

Geho® Heatbarrier design for energy savings in alumina double digestion at Hindalco, India

Introduction

Hindalco Industries Ltd. has awarded Weir Minerals Netherlands b.v. with an order for two Geho® triplex piston diaphragm pumps, model TZPM 250, Heatbarrier design. Part of the order is further to rebuild the existing two TZPM 500 and two ZPM 700 piston diaphragm pumps into Heatbarrier design. The new pumps and rebuilds are ordered to allow high temperature digester feed for the Sunshine project at the Renukoot Plant of Hindalco.



Geho pump house at the Hindalco site.

The process

In the current situation the two Geho® TZPM 500's and ZPM 700's are used for pumping bauxite slurry from the pre-desiccation tank into the digester. There are two types of alumina in bauxite:

- Gibbsite: $Al_2O_3 \cdot 3H_2O$
- Boehmite: $Al_2O_3 \cdot H_2O$

The trihydrate extractable Gibbsite is digested readily into caustic soda

solution at temperatures of 145°C. However the monohydrate Boehmite will digest at temperatures of about 240°C. In the current situation (called single digestion), all the bauxite slurry (including trihydrate and monohydrate) is pumped into the high temperature digester. This means that all bauxite will be heated up to about 240°C, including the trihydrate Gibbsite which already is digested at about 145°C. In fact this means unnecessarily heating Gibbsite from 145°C up to about 240°C. High energy savings will be realized if this unnecessarily heating can be avoided.

Energy savings in the process

Energy saving is getting more and more attention within minerals plants worldwide. Especially in the alumina production process, which is a relatively high energy consumer, substantial savings can be achieved.

Hindalco Industries Ltd. has decided to do so and started with the modification of their digestion process under the name 'Sunshine' project. Design and engineering are done by Alcan.

The process will be changed from single digestion into double digestion. This means that all bauxite slurry will first be fed into the low temperature digester. At this temperature of about 145°C the trihydrate Gibbsite will be dissolved into caustic soda. The harder extractable monohydrate Boehmite will not react yet and stays unsolved.

After this first digestion stage the slurry will go into pressure decantation. The overflow of pressure decantation,

containing the pregnant liquor with the dissolved trihydrate Gibbsite will be separated and goes into the flash vessels in which temperature and pressure will be reduced. Subsequently the dissolved Gibbsite alumina will be recovered from the liquor by precipitation of crystals.

The underflow of pressure decantation only contains unsolved monohydrate bauxite. Only this part of the slurry stream will be fed into the second (high temperature) digester where it will be heated up further to about 240°C. The energy will be saved by avoiding heating up trihydrate Gibbsite bauxite to this high temperature.

The pumps

In the current situation the existing Geho® TZPM 500's and ZPM 700's operate at a slurry temperature of about 90°C – 100°C. In the new double digestion application the pumps will be placed after the first digester where the slurry temperature will be about 145°C. This temperature is above the maximum allowable diaphragm temperature and therefore we apply our Heatbarrier design which keeps the hot slurry temperature away from the diaphragms.

The existing triplex single-acting, TZPM 500 pumps and both new triplex single-acting TZPM 250 pumps will be equipped with our proven Heatbarrier design. In this design the pump valves will be located at some distance from the diaphragm housings. The inter-connecting horizontal 'dropleg' pipe is water-cooled and fitted with a 'separator' that minimizes heat-loss.

Because of the layout of the pump construction, the existing, duplex double-acting ZPM 700 pumps will be rebuilt with a vertical design dropleg, similar to those in operation successfully for gold autoclave feed applications.

Both designs will limit the temperature at the diaphragm housings to an allowable level of about 80 – 100°C.

Weir Minerals Netherlands as dedicated partner

There were various reasons which justified a site visit of a small delegation of Geho specialists:

- The first double digestion application for piston diaphragm pumps worldwide and the related future opportunities.
- To discuss the issues related to the retrofit work and supply of new pumps.
- The tight schedule on site.
- Knowing that successful operation also depends on slurry behaviour for which the pumps need to be designed.

This kick-off and clarification visit to the client has already taken place. From the fruitful meetings both parties have learned that successful result will be maximized when both parties share their knowledge and experience. The client has experienced that we are not only a pump manufacturer, but also a dedicated party with unique knowledge and experience.



Geho Heatbarrier design.

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