



HITACHI

Dale E. Porter
Safety Evaluation Program Manager

3901 Castle Hayne Rd.,
Wilmington, NC 28401
USA

T 910 602-4491
F 910 341-2555
Dale.Porter@ge.com

August 25, 2008
MFN 08-645

Attn: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: Failure of “F” and “G” Switches

**Reference: GE Hitachi Nuclear Energy, Transfer of Information SC 08-07
“Failure of “F” and “G” Switches” Dated August 25, 2008**

Summary

During utility testing of an AK-2A-50 circuit breaker it was identified that a failure in a Safety Related GE Hitachi Nuclear Energy (GEH) model “F” (part number Q192A7153P7) cutoff switch had occurred. An investigation indicates that the failure was caused by an apparent weak spring in the switch that creates the motive force to change position. Both the “F” and “G” cutoff switches both utilize the same spring to provide motive forces to change position.

GEH provided the “F” and “G” cutoff switches (part numbers Q192A7153P7 and Q192A7153P8 respectively) under unspecified application purchase orders and as such did not have the information required to determine if a Substantial Safety Hazard may exist or have been created, or this potential defect could have lead to the violation of a Technical Specification Safety Limit, therefore, GEH provided a Transfer of Information to the utilities that purchased these devices as “unspecified application” in accordance with 10CFR21.21(b) so that each identified utility could review their individual plant conditions to determine if the noted condition represents a reportable condition.

However, since additional licensees may have obtained these devices through other means, GEH cannot assure that all end-users have been identified and/or notified. GEH is therefore providing this information to the NRC for appropriate action.

Background

On February 13, 2008 a General Electric AK-2A-50 circuit breaker failed to close electrically during preventive maintenance activities at a utility. The "F" switch (Q192A7153P7) was replaced during a circuit breaker overhaul performed by maintenance personnel at that utility. The circuit breaker was last overhauled in 2004. The "F" switch is a normally open switch that closes when activated, which is part of a control permissive circuit to allow the circuit breaker to close electrically. The circuit breaker was opened and removed from the plant in support of preventive maintenance activities. A test box was connected to cycle the circuit breaker electrically. The close button was operated and the 52X relay picked up, but the circuit breaker did not close. The "F" switch was shown to be open by a resistance test. It was then verified that the "F" switch was fully activated. The "F" switch was then actuated an additional 3/16-inch and was still found to be open by a resistance test. The "F" switch was then cycled on the bench and still found to be open.

A replacement "F" switch, which was obtained from site stock, also failed after 35 cycles. The "F" switch was replaced again with an "F" switch from site stock from a more recently purchased batch than the previous switches that had failed. The circuit breaker was then cycled to ensure it was working satisfactorily, and the test was performed satisfactorily. The breaker was returned to service. There have been two other documented events involving defective "F" switches at this utility. The defective "F" switches were returned to GEH for evaluation.

This same switch is sold as a renewal part by GEH as part number Q0192A7153P007 and is used in the overhaul and refurbishment of the AK-50/75/100 and AKR-30/50 families of safety related low voltage power circuit breakers.

GE-Industrial Systems Product Department issued Service Advisory Letter (SAL) 316.0 on January 16, 2003. This SAL described a defect found with the "G" switch, which is a Normally Closed (NC) pushbutton switch, part number 192A7153P8. The SAL describes an issue where AKR & WavePro Low Voltage Power Circuit Breakers, produced during fiscal week 43 of 2002 (Date code P243&) and fiscal week 44 of 2002 (Date code P244&) may have been manufactured with non-conforming Motor cutoff "G" switches that may fail to open and fail to de-energize the electric charging motor. GE-Industrial Systems uses this switch in various electrically operated low voltage power circuit breaker control circuit designs. The switch provides a control permissive to the circuit breaker closing spring charging motor and opens when the closing spring is fully charged. The switch opening interrupts power to the charging motor and the motor stops. The defect, as described in SAL 316.0, causes sufficient variability of the switch operating point that in application the switch may not reliably open when acted upon by the parent circuit breaker linkage. If this occurs the charging motor will continue running until damage occurs caused by overheating.

A similar switch (Type "G") is sold as a renewal part by GEH as part number Q0192A7153P008 and is used in the overhaul and refurbishment of the AK-50/75/100 and AKR-30/50 families of safety related low voltage power circuit breakers. A switch failure of the type, described in SAL 316.0, has not been reported in safety related applications.

Refer to figures 1 – 3 for F & G switch typical installation and electrical application.

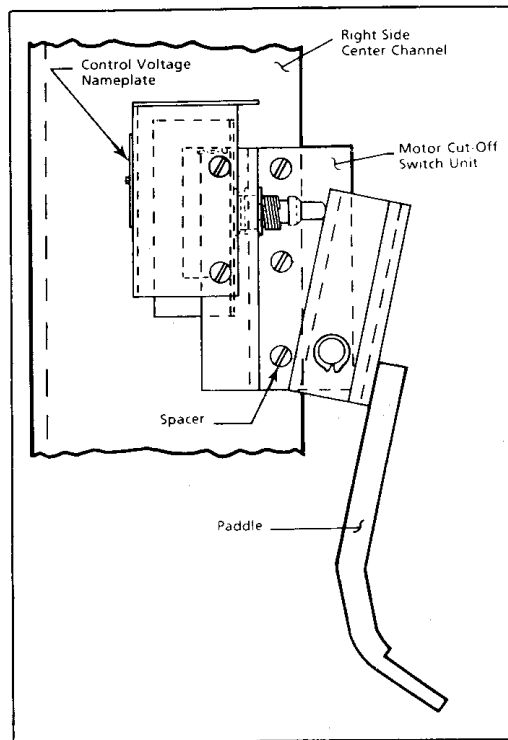


Figure 1: Motor cutoff switch unit

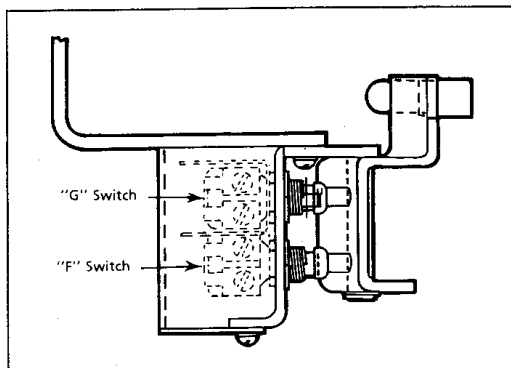


Figure 2: "F" & "G" switch mounting location

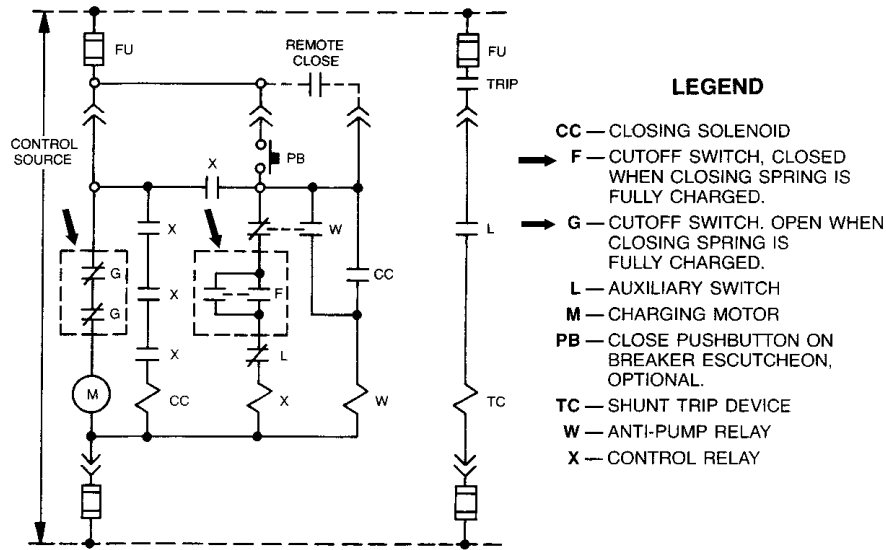


Figure 3: Typical elementary diagram for electrically operated drawout breaker with “F” and “G” switches. Contact positions are shown with breaker open and closing springs discharged.

Discussion

Per the GEH evaluation it was concluded, by examination of an X-ray of the internal components of the “F” switch (Q192A7153P7), that the contact carrier assembly between the lower and upper contact clips had not adequately changed position indicating a weakness in the internal spring. Item 14 (spring) was identified as the weak spring for the “F” switch (Q192A7153P7), causing a failure to change state. Also, per SAL 316.0 it was noted, for the “G” switch (Q192A7153P8), the supplier built the switch with an incorrect, weaker spring supporting the switch’s over-travel button. Both the “F” switch (Q192A7153P7) and “G” switch (Q192A7153P8) were manufactured with the same internal components with the only difference being the orientation of the contact carrier assembly during component assembly (refer to figures 4 & 5).

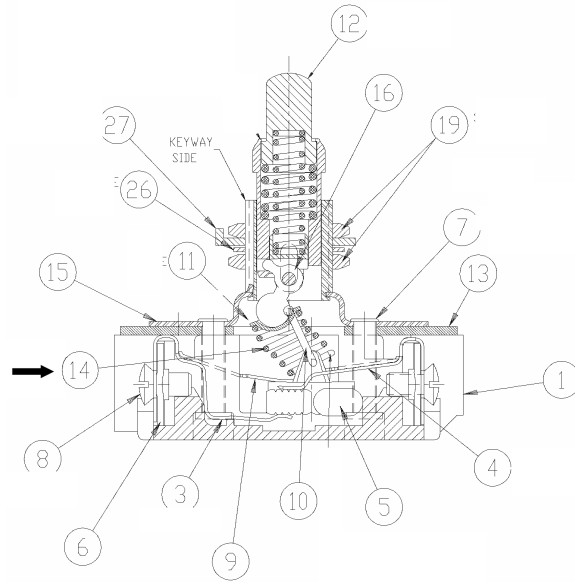


Figure 4: "F" & "G" switch internal component view

ITEM	DESCRIPTION OR NAME OF PART
1	BASE
2	
3	LOWER CONTACT CLIP
4	UPPER CONTACT CLIP
5	CONTACT CARRIER ASSEMBLY
6	TERMINAL PLATE
7	RIVET
8	#5-40 X .250 TERMINAL SCREW
9	ARC BARRIER
10	HANGER
11	SPRING GUIDE
12	OVERTHROW BUTTON
13	INSULATOR
14	SPRING ←
15	COVER ASSEMBLY
16	BELL CRANK
17	RIVET
18	HEX LOCK NUT
19	CAP NUT
20	PUSH BUTTON
21	SPRING
22	PUSH BUTTON SPRING GUIDE
23	GREASE
24	WHITE INK (HEAT CURED)
25	OIL
26	LOCKWASHER
27	LOCKING RING
28	SPRING

Figure 5: "F" & "G" Internal component description

Per GE C & I, Plainville, Cutler-Hammer was the manufacturer for both the "F" (Q192A7153P7) and "G" (Q192A7153P8) switches, which later sold the product line in approximately 2003 to another vendor. Cutler-Hammer was the manufacturer of both the "F" and "G" switches that have experienced the documented failures. Therefore, this notification applies to all "F" (Q192A7153P7) and "G" (Q192A7153P8) switches shipped during or before 2003 that are marked by "C-H" on the bottom of the base. There have been no reported failures or defects for either the "F" or "G" switches since Cutler-Hammer sold the product line to the new manufacturer. GE C & I continues to use both the "F" & "G" switches in present breaker designs with no documented failures since the change in suppliers.

Recommendation

Those plants that utilize GEH Type "F" or "G" cutoff switches (part numbers Q192A7153P7 and Q192A7153P8 respectively) utilized in AK-50/75/100 and AKR-30/50 families of Safety Related low voltage power circuit breakers, or Eaton Cutler-Hammer switches (part number 8980K250 or 8980K251) utilized in any Safety Related application, should identify those applications, review the impact of the potential defect described above on the Safety Related system and schedule replacement of any devices marked with "C-H" on the base of the switch with switches that do not bear the "C-H" marking, at the earliest convenience.

If you have any questions, on this information, please call me at (910) 602-4491.

Sincerely,



Dale E. Porter
Safety Evaluation Program Manager

cc: M. C. Honcharik (NRR/ADRO/PDR/PSP) Mail Stop OWFN 12 E1
C. V. Hodge (NRR/ADRO/DIRS/IO) Mail Stop OWFN 12 G13
P. L. Campbell (GEH)
M. E. Harding (GEH)
J. F. Harrison (GEH)
J. F. Klapproth (GEH)
A. Lingenfelter (GNF)

PRC File

Attachment 1
Potentially Affected Plants

<u>X</u>	<u>Utility</u>	<u>Plant</u>
<u>X</u>	AmerGen Energy Co.	Clinton
<u>X</u>	AmerGen Energy Co.	Oyster Creek
<u>X</u>	Constellation Nuclear	Nine Mile Point 1
<u>X</u>	Constellation Nuclear.	Nine Mile Point 2
<u>X</u>	Detroit Edison Co.	Fermi 2
<u>X</u>	Dominion Generation	Millstone 1
<u>X</u>	Energy Northwest	Columbia
<u>X</u>	Entergy Nuclear Northeast	FitzPatrick
<u>X</u>	Entergy Nuclear Northeast	Pilgrim
<u>X</u>	Entergy Operations, Inc.	Grand Gulf
<u>X</u>	Entergy Operations, Inc.	River Bend
<u>X</u>	Entergy Nuclear Northeast	Vermont Yankee
<u>X</u>	Exelon Generation Co.	CRIT Facility
<u>X</u>	Exelon Generation Co.	Dresden 2
<u>X</u>	Exelon Generation Co.	Dresden 3
<u>X</u>	Exelon Generation Co.	LaSalle 1
<u>X</u>	Exelon Generation Co.	LaSalle 2
<u>X</u>	Exelon Generation Co.	Limerick 1
<u>X</u>	Exelon Generation Co.	Limerick 2
<u>X</u>	Exelon Generation Co.	Peach Bottom 2
<u>X</u>	Exelon Generation Co.	Peach Bottom 3
<u>X</u>	Exelon Generation Co.	Quad Cities 1
<u>X</u>	Exelon Generation Co.	Quad Cities 2
<u>X</u>	FirstEnergy Nuclear Operating Co.	Perry 1
<u>X</u>	FPL Energy	Duane Arnold
<u>X</u>	Nebraska Public Power District	Cooper
<u>X</u>	Nuclear Management Co.	Monticello
<u>X</u>	Pooled Equipment Inventory Co.	PIM
<u>X</u>	PPL Susquehanna LLC	Susquehanna 1
<u>X</u>	PPL Susquehanna LLC	Susquehanna 2
<u>X</u>	Progress Energy	Brunswick 1
<u>X</u>	Progress Energy	Brunswick 2
<u>X</u>	PSEG Nuclear	Hope Creek
<u>X</u>	Southern Nuclear Operating Co.	Hatch 1
<u>X</u>	Southern Nuclear Operating Co.	Hatch 2
<u>X</u>	Tennessee Valley Authority	Browns Ferry 1
<u>X</u>	Tennessee Valley Authority	Browns Ferry 2
<u>X</u>	Tennessee Valley Authority	Browns Ferry 3

	<u>Utility</u>	<u>Plant</u>
<u>X</u>	BKW-FMB, Ltd	Muehleberg
<u>X</u>	Chubu Electric Power Co.	Hamaoka 1-4
<u>X</u>	Chugoku Electric Power Co.	Shimane 1-2
<u>X</u>	Comision Federal de Electricidad	Laguna Verde 1-2
<u>X</u>	Forsmarks Kraftgrupp AB	Forsmark 1-3
<u>X</u>	Iberdrola SA	Cofrentes
<u>X</u>	Hokuriku Electric Power Co.	Shika 1
<u>X</u>	Japan Atomic Power Co.	Tokai 2
<u>X</u>	Japan Atomic Power Co.	Tsuruga 1
<u>X</u>	Kernkraftwerk Gundremmingen GmbH	Gundremmingen B, C
<u>X</u>	Kernkraftwerk Leibstadt AG	Leibstadt
<u>X</u>	Nuclenor SA	Santa Maria De Garoña
<u>X</u>	OKG Aktiebolag	Oskarshamn 1-3
<u>X</u>	Taiwan Power Company	Chinshan 1-2
<u>X</u>	Taiwan Power Company	Kuosheng 1-2
<u>X</u>	Taiwan Power Company	Lungmen 1-2*
<u>X</u>	Tokyo Electric	Fukushima Daiichi 1
<u>X</u>	Tokyo Electric	Fukushima Daiichi 2
<u>X</u>	Tokyo Electric	Fukushima Daiichi 6
<u>X</u>	Tokyo Electric	Fukushima Diani 1-4
<u>X</u>	Tokyo Electric	Kashiwazaki 1-5
<u>X</u>	Tokyo Electric	Kashiwazaki 6-7
<u>X</u>	Vattenfall AB	Ringhals 1

* Under construction

Note: Fukushima Daiichi # is 1F# - Daiichi means 1. Fukushima Diani # is 2F# - Diani means 2.

1F1 and 1F2 are Mark I containment

1F6 and 2F1-4 are Mark II containments

	<u>Utility</u>	<u>Plant</u>
<u>X</u>	Ameren/UE Corp.	Callaway
<u>X</u>	AmerGen Energy	Three Mile Island 1
<u>X</u>	Arizona Nuclear Power Project	Palo Verde 1
<u>X</u>	Arizona Nuclear Power Project	Palo Verde 2
<u>X</u>	Arizona Nuclear Power Project	Palo Verde 3
<u>X</u>	Carolina Power & Light	Robinson
<u>X</u>	Carolina Power & Light	Shearon Harris
<u>X</u>	Constellation Nuclear	Calvert Cliffs 1
<u>X</u>	Constellation Nuclear.	Calvert Cliffs 2
<u>X</u>	Dominion Generation	Millstone 2
<u>X</u>	Dominion Generation	Millstone 3
<u>X</u>	Dominion Generation	North Anna 1
<u>X</u>	Dominion Generation	North Anna 2
<u>X</u>	Dominion Generation	Surry 1
<u>X</u>	Dominion Generation	Surry 2
<u>X</u>	Duke Energy Nuclear LLC	Catawba 1
<u>X</u>	Duke Energy Nuclear LLC	Catawba 2
<u>X</u>	Duke Energy Nuclear LLC.	Oconee 1
<u>X</u>	Duke Energy Nuclear LLC.	Oconee 2
<u>X</u>	Duke Energy Nuclear LLC.	Oconee 3
<u>X</u>	Duke Power Co.	McGuire 1
<u>X</u>	Duke Power Co.	McGuire 2
<u>X</u>	Entergy Nuclear	Arkansas Nuclear One 1
<u>X</u>	Entergy Nuclear	Arkansas Nuclear One 2
<u>X</u>	Entergy Nuclear	Indian Point 2
<u>X</u>	Entergy Nuclear	Indian Point 3
<u>X</u>	Entergy Operations, Inc.	Waterford 3
<u>X</u>	Exelon Generation Co.	Braidwood 1
<u>X</u>	Exelon Generation Co.	Braidwood 2
<u>X</u>	Exelon Generation Co.	Byron 1
<u>X</u>	Exelon Generation Co.	Byron 2
<u>X</u>	Exelon Generation Co.	Zion 1
<u>X</u>	Exelon Generation Co.	Zion 2
<u>X</u>	First Energy Nuclear Operations Co.	Beaver Valley 1
<u>X</u>	First Energy Nuclear Operations Co.	Beaver Valley 2
<u>X</u>	FirstEnergy Nuclear Operating Co.	Davis-Besse
<u>X</u>	Florida Power & Light Co.	St. Lucie 1
<u>X</u>	Florida Power & Light Co.	St. Lucie 2
<u>X</u>	Florida Power & Light	Turkey Point 3
<u>X</u>	Florida Power & Light	Turkey Point 4
<u>X</u>	Florida Power Corp.	Crystal River 3
<u>X</u>	Indiana Michigan Power	Cook 1
<u>X</u>	Indiana Michigan Power	Cook 2

	<u>Utility</u>	<u>Plant</u>
<u>X</u>	Maine Yankee Atomic Power Co.	Maine Yankee
<u>X</u>	North Atlantic Energy Service Corp.	Seabrook
<u>X</u>	Nuclear Management Co.	Kewaunee
<u>X</u>	Nuclear Management Co.	Palisades
<u>X</u>	Nuclear Management Co.	Point Beach 1
<u>X</u>	Nuclear Management Co.	Point Beach 2
<u>X</u>	Nuclear Management Co.	Prairie Island 1
<u>X</u>	Nuclear Management Co.	Prairie Island 2
<u>X</u>	Omaha Public Power District	Fort Calhoun
<u>X</u>	Pacific Gas & Electric Co.	Diablo Canyon 1
<u>X</u>	Pacific Gas & Electric Co.	Diablo Canyon 2
<u>X</u>	PSEG Nuclear LLC	Salem 1
<u>X</u>	PSEG Nuclear LLC	Salem 2
<u>X</u>	Rochester Gas & Electric Corp.	Ginna
<u>X</u>	South Carolina Electric & Gas Co.	Summer
<u>X</u>	South Texas Project Nuclear Operating Co.	South Texas Project 1
<u>X</u>	South Texas Project Nuclear Operating Co.	South Texas Project 2
<u>X</u>	Southern California Edison Co.	San Onofre 2
<u>X</u>	Southern California Edison Co.	San Onofre 3
<u>X</u>	Southern Nuclear Operating Co.	Farley 1
<u>X</u>	Southern Nuclear Operating Co.	Farley 2
<u>X</u>	Southern Nuclear Operating Co.	Vogtle 1
<u>X</u>	Southern Nuclear Operating Co.	Vogtle 2
<u>X</u>	Tennessee Valley Authority	Sequoyah 1
<u>X</u>	Tennessee Valley Authority	Sequoyah 2
<u>X</u>	Tennessee Valley Authority	Watts Bar 1
<u>X</u>	TXU Electric Generation Co.	Comanche Peak 1
<u>X</u>	TXU Electric Generation Co.	Comanche Peak 2
<u>X</u>	Wolf Creek Nuclear Operating Corp.	Wolf Creek