Special requirements demand special solutions

Reliable metal detection in the foundry industry

There are hardly any fields of application that demand more from sophisticated sensor technology in terms of robustness and reliability than the harsh environmental conditions in the foundry industry. When solutions that are within reach fail because they are simply not up to the specific requirements of an application, things get really tricky.

GF Automotive has been a sought-after problem solver for modern automotive technology for decades and employs 70 experts in straight research and development alone. The GF Automotive Division has plants worldwide, including in China. As part of the division, Georg Fischer Automobilguß GmbH, based in Singen (Germany), has positioned itself as a renowned sand foundry in the field of nodular cast iron. The plant in Singen produces castings for chassis, drive systems and frames for trucks and cars, with the value chain including machining and coating.

Returning valuable raw materials directly to production

GF Automotive's foundries are considered pioneers when it comes to the use of management systems in quality assurance and environmental protection. One component of this strategy is the efficient recycling of waste products generated during production. A special collection point has been set up at Georg Fischer Automobilguß for this purpose, where a conveyor belt is filled with recycled material. The belt feeds this via a shaft below the collection point to a container that moves via a shuttle system; this means that the valuable raw material can be fed back into the production processes immediately after melting down.

Time is money, even when it comes to recycling

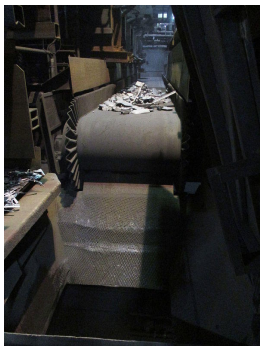
The conveyor belt at the collection point is mounted on weighing cells, with a PLC (programmable logic controller) controlling the uniform filling of the container with metal parts of different sizes and weights. Until now, however, it was not possible to fill the weighing belt if there was no container at the designated position below the shaft, as otherwise it could not be ensured that no castings would fall onto the transfer car's path during the weighing process. Time is money - this simple formula also plays a decisive role with regard to cycle times in recycling. The conveyor belt should therefore be filled with scrap metal even if the container was not underneath the chute.

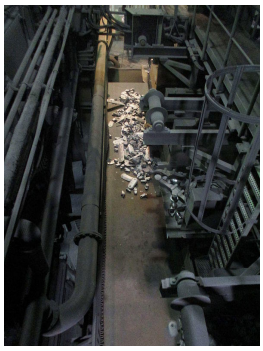
Inhomogeneous surfaces and heavy soiling

In the search for a sensor solution that was as robust as it was intelligent and would allow the weighing belt to be filled even without a container in the filling position, Georg Fischer Automobilguß considered a wide variety of solutions. The biggest hurdles here were that the circulating materials had a very inhomogeneous structure and very different surfaces and sizes, which did not make it easy to identify the metal parts reliably and therefore always with repeatability. What made reliable recognition of the parts even more difficult was the fact that the area in which the conveyor belt was to be monitored was heavily soiled with dust.

Failed to meet the requirements

The initially envisaged solutions ultimately turned out not to be such, as they simply failed due to the high requirements. Specifically, this meant that Optical systems were out of the question due to the massive soiling. Tests with ultrasound solutions also failed, as these were not able to reliably detect the scrap parts due to their inhomogeneous surfaces. Even a radar system failed for the same reasons. The only way out of this dilemma: a system consisting of a metal detector coil and an intelligent amplifier, as well as a competent partner who took up the challenge of implementing such a solution under the most difficult environmental conditions.





The conveyor belt in the area of the discharge chute (here from two different perspectives). The photos clearly show that the operating conditions here are very harsh.

Metal detector system with intelligent evaluation

In ipf electronic, Georg Fischer Automobilguß in Singen finally found a team of motivated engineers and technicians to take on this ambitious task. From the outset, the specialists at ipf electronic considered a system consisting of an inductive metal detector coil and an evaluation device to be the most sensible solution. The metal detector system from ipf electronic is designed for detecting the smallest parts. In conjunction with a sensitivity adjustment, this system responds reliably to small parts such as nails or nuts at maximum sensitivity. The detector coil is mounted with PVC columns on an aluminum base plate that shields against electromagnetic interference from the substructure. This concept also ensures very stable mounting, as required in the application at Georg Fischer Automobilguß. The detector coil is connected to the evaluation unit via a special cable, which can be prolonged to up to 50 meters if necessary.

The response behavior of the detector coil can be set via the evaluation unit.

One task of the evaluation unit is to process the signals emitted by the metal detector coil and convert them into an electronic pulse. As soon as a metal part passes the detector coil, the electromagnetic field generated by the coil is disturbed, resulting in an evaluable signal.

Large-scale detection of the weighing belt

Preferably, the detector coils are positioned underneath conveyor belts to prevent mechanical damage. This is also the case in Singen, where the 950 mm wide metal detector is located at a distance of 200 mm from the weighing belt between two metal conveyor rollers. In this way, the detector can reliably detect a large part of the weighing belt. The conveyor rollers themselves do not interfere with the signal detection, as the evaluation device has an automatic adjustment control. Its reliable operation is therefore guaranteed even if there are potentially interfering metal parts in the vicinity of the detector coil. This control also ensures that only moving metal parts are detected.

The detector coil under the conveyor belt is mounted with PVC columns on an aluminum base plate that shields against electromagnetic interference from the substructure. This concept also ensures a very stable installation.

Reliable recognition of even small parts

The sensitivity of the metal detector is set via a controller. This allows the system at Georg Fischer Automobilguß to be calibrated very accurately, even with regard to the extremely inhomogeneous surfaces and sizes of the parts to be recognized, even at a distance of 200 mm between the detector coil and the conveyor belt. The system in Singen currently reliably recognizes metal parts with a weight of just 200 grams.

More efficient recycling thanks to shorter cycle times

Thanks to the solution from ipf electronic, Georg Fischer Automobilguß is now able to fill the weighing belt in the collection point for the foundry's recycled material even if the container is not in its position below the chute. As soon as the circulating material approaches the discharge chute during the weighing process (approximately two meters in front of the chute), the detector coil emits a signal that stops the weighing process and prevents the castings from falling into the discharge chute in an uncontrolled manner. This process, based on the system from ipf electronic, has increased the cycle times at the Georg Fischer Automobilguß collection station with a view to even more efficient recycling of the recycled material. A faster return of valuable raw material to the production processes was thus made possible.