innovations

IN PROCESS CONTROL

How the Reliability Value Chain helps manufacturers achieve top-quartile reliability returns – full story on page 6

Making a **difference**

> ***Wireless monitoring has shown itself to be a valuable tool in our condition monitoring armoury. Predicting failures in gearboxes of this type can make considerable savings on any subsequent turnaround and help to keep equipment available.***

David Hambling, Instrument Electrical Technical Engineer, SABIC UK Petrochemicals

Emerson's wireless condition monitoring and prediction system is being used at the SABIC Olefins plant in Teesside, UK, to detect potential problems with pumps before they disrupt normal operations. The system helps reduce the risk of unexpected failures that can cause lost production and expensive repairs, as well as safety and environmental incidents.

The critical pumps being monitored are installed on the plant's Olefins Cracker, which is used to produce ethylene, propylene, butadiene and gasoline products. SABIC Teesside previously collected and analysed vibration data for these pumps manually, but potential problems could occur between readings. This led to higher maintenance costs and reduced plant availability, which was affecting overall production.

Emerson's online pump health monitoring system has identified multiple defects including a chipped tooth on a gearbox gear and an impending bearing failure. Without pump health monitoring these faults would have likely resulted in equipment failure. Identifying and rectifying potential problems earlier helps minimise pump failures and maintenance costs.

In addition to measuring overall vibration and temperature, the CSI 9420 Wireless Vibration Transmitter includes PeakVue™ technology, which detects faults that cause impacting, friction, and fatigue, particularly in gearbox and rolling element bearings. Impacting is a key indicator of serious faults such as pump cavitation and insufficient lubrication as well as gearbox and rolling element bearing defects.

The monitoring system takes basic readings every 30 minutes and an in-depth, full spectrum analysis once every day. By tracking rising vibration levels, SABIC Teesside can detect developing faults and improve maintenance scheduling.

The plant's existing Emerson Smart Wireless network made installing the wireless vibration transmitters quick and easy, enabling vibration data to be sent to SABIC's process control system. The established mesh network also makes it easy to add or relocate wireless-enabled devices for additional process information from remote or difficult-to-access locations.

Read more about the CSI 9420 at EmersonProcess.com/IM701 and Pump Health monitoring solutions at EmersonProcess.com/IM702

Welcome to **innovations**

Emerson knows that the reliability of your plant assets directly affects the overall efficiency of your operations. As we detail in this issue, optimised reliability practices reduce costs and improve sales, product quality, health and safety, and environmental compliance. All of these are factors which have a direct bearing on operational risk, and ultimately shareholder value.

In an in-depth study Solomon Associates, a leading benchmarking company, quantifies the significance of top-quartile performance versus lower performers. The key to lifting performance into the top-quartile is a planned, integrated approach to all activities and technologies monitoring plant assets and workflows in order to standardise reliability practices.

Emerson has great experience and a proven track record in successfully implementing plant-wide predictive maintenance solutions, and many tools and methodologies to support these. The front cover of this issue highlights one such process, the Reliability Value Chain, a self-reinforcing pathway to improvement. When combined, for instance, with Emerson's AMS Suite predictive maintenance software, plant operations can be dramatically improved with reliability at the heart of the process.

In this edition we also look at examples where poor maintenance practices can lead to equipment failure and costly downtime, specifically production critical pumps and valves. In addition, we highlight some of our latest products which will help you realise the full potential of your operation through improved monitoring, more effective analysis and dramatically reduced down time and maintenance costs.

Roel Van Doren
President Europe
Emerson Automation Solutions

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Reliability management **consulting**

Alcino Beirao, Industry Solutions Consultant, explains how Emerson's global reliability management consulting practice improves plant reliability – reducing unplanned downtime and enhancing safety. Improved plant reliability translates into savings of millions of Euros in maintenance costs and lost production, helping enterprises to become top-quartile performers.

In today's competitive world, process companies are pushing their facilities to run longer and harder between planned outages or maintenance turnarounds, in order to get the production and productivity they need out of their valuable plant assets. But with many producers in the gas, chemical, refining and power industries routinely suffering 5 to 7 per cent unplanned downtime losses due to poor maintenance practices, chief executives are seeing the need to better manage physical assets for improved profitability.

According to Solomon Associates, a leading benchmarking company in the process industry that tracks companies' performance based on reliability and maintenance metrics, by reducing scheduled and unscheduled downtime, companies can reduce their maintenance spend by 50 per cent or more. Optimised reliability practices, such as increased condition monitoring and analysis-based maintenance activities, drive down costs and also improve sales, quality, health and safety, and environmental compliance. These are all key factors affecting operational risk and shareholder value.

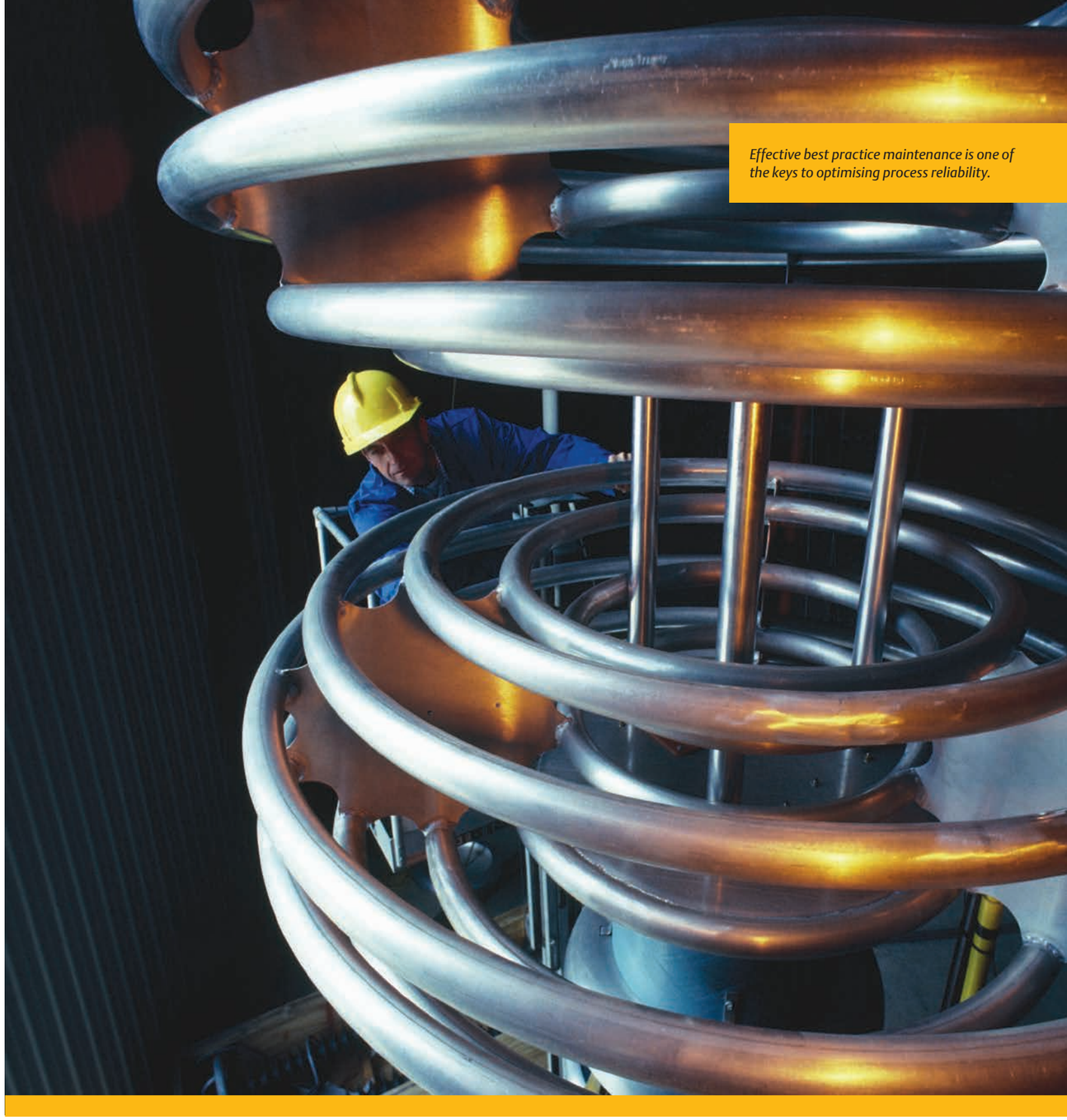
With safety being the number one priority for plant personnel, managers know that reliability has a huge impact on safety. Unsurprisingly, reliable operations are safer than unreliable operations and safety incidents are much more likely to occur when equipment is in transient operations. These occur during start-up and shut-down, or during other abnormal events when operator interaction with the process is increased.

Introducing Emerson's global reliability management consulting practice

To guide leaders on how to better manage maintenance costs, improve safety and reliability, and increase profitability, Emerson has introduced a new global reliability management consulting practice. This is aimed at saving companies millions of Euros in wasted expense and lost revenue. Through its consultants, Emerson can advise global customers on enterprise-wide reliability management programmes that connect the millions of data points collected in a plant. This provides actionable information to trigger maintenance activities before equipment fails.

Emerson has 25 years of experience in improving reliability in industrial manufacturing, with a proven track record of implementing plant-wide predictive diagnostic solutions. These reliability focussed services have recently been expanded with the acquisition of Management Resources Group Inc. (MRG), a leading management consulting firm with 28 years of experience improving reliability in industrial manufacturing. This strategic investment complements Emerson's existing lifecycle services offering, as well as the company's leadership in 'pervasive sensing' which provides manufacturers with more operational insight through greater sensor-based coverage of their plants and assets.

Our approach helps companies dramatically reduce downtime and enhance safety and compliance, increasing the stature and reputation of a company and ultimately providing better value for shareholders. With the right strategy, the typical



Effective best practice maintenance is one of the keys to optimising process reliability.

€800 million (Plant Replacement Value) plant can save €9.6 million, or more, annually in maintenance costs – not including the corresponding operational and production benefits from reduced downtime. Extend that across a corporation's network of facilities and soon reliability becomes the number one strategic lever for a safer, more profitable enterprise.

For example, Corbion, a global food and biochemical company with plants in many countries, implemented standardised best practices of reliability over several years and reduced its global maintenance expense by one third while simultaneously dramatically increasing availability. These actions enabled the company to capture millions of euros in increased profits and sustained increases in capacity and production.

Find out how Emerson's reliability consulting can improve your plant reliability at EmersonProcess.com/IM703

Ensuring all the links in the reliability value chain work in sequence is a giant step towards top-quartile performance.

Reliability Value **Chain**

Having the right reliability methodology can make the difference between being a successful company and an also-ran. Michael Whittaker, Reliability Engagement Senior Manager at Emerson, outlines how the Reliability Value Chain can show the way.

Successful enterprises may operate in very different industry sectors, but they will have one thing in common – a dedication to effective asset management, with consistent standards-based reliability programmes applied across their entire organisation. For those yet to attain such heights there is good news – you have the opportunity to reap the benefits of improved maintenance and operational efficiency in greater profitability, availability and safety.

Research has shown that top-quartile performers adhere to a set of closely linked process elements, a Reliability Value Chain that provides a systematic approach to optimising asset reliability and avoiding ad-hoc or inconsistent practices. Understanding the Reliability Value Chain sets the path for transforming raw data into usable information, into diagnostic knowledge and then into effective action. Ultimately, the ability to achieve top performance is dependent on the robustness of each element and, perhaps more importantly, on the effective connection of all elements within a continuous improvement cycle.

Pivotal to the value chain is the reliability strategy and the analyses used to understand and catalogue failure modes that shape all facets of the chain.

For instance, the classifications chosen to characterise asset master data are driven by the requirements of the reliability strategy. Furthermore, the mitigation of failure modes drives the selection of maintenance procedures, process parameter data, condition indicators and spares stocking strategies. Asset health analysis is interpreted from an understanding of the failure effects observed from process data and condition indicators. Most importantly, setting the reliability strategy must strike a balance between the engineering characteristics of the assets and the capabilities of the organisation to perform the function required within each ring in the chain.

Each category in the chain offers the opportunity for improvement and growth. The asset master data provides the foundation, and includes complete lists of equipment, its importance, parts and technical information and maintenance procedures, which must be applied across all plants. Relevant information comes from condition indicators and process data, which must be connected and cross-referenced to then be used to support maintenance. The union of asset health analysis and work identification produces knowledge, the experience to identify when there is a problem, diagnose what it is and select the appropriate action to correct the condition.

Top-quartile performers must scrutinise every element of the chain for improvements.

For example, only detailed knowledge about all equipment will allow proper analysis and an effective diagnosis of problems, as well as optimisation of preventive maintenance. At the same time enterprise-wide standardisation can, for instance, save money by reducing spare-parts duplication, whilst standard equipment failure terminology allows different sites to see whether they are dealing with similar issues.

While implementing standard practices is a large task that requires solidarity of purpose, standards, tools and experienced partners, the return on investment is large and long-lasting.

Emerson's reliability consultancy is driven by the business case and our extensive experience assists enterprises to roll out best practices consistently. Emerson helps decision-makers understand and value technology, analysis, and intelligence that can be effectively acted upon. A proper understanding of the Reliability Value Chain brings enterprises into the top-quartile.

Reliability, much like financial reporting and safety, should rise to a strategic level of importance and be a priority in any industrial company.

To find out how Emerson can assist you with implementing best practices consistently at your plant go to EmersonProcess.com/IM704

Improved engineering **efficiency drives reliability**

Control devices and instruments are at the heart of any plant, but ensuring they are correctly commissioned and configured has previously been a costly chore. Jean-Luc Goutagny, Reliability Solutions Europe Director at Emerson, explains how AMS Device Manager supports this task, leading to improved plant reliability.

The foundation of a reliable plant is reliable equipment, but the dream of a truly 'connected plant' with smart equipment sharing data to enable better decision making can only become a reality if the equipment and its sensors are correctly set-up and connected to the plant network in the first place.

However, commissioning and configuring instruments and valves has traditionally been a major hassle for industrial manufacturers. A single transmitter can have dozens of parameters that need configuring and performing this task manually is both tedious and time consuming. Whilst a simple device may take only a few minutes to commission and configure, increase the complexity of the asset and multiply that process by hundreds or even thousands of times at a new facility or major expansion and the need for more efficient alternatives is obvious.

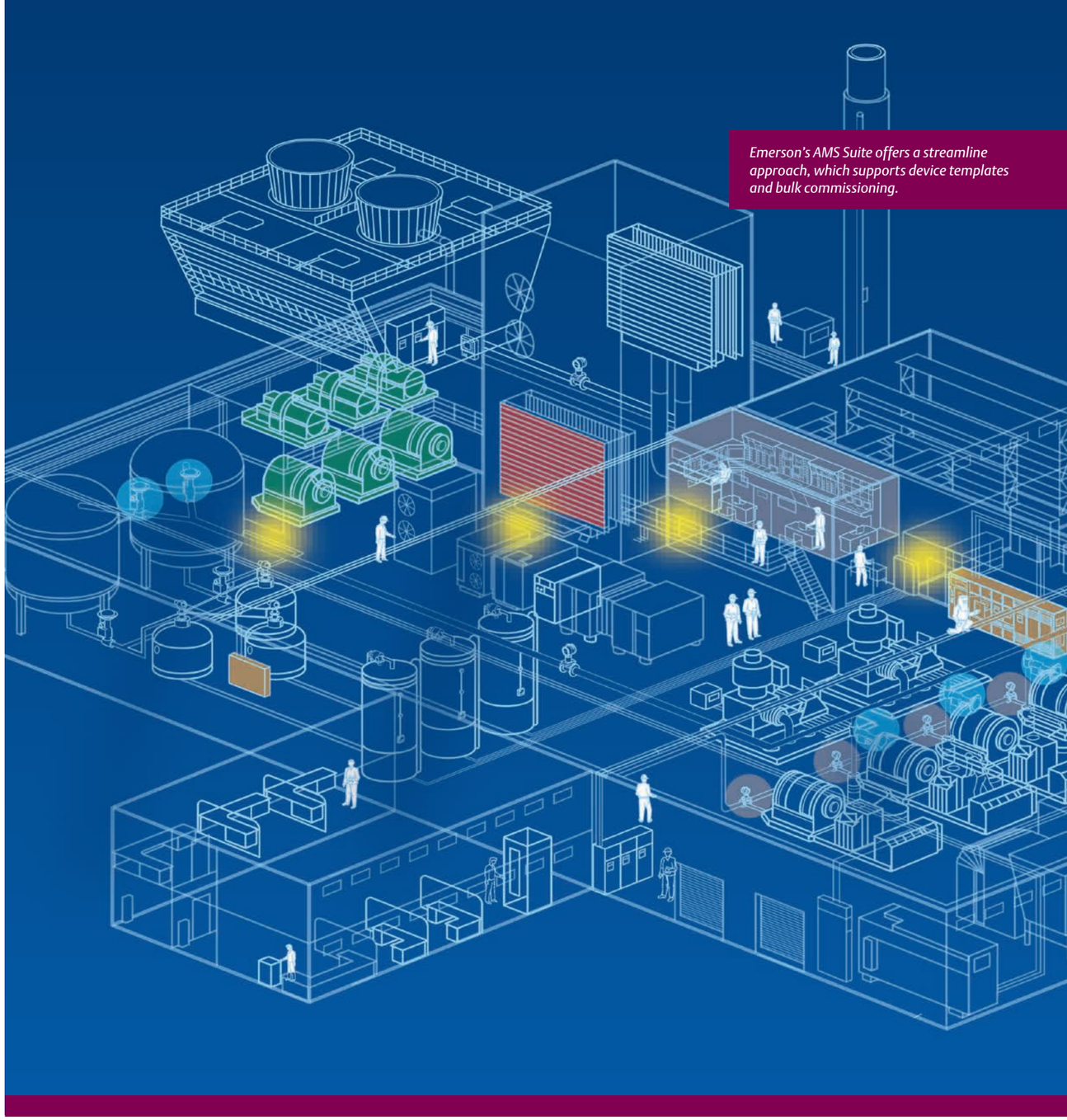
Moreover, the manual one-device-at-a-time nature of traditional commissioning and configuration holds huge potential for mistakes and data entry error. Adding just a few new devices to a network can mean hundreds of points of possible entry errors that can jeopardise operational efficiency, creating an inaccurately configured device that may even be a safety risk. Even something as basic as a typing error, or a technician in the field missing a new device during the configuration phase of the project, can have an impact on the overall reliability and accuracy of a plant's control system.

A streamlined approach

Emerson can provide a solution to these problems in the form of device configuration templates and a bulk commissioning function within the latest version of its AMS Suite: Intelligent Device Manager software. Users can now quickly and reliably standardise asset configuration for both HART® and FOUNDATION™ fieldbus devices, simultaneously applying features, options, and alerts to an unlimited number of devices, in a fraction of the time. Built-in validation reports automatically compare configurations and quickly identify when devices deviate from the associated template, thus reducing errors.

The templates are created by the operator's engineering team, who define user configurations for each device. Spreadsheets are then used to map templates to device tags. Once transferred to the system, the mapping will configure devices automatically according to parameters on the template. If configuration changes are necessary after commissioning, the templates can be modified and reliably reapplied to all devices en masse. It is also possible to fine tune configurations. Verification of the configuration process is automated and users can create verification reports that show devices that were not configured correctly.

With both HART and FOUNDATION fieldbus devices, bulk configuration reduces time to fully configure devices by up to 80 per cent compared to existing work practices. For example the time to verify device configuration of a 10,000-tag system could be reduced by an order of magnitude from 2,500 hours to fewer than 250 hours.



Emerson's AMS Suite offers a streamline approach, which supports device templates and bulk commissioning.

Bulk configuration and commissioning not only present considerable time and cost savings, the technology also provides peace of mind for plant managers in knowing that their smart devices are set-up correctly and will perform as they should when the production begins. In a competitive marketplace, with increasing demands on operating efficiency, ensuring the reliability of critical processes like commissioning and configuration has to be a business imperative.

Learn more about standardising asset configuration using AMS Suite: Intelligent Device Manager at EmersonProcess.com/IM705

Modern valve instrumentation is a vital tool in enhancing process performance and minimising unanticipated downtime.

Process reliability **starts in the basement**

Control valves have a simple yet pivotal part in the reliability of any industrial process. As Richard Grace, Instrument Business Unit Manager at Emerson explains, high calibre digital instrumentation can keep valves in their 'comfort zone'.

For any industrial process plant to achieve the high levels of reliability needed to remain competitive, all elements of that process need to be carefully engineered, correctly commissioned and regularly maintained. Therein lies the challenge: how do you minimise these risks and ensure the most critical elements in a process perform to their highest levels, with consistency and reliability for years to come?

Let us take control valves as an example – these devices are a fundamental part of any industrial process control loop. On the face of it their principles of operation are relatively simple, but their importance and contribution to the overall efficiency and reliability of the process can often be overlooked in favour of more focal and noisy concerns like mechanical pumps, motors and compressors. But as the one dynamic component in a control loop that converts set-point changes of the control system to a physical impact on the process, control valves hold a pivotal role in process reliability and the potential business benefits that can be gained in terms of greater Overall Equipment Effectiveness (OEE), improved process control and reduced conversion costs per unit of saleable product.

The correct selection of a control valve starts with a clear understanding of the application needs, the desired control performance and process specific considerations such as the presence of cavitation, flashing or high noise levels. The gain and rangeability of the application should also be known, so the correct style of valve and trim characteristics can be chosen to ensure the valve will be operating in its 'comfort zone' for optimum performance and longevity of service.

Finally and most importantly, the valve instrumentation needs to be of a high calibre and digital, so it can be tuned to suit the dynamics and characteristics of the valve assembly for optimum control. This point is critical, as it plays a pivotal role in the hierarchical 'communication chain' from control system to valve plug, so directly impacts on the performance and reliability of the valve.

If instrumentation is sub-standard or poorly maintained it will directly limit the achievable performance levels of the valve/loop, as well as present a high-risk reliability factor for the valve and process as a whole. Sadly, poor maintenance of valve instrumentation is not uncommon these days, due to a loss of skill sets and streamlined maintenance on many sites, so is one of the key reasons for valve instrumentation problems that ultimately lead to many control valve failures and the process consequences that brings.

Modern-day digital valve instrumentation like Emerson's Fisher® FIELDVUE™ DVC6200 series Digital Valve Controller offers users an upgrade path to improved overall performance and reliability of their control valves, by ensuring optimum performance and correct operation is achieved from the start of the valves lifecycle during commissioning. Once the process is operational, the powerful in-service diagnostics and alerts support remote monitoring of all aspects of the control valve assembly and supplementary instrumentation, providing an early warning system for pending reliability problems and performance deterioration via a Red, Yellow, Green health index report system.

Integration of SMART instrumentation, such as FIELDVUE, to host systems and maintenance workstations has never been easier using today's *Wireless*HART® self-organising mesh networks. With the simple addition of a THUM™ adaptor, any FIELDVUE Digital Valve Controller can be easily connected to the outside world to automate the monitoring and diagnosis of your most critical control valves, for improved performance and reliability of your process in just a matter of minutes.

Go to EmersonProcess.com/IM707 to find out more about using digital valve instrumentation to increase the reliability of your plant.

The battle against corrosion is unrelenting, but smart monitoring can give plant operators the edge in maintaining efficiency.

Keeping a close eye **on corrosion**

Corrosion is one of the greatest problems facing plant operators, and it's monitoring and effective management is a never-ending battle. Kjell Wold, After Sales and Support Manager for Flow Assurance, describes the problem and shows how Emerson technology is helping operators win the war.

Internal corrosion is a continuous challenge in refinery operations today and a significant problem for operators. Alongside rising maintenance costs and their drain on resources, corrosion poses risks to the safety and integrity of the plant if not properly managed.

Many factors have an impact on refinery corrosion challenges. Age, original construction specification and processes vary from refinery to refinery. Changes in operational temperature and velocities can also influence plant performance. In addition, the quality of the feed (crudes) may play a part, particularly as lower price crudes often have a higher acid content and therefore are more corrosive. Hence, refineries that buy crude in the spot market (opportunity crudes) often need a robust and proactive corrosion protection strategy.

In any case, effective monitoring of corrosion is essential and a range of intrusive and non-intrusive methods exist – each with their own benefits and limitations. Often a combination of methods will give the best overall monitoring programme for a refinery.

Intrusive, retractable style probes are commonly used, with Weight Loss Coupons the simplest devices used. ER (Electrical Resistance) and LPR (Linear Polarisation Resistance) probes offer more sophisticated monitoring, as do UT (Ultrasonic) sensors, which are low cost and can be used in high temperature environments. Field Signature Measurements (FSM) can detect uniform and localised corrosion with great accuracy, though cost and complexity limit FSM's usage to critical applications.

In addition to measurement technology, data acquisition and management is central to effective corrosion management. Traditionally monitoring was carried out manually and off-line, attracting significant labour costs. The industry trend is now clearly towards on-line corrosion monitoring, providing ample data and real-time information.

*Wireless*HART technology is now widely accepted in the industry and makes upgrades to on-line monitoring affordable. Non-intrusive wireless UT sensors are now available and using Emerson's Roxar™ CorrLog wireless corrosion transmitter, high-sensitivity measurements from ER and LPR probes can also be obtained via a single integrated wireless network.

This makes it easier to apply the appropriate probe to each individual part of the process and also to combine various technologies for redundancy and improved reliability.

Different applications can also use the same data management software. As an example, intrusive probes and FSM technology can both be managed within Emerson's Roxar Fieldwatch software, making the correlation and reporting of data more efficient.

A plant like a refinery will have a range of different process corrosion and integrity management issues, which normally will require a combination of monitoring technologies and solutions. It is important to find the combination of technologies that gives the best total coverage of the plants monitoring needs. The Roxar CorrLog Wireless transmitter and the non-intrusive FSM system can play important roles in this respect, and help extend equipment life and increase production.

Learn how Emerson can support you with your fight against corrosion at EmersonProcess.com/IM706

Innovative technologies

Monitoring the health of cooling systems

Effective cooling is essential for many plant processes and any failure in air cooled heat exchangers, or deterioration in the quality or quantity of cooling tower water can have critical consequences for production, along with high repair costs. Manual monitoring of systems is time-consuming and poses hazards to personnel required to take measurements in potentially difficult conditions. To help avoid risks to both production and personnel, Emerson can offer solutions thanks to two members of its robust family of Essential Asset Monitoring applications.

Air cooled heat exchanger failure can limit cooling and reduce plant production by as much as 0.2%. Whilst on hot days a heat exchanger shutdown could result in sudden overpressure of a distillation column overhead, resulting in relief valve lifting and release to flare, which is a recordable incident.

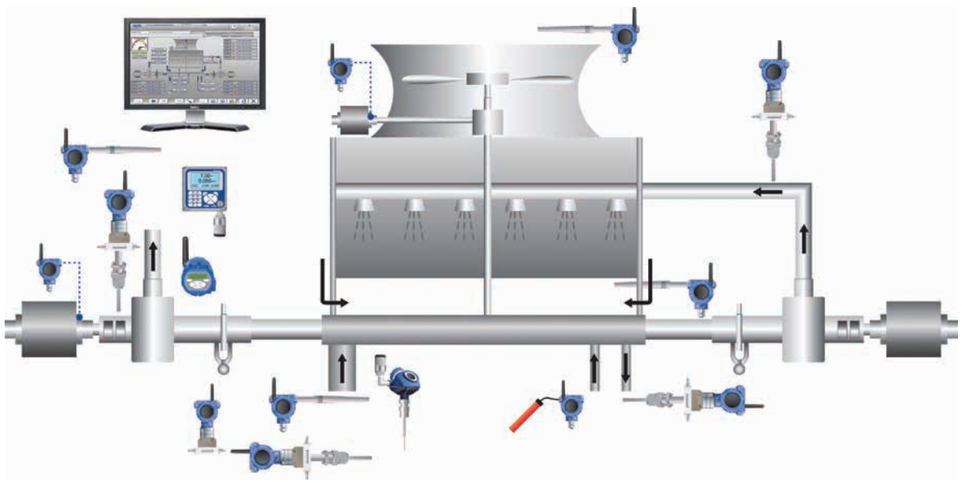
Emerson's Air Cooled Heat Exchanger Monitoring solution provides easily deployed wireless plug-and-play technology, for automated continuous online monitoring. The solution oversees and diagnoses the full range of failure modes, alerting personnel, who can adjust operation and perform corrective maintenance at the appropriate opportunity. This type of predictive maintenance methodology has been proven to save up to 30% of maintenance costs compared to run-to-failure practices.

Similarly, Emerson's integrated Cooling Tower Monitoring solution monitors the water cycle of the cooling tower that services process plants, helping operators ensure makeup water and chemical costs are optimised, whilst minimising scaling and fouling of cooling water exchangers. This solution provides a complete set of pre-engineered applications for 24/7 online monitoring and analysis of the cooling tower and it's related equipment. It uses both wireless and existing wired instruments to provide affordable, easy-to-implement, automatic monitoring.

Emerson estimate the on-line monitoring of a large 350,000 gpm cooling water system can save up to €415,000 annually due to reductions in lost production, lower energy bills, and reduced chemical and water usage.

Emerson's Essential Asset Monitoring suite also includes monitoring solutions for pumps, blowers and heat exchangers.

Find out more about heat exchanger monitoring at EmersonProcess.com/IM708 and cooling tower monitoring at EmersonProcess.com/IM709



Wireless enhancement improves efficiency of technicians in the field

Streamlining routine maintenance and improving diagnostic and corrective response times are key components in preventing unscheduled downtime and enhancing reliability across the board. A further improvement to Emerson's CSI 2140 Machinery Health Analyzer has seen the inclusion of a wireless interface to laser shaft alignment tools. This improves the efficiency of personnel to further streamline the work process to perform route-based vibration data collection; analyse the root cause; and also align the machine all in a single trip.

To streamline your routine maintenance go to EmersonProcess.com/IM712

Condition monitoring system provides improved protection from sudden shutdowns

Ensuring the on-going reliability of key assets is crucial to efficient production, and Emerson has introduced a new device for the enhanced protection of rotating equipment. The CSI 3000 Machinery Health Monitor delivers field-mounted protection for a range of machinery such as pumps, compressors, centrifuges, blowers and generators in situations where a standard system will not fit or is not cost-effective. The user-friendly CSI 3000 offers a quick and reliable route to improved availability and greater safety of rotating assets.

Discover how the CSI 3000 can help protect your rotating equipment at EmersonProcess.com/IM710

Coriolis transmitter reduces maintenance costs

Process operators need repeatable, reliable and accurate measurements to meet the challenges of greater productivity and reduced maintenance costs. Supporting this requirement Emerson has launched the Micro Motion® Model 5700 Transmitter, compatible with Micro Motion Coriolis sensors, that provides much improved measurement insight and simplified solutions. Enhanced diagnostics combined with easy access to detailed measurement history provides actionable insights for improved process management, reduced maintenance costs and increased efficiency, while Smart Meter Verification confirms meter health and accuracy.

For more information about the Model 5700 go to EmersonProcess.com/IM711

Enhanced Magnetic flowmeter for hazardous area applications

Hazardous area applications require greater instrumentation safety and reliability. Emerson's new Rosemount® 8700M Magnetic Flowmeter line provides enhanced safety and reliability along with intelligent diagnostics. These features help users take advantage of improved installation, maintenance and process management practices. An all-welded sensor design and glass feed-throughs transmitting signals between isolated compartments provide the most effective barrier for safety and reliability. Enhanced diagnostics, including Smart Meter Verification and the new Electrode Coating Detection, enable more informed decision making, easier identification of issues, and simplified meter verification.

Find out more about the 8700M at EmersonProcess.com/IM713

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