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A Bosch Company

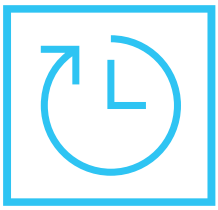
Rule and data-based analyses: How to prevent hydraulic systems breaking down in recycling industry and reduce maintenance costs.

Recycling companies depend on the availability of their systems. If hydraulic equipment fails, they can face significant costs owing to downtimes and financial penalties. Rule and data-based analyses can help to prevent this. Predictive analytics also reduces the maintenance effort and increases the operating life of the equipment. An overview of predictive analytics in the recycling industry. The benefits and when they are worth it.

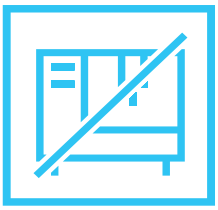
The recycling of raw materials is an established part of industry. As part of supply chains, however, recycling companies are under great time pressure and rely on the continuous availability of process-critical systems. If hydraulically driven recycling machines such as shredders, scrap shears or presses fail, companies can face contractual penalties. And if HGVs, trains or ships have to wait to be loaded, the resulting costs can quickly reach five or six-figure sums.

The current maintenance situation does not make things easier either. An acute shortage of specialist staff and distributed facilities which need to be catered for simultaneously result in unnecessarily long delays. On top of all this, companies waste materials and money if they replace hydraulic parts which are still working perfectly at set intervals as a precautionary measure. So is there a way out of this problem?

Missing hydraulic know-how



Need of continuous monitoring



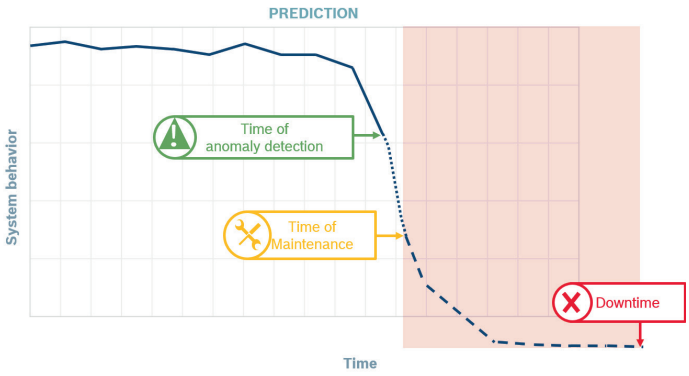
Missing machine insight

High downtime costs

ECG FOR HYDRAULICS

The importance of hydraulics for a recycling system is comparable to the cardiovascular system of a marathon runner. If the “pump” fails because of a slow chain reaction, it is already too late. Nothing more can be done. Doctors therefore check the fitness of competitive athletes on an ongoing basis. With the right data and predictive analytics, hydraulics experts can assess the health of a hydraulic system and the likelihood of its components breaking down so that suitable measures can be recommended in good time. The user then has enough time to plan and prepare maintenance work and carry it out at a suitable point in time.

The monitoring focuses on the pump, the electric motor, the hydraulic oil and the cooling. The pump is mainly checked for leaks and temperature, while the electric motor which acts as a sensor for torque fluctuations can indicate increased power requirements. The fluid is analyzed with regard to temperature, water and particles, which reveals harmful contamination and changes in viscosity.



▲ **Example from a recycling system: After anomalies were detected (1) and maintenance recommendations were given, the operator has one week in which to rectify the fault.**

Stopping slow chain reactions

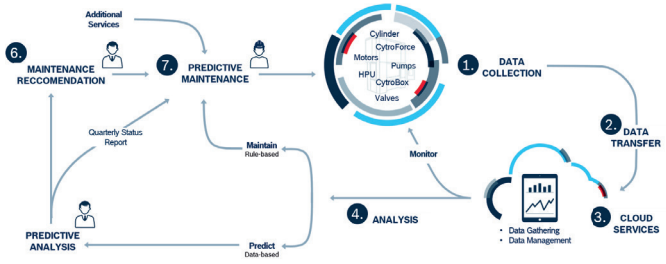
The risks associated with hydraulic systems can be deceptive. After all, breakdowns are often caused by small, seemingly unimportant problems. For example, pressure peaks in a hydraulic cylinder can cause brief but severe vibration which then continues in the system as a whole. In the long term, this vibration damages valves and seals and air enters the system, leading to cavitation in the pump. At this point, the chain reaction has fatal consequences: Tiny pieces measuring just micrometers are ripped from the material, spread throughout the system via the fluid and make deep scores in the pistons. Leaks in proportional vales and cylinders spell the end for the system. It can then take days before the system is repaired and ready for use again – with significant material and personnel costs.

How does predictive analytics work?

Without data, no evaluation is possible. The service provider therefore equips process-critical system parts with suitable sensors first. The sensor data together with details of specific component statuses are sent to a so-called DAQ box (data acquisition). They are then pre-processed in an IoT gateway and transferred in encrypted form to the cloud where they are evaluated by algorithms and compared with values from the data pool. Given the capacity required, such quantities of data can only be processed within a cloud. This also offers the advantage that the user does not need to set up and maintain their own IT infrastructure.

Before the system can provide accurate predictions, suitable models and parameters must be identified and an appropriate algorithm found during the initial learning phase. This is enhanced on an ongoing basis so that it provides increasingly accurate predictions.

During the productive phase, the system detects an anomaly if the machine data actually measured clearly deviate from the comparative values. In the event of a warning, an expert can carry out further analyses if necessary, get an idea of the situation and recommend appropriate maintenance. The system operator then has enough time to plan and prepare the work.



▲ **The path from data collection to predictive maintenance.**

As time goes on, the system gets better because it learns and becomes more intelligent all the time. Thanks to the status reports regarding the condition of the machine, predictions which are made increasingly early and clear recommendations, the predictive analyses can also help to reduce the burden on the maintenance team and increase overall maintenance efficiency. After all, system operators can make full use of the operating life of monitored components with no risk and thus save materials and resources instead of carrying out cost-intensive, regular maintenance at set intervals.

PREDICTIVE ANALYTICS AS A SERVICE: WHEN IS IT WORTHWHILE?

Predictive analyses require a very high degree of specialist knowledge, experience and a comprehensive neural network which processes extreme quantities of data (big data) from a giant pool of anonymous comparative data sourced from similar applications. Anyone who wants to set up a “data lake” of this type requires a great deal of experience. Doing so singlehandedly is not only extremely time-consuming – the lack of comparative data also makes it impossible to achieve an adequate level of quality. As a monthly leased service, predictive analytics also helps to ensure transparent, predictable costs.

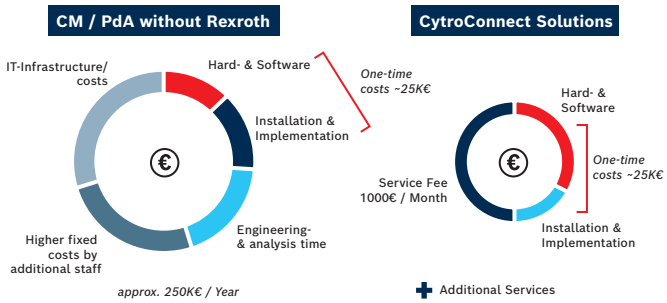
The service pays for itself quickly in most cases

If you compare the significant financial risks with the relatively low fees for a predictive analytics service, it quickly becomes clear that this investment can quickly pay for itself – several times over in certain cases. Depending on the particular system, Bosch Rexroth charges installation fees of between €15,000 and €30,000 for the technical equipment. The monthly fee for the service includes status reports and expert recommendations and is just a fraction of the installation fees. If just one or two breakdowns a year are avoided, the total costs will have been recouped within a few weeks or months.

ROI: When is predictive analytics worthwhile?
How much the failure of a hydraulic component costs depends on how long it takes to procure spare parts. In practice, the costs of a downtime are at least five times higher than the fee for a monitoring system. Generally speaking, predictive analytics pays for itself within a year. Would you like to know exactly? Request an ROI calculation by contacting ***[Mailto].***

Can I not do it myself?

If you use predictive analytics as a service, you not only benefit from a low fixed monthly price – you can also take advantage of our wealth of experience within the sector and our technological expertise. Very few recycling companies have such a level of experience and expertise, and it would take an unreasonable amount of time and effort to build it up. This includes all the initial and operative work such as engineering, the installation of hardware and software, personnel, infrastructure, operation and further development. Because this all comes in all-inclusive packages, the complete process is covered: from installation to status reports and maintenance recommendations. However, the user should also have a contact person who can deal with any questions. Optional maintenance contracts can also reduce the administrative burden, for example through spare parts management including stocking and delivery within 24 hours.



▲ **Comparison of the outlay involved: Predictive analytics singlehandedly and as a service.**

What about data protection?

As a service, predictive analytics can only win over people if data protection and security are taken into account at each point in the process chain. For peace of mind when transferring data, direct encrypted transmission using an external mobile router with a preconfigured SIM card is crucial. To ensure that the machine cannot be influenced in any way on site, data must only flow in a single direction, i.e. without a return channel.

Sovereignty over the process data must also remain with the customer. In the case of the service from Bosch Rexroth, this is contractually regulated. It is also practically guaranteed because the IoT gateway anonymizes the sensor values before they are transmitted. In terms of readable information, the encrypted data stream then contains just physical values from 4 to 20 mA which cannot be traced back to the monitored objects. The sensor names remain encrypted prior to verification in the cloud. After that, they can only be seen by the relevant customer and Bosch Rexroth. The user therefore remains the exclusive owner of the sensor data, while the algorithms for the analysis platform work with anonymous comparative values.

TWO TYPICAL CASES

1. Scrap shears versus ship
An international recycling company delivers among other things steel bales to addresses abroad. The company has a network of over 100 recycling yards and the failure of scrap shears regularly results in significant costs. In addition to the costs of downtimes which amount to around €600 in each case, the company must pay penalties of up to €100,000 per day if a ship cannot set sail on time owing to a breakdown.

The main reason for delayed deliveries is the lack of maintenance staff. Each person is responsible for on average six sites. And in many cases they are unable to reach a site quickly given the distances involved. Time is also lost as a result of looking for faults, procuring spare parts, maintenance and planning.

Solution A predictive analytics service will help to reduce reaction times when carrying out maintenance, minimize the costs of downtimes and penalties and relieve the burden on staff on a permanent basis.

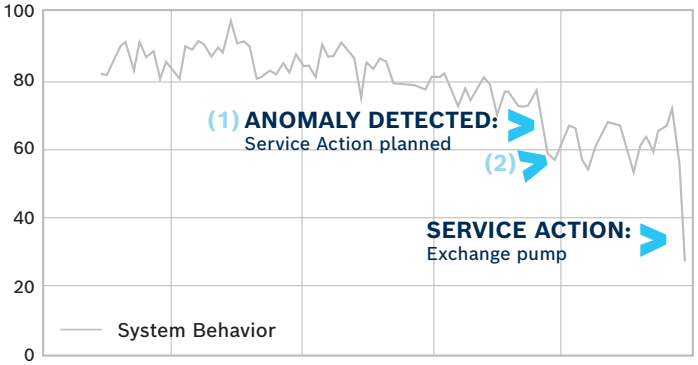
Result With a predictive analytics service including maintenance recommendations, the company could significantly reduce downtimes and avoid penalties thanks to predictive maintenance. The investment costs per system can be recouped as a result of preventing just one breakdown.

Additional benefits On the basis of pressure peaks and electric motor torques, wear in the shears can be detected early on so that the operator can replace the tool as planned. The system also prevents excessive energy consumption, thus reducing electricity costs.

2. A waste shredder that lost its bite
At a recycling company, a shredder is used to shred waste. The product is supplied to a cement works for use as fuel. However, hydraulic pumps and electric motors frequently break down, resulting in delayed deliveries to the customer. These delays frequently result in penalties and additional costs for temporarily storing the delivered waste. The situation is even worse in the peak season for the construction industry. Maintenance suffers owing to a lack of specialist staff.

Solution Predictive analytics for the shredder for a fixed monthly price should help to prevent additional costs owing to breakdowns and penalties and strengthen the company's competitive position.

Result Costs owing to downtimes and other resulting costs were virtually eliminated. The costs of installing the system and the entire annual fee for the predictive analytics service were recouped within six months.

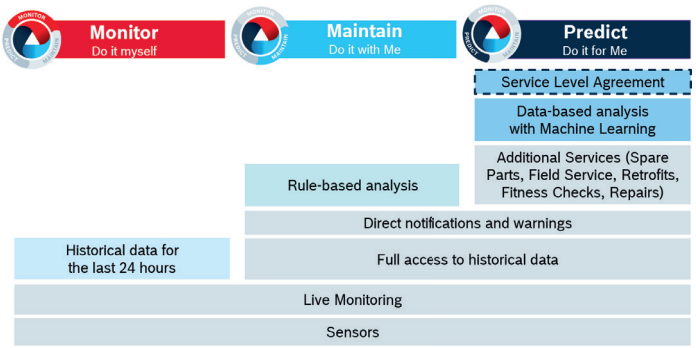


▲ **Minimal production restrictions: After a cavitation was predicted, a pump was replaced at the weekend as planned.**

CONCLUSION

With predictive analytics as a service, operators of recycling facilities with tight supply chains can achieve virtually uninterrupted production without financial penalties. This is quite remarkable given that the sector typically uses many older machines with long running times and an increasing risk of breakdowns. Thanks to timely warnings and maintenance recommendations, operators can now extend the operating life of their equipment. What is more, they can save materials and time and optimize redundancies in the spare parts warehouse.

Given that the investment pays for itself in a short time and the monthly costs are relatively low, predictive analytics could soon become standard within the sector. If you want to stay one step ahead, get involved now and strengthen your competitive position with reduced costs.



▲ **CytroConnect Solutions: three tiered service packages to prevent downtimes – from real-time monitoring alone to a "flat rate" with spare parts management.**

Predictive analytics by Bosch Rexroth

With the *Predict* service package from Bosch Rexroth, the operators of hydraulic recycling systems can avoid the costs of breakdowns while maximizing the operating life of the components that they use. After data are collected using predefi ned sensor packages and transferred in encrypted fashion via a direct connection with no return channel, a cloud-based online diagnostics network produces systematic predictive analyses and detailed status reports. On this basis, experts give maintenance recommendations early on – recommendations which can save customers up to 50 percent of the time it used to take to carry out maintenance. To further improve availability, Bosch Rexroth offers complementary services such as a complete spare parts management system with guaranteed delivery within 24 hours. Find out more at:
https://apps.boschrexroth.com/rexroth/en/connected-hydraulics/service/

Entry-level option: Real-time monitoring and rule-based analyses

Avoid unplanned downtimes and minimize maintenance costs – Bosch Rexroth achieves these aims with the tiered CytroConnect Solutions service. The three packages *Predict, Maintain and Monitor* combine the very latest IoT technology with a wealth of hydraulics expertise to create tailored solutions. System operators achieve maximum availability with *Predict* – the all-inclusive package for a fix ed monthly price. Bosch Rexroth recommends *Maintain* as an introduction to rule and data-based analyses. The AI-based service package monitors the condition of components in the background using predefinedr ules, issues warnings about damage via push message and helps to optimize the application with regular performance and usage reports. The basic *Monitor* package allows real-time monitoring only with access to historical data from the past 24 hours. All three CytroConnect Solutions packages include the necessary dashboards and sensors. Which package is the right one for your application? Find out now!
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