U.S. NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR REACTOR REGULATION

Docket Nos.:	50-275, 50-323
License Nos.:	DPR-80, DPR-82
Report No.:	50-275/97201 50-323/97201
Licensee:	Pacific Gas & Electric Company
Facility:	Diablo Canyon Power Plant, Units 1 and 2
Location:	Avila Beach, California
Dates:	June 9-12, 1997
Inspectors:	Stephen D. Alexander, Team Leader, NRR Billy H. Rogers, Reactor Engineer, NRR
Approved by:	Gregory C. Cwalina, Section Chief Vendor Inspection Section Special Inspection Branch Division of Inspection and Support Programs Office of Nuclear Reactor Regulation

Enclosure 1

EXECUTIVE SUMMARY

During the period of June 9-12, 1997, representatives of the U.S. Nuclear Regulatory Commission's (NRC's) Special Inspection Branch conducted an inspection of Pacific Gas & Electric Company's (PG&E's) activities related to the procurement, modification, testing and installation of replacement 4-kV circuit breakers at the Diablo Canyon Power Plant (DCPP), Units 1 and 2.

The inspectors reviewed engineering and quality assurance documentation, interviewed cognizant staff and examined equipment in order to evaluate PG&E's dedication and modification of 4-kV Yaskawa circuit breakers for use in safety-related applications at DCPP. In 1994, PG&E had discovered that many of the existing 4-kV circuit breakers, both Class 1E (safety-related) and non-safety-related at DCPP, did not have sufficient interrupting capacity (including desired design margin) in order to assure successful clearance of the worst-case (design) faults with the maximum available short-circuit current at their locations. The existing switchgear used GE Type AM-4.16-250 Magne-Blast circuit breakers with 250 megavolt-amperes (MVA) interrupting capacity in the locations of concern where the licensee had determined that the next larger rating available of 350 MVA would be needed.

In order to fit a breaker rated for 350 MVA in the existing switchgear (breaker cubicles, buswork, etc.), a more advanced and efficient fault arc interrupting technology would have to be employed. Therefore, PG&E contracted National Technical Systems (NTS), Inc., of Acton, Massachusetts, in 1994 to undertake the project of acquiring replacement 4-kV circuit breakers using sulfur-hexafluoride (SF_6) gas interrupters to obtain 350-MVA interrupting capacity in a small volume. NTS had the breakers modified and adapted to work in the existing switchgear by Power Distribution Systems (PDS), Inc., of West Chester, Ohio). NTS performed the engineering in consultation with the breaker manufacturer, Yaskawa Electric Co., Ltd., of Japan and with PDS. All requisite design and production testing was conducted at PDS and at PSM Technologies, Inc. (PSM), of Pittsburgh, Pennsylvania, a high-voltage, high-current test facility. NTS provided the quality assurance coverage for the subcontractors required by 10 CFR Part 50, Appendix B.

The primary purpose of the inspection was to determine if prototype design verification testing of the modified Yaskawa breaker was accomplished in accordance with applicable NRC regulations and industry standards. Although there is no regulatory guide endorsing the standards in question, PG&E had committed to them in the Final Safety Analysis Report (FSAR) for DCPP, and they are therefore relevant to the design and licensing basis of the plant.

A secondary purpose of the inspection was to examine several related issues involving production testing, modifications, post installation testing, and in-service failures. The review included all documentation pertinent to the design, design verification (including prototype testing), conversion/modification, fabrication of adapting hardware, production testing, procurement and dedication done by PG&E, its principal contractor, NTS, and PDS, the NTS subcontractor who actually performed the conversions.

The inspectors determined that PG&E's approach to design verification was generally consistent with the applicable NRC regulations, primarily Criterion III, "Design Control," of 10 CFR Part 50, Appendix B, in that PG&E undertook to verify, by engineering analysis and a testing program, that DCPP's safety-related 4-kV electrical distribution system, as converted and modified, would perform its safety functions under all design basis conditions.

The question of consistency of PG&E's approach to the conversion and its design verification process with applicable industry standards, in particular, taking credit for certain design verification tests done by the manufacturer of the circuit breakers used in the conversion, was referred to the Standards Board of the IEEE for consideration by the appropriate subcommittee. In a letter to the NRC, dated August 21, 1997, the Chairman of the High-Voltage Circuit Breaker Subcommittee of the Switchgear Committee of the IEEE Power Engineering Society (sponsor of the principal applicable standard, C37.59) confirmed the licensee's understanding of the intent of the standard regarding required design verification testing for conversions using modular assemblies.

The letter further stated that if the modular assembly is in no way altered with respect to the coupling of the interrupting chambers and the operating mechanism, then some of the original design tests performed by the manufacturer, such as short circuit current interruption, load switching and capacitance switching tests, need not be repeated. However, the letter stated, to apply this waiver, it must be shown that the mechanical operating characteristics of the interrupting chamber, such as contact parting times and contact travel, are still within the range specified for the original module prior to the conversion.

With regard to the engineering evaluations necessary to support the PG&E approach, the inspectors could not, on the basis of documentation for review at DCPP, conclusively determine the adequacy of all the justifications for not reperforming certain design tests. Therefore, this issue remains unresolved and the inspectors identified the need for further review at NTS, and possibly also at PDS. Accordingly, this issue is designated Unresolved Item 50-275,323/97210-01.

Report Details

III. Engineering

E1 Conduct of Engineering

E.1 4-kV Switchgear Conversion Design Verification

a. Inspection Scope

In order to verify that PG&E and its contractors, NTS and PDS, had properly verified the interrupting capacity of the 350-MVA Yaskawa SF6 interrupter breakers, adapted to fit into 250-MVA GE Magne-Blast switchgear, the inspectors reviewed engineering and quality assurance documentation, interviewed cognizant staff, examined equipment, and evaluated PG&E's dedication and modification of 4-kV Yaskawa circuit breakers for use in safety related applications at DCPP.

The primary issues examined were:

- Whether the design verification testing conducted on the complete conversion (consisting of the Yaskawa "modular assembly" plus the hardware to adapt it to the Magne-Blast cubicle) for PG&E (conducted for NTS at PSM) was consistent with ANSI/IEEE Std C37.59-1991, Paragraph 5.1.4.2(2), for conversions using adapted modular assemblies,
- Whether taking credit for the Yaskawa ANSI testing of the modular assembly supplemented by technical evaluations was consistent with Section 5 of C37.59,
- Whether the Yaskawa technical evaluations of its modifications made to the modular assembly after the original design verification tests were adequate to demonstrate that the original test results were still valid after those factory modifications,
- Whether the technical evaluations by NTS were adequate to demonstrate that its additional testing of the complete conversion as required by C37.59 was not invalidated by modifications made in response to installation, setup and operational problems made subsequent to the tests, and
- Whether PG&E adequately resolved the findings identified in its audits of NTS, PDS, and Yaskawa.

Also examined were:

- The material of the breaker secondary disconnect pins and
- The potential overtravel situation involving the stationary auxiliary switch (SAS) in the cubicle possibly preventing full closure of the breaker, and several other interface and operation issues

The inspectors reviewed the PG&E documentation related to the design tests of the 5GYB-1-1200 AND 5GYB-1-2000 circuit breakers performed by Yaskawa, PDS, and PSM; the evaluations performed by NTS which demonstrated the equivalency of the circuit breakers supplied to PG&E to the prototype circuit breakers tested by Yaskawa and the two circuit breakers tested by PDS and PSM; and the review of the production modifications made by Yaskawa and PDS following the ANSI/IEEE testing. The inspectors review was performed to verify that the circuit breakers supplied to PG&E were equivalent to the circuit breakers tested by Yaskawa, PDS, and PSM and that any modifications made to the circuit breakers by Yaskawa or PDS did not invalidate the original design testing.

b. Observations

b.1 Validity of Design Verification Approach

During the initial stages of the original circuit breaker production, Yaskawa had performed the ANSI/IEEE design testing on prototype breakers as representatives of the circuit breaker which Yaskawa would subsequently sell as commercial grade products (non safety-related). This circuit breaker was the Yaskawa SF_6 gas "Fluopac" Series, medium-voltage (4.76-kV-rated), rotary-arc circuit breaker of 350-MVA interrupting capacity. PG&E contracted with NTS to provide the Yaskawa circuit breakers as Class 1E (safety-related) equipment. NTS purchased breakers from Yaskawa and subsequently subcontracted their modification and additional testing to PDS and PSM, to be performed under the quality assurance (QA) coverage of NTS.

The particular models of these breakers that underwent design verification testing were Yaskawa Models 5GYB-1-1200 and 5GYB-1-2000NTS. The conversions performed by PDS used the interrupting chambers and their attached operating mechanisms and chassis (frame) from the circuit breakers. According to the applicable industry standard, ANSI/IEEE Standard C37.59-1991, these components constitute a "modular assembly." PDS adapted the modular assemblies for retrofit into the existing GE Magne-Blast cubicles at DCPP by mounting each assembly in a custom-fabricated enclosure and truck unit containing the necessary hardware with which to make the primary and secondary electrical connections in the cubicles to the 4-kV busses and 125-Vdc control power respectively, as well as the mechanical interfaces with the cubicle vertical lift apparatus, stationary auxiliary switch, truck-operated cubicle switch, and cubicle interlock devices.

The applicable NRC regulations were Appendix A, "General Design Criteria for Nuclear Power Plants," to Part 50 of Title 10 of the *Code of Federal Regulations* (10 CFR Part 50, Appendix A); 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants;" 10 CFR 50.59, "Changes, Tests, and Experiments;" and 10 CFR Part 21, "Reporting of Defects and Noncompliance." The 10 CFR Part 50, Appendix B, criteria that are especially applicable to this project are Criterion III, "Design Control," and Criterion VII, "Control of Purchased Material, Equipment and Services."

The principal industry standards applicable to switchgear conversions are ANSI/IEEE Standards C37.59-1991, "IEEE Standard Requirements for Conversion of Power Switchgear Equipment;" C37.09-1979, "IEEE Standard Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis," and C37.04-1979, "IEEE Standard Rating Structure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis." Although there is no regulatory guide endorsing the standards in question, the inspectors determined that PG&E had committed to them in the Final Safety Analysis Report (FSAR) for DCPP, and they are therefore relevant to the design and licensing basis of the plant.

Paragraph 5.1.4.2(2) of C37.59, which deals with conversions using modular assemblies, requires that the modular assembly undergo the entire series of design tests in accordance with C37.09. PG&E and NTS interpreted this to mean that it must be verified that the complete series of design tests per C37.09 has been performed on a prototype(s) of the modular assembly, e.g. by the manufacturer as part of original testing, with satisfactory results. However, on the basis of the general guidance in the beginning of Section 5 of C37.59, PG&E further interpreted the standard to provide that if engineering evaluations of all subsequent modifications can demonstrate that functions or characteristics (e.g., interrupting capacity) of the converted breaker are not adversely affected by the modifications such that the original tests would be invalidated, then the C37.09 design tests of those functions or characteristics need not be repeated on the complete conversion.

According to the documentation provided to PG&E by NTS (and reviewed by the inspectors), the original circuit breaker design tests had been performed by Yaskawa in accordance with ANSI/IEEE C37.09-1979, C37.20.2-1987, C37.59-1-1991 and PG&E Specification 1001-E-NPG Section 12.1. The purpose of the tests was to determine the adequacy of the design of this particular type and model and its component parts to meet its assigned ratings and operate satisfactorily under normal service conditions/special conditions defined by the PG&E specification. NTS Report No. 60431-95N-C, "Equivalency Evaluation of ANSI Type Tests and ANSI C37 Test Reports," Revision 7, dated June 4, 1997, documented the required ANSI/IEEE tests performed, specifying a description of each test, which company had performed the test, and including the applicable test report.

Paragraph 5.1.4.2(2) of C37.59 then requires specific additional testing of the complete conversion, which includes dielectric, momentary (C37.20.3-1987), continuous current, interlock and auxiliary functions, and mechanical endurance testing (C37.06-1987). The inspectors confirmed by review of the test documentation that these tests were performed on two representative complete conversions with satisfactory results.

In reviewing the design verification of the breaker conversion, the inspectors learned that PG&E had consulted with several industry experts to confirm that its approach was consistent with the requirements of the applicable strandards. However, PG&E had not requested confirmation or interpretation of the standard from the appropriate subcommittee of the IEEE. The experts PG&E consulted included Dr. Ward Laubach who was employed as a consultant to NTS. Dr. Laubach was a member of the IEEE Switchgear Committee of the IEEE Power

Engineering Society, sponsor of ANSI/IEEE Standard C37.59-1991. However, the inspectors noted that Dr. Laubach, who asserted that PG&E's approach was consistent with the provisions of the standard, was not a member of the High-Voltage Circuit Breaker Subcommittee, but rather, he was on the Low-Voltage Switchgear Devices Subcommittee. In addition, the inspectors noted that two other parties consulted by PG&E, who also confirmed the validity of PG&E's approach, were (1) one of the other bidders on the project, an employee of Pacific Breaker Systems, Inc. (who had used the same approach in a project involving French Merlin-Gerin breakers for the Quad Cities and Dresden Nuclear Stations), and (2) an employee of Square D Company, the U.S. representative for Merlin-Gerin (both of which companies are owned by the Schneider Electric conglomerate). The inspectors determined that the industry experts consulted by PG&E were not totally disinterested parties because they were directly or indirectly involved in this or other similar projects.

Therefore, by NRC letter dated July 24, 1997 (Attachment 1 to this report), the question of consistency of the approach with applicable standards, in particular, taking credit for certain design verification tests done by the manufacturer of the circuit breakers used in the conversion, was referred to the Standards Board of the IEEE for consideration by the appropriate subcommittee. In a letter to the NRC, dated August 21, 1997 (Attachment 2 to this report), the Chairman of the High-Voltage Circuit Breaker Subcommittee of the Switchgear Committee of the IEEE Power Engineering Society (sponsor of the principal applicable standard, C37.59) confirmed the licensee's and the inspectors' understanding of the intent of the standard regarding required design verification testing for conversions using modular assemblies.

The IEEE letter stated that while it was intended that all design tests be performed on the converted equipment, in the case of a conversion using a modular assembly, in addition to the specific tests explicitly required to be performed on the complete conversion by Paragraph 5.1.4.2(2) of C37.59-1991, only those design tests that cover an area of performance affected by the modifications associated with the conversion must be repeated on the complete conversion. The letter further stated that if the modular assembly is in no way altered with respect to the coupling of the interrupting chambers and the operating mechanism, then some of the original design tests performed by the manufacturer, such as short circuit current interruption, load switching and capacitance switching tests, need not be repeated. However, the letter stated, to apply this waiver, it must be shown that the mechanical operating characteristics of the interrupting chamber, such as contact parting times and contact travel, are still within the range specified for the original module prior to the conversion.

b.2 Equivalency Evaluation

The inspectors found that the original Yaskawa breaker required extensive and substantial modification in order to successfully adapt it for use in the Magne-Blast switchgear; modification for which neither Yaskawa, nor PG&E's contractors or subcontractors had originally or promptly provided to PG&E comprehensive engineering evaluation(s) (at least in english) to establish that the modifications would not adversely impact the tested interrupting capacity, and would not invalidate the original design tests by Yaskawa.

According to the certifications provided to PG&E, NTS had established that several areas were critical to determining that the circuit breakers supplied to PG&E were equivalent to the circuit breakers tested by Yaskawa, PDS and PSM. The documentation further certified that NTS had maintained the design control of materials, dimensions, and processes, verified that all ANSI/IEEE testing was performed by approved vendors (or surveilled) and performed in a calibrated test facility, and materials on the supplied circuit breakers were appropriately dedicated. In addition, NTS reviewed all design changes made by Yaskawa and PDS and certified that the modification did not invalidate the ANSI/IEEE testing performed by Yaskawa and PDS (and for NTS/PDS at PSM).

Yaskawa had provided NTS information on all design, parts, or material changes made to the circuit breaker since May of 1993, when the type tests had been performed, up to the time of the NTS purchase. The Yaskawa changes were described in Yaskawa Document No. GA9400864, "Statement of Design Change," Revision 2, dated July 31, 1995; which was included in Section 5.0 of NTS Report No. 60431-95N-C. Yaskawa had made numerous changes to the operating mechanism, the interrupter and the general assembly, including items such as material changes, dimensional changes, and drawing changes. Yaskawa stated that none of the indicated changes would impact the results of the ANSI/IEEE type tests which had been performed by Yaskawa in 1993, and provided certification to that effect with the circuit breakers shipped to NTS. In addition, the documents stated that NTS had reviewed the changes and performed an evaluation of those which NTS determined to have the potential to affect the critical characteristics of the as-tested design. The documents also concluded that the Yaskawa changes had not affected the results of the type tests originally performed by Yaskawa.

In addition to Yaskawa's modifications of the modular assemblies, PDS, under NTS controls, had also made modifications to the circuit breakers to facilitate the modular conversion and allow them to operate in the installed DCPP Magne-Blast switchgear. The PDS engineering change notice (ECN) table for Job #1466, included in NTS Report No. 60431-95N-C, described all of the changes that NTS considered relevant to the conversion design. The PDS modifications were primarily mechanical changes to the circuit breaker frame, wheels, and hardware. Each ECN was accompanied by an evaluation for impact on the validity of ANSI/IEEE testing which had been performed by Yaskawa, PDS or PSM. NTS Report No. 60431-95N-C concluded that none of the PDS modifications invalidated the circuit breaker testing performed by Yaskawa, PDS or PSM.

b.3 Low-Voltage Fault Current Test

The inspectors found that although PG&E did not conduct a rated-voltage, rated-fault current interrupting capacity test on the complete conversion, it ordered a special fault current test at PSM (in addition to the additional testing on the complete conversion required by C37.59), which was conducted at 480 volts instead of 4760 volts. PG&E explained that there might be adverse effects of fault-current magnetic fields on the components added to the complete conversion to adapt it to the auxiliary switches and mechanical interlocks of the Magne-Blast cubicle. These effects might cause the added hardware to impede breaker tripping on a fault; effects that may not have been covered by the testing required by the standards. Therefore, PG&E decided to

conduct an interrupting capacity test of a prototype of the complete conversion unit that was already undergoing the testing required by Paragraph 5.1.4.2(2) of ANSI/IEEE Std C37.59 in July 1996 at PSM. However, due to some problem with or unavailability of PSM's main high-current test facility generator, the test was done at 480 Vac (although presumably at the required current level) instead of the 4760 Vac reportedly required for 4-kV breakers by C37.09 (Referenced in C37.59). PG&E argued, that even though the test was at low voltage, the fault current would produce magnetic fields to adequately simulate the fault interrupting conditions that might conceivably affect the operation components in question irrespective of the voltage at which the 41,000-amp test was conducted, as only the current, not the voltage gives rise to the magnetic fields.

c. Conclusion

The inspectors concluded that PG&E's approach to design verification was generally consistent with the applicable NRC regulations, primarily Criterion III, "Design Control," of 10 CFR Part 50, Appendix B, in that PG&E undertook to verify by engineering analysis and a testing program that DCPP's safety-related 4-kV electrical distribution system as converted and modified would perform its safety functions under all design basis conditions. On the basis of the IEEE interpretation of the intent of C37.59, the inspectors further concluded that the PG&E approach was consistent with applicable industry standards, provided the required supporting engineering evaluations were adequate. On the basis of the review of the supporting documentation supplied by Yaskawa, NTS, and PG&E, the inspectors further concluded that the applicable ANSI/IEEE tests had been performed with satisfactory results.

However, although PG&E had certifications from NTS that equivalency had been established between the tested circuit breakers and those supplied to PG&E, the inspectors could not conclude on the basis of documentation available for review at DCPP that the technical evaluations performed primarily by NTS demonstrated that the modification made by Yaskawa and PDS had not impacted the validity of the ANSI/IEEE tests performed on the circuit breakers; therefore, the inspectors could not conclusively determine the adequacy of all the justifications for not reperforming certain design tests. Accordingly, the inspectors identified the need for further review at NTS, and possibly also at PDS and designated this issue as Unresolved Item 50-275,323/97201-01.

E.2 4-kV Production Breaker Installation and Performance Concerns

a. Inspection Scope

The inspectors identified three areas of concern regarding 4-kV breaker installation and performance: (1) 4-kV breaker secondary disconnect contact pin material, (2) breaker operation interference due to stationary auxiliary switch (SAS) overtravel, and (3) SAS adjustment/performance. To address these issues, the inspectors reviewed the associated DCPP Action Requests (ARs) and their dispositions, interviewed cognizant engineering and operations personnel, and examined some representative components.

b. Observations

b.1 Secondary Disconnect Pin Material

In the case of the secondary contact pin material, the pins on the breakers for DCPP Unit 1, which had not yet been shipped were replaced with pins of a stiffer, more tempered material. The pins on the breakers in Unit 2 were not replaced en masse, but rather inspected and replaced if permanently deformed or otherwise damaged or degraded. In addition, PG&E had discovered that the reason the pins (of more malleable material than those of the original GE secondary contact blocks) were becoming deformed, in some cases enough to degrade electrical contact, was the manner in which maintenance electricians had become used to removing the secondary contact test position adapter cable and plug assembly, i.e., by yanking it off partially sideways. Accordingly, PG&E changed procedures and conducted training to ensure that the test cable plugs would be pulled off carefully and only with vertical force to prevent any future pin deformation. In addition, procedures were changed to require the use of a GE secondary contact pin spreading or gapping tool after each test cable removal to ensure that the four segments of each pin were properly spread for adequate electrical contact when the breaker was fully racked up into its operate position. The inspectors determined that DCPP Operations and Engineering were satisfied that the corrective action was adequate. PG&E stated that there were sufficient replacement pins of the improved, stiffer, more tempered material on site to replace any pins that should become irreparably deformed despite improved handling procedures.

b.2 Stationary Auxiliary Switch (SAS) Overtravel

With respect to the potential for an overtravel condition in the SASs potentially preventing the converted Yaskawa breakers from closing fully (which never occurred in service, only during off-line experimentation), the inspectors determined that PG&E's minimum required gap (0.040") between the stationary auxiliary switch operating rod and the breaker's mechanism-operated cubicle plunger (set by adjusting shims in the plunger and thereafter by manually adjusting open breaker elevation in its cubicle), in conjunction with the procedures that required checking and establishing this gap each time a breaker was racked in, would prevent the overtravel condition from occurring.

b.3 SAS Adjustment and Performance

Having suffered several equipment failures since the installation of the converted Yaskawa breakers attributable to problems with the SASs (i.e., not all sets of contacts consistently changing state with breaker operation), PG&E had determined (through testing) the worst case stroke requirement (they are somewhat variable) among all the SASs (i.e., stroke of the operating rod required to ensure that all contacts in the SAS, a GE SB-12 switch, will fully change state). Some older switches that had actually caused failures or were found through testing to be unreliable or out of tolerance were replaced. PG&E then determined the maximum allowable breaker- open, plunger-SAS operating rod gap that would ensure that all SAS contacts would change state when the breaker closed given the worst case (largest) required stroke of all the SB-12 switches.

During this period, another related problem presented itself. Upon investigating the failure of a pump to start, PG&E found that another instance of 4-kV breaker-SAS adjustment to be the cause. Inspection revealed that even though the gap had been set by procedure when the affected breaker was last racked in, the as-found gap was too wide. Thus when this breaker was closed, not all of the contacts in its SAS had changed state. Through further testing and investigation, PG&E discovered that when the adjustment screw at the top of the breaker's SAS plunger is retorqued after replacing adjustment shims, the linkages that operate the SAS plunger become slightly cocked as joints in the linkages expand to their maximum end float. This condition raises the SAS plunger up as much as 0.050 or 0.060 inch above its normal, breaker-open, rest position. During the first subsequent closing operation after the gap has been set with the plunger in the slightly raised position, the end float or looseness in the various linkage connections is closed up which effectively shortens the plunger stroke and thereafter not all of the SAS contacts may change state. To prevent this situation and ensure that the correct (and otherwise consistent) SAS plunger stroke is always obtained, PG&E changed procedures and conducted training to ensure that the plunger is tapped down into its fully withdrawn, breaker-open rest position before setting the plunger-to-SAS operating rod gap. This ensures that all the end float in the linkage is closed up so that a stable gap can then be reliably set by manually adjusting the breaker elevation in the cubicle.

c. Conclusion

With respect to the 4-kV breaker installation, interface, and performance concerns discussed above, the inspectors determined that PG&E's corrective actions were appropriate and adequate.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

Shawn LaForce	RS	Engineer
Stan Ketelsen	NSAL-RS	Supervisor
Bill Bayne	Procurement Systems	Supervisor
Bob Whitgell	Nuclear Quality Systems (NQS)	Supervisor
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Eric Nelson	Mechanical Maintenance	General Foreman
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USNRC

Brad Olson,	Region IV, Walnut Creek Field Office (WCFO)	Project Engineer
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Open Items

This report categorizes the inspection findings as unresolved items and inspection follow-up items in accordance with the NRC Inspection Manual, Manual Chapter 0610. An unresolved item (URI) is a matter about which more information is required to determine whether the issue in question is an acceptable item, a deviation, a nonconformance, or a violation. The NRC Office of Nuclear Reactor Regulation will issue any enforcement action resulting from their review of the identified unresolved items. An inspection follow-up item (IFI) is a matter that requires further inspection because of a potential problem, because specific licensee or NRC action is pending, or because additional information is needed that was not available at the time of the inspection.

Item Number	Finding	Title
50-275:50-323/97201-01	URI	Meeting ANSI/IEEE C37.59-1991 (Section 5)

REPORT #50-275/97201
ATTACHMENT 1

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

July 24, 1997

The Secretary
IEEE Standards Board
445 Hoes Lane
P.O. Box 1331
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Gentlemen:

The Nuclear Regulatory Commission is reviewing a 4.16-kV switchgear conversion by one of our utility licensees using Yaskawa 350-MVA SF_6 gas-rotary-arc circuit breakers (as modular assemblies) to replace GE 250-MVA Magne-Blast circuit breakers in Class 1E (and non-Class 1E) applications. The modular assemblies, consisting principally of the interrupters, mechanism and frame of the Yaskawa breaker, were adapted for retrofit into the unaltered Magne-Blast cubicles by mounting each modular assembly in a custom-fabricated enclosure and truck unit which contains the necessary hardware with which to make the primary and secondary electrical connections as well as the mechanical interfaces with the cubicle vertical lift apparatus, auxiliary switches and cubicle interlock devices. To accomplish design verification, the licensee elected to follow the guidance of ANSI/IEEE Standard C37.59-1991.

Our licensee holds that C37.59 provides in the beginning of Section 5 for taking credit for certain design verification tests, done by the original equipment manufacturer in accordance with ANSI/IEEE Standard C37.09. However, there must be engineering evaluations that demonstrate that modifications made to the modular assembly itself, and/or by the additional hardware added to form the complete conversion, will not have an adverse effect on the performance of the modified breaker in such a way as to invalidate the tests for which credit is being taken.

Paragraph 5.1.4.2(2) of C37.59, specifically addressing the modular assembly type of conversion states that the full series of design tests in accordance with C37.09 is to be done on the modular assembly, and the additional tests specified in the paragraph are to be done on the complete conversion. The licensee's interpretation, taken in context with the general provisions at the beginning of Section 5, is that performing the full series of design tests on the modular assembly means that it must be verified that all the required tests were conducted (e.g., by the manufacturer) in accordance with the applicable ANSI/IEEE standards, with satisfactory results. Further, those tests that are part of the full design series, but that are not explicitly required as additional tests by 5.1.4.2(2), in particular, a full-rated-voltage interrupting capacity test, need not be repeated, provided it can be demonstrated by engineering evaluation that none of the subsequent modifications would adversely affect breaker performance in a manner that would invalidate the original test(s).

The NRC requests that the appropriate subcommittee or working group responsible for the portions of C37.59 in question indicate whether the interpretation stated above is consistent with the provisions and the intent of the standard. We appreciate greatly your assistance in this matter.

Sincerely,

Stuart A. Richards, Chief
Special Inspection Branch
Division of Inspection Support Programs
Office of Nuclear Reactor Regulation

REPORT #50-275-97201
ATTACHMENT 2

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August 21, 1997

Stuart A. Richards
Chief Special Inspection Branch
Division of Inspection Support Programs
Office of Nuclear Reactor Regulation

Re: C37.59 Standard Interpretation

It should be noted that the Scope (section 1.1) of the referenced Standard C37.59 specifically excludes equipment that is labeled or listed by a third party, or **involved in Nuclear Regulatory Commission required conformance.**

As specifically requested, and in reference to Clause 5 of C37.59 the intent of the standard is to specify what design tests have to be performed on the completed conversion, depending upon the extent of such conversion.
It is intended to require that all of the design tests specified in C37.09 have been performed on the converted equipment. A differentiation is made between those conversions which use individual components such as: interrupting chambers which are not a part of a complete assembly and the ones where a complete circuit breaker module, where the operating mechanism is an integral part of the assembly, is used.
In the first case all design tests are required, but in the later case only those tests that take into consideration modifications made to the module and which directly may affect a certain performance characteristic of the circuit breaker: then, the design test covering such area of performance must be repeated.
More specifically, if the circuit breaker module, which consist of an interrupter chamber coupled with a stored energy operating mechanism, is used and if the assembly of the

module is in no way altered with respect to the coupling of the interrupting chambers and the operating mechanism then some of the design tests, such as: Short Circuit Current Interruption, Load Switching and Capacitance Switching tests need not to be repeated. In this case the test certification provided by the manufacturer of the module would suffice. However in order to apply this waiver it must be shown that the mechanical operating characteristics of the interrupting chamber, such as contact parting times and contact travel are still within the range specified for the original module prior to the conversion. Those tests which are explicitly listed in subclause 5.1.4.2 (2) must be performed on the completed conversion.

I hope that the above will answer your questions.

Sincerely,

Ruben D. Garzon
IEEE Switchgear Committee
HVCB Chairman