



## Metal Detection

**Metal objects can contaminate dairy products from a variety of sources including through contaminated ingredients, inadequate cleaning after maintenance or deterioration of equipment. Metal detection devices are used in dairy manufacturing operations to give a greater assurance that the final product is free of metal contamination.**

### The Need for a Metal Detector

Dairy food manufacturers must ensure the production of safe dairy food, as prescribed under the Food Act 1984<sup>1</sup> and the Code of Practice for Dairy Food Safety 2002.<sup>2</sup>

Product contaminated with metal objects may render a product “unsafe”. There are a number of preventative measures that manufacturers may adopt to minimise the chances of product becoming contaminated with metal objects. These can include:

- Stringent ingredient supplier specifications
- Personnel clothing, jewellery and stationery restrictions within production areas of the plant
- Product filtration and sieving steps
- Installation of magnets in production lines
- Routine plant maintenance procedures
- Staff awareness training, particularly for maintenance personnel and plant operators

Despite the most rigid Quality Assurance (QA) systems, product contaminations with metal objects can and do still occur.<sup>3</sup> Potential product failure costs can be considerable, and may include:<sup>4</sup>

- Loss of business
- Product recall
- Replacement of product stock
- Product rework or disposal
- Adverse publicity
- Potential law suits

Making the decision as to whether a metal detector should be installed in any particular

operation will be dependent on a number of factors. Considerations should cover what are:<sup>5</sup>

- The likely hazards
- The possible risks
- The types of process operations, and the potential dangers to consumers if adequate checks and controls were not in place

The decision whether to adopt a metal detection system as a Critical Control Point (CCP) or as a Control Point under the company’s HACCP-based food safety program will be determined through the hazard analysis process, such as described in the Guidelines for Food Safety: Dairy Food Manufacturers.<sup>6</sup>



### The process

Although advances in metal detection equipment have improved reliability and automation in recent years, the principles of operation remain basically unchanged. Product passes through an opening (aperture), which is encircled by three coils connected to a signal processor. One (transmitter) coil generates a field that will “illuminate” any metal particle present. The two other (receiver) coils combine to detect the metal through its conductive and magnetic properties. A user interface converts the outputs analysed by the signal processor into data to activate the rejection systems, produce records for analyses, calculate sensitivities and perform other operations.

Additional to the detection device are specially constructed conveyors, and a product rejection system.

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The installation and commissioning of any system is a critical factor in setting up the operational parameters that will be used on a day-to-day basis.

The detection capability and rejection accuracy is monitored regularly by operators using test samples of metals with known dimensions. The ability to adjust detection sensitivity limits is restricted to authorised staff or maintenance personnel only. Regular servicing of equipment is necessary to verify efficient operation, and to identify potential faults.

### Limitations

Metal detectors will not detect all metal contaminants in all products. Machine operating capability is generally referred to as the sensitivity. Careful consideration needs to be given to sensitivity specifications quoted by suppliers, to ensure figures are comparable for the intended application.

Detectors will have limitations in the size and shape of metal particles that can be picked up. Because detection systems rely on the magnetic and conductive properties of contaminants, metals low in ferrous metal content, such as stainless steel, are difficult to detect. This is of concern to dairy manufacturers, where stainless steel is universally used, and may be a major source of metal contaminations.

The orientation or direction a contaminant is facing within the product, (e.g. wire), will cause variations in its ability to be detected, and is dependent on the type of metal involved. The position of any metal in the product will also have an effect, with the centre of the detector aperture being the least sensitive area of detection, and the outer edges being the most sensitive.

Products that are high in moisture, particularly with added salt, (e.g. cheese), make detections difficult due to the product itself being highly variable in conductivity. Detector sensitivity in such cases is significantly reduced.

Environmental conditions such as plant vibrations, electrical interference and temperature fluctuations can also affect the reliability of detections.

Timing of the product rejection system needs to be accurately set up and maintained. If this is not the case, contaminated product can be detected but not rejected, and uncontaminated product rejected unnecessarily.

### Further considerations

The affordability and practicalities of installing and maintaining a functional metal detection system must be taken into account. Factors to consider may include:

- The capital cost for equipment (including conveyors and rejection equipment)
- On-going operational costs
- Maintenance/service time, frequency and cost
- Space available for installation
- Suitable operating environment
- Training of operators, maintenance, and management staff
- Product composition and dimensions
- Package suitability
- Management support providing ongoing commitment to the system



### Summary

Dairy manufacturers need to evaluate their operations using a hazard analysis to determine the practical benefits and possible need for a metal detection system.

Dependant on the production operations, product composition and size, and the other influencing factors described, some other type of foreign object detection system may be more suitable.

Where the decision is made to install a metal detector, it is essential to ensure that it has been specifically designed for the product/s involved. This will ensure that the maximum sensitivity can be achieved.<sup>7</sup>

Keeping records of all checks, calibrations and rejections will assist in identifying any trends in metal contamination within the process operations. Any necessary corrective actions can then be

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implemented, which will minimise the likelihood of unsafe product entering the marketplace.

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### Further information

For further food safety information, please contact:

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### References

1. Government of Victoria - Department of Premier and Cabinet, (1984), 'Food Act 1984'. Act No.10082/1984. Section 11 (2)
2. Dairy Food Safety Victoria (2002) 'Code of Practice for Dairy Food Safety.' Section 5.2.1 – Physical contaminants. Available at: [www.dairysafe.vic.gov.au/pdf/DFSV\\_CodeOfPractice2002.pdf](http://www.dairysafe.vic.gov.au/pdf/DFSV_CodeOfPractice2002.pdf)
3. Food Standards Australia New Zealand (2006) 'Food Recall Statistics'. Available at: [www.foodstandards.gov.au/foodmatters/foodrecalls/foodrecallstatsinclu2957.cfm](http://www.foodstandards.gov.au/foodmatters/foodrecalls/foodrecallstatsinclu2957.cfm)
4. Lock, A. (1996) 'The Guide to Reducing Metal Contamination in the Food Processing Industry'. Safeline Ltd., Montford Street, Salford. UK
5. Campbell, A. (1995) 'Guidelines for the Prevention and Control of Foreign Bodies in Food - Guideline No 5.' Campden & Chorleywood Food Research Association. Chipping Campden Gloucestershire GL55 6LD UK
6. Dairy Food Safety Victoria (2006) 'Guidelines for Food Safety: Dairy Food Manufacturers.' Section 4 – The application of the HACCP System
7. Loma Systems (2006) Spectrum Inspection Systems. Southwood. Farnborough. UK. 'A Guide to Metal Detection in the Food Manufacturing Industry'. Available at: [www.loma.com/docs/GuidetoMetalDetection.pdf](http://www.loma.com/docs/GuidetoMetalDetection.pdf)

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