

BUILDING A TEST SYSTEM THAT CAN ASSESS CRITICAL DYNAMIC PERFORMANCE CONDITIONS

THE CHALLENGE

Typical high-speed turbine bypass valve applications use a balanced trim to avoid the significant pressure imbalances inherent in turbine bypass operations. That trim inherently leaks, losing hundreds of thousands of pounds of steam over the operational life of the valve normally spanning several years, wasting energy that would otherwise generate valuable electricity.

The solution is a pilot-balanced trim, but how can the operational dynamics be counteracted without costly hydraulic actuation?

THE SOLUTION

CIRCOR partnered with a U.S. based consulting engineering services company, Stress Engineering, to design and build a test system that could assess a critical dynamic performance condition before installing in a power plant. The system was developed using large diameter piping, with an operational pressure up to 2,100 psig and charged with nitrogen at up to the maximum design pressure of the valve. First, a valve and actuator configuration with actual power plant data was tested at pressures and cycle times identical to those experienced in a customer's power plant. This data provided a direct comparison between the test system and the customers' system and validated the test system's ability to duplicate the valve, pneumatic and control system dynamics in the field.

THE RESULTS

The initial tests successfully duplicated the conditions observed in the field. A specially-designed, tight-shutoff, pilot-balanced valve with a custom pneumatic actuator and controls was then tested, and stable performance was verified at several pressures up to full design pressure of 650 psig and valve positions up to full open (100% of valve stroke) at stroke speeds of less than three seconds. The tests were successfully repeated at maximum design pressure for posterity, while high-speed video and data acquisition at 10KHz captured the behavior and internal dynamics.

This proven design solution will improve overall plant efficiency with reduced steam loss, while still meeting the high-speed, stable, and long-stroke performance requirements necessary for critical service, turbine bypass applications. CIRCOR's significant investment and unwavering customer commitment also provides a test bed with which to validate future configurations and technologies and is a key part of our on-going product development efforts to further improve performance, reliability, and efficiency in power generation.



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