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Commonwealth Edison Company

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January 18, 1971

Dr. Peter A. Morris, Director
Division of Reactor Licensing
U.S. Atomic Energy Commission
Washington, D.C. 20545

Subject: Additional Information Relative to Operating License DPR-19 for Dresden Unit 2, AEC Dkt 50-237, and Operating License DPR-25 for Dresden Unit 3, AEC Dkt 50-249

Dear Dr. Morris:

The purpose of this letter is to provide you with information relative to the modifications being made to the control rod drives on Dresden Units 2 and 3.

As you are aware, the boiling water reactors, both foreign and domestic, which have started up in the past two years have experienced increasing control rod drive scram times. The data from these reactors indicate that this is a start-up or break-in problem and, with time, tends to be self-correcting. Our data from Dresden Unit 2 indicate that 85% of the control rod drives have not experienced this phenomenon, while the remaining 15% have had varying and erratic scram times. Technical specification requirements for individual drives on Dresden Unit 2 have been exceeded on several occasions, but at no time has the average of all scram times ever approached the technical specification requirements. Consequently, we intend to modify the design of the control rod drives to prevent similar occurrences in the future.

The modification is basically a change in the location of the inner filter. This modification allows the filter to provide its function of protecting the stop piston seals and bushings but eliminates the need to pass the water which is introduced into or voided from the index tube when the CRD is moved.

The original CRD, Model 7RDB144A2, utilizes an inner filter which is attached to the lower end of the coupling spud. In this location, the inner filter moves with the moving parts of the drive whenever the CRD is inserted, withdrawn or scrammed. During scram, the downward forces on the CRD index tube (due to drawing a vacuum as the index tube is inserted) are minimized by passing water through the inner filter at low pressure drops. If the resistance to flow through this inner filter increases, the pressure drop across the filter

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increases resulting in increased downward forces on the CRD index tube and consequent increase in scram times. The recent slowdown of CRD scram times has been due to plugging of the inner filter by iron oxide. Iron oxide formation is normally greatest during early stages of operation.

The new CRD, Model 7RDB144B1, utilizes an inner filter which is located on top of the stop piston assembly. In this location, the filter has been changed from a moving to a stationary part and, hence, if plugging of this filter should occur, it will not affect the scram time. The inner filter of the Model 7RDB144B1 CRD must pass seal leakage water only; whereas, the model 7RDB144A2 CRD passes the water needed to fill the volume between the stop piston seals and the inner filter whenever the drive moves.

The Model 7RDB144A2 CRD assemblies were initially installed at Dresden Units 2 and 3. A modification kit is being furnished to effect the change to the Model 7RDB144B1 configuration. The present location of the inner filter and the modified location are both shown on the attached General Electric drawing no. 922D171.

To confirm the design worthiness of the new filter assembly on the systems level, a ten month (November 1969 - September 1970) test program consisting of two phases was successfully completed by General Electric Company at their San Jose facility.

Phase 1. Testing was designed to yield preliminary performance characteristics on an effective sampling of six typical Model 7RDB144B1 control rod drives when outfitted with various new inner filter assemblies, modified stop pistons, and modified uncoupling rods. This phase of the testing program subjected each of the CRD configurations to an identical test sequence to obtain directly comparable CRD system performance data and to optimize the final design.

Phase 2. Testing was designed to provide a comprehensive look at inner filter performance as related to CRD performance characteristics based on design specified maintenance life requirements. In addition, limit testing was conducted in which various inner filter and inner filter related CRD failure modes and their resultant effect on system performance were postulated. Final testing at the component level was utilized primarily to assess the mechanical integrity of the inner filter assembly thereby completing the engineering evaluation test program.

The Phase 1 and Phase 2 tests described above were performed primarily at zero and 1030 psi vessel pressure. In addition, during generation of various scram profiles, testing was conducted at vessel pressures of 200, 400, 600, 800, and 1250 psi. This latter testing was done as the vessel pressure was increased from zero to 1030 psi. Following completion of the testing at 1030 psi, the vessel pressure was raised to 1250 psi and two scram times obtained at each of the above pressures as the vessel pressure was lowered from 1250 to zero psi. Temperatures during all tests were at saturation corresponding to the test pressure. During the testing, four control rod drive housings, five piston tube assemblies, four index tubes, six inner filter assemblies, four stop pistons, and five uncoupling rods were utilized in various configurations. This was done to increase the effective control rod drive sample size and to ensure variability in control rod drive make-up from test to test.

The performance of Model 7RDB144B1 CRD for all modes of operation including scram, jogging in, jogging out, driving in, driving out, coupling, and uncoupling showed no significant change when compared to the performance of Model 7RDB144A2 with clean filters (either original .001" mesh or interim .010" mesh). Specifically, the averaging of recorded scram data obtained while accumulating approximately 550 full stroke 1510/575 psi accumulator scrams at 1030 psi vessel pressure resulted in the following average times for the indicated portion of stroke:

5%	10%	50%	90%
.365 sec.	.483	1.475	2.554

Additionally, with the test system grossly contaminated, a total of 100 full stroke 1510/575 psi accumulator scrams at 1030 psi vessel pressure showed the following average times for the indicated portion of stroke:

5%	10%	50%	90%
.378 sec.	.502	1.535	2.664

Tests which simulated a grossly contaminated environment were also carried out with the original filter. The simulation was accomplished by testing at various levels of flow restriction. For a 90% portion of stroke, the following average times were obtained as a function of flow restriction (vessel pressure @ 1030 psi):

Flow Area Restriction (%)	Scram Time (secs.)
98.4	15
98.7	19
99.4	30
99.7	70

Approximately 1250 accumulator and vessel only scrams were conducted during the test program. In addition, continuous drive insert and withdrawal cycles were performed over the 0-1030 psi operating pressure range. Acceptable speed variations between cycles averaging 3.4% driving in and 3.8% driving out were recorded during approximately 1,000 drive cycles of operation with a clean test system. Maximum speed variation during these tests was 11%, which is similar to that obtained with the Model 7RDB144A2 CRD.

A failure mode analysis was made of the modified control rod drive and the following failure modes were identified:

1 - New modification not assembled correctly;
2 - Mechanical failure of the inner filter;
3 - Weld failure at the stop piston;
4 - Spring failure;
5 - Weld failure at the filter; and
6 - Bayonet latch failure.

The consequence of any of the above failures are loose parts within the control rod drive but no performance failure during insertion, withdrawal, or scram of the control rod drive.

In summary, the basic function of the inner filter is to provide protection of the stop piston seals and bushings by filtering the water which enters the index tube from the top. This function has not been compromised with the new design Model 7RDB144B1. The new model eliminates slow scram times as a result of plugging of the inner filter. The new filter design has been thoroughly tested under various conditions of temperature and pressure up to the reactor vessel design pressure of 1250 psig and a temperature of 576°F. All modes of operation including scram, driving in, driving out, coupling, and uncoupling were performed with success in a clean and in a contaminated environment.

All Dresden Unit 3 control rod drives have been modified to the new Model 7RDB144B1 design. The modification will be made to the control rod drives on Dresden Unit 2 as these control rod drives become available for routine maintenance. We do not, at this time, have a schedule for the completion of the modification to the Unit 2 drives. We do not feel that such a schedule is required since it appears that the phenomenon of increasing scram times is self-correcting with time. We feel we are approaching that point in operation where this problem disappears naturally. In addition, the presence of both CRD designs in the core will provide a comparison between the two designs.

In addition to three signed originals, 19 copies of this letter are also submitted.

Very truly yours,

Byron Lee, Jr.

Byron Lee, Jr.
Assistant to the President

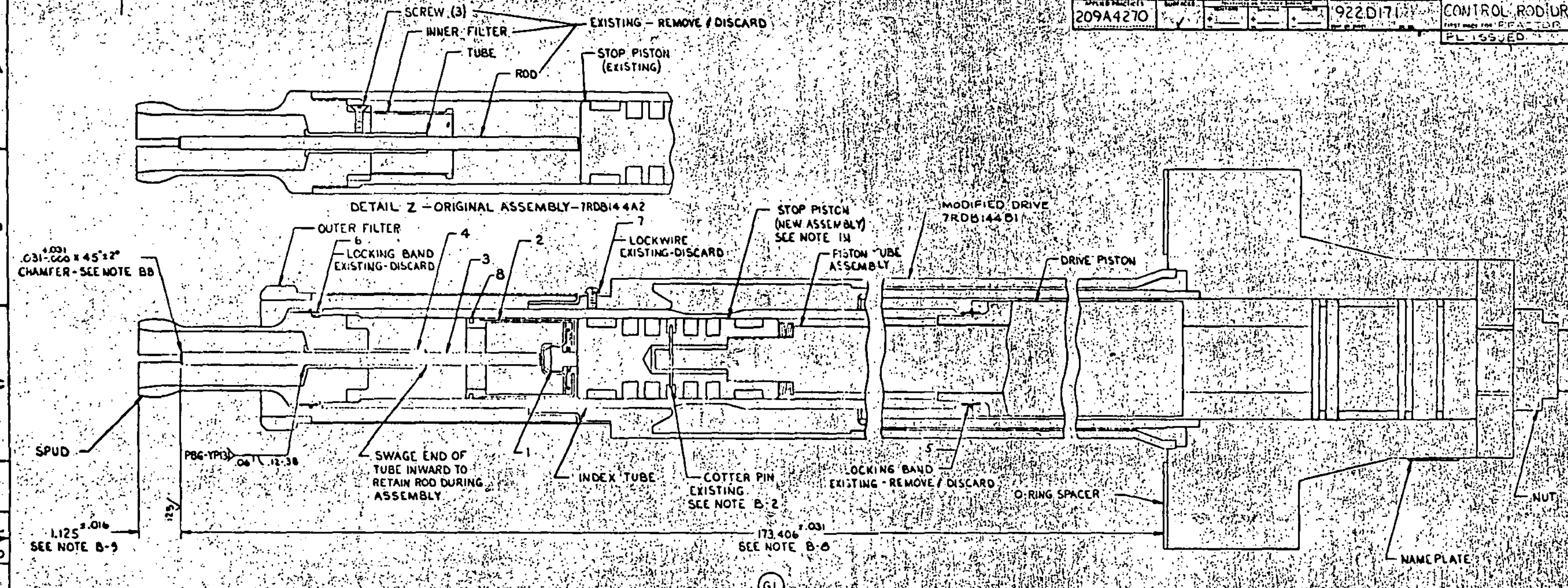
SUBSCRIBED and SWORN to
before me this 18th day
of January, 1971.

Patricia A. Nelson

Notary Public

GENERAL ELECTRIC

209A4270 | 922D171 | CONTROL ROD DRIVE MODIFICATION | PL ISSUED



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NOTES—

A. DISASSEMBLY (REF. INSTRUCTION MANUAL GEI-92808)

1. KEEP ALL PARTS FOR EACH CONTROL ROD DRIVE SEPARATE FROM PARTS OF OTHER CONTROL ROD DRIVES.
2. REMOVE / DISCARD ROD / TUBE FROM SPUD (DETAIL Z).
3. REMOVE OUTER FILTER / SPUD. DISCARD LOCKING BAND.
4. REMOVE / DISCARD INNER FILTER / SCREWS (3) (DETAIL Z).
5. REMOVE PISTON TUBE, INDEX TUBE / DRIVE PISTON ASSEMBLY USING PILOT PLUG (117C4069G1). THIS TOOL IS USED TO REMOVE THE INDEX TUBE AND PISTON TUBE FROM THE CRD WITHOUT DISASSEMBLY OF THE GUIDE CAP, BARREL, COLLET SPRING AND COLLET PISTON. IT SUPPORTS THE END OF THE INDEX TUBE SO THE INDEX TUBE WILL NOT SCRATCH THE CYLINDER WHEN THE INDEX TUBE IS WITHDRAWN FROM THE FLANGE END. REFER TO GEI-92808, SECTIONS 2.4.2 AND 2.4.3.
   TO USE THE TOOL COMPLETE THE CRD DISASSEMBLY TO SECT 2.4.1. OMIT SECTION 2.4.2 AND 2.4.2 a TO d. INSTALL THE PILOT PLUG ON THE INDEX TUBE. PULL THE KNURLED ROD OUT TO ITS STOP. THIS WILL RETRACT THE FINGERS SO THE PILOT PLUG WILL PASS THROUGH THE GUIDE CAP. PROCEED TO 2.4.3 c TO ℓ. WITHDRAW THE PISTON TUBE, WITH THE DRIVE PISTON AND INDEX TUBE AS AN ASSEMBLED UNIT UNTIL THE TAPERED END OF THE PILOT PLUG IS FLUSH WITH THE END OF THE GUIDE CAP. PUSH THE KNURLED ROD IN TO ITS STOP. THIS ACTION CAMS THE SUPPORT FINGERS OUT SO THEY ARE IN CONTACT WITH THE CYLINDER BORE. PROCEED WITH SECT 2.4.3. m.
   KEEP DRIVE PISTON SEALS / BUSHINGS TOGETHER IN MATCHED SETS.
6. DISASSEMBLE INDEX TUBE FROM DRIVE PISTON. DISCARD LOCKING BAND. KEEP STOP PISTON SEALS / BUSHINGS TOGETHER IN MATCHED SETS.

B. MODIFICATION / ASSEMBLY

1. WELD CONNECTOR (P1) TO STOP PISTON PER DRAWING 158B8505G1 USING WELDING FIXTURE.
2. IF NECESSARY STOP PISTON MAY BE REMOVED FROM PISTON TUBE ASSEMBLY PRIOR TO STEP B-1. IF THIS HAS BEEN DONE DISCARD COTTER PIN / REPLACE STOP PISTON USING NEW COTTER PIN.
3. REPLACE STOP PISTON SEALS / BUSHINGS.
4. ASSEMBLE INDEX TUBE AND DRIVE PISTON USING NEW LOCKING BANDS (P5).
5. [2] ASSEMBLE RING, P8 ON FILTER (P2) AND VERIFY THAT RING P8 WILL PASS THROUGH THE RING GAUGE (158B8609P1).
6. INSTALL NEW INNER FILTER (P2) USING FILTER ASSEMBLY TOOL 117C4658G1. PUSH FILTER ONTO CONNECTOR END OF STOP PISTON AND ROTATE UNTIL SPRING FINGERS ENGAGE MACHINED FLATS. TEST ENGAGEMENT BY PULLING FILTER WITH TOOL USING 20-30 LB. FORCE.
7. REPLACE SPUD USING NEW LOCKING BAND (P6).
8. CUT AND CHAMFER ROD (P3) TO 173.406 ±.031 DIMENSION WHEN ROD / FILTER ARE SEATED ON STOP PISTON.
9. WELD ROD (P3) TO TUBE (P4) TO LOCATE END OF ROD AT 1.125 ±.016 FROM END OF SPUD WHEN FLARED PORTION OF TUBE IS SEATED IN SPUD AS SHOWN. DURING THIS ADJUSTMENT, ROD MUST NOT TOUCH STOP PISTON OR FILTER.
10. REPLACE OUTER FILTER / SAFETY WIRE SCREWS USING SAFETY WIRE (P7) PER 209A4287.
11. REVISE MODEL NO. ON NAMEPLATE FROM 7RDB144A2 TO 7RDB144B1. "A2" MAY BE MUTILATED OR GROUND OFF AND "B1" STAMPED ALONGSIDE.

THIS IS A REDUCED PRINT

FOR REVISIONS SEE REVISION STATUS SHEET

SAN JOSE | 922D171