Video and Temperature Monitoring with Furnace Camera

Starting Point

The quality and efficiency of firing systems and the associated operational availability of boiler plants and steam generators is essentially depending on the optimal mixture and dosing of fuel and combustion air in the entire combustion zone. Disturbances of the local fuel-/air ratio result in the following operational conditions:

- Localized combustion areas with high combustion temperatures and high formation of thermal NOₓ
- Localized combustion areas with incomplete combustion and high formation of CO
- High flue gas losses and high amounts of unburned carbon (UBC) or lost of ignition (LOI)
- Local displacement of the main Combustion Zone compared to the design position
- Local overheating of boiler construction material
- High temperature corrosion and thermal stresses combined with boiler tube ruptures

Measures

Control of the combustion process through derived variations of firing parameters like:

- Uniform distribution of fuel according to the design data
- Control of the combustion air distribution over the entire combustion zone

To achieve these targets, the online analysis of the actual firing situation is mandatory and has to deliver the following information:

- Detection of the local position of the main combustion zone
- Flame temperature distribution
- Local flame propagation
- Ignition point of flame
- Local fouling

Video System: Presentation of the Flame Picture

The furnace camera sensor of the DURAG Video System supplies online visual information directly from the combustion chamber to assist the operator in adjusting the complete combustion process optimally.

Thermographic System: Analysis of the Flame Temperature Distribution

The DURAG Thermographic System is an optical pyrometer based on video data processing. In addition to the Video Image it provides methods for:

- The thermal analysis of the spatial temperature distribution out of the combustion chamber
- Temperature determination within freely definable areas and lines (ROI-Region Of Interest and LOI- Line Of Interest)
- Detection of actual position of the combustion zone.

For automatic closed loop control measures all data of the thermographic systems can be transferred to the main process control system (DCS) at the customer site through standardized data interface.
**User Benefits**

The online data from the DURAG Video and Thermographic System supports the analysis of the combustion process; it provides the tools and ability to improve the quality of combustion by taking the necessary measures:

- Correction of undefined and incorrect positioning of the main combustion zone through adjustment of the fuel-/air ratio for individual burners
- Minimizing the amount of unburned carbon in the ash (UBC / LOI)
- Minimizing the flue gas losses and increasing the efficiency level by adjusting the excess air at constant combustion
- Using optimal furnace control to reduce the maintenance requirements and furnace out-of-service conditions due to local overheating and problems in the water and steam systems (avoiding water tube ruptures).
- Minimizing of start up time of boiler through a controlled temperature profile.

**System Components**

**Sensors**

In order to guarantee the largest and unobstructed observation range the sensors along with their optical systems are directly moved into the combustion chamber. In order to withstand high temperatures between 700°C and 1600°C (typical for these furnaces) the sensors are air or water cooled. All parts which are affected by the flue gas are made of special stainless steel to cope with the chemical reactions and high temperatures of the flue gas.

The number and location of the places where they are installed depends on:

- The monitoring task (monitoring of single burner, of elevations, of combustion chambers)
- The measurements of the combustion chamber and of the firing belt
- Plant specific options.

**Control Room Equipment**

- For online visualization of the furnace process: one video monitor for every sensor or for every sensor group
- For thermography and temperature analysis: a PC with a graphic monitor (maximum processing of 2 sensors possible).

**Applications**

Online monitoring and thermal evaluation of the combustion situation in boiler plants with the following firing systems:

- Coal
- Fuel Oil
- Gas (luminous flames)
- Co-combustion of secondary fuels (e.g. waste water sludge)
- Tangential firing systems (corner or wall orientated)
- Wall orientated firing systems
- Opposite burner orientated firing systems ("boxing" firing systems)

**Typical Installations**

<table>
<thead>
<tr>
<th>Application</th>
<th>Location</th>
<th>Output Power</th>
<th>Firing System</th>
<th>Number of Sensors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tirrenpower</td>
<td>Torrevaldaliga-Sud, Italy</td>
<td>1 x 350 MW</td>
<td>tangential - corner</td>
<td>1 x 1 sensor</td>
</tr>
<tr>
<td>Ho-Ping PP</td>
<td>Ho-Ping, Taiwan-R.O.C.</td>
<td>1 x 305 MW</td>
<td>tangential - corner</td>
<td>1 x 2 sensors</td>
</tr>
<tr>
<td>Israel Electric</td>
<td>MDB Hadera PP, Israel</td>
<td>1 x 560 MW</td>
<td>tangential - corner</td>
<td>1 x 22 sensors</td>
</tr>
<tr>
<td>NTPC</td>
<td>Simhadri PP, Indien</td>
<td>2 x 500 MW</td>
<td>tangential - corner</td>
<td>2 x 36 sensors</td>
</tr>
</tbody>
</table>

**Video and Thermography furnace camera system for monitoring the main combustion zone (fire ball or fire cyclone) in a boiler plant. The use of two sensors is dependent on the dimension of the combustion chamber.**