WESTINGHOUSE CLASS 3

EQDP-AE-1
Rev 3 3/82

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.

MEDIUM PUMP MOTORS (OUTSIDE CONTAINMENT)

APPROVED: _____

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SECTION 1 - SPECIFICATIONS

1.0 PERFORMANCE SPECIFICATIONS

1.1 Electrical Requirements

1.1.1 Voltage: 230 to 575 VAC ± 10%; Starting Voltage + 10,-20%
1.1.2 Frequency: 50 or 60 Hz ± 5%
1.1.3 Load: up to 300 HP (7" diameter to 22" diameter)
1.1.4 Electromagnetic Interference: None
1.1.5 Other: Motors to have Class H insulation system

1.2 Installation Requirements: As specified in the instruction manual

1.3 Auxiliary Devices: Qualified lubricants, bearings, and connectors should be used with the motor.

1.4 Preventative Maintenance Schedule: Normal preventive maintenance must be performed in accordance with the instruction manual provided with the equipment. The qualification of lubricants, greases and bearings is discussed in Reference 2. 3

1.5 Design Life: 40 years-Class H insulation operating at less than Class B limit.

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

Application	Pump Motor	40-yr. Total Start & Stops
All	Spent Fuel Pit	14,600
All	Boric Acid Transfer	43,800

1.7 Performance Requirements for[b]: Spent Fuel Pit

Parameter		Normal Conditions	Abnormal Conditions	Containment Test Conditions	DBE Conditions(a) LOCA FLB/SLB	DBE Conditions(a) Seismic	Post DBE Conditions(a) LOCA FLB/SLB	Post DBE Conditions(a) Seismic
1.7.1	Time requirement	350,400	12 hrs.	N/A	Event Duration	Event Duration	1 year	Continuous
1.7.2	Performance requirement	Continuous	As Normal		As Normal	As Normal	As Normal	As Normal
1.8	Environmental Conditions for Same Function[b]							
1.8.1	Temperature(^{o}F)	Figure 1 Part 2	Figure 1 Part 3	N/A	Figure 1 Part 2	Figure 1 Part 2	Figure 1 Part 2	Figure 1 Part 2
1.8.2	Pressure (psig)	0	0		0	0	0	0
1.8.3	Humidity (% RH)	Figure 1 Part 2	Figure 1 Part 3		Figure 1 Part 2	Figure 1 Part 2	Figure 1 Part 2	Figure 1 Part 2
1.8.4	Radiation (R)	< 1 x 10^6 Y	Included Under Normal		Included Under Normal	Included Under Normal	Included Under Normal	Included Under Normal
1.8.5	Chemicals	None	None		None	None	None	None
1.8.6	Vibration (mils) (c)	2	Same as Normal		Same as Normal	Same as Normal	Same as Normal	Same as Normal
1.8.7	Acceleration (g)	None	None		None	Figure 2	None	None

Notes: a: DBE is the Design Basis Event.
b: Margin is not included in the parameters of this section.
c: Bearing housing vibration filtered to running speed.

1.7 Performance Requirements for[b]: Boric Acid Transfer

Parameter		Normal Conditions	Abnormal Conditions	Containment Test Conditions	DBE Conditions(a) LOCA FLB/SLB	DBE Conditions(a) Seismic	Post DBE Conditions(a) LOCA FLB/SLB	Post DBE Conditions(a) Seismic
1.7.1	Time requirement	350,400 hrs.	12 hrs.	N/A	N/A	Event Duration	Same as Normal	Continuous
1.7.2	Performance requirement	6 hrs/day	Same as normal			Same as Normal		Same as Normal
1.8	Environmental Conditions for Same Function[b]							
1.8.1	Temperature(^{o}F)	Figure 1 Part 2	Figure 1 Part 3	N/A	N/A	Figure 1 Part 2	Same as Normal	Figure 1 Part 2
1.8.2	Pressure (psig)	0	0			0		0
1.8.3	Humidity (% RH)	Figure 1 Part 2	Figure 1 Part 3			Figure 1 Part 2		Figure 1 Part 2
1.8.4	Radiation (R)	$\leq$ 400 Y	Included Under Normal			Included In Normal		Included In Normal
1.8.5	Chemicals	None	None			None		None
1.8.6	Vibration (mils) (c)	2	Same as Normal			Same as Normal		Same as Normal
1.8.7	Acceleration (g)	None	None			Figure 2&3		None

Notes: a: DBE is the Design Basis Event.
b: Margin is not included in the parameters of this section.
c: Bearing housing vibration filtered to running speed.

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1.9 Qualified Life: Motor Insulation life to be 40 years based on the actual test condition identified in Table 1.

3 This aging equivalence was arrived at using test data generated at Westinghouse Research and Development Laboratories on motorettes of the same insulation system.

Utilizing an ahrennius type plot, as per IEEE standard 117-1974, the 6,336 hours of aging at 225°C is equivalent to several times the required 40 years at 130°C. The 130°C represents a 90°C rise above an ambient of 40°C.

1.10 Remarks: None

SECTION 2 - QUALIFICATION BY TEST

2.0 TEST PLAN

The seimsic tests were performed at Westinghouse Advanced Energy Systems Division (AESD) in Large Pa. The radiation aging was performed at the Isomedix Inc. plant at Parsippany, N.J. The humidity test and final verification was done at Westinghouse Research and Development Lab.

2.1 Equipment Description: Ten random wound motorettes, assembled in accordance with IEEE standard 117-1974, and identical in insulation to the class H system used by Westinghouse Medium Motor and Gearing Division on all motors supplied by them for class 1E nuclear service. Applicability on a per plant basis will be established with an auditable link letter. 3

2.2 Number Tested: Ten

2.3 Mounting: The Motorettes were attached to a support plate, which in turn was bolted to a seismic test table during vibration aging and seismic testing.

2.4 Connections: Motorette leads terminated at binding posts mounted on the base plate.

2.5 Aging Simulation Procedure
The Motorettes were subjected to thermal, radiation, and vibration aging as described in Reference 1.

2.6 Service Conditions to be Simulated by Test(1)

		Normal	Abnormal	Containment Test	Seismic	HELB	Post-HELB
2.6.1	Temp. (^{o}F)	-20 to 120	Included under normal	N/	Fig. 1 Part 2	Fig. 1 Part 2	Fig. 1 Part 2
2.6.2	Pressure (psig)	0	0		0	0	0
2.6.3	Humidity (% RH)	Fig. 1 Part 2	Fig. 1 Part 3		Fig. 1 Part 2	Fig. 1 Part 2	Fig. 1 Part 2
2.6.4	Radiation (R)	$5 \times 10^{7}\gamma$	Included under normal		Included under normal	Included under normal	Included under normal
2.6.5	Chemicals	None	None		None	None	None
2.6.6	Vibration	Normal*	Included under normal		Normal	Normal	Normal
2.6.7	Acceleration (g)	None	None		Figure 2&3	None	None

* Simulate vibration aging with 1 hour at 60 hz and 1.5 g.

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	A,D	B,C
	2.7.1.2	Pressure		A,B,C,D
	2.7.1.3	Moisture	D	A,B,C
	2.7.1.4	Composition		A,B,C,D
	2.7.1.5	Seismic Acceleration	C	A,B,D
	2.7.1.6	Time	A,B,C,D	
2.7.2	Category II - Input Electrical Characteristics			
	2.7.2.1	Voltage	D	A,B,C
	2.7.2.2	Current		A,B,C,D
	2.7.2.3	Frequency		A,B,C,D
	2.7.2.4	Power		A,B,C,D
	2.7.2.5	Other		A,B,C,D
2.7.3	Category III - Fluid Characteristics			
	2.7.3.1	Chemical Composition		A,B,C,D
	2.7.3.2	Flow Rate		A,B,C,D
	2.7.3.3	Spray		A,B,C,D
	2.7.3.4	Temperature		A,B,C,D
2.7.4	Category IV - Radiological Features			
	2.7.4.1	Energy Type	B	A,C,D
	2.7.4.2	Energy Level	B	A,C,D
	2.7.4.3	Dose Rate	B	A,C,D
	2.7.4.4	Integrated Dose	B	A,C,D

		Required	Not Required
2.7.5	Category V - Electrical Characteristics		
2.7.5.1	Insulation Resistance Following Test		A,B,C,D
2.7.5.2	Output Voltage		A,B,C,D
2.7.5.3	Output Current		A,B,C,D
2.7.5.4	Output Power		A,B,C,D
2.7.5.5	Response Time		A,B,C,D
2.7.5.6	Frequency Characteristics		A,B,C,D
2.7.5.7	Simulated Load		A,B,C,D
2.7.6	Category VI - Mechanical Characteristics		
2.7.6.1	Thrust		A,B,C,D
2.7.6.2	Torque		A,B,C,D
2.7.6.3	Time		A,B,C,D
2.7.6.4	Load Profile		A,B,C,D
2.7.7	Category VII - Auxiliary Equipment None required for safeguards operation		

A Thermal aging
B Radiation aging
C Vibration & Seismic
D Hi Potential Test

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 (Thermal and Radiation)
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 sequence employed which, when used in conjunction with the seismic analysis described under Part 4, constitutes the overall qualification program for this equipment. The justification for employing the specific sequence listed below in lieu of the preferred sequence (Section 2.8) is as follows:

a. Visual inspections were performed to assure that the motorettes were undamaged by previous testing.
b. Test sequence 2.8.3 was performed after each aging cycle and after the final testing. Operational ability was simulated by a high potential test.
c. Westinghouse requires that the medium motors are located such that they do not experience a consequent adverse environment when required to operate following a high energy line break either inside or outside containment. Therefore, test sequences 2.8.6 and 2.8.7 are not required and the only environmental testing required is to demonstrate equipment capability under normal and abnormal environmental extremes.

Step	Notes
2.9.1	Motorettes - Thermal Aging, Radiation Aging, and Seismic Test Sequence.
	2.8.3
	2.8.1
	2.8.4 (Thermal Only)
	2.8.3
	2.8.4 (Thermal Only)
	2.8.3
	2.8.4 (Thermal Only)
	2.8.3
	2.8.4 (Radiation Only)
	2.8.5
	2.8.8

2.10 Type Test Data

2.10.1 Objective

The objective of this qualification program is to demonstrate by test and analysis, employing the recommended practices of Reg. Guide 1.89 (IEEE-323-1974) and Reg. Guide 1.100 (IEE-344-1975), that the Class H insulation, operating below Class B insulation temperature limits, used on Class IE Medium A. C. motors built by Westinghouse Medium Motor and Gearing Division and used on Westinghouse NSSS supplied auxiliary pumps meets or exceeds it's safety-related performance requirements described in EQDP Section 1.7 while subjected to the normal, and simulated abnormal environmental and seismic service conditions specified in Section 3 of WCAP-8687 Supp 2-A01A.

The motor insulation is the critical component necessary for motor performance. Hence, verification of the motor's qualified life is obtained by insulation testing.

2.10.2 Equipment Tested

Ten Motorettes utilizing Class H Insulation were subjected to the tests described below.

2.10.3 Test Summary

2.10.3.1 Aging and Radiation Testing

The Motorettes were baked in an oven to accelerate the thermal aging. The aging was in excess of a 40 year equivalent of operating life at a maximum hot spot temperature of 130°C and includes margin. The motors have Class H insulation, but the temperature rise is held to Class B limit. The motorettes were exposed to a Cobalt-60 gamma source. The gamma dose was equivalent to the dosage that the motor would see during 40 years of service plus 1 year of post LOCA operation and includes margin.

2.10.3.2 Vibration/Testing

Based upon operating experience and engineering judgement, the inservice vibration is not expected to affect the motor insulation system integrity. However, a vibration test was performed. The motorettes were installed on a biaxial seismic test machine at a 90° angle in relation to the test table. A mechanical aging test was performed at a vertical acceleration control of 1.5 g at 60 Hz for one hour per IEEE-117-1974. The motorette assembly was then mounted at a 45° angle in relation to the seismic test table, and a resonance search was performed.

2.10.3.3 Seismic Testing

A seismic test was completed employing multi-axis, multi-frequency inputs in accordance with Regulatory Guide 1.100 (IEEE-344-1975). The response spectrum (Figure 2&3) contains significant margin with respect to any single plant application referencing this program(1).

2.10.3.4 High Potential Test

The motorettes were installed inside an environmental chamber and subjected to an environment of 100% relative humidity for 48 hours per IEEE-117-1974.

Finally, the insulation integrity was tested in accordance with the procedure given in IEEE-117-1974, paragraph 2.3. This test was done while the motorettes were still in the humidity chamber. (Ref IEEE-117-1974 para. 2.2.4). All motorettes passed this test.

2.10.15 Conclusion

The results of the seismic and environmental testing described herein along with the analysis described in Section 4 demonstrates the qualification of the Class H insulation which is the critical motor component and hence demonstrates qualification of the Westinghouse Medium Motor, for a qualified life of 40 years as defined in Section 1.9, 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. Nowak, D.C., "Equipment Qualification Test Report for the Westinghouse Medium Pump Motor," WCAP-8687, Supplement 2-A01A (Proprietary).

2. Draughon, C. G., Anderson, A. A., "Lubricants and Bearing Report for Medium, Large and Chempump Motors," Letter NS-I&CSL-82146 (Proprietary) in progress.

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SECTIONS 3 - QUALIFICATION BY EXPERIENCE

Westinghouse does not employ operating experience in support of the qualification program for the Westinghouse Medium Pump Motors with the exception of inservice vibration.

PART 4 - QUALIFICATION BY ANALYSIS

4.1 Analysis is employed to qualify the motor for operation during and after the seismic event. A static analysis is applicable since the motor has no natural frequencies below 33 Hz.

The analysis considers bearing loading, shaft stresses, shaft deflections, motor feet stress, mounting bolt stresses and the mounting of the conduit box.

The natural frequency of both the rotor and stationery assemblies are calculated.

The results of the seismic analysis performed is available for audit at Westinghouse and the applicable seismic report number will be confirmed on a per plant basis. The analysis assumes that the motor is installed in accordance with the instruction manual. 3

TABLE 1

ACTUAL QUALIFICATION TEST CONDITIONS

EQUIPMENT (1) SYSTEM/CATEGORY	LOCATION STRUCTURAL/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 REF	QUAL PROGRAM STATUS
Boric acid transfer pump motor/ CVCS/ Category d	Safeguards building	W-MM&GD	Temperature Pressure Rel. humidity Radiation Chemistry		$40^{o}C$ Atmos. 95% $5x10^{7}R(\gamma)$ None	6 hrs. Per Day	6 hrs. Per Day	N/A	N/A	40 yrs.	Seq. Test	AE-1	Completed
Spent Fuel Pit pump motor/ Category d	Safeguards building	W-MM&GD	Temperature Pressure Rel. humidity Radiation Chemistry		$40^{o}C$ Atmos. 95% $5x10^{7}R(\gamma)$ None	Con-tin-uous	Con-tin-uous	N/A	N/A	40 yrs.	Seq. Test	AE-1	Completed

Notes:

1. For definition of 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.

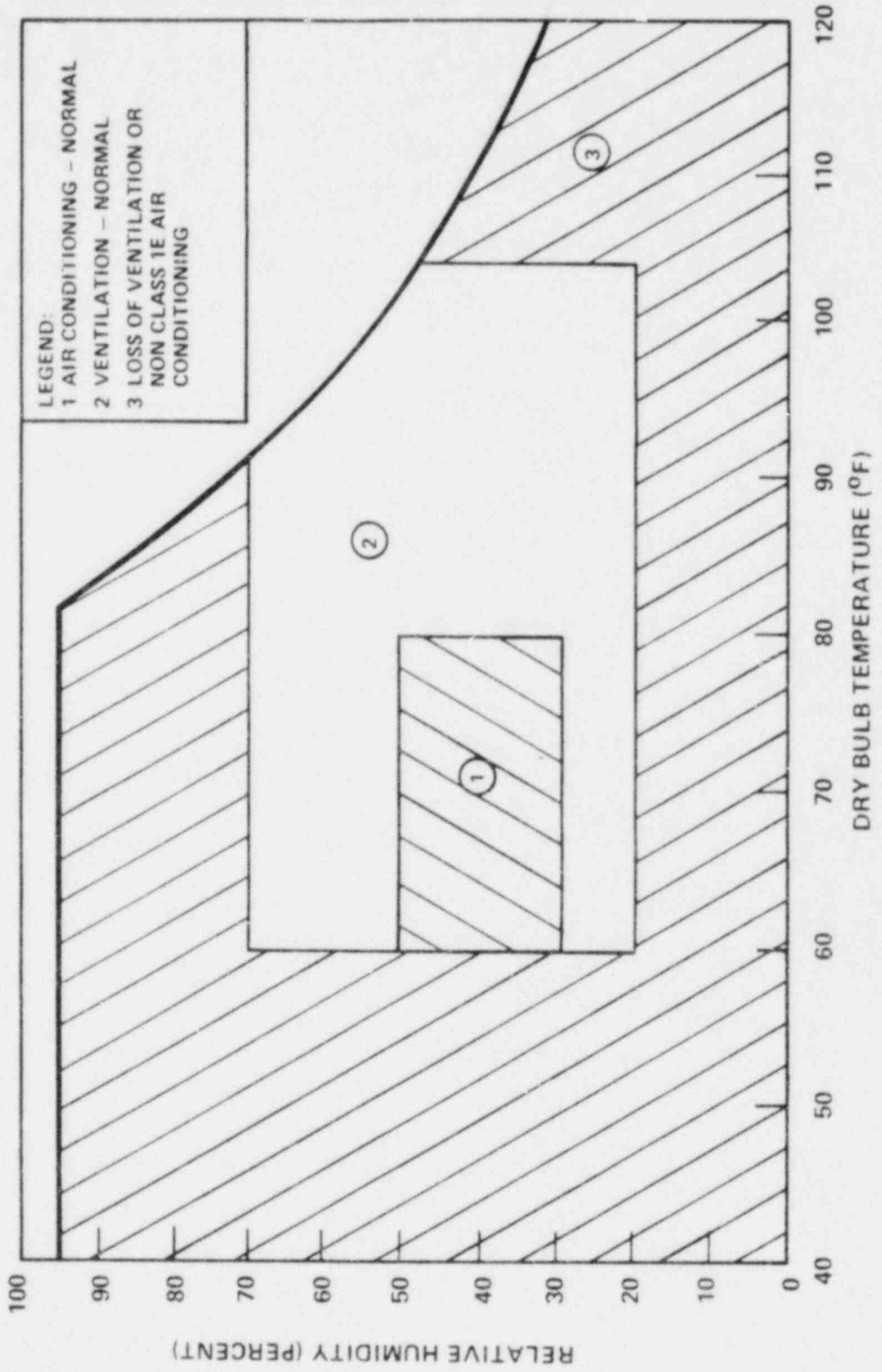
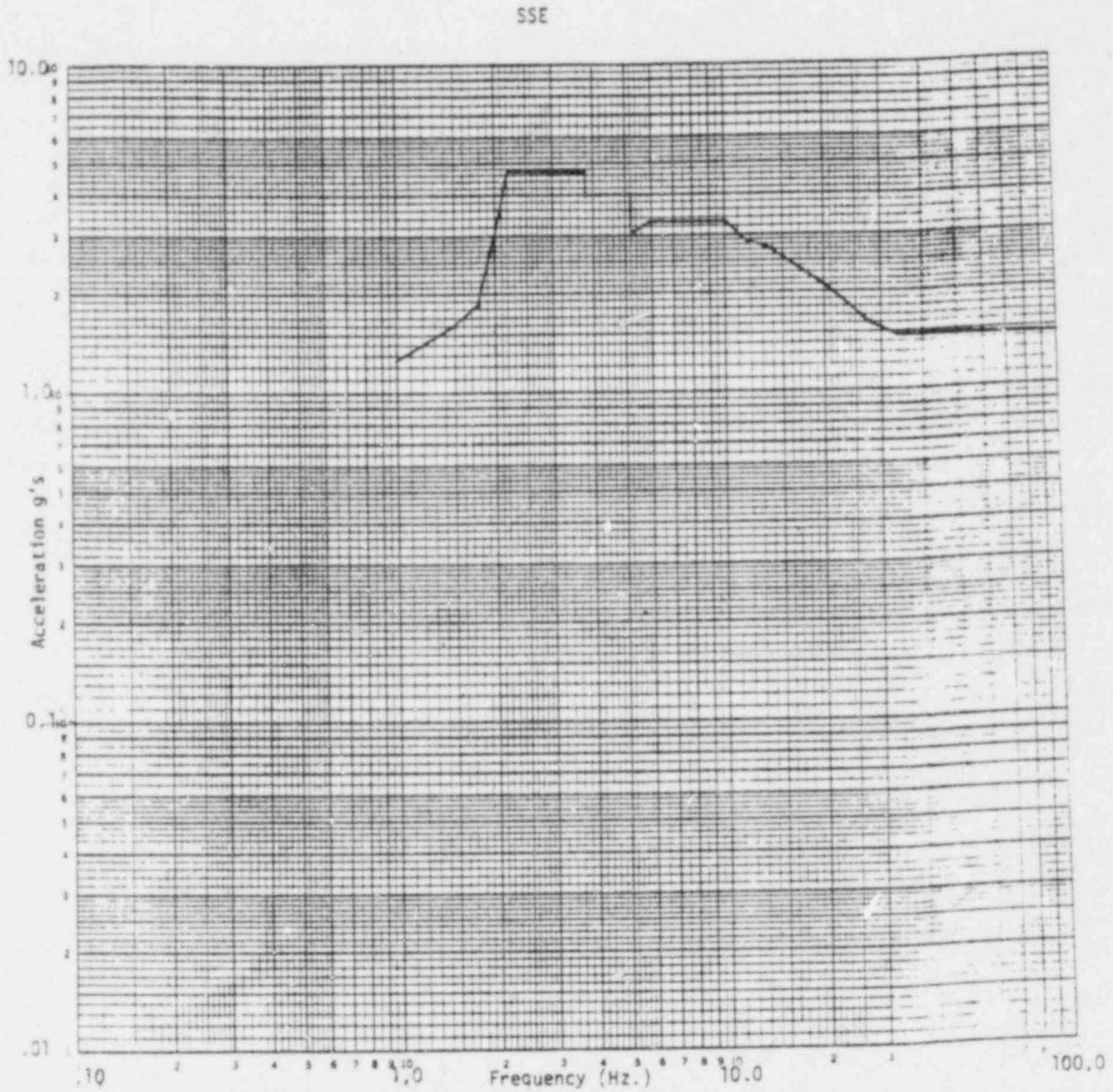


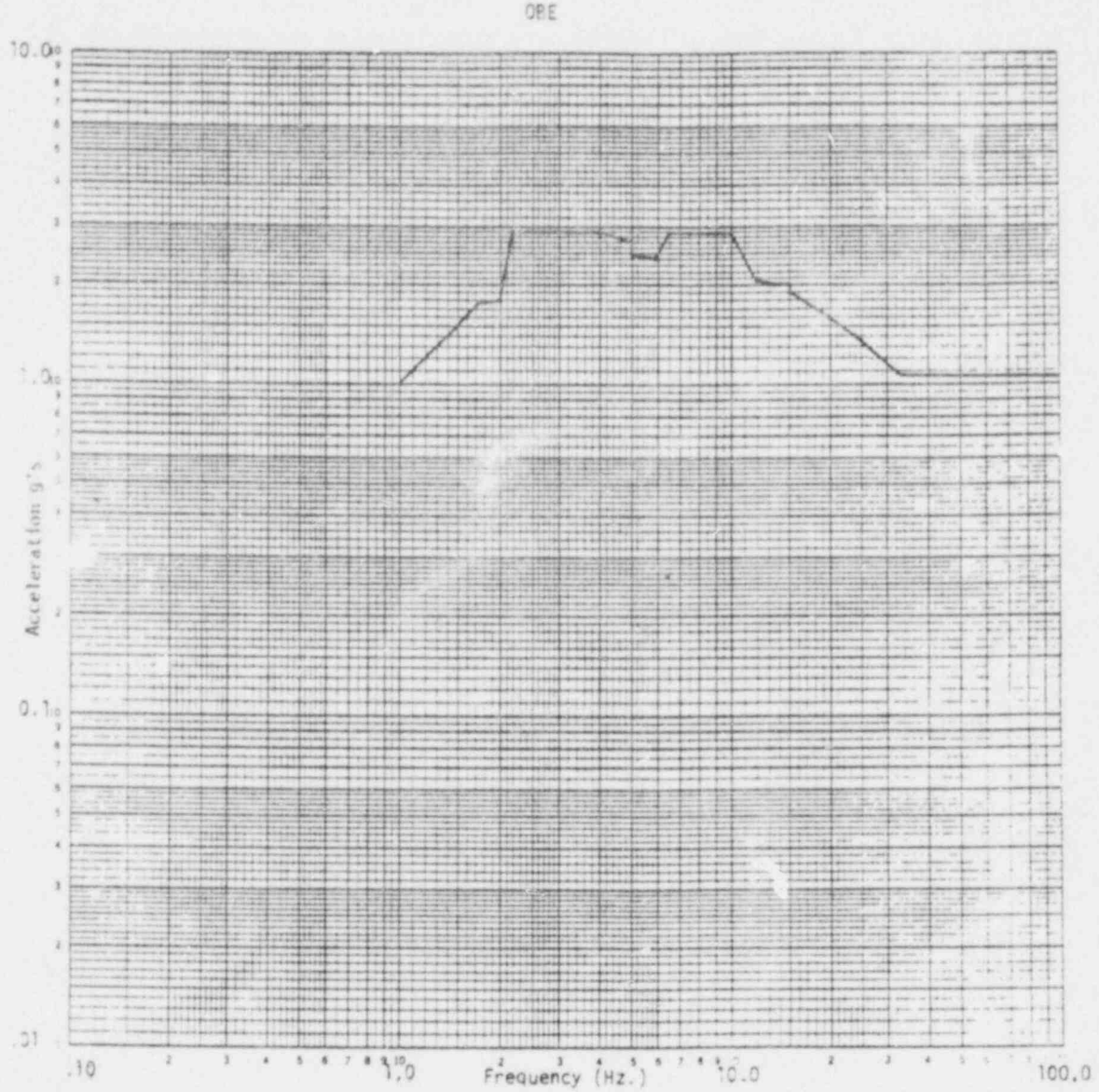
Figure 1. Temperature Versus Humidity-Enclosed Environments Outside Containment



Damping Value of 4%

3

Figure 2 Required SSE Response Spectrum



Damping Value of 2%

Figure 3 Required OBE Response Spectrum