Metal Detectors and X-Ray Technology meet HACCP Guidelines and help Increase Food Safety

by Jeff Kaveney

Like many other manufacturing industries, food packagers are adopting better technology to increase productivity while adhering to stringent food safety guidelines, especially in the wake of tougher federal regulations. While productivity is the end goal for any company, the food packaging industry faces unique challenges, specifically regulations coming from the US Food and Drug Administration (FDA), US Department of Agriculture (USDA) and the company’s own Hazard Analysis and Critical Control Point (HACCP) programs.

Accordingly, food processors invest millions of dollars annually for inspection and detection equipment, proactively reducing the risk that any foreign object or contaminant will be imbedded into a food product sold to supermarkets, grocery stores, restaurants, retailers and general consumers.

Attention to product purity on the production line has never been greater, creating the need for food processors to detect and eliminate foreign objects before the end products reach the consumer. Best practice manufacturing operations now include state-of-the-art inspection systems to help limit product recall and liability claims.

Many food processors today use a combination of inspection technologies, including metal detectors and x-ray inspection systems. These modern systems operate independently or in tandem on the production line to identify minute metal fragments and other non-metallic contaminants before the final products are shipped.

The most sensitive metal detectors, for example, can detect ferrous and nonferrous metals down to 0.15 millimeter in size, making them ideal to prevent metal contamination from reaching consumers. Moreover, detecting metal early in the production stage mitigates damage to process equipment downstream, thus reducing downtime.

Modern metal detectors operate for long periods of time, frequently in adverse environments, with little attention to maintenance. The power required to operate both the detector and the reject drive (if any) is minimal, even if a special conveyor is needed to pass the product through the metal detector. Metal detectors can be configured to reject the contaminated product automatically, even if the rejection point is some distance from the detector. Metal detectors can also be used to verify that desired metal objects ARE present in packaged products—such as novelties in cereal boxes.

X-ray systems, on the other hand, have the added benefit of being able to identify non-metal contaminants, scan for missing or broken products, detect packing voids, confirm fill levels and help control product and package mass. The size of foreign object detected depends on the selected x-ray model, beam energy, product characteristics, contaminant type (bone, glass, stone, etc.) and the package material.

Detecting contaminants along the production chain

The principle of metal detection and x-ray technology is well known because of its long-term use in other industries, most notably health care, airlines and pharmaceutical. The food industry,
with its emphasis on quality control, has dedicated more investment in recent years to this technology as well.

Besides the obvious benefit of product purity, metal detectors and x-ray inspection systems will also protect downstream equipment from damage caused by metal, bone, glass, stone or other foreign objects. Contamination can enter the production process with the raw materials or can get into the product due to wear or failure of processing equipment.

Most metal detectors and x-ray inspection systems are relatively small in size, so adding one into a production line is not cumbersome. Start-up assistance and on-site training helps plant operators inspect products the same day as installation. Today, thousands of machines inspect food every day around the world and all equipment is certified, inspected and regulated for optimum performance.

Metal detectors and x-ray inspection systems are manufactured in different configurations and capacities, depending upon the type of production line in use and food being processed. There are some basic differences between the two technologies.

Modern metal detectors fall into two main systems: The first are capable of detecting ferrous and nonferrous metals as well as stainless steel in fresh and frozen products—either unwrapped or wrapped; the others are capable of detecting ferrous metals only within fresh or frozen products that are packed in foil wrapping.
Dry products, such as sugar, salt and cereals, are easy to inspect and generally do not pose any problems for metal detectors. Wet products, on the other hand, create an interference signal (known as product effect) that will cause a detection even when no metal is present. The signal is caused by a combination of salt and moisture that makes the product conductive and the detector’s electronics must be able to ignore it for the detector to perform satisfactorily; this is called phase adjustment.

Other characteristics of metal detectors include:
- Can be installed in applications including vertical free fall
- Only detect metal
- Work well with dry, non-conductive products
- Have varying degrees of detection among ferrous, nonferrous and stainless steel
- Lower cost than installing an x-ray inspection system

X-ray inspection systems, by comparison, can detect more than just metal. Other detectable foreign objects include glass, stones, some plastics and calcified bones. The varying degrees of detection are dependent upon the size and type of foreign object and the product being inspected.

More food processors are turning to x-ray inspection systems because they utilize foil packaging. When processors use foil packaging, there is a prevailing philosophy that the best quality system is to inspect the final package so there is no danger of a contaminant getting inside the package after that point in the process. In summary, x-ray inspection systems:
- Work equally well with all products (dry and conductive)
- Have consistent detection of ferrous, nonferrous and stainless steel (excluding aluminum)
- Can detect numerous foreign objects not caught by metal detectors
- Cost more than installing a metal detector.

Installing the optimum metal detector and x-ray inspection system

There are a variety of metal detectors and x-ray inspection systems designed particularly for the food processing industry. These units can be installed individually along the processing line or employed in tandem for optimum detection of all foreign objects.

Depending upon the product and packaging configuration, packaging lines can include metal detectors or x-ray inspection systems, with each of these technologies offering their own distinct advantages.

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