Gas is measured in all CCS units, either the Gas Turbines. FLEXIM Gas Measurement is extremely successful in the measurement of Natural Gas.

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- Close identification of Water / Steam Phases
- Certified for operation within extremely high temperatures (EN 13445, TEMA, ASME)
- Fast measuring dynamics, also capturing highly fluctuating flows
- High operational safety with no risk
- Independent of pipe material, diameter, wall thickness and internal pressure
- Accurate and repeatable measurement readings – even at high burner outlet temperatures
- Highly cost-efficient in comparison to wetted instruments

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Technical Facts

- Temperature ranges:
  - Liquids: -40 °C to +200 °C (-190 °C up to +600 °C possible)
  - Gases: -25 °C to +20 °C (1°C up to +400°C possible)

- Flow range:
  - Liquids: 0.01 to 35 m/s
  - Gases: 0.01 to 35 m/s

- Flow stability:
  - Liquid ± 3% of reading ± 0.01 m/s
  - Gas ± 0.1% of reading ± 0.01 m/s

- Turndown ratio:
  - Liquid up to 30:1
  - Gas up to 10:1

- Liquid media:
  - Temperature ranges:
    - -40 °C to +200 °C (-190 °C up to +600 °C possible)
  - Flow rates:
    - 0.01 to 35 m/s
  - Temperature ranges:
    - -40 °C to +200 °C (-190 °C up to +600 °C possible)

- Gas carrying pipes:
  - Liquid filled pipes:
    - Minimum diameter:
      - 2.5 in. for liquids and gases - depending on the calibration certificate

- Liquid media:
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    - 0.01 to 100000 cSt

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    - 0.01 to 35 m/s
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- Technical facts:
  - Engineered for the reliable detection of water and steam phases on the measurement of liquid and gas flow rates.
  - Accurate and reliable metering even at particle saturated or saturated liquids - due to its built-in FLUXUS®
  - Virtually free of wear and maintenance (no need for recalibration)
  - Every measurement system is pre-calibrated in the factory and delivered with a calibration certificate
  - Matched transducers, integrated temperature compensation according to ASME MFC-5.1-2011, very low cost calibration and digital signal processing guarantee a high zero point and flow measurement stability
  - Permanent coupling with unique coupler pads. Reducing secondary inventory features guarantee durable contact pressure also at heavily vibrating pipes

Unique features of the FLUXUS® flow meters:
FLEXIM® capability is put to the test in a CCP HRSG. The Electric Power Research Institute (EPRI) conducted this test to validate the reliability and accuracy of FLEXIM's ultrasonic flow meters in harsh conditions, specifically in a CCP's HRSG. The test was conducted to determine if FLEXIM's ultrasonic meters could provide accurate flow measurement even within hazardous areas (ATEX, IECEx, FM). The test involved the installation of FLEXIM ultrasonic meters on a CCP's HRSG to measure the flow rates of steam and water. The test results confirmed the reliability and accuracy of FLEXIM's ultrasonic meters in extreme conditions, proving their suitability for use in industrial applications.
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Why choose FLEXIM?
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FLEXIM meters.
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FLEXIM meters can significantly improve downtime.
Detection of water in parts of the boiler during startup can prevent premature tube failures in HRSG applications.

FLEXIM meters are perfectly suited for maintenance applications.
FLEXIM meters are portable as well as permanent and can be easily installed under flowing conditions. Flexing values under performing pumps with a portable measurement.

FLEXIM turns your data into information you can use.
Our FluxDiag historian software makes data retrieval a snap. View, and export flow measurements into useful information quickly and easily.

FLEXIM solution for overcoming tube failures
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FLEXIM has provided the solution. Using FLEXIM’s non-intrusive ultrasonic flow metering technology along with the patented WaveInjector technology, we are able to detect water and allow drainage before any damage can occur to the heater tubes. Drain line valves can automatically be controlled to determine the unwanted water, just before any damage to the tubes.

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HRSG solutions
Non-intrusive liquid and gas flow measurement – water / steam phase detection

Permanent applications

Water / Steam Phase Detection on HRSG Drain Lines

EPA Monitoring

Water Treatment

Lubrication Flows

High Pressure Feed Water Flows

Plant Water Systems

Stack Gas Conditioning, Liquid SO2 and Ammonia

Fuel Oil Monitoring

Portable applications

Check Metering

Troubleshooting Valves

Efficiency Testing of the Boiler

Pump Testing and Evaluation
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