EQDP-ESE-68A
Rev. 0 2/88

EQUIPMENT QUALIFICATION DATA PACKAGE

This document contains information, relative to the qualification of the equipment identified below in accordance with methodology of WCAP-8587 and WCAP-9714. The Specification section (Part 1) defines the assumed limits for the equipment qualification and constitute interface requirements to the user.

ATWS MITIGATING SYSTEM ACTUATION CIRCUITRY

(AMSAC) IN STANDARD SEISMIC CABINET

APPROVED: D E Rygg

D. E. Rygg, Manager
RCS Engineering

Westinghouse Electric Corporation
P.O. Box 355
Pittsburgh PA 15230

WCAP-8587
Supp. 1-ESE-68A
Revision 0

ATWS MITIGATING SYSTEM ACTUATION CIRCUITY (AMSAC) IN STANDARD SEISMIC CABINET

ENGINEERING R

B. W. Berringer, Engineer
Class 1E Systems
Author

J. E. Drexler, Engineer
Equipment Qualification and Testing
Author

R. H. Jabs, Engineer
Class 1E Systems
Reviewer

S. Channarasappa, Engineer
Equipment Qualification and Testing
Author

R. B. Miller, Engineer
Instrumentation & Control
Systems Licensing
Reviewer

A. J. Hartmann, Engineer
Equipment Qualification Technology
Reviewer

Approved: C. G. Morris, Manager
Class 1E Systems

Approved: W. V. Cesarski, Manager
Equipment Qualification and Testing

PART 1 - SPECIFICATIONS

1.0 PERFORMANCE SPECIFICATIONS

1.1 Electrical Requirements

1.1.1 Voltage: 118 VAC ±10% Single Phase

1.1.2 Frequency: 60 Hz ± 5%

1.1.3 Load: Steady state - 10 amp AC

1.1.4 Electromagnetic Interference: N/A

1.2 Installation Requirements:

Westinghouse outline and installation Drawing 1854E64 Rev. 4.

1.3 Auxiliary Devices: None

1.4 Preventative Maintenance Schedule:

No preventive maintenance is required to support the equipment qualification. This does not preclude development of a preventive maintenance program designed to enhance equipment performance and identify unanticipated equipment degradation as long as this program does not compromise the qualification status of the equipment.

1.5 Design Life: 40 years

1.6 Operating Cycles (expected number of cycles during design life, including test): Continuous duty.

1.7 Performance Requirements for Function[b]

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

1.8 Environmental conditions for Same Function[b]

1.8.1	Temperature (°F)	60 - 104	Note c	N/A	N/A	N/A	Ambient	N/A	N/A	Ambient
1.8.2	Pressure (psig)	0	0	N/A	N/A	N/A	0	N/A	N/A	0
1.8.3	Humidity (% RH)	20 - 70	Note c	N/A	N/A	N/A	Ambient	N/A	N/A	Ambient
1.8.4	Radiation (R)	< 400	None	N/A	N/A	N/A	None	N/A	N/A	None
1.8.5	Chemicals	None	None	N/A	N/A	N/A	None	N/A	N/A	None
1.8.6	Vibration	None	None	N/A	N/A	N/A	None	N/A	N/A	None
1.8.7	Acceleration(g)	None	None		N/A	N/A	See Fig. 2 and Fig. 3	N/A	N/A	None

Notes: a. DBE is the Design Basis Event.
b. Margin is not included in the parameters of this section.
c. Figure 1, envelope 3. For plants having a Class 1E HVAC for the area in which the AMSAC Cabinet is located, the abnormal extremes are the same as the normal specified above.
d. Safety function is to isolate the AMSAC process signal from the protection function and maintain structural integrity.

1.9 Qualified Life:

The currently demonstrated qualified life is 20 years based on material analysis and seismic test conditions identified in Figures 2 and 3.

1.10 Remarks: None

SECTION 2 - QUALIFICATION BY TEST

2.0 TEST PLAN

Isolation relay seismic tests were performed at the Westinghouse seismic test facility at Large, Pennsylvania.

2.1 Equipment Description

The ATWS System Actuation Circuitry (AMSAC) system is a microprocessor based system that senses a potential loss of normal feedwater or a loss of electrical load. This system is not safety-related. However, it provides output signals to safety-related systems. The output relays that isolate the nonsafety signals of the microprocessors from the safety-related systems are the components that are safety-related.

AMSAC is installed in a floor mounted cabinet. This cabinet and the devices it contains must maintain structural integrity during a design basis seismic event. The cabinet and some devices it contains are qualified on the basis of testing reported in References 1 and 2.

The isolation relays and sockets that were seismically tested are shown below.

RELAY	PART NUMBER	SOCKET PART NUMBER
Latching	405A11H01	405A13H01
Nonlatching	405A10H01	405A12H01

Reference 3 describes the results of the relay seismic testing.

2.2 Number Tested

Three latching relays and three nonlatching relays and their mounting sockets were tested in this program.

2.3 Mounting

Reference 3 describes the mounting configuration for the relays tested.

2.4 Connections

The connections used for the relay test are described in Reference 3.

2.5 Aging

Thermal aging was addressed by analysis and the relays were mechanically aged as described in Reference 3.

2.6 Service Conditions Simulated By the Tests

The service conditions simulated by the relay test program were seismic conditions. The required response spectra for the AMSAC cabinet with relays installed are shown in Figures 2 and 3. Figure 2 is the required response spectrum for cabinet containing both unrestrained nonlatching and latching relays in the same cabinet. Figure 3 is the required response spectrum for a cabinet with unrestrained nonlatching relays only or restrained nonlatching and latching relays in the same cabinet.

2.7 Measured Variables

Electrical isolation between the coil and contacts of the relay was monitored. The coil to contact leakage and contact bounce of the normally open and normally closed contacts of the relays were monitored. These were the only parameters of significance to this test.

2.8 Test Sequence Preferred

This section identifies the preferred test sequence as specified in WCAP-8587.

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 which, constitutes the qualification program for the AMSAC isolation relays. The actual test sequence for the Plant Safety Monitoring System (PSMS) devices is described in Reference 4. The actual sequence test for the cabinet is described in Reference 2.

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 because the AMSAC system is not exposed to a harsh environment due to its location. The abnormal extremes ware addressed by analysis. The aging of the isolation relays was addressed by analysis.

2.9.1 Seismic Test Sequence

2.8.1
2.8.2
2.8.5
2.8.8

2.9.2 Environmental Test Sequence

Environmental test sequence for the relays was accomplished by analysis.

2.9.3 Aging Test Sequence

Aging is addressed by analysis as described in Subprogram C of Appendix B to WCAP-8587 and reported in Reference 3.

2.10 Test Data

2.10.1 Objective

The objective of the relay test program is to demonstrate, employing recommended practices of Reg. Guide 1.89 (IEEE 323-1974) and Reg. Guide 1.100 (IEEE 344-1975), the capability of the AMSAC isolation relays to complete their safety function as described in EQDP Section 1.7. The test objectives for PSMS devices are detailed in Reference 4. The test objectives for the cabinet are detailed in Reference 2.

2.10.2 Equipment Tested

2.10.2.1 Relay environmental qualification was by analysis as described in Reference 3.

2.10.2.2 Relay seismic tests reported in Reference 3.

2.10.2.3 PSMS seismic tests reported in Reference 1. Westinghouse Standard Seismic Cabinet test are reported in Reference 2.

2.10.3 Test Summary

2.10.3.1 Relay Tests

Contact-to-coil leakage current, and voltage across the normally open and normally closed contacts of the relays were monitored before, during, and after the seismic simulations.

2.10.3.2 Relay 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 3 was completed on relays that had been mechanically aged. The

relays were subjected to simulated triaxial multifrequency testing as suggested in IEEE 344-1975. This testing demonstrated that the relays do maintain isolation between the coil and contacts during a simulated design basis seismic event.

The relay normally closed contacts experienced bounce in excess of 2 milliseconds. The results of contact bounce do not pose a significant safety concern for their application within the AMSAC System.

2.10.3.3 PSMS Device Seismic Tests

The results of the seismic testing performed on PSMS devices that are part of the AMSAC system are detailed in Reference 1.

2.10.3.4 Cabinet Seismic Tests

The results of cabinet seismic testing are detailed in Reference 2.

2.11 Conclusions

Based upon the results reported in References 1, 2, and 3, the AMSAC system mounted in the Standard Seismic Cabinet is qualified for operation in mild environments.

2.12 References

1. "Equipment Qualification Test Report, Plant Safety Monitoring System," WCAP-8687, Supplement 2 - E53A (Proprietary), Pittsburgh, PA.

2. WCAP-10763, "Design, Qualification, and Application of the Westinghouse Standardized Cabinet (WESCAB)" (Proprietary), Pittsburgh, PA.

3. Berringer, B. W., S. Channarasappa, and J. E. Drexler, "ATWS Mitigating System Actuation Circuitry, Standard Seismic Cabinet, Qualification Testing and Analysis", WCAP-8586 Supplement 2 - E68A, Rev. 0, 1988. (Proprietary), Pittsburgh, PA.

4. WCAP-8587, "Equipment Qualification Data Packages, Plant Safety Monitoring System", Supplement 1, ESE-53, Rev. 2, 1987, Pittsburgh, PA.

SECTION 3 - QUALIFICATION BY EXPERIENCE

Westinghouse does not employ operating experience in support of the qualification program for AMSAC.

SECTION 4 - QUALIFICATION BY ANALYSIS

4.1 Environmental

The environmental qualification was by analysis at Westinghouse NSID, Monroeville, PA.

The environmental qualification of the isolation relays is based upon an analysis of the Arrhenius properties of the non-metallic materials of the relays and mounting sockets.

The environmental conditions were addressed by analysis of the Arrhenius properties of the nonmetallic components of the isolation relays.

AMSAC is located where it will not experience adverse environments resulting from a high energy line break. The aging characteristics of the relays were evaluated by analysis of the nonmetallic materials in the relays. The results of the analysis are reported in Reference 3.

4.2 Seismic

The cabinet which contains the AMSAC circuitry was qualified by similarity analysis. The analysis was performed using the criteria discussed in Reference 3. The analysis demonstrated that the cabinet will maintain structural integrity during a design basis event (Figure 3).

The structural integrity of the mounting of AMSAC devices not included in the Reference 1 testing was evaluated. The analysis was performed as discussed in Reference 3. The analysis demonstrated the strutural integrity of the device mounting when the AMSAC cabinet is subjected to a design basis event (Figure 3).

TABLE 1

ACTUAL QUALIFICATION 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 REF	QUAL PROGRAM STATUS
AMSAC Isolation Relays/Cat. C	Control building	WNSID	Temperature		120°F	12 hr.		-	-	20 yrs.	Seis. Test and Env. Analysis	ESE-68A	Completed
			Pressure		Atmos.								
			Rel. humidity		88%								
			Radiation		$<10^4$ R(γ)								
			Chemistry		None								

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.

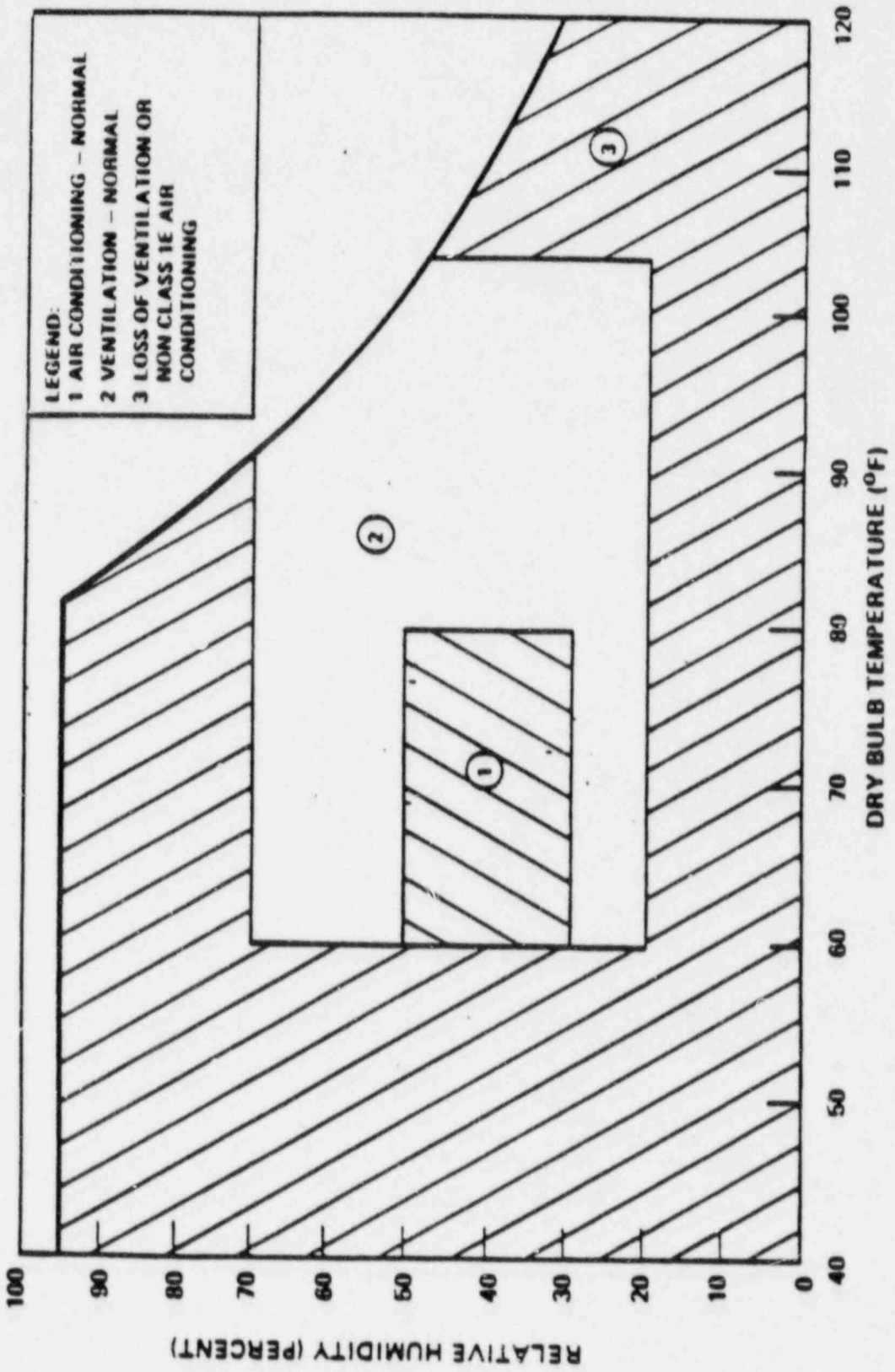

Figure 1: Temperature Versus Humidity-Enclosed Environment Outside Containment

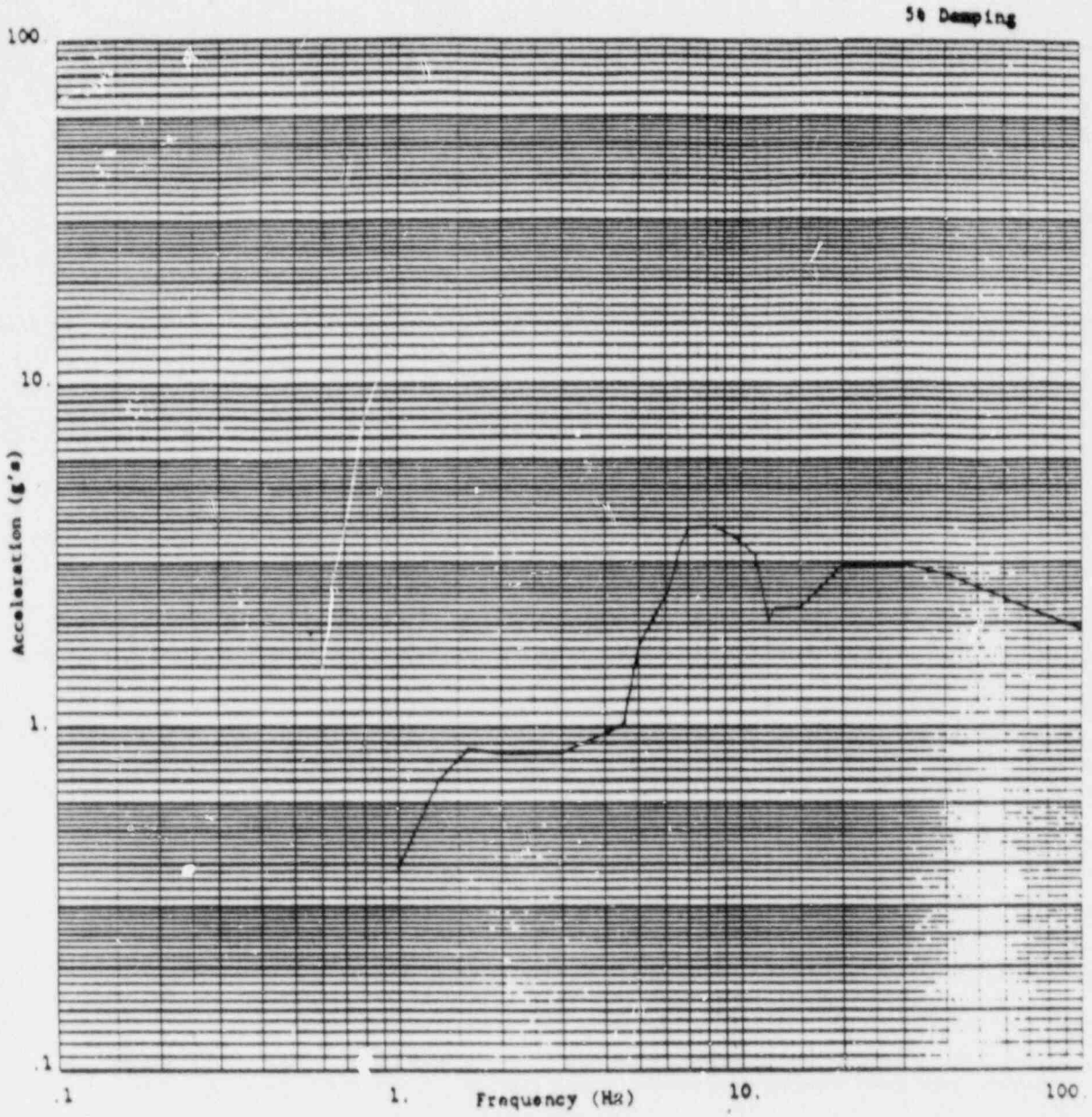

Figure 2: Safe Shutdown Earthquake Required Response Spectra for AMSAC Standard Seismic Cabinet with Unrestrained Nonlatching and Latching Relays Principal Direction

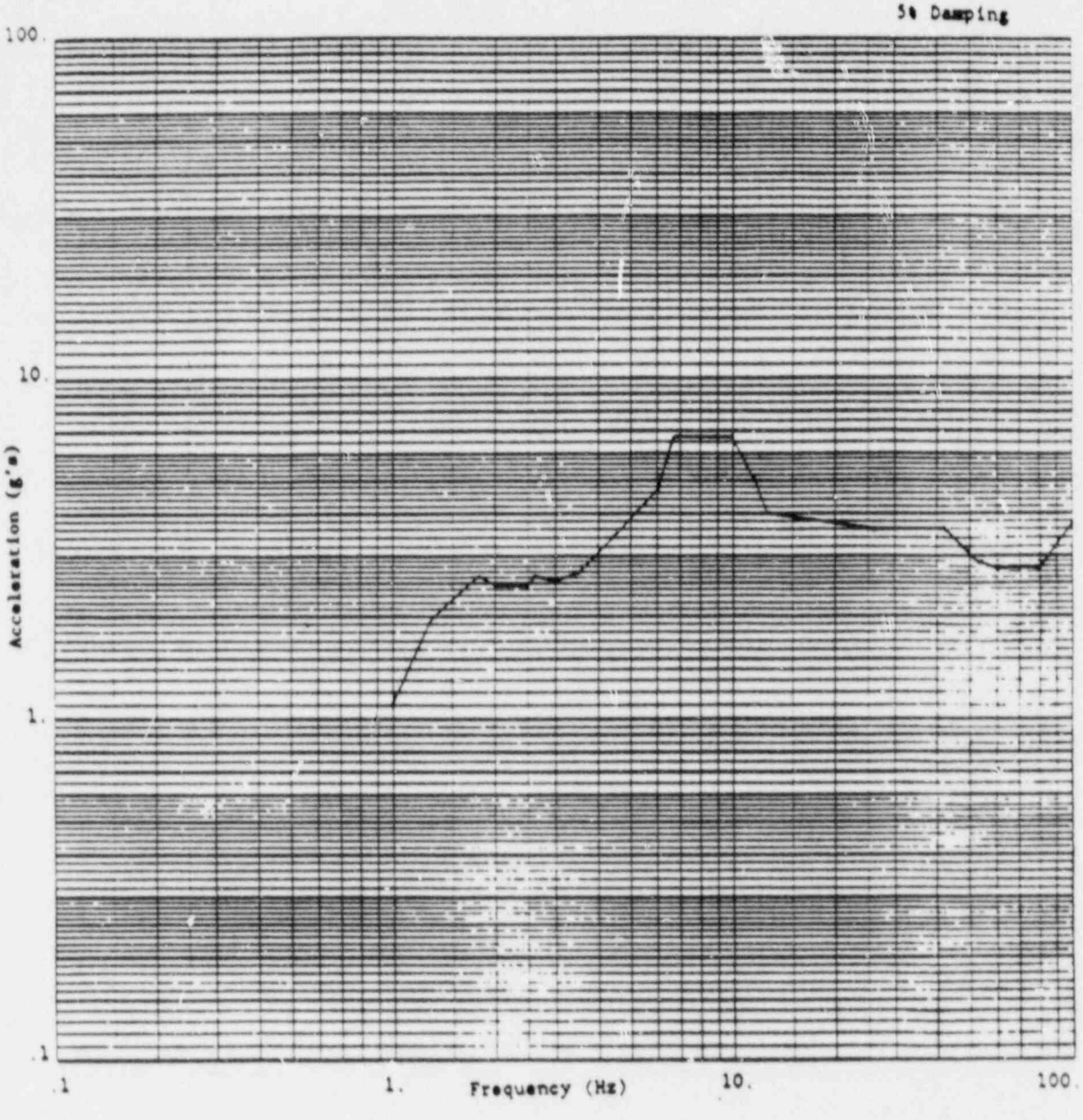

Figure 3: Safe Shutdown Earthquake Required Response Spectra for AMSAC Standard Seismic Cabinet with Only Unrestrained Nonlatching Relays or with Nonlatching Relays and Latching Relays Fitted with Hold-down Bar-Principal Direction