MINING

HIGH PRESSURE ACID LEACHING

Background: Recovery of nickel has become increasingly challenging as yield per ton of ore has decreased dramatically. Existing mines grade decreases and new viable ore bodies are located in remote locations. Certain methods of recovery, such as traditional leaching, have been outmoded. In the last decade, high pressure acid leaching (HPAL) in autoclaves has become the technologically preferred method for processing gold present in sulfide minerals.

HPAL autoclaving entails subjecting the acidic ore to temperatures up to 250°C with pressures in greater than 50 atmospheres (750 psi). Under these conditions, the nickel is leached in fluid slurry.

The microscopic nickel particulates trapped within the ore are freed and are suspended within the slurry. Tank level control from the autoclave is regulated by a let down valve outfitted with severe service trim and an actuator.

Key to success or failure, depends on the pressure let down valves and actuators that control slurry levels within the tanks. Let down valves are constantly modulating, requiring the actuator to have high frequency response to respond to small, constantly varying changes. They can also be subject to scaling and water hammer in controlling the fluid level. Scaling is the building up of residue around the valve, with movement of the valve gradually becoming more restricted over time. Eventually, the scale may even prevent the valve from closing unless the actuator has significant hydraulic stiffness to break away the blockage. Under these conditions, valves and actuators must operate repeatedly with precise modulating control in meeting the exacting process requirements.

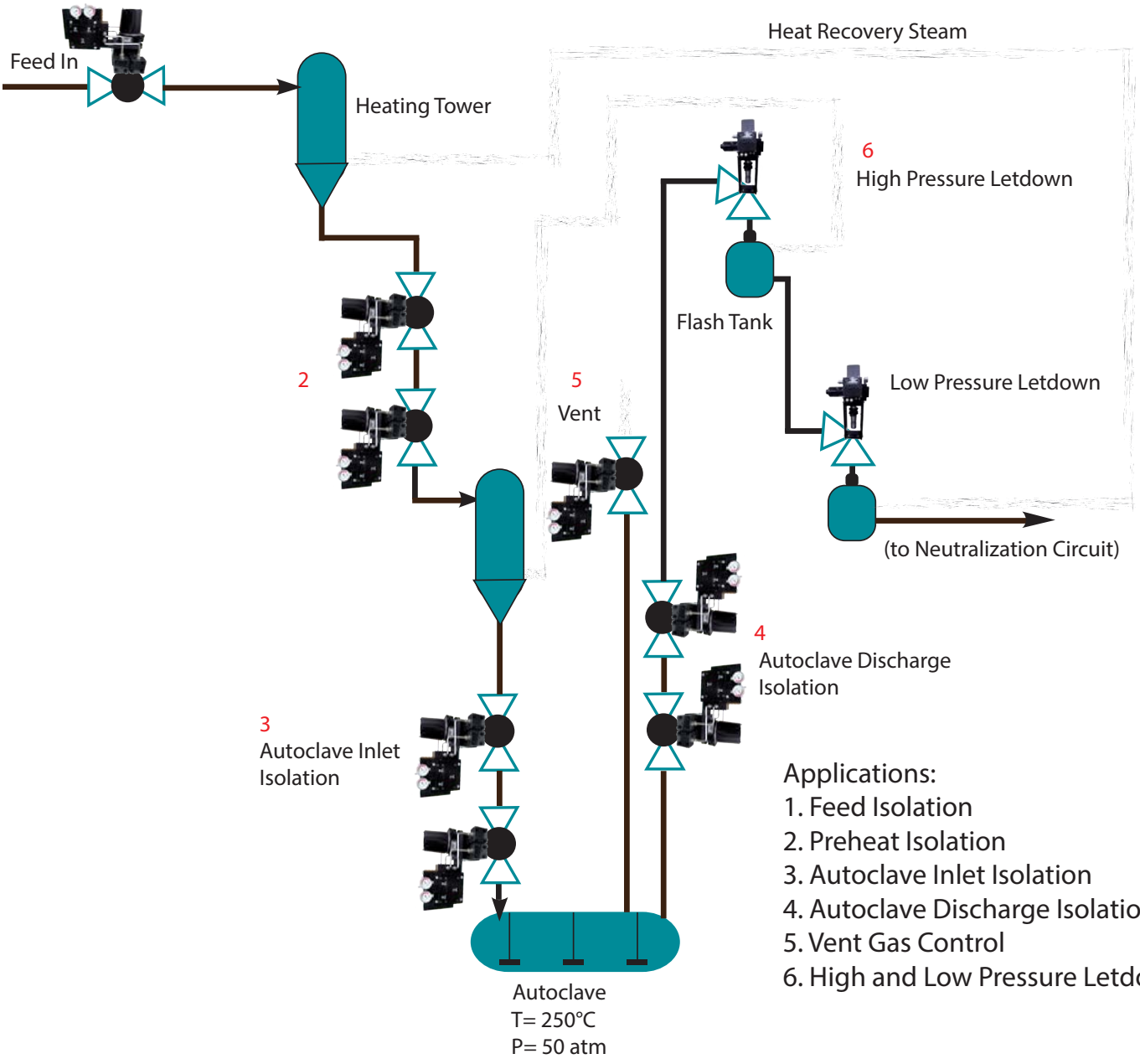
ELECTRAULIC™ ACTUATION

PROBLEM: Tank level control and closure of let down valves requires 100% duty cycle and precision positioning in order to maintain proper tank level and pressure within the autoclave, as well as flash drum slurry flow and pressure after the letdown valve. Most mines utilize pneumatics for their low cost and relatively easy maintenance. Unfortunately, pneumatics couldn't be more inappropriate for this application. The compressibility of air means that pneumatics are constantly hunting, which makes them very unreliable.

In the worst case scenario, poor actuation can create a situation where the pressure and amount of slurry in the autoclave can no longer be controlled. To combat this, a spring return is often incorporated to a pneumatic system to aid in closure. The result, however, can be slamming of the valve shut, thereby creating water hammer that can damage the actuator and the valve seat and can even cause safety issues.

Should this cause the let down valve to fail, plant engineers would have to shut down the plant and vent high-pressure gases out of the system. Such unscheduled shutdowns can take several hours to restart, causing the plant to lose thousands of dollars per minute in lost production opportunity, lower plug lifetime from restarts and lower yield from restarts.

TYPICAL HPAL PROCESS FLOW



Applications:
1. Feed Isolation
2. Preheat Isolation
3. Autoclave Inlet Isolation
4. Autoclave Discharge Isolation
5. Vent Gas Control
6. High and Low Pressure Letdown

Solution: Operators of the mine turned to REXA for an answer to the problem. Clearly, improved control of the Autoclave level and pressure letdown stages were necessary. The autoclave acid slurry level needed to be controlled by linear actuators that provided precise modulation in opening and closing the angle valves.

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. Worse, the minimum position is often fixed with a small gap to prevent the valve plug from inadvertently striking and damaging the valve seat.

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 sub-assembly and an electrical sub-assembly.

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

REXA's Electraulic™ Actuators have been engineered for use with constantly modulating, let down valves in HPAL autoclaves for the recovery of nickel REXA's technology provides the precise modulating control required by using cylinders rated for 2,000,000 full strokes or 20,000,000 dither cycles. Sophisticated electronics allow complex diagnostics and partial stroking for enhancing the operation and service life of the valve. REXA also incorporates in the actuator package a seat loading cylinder to protect the severe service trim.

Software designed specifically for REXA Actuators allows the user to calibrate and customize the actuator operation. The actuation package supports both HART (Highway Addressable Remote Transducer) and Foundation Fieldbus control system protocols.

As a result of the design, features and performance of the REXA Actuators, problems with valve control due to scaling and water hammer have been overcome with less downtime and more effective recovery of nickel particles and other metals.

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