

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

December 3, 1993

NRC INFORMATION NOTICE 93-91: MISADJUSTMENT BETWEEN GENERAL ELECTRIC 4.16-KV  
CIRCUIT BREAKERS AND THEIR ASSOCIATED CUBICLES

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 potential for multiple common-cause failures of logic functions due to misadjustment between General Electric (GE) 4.16-kv Magne-Blast circuit breakers and their associated cubicles. 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

During surveillance testing at the Duane Arnold Energy Center on September 16, 1993, the "B" standby diesel generator output breaker (1A411) to essential bus 1A4 failed to close after simulation of a loss of offsite power (LOOP) and loss of coolant accident (LOCA) signal. During normal plant operation, the normally closed feeder breaker (1A402) from the startup transformer and the normally open feeder breaker (1A401) from the standby transformer provide essential bus 1A4 with two offsite sources of power. One of the "b" contacts (closed when the breaker is open) from each offsite power feeder breaker stationary auxiliary switch (mounted in the breaker cubicle) is used in the diesel generator output breaker automatic close-permissive circuit to indicate whether the two offsite power feeder breakers are open or closed. A closed indication from either breaker 1A401 or 1A402 will prevent the diesel generator output breaker from closing automatically (unsynchronized) onto essential bus 1A4. Breakers 1A401, 1A402, and 1A411 are GE Magne-Blast types.

Troubleshooting revealed that the auto-closing logic for the diesel generator output breaker was not being completed because a "b" contact from breaker 1A401 was open, indicating that the breaker was closed when the breaker was actually open. When the breaker 1A401 is open and in its fully elevated operating position in the cubicle, there is supposed to be a small gap or clearance between the breaker plunger and the stationary auxiliary switch

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operating rod (see Attachment 1, Figure 2) to ensure positive closure of all "b" contacts in the stationary auxiliary switch. However, the plunger of breaker 1A401 was found to be actually pushing its stationary auxiliary switch operating rod up about 4.8 mm [3/16 inch] with the breaker open. This apparently occurred when the breaker was last elevated into its operating position which then opened one or more "b" contacts (including the one in the diesel generator breaker control circuit) from their normally closed position. The misalignment rendered the "B" diesel generator inoperable from July 21, 1993, to September 25, 1993, because it was not capable of automatically closing onto the 1A4 bus.

Upon investigation, the licensee determined that it had performed routine preventive maintenance on breaker 1A401 (a vertically racking, GE model AM-4.16-350-2H) on July 21, 1993, which consisted essentially of lowering the breaker to the bottom of the cubicle, inspecting and lubricating it, and cycling the breaker after elevating it to its test position. However, cycling the breaker in the test position does not operate the stationary auxiliary switch unless a special test link is fitted. Therefore, this action alone does not verify the various control functions performed by the stationary auxiliary switch contacts. The "B" diesel generator monthly tests were completed satisfactorily during the operating cycle, but these tests use a synchronized manual closure of the diesel generator output breaker, which bypasses the breaker automatic close permissive (dead bus) circuit. Even though the once-per-operating-cycle integrated LOOP/LOCA test detected the failure, the potential existed for the "B" diesel generator to be inoperable for an entire operating cycle, or when required during an outage. The periodic routine preventive maintenance performed on breaker 1A401, which may have resulted in the breaker misadjustment and opening of a stationary auxiliary switch contact, was not scheduled in conjunction with a surveillance test (such as the integrated LOOP/LOCA test) that would verify proper operation of the auxiliary switch contacts.

### Discussion

Misadjustment between the stationary auxiliary switch and the breaker plunger on 4.16-kv breakers has the potential to cause multiple common-cause failures of many different logic functions that rely on these auxiliary switch contacts. The circuit breaker plunger to auxiliary switch operating rod adjustment may be affected by breaker maintenance, switchgear maintenance, differences in operating plunger height of interchangeable breakers, differences in breaker cubicles and breaker position switches, and non-repeatability in breaker height when racking in breakers.

During breaker maintenance on July 21, 1993, the licensee for the Duane Arnold plant checked and adjusted the height between the breaker lifting rail and the operating plunger in accordance with the applicable GE breaker technical manual (GEK-7320F, Revision 2/80, "Magne-Blast Circuit Breakers Types AM-4.16-350-2C and -2H"). However, the licensee did not verify the open breaker plunger-to-operating-rod clearance of 0 to 3.2 mm [0 to 1/8 inch] as recommended in the applicable GE switchgear technical manual (GEH-1802, "Instructions - Metal-Clad Switchgear Types M26 and M36 for Magne-Blast

Circuit Breakers Types AM-4.16 and AM-13.8"). In order to ensure a minimum gap for positive "b" contact closure, the manufacturer (now called the GE Specialty Breaker product department) provided additional guidance in its Service Advice Letter (SAL) 073-323.1, issued February 1, 1978, specifying a gap of 1.6 mm [1/16 inch] to 3.2 mm [1/8 inch]. This SAL also provides the recommended sequence of adjustments.

Further conversations between the licensee and GE determined that there are additional dimensional checks (not contained in either the breaker or switchgear technical manual) which would provide additional assurance of proper auxiliary contact operation after breaker maintenance. These additional dimensional checks for a closed breaker (see Attachment 1, Figure 1) are:

- 7.9 ± 1.6 mm [5/16 ± 1/16 inch] from the top of the circuit breaker plunger nut to the bottom of the auxiliary switch operating rod casing.
- All "a" contacts are closed with at least 23.8 mm [15/16 inch] travel of the operating rod.

NOTE: Total specified travel of the plunger is 27 ± 1.6 mm [1 1/16 ± 1/16 inch]. If the total plunger travel is set at the minimum specified value of 25.4 mm [1 inch] and the plunger-to-operating-rod gap is set at the maximum specified value of 3.2 mm [1/8 inch], the amount of travel of the operating rod would only be 22.2 mm [7/8 inch], or less than the required 23.8 mm [15/16 inch] necessary to fully ensure closure of the "a" auxiliary contacts when the breaker closes.

For an open breaker (see Attachment 1, Figure 2) the additional dimensional check is:

- The operating rod collar should rest on the operating rod casing, and the operating rod should not be displaced by the plunger of an open breaker.

GE stated that it will issue a SAL to clarify the instructions and dimensions contained in the previous publications. Meanwhile, licensee inquiries on this subject may be directed to GE Nuclear Energy Power Delivery Services in King of Prussia, Pennsylvania (Phone: 215-992-6049/Fax: 215-992-6191.)

#### Related Generic Communications

- NRC Information Notice 91-55, "Failures Caused by an Improperly Adjusted Test Link in 4.16 KV General Electric Switchgear," dated September 16, 1991.

No specific action or written response is required by this information notice. If you have any questions regarding this matter, 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

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(319) 851-5111

David S. Butler, RIII  
(708) 790-5796

Stephen D. Alexander, NRR  
(301) 504-2995

Attachments:

1. Magne-Blast Circuit Breaker Plunger and Stationary Auxiliary Switch Adjustments
2. List of Recently Issued NRC Information Notices

**MAGNE-BLAST CIRCUIT BREAKER PLUNGER - STATIONARY  
 AUXILIARY SWITCH ADJUSTMENTS (ADAPTED FROM GE  
 MVSD FIELD INSTALLATION DRAWING 0172C7558)**

(Not to Scale)

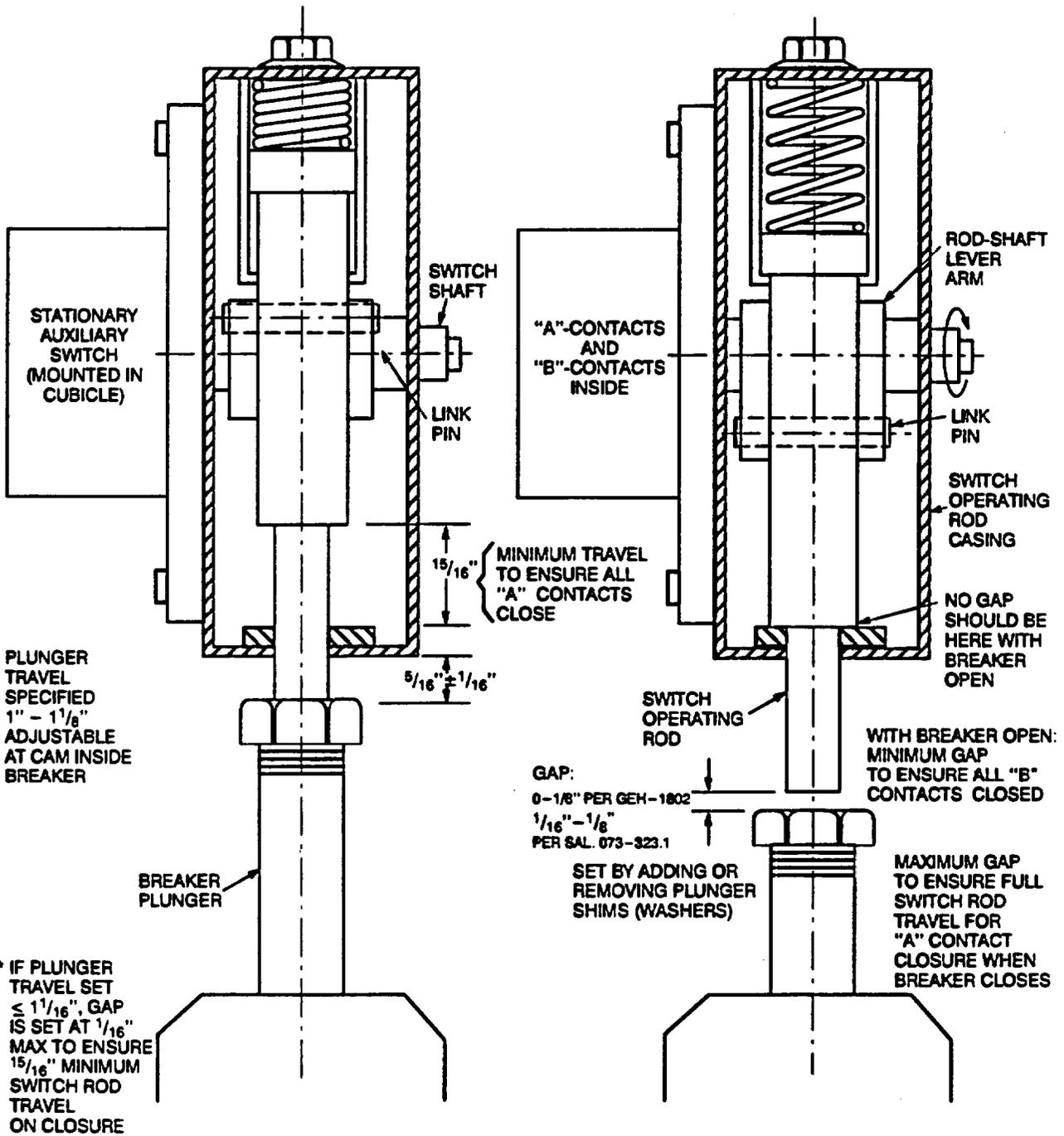


Figure 1  
 BREAKER CLOSED

Figure 2  
 BREAKER OPEN

LIST OF RECENTLY ISSUED  
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
93-90	Unisolatable Reactor Coolant System Leak Following Repeated Applications of Leak Sealant	12/01/93	All holders of OLs or CPs for nuclear power reactors.
93-89	Potential Problems with BWR Level Instrumentation Backfill Modifications	11/26/93	All holders of OLs or CPs for boiling water reactors.
93-88	Status of Motor-Operated Valve Performance Prediction Program by the Electric Power Research Institute	11/30/93	All holders of OLs or CPs for nuclear power reactors.
93-87	Fuse Problems with Westinghouse 7300 Printed Circuit Cards	11/04/93	All holders of OLs or CPs for nuclear power reactors.
93-86	Identification of Isotopes in the Production and Shipment of Byproduct Material at Non-power Reactors	10/29/93	All holders of OLs or CPs for test and research reactors.
93-85	Problems with X-Relays in DB- and DHB-Type Circuit Breakers Manufactured by Westinghouse	10/20/93	All holders of OLs or CPs for nuclear power reactors.
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).

OL = Operating License  
CP = Construction Permit

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orig /s/'d by BKGrimes

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\*SEE PREVIOUS CONCURRENCE

OFFICE	*OEAB:DORS	*OGCB:DORS	*Tech. Ed.	*RGN-III	*RGN-III
NAME	NHunemuller	PWen	DGable	JHopkins	DButler
DATE	10/15/93	10/15/93	10/18/93	10/21/93	10/21/93

*RGN-III	*OEAB:DORS	*OEAB:DORS	*C:EELB:DORS	*C:RVIB:DORS	C:OGCB:DORS
RGreger	RDennig	AChaffee	CBerlinger	LNorrholm	*GMarcus
10/21/93	10/25/93	10/27/93	10/27/93	11/17/93	11/18/93

D:DORS:NRR
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11/3/93

DOCUMENT NAME: 93-91.IN

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RGreger	RDennig	AChaffee	CBerlinger	LNorrholm	JG Marcus TK
10/21/93	10/25/93	10/27/93	10/27/93	11/17/93	11/18/93

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DOCUMENT NAME: ADJGEBKR.WEN

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Attachments:

1. ~~GE Type AM-4-16~~ <sup>Magne-Blast</sup> Circuit Breaker Plunger and Stationary Auxiliary Switch ~~Operating Rod~~ Adjustments
2. List of Recently Issued NRC Information Notices

\*SEE PREVIOUS CONCURRENCE

OFFICE	*OEAB:DORS	*OGCB:DORS	*Tech. Ed.	*RGN-III	*RGN-III
NAME	NHunemuller	PWen	DGable	JHopkins	DButler
DATE	10/15/93	10/15/93	10/18/93	10/21/93	10/21/93

*RGN-III	*OEAB:DORS	*OEAB:DORS	*C:EELB:DORS	<del>C:RYIB:DORS</del>	C:OGCB:DORS
RGreger	RDennig	ACHaffee	CBerlinger	<del>PLNordholm</del>	GMarcus
10/21/93	10/25/93	10/27/93	10/27/93	10/17/93	10/ /93

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11/ /93

DOCUMENT NAME: ADJGEBKR.WEN

NOTE:

- The vendor's comments have been incorporated.

*Peter Wen*  
 11/17/93

1. Closed Circuit Breaker Operating Plunger and Auxiliary Switch Mechanism  
Operating Rod Configuration
2. Open Circuit Breaker Operating Plunger and Auxiliary Switch Mechanism  
Operating Rod Configuration
3. List of Recently Issued NRC Information Notices

CONCURRENCE:

OEAB *MA* 10/15/93  
NHunemuller

OEAB *RD*  
RDennig 10/21/93

DORS  
BGrimes

*PCW*  
OGCB  
PWen  
10/15/93

OEAB *AM*  
AChaffee  
10/27/93

*RlanKsbury for per telecon 10/21/93 71KX*  
RGN-III  
JHopkins

EELB *CB*  
CBerlinger  
10/27/93

*RlanKsbury for per telecon 10/21/93 71KX*  
RGN-III  
DButler

RVIB  
LNorrholm

*RlanKsbury for per telecon 10/21/93 71KX*  
RGN-III  
RGreger

*LSable*  
Tech. Ed. 10-18-93

OGCB  
GMarcus