



*HF Controls*

**HFC-6000 Qualification System  
vs EPRI TR 107330  
Operating Envelope**

**RR901-000-41**

Rev. **A**

Effective Date: 2/19/2010

Prepared By: Ivan Chow

Reviewed By: Charles McKinney

Approved By: Ed Herchenrader

# HFC-6000 Qualifying System vs EPRI TR 107330 Operating Envelope

## Revision History

Date	Revision	Preparer	Changes
2/4/10	A	I. Chow	Initial Revision

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# HFC-6000 Qualifying System vs EPRI TR 107330 Operating Envelope

## 1.0 Introduction

This document describes the differences between the operating envelope of the HFC-6000 Safety Control System qualifying through HFC project ERD111 and the one specified in EPRI TR 107330-1996.

The HFC-6000 systems have been deployed as plant control systems for several nuclear power plants in Korea with plant-specific configurations. In project ERD111, the HFC-6000 system was configured generically so that it could encompass a wide range of applications. Overall, the qualification results demonstrated an operating envelope that met or performed better than most plant-specific system conditions or acceptance criteria.

References to this document are listed in section 2.0.

In section 3.0, the operating envelope of HFC-6000 system and comparison to EPRI TR 107330-1996 acceptance criteria are listed. The operating envelope is based on the qualification test results of the system and software enhancements afterward. RR901-000-37, ERD111 Performance Envelope provides the description of how the envelope is constructed. In the "Remarks" column, less than favorable/completed performances, deviations, as compared to EPRI acceptance criteria are noted in bold-faced fonts. The deviation summary is listed in section 4.0.

When the HFC-6000 platform is configured for use with a plant-specific application, the impacted deviations required for that application will undergo a retesting with the intent of meeting all applicable plant-specific acceptance criteria. The results of this retesting are expected to meet or perform better than the acceptance criteria of EPRI TR 107330-1996 in related areas.

## 2.0 References

EPRI TR 107330	Generic Requirements Specification for Qualifying a Commercially Available PLC for Safety-Related Applications in Nuclear Power Plants, 1996
EPRI TR 102323	Guidelines for Electromagnetic Interference Testing in Power Plants, Revision 1
IEEE C62.45	Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits
RR901-000-37	ERD111 Performance Envelope, Rev. B

## HFC-6000 Qualifying System vs EPRI TR 107330 Operating Envelope

### 3.0 HFC-6000 System vs EPRI TR 107330 Operating Envelopes

#### 3.1 General Performance

The following table shows the general performance specification of HFC-6000 qualifying system.

**Table 1 – General Performance**

Descriptions	HFC-6000 Performance	EPRI Acceptance Criteria EPRI TR 107330-1996	Remarks
<b>A. Accuracy</b>			
<b>16 AI Channels, 4mA to 20mA</b>	<b>HFC-AI16I</b>	4.3.2.1.2 – B. $\pm 0.35\%$ of the entire range	Better than EPRI spec.
Nominal Performance	+0.1% at over entire range		
Response to automated test waveform	$\pm 0.1\%$ of each step level		
Response to 10% - 90% 0.5Hz step waveform	Every transition is detected in AI image in memory $\pm 0.1\%$ at 10% and 90% of span		
<b>8 AO Channels, 4mA to 20mA</b>	<b>HFC-AO8F</b>	4.3.2.1.2.– B. $\pm 0.32\%$ of the entire range	Better than EPRI spec.
Nominal Performance	+0.1% at 10% of span		
Response to automated test waveform	$\pm 0.25\%$ at 10% level $\pm 0.1\%$ at each of the other step level		
Response to 10% - 90% 0.5Hz step waveform	Every transition is logged in memory $\pm 0.3\%$ at each step level		
<b>8 RTD 100<math>\Omega</math> Input Channels</b>	<b>HFC-AI8M</b>	4.3.2.1.3 – C. $\pm 2\text{ }^\circ\text{C}$ accuracy D. 0.1 $^\circ$ resolution for both $^\circ\text{F}$ , $^\circ\text{C}$	Better than EPRI specs.
Nominal Performance	$\pm 0.1\%$ accuracy from 0 $^\circ\text{C}$ to 700 $^\circ\text{C}$ with 0.1 $^\circ$ resolution		

### HFC-6000 Qualifying System vs EPRI TR 107330 Operating Envelope

Descriptions	HFC-6000 Performance	EPRI Acceptance Criteria EPRI TR 107330-1996	Remarks
<b>4 Pulse Input Channels</b>	<b>HFC-AI4K</b>		
Input Signal Characteristics	12 v to 30 v peak pulse input 50 Hz to 10 kHz (8-bit operating mode) 50 Hz to 20 kHz (12-bit operating mode) 100 μs pulse width to 90% duty cycle	4.3.2.3.1 – A. At least 2 inputs. B. At least 2 to 5000 Hz	Better than EPRI spec.
Rate Mode	8-bit or 12-bit count value image 50 Hz minimum input pulse rate (8-bit range and 12-bit range)		
Accumulate Mode	24-bit count image		
<b>B. Response Time</b>			
<b>Digital Response Time</b>	30ms to 180 ms	4.2.1.A – 100ms or less	The response time can be made lower with plant-specific implementations. For this, the required response time for the plant application is required to be met so this is not considered to be a major deviation.
<b>Analog Response Time</b>	160ms to 380ms	4.2.1.A – 100ms or less	
<b>C. I/O Points</b>	(Points in parentheses were configured in the qualifying system)		
<b>Discrete I/O</b>	848 Digital I/O points (409 Digital I/O points)	4.2.1.B – 400 discrete I/O points	Better than EPRI spec.
<b>Analog I/O</b>	848 Analog I/O points (108 Digital I/O points)	4.2.1.C – 100 analog I/O points	Better than EPRI spec.
<b>Combined I/O</b>	848 I/O points for any combinations of analog and digital I/O points (409 Digital I/O and 108 Analog I/O)	4.2.1.D – 50 analog and 400 discrete I/O points	Better than EPRI spec.

### HFC-6000 Qualifying System vs EPRI TR 107330 Operating Envelope

Descriptions	HFC-6000 Performance	EPRI Acceptance Criteria EPRI TR 107330-1996	Remarks
	points)		
<b>D. Discrete Input Channels</b>	<b>HFC-DC33, DC34, DI16I</b> Operate within their specs	5.3.C – Trip and reset points shall be within the manufacturer’s spec.	Met acceptance criteria.
<b>E. Discrete Output Channels</b>	<b>HFC-DC33, DC34, DO8J</b> Operate within their specs	5.3.D – Output states shall be within the manufacturer’s spec.	Met acceptance criteria.
<b>F. Serial Communication Channels</b>	C-Link, ICL Operate within their specs.	5.3.E bit rates, signal levels, and pulse shapes shall be within the specification of the protocol used.	Met acceptance criteria.
<b>G. Timer Function</b>	Accuracy over 10 or more cycles remains within $\pm 0.1\%$ of the interval.	4.4.3, 5.3.G – Accuracy < 0.1% of the timer interval.	Met acceptance criteria.
<b>H. Failover Function</b>	Within 100ms, the failover completes successfully.	5.3.I, 4.3.4.7 – A successful failover should occur with the manufacturer’s failover requirements.	Met acceptance criteria.
<b>I. Loss of Power Response</b>	When power is lost, all digital output channels are on the deenergized states and all analog outputs assume a preset failsafe states. When power is stored, the digital and analog outputs would change states only by valid controller output images.	5.3.J – All I/O shall move to the power off default and power on default states and normal operation shall resume after restoration of power.	Met acceptance criteria. (No DC power sources are used in HFC-6000 system.)

## HFC-6000 Qualifying System vs EPRI TR 107330 Operating Envelope

### 3.2 Environment Stress

#### 3.2.1 Temperature and Humidity Stress

Figure 4-4 of EPRI TR 107330 was used as the testing envelope for the HFC-6000 qualifying system. The overall variations are listed below:

1. Temperature range – 140 °F to 40 °F
2. Relative Humidity (RH) range – 5% RH - 90% RH non-condensing.

The acceptance criteria for the system under stress according to EPRI is that the general performance as described in section 3.1 of this document must be kept. Table 2 shows the summary of the performance of HFC-6000 under temperature and humidity stress.

**Table 2 – Performance under temperature and humidity stress**

Descriptions	HFC-6000 Performance	EPRI Acceptance Criteria EPRI TR 107330-1996	Remarks
<b>A. Accuracy</b>			
<b>16 AI Channels, 4mA to 20mA</b>	<b>HFC-AI16I</b>		
Response to 10% - 90% 0.5Hz step waveform	Every transition is detected in AI image in memory +0.211 % at 10% of span - 0.646% at 90% of span	4.3.2.1.2 – B. $\pm 0.35\%$ of the entire range	Better than EPRI specs.
<b>8 AO Channels, 4mA to 20mA</b>	<b>HFC-AO8F</b>		
Nominal Performance	+0.1% at 10% of span	4.3.2.1.2.– B. $\pm 0.32\%$ of the entire range	Better than EPRI specs.
Response to automated test waveform	$\pm 0.25\%$ at 10% level $\pm 0.1\%$ at each of the other step level		
Response to 10% - 90% 0.5Hz step waveform	+0.22 % at 10% of span - 0.31 % at 90% of span		
<b>8 RTD 100Ω Input Channels</b>	<b>HFC-AI8M</b>		
Nominal Performance	Continued operating without failure but accuracy could not be assessed.	4.3.2.1.3 – C. $\pm 2$ °C accuracy D. 0.1 ° resolution for both °F, °C	Accuracy was undetermined because of the limitation of tests.

### HFC-6000 Qualifying System vs EPRI TR 107330 Operating Envelope

Descriptions	HFC-6000 Performance	EPRI Acceptance Criteria EPRI TR 107330-1996	Remarks
<b>4 Pulse Input Channels</b>	<b>HFC-AI4K</b>		
Input Signal Characteristics	12 v to 30 v peak pulse input 50 Hz to 10 kHz (8-bit) 50 Hz to 20 kHz (12-bit) 100 μs pulse width to 90% duty cycle	4.3.2.3.1 – A. At least 2 inputs. B. At least 2 to 5000 Hz	Better than EPRI specs.
Rate Mode	8-bit or 12-bit count value image 50 Hz minimum input pulse rate		
<b>B. Response Time</b>			
<b>Digital Response Time</b>	30ms to 180 ms	4.2.1.A – 100ms or less	Response time showed no degradation.
<b>Analog Response Time</b>	160ms to 380ms	4.2.1.A – 100ms or less	
<b>C. Discrete Input Channels</b>	<b>HFC-DC33, DC34, DI16I</b> Operate within their specs normally.	5.3.C – Trip and reset points shall be within the manufacturer's spec.	Met acceptance criteria.
<b>D. Discrete Output Channels</b>	<b>HFC-DC33, DC34, DO8J</b> Operate within their specs normally.	5.3.D – Output states shall be within the manufacturer's spec.	Met acceptance criteria.
<b>E. Serial Communication Channels</b>	C-Link, ICL Operate within their specs normally.	5.3.E bit rates, signal levels, and pulse shapes shall be within the specification of the protocol used.	Met acceptance criteria.
<b>F. Timer Function</b>	Accuracy over 10 or more cycles remains within ± 0.1% of the interval.	4.4.3, 5.3.G – Accuracy < 0.1% of the timer interval.	Met acceptance criteria.
<b>G. Loss of Power Response</b>	When power is lost, all digital output channels are on the deenergized states and all analog outputs assume a preset failsafe states. When power is stored, the digital and analog outputs would change states only by valid controller output images.	5.3.J – All I/O shall move to the power off default and power on default states and normal operation shall resume after restoration of power.	Met acceptance criteria. (No DC power sources are used in HFC-6000 system.)

## HFC-6000 Qualifying System vs EPRI TR 107330 Operating Envelope

### 3.2.2 Seismic Acceleration Tolerance

Table 3 shows the test results of HFC-6000 system in the seismic tests. Figure 1 shows the seismic tolerance spectrum, which HFC-6000 used in the testing.

**Table 3 – Seismic Test Results**

Descriptions	HFC-6000 Qualifying Condition	EPRI Acceptance Criteria EPRI TR 107330-1996	Remarks
<b>Seismic Spectrum</b>	Safe Shutdown Earthquake (SSE) – 10g maximum acceleration. See figure 1. Operating Basis Earthquake (OBE) – 10g maximum acceleration. See figure 1.	Figure 4-5 SSE – 14g maximum acceleration OBE – 9.75g maximum acceleration	Maximum SSE of 14g could not be obtained due to the limitation of the laboratory equipment.
<b>Operability</b>	One controller fails over to the secondary controller during the first run of the SSE. One AI module stopped but resumed operation after reset. The test specimen was subjected to 6 OBE tests and 2 SSE tests.	4.3.9 – System shall continue to operate while subjecting to 5 OBEs and 1 SSEs. All connections shall remain intact, all modules shall remain fully inserted, and no parts fall off.	Better than EPRI specs.

# HFC-6000 Qualifying System vs EPRI TR 107330 Operating Envelope

HORIZONTAL AND VERTICAL  
OPERATING BASIS EARTHQUAKE AND SAFE SHUTDOWN EARTHQUAKE  
REQUIRED RESPONSE SPECTRUM

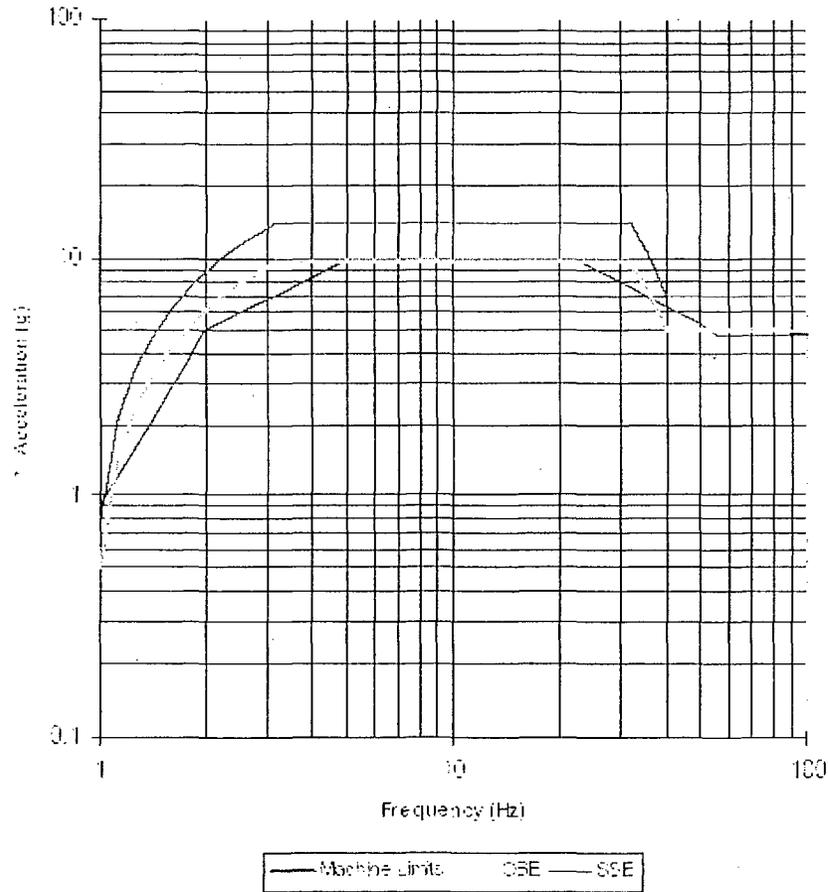


Figure 1 – Seismic Acceleration Spectrum for HFC-6000 Test Specimen

## HFC-6000 Qualifying System vs EPRI TR 107330 Operating Envelope

### 3.2.3 Radiation Exposure Survivability

EPRI TR 107330 4.3.6.1.D and 4.3.6.2.D require the system must be operable within specification for radiation exposure of up to 1000 RADS. While actual tests exposing HFC-6000 system to such radiation was not performed, analysis was done for the system for such radiation exposure. The analysis concluded that HFC-6000 system does not show any vulnerability to such level of radiation exposure. There is no anomaly or deviation from the EPRI specifications.

### 3.2.4 Electro-Magnetic / Radio Frequency Interference (EMI/RFI)

The testing for EMI/RFI was performed in accordance with EPRI TR 102323-R1. As stated in EPRI TR 107330 section 6.3.2, the EMI/RFI susceptibility tests shall be performed at 25%, 50%, 75% and 100% of the specified levels. However, due to scheduling conflicts and availability of the laboratory time, only 100% of all EMI/RFI susceptibility tests were performed. The susceptibility tests results are summarized in Table 4 below.

**Table 4 – EMI/RFI Susceptibility Test Results**

Tests	HFC-6000 Performance	EPRI Acceptance Criteria EPRI TR 102323-R1	Remarks
RS 101	Not performed	Not mentioned.	RG 1.180 Revision 1 2003 stated Equipment that is not intended to be installed in areas with strong sources of magnetic fields (e.g. CRTs, motors, cable bundles carrying high currents) could be exempt from this test.
RS 103	Overall function operates normally except C-Link at below 70MHz	EPRI TR 107330 6.3.2 – 25%, 50%, 75% and 100% of radiated signal 10V/m from 10kHz to 1GHz	<b>Met accepted criteria except C-Link at 10 V/m signal strength at below 70MHz.</b>
CS 101	All function operates normally	EPRI TR 107330 6.3.2 – 25%, 50%, 75% and 100% of radiated signal 6.3Vrms level from 30 Hz to 50 kHz	Met EPRI acceptance criteria.
CS 114	The system operation degraded when exposed to the 103 dBμA from 50kHz to 400MHz.	EPRI TR 107330 6.3.2 – 25%, 50%, 75% and 100% of test signal of 103dBμA from 50 kHz to 400 MHz	<b>Deviated from 50kHz to 400MHz.</b>

## HFC-6000 Qualifying System vs EPRI TR 107330 Operating Envelope

The summary of emission tests for HFC-6000 is shown in table 5.

**Table 5 – EMI/RFI Emission Test Results**

<b>Tests</b>	<b>HFC-6000 Performance</b>	<b>EPRI Acceptance Criteria EPRI TR 102323-R1</b>	<b>Remarks</b>
<b>RE 101</b>	All magnetic field emissions between 30Hz and 100kHz were within limits.	Figure 7-2 shows the emission limits.	All emissions met EPRI 102323 acceptance criteria.
<b>RE 102</b>	Electric field emissions exceeded the limits at various frequencies between: 30 MHz to 800 MHz.	Figure 7-4 shows the emission limits.	<b>Deviated from 30 MHz to 800 MHz.</b>
<b>CE 101</b>	All emissions between 30Hz and 50 kHz on all power leads were within limits.	Figure 7-1 shows the emission limits.	All emission met EPRI 102323 acceptance criteria.
<b>CE 102</b>	Emissions were within specified limits except at 110.2 kHz.	Figure 2-1 shows the emission limits.	<b>Deviations at 110.2 kHz.</b>

As listed in tables 4 and 5, the HFC-6000 system shows deviations in both CS 114 and RS 103 tests at 100% radiated signal levels and the emissions of the HFC-6000 system are over the limits of RE 102 and CE 102 tests. Note that these results were measured under the condition that the HFC-6000 system was without a cabinet. These deviations will be eliminated when the HFC-6000 system is put inside a cabinet.

## HFC-6000 Qualifying System vs EPRI TR 107330 Operating Envelope

### 3.2.5 Electrical Sustainability

Table 6 shows a summary of electrical sustainability vs the requirements of EPRI TR 107330.

Sustainability Tests	HFC-6000 Performance	EPRI Acceptance Criteria EPRI TR 107330-1996	Remarks
<b>Surge Withstand</b>	System operates normally throughout the test.	6.3.5 – peak amplitude of 3kV of various surge waveforms specified in IEEE C62.45	Met acceptance criteria.
<b>Power Quality Tolerance</b>	The tests were performed 3 times during the qualifying process: 1. Pre-qualification/Baseline 2. Environment stress process 3. During seismic acceleration	4.6.1.1 – Power Quality Tolerance	Met 1077330 – 4.6.1.1.A, D, E, F and I acceptance criteria.
<b>Electrostatic Discharge (ESD) Susceptibility</b>	Subjected to 8 kV contact discharges and 15 kV air discharges of ESD test waveforms. No degradations to the system.	EPRI TR 102323-R1 Appendix B, section 3.5	Met acceptance criteria
<b>Class 1E/Non-Class 1E Isolation</b>	Sustain isolation voltage limits: 1. 250 V dc 2. 600 V ac (283 V ac tested on some modules)	4.6.4 – apply 250 V dc and 600 V ac voltage each for 30 seconds	Met 250 V dc acceptance criteria. For 600 V ac limit, some tests only showed 283 V ac limit due to the limitation of test equipment but not the system.

## HFC-6000 Qualifying System vs EPRI TR 107330 Operating Envelope

### 3.2.6 Post Stress Performance

After all the stress/aging tests were applied to the test specimen, operability and prudency tests were applied to the test specimen to evaluate the impact of all the environmental stresses. EPRI does not provide specific guidance for the post stress performance acceptance criteria. Table 6 below shows the summary of post stress performance.

**Table 6 – Post Stress Performance Summary**

Description	HFC-6000 Performance	Remarks
<b>A. Accuracy</b>		
<b>16 AI Channels, 4mA to 20mA</b>	<b>HFC-AI16I</b>	Degraded by 0.1%
Nominal Response	Operate within specifications	
<b>8 AO Channels, 4mA to 20mA</b>	<b>HFC-AO8F</b>	No degradation
Nominal Performance	Operate within specifications.	
<b>8 RTD 100Ω Input Channels</b>	<b>HFC-AI8M</b>	No degradation
Nominal Performance	Operate within specifications.	
<b>4 Pulse Input Channels</b>	<b>HFC-AI4K</b>	No degradation
Input Signal Characteristics	Operate within specifications.	
Rate Mode/Accumulate Mode	Operate within specifications.	
<b>B. Response Time</b>		
<b>Digital Response Time</b>	30ms to 180 ms	Response time showed no degradation.
<b>Analog Response Time</b>	160ms to 380ms	
<b>C. Discrete Input Channels</b>	<b>HFC-DC33, DC34, DI16I</b> Operate within specifications.	No degradation
<b>D. Discrete Output Channels</b>	<b>HFC-DC33, DC34, DO8J</b> Operate within specifications.	No degradation
<b>E. Serial Communication Channels</b>	<b>C-Link, ICL</b> Operate within their specifications.	No degradation.
<b>F. Timer Function</b>	Operate within their specifications.	No degradation.
<b>G. Loss of Power Response</b>	Operate within their specifications.	No degradation.

## HFC-6000 Qualifying System vs EPRI TR 107330 Operating Envelope

### 3.3 Other Considerations

#### 3.3.1 System Analyses

The system analyses of HFC-6000 system were found to have the deviations in the following areas:

1. Availability/Reliability EPRI TR 107330-4.2.3.3
  - a. Common Cause Failures were not considered
  - b. Surveillance Intervals were not considered
2. Setpoint Analysis Support EPRI TR 107330-4.2.4 was not performed

These analyses / inputs were considered to be project-specific or plant-specific. That was the reason they were omitted. These areas will be inputs to any plant specific application in the determination of availability/reliability and setpoints in accordance with ISA 67.04.

#### 3.3.2 Qualification Tests

All the applicable required tests of the operability and prudency tests specified in EPRI TR 107330 section 5.3 and 5.4 were performed in the qualification process.

Since there is no coprocessor in the HFC-6000 system, 5.3.F, "Coprocessor Operability Test", was not part of the operability tests. For the "Failure to complete scan detection" test, it was decided that "Failover Operability" test could be used to cover that test. "Not Applicable for the HFC-6000 System" as stated in the qualification Master Test Plan was misleading and should be replaced as "Included in Failover Operability Test".

The Burst of Events (BOE) tests performed on the HFC-6000 system deviated from EPRI TR 107330 5.4.A and were due to the scope of HFC-6000 system. The HFC-6000 system does not cover the complete list of modules specified in 5.4.A. The TR 5.4.D, Fault Simulation Test, was covered by the "Failover Operability" test in the operability test set.

#### 3.3.3 Set of Modules

EPRI TR 107330 provides guidelines for a broad spectrum of equipment intended to be used in nuclear power plants. As stated in section 1.4.2, page 1-6:

*"A particular PLC platform may encompass a subset or superset of the requirements of this specification."*

The HFC-6000 qualifying system as specified in the Topical Report, Rev. C, contains a subset of modules specified in EPRI TR 107330. Those modules, which are not included in the current qualifying system, include:

1. Voltage-based Analog Modules – EPRI TR 107330-4.3.2.1.1
2. Thermal Couple (TC) Modules – EPRI TR 107330-4.3.2.1.4
3. Discrete AC Input Modules – EPRI TR 107330-4.3.2.2.1
4. TTL Input and Output Channels – EPRI TR 107330-4.3.2.2.3 and 4.3.3.2.4
5. Human/Machine Interface (HMI) Modules – EPRI TR 107330-4.5

## **HFC-6000 Qualifying System vs EPRI TR 107330 Operating Envelope**

Requirements related to these modules are not considered and, therefore, no deviations with regard to the acceptance criteria related to these modules were discovered. However, HFC may file in the future an addendum to our Topical Report to include some or all of these modules as part of the available HFC-6000 nuclear safety platform.

### **4.0 Summary**

Overall, the HFC-6000 system performance is favorably better than the operating requirements from EPRI specifications. The only major deviation from EPRI specifications are related to the EMI/RFI compatibility. As stated above, when installed inside a cabinet, these deviations should be eliminated. HFC is committed to rerun the EMI/RFI tests with future licensees / applicants to provide evidence to support this claim.



HF Controls

## Corrective Action Requested By NRC

### Table of Contents

Tab#	CR#	Opened	Closed
1	2009-0537	10/06/2009	11/17/2009
2	2009-0538	10/06/2009	11/09/2009
3	2009-0539	10/06/2009	11/23/2009
4	2009-0540	10/08/2009	11/19/2009
5	2009-0543	10/12/2009	12/15/2009

# HF Controls

## Condition Report

CR No: 2009-0537

Section I:  
Initiator: James Hall      Feedback:       Phone Number: 6553      Date: 10/6/2009

Department: V&V      Customer/Vendor: HFC      Project Number: VV0901

Time of Discovery: 10/6/09      Part #: DD0401, Rev A      Procedure #:      Other:

Section II: Condition Description / Finding (Attach additional sheets as required): Qty. of Items: 1

Document DD0401 Rev A needs to be reviewed and revised. Table 2-1 incorrectly identifies an HFC-DC33Q, HFC-DC34Q, HFC-DC35Q, even though these parts don't exist.

### Immediate Action Taken:

Initiated CR

### Recommended Action:

Review and revise DD0401, with a focus on Table 2-1

### Section III: Assignment

Assigned Department Manager:      Category:      Date:

Due Date:      Keyword:      Trend Code:

QPP 16.1 Rev G:      Material Disposition Required      Yes       Fast Track MDF

ATTACHMENT 7.2

CORRECTIVE ACTION IMPLEMENTATION FORM

CR NO.: 2009-0537			
Page ___ of ___			
<b>CORRECTIVE ACTION #1 IMPLEMENTATION FORM</b>			
ASSIGNED DEPARTMENT / INDIVIDUAL: Engr. - Gerardis			
Required Action and Estimated Completion Date: 10/25/2009			
Prepared By: Judy Holleman	Date: 10/9/2009		
Indicate The Action Taken:			
Completed By: _____	Date: _____	Management Approval: _____	Date: _____

**Section IV: Response**

Investigation Results /Disposition / Root Cause:

10 CFR Part 21: Yes  No  N/A:

**Section V: Corrective Action Plan** (Enter Department Responsible and Due Date for each action):

Preparer:	Date:	Management Approval	Date:
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<b>Section VI: Closure:</b>	Date:	Results: _____ Pass _____ Fail
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Additional Fail Details: \_\_\_\_\_ Date Return to Administrator

Administrator Notes:	Close Date:	Administrator Initials:	QA Mgr. Approval Date:
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# HF Controls

## Condition Report

CR No: 2009-0538

Section I:  
1. Author: Charles McKinney      Feedback:       Phone Number: X6579      Date: 10/6/2009

Department: Quality      Customer/Vendor: NRC      Project Number: N/A

Time of Discovery: 10/6/2009      Part #: N/A      Procedure #: WI-ENG-830B      Other: N/A

**Section II: Condition Description / Finding (Attach additional sheets as required): Qty. of Items: \_\_\_\_\_**

A review of WI-ENG-830, Rev B, Page 5 of 6, 5.3.5 File Date calls for the identification of the storage location of the module file and the date of creation for this file. A review of a Source Code Review indicates that the identity of the storage location of the module file is not shown.

**Immediate Action Taken:**

Wrote CR.

**Recommended Action:**

Revise WI-ENG-830, Rev B, to ensure the requirement of 5.3.5, page 5 of 6, is included in Source Code Reviews.

**Section III: Assignment**

Assigned Department Manager: \_\_\_\_\_      Category: \_\_\_\_\_      Date: \_\_\_\_\_  
Due Date: \_\_\_\_\_      Keyword: \_\_\_\_\_      Trend Code: \_\_\_\_\_  
QPP 16.1 Rev G: \_\_\_\_\_      Material Disposition Required      Yes       Fast Track MDF

ATTACHMENT 7.2

CORRECTIVE ACTION IMPLEMENTATION FORM

CR NO.: 2009-0538

Page \_\_\_ of \_\_\_

CORRECTIVE ACTION #1 IMPLEMENTATION FORM

ASSIGNED DEPARTMENT / INDIVIDUAL: Engr. - Gerardis

Required Action and Estimated Completion Date: 10/25/2009

Prepared By: Judy Holleman

Date: 10/9/2009

Indicate The Action Taken:

Completed By:

Date:

Management  
Approval:

Date:

Section IV: Response

Investigation Results / Disposition / Root Cause:

10 CFR Part 21: Yes  No  N/A:

Section V: Corrective Action Plan (Enter Department Responsible and Due Date for each action):

Preparer:	Date:	Management Approval	Date:
Section VI: Closure:	Date:	Results: ___ Pass ___ Fail	
Audit Fail Details:	Date Return to Administrator		
Administrator Notes:	Close Date:	Administrator Initials:	QA Mgr. Approval Date:

# HF Controls

## Condition Report

CR No: 2009-0539

**Section I:**

1. Reporter: Charles McKinney

Feedback:

Phone Number: X6579

Date: 10/6/2009

Department: Quality

Customer/Vendor: NRC

Project Number: N/A

Time of Discovery: 10-06-2009 Part #: N/A

Procedure #: PP901-000-01C Other: N/A

**Section II: Condition Description / Finding (Attach additional sheets as required): Qty. of Items: \_\_\_\_\_**

A review of HFC-6000 Safety System Topical Report PP901-000-01, Rec C:

Page 8-17, RG1.172 1997 "Software Requirements Specifications for Digital Computer Software Used in safety Systems of Nuclear Power Plants"

Page 10-5, 10.1.2.1 "Software Requirement"

both require the software requirement specification to completely document all the software components used in a module.

A thread audit found by NRC that the CQ4 block XX4QRTO.A10 did not have a corresponding requirement.

**Immediate Action Taken:**

CR initiated.

**Recommended Action:**

Revise the software requirement specification for HFC-6000 to completely document all the modules used. That include all the CQ4 blocks and any other modules which were not documented.

**Section III: Assignment**

Assigned Department Manager:

Category:

Date:

1. Date:

Keyword:

Trend Code:

QPP 16.1 Rev G:

Material Disposition Required

Yes

Fast Track MDF

ATTACHMENT 7.2

CORRECTIVE ACTION IMPLEMENTATION FORM

CR NO.: 2009-0539

Page \_\_\_\_ of \_\_\_\_

CORRECTIVE ACTION #1 IMPLEMENTATION FORM

ASSIGNED DEPARTMENT / INDIVIDUAL: Engr. - Gerardis

Required Action and Estimated Completion Date: 10/25/2009

Prepared By: Judy Holleman

Date: 10/9/2009

Indicate The Action Taken:

Completed By:

Date:

Management  
Approval:

Date:

**Section IV: Response**

Investigation Results / Disposition / Root Cause:

10 CFR Part 21: Yes  No  N/A:

**Section V: Corrective Action Plan** (Enter Department Responsible and Due Date for each action):

Preparer:	Date:	Management Approval	Date:
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<b>Section VI: Closure:</b>	Date:	Results: <input type="checkbox"/> Pass <input type="checkbox"/> Fail
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Administrator's Initials:	Date Return to Administrator
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Administrator Notes:	Close Date	Administrator Initials:	QA Mgr. Approval Date:
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# HF Controls

## Condition Report

CR No: 2009-0540

**Section I:**  
Initiator: Charles McKinney      Feedback:       Phone Number: X6579      Date: 10/8/2009

Department: Quality      Customer/Vendor: NRC      Project Number: N/A

Time of Discovery: 10/08/09      Part #: N/A      Procedure #: PP901-000-01C      Other: See below

**Section II: Condition Description / Finding (Attach additional sheets as required): Qty. of Items: \_\_\_\_\_**

1. PP901-000-01, Rev C, "HFC-6000 Safety System Topical Report", 8.2, Page 8-6, states: The existing HFC-6000 System design provides confidence that all failure conditions are detectable [or that, for certain failures, the HFC-6000 System redundant components permit continued operation of critical system functions in the presence of automatic switchover]. The second statement implies failures other than detectable failures - inferred conflict with PP901-000-01, page 8-23, 1st sentence of discussion on single failure criteria.
2. RR901-000-10, Rev A, "Requirement Compliance Traceability Matrix," 4.2.3.6, page 8 of 65, says approximately 89% of the postulated failure condition would produce alarm indications. The only type of failure likely to cause a problem is a run-time bit failure in memory. This can be remediated by including a run time memory test in the operating system.
3. RR901-000-10, Rev A, "Requirement Compliance Traceability Matrix," 4.3.4.7.B, page 20 of 65, says FMEA is designed to identify any failure condition that might not be detectable: the FMEA recommends a software modification to detect run-time bit failures in memory.
4. RR901-000-10, Rev A, 4.2.3.6, page 8 of 65 and RR901-000-10, Rev A, 4.3.4.7.B are conflicting statements which questions the statement in RR901-000-01, Rev C, Page 8-6, in the Topical report and also, statements conflict with contents of RR901-000-01, Rev B, "Failure Modes and Effects Analysis."
5. SCR 1068, Anticipated Impacts: does not reference Revision level of FMEA document.
6. On page 8-39 of TR PP901-000-01 Rev. C, it states "These two processors operate asynchronously and share information through the common public memory module, which is multi-ported". But the common public memory module is not multi-ported. Also, it states "this design supports unrestricted simultaneous access by both processors". But the architecture of the dual port memory does not support simultaneous access. Clarifications are needed.

**Immediate Action Taken:**

Wrote CR

**Recommended Action:**

1. Update RR901-000-10, Rev A, 4.2.3.6, page 8 of 65 and 4.3.4.7.B, page 20 of 65, and RR901-000-01, Rev B, to be consistent with PP901-000-01, Rev C, 8.2, Page 8-6. (Topical Report).
2. Update SCR 1068 to reflect revision level of document changes.

**Section III: Assignment**

Assigned Department Manager: \_\_\_\_\_      Category: \_\_\_\_\_      Date: \_\_\_\_\_  
Due Date: \_\_\_\_\_      Keyword: \_\_\_\_\_      Trend Code: \_\_\_\_\_  
QPP 16.1 Rev G: \_\_\_\_\_      Material Disposition Required      Yes       Fast Track MDF

ATTACHMENT 7.2

CORRECTIVE ACTION IMPLEMENTATION FORM

CR NO.: 2009-0540

Page \_\_\_\_ of \_\_\_\_

CORRECTIVE ACTION #1 IMPLEMENTATION FORM

ASSIGNED DEPARTMENT / INDIVIDUAL: Engr. - Gerardis

Required Action and Estimated Completion Date: 11/1/2009

Prepared By: Judy Holleman

Date: 10/16/2009

Indicate The Action Taken:

Completed By:

Date:

Management  
Approval:

Date:

ATTACHMENT 7.2

CORRECTIVE ACTION IMPLEMENTATION FORM

CR NO.: 2009-0540			
Page ___ of ___			
<b>CORRECTIVE ACTION #2 IMPLEMENTATION FORM</b>			
ASSIGNED DEPARTMENT / INDIVIDUAL: V&V Isomela			
Required Action and Estimated Completion Date: 1/6/09			
Prepared By: <i>Wanch</i>	Date: 1/19/09		
Indicate The Action Taken:			
Completed By:	Date:	Management Approval:	Date:

# HF Controls

## Condition Report

CR No: 2009-0543

**Section I:**

Initiator: Charles McKinney

Feedback:

Phone Number: x6579

Date: 10/12/2009

Department: Quality

Customer/Vendor: NRC

Project Number: N/A

Time of Discovery: 10-9-09

Part #: N/A

Procedure #: N/A

Other: N/A

**Section II: Condition Description / Finding (Attach additional sheets as required): Qty. of Items: \_\_\_\_\_**

During the NRC audit, it was found in various qualification test reports, there were contradictions with the actual qualification test results.

**Immediate Action Taken:**

Wrote CR.

**Recommended Action:**

Write a qualification summary report to define the envelopes of:

1. Environment
2. Performance

And ensure the quality of the test results moving forward.

**Section III: Assignment**

Assigned Department Manager:

Category:

Date:

Due Date:

Keyword:

Trend Code:

QPP 16.1 Rev G:

Material Disposition Required

Yes

Fast Track MDF

ATTACHMENT 7.2

CORRECTIVE ACTION IMPLEMENTATION FORM

CR NO.: 2009-0543

Page \_\_\_ of \_\_\_

CORRECTIVE ACTION #1 IMPLEMENTATION FORM

ASSIGNED DEPARTMENT / INDIVIDUAL: Engr. - Gerardis

Required Action and Estimated Completion Date: 11/1/2009

Prepared By: Judy Holleman

Date: 10/16/2009

Indicate The Action Taken:

Completed By:

Date:

Management  
Approval:

Date:

