

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

December 17, 1993

**NRC INFORMATION NOTICE 93-97: FAILURES OF YOKES INSTALLED ON WALWORTH GATE
AND GLOBE VALVES**

Addressees

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

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to the potential for failure of the yokes installed on Walworth gate and globe valves. 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 are not NRC requirements; therefore, no specific action or written response is required.

Background

The actuator of each motor-operated valve (MOV) is supported by a yoke. The valve yoke maintains the actuator in position and prevents linear and rotational movement. The Walworth valve yoke is made of cast carbon steel and has a plate which supports the motor operator and yoke arms that attach to the valve body.

Description of Circumstances

On October 1, 1993, during a refueling outage, the licensee of Peach Bottom Atomic Power Station, Unit 3, notified the NRC resident inspector that it had discovered cracks in the yokes of several valves manufactured by Walworth. The cracks appeared to have originated in the transition between the plate and yoke arms. Attachment 1 is a sketch of a typical Walworth valve yoke showing the general location of the majority of the cracks.

In response to finding these cracks, the licensee inspected those MOVs in Peach Bottom Atomic Power Station, Unit 2, that were accessible during operation and found similar cracks in similar places. As a precaution, the licensee shut down Unit 2 in order to inspect all Walworth valve yokes.

The licensee found cracks in 9 of 62 Walworth valves of the pressure seal design with semicircular yoke legs. The licensee also inspected valves of other designs and confirmed that the cracking was limited to this type of

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valve. All of the cracked valves were safety-related components. The sizes of the cracked valves ranged from 4 inches to 24 inches.

The licensee determined that the cracking appeared to be due to a combination of three factors: (1) a yoke design which concentrated stress in the area of the cracks, (2) insufficient bolt torque, which increased the stress, and (3) existing casting defects. The licensee also stated that the failure mode appeared to be fatigue.

The licensee repaired the cracks by welding in accordance with the American Society of Mechanical Engineers Boiler and Pressure Vessel Code. When reinstalling yokes on valves that were disassembled for repair, the licensee torqued the valve operator mounting fasteners with sufficient preload to reduce joint flexing during valve operation.

Cracks in Walworth valve yokes have been reported twice before; however, these reports pertained to welded assemblies rather than to cast assemblies.

On July 8, 1988, the licensee of the Pilgrim Nuclear Power Station, Unit 1, notified the NRC (Licensee Event Report 88-017 and Revision 1 on July 3, 1989) of a crack in the yoke flange of an 18-inch Walworth pressure seal globe valve. The 270-degree crack originated in the flange-to-yoke leg weld joint. The licensee attributed the cause of the cracking to (1) high peak and discontinuity stresses in the flange-to-yoke weld, (2) low strength flange material, (3) numerous areas of poor fusion in the weld, and (4) higher-than-expected motor operator thrusts.

During construction, on October 1, 1973, the licensee of the Peach Bottom Atomic Power Station, Units 2 and 3, had notified NRC [10 CFR 50.55(e) report] of a crack in the weld between the yoke and the motor operator mounting plate of a 12-inch Walworth globe valve. The licensee stated that the area had cracked because the effective size of the fillet weld throat had been reduced by the unauthorized installation of shims between the yoke legs and the mounting plate. A copy of this report was attached to NRC Bulletin 74-01, "Valve Deficiencies."

Discussion

In Generic Letter (GL) 89-10, "Safety-Related Motor-Operated Valve Testing and Surveillance," the NRC staff asked nuclear power plant licensees to confirm the capability of safety-related MOVs to perform their intended functions by reviewing MOV design bases, verifying MOV switch settings initially and periodically, testing MOVs under design-basis conditions where practicable, improving evaluations of MOV failures and necessary corrective action, and trending MOV problems. In response to GL 89-10, licensees are implementing programs to evaluate the design-basis capability of MOVs within the scope of the generic letter, including the inspection of MOVs for deficiencies and defects.

Cracks in the valve yoke can result in the inability of the MOV to perform its safety function. For example, if the actuator is allowed to rotate or move linearly by a small amount, the stem can bind, decreasing efficiency in the conversion of torque to thrust and causing the actuator torque switch to trip prematurely. More severe movement could render the actuator unable to open or close the valve.

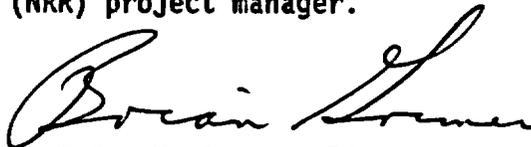
For valve yoke designs similar to those of the Walworth valves at Peach Bottom, the force delivered by the motor actuator may bend the support plate slightly and cause cracks to develop or propagate at the junction of the plate and yoke arms. Loose bolts will induce greater stresses in the yoke mounting flange area, which could greatly reduce the fatigue life of the yoke. This problem could result in common-mode failures affecting both redundant and diverse safety systems.

Although this notice addresses only the cracking of yokes on valves manufactured by Walworth, designs of other valve manufacturers may be susceptible to the development of such cracks. In addition to direct stress-related failures, the events above reveal that the use of high thrust settings can induce fatigue-related failures of MOVs.

Related Generic Communications

NRC has issued other generic communications on overstressing of MOVs. The most recent of these is NRC Information Notice 92-83, "Thrust Limits for Limitorque Actuators and Potential Overstressing of Motor-Operated Valves."

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.



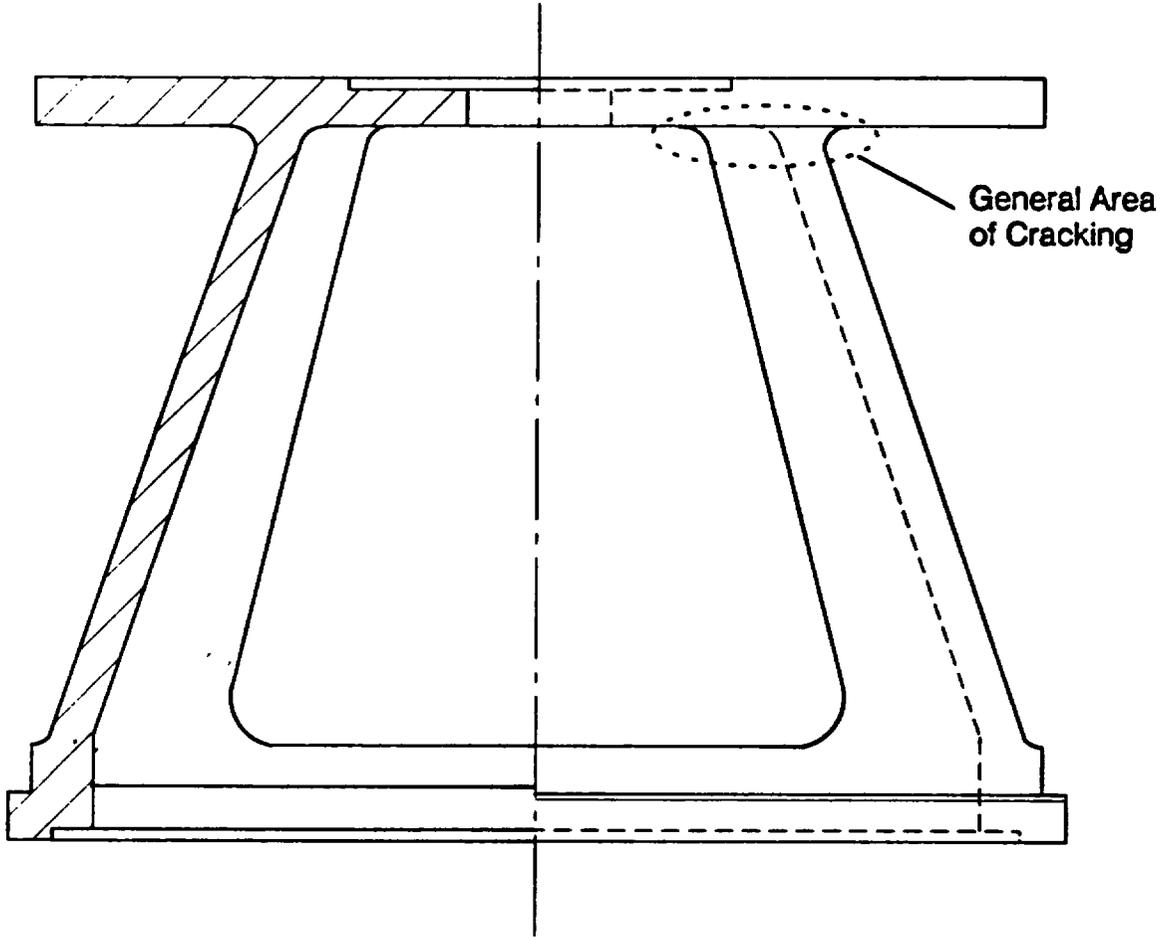
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Attachments:

1. Typical Walworth Valve Yoke
2. List of Recently Issued NRC Information Notices



Typical Walworth Valve Yoke

LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
93-96	Improper Reset Causes Emergency Diesel Generator Failures	12/14/93	All holders of OLs or CPs for nuclear power reactors.
93-95	Storm-Related Loss of Offsite Power Events due to Salt Buildup on Switchyard Insulators	12/13/93	All holders of OLs or CPs for nuclear power reactors located close to a large body of salt water.
93-94	Unauthorized Forced Entry into the Protected Area at Three Mile Island Unit 1 on February 7, 1993	12/09/93	All holders of OLs or CPs for nuclear power reactors.
93-93	Inadequate Control of Reactor Coolant System Conditions During Shutdown	12/08/93	All holders of OLs or CPs for nuclear power reactors.
93-92	Plant Improvements to Mitigate Common Dependencies in Component Cooling Water Systems	12/07/93	All holders of OLs or CPs for nuclear power reactors.
91-21, Supp. 1	Inadequate Quality Assurance Program of Vendor Supplying Safety-Related Equipment	12/07/93	All holders of OLs or CPs for nuclear power reactors and all recipients of NUREG-0040, "License Contractor and Vendor Inspection Status Report" (White Book).
89-77, Supp. 1	Debris in Containment Emergency Sumps and Incorrect Screen Configurations	12/03/93	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
CP = Construction Permit

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orig /s/'d by BKGrimes

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THIS IS THE TEXT ON THE CONCURRENCE SHEET FOR 93-97.IN
*See next page for previous concurrences.

CONCURRENCE PAGE FOR 93-97.IN

OFFICE	*EMEB/DE/NRR	*C:EMEB/DE/NRR	*OGCB/DORS/NRR	*Tech Ed
NAME	TGScarbrough	JANorberg	RJKiessel	RSanders
DATE	10/25/93	10/25/93	11/15/93	11/15/93
OFFICE	*D:DE/NRR	*EB/DRS/RI	*C:DE/DRS/RI	*D:DRS/RI
NAME	JTWiggins	PKEapen	JPDurr	MWHodges
DATE	12/02/93	11/29/93	11/29/93	11/29/93
OFFICE	*OEAB/DORS/NRR	*C:OEAB/DORS/NRR	C:OGCB/DORS/NRR	D:OGCB/DORS/NRR
NAME	NRHunemuller	AEChaffee	*GHMarcus	BGrimes
DATE	12/01/93	12/01/93	12/09/93	12/14/93

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