Kiln Shell Monitoring System

ECS/CemScanner

FLSmidth
Tyre slip monitoring
To ensure lining durability and to avoid kiln deformation and lining damage, the kiln ovality must be kept within certain limits. The kiln shell ovality is greatly affected by the degree of clearance between the tyres and the kiln shell.

The simplest and most accurate procedure is to measure the kiln shell rotation in relation to the tyre rotation. The derived result is termed tyre slip or live ring migration. The Live Ring Migration (LRM) system is an automatic and continuous online computer based measurement and registration system designed to monitor the tyre slip and to anticipate and predict kiln constriction.

It monitors the tyre slip by constantly measuring the relative positions of the kiln and tyres or the rotation time of the kiln and tyres. The slips are computed with the help of statistical calculations to obtain reliable values.

The tyre slip for each tyre is shown on a bar chart. It can also be displayed as trend curves, i.e., together with the shell temperatures on both sides of the tyre. Slip alarm levels are indicated on the bar chart and alarms for slip trend can also be generated.

Fan control
When using cooling fans to control the burning zone section, the ECS/CemScanner system can optionally be equipped with automatic control of the fans through the plant PLC system.

Fans are started when and where it is required by continuous temperature monitoring of the kiln sections. This option enables an optimized use of the fans to prevent uneconomical continuous operation of the fans, thereby increasing their service life.
"Walk inside"...

Brick thickness
The ECS/CemScanner software is able to calculate brick and coating thickness. The results are displayed as a profile or 3-dimensional image updated in real time or based on historical data. Allowance is made for different conductivities of the bricks, internal temperatures and conditions causing abnormally high shell temperatures, not necessarily as a result of thin bricks.

The calculation of brick and coating thicknesses is not an estimate, but is based on solid theoretical grounds.

Skilled users attain accuracy results better than 10% i.e. within a few millimeters. To make sure that historical thickness calculations can be compared, the system requires the use of an encoder to ensure a precise kiln position indication.

The "walk-in-the-kiln" view enables advanced monitoring of the coating conditions by plant operators. In the below screen shots, blockages in two satellite cooler knees are clearly seen.

Historical data
With storage of data for several years, it is possible to easily analyse the kiln. Using the "play" button, operators can search for a kiln temperature profile forward and backward in time. The "Max temperature trend image" will not only give a concentrated summary of the kiln surface temperatures during the latest days or months, it is also a visual browser to search for critical or interesting situations in the past to be opened up for detailed analysis. Users can also manually save a snap shot of the profile for easy later retrieval.

The 3D "walk-in-the-kiln" with selectable view-position enables a practical impression of the coating conditions, without stopping the kiln.

The max temperature trend image provides snap shot information of kiln coating over time.

Refractory management
Usually, plant personnel in charge of refractory maintenance gain valuable experience and know-how on the performance and useful life of the refractory in the plant. Unless this information is centralised and systematically recorded, new planning of refractory lining becomes inefficient because of insufficient information on refractory track record.

Correct use and installation of refractories not only reduces refractory costs, but also results in significant increase of kiln availability and productivity.

Reduce refractory costs

The optional package, BrickGuide, is a unique tool for management of all the relevant information on refractory track-record, consumption and past installations. The software package includes graphical presentation of the history of the installations, lining arrangement, consumption and performance reports for each installed brick type in the kiln.

BrickGuide for brick lining management.
Customize to your needs

Stereo scanner
If it is not possible to obtain a clear view of the kiln shell with one scanner head because of obstacles, one or more additional scanner heads can be installed. The stereo scanner ensures that every portion of the kiln shell is fully covered. The software functions as if there were one scanner head only.

Pyrometers
If obstacles prevent the scanner from viewing parts of the kiln shell, up to 16 infrared pyrometers can be installed to measure temperatures in those specific areas. With the PyroScan option, temperatures of a particular section are scanned and integrated into the thermal image and profile displays of the ECS/CemScanner software.

Integrated scanner camera
Through the scanner window, an integrated camera visually discloses problems with dust on the window or whether the scanner head is out of alignment.

Kiln camera
Spyrometer or kiln TV can optionally be displayed as an integral part of a ECS/CemScanner system.

Trending
In addition to the built-in historical data, any specific process data such as shell temperatures in the burning zone and other sections of the kiln, tyre slips or maintenance data such as the scanner head temperature can be logged for monitoring, trend and early warning purposes.

Diagnostics
Comprehensive diagnostic information and KPI’s on the equipment conditions, scanner raw data, and data communication status are available for monitoring the system and to facilitate maintenance.

Shell heat loss
Shell heat loss from the whole kiln and/or subsections is calculated and can be displayed as trend curves.

Retrofit
In order to continuously serve our existing customers FLSmidth offers various upgrade solutions.

Scanner head
The high-speed infrared scanner heads offer market leading specifications, with superior accuracy and high reliability.

Standard cabinet
The scanner head is installed in a stainless steel rain-cover, with ball head support for easy installation. The cabinet is suitable for installation in areas with temperatures between -20°C and 50°C.

Rugged cabinet
The rugged cabinet can optionally be provided for installation in environments with temperatures outside -20°C and 50°C.

The protective stainless-steel scanner cabinet offers ample space for easy and open access to components. It is air-pressure and heated to maintain a temperature above -20°C and below 50°C.

Product features
- Thermal profile with various statistical values
- Kiln cross-sectional view
- Zoom 2D and 3D
- 3D-IR kiln thermal view from adjustable view angles
- 3D “walk-in-the-kiln” for on-line coating monitoring
- Review of several month of operation on the max temperature trend image
- Calculated brick and/or coating thickness
- User-defined color palette
- Built-in camera for controlling state of the window, obstructions and alignment of the scanner
- Optional OPC and PLC communication drivers for data exchange with plant PLC and SCADA system
- User-interface supporting most major languages

Positioning the ECS/CemScanner is easy with the integrated camera

All monitored parameters can easily be trended.
### Available scanner heads

#### Cement kilns

<table>
<thead>
<tr>
<th>Scanner Head Type</th>
<th>TMC8-1DH3</th>
<th>TMC5-1DH3</th>
<th>TMC4-1DH3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical Application Industry</td>
<td>Cement Kiln</td>
<td>Cement Kiln</td>
<td>Cement, Stereo</td>
</tr>
<tr>
<td>Detector type / Temperature range</td>
<td>MCT/75 - 700 °C</td>
<td>MCT/75 - 700 °C</td>
<td>MCT/75 - 700 °C</td>
</tr>
<tr>
<td>Resolution: (Hot spot detection, 50%)</td>
<td>0,8 mrad</td>
<td>2,2 mrad</td>
<td>2,7 mrad</td>
</tr>
<tr>
<td>Resolution: (Temp. measurement, 90%)</td>
<td>2,0 mrad</td>
<td>5,5 mrad</td>
<td>6,7 mrad</td>
</tr>
<tr>
<td>Scanning sector (FOV)</td>
<td>120°</td>
<td>120°</td>
<td>120°</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±1% or ±3°C Up to 300°C</td>
<td>±1% or ±3°C Up to 300°C</td>
<td>±2% or ±5°C Up to 300°C</td>
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<tr>
<td>Window type</td>
<td>Solid</td>
<td>Solid</td>
<td>Solid</td>
</tr>
<tr>
<td>Integrated IP Camera</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>-25 to - 60 °C</td>
<td>-25 to - 60 °C</td>
<td>-25 to - 60 °C</td>
</tr>
<tr>
<td>Dimensions/weight</td>
<td>244 x 260 x 147mm / 8 kg</td>
<td>244 x 200 x 147mm / 7 kg</td>
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</tr>
</tbody>
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#### Pulp & paper / minerals

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<th>TMC8-1DL3</th>
<th>TMC6-1DL3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical application industry</td>
<td>Pulp &amp; paper / minerals</td>
<td>Pulp &amp; paper / minerals</td>
</tr>
<tr>
<td>Detector type / Temperature range</td>
<td>MCT/50 - 500 °C</td>
<td>MCT/50 - 500 °C</td>
</tr>
<tr>
<td>Scanning frequency</td>
<td>20 Hz (8 - 25 Hz)</td>
<td>20 Hz (8 - 25 Hz)</td>
</tr>
<tr>
<td>Resolution: (Hot spot detection, 50%)</td>
<td>2,0 mRad</td>
<td>3,3 mRad</td>
</tr>
<tr>
<td>Resolution: (Temp. measurement, 0%)</td>
<td>5 mRad</td>
<td>8,3 mrad</td>
</tr>
<tr>
<td>Scanning sector (FOV)</td>
<td>120°</td>
<td>120°</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±1% or ±3°C Up to 100°C</td>
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<td>Solid</td>
<td>Solid</td>
</tr>
<tr>
<td>Integrated IP Camera</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Operating temperature range</td>
<td>-25 to + 55 °C</td>
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