

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555

August 30, 1989

NRC INFORMATION NOTICE NO. 89-61: FAILURE OF BORG-WARNER GATE VALVES TO
CLOSE AGAINST DIFFERENTIAL PRESSURE

Addressees:

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose:

This information notice is intended to alert addressees to potential problems resulting from Borg-Warner gate valves with air or motor actuators failing to close against differential pressures. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

On March 14, 1988, a motor-driven auxiliary feedwater (AFW) pump discharge isolation motor-operated valve (MOV) failed to fully close against a differential pressure of 1800 psi at Catawba Nuclear Power Plant, Unit 2. The valve failed while an AFW piping flush was being performed. At the time of the failure, the reactor was shut down and the steam generators were in hot standby. The failure of the MOV to fully close was a contributing factor that led to overfilling steam generator 2A and resulted in an automatic feedwater isolation. The licensee, Duke Power Company, investigated the failure and reported (Licensee Event Report No. 414/89-10) the cause to be a higher valve factor than originally specified by the valve manufacturer, Borg-Warner, for sizing valve actuators. The valve factor is the term which is multiplied by the valve seat area and the differential pressure across the valve to calculate one of the parameters used in the standard valve thrust formula. If a low valve factor is used when sizing the valve air or motor actuator, the calculated required valve thrust will also be low. This results in low torque switch settings being specified and, in some cases, can result in undersized air or motor actuators.

Discussion:

The AFW MOV that failed to close against 1800 psi, 2CA62A, was a Borg-Warner 4-inch, 1500-psi, flexible wedge, carbon steel gate valve with a pinned body

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guide insert ring disk guide. Actuation of the torque switch stops the motor when the valve is closed and fully seated. The torque switch was not bypassed in the closing direction. Following the March 14, 1988, failure to close, the valve was diagnostically tested and the switch settings were found to be within specified tolerances. Since no problems were found with the torque switch settings, the valve was retested at 1800 psi differential pressure and again failed to fully close. In order to get the valve to fully close at 1800 psi differential pressure, the closed torque switch setting had to be increased to the maximum allowed by the manufacturer's design calculations. During the subsequent refueling outage, the valve was disassembled and inspected by the licensee in order to determine what was creating the excessive friction between the disk and seat rings. The inspection did not reveal any damage or conditions that would have caused excessive friction.

In November 1988, Duke Power Company performed differential pressure testing on an MOV identical in design to 2CA62A. This testing was performed on a test loop at the Riverbend Steam Station. During the testing, valve signature analysis was obtained. This testing resulted in higher than anticipated seating loads at high differential pressure conditions, and the valve failed to close on two of the tests completed with differential pressures greater than 1500 psi.

In November 1988, four Catawba Nuclear Power Plant Unit 1 AFW MOVs, identical in design and size to 2CA62A, were differential pressure tested at 1800 psi. All four valves indicated intermediate position after being closed during the test and were 1/8 inch to 1/2 inch from the fully closed position. The test results identified that all four valves failed to wedge completely shut. One valve did not close enough to shut off flow.

In March 1989, valve 2CA62A and three identical Unit 2 AFW MOVs were differential pressure tested at 1800 psi. During the test, the three Unit 2 identical valves failed to completely close and isolate flow. All four valves failed to wedge completely shut. Valve signature analysis test data obtained during this testing yielded closing valve factors ranging from 0.38 to 0.74 and were different for each valve tested. These were higher than the 0.3 valve factor utilized by the valve manufacturer to size the actuators.

Testing performed by Duke Power Company on carbon steel valves similar in design to 2CA62A has yielded opening valve factors ranging from 0.48 to 0.67. Testing performed by Duke Power Company on stainless steel valves similar to 2CA62A has yielded valve factors ranging from slightly higher than 0.3 to 0.5.

Based on Duke Power Company testing, the valve factor of 0.3 originally utilized for Borg-Warner flexible wedge carbon steel or stainless steel gate valves with pinned body guide insert rings when sizing air or motor actuators was not correct. The actual valve factors, as measured by Duke Power Company, vary from valve to valve but are consistently above 0.3. This results in the potential that air- or motor-actuated valves will not operate against a differential pressure when called upon to do so because of inadequate torque switch settings or undersized actuators.

Related Generic Communications:

The general concern of the ability of motor-operated valves to function properly when subjected to the design basis loadings has been previously addressed in NRC Bulletins 81-02, "Failure of Gate Type Valves to Close Against Differential Pressure," and 85-03, "Motor-Operated Valve Common Mode Failures During Plant Transients Due to Improper Switch Settings;" Circular 77-01, "Malfunctions of Limitorque Valve Operators;" Information Notices 81-31, "Failure of Safety Injection Valves to Operate Against Differential Pressure," and 85-50, "Complete Loss of Main and Auxiliary Feedwater at a PWR Designed by Babcock & Wilcox;" and Generic Letter 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance."

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact the technical contact listed below or the appropriate NRR project manager.

Charles E. Rossi

Charles E. Rossi, Director
Division of Operational Events Assessment
Office of Nuclear Reactor Regulation

Technical Contact: S. Tingen, RII
(404) 331-2603

Attachment: List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
88-48, Supp. 2	Licensee Report of Defective Refurbished Valves	8/22/89	All holders of OLS or CPs for nuclear power reactors.
89-60	Maintenance of Teletherapy Units	8/18/89	All NRC Medical Teletherapy Licensees.
89-59	Suppliers of Potentially Misrepresented Fasteners	8/16/89	All holders of OLS or CPs for nuclear power reactors.
89-58	Disablement of Turbine-Driven Auxiliary Feedwater Pump Due to Closure of One of the Parallel Steam Supply Valves	8/3/89	All holders of OLS or CPs for PWRs.
89-57	Unqualified Electrical Splices in Vendor-Supplied Environmentally Qualified Equipment	7/26/89	All holders of OLS or CPs for nuclear power reactors.
89-56	Questionable Certification of Material Supplied to the Defense Department by Nuclear Suppliers	7/20/89	All holders of OLS or CPs for nuclear power reactors.
89-45, Supp. 1	Metalclad, Low-Voltage Power Circuit Breakers Refurbished With Substandard Parts	7/6/89	All holders of OLS or CPs for nuclear power reactors.
89-55	Degradation of Containment Isolation Capability by a High-Energy Line Break	6/30/89	All holders of OLS or CPs for nuclear power reactors.
89-54	Potential Overpressurization of the Component Cooling Water System	6/23/89	All holders of OLS or CPs for nuclear power reactors.
89-53	Rupture of Extraction Steam Line on High Pressure Turbine	6/13/89	All holders of OLS or CPs for nuclear power reactors.

OL = Operating License
CP = Construction Permit

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This information was received from Region II as an attachment to AFGibson's memorandum to CERossi dated July 12, 1989.

*SEE PREVIOUS PAGE FOR CONCURRENCE

*OGCB:DOEA:NRR RJKiesel 08/8/89	*RII STingen 07/12/89	D/DOEA:NRR CERossi 08/24/89 *RII AFGibson 07/12/89	*C/OGCB:DOEA:NRR CHBerlinger 08/23/89 *C/EMEB:DEST:NRR LBMarsh 08/10/89	*RPB:ARM TechEd 08/8/89 *EAD/DEST:NRR JERichardson 08/11/89
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