WESTINGHOUSE CLASS 3

EQDP-ESE-20
Rev. 4 2/82

8

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.

Reactor Trip Switchgear (DS-416 Circuit Breakers)

APPROVED: _____

E. P. Rahe, Manager
Nuclear Safety Department

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

1.9 Qualified Life: The currently demonstrated qualified life is 5 years. This is based on WCAP-8687, Supplement 2, Appendix A2 (Material Aging) Reference 5 in conjunction with the mechanical aging discussed in WCAP-8687, Supplement 2, E20A (Reference 1). 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.. 3 4

1.10 Remarks: None

2.0 TEST PLAN

Enviromental testing was performed at Westinghouse Low Voltage Switchgear Division (LVSD), East Pittsburgh, Pa., which is also the manufacturers of the equipment. 3

Seismic testing was performed in the testing laboratory at Westinghouse Advanced Energy Systems Division (AESD) in Large, Pa.

2.1 Equipment Description: Reactor Trip Switchgear employing Type DS-416 circuit breakers

2.2 Number Tested: Type test on a two (2) cabinet reactor trip switchgear assembly

2.3 Mounting: See section 1.2.

2.4 Connections: Primary: 260 VAC, 60 Hz, 3 Phase; Control: 48VDC and 125 VDC

2.5 Aging Simulation Procedure

By a separate component test program as described by Subprogram C of Appendix B to WCAP-8587. 3

2.6 Service Conditions to be Simulated by Test(1)

		Normal	Abnormal	Cont. Test	Seismic	HELB	Post-HELB
2.6.1	Temperature (°F)	ambient	Fig. 3	N/A	ambient	N/A	N/A
2.6.2	Pressure (psig)	0	0		0		
2.6.3	Humidity (% RH)	ambient	Fig. 3		ambient		
2.6.4	Radiation (R)	None	None		None		
2.6.5	Chemicals	None	None		None		
2.6.6	Vibration	None	None		5 OBE's		
2.6.7	Acceleration (g)	None	None		TRS>RRS		

2.7 Measured Variables

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

		Required	Not Required
2.7.1	Category I - Environment		
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	Gas 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

		Required	Not Required
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		

A: Seismic testing.

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 Seismic
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 sequence(s) which, in total, constitutes 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 in the Environmental and Seismic Test sequence of Section 2.9.1. The HELB Tests (Section 2.8.6 and 2.8.7) have been excluded since the RTS are not exposed to the HELB environment due to their location. The Abnormal Extremes test included in Section 2.9.1, was performed on the safety-related modules which contain organic materials. The breakers were not included in this test since they are all primarily metallic and the non-metallic materials were evaluated by material analysis (Reference 5). The Aging Test of Section 2.9.2 employs the preferred test sequence (Section 2.8 excluding HELB and abnormal extremes Section 2.8.6, 2.8.7, and 2.8.3) on a representative sample of components from the RTS. The aging tests demonstrate that during the qualified life

there are no in-service aging mechanisms capable of reducing the capability of the RTS to perform during or after a seismic event. As a consequence, the seismic testing on the non-thermally aged RTS, is not prejudiced by any in-service aging mechanisms.

Step		Notes
2.9.1	Environmental and Seismic Test Sequence	
	2.8.1	Aging is operational
	2.8.2	cycling only, no thermal
	2.8.3	aging included
	2.8.4	
	2.8.5	
	2.8.8	
2.9.2	Aging Test Sequence	
	2.8.1	
	2.8.2	Thermal aging is addressed by separate testing
	2.8.4	as described in Subprogram C of Appendix B to
	2.8.5	WCAP-8587 and reported in Reference 5.
	2.8.8	

3
4

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 RTS to complete their 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 Operational Cycling, and Normal and Abnormal Environment Testing

See Reference 1 for a description of the equipment tested.

2.10.2.2 Seismic Testing

See Reference 2 for a description of the equipment tested.

2.10.2.3 Aging Evaluation Program

A representative sample of critical components from the RTS is included in Subprogram C of the Aging Evaluation Program described in Appendix B to WCAP 8587.

3
4

2.10.3 Test Summary

2.10.3.1 Operational Cycling, and Normal and Abnormal Environment Testing

Westinghouse requires that the RTS 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 testing required is to demonstrate equipment capability under normal and abnormal service conditions (temperature, humidity and A.C. power voltage and frequency).

3

Reference 3 summarizes the results of available radiation testing of organic and inorganic materials and justifies that, for radiation doses less than 10^4 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 cability 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 safety-related modules of the RTS 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 equipment to a double cycle of electrical and environmental extremes as described by EQDP Figure 3. This test is considered to satisfactorily demonstrate the RTS 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).

On completion of the extremes test the safety-related modules were installed back in the RTS assembly. The Operational Cycling Tests were then performed to put the RTS in its end of life condition, from a mechanical aging standpoint.

2.10.3.2 Seismic Tests

The single design basis event capable of producing an adverse environment at the equipment location is a seismic event. The seismic testing reported in Reference 2 was completed on the equipment previously tested as reported in Reference 1, employing multi-axis multi-frequency inputs in accordance with Reg. Guide 1.100 (IEEE-344-1975). The generic required response spectrum (Figure 2) contains significant margin with respect to any single plant application referencing this program(1).

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 RTS. 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 RTS to perform during or after a seismic event. As a consequence, the seismic testing on the un-aged (thermally) RTS described above, is not prejudiced by any in-service aging mechanism.

3
4

2.10.4 Conclusion

The currently demonstrated qualified life of the RTS is 5 years. This is based on the review of all critical components in the RTS and is documented in WCAP-8687, Supplement 2, Appendix A2 (Material Aging) Reference 5. In conjunction, mechanical aging has been performed and is reported in WCAP-8687, Supplement 2, E20A

3
4

(Reference 1). Westinghouse is planning an extension of Subprogram C of the Westinghouse Aging Evaluation Program to increase the demonstrated qualified life. The results of the aging program, together with the seismic and environmental testing described herein, demonstrate the qualification of the RTS 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. Faust, C. E., Yalich, M., "Equipment Qualification Test Report Reactor Trip Switchgear (Operational Cycling and Normal and Abnormal Temperature and Humidity Testing)" WCAP-8687 Supp 2-E20A (Proprietary).

2. Faust, C. E., Tang, D. T., Yalich, M., "Equipment Qualification Test Report Reactor Trip Switchgear (Seismic Qualification Testing)" WCAP-8687 Supp 2-E20B (Proprietary).

3. Damerow, F. W., "Effects of Gamma Radiation Doses Below 104 Rads on the Mechanical Properties of Materials," Appendix C, WCAP-8587 (Non-Proprietary). 1

4. Jabs, R., Parello, J., Huang, J., Yalich, M., "Equipment Qualification Test Report Short Term Component Aging Test Program, "WCAP-8687, Supplement 2, Appendix A1 (Proprietary).

5. "Equipment Qualification Test Report Materials Aging Analysis", WCAP-8687, Supplement 2, Appendix A2 (Proprietary).

WESTINGHOUSE CLASS 3

PARTS 3 and 4 QUALIFICATION BY EXPERIENCE AND/OR ANALYSIS

Westinghouse does not employ operating experience or analysis in support of the qualification program for the RTS.

SECTION 1 - SPECIFICATIONS

1.0 PERFORMANCE SPECIFICATIONS

1.1 Electrical Requirements

1.1.1 Voltage: Primary - 260 VAC ± 10%,3 Phase; Control - Nom. 48 VDC ± 10% and 125 VDC (105-140)

1.1.2 Frequency: Primary: 55-60 Hz

1.1.3 Load: Primary - 1275A max.; Control - 3A max.

1.1.4 Electromagnetic Interference: N/A

1.1.5 Other: N/A

1.2 Installation Requirements: WNES Dwg. 108D986 Rev. 8
WLVS Dwg. 685C940 Rev. 6

1.3 Auxiliary Devices: None

1.4 Preventative Maintenance Schedule: The results of WCAP-8687, Supplement 2, Appendix A2 (Materials Aging) Reference 5 (Proprietary) and mechanical aging performed as discussed in WCAP-8687, Supplement 2, E20A demonstrates that no maintenance beyond that defined in the equipment instruction manual is required to support the qualified life defined in Section 1.9. 3 4

1.5 Design Life: 40 year

1.6 Operating Cycles (Expected number of cycles during design life, including test): 1000 (est. 2 per month)

6589A

1.7 Performance Requirements for [b] Reactor Trip

	Normal Parameter	Abnormal Conditions	Containment Test Conditions	Conditions	DBE Conditions[a] FLB/SLB	DBE Conditions[a] LOCA	DBE Conditions[a] Seismic	Post DBE Conditions[a] FLB/SLB	Post DBE Conditions[a] LOCA	Post DBE Conditions[a] Seismic
1.7.1	Time requirement	Continuous	12 hours	N/A	Event duration	Event duration	Event duration	Continuous	Continuous	Continuous
1.7.2	Performance requirement	(d)	as normal		as normal	as normal	as normal	as normal	as normal	as normal

1.8 Environmental Conditions for Same Function[b]

1.8.1	Temperature (^{o}F)	60-104	(c)		Ambient conditions	Ambient conditions	Ambient	Ambient conditions	Ambient conditions	Ambient conditions
1.8.2	Pressure (psig)	0	0				0			
1.8.3	Humidity (% RH)	20-70	(c)				Ambient			
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				Fig. 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 a class 1E HVAC for the area in which the Reactor Trip Switchgear is located, the abnormal extremes are the same as the normal specified above.

d: Trip within 167 milliseconds after voltage is removed from undervoltage coils.

WESTINGHOUSE CLASS 3

TABLE 1

Actual Qualificaton Test Conditions

EQUIPMENT (1) SYSTEM/CATEGORY	LOCATION STRUCTURE/AREA	MANUFACTURER TYPE/MODEL	ABNORMAL/ACCIDENT ENVIRONMENTAL EXTREMES PARAMETER	SPECIFIED (2)	QUALIFIED	OPERABILITY REQ	OPERABILITY DEM	ACCURACY(%) REQ	ACCURACY(%) DEM	QUAL LIFE	QUAL METHOD	QUAL QUAL REF	PROGRAM STATUS
Reactor trip switshgear/ RPS,ESE/ Category d	Control building	Westinghouse LVSD type DS-416 breakers	Temperature Pressure Rel. humidity Radiation Chemistry		120°F Atmos. 95% <10^4R(γ) None	12 hr. cycles	Two 12 hr. cycles	N/A	N/A	5 yrs. (3)	Seq. Test	ESE-20	Completed

Notes:

1. 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.

2. Plant specific environmental parameters are to be inserted by the applicant.

3. Section 2.10.4 has established 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.

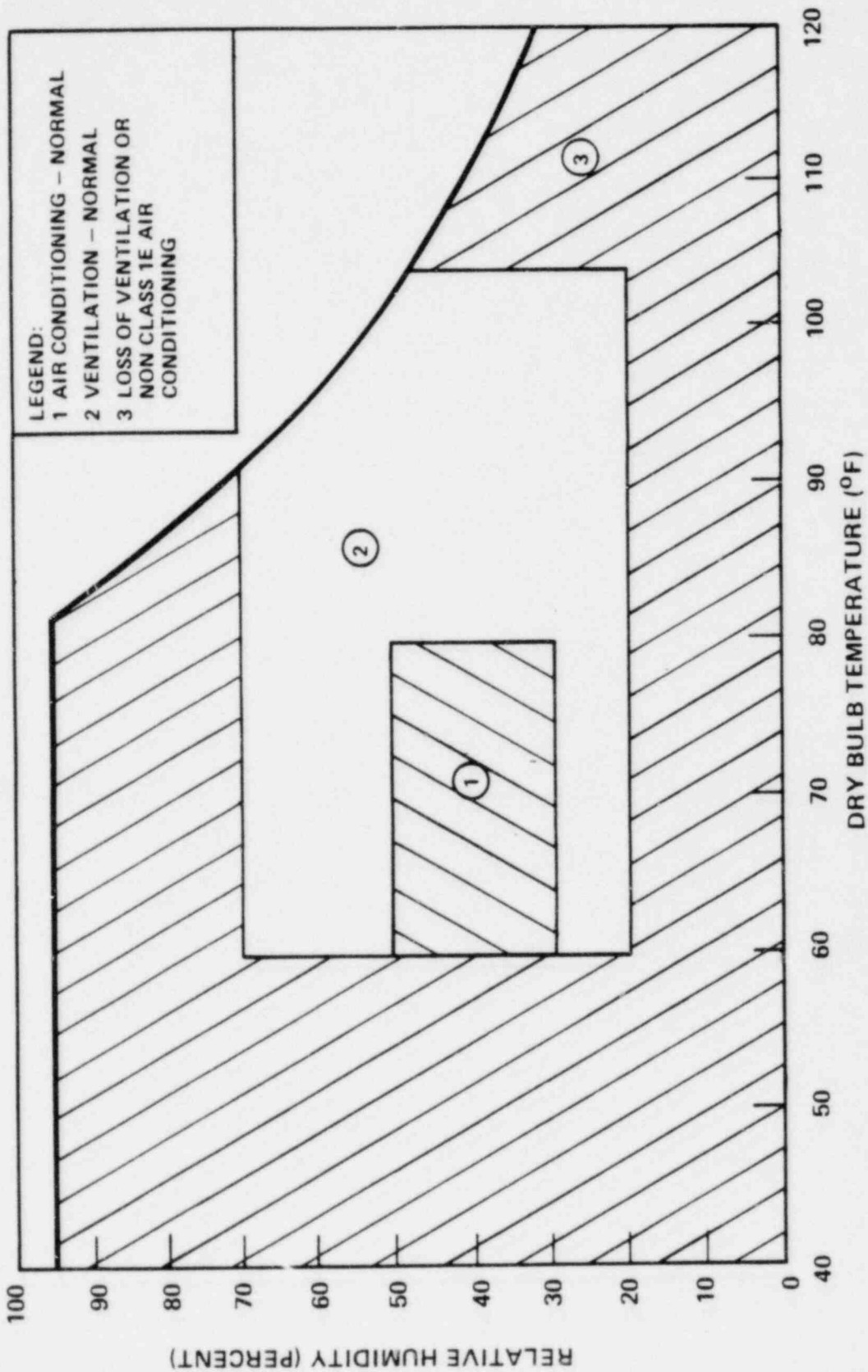

Figure 1 Temperature Versus Humidity - Enclosed Environments Outside Containment

17266-3

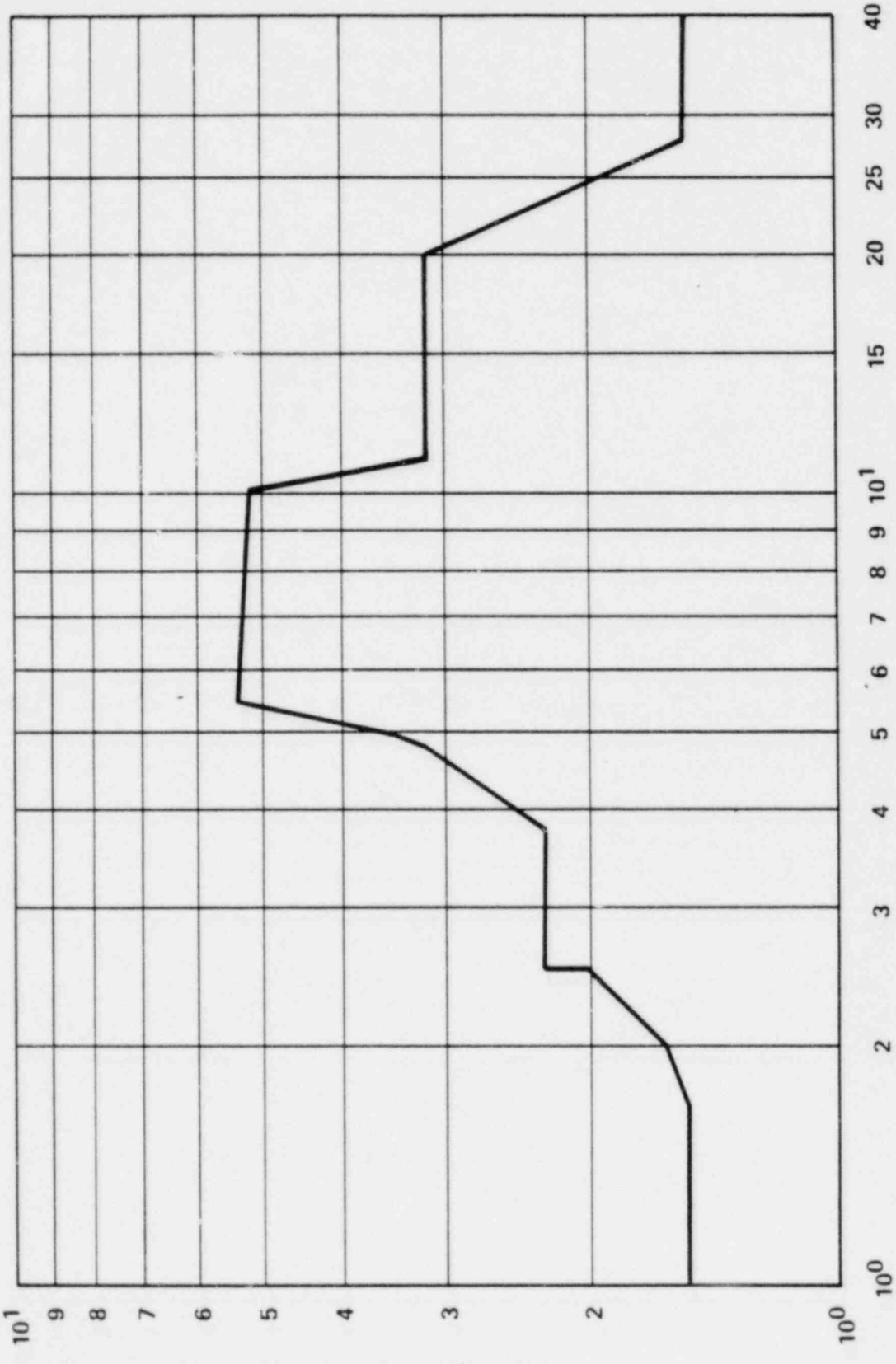

Figure 2 Generic Required Response Spectrum

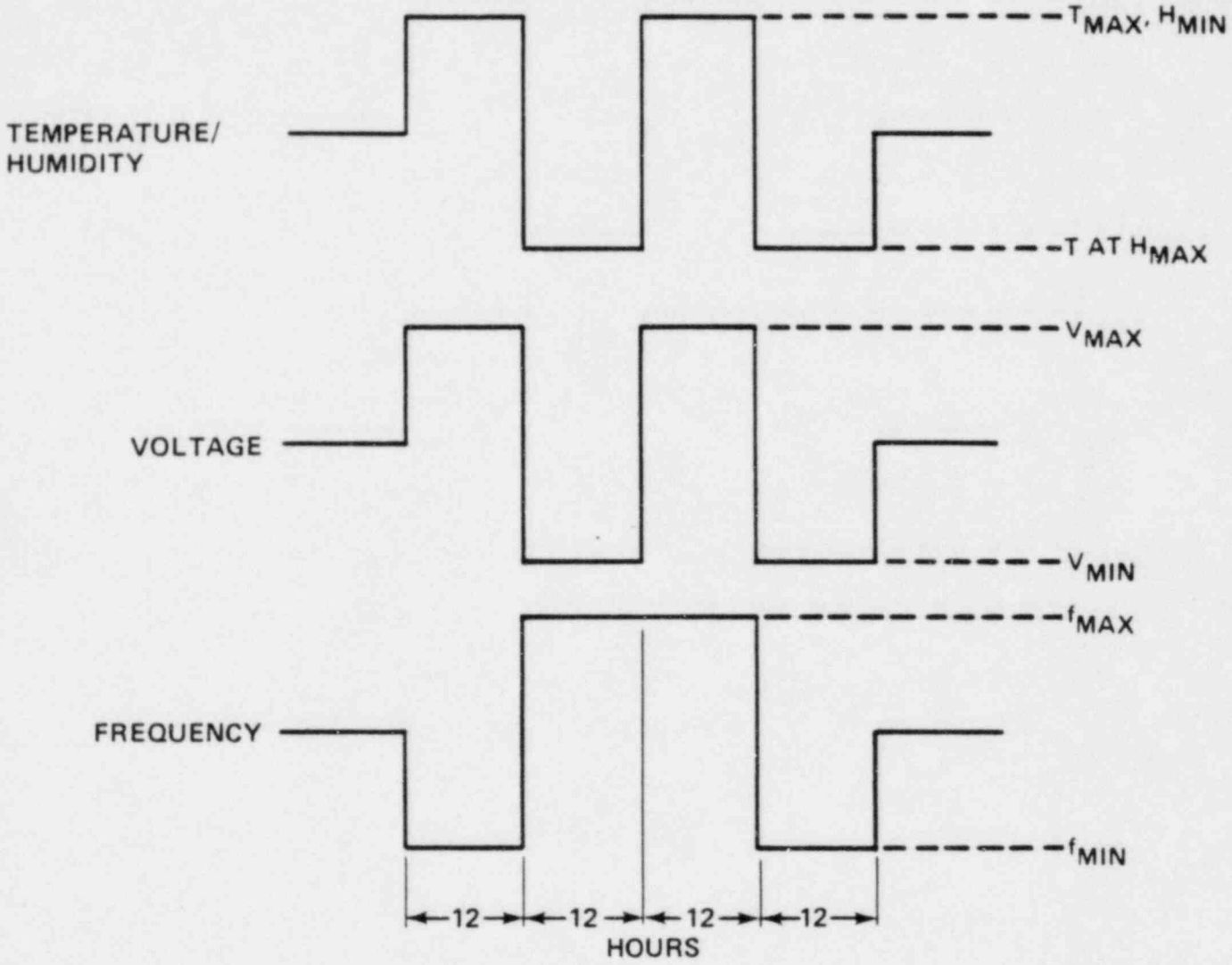

Figure 3 Verification Test Profile