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

March 15, 1989

NRC INFORMATION NOTICE NO. 89-29: POTENTIAL FAILURE OF ASEA BROWN BOVERI CIRCUIT BREAKERS DURING SEISMIC EVENT

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 failures of ASEA Brown Boveri (ABB) K-Line circuit breakers (CBs) during a seismic event. 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 of Circumstances:

ABB submitted two letters, dated January 13 and February 16, 1989, to the NRC in accordance with the requirements of 10 CFR Part 21 regarding a deficiency in K-Line CBs, model numbers K-225 through K-2000, that were delivered to customers before July 1974. These CBs have a slow-close lever that could move during a seismic event and prevent the CBs from closing upon an electrical demand. The slow-close lever is used to perform diagnostic checks on the CB internals during initial installation. The lever is located in the rear portion of the CB and is only accessible while the CB is out of its cubicle.

Discussion:

In late 1988, Rancho Seco personnel asked ABB why some K-Line CBs used at the Rancho Seco plant had springs on the slow-close lever and others did not. ABB investigated the matter and determined that rebound springs were added to CBs manufactured after July 1974 as a response to CB failures that occurred during seismic testing of K-Line CBs.

The seismic testing was conducted on several sample K-Line CBs at Wyle Laboratories in 1974 and consisted of 123 test runs under varying seismic conditions. During test run number 100 (which consisted of side-to-side sine dwell at 23 hertz, amplitude 0.5 g, duration greater than 20 seconds), one K-1600 CB jammed and failed to close on demand. During test run number 101 (which consisted of

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side-to-side sine dwell at 30 hertz, amplitude 0.36 g, duration greater than 20 seconds), a second K-1600 CB failed to close on demand. The causes of the breaker malfunctions were not immediately recognized. ABB later determined that the CBs had failed to close because of vibration-induced movement of the slow-close lever to a position where it interfered with the closing mechanism of the CB. As a result, a rebound spring that prevents any undesired movement of the slow close lever was added to the CB design and installed in all CBs manufactured after mid-1974.

ABB sent the letters of January 13 and February 16, 1989, to all nuclear power plants that have purchased safety-related electrically operated K-Line CBs, model numbers K-225 through K-2000, and requested that all users of these CBs add rebound springs to the slow-close levers. The letters are included as Attachment 1 and Attachment 2 respectively. Attachment 1 also includes a sketch of the location of the slow-close lever with the rebound spring in place and the field installation procedures for adding the rebound spring to the slow-close lever. Additional information on this subject may be obtained by contacting the appropriate ABB representative.

It is important for addressees to determine whether any of the subject CBs, regardless of their delivery or installation date, are installed at their facilities and to verify that the CBs are seismically qualified.

In addition, addressees are reminded that component manufacturers do not typically notify customers who have procured commercial grade items of design changes and deficiencies identified in their components. Therefore, it is important that this fact be considered when purchasing components that were procured as commercial grade and dedicated for safety-related applications by entities other than the component manufacturer.

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

Charles E. Rossi

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

Technical Contact: Jaime Guillen, NRR
(301) 492-1170

Attachments:
1. ASEA Brown Boveri Letter dated January 13, 1989
2. ASEA Brown Boveri Letter dated February 16, 1989
3. List of Recently Issued NRC Information Notices

Albert F. Kaiser
President

ASEA BROWN BOVERI

January 13, 1989

Mr. Carl Berlinger, Branch Chief
Office of Generic Communications
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Slow Close Lever Rebound Spring for ABB Power Distribution K-Line Electrically Operated K-225 through K-2000 Circuit Breakers (Part 21 Report)

Gentlemen:

Recently SMUD Rancho Seco personnel questioned why some of their K-Line Circuit Breakers had a rebound spring on the slow close lever and some did not.

An evaluation of this matter revealed that the rebound spring (Part Number 146119A00) had been added to the K-Line circuit breakers in July 1974. A search of the archives showed that during seismic testing conducted earlier in 1974 that a circuit breaker malfunctioned by not closing normally during the testing. Subsequent evaluation revealed that persistent sine dwell vibration could occasionally cause the slow close bar to move into a position such that the breaker, when called upon to close, went into a slow close rather than closing normally. The addition of the rebound spring to the slow close lever prevents the slow close bar from vibrating to this undesired position.

Subsequent seismic testing over the years has demonstrated that the addition of the rebound spring in July 1974 solved the problem.

Users of K-Line K-225 through K-2000 circuit breaker that were delivered prior to July 1974 should add the rebound spring (Part Number 146119A00) to the slow close pin in accordance with the instructions included in I.B. 8901, a copy of which is included with this report.

A copy of this report is being sent to all Nuclear Generating Stations with K-Line equipment utilized in Nuclear Safety Related applications. A list of Nuclear Generating Stations where K-Line equipment was delivered prior to July 1974 is included as an Appendix to this report.

If there is any doubt on the part of the user, the manufacturing date by month and year is clearly stamped onto the nameplate of the circuit breakers.

ABB Power Distribution Inc.
201 Hickman Drive
P.O. Box 1978
Sanford, FL 32772-1978

Telephone:
407 323-8220

Telefax:
407 322-8934

The rebound spring may be ordered through ABB Power Distribution Sales Offices.

No reports of in-service misoperation of a circuit breaker without this spring have been received. Also it should be noted that if a K-Line circuit breaker without this spring is in the closed position, it will open or trip normally without any misoperation.

A. F. Kaiser

A. F. Kaiser, President
ABB Power Distribution, Inc.

EWR/jm

Enclosures

cc: J. Clark
R. Dietrick
R. Garzon
E. Johnson
M. Kangas
D. Purkey
E. Rhoads

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LIST OF USERS OF K-LINE CIRCUIT BREAKERS DELIVERED PRIOR TO JULY 1974

Arkansas Power & Light	Arkansas Nuclear One
Carolina Power & Light	Brunswick
Cincinnati Gas & Electric	Zimmer
Consumers Power	Palisades
Duke Power	Oconee
Duke Power	McGuire
Florida Power Corporation	Crystal River
Florida Power & Light	St. Lucie
Florida Power & Light	Turkey Point
Indiana & Michigan	D. C. Cook
Iowa Electric	Duane Arnold
Philadelphia Electric Company	Peachbottom
Public Service Colorado	Ft. St. Vrain
Portland General Electric	Trojan
Public Service Electric & Gas	Salem
SMUD	Rancho Seco
Virginia Electric Power Company	North Anna
Virginia Electric Power Company	Surry

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IB-8901

FIELD INSTALLATION OF: Slow Close Lever Rebound Spring Electrically Operated K-225 through K-2000 Circuit Breakers.

PART REQUIRED: Spring Number 146119A00

PROCEDURE:

1. Turn the motor disconnect switch off.

2. Trip the circuit breaker and rack the circuit breaker to the "Disconnect" position.

3. Double check to make sure the closing springs are discharged, then remove the four screws which retain the black front escutcheon to the black housing protruding through the front door of the circuit breaker cubicle. (It will not be necessary to open the front door of the circuit breaker cubicle to perform this procedure.) Retain the screws for future reuse and catch the local electric close and/or trip push buttons that may be on electrically operated circuit breakers.

4. Locate the slow close lever by looking to the right inside the black box. It will be protruding through a small rectangular opening in the silver-grey painted front frame of the breaker.

5. Locate also the upper right Phillips pan head screw which attaches the black housing to the silver-grey front frame. Loosen this screw approximately two turns. See Figure 1.

6. Hook on end of spring 146119A00 over the loosened screw. Stretch the spring so that the hook can be slid down on the slow close lever.

7. Retighten the screw to secure the spring at its top. This completes the spring installation.

8. Reposition the local electric close and/or trip push buttons, if necessary, in the front escutcheon, then line it up to reinstall on the front of the breaker. Before reinstalling the four screws, make sure the padlock hasp is positioned properly and that the white reset button passes through the front escutcheon. With everything in order, reinstall the four screws.

ABB POWER DISTRIBUTION INC.

Circuit Breaker Division
1-95 & MECHANICSVILLE HIGHWAY
PO BOX F-7
FLORENCE, S C 29501 U S A

TELEPHONE
(803) 665-4144

TELEFAX
(803) 667-5109
(803) 664-0520

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9. Check the operation of the various operating levers and buttons to make sure they work freely. When all checkouts prove satisfactory, the breaker can be returned to service.

NOTE: On circuit breakers with bell alarms or solenoid reset of the auto trip indicator, access to the slow close lever is more difficult. In those situations, it may be easier to hook the spring over the slow close lever first. The order of installation is left to the installer.

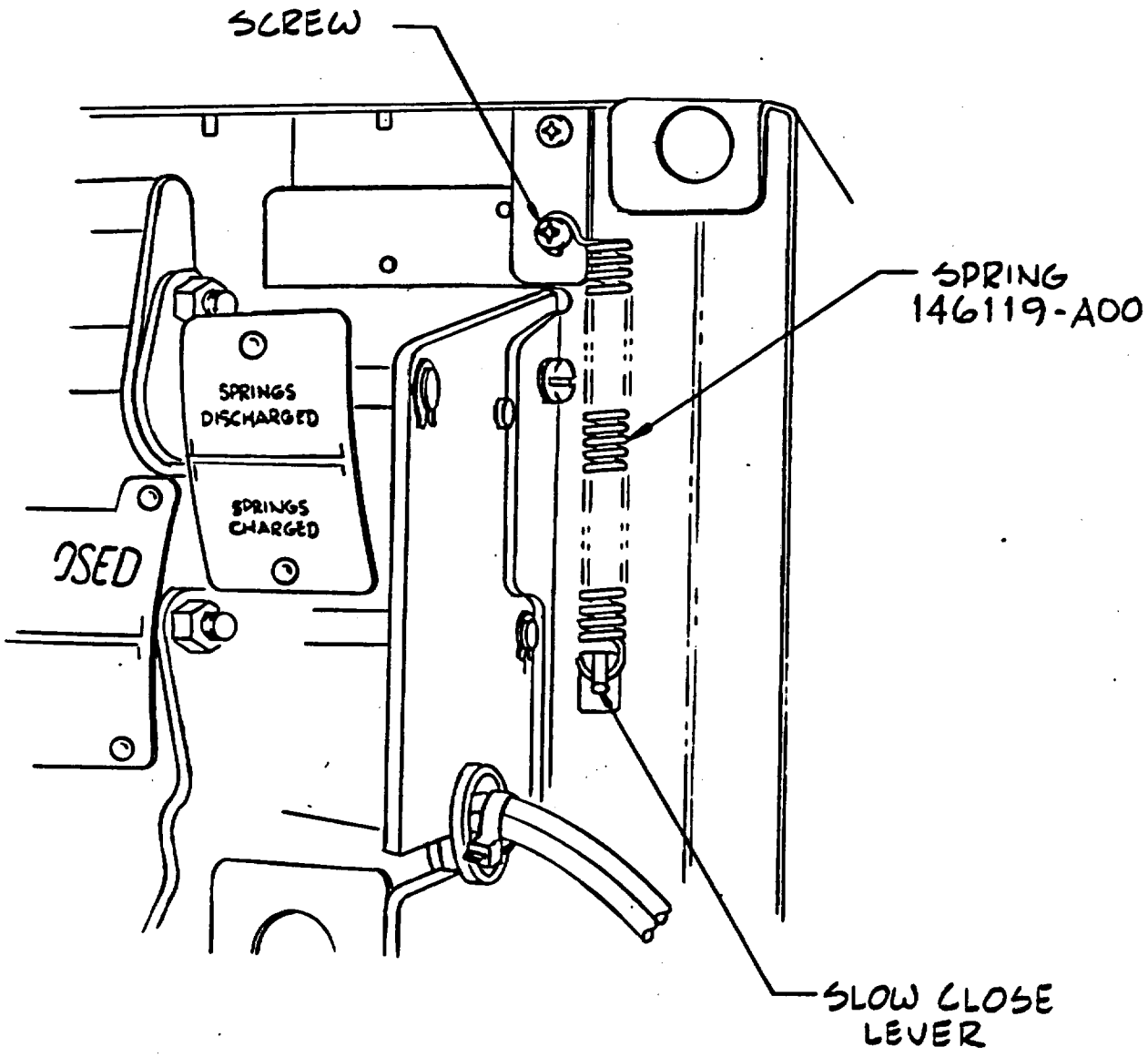
SCREW
SPRING
146119-A00
SPRINGS
DISCHARGED
SPRINGS
CHARGED
OSED
SLOW CLOSE
LEVER

FIGURE 1

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February 16, 1989

Mr. Carl Berlinger, Branch Chief
Office of Generic Communications
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Slow Close Lever Rebound Spring for
ABB Power Distribution, Inc. K-Line
Electrically Operated K-225 through
K-2000 Circuit Breakers
(Part 21 Report)

Gentlemen:

The purpose of this report is to provide additional detailed information to the initial Part 21 Report of January 13, 1989.

Attached is a summary of the details from the Seismic Test of the K-Line Switchgear that detected this malfunction of the circuit breaker slow close latch.

This data can be used to assist the user in conducting their evaluation of this condition. It can be seen that the sine dwell test wherein the malfunction occurred is an unusually severe test and not likely to be encountered in most locations.

By way of clarification the vibration induced mislocation of the slow close latch simultaneously with a close signal to the circuit breaker may result in a jamming of the breaker and a failure to close.

Racking of the circuit breaker either in or out will not cause any vibration to cause this condition.

This malfunction could be reproduced in the factory by near simultaneous trip and close of the breaker. The tripping shock would occasionally bounce the slow close bar into a position such that when called upon to close the breaker went into slow close and jammed. Again, this is not a normal mode of operation for a circuit breaker.

This supplemental information is being sent to the same distribution list as the original report.

E. W. Rhoads
Manager, Quality Assurance

EWR/jm

Attachment

ABB Power Distribution Inc.

ABB Power Distribution Inc.
4379 County Line Road
Chalfont, PA 18914

Telephone:
215 822-4270

Telefax:
215 822-4271

SLOW CLOSE LATCH MALFUNCTION

Wyle Laboratories, Huntsville conducted an extensive test program on a 4-frame sample of ITE K-Line Low Voltage Switchgear (completed May 10, 1974). Results are reported in Wyle Report No. 42686-1.

Testing was biaxial (1 Horizontal and Vertical Axis) and consisted of the following test runs:

Runs 1-5	: F-B Sine Sweep Tests, 1 to 50 Hz, 1 octave/min. 0.2 g and 0.36 g.
Runs 6-19	: F-B RMF Biaxial Tests, > 16 sec. duration up to 1.5 g ZPA.
Runs 20-44	: F-B Sine Dwell at selected resonant frequencies 0.36 and 0.5 g > 20 sec. duration.
Runs 45-62	: F-B Sine Dwell at low frequencies at machine limits, > 20 sec. duration.
Runs 63-66	: S-S Sine Sweep Tests, 1 to 50 Hz, 1 octave/min. 0.2 g and 0.36 g.
Runs 67-80	: S-S RMF Biaxial Tests, > 16 sec. duration up to 1.5 g ZPA.
Runs 81-105	: Sine Dwell at selected resonant frequencies, 0.36 and 0.5 g, > 20 sec. duration.
Runs 105-123	: S-S Sine Dwell at Low Frequencies at machine limits, > 20 sec. duration.

The latch malfunctions occurred on two K-1600 breakers. Breaker 4C jammed on Run 100 (side-to-side sine dwell at 23 Hz, amplitude 0.5 g, duration greater than 20 seconds). Breaker 5C jammed on Run 101 (side-to-side sine dwell at 30 Hz, amplitude 0.36 g, duration greater than 20 seconds.)

It should be noted that this phenomenon did not occur during any of the prior 99 test runs and the sine dwell testing is an unusually severe (and ordinarily not performed) test method.

The cause of the jamming was not identified at the test lab. Subsequent inspection and tests at the factory verified the cause as vibration-induced mislocation of a slow-close latch simultaneously with a close signal to the breaker.

The probability of this occurrence is very small. This is borne out by the fact that many high level RMF tests did not cause this type of malfunction.

Circuit Breaker Engineering proceeded to add a spring to the breaker design which prevents vibration-induced movement of the slow close latch. With this change the latch can only be mechanically engaged by use of the slow close tool. No change was required in other parts to implement this improvement. All K-Line circuit breakers manufactured since approximately mid-1974 have this spring installed.

LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
89-28	Weight and Center of Gravity Discrepancies for Copes-Vulcan Air-Operated Valves	3/14/89	All holders of OLs or CPs for nuclear power reactors.
89-27	Limitations on the Use of Waste Forms and High Integrity Containers for the Disposal of Low-Level Radioactive Waste	3/8/89	All holders of OLs or CPs for nuclear power reactors, fuel cycle licenses and certain by-product materials licenses.
89-26	Instrument Air Supply to Safety-Related Equipment	3/7/89	All holders of OLs or CPs for nuclear power reactors.
89-25	Unauthorized Transfer of Ownership or Control of Licensed Activities	3/7/89	All U.S. NRC source, byproduct, and special nuclear material licensees.
89-24	Nuclear Criticality Safety	3/6/89	All fuel cycle licensees and other licensees possessing more than critical mass quantities of special nuclear material.
89-23	Environmental Qualification of Litton-Veam CIR Series Electrical Connectors	3/3/89	All holders of OLs or CPs for nuclear power reactors.
89-22	Questionable Certification of Fasteners	3/3/89	All holders of OLs or CPs for nuclear power reactors.
89-21	Changes in Performance Characteristics of Molded-Case Circuit Breakers	2/27/89	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
CP = Construction Permit

side-to-side sine dwell at 30 hertz, amplitude 0.36 g, duration greater than 20 seconds), a second K-1600 CB failed to close on demand. The causes of the breaker malfunctions were not immediately recognized. ABB later determined that the CBs had failed to close because of vibration-induced movement of the slow-close lever to a position where it interfered with the closing mechanism of the CB. As a result, a rebound spring that prevents any undesired movement of the slow close lever was added to the CB design and installed in all CBs manufactured after mid-1974.

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*SEE PREVIOUS PAGE FOR CONCURRENCE

			D/DOEA:NRR	*C/OGCB:DOEA:NRR
			CERossi	CHBerlinger
			03/9/89	03/8/89
*OGCB:DOEA:NRR	*SELB:DEST:NRR	*AD/SAD:DEST:NRR	*D/DEST:NRR	*PPMB:ARM
JGuillen	FRosa	AThadani	LShao	TechEd
02/20/89	02/28/89	03/6/89	03/7/89	02/23/89

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OGCB:DOEA:NRR	SELB:DEST:NRR	AD/SAD:DEST:NRR	D/DOEA:NRR	C/OGCB:DOEA:NRR
JGuillen	FRosa	AThadani	CERossi	CHBerlinger
02/22/89	02/28/89	03/6/89	02/ /89	02/8/89
			D/DEST:NRR	PPMB:ARM for
			LShao	TechEd BCalure
			02/7/89	02/23/89 Previously concurred