Flowserve – Anchor Darling
BWR RCIC Steam Valve Upgrade

BWR RCIC Steam Inlet Valve Upgrade

Problem

Quick opening trim on a conventional globe valve resulted in too much flow at low opening heights that caused turbine driven pumps to trip on an overspeed signal.

Solution

Install characterized trim in the globe valve resulting in flow rates that are proportional to the opening height of the valve.

Abstract

BWR's are designed with a Reactor Core Isolation Cooling (RCIC) system in order to supply the core with water in the event that coolant was unavailable through the normal feedwater lines.

Steam from the main steam lines is used to supply a turbine that drives the RCIC pump. The pump takes suction from either the condensate storage tank, the RHR heat exchangers, or in an emergency, from the suppression pool, and then discharges it into the vessel through a connection in the vessel head.

A valve is installed just upstream of the RCIC turbine stop valve to act as a block to keep steam from entering the turbine. Immediately upstream of the block valve is a steam trap. The trap keeps the line upstream of the block free of condensate and full of steam. This ensures that when the block valve is opened, steam is immediately available to roll the turbine.

The plant designers specified this valve as a four-inch or six-inch globe with quick-opening trim. A very small movement of the stem supplies a very large amount of steam.

Plant operators have always had difficulty in getting the turbine on line. With even the greatest care on the part of the operator, lack of resolution in the valve trim results in a large volume of steam entering the turbine. The large volume of steam causes the turbine to trip on overspeed before enough oil pressure can be built up in the governor valve.

In an attempt to improve the situation, the NSSS designer issued a service letter recommending that a small bypass be installed around the block valve. Opening of the bypass would provide a small enough mass of steam to roll the turbine and build up oil pressure in the governor valve without overspeeding the turbine.

While this modification has helped the operators in those plants where it has been installed, the small valves used as the bypass have been very prone to leakage. In addition, some plants have hesitated to install it because of the cost.

A much simpler solution is available. Flowserve Anchor/Darling Valves supplied the majority of these steam block valves. Once aware of the problem, we determined there was a readily available remedy for the plants with Anchor/Darling valves as well as valves from other manufacturers.

The quick-opening trim of the main block valve can be easily replaced with a set of trim that is characterized to provide the desired resolution. One plant has already installed new trim that will provide the desired amount of steam for the first 50 percent of stem travel and then an appropriate increase thereafter. This has enabled them to solve the problem without changing any logic or motor actuator gearing or timing, thus saving thousands of dollars in engineering costs.

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