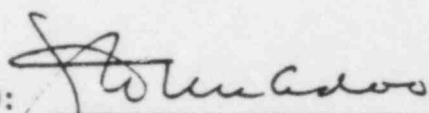


PLANT SAFETY MONITORING SYSTEM

This document contains information, relative to the qualification of the equipment identified below, in accordance with the methodology of WCAP 8587. The Specification section (Section 1) defines the assumed limits for the equipment qualification and constitute interface requirements to the user.

APPROVED:


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EQUIPMENT QUALIFICATION DATA (PART 1 - SPECIFICATIONS)

1.0 PERFORMANCE SPECIFICATIONS

1.1 Electrical Requirements

- 1.1.1 Voltage: 120 VAC \pm 5 percent
- 1.1.2 Frequency: 60 HZ \pm 3 percent
- 1.1.3 Load:
- 1.1.4 Electromagnetic Interference: Per Mil-N-19900B
- 1.1.5 Other: None

1.2 Installation Requirements: Installed as per Reference 1. Welded and bolted configurations permissible. Location in a controlled environment.

1.3 Auxiliary Devices: None

1.4 Preventative Maintenance Schedule: The details of any preventative maintenance schedule, assumed in establishing the qualified life, will be specified in this section on completion of the Westinghouse Aging Evaluation Program.

1.5 Design Life: 40 years

1.6 Operating cycles (Expected number of cycles during design life, including test): Continuous

1.7 Performance Requirements for Function

Parameter	Condition		Containment Test	FLB/SLB	DBE		Seismic	Post DBE		
	Normal	Abnormal			LOCA			FLB/SLB	LOCA	Seismic
1.7.1 Time requirement	Continuous	12 hours	N/A	N/A	N/A		Note A	N/A	N/A	Continuous
1.7.2 Performance Requirement	Note B	Note B					No damage; Note A			Note B

1.8 Environmental Conditions for Same Function

1.8.1 Temperature (°F)	60-80	82-120 Note C	N/A	N/A	N/A		Ambient Conditions	N/A	N/A	Ambient Conditions
1.8.2 Pressure (psig)	0	0					0			
1.8.3 Humidity (% RH)	30-50	35-95 Note C					Ambient			
1.8.4 Radiation (R)	None	None					None			
1.8.5 Chemicals	None	None					None			
1.8.6 Vibration	None	None					None			
1.8.7 Acceleration (g)	None	None					Figure 3			

Notes:

A: Electronic: required to function before and after a seismic event.

B: Accuracy of 0.1% for the Active Current Loop Input, High Level Voltage Output, Current Loop Output and High Level Voltage Input Cards during normal operating conditions. Accuracy of 0.26% for the RTD (4 wire) Input Card and 0.38% for the Thermocouple Input Card (extended range) during normal operating conditions. Refer to WCAP-8687 Supp. 2-E53A for more information on card accuracies.

C: Figure 1, envelope 3. However, since based on Westinghouse experience, operation at low humidity is an equipment operating concern, the abnormal extreme for humidity shall be 95 percent relative humidity.

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1.9 Qualified Life: The currently demonstrated qualified life (Short Term Aging) is 5 years based on the actual test conditions identified in Table 1.

1.10 Remarks: None

EQUIPMENT QUALIFICATION DATA (PART 2 - QUALIFICATION BY TEST)

2.0 TEST PLAN

Environmental and Seismic Testing was performed at the Westinghouse Advanced Energy Systems Division (WAESD) testing laboratory in Large, Pennsylvania. Environmental cycling was performed on the Plant Safety Monitoring System (PSMS) in a temperature and humidity chamber. A microprocessor controls the chamber and maintains the temperature and humidity conditions desired. Seismic tests were performed at the WAESD Seismic Laboratory on the 8' by 8' Magnesium Biaxial Shake Table. Reference 1 provides a more detailed description of the test facility.

2.1 Equipment Description: Plant Safety Monitoring System (See Section 2.10.2)

2.2 Number Tested: type test on one system - Train A

2.3 Mounting: per Section 1.2

2.4 Connections: Standard plant wiring terminated with ring terminals on termination frame in the back of the cabinet.

2.5 Aging Simulation Procedure:

Aging simulation will be addressed in a separate component test program as described by Subprogram C of Appendix B to WCAP 8587.

2.6 Service Conditions to be simulated by test (1): Plant Safety Monitoring System

	<u>Normal</u>	<u>Abnormal</u>	<u>Test</u>	<u>Seismic</u>	<u>HELB</u>	<u>Post-HELB</u>
2.6.1 Temp. (°F)	Ambient	Figure 2	N/A	Ambient	N/A	N/A
2.6.2 Pressure (psig)	0	0		0	---	---
2.6.3 Humidity (% RH)	Ambient	Figure 2		Ambient	---	---
2.6.4 Radiation (R)	None	None		None	---	---
2.6.5 Chemicals	None	None		None	---	---
2.6.6 Vibration	None	None		Effects of 5 OBE's	---	---
2.6.7 Acceleration (g)	None	None		TRS>RRS Figure 3 See Section 2.10.3.2	---	---

2.7 Measured Variables

	Required	Not Required
2.7.1 Category I - Environment		
2.7.1.1 Temperature	<u>A</u>	<u>B</u>
2.7.1.2 Pressure	<u></u>	<u>A,B</u>
2.7.1.3 Moisture	<u>A</u>	<u>B</u>
2.7.1.4 Gas Composition	<u></u>	<u>A,B</u>
2.7.1.5 Vibration	<u>B</u>	<u>A</u>
2.7.1.6 Time	<u>A,B</u>	<u></u>
2.7.2 Category II - Input Electrical Characteristics		
2.7.2.1 Voltage	<u>A,B</u>	<u></u>
2.7.2.2 Current	<u></u>	<u>A,B</u>
2.7.2.3 Frequency	<u>A</u>	<u>B</u>
2.7.2.4 Power	<u></u>	<u>A,B</u>
2.7.2.5 Other	<u></u>	<u>A,B</u>
2.7.3 Category III - Fluid Characteristics		
2.7.3.1 Chemical Composition	<u></u>	<u>A,B</u>
2.7.3.2 Flow Rate	<u></u>	<u>A,B</u>
2.7.3.3 Spray	<u></u>	<u>A,B</u>
2.7.3.4 Temperature	<u></u>	<u>A,B</u>
2.7.4 Category IV - Radiological Features		
2.7.4.1 Energy Type	<u></u>	<u>A,B</u>
2.7.4.2 Energy Level	<u></u>	<u>A,B</u>
2.7.4.3 Dose Rate	<u></u>	<u>A,B</u>
2.7.4.4 Integrated Dose	<u></u>	<u>A,B</u>

2.7.5 Category V - Electrical Characteristics

2.7.4.1	Insulation Resistance		A,B
2.7.4.2	Output Voltage	A,B	
2.7.4.3	Output Current		A,B
2.7.4.4	Output Power		A,B
2.7.4.5	Response Time		A,B
2.7.4.6	Frequency Characteristics		A,B
2.7.4.7	Simulated Load		A,B

2.7.6 Category VI - Mechanical Characteristics

2.7.6.1	Thrust		A,B
2.7.6.2	Torque		A,B
2.7.6.3	Time		A,B
2.7.6.4	Load Profile		A,B

2.7.7 Category VII - Auxiliary Equipment

(List Function and Required Measurements)

None

A: Operational Test, Normal and Abnormal Conditions

B: Seismic Test

2.8 Test Sequence Preferred⁽²⁾

- 2.8.1 Inspection of Test Item
- 2.8.2 Operation (Normal Condition)
- 2.8.3 Operation (Performance Specification Extremes, Section 1)
- 2.8.4 Simulated Aging
- 2.8.5 Vibration⁽³⁾
- 2.8.6 Operation (Simulated High Energy Line break Conditions)
- 2.8.7 Operation (Simulated Post HELB Conditions)
- 2.8.8 Inspection

2.9 Test Sequence Actual⁽²⁾

<u>Step</u>	<u>Justification</u>
2.8 . <u>1</u>	
2.8 . <u>2</u>	
2.8 . <u>3</u>	
2.8 . <u>5</u>	
2.8 . <u>8</u>	
2.8 . <u>4</u>	- Aging uses separate test program - not sequential
2.8 . <u>6</u>	N/A - PSMS not required to operate in a
2.8 . <u>7</u>	N/A HELB environment

2.10 Type Test Data

2.10.1 Objective

The objective of this test program is to demonstrate, employing the recommended practices of Reg. Guide 1.89 (IEEE-323-1974) and Reg. Guide 1.100 (IEEE 344-1975) the capability of the Plant Safety Monitoring System to perform its safety related functions described in EQDP Section 1.7 while exposed to the applicable environments defined in EQDP Section 1.8.

2.10.2 Equipment Tested

The testing was performed on the Plant Safety Monitoring System qualification unit described in General Assembly Drawing 1591E16 Rev. 0, sheets 1 and 2; and PSMS Qualification Unit Configuration Drawing 2323D36 Rev. 0.

2.10.2.1 Normal Environment Testing

A system test under normal environmental conditions is performed on each PSMS unit at the completion of the manufacturing process. The qualification unit was tested under normal environmental conditions before the abnormal environment testing.

2.10.2.2 Abnormal Environment and Seismic Testing

PSMS modules were assembled in a typical system configuration and installed in a standard seismic test cabinet. The modules selected for the qualification unit were chosen to include at least one of each module used in the Plant Safety Monitoring System. The test system was designed to provide automatic electrical exercising of many of the system modules during the abnormal environmental test cycles and seismic testing.

2.10.2.3 Aging Evaluation Program

A representative sample of the critical components from the Plant Safety Monitoring System is included in Subprogram C of the Aging Evaluation Program described in Appendix B to WCAP-8587.

2.10.3 Test Summary

2.10.3.1 Environment Test

Westinghouse requires that the PSMS equipment be located such that it does not experience a consequent adverse environment when required to operate following a high energy line break. Therefore the only testing required is to

demonstrate equipment functionality under normal and abnormal service conditions (temperature, humidity and A.C. power voltage and frequency). (See Figure 2).

Irradiation simulation is not required on this equipment, since estimated in-service radiation doses will not prejudice the capability of the equipment to perform under design basis event (i.e. seismic event) conditions.

The environmental testing reported in Reference 1 is intended to demonstrate the capability of the PSMS to meet the safety-related performance requirements specified in EQDP Section 1.7 when exposed to the variations in temperature, humidity, voltage and frequency specified by Figure 2. The system components were installed in a typical/operating process channel design configuration. The testing successfully demonstrated the safety related requirements. Additional margin was, furthermore, included in this test by submitting the equipment to two additional cycles of electrical and environmental extremes also described by Figure 2. This test is considered to satisfactorily demonstrate the PSMS capability to meet its safety related functional requirements when exposed to the specified abnormal environments (EQDP Section 1.7) and the permitted range of frequency and voltage variations (EQDP Section 1.1) in accordance with IEEE-323-1974 Section 6.3.2(2) and (3).

2.10.3.2 Seismic Tests

The single design basis event capable of producing an adverse condition at the equipment location is a seismic event. Following the abnormal environment testing, the PSMS cabinet and electronics were subjected to multi-axis, multi-frequency inputs in accordance with requirements of Reg. Guide 1.100 (IEEE 344-1975), as described in Reference 1. Figure 3 shows the required response spectrum (RRS) in the principle axes for the equipment of a full level SSE. All test response spectrum (TRS) curves were recorded against the control direction (accelerations 2 higher than those shown in Figure 3) RRS and were verified to meet or exceed that curve. The equipment experienced the effects of five (5) OBE's in the initial orientation followed by four (4) SSE's, one in each of four horizontal orientations (0°, 90°, 180°, 270°).

2.10.3.3 Aging Evaluation

Subprogram C of the Westinghouse Aging Evaluation Program (Appendix B, WCAP-8587) has incorporated a representative sample of components from the PSMS. The program will be reported in WCAP-8587, Supplement 2, Appendix A (Proprietary). The purpose of Subprogram C is to demonstrate that during the qualified life there are no in-service aging mechanisms capable of reducing the capability of the PSMS to perform during or after a seismic event.

2.10.4 Conclusion

The Plant Safety Monitoring System has successfully passed abnormal environmental testing and seismic testing. The results of the aging program, together with the environmental and seismic testing will demonstrate the qualification status of the Plant Safety Monitoring System. The qualification status of the equipment is shown in Table 1.

2.11 Notes

- (1) The generic tests completed by Westinghouse employ parameters designed to envelope a number of plant applications. Margin can be demonstrated on plant applications by comparison of the generic Westinghouse qualification parameters to plant specific parameters.
- (2) Paragraph 2.8 shows the preferred test sequence as specified in IEEE-323-74. The actual sequence employed is shown in paragraph 2.9 including justification for any deviations from the preferred.
- (3) Simulated seismic and other vibration seen in service.

2.12 References

1. Riling, R. W., Parello, J., "Equipment Qualification Test Report, Plant Safety Monitoring System" WCAP-8687, Supplement 2-E53A (Proprietary).

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SECTIONS 3 & 4 QUALIFICATION BY EXPERIENCE AND/OR ANALYSIS

Westinghouse does not employ operating experience or analysis in support of the qualification program for the Plant Safety Monitoring System.

TABLE 1

ACTUAL QUALIFICATION TEST CONDITIONS

EQUIPMENT (1) SYSTEM/CATEGORY	LOCATION STRUCTURE/AREA	MANUFACTURER TYPE/MODEL	ABNORML/ACCIDENT ENVIRONMENTAL EXTREMES			OPERABILITY ACCURACY (%)				QUAL	QUAL	QUAL	QUAL
			PARAMETER	SPECIFIED (2)	QUALIFIED	REQ	DEM	REQ (4)	DEM	LIFE	METHOD	REF	PROGRAM STATUS
PSMS-RPU/DPU Category d	Control Build-	WNSID	Temperature	120°F		12 hr.	Two	0.1%	0.1%	5 yrs.	Seq.	ESE-	Completed
	ing/Control	PSMS/1	Pressure	Atmos.			12 hr.	0.26%	0.26%		Test	53	
	Room, Safeguards		Rel. Humidity	95%			Cycles	0.38%	0.38%				
	Bus Room, Relay		Radiation	None									
	Room, Cable		Chemistry	None									
	Spreading Room												

NOTES:

1. For definition of the category letters, refer to NUREG 0855 "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment," Appendix E, Section 2.
2. Plant specific environmental parameters are to be inserted by the applicant
3. Phase I of the Westinghouse Aging Evaluation Program as described in WCAP-8587 Appendix B will establish a qualified life of at least 5 years for this equipment, Phase II of this program will extend the qualification life to a maximum of 20 years or as far as is achievable.
4. Accuracy of 0.1% for the Active Current Loop Input, High Level Voltage Output, Current Loop Output and High Level Voltage Input Cards during normal operating conditions. Accuracy of 0.26% for the RTD (4 wire) Input Card and 0.38% for the Thermocouple Input Card (extended range) during normal operating conditions. Refer to WCAP-8687 Supp. 2-E53A for more information on card accuracies.

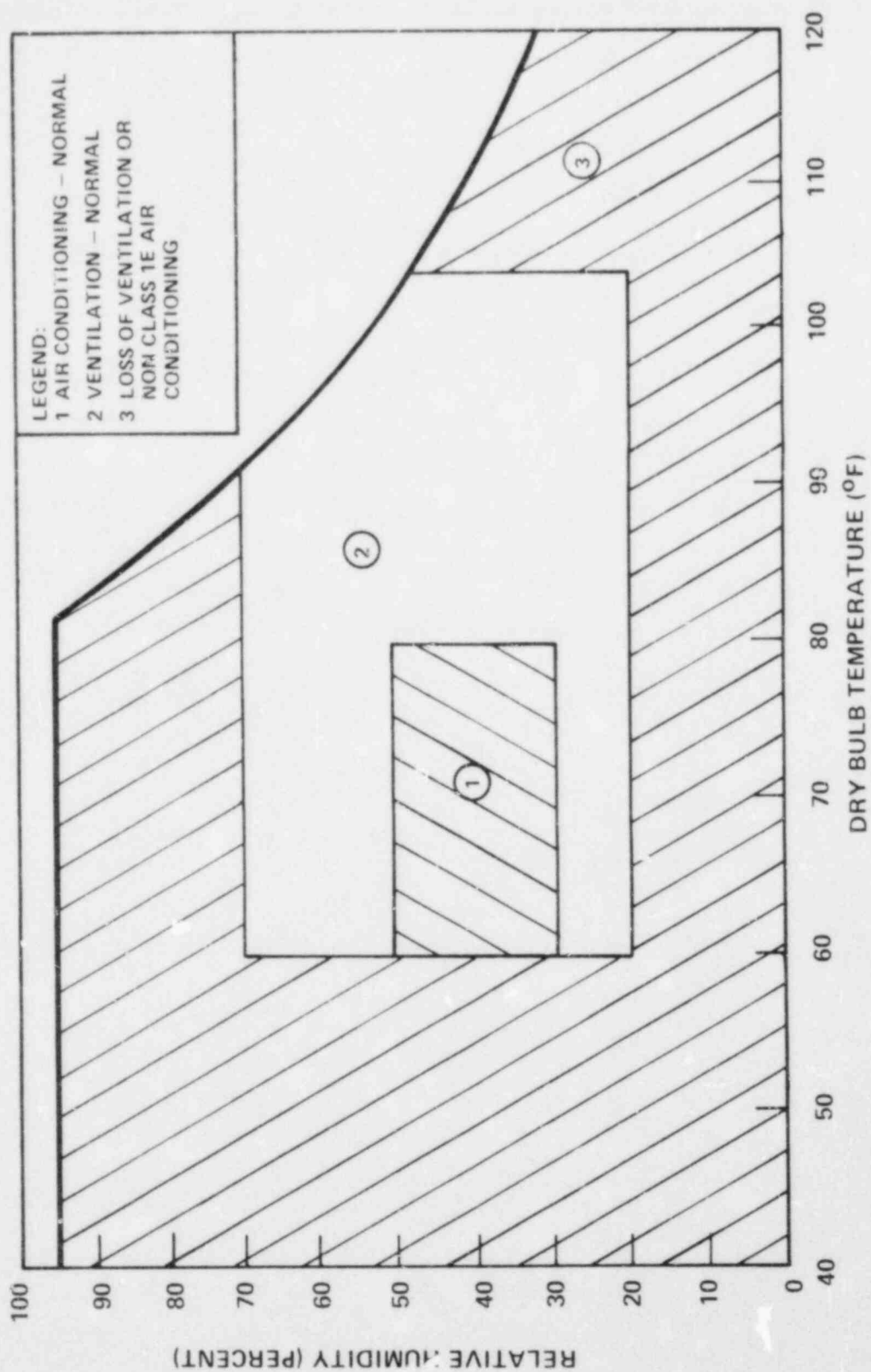


Figure 1 Temperature Versus Humidity - Enclosed Environments Outside Containment

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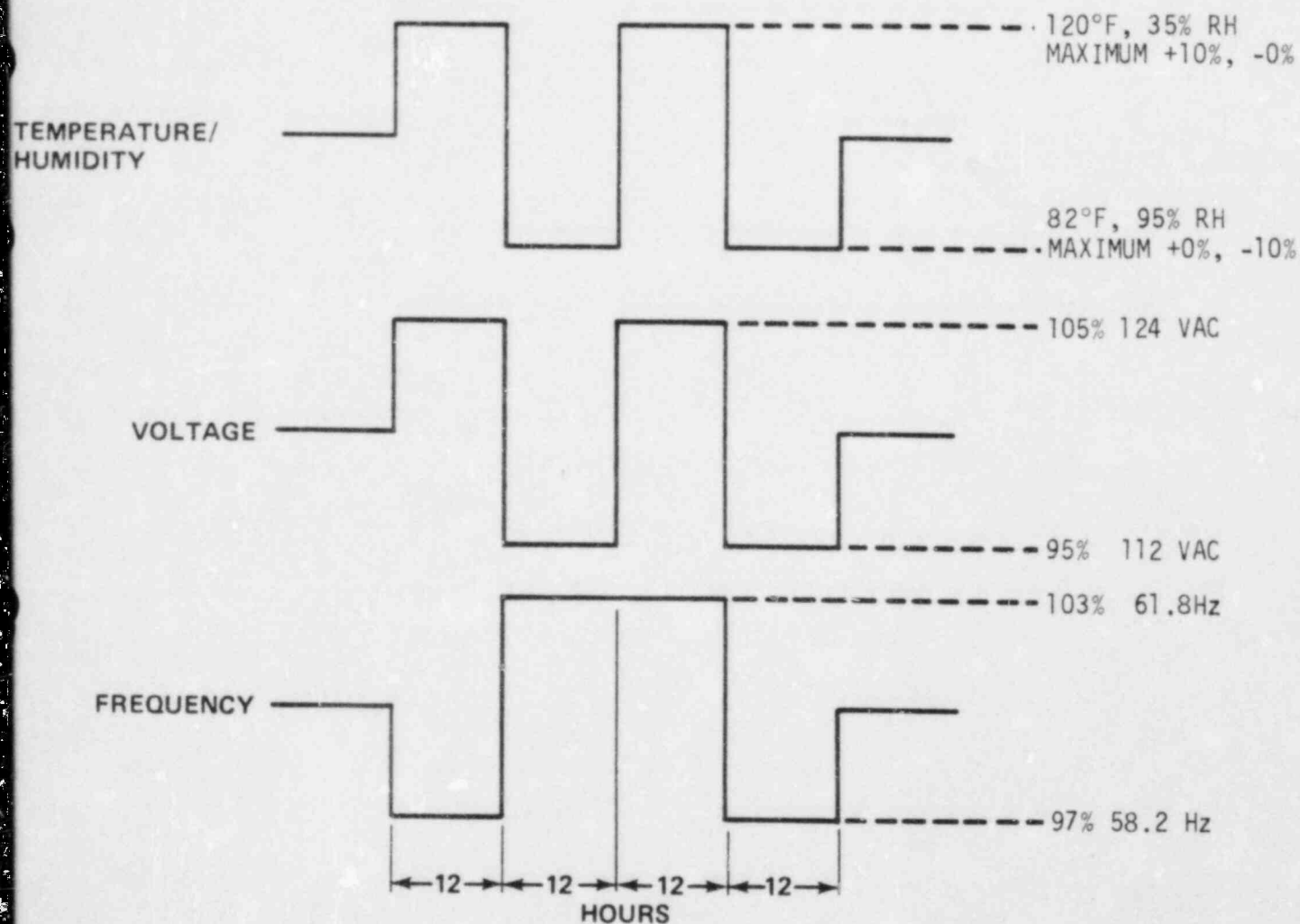


FIGURE 2 VERIFICATION TEST PROFILE--TEMPERATURE AND HUMIDITY TESTING

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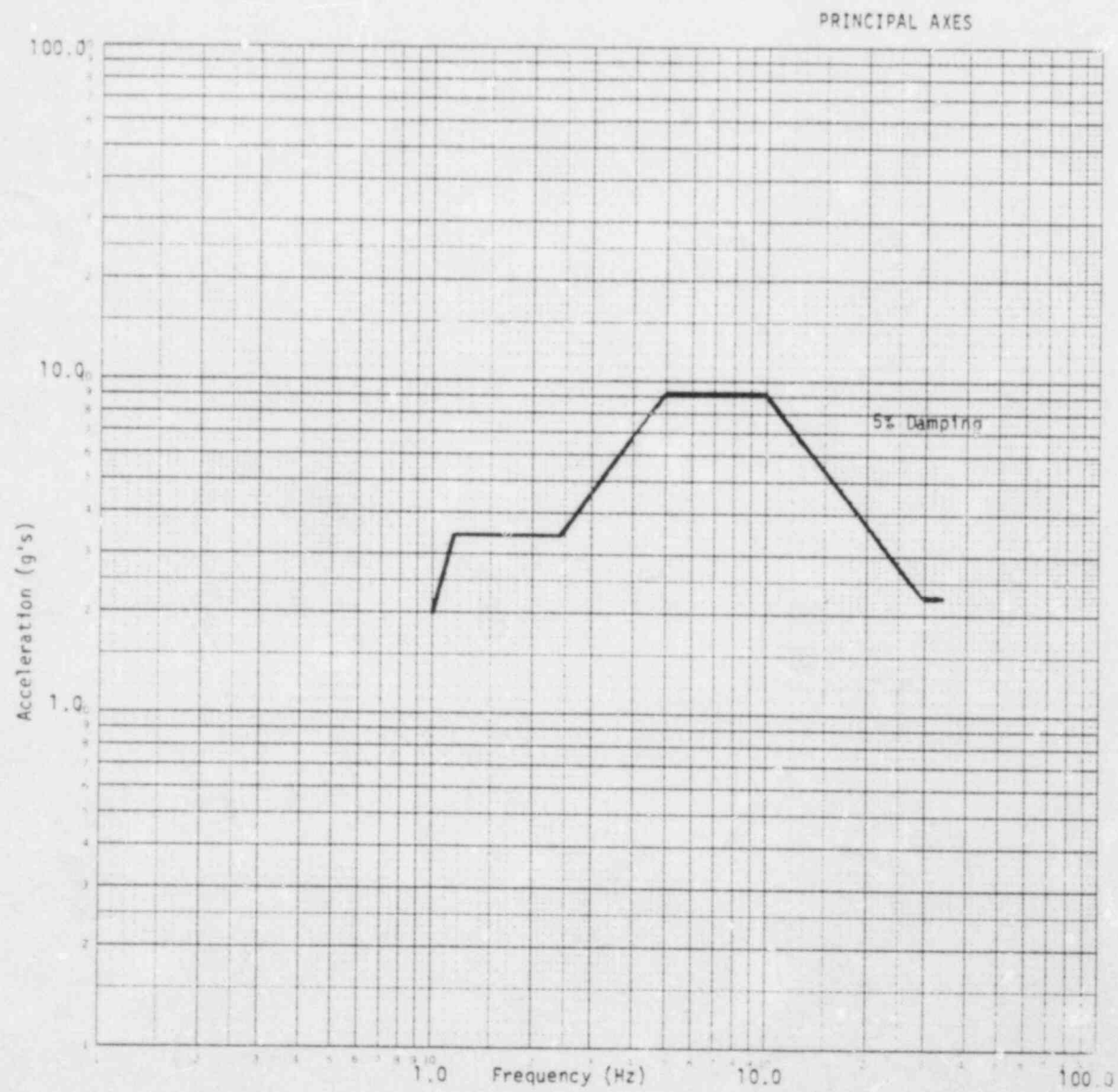


Figure 3: Required Response Spectrum (RRS)
for Safe Shutdown Earthquake (SSE)