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

April 17, 1979

IE Bulletin No. 79-09

FAILURES OF GE TYPE AK-2 CIRCUIT BREAKER IN SAFETY RELATED SYSTEMS

Description of Circumstances:

Twelve failures of General Electric (GE) type AK-2 (i.e., AK-2A-15, 25, 50, 75, or 100) Circuit Breakers installed in safety-related systems have been reported since 1975. The failures occurred at the following facilities:

	Date	Facility	System
1.	9/16/78	Arkansas-1	Control Rod Drive System
2.	9/25/78	Arkansas-1	Control Rod Drive System
3.	10/17/78	Arkansas-1	Control Rod Drive System
4.	1/22/78	Crystal River-3	Control Rod Drive System
5.	8/7/75	Oconee Unit-3	Control Rod Drive System
6.	1/18/79	Oconee Unit-3	Control Rod Drive System
7.	1/22/79	Oconee Unit-1	Control Rod Drive System
8.	1/31/79	Oconee Unit-1	Control Rod Drive System
9.	4/25/75	TMI/1	Containment Spray Pump
10.	11/26/78	Oyster Creek-1	Service Water Pump No. 1
11.	11/30/78	Oyster Creek-1	Service Water Pump No. 2
12.	11/30/78	Oyster Creek-1	

It is significant to note that during a loss-of-off-site power test on November 30, 1978, at Oyster Creek, both service water pump circuit breakers failed to trip, as required. The undervoltage relays which monitor voltage level on each emergency bus functioned properly but could not actuate the trip mechanism via the undervoltage trip device within each circuit breaker. These failures, in turn, created a potential overload condition on each emergency diesel generator unit by allowing simultaneous starting of multiple high horse power motors during the sequential loading phase of the test.

The causes for failure were attributed to either binding within the linkage mechanism of the undervoltage (UV) trip device and trip shaft assembly or out-of-adjustment conditions in the same linkage mechanism. Babcock and Wilcox (B&W) and GE determined that the binding and out-of-adjustment resulted from inadequate preventive maintenance programs

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at the affected operating facilities. In each case listed above, cleaning and relubricating the trip shaft mechanism within the circuit breaker was required to correct the problem.

The enclosed GE Service Advice Letter (SAL) No. 175(CPDD) 9.3 is being sent to all power reactor facilities notifying them of the potential problems. The SAL identifies the causes for failure and provides their recommended corrective action. Similar notification of the problem has been issued by B&W to all specific B&W designed facilities.

Action to be Taken by Licensees:

For all power reactor facilities with an operating license or construction permit:

1. Determine whether or not GE type AK-2 breakers are used or planned for use in safety-related systems at your facility(ies).

2. If such circuit breakers are used or planned for use, identify the safety system involved and provide in written form your plans for developing a preventive maintenance program which will assure design performance with the GE type AK-2 circuit breaker.

3. The program shall include as a minimum but not be limited to the following:

   a. Establish and adhere to a preventive maintenance schedule regarding the subject circuit breakers.

   b. Have the maintenance performed by qualified personnel. The GE power circuit breaker instruction manual should be used as guidance in setting up the maintenance procedures.

   c. During the preventive maintenance, perform the recommended corrective actions described in the enclosed GE Service Alert Letter No. 175(CPDD) 9.3, dated April 2, 1979. A copy of this letter is enclosed for your information and appropriate use.

4. For facilities with an operating license, a written report of the above actions, including the date(s) when they will be completed, shall be submitted within 30 days of receipt of this Bulletin.

5. For facilities with a construction permit, a written report of the above actions, including the date(s) when they will be completed, shall be submitted within 60 days of receipt of this Bulletin.

Reports should be submitted to the Director of the appropriate NRC Regional Office. A copy of your report should be sent to the U.S. Nuclear Regulatory Commission, Office of Inspection and Enforcement, Division of Reactor Operations Inspection, Washington, D.C. 20555.

Approved by GAO, B180225 (R0072); clearance expires 7/31/80. Approval was given under a blanket clearance specifically for identified generic problems.

Enclosures:
1. Copy of Text of General Electric Service Advice Letter (SAL) No. 175(CPDD) 9.3
2. List of IE Bulletins Issued in Last Twelve Months

EXTRACT OF GE SERVICE ADVICE LETTER
NO. 175(CPDD) 9.3

An undervoltage device is used on some AK type breakers to trip the breaker when loss of voltage occurs on the undervoltage device coil. The undervoltage device is an optional accessory for tripping the breaker and is used in some circuits in place of a shunt trip device because of the inference that it "fails safe" i.e., it trips the breaker when all normal sources of control voltage have become unavailable for shunt trip type operations. Because of the many constraints imposed on the undervoltage device, such as the need to withstand rated voltage continuously, to pick-up at 80 percent or rated voltage (industry standards now require pick-up at 85 percent of rated voltage) and to drop out at 30 percent to 60 percent of rated voltage, both the undervoltage device and breaker must be maintained at a high level of performance to provide the assurance the breaker will trip when voltage is removed from the undervoltage device coil. The following is recommended and except where the breaker is in warranty, should be performed at the customer's expense.

Refer To Figure 1

1. Check the undervoltage trip device to assure there is not excessive clearance between the armature and the rivet and that there are no binds as the armature moves through its travel when manually operated. If excessive clearance or binding exists, it should be adjusted by loosening screws (11) and moving the magnet (10) up or down as necessary to obtain the proper freedom of the armature (3) with respect to its pivot on magnet (10) and the guide provided by rivet (13).

2. Check (and adjust if necessary) the trip latch engagement. This adjustment is described in the maintenance manual for that particular breaker.

3. Check (and adjust if necessary) the pick-up setting of the instantaneous undervoltage device. In some instances, the standards for nominal voltage ratings and pick-up settings have been raised since the breakers were shipped from the factory. The new nominal voltages and pick-up settings deviate substantially from these values, the device should be readjusted while it is on the breaker.

Nominal Voltage	Pick-up Setting
125V DC	106
250V DC	213
120V AC	102
240V AC	204

To adjust the pick-up of the instantaneous undervoltage trip device, remove the Locking Wire (15) and turn the adjusting screw (14) clockwise to raise the pick-up to the desired setting. A suitable voltmeter and adjustable voltage source should be connected to the undervoltage device coil leads at the terminal board for stationary breakers or the secondary disconnects for drawout type breakers. On AC devices, the pick-up voltage should be read immediately before the armature closes its air gap. After the pick-up is adjusted, locking wire (15) should be installed.

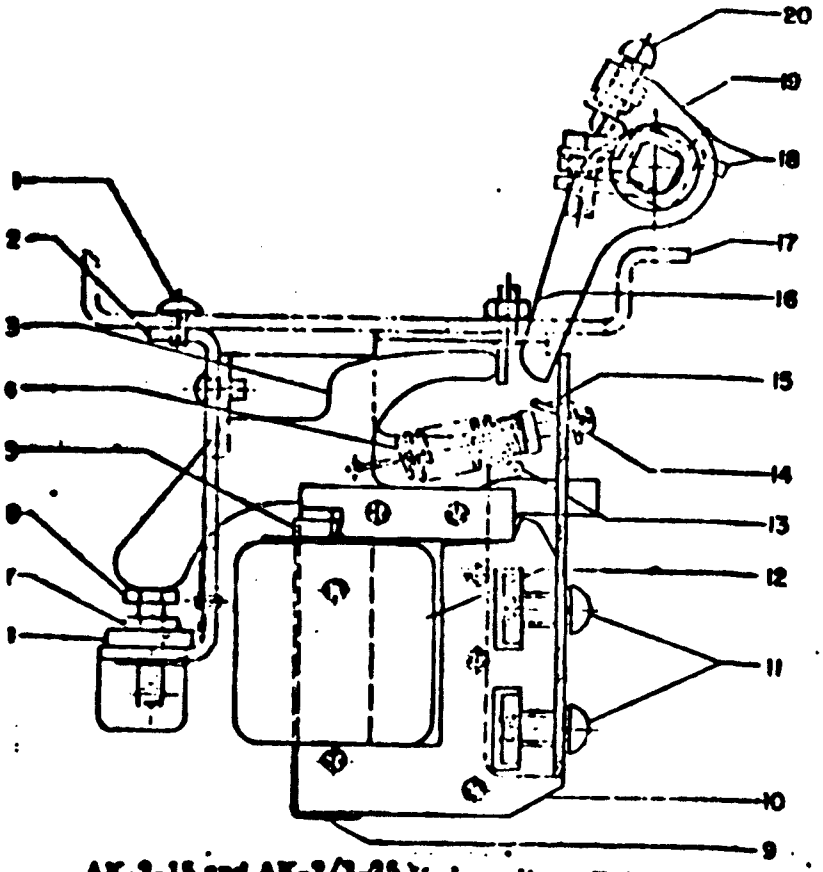
No adjustment is necessary on time-delay undervoltage devices, since the undervoltage device coil is switched by a relay in the time-delay unit.

4. The torque required on the trip shaft to trip a closed breaker should not exceed 1.5 pounds-inches. This may be checked with the equivalent of an open-end wrench fabricated from a piece of sheet metal to which a spring scale can be fastened approximately 1 inch from the trip shaft centerline. Where the torque required to trip the breaker exceeds 1.5 pound-inches, hardened grease in the trip shaft bearings and/or latch bearing may be suspected or dirt may have accumulated on the trip latch surface. Hardened grease must be replaced or revitalized with a suitable solvent such as WD-40 or CRC 5-56 or the bearings must be replaced. Excessive grease and dirt should be removed from the trip latch surface.

5. The adjustment between the undervoltage trip device and the trip paddle on the trip shaft should be checked to assure the required positive trip is maintained (positive trip exists when approximately 1/32 inch additional travel of the armature occurs after the undervoltage device trips the breaker). This adjustment is made with adjusting screw (20).

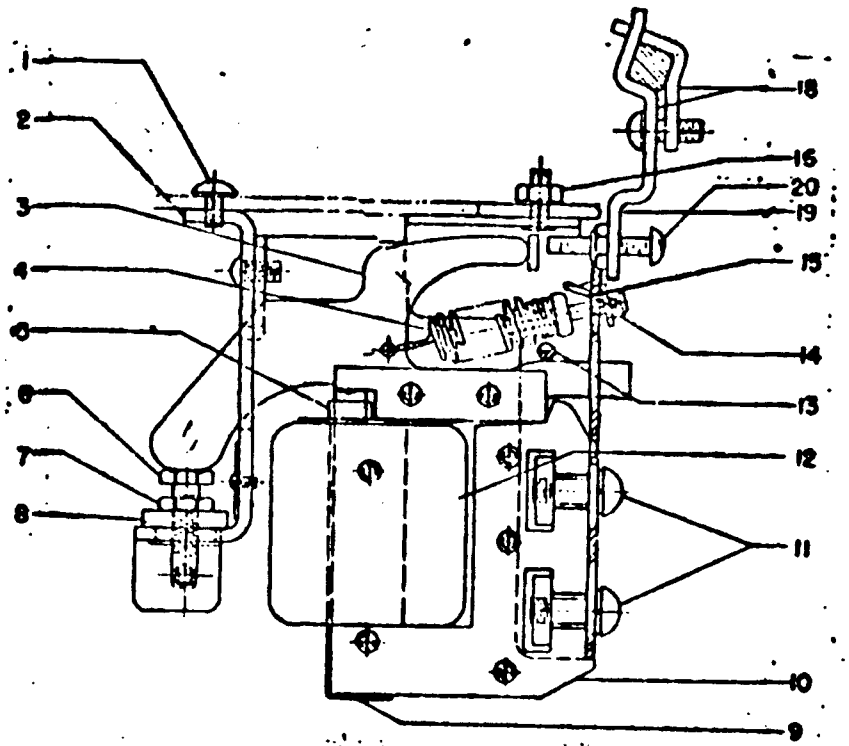
6. The frequency of inspection of the involved breakers should be increased until it can be verified that the revitalization of the grease is effective for the normal maintenance interval. Thereafter the grease in the bearing should be revitalized at normal maintenance intervals.

Attachment:
Figure 1



AK-2-15 and AK-2/3-25 Undervoltage Tripping Device

1. Mounting Screw
2. Frame
3. Armature
4. Spring
5. Shading Ring
6. Adjusting Screw
7. Locking Nut
8. Bushing
9. Clamp
10. Magnet
11. Screws
12. Coil
13. Rivet
14. Adjusting Screw
15. Locking Wire
16. Mounting Nut
17. Mechanism Frame
18. Trip Paddle Clamps
19. Trip Paddle
20. Adjusting Screw



AK—50,75, AND 100 Undervoltage Tripping Device

FIGURE 1

Attachment
Bulletin No.
79-09

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LISTING OF IE BULLETINS
ISSUED IN LAST TWELVE MONTHS

Bulletin No.	Subject	Date Issued	Issued To
78-05	Malfunctioning of Circuit Breaker Auxiliary Contact Mechanism-General Model CR105X	4/14/78	All Power Reactor Facilities with an OL or CP
78-06	Defective Cutler-Hammer, Type M Relays With DC Coils	5/31/78	All Power Reactor Facilities with an OL or CP
78-07	Protection afforded by Air-Line Respirators and Supplied-Air Hoods	6/12/78	All Power Reactor Facilities with an OL, all class E and F Research Reactors with an OL, all Fuel Cycle Facilities with an OL, and all Priority 1 Material Licensees
78-08	Radiation Levels from Fuel Element Transfer Tubes	6/12/78	All Power and Research Reactor Facilities with a Fuel Element transfer tube and an OL.
78-09	BWR Drywell Leakage Paths Associated with Inadequate Drywell Closures	6/14/79	All BWR Power Reactor Facilities with an OL or CP
78-10	Bergen-Paterson Hydraulic Shock Suppressor Accumulator Spring Coils	6/27/78	All BWR Power Reactor Facilities with an OL or CP

LISTING OF IE BULLETINS
ISSUED IN LAST TWELVE MONTHS

Bulletin No.	Subject	Date Issued	Issued To
78-11	Examination of Mark I Containment Torus Welds	7/21/78	BWR Power Reactor Facilities for action: Peach Bottom 2 and 3, Quad Cities 1 and 2, Hatch 1, Monticello and Vermont Yankee
78-12	Atypical Weld Material in Reactor Pressure Vessel Welds	9/29/78	All Power Reactor Facilities with an OL or CP
78-12A	Atypical Weld Material in Reactor Pressure Vessel Welds	11/24/78	All Power Reactor Facilities with an OL or CP
78-12B	Atypical Weld Material in Reactor Pressure Vessel Welds	3/19/79	All Power Reactor Facilities with an OL or CP
78-13	Failures In Source Heads of Kay-Ray, Inc., Gauges Models 7050, 7050B, 7051, 7051B, 7060, 7060B, 7061 and 7061B	10/27/78	All general and specific licensees with the subject Kay-Ray, Inc. gauges
78-14	Deterioration of Buna-N Components In ASCO Solenoids	12/19/78	All GE BWR facilities with an OL or CP
79-01	Environmental Qualification of Class IE Equipment	2/8/79	All Power Reactor Facilities with an OL or CP

LISTING OF IE BULLETINS ISSUED IN LAST TWELVE MONTHS

Bulletin No.	Subject	Date Issued	Issued To
79-02	Pipe Support Base Plate Designs Using Concrete Expansion Anchor Bolts	3/2/79	All Power Reactor Facilities with an OL or CP
79-03	Longitudinal Weld Defects In ASME SA-312 Type 304 Stainless Steel Pipe Spools Manufactured By Youngstown Welding and Engineering Co.	3/12/79	All Power Reactor Facilities with an OL or CP
79-04	Incorrect Weights for Swing Check Valves Manufactured by Velan Engineering Corporation	3/30/79	All Power Reactor Facilities with an OL or CP
79-05	Nuclear Incident at Three Mile Island	4/2/79	All Power Reactor Facilities with an OL and CP
79-05A	Nuclear Incident at Three Mile Island	4/5/79	All B&W Power Reactor Facilities with an OL
79-06	Review of Operational Errors and System Misalignments Identified During the Three Mile Island Incident	4/11/79	All Pressurized Water Power Reactors with an OL License except B&W facilities
79-06A	Review of Operational Errors and System Mis-Alignments Identified During the Three Mile Island Incident	4/14/79	All Pressurized Water Power Reactor Facilities of Westinghouse Design with an Operating License
79-06B	Review of Operational Errors and System Mis-Alignments Identified During the Three Mile Island Incident	4/14/79	All Combustion Engineering Designed Pressurized Water Power Reactor Facilities with an Operating License
79-07	Seismic Stress Analysis of Safety-Related Piping	4/14/79	All Power Reactor Facilities with an OL or CP
79-08	Events Relevant to BWR Reactors Identified During Three Mile Island Incident	4/14/79	All BWR Power Reactor Facilities with an OL