Boiler Diagnostic Systems
Imaging and Water Level Measurement

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Abstract

A range of diagnostic tools are available for boilers including visual and infrared camera systems, through lens temperature measure and optical pyrometers. Water level measurement products, both visual gauges and electronic level indicators, are also available. This presentation will describe the boiler imaging and water level measurement technologies available from Diamond Electronics and their applications.
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TITLE: Principal Engineer, Boiler Performance
BIOGRAPHICAL PARAGRAPH:
Jeffrey S. Kite is a Principal Engineer, Boiler Performance for Diamond Power International and is tasked as one of Diamond Power’s lead technical engineers to work with clients to address boiler performance problems. Jeff is also responsible for the implementation and performance of Diamond Power’s intelligent sootblowing products and conducting boiler performance evaluations. Jeff was the Lead Mechanical Engineer for Applied Synergistics, a pioneering company in intelligent sootblowing, from March 1994 until December 2002 when it was purchased by Diamond Power. Jeff is a graduate of the University of Tulsa with a Bachelor of Science in Mechanical Engineering. Jeff received his certification as a Professional Engineer in Virginia in February 1994. Jeff has been a member of ASME since 1986, and currently participates in two subcommittees. Jeff currently serves on the PRB Coal Users’ Group Board of Directors.
Agenda

• Imaging solutions
• Gas temperature measurement
• Water level measurement
Infrared (IR) Cameras

• Advanced technology infrared camera systems
  – SmeltCam® AT III for recovery boilers
  – UtiliCam® AT III for utility boilers
IR Camera Features

• 105° Diagonal field-of-view
• 1.5” (3.81cm) outer optical probe diameter
• Easily retrofits to existing vidicon IR camera systems
• Color options to further improve monitoring capabilities
• Focusing from rear plate
• Retract system protects the air-cooled camera assembly from air system failure
• TemPro™ II temperature measurement option
IR Camera Benefits

- Improved boiler monitoring
- No vidicon tube replacements
- No calibration
- Reduced operating and maintenance costs over conventional Vidicon / lens tube camera systems
- Dual-walled construction housing
  - High-temperature camera housing isolates and seals the camera from contaminants in plant air supply
UtiliCam® AT III
Visible Range Cameras

• **Wall-Eye™ HD**
  – High definition visible range process viewing system

• **KilnCam™**
  – High resolution Kiln camera w/TempVU temperature measurement software
Wall-Eye™ HD Features

- High resolution, 1/3” format optical probe with optics capable of withstanding temperatures in excess of 1100° F (593.3° C)
- Optics are factory assembled replaceable units for easy maintenance
- Allows for various sizes/designs of cameras including Internet protocol (IP) cameras
- Electronic Digital Pan, Tilt, and Zoom features on select models (local or with remote controller)
- Auto Focus (local or with remote controller)
- Remote camera control using the same coaxial cable used for video display
Wall-Eye™ HD Benefits

- Monitor/inspect areas of the boiler or furnace for process control and performance optimization
- Simplifies maintenance with easy field adjustments
- Provides for lower maintenance & cooling costs
- Delivers highest definition images in the industry
- Provides excellent Field of View = 80°H x 58°V
- Greatly reduces air consumption
- Dual-walled construction housing
  - High-temperature camera housing isolates and seals the camera from contaminants in plant air supply
KilnCam™ Advantages

- 2 color temperature measurement for higher accuracy
- Temperature accuracy = +/- 1%
- Temperature range = 1,400°F to 3,000°F
- High resolution 1024x768 SVGA images
- High resolution/temperature optical probe
- GigE output
- TempVU temperature measurement software
- No moving parts
- Dual-walled construction housing
  - High-temperature camera housing isolates and seals the camera from contaminants in plant air supply
KilnCam™

• Applications
  – Lime Kilns
  – Cement Kilns
  – Steel Slab Reheat Furnace
  – Steel Billet Reheat Furnace

Lime Kiln
KilnCam™ with TempVU

Lime Kiln
KilnCam™ with TempVU

Lime Kiln
TemPro™ II Features/Benefits

• Measures boiler temperatures ranging from 1000°-3000° F
• Monitors up to 15 regions
• +/- 1% degree of accuracy
• 105° diagonal field-of-view
• Remote or local monitoring - LCD screen on camera housing
• NEMA 12 housing to withstand harsh boiler side environments
• Easily integrates into existing DCS
• CSV output to log readings and perform trend analyses
• Capture screen shots at user defined intervals
• Real-time graphical trending
• Bed formation tracking
• Sequential switching of cameras
• Optional 4-20 mA I/O
GasTemp® XT

Extended range optical pyrometer

The GASTEMP® XT optical pyrometer provides absolute temperature data rather than just the direction of temperature change. U.S. Patent 6,733,173 B1
GasTemp® XT Features

• Rugged to withstand the fireside environment
• Small, lightweight design for easy installation and convenient portability
• Built-in readout display with menu driven set-up
• Provides both analog and visual output signals
GasTemp® XT Advantages

The GASTEMP® XT optical pyrometer’s design has been proven to be significantly less sensitive to fuel changes than other commercially available devices.
GasTemp® XT Benefits

- Improved efficiency, reduced Emissions
- Suitable for fuel switches
- Simple, anywhere installation
- Dual-use device
Water Level Monitoring

Diamond® Series II
WATER LEVEL MEASUREMENT PRODUCTS

VISUAL GAUGES / REQUIRED BY CODE (ASME)
- Diamond® Series II  Bi-Color Gauge
- Diamond® Series II  Flatglass
- Diamond® Series II  Reflex

ELECTRONIC LEVEL INDICATORS
- Diamond® Series II  Single Detection Circuit (SDC)
- Diamond® Series II  1 to 4 Probe System
- Diamond® Series II  Multi-Probe System
Diamond® Series II
Visual Gauges

• **Visual Ported Level (Bi-color)**
  – High Pressure 3000 psi

• **Flatglass Gauge**
  – Intermediate Pressure 1000 psi

• **Reflex Gauge**
  – Low Pressure 650 psi (350 psi for steam)
Diamond® Series II
Visual Ported Level (Bi-Color)

- PORTED GAUGE
- GAUGE VISIBILITY
- RATED 3000 PSI / 696°F
- PATENTED LED ILLUMINATOR
- LONG LIFE EXPENTANCY
Diamond® Series II
LED Illuminator
Isolation Valves

Handwheel / Chainwheel

Flow Restrictor & Ball Check
(prevents excessive flow if gauge glass breaks)
Diamond® Series II
Flatglass Gauge

- Rated 1000 psi / 546°F
- Mica shields
- Borosilicate glass
- Single or multiple gauge bodies
- Optional LED illuminator
Diamond® Series II
Reflex Gauge

Rated 350 PSI / 432°F
Borosilicate Glass
Single or Multiple Gauge Sections

Grooved Glass Produces Black/White Image
Diamond® Series II
Electronic Level Indicator (Conductivity)

- Multi-Probe
- 1 to 4 Probe
- Single Detection Circuit (SDC) Probe
Diamond® Series II
Multi-Probe (ELI)

Electronic Unit
Typically 5-12 Probes
(Up To 48 Probes)

Remote Display
(Control Room)

Probe Column
Multi-Probe Electronics

Differentiates between steam / water based on conductivity differences

All probe levels have available alarm / trip relays

DC voltage improves low conductivity water detection

Reversing DC voltage polarity (±) prevents electroplating
# APPLICATIONS

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Hazardous Area
Multi-Probe ELI or Visual Gauge

Ethylene & Petro-chemical

Explosion Proof Enclosures

Zener Barriers

Configuration For Visual & Electronic Level Gauges
Why Diamond?

Unlike many of our competitors Diamond is more than a gauge supplier.

For over 100 years Diamond Power has provided industrial customers in markets such as Power, Pulp & Paper, Steel, Petroleum and others with solutions to their operating needs. Diamond has the experience and understanding of our customers process to assist with problem solving. Our products range from process monitoring, Boiler cleaning, ash handling and process controls.
Conclusion

- Cost Competitive
- High –Medium –Low pressure product offerings
- Can be direct replacement for old model Diamond gauges in most applications
- Old model Diamond gauges will continue to be supported
Questions?

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