BACKGROUNDER

Foreign Object Detection Compliance with Retailer Codes of Practice

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To assure the highest level of food safety possible for their customers, leading retailers have established requirements or codes of practice regarding foreign object prevention and detection. In general, these are enhanced versions of the standards established many years ago by the British Retail Consortium https://www.brcgs.com/brcgs/retail/

One of the most stringent food safety standards was developed by Marks and Spencer (M&S), a leading retailer in the UK. Its standard specifies what type of foreign object detection system should be used, how it must function to assure rejected products are removed from production, how the systems should "fail" safely under all conditions, how it should be audited, what records must be kept and what the desired sensitivity is for various size metal detector apertures, among others. It also specifies when an X-ray system should be used instead of a metal detector.

The purpose of this backgrounder is to describe the M&S requirements so food manufacturers supplying packaged food products to retailers can fully understand what the inspection and detection system features, options and performance requirements are. By meeting this "gold standard," a food manufacturer can have the assurance that their product inspection program will provide the confidence that major retailers are increasingly insisting upon for the safety of consumers. At the same time, it also provides their brand with the best possible protection.

In response to the growing trend among retailers to require such rigorous requirements, Thermo Fisher Scientific has designed the Thermo Scientific™ Sentinel™ Multiscan Metal Detector, Thermo Scientific™ APEX metal detectors and Thermo Scientific™ NextGuard™ X-ray inspection systems to meet these stringent requirements.

Basic Conveyor System Compliance Features

M&S requires the following system features to meet its basic requirements. Please note all these items are standard on Thermo Scientific™ M&S-compliant systems.

- All system sensors must be failsafe, so when they fail they are in the closed position and trigger an alarm
- Automatic rejection system (including belt stop)
- Pack registration photo eye on the infeed
- Lockable reject bin
- Full enclosure between the inspection point and the reject bin to prohibit removal of contaminated product
- Reject confirmation sensing (reject activation for retracting belt systems)
- Bin full notification
- Bin open/unlocked time alarm
- Low air pressure switch with air dump valve
- Key switch to start the line
- Lamp stack with:
  - Red lamp where on/steady indicates alarms and blinking indicates bin open
  - White lamp indicating the need for QA Check (audit software feature)
  - Alarm horn

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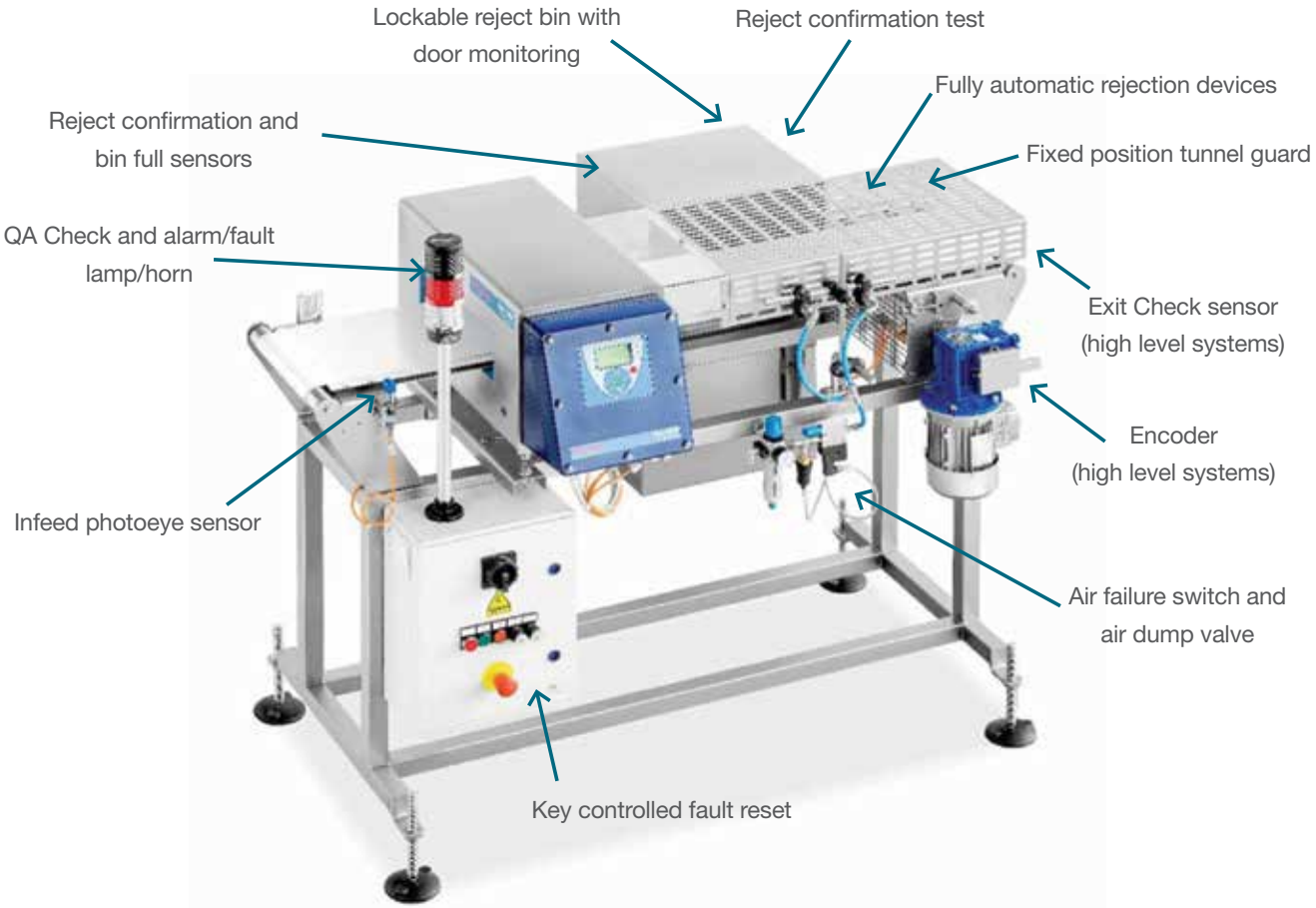
For applications where a higher level of compliance is requested, systems should include the following additional features. These items are supported but optional on Thermo Scientific M&S-compliant systems.

- Exit check sensor
- Speed encoder

The diagram below of an APEX metal detector shows the features described on the previous page. Note that the new Sentinel multiscan metal detector could be used in this system to improve sensitivity and probability of detection and may be the best choice for applications with high product effect (meat, dairy, bakery confectionary, and fresh fruits and vegetables).



APEX Metal Detector Compliant System Features

Failsafe Operation Details

To ensure all production is inspected correctly, the following failsafe features create faults or alarms to notify operators. They are standard in all M&S-compliant systems with the exception of Exit Check.

- Fault and alarm notifications (on screen and via the light stack).
  - Metal detector fault
  - Reject confirmation alarm
  - Reject bin full alarm
  - Reject bin open/unlocked alarm
  - Air pressure failure alarm (for standard pusher and air blast rejection)
  - Reject device failure alarm (for retracting conveyor belt systems only)
  - Exit Check pack detection (higher level compliance, optional)

Please note all faults and alarms must persist after a power cycle and only a QA manager or similar high-level user with a key switch can clear them and restart the line. If desired, this clear function can also be implemented on the Sentinel metal detector or NextGuard X-ray system front panel.

Testing Protocols Supported

All standard Thermo Scientific M&S-compliant systems include the capabilities to execute the following rejection-related tests, assuring system integrity at all times.

- Reject Confirmation Test
  - A key switch is used to enable this test
  - When the key switch is turned to the “Test” position, the electrical supply to the reject solenoid valve is disconnected
  - A test pack with a contaminant can then be passed down the line
  - The inspection system should detect the contaminant and provide a reject signal
  - Because the supply to the reject valve has been disconnected, the reject device should not operate
  - The system should recognize the reject did not enter the bin, alarm and stop the conveyor belt.
- Bin Full Test
  - A mechanical device is installed in the reject bin that breaks the beam of the Bin Full photo eye simulating that the bin is full of product
  - The system should recognize that the bin is full, alarm and stop the conveyor belt

Special Considerations for Belt Stop and Retracting Belt Rejection

Belt Stop systems will include an audible and/or visible reject indicator and a key-switch to restart the system. Retracting belt systems should be used when more than one pack is being inspected across the width of the belt or products are randomly positioned on the conveyor in bulk mode.

Periodic Auditing Capability

All Thermo Scientific metal detectors and X-ray systems include software to automate the auditing process while in production. The system will notify the operator when it is time to audit and prompt them to pass the challenge products with foreign objects. With APEX metal detectors, this feature is called QAT (Quality Audit Test) and with the Sentinel metal detector and NextGuard X-ray system it is called QA Check. Reports are saved on the system showing the time of an audit and if it passed or failed. To meet the M&S auditing requirement it is necessary to create test products for a metal detector with metal in three positions – leading edge, center and trailing edge. To facilitate this test, QA Check can be configured to run three times instead of just once.

QA Check Capability with the Sentinel Metal Detector

Sensitivity Guidelines

The table below shows the sensitivity required to comply with the M&S guidelines.

Level 1 Sensitivity: This is the target range of test piece sizes which should be detectable based on the height of the product on the conveyor and the use of an appropriately sized metal detector. It is expected that the best sensitivity (i.e. smallest test sample) is achieved for each food product.

Level 2 Sensitivity: This range should only be used where documented evidence is available to show that test piece sizes within the Level 1 Sensitivity range are not achievable due to high product effect or the use of metallized film packaging. Again it is expected that the best sensitivity (i.e. smallest test sample) is achieved for each food product.

When using metal detection in the Level 2 range it is recommended to use the Sentinel metal detector with multiscan technology. Its adjustability, higher sensitivity and increased probability of detection will yield the best results.

Table 1 Metal Detection Sensitivity Requirements

	LEVEL 1 SENSITIVITY			LEVEL 2 SENSITIVITY		
Metal Detector Aperture Height	Ferrous	Non Ferrous (Brass)	Stainless Steel (316)	Ferrous	Non Ferrous (Brass)	Stainless Steel (316)
up to 25mm	Up to 0.8 mm	Up to 1.0 mm	Up to 1.2 mm	0.8 to 1.5 mm	1.0 to 2.0 mm	1.2 to 2.5 mm
25 to 75mm	Up to 1.0mm	Up to 1.2mm	Up to 1.5mm	1.0 to 2.0 mm	1.2 to 2.5 mm	1.5 to 3.5 mm
75 to 125mm	Up to 1.2mm	Up to 1.5mm	Up to 2.0mm	1.2 to 2.5 mm	1.5 to 3.0 mm	2.0 to 4.0 mm
125 to 175mm	Up to 1.5mm	Up to 2.0mm	Up to 2.0mm	1.5 to 3.0 mm	2.0 to 3.5 mm	2.0 to 4.5 mm

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When to Use an X-Ray Inspection System

Metal detectors can be used at low frequency with products that have metal in their packaging, but in most cases the sensitivity will be much improved if X-ray is used. This includes packs with metallized film, aluminum foil trays, metal cans and jars with metal lids. X-ray systems can also potentially detect foreign objects like glass, bone or stone. The NextGuard X-ray system is available with all the capabilities to satisfy retailers like M&S in these cases.

Thermo Scientific™ NextGuard™ Pro X-ray Inspection System (not shown with complete M&S capability)

Conclusion

Metal detection and X-ray systems have been adopted worldwide for over 70 years to protect brands and consumers against foreign object contamination. Many times, however, users can have a false sense of security because the complete system was not specified to sense and react correctly to all possible failure modes that could result in unsafe products escaping down the line. Retailer standards like M&S were created to specify a complete system design that is safe under all circumstances, addressing the all-too-common shortcomings of more limited systems. M&S compliance truly represents a food safety best practice and is thus adopted by leading processors worldwide. Thermo Fisher Scientific fully supports these standards because our mission is to make the world a healthier, cleaner and safer place.

Find out more at **thermofisher.com/retailercodes**

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