The role of metal detection in improving manufacturing OEE

by Jonathan Richards, Head of Marketing, Mettler-Toledo Safeline Metal Detection.

When a manufacturer decides to invest in a new inline metal detection system, the reasoning is usually very straightforward. They need to comply with a Global Food Safety Initiative (GFSI) approved food safety standard and they need to establish critical control points (CCPs) to minimise the risk of metal contaminants progressing through the production line, in accordance with the principles of Hazard Analysis and Critical Control Points (HACCP). Clearly, this is the task for which metal detection systems are designed, and it is crucial to uphold the highest product quality and safeguard consumer health and wellbeing.

However, metal detection technology can play an additional supporting role for a manufacturer too. They can help maintain or even improve the overall equipment effectiveness (OEE) calculation of the production line through positively impacting on the three measurable components of OEE: availability, performance efficiency, and quality.

Assessing performance

OEE itself is a well established method for assessing production performance, and requires no further definition or explanation here. Since it covers production as a whole however, and since the more complicated a line is, the more potential negative impacts on OEE there are, it might be thought that adding another piece of equipment – a metal detection system – carries with it the risk of increasing this still further. This is exactly why it is necessary to choose the right metal detection system.

If you consider that OEE is about availability, performance and quality, when you are buying a metal detector you need to make sure that its impact as a critical control point is minimal and that it outperforms the other equipment in your line. We try to get manufacturers to understand how the features of the metal detector support definable customer benefits, which in turn

The Profile Advantage can eliminate active product effect from standard products, and thereby identify contaminants with 50% greater detection sensitivity.

help maintain or improve the production line's OEE. Metal detection systems impact on OEE in four key areas, all of which can have a significant positive effect on production line efficiency:

● Product changeovers

A major factor affecting OEE is the production line downtime caused by product changeovers. Manufacturers who produce a range of products on the same production line as a way to maximise efficiency and meet consumer demand without the need to invest in an expensive new line.

However, the changeover procedure entails production to be stopped while equipment is set up for the new product, negatively affecting productivity. Advanced metal detection systems can minimise the impact on productivity by offering a number of features designed to streamline changeover downtime.

Pre-set product menus, for example, can allow machine operatives to set up the metal detector to inspect a new product at the touch of a button. Innovative product clustering technology allows a single product setting to be used for multiple products with similar moisture content. Such features make metal detectors easier to use and

reduce set-up time during product changeover, maximising production uptime and boosting manufacturing OEE.

● False rejections

Another area where metal detection technology can improve OEE is false rejections. These occur primarily when a metal detector mistakes good product for a metal contaminated product. This 'product effect' phenomenon is a signal generated by the product in the detector (often because of the product's high moisture and salt content) during inspection. This can reduce a detector's ability to detect metal contaminants smaller than a critical size. This is particularly common in 'wet' products, such as meat, ready meal foods and those packed in metallised film. In practical terms, the product effect reduces inspection sensitivity and limits a food manufacturer's ability to meet the toughest of retailer codes of practice or food standards.

Advanced metal detection systems can overcome these product effect challenges in a number of ways. Modern metal detection utilises Multi-Simultaneous Frequency (MSF) technology and sophisticated algorithms. These discriminate between product effect signals and those from metal contaminants,

suppressing the former, enabling the system to identify and remove contaminated products while minimising false rejections. Such solutions can help manufacturers maximise food safety for consumers, while minimising costly product waste, boosting OEE.

● **Breakdowns**

Just like product changeovers, machine breakdowns can have a significant negative impact on line downtime. Metal detection technology can help mitigate this effect though.

Condition monitoring software, for example, automatically checks the performance of components throughout the metal detector system, alerting operatives to issues before they become a problem. This allows targeted maintenance to be carried out on the component in question, reducing downtime and boosting line efficiency. Design features that facilitate ease of access to the metal detector's internal parts, or simplify the removal and installation of the system's components, such as the conveyor belt, can further cut maintenance downtime, enhancing overall line productivity and OEE.

● **Performance verification testing**

An essential component of compliance with GFSI-approved safety standards is performance verification – inserting approved contaminant test samples into the production line to ensure the metal detector system performance is within the correct factory specification levels. Again, such tests can impact on downtime, as production has to be stopped and the sample manually inserted into the line.

However, many advanced metal detection systems offer features that allow performance verification testing to be carried out automatically in the middle of production, ensuring compliance with food safety standards, while minimising testing downtime. The most advanced systems may even allow less frequent testing, providing significant cost reduction, as their system's capability and tolerances to agreed factory standards exceed traditional technology capabilities.

Solving the OEE equation

Modern metal detectors such as Mettler Toledo Safeline's Profile Advantage can help solve many of these challenges for manufacturers to boost OEE. For example, the Profile Advantage's Digital Signal Processor (DSP) allows it to inspect challenging wet product applications, as it can discriminate between the signal generated by the product and that of the metal contaminant. It learns the characteristics of the product signal and places a 'discrimination envelope' around the product signal, allowing it to effectively ignore the product signal inside the envelope while detecting signals outside the envelope. This makes it capable of 50%

The hygienic design comprises curved corners and sloping surfaces to minimise dirt traps and facilitate quick and easy cleaning.

greater detection sensitivity compared with traditional solutions.

In addition, the system is also able to inspect multiple products on a single setting using 'intuitive clustering' technology. This is a way of grouping multiple products under the same system setting so that manufacturers can change products on the line with no loss of detector availability, no loss in sensitivity and no discernible impact of product effect.

Running a world-class product inspection regime requires a manufacturer to regularly check the performance of their systems through monitoring tests. If a metal detector fails a verification test, the products that have passed through since the last successful test must be considered suspect and quarantined for re-inspection. Modern metal detectors can help with condition monitoring and predictive analytics features.

The first of these provides an early warning of a potential fault in the system through continuous monitoring of its critical functions. Predictive analytics also provides an early warning through monitoring changes in detector sensitivity, which it uses to predict when performance may fall outside the factory specification.

Armed with this information, a factory

Predictive analysis is included allowing for fewer scheduled monitoring tests.
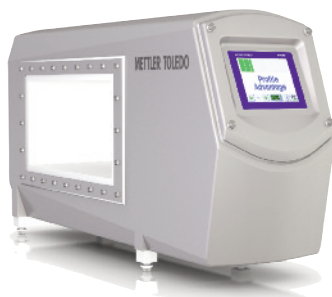
manager is given greater confidence that a metal detector is performing as it should, and can decide to increase the interval between monitoring tests, reducing interruptions to the line and positively affecting OEE performance. If you are maximising the focus on driving OEE, you need the tools that will support your overall equipment effectiveness plan, and Safeline metal detectors are ideal for that. They support a manufacturer to protect their brand, comply with international food safety standards, reduce costs and increase productivity. A further point is that accurate measurement of OEE is dependent upon data collection and incomplete or incorrect performance data can lead to ill-informed decision making. Production performance data is best collected digitally and automatically to be reliable and it needs to be in a consistent format that everyone understands and trusts.

The latest generation of metal detectors are equipped to support production efficiency improvements by providing OEE data either at the device or through various communication protocols into a Management Information System (MIS).

Managers can see how their production line is performing at any given moment and have the data to hand to investigate more deeply and make informed decisions about where they can make critical changes that can help raise their OEE ever closer to a world-class rating.

Greater line efficiency

Today's manufacturing priority is to push production line efficiency to higher levels while not compromising on essential quality and safety standards. A modern metal detection system, optimised to your production environment, plays an integral part of this process on both counts. ∎