

Far more robust

Special sensors for special requirements

The attribute "robust" can mean a lot in sensors with regard to the ambient conditions. This application in an automated continuous pickling line for copper sheets shows the extremely high requirements of such devices in practical use.

CSN Carl Schreiber GmbH processes metal sheets according to customer specifications. "Our core business is the production of plates, sheets, blanks, rings, pre-cut parts as well as machined parts made of copper and copper alloys. In addition, we process brass, bronze, copper-nickel and aluminum. Our products are used among others in apparatus construction, heat exchangers, in the chemical industry, in electrical engineering, as well as in seawater desalination," says Stefan Schnock, CSN Carl Schreiber's company electrician, describing the production spectrum.

As a specialist for the processing of copper, the medium-sized company based in Neunkirchen has developed a fully automatic continuous pickling line. "When rolling copper sheets, an oxide layer is formed on the material surface, which we remove with sulfuric acid solution before the further processing of the sheets in our plant," says Schnock.

Automated material handling

After rolling, the partially up to 500°C hot sheets are transported via a roller conveyor to a straightening machine, which removes the surface ripple. This machine is followed by a device that serves to lift the individual metal sheets from a roller conveyor in order to position them in a correct position in two buffer zones before the pickling chamber. After the two-sided treatment of a sheet in the pickling chamber, this is further conveyed to one of three buffers, which function as an intermediate storage. "If no sheet comes out of the roller, a completely pickled sheet can be picked from this buffer zone via a roller conveyor for further processing. The pickling line is arranged virtually U-shaped around the straightening machine. The buffered sheets therefore always travel through the straightening machine prior to removal, but do not necessarily have to be directed," explains the company electrician.

Sensors with very special properties

In order to ensure a safe process sequence in the fully automatic continuous pickling line, CSN Carl Schreiber required sensor solutions that not only convince by precision and reliability, but should also be extremely robust.

Specifically, suitable devices were sought for the two buffer zones before pickling, for the pickling chamber itself and for the three downstream material buffers, in order to ensure reliable automated handling of the sheets in the plant. Stefan Schnock specifies several requirements: "One problem

was that the copper plates, which are up to 6 meters wide but only 8 to 160mm thick, do not always lie straight on the roller conveyor in front of the pickling chamber and can be somewhat curved due to the small sheet thickness. In addition, the pickling consists of a solution containing 15 to 20 percent sulfuric acid, which can massively damage the sensor system. The sensor solution for the two immediately adjacent buffer zones in front of the pickling chamber should still reliably detect the front position of a metal sheet and in this case can query the complete area just above the roller conveyor over the entire material width.“

Precise laser light barrier for large ranges

As the solution had to provide a very precise, small measuring point with a long range and, in addition, had to withstand very harsh environmental conditions, an application specialist from ipf electronic recommended a laser light barrier.

The through-beam sensor that consists of the transmitter PS180024 and the receiver PE180424 in a metal housing (protection class IP67) has a large switching distance from 0 up to a maximum of 60m, is suitable for ambient temperatures of up to + 50°C and can be - due to the visible laser light – easily adjusted in the area above the roller conveyor. The very small and thus precise measuring point makes it possible to reliably detect the front position of the thin sheets in the two buffer zones in front of the pickling chamber over the entire material width. Stefan Schnock: “The sensors are coupled to the PLC of the continuous pickling line and signal to the control system that a sheet is in the respective buffer zone. If the treatment of a copper plate with the acid solution is completed and the sheet has left the pickling chamber, the sheet in the zone before the pickling chamber can be transported into the chamber. Subsequently, the next sheet is conveyed from the second buffer into the buffer zone before the pickling chamber.“

Robust solution for extreme conditions

In the pickling chamber, the plates are sprayed on roller conveyors in reverse operation from the top and the bottom with pickling. Again, the position of the sheet to be treated must be queried in conjunction with the sensors in the buffer zones. However, an optical solution could not be considered, since the sensor system in the pickling chamber is permanently exposed to a sulfuric acid-containing spray mist. For this reason the decision was made for ipf electronic's IO300160 inductive sensors with active surface made of stainless steel. These particularly robust devices are designed for ambient temperatures up to + 70°C and have the protection class IP68.

At the input and output of the pickling chamber, three parallel-operated inductive sensors were installed in such a way that they can detect the copper plates from below. “The arrangement of the sensors is deliberately chosen because the plate can move somewhat in the longitudinal direction

within the chamber. It is thus ensured that we can query a larger area of the plate from the underside and always at least one sensor responds. If the material position was queried only in the middle, a displaced plate could also reach the area of the chamber door, which would then open slightly, leading to error messages from the control system," Schnock reports.

When a copper plate is inserted into the pickling chamber and one of the inductive sensors at the chamber exit detects the underside of the plate's end, the doors close and the spray process begins. After the surface treatment, the copper plates are transported to the three downstream buffer zones, which are also equipped with the laser light barriers PS180024 / PE180424. The sensors report to the PLC of the continuous pickling line when the buffers are completely occupied so that the control system can stop the system to avoid material jams.

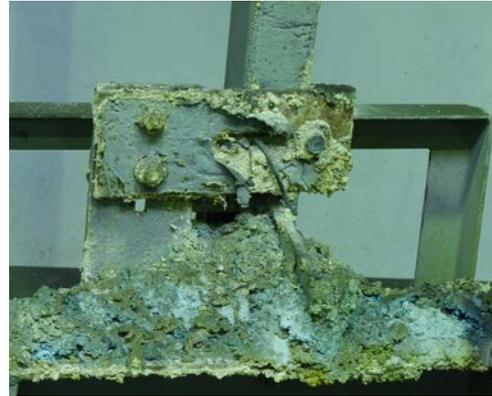
Challenges are met

In view of the various challenges that were to be met for this particular application, the company's electrician Stefan Schnock is extremely satisfied with ipf electronic's solutions: "The sensors in the buffer zones and, above all, in the pickling chamber itself, don't get away with anything. The pickling is very aggressive due to the acid content and therefore extremely damages the equipment. Despite these very adverse environmental conditions, they have proven to work reliably in our automated system."

Image captions:

ipf_Carl_Schreiber_001.jpg / ipf_Carl_Schreiber_002.jpg:

The acid-containing pickling extremely damages the laser light barriers in the buffer zones, as can be seen clearly, but the sensors installed just above the roller conveyors work reliably.



ipf_Carl_Schreiber_003.jpg:

The inductive sensors IO300160 were installed in a way that they can detect the copper plates from below.



ipf_Carl_Schreiber_004.jpg:

In each case three inductive sensors are positioned at the entrance and exit of the pickling chamber. The special arrangement ensures that a larger area of the copper plate can be queried from the underside and thus at least one sensor responds.



ipf_Carl_Schreiber_005.jpg:

The inductive sensors have an active surface made of stainless steel, are therefore very robust (protection class IP68) and made for ambient temperatures of up to + 70°C.



ipf_Carl_Schreiber_006.jpg:

The through-beam sensor consisting of the transmitter PS180024 (top) and the receiver PE180424 proved to be the right choice for the demanding application in the pickling line.

