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Rockwell International

May 27, 1983

In reply refer to 83ESG-3401

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U.S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive
Arlington, Texas 76012

Attention: Mr. John Collins, Administrator
Region IV

References: (1) ESG Letter 83ESG-1483 dated March 11, 1983,
D. C. Empey to John Collins

(2) ESG Letter 83ESG-3402 dated May 24, 1983,
D. C. Empey to John Collins

Gentlemen:

Subject: Status Update on Report of Deviation (10 CFR 21)

Reference (1) provided information regarding failure of circuit breakers during environmental testing. This letter is to update status of our corrective efforts and to complete the listing of suspect model numbers. Also, please note that Reference (2) has expanded the problem to similar circuit breakers made by another manufacturer and essentially duplicates the corrective action stated herein.

Component Description

a) ITE Imperial Corporation circuit breaker, 100A frame, 600-Vac, thermal-magnetic trip, 40°C calibration, EF series.

b) ITE Imperial Corporation circuit breaker, 100A frame, 600-Vac, thermal-magnetic trip, 40°C calibration, HE series.

c) ITE Imperial Corporation circuit breaker, 150A frame, 480-Vac, thermal-magnetic trip, 40°C calibration, EH series.

d) ITE Imperial Corporation circuit breaker, 225A frame, 600-Vac, thermal-magnetic trip, 40°C calibration, Part No. FJ3-B150.

e) ITE Imperial Corporation circuit breaker, 400A frame, 600-Vac, thermal-magnetic trip, 40°C calibration, JL series.

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Test Results

During the IEEE 323 Environmental Qualification Testing, an EF3-B015 thermal-magnetic circuit breaker failed to reset (close) the test circuit at 165°F with a relative humidity of 97% (150°F circuit breaker ambient temperature plus 15°F margin; reference ESG Component Qualification Test Report N001TR700020 and Wyle Laboratories Report NES 58481).

The circuit breaker provides 480-Vac power to various control devices in Rockwell International, Energy Systems Group (ESG), Hydrogen Recombiners. The failure mode, described above, would prevent the operation of the control devices and cause the Hydrogen Recombiner to shut down.

On January 28, 1983, an attempt was made to repeat the test in which the EF3-B015 circuit breaker had failed. The retest, which was completed on January 31, 1983, demonstrated that during post-LOCA environment conditions (i.e., high relative humidity [95-100%] and high temperature 169°F, 165°F base temperature plus 4°F tolerance), the circuit breaker will automatically trip without a load being applied. Further testing was performed to establish the temperature at which the circuit breaker would trip while carrying a normal electrical load. The tests were conducted simulating the worse-case loading of 3.5A, as it is used in the Hatch and LaSalle BWR power plants which are now in operation. The circuit breaker failed to carry the 3.5A by tripping after 13 min at 140°F. At 130°F, the circuit breaker had not tripped after 239 hours and 55 min while carrying the 3.5A load. Based on engineering judgment, this time period is sufficient to have achieved circuit breaker temperature rise stabilization and indicates that this load can be carried continuously at this temperature for the required post-LOCA maximum operating duration of one year.

On March 3, 1983, additional tests were performed on the EF3-B015 circuit breaker to simulate temperature and loading conditions as it is used in PWR power plants. The circuit breaker was loaded to 5A, with a 33A surge for 5 sec to simulate motor starting characteristics. The circuit breaker failed to carry the 33A surge by tripping in 4.5 sec at 130°F. At 120°F, the circuit breaker had not tripped after 91 hours while carrying the continuous load of 5A (the 33A surge for 5 sec was applied at the beginning of the test).

The results of the above tests indicated that a temperature sensitivity problem might be generic to all ITE thermal-magnetic circuit breakers calibrated for 40°C service. Therefore, a test program was established to test representative sizes and types of the ITE thermal-magnetic circuit breakers used in the ESG Hydrogen Recombiners (the circuit breakers actually used in the various recombiners are listed in the section entitled "Affected Plants"). A load current analysis was conducted to determine the worse-case loading for the various circuit breakers.

The objective of the test program was to establish the maximum circuit breaker ambient temperature at which the series of breakers could consistently carry the required load current. This temperature was established to be 120°F.

For the PWR series of power consoles, a temperature rise within the console due to component heating was measured to be 20°F at a console ambient temperature of 72°F. An equivalent rise is estimated for the BWR power consoles due to similarities in design.

The 20°F compartment temperature rise would limit both the BWR and PWR power console external ambient temperature to 100°F for reliable circuit breaker operation.

An investigation was conducted to evaluate replacement devices for the thermal-magnetic circuit breakers. Tests were conducted on representative sizes of magnetic (only) trip circuit breakers to temperatures of 195°F (150°F operating ambient plus 30°F compartment temperature rise (conservative) plus 15°F margin). Verification of operation included both the ability to continuously carry a current load and the ability to trip for simulated fault conditions. The ability to remain closed with no load current when subjected to a temperature of 212°F for six hours and then carry load at 195°F temperature was also verified.

In addition, analysis indicates that slow-blow fuses, with proper temperature and time derating, are also acceptable replacement devices for the thermal-magnetic circuit breakers.

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Affected Plants

Customer Name	NRC Licensed Facility	G.O.	Part No.	Qty[4]	Notes
Detroit Edison	Fermi 2 NPS	4056	EF3-B015	2	2
			FJ3-B150	2	
Long Island Lighting Co.	Shoreham 1 NPS	4093	EF3-B015	4	2
			EF3-B070	2	
			FJ3-B150	2	
Philadelphia Electric Co.	Limerick 1&2 NPS	4097	HE2-B015[1]	4	2
			HE3-B010	4	
			HE3-B030	4	
Georgia Power Co.	Edwin I. Hatch 2 NPS	4154	EF3-B015	4	2, 5
			FJ3-B150	2	
Niagara Mohawk Power Corp.	Nine Mile Point 2 NPS	4193	EF3-B015	4	2
			FJ3-B150	2	
Commonwealth Edison	LaSalle County 1&2 NPS	4198	EF3-B015	4	2, 5
			FJ3-B150	2	
Northern States Power Co.	Monticello	4377	HE2-B015[1]	2	2, 5
			HE3-B015	2	
			HE3-B050	2	
			JL3-B175	2	
			JL3-B225	2	
Arizona Public Service Co.	Palo Verde 1, 2, & 3 NPS	4160	EF2-B015[1]	2	3
			EF3-B015	2	
			EF3-B020	2	
			EF3-B050	2	
			EF3-B100	2	

Customer Name	NRC Licensed Facility	G.O.	Part No.	Qty[4]	Notes
Tennessee Valley Authority	Hartsville & Phipps Bend NPS	4210	EF2-B015[1]	4	3
			EF3-B015	4	
			EF3-B020	4	
			EF3-B070	4	
			EF3-B100	4	
Illinois Power Co.	Clinton 1&2 NPS	4245	EF2-B015[1]	2	3
			EF3-B015	2	
			EF3-B020	2	
			EF3-B070	2	
			EF3-B100	2	
Commonwealth Edison	Byron NPS	4260	EF2-B015[1]	2	3
			EF3-B015	2	
			EF3-B020	2	
			EF3-B070	2	
			EF3-B100	2	

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[1]Two-pole breaker in a three-pole frame (the center pole is not used)

[2]Boiling Water Reactor Plant (BWR)

[3]Pressurized Water Reactor Plant (PWR) or BWR MARK III

[4]Quantity does not include spares

[5]Operating plants (as of February 1983)

Corrective Action/Comments

Specific magnetic breakers have now been identified to replace the thermo-magnetic breakers. Letters have been sent to the plant operators defining the replacement parts which may be used of the power cabinet external ambient temperature is determined to exceed 100°F. (NOTE: The previous interim corrective action identified for operating plants way to bypass the circuit breakers with wire jumpers. This previous action should be superseded as noted above.)

If you require further information or clarification, please call me at (213) 700-3926.

Very truly yours,

D. C. Empey
Director
Quality Assurance

cc: Director, Office of Inspection and Enforcement (3)
U.S. Nuclear Regulatory Commission
Washington, DC 20555