

Pressure Locking and Thermal Binding (Question 5-1)

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Regulatory Requirements for Design-Basis Capability of Safety-Related Power-Operated Valves

- 10 CFR Part 50, Appendix A, General Design Criteria for Structures, Systems, and Components (SSCs) Important to Safety
- 10 CFR Part 50, Appendix B, Quality Assurance Criteria for Safety-Related SSCs
- 10 CFR 50.55a on inservice testing of ASME Code valves
- 10 CFR Part 52 for Design Certification and Combined License (COL) applications

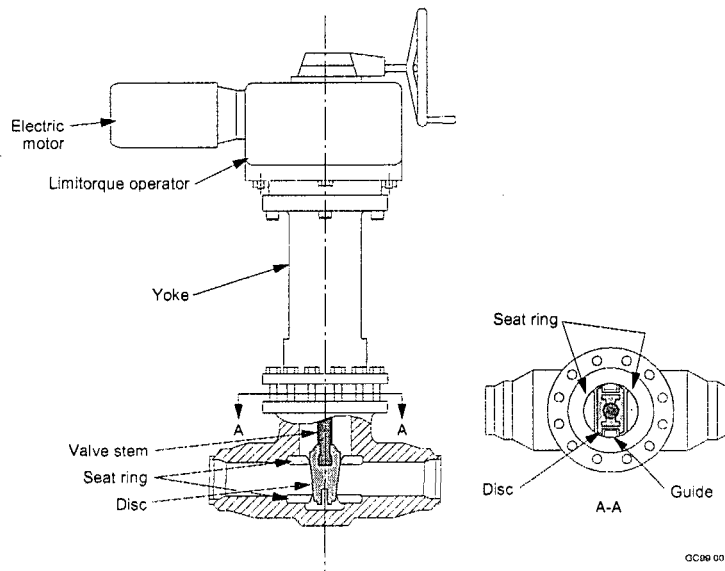
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Pressure Locking and Thermal Binding of Gate Valves

- Pressure locking can occur in a flexible-wedge or double-disk gate valve when the bonnet pressure is higher than line pressure on both sides of the valve
- Thermal binding can occur when a solid- or flexible-wedge gate valve is closed at high temperature and is allowed to cool such that mechanical interference occurs because of contraction of valve body onto disk wedge
- Pressure locking and thermal binding can prevent a valve from opening to perform its safety function

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Motor-Operated Flexible-Wedge Gate Valve



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Operating Experience with Pressure Locking and Thermal Binding

- NUREG-1275, Vol. 9 (March 1993), "Pressure Locking and Thermal Binding of Gate Valves," provided history of pressure locking and thermal binding
- Additional pressure locking and thermal binding problems occurred at operating plants as documented in NRC Generic Letter 95-07 and Information Notices
- In addition to U.S. operating experience, NUREG/CP-0137 (July 1994), "Proceedings of the Third NRC/ASME Symposium on Valve and Pump Testing," included a presentation on pressure-locking events at nuclear power plants in France

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NRC Research Activities

- NRC sponsored research documented in NUREG/CR-6611 (May 1998), "Results of Pressure Locking and Thermal Binding Tests of Gate Valves"
- Test valves included six-inch Walworth flexible-gate valve and six-inch Anchor/Darling double-disc gate valve
- Both valves determined to be susceptible to pressure locking
- No significant thermal binding found for these valves, but previous test program had identified thermal binding

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Regulatory Communications

- GL 95-07, "Pressure Locking and Thermal Binding of Safety-Related Power-Operated Gate Valves," requested licensees to perform
 - (1) evaluations of operational configurations, and
 - (2) analyses and corrective actions to ensure that safety-related power-operated gate valves are capable of performing their safety functions
- NRC issued NRC Information Notices on pressure locking, such as IN 88-72, 92-26, 95-14, 95-18, 95-30, 96-08, and 97-40

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Industry Actions

- U.S. nuclear power plants implemented actions recommended in GL 95-07
- Potential for pressure locking and thermal binding of safety-related power-operated gate valves evaluated at each nuclear power plant
- Corrective actions for pressure locking included use of pressure locking methodologies, procedure revisions, and valve modifications
- Corrective actions for thermal binding included thermal binding threshold evaluations, procedure revisions, and valve modifications

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Results of NRC and Industry Activities

- All U.S. nuclear plants have completed GL 95-07 programs
- NRC prepared safety evaluation reports on GL 95-07 response at U.S. plants
- Lessons learned from valve pressure locking and thermal binding included in qualification process in ASME Standard QME-1-2007, "Qualification of Active Mechanical Equipment Used in Nuclear Power Plants"
- NRC considering acceptance of ASME QME-1-2007 in revision to Regulatory Guide 1.100

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Expectations for New Reactors

- Design Certification applications should consider pressure locking and thermal binding for safety-related power-operated gate valves in the design process
- COL applications need to demonstrate that potential pressure locking and thermal binding included in the design process for power-operated gate valves
- NRC reviews consideration of pressure locking and thermal binding for power-operated gate valves in Design Certification and COL applications

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