U.S. NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR REACTOR REGULATION

Docket/Report No.:	99901043/98-01
Organization:	Repair and Replacement Services (RRS) Westinghouse Nuclear Services Division (WNSD) Energy Systems Business Unit Westinghouse Electric Corporation 2000 Cheswick Avenue Cheswick, Pennsylvania 15024-1358
Contact:	D.P. Adomaitis, Manager, Engineering (724) 275-3552
Nuclear Industry Activity:	Repair, refurbishment and replacement services for Westinghouse electrical equipment
Dates:	October 14-15, 1998, at Eaton/Cutler-Hammer, Greenwood, SC October 28-29, 1998 at RRS, Cheswick, PA
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Enclosure 2

1.0 INSPECTION SUMMARY

On October 14-15, 1998, NRC inspectors observed inspection, testing and repair/rework of six 4.16-kV Westinghouse (W) Type 50DHP350, 1200-ampere, circuit breakers of the ten recently built by Eaton/Cutler-Hammer's (ECH's) Aftermarket Product Center (APC) in Greenwood, South Carolina, for Illinois Power Company's (IPC's) Clinton Power Station (Clinton). IPC had returned the breakers to the ECH Greenwood factory (the APC) for evaluation and correction of material deficiencies in the breakers identified during receipt inspection at Clinton. On October 28-29, 1998, the inspectors reviewed the commercial grade dedication program and its implementation at the Westinghouse Nuclear Services Division (WNSD) Repair and Replacement Services (RRS) facility located in the Westinghouse Electro-Mechanical Division complex in Cheswick, Pennsylvania. The inspection bases were:

- Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to Part 50 of Title 10 of the *Code of Federal Regulations* (10 CFR Part 50, Appendix B)

- 10 CFR Part 21, "Reporting of Defects and Noncompliances"

The inspectors found that the RRS practices in dedicating Type DHP breakers contained weaknesses, including inadequate inspection and corrective action, which allowed deviations in the breakers to remain undetected until identified at Clinton. Accordingly, Nonconformances 98-01-01 and -02 were cited (See Sections 3.1 and 3.4 respectively). For weaknesses in the commercial dedication instruction used to dedicate the DHP breakers, Nonconformance 98-01-03 was cited (See Section 3.2). In addition, Unresolved Item 98-01-04 was identified regarding the proper gage of control wiring and termination size on the Clinton DHP breakers (See Section 3.1.b.2). The program and its implementation at the RRS facility in Cheswick for dedication of commercial-grade items for resale and for use in repairing and refurbishing breakers at Cheswick and at the RRS Lansing, Illinois, facility was generally acceptable.

2.0 STATUS of PREVIOUS INSPECTION FINDINGS

Unresolved Item (URI) 99900404/98-01-02 (redesignated to the RRS docket number: 99901043/98-01-05) (Open): RRS was to complete tests to confirm that minimum trip bar force for W Type DB-50 low-voltage circuit breakers is 14 ounces. RRS was also to determine how (or if) the removal of the so-called "trip pads" on breaker trip bars and the overwound trip pan return spring, found on one or two breakers at Indian Point Station, Unit 2, could affect the operation of the breaker or its seismic qualification. During this inspection, RRS stated that they had completed the tests, but still had to analyze the data. RRS informed the NRC on November 19, 1998, in response to our followup inquiry, that now more testing would be required to confirm the first set of test results. RRS stated that they would inform the NRC when the final, analyzed results are published.

URI 99900404/98-01-03 (Redesignated to the RRS docket number: 99901043/98-01-06) (Closed): In response to reports from IPC Company's Clinton Power Station that there was inadequate clearance between the rear arc horns/arc chute contact fingers and the molded cases of the arc chutes (supplied by RRS) on several W Type 50DHP350, 1200-ampere-rated breakers, RRS was to complete tests to establish the minimum clearances. IPC reported the concern to the NRC under 10 CFR Part 21. The inspectors determined that IPC and RRS resolved the clearance problem and that it was not generic. No further action was required. In addition, review of the applicable factory instruction book, IB 32-253-4B, resolved concerns about its adequacy in this regard.

3.0 INSPECTION FINDINGS AND OTHER COMMENTS

3.1 Evaluation and Repair of Clinton Breakers at ECH

a. Inspection Scope

At the ECH Greenwood Aftermarket Product Center (APC), the inspectors observed evaluation and correction of material deficiencies which were identified in six W Type 50DHP350 breakers during receipt inspection at Clinton. The six deficient breakers were among ten new breakers purchased by IPC from RRS, but manufactured at the ECH APC. The inspectors reviewed relevant procurement, manufacturing, inspection and test documents, examined some of the affected breakers and parts, observed breaker inspection and testing, and interviewed personnel involved, including technical and quality assurance personnel from Clinton, engineering and quality assurance personnel from RRS and engineering and manufacturing personnel from ECH.

b. Findings and Observations

The inspectors determined that IPC had issued Purchase Order (PO) No. 705316, dated August 8, 1997 (and Change Notice 001 of August 26, 1997), to RRS Repair and Replacement Services for six new Type 50DHP350, 4.16-kV, 1200-ampere breakers; three Type 75DHP500, 6.9-kV, 1200-ampere breakers and one Type 75DHP500, 6.9-kV, 2000-ampere breaker, all of which were designated for safety-related (Class 1E) service (and for Class 1E spares) at Clinton. PO 705316 specified that all breakers should be built to the specifications of the original equipment supplied for Clinton's Division I and II 4-kV electrical power distribution systems (including the specific requirement that the control wiring be the same as the original). The PO then referenced the original W East Pittsburgh factory shop order (SO) numbers, but added the exception that the breakers should be fitted with levering-in devices of the current design. The order also included one 50DHP250 breaker for non-Class 1E service, but with the same technical requirements.

In response to this customer order, RRS created its internal General Order (GO) ST30867 and issued its PO MB51470D, dated September 8, 1997, to Westinghouse Electric Supply Company (WESCO) for this equipment. WESCO in turn issued its PO 336551470, dated September 11, 1997 (with Change Notice 003, dated January 29,

1998) to ECH to build and supply the equipment. The inspectors determined that the conditions stipulated by RRS and passed on to ECH were as follows:

- All items furnished were to be new and unused.
- RRS would furnish the control or "Y" (anti-pump) relay (a W Type NBFD44S)
- The vendor (ECH) was to supply a certificate of conformance stating that the equipment supplied was in accordance with the requirements of the PO.
- A certified test report and an instruction book (IB 32-253-4B) was to be supplied with each breaker.
- The name plate serial numbers of the breakers designated for safety-related service were to have the suffix "-1E" ["Class 1E" is the designation of the Institute of Electrical and Electronic Engineers (IEEE) for nuclear safety-related electrical systems and equipment].
- The breakers were to be packaged in accordance with the intent of American National Standards Institute (ANSI) Standard N45.2.2, Level B. The shipping containers were to be labeled "Shock Watch," "Do Not Tilt," "Fragile" and have arrows indicating which end must remain up.
- ECH was to notify RRS if shelf life applied to any item in the order, which required that a minimum of 80% of shelf life remain at the time of shipment.

The NRC inspectors determined that receipt inspectors at Clinton documented adverse findings on breakers shipped directly from ECH in a Receipt Inspection Discrepancy Report (RIDR) for each breaker. Clinton used a "Receipt Inspection Checklist [RIC] for New Westinghouse Circuit Breakers" to inspect the circuit breakers. According to the RIDRs, the six safety-related breakers with deficiencies were identified by the following serial numbers: APC/98/026-1E, APC/98/027-1E, APC/98/028-1E, APC/98/029-1E, APC/98/030-1E, and APC/98/031-1E. The inspectors determined that most of the corrective actions by ECH and RRS for the below-listed deficiencies identified at Clinton were satisfactory with some exceptions as discussed for each deficiency where applicable:

1. Clinton inspectors could not see any sign of the prescribed graphite grease (W Specification 53701AN) on the main and arcing contact surfaces on 3 breakers. The NRC inspectors noted that Clinton was particularly sensitive to this issue because lack of contact lubrication (and removal of factory-applied lubrication) was a principal cause of two failures of 50DHP350 breakers to open at Clinton during the summer of 1997. ECH stated that the contacts had been lubricated at the factory in accordance with the process prescribed in IB 32-253-4B, which calls for applying graphite grease to the contacts, rubbing the lubricant in and wiping off the excess. Nevertheless, ECH technicians at the APC relubricated the contacts after the tests were completed.

2. Breaker control wiring had nicked insulation. The crimp barrels on ring tongue terminals were three American Wire Gage (AWG) sizes too large (AWG 14) for the AWG 22 breaker control wire. RRS stated that they had performed pull tests on samples of these terminations and determined that they were tight, despite being mismatched. RRS explained that the oversized terminals had been used because they had been used on the original breakers according to the shop orders and the breakers had been specified to be built in accordance with those original shop orders as stated above. In fact, Technical Requirement 3 in the procurement documents specified that the control wiring should be the same as the original control wiring. Nevertheless, Clinton personnel decided to replace and/or reterminate the wiring themselves.

   The NRC inspectors noted that this represented a breakdown in communications between the licensee and vendor. RRS and ECH should have recognized and questioned the apparent mismatch in the size of the wire and the terminals and verified what was appropriate for the application, not to mention what was specified in design drawings. If the original shop orders specified terminals for AWG 14 wire, then AWG 14 wire should have been used as well. It was not clear whether ECH had subsequently reduced the wire size, but had not changed the crimp barrel size of the terminals accordingly. The NRC inspectors determined that if the original specifications allowed the terminal-wire size mismatch (although this was viewed as unlikely), it would be necessary to verify, or have the licensee verify, the correct control wire terminations on existing breakers at Clinton, and perhaps elsewhere. For Clinton, this matter was referred to the cognizant staff in NRC Region III. However, in view of the satisfactory pull test results and that Clinton personnel were to reterminate the known affected control wiring, this potential problem was not considered to be of immediate operability or safety concern. Pending confirmation of the original requirements for the control wiring and the status of corrective actions, the issue for RRS of the original W design specifications for the control wiring and any subsequent changes to wire size and/or terminal size, if any, is designated Unresolved Item 99901043/98-01-04.

3. Main contact separation, latch check switch adjustment and the gap between the motor cutoff switch and its operating slide lever (which is also the closing spring charged indicator lever) on some of the breakers were out of specification. ECH technicians readjusted the affected components, but could not explain why they were found out of tolerance at Clinton other than that they might have become misadjusted during breaker handling and shipping.

4. Different types of screws had been used to attach the name plate to breaker APC/98/031-1E. This had no technical significance, but indicated a lack of attention to detail. ECH replaced the affected fasteners with the correct type.

5. A floor tripper screw was found rusted on one of the breakers. ECH replaced the screw, but had no satisfactory explanation for why it was rusted.

6. The gap on the crank shaft between one spacer and the closing cam on one breaker was measured to be 0.095". The RRS engineer determined that a gap of this amount was acceptable.

7. The arc chute supports of several breakers had pin size depressions in the insulation material and another imperfection was on one support. RRS stated that neither the pin size depressions, nor the other imperfection, would reduce the insulation resistance of the arc chute supports which had been confirmed during production dielectric withstand tests. ECH reperformed those tests (with satisfactory results) as part of comprehensive retesting of the breakers at the Greenwood APC.

8. Some moving and stationary arcing contacts were worn and one appeared to be burned. RRS stated that the condition of the arcing contacts was not unusual for breakers that have gone through the normal course of production testing. However, ECH replaced the contacts in the interest of "customer satisfaction."

9. The closing spring retaining plate rubbed against the frame support on one breaker. ECH checked for this condition on all returned breakers and rotated the plate slightly on the affected breaker so that it no longer rubbed against the frame support.

10. The silver plating on the line (stationary) side of the main contacts was different from the plating on the load (moving) side. The RRS engineer found this condition acceptable.

11. The clearance between the closing latch roller and the closing trigger was found to be zero on two breaker(s). This clearance is supposed to be set between 0.010" and 0.030" to ensure that the closing latch will reliably reset. ECH claimed that the clearance was in specification when the breakers left the factory, but conceded that they might have been at the very low end of the tolerance band such that shock and vibration could conceivably cause them to go out of adjustment. ECH checked and/or readjusted the closing latch roller clearance on all the returned breakers and set them all to the middle of the band to avoid the problem.

12. The levering-in device safety interlock was not engaging in five of the six 50DHP350, 1200-ampere-rated breakers because the levering-in device support bracket assembly was welded to the rear of the breaker lower chassis front plate about 1/4-inch too low. This allowed the levering-in device crank handle to be turned beyond its design limit with the breaker closed. The inspectors determined that the initial action taken by ECH to correct the support bracket ring misalignment allowed insertion of the levering-in device shaft, but left the support bracket side plates improperly welded and positioned too low. After the breakers were returned to the APC, ECH replaced the lower chassis front plate assembly on all 5 affected breakers. The sixth breaker was manufactured at a different time and was not affected. ECH and RRS stated that the breakers in question

had all passed their mechanical tests (reportedly witnessed by the RRS representative) in the dummy test cubicle before leaving the factory. This issue resulted in a nonconformance as discussed further in Section 3.4.

13. The top right and bottom mounting screws on the Y-coil (anti-pump relay) were loose on one breaker. ECH technicians tightened them.

14. The main contact penetration was out of specification on two breakers. ECH technicians adjusted the penetration of the main moving contacts into the main stationary contacts.

15. The primary disconnect finger cluster was loose on one breaker. ECH technicians replaced the cluster.

16. On one breaker, the hook on the front end of the right-hand opening spring was not properly seated in the recess between the head and locknut of its 3/8-inch-diameter mounting bolt on the breaker frame. In fact, the spring had been found with its hook completely out of the recess, having worked its way up onto the head of its mounting bolt where only the small clearance between the mounting bolt and an adjacent plate kept the hook from coming off the bolt entirely. ECH technicians adjusted the spring, but the NRC inspectors observed that the recess was not wide enough to allow the spring hook to slip into it fully and rest on the threads of the bolt as it is supposed to. The NRC inspectors examined the applicable drawing and found that the width of the recess as well as the amount that the bolt protrudes from the plate in which it is installed was established on the drawing by a single dimension. The drawing simply showed that the bolt, which is screwed into a threaded hole in the plate, was to be adjusted and locked in place with its locknut such that the distance between the bottom of its head and the face of the plate will be 0.380". At the NRC inspectors' request, ECH technicians measured this dimension on the affected breaker and found that it was slightly greater than 0.380", yet the width of the recess was still too small for the wire diameter of the spring hook. The inspectors observed that the thickness of the locknut depicted on the drawing was not called out; and although it appeared to be a standard locknut (i.e., slightly thinner than a regular fastening nut and also chamfered on both sides), the nut actually being used as a locknut on the breaker was a regular fastening nut of standard thickness, not a locknut, and was clearly thicker, proportionally, than the locknut shown on the drawing. It appeared that during assembly of the breaker, ECH had substituted a regular fastening nut for the required locknut, thus negating the control of the width of the spring hook recess, defined only by the protruding length of the bolt. The inspectors noted that if the type and size of the locknut was not controlled, the 0.380" dimension was rendered useless for purposes of ensuring a wide enough spring hook recess and would only serve to set the amount of bolt protrusion. ECH agreed to correct this situation which could allow opening springs to come off their mounting bolts, but did not determine at that time whether to change the dimension, more closely control the size of the locknut, or both.

17. Screws on auxiliary switch contacts were found loose on one breaker. ECH technicians tightened the screws.

18. On two breakers, the trip latch roller clearance (i.e., clearance between the trip latch roller and the upper notch in the trip trigger) appeared to be zero. Although there is no generally published value for this clearance (as there is for the closing latch roller clearance), there is supposed to be a visible gap to ensure that the trip mechanism can positively reset. The lack of any visible gap prevented the trip latch on one of the breakers from positively resetting and caused the breaker to go trip free on one closure attempt; although it worked on several subsequent attempts. Clinton receipt inspectors confirmed that there was mechanical contact between the trip latch rollers and the trip triggers on the affected breakers because the trip latch rollers would not rotate freely by hand. Thus, while there was no visible gap and there was contact, it was light contact, i.e., the degree of misadjustment was not extreme so that very little force was exerted. This condition therefore would be consistent with the breaker only going trip free occasionally, but would nevertheless render the breaker unreliable. RRS and ECH stated that the trip latch clearances of all the breakers had been verified to be satisfactory before shipping. They could only speculate that the clearances had been lost somehow during shipping and handling. ECH technicians readjusted the trip latch roller clearances in accordance with the procedure in IB 32-253-4B and verified proper operation of the breakers.

    The NRC inspectors noted that Clinton had experienced some difficulty in adjusting the trip latch roller clearance on its Type DHP breakers in 1987. In response to Clinton's request for assistance, RRS provided an alternative procedure in a letter dated January 4, 1987, on file at Clinton in the plant's DHP vendor manual binder. The alternate adjustment procedure, which the letter stated could also be used on DHP breakers, had been incorporated into Clinton's DHP preventive maintenance procedure, but had not been included by the Westinghouse DHP factory in its 1989 revision to IB 32-253-4, Revision B, which is the current revision. The alternate procedure provided a range of measurable values for trip latch roller clearance (similar to closing latch roller clearance) as opposed to starting with no gap and backing off on the trip cam adjusting screw one turn to obtain a visible gap as the standard procedure prescribes.

The NRC inspectors observed the work on several breakers and determined that ECH had completed the corrective action under the supervision of the RRS Quality Assurance engineer. The inspectors found the completed work acceptable.

c. Conclusions

RRS QA and dedication of the Clinton DHP breakers was unacceptable because RRS failed to conduct adequate assembly inspections to ensure, for example, that ECH welded the levering-in device bracket assemblies together and onto the front plates according to applicable drawings in five affected circuit breakers. The inspectors further concluded that RRS conducted inadequate final inspections which did not detect that the front plates were welded improperly and which did not identify the numerous other deficiencies cited above. Thus, failure to perform adequate inspections during and after

manufacture of the breakers and failure to perform adequate verification at the subcontractor source to ensure conformance with procurement documents was contrary to the requirements of Criteria VII and X, respectively, of 10 CFR Part 50, Appendix B. Accordingly, Nonconformance 99901043/98-01-01 was issued.

3.2 RRS Commercial Dedication Instructions

a. Inspection Scope

The inspectors reviewed the commercial dedication instruction (CDI), CEB 0503, Revision 2, dated December 9, 1997, developed for use by RRS personnel in dedicating Type DHP circuit breakers at the ECH switchgear factory (APC) in Greenwood, South Carolina. The inspectors also reviewed other selected CDIs used at the RRS facility in Cheswick, Pennsylvania, for dedicating replacement parts, mostly from ECH, to be used in repairs and refurbishments performed by RRS and for sale to nuclear utilities as basic components (dedicated commercial-grade items).

b. Findings and Observations

Section I.D of CDI CEB 0503 identified the critical characteristics to be verified in two categories: (1) product identification and (2) performance characteristics. The verification instructions, Section I.E of the CDI, required that Critical Characteristic 1, product identification, be verified on each breaker by inspection (per WCAP 12888, VII-1) in accordance with Section II of the CDI, "Inspection and Test Procedure." Section II.C.1 called for verifying breaker nameplate data in accordance with Test Specification (TS) 710030, Section 2.1. However by referencing TS 710030 for verification of nameplate data, the CDI failed to accomplish its desired result of ensuring that each breaker was marked with a unique serial number because the revision of TS 710030, Revision G, in effect for Revision 2 of the CDI, did not specify a serial number as part of required nameplate information. Instead, it specified that a "style" or "shop order" number appear on the nameplate, as was previously the practice when the breakers were being built at the W East Pittsburgh factory. The style number is the drawing and group number of the breaker type, configuration and rating and is not a unique identifier of an individual breaker. The shop order number is also not a unique identifier, but typically identifies a group or series of breakers to be built with similar configuration and ratings. In addition, the CDI called for the breakers to be "serialized" by adding the "1E" suffix, which does not serialize them at all, but merely designates the whole group of breakers as being intended for Class 1E service. An additional discrepancy regarding nameplate data was that the previous revision (A), not the current revision (B) of W Instruction Book 32-253-4 was listed.

Section II.E.2, in addition to prescribing performance of the electric operation tests per Section 5 of TS 710030, required an additional test to verify proper operation of the anti-pump or "Y" relay at minimum control voltage. The inspectors noted that the addition of the special anti-pump function test at reduced (minimum rated) control voltage was good engineering practice. However, the events in the description of the test were out of sequence because the closing spring was said to recharge after the breaker trips open instead of recharging immediately after closing as it is supposed to.

Section II.E also prescribed performance of pole resistance tests (contacts, joints, etc.) per Section 9.0 of TS 710030 using either a micro-ohmmeter or millivolt drop measurements while passing 100 amps minimum through the pole. However, the inspectors found that the acceptance criteria in the test specification, expressed in terms of maximum acceptable millivolt drops, did not correspond to the acceptance criteria expressed in terms of micro-ohms. The inspectors determined that the millivolt drop values listed were greater than millivolt drop values corresponding to the micro-ohm values for 100 amps of test current by factors of 12, 20, and 30 for the 1200, 2000, and 3000-amp-rated breakers respectively. Thus, it appeared that the millivolt drop values given were based on the rated full-load continuous current instead of the prescribed 100 amps test current which would allow far too large values of contact resistance to be accepted. The inspectors pointed out this discrepancy to the ECH engineers. After some research, ECH confirmed the inspectors' suspicion regarding the basis for the millivolt drop values. ECH acknowledged the error in the test specification, but the inspectors observed that in practice, ECH performed this testing using a micro-ohmmeter that passed the prescribed 100 amps of test current and read out in micro-ohms directly, for which test method, the values in the test specification were appropriate.

Finally, the inspectors determined that the CDI lacked sufficient provisions and detailed instructions for inspection by RRS of the breakers and their subassemblies during manufacture to ensure that all components had been manufactured and assembled in accordance with design documents, manufacturing instructions and customer specifications.

c. Conclusions

The inspectors concluded that RRS Commercial Dedication Instruction (CDI) CEB 0503, Revision 2, for dedicating Westinghouse Type DHP circuit breakers manufactured by Eaton/Cutler-Hammer, was not appropriate to the circumstances in that (1) the CDI lacked sufficient provisions and detailed instructions for inspecting the breaker and its subassemblies; (2) instructions for serializing the breakers (by reference to Test Specification (TS) 710030) provided for including style or shop order numbers on nameplates, and for adding a suffix to serial numbers to indicate designation for Class 1E service, but did not provide for inscribing serial numbers per se or other unique identifiers; and (3) the sequence of events in the instructions for testing the breaker anti-pump relay was incorrect. The CDI also referenced TS 710030 for contact resistance tests, but TS 710030 contained inappropriate millivolt drop test acceptance criteria. Accordingly, Nonconformance 99901043/98-01-03 with respect to Criterion V, "Instructions, Procedures and Drawings," of 10 CFR Part 50, Appendix B, was issued.

3.3 RRS Commercial-Grade Dedication Records

a. Inspection Scope

The inspectors reviewed dedication records at the Cheswick facility to determine if RRS adequately dedicated selected commercial-grade components that ECH used to manufacture new 4.16-kV DHP breakers for Clinton. An example of one of these is discussed below.

b. Findings and Observations

RRS performed its overall dedication procedure on these breakers for use in Class 1E applications at Clinton. RRS maintained traceability of the parts used in each individual circuit breaker to their origin and to dedication records through identification slips stored in an envelope for that breaker. This practice is illustrated by the following example of cases reviewed: The identities and records of all the springs used to assemble a specific breaker were in such an envelope.

ECH purchased all the springs used to assemble DHP breakers from Diamond Wire Spring Company (Diamond). Diamond manufactured all the springs at its plants in Pittsburgh, Pennsylvania, and in Greenville, South Carolina. At the request of RRS, ECH had Diamond test all the springs. Records indicated that the Greenville Scale Company of Taylors, South Carolina, calibrated the equipment that Diamond used to test the various springs used to assemble the eleven Clinton circuit breakers. Each spring was uniquely identified with a tag. After a breaker was completely assembled, the tags attached to the springs used in that breaker were secured in an envelope and identified it with the breaker's serial number. By comparison, the inspectors noted several packages of similarly tagged springs on the QA hold shelves at Cheswick that were either awaiting testing or that had been rejected.

RRS QA conducted surveillances to witness calibration of the test equipment that was used to test the springs. The inspectors reviewed the resultant RRS QA trip report, which documented that Greenville Scale Company had found Diamond's test equipment "out of calibration." However, the inspectors determined that the equipment was actually only overdue for calibration and that Greenville Scale Company's calibration reports indicated that the equipment, although overdue for calibration, once calibrated, was found to be still within tolerance.

c. Conclusions

The inspectors concluded that the dedication records at Cheswick for the examples reviewed indicated generally acceptable dedication program and implementation.

3.4 Review of Corrective Action Report (CAR) G98JD008

a. Inspection Scope

To determine if RRS had documented adequate correct actions for the nonconforming conditions on the new Clinton breakers, the inspectors reviewed CAR G98JD008, dated October 13, 1998, which addressed the incorrectly welded levering-in device bracket assemblies on the front panels of five of the six Class 1E 50DHP350, 1200-ampere-rated breakers delivered to Clinton.

b. Findings and Observations

The CAR documented that the levering-in device safety interlock was not engaging in five of the six 50DHP350-1200 Class 1E breakers because the levering-in device support bracket assembly was welded to the rear of the breaker lower chassis front plate about 1/4-inch too low. As explained above, this allowed the levering-in device crank handle to be turned beyond its design limit with the breaker closed. The sixth breaker was manufactured at a different time and was not affected. Corrective actions taken after the breakers were returned from Clinton were to manufacture new front panels, verify that they met design drawings, and replace the deficient panel assemblies on the affected breakers. In addition, shop personnel underwent retraining, and ECH added the chassis front panel assembly to its critical parts list.

ECH and RRS stated that the breakers in question had all passed their mechanical tests (reportedly witnessed by the RRS representative) in the dummy test cubicle before leaving the factory. However, they had determined (and the IPC representatives agreed) that the levering-in device support was out of position just enough such that the interlock might have appeared to be functioning during the factory testing if only a light torque was applied once resistance from the apparently engaged interlock was encountered in attempting to turn the crank handle with the breaker closed in the connected position. Test technicians did not try to turn the crank harder because it was their practice to consider the interlock to be functioning satisfactorily if an apparent stop was encountered within about one half of a turn. They were, of course not aware at the time that the support bracket, which carries the interlock lever, was mispositioned. Apparently, the personnel at Clinton in testing the interlock themselves during receipt inspection, applied considerably more torque to the crank handle, which, with the support brackets out of position, was enough to force the crank past the interlock and allow more than up to about one-half turn of the crank, to which it is supposed to be limited by the interlock with the breaker closed in the connected position.

This condition would not affect plant safety because the levering-in device interlock is a backup measure to prevent challenging the floor tripper feature which will trip the breaker open if it is racked out more than about 1/8 inch from the fully connected position. This happens long before the primary disconnect fingers disengage from the cubicle studs at about 1-1/2 inch of travel. However, the condition effectively removes one personnel safety barrier and, more fundamentally, was another indication of poor quality control in the manufacturing process and inadequate corrective action by

ECH as well as inadequate quality assurance inspection and assurance of adequate corrective action by RRS.

However, through interviews with ECH engineers and factory workers (in particular the lead welder), the inspectors learned that during final assembly of the five affected breakers, the levering-in device tube and nut assemblies could be inserted through the hole in the front plate, but not through the two rings welded into the levering-in device support bracket on the rear of the front plate because the rings were apparently out of position. The inspectors determined that the five defective front plate assemblies were returned to the welding area to be reworked, but the problem was described simply as the rings being out of position. Rather than verify that the entire assembly was built in accordance with the drawing and manufacturing instructions, it appeared that the welder simply ground out the ring welds and rewelded the rings into the support brackets higher up without moving the brackets up as should have been done. The inspectors also noted that welds between the upper edge of the support brackets and the lip on the upper edge of the chassis front plate were missing because the brackets were positioned too low. The lead welder believed it was very likely that the initial mistake was that the welder who fabricated the defective assemblies used the wrong fit-up jig for the bracket assemblies such that the rings were in the wrong position relative to the side plates of the bracket to begin with. In addition, it was apparent that the welder did not use the mandrel (that the lead welder demonstrated the use of for the inspectors) to ensure that the ring holes are aligned with the hole in the front plate when welding the support bracket assembly to the front plate. While demonstrating the fit-up process to be used, the lead welder pointed out that because ECH did not have a bracket assembly-to-front plate fit-up fixture, it was necessary to use the mandrel to hold the bracket assembly to the front plate and align the holes, then take measurements on both sides of the bracket to ensure that the bracket was not rotated, but level with the top of the front plate, a very time consuming and imprecise method. The lead welder also told the inspectors that he had pointed this out to manufacturing supervisors and engineering explaining that it was very difficult for his welders to consistentiy meet the dimensional tolerances on the drawings using such primitive methods.

Finally, the inspectors noted that ECH had not used shop travelers or some other form of in-process control documentation during the manufacture of the breakers. Such a measure would help to prevent problems with use of incorrect tools and fixtures when multiple configurations (e.g., different subassembly drawing group numbers) of the breakers are being built. The inspectors determined that ECH not using such control documentation along with lack of certain welding fixtures were significant contributing causes, but that they were not addressed by RRS in CAR G98JD008.

c. Conclusion

The inspectors concluded that RRS QA oversight of the action taken by ECH to correct the nonconforming condition was not adequate because the original problem was not defined properly to ensure adequate corrective action, the rework instructions did not require review and verification that the new panel assemblies were built to drawing, the new panel assemblies were only functionally tested and not inspected against the

drawings, functional testing failed to detect the remaining interlock problem, and two significant contributing causes, i.e., not using shop travelers and the lack of adequate weld fit-up fixtures, were not identified, either when the levering-in device support bracket misalignment was first identified, or in the final corrective action, as documented in CAR G98JD008. Thus, in addition to RRS QA oversight deficiencies (i.e., inadequate inspection of breakers and their subassemblies as required by Criterion X of 10 CFR Part 50, Appendix B, and inadequate verification at the subcontractor source as required by Criterion VII), for which Nonconformance 98-01-01 was cited and discussed in Section 3.1 above, RRS did not assure that ECH took adequate corrective action when the incorrect position of the rings in the levering-in device bracket assembly was first identified. Further, RRS final corrective action did not address two significant contributing causes. These deficiencies were contrary to the requirements of Criterion XVI, "Corrective Action," of 10 CFR Part 50, Appendix B. Accordingly, Nonconformance 98-01-02 was cited.

3.5 Observation of Commercial-Grade Dedication Activities at Cheswick

a. Inspection Scope

Using the applicable CDI's as references, the inspectors observed RRS technicians perform dedications of selected low- and medium-voltage circuit breaker replacement parts at the Cheswick facility. The dedications observed were of parts purchased from ECH either for resale as basic components or for use by RRS in refurbishing and repairing low-voltage and medium-voltage circuit breakers. The inspectors examined test equipment, parts being dedicated, interviewed technicians and reviewed Material Deviation Reports (MDRs) in which adverse dedication findings were documented. The inspectors also inspected the segregated areas where RRS stores accepted and rejected components and examined dedicated and rejected items, their identifying tags and attached paperwork.

b. Findings and Observations

b.1 Material Deviation Report (MDR) 15710, Revision 0, dated May 8, 1998, documented the following adverse findings identified when RRS technicians inspected 50 levering-in device kits identified as Part (Style) No. 8068A62G02 that ECH supplied for use in DHP type circuit breakers. Technicians inspected the parts against Drawing 8068A62.

1. The parts received for the fifty kits were not sorted as kits.

2. Four Housings had defective plating.

3 There were areas in 25 tube-and-nut assemblies where the wall thickness was below the minimum wall thickness of 0.12".

4. The slots in seven shafts were too deep.

5. Five out of a sample of eight springs failed their initial load test.

6. The size of the threads in ten tube-and-nut assemblies was out of tolerance. All ten had light corrosion inside at the slot, except three which had grease inside.

7. The quantity of shafts received (49) was less than ordered (50).

8. Some of the shafts had uneven yellow zinc chromate treatment.

b.2 MDR 15710, Revision 1, dated October 5, 1998, documented the following findings regarding 50 more levering-in devices:

1. ECH reshipped two springs to RRS that RRS had previously rejected on May 8, 1998, during receipt inspection and returned to ECH.

2. Five shafts had oversize holes.

3. Nine tube-and-nut assemblies that had been previously rejected by RRS were resupplied by ECH.

4. One tube-and-nut assembly had severe weld burnthrough causing an obstruction in its interior that prevented complete insertion of the shaft.

5. One tube-and-nut assembly was removed from a previously assembled kit.

b.3 MDR 15926, dated August 13, 1998, documented the following adverse findings for a Type DHP breaker ratchet-and-cam assembly, Drawing No. 792A120, Revision 01, inspected under CDI CEB 0432, Revision 02:

1. One important dimension the motor pawl stop pin was out of tolerance.

2. The driving pawl plates were cracked.

3. Some dimensions of the manual ratchet lever pawl assembly were out of tolerance.

4. RRS receipt inspectors were unable to remove the hexagonal bolt in the ratchet-and-cam assembly.

5. Manual ratchet lever welds were deficient (e.g., short, undercut).

6. There was corrosion inside one manual ratchet lever on the spacer and stop and inside of the lever.

7. The hardness on one manual ratchet operating handle was not within tolerance.

c. Conclusions

The inspectors concluded that the RRS technicians were conducting thorough inspections in accordance with the applicable CDIs. The inspectors further concluded that receiving inspection findings were well documented and that the dispositions of the findings were appropriate.

3.6 Dedication of DS-532 Breaker Replacement Mechanisms

a. Inspection Scope

To determine the adequacy of dedicating the operating mechanisms for two DS-532 type, 480 volt circuit breakers, identified as Part No. 567F 759 G04, the inspectors reviewed the records in which RRS technicians documented the commercial dedication, using Procedure CDI CEB-0687, Revision 0, to dedicate them. The record review was supplemented by interviews with and demonstrations by technicians, observation of similar dedication work in progress and examination of representative components.

b. Findings and Observations.

Records indicated that RRS technicians performed the following operations on two refurbished operating mechanisms to dedicate them:

Disassemble and clean all parts.
Retrieve replacement parts from stock as required by the CDI.
Inspect and document all worn, broken or damaged parts
Lubricate and reassemble.
Inspect and replace fasteners as necessary
Reassemble, adjust, and test
Relabel and serialize the package

c. Conclusions

On the basis of records, interviews with and demonstrations by technicians, observation of work in progress and examination of representative components, the inspectors concluded that RRS technicians followed the instructions in the CDI for the mechanisms in question and that the operating mechanism was adequately tested before shipment.

3.7 Review of DB-25 Type Circuit Breaker Refurbishing Records

a. Inspection Scope

The inspectors reviewed the RRS records which documented the refurbishment of two DB-25 circuit breakers by RRS, one of which recently failed to close and remain closed upon demand at Rochester Gas and Electric's (RG&E's) R.E. Ginna Nuclear Power

Plant (Ginna). RG&E had returned the two breakers to RRS for failure analysis. The inspectors also consulted Section M2.1 of NRC Inspection Report 50-244/98-09 which discussed the issue.

b. Findings and Observations

Section M2.1, "Refurbishment and Reinstallation of the A-Service Water (A-SW) Pump Circuit Breaker," of NRC Inspection Report 50-244/98-09 discussed RG&E actions to restore the failed A-SW pump breaker to service. The report stated that on August 4, 1998, RG&E sent the A-SW pump breaker to RRS in Cheswick following an in-service failure in which the breaker tripped open after momentarily closing upon a demand signal from the control room on July 30, 1998. The inspectors had been concerned with the high frequency of Westinghouse DB circuit breaker failures at Ginna, particularly in this instance, since neither RG&E nor RRS could determine a root cause for the failure.

The inspectors determined that RRS refurbished the breaker and returned it to Ginna on September 21, 1998. However, electrical maintenance technicians inspected the breaker at the station and noted the following deficiencies: (1) silver coating worn through on secondary contacts; (2) missing "E"-clip on the escutcheon plate assembly; and (3) binding trip mechanism, preventing it from resetting reliably. This condition could cause the breaker to "go trip free" (fail to latch closed) on the next closure attempt. On September 30, 1998, an RG&E system engineer accompanied the breaker to RRS in Cheswick for correction of these problems. RRS determined that the binding trip mechanism was caused by an oversized first toggle link. Following replacement of the toggle link and additional repairs, RRS returned the breaker to Ginna on October 6, 1998, where it was satisfactorily inspected and bench tested. The licensee reinstalled the breaker in its cubicle and returned it to service on October 14, 1998, following a satisfactory functional test. RRS indicated that the oversized toggle link would be evaluated for a potential 10 CFR Part 21 report.

During this inspection, records indicated that the values of the breaker trip load, distance traveled by the trip bar to trip, heights of the trip bar on the left and right, and the gap between the shunt trip lever and trip bar were documented before and after refurbishment. The probable cause of the failure was determined to be the first toggle link being oversized. This condition had been discovered during the incoming testing and inspection. The link was ground to meet the drawing dimensional tolerances during the rework of the breakers. RRS stated that no other customer had reported a similar problem and explained that their investigation had revealed that the breaker only became sensitive to the slightly oversized link when its factory applied lubrication wore off. RRS had determined that this lubrication had worn off prematurely at Ginna because of frequent manual operation of the breaker using excessive closing force on the maintenance closing handle. RRS had determined that for these reasons, only Ginna would be affected by the condition. Therefore, no further 10 CFR Part 21 evaluation or notification was required. The inspectors agreed.

Also during this inspection at Cheswick, the NRC inspectors determined that RG&E had issued its PO NQ-15877-C-JW to RRS to refurbish one safety-related circuit breaker,

Type DB-25, Serial No. 980.018-1. For this job, RRS issued GO SY01052. The breaker was manufactured under the original shop order, 24Y4712-BA9, and RRS had refurbished this breaker in 1992 under shop order 980.148. Ginna operated this breaker for some time and noticed that on the right-hand side of the housing, internal to the operating mechanism, the roller latch pin was missing. With the roller latch pin being out of the correct hole, the roller was at an angle. This affected the proper operation of the breaker.

The pin provides a stop for the mechanism linkage when the breaker is in the closed position. The missing pin did not prevent the breaker from closing, but did allow the closing coil and operating mechanism linkage to extend beyond the normal working positions. RRS concluded that wear marks on the circuit breaker where the pin would have made contact in service indicated the breaker had a pin when it was shipped in 1992 after refurbishing it and that the pin had remained in place for sometime before it apparently worked its way out. RRS confirmed that this pin was missing when they received the breaker and assured the NRC inspectors that it would be assembled correctly before the breaker is returned to Ginna. The inspectors reviewed the records in which RRS documented the refurbishment of the second breaker and identified no adverse findings.

c. Conclusions

RRS has revised the refurbishment procedure to add a line item to check the dimension of the first toggle link which caused the Ginna breakers to operate unsatisfactorily. The inspectors identified no adverse findings in this area.

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ITEMS OPENED, CLOSED AND DISCUSSED

Opened:

99901043/98-01-01	NON	10 CFR Part 50, Appendix B, Criteria VII and X Inadequate QA oversight of ECH (Inspection and dedication)
99901043/98-01-02	NON	10 CFR Part 50, Appendix B, Criterion XVI Inadequate corrective action
99901043/98-01-03	NON	10 CFR Part 50, Appendix B, Criterion V Inadequate commercial dedication instruction
99901043/98-01-04	URI	Potential 10 CFR Part 50, Appendix B, Criterion III Failure to maintain control of control wiring design

Closed:

99901043/98-01-06	URI	(Redesignated from WNSD 99900404/98-01-03) Inadequate rear arc horn/arc chute clearance on Clinton DHP breakers

Discussed:

99901043/98-01-05	URI	(Redesignated from WNSD 99900404/98-01-02, Remains Open): Testing of DB-50 breakers to determine minimum trip bar force, effects of trip pad removal, and overwound trip pan return spring (as found at IP2)