SLon® vertically pulsating high-gradient magnetic separator

Superior separation

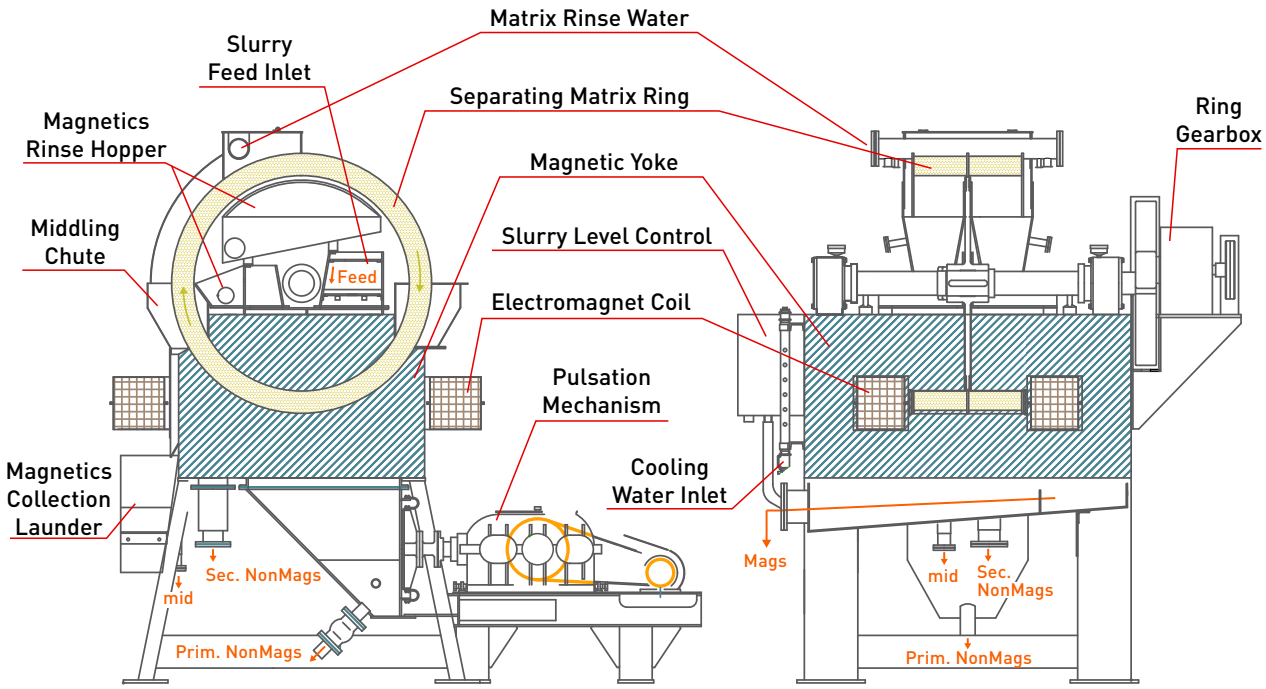
The SLon® vertically pulsating high-gradient magnetic separator (VPHGMS) utilizes the combination of magnetic force, pulsating fluid and gravity to continuously separate magnetic and non magnetic minerals. The SLon possesses the advantages of high beneficiation ratio, high recovery, adaptability to varying particle sizes, and minimized matrix blocking.

Customers find the SLon reliable, and easy to operate and maintain. Thousands of units have been successfully implemented in minerals processing plants worldwide. The modern technology offers many advances over traditional WHIMS type separators including greater efficiency with smaller sized particles, higher grade and recovery, and lower maintenance and operating cost.

Benefits

- High capacity
- Low cost per ton
- High availability
- Superior fine particle separation
- Conventional WHIMS replacement
- Meets worldwide safety standards
- Magnetic or non-magnetic product upgrading

Outotec



Operating principle

Slurry is introduced to the matrix - housed inside the vertical separating ring - through slots in the upper yoke. The magnetic particles are attracted to the matrix and are then carried outside of the magnetic field where they are subsequently flushed to the magnetic concentrate trough. The non-magnetic, or less magnetic, particles pass through the matrix through slots in the lower yoke to the non-magnetic collection hoppers.

Applications:

- Concentration of iron ore, ilmenite, chromite ore and other paramagnetic materials.
- Purification of non-metallic minerals (feldspar, silica sands, etc.)
- Fine particle applications (<20µm)
- Replacement of conventional WHIMS

Outotec Upgrades

- Power supplies
- PLC controls
- Level control system
- Cooling system
- Rinse water reduction
- Worldwide saftey standard compliance

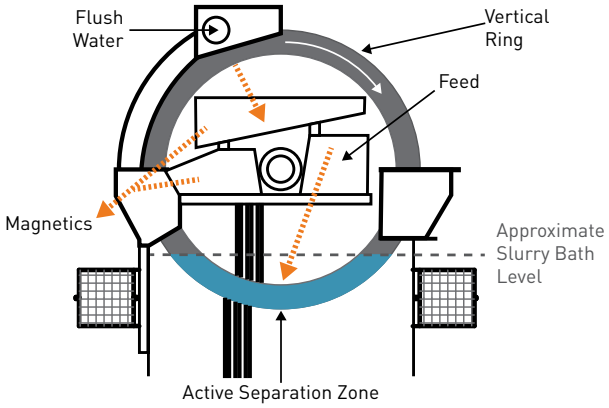
Magnetic strength

Outotec SLon units are offered in 0.6, 1.0 and 1.3 max Tesla versions with magnetic set points infinitely adjustable within the operating range. Magnetic intensity is based on the averaged value over the entire separating area rather than a single point max value achieved. Capturing intensity is even higher on the surface of the matrix. Example: The 1 Tesla version is modeled to reach 1.8 Tesla at the surface of a 2mm matrix. This helps explain why the SLon is outperforming other WHIMS claiming >1 Tesla fields.

Outotec SLon advantages over traditional horizontal carousel type WHIMS	
WHIMS Concerns	**SLon Solutions**
Low particle collection forces and capacities	High gradient rod matrix Increased collection points with rod type matrix
Matrix plugging	Rod matrix with pulsating slurry bath Minimal flux leakage at concentrate flush Reverse matrix flushing
Particle misplacement	Pulsating action
Fine particle recovery	Reduced particle velocities with slurry bath

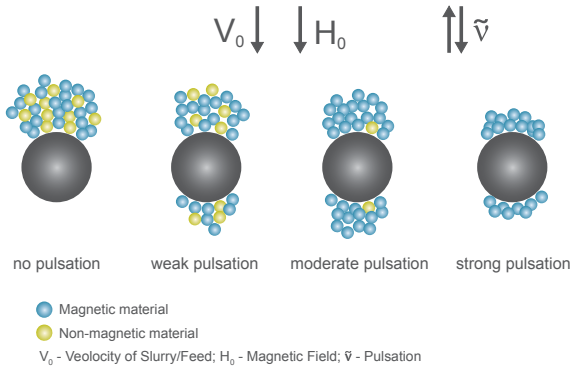
Vertical ring configuration

The ring is arranged in a vertical orientation as opposed to a traditional Jones-type WHIMS which uses a horizontal carousel. The vertical nature of the carousel allows for reverse flushing, i.e. magnetics flushing in the opposite direction of the feed, enabling strongly magnetic and or coarse particles to be removed without having to pass through the full depth of the matrix volume. In addition, the magnetics flushing is accomplished in a location (near the top of rotation) with low stray magnetic field to reduce any residual grip on the magnetic particles. These combined benefits lend to high availability due to minimized matrix plugging.



Pulsation and slurry bath

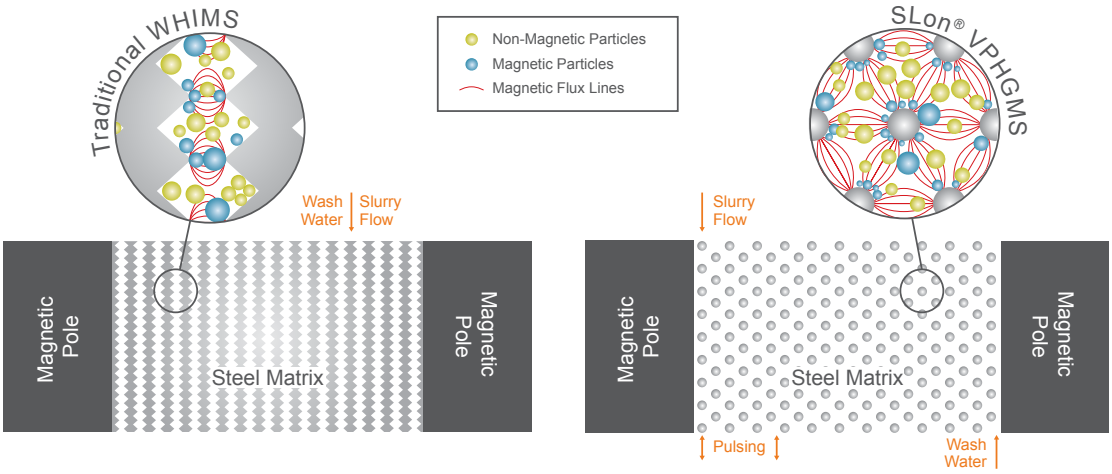
An actuated diaphragm provides pulsation in the separation zone to assist the separation performance by agitating the slurry and keeping particles in a loose state, minimizing entrapment. This mechanism also maximizes the particle accumulation (trapping) on all sides of the rod matrix creating more usable surface area for magnetics collection. A further benefit is to reduce particle momentum, which aids in particle capture by the applied magnetic force. This leads to improved find particle collection and separation.



Rod matrix

The SLon utilizes a filamentary matrix constructed of steel rods to accommodate various size ranges of feeds. The rods are oriented perpendicular to the applied magnetic field to enable optimum magnetic force to be achieved while minimizing the risk for entrapment of particles, when compared to grooved plates, randomly positioned filaments (wool) or expanded metal sheets.

Matrix material selection	
Rod (mm)	**Largest particle (mm)**
1	0.6
1.5	0.8
2	1.2
3	1.5
4	2.0
6	3.0



Finland, January 2013.

Model specifications	100 (lab unit)	500 (pilot scale)	750 (pilot scale)	750II (industrial)	1000 (industrial)	1250 (industrial)	1500 (industrial)	1750 (industrial)	2000 (industrial)	2500 (industrial)	3000 (industrial)	4000 (industrial)
Ring dia. (mm)	n/a	500	750	750	1000	1250	1500	1750	2000	2500	3000	4000
Capacity, dry feed (nominal) (tph)	batch	0.03 - 0.13	0.06 - 0.25	2 - 4	4 - 6	6 - 16	15 - 27	25 - 45	45 - 70	70 - 125	125 - 225	225 - 450
Slurry throughput (nominal) (m^3/h)	n/a	0.25 - 0.50	0.5 -1.0	5 - 10	10 - 20	20 - 50	50 - 100	75 - 150	100 - 200	200 - 400	350 - 650	550 - 1050
Feed concentration (typ.) (%)	n/a	10 - 40	10 - 40	10 - 40	10 - 40	10 - 40	10 - 40	10 - 40	10 - 40	10 - 40	10 - 40	10 - 40
Available field strength (T)	1.2 & 1.7	1.0	1.0	1.0	1.0	1.0 & 1.3	1.0 & 1.3	0.6, 1.0 & 1.3	0.6, 1.0 & 1.3	0.6, 1.0 & 1.3	1.0	1.0
Rectifier installed power* (typ.) (kVA)	31	31	31	31	30	55	69	70	75	94	133	158
Motor power req'd (typ.) (kW)	0.75	0.74	1.3	2.25	3.3	3.7	7	8	13	22	37	74
Flush water volume (m^3/h)	batch	0.75 - 1.5	1.5 - 2.5	5 - 8	10 - 20	30 - 45	60 - 90	80 - 120	100 - 150	200 - 300	350 - 530	600 - 1200
Cooling water volume† (m^3/h)	4	4	5	4	5	6	8	11	12	15	20	24
Total machine weight (kg)*	1100	1500	3000	4000	6000	14000	20000	35000	50000	105000	175000	398000
Separator dimensions (LxWxH)(mm)*	1600 800 1600	1800 1400 1320	2000 1360 1680	2250 1700 1680	2700 2000 2400	3200 2340 2700	3600 2900 3200	3900 3300 3800	4200 3550 4200	5800 5000 5400	6600 5300 6400	8000 6000 7400

**1.0 & 1.2 Tesla version*
†Plant process water needed to cool closed loop heat exchange system

Outotec supplier advantages

Power Supplies: Outotec switch-mode and SCR water-cooled power supplies meet worldwide electrical standards with both IP65 and Nema 4X cabinet designs.

PLC Controls: Integrated PLC for ease of local control and integration to plant PLC system.

Level control system: Automated system to maintain slurry bath level by use of pneumatic valves and level sensor. Maintains optimum slurry level without frequent operator attendance.

Rinse water reduction: An optimized spray design to reduce water consumption during matrix rinse.

Cooling system: Closed loop cooling system to cool both SLon unit and power supply are offered with various external heat removal features (heat exchanger, air cooled, cooling tower). The closed loop system eliminates potential blockages within cooling system.

Global safety standards: Units designed to customer specified local standards in all market areas.

Services: Global presence means local support including: Spare parts, modernizations, and technical, operation and maintenance services. Testing services, feasibility and pilot studies, and flowsheet development services are also provided in select market areas.

Outotec provides leading technologies and services for the sustainable use of Earth's natural resources. As the global leader in minerals and metals processing technology, Outotec has developed over decades many breakthrough technologies. The company also provides innovative solutions for industrial water treatment, the utilization of alternative energy sources and the chemical industry.
Outotec shares are listed on NASDAQ OMX Helsinki

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