

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

February 13, 1987

IE INFORMATION NOTICE 87-12: POTENTIAL PROBLEMS WITH METAL CLAD CIRCUIT  
BREAKERS, GENERAL ELECTRIC TYPE AKF-2-25

Addressees:

All nuclear power reactor facilities holding an operating license or a construction permit.

Purpose:

This notice is to alert recipients of potential problems with the General Electric Company (GE) AKF-2-25 type circuit breakers failing to fully open on demand. It is expected that recipients will review the information for applicability to their facilities and consider actions, if appropriate, to preclude similar problems. However, suggestions contained in this information notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

1. Pilgrim Nuclear Power Station

On June 29, 1986, the "A" recirculation pump (RP) motor/generator (MG) set field breaker (AKF-2-25) failed to trip while the MG was being removed from service. Licensee investigation revealed that the breaker was mechanically bound and could not be actuated by rotating the trip shaft. Because the breaker had not fully opened, the breaker auxiliary switch "a" contact, which is in series with the shunt trip coil (STC), did not open the circuit to the STC, which then burned out. Improper lubrication and misadjustment appeared to be the cause of binding.

On March 15, 1985, the turbine generator field breaker (AKF-2-25) failed to open when it received a trip signal from its manual control switch. Examination determined that there was insufficient lubrication on the link and cam of the centerpole of the breaker and that the eccentric cam bushing was improperly installed.

On February 9, 1985, the "A" RP MG-set field breaker (AKF-2-25) failed to open on demand after the "A" RP motor tripped. The control/ATWS STC was observed to be burned and open circuited. Additionally, the auxiliary switch that was connected to the breaker trip shaft was found to have loose mounting bolts and to be damaged. The licensee determined that mechanical binding and/or auxiliary switch problems caused the failure of the breaker to trip on demand.

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On April 3, 1983, the "B" RP MG-set field breaker (AKF-2-25) failed to open; consequently, the STC burned out when the "B" RP was secured by the control room operators. The licensee maintenance personnel found mechanical binding of the breaker unit, which required partial disassembly to free the breaker. The licensee determined that the shunt trip device rotated the trip shaft, thereby starting the trip action; however, the cam arrangement failed to complete its intended action and the trip action was interrupted.

## 2. Dresden Unit 3

On September 2, 1983, personnel could not open the "B" RP MG-set field breaker (AKF-2-25) and found the STC burned out. The STC was replaced and the breaker was cleaned and lubricated.

On March 1, 1982, while performing the ATWS surveillance, which requires tripping and reclosing the field breaker, the plant personnel found the field breaker inoperable. Plant personnel investigated and found the operator arm disconnected from the auxiliary contacts. The arm was reconnected and the surveillance was performed.

### Discussion:

On February 21, 1980, the NRC issued an order requiring the installation of an ATWS RP trip function. Some licensees installed a second STC on the two RP MG-set field breakers and the necessary instrumentation/logic to cause a breaker trip when certain parameters are sensed. Pilgrim and Dresden have this arrangement. Other licensees installed the ATWS trip coils in the 4.16 kV/6.9 kV circuit breakers that supply power to the two MG-sets.

The AKF-2-25 circuit breaker is a field switch without overcurrent protection. It is a three-pole breaker with the center pole modified specifically to serve as a dc switch. In the ATWS RP trip function application, the AKF-2-25 field breaker is equipped with two STCs, one of which is dedicated to respond to an ATWS demand. Each STC is energized through a normally open "A" contact that is controlled by the breaker's moving contacts. The "A" contact is an auxiliary switch that opens when the breaker is fully open and closes when the breaker is closed (ON position). The "A" contact is in series with the STC. Thus, when the breaker is closed, the "A" contact is closed and the STC is ready to trip on receipt of a signal from the control room or the ATWS logic. The STC is not rated for continuous duty and will overheat and fail if subjected to full voltage for more than a few seconds. If a breaker does not fully open when demanded by an STC, the "A" contact will not open and the STC will overheat and fail. Therefore, if a subsequent ATWS trip signal is initiated, the safety function will not be performed. An STC failure can only be detected by testing; remote indication is not provided.

The most recent breaker failure at Pilgrim has been attributed to improper maintenance performed by GE service technicians, who at the time were unaware of special maintenance practices developed by the GE Atlanta Service Shop. The GE Atlanta facility disassembled the failed breaker and discovered that it was out of adjustment and that improper lubricants had apparently been used. GE has issued Service Information Letter Number 448 to address special maintenance practices developed for the entire AK type breaker series which includes AK, AKU, AKF, and AKR type circuit breakers.

The ATWS trip function is required by 10 CFR 50.62(c)(5) and specific quality assurance guidance has been provided for non-safety-related ATWS equipment (NRC Generic Letter 85-06 dated April 16, 1985).

The GE AKF type circuit breakers have been shown to be susceptible to failure as a result of binding within the breaker cam mechanism, unless proper maintenance procedures are developed and followed by individuals trained specifically to service the AKF breaker. GE has suggested that the following maintenance information be incorporated into licensee programs for GE AKF-type circuit breakers:

- (1) Maintenance/inspection intervals of every 12 months or at each refueling outage. A complete breaker overhaul every 5 years is recommended to complement the annual cyclical maintenance.
- (2) Only specified lubricants should be used on these circuit breakers. Molykote BR2 Plus grease or equivalent for the slot in the circuit breaker center-pole cam-link and GE Specification D50HD38 (Mobil 28) for all other applications. The grease of GE Specifications D50H15 and D50H47 is no longer recommended for this breaker.

**NOTE:** D50HD38 lubricant should not be mixed with D50H15 and D50H47 lubricants. Before changing to D50HD38 lubricant, maintenance personnel should clean the circuit breaker thoroughly to remove all D50H15 and D50H47 lubricant from the circuit breaker.

- (3) Because of the complexity and difficulty in properly making crucial adjustments unique to GE AKF type circuit breakers, only qualified, properly trained personnel should perform these maintenance activities.
- (4) For type AKF circuit breakers which have not yet been converted to D50HD38 lubricant, cycle the breakers a few times between maintenance and inspection events whenever plant conditions allow.

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

Edward L. Jordan, Director  
Division of Emergency Preparedness  
and Engineering Response  
Office of Inspection and Enforcement

Technical Contacts: K. R. Naidu, IE  
(301) 492-4179

J. Jacobson, IE  
(301) 492-8845

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*Jk*  
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*BC/EGCB:DEPER BLBaer 02/04/87	<i>SSchwartz</i> SSchwartz 2/9/87 <i>mkm</i>	DIR/DEPER ELJordan 2/9/87
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Information Notice No.	Subject	Date of Issue	Issued to
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87-10	Potential for Water Hammer During Restart of Residual Heat Removal Pumps	2/11/87	All BWR facilities holding an OL or CP
87-09	Emergency Diesel Generator Room Cooling Design Deficiency	2/5/87	All power reactor facilities holding an OL or CP
87-08	Degraded Motor Leads in Limitorque CD Motor Operators	2/4/87	All power reactor facilities holding an OL or CP
87-07	Quality Control of Onsite Dewatering/Solidification Operations by Outside Contractors	2/3/87	All power reactor facilities holding an OL or CP
87-06	Loss of Suction to Low-Pressure Service Water System Pumps Resulting From Loss of Siphon	1/30/87	All power reactor facilities holding an OL or CP
87-05	Miswiring in a Westinghouse Rod Control System	2/2/87	All Westinghouse power reactor facilities holding an OL or CP
87-04	Diesel Generator Fails Test Because of Degraded Fuel	1/16/87	All power reactor facilities holding an OL or CP
87-03	Segregation of Hazardous	1/15/87	All NRC licensees
87-02	Inadequate Seismic Qualification of Diaphragm Valves by Mathematical Modeling and Analysis	1/15/87	All power reactor facilities holding an OL or CP

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OL = Operating License  
CP = Construction Permit

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