

Magnetic Separators in Food Processing



Metal pieces in food products pose a safety risk to consumers and can damage processing equipment. Detection and removal of metal contaminants is common practice in the food processing industry. One approach to reduce or eliminate metallic contamination is the use of magnetic separators.

Sources of Metal Contamination

Metal contamination may come from a variety of sources including:

- incoming ingredients and raw materials
- processing equipment (grinders, crushers, etc.) general abrasion or vibration causing the loss of nuts and bolts
- inadequate personnel practices and environmental causes

Designs of Magnetic Separators

Magnetic separators are available in a wide range of designs and have different uses. The following table summarizes some of the most common magnetic separators used in the food industry.

Magnetic Separator Design	Description	Use
Bar Magnets	Permanent non-electric magnetic units, can be used in a wide range of applications.	Remove metal contamination present in small, shallow quantities of flowing powder, granules, fibers and liquids.
Plate Magnets	Simple and economical to install. Used in the bottom of an inclined chute or suspended above conveyor belts.	Remove large pieces of metal such as nuts, bolts, staples from dry products.
Grate Magnets	Magnetic tubes designed in a grid configuration that allows the flow of material to cascade through the grate. They spread magnetic protection through cross-sectioned areas of equipment, such as pipes or hoppers.	Remove fine or relatively large pieces of metal contaminants.
Liquid Line Trap Magnets	Traps with tube magnets inside them, designed with an inlet port to match existing pipelines.	Remove metal pieces like baling wire or staples.
Suspended Magnets	Designed to hang above conveyor belts and remove metal fragments from the material being transported on a conveyor as it passes under the magnet.	Remove large pieces of metal, can protect equipment, such as crushers, from damage.

Magnet Materials

There are several types of materials used for magnetic separators:

- **Alnico magnets** are made from aluminum, nickel cobalt and iron. They are economical magnet sources used in applications that have high temperatures (>204 °C). Alnico is comparable in strength to ceramics and it is used to remove relatively large pieces, such as bolts or nuts.
- **Ceramic magnets** are low cost magnets made from a composite of iron oxide and barium/strontium carbonate. They are used to remove relatively large pieces of ferrous metal such as nuts, bolts, nails and other metallic objects in that size.
- **Rare Earth magnets** generate an extremely strong magnetic field, allowing them to remove fine or weakly magnetic contamination such as rust or work-hardened stainless steel from a product flow. Extensively used by the food industry.

Factors Affecting Magnets Performance

There are several factors that can affect the effectiveness of a magnet's performance including:

- **Temperature:** magnetic materials lose strength when exposed to elevated temperatures and it cannot be recovered by cooling.
- **Equipment Design:** spacing and number of tubes in magnetic equipment affect the strength of the magnetic field it generates. Closer spacing and more tubes means a stronger magnetic field and higher efficiency.
- **Flow Characteristics:** many food products exhibit different flow characteristics when damp or moist affecting the flow between the magnetic separator and the product.
- **Product Characteristics:** assessing the characteristics of the material that is processed is a key point in selecting the right magnetic separator. For more information visit: [Magnetic Separators in Food Processing](#)

Evaluation of Magnet Performance

Magnets can lose strength over time and should be tested at least once a year. There are two types of measurements that evaluate magnets:

- **Pull Test:** easy and repeatable test to evaluate the performance of a magnet. Test equipment can be purchased commercially to assess the efficiency of a separator by measuring the holding force of the magnet.
- **Gaussmeter:** provides standard measurement for evaluating a magnet design. It is not practical for assessing the relative effectiveness of a magnetic separator. The effectiveness (strength) depends on the magnet material but also the size and weight.

For more information on food safety please contact the Food Safety and Inspection Branch at foodsafety@gov.mb.ca.