



GEOHERMAL STEAM TURBINE GOVERNOR CONTROL

BACKGROUND: The focus is growing on Geothermal power as one of the most promising forms of renewable energy. Often referred to as limitless, reservoirs are found on fault lines and near volcanic active areas. Replenishing is natural through rain water and snow melt, in addition to leftover fluids injected back into the well. And unlike other forms of renewable energy, geothermal power is always available. It's important to maximize the use of geothermal fluids, whether it be steam, brine, or two-phase flow. Separator efficiency is key to sending the highest quality of steam to the turbine, while proper operation of the governor control valves send the right amount of steam to the turbine. Their accuracy and reliability are important for maintaining the highest turbine output, and maximum megawatt hours to the grid.

KEY TO SUCCESS in controlling steam turbine speed, is to accurately and reliably position governor control valves to required positions. Balancing steam load is critical for proper and stable operation of the turbine to design conditions. Trying to precisely throttle steam using the typical turbine OEM butterfly valves is no easy feat. In addition to modulating capabilities, these valves must also be able to close or trip to position in less than a second on load shed, to prevent overspeed and potential turbine damage.



PROBLEM: In a dry steam or flash type plant, predictable operation of governor control valves driven by a Hydraulic Power Unit (HPU) is a continually sought-after concept. Long known as standard equipment on these large steam turbine valve installations, HPU based systems are very susceptible to environmental contamination through the oil sump. And by nature of the location of geothermal fields, near fault lines and volcanic areas, plants have some of the most severe ambient conditions anywhere.

Though separation systems strip out most brine contaminants, there are still dissolved minerals and gasses imbedded in dry or flashed steam, that make their way into the turbines. This steam then comes in contact with the turbine lube oil, which in most cases is from the same source that powers the hydraulic operator system. By design, this is a built-in contamination path starting at the turbine. It doesn't take long to have an effect on HPU oil. This leads to unpredictable valve performance, fluctuating MW output, and ultimately turbine trips. It's bad enough these valve are almost always butterflies that have no modulating qualities, but add into the equation hydraulic actuators using contaminated oil, and operators will not have an easy time maintaining turbine speed.

The components most sensitive to poor quality oil are the servo/proportional valves used to move the actuators to position. The small working clearances and precision movements required for proper control, make these hydraulic elements extremely sensitive to contaminants. Many hours are spent troubleshooting systems, compounded by the massive expense of constant oil based maintenance.

SOLUTION: REXA [Electraulic™ Actuation](#) offers a responsive and dependable solution for Geothermal Steam Turbine Governor Control Valve applications. Designed for continuous modulating service, the patented self-contained, closed loop, hydraulic circuit provides stiff, stable control in the harshest conditions (-40°F to +250°F). The closed hydraulic system requires no filters, and does not require any oil based maintenance. A dedicated microprocessor control enclosure operates the drive unit, and is usually located in a convenient area. Set-up and calibration is made simple through a membrane key pad on the enclosure cover. Performance is unmatched in the industry with adjustable dead-band to 0.05% of stroke, resolution of <0.1% and frequency

response of 1.5 to 5.0 Hz. Standard product offerings are fail to position or fail in place, as well as rapid full stroke speeds (< 2 seconds) with no hysteresis or overshoot. Fail Safe options include a simple, reliable, and compact mechanical spring module, or a nitrogen charged piston accumulator system for higher outputs and longer strokes.



RESULT

A geothermal plant operator will notice improved reliability and control of the governor steam valves immediately. The REXA actuator positioning will track control signals precisely, with a 90 Ms dead time, and repeatability of <0.1%. Steam supply to both sides of the turbine can be easily balanced, allowing maximum MW output to the grid. Maintenance costs are also greatly reduced, eliminating the need for expensive servo valves and filter systems.

Since the REXA oil system is self-contained and positive pressure sealed, no oil maintenance is required. When it comes to reliability, choose to Rely on REXA.

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