

# GOUDSMIT

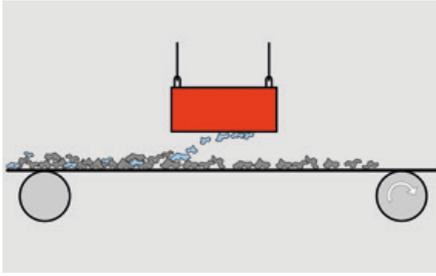
## MAGNETICS

# Recycling & Sorting

Recovery of metals with magnetic separators

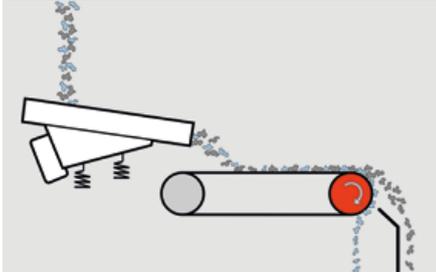


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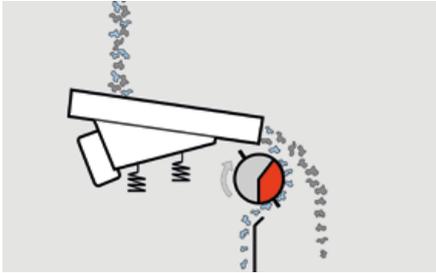
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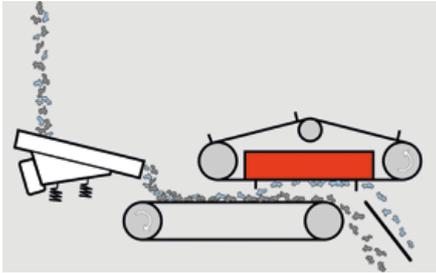
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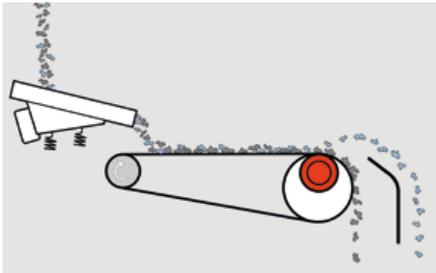
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Suspended block magnets remove undesirable ferromagnetic (Fe) particles – such as iron and steel – from material flows containing relatively little Fe contamination. The magnet pulls pieces of metal out of the raw material flow and holds them in place. This results in a pure iron fraction suitable for immediate reuse (recycling).

The block magnet is suitable for placement above flat or trough-shaped conveyor belts and serves to control incoming product flows or to protect machines such as shredders and sieves. When heavy metal contamination is present, it is better to use an overbelt magnet, which continuously carries away the ferrous metals.

## Permanent block magnets

### Advantages

- No energy or power consumption.
- Easy to integrate or install.

### Characteristics

- With lifting eyes or flange mounting.
- Always 'on'.



## Electromagnetic block magnets

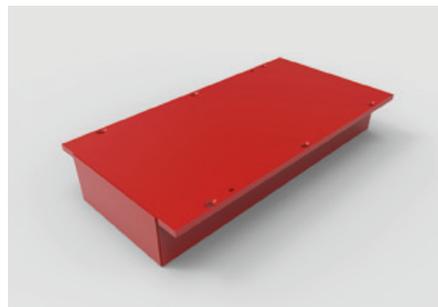
### Advantages

- Can be switched on/off for cleaning.
- Easy to integrate or install.

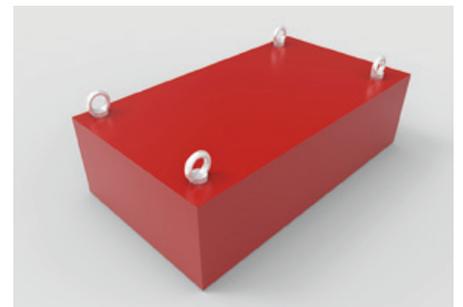
### Characteristics

- Need a control box as power supply.
- Get warmer as the operating time increases.

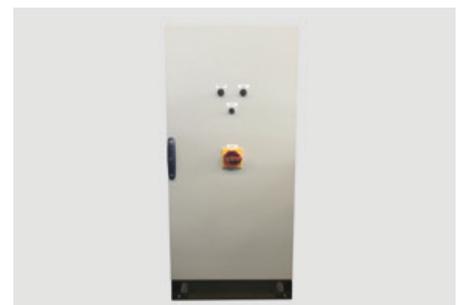
You can find more information about block magnets on our website.



Permanent block magnets



Electromagnetic block magnets



Control box

# Magnetic head pulleys

A magnetic head pulley separates ferromagnetic particles, such as iron or steel, and even weakly magnetic particles, such as particles from processed stainless steel, from coarse to very fine fractions and carries them away completely automatically and continuously. This magnetic pulley is built into an existing conveyor belt system as a head or tail pulley and is a cost-effective magnetic metal separator.

Magnetic head pulleys require almost no maintenance. By integrating these magnets into an existing installation, you have no additional operating and energy costs.

For larger layer thicknesses we recommend combining a magnetic head pulley with an overbelt magnet. In this configuration the suspended or overbelt magnet draws the pieces of steel out of the upper layer and the magnetic head pulley draws them out of the lower layers of the bulk flow. It is important to feed the material onto the conveyor belt with the magnetic pulley in a thin layer (ideally a mono-layer).



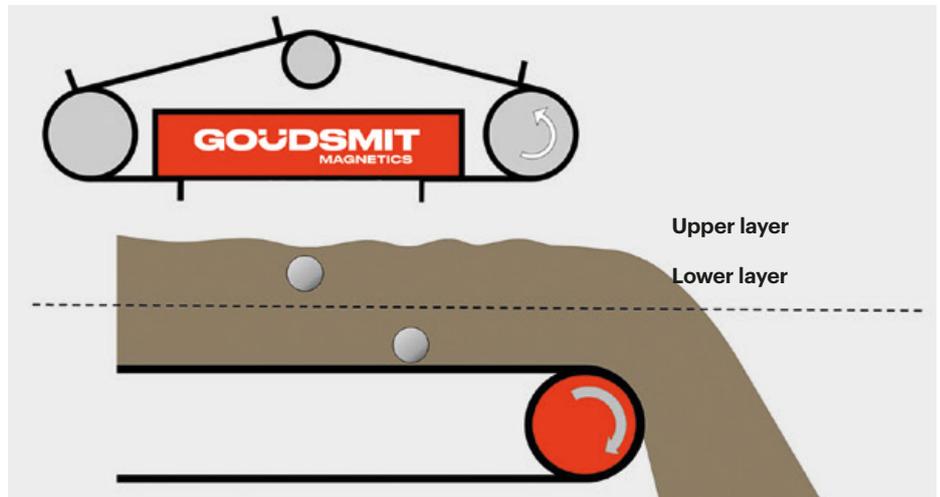
## Add-on magnetic head pulleys

### Advantages

- High degree of separation.
- Easy to integrate/install.
- Choice of four magnetic strengths.
- Many sizes (working widths, diameters and shaft types).
- No additional power consumption.
- Suitable for wet or damp product flows.
- Cost-efficient.

### Characteristics

- Magnetic head pulleys are often used as drive or reversing rollers in a conveyor belt system.
- In combination with an overbelt magnet, they ensure a highly efficient separation.
- Limited magnetic field depth, up to 150 mm.



Note: If possible, place the belt scraper after the separation point. You can find more information about magnetic head pulleys on our website.

## High-gradient magnetic head pulleys

This extra-powerful magnetic head pulley – the high-gradient version – has a radial magnet construction. It separates weakly magnetic and paramagnetic particles, such as stainless steel and steel alloys, up to approximately 40 mm.

The high-gradient magnet is used after the separation step for the strongly magnetic ferrous metals. The HG system is suitable for small, mono-layer fractions ranging in size from 0 to 40 mm, at low capacities.

The complete solution is a compact, maintenance-friendly conveyor belt system.



### Advantages

- Extremely high flux density (magnetic strength) of 9,000 to 10,000 Gauss on the belt.
- Separation of weakly magnetic and stainless steel particles.
- Separation of weakly magnetic particles >0.1 mm.
- Separation of ferrous particles > 30 µm (sporadically).

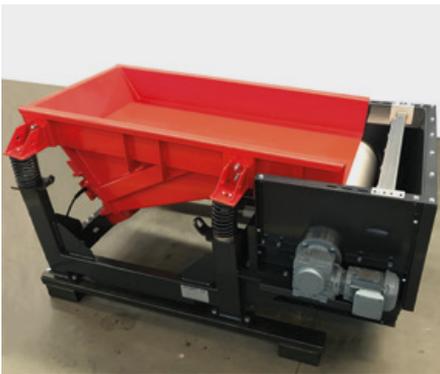
- Magnetic field depth 10 mm.
- Robust machine with reliable separation.
- Integrated belt change system.
- Height-adjustable frame.
- Modular design, with various options.

### Characteristics

- Radial magnet construction.
- No belt scraper possible, due to A-profile belt (cleat) on the conveyor belt.
- The magnet can be too powerful, separating valuable metals such as nickel or other alloys that will have to be recovered at a later stage.

# Magnetic drum separators

Magnetic drum separators for recycling are suitable for separation of ferromagnetic (Fe) or weakly magnetic particles from a bulk material flow. Magnetic drum separators have many uses and a low overall height. This makes them suitable for many applications, even where there is no room for overbelt magnets.



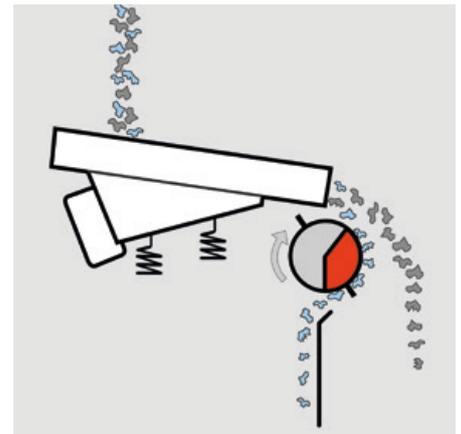
## Advantages

- High degree of separation.
- Choice of four magnetic strengths.
- Continuous separation.
- Relatively little installation space required.
- Complete system or add-on module.
- Various options available (wear shells, magnet segment rotation etc.)

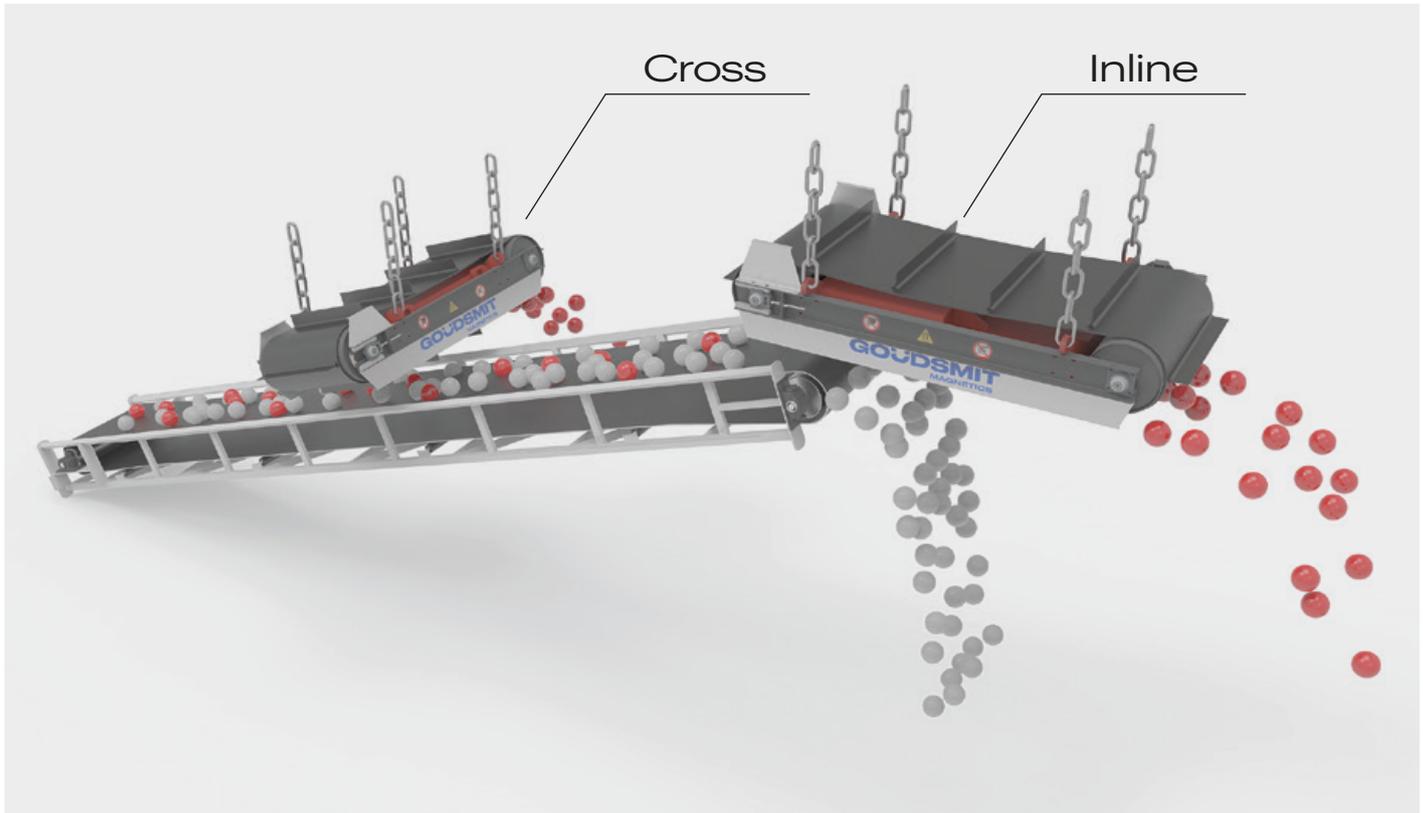
## Characteristics

- Incoming product flow must be spread evenly (by a vibratory feeder, for example).
- Not suitable for damp product flows.
- The cleats enable it to pull the material along.

They can handle high volumes, because the drum rotates continuously and therefore separates and carries away pieces of ferrous metal fully automatically. To achieve good separation it is important that the material is supplied evenly. This can be achieved with a vibratory feeder or conveyor belt.



An overbelt magnet is suitable for removing or separating high volumes of iron or steel and is suspended above a flat or trough-shaped conveyor belt. This type of magnet is self-cleaning and continuously separates ferromagnetic particles from material flows.



The deferrization efficiency of overbelt magnets ranges from 70 to 90%. This depends on the magnet design, product flow and placement.

Automatic self-cleaning magnetic separators can be used for the recovery or recycling of ferrous metals as well as for the removal/elimination of undesired pieces of iron or iron contamination.

These magnets are mainly used for coarser fractions containing pieces larger than 10 mm. Because this technology is robust and reliable, these magnets are used in many industries. All that is needed to install a permanent overbelt magnet are four suspension points, sufficient space and power for the conveyor belt drive.

## **Cross**

In practice, installation at right angles to the conveyor belt is most common, because this is the simplest solution in an existing line. An additional advantage is that the pieces of ferrous metal are discharged to the side. From the logistical standpoint, this makes processing simpler.

## **Inline**

If you have the option of placing the overbelt magnet in line with the conveyor belt, this is always preferable. The advantage of this is that the transported material 'flies apart' at the end of the belt, where the pulley is located, and is completely separated for several milliseconds. This allows the magnet to easily pull the ferrous metal out of the product flow.

## Ferrite overbelt magnets

### Advantages

- Low power consumption; just the conveyor belt motor.
- Continuously self-cleaning.
- Low maintenance; just belt and bearings.
- Pure iron fraction.
- Suitable for low and high temperatures.

### Characteristics

- Construction near the magnet must be made of stainless steel or non-magnetic material.
- Located above the conveyor belt or reversing pulley.
- Maximum installation height up to 450 mm.
- Relatively large and heavy.



## Neodymium overbelt magnets

The Neoflux® overbelt magnets are made of Nd-Fe-B or Neodymium magnetic material. They are extremely powerful and very compact.

An important advantage over the ferrite overbelt magnet is that the holding field of the neodymium version is approximately twice as strong in the first 10 cm. Neodymium overbelt magnets are therefore very suitable for use in fine-grained fractions. The magnetic field penetrates somewhat less deeply, making them suitable for maximum layer thicknesses of 250 mm.

The neodymium overbelt magnets are designed in such a way that they can be used for both cross/transverse and inline installation. They are lightweight and therefore particularly suitable for placement on a mobile crusher, shredder or sieve.

### Advantages

- Low power consumption; just conveyor belt motor.
- Continuously self-cleaning.
- Low maintenance; just belt and bearings.
- Pure iron or ferrous fraction.
- Hydraulic, slip-in or drum motor possible.

- Fully stainless steel enclosure.
- Lightweight.
- Compact design.

### Characteristics

- Construction around the magnet must be made of stainless steel or non-magnetic material.
- Maximum installation height up to 350 mm.



### Permanent installation

Suitable for use in confined spaces where there is a need to remove ferrous metals.



### Mobile installation

Often equipped with a hydraulic motor, thus eliminating the need for a separate power supply.



## Electro overbelt magnets

The electro overbelt magnet has the deepest holding field and is therefore the most suitable of all the overbelt magnets for the removal of ferrous materials from thick material flows. Disadvantages are the higher power consumption and higher weight compared to the permanent overbelt magnets.

What makes Goudsmit electro overbelt magnets exceptional is the construction of the magnet block. Rather than the cheaper square blocks, Goudsmit has chosen to use an extended central pole. This creates what is called an 'attenuator'. This prevents the ferrous object at the end of the magnet from continuing to rotate and being pulled back again. The extended central pole results in a gradual ejection trajectory, so there is no product spill, which results in pure separation.

### Advantages

- Deep magnetic field up to 800 mm.
- Continuously self-cleaning.
- Can be switched off for maintenance.
- Various options possible (mesh or closed housing, sensors etc.)

### Characteristics

- Construction around the magnet must be made of stainless steel or non-magnetic material.
- Requires power.
- Temperature; the magnet heats up as the operating time increases.
- Maximum installation height up to 800 mm.
- Relatively heavy machine.



# Non-ferrous separators (Eddy current)

Eddy current separators, or non-ferrous separators, separate non-magnetic metals. They eliminate impurities from large bulk flows and/or separate non-ferrous metals for reuse. These separators have many uses. They can handle high volumes, because the conveyor belt separates and carries away non-ferrous metals continuously and fully automatically.

All Goudsmit Eddy current separators are very robustly built. Just consider the following aspects:

1. All the separators are based on an **eccentric design**. This means that the magnet rotor rotates eccentrically in an outer tube. This offers several advantages over concentric systems:
  - A. Concentric systems suffer from 'burn in'. This occurs when the product flow still contains iron or ferrous particles and they end up under the conveyor belt. The Eddy currents heat these magnetic particles, just like an induction hob. The hot magnetic particles then burn through the protective jacket, causing permanent damage. Eccentric systems are not susceptible to this problem because they are not magnetic around the entire circumference of the tube. As a result, magnetic particles do not remain attached around the entire circumference.
  - B. Adjustability of the rotor's magnetic field. It can be adjusted from 0 to 37.5 degrees to attain optimum separation for your specific product flow.
2. **Goudsmit EC separators are made based on a modular design**, with many upgrade options available to accommodate your process needs.
3. The fact is, non-ferrous metals are better separated when they lie still at the separation point of the Eddy current rotor. This is why we support the conveyor belt with stainless steel slide plates, which ensure flat, stable transport of the material. Other suppliers use conveyor rollers that allow the material to 'bounce', which has a negative impact on the separation.



Another disadvantage of this is that such machines require extra maintenance, because the bearings of the support rollers wear.

4. The Goudsmit separator has a very sturdy **subframe** with removable lifting eyes.
5. The conveyor belt is driven by a Van der Graaf drum motor, with an IP65 protection rating.

These are very compact and do not allow any parts to protrude.

6. **The electrical cabinets** for the Eddy current separators have a digital touch screen that shows all the necessary information, such as lubrication messages, real-time machine performance, help menu, parameters etc.



## EddyXpert

The EddyXpert is the all-rounder of the Eddy current machine line. By choosing the right Eddy current magnet rotor, it can be used for many different product flows. The magnetic systems are fully interchangeable, due to the standardized outer dimensions. This makes it easy to upgrade your Eddy current separator.

### 12-pole Eddy current rotor (coarse fraction)

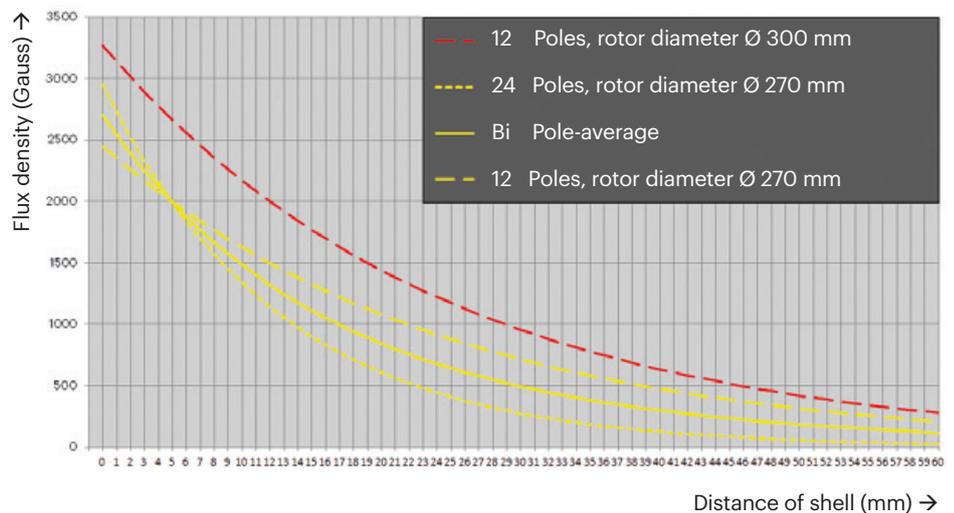
The advantage of the 12-pole magnet system is the deep magnetic field. This is specially designed for coarse fractions and larger pieces. A high magnetic field results in more force to 'push' non-ferrous pieces out of a thick layer or product flow. The 12-pole EC rotor has the same pole distribution around its entire circumference, while other machines on the market have a bi-pole system (50%/50% divided into 12 poles/24 poles). Bi-pole systems have just half the number of magnets to generate this power, as the other half is intended for the smaller pieces. (see graph below).

### 22HI-pole Eddy current rotor (medium/fine fractions)

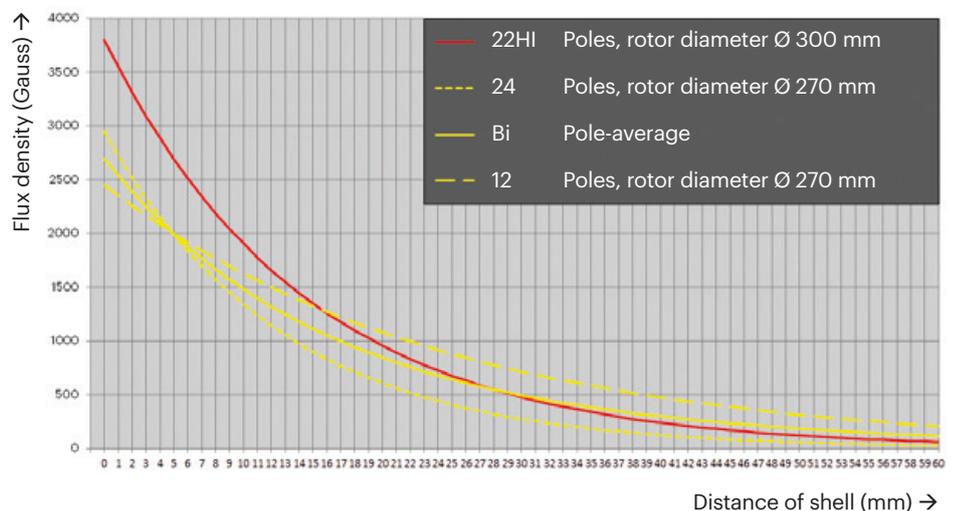
The outer dimensions of the 22HI rotor are identical to those of the 12-pole rotor, but the magnet configuration is radically different. It has nearly twice the number of poles, and the rotor can run at a higher speed – 4000 rpm – resulting in a frequency of 733 Hz. The HI (high intensity) construction produces a high magnetic force at the surface of the conveyor belt, on average 1000 gauss higher than that of other suppliers' systems. The high frequency in combination with the high magnetic force provides an ideal separation efficiency for the medium and fine fractions (5-100 mm; see graphic).



Flux density in relation to distance of shell



Flux density in relation to distance of shell



## EddyFines

The EddyFines is the top-of-the-line machine in the Eddy current line.

This non-ferrous separator is specifically designed to separate the very smallest pieces of non-ferrous metals, also referred to as 'fines' or the 'fine fraction'.

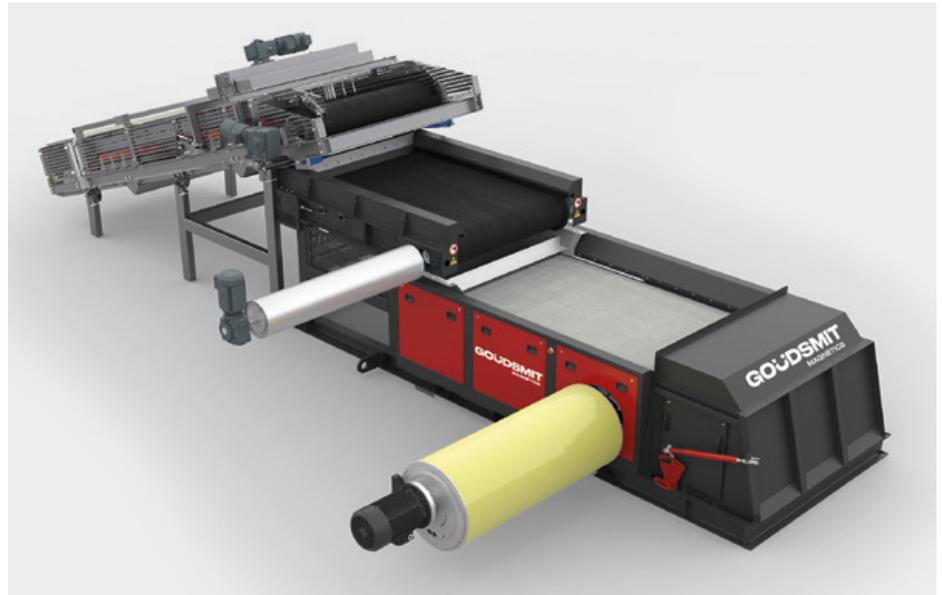
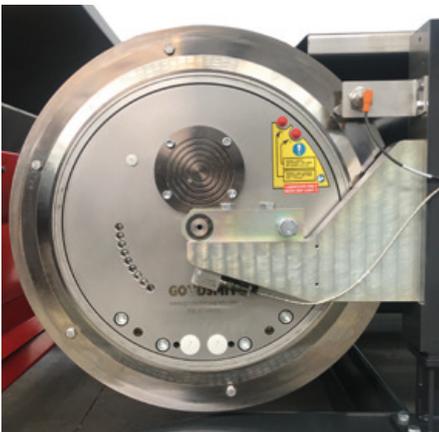
### 38HI-pole Eddy current rotor (fine fraction)

The 12 pole and 22HI are directly interchangeable; the 38HI is larger and therefore not interchangeable with the others. This EC rotor has the largest diameter currently available in the market. The large rotor allows us to fit more magnetic pole pairs and magnet volume. The 38-pole HI (high intensity) magnet configuration provides the perfect balance between magnetic force and frequency, especially for the fine fraction in the 0-10 mm range.

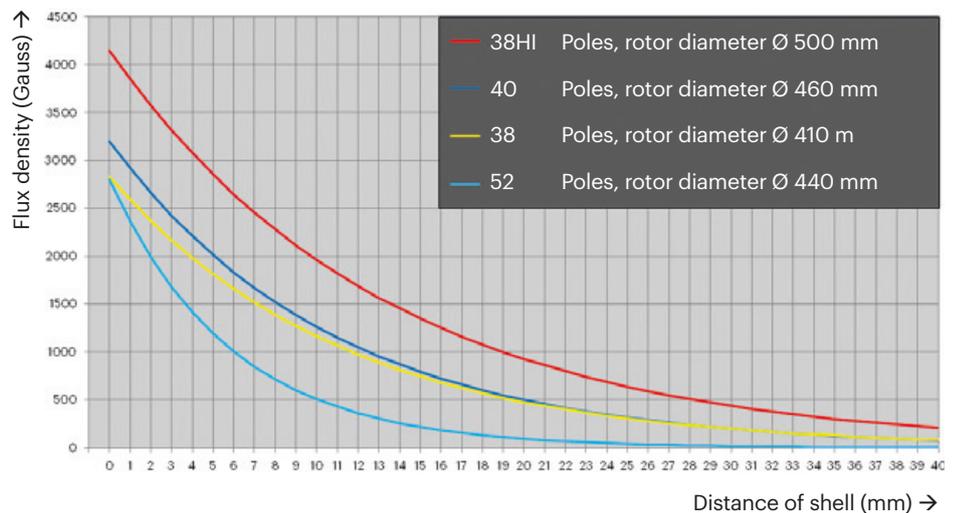
Because Goudsmit focuses more on magnetic power, our machines are a cut above the rest when it comes to separating HNF (heavy non-ferrous) metals. This is also confirmed in metal mix analyses, where the separation results for metals such as copper, brass, silver and gold in particular are significantly higher than for other magnet suppliers' products.

In addition, the 38HI rotor has smart sensors: a temperature sensor and a vibration sensor on both sides.

These monitor the performance of the machine and protect the magnet package from excessive temperatures. The machine actively signals when maintenance is needed or when, for example, too much vibration occurs.



### Flux density in relation to distance of shell



## Mobile MetalXpert

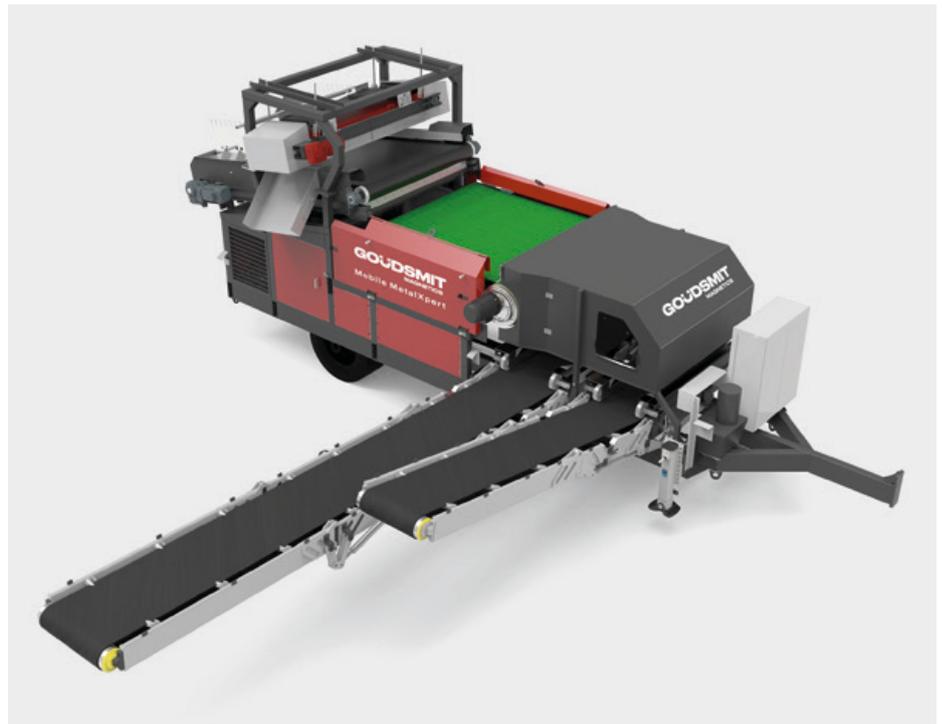
This mobile magnetic separator is able to separate both ferrous and non-ferrous metals in one run. The machine is easy to position in the right place and is designed for coarse bulk flows, such as shredded wood. Available options make it easy to upgrade, and the system is fully customizable for optimum separation of your product flow.

The Goudsmit MetalXpert has an overbelt magnet and a non-ferrous separator. The first magnet is intended for ferrous metals, such as nails, screws, staples and hinges. The second magnet – the eddy current separator – separates the non-ferrous metals, such as door handles and aluminium strips. The result is three separate material flows: ferrous, non-ferrous and clean (inert) bulk material that is suitable for reuse.

The mobile machine is suitable for construction and demolition waste, refuse-derived fuels and industrial waste, among other things.

### Mobile demo machines

We have mobile demo machines available so that, at your request, we can perform a test at your location to get an idea of the separation result. For more information: visit our website or contact one of our specialists.



# Test center

Various fully operational magnetic separators are available in our own demo and test area. Here our experts test various recycling and waste materials on a range of separators, including magnetic head pulley, overbelt magnet, high gradient and non-ferrous separators.

This gives you as our customer, a good indication of the separation efficiency of a magnetic separator when used with your own bulk material and gives you the opportunity to see how the machine performs and is operated. Our application engineer supervises these product tests and is happy to answer all your questions regarding capacity, maintenance, separation etc.

As this brochure shows, there are many different magnetic separators, each with its own application and characteristics. By helping you choose the right separator or combination of separators, we ensure that you achieve the highest possible yield.

Of course, we also examine the process upstream and downstream of the magnetic separators and advise you on aspects such as the use of a sieve or product distributor. In short, we are happy to share the experience and knowledge of material and metal processing we have gained over the past 60 years.



## Service

Our experts calculate the magnetic performance of a system before it is designed and manufactured. We have a special R&D department where we use the latest multiphysics simulation software that can perform these kinds of calculations.

Our service engineers carry out the installation and placement of new products, configuration of the controller, repairs and maintenance, and the replacement of parts. They do this worldwide, on location, to keep your downtime to an absolute minimum.



Goudsmit Magnetics is an international industrial company, founded in 1959, specialized in the design and manufacture of magnets and magnet systems for metal separation, recycling, transport, lifting, grabbing and demagnetization in various sectors of industry. Goudsmit also supplies magnets and components for the automotive, aerospace and medical industries in accordance with the NEN-ISO 9001, IATF16949 and AS9100c standards.



## Magnets for recycling & sorting

The recovery of metals from flows of waste or raw material (for reuse, among other purposes) is becoming increasingly important. Raw materials are becoming scarcer, and the costs of waste disposal continue to rise. Governments are seeking to reduce the environmental burden too, by promoting and subsidizing recycling

initiatives for example. This results in increased market demand for the recycling of metals from waste.

Goudsmit has developed many separators that are capable of separating/sorting **ferromagnetic metals** (iron, steel and weakly magnetic metals such as

processed stainless steel) as well as **non-ferromagnetic metals** such as aluminium, copper, zinc, gold, silver and magnesium. These are often valuable metals, which makes the payback period very short.

