On-off and safety valve diagnostics

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Agenda

• Brief history to valve diagnostics
• From control valve to safety and on-off valve diagnostics
• Different ‘generations’ of valve diagnostics
• On-off & safety valve diagnostics – Latest developments
• Benefits of predictive valve maintenance
• Summary
• Questions, comments & discussion
Brief history to valve diagnostics
Brief history to valve diagnostics

• First separate diagnostics tools available already in the 1980’s
  - Standalone devices for control valves
  - Offline tests needed to collect the diagnostics

• Digital positioners in the 1990’s
  - Enabling offline testing for control valves without standalone diagnostics tools

• First intelligent valve controllers, early 2000’s
  - Collecting control valve diagnostics data also when the process is online
  - Capability to analyze the data and provide online alarms
From control valve to safety and on-off valve diagnostics
From control valve to safety and on-off valve diagnostics

- Following the development of control valve related online testing and monitoring capabilities, the first automatic safety valve testing devices were introduced to the market almost 15 years ago.

- These devices brought along online diagnostics also for safety valves (both ESD & ESV valves).
From control valve to safety and on-off valve diagnostics

- Besides safety valves, online diagnostics have been available for cycling on-off valves as well for more than 5 years already.
Different ‘generations’ of valve diagnostics
First generation diagnostics

- Diagnostics are based on tests that are run during start-up / commissioning and shutdowns
  - This information doesn’t help with maintenance planning
- Valve is not under true process conditions and the analysis result doesn’t necessarily reflect the real condition of the valve
- Often there is not enough time to test, analyze and make decisions on every valve during the shutdowns
Second generation diagnostics

• Besides the offline tests, the valve performance is assessed also during process run-time
• The intelligent valve controller measures and stores the diagnostic data
  • Real-time information available on the valve condition via asset management system
• Diagnostics analysis can be conducted continuously and/or prior to shutdowns
  • Enabling predictive maintenance planning
Third generation online diagnostics

- Intelligent valve controllers are capable of analysing the diagnostics data those collect and to present it in user-friendly format.
On-off and safety valve diagnostics – Latest developments
Latest developments

• As with control valves, also the safety and on-off valve related diagnostics capabilities have been further developed since those were introduced

• The industry benchmark devices available can nowadays offer similar online diagnostics with safety and on-off valves as are available with control valves
Safety valve diagnostics

• Lifecycle diagnostics are based on online tests, e.g. on partial stroke tests
• The intelligent devices conducting the partial stroke test not only record the result graphs, but can also do a pre-analysis on the results
• Online warnings and alarms based on valve performance degradation
• Visual presentation of the condition of the valve
• Trouble-shooting guide available
On-off valve diagnostics

- Similar level of information available than with control and safety valves
- Lifecycle diagnostics are based on the open and close strokes the valve does during process run time
  - No need for separate tests
- Online warnings and alarms based on valve performance degradation
- Visual presentation of the condition of the valve
- Trouble-shooting guide available
Examples of diagnostics information available for on-off valves

- **Trends**
  - Stroke time and deviation
    - To diagnose valve mechanical failures
  - Spool valve reaction time
    - To diagnose pneumatics problems
  - Valve reaction time and breakaway pressure
    - To diagnose valve jamming problems
  - Supply pressure
    - To diagnose filter regulator

- **Counters**
  - Total operation time
  - Valve and actuator strokes
Advanced diagnostics help to make the right maintenance decisions

- The diagnostics information is presented in a format that doesn’t require true valve expertise to interpret
- A report is provided to highlight the existing problems and to recommend the necessary maintenance actions
- Maintenance resources can focus on the field devices that truly require their attention
Benefits of predictive valve maintenance
Condition of valves during a shutdown

Typical example of condition of overhauled valves during a shutdown

- Full overhaul: 30%
- Minor repair: 25%
- Adjustment: 35%
- OK: 10%
Significance of valves on the safety side

Safety loop failure sources by OREDA

- FINAL ELEMENTS: 50%
- SENSORS: 42%
- SAFETY SYSTEMS: 8%
Condition monitoring and predictive maintenance will help to

• Improve safety and reduce environmental risks
  - Eliminate safety risks in manual inspections
  - Minimize safety and environmental risks related to unexpected equipment failure

• Reach high process availability and performance
  - Avoid unexpected failures by detecting developing defects
  - Minimize downtimes by being able to prepare for maintenance
  - Improve the production process performance by optimizing equipment performance

• Increased maintenance productivity
  - Daily remote checking of the condition of process equipment
  - Plan equipment repairs well ahead with right parts, tools and resources at place
  - Reduce the unplanned maintenance work
Summary
Summary

• Valve diagnostics tools have taken a giant leap since the first devices were introduced in the 1980’s
• Online diagnostics are nowadays available also for on-off and safety valves
• The so called third generation diagnostics are taking possibilities for predictive valve maintenance to a new level
• Adopting predictive maintenance helps to enhance maintenance efficiency, improve process performance and to achieve significant maintenance cost savings
Thank you for your attention!

Questions / comments?