

Trusted for experience. Preferred for performance.

Boiler Diagnostic Systems Imaging and Water Level Measurement

Western Regional Boiler Association Conference

March 8, 2016

Portland, OR

© 2016 DIAMOND POWER INTERNATIONAL, INC. ALL RIGHTS RESERVED. This document is the property of DIAMOND POWER INTERNATIONAL, INC. (DPII) and is "CONFIDENTIAL AND PROPRIETARY" to DPII. Recipient and/or its representatives have, by receiving same, agreed to maintain its confidentiality and shall not reproduce, copy, disclose or disseminate the contents, in whole or in part, to any person or entity other than the Recipient and/or Recipient's representatives without the prior written consent of DPII.





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.



Speaker Biography



NAME: Jeffrey S. Kite, P.E.

COMPANY: Diamond Power International, Inc.

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



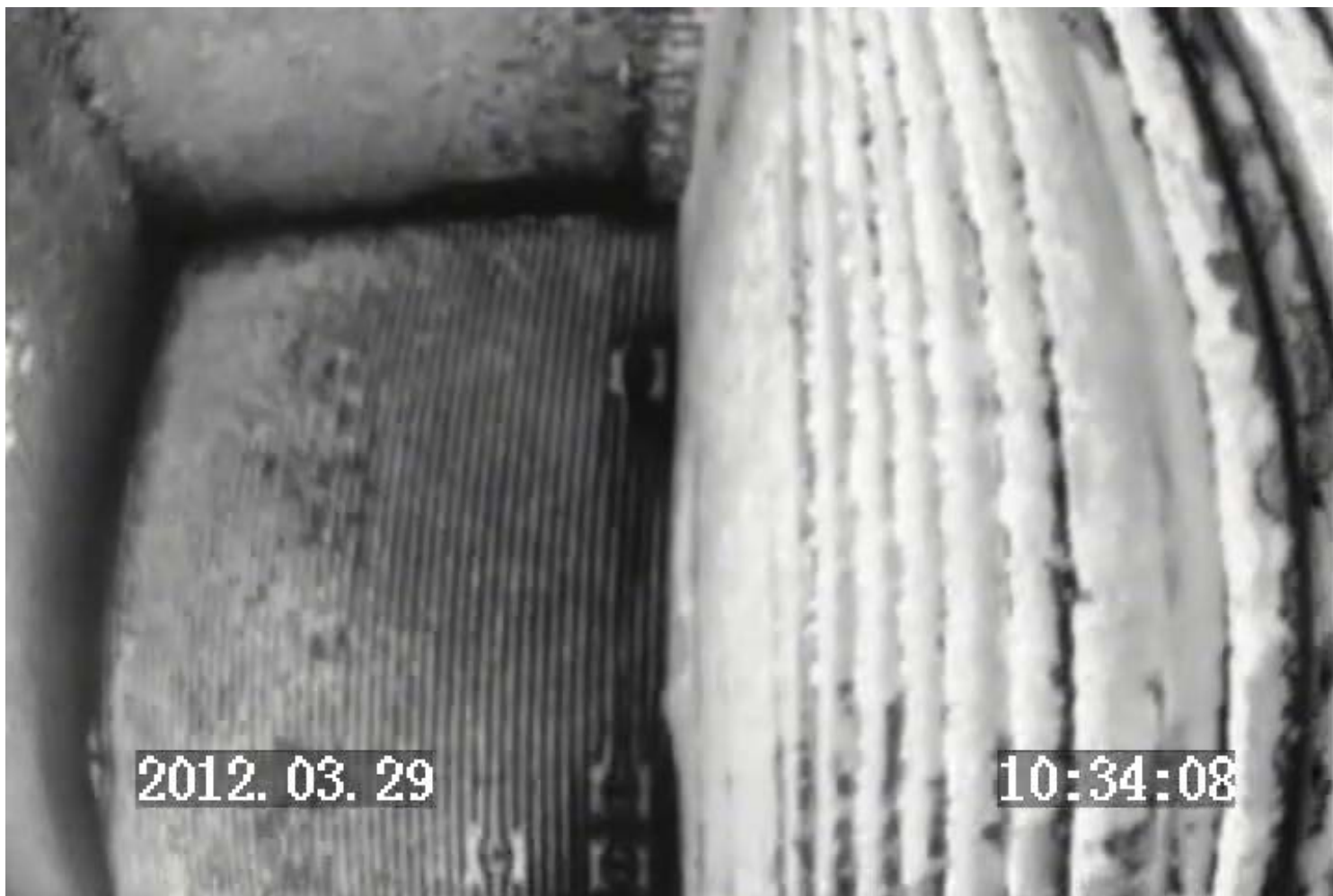


UtiliCam[®] AT III

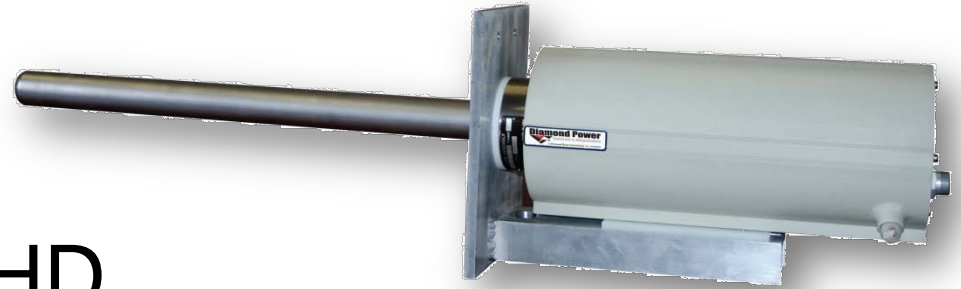




UtiliCam[®] AT III



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



Wall-Eye™ HD





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



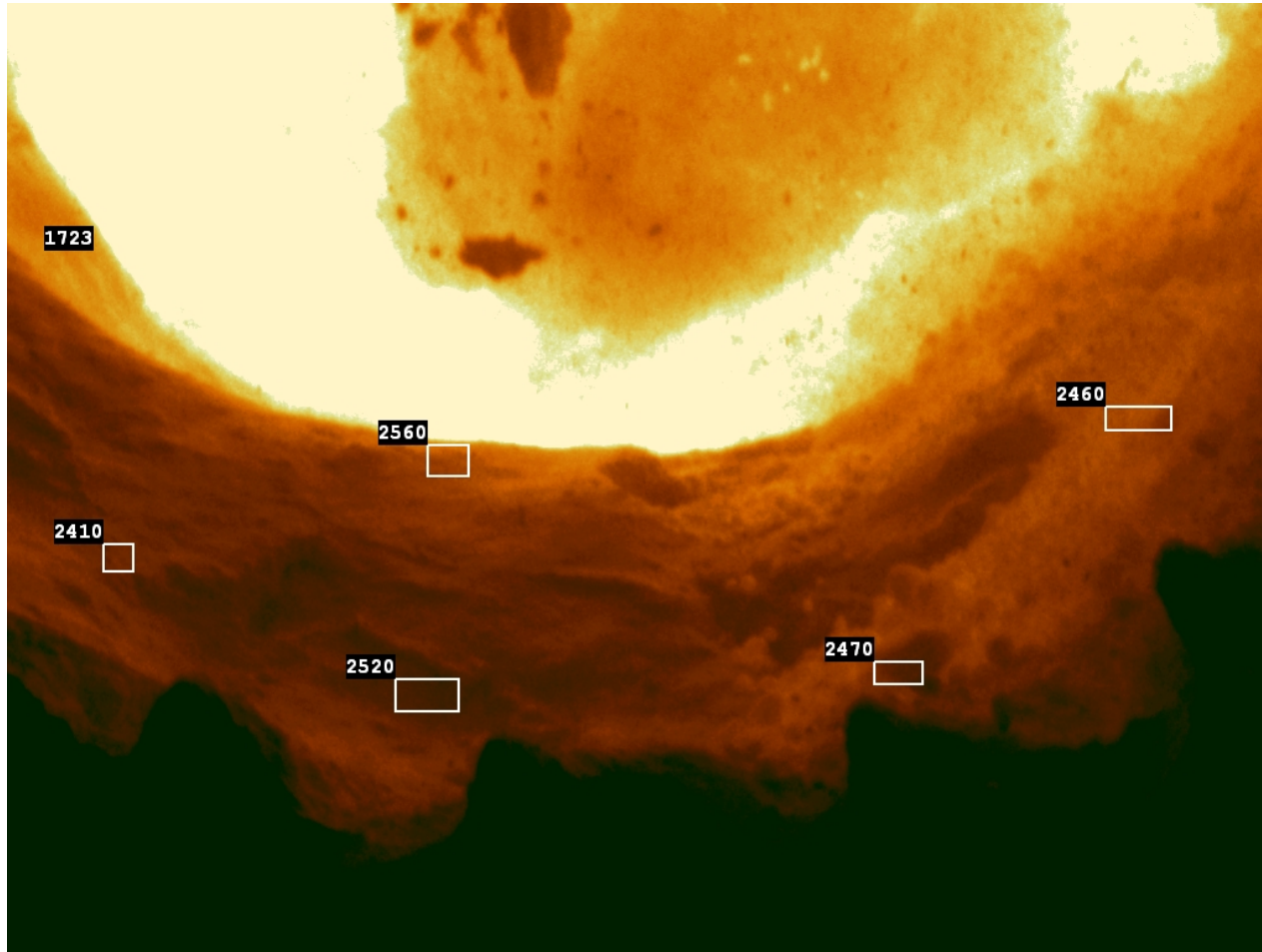
KilnCam™

- 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





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



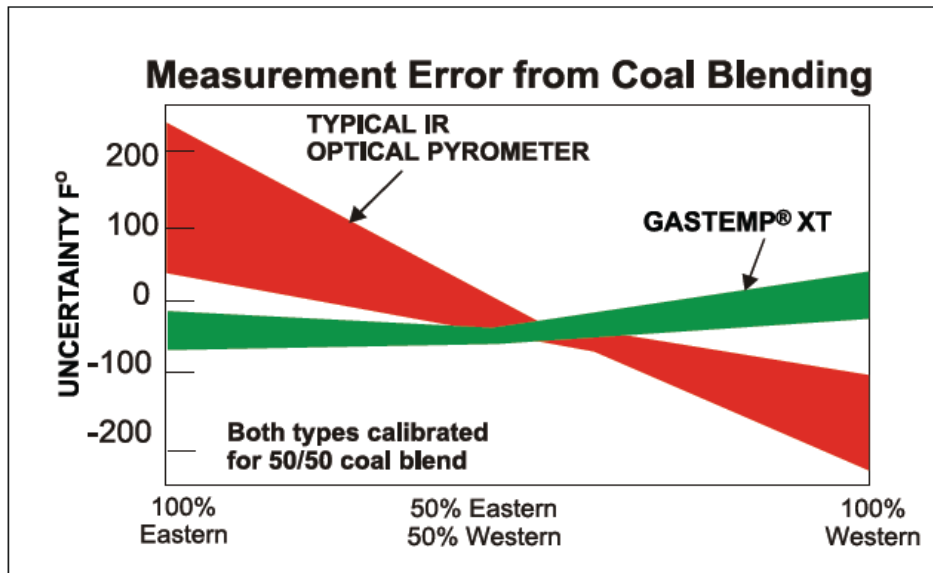


GasTemp[®] XT Features

- 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**





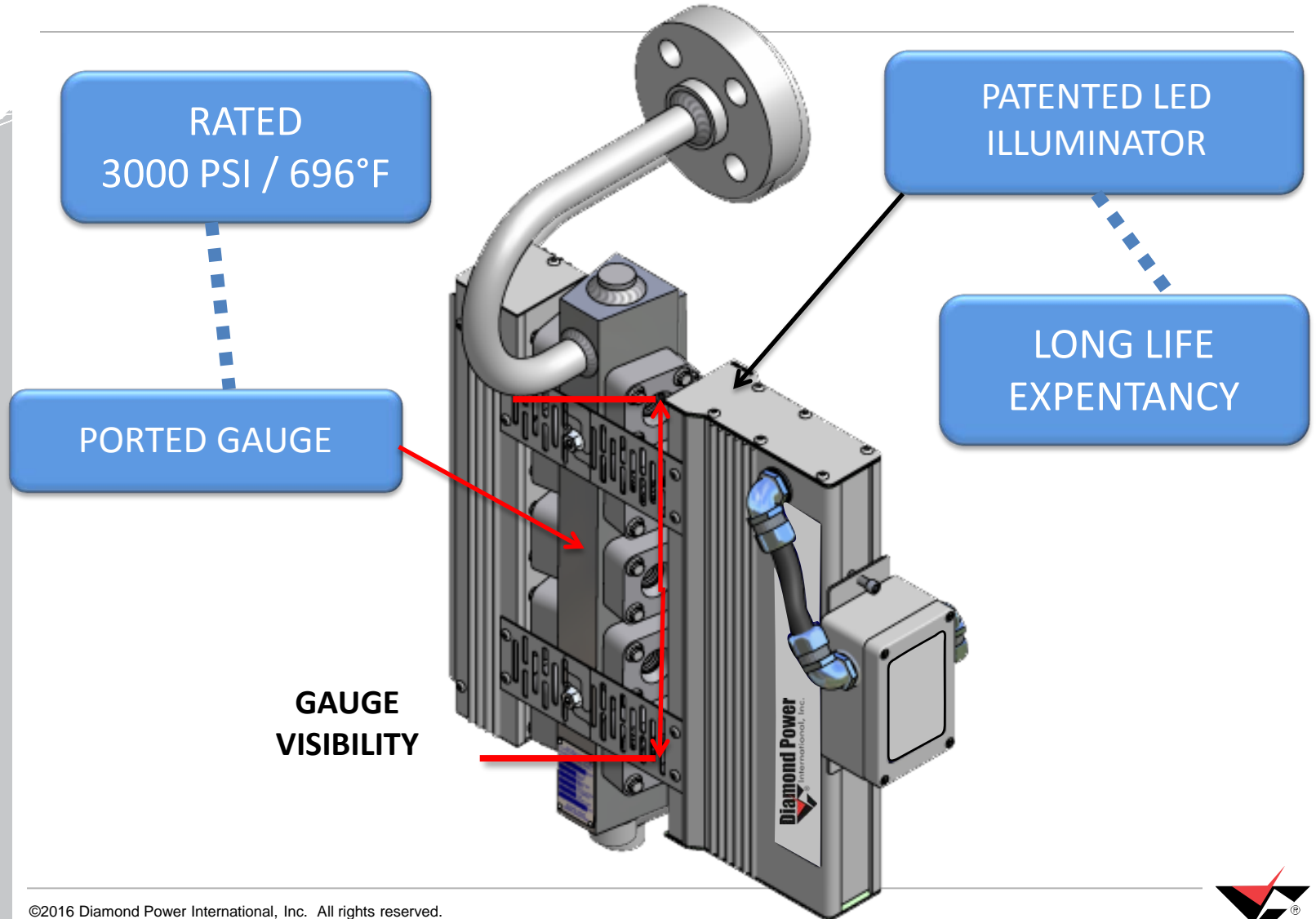
Diamond[®] Series II

Visual Gauges

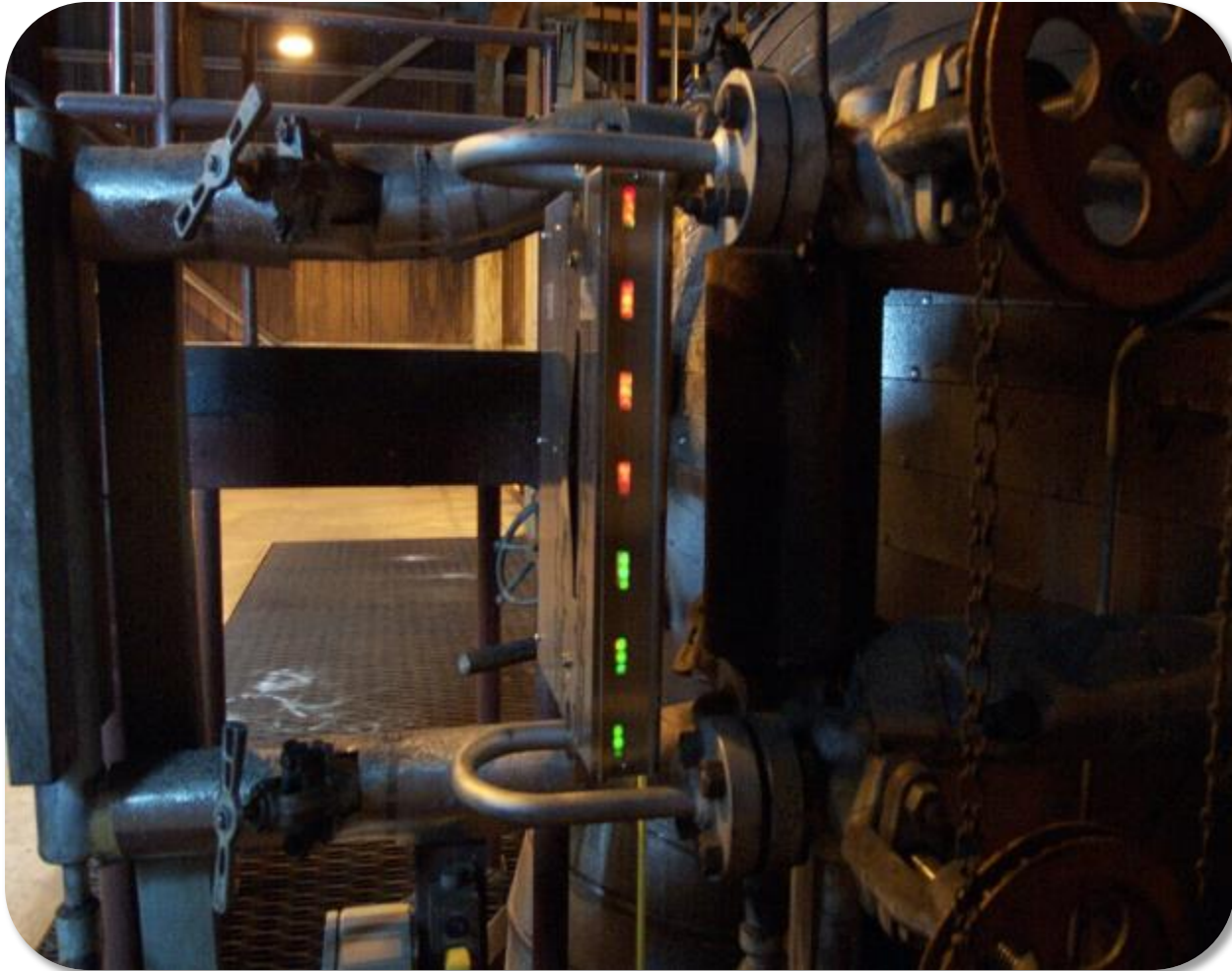
- **Visual Ported Level (Bi-color)**
 - High Pressure 3000 psi
- **Flatglass Gauge**
 - Intermediate Pressure 1000 psi
- **Reflex Gauge**
 - Low Pressure 650 psi (350 psi for steam)



Diamond[®] Series II Visual Ported Level (Bi-Color)



Diamond[®] Series II LED Illuminator



Isolation Valves

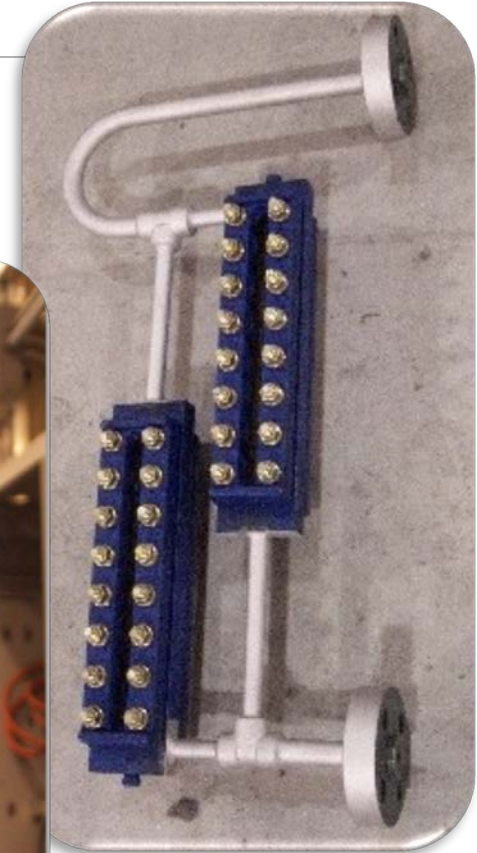
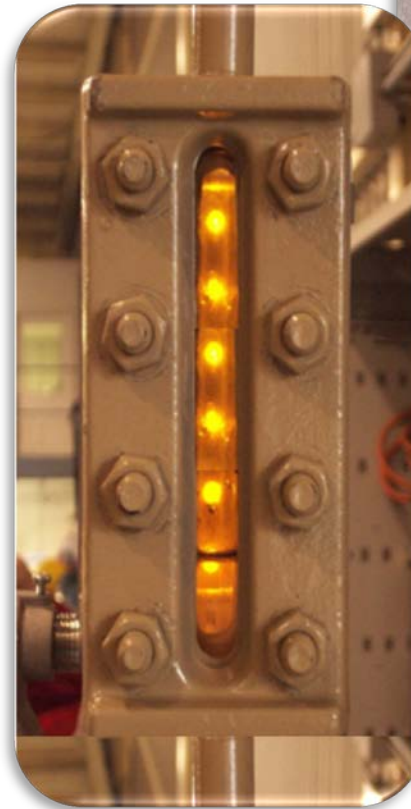
Handwheel / Chainwheel

**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

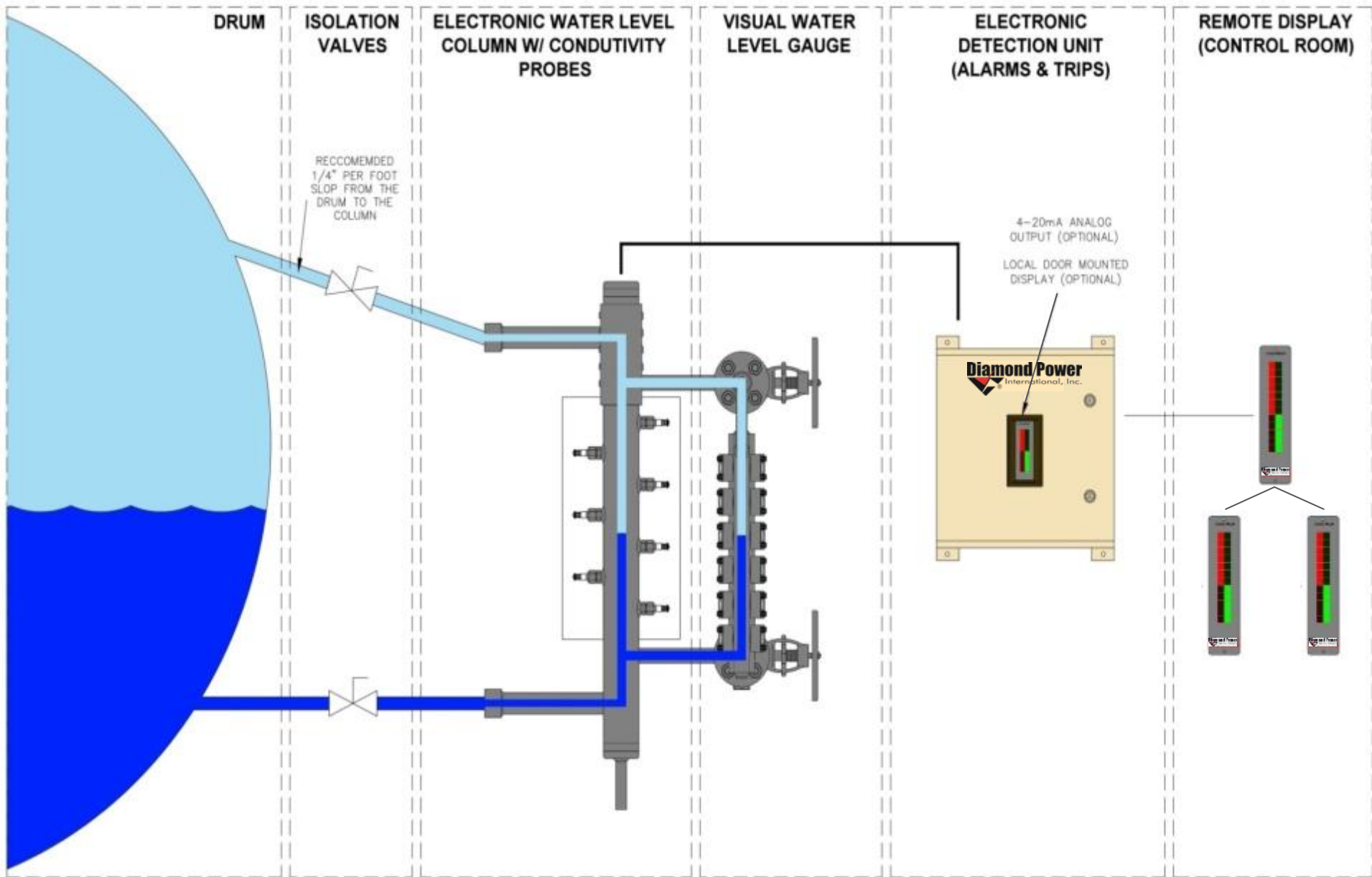
Differentiates between steam / water based on conductivity differences

All probe levels have available alarm / trip relays

DC voltage improves low conductivity water detection

Reversing DC voltage polarity (\pm) prevents electroplating





APPLICATIONS

POWER
BOILER

Visual
GAUGE

Multi-Probe
LEVEL
Indicator

FEEDWATER
HEATER

1 to 4
Probe
Indicator

Multi-Probe
LEVEL
Indicator

TURBINE
WATER
PROTECTION

1 to 4
Probe
Indicator

Single
Detection
Circuit

HEAT
RECOVERY
STEAM
GENERATOR
(HRSG)

Ported Visual
GAUGE

FLATGLASS
GAUGE

REFLEX
GAUGE

Multi-Probe

HAZARDOUS
AREA

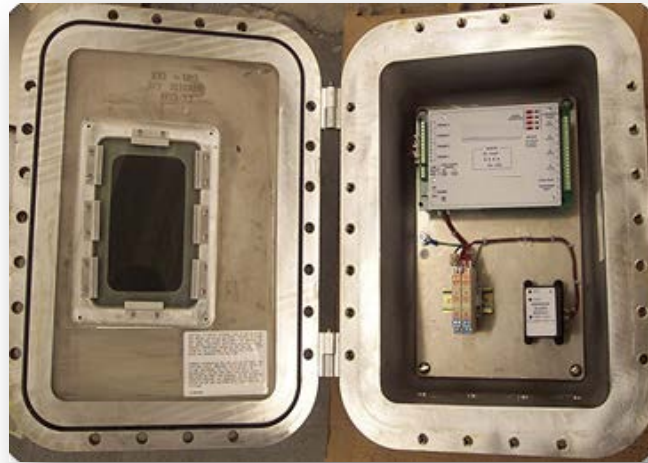
Visual
GAUGE

Multi-Probe
LEVEL
Indicator



Hazardous Area

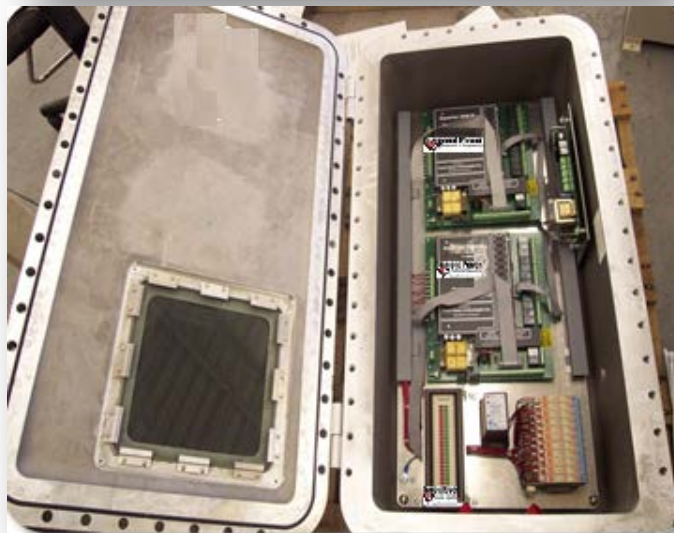
Multi-Probe ELI or Visual Gauge



Ethylene &
Petro-chemical

Explosion Proof
Enclosures

Zener Barriers



Configuration For
Visual & Electronic
Level Gauges





Why Diamond?

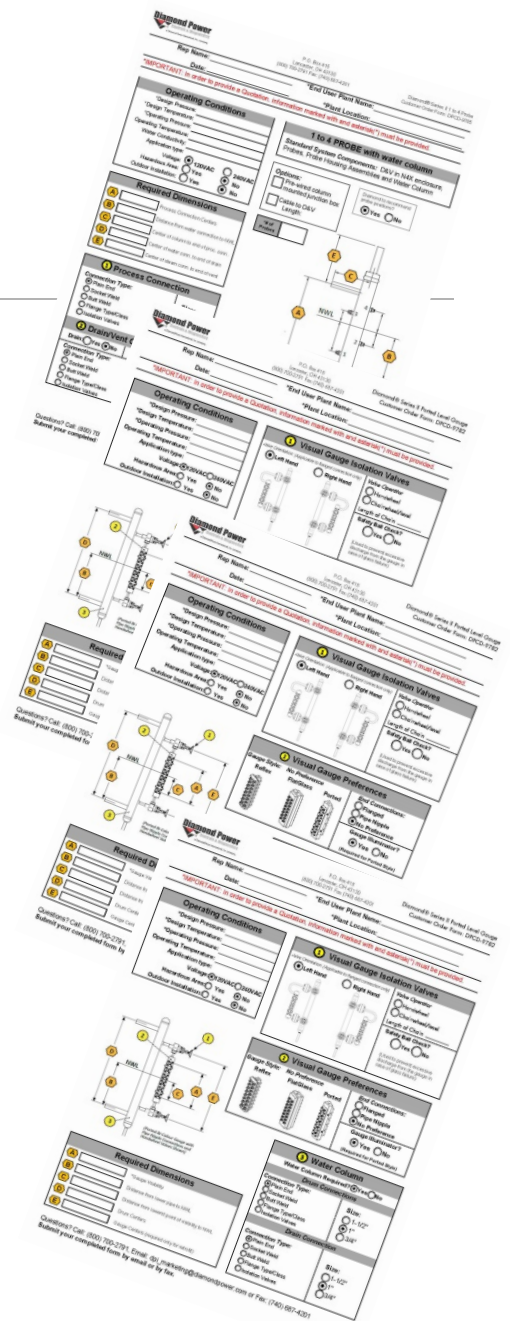
Unlike many of our competitors Diamond is more than a gauge supplier.

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?

Jeff Kite
Principal Engineer
Diamond Power

2600 East Main St.
P.O. Box 415
Lancaster, Ohio 43130-0415

Tel: (740) 687-4388
Fax: (740) 687-4301
Cell: (434) 258-5222
E-mail: jskite@diamondpower.com

Ronald Pon
Account Manager
Babcock & Wilcox

710 Airpark Road
Napa, CA 94558

Tel: (707) 265-1055
Fax: (707) 265-1000
Cell: (925) 451-4272
E-mail: rtpon@babcock.com

