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

June 15, 1988

NRC INFORMATION NOTICE No. 88-38: FAILURE OF UNDERVOLTAGE TRIP ATTACHMENT ON GENERAL ELECTRIC CIRCUIT BREAKERS

Addressees:

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

Purpose:

This information notice is being provided to alert addressees to potential problems resulting from the failure of the undervoltage trip attachment on General Electric (GE) circuit breakers, Types AK-2-15 and AK-2-25. 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 do not constitute NRC requirements; therefore, no specific action or written response is required.

Description:

Two failures of GE circuit breakers installed as reactor trip breakers (RTBs) have been reported recently. On March 16, 1988, during a routine monthly surveillance test, the undervoltage device (UVD) on one of four dc reactor trip breakers at Three Mile Island Unit 1 (TMI 1) failed. This UVD was mounted on a Model AK-2-15-1 dc breaker. On March 23, 1988, a similar failure occurred at Rancho Seco. The Rancho Seco licensee reported that the UVD on a GE Model AK-2-25 RTB, one of four dc RTBs, failed during a monthly surveillance test. The shunt trip test for each of the breakers was performed without any problems during these tests. The UVD and shunt trip device are tested independently during monthly surveillances. The analyses of both failures revealed that mechanical binding of the UVD trip linkage had occurred and prevented the operation of the breakers.

Figure 1 shows the normal pre-trip position of the UVD. On a valid undervoltage trip signal, the coil is deenergized, releasing the armature. The spring attached between the armature and the UVD frame causes the armature to pivot in a clockwise direction between the roller rivet and coil core support. The small circular disk welded to the armature then contacts the trip paddle causing it to engage and rotate the circuit breaker's trip bar. Figure 2 shows the normal post-trip configuration of the UVD.

The investigation conducted by the TMI 1 licensee revealed that the clearance between the end of the armature and the trip paddle was such as to allow the paddle to become positioned to prevent the armature from moving. This improper clearance resulted from a manufacturing anomaly which produced a trip paddle of shorter dimensions than design specifications dictate. Thus, the position held by the trip paddle at the time the UVD coil was deenergized impeded the motion of the armature and prevented the breaker's operation.

The TMI 1 licensee is investigating changes in the preventive maintenance process to ensure that the appropriate clearances are maintained for all UVDs mounted on RTBs.

The Rancho Seco licensee's investigation determined that the failure mode of the UVD also involved internal binding of the UVD's linkage. However, the root cause of the binding at Rancho Seco differed from that at TMI 1. The Rancho Seco licensee found that the clearance between the armature and trip paddle was inadequate. The licensee also determined that the armature disk was improperly welded in a position both vertically and horizontally off center of the end of the armature. This altered the armature/trip paddle points of contact from the prescribed configuration shown in Figure 3a to the undesirable configuration shown in Figure 3b. Another factor relating to the incident is the lack of adequate clearance between the armature disk and the trip paddle in the energized position.

Because of the mechanical oscillation inherent in an ac powered electromagnet, the armature of the UVD vibrates continuously. Since the armature disk and trip paddle were in contact, these vibrations eventually created a groove in the upper portion of the armature disk and in the end of the trip paddle. As long as the grooves in the disk and trip paddle were in a certain configuration, the device operated properly. However, when the disk/trip paddle groove relationship was disturbed (side movement), the disk would bind on the trip paddle resulting in failure of the UVD to trip the breaker (Figure 4). The affected breaker was removed from service and a spare breaker was installed. All RTBs were taken out and visually inspected for the anomalies identified above; no abnormal UVDs were identified. The licensee has also modified its preventive maintenance procedure to ensure that all known problems with these breakers have been addressed to preclude the recurrence of these problems.

Previous Generic Communications:

- IE Bulletin No. 79-09, "Failures of GE Type AK-2 Circuit Breaker in Safety Related Systems."

- IE Bulletin No. 83-04, "Failure of the Undervoltage Trip Function of Reactor Trip Breakers."

- IE Bulletin No. 83-08, "Electrical Circuit Breakers With An Undervoltage Trip Feature in Use in Safety-Related Applications Other Than the Reactor Trip System."

- IE Information Notice No. 83-18, "Failures of the Undervoltage Trip Function of Reactor Trip System Breakers."

- IE Information Notice No. 85-58, (and supplement), "Failure of a General Electric Type AK-2-25 Reactor Trip Breaker."

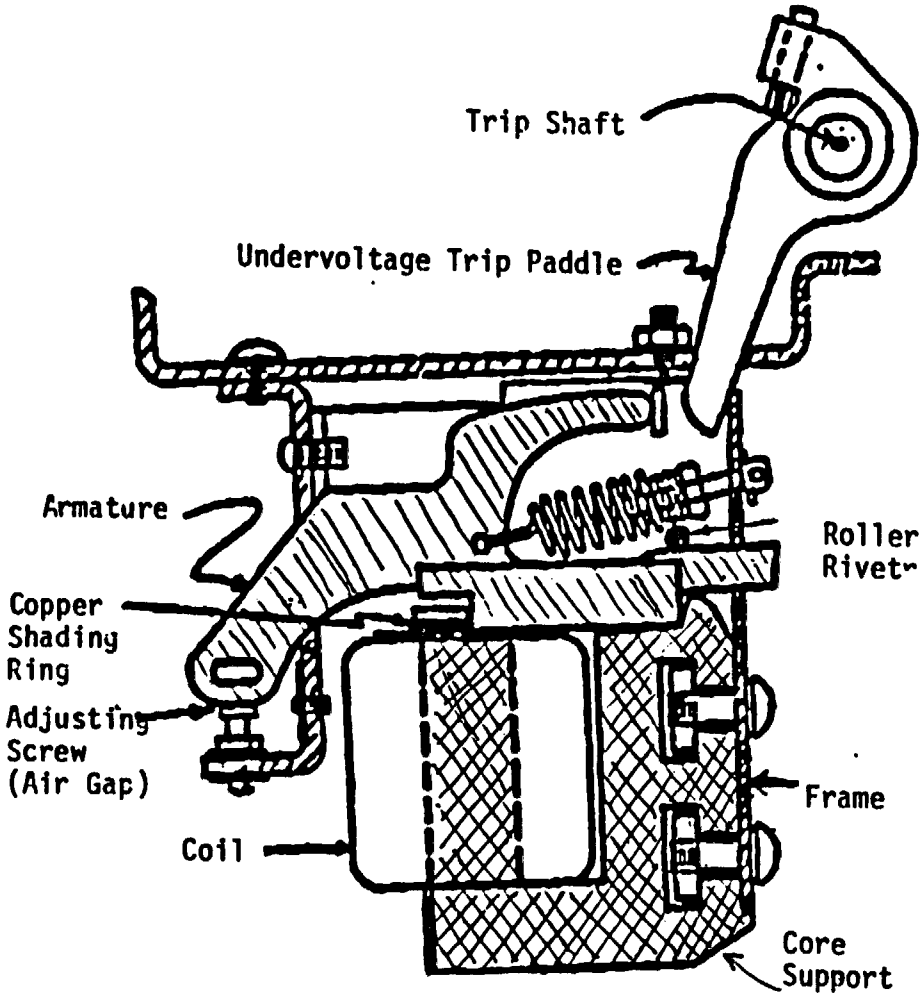
A GE Service Advice Letter (SAL) 175 (CPDD) 9.3 (April 15, 1983) set forth maintenance procedures to forestall the types of failures that were known prior to issuance of the SAL.

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

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

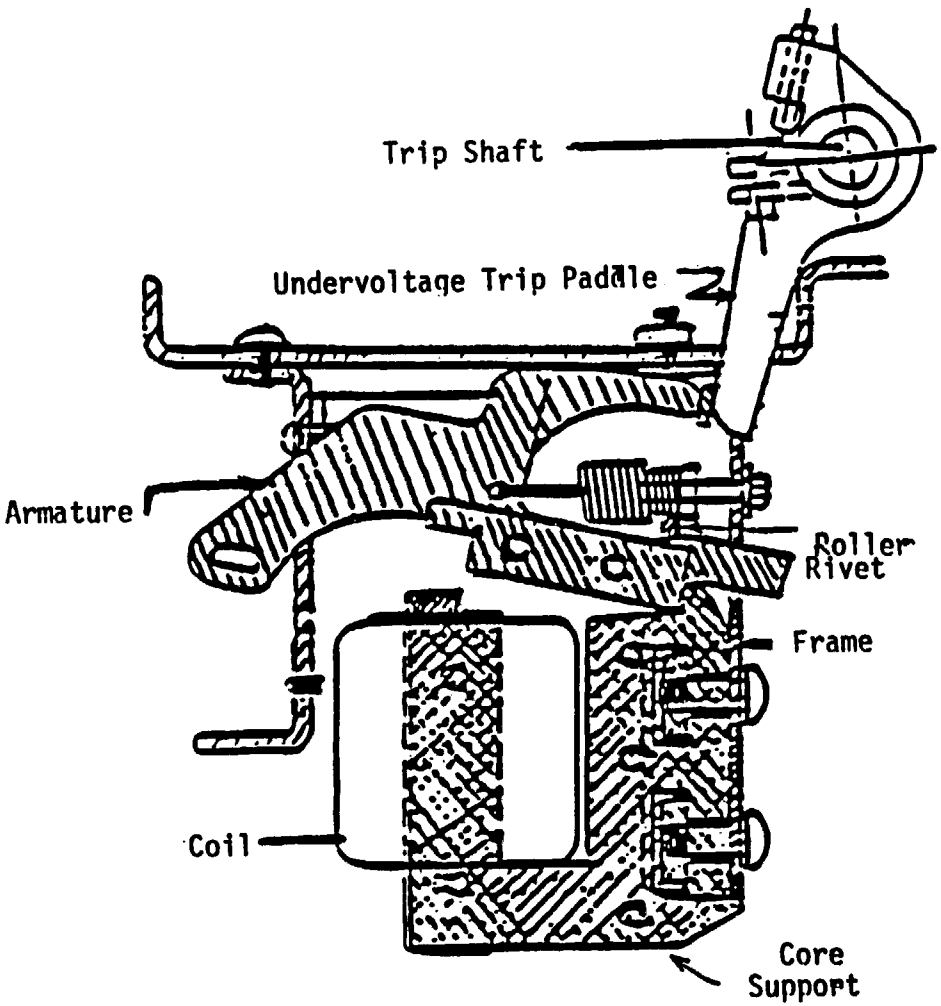
Technical Contact: E. N. Fields, NRR
(301) 492-1173

Attachment: List of Recently Issued NRC Information Notices



UNDERVOLTAGE TRIP DEVICE
COIL ENERGIZED

Figure 1



UNDERVOLTAGE TRIP DEVICE

COIL DE-ENERGIZED

Figure 2

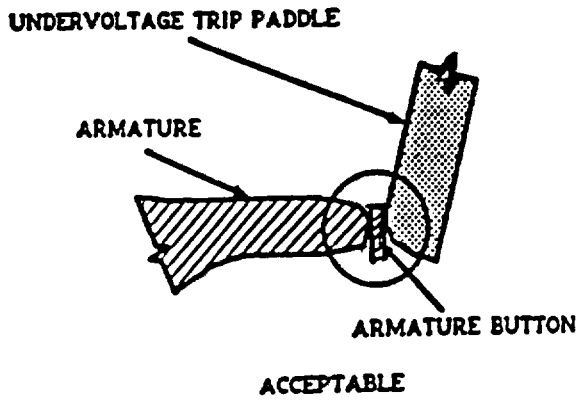


Figure 3a

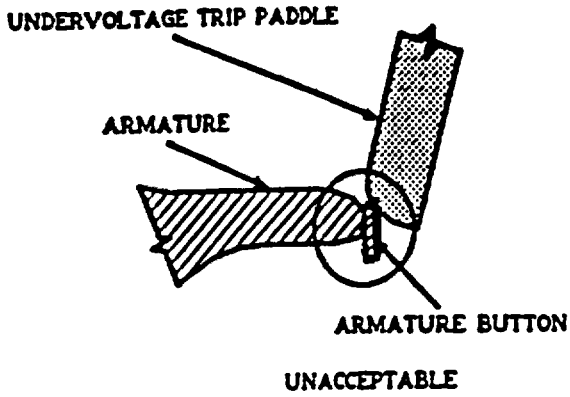


Figure 3b

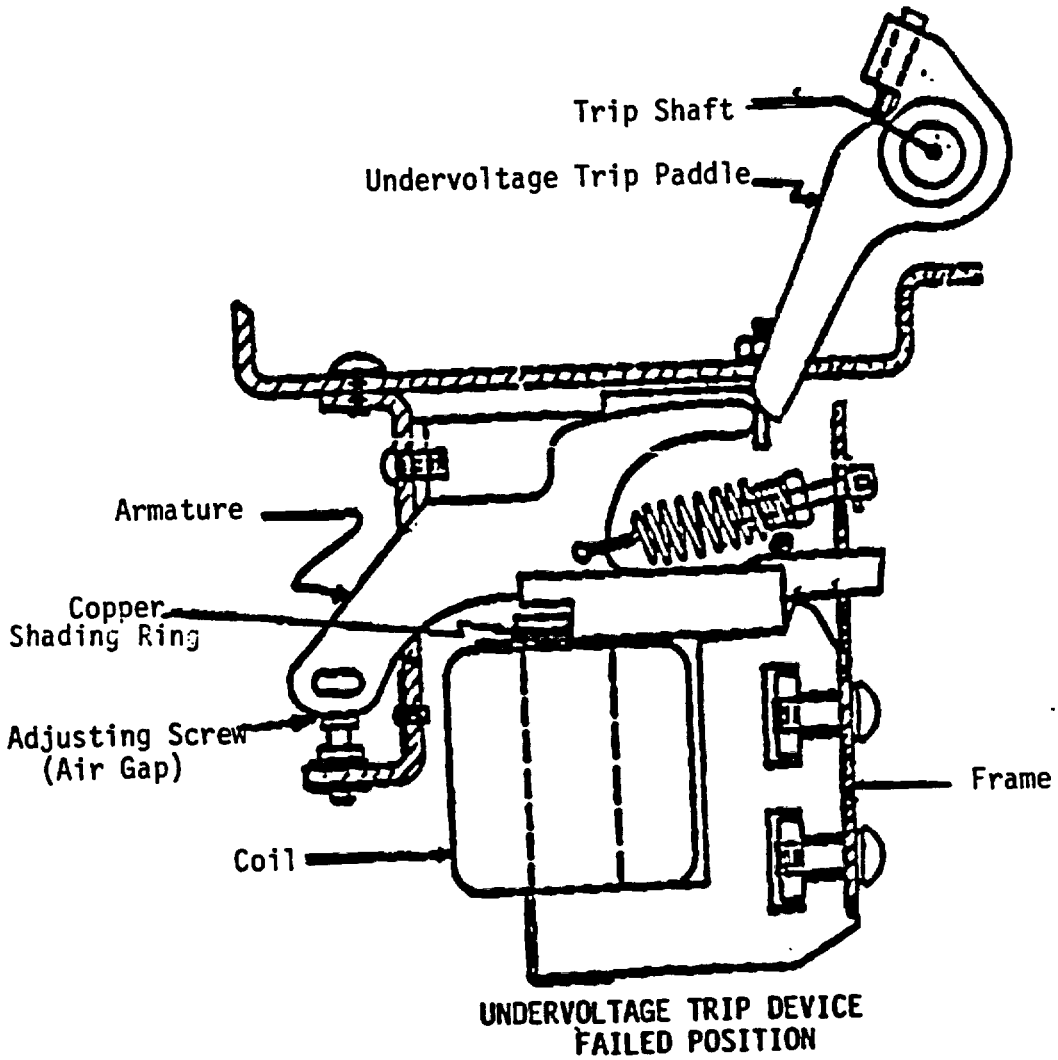


Figure 4

LIST OF RECENTLY ISSUED NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
88-37	Flow Blockage of Cooling Water to Safety System Components	6/14/88	All holders of OLs or CPs for nuclear power reactors.
88-36	Possible Sudden Loss of RCS Inventory During Low Coolant Level Operation	6/8/88	All holders of OLs or CPs for PWRs.
88-35	Inadequate Licensee Performed Vendor Audits	6/3/88	All holders of OLs or CPs for nuclear power reactors.
88-34	Nuclear Material Control and Accountability of Non-Fuel Special Nuclear Material at Power Reactors	5/31/88	All holders of OLs or CPs for nuclear power reactors.
87-61, Supplement 1	Failure of Westinghouse W-2-Type Circuit Breaker Cell Switches	5/31/88	All holders of OLs or CPs for nuclear power reactors.
88-33	Recent Problems Involving the Model Spec 2-T Radiographic Exposure Device	5/27/88	All Agreement States and NRC licensees authorized to manufacture, distribute or operate radiographic exposure devices and source changers.
88-32	Promptly Reporting to NRC of Significant Incidents Involving Radioactive Material	5/25/88	All NRC material licensees.
88-31	Steam Generator Tube Rupture Analysis Deficiency	5/25/88	All holders of OLs or CPs for Westinghouse and Combustion Engineering-designed nuclear power plants.

OL = Operating License
CP = Construction Permit

- IE Information Notice No. 83-18, "Failures of the Undervoltage Trip Function of Reactor Trip System Breakers."

- IE Information Notice No. 85-58, (and supplement), "Failure of a General Electric Type AK-2-25 Reactor Trip Breaker."

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*See Previous Concurrence

EAB:NRR*	EAB:NRR*	C:EAB:NRR	TECH:ED*	C:GCB:NRR*	D:DOEA:NRR
NFields:db	RLobel	WLanning		CHBerlinger	CERossi
4/27/88	5/26/88	5/27/88	5/12/88	6/2/88	6/10/88

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