Maintenance and safety improvements in flotation cell design

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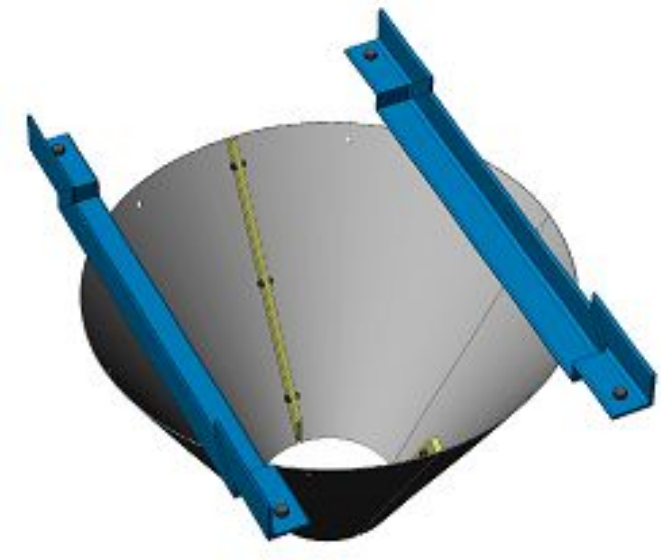
Maintenance shutdowns are critical in ensuring a mining plant operates at full capacity. With a specific block of time allocated to complete a schedule of tasks, it is imperative these tasks are completed in a safe and timely manner. Although it now seems like decades ago, the mining industry's unprecedented growth spurt up to 2007 resulted in high staff turnaround. Consequentially, this rotation of staff has resulted in longer times to complete maintenance tasks. Improvements in maintenance tools and procedures can not only make life easier for maintenance and operation staff, but can also improve a site's bottom line.

This article will look at three main areas in flotation maintenance - these being design, procedures and tools.

Design

There are many small design features in a modern flotation cell which can improve maintenance, whilst still keeping it safe and effective.

The flotation mechanism is the heart of a flotation cell and combines a rotating part (rotor) and a static part (stator). Most rotors and stators nowadays are engineered for easy replacement with common flange mounting details. Stators can also come in sections to allow safer and easier handling.



FrothBooster cone, with maintenance beams

FrothBooster cones, for example, are fitted in Outotec flotation TankCells® to reduce the open surface area in the flotation cell and optimise froth handling. Booster cones decrease the distance the froth has to travel to reach the launders. Process conditions will decide the diameter of the booster cone. To ensure maintenance of these booster cones, they have been designed to split into two parts and the bolts are then sikaflexed to protect them.

Another simple innovation is the introduction of sample hatches into a float cell design. Sampling of flotation cells is critical in monitoring performance. On some sites the removal of grating on top of a flotation cell requires hard barricading and permits and this can really hamper the operators' efforts. Outotec's sample hatches allow froth lip samples to be taken, depth samples from within the cell and access for a bubble viewer to monitor bubble size and superficial gas velocity.

Rectangular froth discharge outlets have been another important development, allowing the froth to flow freely from the flotation cell. There have been examples in the past where a round outlet has restricted flow and this has affected flotation cell performance. It is also recommended that the transition piece between the outlet and the launder has a slope, thereby ensuring the froth is cleanly taken away from the flotation cell.

Although a pretty obvious solution, the addition of access doors provides a safe method for entering and inspecting flotation cells on a maintenance shutdown. The access doors on Outotec 's TankCell and SkimAir units have been designed so that the only tool required is a suitable hammer to release the locking plates. The design is simple, yet effective.

Another design area to review is valves. When pinch valves are sized, for example, it is normal to design to the maximum flow. On some applications, the diameter of the discharge flange is increased to the next size, with a reduced bore sleeve for the pinch valve. This enables the site to increase the sleeve size and, therefore, throughput when required. It allows greater flexibility in design and does not require any modification of the flotation cells.

Procedures

Simplifying procedures and using adequate tools can optimise time and safety in flotation cell maintenance. A regular review of procedures can help simplify the number of steps required, whilst making safety a priority. The procedures for a motor change-out, for example, could be illustrated in the simple process below:

Rotor change-out

- Drain flotation cell and flush with water
- Isolate drive motor and disconnect wiring
- Remove pulley cover
- Remove all rack bolts
- Attach lifting frame to drive rack
- Position maintenance beam
- Attach lower shaft and booster cone
- Unbolt upper shaft and lower shaft flange
- Lift out main drive rack

Lifting frames for flotation mechanisms

Tools

The final piece of the puzzle relates to tools which help ensure that flotation cell maintenance become as effortless as possible. Outotec, for example, currently supply a lifting frame and maintenance beam that provides a safe alternative for completing maintenance of flotation mechanisms. Cradles have also been designed to support Outotec flotation mechanisms, creating a safer working environment. These cradles can be designed to carry a range of different sized mechanisms.

Conclusion

The completion of flotation cell maintenance in a safe and timely manner is not something to be overlooked. In fact, with the correct design, procedures and tools in place, significant manhours can be saved, whilst still ensuring safety is a high priority.

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