



ELECTROSWITCH • SWITCHES & RELAYS
UNIT OF ELECTRO SWITCH CORP.

180 King Avenue • Weymouth, MA 02188 • Phone 781-335-5200 • Fax 781-335-4253

October 20, 2016

U. S. Nuclear Regulatory Commission
NRC Operations Center
Facsimile # 301-816-5151

Subject: Response to questions about Electroswitch's response to the U.S. Nuclear Regulatory Commission Inspection Report NO. 99900833/2016-201 and Notice of Nonconformance (Letter from Terry W. Jackson, Branch Chief, dated August 5, 2016)

Reference: 10 CFR Part21 Reporting of Defects and Noncompliance - Vendor Inspection of Electroswitch Corporation Docket #99900833 (Event #51915)

To Whom It May Concern:

Below are the questions and Electroswitch's responses:

Question #1: Your documents that correspond to NON 99900833/2016-201-01 show differing test numbers on the product tags that do not seem to match the original test reports. Four of the six samples are tagged from being from Test 2392-XX, but are tied to differing numbered reports:

- a. Series 24 I&C - tag 2392-21 with report 2983-2
- b. Series 24 LOR - tag 2393-21 with report 2983-3
- c. Series 24 LOR/ER - tag 2392-5 with report 2983-3
- d. Series CSR and LSR - tag 2983-1 with report 2983-3
- e. Series 21 I&C - tag 2392-7 with report 2392-6A
- f. Series 20 CAM and 20M - tag 2392-12 with report 2970-2

Please clarify or provide documentation that supports or correlates the test specimens to their corresponding test reports.

Response #1: The test reports and test tag numbers identified above have a parent/child connection. The test report covers the family of products whereas the test tag number is associated with that specific model. Attachment A shows the various switch models which were tested as part of the product family.

Question #2: Your documents that correspond to NON 99900833/2016-201-01 seems to be missing Series 31 TR/LSR in Appendix B of your documents. Please provide the supporting documentation for Series 31 TR/LSR.

IED9
NRD

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Response #2: The Series 31 TR/LSR test report #8629-1 dated June 24, 2016 had been inadvertently been omitted from CAR #16-010 (NRC Finding) revised 9-8-16. Attachment B is the revised CAR, which includes the Series 31 RTR/LSR test report 8629-1 dated June 24, 2016.

Question #3: Your documents that correspond to NON 99900833/2016-201-01 shows Series 20 CAM test documentation with a test specimen date code in 1977 (code 7740), but the picture in the tag shows 12/7/1978. Please verify this information is correct and corresponds to the correct documentation. If correct, please explain why they differ.

Response #3: The test specimen date code in 1977 (code 7740) on the Series 20 CAM product is correct. It is the date (year/week) when the switch was built. The tag on the switch represents the date that the switch had begun its suite of tests. There were lags from when the switch was built and when it had been tested. Because the (parent) test report covered a number of switches, the time from when the switch was built and tested had been lengthy.

Question #4: Your documents that correspond to NON 99900833/2016-201-01 have test specimen date codes around 1977 or early 1980s. The reports are all from the late 1984, 1985 timeframe. Please expound on the significant time gap between specimens and reports. Also, please verify which IEEE standards were used on the test specimens and which IEEE standards are referenced in the reports and ensure the required IEEE documents, either via license purchase orders or via your certificate of conformance, were all met.

Response #4: The test specimen date codes were between 1977 and the early 1980's. Because the (parent) test report covered a number of switches, the time from when the test specimen switches were built and subsequently tested had taken a very long time, in some cases, up to 6 years.

The IEEE standards, to which the switches were tested to conform, are identified in each of the test reports (refer to Attachment A).

Question #5: Your documents that correspond to NON 99900833/2016-201-02 have not addressed the services that were listed in the NON that were used to support the qualification testing that was done. The NRC report listed three commercial testing services used without supporting documentation: Acton Environmental Testing Corp. (radiation aging), Arnold Greene Testing Lab (radiation aging), and ASL (seismic). Please summarize the supporting documentation, verification, and/or justification for acceptance of the services used at the time of qualification testing. We are particularly interested in the evidence that establishes that the services had the capability and traceability to support the qualification testing of Electroswitch's control switches and relays to ensure intended safety function performance at end of life and following a design basis event. Additionally, are there other commercial services that were used to support original qualification testing that were not evaluated?

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Response #5: There was a Supplier Quality System Questionnaire sent to and received from Acton Environmental Test Corp., who had performed the radiation aging tests. They noted that their procedures were based on MIL-Q-9858A, MIL-STD-45662 and 10CFR50 App. B. Acton Environmental Test Corp. was purchased by NTS Huntsville, who is an A2LA accredited lab.

There is no supporting documentation such as Commercial Grade Surveys, Vendor visits or Supplier Quality Questionnaires for Arnold Green Testing Lab, who had performed the radiation aging tests. Their test reports do have the ACIL (American Council of Independent Laboratories) seal on them.

Because these services were provided back in the 1977-1985 timeframes, there is nothing further that can be done. Additionally, Electroswitch does not know what the safety function of the product is.

Question #6: Your documents corresponding to NON 99900833/2016-201-02 do not address the failure to adequately dedicate or verify acceptability of past components that have been shipped. Rather, it explains reliance on historical performance of a commercial vendor (commonly described as commercial-grade dedication method 4 acceptance), which the NRC has explained its usage and acceptability in Generic Letter 89-02. Your response detailing periodic Class II testing and Statistical Process Control is what the NRC understood during the inspection and is insufficient in terms of meeting 10 CFR 50 Appendix B requirements. Please provide any additional evaluation you have completed on safety-related product that has been shipped and how the inadequate dedication/verification of material/chemical composition and dimensions/thickness cited in the finding would not prevent products from performing their intended safety function in a reliable manner and under all potential operating conditions.

Response #6: Other than the periodic Class II testing and Statistical Process Control that was seen during the NRC vendor inspection, there is no other evaluations or activities to provide. Electroswitch does not know what the safety function of the product is. Based upon the historical performance data of the products manufactured and sold since the product qualification, Electroswitch can state that product has met the design specifications.

Question #7: Your documents corresponding to NON 99900833/2016-201-02 do not mention your use of various commercial suppliers for small sub-components used in some safety related components, such as commercial solenoids and relays, which were not dedicated or verified. Please provide any additional evaluation you have completed on safety-related solenoids and relays would not prevent products from performing their safety function in a reliable manner and under all potential operating conditions.

Response #7: Other than the periodic Class II testing and Statistical Process Control that was seen during the NRC vendor inspection, there is no other evaluations or activities to provide. Electroswitch does not know what the safety function of the product is. Based upon the



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historical performance data of the products manufactured and sold since the product qualification, Electroswitch can state that product has met the design specifications.

Please sign below, acknowledging receipt of this request, and return a copy to the attention of Larry Friedman, Quality Assurance Manager, at the above address or fax to 781-335-4253 within 10 working days after receipt.

Sincerely,
ELECTROSWITCH

Larry Friedman
Quality Assurance Manager

Please let us know if ANY of your mailing information changes – name of recipient, name of company/facility, address, etc. Mark the changes on this acknowledgement form and send to us by mail to the address above or by FAX to 781-335-4253.

RECEIVED: _____

DATE: _____



ELECTROSWITCH

Report No. 2983-2

QUALIFICATION INSPECTION
OF
SERIES 24
INSTRUMENT AND CONTROL SWITCHES
TO
ESC-STD-1000 REV. 3

APPROVALS

	PROCEDURE	DATE	REPORT	DATE
Prepared by:		10/15/84		10/15/84
Approved by:		10/15/84		10/15/84
Test Lab		10/15/84		10/15/84
Applications Eng.		10/15/84		10/15/84
Project Eng.		10/15/84		10/15/84
Quality Control		10/15/84		10/15/84
Validated by:				
DCASMA		10/15/84		10/15/84
Boston Rep.		10/15/84		10/15/84
Released by:		10/15/84		10/15/84



ELECTRO SWITCH CORP.
Weymouth, Massachusetts 02188.

ENGINEERING TEST REPORT

REPORT NO. 2983-2
PAGE 3 OF 11
DATE: OCT 15 1984
PREPARED BY *[Signature]*
APPROVED BY *[Signature]*

ADMINISTRATIVE DATA

Purpose

The purpose of these tests is to determine the ability of the series 24 Instrument and Control Switches to conform to the qualification requirements of ANSI/IEEE 323-1983 and IEEE-Std 344-1975 while the product is manufactured in accordance with ANSI/ASME NQA-1-1983. This is accomplished by subjecting the switches to the Qualification Inspection requirements of Electro Switch Technical Publication ESC-Std-1000 Rev. 3 dated 9/3/84.

The testing consists of four parts:

1. Establishing the baseline by initial tests and measurements.
2. Performing unusual ambient tests including contact temperature rise, elevated temperature, and elevated humidity.
3. Aging the product to a simulated forty year life by subjecting the product to accelerated radiation and electromechanical aging followed by seismic testing.
4. Final operational testing and inspections to verify that the product did not deteriorate from the baseline beyond accepted parameters or tolerances.

Summary of Results

The results of the tests indicate that the series 24 switches do conform to the Qualification Inspection requirements of ESC-Std-1000 Rev. 3 and thereby meet the qualification requirements of ANSI/IEEE 323-1983 and IEEE Std 344-1975 and the quality assurance requirements of ANSI/ASME NQA-1-1983 (which includes, by reference, the NRC regulation 10CFR50 Appendix B).

A summary of the results is published on page 5. Complete test results follow.

Specifications

ANSI/IEEE 323-1983 Qualifying Class 1E Equipment for Nuclear Power Generating Stations.

IEEE Std 344-1975 IEEE Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations.

ANSI/ASME NQA-1-1983 Quality Assurance Program Requirements for Nuclear Power Plants.

ESC-Std-1000 Rev. 3 General Specifications for Rotary Switches and Auxiliary Relays for Utility Applications including Class 1E Equipment Requirements for Nuclear Power Generating Stations.



ELECTRO SWITCH CORP.
Weymouth, Massachusetts 02188.

ENGINEERING TEST REPORT

REPORT NO. 2983-2

PAGE 4 OF 11

DATE: OCT 15 1984

PREPARED BY

APPROVED BY

ADMINISTRATIVE DATA (Continued)

Manufacturer

Electro Switch Corp.
180 King Avenue, Weymouth, Massachusetts 02188

Material

Twelve samples of series 24 Instrument and Control Switches in accordance with ESC-Std-1000 Rev. 3 using normal production processes and tools. The samples are:

<u>QUANTITY</u>	<u>SAMPLE NUMBERS</u>	<u>SERIES</u>	<u>CATALOG NUMBER</u>
4	1,2,3,4	24	24210B
4	1A,2A,3A,4A	24	2457D
4	1B,2B,3B,4B	24	24310B

Test Laboratories

Electro Switch Corp.
180 King Avenue, Weymouth, Massachusetts 02188

Acton Environmental Testing Corp.
Acton, Massachusetts 01720

Arnold Greene Testing Laboratories, Inc.
Natick, Massachusetts 01760



ELECTROSWITCH

Report No. 2983-3

QUALIFICATION INSPECTION
OF
SERIES 24LOR, LOR/ER, and LSR
AUXILIARY RELAYS and LOCK-OUT RELAYS
TO
ESC-STD-1000 REV. 3

APPROVALS

	PROCEDURE	DATE	REPORT	DATE
Prepared by:		1/11/85		1/11/85
Approved by:		1/11/85		1/11/85
Test Lab		1/11/85		1/11/85
Applications Eng.		1/11/85		1/11/85
Project Eng.	—	—	—	—
Quality Control		1/11/85		1/11/85
Validated by:	—	—	—	—
DCASMA	—	—	—	—
Boston Rep.		1/11/85		1/11/85
Released by:		1/11/85		1/11/85



ELECTRO SWITCH CORP.
Weymouth, Massachusetts 02188.

ENGINEERING TEST REPORT

REPORT NO. 2983-3

PAGE 3 OF 10

DATE: JAN 11 1985

PREPARED BY

APPROVED BY

ADMINISTRATIVE DATA

Purpose

The purpose of these tests is to determine the ability of the series 24LOR, LOR/ER, and LSR Auxiliary Relays and Lock-out Relays to conform to the qualification requirements of ANSI/IEEE 323-1983 and IEEE-Std 344-1975 while the product is manufactured in accordance with ANSI/ASME NQA-1-1983. This is accomplished by subjecting the switches to the Qualification Inspection requirements of Electro Switch Technical Publication ESC-Std-1000 Rev. 3 dated 9/3/84 which conforms to ANSI/IEEE C37.90-1978, ANSI/IEEE C37.98-1978, and ANSI/IEEE C37.101-19XX.

The testing consists of four parts:

1. Establishing the baseline by initial tests and measurements.
2. Performing unusual ambient tests including contact temperature rise, elevated temperature, and elevated humidity.
3. Aging the product to a simulated forty year life by subjecting the product to accelerated radiation and electromechanical aging followed by seismic testing.
4. Final operational testing and inspections to verify that the product did not deteriorate from the baseline beyond accepted parameters or tolerances.

Summary of Results

The results of the tests indicate that the series 24 relays do conform to the Qualification Inspection requirements of ESC-Std-1000 Rev. 3 and thereby meet the qualification requirements of ANSI/IEEE 323-1983 and IEEE Std 344-1975 and the quality assurance requirements of ANSI/ASME NQA-1-1983 (which includes, by reference, the NRC regulation 10CFR50 Appendix B).

A summary of the results is published on page 5. Complete test results follow.

Specifications

ANSI/IEEE 323-1983 Qualifying Class 1E Equipment for Nuclear Power Generating Stations.

IEEE Std 344-1975 IEEE Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations.

ANSI/ASME NQA-1-1983 Quality Assurance Program Requirements for Nuclear Power Plants.

ESC-Std-1000 Rev. 3 General Specifications for Rotary Switches and Auxiliary Relays for Utility Applications including Class 1E Equipment Requirements for Nuclear Power Generating Stations.



ELECTRO SWITCH CORP.
Weymouth, Massachusetts 02188.

ENGINEERING TEST REPORT

REPORT NO. 2983-3
PAGE 4 OF 10
DATE: JAN 11 1985
PREPARED BY [Signature]
APPROVED BY [Signature]

ADMINISTRATIVE DATA (Continued)

Specifications (continued)

ANSI/IEEE C37.90-1978 Relays and Relay Systems Associated with Electric Power Apparatus

ANSI/IEEE C37.98-1978 IEEE Standard Seismic Testing of Relays

ANSI/IEEE C37.105-19XX Standard for Qualifying Class 1E Protective Relays and Auxiliaries for Nuclear Power Generating Stations

Manufacturer

Electro Switch Corp.
180 King Avenue, Weymouth, Massachusetts 02188

Material

Twelve samples of series 24LOR, LOR/ER, and LSR Auxiliary Relays and Lock-out Relays in accordance with ESC-Std-1000 Rev. 3 using normal production processes and tools. The samples are:

<u>QUANTITY</u>	<u>SAMPLE NUMBERS</u>	<u>SERIES</u>	<u>CATALOG NUMBER</u>
4	1, 2, 3, 4	24LOR	7810D
4	1A, 2A, 3A, 4A	24LOR/ER	7828DD
4	1B, 2B, 3B, 4B	24LSR	9210DD

Test Laboratories

Electro Switch Corp.
180 King Avenue, Weymouth, Massachusetts 02188

Acton Environmental Testing Corp.
Acton, Massachusetts 01720

Neutron Products, Inc.
Dickerson, MD 20753




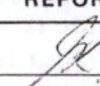

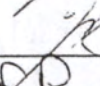

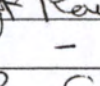

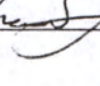

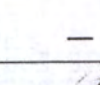








ELECTROSWITCH

REV A

Report No. 2392-6A

QUALIFICATION INSPECTION OF
SERIES 31 LATCHING SWITCH RELAY
AND
SERIES 31 DETENT ACTION SWITCHES
INSTRUMENT AND CONTROL SWITCHES TO
ESC-STD-1000 REV. 1

APPROVALS

	PROCEDURE	DATE	REPORT	DATE
Prepared by:		12/19/84		12/19/84
Approved by:		12/19/84		12/19/84
Test Lab		12/19/84		12/19/84
Applications Eng.		-		-
Project Eng.		12/19/84		12/19/84
Quality Control		-		-
Validated by:		-		-
DCASMA		12/19/84		12/19/84
Boston Rep.		-		-
Released by:		-		-



ELECTRO SWITCH CORP.
Weymouth, Massachusetts 02188.

ENGINEERING TEST REPORT

REPORT NO. 2392-6A (Rev. A)

PAGE 3 OF 11

DATE: MAR 20 1987

PREPARED BY *[Signature]*

APPROVED BY *[Signature]*

ADMINISTRATIVE DATA

Purpose

The purpose of these tests is to determine the ability of the series 31LSR and series 31 detent action switches to conform to the qualification requirements of ANSI/IEEE 323-1974 and IEEE-Std 344-1975 while the product is manufactured in accordance with ANSI/ASME NQA-1-1983. This is accomplished by subjecting the switches to the Qualification Inspection requirements of Electro Switch Technical Publication ESC-Std-1000 Rev. 1 dated 2/15/78.

The testing consists of four parts:

1. Establishing the baseline by initial tests and measurements.
2. Performing unusual ambient tests including contact temperature rise, elevated temperature, and elevated humidity.
3. Aging the product to a simulated forty year life by subjecting the product to accelerated radiation and electromechanical aging followed by seismic testing.
4. Final operational testing and inspections to verify that the product did not deteriorate from the baseline beyond accepted parameters or tolerances.

Summary of Results

The results of the tests indicate that the series 31LSR and series 31 detent action switches do conform to the Qualification Inspection requirements of ESC-Std-1000 Rev. 1 and thereby meet the qualification requirements of ANSI/IEEE 323-1974 and IEEE Std 344-1975 and the quality assurance requirements of ANSI/ASME NQA-1-1983 (which includes, by reference, the NRC regulation 10CFR50 Appendix B).

A summary of the results is published on page 5. Complete test results follow.

Specifications

- ANSI/IEEE 323-1974 Qualifying Class 1E Equipment for Nuclear Power Generating Stations.
- IEEE Std 344-1975 IEEE Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations.
- ANSI/ASME NQA-1-1983 Quality Assurance Program Requirements for Nuclear Power Plants.
- ESC-Std-1000 Rev. 1 General Specifications for Rotary Switches and Auxiliary Relays for Utility Applications including Class 1E Equipment Requirements for Nuclear Power Generating Stations.



ELECTRO SWITCH CORP.
Weymouth, Massachusetts 02188.

ENGINEERING TEST REPORT

REPORT NO. 2392-6A (Rev. A)

PAGE 4 OF 11

DATE: MAR 20 1987

PREPARED BY *[Signature]*

APPROVED BY *[Signature]*

ADMINISTRATIVE DATA (Continued)

Manufacturer

Electro Switch Corp.
180 King Avenue, Weymouth, Massachusetts 02188

Material

Twelve samples of series 31LSR and series 31 detent action switches in accordance with ESC-Std-1000 Rev. 1 using normal production processes and tools. The samples are:

<u>QUANTITY</u>	<u>SAMPLE NUMBERS</u>	<u>SERIES</u>	<u>CATALOG NUMBER</u>
4	1,2,3,4	31	9308DB
4	1A,2A,3A,4A	31	31210B
4	1B,2B,3B,4B	31	31310B

Test Laboratories

Electro Switch Corp.
180 King Avenue, Weymouth, Massachusetts 02188

Acton Environmental Testing Corp.
Acton, Massachusetts 01720

Arnold Greene Testing Laboratories, Inc.
Natick, Massachusetts 01760



ELECTROSWITCH

Report No. 2970-2

QUALIFICATION INSPECTION
OF
SERIES 20
INSTRUMENT AND CONTROL SWITCHES
TO
ESC-STD-1000 REV. 3

APPROVALS

	PROCEDURE	DATE	REPORT	DATE
Prepared by:		12/12/84		12/12/84
Approved by:		12/12/84		12/12/84
Test Lab				
Applications Eng.	JF Royce	12/12/84	JF Royce	12/12/84
Project Eng.				
Quality Control	Brian Sp	12/12/84	BS	12/12/84
Validated by:				
DCASMA				
Boston Rep.				
Released by:		12/12/84		12/12/84



ELECTRO SWITCH CORP.
Weymouth, Massachusetts 02188.

ENGINEERING TEST REPORT

REPORT NO. 2970-2

PAGE 3 OF 11

DATE: DEC 12 1984

PREPARED BY

APPROVED BY

ADMINISTRATIVE DATA

Purpose

The purpose of these tests is to determine the ability of the series 20 Instrument and Control Switches to conform to the qualification requirements of ANSI/IEEE 323-1983 and IEEE-Std 344-1975 while the product is manufactured in accordance with ANSI/ASME NQA-1-1983. This is accomplished by subjecting the switches to the Qualification Inspection requirements of Electro Switch Technical Publication ESC-Std-1000 Rev. 3 dated 9/3/84.

The testing consists of four parts:

1. Establishing the baseline by initial tests and measurements.
2. Performing unusual ambient tests including contact temperature rise, elevated temperature, and elevated humidity.
3. Aging the product to a simulated forty year life by subjecting the product to accelerated radiation and electromechanical aging followed by seismic testing.
4. Final operational testing and inspections to verify that the product did not deteriorate from the baseline beyond accepted parameters or tolerances.

Summary of Results

The results of the tests indicate that the series 20 Instrument and Control switches do conform to the Qualification Inspection requirements of ESC-Std-1000 Rev. 3 and thereby meet the qualification requirements of ANSI/IEEE 323-1983 and IEEE Std 344-1975 and the quality assurance requirements of ANSI/ASME NQA-1-1983 (which includes, by reference, the NRC regulation 10CFR50 Appendix B).

A summary of the results is published on page 5. Complete test results follow.

Specifications

ANSI/IEEE 323-1983 Qualifying Class 1E Equipment for Nuclear Power Generating Stations.

IEEE Std 344-1975 IEEE Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations.

ANSI/ASME NQA-1-1983 Quality Assurance Program Requirements for Nuclear Power Plants.

ESC-Std-1000 Rev. 3 General Specifications for Rotary Switches and Auxiliary Relays for Utility Applications, including Class 1E Equipment Requirements for Nuclear Power Generating Stations.



ELECTRO SWITCH CORP.
Weymouth, Massachusetts 02188.

ENGINEERING TEST REPORT

REPORT NO. 2970-2
PAGE 4 OF 11
DATE: DEC 12 1984
PREPARED BY [Signature]
APPROVED BY [Signature]

ADMINISTRATIVE DATA (Continued)

Manufacturer

Electro Switch Corp.
180 King Avenue, Weymouth, Massachusetts 02188

Material

Sixteen samples of series 20 Instrument and Control Switches in accordance with ESC-Std-1000 Rev. 3 using normal production processes and tools. The samples are:

<u>QUANTITY</u>	<u>SAMPLE NUMBERS</u>	<u>SERIES</u>	<u>CATALOG NUMBER</u>
4	1,2,3,4	20K	20KB-1124A4
4	1A,2A,3A,4A	20L	20LB-1112D4
4	1B,2B,3B,4B	20PH	20PHD-57
4	1C,2C,3C,4C	20PJD	20PJD-57

Test Laboratories

Electro Switch Corp.
180 King Avenue, Weymouth, Massachusetts 02188

Acton Environmental Testing Corp.
Acton, Massachusetts 01720

Arnold Greene Testing Laboratories, Inc.
Natick, Massachusetts 01760

Electroswitch	NON CONFORMANCE REPORT	Rev: J	Document no: NONCON-1 CAR #16-010
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Attachment B

A
N
Y

E
M
P
L
O
Y
E
E

DATE: 4/28/16	REF. #: NRC Vendor Inspection Docket #99900833	INITIATED BY: Larry Friedman
ITEM: Criterion III of 10CFR50 Appendix B		
NONCONFORMANCE : Compliance to Criterion III – Design Control		AREA: Design

DESCRIPTION OF NON CONFORMANCE:

Criterion III, Design Control, of 10CFR50 Appendix B in part states “Measures shall be established to assure that applicable regulatory requirements and the design basis, as defined in § 50.2 and as specified in the license application, for those structures, systems, and components to which this appendix applies are correctly translated into specifications, drawings, procedures, and instructions. These measures shall include provisions to assure that appropriate quality standards are specified and included in design documents and that deviations from such standards are controlled.”

Electroswitch’s ESC-STD-1000 Rev. 3 dated 9/3/1984 General Specifications for Rotary Switches and Auxiliary Relays for Utility Applications including Class 1E Equipment for Nuclear Power Generating Stations states the following:

1. Dielectric Withstanding Voltage – 2200VRMS, 60Hz for one minute with a maximum of 100 microamps leakage initially and 600VRMS, 60Hz for one minute with a maximum of 100 milliamps after aging.
 - a. This is contrary to contrary to IEEE C37.90-1978 Relays and Relay Systems Associated with Electric Power Apparatus.
2. Insulation Resistance – 100 megohms minimum at 500VDC for one minute and 50 megohms minimum at 500VDC for one minute after endurance and aging.
 - a. This is contrary to paragraph 3.8 of ESC-STD-1000 Rev. 3 dated 9/3/1984, which states 100 megohms minimum.
3. Contact Resistance – 10 milliohms maximum at rated current and 10 milliohms at 100 milliamps after endurance.
 - a. This is contrary to paragraph 3.9 of ESC-STD-1000 Rev. 3 dated 9/3/1984, which states 10 milliohms maximum at rated current.

Electroswitch

NON CONFORMANCE REPORT

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NONCON-1

CAR #16-010

Attachment B

IMMEDIATE DISPOSITION/SHORT TERM FIX: (DUE WITHIN 10 WORKING DAYS OF FINDING)

1. Reviewed the product qualification test reports for the nine families to determine which products fell into the same findings. See **Appendix A** for matrix showing before and after parameters used. Completion date: 5/17/16
2. The actual products used for the initial product qualification testing were retrieved from storage. The three tests using the before aging parameters have been completed. The actual results are documented in Electroswitch Test Reports (see **Appendix B**):
 - a. All products **passed** the Dielectric Withstanding Voltage test at the 2200VRMS 60HZ for 1 minute.
 - b. All products **passed** the Insulation Resistance Test 100 megaohm minimum at 500VDC.
 - c. All products **passed** the Contact Resistance test at the rated current.

RESPONDED DATE: **6/24/16**

DISPOSITIONED BY:

Larry Friedman

WHAT CAUSED THE NONCONFORMANCE? (ROOT CAUSE):

When the Dielectric Withstanding Voltage, Insulation Resistance and Contact Resistance after aging test parameters in ESC-STD-1000 standard was specified, Electroswitch did not take into consideration that the lower specifications would not simulate the operation of the product at end of life and a design basis event (DBE).

SIGNATURE: **LARRY FRIEDMAN**

ACTIONS TO PREVENT RECURRENCE (CORRECTIVE ACTION):

1. Internal review of ESC-STD-1000 General Specifications for Rotary Switches and Auxiliary Relays for Utility Applications including Class 1E Equipment for Nuclear Power Generating Stations document, specifically, the after aging test parameters for Dielectric Withstanding Voltage, Insulation Resistance and Contact Resistance has been conducted.
2. Engineering revised the ESC-STD-100 General Specifications for Rotary Switches and Auxiliary Relays for Utility Applications including Class 1E Equipment for Nuclear Power Generating Stations document. The new revision 7 has the before and after aging test parameters for Dielectric Withstanding Voltage, Insulation resistance and Contact Resistance the same.

Preventive Action Report Reference # (Where Applicable):

ASSIGNED TO: * **Ed Reszenski**

DUE DATE: 6/24/16

SIGNATURE AT COMPLETION: ED RESZENSKI

DATE: 7/1/16

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* All blocks to be completed and legible – no pencil

Electroswitch	NON CONFORMANCE REPORT	Rev: J	Document no: NONCON-1 CAR #16-010
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Attachment B

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CLOSE OUT DETAILS (REVIEW EFFECTIVENESS OF ACTIONS TAKEN):

1. Quality has conducted and documented the results of the Dielectric Withstanding Voltage, Insulation Resistance and Contact Resistance tests using the same parameters as before aging.
2. Quality reviewed and verified that the ESC-STD-1000 standard Rev. 7 that the before and after aging test parameters for Dielectric Withstanding Voltage, Insulation resistance and Contact Resistance are the same.

4.6.3 Dielectric withstanding voltage (see 3.7). The product shall be tested in accordance with ANSI/IEEE C37.90-1989 (paragraph 8). The following details shall apply:

- a. ~~(c)~~ Unless otherwise specified (see 3.1 and 6.2.2), the test voltage shall be 2200VRMS, 60Hz, alternating current (AC), ~~except after elevated humidity testing (see 3.11) the test voltage shall be 1000VRMS, 60Hz; after all aging test, the test voltage shall be 600VRMS, 60Hz.~~

4.6.4 Insulation resistance (see 3.8). The product shall be tested in accordance with this standard. Insulation resistance measurements shall be made on an apparatus suitable for the characteristic to be measured such as a megohm bridge, megohmmeter, insulation resistance test set, or other suitable apparatus. The following details shall apply:

- b. (a) The test potential shall be ~~100 megohms minimum at~~ 500VDC $\pm 10\%$.

4.6.5 Contact resistance (see 3.9). The product shall be tested in accordance with this standard. Contact resistance values between two contacting surfaces are influenced by such factors as the resistivities of the surface materials, contact pressure, area, shape, condition of surfaces (including relative cleanliness, smoothness, and hardness), current, open circuit voltage appearing at the contacts during interruption of current, temperature, and thermal conductivity of leads. The resistance of the contacts shall be measured using voltmeter-ammeter method. The following detail shall apply:

- c. (b) The maximum allowable measurement error shall be 5%.
(c) The test leads shall be connected by a method suitable for the product terminals.
~~(d)~~ The test current shall be ~~at rated current. except 100 milliamperes (mA) may be used after endurance (see 3.14).~~

SIGNATURE: LARRY FRIEDMAN

DATE: 7/1/16

A
N
Y

COMMENTS:

* All blocks to be completed and legible – no pencil

Electroswitch

NON CONFORMANCE REPORT

Rev:

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Attachment B

Appendix A:

Initial Product Qualification									
Switch Family	Part Number	Test Report #	Test Date	Test Parameters (before aging)			Test Parameters (after aging)		
				Dielectric Withstanding Voltage	Insulation Resistance	Contact Resistance (at rated current)	Dielectric Withstanding Voltage	Insulation Resistance	Contact Resistance
Series 24 Instrument & Control	24XX / 242XX / 243XX / 74XXX	2983-2	10/15/1984	2200VRMS, 60HZ for 1 Min	100 megohms min. at 500VDC	10 milliohms max. 20A	600VRMS, 60HZ for 1 Min	50 megohms min. at 500VDC	10 milliohms max. 100mA
Series 24 LOR	78XX	2983-3	1/11/1985	2200VRMS, 60HZ for 1 Min	100 megohms min. at 500VDC	10 milliohms max. 20A	2200VRMS, 60HZ for 1 Min	50 megohms min. at 500VDC	10 milliohms max. 100mA
Series 24 LOR/ER	78XX	2983-3	1/11/1985	2200VRMS, 60HZ for 1 Min	100 megohms min. at 500VDC	10 milliohms max. 20A	2200VRMS, 60HZ for 1 Min	50 megohms min. at 500VDC	10 milliohms max. 100mA
Series 24 CSR	88XX	2983-3	1/11/1985	2200VRMS, 60HZ for 1 Min	100 megohms min. at 500VDC	10 milliohms max. 20A	2200VRMS, 60HZ for 1 Min	50 megohms min. at 500VDC	10 milliohms max. 100mA
Series 24 LSR	92XX	2983-3	1/11/1985	2200VRMS, 60HZ for 1 Min	100 megohms min. at 500VDC	10 milliohms max. 20A	2200VRMS, 60HZ for 1 Min	50 megohms min. at 500VDC	10 milliohms max. 100mA
Series 31 Instrument & Control	31XXX / 65XXX / 75XXX	2392-6A	12/19/1984	2200VRMS, 60HZ for 1 Min	100 megohms min. at 500VDC	10 milliohms max. 10A	600VRMS, 60HZ for 1 Min	50 megohms min. at 500VDC	10 milliohms max. 10A
Series 31 TR/LSR	93XX	2392-6A	12/19/1984	2200VRMS, 60HZ for 1 Min	100 megohms min. at 500VDC	10 milliohms max. 10A	600VRMS, 60HZ for 1 Min	50 megohms min. at 500VDC	10 milliohms max. 10A
Series 20 Cam	20KB / 20KD / 20LB / 20LD / 20MB / 20MD / 20MF / 20MG / 20PF / 20PG / 20PH / 20PI / 20PL / 20PY	2970-2	12/12/1984	2200VRMS, 60HZ for 1 Min	100 megohms min. at 500VDC	10 milliohms max. 20A	600VRMS, 60HZ for 1 Min	50 megohms min. at 500VDC	10 milliohms max. 100mA
	29XXX / 30XXX / 32XXX / 38XXX / 40XXX / 60XXX	2970-2A	1/24/1985	2200VRMS, 60HZ for 1 Min	100 megohms min. at 500VDC	10 milliohms max. 20A	600VRMS, 60HZ for 1 Min	50 megohms min. at 500VDC	10 milliohms max. 100mA

* All blocks to be completed and legible – no pencil



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180 King Avenue
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ENGINEERING TEST REPORT

REPORT NO. 8624-1

PAGE 1 of 4

DATE: JUNE 24, 2016

PREPARED BY: DAN MENARD

APPROVED BY: LARRY FRIEDMAN

MATERIAL

Original Series 24 Instrument and Control switch part #24208B date code 8026, which was used for the initial product qualification test and documented in Test Report 2983-2 dated 10/15/1984.



PURPOSE

To address the nonconformance:

Initial Product Qualification Tests for Dielectric Withstanding Voltage, Insulation Resistance and Contact Resistance as defined in Electroswitch's ESC-STD-1000 Rev. 3 dated 9/3/1984 General Specifications for Rotary Switches and Auxiliary Relays for Utility Applications including Class 1E Equipment for Nuclear Power Generating Stations was found to be in contradiction to IEEE C37.90-1978 Relays and Relay Systems Associated with Electric Power Apparatus.

REFERENCES

- (a) ESC-STD-1000 (Rev 3) Para. 4.5.2 and 4.6
- (b) ANSI/IEEE C37.90.1978

PROCEDURE

The sequence of tests as detailed in ESC-STD-1000 (Rev 3) Table I was Dielectric Withstanding Voltage, Insulation Resistance and Contact Resistance.

RESULTS

1. **Passed** the Dielectric Withstanding Voltage test at the 2200VRMS 60HZ for 1 minute.
2. **Passed** the Insulation Resistance Test 100 megaohm minimum at 500VDC.
3. **Passed** the Contact Resistance test at the rated current of 20A.



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ENGINEERING TEST REPORT

REPORT NO. 8624-1

PAGE 2 of 4

DATE: JUNE 24, 2016

PREPARED BY: DAN MENARD

APPROVED BY: LARRY FRIEDMAN

DATE STARTED: 6/7/16	TEST: Dielectric Withstanding Voltage	ORDER NUMBER: Not applicable
DATE COMPLETED: 6/7/16	TEST SPEC: ESC-STD-1000 (Rev. 3) para. 4.6.3	
TEMPERATURE: 23.7C	SAMPLE NO/DESCRIPTION: Original sample	TEST CONDUCTED BY: DM
HUMIDITY: 49%		

REQUIREMENT: When tested as specified, product shall withstand 2200 VRMS, 60Hz (AC) for 1 minute without arcing, breakdown of insulation, or damage and there shall be no leakage current greater than 100 microamperes.

AFTER AGING

Deck	TEST A	TEST B
1	10	11
2	10	11
3	10	10
4	10	10
5	10	11
6	10	10
7	10	10
8	10	10

NOTES: 1 Values are maximum found in microamperes.

2 Test voltage applied between:

Test A- Open Circuit contacts

Test B- Closed contacts and non current carrying parts.



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ENGINEERING TEST REPORT

REPORT NO. 8624-1

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DATE: JUNE 24, 2016

PREPARED BY: DAN MENARD

APPROVED BY: LARRY FRIEDMAN

DATE STARTED: 6/14/16	TEST: Insulation Resistance	ORDER NUMBER: Not applicable
DATE COMPLETED: 6/14/16	TEST SPEC: ESC-STD 1000 (Rev 3) para. 4.6.4	
TEMPERATURE: 23.7C	SAMPLE NO/DESCRIPTION: Original sample	TEST CONDUCTED BY: DM
HUMIDITY: 49%		
REQUIREMENT: When the product is tested as specified at 500VDC \pm 10% for 1 minute, the insulation resistance shall be greater than 100 megohms.		
AFTER AGING		
Deck	TEST A	TEST B
1	>550	>550
2	> 550	>550
3	> 550	>550
4	>550	>550
5	>550	>550
6	>550	>550
7	>550	>550
8	> 550	>550
NOTES: 1 Values are maximum found in megohms (K=1,000)		
2 Test voltage applied between:		
Test A- Open Circuit contacts		
Test B- Closed contacts and non-current carrying parts.		



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ENGINEERING TEST REPORT

REPORT NO. 8624-1

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DATE: JUNE 24, 2016

PREPARED BY: DAN MENARD

APPROVED BY: LARRY FRIEDMAN

DATE STARTED: 6/16/15	TEST: Contact Resistance	ORDER NUMBER: Not applicable
DATE COMPLETED: 6/16/16	TEST SPEC: ESC-STD-1000 (Rev. 3) para. 4.6.5	
TEMPERATURE: 23.7C	SAMPLE NO/DESCRIPTION: Original sample	TEST CONDUCTED BY: DM
HUMIDITY: 49%		
REQUIREMENT: When the product is tested as specified, the contact resistance shall not exceed 10 milliohms at rated current of 20A. The products shall be operated once prior to taking measurements to cleanse the contact.		
Sample	CONTACT CIRCUIT:	MAXIMUM OF READING
1	11-12	5.89
	21-22	4.30
	31-32	8.74
	41-42	1.51
	51-52	3.05
	61-62	8.43
	71-72	2.90
	81-82	2.14
NOTES: 1. Values are the average of five measurements in milliohms		



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Weymouth, Massachusetts 02188

ENGINEERING TEST REPORT

REPORT NO. 8625-1

PAGE 1 of 3

DATE: JUNE 24, 2016

PREPARED BY: DAN MENARD

APPROVED BY: LARRY FRIEDMAN

MATERIAL

Original Series 24 Lockout Relay switch part #7810D date code 8151, which was used for the initial product qualification test and documented in Test Report 2983-3 dated 1/11/1985.



PURPOSE

To address the nonconformance:

Initial Product Qualification Tests for Insulation Resistance and Contact Resistance as defined in Electroswitch's ESC-STD-1000 Rev. 3 dated 9/3/1984 General Specifications for Rotary Switches and Auxiliary Relays for Utility Applications including Class 1E Equipment for Nuclear Power Generating Stations was found to be in contradiction to IEEE C37.90-1978 Relays and Relay Systems Associated with Electric Power Apparatus.

REFERENCES

- (a) ESC-STD-1000 (Rev 3) Para. 4.5.2 and 4.6
- (b) ANSI/ IEEE C37.90.1978

PROCEDURE

The sequence of tests as detailed in ESC-STD-1000 (Rev 3) Table I was Insulation Resistance and Contact Resistance.

RESULTS

1. **Passed** the Dielectric Withstanding Voltage test at 2200VRMS 60HZ for 1 minute during **original test.**
2. **Passed** the Insulation Resistance Test 100 megaohm minimum at 500VDC.
3. **Passed** the Contact Resistance test at the rated current of 20A.



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ENGINEERING TEST REPORT

REPORT NO. 8625-1

PAGE 2 of 3

DATE: JUNE 24, 2016

PREPARED BY: DAN MENARD

APPROVED BY: LARRY FRIEDMAN

DATE STARTED: 6/14/16	TEST: Insulation Resistance	ORDER NUMBER: Not applicable
DATE COMPLETED: 6/14/16	TEST SPEC: ESC-STD 1000 (Rev 3) para. 4.6.4	
TEMPERATURE: 23.7C	SAMPLE NO/DESCRIPTION: Original sample	TEST CONDUCTED BY: DM
HUMIDITY: 49%		
REQUIREMENT: When the product is tested as specified at 500VDC \pm 10% for 1 minute, the insulation resistance shall be greater than 100 megohms.		
AFTER AGING		
	Deck	TEST A TEST B
	1	>550 >550
	2	> 550 >550
	3	> 550 >550
	4	>550 >550
	5	>550 >550
	6	>550 >550
	7	>550 >550
	8	> 550 >550
NOTES: 1 Values are maximum found in megohms (K=1,000)		
2 Test voltage applied between:		
Test A- Open Circuit contacts		
Test B- Closed contacts and non-current carrying parts.		



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ENGINEERING TEST REPORT

REPORT NO. 8625-1

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DATE: JUNE 24, 2016

PREPARED BY: DAN MENARD

APPROVED BY: LARRY FRIEDMAN

DATE STARTED: 6/16/15	TEST: Contact Resistance	ORDER NUMBER: Not applicable
DATE COMPLETED: 6/16/16	TEST SPEC: ESC-STD-1000 (Rev. 3) para. 4.6.5	
TEMPERATURE: 23.7C	SAMPLE NO/DESCRIPTION: Original sample	TEST CONDUCTED BY: DM
HUMIDITY: 49%		
REQUIREMENT: When the product is tested as specified, the contact resistance shall not exceed 10 milliohms at rated current of 20A. The products shall be operated once prior to taking measurements to cleanse the contact.		
Sample	CONTACT CIRCUIT:	MAXIMUM OF READING
1	12-18	4.22
	22-28	2.33
	32-38	2.51
	42-48	3.11
	52-58	2.58
	62-68	2.33
	72-78	2.83
	82-88	4.75
	92-98	3.11
	102-108	2.38
NOTES: 1. Values are the average of five measurements in milliohms		



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ENGINEERING TEST REPORT

REPORT NO. 8626-1

PAGE 1 of 3

DATE: JUNE 24, 2016

PREPARED BY: DAN MENARD

APPROVED BY: LARRY FRIEDMAN

MATERIAL

Original Series 24 Lockout Relay Electric Reset switch part #7828DD date code 7733, which was used for the initial product qualification test and documented in Test Report 2983-3 dated 1/11/1985.



PURPOSE

To address the nonconformance:

Initial Product Qualification Tests for Insulation Resistance and Contact Resistance as defined in Electroswitch's ESC-STD-1000 Rev. 3 dated 9/3/1984 General Specifications for Rotary Switches and Auxiliary Relays for Utility Applications including Class 1E Equipment for Nuclear Power Generating Stations was found to be in contradiction to IEEE C37.90-1978 Relays and Relay Systems Associated with Electric Power Apparatus.

REFERENCES

- (a) ESC-STD-1000 (Rev 3) Para. 4.5.2 and 4.6
- (b) ANSI/ IEEE C37.90.1978

PROCEDURE

The sequence of tests as detailed in ESC-STD-1000 (Rev 3) Table I was Resistance and Contact Resistance.

RESULTS

1. **Passed** the Dielectric Withstanding Voltage test at 2200VRMS 60HZ for 1 minute during **original test.**
2. **Passed** the Insulation Resistance Test 100 megaohm minimum at 500VDC.
3. **Passed** the Contact Resistance test at the rated current of 20A.



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ENGINEERING TEST REPORT

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DATE: JUNE 24, 2016

PREPARED BY: DAN MENARD

APPROVED BY: LARRY FRIEDMAN

DATE STARTED: 6/14/16	TEST: Insulation Resistance	ORDER NUMBER: Not applicable
DATE COMPLETED: 6/14/16	TEST SPEC: ESC-STD 1000 (Rev 3) para. 4.6.4	
TEMPERATURE: 23.7C	SAMPLE NO/DESCRIPTION: Original sample	TEST CONDUCTED BY: DM
HUMIDITY: 49%		
REQUIREMENT: When the product is tested as specified at 500VDC $\pm 10\%$ for 1 minute, the insulation resistance shall be greater than 100 megohms.		
AFTER AGING		
Deck	TEST A	TEST B
1	>550	>550
2	> 550	>550
3	> 550	>550
4	>550	>550
5	>550	>550
6	>550	>550
7	>550	>550
8	> 550	>550
NOTES: 1 Values are maximum found in megohms (K=1,000)		
2 Test voltage applied between:		
Test A- Open Circuit contacts		
Test B- Closed contacts and non-current carrying parts.		



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ENGINEERING TEST REPORT

REPORT NO. 8626-1

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DATE: JUNE 24, 2016

PREPARED BY: DAN MENARD

APPROVED BY: LARRY FRIEDMAN

DATE STARTED: 6/16/15	TEST: Contact Resistance	ORDER NUMBER: Not applicable
DATE COMPLETED: 6/16/16	TEST SPEC: ESC-STD-1000 (Rev. 3) para. 4.6.5	
TEMPERATURE: 23.7C	SAMPLE NO/DESCRIPTION: Original sample	TEST CONDUCTED BY: DM
HUMIDITY: 49%		
REQUIREMENT: When the product is tested as specified, the contact resistance shall not exceed 10 milliohms at rated current of 20A. The products shall be operated once prior to taking measurements to cleanse the contact.		
Sample	CONTACT CIRCUIT:	MAXIMUM OF READING
1	12-18	1.88
	22-28	2.99
	32-38	3.63
	42-48	1.42
	52-58	1.19
	62-68	2.29
	72-78	2.75
	82-88	2.36
NOTES: 1. Values are the average of five measurements in milliohms		



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ENGINEERING TEST REPORT

REPORT NO. 8627-1

PAGE 1 of 3

DATE: JUNE 24, 2016

PREPARED BY: DAN MENARD

APPROVED BY: LARRY FRIEDMAN

MATERIAL

Original Series 24 Latching Switch Relay part #9210DD date code 8135, which was used for the initial product qualification test and documented in Test Report 2983-3 dated 1/11/1985.

NOTE: Series 24 Control Switch Relay was qualified by similarity.



PURPOSE

To address the nonconformance:

Initial Product Qualification Tests for Insulation Resistance and Contact Resistance as defined in Electroswitch's ESC-STD-1000 Rev. 3 dated 9/3/1984 General Specifications for Rotary Switches and Auxiliary Relays for Utility Applications including Class 1E Equipment for Nuclear Power Generating Stations was found to be in contradiction to IEEE C37.90-1978 Relays and Relay Systems Associated with Electric Power Apparatus.

REFERENCES

- (a) ESC-STD-1000 (Rev 3) Para. 4.5.2 and 4.6
- (b) ANSI/ IEEE C37.90.1978

PROCEDURE

The sequence of tests as detailed in ESC-STD-1000 (Rev 3) Table I was Insulation Resistance and Contact Resistance.

RESULTS

1. **Passed** the Dielectric Withstanding Voltage test at 2200VRMS 60HZ for 1 minute during **original test.**
2. **Passed** the Insulation Resistance Test 100 megaohm minimum at 500VDC.
3. **Passed** the Contact Resistance test at the rated current of 20A.



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ENGINEERING TEST REPORT

REPORT NO. 8627-1

PAGE 2 of 3

DATE: JUNE 24, 2016

PREPARED BY: DAN MENARD

APPROVED BY: LARRY FRIEDMAN

DATE STARTED: 6/14/16	TEST: Insulation Resistance	ORDER NUMBER: Not applicable
DATE COMPLETED: 6/14/16	TEST SPEC: ESC-STD 1000 (Rev 3) para. 4.6.4	
TEMPERATURE: 23.7C	SAMPLE NO/DESCRIPTION: Original sample	TEST CONDUCTED BY: DM
HUMIDITY: 49%		

REQUIREMENT: When the product is tested as specified at 500VDC + 10% for 1 minute, the insulation resistance shall be greater than 100 megohms.

AFTER AGING

Deck	TEST A	TEST B
1	>550	>550
2	> 550	>550
3	> 550	>550
4	>550	>550
5	>550	>550
6	>550	>550
7	>550	>550
8	> 550	>550

NOTES: 1 Values are maximum found in megohms (K=1,000)

2 Test voltage applied between:

Test A- Open Circuit contacts

Test B- Closed contacts and non-current carrying parts.

ENGINEERING TEST REPORT

REPORT NO. 8627-1

PAGE 3 of 3

DATE: JUNE 24, 2016

PREPARED BY: DAN MENARD

APPROVED BY: LARRY FRIEDMAN

DATE STARTED: 6/16/15	TEST: Contact Resistance	ORDER NUMBER: Not applicable
DATE COMPLETED: 6/16/16	TEST SPEC: ESC-STD-1000 (Rev. 3) para. 4.6.5	
TEMPERATURE: 23.7C	SAMPLE NO/DESCRIPTION: Original sample	TEST CONDUCTED BY:
HUMIDITY: 49%		DM
REQUIREMENT: When the product is tested as specified, the contact resistance shall not exceed 10 milliohms at rated current of 20A. The products shall be operated once prior to taking measurements to cleanse the contact.		
Sample	CONTACT CIRCUIT:	MAXIMUM OF READING
1	14-13	1.60
	21-23	1.39
	31-33	1.76
	41-43	1.10
	51-53	1.30
	61-63	1.27
	71-73	1.47
	81-83	1.24
	91-93	1.45
	101-103	1.25
NOTES: 1. Values are the average of five measurements in milliohms		



180 King Avenue
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ENGINEERING TEST REPORT

REPORT NO. 8628-1

PAGE 1 of 3

DATE: JUNE 24, 2016

PREPARED BY: DAN MENARD

APPROVED BY: LARRY FRIEDMAN

MATERIAL

Original Series 31 Instrument and Control switch part #31310B date code 77XX, which was used for the initial product qualification test and documented in Test Report 2392-6A dated 12/19/1984.



PURPOSE

To address the nonconformance:

Initial Product Qualification Tests for Dielectric Withstanding Voltage and Insulation Resistance as defined in Electroswitch's ESC-STD-1000 Rev. 3 dated 9/3/1984 General Specifications for Rotary Switches and Auxiliary Relays for Utility Applications including Class 1E Equipment for Nuclear Power Generating Stations was found to be in contradiction to IEEE C37.90-1978 Relays and Relay Systems Associated with Electric Power Apparatus.

REFERENCES

- (a) ESC-STD-1000 (Rev 3) Para. 4.5.2 and 4.6
- (b) ANSI/IEEE C37.90.1978

PROCEDURE

The sequence of tests as detailed in ESC-STD-1000 (Rev 3) Table I was Dielectric Withstanding Voltage and Insulation Resistance.

RESULTS

1. **Passed** the Dielectric Withstanding Voltage test at the 2200VRMS 60HZ for 1 minute.
2. **Passed** the Insulation Resistance Test 100 megohm minimum at 500VDC.
3. **Passed** the Contact Resistance Test at the rated current of 10A during **original test**.



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180 King Avenue
Weymouth, Massachusetts 02188

ENGINEERING TEST REPORT

REPORT NO. 8628-1

PAGE 2 of 3

DATE: JUNE 24, 2016

PREPARED BY: DAN MENARD

APPROVED BY: LARRY FRIEDMAN

DATE STARTED: 6/7/16	TEST: Dielectric Withstanding Voltage	ORDER NUMBER: Not applicable
DATE COMPLETED: 6/7/16	TEST SPEC: ESC-STD-1000 (Rev. 3) para. 4.6.3	
TEMPERATURE: 23.7C	SAMPLE NO/DESCRIPTION: Original sample	TEST CONDUCTED BY: DM
HUMIDITY: 49%		
REQUIREMENT: When tested as specified , product shall withstand 2200 VRMS, 60Hz (AC) for 1 minute without arcing, breakdown of insulation, or damage and there shall be no leakage current greater than 100 microamperes.		
AFTER AGING		
Deck	TEST A	TEST B
1	10	11
2	10	11
3	11	11
4	11	11
5	11	11
6	10	12
7	10	12
8	10	11
9	11	12
10	10	11
NOTES: 1 Values are maximum found in microamperes.		
2 Test voltage applied between:		
Test A- Open Circuit contacts		
Test B- Closed contacts and non current carrying parts.		



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DATE: JUNE 24, 2016

PREPARED BY: DAN MENARD

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DATE STARTED: 6/14/16	TEST: Insulation Resistance	ORDER NUMBER: Not applicable
DATE COMPLETED: 6/14/16	TEST SPEC: ESC-STD 1000 (Rev 3) para. 4.6.4	
TEMPERATURE: 23.7C	SAMPLE NO/DESCRIPTION: Original sample	TEST CONDUCTED BY: DM
HUMIDITY: 49%		
REQUIREMENT: When the product is tested as specified at 500VDC $\pm 10\%$ for 1 minute, the insulation resistance shall be greater than 100 megohms.		
AFTER AGING		
Deck	TEST A	TEST B
1	>550	>550
2	> 550	>550
3	> 550	>550
4	>550	>550
5	>550	>550
6	>550	>550
7	>550	>550
8	> 550	>550
NOTES: 1 Values are maximum found in megohms (K=1,000)		
2 Test voltage applied between:		
Test A- Open Circuit contacts		
Test B- Closed contacts and non-current carrying parts.		



ELECTROSWITCH
• SWITCHES & RELAYS
UNIT OF ELECTRO SWITCH CORP.

180 King Avenue
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ENGINEERING TEST REPORT

REPORT NO. 8629-1

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DATE: JUNE 24, 2016

PREPARED BY: DAN MENARD

APPROVED BY: LARRY FRIEDMAN

MATERIAL

Original Series 31 Latching Relay switch part #9308DB date code 7801, which was used for the initial product qualification test and documented in Test Report 2392-6A dated 12/19/1984.



PURPOSE

To address the nonconformance:

Initial Product Qualification Tests for Dielectric Withstanding Voltage and Insulation Resistance as defined in Electroswitch's ESC-STD-1000 Rev. 3 dated 9/3/1984 General Specifications for Rotary Switches and Auxiliary Relays for Utility Applications including Class 1E Equipment for Nuclear Power Generating Stations was found to be in contradiction to IEEE C37.90-1978 Relays and Relay Systems Associated with Electric Power Apparatus.

REFERENCES

- (a) ESC-STD-1000 (Rev 3) Para. 4.5.2 and 4.6
- (b) ANSI/ IEEE C37.90.1978

PROCEDURE

The sequence of tests as detailed in ESC-STD-1000 (Rev 3) Table I was Dielectric Withstanding Voltage and Insulation Resistance.

RESULTS

1. **Passed** the Dielectric Withstanding Voltage test at the 2200VRMS 60HZ for 1 minute.
2. **Passed** the Insulation Resistance Test 100 megaohm minimum at 500VDC.
3. **Passed** the Contact Resistance Test at the rated current of 10A during **original test**.



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Attachment B ENGINEERING TEST REPORT

REPORT NO. 8629-1

PAGE 2 of 3

DATE: JUNE 24, 2016

PREPARED BY: DAN MENARD

APPROVED BY: LARRY FRIEDMAN

DATE STARTED: 6/7/16	TEST: Dielectric Withstanding Voltage	ORDER NUMBER: Not applicable
DATE COMPLETED: 6/7/16	TEST SPEC: ESC-STD-1000 (Rev. 3) para. 4.6.3	
TEMPERATURE: 23.7C	SAMPLE NO/DESCRIPTION: Original sample	TEST CONDUCTED BY: DM
HUMIDITY: 49%		

REQUIREMENT: When tested as specified, product shall withstand 2200 VRMS, 60Hz (AC) for 1 minute without arcing, breakdown of insulation, or damage and there shall be no leakage current greater than 100 microamperes.

AFTER AGING

Deck	TEST A	TEST B
1	11	10
2	9	11
3	9	10
4	10	10
5	10	11
6	10	11
7	10	12
8	10	10

NOTES: 1 Values are maximum found in microamperes.

2 Test voltage applied between:

Test A- Open Circuit contacts

Test B- Closed contacts and non current carrying parts.



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DATE: JUNE 24, 2016

PREPARED BY: DAN MENARD

APPROVED BY: LARRY FRIEDMAN

DATE STARTED: 6/14/16	TEST: Insulation Resistance	ORDER NUMBER: Not applicable
DATE COMPLETED: 6/14/16	TEST SPEC: ESC-STD 1000 (Rev 3) para. 4.6.4	
TEMPERATURE: 23.7C	SAMPLE NO/DESCRIPTION: Original sample	TEST CONDUCTED BY: DM
HUMIDITY: 49%		
REQUIREMENT: When the product is tested as specified at 500VDC +- 10% for 1 minute, the insulation resistance shall be greater than 100 megohms.		
AFTER AGING		
Deck	TEST A	TEST B
1	>550	>550
2	> 550	>550
3	> 550	>550
4	>550	>550
5	>550	>550
6	>550	>550
7	>550	>550
8	> 550	>550
NOTES: 1 Values are maximum found in megohms (K=1,000)		
2 Test voltage applied between:		
Test A- Open Circuit contacts		
Test B- Closed contacts and non-current carrying parts.		



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ENGINEERING TEST REPORT

REPORT NO. 8630-1

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DATE: JUNE 24, 2016

PREPARED BY: DAN MENARD

APPROVED BY: LARRY FRIEDMAN

MATERIAL

Original Series 20 CAM switch part #20PHD-57 date code 7740, which was used for the initial product qualification test and documented in Test Report 2970-2 dated 12/12/1984.

NOTE: Series 20M switch part #80162-33-4 was qualified by similarity in Test Report 2970-2A dated 1/24/1985, because a Series 20 CAM switch is part of the Series 20M module.



PURPOSE

To address the nonconformance:

Initial Product Qualification Tests for Dielectric Withstanding Voltage, Insulation Resistance and Contact Resistance as defined in Electroswitch's ESC-STD-1000 Rev. 3 dated 9/3/1984 General Specifications for Rotary Switches and Auxiliary Relays for Utility Applications including Class 1E Equipment for Nuclear Power Generating Stations was found to be in contradiction to IEEE C37.90-1978 Relays and Relay Systems Associated with Electric Power Apparatus.

REFERENCES

- (a) ESC-STD-1000 (Rev 3) Para. 4.5.2 and 4.6
- (b) ANSI IEEE C37.90.1978

PROCEDURE

The sequence of tests as detailed in ESC-STD-1000 (Rev 3) Table I was Dielectric Withstanding Voltage, Insulation Resistance and Contact Resistance.

RESULTS

- 1. **Passed** the Dielectric Withstanding Voltage test at the 2200VRMS 60HZ for 1 minute.
- 2. **Passed** the Insulation Resistance Test 100 megaohm minimum at 500VDC.
- 3. **Passed** the Contact Resistance test at the rated current of 20A.



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Attachment B ENGINEERING TEST REPORT

REPORT NO. 8630-1

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DATE: JUNE 24, 2016

PREPARED BY: DAN MENARD

APPROVED BY: LARRY FRIEDMAN

DATE STARTED: 6/7/16	TEST: Dielectric Withstanding Voltage	ORDER NUMBER: Not applicable
DATE COMPLETED: 6/7/16	TEST SPEC: ESC-STD-1000 (Rev. 3) para. 4.6.3	
TEMPERATURE: 23.7C	SAMPLE NO/DESCRIPTION: Original sample	TEST CONDUCTED BY: DM
HUMIDITY: 49%		
REQUIREMENT: When tested as specified , product shall withstand 2200 VRMS, 60Hz (AC) for 1 minute without arcing, breakdown of insulation, or damage and there shall be no leakage current greater than 100 microamperes.		
AFTER AGING		
Deck	TEST A	TEST B
1	10	11
2	10	11
3	10	10
4	10	10
5	10	11
6	10	10
7	10	10
8	10	10
NOTES: 1 Values are maximum found in microamperes.		
2 Test voltage applied between:		
Test A- Open Circuit contacts		
Test B- Closed contacts and non current carrying parts.		



ELECTRO SWITCH
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ENGINEERING TEST REPORT

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DATE: JUNE 24, 2016

PREPARED BY: DAN MENARD

APPROVED BY: LARRY FRIEDMAN

DATE STARTED: 6/14/16	TEST: Insulation Resistance	ORDER NUMBER: Not applicable
DATE COMPLETED: 6/14/16	TEST SPEC: ESC-STD 1000 (Rev 3) para. 4.6.4	
TEMPERATURE: 23.7C	SAMPLE NO/DESCRIPTION: Original sample	TEST CONDUCTED BY: DM
HUMIDITY: 49%		
REQUIREMENT: When the product is tested as specified at 500VDC $\pm 10\%$ for 1 minute, the insulation resistance shall be greater than 100 megohms.		
AFTER AGING		
Deck	TEST A	TEST B
1	>550	>550
2	>550	>550
3	>550	>550
4	>550	>550
5	>550	>550
6	>550	>550
7	>550	>550
8	>550	>550
NOTES: 1 Values are maximum found in megohms (K=1,000)		
2 Test voltage applied between:		
Test A- Open Circuit contacts		
Test B- Closed contacts and non-current carrying parts.		



ELECTROSWITCH
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Attachment B

ENGINEERING TEST REPORT

REPORT NO. 8630-1

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DATE: JUNE 24, 2016

PREPARED BY: DAN MENARD

APPROVED BY: LARRY FRIEDMAN

DATE STARTED: 6/16/15	TEST: Contact Resistance	ORDER NUMBER: Not applicable
DATE COMPLETED: 6/16/16	TEST SPEC: ESC-STD-1000 (Rev. 3) para. 4.6.5	
TEMPERATURE: 23.7C	SAMPLE NO/DESCRIPTION: Original sample	TEST CONDUCTED BY: DM
HUMIDITY: 49%		
REQUIREMENT: When the product is tested as specified, the contact resistance shall not exceed 10 milliohms at rated current of 20A. The products shall be operated once prior to taking measurements to cleanse the contact.		
Sample	CONTACT CIRCUIT:	MAXIMUM OF READING
1	11-12	5.89
	21-22	4.30
	31-32	8.74
	41-42	1.51
	51-52	3.05
	61-62	8.43
	71-72	2.90
	81-82	2.14
NOTES: 1. Values are the average of five measurements in milliohms		