A REVOLUTION IN PASTE PLANT DESIGN

Paste for underground mine backfill delivers significant benefits in terms of ore recovery and mine productivity. Increasingly paste backfill is replacing other types of backfill (i.e. rock-based fills or hydraulic fill) due to operating benefits as well as its reduced surface tailings footprint.

However, the major impediment to paste being more widely adopted is the capital cost of the paste fill system. So, although operationally there are significant benefits, paste fill is initially more capital intensive. A new globally patented paste plant design, the mid range paste backfill plant (MPB), significantly reduces the capital cost of the paste plant and produces paste at a new lower cost point.

Traditional paste plant
Traditionally the paste is mixed and then discharged into a paste hopper of suitable size to maintain vacuum conditions.

The picture below shows a traditional paste plant layout, using a belt filter. Here, a long conveyor is required to transport the filter cake from the belt filter up to the mixing unit that sits above a paste hopper. Additionally, further height is needed under the paste hopper to feed the paste by gravity outside of the paste hopper, thereby facilitating drill rig access.

BENEFITS

- 20-30% reduced capital cost
- Easier operability - rotating platform, easy access to clear blockages or new drilling
- Reduced paste plant height and footprint
- Maximises orebody value, improving sustainability
- Faster install, assembly-ready product
- Modular design - cheaper and faster
New design - optimized solution
The MPB both mixes the paste product and utilises the product volume (maintained within the combined mixer and storage unit) to create the seal for maintaining vacuum in the borehole.

The mixer is a single shaft cylindrical mixer. The material discharges from the MPB unit, and the rate of discharge is controlled using a pinch valve. The level within the combined unit apparatus is measured using a pressure or direct level sensing instrument. Where gravity is insufficient to deliver the paste underground, a transfer pump is sometimes required. Traditionally, a paste hopper was used to ensure the pump inlet is fully submerged in paste and not exposed to the atmosphere. However, the MPB removes the need for a paste hopper and the pump is directly connected to the bottom of the mixing and storage device.

Easier operability
The pictures show the compact nature of the MPB plant. The combined mixing and storage unit is mounted on a rotating platform. This allows the entire unit to be mounted very low over the boreholes. The unit can be rotated to provide access to drill out boreholes in the event of a blockage or to install new boreholes without dismantling the plant.

Optimized maintenance
In addition to the capital cost saving, the maintenance of the plant is also improved. Cleaning of cemented paste is a major cause of paste plant downtime and use of operating labour. Most paste plants are shut down for 1-2 hours each day for cleaning of cemented paste build-up. Removing the paste hopper eliminates one large area that requires daily cleaning, allowing the plants to be run longer and stopes filled faster. The cleaning of the plant is further improved through the use of the cylindrical mixing and storage device with no dead zones.

Remote operation
Traditionally paste plants have required full time operators primarily due to high levels of manual cleaning. With the use of a vortex mixer for pre-mixing of cement and slurry, and the combined cylindrical mixing and storage device, the remote operation of paste plants is now achievable. This feature results in a less operator-intensive operation and faster filling of stopes.

Modular design
One of the core objectives of the MPB plant is to deliver a plant that is modularised and eliminates project-specific engineering. This pre-engineered product results in significant cost savings, as well as reduction in delivery time.

Summary
The MPB design provides several advantages. The primary advantage is that it allows the entire paste plant to be designed in a much more compact package since all of the items being fed to the mixer can be installed significantly lower. The result is a 20-30% capital cost saving compared to the traditional paste plants. On a 100 m³/hr plant, for example, this saving would exceed $2 million AUD. Another advantage is the rotating platform design which facilitates easier cleaning and drilling of new boreholes. The modular design is cheaper and faster to install. Furthermore, the design facilitates reduced cleaning requirements, allowing plants to run longer and fill stopes faster.

Through the development of this lower cost paste plant there is the opportunity for further paste implementation globally. The introduction of paste will facilitate improved underground ore recovery and allow further increases of paste placement underground. This generates a more sustainable approach through reducing the size of surface tailings storage facilities.

In 2017, Outotec will supply the MPB backfill plant to OceanaGold’s Didipio gold mine in the Philippines and to MMG’s Dugald River in Australia.

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