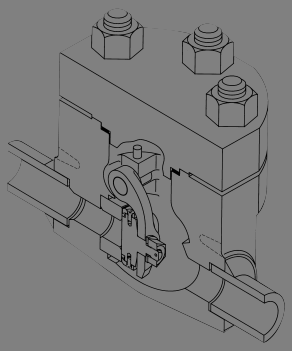

Dual-Seat Check Valve

FCD ADAMS8009-01

For Isolation Service

Repeated valve failure during air or nitrogen local leak rate testing (LLRT) has contributed significantly to the maintenance burden and extension of critical paths during refueling outages at BWR and PWR plants.

Frequently, check valves repaired in a previous outage will require extensive rework to achieve satisfactory test results. Even during a single outage, some check valves have required a rework of the seats several times before they could meet the technical specifications established by the NRC in their directive 10CFR50, Appendix J.

Recently the NRC has given consideration to increasing the frequency of LLRT performance. If approved, this would result in additional maintenance by BWR and PWR plants to assure that leakage from conventional check valves has been eliminated.

Conventional Check Valve Problems

Under normal system operating conditions, proper sealing of conventional check valves occurs due to high operating pressure (up to 1000 psi for BWRs and 2200 psi for PWRs). When the same valves are subjected only to low containment pressures, the pressure acting on the disc is inadequate to provide sufficient force for proper sealing of the metal seat.

To obtain effective sealing at containment pressure levels, seat widths were narrowed to increase the unit loading over a thinner sealing band. However, the resultant higher unit loading during normal operation caused the base material under the hardfacing to fail in compression. This resulted in distorted seating surfaces and leakage.

Flowserve Anchor/Darling Valves Dual-Seat Design

The dual-seated check valve designed by Anchor/Darling Valves provides leak-free sealing capabilities for both low and high differential pressure levels.

For low differential pressure during LLRT, a secondary seat utilizing resilient elastomers has been added. Containment pressure acting against the underside of the elastomer sealing ring causes it to deform slightly so as to push the outer face against the seat ring and thereby achieve closure (Figure 1).

Under the higher differential pressures experienced in normal operation, the relief in the base of the elastomer seal allows it to deform sufficiently to permit Stellite-to-Stellite sealing of the disc and body (Figure 2).

Anchor/Darling's design of the elastomer seat eliminates the possibility of compression, i.e., permanent deformation, or blowout under normal operating pressures.

A recent alternative proposal suggests that a resilient O-ring installed in a dovetailed groove can eliminate leakage during LLRT. When subjected to high unit loading conditions in normal operations, this design will either experience seat compression or allow sufficient pressure behind the O-ring to eventually wash the material out of the groove.

In 1976 and 1977, the inboard and outboard feedwater check valves in Boston Edison's Pilgrim Station were modified with the Anchor/Darling seat design. After three years of use, the dual-seat check valves have passed all annual containment isolation testing.

By eliminating the need for disassembly and rework, this valve's design has established a new level of reliability for isolation check valves. It should be considered in upcoming modification, retrofit, and new installation programs.

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Anchor/Darling Valves

Figure 1 – Low Differential Seating

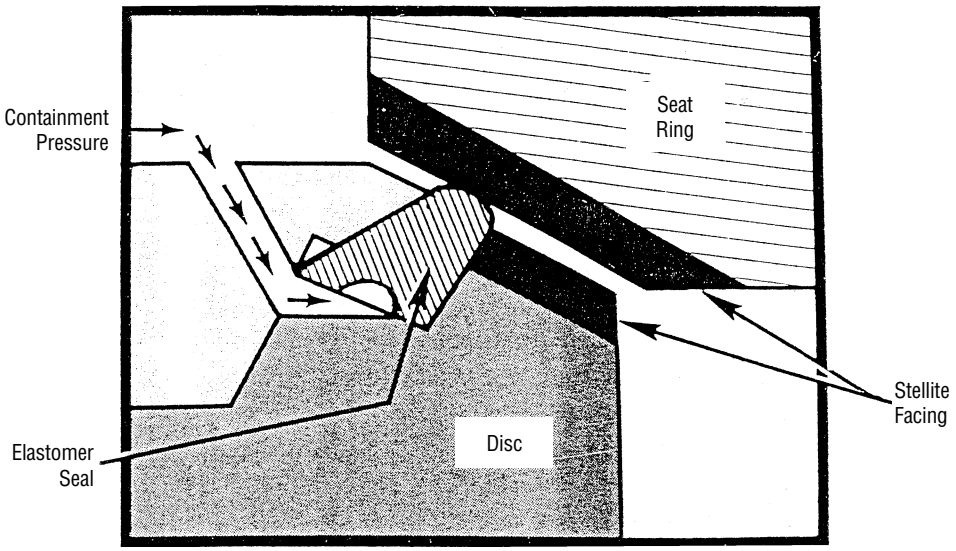
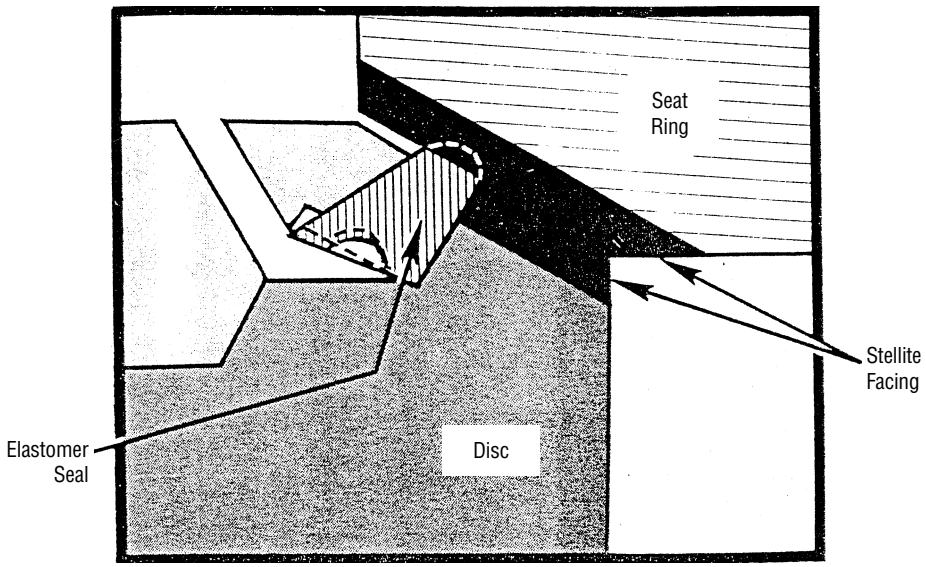


Figure 2 – Typical High Differential Seating



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