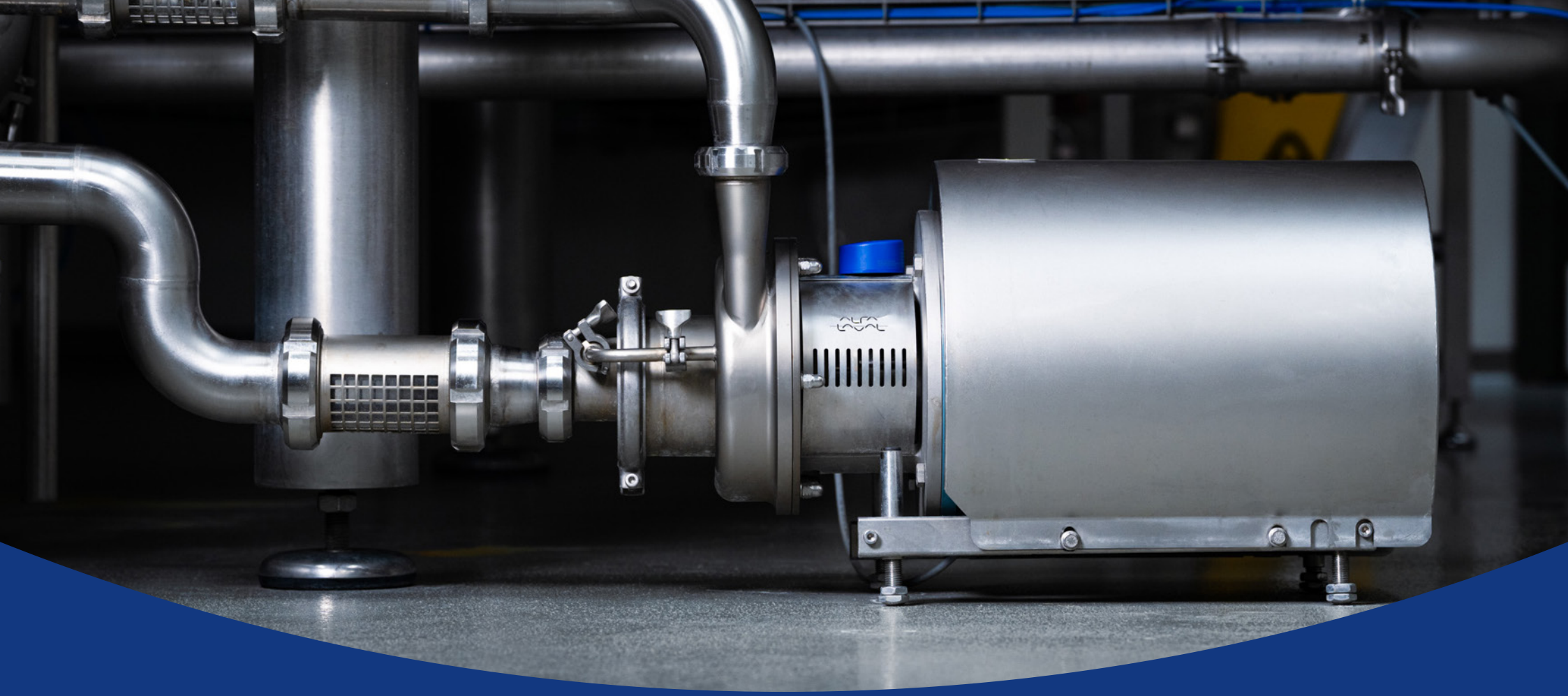

Condition monitoring
Modernizing maintenance

A Buyer's Guide
to condition monitoring
in hygienic industries

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Changing the game with condition monitoring

In today's fast-paced world, high uptime and performance are more critical than ever. Condition monitoring is no longer a 'nice to have', it is a 'need to have' to stay on top of the competition and achieve sustainability goals.

According to a study published by Forbes, unplanned downtime costs manufacturers 44 billion euro a year - that's 800 hours of lost production every year and 15 hours per week waiting for machines to restart.

Condition monitoring flips the script by detecting issues early, reducing downtime, and keeping operations running, saving on OPEX, and securing timely deliveries to customers.

While most manufacturers recognize condition monitoring as the future – the questions remain:

How do we implement condition monitoring effectively? And how do we choose the right condition monitoring solution for our production?

This guide helps you make the right decision.

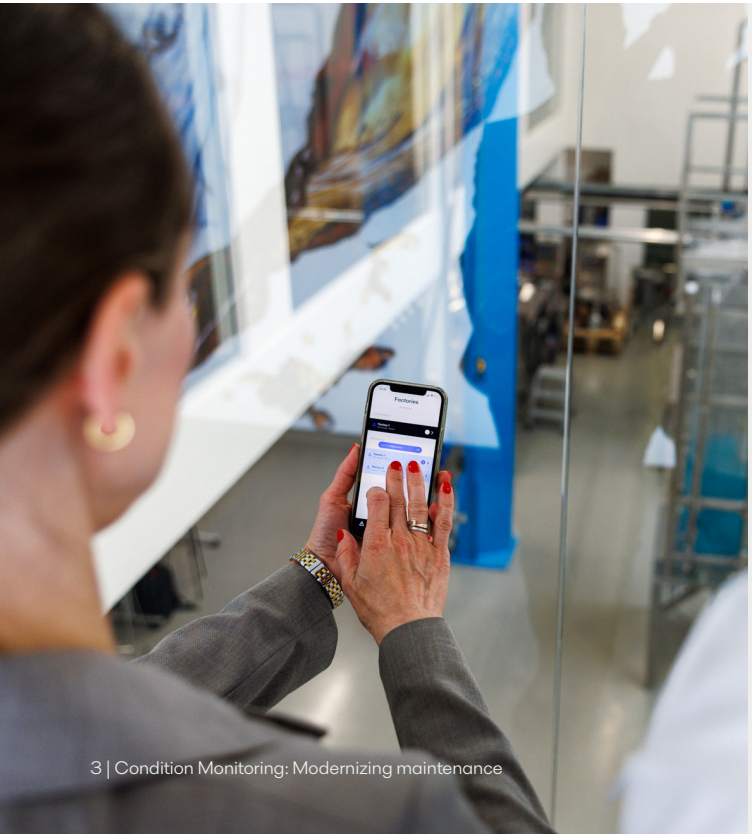
The cost of unplanned downtime

$44 billion
a year unplanned downtime costs*

800 hours
of lost production

15 hours per week
waiting for machines to restart.

* Unplanned Downtime Costs More Than You Think



"Just 45 minutes of maintenance triggered by our condition monitoring solution prevented 4 hours of unexpected downtime and 2,000 liters of wasted water"

Soft drink producer, UK

The forces reshaping manufacturing

Sustainability is no longer a choice.
Investors, regulators, customers, and consumers demand transparency. According to Our World in Data, the Food & Beverage sector accounts for around one third of global greenhouse gas emissions. Regulation is getting stricter, e.g. the EU CSRD, forcing producers to rethink value chain transparency, waste, and efficiency.

Value chains are expanding.
Better insight into equipment conditions enables efficient resource utilization and efficient benchmarking across production sites.

Resilience starts with cybersecurity.
In an era of connected operations, protecting digital infrastructure is as vital as keeping equipment running.

The case of condition monitoring

The challenges facing producers are many, and unplanned downtime only adds to these challenges.

Manufacturers therefore need a resilient, data-driven, and secure approach to optimize performance and minimize unplanned downtime.

Why invest in condition monitoring?

Less unplanned downtime:
Condition monitoring can help you reduce or even eliminate unplanned downtime in your production line, increasing yield and output.

Shorter, planned downtime:
Timely notifications allow timely inspection and repair – without interrupting production.

Maintenance crew efficiency:
Condition monitoring helps maintenance teams focus on the machines that need attention and frees up resources for continuous process optimization.

Better value chain management:
Being able to detect issues early enables proactive communication with value chain partners, guarding against additional fees and improving partner relations.

High resource efficiency and lower footprint:
Condition monitoring minimizes resource waste, i.e. loss of product as well as energy, water and chemicals for extra Cleaning-in-Place (CIP), and extends asset life of valuable components.

Plant safety:
Most accidents happen during maintenance. The pressure from unplanned downtime can lead crews to take inappropriate risks. Condition monitoring can help improve plant safety.

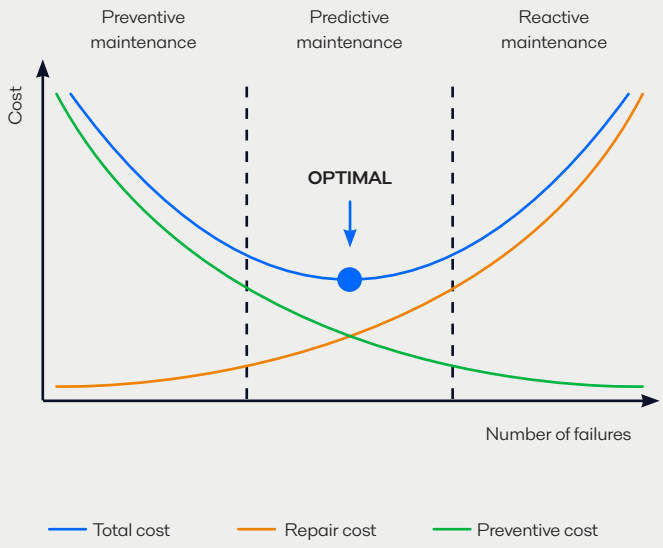
"Just this one notification paid for our entire investment in the condition monitoring solution and the first year of our Analytics subscription."

Chris Heslop,
Engineering Specialist at the Rugby facility, Britvic

In the case of Britvic's Rugby facility, condition monitoring turned a standard six hours of unplanned downtime - and a loss of 288,000 bottles - into just 45 minutes for pump disassembly, repair, and reinstallation.

Enabling predictive maintenance

Choosing the right maintenance approach makes a substantial difference. According to a study published by Oden Technologies, applying a predictive, condition-based monitoring approach can cut downtime-related costs by nearly 40%.



What are the pros and cons of different maintenance strategies?

	Advantages	Disadvantages	Suitable for
Reactive maintenance Fix it when it breaks	• Low upfront costs	• Unplanned downtime • Damage to machinery • Expensive repairs • Idle machinery and man-power • Delays in deliveries	• Small businesses with limited reliance on machinery
Preventive maintenance Fix it when planned	• Estimated 12% to 18% cost savings over reactive maintenance programs according to 'Operations & Maintenance Best Practices' published by the US Department of Energy • High reliability, few breakdowns • Allows scheduling of maintenance	• Too-early replacement of parts • High inventory costs • High inspection costs on potentially low-risk equipment • Relies on estimated failure rates	• Businesses requiring operational continuity at any cost
Predictive maintenance Fix it when needed	• Estimated 19% to 28% cost savings over reactive maintenance programs according to 'Operations & Maintenance Best Practices' published by the US Department of Energy • Prevents failure before it occurs • Saves time and resources • Improves workers' safety • Ensures high resource and throughput efficiency	• Requires investments in sensors and monitoring tools • Poor data quality can cause false alarms • Requires training of technicians • Needs to be fit for purpose for high efficiency and reliability	• Businesses requiring operational continuity at the lowest possible cost

Selecting the right condition monitoring solution

In food, beverage, and pharmaceutical production, strict hygiene regulations require the highest levels of product safety. If equipment is not operated correctly, the risk increases, caused by for instance faulty gaskets, mechanical issues, or unstable process conditions. At the same time, the highly dynamic hygienic processes with frequent change-overs and cleaning cycles require a fit-for-purpose condition monitoring solution.

What to consider before you buy?

Total cost of ownership
- License cost structures
- Warranty & Guarantee
- Implementation & integration
- Maintenance & service
- Training of employees
- Hardware

Scalability
- Ease of installation and use
- Integration with existing equipment
- Installation without interrupting operations
- Intuitive and easy-to-use interface
- High reliability and relevance of notifications

Investing in a future-proof solution
- Tailored to demanding hygienic processes
- Continuous compliance with industry regulations
- Selecting a cyber-secure solution
- Scale and evolve with production needs
- Support improved yield and reduced production waste
- Provide insights needed to optimize production and ensure on-time delivery

"After investing in condition monitoring we managed to optimize working time for two technicians who maintain the pump fleet in our facility. In fact, condition monitoring has proved to be the most important tool for our technicians."

Dairy plant, Europe

Investing in the future

Investing in condition monitoring requires careful evaluation of the pros and cons of different solutions.

Choosing the right solution is not only about solving today's challenges – it is also about staying ahead for years to come.

What does the ideal condition monitoring solution look like in hygienic industries?

There are many different condition monitoring solutions in the market. The following table provides a simplified overview of some of the main characteristics of different solutions for pumps, ranging from the application of a generic solution for pumps to installing a tailor-made solution for hygienic industries.

	Generic applications	Specific applications	Ideal for hygienic industries
Sensors per piece of equipment	Many	Few	One
Sensor installation	Onto equipment	Onto pumphouse for pumps	Onto pumphouse for pumps
Ease setup	Part of a larger system install	Stand-alone with some expertise needed	Maintenance crew can easily install
Water protection	Water resistant	Water protected	Fully protected and designed for wet environments
Security and data protection	Handled in the bigger system	Handled in the bigger system	Encrypted and standalone to ensure security
Connectivity	Locked into larger IoT ecosystem	Limited choice of IoT ecosystem	IoT-based and standalone with API connectivity option for full freedom

Paving the way for effective condition monitoring

For condition monitoring to truly deliver impact, it requires alignment and buy-in across functions. From plant management to factory floor, there are benefits for everybody.

What is at stake for different functions involved in the buying process?

	Management	Operators	Technicians	Finance
Main goal	• Sustain competitive advantage and meet ESG requirements	• Meet delivery, quality, cost and HSE targets	• Secure continuous high performance and uptime	• Reduce costs and ensure profitability
How condition monitoring helps	• Ensures compliance. • Increases uptime and productivity. • Minimizes waste and ensures resource efficiency. • Provides global performance insights. • Contributes to a safe and healthy working environment.	• Prevents unplanned downtime. • Allows more time to focus on optimization and continuous improvements. • Reduces resource waste. • Enhances workforce productivity and relieves stress. • Provides peace of mind.	• Automates troubleshooting, saving time and effort. • Catches minor issues before they cause major failures. • Reduces emergency spare part orders and associated costs. • Provides insights through historical data, tracking typical pitfalls. • Reduces high-pressure situations by preventing urgent repairs.	• Reduces costs for equipment replacement • Saves on repair expenses. • Cuts OPEX and improves ESG metrics. • Minimizes overtime wages by preventing emergency repairs. • Reduces need for inventory, improving the cash conversion cycle. • Improved equipment • ROI, enhancing long-term financial returns.

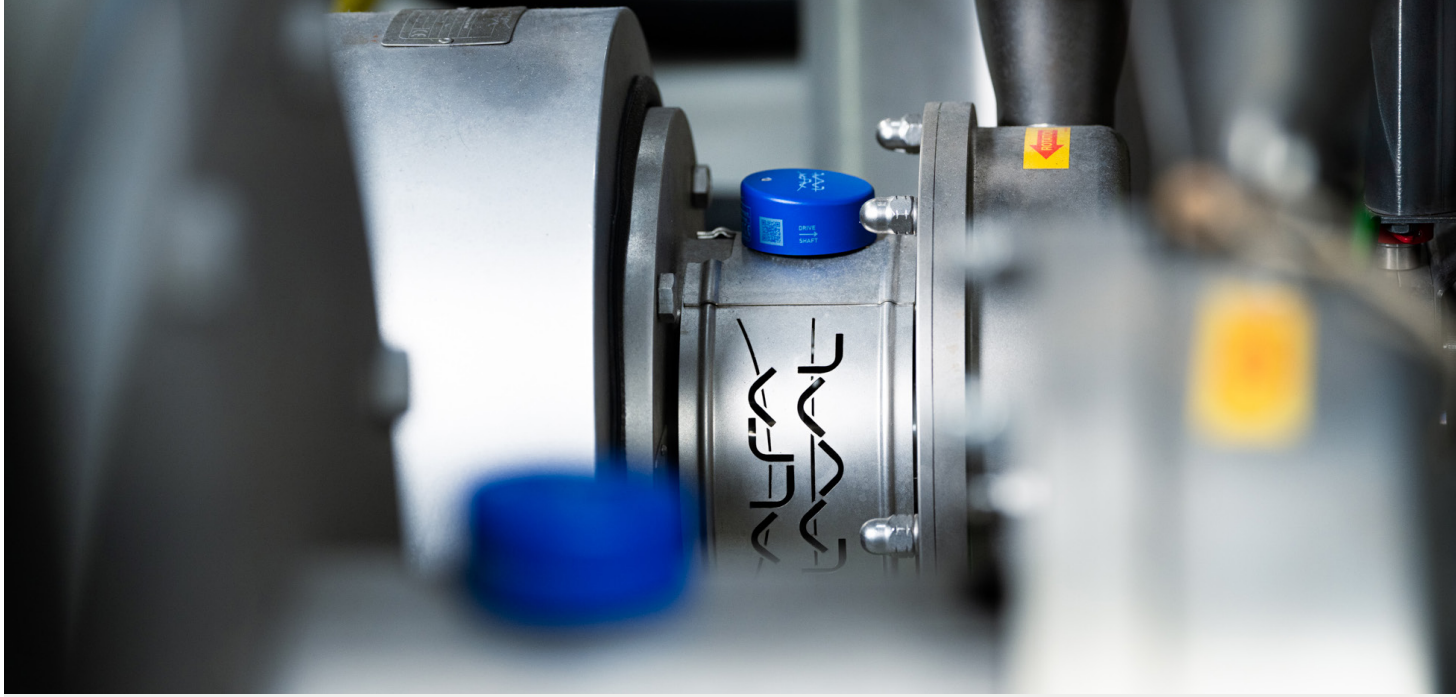
Selecting condition monitoring tailored to hygienic industries

With 140 years of industry experience in hygienic applications, Alfa Laval has developed Clariot™ - a condition monitoring solution specifically compatible with hygienic fluid handling.

The sensors are tailor-made for the dynamic environment of hygienic production, where frequent sensor readings are important to closely monitor equipment and process health.

Instead of placing sensors on motor bearings, where it is hard to detect issues early, the sensors are mounted on the pump housing to detect problems sooner and more accurately.

This means quicker responses, less downtime, and more dependable production.



What benefits to look for?

Fast to install and commission: Switching to predictive maintenance with Alfa Laval condition monitoring is simple and cost-effective. There is no need for extra cables or technicians, keeping entry costs low.

Fast payback time (ROI): In a setup with 50 pumps, just one unplanned stop per quarter can result in 80,000 EUR in annual losses. Condition monitoring from Alfa Laval costs less than a tenth of that scenario - delivering a fast payback time.

Flexible design: Compatible with most pumps in the market. The Clariot™ measurement strategy differs from the strategy of competitors, and the modular design allows for customized analytics packages that fit your needs.

Measurement strategy: Many systems only measure occasionally. In the Hygienic industry, pressure shocks and other short duration impacts occurs, continuously measurement of the equipment is needed.

Easy to service and maintain: The system collects and analyzes pump data 24/7 using AI-based analytics. When actions are needed an email notification is sent with suggestions for root causes and specific guidelines for inspection and repair.

Competitive cost per unit: 10–60% more cost-competitive than standard off-the-shelf solutions, while also offering customizable and industry-specific features.

Extended warranty: Extended warranty on equipment if monitored and serviced according to recommendations.

Expert support: Alfa Laval's Customer Success Team provides expert support with technical installation, overall error monitoring and problem identification, and documentation of value and impact.

Demystifying wireless condition monitoring

There are some widespread myths about wireless condition monitoring that we can debunk with Clariot™.

Assumption	Fact	Reason
Wireless monitoring solutions provide lower data quality.	Wireless systems used to come with some limitations in both data quality and frequency of measurements. These issues have been resolved with Clariot™ that measures at a high sample rate – continuously.	Development of new hardware components based on knowledge and experience from previous systems is the main reason for the improved data quality.
A wireless condition monitoring solution is costly.	A full monitoring system with a fully integrated cloud solution and AI- based analytics takes a lot of resources to develop. Therefore, a large installed base of sensors is necessary in order to improve the machine learning and lower the cost per unit.	Alfa Laval Clariot™ is a strategic investment and the needed required resources for developing and improving the system are available.
A wireless condition monitoring solution is time consuming to install.	Clariot™ is designed as a "plug and play" solution. The installation of the system is simple and intuitive, the commissioning is done via an app and the system is up and running within 48 hours. 50 units can easily be installed in one day.	In the ideal world, all historical data should be collected and fed into the analytics system. Clariot™ uses pictures from the commissioning process and reference data from similar equipment to start monitoring immediately. As the system collects more historical data from the individual piece of equipment, the system continuously improves the reliability and confidence level.

Getting started with condition monitoring

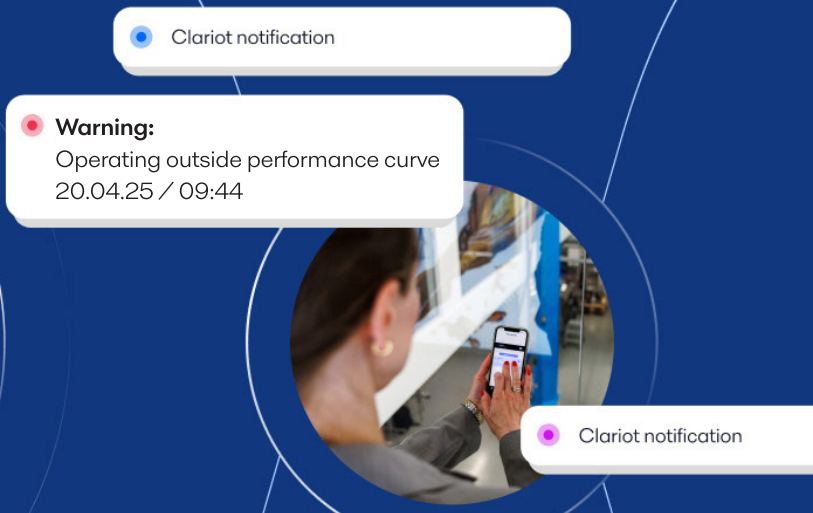
Alfa Laval's condition monitoring solution Clariot™ bundles the hardware and software to ensure the optimal performance of rotating equipment, such as pumps and agitators.

Monitor

A small sensor is attached to the equipment . The sensor measures vibration and temperature.
The sensor sends this data wirelessly to a nearby gateway.

Analyze

The gateway securely uploads the data to the cloud, where you can check everything from your phone, tablet, or computer - anytime, anywhere.



Act

If something is off, e.g. the equipment is vibrating too much, you get a detailed alert so you can address the issue before it causes unplanned downtime and/or severe damage to equipment.

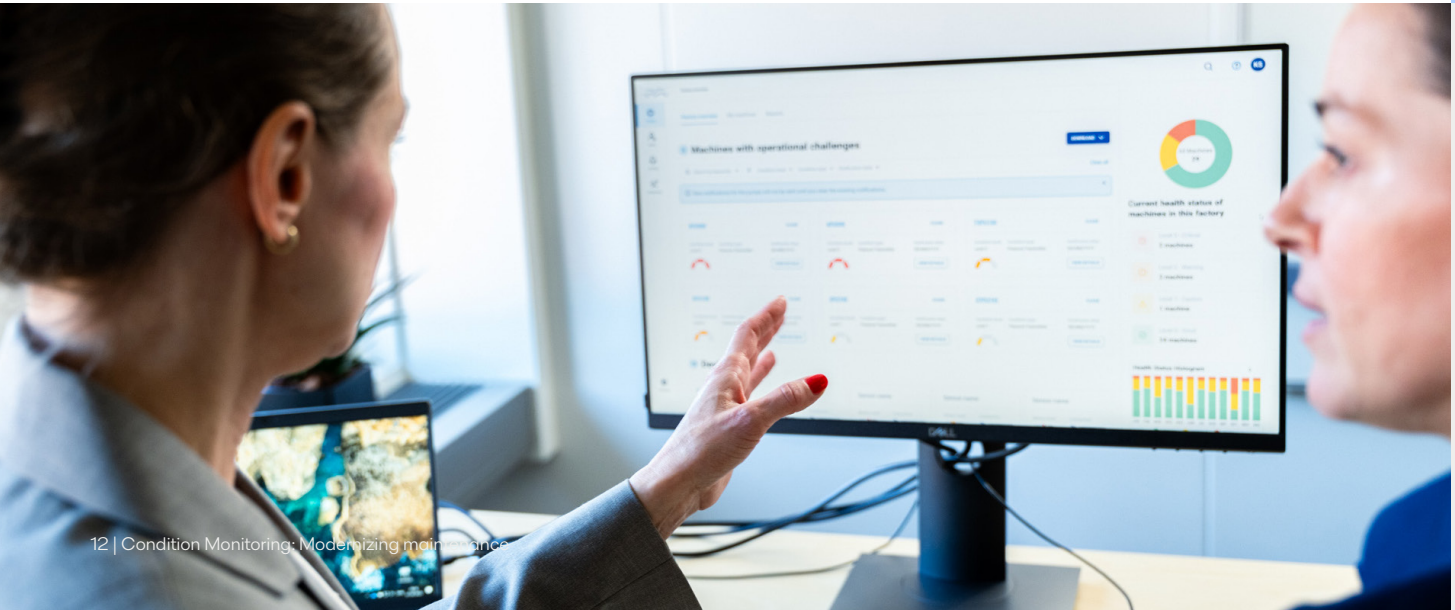
Speaking the language of Clariot™

What are the typical issues with rotating equipment? Rotating equipment faults can stem from various sources. The key is to effectively troubleshoot and identify the exact problem and track recurring patterns. By using this knowledge, technical teams can handle maintenance faster and more appropriately. In the case of pumps, typical issues and recommendations are:

Condition		Typical recommendations
Process	• Running outside desired curves • Possible cavitation	• Check process for operation within pump specifications • Check pump for correct operation withing pump specifications
Installation	• Looseness of equipment • Insufficient support of the pump	• Perform a visual inspection of the pump legs • Check if the pump has good and even contact on all 4 feet • Check piping support
Mechanical	• Seals, impeller, bearingor parts wear	• Inspect pump for seal leakage • Inspect the pump for unusual sounds from bearings • Check if there is impeller wear

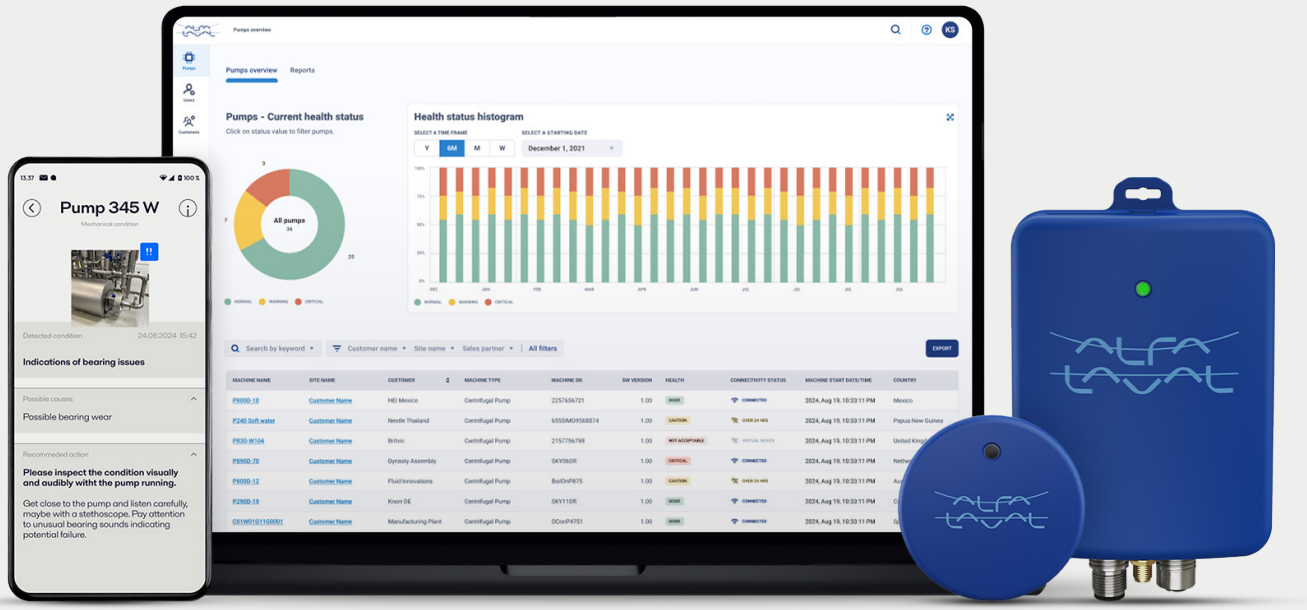
Instead of just sending raw data, Clariot™ provides a user-friendly dashboard to give you clear insights and simple notifications and recommendations for next step:

- **Red (Alarming):**
  A critical issue has been detected. Immediate attention is required to prevent downtime.
- **Yellow (Warning):**
  The pump is showing signs of potential problems over a period. Maintenance should be scheduled soon.
- **Orange (Event):**
  A change in performance has been detected. No immediate action needed, besides inspection on operating unit, according to notification.
- **Green (OK):**
  Everything is running smoothly - no action needed.
  By continuously tracking vibrations, temperature, and runtime, Clariot™ ensures more accurate and reliable condition monitoring, helping you prioritize resources and be as efficient as possible in plant maintenance.



"A tenth of the connected pumps presented a condition. Of those conditions, 45% were installation faults, 30% mechanical faults, and 25% process faults."

Cheese manufacturer, Europe



Getting on board with Clariot™ is simple

Buying a condition monitoring solution is like getting a smartphone with a mobile plan – you do not just buy the phone - you also need the services that make it work.

With Clariot™ you are not just getting the hardware. With Clariot™ you get a complete solution:

Clariot™ VX sensors and Clariot™ Connect gateway:
The essential hardware that collects and transmits critical equipment data.

Clariot™ Analytics subscription:
Real-time condition insights, and customizable dashboards to track performance and predict failures before they happen.

The solution comes with a one-year subscription, including training and ongoing support so that you can fully leverage the power of predictive maintenance and condition monitoring from day one.

Clariot™ is developed for demanding hygienic processes, but is equally suited for use in less complex applications.

To learn more about Clariot™, visit www.alfalaval.com/clariot

This is Alfa Laval
The ability to make the most of what we have is more important than ever. Together with our customers, we're innovating the industries that society depends on and creating lasting positive impact. We're set on helping billions of people to get the energy, food, and clean water they need. And, at the same time, we're decarbonizing the marine fleet that's the backbone of global trade.

We pioneer technologies and solutions thatfree our customers to unlock the true potential of resources. As our customers' businesses grow stronger, the goal of a truly sustainable world edges closer.

The company is committed to optimizing processes, creating responsible growth, and driving progress to support customers in achieving their business goals and sustainability targets. Together, we're pioneering positive impact.

How to contact Alfa Laval
Contact details for all countries are continually updated on our website.
Please visit www.alfalaval.com to find the information you need.

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