

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

July 30, 1987

NRC INFORMATION NOTICE NO. 87-35: REACTOR TRIP BREAKER, WESTINGHOUSE MODEL DS-416, FAILED TO OPEN ON MANUAL INITIATION FROM THE CONTROL ROOM

Addressees:

All nuclear power reactor facilities holding an operating license (OL) or construction permit (CP) employing Westinghouse DS-416 reactor trip breakers.

Purpose:

This notice is provided to alert recipients to a potentially significant safety problem associated with a reactor trip breaker (RTB). The NRC expects that recipients will review this notice for applicability to their facilities and consider actions, if appropriate, to preclude a similar problem. However, suggestions contained in this notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

On July 2, 1987, McGuire Nuclear Station Unit 2 was performing control rod drop tests after its recent refueling outage. This test was in progress with the plant in mode 3 (hot shutdown). With all control rods inserted and the RTBs closed for testing the next bank of control rods, station personnel smelled smoke in the vicinity of the RTBs. A manual trip of A and B train RTBs was initiated from the control room. Only the A train RTB opened. The B train RTB was eventually tripped manually at the breaker panel. The smoke had come from the B train breaker shunt trip coil, which had burned and shorted while trying to open the breaker. The coil is designed for intermittent duty and to carry current only until the breaker opens. Failure of the breaker to open resulted in a prolonged and damaging current. Operators in the control room stated that open indications for both the A and B train redundant RTBs were observed for all attempted breaker opening evolutions during the control rod drop testing process. However, the event recorder indicated that the B train RTB failed to open on a previous manual trip attempt (approximately 4 minutes before) when operators were setting up for the control rod drop test on the last bank of rods.

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Concurrence Copy

An NRC Augmented Inspection Team (AIT) evaluated the licensee's investigation into the reactor trip breaker problem. Abnormal wear and a broken weld were found in this early vintage of Westinghouse DS-416 breaker (see Westinghouse Figure, Attachment 1). The broken weld was on the main drive link between the center pole lever and the pole shaft. Except for the shunt trip coil that had burned and shorted while trying to open the breaker, the breaker's electrical controls and auxiliary contacts were verified to be properly wired and operating as designed. The cause for the anomalous breaker status indication is still under investigation.

Attempts to repeat the condition, where the breaker was mechanically binding in the closed position, were minimally successful. Preliminary conclusions of the AIT are that the breaker's mechanical binding was caused by a combination of wear (greater than 2000 cycles of operation), manufacturing tolerances in this early vintage breaker, and the broken weld. These factors may have combined to allow sufficient lateral movement of the main linkage to cause it to jam at or near full breaker closure and thus prevent the breaker from opening. Since the control room operating personnel stated that they observed the open indication on the closed B train RTB, the field wiring is being verified by the licensee to ensure that wiring is as designed. The shorted shunt trip coil had allowed 125 volts dc between the positive terminal and the chassis; a "sneak" circuit is possible.

#### Discussion:

Final conclusions for the cause of this event have not been reached. Further investigation and dismantling of the breaker will be conducted in Westinghouse laboratory facilities. The licensee and NRC will participate in this investigation. If the results indicate findings different than the above preliminary conclusions, a supplement to this notice will be issued.

The licensee is inspecting all of the RTBs for signs of abnormal wear, cracks in welds, and excessive lateral play (greater than 1/8 inch) in the roller end of the main drive link where it contacts the close cam. This measurement had not previously been part of the periodic preventive maintenance for the RTB. Moreover, following any reactor trip, the licensee is ensuring the open position of both RTBs by inspecting the breaker before reclosure. These are short-term corrective actions until the detailed analysis of the deficiencies is completed.

A significant number of generic communications have been issued with regard to reactor trip breakers (RTBs) and similar circuit breakers used in safety-related systems. Such communications that may be related to the matter in this information notice are listed in Attachment 2.

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

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

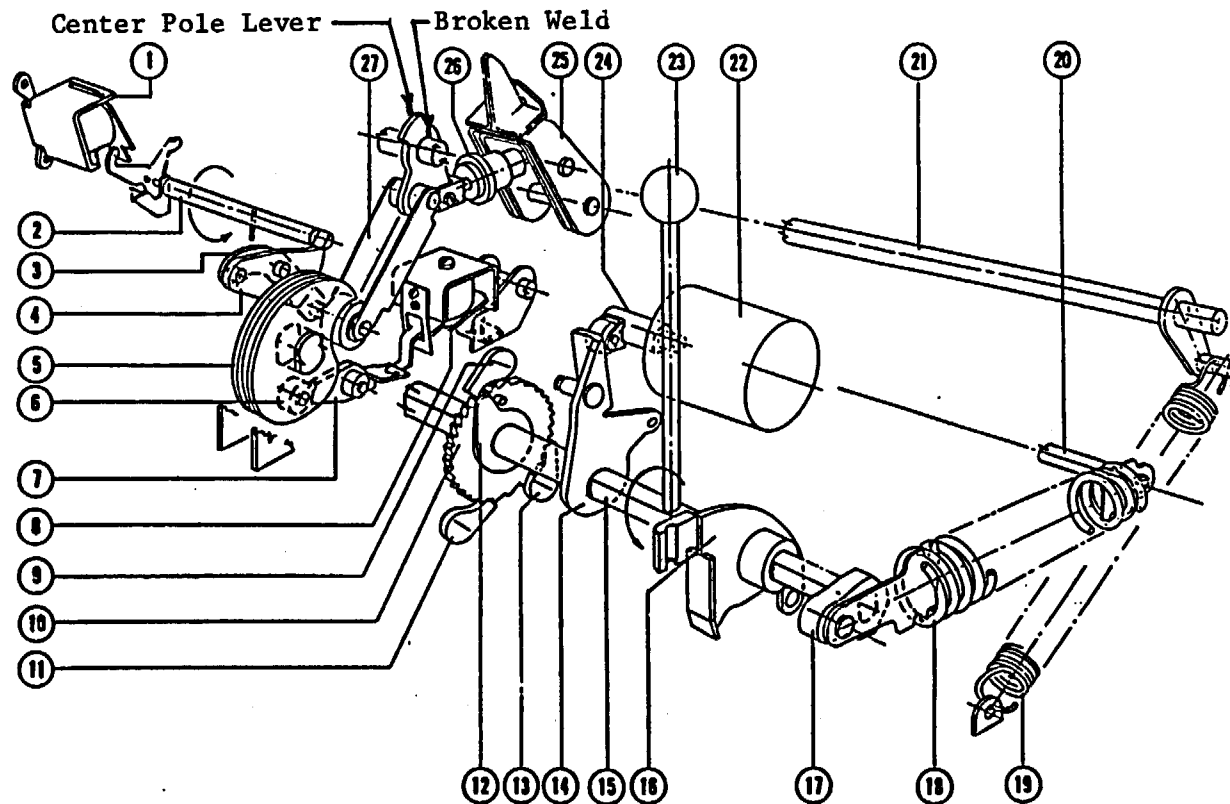
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Attachments:

1. Power-Operated (Stored-Energy) Mechanism Graphic Details
2. Generic Communications on Reactor Trip Breakers and Similar Circuit Breakers
3. List of Recently Issued NRC Information Notices



- |                             |                             |                             |
|-----------------------------|-----------------------------|-----------------------------|
| 1. SHUNT TRIP DEVICE        | 10. RATCHET WHEEL           | 19. RESET SPRING            |
| 2. TRIP SHAFT               | 11. HOLD PAWL               | 20. CLOSING SPRING ANCHOR   |
| 3. ROLLER CONSTRAINING LINK | 12. DRIVE PLATE             | 21. POLE SHAFT              |
| 4. TRIP LATCH               | 13. EMERGENCY CHARGE PAWL   | 22. MOTOR                   |
| 5. CLOSE CAM                | 14. OSCILLATOR              | 23. EMERGENCY CHARGE HANDLE |
| 6. STOP ROLLER              | 15. CRANK SHAFT             | 24. MOTOR CRANK AND HANDLE  |
| 7. SPRING RELEASE LATCH     | 16. EMERGENCY CHARGE DEVICE | 25. MOVING CONTACT ASSEMBLY |
| 8. SPRING RELEASE DEVICE    | 17. CRANK ARM               | 26. INSULATING LINK         |
| 9. OSCILLATOR PAWL          | 18. CLOSING SPRING          | 27. MAIN DRIVE LINK         |

**Figure 2-16. Power-Operated (Stored-Energy) Mechanism Graphic Details  
(Close Spring Shown in the Charged Position)**

Broken weld from center pole lever to pole shaft (21). Another lever not shown in diagram had an intact weld. The combination of broken weld, manufacturing tolerance, and high cycle wear are considered to be factors in the mechanical binding of the breaker.

(Figure from Maintenance Program Manual MPM-WOGRSDDS 416-01 for W type DS-416 reactor trip circuit breakers.)

**GENERIC COMMUNICATIONS ON REACTOR TRIP BREAKERS  
AND SIMILAR CIRCUIT BREAKERS**

Information Notice 86-62, "Potential Problems in Westinghouse Molded Case Circuit Breakers Equipped With a Shunt Trip," July 31, 1986.

Information Notice 85-93, "Westinghouse Type DS Circuit Breakers, Potential Failure of Electric Closing Feature Because of Broken Spring Release Latch Lever," December 6, 1985.

Bulletin 85-02, "Undervoltage Trip Attachments of Westinghouse DB-50 Type Reactor Trip Breakers," November 5, 1985.

Information Notice 85-58, "Failure of a General Electric Type AK-2-25 Reactor Trip Breaker," July 17, 1985.

-----Supplement 1, November 19, 1985.

Information Notice No. 83-76, "Reactor Trip Breaker Malfunctions (Undervoltage Trip Devices on GE Type AK-2-25 Breakers)," November 2, 1983.

Generic Letter 83-28, "Required Actions Based on Generic Implications of Salem ATWS Events," July 8, 1983.

Information Notice 83-18, "Failures of the Undervoltage Trip Function of Reactor Trip System Breakers," April 1, 1983.

Bulletin 83-04, "Failure of the Undervoltage Trip Function of Reactor Trip Breakers," March 11, 1983.

Bulletin 83-01, "Failure of Reactor Trip Breakers (Westinghouse DB-50) to Open on Automatic Trip Signal," February 25, 1983.

Circular 81-12, "Inadequate Periodic Test Procedure of PWR Protection System," July 22, 1981.

Bulletin 79-09, "Failures of GE Type Circuit Breaker in Safety Related System," April 17, 1979.

LIST OF RECENTLY ISSUED  
INFORMATION NOTICES 1987

Information Notice No.	Subject	Date of Issuance	Issued to
87-34	Single Failures in Auxiliary Feedwater Systems	7/24/87	All holders of an OL or a CP for pressurized water reactor facilities.
87-33	Applicability of 10 CFR Part 21 to Nonlicensees	7/24/87	All NRC licensees.
87-32	Deficiencies in the Testing of Nuclear-Grade Activated Charcoal.	7/10/87	All nuclear power reactor facilities holding an OL or CP.
87-31	Blocking, Bracing, and Securing of Radioactive Materials Packages in Transportation.	7/10/87	All NRC licensees.
87-30	Cracking of Surge Ring Brackets in Large General Electric Company Electric Motors.	7/2/87	All nuclear power reactor facilities holding an OL or CP.
87-29	Recent Safety-Related Incidents at Large Irradiators.	6/26/87	All NRC licensees authorized to possess and use sealed sources in large irradiators.
87-28	Air Systems Problems at U.S. Light Water Reactors.	6/22/87	All nuclear power reactor facilities holding an OL or CP.
87-27	Iranian Official Implies Vague Threat to U.S. Resources.	6/10/87	All nuclear power reactor facilities holding an OL or CP, research and nonpower reactor facilities, and fuel fabrication and processing facilities using or possessing formula quantities of special nuclear material.

OL = Operating License  
CP = Construction Permit

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Attachments:

1. Power-Operated (Stored-Energy) Mechanism Graphic Details
2. Generic Communications on Reactor Trip Breakers
3. List of Recently Issued NRC Information Notices

*Re concurred by [signature] in format by 7/27 phone to CR*  
\*SEE PREVIOUS CONCURRENCES

\*OGCB:DOEA:NRR \*RII

CVHodge  
07/17/87

TPeebles  
07/17/87

\*PPMB:ARM \*C/OGCB:DOEA:NRR

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