Pall Corporation

White Paper

The Crixus™ Fluid Condition Monitoring Platform

Overview

The Coming Revolution in Supply-Chain Efficiency, Equipment Upkeep, and Inventory Management

The Internet of Things (IoT) is the future of business. Sensors, monitors, and other Internet-connected devices are increasingly being used to track, monitor, and control physical objects in production plants, traveling on ships, planes, trains and trucks, or at the store. Sensors can monitor factory or stockroom inventory. According to recent reporting in Fortune, IoT sensors can be used to continuously monitor machine performance, schedule preventative maintenance, and even predict breakdowns, reducing maintenance costs up to 25 percent, cutting unplanned outages up to 50 percent, and extending machine life by years. This is a potential revolution in supply-chain efficiency, equipment upkeep, and inventory management.

Background: Industrial Internet Will Lift Industry to New Levels

Fortune magazine cites McKinsey Global Institute research, which analyzed more than 150 specific IoT applications that exist today or could be in widespread use within 10 years. They estimate these applications could have a total economic impact of $3.9 trillion to $11.1 trillion per year in 2025. As a comparison, the U.S. economy in 2015 was $18 trillion, and the Chinese economy was $10.5 trillion. A Machina Research report on the growth of the machine-to-machine (M2M) market supports this prediction, with the assertion that “the total number of M2M connections will grow from 5 billion in 2014 to 27 billion in 2024,” meaning “the total M2M revenue opportunity will be USD $1.6 trillion in 2024, up from USD $500 billion in 2014.”

M2M IoT connections, devices, and applications will thus be a significant source of revenue. The Internet of Things is only one aspect of the coming changes for industry. Combined with Big Data analytics, an entire Industrial Internet will lift industry to new levels. While many executives see the incredible opportunities presented by the Industrial Internet, new research from GE and Accenture shows there are still many concerns involving security, data silos, and integrating systems between organizations. As a result, many companies are not ready to make the leap into the Industrial Internet. According to the GE/Accenture report:

> *Asked to describe their current capabilities in Big Data analytics, almost two-thirds of respondents (65 percent) are focusing on monitoring—the ability to monitor assets to identify operating issues for more proactive maintenance. Fifty-eight percent have capabilities such as connecting equipment to collect operating data and analyzing the data to produce insights. However, only 40 percent can predict based on existing data, and fewer still (36 percent) can optimize operations from that data.*

The report further points out “this finding is validated by other responses. When asked about their progress in managing business operations, only one-fourth said they had predictive capabilities and only 17 percent indicated the ability to optimize.” This tension between uncertainty and excitement is bound to break toward the latter; businesses who embrace early adoption will end up the winners in their industries.

The Solution: Increased Connectivity, Monitoring, and Analysis

The development of optimization capabilities and predictive models will require massive amounts of data, which can only be collected through increased connectivity, monitoring, and analysis. The first steps toward the Industrial Internet for any company, then, is to increase monitoring, connectivity among machines, and data analysis.

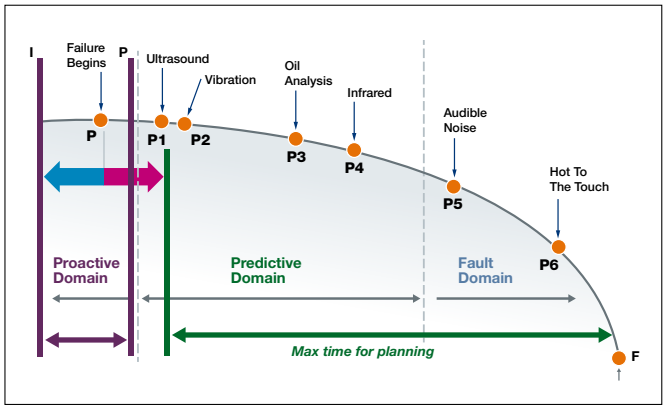
The necessity of fluid cleanliness in industrial manufacturing processes is well-understood. Advances in filtration technology have played a critical role in improving system operation and reliability. Regular maintenance remains integral in any system's ongoing health. This is mostly performed on an interval basis. The problem is this approach doesn't take into account condition fluctuation between scheduled reviews. Poor performance and excess component wear remain potential risks.

Continual real-time monitoring results in faster responses to system issues, meaning mitigation strategies can be quickly put in place to prevent system downtime. The combination of data, experience, and intelligence will allow the prediction of maintenance upsets before they occur. Analysis of historic data trends based on actionable information from the cloud will help determine more effective maintenance procedures. This means less downtime, more efficient and effective maintenance, and increased production at lower costs.

The Crixus™ Fluid Monitoring Platform Provides Embedded Control to Monitor Filtration Performance and Fluid Condition

The Crixus™ Fluid Monitoring Platform combines 60 years of Pall expertise with the latest filtration technology to create a platform that provides embedded control to monitoring both filtration performance and fluid condition, improving operational efficiency and productivity. The cloud-based platform provides real-time access to in-the-moment data, historical trend data, and instant notification of system upset or required maintenance. Because the Crixus™ Fluid Monitoring Platform monitoring is constant, issues are identified and reported the moment they occur, saving time, reducing downtime and maintenance costs, and increasing production process efficiency.

The Crixus™ Fluid Monitoring Platform uses a series of in-line sensors to continually monitor filter performance and fluid condition. This data is transmitted via wireless network to a gateway node connected to the Crixus™ Fluid Monitoring Platform Cloud. Intelligent software translates the data, maps it against historical trends, process variables, and predictive algorithms, then presents it through a reporting and notification system. Access to the Crixus™ Fluid Monitoring Platform Cloud 24/7 means fluid condition and filter performance can be monitored via desktop and mobile applications anywhere there's an internet connection. RFID technology built into the Crixus™ Fluid Monitoring Platform-equipped filter elements helps pinpoint, identify, and verify the performance of every filter in a system. Filter media grade, remaining life, and other process filter data can be locally accessed via a tablet or smart phone, helping streamline the maintenance process and improve site efficiency.



Leveraging the Power of the PF Interval

The PF Interval is a key concept when selecting preventive maintenance tasks. It is the time interval between the point at which we can first detect equipment starting to fail ("potential failure"), and the point at which the equipment actually fails ("functional failure"). To be effective, then, Condition-Based inspection must be performed at a frequency that is less than the PF Interval. The PF Interval is useful in the Industrial Internet of Things, in which equipment health is continuously monitored, because it helps determine the level of "health" at which an alarm should be raised and action taken. It is possible, for example, to raise different alarms at different points on the curve, depended on how much warning is required to avoid functional failure of a particular piece of equipment.

The PF Interval can be applied to equipment fitted with real-time health monitoring like the Pall Crixus™ Fluid Monitoring Platform, and where equipment health is assessed using Predictive Analytics and Big Data.

The Crixus™ Fluid Monitoring Platform users will benefit from faster response to system issues, 60 years of Pall intelligence programmed into the predictive data analytics package and planned maintenance schedules based on actionable information received from the cloud. Users will also benefit from analysis of historical data trends to help determine more effective maintenance procedures, user-programmable alarms that allow the Crixus™ Fluid Monitoring Platform to be tailored to individual system requirements, identification and location of filter housings via the 360°LED beacon, and simple installation and setup. This means be less downtime through mitigation strategies being put in place, and predicting maintenance upsets before they occur.

Conclusion: Save Time and Money by Predicting Problems And Reducing System Downtime

Example Scenario: Jack is a systems engineer responsible for day-to-day production at a manufacturing company. His day begins at home with a quick systems status check on his mobile phone. He sees that overnight production has been problem-free. Later that morning, in the office, Jack checks the system status at his computer. The Crixus™ Fluid Monitoring Platform web app notifies him that fluid viscosity has decreased across the stamping machine process, triggering an alert. Immediately Jack requests a fluid analysis be performed. The results indicate the hydraulic fluid has begun to degrade; fluid replacement is required.

This data-driven, proactive approach allows him to implement preventative maintenance actions earlier, preventing problems from occurring further down the road. Jack leaves the office to attend a meeting. While on the road, he receives an alert on his mobile. He pulls over and calls the site maintenance team to report the alert. The team responds immediately and, using the Crixus™ Fluid Monitoring Platform mobile app, is able to locate and identify that a critical filter in the process needs replacing. On his

return from the meeting, Jack is anxious to get a progress report of the day's events. He logs in to see the required actions have been completed and the system status has been updated.

To discover how the Crixus™ Fluid Monitoring Platform can save you time and money by predicting problems and reducing system downtime in your processes, visit www.crixus-pall.com.

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Filtration. Separation. Solution.SM

M&EWPIMCRX1711EN Printed in the UK November 2017

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