

Project: TRICON v10 NUCLEAR QUALIFICATION PROJECT

Non -Proprietary copy per 10CFR2.390
 - Areas of proprietary information have been redacted.
 - Designation letter corresponds to Triconex proprietary policy categories (Ref. transmittal number NRC-V10-09-001, Affidavit, Section 4.)

ENVIRONMENTAL TEST REPORT

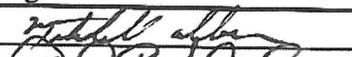
Document No: 9600164-525

Revision 0

July 17, 2007

MPR ASSOCIATES QUALITY ASSURANCE DOCUMENT

This document has been prepared, reviewed and approved in accordance with the Quality Assurance requirements of 10CFR50, Appendix B, as specified in the MPR Quality Assurance Manual and in accordance with the requirements of Invensys Triconex Purchase Order No. 113803, dated March 23, 2006.

	Name	Signature	Title
Preparer:	Mitchell Albers		MPR Project Manager
Reviewer:	David Schwade		MPR Level II Test Engineer
Approval:	Eric Claude		MPR ICT Group Manager

Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT		
Revision:	0	Page:	2 of 22	Date:	07/17/07

Document Change History			
Revision	Date	Change	Preparer
0	07/17/07	Initial Issue	M. Albers

Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT		
Revision:	0	Page:	3 of 22	Date:	07/17/07

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
1.0 EXECUTIVE SUMMARY	4
2.0 PURPOSE	6
3.0 TEST OBJECTIVE	6
4.0 DESCRIPTION OF TEST SPECIMEN	6
5.0 TEST SETUP AND INSTRUMENTATION	7
6.0 TEST PROCEDURES	10
7.0 TEST RESULTS	13
8.0 CONCLUSIONS	19
9.0 REFERENCES	21
10.0 ATTACHMENTS	

Attachment 1: Example Plots of TUT Normal Operating Data

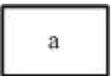
Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT		
Revision:	0	Page:	4 of 22	Date:	07/17/07

1.0 EXECUTIVE SUMMARY

The TRICON v10 Nuclear Qualification Project Environmental Test was performed on December 13, 2006 to January 15, 2007 by National Technical Systems (NTS) Laboratories using a temperature and humidity controlled test chamber at their facility in Boxborough, Massachusetts. As required by Triconex Document No. 9600164-500, “Master Test Plan,” (Reference 9.1), the Environmental Test was performed to demonstrate the TRICON v10 Programmable Logic Controller (PLC) will not experience failures due to abnormal service conditions of temperature and humidity.

MPR Procedure No. 9600164-506, “Environmental Test Procedure,” (Reference 9.2), was developed in accordance with the requirements of EPRI TR-107330, “Generic Requirements Specification for Qualifying a Commercially Available PLC for Safety-Related Applications in Nuclear Power Plants,” (Reference 9.3), Triconex Document No. 9600164-500, “Master Test Plan,” (Reference 9.1), and Triconex Document No. 9600164-002, “Nuclear Qualification Quality Plan,” (Reference 9.4). The procedure included steps to direct: 1) proper setup of the TRICON-Under-Test (TUT) prior to testing, 2) application of the required temperature and humidity exposure levels to the TUT components, 3) acquisition of TUT operational parameters during testing, and 4) evaluation of acceptable TUT performance during testing. The TUT executed a verified and validated Test Specimen Application Program (TSAP) throughout Environmental Testing. The TSAP revision used was “V10_TSAP_REV_0”. Environmental Testing was performed by MPR certified Project Test Engineers and witnessed by Triconex Project Quality Assurance.

Triconex Drawing No. 9600164-100, “TRICON v10 Nuclear Qualification Project TRICON-Under-Test, General Arrangement,” (Reference 9.5), shows the basic configuration of the TUT components for Environmental Testing.



Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT		
Revision:	0	Page:	5 of 22	Date:	07/17/07

The Environmental Test results demonstrate that the Triconex TRICON v10 PLC will not experience failures due to normal and abnormal service conditions of temperature and humidity exposure. The specific TRICON v10 PLC hardware which was tested (chassis, power supplies, modules, external termination assemblies and interconnecting cabling) is identified in Triconex Document No. 9600164-540, “Master Configuration List,” (Reference 9.6).

Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT		
Revision:	0	Page:	6 of 22	Date:	07/17/07

2.0 PURPOSE

The purpose of this test report is to summarize the results of Environmental Testing of the TRICON v10 Nuclear Qualification Project TRICON-Under-Test (TUT) to meet the requirements of Section 6.3.3 of EPRI TR-107330 (Reference 9.3). The format of this report conforms to Section 8.3.(4) of IEEE Standard 323-1974, “Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations,” (Reference 9.7).

Details regarding the performance and results of the Environmental Testing are recorded in the completed MPR Procedure No. 9600164-506, “Environmental Test Procedure,” (Reference 9.8). This completed procedure identifies additional Triconex procedures that were performed in support of Environmental Testing and provide additional testing details and results. Conclusions from the Environmental Testing are provided in Section 8.0 of this report.

3.0 TEST OBJECTIVE

Section 6.3.3 of EPRI TR-107330 (Reference 9.3) states that Environmental Testing provides assurance that the PLC system does not have failures due to (abnormal) service conditions of temperature and humidity. MPR Procedure No. 9600164-506 (Reference 9.2) reiterates this test objective. Appendix 5 of Triconex Document No. 9600164-500 (Reference 9.1) states that Environmental Testing is conducted to simulate the specified EPRI TR-107330 Environmental Test conditions (including margin) to confirm the capability of the TRICON v10 PLC to meet its performance specifications when subject to such conditions.

4.0 DESCRIPTION OF TEST SPECIMEN

The equipment tested consists of four TRICON v10 PLC chassis populated with selected main processor, input, output, communication, chassis interface and chassis power supply modules. The tested equipment also includes external termination panels (ETPs) provided for connection of field wiring to the TRICON v10 input and output modules, and interfacing cable assemblies for connection of the ETPs to the TRICON v10 chassis and for interconnection of the TRICON v10 chassis.

Triconex Drawing No. 9600164-100 (Reference 9.5), shows the basic configuration of the TUT components for Environmental Testing. Triconex Drawing No. 9600164-103, “TRICON v10 Nuclear Qualification Project System Block Diagram,” (Reference 9.9), shows the general arrangement and interconnection of the TUT chassis. Triconex Document No. 9600164-541, “TRICON v10 Nuclear Qualification Project, System Description,” (Reference 9.10), provides an overview and description of the TUT and test system. A detailed identification of the tested equipment is provided in Triconex Document No. 9600164-540 (Reference 9.6).

Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT		
Revision:	0	Page:	7 of 22	Date:	07/17/07

During testing, the TUT was executing a Test Specimen Application Program (the TSAP) developed specifically for the qualification project and designed to support the test procedures, which demonstrate the functionality of the TUT during all phases of qualification testing. Requirements for operation of the TSAP are defined in Triconex Document No. 9600164-517, “Test Specimen Application Program (TSAP) Software Requirements Specification (SRS),” (Reference 9.11). The completed MPR Procedure No. 9600164-506 (Reference 9.8) identifies the TSAP revision used during this testing as “V10_TSAP_REV_0”. Triconex Document No. 9600164-540 (Reference 9.6) identifies the revision level of all TUT firmware.

5.0 TEST SETUP AND INSTRUMENTATION

The following sections describe the setup of the TUT during Environmental Testing, the instrumentation used to measure the applied temperature and humidity test conditions, and the instrumentation used to measure TUT performance during testing. The TUT setup is documented in the completed MPR Procedure No. 9600164-506 (Reference 9.8). Specifications for test instrumentation supplied by NTS Laboratories are included in NTS Test Procedure No. TP62987-07N-ENV, “Test Procedure for Environmental Exposure of the TRICON v10 Nuclear Qualification Project TRICON-Under-Test,” (Reference 9.12).

5.1 TRICON-Under-Test Mounting

Section 6.3.3.1 of EPRI TR-107330 (Reference 9.3) requires that the test PLC be mounted on a simple structure that does not enclose the test specimen chassis. No additional cooling fans shall be included in the test chamber.

a

The TUT configuration for Environmental Testing met the above requirements.

5.2 TRICON-Under-Test Chassis and Module Configuration

Section 4.0 above describes the general arrangement of the TUT which was maintained throughout all of the qualification testing. Chassis configurations for Environmental Testing are documented in Triconex Document No. 9600164-540 (Reference 9.6). Section 6.2.1.1 of EPRI TR-107330 (Reference 9.3) requires that the modules be arranged to simulate the maximum expected temperature rise across the chassis for any reasonable arrangement of modules included

Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT		
Revision:	0	Page:	8 of 22	Date:	07/17/07

in the qualification.

a

5.3 TRICON-Under-Test Power Supply Configuration

Section 6.3.3 of EPRI TR-107330 (Reference 9.3) requires that Environmental Testing be performed with the PLC power supply sources set to values that maximize heat dissipation in the test PLC. The TUT configuration for Environmental Testing met this requirement. During Environmental Testing, the AC and DC power sources to the TUT chassis power supply modules were set as follows:

- a) One power supply module in each TUT chassis was de-energized during Environmental Testing. This placed the full chassis load on the remaining energized power supply module. This configuration resulted in greater heat dissipation than operating two power supply modules in each chassis at significantly lower loadings.
- b) The power sources to the energized TUT power supply modules were set below the manufacturer’s nominal source voltage and frequency specifications. This resulted in greater current draw by the power supply modules, which resulted in increased heat dissipation.

Section 6.2.1 of EPRI TR-107330 (Reference 9.3) requires that additional resistive loads be placed on each test PLC power supply output so that nominal current draws at nominal power supply output voltages are equal to the power supply rating. Section 6.3.3.1 requires that these additional resistive loads be placed in the environmental chamber.

a

Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT		
Revision:	0	Page:	9 of 22	Date:	07/17/07

5.4 NTS Instrumentation

Instrumentation supplied by NTS for Environmental Testing included temperature and relative humidity measurement devices. The test chamber ambient temperature and relative humidity were digitally recorded throughout the duration of the Environmental Test. In accordance with Section 6.3.3.1 of EPRI TR-107330 (Reference 9.3) for PLC’s that use natural circulation cooling, air temperature was monitored and recorded at the bottom of each TUT chassis. NTS installed thermocouples on the bottom of each chassis prior to the start of the test.

5.5 Triconex and MPR Instrumentation

During Environmental Testing, operation of the TUT was monitored and recorded

a

Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT		
Revision:	0	Page:	10 of 22	Date:	07/17/07

5.6 Instrument Calibration

All tests were performed using calibrated test instruments. Calibration certifications are held by NTS Laboratories, MPR and Triconex. National Technical Systems Test Report No. TR62987-07N-ENV, “Test Report for Environmental Qualification of TRICON v10 Nuclear Qualification Project TRICON-Under-Test,” (Reference 9.18) documents the calibration status of the test instrumentation used by NTS. The completed MPR Procedure No. 9600164-506 (Reference 9.8) documents the calibration status of the test instrumentation used by MPR. The completed Triconex Setup and Checkout, Operability and Prudency Procedures (References 9.13 through 9.17) document the calibration status of the test instrumentation used by Triconex.

6.0 TEST PROCEDURES

Environmental Testing of the TUT was performed to the specific requirements of Sections 4.3.6 and 6.3.3 of EPRI TR-107330 (Reference 9.3), and the general requirements of IEEE 381-1977, “Standard Criteria for Type Tests of Class 1E Modules Used in Nuclear Power Generating Stations,” (Reference 9.19). The following sections describe the approach to satisfying the requirements of the referenced documents during Environmental Testing of the TUT. The test procedure used by NTS Laboratories to perform Environmental Testing is NTS Procedure No. TP62987-07N-ENV (Reference 9.12). The test procedure used by MPR to perform Environmental Testing is MPR Procedure No. 9600164-506,” (Reference 9.2). The test procedures used by Triconex to perform Operability and Prudency Testing during Environmental Testing are Triconex Procedure No. 9600164-503 (Reference 9.20) and No. 9600164-504 (Reference No. 9.21).

6.1 Test Sequence

Figure 2 of Triconex Document No. 9600164-500 (Reference 9.1) shows the sequence of qualification testing performed on the TUT. In accordance with the test sequence shown in Figure 2, Environmental Testing was performed after Radiation Exposure Testing and prior to all other qualification testing (i.e., Seismic, EMI/RFI, Electrical Fast Transient, Surge Withstand, Electrostatic Discharge and Class 1E to Non-1E Isolation Testing).

Per EPRI TR-107330 (Reference 9.3), the PLC is intended for installation in a mild environment. Aging analyses to be included in the project Final Summary Report will demonstrate that degradation of any TRICON v10 PLC components subject to significant aging mechanisms can be accounted for by periodic surveillance/maintenance.

6.2 Test Method

Environmental testing of the TUT was performed using the NTS Laboratories environmental test chamber. Inside the test chamber, the equipment was subjected to abnormal

Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT		
Revision:	0	Page:	11 of 22	Date:	07/17/07

environmental conditions which simulated minimum and maximum extremes of temperature and air moisture content that could be experienced by the equipment during and after an accident condition in a nuclear power plant. The abnormal environmental conditions were applied to the TUT in accordance with a time varying profile which included ramp-ups, ramp-downs and hold periods of temperature and humidity, eventually returning to ambient conditions. In accordance with EPRI TR-107330 (Reference 9.3), TUT performance was monitored throughout the test period, and detailed performance tests were performed after each hold period at high temperature and high humidity, low temperature and low humidity, and return to ambient temperature.

6.3 Test Levels

Section 4.3.6.2 of EPRI TR-107330 (Reference 9.3) requires that the generic PLC meet its performance requirements over abnormal environmental conditions of 40°F to 120°F and 10% to 95% relative humidity (non-condensing). Section 4.3.6.3 of EPRI TR-107330 (Reference 9.3) requires that the test PLC operate for the environmental (temperature and humidity) withstand profile given in Figure 4-4 of the TR. The profile includes a beginning ramp-up period (unspecified in duration) from ambient to 140°F and 90% relative humidity (non-condensing). These conditions are held for 48 hours minimum, after which the Operability and Prudency tests are run. Conditions are then ramped down over a four hour minimum period to 40°F and 5% relative humidity. These conditions are held for 8 hours minimum, after which a second Operability test is run. Conditions are then ramped up over a four hour minimum period to ambient temperature and relative humidity. The equipment is stabilized at ambient conditions, after which a final Operability test is run. Section 6.3.3 of EPRI TR-107330 (Reference 9.3) requires that Environmental Testing be performed with margins of 5°F and 5% applied to the temperature and humidity values given above.

The three sections of the EPRI TR described above present inconsistent maximum and minimum conditions of temperature and humidity for Environmental Testing. Based on discussions with the EPRI Working Group (B. Sotos), the Figure 4-4 profile of EPRI TR-107330 (Reference 9.3) was specified for Environmental Testing of the TRICON v10 PLC with maximum temperature and relative humidity conditions of 140°F and 95%, and minimum temperature and relative humidity conditions of 35°F and 5%. These conditions include the required test margin of 5°F and 5% relative humidity, and consider the TRICON v10 hardware temperature rating of 140°F. These conditions bound all of the Environmental Test conditions given in EPRI TR-107330 (Reference 9.3).

Figure 8-1 of this report shows the actual Environmental Test profile which was achieved in the NTS Laboratories environmental test chamber. This profile bounds the test profile given in Figure 4-4 of EPRI TR-107330 (Reference 9.3).

Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT		
Revision:	0	Page:	12 of 22	Date:	07/17/07

6.4 TRICON-Under-Test Operation

Section 6.3.3 of EPRI TR-107330 (Reference 9.3) requires that the test PLC be powered with its TSAP operating during Environmental Testing, with 1/2 of the discrete and relay outputs ON and loaded to their rated current. In addition, all analog outputs shall be set to between 1/2 and 2/3 of full scale.

a, b

6.5 TRICON-Under-Test Performance Monitoring

Section 4.3.6.3 of EPRI TR-107330 (Reference 9.3) requires that the test PLC operate as intended during and after exposure to the temperature and humidity profile given in Figure 4-4 of TR-107330.

During Environmental Testing, operation of the TUT was continuously monitored and recorded

a, b

Attachment 1 of this test report includes a set of figures showing the normal performance of the data points which were monitored during Environmental Testing. The data was monitored for deviations or trends from the normal performance shown in the figures.

Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT		
Revision:	0	Page:	13 of 22	Date:	07/17/07

6.6 Test Acceptance Criteria

The Environmental Test acceptance criteria are as given below. These criteria were developed based on Appendix 5 of Triconex Document No. 9600164-500 (Reference 9.1), and Section 4.3.6 of EPRI TR-107330 (Reference 9.3).

- (a) The TUT shall operate as intended during and after exposure to abnormal Environmental Test conditions. Evaluation of normal operating performance data (inputs, outputs and diagnostic indicators) collected during testing shall demonstrate operation as intended.
- (b) The TUT shall meet all acceptance criteria of the Operability Test, as implemented by Triconex Procedure No. 9600164-503 (Reference 9.20), at the following times during and after the Environmental Test:
 - Following at least 48 hours of operation at 140°F and 95% relative humidity (non-condensing).
 - Following at least 8 hours of operation at 35°F and 5% relative humidity.
 - Upon completion of the Environmental Test and after 2 hours minimum stabilization time at ambient conditions.
- (c) The TUT shall meet all acceptance criteria of the Prudency Test, as implemented by Triconex Procedure No. 9600164-504 (Reference 9.21), following at least 48 hours of operation at 140°F and 95% relative humidity.

7.0 TEST RESULTS

This section summarizes the results of Environmental Testing of the TUT. This section also discusses performance or data anomalies which were observed or recorded during the testing.

7.1 Environmental Test Setup and Checkout Testing

Triconex Procedure No. 9600164-502, “System Setup and Checkout Procedure,” (Reference 9.22) directs setup of the TUT for the different qualification tests to be performed, and verifies proper operation of the TUT and test system prior to start of testing. Environmental Testing of the TUT was performed by MPR Associates following Radiation Exposure Testing and upon completion of the Post-Radiation Exposure Testing Run No. 3.3 of the System Setup and Checkout Procedure by Triconex. Results of the Post-Radiation Exposure Testing Run No. 3.3 of the System Setup and Checkout Procedure are included in the completed Triconex Document No. 9600164-502 (Reference 9.13). As reported by Triconex, the test results show that the system was operating correctly prior to start of Environmental Testing.

Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT		
Revision:	0	Page:	14 of 22	Date:	07/17/07

7.2 Environmental Testing

Environmental Testing of the TUT was performed in accordance with MPR Procedure No. 9600164-506 (Reference 9.2), NTS Test Procedure TP62987-07N-ENV (Reference 9.12), and Triconex Procedure Nos. 9600164-503 (Reference 9.20) and 9600164-504 (Reference 9.21).

a

Figure 8-1 shows the above Environmental Test sequence. The test sequence and conditions shown in Figure 8-1 bound the sequence and conditions required by Figure 4-4 of EPRI TR-107330 (Reference 9.3). A record of the applied temperature and humidity test conditions is included in NTS Test Report TR62987-07N-ENV (Reference 9.18).

7.3 TRICON-Under-Test Performance Monitoring

During Environmental Testing, the TUT was operating in accordance with execution of the Test Specimen Application Program (TSAP). The TUT performance was monitored continually throughout the test period (except during Operability and Prudency test periods).

a, b

Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT		
Revision:	0	Page:	15 of 22	Date:	07/17/07

a, b

7.4 Environmental Test Operability and Prudency Tests

Section 5.5 of EPRI TR-107330 (Reference 9.3) requires Operability and Prudency testing during Environmental Testing to assess the impact of exposure to abnormal environmental conditions on the operability of the TUT. In accordance with EPRI TR-107330 (Reference 9.3), Operability and Prudency testing was performed by Triconex at the following times:

- After the high temperature, high humidity hold period (Operability and Prudency)
- After the low temperature, low humidity hold period (Operability only)
- After return to ambient temperature (Operability only).

References 9.14 through 9.17 document performance of Operability and Prudency tests at these times, and provide analyses of the test data and test results. As reported by Triconex, the test results shows that exposure to the Environmental Test conditions had no adverse effect on the TUT performance.



Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT		
Revision:	0	Page:	16 of 22	Date:	07/17/07

a, b



Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT		
Revision:	0	Page:	17 of 22	Date:	07/17/07

a, b



Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT		
Revision:	0	Page:	18 of 22	Date:	07/17/07

a, b

Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT		
Revision:	0	Page:	19 of 22	Date:	07/17/07

8.0 CONCLUSIONS

1. Environmental Testing of the TUT was performed in accordance with the requirements of EPRI TR-107330 (Reference 9.3) as clarified in Section 6.3 of this report, and following the guidelines provided in IEEE Standard 381-1977 (Reference 9.19).
2. The TUT met the Test Acceptance Criteria given in Section 6.6 of this report. Specifically, during Environmental Testing:
 - (a) Evaluation of normal operating data showed that the TUT operated as intended during and after exposure to the Environmental Test conditions.
 - (b) As reported by Triconex, the TUT met all acceptance criteria of the Operability Test performed at the following times during and after Environmental Testing:
 - Following 48 hours of operation at 140°F and 95% relative humidity (non-condensing).
 - Following 8 hours of operation at 35°F and 5% relative humidity.
 - Upon completion of the Environmental Test and after 2 hours stabilization time at ambient conditions.
 - (c) As reported by Triconex, the TUT met all acceptance criteria of the Prudency Test performed following 48 hours of operation at 140°F and 95% relative humidity.
3. The Environmental Test results demonstrate that the Triconex TRICON v10 PLC will not experience failures due to abnormal service conditions of temperature and humidity. The specific TRICON v10 PLC hardware which was tested (chassis, power supplies, modules, external termination assemblies and interconnecting cabling) is identified in Triconex Document No. 9600164-540 (Reference 9.6).
4. The temperature and humidity profile applied during Environmental Testing of the TUT is shown in Figure 8-1. The test profile shown in Figure 8-1 bounds the test conditions required by Figure 4-4 of EPRI TR-107330 (Reference 9.3).

Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT		
Revision:	0	Page:	20 of 22	Date:	07/17/07

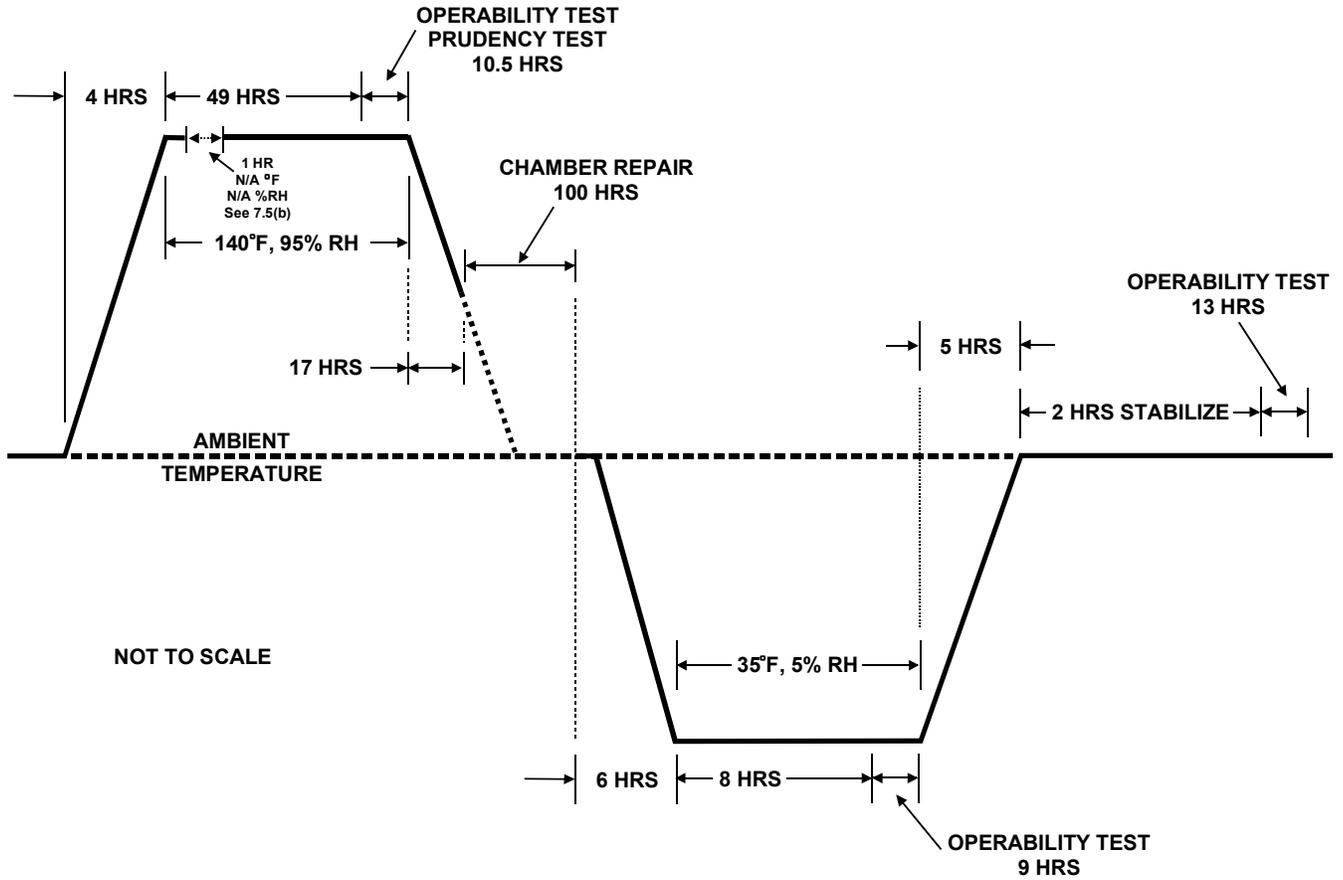


Figure 8-1: Environmental Test Applied Temperature and Humidity Profile

Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT		
Revision:	0	Page:	21 of 22	Date:	07/17/07

9.0 REFERENCES

Note: Triconex qualification project documentation and hardware is configuration controlled under the Triconex Quality Assurance Program. Triconex Document No. 9600164-540, “Master Configuration List,” (Reference 9.6) provides a record of the currently applicable revision level of all Triconex documents, procedures and drawings throughout performance of the qualification program. As recorded in the completed MPR Procedure No. 9600164-506 (Reference 9.8), Triconex Document No. 9600164-540, Rev. 3 was in effect at the start of Environmental Testing.

- 9.1 Triconex Document No. 9600164-500, “Master Test Plan,” Rev. 4
- 9.2 MPR Procedure No. 9600164-506, “Environmental Test Procedure,” Rev. 0
- 9.3 EPRI TR-107330, “Generic Requirements Specification for Qualifying a Commercially Available PLC for Safety-Related Applications in Nuclear Power Plants,” Final Report dated December, 1996
- 9.4 Triconex Document No. 9600164-002, “Nuclear Qualification Quality Plan,” Rev. 3
- 9.5 Triconex Drawing No. 9600164-100, “TRICON v10 Nuclear Qualification Project Tricon Under Test - General Arrangement,” Rev. 1
- 9.6 Triconex Document No. 9600164-540, “Master Configuration List,” Rev. 18
- 9.7 IEEE Standard 323-1974, “Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations”
- 9.8 Completed MPR Procedure No. 9600164-506, “Environmental Test Procedure,” Rev. 0, MPR Review and Approval Dated April 12, 2007
- 9.9 Triconex Drawing No. 9600164-103, “TRICON v10 Nuclear Qualification Project System Block Diagram,” Rev. 2
- 9.10 Triconex Document No. 9600164-541, TRICON v10 Nuclear Qualification Project, System Description,” Rev. 0
- 9.11 Triconex Document No. 9600164-517, “Test Specimen Application Program (TSAP) Software Requirements Specification (SRS),” Rev. 3

Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT		
Revision:	0	Page:	22 of 22	Date:	07/17/07

- 9.12 National Technical Systems Test Procedure No. TP62987-07N-ENV, “Test Procedure for Environmental Exposure of the TRICON v10 Nuclear Qualification Project TRICON-Under-Test,” Rev. 0
- 9.13 Completed Post-Radiation Exposure Run No. 3.3 of Triconex Procedure No. 9600164-502, “System Setup and Checkout Procedure,” Rev. 0
- 9.14 Completed Environmental High-Temperature, High-Humidity Testing Run No. 3.3 of Triconex Procedure No. 9600164-503, “Operability Test Procedure,” Rev. 2
- 9.15 Completed Environmental Low-Temperature, Low-Humidity Testing Run No. 3.4 of Triconex Procedure No. 9600164-503, “Operability Test Procedure,” Rev. 2
- 9.16 Completed Environmental Ambient Temperature and Humidity Testing Run No. 3.5 of Triconex Procedure No. 9600164-503, “Operability Test Procedure,” Rev. 2
- 9.17 Completed Environmental High-Temperature, High-Humidity Testing Run No. 3.3 of Triconex Procedure No. 9600164-504, “Prudency Test Procedure,” Rev. 1
- 9.18 National Technical Systems Test Report No. TR62987-07N-ENV, “Test Report for Environmental Qualification of TRICON v10 Nuclear Qualification Project TRICON-Under-Test,” Rev. 0
- 9.19 IEEE Standard 381-1977, “Standard Criteria for Type Tests of Class 1E Modules Used in Nuclear Power Generating Stations”
- 9.20 Triconex Procedure No. 9600164-503, “Operability Test Procedure,” Rev. 3
- 9.21 Triconex Procedure No. 9600164-504, “Prudency Test Procedure,” Rev. 1
- 9.22 Triconex Procedure No. 9600164-502, “System Setup and Checkout Procedure,” Rev. 4

10.0 ATTACHMENTS

Attachment 1: Example Plots of TUT Normal Operating Performance Data



Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT: ATTACHMENT 1		
Revision:	0	Page:	1 of 14	Date:	07/17/07

a, b



Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT: ATTACHMENT 1		
Revision:	0	Page:	2 of 14	Date:	07/17/07

a, b



Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT: ATTACHMENT 1		
Revision:	0	Page:	3 of 14	Date:	07/17/07

a, b



Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT: ATTACHMENT 1		
Revision:	0	Page:	4 of 14	Date:	07/17/07

a, b



Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT: ATTACHMENT 1		
Revision:	0	Page:	5 of 14	Date:	07/17/07

a, b



Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT: ATTACHMENT 1		
Revision:	0	Page:	6 of 14	Date:	07/17/07

a, b



Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT: ATTACHMENT 1		
Revision:	0	Page:	7 of 14	Date:	07/17/07

a, b



Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT: ATTACHMENT 1		
Revision:	0	Page:	8 of 14	Date:	07/17/07

a, b



Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT: ATTACHMENT 1		
Revision:	0	Page:	9 of 14	Date:	07/17/07

a, b



Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT: ATTACHMENT 1		
Revision:	0	Page:	10 of 14	Date:	07/17/07

a, b



Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT: ATTACHMENT 1		
Revision:	0	Page:	11 of 14	Date:	07/17/07

a, b



Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT: ATTACHMENT 1		
Revision:	0	Page:	12 of 14	Date:	07/17/07

a, b



Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT: ATTACHMENT 1		
Revision:	0	Page:	13 of 14	Date:	07/17/07

a, b



Document:	9600164-525	Title:	ENVIRONMENTAL TEST REPORT: ATTACHMENT 1		
Revision:	0	Page:	14 of 14	Date:	07/17/07

a, b