

EQUIPMENT QUALIFICATION DATA PACKAGE

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.

Instrument Bus Distribution Panel

APPROVED: 

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E. P. Rahe, Manager  
Nuclear Safety Department

Westinghouse Electric Corporation  
Nuclear Energy Systems  
P.O. Box 355  
Pittsburgh, Pennsylvania 15230

WESTINGHOUSE CLASS 3  
SECTION 1 - SPECIFICATIONS

1.0 PERFORMANCE SPECIFICATIONS

1.1 Electrical Requirements

1.1.1 Voltage: 118 VAC,  $\pm$  2% single phase

1.1.2 Frequency: 60 Hz  $\pm$  1 Hz

1.1.3 Load: 7.5 KVA Max. Total

1.1.4 Electromagnetic Interference: N/A

1.1.5 Other: None

1.2 Installation Requirements: W NES Dwg 1143E61 Rev. 2

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): 120 (Estimate of 3 per year). The three cycles per year is an average of the possible cycles of operation per year, i.e., considering its potential use as a service switch, maintenance function, or for isolation for repairs.

1.7 Performance Requirements for<sup>(b)</sup>:

Parameter	Normal Conditions	Abnormal Conditions	Containment Test Conditions	DBE Conditions <sup>(a)</sup>			Post DBE Conditions <sup>(a)</sup>		
				FLB/SLB	LOCA	Seismic	FLB/SLB	LOCA	Seismic
1.7.1 Time requirement	Continuous	12 Hrs.	N/A	Event duration	Event duration	Event duration	Continuous	Continuous	Continuous
1.7.2 Performance requirement	To supply 7.5 KVA Max. to connected Load <sup>(d)</sup>	As normal	As normal	As normal	As normal	As normal	As normal	As normal	As normal

1.8 Environmental Conditions for Same Function<sup>(b)</sup>

1.8.1 Temperature(°F)	60 - 104	Note C	Ambient Conditions	Ambient Conditions	Ambient Conditions	Ambient Conditions	Ambient Conditions	Ambient Conditions	Ambient Conditions
1.8.2 Pressure (psig)	0	0				0			
1.8.3 Humidity (% RH)	20 - 70	Note C				Ambient Conditions			
1.8.4 Radiation (R)	<400	None				None			
1.8.5 Chemicals	None	None				None			
1.8.6 Vibration	None	None				None			
1.8.7 Acceleration (g)	None	None				See Section 2.10.3.2			

- Notes: a: DBE is the Design Basis Event.  
 b: Margin is not included in the parameters of this section.  
 c: Figure 1, Envelope 3. However, for plants having Class 1E HVAC for the area in which the distribution panels are located, the abnormal extremes are the same as the normal specified above.  
 d: The purpose of these panels is to pass current, not to interrupt current.

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1.9 Qualified Life: The currently demonstrated qualified life (Phase I Short Term Aging) is 5 years based on WCAP-8687, Supplement 2, Appendix A2 (Material Aging). Westinghouse is planning an extension (Phase II Long Term Aging) of Subprogram C of the Aging Evaluation Program (Appendix B to WCAP-8587) to increase the demonstrated qualified life. Also see Table 1.

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1.10 Remarks: None

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SECTION 2 - QUALIFICATION BY TEST

2.0 TEST PLAN

2.1 Equipment Description: 7.5 KVA Instrument Bus Distribution Panel  
Model Number (WEB-1-PH/2-W)

2.2 Number Tested: Type test on two (2) units

2.3 Mounting: As per Section 1.2

2.4 Connections: Power 118 VAC, 60 Hz, Single phase

2.5 Aging Simulation Procedure

By 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<sup>(1)</sup>

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		Containment					
		<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	Fig. 2	N/A	Ambient	N/A	N/A
2.6.2	Pressure (psig)	0	0		0		
2.6.3	Humidity (% RH)	Ambient	Fig. 2		Ambient		
2.6.4	Radiation (R)	None	None		None		
2.6.5	Chemicals	None	None		None		
2.6.6	Vibration	None	None		None		
2.6.7	Acceleration (g)	None	None		See 2.10.3.2		

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## 2.7 Measured Variables

This section identifies the parameters required to be measured during the test sequence(s).

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

		<u>Required</u>	<u>Not Required</u>
2.7.5	Category V - Electrical Characteristics		
2.7.5.1	Insulation Resistance		A,B
2.7.5.2	Output Voltage	A,B	
2.7.5.3	Output Current	A,B	
2.7.5.4	Output Power	A,B	
2.7.5.5	Response Time		A,B
2.7.5.6	Frequency Characteristics		A,B
2.7.5.7	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	None	

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A: Seismic Test.

B: Operational Test, Normal and simulated abnormal conditions.



## 2.8 Test Sequence Preferred

This section identifies the preferred test sequences as specified in IEEE-323-74

- 2.8.1 Inspection of Test Item
- 2.8.2 Operation (Normal Condition)
- 2.8.3 Operation (Performance Specifications Extremes, Section 1)
- 2.8.4 Simulated Aging
- 2.8.5 Vibration
- 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

This section identifies the actual test sequences which, in total, constitute the overall qualification program for this equipment. The separate subsections indicate the separate test sequences completed on differing, but essentially identical, equipment and/or components. The justification for employing anything other than the preferred sequence is as follows;

The DBE is simulated by the Seismic Test sequence of Section 2.9.1. The HELB Tests (Section 2.8.6 and 2.8.7) have been excluded since the Instrument Bus Distribution Panel is not exposed to the HELB environment due to its location. The abnormal extremes test of Section 2.9.2 was performed on two units that were physically identical as permitted by IEEE-323-74, Section 6.3.2(3) and manufactured to the same baseline; thus the units are not different in any way that would affect the test. The aging test employs the preferred test sequence (Section 2.8 excluding HELB and abnormal extremes Sections 2.8.6, 2.8.7, and 2.8.3) on a representative sample of

components from the Distribution Panel. The aging tests will demonstrate that during the qualified life there are no in-service aging mechanisms capable of reducing the capability of the Instrument Bus Distribution Panel to perform during or after a seismic event. As a consequence, the seismic testing on the un-aged Instrument Bus Distribution Panel is not prejudiced by any in-service aging mechanisms.

<u>Step</u>	<u>Notes</u>
2.9.1 Seismic Test Sequence	
2.8.1 Seismic (DBE) test sequence	
2.8.2	
2.8.5	
2.8.8	
2.9.2 Environmental Test Sequence	
2.8.1	
2.8.2 Environmental Type Test Sequence on similar	
2.8.3 piece of equipment as permitted by IEEE-323-74	
2.8.8 Section 6.3.2(3).	
2.9.3 Aging Test Sequence	
2.8.1	
2.8.2 Aging to be addressed by separate testing as	
2.8.4 described in Subprogram C of Appendix B to	
2.8.5 WCAP-8587	
2.8.8	

## 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 Instrument Bus Distribution Panel to complete 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

## 2.10.2.1 Environmental Test

See Reference 1 for a description of the equipment

## 2.10.2.2 Seismic Test

See References 2 and 3 for a description of the Equipment Aging Evaluation Program.

2.10.2.3 A representative sample of critical components from the Instrument Bus Distribution Panel will be 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 Seismic Tests

The single design basis event capable of producing an adverse environment at the equipment location is a seismic event. The demonstration requested by the NRC employing multi-axis single frequency inputs as reported in References 2 and 3, demonstrate the capability of the Instrument Bus Distribution Panel to perform prespecified safety-related functions during and after seismic events up to and including those required for plants in areas of high seismic activity (Reference 3) in

accordance with the procedures recommended by Reg. guide 1.100 (IEEE 344-1975). The seismic testing which has been performed and demonstrates the transition from IEEE-344-71 testing to IEEE-344-75 requirements is reported in Reference 5. The generic seismic test level contains significant margin with respect to any single plant application referencing this program.(1)

#### 2.10.3.2 Normal and Abnormal Environment Testing

Westinghouse requires that the Instrument Bus Distribution Panel be located such that it does not experience a consequent adverse environment when required to operate following a high energy line break either inside or outside containment. Therefore the only environmental testing required is to demonstrate equipment capability under normal and abnormal environmental extremes.

Reference 4 summarizes the results of available radiation testing of organic and inorganic materials and justifies that, for radiation doses less than 10<sup>4</sup> rads, no deterioration in material structural properties is detectable. As a consequence, a radiation 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 designed to demonstrate the capability of the Instrument Bus Distribution Panel 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 EQDP Figure 3. The testing successfully demonstrated the specified safety-related requirements. Additional margin was, furthermore, included in this test by submitting the

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equipment to a double cycle of electrical and environmental extremes as described by EQDP Figure 2. This test is considered to satisfactorily demonstrate the Instrument Bus Distribution Panel capability to meet its safety-related functional requirements when exposed to the specified normal and 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).

#### 2.10.3.3 Aging Evaluation

Subprogram C of the Westinghouse Aging Evaluation Program (Appendix B, WCAP 8587) will incorporate a representative sample of components from the Instrument Bus Distribution Panel. This program is currently in progress and will be Reported in WCAP-8587 Supplement 2, Appendix A, (Non-Proprietary) WCAP-8687, Supplement 2, Appendix A (Proprietary). The objective 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 Instrument Bus Distribution Panel to perform during or after a seismic event. As a consequence, the seismic testing on the un-aged Instrument Bus Distribution Panel described above, is not prejudiced by any in-service aging mechanism.

## 2.10.4 Conclusion

The demonstrated qualified life of the Instrument Bus Distribution Panel will be established by Subprogram C of the Westinghouse Aging Evaluation Program. The results of the aging program, together with the seismic and environmental testing described herein, demonstrate the qualification of the Instrument Bus Distribution Panel employing the practices recommended by Reg. Guide 1.89 and 1.100.

## 2.11 Section 2 Notes

- (1) The generic tests completed by Westinghouse employ parameters designed to envelope a number of plant applications. Margin is a plant specific parameter and will be established by the applicant.

## 2.12 References

1. Yalich, M. "Equipment Qualification Test Report Instrument Bus Distribution Panel (Normal and Abnormal Temperature and Humidity Testing)." WCAP-8687 Supplement 2 ESE-19A (Proprietary), WCAP-8587 Supplement 3 ESE-19A (Non-Proprietary).
2. Figenbaum, E. K., "Seismic Testing of Electrical and Control Equipment Static Inverter and Instrument Bus Distribution Panel" WCAP-7821 Supplement 2 Addendum 1 (Non-Proprietary), October 1975.
3. Vogeding, E. L., "Seismic Testing of Electrical and Control Equipment to High Seismic Plants" WCAP-7821 Supplement 5. (Non-Proprietary) September 1976.

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4. Damerow, F. W., "Effects of Gamma Radiation Doses Below 104 Rads on Mechanical Properties of Materials." WCAP-8587 Appendix C, (Non- Proprietary).
5. Chang, S. M., "Seismic Evaluation of the Single Frequency Sine-Beat Test Inputs Employed During 1971 Qualification Testing," ST-STA-218 (Proprietary) in progress.

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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 Instrument Bus Distribution Panel.



Table 1 Actual Qualification Test Conditions

EQUIPMENT (1) SYSTEM/CATEGORY	LOCATION STRUCTURE/AREA	MANUFACTURER TYPE/MODEL	ABNORMAL/ACCIDENT ENVIRONMENTAL EXTREMES		OPERABILITY		ACCURACY(%)		QUAL	QUAL	QUAL	QUAL	
			PARAMETER	SPECIFIED (2)	QUALIFIED (3)	REQ	DEM	REQ	DEM	LIFE	METHOD	REF	PROGRAM STATUS
Instrument bus distribu- tion panel/ RPS, ESF/ Category d	Control building	W PED 7.5 KVA	Temperature	120 <sup>0</sup> F		12 hr. Two	N/A	N/A	5	Seq.	ESE-	Completed	
			Pressure	Atmos.		cycles 12			hrs.	Test	19		
			rel. humidity	95%		hr.			(4)				
			Radiation	<10 <sup>4</sup> R(γ)		cycles							
			Chemistry	None									

Notes:

- For definition of the category letters, refer to NUREG 0588 "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment," Appendix E, Section 2.
- Plant specific environmental parameters are to be inserted by the applicant.
- The values listed represent the design conditions plus margin. For completed programs, the values listed were met in the test. Any variations from the values listed were in a conservative direction or were not considered significant.
- 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.

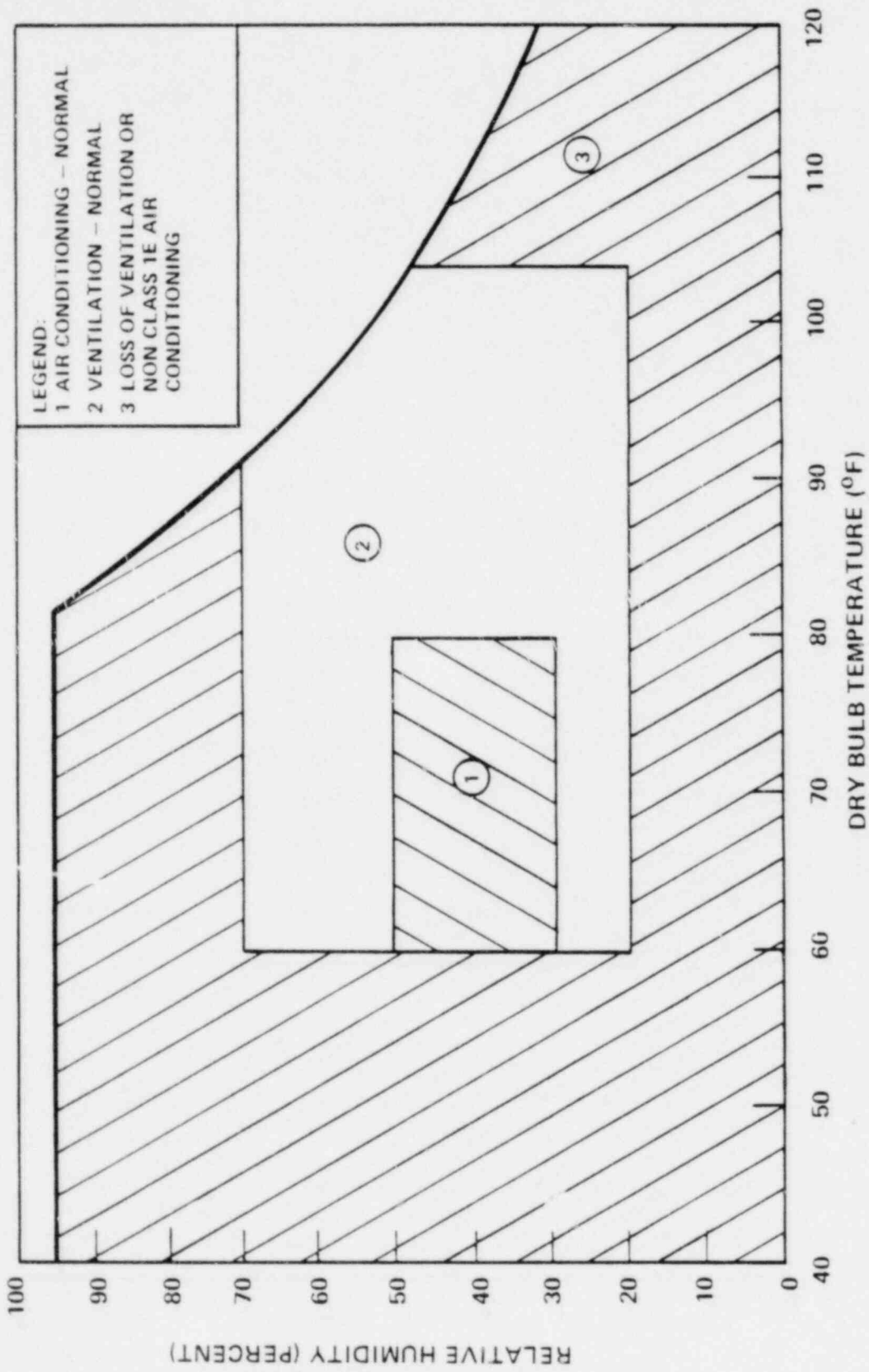


Figure 1 Temperature Versus Humidity - Enclosed Environments Outside Containment

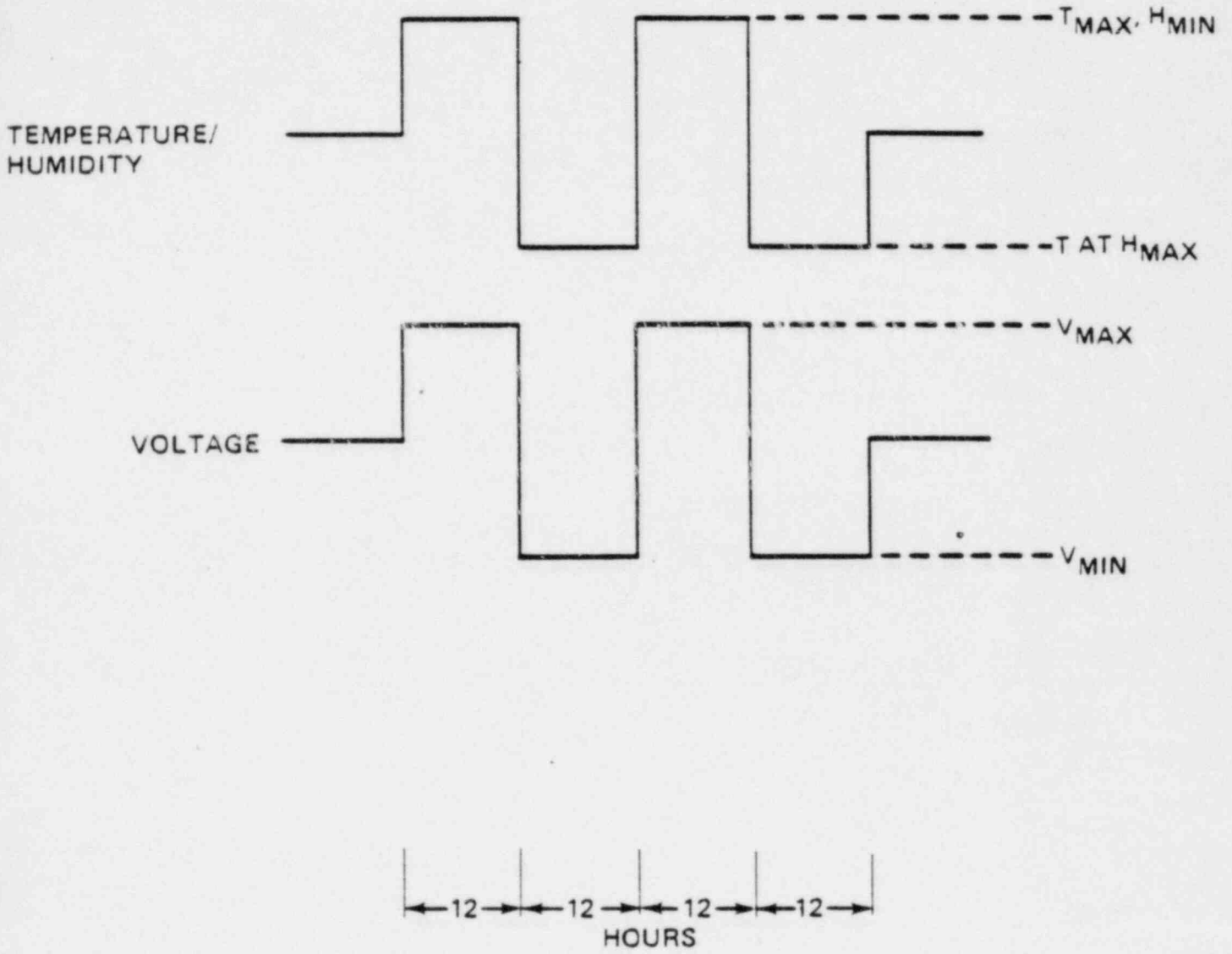


Figure 2 Verification Test Profile