



*Flowserve – Anchor Darling  
RHR Shutdown Cooling Suction Valves*

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## Problem

Flex-wedge and solid-wedge type gate valves installed in Residual Heat Removal (RHR) shutdown cooling suction lines that fail to open due to thermal binding.

## Solution

Flowserve Anchor/Darling Double-Disc Gate valves – a design that is impervious to thermal binding.

Containment isolation valves in the RHR Shutdown Cooling Suction lines have been the source of significant maintenance and operating problems in all Boiling Water Reactors (BWR). Efforts to initiate shutdown cooling have frequently been thwarted by the inability of the operators to open the suction valves. Signals to open were met with tripped torque switches and, in some cases, burned out motors. Even attempts to declutch the actuator and manually open the valves were often unsuccessful. One plant routinely applied heat to a stuck valve after finding this allowed the valve to open. Other plants have replaced original actuators with much larger actuators.

In addition to operational problems, these valves have required frequent maintenance. Because they are containment isolation valves, they are subject to local leak rate testing (LLRT). It is very common for these valves to fail their type “C” tests and have to be disassembled for repair. Inspection typically reveals that either the disc or seat (or both) are cracked and require repair or replacement.

Since the majority of valves in this service were Flowserve Anchor/Darling flex-wedge gates, we investigated the root cause of these problems. After discussing the problem with system engineers, operators and maintenance personnel, Flowserve became convinced these valves were becoming thermally bound. The fact that applying heat to the valves caused them to become “unstuck” convinced us that our diagnosis was correct. The presence of radial cracking on the Stellite sealing surfaces of the discs and seats in valves that failed LLRTs is an additional sign these valves were becoming thermally bound.

Thermal binding is not a new issue. The Naval Reactors Program was aware of the problems decades ago and consequently avoided using wedge gate valves in safety-related applications. They installed double-disc gate valves, which are immune to thermal binding in all their primary systems. Likewise, several BWR owners have replaced their problem-plagued shutdown cooling suction flex-wedge gate valves with Anchor/Darling double-disc gate valves and found their operational and maintenance problems have been greatly reduced.

The publication of NRC Generic Letter 95-07 focused even more attention on thermal binding issues. If your BWR has a history of problems with RHR Shutdown Cooling Suction Valves and you would like information on a proven solution, contact your Anchor/Darling Valves Regional Manager.



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