Smart Machinery Health™ Management
Improve Reliability, Availability and Performance
In an increasingly competitive market, organizations are challenged to run their plants more profitably and with greater efficiency. Yet mechanical equipment deteriorates causing a decrease in performance, a reduction in throughput and a rise in operating costs. Or an unplanned shutdown grinds production to a halt, resulting in a large loss in revenue.

IS YOUR MACHINERY’S HEALTH PUTTING YOUR OPERATIONAL GOALS AT RISK?
Deterioration in machinery health and performance is usually associated with misalignment or imbalance, corrosion and wear, fouling, sediment build-up or poorly lubricated parts. Detecting these underlying problems early allows you to correct issues before they affect your process, optimizing the performance of your plant.

Emerson’s combination of best-in-class technologies and services helps increase equipment effectiveness, reliability and performance by allowing you to be proactive in your maintenance. With Emerson’s Smart Machinery Health Management solution, you have a comprehensive view of every machine, allowing you to diagnose problems early – before they even become an issue.

- Increase throughput, availability and reliability
- Improve operating performance
- Reduce maintenance expenditures
- Avoid unplanned shutdowns
- Reduce energy consumption and costs
- Extend equipment lifespan

Turn to Emerson to ensure optimal health and performance of your mechanical equipment.
CRITICAL ASSETS IN A HIGH-STAKES WORLD


In an environment that relies on critical mechanical equipment, any failure can have a dramatic effect. A prolonged process interruption can be the difference between profit and loss. With this much at stake, having the correct protection, prediction, and performance monitoring system in place is essential. With Emerson’s online machinery monitoring technologies, you can monitor mechanical assets and analyze temperature, vibration, efficiency, and deviation data for changing conditions that could result in a shutdown.

Emerson offers the most comprehensive protection, plant-wide prediction, and performance monitoring system integrated with process automation.

Emerson’s online machinery monitoring capability

- For American Petroleum Institute (API) 670 standard and insurance requirements, PlantWeb’s protection capabilities coordinate asset or plant emergency shutdown with process automation.
- Continuous online monitoring delivers real-time predictive diagnostics to an asset management system and triggers alerts that allow operations to make informed production decisions.
- Analysis of deterioration in performance identifies the root cause of equipment inefficiencies so maintenance can be proactively planned.

Delivering reliability to your critical assets

Combining protection, prediction, and performance capabilities makes the difference in knowing your mechanical equipment is truly reliable.

- Protect against catastrophic failures
- Reduce process disruption
- Improve maintenance effectiveness
- Start-up safely
- Increase plant profitability
- Reduce operating costs

A complete picture of machinery health

From online monitoring with protection, prediction, and performance to portables for vibration analysis and more, Emerson’s integrated Smart Machinery Health Management solution delivers critical predictive diagnostic information on your high-stakes assets in AMS Suite. You get a holistic view that allows you to make informed decisions about your operation. Depend on the innovation and expertise of Emerson for a complete picture of machinery health.
Emerson’s machinery management and reliability solutions have been deployed in a variety of sites and processes around the world. Here are some of the quantifiable results that our customers report:

- **Dolphin Energy** uses PeakVue™ Technology extensively to reveal under-lubrication and prevent unexpected breakdowns due to defective bearings.
- **Egypt Basic Industries Corp.** attributed additional uptime of five to seven days annually at a worth of $4.1 to $5.8 million to predictive maintenance with AMS Suite.
- **Pine Bend Refinery** achieved an 18 percent improvement in mean time between repairs (MTBR) on rotating assets and is “definitely saving maintenance dollars”.
- **Lyondell Chemical Company** saved $125,000 through predictive maintenance, while eliminating or reducing preventive maintenance.
- **Braskem** identified excessive vibration on a key reactor pump and avoided an emergency shutdown that could have cost more than $6 million in lost revenue.
- **Cemex** used vibration measurements to identify a severe bearing fault on a cement mill, avoiding unplanned downtime that could have cost as much as $510,000.
- **International Power Australia** integrates real-time prediction monitoring with turbine controls for powerful and flexible protection.

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BEST-IN-CLASS DIAGNOSTICS
PROMOTE OPERATIONAL EXCELLENCE

From API 670 and API 618 machinery protection to real-time analysis of critical machines, Emerson is the single source for optimizing your mechanical assets.

With a proven track record of implementing plant-wide predictive diagnostic solutions, you can count on Emerson to unlock the maximum potential in your machinery. Emerson’s AMS Suite predictive diagnostic software integrates information from robust diagnostic technologies. This powerful combination of software, online technologies, and portable technologies builds a predictive diagnostic foundation for your machinery management program leading to improved productivity.

SOFTWARE

- Machinery Health Management – multi-technology integration, analysis and reporting tools allowing enterprise-wide predictive maintenance planning.

- Performance Monitoring – analyze and obtain peak performance of critical mechanical and process equipment in real time.

ONLINE TECHNOLOGIES

- Online Machinery Monitoring – includes complete protection, prediction and performance monitoring capabilities integrated with process automation, as well as options for portable monitoring and digital overspeed protection.
PORTABLE TECHNOLOGIES

- Vibration Analysis – conclusive condition information about bearings, gears and other rotating components; implement on a periodic basis.
- Alignment and Balancing – ensure precise alignment and balance of rotating machinery.
- Lubrication Analysis – determine that lubricants and fluids are clean and moisture-free; detect particles in oil after onset of wear.
- Infrared Thermography – thermal imaging detects mechanical and electrical anomalies.

TRANSMITTERS

- Wireless Vibration Transmitter – interface with existing plant monitoring systems to deliver vibration levels on critical equipment.

EXPERTISE

- PDM Services – launch a new PDM program or implement new technologies within an existing program.
Predictive Intelligence
AMS Suite distributes predictive intelligence to the right people at the right time so accurate, timely decisions can be made. The integrated family of AMS Suite predictive maintenance applications brings together information from critical production assets, including mechanical equipment, process equipment, instruments and valves.

Machinery Health Management
AMS Suite integrates Emerson’s protection and prediction maintenance technologies. You gain a comprehensive view of each machine so you can accurately diagnose developing problems. Unsurpassed analytical capabilities through automated diagnostics, plotting, and reporting help determine machinery health. Through AMS Suite, you can document, trend and communicate all details of machinery health.

Performance Monitoring
AMS Suite provides real-time performance calculations, allowing you to improve the efficiency of your critical machinery – turbines, compressors, boilers and other assets. By analyzing machinery performance, you can run your process more efficiently, track operating performance against targets, schedule maintenance activities, and determine the root cause of equipment inefficiencies. Equipped with health and performance diagnostics information and backed by a team of Emerson engineers, you can move from reactive to targeted predictive and proactive maintenance programs. AMS Suite helps you focus on the assets that impact your bottom line, bringing improved performance and restoring your peace of mind.

THE SOFTWARE TOOLS FOR ASSET MANAGEMENT AND PREDICTIVE DIAGNOSTICS

The performance and health of mechanical equipment will deteriorate over time. Early detection is vital.

Ensure gradual deterioration doesn’t strip away performance or your peace of mind. Knowing the health and performance of your mechanical equipment allows you to be proactive with your maintenance planning instead of reacting to unexpected events. When your maintenance and operations staff are alerted to degrading asset health, critical production decisions can be made to eliminate outages and improve the bottom line.

- Develop a planned maintenance approach
- Prioritize and plan maintenance activities
- Achieve and maintain optimum equipment performance
- Quantify thermodynamic efficiency losses
- Evaluate the effectiveness of maintenance on production and equipment condition
- Track key performance indicators against targets
- Determine the root cause of production inefficiencies
ARABIAN CEMENT COMPANY AVOIDS COSTLY UNPLANNED DOWNTIME BY SOLVING COMPLEX VIBRATION PROBLEM

- Saved about $28,000 USD by avoiding a production shutdown
- Prevented bearing failure, avoiding further damage to plant equipment
- Reduced maintenance costs through Predictive Maintenance

“AMS Machinery Manager is an important tool in providing information about the condition of rotating equipment throughout this plant, enabling us to effectively reduce costs through predictive maintenance.”

Ahmed M. Ibrahim, Predictive Maintenance Engineer, Arabian Cement Co.

Learn more about this application and others at www.assetweb.com/customerproven.
CONTINUOUS ONLINE MONITORING FOR PROTECTION AND PREDICTION

Critical machinery problems can bring production to a halt. A combination of shutdown protection and prediction capabilities ensure your machinery will continue to perform within acceptable parameters.

Machinery Protection
Today’s plants require machinery protection systems for the most critical rotating machinery. The CSI 6500 Machinery Health ™ Monitor meets API 670 and API 618 requirements and provides PlantWeb protection integrated with process automation systems. The modularity of design gives the CSI 6500 flexibility in retrofit applications for existing cabinets.

The CSI 6500 protection system provides vital shutdown protection to prevent catastrophic failure.

- Continuous online monitoring for machinery prediction and protection
- Compliant with API 670 and API 618 standard
- Integrated with process automation systems

Prediction Monitoring
Visibility to machinery health before the protection system engages is considered the critical missing component of today’s machinery protection solutions. Operations and maintenance personnel are no longer looking for just a protection capability when replacing an outdated protection system. They are requiring a complete protection, prediction, and performance monitoring capability integrated with process automation.

By inserting prediction modules, the CSI 6500 Machinery Health Monitor provides machinery prediction and protection in a single integrated rack. The modular architecture easily facilitates integration to an existing protection system, AMS Suite, and process automation. The CSI 6500 delivers real-time feedback to both maintenance and operations, so plant personnel can make informed decisions well ahead of a shutdown.

With prediction, a machine can continue performing as long as it is within acceptable parameters. Repairs can be made when they are economically convenient.

- Automated, continuous, predictive machinery health monitoring
- PeakVue® technology provides bearing fault detection
- Record, view and replay transient data during startup, shutdown and trips

Empowering Decisions
When real-time machinery health information moves throughout the enterprise through the Ovation® or DeltaV™ process automation system and AMS Suite predictive maintenance software, both operations and maintenance are empowered to make the right decisions based on valuable predictive intelligence.
Digital Overspeed Protection

For rotating equipment operating in overspeed conditions, protection is a critical issue for maintaining a safe operating environment. The CSI 6300 SIS Digital Overspeed Protection system complies with the latest version of industry safety standard DIN EN 61508:2010, in addition to European Machine Directive 2006/42/EG and the API 670 standard. The CSI 6300 SIS provides rotation direction detection as an additional SIL 2-rated safety function.

COSTLY UNPLANNED PUMP EVENTS REDUCED AT FLINT HILLS REFINERY

- No significant unplanned environmental, health, and safety (EHS) events in route-monitored machinery in three years
- 18% increase in mean time between repairs (MTBR) on pumps
- 100% completion of vibration data collection on 1500 pumps
- Shorter response time when potential failures are identified

“We are definitely saving maintenance dollars as a result of the extended MTBR on rotating assets.”

Michael Popelka,
Reliability Engineer,
Pine Bend Refinery

Learn more about this application and others at www.assetweb.com/customerproven.
PORTABLE DATA COLLECTION: THE FOUNDATION OF YOUR RELIABILITY PROGRAM

By improving machine reliability, you can maximize output and significantly lower production costs.
Experience savings by employing predictive and proactive maintenance strategies.

Vibration Analysis
In an environment where you cannot afford to constantly chase the next breakdown, you need to quickly and accurately identify developing faults and, ultimately, the underlying root cause of the machinery problem. Vibration analysis offers the most information about the condition of rotating machinery.

The CSI 2130 Machinery Health Analyzer simplifies the task of vibration analysis by monitoring virtually every machine in the plant. Onboard analysis for advanced troubleshooting is available at the push of a button, providing an instantaneous machinery health assessment.

- Unmatched data collection speed
- Powerful in-field alerts and analysis for guided, machine-side testing and troubleshooting
- PeakVue technology for advanced bearing and gear fault detection

The CSI 2125-IS Machinery Health Analyzer provides data collection and in-field analysis for hazardous environments requiring intrinsically safe technology.

Alignment and Balancing
Alignment and balancing can extend the life of your rotating machinery. The CSI 2130 is used to precision balance or laser align machine trains before returning them to service. It balances machines in up to 4 planes and at multiple speeds, and can automatically detect and alert you to secondary structural faults that might complicate the balancing job. Unique laser heads include dual high-speed angle sensors that measure the exact rotational position of laser heads, reducing sweep time and providing an accurate alignment solution.

- User-friendly display for faster balance and alignment jobs
- Balance four planes and multiple speeds
- Alignment within one quarter turn of shaft rotation

Electric Motor Diagnostics
After bearing problems, the most common motor problem is electrical failure. Heat and fatigue, associated with excessive motor starts or overloading, can lead to broken rotor bars in electric motors.

The CSI 2130 non-intrusively collects current, flux, and temperature data while the motors remain online. This motor analysis technology can diagnose electrical problems, providing information on rotor-related electrical faults such as broken rotor bars, high-resistance joints and cracked rotor end rings.

- Early detection of rotor and stator faults
- Collect motor analysis data while the motor is online
- Trend motor condition over time to plan and prioritize maintenance action
ONLINE MACHINERY HEALTH TECHNOLOGY REDUCES PLANT SHUTDOWNS AND INCREASES PRODUCTIVITY AT PAPER MILL

- €720,000 in lost production avoided following the prevention of three shutdowns
- Detection of a failed outboard motor bearing and fan bearing cage
- Fan misalignment of a fan detected and consequently corrected

“By identifying problems with bearings at an early stage, we have been able to schedule repairs and avoid shutting the plant unnecessarily. This has increased production as well as lowered our overall maintenance costs.”

Maintenance & Automation Manager

Learn more about this application and others at www.assetweb.com/customerproven.

Unattended, 24-Channel Portable Analysis

Some critical plant assets require more than the data collected as part of a route-based vibration analysis program. Turbomachinery and other complex machines may require temporary, but continuous monitoring across a machine or multiple machines.

The CSI 2600 Machinery Health Expert is a temporary continuous monitoring and analysis system. It records data for hours or weeks at a time, and makes use of the advanced PeakVue technology for rolling element bearings and gearboxes. Real-time transient events can be viewed and replayed for further analysis with animated machine and structure views for advanced diagnosis of the most difficult reoccurring machinery problems.

- Monitoring and troubleshooting for turbomachinery startup, coast down, and production state
- Record 100 hours of simultaneous, continuous time waveform across 24 channels
- Live oscilloscope and FFT analyzer
**Lubrication Analysis**

Oil and lubrication analysis are widely-accepted tools for determining the health of machinery. Results provide a warning of unseen corrosion, contaminates, improper lubrication, and machine wear, and can eliminate the root cause of equipment failure. Testing all machinery lubricants in an offsite lab can be an untimely, inefficient, and potentially costly means for recognizing the benefits of oil and lubrication analysis. The ideal lubrication analysis program balances the benefits of onsite testing with follow-up by a sophisticated offsite lab for questionable samples.

- Accurate onsite analysis of oil health information
- Early indication of machine wear and fatigue
- Verifies correct oil usage by screening oil supplies

**Infrared Thermography**

Emerging faults are frequently accompanied by excessive heat or heat loss. Capturing the thermal images of these potential problems and analyzing them alongside data from vibration and oil analysis allows users to move quickly and easily from a single IR image to a detailed report of machinery health.

- Diagnose anomalies in electrical systems
- Scan mechanical equipment for heat-related problems
- Detect hot spots
TRANSMITTERS: KEEPING YOU CONNECTED TO THE HEALTH OF YOUR MACHINERY

Careful monitoring of critical assets prevents lost profit from unplanned downtime.

Wired Vibration Transmitter
To gain continuous access to vibration levels on your critical machinery, the CSI 9330 Vibration Transmitter interfaces with existing plant monitoring systems while automatically detecting vibration levels.

- Continuous monitoring of machinery
- Convert vibration data into a 4-20 mA signal
- Measure overall vibration and Peakvue or temperature

Wireless Vibration Transmitter
As part of Emerson’s Smart Wireless solution, the rugged CSI 9420 Wireless Vibration Transmitter connects quickly, easily, and economically to any machine. It delivers vibration information over a highly-reliable, self-organizing WirelessHART™ network for use by both operations and maintenance personnel.

- Measure vibration, temperature, and bearing wear with PeakVue
- Ideal for hard-to-reach and cost-prohibitive locations
- Measure vibration on any plant asset
- Rated intrinsically safe for use in virtually all plant areas.
PEOPLE MAKE THE DIFFERENCE IN A SUCCESSFUL MACHINERY HEALTH PROGRAM

Build a best-in-class team
Implementing a world class machinery health program is no easy matter. Whether you are adding to an existing program or building from the ground up, you need confidence in your partner and confidence in your team’s ability to work with and maintain the program. That’s where Emerson’s machinery health experts can ensure a strong start and the training needed to sustain success.

Customer Support
Emerson’s team of machinery health experts is committed to helping you do YOUR job, day or night, wherever you are in the world. Whether you need calibration of your analyzer, help with software functionality, or hardware repair Emerson provides the expertise and assistance you need at the time you need it most! Customer support allows you to:

- Review technical notes and application papers via online database
- Download software and firmware from the web
- Access global call centers 24/5 for personal assistance

Training
Training can be critical at every stage of a machinery health program. New programs and new staff require basic skills, but even experienced personnel benefit from expanding their knowledge of more advanced monitoring and analysis concepts. Every year more than 1500 individuals participate in Emerson’s Education Services on machinery health topics.

- Classes are offered in Emerson training facilities, regional locations, or customized for on-site instruction
- Most courses offer hands-on opportunity in a lab environment to increase retention
- Certification testing ensures your people have the skills needed to comply with all requirements
When you consider a critical technology investment, you cannot afford to overlook service. Emerson understands the requirements for comprehensive expertise to ensure start-up success and long-term support. We are fully committed to supporting you through all of the installation steps and to keep your system running smoothly and reliably.

- Identify and quantify your largest and most significant opportunities for improvement through an opportunity assessment to uncover performance gaps and potential opportunities in your current maintenance plan.
- Develop a roadmap for asset prioritization that allows you to focus PlantWeb technologies on the assets with the highest benefit.
- Implement a structured approach to technology implementation, based on proven experience, to ensure your reliability program starts right and endures over the years.
- Assess the skill sets of your workforce and deliver training programs with an emphasis on implementing maintenance practices that take full advantage of new technologies.
- Extend the predictive power of PlantWeb to help reach your plant’s true performance and availability levels.

REALIZE FULL VALUE FROM YOUR MACHINERY MANAGEMENT SOLUTION
EMERSON – YOUR PARTNER FOR
ASSET OPTIMIZATION

Realize the true potential of your plant.
When you partner with Emerson, you achieve optimal health and performance while experiencing the value of a predictive environment:

- Prevent catastrophic failures and unplanned shutdowns
- Meet production targets
- Diagnose the root cause of performance degradation
- Reduce maintenance and repair costs
- Reduce inventory and overtime
- Achieve predictive or proactive maintenance

Emerson is your single source for reliability technology. Since the introduction of our first portable vibration analyzer in 1986, Emerson has led the market in the development of advanced vibration technologies. With an annual investment in machinery health research and development that exceeds the sales revenue of many reliability suppliers, Emerson continues to lead the industry in the release of new products for monitoring the health and performance of your mechanical equipment.

In addition to our expertise in mechanical equipment, no one knows instruments, valves, electrical systems and process control like Emerson. With a view to the complete manufacturing process and the combined power of Emerson’s PlantWeb digital plant architecture with Asset Optimization Services expertise, we provide real-time predictive diagnostics on all your key production assets to drive operational excellence within your facility.

With Emerson, you have the complete portfolio of machinery health management technologies, software and services ensuring your mechanical equipment is maintained correctly for optimal health and performance.

Turn to Emerson as your critical machinery management partner to manage and realize your machinery’s potential to achieve your operational goals.