
FMR Pumps-App_Story

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Application Story

V3 – 1725

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Figure 1 Regular inspections and maintenance help ensure both duty and standby mill discharge pumps are ready for action (IMG: _30A9200.jpg)

Pumping up gold production rates at Greenfields Mill

Owned and operated by FMR Investments, Greenfields Mill is situated 3 km east of Coolgardie in Western Australia. The mill has provided a first class toll milling facility to the local gold mining industry for over twenty years. Originally founded in 1989 as Barmenco Pty Ltd, a specialist underground mining contractor, FMR Investments was formed subsequent to Barmenco's divestment and sale in 2007. The company also operates two mining projects: Eloise Copper Mine in northwest Queensland, and Gordon Sidar Mine in Western Australia.

The Greenfields plant has three ball mills, allowing the circuit to be optimised to suit the needs of different clients to maximise gold recovery. In the current configuration the plant is able to treat up to one million tonnes per annum.

Plant overview

The crushing circuit is a three stage crushing system consisting of a Metso C130 as the primary crusher, and a HP300 and HP4 as the secondary and tertiary crushers respectively. The secondary and tertiary feed are screened over a double deck 20x8 Nordberg screen. The product produced from the crusher circuit is crushed to a final size of 6-8 mm and stored in a 1000 t mill feed bin.

The mill circuit consists of 1300 kW, 875 kW and 500 kW ball mills, and classification of leach feed product is handled by both 15 inch standard and Cavex Cyclones.

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Cyclones create a centrifugal force to separate and classify different sized particles. Lighter particles rise through the top overflow, while denser or larger solid particles pass through the bottom underflow. The underflow may contain free gold particles, which are separated with a Falcon Concentrator and sent to the gold room for direct smelting, while the remaining underflow goes back to the grinding circuit to be reduced further.

The overflow product from the cyclones is sent to a CIL (Carbon In Leach) circuit consisting of four leach tanks and nine adsorption tanks. In this process, gold is dissolved from the ore in a cyanide solution in the presence of oxygen, and the resultant gold cyanide complex molecule is then adsorbed onto activated carbon.

The gold is stripped from the loaded carbon, in a process known as elution, using a Zadra circuit. The Zadra process, developed in the USA in the 1950s, involves circulating a sodium hydroxide and sodium cyanide solution through a stationary bed of loaded carbon at about 90°C, causing a reversal of the adsorption process. Gold is later recovered from the pregnant strip solution by electrowinning onto steel wool, and direct smelted before shipment to an external refinery.



Figure 2 Morgan Dombroski
(IMG: _30A9177.jpg)

Mill discharge pumps a critical component

Critical to the operation of the mill-to-classification process are the mill discharge (MD) pumps. These pumps are responsible for pumping the milled slurry from the mills up a large vertical pipe to the cyclones.

Alternative Registered Manager at Greenfields Mill, Morgan Dombroski, highlights the mill discharge pumps are a critical part of the sites process. “The pumps feed the classification cyclones, which are the mother of the whole plant. If the pumps are down, we aren’t producing a product – which is a big deal for the site,” she said.



Figure 3: Duty and standby pumps always allow for a backup option (IMG:DSC00797.JPG)

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There have been occasions in the past when shutdowns have occurred due to the pumps getting bogged. This can sometimes occur if there is an electrical mains failure, stopping the pumps and causing the slurry to fall back into the pump and cause it to block, or if wear in the mill trommel causes a large rock or even a steel milling ball to pass through to the pump.

And when the pumps shut down, the mill circuit also needs to be shut down to stop the feed.

“When the mill circuit is stopped, it basically costs the business about \$40k per hour,” said Dave Scott, Maintenance Supervisor. “It’s a costly business to have to shut down, so this is why the pumps are operated in a pair with a standby pump to take over if the currently active pump fails or is under maintenance.”

Innovative pump design makes pump access easier

In 2014, the plant invested in two Metso HH200 pumps. The result has been a dramatic reduction in unexpected downtime and significantly quicker and easier maintenance, compared with the pumps they replaced.

When the active pump gets bogged or worn it is necessary to switch to the standby pump and repair the duty pump in-situ. With the previous pumps, this required disconnecting the suction and discharge spools, removing the front casing, and removing the case liner – all of which require the use of a mobile franner crane. As a result, such repairs took 6-8 hours to complete.

Understandably, such difficulties also did not encourage regular preventative maintenance.



Figure 4 Dave Scott
(IMG: 30A9286.jpg)

In contrast the new HH200 pumps are equipped with hydraulic slide-base technology that is unique to Metso pumps. The slide-base allows operators to open the pump without removing the suction and discharge pipework.

So while a shutdown is still required in the case of bogging – to clear the blockage and restart with the standby pump – the time and effort required for repair has been significantly reduced.

As a smaller site, one of the logistical problems is that there may not always be someone available to operate the crane at short notice.

“Not everyone on-site has a ticket to drive the franner crane,” said Travis Dingle, maintenance fitter.

“With the Metso pump it is easy with two people, but you can even do it by yourself if you need to, if everyone is busy. Two people can unbog a pump in less than an hour,” he said.

Easier regular maintenance lowers costs and improves safety

The mill discharge pumps process a high volume of material that is abrasive in nature. As such, many of the internal components are subjected to wear, and must be regularly monitored and maintained.

“Our team here have a lot of experience at the site and are good at forecasting maintenance activities,” said Domboski. “We monitor the pumps through weekly inspections including a ‘shimming’ process. This optimises both front and rear impeller clearances which makes the pump operate more efficiently and extends wear life.”

This is where the hydraulic slide base technology is a great asset, since it makes it extremely easy to inspect wear components and conduct routine maintenance on a more regular basis.

“We can do our regular checks by undoing eight bolts and sliding the pump out to inspect,” said Scott.

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With the Metso pumps, in conjunction with a Tech-Taylor changeover valve, it is possible to perform preventative maintenance on the pumps weekly without shutting down the process. The duty pump is ramped down, while the standby pump is ramped up, causing the Tech-Taylor ball valve to flip over, blocking the duty pump discharge and allowing the standby pump to take over.

“On Wednesday or Thursday we have changeover,” said Dingle. “Two fitters open the pump up and check the shimming, to get as much life out of the pumps as possible.”

Shimming is the process by which the gap between the impeller and the volute lining is adjusted.

“The closer the impeller is to the volute liner, the better the wear,” he explained “If you have a large gap, larger product gets in there and wears the volute down faster, and then you are more likely to have to change out the volute liner.

“What makes it easy with the Metso pumps is the hydraulic slide. We connect a hydraulic pump to the slide base, unbolt the volute bolts and the pump pulls the housing back, without any need for a crane.”

By weekly inspection and shimming of both the duty pump and the standby pump, Greenfields Mill has been able to reduce the need for major overhauls, reducing costs. But of course those overhauls will eventually be necessary.



Figure 5 Travis Dingle
(IMG:_30A9242.jpg)

“We’ve got predicting the pump wear figured out,” said Dombroski. “If the hopper is staying high and the pump is working harder, using higher amps, then you know it is getting worn.

Maintenance supervisor Dave Scott says that cost have been reduced because the weekly maintenance cost is only the labour, and the slide-bases on the Metso pumps has reduced the effort dramatically.

“Servicing a pump costs about three to four hours for a basic open inspection and shim check for both pumps, which is all only at labour cost,” he said. “Doing it every week has reduced costs because you don’t have to do major refitting as often.

“The total cost of a full rebuild can be up to about \$35k, involving the impeller, back plate, shaft sleeve, volute housing. At one point we had to do this monthly, but now with the regular maintenance we get about two to three months on the impeller and the housing, which has reduced costs by about half.”

Use of the Metso slide-base has not only improved the time to repair or maintain, but has had an impact on safety as well.

“Because using the slide-base means not having to use a crane, there is no rigging gear you can be struck by,” said Scott. “And not having to almost completely disassemble everything removes most of the possible pinch points in the process.”

The benefit of local support in Kalgoorlie

It has been of benefit to the team at Greenfields Mill to have support from Metso locally in Kalgoorlie.

“We have found the Metso team to be very friendly people and easy to get along with,” said Domboski. “Most of our major equipment now is from Metso, so it is definitely good having a Metso presence in Kalgoorlie, and they check in from time to time to make sure all is well. They know the importance to the plant of the equipment we have purchased, and they make sure our parts stock is built up to avoid any downtime that may occur from not having the right part.

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“Our team, along with the guys from Metso, has undergone many hours and days together on rebuilds and installation of new products, so they have established a good rapport. They are defiantly easy to deal with and are prompt with helping us out in any situation.”

I’m on the phone with Metso most days – making sure we have all the parts needed.” said Dave Scott. “It’s good to have them close by and know that we can get the parts we need at short notice.”

Metso is a world leading industrial company serving the mining, aggregates, recycling, oil, gas, pulp, paper and process industries. We help our customers improve their operational efficiency, reduce risks and increase profitability by using our unique knowledge, experienced people and innovative solutions to build new, sustainable ways of growing together.

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