



## CONDENSER HOTWELL LEVEL CONTROL



**BACKGROUND:** The condenser is a key component in any power plant that uses a steam turbine. Its primary function is to increase power by maximizing the pressure drop across the turbine, where efficiency is directly related to the vacuum created by condensing steam. Geothermal condensers are fundamentally different than those found in fossil fuel plants, in that turbine exhaust steam is never recycled to a boiler. Therefore, a direct contact condenser is typically used. In lieu of cooling tower water run through sealed piping, it's sprayed into the steam, and drains to the condenser hotwell. From there it's pumped through the level control valve and into the cooling tower, cooled, and collected in the cold-water basin at the bottom of the tower. It is then fed back into the condenser, for the process to repeat. Regardless of plant design, maintaining a proper condenser hotwell level during all phases of operation is critical to generate rated megawatt output.

**KEY TO SUCCESS:** Achieving proper condenser hotwell level control requires accurately positioning the discharge valve during turbine startup and operation. This requires immediate response to signal change with no overshoot and a high degree of repeatability. A stable process is required to maximize turbine efficiency and plant uptime.

**PROBLEM:** Startup delays caused by the condenser hotwell level control valve are a major concern for plant operators. Instability can quickly result in a startup sequence balancing act where fill/discharge valves and the hotwell pump must be manually operated. Large butterfly valves are typically used with direct contact condensers. These valves

# ELECTRAULIC™ ACTUATION

are traditionally operated by piston type pneumatic actuators which are susceptible to static friction and excessive deadtime. Sulfur scaling inside the valve compounds the problem, leading to excessive friction that prevents valve motion. During this time, the condenser water level continues to rise, resulting in a panicked signal increase to prevent overflow. Once the valve disc breaks loose, overshoot occurs, which in turn drains the hotwell and trips the pump. The sequence must then be repeated, often several times, just to fill and maintain a proper level in the hotwell.

To minimize the effect of static friction on this system, operators try different startup sequences, including not fully seating the level control valve. It's all been proven to lead to the same end result of a similar sine wave in control, with the same delays, and frustrated control room staff.

**SOLUTION:** REXA offers a responsive and dependable solution for geothermal condenser hotwell level control valve applications. REXA Electraulic™ Actuators are engineered for use in critical applications in the harshest environments requiring continuous modulating duty cycle with accurate and repeatable positioning. The self contained, closed loop, hydraulic circuit provides stiff, stable control independent of load variation. The sealed, positive pressure hydraulic system requires no filters or oil-based maintenance of any kind. A dedicated microprocessor control enclosure, with a user-friendly control interface, operates the actuator. Set-up and calibration are made simple through a membrane key pad on the enclosure door. Performance capabilities include deadband as tight as 0.05% of stroke, resolution of <0.1%, and frequency response of 1.5 to 5.0 Hz. Full stroke speeds of <2 seconds with zero hysteresis or overshoot are achievable. Optional fail-safe configurations featuring a mechanical spring, or a nitrogen-charged piston accumulator are also available.



## RESULT

With REXA Electraulic™ Actuation, plant operators will immediately notice improved reliability and control of the condenser hotwell level valves. The REXA actuator will track control signals precisely and repeatably. Scale buildup will no longer impact response time. The valve will move to position immediately without overshoot, allowing the startup sequence to succeed on the first try. Maintenance costs are also greatly reduced. Corroded pneumatic component replacement, control air water separation, and contaminate filtering are eliminated.

REXA's combination of performance and reliability is unmatched in the industry. Choose to rely on REXA for your geothermal power plant applications.

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