

Case Study

Intelligent condition monitoring keeps thermal paper production running

A condition monitoring system installed on a paper coating machine has enabled the Mitsubishi HiTec Paper plant in Bielefeld, Germany to switch from time-based to condition-based monitoring, helping to avoid unnecessary machine shutdowns. Enabling the new system is a Mitsubishi Electric L-series PLC that operates as a bidirectional gateway between the controller and sensors.



Thermal paper gets its characteristics from a special coating. It is typically used for sales receipts and tickets. At the Mitsubishi HiTec Paper plant in Bielefeld, Germany (MPEB), around 300 tonnes of thermal paper goes through one of the coating machines every day.

The four-storey machine has a maximum operating speed of up to 1730m/min. Coating Machine 3 has 26 fan units, each consisting of a supply fan and an exhaust air fan. These ensure contactless drying of the coated paper. The air supply fans blow hot air at up to 250°C into the drying hoods. In the process, the surface of the thermal paper must not be heated above 68°C, otherwise the paper will react and an undesirable discolouration will occur.

Jürgen Heitland, Head of Electronics and Measurement and Control Technology (EMSR) at MPEB, explains: “On Coating Machine 3, we finish the raw paper with a pre-coat and a top coat to give it its thermal characteristics. In order to guarantee the perfect coating, the paper which can be up to 2.9 metres wide must be dried without contact. That critical task is carried out by a total of 13 hot air drying hoods, each with two large radial fans for supply and exhaust air.”

The fans have a diameter of just over 1m and weigh around 100kg, while the exhaust air fans are slightly smaller and lighter. With the fan also rotating at a speed of 1500rpm, there can be a slight imbalance, which over time can prematurely wear the bearings. If that imbalance is not detected and rectified in time, the result will be a production shortfall. If one of the first four hot air drying hoods is affected, production will come to a standstill.

- Early warning of bearing outer ring issue
- Easy installation
- Flexible system expansion

Three years ago, when an imbalance in Coating Machine 3 was not detected in time, it resulted in the complete failure of a fan. Besides the bearing, attachment parts were also heavily damaged. This resulted in a short system shutdown which led to a reduction in the rate of production.

“That fan failure was the catalyst for our decision to look for a way to switch from time-based to condition-oriented maintenance,” says Heitland.

“We wanted to be able to detect imbalances or damage to roller bearings early before they became apparent through noise or an increase in temperature – by the time the temperature rises in the bearing, it is usually too late for a scheduled component replacement. Replacement parts are often not immediately available, meaning that the failure of the fan goes on for even longer.”

To counteract this problem, 26 SmartCheck sensors from Schaeffler now monitor those fans by carrying out vibration measurements. A SmartController - based on a Mitsubishi Electric PLC from the MELSEC L-series - operates as a bidirectional gateway between the controller and sensors. As a result, unscheduled machine shutdowns can be avoided.

Condition monitoring aims to indicate in good time when limit values will be exceeded. SmartCheck systems have a status indicator based on a traffic light system: if the status changes from green to yellow (preliminary-alarm status), a predefined limit value has been exceeded. However, the machine can still continue to operate for the time being. A red alarm indicates an urgent need for action.

The operator can access each individual sensor via an integrated web server and display detailed information. As the system can issue an initial warning via the yellow preliminary alarm up to three months in advance, that leaves sufficient time to schedule a system shutdown and order replacement parts, thus avoiding bearing damage in the process. As a result, machine availability and process reliability have improved.