

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

February 19, 1993

NRC INFORMATION NOTICE 93-16: FAILURES OF NUT-LOCKING DEVICES IN CHECK 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 problems found with the nut-locking devices in certain check 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.

Description of Circumstances

Trojan Nuclear Plant

On December 20, 1991, the Trojan Nuclear Plant was in mode 5, cold shutdown, for a refueling outage. Portland General Electric Company (the licensee) was conducting routine inservice testing of the residual heat removal (RHR) pumps. While testing the A RHR pump, operators noticed that indicated flow was lower than expected and the B RHR pump was rotating backwards, indicating the B RHR pump discharge check valve was leaking.

On January 21, 1992, the licensee inspected the B RHR pump discharge check valve. The licensee discovered the nut, washer, and lock wire which fasten the disk to the swing arm (see diagram, Attachment 1) were missing. On January 28, 1992, the licensee inspected the A RHR pump discharge check valve. The licensee discovered the nut was loose and the lock wire was broken, although the disk nut and washer were in place.

The licensee reported this event to the NRC, as a condition that alone could have prevented the fulfillment of the safety function of systems needed to mitigate the consequences of an accident. The licensee based this determination on the potential scenario of the discharge check valve disks for both trains separating from the swing arms, falling into the valve bodies, and impeding RHR flow.

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Vogtle Electric Generating Plant, Unit 1

On April 2, 1992, the Vogtle Electric Generating Plant, Unit 1, was operating at 100 percent power. Georgia Power Company (the licensee) reduced power to 65 percent when the internals of the "B" feedwater (FW) pump discharge check valve failed. The licensee inspected the check valve and discovered the valve disk and hanger assembly were not in place. Subsequently, the licensee inspected the downstream piping and found the disk wedged in a reducer section of the pipe. The licensee retrieved two hanger capscrews and a portion of the hanger capscrew locking device from a downstream FW heater.

Discussion

Trojan Nuclear Plant

The Trojan Nuclear Plant licensee determined the root cause of the check valve failures to be inadequate design of the valve disk nut locking device. Inadequate disk nut torquing had allowed the nut to rotate slightly back and forth. The free motion at the nut/lock wire interface induced low stress, high cycle fatigue and eventual failure of the lock wire. Nut motion had been caused by flow induced vibration and by normal operational actuation movement of the valve internal components.

The licensee believes this problem is limited to valves actuated frequently or to cases where the associated piping has undesirable flow characteristics. The valves in question are Copes-Vulcan Model 8C74 valves. The licensee believes this failure mechanism is not limited to Model 8C74 valves, as similar nut locking device design (i.e., thin gauge lock wire) exist in other model Copes-Vulcan check valves. Licensee repair of the check valves consisted of torquing the disk retaining nut and replacing the lock wire with a 1/8-inch cotter pin.

The licensee examined five other Copes-Vulcan valves but no other lock wires had failed. In addition, the licensee torqued all retaining nuts and replaced all lock wires with cotter pins on the valves examined.

The licensee modified its check valve inspection program to require documentation of the type and condition of all valve retaining nut locking devices, including the extent to which retaining nut rotation was limited by the locking device.

Vogtle Electric Generating Plant

The Vogtle Unit 1 licensee determined the root cause of the check valve failure to be inadequate procedural guidance on check valve maintenance. Procedural deficiencies identified included lack of specifications for (1) capscrew torque requirements; (2) the correct number of hanger capscrews to be used; and (3) the correct use and/or reuse of hanger capscrew locking devices. The hanger capscrew locking device, shown in Attachment 2, is a stainless steel plate used to prevent the inadvertent loosening of the hanger capscrews. The locking devices undergo plastic deformation during installation. Reuse of the locking devices results in work hardening of the material, making it more susceptible to unacceptable levels of cracking. As a result of procedural deficiencies, some valves were reassembled without locking devices, or with used locking devices. Locking device failure can allow the hanger capscrews to loosen and the hanger to separate from the body of the valve.

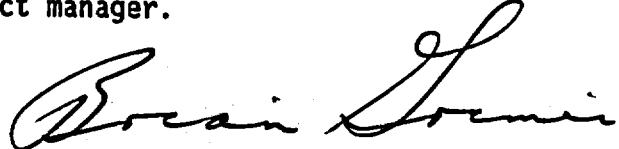
Valve failure may also have been partially caused by the use of an incorrect number of capscrews. The valve body is drilled and tapped to accept three capscrews. The locking device and hanger shims are predrilled for use with three capscrews. The disk hangers (also illustrated on Attachment 1) removed from the Vogtle Unit 1 check valves were drilled for use with only two capscrews. Both Unit 1 check valves had previously undergone hanger replacement, as evidenced by warehouse records. The disk hangers supplied by Pacific Valve, as stock spares, are blanks which must be drilled at the time of installation to ensure proper disk/seat alignment. The licensee believes Pacific Valve may have originally supplied check valves with disk hangers drilled for use with only two capscrews. This belief was based on an inspection of a Vogtle Unit 2 check valve. The original disk hanger for the pre-assembled valve was drilled for use with only two capscrews.

The licensee is revising its check valve maintenance procedure to ensure the hanger capscrews are adequately torqued and the required locking device is correctly installed. In addition, Pacific Valve Engineering is being asked to specify the correct number of capscrews required for integrity of the hanger/body bolted joint, and to identify any differences between design and installation configurations.

Related Generic Communication

In Information Notice 81-35, "Check Valve Failures," the NRC discussed an event similar to the failure at Trojan involving Anchor Darling check valves. The Anchor Darling check valve failures were attributed to the valve being assembled with lock wire used as the retaining nut locking device, rather than a locking pin as shown on the design drawing.

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.



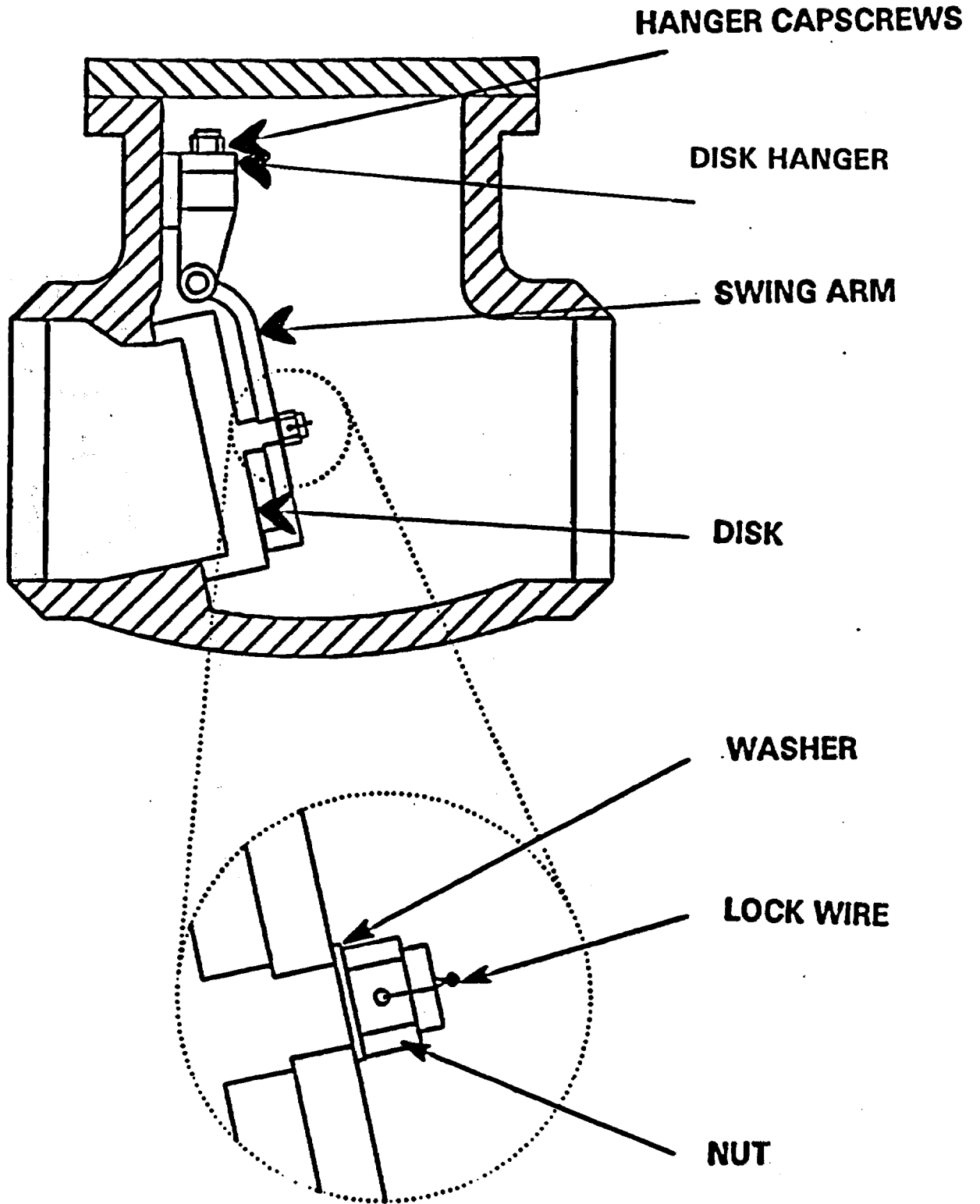
Brian K. Grimes, Director
Division of Operating Reactor Support
Office of Nuclear Reactor Regulation

Technical contacts: Eric J. Benner, NRR
(301) 504-1171

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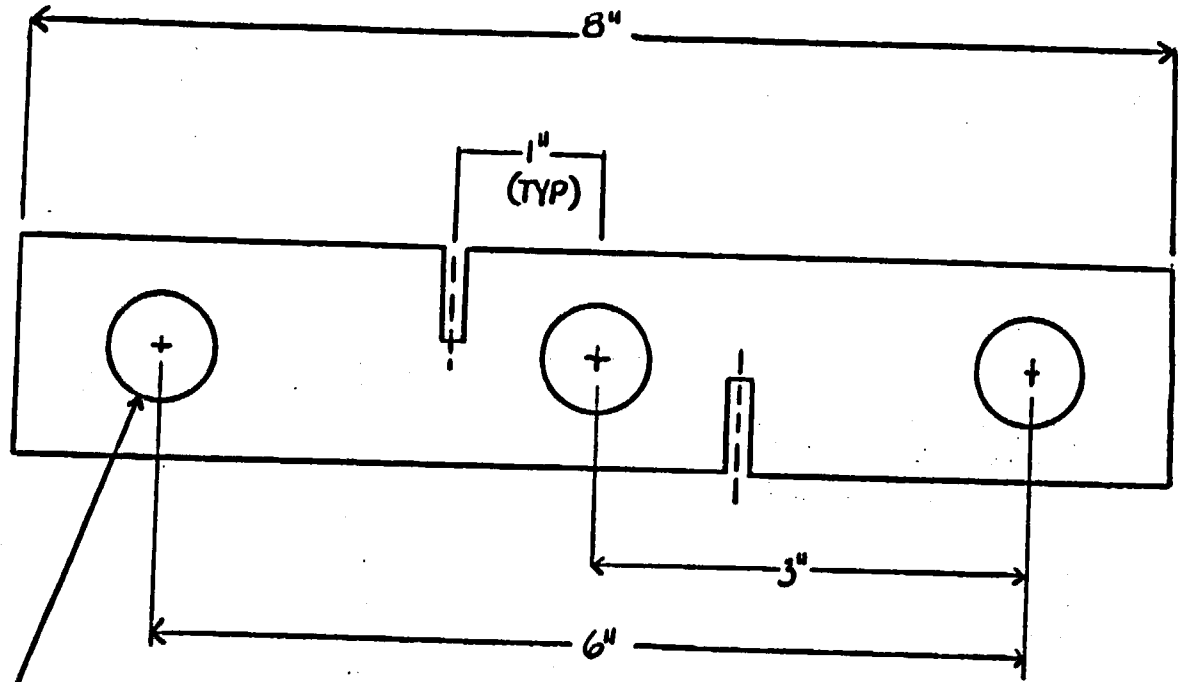
Attachments:

1. Copes-Vulcan Check Valve Internals
2. Copes-Vulcan Hanger Capscrew Locking Device
3. List of Recently Issued NRC Information Notices

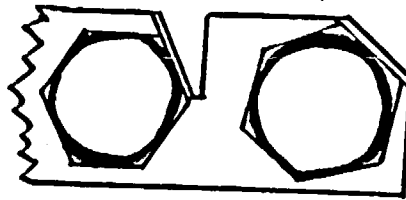


COPEs-VULCAN CHECK VALVE INTERNALS

LOCKING TAB



3 Holes: $1\frac{1}{16}$ DRILL THEM



LIST OF RECENTLY ISSUED
 NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
93-15	Failure to Verify the Continuity of Shunt Trip Attachment Contacts in Manual Safety Injection and Reactor Trip Switches	02/18/93	All holders of OLs or CPs for nuclear power reactors.
93-14	Clarification of 10 CFR 40.22, Small Quantities of Source Material	02/18/93	All licensees who possess source material.
93-13	Undetected Modification of Flow Characteristics in the High Pressure Safety Injection System	02/16/93	All holders of OLs or CPs for nuclear power reactors.
93-12	Off-Gassing in Auxiliary Feedwater System Raw Water Sources	02/11/93	All holders of OLs or CPs for nuclear power reactors.
93-11	Single Failure Vulnerability of Engineered Safety Features Actuation Systems	02/04/93	All holders of OLs or CPs for nuclear power reactors.
93-10	Dose Calibrator Quality Control	02/02/93	All Nuclear Regulatory Commission medical licensees.
93-09	Failure of Undervoltage Trip Attachment on Westinghouse Model DB-50 Reactor Trip Breaker	02/02/93	All holders of OLs or CPs for nuclear power reactors.
93-08	Failure of Residual Heat Removal Pump Bearings due to High Thrust Loading	02/01/93	All holders of OLs or CPs for nuclear power reactors.
93-07	Classification of Transportation Emergencies	02/01/93	All Licensees required to have an emergency plan.

OL = Operating License
 CP = Construction Permit

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Original signed by
Brian K. Grimes

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Reviewed by J. Main, Technical Editor
on 04/24/92

DOCUMENT NAME: 93-16.IN

*SEE PREVIOUS CONCURRENCES

OFC	:OEAB:DORS	:EMEB:DE	:PM:PDV:DRP	:PM:PDII:DRP	:
NAME	:DGarcia*	:FGrubelich*	:LKokajko*	:DHood*	:
DATE	:09/24/92	:10/07/92	:10/09/92	:10/09/92	:

OFC	:SC/OEAB:DORS	:C/OEAB:DORS	:C/OGCB:DORS	:D/DORS	:
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DATE	:11/05/92	:12/07/92	:02/09/93	:2/16/93	:

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See file jacket

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2/9/93*

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