Intelligent Sootblowing

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SMART Clean

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FPK II – Combustion Chemistry II
Åbo Akademi University, Åbo
Conventional Boiler cleaning system

Cleaning devices

Controls
Conventional Online Boiler cleaning
Wall Blower

Furnace
Conventional Online Boiler cleaning Retractable Sootblower

Convective part

Up to 20 m
Innovative Cleaning technology
Water Cannon
Innovative Cleaning Technology – Retractable Sootblower with Flexible Helix

- **Operation Principle:**
  - Dual drive (axial and rotational)
    - axial speed: variable
    - rotational speed: variable
  - Dynamic helix or **Go-Stop-Go** operating mode
  - Blowing pressure: variable
Intelligent Boiler cleaning

SMART Clean
- Selective and targeted cleaning actions
  - When? Where? How?

Controls
- SMART Control PLC
  - Selective and targeted cleaning actions

DCS
- Decision
- Analysis
- Diagnostic

Closed Loop
SMART Clean ISB

- Decision
- Analysis
- Diagnostics
Diagnostic Furnace

- Heat flux measurement
- Wall temperature measurement
- Measurement of furnace exit gas temperature
Heat flux measurement

\[
\dot{Q} = \frac{\Delta \vartheta}{S} \lambda
\]

\begin{align*}
\Delta \vartheta &= T1 - T2 \,[\text{K}] \\
S &= \text{Distance} \,[\text{m}] \\
\lambda &= \text{Heat conductance value} \,[\text{W/m}^*\text{K}] 
\end{align*}
Diagnostic Furnace

Wall temperature measurement

- Large scale analysis of temperature distribution on furnace walls
- Detection of slagging hot spots
- Cleaning strategy is flexibly adapted to slagging status
Diagnostic Furnace

Wall temperature measurement

- Detection of **slagging**
- Deduction of **cleaning strategy**
- Determination of **Blowing figures**
  - Demand driven
  - Flexible
  - Automatic

In cooperation with CMV Systems GmbH & Co. KG
Diagnostic Convective part

- Weight measurement at the heat exchanger
Diagnostic Convective part

Weight measurement

- Principle of measurement is based on strain gage technology
- Deposits will be registered as weight increase
- Installed at the hanger rods depending on the geometry of the boiler and the position of the cleaning devices
- Specific sensors for local temperature requirements
Analysis Convective part

- Thermodynamic Balancing
- Software module for heat exchanger analysis
Analysis Convective part
Analysis Convective part

- Compilation of plant specific boiler model
- Calculation of the following values depending on boundary conditions and process data:
  - Fuel and flue gas mass flow
  - Heat transfer coefficient of each heating surface incl. “Cleanliness Factor”
  - Flue gas temperature profile along boiler height
  - Boiler efficiency

**Cleanliness Factor**

\[
CF = \frac{\text{Current heat transfer}}{\text{Reference heat transfer}}
\]
Diagnostic Convective part

Combination of measurement data and thermo dynamic balancing

Without Matrix Clean:
Both sootblower levels will be activated for cleaning due to unknown deposit position within the heat exchanger bundle.

With Matrix Clean:
Only these two single sootblowers which reach the localised deposit will be activated.

Analysis result by TDM:
Heat transfer decreases

Analysis result by Matrix Clean:
Weight increase by heavy deposit spot
Advantages & Benefits

- Conventional Sootblowing
  - Removal of deposits
  - Increase of heat absorption
  - Prevention of uncontrollable deposits

- Intelligent Online Boiler cleaning
  - Conventional sootblowing +
  - Higher process flexibility and more flexibility while firing fuel mixes
  - Less usage of cleaning media
  - Less erosion on the heating surfaces
  - Reduced Service and Maintenance