

Project:

TRICON v10 NUCLEAR QUALIFICATION PROJECT

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TEST REPORT

PRUDENCY TEST PROCEDURE

PERFORMANCE PROOF TEST
(Run ID 3.4)

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Revision History

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1.0 EXECUTIVE SUMMARY

The Tricon v10 Nuclear Qualification Project Prudency Test Procedure (9600164-504), Performance Proof Test (Run ID: 3.4) was conducted on May 10th and 11th of 2007 at Invensys Triconex, Irvine, CA. As required by the Master Test Plan (MTP), the Prudency Test Procedure, Performance Proof Test (Run ID: 3.4) was executed to establish the performance data on the Tricon-Under-Test (TUT) after being subjected to all qualification tests. Prior to test execution, the following documents were approved and listed in the Master Configuration List (MCL) (Reference 9.4) in accordance with the requirements of the Nuclear Qualification Quality Plan (NQQP) (Reference 9.3):

1. Master Test Plan
2. Nuclear Qualification Quality Plan
3. System Setup & Checkout Procedure
4. Prudency Test Procedure

Note: Throughout this Test Report reference is made to the requirements of EPRI TR-107330. All statements regarding EPRI TR-107330 are understood to include the exceptions noted in Appendix A, Equipment Qualification Summary Report, EPRI TR-107330 Requirements Compliance and Traceability Matrix (Reference 9.8).

The Prudency Test Procedure was developed based on the applicable requirements of the EPRI TR-107330 (Reference 9.1), the MTP and the NQQP. The procedure was designed to demonstrate that the TUT will perform basic functionality at minimum source power supply voltage and frequency conditions under highly dynamic loading and adverse noise conditions in accordance with Invensys Triconex published specifications and/or EPRI TR-107330 specifications.

The Prudency Test Procedure, Performance Proof Test (Run ID: 3.3) was executed following the successful completion of Operability Test Procedure, Performance Proof Test (Run ID: 3.7). The Prudency Test Procedure was executed by certified Project R&D Engineers and witnessed by the Project Quality Assurance Engineer (PQAE).

During execution of the test, no Qualification Project Anomaly Reports (QPAR) were generated specific to this Run ID of the Prudency Test Procedure.

All acceptance criteria specified in the Prudency Test Procedure, Performance Proof Test (Run ID: 3.4) were satisfied with the exception of Section 2, Subsection 11.0, Steps 11.4 and 11.7 (See QPAR 015). The TUT was functioning properly and performance data for the TUT were established.

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2.0 PURPOSE

This test report documents the results of the Prudency Test Procedure, Performance Proof Test (Run ID: 3.4) of the TUT to meet the requirements of EPRI TR-107330 and/or Invensys Triconex published specifications after being subjected to all qualification tests.

3.0 TEST OBJECTIVE

The objective of the Prudency Test Procedure, Performance Proof Test (Run ID: 3.4) was to ensure that performance data for the TUT were achieved in accordance with Invensys Triconex published specifications and/or EPRI TR-107330 specifications after being subjected to all qualification tests and that all acceptance criteria stated in the procedure were met. Exceptions from EPRI TR-107330 requirements are detailed in Section 5.0, Test Setup, 1st and 2nd Bullet in this report.

4.0 TEST DESCRIPTION

The Prudency Test Procedure provides a systematic approach to test the TUT against the acceptance criteria stated in the procedure. The procedure is broken into 3 sections and each section is broken into multiple steps to test the TUT. In addition, the procedure provides information about the list of various operability tests conducted to verify acceptable performance of the TUT in accordance with Invensys Triconex published specifications and/or EPRI TR-107330 specifications. The test results are recorded in each step of the corresponding section and the results are summarized at the end of each section.

Prudency testing involves exposing the TUT to various normal and abnormal conditions of input/output operation and source power at minimum source power supply voltage and frequency conditions. EPRI TR-107330 section 5.4 describes the specific criteria to be met for prudency tests.

5.0 TEST SETUP

The nuclear qualification test system setup for prudency tests included successful completion of the System Setup & Checkout Procedure, Performance Proof Test (Run ID: 3.11) to ensure proper assembly, configuration, integration and functioning of the nuclear qualification test system.

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6.0 TEST PROCEDURE

The Prudency Test Procedure, High Temperature Test (Run ID: 3.3) was performed in accordance with the requirements of Sections 5.4 of EPRI TR-107330 (Reference 9.1) and as described in Appendix 3 of the Master Test Plan (Reference 9.2).

Each section is described below indicating the applied test conditions and associated acceptance criteria. In addition, the rationale for determining acceptability of each applied section is discussed.

The Prudency Test Procedure, Performance Proof Test (Run ID: 3.4) is divided into 3 sections and associated subsections. Each subsection is designed to test one criteria of the TUT. The prudency tests performed and the associated Section numbers are:

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- Section 2 – Burst of Events Test: This test was performed in accordance with EPRI TR-107330, Section 5.4.A on the TUT.

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- Section 3 – Failure of Serial Port Receiver Test / Serial Port Noise Test: This test was performed in accordance with EPRI TR-107330, Section 5.4.B and 5.4.C on the TUT.

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7.0 TEST RESULTS

All prerequisites delineated in Subsection 6.0 of each Section of the Prudency Test Procedure, High Temperature Test (Run ID: 3.3) were satisfied and all M&TE were determined to be within its calibration cycle before entering into Subsection 10.0, Procedure, of each Section of the procedure.

All tests performed during execution of the procedure complied with the stated acceptance criteria. The individual results of each section are given below.

- Section 1 – No Acceptance Criteria associated with this Section.
- Section 2, Subsection 10.0 – Passed. Section 2, Subsections 11.1 thru 11.3, 11.5 and 11.6, and 11.8 – Passed. Subsections 11.4 and 11.7 – Failed.

QPAR 015 was issued during the Prudency Test Procedure, Pre-Qualification Test (Run ID: 3.1) to document the failure of analog output module (3805E) to meet the acceptance criteria.

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Further analysis concluded that the test system loopback setup, which was designed for testing purposes, was the cause of the failure to meet the acceptance criteria. The test system loopback setup is not an installation arrangement that would be utilized by a customer. The analog input module (3703E) and the analog output module (3805E) will perform as intended, within the required accuracy, in a customer installation.

- Section 3, Subsections 10.1 thru 10.4 and Subsections 11.1 thru 11.4 – Passed.

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8.0 CONCLUSIONS

The Prudency Test Procedure, Performance Proof Test (Run ID: 3.4) demonstrated that performance data for the TUT were achieved at minimum source power supply voltage and frequency conditions under highly dynamic loading and adverse noise conditions in accordance with Invensys Triconex published specifications and/or EPRI TR-107330 specifications and all acceptance criteria stated in the procedure were met with the exception of Section 2, Subsection 11.0, Steps 11.4 and 11.7 (See QPAR 015).

In addition, the test results of the Prudency Test Procedure, Pre-Qualification Test (Run ID: 3.1) and Prudency Test Procedure, Performance Proof Test (Run ID: 3.4) were analyzed to determine any de-gradation in the performance of the TUT. The analyses established that the TUT performed in accordance with Invensys Triconex published specifications and/or EPRI TR-107330 specifications before and, after Qualification Tests and no de-gradation in the performance of the TUT were identified. Table 1 provides a comparison of Pre-Qualification and Performance Proof Prudency test results.

Table 1

	Description	Pre-Qualification Test	Performance Proof Test	Comments
Section 2	Burst of Events Test	Failed	Failed	No degradation in the TUT performance. QPAR 015 was issued to address the Failed test.
Section 3	Failure of Serial Port Receiver Test / Serial Port Noise Test	Passed	Passed	No degradation in the TUT performance.

9.0 REFERENCES

- 9.1 EPRI Technical Report TR-107330, Generic Requirements Specification for Qualifying a Commercially Available PLC for Safety-Related Applications in Nuclear Power Plants



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- 9.2 9600164-500, Master Test Plan
- 9.3 9600164-002, Nuclear Qualification Quality Plan
- 9.4 9600164-500, Master Configuration List
- 9.5 9600164-502, System Setup & Checkout Procedure
- 9.6 9600164-503, Prudency Test Procedure
- 9.7 9600164-731, Maximum Response Time Calculations
- 9.8 9600164-545, Equipment Qualification Summary Report, Appendix A, EPRI TR-107330 Requirements Compliance and Traceability Matrix

10.0 APPENDICES

None

11.0 ATTACHMENTS

None