Minebea intec The true measure

How the right technologies can provide effective protection against recalls

Any recall of food products from the retail trade represents a threat to the manufacturer's reputation and poses a risk of considerable economic damages. Foreign object detection and fill level control technologies minimise this risk and secure your production processes.

The best recalls are the ones you avoid altogether

Consumers rightly expect their food products to be safe and not to pose any health risks. For manufacturers in the food production sector, this means securing their incoming goods, production and supply chains so that withdrawal or recall measures never have to be taken – starting with the 'fresh from the field' raw material', through to maintaining the cold chain en route to the outlets. Foreign objects in food and deviating fill levels are significant risk factors but can be reliably identified at multiple points along the production process. Minebea Intec offers a wide range of products for this exact purpose. We support you by providing the right technology at the points in the production process that prove critical for safety. This how-to guide identifies strategies and options, and describes various technologies. You can use the check list at the end of this guide to determine your own needs and the options available to make your production facilities even safer. We hope you find the information below to be informative!

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Why it is increasingly important to avoid recalls

The increasing globalisation and digitalisation of our world comes with a few drawbacks. It is not uncommon for batches to be delivered to twenty or more countries and, in the event of an emergency, this can mean more than just high recall costs. Read on for an overview of the risk.





Paying the price for a good reputation

Recalls pose a **significant**, **multi-faceted risk** and – for good reason – are a regular feature on the risk registers of manufacturers in the food industry. Alongside the **economic costs of a recall**, manufacturers are particularly affected by the growing **risk of reputational damage**. **Trade relations**, too, are especially susceptible to damage.

The number of product recalls is rising...

The production volume of food is increasing every year and the traceability of recalls is getting better – which means that consumers are becoming much more aware of the issue.

Economic costs

Aside from the issue of public health, food recalls represent a major economic problem. According to a joint industry study* by the Food Marketing Institute and the Grocery Manufacturers Association, the **cost** to food companies of every second recall in 2010 was more than **USD 10 million**.

However, this only accounts for the direct costs, which tend to include the following items in addition to the extra labour costs:

- notifying the supervisory bodies, supply chains and consumers
- retrieving the affected product batch
- storing and destroying the affected product batch
- the unsaleable product batch itself.

These costs depend, for example, on production costs, sales price, batch size and distribution, and vary accordingly in each individual case.

Number of EU RASFF recalls due to foreign objects – per year and risk. Databases from different countries, such as RASFF, show a slight increase in recalls and an increase in cases that can be classified as "serious". Although the production volume of food is also increasing and traceability improving – there is an increase in consumer awareness.





^{*} GMA, Covington & Burling LLP, and Ernst & Young (2010), Capturing Recall Costs: Measuring and Recovering the Losses

^{**} Own analysis using Rapid Alert System for Food and Feed (RASFF) Portal, 2020



Reputational damage

In times of advancing digitalisation, news is shared at **increasing speed** and is extremely difficult to control. Today's consumers have no choice but to be informed about food recalls, as the media reports on them around the clock, while **social networks** spread the news and influence how brands are perceived.

In terms of economic damage, it is therefore very difficult for those companies affected **to recover the loss of consumer confidence** and to restore or improve the image of the individual product, the brand or even the entire company. Of course, these processes also generate costs, although they are extremely difficult to measure.

Damaged trade relations

As a bulk purchaser, the retail trade expects reliable, **complete deliveries** from its trading partners. If a batch cannot be delivered, the shelves remain empty, which in turn annoys the consumer and, in the worstcase scenario, drives them into the arms of the competition.

Understandably, delayed and incomplete deliveries or recurrent product recalls result in **products and manufacturers being blacklisted**. In the case of entire retail chains, this causes significant economic damage.



) Risk detected – recall avoided

At one German food manufacturer, a defect in the dosing system led to the suspicion that a metal part may have entered the product during the filling process. The pressure to deliver was extremely high. The affected packages required a reliable X-ray inspection solution to safely rule out the risk of foreign object contamination. The manufacturer contacted its long-standing partner, Minebea Intec. Arrangements were made to lease a system from our own factory in Aachen as quickly as possible, which meant the affected batch could be checked and the foreign object identified before the product was delivered.



To Best Practice

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The legal framework, standards and regulations for safe production processes

In the food industry, we encounter a large number of legal regulations, with very few of them being global in scope. As a reliable partner, Minebea Intec supports quality management and efforts to enable safe production processes.

Two examples.





Continuous testing and certification procedures ensure compliance with numerous national and international standards, concepts and regulations such as FDA, HACCP, IFS, EAC, AAA, EHEDG and NSF. Regulation (EC) No 852 / 2004 requires any food business operator engaged in the production, processing and distribution of primary products – as well as related operations at the subordinate stages of production, processing and distribution of food – to establish, implement and maintain a process based on the principles of the Hazard Analysis and Critical Control Points (HACCP) system.

The HACCP principle

One objective of the HACCP is to **protect consumer health by avoiding foreign object contamination**. In this case, it is useful to check packaged products or products shortly before packaging, provided that this offers benefits with regard to the detectability of the foreign objects (based on the hazard analysis).

In addition, it can be beneficial to **use a foreign object detection system before each process stage**, which can break down larger foreign objects in such a way that these parts can no longer be detected at a later stage. In addition to **preventing contamination of foreign objects**, the food industry also aims to produce **safe and high-quality products for consumers**.



Example representation of a process line. Critical control points according to the HACCP principle avoid foreign object detection for the consumer.

Potential hazards according to the HACCP concept

Physical hazards

Shards (e.g. wood, glass, metals, bone) Rubber, plastics, hair, fingernails, insects, other foreign objects

Chemical hazards

Contaminants (e.g. heavy metals, acrylamide) Residues (e.g. veterinary drugs, pesticides) Additives (anti-oxidants, preservatives)

Biological hazards

Bacteria Fungus Pests Parasites

Potential hazards in the food industry



In addition to the HAACP, there are **other recognised standards for the continuous improvement of quality management systems in the field of food safety standards** for consumers. The Global Food Safety Initiative (GFSI) is designed especially for this purpose.

GFSI: Global Food Safety Initiative

The GFSI was founded in 2000. Discussing the matter at a conference, the directors of a group of international companies agreed on the need to raise **consumer confidence in food and food safety**.

The aim of the initiative is therefore to continuously improve quality management systems for food safety, cost efficiency in the supply chain and, above all, food safety itself for consumers all over the world. At present, there are **five standards recognised by the GFSI**. Among the common standards which apply in Europe are the **IFS and the BRC**. The SQF 2000 has virtually no relevance in Europe and is limited to the USA.

Other recognised standards are the **Global Standard Food Version 5 and the Dutch HACCP.** These are both becoming less and less significant and are only encountered very rarely. The ISO 22000 standard, which is not yet recognised by the GFSI, is becoming increasingly important, for example in Russia.





Foreign objects, such as glass shards, pose an enormous health threat to the consumer. However, they are extremely difficult to detect. Weighing and inspection solutions to ensure compliance with regulations

Choosing the right system depends on the type of product and how it is packaged. One crucial factor is whether the packaging contains metals and whether metals need to be detected as foreign objects. The product and packaging also determine which is the right technology to choose for fill level monitoring.





Metal detection ensures product quality and safety

Metal detectors detect **metal parts made of iron**, **steel and stainless steel** but also **non-ferrous metals** such as aluminium. Their sensor technology can detect not only **magnetic** but also **non-magnetic** metals. From the size of the outlet opening to the product effect, a number of factors can influence the attainable detection result. Expert advice is definitely helpful in this regard.

How metal detectors work

A typical metal detector comprises **a transmitter coil and a receiver coil**. The receiver coil actually contains two coils, which are mounted symmetrically to the transmitter. An electromagnetic field is generated and balanced between these two coils. When a 'clean', non-contaminated product is passed through, **the conductivity itself produces a greater or lesser change in this field**. This is measured (like a voltmeter) and stored. The effect of this product in its **non-contaminated state is referred to the as the 'product effect'**.

If **metal**, such as a screw nut, is present in the product passing through the detector, this has an even greater effect on the electromagnetic field, and the detector reacts to it **and reports this deviation**. There is a wide selection of different metal detectors available. For products that are not transported on a conveyor belt, we are able to offer **custom detection solutions:** under the well-known Vistus[®] brand, Minebea Intec offers solutions for both free-flowing and pumped goods.

() Diagram to show the basic workings of a metal detector

The illustration below shows the construction of a metal detector, comprising a transmitter coil and two symmetrically arranged receiver coils. As the product flows past the detector, it causes a change in the electromagnetic field (illustration on the right). If there is metal in the product passing through, this has an even greater effect on the field and the detector reacts to it.



Horizontal metal detection with search and receiver coils



X-ray inspection expands the range of detection options

An X-ray inspection system identifies a significantly greater number of physical foreign objects such as metals, glass, rubber, stones and even certain types of plastics. For this reason, this method is used in applications with particularly high quality requirements or complex tasks, or where metal detectors are not suitable due to the packaging containing materials such as metal foils.

X-ray inspection systems have become more efficient, reliable and user-friendly in recent years. Minebea Intec systems not only detect foreign objects, but can also check weight, the number of product components, fill levels or the seal integrity of packaging.

Thanks to a combination of process reliability and quality control, these systems offer added value and help to reduce production costs.





individual areas



Product weight check Weight calculation of Integrity check

How X-ray inspection systems work

In vertical or 'top-down' X-ray inspection systems, an X-ray generator is installed above the conveyor **belt**, which sends a beam through the product as it moves along the belt. A detector is installed below the belt, which scans the beam as it passes through the product. This process uses the **absorption** to generate a greyscale image of the product.

The greater the density of the material, the darker the image. In horizontal or 'side-shoot' systems, either one (single-beam) or two (double-beam) X-ray generators are installed on one side of the belt and the corresponding detectors on the other side.

The technology is similar to that used in the medical field, the difference being that the X-ray inspection solution scans line by line (while the product is moving). In medicine, the entire image is usually captured at once. Metal parts become visible due to their high **density**, and the product can then be removed. The best solution is selected in each case, depending on the application and the product to be checked.



Detection of a product with double-beam technology

If, for example, upright, difficult-to-inspect products such as bottles or jars are to be checked, the use of a **double-beam solution** is recommended. The latter has a second X-ray beam which is mounted at an angle of 90° to the first X-ray beam, as well as a second detector. As a result, glass containers can be inspected without gaps, and 'blind spots' can be eliminated. Double-beam X-ray inspection solutions detect the tiniest shards of glass in glass containers – under the lid, at the edge and even in the rounded part of the container – and thus make a significant contribution to consumer health.



() X-ray inspection solves the most complex requirements

The particular properties of the cereal in this two-compartment yoghurt pot presented one dairy product manufacturer with a difficult challenge. The solution was found in the form of the Dymond X-ray inspection system, which ensured that the products remained free from contamination while retaining the ideal cereal consistency.





<u>To Best</u> Practice



High speed, including on the packaging line

For dynamic checkweighing of its long, narrow packaging, one food manufacturer was looking for a reliable and versatile checkweigher that could guarantee high volumes. Minebea Intec impressed with a tailor-made, high-speed solution: the checkweigher Flexus[®] weighs up to 600 products per minute.

To Best Practice

Checkweighers ensure correct filling and provide greater efficiency

In the production of high volumes, even minimal changes have a significant impact on the outcome. The slightest fluctuations in product weight will later lead to under filling or over filling on the packaging line. Underfilled products are rejected. Overfilled products result in wasted raw materials. Precision, checking, and the combination of modern technologies and software solutions help in all automated and manual processes.

Function and benefits of a checkweigher

Checkweighers are based on a **load cell installed under the conveyor belt** that measures the product weight in a fraction of a second. High-speed models have a **load cell with electromagnetic force compensation**, which not only supports faster belt speeds of up to 3 metres per second, but can also weigh low weights, starting at just 5 grams.

Checkweighers from Minebea Intec also help to **optimise filling quantities**: when it comes to reducing the consumption of raw materials and ingredients used, the first thing many manufacturers think of is the filling systems in their production process. When casting in moulds, there is great savings potential in determining the exact filling quantity. There is also additional potential for optimisation in the filling equipment of the packaging line. If sweets are filled loosely into tubular bags, for example, over filling is often accepted in order to avoid under filling. The checkweighers Synus[®] or Flexus[®] and optional Essentus[®] performance from Minebea Intec offer a special option to address this issue. **Trend control is used to control the upstream filling, portioning or cutting machine** in order to keep the weights consistent and as close as possible to the defined target weight. This prevents **unnecessary over filling or under filling** and reduces the number of rejects and thus the level of material waste.

To determine the exact quantity of material used, precise measurement results are also required on silos for storage and process vessels. **Digital and analogue load cells** as well as weighing electronics reliably determine filling levels. The weighing of mixing systems in particular is a challenge because of the **lateral forces** that arise. In this case, the hygienic weighing modules of the Novego series offer the highest level of precision.

What do you want to find: incorrectly filled products or foreign objects?

The earlier that errors are detected in the production process, the lower the damage. Recalling a product contaminated with a foreign object that has already made its way to the supermarket, or has already been sold to the end consumer, is extremely detrimental both financially and to the brand image. Different applications require different weighing or inspection solutions.





Incorrectly filled products: checkweigher or X-ray inspection system?

To ensure the correct filling of packs, it is recommended to use either a **checkweigher** or an **X-ray inspection system**. The choice between the two solutions depends on the requirement profile as well as the quantity to be weighed and the required accuracy.

Checkweigher: for integrity checking of products and packaging

Along a production line, checkweighers have the task of removing incomplete or over-filled products from the product flow. Different models are available to the user, depending on the **requirements profile**, Minebea Intec customers can choose from the Essentus[®] basic model, the proven Synus[®] all-rounder, and the customised, high-precision Flexus[®] solution.

As a general rule, applications with **high production speeds** require sophisticated checkweighing solutions. Infeed and outfeed belts must not influence the weighing result at high speeds and require **sophisticated conveying technology**.

Weighing in the **millisecond** range requires highprecision weighing technology. This also features a stable, **vibration-free construction** which is solid but also accessible for fast cleaning processes. Using a customised Flexus[®] checkweigher with possible process speeds of up to 3 m/s provides a range of efficient and reliable options. As a **multi-lane solution**, the checkweigher even offers simultaneous checkweighing and ejection on 2 to 6 lanes.



The ${\sf Flexus}^{\circledast}$ checkweigher can be adapted to various applications thanks to a large number of design details



X-ray inspection system: if checkweighing does not provide the desired result

X-ray inspection systems allow in-line quality checks with a variety of functions, based on a reference product.

- Weight determination: by referring to the mass of the reference product, the systems can detect deviations in other products.
- Counting components: by determining the density, it is possible to establish whether or not the products contain the correct number of individual components.
- Detection of missing or defective products: an image of the density identifies defective products.
- Fill level monitoring: X-ray inspection can also determine whether the required level has been reached by measuring the mass.
- Checking the integrity of seals: the systems check the presence and the secure fit of seals and lids to guarantee the freshness of the products and to prevent potential contamination by bacteria.





Product weight check Weight calculation of individual areas Integrity check

The systems also prove to be a good investment **in terms of product safety, integrity and quality**. Their ability to detect foreign objects in products in a variety of packaging types and shapes and reliably remove them from the production or packaging line promotes **compliance with industry standards** such as HACCP, IFS and BRC, **protects the brand image** and helps to avoid costly product recalls.



Thanks to the X-ray inspection system Dylight, a reliable X-ray inspection can be implemented even when there is little space available. The system requires no more than one metre of production line – including separators and run-off containers.

Foreign object detection: metal detectors or X-ray inspection system?

Precise knowledge of possible weaknesses in the process is critical for the effectiveness of production control. Here, each manufacturer must carry out the legally prescribed risk analysis. Minebea Intec provides the right system for many food production stations.





The answer as to whether a metal detector or an X-ray inspection solution is to be installed in the packaging line depends both on the **requirements of the packaging used and on the substances to be detected**. For example, the use of aluminium foils or packaging layers with metallic materials largely precludes the use of a metal detector. If this type of packaging is not used and the issue is metallic contamination, a metal detector may be sufficient.

Metal detectors – reliable detection solutions for metallic foreign objects

Metal detection devices can detect **both ferrous foreign objects and non-ferrous metals** and **reliably remove contaminated products from the production or packaging line**. Specifically, the devices reliably detect ferromagnetic and non-ferromagnetic metals, lightweight metals and different types of stainless steel.

Metallic foreign objects can enter the product in various ways. Often, the foreign objects are introduced into the process along with the raw material, but even more frequently they enter during the ongoing production process. Examples include screws from filling systems or rejected elements from the casting mould. If the risk analysis identifies a metal detector as a suitable inspection solution, the user can choose from a variety of devices and technologies for vertical and horizontal foreign object detection. Depending on the application, metal detectors are available with a rectangular opening for **use on the conveyor belt** and with a round opening for **use in pipelines**.

As a general rule, the metal detection checkpoint is installed **at the end of the production line** to prevent production-related contamination as far as possible.

() All about metal detection

Requirements, technology and application recommendations: increase your expertise in foreign-object detection by downloading our White Papers.



White Paper Metal detection



X-ray inspection systems – wide range of detectable foreign objects

In contrast to metal detectors, X-ray inspection systems offer a significantly expanded range of detection options. In addition to unwanted metallic objects, the inspection solutions also detect foreign objects made of glass, stones or minerals, and even some types of plastic. When it comes to inspecting packaging containing metal elements, X-ray inspection systems are the recommended option.

There is a wide choice of systems available. For special applications such as the **detection of glass shards in glass containers**, we offer side-shoot systems with double-beam technology. Thanks to the 90-degree angle of the X-rays, these high-quality systems can even detect foreign objects on the sides and in the rounded sections of jars or bottles.

Risk analyses show that, in recent years, the **variety of foreign object materials** has **increased** – which is a clear argument in favour of X-ray inspection solutions. X-ray inspection systems are not subject to fluctuations in product effects. External factors such as heat or vibrations similarly do not influence the detection result.

Foreign object materials in product recalls

The distribution of foreign object materials in product recalls is relatively balanced, as the statistics show. This means that materials such as glass or plastic are just as important to consider when conducting a HACCP analysis.



Source: Own analysis using Rapid Alert System for Food and Feed (RASFF) Portal, 2020

() All about X-ray inspection

Requirements, technology and application recommendations: increase your expertise in foreign-object detection by downloading our White Papers.



White Paper X-ray inspection





Check list: how can I minimise the risk of product recalls?

The reliable detection of foreign objects in food production secures processes and minimises the risk of subsequent withdrawal or recall measures after the product has already left your site. Ensure the correct filling quantity by using weighing or inspection solution to control fill levels. Our experts will provide you with free, comprehensive advice relating to Minebea Intec solutions. Please use the following check list as an initial guide.

Please check the following questions. If you answer YES to three or more of the questions, you should consult our application specialists to find the best weighing and inspection solution to meet your requirements.

	Are you already using inspection solutions for foreign object detection?	Yes	No
	Have you ever had to recall a product due to contamination?	Yes	No
	Is your product perceived as being of particularly high quality?	Yes	No
	Are you planning to install a new food processing or packaging system in the next 12 months?	Yes	No
	Are you planning to change the packaging materials on an existing production line in the next 12 months?	Yes	No
•	Is compliance with legal regulations such as FDA, HACCP, IFS or EHEDEG an important requirement in your production facilities?	Yes	No
	Is compliance with local product content/labelling regulations important for your production facilities?	Yes	No
	Is your product highly variable?	Yes	No
	Is your product very temperature-sensitive?	Yes	No
	Does over filling or under filling of products in your plant play an important role?	Yes	No
	Do you have the tools you need to check large packs?	Yes	No
	Is the production of rejects/product loss a cost factor for your company?	Yes	No

Everything from a single source

Minebea Intec provides products, solutions and services to improve the reliability, safety and efficiency of production and packaging lines in the industry. From goods receipt to goods issue - our portfolio comprises a variety of automatic and manual weighing and inspection solutions, software and services for a wide range of applications and industries.

Process weighing and automation

- Vessel and silo scales
- Bench and floor scales
- Components for truck scales Batching and formulation
- X-ray inspection systems Checkweighers

Quality assurance

- Metal detectors Statistical process control
- Technical support

Services

- Upgrades
- Commissioning
- Maintenance and repair







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