

## No Matter How Challenging, Keep the Ore Flowing

Abrasion can create one of the most arduous service environments and remains a major challenge for mining operators, going from mineral excavation to metal refining. It is one of the most common problems for hydraulic transport systems operating at high throughput rates and conveying velocities, and it can lead to premature failure causing lengthy downtimes and significant revenue loss.

### Hyperabrasive environment for slurry pumps

Slurry pumps are one of the most susceptible pieces of equipment to abrasion wear throughout the beneficiation process. Due to the harsh operational environments and the tough heavy duty surface and underground mining processes, the early failure of slurry pumps used in the transportation of abrasive solids in large volumes is a common issue. When a critical slurry pump goes offline unexpectedly, a large mine can lose as much as US \$100,000 per hour in revenue.

Even though in recent years there has been significant progress with regards to the mechanical design of slurry pumps, they are still plagued with erosion issues and abrasion is considered to be the main threat to their longevity and performance. Commonly constructed of erosion resistant exotic alloys such as Inconel<sup>®</sup>, Monel<sup>®</sup>, duplex, superduplex and Ni-hard and hence characterised by their ability to handle rocks, gravel and mud, slurry pumps still fail on a large scale due to the high slurry abrasion rates.

Depending on the properties of the abrasive particles, i.e. solid size, solid concentration, hardness and temperature, as well as the operating conditions and process parameters, i.e. flow rate and inlet velocity, the wetted parts of the slurry pump can be tremendously impacted. The components of the impeller, casing and suction liner can be worn significantly within just a few hours and are therefore in need of replacement at regular intervals. This sets the financial loss of downtime and replacement at very high levels, since the purchase expenses of a slurry pump are many times that of a standard water pump.

As a result, the use of a protective coating that slows down the abrasion process in the pump is of paramount importance. Specifying the coating materials for slurry pumping applications is not a standard procedure and must account for all variable characteristics, such as the type and speed of the pump and the nature of the solids. Even though handling abrasive fluids presents a tremendous challenge to any protective material, a carefully selected abrasion resistant coating can reduce impact wear effects, extend the life of the pump and optimise the overall performance of the pumping process.

### Hazelton VDS slurry pump repair

An Australian market leader in the production and marketing of nickel and cobalt have been in constant need of a reliable restoration and efficiency enhancement solution for the refinery's centrifugal vertical slurry pumps.

The refinery processes nickel and cobalt-bearing laterite ores purchased from third party mines in New Caledonia, Indonesia and the Philippines. Nickel ore is dried, ground, roasted

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and leached in an ammonia solution to extract the nickel and cobalt in the processing plant. Nickel and cobalt are then separated and further refined in the metal refining area.

One of the most critical pumps of the refinery is the 12" Hazelton VDS slurry pump used to extract and transport the ore from the primary tailing sump and distribute it to the process units for refinement. The slurry mixture contains approximately 60% solids by volume and has a temperature of 70°C-80°C (158°F-176°F). Since the pump is running continuously 24 hours a day and due to the extreme wear, a second pump is required to be constantly in-situ as a standby unit. In order for this to be ensured, a third pump is used as a spare rotatable unit. After 2500 hours of continuous operation, the operational unit that has been running will be replaced by the second unit. This second standby unit will then be replaced by the third spare pump and the removed pump will be stripped and inspected.

Using Belzona composite repair systems and protective coatings, Rezitech Services PTY LTD, the authorised Belzona Distributor in Australia, will then undertake the restoration of the eroded unit, even if the pump has been severely damaged. "An uncoated volute was put into service in 2013, and was almost irreparable after 5000 hours," explains Levi Boyd, North Queensland Manager at Rezitech Services PTY LTD. "The unit should have been scrapped, but since replacement would have taken up to four months to arrive, it has been repaired instead."

### **Specified application products**

In order to provide a holistic repair to the casing of the Hazelton slurry pump that commonly suffers extreme wear on both cut waters, rendering it unsuitable for use, the polymeric compounds should offer long-term erosion protection. The materials need to be highly durable, satisfy the need for high abrasion resistance under immersed conditions at high temperatures and provide excellent mechanical strength.

On the basis of these considerations, a set of four erosion-corrosion resistant composite repair materials and protective coatings, Belzona 1812 (Ceramic Carbide FP), Belzona 1321 (Ceramic S-Metal), Belzona 1311 (Ceramic R-Metal) and Belzona 1391 (Ceramic HT), has been proven to fulfil the imperative abrasion and temperature resistance requirements.

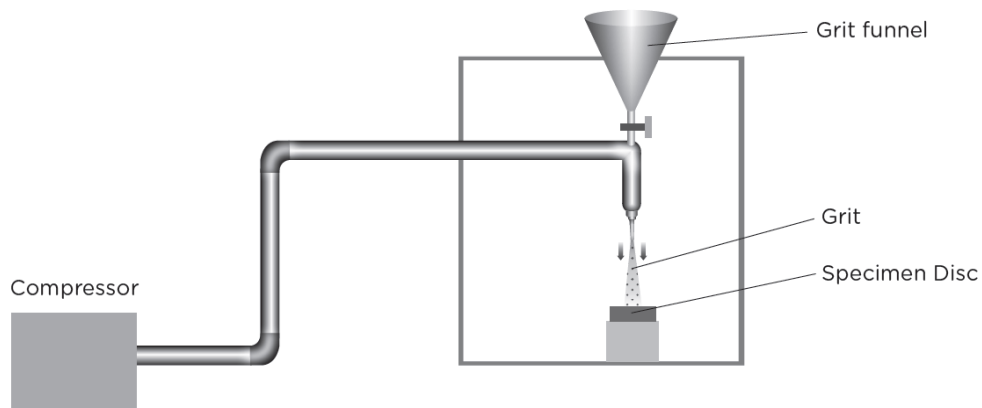
To measure the impingement abrasion resistance of their materials, Belzona runs a grit blast abrasion test as part of their abrasion/erosion testing program. This is an in-house testing method where a cast specimen disc of the cured epoxy composite is pre-weighed and placed at a set distance from the blast nozzle. The sample is held at an angle, 30° or 90°, to the nozzle then the abrasive chilled iron grit is fired using an air powered blast pistol at around 5.5 bar (80 psi). The erosion resistance of the material will be determined from the associated volume loss.

When the G34 chilled iron grit was fired at 75 psi and with a 90° angle, Belzona 1812 (Ceramic Carbide FP), an abrasion resistant lining based on high molecular weight polymers and oligomers incorporating ceramic aggregates, exhibited a volume loss of just 8mm<sup>3</sup>.

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### *Belzona Grit Blast Abrasion Test Program*

#### **Application Steps**

Since the pump is constructed of Ni-Hard, a white cast iron alloyed with nickel and chromium, abrasive blasting of the substrate is conducted to Swedish Standard SA 2½ with aluminium oxide, a very hard and sharp ceramic aggregate, in order to achieve the required surface profile and avoid contamination of the substrate.

In addition, customised templates are affixed to the impeller ring and discharge port openings of the casing to serve as a mould in order to restore the internal diameter and also to ensure correct alignment by enabling the applicator achieve an even coating thickness throughout the surface of the repair area. Once all arrangements are completed and prior to the application of the Belzona materials, the repair areas are thoroughly cleaned.

The extremely worn cutwaters that are commonly reduced by approximately 100 mm are repaired with Belzona 1311, a paste grade ceramic filled epoxy-based repair composite for rebuilding and re-profiling of damaged areas. Once cured, the cutwaters are shaped to the required dimensions using an angle grinder.

Belzona 1321, a ceramic-filled epoxy coating designed to protect against moderate abrasion, is applied to the entire casing internals as a priming coat to assist adhesion to the Ni-Hard substrate. Belzona 1321 exhibits excellent bonding to the cast iron surface and cures with no signs of shrinkage since the system is 100% solid.

Belzona 1812, an epoxy-based composite material that has been formulated with highly hard ceramic aggregates closely packed in a polymeric binder, is then applied at a thickness of approximately 6 mm utilizing the templates previously installed.

A final layer of Belzona 1391, ideal for equipment that operates at high temperatures under immersion, will be also applied throughout the entire pump internals to provide additional heat resistance. Once the final coat is cured, the templates are removed using jacking bolts, and all extruded material is ground off. The pump externals are then coated with Belzona 5891 (HT Immersion Grade) to protect the entire unit from the high temperature process fluids in the primary tailing sump.

#### **Minimised downtime – enhanced performance**

From start to finish, the application lasts less than a week and with simplified application techniques, the client can avoid replacement costs in excess of approximately US \$15,000. The repair solution, proven to be more durable than the Ni-hard substrate, cost

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approximately half of this amount and prevents downtime at approximately US \$77,000 per hour.

The refinery have been a loyal Belzona client for repairing further mining refinery equipment such as vacuum pumps, large filter heads and chemical containment areas since they started in 1970s and have expressed themselves happy with Belzona materials ever since.



Pump casing disassembled for repair

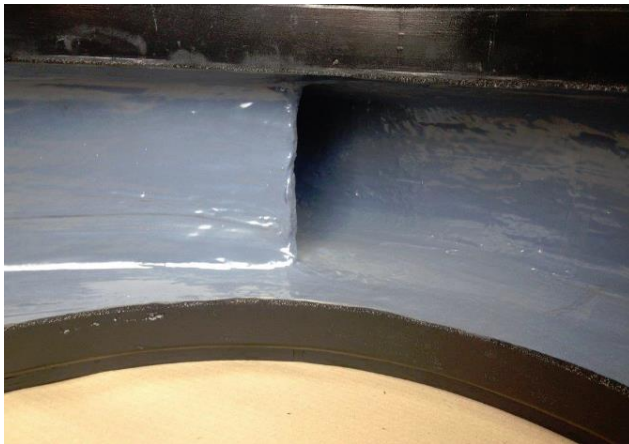


Profile loss of pump cutwater

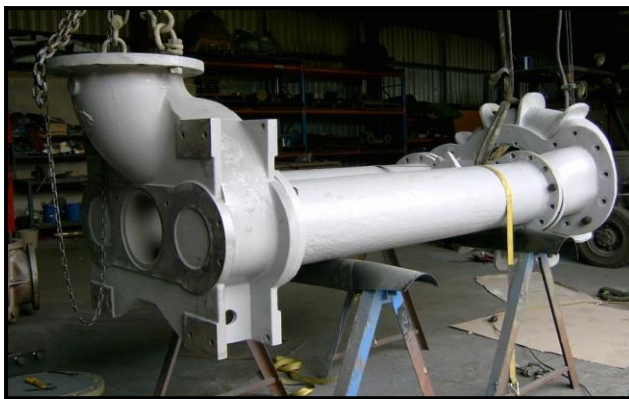
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Pump cutwater rebuilt and protected against abrasion and high temperature



External surface protected against high temperature

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Cassia Sanada has joined Belzona Inc. in 2011. Cassia is a Chemical Engineer and holds a Masters in Biotechnology.

For further information on this application or to book an appointment with your local Belzona representative visit [www.belzona.com](http://www.belzona.com)

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### **Notes to Editor;**

#### **About Belzona:**

- Established in 1952, Belzona has pioneered innovative polymer technology that has revolutionised industrial repair and maintenance procedures.
- Belzona is a leading company in the design and manufacture of polymer repair composites and industrial protective coatings for the repair, protection and improvement of machinery, equipment, buildings and structures.

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- At Harrogate, the full Belzona product range is manufactured to stringent quality and environmental control guidelines complying with the requirements of ISO 9001:2008 and ISO 14001:2004.
- Belzona has over 140 Distributors in more than 120 countries ensuring not only the availability of Belzona materials, but also specification support, project management, application and supervision services. Distributorships and their teams are supported by Belzona Corporate offices in Europe, North America and Asia.

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