MINING

IMPROVE COPPER RECOVERY

Background: Mining of copper typically encompasses separating of sulfide ore and recovery of the purer metal particles from gangue minerals using froth flotation. The process follows crushing, grinding, and milling of the ore into fine particles, which are mixed with water into a slurry that is then fed into a flotation cell.

An agitator at the bottom of the cell stirs the slurry – commonly called pulp – and suspends the particles in the mix. Air supplied to the cell through the agitator creates bubbles which rise to the top of the tank, creating the froth. The addition of chemicals to the tank enables the metal particles to attach themselves to the bubbles as they rise to the surface. The "tailings," or residue, remaining in the slurry exit an outlet in the base of the tank and are generally discharged to a tailing pond.

Key to success in effectively removing the copper particles is the level and consistency of the metal-containing froth in the tank as it flows over the lip of the tank into a concentrate launder for further processing. Given that the average grade of pure metal in copper mines throughout the world is declining and now below 0.6%, the ability of the concentrator to effectively separate the copper is essential to mine productivity.

Problem: At a copper mine near Tucson, Arizona, the concentrator can process up to 100,000 tons of sulfide ore a day. The mine has relied on pneumatic actuators (as do many other mines) to control the pulp height in its flotation cells via modulating dart valves. Unfortunately, even with the use of smart positioners, the actuators lacked precision due to the compressibility of air. In monitoring the slurry discharge copper grade, as

ELECTRAULIC™ ACTUATION

well as occurrences of pulp surging over the launder lip, the mine operators found the results to be increasingly disappointing.

Ultimately, at least part of the problem was traced to the inability of the pneumatic actuators to control and maintain the proper pulp level in the tanks by effectively and rapidly opening and closing the dart valves in the tanks. Flotation cells, should the froth be too thick, the bubbles can collapse with the particles dispersing back into the slurry. Too foamy a froth, on the other hand, can mean poor transfer of the froth over the lip and into the launder.

Solution: Operators of the mine turned to REXA for an answer to the problem. Clearly, improved control of the flotation level and the consistency were necessary. The flotation level needed to be controlled by linear actuators that provided precise modulation in opening and closing the valves in the tanks (two per tank). Doing so would stabilize and reduce the pulp level fluctuations, including slurry volume fluctuations attributable to neighboring cells.

Pneumatic actuators simply could not provide the precision required. The compressibility of air meant slow and ineffective response in controlling the position of the valves. REXA's answer was to replace the pneumatic actuators with self-contained X2 linear actuators based on the company's Electraulic® technology.

Electraulic® Technology is comprised of two primary subassemblies: a mechanical subassembly and an electrical subassembly. The principle behind its technology is a unique hydraulic circuitry called the Flow Match Valve system. The actuator incorporates a bi-directional gear pump coupled to either a DC stepper or an AC servo motor that provides a highly efficient method of pumping hydraulic fluid from one side of a double-acting cylinder to the other. The discrete operation of the motor and pump creates action only when a position change is required. Once the required position is reached, the motor shuts off and the Flow Match Valve system hydraulically locks the actuator in place. Power is not required to maintain actuator position. The motor and pump sit idle until a new command signal is received.

Result

When installed in only two scavenger flotation cells, the four REXA Actuators resulted in an immediate improvement in valve control, which has led to increased recovery of copper content during production runs. In fact, results during a test period after installation of REXA Actuators indicated a 25% increase the capture of copper content in the scavenger cells during tank flow disruption. What this means is that at that level of capture, in processing 100,000 pounds annually of ore by the mine, as much as 33,000 pounds of copper could be recovered from the ore with the use of REXA actuators to maintain pulp level cell height.

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