

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
OFFICE OF INSPECTION AND ENFORCEMENT  
WASHINGTON, D.C. 20555

May 14, 1985

IE INFORMATION NOTICE NO. 85-20 SUPPLEMENT 1: MOTOR-OPERATED VALVE FAILURES  
DUE TO HAMMERING EFFECT

Addressees:

All nuclear power reactor facilities holding an operating license (OL) or a construction permit (CP).

Purpose:

This supplement to IE Information Notice (IN) 85-20 is provided to alert recipients of additional information on a potentially significant problem pertaining to motor-operated valve failures caused by the hammering that may result when a fully closed (opened) valve continues to receive a close (open) signal at the valve operator. It is expected that recipients will review the information for applicability to their facilities and consider actions, if appropriate, to preclude a similar problem occurring at their facilities. However, suggestions contained in this notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Background:

IN 85-20 described a number of valve failures at the Dresden Nuclear Power Station Unit 2 and Quad Cities Nuclear Power Station Unit 1 sites. It identified a process by which the relaxation of torque on a closed valve would lead to repeated attempts to further close the valve as long as the valve operator continued to receive a valve-close demand signal. Such a continuing signal would occur if the plant operator held the control switch in the closed position or an emergency signal (i.e., containment isolation, etc.) was present.

Discussion:

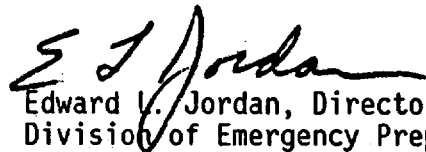
Subsequent conversations with several utilities and Limitorque Corporation, the manufacturer of the motor operators used on the valves identified in the information notice, have clarified the conditions under which this hammering effect can occur. The majority of valve motor operators manufactured by Limitorque use a self-locking worm-and-worm gear to drive the valve stem. In such installations, when the valve is fully closed, the Belleville washer is compressed and the torque switch opens, stopping the motor. The geometry of the worm gear tooth form prevents the worm from moving when the motor stops. Thus, the torque is maintained on the valve, the torque switch remains open, and hammering is prevented.

However, Limitorque also produces an actuator which uses a low-ratio worm gear that is not self-locking. This is generally associated with high speed valve applications. In this type of actuator, the worm may be repositioned by the energy stored in the compressed Belleville washers, which are located at one end of the worm. Because the operator essentially uses the position of the worm as an indication of torque, this movement of the worm closes the torque switch contacts. Thus, if a valve-close demand signal is still present, the motor will restart and attempt to further close the valve.

Table 1 provides a list of worm gear ratios that are not self-locking. Conversations with Commonwealth Edison confirmed that the valves identified in the information notice had high-speed operators on them.

Conversations with several utilities who were previously aware of this problem indicated that their normal design practice was to close on torque unless the valve had a high-speed operator. In such cases, they closed on valve position. However, now the current philosophy is to use a combination of torque and position to ensure closure while preventing hammering. Limitorque Corporation indicated that actuators without self-locking ratios and with a motor brake, generally do not experience this hammer effect. As noted in the information notice, Quad Cities was not aware of this in their change to the operator logic until after they removed the motor brake from the valves.

No specific action or written response is required by this information notice supplement. If you have any questions about this matter, please contact the Regional Administrator of the appropriate NRC regional office or this office.



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Division of Emergency Preparedness  
and Engineering Response  
Office of Inspection and Enforcement

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Attachments:

1. Table 1, "Worm Gear Ratios Which Are Not Self-locking"
2. List of Recently Issued IE Information Notices

TABLE 1 WORM GEAR RATIOS WHICH ARE NOT SELF-LOCKING

MODEL SMB OR SB SIZE	WORM GEAR RATIO
000	18 2/3 : 1
00	19 : 1
0	18 2/3 : 1
1	14.5 : 1
2	13.3 : 1
3	10.3 : 1
	16 : 1
4	12 2/3 : 1
	19 : 1
5	none

LIST OF RECENTLY ISSUED  
 IE INFORMATION NOTICES

Information Notice No.	Subject	Date of Issue	Issued to
85-36	Malfunction Of A Dry-Storage, Panoramic, Gamma Exposure Irradiator	5/9/85	All licensees possessing gamma irradiators
84-52 Sup. 1	Inadequate Material Procurement Controls On The Part Of Licensees And Vendors	5/8/85	All power reactor facilities holding an OL or CP
85-35	Failure Of Air Check Valves To Seat	4/30/85	All power reactor facilities holding an OL or CP
85-34	Heat Tracing Contributes To Corrosion Failure Of Stainless Steel Piping	4/30/85	All power reactor facilities holding an OL or CP
84-84 Rev. 1	Deficiencies In Ferro-Resonant Transformers	4/24/85	All power reactor facilities holding an OL or CP
85-33	Undersized Nozzle-To-Shell Welded Joints In Tanks And Heat Exchangers Constructed Under The Rules Of The ASME Boiler And Pressure Vessel Code	4/22/85	All power reactor facilities holding an OL or CP
85-32	Recent Engine Failures Of Emergency Diesel Generators	4/22/85	All power reactor facilities holding an OL or CP
85-31	Buildup Of Enriched Uranium In Ventilation Ducts And Associated Effluent Treatment Systems	4/19/85	All uranium fuel fabrication licensees
85-30	Microbiologically Induced Corrosion Of Containment Service Water System	4/19/85	All power reactor facilities holding an OL or CP

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OL = Operating License  
 CP = Construction Permit