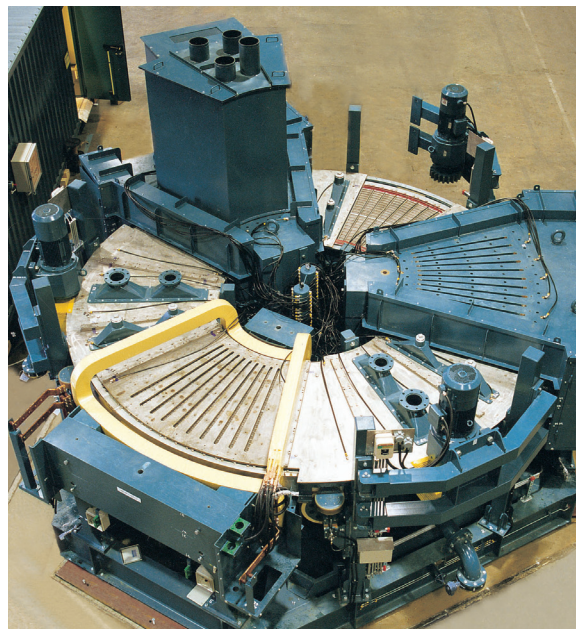


High gradient magnetic separators

HGMS continuous

Metso's HGMS, high gradient magnetic separators, recover ferro-magnetic and para-magnetic materials from ore slurries. The separators are designed around the unique magnetic system providing magnetic fields up to 1,5 T (15 000 Gauss).

The separator handles particle sizes from 0,1 µm up to 1 mm and due to the excellent control parameters the metallurgical performance is superior. The cyclic HGMS is best suited for material with more than about 5 % magnetically produced fractions.



Applications

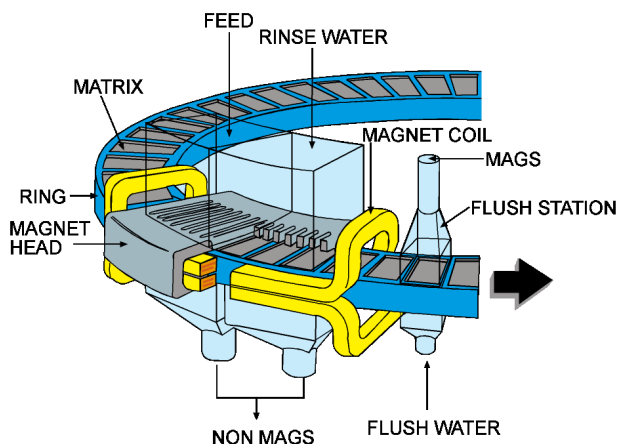
Metso HGMS carousel magnetic separators can be used for many applications including the processing of iron ores, rare earths and industrial minerals. In addition to the strongly magnetic compounds of Fe, Co, and Ni, a vast number of weakly magnetic compounds, which are not normally treatable by ordinary magnetic separation, may be processed by high gradient magnetic separation.

A number of extremely effective applications include the following: increasing the brightness of kaolin clay, reduction of copper in molybdenum concentrates, separation of galena from chalcopyrite and sphalerite, reduction of iron from glass sand, barytes and ceramic clays and in the purification of coal, refractory materials and phosphates.

Advantages:

- Broad range of applications
- Processing of fine particles
- High separation efficiency
- Simple, reliable design

- Non-clogging operations
- Easy flushing of magnetics
- Patented backward flush)
- Low specific power consumption
- Low maintenance
- Long component life
- Minimal monitoring
- Large process capacity



For more information, contact your local Metso representative. www.metso.com
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Operating principle

The simplified equation for the magnetic attraction force on particles is

$$F_m \propto d^3 \cdot \chi \cdot B \cdot \frac{dB}{dx}$$

S = particle volum

χ = particle magnetic susceptibility

B = magnetizing field

$\frac{dB}{dx}$ = magnetizing field gradient

From the above equation it is evident that in a homogenous magnetic field there is no resultant attraction force on the particles. This is illustrated in Fig.1 where the left part shows the undisturbed field and the right part shows a disturbed field. Field gradient is shown here by the varying distance between the field lines.

Any sharp edges of small dimensions will cause such a field distortion, and, hence, an increased gradient.

The Metso HGMS magnet design is comprised of a solenoid surrounding a non-magnetic canister that is enclosed by an iron return frame. This solenoid design overcomes many of the limitations of working within the air gap of a conventional horseshoe shaped magnet. The most important advantage of the solenoid design is that the return frame cross-section can

be increased to cope with higher field strengths without saturation.

The resulting homogenous magnetic field within the solenoid volume is then manipulated by inserting varying types of matrices into the canister.

The selected type of matrix is a function of feed particle size and usually several layers of expanded metal are used. Matrix material is manufactured from a ferromagnetic grade of stainless steel. In addition to the magnetic separator the application of the continuous HGMS involves auxiliary equipment like

- Power supply system control unit, including a PLC
- Passive matrix for oversize removal
- Cooling system for the electrical supply and magnet coils
- Vacuum system for magnetic product removal
- Automatic lubrication system

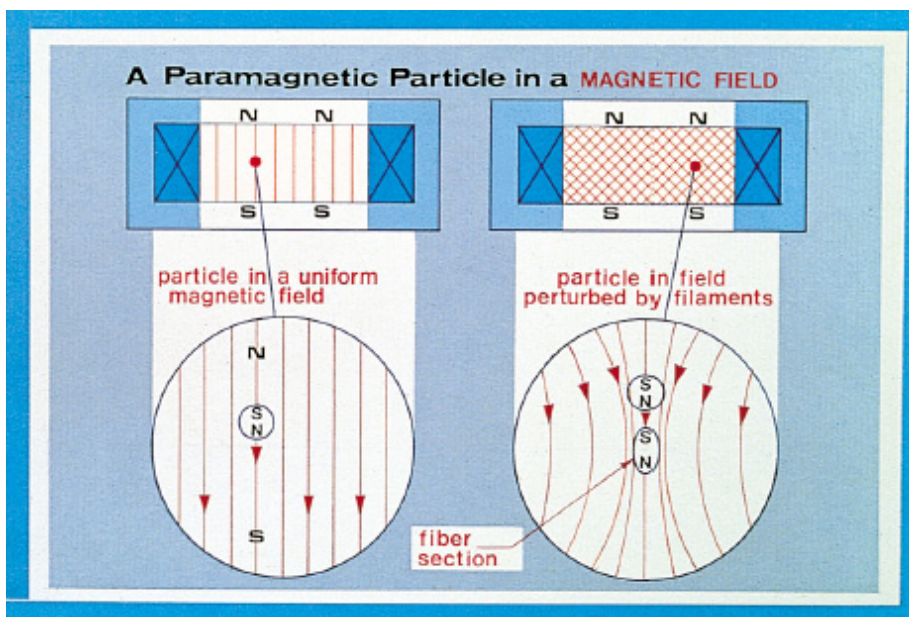


Fig.1

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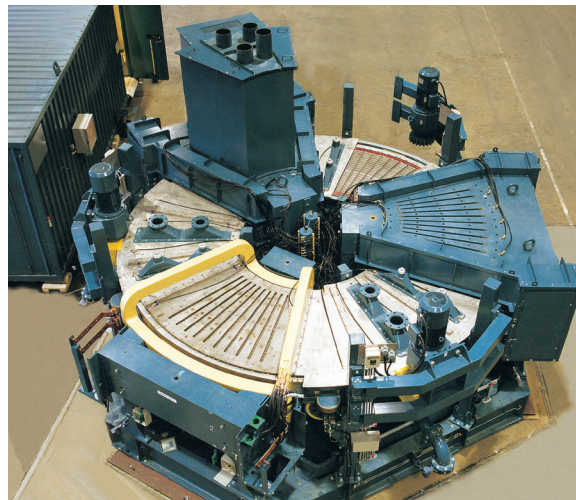
Establishing process parameters

The feasibility of using the HGMS for a particular application must be tested in a laboratory HGMS. When testing is performed, not only the separation efficiency is obtained but also the equipment sizing parameters like matrix loading, magnetic rating, pulp flow velocity and matrix grade are also obtained.

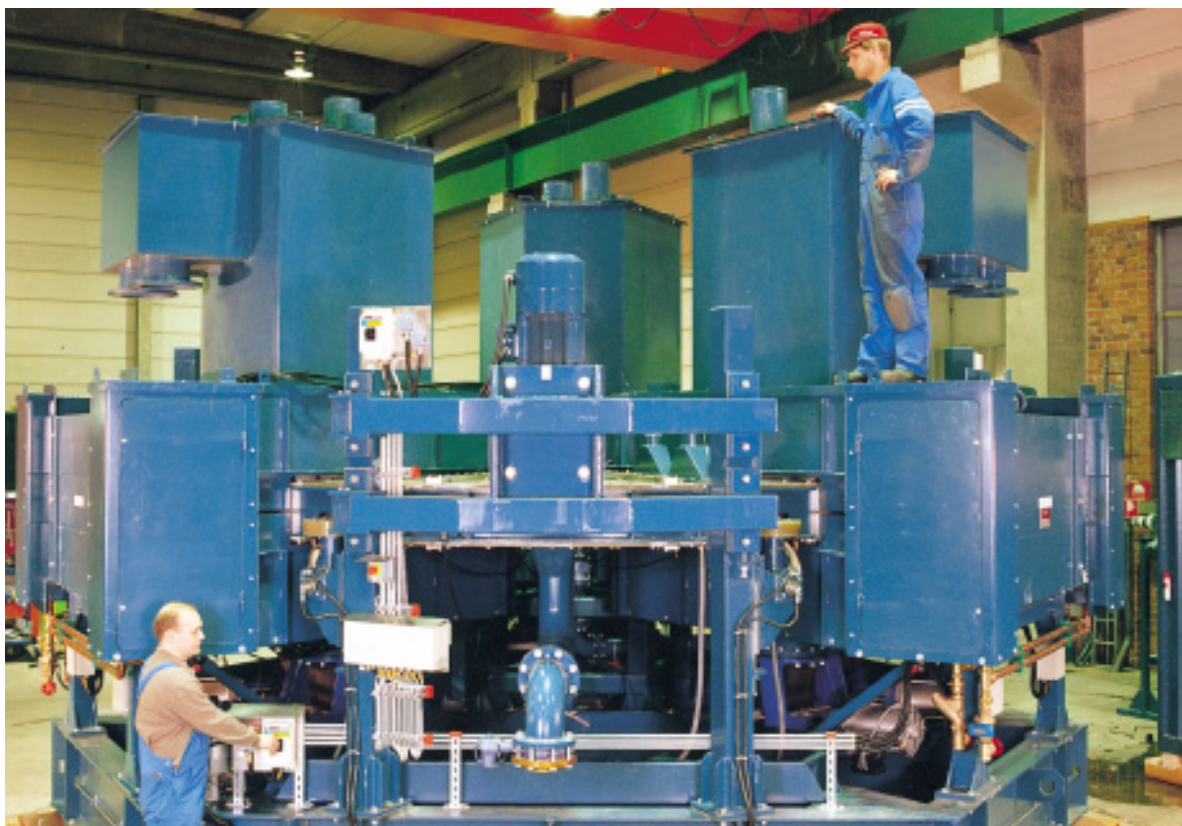
Many applications can be scaled-up from laboratory results; however, it is often advisable to perform pilot plant testing.

Continuous high gradient magnetic separator pilot plant unit

The Metso HGMS carousel pilot unit can process from 1 to 12 tons per hour of ore at a maximum magnetic field strength of 15 kGauss. As part of Metso's mineral processing service, the carousel may be incorporated in a flowsheet that includes crushing, grinding and classifying equipment. A pilot model carousel may be leased separately for on-site pilot testing.



Metso HGMS carousel during shop assembly

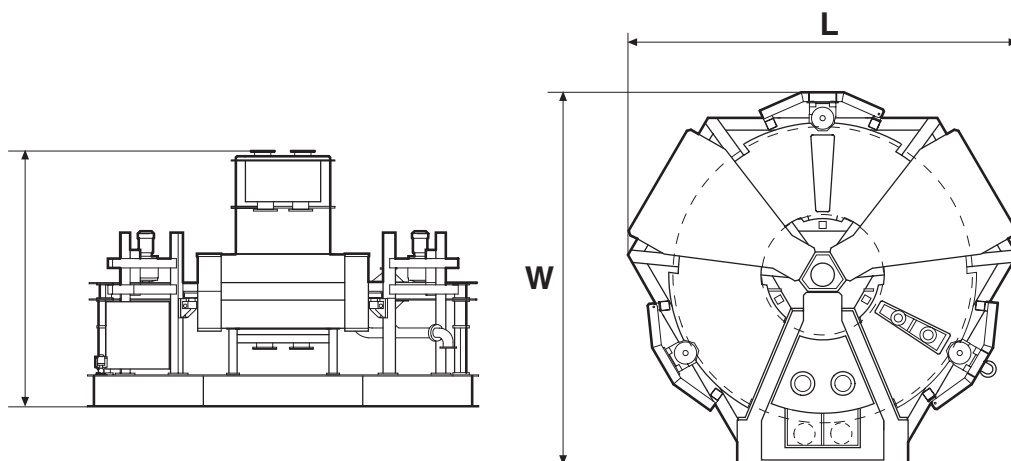


Above pictures show an HGMS 350-5-5 during assembly in our factory intended for iron ore processing.

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Dimensions



Model	L (mm)	W (mm)	H (mm)	Max. no. magnetic Heads	Field rating (kGauss)	Power/head (kW)	Basic weight (ton)	Add. weight per head (ton)	Nom. cap./head* (ton/h)
120	2600	2200	2800	2	10	75	4	4	6
120	2600	2200	2800	2	15	175	4	6	6
185	4100	3700	4100	2	7	65	9	13	36
185	4100	3700	4100	2	10	85	9	19	36
185	4100	3700	4100	2	15	200	9	33	36
250	6300	5100	4600	2	5	40	20	22	107
250	6300	5100	4600	2	7	75	20	32	107
250	6300	5100	4600	2	10	120	20	54	107
250	6300	5100	5600	2	15	260	20	95	107
350	7000	7200	4600	3	5	78	40	26	150
350	7000	7200	4600	3	7	136	40	37	150
350	7000	7500	4600	3	10	165	40	66	150

Notes

- Model 120, 185 and 250 are available with one or two heads; model 350 is available with one to three heads.
Heads in the same unit can work in parallel or in series and can be built for the same or different magnetic field intensities.
- Metso reserves the right to change these specifications.
- Machine weight is basic weight + additional weight of magnetic heads.
- For lower field ratings or between-sizes, field ratings nearest larger size is used.