

May 16, 2013

Mr. Bryan L. Tauzer, Quality Assurance Manager
ABB, Inc.
4300 Coral Ridge Road
Coral Springs, FL 33065

SUBJECT: NUCLEAR REGULATORY COMMISSION INSPECTION REPORT
NO. 99901423/2013-201

Dear Mr. Tauzer:

From April 8–12, 2013, the U.S. Nuclear Regulatory Commission (NRC) staff conducted an inspection at the ABB Inc., facility (hereinafter referred to as ABB) in Coral Springs, FL. The inspection assessed ABB's compliance with Title 10 of the *Code of Federal Regulations* (10 CFR) Part 21, "Reporting of Defects and Noncompliance," and selected portions of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities." The technically focused inspection specifically evaluated quality assurance (QA) activities associated with the design, qualification, testing, and dedication of class 1E safety-related relays supplied to U.S. nuclear power plants. This NRC inspection report does not constitute NRC endorsement of ABB's overall QA or 10 CFR Part 21 programs.

Based on the inspection samples, the NRC inspection team concluded that ABB met all program requirements, and the team did not identify any violations or nonconformances within the scope of this inspection.

In accordance with 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding," which is part of the NRC's "Rules of Practice," a copy of this letter and its enclosures will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's Agencywide Documents Access and Management System which is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>.

Sincerely,

/RA/

Richard A. Rasmussen, Chief
Electrical Vendor Branch
Division of Construction Inspection
and Operational Programs
Office of New Reactors

Docket No.: 99901423/2013

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bryan.l.tauzer@us.abb.com

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NRC-001

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**U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NEW REACTORS
DIVISION OF CONSTRUCTION INSPECTION AND OPERATIONAL PROGRAMS
VENDOR INSPECTION REPORT**

Docket No.: 99901423

Report No.: 99901423/2013-201

Vendor: ABB, Inc.
4300 Coral Ridge Dr.
Coral Springs, FL 33065

Vendor Contact: Mr. Bryan L Tauzer
Quality Assurance Manager
Telephone: 954-825-0663

Nuclear Industry Activity: The ABB, Inc., Coral Springs facility supplies safety-related relays, switches, substation control equipment, and relay systems to U.S. nuclear power plants.

Inspection Dates: April 8–12, 2013

Inspection Team Leaders: Shavon J Edmonds, NRO/DCIP/CEVB
Stacy Smith, NRO/DCIP/CEVB

Inspection Team Members: Doug Bollock, NRO/DCIP/CEVB
Tania Martinez-Navedo, NRR/DE/EEEB
Nicholas Karlovich, R-II/DCI/CIB1

Approved by: Richard A. Rasmussen, Chief
Electrical Vendor Branch
Division of Construction Inspection
and Operational Programs
Office of New Reactors

Enclosure

EXECUTIVE SUMMARY

ABB
99901423/2013-201

The U.S. Nuclear Regulatory Commission (NRC) conducted this inspection to verify that the ABB, Inc., (hereinafter referred to as ABB) facility implemented an adequate quality assurance (QA) program for the design, qualification, testing, and dedication of safety-related relays supplied to U.S. nuclear power plants that complied with the requirements of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities." In addition, the NRC performed this inspection to verify that ABB implemented a program under 10 CFR Part 21, "Reporting of Defects and Noncompliance," which met the NRC's regulatory requirements.

The NRC conducted the inspection at the ABB facility in Coral Springs, FL, April 8–12, 2013.

These regulations served as the bases for the NRC inspection:

- Appendix B to 10 CFR Part 50
- 10 CFR Part 21

During this inspection, the NRC inspection team implemented Inspection Procedure (IP) 43002, "Routine Inspections of Nuclear Vendors," dated April 25, 2011; IP 43004, "Inspection of Commercial-Grade Dedication Programs," dated April 25, 2011; and IP 36100, "Inspection of 10 CFR Part 21 and Programs for Reporting Defects and Noncompliance," dated February 13, 2012.

The NRC inspection team observed various activities associated with design, qualification, testing, and dedication of safety-related electromechanical relays, solid-state relays, flexi test switches; conducted interviews with responsible ABB personnel; and reviewed documents to determine if ABB performed these activities in accordance with the applicable design, quality, and technical requirements imposed in the purchase orders (PO). Some of the activities the NRC inspection team observed included:

- inspections supporting commercial-grade dedication (CGD) activities
- in-process testing and acceptance activities of a Type 27 N solid-state relay and a CVX-1 electromechanical relay

In addition to observing these activities, the NRC inspection team walked down ABB's assembly floor and verified that ABB had properly identified, marked, and segregated nonconforming materials to ensure they were not reintroduced into the production processes.

The NRC inspection team concluded that ABB's QA policies and procedures comply with the applicable requirements in 10 CFR Part 21 and Appendix B to 10 CFR Part 50, and that ABB's personnel are implementing these policies and procedures effectively. The results of this inspection are summarized below.

10 CFR Part 21 Program Implementation

The NRC inspection team concluded that ABB is implementing its procedures that govern its 10 CFR Part 21 evaluation and reporting programs in a way consistent with the regulatory requirements of 10 CFR Part 21.

Electromechanical Relays

The NRC inspection team concluded that ABB is implementing its procedures that govern the procurement, design, assembly, qualification, testing, and CGD of electromechanical relays in a way consistent with the regulatory requirements of Appendix B to 10 CFR Part 50.

Solid-State Relays

The NRC inspection team concluded that ABB is implementing its procedures that govern the procurement, design, assembly, qualification, testing, and CGD of solid-state relays in a way consistent with the regulatory requirements of Appendix B to 10 CFR Part 50.

Test Switches

The NRC inspection team concluded that ABB is implementing its procedures that govern the procurement, design, assembly, qualification, testing, and CGD of test switches in a way consistent with the regulatory requirements of Appendix B to 10 CFR Part 50.

Control of Measuring and Test Equipment

The NRC inspection team concluded that ABB is implementing its policies and implementing procedures that govern the measuring and test equipment program in a way consistent with the regulatory requirements of Criterion XII, "Control of Measuring and Test Equipment," in Appendix B to 10 CFR Part 50.

Oversight of Contracted Activities

The NRC inspection team concluded that ABB is implementing its policies and procedures that govern the oversight of contracted activities in a way consistent with the regulatory requirements of Criterion IV, "Procurement Document Control," and Criterion VII, "Control of Purchased Material, Equipment, and Services," in Appendix B to 10 CFR Part 50.

Corrective Action and Nonconforming Materials, Parts, or Components

The NRC inspection team concluded that ABB is implementing its policies and procedures that govern the control of nonconforming material, parts, and components and corrective actions in a way consistent with the regulatory requirements of Criterion XV, "Nonconforming Materials, Parts, or Components," and Criterion XVI, "Corrective Action," in Appendix B to 10 CFR Part 50.

REPORT DETAILS

1. 10 CFR Part 21

a. Inspection Scope

The U.S. Nuclear Regulatory Commission (NRC) inspection team reviewed ABB's policies and implementing procedures that govern its program under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 21, "Reporting of Defects and Noncompliance," to verify compliance with this regulation. The NRC inspection team reviewed a sample of corrective action reports (CARs) that contained 10 CFR Part 21 evaluations and ABB's implementation of 10 CFR 21.21, "Notification of Failure to Comply or Existence of a Defect and its Evaluation." In addition, the NRC inspection team reviewed ABB's process and procedures to verify that they provide a direct connection from the control of nonconformance and corrective actions to the Part 21 program.

b. Observations and Findings

b.1 Policy and Procedures

The NRC inspection team verified that ABB procedures provide the guidance and organizational structure necessary to implement the requirements of 10 CFR Part 21 associated with timely identification, evaluation, and reporting of defects and failures to comply that could create a substantial safety hazard. The NRC inspection team verified that procedures provide the necessary guidance to assess deviations and failures to comply in an effective and timely manner and provide appropriate guidance for interim reports.

b.2 10 CFR Part 21 Evaluations

The NRC inspection team reviewed applicable CARs to verify that ABB adequately screened issues for evaluation within the 10 CFR Part 21 program. The NRC inspection team reviewed a sample of CARs with Part 21 evaluations to verify that the technical justifications were adequate to determine that a substantial safety hazard did not exist.

b.3 10 CFR Part 21 Postings

The NRC inspection team reviewed the content of the ABB Part 21 postings, as well as the location of postings at the ABB facility. The NRC inspection team verified that the information required in 10 CFR 21.6, "Posting Requirements," was included on the postings. The NRC inspection team walked down the location and also verified that the required documents were posted in conspicuous locations in a way consistent with the intent of 10 CFR 21.6.

c. Conclusions

The NRC inspection team concluded that ABB is implementing its procedures that govern its 10 CFR Part 21 evaluation and reporting programs in a way consistent with the regulatory requirements of 10 CFR Part 21.

2. Electromechanical Relays

a. Inspection Scope

The NRC inspection team reviewed ABB's policies and implementing procedures that govern the quality assurance (QA) criteria applicable to safety-related relays—including the criteria for the relays' design, commercial-grade dedication (CGD), inspection, qualification, and testing—to verify compliance with the regulatory requirements of Appendix B to 10 CFR Part 50. The NRC inspection team reviewed design documentation to verify that applicable design inputs were translated correctly into specifications, drawings, procedures, or instructions. Additionally, the NRC inspection team reviewed the dedication process, qualification, and testing activities necessary to verify that the safety-related relays met the technical and quality requirements established by the specifications identified in their purchase orders (PO).

b. Observations and Findings

b.1 Procurement Document Control

The NRC inspection team verified that the POs for electromechanical relays adequately documented the procurement requirements as established by ABB's governing policies and implementing procedures, which include (1) imposition of appropriate quality, technical, and regulatory requirements, and (2) identification of the applicable codes and standards.

The NRC inspection team reviewed the process ABB customers use to order safety-related relays. The customer selects a product through a catalog that describes the technical specifications. The technical specifications listed for safety-related relays in the catalog reflect the specifications used to qualify that type of relay. In addition, the customer has the option to add additional technical specifications specific to their order.

The NRC inspection team observed that ABB relies on a combination of individual function testing and qualification of type testing to demonstrate relays will perform in accordance with technical requirements. The NRC inspection team verified through the following sample that this method was adequate to ensure that the electromechanical relays could perform their safety-related function.

The NRC inspection team reviewed the following POs:

- PO 10347498, Type AR, Style Number 1456C88A09 (125 VDC)
- PO 00499962, Type CVX-1, Style Number 1358D39A01 (120 VAC)

b.2 Design Control

Standard Operating Procedure (SOP) 20.904.012, "Engineering Change Procedure," Revision 17, dated March 27, 2013, identifies the process used to generate an engineering change request (ECR) and the approval process required to ensure that any changes are in line with the design requirements. ECRs are submitted to two engineering approvers to approve or reject the

engineering change and review during an ECR release meeting. Documentation to justify why design changes do not invalidate 1E qualification are only required when engineering determines that the change requires test verification; however, ABB was able to provide additional information to the NRC inspection team to justify why the ECRs sampled did not invalidate 1E qualification.

PO 10347498 and PO 00499962 required that a certificate of conformance be provided to demonstrate that the relay was designed to meet the requirements of standard IEEE C37.90-1989/2005. The NRC inspection verified, through discussions with ABB staff, that changes from the 1989 to the 2005 revision of the standard were appropriately addressed to ensure that changes to the standard did not affect relay qualification.

The NRC inspection team verified the original design criteria for the AR relay type for PO 10347498 that are documented in Form 6147U, dated March 6, 1979. The NRC inspection team verified that individuals other than those who performed the original design performed design verification and that design changes underwent the same level of review as the original design. Specifically, the NRC inspection team verified that this design change did not invalidate the relays' qualification:

- for AR Type Relay, ECR EM2007-1095, material for switch blade barrier, dated November 29, 2007

b.3 Qualification and Testing

PO 10347498 required a certificate of conformance be provided to demonstrate that the AR relay type (Style 1256C88A09) has been tested to meet the requirements in ABB's Class 1E qualification test program outlined in STR-1, dated November 2001. Specifically, the NRC inspection team reviewed CTR-AR, "Qualification Report for Class 1E Apparatus CTR-AR," Revision 1, dated February 27, 2008, to verify that the methods used to qualify the electromechanical relay device were in accordance with applicable to the Institute of Electrical and Electronic Engineers (IEEE) standards C37.98-1987 and C37.105-1987. Because CTR-AR documents the qualification of the AR relay type, but does not qualify all the styles of the AR relay, and specifically not the style of the AR type procured in PO 10347498, the NRC verified that ABB performed an adequate evaluation by analysis to show similarity of the tested relay to the other relays in the relay type.

ABB tested three samples of the relay from normal production or stock to verify contact and armature gaps, contact bounce, and armature pickup and drop off were all in acceptable ranges prescribed by applicable IEEE standards. In addition, testing was performed for operational aging, life-cycle function tests, seismic tests, and post-seismic functional tests. Analysis was performed for qualified life, thermal aging, and radiation aging. The NRC inspection team found this approach to be acceptable and met the qualification requirements defined in IEEE C.37.105-1987, "IEEE Standard for Qualifying Class 1E Protective Relays and Auxiliaries for Nuclear Power Generation Stations." The NRC inspection team also verified that no design changes had invalidated the seismic testing performed in 1978.

In addition, PO 00499962 required a certificate of conformance be provided to demonstrate that the CVX-1 relay type (Style 1358D39A01) has been tested to meet the requirements in ABB's Class 1E qualification test program outlined in STR-1, dated November 2001. Specifically, the NRC inspection team reviewed CTR-CVX-1, "Qualification Report for Class 1E Apparatus CTR-CVX-1," Revision 3, dated April 2, 2013, to verify that the methods used to qualify the electromechanical relay device were in accordance with applicable IEEE standards C37.98-1987 and C37.105-1987. Because CTR-CVX-1 documents the qualification of the CVX-1 relay type, but does not qualify all the styles, and specifically not the style of the relay type procured in PO 00499962, the NRC verified that ABB performed an adequate evaluation by analysis to show similarity of the tested relay to the other relays in the relay type.

b.4 Commercial-Grade Dedication

SOP 20-904.02, "Class 1E Dedication Program," Revision 6, dated December 27, 2012, identifies the steps necessary to follow the guidelines, requirements, and processes in order to perform CGD. The NRC inspection team verified that ABB conforms to the guidance contained in Electric Power Research Institute 5652, "Guideline for the Utilization of Commercial Grade Items in Nuclear Safety-Related Applications," dated June 1, 1988 (as conditionally endorsed by NRC Generic Letter 89-02, "Actions to Improve the Detection of Counterfeit and Fraudulently Marketed Products," dated March 21, 1989), for their dedication of finished components by reviewing these dedication packages:

- F20-904.T20, "Class 1E Test Plan for PO 10347498" Type AR, Style Number 1456C88A09
- F20-904.Q20, "Class 1E Test Plan for PO 00499962," Type CVX-1, Revision 2

The NRC inspection team observed the dedication of Type CVX-1 for PO 00499962, dated August 8, 2006. The CVX-1 relay is designed as a synchro-verifier used in reclosing relay applications that actuate when two voltages reach synchronism following a trip. The ABB Senior Analysis Technician initiated the dedication process by verifying the product for counterfeit parts through a visual inspection. The technician then proceeded to verify the dedication package containing the mechanical and electrical critical characteristics to ensure that all the testing related to the verification of the critical characteristics had been performed to ensure, in turn, that the relay could perform its intended safety function. The technician later proceeded to perform a functional test at the CV test station to verify that the contacts opened and closed given the prescribed conditions in the manufacturer specification. The NRC inspection staff verified that the process ABB used to dedicate the CVX-1 was adequate.

c. Conclusions

The NRC inspection team concluded that ABB is implementing its procedures that govern the procurement, design, assembly, qualification, testing, and CGD

of electromechanical relays in a way consistent with the regulatory requirements of Appendix B to 10 CFR Part 50.

3. Solid-State Relays

a. Inspection Scope

The NRC inspection team reviewed ABB's policies and implementing procedures that govern the QA criteria applicable to solid-state relays—including the criteria for the relays' design, CGD, inspection, qualification, and testing—to verify compliance with the regulatory requirements of Appendix B to 10 CFR Part 50. The NRC inspection team reviewed design documentation to verify that applicable design inputs were translated correctly into specifications, drawings, procedures, or instructions. Additionally, the NRC inspection team reviewed the dedication-process, qualification, and testing activities necessary to verify that safety-related relays met technical and quality requirements established by the specifications identified in their POs.

b. Observations and Findings

b.1 Procurement Document Control

The NRC inspection team verified that the POs for solid-state relays adequately documented the procurement requirements as established by ABB's governing policies and implementing procedures, which include (1) imposition of appropriate quality, technical, and regulatory requirements and (2) identification of the applicable codes and standards.

The NRC inspection team reviewed the process ABB customers use to order solid-state relays. The customer selects a product through a catalog (as described in Section 2.b.1 of this report, "Procurement Document Control," for electromechanical relays).

The NRC inspection team reviewed the following POs:

- PO 00041983, 2 Type 27N, Solid-State Under-voltage Relays
- PO 10360124, 3 Type 59N, Solid-State Control Voltage Relays
- PO 00335385, 2 Type 27N, Solid-State Under-voltage Relays
- PO 10309870, 2 Type 50H, Solid-State Over-current Relays

b.2 Design Control

PO 00041983, PO 10360124, PO 00335385 and PO 10309870 required that a certificate of conformance be provided to demonstrate that the relay was designed to meet the requirements of standard IEEE C37.90-1989/2005. The NRC inspection verified, through discussions with ABB staff, that changes from the 1989 to the 2005 revision of the standard were appropriately addressed to ensure that the changes to the standard did not affect relay qualification.

The NRC inspection team verified that the original design criteria for the 27N solid-state under-voltage relays were documented in report RC-5039B,

dated December 1986. The NRC inspection team verified that the original design criteria for the 59N solid-state over-current relays were documented in report RC-1001, dated June 1, 1970. The NRC inspection team verified that the original design criteria for the 50H solid-state relays were documented in report RC-1017, dated May 15, 1972. The NRC inspection team verified that individuals other than those who performed the original design performed design verification and that design changes underwent the same level of review as the original design.

b.3 Qualification and Testing

The purchase orders required a certificate of conformance be provided to demonstrate that all the solid-state relays had been tested to meet the requirements in ABB's Class 1E qualification test program outlined in STR-1, dated November 2001. Specifically, the NRC inspection team reviewed RC-5103D, "Class 1E Electrical Equipment Qualification 50D/H Overcurrent Relay," Revision 1, dated December 2000; RC5142-B, "Class 1E Electrical Equipment Qualification 59N Overvoltage Relay," Revision 0, dated August 1995; and RC-5139-B, "Class 1E Electrical Equipment Qualification 27N Undervoltage Relay," Revision 2, dated October 1995, to verify that the methods used to qualify the solid-state relay device were in accordance with applicable IEEE standards C37.98-1987 and C37.105-1987.

ABB tested samples of the 27N, 59N and 50D/H solid-state relays from normal production or stock to verify that pickup function, drop out, pickup vernier range, repeatability, push to test, and other functions were all in acceptable ranges prescribed by applicable IEEE standards. In addition, testing was performed for operational aging, life-cycle function tests, seismic tests, and post-seismic functional tests. Analysis was performed for qualified life, thermal aging, and radiation aging. The NRC inspection team found that this approach was acceptable and met the qualification requirements defined in IEEE C.37.105-1987. In addition, the NRC inspection team verified that no design changes had invalidated the seismic testing last performed in 1989.

b.4 Commercial-Grade Dedication

The NRC inspection team observed the dedication of a 27N Type Undervoltage relay for PO 10358367, dated December 10, 2012. The NRC inspection team observed that each dedication package included these forms that documented the dedication: F10-908.102, "Class 1E Data File Checklist"; F10-911.101, "Class 1E-Dielectric Test Data Form"; C-31231, "Conformance Test Report (Critical Characteristics)"; and F10-908.202, "Test Equipment List Class 1E." The ABB Technician initiated the dedication process by verifying the product for counterfeit parts through a visual inspection. The technician then proceeded to verify the dedication package containing the mechanical and electrical critical characteristics to ensure that all the testing related to the verification of the critical characteristics had been performed in order to ensure that the relay could perform its intended safety function. The technician later proceeded to perform a functional test at the Class 1E solid-state test station to verify that the contacts opened and closed given the prescribed conditions in the manufacturer's specification. The NRC inspection team also verified that the solid-state relays

were assembled to the standards of IPCA-610, "Acceptability of Electronic Assemblies." The inspectors also witnessed the post-assembly electrical-characteristics test that is performed during the dedication process. This Hi-Potential Dielectric Test was conducted under ABB quality controls with properly calibrated equipment.

c. Conclusions

The NRC inspection team concluded that ABB is implementing its procedures that govern the procurement, design, assembly, qualification, testing, and CGD of solid-state relays in a way consistent with the regulatory requirements of Appendix B to 10 CFR Part 50.

4. Test Switches

a. Inspection Scope

The NRC inspection team reviewed ABB's policies and implementing procedures that govern the QA criteria applicable to test switches—including the criteria for the switches' design, CGD, oversight of contracted activities, inspection, qualification, and the testing process—to verify compliance with the regulatory requirements of Appendix B to 10 CFR Part 50. The NRC inspection team reviewed design documentation to verify that applicable design inputs were translated correctly into specifications, drawings, procedures, or instructions. Additionally, the NRC inspection team reviewed the dedication process, qualification, and testing activities necessary to verify that test switches met technical and quality requirements established by the specifications identified in their purchase orders.

b. Observations and Findings

b.1 Procurement Document Control

The NRC inspection team verified that PO 4500699207, a purchase order of an FT-1 test switch, adequately documented the procurement requirements which include (1) imposition of appropriate quality, technical, and regulatory requirements and (2) identification of the applicable codes and standards.

b.2. Design Control

PO 4500699207 required a certificate of conformance be provided to demonstrate that the test switch was designed to meet the requirements of standard IEEE C37.90-1989. The NRC inspection team verified that the original design criteria for the test switch were documented in Form 6147U, dated April 24, 1978, and that individuals other than those who performed the original design performed the design verification. In addition, the NRC inspection team verified that design changes underwent the same level of review as the original

design. Specifically, the NRC inspection team verified the following design changes:

- ABB-initiated design change, CS-ENG-1335, FT Switch Handle new design, dated November 4, 2009
- Customer-order design change, CS-ENG-2471, F-1 Switch 10 position, dated March 12, 2012

b.3 Qualification and Testing

PO 4500699207 required a certificate of conformance be provided to demonstrate that the test switch has been tested to meet the requirements in ABB's Class 1E qualification test program outlined in STR-1, dated November 2001. Specifically, the NRC inspection team reviewed CTR-FT-1, "Qualification Report for Class 1E Apparatus CTR-FT-1," Revision 1, dated April 8, 2013, to verify that the methods used to qualify the test switches were in accordance with applicable IEEE standards C37.98-1987, 323-1983, and 344-1987. Because CTR-F-1 documents the qualification of the flexitest switches, but does not qualify all the styles of the switch, and specifically not the style of the switch procured in PO 4500699207, the NRC verified that ABB performed an adequate evaluation by analysis to show similarity of the switches.

ABB tested three samples of the switch from normal production or stock to verify that the analysis performed for qualified life, thermal aging, and radiation aging was in accordance with IEEE C.37.105-1987. In addition, the NRC inspection team verified that design change CS-ENG-1335 did not invalidate the seismic testing.

b.4 Commercial-Grade Dedication and Acceptance Testing

The NRC inspection team reviewed the dedication for the FT-1. The Type FT-1 Flexitest Switches are designed and manufactured to allow multi-circuit testing of switchboard relays, meters, and instruments. ABB uses F20-904.B23, "Identification of Class 1E Critical Characteristics for Switch Type FT-1," Revision 1, dated May 22, 2012, for this purpose. However, ABB has not dedicated any flexitest switches since this document was developed; therefore, the NRC inspection team verified dedication of a flexitest switch FT-1 on PO 4500699207 through F10-910.1H7, "Quality Inspection Report: Class 1E Serial Number 12740," dated May 2, 2012.

The NRC inspection team was able to verify that ABB identified appropriate electrical and mechanical critical characteristics on the QA inspection report form to ensure that the flexitest switch could perform its intended safety function. This included verifying the assembly of the device and the movement of each jaw when the mating blade penetrated or was removed from the jaw. The NRC inspection team noted that for verification of electrical critical characteristics, the inspection report was marked "not applicable"; however, ABB staff indicated that electrical critical characteristics were verified through a test box designed and

programmed by ABB staff in Labview and recorded in an SQL query. M-SPEC 20221, Sub 86, "FT-1 Switch Check," outlines this testing process.

c. Conclusions

The NRC inspection team concluded that ABB is implementing its procedures that govern the procurement, design, assembly, qualification, testing, and CGD of test switches in a way consistent with the regulatory requirements of Appendix B to 10 CFR Part 50.

5. Measuring and Test Equipment

a. Inspection Scope

The NRC inspection team reviewed ABB's policies and implementing procedures that govern the ABB Measuring and Test Equipment Program to verify compliance with the regulatory requirements of Criterion XII, "Control of Measuring and Test Equipment," in Appendix B to 10 CFR Part 50. Additionally, the NRC inspection team reviewed the calibration certificates of the equipment used during the CGD process.

b. Observations and Findings

The NRC inspection team verified that the following pieces of measurement and testing equipment (M&TE) used to verify critical characteristics during the functional test were within their calibration dates as described in SOP 10.911.001, "Monitoring Measuring and Test Equipment Calibration Control and Use," Revision 9, dated March 27, 2013. In addition, the NRC inspection team reviewed the certificates of calibration for the M&TE used in the functional test, including:

- Fluke, true RMS multimeter, Serial no. 61480121
 - Certificate No. 61480121 1303 from Florida Standards Laboratory
- WRID, Interval Timer, Serial no. N-14814
 - Certificate No. N-14814 0912
- Epoch-I, Relay Test Set, Serial no. N-14724
 - Certificate No. N-14724 0512 from Florida Standards Laboratory
- Fluke, true RMS digital multimeter, Serial no. CS-2017
 - Certificate of calibration dated August 2012 from Florida Standards Laboratory
- Megger, AC/DC HiPot Tester, Serial no. CS-2016
 - Certificate of calibration dated December 2012 from Florida Standards Laboratory

- Doble, F2100 Test System, Serial no. TI-4016R
 - Certificate of calibration dated December 2012 from Florida Standards Laboratory

c. Conclusions

The NRC inspection team concluded that ABB is implementing its policies and implementing procedures that govern the measuring and test equipment program in a way consistent with the regulatory requirements of Criterion XII, "Control of Measuring and Test Equipment," in Appendix B to 10 CFR Part 50.

6. Oversight of Contracted Activities

a. Inspection Scope

The NRC inspection team reviewed the policies and implementing procedures that govern the implementation of ABB's oversight of contracted activities to verify compliance with the requirements of Criterion IV, "Procurement Document Control," and Criterion VII, "Control of Purchased Material, Equipment, and Services," in Appendix B to 10 CFR Part 50. The NRC inspection team reviewed a sample of POs to evaluate compliance with ABB's oversight program and technical requirements. The NRC inspection team discussed ABB's oversight of contracted activities with ABB management and technical staff.

b. Observations and Findings

b.1 Procurement Document Control

The NRC inspection team verified that the POs adequately documented the procurement requirements as established by ABB's governing policies and implementing procedures. In addition, the NRC inspection team reviewed TP 9Q005.8, "Seismic Qualification Test Procedure for an ABB Type AR Auxiliary Relay," dated December 14, 2001, to verify that IEEE 344, IEEE 323, 10 CFR Part 21, and 10 CFR 50 Appendix B requirements were passed down to sub-suppliers as appropriate.

b.2 Supplier Qualification Activities

The NRC inspection team reviewed four external surveys and the associated checklists performed by ABB to verify that ABB provided oversight of its suppliers for quality activities in accordance with their procedure WI-0040, "Conducting Supplier Audits, Surveys, and Source Inspections." The NRC inspection team reviewed a sample of three supplier corrective action requests to verify that findings identified in surveys were tracked in a corrective action program to completion. The NRC inspection team reviewed the training requirements for two of the lead auditors to verify that they were qualified in accordance with ABB's procedure WI-0039, "Auditor Qualifications," Revision 3, dated September 10, 2012.

c. Conclusions

The NRC inspection team concluded that ABB is implementing its policies and implementing procedures that govern the oversight of contracted activities in a way consistent with the regulatory requirements of Criterion IV, "Procurement Document Control," and Criterion VII, "Control of Purchased Material, Equipment, and Services," in Appendix B to 10 CFR Part 50.

7. Corrective Action and Nonconforming Materials, Parts, or Components

a. Inspection Scope

The NRC inspection team reviewed a sample of nonconformance and corrective action documents with an emphasis on the dedication of ABB's electromechanical and solid-state relays to verify compliance with Criterion XV, "Nonconforming Materials, Parts, or Components," and Criterion XVI, "Corrective Action," in Appendix B to 10 CFR Part 50. In addition, the NRC inspection team discussed the nonconformance and corrective action programs with ABB management and technical staff.

b. Observations and Findings

b.1 Nonconformances

The NRC inspection team verified that, for the sample of nonconformance reports reviewed, ABB had (1) dispositioned nonconformance reports identified in accordance with ABB-approved procedures, (2) presented an appropriate technical justification for the disposition, and (3) taken adequate action with regard to the nonconforming material or item. The NRC inspection team also verified that nonconformances identified in qualification and dedication reports related to the Type AR relay were evaluated, dispositioned, and resolved with the appropriate technical justifications.

b.2 Corrective Actions

The NRC inspection team evaluated corrective actions reports to verify that items are reviewed and dispositioned in a way consistent with ABB implementing procedures. Specifically, the NRC inspection team sampled corrective action reports that were classified as conditions adverse to quality in which a root-cause evaluation was required consistent with 10-914.001, "Corrective and Preventative Actions." The NRC inspection team verified that root-cause reports had adequate causes and actions and contained a development plan to prevent recurrence. In addition, the NRC inspection team reviewed supplier corrective action reports and audit findings to ensure that issues were being appropriately entered into the corrective action program and that the root causes for significant conditions adverse to quality were being appropriately identified to prevent recurrence.

c. Conclusions

The NRC inspection team concluded that ABB is implementing its policies and implementing procedures that govern the control of nonconforming material, parts, or

components and corrective actions in a way consistent with the regulatory requirements of Criterion XV, "Nonconforming Materials, Parts, or Components," and Criterion XVI, "Corrective Action," in Appendix B to 10 CFR Part 50.

8. Entrance and Exit Meetings

On April 8, 2013, the NRC inspection team discussed the scope of the inspection with Mr. Dennis Batovsky, Managing Director; Mr. Bryan Tauzer, Quality Assurance Manager; and other members of the ABB management and staff. On April 12, 2013, the NRC inspection team presented the inspection results and observations during an exit meeting with Mr. Batovsky, Mr. Tauzer, and other ABB staff. The attachment to this report lists the entrance and exit meeting attendees, as well as those individuals the NRC inspection team interviewed.

ATTACHMENT

1. PERSONS CONTACTED

Name	Title	Affiliation	Entrance	Exit	Interviewed
Timothy Masters	Engineering Supervisor	ABB	X	X	X
Rita Novoseletsky	Product Engineer	ABB	X	X	
Gary Goldfarb	Quality Technician	ABB	X	X	
Brian Jordan	Quality Engineer	ABB	X	X	
Terry Malloy	Nuclear Program Manager	ABB	X		
Rene Henriquez	Quality Engineer	ABB	X	X	
Wanda Jackson-Davis	Supply Chain Manager	ABB	X	X	
Dennis Batovsiky	Managing Director	ABB	X	X	
Douglas Larry	Production Supervisor	ABB	X	X	
Ivan J. Ramirez	Production Supervisor	ABB	X	X	
Frank Waters	Manager	ABB	X	X	
Bryan Tauzer	Quality Assurance Manager	ABB	X	X	X
Robert Davis	Materials Manager	ABB	X	X	
Todd Gentile	Senior Engineering Technician	ABB	X	X	X
S. Smith	Inspection Team Lead	NRC	X	X	
T. Navedo-Martinez	Inspection Team Member	NRC	X	X	
S. Edmonds	Inspection Team Lead	NRC	X	X	
N. Karlovich	Inspection Team Member	NRC	X	X	
D. Bollock	Inspection Team Member	NRC	X	X	
S. Smith	Inspection Team Lead	NRC	X		

2. INSPECTION PROCEDURES USED

Inspection Procedure 36100, "Inspection of 10 CFR Part 21 and Programs for Reporting Defects and Noncompliance," dated February 13, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML113190538)

Inspection Procedure 43002, "Routine Inspections of Nuclear Vendors," dated April 25, 2011 (ADAMS Accession No. ML110871933)

Inspection Procedure 43004, "Inspection of Commercial Grade Dedication Programs," dated April 25, 2011 (ADAMS Accession No. ML110871957)

3. LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

None.

4. DOCUMENTS REVIEWED

Procedures

- SOP 20-911.002, "Control of Software for Manufacturing Processes," Revision 12, dated February 25, 2013
- SOP 20.904.012, "Engineering Change Procedure," Revision 17, dated March 27, 2013
- SOP 20-904.02., "Class 1E Dedication Program," Revision 6, dated December 27, 2012
- SOP 20-904.008, "Class 1E Relays," Revision 20, dated June 3, 2011
- SOP 20-911.001, "Hi Pot Test," Revision 15, dated May 25, 2012
- SOP 10-910.007, "Final Production Inspection," Revision 26, dated March 27, 2013
- SOP 24-910.001, "Final Product Inspection and Testing," Revision 14, dated March 27, 2013
- SOP 10-911.001, "Monitoring Measuring and Test Equipment Calibration Control and Use," Revision 29, dated March 27, 2013
- F10-908.202, "Test Equipment List- Class 1E," Revision 0, dated November 28, 2005
- L10-910.803, "HiPot Test Mechanical Inspection Guidelines," Revision 11, dated December 3, 2012
- L10-910.107, "Relay Component Inspection Criteria," Revision 10, dated November 21, 2011
- L10-910.207, "Mechanical Inspection Criteria for Class 1E Products," Revision 12, dated December 26, 2012
- M-SPEC #25015, "High Accuracy Undervoltage Relay," Revision 2, dated April 1, 2013
- RC-3123, "27N Undervoltage Relay," Revision 13, dated June 18, 1996
- RC-3128, "59N Test Procedure," Revision 7, dated March 3, 1993
- RC-3139, "50D/H Test Procedure," Revision 5, dated April 30, 2002
- 20-904.020, "Class 1E dedication Program", Revision 6, dated December 27, 2012

- 12-906.001, "Supplier Evaluation Selection and Approval Criteria", Revision 44, dated November 26, 2012
- 10-910.002, "Incoming Inspection", Revision 30, dated April 4, 2013
- 10-913.004, "Control of Nonconforming Product," Revision 34, dated October 11, 2012
- 10-908.004, "Implementation of 10 CFR 21", Revision 14, dated April 5, 2013
- 10-914.001, "Corrective and Preventative Actions", Revision 17, dated November 5, 2012
- WI-0039, "Auditor Qualifications", Revision 3, dated September 10, 2012
- WI-0040, "Conducting Supplier Audits, Surveys, and Source Inspections", Revision 5, dated April 4, 2013

Miscellaneous Documents

- FT Test Box document, "Validate functionality of new FT-1, FT-14 Test Box," dated October 16–17, 2007
- F10-908.102, "Class 1E Data File Checklist," dated July 18, 2011
- F20-911.101, "Class 1E Dielectric Test Data Form," Revision 5, August 24, 2011
- F20-904.A21, "Relay Type 27N, 27N-R & 59N Identification of Class 1E Critical Characteristics," Revision 3, dated January 17, 2013
- F20-904.A21, "Relay Type 27N Identification of Class 1E Critical Characteristics," Revision 2, dated April 26, 2013
- RC-5139-B, "Class 1E Electrical Equipment Qualification 27N Undervoltage Relay," Revision 2, dated October 1995
- RC-5039-B "Equipment Performance Specification 27N Undervoltage Relay," Revision 0
- RC-6004A, "Qualification Test Report for Solid-State Relays; Harmonic Filter for ITE-27N, 59N," dated December 1986
- RC-6004, "Type Test for Type 27N High Accuracy Relays, Catalog Series 211T and 41T," Revision 0, February 10, 1989
- RC-6012, "Type Test for Type 59N High Accuracy Overvoltage Relays, Catalog Series 211U and 411U," Revision 0, dated February 10, 1989
- RC-1017, "Design Specification Circuit Shield Instantaneous Overcurrent Relays," Revision 1, dated August 8, 1973
- RC-1001, "Design Specification Solid State Overcurrent Relays," Revision 1, dated June 1, 1970
- RC-6019A, "Qualification Test Report for Solid State Relays, Type 50D/H," Revision 0, dated June 10, 1985

Purchase Orders

- PO 00041983, "2 ABB-27N Undervoltage Relays to Monticello Nuclear Generation," Revision 2, dated May 16, 2012
- PO 10360124, "3 ABB-59N Control Voltage Relays to Palisades Nuclear Power Plant," Revision 0, dated September 11, 2012
- PO 00335385, "2 ABB-27N Undervoltage Relays to Columbia Generating Station," Revision 0, dated May 7, 2012
- PO 10309870, "2 ABB-50H Overcurrent Relays to Pilgrim Nuclear Power Station," Revision 4, dated March 12, 2012

- PO 10358367, "1 ABB-27N Undervoltage Relay to Grand Gulf," Revision 0, dated December 10, 2012

Drawings

- 1616C24, "FT1 Switch – General Drawing Class 1E Application," Revision 27, dated August 7, 2007, Sheets 1–7

Records of Inspections Associated with 27N

- Incoming Inspection, dated January 31, 2013
- Incoming Inspection, dated December 1, 2011
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Other Records of Inspections

- Lot 4500848134, Delta Group Electronics
- Lot 4500419834, Zurvahn, LLC

Inspection-Related Documents Associated with Testing of 27N

- 10-910.007, "Final Product Inspection", Revision 26, dated March 27, 2013
- 24-910.001, "Final Product Inspection & Testing," Revision 14
- L10-910.803, "HiPot Test Mechanical Inspection Guidelines," Revision 11, dated December 3, 2012

Commercial-Grade Surveys

- Survey Report for GES, Venture, dated December 12, 2010
- Commercial Grade Survey Checklist for GES Manufacturing Services, dated September 10, 2010
- Survey Report for Partnership Sourcing Services, dated September 9, 2011
- Commercial Grade Survey Checklist for Partnership Sourcing Services, 7–9, 2011
- Survey Report for Mack Technologies Florida, Inc, Southeast Facility, dated August 30, 2011
- Commercial Grade Survey Checklist for MACK Technologies Florida, Inc., dated August 25 and 26, 2011
- Survey Report for Florida Standards Lab, dated October 12, 2012
- Commercial Grade Survey Checklist for Florida Standards Lab, dated September 28, 2012
- SCAR-135, "Preservation of Product," dated August 30, 2011
- SCAR-133, "Records," dated August 30, 2011
- SCAR-119, "Contract Review," dated December 9, 2011

Additional Documents

- TP 9Q005.8, "Seismic Qualification Test Procedure for an ABB Type AR Auxiliary Relay," Revision 0, dated December 14, 2001. (from the AR Quality Report)

Training Records

- Training Record for a Senior or Manufacturing Tech Solid State and Microprocessor Relays
- Training Records for Lead Auditors
- MSPEC-25041, "Solid State Ground Fault Relay," Revision 4
- MSPEC-20087, "Ground Test (Solid State Relays)," Revision 10

Nonconformances

- NCMR-5027, "K-line Test Set Panel Blank," dated March 7, 2013
- NCMR-4973, "Gaskets falling off," dated February 12, 2013
- NCMR-4930 "Visual assembly test/K1 components," dated January 9, 2013
- NCMR-4999, "Lockwasher Missing," dated February 20, 2013
- Corrective Action Requests and Part 21 Evaluation Documents

- GGOB-8ZJQ7C, "Telephone Relay," dated October 29, 2012
- Corrective Action Worksheet 2-1617061-6, Relay Bearing Pin, dated November 20, 2012
- Letter to WESCO Distribution, Inc., dated December 21, 2012
- PIC Notes for Telephone Relay Armature Pivot Pin, dated October 30, 2012
- KAGE-8J85SM, "LER on ABB ITE-27N Relays," dated June 22, 2011
- TPMY-8LYFXF "Part 21 Evaluation not completed within 60 days of ID," dated September 23, 2011
- Procedure 10-913.003, Product Integrity Committee (PIC), Revision 19, dated December 20, 2012
- RHEZ-8LYFEH, "Instantaneous Trip Function," dated September 23, 2011
- KAGE-8J86CS, "PCB Terminal Pins," dated April 5, 2011
- Letter to Beaver Valley Power Station dated May 13, 2011
- ECR CS Eng- 2060, "A-Spec Release 59G," dated May 11, 2011
- BLTR-8MDKN3, "Cement Replacement," dated October 6, 2011
- TR 53314YX, "Thermal-Radiation Materials Application Data for Neoprene Rubber Sealing Cement," dated September 1980
- DN 53314YY-YZ, "Material Sheet for Buna N Adhesive," dated October 5, 1987
- DN 53314ZT-ZW, "Material Sheet for Neoprene Adhesive," dated June 20, 1989
- IFAV-8STRNF, "ICs," dated March 28, 2012
- Engineering Report USPPMV, "Radiation Exposure to Plastic IC's used on SS Relays," 2013-04-08, Revision 1, dated April 8, 2013
- KAGE-8J866L, "HiPoT," dated June 20, 2011
- KAGE-8J866C, "NAVL," dated June 10, 2011
- KAGE-8J866F, "Hi-Pot," dated June 15, 2011
- KMOD-962k29, " Internal Audit," dated March 22, 2013