ORGANIZATION: FARWELL & HENDRICKS, INC.
MILFORD, OHIO

REPORT NO.: 99900918/90-01	INSPECTION DATE: June 25-27, 1990	INSPECTION ON-SITE HOURS: 51

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NUCLEAR INDUSTRY ACTIVITY: Farwell & Hendricks (F&H) supplies qualified parts and services for nuclear plant applications. F&H conducts commercial-grade dedication activities for electrical and mechanical equipment (including testing) at their Ohio facilities.

ASSIGNED INSPECTOR: Uodis Potapovs for R. P. McIntyre, Reactive Inspection Section No. 1 (RIS-1), Vendor Inspection Branch — 10-31-90 Date

OTHER INSPECTOR(S): S. D. Alexander, RIS-2

APPROVED BY: Uodis Potapovs — U. Potapovs, Chief, RIS-1, Vendor Inspection Branch — 10-31-90 Date

INSPECTION BASES AND SCOPE:

A. BASES: 10 CFR Part 50 Appendix B, 10 CFR Part 21

B. SCOPE: To review the F&H program and process for the dedication of commercial-grade electrical and mechanical items sold to nuclear licensees as safety-related.

PLANT SITE APPLICABILITY: Potentially generic

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A. VIOLATIONS:

None identified during this inspection.

B. NONCONFORMANCES:

1. Contrary to the requirements of Criterion III of Appendix B to 10 CFR Part 50 and Farwell & Hendricks Technical Procedure TP 3-001 "Procedure for Establishment and Procurement of Commercial-Grade Items for Use as a Basic Component," F&H procured certain commercial-grade items (CGIs), including molded case circuit breakers, processed them through their dedication program for use in safety-related nuclear plant service, and sold them to nuclear utilities without conducting a complete review for suitability of application of equipment essential to the safety-related functions of structures, systems, and components or verifying the adequacy of design through a complete testing program. (99900918/90-01-01)

C. UNRESOLVED ITEMS:

None identified during this inspection.

D. STATUS OF PREVIOUS INSPECTION FINDINGS:

No previous inspection findings.

E. INSPECTION FINDINGS AND OTHER COMMENTS:

1. Review of F&H Dedication Process for Commerical-Grade Items

The process of dedicating commercial-grade items for use in safety-related applications is described in F&H Technical Procedure TP 3-001, Rev. 0, "Procedure for Establishment and Procurement of Commercial-Grade Items For Use as a Basic Component." This procedure gives guidelines and instructions for the purchase, dedication and documentation of commercial-grade items (CGIs) classified as spare, replacement, and fabricated parts, subcomponents, components, or assemblies and are used for Class 1E electrical and safety-related mechanical and structural equipment. F&H defines "Dedication" as the process whereby a commercial-grade component/part is designated for use as a basic (safety-related) component. This includes the act of verifying that the CGI is acceptable for nuclear safety-related applications. Dedication of a CGI occurs prior to use when that

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item is designated acceptable for use as, or a part of, a basic component. This dedication process is accomplished using various methods to verify that the CGI is acceptable for nuclear safety-related application. If "likeness" cannot be established through review of available data, then an engineering evaluation which addresses the following elements is conducted:

a. Critical characteristics.

b. Supplier/manufacturer selection.

c. Materials of construction [including environmental qualification (EQ)].

d. Design requirements (including seismic).

e. Manufacturing process, as applicable.

f. Product characteristics.

g. Test and/or analysis development plan.

h. Test or analysis verification.

i. Evaluation of analysis or test results.

j. Acceptance criteria justification.

k. Qualification evaluation and maintenance.

The actual product dedication by F&H is conducted using a combination of the following activities depending upon the product and end application:

a. Equivalency approval and product verification by a responsible engineer.

b. Comparison of product characteristics or a determination of satisfactory product characteristics.

c. Verification receiving inspection.

d. Compliance with industrial codes or standards as applicable.

e. Verification of the manufacturer's control program as applicable.

f. Verification of product characteristics by inspections and tests.

g. Quality assurance (QA) verification of certificate of compliance (COC) by methods such as source inspection, receipt inspection including functional tests, and seismic test or environmental analysis or test.

This dedication process assesses the adequacy of the manufacturers commercial product quality using a combination of QA control, receipt inspection, traceability to the manufacturer and both seismic and environmental qualification. This information as well as the elements discussed earlier are documented by a Qualified Technical Preparer in the Commercial-Grade Dedication File data package, including a data package review and approval verification checklist.

Upon completion of the dedication, F&H provides their customers with a COC for the subject parts (by F&H Part No.) covered by the certificate, as well as a listing of all technical, quality and general provisions which have been met as part of the dedication. The data package number and other pertinent F&H information are also documented on the COC. The COC is signed and dated by the Qualified Technical Preparer, the Engineer who performed the independent design review, the Engineering or Project Manager, and the QA Engineer or Manager.

2. Dedication Implementation

During the inspection, several Commercial-Grade Dedication File data packages were reviewed. These data packages were chosen after a review of the F&H Commercial Quality (CQ) Parts Catalog, dated May 17, 1990. The packages were selected by manufacturer with the part type, description, dedication completion date, and data package number used as selection input. The data packages reviewed included parts such as: Agastat relays, ASCO solenoid valves, Bussman fuses, GE/Yokogawa meter, various model GE molded case circuit breakers, Limitorque limit switch, Masoneilan pressure controller, Potter & Brumfield relays, York chiller parts such as an oil jet pump, and an IMO Delaval level switch.

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During the review of the data packages the inspectors were able to evaluate Procedure TP 3-001 and its implementation. From a programmatic standpoint, Procedure TP 3-001 addresses the guidelines established in EPRI NCIG-07 (NP-5652) "Utilization of Commercial-grade Items in Nuclear Safety-related Applications" as satisfing the requirements of 10 CFR Part 50, Appendix B, and 10 CFR Part 21, with respect to verifying that parts purchased as commerical grade items and dedicated under the guidelines of this procedure would be suitable for nuclear safety-related applications. It appears that F&H has established a sound dedication program, and, if properly implemented, should provide adequately dedicated and qualified commercial-grade items for use in nuclear safety-related applications.

However, the inspection did identify certain deficiencies in the implementation of the F&H dedication program as well as shortcomings in the dedication activities for molded case circuit breakers, which are described later in Section 3. Specific examples are provided below:

a. Data Package 60448.1 - GE/Yokagawa Corporation type DB-40 tachometer (0-600 rpm) meters. F&H purchased two meters from GE Supply Company (GESCO), Cincinnati, Ohio. One meter was qualification and functionally tested and the other was sold to IMO Delaval. The COC to Delaval is dated October 13, 1988. EQ and seismic qualification were both adequately addressed. One problem area identified with this dedication concerned the traceability to the original manufacturer. F&H received a generic packing slip from GESCO with no corporate letter head. There was no verifiable traceability to the manufacturer established in this case, but since two identical meters were purchased with one being functionally tested and materials verified at elevated temperatures. Since a similarity analysis established equivalency, traceability is not a major concern in this case. The inspectors emphasized that documented verifiable traceability to the OEM is essential when dedicating commercial-grade items purchased from distributors and suppliers such as GESCO.

b. Data Package 60500 - Bussmann fuses and fuse holders. F&H's dedication for Bussmann fuses and fuse holders is based on a combination of supplier audits, traceability to the manufacturer through drop shipment and date coding, receiving

inspection and functional/performance testing. Review of Data Package 60500 indicated that dimensional measurements for the fuse holders were taken and recorded in Attachment B to the qualification report (Section IV) with the following comment: "Part dimensions taken and compared to test sample and manufacturing information and found acceptable." However, corresponding dimensional measurements for the fuses were not made.

c. Data Package 60058 - Norgren Prospector poppet valves, Model No. D-1-02-3-C-00-MC. These valves were supplied as replacement parts to Nebraska Public Power District. The customer's purchase order included the requirement for the supplier to furnish cure dates, recommended shelf life and type of material for all shelf life items. Review of the data package indicated that although most of the age sensitive materials had been adequately considered in the F&H materials analysis, the analysis did not address the valve coil construction materials (leads, bobbin, varnish, etc.).

Nonconformance 90-01-01 was identified in this program area involving the dedication implementation.

3. Dedication of Molded Case Circuit Breakers:

The inspector reviewed the F&H computerized listing of equipment by manufacturer name. The computer printout report was entitled "Commercial Quality Parts Catalog by Manufacturer" and showed projects completed as of May 17, 1990. This document listed MCCBs manufactured by Air Pax, American Circuit Breaker, General Electric (GE), Heineman, ITE-Siemens, Square D, and Westinghouse (W). From this listing, the inspector selected for review a sampling of orders and projects representative of some of the major types of GE MCCBs including Project/Report numbers 60447 and 74000, done for Public Service Electric & Gas (PSE&G) Company's Salem Generating Station (Salem), 74001, for Northeast Utilities Service Company (NUSCO) for the Millstone Nuclear Power Plant, and 74003, for the Commonwealth Edison Company (CECo). Also, the inspector briefly reviewed files associated with Project/Report 74002 covering some W MCCB models. The 60447 series and 74000 and 74001 series files represented the earlier of the two major phases in the development of F&H's MCCB dedication program and methodology; whereas, the 74003 project was done under the later phase, designed to address concerns identified in NRC Bulletin 88-10.

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To verify implementation of the F&H MCCB dedication program as written, the inspector first reviewed selected representative, specific MCCB dedication data packages (DPs) as follows: 60447.1, dated June 17, 1988; 74000.1, dated March 28, 1989; 74001.1, dated March 28, 1989; and 74001.1, Revision 1, dated April 28, 1989.

a. DP 60447.1 - Compiled for Salem under PSE&G purchase order (PO) number P1-263623, dated June 3, 1988. This DP covered some GE and ITE MCCBs to be supplied as safety-related equipment under F&H's Appendix B QA program with 10 CFR Part 21 being applicable and qualified in accordance with IEEE Standards 323-1974 and 344-1975. Item 1 of the PO was 20 GE MCCBs of catalog number THED136050WL (expressed in various places as "THED 13605 OWL"). The associated F&H Certificate of Conformance (COC) 60447.1, and its Revision 1, dated July 14, 1988, certified that the purchased material was procured and dedicated in accordance with 10 CFR Part 50, Appendix B, 10 CFR Part 21, and ANSI Standard N45.2-1977, and qualified in accordance with IEEE Std 344-75. Section 11.3.1 of the documentation supporting dedication (and qualification) listed the MCCB critical characteristics for dedication as (1) insulation resistance greater than 1 megohm at 1000 VDC, (2) satisfactory thermal (time delay overcurrent) trip at 300 percent of rated current, and (3) satisfactory instantaneous magnetic trip function at "1000+500%." Full-load hold-in capability was obliquely mentioned by the assertion in Section 11.5.4 that the manufacturer's trip curves are based on the National Electrical Manufacturers Association (NEMA) MCCB field performance verification procedures, NEMA AB 2, and also that the MCCBs were "... listed for 100 percent of rated load continuously per [Underwriters Laboratories (UL) Standard] UL-489." Not explicitly addressed and/or demonstrated in the dedication documentation were the critical characteristics of fault interrupting capability and contact resistance or milivolt drop.

With regard to the thermal overcurrent trip function, Table 1 listed "Required Test Parameters," giving 8 to 40 seconds as the range for a 300-percent, time-delayed overcurrent trip test. The inspector confirmed that these values were consistent, as stated in the record, with the minimum and maximum clearing times at 300 percent of rated

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current taken from GE time-current characteristic curve GES-6119C for type-TED and THED MCCBs in the 15-to-50-amp range of rated current. However, the inspector noted that the supporting dedication documentation indicated that only 7 out of the 20 MCCBs supplied, specimen tag numbers 60447-01-01-20 through 05-20, 19-20, and 20-20, were tested, including time-overcurrent testing at 300 percent (at room temperature) although all poles of the samples tested were reported to have tripped within 8 to 40 seconds.

The magnetic trip function specification was explained by F&H to mean at 1000 amps and at 500 amps; however, the inspector noted that the MCCBs tested were not tested at 500 percent, but the record did indicate that Pole 1 of Sample 01-20 tripped at 475 amps. This value would be considered low-out-of-specification with respect to minimum instantaneous clearing level of 600 amps on the trip curve even if the NEMA AB 2 field tolerance criterion of -20 percent (480 amps) of the adjustable low setting were applied to this non-adjustable magnetic trip.

In partial response to these concerns, F&H explained their position that MCCB interrupting capability was demonstrated by continued UL listing of the design and periodic testing by the manufacturer under the UL program to confirm manufacturing process and product quality control. Providing that traceability of MCCBs to CBMs' testing being relied upon could be maintained and providing that F&H assures that the CBMs' programs provide an adequate basis for accepting CBM-provided certifications, this position was considered reasonable. F&H also cited MCCB traceability to the CBM, i.e., their dedication only of verified new, unused, and non-refurbished MCCBs, as the basis for their position that MCCB contact condition, as determined by contact resistance and/or milivolt drop tests, would not be expected to be other than satisfactory, and therefore would not be a characteristic needed to be verified by such tests in their dedication program. F&H also took credit for their elevated temperature testing done for mild environment materials qualification evaluation, contending that poor contact conditions would present readily as excessive MCCB temperature rises.

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However, the inspector noted that the assertions in the file regarding the basis of the manufacturer's trip curves and full load hold-in capability were incorrect and/or unsubstantiated in that (1) manufacturers' trip curves are design curves, indicative of installed performance, and are developed in the laboratory under controlled conditions; whereas NEMA AB 2 procedures (which are no longer in effect and were withdrawn by NEMA) are a field guide and (2) the subject MCCBs would be presumed to be standard-rated, since 100 percent-rated were not ordered specifically, which means they are listed, per UL-489, as being rated for intermittent load (i.e., three hours or less) at 100 percent of rated load (current), but for continuous load only at 80 percent of rated current.

To evaluate F&H receiving practices, and verify the claim of traceability, the inspector reviewed documentation associated with receipt inspection and handling of MCCBs under this order and discovered some discrepancies in documentation of receipt inspection results, but in particular, the inspector identified an instance in which traceability was not maintained. Review of F&H Material Receiving Disposition Report (MRDR) 60447/Corrective Action Request (CAR) 1, dated June 1, 1988, revealed that 1 of 17, 50-amp-rated, GE THED136050WL MCCBs, ordered under item 1 of F&H PO E0555/60447, dated May 27, 1988, was found upon receipt inspection to be a 40-amp THED136040WL MCCB. These breakers had been procured through the GE Supply Company (GESCO), Cincinnati, Ohio, location, and according to Packing List Number 0373899, also dated May 27, and showing the F&H PO number, they were drop shipped from GE Electrical Distribution & Control (ED&C) warehouse to F&H. According to the records, the discrepant MCCB was returned to GESCO and a replacement of the correct current rating received with a packing list, number 411416, from GESCO, Chicago, dated June 7, 1988, not from ED&C. According to F&H research into this matter, this non-traceable MCCB ended up with one of the tag numbers from 16-20 through 20-20, that were sent to PSE&G, but which of those 5 it could not be determined. The inspector noted therefore that the non-traceable MCCB could have been among those that were not functionally tested by F&H.

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b. Review of DPs 74000.1, 74001.1, revealed that the MCCBs dedicated in these projects underwent essentially the same process (except that no other incidents of loss of traceability were identified). Therefore, the inspector concluded that the basis for dedication of certain MCCBs sold as suitable for safety-related nuclear plant applications was inadequate to assure proper performance of their safety functions and, accordingly, Nonconformance 90-01-01 was identified as stated in paragraph B.1 of this inspection report.

In the course of evaluating the F&H MCCB dedication program and its implementation, the inspector reviewed the MCCB dedication test procedure associated with the 60447, 74000, and 74001 files, noting some deficiencies. The procedure appeared to have been largely derived from NEMA AB 2 and some of the statements were generic and not appropriate to the particular MCCBs under test. Table 1 of NEMA AB 2 specified 300-percent overcurrent trip values for 600-VAC-rated MCCBs as 70 and 125 seconds maximum [only] for 15-45-amp and 50-100-amp-rated MCCBs respectively. These values are considered an inadequate acceptance criterion for thermal overload trip function verification in that adherence to design specifications, even at the one point tested cannot be determined. Similarly, the magnetic trip acceptance criterion of checking for trip function at the two points given above is not adequate to determine the actual operating point of the trip, i.e., a magnetic calibration, and hence premature tripping cannot be ruled out. On the basis of these findings, the inspector identified Nonconformance 90-01-01 as stated in paragraph B.1 of this report.

F. PERSONS CONTACTED:

C.R. Farwell, Jr., Chairman and Chief Executive Officer
*J.R. Hendricks, President
*M.E. Lilly, Quality Assurance Manager
*H. Robey, NEQ Engineer
*E. Bachman, NEQ Engineer
*D.P. Rettig, Engineering Manager
*W. Wooldridge, NEQ Engineer

* Attended exit meeting