Metso:Outotec

For dry and wet processing

Low Intensity Magnetic Separators (LIMS)







Low Intensity Magnetic Separators (LIMS) are designed to recover magnetic material from non-magnetic matter. The separators have modular design with several frames and process tank designs using a common magnetic drum for ease of selection of the best machine for each individual application.

Benefits

- High capacity
- Separation selectivity
- Ease of operation
- Low maintenance costs

LIMS process and application

History
Metso Outotec (former Metso, Sala int. Svedala, etc.) entered into magnetic separation shortly after the World War II. However, this field was not new to Sala as Sala Machine Works produced its first electromagnetic separators already in the 1890's.

The development of even more powerful magnet materials led to the implementation of permanent magnets to create the magnetic field. LIMS typically relies on strontium ferrite magnets while MIMS (Medium Intensity Magnetic Separators) commonly use an alloy of neodymium, iron, and boron (NdFeB).

Magnetic separation process
Magnetic separation technology can roughly be divided into three classes of magnetic intensity i.e., low, medium, and high, all depending on the characteristics of the minerals subjected to magnetic processing:

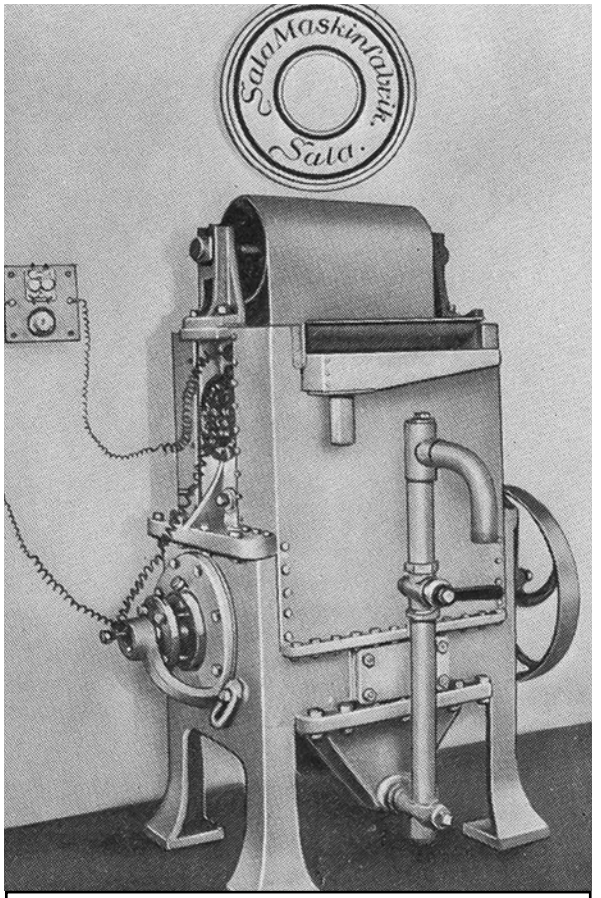
- Strong magnetic minerals (ferromagnetic) can be processed by Low Intensity Magnetic Separators (LIMS).
- Medium magnetic minerals (generally defined as high susceptibility, ferri- or paramagnetic minerals) can be processed by Medium Intensity Magnetic Separators (MIMS).
- Weak magnetic minerals (generally defined as low susceptibility, para- ferri- or anti-ferromagnetic minerals) are processed by HIMS (High Intensity Magnetic Separators). The Metso Outotec HIMS is referred to as HGMS (High Gradient Magnetic Separators).

Mineral particles in the proximity of a magnetic field will be subjected to a magnetic force that influences their behaviour to a degree that varies with their magnetic properties. The magnetic force is balanced by competing forces such as hydraulic drag, gravity, and centrifugal force. In wet magnetic separation, the hydraulic drag is the most important force, while centrifugal force is the main balancing force in dry separation.

As for all separators, the equipment splits an input feed stream into two output streams, based on the relative magnetic characteristics of the individual particles in the feed. Although particles in both output streams may be magnetic, with one stream being more magnetic than the other, it is convenient to refer to the two output products as magnetic and non-magnetic.

LIMS application
Only very few naturally occurring materials are sufficiently magnetic (i.e., high magnetic susceptibility) to be captured by the LIMS' relatively low magnetic field, e.g., maghemite, magnetite, pyrrhotite, etc. The only mineral with economic importance in the mining industry for LIMS separation, is magnetite.

Other LIMS applications are iron/steel recovery from slag, atomised iron, pyrrhotite removal from base metal sulphide concentrate, dense media (magnetite and ferrosilicon), recovery in coal wash plants, diamond processing, etc.



Metso Outotec (former Metso, Sala int. Svedala, etc.) produced its first electromagnetic separators already in the 1890's.

Magnetite beneficiation and dry/wet processing





The magnetite beneficiation process
The degree to which an iron ore is processed depends mainly on the iron ore products being made. The most common iron ores on the market are lump ore, sinter fines and iron ore pellets/pellet feed. Which products are suitable for a mine is dictated by the ore's liberation characteristics and market demands.

Lump ore is generally between 7 and 25 mm in size and usually requires as little processing as crushing and screening. Lump ore is manly hematite. Sinter fines, usually below ca 10 mm in size, may or may not require processing beyond comminution. Gravity separation (jigging) is common for hematite, while dry magnetic (dry LIMS) separation is the preferred method for magnetite.

If the ore's liberation characteristics require further processing to remove unwanted elements, pellet feed can be produced. The pellet feed is converted to ore particle agglomerates, pellets. Agglomeration requires a certain particle size distribution, so the ore needs to be ground, usually in several stages, with a number of wet LIMS beneficiation stages in-between.

Due to the energy and grinding media consumption and the need for significant amounts of process water, wet processing is considerably more costly and leaves a much larger environmental footprint compared to dry processes. Dry, coarse tailings do not require tailings ponds but can be dry stacked.

It makes a lot of sense from an economical and environmental point of view to pre-process magnetite in a dry state whenever possible. Pre-concentration is often referred to as cobbing or sorting.

Cobbing/Sorting dry processing
The main purpose of sorting is to reject low value rocks in a dry, coarse, and early stage. This reduces the tonnage to the downstream process, increasing capacity and reducing the cost per ton of product. For this to be efficient, the ore needs to meet some certain criteria, i.e., it needs to display a range of value mineral content in the particle size range addressed. Ideally, sorting is used to discard no-value side rock unintentionally reporting to the magnetite run of mine due to the mining method used. By increasing the wet process iron feed grade by only a few percent by pre-concentration, significant gain can be achieved.

Metso Outotec dry LIMS range covers the entire process from post primary crusher to post secondary crusher. The belt separators are specifically designed to handle coarse feed (feed top size ca 200 mm), while the dry drum LIMS is optimised for medium sized material (feed top size ca 20 mm).

Wet processing
It is beneficial also in the wet process to discard liberated nonvalues as soon as possible. By applying separators between each consecutive mill stage, grinding energy and media consumption can be reduced

Metso Outotec offers a full range of wet LIMS, from wet cobbers (feed top size ca 8 mm), via wet roughers (feed top size ca 3 mm) to wet finisher cleaners (feed top size ca 0.8 mm). By employing the correct LIMS type at each stage, capacity and cost can be optimised and the environmental footprint can be reduced

Metso Outotec also offers wet LIMS designs optimised for flotation froth scavenging, recovering magnetite lost to the floats and dense media recovery.

Metso Outotec LIMS features

Models for dry processing

All low intensity separators are designed around the revolving magnet drum with an internal stationary magnet array. The Low intensity magnetic separators are available in several types for vast number of duties and could be seen as split into two categories, i.e. dry separation and wet separation.

The dry models are intended predominantly for material 2 to 200 mm in dry or nearly dry state like crushed iron ore. The wet models are designed for material of a few micrometres size to less than around 6 - 8 mm suspended in water. For both separator types a number of magnetic systems are available for highest possible efficiency in each application.

For dry material, 20 mm and coarser the belt drum type of separator, BSS or BSA, is preferred. For dry material finer than 20 mm the dust house enclosed drum separator, model DS, is recommended.

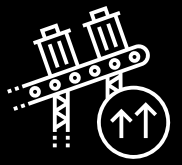
Models for wet processing

Finer material is in almost all applications preferably processed in water. Also, for the wet processing there are a number of models to choose from to suit the various requirements.

The concurrent, CC, and counter-rotation, CR, models are mostly selected for processing of ore at the feed end of the concentration circuit. For final concentrate separation, the counter-current, CTC, model is the most efficient and most widely used model to produce high grade products.

To recover of e.g., magnetite and ferro-silicon in dense media separation processes a special model, DM and CR, are designed to provide highest possible media recovery. For all wet processing separators, the magnet system is selected to achieve best performance in each individual case.

Read more:
mogroup.com/portfolio/lims-magnetic-separators/



High capacity

While the capacity of LIMS is very much dependant on the material to be processed, the LIMS have proven to have outstandingly high capacity thus fewer machines are required. The separators are available in several sizes and designs to suit each individual application.



Low maintenance costs

The LIMS are protected against wear by tank rubber lining and rubber or steel drum cover. Bearings are designed for extremely long duty and the lubrication can easily be automated. The Metso Outotec LIMS availability has proven to be excellent from many years in service.



Outstanding separation selectivity

The unique magnet system design promotes excellent selectivity between magnetic and non-magnetic material and the need for fewer machines. Since fewer machines are in service, less maintenance is required, and lower capital and operating costs are achieved.



Ease of operation

The Metso Outotec LIMS are designed to allow normal variations in feed conditions without the need of any adjustment. Parameter adjustments, sometimes required at time of commissioning, are made easy by the machines design.

Metso Outotec is a frontrunner in sustainable technologies, end-to-end solutions and services for the aggregates, minerals processing and metals refining industries globally. By improving our customers' energy and water efficiency, increasing their productivity, and reducing environmental risks with our product and process expertise, we are the **partner for positive change.**

Metso:Outotec

Metso Outotec, Töölönlahdenkatu 2, FI-00100, Helsinki, Finland
tel. +358 20 484 100
mogroup.com

© 2022 Metso Outotec. All trademarks and registered trademarks are the property of their respective owners. 4777-08-22-EN-MNG