Iron ore processing

Wet low intensity magnetic separators

metso
Expect results

Series WS1200 CR, CC, DW and CTC

Wet low intensity magnetic separators, LIMS

Metso has been involved in magnetic separation for more than one hundred years. Metso has produced more than five thousand magnetic drums used in both dry and wet processing.

Metso wet magnetic separators are continuously undergoing improvements to meet the ever-increasing demands of our customers. Metso has been and is still the leader in the development of high capacity, high performance wet low intensity magnetic separators (LIMS) for several decades.

Designs and sizes

Metso's wet magnetic separators are available in several sizes and tank designs in order to meet the varying requirements of the iron ore processing industry. Metso has always worked closely with the iron ore industries, which has led to some unique features in the magnetic separators that have resulted in outstanding operating performance.

Metso wet magnetic separators are available in the WS1200 series - 1200 mm (4 ft) drum diameter with drum lengths up to 3,6 m (12 ft). Two different designs of magnetic systems are available as well as four different tank styles to enable processing of the full range of magnetic ores and particle sizes.

Customers and applications

Customers for the equipment in this brochure are to be found mainly in the iron ore industries located on all continents. Large concentrator operations in the USA, Canada, Ukraine, Russia, South Africa, Sweden, Norway, Spain, Iran, and India are among Metso's customers.

Metso's customers have reported exceptionally high recoveries for specific feed tonnages. During a recent refurbishment of a USA plant, new Metso magnetic separators were installed as a replacement for old units from a competitor. The number of new machines installed was reduced by about 80 percent while improving both recovery and grade and adding flexibility to the plant for processing different ores.

The LIMS is also operating in many other applications such as titanomagnetite production, removal of grinding media in e.g. ball mill discharge products, pyrrhotite reduction in sulphide ores, iron reduction in

e.g. glass sand and feldspar production. It is also commonly installed for removal of ferromagnetic matter ahead of WHIMS (Wet high intensity magnetic separators) or HGMS (High gradient magnetic separators) units. In dense media circuits LIMS is standard equipment; ask for our special brochure for dense media recovery.

After market services

Our greatest asset is the experience of our people which assures competent technical field services and parts supply for systems and equipment designed, manufactured and supplied by Metso.

Our safety certified field service engineers have specialized experience working on both existing and new processing equipment and systems. They are trained to search for the cause of problems and to use our knowledge of similar machines and the latest available technology to help you maintain and improve your operation.

Our parts technicians provide a highly specialized service to customers through our parts supply programs. Genuine replacement parts are supplied to keep equipment in productive operation with the right part at the right time.

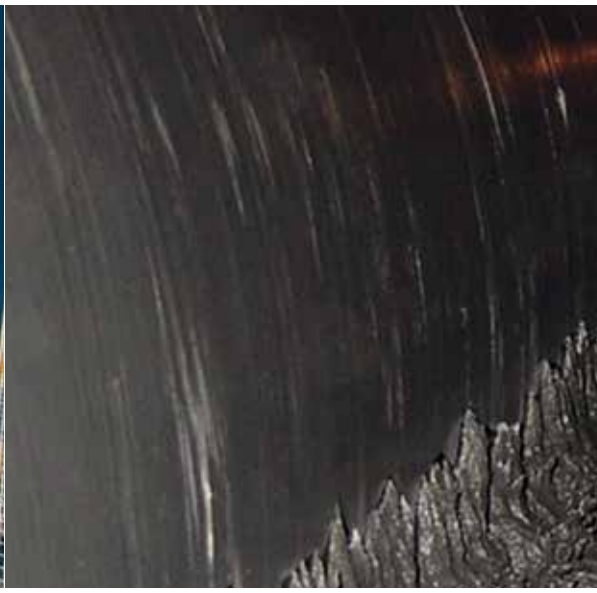
Magnetic separation theory

The magnetic separation process is complex in many respects due to the varying magnetic susceptibility of the different ores, the amount of middlings, and the particle size distribution of the processed ore.

The magnetic force acting on a specific particle is dependent upon these factors as well as other properties such as magnetic flux and magnetic field gradient, which are created by the magnetic system in the separator. The product of field times gradient, also called the magnetic force index, varies between different magnetic system designs and is a factor when selecting the most suitable magnetic system for a particular process.

As in all applications, the magnetic force is competing with other forces such as gravity and hydraulic drag; therefore, the feed volume and tonnage must be balanced to obtain a suitable level of performance.

Generally speaking, the smaller the particle size that is being processed results in a lower feed capacity of the equipment. By selecting a higher magnetic field strength (magnetic flux) the feed capacity can be increased considerably, in many cases the recovery of the fines increases significantly with the field strength.



Tank design CC and CR

CC – Concurrent

The concurrent style of magnetic separator features:

- Feed box with serrated weir overflow for even distribution of the feed slurry
- Feed entry section to improve on feed pulp distribution thus ensuring full width feed to drum;
- Short pick-up zone, which reduces the risk of coarse material settling on tank bottom.
- Exchangeable outlet spigots in tank bottom to allow coarse material to discharge trouble free;

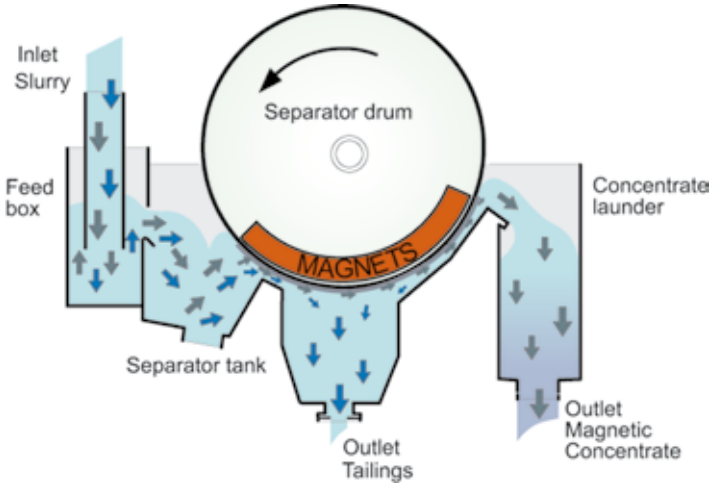
Suited for processing of coarse ore up to 6 - 8 mm (3 mesh) and, with special arrangement, up to 15 mm (5/8 inch).
The pulp density recommended for this type of tank is 30 to 50 percent solids by weight.

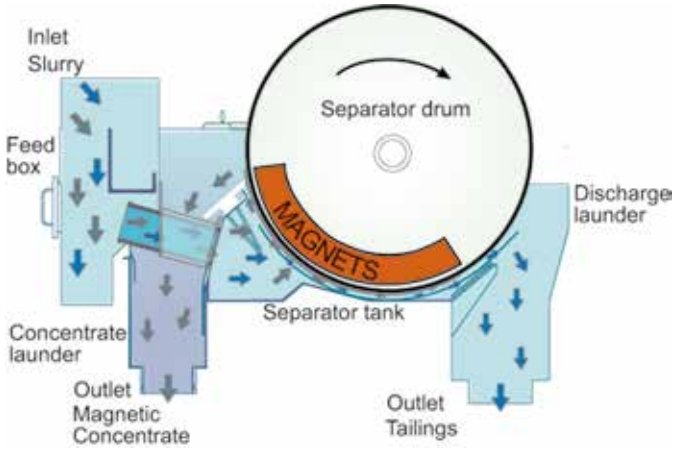
CR – Counter-rotation

The counter-rotation style of magnetic separator features:

- Feed box with feed tubes;
- Feed entry section to improve on feed pulp distribution thus ensuring full width feed to drum;
- Long pick up zone;
- Spigot-less, full width weir with adjustable (manual) overflow discharge of the effluent for pulp level control allowing surges in feed flow;
- Feed tubes are wear protected on the outside by molded polyurethane saddles and on the inside by polyurethane inserts;

The CR tank is suited for processing medium coarse ore up to 3-8 mm (4 mesh) at medium to high densities (30 to 50% solids). The CR tank is also available in an economy version with rubber-lined feed tubes and a fixed concentrate overflow weir.





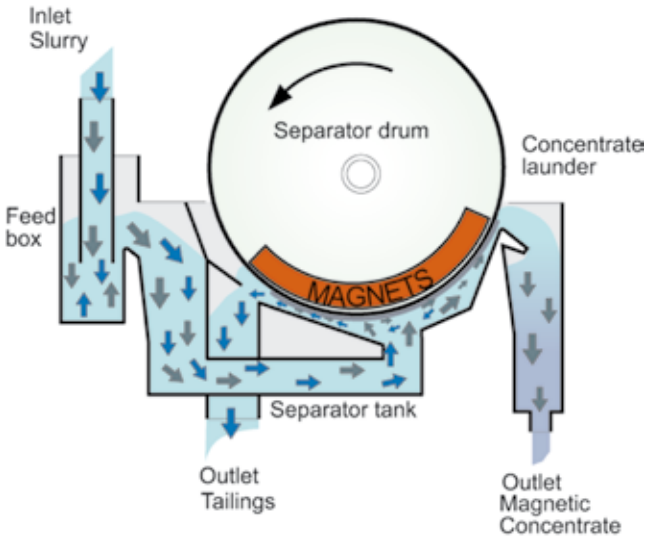
Tank design CTC and DWHG

CTC – Countercurrent

The countercurrent style of magnetic separator features:

- Feed box with serrated weir overflow for even distribution of the feed;
- Feed entry section to improve on feed pulp distribution with full width feed to drum;
- Medium long pick-up zone;
- Full-width effluent overflow weir for pulp level control;

The CTC tank design is suited for processing fine to medium sized ore up to 0,8 mm (20 mesh). The pulp density range recommended for this type of tank is 25 to 45 percent solids by weight.

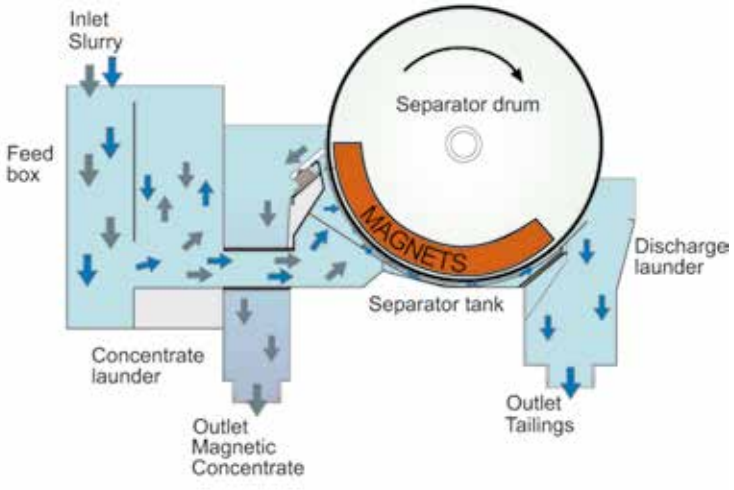


DWHG – Counter-rotation

The DWHG style of magnetic separator features:

- Basically counter-rotation tank design
- Extremely long pick-up zone;
- Entry chamber designed to allow for entrapped air to escape and to improve concentrate drainage;
- Longer magnet assembly arc to compensate for disturbances due to entrapped air in the pulp;
- High gradient style magnetic assembly for recovery of fine to extremely fine magnetic material;
- Full-width weir with adjustable (manual) overflow discharge of the effluent for pulp level control allowing surges in feed flow.

This tank design is especially intended for recovery of magnetic matter from dilute flotation tailings with entrapped air. Particle size limits are dependent on flow rate but up to 1 mm material will normally not cause any concern.



CR feed tubes are protected by polyurethane saddles against abrasion.

Features and benefits

Magnetic system

The heart of the magnetic separator is the magnet assembly. Metso provides basically two different assemblies: high capacity and high gradient, (HG).

The high capacity assembly is the standard magnetic system. The main differences between the two magnet assemblies are pole pitch, pole sizes, and number of poles. The magnet assemblies are similar in design with both having a number of main poles and a number of intermediate cross poles for flux control and enhancement of the magnetic performance. The magnet poles are attached to a rigid steel yoke, which, in turn, is attached to the drum shaft.

The high capacity assembly is comprised of six main poles and four intermediate poles, while the high gradient assembly has twelve main poles and eleven cross poles. A special magnet assembly is the DWHG, which consists of fourteen main poles and thirteen cross poles.

The high capacity assembly has a higher magnetic flux rating but due to its inherently lower field gradient the magnetic attraction force is actually lower when compared with the high gradient type.

The High gradient version is hence more capable of recovering material, which is finer or less magnetic; however, its capacity is reduced as its magnetic force drops off faster as the distance increases from the magnets. The arc of the high capacity magnetic system is 124° and has a rating of 120 mT at 50 mm from the magnet surface while the high gradient magnetic system has an arc of 113° and a rating of 60 mT. The magnetic system of the DWHG has an arc of 133° and a rating of 60 mT at 50 mm.

Magnetic drum

The magnetic assembly is mounted inside of a revolving drum consisting of a stainless steel shell with aluminum heads. The magnetic assembly is stationary but is adjustable peripherally.

The drum shaft is supported by spherical roller bearings. All drum bearings are lubricated from the non-rotating shaft end.

Wear protection

The feed slurry to the separators is at times very abrasive and hence all tanks, boxes and launders are lined inside with rubber. The revolving drum is lined with either rubber or stainless steel and its ends are fitted with specially designed end collars.

At some applications these wear protection measures need to be reinforced by increase of liner thickness or replacement by even tougher material such as ceramics or polyurethane.

Magnet positioning

Inside of CR feedbox

Direct gear motor drive

Features and benefits

Adjustment of magnet and drum position

The magnetic drum and magnetic assembly can easily be adjusted to obtain the best process performance. The adjustment possibilities include

- Magnet assembly positioning in relation to concentrate discharge weir.
- Horizontal positioning of drum
- Vertical positioning of drum

Feed boxes

The feed system for primary distribution of the pulp to the feed boxes that are supplied with the separators is normally not part of the equipment supply; however, Metso can optionally supply or advise on solutions for these systems.

All feed boxes are normally made from mild steel and rubber lined. Other features of the feed boxes are:

- For models CC and CTC the overflow weir is serrated for more even distribution
- The feed box for the CR model discharges through a number of steel tubes into the separator tank

Drum drive system

The drum on any Metso magnetic separator has a drive shaft, which can be adapted to any type of drive. The position of the drive components is very favourable, since they are located outside of the tank away from pulp splashes and water. Our experience shows that the drum speed is very seldom altered and hence most of our separators have been delivered with direct-drive gearboxes. This system has proven to be safe, efficient, clean, and quiet and requires very little maintenance.

The older drive system with an integrated V-belt drive is also available and is recommended for users who want to maintain the possibility of modifying the drum speed (by shifting drive sheaves).
The normal peripheral speed of the drum is 1,2 m/s unless another drum speed has been agreed upon.

Adjustable concentrate overflow weir

CR tank with pulp level bars

Concentrate discharge and collection

An overflow weir is provided for the magnetic concentrate discharge. This weir, manufactured of HDPE or, optionally, in polyurethane, is adjustable to obtain optimum discharge conditions.
The launders for collection of the concentrate that is discharged over the weir are made of a rubber-lined combination of mild and stainless steel and are bolted to the separator tank frame. Depending on the installation situation, standard launders or, optionally, custom tailored launders are provided.

Effluent (tailings) discharge and collection

The tailings effluent stream is normally discharged into a trough beneath the magnetic separators. This trough is not part of the standard equipment and is designed and provided for by the customer. Metso will assist with engineering of this through if required.

The separators may, if so ordered, be directly connected by steel pipes or rubber slurry hoses to the customer's effluent system thus eliminating the need of troughs under the tanks. This is possible with the CR and CTC models and with special arrangements, also for the CC.

Application guide lines

Absolute guidelines for model selection and dimensions are not available due to the widely varying nature of iron ores; hence, the data shown in the table below are only indicative and, when in doubt of the properties of a specific ore, the lower feed rate should be used. Testing in a laboratory, followed by on site testing is always advisable especially when planning for larger installations. Sizing of full-size machines using only laboratory data is normally not sufficient to determine the number of magnetic separators that are required.

The capacities in the table beside are indicative only and can vary widely from one application to another, even when processing ore within the same ore body.

Application and particle size classification	Typical particle size, top size, µm Amount finer than 74 µm	Typical feed rate, dry basis, tph per meter of drum width	Typical slurry feed rate , m^3 per hour per meter of drum width	Recommended tank design
Iron ore separation Coarse (Cobbing)	8 000 – (15 000) 0 – 10%	100 – 160	200 – 350	Concurrent Counter-rotation
Iron ore separation Medium to coarse (Rougher)	2 000 – 5 000 20 – 25%	80 – 120	200 – 350	Counter-rotation Counter-current
Iron ore separation Fine to medium	1 000 40 – 50%	40 – 80	150 – 250	Counter-rotation Counter-current
Iron ore separation Fine (Finishing)	100 60 – 100	10 – 60	100 – 200	Counter-current

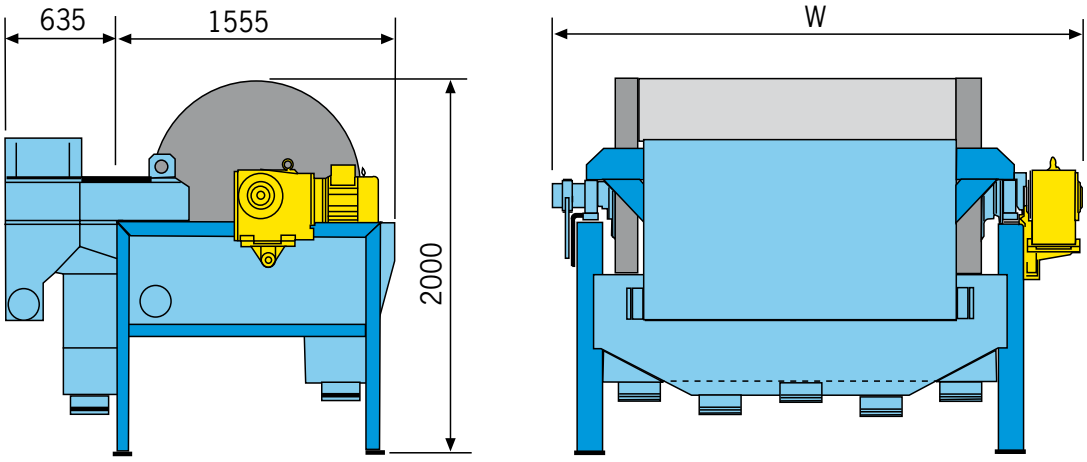
Dimensions and weights

Dimensions and weights of the equipment, shown in the table below, are approximate only and will be confirmed at time of order.

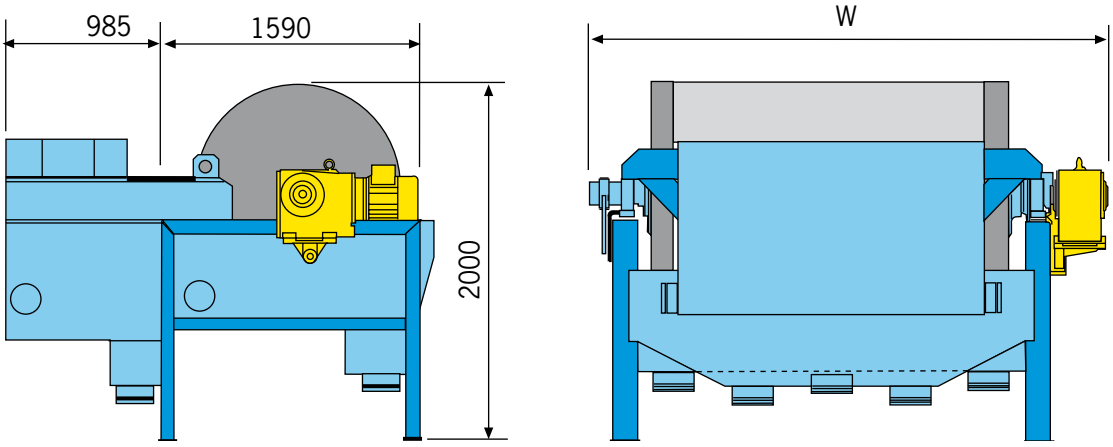
Types WS1200CC, WS1200CTC, WS1200CR, WS1200DWHG

Model and size	Drum effective magnet length, mm	Motor size, kW	Dimensions W, mm	Machine unit weight, kg
WS 1206	600	3,0	1 771	2 400
WS 1212	1 200	4,0	2 371	3 300
WS 1218	1 800	5,5	2 971	4 000
WS 1224	2 400	5,5	3 571	4 800
WS 1230	3 000	7,5	4 218	5 700
WS 1236	3 600	11	4 818	6 600

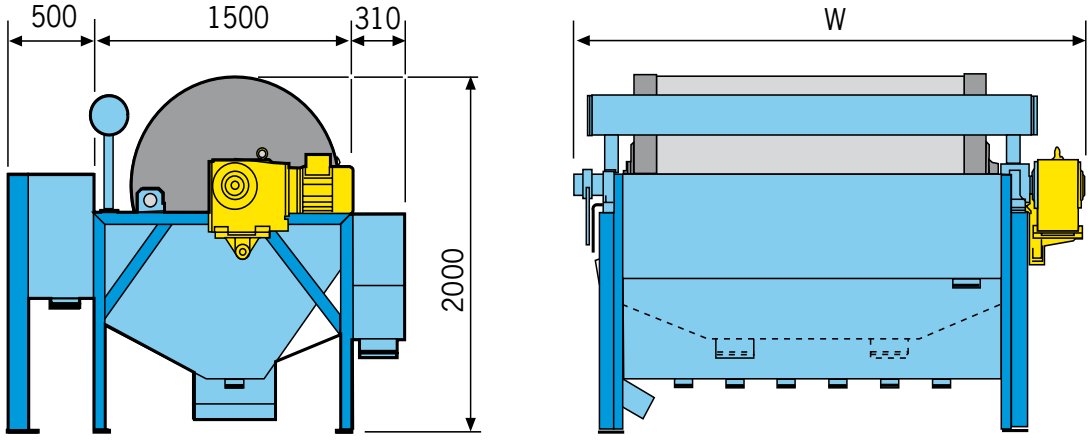
Dimension W and weights are given for equipment with the standard gearbox.



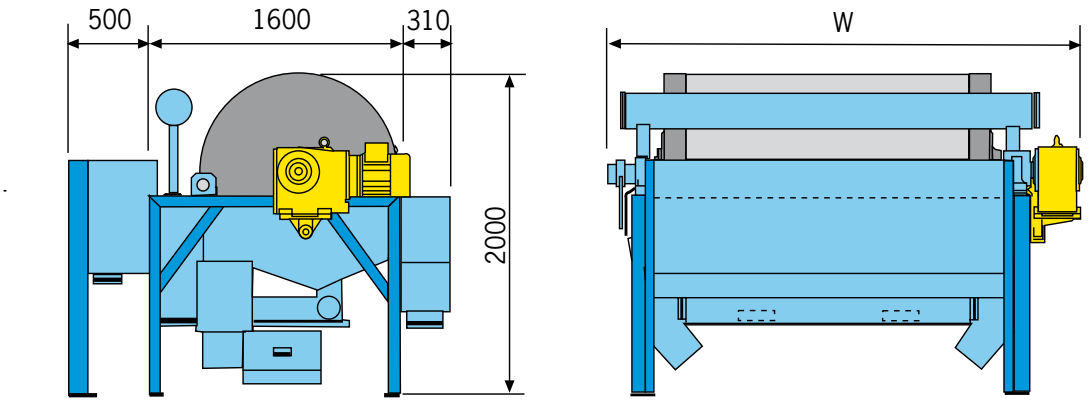
WS 1200CR



WS 1200DWHG



WS 1200CC



WS 1200CTC

- **Metso Sweden AB**
  Norrängsgatan 2, SE-733 38 Sala, Sweden, Phone: +46 224 570 00, Fax: +46 224 169 50
- **Metso Minerals Industries, Inc.**
  2715 Pleasent Valley Road, York, PA 17402, USA, Phone: +1 717 843 8671
- **Metso Minerals (South Africa) (Pty) Ltd.**
  Private Bag X2006, Isando, Johannesburg,1600, South Africa, Phone: +27 11 961 4000, Fax: +27 11 397 2050
- **Metso Minerals (Australia) Ltd.**
  Level 2, 1110 Hay Street, West Perth, WA 6005, Australia, Phone: +61 8 9420 5555, Fax: +61 8 9320 2500
- **Metso Minerals (India) Pvt Ltd**
  1th floor, DLF Building No. 10, Tower A, DLF Cyber City, Phase - III, Gurgaon - 122 002, India, Phone: +91 124 235 1541, Fax: +91 124 235 1601
- **Metso Perú S.A.**
  Calle 5 Nro. 144, Urb. Industrial Vulcano, Ate, Lima 03, Peru, Phone: +51 1 313 4366, Fax: +51 1 349 0913
- **Metso Minerals (Chile) S.A.**
  Av. Los Conquistadores 2758, Piso 3, Providencia, Santiago, Chile, Phone: +56 2 370 2000, Fax: +56 2 370 2039
- **Metso Brasil Indústria e Comércio Ltda.**
  Av. Independência, 2500 Éden, 18087-101 Sorocaba-SP - Brazil, Phone: +55 15 2102 1300

www.metso.com
E-mail: minerals.info@metso.com

Metso Corporation, Fabianinkatu 9 A, P.O. Box 1220, FI-00101 Helsinki, Finland, tel. +358 20 484 100, fax +358 20 484 101, www.metso.com

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