Site report

Economic and safe tailings pumping at Bulyanhulu in Tanzania

Double piston pumps for very abrasive tailings

Barrick Gold Corp's Bulyanhulu Mine in Tanzania started production in April 2001 and is on its way to producing nearly 400.000 oz/year of gold by 2002.
Reserves have tripled since the Toronto based corporation bought Bulyanhulu in March 1999 as part of its aquisition of Sutton Resources.
Gold reserves total 10 million ounces with an average grade of 14,76 g/t.

The tailings pumping plant is a vital part of the production process. If the tailings plant stops the production has to stop as well. The plant has to run in an absolutely reliable manner i.e. 24 hours per day and 365 days per year! Due to this Barrick chose the best and proven equipment. Wear, energy consumption and water consumption have to be low at this remote site.

The Putzmeister double piston pumps are prepared for extremely high Miller numbers such as 197, as in this case, or more. 700.000 m^3 per year have to be pumped by the Putzmeister tailings pumping system. The powerful Putzmeister double piston pump pushes the tail ings over a distance of 2100 metres through a 200 mm diameter delivery line into the tailings pond. The discharge pipe is mounted in a 12 m high steel tower and the tailings flow out at the top.

Above: Backfill plant at Bulyanhulu
Below: The airport

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Tailings material

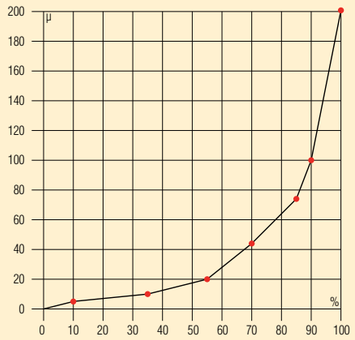
The fine grained tailings are abrasive with a Miller number of 197. The specific weight of the paste is 1,970 kg/m³. The paste has a solid content of 76 % by weight which results in a slump of 195 mm. The pH value is approx. 11. The paste temperature is between 30 and 35 °C.

Filter cake from disc and pressure filters will be discharged at a moisture content of 19 % into a premixer to produce the paste. Then the tailings are fed through a 7 m long inclined downpipe into the low pressure damper (LPD) of the Putzmeister high density solids pump of type HSP 25100 HP. The LPD reduces pressure peaks on the suction side.

The poppet valves of the Putzmeister pump are hydraulically activated; when they are closed, then they are really closed. This reduces the danger of jet wear. The piston speed is only 0.22 m/s and this guarantees a high availability and low wear on the double chromed and honed delivery cylinders as well as on the pistons.
In former times there was the thesis, that piston pumps are not suitable for Miller numbers higher than 50 due to the wear on the delivery cylinders and the pistons. This is wrong. The delivery cylinders show nearly no wear and only for security reasons the piston sleeves are changed together with the valve seats and plates.

Tailings pond with discharge pipe and tower

Grain size diagram of the tailings



Grain size distribution

Percentage	Passing size
100 %	210 µm
90 %	100 µm
85 %	74 µm
70 %	43 µm
55 %	20 µm
35 %	10 µm
10 %	5 µm

Description of the pumping plant

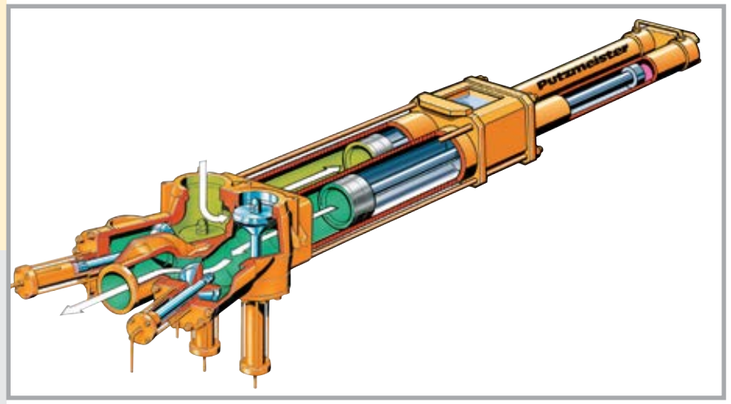
The pumping plant consists of:

- **2 HSP 25100 double piston pumps, 1 working, 1 standby**
- **2 HA 315 E, 1 working, 1 standby**
- **1 HPD 200/750 high pressure damper**
- **1 Diversion valve DVH 4/2, ZX 200**
- **1 Pig in gate, ZX 200**
- **1 HA 11 E to drive the diversion valve and the pig in gate**

The advantages of Putzmeister double piston pumps in comparison with diaphragm pumps

- The HSP 25100 is able to convey 80 m³/h tailings at 80 bar continuously.
  Due to the long stroke of 2,500 mm and the big delivery cylinder diameter of 360 mm only 5.5 strokes per minute are necessary to convey 80 m³/h.
- Only 5.5 hydraulically controlled switch overs of the seat valves guarantee a long lifetime of the main wear parts, the valve seats and plates, compared to 50 – 60 switch overs of the diaphragm pump.

Two HSP 25100 with suction connection and low pressure damper



Arrangement of the Putzmeister pumping system

The high density solids pump consists essentially of two hydraulic cylinders, two delivery cylinders as well as a plate valve controlled pump head.
An electro hydraulic power pack provides the 315 kW to drive the HSP 25100. The pump head has a big suction and pressure valve with 220 mm cross section per delivery cylinder.
Putzmeister dimensioned these components especially large to reduce the speed of the material and due to this the wear on the seats and plates.

To ensure continuous operation of 8,760 hours per year a standby pump and power pack are necessary.

The two HSP 25100 pumps are each driven by a HA 315 E

The two pumping systems are installed side by side and are connected to the delivery line by a DVH 4/2 with a forked pipe. Each pump can be switched electro-hydraulically by the HA 11 E to the delivery line.

Behind the forked pipe the high pressure damper HPD 200/750 is mounted on top of the ZX 200 delivery line. During the pumping stroke of the HSP 25100 the damper fills itself with the conveying medium.
Just before the pump stroke is completed, the damper is activated and discharges the material into the delivery line during the short interruption phase while the delivery pistons switch over. In this way a uniform delivery velocity is achieved and decompression impacts are minimized.

For cleaning a pig in gate (ZX 200) is mounted into the delivery line. With the Putzmeister pig in gate it is possible to clean the pipeline without opening even whilst conveying is being carried out. The pig sluice is independently switched by the HA 11 E and passes the cleaning plug into the delivery line.

The pig in gate ZX 200, the high pressure damper HPD 200/750 and the diversion valve DVH 4/2

Conclusions

Criteria for using a Putzmeister double piston pump are the reliability and safe operation even while conveying very abrasive material – Miller No. 197 – and more abrasive material is possible.
Operating life of the seats and valves of more than 800 working hours guarantees us a satisfied customer.
Due to the experience of the engineering company SNC-Lavalin, Golden Paste Tec. and the know-how of Putzmeister Solid Pumps this tailings pumping project was made a big success. Also many thanks to Russ Evans, the mine site Supervisor responsible for the operation of the paste system, and to the crew that are so capably operating the tailings disposal plant.

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