Precise forecast of wear limits

The pharmaceutical company Boehringer Ingelheim relies on vibration diagnostics from ifm for condition-based maintenance in its cleanroom ventilation systems.

Boehringer Ingelheim is one of the world's top 20 pharmaceutical companies with over 130 years of experience. It is also the largest research-based pharmaceutical company in Germany.

The path to condition-based maintenance in pharmaceutical ventilation technology at Boehringer Ingelheim

Cleanrooms are indispensable for the safe production of sensitive products that have to meet quality requirements, such as those in the pharmaceutical industry. The importance of a properly functioning supply of low-particle air to the laboratory and production rooms is correspondingly high. That is why the pharmaceutical company Boehringer Ingelheim monitors its ventilation systems around the clock to ensure trouble-free operation. Condition-based maintenance could take this process to a new level. Boehringer Ingelheim is on the way there with its partner ifm.

After a thorough assessment, Boehringer Ingelheim decided to upgrade with ifm's vibration and rolling bearing monitoring systems.

Since 2008, the Engineering & Technology department of Boehringer Ingelheim has been working together with the automation specialist ifm in the field of vibration and rolling bearing analysis.
The VSE100 vibration diagnostic system plays a central role in process and ventilation technology, as it ensures trouble-free operation of GMP-compliant ventilation systems. GMP stands for Good Manufacturing Practice. These are internationally applicable guidelines for quality assurance that are primarily used in the manufacture of pharmaceutical products.

The heart of the system is the VSE100 evaluation unit. It offers inputs for up to four vibration sensors. The vibration behaviour is analysed and evaluated internally. Abnormal changes in the vibration behaviour are detected and signalled in several stages via switching outputs if the limit value is exceeded. This ensures reliable vibration monitoring of machines and plants. Wear, for example on the rolling bearings of drives, is thus detected at an early stage before critical conditions or even failures occur.

Compact vibration diagnostics: VSE series evaluation units for four vibration sensors and additional analogue sensors.

In the previous version of the vibration diagnostic system from ifm, the vibration behaviour and, thus, the status of the monitored fans was visualised in the building management system with a traffic light. When the colour changed from "green" to "yellow", service technicians received indications of possible damage to the engine or fan. Thanks to the system, the ventilation systems have been running trouble-free ever since. However: In order to analyse a message further, the service technicians previously had to dock with a laptop to the evaluation unit in order to read it out and thus assess the damage in detail.

About three years ago, the Engineering & Technology department decided to make a forward-looking investment in vibration and rolling bearing diagnostics. This is associated with a change from purely preventive maintenance to condition-based maintenance.

Rafael Cannas, Maintenance Manager and a maintenance employee at Boehringer Ingelheim for 26 years, explains: "Our goal was to initially implement a combination of preventive and condition-based maintenance. An intermediate step on our way to condition-based maintenance is working in condition monitoring on our example equipment. On the IT side, we relied on the dashboard from ifm that we implemented a year ago. For the future, we are aiming for AI-based failure prediction. Algorithms are then supposed to calculate and inform us when which equipment has reached its remaining service life".

Various systems tested

In the first consultations with ifm's sales specialists, the existing VSE100 system has been modernised and replaced on a sample installation from 2008. In parallel, further trials were conducted with other suppliers in a wide variety of applications. Various remote systems were tested: In some of them, diagnostics could be completely outsourced while in other vibration and rolling bearing systems, technicians could take measurements on site.

After about a year, a résumé was drawn. After a thorough assessment, Boehringer Ingelheim decided to upgrade with ifm's vibration and rolling bearing monitoring systems. The decisive factor was the reliable and positive experience with the system since 2008, but also the easy handling of the dashboard that is used for evaluation.

In addition, it was important for Boehringer Ingelheim to have a partner in ifm who has already gained experience with such systems in other industrial sectors.

Precise forecasting saves millions

The project "Setting up condition monitoring for rolling bearing vibration analyses" started in autumn 2019. The goal: Monitoring the ventilation systems selected for the project in a pharmaceutical production building in Ingelheim for the greatest economic risk of failure.

These ventilation systems supply rooms of "clean room class D" without exception. The aim was to monitor the plant only automatically via an analysis tool as early as summer 2020. Together with ifm, this goal has been achieved: The ventilation systems were converted and put into operation in the summer.

Short-term savings in the six-figure range

The VES004 dashboard has been used for preventive maintenance from this point on. Experts from Boehringer Ingelheim's engineering unit and its own service centre jointly determined the condition of the component at six-monthly intervals and came up with a recommendation for action.

The success was remarkable: The conversion brought in savings in the high six-figure range in a short time because it was possible to avoid production downtimes due to coordinated or planned repairs to ventilation systems.

Rafael Cannas checks the status of the rolling bearings, which is clearly visualised on the dashboard.

> *On our way to condition-based maintenance on the IT side, we have opted for ifm's dashboard.*

In the meantime, thanks to reliable forecasting, the rolling bearings of the plants are no longer replaced based on time, but only when their wear supply is actually exhausted. This requirement-based maintenance reduces material and maintenance costs while at the same time reducing the burden on the environment – and staff can also be deployed more efficiently.

Training rethought in times of COVID 19 pandemic

During the COVID 19 pandemic, Boehringer Ingelheim employees have been trained remotely by ifm in the use of the analysis software. This was an exciting experience for both sides since practical work on test objects is part of the training content.

The project team is currently on its way to mapping condition-based maintenance. The aim is to do this in an SAP cloud/PAI. There, one could then forecast the probability of failure of ventilation systems due to rolling bearing damage or an imbalance.

For this purpose, the data of the VSE100 has been embedded in a new IT architecture, and Boehringer Ingelheim is working in partnership with the data specialists of the ifm subsidiary statmath to bring this data into a usable quality for further use. "It suits us that statmath has already successfully implemented precisely these points in the automotive industry and thus has extensive experience," says **Julia Kaufmann,** Maintenance Manager at Boehringer Ingelheim.

It is elementary for the pharmaceutical company to include good manufacturing practice as a basis in its maintenance. This requires, for example, a risk assessment when adjusting the maintenance type. This will also be taken into account in the pilot project.

Rafael Cannas: "In the context of digitisation, the topic of maintaining the validated state of the systems will continue to occupy us, as will the qualification of our own technicians to make them fit for the future. We have already demonstrated the benefits of condition monitoring in our pilot project. In the future, we envision predicting the equipment's likelihood of failure so that we can use that knowledge to plan repairs in a way that won't disrupt or interrupt manufacturing operations in their production time."

Conclusion

The pilot project at Boehringer Ingelheim shows: Companies can benefit significantly from modern condition monitoring. Especially when the maintenance of highly relevant production facilities can be carried out according to the requirements and no longer on a time-based basis, savings can be achieved to a great extent: Targeted maintenance planning reduces downtimes, minimises material costs and relieves skilled personnel and, last but not least, protects the environment.

They have taken condition-based maintenance to a new level at the pharmaceutical company Boehringer Ingelheim (from left to right): Christian Ritz (Sales Engineer ifm), Rafael Cannas, Julia Kaufmann (both Specialist Maintenance Engineer at Boehringer Ingelheim)