



Brown Boveri Electric, Inc.

Manufacturer of I-T-E Electrical Power Equipment

October 5, 1983

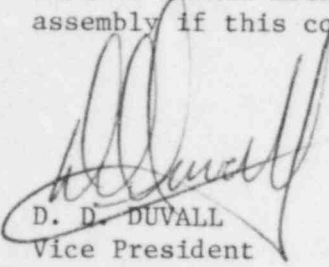
Mr. R. C. DeYoung, Director
Office of Inspection & Enforcement
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. DeYoung:

On March 17, 1983 Detroit Edison Company (Fermi II) filed a 10CFR50.55(e) report with the NRC concerning some cracked and broken puffer piston rods in the Brown Boveri Electric 5HK 250/350, 1200/2000A circuit breakers.

Attached is an interim report on the BBE evaluation status to date on this condition.

Based on the test results and other information available at this time the BBE recommendation is to inspect for cracked or broken puffer piston push rods at normal maintenance intervals and to replace the puffer piston assembly if this condition is found.



D. D. DUVALL
Vice President

DDD/jm

Attachment

cc: A. E. Boetticher
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October 3, 1983

INTERIM REPORT
5HK CIRCUIT BREAKERS
PUFFER PISTON RODS

The purpose of this interim report is to summarize the status of the evaluation to date and to provide a history regarding cracked/broken puffer piston rods (Part No. 193642-B) in the Brown Boveri Electric 5HK 250/350, 1200/2000A circuit breakers.

In January, 1983, a report of some cracked/broken puffer piston rods at the Mohave Generating Station of Southern California Edison in Laughlin, Nevada was received. These circuit breakers are 5HK 350-1200A supplied on S.O. 33-44107 and have been in operation since about 1970. The cracks/breakage of the puffer piston rods occurs at the operating pin hole. The conditions were noted while performing an overhaul on the circuit breakers, with some twenty (20) circuit breakers in Unit No. 1 and twenty (20) in Unit No. 2, thus a total of 120 puffer pistons are in operation at this station. A total of eight (8) puffer piston rods were found to be broken. The number of puffer piston rods that were cracked is not known, however the user ordered a total of twenty (20) replacement parts.

The average ambient temperature at this station is about 80°F. Temperature excursions normally vary between 35°F and 125°F, but extremes to a low of +30°F and a high of 135°F have occurred. The humidity is normally between 10% and 15%. No more than one broken puffer piston rod per breaker was found during any inspection.

A March 17, 1983 report received from Detroit Edison (Fermi) indicates that one (1) broken puffer piston rod and nine (9) cracked rods in 5HK 350-1200A circuit breakers were found. These circuit breakers were manufactured in 1973 on S.O. 33-47196 and the reported conditions were noted in a total of five (5) circuit breakers. No operation count was reported on these breakers.

A BBE Service Engineering Report dated August, 1983 identifies that some 5HK 250-1200A and 2000A at the Salt River Project, Navajo Generating Station manufactured between 1972 and 1980 were examined for puffer piston rod cracks. There are approximately eighty-six (86) circuit breakers at this location, some of which have over 10,000 operations. This inspection showed that there were no cracks or breakage in any of the puffer piston rods. The environmental conditions at this station are similar to those noted at the Mohave Generating Station.

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The 5HK circuit breakers have been in production since 1960 with essentially the same design configuration and materials used today. The puffer piston tube was originally made with Zytel 101 unfilled material. This material was used until 1980 when the vendor and material was changed to Nylafil E1-30-EM. Puffer piston rods of both the Zytel and Nylafil material have been subjected to thermal aging tests with no significant degradation trend being noted after initial "drying out" of the nylon material. When humidified after long exposure at high temperature the material returns to essentially the same strength characteristics as when new. Thermally aged puffer piston rods in the dry condition were subjected to endurance testing of over 5000 operations. Subsequent inspection of these items disclosed no cracking or damage to the puffer piston rods.

Three (3) puffer piston rods with cracks were obtained from Detroit Edison Fermi 2 Station. These were subjected to mechanical endurance testing in a test breaker to investigate the tendency for existing cracks to progress into failures. After 1200 operations, the inspection indicated that the cracks did not propagate nor did any parts break. One of the puffer piston rods for this test was modified wherein the holes for the operating pin were redrilled in a smaller diameter to determine if this interference fit of the pin could result in a test failure. The inspection of this part upon the completion of the endurance test (1200 operations) indicated that cracks had not developed.

A puffer piston in the 5HK circuit breaker performs two functions. For low current interruptions the puffer is needed to assist the magnetic forces to move the arc into the interrupting chamber. A puffer piston also provides a pneumatic cushion which reduces the shock forces imposed on the mechanism and current carrying parts on opening. For lower values of current, arc interruption could be adversely affected by failure of one puffer piston with failure to extinguish the arc. Mechanically, loss of a puffer could reduce the number of operations before maintenance would be necessary.

BBE has never experienced a circuit breaker failure due to a broken puffer piston rod.

At this time, the BBE evaluation of data indicate that aging is not a likely cause for the puffer piston rod cracks. Also, BBE testing and the sampling inspections conducted to date also indicate that the cracking is not a generic defect.



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Efforts are under way to obtain additional aged samples from the field and consultations with other materials experts are planned. At the time of this interim report there is no clear explanation for the presence of puffer piston rod cracks at Fermi 2. Information gathered to date also indicates that no more than one broken puffer piston rod per breaker has been found at any inspection.

BBE is continuing its evaluation of this situation and will keep you advised of any significant findings.

The BBE recommendation at this time is to inspect for this condition at normal maintenance intervals and to replace cracked or broken assemblies. The assembly part number is 193989-T2.