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Coking.com
MORE PRODUCTION - LESS RISK!

Improving Decoking System Reliability

Coking.com Calgary
September 2009

Experience In Motion

Flowserve Overview

Flowserve is the recognized world leader in supplying pumps, valves, seals automation and services to the power, oil, gas, chemical and other industries.

With more than 14,000 employees in more than 56 countries, we combine our global reach with a local presence.

Serving the process industries with a strong history of brand names and industry experience

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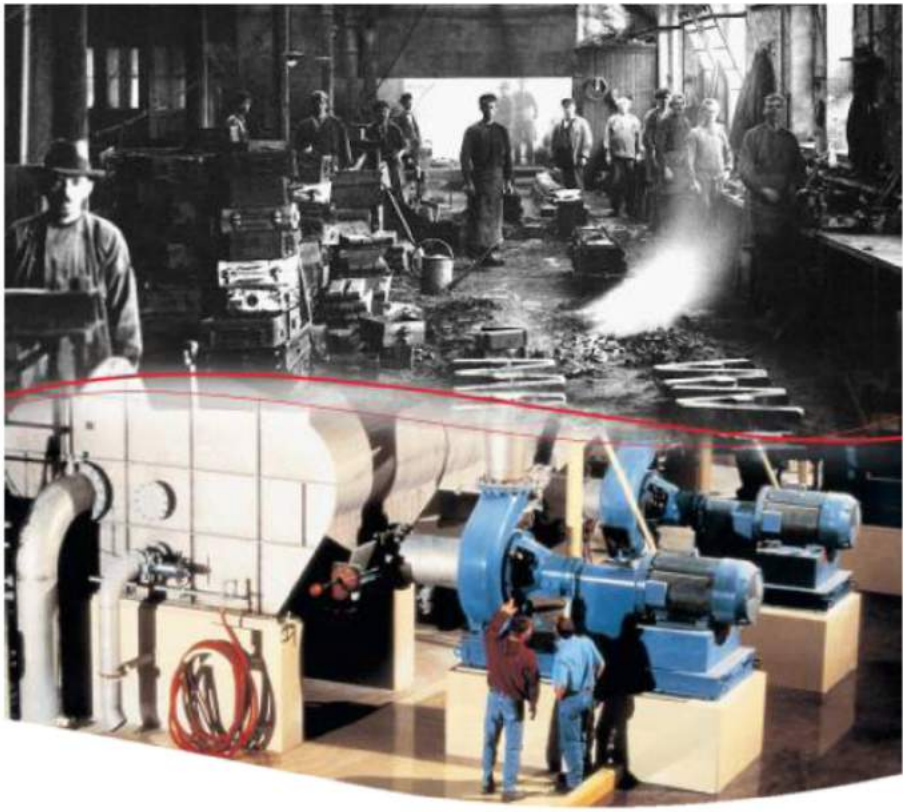
Flowserve History

- The Flowserve heritage dates back to the 1790 founding of Simpson & Thompson
- The company was created in 1997 with the merger of two leading fluid motion and control companies – BW/IP and Durco International
- The Flowserve Corporation includes more than 50 companies and product brands



Breadth of Flowserve Products

Valves

- Ball Valves
- Plug Valves
- Gate, Globe, Check Valves
- Globe Control Valves
- Rotary Control Valves
- Actuators
- Steam Valves and Traps
- Positioners
- Switches
- Services

Pumps

- Multi-Stage Pumps
- Vertical Pumps
- High Pressure Pumps
- Multi-Phase pumps
- ANSI/API/ISO Pumps
- Specialty Products
  - Hydraulic Decoking
  - LNG Expanders
  - Ebullators
- Services

Seals

- Mechanical Seals
  - Bellows
  - Compressors
  - Lift-Off, Dry Running
  - Mixer
  - Pusher
  - Steam
  - Standard Cartridge
  - Slurry
- Services

Oil and Gas (Exploration, Pipeline, Refining) • Power Generation • Chemicals • Food and Beverage Waste Water • Clean Water • Aerospace • Pharmaceuticals • Agriculture • Navy/Marine

Hydraulic Decoking Systems

Flowserve is the recognized world leader for decoking

- Combined technology of 

and 

heritage companies
- Reliable operation since 1938
- Operating in over 150 delayed coker units worldwide

Continuously developing solutions to improve safety, reliability and value to refiners

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Challenges facing end users

- Reduced operating budgets flat
- Rising energy costs
- Spare parts inventory
  - Availability, carrying costs
- Unplanned or Emergency breakdowns
- Lack of useful data / too much data
  - Expertise in what it all means
- Aging workforce
  - Rotating equipment expertise retiring

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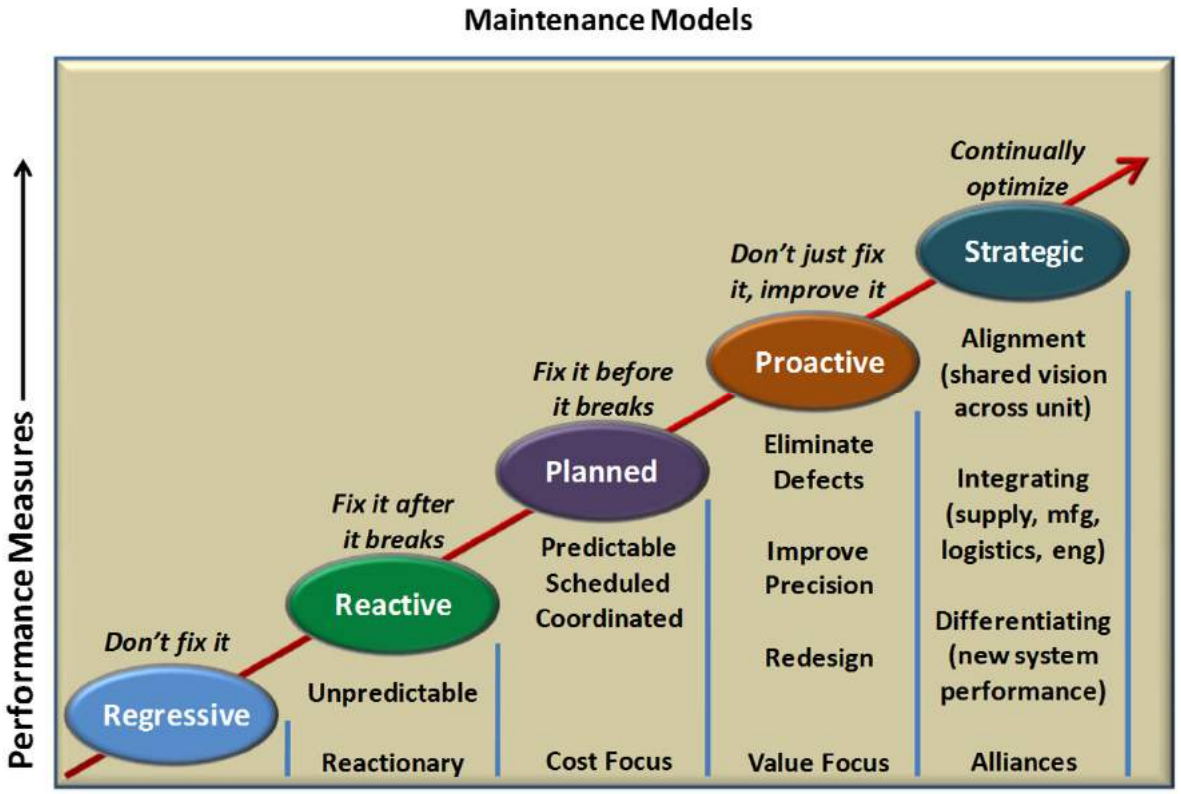
Reducing Cost & Maximizing Reliability



- Training
- Failure prevention technology
- Predictive maintenance
- Energy monitoring & optimization
- Additional consultative services
  - Inventory reduction management assistance
  - Outsource repair/rebuild activities
  - Engineering services

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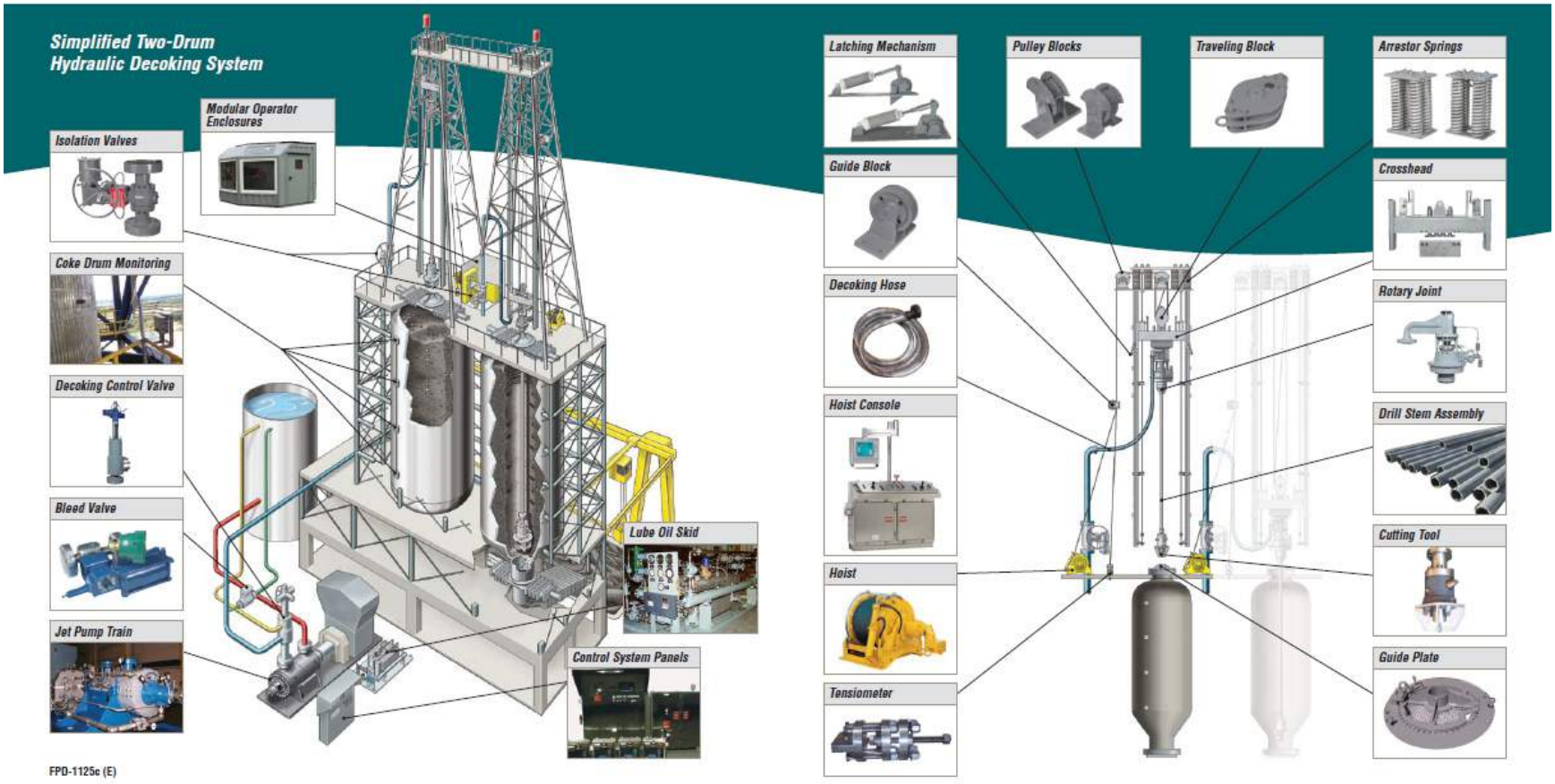
Hydraulic Decoking Systems

1. Remove coke from drum
2. Protect personnel
3. Maximize performance and reliability

Hydraulic Decoking Systems



Online Assurance™ for Hydraulic Decoking

- Utilizes system operational data for conversion into actionable information
- Goal is to improve reliability, availability and efficiency of the decoking system

Online Assurance for Hydraulic Decoking

- Real-time equipment monitoring and control systems
- Advanced diagnostics algorithms which predict equipment behavior and provide information to help prevent unplanned or emergency breakdowns
- Intelligent algorithms for automated control of the decoking process
- Customized data viewing portals for global access to actionable information

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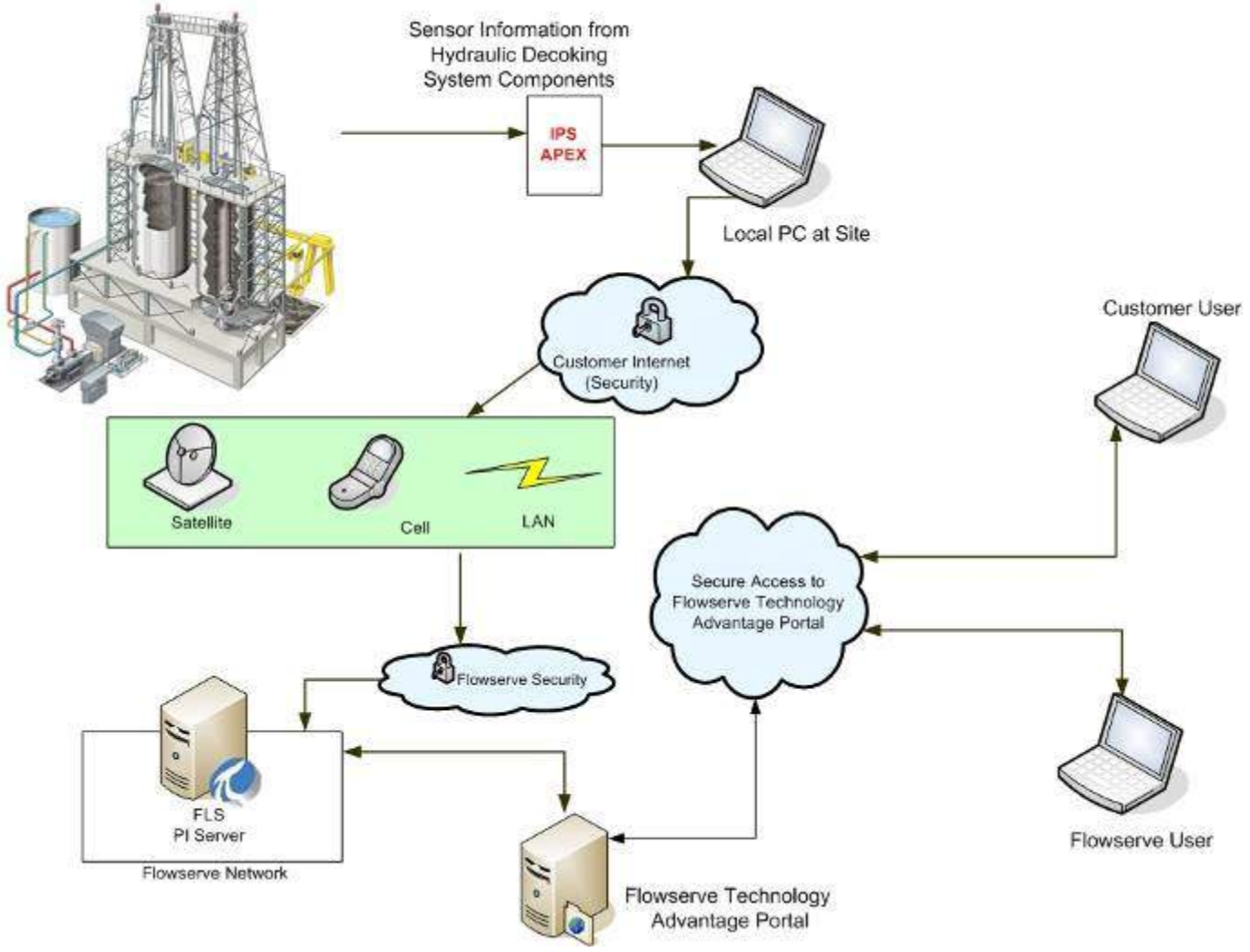
Real-time equipment monitoring



Decoking System Diagnostics

- Jet pump performance, pressures and cutting times to assess cutting nozzle wear
- Decoking valve differential pressures and flows for proactive maintenance
- Rotary joint bearing vibration, gear box oil condition and seal leakage for proactive maintenance
- Equipment in-service counters for preventive maintenance reminders

Automated Decoking

Fully automated systems

- Embedded intelligence and advanced algorithms to process signals and control the cutting process
- Automatic coke cutting with continuous feedback
- Operator consulting only required for exceptions

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Automated Decoking

Benefits

- Improved cutting personnel safety
- Process efficiency and consistency
- Improved equipment reliability
- Data recording for process optimization or troubleshooting

Automated Decoking

Basic operation

- Use vibration sensors mounted on the coke drum to provide feedback on the state of cleanliness of the drum wall
- Sensors provide interactive feedback on the cutting status that can optimize the cutting time
- Program is customized based on site-specific cutting practices and configured with end user

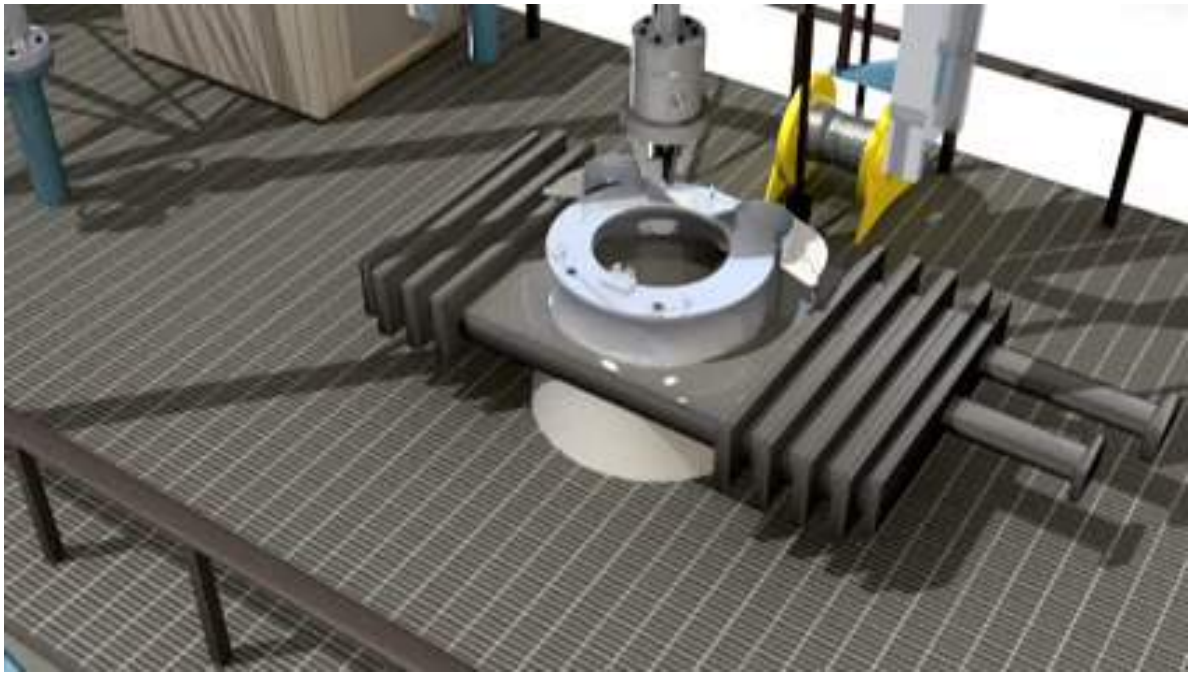
Hydraulic Decoking Procedure

Removing coke from the drum

- Fracture coke bed hydraulically using high-pressure water
- Cutting water is recycled

- 2-Step process

    1. Boring



Hydraulic Decoking Procedure

Removing coke from the drum

- Fracture coke bed hydraulically using high-pressure water
- Cutting water is recycled

- 2-Step process

    1. Boring

    2. Cutting

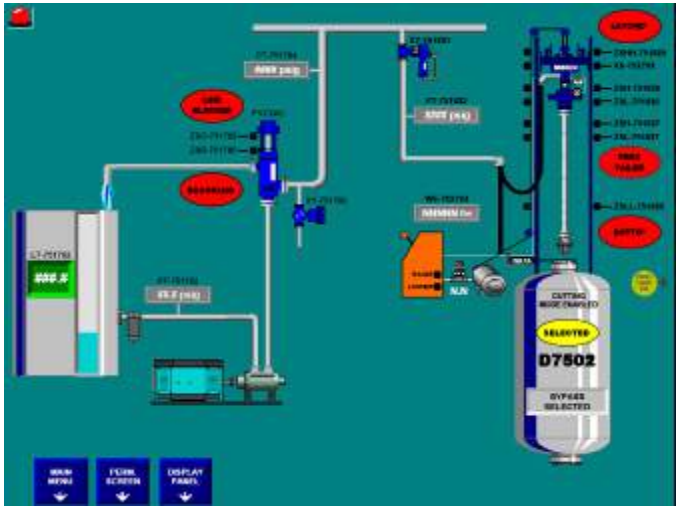
AutoShift Installations

- Flowserve has AutoShift tools in-service since January 2004
- Currently have 98 AutoShift tools in operation at 32 refineries
- More than 70 additional tools/conversions are pending delivery or commissioning

Automated Decoking

Winch and drill stem are operated via PLC control unit and depend upon signals monitoring:

- Position of the cutting tool
- Speed for lowering and lifting the cutting tool
- Wire rope tension
- Rotation of the drill stem
- Coke cutting progress via drum monitoring system

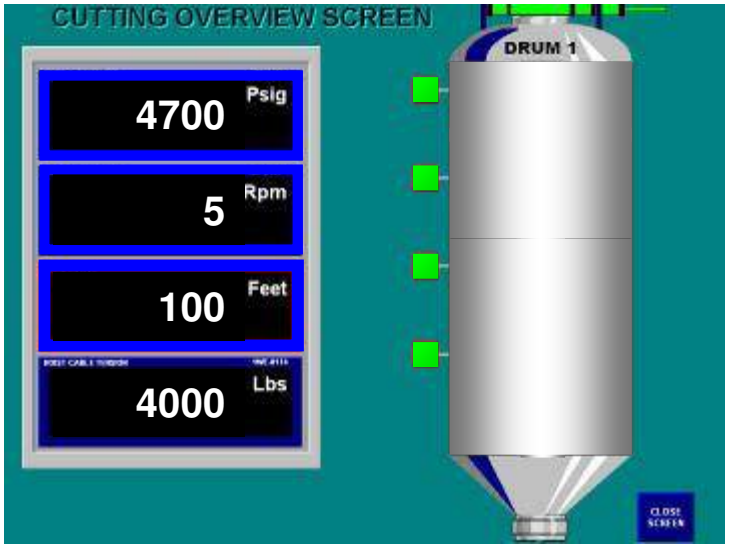


Coke Drum Monitoring

Vibration systems

- Progress monitored on customizable display screens

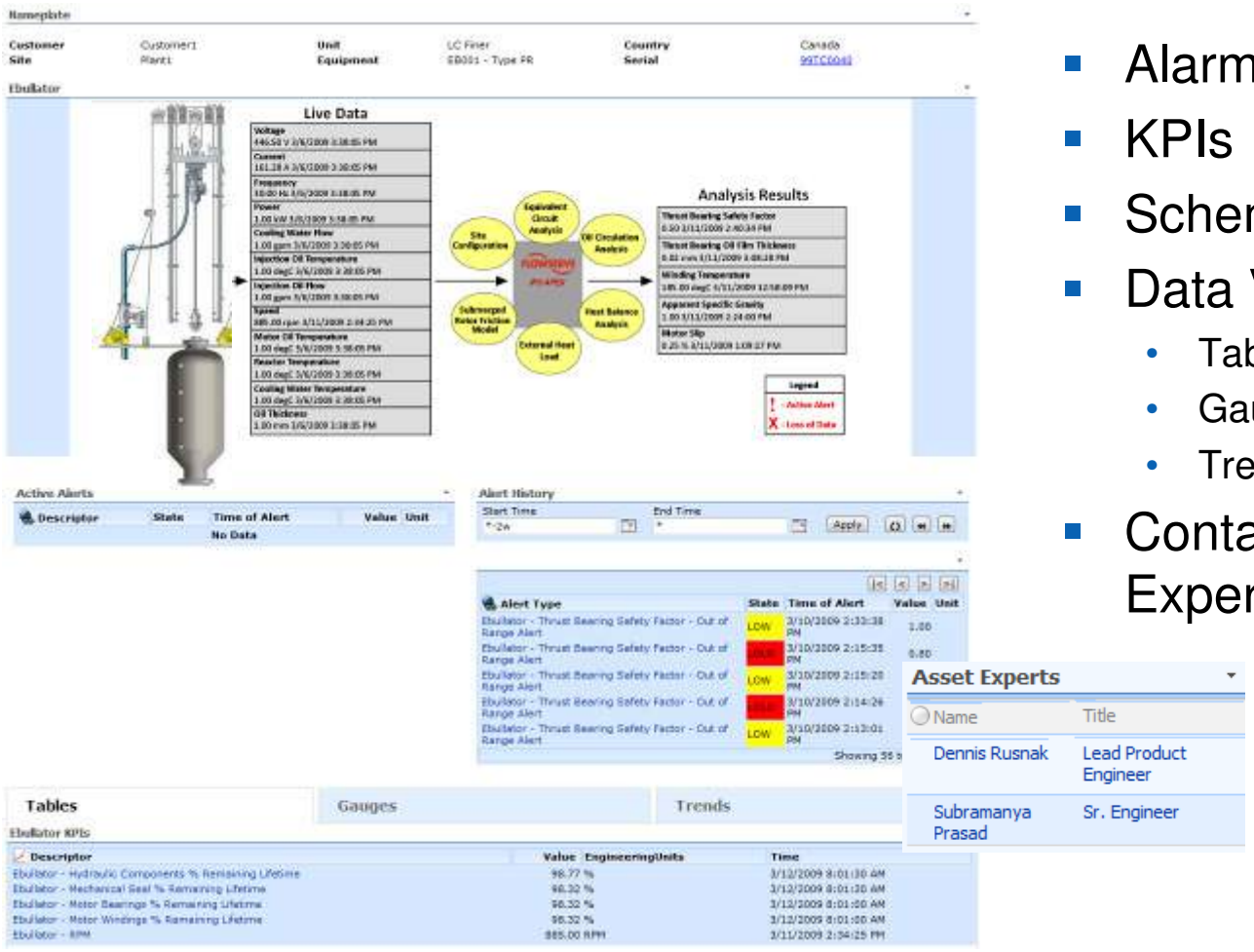
CUTTING



Online Assurance for Hydraulic Decoking

- Customized data viewing portals for global access to actionable information

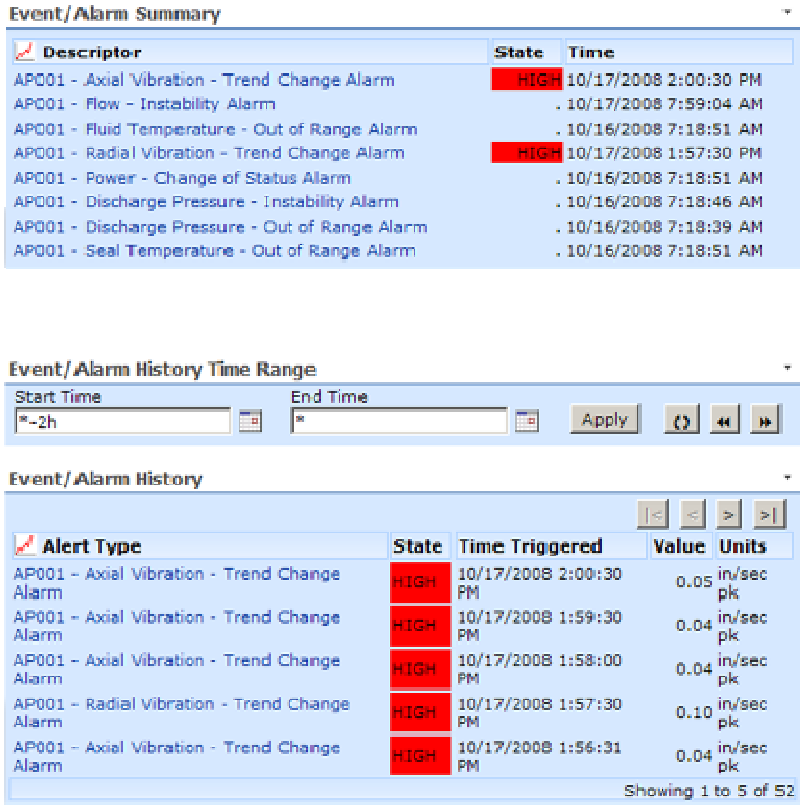
Unit / Equipment Level



- Alarms / Notifications
- KPIs
- Schematics
- Data Views:
  - Tables
  - Gauges
  - Trends
- Contact: Asset Experts

Alarms / Notifications

- Setup based on sensory data, KPIs, or custom formulas
- Notifications can be sent via e-mail or SMS
- Alarms can be color coded



Event/Alarm Summary

Descriptor	State	Time
AP001 - Axial Vibration - Trend Change Alarm	HIGH	10/17/2008 2:00:30 PM
AP001 - Flow - Instability Alarm		10/17/2008 7:59:04 AM
AP001 - Fluid Temperature - Out of Range Alarm		10/16/2008 7:18:51 AM
AP001 - Radial Vibration - Trend Change Alarm	HIGH	10/17/2008 1:57:30 PM
AP001 - Power - Change of Status Alarm		10/16/2008 7:18:51 AM
AP001 - Discharge Pressure - Instability Alarm		10/16/2008 7:18:46 AM
AP001 - Discharge Pressure - Out of Range Alarm		10/16/2008 7:18:39 AM
AP001 - Seal Temperature - Out of Range Alarm		10/16/2008 7:18:51 AM

Event/Alarm History Time Range

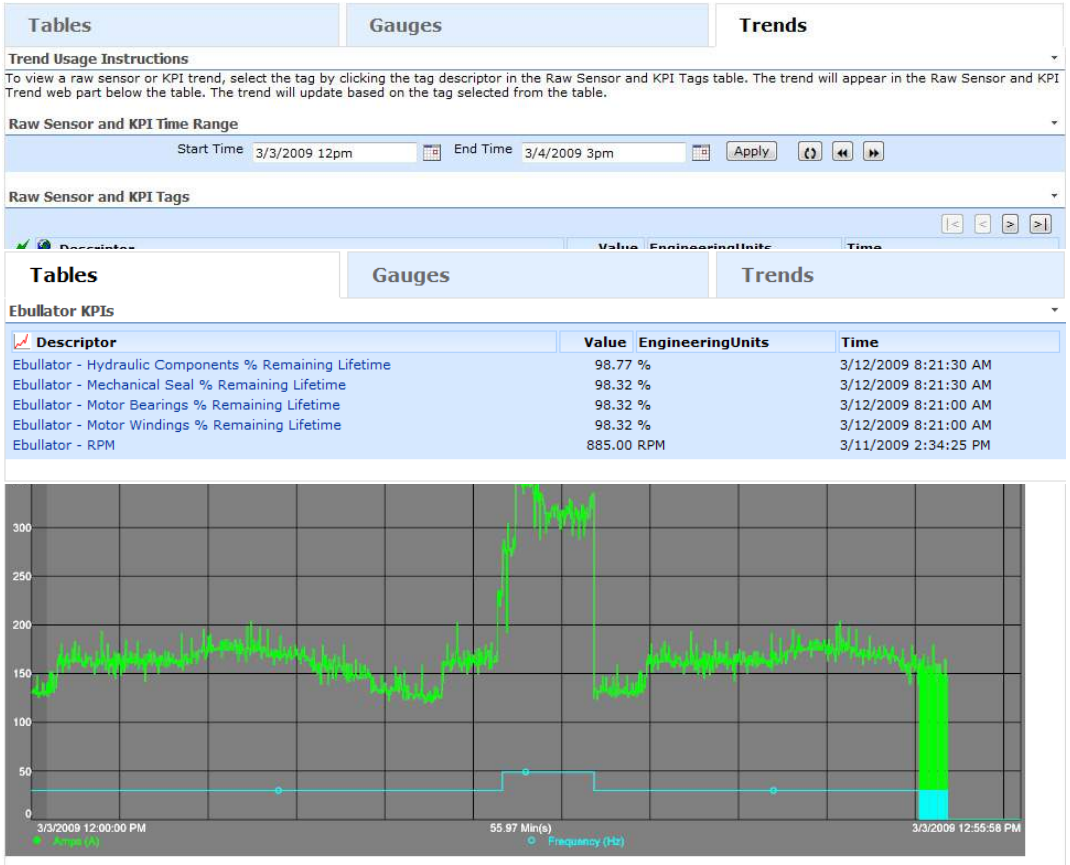
Start Time: *-2h End Time: * Apply

Event/Alarm History

Alert Type	State	Time Triggered	Value	Units
AP001 - Axial Vibration - Trend Change Alarm	HIGH	10/17/2008 2:00:30 PM	0.05	in/sec pk
AP001 - Axial Vibration - Trend Change Alarm	HIGH	10/17/2008 1:59:30 PM	0.04	in/sec pk
AP001 - Axial Vibration - Trend Change Alarm	HIGH	10/17/2008 1:58:00 PM	0.04	in/sec pk
AP001 - Radial Vibration - Trend Change Alarm	HIGH	10/17/2008 1:57:30 PM	0.10	in/sec pk
AP001 - Axial Vibration - Trend Change Alarm	HIGH	10/17/2008 1:56:31 PM	0.04	in/sec pk

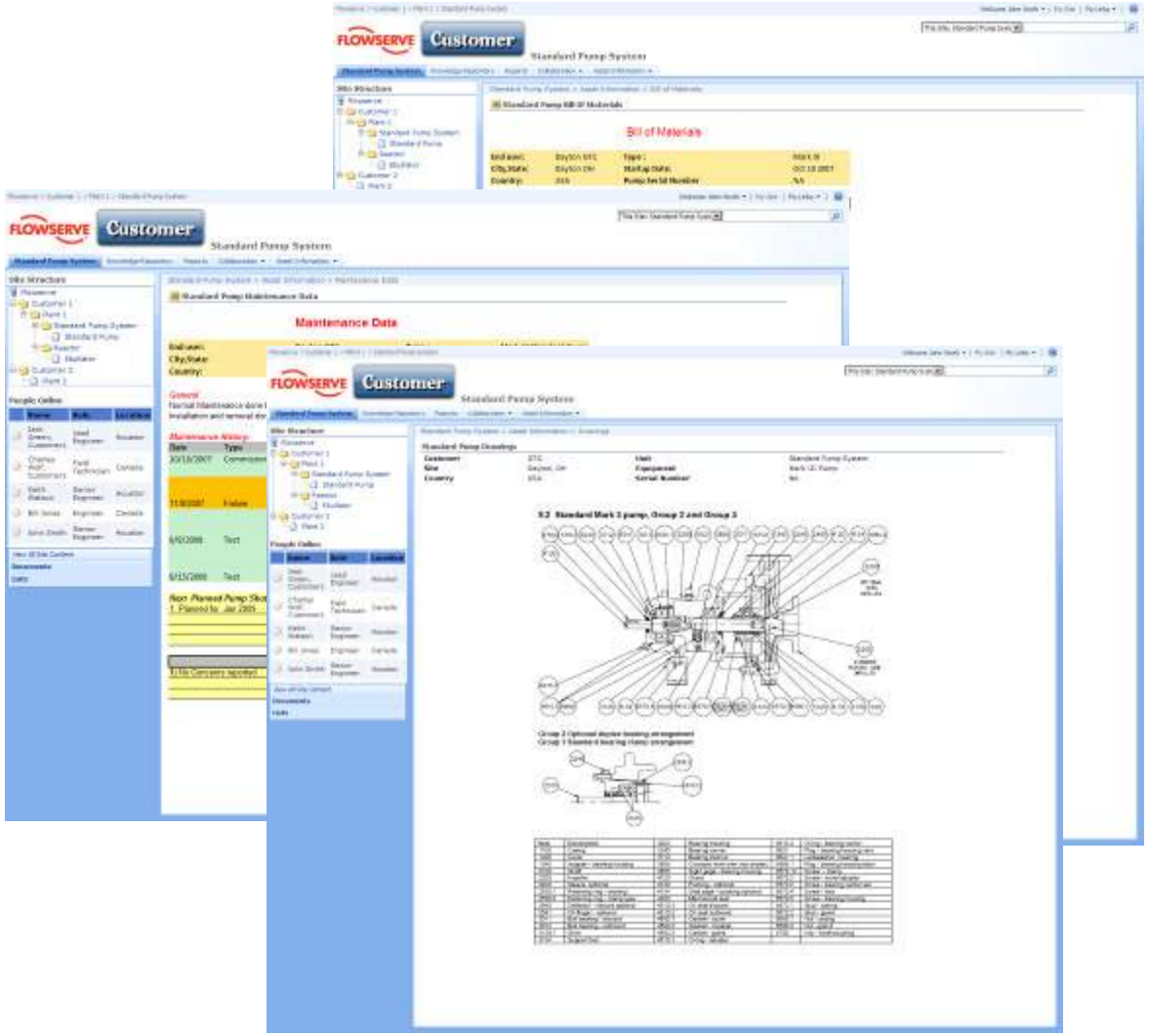
Showing 1 to 5 of 52

KPIs –Tables / Gauges / Trends



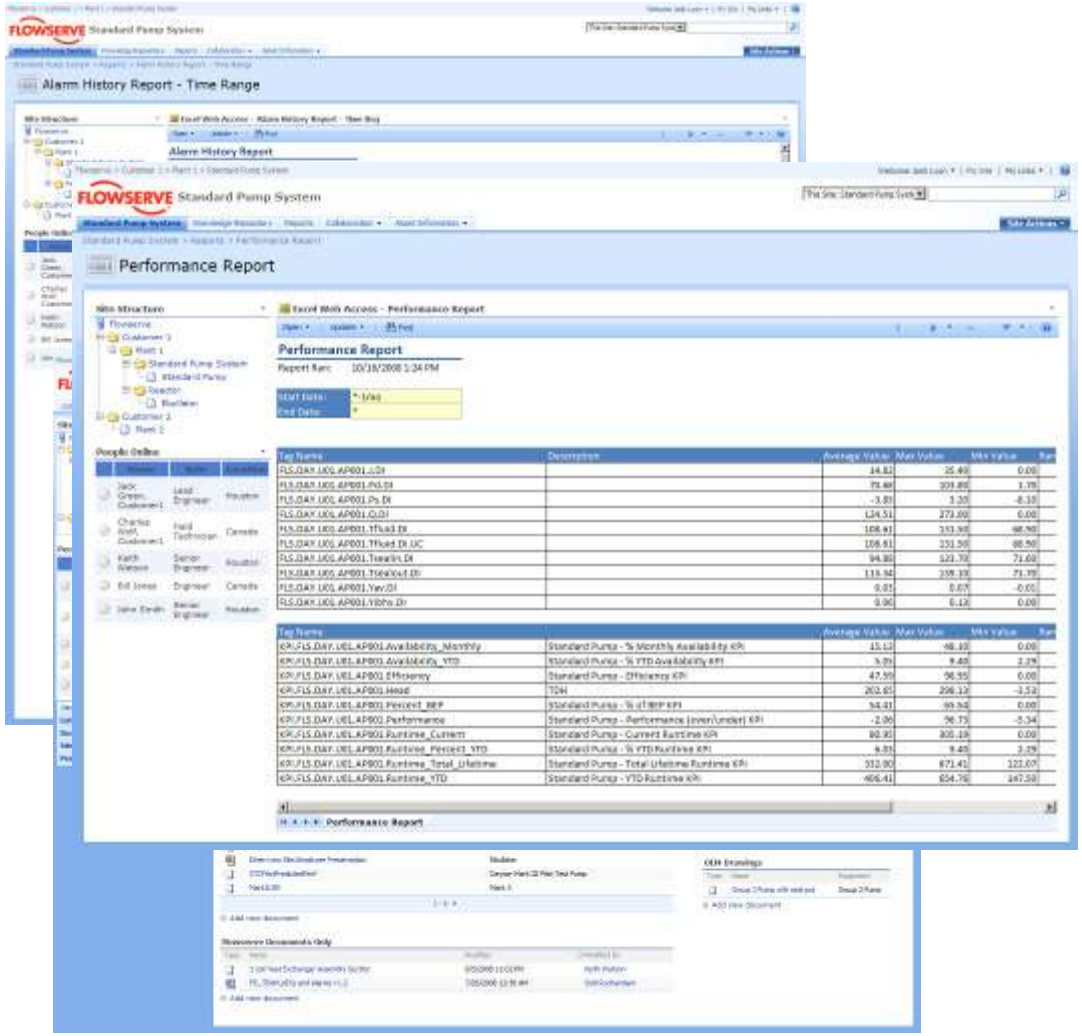
- Key Performance or Process Indicators
- Can be based on sensory data, equations, life cycle data, etc
- Multiple visualizations:
  - Tables, Gauges, Trends

Asset Info - Enterprise Data



- Maintenance Data
- Installation Information
- Drawings
- Bill of Materials

Reports



- Reports are built using Excel and shared via the web
- Custom layouts
- Can pull sensory data live and/or historically
- Can embed trends, graphics, etc.

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