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REPLACEMENT TURBINE BYPASS VALVE ADDRESSES CRITICAL TRIP CONDITIONS

An 800 MW combined cycle power plant in the UK had experienced repeated issues with their high pressure turbine bypass valves in full-load trip conditions. If the plant tripped under full load, the valves would not operate properly and would cause the gas turbines to trip off-line as well. In this configuration, the high pressure steam (130 bar) dumps directly to an air cooled condenser and is used during startup to warm the condenser and maintain condenser vacuum and to bypass steam flow to the condenser in the event of a steam turbine trip. The existing valves were replaced with two Fisher CVX steam conditioning valves with 132mm ports and 1066mm outlets.

Turbine bypass applications are the most critical valves in a combined cycle power plant. Given the large flows and high pressure drop, noise generation is also a concern. The CVX design (Figure 1) stages the pressure drop across a series of internal diffusers that lower the turbulence in the outlet of the valve body thus lowering the valve noise. The forged body design also readily fits nearly any piping system.

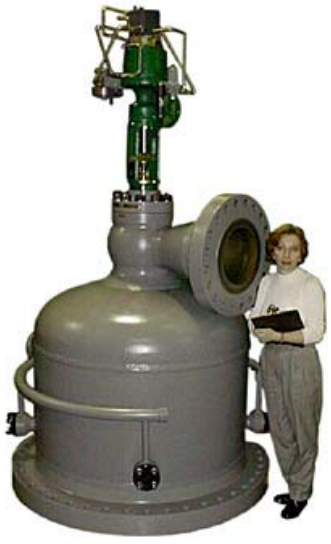

Figure 1: CVX Turbine Bypass Valve

After installation, the valves performed flawlessly during the startup of the boiler. Before installation, the typical cold start-up procedure would take up to 14 hours. After installation of the CVX valves, the start-up time was reduced to two hours.

In order to test the ability of the valves to control under a full load turbine trip, a simulated trip was planned. However, the plant had an unplanned trip two days after installation. The bypass valves performed exactly as anticipated and one of the gas turbine/boiler trains was able to continue its operation due to the fast and accurate control of the valves. The plant manager confirmed that had the previous valves been in place, the entire plant would have tripped.

DST ADDRESSES PLUGGED BOILER FEEDWATER STARTUP VALVE

Several years ago, a 450 MW Michigan power plant experienced repeated issues with plugged cages in their boiler feedwater startup valve. The valve utilized a small passage, anti-cavitation trim to address the high pressure drops experienced during startup. However, the valve would plug in a matter of months, usually providing less than three months of operation before the plugging would reduce capacity to the point of affecting plant operation.

This is a common issue seen in many older power plants that experience debris in the feedwater lines. Most anti-cavitation trims rely upon small passages to eliminate the potential for cavitation. As can be seen in this example, in many older plants, or new plants going through startup, these types of trim can make for great strainers.

In order to address this issue, the plant turned to Fisher. A solution was developed that incorporated large passages that allowed the entrained particulate to pass while also providing pressure staging to eliminate the formation of damaging cavitation. The Dirty Service Trim, commonly referred to as DST, has been used repeatedly in applications where plugging and subsequent capacity restriction are concerns.

The DST design uses combined axial and radial flow paths that feature large openings that allow particulate up to ¾" in diameter to pass while also eliminating the potential for velocity induced erosion.

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The DST (Figure 2) also incorporates a protected seat design that separates the shutoff and throttling locations. All significant pressure drop is taken downstream of the seating surface. As a result, the seating surfaces are not worn away by throttling control action.

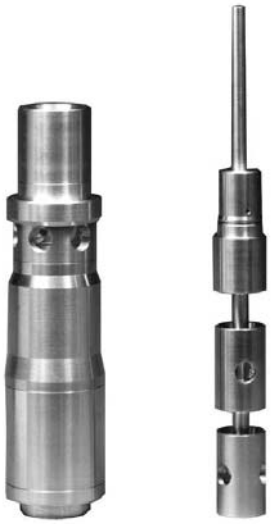

Figure 2: Dirty Service Trim

Since trim installation in 1996, the valve has yet to be opened. There have been no issues with a reduction in capacity or with leakage through the valves.

WHISPERFLO® RETROFIT ADDRESSES ISSUES WITH BYPASS VALVE

A large turbine bypass valve at a New England pulp and paper mill was a repeated source for maintenance activities because of poor control, vibration and leakage. The existing 24" globe valve was used to bypass 500 psi steam around a steam turbine to condenser. The existing valve did not incorporate any method of noise attenuation, which led to pipe vibration and failure of actuator accessories.

Because the existing valve was welded in line, the cost of a total valve replacement was prohibitive. However, the Fisher Severe Service Team proposed the use of noise attenuating trim within the existing valve body.

The solution was the proven WhisperFlo noise abatement trim. WhisperFlo (Figure 3) is a multi-path, multi-stage noise abatement technology that can reduce noise by up to 40 dBA, surpassing conventional noise trims by 10 dBA.

Figure 3: WhisperFlo Trim in Production

The mill worked with the Fisher design team to obtain measurements of the existing valve trim and the internal dimensions of the valve body. With this information, the WhisperFlo trim was designed to drop into the existing valve.

In order to provide better overall control, the valve was also retrofitted with a new actuator that was designed to mount directly onto the existing valve bonnet. The new actuator incorporated an accessory package that provides fast stroking capabilities along with minimal overshoot and tight control.

In this case, the cost associated only with removing the existing valve and installing a new valve justified the cost of the retrofit. Coupled with the improvements in performance and shutoff, the plant is confident that WhisperFlo will solve the problem.