

WE CREATE PREDICTIVE MAINTENANCE.

Our experts are developing status-oriented maintenance strategies for the large-scale production of specialty paper at Mitsubishi HiTec Paper Europe GmbH.

Whether used for receipts, bank statements or tickets – thermal paper is everywhere. Around 300 tons of thermal paper are given a special coating by Coating Machine 3 at Mitsubishi HiTec Paper Europe GmbH every day. And that at the record speed of up to 1,730 meters per minute.

Coating Machine 3 has 26 ventilation units that ensure a contactless drying of the paper. These ventilators are monitored for deviant vibrations using 26 FAG SmartCheck systems. This monitoring system helps to avoid machine malfunctions, meaning that production can be optimised and total operating costs lowered significantly.



The futuristic-looking Coating Machine 3 built in 2001 is the result of a design study carried out by the machine manufacturer.
[Source: Mitsubishi HiTec Paper Europe GmbH]

We are turning paper refining into a high-tech issue

Mitsubishi HiTec Paper Europe GmbH is part of the international Mitsubishi Paper Mills Group and operates locations in Bielefeld (MPEB) and Flensburg (MPEF).

The tradition-steeped factory in Nordrhein-Westfalen, with factory premises at over 418,000 square meters, has around 450 employees and a production capacity of 150,000 tons per year. Its portfolio includes coated specialty paper for all areas of use and printing technologies, for example, thermal, Inkjet, carbonless or label paper. The base paper is created in-house so that paper and coatings can be

coordinated with one another in the best possible way.

Jürgen Heitland, Director of Electronics, Measurement and Control Technology (EMSC) at MPEB, states: "At Coating Machine 3, we refine raw paper with one precoat and one surface coating and give

it its thermal properties. In order to ensure a proper coat the paper, which can be up to 2.9 meters wide, must be dried without being touched. A total of 13 hot air dryers, with two large fans each for intake and exhaust, handle this critical task." The intake fans blow hot air that is up to 250 degrees Celsius into the air dryers. When doing so, the surface of the thermal paper mustn't exceed a temperature of 68 degrees Celsius. Otherwise the paper will turn an unwanted gray.

The larger intake fans have a diameter of a bit more than one meter and weigh around 100 kilograms. The exhaust fans are a bit smaller and lighter. Up to 100 kilograms of fan blades now move at a speed of 1,500 revolutions per minute, creating an imbalance over time that has adverse effects on the mounting. If this imbalance is not recognized and eliminated in a timely manner, this results

in a production shortfall or, if one of the first four hot air dryers is affected, a halt in production.

Our switch to status-oriented maintenance

In mid 2013, one fan completely failed due to an imbalance on Coating Machine 3 that was not recognized in time. As well as the mounting itself, attachment components were severely damaged. This briefly stopped the production system and led to a corresponding reduction in production speed. The EMSC director looks back: "This fan failure was the trigger that led us to search for an option to switch from a time-based to a status-oriented maintenance procedure. We wanted to be in a position to quickly recognize imbalances or damage to ball bearings, rather than waiting till problems become apparent due to noise or an increase in temperature. Because as soon as the temperature increases, it is usually too late for the planned component replacement. Everything then has to move quickly. However, replacement parts are not normally available immediately. As a consequence, the fan is out of commission for a longer time. Unplanned failures of this kind are always expensive." Arkadius Schostak, Director of Service at the company Werthenbach and the person in charge of developing and implementing solutions, explains: "The early-warning system with the FAG SmartCheck allows us to achieve lead times of up to several months before the component actually fails. This gives us enough time to order replacement parts and initiate a planned system downtime for maintenance and repair work. This significantly increases machine availability and process safety."

We create teams of experts

Werthenbach has worked with Schaeffler for decades in the field of ball bearings. As an authorized premium partner, the company has initiated projects involving status monitoring with the help of ball bearing specialists and their service experts. "We are implementing the FAG SmartCheck with other customers as well, but the scope of this project at MPEB was really extraordinary", says Arkadius Schostak. Werthenbach also has decades of cooperation with MPEB. Consequently, the service team knows their customers well and understands their needs. The cooperation between Schaeffler and Mitsubishi Electric began during the product development of FAG SmartCheck in 2010. Today, Schaeffler is a partner of the Mitsubishi Electric e-F@ctory Alliance. Christoph Behler, Senior Business Development Manager at Factory Automation – European Business Group at Mitsubishi Electric, explains: "Schaeffler was looking for a way to connect intelligent vibration sensors to customer systems using a control process that is just as intelligent. The controllers for our MELSEC L series are able to communicate with all standard fieldbus systems via Ethernet at the supervisory and sensor level. The SLMP protocol (Seamless Message Protocol) that runs between sensor and controller is based on Ethernet TCP/IP and therefore allows for simultaneous system access via a web browser, as well as bidirectional data communication with the controller."

Six months passed from when the problem was identified until the solution was implemented. Werthenbach first created full documentation, collected

additional data based on offline vibration measurements for all fans and then evaluated this. Schaeffler meanwhile collected recommendations for action and created a list of measures. All of this information contributed to a solution proposal. After MPEB technicians made a detailed inspection, Werthenbach received the order and, after six weeks or so, the system was brought on line.

Werthenbach conducted the installation while Schaeffler handled configuration and activation. With the support of Mitsubishi Electric it only took a few hours to set up the network communication, i.e. the actual integration of extensive monitoring solutions into customer systems.

Specific customer requests and our specific solutions

The technical department from MPEB has specific requirements for the online monitoring solution. One primary criterion was using as little wiring as possible for maximum cost-efficiency. By using power-over Ethernet (PoE), the amount of wiring was reduced to a third. Thomas Schmitz, Service Manager for Condition Monitoring at Schaeffler, goes on to say: "When upgrading an existing system, it is often difficult to retroactively lay wires, especially for Coating Machine 3, which is over three stories tall. Thanks to PoE, only one wire is necessary instead of a cable each for communication, power and additional signal. In addition to bidirectional data communication, the wire also provides the entire system with power and connects it to the network over Ethernet.



A FAG SmartController in the form of a Mitsubishi Electric PLC from the MELSEC L-series operates as a bidirectional gateway between the customer controller and sensors in the condition monitoring system. [Source: Mitsubishi Electric Europe B.V.]

All signals are allocated to recipients by the FAG SmartController. The programming required for this was minimal."

Another challenge was automatically processing speeds without adversely impacting customer control. The FAG SmartController fulfills this requirement. As an intelligent gateway between customer controls and sensors, it provides bidirectional communication and is connected to the FAG SmartChecks as well as customer controls via Ethernet cable and PoE switches. It sends vibration data and status information from the sensors to customer controls, where they can be visualized using a SCADA system. The SmartController also allocates the individual, variable speed information from customer controls to the individual sensors.

This solution can be freely upgraded, meaning that the entire four-story machine can be monitored using a standardized system in order to exactly determine the behavior of all rotating parts when increasing the speed. Theoretically, the system can be accessed from every workstation in the factory that has the corresponding programs.

The Werthenbach service team can also connect externally for support purposes via a VPN connection. Additionally, there is hardware for a WLAN connection that will allow access over mobile devices at any time from anywhere within the factory premises in future.

Small device – huge effect: Our FAG SmartCheck

Status monitoring promptly displays when thresholds are exceeded. To do so, the FAG SmartCheck systems have a status display that works like a traffic light. If that status changes from green to yellow, then a preset threshold has been exceeded. The system can, however, be run normally for the time being. A red alarm means there is an acute need for action. Operating personnel can access each individual sensor via an integrated web server and see detailed information. When needed, Werthenbach sends this information to specialists from Schaeffler who not only identify the problem but also create a written action proposal. Because the system provides the first warning via the yellow alarm up to three months in advance, there is sufficient time to plan for the system being down and to order replacement parts. This avoids damage to bearings.

This monitoring solution provides a complete supervisory function over processes in addition to simply monitoring bearings. Thomas Schmitz explains: "Each FAG SmartCheck system monitors one fan unit for unacceptable vibrations. When doing so, the pillow blocks and the fan each have their own vibration pattern. Using the data history, trend curves can

be created based on interpretations of the machine status and processes. This often means that one can even determine when and, above all, why a problem first arose in order to eliminate it once and for all. Using powerful data as a basis, MPEB is able to follow the behavior of the system over the long term among constantly changing production conditions, as well as to carry out targeted and constructive improvements.

The outcome

Just a few months after being put into operation, the monitoring system proved its effectiveness and reported abnormalities in two exhaust flotation dryers. The Werthenbach service team recorded the data and conducted an initial analysis. Experts from Schaeffler went one step further and pooled the results as well as a suggested course of action into one written report. The cause of the abnormalities was an improperly high imbalance as well as damage to the outer bearings. Both problems were eliminated quickly through planned maintenance, long before the imbalance would have become audible or visible or even lead to damage to adjacent components. This enabled us to avoid a long and costly error search and consequently higher costs.

The goal is to develop knowledge of the monitoring system for in-house technical and operating personnel at MPEB so that the system can be monitored independently. Werthenbach guides customers during this learning process through remote analysis of the data, among other means. The first personnel training sessions are also planned.

Based on good results from the pilot project, Mitsubishi HiTec Paper Europe decided to also equip the coating machine at the Flensburg location with the FAG SmartCheck. 22 systems are monitoring vibrations there at eleven intake and exhaust fans. "The system was installed successfully! We are currently outlining corresponding recommendations of a similar scope for two additional interested parties", explains Arkadius Schostak. "A solution like this is conceivable for every area of process engineering in which fluctuations arise for continuous processes, for example in electric motors, pumps, compressors or drive systems."

Jürgen Heitland concludes: "Status monitoring with the FAG SmartCheck means a decisive step in the direction of Industry 4.0 for us. The FAG SmartController is the core, because it enables us to pass along sensor information from the field level to the controller level as well as from the maintenance level to the ERP system. We can use it there as well as directly when implementing data from higher levels at the field level."

