NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/85

# LICENSEE EVENT REPORT (LER)

| FACILITY NAME (1) | DOCKET NUMBER (2) | PAGE (3) |
|---|---|---|
| RANCHO SECO NUCLEAR GENERATING STATION UNIT NO. 1 | 0 5 0 0 0 3 1 2 | 1 OF 0 2 |

TITLE (4)
CRD BREAKER FAILURE

| EVENT DATE (5) | | | LER NUMBER (6) | | | REPORT DATE (7) | | | OTHER FACILITIES INVOLVED (8) | |
|---|---|---|---|---|---|---|---|---|---|---|
| MONTH | DAY | YEAR | YEAR | SEQUENTIAL NUMBER | REVISION NUMBER | MONTH | DAY | YEAR | FACILITY NAMES | DOCKET NUMBER(S) |
| | | | | | | | | | | 0 5 0 0 0 |
| 0 6 | 0 5 | 8 5 | 8 5 | 0 0 6 | 0 0 | 0 7 | 0 2 | 8 5 | NONE | 0 5 0 0 0 |

| OPERATING MODE (9) | THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11) | | | |
|---|---|---|---|---|
| POWER LEVEL (10) | 20.402(b) | 20.405(c) | 50.73(a)(2)(iv) | 73.71(b) |
| | 20.405(a)(1)(i) | 50.36(c)(1) | 50.73(a)(2)(v) | 73.71(c) |
| | 20.405(a)(1)(ii) | 50.36(c)(2) | X 50.73(a)(2)(vii) | OTHER (Specify in Abstract below and in Text, NRC Form 366A) |
| | 20.405(a)(1)(iii) | 50.73(a)(2)(i) | 50.73(a)(2)(viii)(A) | |
| | 20.405(a)(1)(iv) | 50.73(a)(2)(ii) | 50.73(a)(2)(viii)(B) | |
| | 20.405(a)(1)(v) | 50.73(a)(2)(iii) | 50.73(a)(2)(x) | |

LICENSEE CONTACT FOR THIS LER (12)

| NAME | TELEPHONE NUMBER |
|---|---|
| | AREA CODE |
| Ron W. Colombo, Regulatory Compliance Supervisor | 9 1 6 4 5 2 - 3 3 1 1 |

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

| CAUSE | SYSTEM | COMPONENT | MANUFACTURER | REPORTABLE TO NPRDS | | CAUSE | SYSTEM | COMPONENT | MANUFACTURER | REPORTABLE TO NPRDS | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| D | J C | 7 2 | G 0 8 1 | Y | | | | | | | |
| | | | | | | | | | | | |

| SUPPLEMENTAL REPORT EXPECTED (14) | | EXPECTED SUBMISSION DATE (15) | MONTH | DAY | YEAR |
|---|---|---|---|---|---|
| X YES (If yes, complete EXPECTED SUBMISSION DATE) | NO | | 0 9 | 1 5 | 8 5 |

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)


On June 5, 1985, it was reported via an internal Occurrence Description Report, that the "C" CRD DC breaker failed to open on undervoltage during a bench test. The breaker that failed was of the AK-2 type manufactured by GE. The NRC was alerted to the details of the failure through the NRC Resident Inspector and subsequent telephone conversations.

An investigation of this event revealed that the breaker failure was caused by an incorrect setting of the rivet-to-armature clearance. The breaker of concern had been refurbished during the refueling outage and returned to the site. Refurbishment was performed by the manufacturer (GE) and certified by the NSSS vendor (B&W). The District will perform a Root Cause Analysis to determine the reason for the incorrect rivet-to-armature gap.

It should be noted that if this event had occurred under operating conditions, the reactor still would have been tripped by an alternate method, i.e., the shunt trip.

To prevent a recurrence of this event, procedure STP.944 (CRD Breaker Operation Assurance) was written to assure that all CRD breakers have been properly refurbished, adjusted and certified by the repairing vendor prior to reinstallation. This procedure was successfully performed on June 9, 1985.

The District is performing a review to determine if further corrective action is needed. Results of this review will be submitted in a follow-up report.

There were no effects on plant or public safety as a result of this event.


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| FACILITY NAME (1) | DOCKET NUMBER (2) | LER NUMBER (6) | | | PAGE (3) |
|---|---|---|---|---|---|
| | | YEAR | SEQUENTIAL NUMBER | REVISION NUMBER | |
| RANCHO SECO NUCLEAR GENERATING STATION UNIT NO. 1 | 0 5 0 0 0 3 1 2 | 8 5 | — 0 0 6 | — 1 | 0 2 OF 0 2 |

TEXT (If more space is required, use additional NRC Form 366A's) (17)

On June 5, 1985, it was reported via an internal Occurrence Description Report that the "C" CRD DC breaker failed to open on undervoltage during a pre-installation bench test. The breaker that failed was of the AK-2 type manufactured by General Electric. The NRC was alerted to the details of the failure through the NRC Resident Inspector and subsequent telephone conversations.

An investigation of this event revealed that the failure was caused by an incorrect setting of the rivet-to-armature clearance. The breaker of concern, had been refurbished during the plant refueling outage and returned to the site. Refurbishment was performed by the manufacturer (GE) and certified by the NSSS vendor (B&W). The rivet-to-armature clearance adjustment was a specific item to be performed during the refurbishment, and the successful accomplishment of this item is supported by proper vendor documentation. Lengthy meetings and discussions with the NSSS vendor and the breaker manufacturer proved inconclusive in determing the reason for the incorrect gap setting. The District will perform a Root Cause Analysis to determine the reason for this discrepancy.

It should be noted that if this event had occurred under operating conditions, the reactor still would have been tripped by the alternate shunt trip method.

To prevent a recurrence of this event, STP.944 (CRD Breaker Operation Assurance) was written to assure that all CRD breakers have been properly refurbished, adjusted and certified by the repairing vendor prior to reinstallation as the final elements in the Reactor Protection System trip string. This corrective action was completed June 9, 1985. The consultation of both the NSSS vendor and the breaker manufacturer were utilized in the preparation of the procedure.

The District also sent a Quality Assurance engineer to the GE Service Center in Atlanta, Georgia and the Babcock & Wilcox facility in Lynchburg, Virginia, to verify the quality of operations at these facilities and to witness checkouts of the GE AK-2 breakers. While at these facilities the engineer gathered information for (1) use in improving the Rancho Seco maintenance program on these breakers and (2) input to the B&W Owner's Group, which has a vested interest in the breaker issue resolution. A copy of the engineer's Surveillance Activities Report is attached for information. The District is reviewing the Surveillance Activities Report to determine if further corrective action is needed to prevent the recurrence of this event. Upon completion of the review and implementation of any further corrective or investigative action, the District will submit a follow-up report describing the details of the action.

There were no effects on plant or public safety as a result of this event.

# QUALITY ASSURANCE SURVEILLANCE ACTIVITIES REPORT FILE

I. **Location:** Rancho Seco I&C Shop/GE-Atlanta B&W-Lynchburg **QA Surveillance No.** 342A

**Activity Dates:** June 7-12, 1985 **Report Date:** June 24, 1985

**MOD No.**____ **ECN No.**____ **WR No.**____ **NCR No.**____ **CRITERIA No.** IV,V,VIII,X XIII,XV

**MSRC No.**____ **Tech Spec**____ **SOQAP**____ **QA Hours**____

**Prepared By** Harvey L. Canter H L Canter **Date** June 18, 1985

II. **Activity Description:**
Witness GE AK-2 breaker checkouts at Rancho Seco, GE Service Center in Atlanta, Georgia, and B&W in Lynchburg, Virginia.

III. **Summary:**
Different technicians performing similar functions produce different results. Packaging, shipping and receipt inspection techniques need review and possible changes made.

IV. **Observations and Comments:**

A. Surveillance 342 and a 6/7/85 telecon (both attached) document QA's involvement to June 7, 1985 in a DC Breaker's failure.

B. Between June 7 and June 9, the MSRC met with B&W and GE experts to attempt to scope out courses of action. The PRC met and approved STP944, CRD Breaker Operation Assurance, on Saturday, June 8 at 4:30pm. Shortly thereafter, work requests were written and the procedure was commenced. The QA monitor witnessed various phases of STP944 on three CRD breakers. It was discovered that the technique used to set the rivet-to-armature clearance was incorrect. The GE representative instructed Rancho Seco technicians on the proper method.

(See Page 2)

V. **Recommendations:**

A. Have SMUD technicians receive hands-on training by GE technicians in Atlanta prior to the next six month maintenance on the GE-AK breakers, **OR** bring the GE experts to Rancho Seco to perform said checkouts and maintenance.

B. Analyze the efficacy of using GLYPTOL (a rigid sealing compound) on all critical adjustment screws. Same method is needed to determine (See Page 10)

VI. Followup Activity: ☐ None Required, or see noted action below:

- ☐ QA Followup List
- ☐ ALARA Suggestion
- ☐ Speak Out
- ☐ Safety Recommendation, SMUD 1291
- ☐ Coordinated Commitment List (CCL)
- ☐ Memorandum
- ☒ Other, List Followup by December 31, 1985.

VII. Second Level Review J. L. Jewett 6/25/85 Date

This Surveillance is: ☐ Closed ☒ Open and additional followup is required

cc: L Schwieger/J Jewett/D Elliott/N Brock/R Colombo/S Crunk/J Janis(B&W)/K Price(B&W)
J Eckhardt(NRC)/G Coward/P Oubre'/R Rodriguez/R Dieterich/R Roehler/J Wheeler
C Linkhardt/M Austin(GE)/W Winters(GE)/J Sullivan/ D Raasch/L Keilman/J McColligan

Item IV from Sheet 1 QA Surveillance No. 342A

B. The bottom line on this adjustment apparently is that only the failed breaker...506 CG-1, had an out-of-spec rivet-to-armature gap. In addition, the pick-up voltage for CB1 and CB4 was shown to be less than the 100V minimum specification and the torque valve on CB4 may have been too high (between 16 and 21in.oz.). All six breakers were left in as close to "factory specs" as possible. They were functionally tested on Sunday June 9, 1985 and all passed. The failed breaker was stored for future use, and was not readjusted.

C. With the above information at hand, the QA monitor traveled to the GE Service Center in Atlanta, GA. He met with W. Winters, J. Rider, R. Rider and H. Bruce of GE, and K. Price of B&W. The scope of the surveillance was discussed. The stated purpose of this trip was to show interest in the "tool" used to set the rivet-to-armature clearance; to walk through a procedure on a GE-AK breaker (preferably one of ours which was still in the shop); to examine the procedures used to maintain and repair our breakers; to look at actual data for our breakers; to concentrate on data for the failed breaker 224A3515-506CG-1; to look at spare parts such as uv trip paddles; to address pick-up voltage problems on CB1 (...506LF) and CB4 (...506CG-3); to look at torque taking techniques, especially because of the erratic torque on CB4; to look at shipping practices; and, to repeat the same agenda with B&W in Lynchburg on June 12, 1985. The following are comments and observations made by the QA monitor:

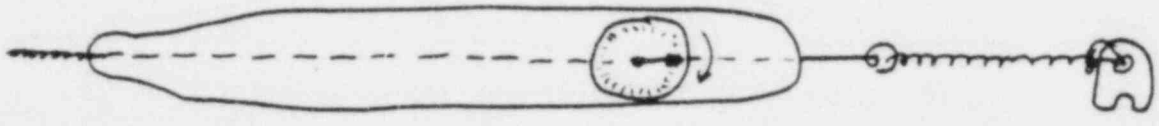
1) GE's procedures are written for people who are certified to perform the work. Seven people at the Atlanta shop are certified by GE to work on GE-AK-2s. The monitor did not examine records to verify this, but the GE representative discussed a training program that must be passed to be certified. The program includes a written test.
2) GE's "specs" are tighter than need be for proper breaker operation. For example, the 16 to 20in-oz. spec on Trip Bar Torque is <16in-oz at the shop: 1-10 mils for the rivet-to-armature gap is <6 mils at the shop, etc. If GE's "specs" are met, the margin for proper breaker operation is at its peak.
3) R. Rider and H. Bruce performed all the GE work on our breakers. They are certified to do this work. Technically, Mr. Bruce was certified and Mr. Rider was the certified QC man, but in actuality, it appeared as if both people performed the work and Mr. Rider was "running the procedure".
4) The monitor saw a trip paddle on a spare GE-AK-2 in the shop - It looked exactly the same as the failed breaker's paddle. Figure 28 which shows a side view of the paddle is not an accurate representation of the corner radii. The end of the paddle shows two relatively sharp radii rather than the gradual slope depicted in the drawing. (Figure 28 is attached.)
5) Mssrs Rider and Bruce stated that there appears to be a temperature sensitivity on the pick-up voltage for the ac uv device. They've seen a 1 volt variance in the pick-up time after a non-descript period of uv energization. (See further discussion on pick-up voltage)
6) When asked for an opinion as to why the DC CRD breaker failed at Rancho Seco, the two answers that were discussed were rough handling or shipping, and improper training at B&W or sites. A slip-up at the Atlanta service facility was discounted as a possibility by GE personnel. The monitor believes it to be a very remote possibility that the procedure step was missed that checks and adjusts the armature-to-rivet gap.

D. A number of tests were witnessed by the monitor. These tests were run on Rancho Seco's AC-CRD breaker... 200DG(Breaker A). Breaker...200CG was laying on a cart, broken down and awaiting parts. The procedure was run by Mr. R. Rider and B. Beechy. Prior to proceeding, the monitor was asked to look at the closing coil which had a piece of broken plastic casing. This break would not affect breaker operation, but the coil could be susceptable to cleanliness problems later, so GE recommended replacing it. GE said it would take 6 weeks to procure and replace it. The following observations were noted as the testing procedures were performed: (Note-Procedure Review section in this report may amplify on some of the following observations.)

(See Page 3)

Item D from Sheet 2 QA Surveillance No. 342A

1) A 2 to 6 in-oz. torque on the trip shaft at the beginning of the test is indicative of improper operation. This is performed with the breaker OPEN.
2) The stationary contact push test was run. An instrument was placed on each contact and pushed. The "spec" was not met on all three phases so the springs on all the contacts were replaced. A Chatillon model DPP-10 (s/n 2490) was used for this test. It measured the number of pounds of force that was necessary to just move the contacts against the spring force. The instrument was calibrated on 6-10-85 and the prior calibration date was 6-4-84. It was calibrated by Wiggins Scale Co., 1005 Hemphill Ave., NW, Atlanta, GA 30318 (Phone 872-4994). Note: The scale read in 10 X .10 pound increments. Adjustments were made in accordance with the Maintenance Instruction on the top left of page 12. The Maintenance Instruction on GE Power CBs: GEI-50299E (includes Supplement GEI-86153) is the manual in question.
3) Trip shaft torque was checked next. A Chatillon Model DPP-5 instrument, similar to the one used in the stationary contact push test, was used here. It had a scale of 5 X .5 pounds and was calibrated at the same time as the DPP-10 instrument. A conversion factor of 0.8 was used as a multiplier of the instrument scale reading. The result was given in inch-oz. The instrument was attached to an inch-long spring which in turn was attached to a modified open-end wrench with a 1 inch moment arm The instrument looked something like this:



4) Next was the pick-up voltage check. The GE technicians said that the following order of check is always to be performed. By not following this order, one may not see proper operations because all these checks play on each other.

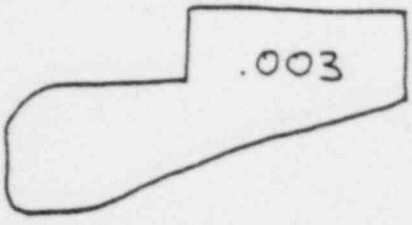
   a. Adjust armature-to-rivet gap(ENERGIZED)
   b. Adjust armature-to-magnet gap
   c. Check Pick-up
   d. Check Drop-out
   e. Adjust spring tension

   The GE technicians also stated that after three tests of pick-up and drop-out to wait at least a half hour before retesting because temperature can affect pick-up by a volt or more. This was especially true for DC uv devices, but AC devices may exhibit some temperature sensitivity too.
5) Next the comment was made that we were not manually operating the breaker with the correct tool. We were using an ITE maintenance handle rather than a GE AK maintenance handle. (B&W supplied the monitor with one to take back to Rancho Seco - The handle was given to D. Yount on 6-17-85) The use of an improper handle just had the effect of scratching and denting the escutcheon as far as could be determined.
6) Wipe was measured at the contact point with a metal scale similar to that used at Rancho Seco (a Sears 6" scale cut off @ 4"). However, with the main contacts closed one cannot measure at the contact point, for obvious reasons, so GE places the scale next to the moving contact - measures the wipe - and then subtracts 1/32 inch. That is the number used in the wipe calculation. The monitor also noted that if the open contact reading is not the same at both contact points, adjustments are made per procedure until the numbers are the same.
7) Shunt overtravel is adjusted by putting a 30 mil pin gage on the shunt magnet. If pinched when tripped the overtravel is proper. All devices require a 1/16" overtravel. GE said that if this overtravel isn't correct they bend the trip paddle. Some paddles in the past have broken because they weren't made with the right material, but that issue was solved a while ago, according to GE.

Item D from Sheet 3 QA Surveillance No. 342A

D. 8) The armature-to-rivet gap was adjusted next. This adjustment is done in the energized position, per procedure. A six mil feeler gage was placed into the space between the rivet and armature on the inside lip of the armature casing. Since the gage fit the gap an adjustment was made. The two adjust screws (Part #11 on Figure 28 - attached) were loosened so that the armature assembly could be moved down. A 3 mil template was placed in the gap and the armature jammed up against the template. Another person tightened the screws and then the 6 mil feeler gage was used again to check the gap. This time, the gage didn't fit the gap, so the adjustment was completed. The template was as shown below in actual size. It was stamped with a .003 on it, but the monitor didn't independently verify its thickness:

(Note: There is no "spec" or check for torque on Part 11.)




The monitor measured the clearance after adjustment with a feeler gage on the inside of the armature. Two mils fit the gap and 4 mils didn't. There was no 3 mil gage, but the gap was obviously about 3 mils.

9) To adjust the uv open magnet gap one places a .2010 pin gage in the gap through the side of the device and adjusts with the screw on the front of the uv frame (#A on Figure 28). GE then takes a .2055 pin gage, and the technician attempts to fit the gap. If it doesn't fit, the adjustment is left as is. On our 2000G breaker, the gap was reset. (Note: In all mechanical adjustments, as found information is not written down offically. Only as left data appears on the data sheets.)

10) GE stated that they are thinking about using some sort of rigid sealing compound (GLYPTOL) on all adjustment screws. Receipt inspections should include a look at the condition of the compound.

11) UV pickup was checked using a Fluke 8024B Multimeter calibrated on 5-14-85 and due for calibration on 5-14-86. Pins 4 and 5 on the top right contact board were used. A pickup of 102.9 vac was received which was within the 100-106 vac "spec". The The dropout was a 52.8 vac. The check was done once and is typically only done once. The monitor asked the technicians to repeat the test. This was done 3 more times with pickup values of 102.9 after a 3 minute wait, 102.8 after 2 more minutes and 102.9 after 2 more minutes. The GE technicians stated that if pickup were not proper, the spring tension would be adjusted.

12) More on trip shaft torque: The following results were obtained:

| Try #** | Gage Reading | In-oz*** (Gage Reading X .8) |
|---|---|---|
| 1 | 22 | 17.6 |
| 2** | 16 | 12.8 |
| 3 | 17 | 13.6 |
| 4 | 14 | 11.2 |
| 5 | 15 | 12.0 |
| 6 | 13 | 10.4 |

* GE usually takes 4 or 5 torque readings and records the last one as the "as left" value.

** Operated the breaker eight times and then continued with readings. GE said that when the breakers are not operated for extended periods, the torque increases. The only quantitative statement tendered by GE was that if you let a breaker sit for six months without operation, the torque will be high.

*** The factory "spec" is <16 in-oz.

(See Page 5)

Item D from Sheet 4 QA Surveillance No. 342A

D. 12) The "open-end wrench" torque tester was placed between the AC trip paddle and the latch adjust mechanism, for the above tests. The monitor asked the tests to be run towards the end of the trip shaft. This was done and the following inconclusive results obtained:

| Try # | Gage Reading | In-oz. (Gage Reading X .8) |
|---|---|---|
| 1 | 17 | 13.6 |
| 2 | 19 | 15.2 |
| 3 | 23 | 18.4 |
| 4 | 18 | 14.4 |

It appears as if torque values are a bit higher when taken at the right end of the trip shaft. GE takes the readings as described earlier and that is where all technicians should take the readings. Also, the instrument used to take the readings was able to generate fairly repeatable readings and it was relatively easy to pull at a 90° angle as required. Also, since the wrench was attached to a spring which was attached to the Chatillon tool, there was no possibility of the equipment falling into the breaker after each trip.

Note: GE stated that prior to shipment from GEs Atlanta shop, the torque is measured again because this test tends to prove functionality pretty well.

13) Positive Trip on uv: GE used a 30 mil pin gage at the top of the uv slot in the front of the frame. The breaker should trip with manual operation of uv device and with the wire inplace and the wire should stay captured in the slot. If not, the trip paddle screw should be adjusted per the manual. GE says this almost always needs to be adjusted. The data sheet doesn't indicate if adjustments were made, however.

14) The uv device was tested for trip by itself and worked fine, meggar checks were fine, Hi Pot tests were fine, and Ductor readings were fine.

15) Open and Close Time Tests: UV and Shunt Device tests were run with open times @ .01 sec. for both devices. The shunt device was checked with the uv device tied in the energized position with wire. The spec was <.1 sec. for the shunt device and <.05 sec. for the uv device. Close times were also in "spec" (<.1 sec.). If these checks fail, the device is to be inspected for binding. GE would suggest replacing device if nothing obvious shows up in this visual check. Also during this check they looked at coil condition and noticed the broken plastic section on the closing coil.

16) Final Torque Checks: Three final checks were made. The results were 12.8, 12.0 and 11.2 inch-oz. Arc chutes were replaced and the breaker reassembled.

E. A procedure examination was conducted by the monitor at the GE fcility. The actual procedures were felt to be proprietary information on the part of GE, but the monitor was allowed to examine them and take notes. The following comments apply:

1) Only as left data is officially recorded. As found data may be written but not officially.

2) No comments were tendered on procedure AK-X-25 dated 3-85 which was a procedure on fitting new trip shaft bearings.

3) The AK-X-25 Rev. 7 procedure dated 10-84 on changing trip arm bearings and roller bearing latch assemblies was examined. It referred to GE documents GEI-50299E and GEF-4149G-N. This procedure says that the trip shaft torque is checked with the breaker open and should be between 2-6 inch-oz. If maximum torque exceeds 6 in-oz., then one is to check for binding due to mechanism misalignment on frame. Adjustments are to be made with a punch set at mechanism mounting screws. If torque is below 2 in-oz., check return spring.

The last step in the procedure is to check the closed torque shaft valve which "should be less than 16in-oz."

(See Page 6)

Item E from Sheet 5 QA Surveillance No. 342A

E. 4) The test procedure dated 9-84 on AK-X- and AK-XX- breakers for high current, meggaring, Hi-Pot, and ductor resistance was examined. It referred to the major data sheet GEZ-6058B-N. The procedure basically has one perform the following steps:

a. Meggar all phases in open and close position.
b. Perform Hi-Pot test on all auxiliary contacts.
c. Same for ductor tests on all phases.
d. Perform "as found" TDs on all phases.
e. If adjustment are made - do the adjustment and record "as left" data.
f. Perform open time shunt and uv trips and close time tests. Record data.
g. Record test equipment information.

In general, the GEZ-6058B-N data sheet records the following data:

a. Shop and breaker information.
b. Overcurrent trip device information (N/A at Rancho Seco)
c. Stationary contact push test results on all four contacts for all phases.
d. Closed - Trip Shaft Torque.
e. Open-time in seconds.
f. Close-time in seconds.
g. UV pick-up and drop out values ("as left").
h. Test equipment information.

5) UV device procedure on type 269 C2826 (as required) E/W DC or AC coil was examined. The referenced document was GEI-50299E. Highlights of this procedure follow:

a. Figure 28 (attached) in GEI-50299E was referred to extensively.
b. Procedure calls for a 1-5 mil play at the armature-to-rivet clearance. It says that the clearance should be done with uvd removed and with a feeler gage inserted through the side of the frame and armature manually closed. The measurement should be taken at the outer edges of the armature where a constant radius is in close proximity to the rivet. The gap should be relatively constant for all armature positions.
c. If play is too much, loosen 2 screws (Item 11 in Figure 28, attached) holding coil assembly to frame and move frame as required.
d. The procedure talks about adjustment of the armature stop bracket. Adjust the armature stop bracket to allow a 1/4 inch clearance between armature (Item 3) and magnet (Item 10) when the armature is OPEN. Screw [A] is used for this adjustment. The armature air gap is set by; loosening [A], placing a .201 inch rod in the "step" on the magnet, lowering armature to stop on the .201 diameter pin, sliding the air gap step plate against arm and tightening the screw. If adjustment is correct, a .2055 inch pin won't go through the gap. If .201" goes but a .209" doesn't, then the air gap is ok. Perform this adjustment after the armature-to-rivet adjustment is made only, and before pick-up is checked. Reseal screw with RTV108.
e. After an inspection for completion of prior steps, the procedure discusses methods for pick-up and drop out tests with traceable meters and power sources. For our 120VAC uvd, the nominal setpoint is 120VAC with a range of 100 to 106VAC. By procedure, if adjustment is needed, one is to loosen the wire from the spring screw and turn screw counter-clockwise to lower. The procedure goes on to state that no drop out adjustment is done on AC uvds. The screw is to be resealed with RTV108.
f. The procedure addresses a 1 hour de-energization of the uvd or make sure device is at room temperature of 20-25°C after adjustment. Then retest for pick-up and drop-out values. Actual values are then recorded.

(See Page 7)

Item E from Sheet 6 QA Surveillance No. 342A

f. GE personnel told the monitor that this step is primarily for DC uvd's.

g. Trip latch engagement is checked. It is adjusted with the buffer screw on the right side of the bearing plate. One closes the breaker and then turns the screw slowly clockwise until the breaker trips. Then the technician turns the screw 3½ turns counter-clockwise. That is the proper adjusted position.

h. Torque trip is checked as described earlier. <16 in-oz. is "spec" for a new or refurbished breaker; <20in-oz. for an old one. The actual "as left" value is recorded.

i. Overtravel on the uvd trip paddle is checked. The procedure says in one place to check for a 1/32" + or - 1/64" overtravel. This overtravel should exist to provide positive trip action. Another section of the procedure says that overtravel should be 1/32" + 1/64" minus Ø - ie., between 3/64" and 1/32". The latter is the correct tolerance, according to GE. This check is done with a 1/32" wire placed between the open air gap stop and armature extension. Contacts should just start to close when the mechanism is operated closed. Adjust screw (Item 20 on Figure 28) until this condition is obtained. Note that with the wire removed, the breaker should be trip free with no contact movement or resistance when the mechanism is operated.

j. Finally, the uvd trip on voltage decay below the drop out voltage is checked.

F. Data was reviewed for five Rancho Seco breakers. This surveillance describes somewhat what the data means. The data is not necessarily "as found" data and it is not necessarily representative of how many times the check was run before the data was recorded. It does represent "as left" conditions. The monitor examined the following "as left" data from original records:

| | CB1 | CB2 (Failed Brkr) | CB3 | CB4 | Spare(AC) (258A2620-02) |
|---|---|---|---|---|---|
| Pickup(VAC) | 100.8 | 102.6 | 101.6 | 100.8 | 102.4 |
| Drop out(VAC) | 42.9 | 57.4 | 51.7 | 47.5 | 50.2 |
| #1 Torque(in-oz) | 10.2 | 11.2 | 11.2 | 12.2 | 5.6 |
| #2 Torque(in-oz) | 11.2 | 11.2 | 11.2 | 13.6 | 6.4 |
| Wipe(in) | 3/32 3/32 | 3/32 3/32 | 3/32 3/32 | 3/32 3/32 | 3/32 3/32 3/32 |
| Rivet-to-Armature Gap (mils) | <6 | <6 | <6 | <6 | <6 |

G. GE uses the packages that are sent to them for shipping the breakers. They've seen horizontally supported breakers in plywood boxes, fiberglass molded containers and vertically mounted breakers in plywood boxes.

H. On June 12, 1985, the monitor went to B&W Lynchburg to repeat the procedure followed at the GE Facility in Atlanta. (Available in the QA Surveillance Office are copies of the original, pencilled data sheets, some GE breaker certifications, and procedures for the seven breakers currently at the plant.) Data from these procedures were transferred clean copies with ink used for signatures and data. Mr. Ken Price, Associate Business Manager, was the monitor's escort for the surveillance. The two gentlemen who were involved with all our breakers and who walked the monitor through the procedure were Mr. Ray Boven (B&W Task Engineer on CRD Control Systems) and Mr. Don Lee(Technical Support QC Engineer). Mr. Boven wrote the B&W procedures entitled Receiving Inspection for SMUD AK-2A-25 AC Breaker and Receiving Inspection Instructions for SMUD AK-2-15 DC Breaker. Mr.Boven patterned his procedure after that used at Diamond Power when Mr. Boven worked there years ago. Mr. Boven also stated that the B&W certification that he performs is aimed mainly at seismic and 1E qualifications and to defects in the breakers that are found at the time of the inspection.

(See Page 8)

Item H from Sheet 7 QA Surveillance No. 342A

The following are comments on observations made by the monitor during and after witnessing the work done by B&W on a breaker similar to ours:

1) B&W uses a non-calibrated spring scale with a range of 0-32oz. to perform the trip torque test. The technique is similar to that used at Rancho Seco.
2) B&W has received breaker(s) from GE with the uvd wired down. This might be due to the last trip torque tests that GE does at the end of their maintenance proceudres. The GE procedure does not say that a wire is to be used or remove from the uvd.
3) While witnessing B&W walkthrough, the monitor noted that B&W personnel were using GEI-50299B as a reference. Version E was used in Atlanta. B&W personnel stated that they have Version E available.
4) B&W used large clear snapshots of a typical breaker to help identify components that were to be worked on during the checking procedure.
5) Mr. Boven has run the procedure on about 27 breakers and Mr. Lee has QC'd about 12.
6) The procedures used by B&W state "...this document establishes a file for traceability of the Breaker as a 10CFR21 item and confirms a no defect condition of the Breaker at time of inspection."
7) The official copy of the procedure on Inspection Report DLL-5 (for CB-1) has a verification signature missing on Step 2. Mr. Boven stated that he neglected to sign this step when transferrring information from the "original" document to the "official" document. (The original document was signed and dated 4-22-85).
8) The B&W procedure calls for an identification of the wire used between contacts in the breaker. It asks one to verify that Vulkene Wire was used. On CB-1, B&W could not identify the wire, but GE told B&W over the phone that the wire used is flame retardant and is therefore acceptable.
9) Item 40A was added to SMUD's request, to have B&W verify that the Z bracket holding the Shunt Trip Coil was properly installed.
10) At the end of Step 4, a "note" says to examine the breaker for physical damage, loose nuts, screws or washers, etc. The monitor watched this being performed by Mr. Boven. He used a short shank screwdriver to check a number of screws for tightness. The two uvd screws were not checked. The monitor asked if the screws are normally checked for tightness. Mr. Boven said that he may check these screws, but not always. At this point, Mr. Boven took the short shank screwdriver in behind the uvd and checked for tightness. Mr. Boven stated and showed the monitor that he does consistently wiggle the shunt and uvd vociferously to see if they are loose. The monitor stated that an offset screwdriver might be more appropriate.
11) The monitor asked how breakers are transferred between the warehouse and the shop which is at the Mt. Athos Fuel Facility. The breakers are transferred in their own shipping containers.
12) Step 8 asks one to verify that the armature on the uvd has been beveled. This is an important and easy check. It is important according to Mr. Boven because between 1976 to 1978, GE sent representatives to each utility to check that the bevel exists. Apparently, some uvd's were distributed with square corners This will affect the rivet-to-armature clearance.
13) The Fluke used for pickup and drop out tests was due for calibration in August, 1985 on a yearly calibration schedule.

(See Page 9)

Item H from Sheet 8 QA Surveillance No. 342A

14) A Techtronix scope and extra circuitry is used for trip time tests. When hooked up properly, the technician can read millisecond trip times on the scope trace. While performing this check, the monitor asked if the scope had a memory function which would keep the trace on the screen longer and make the reading slightly easier. A shop technician set the scope up for the memory mode and the test went well. The scopes used had no calibration information available.

15) The "Trip Function Using Undervoltage and Shunt Trip Devices" test was felt to be superfluous from the monitors viewpoint. It in effect checks that the uvd trips the breaker in the same manner as done in Step 10. Mr. Boven stated that the test simulates external auxiliary contacts effects on the shunt trip device circuitry and was added at the request of TMI. The test only shows that the relay added in the test circuitry trips the shunt device from a signal to the uvd, but does not tell you what would happen in the plant.

16) The trip shaft torque measurement is done in a similar manner to the way it is performed at Rancho Seco. A one inch moment arm is used via a sort of modified "open end wrench" tool which has a stainless steel wire attached. The uncalibrated 4#x1oz. HOMS scale with zero adjustment is hooked on to the wire and the test is performed. These trips are done and all three values recorded.

17) Finally, the monitor went to the B&W shipping warehouse. There were about six breakers from various licensees and from stock in the warehouse. All breakers were in wood shipping boxes except one that had a burned out uvd and was sort of the shop spare. A GPU breaker was noted in the warehouse. It was in a horizontal position on its back in a GPU shipping container. Rough handling is possible here or anywhere else in its transportation, but the people at the warehouse seemed very sensitive to proper handling techniques. The personnel at the warehouse supplied the monitor with a proper handling tool for GE AK breakers. This type of tool should have been shipped with a new breaker purchased by SMUD and may have been shipped in other returned breakers. At any rate, Don Yount at Rancho Seco was presented with the tool when the monitor returned to Rancho Seco on June 17, 1985.

Item V from Sheet 1

QA Surveillance No. 342A

if the critical adjustment screws have been tampered with or moved due to rough handling.

C. Package CRD breakers in more shock resistant containers than are currently used. Determine if vertical or horizontal shipping position is best.

D. Look into packaging with accelerometers placed so as to determine the magnitude of rough handling experienced during all movements of the breaker, including short hauls from a warehouse to a shop for example.

E. Analyze what additions need to be made to RIDRs to verify the quality of operation of the breaker when returned from a vendor.

F. Look into setting torque valves on adjustment screws, which must be checked by procedure either during maintenance or at receipt.

G. Implement the above changes and analyses prior to the next six month maintenance on our CRD breakers and determine which of the above are applicable to the two breakers that are still in GE and/or B&W facilities.

# QUALITY ASSURANCE SURVEILLANCE ACTIVITIES REPORT FILE

**I. Location:** I & C Shop **QA Surveillance No.** 342

**Activity Dates:** June 6, 1985 **Report Date:** June 6, 1985

**MOD No.** ____ **ECN No.** ____ **WR No.** ____ **NCR No.** ____ **CRITERIA No.** IV,V,VIII,X, XIII, XV

**MSRC No.** 35 **Tech Spec** 3.5 **SOQAP** X **QA Hours** 10

**Prepared By** Harvey L. Canter HL Canter **Date** June 6, 1985

**II. Activity Description:**
Monitor the investigation into the failure of a DC-CRD breaker.

**III. Summary:**
A failure mechanism was discovered during the bench test process on a GE AK-2 CRD breaker. The uv trip paddle became mispositioned and disabled the uv trip function. If the plant were operating and this failure occurred, the reactor would still have tripped.

**IV. Observations and Comments:**

1. A review of CRD related RIDRs and NCRs show there to be seven CRD breakers on-site: 5 DC GE AK2's and 2 AC CRD breakers.
2. The paper work shows on Certificate of Conformances for all these breakers that they have "passed a visual, dimensional, and functional test performed by B&W personnel."
3. The surveillance monitor witnessed initial bench tests on the failed breaker #224A3515-506CG-1. The results as seen by the monitor follow:
   a. With the breaker as it came from the DC cubicle, the technicians picked up and dropped out the uv six times. The coil operated as it was supposed to all six times.

(See page 2)

**V. Recommendations:**
SMUD QA and/or a member of the I&C Staff should travel to the B&W and GE facilities where the refit work was done to audit the procedures, review records and have a walk-through of the work that was performed.

**VI. Followup Activity:** ☐ None Required, or see noted action below:

- ☐ QA Followup List
- ☐ ALARA Suggestion
- ☐ Speak Out
- ☐ Safety Recommendation, SMUD 1291
- ☐ Coordinated Commitment List (CCL)
- ☐ Memorandum
- ☒ Other, List Perform followup surveillance to document the results of the recommendation - Due 7-1-85

**VII. Second Level Review** John D. Jewett 6/6/85 Date

This Surveillance is: ☐ Closed ☒ Open and additional followup is required

cc: L.G. Schwieger/ R Rodriguez/ P Oubré/ G Coward/ J Jewett/ J Eckhardt(NRC)/ N Brock/ C Linkhart/ J Wheeler/ B Dieterich/ R Colombo/ B Daniels

Item IV from Sheet 1 QA Surveillance No. 342

It was then noted that the uv trip paddle was not anywhere close to the uv armature, so that it couldn't be contacted and hense trip the breaker.

b. The technician then freely rotated the trip paddle until it contacted the armature. An attempt to drop out the uv coil then failed, and it was impossible to lift the armature manually. This reproduced the failure noted during the functional test that originally surfaced the failure.

c. The breaker was then tripped with the DC shunt device. The uv device was noted to have remained jammed.

d. The breaker was closed manually - the uv device remained jammed.

e. The uv was cycled electrically 13 times. The trip paddle and uv armature could be seen to move a small amount ( ~ 1/16").

f. The shunt trip was energized again - the breaker tripped but the uv was still jammed.

g. The trip paddle was pushed into its "proper" position and the breaker then operated successfully six times with the uv trip signal.

4. Later in the day, because all armature gap measurements were out-of-specification, management decided to set the gap between the armature and a horizonal rivet to the values (1-10 mils) required in Service Bulletin SB 25-014. This bulletin (#51-1157077-00 dated 4-24-85) appears to be the latest bulletin that describes the adjustments recommended for plants of the B&W Owners Group based on Post-Salem test and operating experience.

5. Using the SB is considered a good practice and in accordance with the maintenance procedure for CRD breakers. Ie, EM 175 (7-11-84) states in step 6.19 that one is to check mechanical adjustments and readjust as needed per vendor instruction manual. The Service Bulletin is apparently the latest Instruction Manual.

6. It's not clear why the stated gaps were apparently not set at the levels described in the Service Bulletin by B&W or GE prior to shipment to Rancho Seco.

ATTACHMENT TO QA SURVEILLANCE 342A

FILE

TELEPHONE CONVERSATION LOG

CALL TO/CALL FROM Jim Lusk & Ken Price DATE 6/7/85 TIME 1110-1125

B&W-Lynchburg, Virginia

MADE/RECEIVED BY Harvey L. Canter PHONE (804) 385-2957

SUBJECT/REFERENCE Control Rod Drive Breakers

SUMMARY a. B&W did not perform a 1 for 1 verification of GE activities.

b. B&W did not check the armature-to-rivit gap.

c. GE certified that they did set the gap with a special tool.

d. B&W said they functionally tested the breakers. They performed 3 uv trips per breaker. No failures.

e. B&W performed trip time tests, pick-up and drop out tests, torque checks, etc.

f. NO TESTS FAILED.

g. For info: Arkansas breakers had some drop out time problems. Had to reset from about 95v to >100 volts.

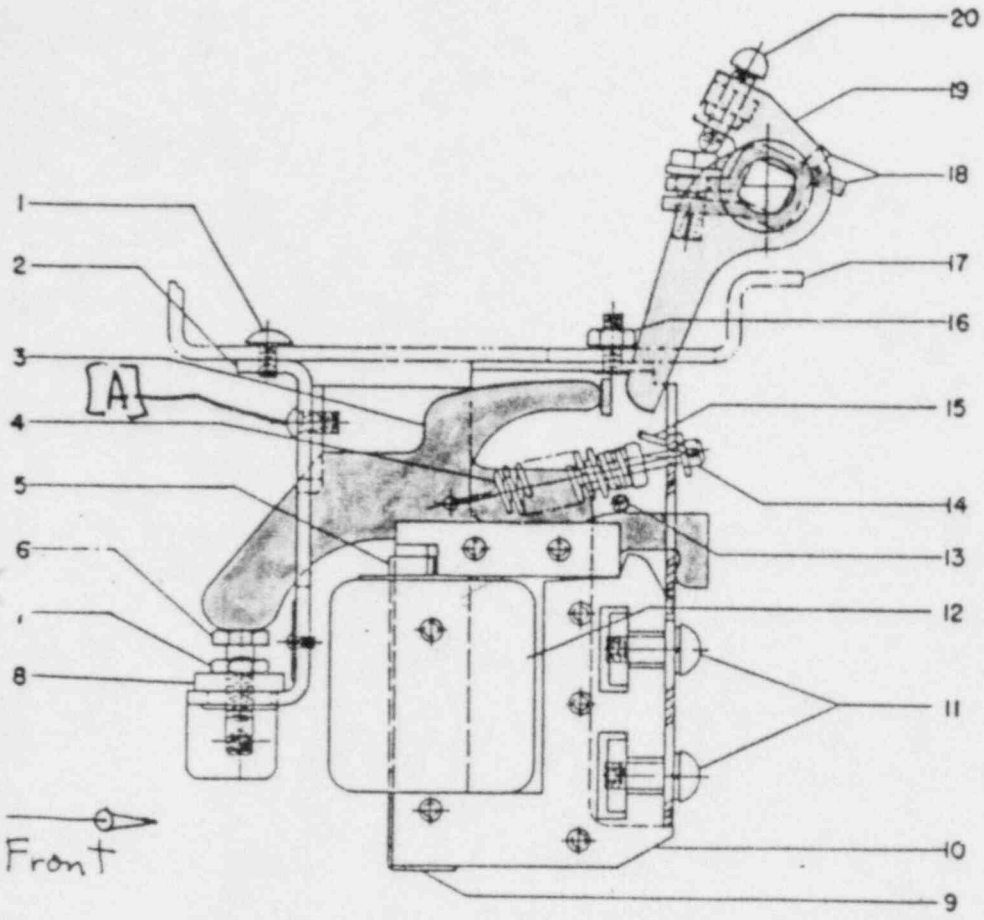
h. Some GE items were double checked, but not the gap setting.

i. The GE man "in-the-know" was Mike Austin who will be out here at Rancho Seco soon. His phone # is (404) 447-7271. The technician apparently involved with GE in Atlanta is Jim Ryder (GE Repair Center in Atlanta).

FOLLOW-UP REQUIRED It might be prudent for QA and/or I&C to travel to B&W-Lynchburg and GE-Atlanta to review their maintenance/adjustment procedures, review the data that was generated for refit of our breakers, and request a walkthrough of their procedures, if possible.

cc: L Schwieger, J Eckhardt, R Miller, R Colombo, G Coward, N Brock, R Lawrence, J McColligan,

SMUD-1185 2-81 D Raasch, L Keilman, R Rodriguez, P Oubré, J Jewett, R Spencer, J Sullivan




1. Mounting Screw
2. Frame
3. Armature
4. Spring
5. Shading Ring
6. Adjusting Screw
7. Locking Nut
8. Bushing
9. Clamp
10. Magnet
11. Screws
12. Coil
13. Rivet
14. Adjusting Screw
15. Locking Wire
16. Mounting Nut
17. Mechanism Frame
18. Trip Paddle Clamps
19. Trip Paddle
20. Adjusting Screw

Figure 23. (0152C9206) Undervoltage Tripping Device

SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT □ 6201 S Street, P.O. Box 15830, Sacramento CA 95852-1830, (916) 452-3211
AN ELECTRIC SYSTEM SERVING THE HEART OF CALIFORNIA

RJR 85-325

July 2, 1985

J B MARTIN, REGIONAL ADMINISTRATOR
REGION V OFFICE OF INSPECTION AND ENFORCEMENT
ATTN: DOCUMENT CONTROL DESK
U S NUCLEAR REGULATORY COMMISSION
WASHINGTON DC 20555

DOCKET NO. 50-312
LICENSE NO. DPR-54
LICENSEE EVENT REPORT NUMBER 85-06

In accordance with the requirements of 10 CFR 50.73(a)(2)(vii), the Sacramento Municipal Utility District hereby submits Licensee Event Report Number 85-06. Licensee Event Report Number 85-06 replaces a previously assigned event report that was subsequently determined to be nonreportable and thus, not transmitted to the NRC. This number has been reissued in order to eliminate the resulting gap in the number sequencing.

If there are any questions concerning this report, please contact Mr. Ron Colombo at the Rancho Seco Nuclear Generation Station.

R J RODRIGUEZ
ASSISTANT GENERAL MANAGER, NUCLEAR

cc: Region V (2)
INPO

Attachments

IE22
1/1