Heat Flux and Corrosion (HFC^{TM}) Monitors

Non-Intrusive Systems Designed for Focused Monitoring of Boiler Membrane Walls at Point Locations using External Sensors

A New Monitoring Approach, developed from our Established Electrical Resistance Technology and Tailored for Point Locations

On-Line Monitoring of Fireside Conditions using Robust External Sensors

Real-Time Monitoring of Thermal Behaviour: Heat Flux, Surface Temperatures, Slagging, Fouling and Wall Cleaning

Can be used in Place of Intrusive Heat Flux Sensors

Continuous Monitoring of Fireside Tube Wall Corrosion and Erosion

Compact Fully-Independent Technology: Multiple configurations with Low Installation Costs

Multiple Interface Options with Plant Information Systems

Patented Technology

ROWAN
TECHNOLOGIES LTD

www.rowantechnologies.co.uk

SYSTEM OVERVIEW

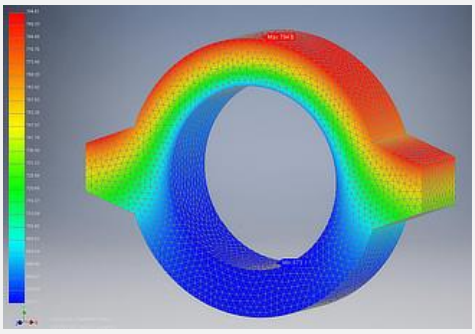
HFC monitors are non-intrusive heat flux monitoring systems with in-built tube wall corrosion and erosion monitoring capability. They use ‘active’ measurement methods by applying signals through the tube wall cross-section during both thermal and corrosion measurement cycles.

These recently-developed systems have evolved from RTL’s scanner technology: included within the HFC systems are refinements of techniques used within the scanners, as well as incorporating new measurement methods.

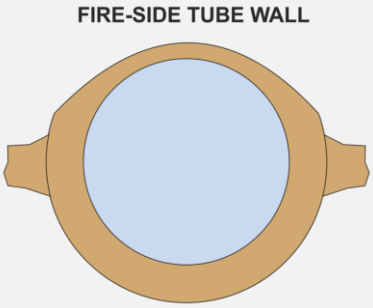
HFC systems use a ‘focused’ approach: measurements typically taken across 1 or 2 tubes as compared to the ‘whole wall’ approach, using rectangular arrays of sensors, normally used by the scanners.

Like the scanner sensors, the HFC sensors are non-intrusive - no access through the boiler wall is required. The sensors are welded directly to the cold-side wall surfaces.

The monitors comprise fully-independent electronics with on-board computing power, all housed within a small double-sealed enclosure that can be interfaced to plant information systems using a variety of methods. Additional multiplexing creates multi-point monitoring capability.

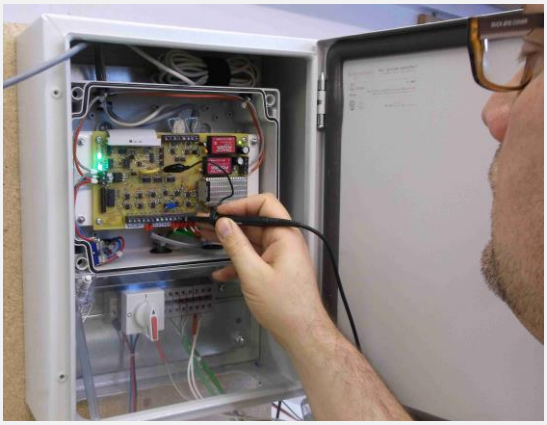


Finite Element Tube Wall Heat Flux Simulation:



Fireside Corrosion: Subcritical Boiler

Sensor Configuration



Sealed Dual-Enclosure Design

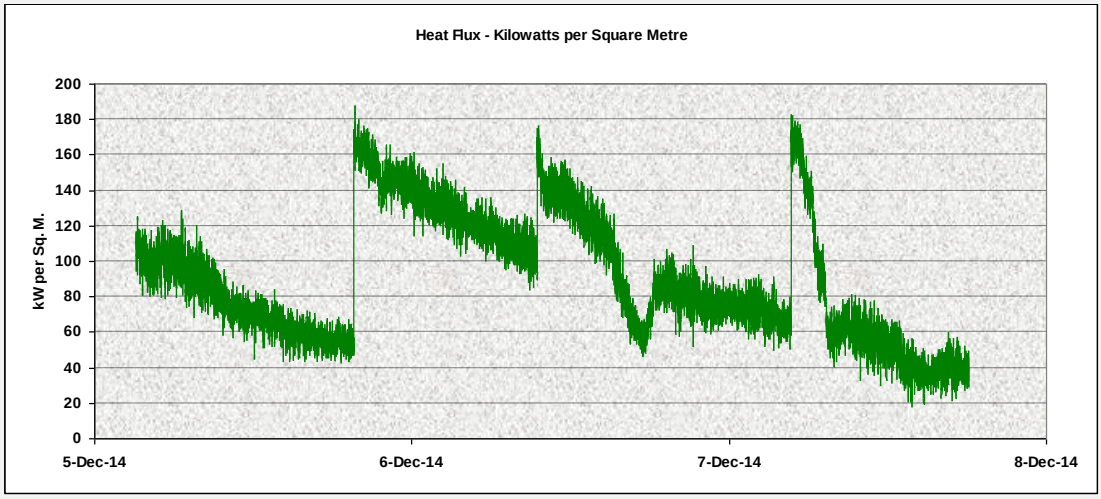
THERMAL MONITORING

For heat flux monitoring, HFC systems combine heat flow finite element modelling with a dual measurement approach: the first method (a refinement of the scanner's technique) uses passive measurement of tube surface conditions, whilst the second method actively passes signals through the whole wall cross-section, including the fireside tube wall. Results from both methods reinforce each other and are combined to provide enhanced-quality heat flux data.

Up to around ten measurements per minute are processed in real-time, stored locally at the electronics and made available to the plant information systems via a number of methods:

- 0-10V or 4-20 mA analogue signals.
- Digitally via serial or Ethernet links.

These methods provide a range of options for real-time data acquisition and display using an office or control room computer.



HFC Heat Flux Data: Subcritical Boiler

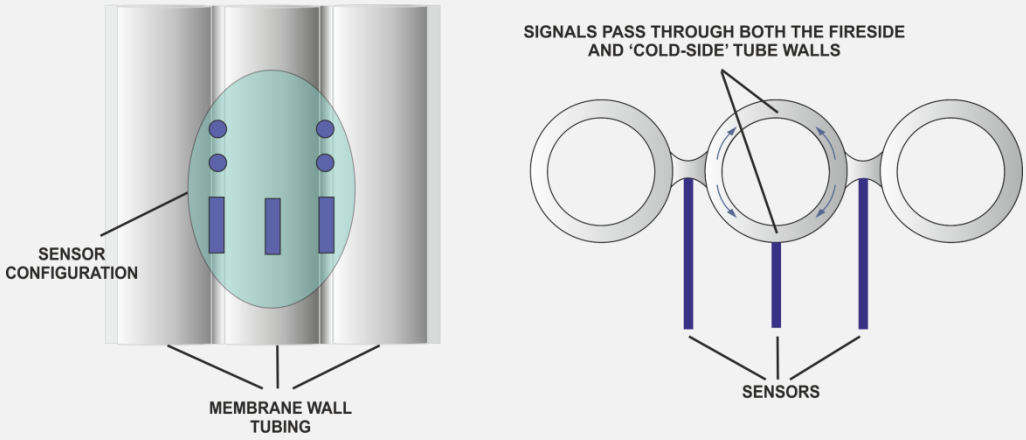
CORROSION MONITORING

HFC monitors use a refined version of the scanner's electrical resistance corrosion monitoring methods. The highly-focused monitoring approach i.e. typically across a single tube, helps to minimize sources of measurement noise (mainly caused by the dynamics of the boiler wall), resulting in improved response times when detecting metal loss. Corrosion data is stored locally at the electronics and is also delivered to plant information systems in the same way as thermal data.

Superheater Tube Wall Corrosion

HARDWARE OVERVIEW

The schematic below shows the electrode/sensor arrangement. A total of seven robust sensors are welded directly to the cold-side of the tube wall, typically around a single tube. During the measurement sequence, signals pass around both cold-side and fireside tube walls, enabling the cold-side sensors to detect fireside tube wall conditions.



HFC enclosures are usually positioned in readily-accessible locations within about 15 metres of the sensor locations. Signal cables, pre-connected to the enclosure, run to the sensors in suitable conduit. Enclosures are powered from a single low-voltage DC supply.

As well as operating as single stand-alone units, HFC systems can be:

- Configured as multiple-units with a central computer, covering a wide area
- Configured, with additional multiplexing, for multiple-point monitoring.
- Integrated with normal scanner hardware and systems.

SPECIFICATIONS

THERMAL MONITORING

- Maximum approx.10 heat flux measurements per minute.
- Sensor difference accuracy <0.2^0 C (most critical for heat flux measurements).
- Cold-side surface temperature stability approx. +/- 1^0 C and accuracy approx. +/-2^0 C.

CORROSION/EROSION MONITORING

Sensitivity to metal loss - typical values:

- Boiler wall (dynamic central zone) — 2000 ppm (1 part in 500).
- 6 mm tube wall @ ~0.5mm/year metal loss — ~30 days response time.

Quantification is achieved more quickly for higher corrosion rates, thinner walls and thermally less-dynamic conditions. Above figures assume normal ‘uniform’ corrosion, as compared to highly localized pitting.

OUTPUTS, DATA COMMUNICATION OPTIONS AND DATA STORAGE

- 2 x 4-20 mA.
- 2 x 0-10V.
- Bespoke serial data link to (optional) data logger.
- Ethernet.
- Minimum 10 GBytes on-board storage.

POWER REQUIREMENTS

Single 24 or 48V DC supply. Max. 3A.

HARDWARE CONFIGURATIONS

- Single base unit will serve up to two sensor locations.
- Multiple base units can be configured with central data logger.
- Optional multiplexing electronics for increased sensor capacity with scanner capability.
- Can be integrated with standard scanner electronics.

Above figures are a guide and may be subject to change.

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