

Northeast Utilities  
Millstone - Unit 3


Independent Corrective Action Verification Program  
(ICAVP)

Modification Review Checklist

CK-MP3-03-10, Rev. 1


Electrical Equipment Qualification Review Checklist

Prepared by: S. YASSIN  
Name

  
(ON FILE)  
Signature

9/10/97  
Date

Approved by: A. A. NEIRI  
Name

  
(ON FILE)  
Signature

9/10/97  
Date

IMPLEMENTATION

System	
Modification No. / Rev. No.	
Verified by:	Date:
SRG Concurrence by:	Date:

Electrical Equipment Qualification Review

Instructions

This checklist shall be used for the design process document review process described in PI-MP3-02 and for the modification review process described in PI-MP3-03.

1. The Lead Verifier shall enter the System, and if applicable, the Modification Number/ Description, on the checklist cover sheet.
2. [If reviewing a modification, the Lead Verifier or Discipline Verifier shall first determine whether the modification includes the addition of electrical components subject to Equipment Qualification requirements. If no such components are being added by the modification, Attachments A through F are not applicable, and the Verifier shall complete Attachment G only. For all other modifications, and for the system review, Attachments A through F shall be completed (as applicable) as instructed below.] The Lead Verifier or Discipline Verifier shall determine which electrical components in the System or Modification are subject to environmental qualification, and shall list those components on Attachment A of this checklist. (Note that components which are identical or similar may be grouped on Attachment A, such that the environmental qualification review may cover a group of components. Grouping in this fashion should be based not only on component similarity, but also on the Millstone environmental qualification documentation.) All components listed on Attachment A shall be reviewed using, as a minimum, Attachment B of this checklist, entitled "Environmental Qualification Review of Class 1E Equipment." In addition, specific categories of electrical components shall also be reviewed using the specialized checklists in Attachment C, D, E, or F, as follows:

<u>Component Category</u>	<u>Use Attachment B plus</u>
Cable & Splices	C
Electrical Penetrations	D
Valve Actuators	E
AC Induction Motors	F

Attachment G shall be completed for all modifications.

Use of one of the additional checklists shall be indicated on Attachment A in the space provided. When Attachment A has been completed for the applicable System or Modification, print, sign, and date the bottom of Attachment A.

3. Based on Attachment A, the Lead Verifier or Discipline Verifiers shall complete Attachment B for all components and Attachments C, D, E, or F for specific categories of components, as required. The checklists shall be numbered sequentially within each category, i.e., Attachment B checklist numbered 1 through x, etc., with the last one identified as "Final." When filling out the Attachments, the following shall be observed:
  - a. An answer shall be provided to each question, no questions are to be left blank.
  - b. Not Applicable (N/A) shall only be used where an "N/A" blank is provided in the checklist.
  - c. Whenever the answer to a question is "No", meaning that the environmental qualification aspect being reviewed is unsatisfactory, a Comment No. shall be entered in the right hand column of the checklist, and a comment shall be entered on the Comment Sheet, provided at the end of the Attachment. Comments shall be numbered sequentially within an individual attachment.





Attachment B  
Review of EQ for Class 1E Electrical Equipment

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Spec No. and  
Title: \_\_\_\_\_

Vendor: \_\_\_\_\_

Equipment Name/Description: \_\_\_\_\_

Equipment Model Number(s): \_\_\_\_\_

Qualification Report No., Title, Revision, and Date: \_\_\_\_\_

Qualification Report Status:  Approved by Vendor  Not Approved by Vendor  
Source for Environmental Conditions: \_\_\_\_\_

A. **CONCLUSION OF REVIEW**

Accepted  Rejected

Comments: \_\_\_\_\_  
\_\_\_\_\_

B. **METHOD OF QUALIFICATION**

Type Testing  Analysis  Operating Experience  
 Other: \_\_\_\_\_

C. **INSTRUCTIONS**

C1. Review all reports against Section B, D, and E and (depending on the qualification method shown in B) against the applicable Section(s) F, G, and/or H.

\*C2. In the space provided for comments after each question.

- (a) If the answer to the question is "yes", reference the report section where the information can be found.
- (b) If the answer to the question is "no", indicate if the exclusion of information is acceptable or unacceptable and state the basis for the decision (attach justification, if necessary).

**Attachment B**  
**Review of EQ for Class 1E electrical Equipment**

(c) If the answer to the question is "not applicable", explain the basis for the decision.

C3. If a component-unique checklist is used for this review, Sections F through I of this checklist, may not be required and Section D3 must identify the unique checklist

C4. For equipment located in mild environments, use only the applicable sections of this checklist.

\*The reviewer need not provide specific references for each question in order to satisfy (a), (b), and (c) requirements whenever, in his judgment, such information is not necessary.

**D. REFERENCES**

D1. IEEE 323 (1974) - "IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations."

D2. NUREG-0588 (July 1981) - "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment."

D3. Other. Specify \_\_\_\_\_

**E. EQUIPMENT DESCRIPTION**

E1. Has all the equipment in the report been identified by manufacturer and model number?

E2. Is the equipment listed in the report identical to that being supplied under the specification?

**F. QUALIFICATION BY TYPE TESTING**

F1. Performance Requirements: Does the report outline the equipment and characteristics needed to judge performance [Refs. D1: Sec. 6.3.1.1(6) and D2: Sec. 2.2(7)]?

F2. Acceptance Criteria: Based on the identified performance measurements, does the report identify the limiting values of these measurements which would constitute failure [Refs. D1: 6.3.1.1(9) and D2: Sec. 2.2(1)]?

YES      NO      Comment #      N/A

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Attachment B**  
**Review of EQ for Class 1E electrical Equipment**

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	<u>YES</u>	<u>NO</u>	<u>Comment #</u>	<u>N/A</u>
F3. <u>Test Sequence:</u> Has the equipment been tested to the following required sequence: inspection of equipment for damage, performance measurements, aging (wear, thermal, radiation), DBA exposure, performance measurement, and inspection? (Refs. D1: Sec. 6.3.2 and D2: Sec. 2.3)	---	---	---	---
F4. <u>Actual Type Testing:</u> Use the following References: Aging, D1: Sec. 6.3.3 and D2: Sec. 4.0; Quantities, D1: Sec. 6.3.1.1(2); Mounting, D1: Sec. 6.3.1.2; Connections, D1: Sec. 6.3.1.3; DBA, D1: Sec. 6.3.2(6) and D2: Sec. 2.2.				
F4.1 <u>Thermal Aging:</u>				
F4.1.1 Does the report identify the number of samples of equipment to be thermally aged?	---	---	---	---
F4.1.2 Does the report describe how the equipment is mounted during thermal aging?	---	---	---	---
F4.1.3 Does the mounting description provided in the report reflect the installation design?	---	---	---	---
F4.1.4 Have the accelerated aging parameters been identified (time and temperature)?	---	---	---	---
F4.1.5 Have the equivalent real time and temperatures been identified?	---	---	---	---
F4.1.6 If an activation energy is used for determining accelerated parameters, is a reference provided identifying the source of the activation energy value?	---	---	---	---
F4.1.7 If a regression line is used for determination of accelerated values, are the following provided?				
a. Test points identified on the line	---	---	---	---
F4.1.8 Was the equipment operated during thermal aging?	---	---	---	---
F4.2 <u>Radiation Aging:</u>				
F4.2.1 Does the report identify the number of samples of equipment to be irradiated?	---	---	---	---

Attachment B  
Review of EQ for Class 1E electrical Equipment

	YES	NO	Comment #	N/A
F4.2.2 Does the report identify the test radiation source type?	---	---	---	---
F4.2.3 Is the exposure dose acceptable?	---	---	---	---
F4.3 <u>Cyclic or Wear Aging:</u>				
F4.3.1 Does the report identify the number of samples of equipment to be cycle aged?	---	---	---	---
F4.4 Does the report address qualification to the normal operating conditions of ambient humidity and pressure (these items may be addressed through a LOCA or HELB test)?	---	---	---	---
F4.5 Does the report describe loads (or load combination) applied to the equipment during testing?	---	---	---	---
F4.6 Does the applied loads reflect normal operating conditions?	---	---	---	---
F4.7 <u>Synergistic Effects: (Ref. D2, Sec. 4.3):</u>				
F4.7.1 Does the report address synergistic effects?	---	---	---	---
F4.8 <u>DBA</u>				
F4.8.1 Does the report identify the number of samples of equipment to be typed tested?	---	---	---	---
F4.8.2 Was the equipment operated throughout its range of anticipated input power requirements? (E.g., voltage, current, power, frequency, pressure, etc.)	---	---	---	---
F4.8.3 Were performance measurements taken before/during/after DBA exposure?	---	---	---	---
F4.8.4 Does the report include qualification of equipment for the specified post-DBA time period? Post-DBA is considered to be the extended time period (e.g., time period out to one year or 100 days) following the exposure to elevated temperature and pressure.	---	---	---	---
F4.8.5 Was chemical spray and/or demineralized water spray introduced during LOCA exposure?	---	---	---	---
F4.9 <u>Seismic:</u> Were seismic tests performed on aged samples?	---	---	---	---



Attachment B  
Review of EQ for Class 1E electrical Equipment

	YES	NO	Comment #	N/A
F4.10 <u>Anomalies:</u> Were any anomalies identified in the report?	---	---	---	---
F5. <u>Service Conditions:</u>				
F5.1 Does the report identify values for the normal plant service conditions for which the equipment is qualified?	---	---	---	---
F5.2 Do these test values (in F5.1) outlined in the report envelope the specified requirements?	---	---	---	---
F5.3 Identify the type of DBA tested for in the report:				
<input type="checkbox"/> LOCA				
<input type="checkbox"/> HELB				
<input type="checkbox"/> Combination LOCA/HELB				
<input type="checkbox"/> Seismic				
<input type="checkbox"/> Other: (list in Comments Section)				
F6. <u>Margin:</u> For all service conditions, does the report address and identify the degree of applied margin? Refs. D1: Sec. 6.3.1.5 and D2: Sec. 3.	---	---	---	---
F7. <u>Submergence:</u> Does the report qualify the equipment for long term submergence?	---	---	---	---
F8. <u>Environmental Variables:</u> Does the report identify the environmental variables monitored to simulate the service conditions?	---	---	---	---
F9. <u>Test Equipment:</u>				
F9.1 Does the report outline the test equipment (meters, volt meters, etc.) used during testing?	---	---	---	---
F9.2 Have test equipment accuracies and latest date of calibration been documented?	---	---	---	---
F10. <u>Test Results and Conclusions:</u> Have the results of all type tests been identified? Has a conclusive statement been made regarding the equipment's qualified life?	---	---	---	---
F11. <u>Maintenance and Inspection:</u> Do the maintenance and inspection requirements consist of nondestructive tests and realistic requirements for inspection?	---	---	---	---



Attachment C  
Review of EQ for Class 1E Electrical Cables and Splices

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Checklist No. \_\_\_\_\_ Component No.(s) \_\_\_\_\_

Specification Number: \_\_\_\_\_

Qualification Report No.,  
Title, Rev., & Date: \_\_\_\_\_

A. REFERENCES

In addition to References D1 and D2 in Attachment B, the following documents were used as a basis for developing this qualification checklist:

- A1. IEEE 383 (1974) - "IEEE Standard for Type Test of Class 1E Electric Cables, Field Splices, and Connections for Nuclear Power Generating Station."
- A2. ICEA S-68-516 (1984) - "ICEA/NEMA Standards Publication for Ethylene-Propylene-Rubber Insulated Wire and Cable."
- A3. ICEAS-66-524 (1984) - "ICEA/NEMA Standards Publication for Cross-Linked Thermosetting Polyethylene Insulated Wire and Cable."
- A4. AEIC CS6-82 - "Specifications for Ethylene-Propylene-Rubber Insulated Shielded Power Cables Rated 5 through 69kV," 4th Edition.
- A5. AEIC CS5-82 - "Specifications for Thermoplastic and Cross-Linked Polyethylene Insulated Shielded Power Cables Rated 5 through 69 kV," 8th Edition.
- A6. 1978 Annual Book of ASTM Standards, Parts 39 & 40 - Electrical Insulation.
- A7. 1977 Annual Book of ASTM Standards - Copper and Copper Alloys.
- A8. U.S. NRC Regulatory Guide 1.131 - "Qualification Tests of Electric Cables, Field Splices, and Connections for Light-Water-Cooled Nuclear Power Plants" (8/77).

Attachment C  
Review of EQ for Class 1E Electrical Cables and Splices

	YES	NO	Comment #	N/A
<b>B. QUALIFICATION BY TYPE TESTING</b>				
B1. Identification. Does the report identify the following?				
B1.1 Conductor (Refs. A2, A3, and A6)				
Material, Size, Stranding, Coating	---	---	---	---
B1.2 Insulation (Refs. A2, A3, and A4)				
Material, Thickness	---	---	---	---
B1.3 Assembly (for multiconductors only) (Refs. A2 and A3). Number and arrangement of conductors.	---	---	---	---
B1.4 Shielding (Refs. A2 and A3).	---	---	---	---
B1.5 Jacket (Refs. A3 and A3). Type, Thickness	---	---	---	---
B1.6.1 Rated voltage/current	---	---	---	---
B1.6.2 Operating temperature rating (Refs. A4 and A5).	---	---	---	---
B2. Testing to Qualify for Normal Operation	---	---	---	---
B2.1 Does the report cover the temperature and moisture resistance?	---	---	---	---
B2.2 Long term thermal aging properties:				
B2.2.1 Does the report identify the number of samples used for evaluating the long term thermal aging properties?	---	---	---	---
B2.2.2 Have the long term thermal aging parameters been identified (time(s) and temperature(s))?	---	---	---	---
B.2.2.3 Was the equipment operated during the collection of these parameters?	---	---	---	---
B2.2.4 have the equipment real time and temperature been identified?	---	---	---	---
B2.2.5 If an activation energy is used for determining acceleration parameters, is a reference provided identifying the source of	---	---	---	---

Attachment C  
Review of EQ for Class 1E Electrical Cables and Splices

	the activation energy value?				
B2.2.6	If a regression line is used for determining acceleration values, are the following provided?				
	Test points identified on the line?	—	—	—	—
B2.3	Thermal and radiation exposure:				
B2.3.1	Does the report identify the number of samples that received thermal and radiation aging?	—	—	—	—
B2.3.2	Does the report identify the time and temperature used for thermal aging?	—	—	—	—
B2.3.3	Was the equipment operated during the thermal aging?	—	—	—	—
B2.3.4	Does the report identify the test radiation source type?	—	—	—	—
B2.3.5	Is the exposure dose acceptable?	—	—	—	—
B2.4	Do the parameters in B.2. and B2.3 meet the specification requirements?	—	—	—	—
B2.5	Synergistic effects				
B2.5.1	Does the report address synergistic effects?	—	—	—	—
B3.	Service Conditions:				
B3.1	Does the report identify values for the normal plant service conditions for which the equipment is qualified?	—	—	—	—
B3.2	Do these test values (in B3.1) envelop the specification requirements?	—	—	—	—
B4.	Testing for Operation During DBA.				
B4.2	Identify the type of DBA tested for in the report.				
	<input type="checkbox"/> LOCA		<input type="checkbox"/> HELB		
	<input type="checkbox"/> Combination LOCA/HELB		<input type="checkbox"/> Seismic		
	<input type="checkbox"/> Other: (List in Comment Section)				
B4.3	Does the report identify values for the DBA testing conditions for which the equipment is qualified?	—	—	—	—

Attachment C  
Review of EQ for Class 1E Electrical Cables and Splices

	YES	NO	Comment #	N/A
B.4.4 Post LOCA simulation (Reg. A1):				
B4.4.1 Voltage withstand test.	---	---	---	---
B4.4.2 Insulation resistance.	---	---	---	---
B4.5 Do the test parameters in B4.1 through B4.4 meet the specification requirements?	---	---	---	---
B4.6 Have the type tests been performed in accordance with the following sequence: Thermal, radiation aging, and DBA?	---	---	---	---
B5 Flame Tests (Reg. A1) Vertical Tray.	---	---	---	---
B5.1 Does the report identify the following:	---	---	---	---
B5.1.2 Evaluation.	---	---	---	---
B5.1.3 Test specimen data.	---	---	---	---
B5.2 Do the test parameters in B5.1 meet the specification requirements?	---	---	---	---
B6. <b>Margin:</b> For all service conditions, does the report address and identify the degree of applied margin?	---	---	---	---
B7. <b>Test Equipment:</b> Does the report outline the test equipment used (meters, volt meters, etc.), accuracies and latest date of calibration?	---	---	---	---
B8. <b>Maintenance and Inspection:</b> Do the maintenance and inspection requirements consist of nondestructive tests and realistic requirements of inspection?	---	---	---	---



Attachment D  
Review of EQ for Class 1E Electrical Penetration

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Checklist No. \_\_\_\_\_ Component No.(s) \_\_\_\_\_

Specification Number: \_\_\_\_\_

Qualification Report No.,  
Title, Rev., & Date: \_\_\_\_\_

A. REFERENCES

In addition to References D1 and D2, the following documents were used as a basis for developing this qualification checklist:

- A1. "IEEE 317 (1983) - IEEE Standard for Electric Penetration Assemblies in Containment Structures for Nuclear Power Generating Stations."
- A2. U.S. NRC Regulatory Guide 1.63 - "Electric Penetration Assemblies in Containment Structures for Light Water Cooled Nuclear Plants" (Revision 2, July 1978)
- A3. ANSI C96.1-1964 - "Temperature Measurement Thermocouple"
- A4. ANSI K65.21-1965 - "Method of Test for Flammability of Self-Supporting Plastics" (ASTM D635-68).
- A5. ANSI K65.12001971 - "Method of Test for Flammability of Flammable Plastics" (ASTM D568-69).
- A6. ANSI N45.2.2-1972 - "Packaging, Shipping, Receiving Storage and Handling of Items for Nuclear Power Plants (During the Construction Phase)."
- A7. IEEE 98 (1984) - "Guide for the Preparation of Test Procedures for the Thermal Evaluation and Establishment of Temperature Indexes of Solid Electrical Insulating Materials."
- A8. IEEE 101 91972) - "Guide for the Structural Analysis of Thermal Life Test Data."
- A9. IEEE 336 (1985) - "Installation, Inspection, and Testing Requirements for Instrumentation and Electric Equipment During the Construction of Nuclear Power Generating
- A10. IEEE 383 91974) - "Standard for type Test of Class 1E Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations" (for pigtail and socket connections).



Attachment D  
Review of EQ for Class 1E Electrical Penetration

	YES	NO	Comment #	N/A
A11. IPCEA-S-19-81 (NEMA WC-3) - "Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy" 91984)				
A12. ASME Boiler & Pressure Vessel Code, Section III, Subsection NE, 1974 Edition.				
<b>B. QUALIFICATION BY TYPE TESTING</b>				
B1. <b>Quantities.</b> Does the report identify the quantity of penetration assemblies or feedthroughs for each phase of type testing?	---	---	---	---
B2. <b>Mounting.</b>				
B2.1 Does the report describe the mounting of the penetration assemblies during each phase of type testing?	---	---	---	---
B3. <b>External Connections.</b>				
B3.1 Does the report describe how external connections are made to the penetration assemblies during each phase of type testing?	---	---	---	---
B4. <b>Performance Requirements.</b> Does the report consider and identify the following characteristics / Ratings needed to judge performance?  Temperature, Voltage, Continuous Current, Short-Time Current and duration, Maximum Gas Leakage Rate, Maximum Duration of Rated Short Circuit Current	---	---	---	---
B5. <b>Acceptance Criteria.</b> Based on the identified performance characteristics, does the report identify the limiting values of the measurements which would constitute failure/acceptance for the following tests?	---	---	---	---
B5.1 Insulation type tests.				
Dielectric strength test (each medium voltage power conductor must be given an impulse withstand test)	---	---	---	---
Insulation resistance test	---	---	---	---
Partial-discharge (Corona) test (medium voltage power	---	---	---	---

Attachment D  
Review of EQ for Class 1E Electrical Penetration

conductors only)				
B5.2 Continuous current rating test.	---	---	---	---
B5.3 Short-time overload (STOL) current rating and duration test.	---	---	---	---
B5.4 Short circuit current rating and duration test.	---	---	---	---
B5.5 Rated maximum duration of rated short circuit current test.	---	---	---	---
B5.6 Pneumatic pressure rating test.	---	---	---	---
F.5.7 Maximum gas leakage rate test.	---	---	---	---
<b>B6. Type Tests.</b> Were the following performed?				
B6.1 Gas leak rate test (may be combined with pneumatic pressure test).	---	---	---	---
B6.2 Pneumatic pressure test (may be combined with gas leak test).	---	---	---	---
B6.3 Conductor continuity test.	---	---	---	---
B6.4 Dielectric strength test.	---	---	---	---
B6.5 Impulse test (for medium voltage power conductors only).	---	---	---	---
B6.6 Insulation resistance test.	---	---	---	---
B6.7 Partial-discharge (Corona) test (medium voltage power conductors only).	---	---	---	---
B6.8 Rated continuous current test.	---	---	---	---
B6.9 Cycling and aging tests.				
Shipping and storage simulation	---	---	---	---
Installation welding test	---	---	---	---
Thermal cycle test	---	---	---	---
Thermal aging (simulation or normal service conditions)				
Radiation aging (normal service environment exposure)	---	---	---	---

**Attachment D**  
**Review of EQ for Class 1E Electrical Penetration**

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	YES	NO	Comment #	N/A
B6.10 <b>Acceptance tests.</b>				
Gas leak rate test	---	---	---	---
Dielectric resistance test	---	---	---	---
Insulation resistance test	---	---	---	---
Conductor continuity test	---	---	---	---
B6.11 <b>Synergistic effects:</b>				
B6.11.1 Does the report address synergistic effects?	---	---	---	---
B6.12 Rated short-time overload (STOL) current test.	---	---	---	---
B6.13 Short circuit current and duration test.	---	---	---	---
B6.14 Seismic testing.	---	---	---	---
B6.15 Rated continuous current test.	---	---	---	---
B6.16 Design Basis Event tests	---	---	---	---
B6.17 Rated maximum duration of rated short circuit current test.	---	---	---	---
B6.18 A final gas leak rate test.	---	---	---	---
B6.19 Was the test sequence of B6.1 through B6.18 followed?	---	---	---	---
B7. <b>Service Conditions:</b>				
B7.1 Does the report identify values for the normal and abnormal service conditions for which the penetration assemblies are qualified?	---	---	---	---
B7.2 Identify the type of DBA tested for in the report.				
<input type="checkbox"/> LOCA <input type="checkbox"/> HELB				
<input type="checkbox"/> Combination LOCA/HELB <input type="checkbox"/> Seismic				
<input type="checkbox"/> Other: (List in Comment Section)				
B7.3 Do the service condition parameters (in B7.1) envelope the specification requirements?	---	---	---	---
B8. <b>Material tests:</b>				

Attachment D  
Review of EQ for Class 1E Electrical Penetration

	YES	NO	Comment #	N/A
B8.1 Time and temperature aging:				
B8.1.1 Have the acceleration aging parameters been identified (times and temperatures)?	---	---	---	---
B8.1.2 Have the equivalent real time and temperatures been identified?	---	---	---	---
B8.1.3 If an activation energy is used for determining acceleration parameters, is the source of the activation energy value identified?	---	---	---	---
B8.1.4 If a regression line is used for determining acceleration values, are the following provided?				
Test points identified on the line?	---	---	---	---
B8.2 Radiation:				
B8.2.1 Does the report identify the test radiation source type?	---	---	---	---
B8.2.2 Is the exposure rate provided?	---	---	---	---
B8.3 Fire resistance:				
B8.3.1 Have the insulated conductors been qualified in accordance with Ref. A10?	---	---	---	---
B9. DBA Testing:				
B9.1 Does the report identify values for the abnormal plant service conditions for which the equipment is qualified?	---	---	---	---
B9.2 Were insulation resistance for Class 1E conductors and pressure and temperature of the assembly monitored periodically during the DEA testing to verify specified performance?	---	---	---	---
B9.3 Was the equipment exposed to the entire time frame of the accident as called for in the specification?	---	---	---	---
B9.4 Does the report include qualification of equipment for the specified post-DBA time period?	---	---	---	---

Attachment D  
Review of EQ for Class 1E Electrical Penetration

	YES	NO	Comment #	N/A
<b>B10. Margin:</b>				
B10.1 Were the following minimum test margins applied to the service conditions for which the electric penetration is qualified?				
+5% of rated current values	---	---	---	---
+10% of rated voltage values	---	---	---	---
+8°C (+15°F)	---	---	---	---
+10% of gauge pressure, but not more than $7 \times 10^4$ Pa (10 lbf/in <sup>2</sup> )	---	---	---	---
+10% added to the acceleration of the response spectrum at the mounting point of the penetration assembly	---	---	---	---
+10% radiation (on accident dose)	---	---	---	---
B10.2 If the qualification testing were conducted under saturated steam conditions, was the temperature margin such that the test pressure did not exceed the saturated steam pressure (corresponding to peak service temperature) by more than $7 \times 10^4$ Pa (10 lbf/in <sup>2</sup> )?	---	---	---	---
B11. <b>Environmental Variables.</b> Does the report identify the environmental variables monitored to simulate the specified service conditions?	---	---	---	---
<b>B12. Test Equipment:</b>				
B12.1 Does the report outline the test equipment (meters, voltmeters, etc.) used during testing?	---	---	---	---
B12.2 Have test equipment accuracies and latest date of calibration been documented?	---	---	---	---
B13. <b>Test Results and Conclusions.</b> Have the results of all type tests been identified? Has a conclusive statement been made regarding the penetration's qualified life?	---	---	---	---
B14. <b>Maintenance and Inspection.</b> Do the maintenance and inspection requirements consist of nondestructive tests and realist requirements for inspection?	---	---	---	---



Attachment E  
Review of EQ for Class 1E Electric Valve Actuators

Checklist No. \_\_\_\_\_ Component No.(s) \_\_\_\_\_

Specification Number: \_\_\_\_\_

Qualification Report No.,  
Title, Rev., & Date: \_\_\_\_\_

A. REFERENCES

In addition to References D1 and D2 in Attachment B, the following documents were used as a basis for developing this qualification checklist:

	<u>YES</u>	<u>NO</u>	<u>Comment #</u>	<u>N/A</u>
<b>B. <u>EQUIPMENT IDENTIFICATION</u></b>				
B1. Does the qualification report identify the samples and the bases on which samples were selected to represent a generic actuator group?	_____	_____	_____	_____
B2. Is the equipment listed in the report identical to that is being supplied under the specification?	_____	_____	_____	_____
B3. Does the report include the document requirements specified in Ref. A1, Sec. 7.2 and 7.3?	_____	_____	_____	_____
<b>C. <u>QUALIFICATION BY ANALYSIS</u></b>				
Does the analysis include the following details?				
C1. Identification of Valve Actuators' performance requirements.	_____	_____	_____	_____
C2. A listing of qualified service conditions.	_____	_____	_____	_____
C3. Do the service conditions envelop the plant operating conditions?	_____	_____	_____	_____
C4. Do the mounting method and external connections of the Valve Actuator in the report simulate plant conditions?	_____	_____	_____	_____
<b>C5. <u>Mathematical Model:</u></b>				
C5.1 Description of mathematical model (a regression analysis is considered a mathematical model).	_____	_____	_____	_____
C5.2 Principles by which model was developed (e.g., standards.	_____	_____	_____	_____

**Attachment F**  
**Review of EQ for Class 1E AC Induction Motors**

	test data, operating experience)				
C5.3	A listing of the environmental variables monitored which affect equipment performance.	_____	_____	_____	_____
C5.4	Justification for any environmental variable not listed in C5.3.	_____	_____	_____	_____
C5.5	Model identified such that equipment performance is a function of time and variables as listed in C5.3.	_____	_____	_____	_____
C6.	<b>Extrapolation of the Model:</b>				
C6.1	Identification of postulated equipment failure modes.	_____	_____	_____	_____
C6.2	The postulated failure modes for the equipment should be shown to be the same as those produced by the model.	_____	_____	_____	_____
C6.3	The extrapolation of the model to the desired life must be justified by using:				
	a. Confidence bounds.	_____	_____	_____	_____
	b. Thermal testing of a component based on the aging rate of the regression line and to same failure criteria.	_____	_____	_____	_____
	c. Through surveillance requirements.	_____	_____	_____	_____
	d. Other (List in Comment Section)	_____	_____	_____	_____
C6.4	Description of Analytical Methods. A written explanation of how the model was selected to represent a generic actuator group and the parameters on which the selection was based.	_____	_____	_____	_____
C7.	A comparison of the Valve Actuator to be qualified to the qualified generic Valve Actuator:	_____	_____	_____	_____
C8.	Determination of qualified life. The model must demonstrate that the equipment performance exceeds requirements for an environment as severe as that anticipated in service.	_____	_____	_____	_____
C9.	Maintenance. A description of periodic maintenance and replacement requirements.	_____	_____	_____	_____





Attachment F  
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Checklist No. \_\_\_\_\_ Component No.(s) \_\_\_\_\_

Specification Number: \_\_\_\_\_

Qualification Report No.,  
Title, Rev., & Date: \_\_\_\_\_

A. REFERENCES

In addition to References D1 and D2 in Attachment B, the following documents were used as a guide in developing this qualification checklist:

- A1. IEEE 43-1974 - "Recommended Practice for Testing Insulation Resistance of Rotating Machinery."
- A2. IEEE 56-1977 - "Guide for Insulation Maintenance for Large Alternating Current Rotating Machinery."
- A3. IEEE 62-1978 - "Guide for Field Testing Power Apparatus Insulation."
- A4. IEEE 98-1984 - "guide for the Preparation of Test Procedures for the Thermal Evaluation and Establishment of Temperature Indices of Solid Electrical Insulation Materials."
- A5. IEEE 99-1980 - "Recommended Practice for the Preparation of Test procedures for the Thermal Evaluation of Insulation Systems for Electrical Equipment."
- A6. IEEE 101-1972 - "guide for the Statistical Analysis of Thermal Life Test Data."
- A7. IEEE 117-1974 - "Standard Test procedure for Evaluation of Systems of Insulating Materials for Random-Wound AC Electric Machinery."
- A8. IEEE 275-181 - "Recommended Practice for Thermal Evaluation of Insulation Systems for AC Electric Machinery Employing Form-Wound Preinsulated Stator Coils (machine Rated 6900V and Below."

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- |   | <u>YES</u> | <u>NO</u> | <u>Comment #</u> | <u>N/A</u> |
|---|------------|-----------|------------------|------------|
| A9. IEEE 334-1974 - "Standard for Type Tests of Continuous Duty Class 1E Motors for Nuclear Power Generating Standards."                                    |            |           |                  |            |
| A10. IEEE 429-1972 - "Standard Test Procedure for the Evaluation of Sealed insulation Systems for AC Electric Machinery Employing Form-Wound Stator Coils." |            |           |                  |            |
| A11. NEMA MG-1-1978 - "ANSI/NEMA Standards Publication, Motors and Generators."   |            |           |                  |            |

B. QUALIFICATION BY TYPE TESTING

- |   |     |     |     |     |
|---|-----|-----|-----|-----|
| B1. Identification. Does the qualification report identify the following? |     |     |     |     |
| B1.1 Coil Construction (check one)  | --- | --- | --- | --- |
| B1.2 Insulation Class (Ref. A11)  | --- | --- | --- | --- |
| For B1.3 through B1.7, indicate type and material                         | --- | --- | --- | --- |
| B1.3 Temperature Values (Ref. A11)  |     |     |     |     |
| Ambient Temperature   | --- | --- | --- | --- |
| Temperature rise by resistance  | --- | --- | --- | --- |
| B1.4 Lubricant: Manufacturer / Type                                       | --- | --- | --- | --- |
| B1.5 Bearings Type  | --- | --- | --- | --- |
| B1.6 Seals  | --- | --- | --- | --- |
| B1.7 Auxiliary Devices  |     |     |     |     |
| Space Heaters   | --- | --- | --- | --- |
| Stator Resistance Temperature Detectors                                   | --- | --- | --- | --- |
| Bearing Thermocouples   | --- | --- | --- | --- |

Attachment F  
Review of EQ for Class 1E AC Induction Motors

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Insulated Lugs	---	---	---	---
Stator Lead Cables	---	---	---	---
Other	---	---	---	---
B2. Regression Analysis				
B2.1 <b>Motorette Construction:</b> Is the description or reference in accordance with one of the following:				
Random Wound (Sec. 2.1, IEEE 429)	---	---	---	---
Form Wound (Section 2.1, IEEE 429)	---	---	---	---
B2.2 <b>Quantities of Motorettes and Test Temperatures</b>				
Were at least 3 test temperatures used?	---	---	---	---
Were at least 10 motorettes per temperature used?	---	---	---	---
B2.3 <b>Motor Insulation System:</b>				
B2.3.1 <b>Motor Insulation:</b> Does the report state that the insulation on the motorettes is the same as the insulation used on actual motors?				
	---	---	---	---
B2.3.2 <b>Motor Lead Insulation:</b> Does the report state that the insulation on the motorettes is the same as the insulation used on actual motors?				
	---	---	---	---
B2.4 <b>Test Cycle and Voltage Checks:</b> Are the test cycle and voltage checks as described or referenced in accordance with one of the following:				
Random-Wound (Test Cycle, Sec. 2.2, IEEE 117) (Voltage Checks, Sec. 2.3, IEEE 117)	---	---	---	---
Form-Wound (Test Cycle, Sec. 2.2, IEEE 429) (Voltage Checks, Sec. 2.3, IEEE 429) (Test Cycle, Part 2, Sec. 2, IEEE 275) (Voltage Checks Part 2, Sec. 3, IEEE 275)	---	---	---	---
B3. <b>Qualification of Equipment:</b>				
<input type="checkbox"/> Inside Containment <input type="checkbox"/> Outside Containment				

Attachment F  
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	YES	NO	Comment #	N/A
B3.1 <b>Temperature:</b> Is the qualified life statement based on the total temperature (winding temperature rise plus ambient) rating of the insulation class? (If yes, motor is qualified for continuous operation at the qualified life value.)	---	---	---	---
<b>B3.2 Time and Temperature Aging:</b>				
B3.2.1 Have the accelerated aging parameters been defined?	---	---	---	---
B3.2.3 Are the aging parameters based on regression analysis?	---	---	---	---
<b>B3.3 Radiation:</b>				
B3.3.1 <b>Analysis</b> :Are references provided as to the source of the input data used in the analysis?	---	---	---	---
<b>B3.3.2 Type testing During Regression Development:</b>				
Were all motorettes at each test temperature used?	---	---	---	---
Is the radiation source identified?	---	---	---	---
Is the total integrated dose identified?	---	---	---	---
<b>B.3.3.3 Type Testing of New Motorettes and/or Motors:</b>				
Is the radiation source identified?	---	---	---	---
Is the total integrated dose identified?	---	---	---	---
Was an AC high potential test performed at the end of radiation testing?	---	---	---	---
B3.4 <b>Humidity:</b> Does the report identify level of humidity?	---	---	---	---
B3.5 <b>Vibration:</b> Does the report identify level of vibration?	---	---	---	---
B3.6 <b>Seismic:</b> Has the vendor submitted a seismic report for the motor?	---	---	---	---
<b>B3.7 Lubricant:</b>				
B3.7.1 Was the lubricant included in a radiation test/analysis?	---	---	---	---

Attachment F  
Review of EQ for Class 1E AC Induction Motors

	YES	NO	Comment #	N/A
B3.7.2 Was the lubricant included in a thermal aging test/a nalysis?	___	___	_____	___
B3.8 <b>Bearings:</b> Has the vendor provided the rating in accordance with the Anti-Friction Bearing Manufacturing Association Standards 9-1978 and 11-1978?	___	___	_____	___
B3.9 <b>Seals:</b>				
Were the seals included in a radiation test or analysis?	___	___	_____	___
Were the seals included in a thermal aging test or analysis?	___	___	_____	___
B3.10 <b>Test Samples:</b> For the motor to be typed tested, has the following information been provided?				
B3.10.1 Type	___	___	_____	___
B3.10.2 Frame Size	___	___	_____	___
B3.10.3 Bearing and Lubrication System	___	___	_____	___
B3.10.4 Insulation System Classification	___	___	_____	___
B3.10.5 Total Temperature Rise (°C) by Resistance	___	___	_____	___
B3.10.6 Voltage Rating	___	___	_____	___
B3.11 <b>Performance Requirements:</b>				
Does the report identify the variables that will be monitored during testing to judge performance?	___	___	_____	___
B3.12 <b>Acceptance Criteria:</b>				
Based on the variables to be monitored, have acceptance criteria been defined?	___	___	_____	___
B3.13 <b>Design Basis Event:</b>				
B3.13.1 Was the motor operated during the DBA?	___	___	_____	___
B3.13.2 Were the voltage and frequency varied?	___	___	_____	___

Attachment F  
Review of EQ for Class 1E AC Induction Motors

	YES	NO	Comment #	N/A
B3.13.3 Were performance measurements taken before, during, and after the DBA?	---	---	---	---
P3.13.4 Was chemical spray introduced?	---	---	---	---
B3.13.5 Does the temperature/pressure profile envelope the plant profile?	---	---	---	---
B3.13.6 Was the equipment exposed to the entire frame of the accident as called for in the specification?	---	---	---	---
B3.13.7 Was the exposure at least 1 hour beyond the equipments' required operability during a DBA?	---	---	---	---
<b>B4. Test Equipment:</b>				
B4.1 Does the report identify the test equipment used during the testing?	---	---	---	---
<b>B5. Test Results and Conclusion:</b>				
Does the report include the tabulated results of the performance measurements?	---	---	---	---
<b>B6. Maintenance and Inspection:</b>				
Have the maintenance and inspection requirements been defined to ensure qualified life?	---	---	---	---





Attachment G  
Review of Modification for Impact on EQ for Existing Electrical Components

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Identify potential impact of the modification on equipment qualification of existing electrical components as a result of the modification changing any of the following:

- Normal pressure, temperature, humidity or radiation dose/exposure
- Abnormal (accident) pressure, temperature, humidity or radiation dose/exposure

Discuss the specific impact, delineate how the modification addressed it, and indicate whether it was adequately addressed, and why it is adequate. If it is determined that the impact was not adequately addressed, initiate a Discrepancy Report (DR) per PI-MP3-11, and include reference to the DR number in this Attachment G. (Use the continuation page as necessary.)

The effects of the modification on EQ of existing electrical components were adequately addressed.

\_\_\_\_\_  
Yes

\_\_\_\_\_  
No

\_\_\_\_\_  
Prepared by

\_\_\_\_\_  
Date

Northeast Utilities  
Millstone Unit 3

CK-MP3-03-10

System \_\_\_\_\_

Modification No. \_\_\_\_\_

Sheet \_\_\_\_\_ of \_\_\_\_\_

Attachment G  
Review of Modification for Impact on EQ for Existing Electrical Components

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(Continuation Page)