

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

October 20, 1993

NRC INFORMATION NOTICE 93-85: PROBLEMS WITH X-RELAYS IN DB- AND DHB-TYPE  
CIRCUIT BREAKERS MANUFACTURED BY WESTINGHOUSE

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 possible failure of the 52X-relay (X-relay) to reset in DB- and DHB-type Westinghouse Electric Company (Westinghouse) circuit breakers, thus preventing them from reclosing on demand. 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

On June 27, 1993, power to a motor control center was lost at the Haddam Neck nuclear power plant. Connecticut Yankee Atomic Power Company, the licensee, determined that the possible root cause for this event was a failure of the X-relay (anti-pump relay) to reset to the de-energized position in a Westinghouse DB-25 circuit breaker.

Previously, between July 1 and August 24, 1984, the licensee reported five incidents in which one DB-25 and four DHB-250 breakers failed to close when required. All five of those failures were attributed to malfunctions of the X-relay. The licensee believed that dirt had caused the problem and instituted a program for cleaning the stationary and moving cores of the relay.

On June 11, 1991, and on January 28, 1992, Duke Power Company reported that, at the Oconee Nuclear Station, X-relays failed to reset and prevented the DB-25 breakers from closing in the Keowee hydroelectric generator field and field flashing circuitry. (The Keowee hydrostation supplies emergency power to the Oconee station.) The licensee modified the anti-pump function with an electrical scheme that does not require the X-relay.

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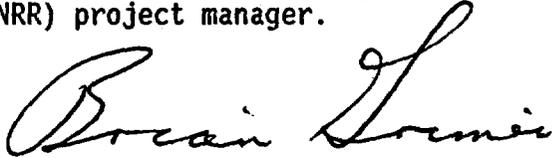
## Discussion

The X-relay is usually denoted by the symbol 52X in the electrical control circuit schematic diagram for the breaker. On receipt of a signal to close the breaker, the X-relay energizes and one set of its normally open contacts closes to enable momentary energizing of the breaker closing coil. After the breaker closes, the same set of X-relay contacts opens to deenergize the closing coil even though the X-relay remains energized by the close signal. If the close signal is still present after the breaker trips, the X-relay serves to inhibit repeated closure attempts until the close signal is removed. Thus, it provides anti-pump protection to the breaker by preventing repeated breaker closure attempts when a standing closure signal exists after a breaker trips.

The armature assembly of an X-relay (see Figure 1) fits inside a brass sleeve and is surrounded by the electromagnetic coil (different from the breaker closing coil) of the relay. When this coil is energized, the plunger (moving core) is drawn up towards the top cap piece (stationary core) of the assembly and the latch arm operates the relay contacts. In its uppermost position, an air gap is maintained between the bullet-shaped top of the plunger and the cavity in the cap piece, with the shoulder of the plunger mating with the lip on the cap piece. When the coil is de-energized, the moving core is designed to fall, by gravity, into its lowest position. The failure of the moving core to fall to its lowest position is the possible failure mode of interest at Haddam Neck.

Westinghouse and the licensee believe that residual magnetism associated with continuous energization of the relay or mechanical adherence between the two parts are probable causes for the plunger failing to fall. Westinghouse is testing a design enhancement that uses a brass spacer between the moving and stationary cores to create a controlled air gap. Westinghouse plans to issue a Nuclear Safety Advisory Letter to notify users of this problem. The licensee is evaluating a design modification for the X-relay function in the motor control center.

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: Kamalakar Naidu, NRR  
(301) 504-2980

Frederick H. Burrows, NRR  
(301) 504-2901

Attachments:

1. Figure 1, X-Relay Magnetic Core
2. List of Recently Issued NRC Information Notices

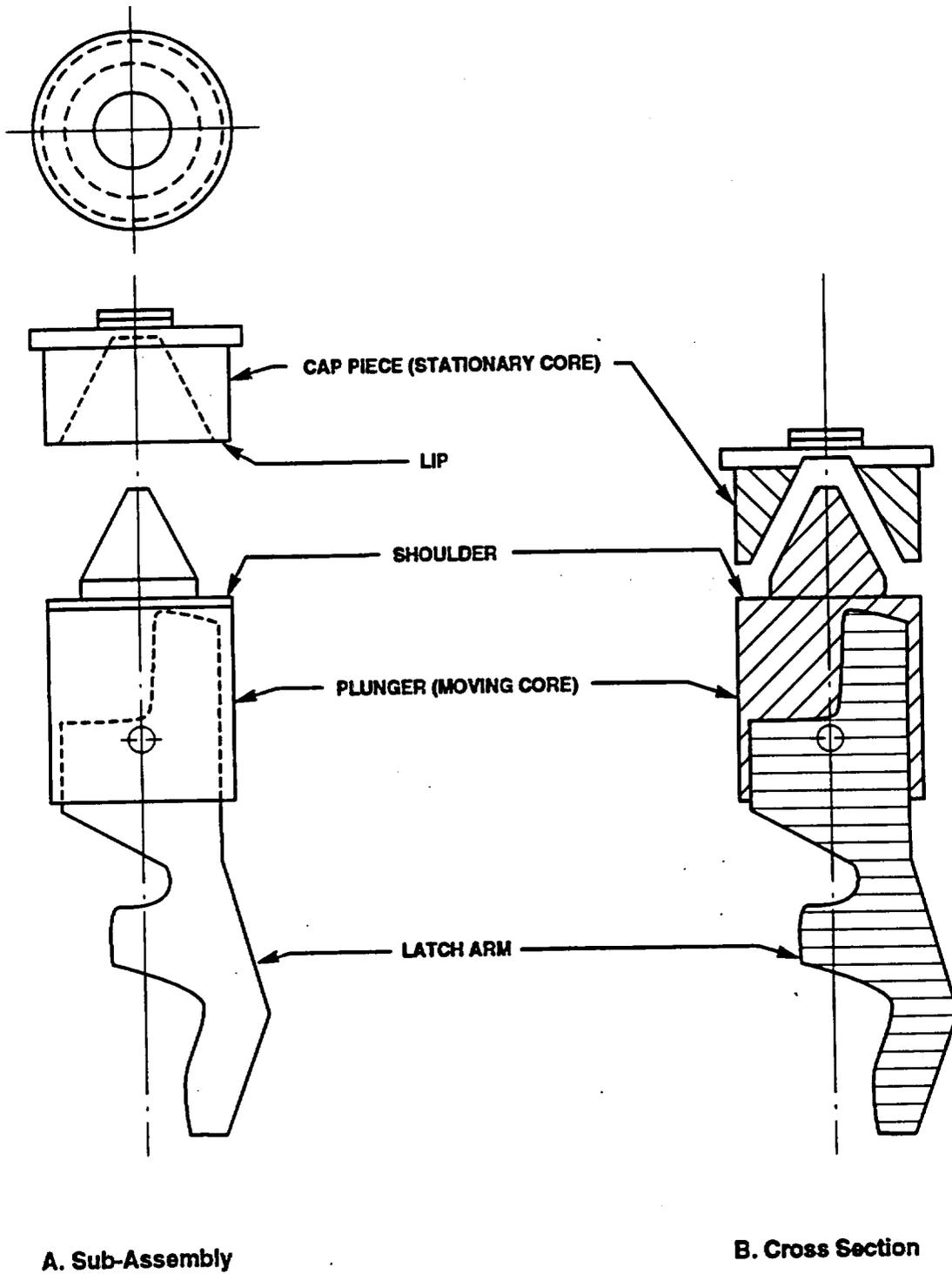


Figure 1. X-relay Magnetic Core

LIST OF RECENTLY ISSUED  
 NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
93-84	Determination of Westinghouse Reactor Coolant Pump Seal Failure	10/20/93	All holders of OLs or CPs for pressurized water reactors (PWRs).
93-83	Potential Loss of Spent Fuel Pool Cooling Following A Loss of Coolant Accident (LOCA)	10/07/93	All holders of OLs or CPs for boiling water reactors (BWRs).
93-82	Recent Fuel and Core Performance Problems in Operating Reactors	10/12/93	All holders of OLs or CPs for nuclear power reactors and all NRC-approved fuel suppliers.
93-81	Implementation of Engineering Expertise on Shift	10/12/93	All holders of OLs or CPs for nuclear power reactors.
93-80	Implementation of the Revised 10 CFR Part 20	10/08/93	All byproduct, source, and special nuclear material licensees.
93-79	Core Shroud Cracking at Beltline Region Welds in Boiling-Water Reactors	09/30/93	All holders of operating licenses or construction permits for boiling-water reactors (BWRs).
93-78	Inoperable Safety Systems At A Non-Power Reactor	10/04/93	All holders of OLs or CPs for test and research reactors.
93-77	Human Errors that Result in Inadvertent Transfers of Special Nuclear Material at Fuel Cycle Facilities	10/04/93	All nuclear fuel cycle licensees.
93-76	Inadequate Control of Paint and Cleaners for Safety-Related Equipment	09/21/93	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License  
 CP = Construction Permit

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Original signed by  
 Brian K. Grimes

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 Office of Nuclear Reactor Regulation

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1. Figure 1, X-Relay Magnetic Core
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\*See previous concurrences

OFFICE	RVIB:DRIL	RVIB:DRIL:NRR	C/RVIB:DRIL:NRR	D/DRIL:NRR
NAME	*KNaidu/FHB	*GCwalina	*LNorrholm	*ERossi
DATE	09/13/93	09/13/93	09/14/93	09/20/93
OFFICE	TECHED:ADM	OGCB:DORS:NRR	C/OGCB:DORS:NRR	D/DORS:NRR
NAME	*DGable	*JLBirmingham	*GHMarcus	BKGrimes
Date	09/22/93	09/22/93	09/22/93	10/15/93

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Document Name: X-RELAYS.JLB

W is testing a design enhancement that uses a brass spacer (anti-freeze washer) between the moving and stationary cores to create a controlled airgap. W proposes to issue a Nuclear Safety Advisory Letter to advise users of this problem.

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