Special requirements demand special solutions

Reliable metal detection in the foundry industry

There are hardly any fields of application that require more sophisticated sensor technology in terms of robustness and reliability than the harsh environmental conditions in the foundry industry. If then close solutions still fail, because they simply cannot meet the specific requirements of an application, it is really tricky.

GF Automotive has been a problem solver in great demand for modern automotive technology for decades and employs 70 experts in research and development. The GF Automotive Division has factories around the world, inter alia in China. As part of the division, Georg Fischer Automobilguß GmbH, headquartered in Singen (Germany), has positioned itself as a renowned sand foundry in the area of spheroidal graphite iron. The plant in Singen produces castings in the area of chassis, drive and frames for trucks and passenger cars, whereby the value-added chain comprises machining and coating.

Transfer valuable raw materials directly into production

The foundries of GF Automotive are said to be pioneers in the use of management systems in quality assurance and environmental protection. An element of this strategy is inter alia the efficient recycling of the waste products that are generated during production. A special collection point has been set up specifically for this purpose at Georg Fischer Automobilguß, where a conveyor belt is filled with return material. The belt is fed via a shaft below the collecting point to a container, which travels via a shuttle system. Thus, the valuable raw material can be returned to the production processes immediately after melting down.

Time is money, even when recycling

The conveyor belt at the collecting point is supported on weighing cells, whereby a PLC controls the uniform filling of the container with metals of various sizes and different weights. However, the filling of the weighing belt was not yet possible if no container was located at the position provided below the shaft, since otherwise it could not be ensured that no casting falls onto the transport path of the transfer carriage during the weighing process.

Time is money, this simple formula also plays a decisive role with regard to cycle times during recycling. Therefore, the conveyor belt should be filled with metal scrap even if the container was not below the shaft.

Inhomogeneous surfaces and heavy soiling

In the search for an equally robust as well as intelligent sensor solution that enabled the weighing belt to be filled even without a container in the filling position, Georg Fischer Automobilguß focused on a wide range of solutions. The biggest hurdles in this process were that the return materials had very heterogeneous microstructures or very different surfaces and sizes, which made the reliable and thus reproducible identification of the metal parts not easy. For the safe detection of the parts it was aggravating that the area in which the conveyor belt had to be monitored was subject to high contamination by strong dust.

Failed on the requirements

In the end, the initially targeted solutions did not emerge as such, since they simply failed to meet the high requirements. Specifically, this meant that optical systems were beyond question because of the massive pollution. Tests with ultrasonic solutions also failed because they 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 to implement such a solution under the most difficult environmental conditions.

Metal detector system with intelligent evaluation

At ipf electronic, the Georg Fischer Automobilguß company in Singen finally found a team of motivated engineers and technicians that took on this ambitious task.
As the most useful solution, the specialists from ipf electronic envisaged from the outset a system consisting of an inductive metal detector coil and an evaluation unit.

Ipf electronic's metal detector system is designed for the detection of very small parts. In conjunction with a sensitivity setting, this system reliably responds to small parts, such as nails or nuts, with the highest sensitivity.
The detector coil is mounted with PVC columns on an aluminum base plate, which shields against electro-magnetic interferences of the substructure. This concept also ensures a very stable assembly, as it is necessary in the application at Georg Fischer Automobilguß. The detector coil is connected to the evaluation unit via a special cable, which can be extended up to 50 meters if required.

A task of the evaluation device is to process the signals emitted by the metal detector coil and to

convert them into an electronic pulse. As soon as a metal part passes through the detector coil, the electromagnetic field produced by the coil is disturbed, resulting in an evaluable signal.

Large-scale detection of the weighing belt

Preferably, the detector coils are arranged below conveyor belts to prevent their mechanical damage. This is also the case in Singen, with the 950mm wide metal detector being located at a distance of 200mm 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, since the evaluation unit has an automatic adjustment control. Its safe functioning is thus ensured even if there are potentially interfering metal parts in the vicinity of the detector coil. This control also has the effect that only moving metal parts are detected.

Safe detection of even the smallest parts

The sensitivity of the metal detector is adjusted by a controller. This means that the system can be very precisely calibrated at Georg Fischer with regard to the extremely inhomogeneous surfaces and sizes of the parts to be recognized, even in the case of a distance of 200mm between the detector coil and the conveyor belt. Currently, the system in Singen recognizes metal parts weighing only 200 grams.

More efficient recycling through shorter cycle times

Due to the solution of ipf electronic, Georg Fischer Automobilguß is now able to fill the weighing belt at the collection point for the return material of the foundry even if the container is not in its position below the shaft.
As soon as the return material approaches the discharge chute during the weighing process (approximately two meters in front of the chute), a signal is outputted by the detector coil, which stops the weighing process and prevents an uncontrolled falling down of the casting parts into the chute. This process, based on ipf electronic's system, allowed the cycle times at the Georg Fischer Automobilguß to be increased with a view to even more efficient recycling of the return material. A faster return of valuable raw material into the production processes has thus been realized.

Image captions:

ipf_electronic-gf_automotive_01/ ipf_electronic-gf_automotive_02:

The detector coil under the conveyor belt is mounted with PVC columns on an aluminum base plate, which shields against electromagnetic interferences of the substructure. This concept also ensures a very stable assembly.

ipf_electronic-gf_automotive_03:

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

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The conveyor belt in the area of the discharge chute (here from two different perspectives). The pictures clearly show that very rough operating conditions prevail here.