



*Flowserve – Anchor Darling
RWCU Suction Containment Isolation Valves*

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Problem

Wedge-type gate valves installed in Reactor Water Clean Up (RWCU) systems that fail to open due to thermal binding.

Solution

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

The containment isolation valves in the suction lines from the reactor recirculation piping to the Reactor Water Clean Up (RWCU) System have been frequent maintenance problems at most BWR plants. The valves regularly fail local leak rate tests (LLRT) and subsequently are disassembled for repair.

Almost universally, inspection reveals damage to the disc and/or seat sealing surfaces. In many instances, the hardfacing is cracked so badly that complete replacement of the disc and seat rings is necessary.

Because Flowserve Anchor/Darling Valves has supplied the majority of the valves in this service, we have been studying the problem since it was first identified. In that all of the

valves were of the wedge gate design and the failure mechanisms (hardface cracking) were symptomatic of thermal binding, we immediately focused on that aspect. However, in talking to system engineers, we were unable to identify a scenario whereby the thermal binding could occur.

The RWCU suction valves are open virtually all the time, during both power operations and refueling. In order for the thermal binding to occur, there had to be a mode during which the valve cooled down while in the closed position.

We recently were supplied with the key to the puzzle. The RWCU suction containment valves, upon receiving an isolation signal (generated by either a high system temperature, a high system pressure, low reactor vessel level or SLC initiation), are automatically signaled to close. As a result of instrumentation problems, these valves are frequently given spurious signals and isolate during normal power operations.

Because it generally takes some time for the signal to be cleared, the valves can remain closed for several hours. In the absence of flow, the valves cool down and quite often these wedge-type gate valves become thermally bound. During attempts to reopen the valves, the wedge (under severe compressive loads) deflects and the less ductile hardfacing cracks.

As in other instances of thermal binding, the problem lies with the use of a wedge-type gate valve for this service. Although there is sufficient flexibility in some flex-wedge and split-wedge designs to allow the valve to be reopened (as opposed to solid wedge designs which will stay stuck until reheated), the sealing surfaces are almost always damaged in the process.

In contrast, Anchor/Darling's double-disc gate valve with its unique, collapsible wedging mechanism is quite immune to thermal binding. In thousands of containment isolation applications and most importantly in RWCU suction service, Anchor/Darling double-disc gate valves have been subjected to thermal transients and continue to pass LLRT requirements.



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