

# Study of peristaltic hose pump technology in precious metal mining

More efficient operation and higher productivity time

## Key conclusions

A number of primary advantages are linked to the use of peristaltic hose pumps for high density, abrasive paste transfer at precious metal mines. For competing pump types there is a high degree of difficulty in handling abrasive paste with varying density, over long distances and without frequent breakdowns. This difficulty is compounded when chemicals are added to the paste.

In summary, peristaltic hose pumps offer benefits that include:

- Significantly reduced pump downtime
- The ability to perform maintenance in-situ and without the need for special tools
- More efficient operations and higher productivity
- Greater safety through better handling of aggressive chemicals and abrasive paste
- Fewer filters required and filter capacity can be reduced by 75%. Disc filters cost around \$100,000 each so significant savings achieved
- No mechanical seal flush water is required: many centrifugal pumps need around 72 litres of water per minute
- Less storage required for tailings; the number of basins or pools can be reduced, due to higher slurry density in less water

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*Above: Grit and solids laden water being pumped for mining operations*

## Facing up to social and environmental responsibilities

Precious metals are extracted at greater cost to the environment. Peristaltic hose pumps can help ensure the environment is better protected through safe and responsible transfer.

### Mining for precious metals

A strong focus on water consumption is present within filtration-based mining as large volumes are required in the process. In the first stage, ore is crushed and ground, after which the fine ore is mixed with water in froth flotation cells, which serve to extract precious metals. The resulting tailings froth is thickened in a sedimentation tank, where the overflow is water and the underflow contains concentrated ore paste, typically 40-75%,

reaching the higher end of this range at the bottom of the tank.

At precious metal mining facilities it is desirable to have a thickener underflow with a high dry solid content; the less water involved, the higher the efficiency of the filter press. It is the pumps – which are installed beneath the thickener – that determine the maximum allowable dry solid content. As a result, pump technology is the limiting factor. ►

► Mines often use at least two pumps per tank, one to lift from the tank and the other to feed a filter up to 300 metres away. Compared to heavy duty peristaltic pumps typical centrifugal slurry pumps can not maintain accurate fixed flow rates against such pumping condition variations.

**Drawbacks of centrifugal pumps**

Centrifugal pumps are used widely in mining, especially for thickener underflow applications, but have many notable shortcomings. For example, the quantity of dry solids that can be accommodated by centrifugal pumps is limited. In numerous applications impellers last just a few weeks due to factors such as strong acidity and/or abrasive content.

To overcome corrosion issues mine operators can use centrifugal pumps made of exotic high alloy materials to reduce frequent major component replacement. However capital investment for these pumps is very expensive and abrasive wear rates no better.

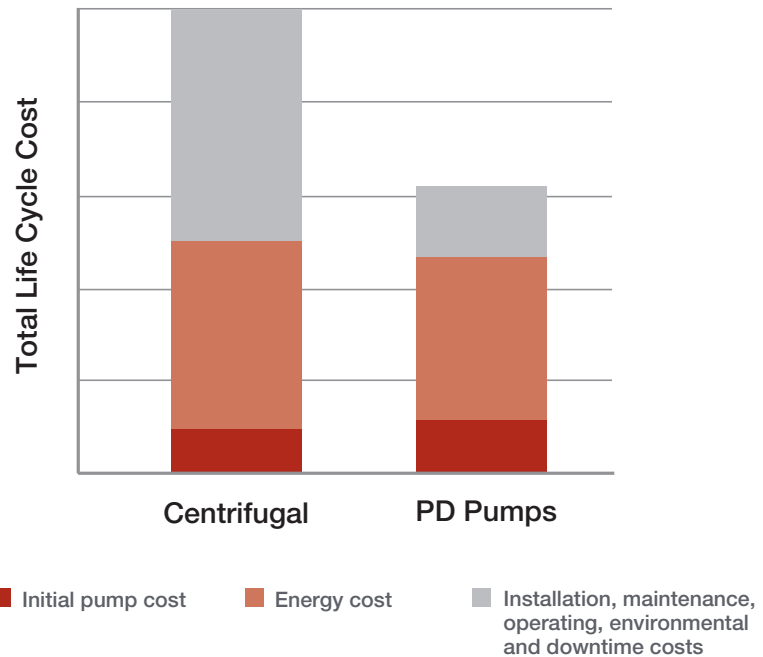
Unlike other pumps, the performance of Bredel peristaltic hose pumps is not affected by the abrasive/aggressive nature of slurry and chemicals. Among the many benefits of peristaltic pumps are:

- No mechanical seals
- No requirement for seal gland water
- No seal water flush systems
- No moving parts in contact with the pumped fluid
- Pumping action without internal friction for increased wear resistance

The longer a pump can function without maintenance or downtime, the better. The wear-free performance of hose pumps is an attribute that results from a unique operating principle. Unlike other pumps, the abrasive nature of the product has no influence on pump life, so the need for routine maintenance and spare parts is greatly reduced.

Centrifugal pumps continue to run at the

**Life cycle cost – Relative comparison  
Centrifugal vs. positive displacement (PD) pumps**



set speed, but flow rates decrease as the paste density increases towards the bottom of the underflow thickener (up to 75% solids are typically present in the bottom third of the tank). Bredel pumps keep pumping at the same flow rate, irrespective of the paste density.

Pumps like the Bredel hose pumps are virtually maintenance-free as there are no impellers, liners, casings, wear liners and seals to replace, no check valves to clog or wear out. The only wear part is the hose, which can be replaced in a matter of minutes without any requirement for special tools. Longer hose life enables customers to reduce maintenance downtime and spares inventory; two important aspects in rugged and remote mining duties.

Another benefit, certainly in terms of cost is that Bredel hose pumps can reduce filter capacity by as much as 75%. ►

**How we mine is becoming just as important as what we mine. ICMM is driving improvements in technology to support safety and environmental performance. In addition to driving continual improvement in sustainable performance**

*ICMM 2017 Chair, Donald Lindsay, President and Chief Executive Officer, Teck*



*Above: Breidel 80 hose pump in thickener underflow application*

► Not only are disc filters very expensive, at circa \$100,000 each, but the feed has to be constant to ensure working efficiency is maximised. However, even more relevant to dry solids content is the storage of tailings in the ponds. Also less volume of paste means smaller dams are possible and reduced water content brings greater safety by reducing the risks of saturated dams. Reduced water content brings greater safety by reducing the risks of saturated dams.

#### **Case study: Niobium extraction**

Niobium (Nb) is a rare earth mineral with impressive anti-corrosive properties, making it very resistant to heat and wear. There are currently only three mines producing the majority of the world's niobium: CBMM in Brazil; CMOC International in Brazil; and the Niobec mine in Canada.

Paste at the Ovidor mine of CMOC International is made up of 44% niobium

with water, sulphuric acid, isopropyl and a flocculant. The solids content rises to 75% as the pulp becomes more concentrated at the bottom of the underflow thickener tank.

Put simply, centrifugal pumps could not manage such a high concentration of solids.

Sometimes piston pumps are deployed for high-density sludge, but the types that can withstand the abrasion levels are extremely expensive.

Bredel hose pumps were installed, using 75mm diameter suction and discharge piping, to discharge the sludge from the tank and transfer it 300 metres to the filter press. The pumps are controlled manually and speed is reduced if pressure at the filter press increases. Following solids removal by filtration, the remaining wastewater is pumped to a lagoon or tailings dam. At this point there ►

**Mining companies sustain losses up to \$3,000 per hour for every equipment failure incident**



► are still residues of aggressive chemicals in the water. Bredel pumps cope with not only the abrasive solids, but also the chemical content.

At Ouvidor, the centrifugal pumps suffered badly due to abrasive wear and chemical attack. The downtime to repair a pump was at least 6-8 hours. In addition, the pumps had to be removed from beneath the thickener. In contrast, a Bredel hose and lubricant can be changed in less than four hours, and does not require a standby pump to be moved into place so both uptime and productivity levels can be increased.

The mine has installed several Bredel hose pumps, some of which have been providing reliable operation for nearly a decade. Many are pumping niobium pulp (44%), and although some were acquired for new applications, a number replaced existing centrifugal pumps.

A case in point is a Bredel 65, which replaced a centrifugal pump that required frequent maintenance. Seven years later, the Bredel is still performing strongly, pumping through a 3m high, 8m long discharge pipe at a flow rate of 7m<sup>3</sup>/h. Also installed around the same time was a Bredel 50, which replaced a centrifugal pump with an open impeller that again was suffering due to attack from chemicals and abrasive wear. In this tank-transfer application, the niobium pulp is discharged through a 4m high, 5m long pipe at a flow rate of 4.5m<sup>3</sup>/hr.

Elsewhere at Ouvidor, Bredel pumps serve applications including dosing of coagulant, and reject suction and filter press feed. The latter application was performed by a vertical centrifugal pump which could not transfer the pulp in high concentration or cope with the pressure of the filter press. The replacement Bredel pump has successfully been in service for nine ►

*Above: Hose pump transferring waste from the filter press to the tailings pond*

**Several Bredel hose pumps are in operation, all pumping niobium pulp in tank transfer duties, running 18 to 24 hours/day with EPDM hose life five months**

► years, pumping the phosphate reject with fluosilicic acid at a flow rate of 28m<sup>3</sup>/h and 7 bar pressure along a 320m long discharge pipe (3m high).

**Case study – Platinum extraction**

Allowing for losses which occur during refining, and the varying platinum content of the different ores found within the Bushveld Igneous Complex SA, between 10 and 40 tonnes of ore must be processed to obtain a single ounce of platinum. Concentration is the process of separating milled ore into two streams: one greatly enriched in the valuable mineral (concentrate) and another of waste material (tailings). This step is vital in terms of economics as it reduces the volume of material which must be transported to and processed in a smelter/refinery.

At the Waterval plant of Sibanye Platinum in South Africa, six Bredel 100 hose pumps are being deployed to transfer concentrated platinum paste with specific gravities of between 1.4 and 1.7. Four of the Bredel 100 pumps are transferring paste from thickener to storage tanks over a distance of 90-100m, while the other two are transferring it around 180m from a holding tank to a storage tank.

**Case studies – Gold mining**

An interesting case study involves the Peñasquito gold mine in Mexico, which is operated by GoldCorp Group. The customer, Mex-Mex Peñoles, is the foundry that receives all of the concentrates from Peñoles group mines, which are then processed to separate the minerals.

The pump application centres on thickener underflow for acid leaching and hot acid leaching (used to extract minerals from the ore). Several Bredel hose pumps are deployed with some having been in use for over 13 years. Such longevity is despite the use of aggressive chemicals, including cyanide, where leaching dissolves gold out of the ore using a chemical solvent as part of a process called carbon-in-pulp (CIP). Carbon particles are also used, primarily to attract the gold, while hot caustic



is deployed to separate gold from the carbon. Further chemicals in use include lime for water treatment, and flocculant to consolidate solids and retrieve water.

*Above: Treated wastewater which will be reused for thickener underflow*

In a thickener underflow application at the Queiroz mine of AngloGold Ashanti in Brazil, Bredel hose pumps have replaced centrifugal models due to extremely high maintenance costs and high water consumption. Two units (four pumps) serve two tanks handling gold paste at 70% solids content (30% H<sub>2</sub>SO<sub>4</sub>) with a viscosity of 2150 mPa.s. Elsewhere at this plant, two smaller Bredel pumps transfer a cyanide and caustic soda mix in acid leaching applications. ►

**One mine has cut the cost of spares by nearly 50% since the installation of their Bredel 100 hose pumps**

At a gold mine in Brazil, owned by Mineracao Turmalina Ltd, a number of hose pumps are being used to handle substances such as ethanol, hydrochloric acid and paste containing 73% solids content (68% waste solids, 5% cement and water). In this instance, the paste discharge is via 500 metres horizontal piping, followed by a further 300 metres

vertical pipe downwards. The distance from the tank to the final outlet means that a maximum discharge pressure of up to 12 bar is generated at the pump. Despite aggressive chemicals and back pressures up to 12 bar, the Bredel hose pumps in these gold extraction processes achieved hose life between three and five months, in 18 hour continuous duty.

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## **Conclusion**

**Moving ores, concentrates and residues in slurry form are essential parts of industrial mining processes. However mining operators must constantly seek ways to meet their social and environmental responsibilities.**

**In mines around the world Bredel heavy duty hose pumps have helped companies reduce water and chemical usage. This, combined with lower maintenance intervals and the need for fewer spare parts means Bredel hose pumps are helping mining operators meet their environmental obligations whilst saving costs. ■**



# Bredel

## Hose Pumps

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**Bredel Hose Pumps is a brand of Watson-Marlow Fluid Technology Group.**

Watson-Marlow Fluid Technology Group is the world leader in niche peristaltic pumps and associated fluid path technologies. Comprising ten established brands, each with their own area of expertise, but together offering our customers unrivalled solutions for their pumping and fluid transfer applications

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