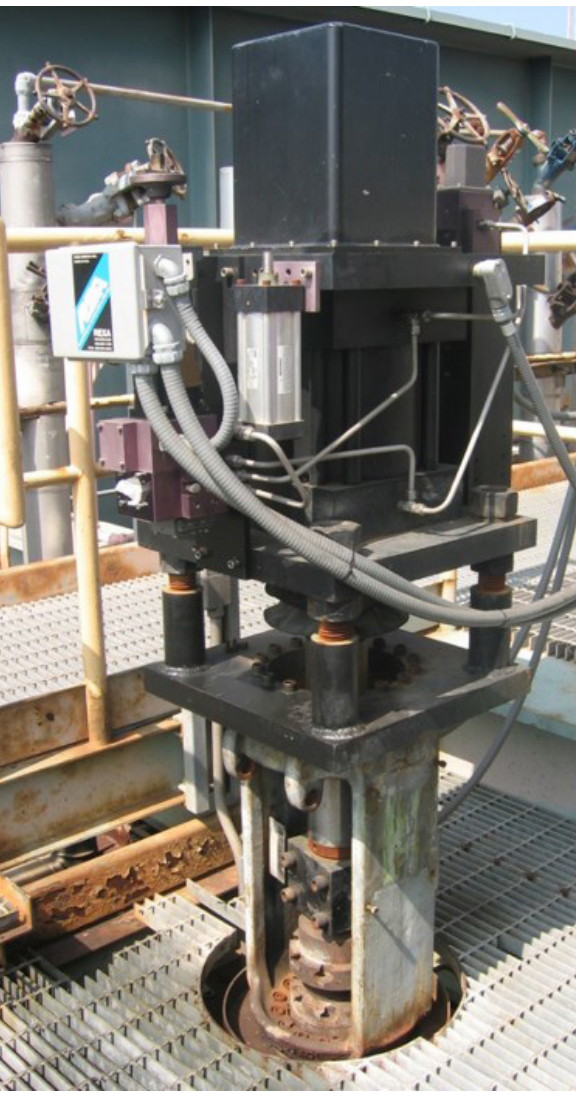
POWER

SUPERCRITICAL PLANT **STARTUP CONTROL**



Background: Coal fired Supercritical Power Plants are an integral component of the strategy for many generation companies. With a higher pressure/temperature range near 4300 psi and 1100°F, supercritical plants operate more efficiently than their subcritical counterparts. Whether an older design base load plant is now called upon to cycle more often, or a newer Supercritical plant designed to do so, it is imperative that the startup system perform at optimal levels. Without the additional stored water and steam volume available in most subcritical boilers, large step changes don't come easily in supercritical plants. But with thinner walled components and smaller storage capacity, shorter startup times are more common.

The various startup systems from each boiler manufacturer all serve a common purpose to provide an orderly sequence to synchronize and roll the turbine. This involves maintaining a constant flow through boiler tubes to prevent overheating, and to keep the pressure above the saturation point, to prevent flashing.

Key to success: for bringing up boiler pressure and temperature during startup, is to effectively use and control the bypass system. Without the added steam and water storage capacity of a subcritical plant, stable enthalpy levels in the flash tank play an important role for ramping in a minimum amount of time. Directing steam through the turbine bypass valves to the condenser, also allow better temperature matching for the turbine.

Problem: With a complicated startup system and operational sequence, any valve positioning problem can increase ramp times significantly,

and lower operational availability of a steam turbine compared to subcritical units. Electro-mechanical actuators found in most supercritical plants are the root cause due to poor accuracy, repeatability, and are unable to track control signal position. During initial firing, it's important that level control valves allow the deaerator to build pressure as quickly as possible, then accurately control the flash tank or separator level. Superheater bypass valves are then required to throttle at minimum positions to maintain temperature. When the turbine bypass valve begins to warm the steam lines, the actuator cannot hunt around the set point due to over shoot and under shoot. Thus problems will cascade back into the flash tank and other level control valves. Once steam is admitted to the turbine, a delicate balance of enthalpy is required to maintain the flash tank level/pressure, deaerator pressure, and flow through the primary superheater. Sticking or leaking valves can delay transfer of steam to the secondary superheater, and subsequent turbine load increases. As steam pressure builds, the flow to the flash tank decreases, until it is warmed only in the event of overpressure relief. When transfer to once through operation is complete, it is critical that high differential pressure superheater bypass valves remain tightly shutoff, as boiler efficiency can be affected.

Solution: REXA Electraulic™ Actuation offers a responsive and repeatable control solution for Supercritical Plant Startup 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 and no oil based maintenance. A dedicated microprocessor control enclosure operates the drive unit, and is usually located in a convenient area. Setup and calibration is made simple through a membrane keypad 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 options allow for fail to position or fail in place, as well as rapid full stroke speeds (< 2 seconds) with no hysteresis or overshoot.

Result

A supercritical plant operator will immediately notice smooth ramping startup valves that don't jump, stick, or overshoot. Putting a startup valve into auto mode for the first time is not uncommon. The ability to throttle bypass and level control valves at minimum travel becomes normal, thanks to 70mS deadtime, and a resolution of <0.1%.

Most importantly, once these valves are moved to the closed position, Rexa's hydraulic lock keeps them there with full seat load, reducing erosion, and maintenance costs for expensive trim parts.

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