



## Cryofilter® superconducting magnetic separator

### Process benefits

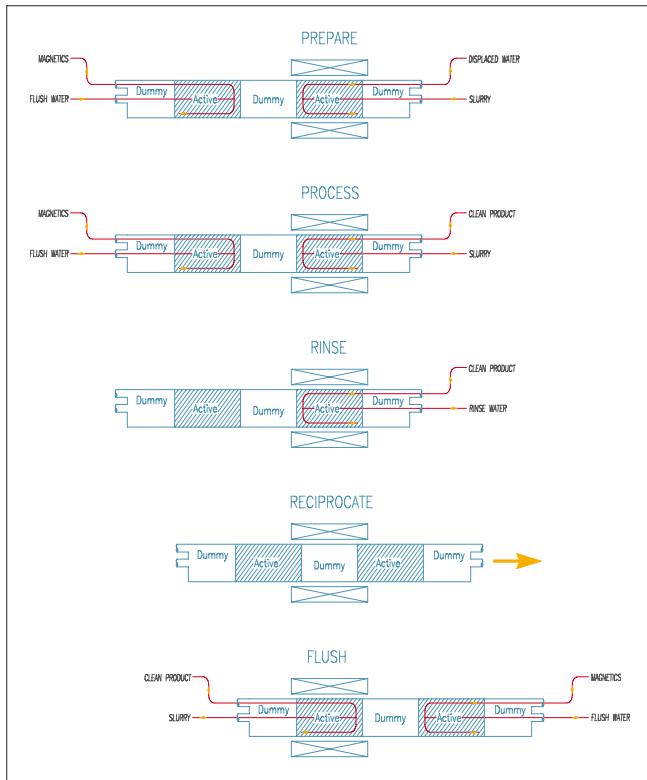
- High throughput
- Exceptional "process guaranteed" brightness gain
- Low power consumption
- Low installed weight
- Fully automatic operation
- Low maintenance
- Robust design

The Cryofilter® line is an advanced generation of high gradient magnetic separation (HGMS) systems suited to the treatment of fine materials requiring magnetic particle removal. Employing a superconducting magnet operating at a temperature near absolute zero, the Cryofilter® HGMS system produces a powerful magnetic field with low power consumption. It uses unique, patented reciprocating twin section canister train technology to process slurry material on a nearly continuous basis.

Cryofilter® technology was originally developed for the processing of kaolin. The first installation at Goonvean & Rowstowrack (UK), has been followed with industrial scale processing plants in the United States, Brazil, Germany, Australia, China and the Czech Republic. Outotec is dedicated to the application of superconducting magnetic separation for minerals processing and other markets.

Outotec is able to examine the process requirements of many materials and subsequently support its installations with a customer oriented process guarantee. Materials tested to date include kaolin, calcium carbonate, talc, etc. although any fine material (nominally <100µm in particle size) that can be processed in slurry form is suitable for Cryofilter® processing.

**Outotec**  
More out of ore



The Cryofilter® series of HGMS processing systems has proven robust performance in less than ideal environmental conditions. Operation is fully automatic, with a simple, error proof system for adjusting the process parameters. Beyond the annual service, there is very little maintenance required on the Cryofilter® system. Changing the matrix in the canister train is straight forward, requiring only a few hours of down time even on the largest system. This feature, or the option of a second canister train, allows the grade of matrix to be an operating variable.

System reliability, on-site support and process warranty are the cornerstones upon which Outotec specify, build and support any Cryofilter® installation. Outotec's specialized knowledge covering material processing, in addition to equipment operation, has enabled some customers to improve their processing specifications beyond that originally expected.

### Design features

The technology used with the Outotec industrial Cryofilter® HGMS system gives it unique benefits that a process plant owner will find advantageous.

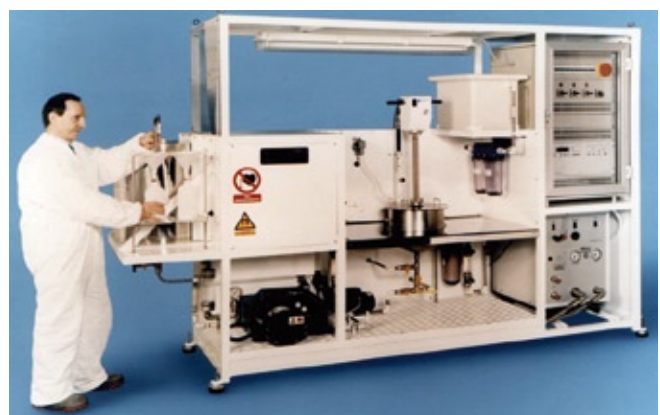


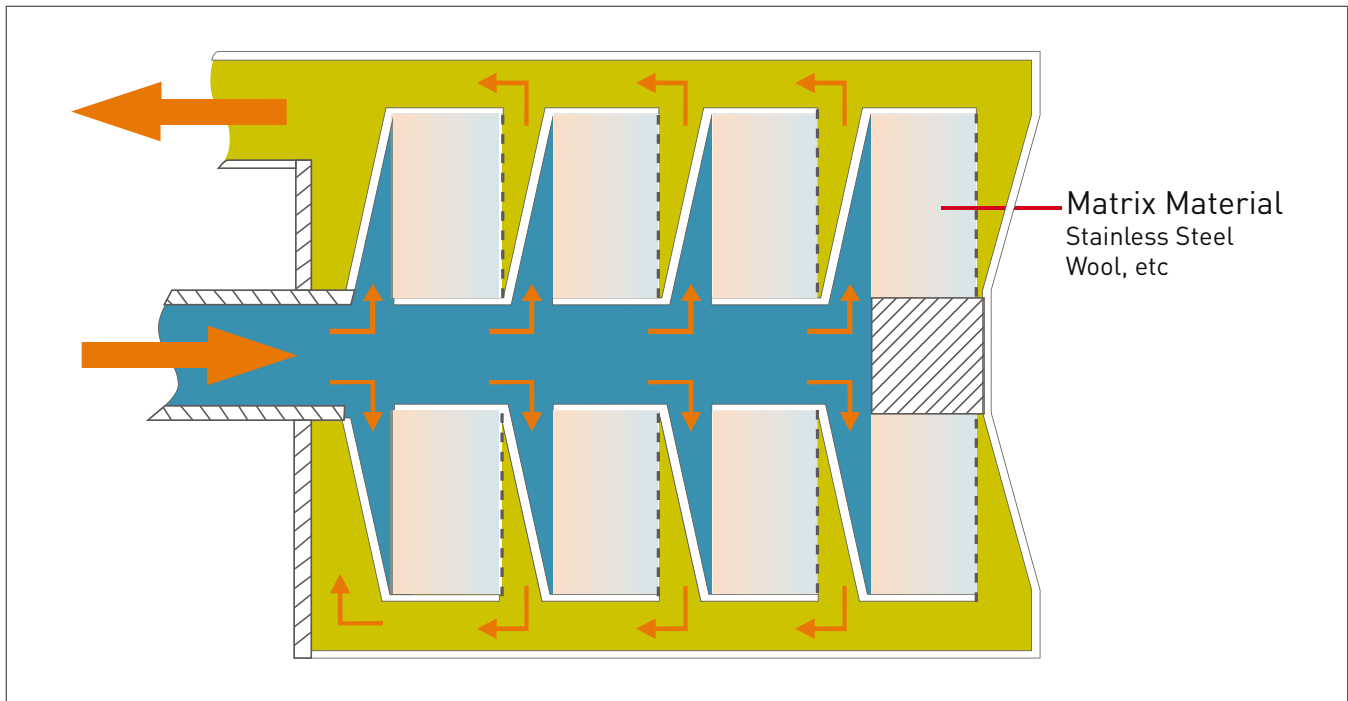
The horizontal superconducting magnet design ensures that the working environment is easily shielded using a low mass iron shield. This results in a low floor load that does not require excessive building engineering. As the system undergoes full reliability testing prior to shipment, the on-site installation time is reduced ensuring the Cryofilter® can be brought on-line in the shortest possible time.

### Technical services and support

The Outotec testing facility is available in Jacksonville, Florida and/or on-site to aid in identification of operating parameters needed to produce the highest quality products and optimization of slurry preparation. The analytical/research units are specifically designed with this function in mind.

Following installation, our team of specialists still looks to support the Cryofilter® user to maximize the future production capabilities of our systems.





### Principle of operation

Central to the design of the Cryofilter® is the patented reciprocating canister train and use of a powerful 5 Tesla field superconducting magnet.

Operating the system in persistent mode, with the current leads de-energized (and withdrawn on the industrial units), enables the superconducting magnet to remain at field all through the production cycle. The twin canister configuration within the single assembly adopted for the industrial units, enables one canister to process in field, while the other is flushing out of field. Regular reciprocation results in almost continuous operation through freshly cleaned matrix. While single canister design has been adopted on the pilot-scale systems, the magnet still remains at field when flushing occurs.

The Cryofilter® series of separators are designed for reliability and ease of operation. On the industrial units, start-up and shutdown are fully automatic, requiring only push button operation. An industrial PLC and SCADA system control and monitor the complete operation of the Cryofilter® and allow for integration with the process plant. The pilot-scale Cryofilter® range has a dedicated control system, while the research units are generally manually operated.

### Canister Design Highlights

The patented multi-axial canister train used in the industrial Cryofilter® systems consists of two active matrix-containing canister sections, sandwiched between three magnetically balanced dummy canister sections. This modular design allows the detail of any particular canister train to be modified to suit the configuration needed for a specific application.

The system's HGMS capacity is directly related to the cross-sectional area of matrix available for material to flow through. With this in mind, the Cryofilter® multi-axial canister is designed to maximize the surface area of the matrix available for HGMS within the volume of the chamber and to ensure even flow distribution for each matrix pad section.

Detailed design of the Cryofilter® series ensures that the slurry flow and capture configuration are the same for the industrial units, pilot-scale and research units. Careful study of the slurry flow characteristics confirms that the design provides uniform flow distribution to each matrix pad over a wide range of flow rates and viscosities. This allows direct scale up of laboratory research results and enables Outotec to offer process guarantees for industrial installations based on the tests carried out on "to be processed" material.

*Outotec is a worldwide technology leader in minerals and metals processing, providing innovative and environmentally sound solutions for a wide variety of customers in minerals processing, iron and steel, aluminum and non-ferrous metals industries. Outotec Oyj is listed on the OMX Nordic Exchange Helsinki.*

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