White Paper

Five Steps
to Food Safety

Contents

METTLER TOLEDO

Ensuring Optimal Protection Against
Foreign Body Contamination

The need to equip food and pharmaceutical processing lines with top-quality product inspection equipment is more pressing than ever before. Tightened regulatory standards and heightened consumer awareness require that food manufacturers take all measures necessary to protect both customers and their brand reputation.

1. Ensuring Optimal Protection Against Product Contamination

In 2010, the UK Food Standards Agency (FSA) reported 116 incidents of physical contamination, with 66% concerning "extrinsic material not related to the food itself". Thirteen product recall notices were issued. Interestingly, in 2009 the number of incidents was fifty-six, less than half the 2010 figure.

These figures are the sort to provoke concern amongst food manufacturers. There are inevitable and serious consequences in the event of a product recall – the financial cost of sanctions, fines and damaged machines is often high, and can have immediate and long-term implications for company share price.

Food and pharmaceutical safety scares can dent consumer confidence to such an extent that affected brands may find it very difficult to recover. In order to keep your brand protected, certain steps must be taken.

What follows is a five-point checklist of your route to the highest quality x-ray inspection.

2. The Five Steps

Step 1: Understand the Regulations

The first step in satisfying the requirements of food and pharmaceutical regulations and standards is to acquire a full understanding of what they entail, and which particular ones apply to your organisation.

It is important to select equipment and suppliers that can ensure compliance and have knowledge of global quality standards, regional differences and industry variations. X-ray inspection systems must satisfy legislation implemented by state regulators–bodies such as the Chinese State Food and Drug Administration, Germany's Federal Ministry of Food, Agriculture and Consumer Protection, and non-federal US state regulators – in their ability to guarantee process and product security.

In many cases, it is also important to choose technology and equipment that adheres to the demands of the industry, such as standards encompassed by the Global Food Safety Initiative (GFSI), which includes schemes of the British Retail Consortium

(BRC), International Food Standard (IFS) and Food Safety System Certification 22000 (FSSC 22000).

The requirements heaped upon manufacturers do not end with food safety legislation, global certification schemes and process-specific standards.

For example innovative, centralised x-ray inspection device management helps to placate retailers who have their own individual sets of standards – for example Tesco, Marks & Spencer and WalMart, especially in terms of due diligence.

Step 2: Know Your Product

Armed with an awareness of relevant regulations and standards, manufacturers must turn their focus to the nature of their product:
- Is it liquid, powdered or solid?
- Or is it dry, wet, loose or packed?
- What is the product density and thickness?
- Is it packaged in glass bottles, jars, cans or cartons?
- Is the product individually wrapped or in bulk loose flow?

For complete safety, it is important to understand at what point, or points, in the production process your product needs to be inspected and what contaminants you are looking for at each point.

X-ray systems can detect a range of dense contaminants such as ferrous, non ferrous and stainless-steel metals, glass, mineral stone and ceramic. The effectiveness of x-ray inspection is limited by several factors, including the thickness, homogeneity, density and size of products. X-ray inspection systems works best with homogenous products, like cheese, as they create clearer images, compared to non-homogenous products, such as a box of cereal with various components of differing density i.e. flakes, nuts and vine fruit.

Packaged Products in Flow-wraps, Pouches, Cartons, Trays and Cases

X-ray inspection systems are most commonly used for the inspection of fast-moving consumer goods, such as flow-wraps, pouches, cartons, trays and cases. These products are typically smaller in depth than in width and length.

The best detection sensitivity is provided by inspecting the products through the vertical cross-section where the least product depth is. The X-ray machine incorporates its own conveyor; it transports packs from the manufacturer's line through to the x-ray beam and back on to the line.

As with all x-ray systems, an automatic reject system can be fitted to remove faulty packs efficiently from the line.

To ensure inspection of the entire product, each pack should fit within the triangular shaped vertical beam. Packs should be guided to and positioned on the centreline of the belt. The largest width and depth of pack to be inspected determines the size of the x-ray beam.
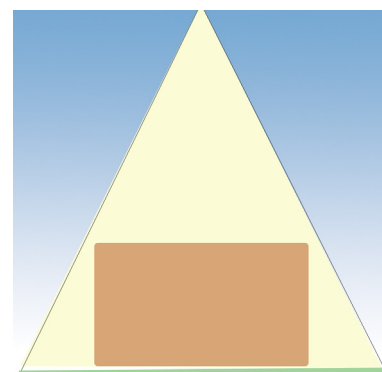
Bulk-flow Products – Wet, Dry and Free-flowing Products

These systems inspect bulk-flow, or loose products before they are packaged or added as ingredients to a finished product. Typical applications include grains, peanuts, extruded snacks, dried fruits, tea and coffee, powders, vegetables and pulses. Detection sensitivity in bulk-flow products is usually better than in final closed packs as the depth of product is typically less. A single layer of product, or a constant depth of product flow, can be achieved, improving detection sensitivity.

Consideration should be given to the location of these x-ray machines in the production line.

When placed early in the process, incoming goods or raw materials can be inspected, allowing contaminants to be removed at the source and immediately traced back to the supplier.

Contaminants in incoming goods are at their largest and most detectable. Further downstream, there is the risk they get broken into smaller, less detectable fragments, as part of the manufacturing process.

Eliminating contaminants early in the production process has numerous advantages, including preventing further value being added to products through processing and packaging, thereby minimising waste and overall production costs.

Pipeline Machines – Pumped Products

X-ray systems are also commonly used to inspect pumped products, typically slurries, semi-solids and fluids before final packaging and further value is added. Applications include sauces, jams, minced meat, whole muscle, chocolate, fruit puree, dairy spreads and pharmaceutical slurries.

A beam scans the product as it passes through a pipe and detects products containing contaminants. Which is then diverted away from the good product via a reject diverter valve. Like bulk-flow machines, the x-ray pipeline system is usually located up-stream to inspect product at an early stage, and offers good detection levels as the product is homogeneous.

Tall Rigid Containers - Glass Jars

For the inspection of tall rigid containers, multiple x-ray beam systems are commonly used to optimise the Probability of detection.

Inspection of Metal Cans

Two x-ray beams from a single generator (known as a split beam) increase the probability of detection of contaminants, as two images are created from different angles simultaneously.

This is particularly useful for packaging such as metal cans because it is difficult to detect contaminants on the base or side walls of the can. A split dual-beam x-ray system overcomes this challenge as every metal can is imaged twice. Each image represent a different viewing angle, thereby increasing the coverage inside the container and the probability of detection.

Glass Bottles

Products packaged in glass bottles and jars are among the most challenging to inspect. The base, sidewalls and neck can cause 'blind spots' when inspected using a single x-ray beam and even dual beams cannot offer 100% inspection.

The probability of detection can, however, be improved by using multiple x-ray beams – a combination of vertical and horizontal beams. For example, one vertical and three horizontal x-ray beams will scan the product simultaneously to produce a series of images from a range

of angles, reducing blind spots and optimising detection. The orientation of the beam may also be optimised at different angles to suit the type of container and product type.

Part of knowing your product is understanding the factors that could limit inspection sensitivity.

This draws upon knowledge of product technology, potential contaminants and environmental factors.

Step 3: Increase Risk Awareness

Good manufacturing practices, such as those outlined in a Hazard Analysis and Critical Control Points (HACCP) program, should be in place no matter where or what your company is manufacturing.

A comprehensive manufacturer audit, which in the case of HACCP requires the following of seven key principles, involves the systematic identification of manufacturing risks, and the incorporation of means to mitigate the risk when identified or the implementation of corrective actions to manage them.

The seven key principles apply across the board, whether you produce wet or dry, fresh or frozen foods.

Conducting a Hazard Analysis

Every manufacturer should perform a hazard analysis for each product it produces, to assess the risk of contaminants being present. A hazard can be considered anything that could be a threat to human health.

The following is a brief outline of how to conduct a hazard analysis.

1. Create a flow diagram of your production process, including every operation and input (any ingredient or packaging material that touches or affects the line).
2. For every operation / process and input, identify the potential hazards including their sources. For every hazard, consider whether your manufacturing processes introduce, control or increase the hazard.
3. Evaluate the likelihood of each hazard occurring, as filtering out unlikely events helps you focus on the risks which are relevant.
4. Think about preventative measures you could put in place to reduce the risk of the hazard occurring. Concentrate on operational procedures – frequency of maintenance, safety inspections, visual checks, encasing of the line, training etc – that minimise the likelihood of contaminants entering products. Bear in mind that some hazards may require more than one preventative measure.

Seven Core Principles of HACCP
1. Conduct a food safety hazard analysis
2. Identify the Critical Control Points (CCP)
3. Establish critical limits for each CCP
4. Establish CCP monitoring requirements
5. Establish corrective actions
6. Establish record-keeping procedures
7. Establish procedures to verify system is working as intended

HACCP analysis enables manufacturers to get a grasp on which contaminants are most likely to affect their products, be it metal, glass, calcified bone or high-density plastics, as well as all product integrity risks on their production lines.

X-ray systems can inspect products for a range of product integrity checks, such as broken products,

damaged packaging, and inconsistent fill levels.

Once the initial risk assessment is complete, food manufacturers are in a position to better understand which x-ray system is ideal for their particular risk control requirements and where on the production line it needs to be installed.

Step 4: Optimise Productivity

Whilst an x-ray inspection system will ensure quality and safety, additional features can be selected to facilitate increased productivity and minimise downtime.

Manufacturers don't just use x-ray inspection to detect contaminants; x-ray systems can simultaneously perform a wide range of in-line quality checks.

The additional tasks an x-ray system can perform include:
• Measuring product length, width, area and volume;
• Measuring the mass of a product;
• Counting components;
• Identifying missing or broken products;
• Monitoring fill levels;
• Inspecting the integrity of a product seal or closure
• Checking for damaged product and packaging.

In market-leading x-ray inspection solutions, intuitive touch screens provide an easy and efficient system through which to control line parameters, speed up the set-up process and provide further productivity boosts.

Easy integration with other surrounding pieces of equipment is also important for x-ray inspection machines – this allows installation

time to be kept to a minimum which in-turn increases up-time. Similarly, system options exist to provide flexibility for the inspection of multiple products at a single machine setting, of up to 8 lanes.

Integrated data monitoring software programs, such as Mettler-Toledo's centralised product management platform ProdX, enable real-time monitoring of multiple locations and greatly enhance Overall Equipment Effectiveness (OEE).

Simple-to-understand online visualisation of the complete production line, and at-a-glance status of device health and effectiveness, ensures that interventions are planned rather than reactive.

Step 5: Rely on the Experts

The purchase of x-ray inspection equipment best suited to your line needs can appear, on first sight, a daunting task.

With food safety regulations changing continuously, there is an added pressure on manufacturers to ensure product safety and traceability.

In order to eliminate confusion, and select the most appropriate x-ray inspection solution, food and pharmaceutical manufacturers need a partner they can rely on.

They should be able to call on an equipment provider with the worldwide expertise necessary to give close consultation on optimum systems, corrective actions, and the ability to provide the best x-ray inspection equipment available.

3. Conclusion

The choice of the ideal x-ray inspection system can be overwhelming as it depends on a number of factors, from product characteristics to regulations and standards.

X-ray systems provide optimum efficiency as they are able to keep up with the speed of the production line, whilst inspecting products.

With food and drug safety regulations intensifying, compliance and traceability through every stage of a product's life cycle is growing in importance. X-ray inspection is increasingly being used by manufacturers of well-known brands to detect and reject contaminated products.

X-ray inspection systems can find contaminants at every stage of the production process for raw, bulk, pumped, and packaged products, but the effectiveness of the technology depends on the density, thickness and homogeneity of the product.

However, one thing's for certain, the product that successfully passes x-ray inspection contains no shocks, surprises, or disappointments.

By detecting contaminants, x-ray inspection enhances food and pharmaceutical manufacturers' confidence in the quality and safety of their products and helps them comply with industry standards, including Hazard Analysis Critical Control Points (HACCP), the Global Food Safety Initiative (GFSI) and Good Manufacturing Practice (GMP).

These five steps above shed some light on the important decisions a manufacture has to make to ensure quality products, productivity and compliance.

Notes

Further Information about X-ray Inspection

Free Technical Guide
Make an informed decision

METTLER TOLEDO has published an authoritative product inspection guide for x-ray inspection systems.

The 73 page guide enables you to select the right x-ray inspection system for your production line. It supports you to install an all-encompassing product inspection programme and to achieve compliance with standards, regulations and legislation.

Register today for your **Free** copy: **www.mt.com/xray-guide**

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