Thermal Scanner Systems

Monitoring and Mapping For High Heat Flux Applications

Multi-Enclosure Systems for up to 500 Sensor Locations and Multiple Monitoring Areas. Can be used as an Integral Part of Wall Cleaning Operations.

- Monitoring and Mapping of Boiler Wall Heat Flux and Tube Temperatures over Large Areas of Boiler Wall
- Non-Intrusive Technology: Sensors are Welded to External Tube Walls.
- Real-Time Monitoring of Slagging and Fouling Behaviour and the Effectiveness of Tube Cleaning.
- Monitor at Multiple Locations: for example all Four Walls of a Power Plant Boiler
- Use Scanner Data as Feedback for Wall Cleaning Operations, forming an Integral Part of Boiler Wall Cleaning Systems.
- Helps Identify possible Damaging Tube Wall Conditions.
- More than 15 Scanner Installations now in Europe, Asia and N. America

www.rowantech.co.uk
Introduction

Rowan Technologies thermal scanner systems are specifically designed to monitor the thermal behaviour of boiler walls, i.e. heat flux and surface temperatures. Scanners use arrays of sensors welded to external (cold-side) surfaces, allowing monitoring and mapping of large areas of wall.

In this brochure we describe our multi-enclosure systems that cater for up to 500 sensor locations and can, for example, monitor all four walls of the largest power generation boilers.

We also provide combined corrosion and thermal systems, together with smaller ‘mini-scanner’ systems that cater for up to 50 sensor locations - please see our website for further details. Our website also includes a case study on investigation of root causes of tube wall crack formation and propagation, using the thermal monitoring capabilities of our scanners.

Principal Features and Benefits

- Monitoring and mapping of real-time or historical thermal data over large areas of boiler wall using arrays of sensors that are welded to external surfaces.

- Mapping of external surface temperatures, tube wall heat flux and fireside tube temperatures, providing information on slagging behaviour, flame impingement, effectiveness of wall cleaning, excessive tube temperatures etc.

- Correlate thermal behaviour with boiler operations, enabling combustion conditions to be optimised to help improve efficiency.

- Provides absolute wall temperature, temperature differential and thermal cycling data: helping to quantify tube stresses and pinpoint underlying causes of tube damage or failure.

- Systems can be interfaced to plant information systems for data storage and retrieval.

- Fast scanning provides real-time feedback of wall cleaning operations: scanners can be integrated into wall cleaning control systems.

- Dedicated software allows data analysis and presentation in a multitude of ways – historical or real time data, linear traces and 2-D plots.

- Custom-built, robust electrode/sensor assemblies that are simple to install. Two sensors at each location allow estimation of heat flux and fireside tube temperatures.
Scanner Data Capture, Storage and Presentation

Arrays of scanner sensors are rapidly ‘scanned’ in sequence and the data is immediately stored at the scanner’s data logger. Fast scanning allows capture of rapid thermal transients resulting from operational changes or slag removal. Data can be sent directly, via Ethernet link, to plant information systems, office or control room for immediate data processing and presentation in the form of maps or time-dependant linear traces.

The scanner’s dedicated analysis software can be used by anyone with network access to the data - from office or control room. The main features are:

- Real time data capture and display, or analysis of historical data.
- Data can be plotted as linear traces for each sensor location, or as 2-D thermal maps: surface temperatures, estimated heat flux or estimated fireside tube wall temperatures.
- Before-to-after ‘difference’ mapping: for example to highlight the effectiveness of wall cleaning.
- Print and save traces and plots, and create map sequences to easily visualise changes over time
- Statistical data analysis capabilities.
- Optional data retrieval from plant servers using OLEDB software - performs a similar function to other data retrieval packages but with special provision for scanner data.
Example Scanner Maps and Data

Tube Wall Cleaning following Activation of the Top Two Wall Blowers. Estimated Fireside Surface Temperatures. Scale in °F.

Scanner Map Sequence (6-Minute Intervals) of Estimated Fireside Tube Wall Temperatures following a Slag 'Avalanche' - 7m x 8m Supercritical Tube Wall

The Scanner Captures and Displays Thermal Transients as Linear Traces. Here Changes in Surface Temperatures and Heat Flux, as a Function of Time, from an Individual Sensor Location, are Displayed
Example Installation - Large Power Generation Boiler

The schematic below shows an example scanner configuration for monitoring the walls of a large power generation boiler.

Multi-enclosure systems have a main control unit located near the monitoring areas. The control unit may also house the scanner data logger but this can be located some distance away if fibre-based serial communications to the control unit is used. The control unit and logger communicate with electronics PCB enclosures positioned local to the monitoring areas. Field cables run directly from these enclosures to the wall sensors.

Additional hardware can be added to existing scanner installations to expand existing monitoring areas or to create new ones. If corrosion is a concern, it’s possible to integrate both our corrosion probes and HFC (Heat Flux and Corrosion) monitors to create a single multi-purpose system.

Using an Ethernet link, the scanner data logger can connect to plant servers and/or data analysis and presentation PCs located in a control room or office. This allows the latest scanner data to be processed and displayed in the form of real-time maps or linear traces using the scanner’s data analysis software. The scanner’s thermal monitoring capabilities can also be used as an integral part of wall cleaning feedback control systems.

PCB Enclosures located Close to the Boiler Walls

Commissioning of Main Control Cabinets

Data Analysis and Display Software: Control Room or Office
Scanner Configurations and Installation

The scanner hardware is designed to be very adaptable, allowing systems to be configured for a variety of sensor layouts. Hardware can be adapted for possible site restrictions such as high ambient temperatures and boiler exclusion zones.

Sensors, welded to external surfaces, do not require specialist welding skills. System design is also sensitive to the need to temporarily remove hardware for possible maintenance.

Specifications

- Approx. 150 msec per sensor measurement - an array of 100 sensor locations scanned in about 30 seconds for a standard system. Data acquisition speeds can be increased with additional hardware.

- For optimum accuracy, systems are specifically designed for accurate and stable temperature differences between adjacent paired sensors at each sensor location: difference accuracy to within approx. ±0.2°C (0.4 °F).

- For (less-critical) absolute values (rather than differences): stability at any one sensor location approx. ±1 °C (2 °F) and accuracy within approx. ±3 °C (5 °F).

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