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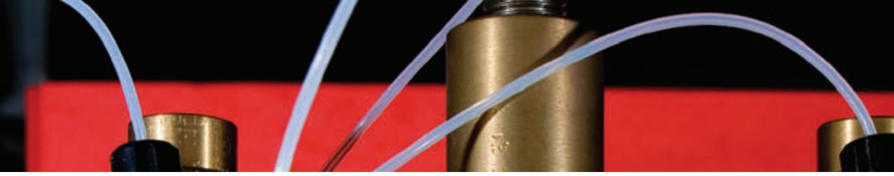
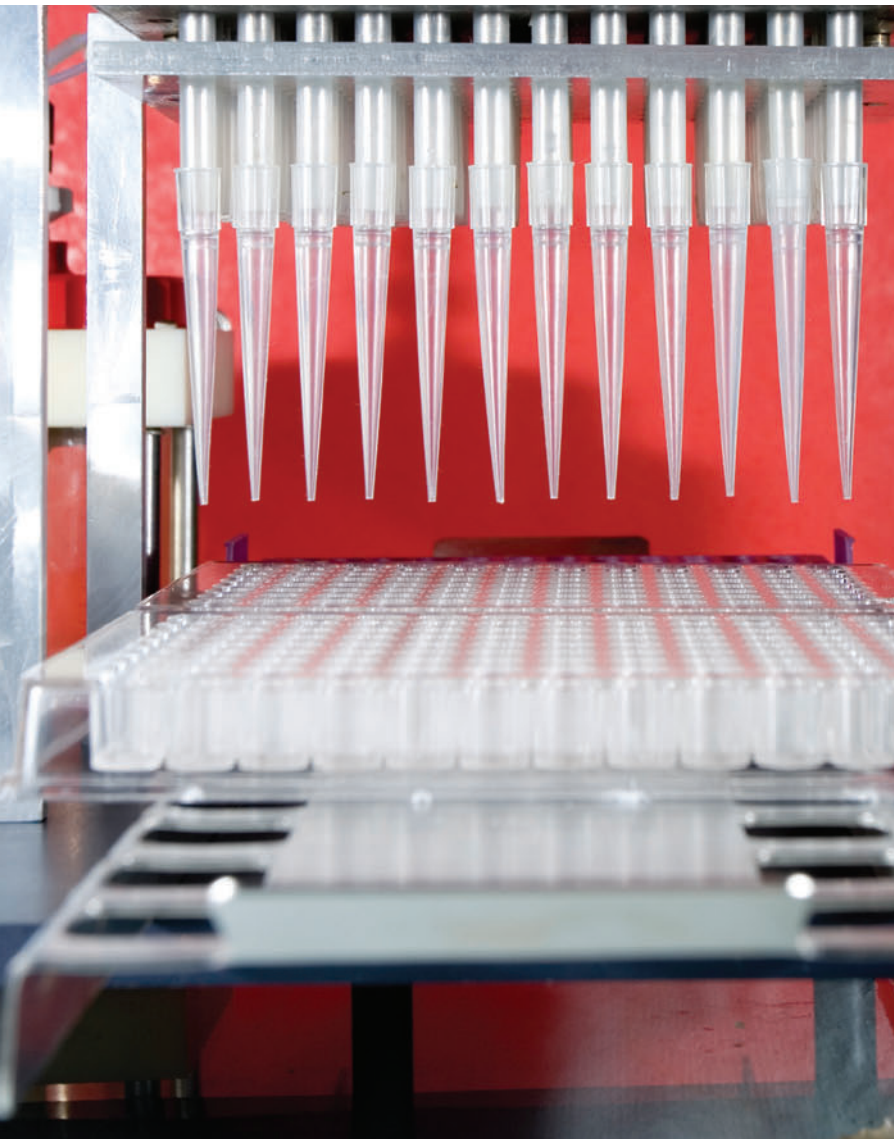




Microbial maintenance

Asset management software simplifies maintenance in biotech facility

By David Hillyer and James Cox

The word maintenance can strike fear into any production unit trying to achieve its output targets. Like it or not, maintenance is a necessary evil to ensure plant equipment is reliable and trouble-free. In the pharmaceutical industry, preventing equipment from breaking down or determining when it may break down helps improve plant availability and reduces process disruption as well as costly losses.

During a recent expansion at an Eli Lilly facility, we made use of technology to improve instrument and control valve reliability and reduce time-based maintenance, still widely used within the organization. The expansion project delivered a new facility using a distributed control system (DCS) as the process control application and Foundation Fieldbus smart field instruments. To take advantage of the smart capabilities, we implemented a project in parallel with the expansion, using asset management software and SNAP-ON tools.

FAST FORWARD

- Biotech plant expands with control valve reliability to reduce time-based maintenance.
- Asset management software gives end users remote calibration.
- Predictive maintenance strategies reduce instrument time-based maintenance.

The software package is a predictive maintenance application for instrumentation and control valves. It helps improve equipment availability and allows a maintenance team to easily monitor field device health and resolve potential issues before they become costly problems. Asset management software, along with a self-documenting calibrator, provides a fully automated calibration process. In this case, the software allowed a radical change to the maintenance process and saved 2,000 man-hours per year of maintenance costs. The move away from time-based maintenance significantly increased plant availability.

The software package has changed the way we carry out maintenance in the new facility. We have developed a maintenance strategy to take full advantage of the software technology and the smart capabilities of the self-documenting calibrators to provide a radical approach to instrument and control-valve maintenance.

The engineering group has fully adopted and endorsed this software package as a technology since they are changing from the traditional preventive maintenance techniques to the more proactive predictive maintenance. Using asset management software has also prompted other plant sites within the corporation to evaluate it as a maintenance solution. Furthermore, we are identifying other processes with a view to extending this software across the local site.

Self-documentation

The asset management software system consists of the core application intelligent device manager and a number of SNAP-ON tools. The device manager offers a single interface into Foundation Fieldbus and HART-based intelligent field devices and provides real-time predictive diagnostics, documentation, calibration management, and device configuration management.

The facility also takes advantage of the calibration assistant and software SNAP-ON tools. Interfaces to the self-documenting calibrators allowed us to download test schemes to the calibrator and use them in the field to perform the calibration. We recorded results in the calibrator before uploading them to the software system. The fully automated calibration process helps us compare the input of the transmitter to the digital output the calibrator measures. The assistant allows us to create calibration routes and add up to 150 device tags before downloading them into the calibrator to multiple field calibrations without the need to return to the system.

You can generate printed calibration reports after uploading the results from the calibrator into the system. The printed report provides device information, test scheme information (calibration procedure), and calibration results in graphical and tabular format.

Remote calibration

The system architecture for the facility satisfies the end user's requirements—ability to perform device calibration in the field and remotely in the control workshop. The unique architecture provided a second DCS/asset management software system in the workshop, allowing us to decommission field devices from the plant and recommission them in the workshop, and allowing us to perform calibrations on the plant and in the workshop while still maintaining a single database within the software for device history. This architecture has provided a flexible solution for local and remote device calibrations and access into the software system.

The system monitors a total of 365 Foundation Fieldbus devices, a mix of temperature, level, pressure, flow, pH, conductivity, and control valves. Some specialized devices (analytical) not available in the fieldbus format were interfaced to the system via a conditioning resistor and millivolt-to-fieldbus converter to take advantage of the real-time diagnostics and calibration management.

Maintenance strategies

Preventive maintenance (or time-based maintenance) is a strategy for maintaining equipment at fixed intervals to minimize equipment failure based on industry anticipated equipment life expectancy. With preventive maintenance, you should perform maintenance regardless of the equipment condition and remove equipment from service.

As in other organizations, preventive maintenance is important for mechanical equipment and instrumentation on site. Instrumentation maintenance typically consisted of calibration checks for measuring devices and full overhaul for control valves at predetermined intervals anywhere from once a month (for pH and conductivity) through every other year (for control-valve overhaul).

Preventive maintenance is costly and disruptive, and it does not fully improve reliability. A bathtub curve suggests maintenance-induced failure is a significant threat to any piece of equipment that has undergone some form of routine maintenance.

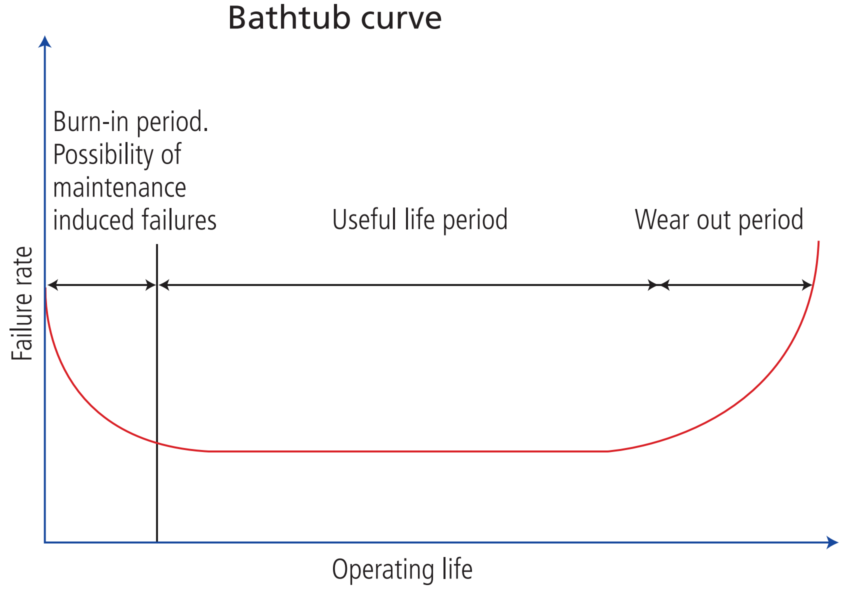
Frequently a perfectly working instrument or control valve suffers a problem or failure after maintenance activities. The problem is not just with the equipment. Interfering with the process can result in pipe-work leaks and isolations not being fully removed after maintenance, which result in processing issues and even production losses.

Historical inefficiencies included 40% of the control technician's time spent filling in calibration checklists, and more than 80% of the preventive maintenance calibrations completed were within the acceptable tolerance level with no necessary adjustment. More than 80% of control valves removed routinely for full overhaul needed no maintenance.

We experienced deviations and process losses every year following maintenance activities.

The new facility gave us the opportunity to change the way we carried out maintenance. Instead of reacting to problems and performing routine maintenance regardless of the equipment condition, we decided to use predictive maintenance.

Predictive maintenance (or condition-based maintenance) techniques determine the condition of equipment to predict when maintenance is necessary. Predictive maintenance happens while the equipment is in service by routine monitoring or continuous monitoring and offers cost savings because you only perform maintenance when it is warranted.



Predictive proposal

The facility proposed to take full advantage of the software system and the smart capabilities of the fieldbus devices to implement a predictive maintenance system, hoping to reduce the amount of time-based maintenance on instrument devices.

The radical change to the maintenance strategy was to eliminate time-based maintenance on the fieldbus devices. Instead, we relied on the smart capabilities and self-diagnostics of these devices to determine when maintenance was required. The data from the device and the continuous monitoring from asset management software would provide the means to implement a predictive maintenance strategy in the facility.

The quality unit was concerned about not performing routine maintenance on devices measuring critical process parameters. The risks lie in the newness of asset management software and fieldbus to the site and the lack of data to support such a radical change to the traditional maintenance strategy.

As a compromise, the project team and the quality unit agreed we could maintain non-critical devices using predictive techniques, whereas devices measuring a critical process parameter would continue using time-based maintenance until gaining sufficient data and experience to reassess the maintenance strategy for critical devices. This approach still provided significant benefits and savings because non-critical devices accounted for 80% of the total number of devices monitored by the system.

Implementation

Throughout 2006 and 2007, the software project implemented the server-client hardware, setting up device configuration, writing test schemes, and creating standard operating procedures to support the system. During the commissioning of the system, it became apparent the device range we saw in the DCS was different from the range we saw in the system device manager; the DCS range was configured to 0°C to 100°C whereas the software package displayed the factory trim range of -200°C to +850°C. This meant we could not set meaningful calibration failure limits as a percentage of device trim setting because of the different ranges in the system and the DCS. In order to implement the calibration strategy, using failure limits based on percentage, the DCS operational range and software device trim range had to be identical.

The result of this finding was to carry out a re-trim exercise on each of the Fieldbus devices to align the factory trim range with the range configured in the AI Block of the DCS. This was one of the key lessons learned during the project. When installing Fieldbus devices in the future, specify the factory trim is configured to the same range as the DCS operational range.

We validated the software system to corporate computer validation standards before accepting the system and handing it over to the engineering team in early 2008.

The software system has been in use for over 12 months. We gathered data during the project and following system acceptance. This time has allowed the engineering and automation teams to evaluate the data to determine the actual benefits and savings the system has provided.

Strategy changes

Of the 365 Fieldbus devices, we maintain 80% (nearly 300) using predictive maintenance techniques provided by continuous monitoring rather than performing unnecessary time-based preventive maintenance and reacting to problems.

Predictive Maintenance has resulted in savings greater than 2,000 man-hours per year, based on control technicians' time to complete the calibration and paperwork, engineering planning time, and engineering coordination and paperwork review. We believe this is one of the most significant cost savings the system has achieved.

One of the control technicians' duties is to review the device alerts every shift. He investigates new alerts, and if necessary, raises a work order before carrying out maintenance.

Reducing time-based maintenance has allowed control technicians to perform more meaningful tasks, including continuous improvement activities, in-house projects, data gathering to support changes to the maintenance strategy, training, and sharing their fieldbus and asset management knowledge and experience.

The facility has fully adopted the software technology and smart capabilities of the Fieldbus devices to significantly reduce the amount of time-based maintenance and instead rely on the continuous device monitoring provided by the system.

Automated calibration

The software package provides a fully automated calibration process by seamlessly integrating with a self-documenting calibrator that records results and generates a printed calibration report.

The automated process eliminates the need to hand-write calibration records. It also eliminates documentation and transposition errors as well as the requirement to calculate calibration tolerance results.

Reducing the amount of time-based maintenance has allowed us to reduce the annual shutdown window from 21 days to nine days, thus increasing plant availability and allowing additional production batches.

ABOUT THE AUTHORS

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RESOURCES

High winds tester
www.isa.org/InTech/20080906

There's a kind of emergence
www.isa.org/link/Emerge_04

Looking for automation's efficiencies
www.isa.org/intech/blog/2007_04_01_archive.html