MISSISSIPPI POWER & LIGHT COMPANY
Helping Build Mississippi
P. O. BOX 1640, JACKSON, MISSISSIPPI 39205

July 7, 1981

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U.S. NUCLEAR REGULATORY COMMISSION

NUCLEAR PRODUCTION DEPARTMENT

Mr. Robert L. Tedesco
Assistant Director of Licensing
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Tedesco:

SUBJECT: Grand Gulf Nuclear Station
Units 1 and 2
Docket Nos. 50-416 and 50-417
File 0260/0277/L-860.0/M-001.0
Equipment Qualification for Seismic and Hydrodynamic Loads
AECM-81/244

Attached are the Seismic Qualification Review Team Summary Forms for each of the items requested by telecopy to Bechtel Power Corporation on July 7, 1981.

Yours truly,

John D Richardson for
L. F. Dale
Manager of Nuclear Services

SHH/JDR:lm
Attachments

cc: Mr. N. L. Stampley
Mr. G. B. Taylor
Mr. R. B. McGehee
Mr. T. B Conner

Mr. Victor Stello, Jr., Director
Office of Inspection & Enforcement
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

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GRAND GULF SQRT EQUIPMENT LIST

NSSS

Item No.	Description	Master Parts List Number	Vendor	Location	Qualification	Available
1	Recirc. Flow Control Valve	B33-F060	Fisher Controls SS150	Drywell, 107'	Fisher/A	Yes
2	RHR Pump & Motor	E12-C002	Pump-Byron Jackson motor-GE LM&C	Auxiliary Building 93'	DRF (GE)/TA	Yes
3	Panel Mounted Device on H13-P618	E12A-K40B	GE	Control Bldg. 166'	SAI/T	Yes
4	Transfer Tube System	F11-E015	Sundstrand Energy System	Cont./Aux. 185'	Sundstrand/A	Yes
5	Panel Mounted Device on H22-P011	C41A-S04B	GE	Containment 185'	SAI/T	Yes
6	SLC Pump	C41-C001	Union	Containment 185'	VPF/TA	Yes
7	Control Room Panel	H13-P601	GE	Control Bldg. 166'	SAI/T	Yes
8	Hydraulic Control Unit	C11-D001	GE	Containment 135'	Wyle/T	Yes
9	Termination Cab. P701	H13-P701	GE	Control Bldg. 166'	D. M. Rhuble, etc./T	Yes
10	SLC System Explosive Valve	C41-F004	Conax	Containment 185'	Conax/T	Yes
11	Head Strong-Back Carousel	F13-E009	GE	Containment 208'	DRF (GE)/A	Yes
12	Sample Probe	B33-D014	Associated Piping & Eng.	Containment 125'	GE/A	Yes
13	Nuclear Boiler SRV	B21-F041	Dikkers	Drywell 157'	Wyle/T	Yes
14	RCIC Pump	E51-C001	Bingham/Williamette	Auxiliary El. 98'	?	Yes
15	RCIC Turbine	E51-C002	Terry	Auxiliary El. 98'	?	Yes

GRAND GULF SQRT EQUIPMENT LIST

BOP

Item No.	Description	Master Parts List Number	Vendor	Location	Qualification	Available
1	Drywell Head	QSM10Y001	W. J. Woolley Co.	Containment 184'-6"	1.J Static Dynamic Analysis	Yes
2	6.9 KV Switchgear	Q1R22S103C-B	General Electric	Auxiliary 139'-0"	Test by Wyle Mult. freq. & Axis	Yes
3	Standby Service Water Pressure Indicator Switch	1P41-PIS-N602A	Rosemount	Control Bldg. 190'-0"	Test Single Freq. 11g @ 15 & 33 Hz	Yes
4	SSW Cooling Tower	QSP41B001A	Ceramic Cooling Tower, Inc.	D. G. Bldg. 131'-0"	Dynamic Analysis	Yes
5	Standby D.G. Jacket Water Standby Pump	Q1P75A002A	DeLaval	D. G. Bldg. 136'-0"	[illegible]namic Analysis	Yes
6	RHR Solenoid Valve	1E12-SV-F060A	Target Rock Corp.	Auxiliary 139'-0"	Test & Analysis	No
7	SRV Air Accumulator	Q1B21A004A	Buffalo Tank	Drywell 161'-0"	Equivalent Static Analysis	Yes
8	CRD 6" Gate Valve & Actuator	SQ-6-HBC-GTF-MO-F322-UWY	Power/Limitorque	Auxiliary 119'-0"	Valve-Test & Analysis Actuator-Test	Yes
9	Flexible Pipe Connection	Q1B21D030A	Metal Bellows Corp.	Drywell 161'-0"	Static Equivalent	Yes
10	Load Center Motor-Control Centers R-20	Q1R20S650B	I-T-E Imperial Switchgear Division	SSWT Basin 131'-0"	Test Multi-frequency Multi-Axis	Yes
11	125 V DC Panel Board 1DA2	Q1L21P112A	Delta Switchboard Company	Auxiliary Bldg. 119'-0"	Test Multi-frequency Multi-Axis	Yes
12	Control Room HVAC System Fire Damper	N/A	American Warming & Ventilating	Control Bldg. 177'-0"	Static Analysis	Yes
13	Standby D.G. Generator Control Panel	1H22P113	DeLaval	D.G. Bldg. 136'-0"	Test	Yes
14	HPCS Service Water Pump	Q1P41-C002-C	Goulds	Service Water Pump House 80'-153'	Dynamic Analysis	Yes

GRAND GULF SQRT EQUIPMENT LIST

BOP

Item No.	Description	Master Parts List Number	Vendor	Location	Qualification	Available
15	Fan-40 MW	QSZ51D002A	Buffalo Forge Co.	Control Bldg. 133'-0"	Static Analysis	Yes
16	Polar Crane	Q1F13E001	Harnischfeger Corp.	Containment 238'-0"	Dynamic Response Static Analysis 0 to 30 Hz	Yes
17	ASCO Solenoid Valves	Q1Z77-F002A	ASCO	Control Bldg. 111'-0"	Test	Yes
18	Damper	Q1Z77-F001A	Pacific Air	Control Bldg. 111'-0"	Static Analysis	Yes

Qualification Summary of Equipment MPL: B33-F060

I. Plant Name: Grand Gulf

Type:

1. Utility: Mississippi Power & Light

PWR ____

2. NSSS: GE 3. A/E: Bechtel

BWR-6 Mark III

II. Component Name Recirculation Flow Control Valve

1. Scope: [X] NSSS [ ] BOP

2. Model Number: SS 150 Quantity: 2

3. Vendor: Fisher Controls

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance Straight through ball-type valve

b. Dimensions 72" long x 94" high

c. Weight approx. 16,000 lbs. (wet)

6. Location: Building: Drywell

Elevation: 107'

7. Field Mounting Conditions [ ] Bolt (No.____, Size____)
[ ] Weld (Length____)
[X] Welded in piping

8. a. System in which located: Recirculation System

b. Functional Description: Controls Recirculation Flow

c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown

[ ] Both [X] Neither

9. Pertinent Reference Design Specifications: 21A3872, Rev 6

12/80

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method:

[ ] Test [X] Analysis [ ] Combination of Test and Analysis

Qualification Report*: Design Report for 24 inch SS-150 Ball Valve

(No., Title and Date) TR-2608-1, Design Report, January 1978

Company that Prepared Report: Fisher Controls

Company that Reviewed Report: General Electric

V. Vibration Input:

1. Loads considered: a. [ ] Seismic only

   b. [ ] Hydrodynamic only

   c. [X] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [X] SRSS [ ] - (other, specify)

3. Required Response Spectra (attach the graphs): N/A

4. Damping Corresponding to RRS: OBE - SSE -

5. Required Acceleration in Each Direction: [ ] ZPA [X] Other Letter Report (Ref. 3, Table 8.2) (specify)

   OBE S/S = F/B = V =
   SSE S/S = 1.2g F/B = 1.2g V = 0.6g

6. Were fatigue effects or other vibration loads considered?

   [X] Yes [ ] No

   If yes, describe loads considered and how they were treated in overall qualification program: Fatigue effects of constant "dither" were considered in design and materials and stresses were selected for 40-year life of components.

*NOTE: If more than one report complete items IV thru VII for each report.

VI. If Qualification by Test, then Complete*: N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] ____________

2. [ ] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE ________ SSE ________ Other ________ (specify)

4. Frequency Range: ____________________________

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = ______________ F/B = ______________ V = ______________

6. Method of Determining Natural Frequencies

   [ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graphs [ ] No

8. Input g-level Test: OBE S/S = ________ F/B = ________ V = ________

   SSE S/S = ________ F/B = ________ V = ________

9. Laboratory Mounting:

   1. [ ] Bolt (No. _____, Size _____) [ ] Weld (Length ______) [ ] ______

10. Functional operability verified: [ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: ____________________________

    ____

12. Other test performed (such as aging or fragility test, including results):

    ____

    ____

*Note: If qualification by a combination of test and analysis also complete Item VII.

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

   [X] Static Analysis [ ] Equivalent Static Analysis

   [ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = > 60 Hz F/B = > 60 Hz V = > 60 Hz

3. Model Type: [X] 3D [ ] 2D [ ] 1D

   [ ] Finite Element [X] Beam [ ] Closed Form Solution

4. [ ] Computer Codes: ____________________

   Frequency Range and No. of modes considered: ____________________

   [X] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
   Not applicable [ ] Other: ____________________ (specify)

6. Damping: OBE - SSE - Basis for the damping used: -

7. Support Considerations in the model: -

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Housing to Body Studs		6g's(V),9g's(H)*		66.5 ksi	81.0 ksi

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

Operability not required.

*Actual required accelerations (New Load Analysis) are much lower.

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B33 - F060

GENERAL ELECTRIC COMPANY
BOILING WATER REACTOR SYSTEMS DEPARTMENT

SPEC NO. 22A6976

REV. NO. 0
PAGE NO.

OG REC B ACCELERATION

Letter Report
Reference 3

Table 8.2

Flow Control Valve Operator Acceleration

Attachment 1

VALVE OPERATOR NODE=078. TO=054. OPERATOR CO

LOAD TYPE	CASE	AX	AY	AZ
SEISMIC	1	0.15162	0.09147	0.10495
SEISMIC	2	0.08862	0.06088	0.04330
SEISMIC	3	0.11105	0.08800	0.14341
RV2 I	1	0.51127	0.37747	0.44394
RV2 I	2	0.47852	0.30642	0.22830
RV2 I	3	0.35968	0.29289	0.48399
RV2 ADSI	1	0.25432	0.16565	0.19913
RV2 ADSI	2	0.37667	0.24268	0.17475
RV2 ADSI	3	0.17094	0.12057	0.20446
CHUG. I	1	0.07453	0.05361	0.05215
V.L.C. I	1	0.07453	0.05361	0.05215
CHUG. I	2	0.07853	0.05832	0.04676
V.L.C. I	2	0.07853	0.05832	0.04676
CHUG. I	3	0.05142	0.04911	0.06876
V.L.C. I	3	0.05142	0.04911	0.06876
A.P.I.	1	0.34517	0.26155	0.39101
A.P.I.	2	0.29624	0.22704	0.26426
A.P.I.	4	0.43682	0.32645	0.42682
A.P.I.	5	0.39338	0.28915	0.30115
A.P.I.	7	0.68387	0.53990	0.71629
A.P.I.	8	0.47452	0.35840	0.39750
SSEI	1	0.29138	0.17862	0.20523
SSEI	2	0.16331	0.10650	0.07531
SSEI	3	0.21443	0.16565	0.28338
COND. I	1	0.07453	0.05361	0.05215
COND. I	2	0.07853	0.05832	0.04676
COND. I	3	0.05142	0.04911	0.06876
RV2 SVII	1	0.30117	0.17611	0.21404
RV2 SVII	2	0.15338	0.10078	0.07500
RV2 SVII	3	0.21753	0.17472	0.29299

			AH	AAH	RATIO	AV	AAV	RATIO
LEVL B		1	0.27682	9.00000	0.03076	0.14077	6.00000	0.02346
LEVL B		2	0.27682	9.00000	0.03076	0.14077	6.00000	0.02346
LEVL B		3	1.08621	9.00000	0.12069	0.58479	6.00000	[illegible]
LEVL B		4	0.61274	9.00000	0.06808	[illegible]	6.00000	[illegible]
LEVL C	POSTUL	1	[illegible]	9.00000	0.01721	[illegible]	6.00000	[illegible]
LEVL C	POSTUL	2	0.60973	9.00000	0.06775	0.23008	6.00000	[illegible]
LEVL C	POSTUL	3	[illegible]	9.00000	0.06313	[illegible]	6.00000	[illegible]
LEVL D		1	[illegible]	9.00000	0.05939	[illegible]	6.00000	[illegible]
LEVL D		2	1.17850	9.00000	0.13094	0.62677	6.00000	0.10446
LEVL D	POSTUL	3	0.81082	9.00000	0.09009	0.42454	6.00000	[illegible]
LEVL D	POSTUL	4	0.78005	9.00000	0.08667	[illegible]	6.00000	[illegible]
LEVL D	POSTUL	5	0.81082	9.00000	0.09009	0.42454	6.00000	[illegible]
LEVL D	POSTUL	6	0.78005	9.00000	0.08667	[illegible]	6.00000	[illegible]

WORST CASE

Qualification Summary of Equipment

MPL: E12C002

I. Plant Name: Grand Gulf

Type:

1. Utility: Mississippi Power & Light

PWR ____

2. NSSS: GE   3. A/E: Bechtel

BWR-6 Mark III

II. Component Name RHR Pump/Motor

1. Scope: [X] NSSS   [ ] BOP
2. Model Number: 30DX-20CKXH (Pump) 5K6339XC186A (Motor)   Quantity: 3
3. Vendor: Byron Jackson, GE Motor Plant
4. If the component is a cabinet or panel, name and model No. of the devices included: N/A
5. Physical Description a. Appearance Vertical deep well pump with motor

   b. Dimensions Dia:59.38"(including nozzles); Length: 443" (includes motor)

   c. Weight 38,500 flooded, with motor
6. Location: Building: Auxiliary Building

   Elevation: 93'-0"
7. Field Mounting Conditions [X] Bolt (No. 24, Size 2")

   [ ] Weld (Length ____)

   [ ] ____
8. a. System in which located: Residual Heat Removal (RHR)

   b. Functional Description: This pump/motor provides pressurized water for ECCS system functions and shutdown cooling

   c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown

   [X] Both [ ] Neither
9. Pertinent Reference Design Specifications: GE Spec. #21A3504AE & GE Spec. #21A3504

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III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method:

[ ] Test [ ] Analysis [X] Combination of Test** and Analysis

Qualification Report*: RHR/Pump & Motor Operability Assurance Analysis

(No., Title and Date) DRF #E12-53

Company that Prepared Report: GENERAL ELECTRIC

Company that Reviewed Report: GENERAL ELECTRIC

V. Vibration Input:

1. Loads considered: a. [X] Seismic only

   b. [ ] Hydrodynamic only

   c. [ ] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [ ] SRSS [X] RSS not combined since seismic was only significant load acting. (other, specify)

3. Required Response Spectra (attach the graphs): Attached

4. Damping Corresponding to RRS: OBE ___ SSE 0.03

5. Required Acceleration in Each Direction: [ ] ZPA [X] Other * (specify)

*Since response spectrum analysis was performed one particular acceleration value was not used. Refer to attached curve values.

OBE S/S = ___ F/B = ___ V = ___

SSE S/S = ___ F/B = ___ V = ___

6. Were fatigue effects or other vibration loads considered?

[X] Yes [ ] No

If yes, describe loads considered and how they were treated in overall qualification program: This pump/motor is located outside the reactor building and is not affected by high cycle suppression pool hydrodynamic loads. The number of stress cycles produced by seismic loading results in an ASME Code alternating stress allowable (S_A) that is higher than all peak stresses expected at pump stress concentrations. Vibration displacements from pump operation are measured to be less than Hydraulic Institute Standards; therefore high cycle vibration stresses are low and would not lead to pump failure.

*NOTE: If more than one report complete items IV thru VII for each report.

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** Test refered to vendor performance and operability testing as described in Qualification Summary paragraph 6.

VI. If Qualification by Test, then Complete*: N/A

1. [ ] Single Frequency   [ ] Multi-Frequency: [ ] random / [ ] sine beat / [ ] ______

2. [ ] Single Axis   [ ] Multi-Axis

3. No. of Qualification Tests: OBE______ SSE______ Other______ (specify)

4. Frequency Range:______

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = ______ F/B = ______ V = ______

6. Method of Determining Natural Frequencies

   [ ] Lab Test   [ ] In-Situ Test   [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graphs)
   [ ] No

8. Input g-level Test: OBE S/S = ______ F/B = ______ V = ______

   SSE S/S = ______ F/B = ______ V = ______

9. Laboratory Mounting:

   1. [ ] Bolt (No.____, Size____) [ ] Weld (Length____) [ ]____

10. Functional operability verified: [ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made:______

______

12. Other test performed (such as aging or fragility test, including results):

______

______

*Note: If qualification by a combination of test and analysis also complete Item VII.

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[X] Dynamic Analysis: [ ] Time-History [X] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 18 Hz F/B = 18.3 Hz V = 68 Hz

3. Model Type: [X] 3D [ ] 2D [ ] 1D

[X] Finite Element [ ] Beam [ ] Closed Form Solution

4. [X] Computer Codes: SAP4G06, FLTFG01

Frequency Range and No. of modes considered: 1 Hz to 160 Hz (30 modes)

[X] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS [X] Other: * (specify)

*Response to input from 3 orthogonal directions combined SRSS; & responses due to individual modes combined SRSS, with closely spaced modes combined according to Reg.Guide 1.92.

6. Damping: OBE ______ SSE 3% Basis for the damping used: 384HA137

7. Support Considerations in the model: Bolted on flexible foundation. Calculated support stiffness considered infinite element model.

8. Critical Structural Elements:

A. Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
1. Suction Barrel Shell		P_S+S+N+SSE		10,953	21,000
2. Discharge Hd. Shell		P_S+S+N+N_L+SSE		32,465	34,650

B. Max. Critical Deflection Calculated	Allowable	Location	Maximum Allowable Deflection to Assure Functional Operability
V .163g H .324g	V 1.25 g H 3.00g	Acceleration at motor CG	1. Avoid contact between rotor/stator.
4.647×10^{-3}	9.0×10^{-3}	Relative displacement between shaft & throttle bushing	2. Avoid contact to prevent galling.
4.296×10^{-3}	30×10^{-3}	Relative displacement between shaft & mechanical seal	3. Avoid contact to prevent seal damage.

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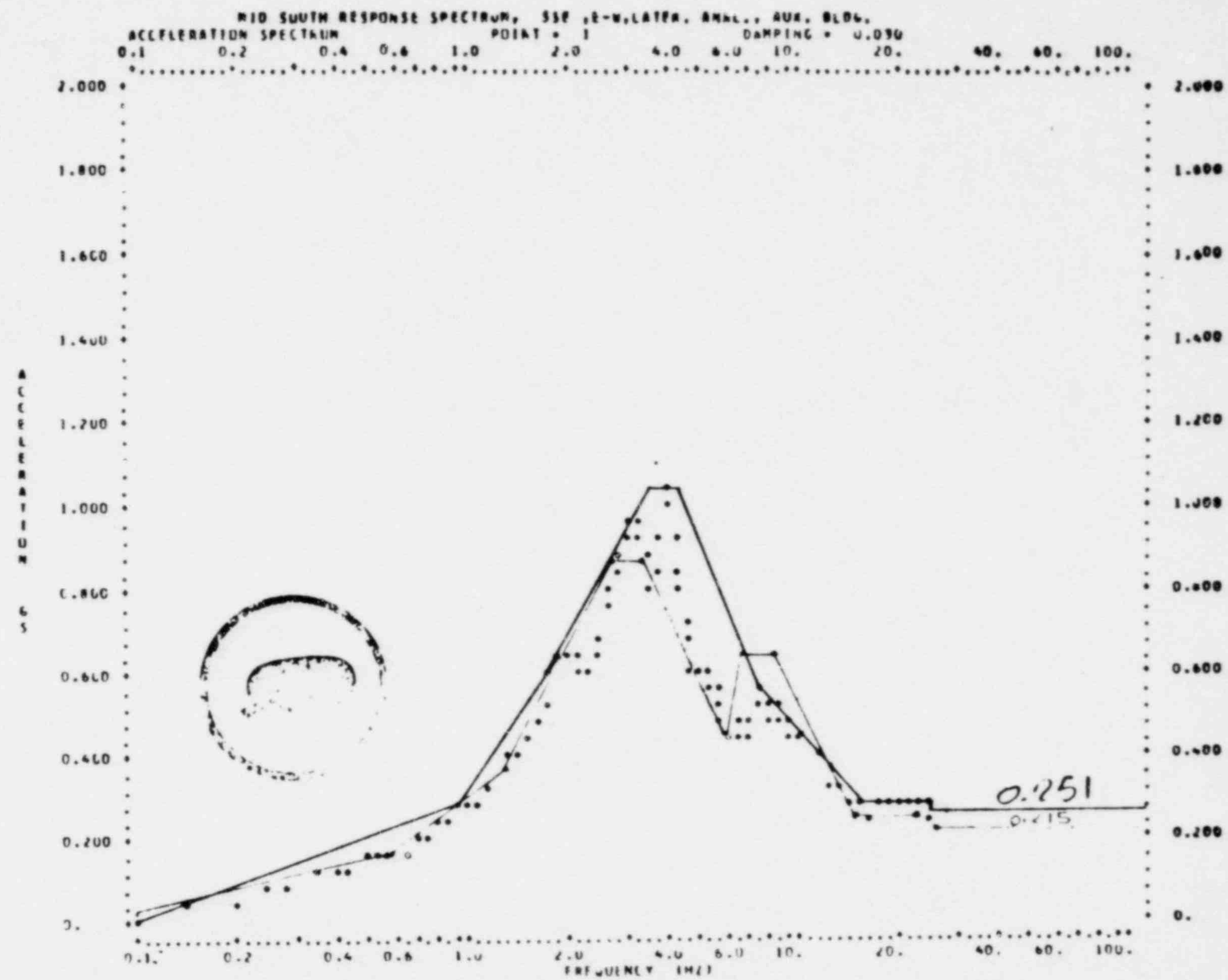

Note: GE documents 385HA603 (Seismic Design of BWRSD Supplied Equipment) and 386HA607 (Dynamic Loads Methods) specify 3% faulted case.

No.	DATE	REVISIONS	BY	CH'K	APPR
0	6/11/73	ISSUED FOR USE			

BECHTEL

AUX. BLDG. FLOOR SPECTRUM
SSE, E-W, EL. 93'-0", 3%

GRAND GULF NUCLEAR STATION UNITS 1&2

JOB No. 9645

E114 REV

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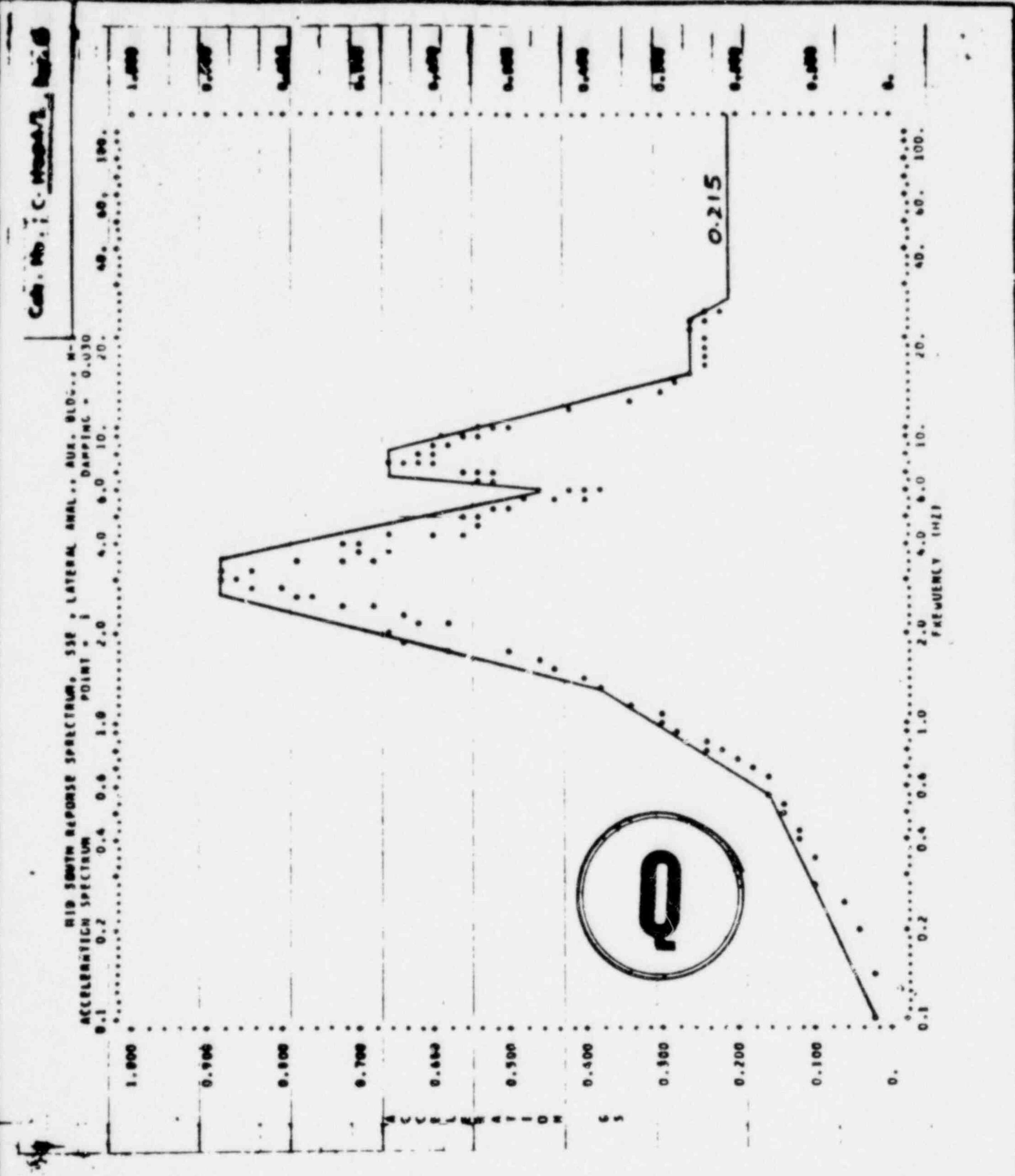

No.	DATE	REVISIONS	BY	CH'K	APPR
0	6/11/73	ISSUED FOR USE		T&H	

M P&L — BECHTEL

AUX. BLDG. FLOOR SPECTRUM
SSE, N-S, EL. 93'-0" 3%

GRAND GULF NUCLEAR STATION UNITS 1&2

JOB No. 9645

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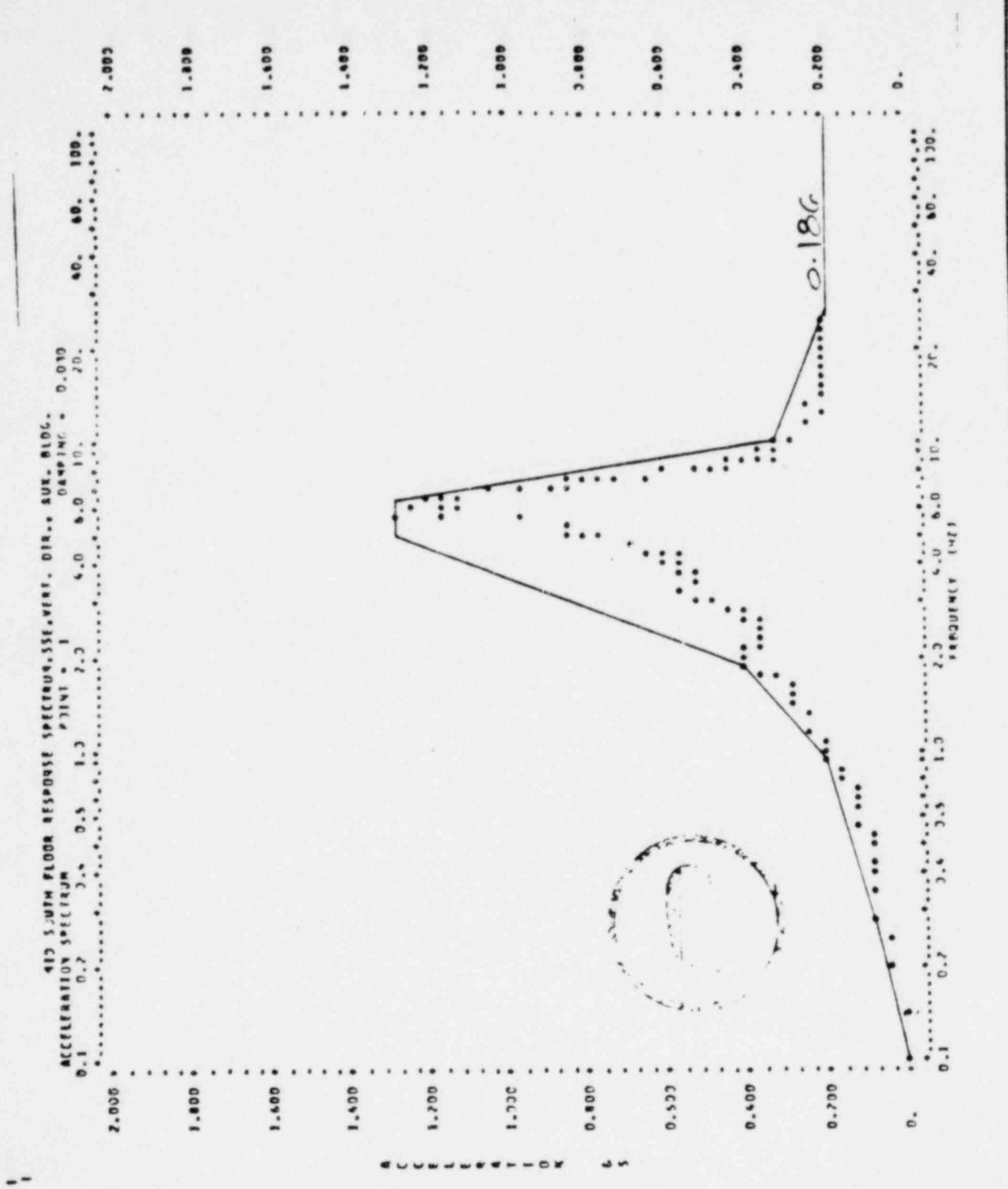

No.	DATE	REVISIONS	BY	CH'K	APPR
0	6/11/23	ISSUED FOR USE			

AUX. BLDG. FLOOR SPECTRUM
SSE, VERT., EL. 93'-0", 3%

GRAND GULF NUCLEAR STATION UNITS 1&2

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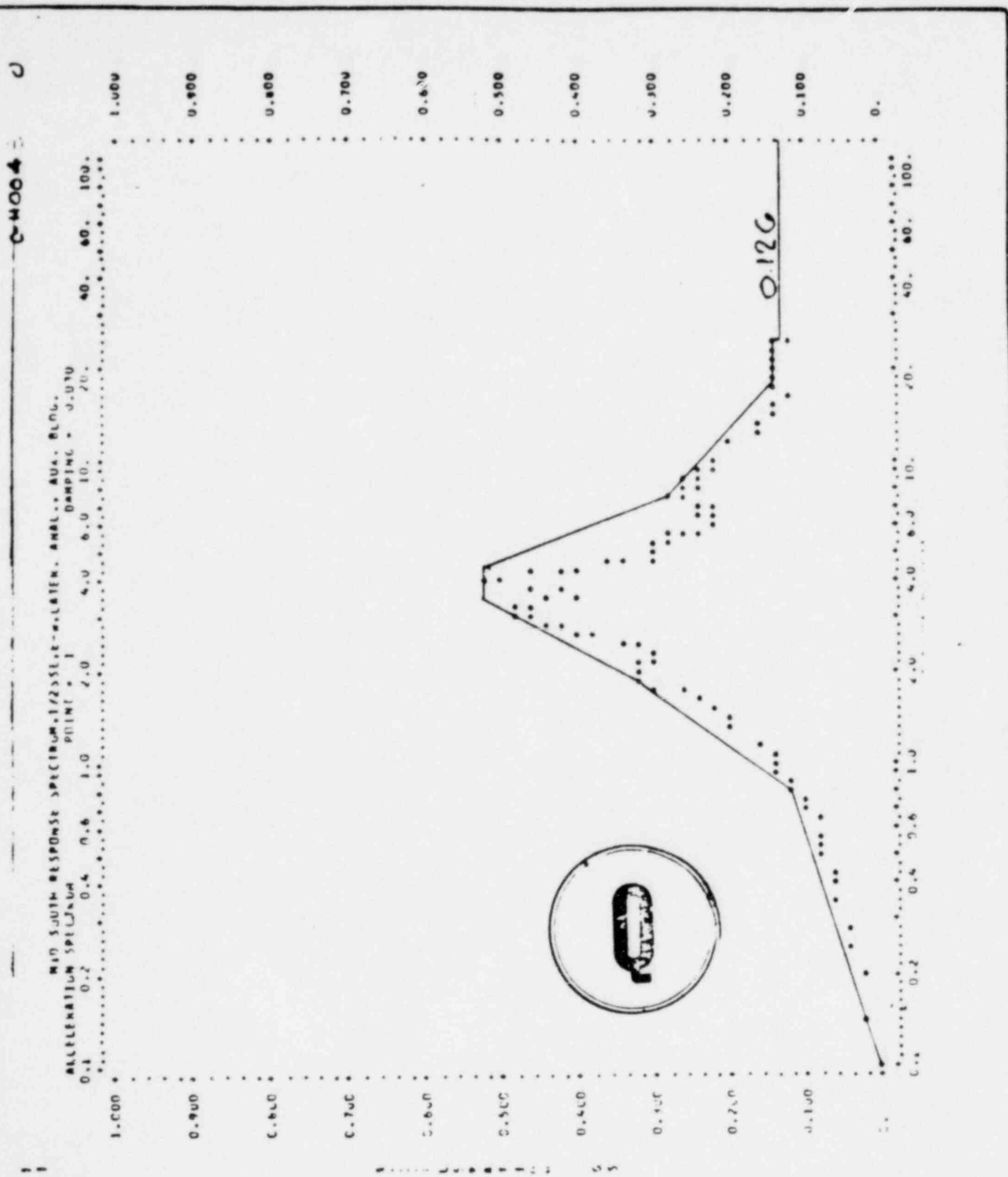

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0	6/11/73	ISSUED FOR USE			

BECHTEL

AUX. BLDG. FLOOR SPECTRUM
½ SSE, E-W, EL. 93'-0", 3%
GRAND GULF NUCLEAR STATION UNITS 1&2

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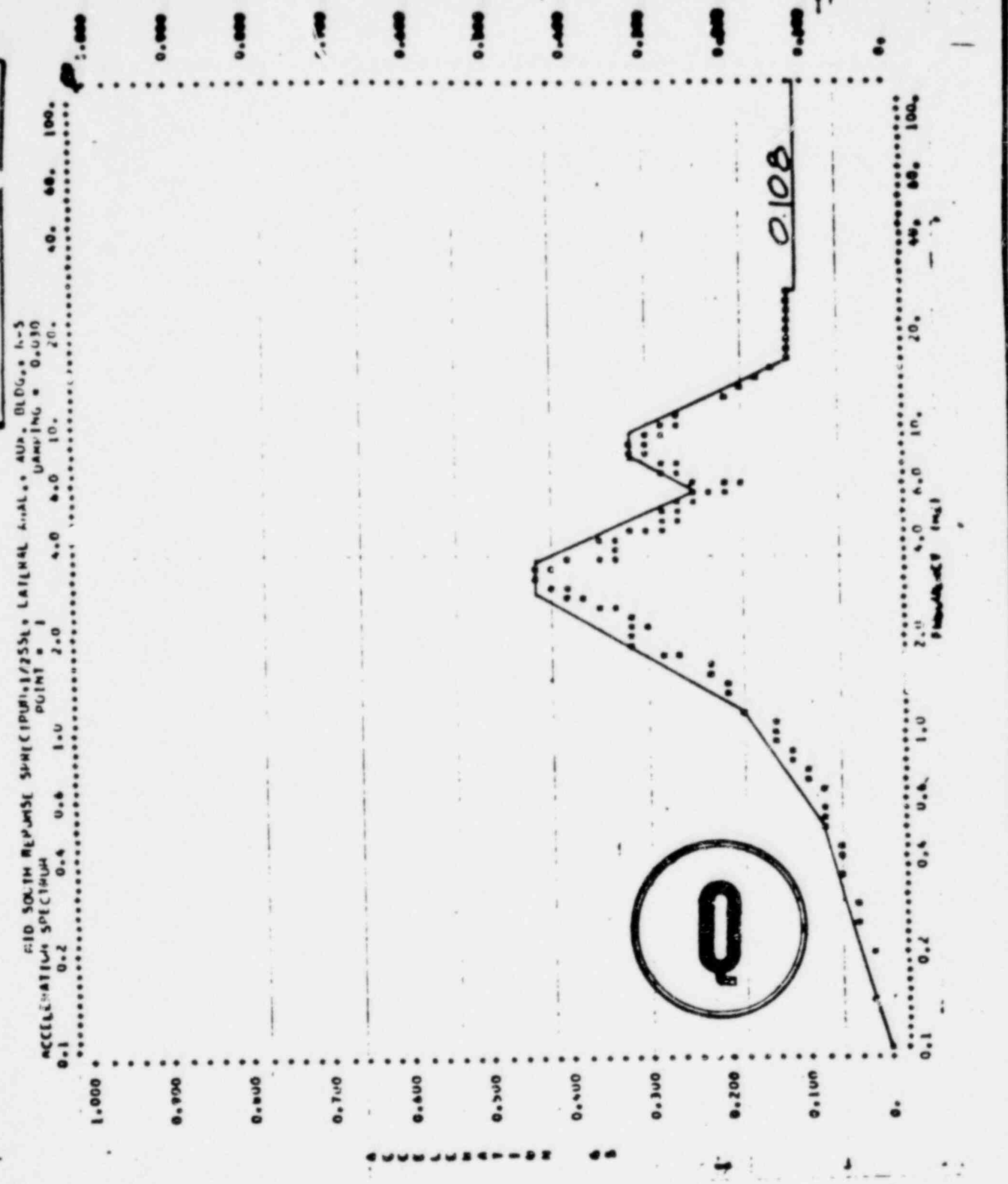

No.	DATE	REVISIONS	BY	CH'K	APPR
0	6/11/73	ISSUED FOR USE		T&H	

BECHTEL

AUX. BLDG. FLOOR SPECTRUM
½ SSE, N-S, EL. 93'-0", 3%

GRAND GULF NUCLEAR STATION UNITS 1&2

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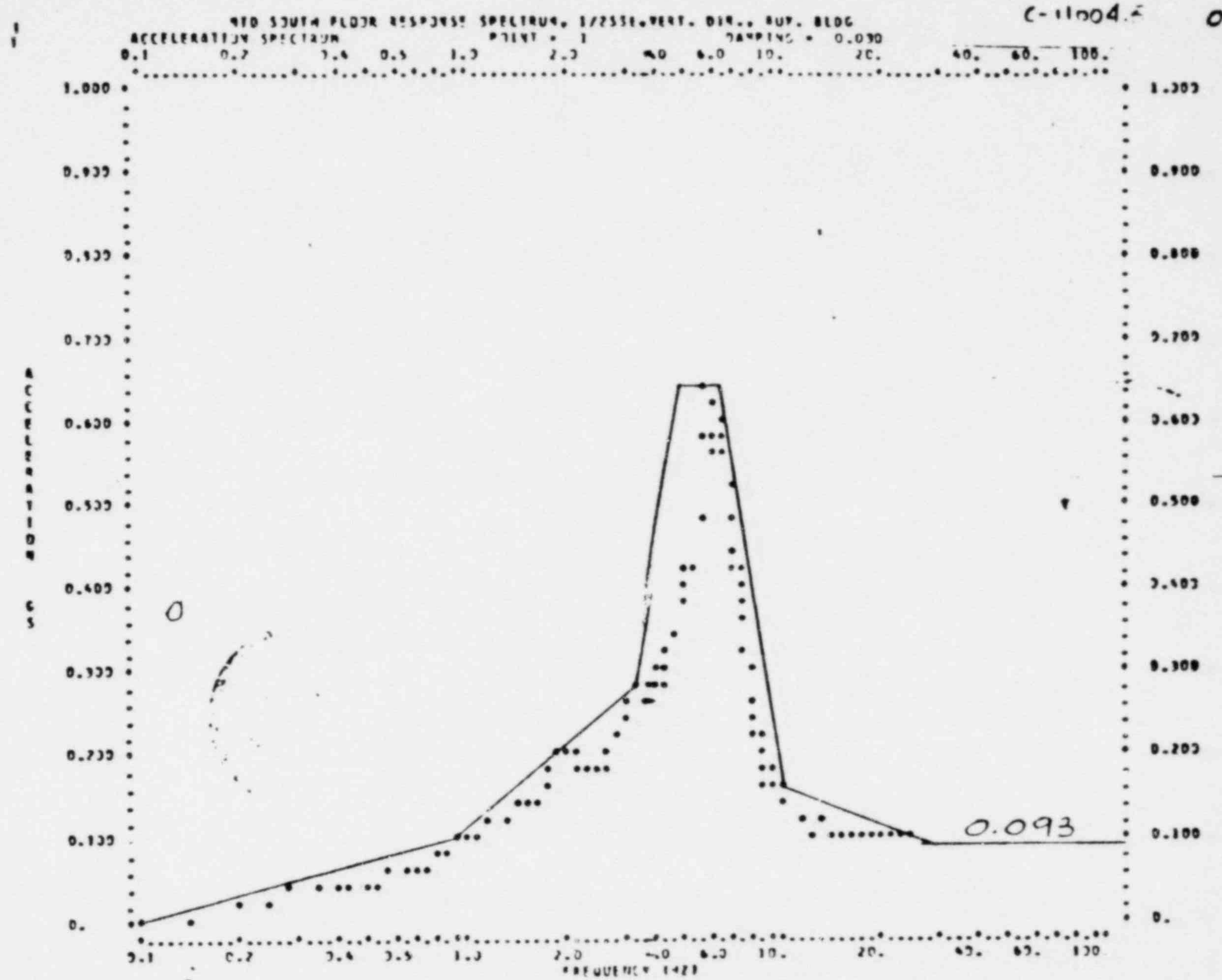

No	DATE	REVISIONS	BY	CH'K	APPR
0	6/11/73	ISSUED FOR USE	[illegible]	[illegible]	[illegible]

AUX. BLDG. FLOOR SPECTRUM
½ SSE, VERT., EL. 93'-0", 3%
GRAND GULF NUCLEAR STATION UNITS 1&2

JOB No 9645
V104
REV 0
SHEET 1 OF [illegible]

Qualification Summary of Equipment

I. **Plant Name:** GRAND GULF

Type:

1. **Utility:** MISSISSIPPI POWER & LIGHT

PWR ______

2. **NSSS:** GE 3. **A/E:** BECHTEL

BWR 6 Mk III

II. **Component Name** Control Room Panels

1. **Scope:** [X] NSSS [ ] BOP

2. **Model Number:** H13-P618; P629; P632:P655 **Quantity:** 1 each

3. **Vendor:** General Electric Co.

4. **If the component is a cabinet or panel, name and model No. of the devices included:** See attached device list

5. **Physical Description** a. **Appearance** Vertical/Bench Boards

b. **Dimensions** See device list

c. **Weight** NA

6. **Location:** **Building:** Control

Elevation: See device lists.

7. **Field Mounting Conditions** [X] Bolt (No. * , Size 5/8")
[ ] Weld (Length ____)
[ ] ______

* on 6" centers

8. a. **System in which located:** See attached device list

b. **Functional Description:** See attached device list.

c. **Is the equipment required for** [ ] Hot Standby [ ] Cold Shutdown

▲[X] Both [ ] Neither

9. **Pertinent Reference Design Specifications:** See reference 4.3.4.

▲ H13-P629

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III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method:

[X]Test [ ]Analysis [ ]Combination of Test and Analysis

Qualification Report*: Seismic Test Report H13-P618

(No., Title and Date) See Reference 4.3.1

Company that Prepared Report: General Electric Co.

Company that Reviewed Report: General Electric Co.

V. Vibration Input:

1. Loads considered: a.[X]Seismic only b.[ ]Hydrodynamic only c.[ ]Explosive onl

   d.[ ]Other (Specify)__________ e.[ ]Combination of__________

   f. Method of Combining RRS: [ ]Absolute Sum [ ]SRSS [ ]__________ (other, specify)

2. Required Response Spectra (attach the graphs): See Section 2

3. Damping Corresponding to RRS: OBE 3% SSE 3%

4. Required Acceleration in Each Direction: [X]ZPA [ ]Other__________ (specify)

OBE	S/S = .254	F/B = .254	V = .120
SSE	S/S = .507	F/B = .507	V = .239

5. Is long-term vibration load effects considered [ ]Yes [X]No

* Note: These panels are compared to a similar tested cofrentes H13-P618 panel and the test results are extended to them by the methodology described in the text.

VI. <u>If Qualification by Test, then Complete:</u>

1. [ ] Single Frequency [X] Multi-Frequency: [ ] random [ ] sine beat [X] In and out-of-phase
2. [ ] Single Axis [X] Multi-Axis
3. No. of Qualification Tests: OBE 5 SSE 1 Other ____ (specify)
4. Frequency Range: 1-33 Hz
5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = 19 F/B = 27.4 V = 33
6. Method of Determining Natural Frequencies

   [X] Lab Test [ ] Insitu Test [ ] Analysis
7. TRS enveloping RRS using Multi-Frequency Test [X] Yes (Attach TRS & RRS graph [ ] No (See section 2)
8. Input g-level Test: OBE S/S = 1.0 F/B = 1.0 V = 1.0

   SSE S/S = 1.5 F/B = 1.5 V = 1.5
9. Laboratory Mounting: (All mounting holes used)

   1. [X] Bolt (No. ____, Size 5/8) [ ] Weld (Length ____) [X] clamps
10. Functional operability verified: [X] Yes [ ] No [ ] Not Applicable
11. Test Results including modifications made: The tested panel maintained its structural integrity and the devices performed their Class 1E function.
12. Other test performed (such as aging or fragility test, including results): Fragility test results were applied as noted on the device lists to establish seismic capability of certain devices.

VII. If Qualification by Analysis or by the Combination of Test and Analysis, then Complete:

1. Descripition of Test including Results: NA

2. Method of Analysis:

   [ ] Static Analysis   [ ] Equipment Static Analysis

   [ ] Dynamic Analysis: [ ] Time-History

   [ ] Response Spectrum

3. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = ______ F/B = ______ V = ______

4. Method of Determining Natural Frequencies

   [ ]Lab test   [ ]insitu Test   [ ]Analysis

5. Model Type: [ ] 3D   [ ] 2D   [ ] ID

   [ ] Finit Element   [ ] Beam   [ ] Closed Form Solution

6. [ ] Computer Codes: ______

   Frequency Range and No. of modes considered: ______

   [ ] Hand Calculations

7. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
   [ ]Other: ______ (specify)

8. Damping: OBE ______ Basis for the damping used: ______
   SSE ______

9. Support Considerations in the model: ______

10. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

Section 2

2.0 REQUIRED RESPONSE SPECTRA (RRS) AND TEST RESPONSE SPECTRA (TRS)

2.1 HORIZONTAL MODE

Figure 1 gives the relationship between the Grand Gulf horizontal (longitudinal and lateral) required response spectrum and the test response spectrum.

2.2 VERTICAL MODE

Figure 2 gives the relationship between the Grand Gulf vertical required response spectrum and the test response spectrum.

NOTE:

1. The RRS as shown are for the control room upper floor at the 189' level (see Reference 4.3.5). They envelop the RRS of all control room panel locations, i.e., the 189' and 166' levels of the control building.
2. The TRS as shown is the lowest for all tests conducted on the control room panels (see Reference 4.3.1).

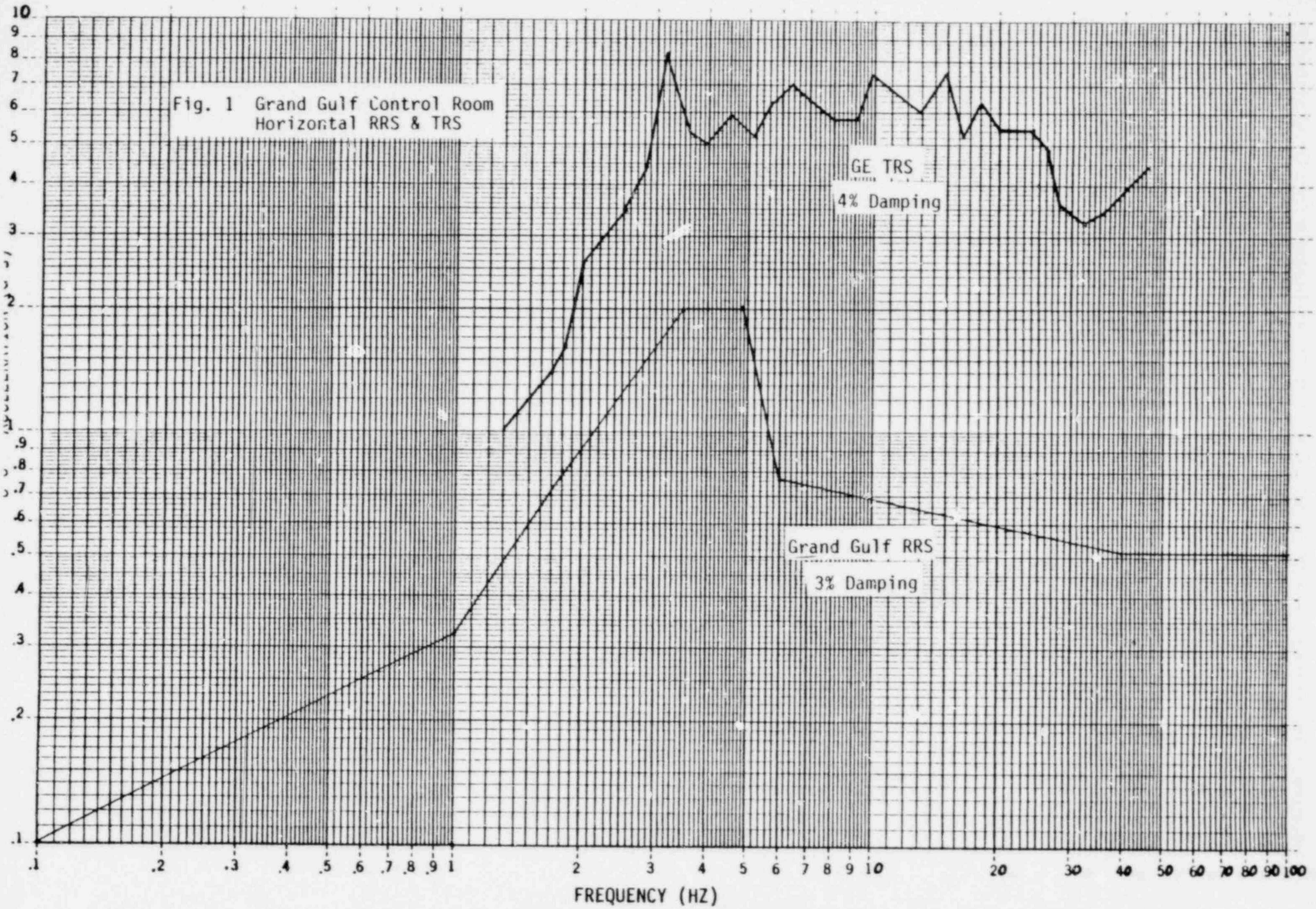
Fig. 1 Grand Gulf Control Room
Horizontal RRS & TRS
GE TRS
4% Damping
Grand Gulf RRS
3% Damping
FREQUENCY (HZ)
10
9
8
7
6
5
4
3
2
1
.9
.8
.7
.6
.5
.4
.3
.2
.1
.1 .2 .3 .4 .5 .6 .7 .8 .9 1 2 3 4 5 6 7 8 9 10 20 30 40 50 60 70 80 90 100

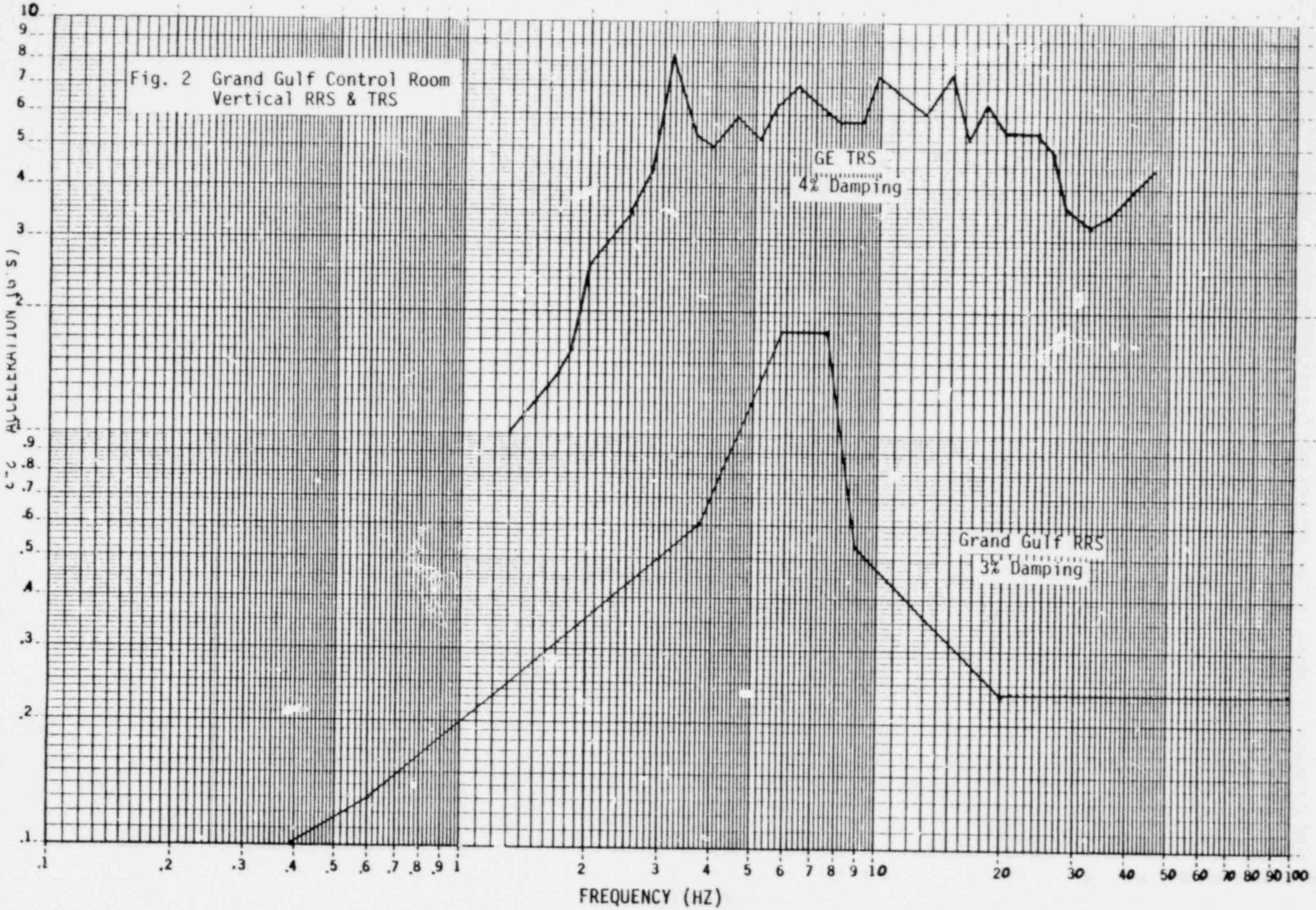
Fig. 2 Grand Gulf Control Room
Vertical RRS & TRS
GE TRS
4% Damping
Grand Gulf RRS
3% Damping
ACCELERATION (G'S)
FREQUENCY (HZ)
10
9
8
7
6
5
4
3
2
.9
.8
.7
.6
.5
.4
.3
.2
.1
.1
.2
.3
.4
.5
.6
.7
.8
.9
1
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3
4
5
6
7
8
9
10
20
30
40
50
60
70
80
90
100

SEISMIC QUALIFICATION REEVALUATION

72 INCH WIDE CONTROL ROOM PANEL CLASS 1E EQUIPMENT

Panel MPL Ref: H13-P618
Location, Elevation: Central Floor, 166'

System: Div. 2 RHR Relay VB
Panel Dimensions: 72" X 90" X 36"

EQUIPMENT MPL NO.	DESCRIPTION	IDENTIFICATION	CURRENT SEISMIC CAPABILITY/ MALFUNCTION LIMIT			MAXIMUM EXPECTED PEAK ACCELERATION			REMARKS
			f-b	s-s	v	f-b	s-s	v	
E12A-K117 - K114B	Relay	164C5258P002	4	3	1.5	3.3	1.7	0.3	
E12A-K112BC	Relay	164C5258P004	4	3	1.5	3.3	1.7	0.3	
E12A-K22	Relay	159C4251P001	3.2	2	2.8	1.8	1.2	0.3	
E12A-K116	Relay	164C5257P010	17	17	4.6	1.9	1.2	0.3	See Note 3.1.3
E12A-K40B K41BC K45 K46 thru K49	Relay	164C5258P004	4	3	1.5	3.3	1.7	0.3	
E12A-K52 K53	Relay	164C5258P001	4	3	1.5	1.8	1.2	0.3	
E12A-K113B - K125B - K126B - K127B - K128 - K120BC - K129B - K131 - K132 - K130B	Relay	164C5258P002	4	3	1.5	3.3	1.7	0.3	

Qualification Summary of Equipment MPL: F11-E015

I. Plant Name: Grand Gulf Type:

1. Utility: Mississippi Power & Light PWR

2. NSSS: GE 3. A/E: Bechtel BWR-6 Mark III

II. Component Name Horizontal Fuel Transfer System

1. Scope: [X] NSSS [ ] BOP

2. Model Number: GE-794E945 Quantity: 1

3. Vendor: Sundstrand Energy Systems

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance Horizontal tube extending between the containment ~~pool and the storage pool with~~ a carrage, upenders, a drive unit, and isolating mechanism.

b. Dimensions Diameter = 35". Approx. length = 358"

c. Weight Approx. 30,000 lbs.

6. Location: Building: Between Containment and Auxiliary Buildings

Elevation: 185 Ft. 4 In.

7. Field Mounting Conditions [ ] Bolt (No.____, Size____)
[X] Weld (Length____) Continuous
[X] Clamps and Hinges

8. a. System in which located: Fuel Service Equipment

b. Functional Description: The tube provides underwater access between the containment pool and the storage pool for the transfer of fuel.

c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown [ ] Both [X] Neither

9. Pertinent Reference Design Specifications: 22A4614 Rev. 0 and 21A3560 Rev. 4

III. Is Equipment Available for Inspection in the Plant: [x] Yes [ ] No

IV. Equipment Qualification Method:

- [ ] Test [x] Analysis [ ] Combination of Test and Analysis

Qualification Report*: VPF 5520-37-2

(No., Title and Date) **Horizontal Fuel Transfer System Containment Closure Structural Analysis, Dated 1/3/78

Company that Prepared Report: Sundstrand Energy Systems

Company that Reviewed Report: General Electric

V. Vibration Input:

1. Loads considered: a. [ ] Seismic only

   b. [ ] Hydrodynamic only

   c. [x] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [ ] SRSS [x] Both SRSS & ABS. (other, specify)

3. Required Response Spectra (attach the graphs): Attachments 1 and 2

4. Damping Corresponding to RRS: OBE 2% SSE 3%

5. Required Acceleration in Each Direction: [x] ZPA [ ] Other (specify)

   OBE Horizontal = 0.56g ABS. V = 0.31g ABS

   SSE Horizontal = 0.75g ABS. V = 0.4g ABS

6. Were fatigue effects or other vibration loads considered?

   [ ] Yes [x] No

   If yes, describe loads considered and how they were treated in overall qualification program:

*NOTE: If more than one report complete items IV thru VII for each report.

** VPF 5520-37-2 is a Qualification Report for the Containment Penetration Closure. It is the only essential component within the the Horizontal Fuel Transfer System. Other components within the system have dynamic analyses But, as they are not essential, they will not be included in this summary.

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VI. If Qualification by Test, then Complete*: N/A

1. [ ] Single Frequency   [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] ________

2. [ ] Single Axis   [ ] Multi-Axis

3. No. of Qualification Tests: OBE________ SSE________ Other________ (specify)

4. Frequency Range: ________

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = ________ F/B = ________ V = ________

6. Method of Determining Natural Frequencies

   [ ] Lab Test   [ ] In-Situ Test   [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graphs) [ ] No

8. Input g-level Test: OBE S/S = ________ F/B = ________ V = ________

   SSE S/S = ________ F/B = ________ V = ________

9. Laboratory Mounting:

   1. [ ] Bolt (No.____, Size____) [ ] Weld (Length____) [ ]____

10. Functional operability verified: [ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: ________

    ____

12. Other test performed (such as aging or fragility test, including results):

    ____

    ____

*Note: If qualification by a combination of test and analysis also complete Item VII.

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

   [ ] Static Analysis [X] Equivalent Static Analysis

   [ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = >188 Hz F/B = >188 Hz V = >188 Hz

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

   [ ] Finite Element [ ] Beam [X] Closed Form Solution

4. [ ] Computer Codes: ____

   Frequency Range and No. of modes considered: One

   [X] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [X] SRSS
   [ ] Other: ____ (specify)

6. Damping: OBE ____ SSE 3 % Basis for the damping used: GE-22A4614

7. Support Considerations in the model: Fixed with infinite stiffness at closure flange.

8. Critical Structural Elements: Fixed Hinge, Movable Hinge, and Clamp.

A.*

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Fixed Hinge	On Door Frame	DL+SSE+P+SRV		18671 psi	19700 psi
Movable Hinge	On Door	DL+SSE+P+SRV		19645 psi	19700 psi
Clamp	Outside Edge of Door	Pressure (loss of one clamp)		14522 psi	19700 psi

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

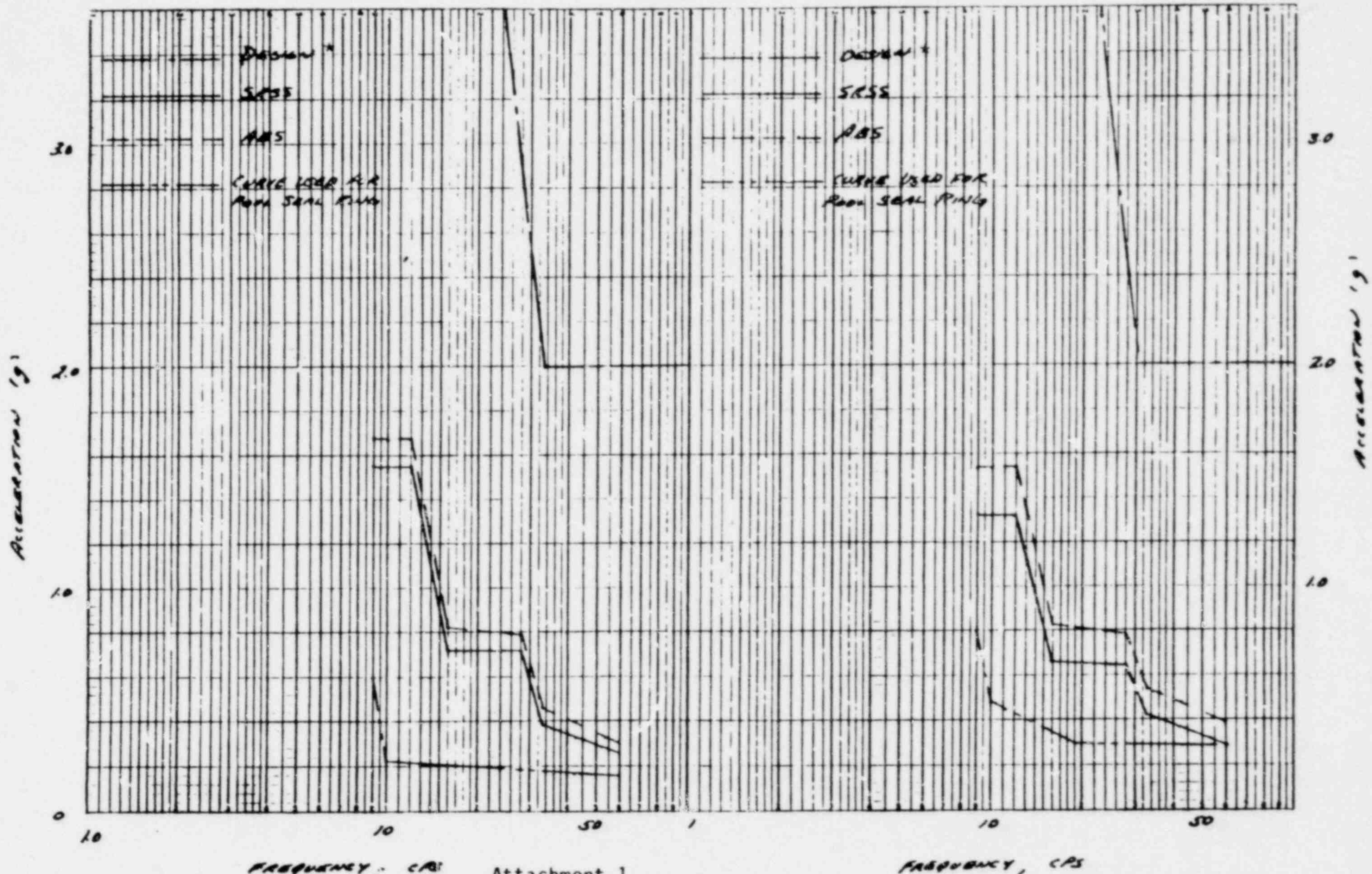
* These calculations are from the Standard Plant Analysis. Plant Specific Analysis requirements are considerably less. Therefore, a larger margin then shown does in fact exsist.

FN 522-B (8-50)(E) GENERAL ELECTRIC COMPANY SCHENECTADY N.Y. U.S.A.

FIGURE 5.4.A
DESIGN SPECTRA VS GRAND GULF SPECTRA
HFTS
OBE + SRV

VERTICAL

FIGURE 5.4.C
DESIGN SPECTRA VS GRAND GULF SPECTRA
HFTS
SSE + SRV



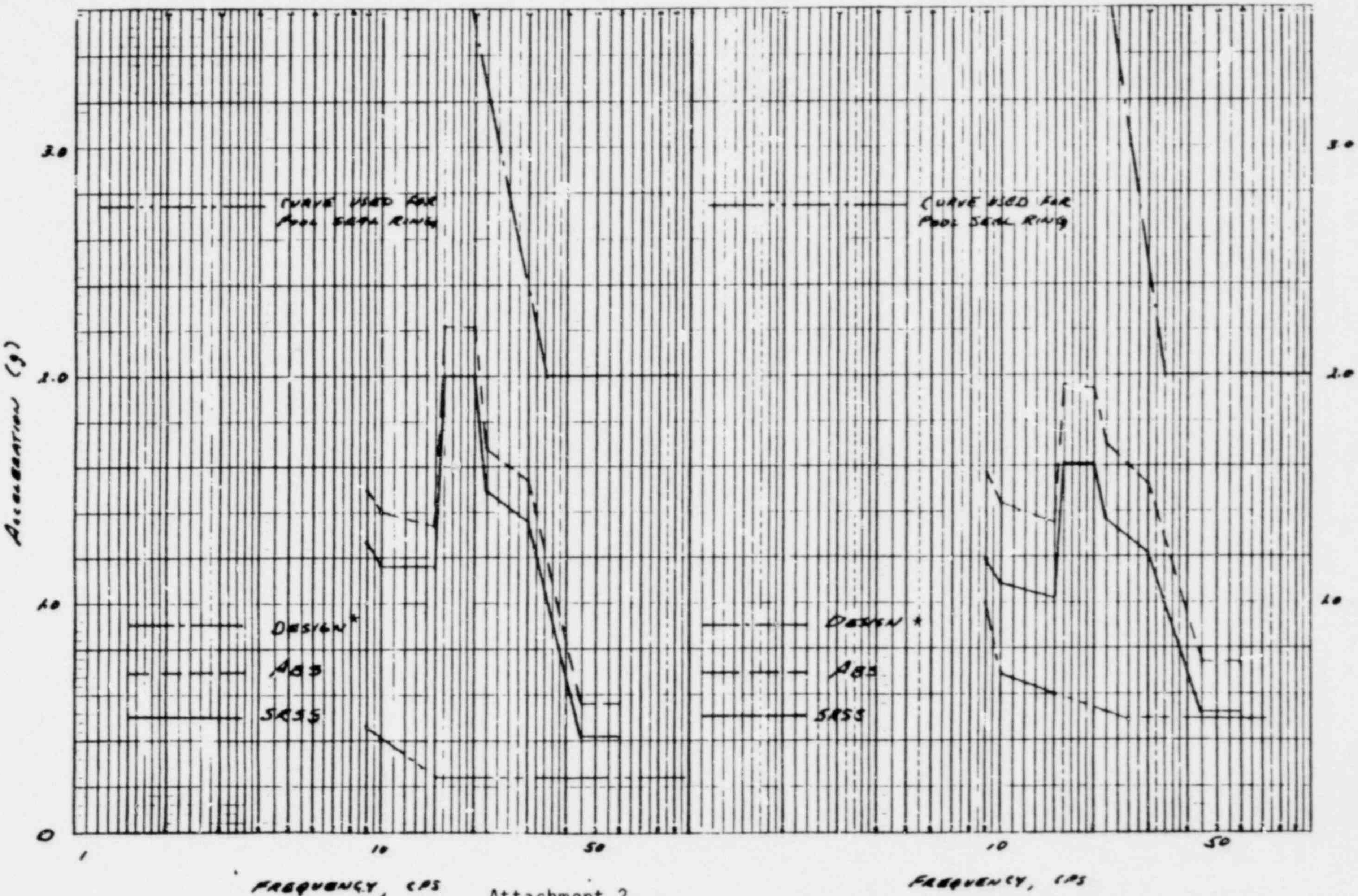
Attachment 1.

* The Horizontal Transfer System and Penetration Closure was designed to 1.75g ZPA

HORIZONTAL

FIGURE 5.4.C
DESIGN SPECTRA VS GRAND GULF SPECTRA
HFTS
OBE + SRV

FIGURE 5.4.D
DESIGN SPECTRA VS GRAND GULF SPECTRA
HFTS
SSE + SRV



Attachment 2.

* The Horizontal Transfer System and Penetration Closure was designed to 1.759 ZPA.

Qualification Summary of Equipment

I. Plant Name: GRAND GULF **Type:**

1. **Utility:** MISSISSIPPI POWER & LIGHT **PWR** ______
2. **NSSS:** GE 3. **A/E:** BECHTEL **BWR** 6 MK III

II. Component Name 48" Wide Panels

1. **Scope:** [x] **NSSS** [ ] **BOP**
2. **Model Number:** H22-P001;P005;P010;P011;P015; P021;P024; P025;P026;P041;P042 **Quantity:** 1 each
3. **Vendor:** General Electric Co.
4. **If the component is a cabinet or panel, name and model No. of the devices included:** See Attached Device Lists
5. **Physical Description a. Appearance** Open Rack
   b. Dimensions 48" X 84" X 30"
   c. Weight NA
6. **Location: Building:** Containment except P001 Auxiliary & P021,P024 Auxiliary, P011 Containme
   Elevation: 136' 93' 103' 184'6"
7. **Field Mounting Conditions** [ ] **Bolt (No.____, Size____)**
   [x] **Weld (Length** 2-3"**)**
   [ ] ______
8. **a. System in which located:** See Attached Device Lists
   b. Functional Description: Instrument Support
   c. Is the equipment required for [ ] **Hot Standby** [ ] **Cold Shutdown**
   ▲[x] **Both** [ ] **Neither**
9. **Pertinent Reference Design Specifications:** See reference 8.

▲ H22-P005

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III. Is Equipment Available for Inspection in the Plant: [x] Yes [ ] No

IV. Equipment Qualification Method:

[x]Test [ ]Analysis [ ]Combination of Test and Analysis

Qualification Report*: Cofrentes Sesmic Test Report

(No., Title and Date) See Reference 1

Company that Prepared Report: General Electric

Company that Reviewed Report: General Electric

V. Vibration Input:

1. Loads considered: a.[ ]Seismic only b.[ ]Hydrodynamic only c.[ ]Explosive on'
   d.[ ]Other (Specify)_____ e.[x]Combination of a & b
   f. Method of Combining RRS: [ ]Absolute Sum [x]SRSS [ ]_____ (other, specify)
2. Required Response Spectra (attach the graphs): See Section 2
3. Damping Corresponding to RRS: OBE 4% SSE 4%
4. Required Acceleration in Each Direction: [ ]ZPA [x]Other At equipment location (specify)

OBE	S/S = NA	F/B = NA	V = NA
SSE	S/S = 5**	F/B = 7**	V = 1.8**

5. Is long-term vibration load effects considered [ ]Yes [x]No

* Note: These Grand Gulf panels are similar (see text) to the Cofrentes H22-P005 panel that was tested to IEEE 344-1975. The results of this test are extended to these Grand Gulf panels.

** Note: Envelopes the maximum required accelerations at any equipment location on the panel.

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VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [X] Multi-Frequency: [ ] random [ ] sine beat [X] In and Out-of-Phase
2. [ ] Single Axis [X] Multi-Axis
3. No. of Qualification Tests: OBE 5 SSE 1 Other ______ (specify)
4. Frequency Range: 1-60 Hz
5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
   S/S = 14 F/B = 15.5/43 V = 53
6. Method of Determining Natural Frequencies
   [X] Lab Test [ ] Insitu Test [ ] Analysis
7. TRS enveloping RRS using Multi-Frequency Test [X] Yes (Attach TRS & RRS grapl
   [ ] No (See Section 2)
8. Input g-level Test: OBE S/S = 1.0 F/B = 1.0 V = 1.0
   SSE S/S = 1.5 F/B = 1.5 V = 1.5
9. Laboratory Mounting: (All mounting holes used)
   1. [X] Bolt (No._____, Size 5/8") [ ] Weld (Length______) [X] clamps
10. Functional operability verified: [X] Yes [ ] No [ ] Not Applicable
11. Test Results including modifications made: The tested panel maintained its structural integrity and the mounted devices maintained their Class 1E function.
12. Other test performed (such as aging or fragility test, including results):
    Fragility test results were applied as noted on the device lists to establish seismic capability.

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VII. If Qualification by Analysis or by the Combination of Test and Analysis, then Complete:

1. Description of Test including Results: N/A

2. Method of Analysis:

[ ] Static Analysis [ ] Equipment Static Analysis

[ ] Dynamic Analysis: [ ] Time-History

[ ] Response Spectrum

3. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ______ F/B = ______ V = ______

4. Method of Determining Natural Frequencies

[ ]Lab test [ ]Insitu Test [ ]Analysis

5. Model Type: [ ] 3D [ ] 2D [ ] ID

[ ] Finit Element [ ] Beam [ ] Closed Form Solution

6. [ ] Computer Codes: ______

Frequency Range and No. of modes considered: ______

[ ] Hand Calculations

7. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS [ ]Other: ______ (specify)

8. Damping: OBE ______ Basis for the damping used: ______
SSE ______

9. Support Considerations in the model: ______

10. Critical Structural Elements:

A. Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B. Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

Section 2

2.0 REQUIRED RESPONSE SPECTRA AND TEST RESPONSE SPECTRA

2.1 HORIZONTAL MODE

Figure 1 gives the relationship between the Grand Gulf horizontal (longitudinal and lateral) required response spectrum and the test response spectrum.

2.2 VERTICAL MODE

Figure 2 gives the relationship between the Grand Gulf vertical required response spectrum and the test response spectrum.

NOTE:

1. The RRS as shown are composites of the worst combination of seismic and hydrodynamic loads in the containment (see reference 4), and as such they envelop the RRS's of the actual local panel locations, i.e., the 136' level of the containment building and the 93', 103' and 119' levels of the auxiliary building.

2. The TRS as shown is the lowest for all tests on the Cofrentes panels (see reference 1).

Fig 1 Grand Gulf Containment
Horizontal RRS & TRS (Ref. 4)
Grand Gulf RRS
3% Damping
FREQUENCY (HZ)

K•E LOGARITHMIC 2 X 3 CYCLES KEUFFEL & ESSER CO. MADE IN U.S.A.

46 7323

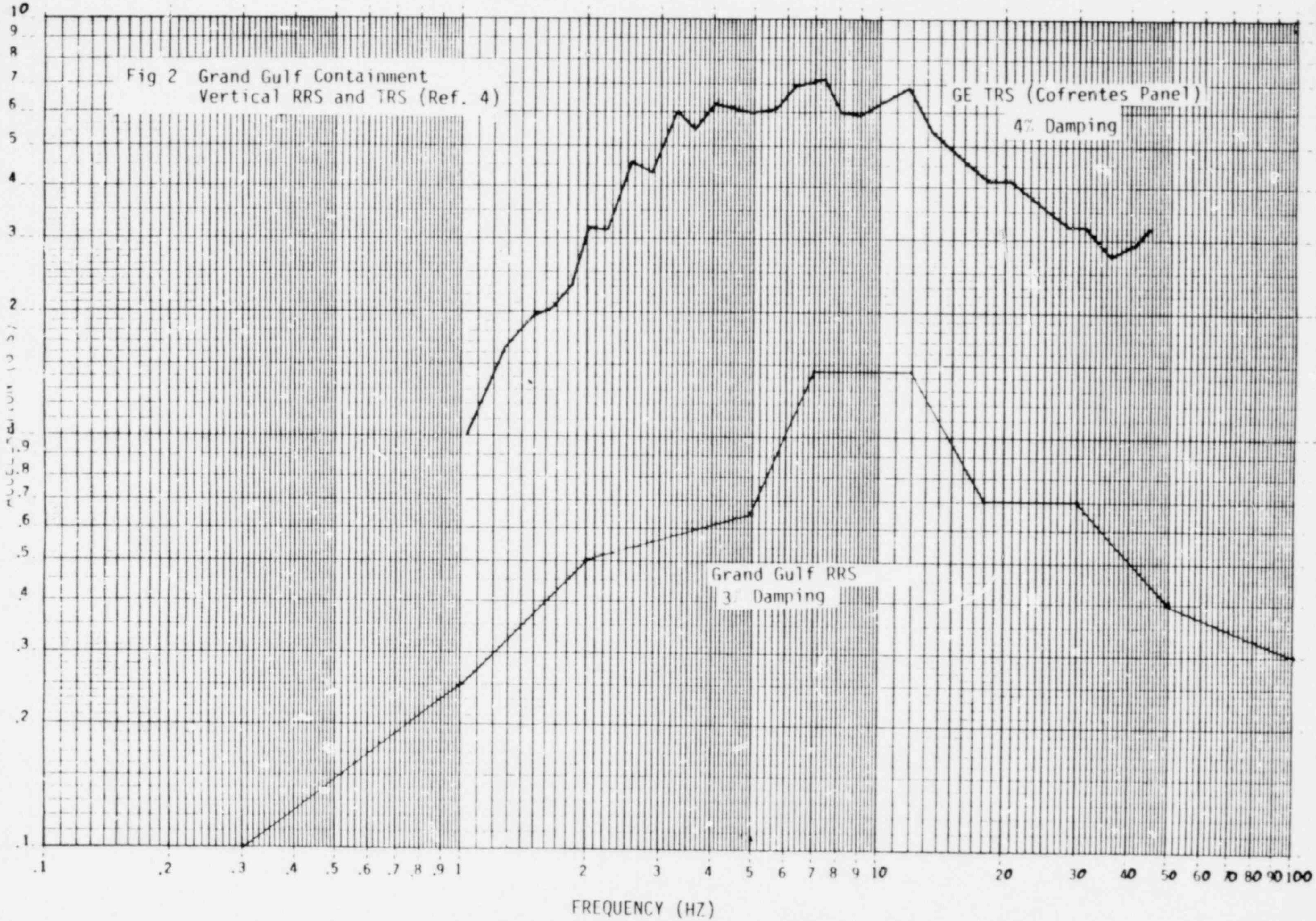

Fig 2 Grand Gulf Containment Vertical RRS and TRS (Ref. 4)

SEISMIC QUALIFICATION REEVALUATION

48 INCH WIDE LOCAL PANEL CLASS 1E EQUIPMENT

anel MPL Ref: H22-P011
ocation, Elevation: Containment, 184'6"

System: Standby Liquid Control
Panel Dimension: 48" X 84" X 30"

SEISMIC EVALUATION	EQUIPMENT MPL NO.	DESCRIPTION	IDENTIFICATION	EC	SEISMIC CAPABILITY f-b	s-s	v	REMARKS
.0 NATURAL FREQUENCIES	C41A-S03A - S03B	Switch	145C3040P004	M	7.5	10	4	See Note 3.1.1
-b: 15.5 /43 -s: 14 : 53	C41A-S04A - S04B	Switch	145C3040P002	M	7.5	10	4	See Note 3.1.1
.0 MINIMUM CLASS 1E EQUIPMENT REQUIRED SEISMIC CAPABILITY								
-b: 7 -s: 5 : 1.8								

Qualification Summary of Equipment MPL: C41-C001

I. Plant Name: Grand Gulf 1 & 2

Type:

1. Utility: Mississippi Power & Light

PWR

2. NSSS: X 3. A/E:

BWR-6 Mark III

II. Component Name Standby Liquid Control (SLC) Pump and Motor Assembly

1. Scope: [X] NSSS [ ] BOP

2. Model Number: 2X3TD-60 w/Gear Pac & Motor Quantity: 2

3. Vendor: Union Pump Co., Battle Creek, Michigan

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance Horizontal, Reciprocating Action ~~Pump with Base Plate~~

b. Dimensions Height 21-7/8", Length O.A. 59", Width O.A. 43"

c. Weight Approx. 2350 lbs.

6. Location: Building: Containment

Elevation: 185 Ft.

7. Field Mounting Conditions [X] Bolt (No. 7, Size 3/4")
[ ] Weld (Length)
[ ]

8. a. System in which located: Standby Liquid Control System

b. Functional Description: To inject a neutron absorber into the reactor vessel in case of control rod failure.

c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown

[ ] Both [X] Neither

9. Pertinent Reference Design Specifications: Equipment Purchase Specification 21A1921 & 21A1921AB, System Spec. 22A3130.

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MPL: C41-C001

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method:

- [X] Test (Motor only) [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: 5430-6958 (VPF 5517-2-2)

(No., Title and Date) Seismic Qualification Test Report, 1/28/77

Company that Prepared Report: Approved Engineering Test Laboratories

Company that Reviewed Report: General Electric Company

V. Vibration Input:

1. Loads considered: a. [X] Seismic only

   b. [ ] Hydrodynamic only

   c. [ ] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [ ] SRSS [X] Assumed Acceleration loads (other: specify)

3. Required Response Spectra (attach the graphs): N/A

4. Damping Corresponding to RRS: OBE N/A SSE N/A

5. Required Acceleration in Each Direction: [X] ZPA 1.75 [ ] Other (specify)

   OBE S/S = 1.4g F/B = 1.4g V = 1.4g
   SSE S/S = 2.0g F/B = 2.0g V = 2.0g

6. Were fatigue effects or other vibration loads considered?

   [ ] Yes [X] No

   If yes, describe loads considered and how they were treated in overall qualification program: ____

*NOTE: If more than one report complete items IV thru VII for each report.

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method: (Pump and Motor Assembly)

[ ] Test [X] Analysis [ ] Combination of Test and Analysis

Qualification Report*: VPF 3679-10-3

(No., Title and Date) Pump, Seismic Design Calculations 11/12/75

Company that Prepared Report: Union Pump

Company that Reviewed Report: General Electric

V. Vibration Input:

1. Loads considered: a. [ ] Seismic only

   b. [ ] Hydrodynamic only

   c. [X] Combination of (a) and (b) Faulted (SSE, SRV and LOCA)

2. Method of Combining RRS: [ ] Absolute Sum [X] SRSS [ ] ______ (other, specify)

3. Required Response Spectra (attach the graphs): Attached (385HA603, Sheets 17 & 18)

4. Damping Corresponding to RRS: OBE 2% SSE 3%

5. Required Acceleration in Each Direction: [X] ZPA [ ] Other ______ (specify)

   OBE S/S = 1.17g F/B = 1.17g V = 1.17g
   SSE S/S = 1.75g F/B = 1.75g V = 1.75g

6. Were fatigue effects or other vibration loads considered?

   [ ] Yes [X] No

   If yes, describe loads considered and how they were treated in overall qualification program: ______

*NOTE: If more than one report complete items IV thru VII for each report.

MPL: C41-C001

VI. If Qualification by Test, then Complete*: (Motor Only)

1. [X] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] ________

2. [ ] Single Axis [X] Multi-Axis

3. No. of Qualification Tests: OBE 4 SSE 8 Other ________ (specify)

4. Frequency Range: 10-80-10 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = None detected F/B = None detected V = None detected

6. Method of Determining Natural Frequencies

   [X] Lab Test [ ] In-Situ Test [X] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graphs) [X] No

8. Input g-level Test: OBE S/S = 1.4g F/B = 1.4g V = 1.4g

   SSE S/S = 2.0g F/B = 2.0g V = 2.0g

9. Laboratory Mounting:

   1. [X] Bolt (No. 4, Size 1/2") [ ] Weld (Length ______) [ ] ______

10. Functional operability verified: [X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: No motor failure during seismic testing. Upon completion of test motor was coupled to a dynamometer set for 40 HP and ran continuously for 125 minutes, spec. maximum run time.

12. Other test performed (such as aging or fragility test, including results): Accelerated thermal aging performed to simulate end of life condition of the motor insulation system. Nonmetallic parts irradiated to 4.6×10^6 rads. No degradation of materials visible. Aging and radiation performed prior to seismic type test.

*Note: If qualification by a combination of test and analysis also complete Item VII.

VII. If Qualification by Analysis, then complete:

1. Method of Analysis: (Pump and Motor Assembly)

[X] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = > 100 Hz F/B = > 100 Hz V = > 100 Hz

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam [ ] Closed Form Solution

4. [ ] Computer Codes: N/A

Frequency Range and No. of modes considered: 100 Hz

[ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [X] SRSS
[ ] Other: ______ (specify)

6. Damping: OBE ______ SSE 2% Basis for the damping used: 385HA603 *
(Ref. 10, Sheet 10)

7. Support Considerations in the model: N/A

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Motor hold down bolts	(Tension)	Faulted		5,600	15,000
	(Shear)	"		3,470	12,000
Pump hold down bolts	(Tension)	Faulted		17,680	37,500
	(Shear)	"		11,350	30,000

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

* This is a conservative evaluation since BWR-6 documentation defines an allowable damping value of 3 percent for SSE seismic spectra and for emergency and faulted load combinations.

GENERAL ELECTRIC
NUCLEAR ENERGY DIVISION

385HA603	SH. NO. 17
REV. 1	

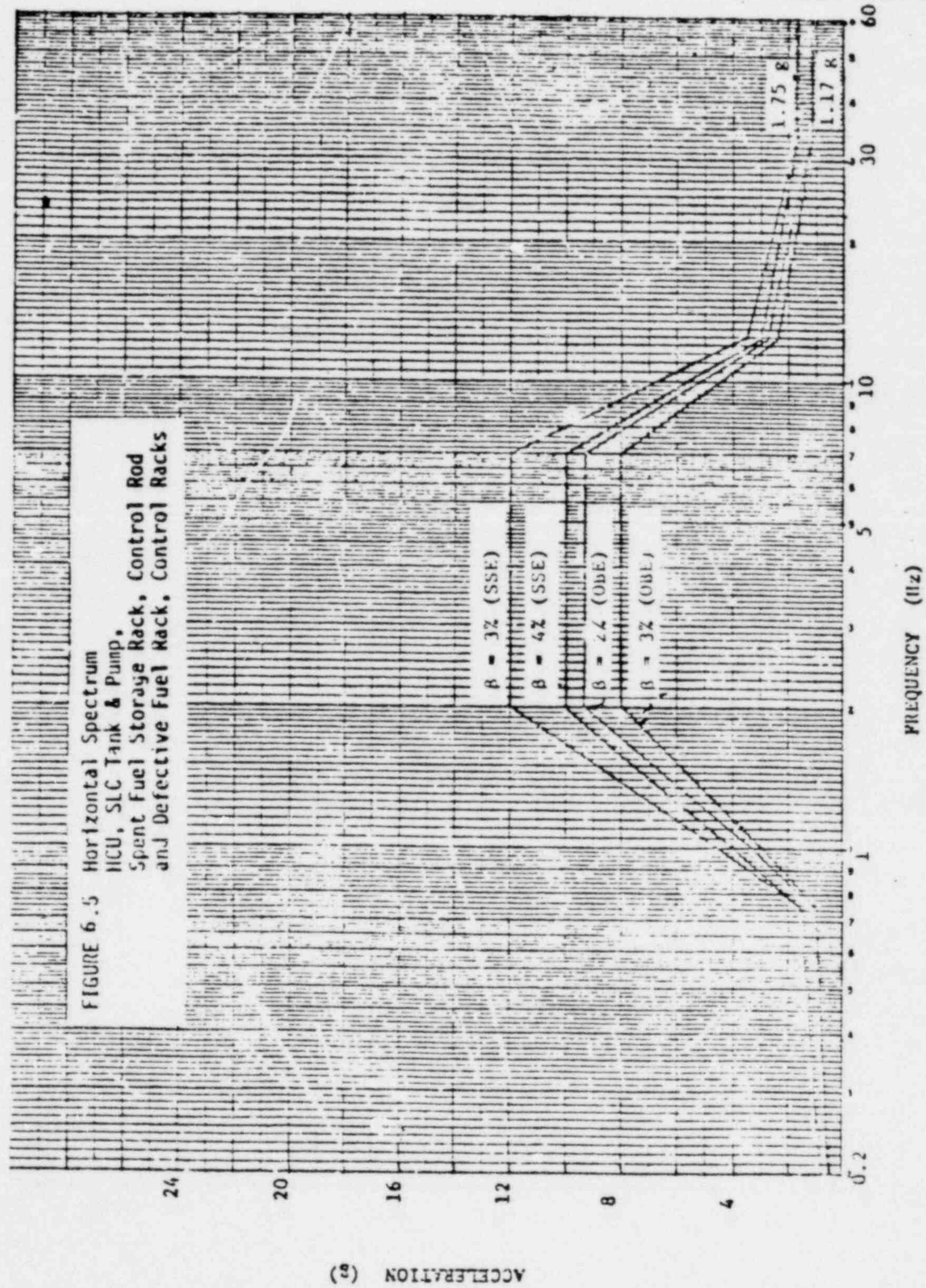

FIGURE 6.5 Horizontal Spectrum
HCU, SLC Tank & Pump,
Spent Fuel Storage Rack, Control Rod
and Defective Fuel Rack, Control Racks

Attachment 1.

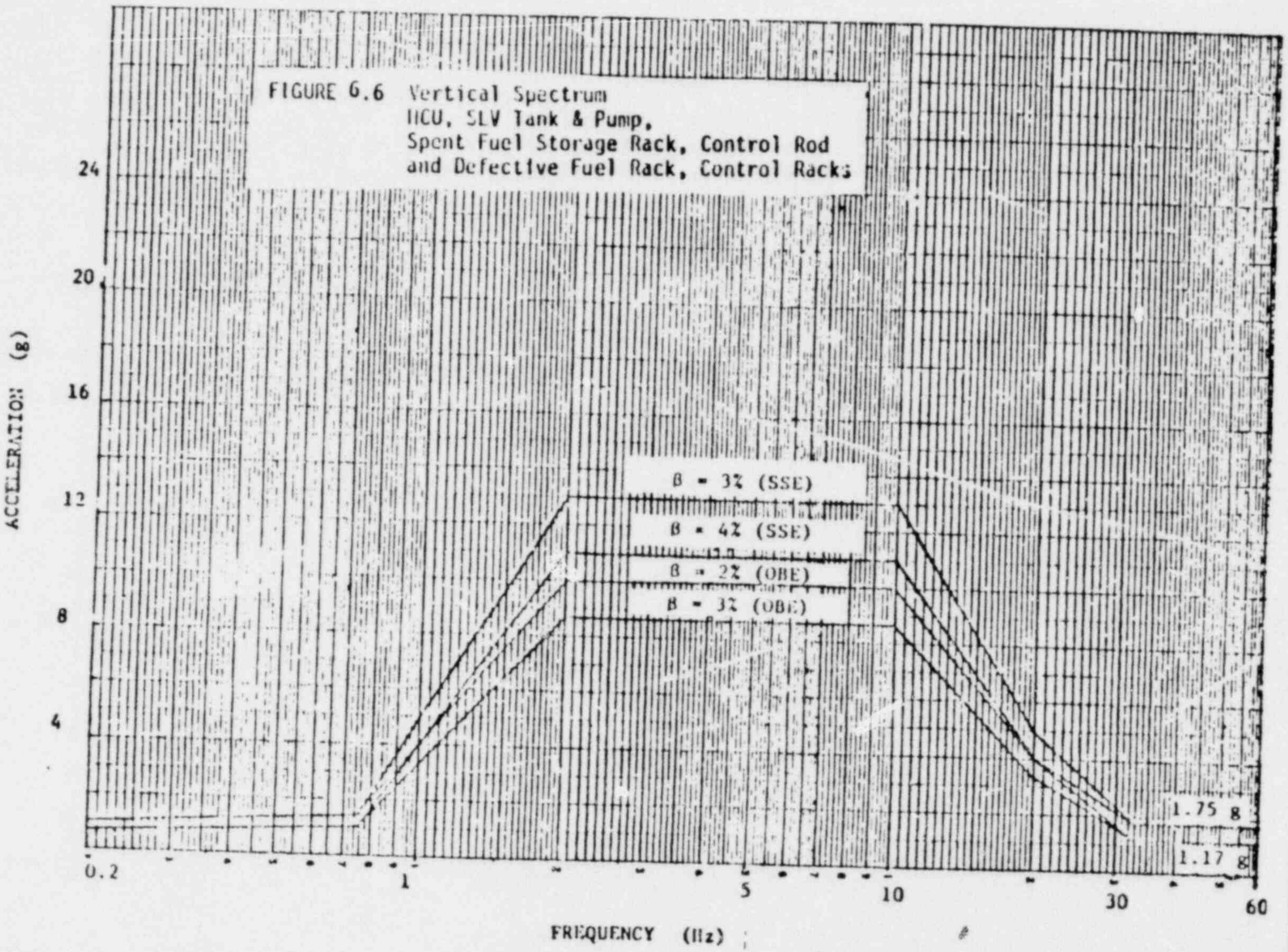

FIGURE 6.6 Vertical Spectrum
HCU, SLV Tank & Pump,
Spent Fuel Storage Rack, Control Rod
and Defective Fuel Rack, Control Racks

Attachment 1.

GENERAL ELECTRIC
NUCLEAR ENERGY DIVISION

385HA603
SH. NO. 18
REV. 1

MPL: C41-C001

Qualification Summary of Equipment

I. **Plant Name:** GRAND GULF

Type:

1. **Utility:** MISSISSIPPI POWER & LIGHT

PWR ______

2. **NSSS:** GE 3. **A/E:** BECHTEL

BWR 6 Mk III

II. **Component Name** Control Room Panel

1. **Scope:** [X] NSSS [ ] BOP
2. **Model Number:** H13-P601 **Quantity:** one
3. **Vendor:** General Electric Co.
4. **If the component is a cabinet or panel, name and model No. of the devices included:** See attached device list
5. **Physical Description a. Appearance** Vertical/Bench Board
   b. Dimensions 117.5" X 84" X30"
   c. Weight NA
6. **Location: Building:** Control
   Elevation: See attached device list
7. **Field Mounting Conditions** [X] Bolt (No. * , Size 5/8")
   [ ] Weld (Length ____)
   [ ] ______

   * On 6" centers
8. **a. System in which located:** Reactor Core Cooling System
   b. Functional Description: Reactor Core Cooling Bench Board
   c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown [X] Both [ ] Neither
9. **Pertinent Reference Design Specifications:** See reference 4.3.4

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III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method:

[X]Test [ ]Analysis [ ]Combination of Test and Analysis

Qualification Report*: Seismic Test Report H12-P870

(No., Title and Date) See Reference 4.3.1

Company that Prepared Report: General Electric Co.

Company that Reviewed Report: General Electric Co.

V. Vibration Input:

1. Loads considered: a.[X]Seismic only b.[ ]Hydrodynamic only c.[ ]Explosive on

   d.[ ]Other (Specify)________ e.[ ]Combination of________

   f. Method of Combining RRS: [ ]Absolute Sum [ ]SRSS [X] NA (other, specify)

2. Required Response Spectra (attach the graphs): See section 2

3. Damping Corresponding to RRS: OBE 3% SSE 3%

4. Required Acceleration in Each Direction: [X]ZPA [ ]Other________ (specify)

   OBE S/S = .254 F/B = .254 V = .120
   SSE S/S = .507 F/B = .507 V = .239

5. Is long-term vibration load effects considered [ ]Yes [X]No

*Note: The H13-P601 panel is similar to the tested prototype H12-P870 panel. The results of the H12-P870 test were applied to the H13-P601 panel per the methodology described in the text.

VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [X] Multi-Frequency: [ ] random [ ] sine beat [X] In and out-of-phase

2. [ ] Single Axis [X] Multi-Axis

3. No. of Qualification Tests: OBE 5 SSE 1 Other ____ (specify)

4. Frequency Range: 1-33 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 13 F/B = 15.5 V = None

6. Method of Determining Natural Frequencies

[X] Lab Test [ ] Insitu Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [X] Yes (Attach TRS & RRS graphs [ ] No See Section 2

8. Input g-level Test: OBE S/S = 1.0 F/B = 1.0 V = 1.0

SSE S/S = 1.5 F/B = 1.5 V = 1.5

9. Laboratory Mounting: (All mounting holes used)

1. [X] Bolt (No.____, Size 5/8) [ ] Weld (Length____) [X] clamps

10. Functional operability verified: [X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: The panel maintained its structural integrity and the devices performed their Class 1E function.

12. Other test performed (such as aging or fragility test, including results): Fragility test results were applied as noted on the device list to establish seismic capability of certain devices.

VII. <u>If Qualification by Analysis or by the Combination of Test and Analysis, then Complete:</u>

1. Description of Test including Results: NA

2. Method of Analysis:

   [ ] Static Analysis [ ] Equipment Static Analysis

   [ ] Dynamic Analysis: [ ] Time-History

   [ ] Response Spectrum

3. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = ______ F/B = ______ V = ______

4. Method of Determining Natural Frequencies

   [ ]Lab test [ ]Insitu Test [ ]Analysis

5. Model Type: [ ] 3D [ ] 2D [ ] ID

   [ ] Finit Element [ ] Beam [ ] Closed Form Solution

6. [ ] Computer Codes: ______

   Frequency Range and No. of modes considered: ______

   [ ] Hand Calculations

7. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
   [ ]Other: ______ (specify)

8. Damping: OBE ______ Basis for the damping used: ______
   SSE ______

9. Support Considerations in the model: ______

10. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

Section 2

2.0 REQUIRED RESPONSE SPECTRA (RRS) AND TEST RESPONSE SPECTRA (TRS)

2.1 HORIZONTAL MODE

Figure 1 gives the relationship between the Grand Gulf horizontal (longitudinal and lateral) required response spectrum and the test response spectrum.

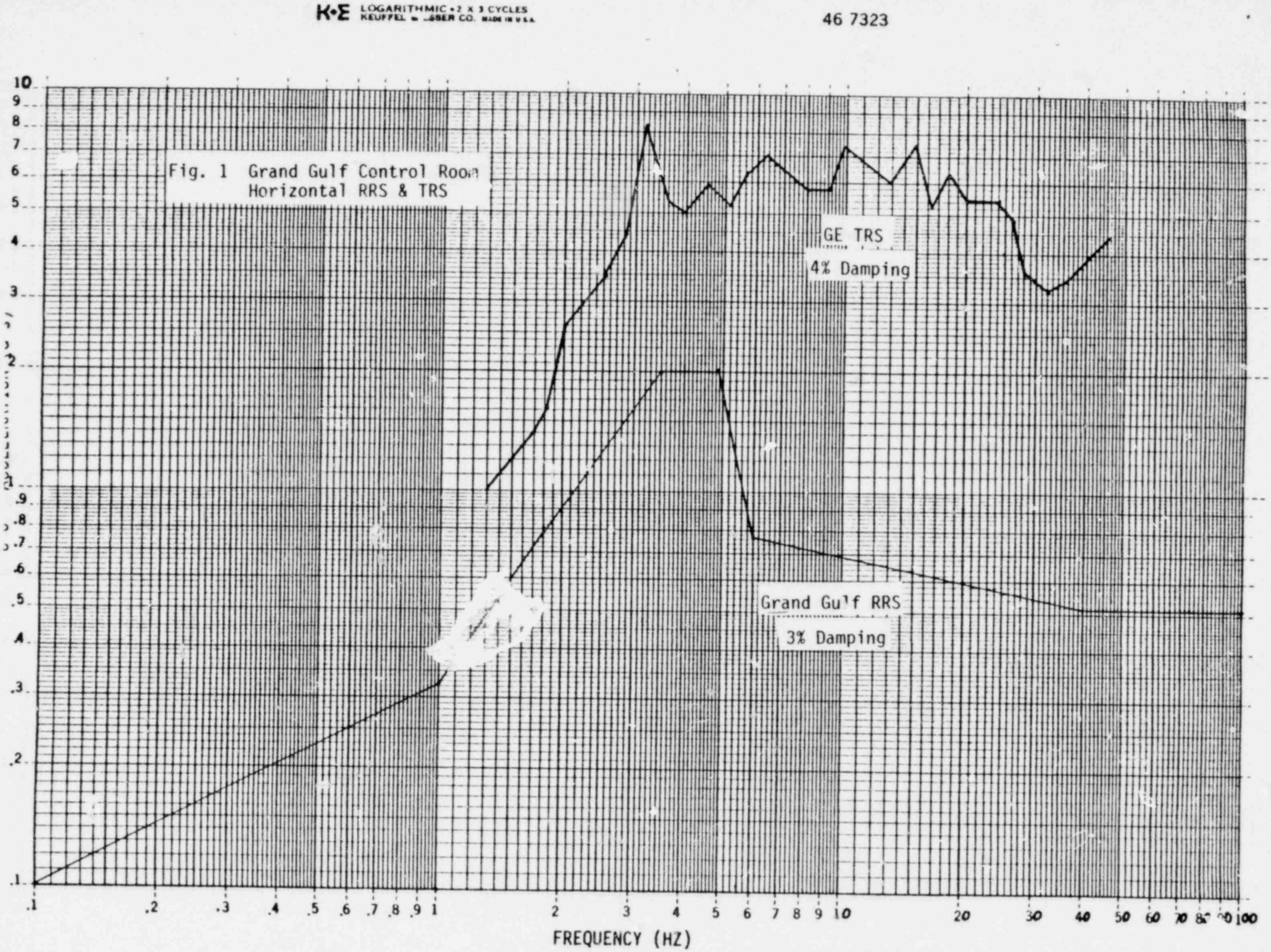
2.2 VERTICAL MODE

Figure 2 gives the relationship between the Grand Gulf vertical required response spectrum and the test response spectrum.

NOTE:

1. The RRS as shown are for the control room upper floor at the 189' level (see Reference 4.3.5). They envelop the RRS of all control room panel locations, i.e., the 189' and 166' levels of the control building.

2. The TRS as shown is the lowest for all tests conducted on the control room panels (see Reference 4.3.1).


K•E LOGARITHMIC • 2 X 3 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 7323
Fig. 1 Grand Gulf Control Room
Horizontal RRS & TRS
GE TRS
4% Damping
Grand Gulf RRS
3% Damping
10
9
8
7
6
5
4
3
2
1
.9
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70
100
FREQUENCY (HZ)

K•E LOGARITHMIC 2 X 3 CYCLES KEUFFEL & ESSER CO. MADE IN U.S.A.

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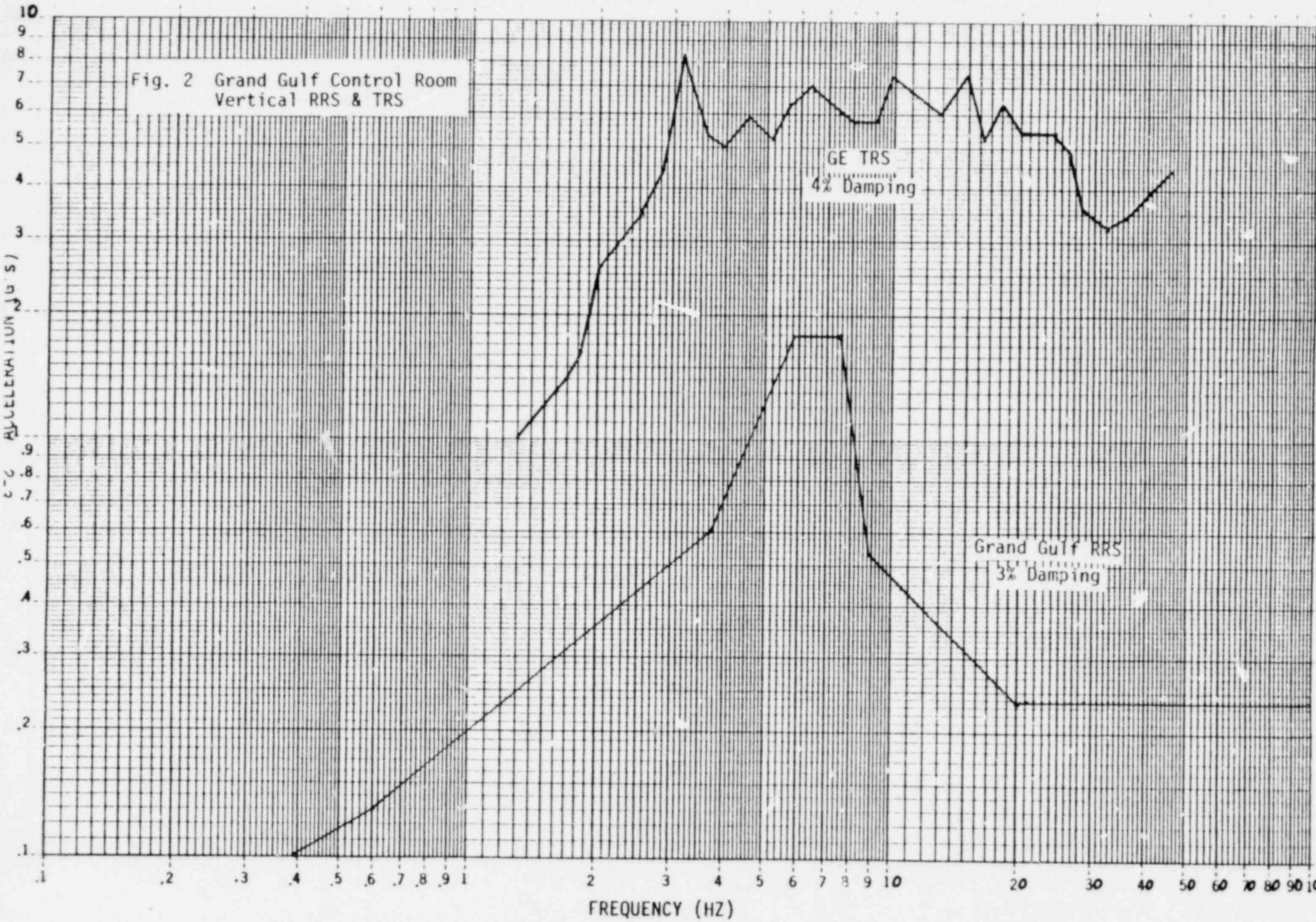

Qualification Summary of Equipment

HPL: C11-D001

I. Plant Name: Grand Gulf

Type:

1. Utility: Mississippi Power & Light

PWR

2. NSSS: GE 3. A/E: Bechtel

BWR-6 Mark III

II. Component Name: Hydraulic Control Unit

1. Scope: [X] NSSS [ ] BOP

2. Model Number: GE-767E800 Quantity: 193

3. Vendor: General Electric

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance: Assembly of valves, tanks, piping and electric controls.

b. Dimensions: Width 22"; Height 102"; Depth 20"

c. Weight: 920 lbs.

6. Location: Building: Containment

Elevation: 135' 4"

7. Field Mounting Conditions [X] Bolt (No. 2(Top), 4(floor) Size 3/8")
[ ] Weld (Length ____)
[ ] ____

8. a. System in which located: Control Rod Drive Hydraulic System

b. Functional Description: HCU is required to perform by activation of the SCRAM pilot valve and the associated SCRAM components to insert control rod

c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown

[X] Both [ ] Neither

9. Pertinent Reference Design Specifications:

22A4168, 384HA137

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method:

- [X] Test
- [ ] Analysis
- [ ] Combination of Test and Analysis

Qualification Report*: Report No. 58530

(No., Title and Date) Seismic Qualification Test Program on HCU for General Electric Co.

Company that Prepared Report: Wyle Lab

Company that Reviewed Report: General Electric

V. Vibration Input:

1. Loads considered: a. [ ] Seismic only

   b. [ ] Hydrodynamic only

   c. [X] Combination of (a) and (b) (SSE + SRV + LOCA)

2. Method of Combining RRS: [X] Absolute Sum [ ] SRSS [ ] (other, specify)

3. Required Response Spectra (attach the graphs): Attached

4. Damping Corresponding to RRS: OBE ______ SSE 3%

5. Required Acceleration in Each Direction: [ ] ZPA [ ] Other (specify)

   OBE S/S = Not applicable F/B = V =
   SSE S/S = F/B = V =

6. Were fatigue effects or other vibration loads considered?

   [X] Yes [ ] No In DRF #147-C11D001-N*3-129

   If yes, describe loads considered and how they were treated in overall qualification program: The required fatigue cycles were 7 times the total number of SRV actuations in 40 years. Allowable fatigue cycles were determined from ASME Section III Division I Appendices and were shown to be higher than the required cycles.

*NOTE: If more than one report complete items IV thru VII for each report.

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency   [X] Multi-Frequency: [X] random [ ] sine beat [ ] ______

2. [ ] Single Axis   [X] Multi-Axis

3. No. of Qualification Tests: OBE 5 SSE 1 Other ______ (specify)

4. Frequency Range: 1.25-100 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):***

S/S = ______ F/B = ______ V = ______

6. Method of Determining Natural Frequencies

[X] Lab Test   [ ] In-Situ Test   [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [X] Yes (Attach TRS & RRS graphs)
[ ] No

8. Input g-level Test: OBE S/S = ______ F/B = ______ V = ______

Not Applicable   SSE S/S = ______ F/B = ______ V = ______

9. Laboratory Mounting: **

1. [X] Bolt (No.______, Size______) [ ] Weld (Length______) [ ]______

10. Functional operability verified: [X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: 5-OBE and 1-SSE seismic tests were completed and functional tests were performed before, during, and after each seismic test.

12. Other test performed (such as aging or fragility test, including results):

______

______

*Note: If qualification by a combination of test and analysis also complete Item VII.

**The test specimen was attached to the test fixtures using the normal inservice hardware furnished by G.E. (Normal field mounting conditions.)

*** Basic data is in the transmissibility plots from the resonance search.

VII. If Qualification by Analysis, then complete: Not Applicable

1. Method of Analysis:

   [ ] Static Analysis [ ] Equivalent Static Analysis

   [ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = ________ F/B = ________ V = ________

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

   [ ] Finite Element [ ] Beam [ ] Closed Form Solution

4. [ ] Computer Codes: ________

   Frequency Range and No. of modes considered: ________

   [ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
   [ ] Other: ________ (specify)

6. Damping: OBE ________ SSE ________ Basis for the damping used: ________

7. Support Considerations in the model: ________

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

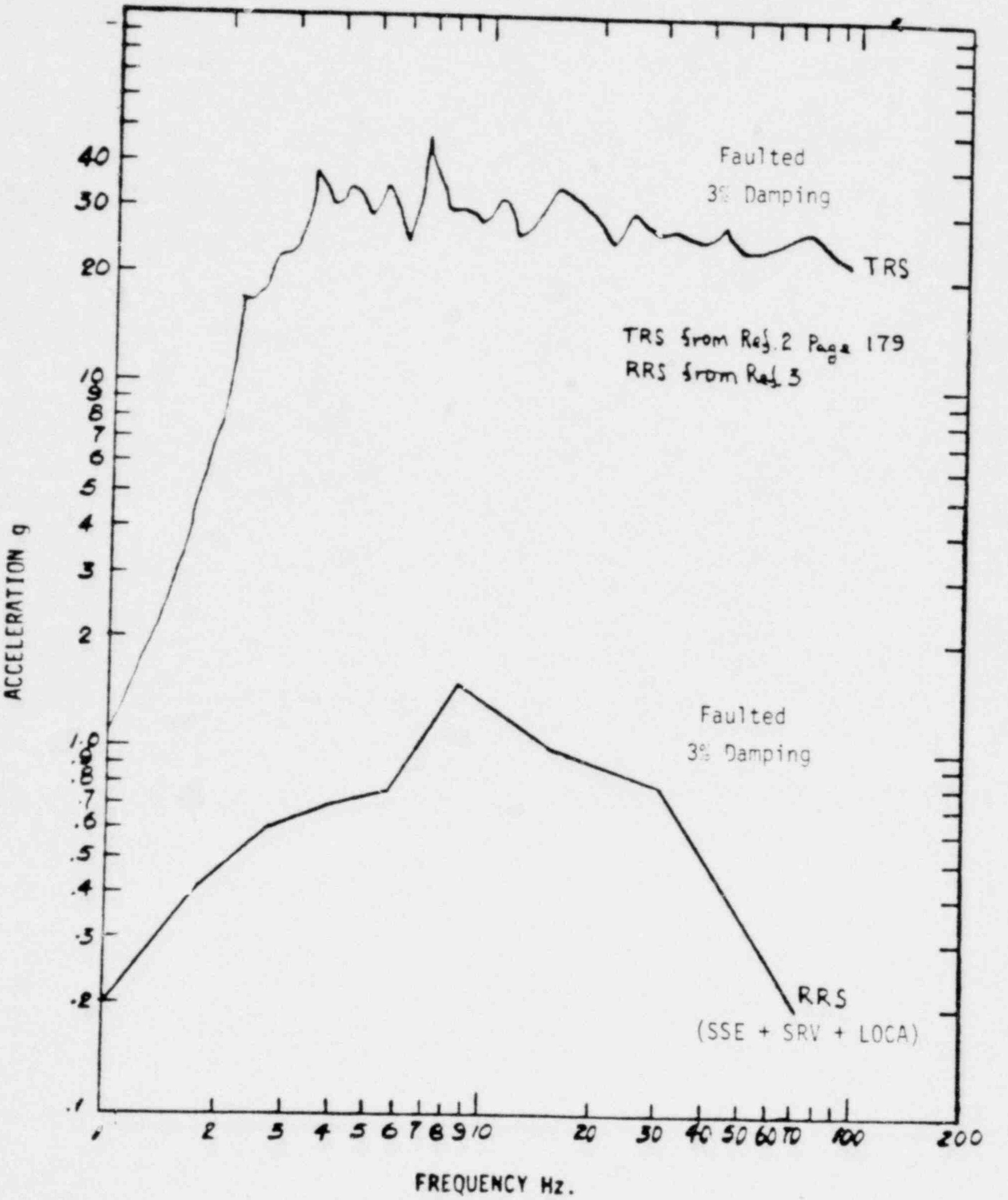

Figure 2, TRS and RRS in the Vert. X-Y direction, flexible mounting.

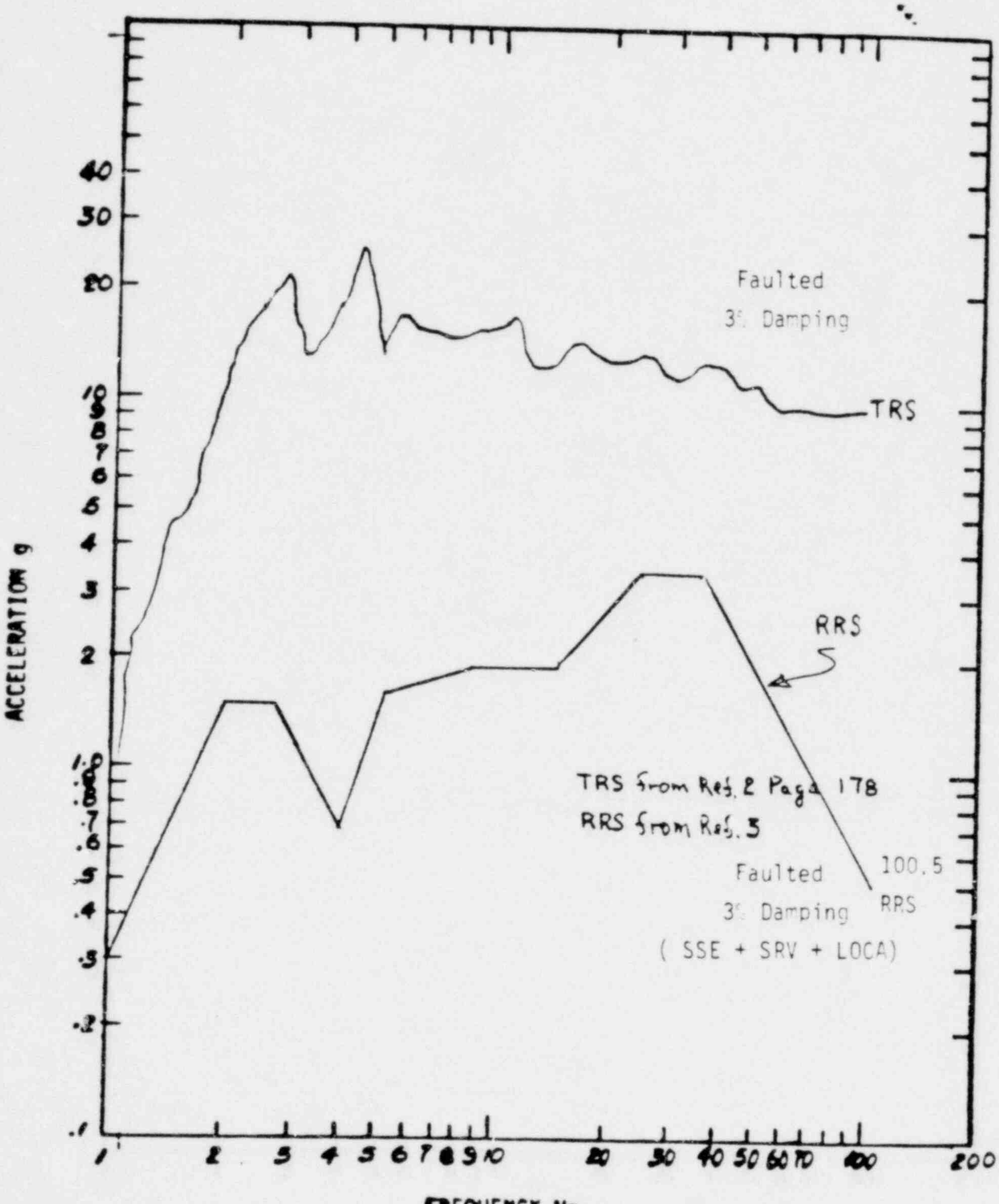

Figure 3, TRS and RRS in the Horiz. X-Y direction, flexible mounting.

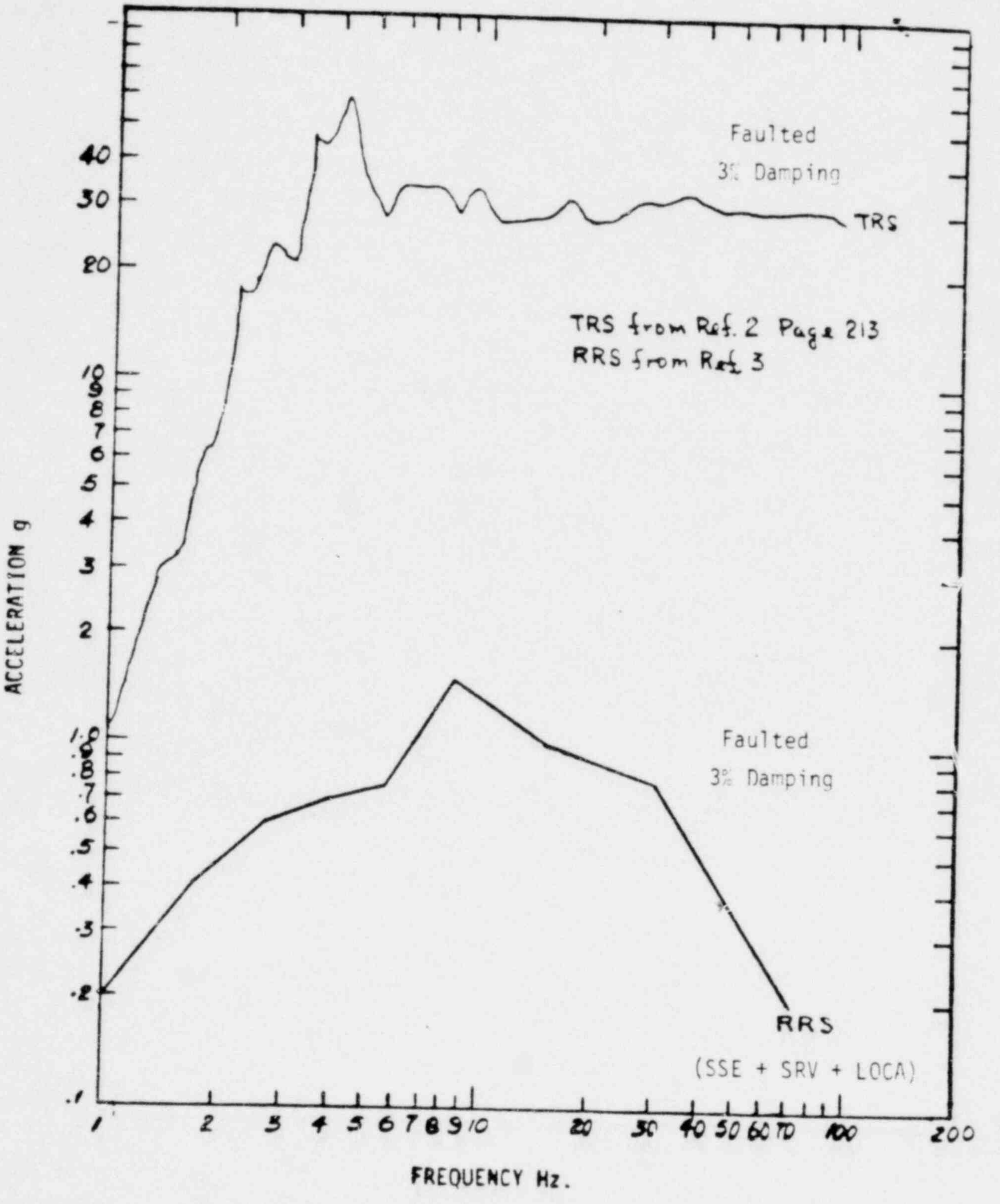

Figure 4, TRS and RRS in the Vert. Z-Y direction, flexible mounting.

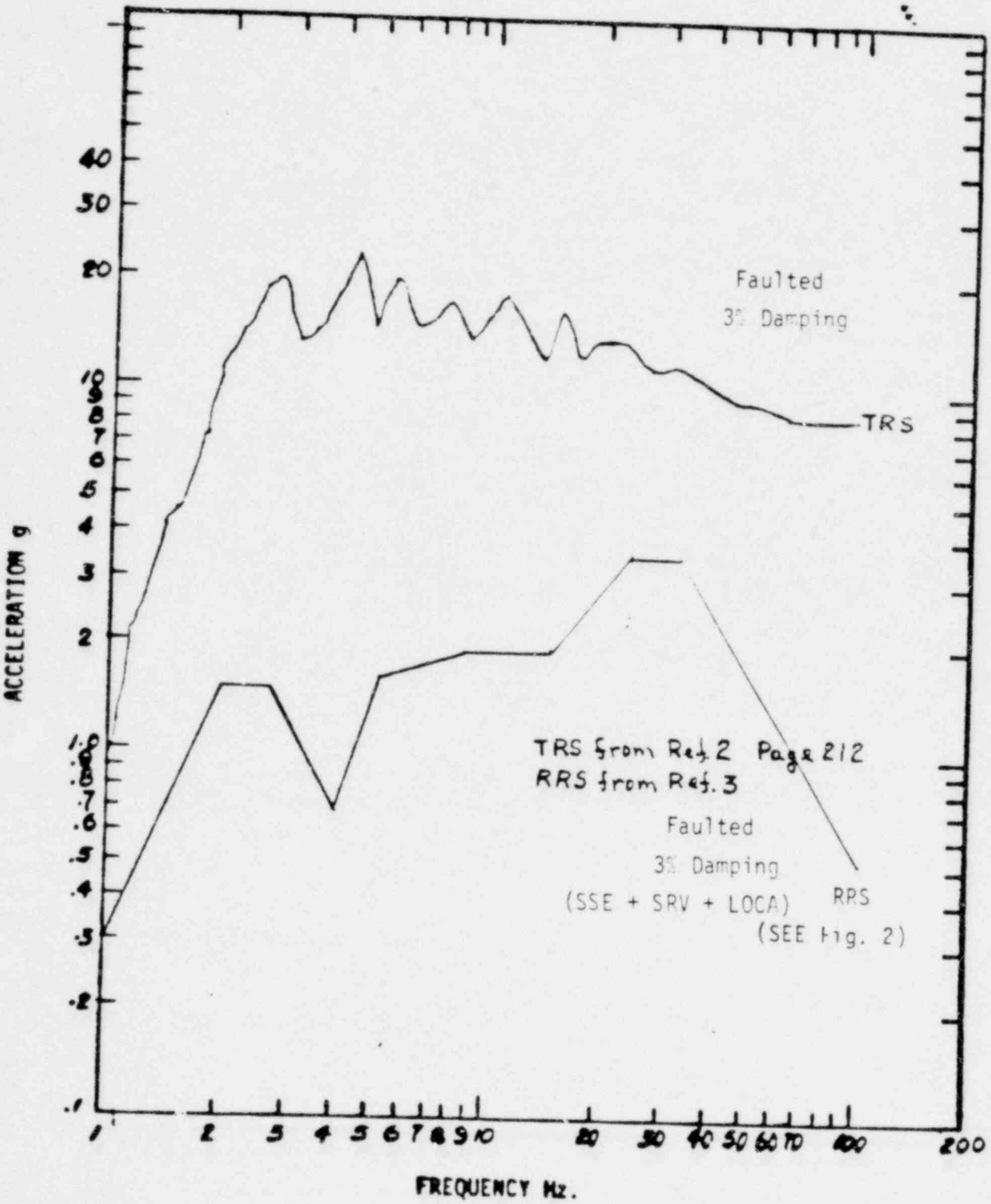

Figure 5, TRS and RRS in the Horiz. Z-Y direction, flexible mounting.

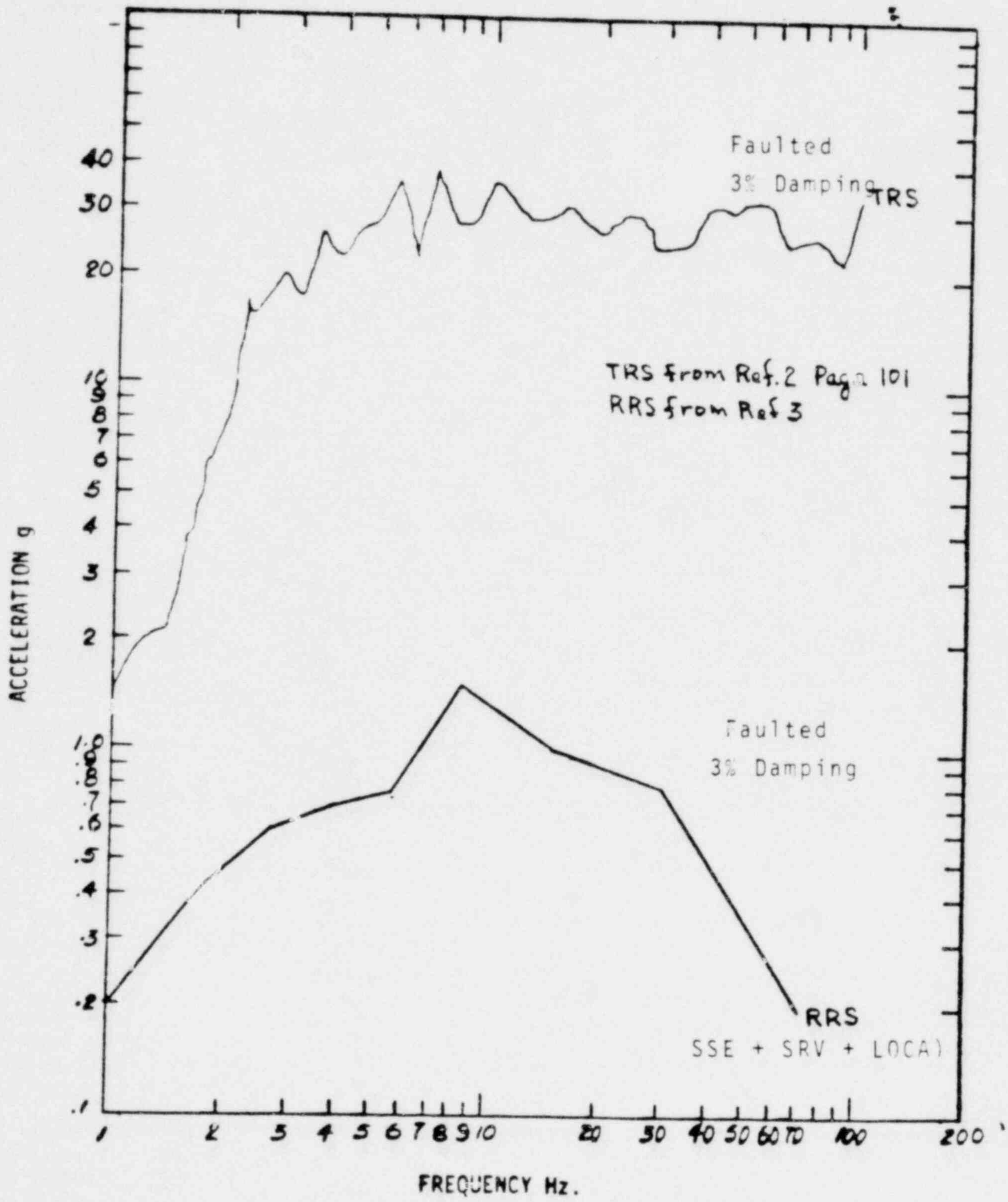

Figure 6, TRS and RRS in the Vert. X-Y direction, rigid mounting.

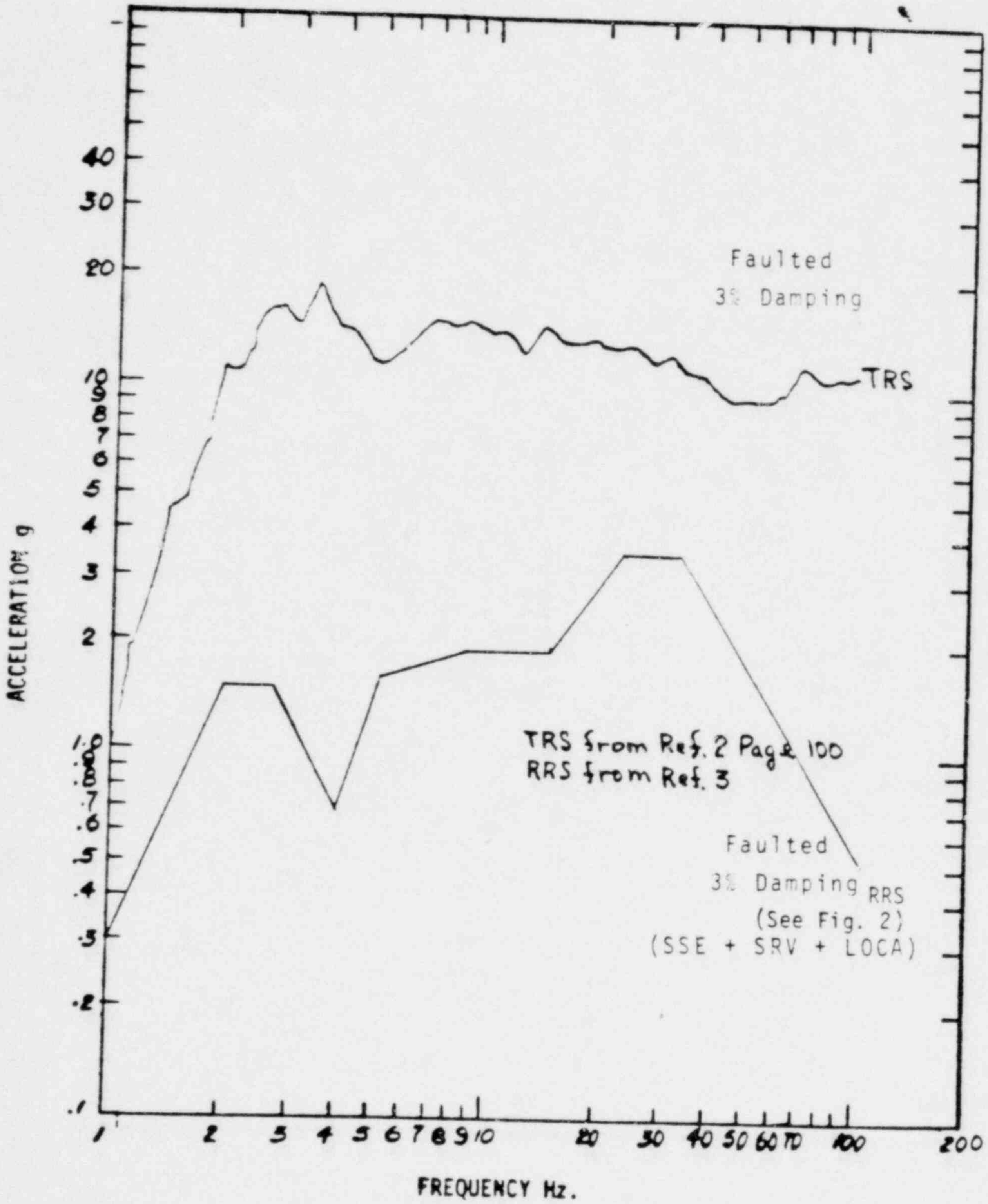

Figure 7, TRS and RRS in the Horiz. X-Y direction, rigid mounting.

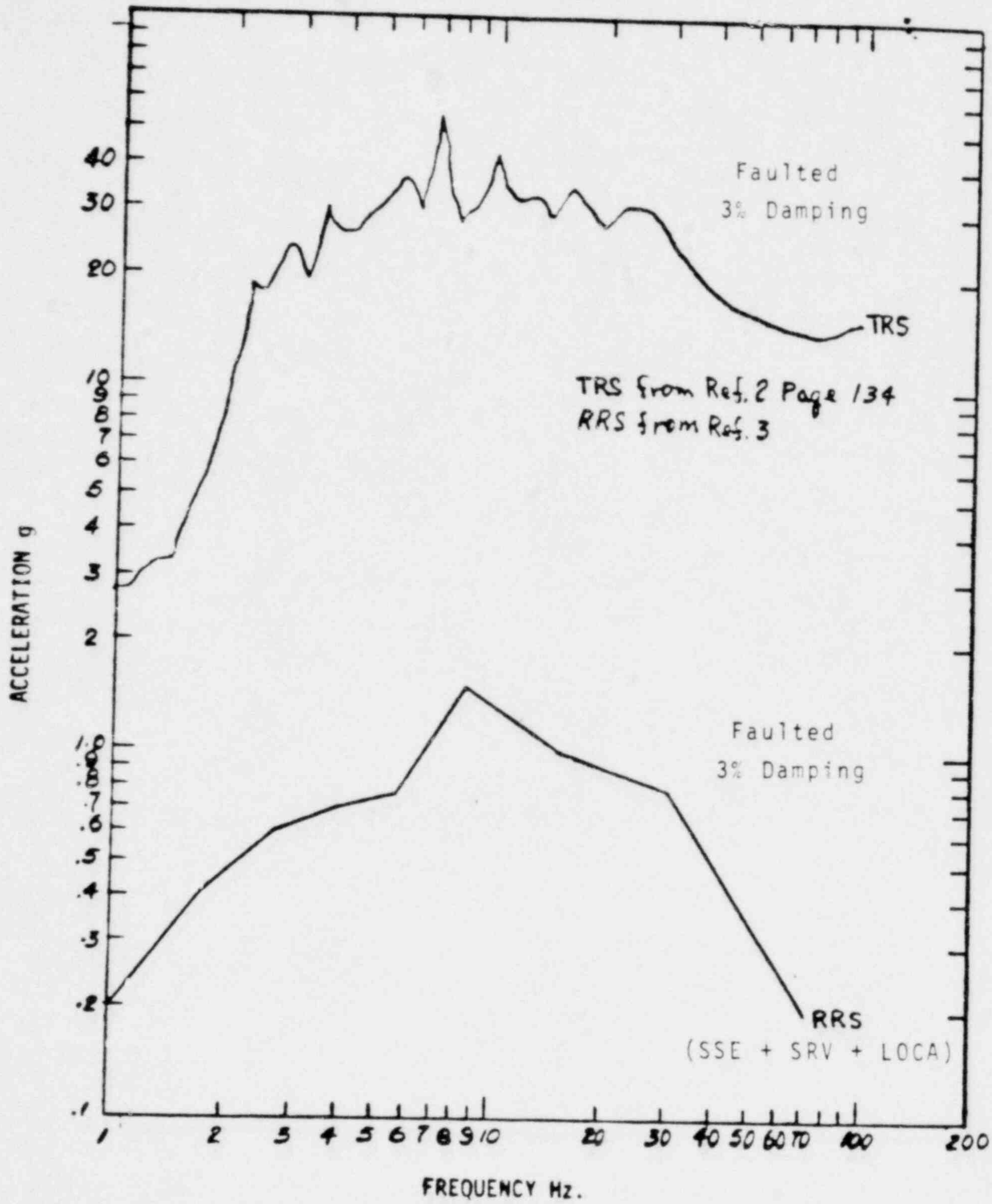

Figure 8, TRS and RRS in the Vert. Z-Y direction, rigid mounting.

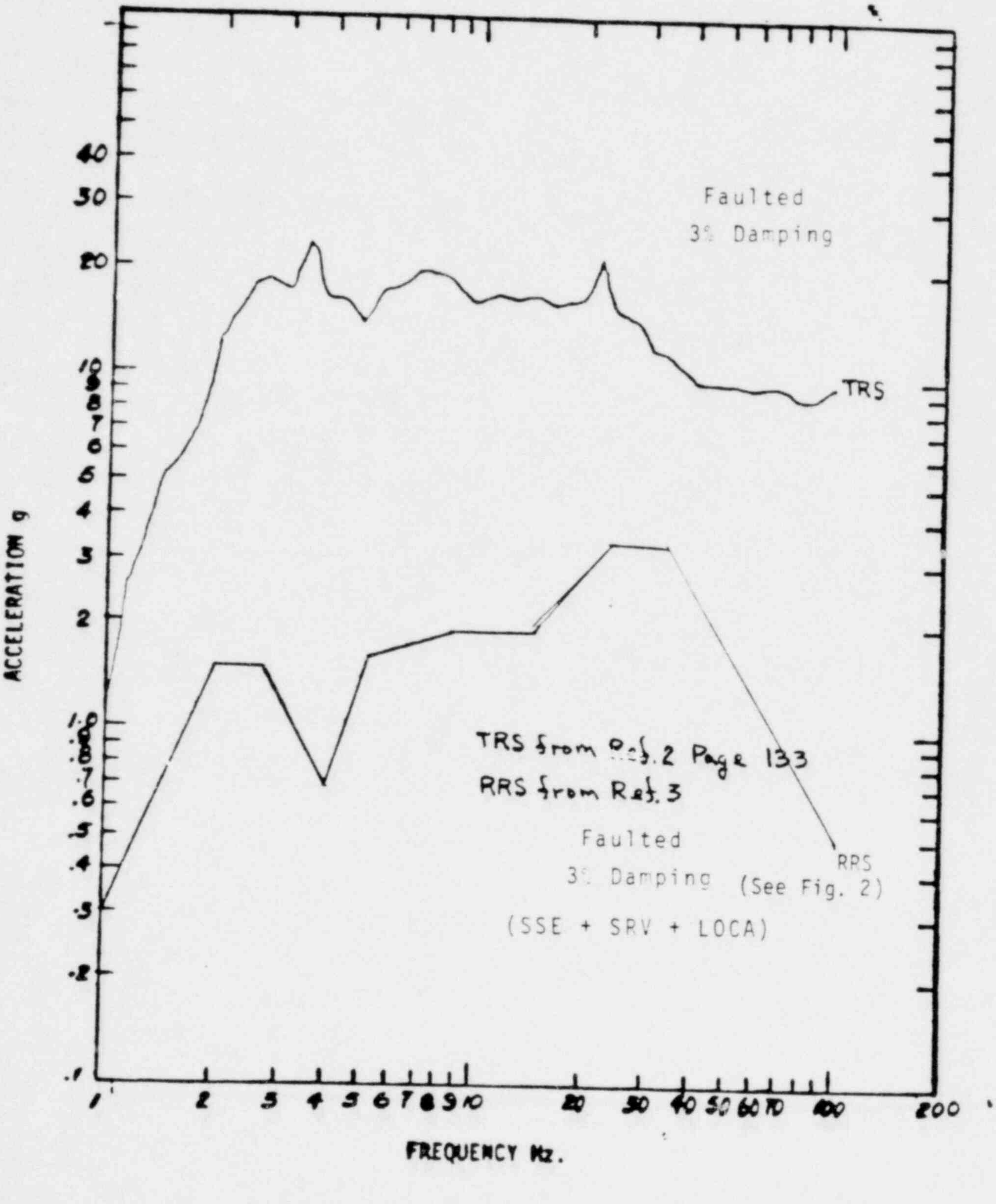

Figure 9, TRS and RRS in the Horiz. Z-Y direction, rigid mounting.

Qualification Summary of Equipment

I. **Plant Name:** Grand GULF

Type:

1. **Utility:** Pennsylvannia Power and Light

PWR ______

2. **NSSS:** G.E. 3. **A/E:** Bechtel

BWR 6 MKIII

II. **Component Name** Termination Cabinet

1. **Scope:** [X] NSSS [ ] BOP

2. **Model Number:** H13-P700,P701,P702,P710,P711 P712,P713,P714,P715,P717,P732, P736 **Quantity:** 1 each

3. **Vendor:** G.E.

4. **If the component is a cabinet or panel, name and model No. of the devices included:** Termination and termination connector modules; cables.

5. **Physical Description a. Appearance** Cabinet

   b. **Dimensions** 96 " x 102" x 36"

   c. **Weight** N/A

6. **Location: Building:** Control

   Elevation: 166' - (P700,P701,P702,P710,P711,P712,P714,P732)
   189' - (P713,P715,P717,P736)

7. **Field Mounting Conditions** [ ] Bolt (No._____, Size_____)
   [X] Weld (Length 1") (12: centers)
   [ ] ______

8. a. **System in which located:** PGCC

   b. **Functional Description:** Housing for terminals & connectors

   c. **Is the equipment required for** [ ] Hot Standby [ ] Cold Shutdown [ ] Both [X] Neither

9. **Pertinent Reference Design Specifications:**

   G.E. assembly drawings 137D7617 thru 137D7634

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III. Is Equipment Available for Inspection in the Plant: [x] Yes [ ] No

IV. Equipment Qualification Method:

[x]Test [ ]Analysis [ ]Combination of Test and Analysis

Qualification Report*: A00-794-5-1

(No., Title and Date) See Reference 4.3.6

Company that Prepared Report: David M. Rhuble & Assoc.

Company th Reviewed Report: General Electric Co.

V. Vibration Input:

1. Loads considered: a.[x]Seismic only b.[ ]Hydrodynamic only c.[ ]Explosive onl
   d.[ ]Other (Specify)________ e.[ ]Combination of________
   f. Method of Combining RRS: [ ]Absolute Sum [ ]SRSS [ ]________ (other, specify)
2. Required Response Spectra (attach the graphs): attached
3. Damping Corresponding to RRS: OBE 4% SSE 4%
4. Required Acceleration in Each Direction: [x]ZPA [ ]Other________ (specify)

OBE	S/S = .254	F/B = .254	V = .120
SSE	S/S = .507	F/B = .507	V = .239

5. Is long-term vibration load effects considered [ ]Yes [x]No

*Grand Gulf's termination cabinets H13-700 series and components are identical to the termination cabinets and components that passed seismic testing to IEEE 344-1975.

VI. <u>If Qualification by Test, then Complete:</u>

1. [ ] Single Frequency [x] Multi-Frequency: [ ] random
   [ ] sine beat
   [x] In and out-of-phase

2. [ ] Single Axis [x] Multi-Axis

3. No. of Qualification Tests: OBE 5 SSE 1 Other ______ (specify)

4. Frequency Range: 5-33 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = 22.5 / 27.5 F/B = 6/20 V = Rigid

6. Method of Determining Natural Frequencies

   [x] Lab Test [ ] Insitu Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [x] Yes (Attach TRS & RRS graphs
   [ ] No

8. Input g-level Test: OBE S/S = 1.0 F/B = 1.0 V = 1.0

   SSE S/S = 1.5 F/B = 1.5 V = 1.5

9. Laboratory Mounting: (All mounting holes used)

   1. [x] Bolt (No.______, Size 5/8) [ ] Weld (Length______) [ ]______

10. Functional operability verified: [x] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: The cabinets maintained their structural integrity and the devices performed their Class 1E functions.

12. Other test performed (such as aging or fragility test, including results):
    See Reference 4.3.2

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VII. If Qualification by Analysis or by the Combination of Test and Analysis, then Complete:

1. Descripition of Test including Results: N/A ______________________________

____

____

2. Method of Analysis:

   [ ] Static Analysis   [ ] Equipment Static Analysis

   [ ] Dynamic Analysis: [ ] Time-History

   [ ] Response Spectrum

3. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = ______________   F/B = ______________   V = ______________

4. Method of Determining Natural Frequencies

   [ ]Lab test   [ ]Insitu Test   [ ]Analysis

5. Model Type: [ ] 3D   [ ] 2D   [ ] ID

   [ ] Finit Element   [ ] Beam   [ ] Closed Form Solution

6. [ ] Computer Codes: ______________________________

   Frequency Range and No. of modes considered: ______________________________

   [ ] Hand Calculations

7. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
   [ ]Other: ______________________________
   (specify)

8. Damping: OBE______________ ______________ Basis for the damping used: ______________
   SSE______________ ______________

9. Support Considerations in the model: ______________________________

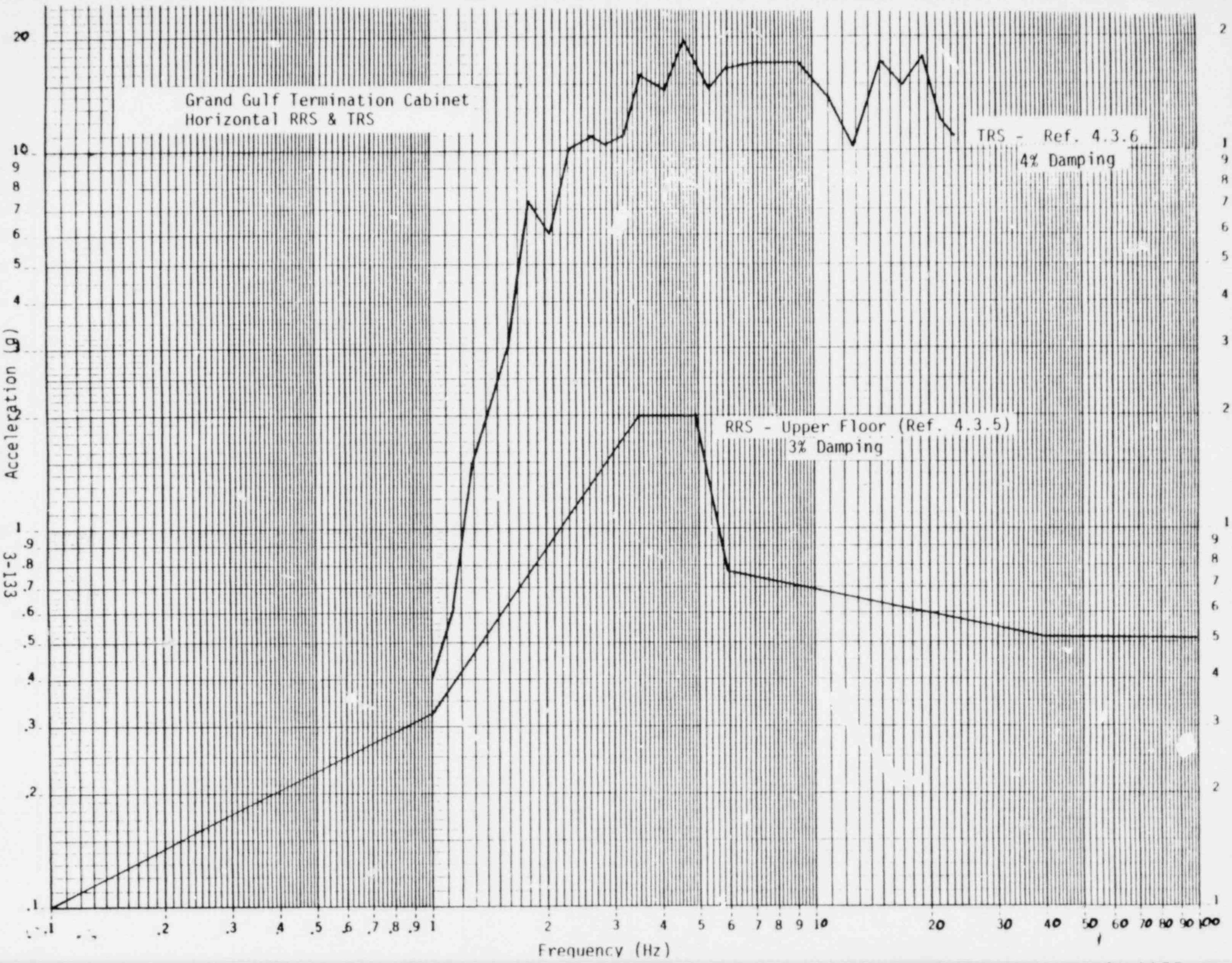
10. Critical Structural Elements:

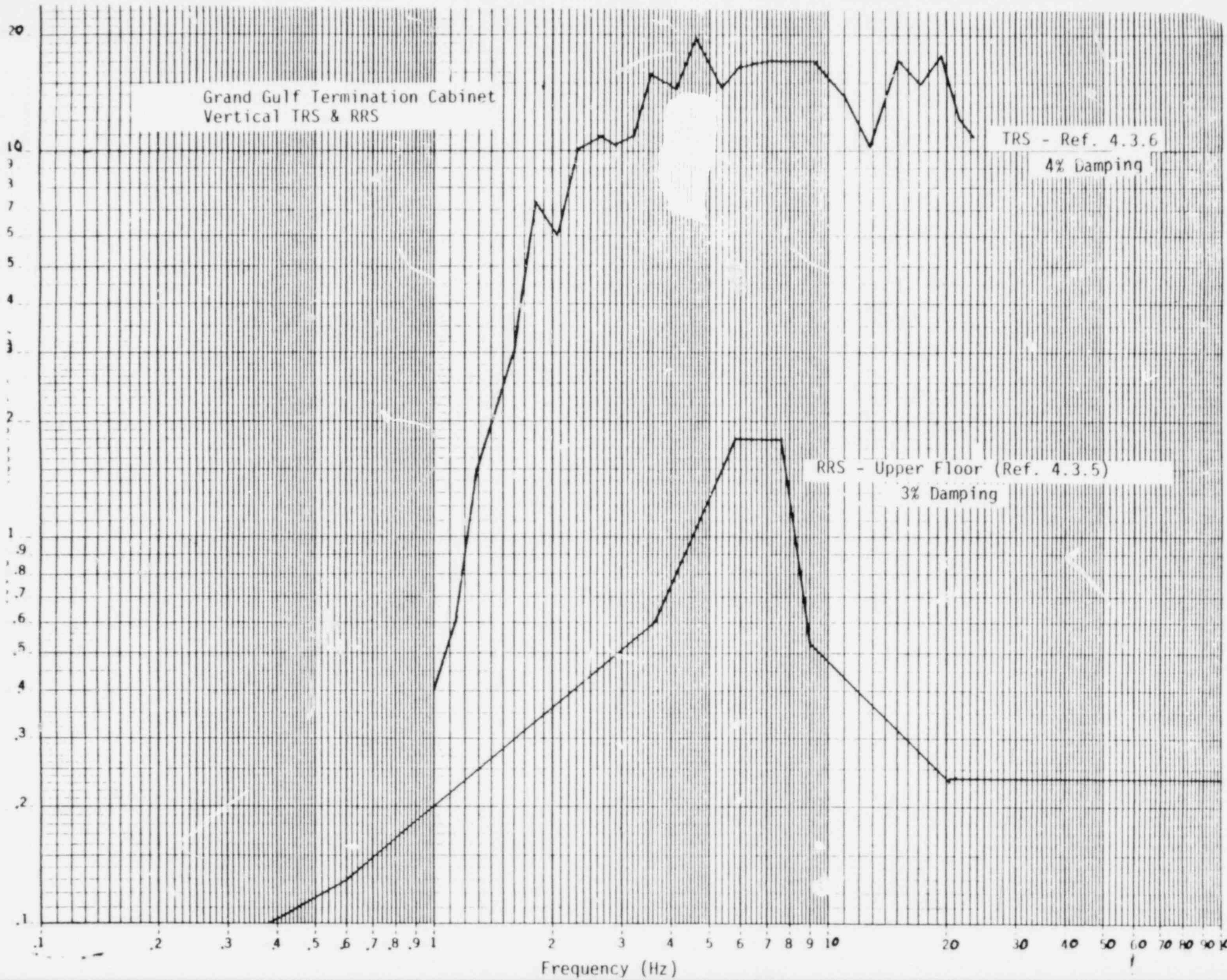
A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability


Grand Gulf Termination Cabinet
Horizontal RRS & TRS
TRS - Ref. 4.3.6
4% Damping
RRS - Upper Floor (Ref. 4.3.5)
3% Damping
Acceleration (g)
Frequency (Hz)



Grand Gulf Termination Cabinet
Vertical TRS & RRS
TRS - Ref. 4.3.6
4% Damping
RRS - Upper Floor (Ref. 4.3.5)
3% Damping
Frequency (Hz)

Qualification Summary of Equipment

MPL: C41-F004

I. Plant Name: Grand Gulf

Type:

1. Utility: Mississippi Power & Light

PWR

2. NSSS: GE   3. A/E: Bechtel

BWR-6 Mark III

II. Component Name Standby Liquid Control System Explosive Valve

1. Scope: [X] NSSS   [ ] BOP

2. Model Number: 1832 - 159-01   Quantity: 2

3. Vendor: Conax

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance Valve, explosive actuated

b. Dimensions 7"diameter, 4.5" long, 9.81" height

c. Weight 38 lbs.

6. Location: Building: CONTAINMENT

Elevation: 185 Ft.

7. Field Mounting Conditions [X] Bolt (No. 4, Size 1")
[ ] Weld (Length ___)
[ ] ______

8. a. System in which located: Standy Liquid Control

b. Functional Description: Provide leak-tight shut off of SLC system until operated (fired). Functionable up to 1 hour after the start of the accident

c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown

[ ] Both   [X] Neither

9. Pertinent Reference Design Specifications: 21A9370, Rev. 6 and 21A9370AB, Rev. 6.

III. Is Equipment Available for Inspection in the Plant: [x] Yes [ ] No

IV. Equipment Qualification Method:

[x] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: VPF 3394-36-2

(No., Title and Date) Environmental Qualification Test Report

Company that Prepared Report: Conax Corporation

Company that Reviewed Report: General Electric

V. Vibration Input:

1. Loads considered: a. [ ] Seismic only

   b. [ ] Hydrodynamic only

   c. [x] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [x] SRSS [ ] (other, specify)

3. Required Response Spectra (attach the graphs): *Not applicable

4. Damping Corresponding to RRS: OBE N/A* SSE N/A*

5. Required Acceleration in Each Direction: [ ] ZPA [ ] Other (specify)

OBE	S/S = not available	F/B = not available	V = not available
Combined faulted	N/S = 2.144g	E/S = 3.211g	V = 1.363g

6. Were fatigue effects or other vibration loads considered?

   [ ] Yes [x] No

   If yes, describe loads considered and how they were treated in overall qualification program: The applicable ASME Code exempted valves mounted on pipes below 4" diameter from fatigue analysis.

*NOTE: If more than one report complete items IV thru VII for each report.

*As the equipment is rigid, only the ZPA is relevant. Damping coefficient is not significant for ZPA.

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency   [ ] Multi-Frequency: [ ] random, [ ] sine beat, [ ] ______

2. [ ] Single Axis   [X] Multi-Axis

3. No. of Qualification Tests: OBE 5 SSE 1 Other (See Note 1) (specify)

4. Frequency Range: 1-35 HZ (see note2)

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical): (see note2)

S/S = >35HZ   F/B = >35 HZ   V = >35 HZ

6. Method of Determining Natural Frequencies

[X] Lab Test   [ ] In-Situ Test   [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graphs)
[X] No (ZPA only) (note 3)

8. Input g-level Test: OBE S/S = 4.5g   F/B = 4.5g   V = 3g

SSE S/S = 6.5g   F/B = 6.5g   V = 4.5g

9. Laboratory Mounting:

1. [X] Bolt (No. 4, Size 1") [ ] Weld (Length ______) [ ] ______

10. Functional operability verified: [X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Valve was found to have sustained no structural damage. The electrical resistance before, during and after the tests was found to be normal. Valve actuated upon command after the dynamic test.

12. Other test performed (such as aging or fragility test, including results):

*Note: If qualification by a combination of test and analysis also complete Item VII.

Note 1 = 5-OBE & 1-SSE test for each combination of the vertical axis and one of the horizontal axis.

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Note 2 = No resonance frequency was found during the resonance frequency search between 1 and 35 HZ. From hand calculations, the natural frequency is estimated to be over 60 HZ.

Note 3: As the valve is rigid within the frequency range of interest, the consideration of ZPA alone is justified.

VII. <u>If Qualification by Analysis, then complete:</u>

1. Method of Analysis: N/A

   [ ] Static Analysis [ ] Equivalent Static Analysis

   [ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = ________ F/B = ________ V = ________

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

   [ ] Finite Element [ ] Beam [ ] Closed Form Solution

4. [ ] Computer Codes: ________

   Frequency Range and No. of modes considered: ________

   [ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
   [ ] Other: ________
   (specify)

6. Damping: OBE________ SSE______ Basis for the damping used: ________

7. Support Considerations in the model: ________

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

Qualification Summary of Equipment MPL: F13-E009

I. Plant Name: Grand Gulf Type:

1. Utility: Mississippi Power & Light PWR

2. NSSS: GE 3. A/E: Bechtel BWR-6 Mark III

II. Component Name Head Strongback Carousel

1. Scope: [X] NSSS [ ] BOP

2. Model Number: 767E572G3 Quantity: 1

3. Vendor: General Electric

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance Cruciform shaped lifting strongback with circular tray and rails.

b. Dimensions 26 Ft. Dia. and 19 Ft. high

c. Weight 29 tons when loaded with associated equipment.

6. Location: Building: Containment

Elevation: 208' 10"

7. Field Mounting Conditions [ ] Bolt (No.____, Size____)
[ ] Weld (Length____)
[XX] Suspended from building crane

8. a. System in which located: Fuel Servicing Equipment

b. Functional Description: To untension and lift RPV head

c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
[ ] Both [X] Neither

9. Pertinent Reference Design Specifications: 105D5281 Rev. 7

III. Is Equipment Available for Inspection in the Plant: [x] Yes [ ] No

IV. Equipment Qualification Method:

[x] Test [x] Analysis [ ] Combination of Test and Analysis

Qualification Report*: DRF F13-12

(No., Title and Date) Design Record File

Company that Prepared Report: General Electric

Company that Reviewed Report: General Electric

V. Vibration Input: Not Specified

1. Loads considered: a. [ ] Seismic only

   b. [ ] Hydrodynamic only

   c. [ ] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [ ] SRSS [ ] ______ (other, specify)

3. Required Response Spectra (attach the graphs): ______

4. Damping Corresponding to RRS: OBE ______ SSE ______

5. Required Acceleration in Each Direction: [ ] ZPA [ ] Other ______ (specify)

   OBE S/S = ______ F/B = ______ V = ______
   SSE S/S = ______ F/B = ______ V = ______

6. Were fatigue effects or other vibration loads considered?

   [ ] Yes [x] No

   If yes, describe loads considered and how they were treated in overall qualification program: ______

*NOTE: If more than one report complete items IV thru VII for each report.

VI. If Qualification by Test, then Complete*: (Load Test- 125% Rated Load)

1. [ ] Single Frequency   [ ] Multi-Frequency: [ ] random / [ ] sine beat / [ ] ____________

2. [ ] Single Axis   [ ] Multi-Axis

3. No. of Qualification Tests: OBE ________ SSE ________ Other ____________ (specify)

4. Frequency Range: ______________________________

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = ______________ F/B = ______________ V = ______________

6. Method of Determining Natural Frequencies

   [ ] Lab Test   [ ] In-Situ Test   [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graphs)
   [ ] No

8. Input g-level Test: OBE S/S = ________ F/B = ________ V = ________

   SSE S/S = ________ F/B = ________ V = ________

9. Laboratory Mounting:

   1. [ ] Bolt (No.____, Size_____) [ ] Weld (Length______) [ ]______

10. Functional operability verified: [X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: The unmodified Head Strongback passed the 125% load test without any problems.

12. Other test performed (such as aging or fragility test, including results):

All load carrying welds were mag. particle inspected per GE specification E50-YP1 before and after the load test. Load carrying memb s were inspected for permanent deformation from load. No deformation or cracks were found.

*Note: If qualification by a combination of test and analysis also complete Item VII.

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

   [X] Static Analysis   [ ] Equivalent Static Analysis

   [ ] Dynamic Analysis: [ ] Time-History   [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = N/A   F/B = N/A   V = N/A

3. Model Type: [ ] 3D   [ ] 2D   [ ] 1D

   [ ] Finite Element   [ ] Beam   [ ] Closed Form Solution

4. [ ] Computer Codes: ____________

   Frequency Range and No. of modes considered: N/A

   [ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
   [ ] Other: N/A (specify)

6. Damping: OBE ______ SSE ______ Basis for the damping used: N/A

7. Support Considerations in the model: Hangs from wire cable which damp out floor motions.

8. Critical Structural Elements:

A. Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

The Strongback Carousel is considered a lifting device and has been designed for a minimum safety factor of 5 with respect to the ultimate material strenght when lifting a maximum load of 125 tons.

B. Max. Critical Deflection	Location	bility
N/A		

Qualification Summary of Equipment   MPL: B33-D014

I. Plant Name: Grand Gulf   Type:

1. Utility: Mississippi Power & Light   PWR

2. NSSS: GE   3. A/E: Bechtel   BWR-6 Mark III

II. Component Name Recirculation System Sample Probe

1. Scope: [X] NSSS   [ ] BOP

2. Model Number: 166B7284P002   Quantity: 1/Unit

3. Vendor: Associated Piping & Eng. Corp. Inc.   Compton, CA

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance 3/4" Pipe welded to Recirc Pipe

b. Dimensions 3/4" Pipe, 20 in. long

c. Weight Approximately 5 lbs

6. Location: Building: Containment

Elevation: 121 Ft. 4.25 in.

7. Field Mounting Conditions [ ] Bolt (No.____, Size____)
[X] Weld (Length____) Continuous Weld
[ ]

8. a. System in which located: Recirculation

b. Functional Description: Test Water Chemistry

c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
[ ] Both [X] Neither

9. Pertinent Reference Design Specifications: Supplied with B33-G001
Purchase Specification 22A6417, Rev. 0

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method:

[ ] Test [X] Analysis [ ] Combination of Test and Analysis

Qualification Report*: Sample Probe Evaluation

(No., Title and Date) MED Design Memo # 150-18, 2/20/81

Company that Prepared Report: General Electric

Company that Reviewed Report: General Electric

V. Vibration Input:

1. Loads considered: a. [ ] Seismic only

   b. [ ] Hydrodynamic only

   c. [X] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [X] SRSS [ ] ________ (other, specify)

3. Required Response Spectra (attach the graphs): Attached

4. Damping Corresponding to RRS: OBE 2% SSE 3%

5. Required Acceleration in Each Direction: [ ] ZPA [ ] Other Max accel. (specify)

OBE	S/S = 1.4g	F/B = 1.4g	V = 0.27g
SSE	S/S = 1.45g	F/B = 1.45g	V = 0.55g

6. Were fatigue effects or other vibration loads considered?

   [ ] Yes [X] No

   If yes, describe loads considered and how they were treated in overall qualification program: Not required by ASME code for piping smaller than 4 inches in diameter.

*NOTE: If more than one report complete items IV thru VII for each report.

VI. If Qualification by Test, then Complete*: N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] ________

2. [ ] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE________ SSE________ Other________ (specify)

4. Frequency Range: ________________________________

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = ________________ F/B = ________________ V = ________________

6. Method of Determining Natural Frequencies

   [ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graphs)
   [ ] No

8. Input g-level Test: OBE S/S = ________ F/B = ________ V = ________

   SSE S/S = ________ F/B = ________ V = ________

9. Laboratory Mounting:

   1. [ ] Bolt (No.____, Size____) [ ] Weld (Length____) [ ]____

10. Functional operability verified: [ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: ________________________

    ____

12. Other test performed (such as aging or fragility test, including results):

    ____

    ____

*Note: If qualification by a combination of test and analysis also complete Item VII.

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[X] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 342 HZ F/B = 342 HZ V = 342 HZ

3. Model Type: [X] 3D [ ] 2D [ ] 1D

[ ] Finite Element [ ] Beam [ ] Closed Form Solution

4. [ ] Computer Codes: N/A

Frequency Range and No. of modes considered: ____

[X] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [X] SRSS
[ ] Other: ____ (specify)

6. Damping: OBE 2% SSE 3% Basis for the damping used: 385HA603

7. Support Considerations in the model: Not applicable

8. Critical Structural Elements:

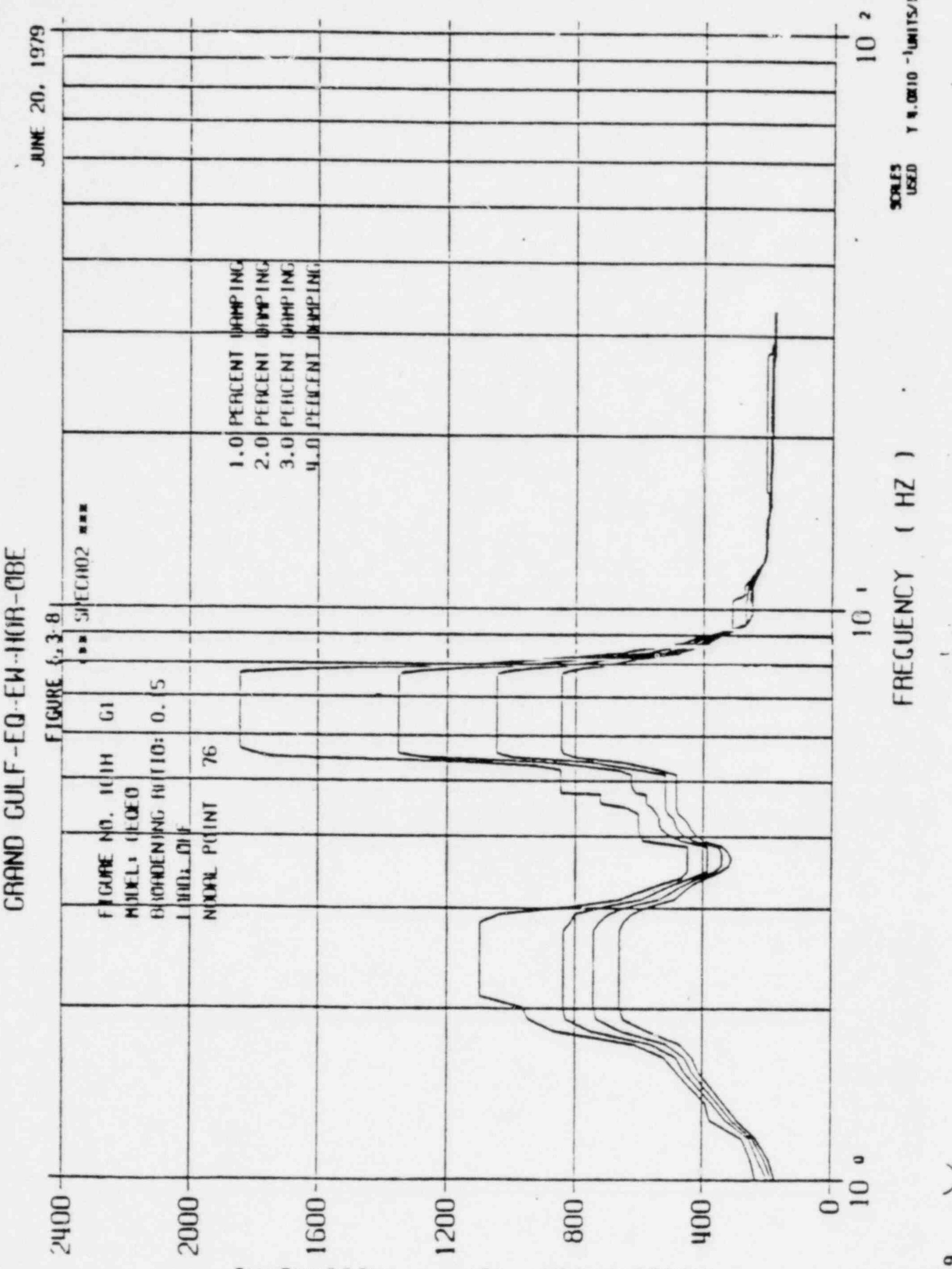
A.

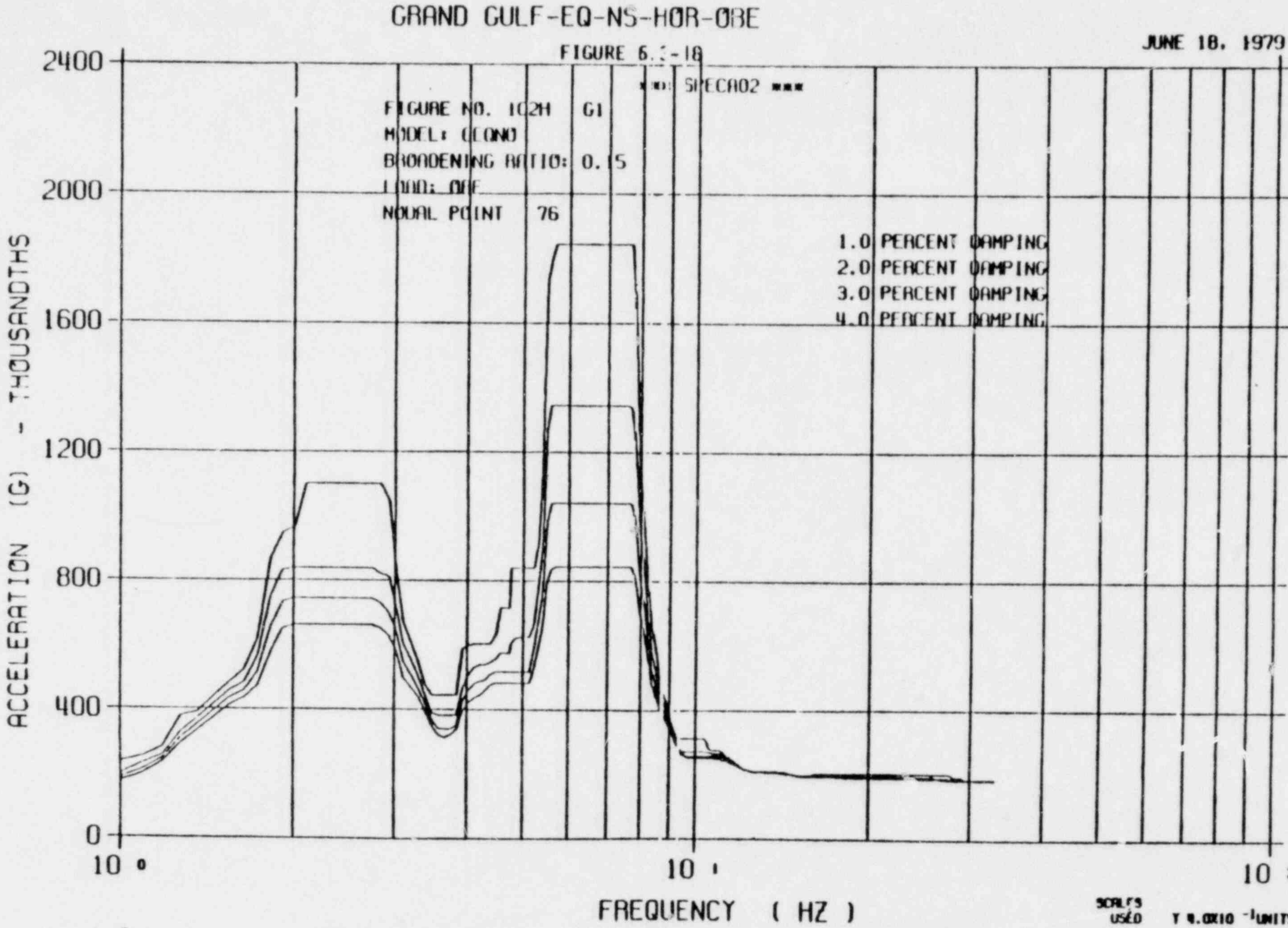
Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Sample Probe	Recir. Disch.	Weight+Dynamic Inertia+Drag Load		5981 psi	17,225 psi

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
Not applicable		

(Extracted from Ref. 6)





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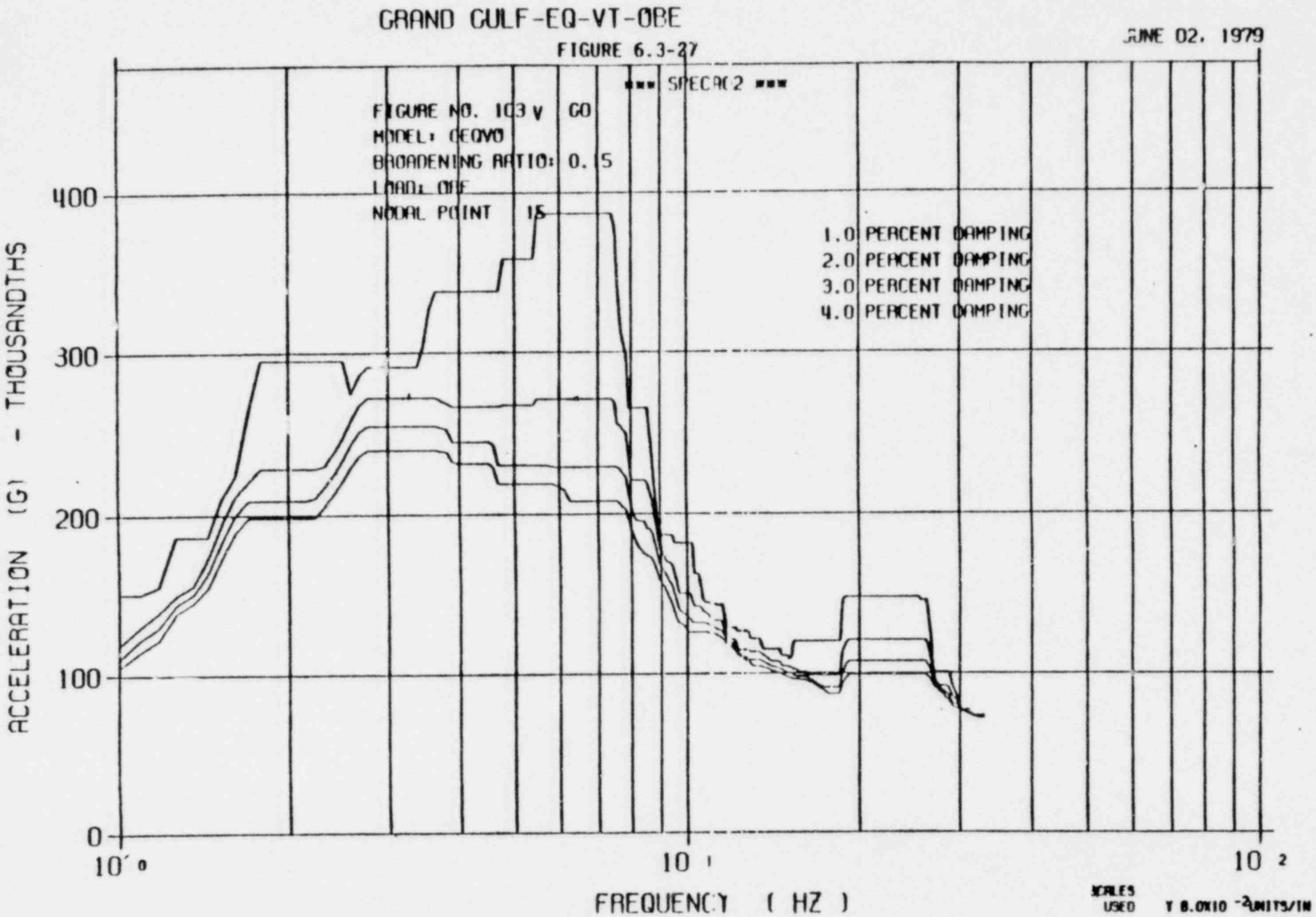
(Extracted from Ref. 6)

(Extracted from Ref. 6)



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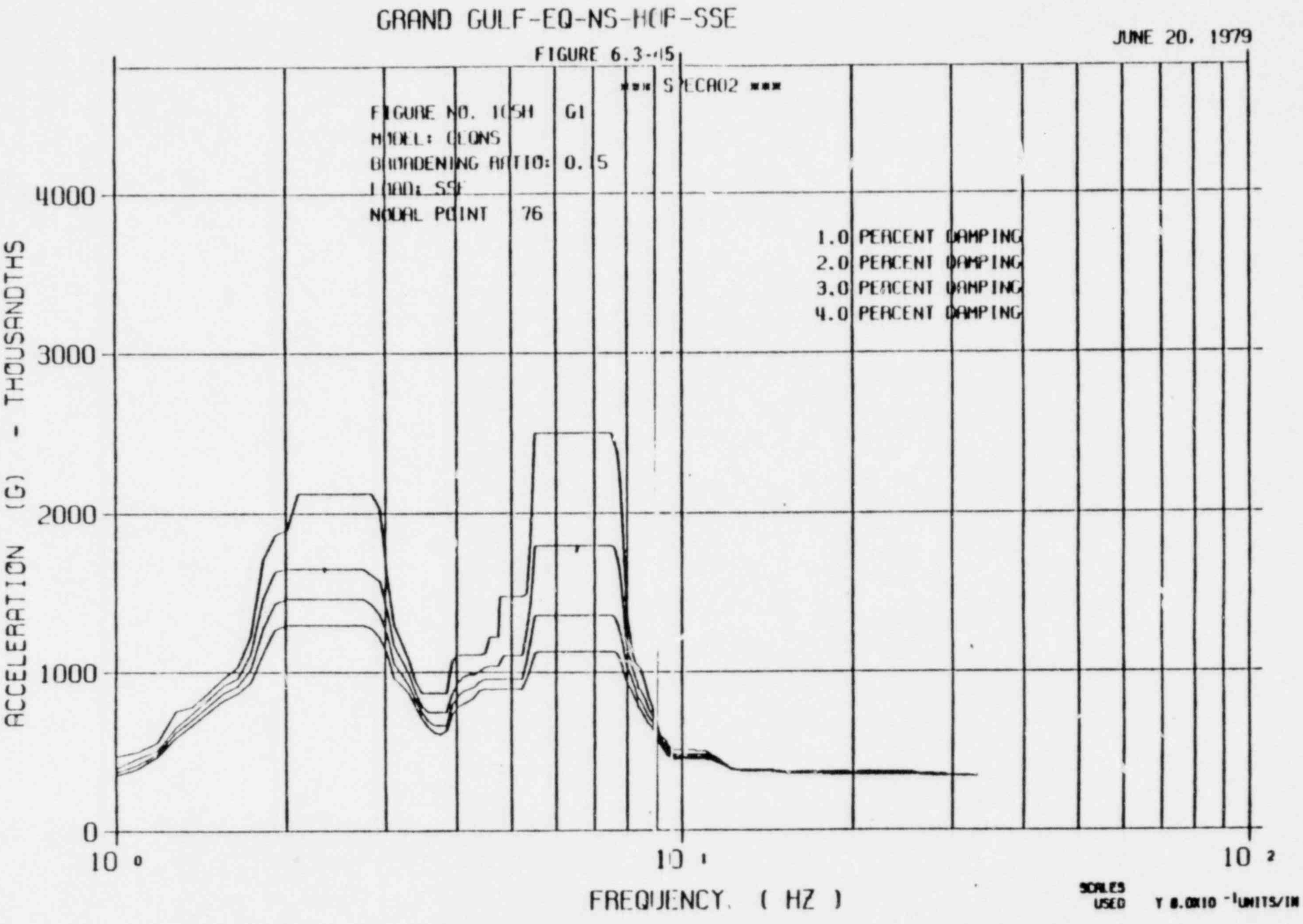
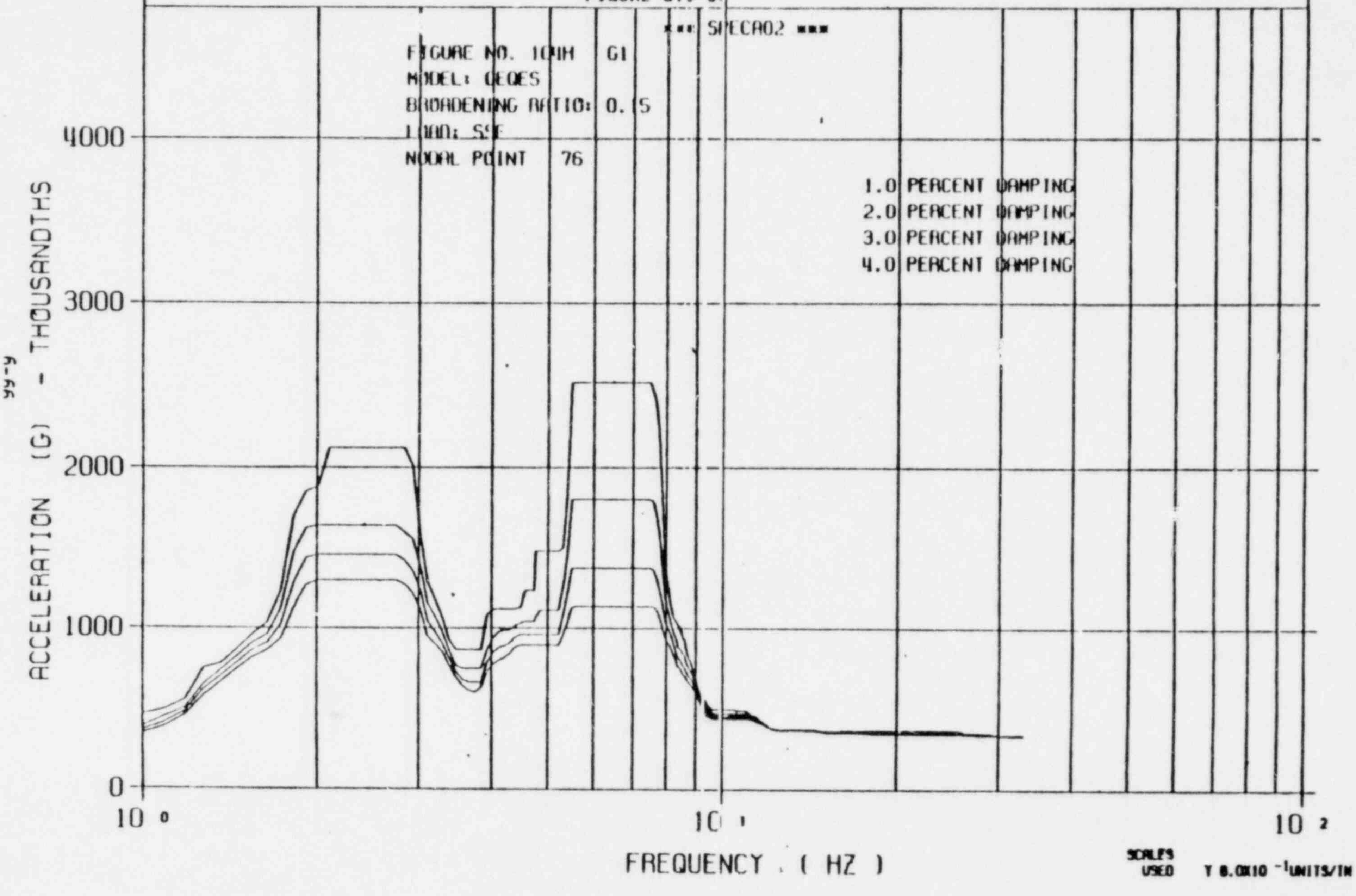


PL 9

GRAND GULF-EQ-EW-HCR-SSE

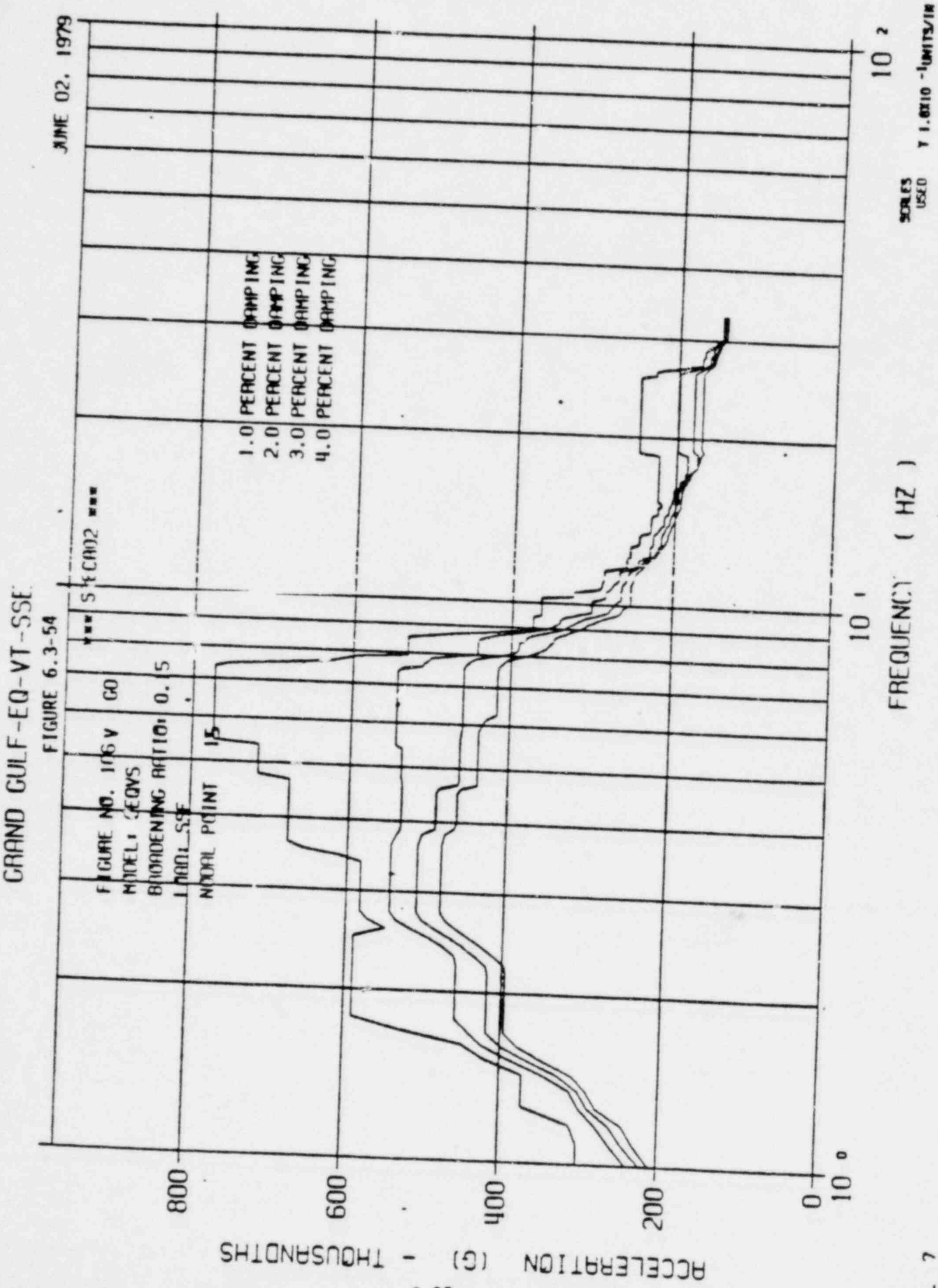
FIGURE 6.3-35

JUNE 20, 1979



PL 9

(Extracted from Ref. 6)



Qualification Summary of Equipment

MPL: B21-F041

I. Plant Name: Grand Gulf

Type:

1. Utility: Mississippi Power & Light

PWR

2. NSSS: GE

3. A/E: Bechtel

BWR-6 Mark III

II. Component Name MAIN STEAM SAFETY RELIEF VALVE

1. Scope: [X] NSSS [ ] BOP

2. Model Number: G471-6/125.04 Quantity: 8

3. Vendor: Dikkers

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance spring loaded SRV with pneumatic actuator

b. Dimensions 24" thick, 36" long & 55" tall

c. Weight Dry 3050 lbs, wet 3155 lbs.

6. Location: Building: Drywell

Elevation: 157'

7. Field Mounting Conditions [X] Bolt (No.____, Size____) inlet 12 studs 1 5/8"-8un outlet 16 studs 1"-8unc
[ ] Weld (Length____)
[ ] ________

8. a. System in which located: Main Steam Lines

b. Functional Description Relieve reactor pressure at set value, upon automatic signal, or operator command

c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown

[X] Both [ ] Neither

9. Pertinent Reference Design Specifications: 21A9538 Rev. 4 & 21A9538 AB Rev. 3

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III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method:

[X] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: VPF 5529-25-1 (Ref. 2)

(No., Title and Date) Seismic simulation test program on an 8x10 safety relief valve with air-operated actuator

Company that Prepared Report: Wyle Lab, Huntsville, ALA

Company that Reviewed Report: GE

V. Vibration Input:

1. Loads considered: a. [ ] Seismic only

   b. [ ] Hydrodynamic only

   c. [X] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [X] SRSS [ ] ________ (other, specify)

3. Required Response Spectra (attach the graphs): not applied

4. Damping Corresponding to RRS: OBE 5% SSE 5%

5. Required Acceleration in Each Direction: [X] ZPA [ ] Other ________ (specify)

   OBE S/S = F/B = V =
   SSE Horizontal (combined) = 7.2g V = 2.27g

6. Were fatigue effects or other vibration loads considered?

   [X] Yes [ ] No

   If yes, describe loads considered and how they were treated in overall qualification program: A total of 56 dynamic load tests were run in this program. The acceleration level varied from 0.2g to 9g horizontally and 0.2 to 6.5g vertically over a frequency range of 1 to 150hz.

*NOTE: If more than one report complete items IV thru VII for each report.

VPF 5529-117-1 is Dikkers Summary of the same test described by VPF 5529-25-1.

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency [X] Multi-Frequency: [X] random / [ ] sine beat / [ ] ______

2. [ ] Single Axis [X] Multi-Axis

3. No. of Qualification Tests: OBE 5 SSE 1 Other ** ______ (specify)

4. Frequency Range: 1-150hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 57hz F/B = 60hz V = 59hz

6. Method of Determining Natural Frequencies

[X] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graphs) [ ] No
RRS NOT APPLICABLE.

8. Input g-level Test: OBE S/S = 6.5g F/B = 6.5g V = 4.5g

SSE S/S = 9g F/B = 9g V = 6g

9. Laboratory Mounting:
Inlet 12 studs 1 5/8"-8UN. Outlet 16 studs, 1"-8UNC.
1. [X] Bolt (No.______, Size______) [ ] Weld (Length______) [ ]______

10. Functional operability verified: [X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: The valve survived all tests and functioned properly. No modification was needed.

12. Other test performed (such as aging or fragility test, including results):

______

______

*Note: If qualification by a combination of test and analysis also complete Item VII.

** An additional 5 OBE and 1 SSE were run at extended load.

VII. <u>If Qualification by Analysis, then complete:</u> N/A

1. Method of Analysis:

   [ ] Static Analysis [ ] Equivalent Static Analysis

   [ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = ________________ F/B = ________________ V = ________________

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

   [ ] Finite Element [ ] Beam [ ] Closed Form Solution

4. [ ] Computer Codes: ____

   Frequency Range and No. of modes considered: ______________________

   [ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
   [ ] Other: ____________________
   (specify)

6. Damping: OBE________ SSE______ Basis for the damping used: ______________

7. Support Considerations in the model: ___________________________________

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

Qualification Summary of Equipment MPL: E51-C001

I. Plant Name: Grand Gulf 1 & 2 Type:

1. Utility: Mississippi Power & Light PWR ______

2. NSSS: GE 3. A/E: Bechtel BWR 6 MK III

II. Component Name Reactor Core Isolation Cooling (RCIC) Pump

1. Scope: [X] NSSS [ ] BOP

2. Model Number: 6X6X10.5-(D-CP) S/N 230520 Quantity: 1

3. Vendor: Bingham Willamette Pump Company

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance Horizontal cylinder on base plate (6x6x10-1/2 cp. 4 stage)

b. Dimensions Length 62-1/2 in, Height 45 in, Width 47 in.

c. Weight Pump and base weight 6,575 lbs.

6. Location: Building: Auxiliary

Elevation: 93 feet

7. Field Mounting Conditions [X] Bolt (No. 4, Size 1½")
[ ] Weld (Length ____)
[ ] ______

8. a. System in which located: Reactor Core Isolation Cooling System

b. Functional Description: Injects cooling water into the reactor during isolation

c. Is the equipment required for [X] Hot Standby [ ] Cold Shutdown

During Isolation [ ] Both [ ] Neither

9. Pertinent Reference Design Specifications: Purchase Spec. 21A9443AF Rev. 5

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method:

- [ ] Test [X] Analysis [ ] Combination of Test and Analysis

Qualification Report*: Seismic Analysis Report

(No., Title and Date) VPF 3641-14-3, 3/28/74

Company that Prepared Report: Bingham Willamette Co.

Company that Reviewed Report: General Electric Co. (1/22/76)

V. Vibration Input:

1. Loads considered: a. [X] Seismic only

   b. [ ] Hydrodynamic only

   c. [ ] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [ ] SRSS [x] Seismic was the only significant load. (other, specify)

3. Required Response Spectra (attach the graphs): See attached response spectra curves.

4. Damping Corresponding to RRS: OBE ______ SSE 3%

5. Required Acceleration in Each Direction: [X] ZPA [ ] Other (specify)

OBE	S/S =	F/B =	V =
SSE	E-W = 0.251g	N-S = 0.215g	V = 0.186g

6. Were fatigue effects or other vibration loads considered?

   [X] Yes [ ] No

   If yes, describe loads considered and how they were treated in overall qualification program: This pump is located outside the reactor building and is not affected by high cycle suppression pool hydrodynamic loads. The number of stress cycles produced by seismic loading results in ASME Code alternating stress allowable (SA) that is higher than all peak stresses expected at pump stress concentrations. Vibration displacements from pump operation are measured to be less than Hydraulic Institute standards; therefore, high cycle vibration stresses are low and would not lead to pump failure.

*NOTE: If more than one report complete items IV thru VII for each report.

VI. If Qualification by Test, then Complete*: N/A

1. [ ] Single Frequency   [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] ________

2. [ ] Single Axis   [ ] Multi-Axis

3. No. of Qualification Tests: OBE________ SSE________ Other________ (specify)

4. Frequency Range: ________________________________

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = ______________ F/B = ______________ V = ______________

6. Method of Determining Natural Frequencies

   [ ] Lab Test   [ ] In-Situ Test   [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graphs [ ] No

8. Input g-level Test: OBE S/S = ________ F/B = ________ V = ________

   SSE S/S = ________ F/B = ________ V = ________

9. Laboratory Mounting:

   1. [ ] Bolt (No.____, Size____) [ ] Weld (Length____) [ ]____

10. Functional operability verified: [ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: ________________________

____

12. Other test performed (such as aging or fragility test, including results):

____

____

*Note: If qualification by a combination of test and analysis also complete Item VII.

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[X] Static Analysis [ ] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

Horizontal = 47 HZ ______ V = > 47 Hz

3. Model Type: [X] 3D [ ] 2D [ ] 1D

[ ] Finite Element [X] Beam [X] Closed Form Solution

4. [ ] Computer Codes: ______

Frequency Range and No. of modes considered: ______

[X] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [X] SRSS
[ ] Other: ______ (specify)

6. Damping: OBE ______ SSE 3% Basis for the damping used: 385HA603 Rev. 0

7. Support Considerations in the model: Bolting between pump and pedestal is treated as rigid. The pedestal is mounted on a rigid foundation.

8. Critical Structural Elements:

A. Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
End Cover bolting	(tension)	seismic		21,088 psi	25,000 psi
Pump bolts	(tension)	"		9,104 psi	40,000 psi
Alignment pin	(shear)	"		9,378 psi	18,000 psi
Bearing housing pin	(shear)	"		2,280 psi	18,000 psi

B. Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

Pump and internal components rigid. Deflection information not representative of operability.

Qualification Summary of Equipment

I. Plant Name: Grand Gulf

Type:

1. Utility: Mississippi Power & Light

PWR ____

2. NSSS: GE   3. A/E: Bechtel

BWR 6 MK III

II. Component Name Reactor Core Isolation Cooling Turbine

1. Scope: [X] NSSS   [ ] BOP

2. Model Number: GS-2 No. 38175-A   Quantity: 1

3. Vendor: Terry Steam Turbine Company

4. If the component is a cabinet or panel, name and model No. of the devices included:

   N/A

5. Physical Description a. Appearance Single stage base mounted turbine

   b. Dimensions 75" long X 36" wide X 63" high

   c. Weight 6000 lbs.

6. Location: Building: Auxiliary

   Elevation: 93 feet

7. Field Mounting Conditions [X] Bolt (No. 6, Size 1")
   [ ] Weld (Length ____)
   [ ] ____

8. a. System in which located: Reactor Core Isolation Cooling

   b. Functional Description: Drives RCIC pump to inject water into reactor during isolation

   c. Is the equipment required for [X] Hot Standby [ ] Cold Shutdown
   [ ] Both [ ] Neither

9. Pertinent Reference Design Specifications:

   Purchase Spec. 21A9526AB Rev. 3

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method:

- [X] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: Design and Seismic Documentation

(No., Title and Date) VPF 3622-79(1)-2, 12-20-78

Company that Prepared Report: Terry Steam Turbine Company

Company that Reviewed Report: General Electric

V. Vibration Input:

1. Loads considered: a. [X] Seismic only

   b. [ ] Hydrodynamic only

   c. [ ] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [ ] SRSS [X] Seismic was the only significant load (other, specify)

3. Required Response Spectra (attach the graphs): See attached response spectra

4. Damping Corresponding to RRS: OBE ______ SSE 3%

5. Required Acceleration in Each Direction: [ ] ZPA [X] Other ______ (specify)

   Since test was performed over a freq. range individual

   OBE S/S = acceleration values F/B = were not used. V = ______

   SSE S/S = ______ F/B = ______ V = ______

6. Were fatigue effects or other vibration loads considered?

   [X] Yes [ ] No

   If yes, describe loads considered and how they were treated in overall qualification program:

   Cyclic loading due to an OBE event was considered by performing five OBE tests simulated by seven 30-sec. test runs each enveloping the OBE spectra. One SSE event was simulated by eight test runs.

*NOTE: If more than one report complete items IV thru VII for each report.

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency   [ ] Multi-Frequency: [X] random / [X] sine beat / [ ] ________

2. [ ] Single Axis   [X] Multi-Axis

3. No. of Qualification Tests: OBE________ SSE________ Other________ (specify)

4. Frequency Range: 1 to 100 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 15   F/B = 15   V = 22

6. Method of Determining Natural Frequencies

[X] Lab Test   [ ] In-Situ Test   [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [X] Yes (Attach TRS & RRS graphs)
[ ] No

8. Input g-level Test: OBE S/S = ________ F/B = ________ V = ________

SSE S/S = 7g   F/B = 7g   V = 12g

9. Laboratory Mounting:

1. [X] Bolt (No. 6, Size 1") [ ] Weld (Length______) [ ]______

10. Functional operability verified: [X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: The unmodified turbine performed adequately during and after the test.

12. Other test performed (such as aging or fragility test, including results):

None

*Note: If qualification by a combination of test and analysis also complete Item VII.

VII. If Qualification by Analysis, then complete: N/A

1. Method of Analysis:

   [ ] Static Analysis [ ] Equivalent Static Analysis

   [ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = ________ F/B = ________ V = ________

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

   [ ] Finite Element [ ] Beam [ ] Closed Form Solution

4. [ ] Computer Codes: ________

   Freque..y Range and No. of modes considered: ________

   [ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
   [ ] Other: ________ (specify)

6. Damping: OBE ________ SSE ______ Basis for the damping used: ________

7. Support Considerations in the model: ________

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

Grand Gulf I

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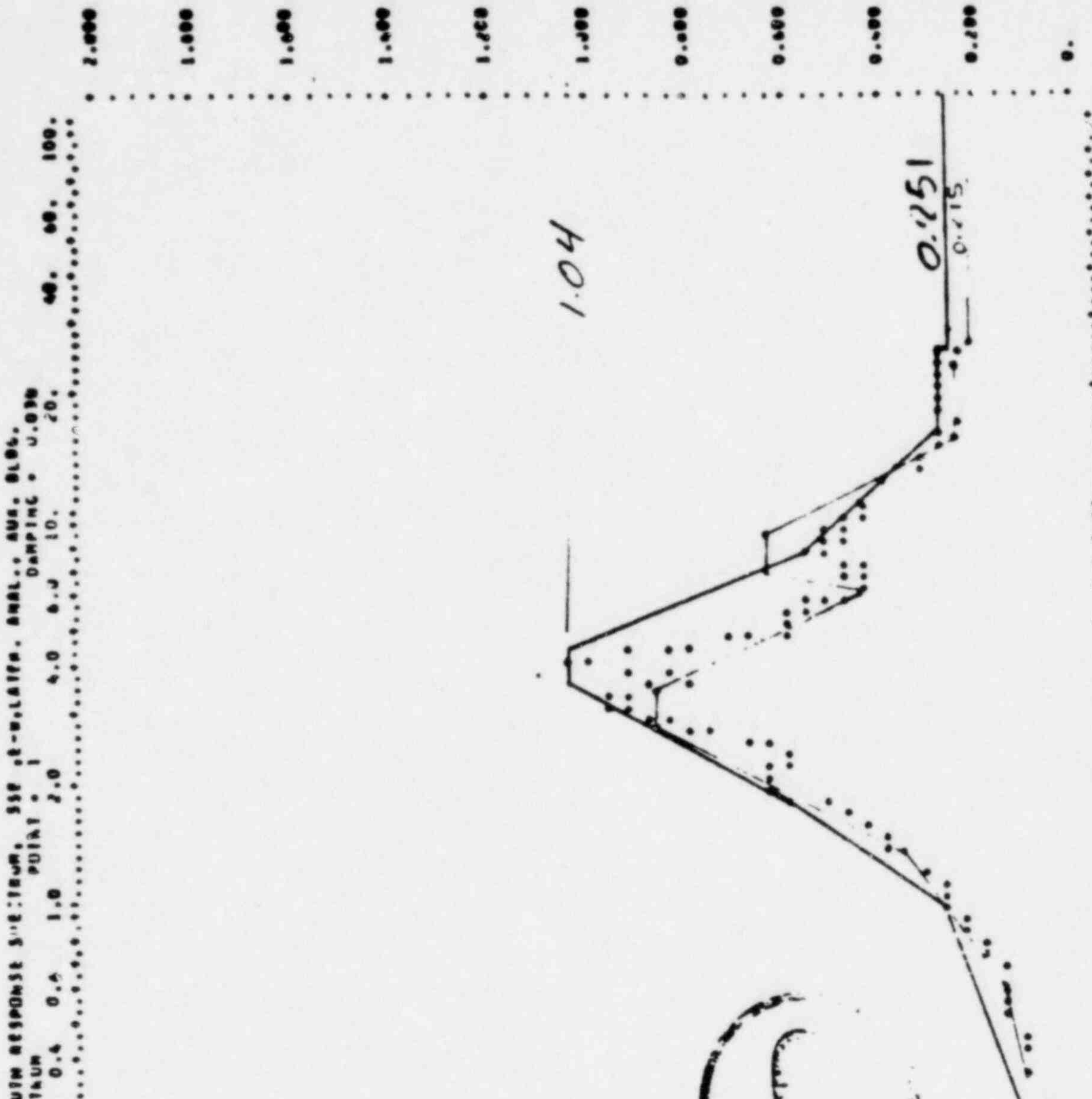


Note: GE documents 385HA603 (Seismic Design of BWRSD Supplied Equipment) (RS obtained from Ref. 5)

No.	DATE	REVISIONS	BY	CH'K	APPR
0	6/11/73	ISSUED FOR USE			

MP&L · BECHTEL

AUX. BLDG. FLOOR SPECTRUM
SSE, E-W, EL. 93'-0", 3%

GRAND GULF NUCLEAR STATION UNITS 1&2

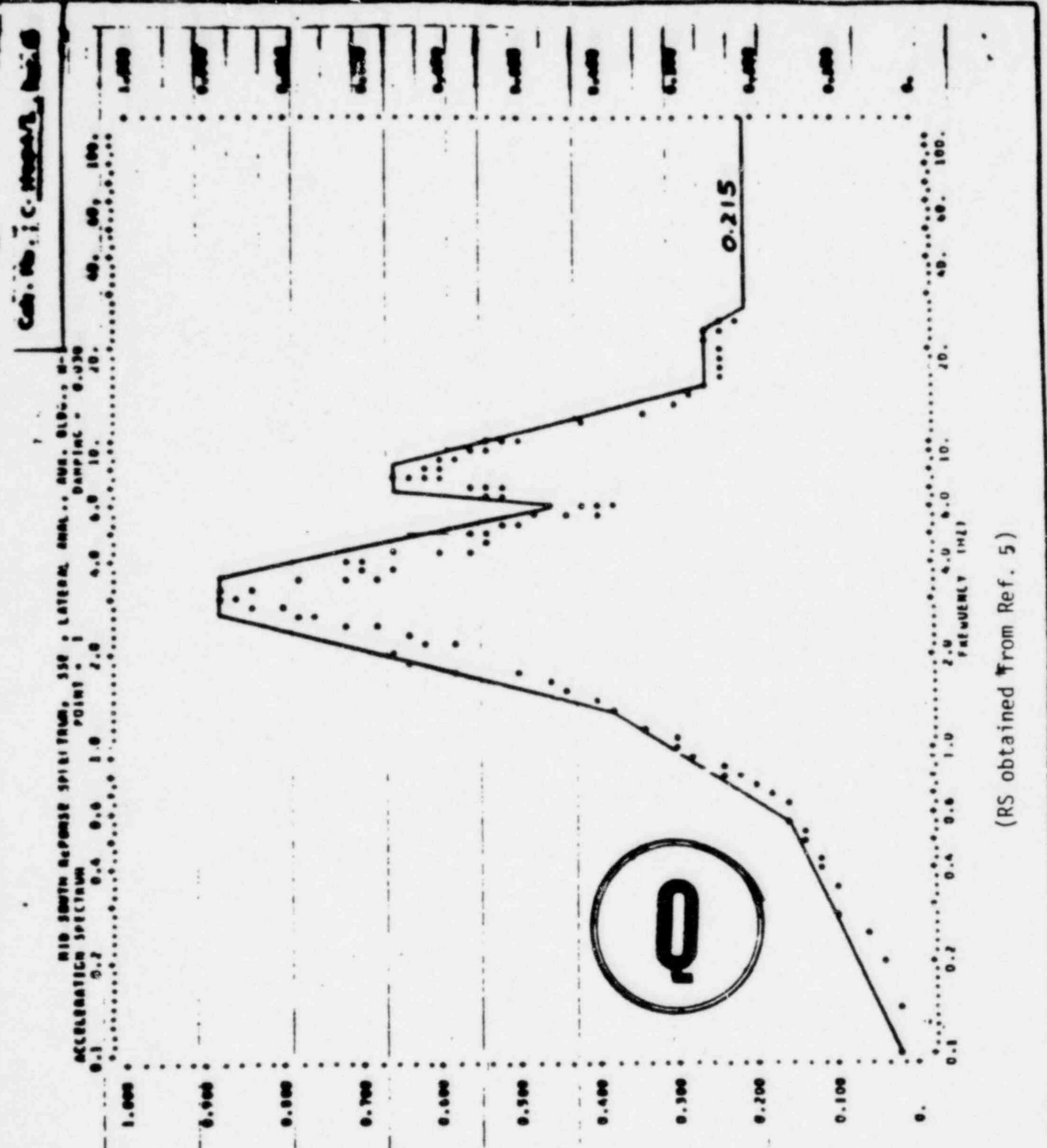
JOB No. 9645

E114 REV.

SHEET OF 32

GG-39

GG-39



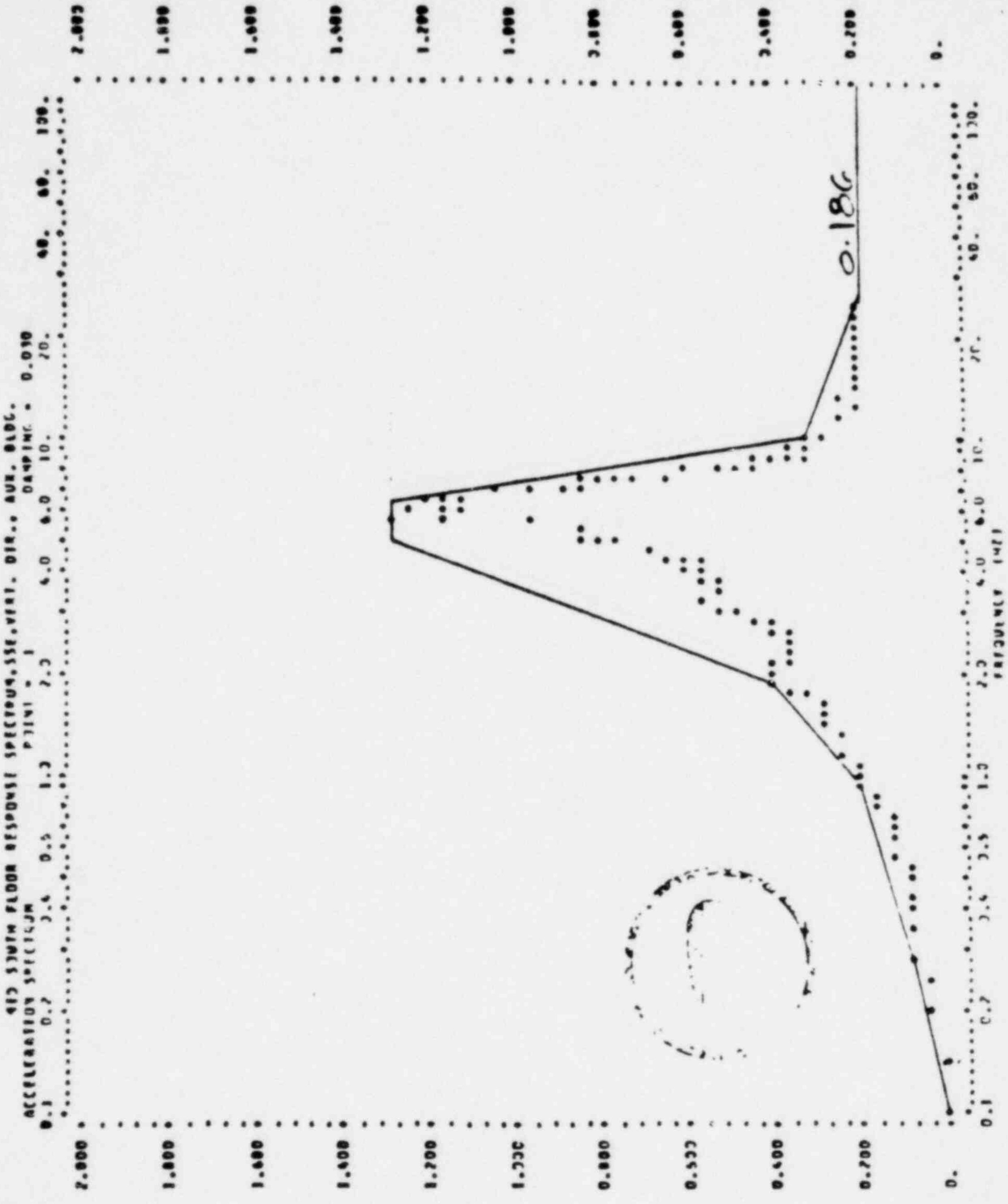
No.	DATE	REVISIONS	BY	CH'K	APPR
0	6/11/73	ISSUED FOR USE		T&H	

BECHTEL

AUX. BLDG. FLOOR SPECTRUM
SSE, N-S, EL. 93'-0" 3%
GRAND GULF NUCLEAR STATION UNITS 1&2

JOB No. 9645
N114 REV.
SHEET 4 OF 32

C HOLD.G



(RS obtained from Ref. 5)

No.	DATE	REVISIONS	BY	CH'K	APPR
0	6/11/73	ISSUED FOR USE	HG	JHH	BHL

BECHTEL

AUX. ~~BLDG.~~ FLOOR SPECTRUM
SSE; VERT., EL. 93'-0", 3%
GRAND GULF NUCLEAR STATION UNITS 1&2

JOB No 9645
V114 REV.
SHEET 4 OF 2

GG-39

Qualification Summary of Equipment

I. Plant Name: Grand Gulf Nuclear Station

Type:

1. Utility: Mississippi Power & Light Co.

PWR

2. NSSS: GE 3. A/E: Bechtel

BWR X

II. Component Name Drywell Head

1. Scope: [ ] NSSS [X] BOP

2. Model Number: N/A Quantity: One

3. Vendor: W. J. Woolley Co.

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance Cylindrical/Elliptical Head Closure above RPV

b. Dimensions 384 inch I.D.

c. Weight 110,000 lbs.

6. Location: Building: Containment/Drywell Structure

Elevation: 184'-6"

7. Field Mounting Conditions [X] Pins (No. 36, Size 3.0"ϕ)
[ ] Weld (Length ____)
[ ] ____

8. a. System in which located: M10

b. Functional Description: Drywell Pressure Boundary above RPV

c. Is the equipment required for [X] Hot Standby [ ] Cold Shutdown

[ ] Both [ ] Neither

9. Pertinent Reference Design Specifications: 9645-C-153.0

III. Is Equipment Available for Inspection in the Plant: [x] Yes [ ] No

IV. Equipment Qualification Method:

[ ] Test [X] Analysis [ ] Combination of Test and Analysis

Qualification Report*: MPR-451, Vol 1 (9645-C-153.0-QSM10Y001-8.0-1-0) with Addendum No. 3, Rev. 0 (9645-C-153.0-QSM10Y001-8-07-0)
(No., Title and Date) MPR 451 Vol 1 with Addendum No. 3, Rev. 0
Analysis of Drywell Head for Grand Gulf Nuclear Station December 12, 1980

Company that Prepared Report: MPR Associates for Hahn & Clay for W. J. Woolley Co.

Company that Reviewed Report: Bechtel Power Corp.

V. Vibration Input:

1. Loads considered: a. [ ] Seismic only

   b. [ ] Hydrodynamic only

   c. [X] Combination of (a) and (b)

2. Method of Combining RRS: [X] Absolute Sum [ ] SRSS [ ] ____ (other, specify)

3. Required Response Spectra (attach the graphs): Attached

4. Damping Corresponding to RRS: OBE 1% SSE 2%

5. Required Acceleration in Each Direction: [x] ZPA [ ] Other ____ (specify)

OBE	S/S = .23	F/B = .23	V = 0.062
SSE	S/S = .43	F/B = .43	V = 0.14

6. Were fatigue effects or other vibration loads considered?

   [ ] Yes [X] No

   If yes, describe loads considered and how they were treated in overall qualification program: ____

*NOTE: If more than one report complete items IV thru VII for each report.

12/80

VI. If Qualification by Test, then Complete*: N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random
[ ] sine beat
[ ] ____________

2. [ ] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE________ SSE________ Other________
(specify)

4. Frequency Range: ______________________________

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ____________ F/B = ____________ V = ____________

6. Method of Determining Natural Frequencies

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graphs)
[ ] No

8. Input g-level Test: OBE S/S = ________ F/B = ________ V = ________

SSE S/S = ________ F/B = ________ V = ________

9. Laboratory Mounting:

1. [ ] Bolt (No.______, Size______) [ ] Weld (Length______) [ ]______

10. Functional operability verified: [ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: ______________________________

____

12. Other test performed (such as aging or fragility test, including results):

____

____

*Note: If qualification by a combination of test and analysis also complete Item VII.

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

   [ ] Static Analysis   [ ] Equivalent Static Analysis

   [X] Dynamic Analysis: [ ] Time-History   [X] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = ----   F/B = -----   V = ----

3. Model Type: [ ] 3D   [X] 2D   [ ] 1D

   [X] Finite Element   [ ] Beam   [ ] Closed Form Solution

4. [ ] Computer Codes: ASHSD

   Frequency Range and No. of modes considered: 14 Modes

   [ ] Hand Calculations

5. Method of Combining Dynamic Responses: [X] Absolute Sum [ ] SRSS
   [ ] Other: ________ (specify)

6. Damping: OBE 2%   SSE 2%   Basis for the damping used: Specificaton 9645-C-153.0

7. Support Considerations in the model: Pinned

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Drywell Head Closure Head and Cylindrical Shell	184'-6"	D+L+(To+Ta)+P +E'+SRV+Pchug.	See Table II-1 of Addendum No. 3		

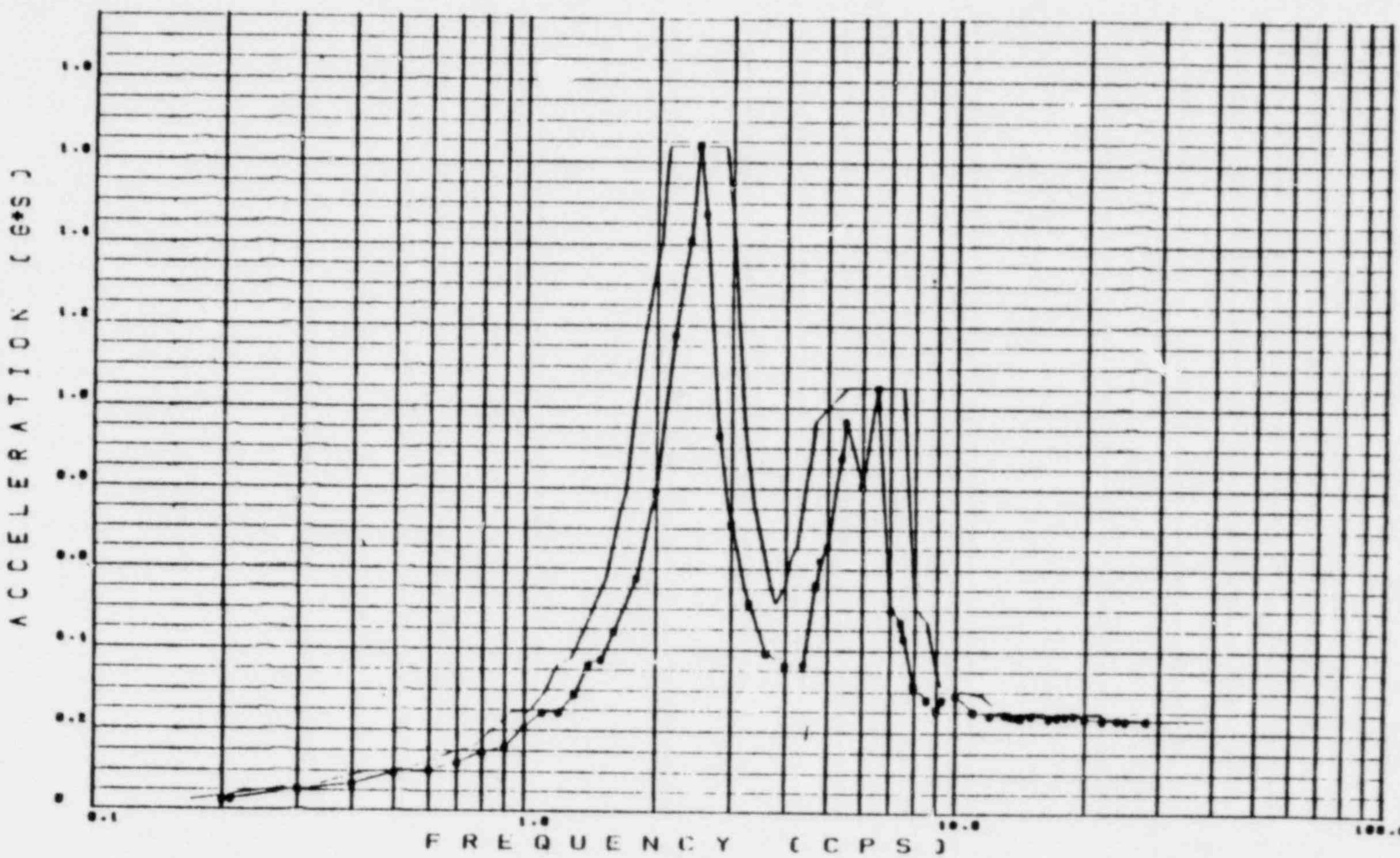
B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

Not required for functional operability.

DAMPING = .0100

BECHTEL CORPORATION



SPECTRA NODE 16 DRYWELL EL. 184.50

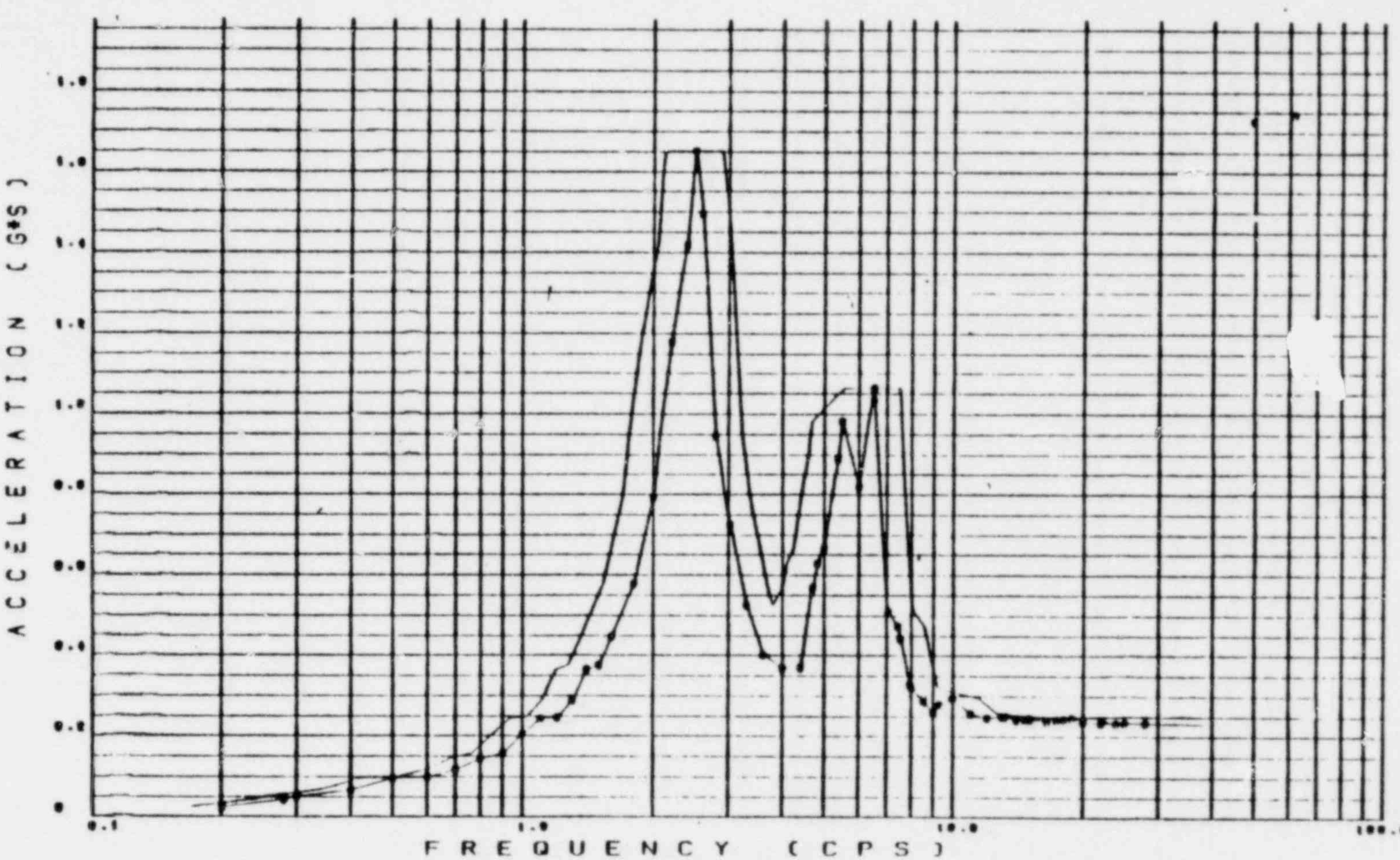
OBE E-W

E1302

Sht 12
Rev 3

DAMPING = .0100

BECHTEL CORPORATION



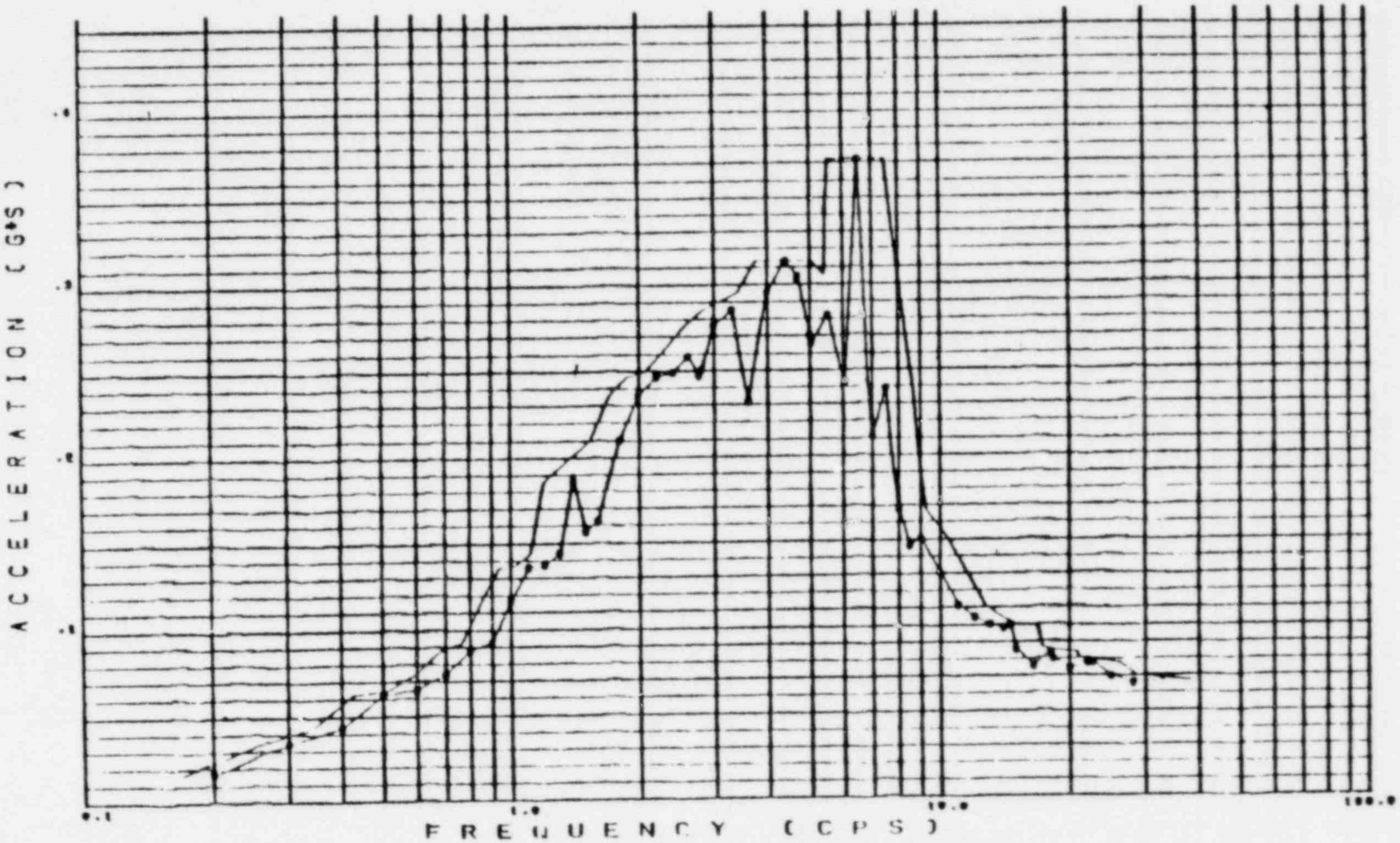
SPECTRA NODE 16 DRYWELL EL. 184.50
OBE N-S

NI302

Sht 24
Rev. ?

DAMPING = .0100

BECHTEL CORPORATION



SPECTRA NODE 16 DRYWELL EL. 184.50
OBE VERTICAL

V1302

Sup- 36
Rev 3

DAMPING = .0200

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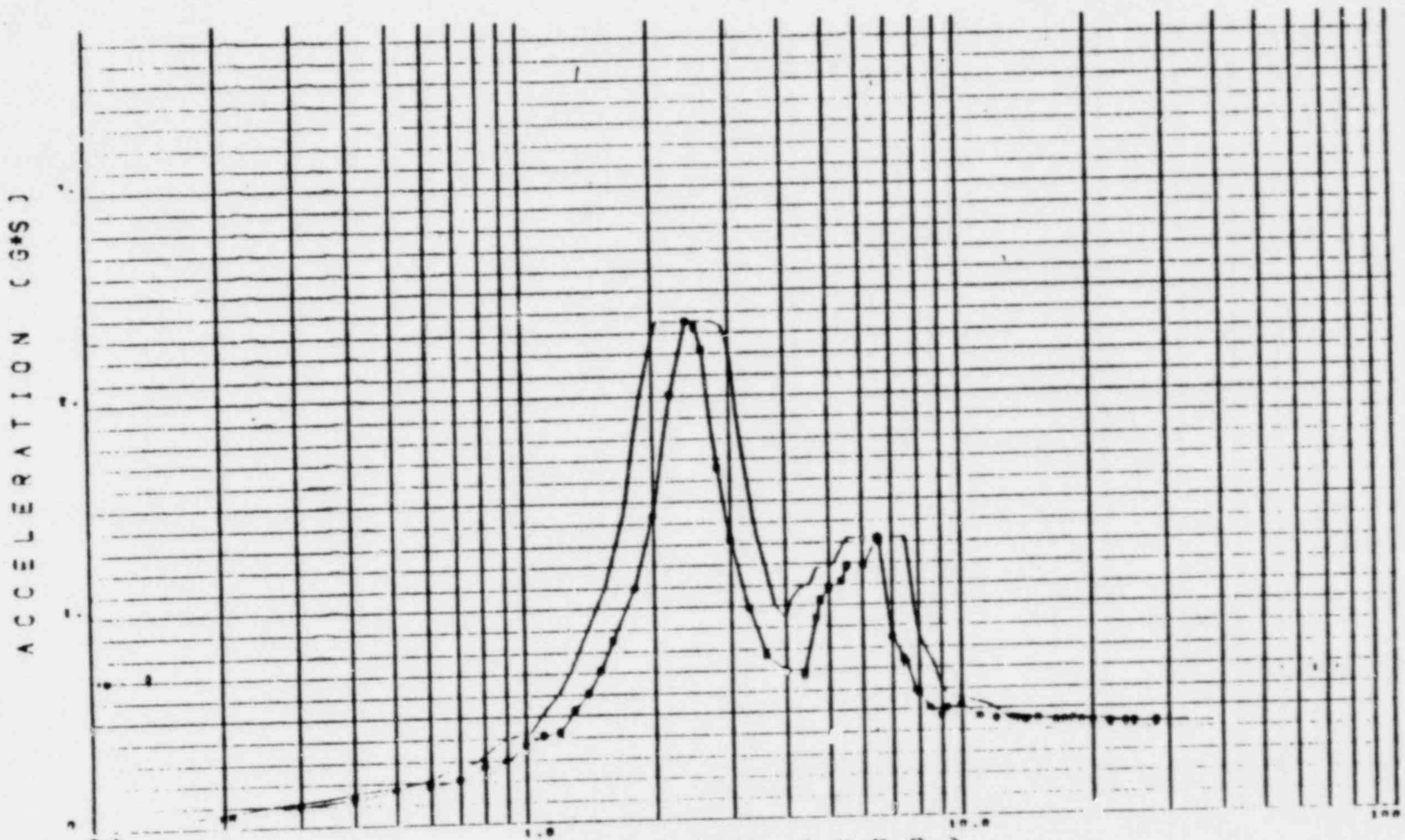


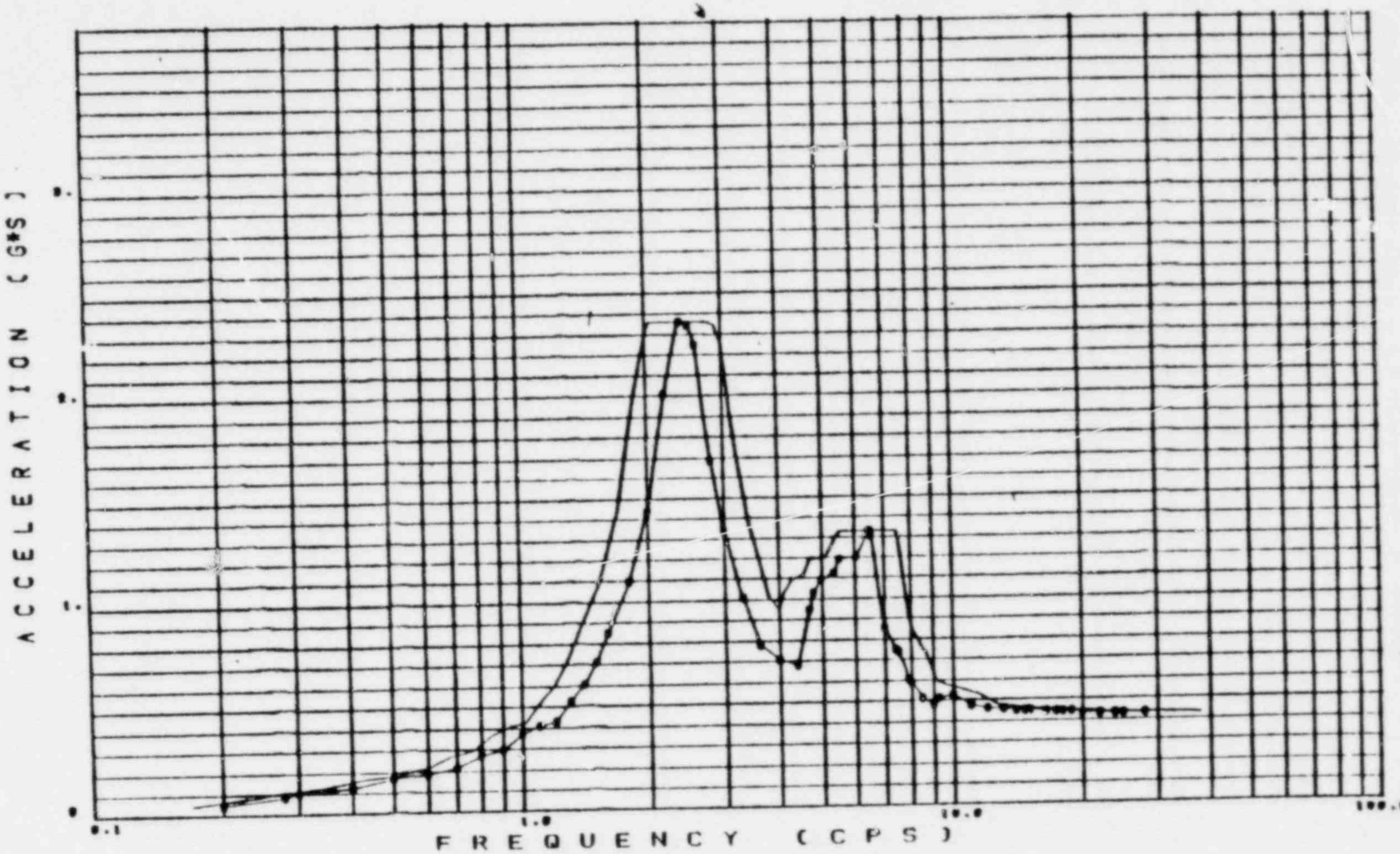
SPECTRA NODE 16 DRYWELL EL. 134.50
SSE E-W

E1313

SHT 49
REV 3

DAMPING = .0200

BECHTEL CORPORATION



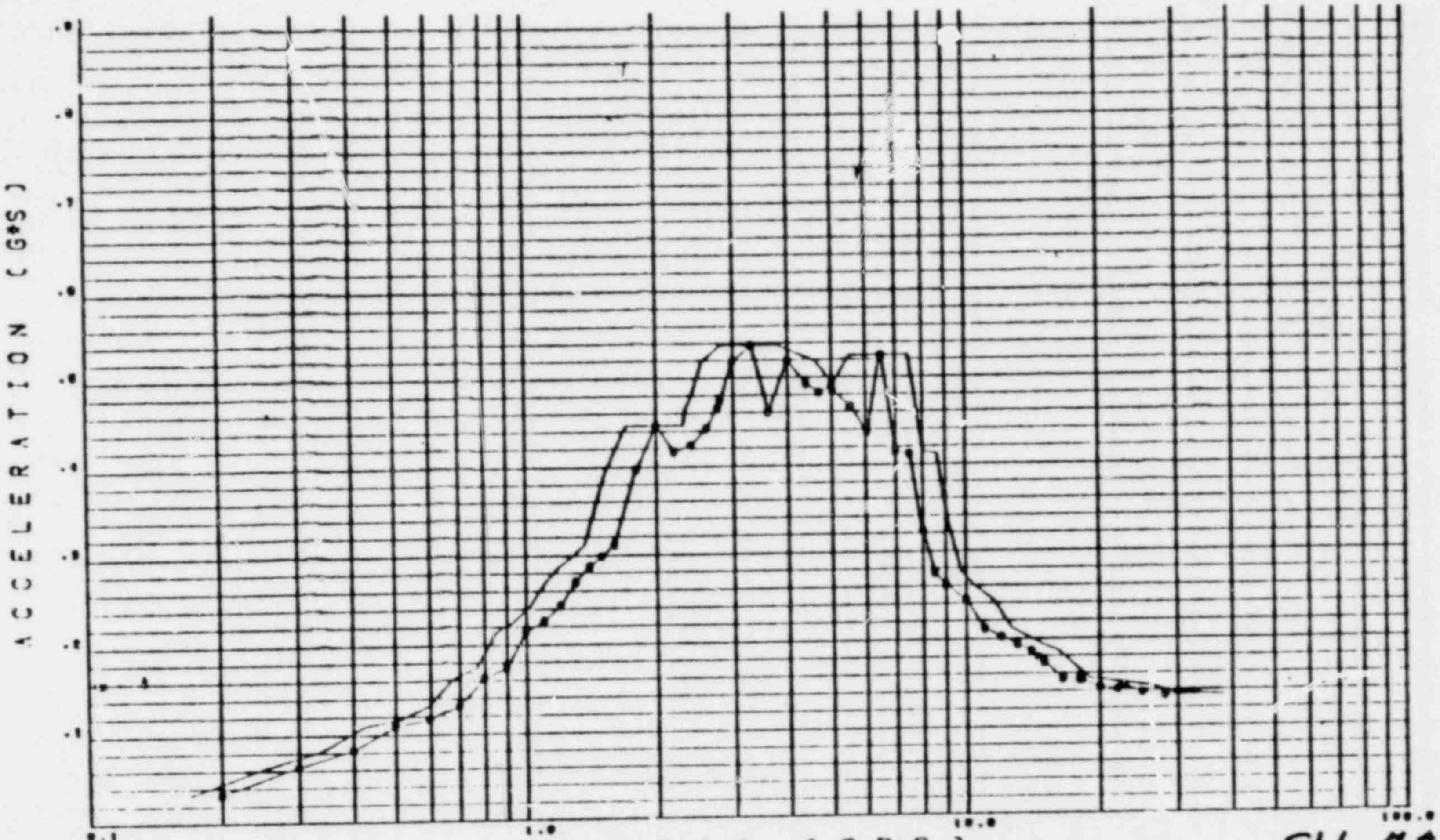
SPECTRA NODE 16 DRYWELL EL. 184.50
SSE N-S

N1313

Sht 61
Rev 3

DAMPING = .0200

BECHTEL CORPORATION

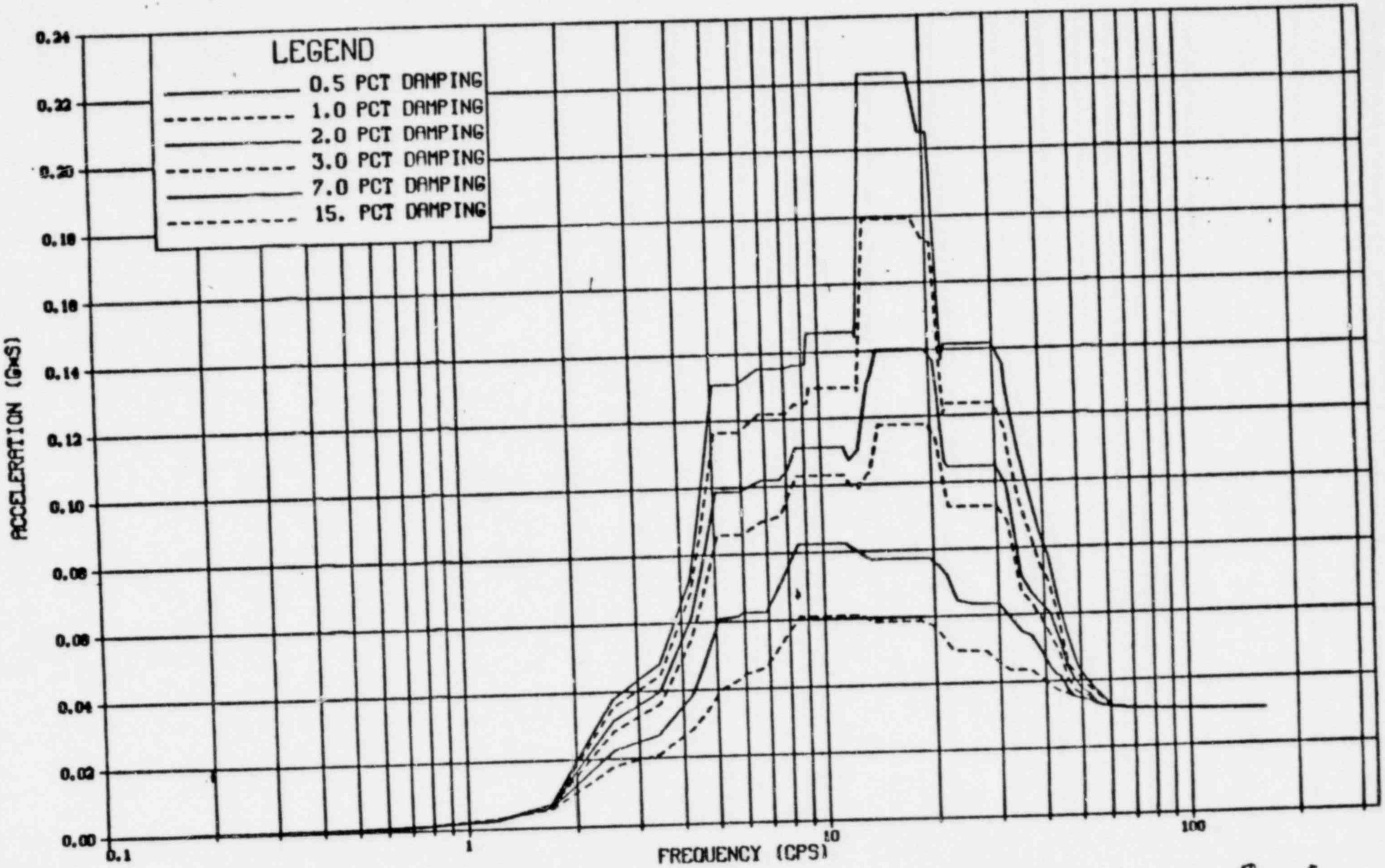


SPECTRA NODE 16 DRYWELL EL. 184.50
SSE VERTICAL

V1313

Sht. 73
Rev. 3

RESPONSE .PECTRA ENVELOPES



SPECTRA NODE1 BELLOWS EL.182, 7 HORZTL
SRVA TWENTY VALVE CASE SCALE FACTOR - .65

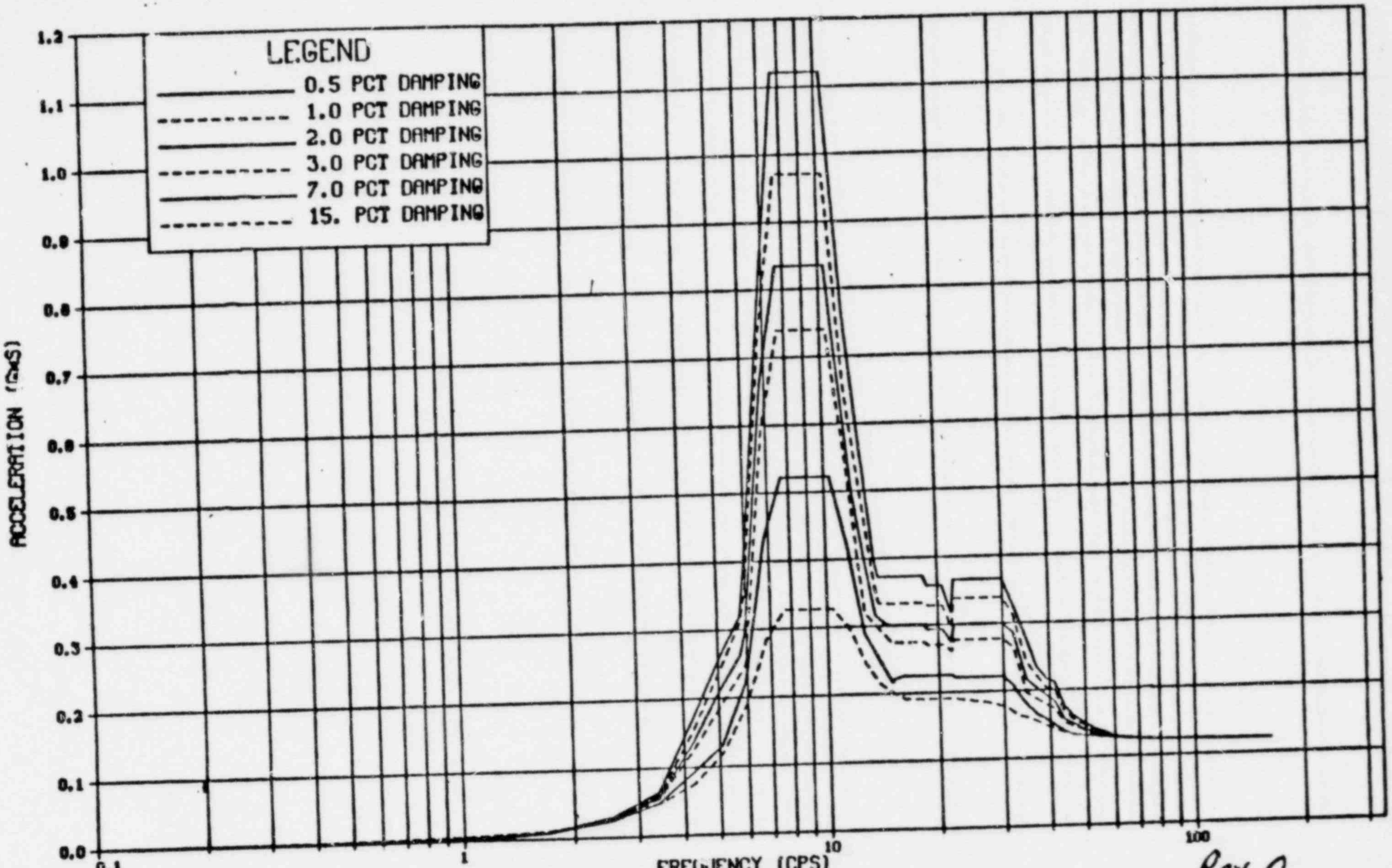
H1401

Rev. 0

Sht 1

PLOT 1 13.04.08 MON 2 JUL, 1979 JOB-ACISERO . CIRCUIT SCOPES.4 DISSPLA VER 7.5

RESPONSE SPECTRA ENVELOPES



Rev. 0

SPECTRA NODE1 BELLOWS EL. 182.17 VERTCL
SRVA TWENTY VALVE CASE SCALE FACTOR - .65

V140'

SHT 2

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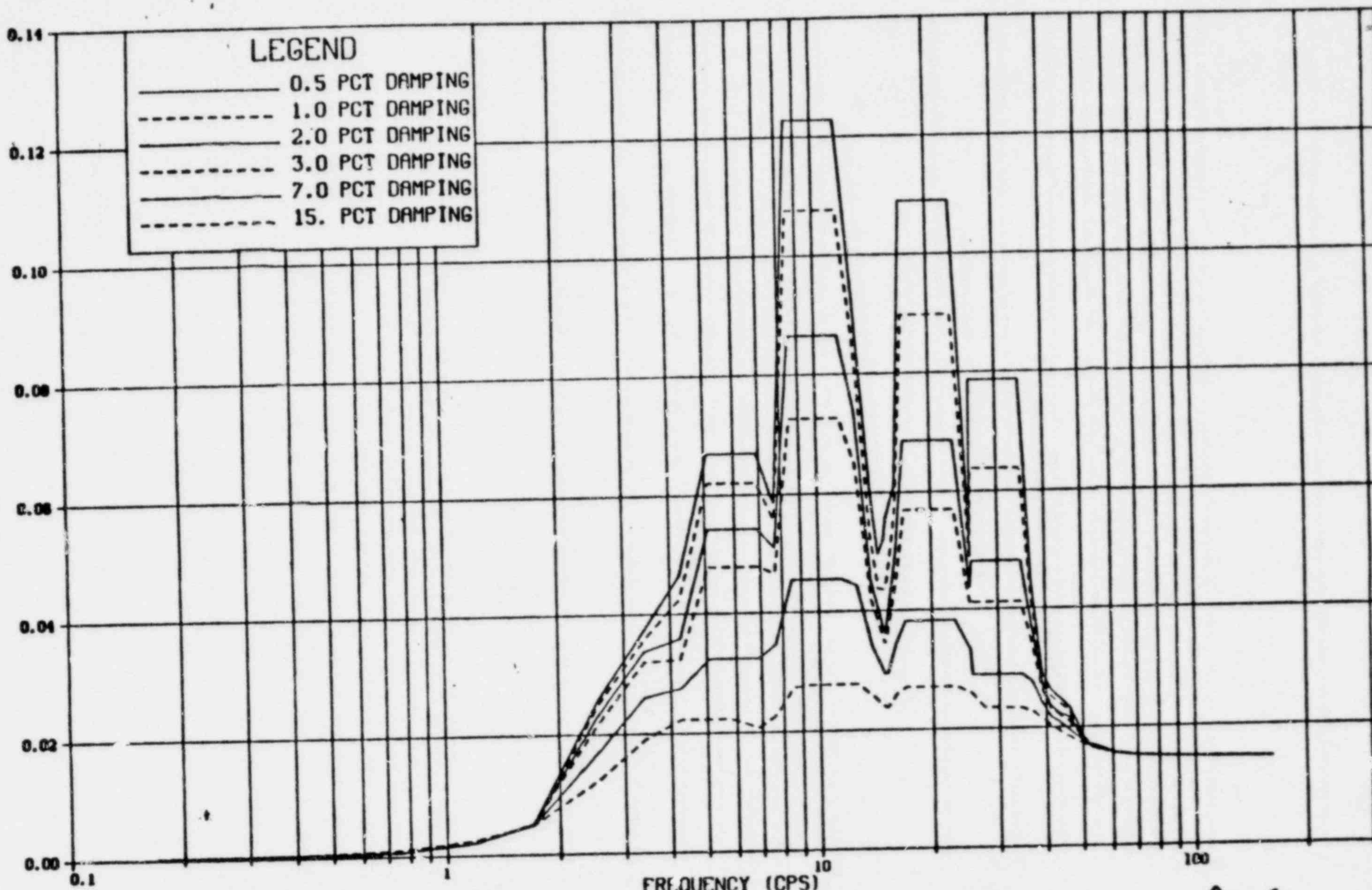

SPECTRA NODE1 BELLOWS EL. 182.17 HORZTL
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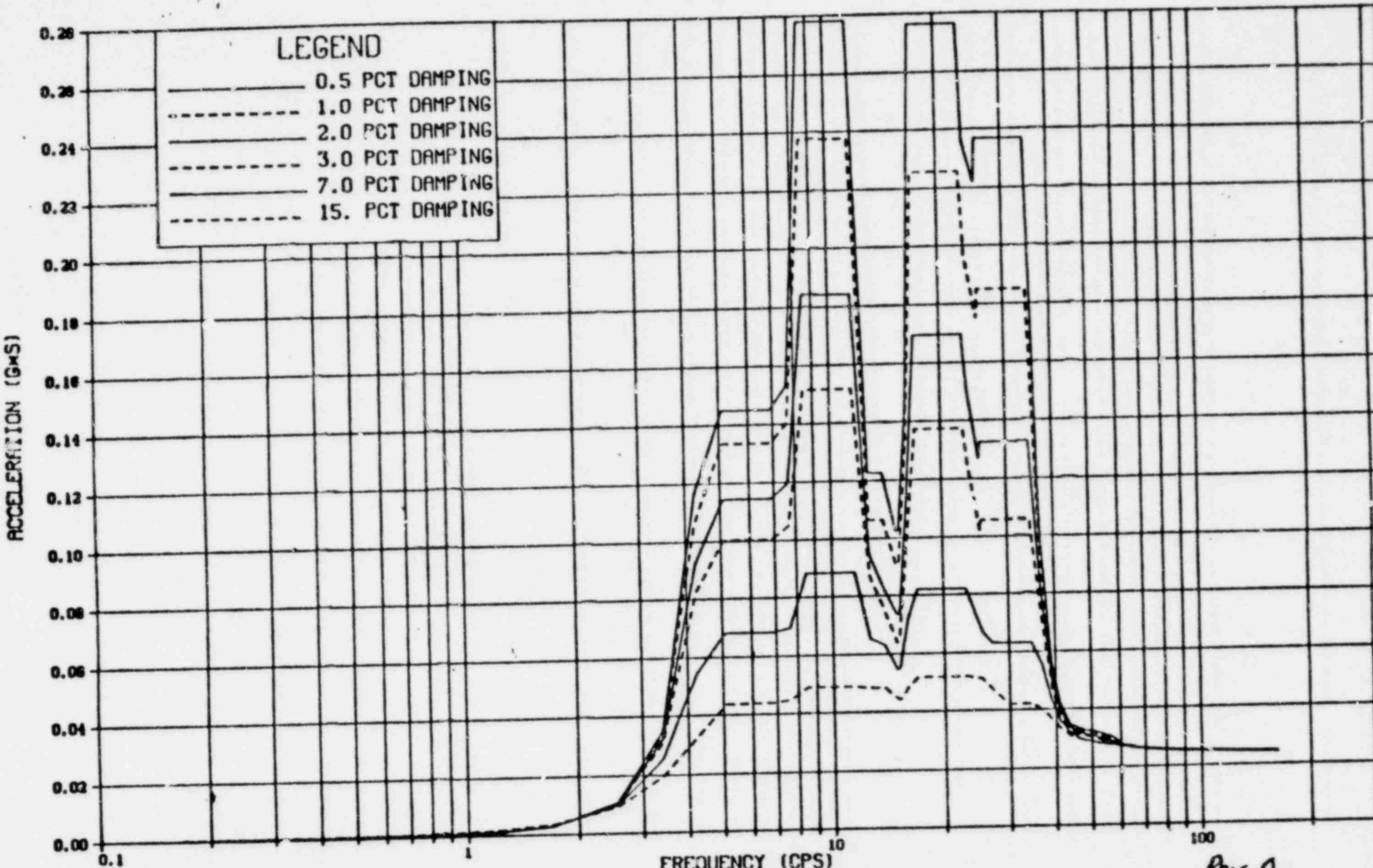
Rev 0

H1411

Sht 11

RESPONSE SPECTRA ENVELOPES



Rev. 0

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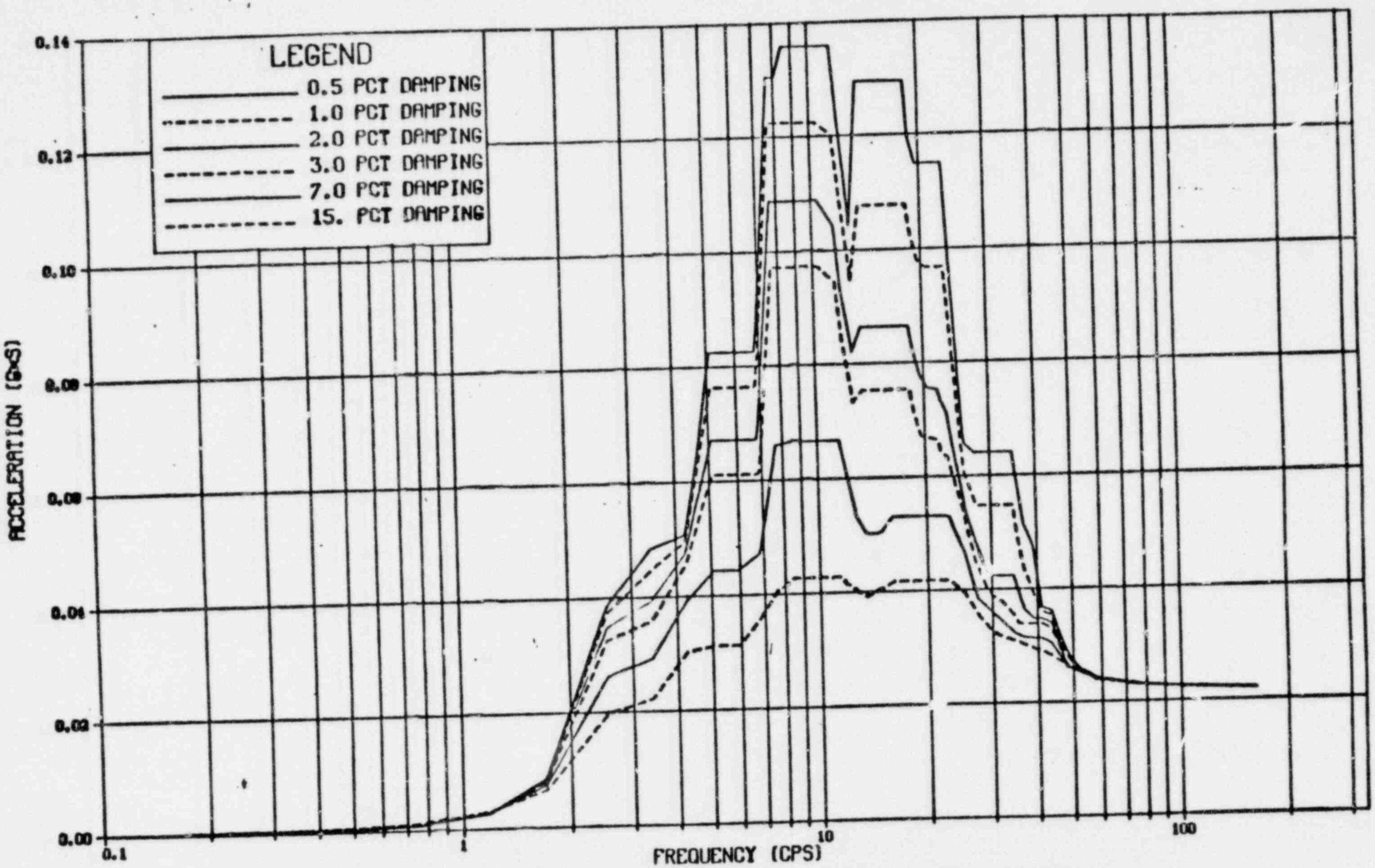
V1411

Sht 12

RESPONSE SPECTRA ENVELOPES



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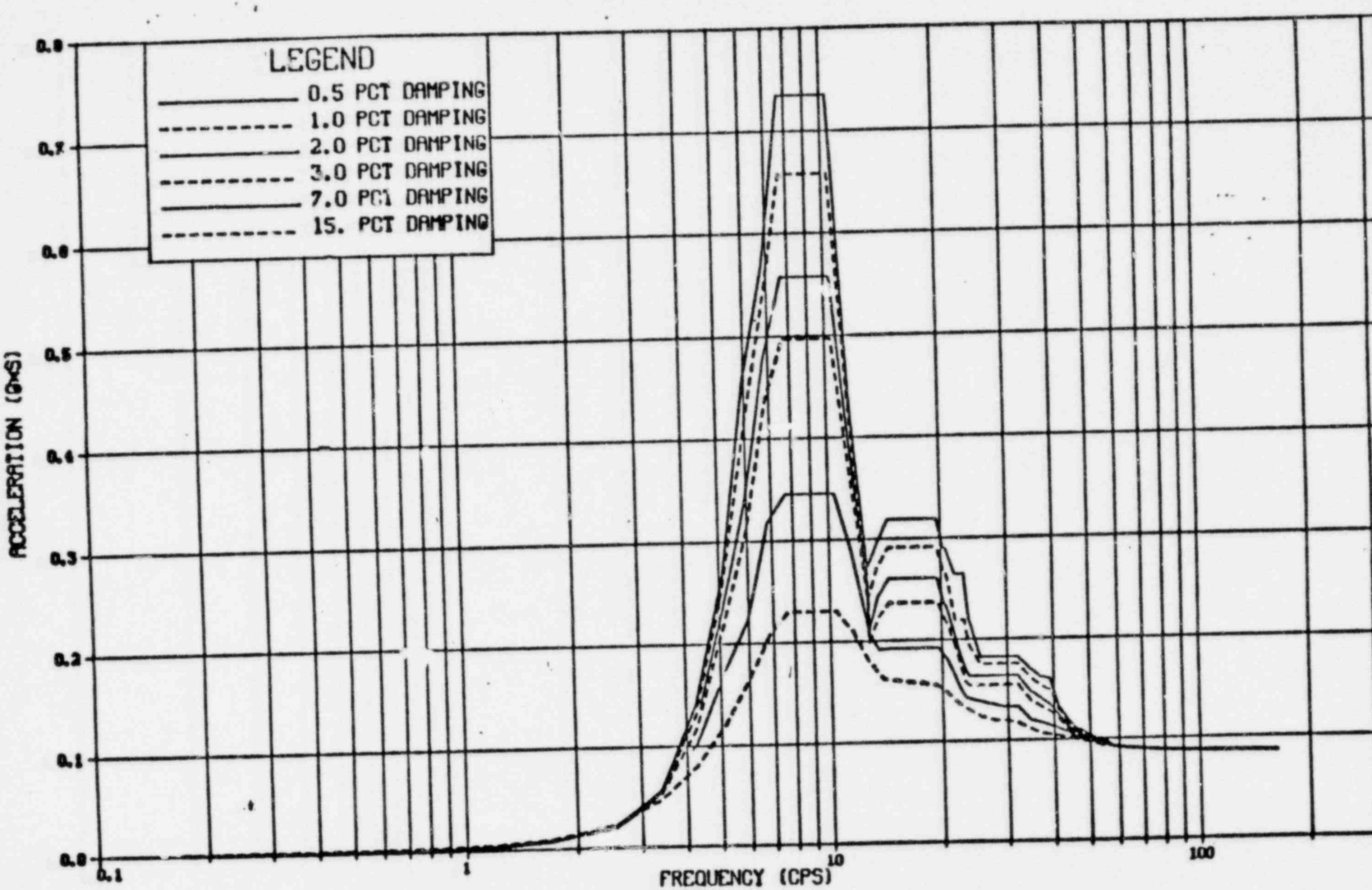
SRVA EIGHT ADS VALVES   SCALE FACTOR - .65

H1421

Rev 0
Sht 21

RESPONSE SPECTRA ENVELOPES



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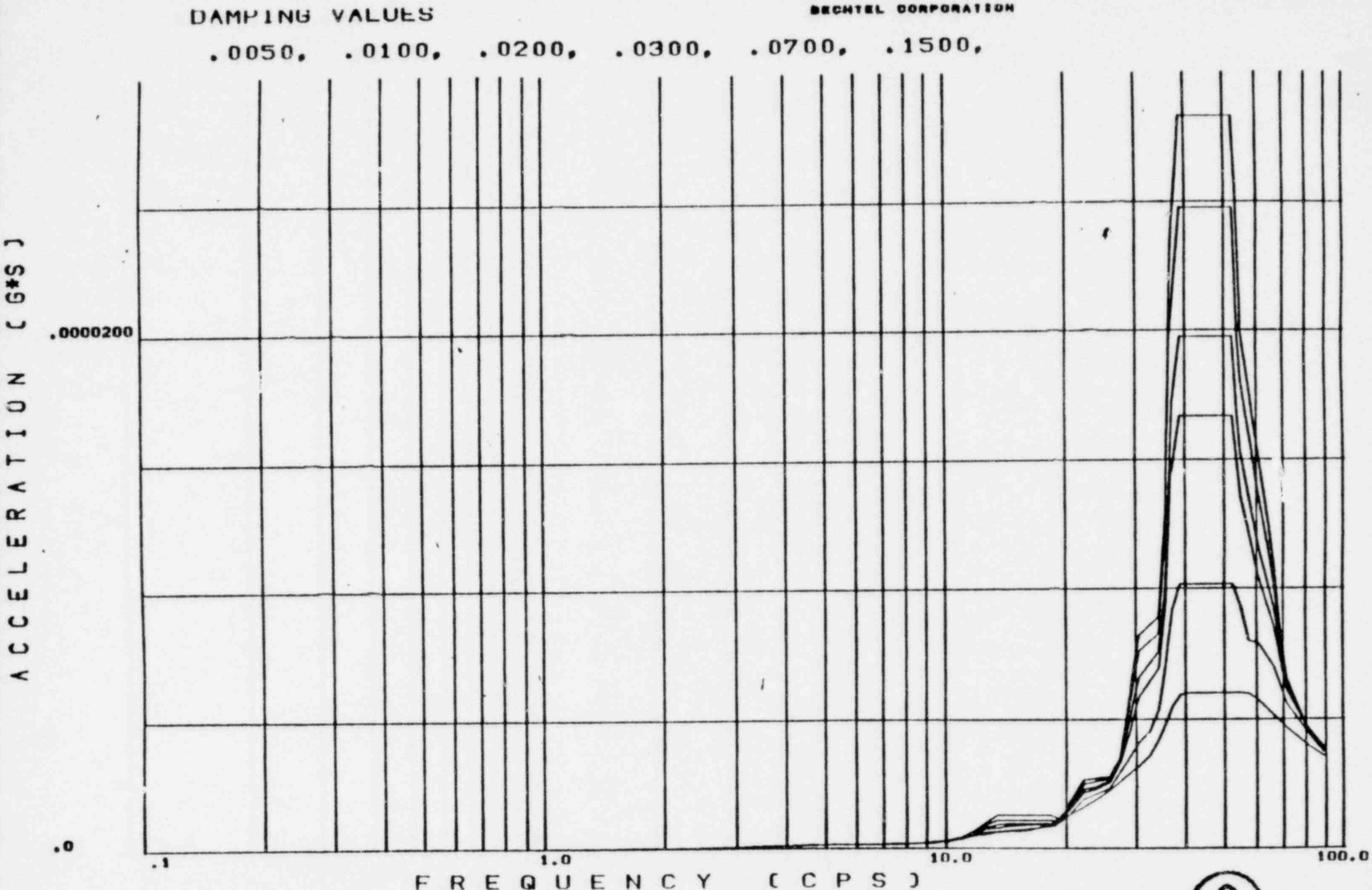
SRVA EIGHT ADS VALVES SCALE FACTOR - .65

V1421

Rev 0
Sht 22

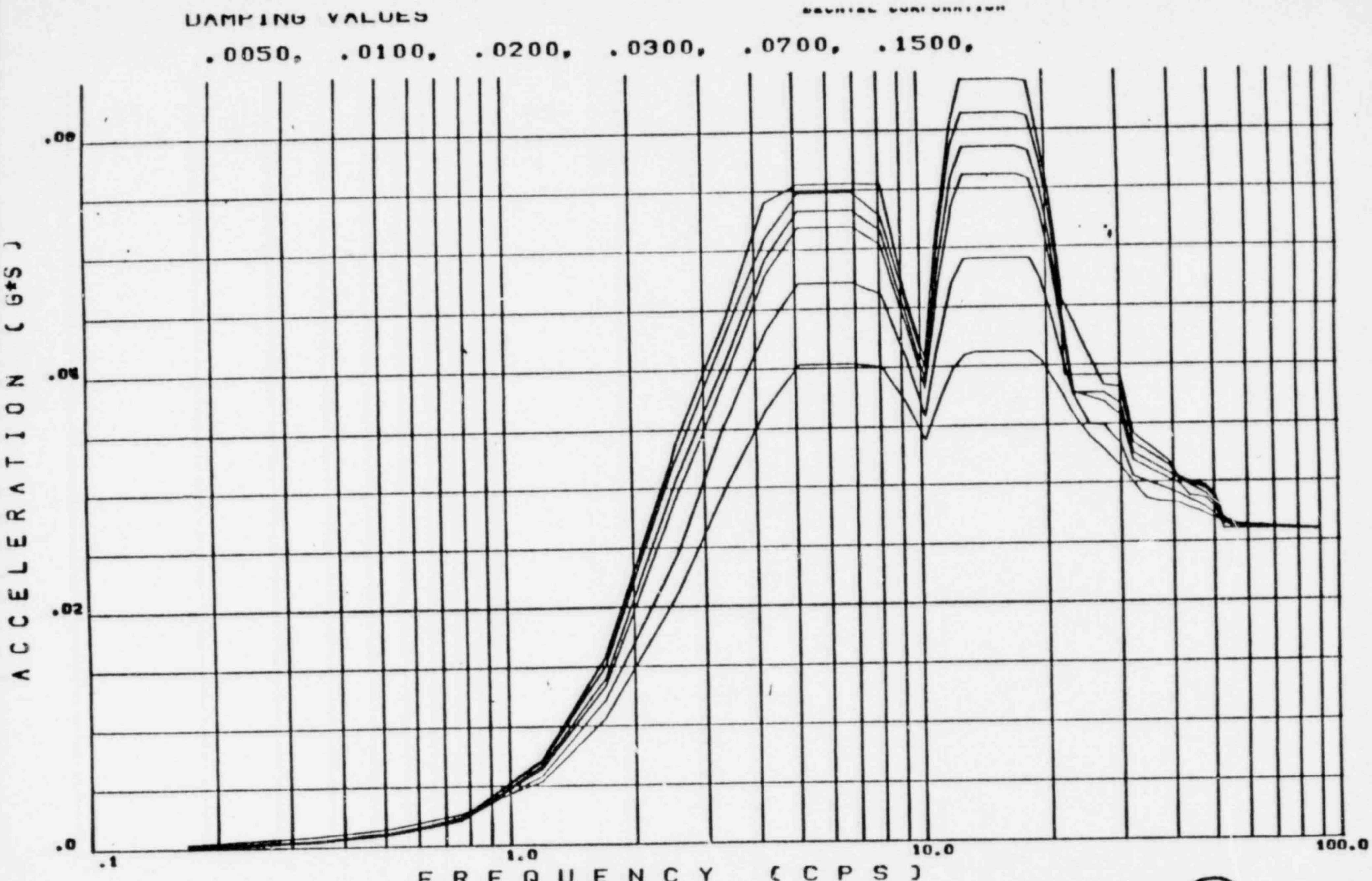


SPECTRA NODE1 BELLOWS EL.182.17 RADIAL
LOCA - VENT CLEARING

Q

Rev0

CE802E1 REBHEW6 11/29/79 FRAME 1

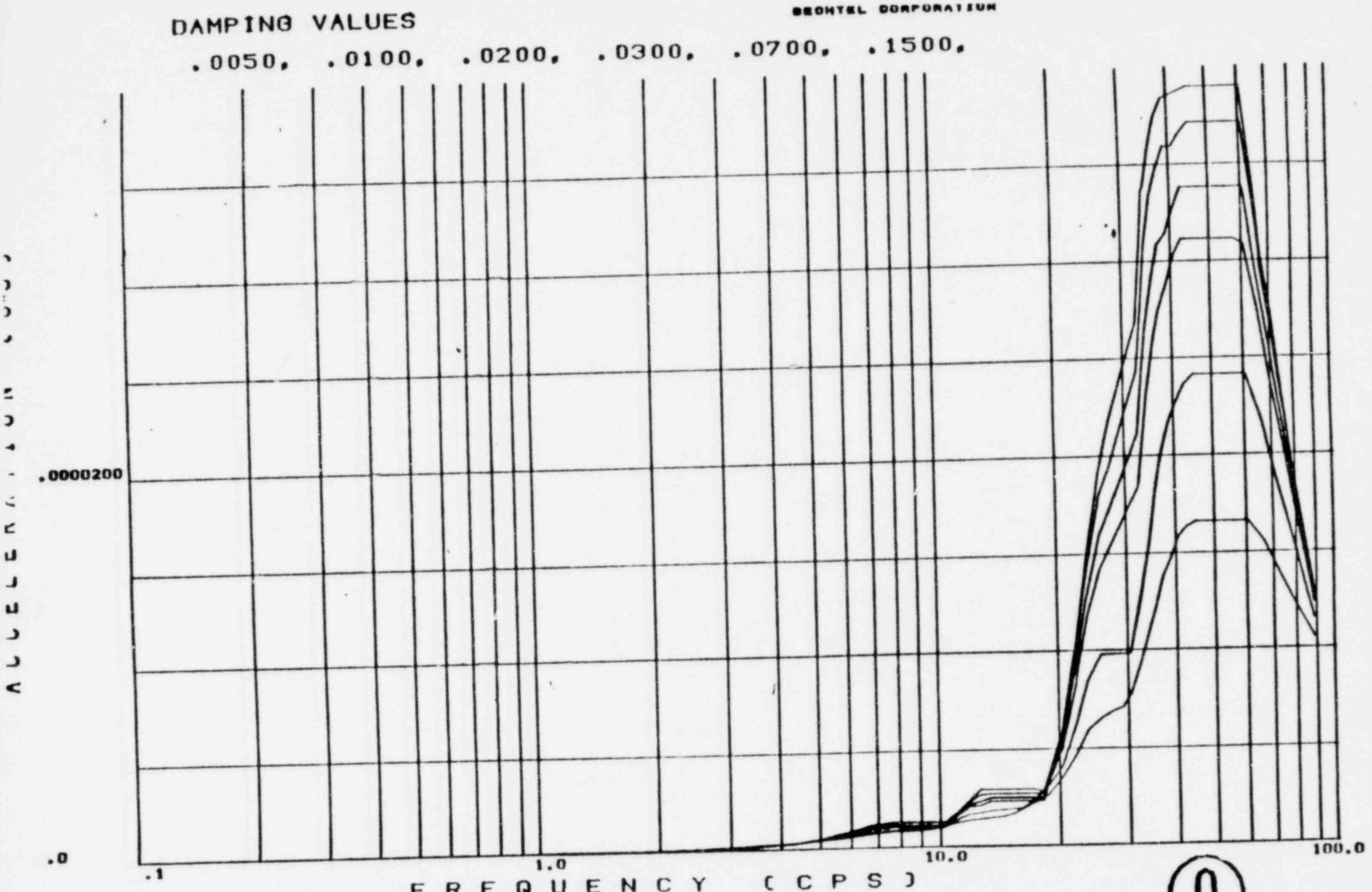


SPECTRA NODE1 BELLOWS EL.182.17 VERTCL (Q)
LOCA - VENT CLEARING

Rev 0

CE802E1 REBHEW6 11/29/79 FRAME 2

Sht 32



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LOCA - POOL SWELL

Q

Sh. 41
Rev 0

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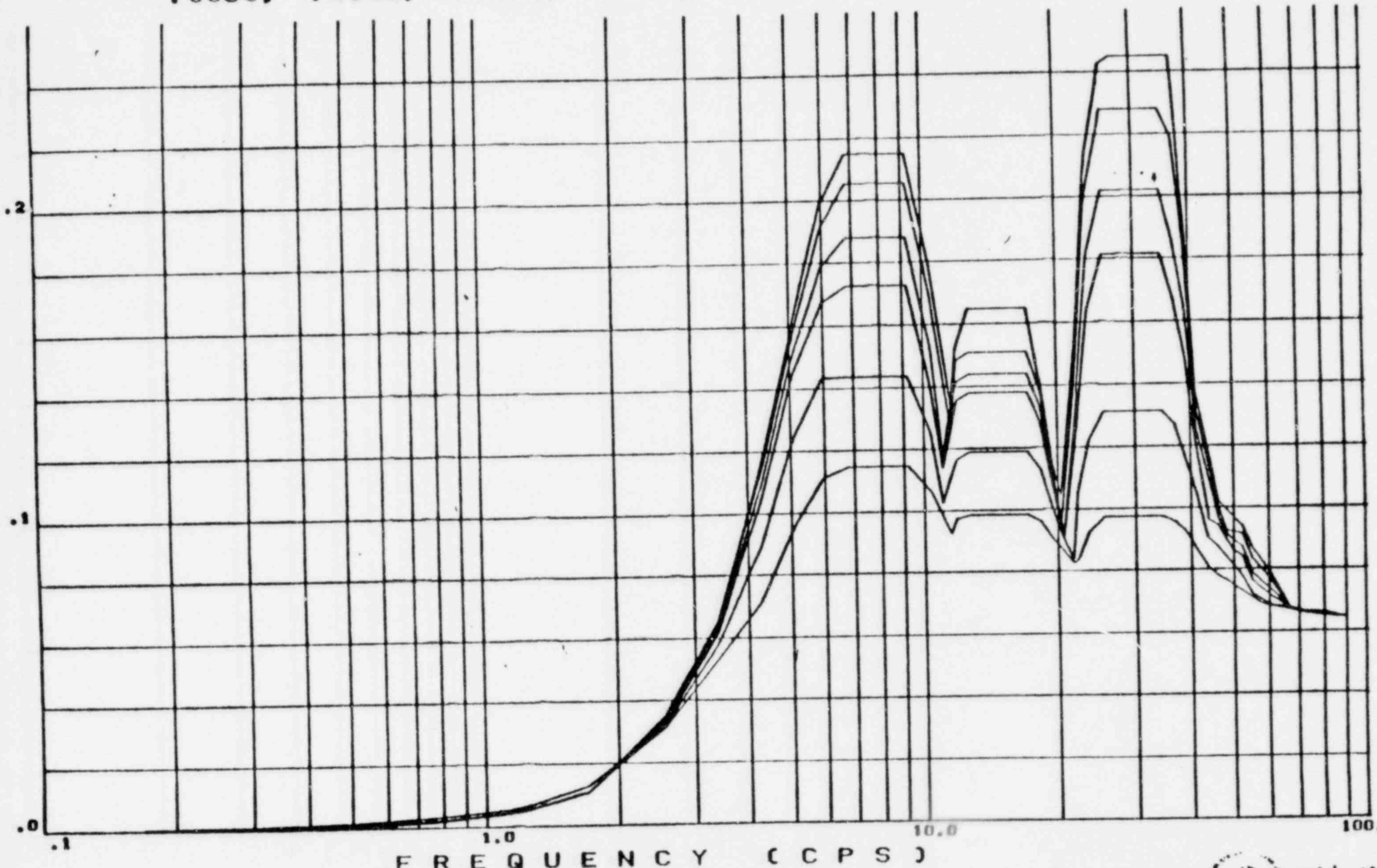

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LOCA - POOL SWELL

(1) Sht. 42 Rev.0

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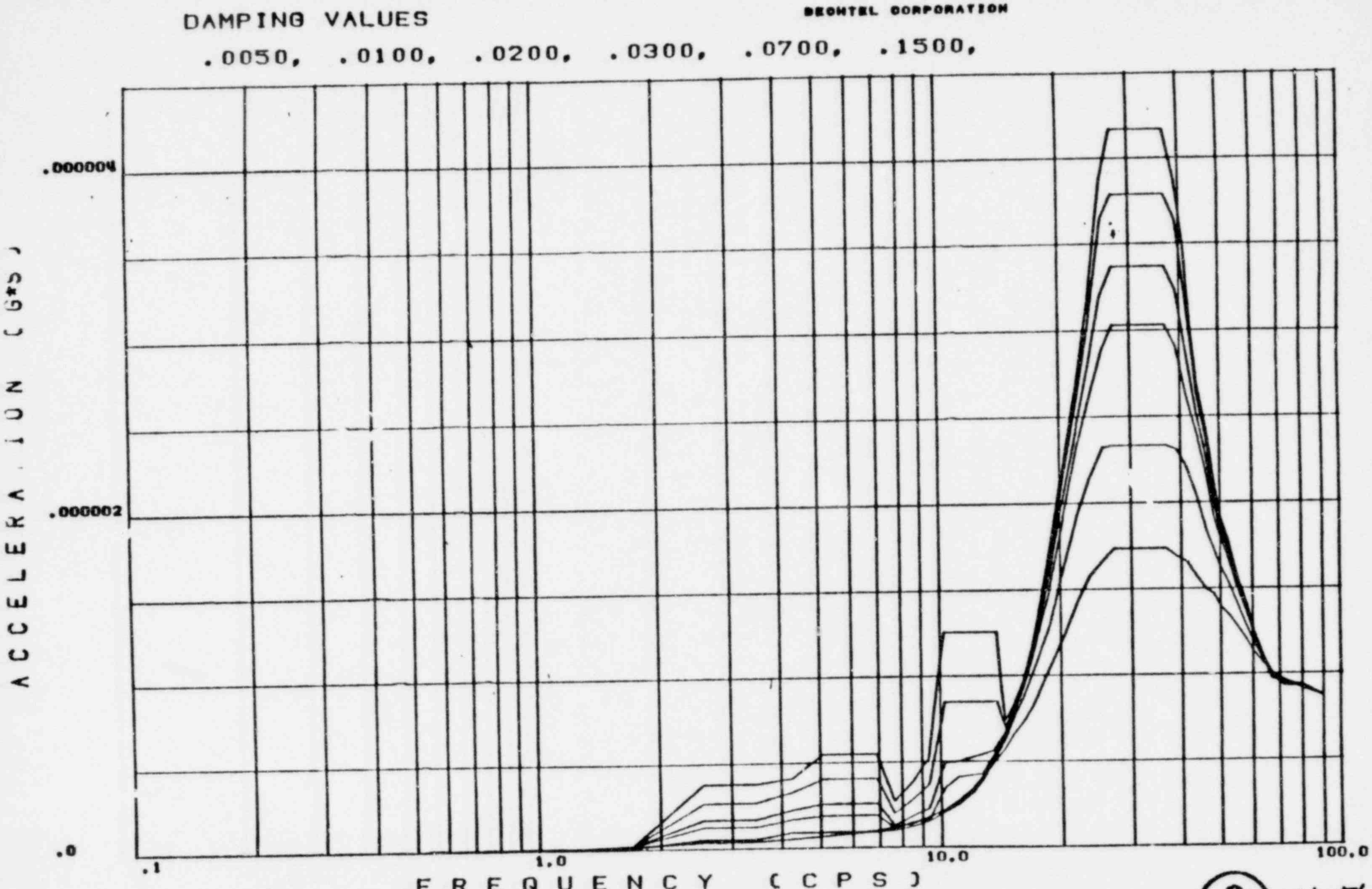

Q SAt. 51 Rev.0

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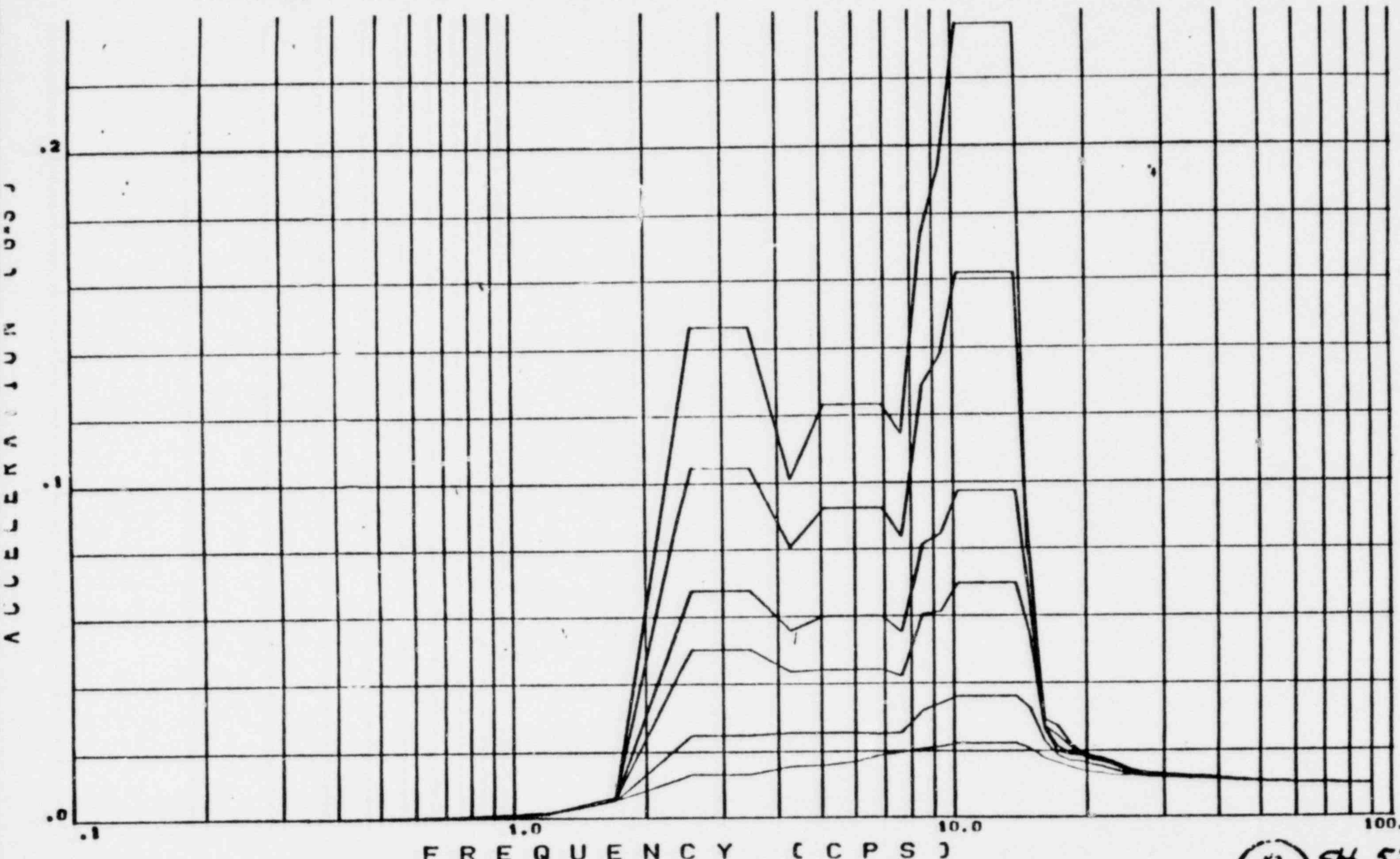

Q Sh. 52 Rev. 0

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LOCA - CONDOSC

CEB02F1 RDNQENQ 12/03/79 FRAME 2

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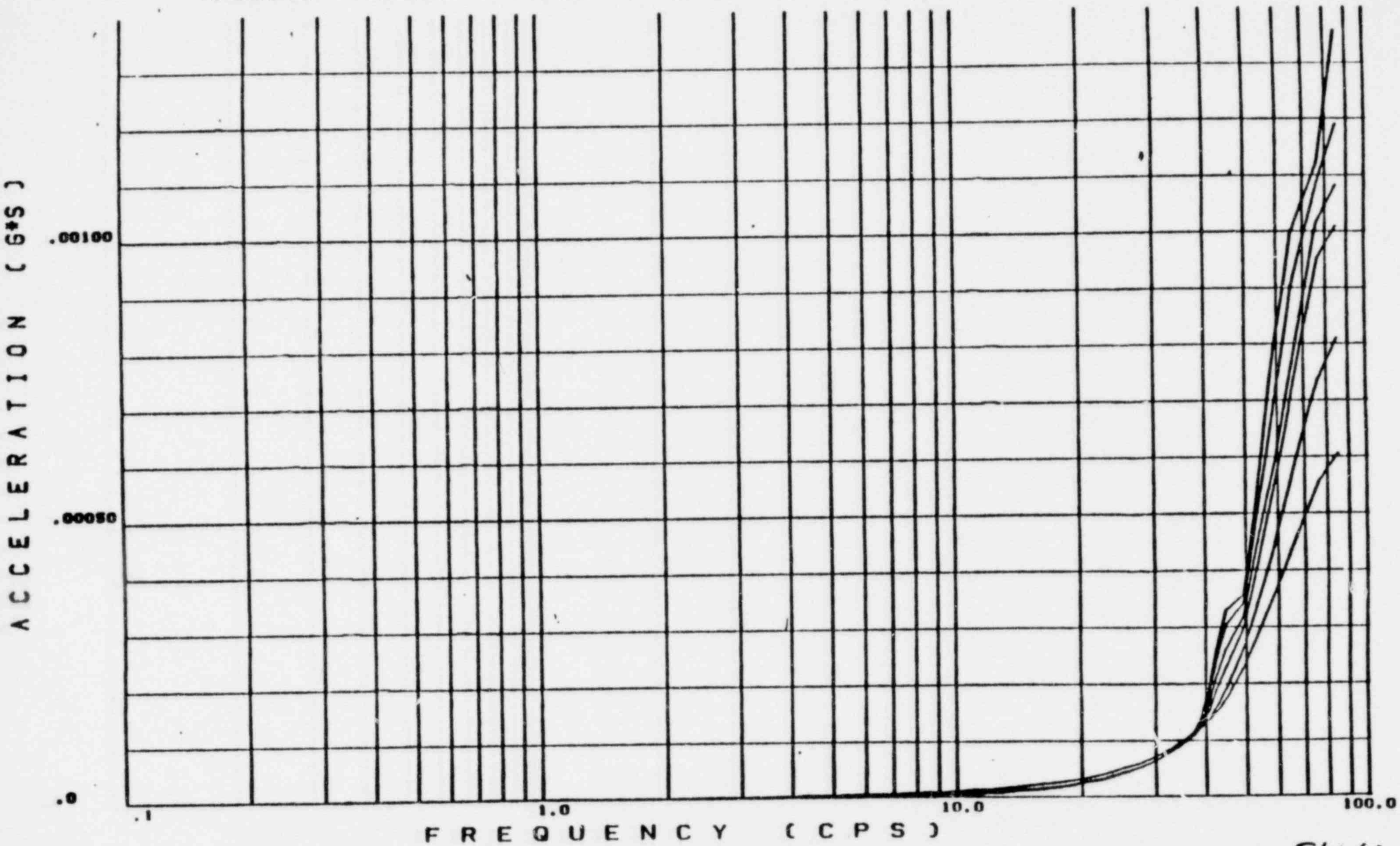
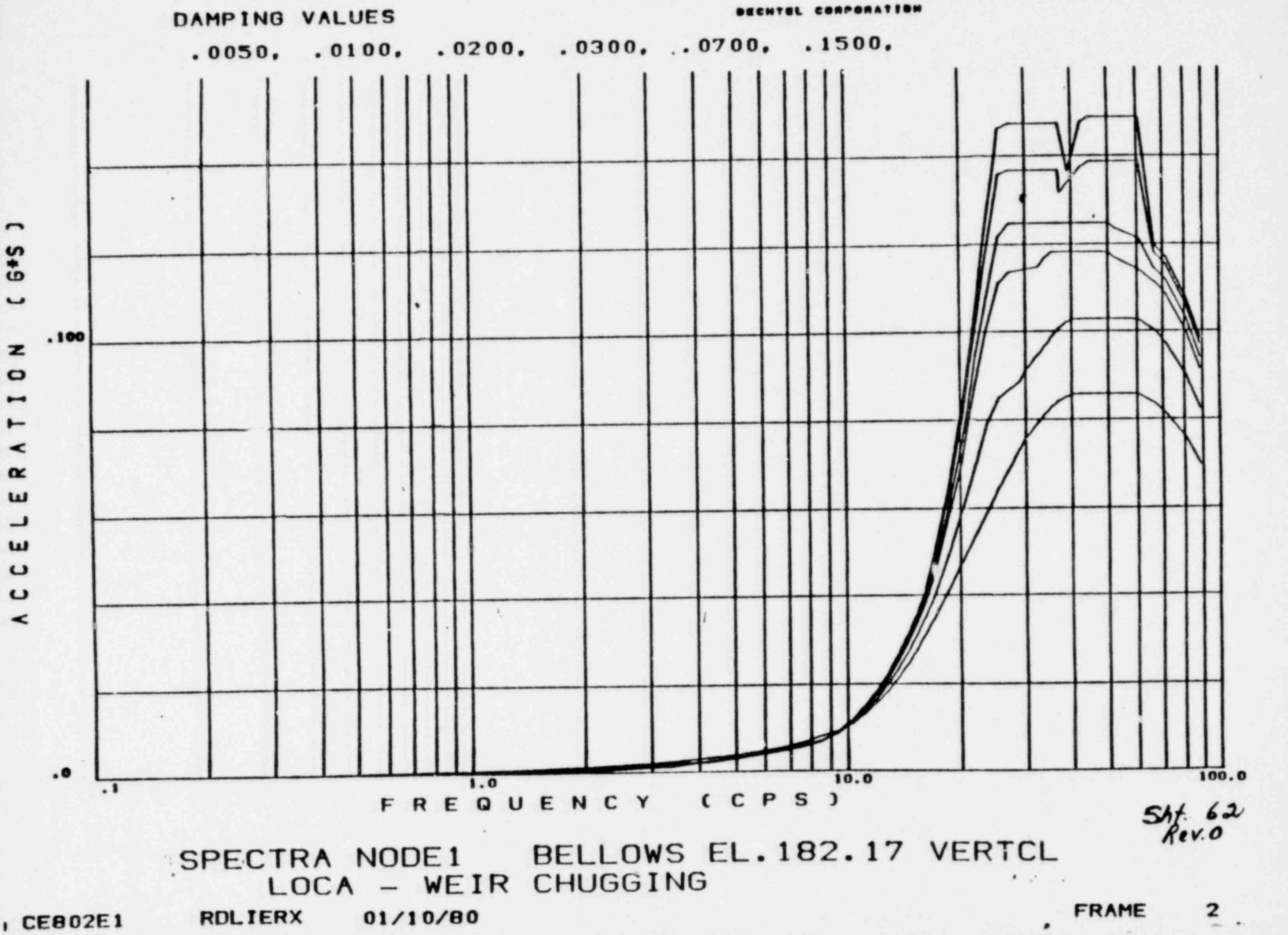


Sht. 61
Rev 0

SPECTRA NODE1 BELLOWS EL.182.17 RADIAL
LOCA - WEIR CHUGGING

CE802E1 RDLIERX 01/10/80 FRAME 1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FREQUENCY (CPS)
Sht. 62
Rev.0
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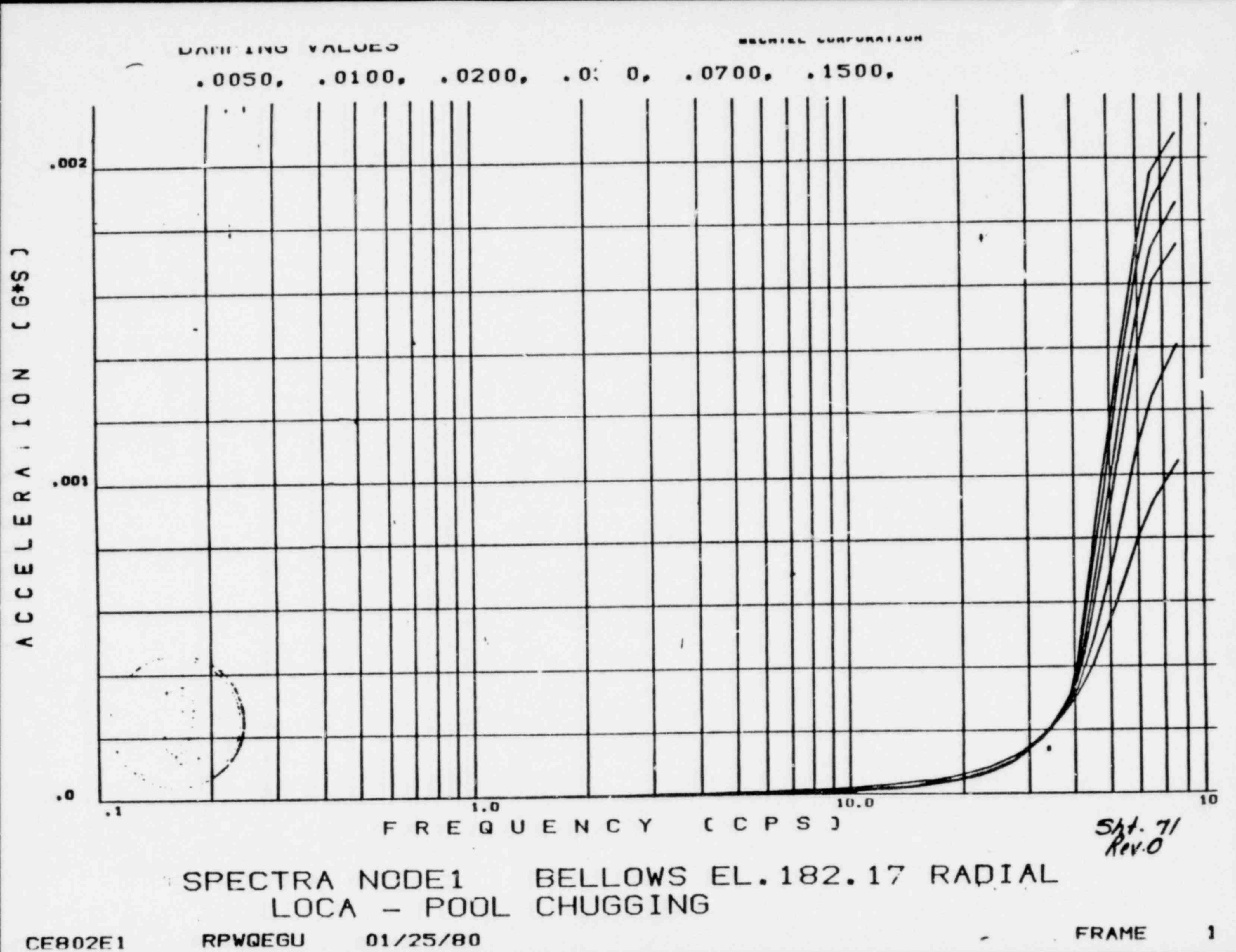
LOCA - WEIR CHUGGING
CE802E1
RDLIERX
01/10/80
FRAME 2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Sht. 71
Rev.0
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LOCA - POOL CHUGGING
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RPWQEGU
01/25/80
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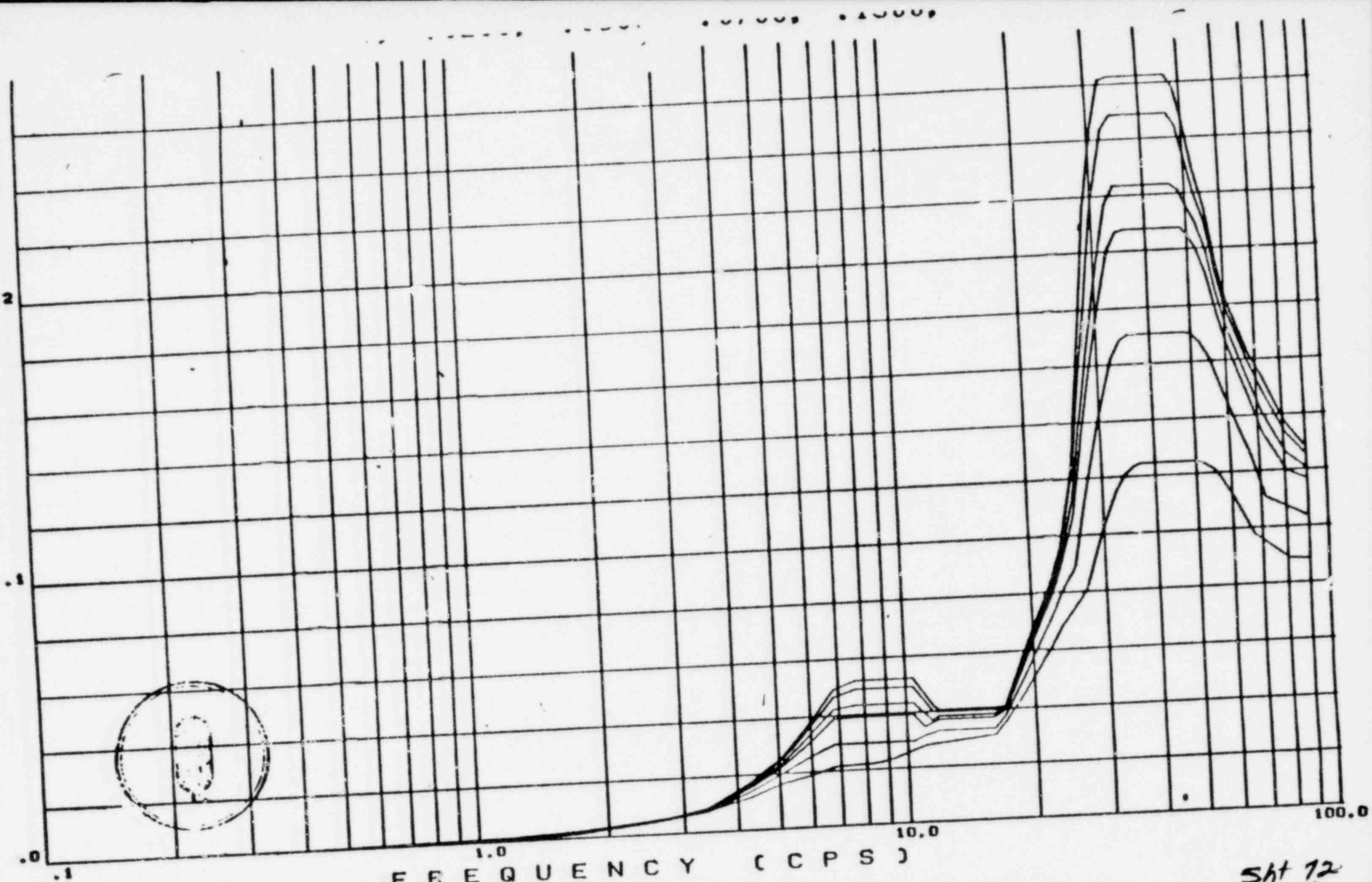


SPECTRA NODE1 BELLOWS EL.182.17 VERTCL
LOCA - POOL CHUGGING

Sht 72
Rev.0

FRAME 2

:802E1 RPWQEGU 01/25/80

ITEM 3

GRAND GULF NUCLEAR STATION UNIT 1

QUALIFICATION SUMMARY

1. **Equipment Name** Pressure Indicator Switch (Master Trip Unit)
2. **Equipment No.** 1P41 PIS N602A
3. Qalification Documentation (Enclosed with this report.)

   A. Qualification Summary of Equipment (SQRT form), including required response spectra with TRS plotted on RRS graph as appropriate.

   See attached SQRT Forms

   B. Reference Documents

Reference Number	Document Identification	Revision or Date	Title/Subject
1	9645-J-301.0 (with App. WD)	Rev. 23/5-15-81	Technical Specification for Electronic Instruments
2	3768A	3-9-76	Qualification Test Summary for the Trip/Calibration System Rosemount Model 510D
3	77522F		Rosemount Acceptance Test Procedures
4	4247-1 (Section II)	7/76	Trip/Calibration System Model 510DU

   C. Additional Supporting Documents

Document Identification	Revision or Date	Title/Subject
No. H 13-6 Index 1•15 Section 10 (For Panel H13-P871)	6-29-78	PGCC Seismic Certification Report (by General Electric)

QUALIFICATION SUMMARY (CONTINUED)

EQUIPMENT NO. 1P41-PIS-N602A

4. Functional Requirements

Energize on decreasing process conditions at a pre-determined set point.

5. Demonstration Capability

The pressure indicator switches (master trip units) performed successfully in accordance with Rosemount acceptance test procedure (Ref. 3).

The allowable shift in the trip unit was ± 0.13% of span. Tests showed a maximum shift of -0.024% of span which is within specified limits.

6. Rationale for Qualification Certification

(Include Decision analysis with comparison to acceptance criteria, approach for demonstrating operability, and consideration of high-frequency response.)

The fact that the equipment survived an operational 11g and a non-operational 15g, 33HZ single frequency, single axis test was considered as creditable evidence of the specimens ability to resist seismically induced stresses. 1P41-PIS-N602A is located on panel 1H13-P871. Document No. H13-6, Index 1.15, PGCC Seismic Certification Report, Figure 1 on Page 13A shows location (4) for trip units. Test g level of 11g's on each axis exceeds the g level requirements for this equipment on the panel.

Qualification Summary of Equipment

I. **Plant Name:** Grand Gulf Nuclear Station Unit 1 — **Type:**

1. Utility: Mississippi Power and Light Co. — PWR ______

2. NSSS: G.E. 3. A/E: Bechtel Power Corp. — BWR 6, Mark III

II. Component Name: Pressure Indicator Switch

1. Scope: [ ] NSSS [X] BOP

2. Model Number: 510DU237028 Quantity: 2

3. Vendor: Rosemount Inc.

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance Circuit Board with a front control panel

   b. Dimensions (H x W x D) 6-31/32" x 1-3/16" x 9-7/8" (Ref. 4)

   c. Weight 1-3/8 pounds (0.62 kg) (Ref. 4)

6. Location: Building: Control Building

   Elevation: 190' 0"

7. Field Mounting Conditions [ ] Bolt (No.____, Size____)
   [ ] Weld (Length____)
   [X] 2 Captive Screws

8. a. System in which located: Standby service water

   b. Functional Description: Energize on decreasing process condition at a pre-determined set point

   c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
   [X] Both [ ] Neither

9. Pertinent Reference Design Specifications: 9645-J-301.0 Rev. 23 (with Appendix WD) (Ref. 1)

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method:

[X] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: 3768A/ Qualification Test Summary for the

(No., Title and Date) Trip/Calibration System Rosemount Model 510DU/ 3-9-76 (Date)

Company that Prepared Report: Rosemount Inc.

Company that Reviewed Report: Rosemount Inc.

V. Vibration Input:

1. Loads considered: a. [X] Seismic only

   b. [ ] Hydrodynamic only

   c. [ ] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [ ] SRSS [X] N/A (other, specify)

3. Required Response Spectra (attach the graphs): Attached Figure 2

4. Damping Corresponding to RRS: OBE 3% SSE 3%

5. Required Acceleration in Each Direction: [X] ZPA [ ] Other (specify)

OBE	S/S = 0.55g	F/B = 0.55g	V = 0.55g
SSE	S/S = 0.55g	F/B = 0.55g	V = 0.55g

6. Were fatigue effects or other vibration loads considered?

   [X] Yes [ ] No

   If yes, describe loads considered and how they were treated in overall qualification program: Fragility tests were considered at 15 and 20g's to determine if the unit is still operational after exposure to these high g levels

*NOTE: If more than one report complete items IV thru VII for each report.

VI. If Qualification by Test, then Complete*:

1. [X] Single Frequency [ ] Multi-Frequency: [ ] random [X] sine beat [ ] ________

2. [X] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE ________ SSE 1 Other See VI-12 (specify)

4. Frequency Range: Single frequency of 33HZ

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = None below 33HZ F/B = None below 33HZ V = None below 33HZ

6. Method of Determining Natural Frequencies

   [X] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graphs) [X] No

8. Input g-level Test: OBE S/S = ________ F/B = ________ V = ________

   SSE S/S = 11g F/B = 11g V = 11g

9. Laboratory Mounting:

   1. [ ] Bolt (No.____, Size____) [ ] Weld (Length____) [X] 2 Captive Screws

10. Functional operability verified: [X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Test results showed a maximum shift in trip point was -0.024% of span. This was within the specified shift of ±0.13% of span. No modifications to the trip units were required.

12. Other test performed (such as aging or fragility test, including results): After seismic test of 11g's, temperature/humidity and radiation tests were performed successfully. Fragility tests were then performed at 15g's and 20g's. The trip units passed the tests successfully although some damage was sustained by the cardfile structure holding the trip units.

    A resonance search from 5HZ to 200HZ at 2g's with sweep rate of 1 octave per minute in each of 3 mutually perpendicular axes was conducted before 11g's **

*Note: If qualification by a combination of test and analysis also complete Item VII.

** seismic test. All resonances with Q's greater than 2 were found to be at frequencies above 33HZ.

VII. If Qualification by Analysis, then complete: N/A

1. Method of Analysis:

   [ ] Static Analysis [ ] Equivalent Static Analysis

   [ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = ________ F/B = ________ V = ________

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

   [ ] Finite Element [ ] Beam [ ] Closed Form Solution

4. [ ] Computer Codes: ________

   Frequency Range and No. of modes considered: ________

   [ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
   [ ] Other: ________ (specify)

6. Damping: OBE ________ SSE ________ Basis for the damping used: ________

7. Support Considerations in the model: ________

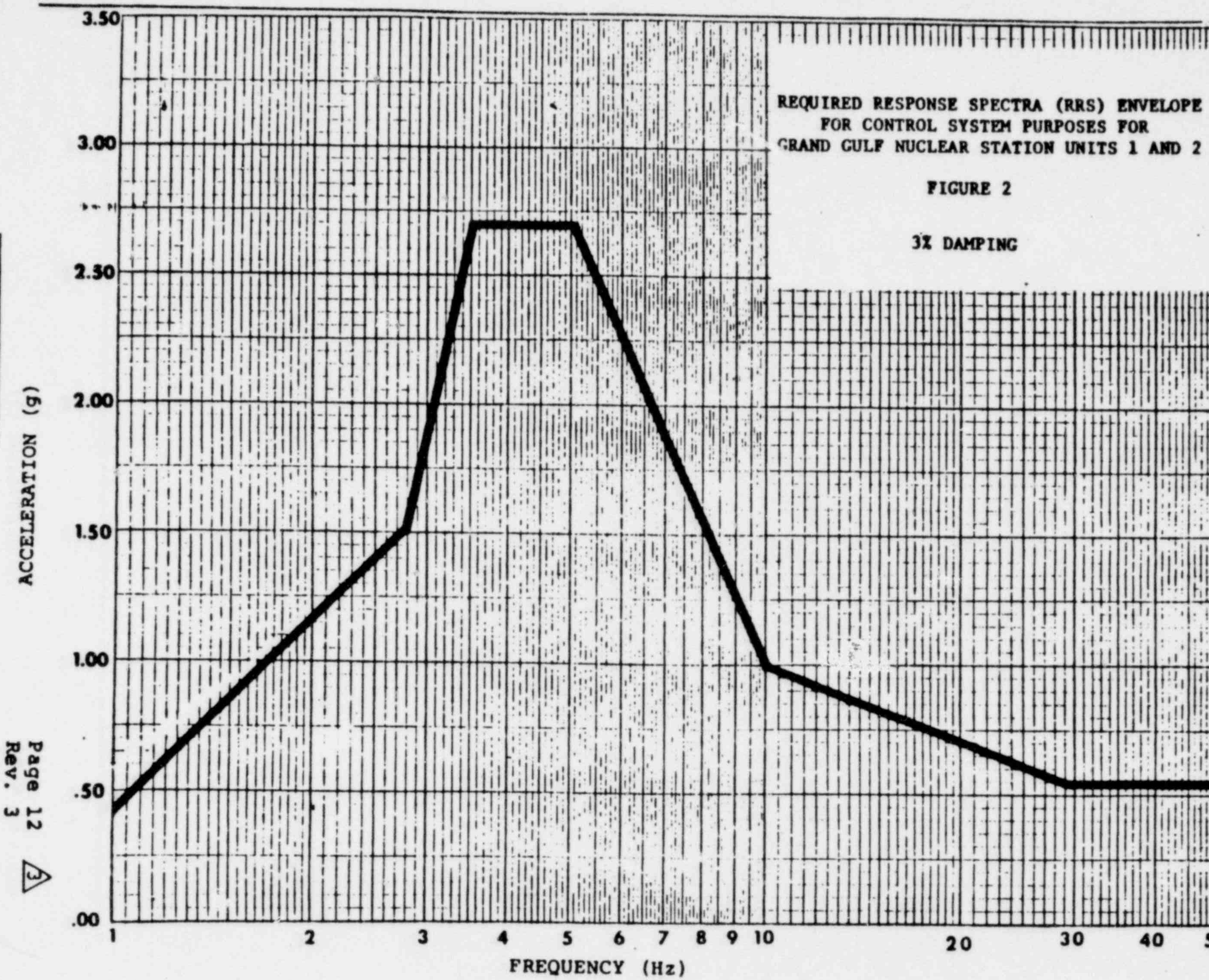
8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability


REQUIRED RESPONSE SPECTRA (RRS) ENVELOPE
FOR CONTROL SYSTEM PURPOSES FOR
GRAND GULF NUCLEAR STATION UNITS 1 AND 2
FIGURE 2
3% DAMPING
ACCELERATION (g)
3.50
3.00
2.50
2.00
1.50
1.00
.50
.00
FREQUENCY (Hz)
1
2
3
4
5
6
7
8
9
10
20
30
40
50

GRAND GULF NUCLEAR STATION UNIT 1

QUALIFICATION SUMMARY

1. **Equipment Name** Solenoid Valve, Model No. 75GG001
2. **Equipment No.** 1E12-SV-F060A
3. Qalification Documentation (Enclosed with this report.)

   A. Qualification Summary of Equipment (SQRT form), including required response spectra with TRS plotted on RRS graph as appropriate.

   SQRT forms attached

   B. Reference Documents

	Reference Number	Document Identification	Revision or Date	Title/Subject
1)	9645-J-610.0	Bechtel Design Specification	Rev. 16	Nuclear Service Solenoid Valves for MP&L
2)	Appendix WW	Bechtel Seismic Requirements	Rev. 5	Power Operated Valves Requiring Seismic Qual. For MP&L
3)	Report 1735	Target Rock Corp.	5-7-76	Seismic Report for Solenoid Motor Operated Valves (Analysis)
4)	Report 1827	Target Rock Corp.	11-4-76	Environmental Test Report on 75GG002 Solenoid Motor Valve, Soft Seated, High Pressure Version
5)	Report 1500	Target Rock Corp.	10-22-74	Environmental Test Report on 72V Solenoid Valve (with rectifier)

   C. Additional Supporting Documents

Document Identification	Revision or Date	Title/Subject

4. Functional Requirements

must maintain their safety related functional capability under all normal and abnormal plant operating conditions--must maintain a set position open, closed or modulating during a seismic event--must maintain system pressure integrity in order to perform their safety function

5. Demonstration Capability

Solenoid valves operated satisfactorily before, during and following tests that were performed to demonstrate that they could meet the functional requirements

6. Rationale for Qualification Certification

(Include Decision analysis with comparison to acceptance criteria, approach for demonstrating operability, and consideration of high-frequency response.)

Both the test and analysis used 4.5g's as input acceleration which is conservatively greater and more severe than the required input motion of 3g ZPA minimum (Ref. App. WW, Fig. 1).

Operability without degradation was demonstrated before, during and after testing.

High frequency response considerations are not applicable as these devices are located in the auxiliary building.

Testing was performed on a solenoid valve without a rectifier, Ref. 4; with a rectifier, Ref. 5; and an analysis was performed on a solenoid valve, Ref. 3.

Qualification Summary of Equipment

I. **Plant Name**: Grand Gulf Nuclear Station Unit 1 | Type:

1. Utility: Mississippi Power & Light Co. (MP&L) | PWR ______

2. NSSS: General Electric 3. A/E: Bechtel | BWR 6, Mark III

II. Component Name Solenoid Valve

1. Scope: [ ] NSSS [X] BOP

2. Model Number: 75GG001 Quantity: 4

3. Vendor: Target Rock Corp., East Farmingdale, N.Y.

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance 2-Way, In-Line, Solenoid Valve

b. Dimensions 7½" x 14 3/4"

c. Weight 24 lbs.

6. Location: Building: Aux. Bldg., RHR Pump Room A

Elevation: 123'

7. Field Mounting Conditions [ ] Bolt (No.____, Size____)
[ ] Weld (Length____)
[X] In-Line, Socket Weld

8. a. System in which located: Residual Heat Removal System (RHR)

b. Functional Description: Provides on-off control in the RHR for Post Acc. Sampling

c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown

[X] Both [ ] Neither

9. **Pertinent Reference Design Specifications**: 9645-J-610.0, Rev. 16 and Appendix WW, Power Operated Valves Requiring Seismic Qualification for MP&L, Rev. 5.

III. Is Equipment Available for Inspection in the Plant: [x] Yes [ ] No

IV. Equipment Qualification Method:

[ ] Test [x] Analysis [ ] Combination of Test and Analysis

Qualification Report*: No. 1735, Seismic Report for Solenoid Motor Operated Globe

(No., Title and Date) Valve Assemblies, Model No's 75GG-001 & 75GG-002, 5-7-76

Company that Prepared Report: Target Rock Corporation

Company that Reviewed Report: Target Rock Corporation

V. Vibration Input:

1. Loads considered: a. [x] Seismic only

   b. [ ] Hydrodynamic only

   c. [ ] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [ ] SRSS [x] N/A (other, specify)

3. Required Response Spectra (attach the graphs): Used Required Input Motion (App.W Fig.1

4. Damping Corresponding to RRS: OBE N/A SSE N/A

5. Required Acceleration in Each Direction: [x] ZPA [ ] Other (specify)

OBE	S/S = 3g	F/B = 3g	V = 3g
SSE	S/S = 3g	F/B = 3g	V = 3g

6. Were fatigue effects or other vibration loads considered?

   [ ] Yes [x] No

   If yes, describe loads considered and how they were treated in overall qualification program:

*NOTE: If more than one report complete items IV thru VII for each report.

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis   [ ] Equivalent Static Analysis

[x] Dynamic Analysis: [ ] Time-History   [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 279.7 HZ   F/B = 279.7 HZ   V = 279.7 HZ

3. Model Type: [ ] 3D   [ ] 2D   [ ] 1D

[ ] Finite Element   [x] Beam   [ ] Closed Form Solution

4. [ ] Computer Codes:

Frequency Range and No. of modes considered:

[x] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
[x] Other: N/A
(specify)

6. Damping: OBE None   SSE None   Basis for the damping used: Used required input motion

7. Support Considerations in the model: None required

8. Critical Structural Elements:

A. Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

N/A

B. Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
.000707"	C.G. of maximum g" loading which is in the bonnet	.008" min. clearance

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method:

[X] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: No. 1827 Environmental Test Report on

(No., Title and Date) Solenoid Valve (less rectifier), 11-4-76

Company that Prepared Report: Target Rock Corp.

Company that Reviewed Report: Target Rock Corp.

V. Vibration Input:

1. Loads considered: a. [X] Seismic only

   b. [ ] Hydrodynamic only

   c. [ ] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [ ] SRSS [X] N/A (other, specify)

3. Required Response Spectra (attach the graphs): Used required input motion (App.W Fig.1)

4. Damping Corresponding to RRS: OBE N/A SSE N/A

5. Required Acceleration in Each Direction: [X] ZPA [ ] Other (specify)

OBE	S/S =	3g	F/B =	3g	V =	3g
SSE	S/S =	3g	F/B =	3g	V =	3g

6. Were fatigue effects or other vibration loads considered?

   [ ] Yes [X] No

   If yes, describe loads considered and how they were treated in overall qualification program: ______

*NOTE: If more than one report complete items IV thru VII for each report.

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency [X] Multi-Frequency: [ ] random [ ] sine beat [X] dwell

2. [ ] Single Axis [X] Multi-Axis

3. No. of Qualification Tests: OBE ______ SSE ______ Other see note 1 below (specify)

4. Frequency Range: each ½ octave from 1-35HZ, plus each resonant freq.

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 20 HZ F/B = 18 HZ V = None

6. Method of Determining Natural Frequencies

[X] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graphs) [X] No

8. Input g-level Test: OBE S/S = 4.5g F/B = 4.5g V = 4.5g

SSE S/S = 4.5g F/B = 4.5g V = 4.5g

9. Laboratory Mounting:

1. [ ] Bolt (No. ____, Size ____) [ ] Weld (Length ____) [X] Test Fixtur

10. Functional operability verified: [X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: during and following each dwell test the valve operated satisfactorily

12. Other test performed (such as aging or fragility test, including results):

Aging simulation (including 50% of radiation), functional, temp. and humidity exposure, functional and cyclic tests were performed prior to seismic tests. Following seismic testing, functional, accident simulation (including radiation, temp/press. profile) and functional tests performed. The solenoid valve passed all tests.

*Note: If qualification by a combination of test and analysis also complete Item VII.

NOTE 1 No. of Qual. Tests-- Vertical and horizontal inputs of 4.5g's were applied simultaneously to each ½ octave frequency from 1-35HZ "in-phase" then repeated for 180° out-of-phase. Total 78 tests. (Exclusive of the resonant frequency survey)

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method:

[x] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: No. 1500 Environmental Test Report on

(No., Title and Date) Solenoid Valve (with rectifier)

Company that Prepared Report: Target Rock Corp.

Company that Reviewed Report: Target Rock Corp.

V. Vibration Input:

1. Loads considered: a. [x] Seismic only

   b. [ ] Hydrodynamic only

   c. [ ] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [ ] SRSS [X] N/A (other, specify)

3. Required Response Spectra (attach the graphs): Used Required Input Motion, (App. WW Fig. 1)

4. Damping Corresponding to RRS: OBE N/A SSE N/A

5. Required Acceleration in Each Direction: [X] ZPA [ ] Other (specify)

OBE	S/S = 3g	F/B = 3g	V = 3g
SSE	S/S = 3g	F/B = 3g	V = 3g

6. Were fatigue effects or other vibration loads considered?

   [ ] Yes [X] No

   If yes, describe loads considered and how they were treated in overall qualification program: ______

*NOTE: If more than one report complete items IV thru VII for each report.

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency [X] Multi-Frequency: [ ] random [ ] sine beat [X] dwell

2. [X] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE ______ SSE ______ Other see note 1 below (specify)

4. Frequency Range: 1-35 HZ

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 16.5, 20 & 26.5 HZ F/B = 9, 17.5 & 26.5 HZ V = 21 HZ

6. Method of Determining Natural Frequencies

[X] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graphs) [X] No

8. Input g-level Test: OBE S/S = 3g & 4.5g F/B = 3g & 4.5g V = 3g & 4.5g

SSE S/S = 3g & 4.5g F/B = 3g & 4.5g V = 3g & 4.5g

9. Laboratory Mounting:

1. [ ] Bolt (No.____, Size____) [ ] Weld (Length____) [X] Test fixtu

10. Functional operability verified: [X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Valve operated satisfactorily during the resonance dwell periods and following the dwell tests

12. Other test performed (such as aging or fragility test, including results):

Aging simulation, seismic testing and accident simulation, functional operability was satisfactory before, during and following each test.

*Note: If qualification by a combination of test and analysis also complete Item VII.

NOTE 1 No. of Qual. Tests-- A uni-axial input acceleration of 3.0g's at each noted resonant frequency for 10 seconds, then repeated with an input of 4.5g's was applied to each of 3 mutually perpendicular axes. (Exclusive of the resonance scan) Total 14 tests.

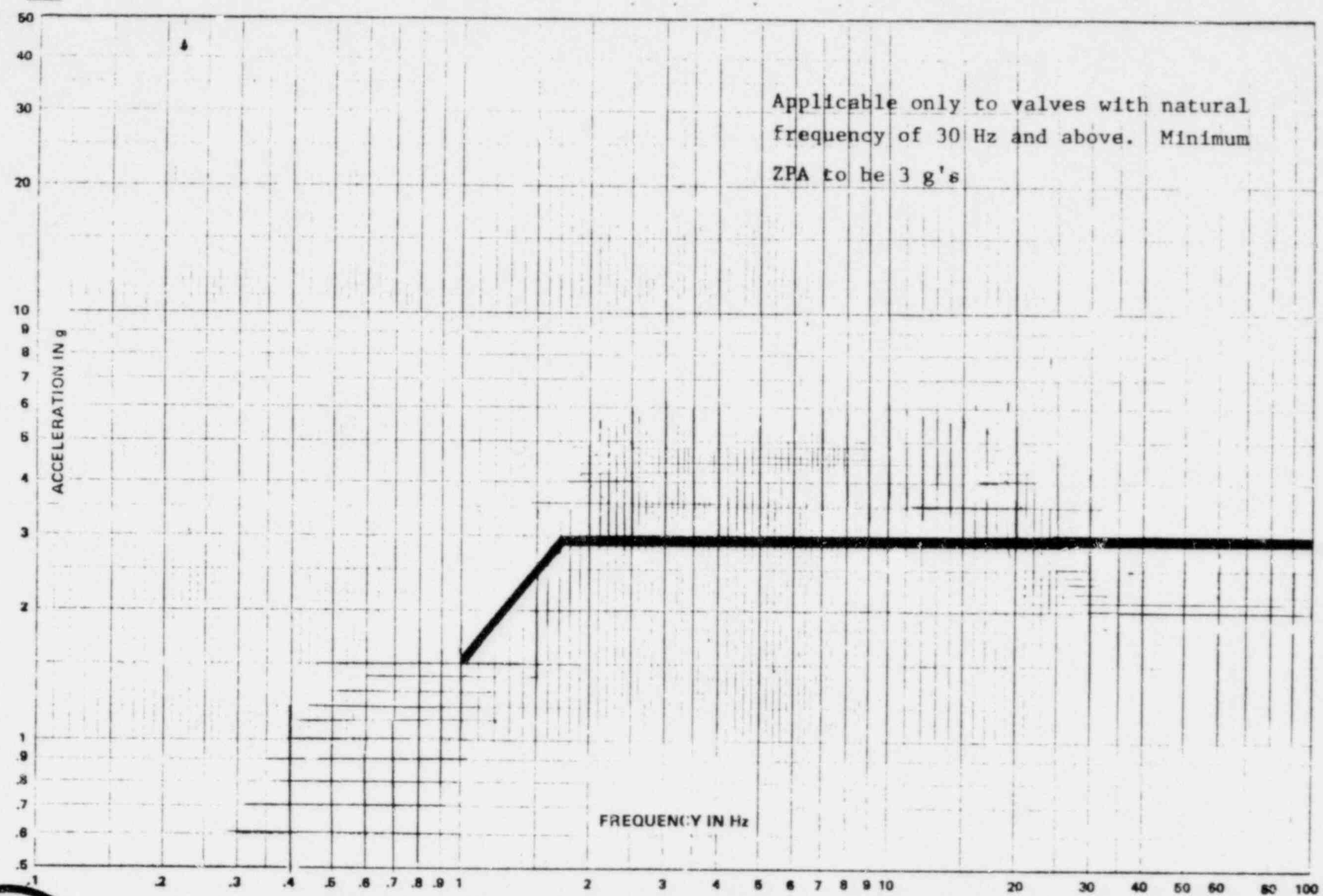


Fig. 1. — Required Input Motion (RIM) for Control Systems Purposes for Line Mounted Devices

Qualification Summary of Equipment

I. Plant Name: Grand Gulf Nuclear Station Unit 1

Type:

1. Utility: MP&L

PWR

2. NSSS: GE 3. A/E: Bechtel

BWR BWR/6

II. Component Name Load Center Unit Substation

1. Scope: [ ] NSSS [x] BOP

2. Model Number: Quantity: 1

3. Vendor: I-T-E Imperial Corporation

4. If the component is a cabinet or panel, name and model No. of the devices included: Refer to I-T-E Seismic Cerification Report:

I-T-E S.O. No. 33-50481

5. Physical Description a. Appearance 4 cubicle line-up, CUB1-5KV ATC, CUB2-750 KVA XFMR, CUB 3 & 4, low voltage swgr.

b. Dimensions 90"H, 58" D, 138" L

c. Weight 7691 lbs. including breakers

6. Location: Building: SSWT

Elevation: 133'-0"

7. Field Mounting Conditions [ ] Bolt (No.____, Size____)
[X] Weld (Length 4x5/16") 4 places XFMR Sectio
[X] 4 plug welds per frame

8. a. System in which located: R-20

b. Functional Description: 4160/480V Distribution System

c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown

[X] Both [ ] Neither

9. Pertinent Reference Design Specifications: 9645-E-017.0,

9645-E-091.0

12/80

III. Is Equipment Available for Inspection in the Plant: [x] Yes [ ] No

IV. Equipment Qualification Method:

[x] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: 750 KVA XFMR with primary air terminal chamber.

(No., Title and Date) Seismic certification report ITE-6.0 33-50481

Company that Prepared Report: Wyle Laboratories tested under I-T-E D.O. 960-4107

Company that Reviewed Report: I-T-E Imperial Corporation switchgear division.

V. Vibration Input:

1. Loads considered: a. [X] Seismic only

   b. [ ] Hydrodynamic only

   c. [ ] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [ ] SRSS [ ] ________ (other, specify) N/A

3. Required Response Spectra (attach the graphs): Graphs attached

4. Damping Corresponding to RRS: OBE 1% SSE 1%

5. Required Acceleration in Each Direction: [ ] ZPA [ ] Other ________ (specify)

	N-S	E-W	
OBE	S/S = 0.175g	F/B = 0.180g	V = 0.107g
SSE	S/S = 0.349g	F/B = 0.361g	V = 0.214g

6. Were fatigue effects or other vibration loads considered?

   [X] Yes [ ] No

   If yes, describe loads considered and how they were treated in overall qualification program: 5 OBE followed by 2 SSE.

*NOTE: If more than one report complete items IV thru VII for each report.

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency [x] Mu -Frequency: [x] random [ ] sine beat [ ] ________
2. [ ] Single Axis [X] Multi-Axis
3. No. of Qualification Tests: OBE 5 SSE 2 Other Plus minimum 2 less than SSE (specify)
4. Frequency Range: 0.5 Hz-50 Hz
5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = 8.5, 11, 18, 24, 32Hz F/B = 5.5,9,11,14,17, 21,24,49 Hz V = ________
6. Method of Determining Natural Frequencies

   [X] Lab Test [ ] In-Situ Test [ ] Analysis
7. TRS enveloping RRS using Multi-Frequency Test [X] Yes (Attach TRS & RRS graphs) [ ] No
8. Input g-level Test: OBE S/S = 1.5g F/B = 1.25g V = 0.75g

   SSE S/S = 3g F/B = 2.5g V = 1.5g
9. Laboratory Mounting:

   1. [X] Bolt (No. 4, Size 0.75) [ ] Weld (Length ______) [ ] ______
10. Functional operability verified: [X] Yes [ ] No [ ] Not Applicable
11. Test Results including modifications made: Test is successfully performed without any modifications.
12. Other test performed (such as aging or fragility test, including results):

    None

*Note: If qualification by a combination of test and analysis also complete Item VII.

III. Is Equipment Available for Inspection in the Plant: [x] Yes [ ] No

IV. Equipment Qualification Method:

[x] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: Indoor low voltage metal clad switchgear seismic certification
(No., Title and Date) I.T.E. S.O. #33-50481

Company that Prepared Report: Wyle Laboratories No. 42686-1

Company that Reviewed Report: I-T-E Imperial Corp. Switchgear Division

V. Vibration Input:

1. Loads considered: a. [X] Seismic only

   b. [ ] Hydrodynamic only

   c. [ ] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [ ] SRSS [ ] ______ (other, specify)

3. Required Response Spectra (attach the graphs): Graphs attached

4. Damping Corresponding to RRS: OBE 1% SSE 1%

5. Required Acceleration in Each Direction: [x] ZPA [ ] Other ______ (specify)

OBE	S/S = 0.181g	F/B = 0.175g	V = 0.107 g
SSE	S/S = 0.361g	F/B = 0.349g	V = 0.214g

6. Were fatigue effects or other vibration loads considered?

   [x] Yes [ ] No

   If yes, describe loads considered and how they were treated in overall qualification program:

   F/B, V-8 OBE, 2 SSE; S/S, V-3 OBE, 4 SSE

*NOTE: If more than one report complete items IV thru VII for each report.

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency [x] Multi-Frequency: [x] random [ ] sine beat [ ] ________

2. [ ] Single Axis [x] Multi-Axis

3. No. of Qualification Tests: OBE 11 SSE 6 Other ________ (specify)

4. Frequency Range: 0.5 Hz - 50 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S /V = 4,5,13,18,23,30,40Hz F/B /V = 6,8,11,19,23,33Hz V = ________

6. Method of Determining Natural Frequencies

[x] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [x] Yes (Attach TRS & RRS graphs) [ ] No

8. Input g-level Test: OBE S/S /V = 0.75g F/B /V = 0.75g V = ________

SSE S/S = 1.5g F/B = 1.5g V = ________

9. Laboratory Mounting:
The mounting of each specimen will duplicate the actual in service configuration
1. [ ] Bolt (No.______, Size______) [ ] Weld (Length______) [ ]______

10. Functional operability verified: [x] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Composite seismic certification For (1) Basic Low Voltage Switchboard (2) Electrical B/M Pieces.

12. Other test performed (such as aging or fragility test, including results):

____

____

*Note: If qualification by a combination of test and analysis also complete Item VII.

FOR SWGR

Specimen Reference Source;
Test Program No. 42686-1
Run No. 19, HCA

Figure 1

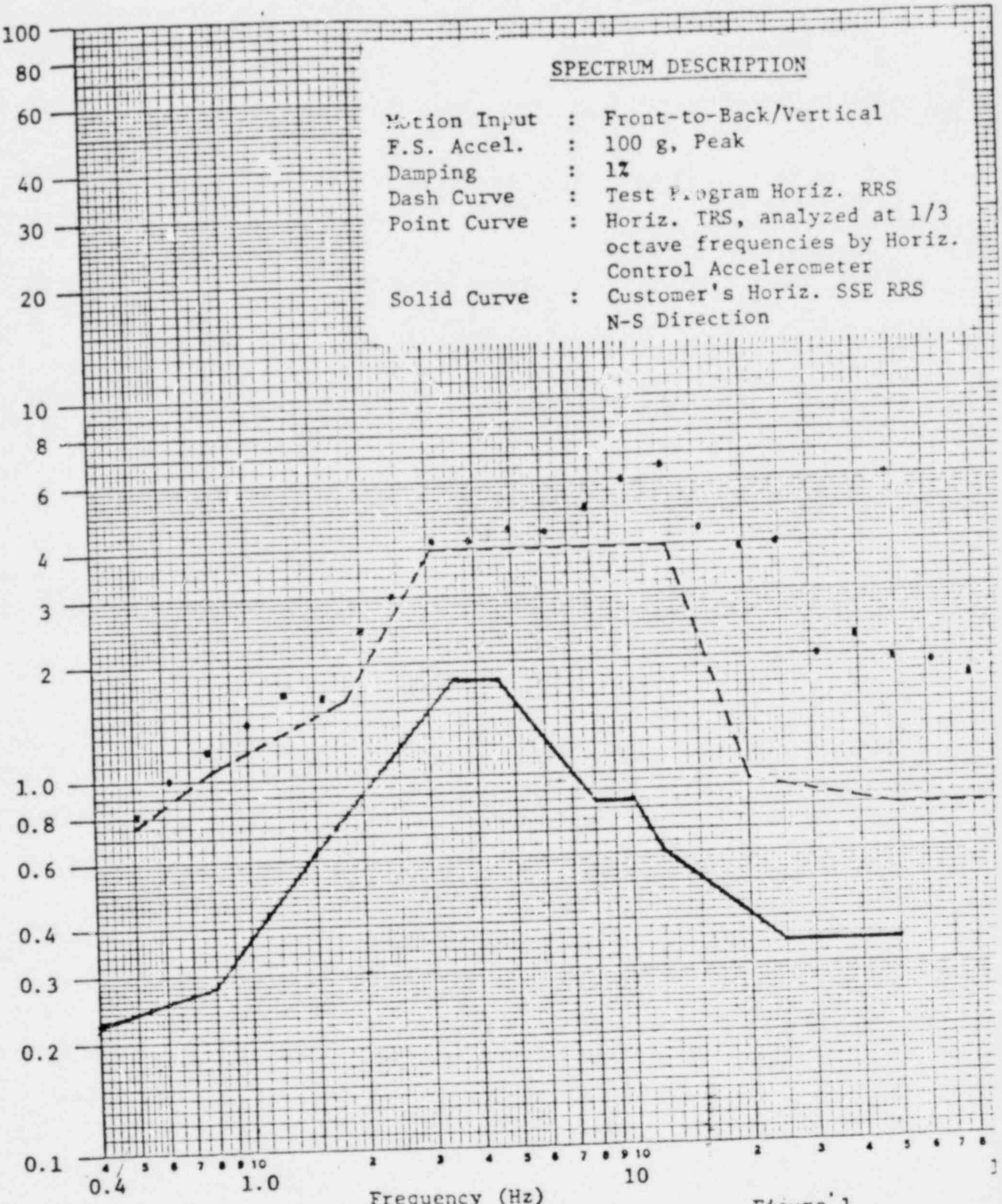


Figure 1

COMPARISON OF THE CUSTOMER'S HORIZONTAL SSE RRS TO THE HORIZONTAL FRONT-TO-BACK TRS OF THE K-LINE SWITCHGEAR TEST SPECIMEN

8151 30481

21

FOR SWGR.

Spectrum Reference Source;
Test Program No. 42686-1
Run No. 19, VCA

Figure 2

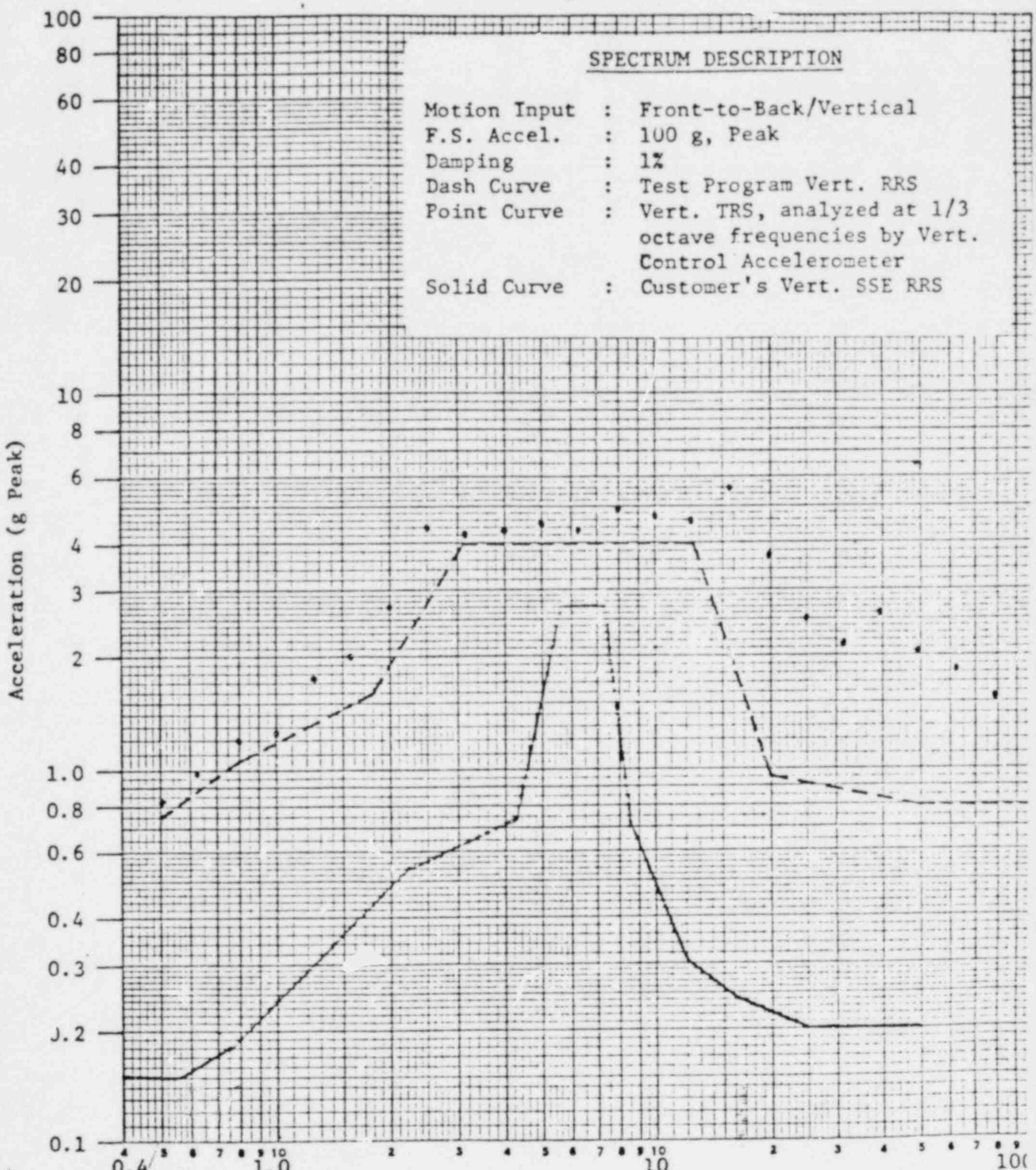


Figure 2

COMPARISON OF THE CUSTOMER'S VERTICAL SSE RRS TO THE VERTICAL TPS OF THE K-LINE SWITCHGEAR TEST SPECIMEN

FOR SWGR

Spectrum Reference Source;
Test Program No. 42686-1
Run No. 80, HCA

Figure 3

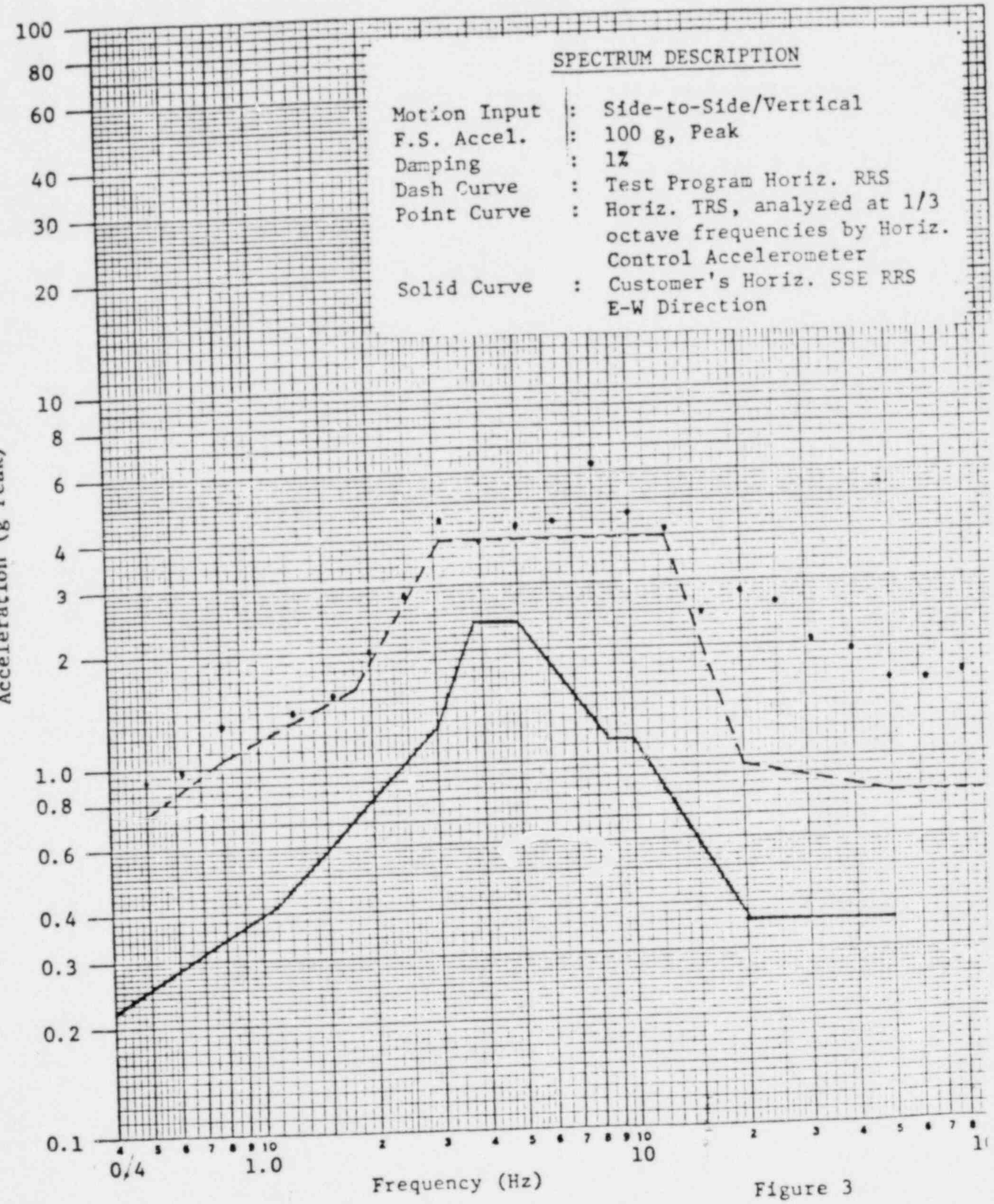
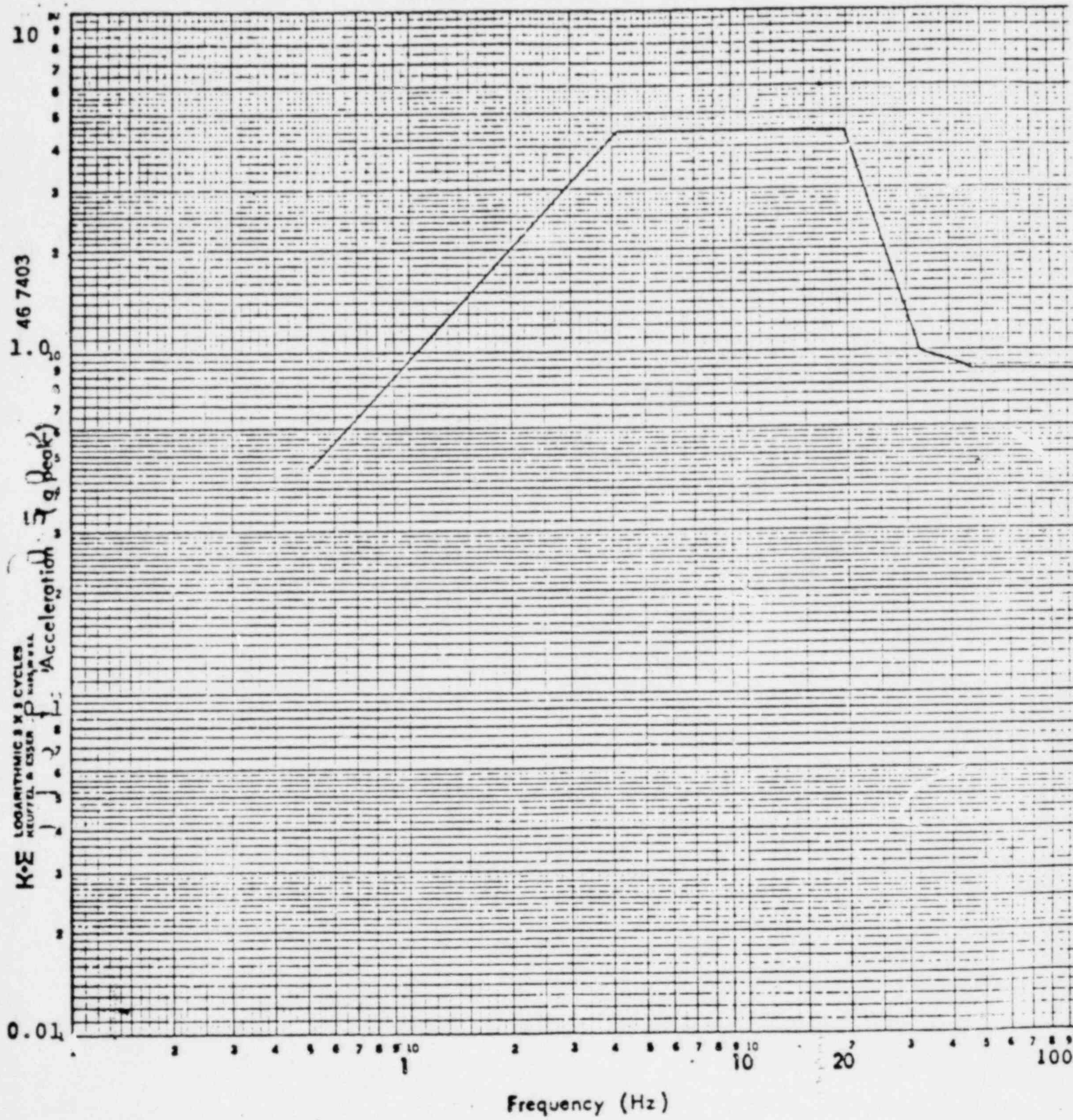


Figure 3

COMPARISON OF THE CUSTOMER'S HORIZONTAL SSE RRS TO THE HORIZONTAL SIDE-TO-SIDE TRS OF THE K-LINE SWITCHGEAR TEST SPECIMEN

2(

FOR XFMR P45 - P68



CURVE C

Full level required response spectra (1.0 RRS)
Damping 1%
I-T-E Test Program D.O. 960-4107

45

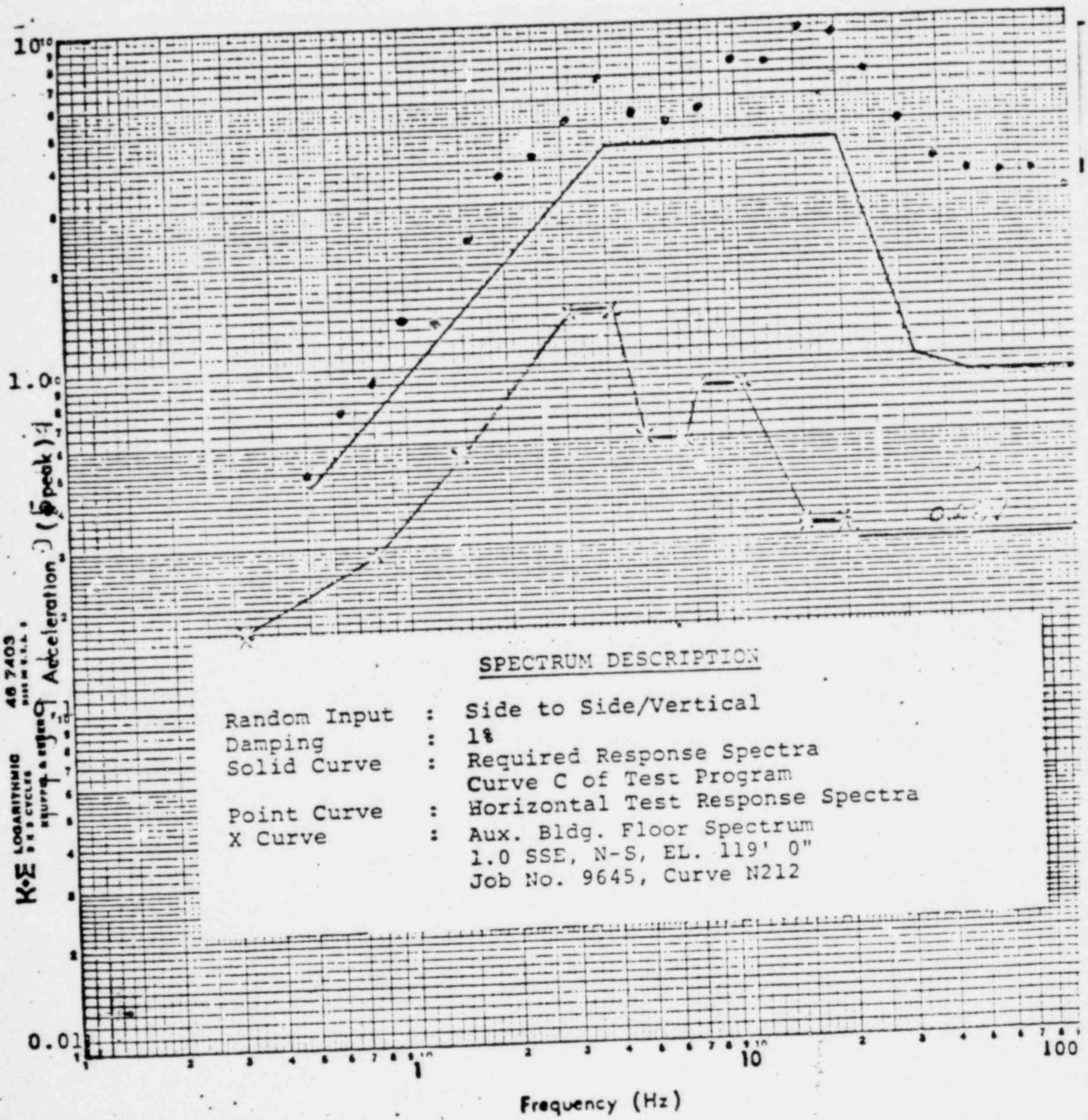


FIGURE 1

Comparison of specified 1.0 SSE Horizontal Acceleration Response Spectra to that of Tested Specimen.

4

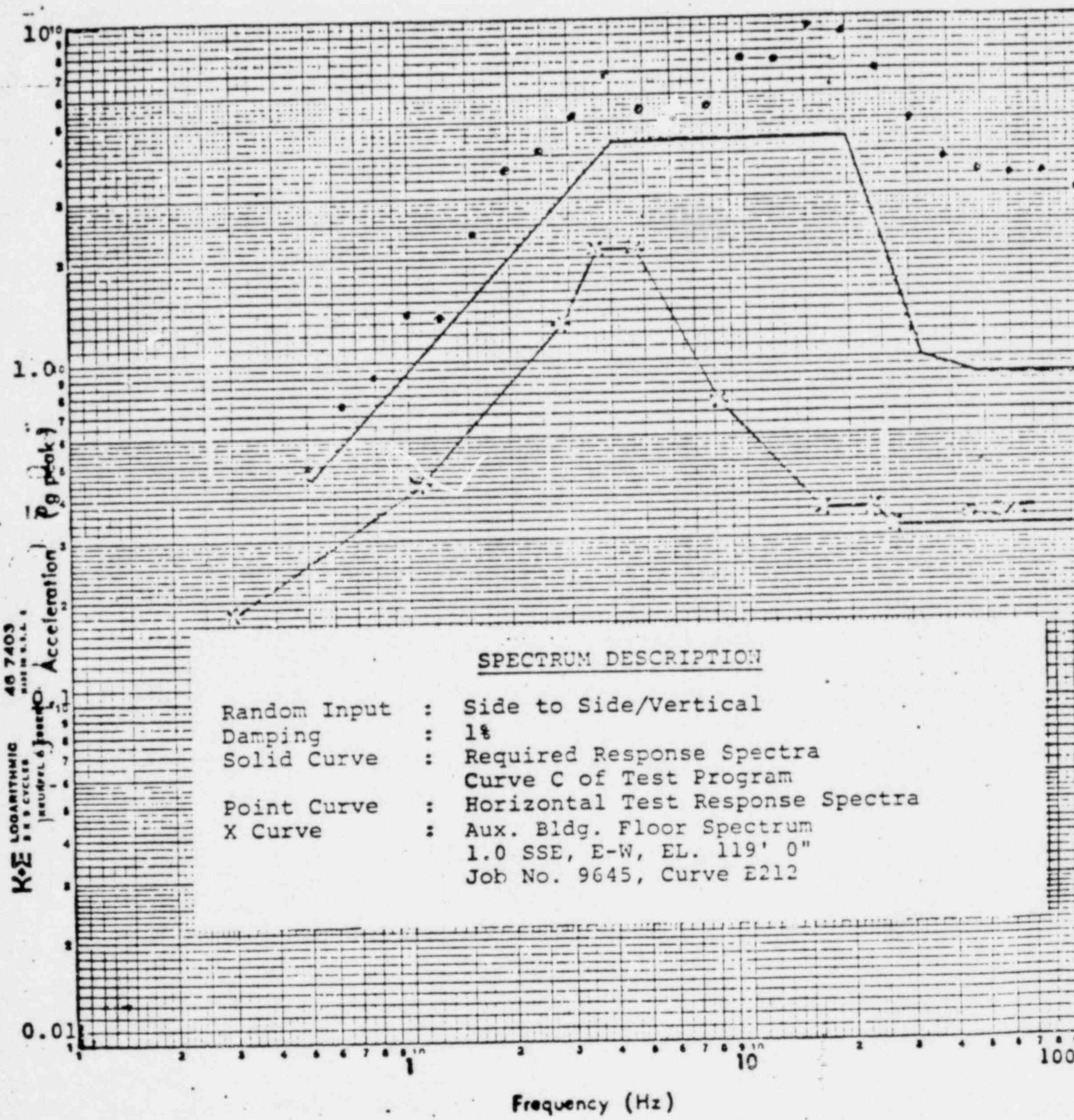


FIGURE 2

Comparison of specified 1.0 SSE Horizontal Acceleration Response Spectra to that of Tested Specimen.

4i

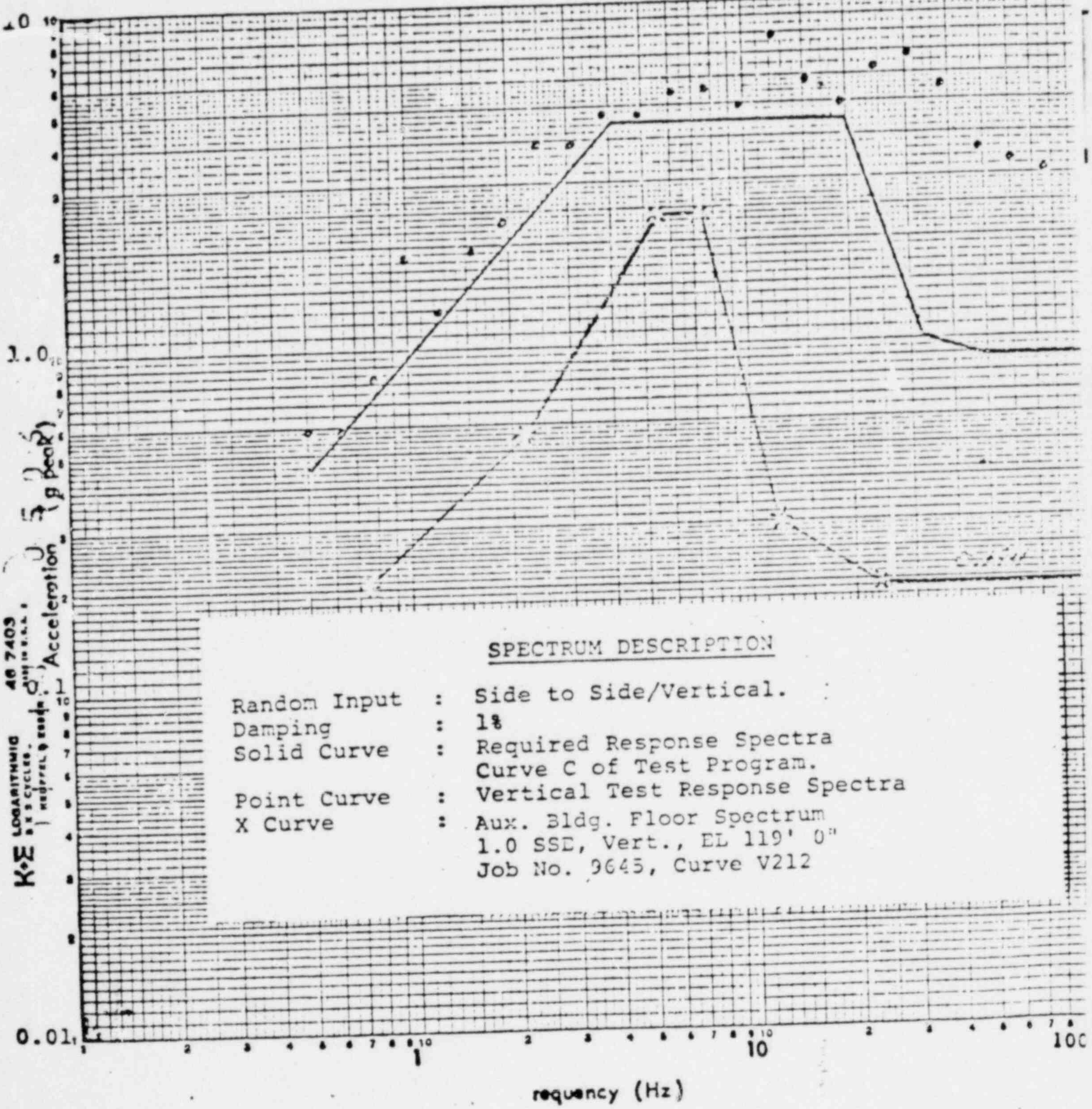


FIGURE 3

Comparison of specified 1.0 SSE Vertical Acceleration Response Spectra to that of Tested Speciman.

4C

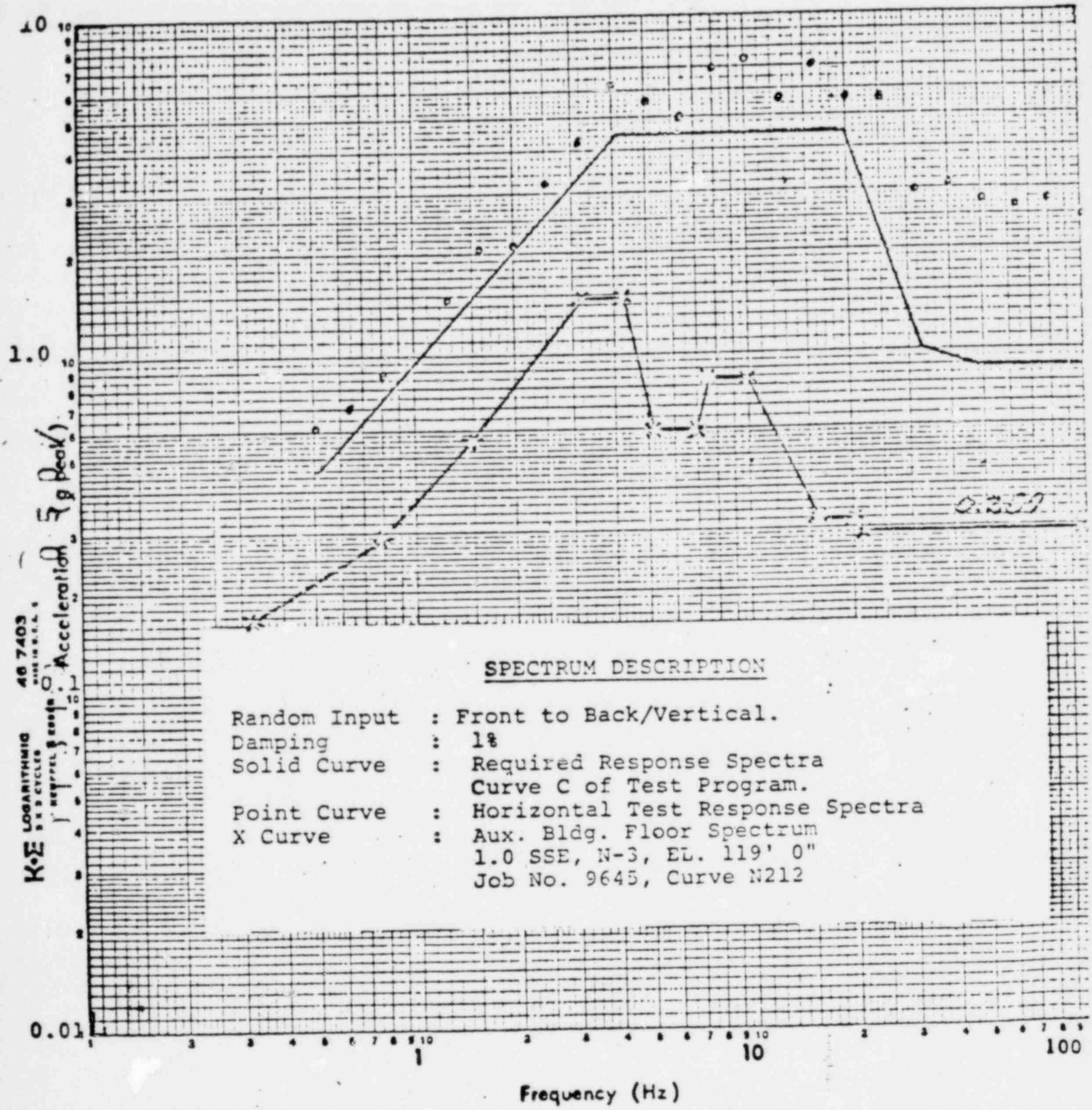


FIGURE 4

Comparison of specified 1.0 SSE Horizontal Acceleration Response Spectra to that of Tested Specimen.

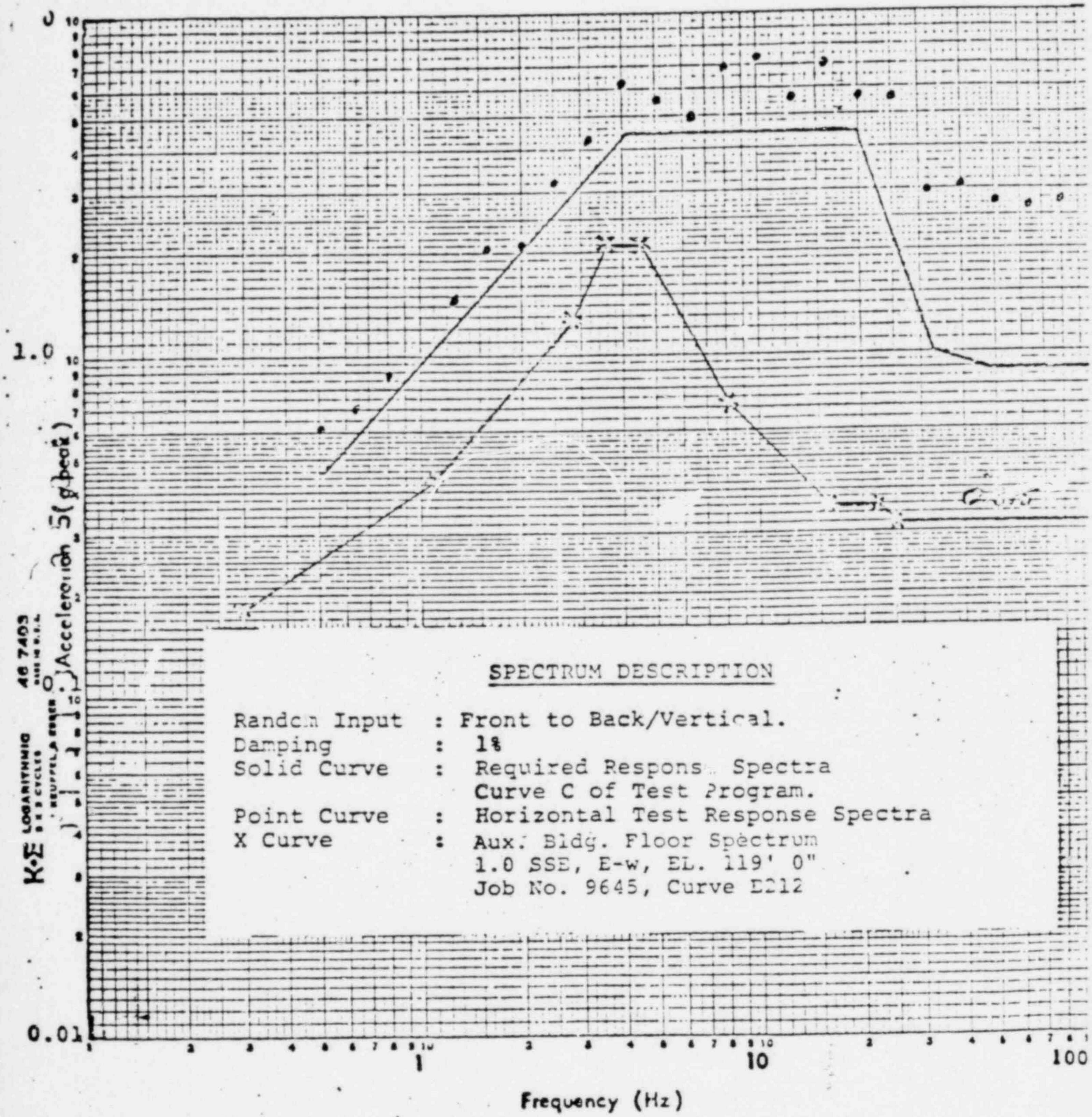


FIGURE 5

Comparison of specified 1.0 SSE Horizontal Acceleration Response Spectra to that of Tested Specimen.

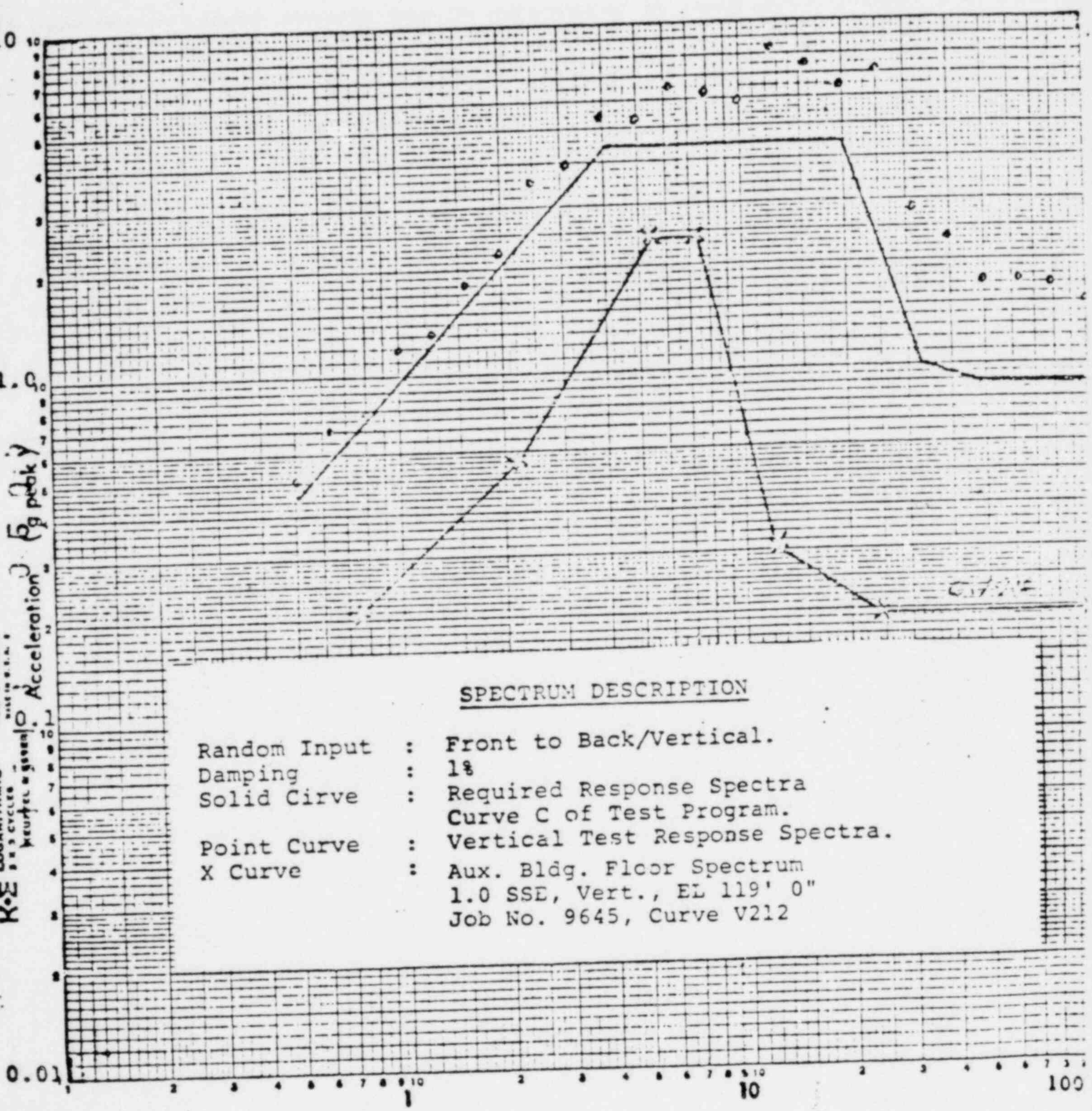


FIGURE 6

Comparison of specified 1.0 SSE Vertical Acceleration Response Spectra to that of Tested Specimen.

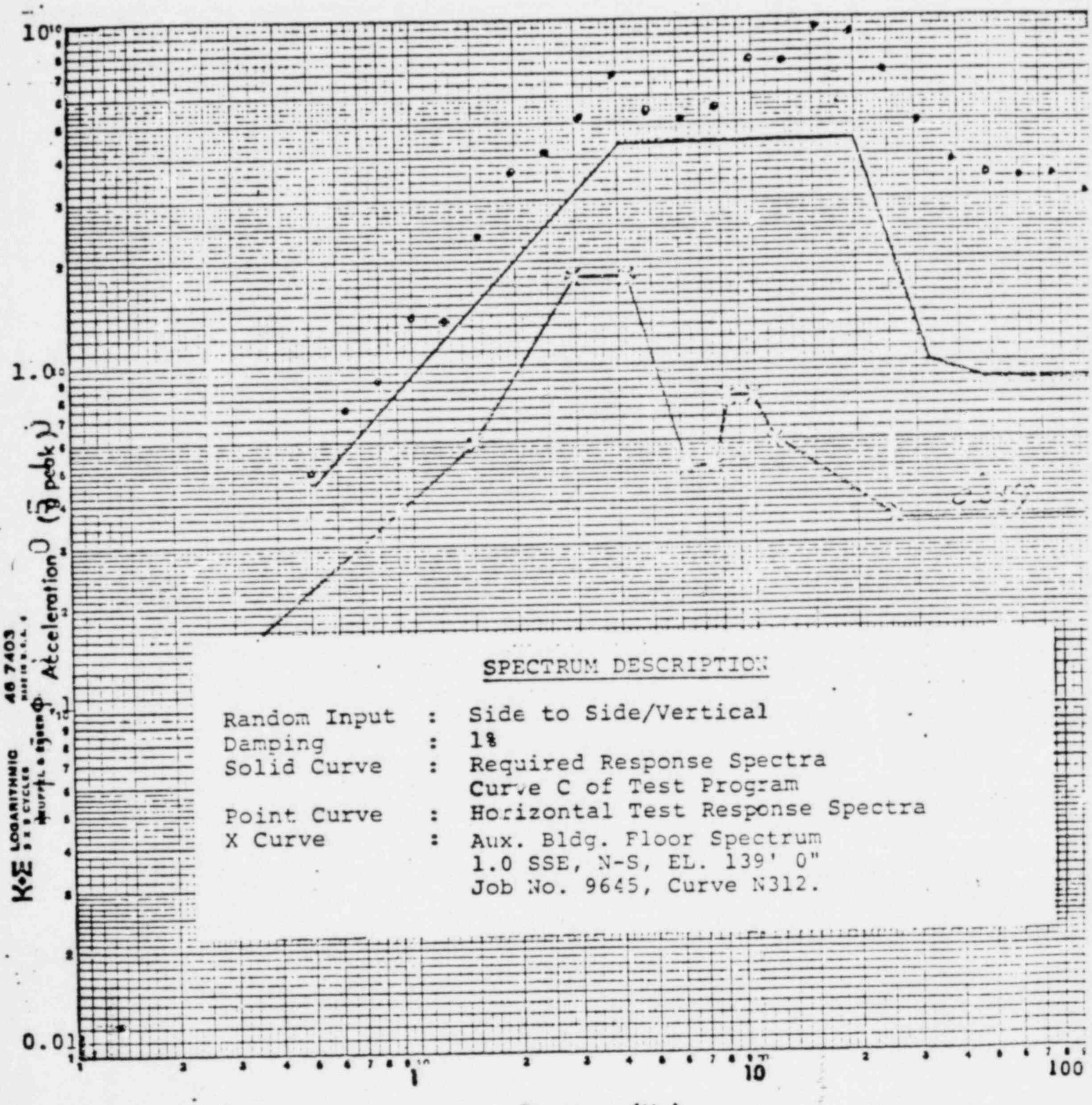


FIGURE 7

Comparison of specified 1.0 SSE Horizontal Acceleration Response Spectra to that of Tested Specimen.

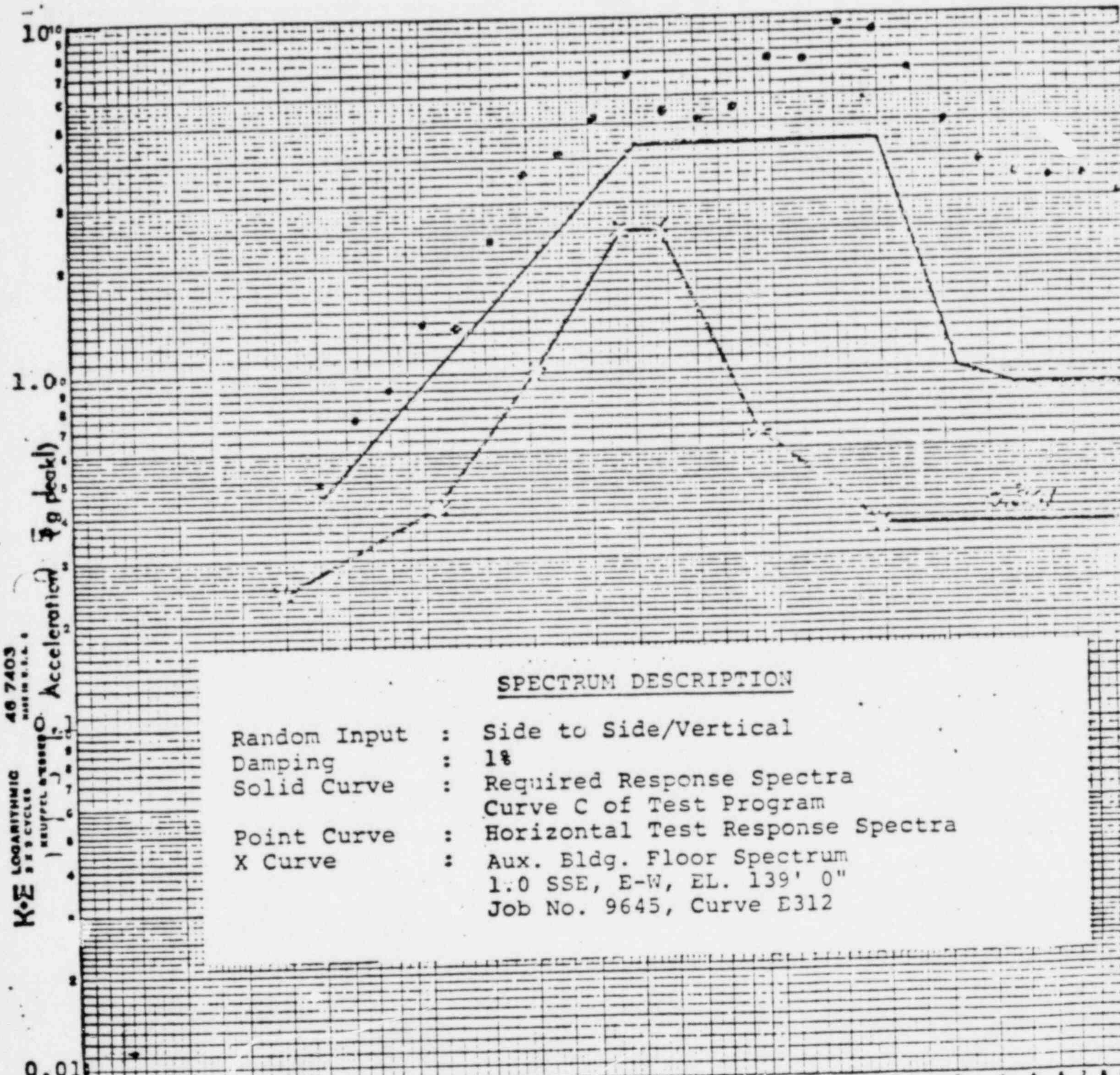


FIGURE 8

Comparison of specified 1.0 SSE Horizontal Acceleration Response Spectra to that of Tested Specimen.

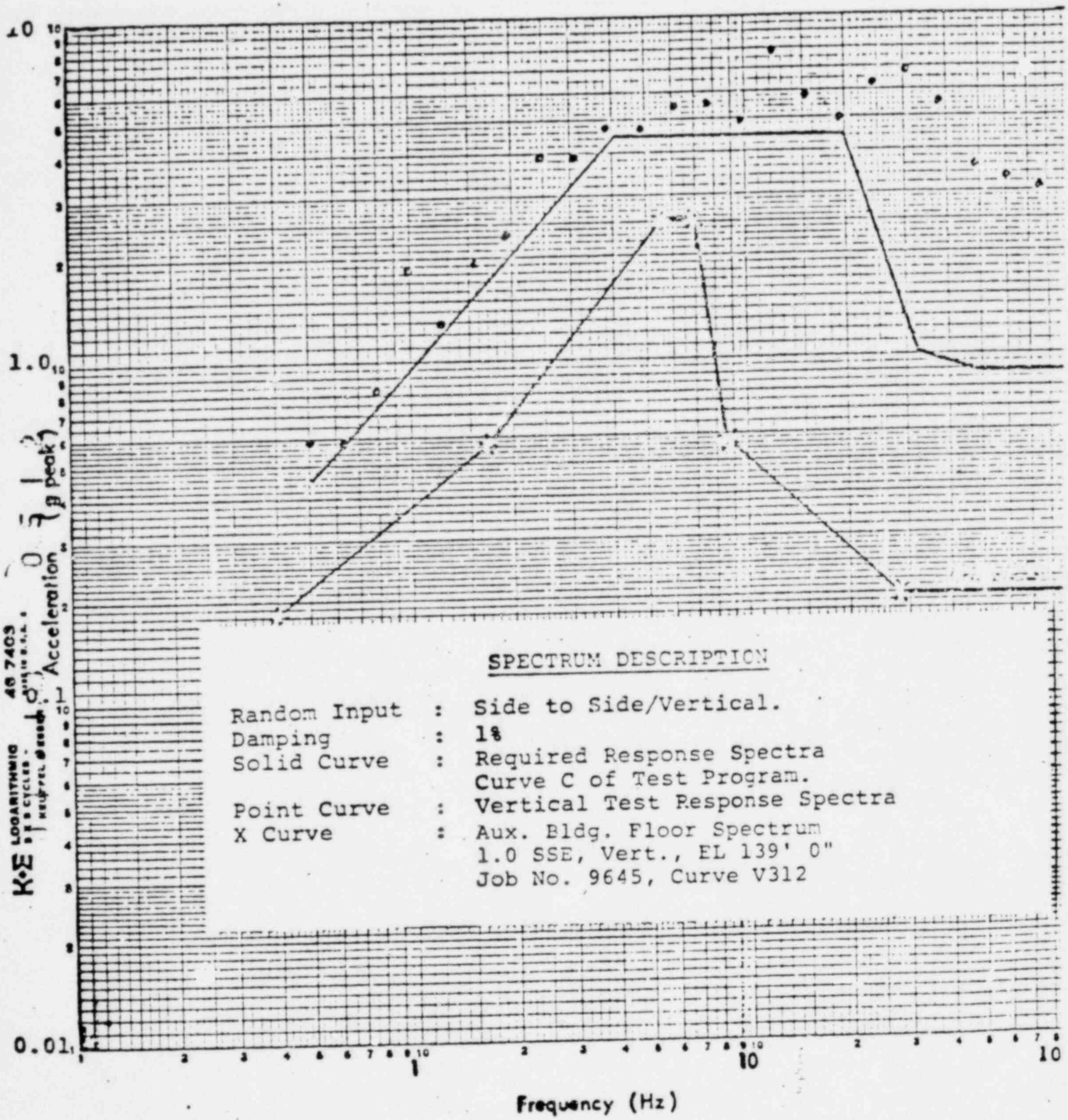


FIGURE 9

Comparison of specified 1.0 SSE Vertical Acceleration Response Spectra to that of Tested Speciman.

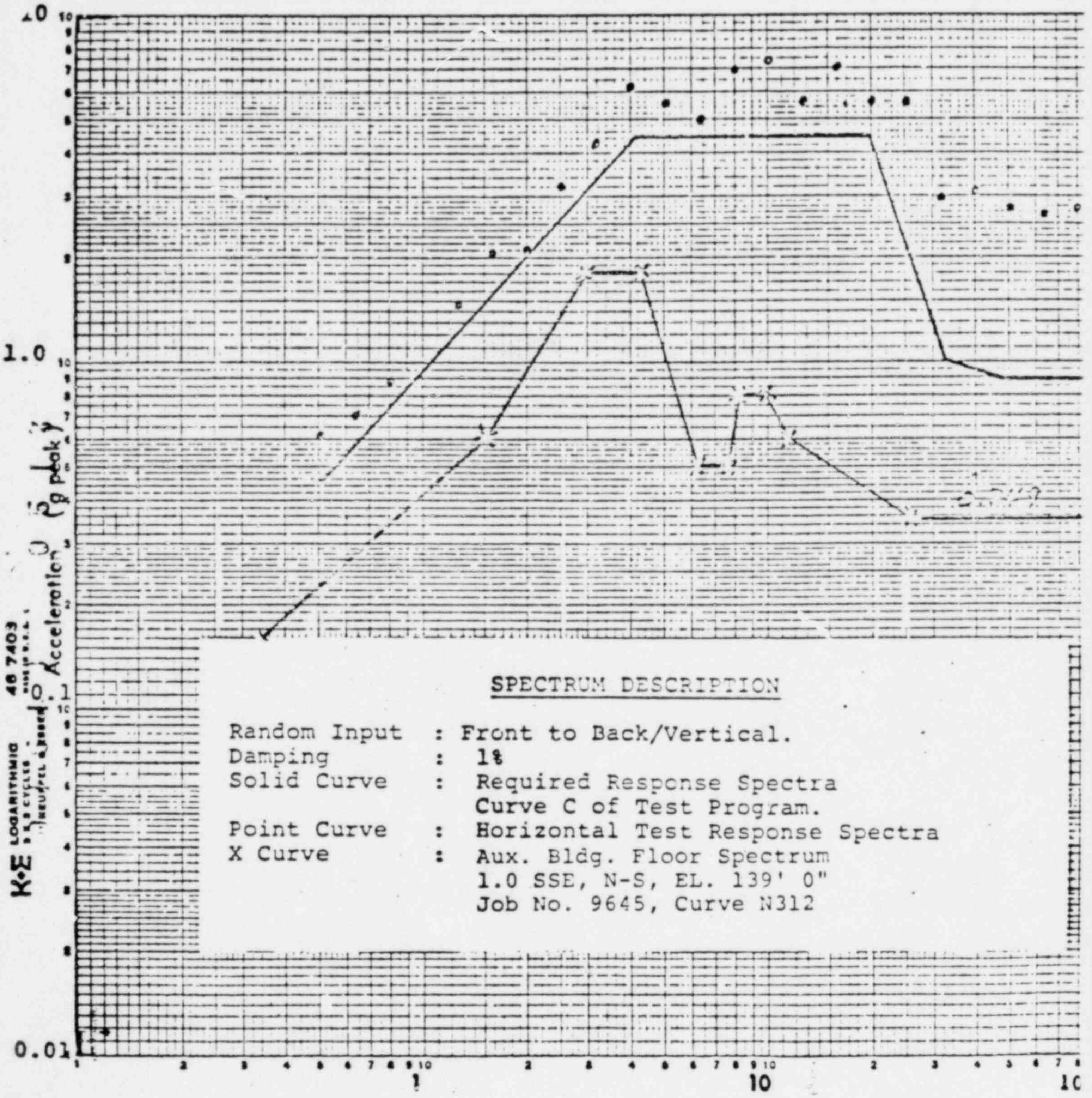


FIGURE 10

Comparison of specified 1.0 SSE Horizontal Acceleration Response Spectra to that of Tested Specimen.

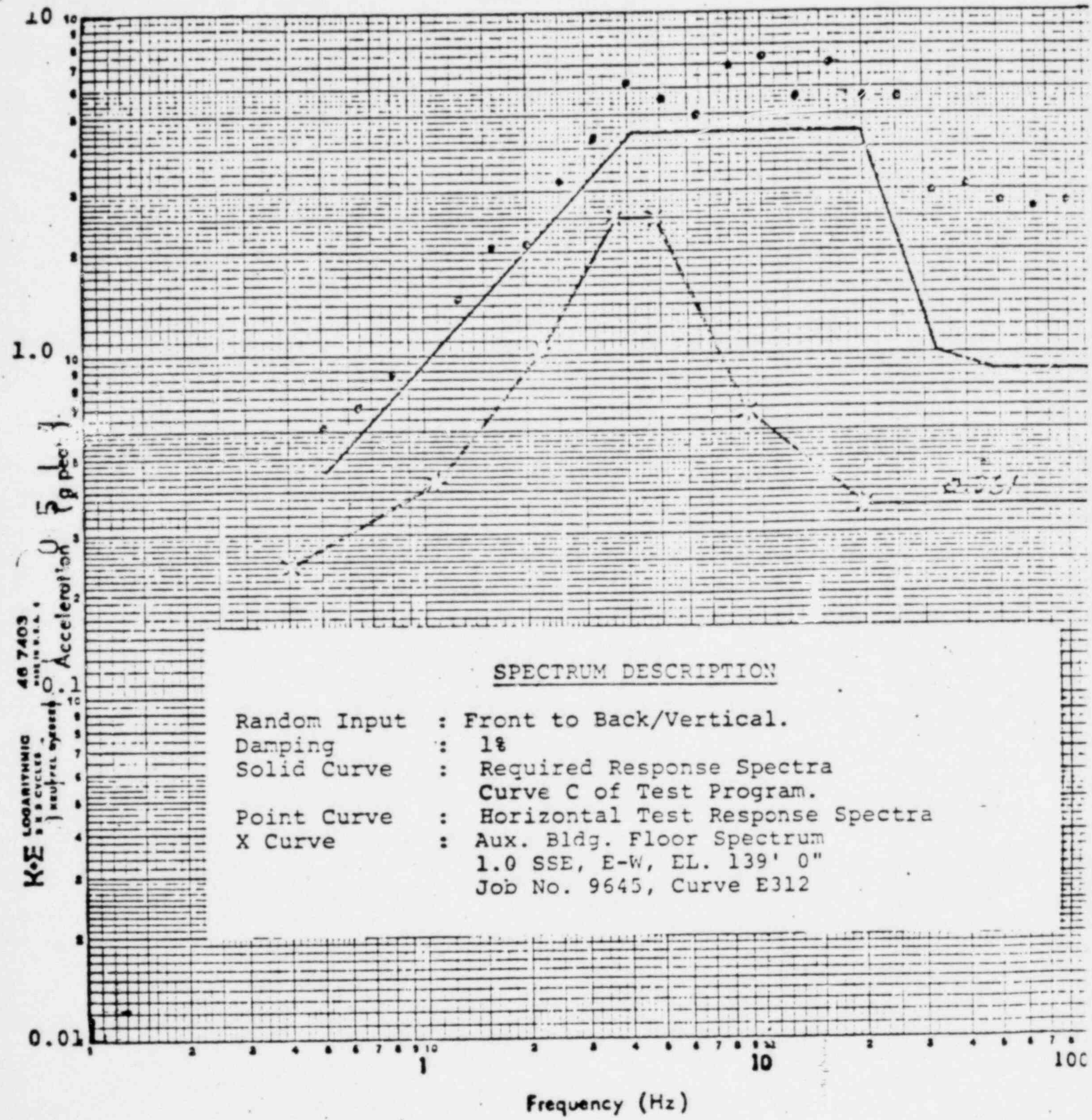


FIGURE 11

Comparison of specified 1.0 SSE Horizontal Acceleration Response Spectra to that of Tested Specimen.

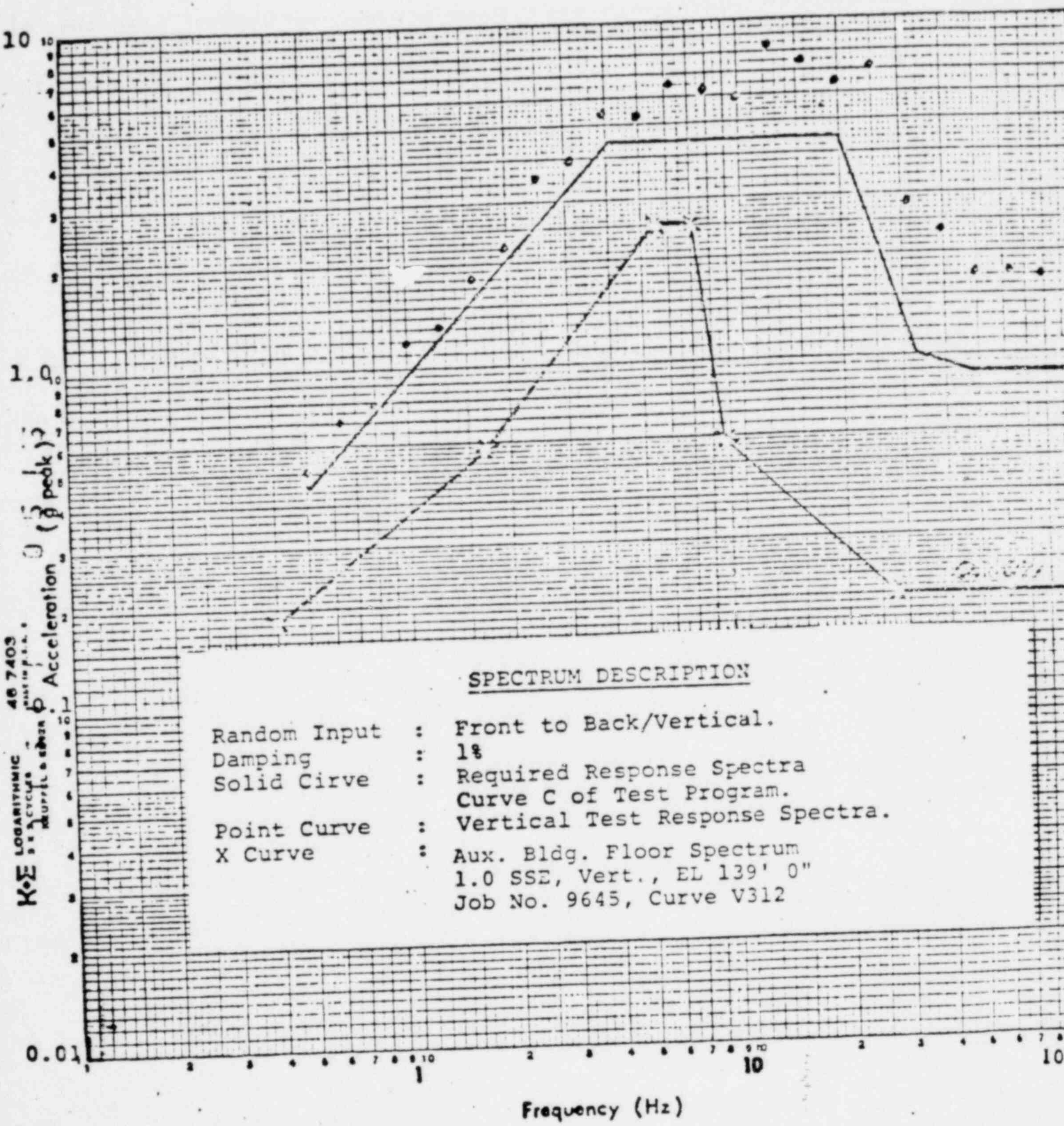


FIGURE 12

Comparison of specified 1.0 SSE Vertical Acceleration Response Spectra to that of Tested Specimen.

58

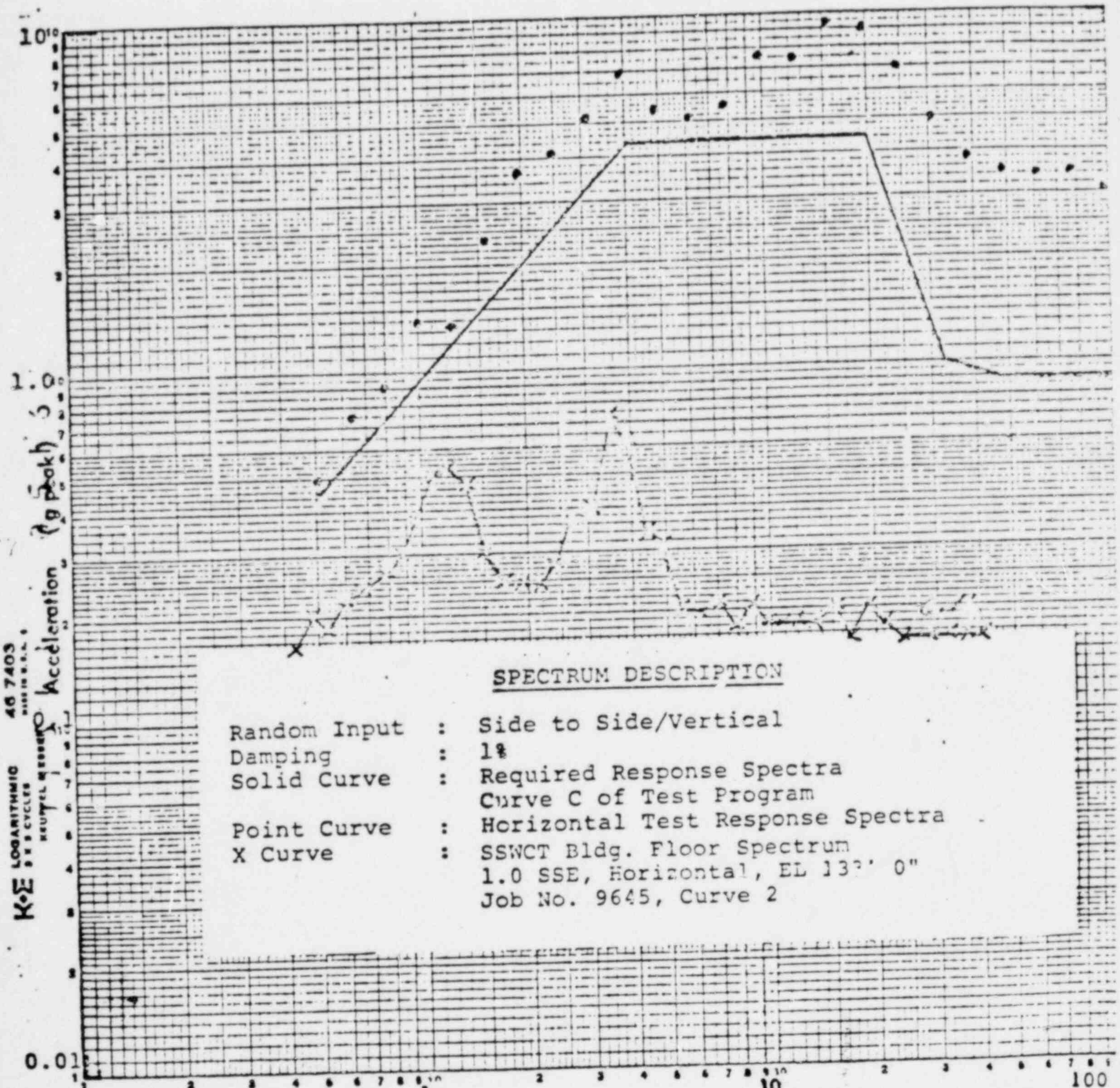


FIGURE 13

Comparison of specified 1.0 SSE Horizontal Acceleration Response Spectra to that of Tested Specimen

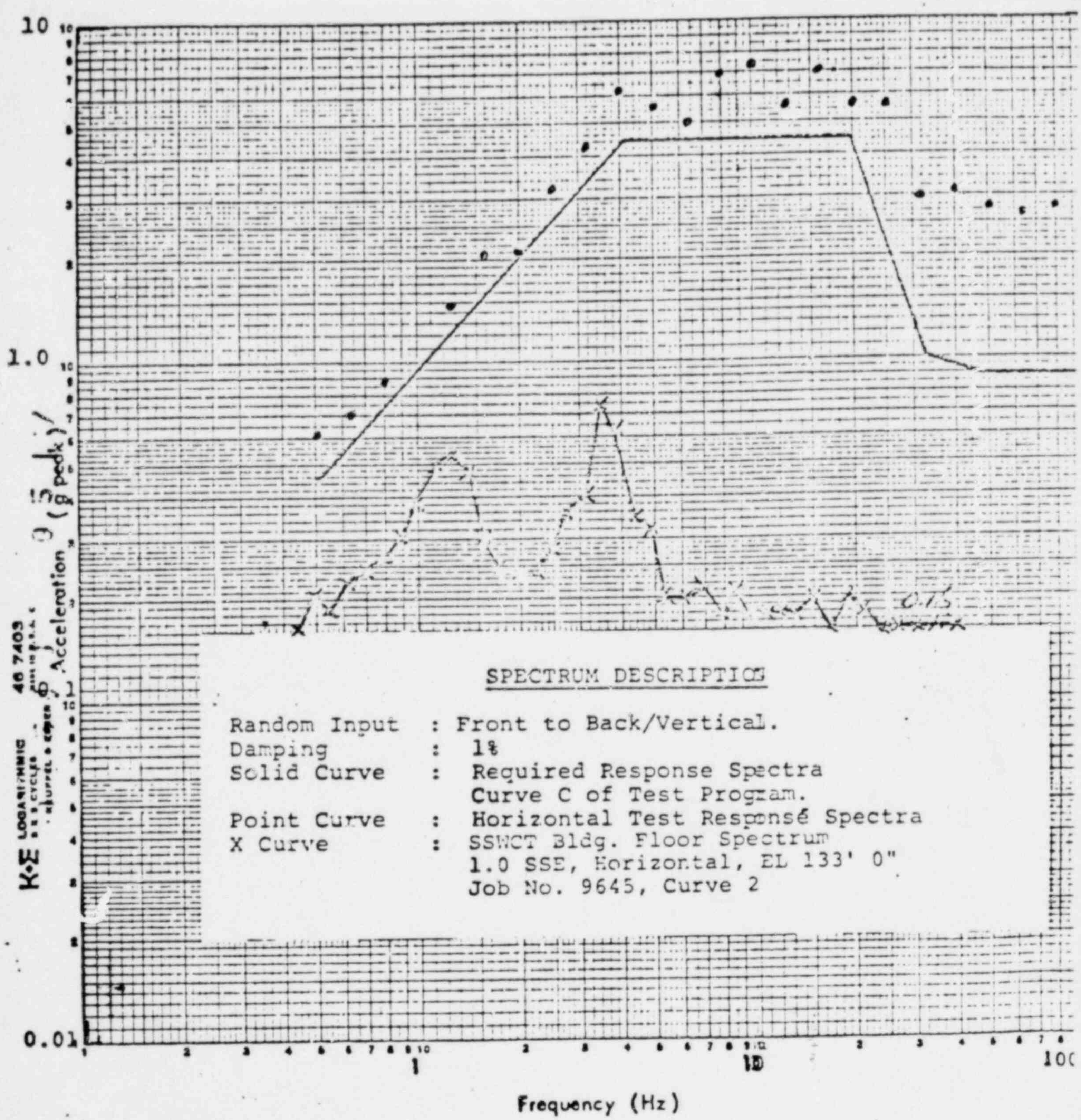


FIGURE 14

Comparison of specified 1.0 SSE Horizontal Acceleration Response Spectra to that of Tested Specimen

60

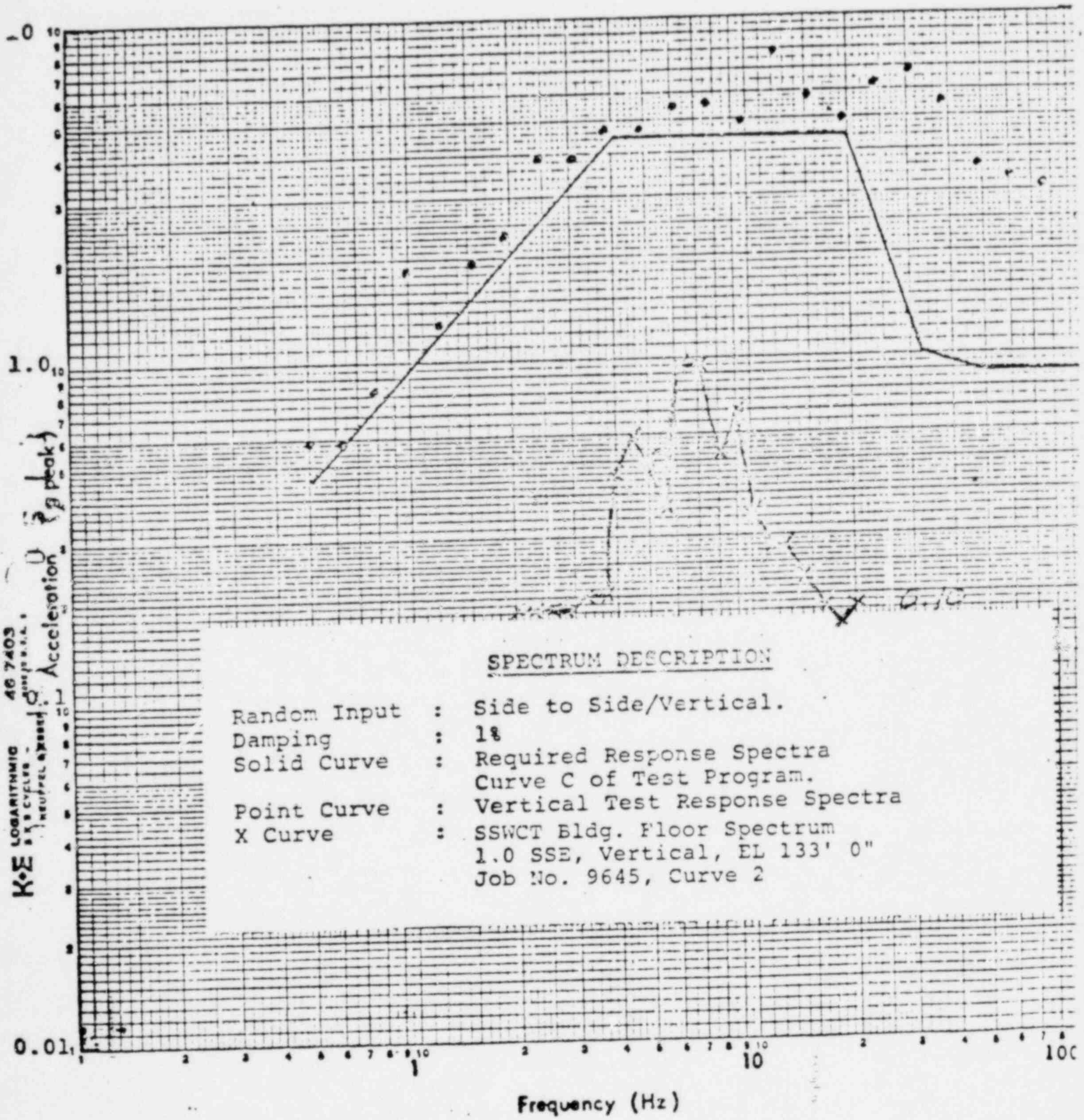


FIGURE 15

Comparison of specified 1.0 SSE .ertical Acceleration Respon· Spectra to that of Tested Speciman.

(1)

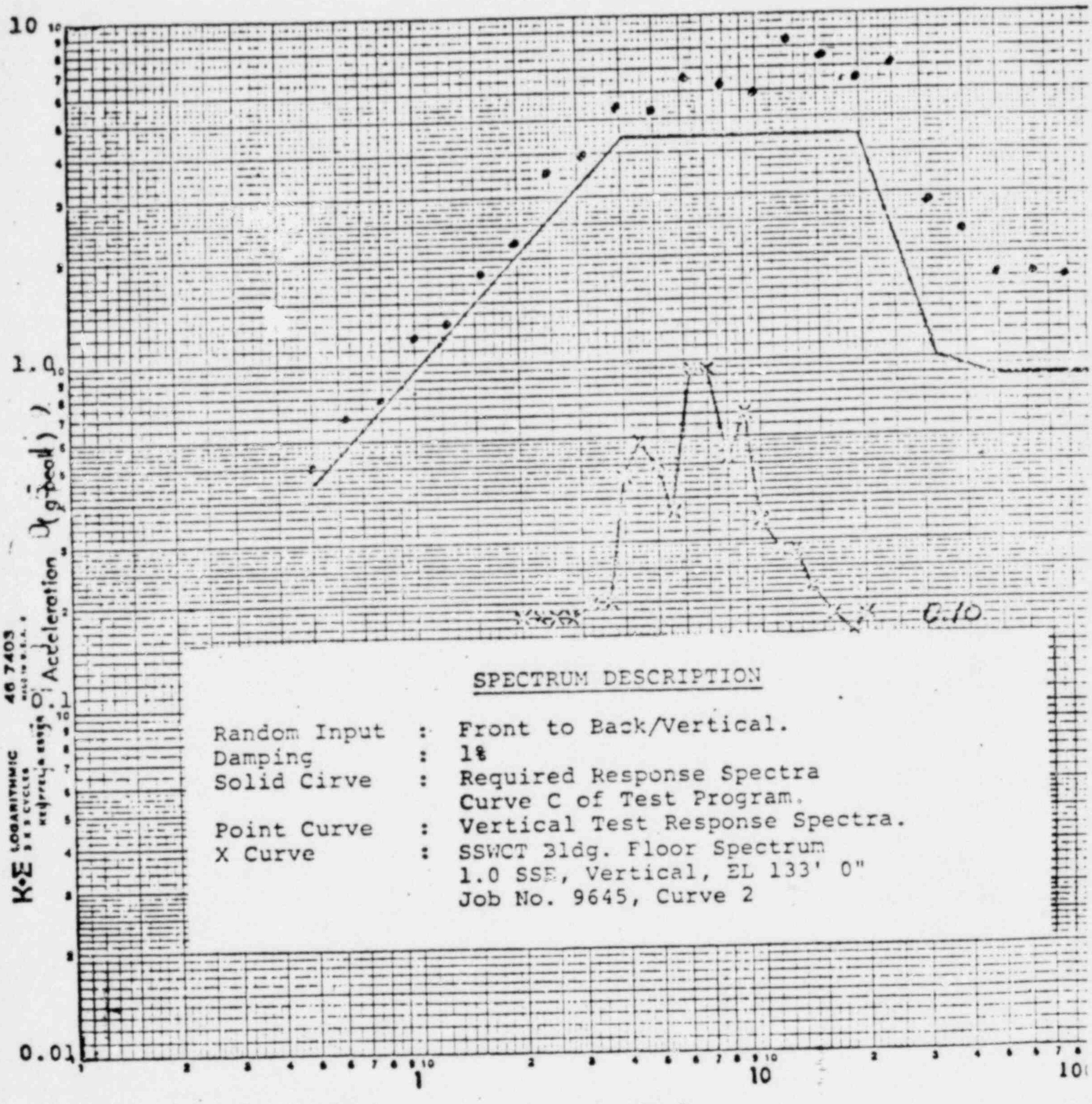


FIGURE 16

Comparison of specified 1.0 SSE Vertical Acceleration Response Spectra to that of Tested Specimen.

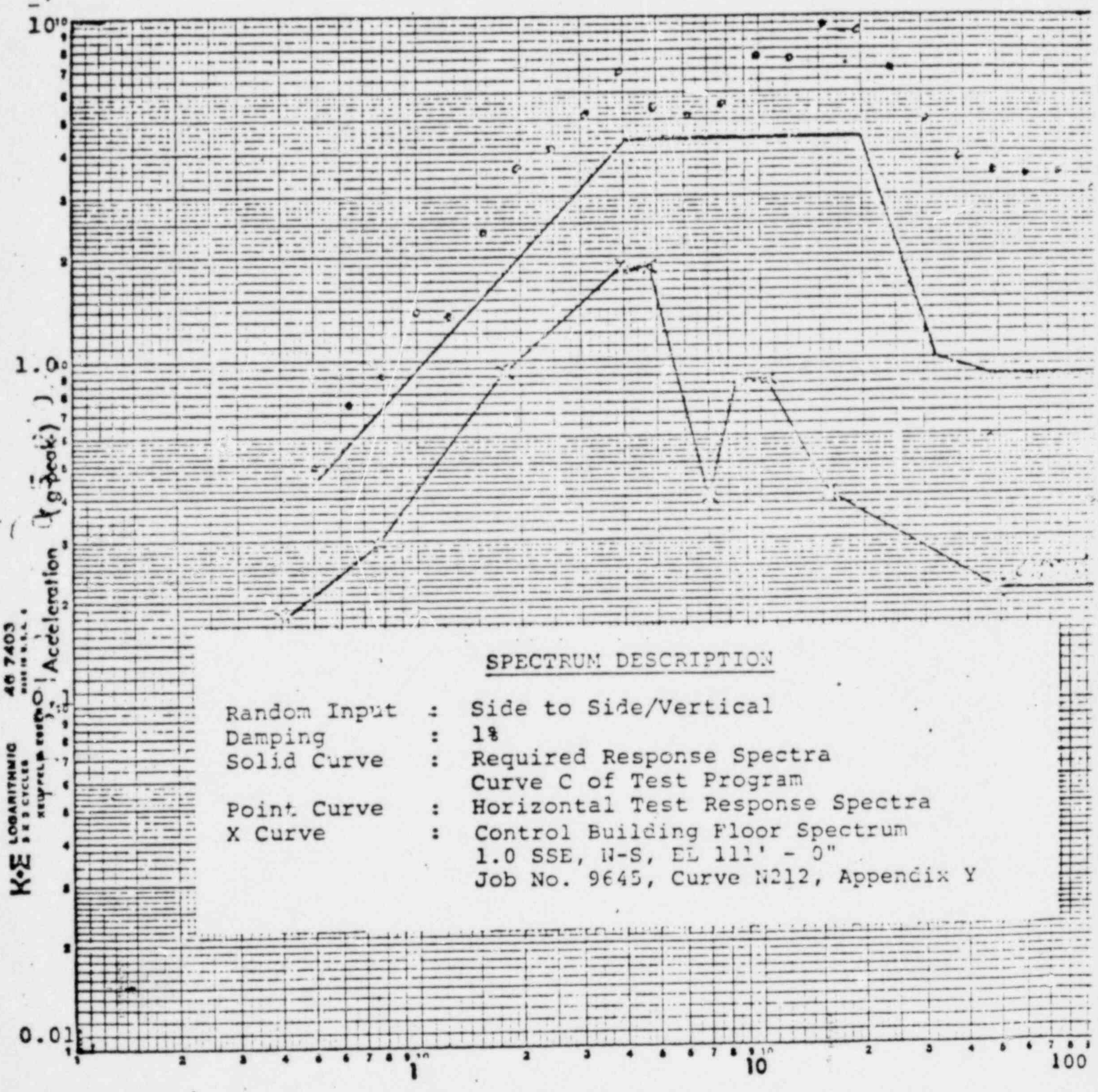


FIGURE 17

Comparison of specified 1.0 SSE Horizontal Acceleration Response Spectra to that of Tested Specimen.

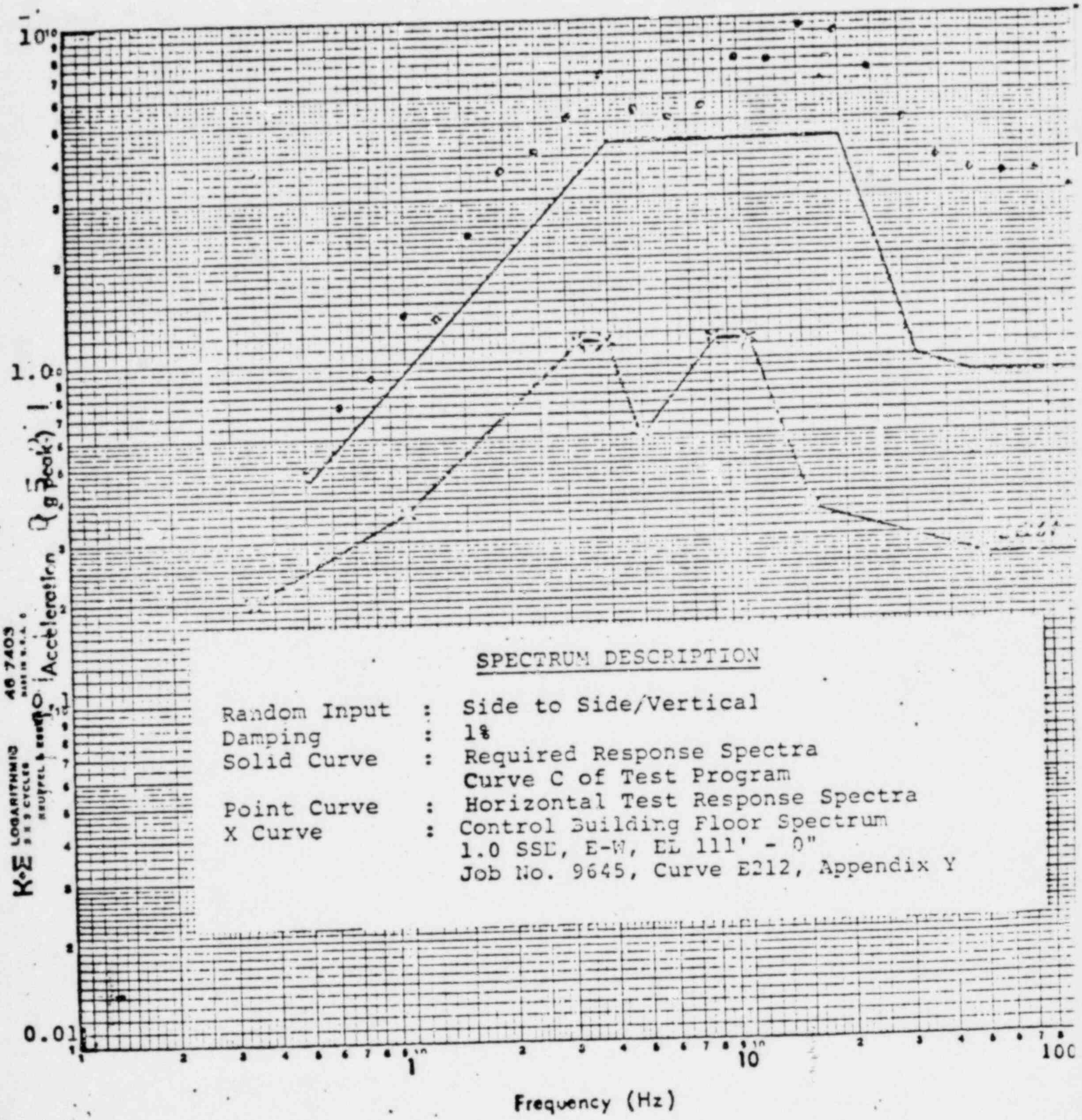


FIGURE 18

Comparison of specified 1.0 SSE Horizontal Acceleration Response Spectra to that of Tested Specimen.

64

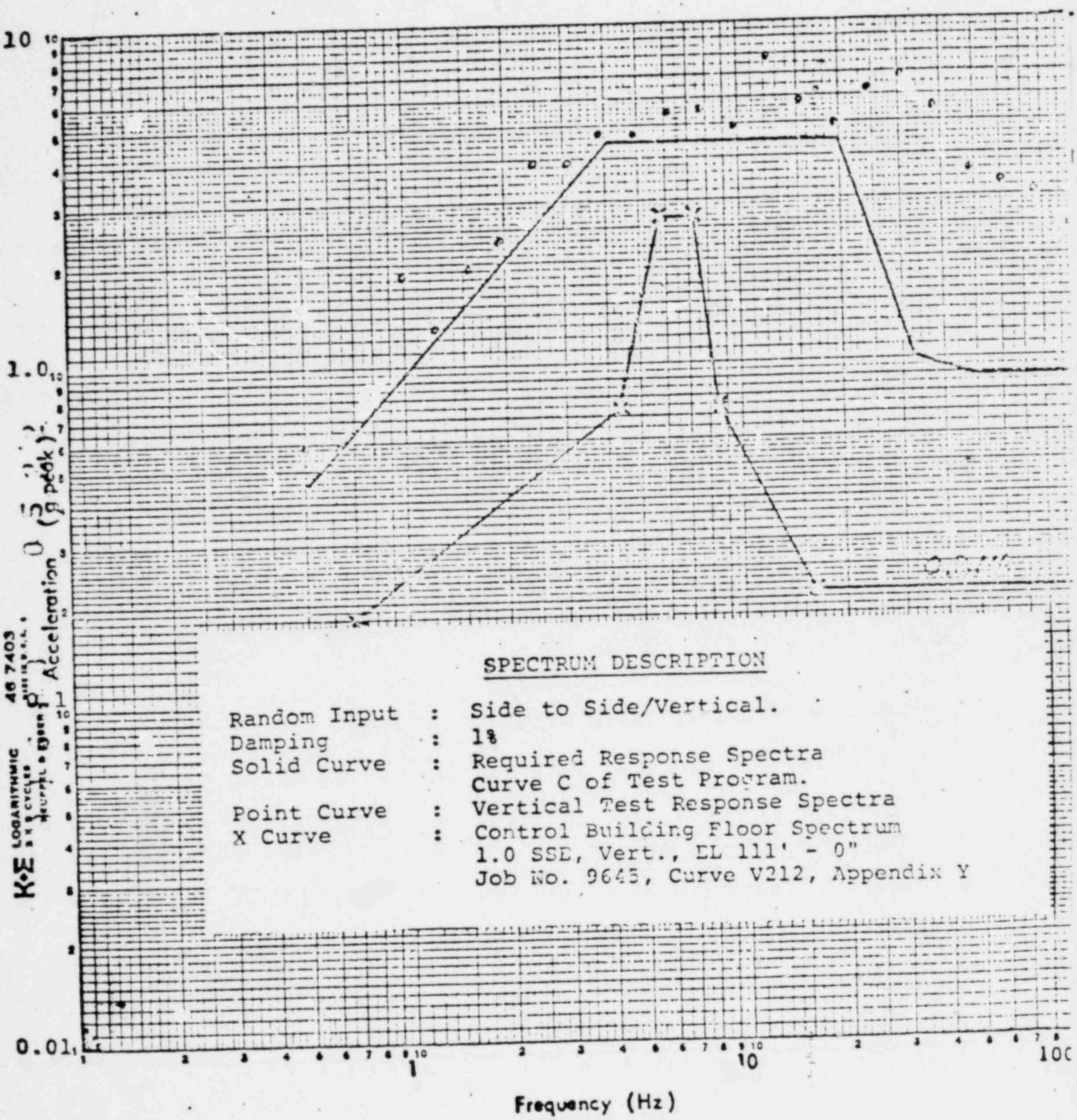


FIGURE 19

Comparison of specified 1.0 SSE Vertical Acceleration Response Spectra to that of Tested Speciman.

65

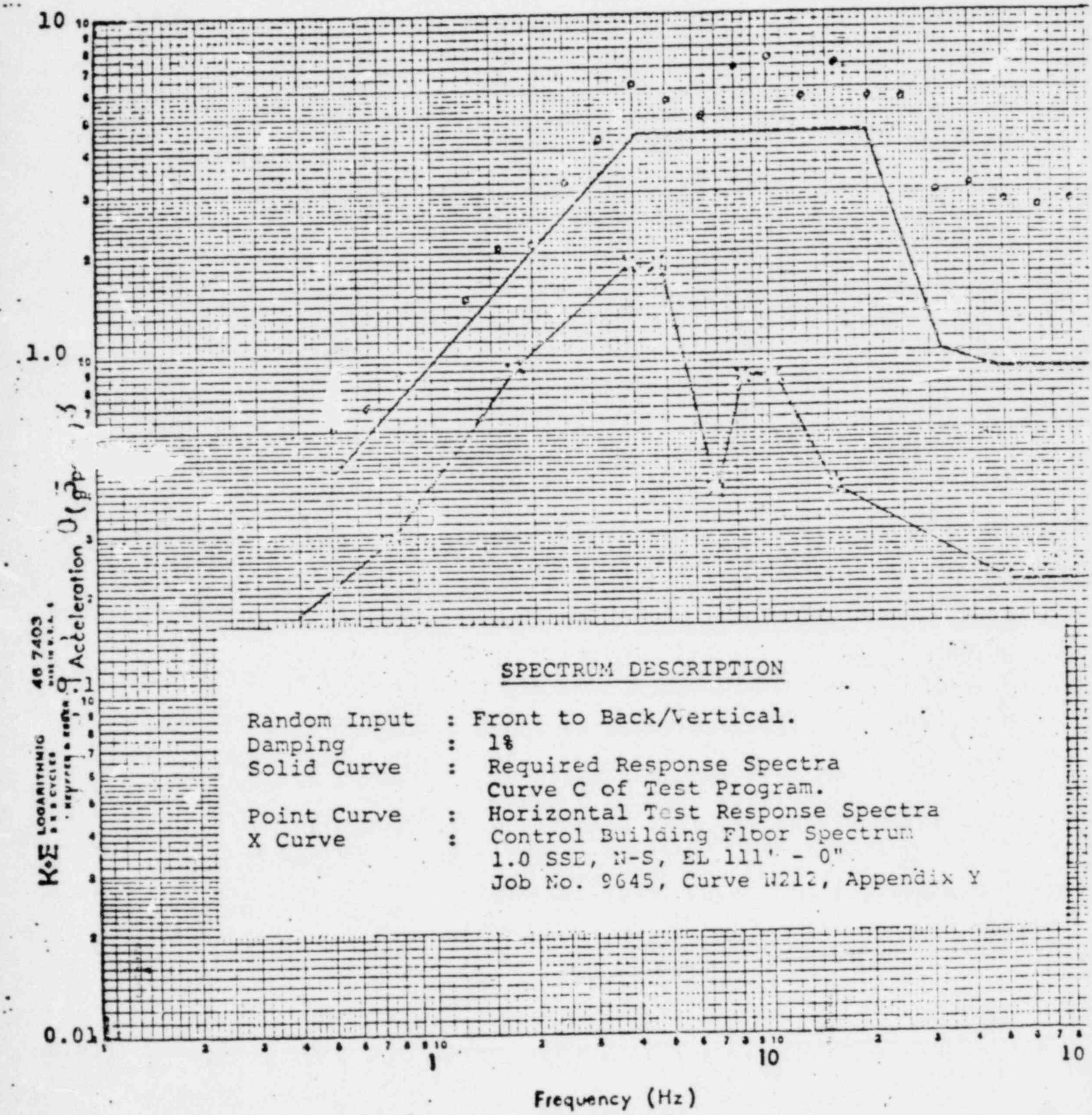


FIGURE 20

Comparison of specified 1.0 SSE Horizontal Acceleration Response Spectra to that of

66

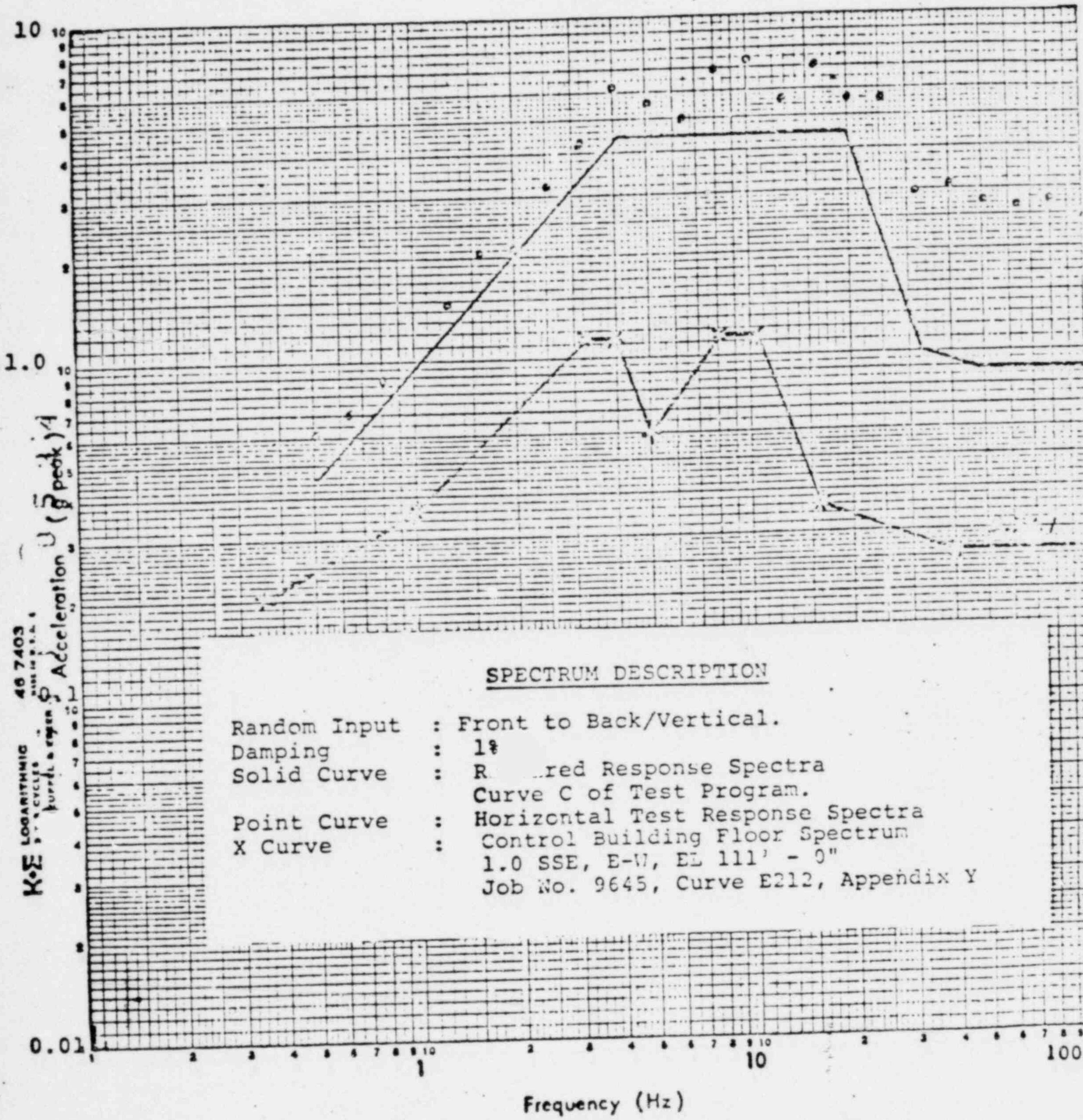


FIGURE 21

Comparison of specified 1.0 SSE Horizontal Acceleration Response Spectra to that of Tested Specimen.

67

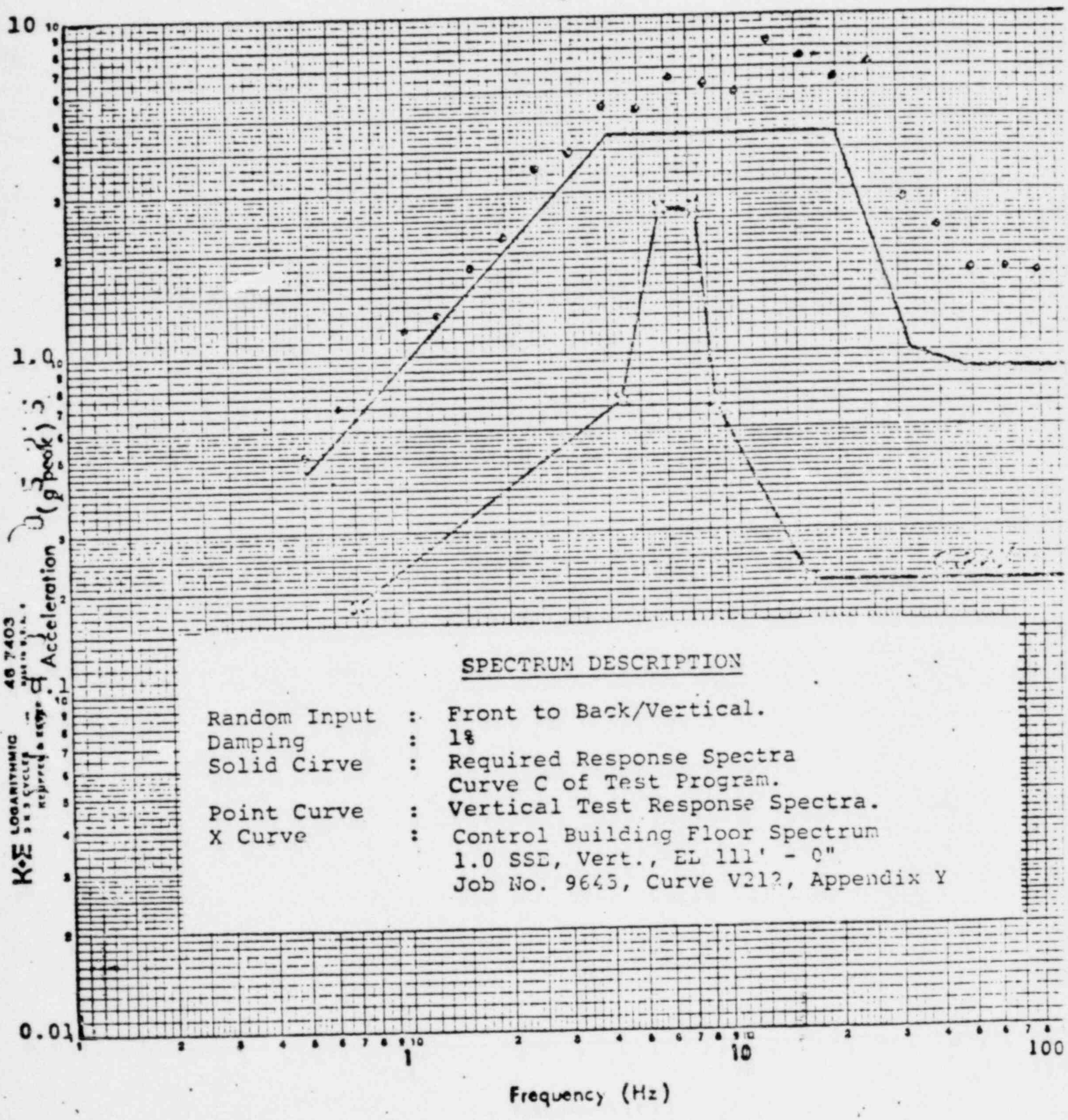


FIGURE 22

Comparison of specified 1.0 SSE Vertical Acceleration Response Spectra to that of Tested Specimen

68

Qualification Summary of Equipment

I. Plant Name: Grand Gulf Nuclear Station Unit 1

Type:

PWR ______

BWR BWR/6

1. Utility: Mississippi Power & Light Co.
2. NSSS: General Electric
3. A/E: Bechtel Power Corp.

II. Component Name 7200 Volt Metal Clad Switchgear for Recirc. Pump Trip

1. Scope: [ ] NSSS [X] BOP
2. Model Number: VM-13.8 Power/Vac M/C Swgr. Quantity: 1
3. Vendor: General Electric Co.
4. If the component is a cabinet or panel, name and model No. of the devices included: VB-7.2-500-1200 Power/Vac Vacuum Circuit Breaker
5. Physical Description a. Appearance Double Stack

   b. Dimensions 72" x 94" x 95"

   c. Weight 13,450 lbs.
6. Location: Building: Auxiliary Bldg.

   Elevation: 139'-0"
7. Field Mounting Conditions [ ] Bolt (No._____, Size_____)

   [X] Weld (Length *) Per Dwg # 9645-E-009.4- Q1R22S103B-A-1.1-1-1 Q1R22S103C-F

   [ ] ______
8. a. System in which located: R-22 - 6.9 KV Swgr.

   b. Functional Description: Recirculating Pump Trip (RPT) Switchgear

   c. Is the equipment required for [X] Hot Standby [X] Cold Shutdown

   [X] Both [ ] Neither
9. Pertinent Reference Design Specifications:

   Bechtel Specification 9645-E-009.4

   Bechtel Seismic Specification 9645-E-091.0

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method:

[X] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: G.E. Certified Seismic Report - Req. 311-06659

(No., Title and Date) Wyle Report 43831-4 and -5

Company that Prepared Report: Wyle Laboratories; Huntsville, Ala.

Company that Reviewed Report: General Electric Co.
Switchgear Business Dept.

V. Vibration Input:

1. Loads considered: a. [X] Seismic only

   b. [ ] Hydrodynamic only

   c. [ ] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [ ] SRSS [ ] N/A (other, specify)

3. Required Response Spectra (attach the graphs): Graphs attached

4. Damping Corresponding to RRS: OBE 1% SSE 1%

5. Required Acceleration in Each Direction: [X] ZPA [ ] Other (specify)

   OBE S/S = 0.180 g F/B = 0.174 g V = .101 g
   SSE S/S = 0.361 g F/B = 0.349 g V = .202 g

6. Were fatigue effects or other vibration loads considered?

   [X] Yes [ ] No

   If yes, describe loads considered and how they were treated in overall qualification program: Five OBE and one SSE Tests.

*NOTE: If more than one report complete items IV thru VII for each report.

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency [X] Multi-Frequency: [X] random [X] sine beat [ ] ________

2. [ ] Single Axis [X] Multi-Axis

3. No. of Qualification Tests: OBE 5 SSE 1 Other ________ (specify)

4. Frequency Range: 1 to 40 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = 5.3 - 6 Hz F/B = 13 - 14 Hz V = 31 - 32 Hz

6. Method of Determining Natural Frequencies

   [X] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [X] Yes (Attach TRS & RRS graphs)
   [ ] No

8. Input g-level Test: OBE S/S = 1.6 g F/B = 0.8 g V = 0.75 g

   SSE S/S = 3.2 g F/B = 1.6 g V = 1.5 g

9. Laboratory Mounting:

   1. [ ] Bolt (No.______, Size______) [X] Weld (Length______) [ ]______
   Weld Locations - Wyle Report #43831-4 PG-16

* 10. Functional operability verified: [X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: ________

12. Other test performed (such as aging or fragility test, including results):

    Power/Vac breakers subjected to mechanical life testing prior to this seismic test program.

*Note: If qualification by a combination of test and analysis also complete Item VII.

* Functionally, the Power/Vac being furnished only has to trip upon command due to a fault or from a remote location. This function was successfully demonstrated 24 times (8 times for each of the 3 breakers) without failure during the double stack test series and 6 times without failure during the single stack test series.

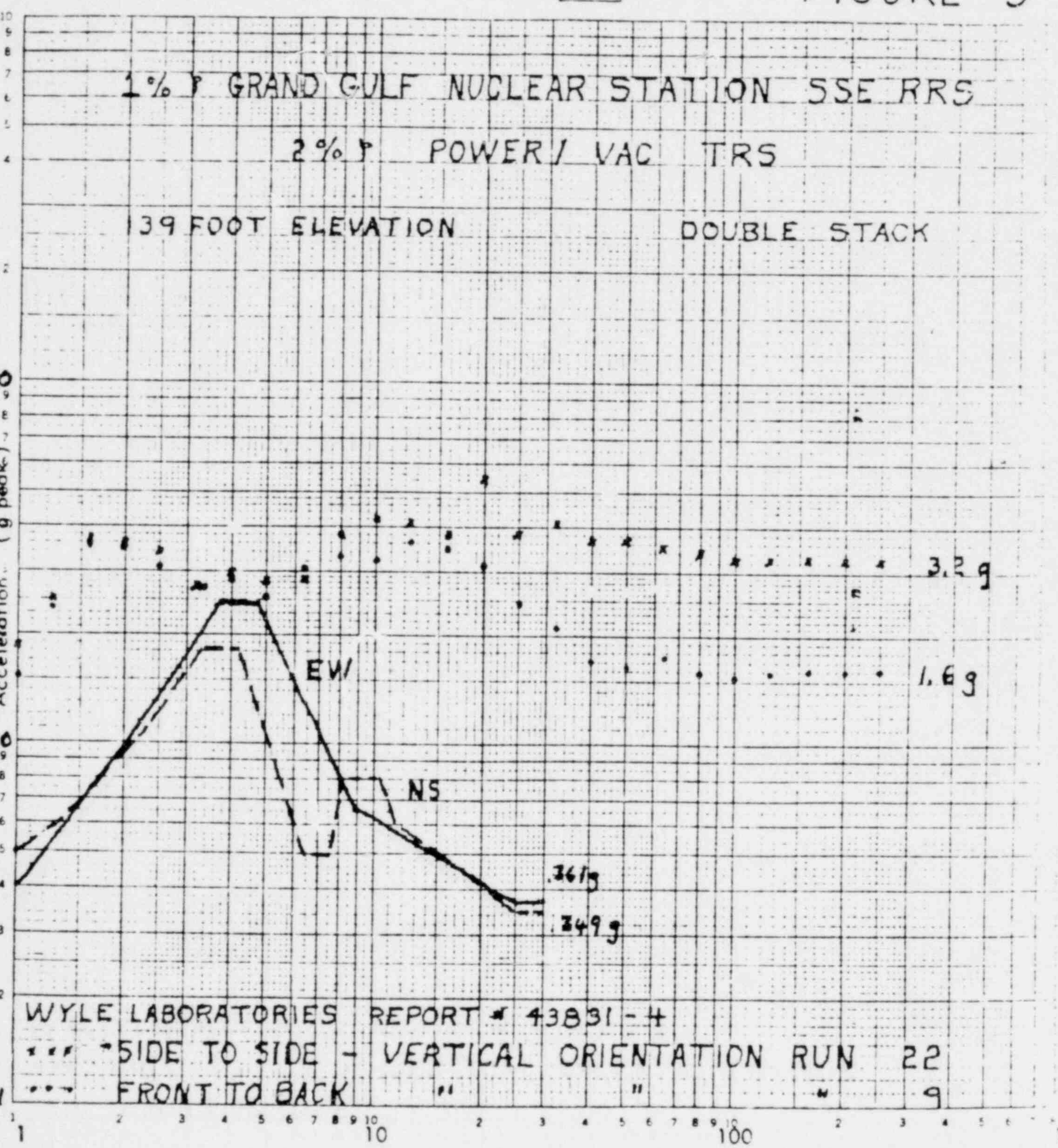
12/80

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING [%]

FIGURE 5



AXIS HORIZONTAL

LOCATION NO. ________

TEST RUN NO. ________

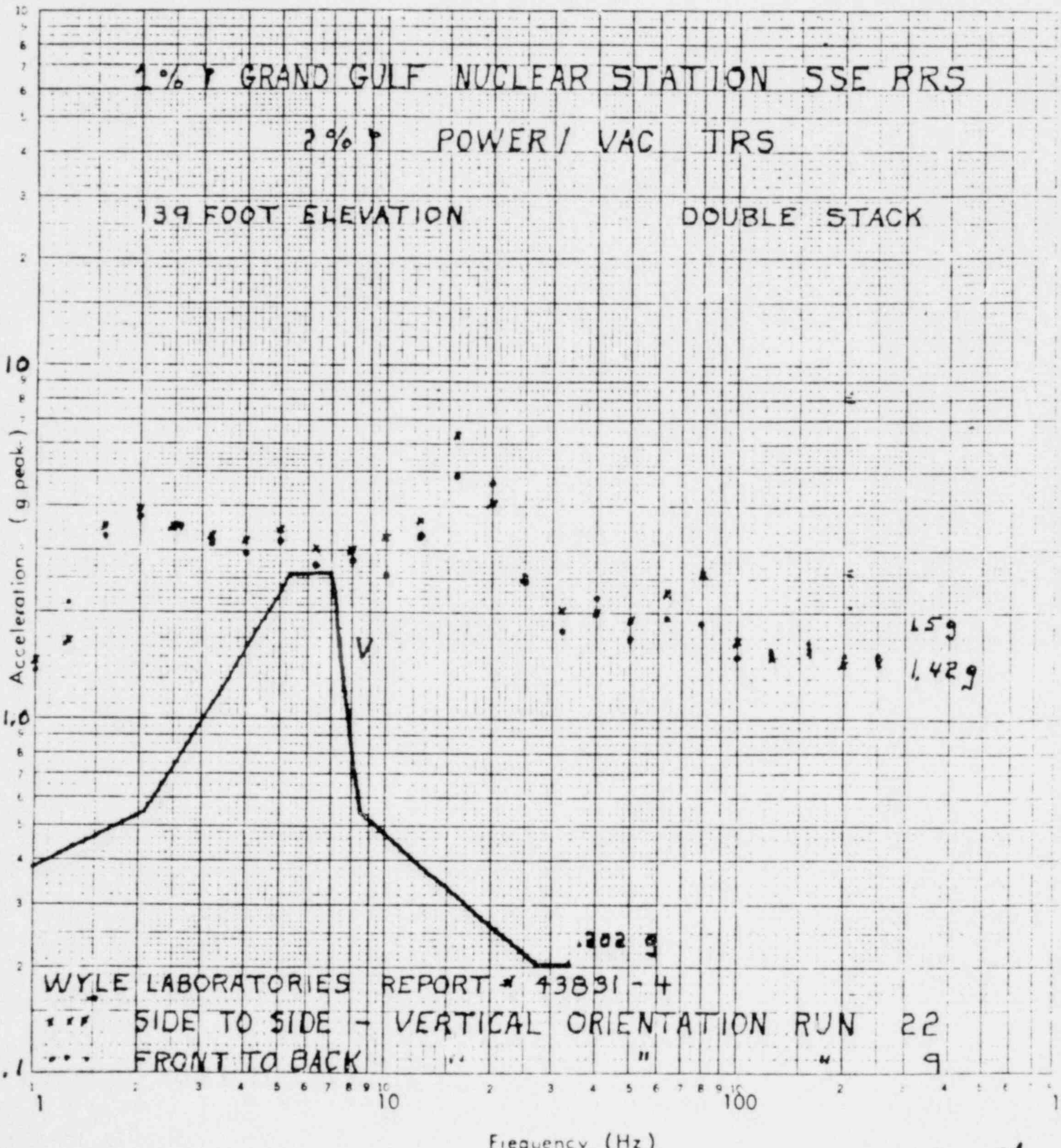
E M Fitzgerald
June 21, 1978

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING [%]

FIGURE 6



AXIS VERTICAL

LOCATION NO. ______

TEST RUN NO. ______

E M Fitzgerald
June 21, 1978

Qualification Summary of Equipment

I. Plant Name: Grand Gulf Nuclear Station Unit 1 — Type:

1. Utility: MP&L — PWR

2. NSSS: G. E. 3. A/E Bechtel — BWR BWR/6

II. Component Name 125 V DC Panelboard 1DA2; MPL #Q1L21P112A

1. Scope: [ ] NSSS [X] BOP

2. Model Number: None Quantity: 1

3. Vendor: Delta Switchboard Company

4. If the component is a cabinet or panel, name and model No. of the devices included: GE Breakers; Type 'THED'

5. Physical Description a. Appearance Cabinet

b. Dimensions 30" L X 14" D X 90" H

c. Weight 850 Lbs.

6. Location: Building: Auxiliary Building

Elevation: 119'-0"

7. Field Mounting Conditions [X] Bolt (No. 4, Size 1/2")
[ ] Weld (Length)
[ ]

8. a. System in which located: L21

b. Functional Description: 125 V DC Distribution

c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
[X] Both [ ] Neither

9. Pertinent Reference Design Specifications: 9645-E-020.0, 9645-E-091.0

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method:

[X] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*:

(No., Title and Date) 58039; Seismic Test of Panel IDA2; March 9, 1976

Company that Prepared Report: Wyle Laboratories

Company that Reviewed Report: Wyle Laboratories

V. Vibration Input:

1. Loads considered: a. [X] Seismic only

   b. [ ] Hydrodynamic only

   c. [ ] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [ ] SRSS [ ] ______ (other, specify)

3. Required Response Spectra (attach the graphs): Graphs attached

4. Damping Corresponding to RRS: OBE 1% SSE 1%

5. Required Acceleration in Each Direction: [X] ZPA [ ] Other ______ (specify)

OBE	S/S = 0.144 g	F/B = 0.157 g	V = .097 g
SSE	S/S = 0.289 g	F/B = 0.315 g	V = .194 g

6. Were fatigue effects or other vibration loads considered?

   [X] Yes [ ] No

   If yes, describe loads considered and how they were treated in overall qualification program: 5 OBE Followed by 2 SSE

*NOTE: If more than one report complete items IV thru VII for each report.

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency [X] Multi-Frequency: [X] random
[ ] sine beat
[ ] ______

2. [ ] Single Axis [X] Multi-Axis

3. No. of Qualification Tests: OBE 5 SSE 2 Other ______ (specify)

4. Frequency Range: 1.1 to 100 HZ

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical): None

S/S = ______ F/B = ______ V = ______

6. Method of Determining Natural Frequencies N/A

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [X] Yes (Attach TRS & RRS graphs)
[ ] No

8. Input g-level Test: OBE S/S = 0.21g F/B = 0.3g V = 0.28g

SSE S/S = 0.40g F/B = 0.52g V = 0.50g

9. Laboratory Mounting: Same as Field Mounting

1. [ ] Bolt (No.______, Size______) [ ] Weld (Length______) [ ]______

10. Functional operability verified: [X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Test is successfully performed without any modifications

12. Other test performed (such as aging or fragility test, including results):

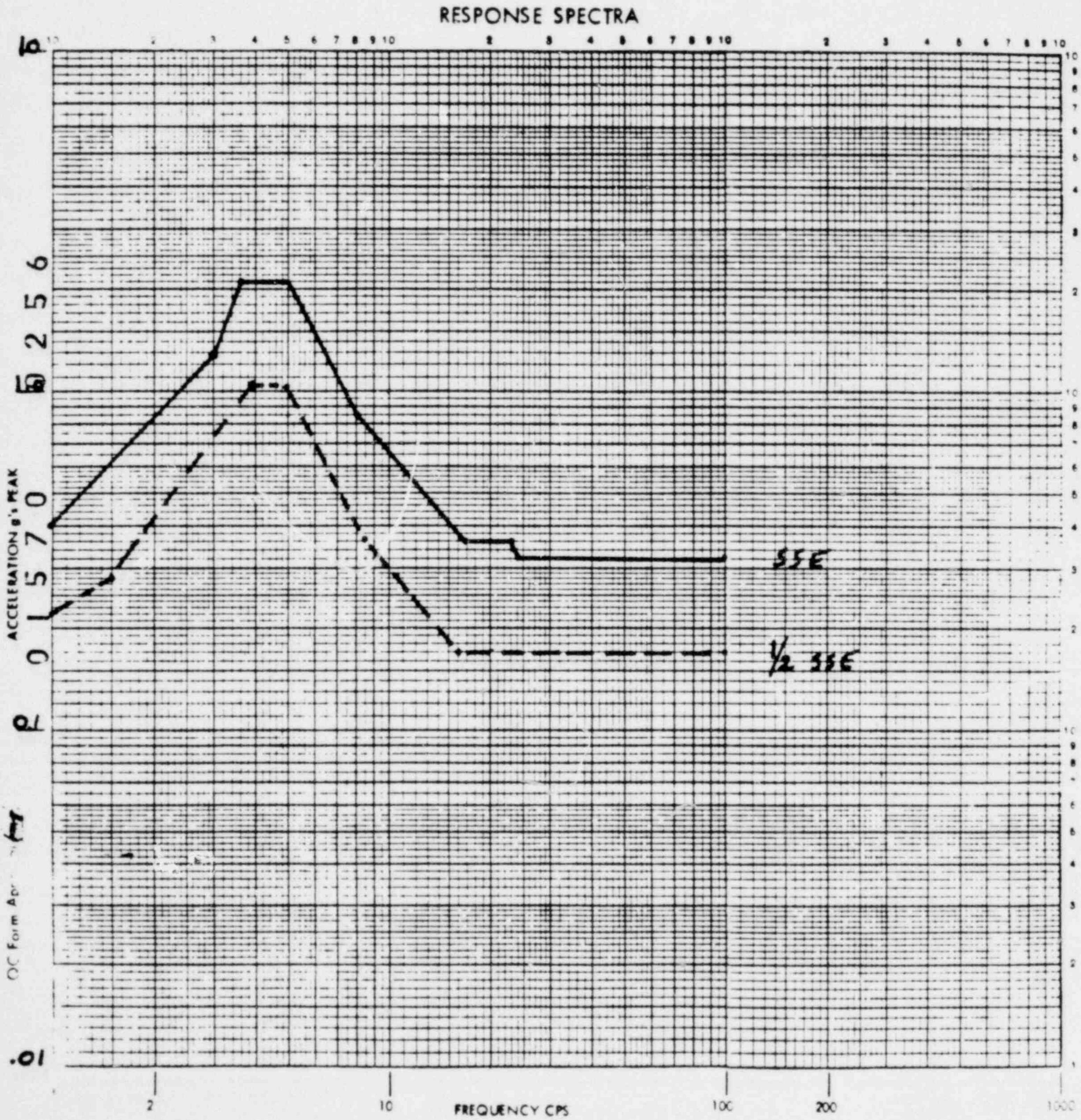
None

*Note: If qualification by a combination of test and analysis also complete Item VII.

The curves check OK
with the ones supplied by
Bechtel

FIGURE 1

E-W HORIZONTAL AXIS
(Front to Back)
1% Damping

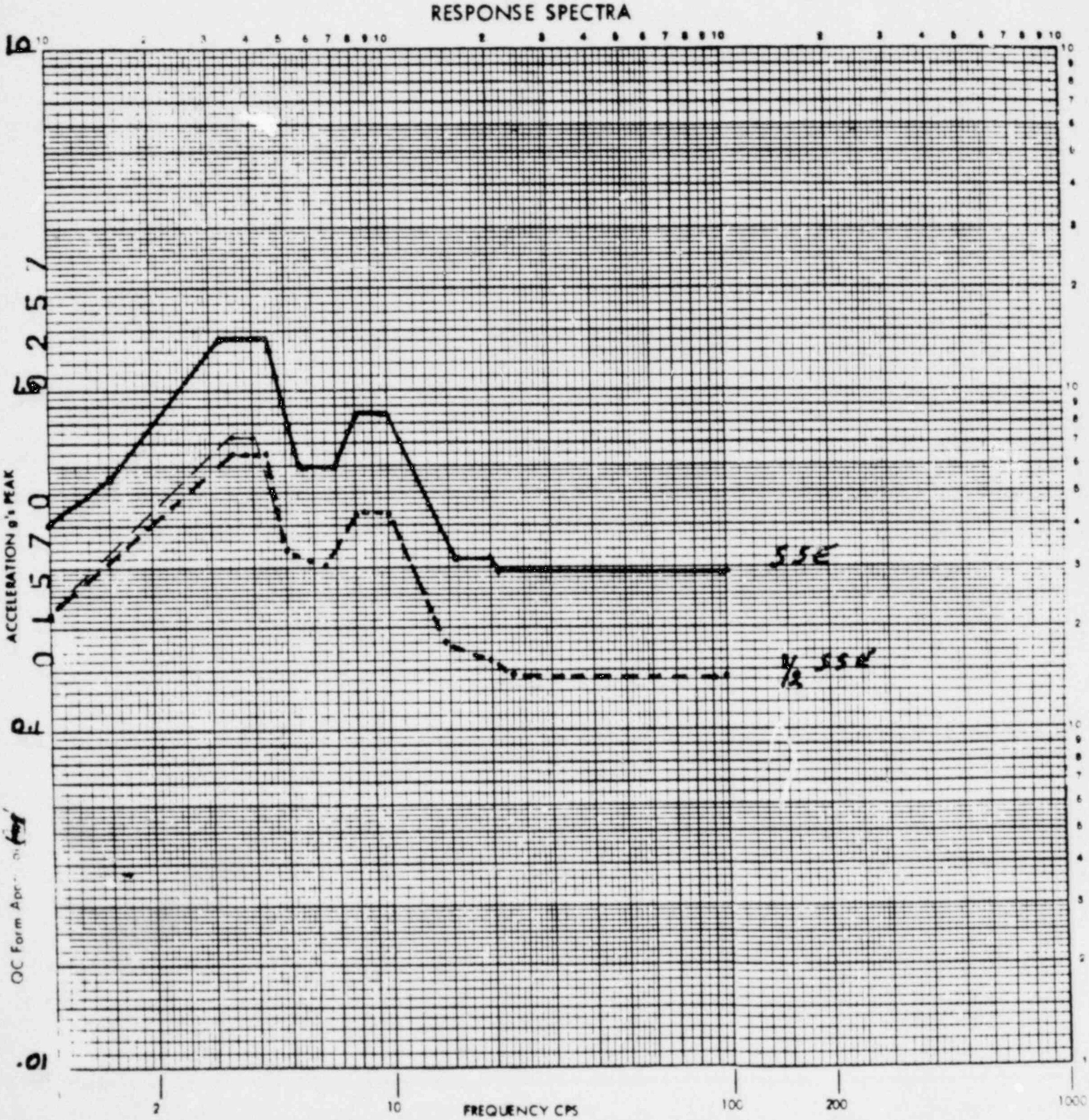


The curve for 1/2 SSE is revised to conform to that of Bechtel.

The curve for SSE checks OK with that of Bechtel

FIGURE 2

N-S HORIZONTAL AXIS
(Side to Side)
1% Damping

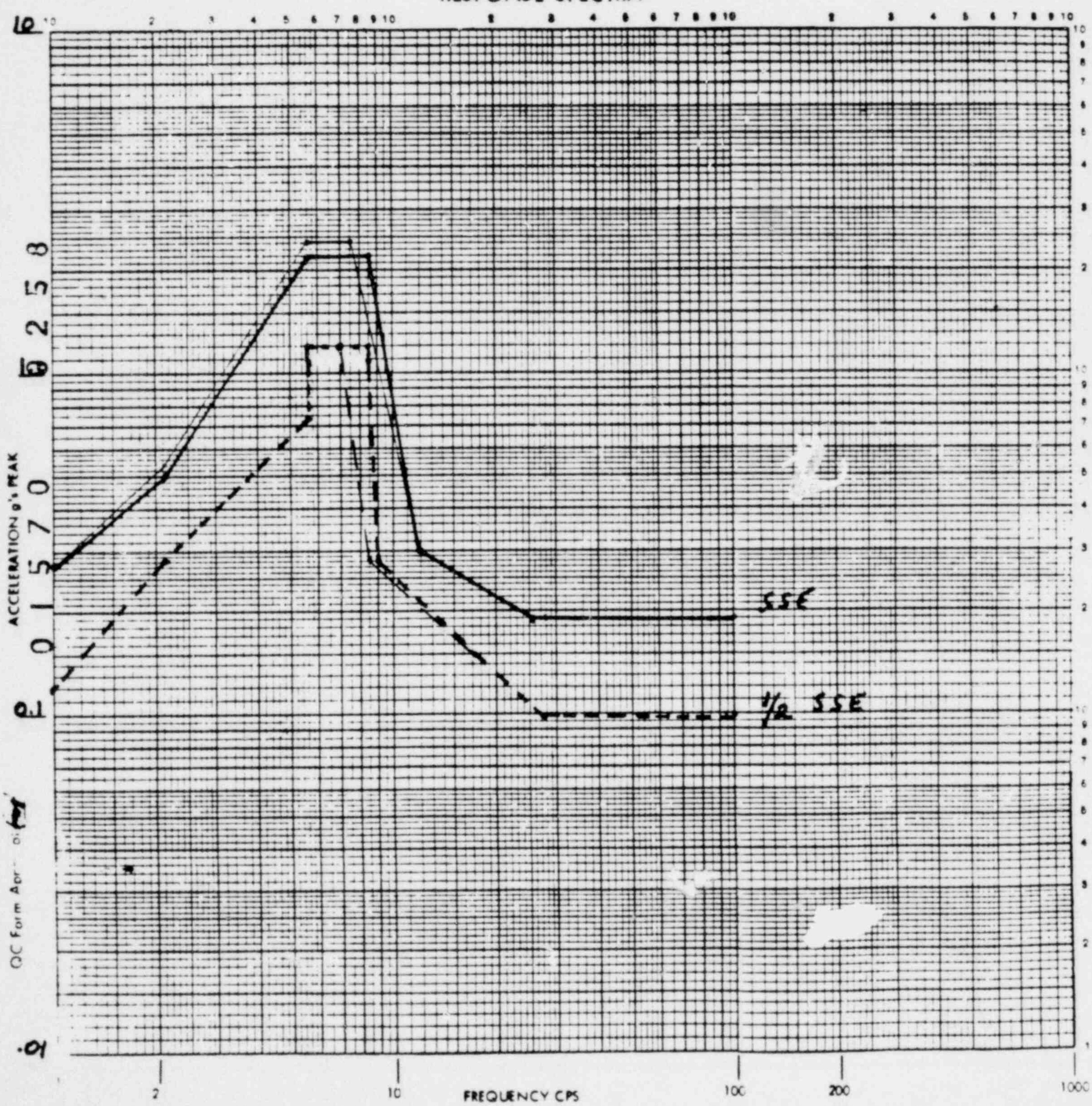


The curves are corrected to conform to that of Bechtel.

FIGURE 3

VERTICAL AXIS
1% Damping

RESPONSE SPECTRA



BECHTEL POWER CORP.
RECEIVED
APR 0 1 1976
JOB NO. 9645

TEST REPORT

REPORT NO. 58039
OUR JOB NO. ND 58039
YOUR P. O. NO. 51970-50375
CONTRACT --

WYLE LABORATORIES / Norco, California . 737-0871 , 689-2104 . TWX 910-332-1204 . Cable WYLAB

Delta Switchboard Co.
705 No. Carlton Avenue
Stockton, California 95201

63 - Page Report

DATE 9 March 1976

VENDOR'S DOCUMENT REVIEW
1 [X] Approved - Mfg. may proceed
2 [ ] Approved - Submit final dwg. - Mfg. may proceed
3 [ ] Approved - except as noted - Make changes and submit final dwg. - Mfg. may proceed as approved
4 [ ] Not Approved - Correct and resubmit
5 [ ] Review not required - Mfg. may proceed
Approval of this drawing does not relieve supplier from full compliance with contract or purchase order requirements.
By: IDM Date 5.25.76
BECHTEL
JOB NO. 9645 BECHTEL CORPORATION POWER & INDUSTRIAL DIVISION P. O. BOX 607 GAITHERSBURG, MD

0 1 5 7 0 0 2 5 3

SEISMIC TEST

OF

ONE PANEL

PART NUMBER 1DA2, SERIAL NUMBER Q1L21P112A

FOR

DELTA SWITCHBOARD CO.

9645 E-0000-70-2-0

00148456

STATE OF CALIFORNIA }
COUNTY OF RIVERSIDE } ss.

Ray C. Myrick, being duly sworn, deposes and says: That the information contained in this report is the result of complete and carefully conducted tests and is to the best of his knowledge true and correct in all respects.

Ray C. Myrick

SUBSCRIBED and sworn to before me this 10th day of March, 1976

Catherine C. Kelty
Notary Public in and for the County of Riverside, State of California

My Commission expires 14 July, 1979

OFFICIAL SEAL
CATHERINE C. KELTY
NOTARY PUBLIC - CALIFORNIA
RIVERSIDE COUNTY
My comm. expires JUL 14, 1979

DEPARTMENT DYNAMICS

DEPT. MGR. Robinson

TEST ENGINEER Luther F. Goad
L. F. Goad

Registered Professional Engineer George D. Shipway

REGISTERED PROFESSIONAL ENGINEER
GEORGE D. SHIPWAY
No. 12157
MECHANICAL
STATE OF CALIFORNIA

DCAS-QAR VERIFICATION

QUALITY CONTROL Al Heeseman

W-867A

1.0 REFERENCES

1.1 Wyle Laboratories Test Plan No. ND 751359.

1.2 Delta Switchboard Co. Purchase Order No. 51970-50375, dated 23 February 1976.

2.0 TEST PROCEDURES

2.1 Receiving Inspection

Upon receipt at Wyle Laboratories, and prior to testing, the test specimen was visually examined for evidence of damage due to shipping. The identification information for the specimen was recorded on the receiving inspection data sheet included as Page 7 of this report.

2.2 Specimen Mounting

The 1DA2 panel was bolted to a book-end type test fixture which in turn was welded to the seismic test machine. The test specimen was attached to the test machine in a manner that simulated normal in-service attachment.

2.3 Functional Setup

A chatter-transfer detector was wired to six circuit breaker contacts, and contact chatter was visually monitored during the seismic tests. Chatter is defined as the momentary opening of normally closed contacts, and transfer is the momentary closure of normally open contacts. The chatter/transfer detector was pre-set to monitor ten microseconds or greater contact interruption. If contact interruptions of ten microseconds or greater were detected a red indicating light illuminated and stayed on until that channel of the chatter detector was reset.

2.4 Seismic Random

The seismic random motion was synthesized by applying a random signal to a group of parallel one-third octave filters centered at one-third octave frequency intervals over the frequency range of 1.25 to 35 Hz. Each filter incorporated an amplitude control which was adjusted such that the analysis of the resulting table motion yielded the required response spectra as shown in Figures 1 through 3, included as Pages 4 through 6 of this report.

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2.4 (continued)

The seismic random motion for each horizontal axis was excited separately but each one was excited simultaneously with the vertical axis. Independent signal sources were used for the horizontal and vertical axes so that input phasing was random. Five one-half SSE tests and two SSE tests were performed in each axis. The duration of each test was 30 seconds.

All the one-half SSE tests were performed with the breaker contacts in the open condition. One SSE test was performed with the breakers in the open condition, and then repeated with the breakers in the closed condition.

2.4.1 Response Analysis

The seismic response spectra analysis was performed by a shock analyzer generating the maximum response amplitudes at one-third octave intervals over the frequency range of 1.1 to 100 Hz. A damping ratio of 1% (Q=50) was utilized in the analysis of the table motion.

3.0 TEST RESULTS

3.1 Receiving Inspection

Visual examination of the test specimen revealed no damage had occurred due to shipping.

3.2 Functional

No contact interruption was noted during the seismic test.

3.3 Seismic Random

Visual examination of the test specimen upon completion of each test revealed no structural damage or change in performance of the test specimen had occurred during testing.

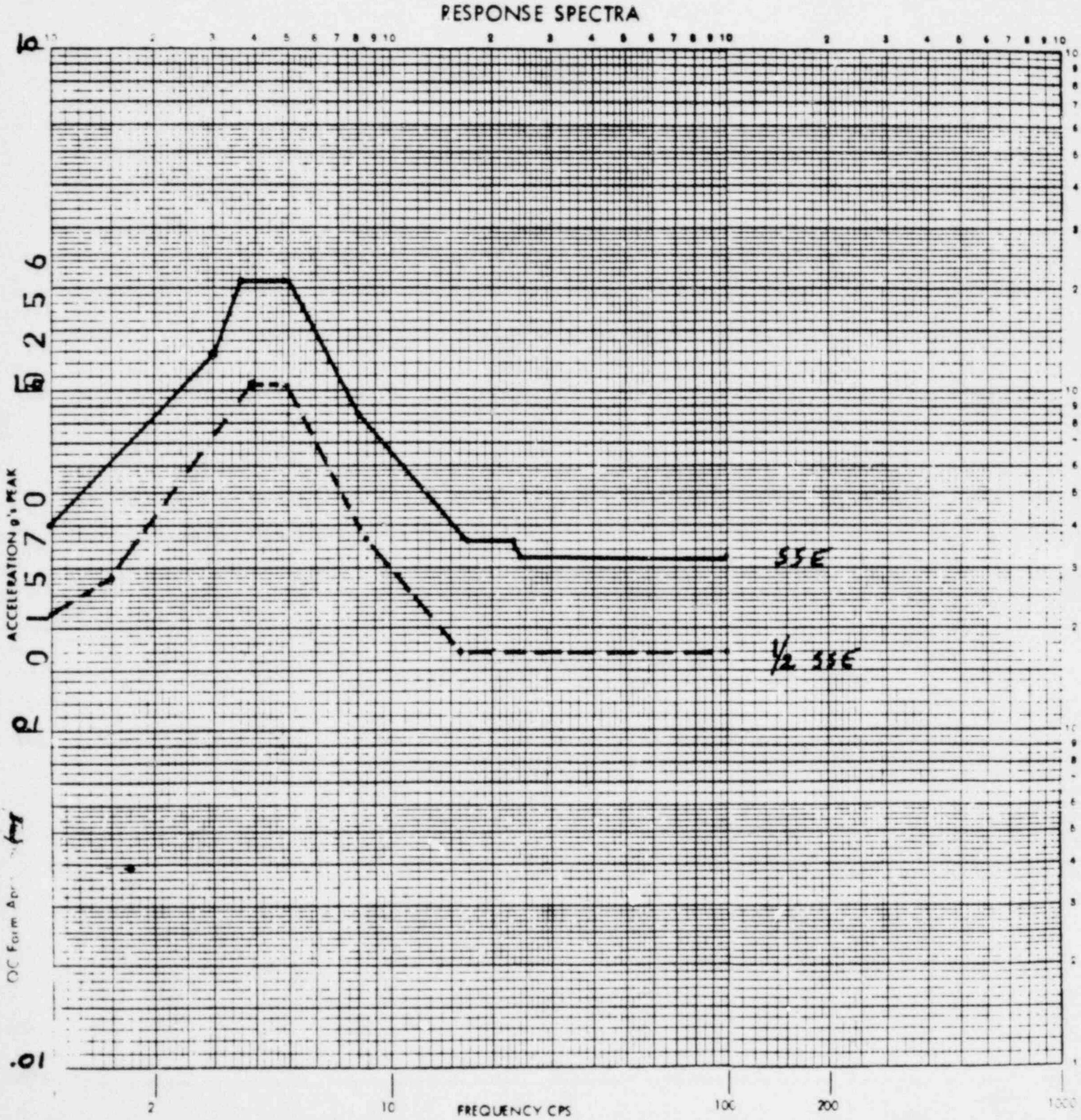
Additional information, such as accelerometer locations, test equipment used, and calibration dates, is shown on the following data sheets. Test setups and accelerometer locations are shown in Photographs 1 through 4.

0157002255

The curves check OK
with the ones supplied by
Bechtel

FIGURE 1

E-W HORIZONTAL AXIS
(Front to Back)
1% Damping



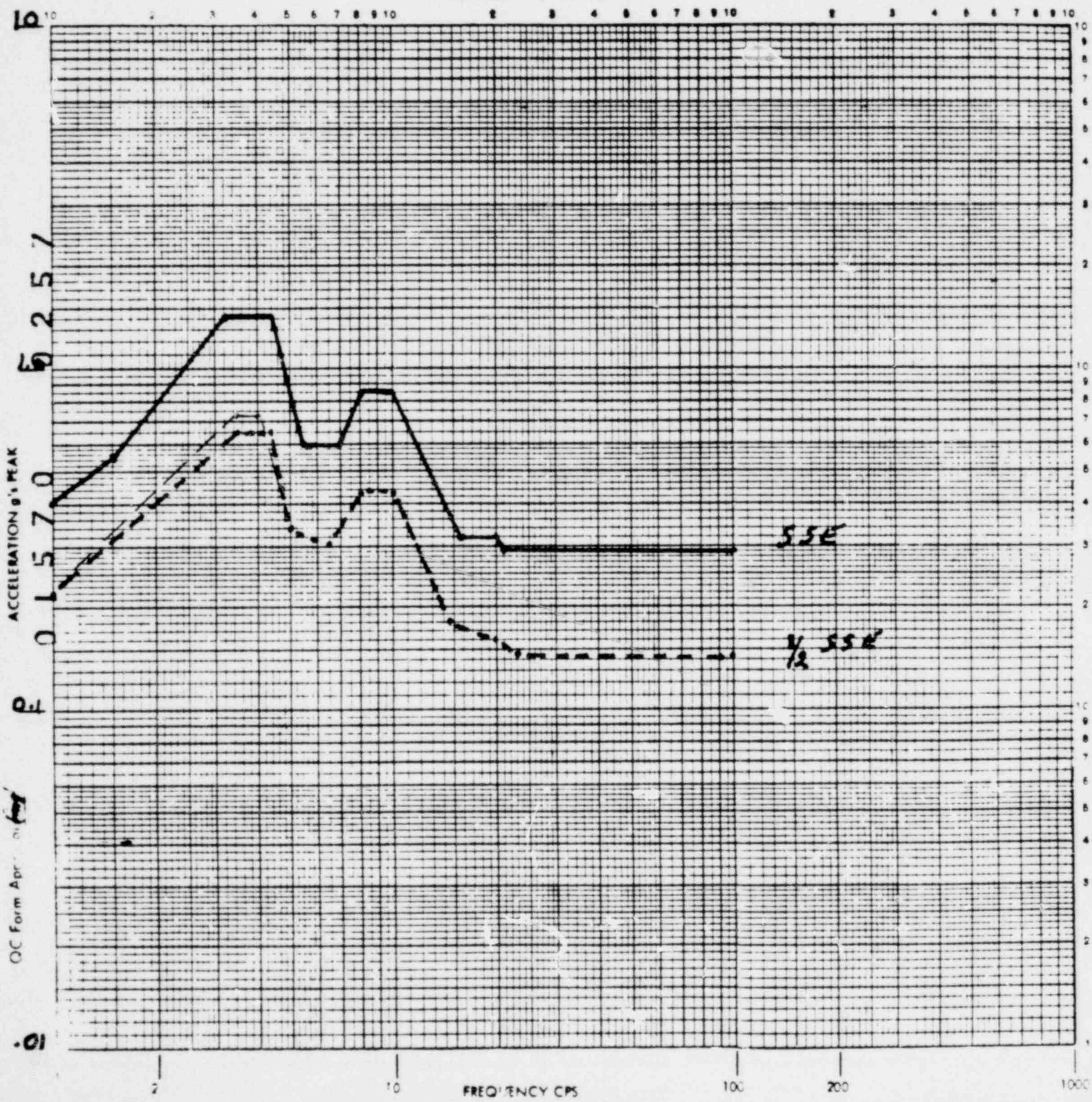
The curve for 1/2 SSE is revised to conform to that of Bechtel.

The curve for SSE checks OK with that of Bechtel

FIGURE 2

N-S HORIZONTAL AXIS
(Side to Side)
1% Damping

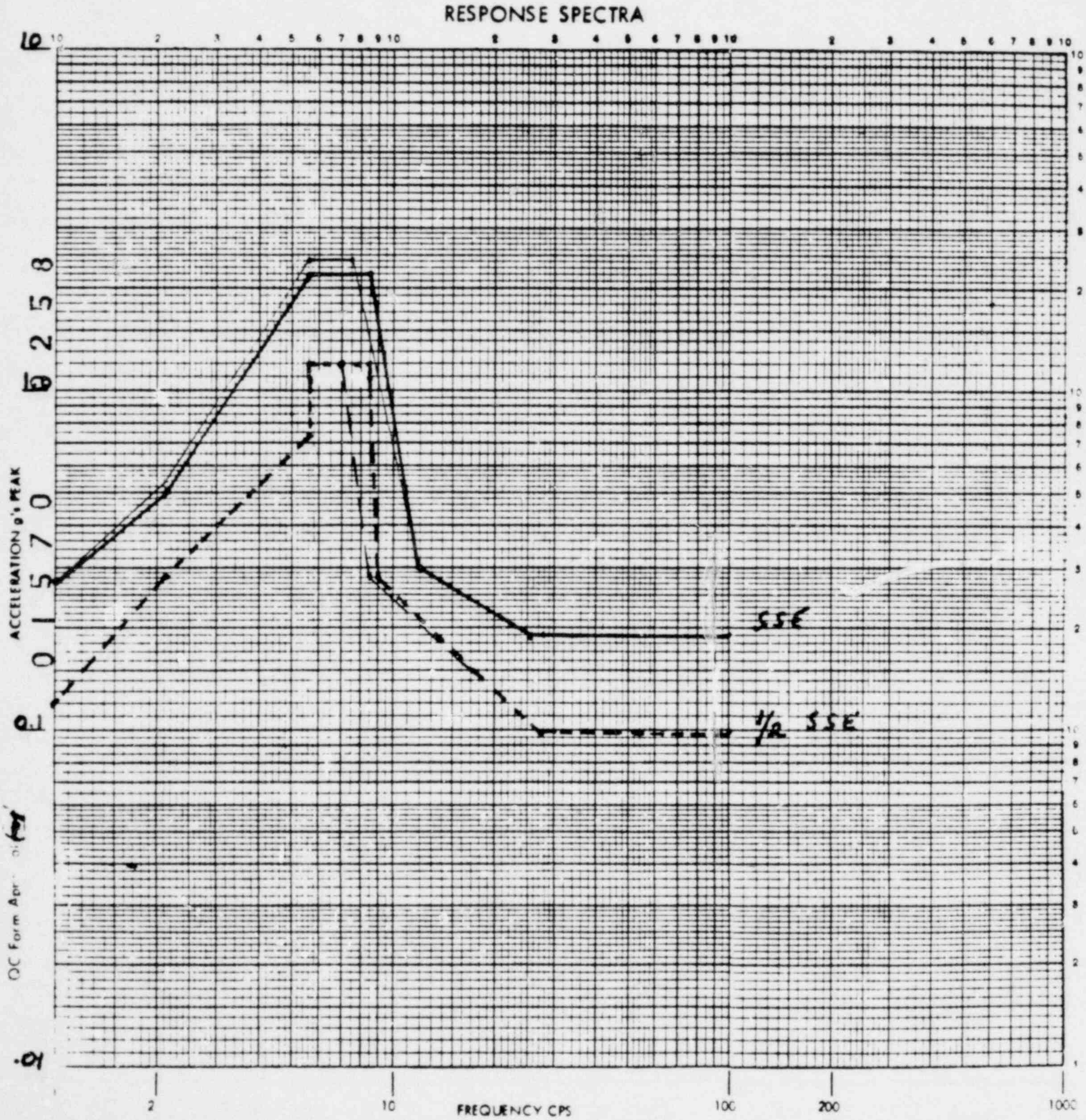
RESPONSE SPECTRA



The curves are corrected to conform to that of Bechtel.

FIGURE 3

VERTICAL AXIS
1% Damping



DATA SHEET

Customer DELTA SWITCH BOARD Job No. 58039

Date 3-1-76

Specimen PANEL

RECEIVING INSPECTION

No. of Specimens Received: (1) ONE

Record identification information exactly as it appears on the tag or specimen:

Manufacturer DELTA SWITCHBOARD

Part Numbers 1DA2

How does identification information appear: (name plate, tag, painted, imprinted, etc.)

NAME PLATE

Serial Numbers:* ——

Q1L21P112A

Examination: Visual, for evidence of damage, poor workmanship, or other defects, and completeness of identification

Inspection Results: There was no visible evidence of damage to the specimens unless noted below

NONE

* If additional space is required for serial numbers, use an additional page, or reference first functional test data sheet (if applicable)

Inspected By P. Burall

Sheet No. of

Approved Luther J. Good Date 3-5-76

W-614

Q.C. Form Approval [signature]

0157 0 0259

WYLE LABORATORIES

DATA SHEET

Report No. 58039

Page No. 8

CUSTOMER DELTA SWITCH BOARD

Test Title: SEISMIC RANDOM

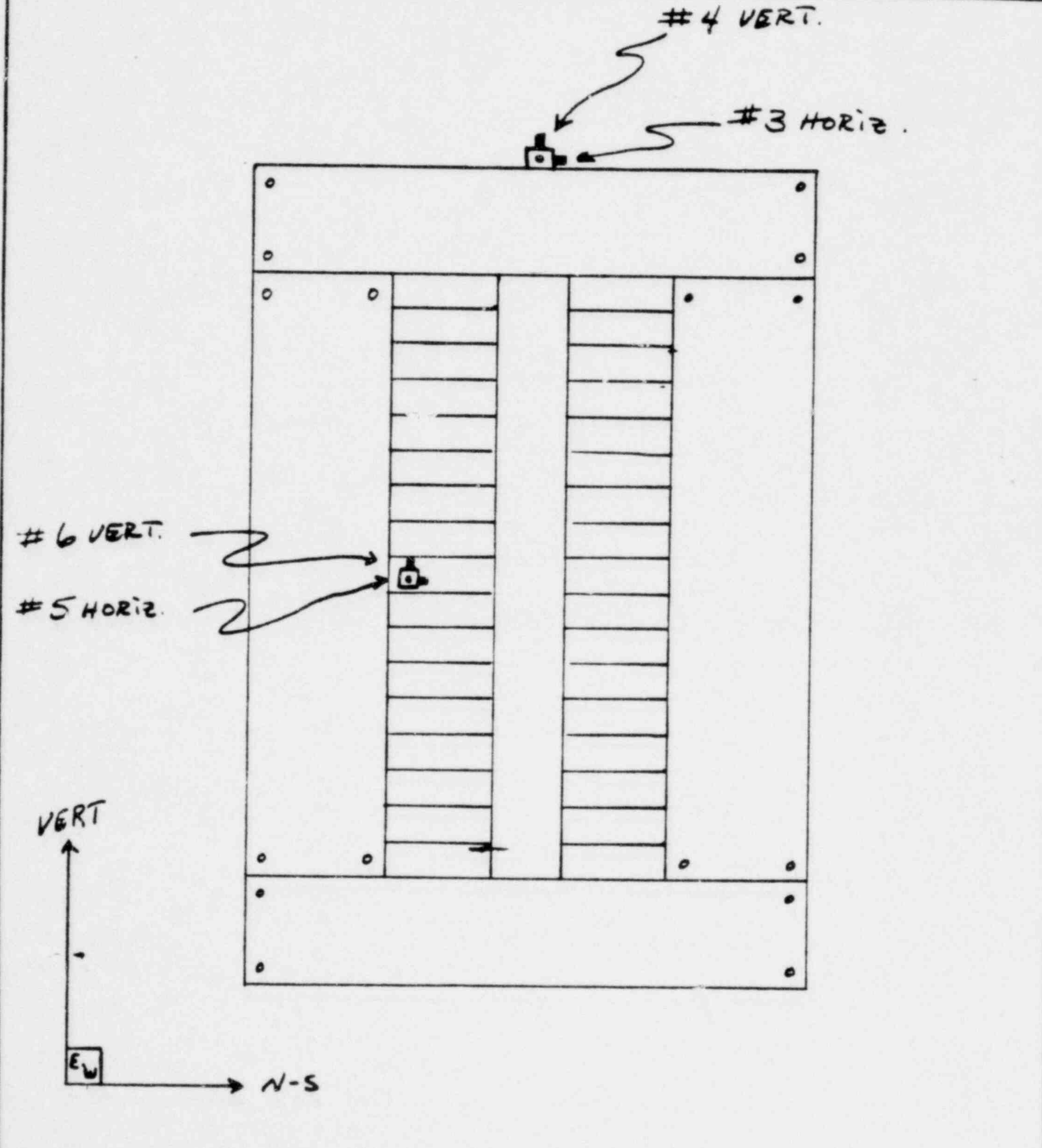
Specimen PANEL

Part No. 1DA2

Job No. 58039

S/N Q1L21P112A

Date 3-1-76



01570 0260

W-1-8

QC Form Approval

SHEET ____ OF ____

DATA SHEET

Report No 58039

Page No. 9

CUSTOMER DELTA SWITCH BOARD

Test Title: SEISMIC RANDOM

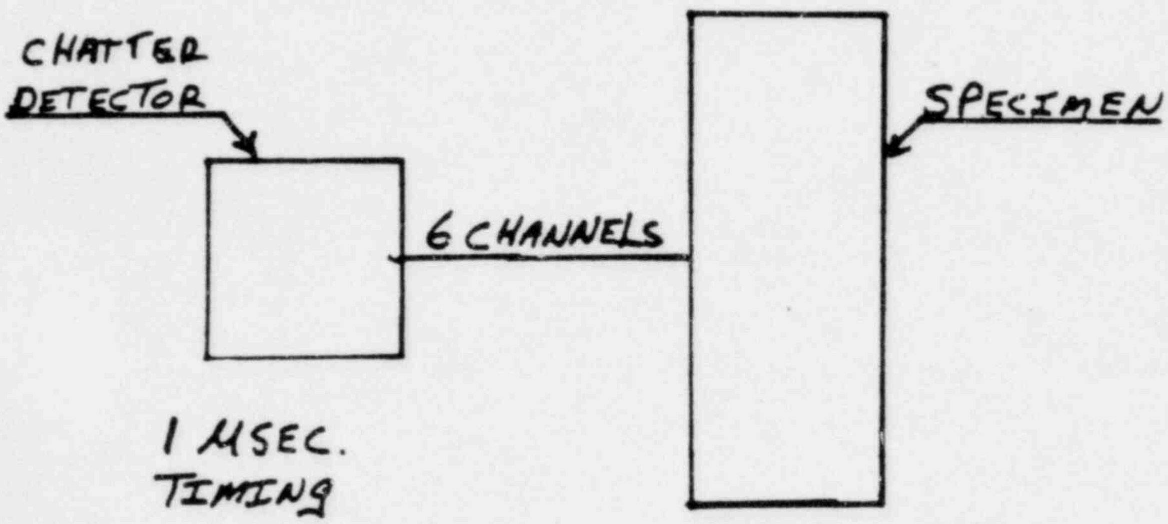
Specimen PANEL

Part No. 1DA2

Job No. 58039

S/N QTL21P112A

Date 3-1-76



0 1 5 7 0 0 2 6 1

WYLE LABORATORIES

DATA SHEET

Report No. 58039

Page No. 10

CUSTOMER DELTA SWITCH BOARD

Test Title: SEISMIC RANDOM

Specimen PANEL

Part No. 1DA2

Job No. 58039

S/N Q1L21P112A

Date 3-1-76

DATE	TIME	AXIS	TEST	COMMENTS
3-1	1411	E-W, VERT	RANDOM	1ST 1/2 SSE. (OPEN)
3-1	1417	E-W, VERT	RANDOM	2ND 1/2 SSE. (OPEN)
3-1	1424	E-W, VERT	RANDOM	3RD 1/2 SSE. (OPEN)
3-1	1428	E-W, VERT	RANDOM	4th 1/2 SSE. (OPEN)
3-1	1433	E-W, VERT	RANDOM	5th 1/2 SSE. (OPEN)
3-1	1441	E-W, VERT	RANDOM	1ST FULL SSE (OPEN)
3-1	1446	E-W, VERT	RANDOM	2ND FULL SSE (CLOSED)
3-1	1636	N-S, VERT	RANDOM	1ST 1/2 SSE (OPEN)
3-1	1655	N-S, VERT	RANDOM	2ND 1/2 SSE (OPEN)
3-1	1657	N-S, VERT	RANDOM	3RD 1/2 SSE (OPEN)
3-1	1701	N-S, VERT	RANDOM	4th 1/2 SSE (OPEN)
3-1	1703	N-S, VERT	RANDOM	5th 1/2 SSE (OPEN)
3-1	1707	N-S, VERT	RANDOM	1ST FULL SSE (OPEN)
3-1	1712	N-S, VERT	RANDOM	2ND FULL SSE (CLOSED)

Luther L. Good

0 1 5 7 0   0 2 6 2

W 618 B

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SHEET ____ OF ____

WYLE LABORATORIES

Report No. 58039

Customer Delta Swboard Job No. 58039

Page No. 11

Channel Identification: T/R — Trk. No. —

Accel. No. 1

Transducer S/N 1134 Control (+),

Response ( )

Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

Mode OFF

Specimen S/N QIL21P112A

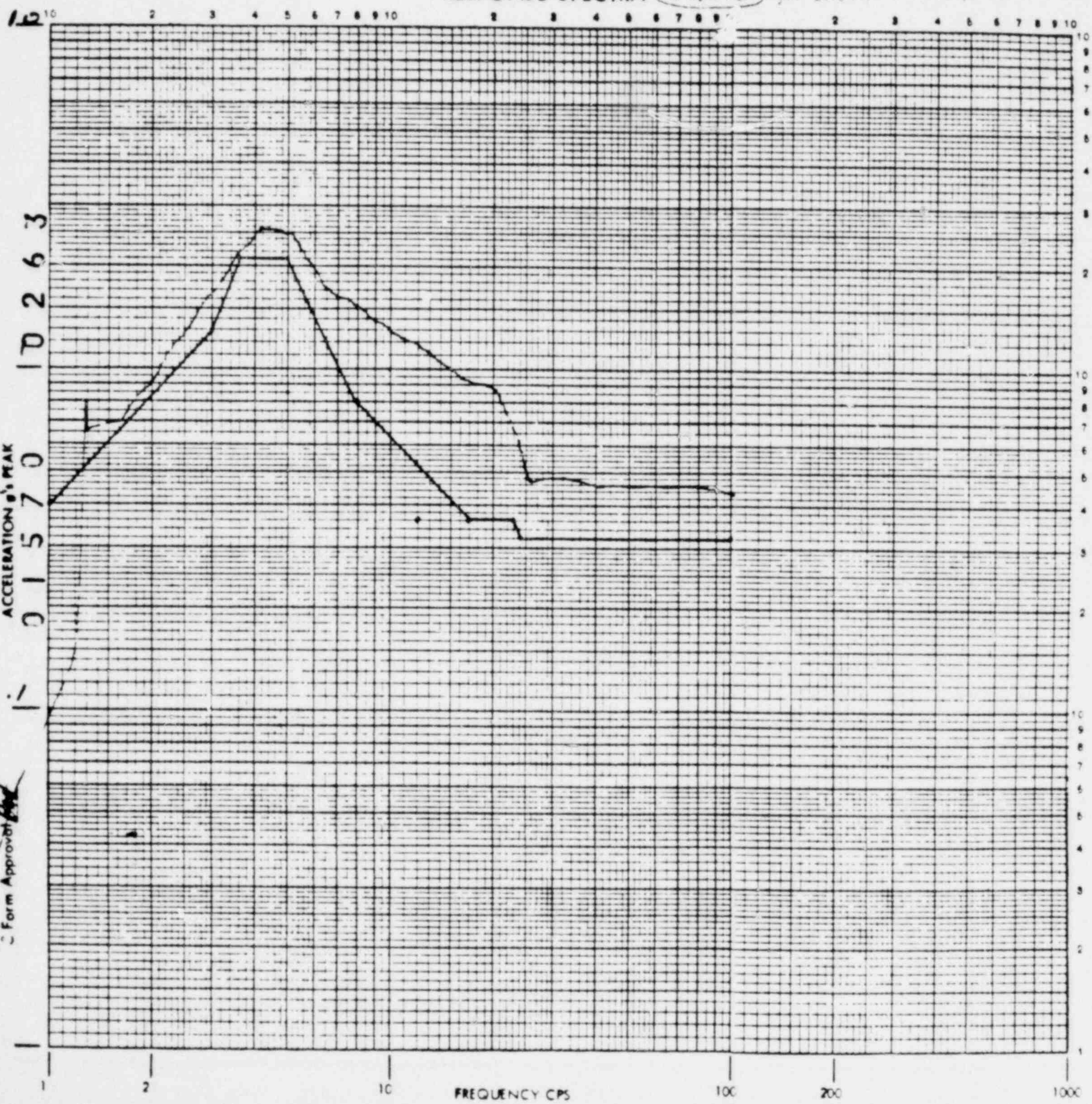
Operator Knoll

P/N 1DA2

Date 3-1-76 Polarity + Q 50

Axis of Test E-W Horiz

RESPONSE SPECTRA (CALIB) for calibration SSE



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WYLE LABORATORIES

Report No. 58039

Customer DELtA SwJ. Board Job No. 58039

Page No. 12

Channel Identification: T/R - Trk. No. -

Accel. No. 2

Transducer S/N 1168 Control (✓)

Response ( )

Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

Mode OFF

Specimen S/N QL21P112A

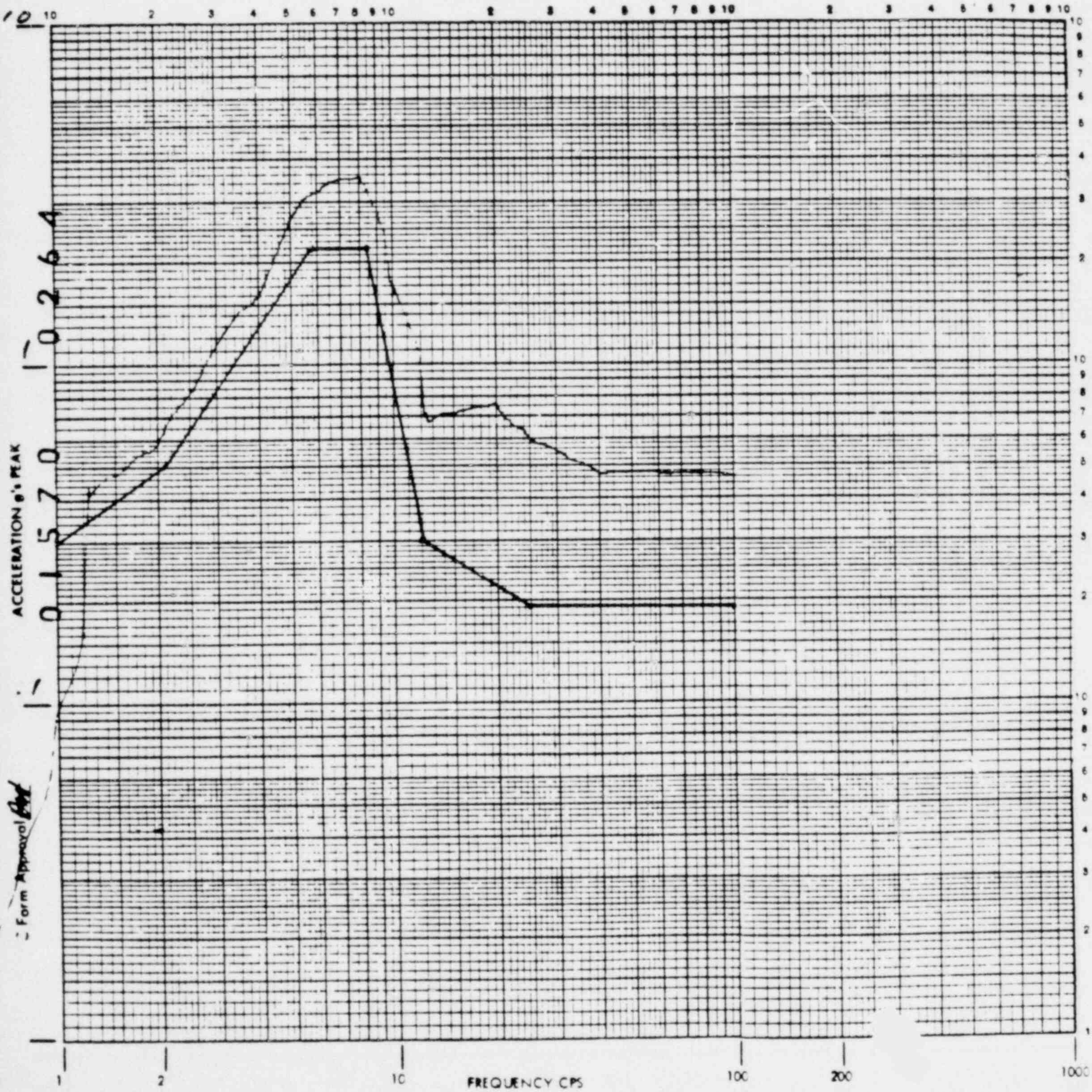
Operator KNoll

P/N 1-DA2

Date 7-1-76 Polarity ± Q 50

Axis of Test VERT SSE

RESPONSE SPECTRA CALib



WYLE LABORATORIES

Report No. 58039

Customer Delta Sw. Board Job No. 58039

Page No. 13

Channel Identification: T/R 1 Trk. No. 1 Accel. No. 1

Transducer S/N 1134 Control (✓)

Response ( )

Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

Mode OFF

Specimen S/N Q1L2P112A

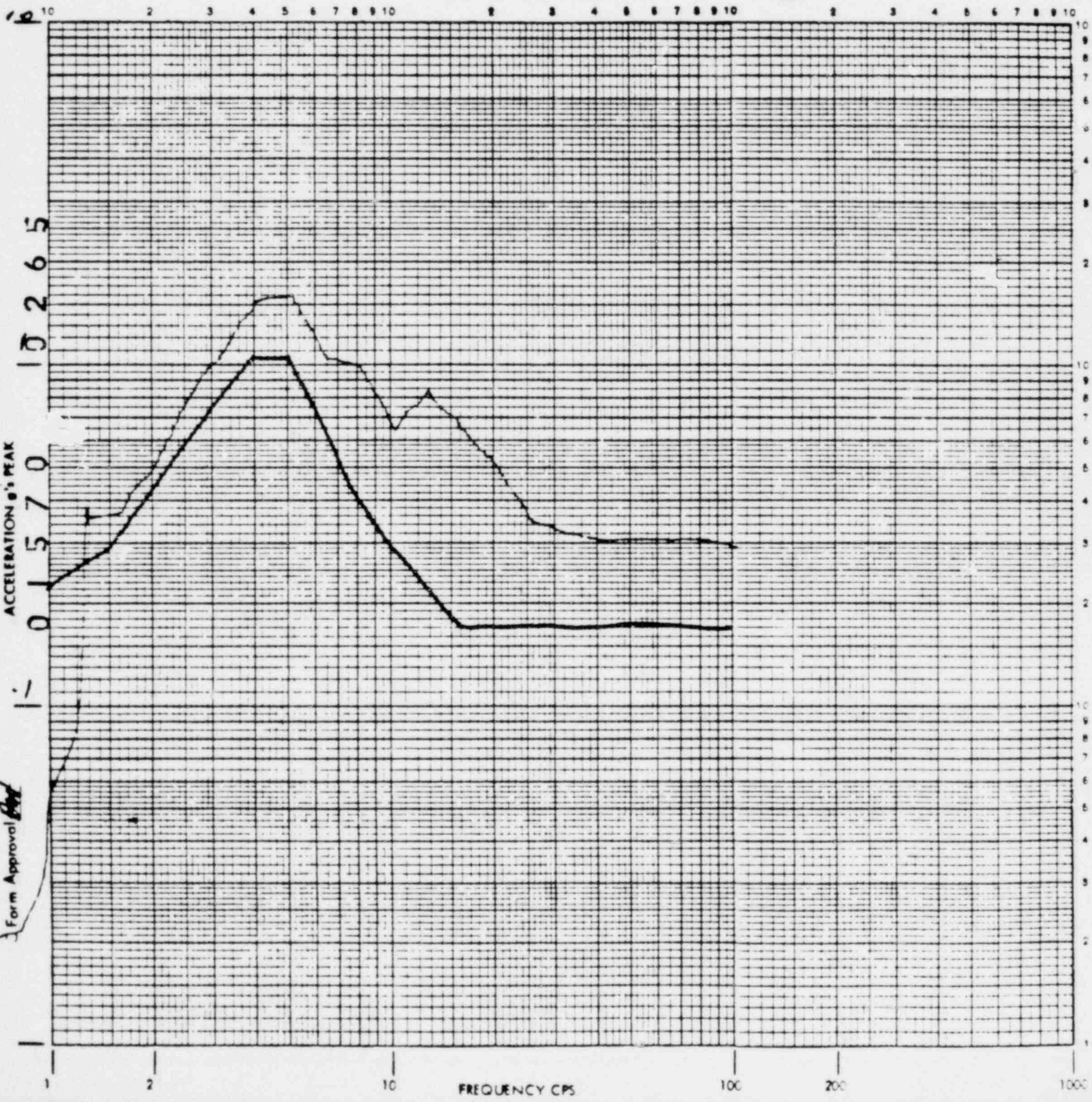
Operator Knoll

P/N 1DA2

Date 3-1-76 Polarity + Q 50

Axis of Test E-W HORIZ.

RESPONSE SPECTRA 1st ½ SSE



WYLE LABORATORIES

Report No. 58039

Customer DELTA SW. Board Job No. 58039

Page No. 14

Channel Identification: T/R 1 Trk. No. 2 Accel. No. L

Transducer S/N 1168 Control (+) Response ( )

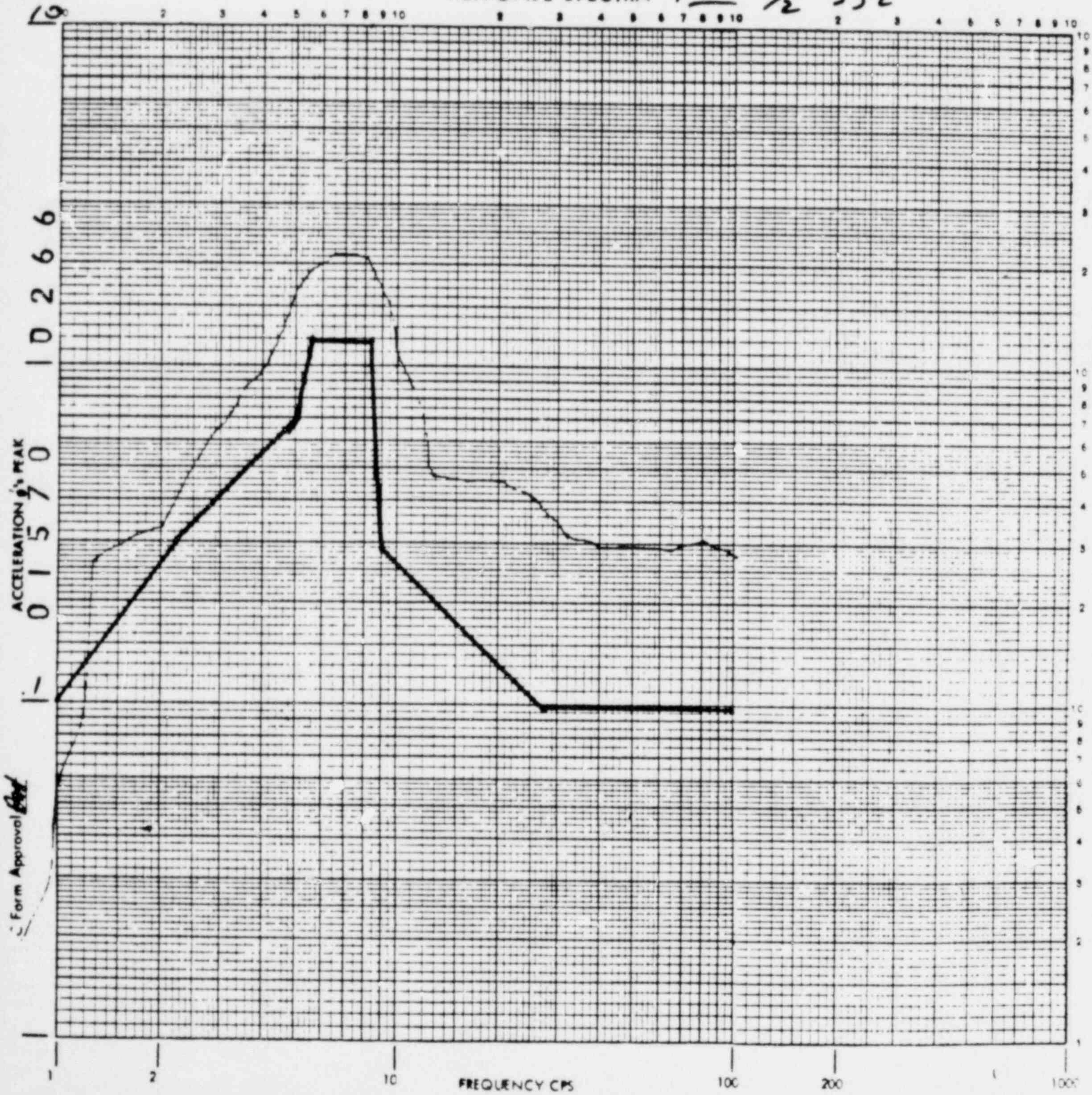
Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

Mode OFF Specimen S/N Q1L21P112A

Operator Knoll P/N 1DA2

Date 3-1-76 Polarity + Q 50 Axis of Test (E-W) VERT.

RESPONSE SPECTRA 1st 1/2 SSE



WYLE LABORATORIES

Report No. 58039

Customer DELTA Sw. Board Job No. 58039

Page No. 15

Channel Identification: ?/R 1 Trk. No. 1 Accel. No. 1

Transducer S/N 1134 Control (+) Response ( )

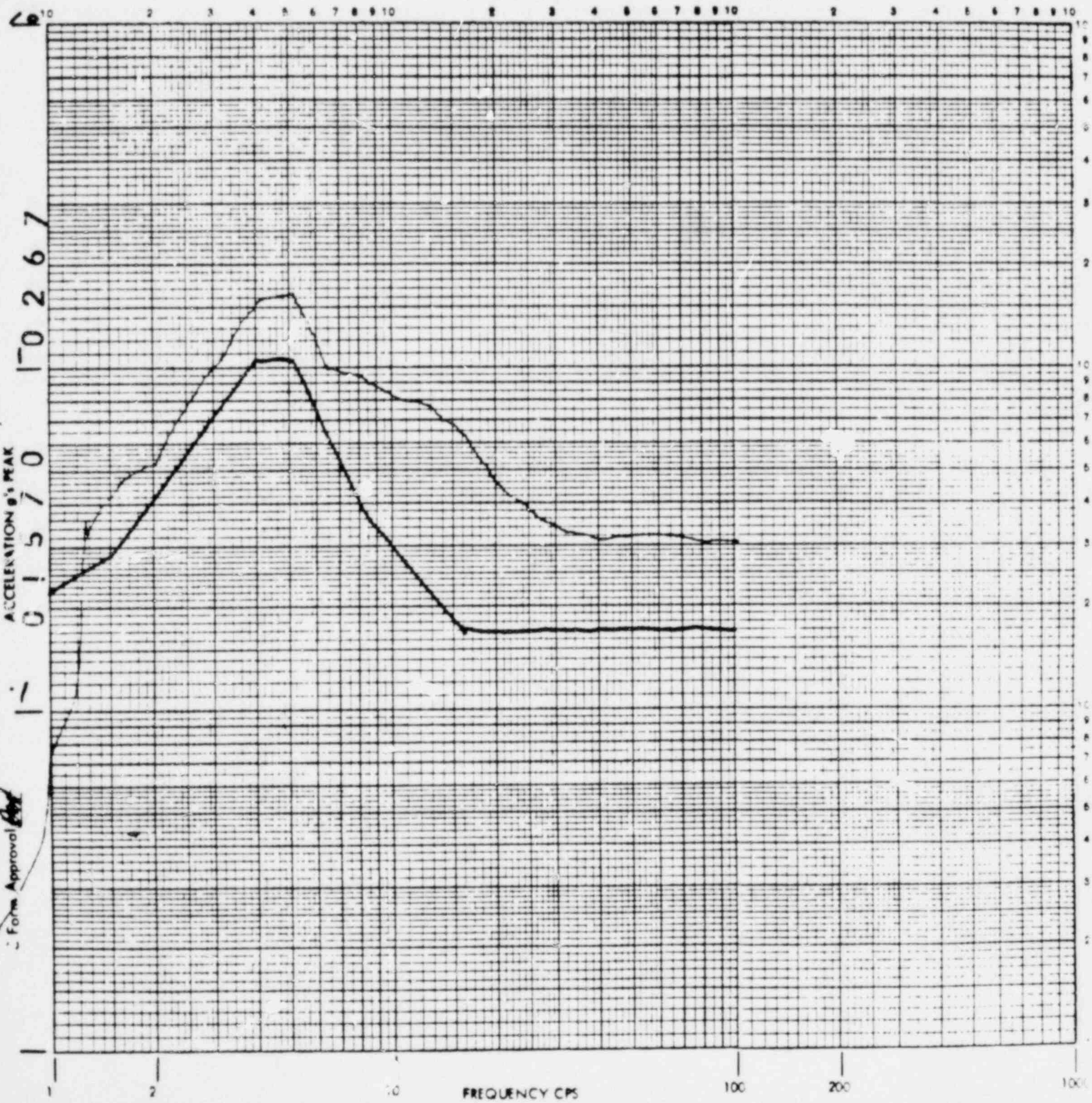
Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

Mode OFF Specimen S/N Q1L21P112A

Operator Kadv P/N 1DA2

Date 3-1-76 Polarity + Q 50 Axis of Test E-W Horiz.

RESPONSE SPECTRA 2ND 1/2 SSE



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WYLE LABORATORIES

Customer DELtA Sw. Board Job No. 58039

Report No. 58039

Page No. 16

Channel Identification: T/R 1 Trk. No. 2

Accel. No. 2

Transducer S/N 1168 Control (+)

Response ( )

Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

Mode OFF

Specimen S/N Q1L21P112A

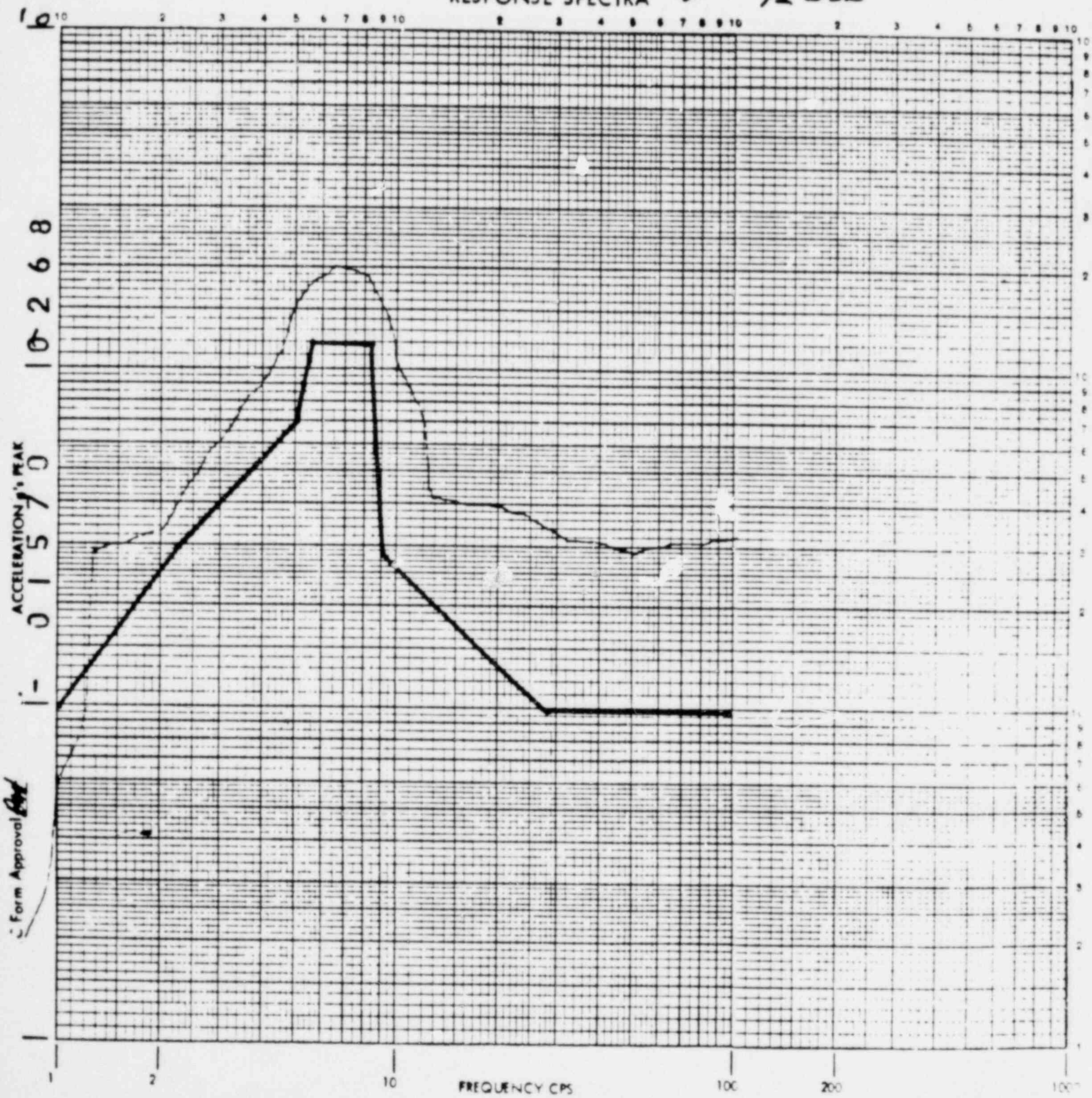
Operator Knoll

P/N 1DA2

Date 7-1-76 Polarity + Q 50

Axis of Test (R-W) VERT.

RESPONSE SPECTRA 2ND 1/2 SSE



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Report No. 58039

Customer Delta Sw. Board Job No. 58039

Page No. 17

Channel Identification: T/R 1 Trk. No. 1 Accel. No. 1

Transducer S/N 1134 Control (✓ Response ( )

Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

Mode OFF

Specimen S/N Q1L21P112A

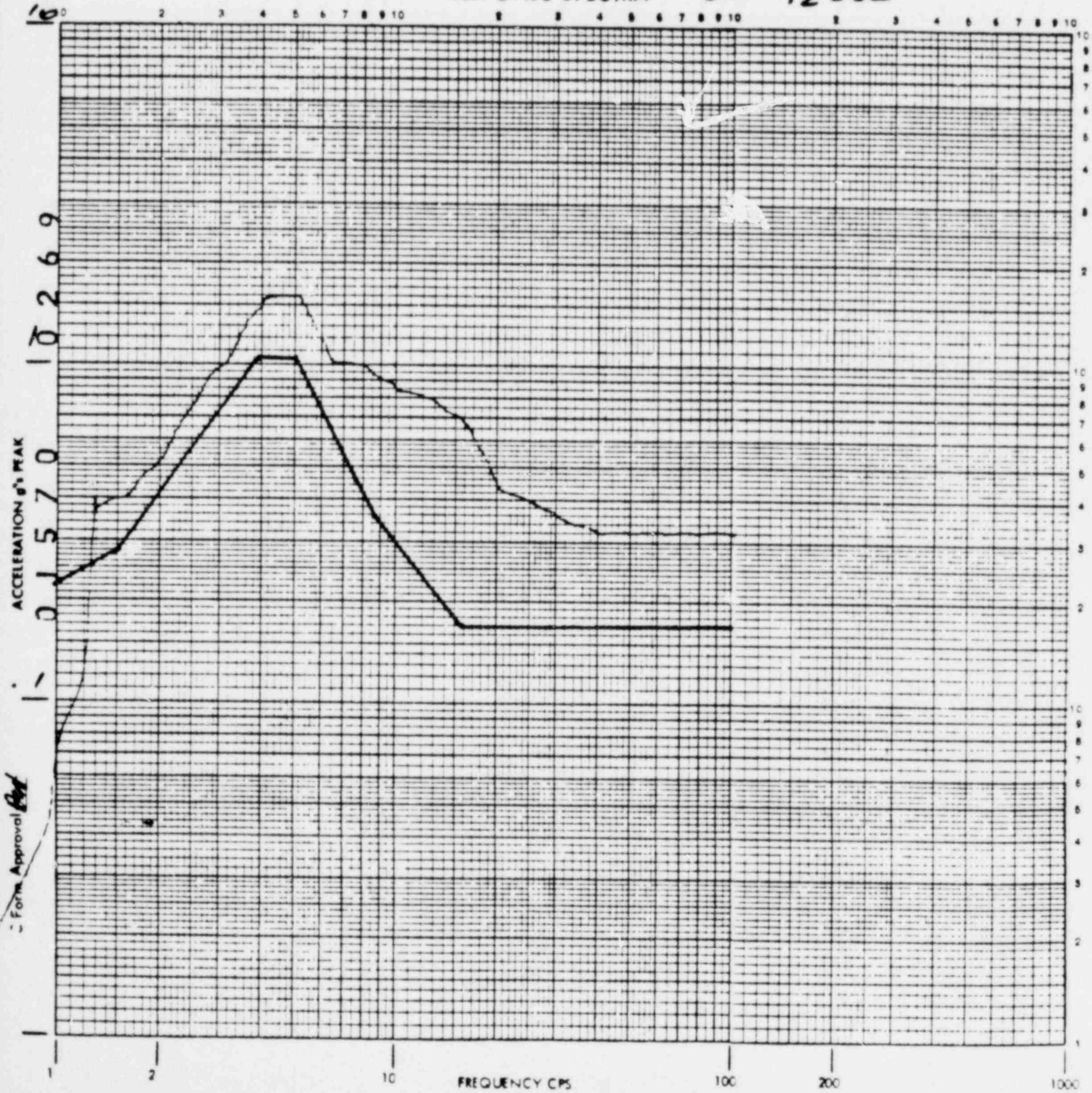
Operator Knoll

P/N 1DA2

Date 3-1-76 Polarity + Q 50

Axis of Test E-W HORIZ.

RESPONSE SPECTRA 3RD 1/2 SSE



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Report No. 58039

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Customer Delta Sw. Board Job No. 58079

Channel Identification: T/R 1 Trk. No. 2 Accel. No. 1

Transducer S/N 116B Control (+) Response ( )

Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

Mode OFF

Specimen S/N Q1L21P112A

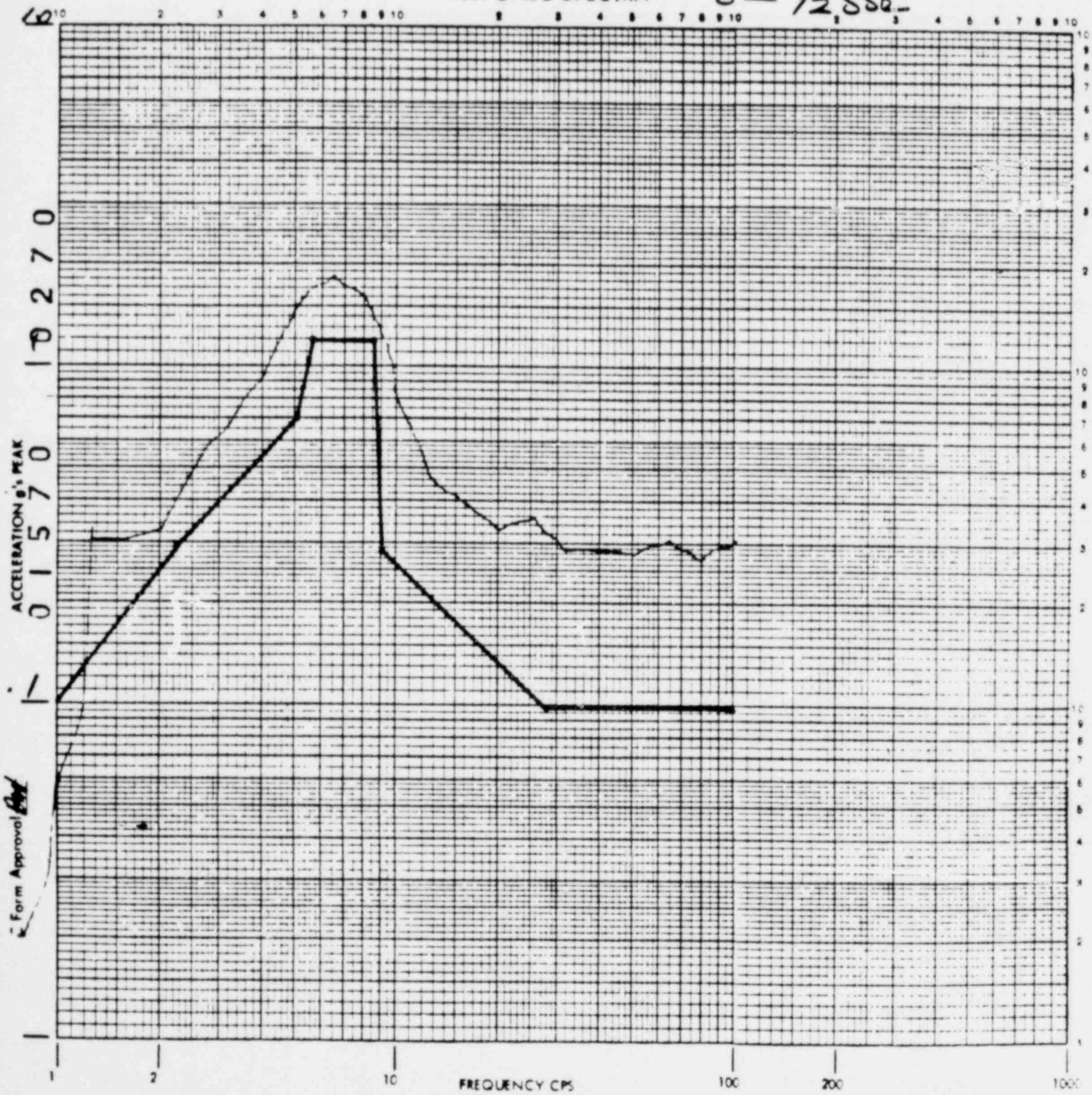
Operator Knoll

P/N 1DA2

Date 3-1-76 Polarity + Q 50

Axis of Test (E-W) VERT.

RESPONSE SPECTRA 3RD 1/2 SSE



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Report No. 58039

Customer DELTA Sw. Board Job No. 58039

Page No. 19

Channel Identification: T/R 1 Trk. No. 1 Accel. No. 1

Transducer S/N 1174 Control (+) Response ( )

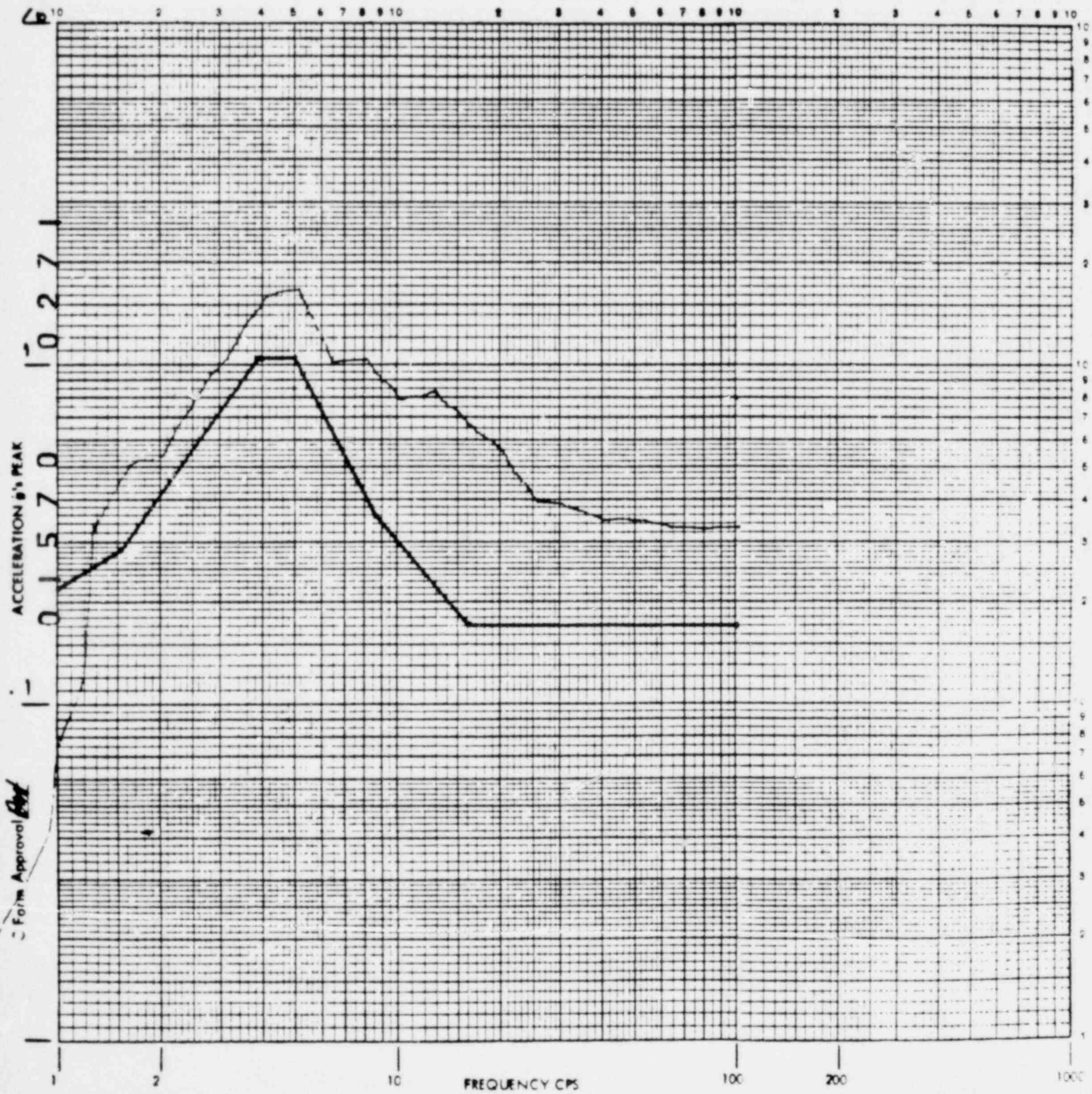
Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

Mode OFF Specimen S/N Q1L21P112A

Operator KNOU P/N 1DA7

Date 3-1-76 Polarity + Q 50 Axis of Test E-W HORZ.

RESPONSE SPECTRA 4th 1/2 SSE



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Report No. 58039

Customer DELTA Sw. Board Job No. 58079

Page No. 20

Channel Identification: T/R 1 Trk. No. 2

Accel. No. 2

Transducer S/N 1168 Control ( )

Response ( )

Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

Mode OEF

Specimen S/N QIL21P112A

Operator Knoll

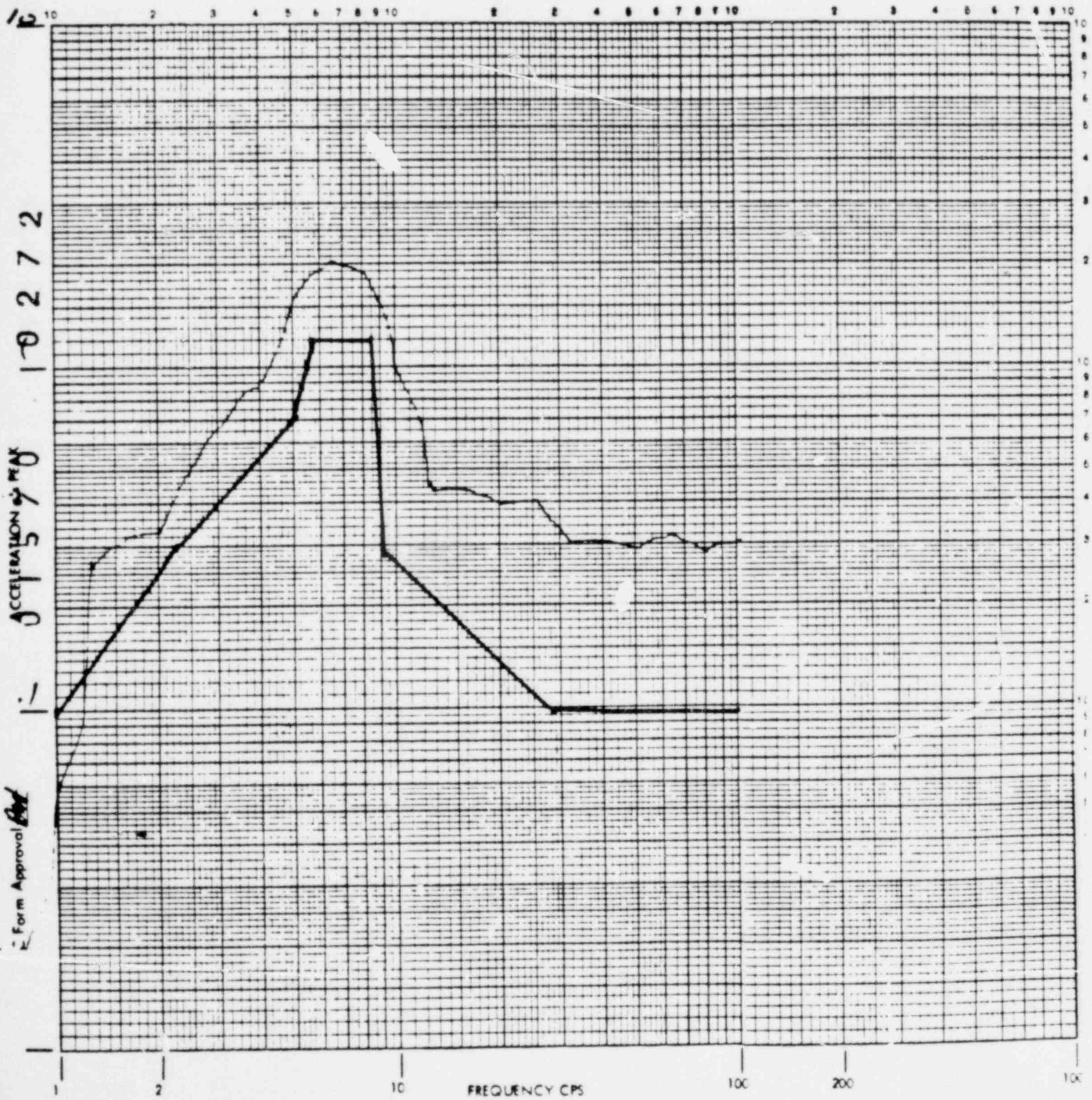
P/N 1DA2

Date 3-1-76 Polarity + Q 50

Axis of Test VERT (E-W)

4th 1/2 SSE

RESPONSE SPECTRA



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Report No. 58039

Customer DELta Sw. Board Job No. 58039

Page No. 21

Channel Identification: T/R 1 Trk. No. 1 Accel. No. 1

Transducer S/N 1134 Control (✓)

Response ( )

Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

Mode OFF

Specimen S/N Q1L21P112A

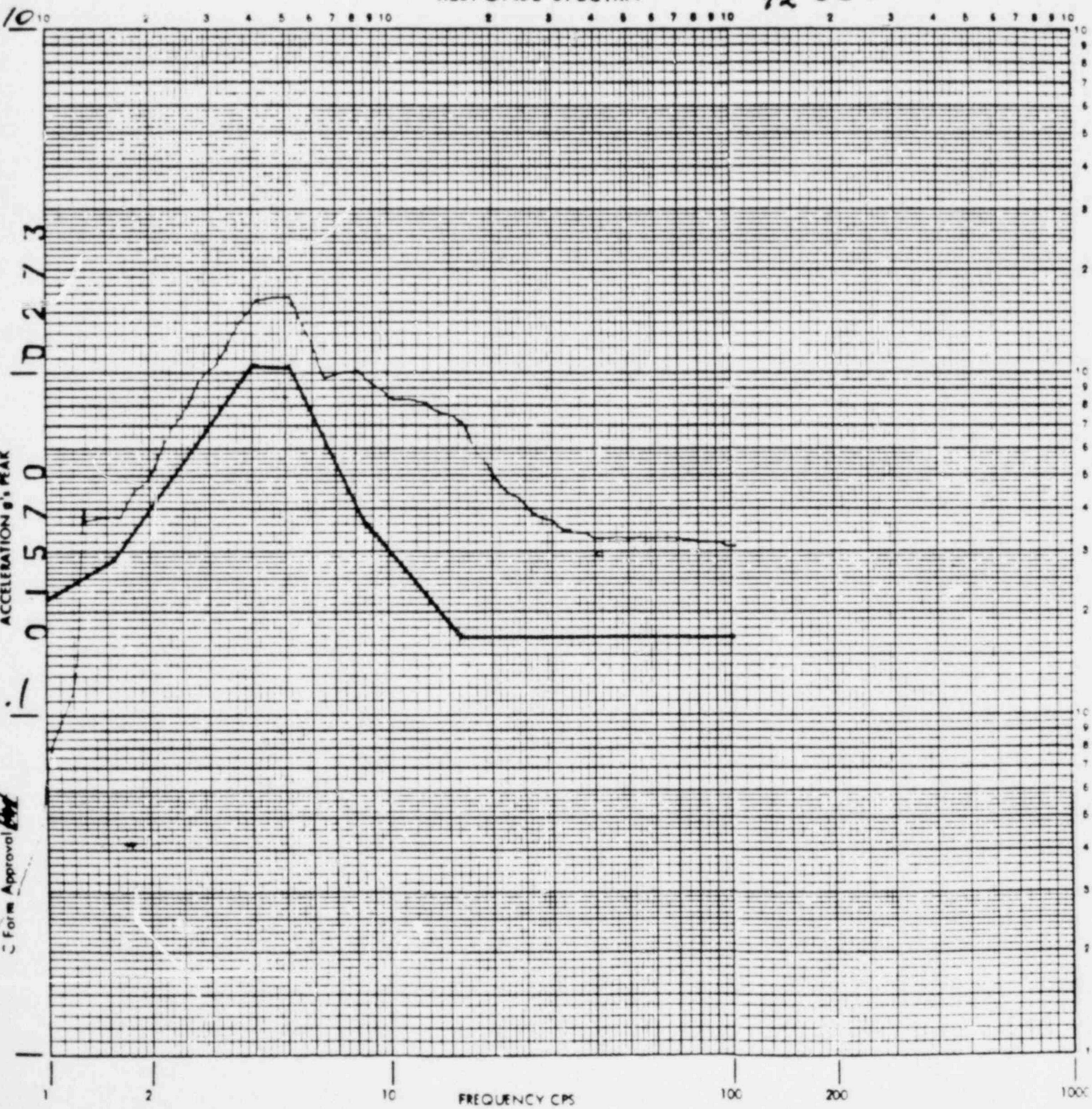
Operator Knoll

P/N 1DA2

Date 3-1-76 Polarity + Q 50

Axis of Test E-W HORIZ.

RESPONSE SPECTRA 5th 1/2 SSE



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Customer DELta Sv. Board Job No. 58039

Report No. 58039

Page No. 22

Channel Identification: T/R 1 Trk. No. 2 Accel. No. 2

Transducer S/N 1168 Control (T) Response ( )

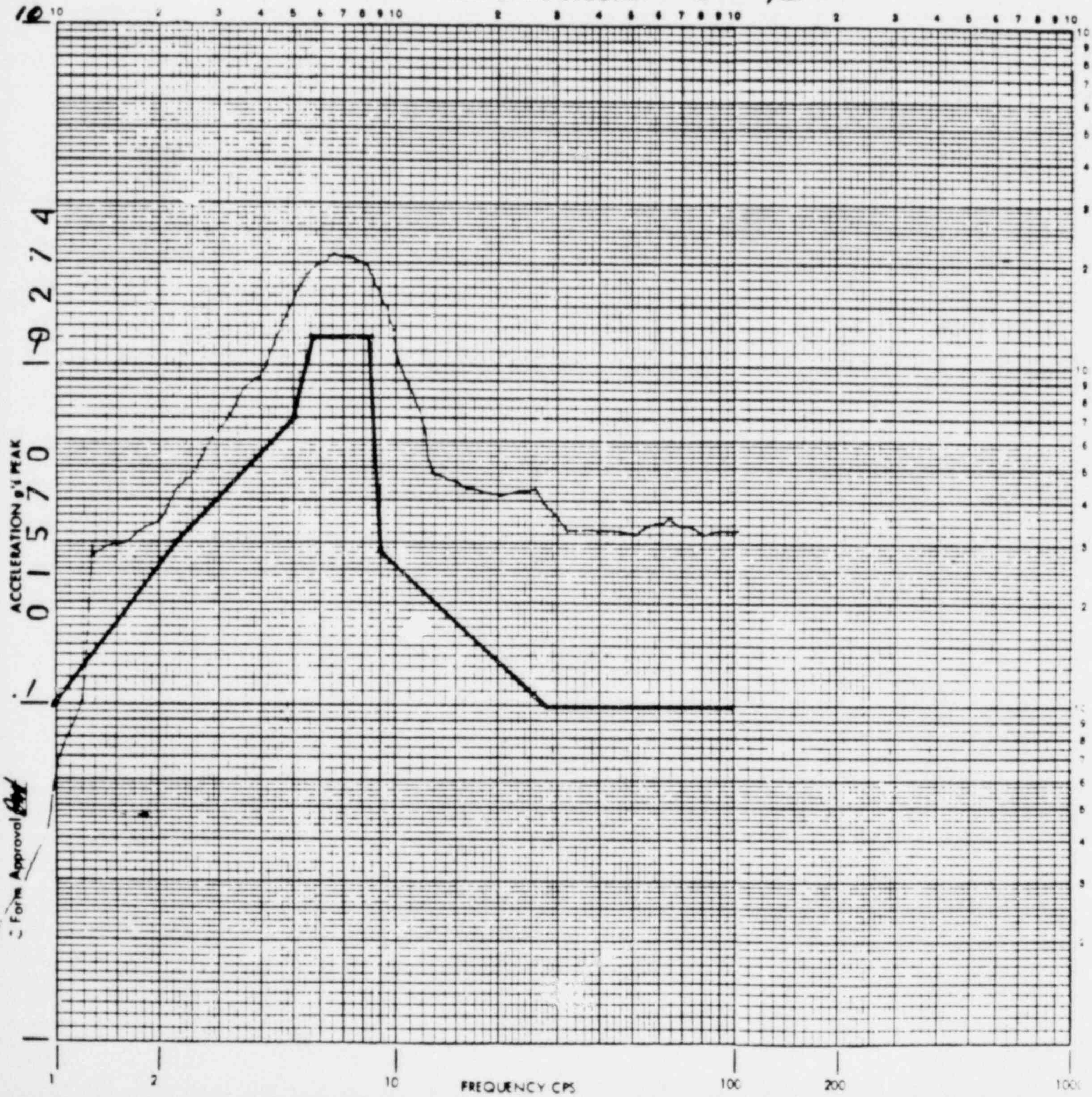
Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

Mode OFF Specimen S/N Q1L21P112A

Operator Knoll P/N 1DA2

Date 3-1-76 Polarity + Q 50 Axis of Test VERT (E.W)

RESPONSE SPECTRA 5th 1/2 SSE



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Report No. 58039

Customer Delta Sw. Board Job No. 58039

Page No. 23

Channel Identification: T/R 1 Trk. No. 3

Accel. No. 3 Horiz

Transducer S/N 1024 Control ( ),

Response (+

Full Scale 10 G Cal Voltage 100 MVPK/ 1 G

Mode OFF

Specimen S/N Q1L21P112A

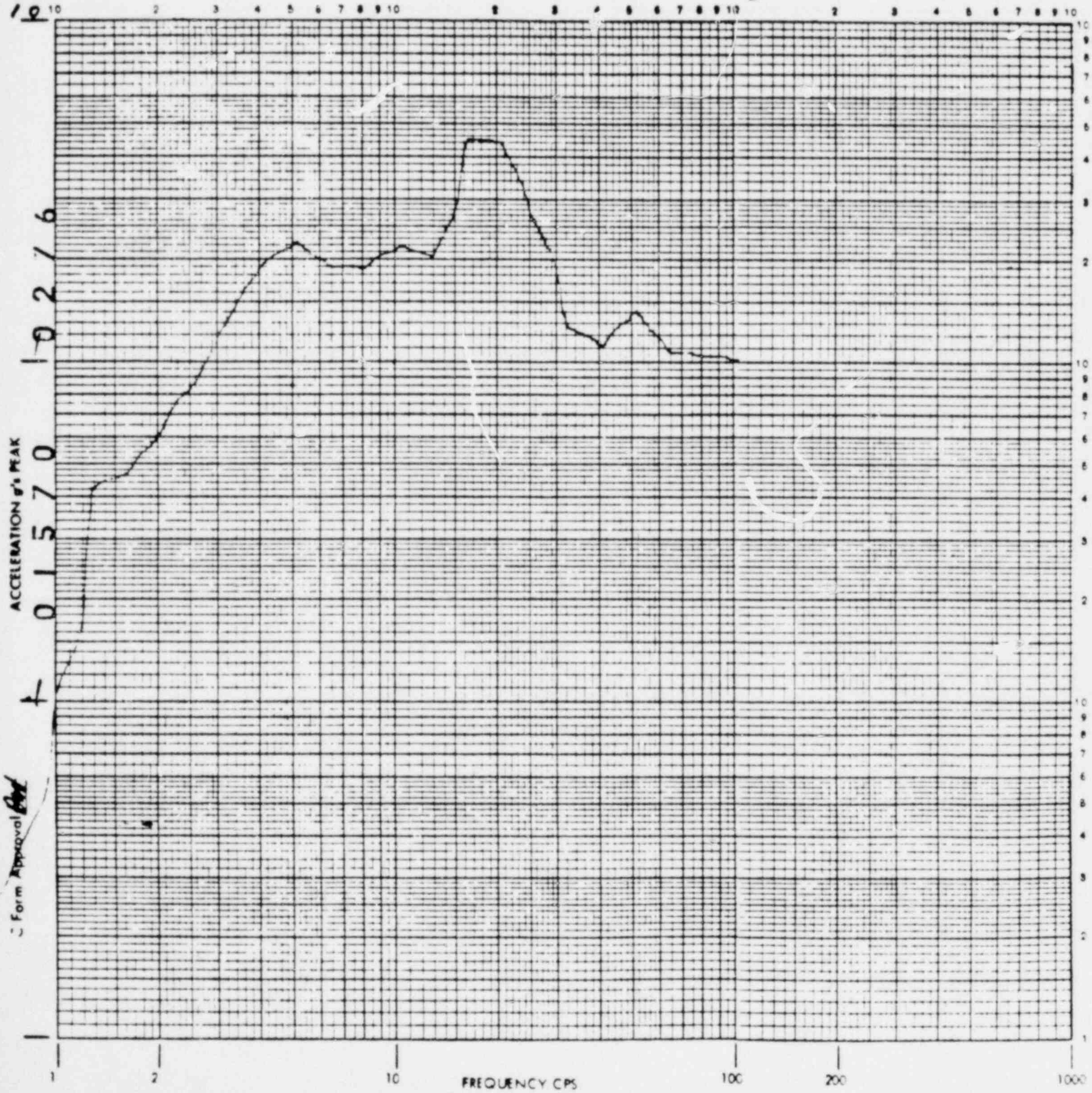
Operator Fogg.

P/N 10A2

Date 3-1-76 Polarity + Q 50

Axis of Test E-W Horiz

RESPONSE SPECTRA ½ SSE #5



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Report No. 58039

Customer DELta Sw. Board Job No. 58039

Page No. 24

Channel Identification: T/R 1 Trk. No. 4

Accel. No. 4

Transducer S/N 1054 Control ( ),

Response (4

Full Scale 10 G Cal Voltage 100 MVPK/ 1 G

Mode OFF

Specimen S/N QIL21P112A

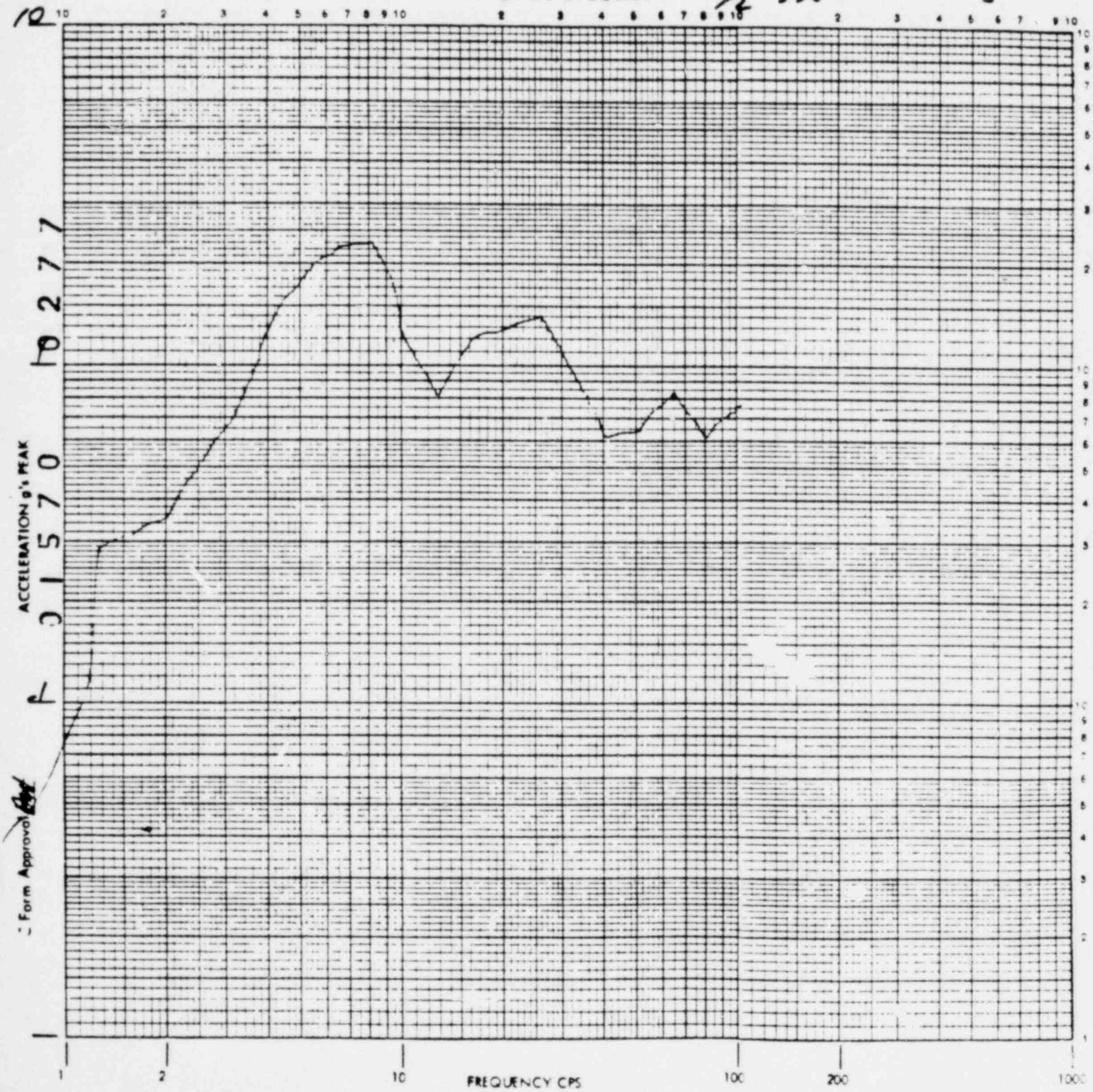
Operator Knoll

P/N 7DA2

Date 3-1-76 Polarity + Q 50

Axis of Test (E-W) (Vert)

RESPONSE SPECTRA 1/4 SSE #5



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WYLE LABORATORIES

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Customer DELTA SW. BOARD Job No. 58039

Page No. 25

Channel Identification: T/R 1 Trk. No. 5 Accel. No. 5

Transducer S/N 979 Control ( ), Response (X)

Full Scale 10 G Cal Voltage 100 MVPK/ 1 G

Mode off

Specimen S/N ~~SE~~ Q1L21P112A

Operator Knoll

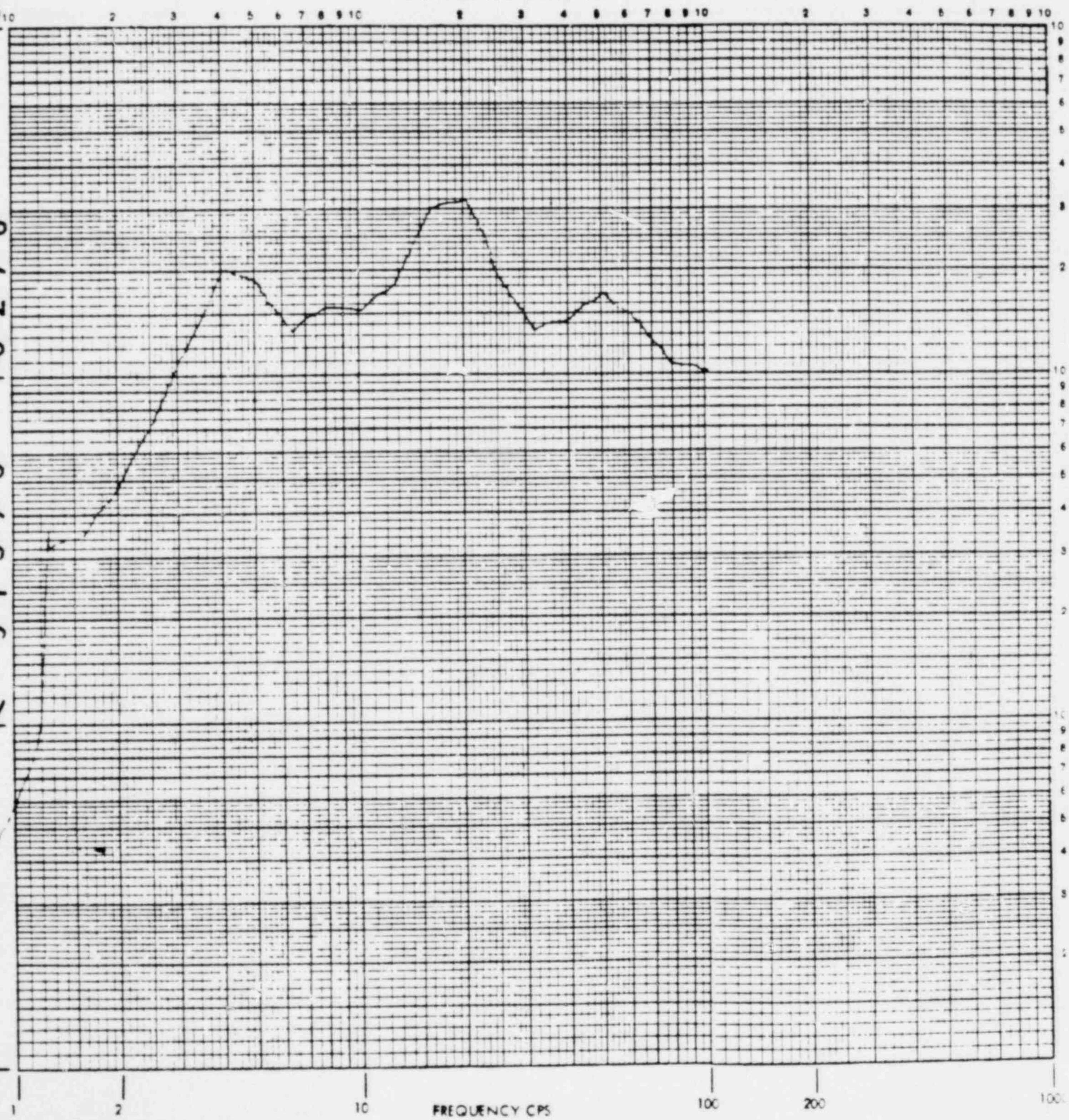
P/N ~~Q1L21P112A~~ 1DA2 PWR

Date 3-1-76 Polarity + Q 50

Axis of Test E-W HORIZ

1/2 SSE #5

RESPONSE SPECTRA



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7 8 0 2 7 8

9 1 0 2 7 0

0 1 5 7 0

9 1

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WYLE LABORATORIES

Report No. 58039

Customer DELTA SW. BOARD Job No. 58039

Page No. 26

Channel Identification: T/F 1 Trk. No. 6 Accel. No. 6

Transducer S/N 1109 Control ( ), Response (✓)

Full Scale 10 G Cal Voltage 100 MVPK/ 1 G

Mode off

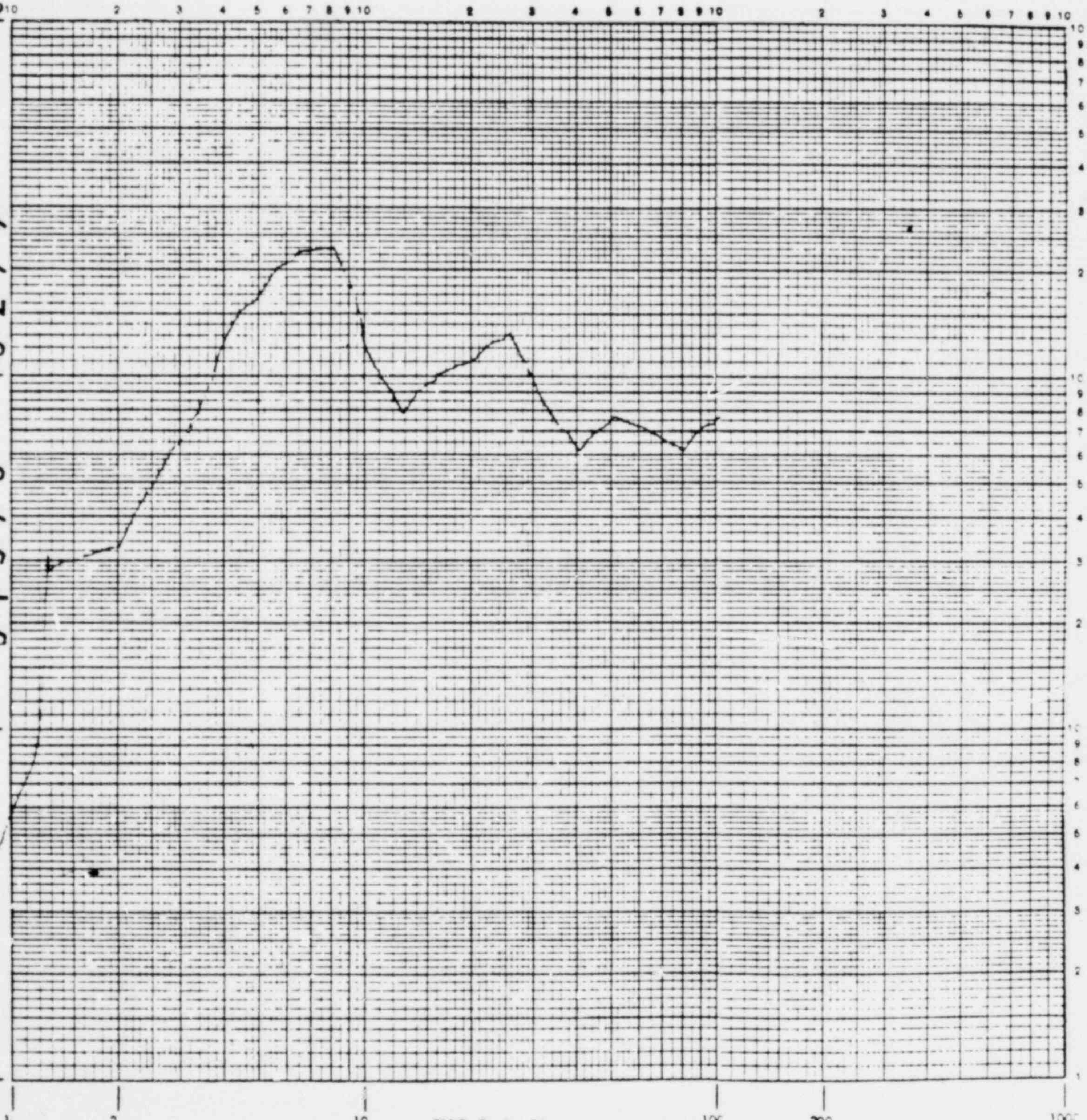
Specimen S/N Q1L21P112A

Operator KNOLL

P/N 1DA2

Date 3-1-76 Polarity + Q 50 Axis of Test (E-W) VERT.

RESPONSE SPECTRA ½ SSE #5



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7 0 1 5 7 0 2 7 9

WYLE LABORATORIES

Report No. 58039

Customer DELta Sw. Board Job No. 58039

Page No. 27

Channel Identification: T/R 1 Trk. No. 1 Accel. No. 1

Transducer S/N 1134 Control (4) Response ( )

Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

Mode OAC

Specimen S/N Q1L21P112A

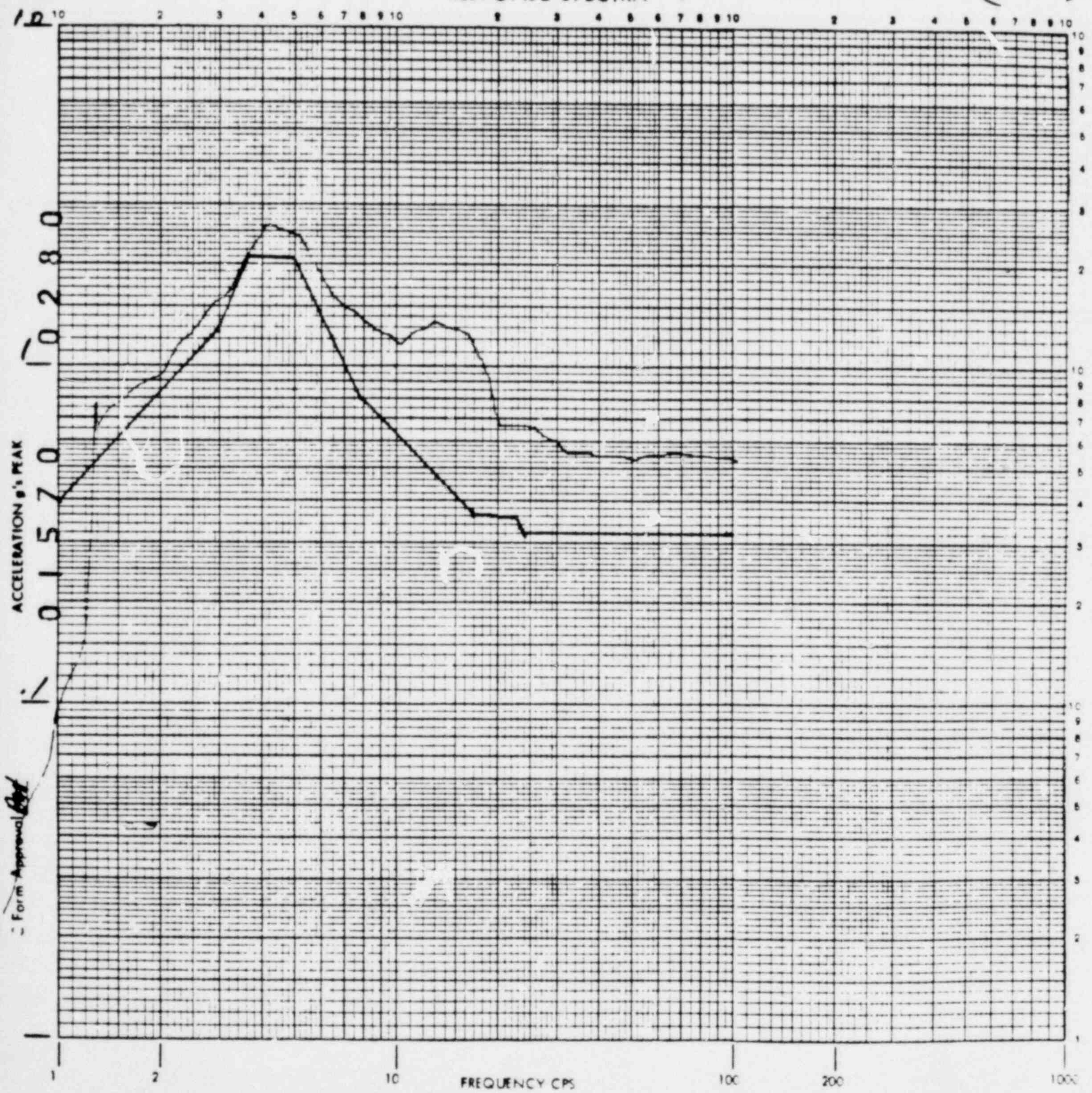
Operator Knoll

P/N 1DA2

Date 3-1-76 Polarity + Q 50

Axis of Test E-W Horiz

RESPONSE SPECTRA 1ST FULL SSE. (OPEN)



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Report No. 58039

Customer DELtA Sw. Board Job No 58039

Page No. 28

Channel Identification: T/R 1 Trk. No. 2 Accel. No. 2

Transducer S/N 1168 Control (+)

Response ( )

Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

Mode OFF

Specimen S/N Q1L21P112A

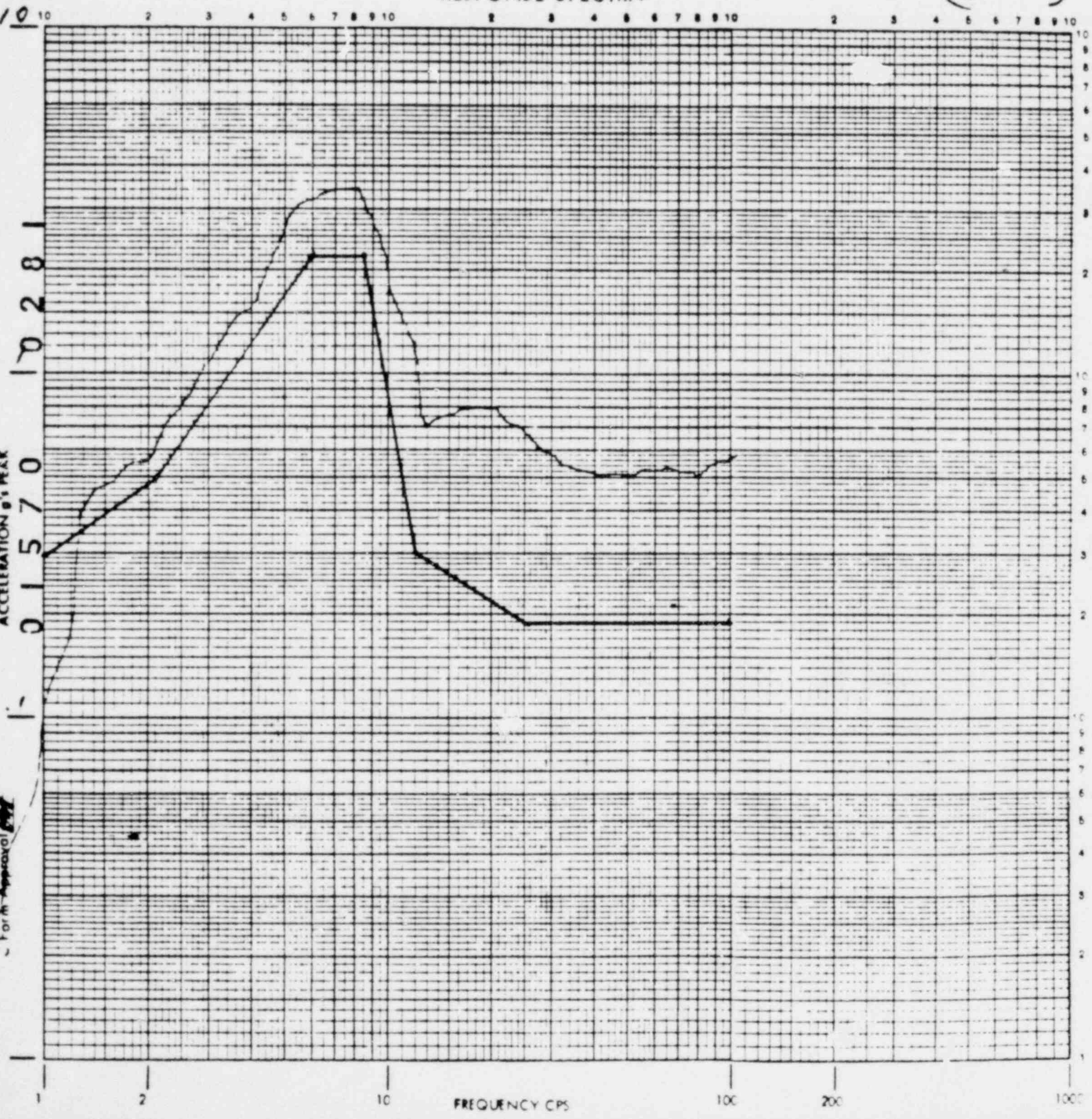
Operator Knou

P/N 1DA2

Date 3-1-76 Polarity + Q 50

Axis of Test (E-W) VERT

RESPONSE SPECTRA 1ST FULL SSE (OPEN)



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WYLE LABORATORIES

Report No. 58039

Customer DELTA Sw Board Job No. 58039

Page No. 29

Channel Identification: T/R 1 Trk. No. 1 Accel. No. 1

Transducer S/N 1134 Control (4. Response ( )

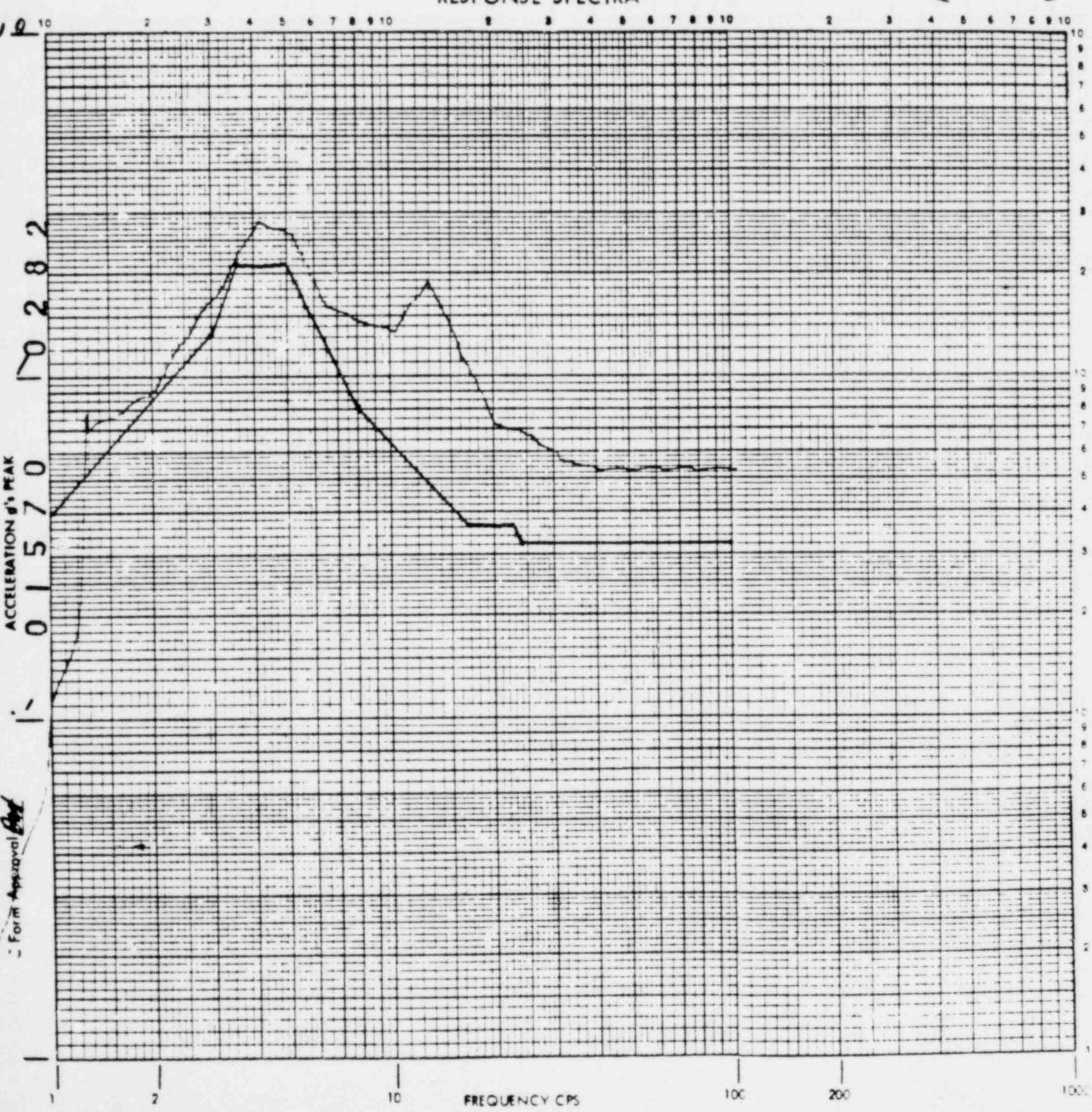
Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

Mode OFF Specimen S/N Q1L21P1124

Operator Knoll P/N 1DA2

Date 3-1-76 Polarity + Q 50 Axis of Test E-W Horiz

RESPONSE SPECTRA 2ND FULL SSE (CLOSED)



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WYLE LABORATORIES

Report No. 58039

Customer DELta Sw. Board Job No. 58039

Page No. 30

Channel Identification: T/R 1 Trk. No. 2 Accel. No. 2

Transducer S/N 116B Control (+)

Response ( )

Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

Mode OFF

Specimen S/N QiL2IP112A

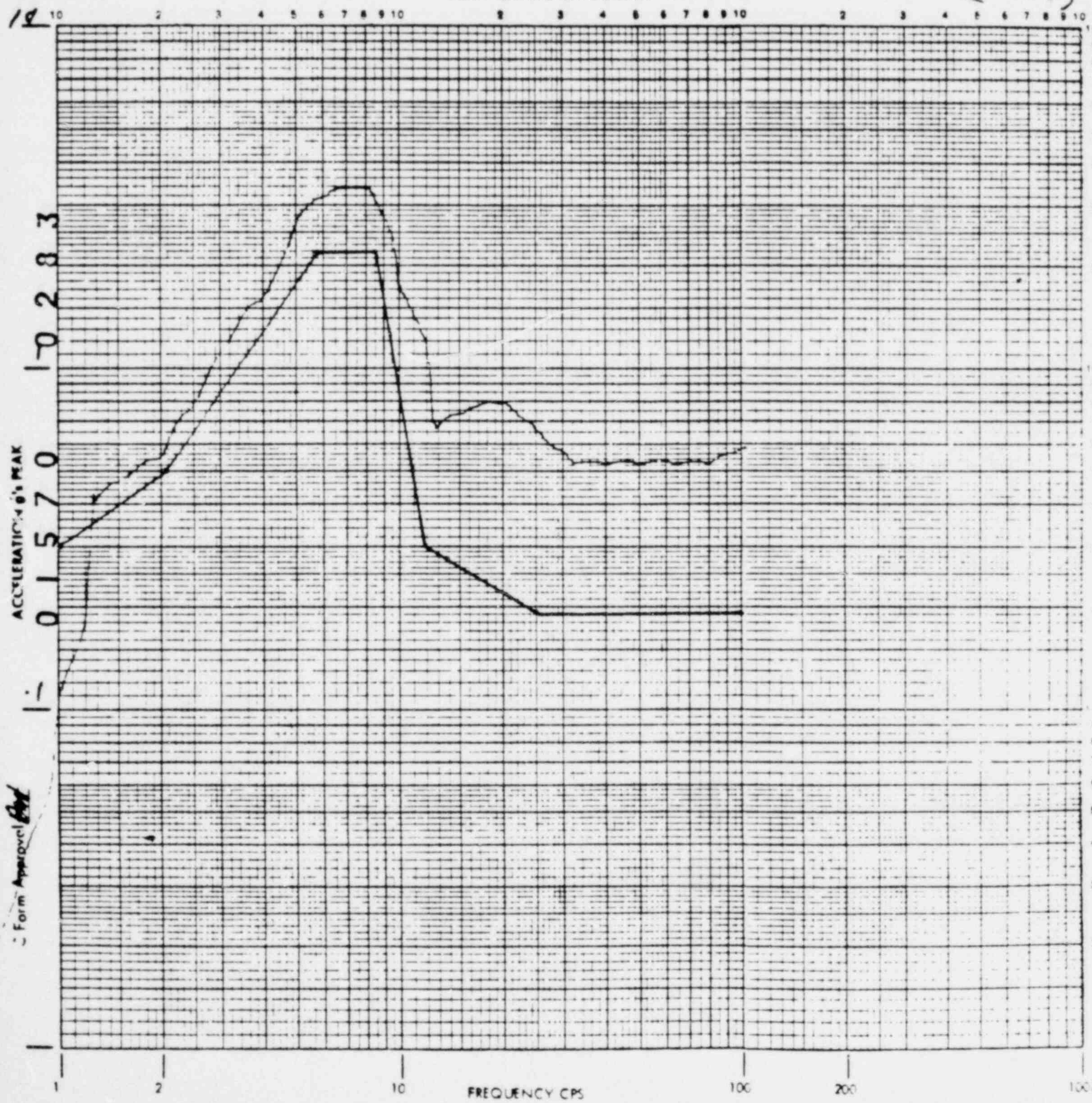
Operator Knoll

P/N 1DA2

Date 3-1-76 Polarity + Q 50.

Axis of Test (E-W) VERT.

RESPONSE SPECTRA 2ND FULL SSE (CLOSED)



WYLE LABORATORIES

Report No. 58039

Customer DELTA SW. BOARD Job No. 58039

Page No. 31

Channel Identification: T/R 1 Trk. No. 3 Accel. No 3

Transducer S/N 1024 Control ( ), Response (X)

Full Scale 10 G Cal Voltage 100 MVPK/ 1 G

Mode off

Specimen S/N Q1L21PM2A

Operator KNOLL

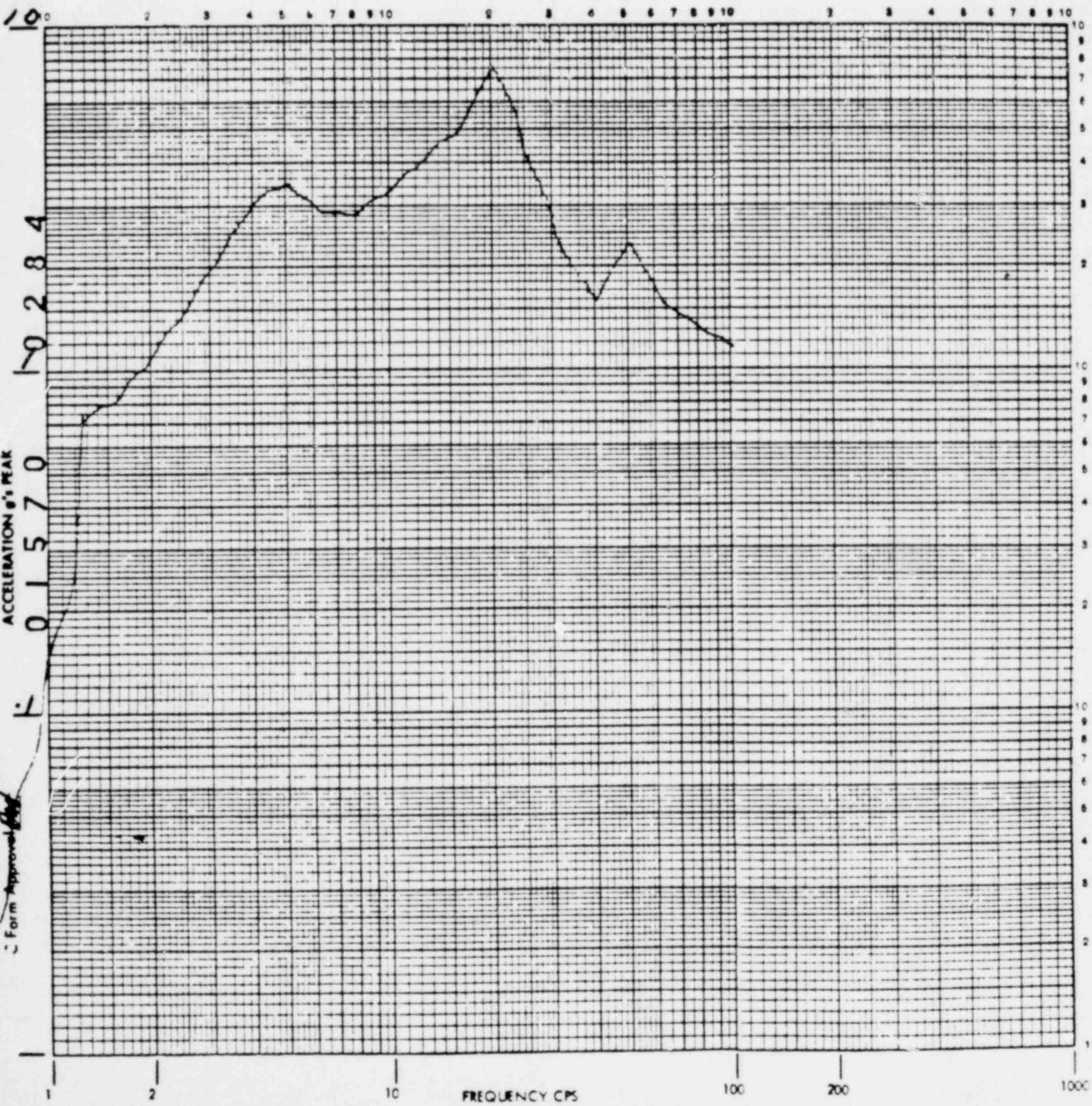
P/N 1DA2

Date 3-1-76 Polarity + Q 50

Axis of Test E-W HORIZ

FULL SSE #2

RESPONSE SPECTRA



WYLE LABORATORIES

Report No. 58039

Page No. 32

Customer DELTA SW. BOARD Job No. 58039

Channel Identification: T/R 1 Trk. No. 4 Accel. No. 4

Transducer S/N 1054 Control ( ), Response (X)

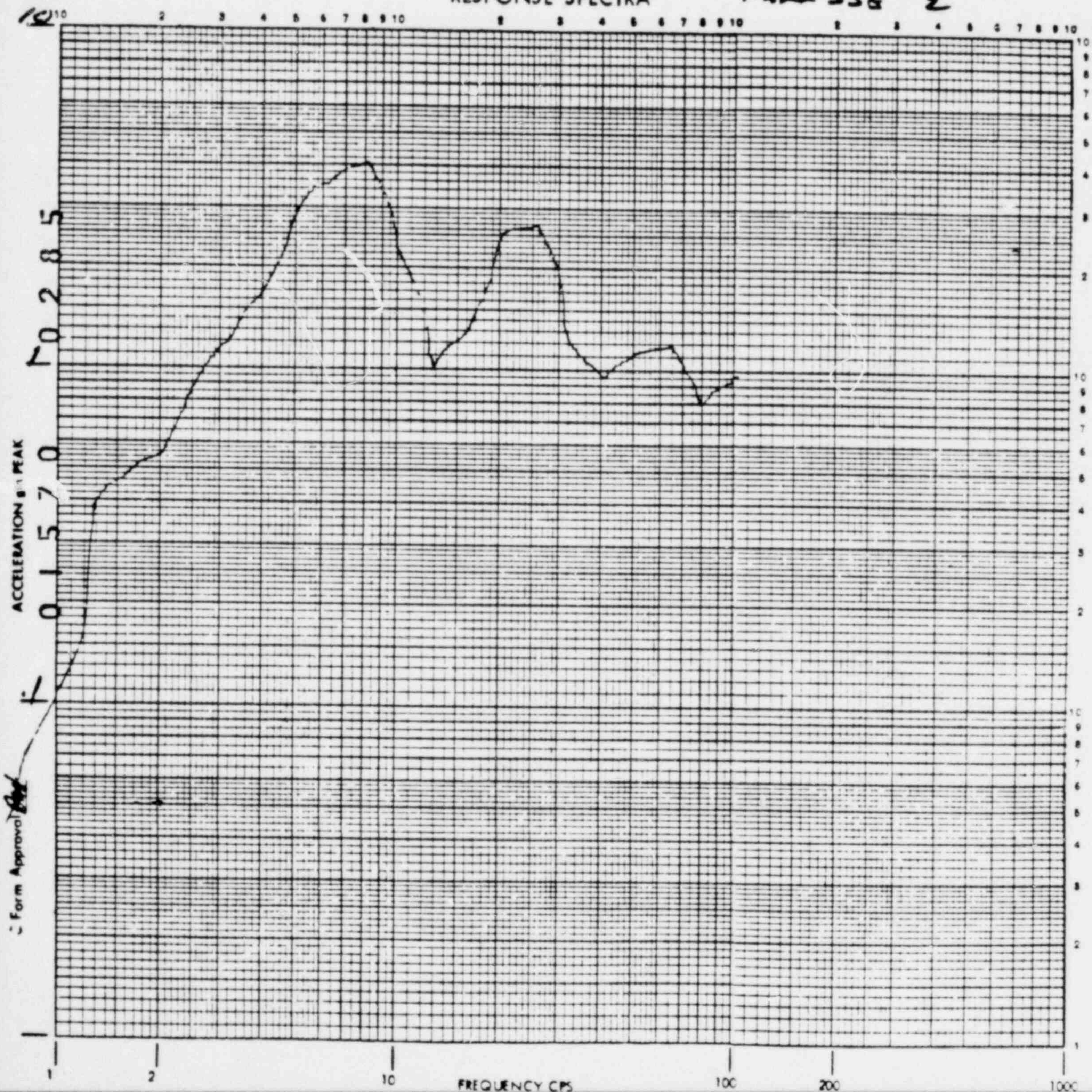
Full Scale 10 G Cal Voltage 100 MVPK/ 1 G

Mode off Specimen S/N QIL21P112A

Operator Knoll P/N 1DA2

Date 3-1-76 Polarity + Q 50 Axis of Test (E-W) VERT

RESPONSE SPECTRA FALL SSE #2



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WYLE LABORATORIES

Report No. 58039

Customer DELTA SW. BOARD Job No. 58039

Page No. 33

Channel Identification: T/R 1 Trk. No. 5 Accel. No. 5

Transducer S/N 979 Control ( ), Response (X)

Full Scale 10 G Cal Voltage 100 MVPK/ 1 G

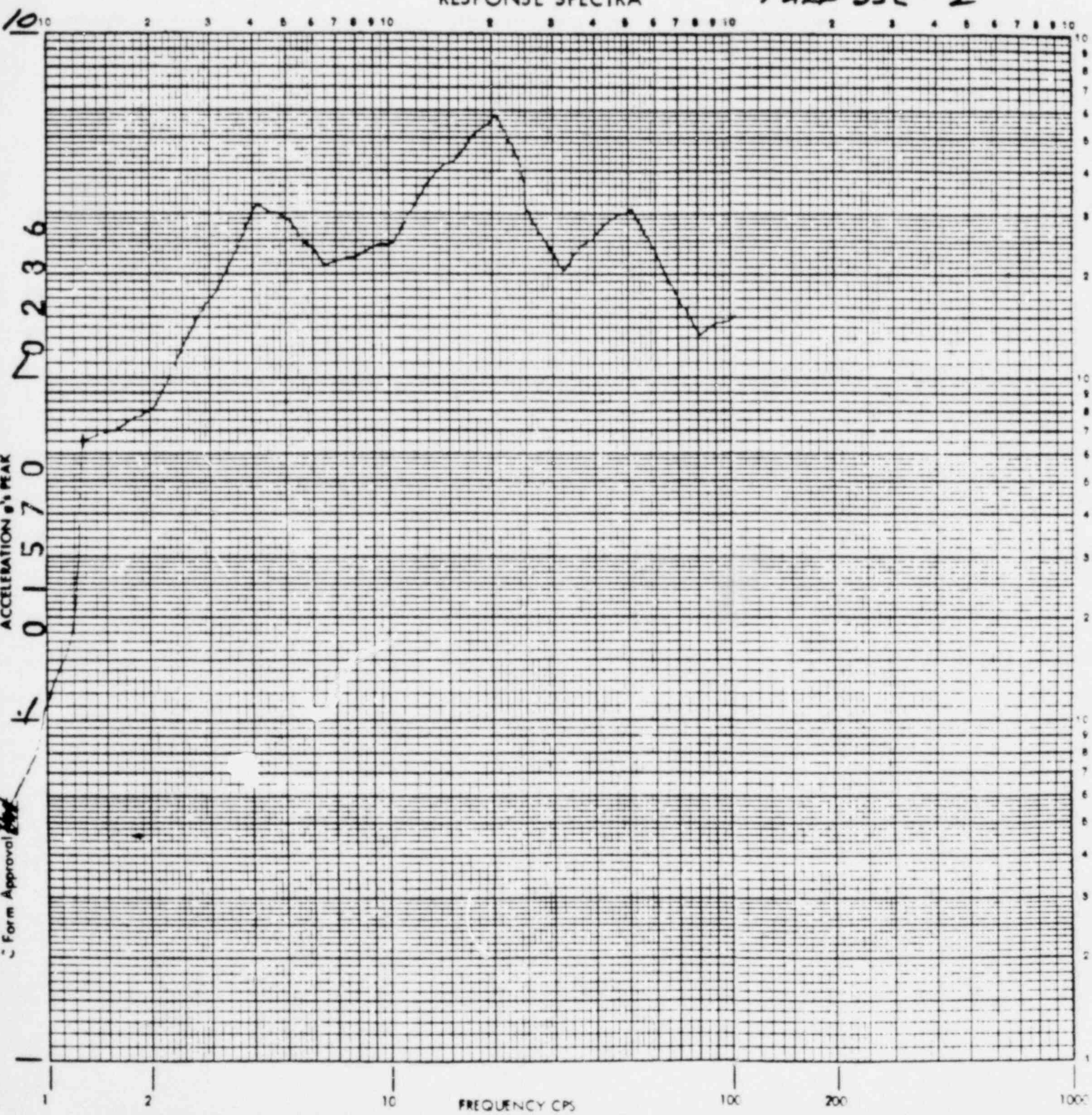
Mode off Specimen S/N Q1L217P1124

Operator KNOLL P/N 1DA2

Date 3-1-76 Polarity + Q 50 Axis of Test E-W HORIZ

FALL SSE #2

RESPONSE SPECTRA



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WYLE LABORATORIES

Report No. 58039

Customer DELTA SW. BOARD Job No. 58039

Page No. 34

Channel Identification: T/R 1 Trk. No. 6 Accel. No. 6

Transducer S/N 1105 Control ( ), Response (X)

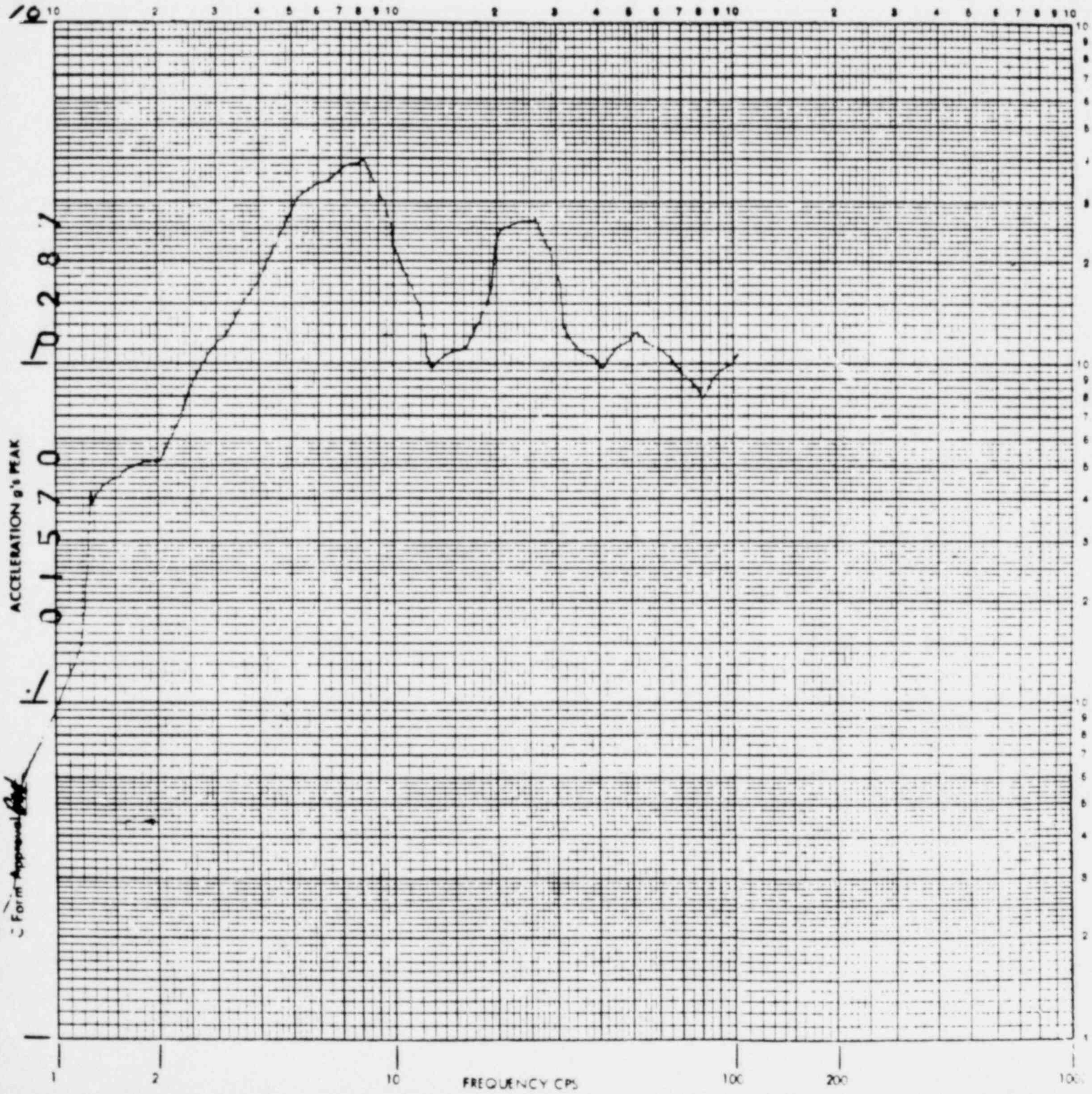
Full Scale 10 G Cal Voltage 100 MVPK/ 1 G

Mode Off Specimen S/N Q1L21P112A

Operator KNOLL P/N 1DA2

Date 3-1-76 Polarity + Q 50 Axis of Test (E-W) VERT

RESPONSE SPECTRA FULL SSE #2



WYLE LABORATORIES

Report No. 58039

Customer DELTA Swi Board Job No. 58039

Page No. 35

Channel Identification: T/R — Trk. No. -

Accel. No. 1

Transducer S/N 1134 Control ✓

Response ( )

Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

Mode OFF

Specimen S/N QiL2iPii2A

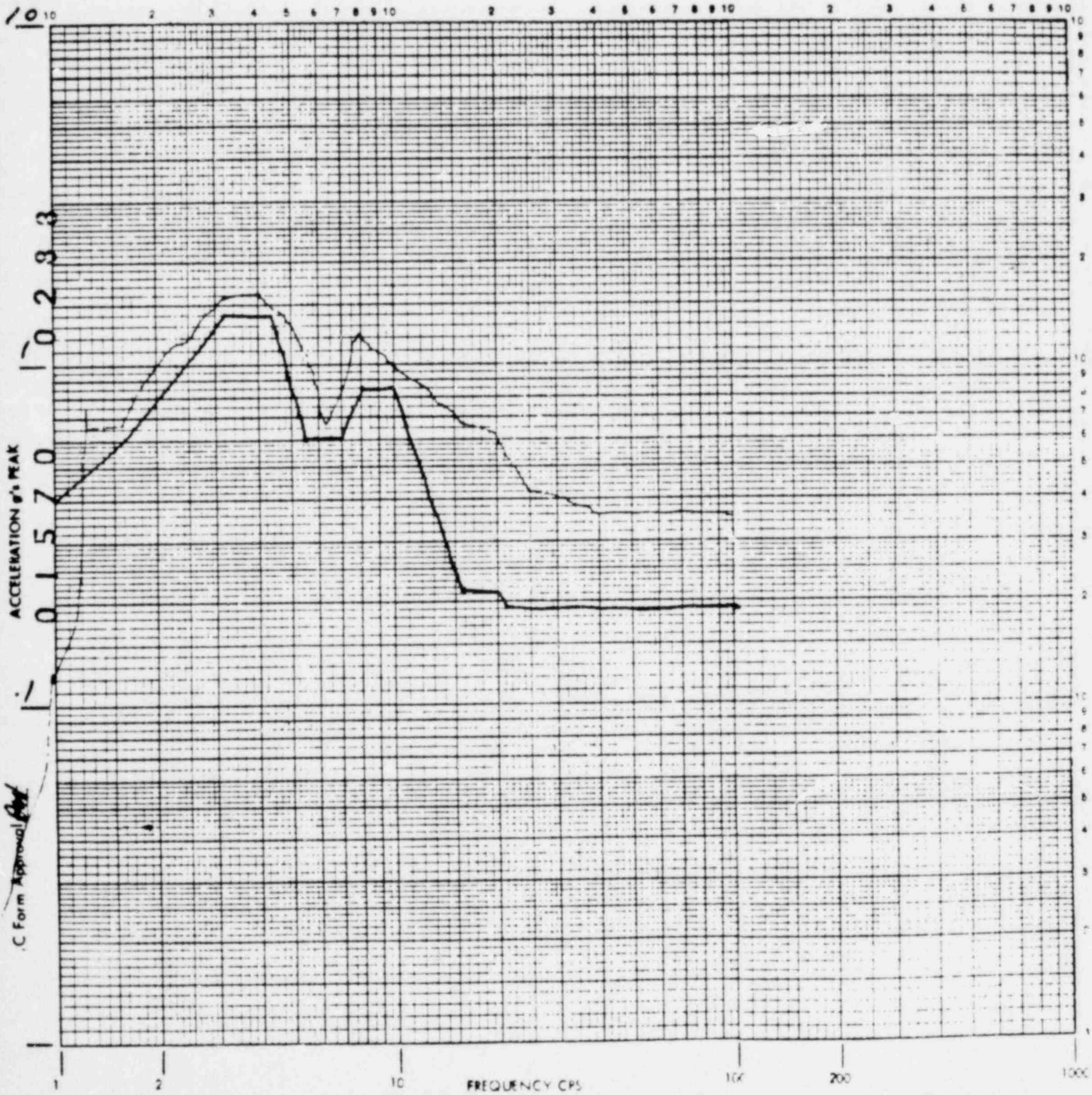
Operator Knoll

P/N 1DA2

Date 3-1-76 Polarity ± Q 50

Axis of Test N-S HORIZ SSE

RESPONSE SPECTRA CALib.



C Form Approval

WYLE LABORATORIES

Report No: 58034

Customer Delta Sw. Bomon Job No. 58039

Page No. 36

Channel Identification: T/R 1 Trk. No. 1 Accel. No. 1

Transducer S/N 1143 Control (✓) Response ( )

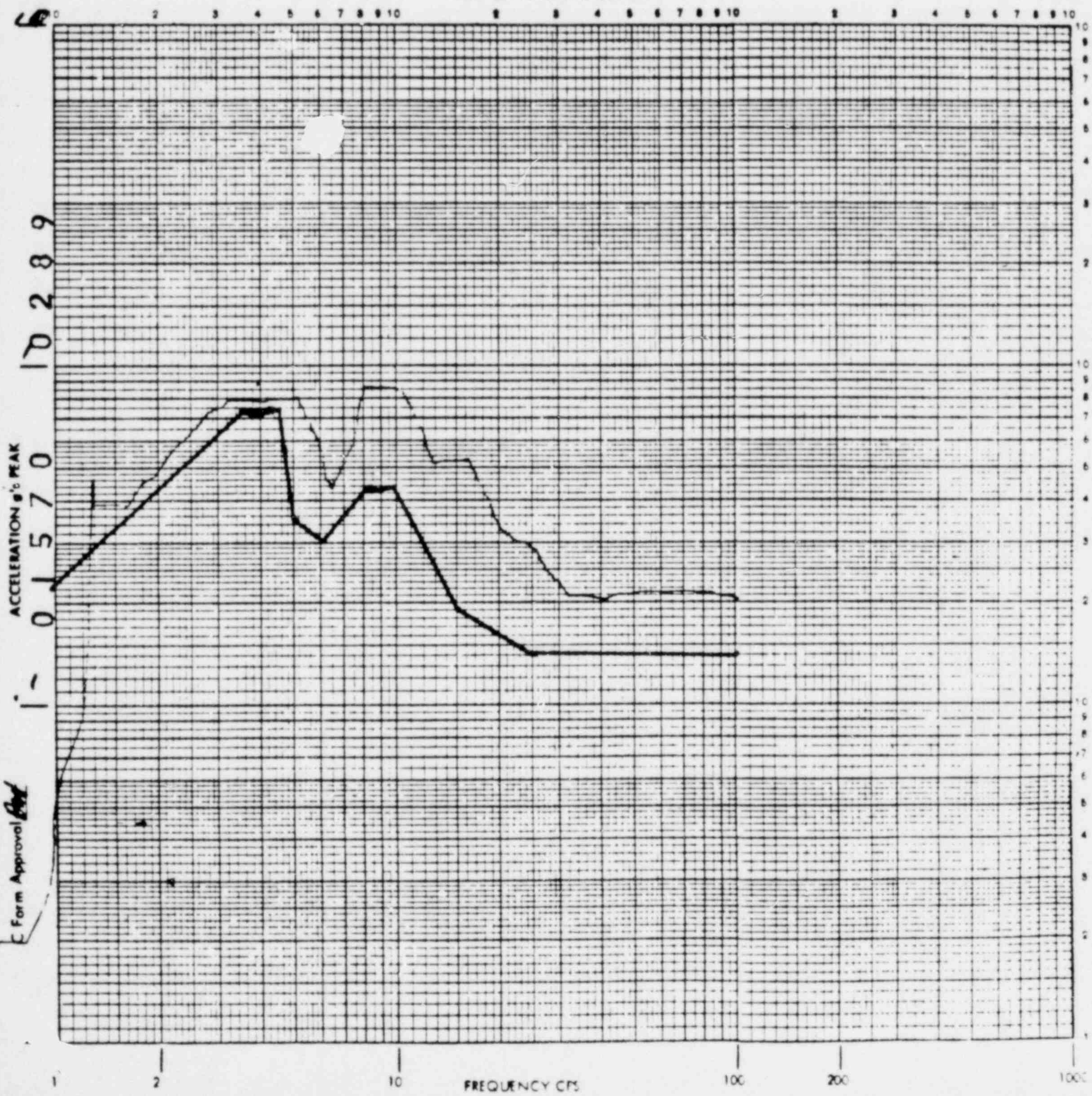
Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

Mode OFF Specimen S/N QIL21[illegible]A

Operator Knoll P/N 1DA2

Date 3-1-76 Polarity + Q 50 Axis of Test N-S Horiz 1st Pass

RESPONSE SPECTRA



C Form Approval

WYLE LABORATORIES

Report No. 58039

Customer DELTA Sv. Board Job No. 58079

Page No. 37

Channel Identification: T/R 1 Trk. No. 2 Accel. No. 2

Transducer S/N 1168 Control (✓)

Response ( )

Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

Mode OFF

Specimen S/N Q1L21P112A

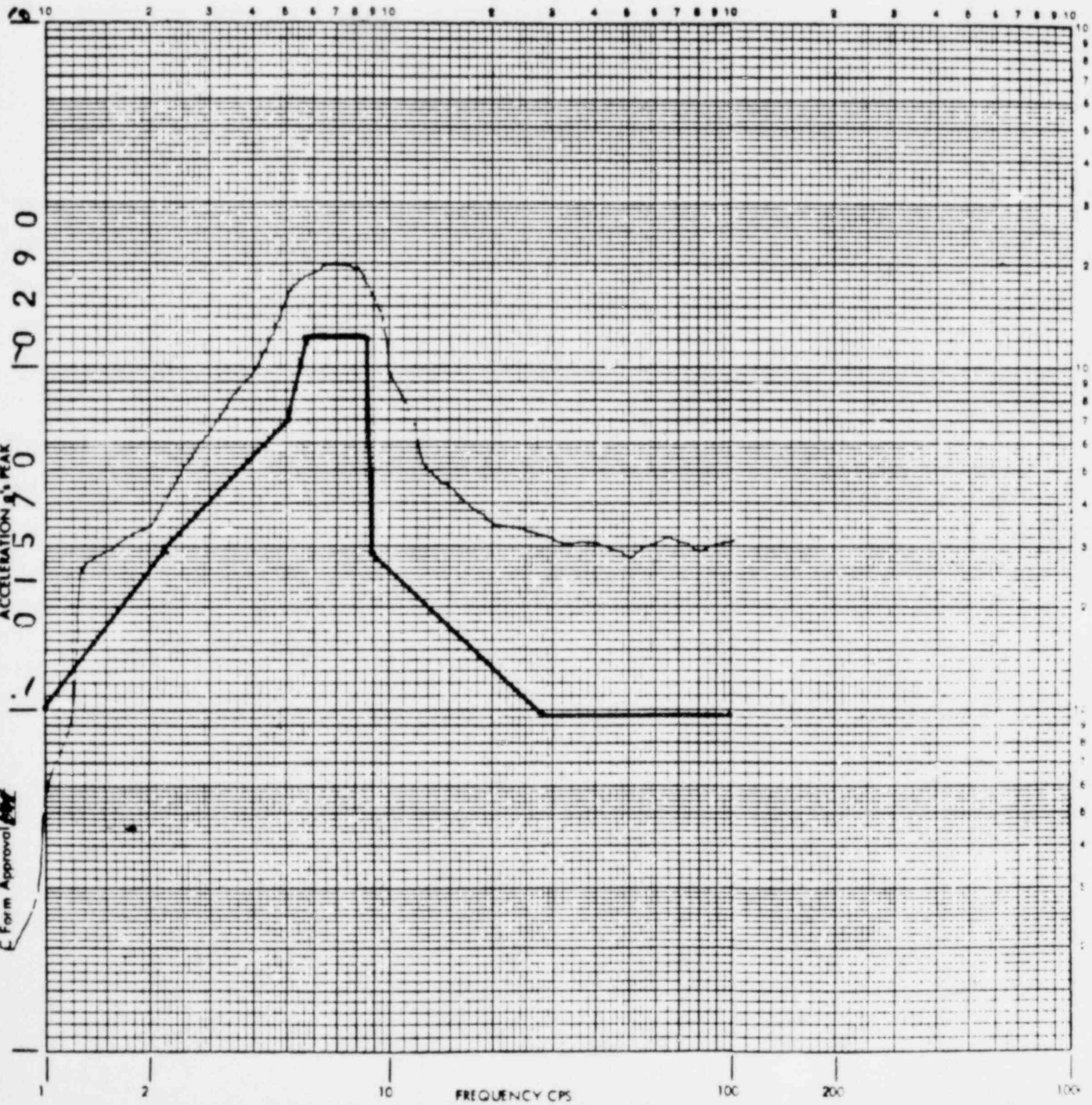
Operator Knoll

P/N 1DA2

Date 3-1-76 Polarity + Q 50

Axis of Test VERT (N-S)

RESPONSE SPECTRA 1ST ½ SSE



WYLE LABORATORIES

Report No. 58039

Customer DELta Sw. Board Job No. 58039

Page No. 38

Channel Identification: T/R 1 Trk. No. 1 Accel. No. 1

Transducer S/N 1143 Control (+)

Response ( )

Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

Mode off

Specimen S/N Q1L21P112A

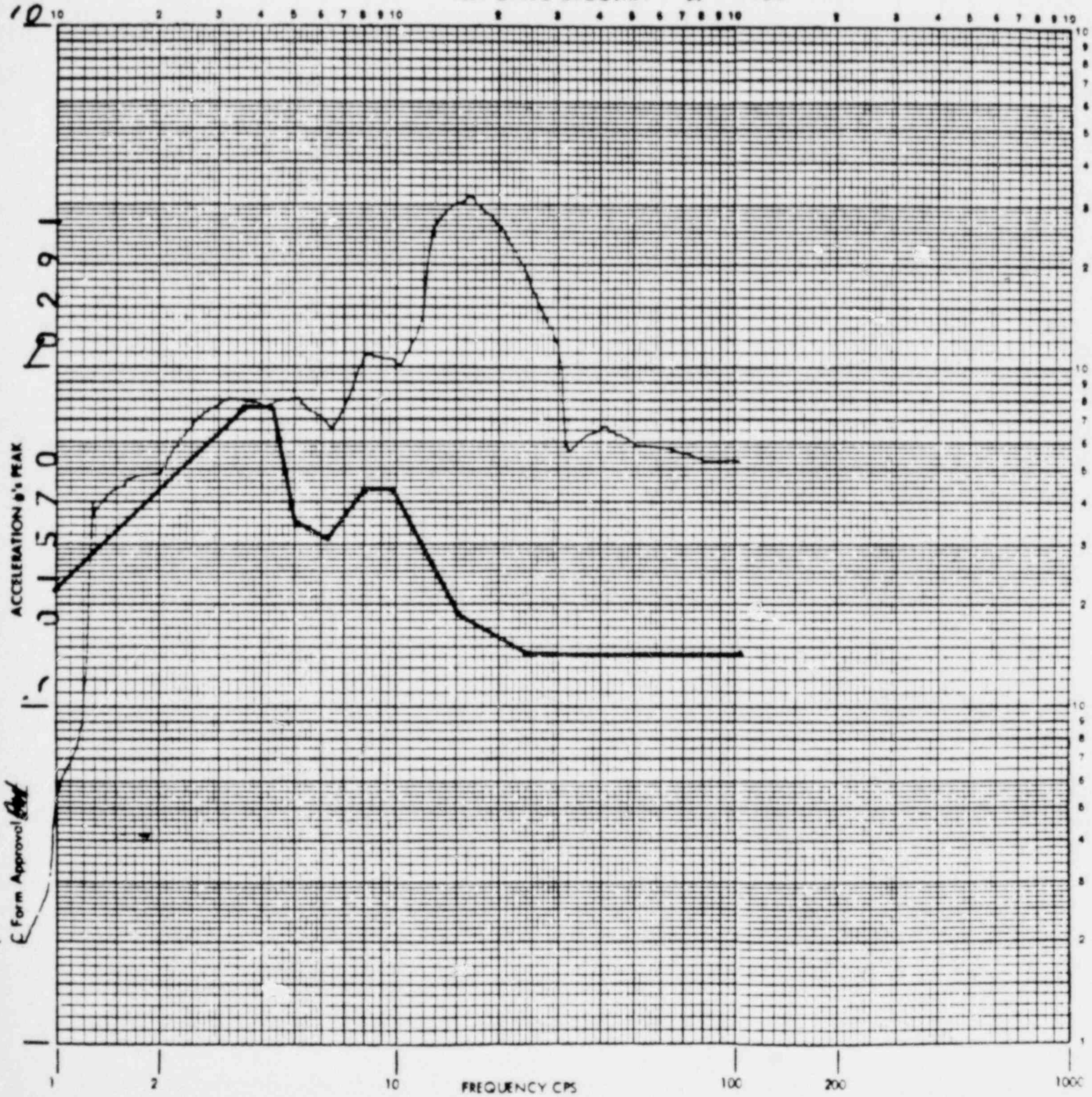
Operator Knoll

P/N 1DA2

Date 3-1-76 Polarity + Q 50

Axis of Test N-S HORIZ.

RESPONSE SPECTRA 2ND ½ SSE



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WYLE LABORATORIES

Report No. 58039

Customer DELTA Sw. Board Job No. 58039

Page No. 39

Channel Identification: T/R 1 Trk. No. 2

Accel. No. 2

Transducer S/N 1168 Control (+)

Response ( )

Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

Mode OFF

Specimen S/N Q1L21P112A

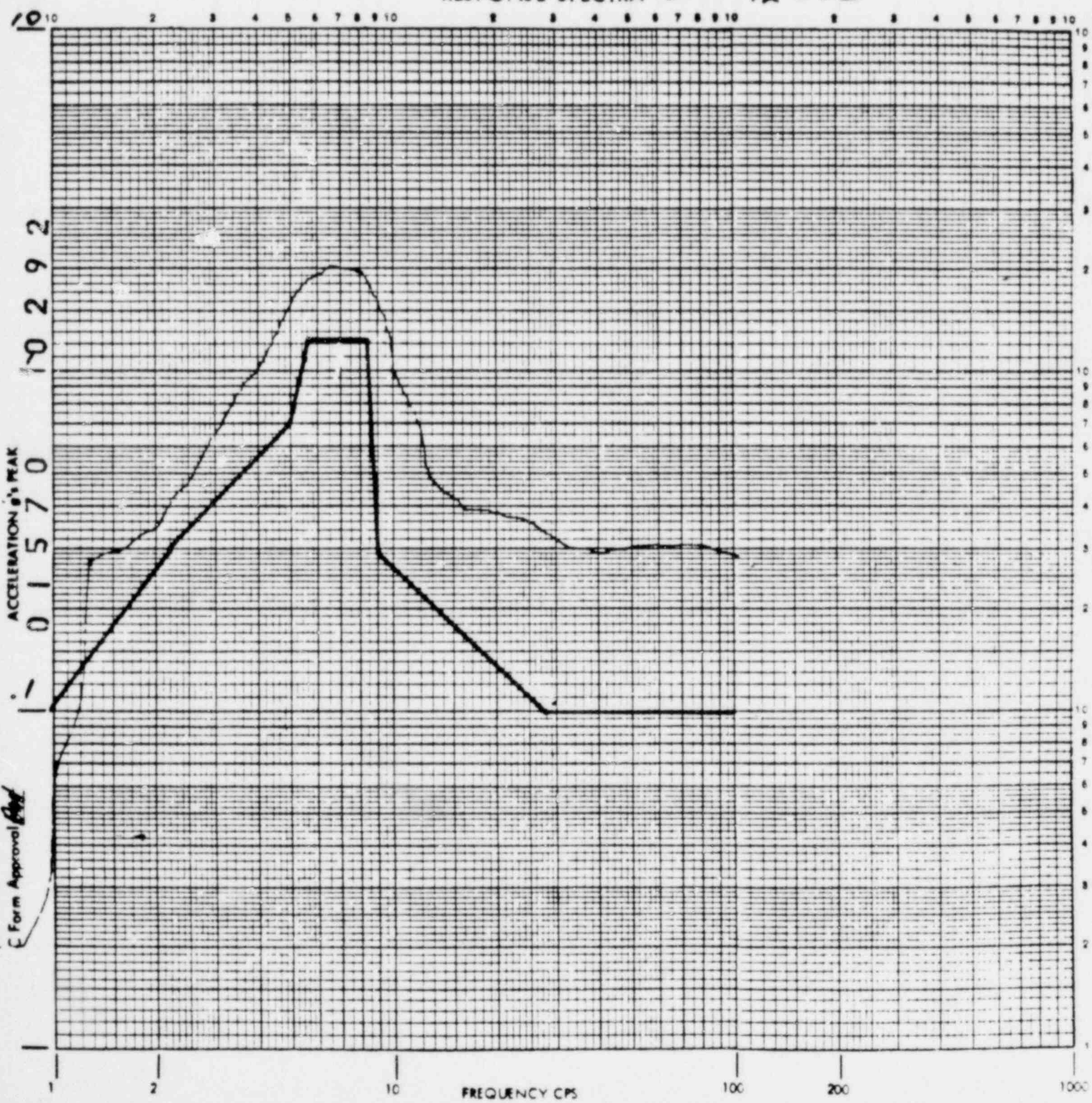
Operator Knoll

P/N 1DA2

Date 3-1-76 Polarity + Q 50

Axis of Test VERT (N-S)

RESPONSE SPECTRA 2ND 1/2 SSE



WYLE LABORATORIES

Report No. 58039

Customer TELTH SW. Board Job No. 58039

Page No. 40

Channel Identification: T/R 1 Trk. No. 1 Accel. No. 1

Transducer S/N 1134 Control (✓) Response ( )

Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

Mode OFF

Specimen S/N Q1L21P112A

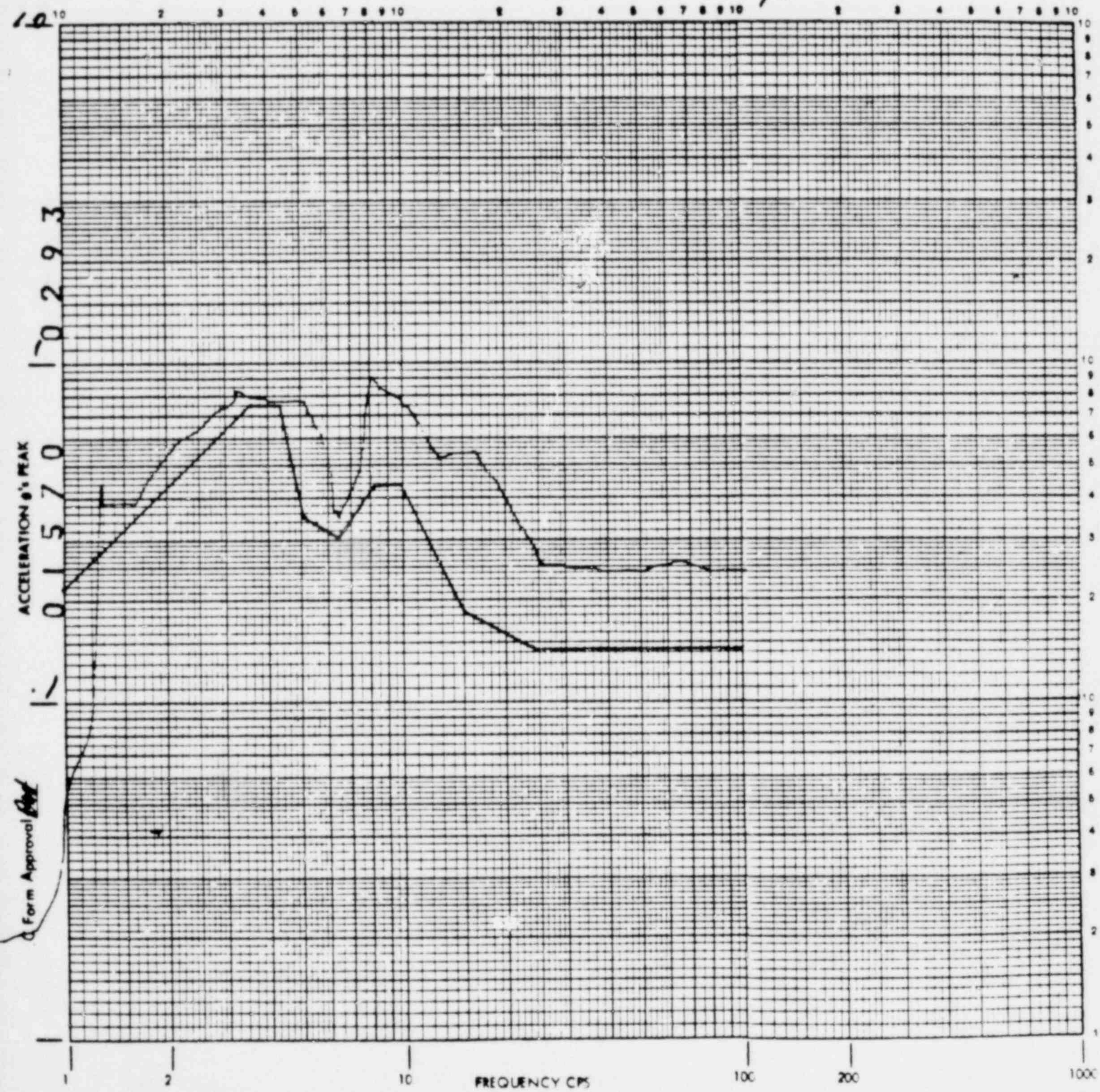
Operator Knoll

P/N 1DA2

Date 3-1-76 Polarity + Q 50

Axis of Test N-S HORIZ.

RESPONSE SPECTRA 3RD 1/2 SSE



WYLE LABORATORIES

Report No. 58039

Customer DELTA SW. Board Job No. 58039

Page No. 41

Channel Identification: T/R 1 Trk. No. 2 Accel. No. 2

Transducer S/N 1168 Control (✓) Response ( )

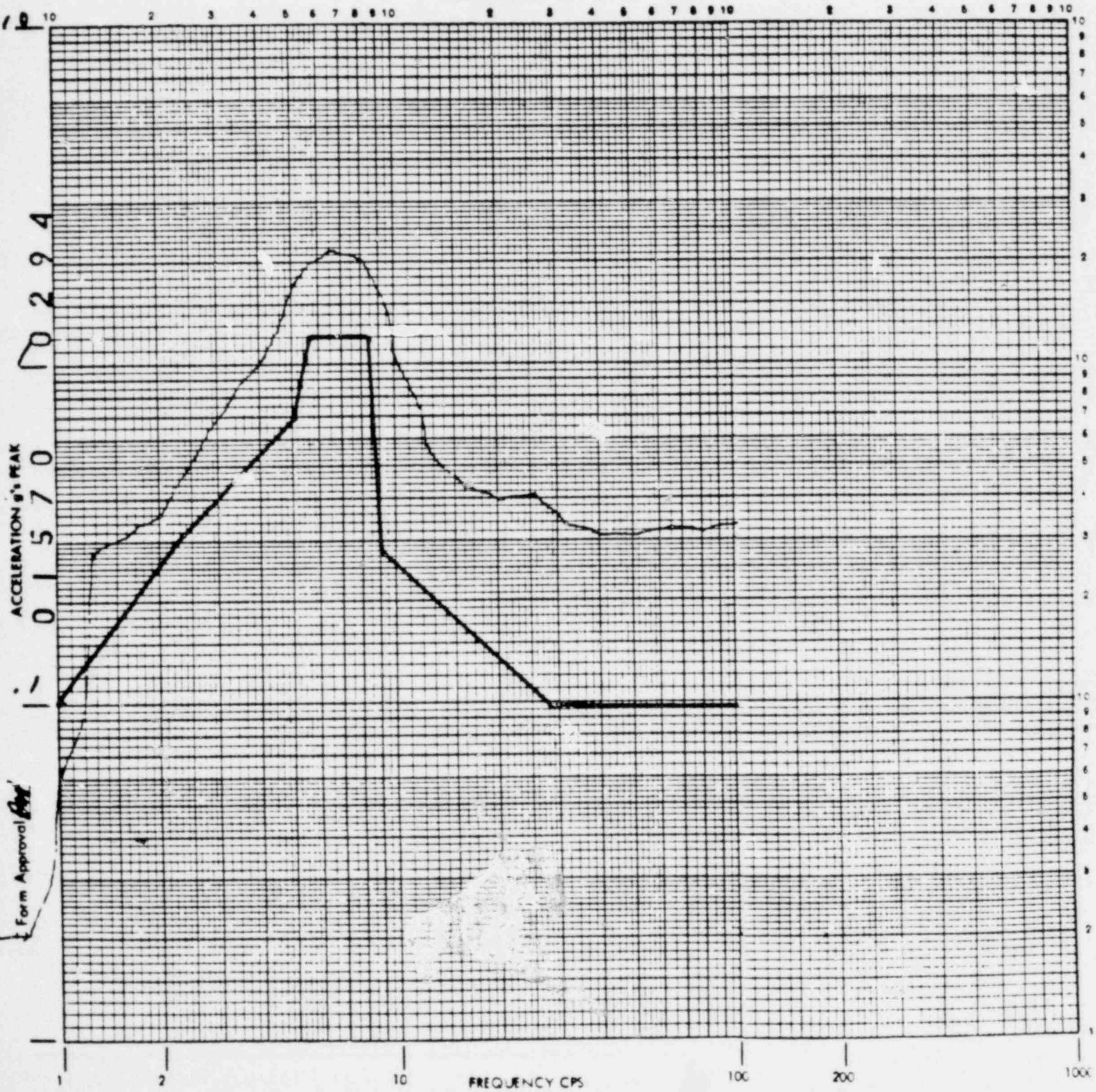
Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

Mode OFF Specimen S/N Q1L21P112A

Operator Knoll P/N 1DA2

Date 3-1-76 Polarity + Q 50 Axis of Test VERT (N-S)

RESPONSE SPECTRA 3RD 1/2 SSE



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WYLE LABORATORIES

Report No. 58039

Customer Delta Sw. Board Job No. 58039

Page No. 42

Channel Identification: T/R 1 Trk. No. 1 Accel. No. 1

Transducer S/N 1143 Control (✓) Response ( )

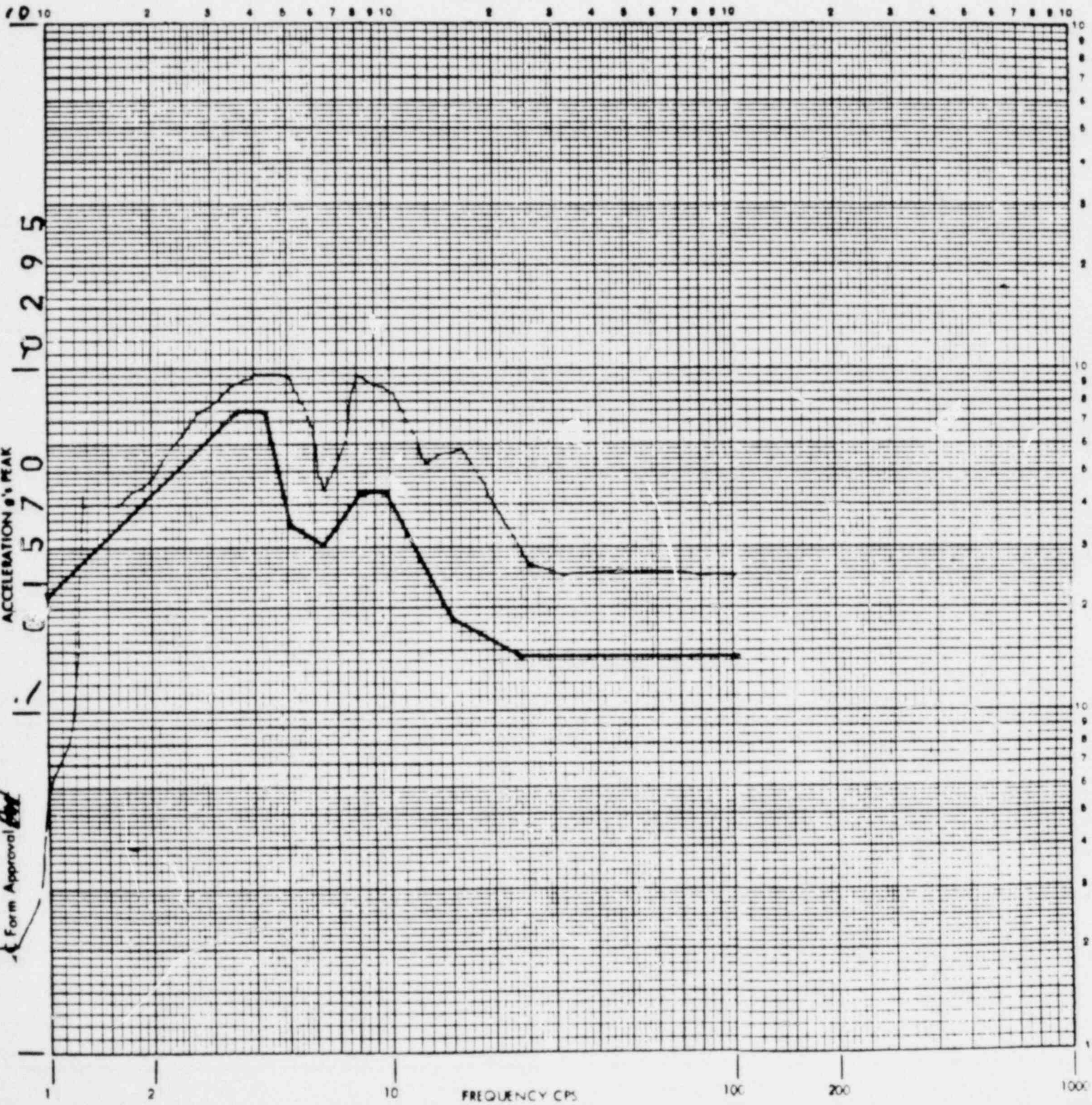
Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

Mode OFF Specimen S/N QIL21P112A

Operator Knoll P/N 1DA2

Date 3-1-76 Polarity + Q 50 Axis of Test N-S HORIZ.

RESPONSE SPECTRA 4th 1/2 SSE



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WYLE LABORATORIES

Report No. 58039

Customer DELtA Sw. Board Job No. 58079

Page No. 43

Channel Identification: T/R 1 Trk. No. 2 Accel. No. 2

Transducer S/N 1168 Control (+) Response ( )

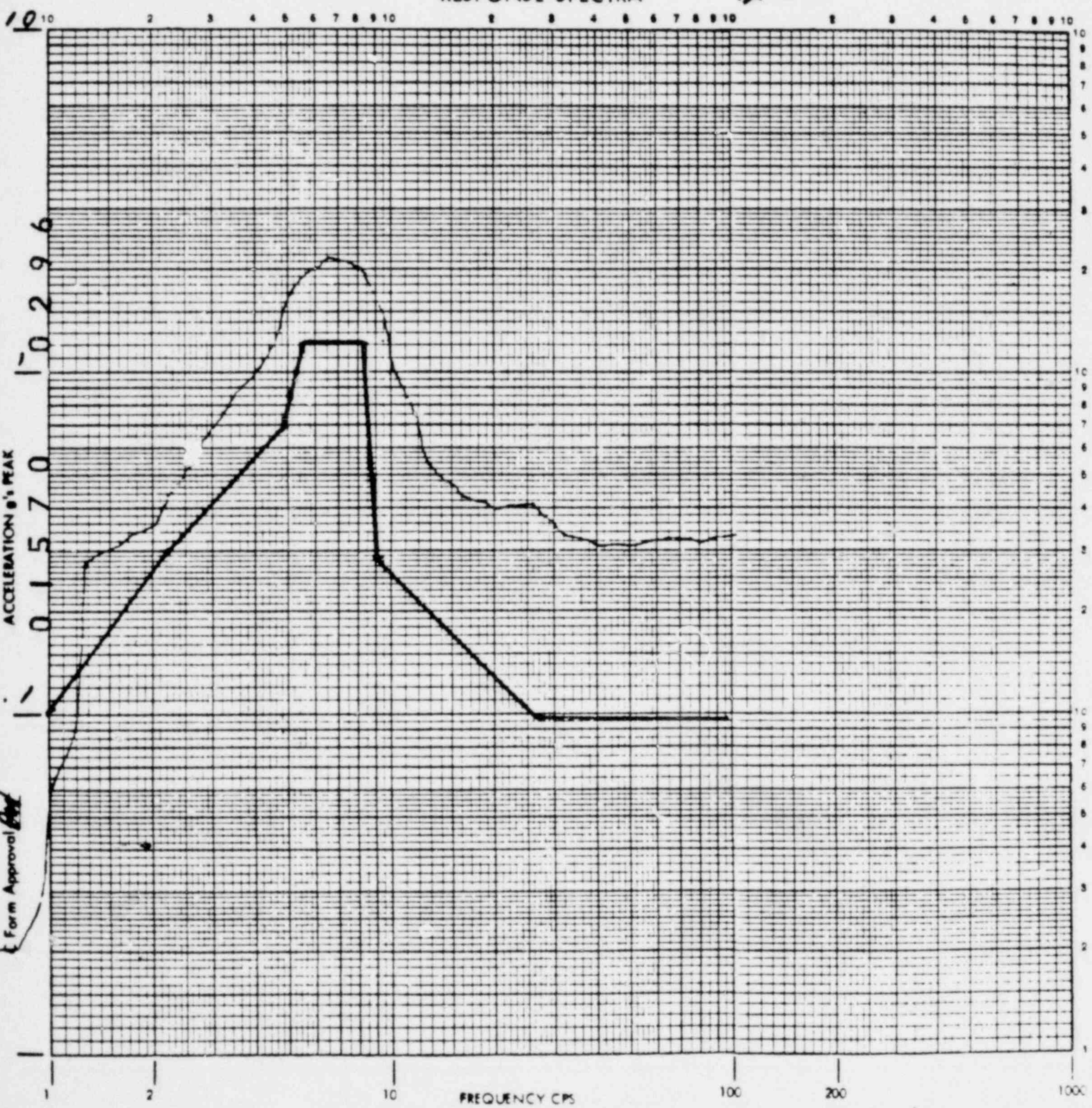
Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

Mode OFF Specimen S/N Q1L21P112A

Operator KNoll P/N 1DA2

Date 3-1-76 Polarity + Q 50 Axis of Test VERT (N-S)

RESPONSE SPECTRA 4th 1/2 SSE



WYLE LABORATORIES

Report No. 58039

Customer DEL-TA SW. Board Job No. 58039

Page No. 44

Channel Identification: T/R 1 Trk. No. 1 Accel. No. 1

Transducer S/N 1143 Control (✓) Response ( )

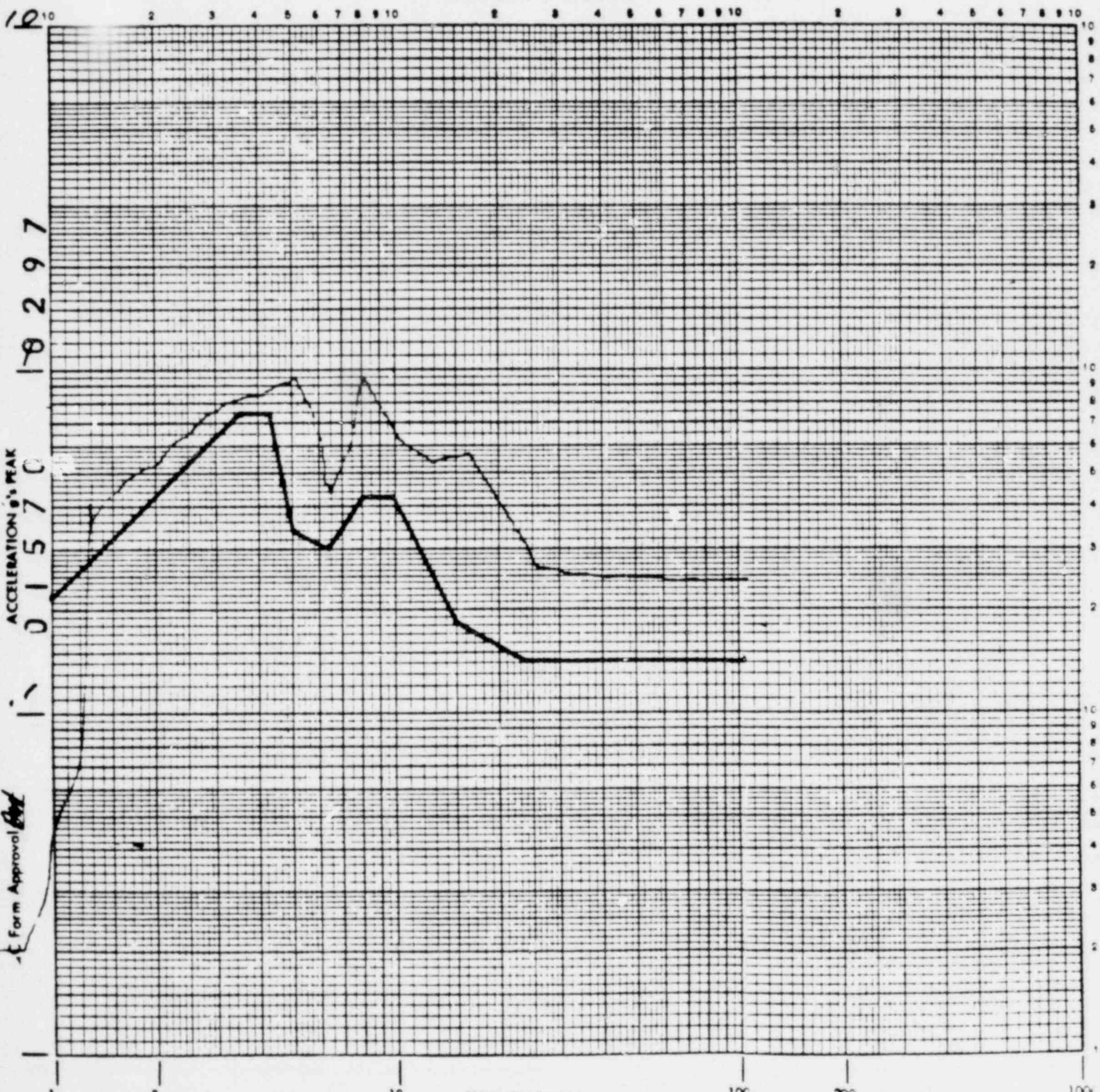
Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

Mode OFF Specimen S/N Q1L21P112A

Operator Knoll P/N 1DA2

Date 3-1-76 Polarity + Q 50 Axis of Test N-S HORIZ.

RESPONSE SPECTRA 5th 1/2 SSE



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WYLE LABORATORIES

Report No. 58039

Customer Delta Sw Board Job No. 58039

Page No. 45

Channel Identification: T/R 1 Trk. No. 2 Accel. No. 2

Transducer S/N 1068 Control (✓) Response ( )

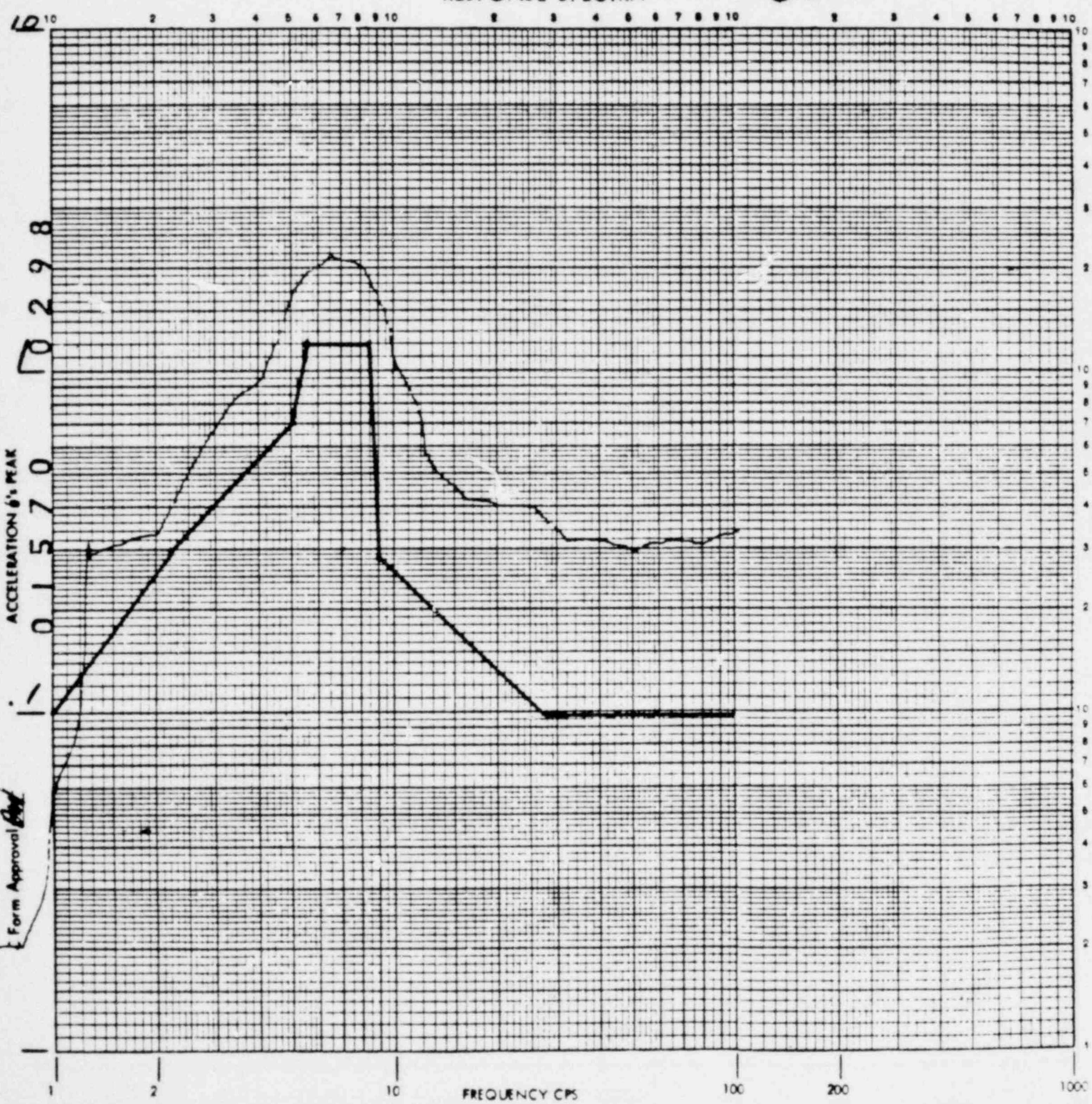
Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

Mode OFF Specimen S/N Q1L21P112A

Operator Knoll P/N 1DA2

Date 3-1-76 Polarity + Q 50 Axis of Test VERT (N-S)

RESPONSE SPECTRA 5th 1/2 SSE



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Report No. 58039

Customer DELTA SW. BOARD Job No. 58039

Page No. 46

Channel Identification: T/R 1 Trk. No. 7 Accel. No. 3

Transducer S/N 1024 Control ( ), Response (✓)

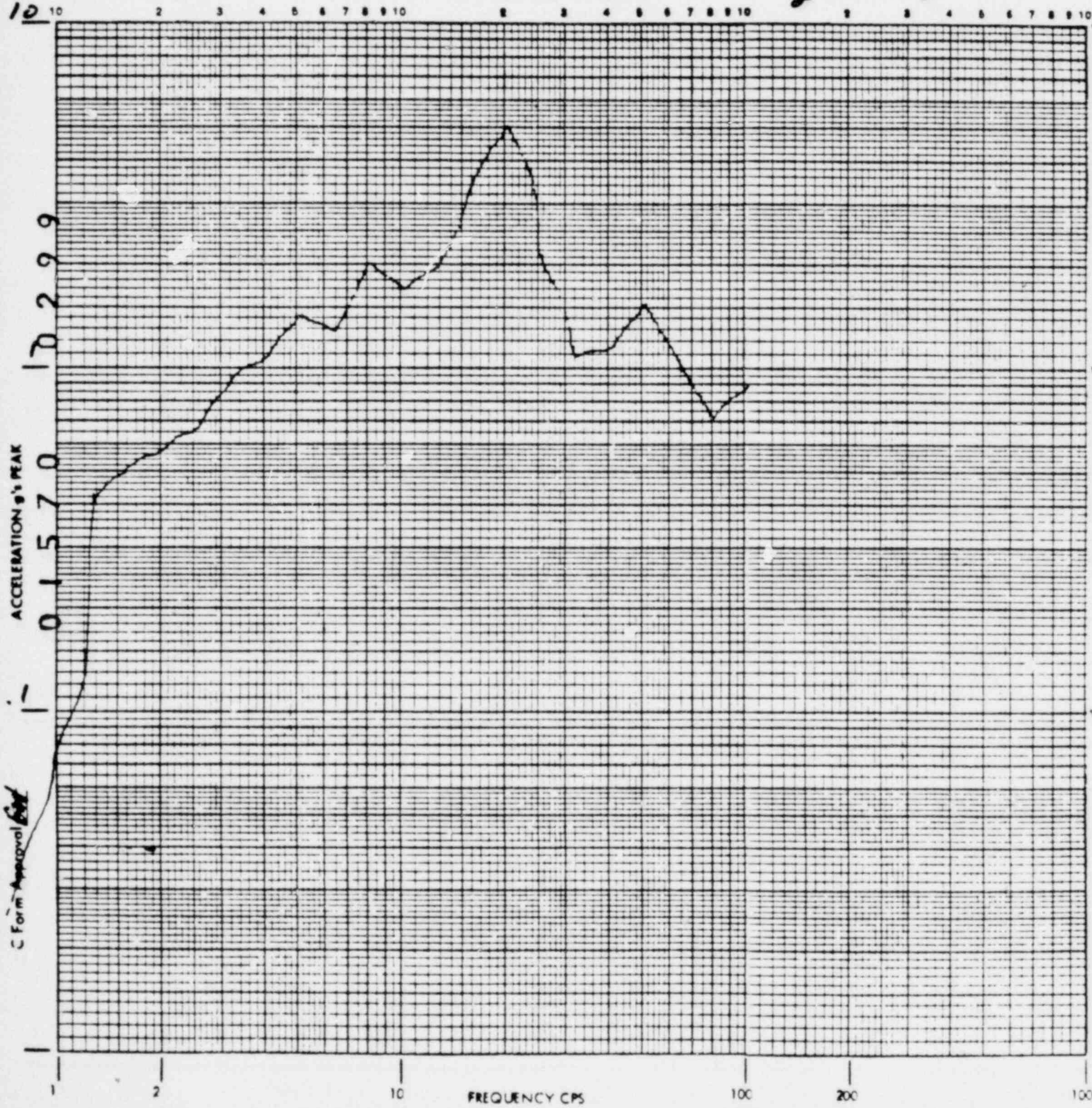
Full Scale 10 G Cal Voltage 100 MVPK/ 1 G

Mode OFF Specimen S/N QIL21P112A

Operator Knoll P/N 1DA2

Date 3-1-76 Polarity + Q 50 Axis of Test N-S Horiz

RESPONSE SPECTRA ½ SSE #5



10 2 9 9 7 0 5 7 0 1 5 0 1

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Report No. 58039
Page No. 47

Customer DELtA Sw. Board. Job No. 58039

Channel Identification: T/R 1 Trk. No. 4 Accel. No. 4

Transducer S/N 1054 Control ( ). Response (X)

Full Scale 10 G Cal Voltage 100 MVPK/ 1 G

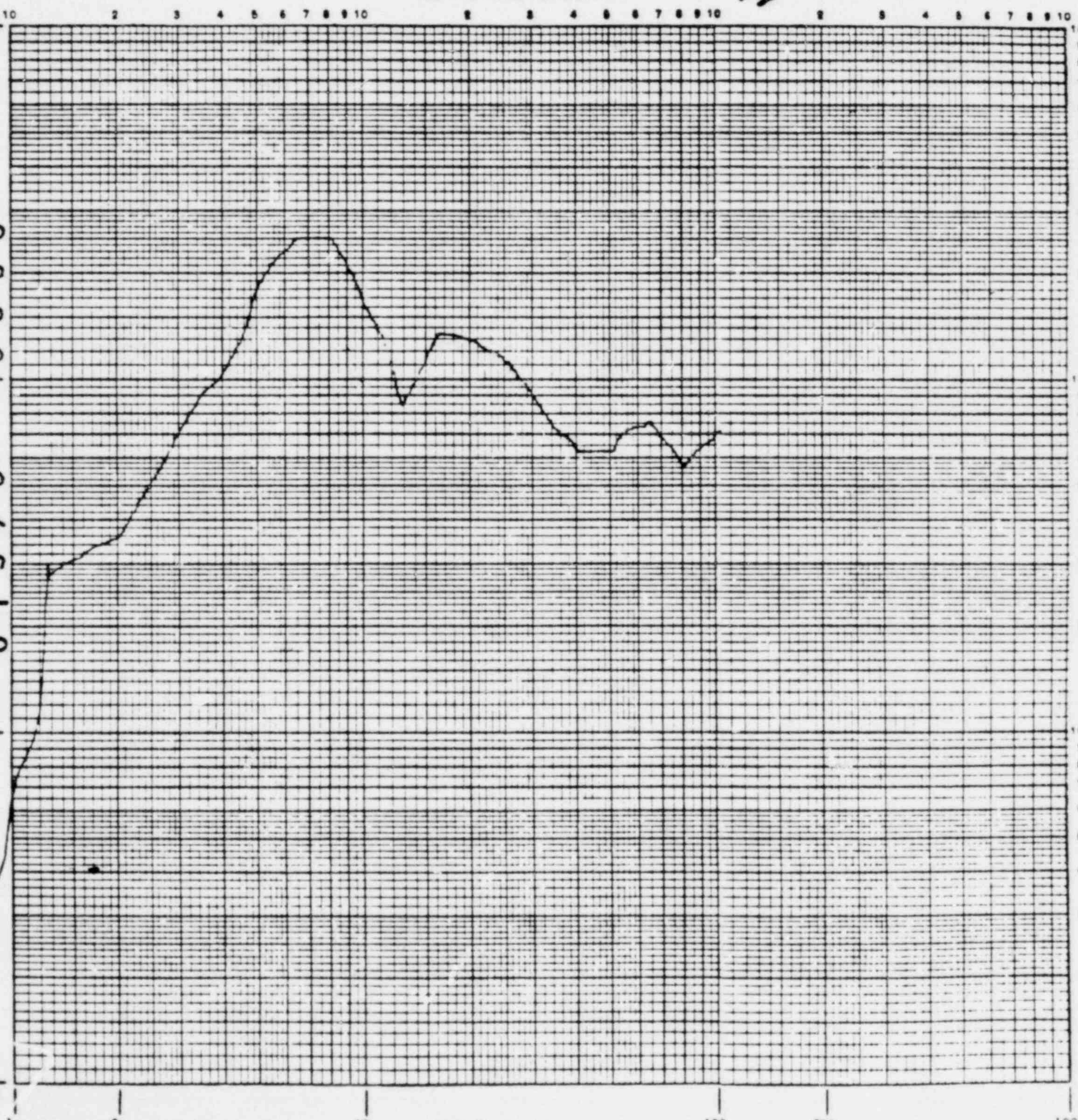
Mode OFF Specimen S/N G1L21P113A

Operator Knoll P/N 1DA2

Date 3-1-76 Polarity + Q 50 Axis of Test N-S Vert

½ SSE #5

RESPONSE SPECTRA



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WYLE LABORATORIES

Report No. 58039

Customer Delta Sw Board Job No. 58039

Page No. 48

Channel Identification: T/R 1 Trk. No. 5 Accel. No. 5

Transducer S/N 979 Control ( ), Response (X)

Full Scale 10 G Cal Voltage 100 MVPK/ 1 G

Mode OFF

Specimen S/N Q1L21P112A

Operator Knoll

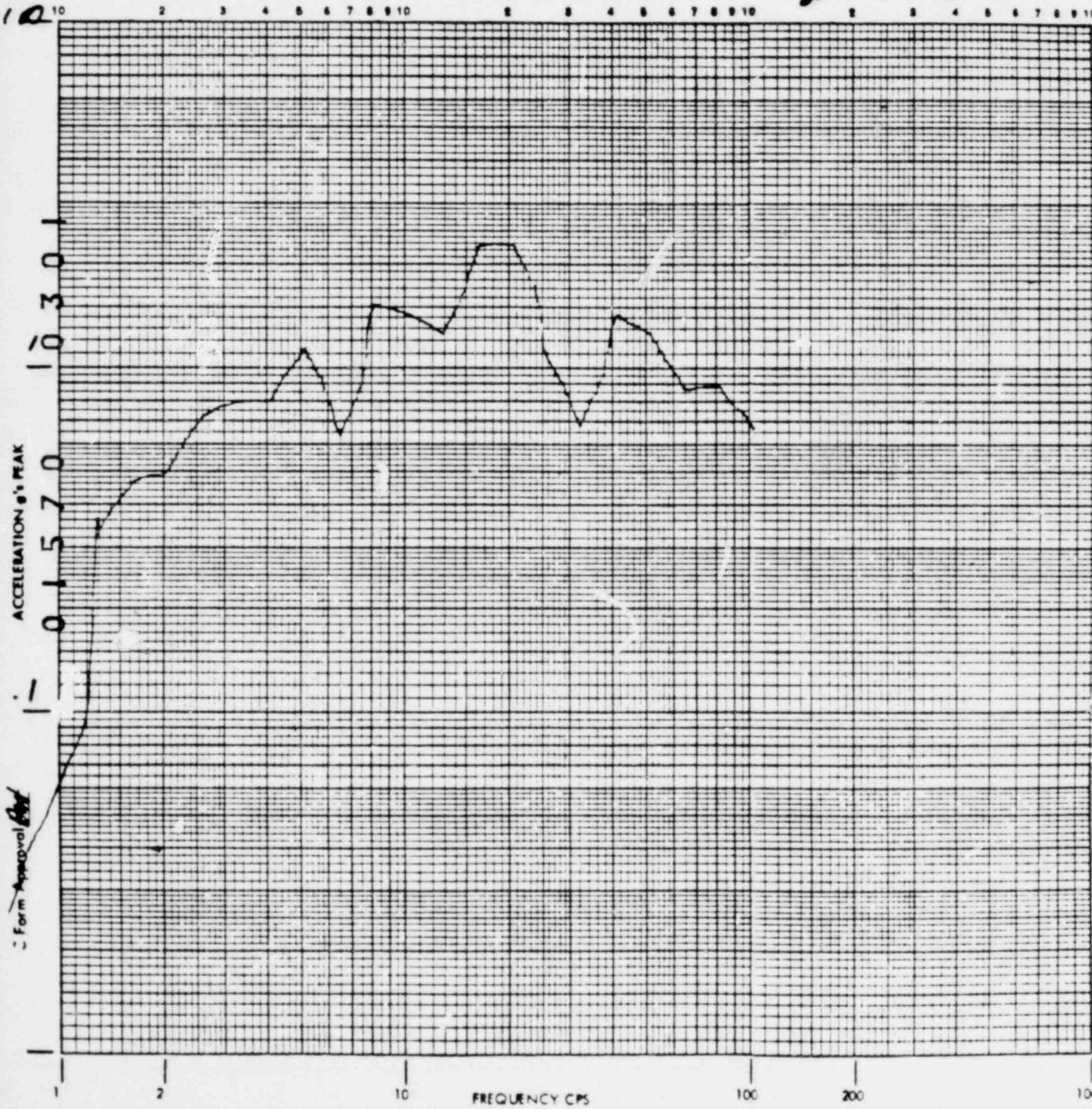
P/N 1DA2

Date 3-1-76 Polarity + ς 50

Axis of Test N-S Horiz

½ SSE #5

RESPONSE SPECTRA



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WYLE LABORATORIES

Report No. 58039

Customer DELTA Sw Board Job No. 58039

Page No. 49

Channel Identification: T/R 1 Trk. No. 6 Accel. No. 6

Transducer S/N 1109 Control ( ), Response (X)

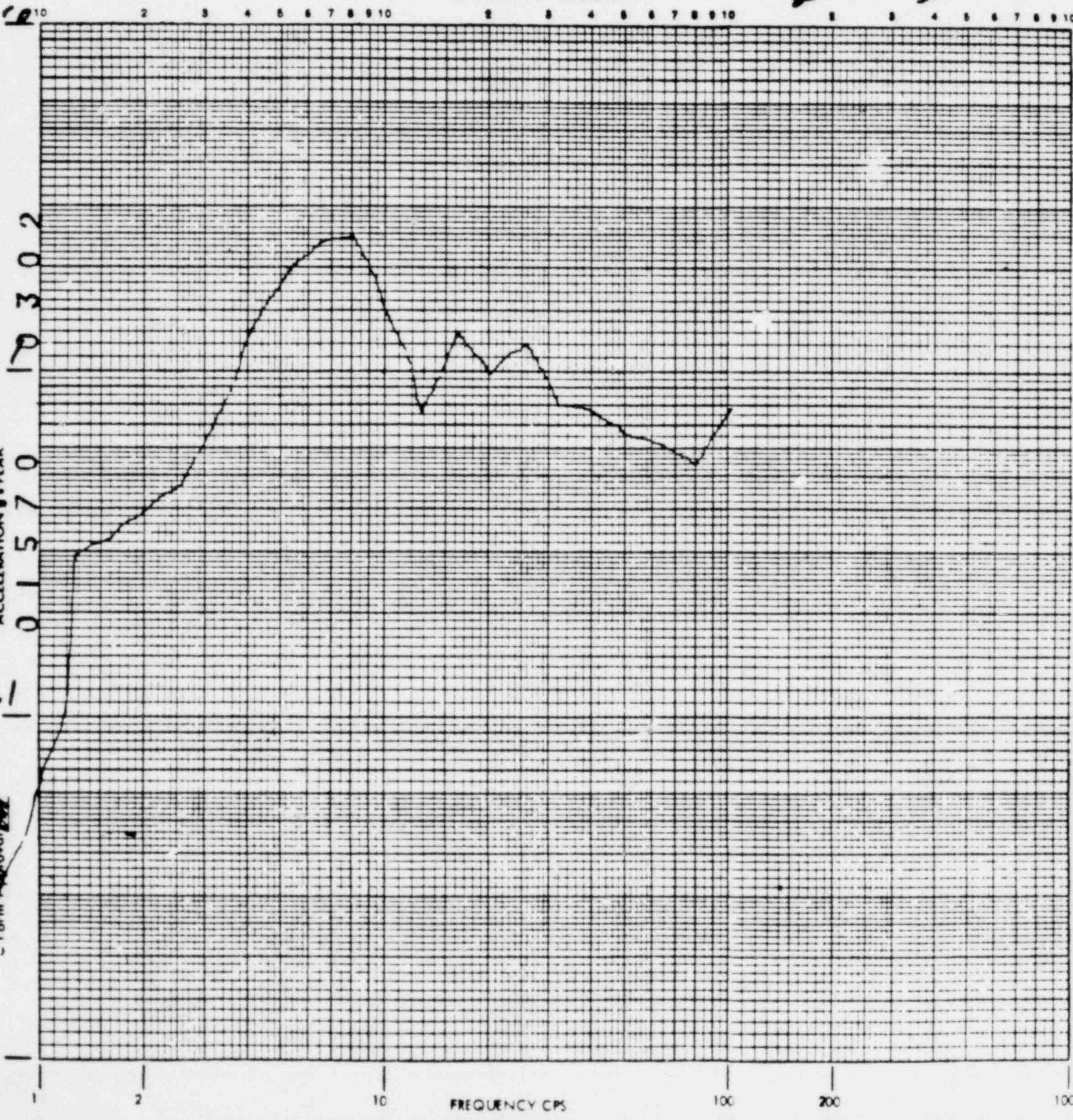
Full Scale 10 G Cal Voltage 100 MVPK/ 1 G

Mode OFF Specimen S/N Q1L21P112A

Operator Knoll P/N 1DA2

Date 3-1-76 Polarity + Q 50 Axis of Test N-S Vert

RESPONSE SPECTRA ½ SSE #5



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WYLE LABORATORIES

Report No. 58039

Page No. 50

Customer DELTA Sol. Board Job No. 58039

Channel Identification: T/R 1 Trk. No. 1 Accel. No. 1

Transducer S/N 1143 Control (+) Response ( )

Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

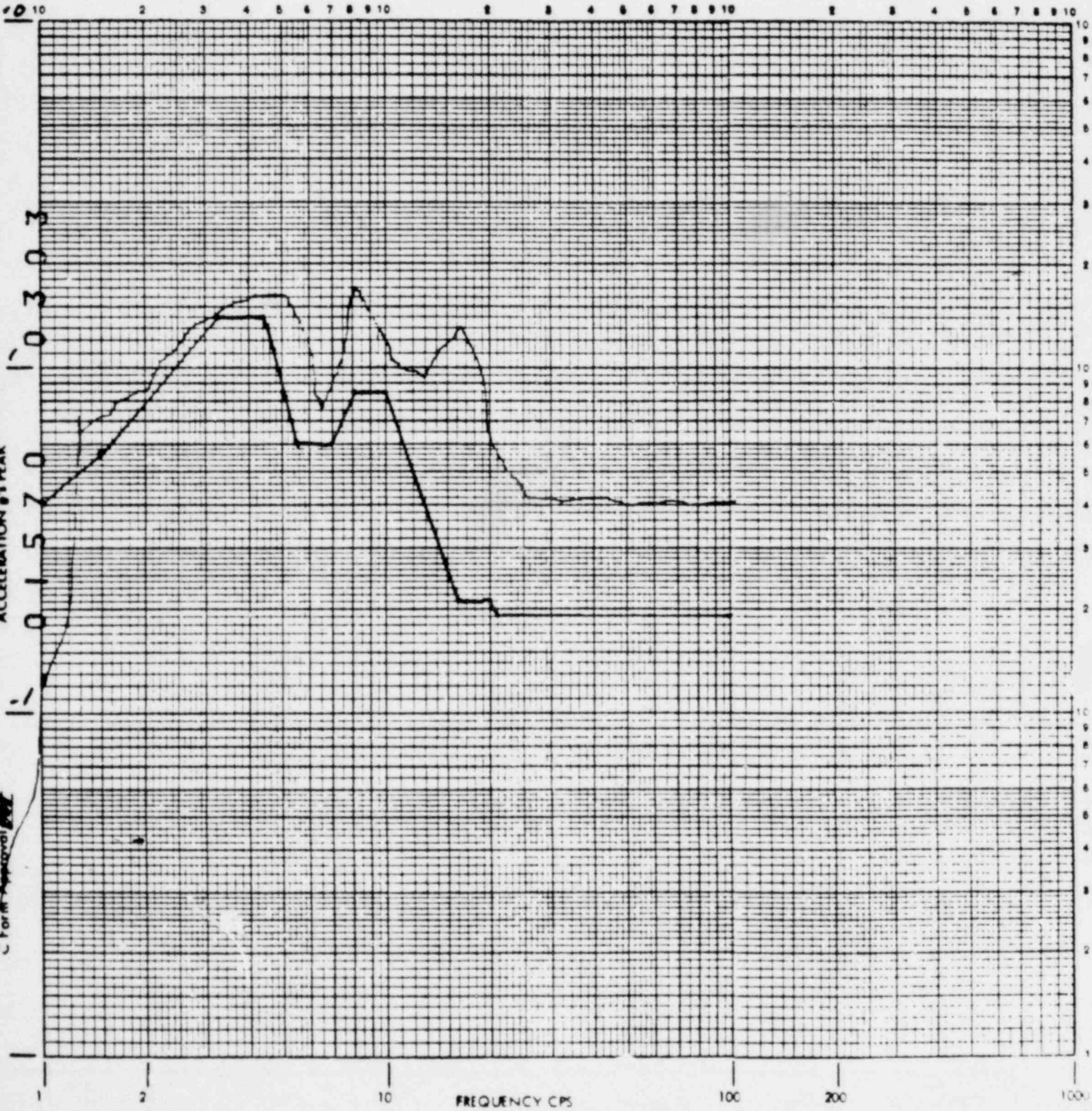
Mode OFF Specimen S/N QIL21P112A

Operator Knoll P/N 1DA2

Date 3-1-76 Polarity + Q 50 Axis of Test N-S Horiz.

1st Full SSE (OPEN)

RESPONSE SPECTRA



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Report No. 58039

Customer Delta Sw. Board Job No. 58039

Page No. 51

Channel Identification: T/R 1 Trk. No. 2 Accel. No. C

Transducer S/N 116B Control (+T,

Response ( )

Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

Mode OFF

Specimen S/N Q1L21P112A

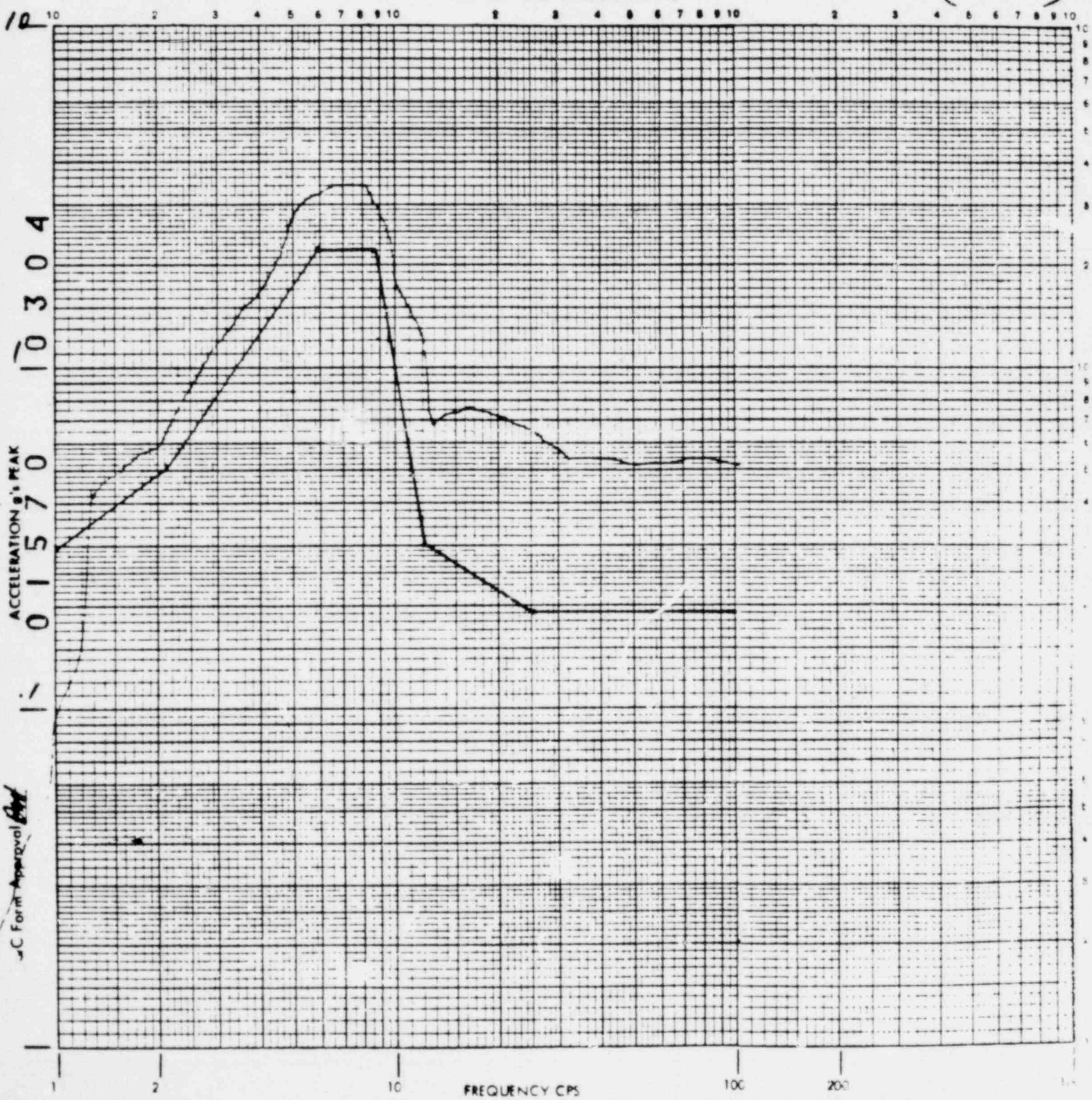
Operator Knoll

P/N 1DA2

Date 3-1-76 Polarity + Q 50

Axis of Test (LHS) Vert

RESPONSE SPECTRA 1ST FULL SSE (OPEN)



WYLE. LABORATORIES

Report No. 58039

Customer DELtA Sw. Board Job No. 58039

Page No. 52

Channel Identification: T/R 1 Trk. No. 1 Accel. No. 1

Transducer S/N 1143 Control (+) Response ( )

Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

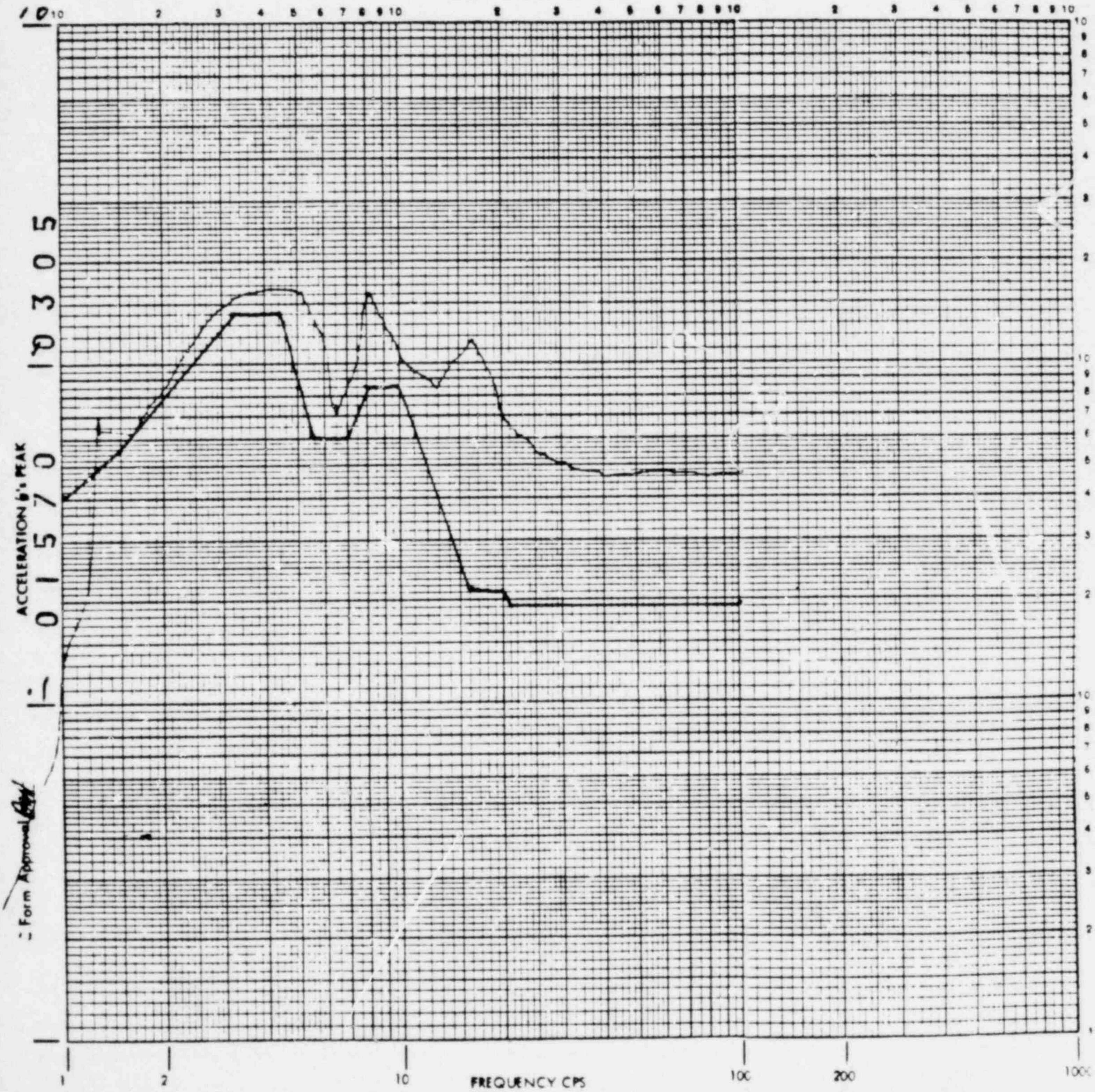
Mode OFF Specimen S/N QIL21P112A

Operator Knoll P/N 1DA2

Date 3-1-76 Polarity + Q 50 Axis of Test N-S Horiz

2ND Full SSE (CLOSED)

RESPONSE SPECTRA



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Report No. 58039

Customer DELta Sw. Board Job No. 58039

Page No. 53

Channel Identification: T/R 1 Trk. No. 2

Accel. No. 2

Transducer S/N 1168 Control (✓)

Response ( )

Full Scale 10 G Cal Voltage 500 MVPK/ 1 G

Mode OFF

Specimen S/N Q1L21P112A

Operator Knoll

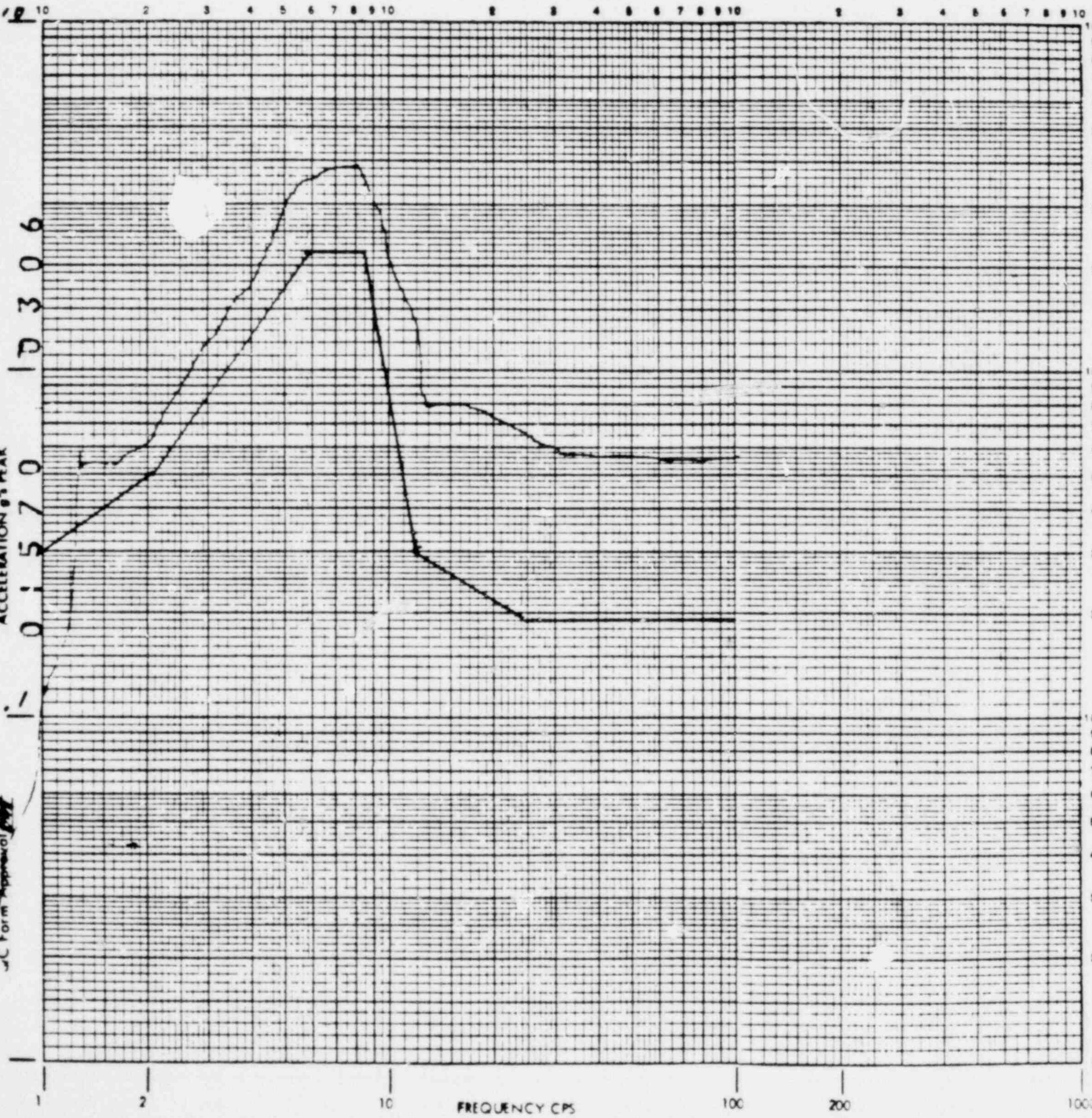
P/N 1DA2

Date 3-1-76 Polarity + Q 50

Axis of Test (N-S) VERT

2ND FULL SSE CLOSED

RESPONSE SPECTRA



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WYLE LABORATORIES

Report No. 58039

Customer DELTA SW. BOARD Job No. 58039

Page No. 54

Channel Identification: T/R 1 Trk. No. 3 Accel. No. 3

Transducer S/N 1024 Control ( ), Response (X)

Full Scale 100 G Cal Voltage 100 MVPK/ 1 G

Mode off

Specimen S/N Q1L21P112A

Operator Knoll

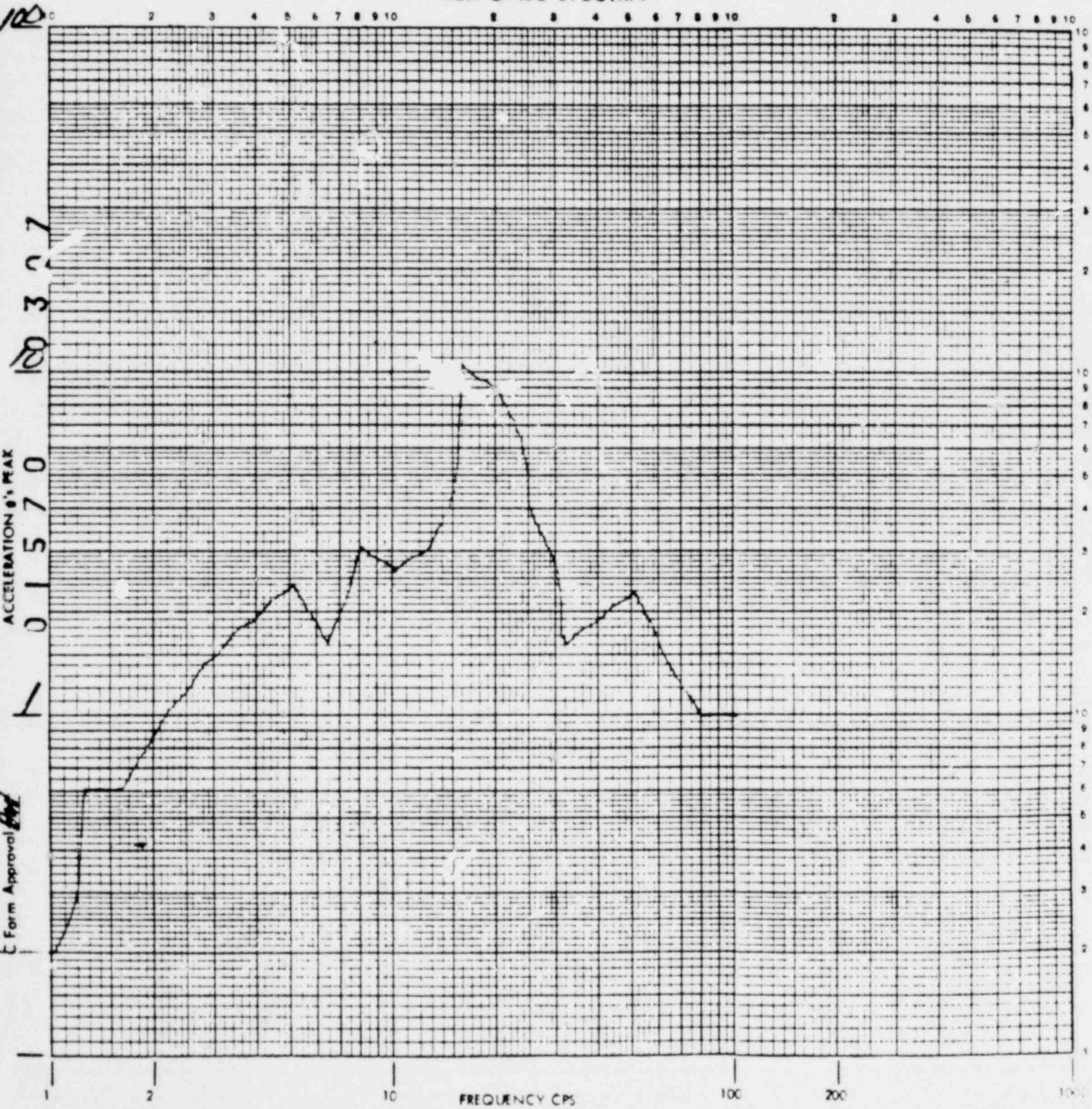
P/N 1DA2

Date 3-1-76 Polarity + Q 50

Axis of Test N-S HORIZ

Full SSE #2

RESPONSE SPECTRA



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Report No. 58039

Customer DELTA SW. BOARD Job No. 58039

Page No. 55

Channel Identification: T/R 1 Trk. No. 4 Accel. No. 4

Transducer S/N 1054 Control ( ), Response (X)

Full Scale 10 G Cal Voltage 100 MVPK/ 1 G

Mode Off

Specimen S/N QIL21P112A

Operator KNOLL

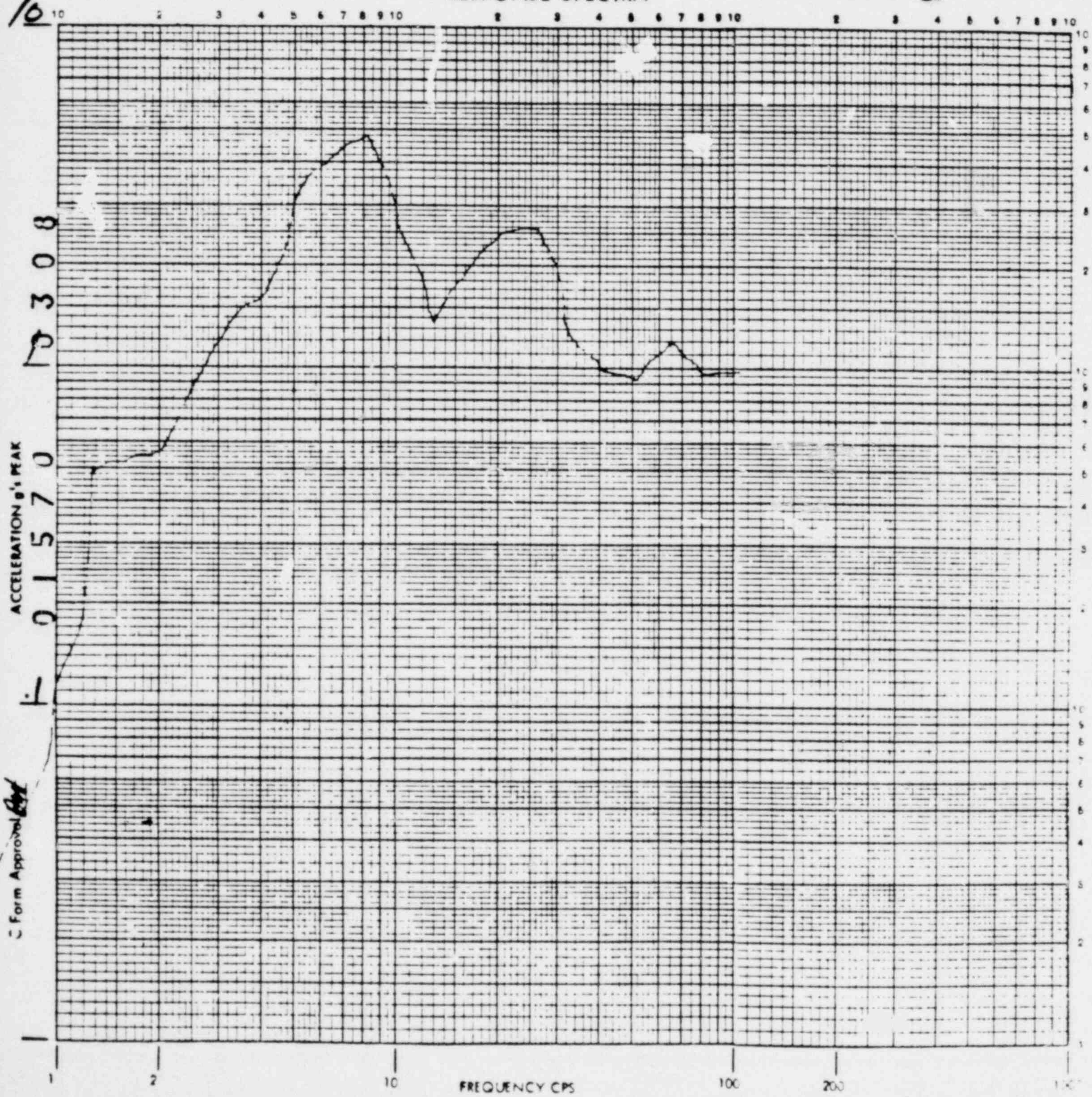
P/N 1DA2

Date 3-1-76 Polarity + Q 50

Axis of Test N-S VERT

FULL SSE #2

RESPONSE SPECTRA



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WYLE LABORATORIES

Report No. 58039

Customer DELTA SW. BOARD Job No. 58039

Page No. 56

Channel Identification: T/R 1 Trk. No. 5 Accel. No. 5

Transducer S/N 979 Control ( ), Response (X)

Full Scale 10 G Cal Voltage 100 MVPK/ 1 G

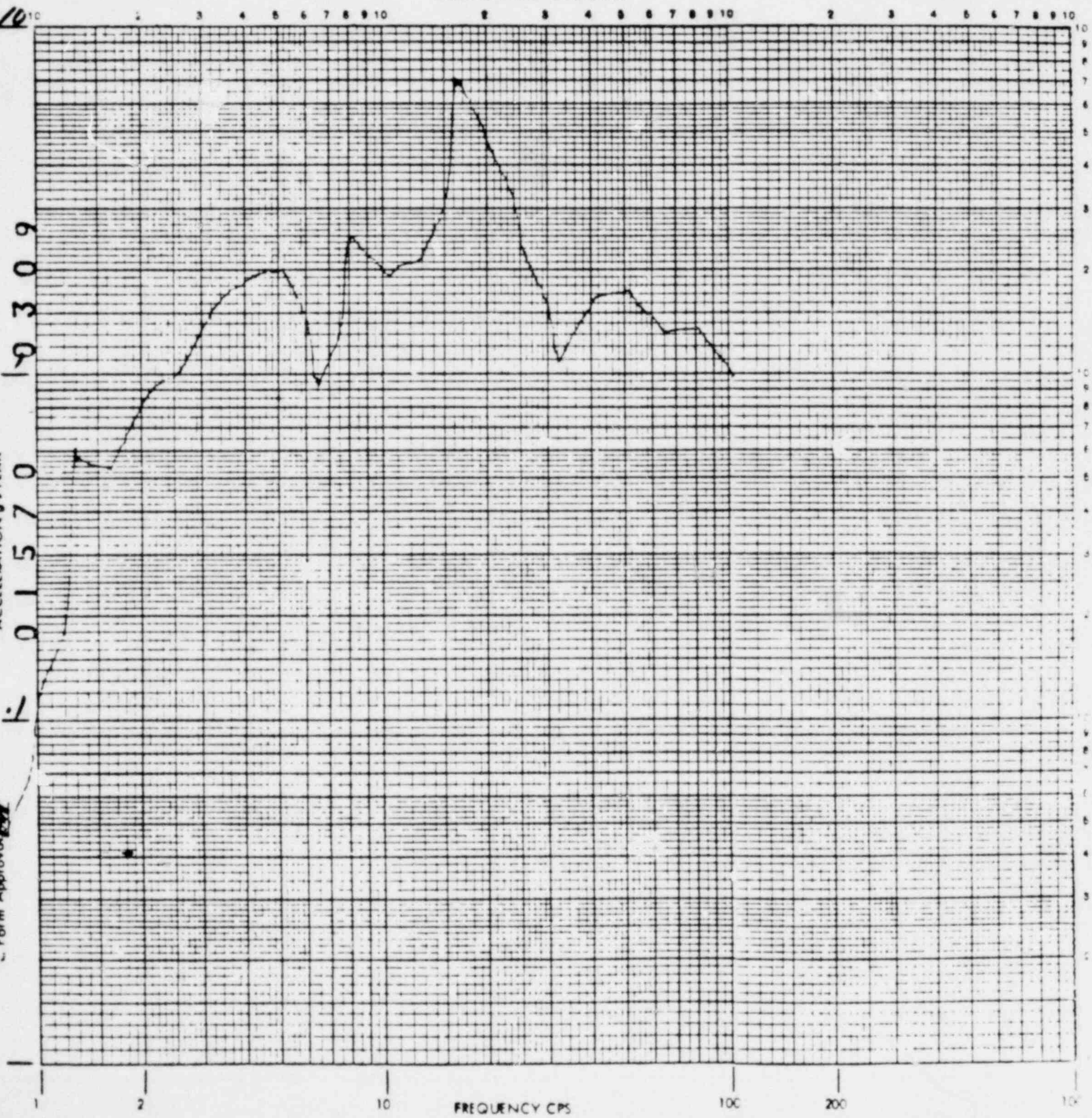
Mode OFF Specimen S/N Q1L21P1121

Operator Knoll P/N 1DA2

Date 3-1-76 Polarity + Q 50 Axis of Test N-S HORIZ

FULL SSE #1

RESPONSE SPECTRA



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Report No. 58039

Customer DELTA 5W BOARD Job No. 58039

Page No. 57

Channel Identification: T/R 1 Trk. No. 6 Accel. No. 6

Transducer S/N 1109 Control ( ), Response (X)

Full Scale 10 G Cal Voltage 100 MVPK/ 1 G

Mode off

Specimen S/N QIL21P112A

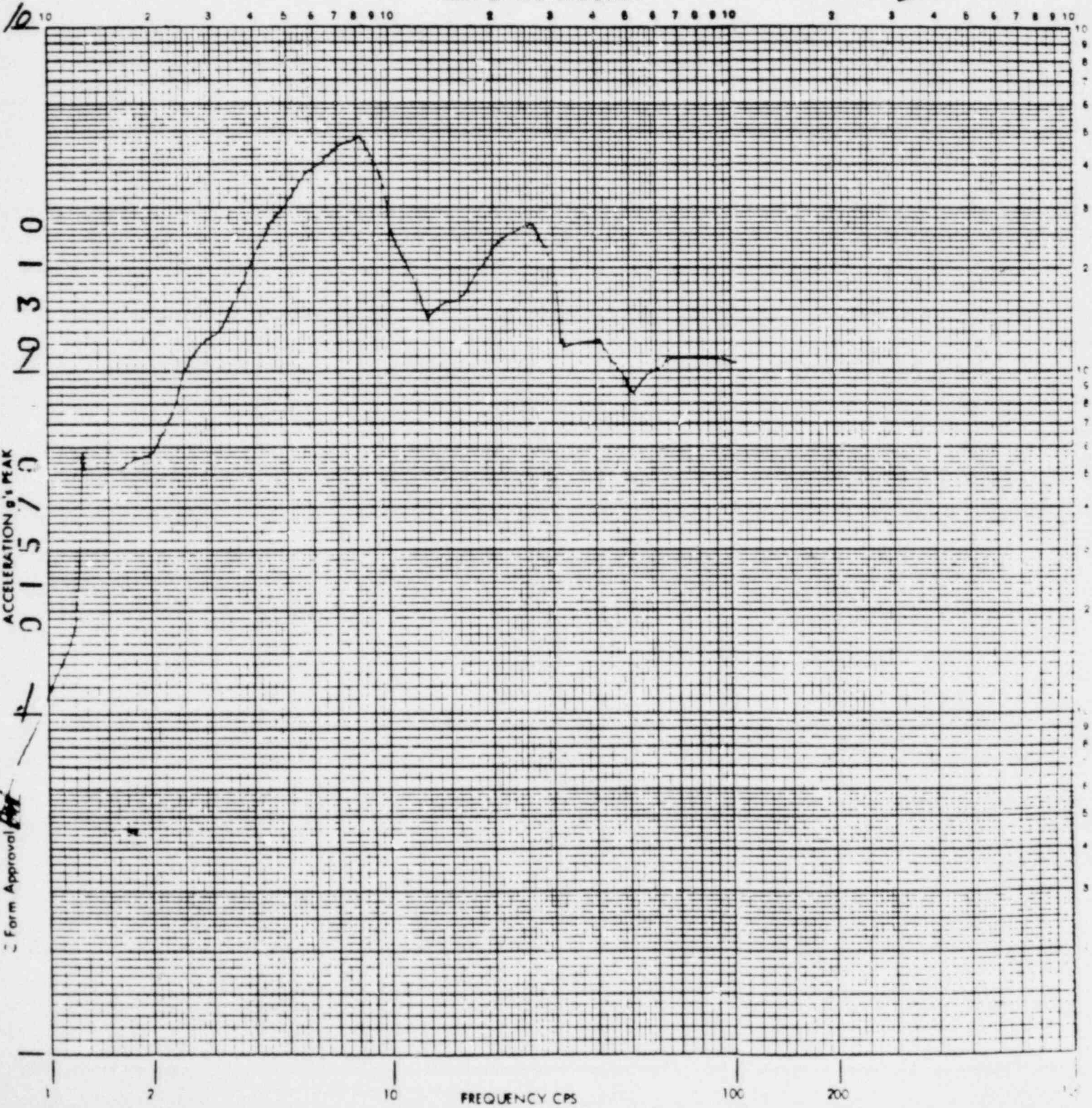
Operator Knoll

P/N 1DA2

Date 3-1-76 Polarity + Q 50

Axis of Test N-S VERT

FALL SSE #2



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WYLE LABORATORIES

SPECIMEN PANEL
CUSTOMER DELTA SWITCH BOARD
PART NO. 1DA2
S/N Q1L21P112A
TEST: SEISMIC RANDOM

JOB NO. 58039
DATE 3-1-76
TEST BY P. Knoll
WITNESS ART RULE

EQUIPMENT	MANUFACTURER	MODEL NO.	RANGE	WYLE NO.	CALIBRATION		ACCY.
					LAST	DUE	
EXCITER	TEAM CORP	W 3000	12" DA 30,000 FORCE LBS	—	—	—	N/A
EXCITER	TEAM CORP	W 1800	10" DA 18,000 FORCE LBS	—	—	—	N/A
EXCITER	TEAM CORP	W 1800	10" DA 18,000 FORCE LBS	—	—	—	N/A
SERVO CONTROLLER	McFADDEN	152 A	—	—	PRIOR TO	USE	N/A
SERVO CONTROLLER	McFADDEN	152 A	—	—	PRIOR TO	USE	N/A
SERVO CONTROLLER	McFADDEN	152 A	—	—	PRIOR TO	USE	N/A
AMPLIFIER	McFADDEN	152 A	—	—	PRIOR TO	USE	N/A
AMPLIFIER	McFADDEN	152 A	—	—	PRIOR TO	USE	N/A
AMPLIFIER	McFADDEN	152 A	—	—	PRIOR TO	USE	N/A
SHOCK SPECTRUM ANALYZER	SPECTRAL DYNAMICS	13231	120 CHANNEL	7530	SYSTEM	CALIBRATION	MFG. SPEC.
SPECTRUM SHAPER	BRUEL KJAER	123	12.5 TO 40 KHZ	31337	PRIOR TO	USE	N/A
SPECTRUM SHAPER	BRUEL KJAER	123	12.5 TO 40 KHZ	31570	PRIOR TO	USE	N/A
EQUALIZER SHAPER	TRACOR	822	1.25 TO 10 HZ	31534	PRIOR TO	USE	N/A
EQUALIZER SHAPER	TRACOR	822	1.25 TO 10 HZ	31574	PRIOR TO	USE	N/A
X-Y RECORDER	HEWLETT PACKARD	7005B	X = 30"/SEC Y = 20"/SEC	99992	PRIOR TO	USE	MFG. SPEC.
OSCILLOSCOPE	HEWLETT PACKARD	122 AR	DUAL TRACE	30636	10-30-75	5-2-76	±5%
ELECTRONIC VOLTMETER	BRUEL KJAER	2416	0.01 TO 1000 VOLTS	30606	11-7-75	3-7-76	±4% AVE

W 614 C Q.C. Approval [illegible]

SHEET OF

WYLE LABORATORIES

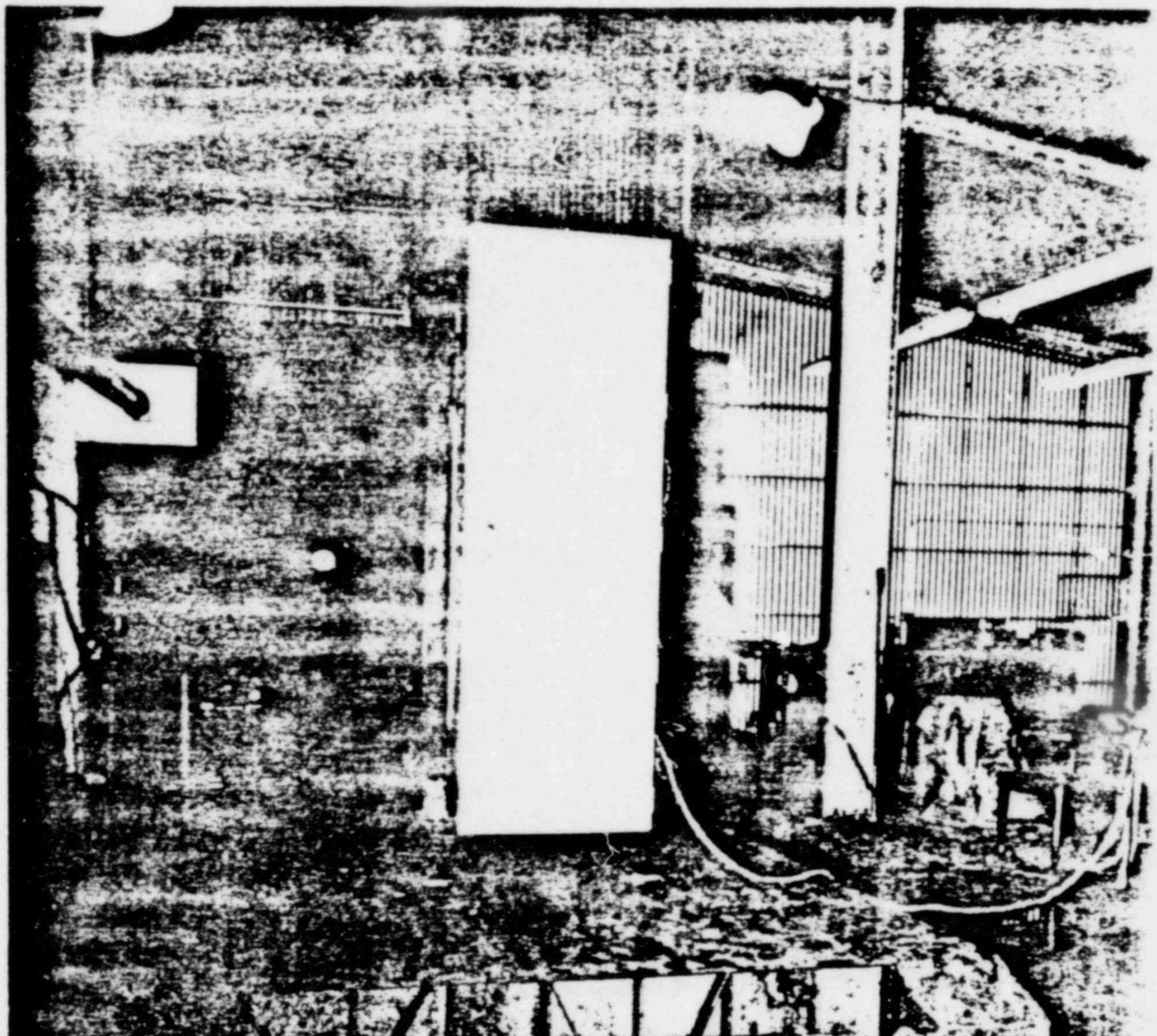
SPECIMEN PANEL
CUSTOMER DELTA SWITCH BOARD
PART NO. 1DA2
S/N QIL21P112A
TEST: SEISMIC RANDOM

JOB NO. 58039
DATE 3-1-76
TEST BY P. KNOLL
WITNESS ART RULE

EQUIPMENT	MANUFACTURER	MODEL NO.	RANGE	WYLE NO.	CALIBRATION LAST	CALIBRATION DUE	ACCY.
POWER AMPLIFIER	HEWLETT PACKARD	450A	—	31569	SYSTEM	CALIB	± N/A
POWER AMPLIFIER	HEWLETT PACKARD	450A	—	31336	SYSTEM	CALIB.	± N/A
CHATTER DETECTOR	S.D	650	32 CHANNEL	30026	11-7-75	3-7-76	±2%
ACCELEROMETER	UNHOLTZ DICKIE	75D21	0-2000 HZ	7532	1-12-76	4-12-76	±2%
ACCELEROMETER	UNHOLTZ DICKIE	75D21	0-2000 HZ	7398	2-3-76	5-3-76	±2%
ACCELEROMETER	UNHOLTZ DICKIE	75D21	0-2000 HZ	7377	12-12-75	3-12-76	±2%
ACCELEROMETER	UNHOLTZ DICKIE	75D21	0-2000 HZ	7320	2-17-76	5-17-76	±2%
ACCELEROMETER	UNHOLTZ DICKIE	75D21	0-2000 HZ	7144	2-3-76	5-3-76	±2%
ACCELEROMETER	UNHOLTZ DICKIE	75D21	0-2000 HZ.	7523	1-12-76	4-12-76	±2%
CHARGE AMP	UNHOLTZ DICKIE	D22	0-1000G	7341	1-13-76	7-11-76	±2%
CHARGE AMP	UNHOLTZ DICKIE	D22	0-1000G	7342	1-13-76	7-11-76	±2%
CHARGE AMP	UNHOLTZ DICKIE	D22	0-1000G	7343	1-13-76	7-11-76	±2%
CHARGE AMP	UNHOLTZ DICKIE	D22	0-1000G	7344	1-13-76	7-11-76	±2%
CHARGE AMP	UNHOLTZ DICKIE	D22	0-1000G	7346	1-13-76	7-11-76	±2%
CHARGE AMP	UNHOLTZ DICKIE	D22	0-1000G	7335	1-27-76	7-25-76	±2%
TAPE RECORDER	SANBORN	3924	14 CHANNEL	31265	PRIOR	TO USE	±2%
TAPE RECORDER	SANBORN	3924	14 CHANNEL	31266	PRIOR	TO USE	±2%

W-614 Q.C. Approval [illegible]

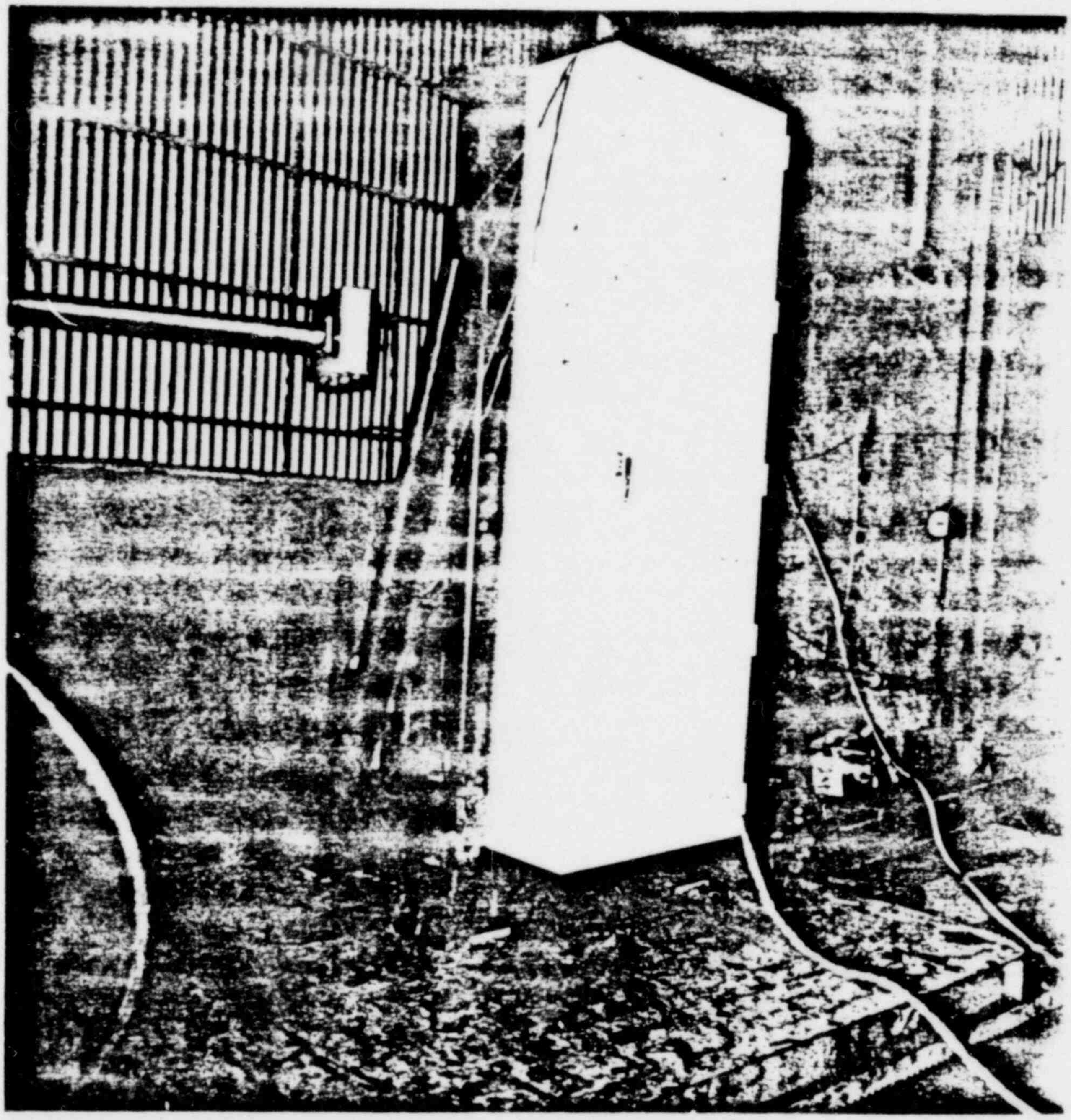
SHEET OF



PHOTOGRAPH 1

VIBRATION TEST SETUP
E-W AXIS

0 1 5 7 0   0 3 1 3

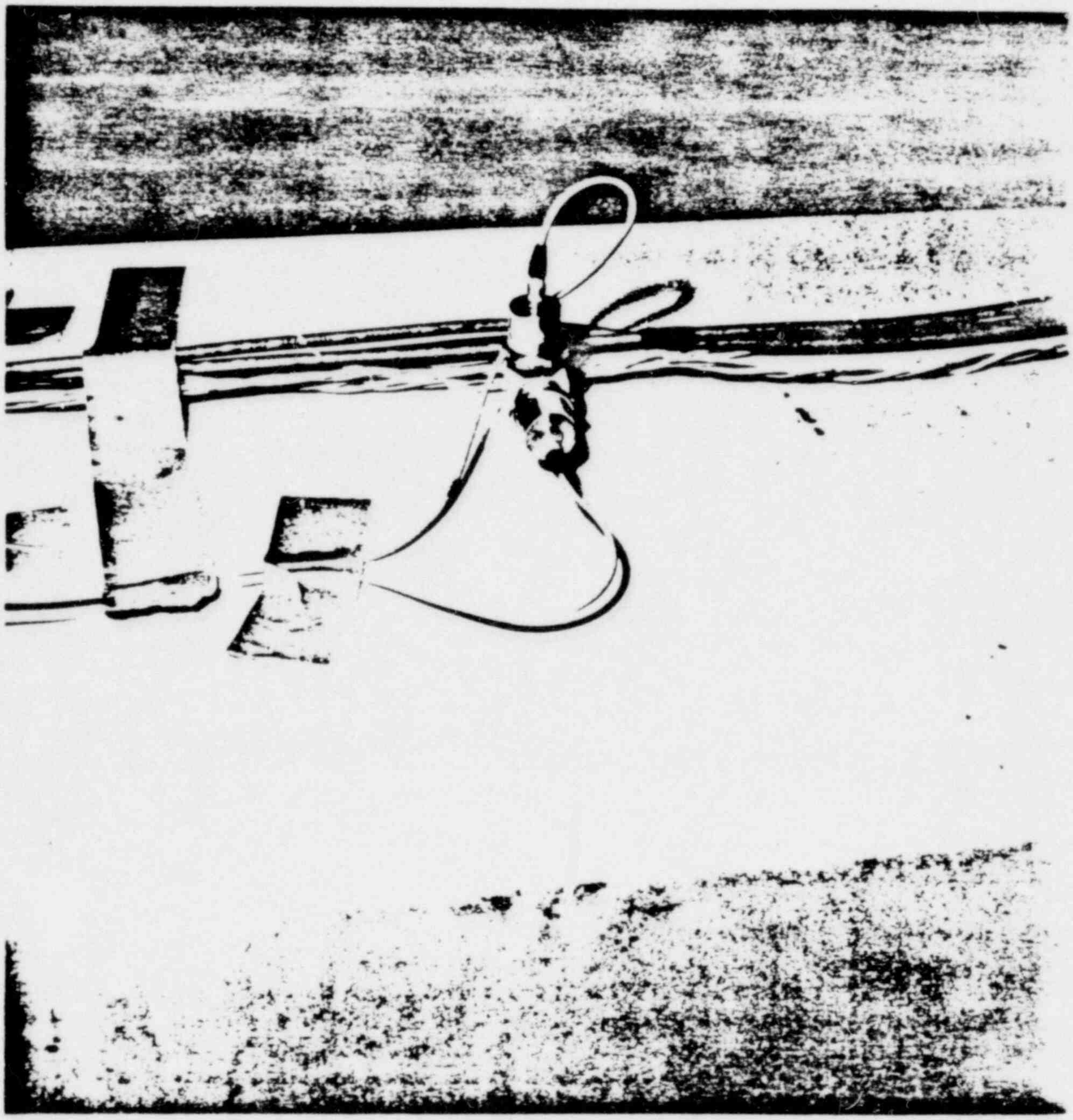


PHOTOGRAPH 2

VIBRATION TEST SETUP
N-S AXIS

01570 0314

01570 0315



PHOTOGRAPH 3

LOCATIONS OF RESPONSE ACCELEROMETERS NOS. 3 AND 4

GRAND GULF
NUCLEAR STATION
UNIT 1

SEISMIC AND HYDRODYNAMIC LOADS

REQUALIFICATION CERTIFICATION

JOB NO. MPL-02

EQUIPMENT NAME: Standby Diesel Generator Engine and Appendages — SPEC. NO: 9645-M-018.0

EQUIPMENT NO: Q1P75E001A/B

LOCATION: Diesel Generator Bldg., El. 136'-0"

EQUIPMENT CLASSIFICATION: ☒ ACTIVE ☐ PASSIVE

SEISMIC QUALIFICATION REPORT REFERENCE:

9645-M-018.0-Q1P75E001A-7.0-8-1, Report No. 7490, Seismic Qualification Report on DeLaval Diesel Generator, 4/7/77, by Structural Dynamics Research Corporation.

THE ABOVE SEISMIC QUALIFICATION REPORT(S) HAVE BEEN REEVALUATED AND REQUALIFIED WHERE NECESSARY TO SHOW THAT THE ABOVE-MENTIONED COMPONENT IS CAPABLE OF PERFORMING ITS INTENDED SAFETY FUNCTION UNDER ALL THE APPLICABLE LOADING COMBINATIONS INCLUDING THE POOL DYMANIC LOADS.

PREPARED: TRMager
T. R. Mager

APPROVED: J. Rawlings for
V. J. Brocato

DATE: 7-10-81

GRAND GULF NUCLEAR STATION UNIT 1

QUALIFICATION SUMMARY

1. Equipment Name Standby Diesel Generator Engine & Appendages
2. Equipment No. Q1P75E001A/B
3. Qualification Documentation (Enclosed with this report.)

   A. Qualification Summary of Equipment (SQRT form), including required response spectra with TRS plotted on RRS graph as appropriate.

   B. Reference Documents

Reference Number	Document Identification	Revision or Date	Title/Subject
9645-M-018.0-Q1P75E001A-7.0-8-1	7490	4/7/77	Seismic Qualificatic Report on DeLaval Diesel Generator

   C. Additional Supporting Documents

Document Identification	Revision or Date	Title/Subject
..[illegible]-M-018.0	Rev. 21	Design Specification for Standby Diesel Genera[illegible]rs for Mississippi Power & Light Company Grand Gulf Nuclear Station Units 1 and 2

Qualification Summary of Equipment

I. Plant Name: Grand Gulf Nuclear Station Unit I

Type:

1. Utility: Mississippi Power and Light Co.

PWR ______

2. NSSS: G.E. 3. A/E: Bechtel Power Corp.

BWR 6, Mark III

II. Component Name Standby Diesel Generator - Engine Block and Appendages

1. Scope: [ ] NSSS [x] BOP

2. Model Number: DSRV-16-4 Quantity: 2

3. Vendor: DeLaval Turbine Inc., Engine & Compressor Div.

4. If the component is a cabinet or panel, name and model No. of the devices included: Governor; Mechanical Overspeed Trip; Lube Oil pp; Fuel Oil Booster pp; Water pp; Turbo; Intercooler; Check vlv; Lube Oil Strainer; Fuel Oil Filter; Fuel Oil Strainer

5. Physical Description a. Appearance ______

b. Dimensions 215" Long X 120" Wide X 150" High

c. Weight 268,000 Lb. (Including Fluids)

6. Location: Building: Diesel Generator Bldg.

Elevation: 133'-0"

7. Field Mounting Conditions [x] Bolt (No. 22, Size 2") Engine to Foundation
[ ] Weld (Length ______)
[ ] ______

Turbo to engine: 12-3/4": intercooler to turbo bracket: 6-3/4"

8. a. System in which located: Standby Diesel Generator System

b. Functional Description: Provide standby power for operation of emergency systems during & following shutdown of reactor.

c. Is the equipment required for [ ] Hot Standby [x] Cold Shutdown

[ ] Both [ ] Neither

9. Pertinent Reference Design Specifications: BPC 9645-M-018.0 Rev. 21.

Prepared by: Gaf 2/26/81

Verified by: TRM 3/24/81

12/80

III. Is Equipment Available for Inspection in the Plant: [x] Yes [ ] No

IV. Equipment Qualification Method:

[ ] Test [ ] Analysis [x] Combination of Test and Analysis

Qualification Report*: 9645-M-018.0-Q1P75E001A-7.0-8-1

(No., Title and Date) 7490, Seismic Qualification Report on Delaval D.G., 4/7/77

Company that Prepared Report: Structural Dynamics Research Corp.

Company that Reviewed Report: Bechtel/Nutech

V. Vibration Input:

1. Loads considered: a. [x] Seismic only

   b. [ ] Hydrodynamic only

   c. [ ] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [ ] SRSS [x] Not Combined (other, specify)

3. Required Response Spectra (attach the graphs): 136 ft. elevation

4. Damping Corresponding to RRS: OBE 1%, 2% SSE 1%, 2%

5. Required Acceleration in Each Direction: [x] ZPA [ ] Other (specify)

OBE	S/S = 0.110	F/B = 0.100	V = 0.069
SSE	S/S = 0.221	F/B = 0.200	V = 0.138
	(N/S)	(E/W)	

6. Were fatigue effects or other vibration loads considered?

   [x] Yes [ ] No

   If yes, describe loads considered and how they were treated in overall qualification program: Per design spec: torsional vibratory limits defined, single order and summation of major orders.

*NOTE: If more than one report complete items IV thru VII for each report.

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency [x] Multi-Frequency: [x] random [ ] sine beat [x] Resonance Search

2. [ ] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE________ SSE________ Other________ (specify)

4. Frequency Range: 1-40 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 10-20 Hz F/B = - V = -

6. Method of Determining Natural Frequencies

[x] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graph [ ] No

8. Input g-level Test: OBE S/S =________ F/B =________ V =________

SSE S/S =________ F/B =________ V =________

9. Laboratory Mounting:

1. [x] Bolt (No. 22, Size 2") [ ] Weld (Length______) [ ]______

10. Functional operability verified: [ ] Yes [x] No [ ] Not Applicable

11. Test Results including modifications made: Observed natural frequency dependent on the foundation; therefore, the block itself is rigid.

12. Other test performed (such as aging or fragility test, including results):

*Note: If qualification by a combination of test and analysis also complete Item VII.

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency [X] Multi-Frequency: [ ] random [ ] sine beat [X] complex
2. [ ] Single Axis [X] Multi-Axis
3. No. of Qualification Tests: OBE 5 SSE 1 Other ______ (specify)
4. Frequency Range: 1-40 Hz
5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = rigid F/B = - V = -
6. Method of Determining Natural Frequencies

   [X] Lab Test [ ] In-Situ Test [ ] Analysis
7. TRS enveloping RRS using Multi-Frequency Test [X] Yes (Attach TRS & RRS graph [ ] No
8. Input g-level Test: OBE S/S = 1.8-2.9g F/B = 1.8-2.9g V = 1.9-2.6g

   SSE S/S = 2.5-3.2g F/B = 2.5-3.2g V = 2.6-3.2g
9. Laboratory Mounting: ***

   1. [X] Bolt (No.______, Size______) [ ] Weld (Length______) [ ]______

** 10. Functional operability verified: [ ] Yes [X] No [ ] Not Applicable

11. Test Results including modifications made: Unit was structurally sound before and after test.
12. Other test performed (such as aging or fragility test, including results): Checked for structural failure.

*Note: If qualification by a combination of test and analysis also complete Item VII.

** Note: Checked for structural failure only.

***Note: Unit mounted horizontally bolted to angle support. This unit bolts directly to engine.

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency [x] Multi-Frequency: [ ] random [ ] sine beat [x] complex
2. [ ] Single Axis [x] Multi-Axis
3. No. of Qualification Tests: OBE 5 SSE 1 Other ________ (specify)
4. Frequency Range: 1-40 Hz
5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = 20 Hz F/B = 17 Hz V = -
6. Method of Determining Natural Frequencies

   [x] Lab Test [ ] In-Situ Test [ ] Analysis
7. TRS enveloping RRS using Multi-Frequency Test [x] Yes (Attach TRS & RRS graph) [ ] No
8. Input g-level Test: OBE S/S = 1.9-3.0g F/B = 1.9-3.0g V = 1.6-2.6g

   SSE S/S = 2.8-3.8g F/B = 2.8-3.8g V = 2.6-2.8g
9. Laboratory Mounting: **

   1. [x] Bolt (No.______, Size______) [ ] Weld (Length______) [ ]______
10. Functional operability verified: [x] Yes [ ] No [ ] Not Applicable
11. Test Results including modifications made: Fully operational before, during, and after test.
12. Other test performed (such as aging or fragility test, including results):

    None

*Note: If qualification by a combination of test and analysis also complete Item VII.

**Note: Unit bolted to table on same skid which it is mounted on in actual installation.

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency [x] Multi-Frequency: [ ] random [ ] sine beat [x] complex

2. [ ] Single Axis [x] Multi-Axis

3. No. of Qualification Tests: OBE 5 SSE 1 Other ______ (specify)

4. Frequency Range: 1-40 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = rigid F/B = - V = -

6. Method of Determining Natural Frequencies

[x] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [x] Yes (Attach TRS & RRS graph
[ ] No

8. Input g-level Test: OBE S/S = 1.9-3.0g F/B = 1.9-3.0g V = 1.6-2.6g

SSE S/S = 2.8-3.8g F/B = 2.8 3.8g V = 2.6-2.8g

9. Laboratory Mounting: **

1. [X] Bolt (No.______, Size_____) [ ] Weld (Length______) [ ]______

10. Functional operability verified: [x] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Unit was fully operational before, during and after test.

12. Other test performed (such as aging or fragility test, including results):

None

*Note: If qualification by a combination of test and analysis also complete Item VII.

**Note: Unit was bolted to table on same skid which it is mounted on in actual installation.

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency [X] Multi-Frequency: [ ] random [ ] sine beat [X] complex ______

2. [ ] Single Axis [X] Multi-Axis

3. No. of Qualification Tests: OBE 5 SSE 1 Other ______ (specify)

4. Frequency Range: 1-40 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = rigid F/B = - V = -

6. Method of Determining Natural Frequencies

[x] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [X] Yes (Attach TRS & RRS graph
[ ] No

8. Input g-level Test: OBE S/S = 1.8-2.4g F/B = 1.8-2.4g V = 1.6-2.1g

SSE S/S = 2.6-3.2g F/B = 2.6-3.2g V = 2.2-3.2g

9. Laboratory Mounting: ***

1. [x] Bolt (No.______, Size______) [ ] Weld (Length______) [ ]______

** 10. Functional operability verified: [ ] Yes [x] No [ ] Not Applicable

11. Test Results including modifications made: Unit was structurally sound and without leakage during and after tests.

12. Other test performed (such as aging or fragility test, including results):

None

*Note: If qualification by a combination of test and analysis also complete Item VII.

**Note: Checked for structural failures and leakage only.

***Note: Unit was mounted on a special test fixture to simulate actual mounting conditions.

VI. <u>If Qualification by Test, then Complete*:</u>

1. [ ] Single Frequency [x] Multi-Frequency: [ ] random / [ ] sine beat / [x] complex
2. [ ] Single Axis [x] Multi-Axis
3. No. of Qualification Tests: OBE 5 SSE 1 Other ______ (specify)
4. Frequency Range: 1-40 Hz
5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = rigid F/B = - V = -
6. Method of Determining Natural Frequencies

   [x] Lab Test [ ] In-Situ Test [ ] Analysis
7. TRS enveloping RRS using Multi-Frequency Test [x] Yes (Attach TRS & RRS graph
   [ ] No
8. Input g-level Test: OBE S/S = 1.9-3.0g F/B = 1.9-3.0g V = 1.6-2.5g

   SSE S/S = 3.6g F/B = 3.6g V = 3.1-3.2g
9. Laboratory Mounting:**

   1. [x] Bolt (No._____, Size_____) [ ] Weld (Length______) [ ]______
10. Functional operability verified: [ ] Yes [x] No [ ] Not Applicable
11. Test Results including modifications made: Modified turbo/cooler bracket to eliminate natural frequency @ 8,14, and 22 Hz.
12. Other test performed (such as aging or fragility test, including results): Checked for leakage, turbo blade radial movement, and structural failure.

*Note: If qualification by a combination of test and analysis also complete Item VII.

**Note: Turbocharger bracket not used due to weight restrictions. Turbo mounted to table by special test fixture.

Jacket Water
Thermostatic Valve
(F-157-202)

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency [x] Multi-Frequency: [ ] random [ ] sine beat [x] complex

2. [ ] Single Axis [x] Multi-Axis

3. No. of Qualification Tests: OBE 5 SSE 1 Other ______ (specify)

4. Frequency Range: 1-40 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = rigid F/B = - V = -

6. Method of Determining Natural Frequencies

   [x] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [x] Yes (Attach TRS & RRS graph
   [ ] No

8. Input g-level Test: OBE S/S = 1.9-2.4g F/B = 1.9-2.4g V = 1.8-2.0g
   (Unit Wet) SSE S/S = 2.2-3.2g F/B = 2.2-3.2g V = 2.7-3.2g

9. Laboratory Mounting:**

   1. [x] Bolt (No.______, Size______) [ ] Weld (Length______) [ ]______

10. Functional operability verified: [x] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Unit was fully operational before and after tests with no structural failures.

12. Other test performed (such as aging or fragility test, including results):

    None

*Note: If qualification by a combination of test and analysis also complete Item VII.

**Note: Unit was mounted vertically from a test fixture and bolted to table to simulate actual mounting conditions.

Lube Oil Inlet
Pressure Strainer
(F-124-087)

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency [x] Multi-Frequency: [ ] random [ ] sine beat [x] complex

2. [ ] Single Axis [x] Multi-Axis

3. No. of Qualification Tests: OBE 5 SSE 1 Other ____ (specify)

4. Frequency Range: 1-40 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 28,30 Hz F/B = 28,30 Hz V = rigid

6. Method of Determining Natural Frequencies

[x] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graph
[ ] No

8. Input g-level Test: OBE S/S = 1.9-3.0g F/B = 1.9-3.0g V = 1.6-2.5g

SSE S/S = 3.6g F/B = 3.6g V = 3.1-3.2g

9. Laboratory Mounting:**

1. [x] Bolt (No.____, Size____) [ ] Weld (Length____) [ ]____

10. Functional operability verified: [ ] Yes [x] No [ ] Not Applicable

11. Test Results including modifications made: Unit held pressure with no structural failures before, during, and after tests.

12. Other test performed (such as aging or fragility test, including results): RRS was modified to account for amplification in the normal mounting configuration. Checked for leakage and structural failure.

*Note: If qualification by a combination of test and analysis also complete Item VII.

**Note: Unit bolted directly to table simulates actual mounting conditions as closely as possible.

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency [x] Multi-Frequency: [ ] random [ ] sine beat [X] complex

2. [ ] Single Axis [x] Multi-Axis

3. No. of Qualification Tests: OBE 5 SSE 1 Other ____ (specify)

4. Frequency Range: 1-40 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = rigid F/B = - V = -

6. Method of Determining Natural Frequencies

   [x] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [X] Yes (Attach TRS & RRS graph
   [ ] No

8. Input g-level Test: OBE S/S = 1.9-2.4g F/B = 1.9-2.4g V = 1.8-2.0g

   SSE S/S = 2.2-3.2g F/B = 2.2-3.2g V = 2.7-3.2g

9. Laboratory Mounting:**

   1. [x] Bolt (No.______, Size______) [ ] Weld (Length______) [ ]______

10. Functional operability verified: [ ] Yes [X] No [ ] Not Applicable

11. Test Results including modifications made: Modified turbo/cooler bracket to eliminate natural frequency @ 8,14, and 22 Hz.

12. Other test performed (such as aging or fragility test, including results):

    Checked for leakage, turbo blade radial movement and structural failure.

*Note: If qualification by a combination of test and analysis also complete Item VII.

**Note: Turbocharger bracket not used due to weight restrictions. Turbo mounted to table by special test fixture.

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency [x] Multi-Frequency: [ ] random [ ] sine beat [X] complex

2. [ ] Single Axis [x] Multi-Axis

3. No. of Qualification Tests: OBE 5 SSE 1 Other ______ (specify)

4. Frequency Range: 1-40 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = rigid F/B = - V = -

6. Method of Determining Natural Frequencies

   [x] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [x] Yes (Attach TRS & RRS graph
   [ ] No

8. Input g-level Test: OBE S/S = 1.9-3.0g F/B = 1.9-3.0g V = 1.6-2.6g

   SSE S/S = 2.8-3.8g F/B = 2.8-3.8g V = 2.6-2.8g

9. Laboratory Mounting: **

   1. [x] Bolt (No.______, Size______) [ ] Weld (Length______) [ ]______

10. Functional operability verified: [x] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Unit successfully held pressure with no leakage before, during, and after test.

12. Other test performed (such as aging or fragility test, including results):

    None

*Note: If qualification by a combination of test and analysis also complete Item VII.

**Note: Unit mounted vertically from a test fixture and bolted to table to simulate actual mounting conditions.

Thermostatic Valve
(Lube Oil)
(KK-010-000)

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency [x] Multi-Frequency: [ ] random [ ] sine beat [x] complex

2. [ ] Single Axis [x] Multi-Axis

3. No. of Qualification Tests: OBE 5 SSE 1 Other ________ (specify)

4. Frequency Range: 1-40 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = rigid F/B = - V = -

6. Method of Determining Natural Frequencies

[x] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [x] Yes (Attach TRS & RRS graph [ ] No

8. Input g-level Test: OBE S/S = 1.9-2.4g F/B = 1.9-2.4g V = 1.8-2.0g

SSE S/S = 2.2-3.2g F/B = 2.2-3.2g V = 2.7-3.2g

9. Laboratory Mounting: **

1. [x] Bolt (No.______, Size______) [ ] Weld (Length______) [ ]______

10. Functional operability verified: [x] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Unit was fully operational before and after tests with no structural failures.

12. Other test performed (such as aging or fragility test, including results):

None

*Note: If qualification by a combination of test and analysis also complete Item VII.

**Note: Unit was mounted from a test fixutre in the same orientation as in actual service.

Check Value, related to air start redundancy (KE-008-000)

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency [x] Multi-Frequency: [ ] random [ ] sine beat [x] complex

2. [ ] Single Axis [x] Multi-Axis

3. No. of Qualification Tests: OBE 5 SSE 1 Other ______ (specify)

4. Frequency Range: 1-40 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = rigid F/B = - V = -

6. Method of Determining Natural Frequencies

   [x] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [x] Yes (Attach TRS & RRS graph [ ] No

8. Input g-level Test: OBE S/S = 1.9-3.0g F/B = 1.9-3.0g V = 1.6-2.5g

   SSE S/S = 2.2-3.6g F/B = 2.2-3.6g V = 2.7-3.2g

9. Laboratory Mounting: **

   1. [x] Bolt (No. ______, Size ______) [ ] Weld (Length ______) [ ] ______

10. Functional operability verified: [x] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Check valve was operational before, during, and after tests with no structural failures.

12. Other test performed (such as aging or fragility test, including results):

    None

*Note: If qualification by a combination of test and analysis also complete Item VII.

**Note: Unit was mounted to special test fixture to simulate actual mounting conditions.

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency [x] Multi-Frequency: [ ] random [ ] sine beat [x] complex

2. [ ] Single Axis [x] Multi-Axis

3. No. of Qualification Tests: OBE 5 SSE 1 Other ____ (specify)

4. Frequency Range: 1-40 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = rigid F/B = - V = -

6. Method of Determining Natural Frequencies

   [x] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [x] Yes (Attach TRS & RRS graph
   [ ] No

8. Input g-level Test: OBE S/S = 1.9-2.9g F/B = 1.9-2.9g V = 1.5-2.3g

   SSE S/S = 2.8-4.1g F/B = 2.8-4.1g V = 2.0-3.2g

9. Laboratory Mounting: **

   1. [x] Bolt (No.____, Size____) [ ] Weld (Length____) [ ]____

10. Functional operability verified: [x] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Unit was fully operational before, during, and after all tests.

12. Other test performed (such as aging or fragility test, including results):

    None

*Note: If qualification by a combination of test and analysis also complete Item VII.

**Note: Unit was mounted to shake table on same skid used in actual installation.

Engine Driven Jacket
Water Pump (1A-6110)

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency [X] Multi-Frequency: [ ] random [ ] sine beat [X] complex ____

2. [ ] Single Axis [X] Multi-Axis

3. No. of Qualification Tests: OBE 5 SSE 1 Other ____ (specify)

4. Frequency Range: 1-40 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = rigid F/B = - V = -

6. Method of Determining Natural Frequencies

[x] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [X] Yes (Attach TRS & RRS graph
[ ] No

8. Input g-level Test: OBE S/S = 1.9-2.9g F/B = 1.9-2.9g V = 1.5-2.3g

SSE S/S = 2.8-4.1g F/B = 2.8-4.1g V = 2.0-3.2g

9. Laboratory Mounting:**

1. [x] Bolt (No.____, Size____) [ ] Weld (Length____) [ ]____

10. Functional operability verified: [ ] Yes [X] No [ ] Not Applicable

11. Test Results including modifications made: Unit remained structurally sound with no leakage during and after tests.

12. Other test performed (such as aging or fragility test, including results): Transmissibility test with unit dry to detect relative motion between impeller and housing - none, checked for leakage and structural failure.

*Note: If qualification by a combination of test and analysis also complete Item VII.

**Note: Unit was mounted on a special test fixutre to simulate actual mounting conditions.

12/80

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency [x] Multi-Frequency: [ ] random [ ] sine beat [X] complex
2. [ ] Single Axis [x] Multi-Axis
3. No. of Qualification Tests: OBE 5 SSE 1 Other ________ (specify)
4. Frequency Range: 1-40 Hz
5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = rigid F/B = - V = -
6. Method of Determining Natural Frequencies

   [x] Lab Test [ ] In-Situ Test [ ] Analysis
7. TRS enveloping RRS using Multi-Frequency Test [x] Yes (Attach TRS & RRS graph [ ] No
8. Input g-level Test: OBE S/S = 1.8-2.4g F/B = 1.8-2.4g V = 1.6-2.1g

   SSE S/S = 2.6-3.2g F/B = 2.6-3.2g V = 2.2-3.2g
9. Laboratory Mounting:**

   1. [x] Bolt (No.______, Size______) [ ] Weld (Length______) [ ]______
10. Functional operability verified: [x] Yes [ ] No [ ] Not Applicable
11. Test Results including modifications made: Original natural frequency of 12.8 Hz was eliminated by modifying support bracket.
12. Other test performed (such as aging or fragility test, including results):

    Checked for leakage and structural failure.

*Note: If qualification by a combination of test and analysis also complete Item VII.

**Note: Unit was mounted using same mounting bracket which is used in service. Mounting bracket was attached to a special fixture.

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency [x] Multi-Frequency: [ ] random [ ] sine beat [x] complex
2. [ ] Single Axis [x] Multi-Axis
3. No. of Qualification Tests: OBE 5 SSE 1 Other ________ (specify)
4. Frequency Range: 1-40 Hz
5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = rigid F/B = - V = -
6. Method of Determining Natural Frequencies

   [x] Lab Test [ ] In-Situ Test [ ] Analysis
7. TRS enveloping RRS using Multi-Frequency Test [x] Yes (Attach TRS & RRS graph [ ] No
8. Input g-level Test: OBE S/S = 1.8-2.4g F/B = 1.8-2.4g V = 1.6-2.1g

   SSE S/S = 2.6-3.2g F/B = 2.6-3.2g V = 2.2-3.2g
9. Laboratory Mounting: **

   1. [x] Bolt (No.______, Size______) [ ] Weld (Length______) [ ]______
10. Functional operability verified: [x] Yes [ ] No [ ] Not Applicable
11. Test Results including modifications made: Unit held pre[illegible] before, during, and after tests and no structural failures.
12. Other test performed (such as aging or fragility test, including results):

    None

*Note: If qualification by a combination of test and analysis also complete Item VII.

**Note: Unit was mounted using same mounting bracket which is used in service. Mounting bracket was attached to a special fixture.

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency [x] Multi-Frequency: [ ] random [ ] sine beat [x] complex

2. [ ] Single Axis [x] Multi-Axis

3. No. of Qualification Tests: OBE 5 SSE 1 Other ______ (specify)

4. Frequency Range: 1-40 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 7.5-8 Hz F/B = 7.5-8 Hz V = rigid

6. Method of Determining Natural Frequencies

[x] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [x] Yes (Attach TRS & RRS graph
[ ] No

8. Input g-level Test: OBE S/S = 1.7-2.0g F/B = 1.7-2.0g V = 1.4-1.7g

SSE S/S = 2.2-4.0g F/B = 2.2-4.0g V = 1.8-3.6g

9. Laboratory Mounting:**

1. [x] Bolt (No.______, Size______) [ ] Weld (Length______) [ ]______

10. Functional operability verified: [ ] Yes [ ] No [x] Not Applicable

11. Test Results including modifications made: Mounting tabs failed, redesigned with full 360° flanged skirt, tested OK.

12. Other test performed (such as aging or fragility test, including results):

Structural integrity verified.

*Note: If qualification by a combination of test and analysis also complete Item VII.

**Note: Filter was mounted directly to table in same orientation and using same type bolts as in actual service.

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency [x] Multi-Frequency: [ ] random [ ] sine beat [x] complex

2. [ ] Single Axis [x] Multi-Axis

3. No. of Qualification Tests: OBE 5 SSE 1 Other ______ (specify)

4. Frequency Range: 1-40 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = rigid F/B = - V = 33 Hz

6. Method of Determining Natural Frequencies

[x] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [x] Yes (Attach TRS & RRS graph
[ ] No

8. Input g-level Test: OBE S/S = 2.1-3.4g F/B = 2.1-3.4g V = 1.8-2.8g

SSE S/S = 3.2-5.0g F/B = 3.2-5.0g V = 2.8-4.5g

9. Laboratory Mounting: ***

1. [x] Bolt (No.______, Size______) [ ] Weld (Length______) [ ]______

**10. Functional operability verified: [x] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Unit fully operational at operating speed and trip speed before, during, and after the test.

12. Other test performed (such as aging or fragility test, including results):

None

*Note: If qualification by a combination of test and analysis also complete Item VII.

**Note: Setpoint drift not stated in report.

***Note: Unit was supported from the shake table in same orientation as in service by means of a right angle bracket. Outboard end of unit drive shaft was supported by a bearing.

Woodward Governor
(Mfg. No. EGB-35C)

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency [x] Multi-Frequency: [ ] random [ ] sine beat [x] complex

2. [ ] Single Axis [x] Multi-Axis

3. No. of Qualification Tests: OBE 5 SSE 1 Other ______ (specify)

4. Frequency Range: 1-40 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = rigid F/B = - V = -

6. Method of Determining Natural Frequencies

[x] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [x] Yes (Attach TRS & RRS graph [ ] No

8. Input g-level Test: OBE S/S = 2.8-4.8g F/B = 2.8-4.8g V = 1.8-2.6g

SSE S/S = 3.7-5.0g F/B = 3.7-5.0g V = 2.0-3.9g

9. Laboratory Mounting: ***

1. [x] Bolt (No.______, Size______) [ ] Weld (Length______) [ ]______

**10. Functional operability verified: [x] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Fully operational before and after test.

12. Other test performed (such as aging or fragility test, including results):

*Note: If qualification by a combination of test and analysis also complete Item VII.

**Note: Verified that fuel rack did not go to the no fuel (tripped position), did not verify speed regulation.

***Note: Unit was mounted on a special test fixture to simulate actual mounting conditions. Actual mounting bolts were used.

12/80

Jacket Water Cooler/
Lube Oil Cooler*
(74033-103/74033-104)

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[x] Dynamic Analysis: [ ] Time-History [x] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 28.4 Hz F/B = 16.4 Hz V = -

3. Model Type: [x] 3D [ ] 2D [ ] 1D

[x] Finite Element [ ] Beam [ ] Closed Form Solution

4. [x] Computer Codes: ANSYS

Frequency Range and No. of modes considered: 0-100Hz

[ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [x] SRSS
[ ] Other: ____________
(specify)

6. Damping: OBE 1% SSE 1% Basis for the damping used: Reg. Guide 1.61

7. Support Considerations in the model: ____________

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	(psi) Seismic Stress	(psi) Total Stress	(psi) Stress Allowable
Max. Stress	Cylinder Shell	SSE		11100	27000
Max. Stress	Cooling Tubes	SSE		1700	13500
Axial Stress	Base Bolts	OBE & Preload	2992	(Criteria Value = 0.131)	

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
Not Critical		

* Due to geometric and support similarities, only the water cooler was analyzed because it is more massive and more flexible

VII. If Qualification by Analysis, then complete: Auxiliary Equipment Skid

1. Method of Analysis:

   [ ] Static Analysis   [ ] Equivalent Static Analysis

   [x] Dynamic Analysis: [ ] Time-History   [x] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = 11.98, 15.57, 20.56, 22.66 & 24.58 Hz   F/B = 11.98, 15.57, 20.56, 22.66 & 24.58 Hz   V = -

3. Model Type: [x] 3D   [ ] 2D   [ ] 1D

   [ ] Finite Element   [x] Beam   [ ] Closed Form Solution

4. [x] Computer Codes: ANSYS

   Frequency Range and No. of modes considered: 0-100 Hz, 5 mode ranges

   [ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [x] SRSS

   [x] Other: Abs. Sum of Closely Spaced Modes.
   (specify)

6. Damping: OBE 1%   SSE 1%   Basis for the damping used: Reg. Guide 1.61

7. Support Considerations in the model:

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	(psi) Seismic Stress	(psi) Total Stress	(psi) Stress Allowable
Shear Stress	Channels	OBE		4350	4500
Axial Stress	Base Bolts	OBE & Preload	3457	(Criteria Value = .881)	

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
Not Critical		

VII. If Qualification by Analysis, then complete: Standpipe

1. Method of Analysis:

   [ ] Static Analysis   [ ] Equivalent Static Analysis

   [x] Dynamic Analysis: [ ] Time-History   [x] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = 11.98,20.56, 15.57,22.66,24.58   F/B = 15.57,20.56,24.58   V = -

3. Model Type: [x] 3D   [ ] 2D   [ ] 1D

   [ ] Finite Element   [x] Beam   [ ] Closed Form Solution

4. [x] Computer Codes: ANSYS

   Frequency Range and No. of modes considered: 0-100 Hz, 5 mode ranges

   [ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [x] SRSS

   [x] Other: Abs. Sum of Closely Spaced Modes. (specify)

6. Damping: OBE 1%   SSE 1%   Basis for the damping used: Reg. Guide 1.61

7. Support Considerations in the model:

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	(psi) Seismic Stress	(psi) Total Stress	(psi) Stress Allowable
Max. Stress	Cylindrical Shell	SSE		3500	37800
Max. Stress	Seismic Supports	SSE		2900	27000
Axial Stress	Base Bolts	OBE & Preload	5434	(Criteria Value = 0.969)	

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
Not Critical		

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

   [ ] Static Analysis   [ ] Equivalent Static Analysis

   [x] Dynamic Analysis: [ ] Time-History   [x] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = 45.2 Hz   F/B = ________   V = ________

3. Model Type: [x] 3D   [ ] 2D   [ ] 1D

   [x] Finite Element   [ ] Beam   [ ] Closed Form Solution

4. [x] Computer Codes: ANSYS

   Frequency Range and No. of modes considered: 0-100 Hz

   [ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [x] SRSS
   [ ] Other: ________
   (specify)

6. Damping: OBE 1%   SSE 1%   Basis for the damping used: Reg. Guide 1.61

7. Support Considerations in the model: ________

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	(psi) Total Stress	(psi) Stress Allowable
Max. Stress	Tank Walls	OBE		10800	12600
Shear Stress	Base Bolts	OBE & Preload	4093	(Criteria Value = 0.121)	

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
Not Critical		

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

   [ ] Static Analysis [ ] Equivalent Static Analysis

   [x] Dynamic Analysis: [ ] Time-History [x] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = 39.94 Hz F/B = ________ V = Oil Lift Tube only: 13.43 Hz/122 Hz

3. Model Type: [x] 3D [ ] 2D [ ] 1D

   [ ] Finite Element [x] Beam [ ] Closed Form Solution

4. [x] Computer Codes: ANSYS

   Frequency Range and No. of modes considered: 0 -100 Hz

   [ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [x] SRSS
   [ ] Other: ________ (specify)

6. Damping: OBE 1% SSE 1% Basis for the damping used: Reg. Guide 1.61

7. Support Considerations in the model: ________

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	(psi) Seismic Stress	(psi) Total Stress	(psi) Stress Allowable
Max. Stress	Oil Distr. Plate	SSE		4192	
Max. Stress	Cylindrical Shell	SSE		1600	36,000
Axial Stress	Base Bolts	OBE & Preload	4348	(Criteria Value = 0.914)	

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
Not Critical		

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

   [ ] Static Analysis [ ] Equivalent Static Analysis

   [x] Dynamic Analysis: [ ] Time-History [x] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = 42 Hz F/B = ______ V = ______

3. Model Type: [x] 3D [ ] 2D [ ] 1D

   [x] Finite Element [ ] Beam [ ] Closed Form Solution

4. [x] Computer Codes: ANSYS

   Frequency Range and No. of modes considered: ______

   [ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [x] SRSS
   [ ] Other: ______ (specify)

6. Damping: OBE ______ SSE ______ Basis for the damping used: N/A, rigid structure

7. Support Considerations in the model: ______

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

Single objective of analysis was to confirm that rigid body side to side mode of engine was above 33 Hz.

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

   [ ] Static Analysis [x] Equivalent Static Analysis (0.55g ZPA)

   [ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = > 33 Hz F/B = > 33 Hz V = > 33Hz

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

   [ ] Finite Element [ ] Beam [ ] Closed Form Solution

4. [ ] Computer Codes: ____________

   Frequency Range and No. of modes considered: ____________

   [x] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [x] SRSS
   [ ] Other: ____________ (specify)

6. Damping: OBE - SSE - Basis for the damping used: Rigid structure >33H

7. Support Considerations in the model: ____________

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Max. Axial Stress	Engine Bolts	OBE & Preload	2775psi	(Criteria Value = 0.271)	

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
Not Critical		

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

   [ ] Static Analysis [x] Equivalent Static Analysis (.55g ZPA)

   [ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = >33 Hz F/B = >33 Hz V = ________

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

   [ ] Finite Element [ ] Beam [ ] Closed Form Solution

4. [ ] Computer Codes: ________

   Frequency Range and No. of modes considered: Rigid structure - used ZPA value

   [x] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [x] SRSS
   [ ] Other: ________ (specify)

6. Damping: OBE - SSE - Basis for the damping used: Rigid Structure >33 Hz

7. Support Considerations in the model: ________

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Max. Axial Stress	Intercooler Bolts	OBE & Pre-load	7826psi	(Criteria Value = 0.170)	
Max. Axial Stress	Turbo-Charger Bolts	OBE & Pre-load	8801psi	(Criteria Value = 0.179)	

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
Not Critical		

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[x] Dynamic Analysis: [ ] Time-History [x] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 44.5 Hz F/B = - V = -

3. Model Type: [x] 3D [ ] 2D [ ] 1D

[ ] Finite Element [x] Beam [ ] Closed Form Solution

4. [x] Computer Codes: Ansys

Frequency Range and No. of modes considered: 0-100 Hz

[ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [x] SRSS
[ ] Other: ________ (specify)

6. Damping: OBE 1% SSE 1% Basis for the damping used: Reg. Guide 1.61

7. Support Considerations in the model: ________

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	(psi) Seismic Stress	(psi) Total Stress	(psi) Stress Allowable
Max. Stress	Dryer Bracket	SSE		2188	21600
Max. Stress	Base	SSE		< 1332	21600
Axial Stress	Base Bolts	OBE & Preload	1379	(Criteria Valve = 0.760)	

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
Not Critical		

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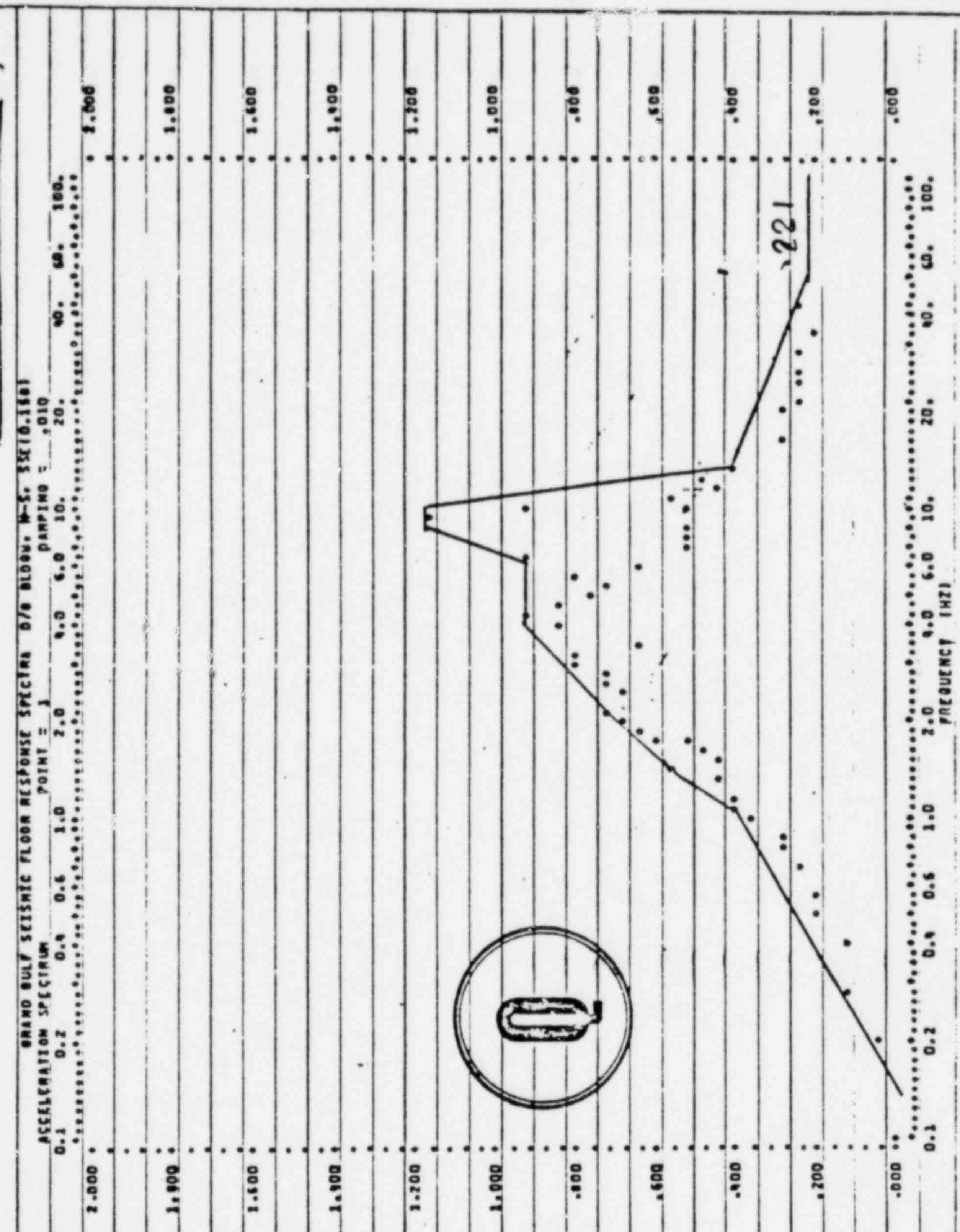

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1	11/21/75	REVISED AND REISSUED FOR USE	DOD	TH	
0	7/23/73	ISSUED FOR USE			

DIESEL GENERATOR BLDG. FLOOR SPECTRUM
SSE, N-S, EL. 136' - 0", 1%

9645-M-018.0

JOB No. 9645

N/12

Appendix D

REV 1

SG-39

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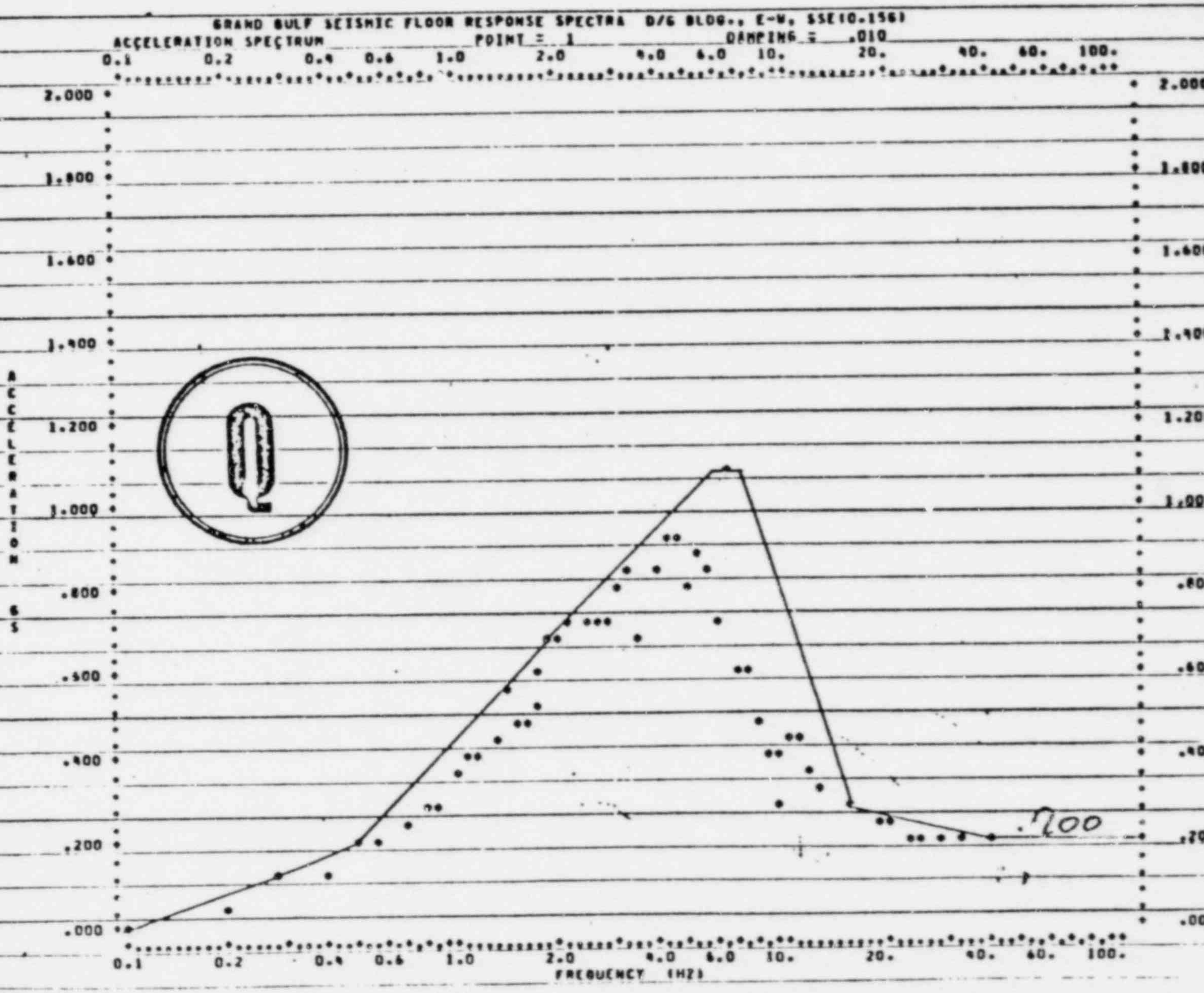
CG-39

Rev. 1



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0	7/23/73	ISSUED FOR USE	GLM	[illegible]	[illegible]

DIESEL GENERATOR BLDG. FLOOR SPECTRUM
SSE, E-W, EL. 136' - 0", 1%
9645-M-018.0

JOB No. 9645
E 112
Appendix Q

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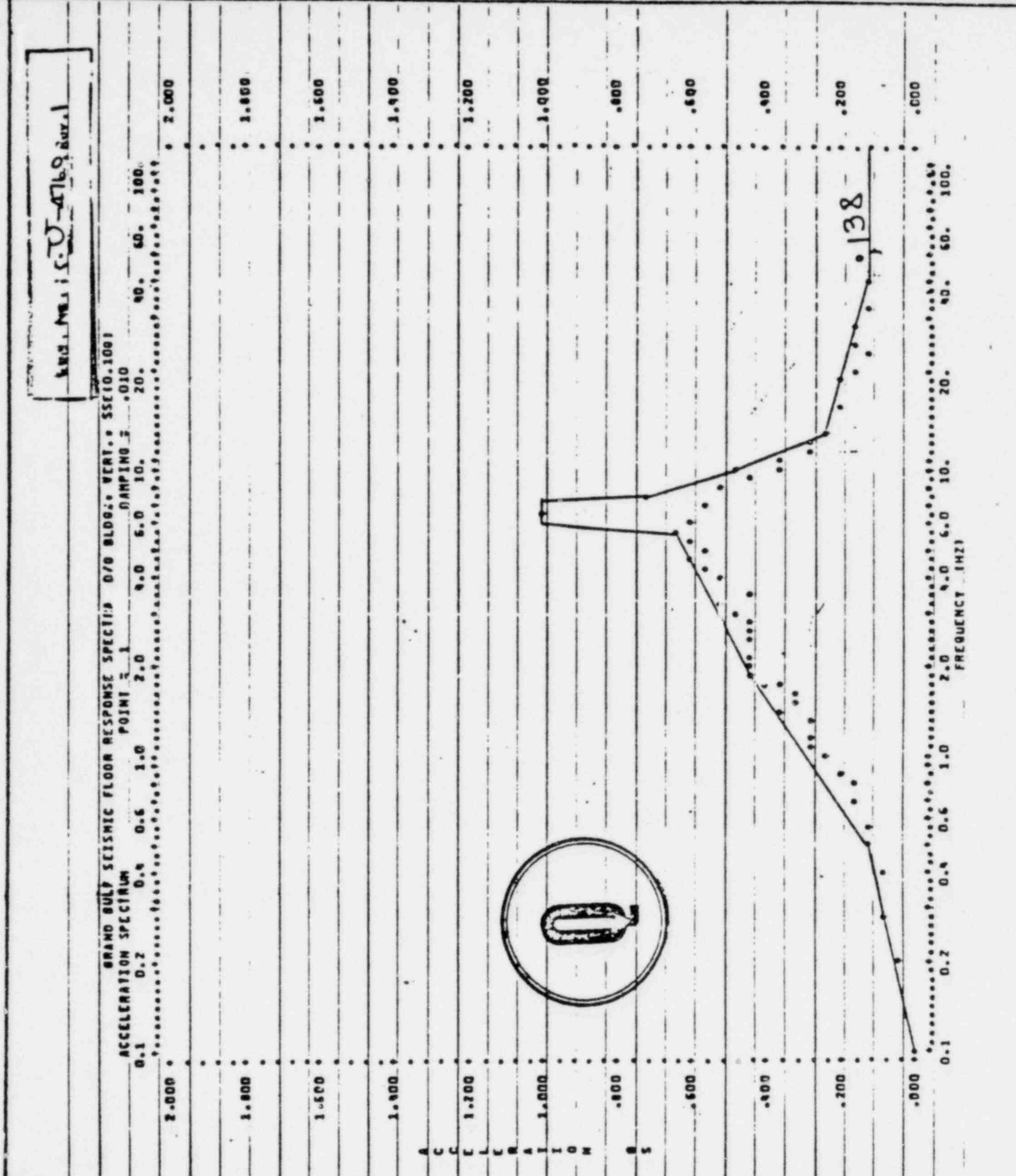

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DIESEL GENERATOR BLDG. FLOOR SPECTRUM
SSE, VERTICAL, EL. 136' - 0", 1%

9645-M-018.0

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V112

Appendix Q

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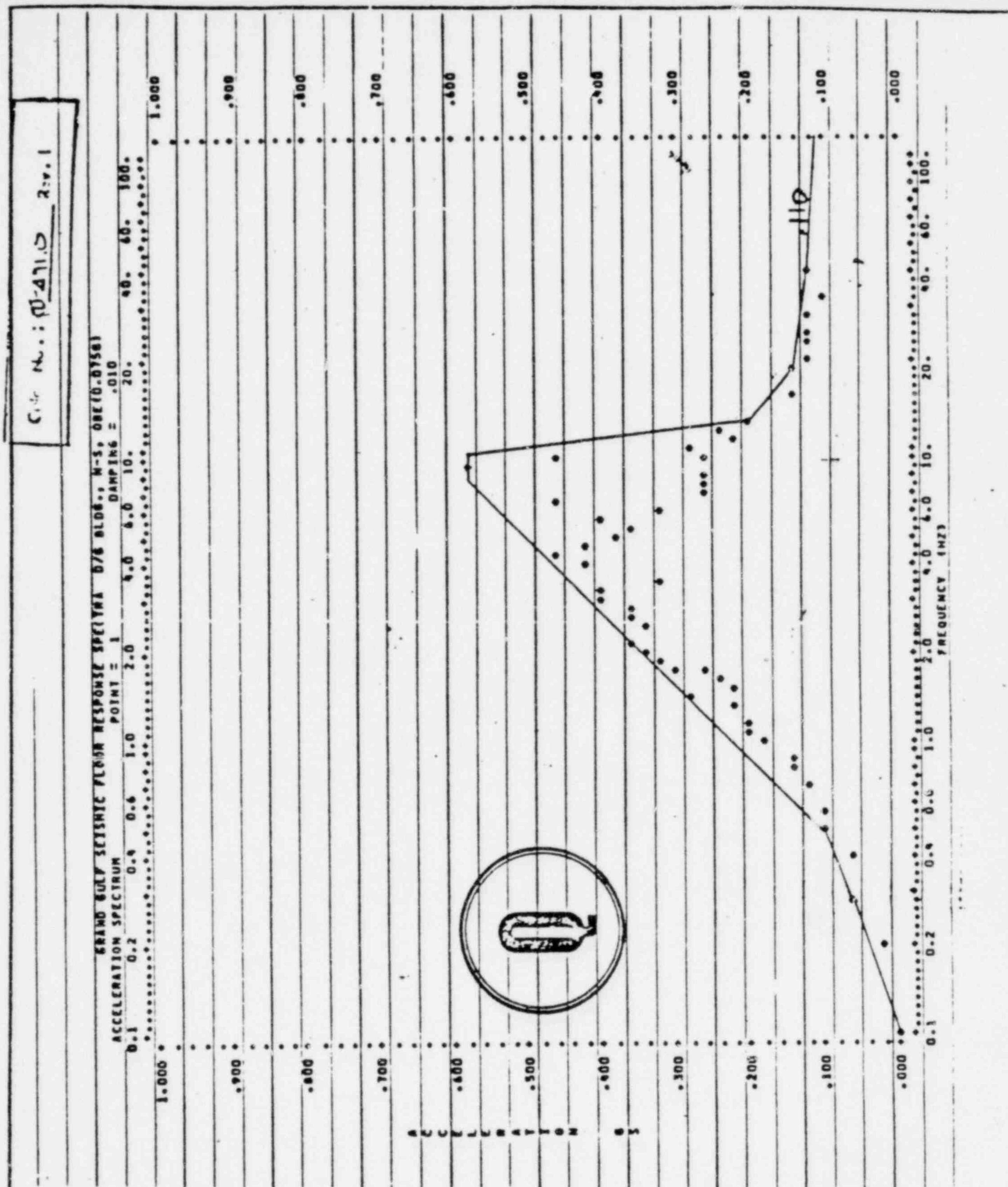

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DIESEL GENERATOR BLDG. FLOOR SPECTRUM
½SSE, N-S, EL. 136' - 0", 1%

9645-M-018.0

JOB No. 9645

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Appendix Q

REV 1

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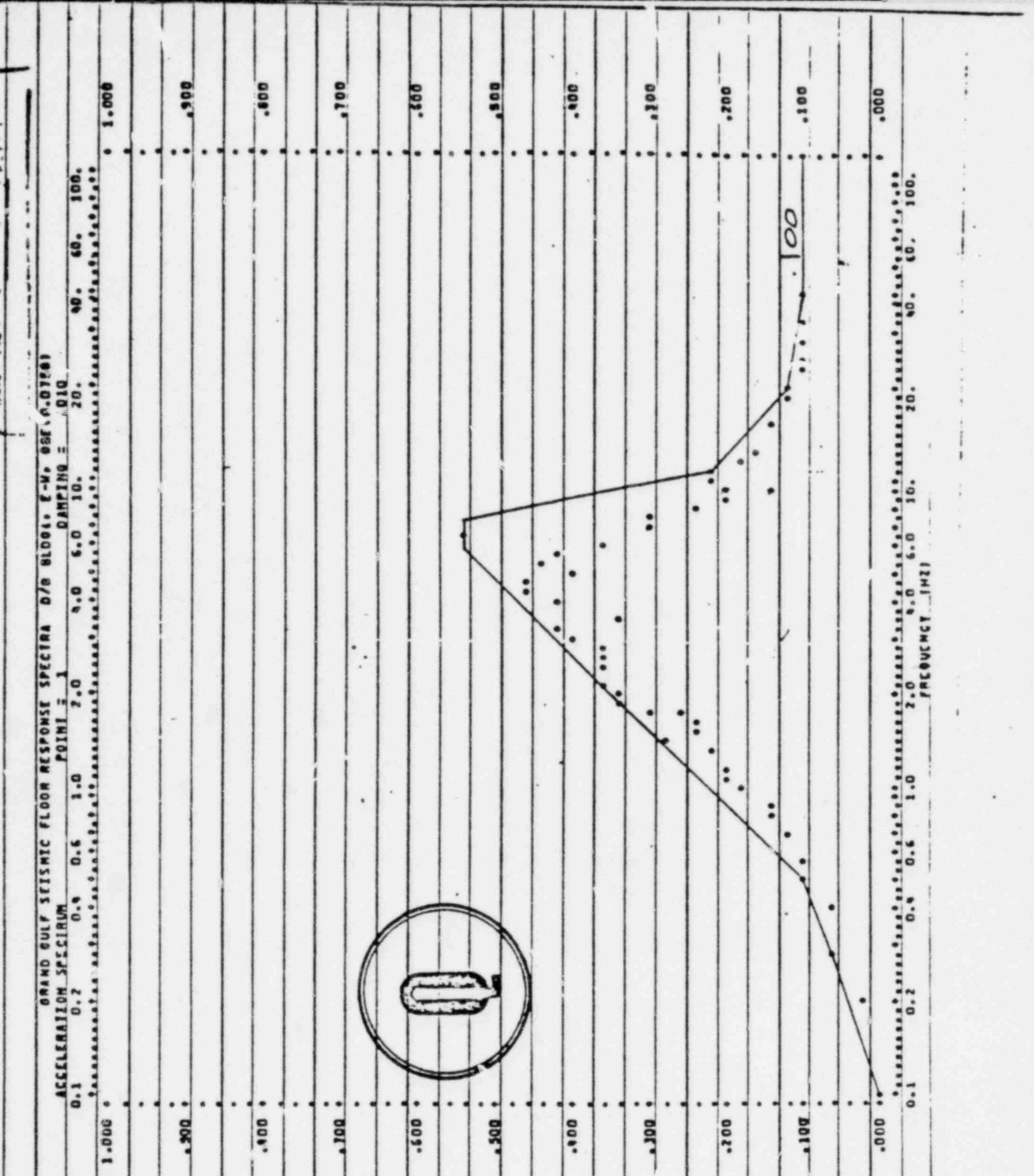

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0	7/23/73	ISSUED FOR USE			

DIESEL GENERATOR BLDG. FLOOR SPECTRUM
½SSE, E-W, EL. 136' - 0", 1%

9645-M-018.0

JOB No. 9645

E102

REV 1

Appendix Q
SHEET 4

G-39

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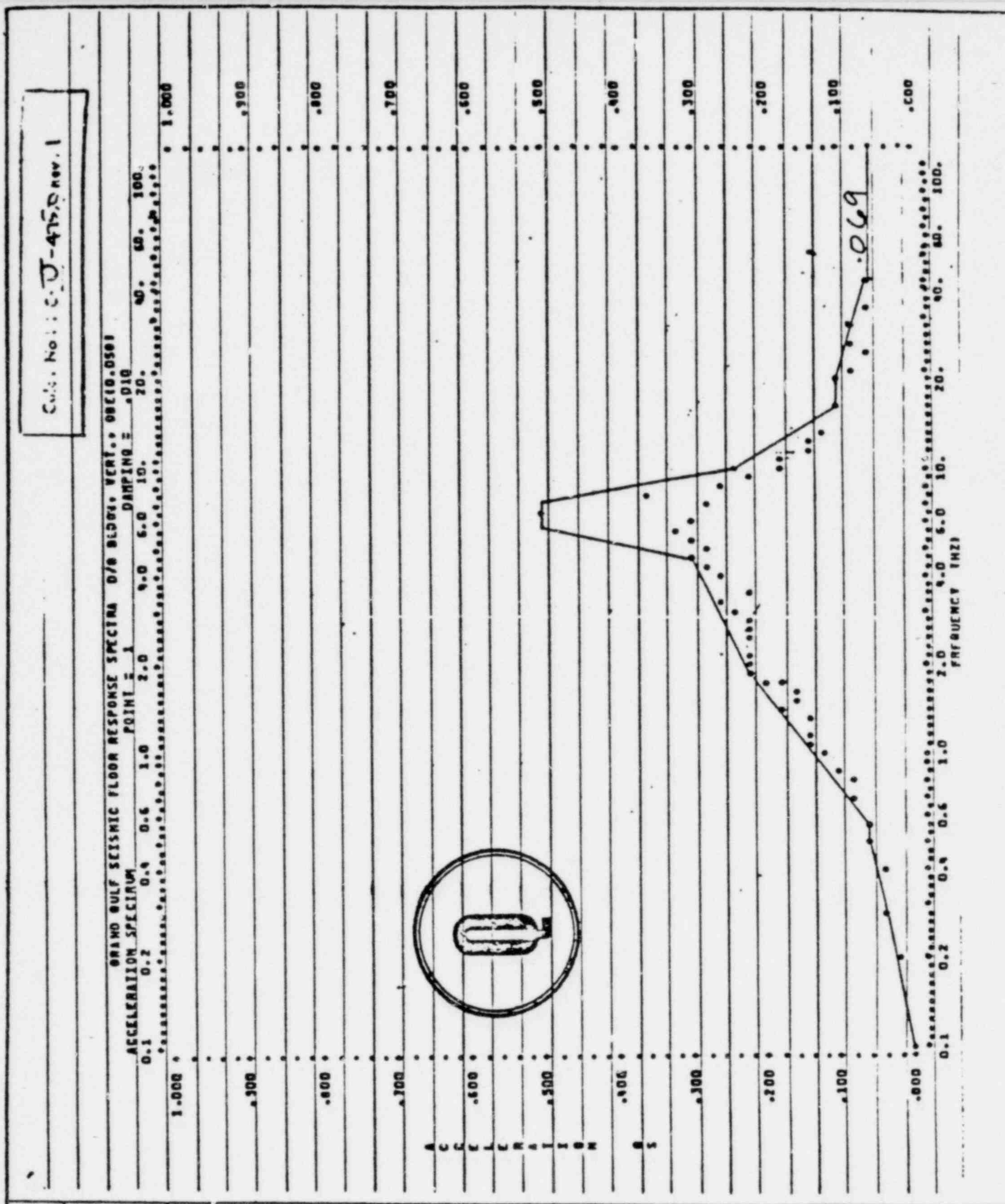

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DIESEL GENERATOR BLDG. FLOOR SPECTRUM
½SSE, VERTICAL, EL. 136' - 0", 1%

9645-M-018.0

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V102

Appendix Q

1

GC-39

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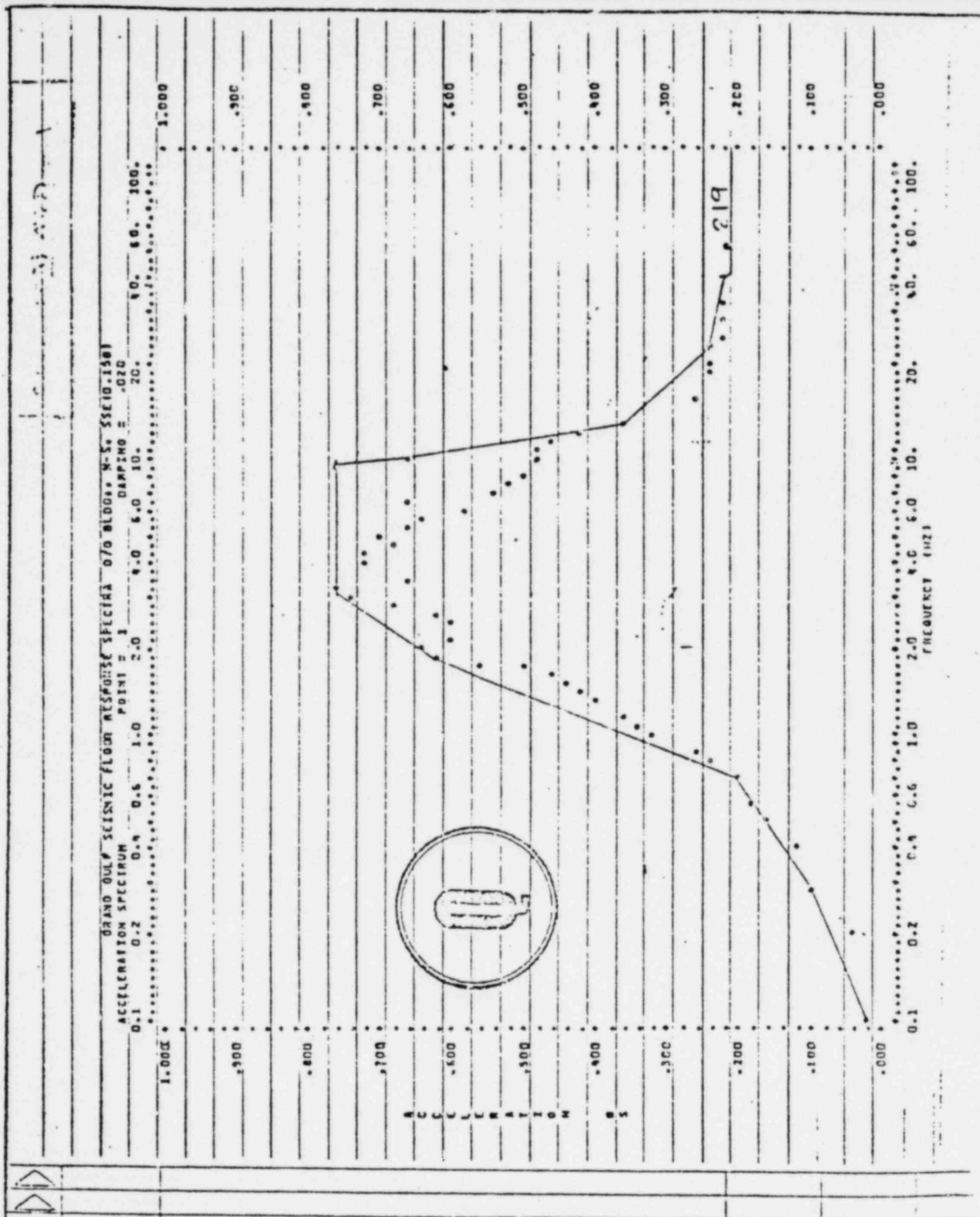

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0	7/23/73	ISSUED FOR USE	[illegible]	[illegible]	[illegible]

DIESEL GENERATOR BLDG. FLOOR SPECTRUM
SSE, N-S, EL. 136' - 0", 2%

JOB No. 9645 -M-018.0

N113 Appen Q Sh 12

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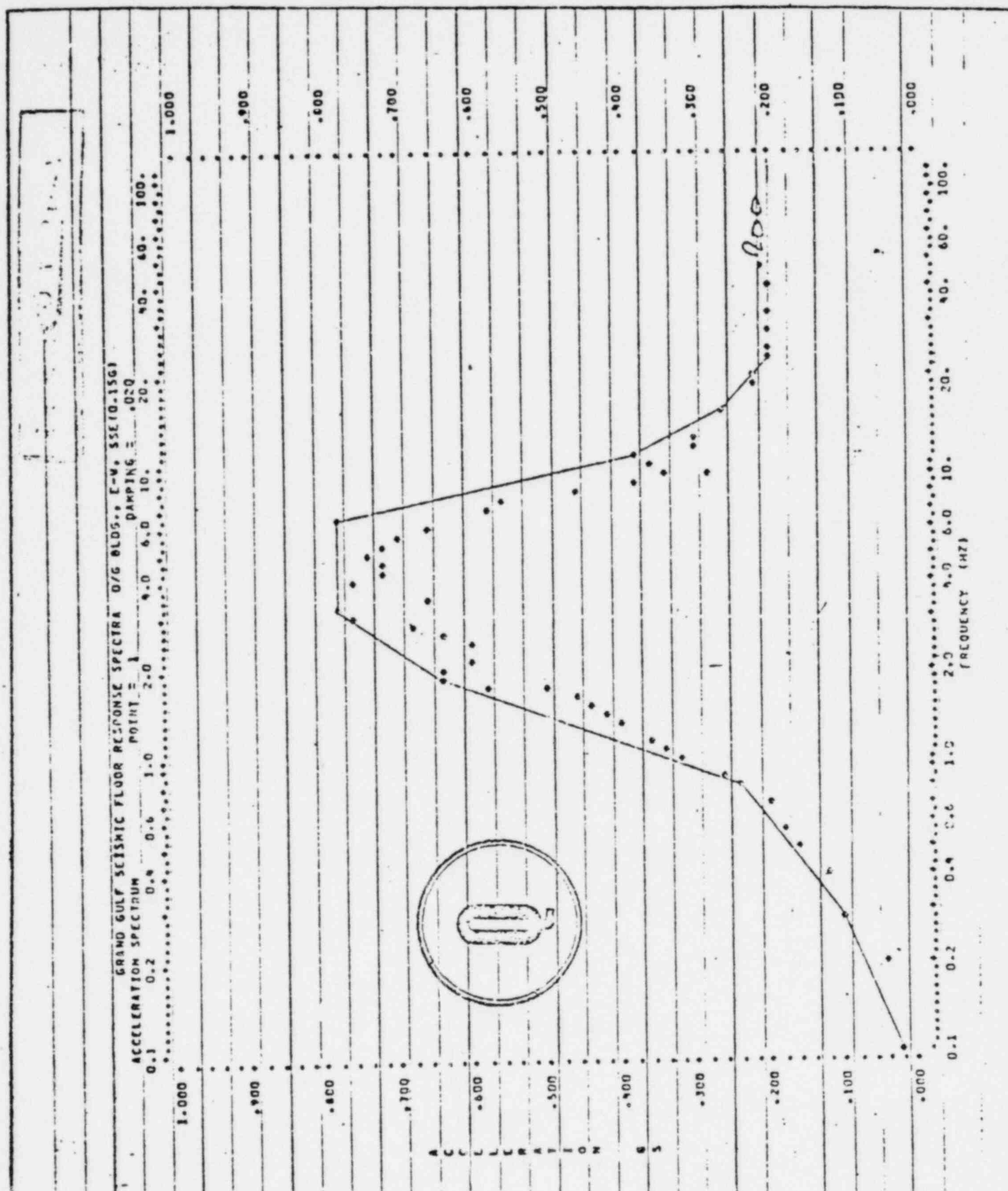

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DIESEL GENERATOR BLDG. FLOOR SPECTRUM SSE E-W EL 136' - 0" 2%

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E113 Appen Q Sh 11

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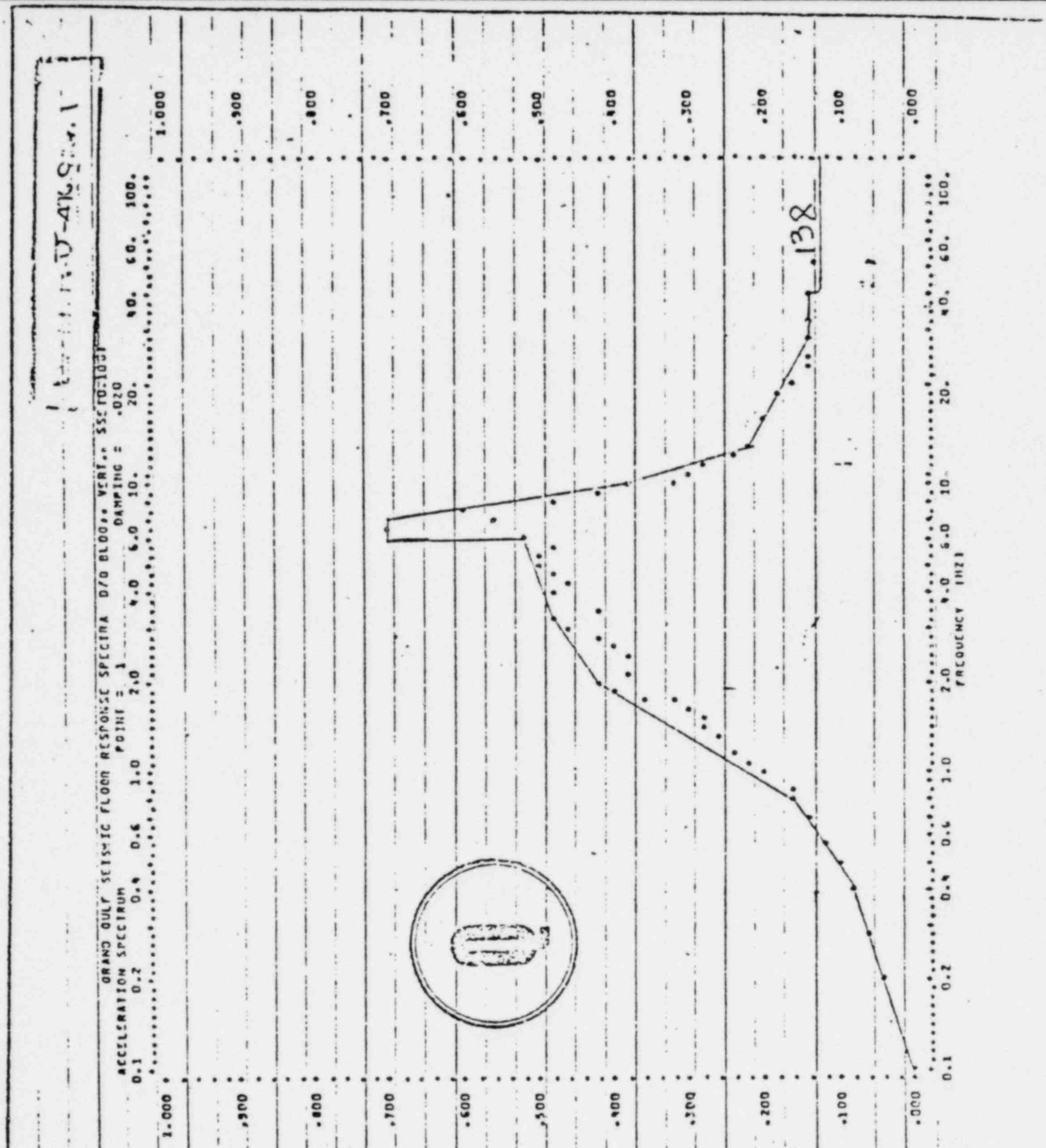

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DIESEL GENERATOR BLDG. FLOOR SPECTRUM
SSE, VERTICAL, EL. 136' - 0", 2%

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V113 Appen Q Sh 13 REV

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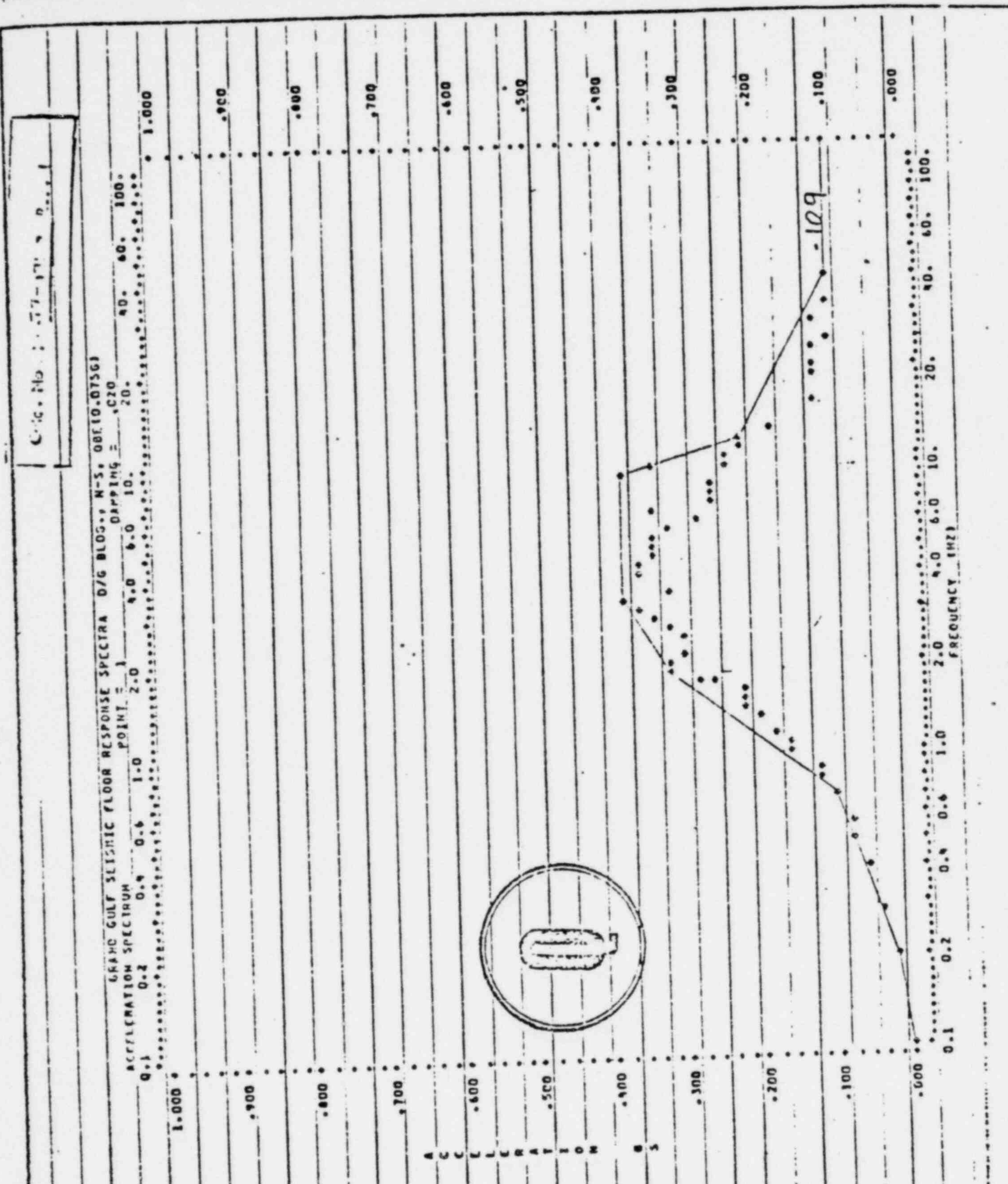

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1	11/21/75	REVISED AND REISSUED FOR USE	DAD	
0	7/23/73	ISSUED FOR USE		

DIESEL GENERATOR BLDG. FLOOR SPECTRUM

½SSE N-S EL 136' - 0" 2"

JOB No 9645-M-018.0

N103 Appen Q Sh 9

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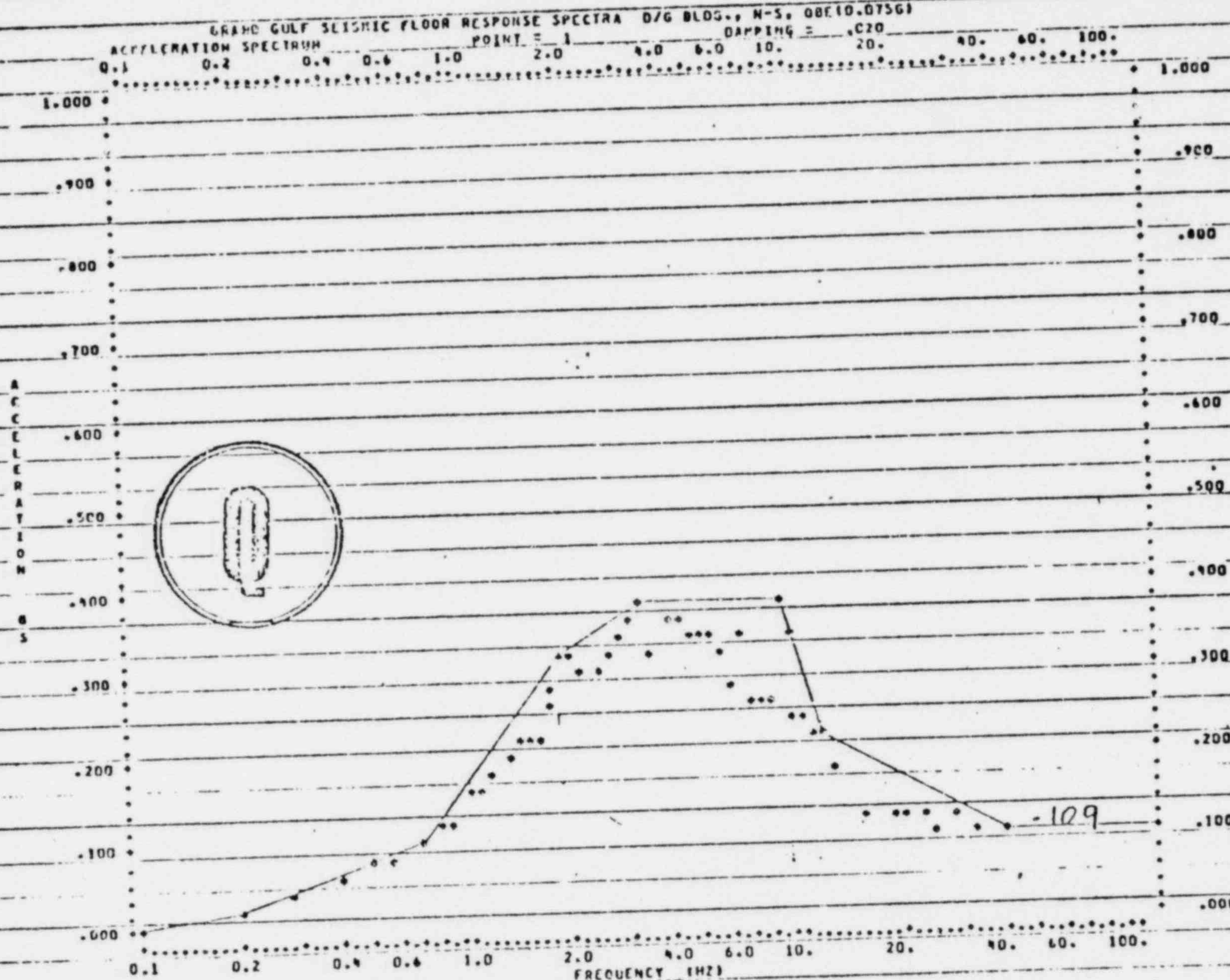

No.	DATE	REVISIONS	BY	CHK
1	11/21/75	REVISED AND REISSUED FOR USE	DAD	[illegible]
0	7/23/73	ISSUED FOR USE	[illegible]	[illegible]

DIESEL GENERATOR BLDG. FLOOR SPECTRUM

1/2 SSE N-S EL 136' - 0" 2"

JOB No 9645-M-018.0

N103 Appen Q Sh 9

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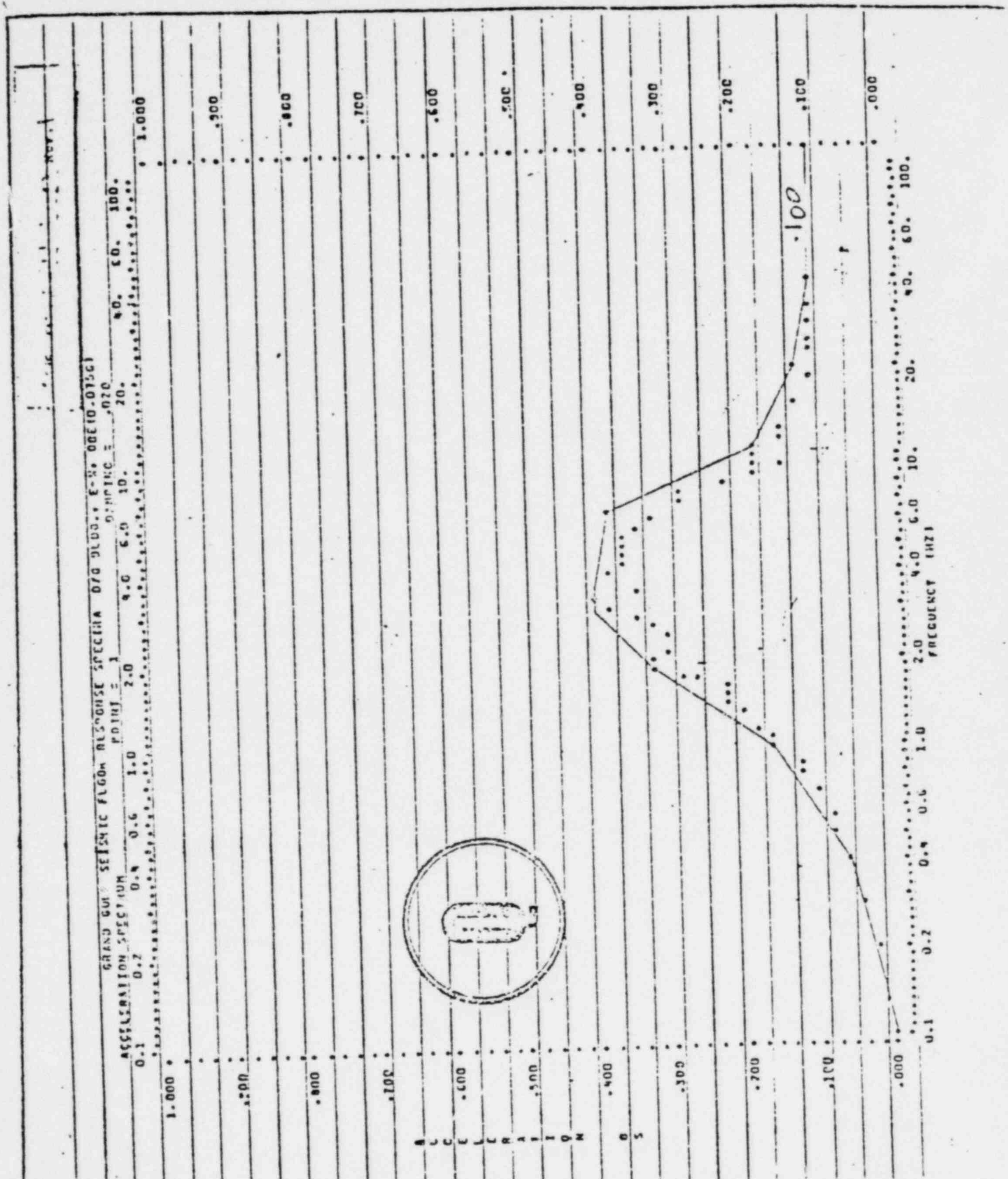

No.	DATE	REVISIONS	BY	CHK
1	11/21/75	REVISED AND REISSUED FOR USE	DAD	
0	7/23/73	ISSUED FOR USE		

DIESEL GENERATOR BLDG. FLOOR SPECTRUM

½SSE E-W EL 136' - 0" 2%

JOB No. 9645

9645-F103 Annen O Sh 8

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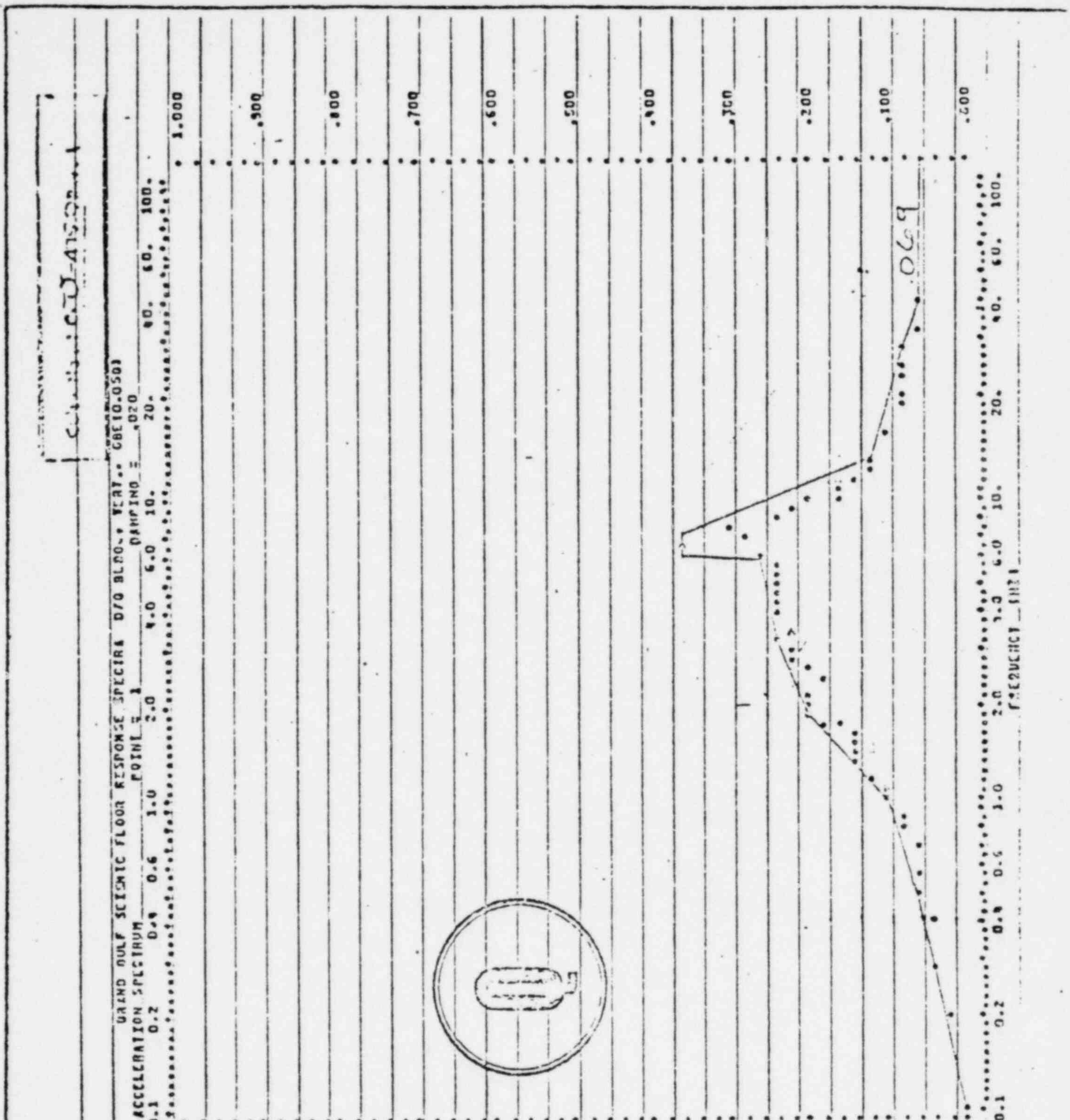

No.	DATE	REVISIONS	BY	CHK	APP
1	11/21/75	REVISED AND REISSUED FOR USE	DAD		
0	7/23/73	ISSUED FOR USE			

DIESEL GENERATOR BLDG. FLOOR SPECTRUM
SSE, VERTICAL, EL. 136' - 0", 2%

JOB No. 9645-M-018.0
V103 Appen Q Sh 10

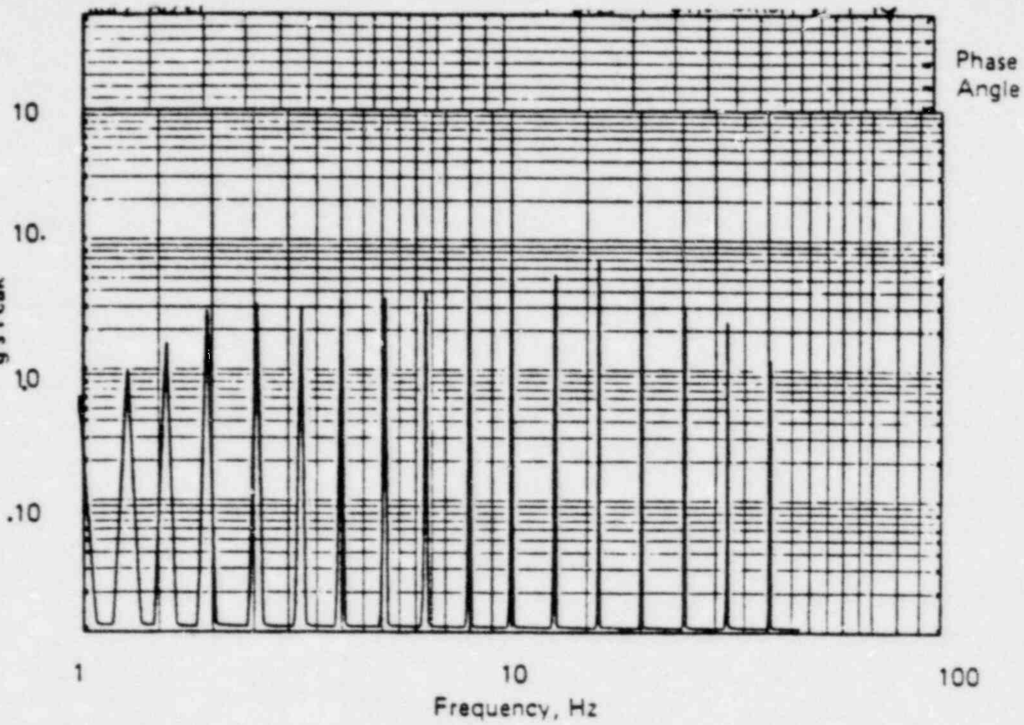

Figure No. IV.21 Test Run No. 1 Orientation 1 OBE 1 DBE ____

Transmissibility ____ or TRS ✓ % Damping 3 Direction (Horizontal) Vertical

Test Item(s) Auxiliary Lube Oil Pump, Engine Driven F.O.B Pump, Motor Driven F.O.B. Pump

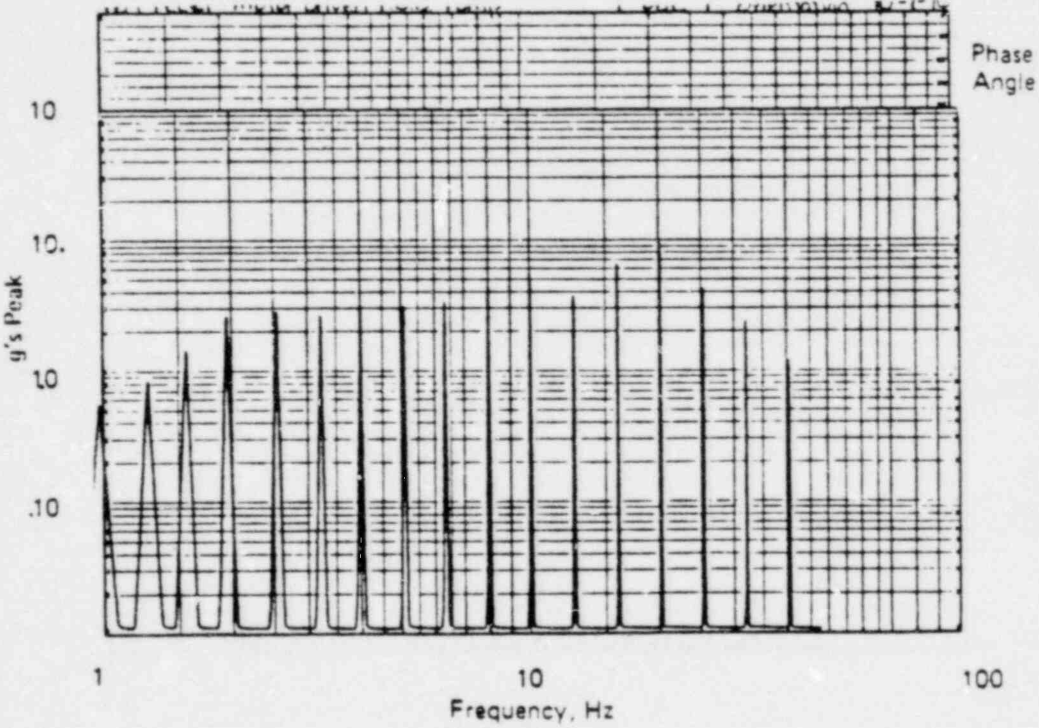

Figure No. IV.22 Test Run No. 1 Orientation 1 OBE 1 DBE ____

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal (Vertical)

Test Item(s) Aux. L.O Pump, Engine Driven F.O.B Pump, Motor Driven F.O.B Pump

01598 0203

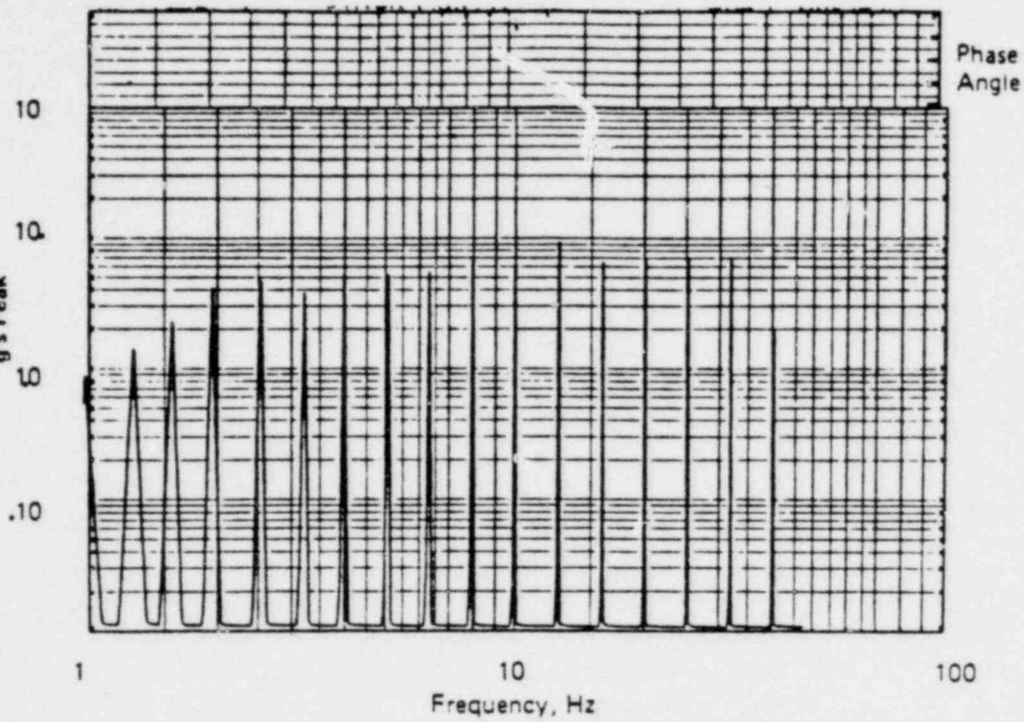

Figure No. IV.23 Test Run No. 2 Orientation 1 OBE ___ DBE 1
Transmissibility ___ or TRS ✓ % Damping 3 Direction Horizontal Vertical
Test Item(s) Aux. L.O. Pump, Engine Driven F.O.B. Pump, Motor Driven FOB Pump

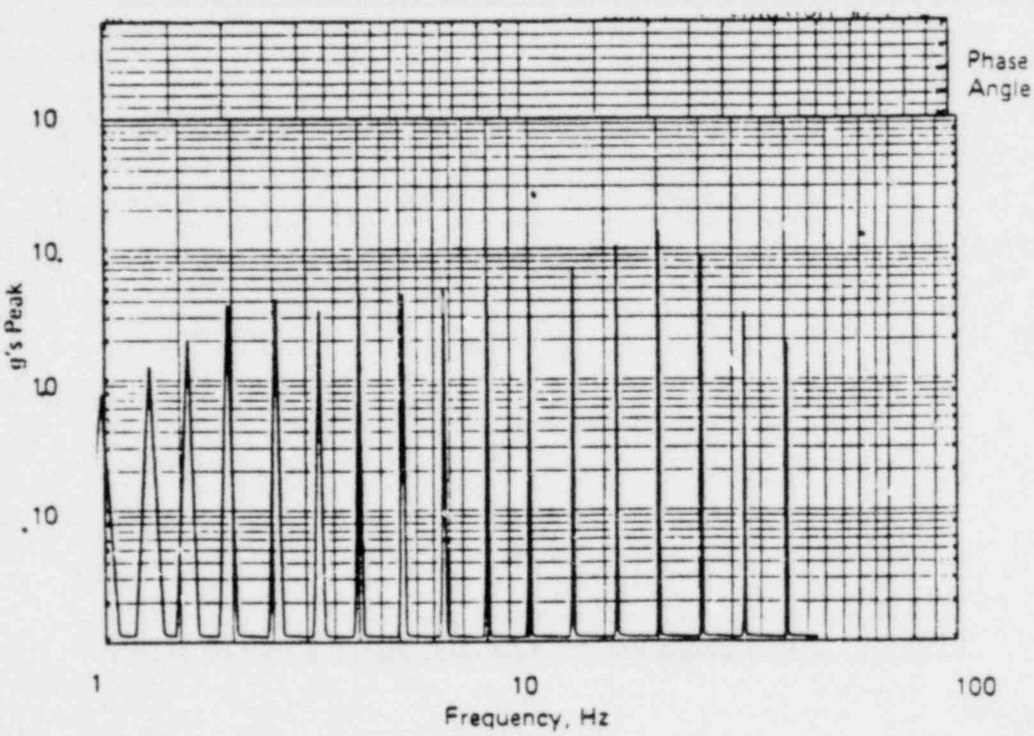

Figure No. IV.24 Test Run No. 2 Orientation 1 OBE ___ DBE 1
Transmissibility ___ or TRS ✓ % Damping 3 Direction Horizontal Vertical
Test Item(s) Aux. L.O Pump, Engine Driven F.O.B Pump, Motor Driven F.O.B Pump

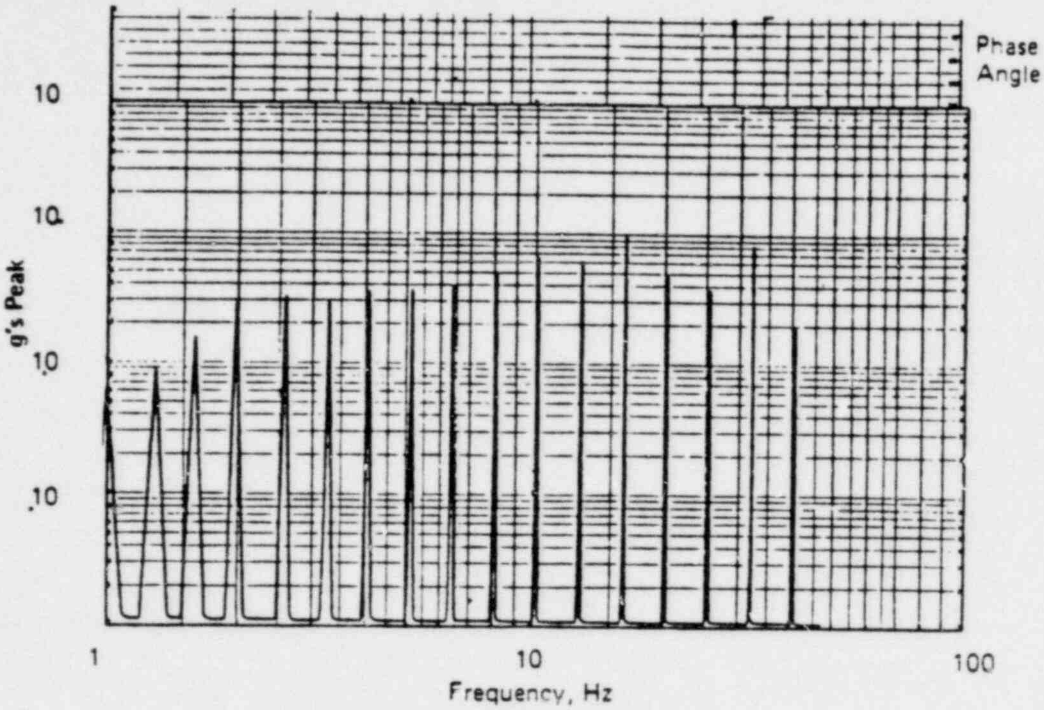

Figure No. IV.33 Test Run No. 7 Orientation 2 OBE 1 DBE ____
Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical
Test Item(s) Aux. L.O. Pump, Engine Driven FOB Pump, Motor Driven FOB Pump

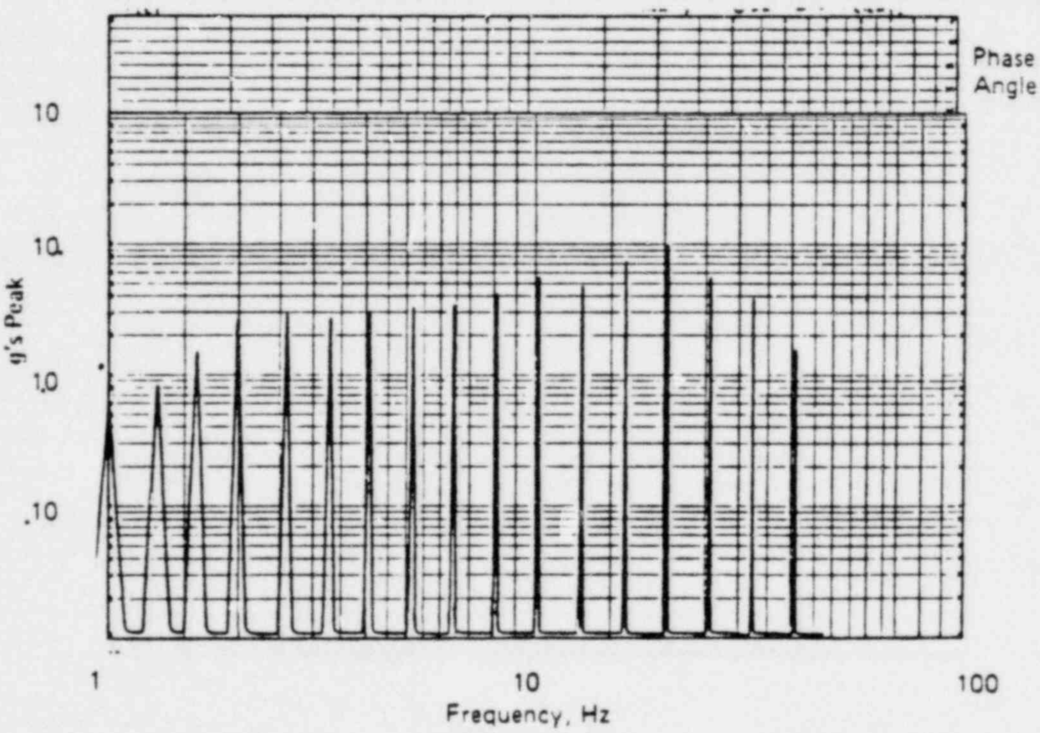

Figure No. IV.34 Test Run No. 7 Orientation 2 OBE 1 DBE ____
Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical
Test Item(s) Aux. L.O. Pump, Engine Drive FOB Pump, Motor Driven FOB Pump

01598 0214

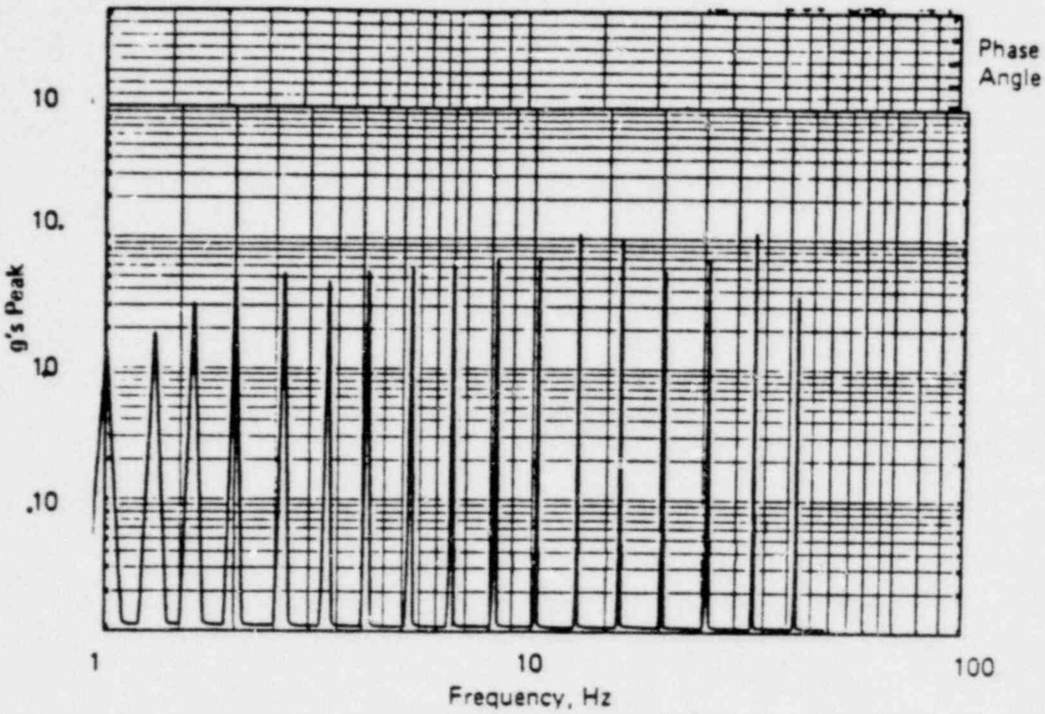

Figure No. IV.43 Test Run No. 12 Orientation 2 OBE ____ DBE 1

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Aux. LO Pump, Engine Driven FOB Pump, Motor Driven FOB Pump

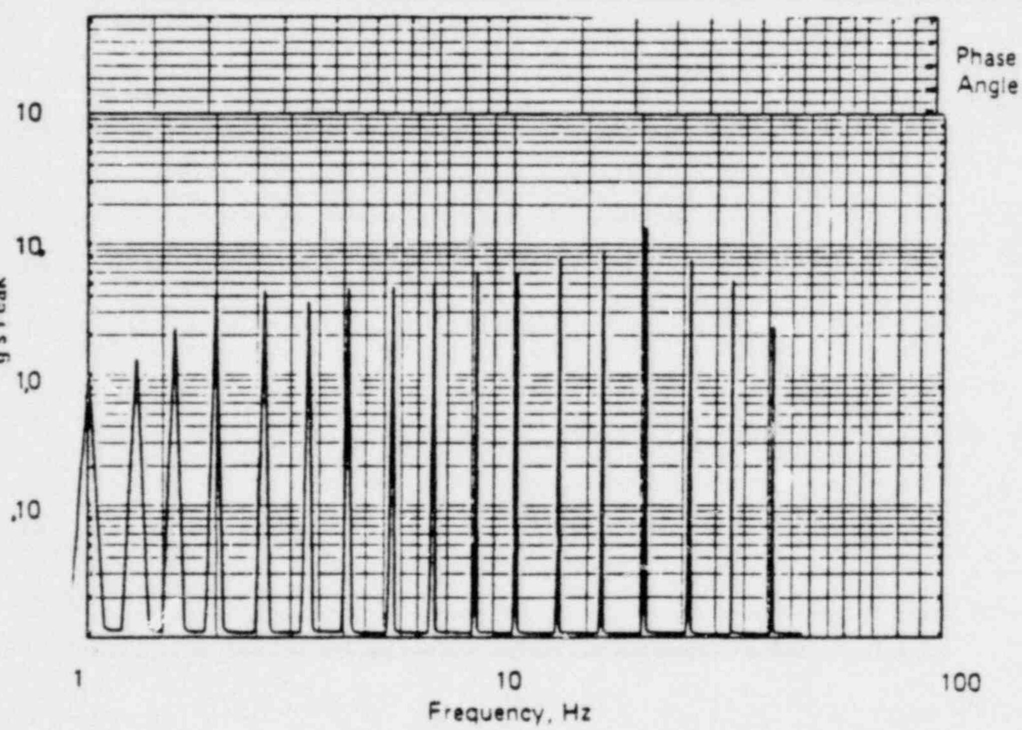

Figure No. IV.44 Test Run No. 12 Orientation 2 OBE ____ DBE 1

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Aux. LO Pump, Engine Driven FOB Pump, Motor Driven FOB Pump

01598 0219

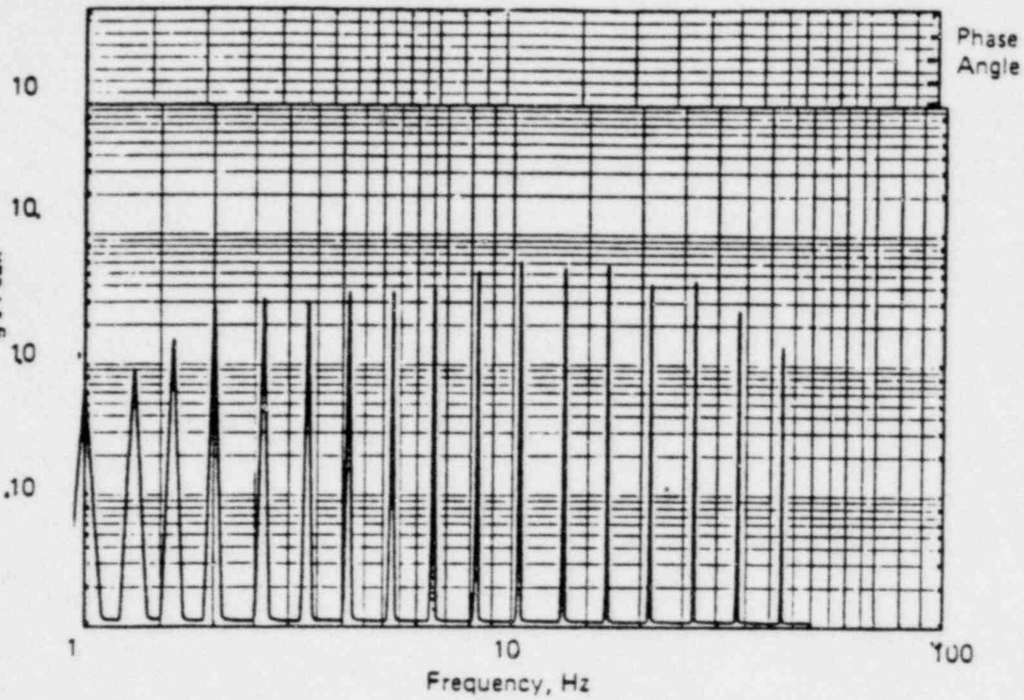

Figure No. IV.45 Test Run No. 13 Orientation 3 OBE / DBE ____

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Aux. LO Pump, Engine Driven FOB Pump, Motor Driven FOB Pump

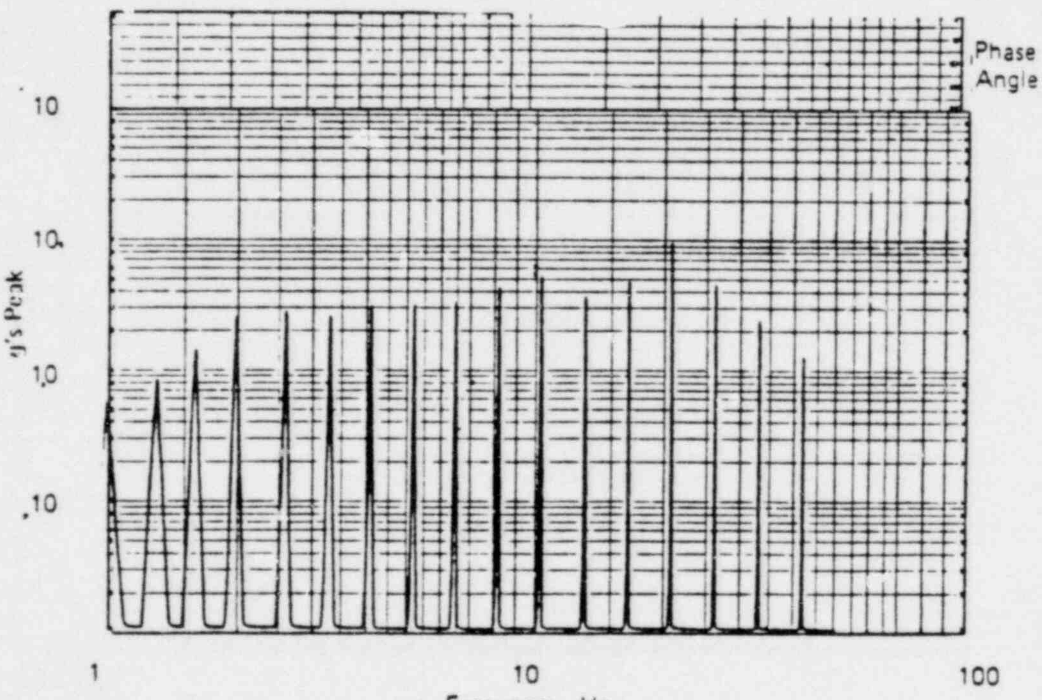

Figure No. IV.46 Test Run No. 13 Orientation 3 OBE / DBE ____

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Aux. L.O. Pump, Engine Driven FOB Pump, Motor Driven FOB Pump

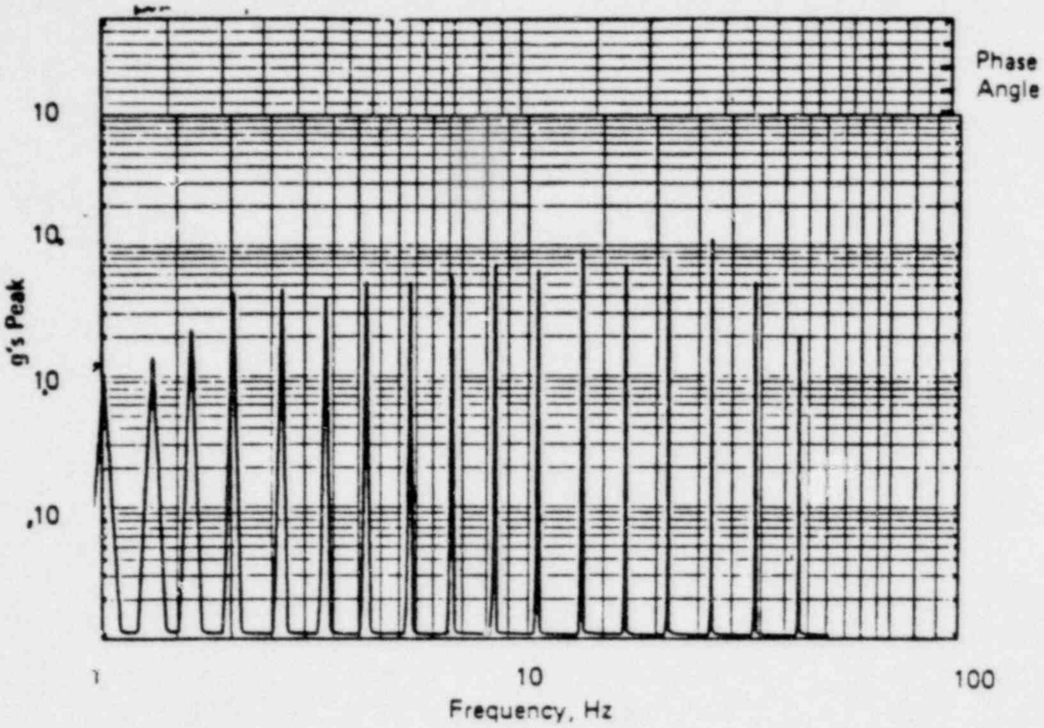

Figure No. IV.55 Test Run No. 18 Orientation 3 OBE ____ DBE 1

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Aux. L.O. Pump, Engine Driven FOB Pump, Motor Driven FOB Pump

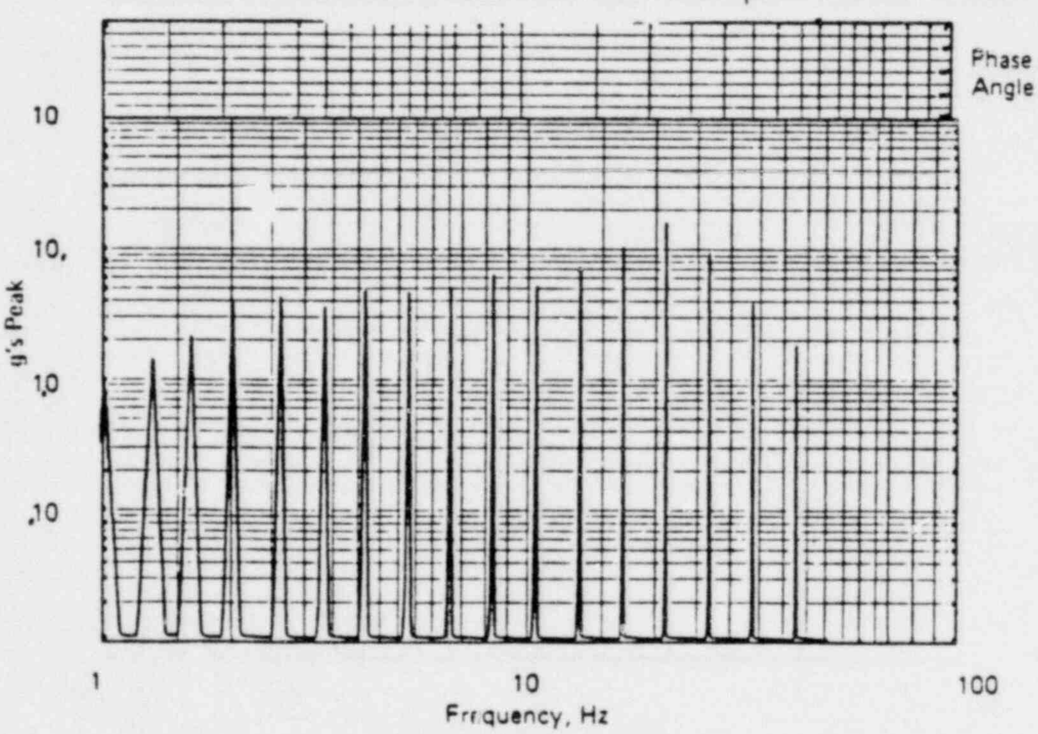

Figure No. IV.56 Test Run No. 18 Orientation 3 OBE ____ DBE 1

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Aux. L.O. Pump, Engine Driven FOB Pump, Motor Driven FOB Pump

Structural Dynamics Research Corporation

01598 0225

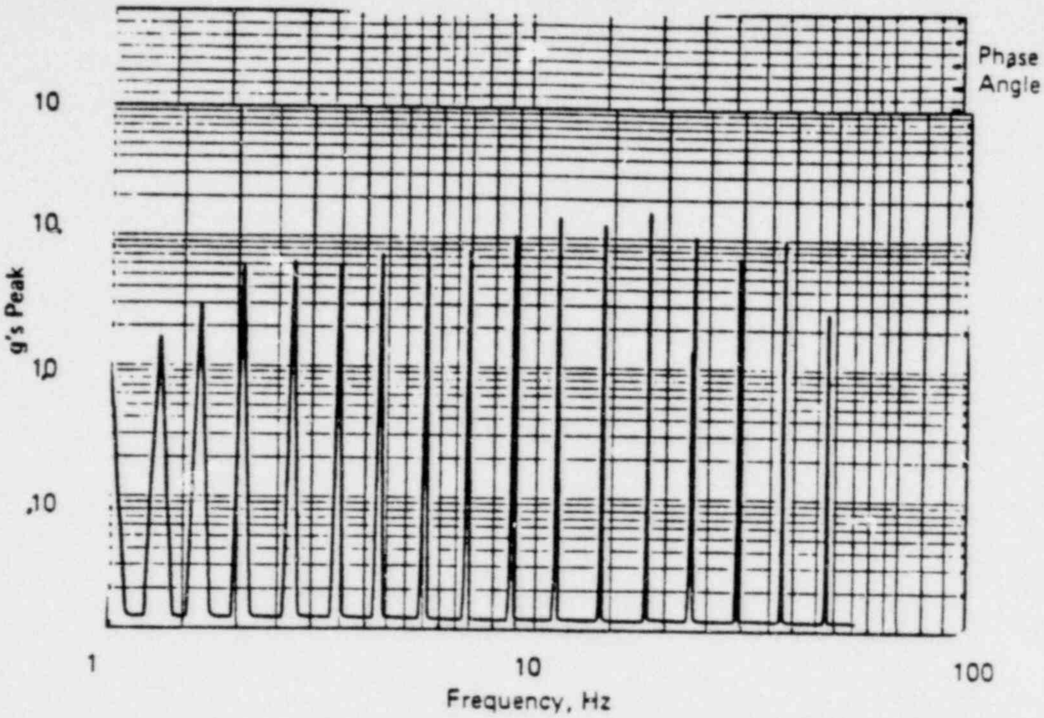

Figure No. IV.57 Test Run No. 19 Orientation 4 OBE ____ DBE 1

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Aux. L.O. Pump, Engine Driven FOB Pump, Motor Driven FOB Pump

Figure No. IV.58 Test Run No. 19 Orientation 4 OBE 1 DBE ____

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Aux. L.O. Pump, Engine Driven FOB Pump, Motor Driven FOB Pump

Structural Dynamics Research Corporation

0 1 5 9 8 0 2 2 6

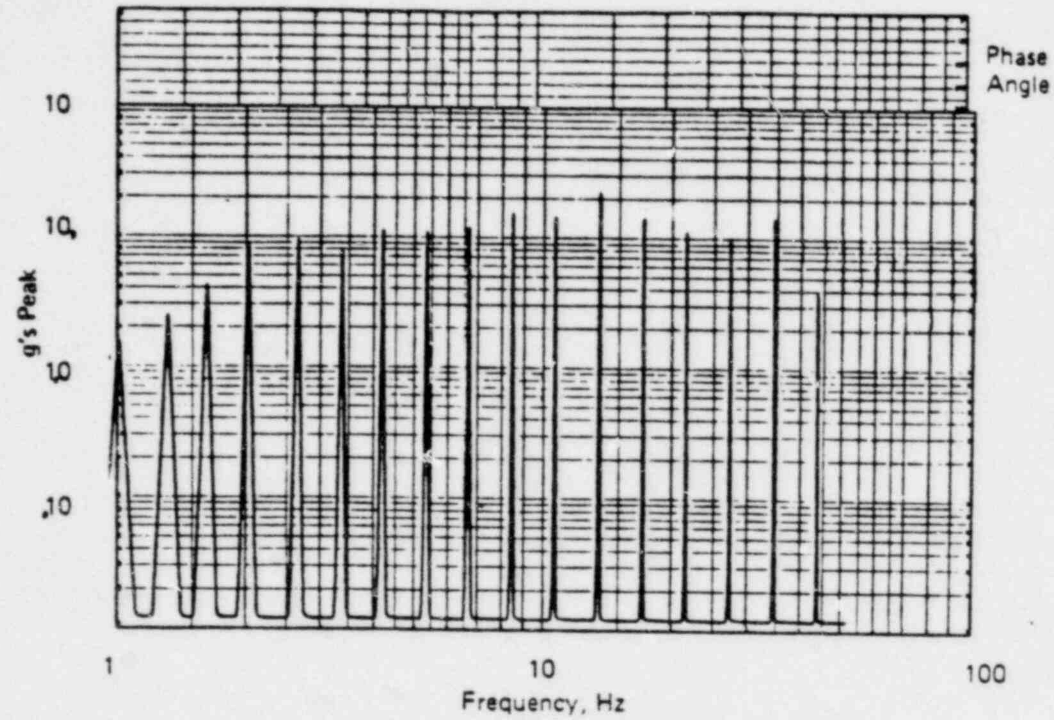

Figure No. IV.67 Test Run No. 24 Orientation 4 OBE ____ DBE 1

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Aux. L.O. Pump, Engine Driven F.O.B. Pump, Motor Driven FOB Pump

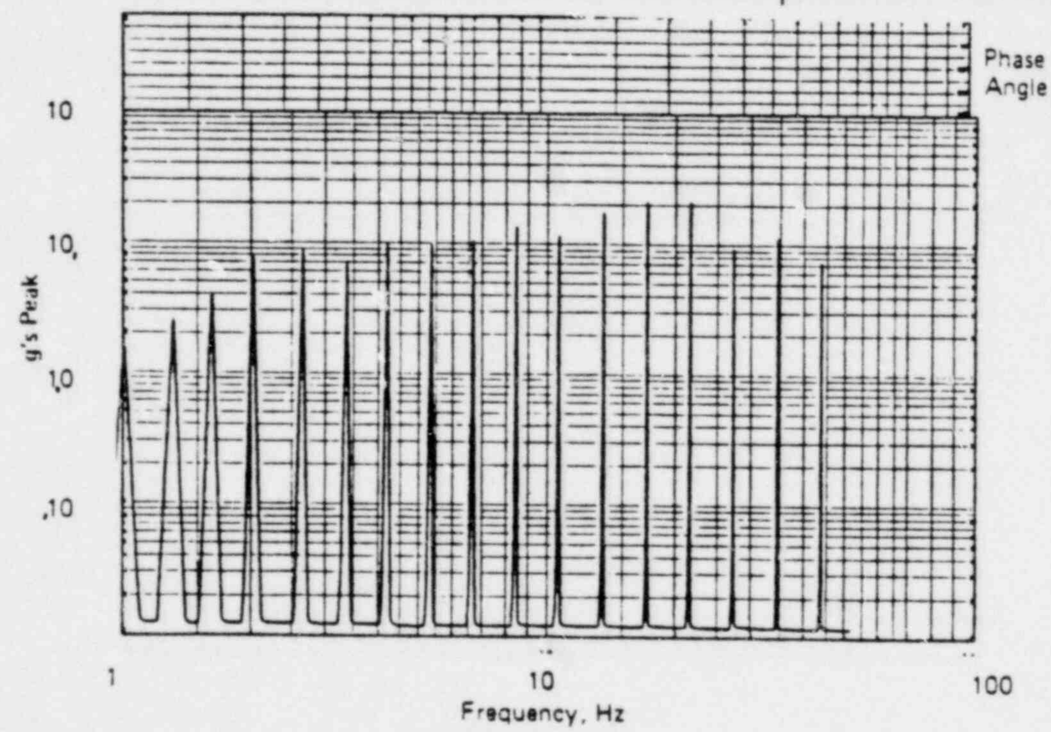

Figure No. IV.68 Test Run No. 24 Orientation 4 OBE ____ DBE 1

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Aux. L.O. Pump, Engine Driven FOB Pump, Motor Driven FOB Pump

0 1 5 9 8 0 2 3 1

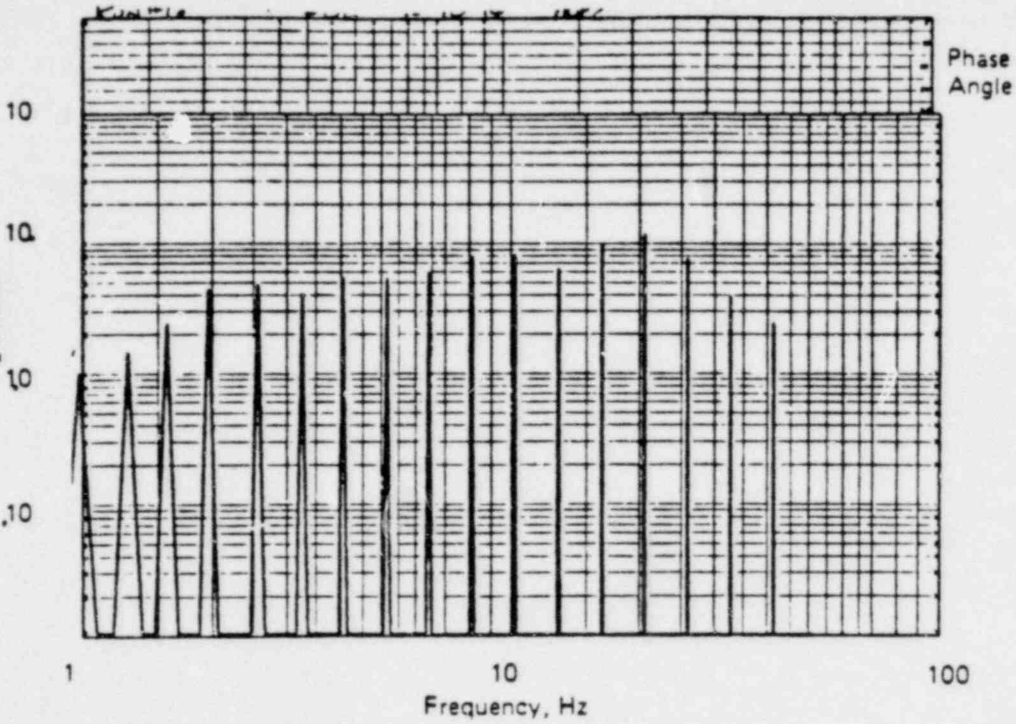

Figure No. IV.107 Test Run No. 6 Orientation 1 OBE ____ DBE 1

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical

Test Item(s) J.W. Pump, Motor Driven FCB Pump, Intercooler

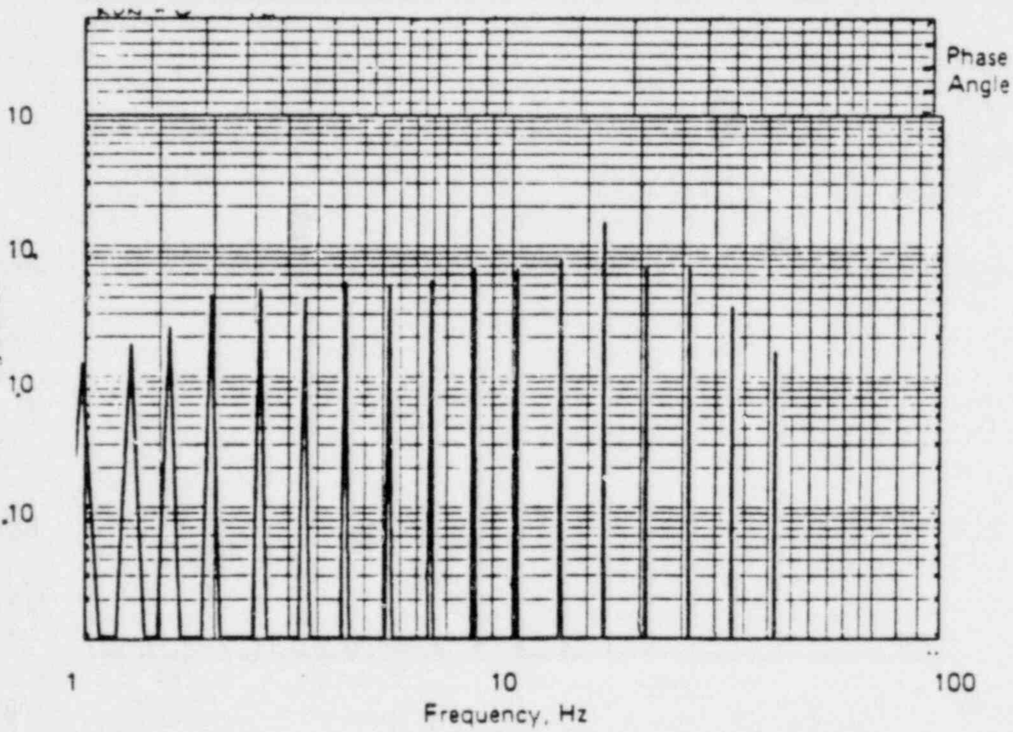

Figure No. IV.108 Test Run No. 6 Orientation 1 OBE ____ DBE 1

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical

Test Item(s) J.W. Pump, Motor Driven FCB Pump, Intercooler

0 1 5 9 8 - 0 2 5 9

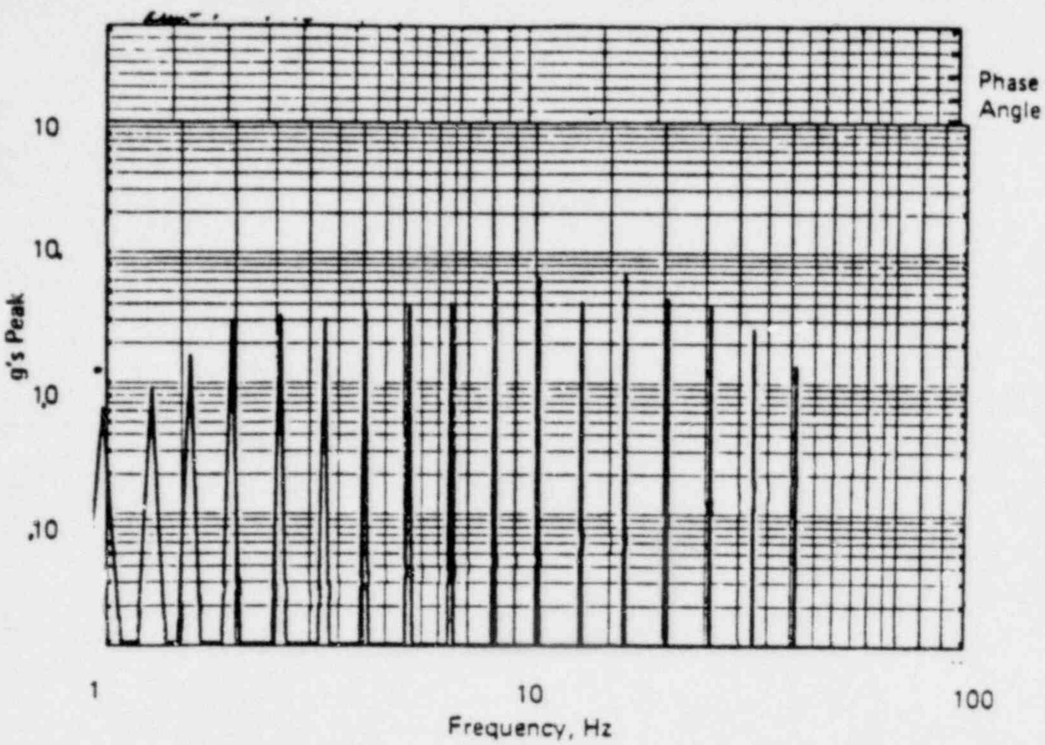

Figure No. IV.109 Test Run No. 7 Orientation 2 OBE 1 DBE ____

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical

Test Item(s) J.W. Pump, Motor Driven FOB Pump, Intercooler

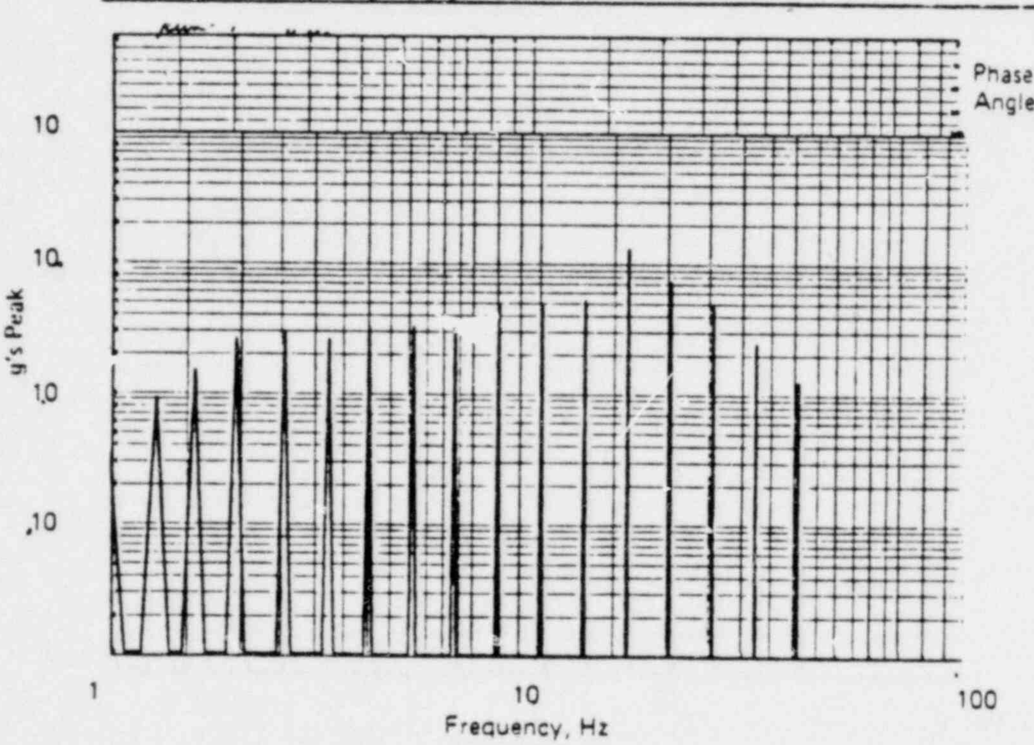

Figure No. IV.110 Test Run No. 7 Orientation 2 OBE 1 DBE ____

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical

Test Item(s) J.W. Pump, Motor Driven FOB Pump, Intercooler

01598 0260

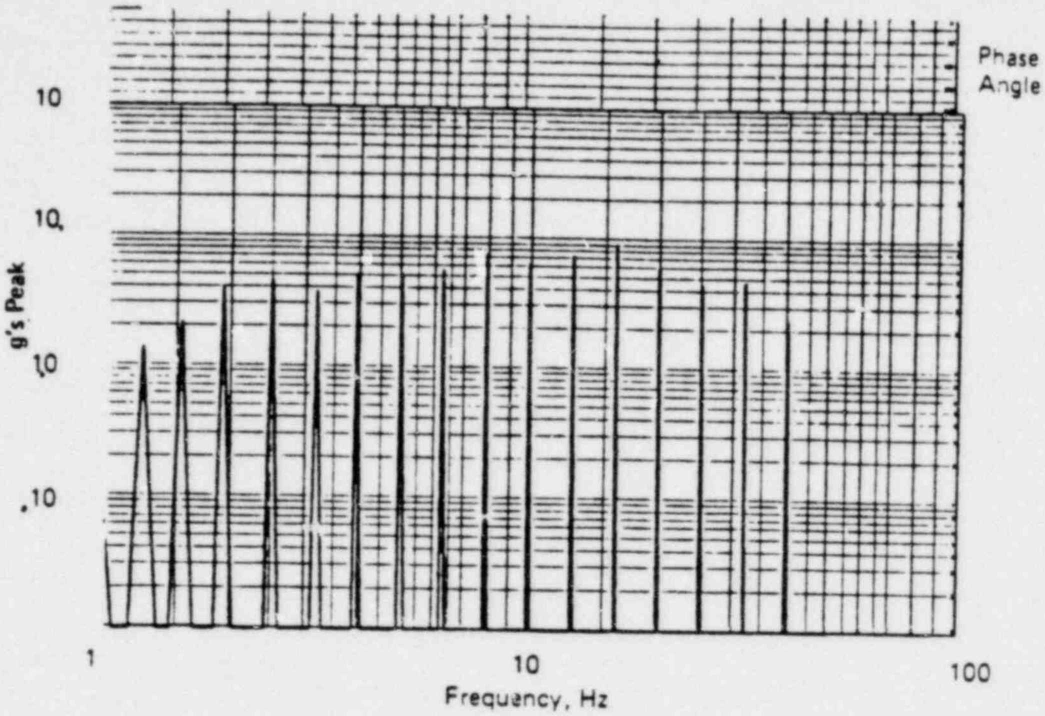

Figure No. IV.119 Test Run No. 12 Orientation 2 OBE ____ DBE 1

Transmissibility ____ or TRS ✓ % Damping 3 Direction (Horizontal) Vertical

Test Item(s) J.W. Pump, Motor Driven FOB Pump

Intercooler

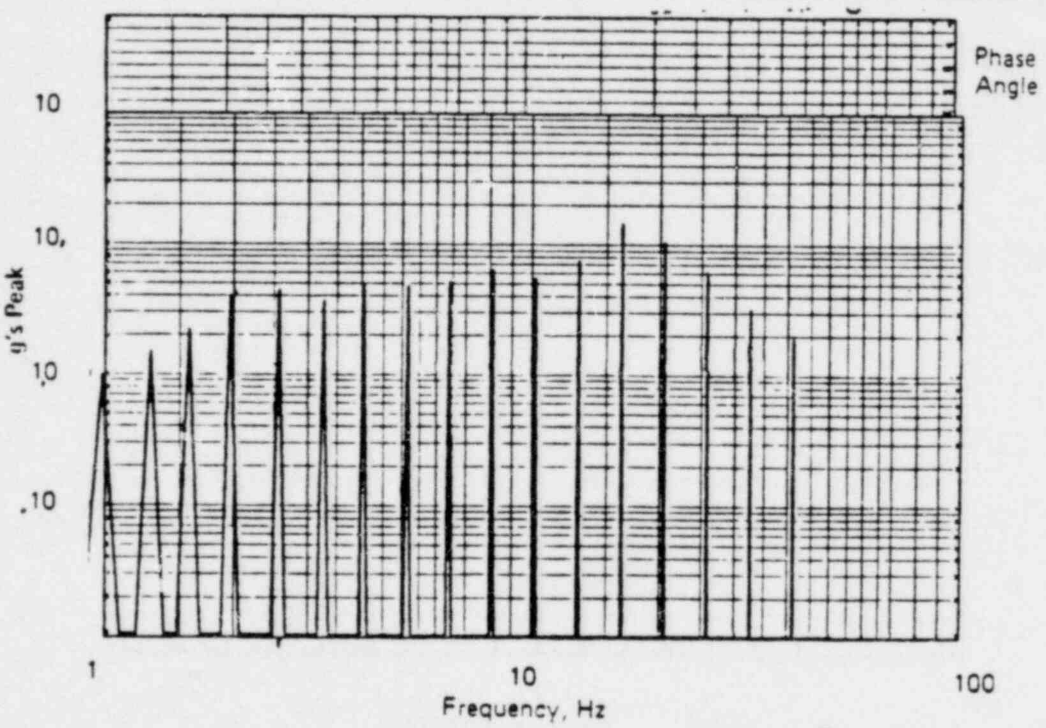

Figure No. IV.120 Test Run No. 12 Orientation 2 OBE ____ DBE 1

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal (Vertical)

Test Item(s) J.W. Pump, Motor Driven FOB Pump,

Intercooler

01598 0265

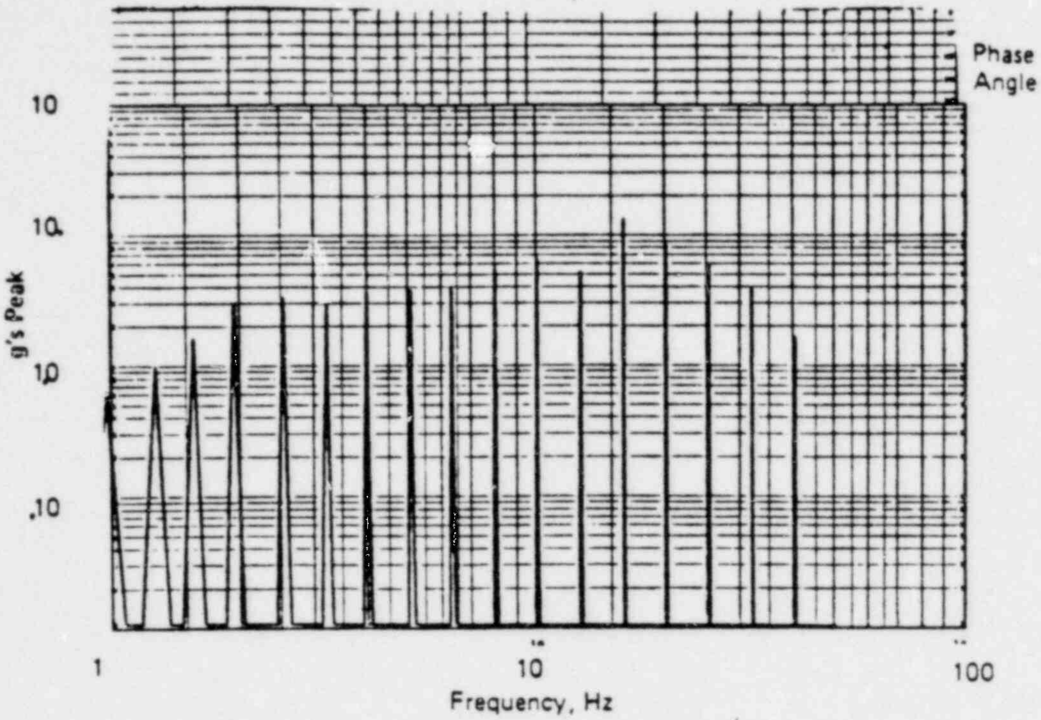

Figure No. IV.121 Test Run No. 13 Orientation 3 OBE 1 DBE ____

Transmissibility ____ or TRS √ % Damping 3 Direction (Horizontal) Vertical

Test Item(s) J.W. Pump, Motor Driven FOB Pump, Intercooler

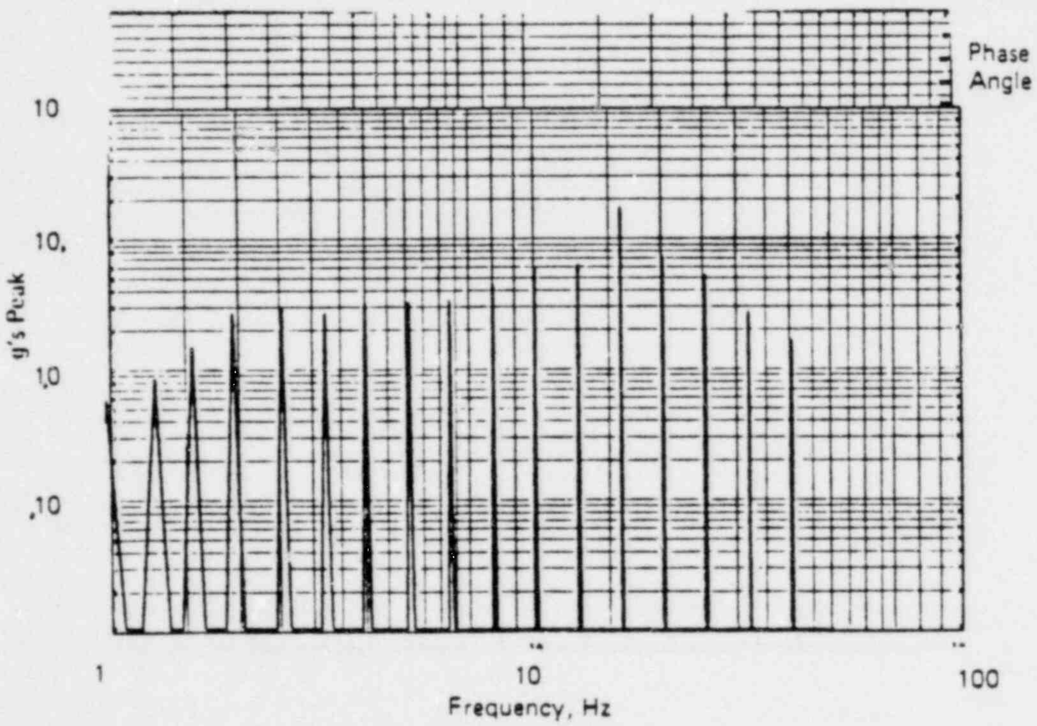

Figure No. IV.122 Test Run No. 13 Orientation 3 OBE 1 DBE ____

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal (Vertical)

Test Item(s) J.W. Pump, Motor Driven FOB Pump, Intercooler

01598 0266

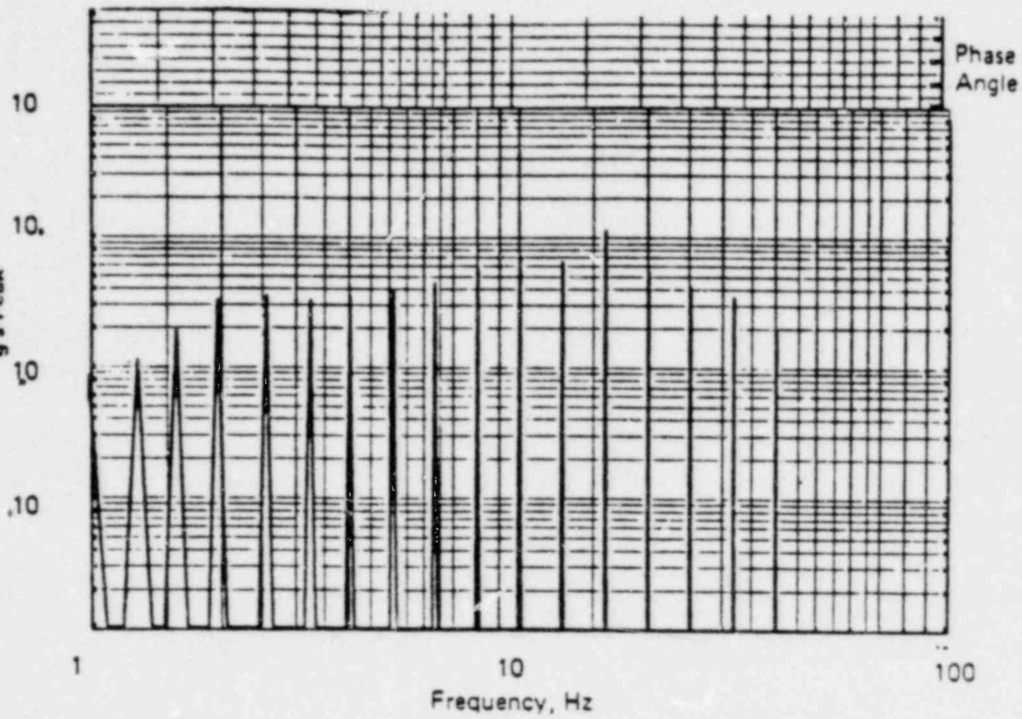

Figure No. IV.133 Test Run No. 19 Orientation 4 OBE 1 DBE ____

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) J.W. Pump, Motor Driven FOB Pump, Intercooler

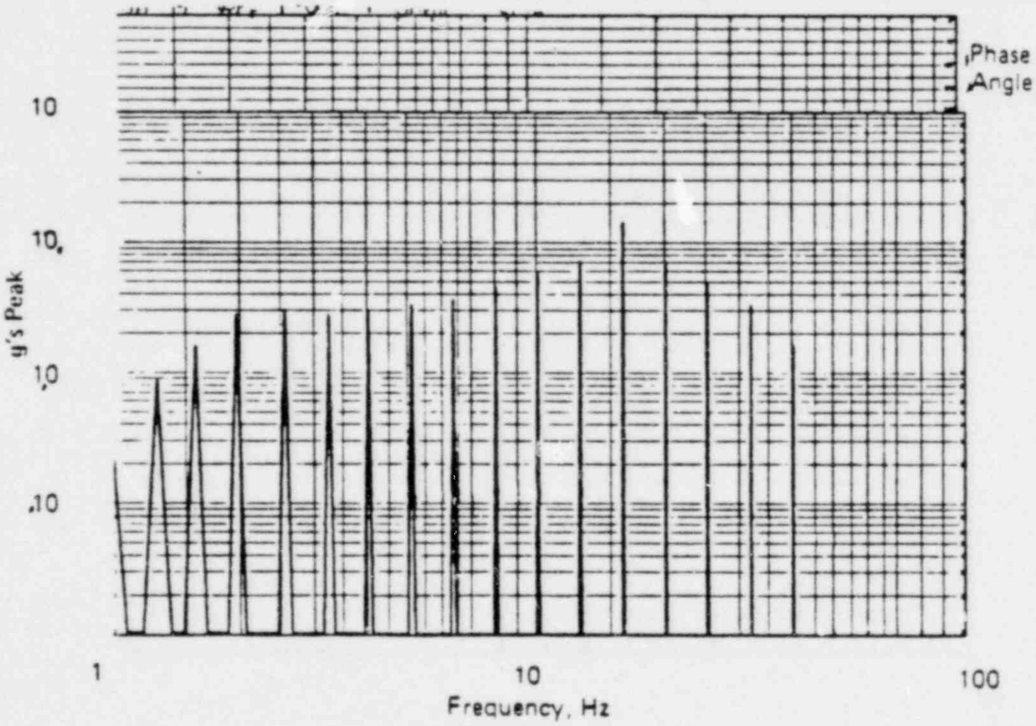

Figure No. IV.134 Test Run No. 19 Orientation 4 OBE 1 DBE ____

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) J.W. Pump, Motor Driven FOB Pump, Intercooler

01598 0272

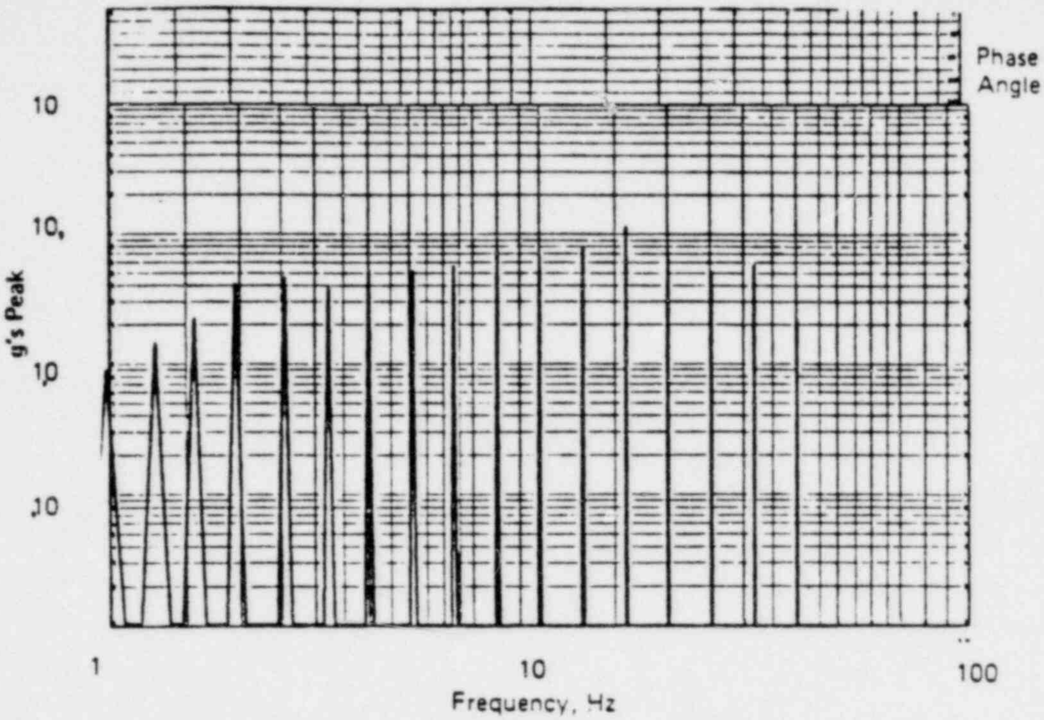

Figure No. IV.143 Test Run No. 24 Orientation 4 OBE ____ DBE 1

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical

Test Item(s) J.W. Pump, Motor Driven FOB Pump, Intercooler

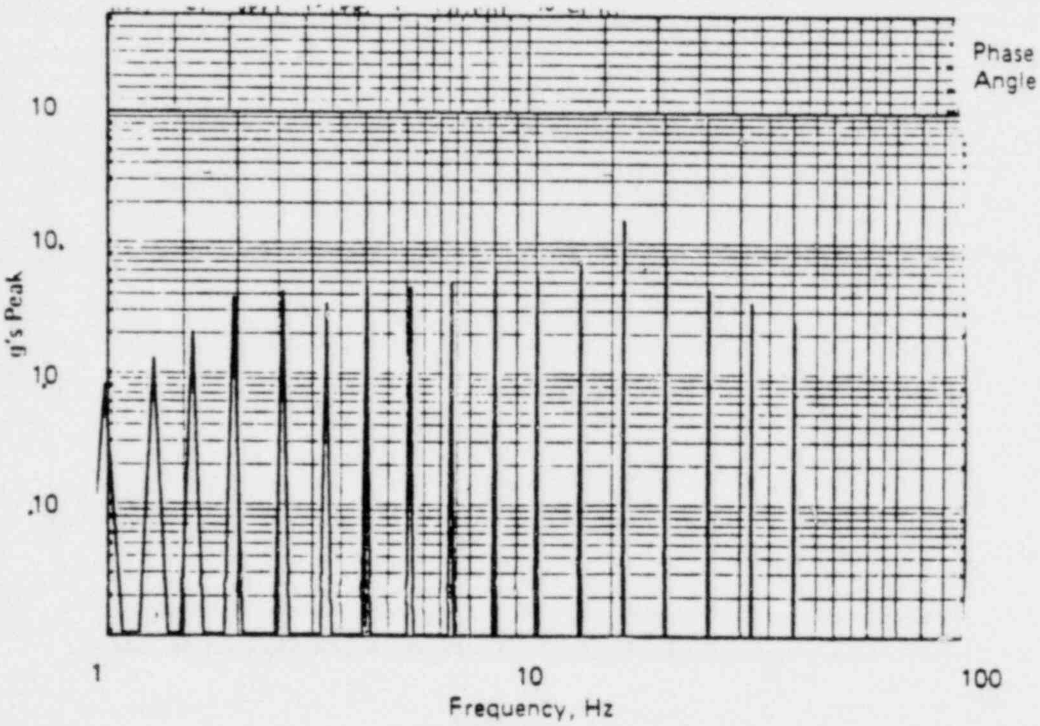

Figure No. IV.144 Test Run No. 24 Orientation 4 OBE ____ DBE 1

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical

Test Item(s) J.W. Pump, Motor Driven FOB Pump, Intercooler

01598 0277

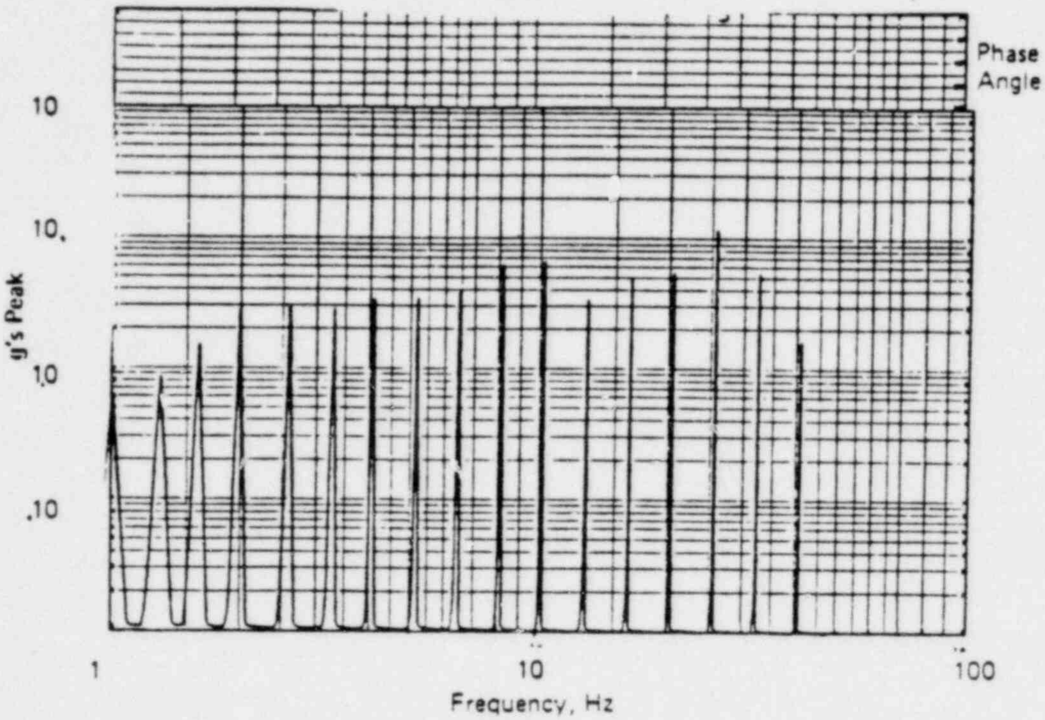

Figure No. IV.185 Test Run No. 1 Orientation 1 OBE 1 DBE ____

Transmissibility ____ or TRS ✓ % Damping 3 Direction (Horizontal) Vertical

Test Item(s) Turbocharger R.B., Lube Oil Thermostatic Valve, Jacketwater Thermostatic Valve, L.O. Inlet Pressure Strainer Fig IV.16 - IV.23

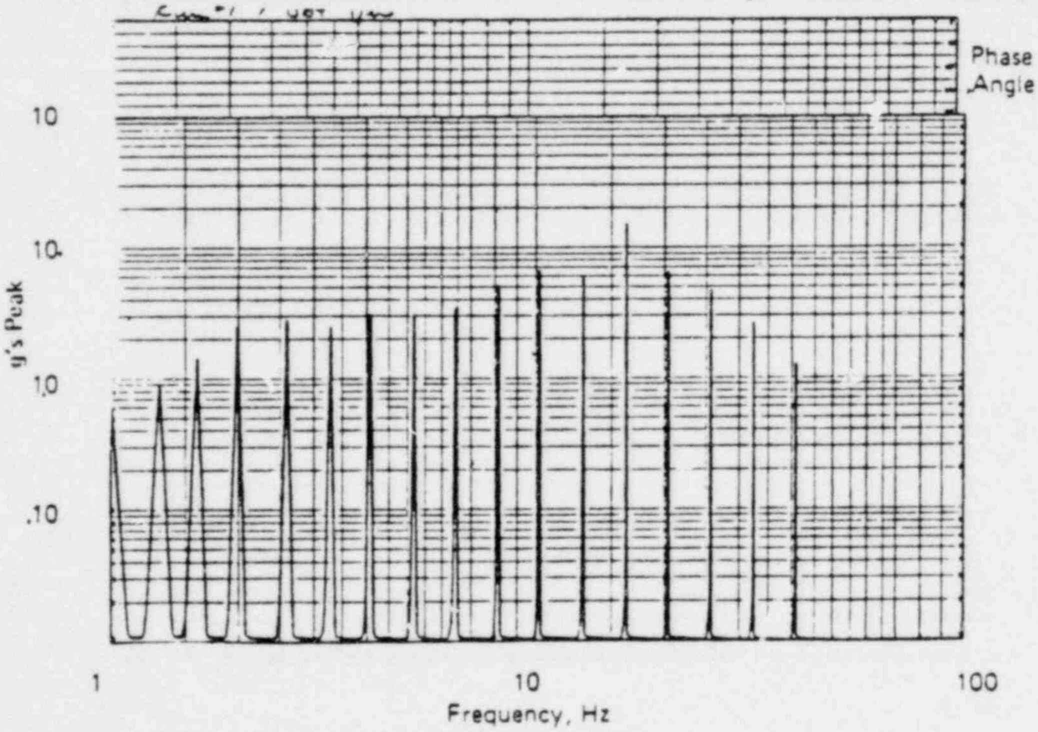

Figure No. IV.186 Test Run No. 1 Orientation 1 OBE 1 DBE ____

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal (Vertical)

Test Item(s) Turbocharger R.B.

01598 0309

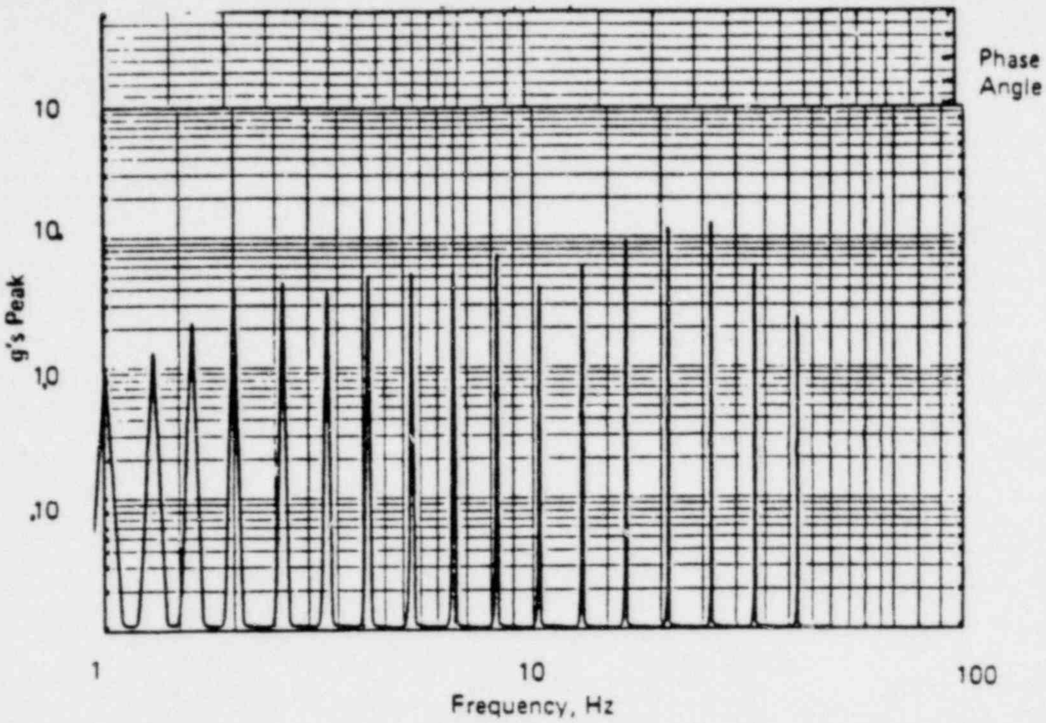

Figure No. IV.195 Test Run No. 6 Orientation 1 OBE ____ DBE 1

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Turbocharger R.B

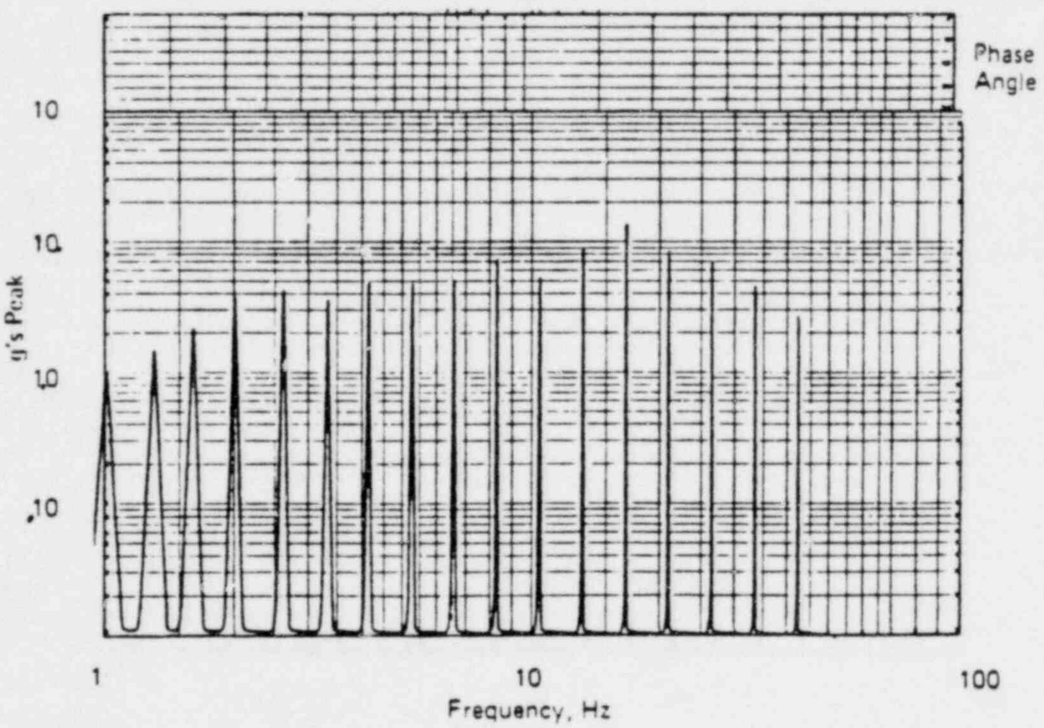

Figure No. IV.196 Test Run No. 6 Orientation 1 OBE ____ DBE 1

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Turbocharger R.B

01598 0314

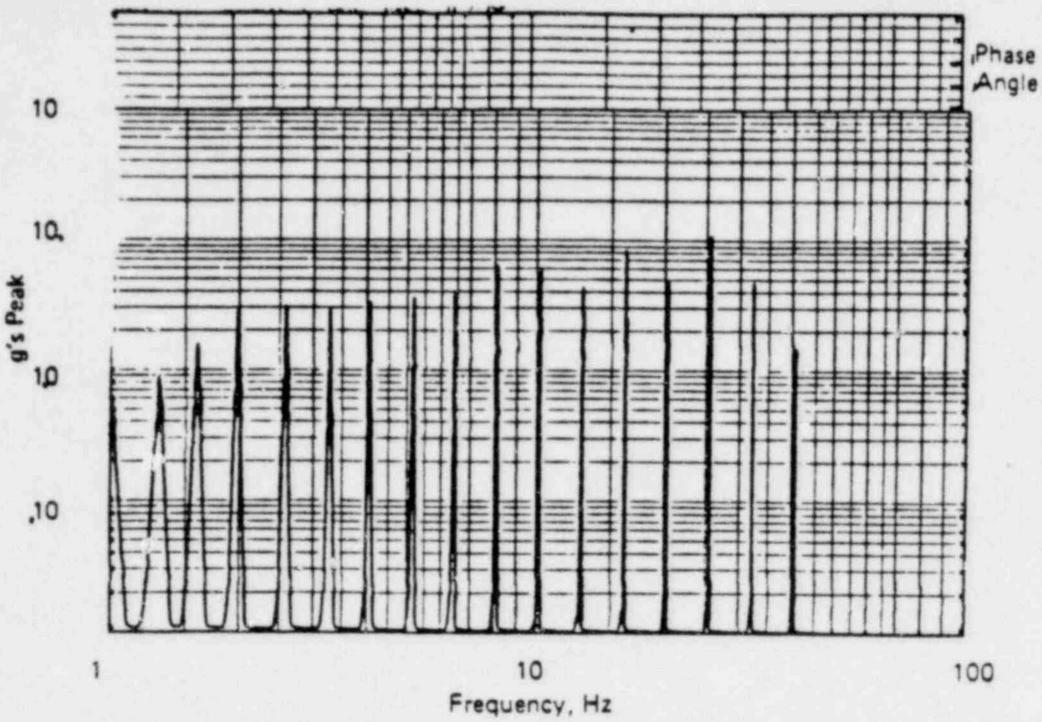

Figure No. IV.197 Test Run No. 7 Orientation 2 OBE 1 DBE ____

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Turbocharger R.B

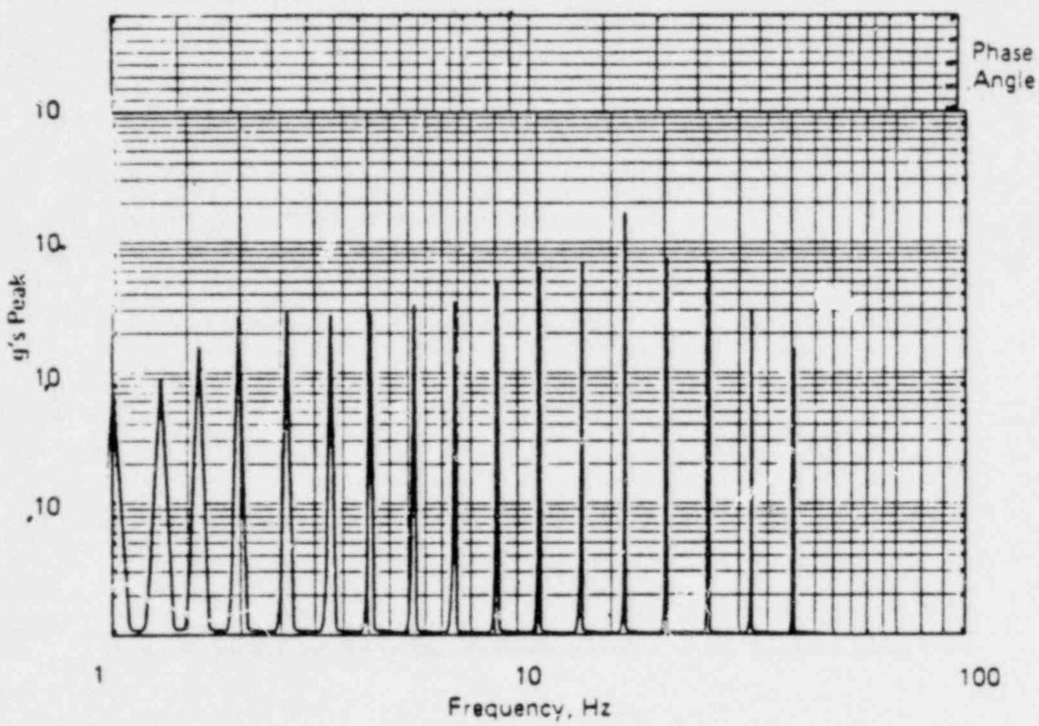

Figure No. IV.198 Test Run No. 7 Orientation 2 OBE 1 DBE ____

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Turbocharger R.B

0159 8 0315

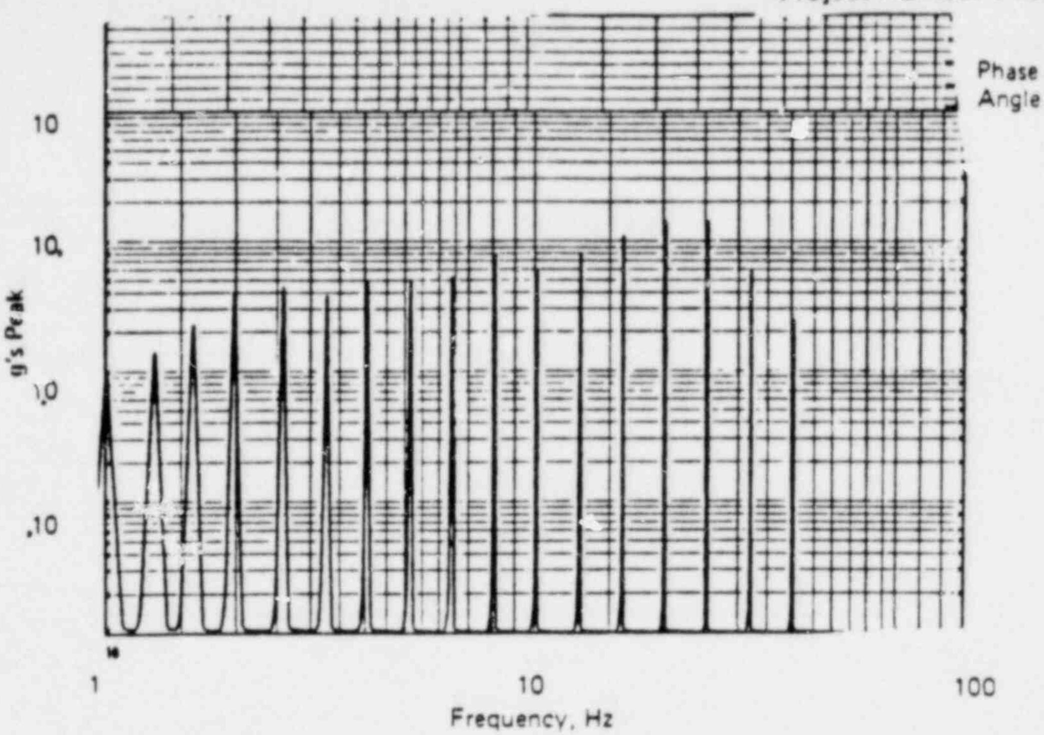

Figure No. IV.207 Test Run No. 12 Orientation 2 OBE ___ DBE 1

Transmissibility ___ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Turbocharger R.B

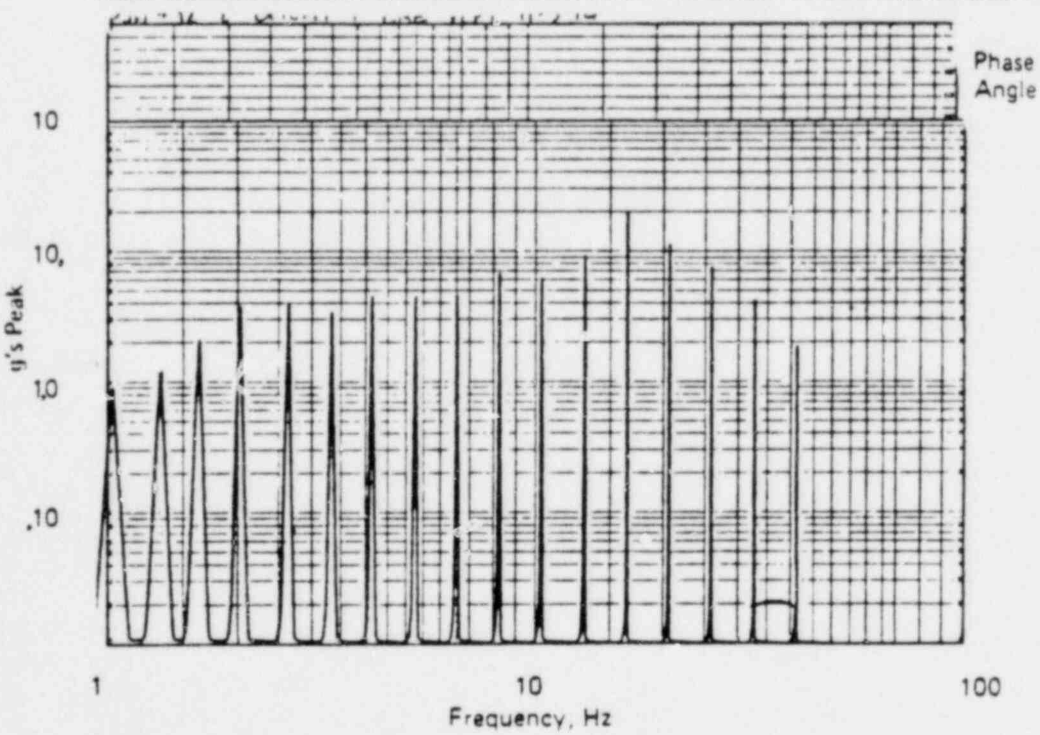

Figure No. IV.208 Test Run No. 12 Orientation 2 OBE ___ DBE 1

Transmissibility ___ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Turbocharger R.B

01598 - 0320

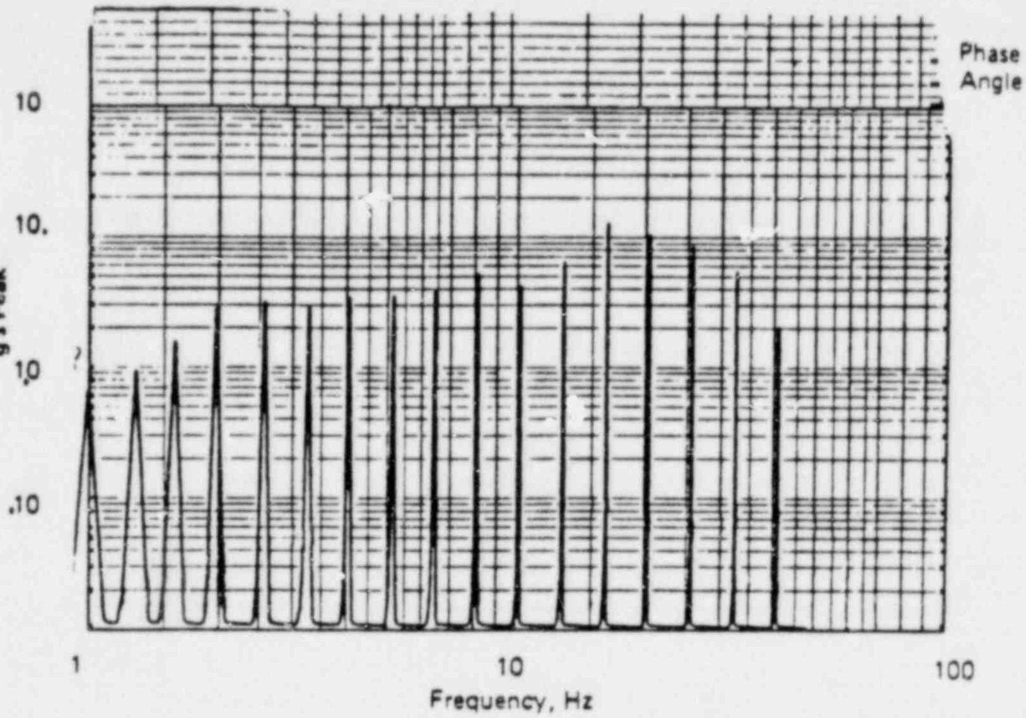

Figure No. IV.209 Test Run No. 13 Orientation 3 OBE 1 DBE ____

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Turbocharger R.B.

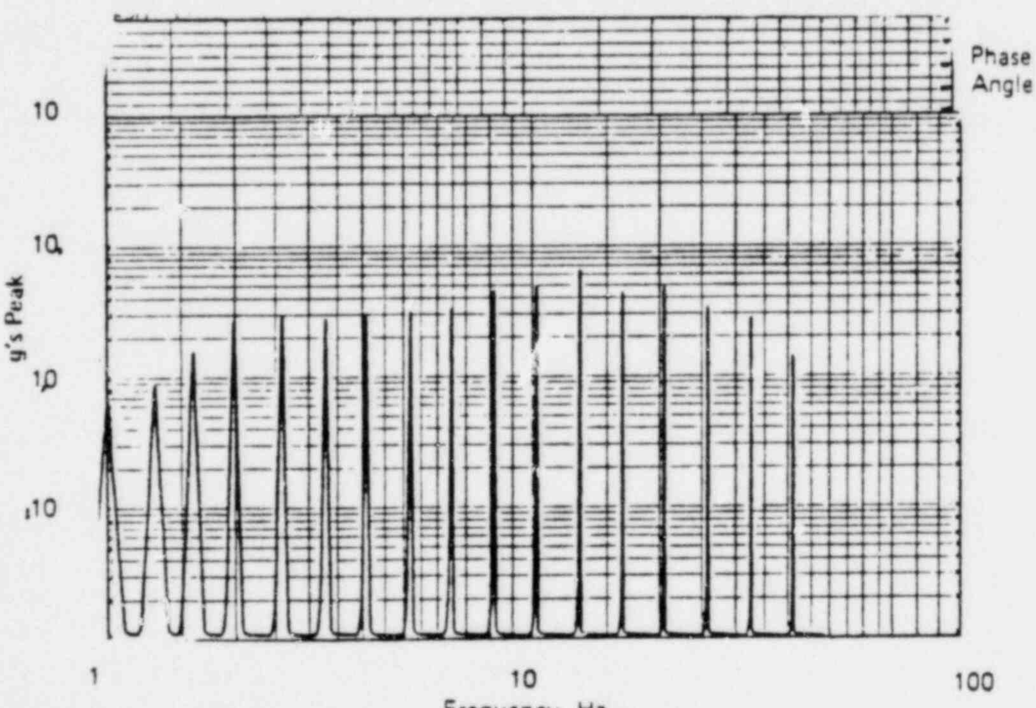

Figure No. IV.210 Test Run No. 13 Orientation 3 OBE ____ DBE ____

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Turbocharger R.B

01598 0321

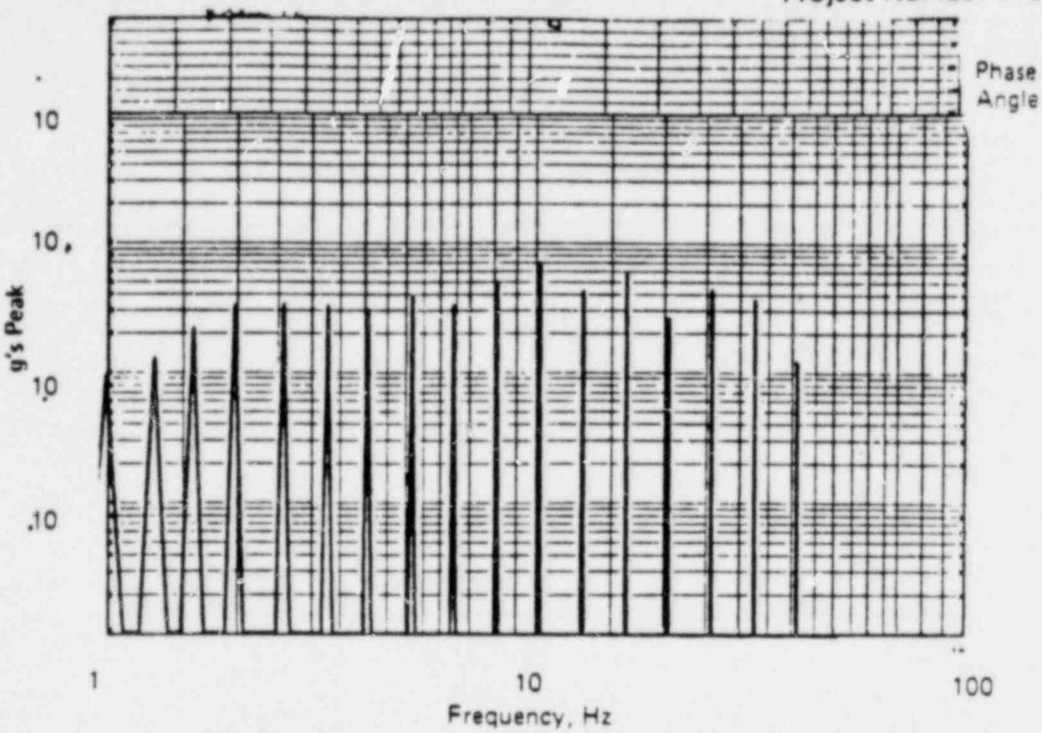

Figure No. IV.219 Test Run No. 18 Orientation 3 OBE ___ DBE 1

Transmissibility ___ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Turbocharger R.B.

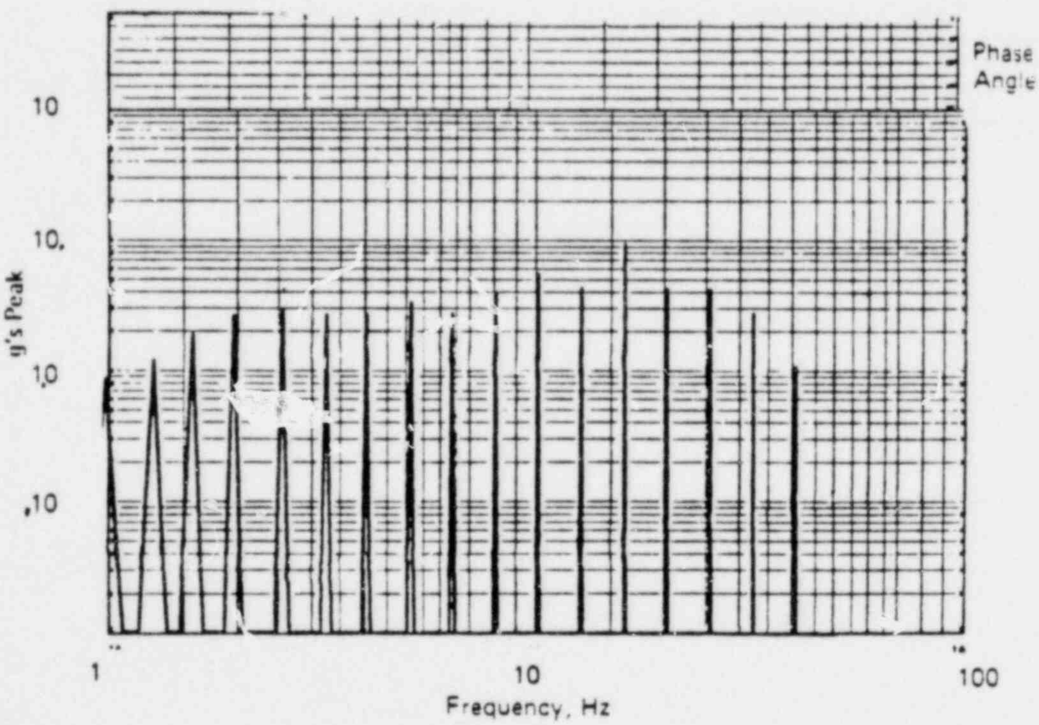

Figure No. IV.220 Test Run No. 18 Orientation 3 OBE ___ DBE 1

Transmissibility ___ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Turbocharger R.B.

01598 0326

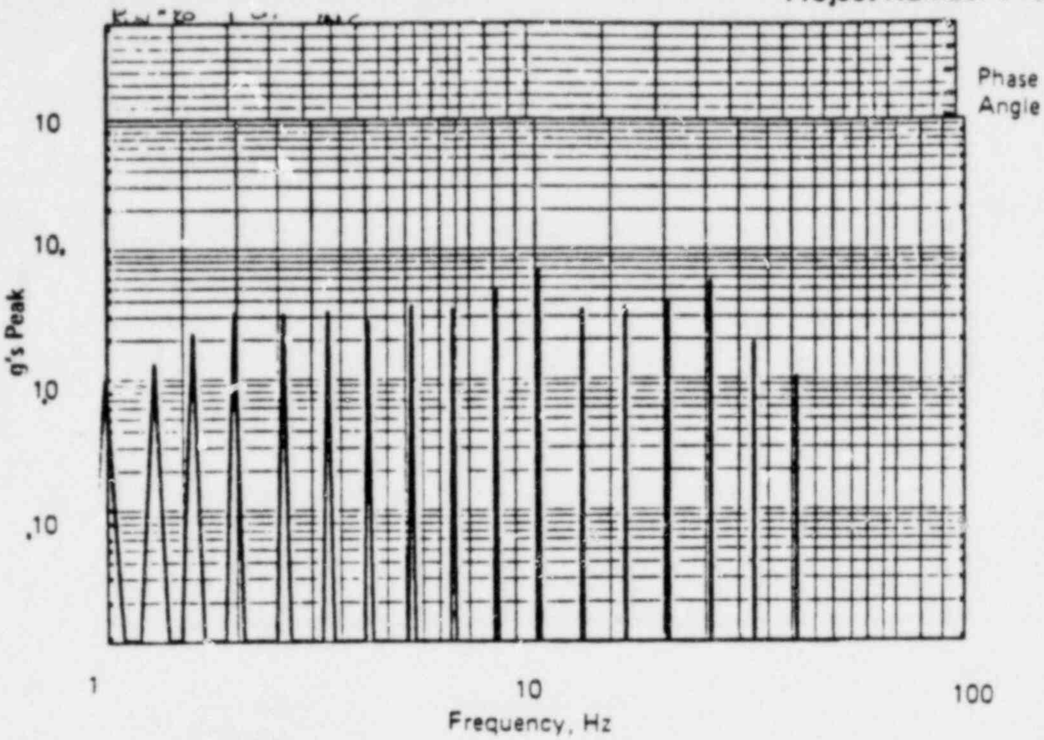

Figure No. IV.223 Test Run No. 20 Orientation 4 OBE 1 DBE ____
Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical
Test Item(s) Turbocharger R.B.

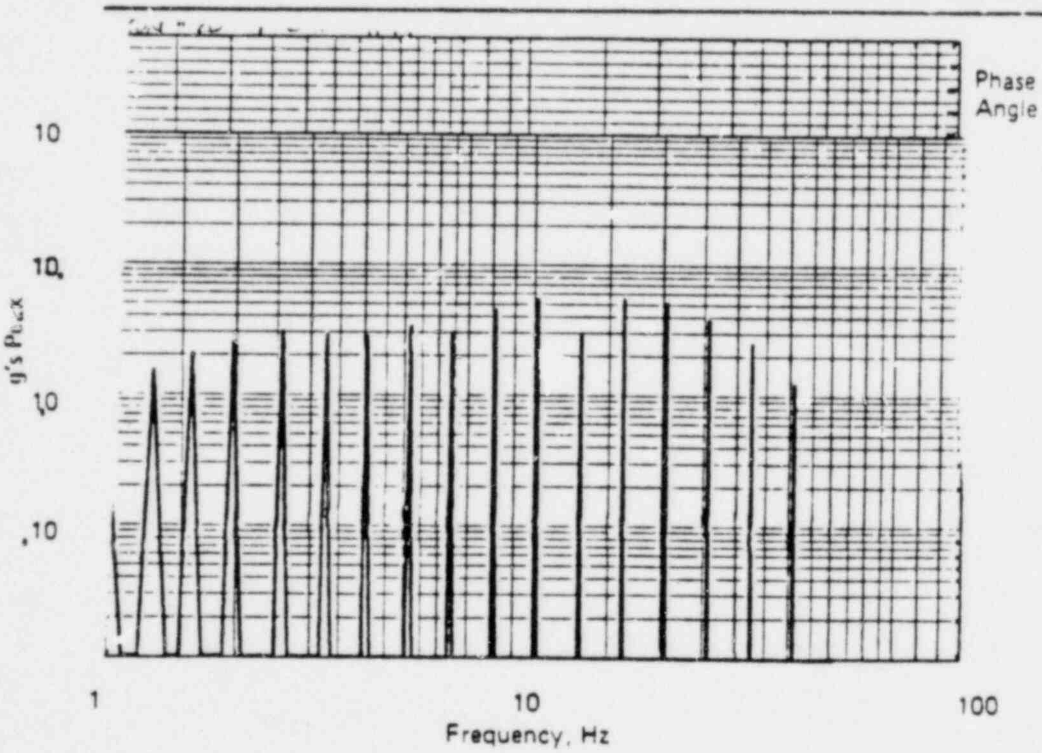

Figure No. IV.224 Test Run No. 20 Orientation 4 OBE 1 DBE ____
Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical
Test Item(s) Turbocharger R.B.

01598-0328

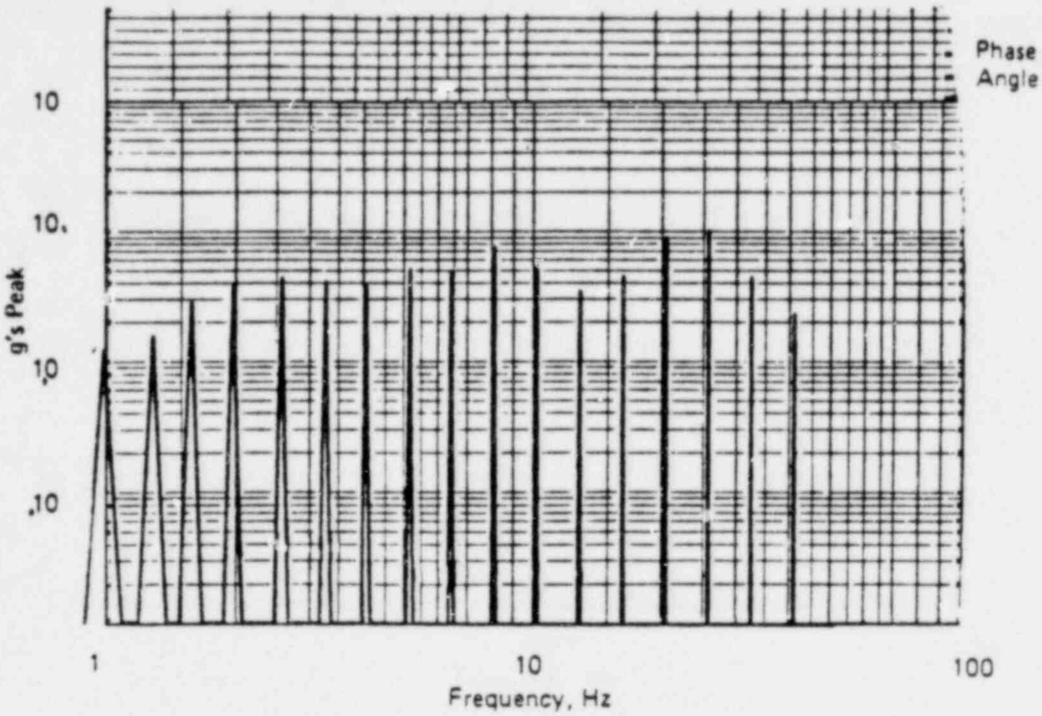

Figure No. IV 233 Test Run No. 25 Orientation 4 OBE ____ DBE 1

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Turbocharger R. B

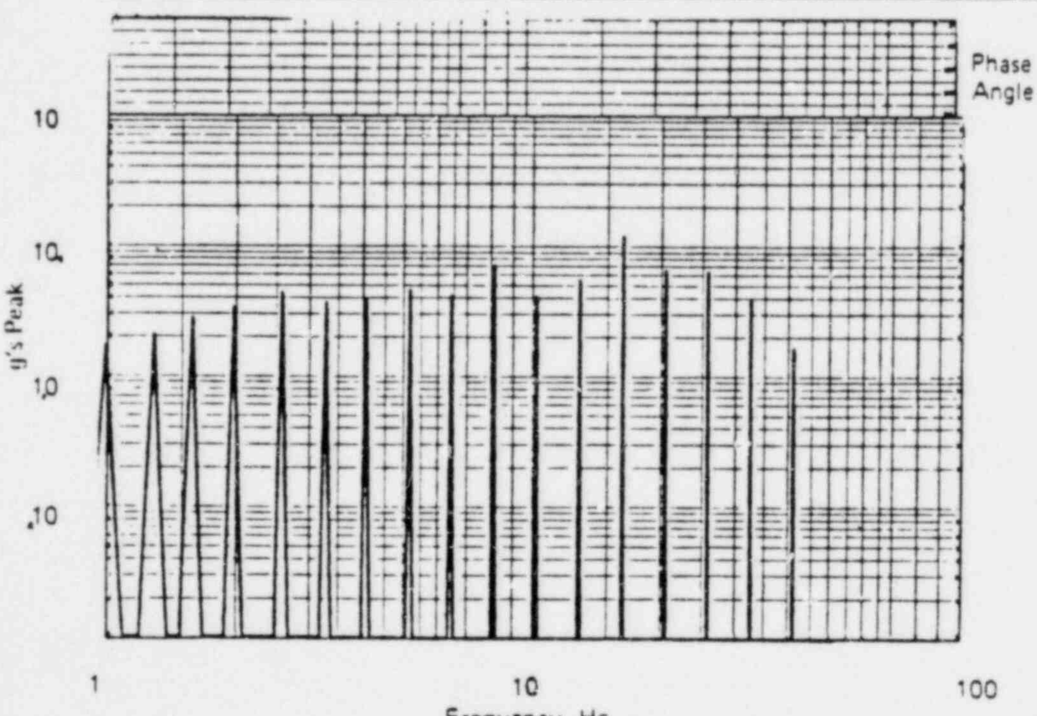

Figure No. IV 234 Test Run No. 25 Orientation 4 OBE ____ DBE 1

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Turbocharger R.B

01598 0333

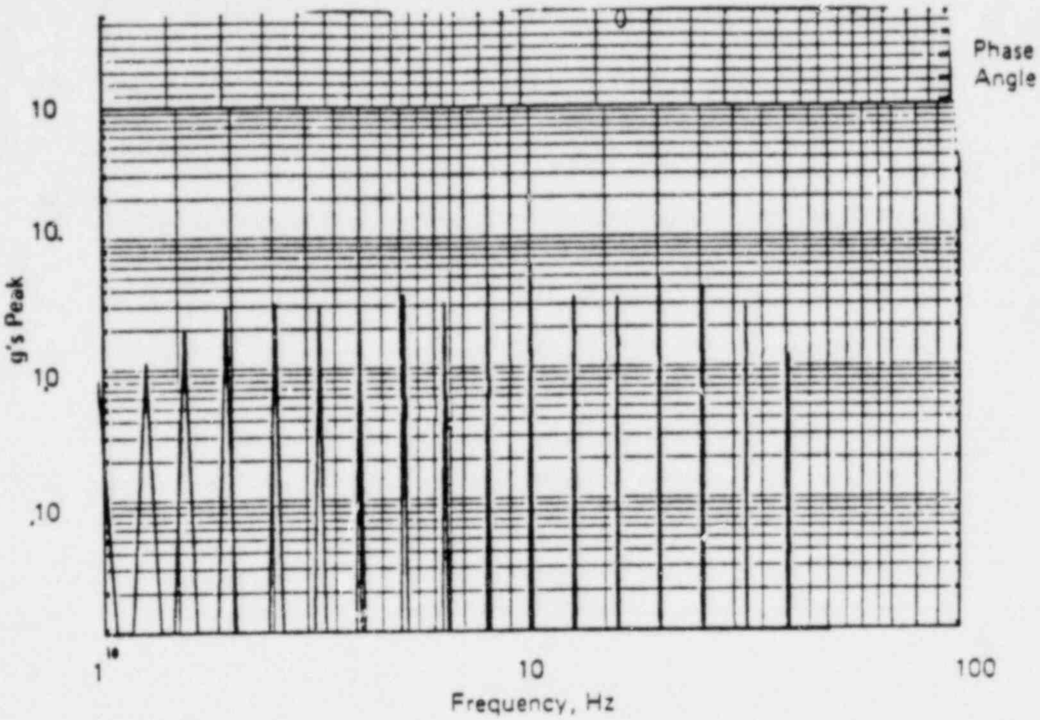

Figure No. IV.266 Test Run No. 1 Orientation 1 OBE 1 DBE ____

Transmissibility ____ or TRS √ % Damping 3 Direction (Horizontal) Vertical

Test Item(s) Turbocharger L.B., Check Valve, J.W.
Thermostatic Valve L.O. Thermostatic Valve Figs IV.266 thru IV.319

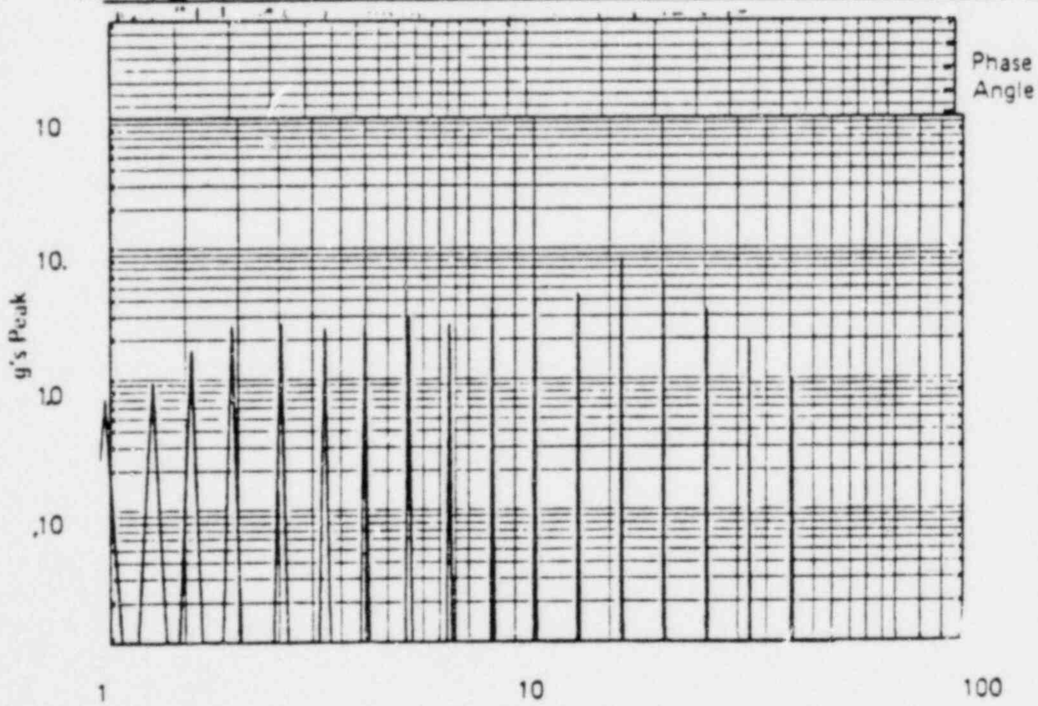

Figure No. IV.267 Test Run No. 1 Orientation 1 OBE 1 DBE ____

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal (Vertical)

Test Item(s) Turbocharger LB

01598 0369

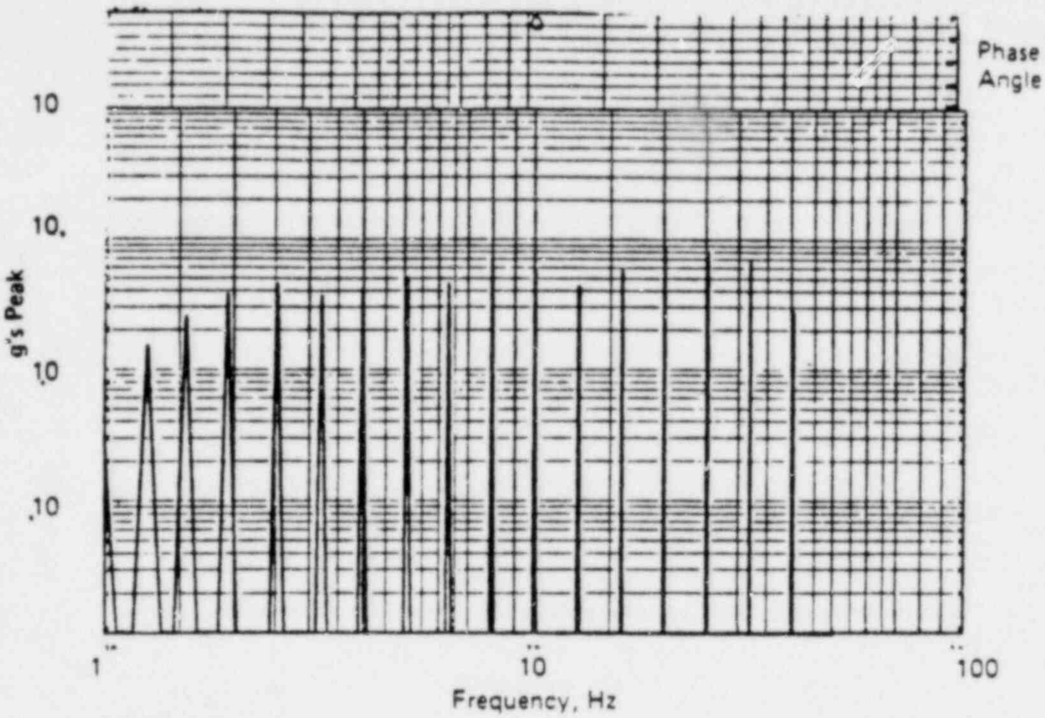

Figure No. IV.276 Test Run No. 6 Orientation 1 OBE ____ DBE 1

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical

Test Item(s) Turbocharger - L.B

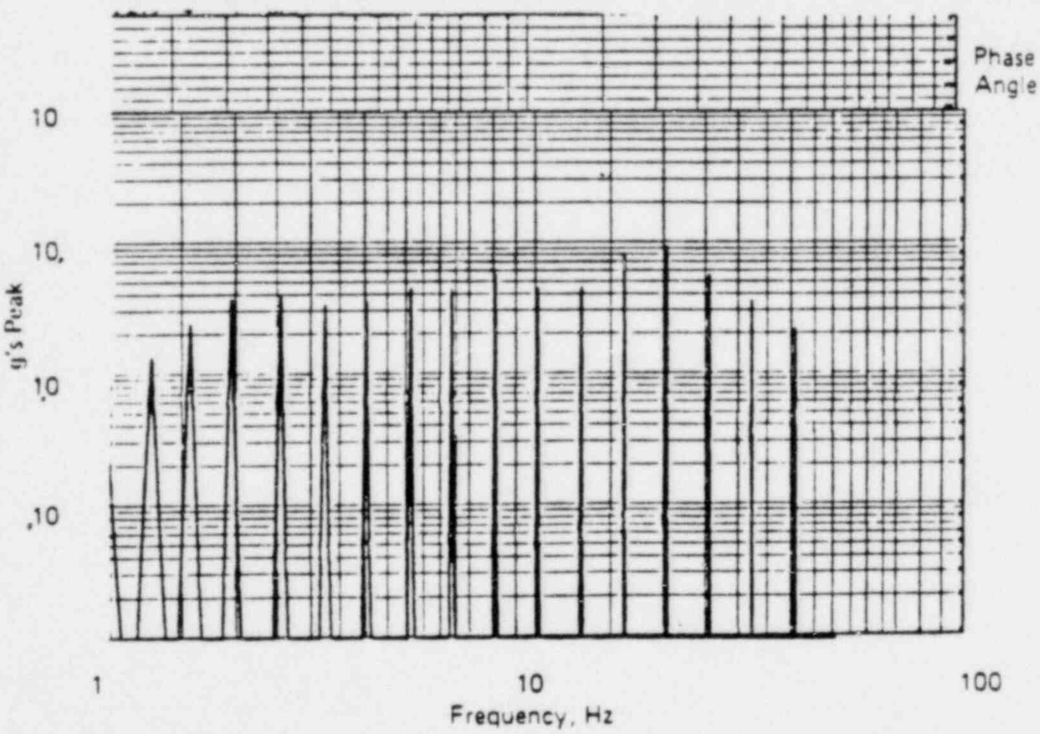

Figure No. IV.277 Test Run No. 6 Orientation 1 OBE ____ DBE 1

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical

Test Item(s) Turbocharger L.B

0 1 5 9 8 0 3 6 5

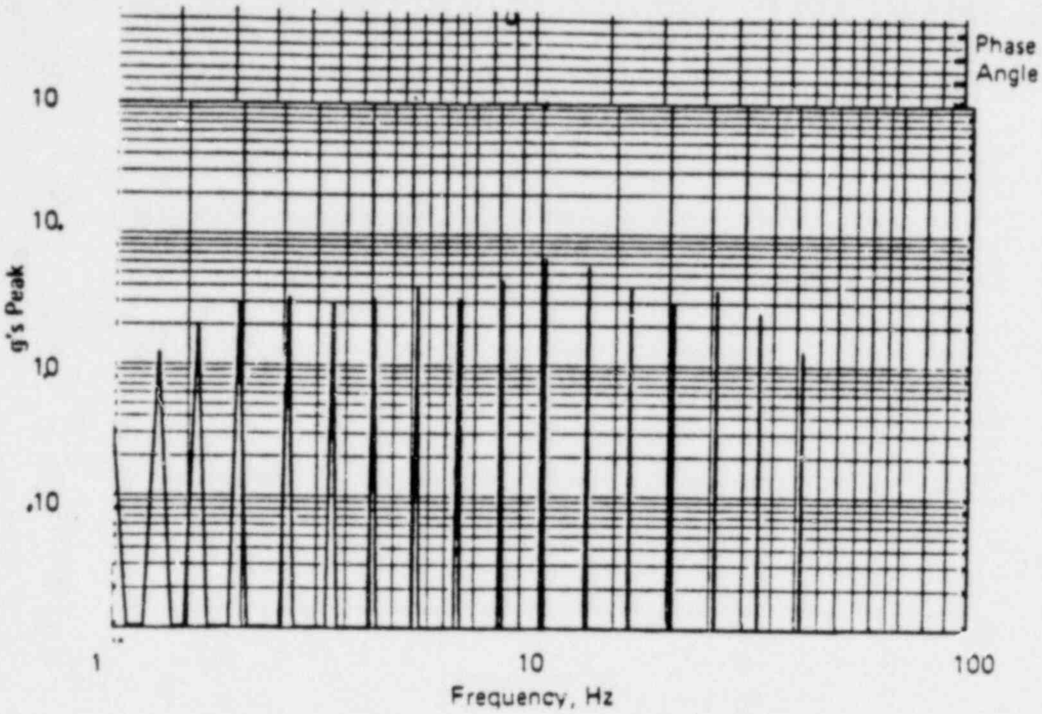

Figure No. IV.278 Test Run No. 7 Orientation 2 OBE 1 DBE ____
Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical
Test Item(s) Turbocharger L.B.

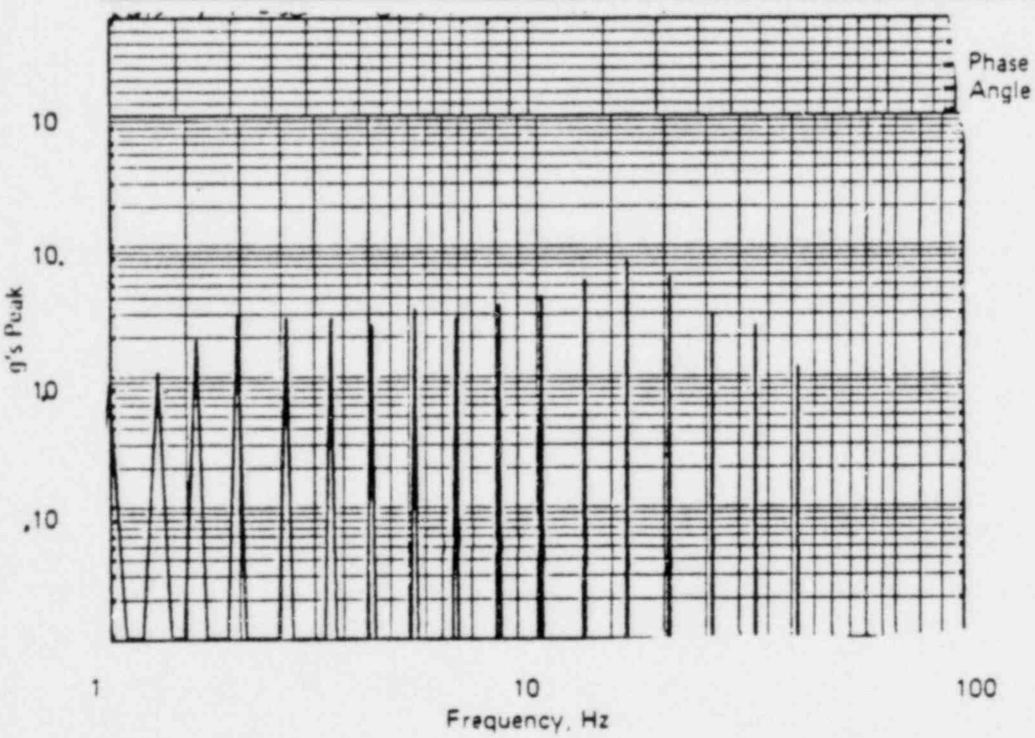

Figure No. IV.279 Test Run No. 7 Orientation 2 OBE 1 DBE ____
Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical
Test Item(s) Turbocharger L.B.

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0159803 66

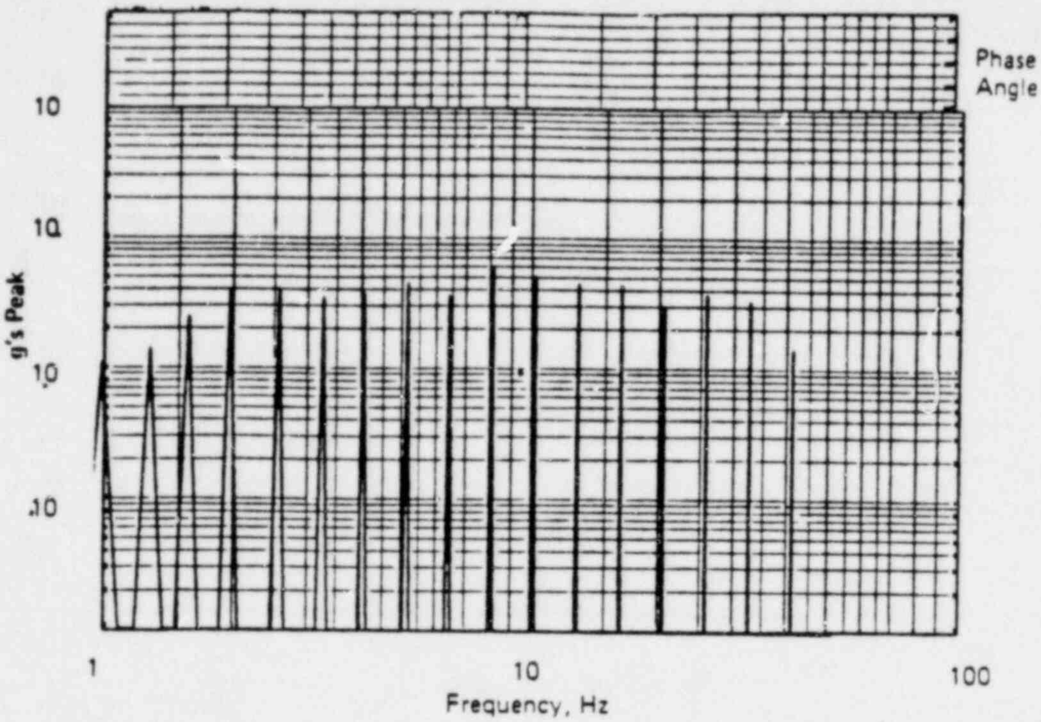

Figure No. IV.288 Test Run No. 12 Orientation 2 OBE ____ DBE 1

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical

Test Item(s) Turbocharger L.B

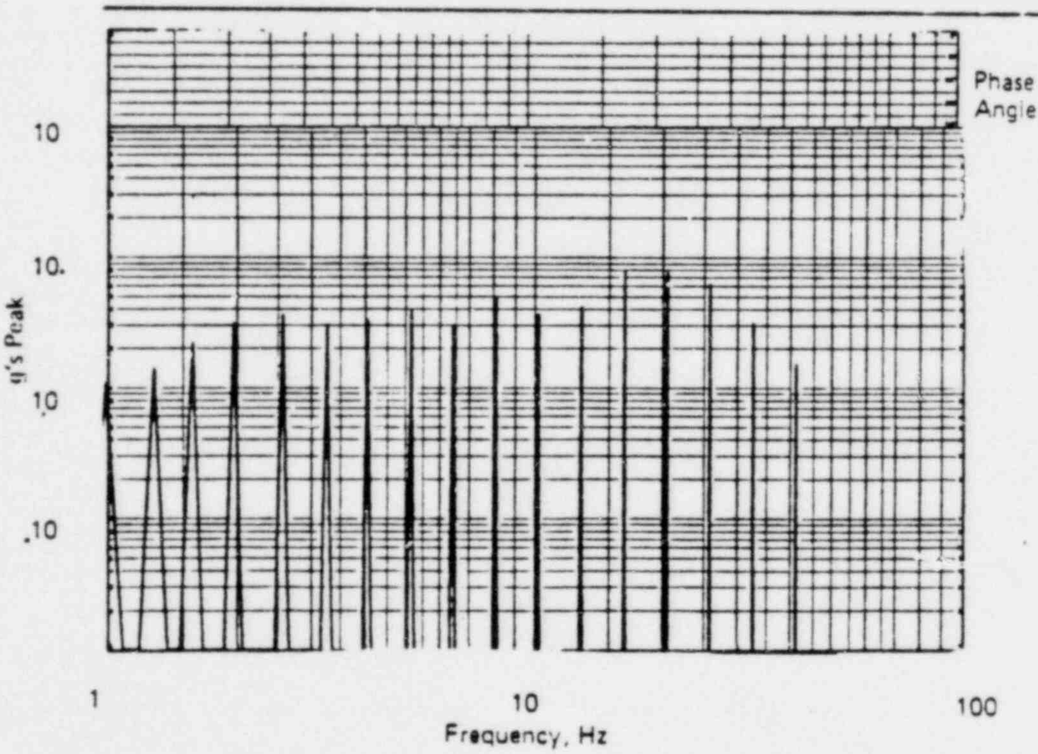

Figure No. IV.289 Test Run No. 12 Orientation 2 OBE ____ DBE 1

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical

Test Item(s) Turbocharger L.B

01598 0371

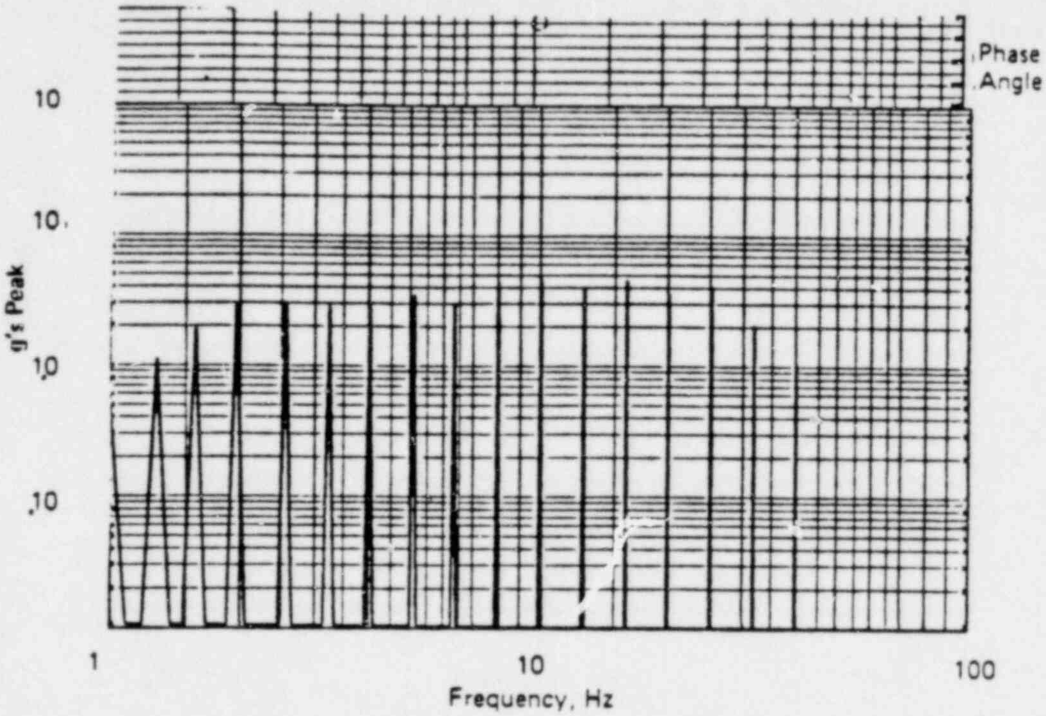

Figure No. IV.292 Test Run No. 14 Orientation 3 OBE 1 DBE ____
Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical
Test Item(s) Turbocharger L.B.

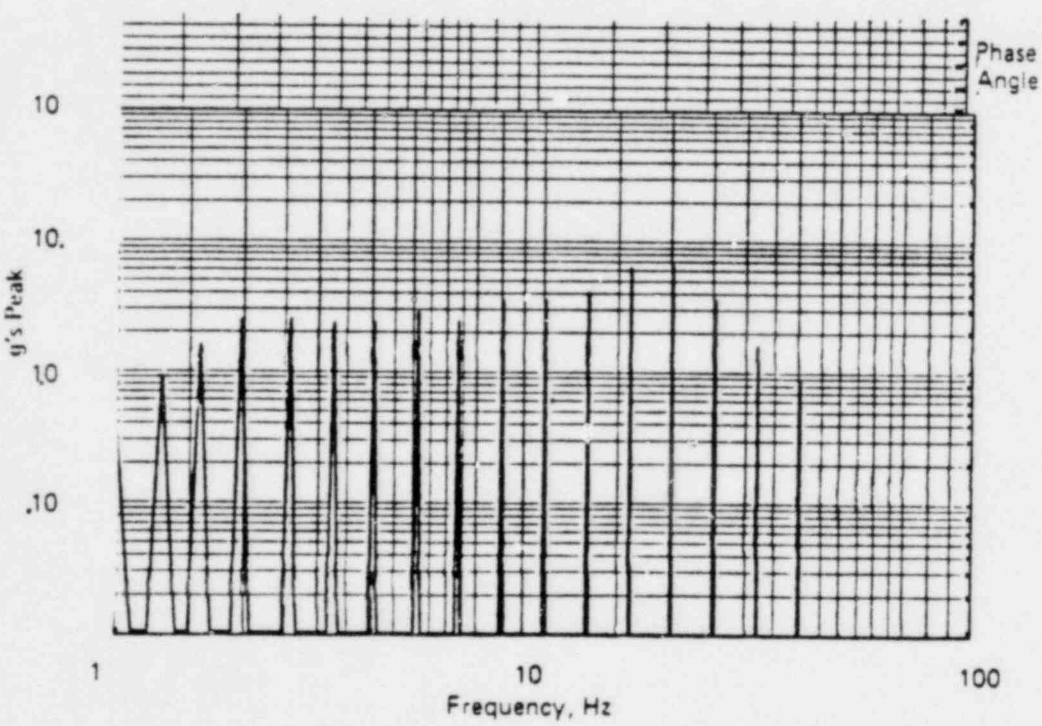

Figure No. IV.293 Test Run No. 14 Orientation 3 OBE 1 DBE ____
Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical
Test Item(s) Turbocharger L.B.

01598 0373

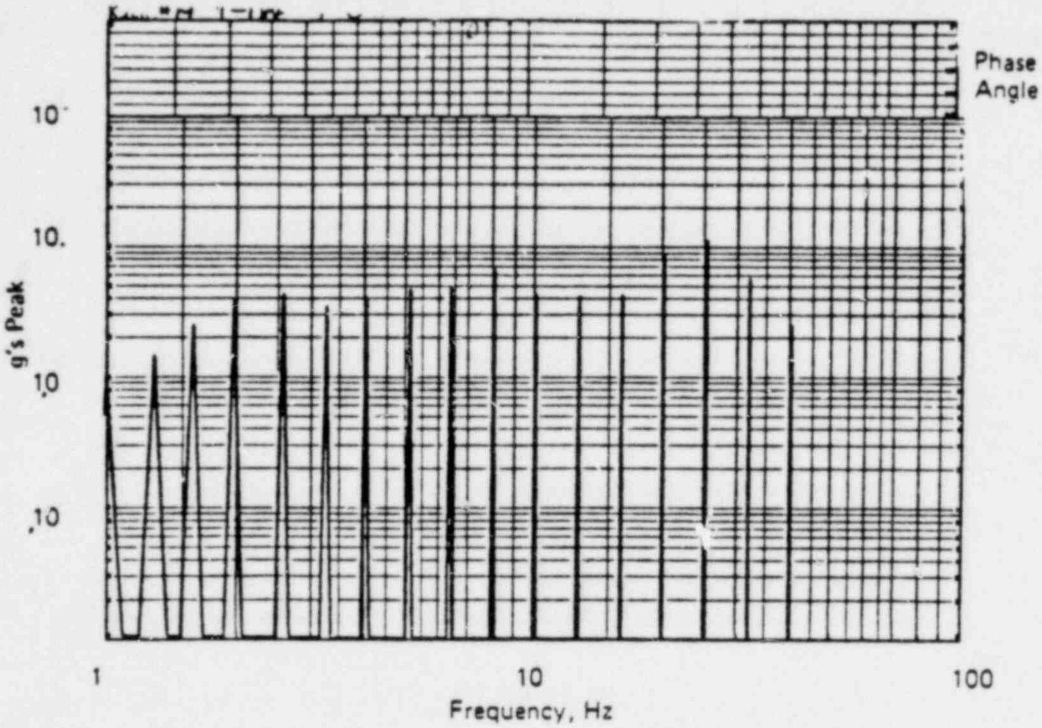

Figure No. IV.302 Test Run No. 19 Orientation 3 OBE ____ DBE 1

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Turbocharger L.B

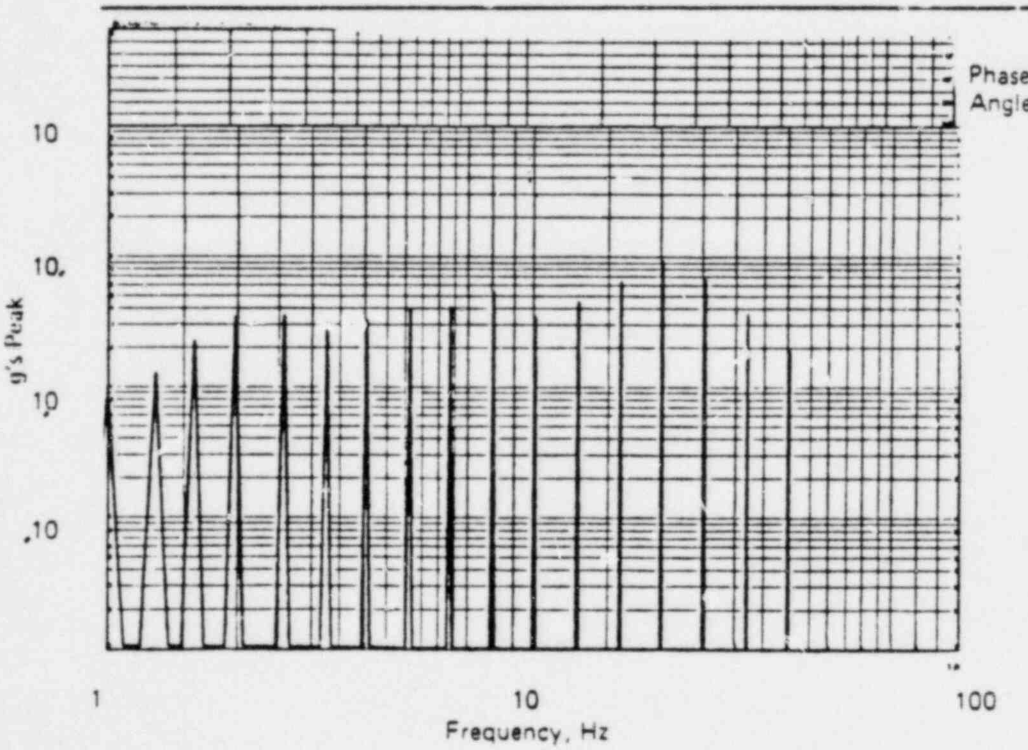

Figure No. IV.303 Test Run No. 19 Orientation 3 OBE ____ DBE 1

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Turbocharger L.B

0 1 5 9 8 0 3 7 8

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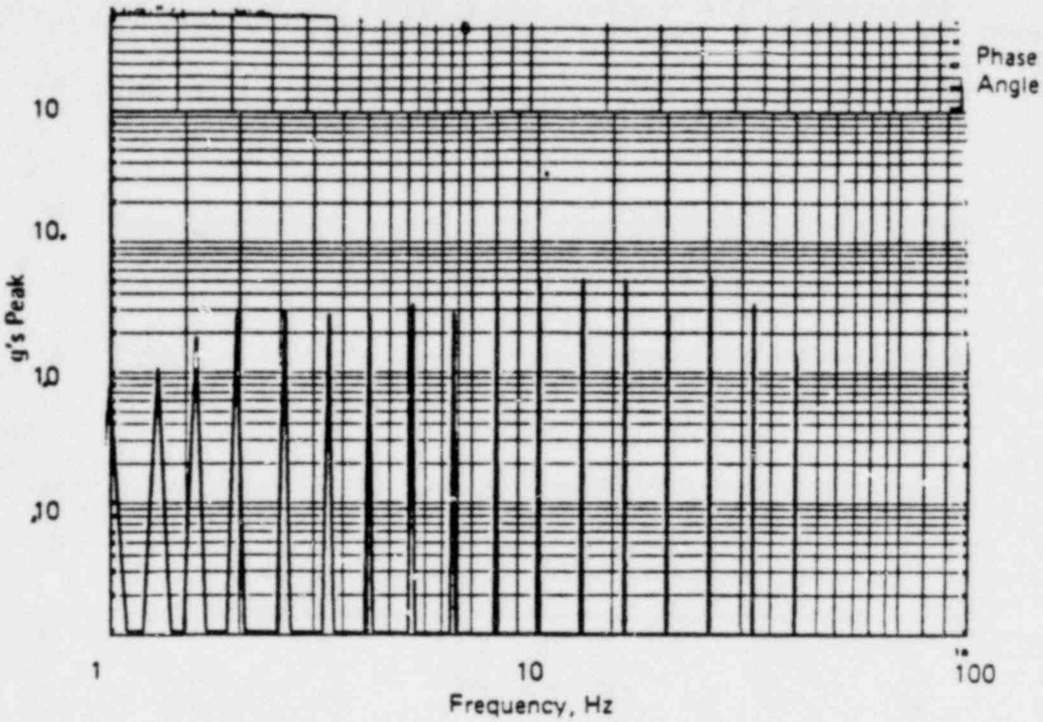

Figure No. IV.306 Test Run No. 21 Orientation 4 OBE 1 DBE ____

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical

Test Item(s) Turbocharger L.B.

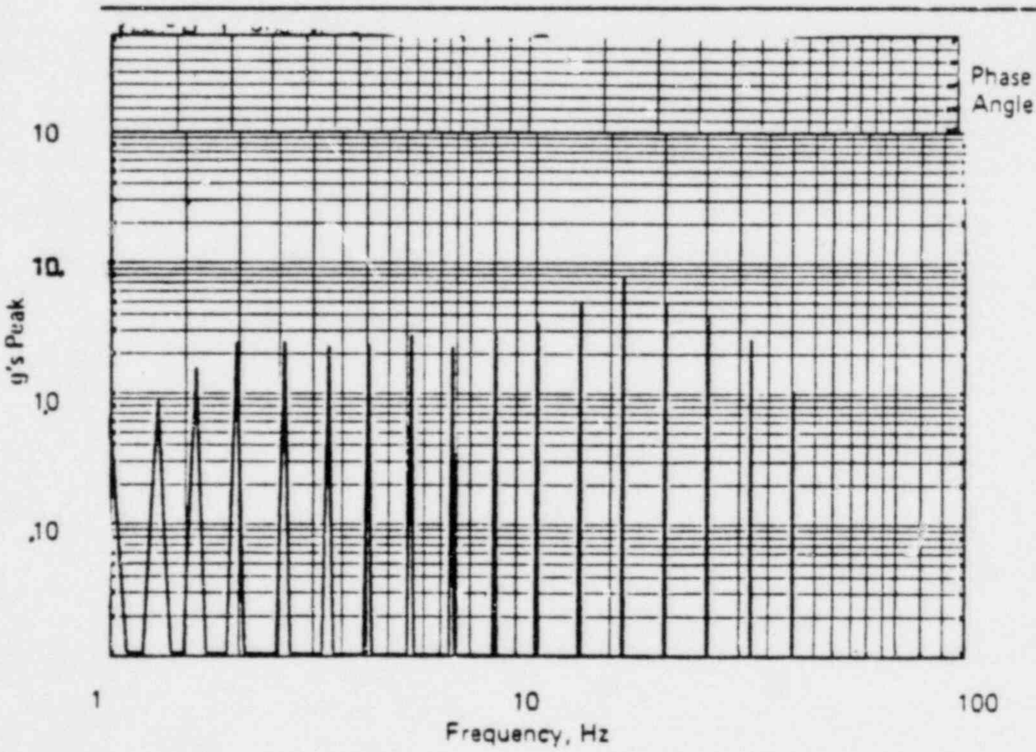

Figure No. IV.307 Test Run No. 21 Orientation 4 OBE 1 DBE ____

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical

Test Item(s) Turbocharger L.B.

01598 0380

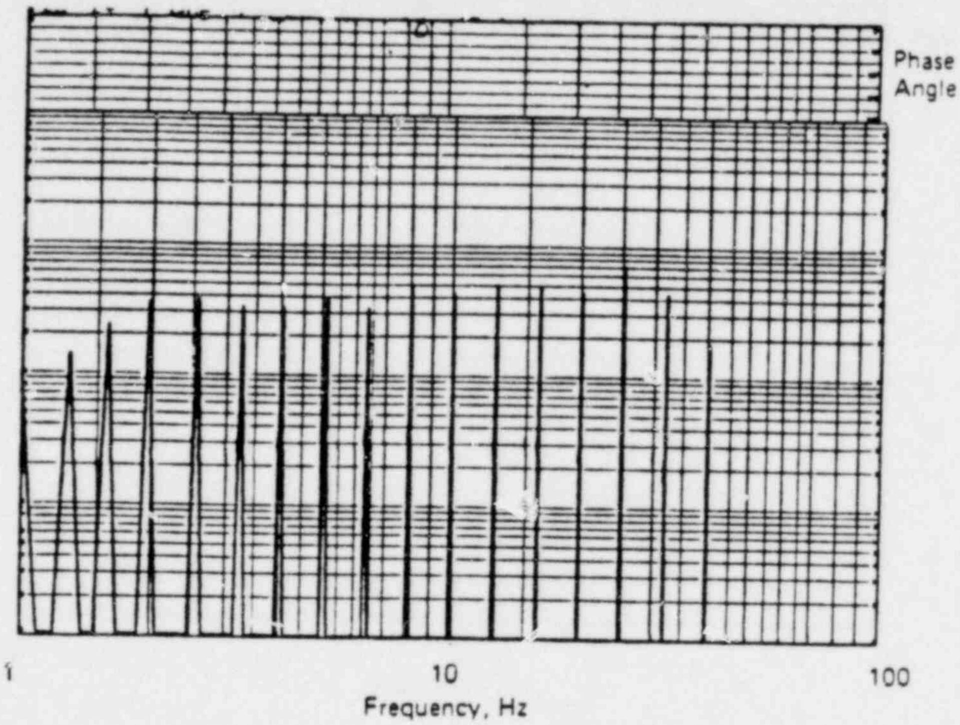

Figure No. IV.316 Test Run No. 26 Orientation 4 OBE ____ DBE 1

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical

Test Item(s) Turbocharger L.B

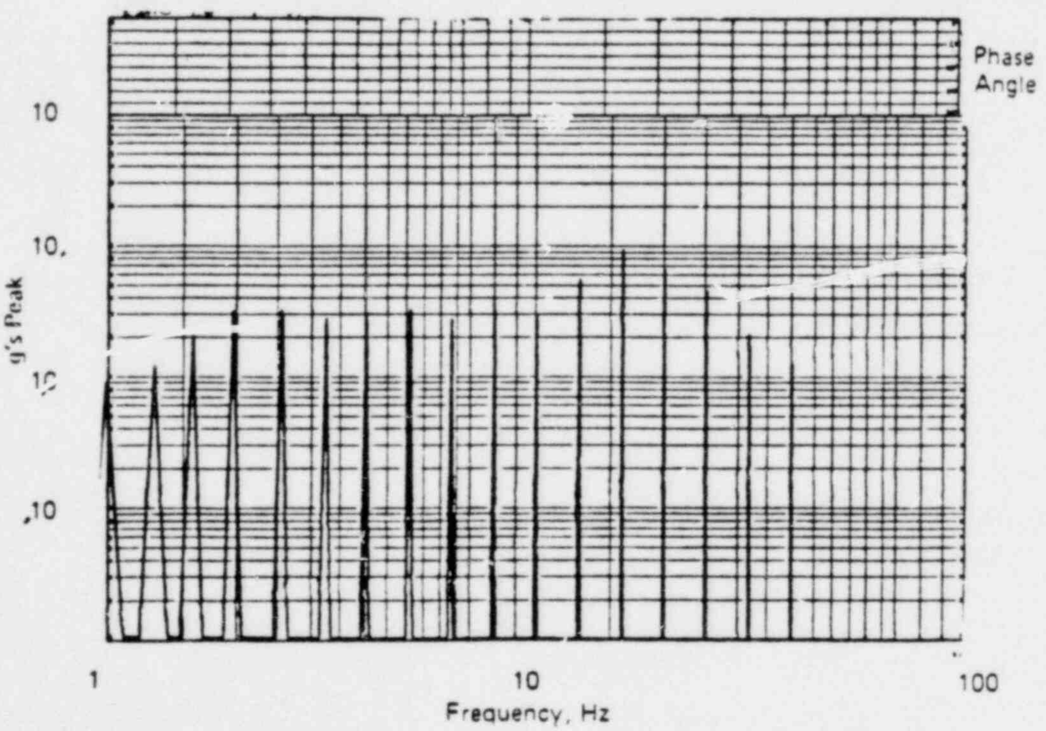

Figure No. IV.317 Test Run No. 26 Orientation 4 OBE ____ DBE 1

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical

Test Item(s) Turbocharger L.B.

0 1 5 9 8 - 0 3 8 5

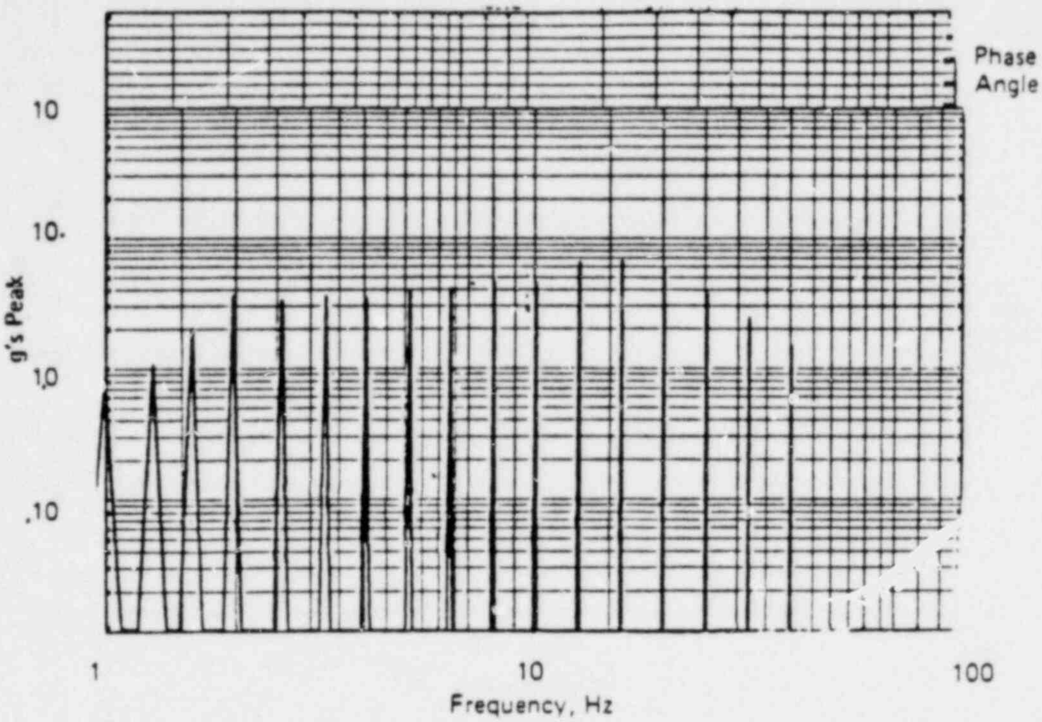

Figure No. IV.382 Test Run No. 1 Orientation 1 OBE 1 DBE ____

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical

Test Item(s) Motor Driven B+A Lube Oil Pump

Engine Driven Jacket Water Pump FIG IV382 Thru IV.433

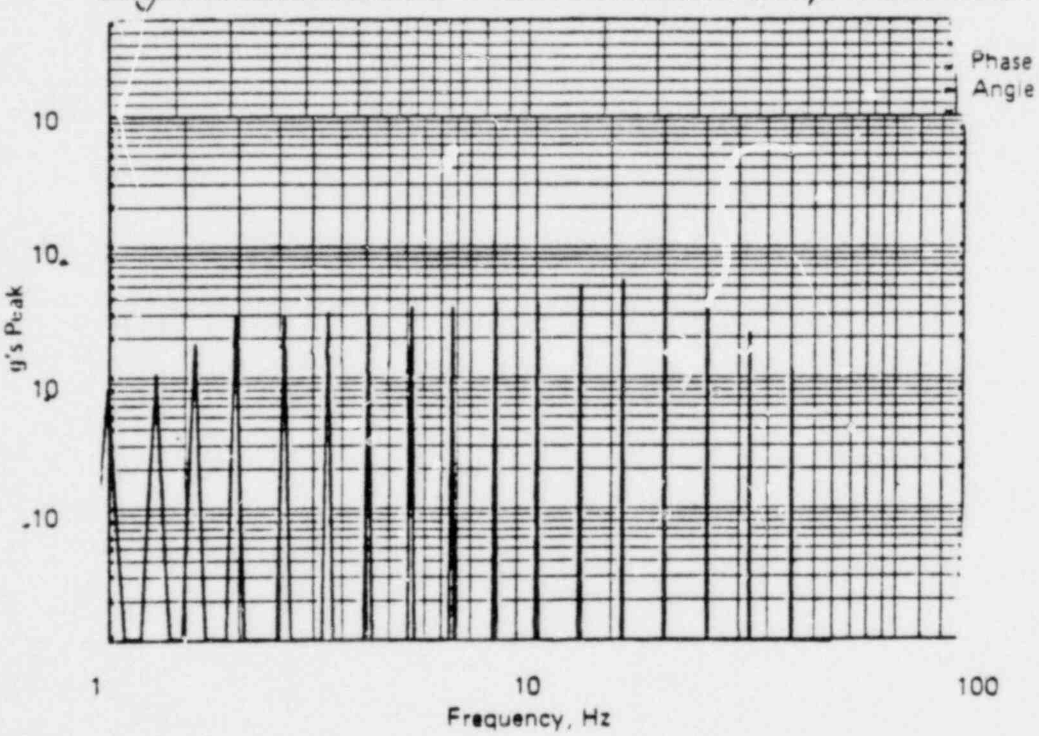

Figure No. IV.383 Test Run No. 1 Orientation 1 OBE 1 DBE ____

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical

Test Item(s) Motor Driven B+A Lube Oil Pump

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01598 0433

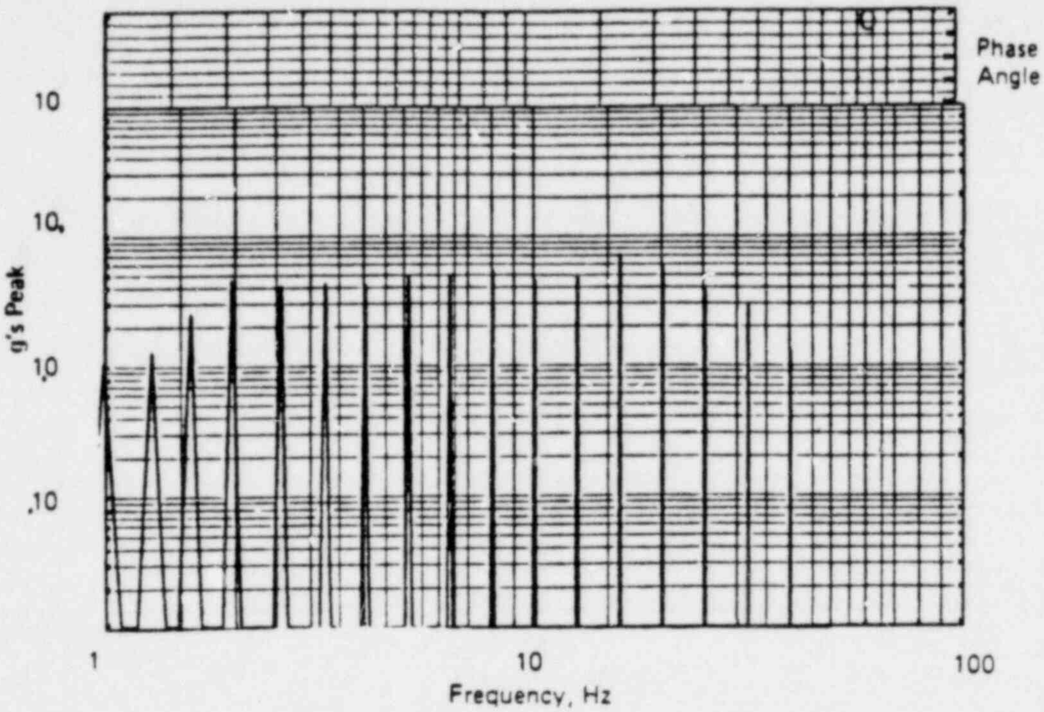

Figure No. IV.392 Test Run No. 6 Orientation 1 OBE ____ DBE 1

Transmissibility ____ or TRS ____ % Damping ____ Direction Horizontal Vertical

Test Item(s) Motor Driven B + A Lube Oil Pump

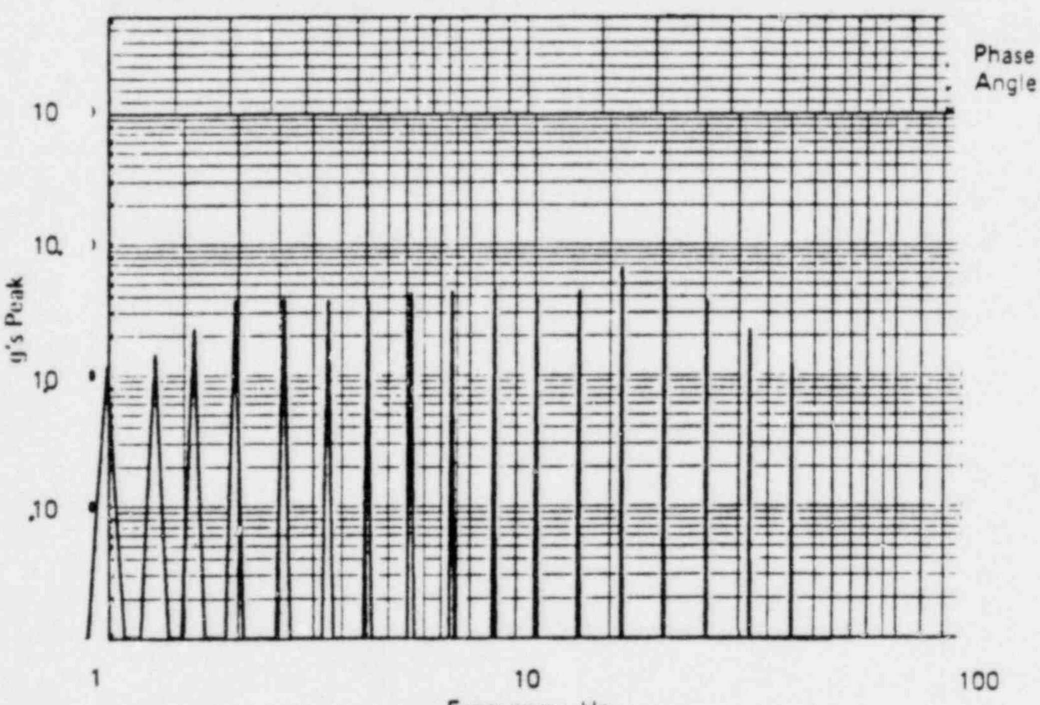

Figure No. IV.393 Test Run No. 6 Orientation 1 OBE ____ DBE 1

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical

Test Item(s) Motor Driven B + A Lube Oil Pump

01598 0439

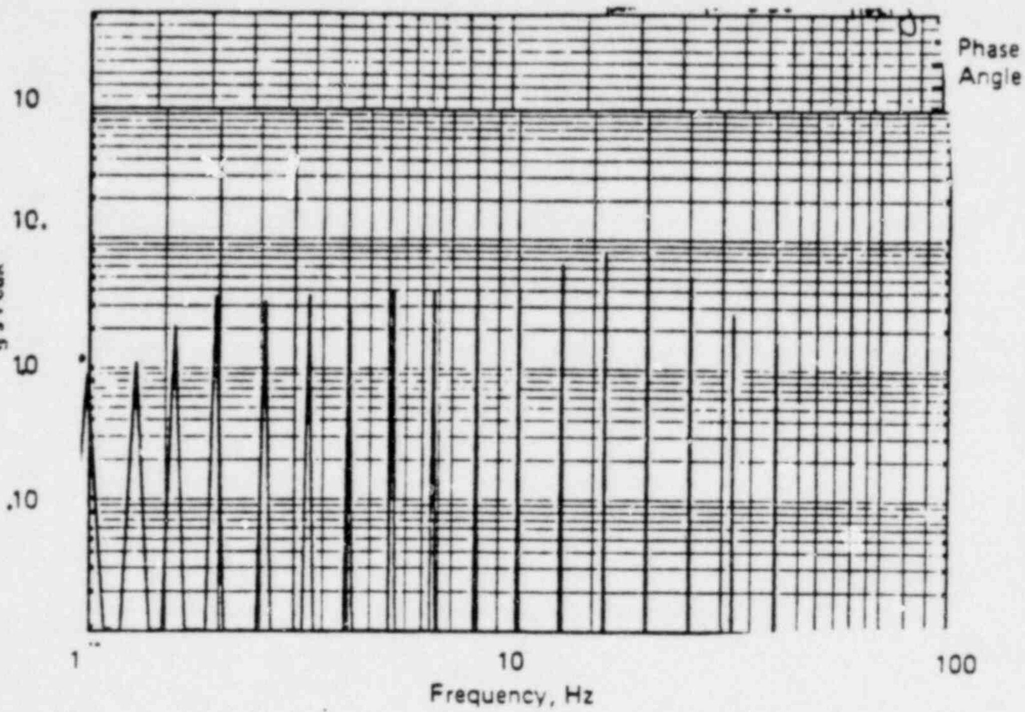

Figure No. IV.346 Test Run No. 8 Orientation 2 OBE 1 DBE ____
Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical
Test Item(s) Motor Driven B+A Lube Oil Pump

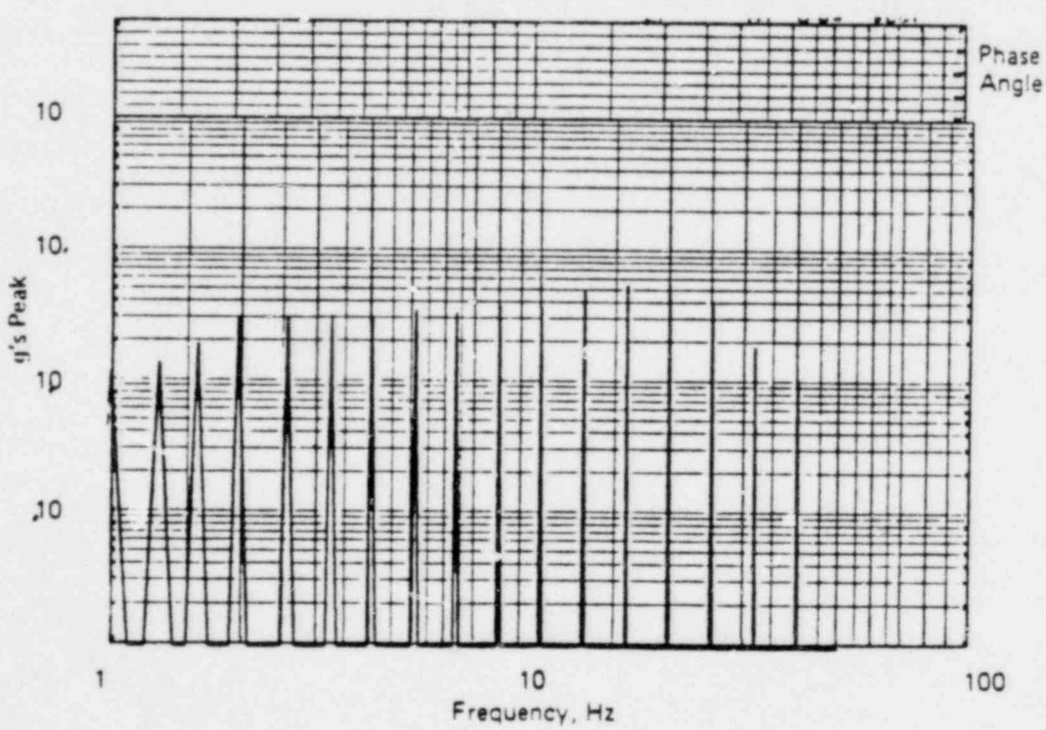

Figure No. IV.347 Test Run No. 8 Orientation 2 OBE 1 DBE ____
Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical
Test Item(s) Motor Driven B+A Lube Oil Pump

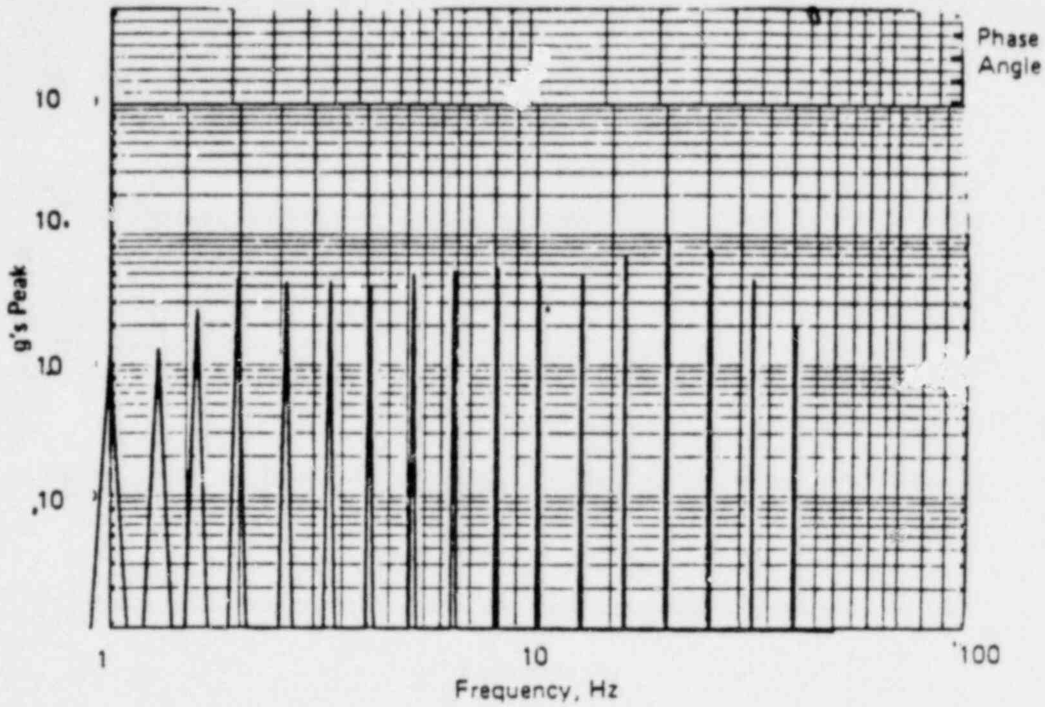

Figure No. IV.406 Test Run No. 13 Orientation 2 OBE ___ DBE 1

Transmissibility ___ or TRS √ % Damping 3 Direction Horizontal Vertical

Test Item(s) Motor Driven B+A Lube Oil Pump

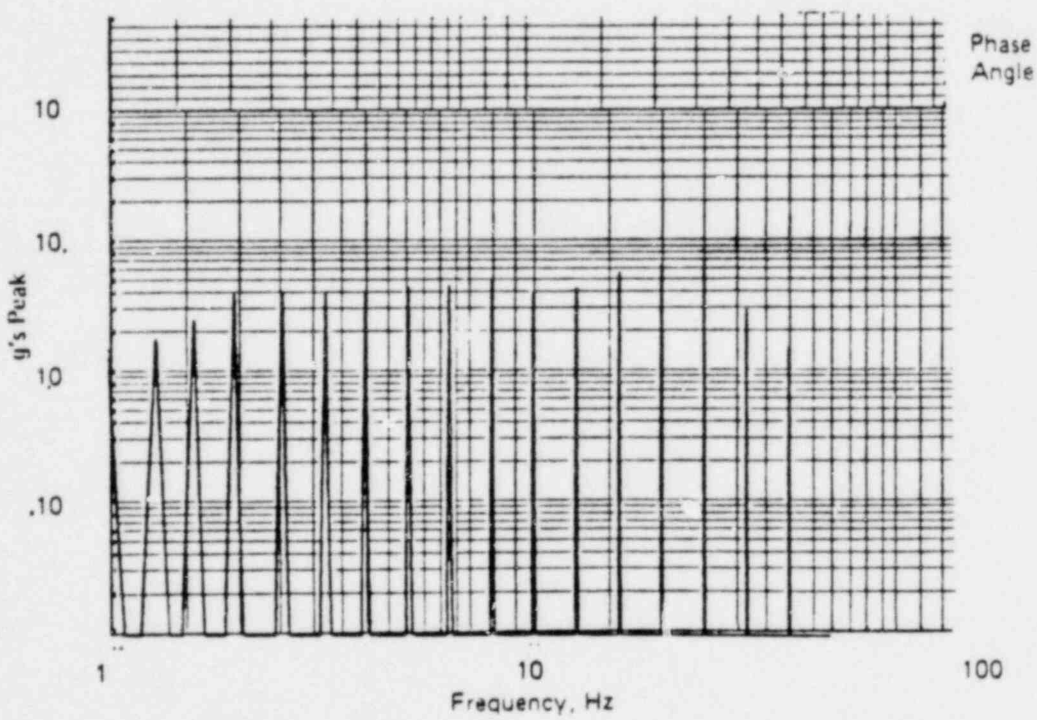

Figure No. IV.407 Test Run No. 13 Orientation 2 OBE ___ DBE 1

Transmissibility ___ or TRS √ % Damping 3 Direction Horizontal Vertical

Test Item(s) Motor Driven B+A Lube Oil Pump

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0 1 5 9 8 0 4 4 6

01598 0448

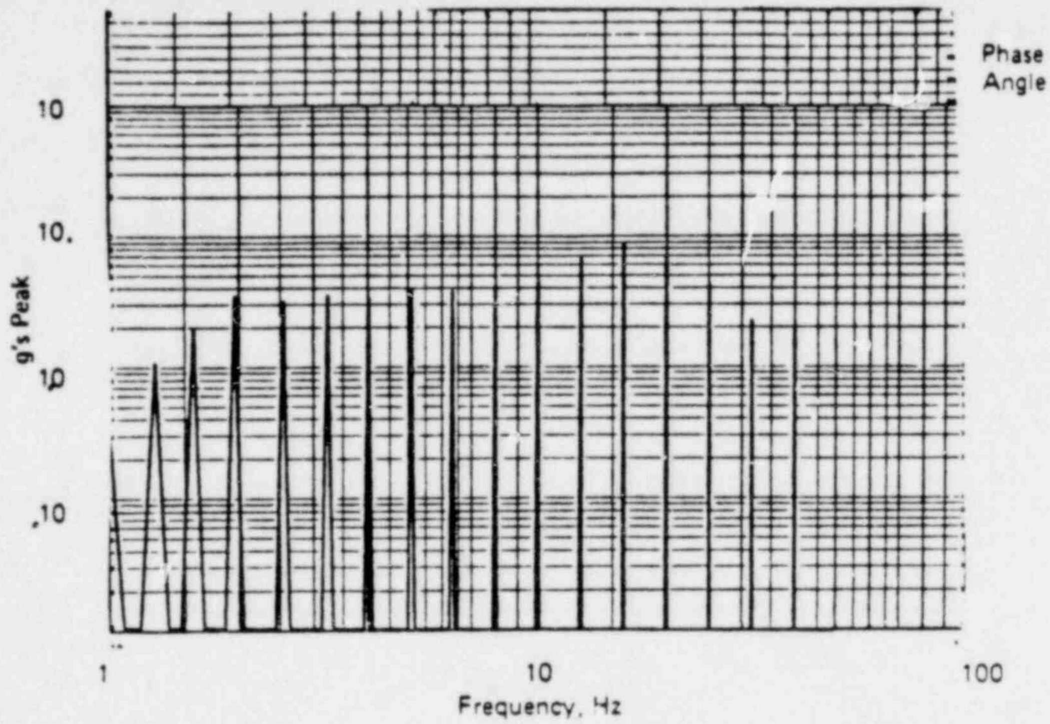

Figure No. IV.410 Test Run No. 15 Orientation 3 OBE 1 DBE ____

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical

Test Item(s) Motor Driven B+A Lube Oil Pump

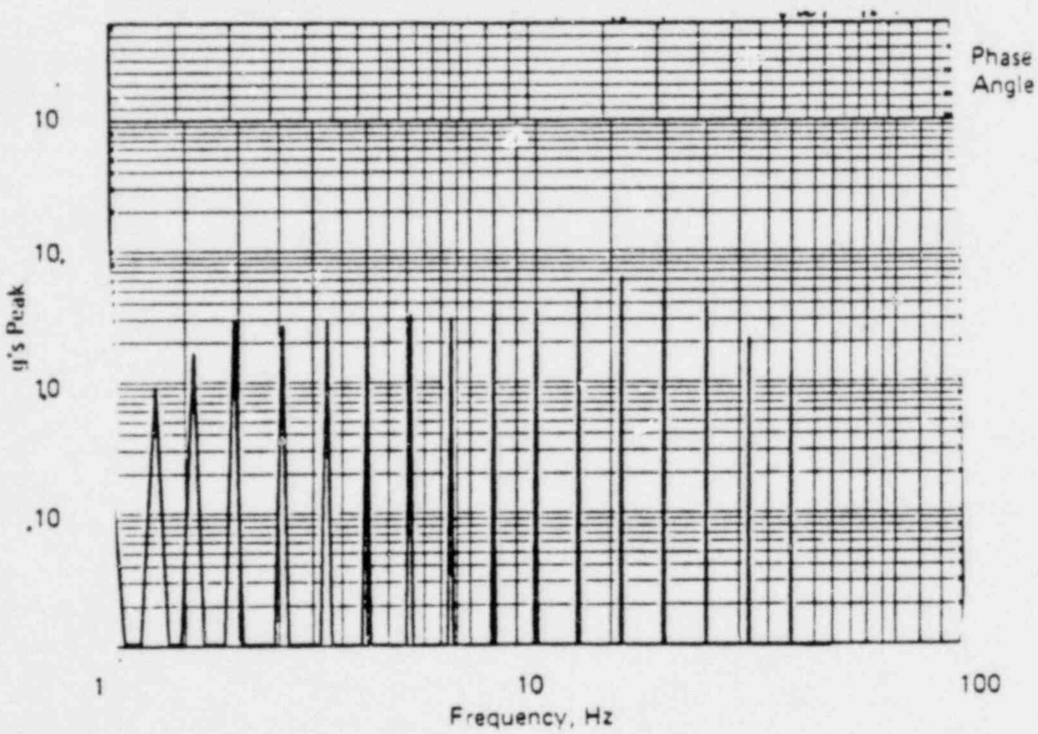

Figure No. IV.411 Test Run No. 15 Orientation 3 OBE 1 DBE ____

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical

Test Item(s) Motor Driven B+A Lube Oil Pump

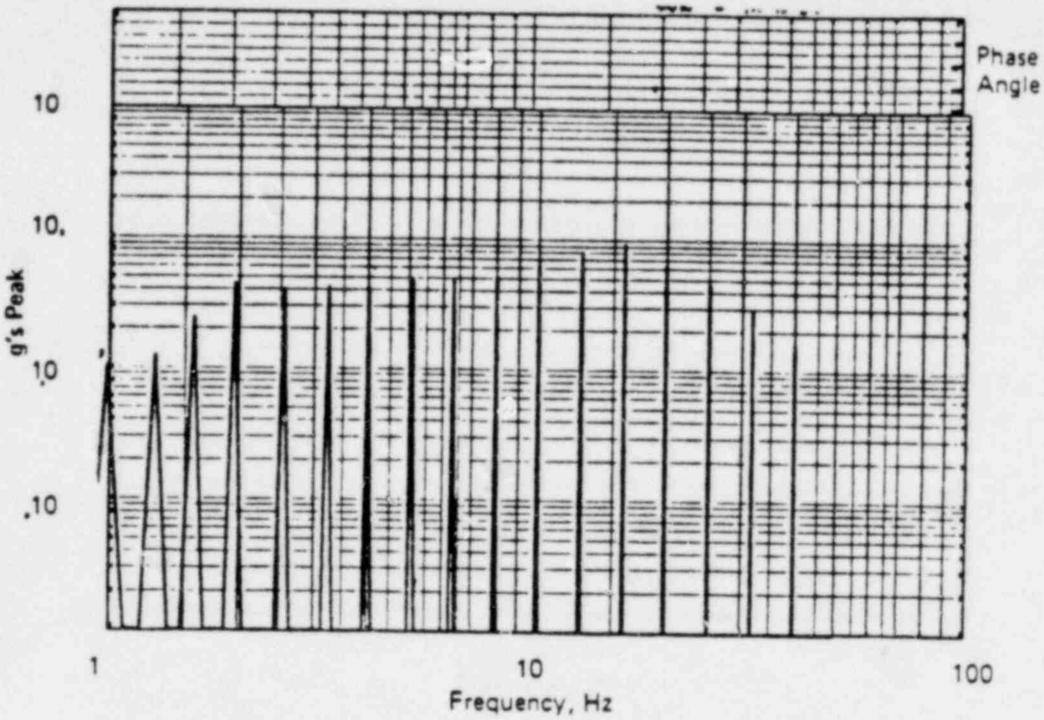

Figure No. IV.420 Test Run No. 20 Orientation 3 OBE ____ DBE 1

Transmissibility ____ or TRS √ % Damping 3 Direction (Horizontal) Vertical

Test Item(s) Motor Driven B+ Lube Oil Pump

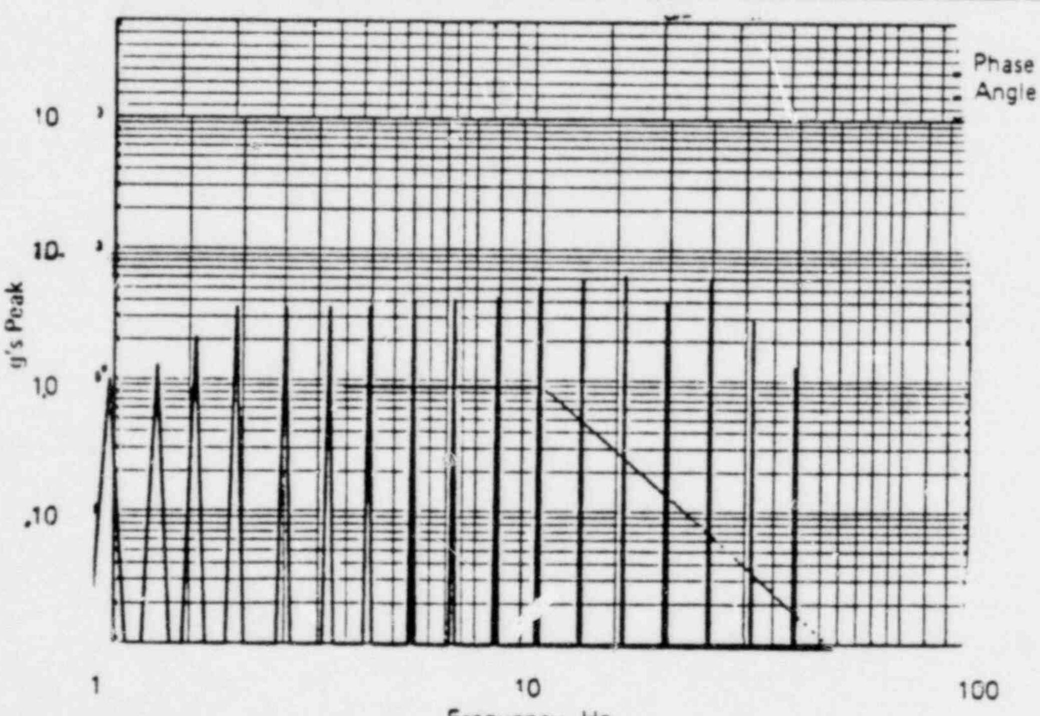

Figure No. IV.421 Test Run No. 20 Orientation 3 OBE ____ DBE 1

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal (Vertical)

Test Item(s) Motor Driven B+A Lube Oil Pump

0 1 5 9 8 0 4 5 3

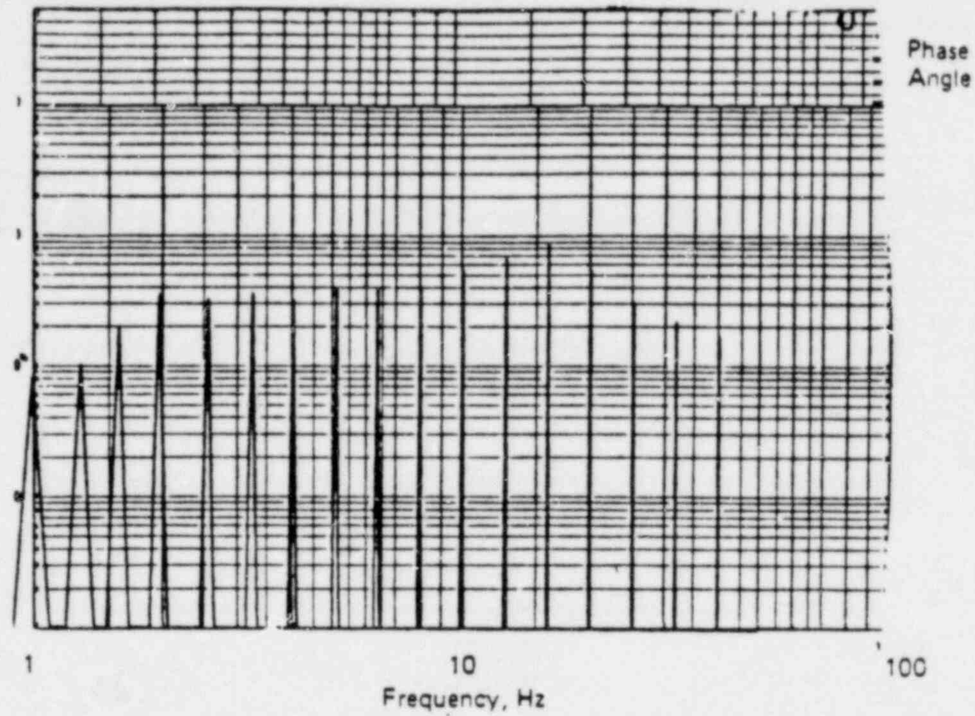

Figure No. IV.422 Test Run No. 21 Orientation 4 OBE 1 DBE ____
Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical
Test Item(s) Motor Driven B+A Lube Oil Pump

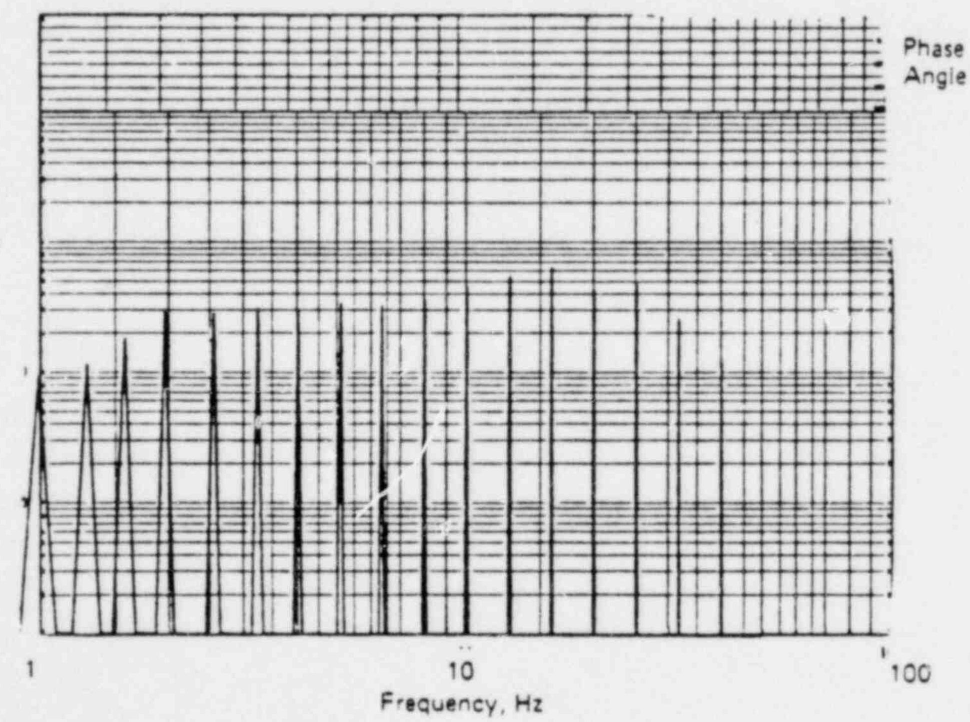

Figure No. IV.423 Test Run No. 21 Orientation 4 OBE 1 DBE ____
Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical
Test Item(s) Motor Driven B+A Lube Oil Pump

0 1 5 9 8 0 4 5 4

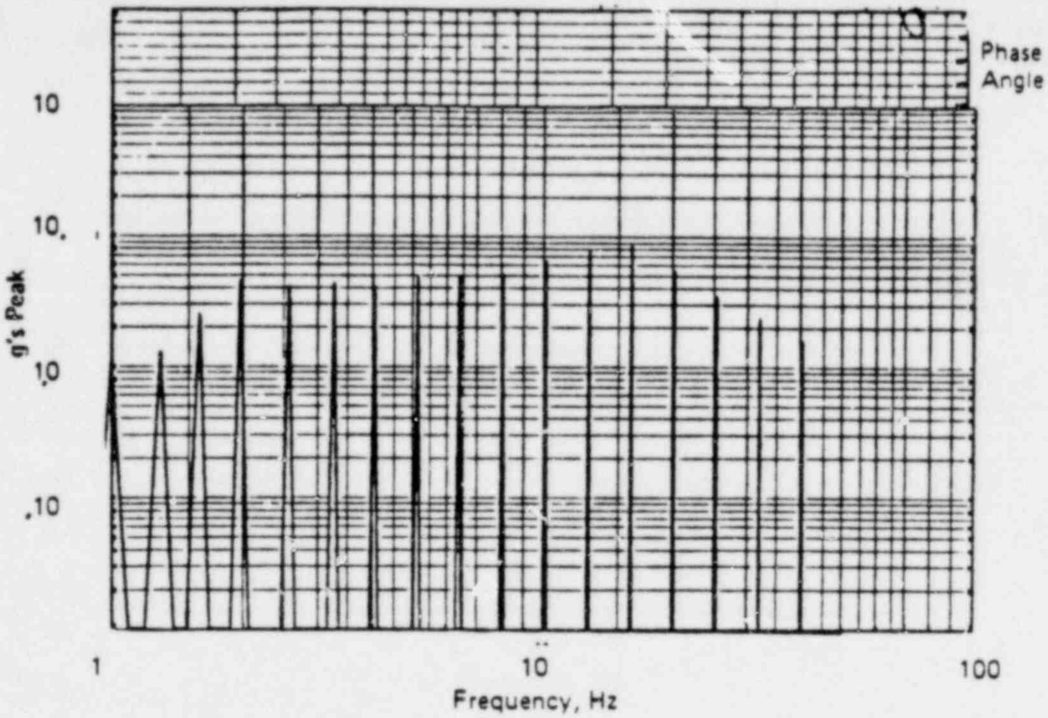

Figure No. IV.432 Test Run No. 26 Orientation 4 OBE ____ DBE 1

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Motor Driven B+A Lube Oil Pump

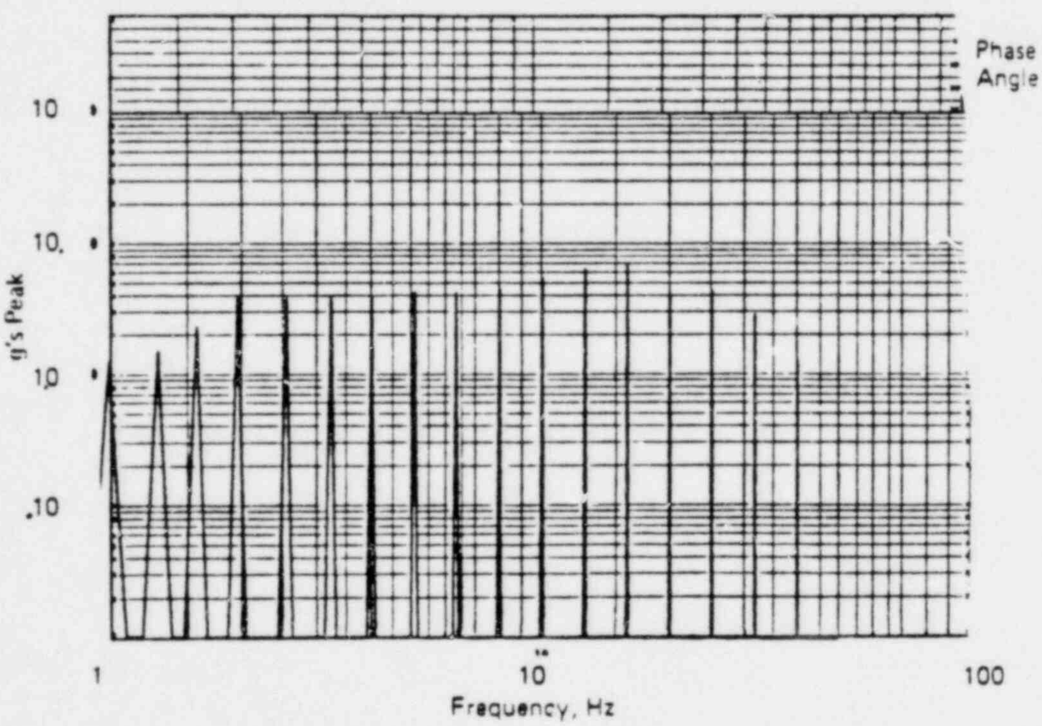

Figure No. IV.433 Test Run No. 26 Orientation 4 OBE ____ DBE 1

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Motor Driven B+A Lube Oil Pump

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0 1 5 9 8 0 4 5 9

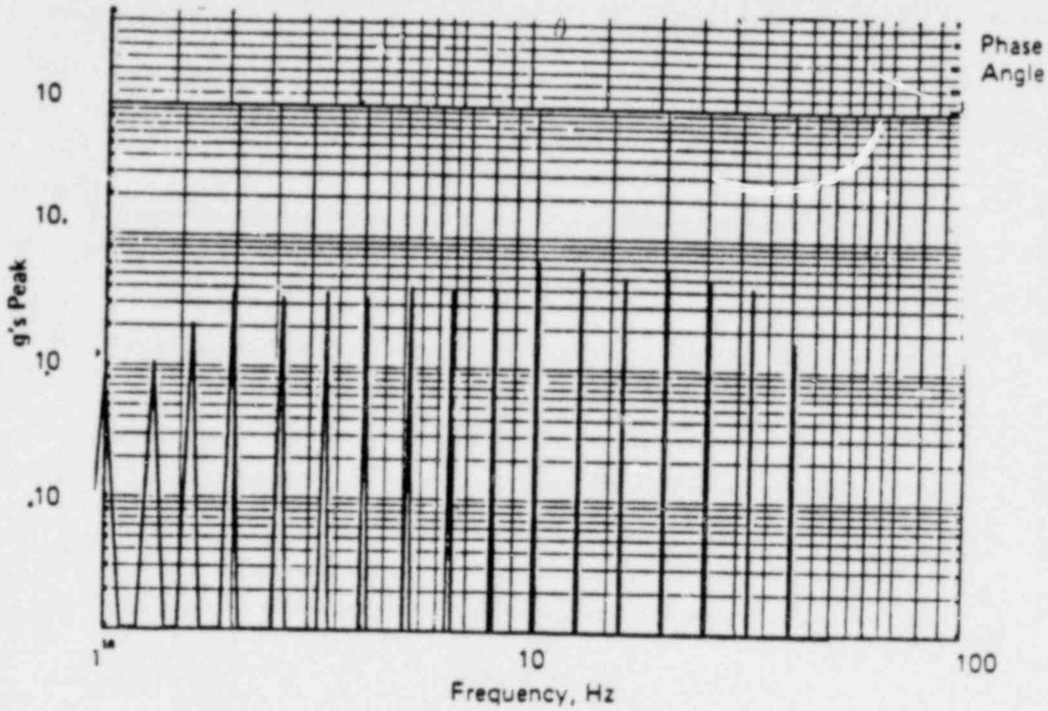

Figure No. IV.470 Test Run No. 1 Orientation 1 OBE 1 DBE ____

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Lube Oil Filter

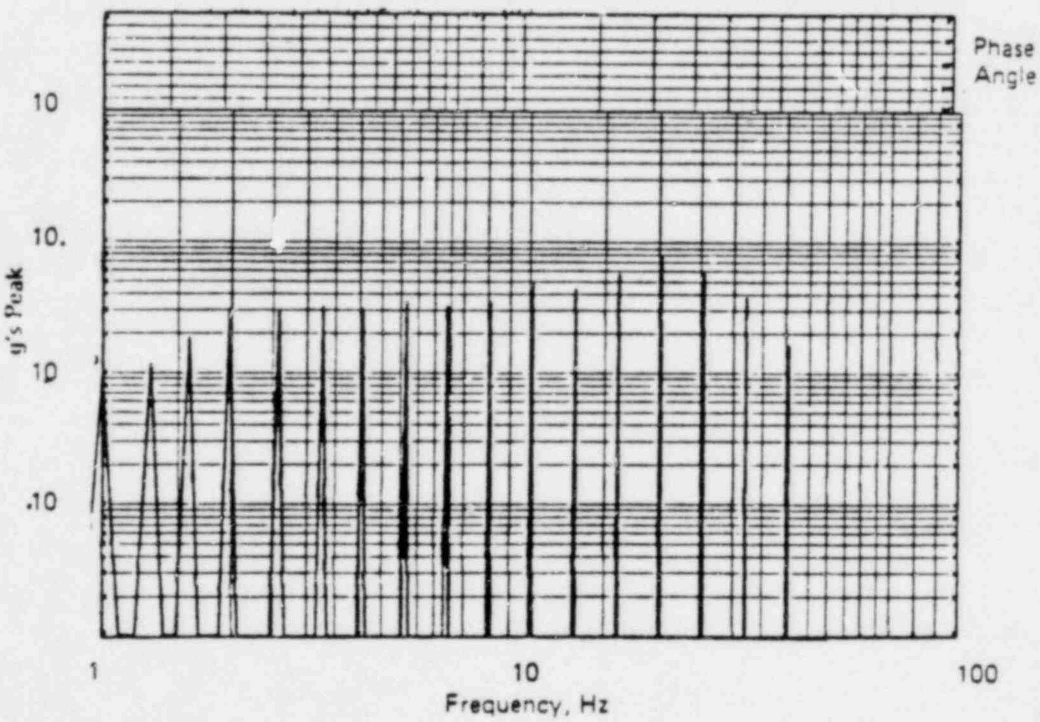

Figure No. IV.471 Test Run No. 1 Orientation 1 OBE 1 DBE ____

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Lube Oil Filter

0 1 5 9 8 0 4 8 6

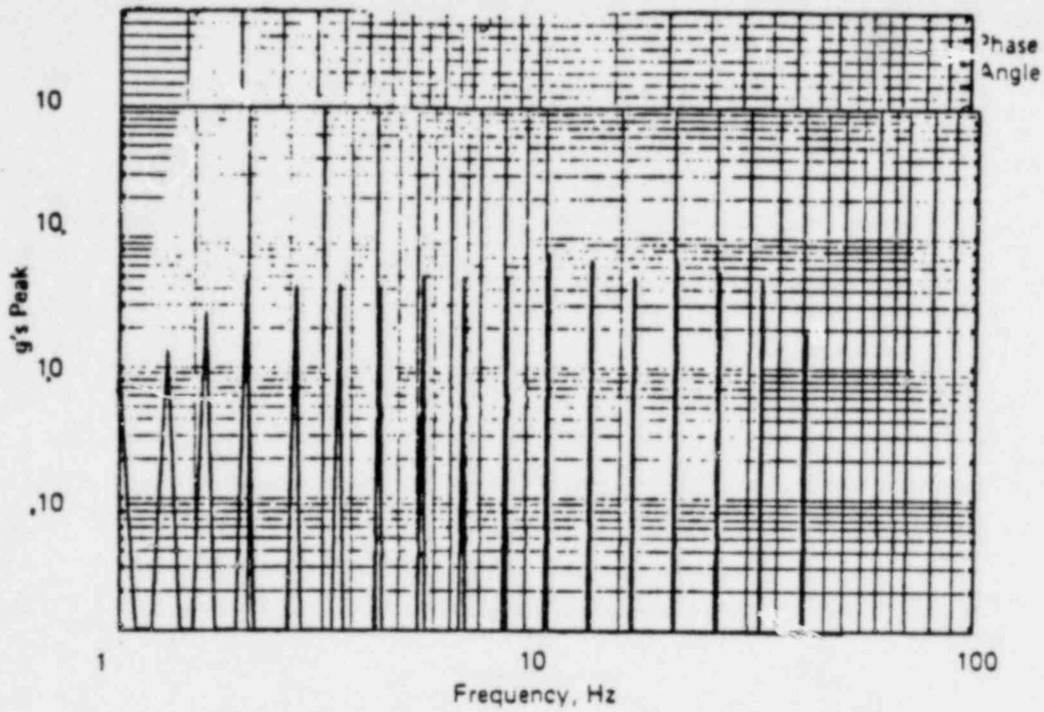

Figure No. IV.480 Test Run No. 6 Orientation 1 OBE ____ DBE 1

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Lube Oil Filter

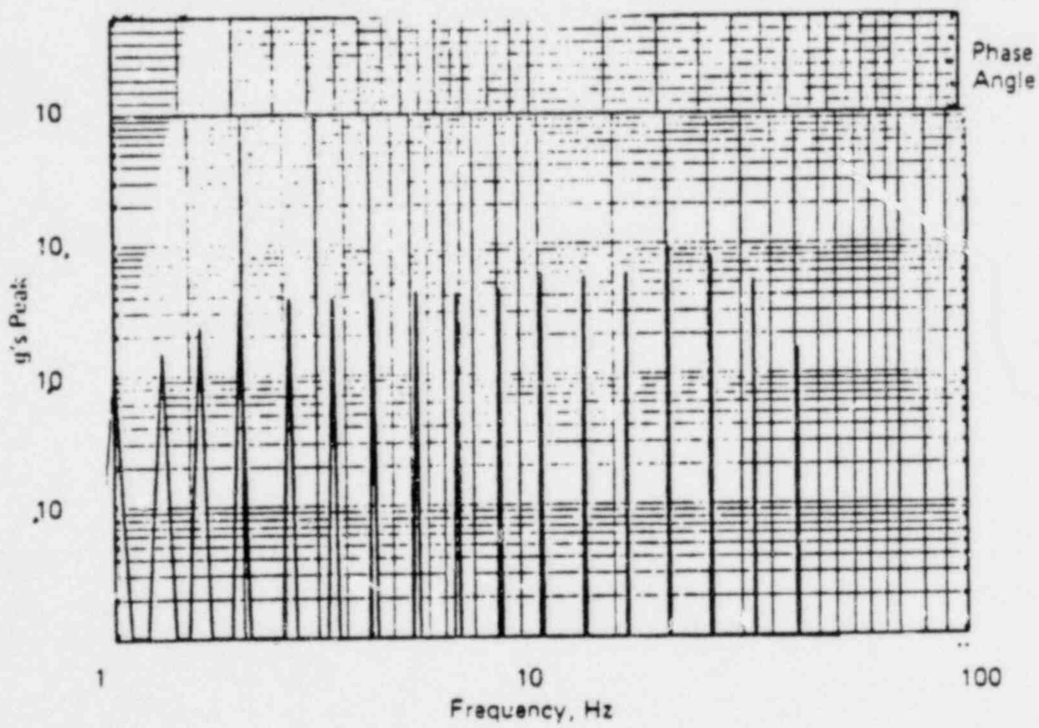

Figure No. IV.481 Test Run No. 6 Orientation 1 OBE ____ DBE 1

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Lube Oil Filter

01598 0491

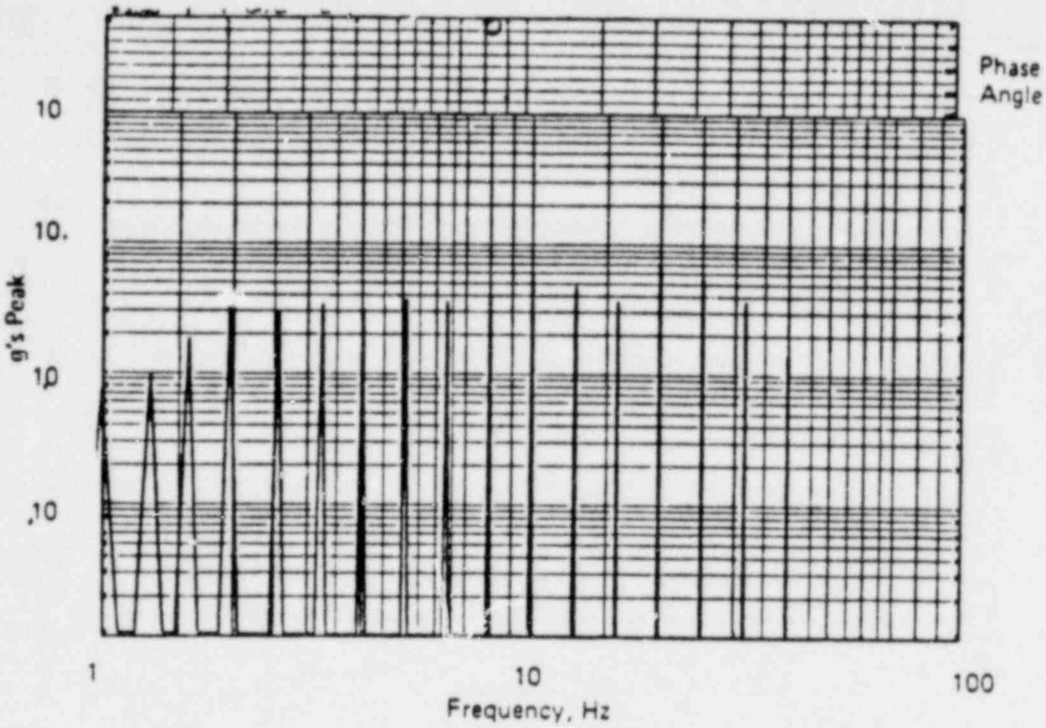

Figure No. IV.482 Test Run No. 7 Orientation 2 OBE 1 DBE ____
Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical
Test Item(s) Lube Oil Filter

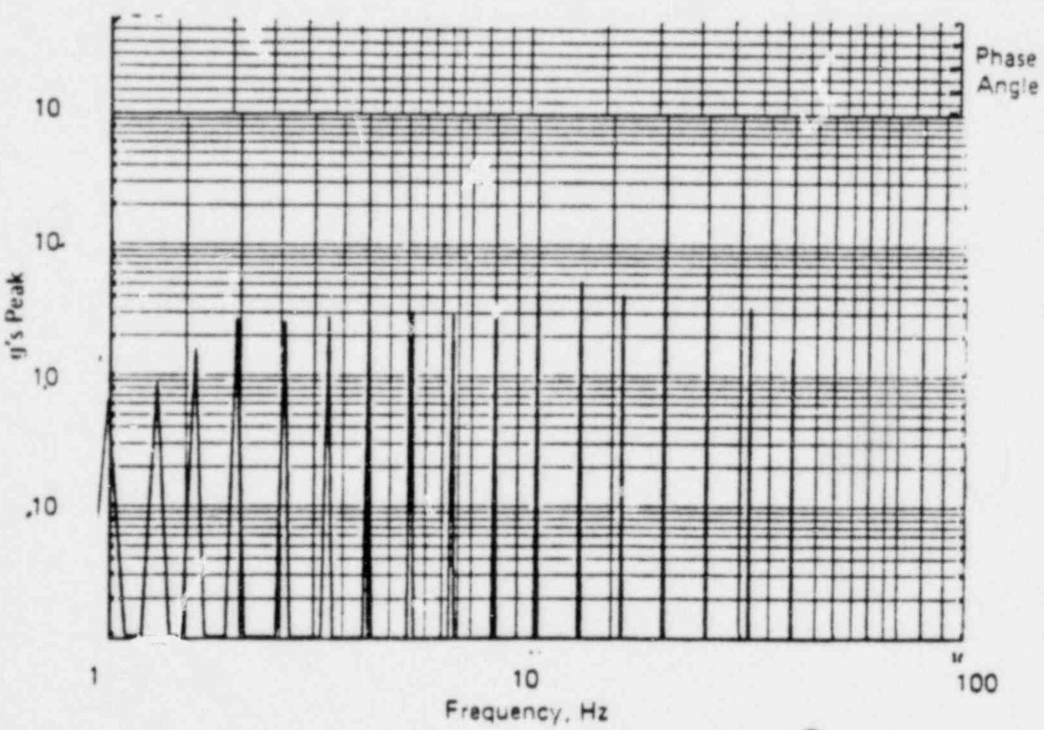

Figure No. IV.483 Test Run No. 7 Orientation 2 OBE 1 DBE ____
Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical
Test Item(s) Lube Oil Filter

01598 0492

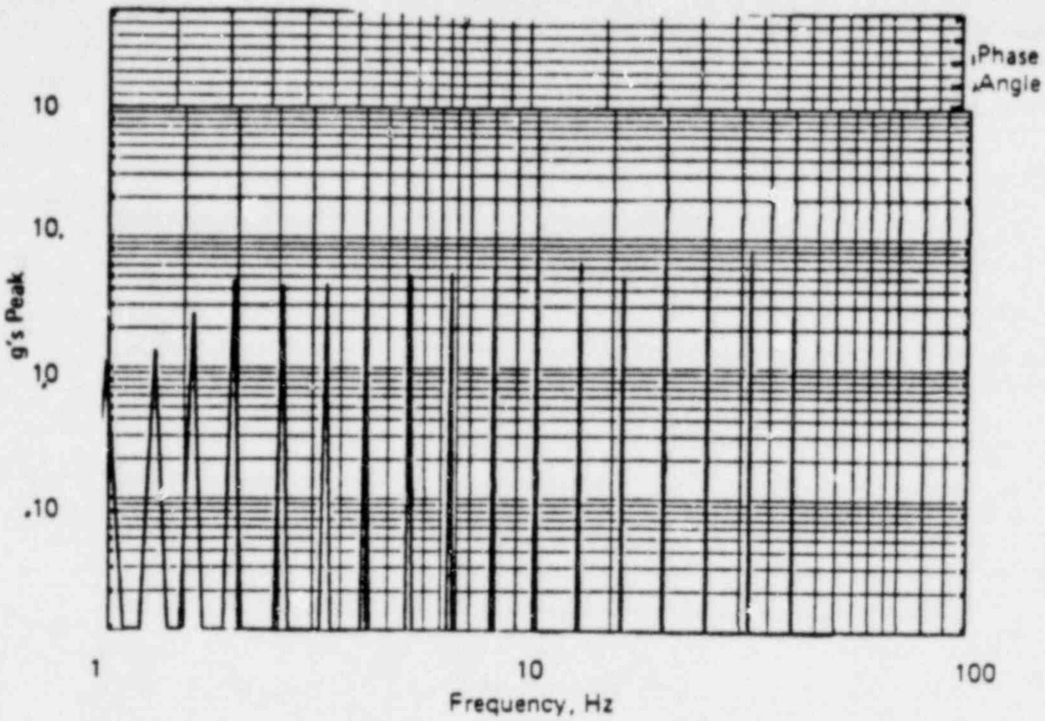

Figure No. IV.492 Test Run No. 12 Orientation 2 OBE ____ DBE 1

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Lube Oil Filter

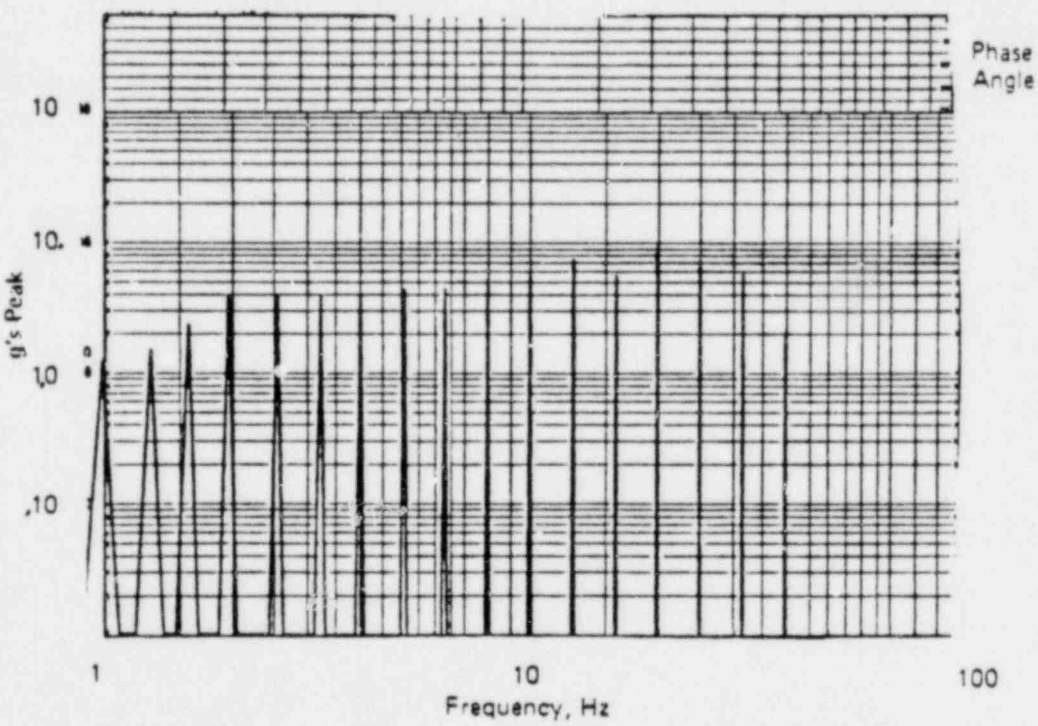

Figure No. IV.493 Test Run No. 12 Orientation 2 OBE ____ DBE 1

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Lube Oil Filter

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01598 0497

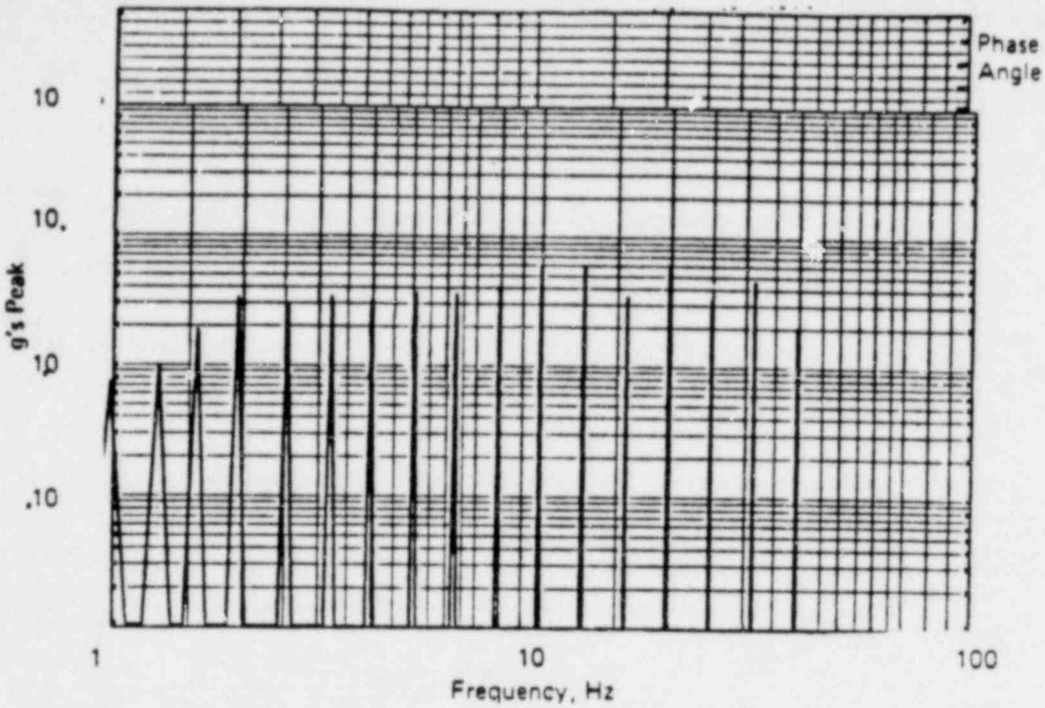

Figure No. IV.494 Test Run No. 13 Orientation 3 OBE 1 DBE ____

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Lube Oil Filter

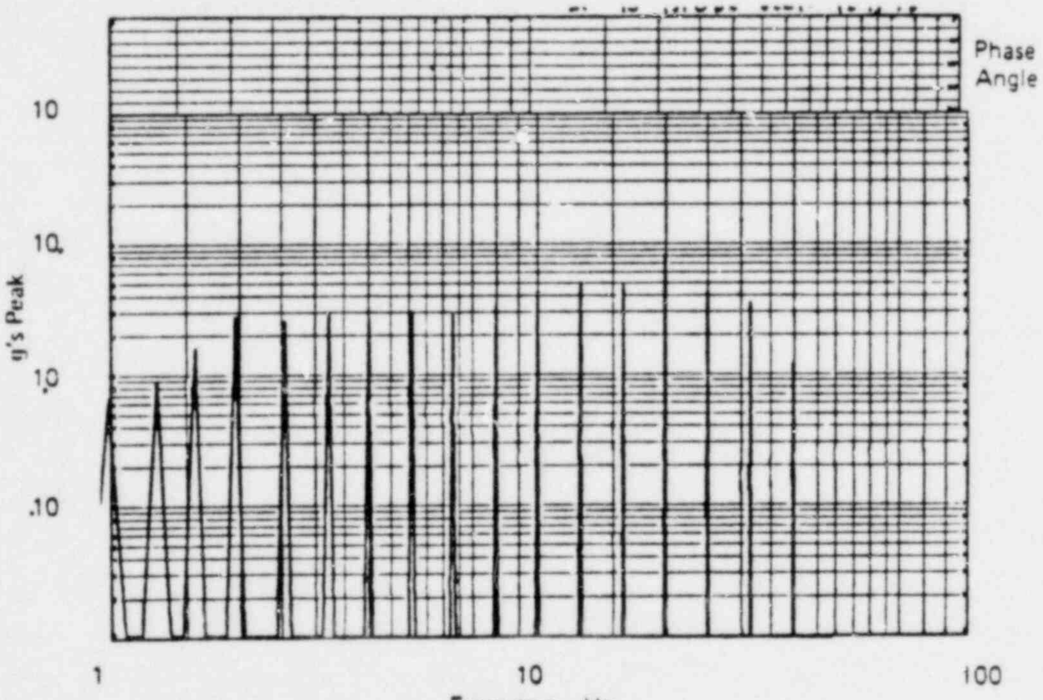

Figure No. IV.495 Test Run No. 13 Orientation 3 OBE 1 DBE ____

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Lube Oil Filter

01598 0498

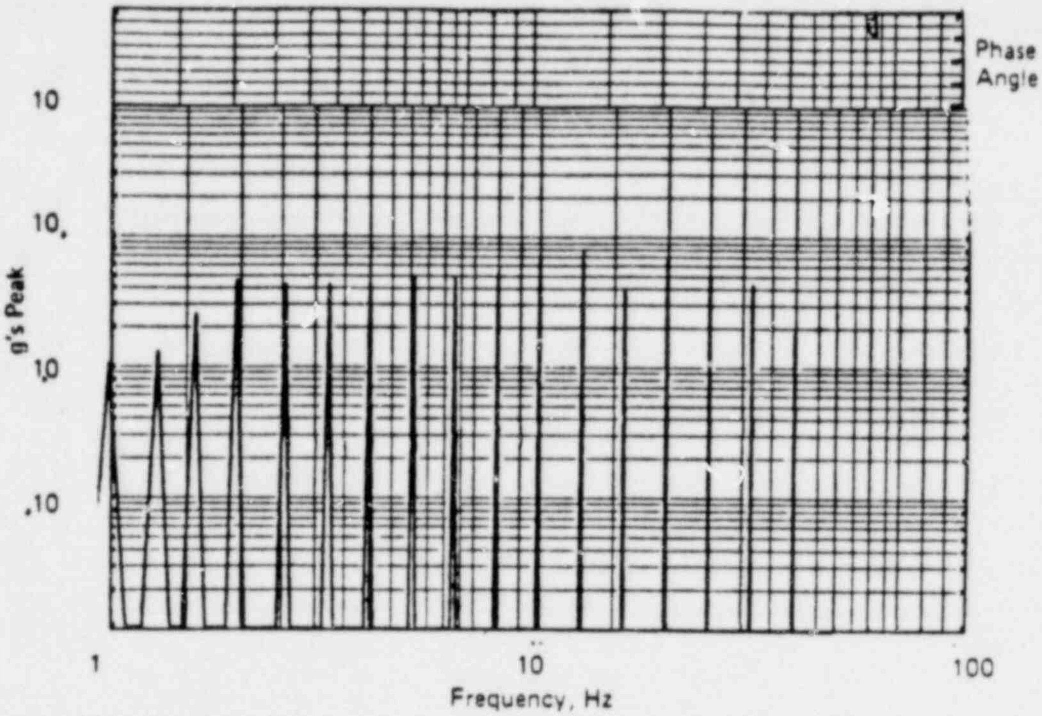

Figure No. IV.504 Test Run No. 18 Orientation 3 OBE ____ DBE 1

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical

Test Item(s) Lube Oil Filter

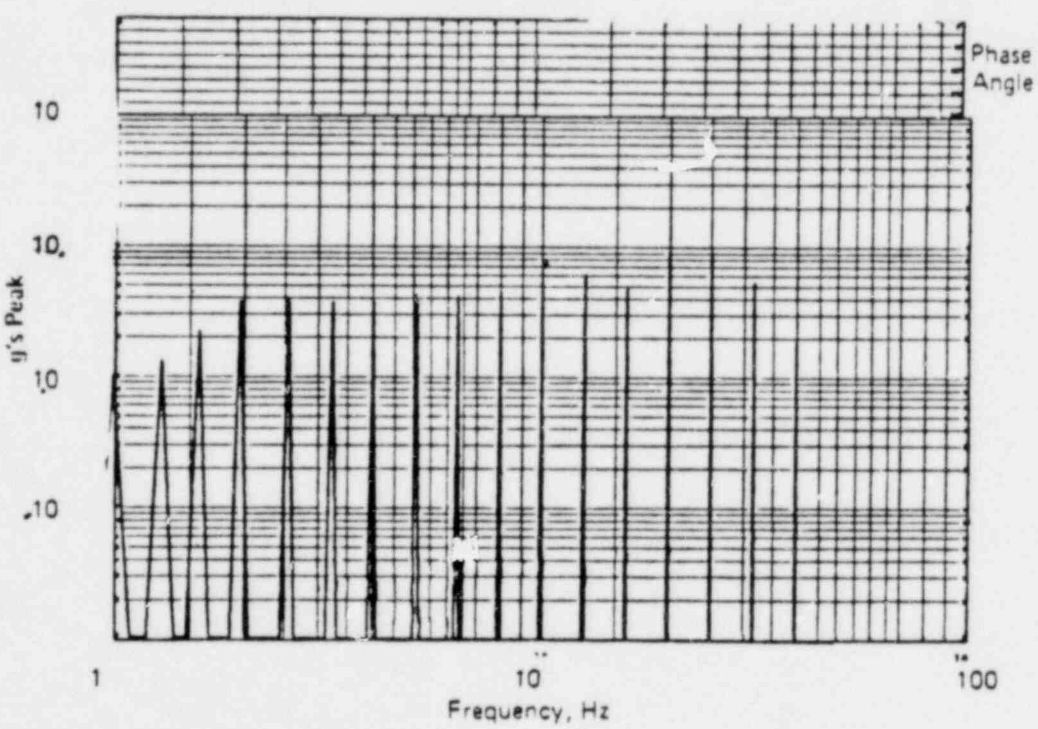

Figure No. IV.505 Test Run No. 18 Orientation 3 OBE ____ DBE 1

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical

Test Item(s) Lube Oil Filter

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0 1 5 9 8 0 5 0 3

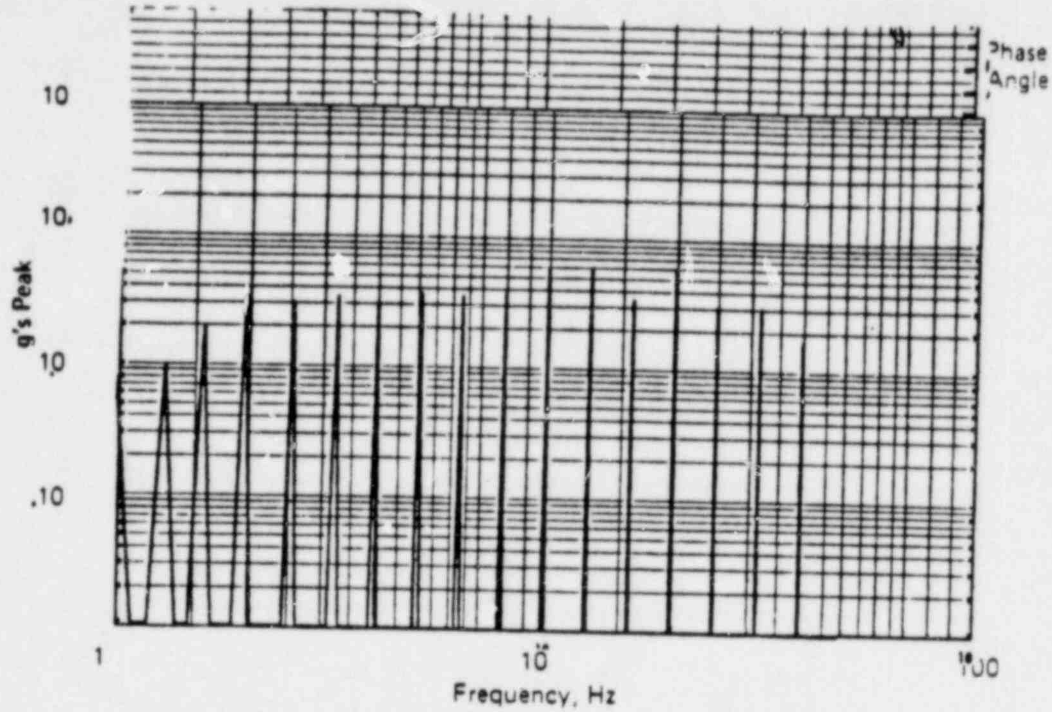

Figure No. IV.506 Test Run No. 19 Orientation 4 OBE 1 DBE ____
Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical
Test Item(s) Lube Oil Filter

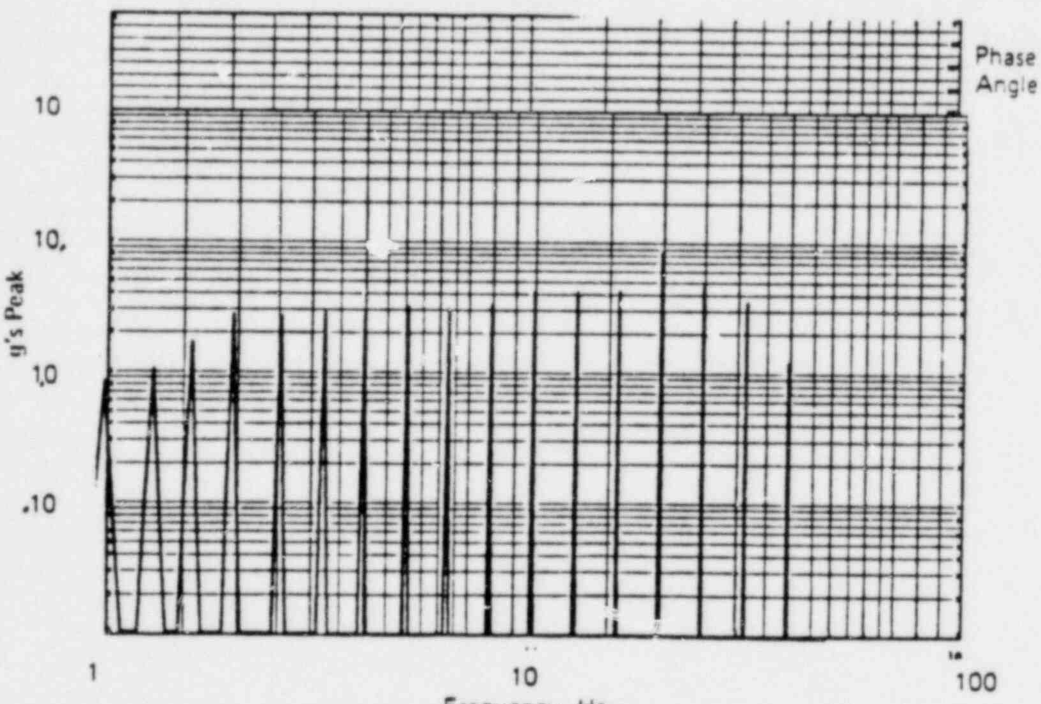

Figure No. IV.507 Test Run No. 19 Orientation 4 OBE 1 DBE ____
Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical
Test Item(s) Lube Oil Filter

0 1 5 9 8 - 0 5 0 4

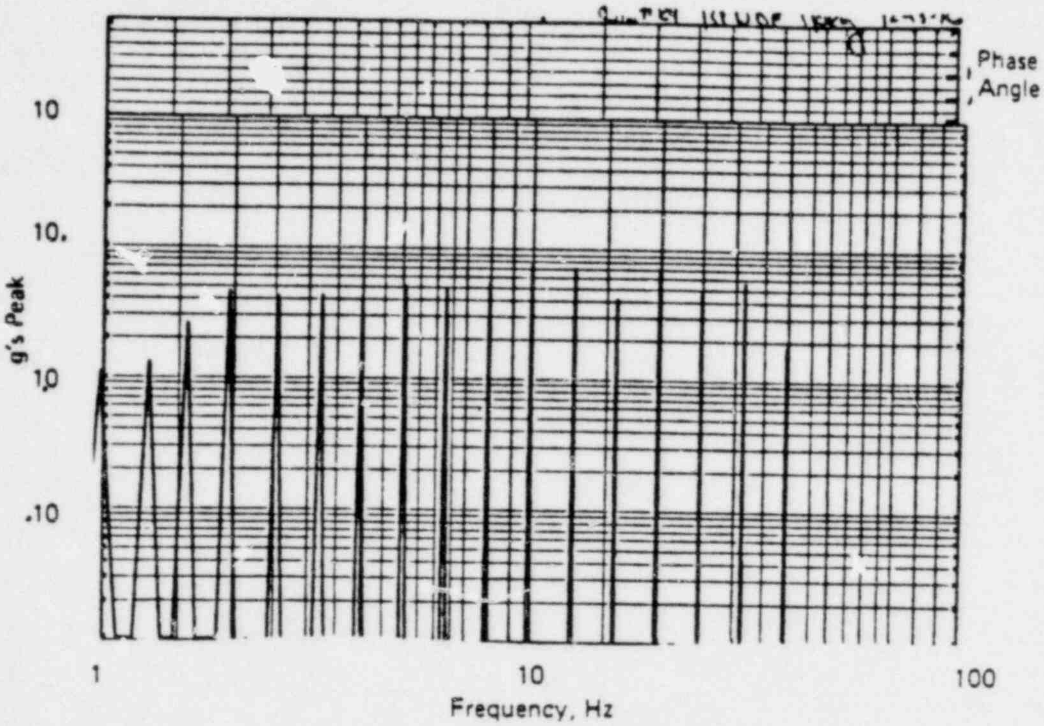

Figure No. IV.516 Test Run No. 24 Orientation 4 OBE ____ DBE 1

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Lube Oil Filter

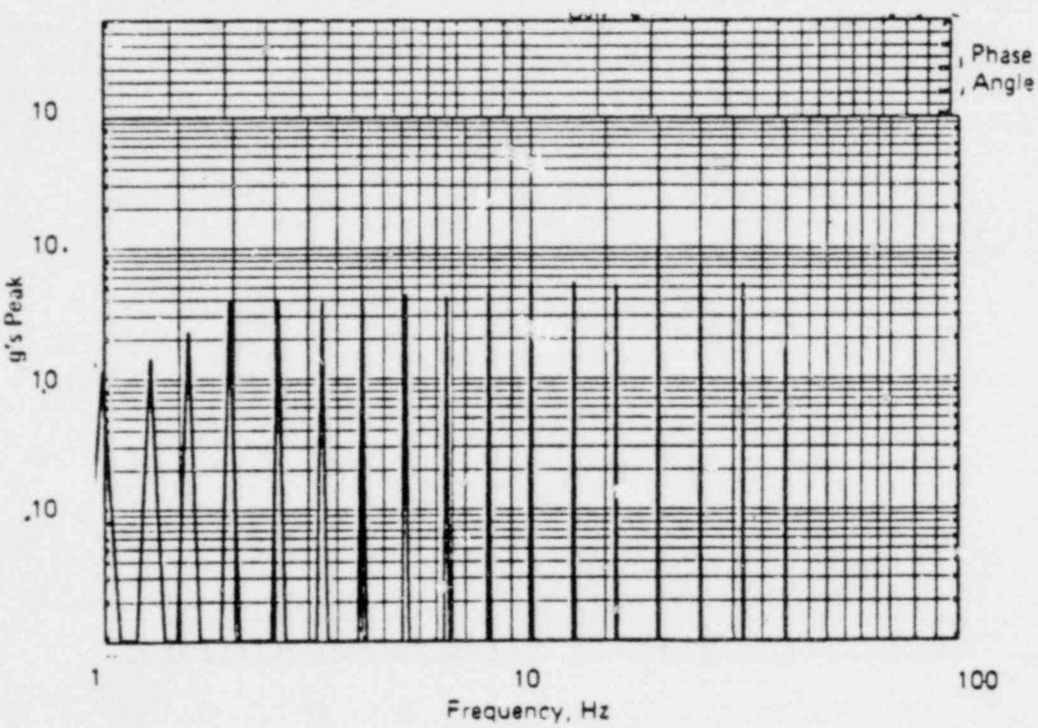

Figure No. IV.517 Test Run No. 24 Orientation 4 OBE ____ DBE 1

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Lube Oil Filter

01598 0509

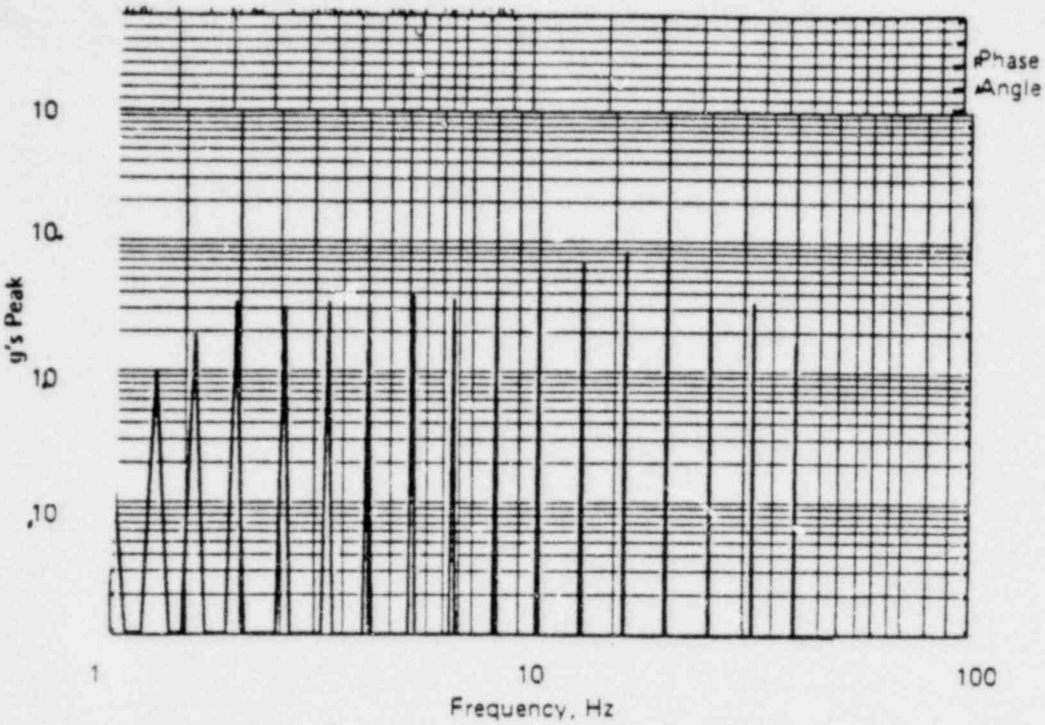

Figure No. IV.536 Test Run No. 1 Orientation 1 OBE 1 DBE ____

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Engine Driven Lube Oil Pump

Fuel Oil Filter & Fuel Oil Strainer Fig IV.536 Thru IV 583

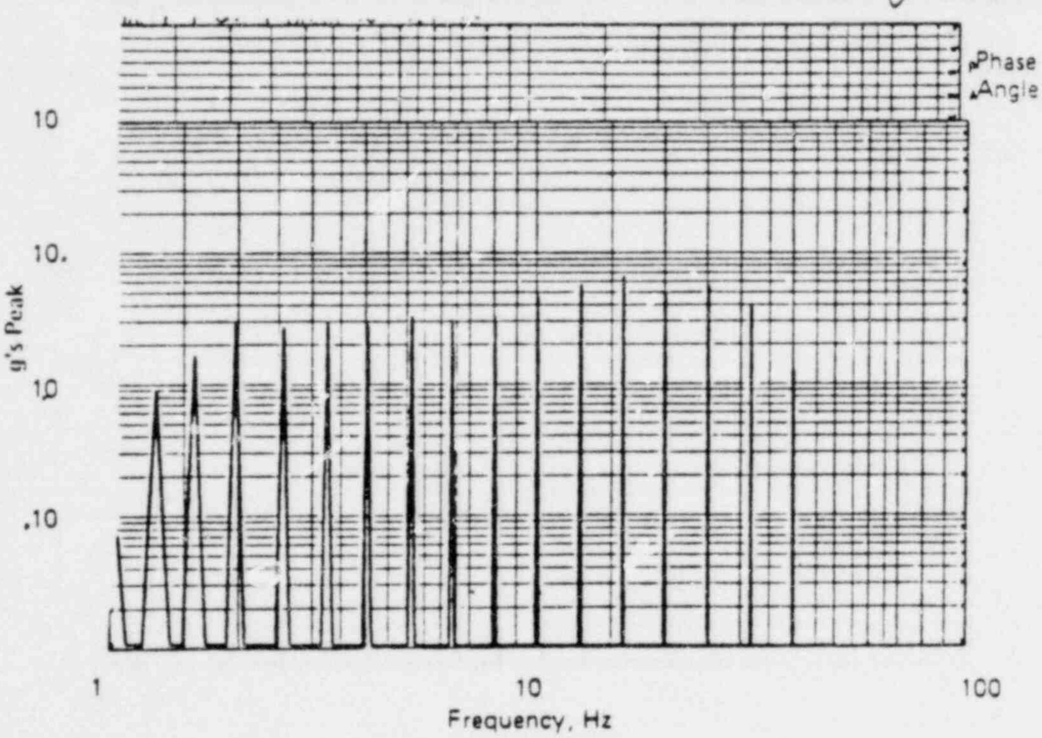

Figure No. IV.537 Test Run No. 1 Orientation 1 OBE 1 DBE ____

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Engine Driven Lube Oil Pump

01598 0522

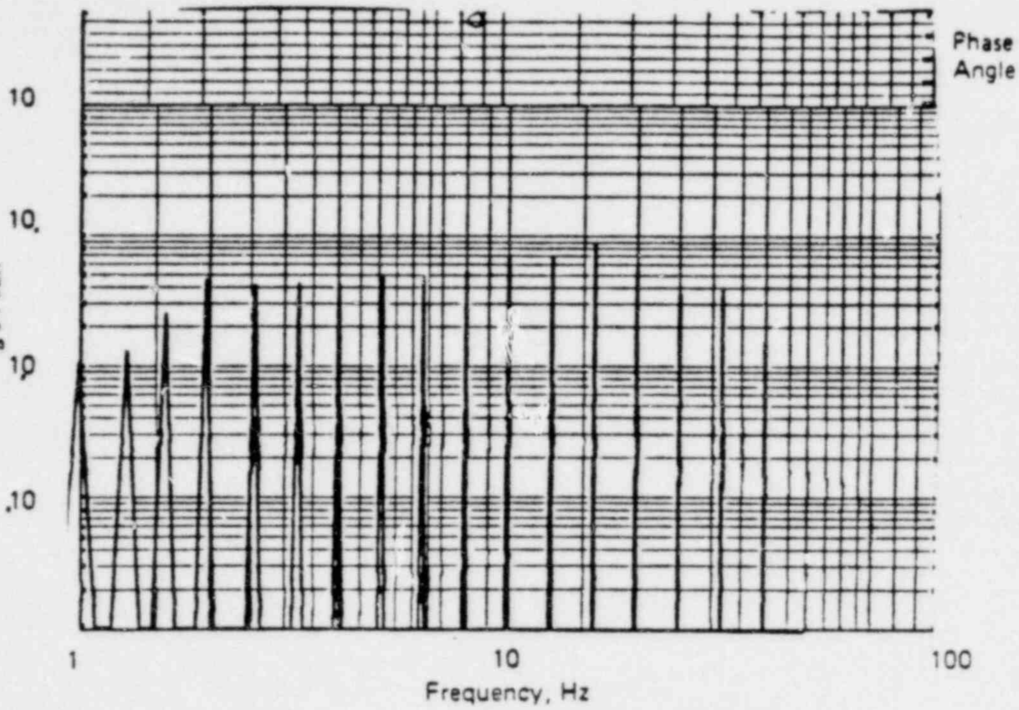

Figure No. IV.546 Test Run No. 6 Orientation 1 OBE ____ DBE 1
Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical
Test Item(s) Engine Driven Lube Oil Pump

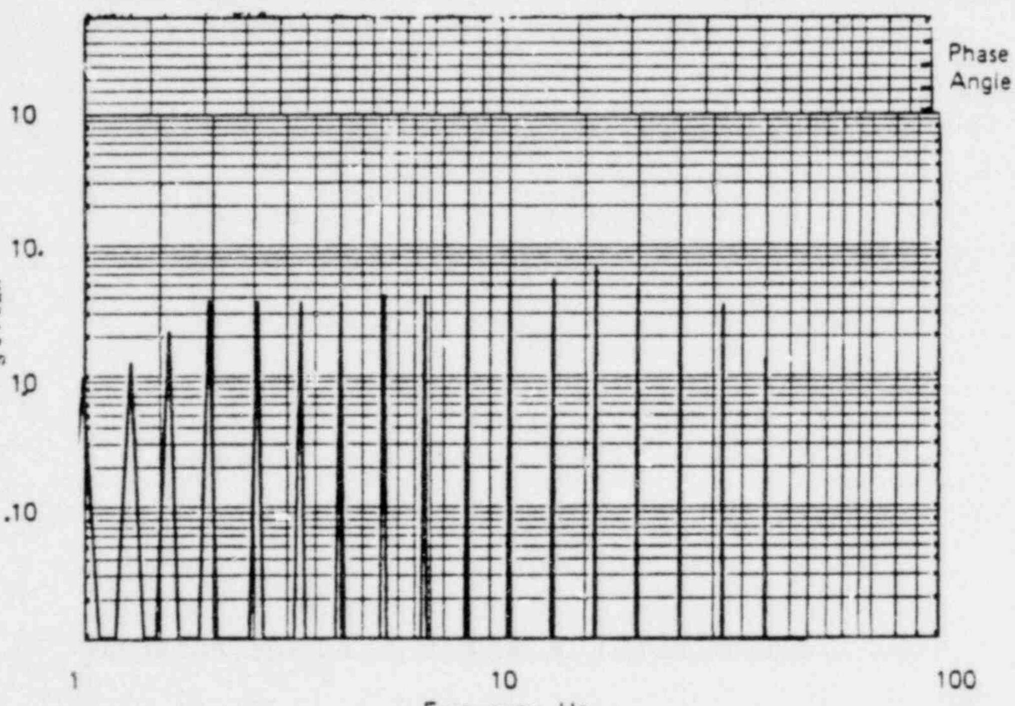

Figure No. IV.547 Test Run No. 6 Orientation 1 OBE ____ DBE 1
Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical
Test Item(s) Engine Driven Lube Oil Pump

0 1 5 9 8 0 5 2 7

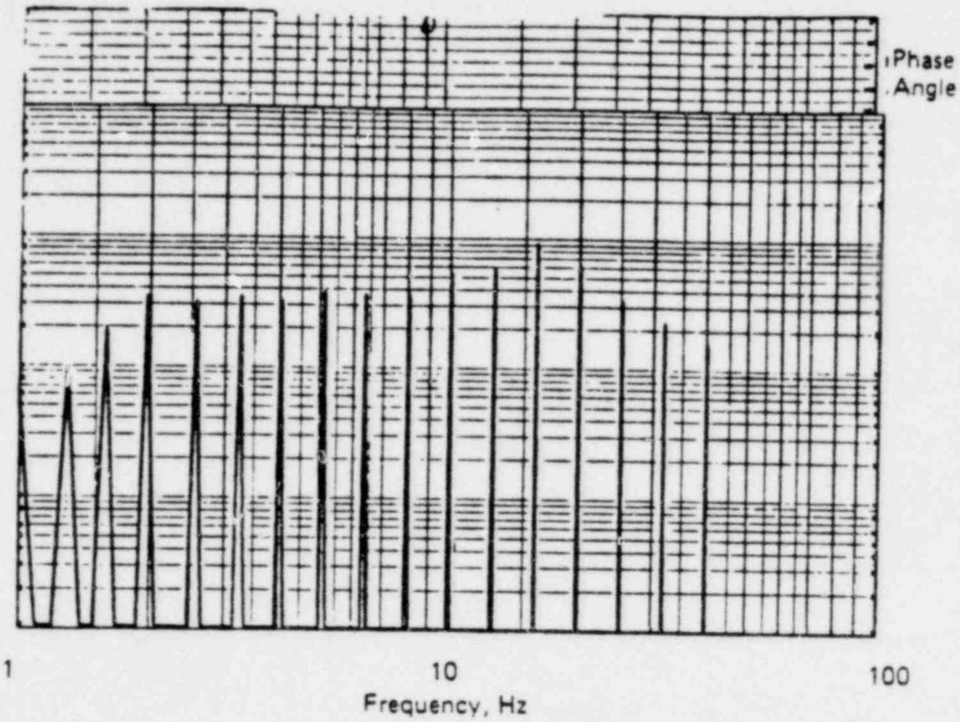

Figure No. IV.548 Test Run No. 7 Orientation 2 OBE 1 DBE ___
Transmissibility ___ or TRS √ % Damping 3 Direction Horizontal Vertical
Test Item(s) Engine Driven Lube Oil Pump

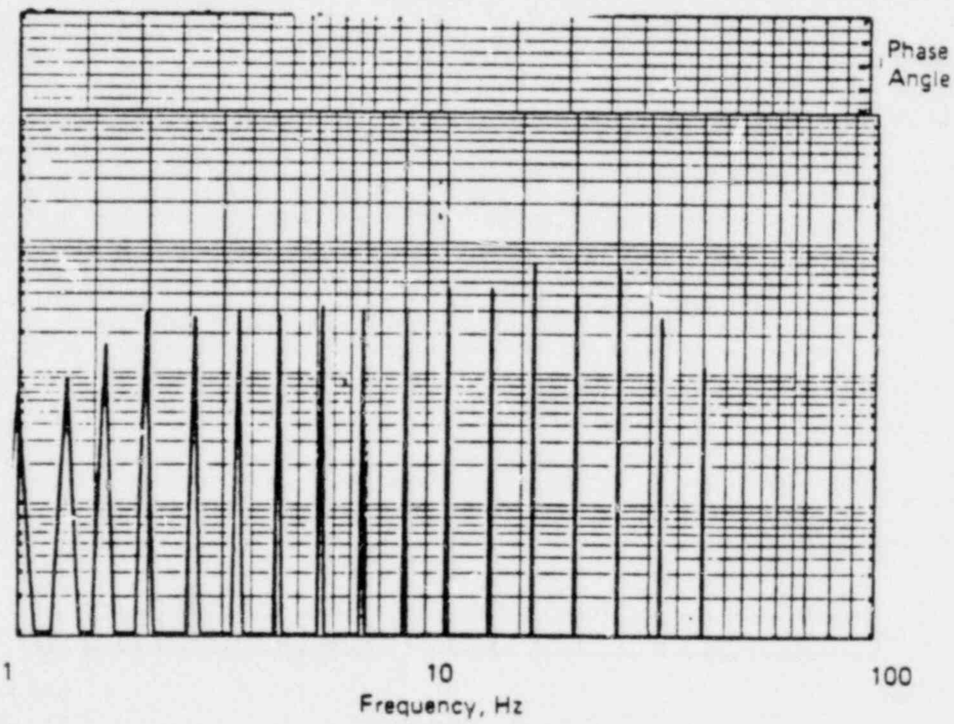

Figure No. IV.549 Test Run No. 7 Orientation 2 OBE 1 DBE ___
Transmissibility ___ or TRS √ % Damping 3 Direction Horizontal Vertical
Test Item(s) Engine Driven Lube Oil Pump

0 1 5 9 8 0 5 2 8

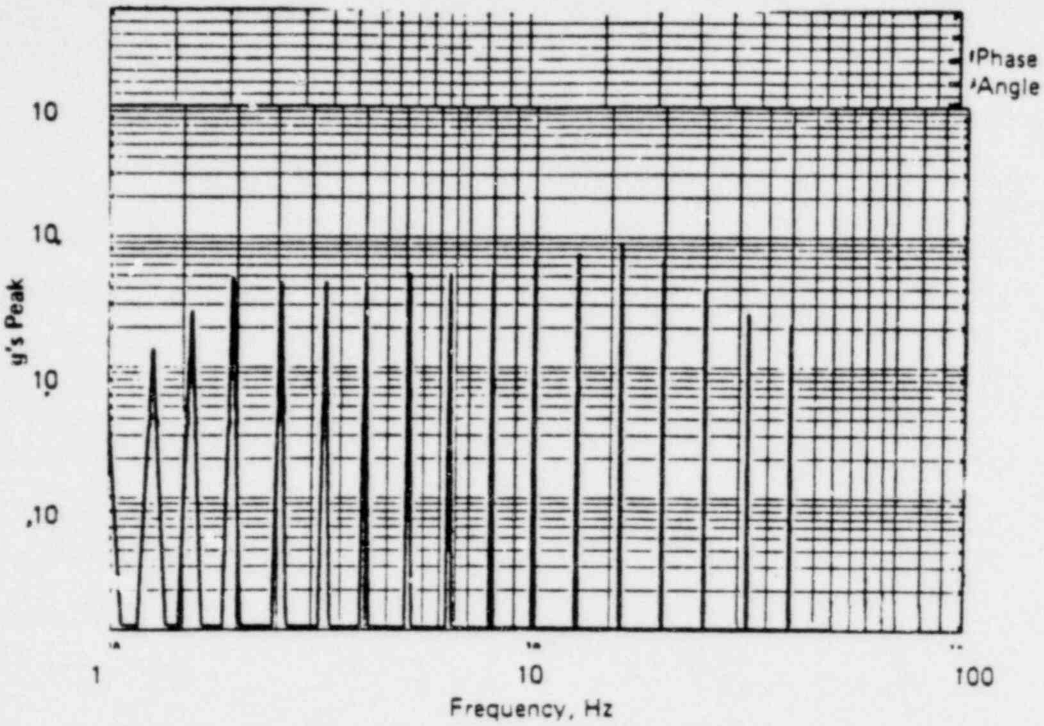

Figure No. IV.558 Test Run No. 12 Orientation 2 OBE ____ DBE 1

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical

Test Item(s) Engine Driven Lube Oil Pump

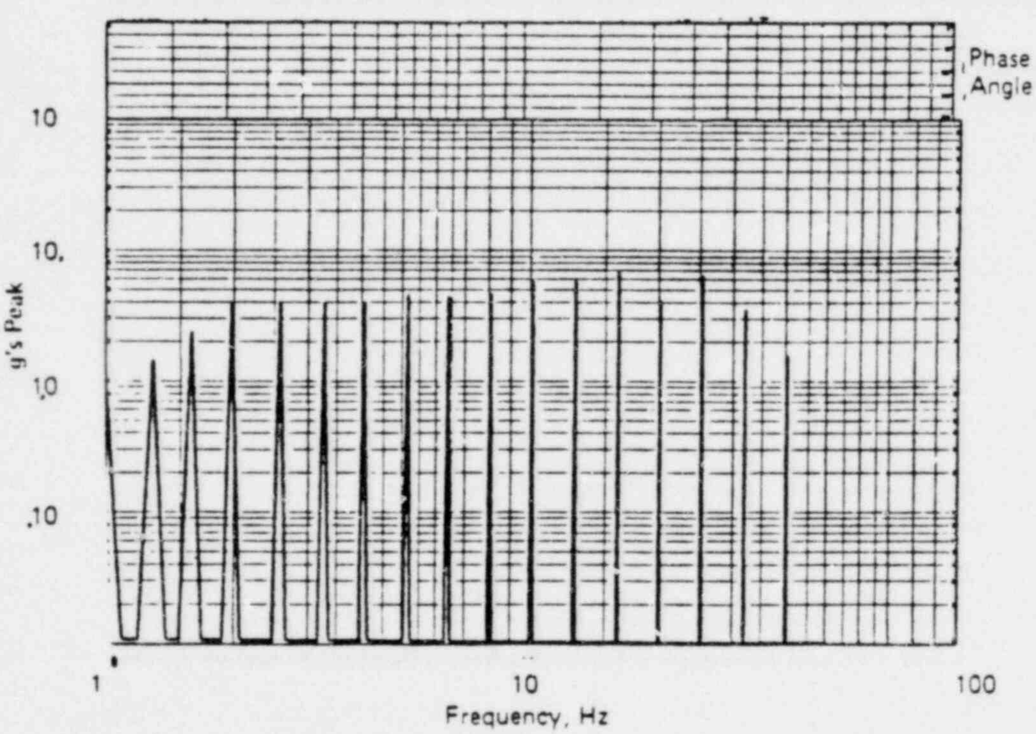

Figure No. IV559 Test Run No. 12 Orientation 2 OBE ____ DBE 1

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical

Test Item(s) Engine Driven Lube Oil Pump

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0 1 5 9 8 0 5 3 3

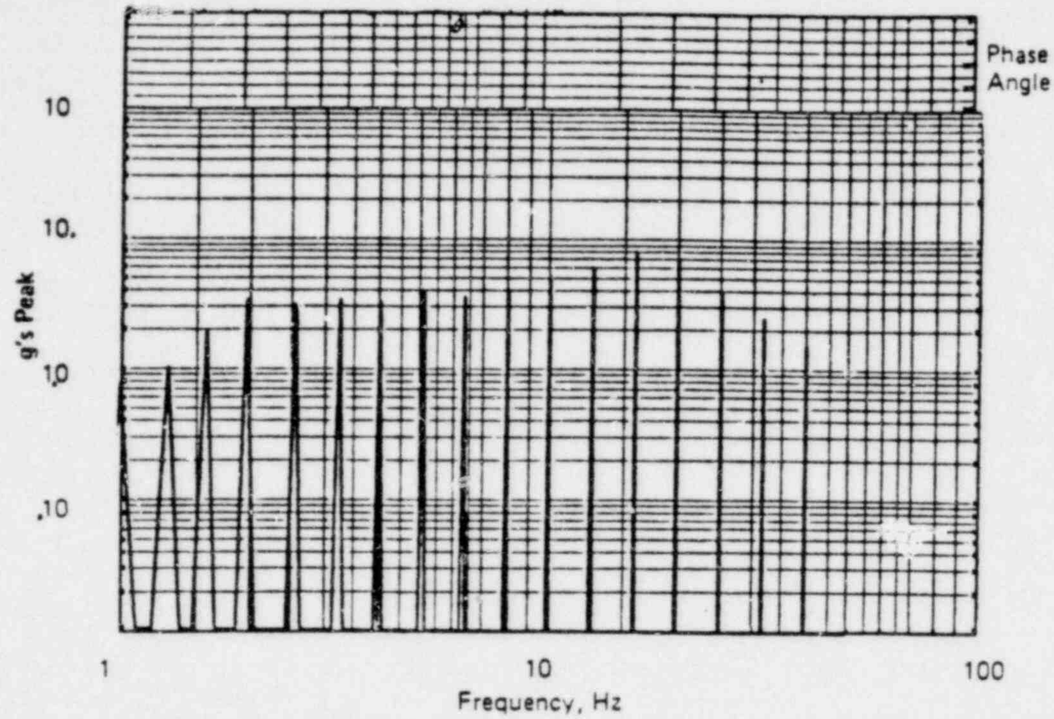

Figure No. IV.560 Test Run No. 13 Orientation 3 OBE 1 DBE ____
Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical
Test Item(s) Engine Driven Lube Oil Pump

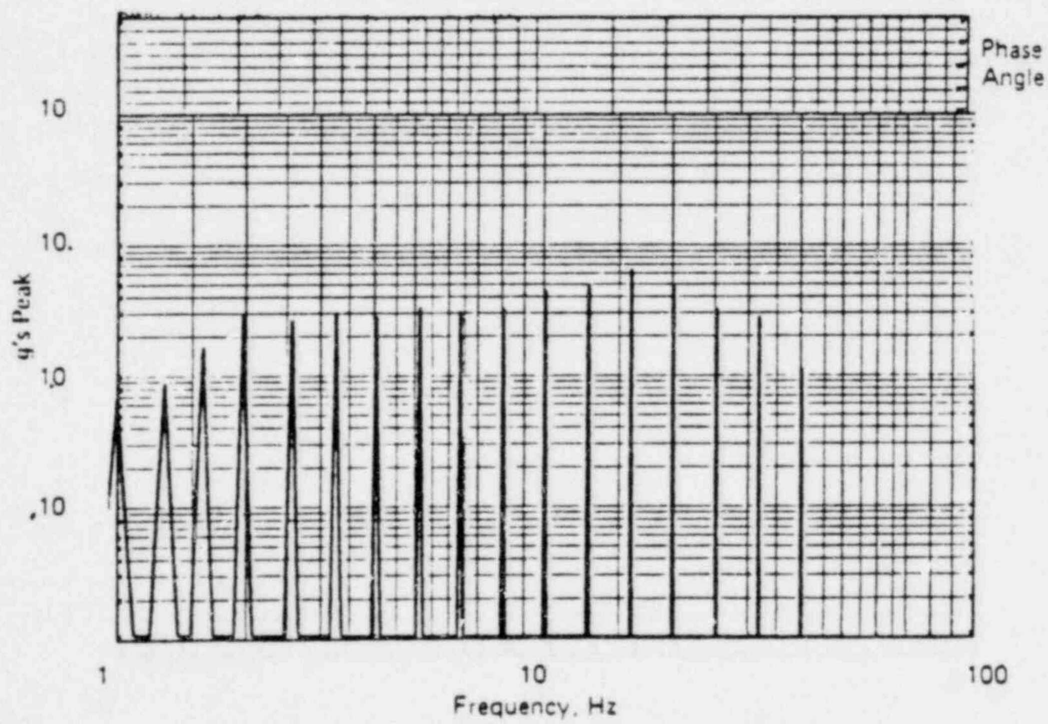

Figure No. IV.561 Test Run No. 13 Orientation 3 OBE 1 DBE ____
Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical
Test Item(s) Engine Driven Lube Oil Pump

01598 0534

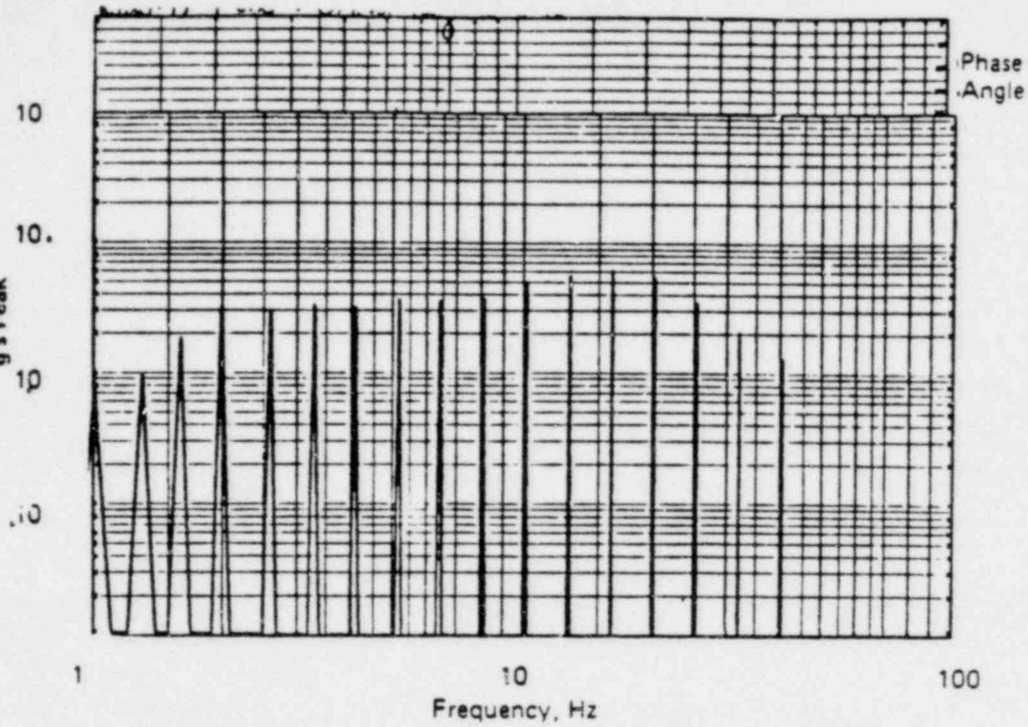

Figure No. IV.572 Test Run No. 19 Orientation 4 OBE 1 DBE ____

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Engine Driven Lube Oil Pump

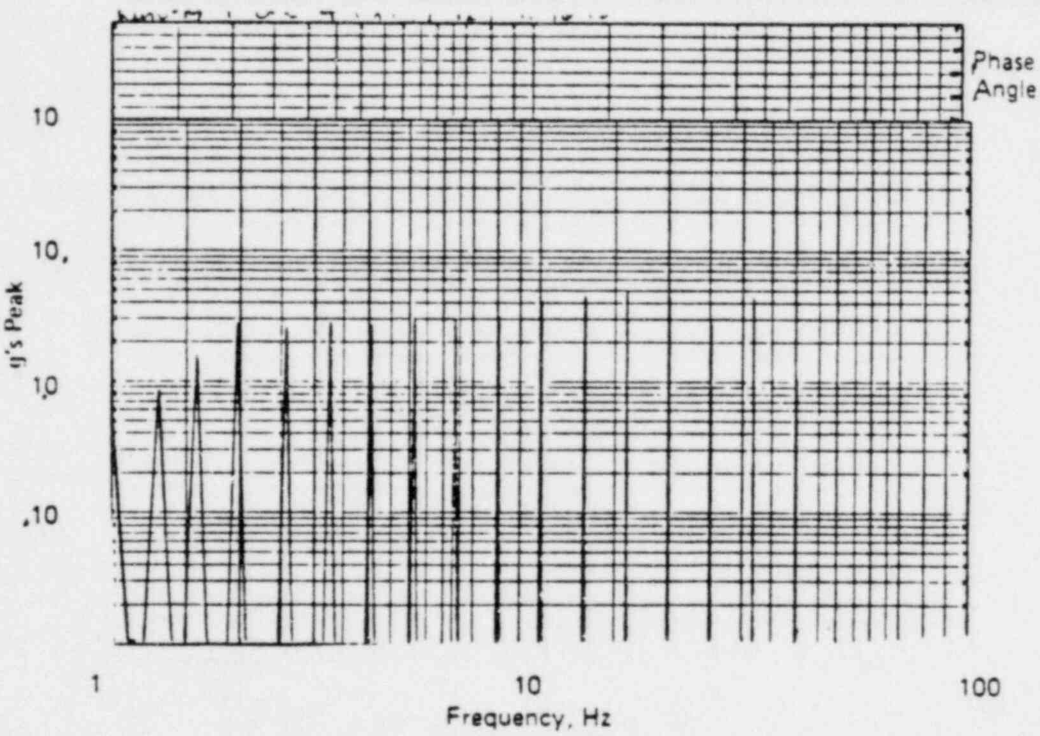

Figure No. IV.573 Test Run No. 19 Orientation 4 OBE 1 DBE ____

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Engine Driven Lube Oil Pump

01598 0540

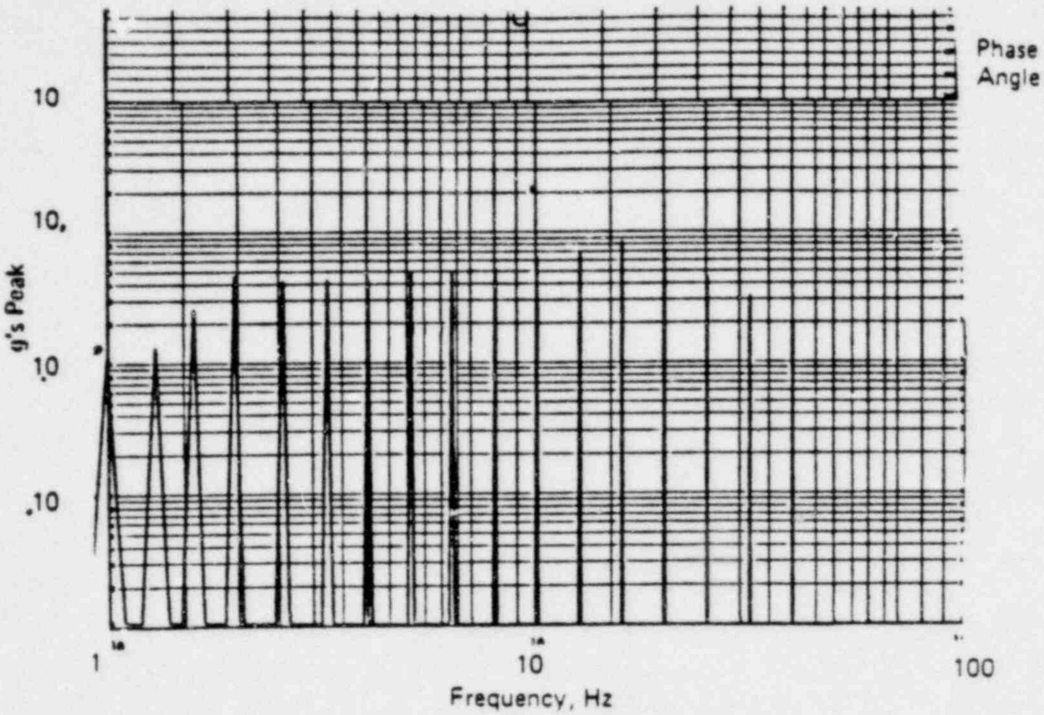

Figure No. IV.582 Test Run No. 24 Orientation 4 OBE ____ DBE 1

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal (circled) Vertical

Test Item(s) Engine Driven Lube Oil Pump

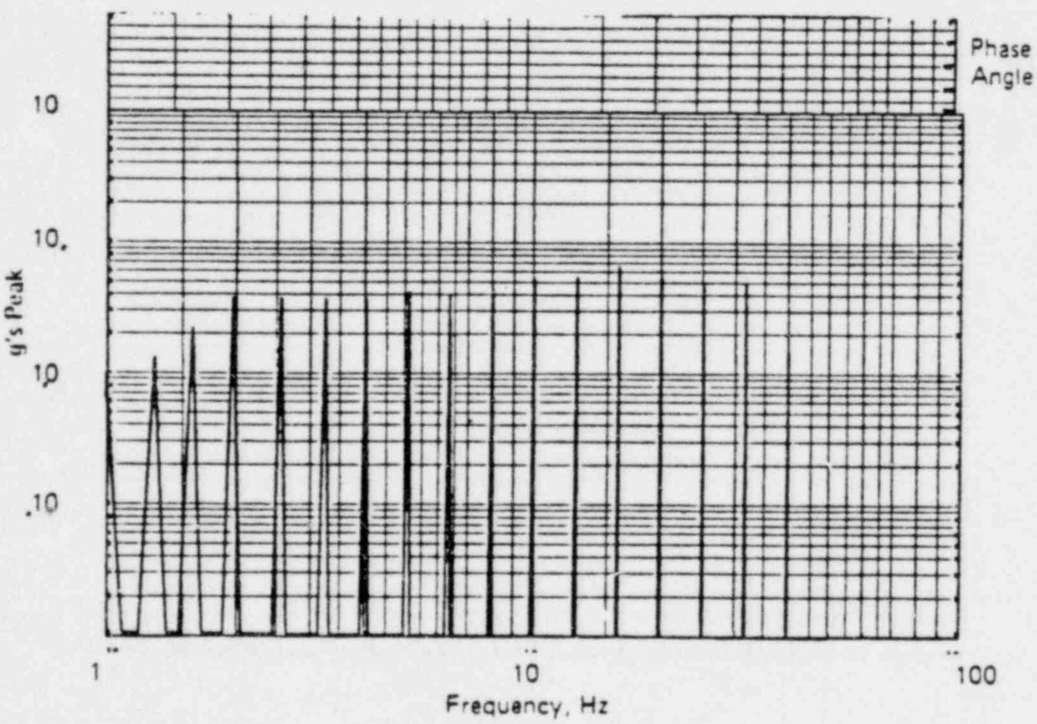

Figure No. IV.583 Test Run No. 24 Orientation 4 OBE ____ DBE 1

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical (circled)

Test Item(s) Engine Driven Lube Oil Pump

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01598 0545

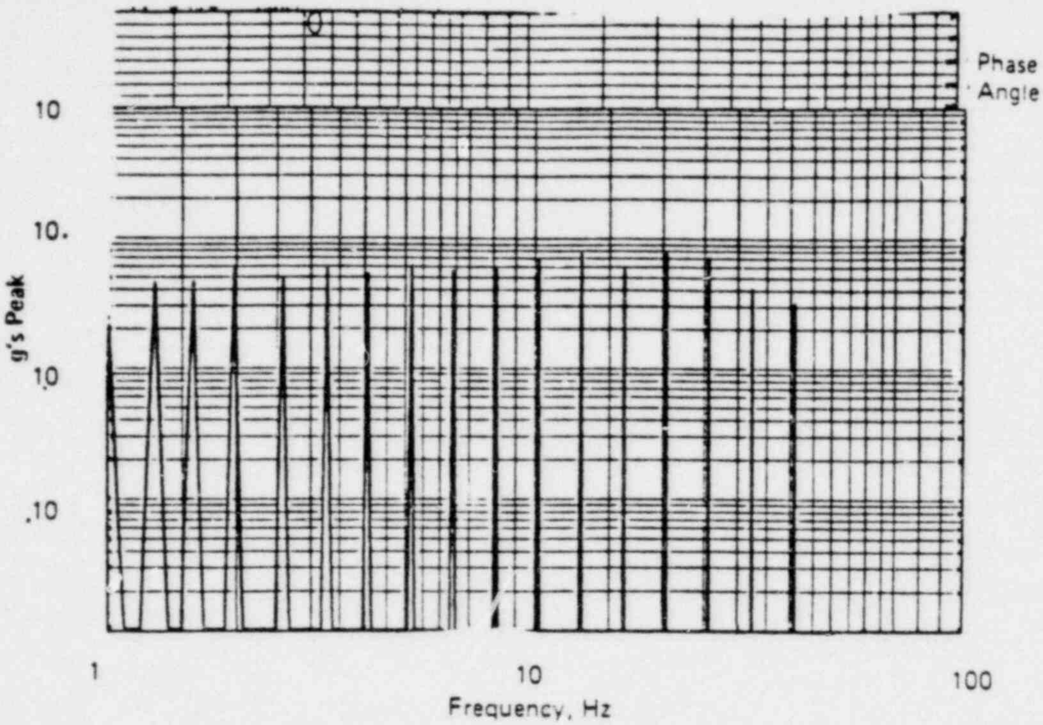

Figure No. IV.628 Test Run No. 1 Orientation 1 OBE 1 DBE ____
Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical
Test Item(s) Motor Driven Jacket Water Pump
Prelube Filter Fig IV. 628 thru IV. 683

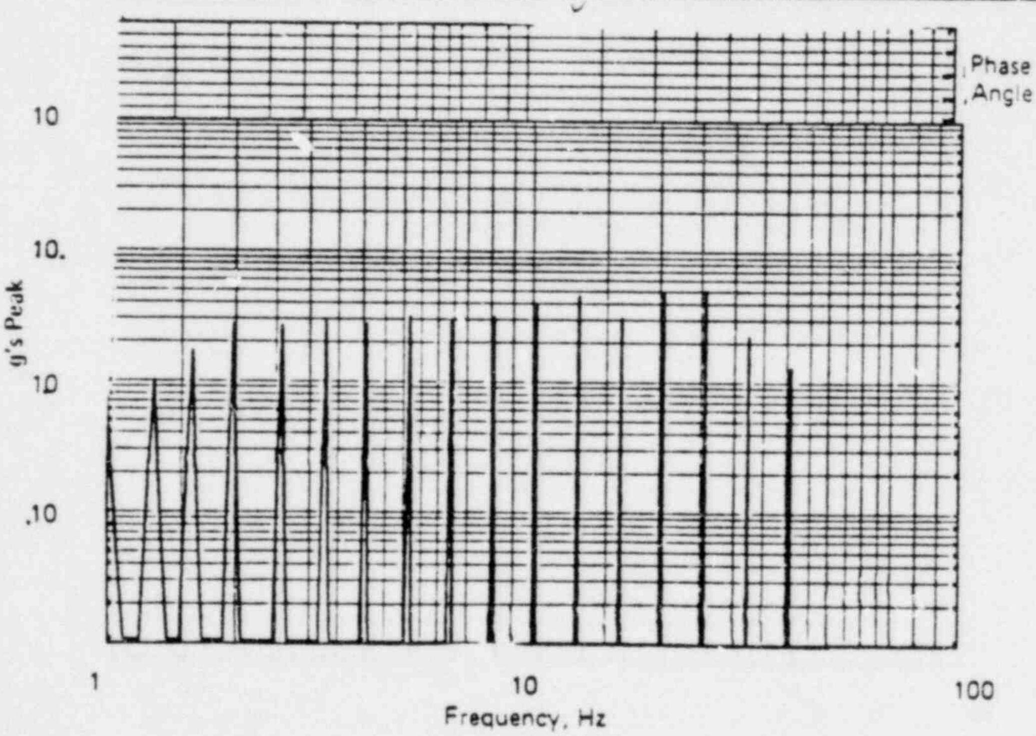

Figure No. IV.629 Test Run No. 1 Orientation 1 OBE 1 DBE ____
Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical
Test Item(s) Motor Driven Jacket Water Pump

0159R 0580

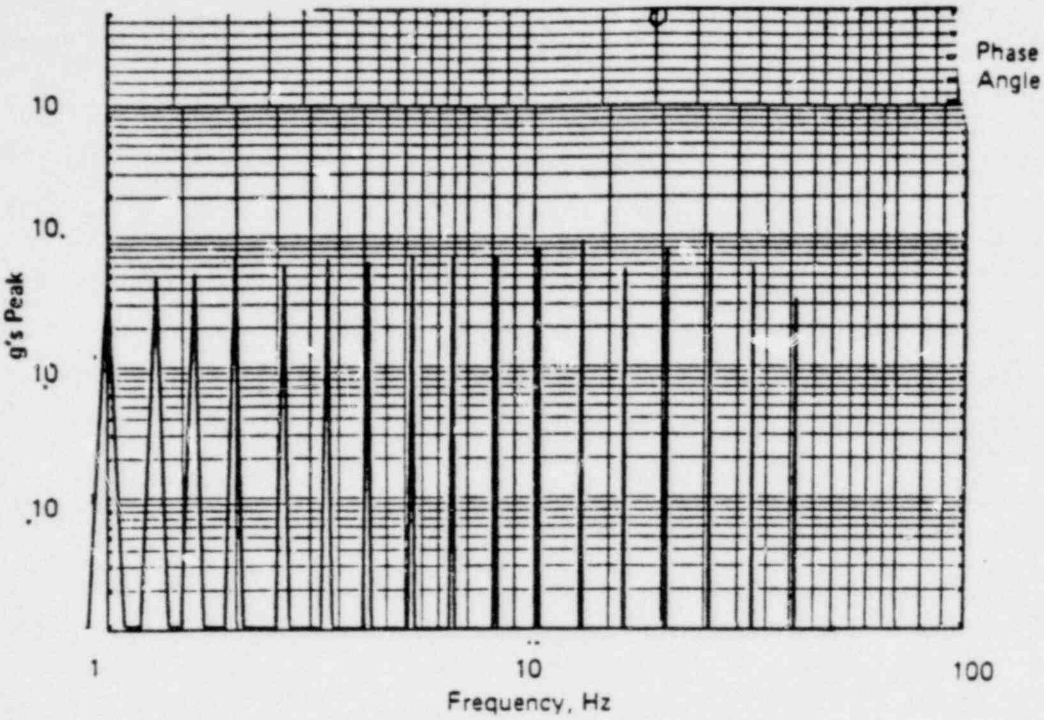

Figure No. IV.638 Test Run No. 6 Orientation 1 OBE ____ DBE 1
Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical
Test Item(s) Motor Driven Jacket Water Pump

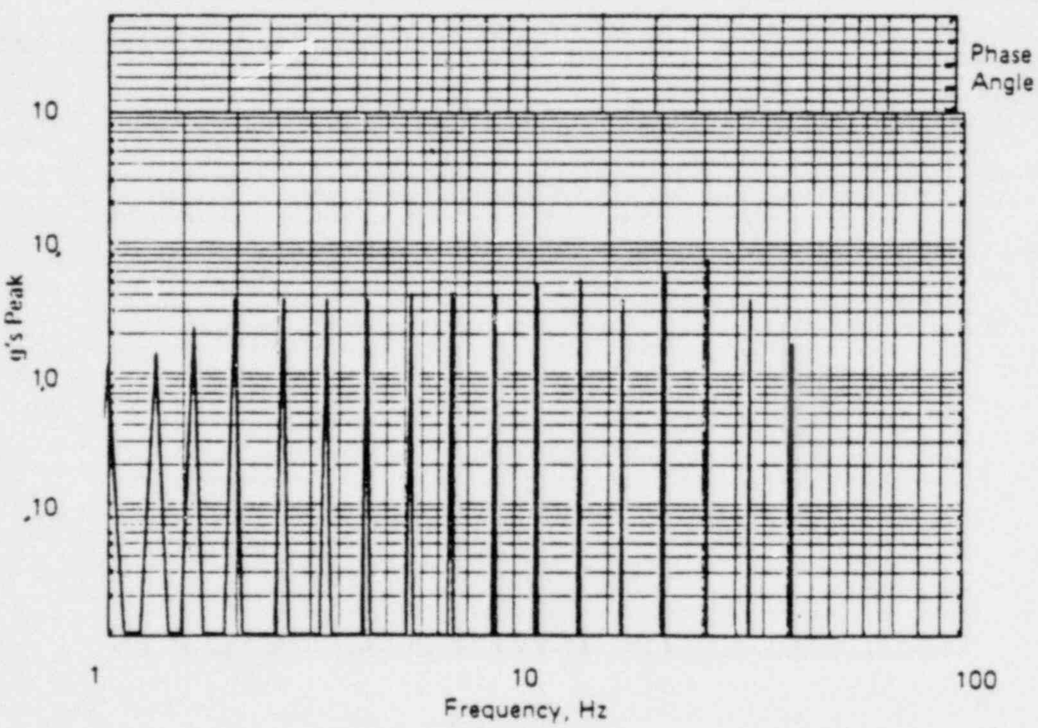

Figure No. IV.639 Test Run No. 6 Orientation 1 OBE ____ DBE 1
Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical
Test Item(s) Motor Driven Jacket Water Pump

01598 0585

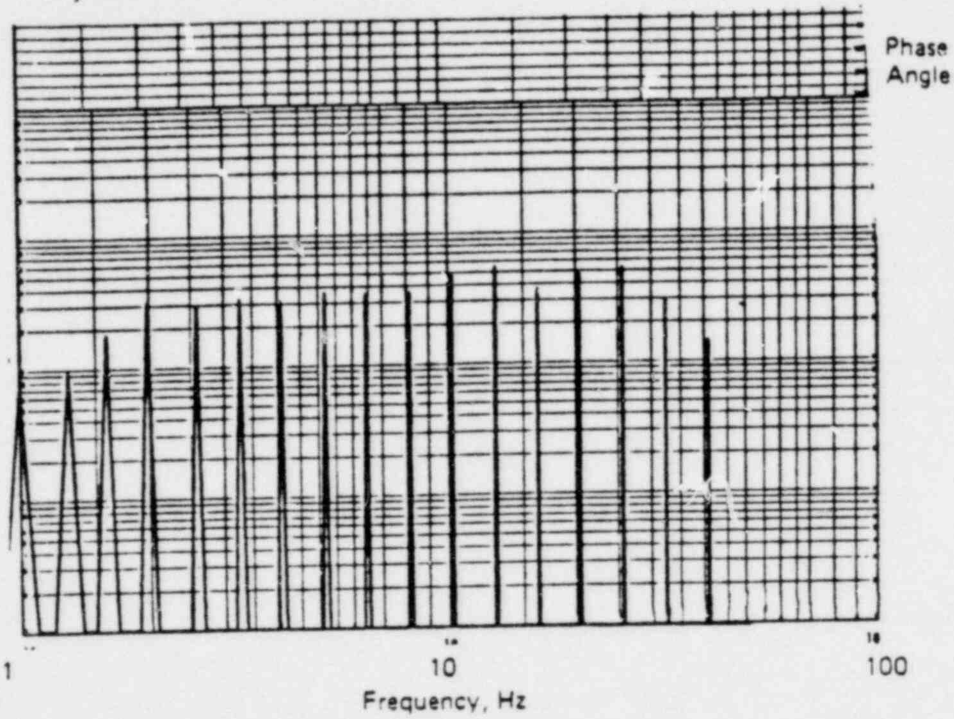

Figure No. IV.642 Test Run No. 8 Orientation 2 OBE 1 DBE ____
Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical
Test Item(s) Motor Driven Jacket Water Pump

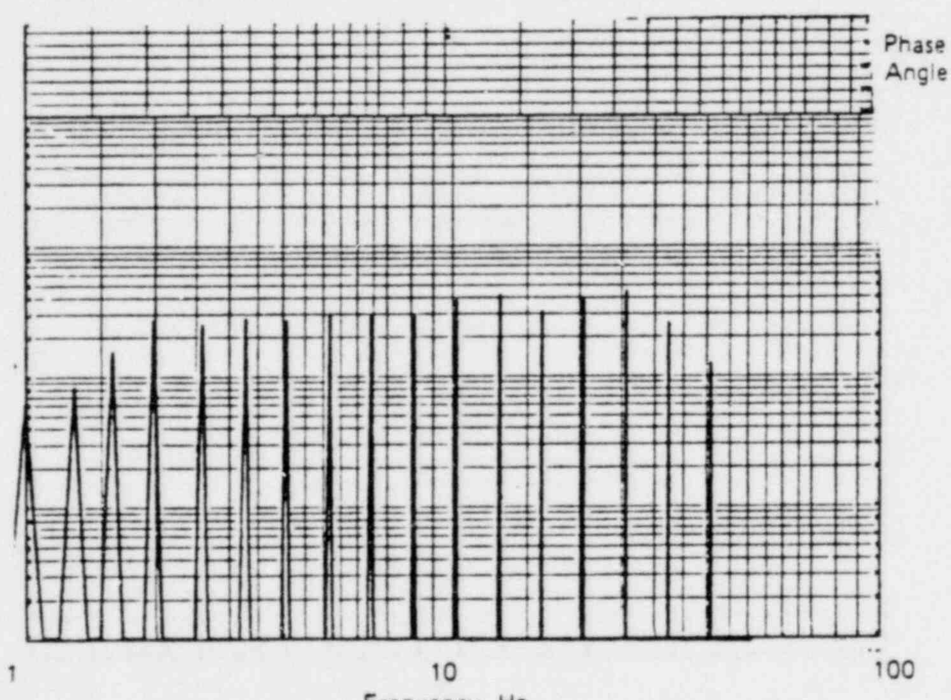

Figure No. IV.643 Test Run No. 8 Orientation 2 OBE 1 DBE ____
Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical
Test Item(s) Motor Driven Jacket Water Pump

0159 0587

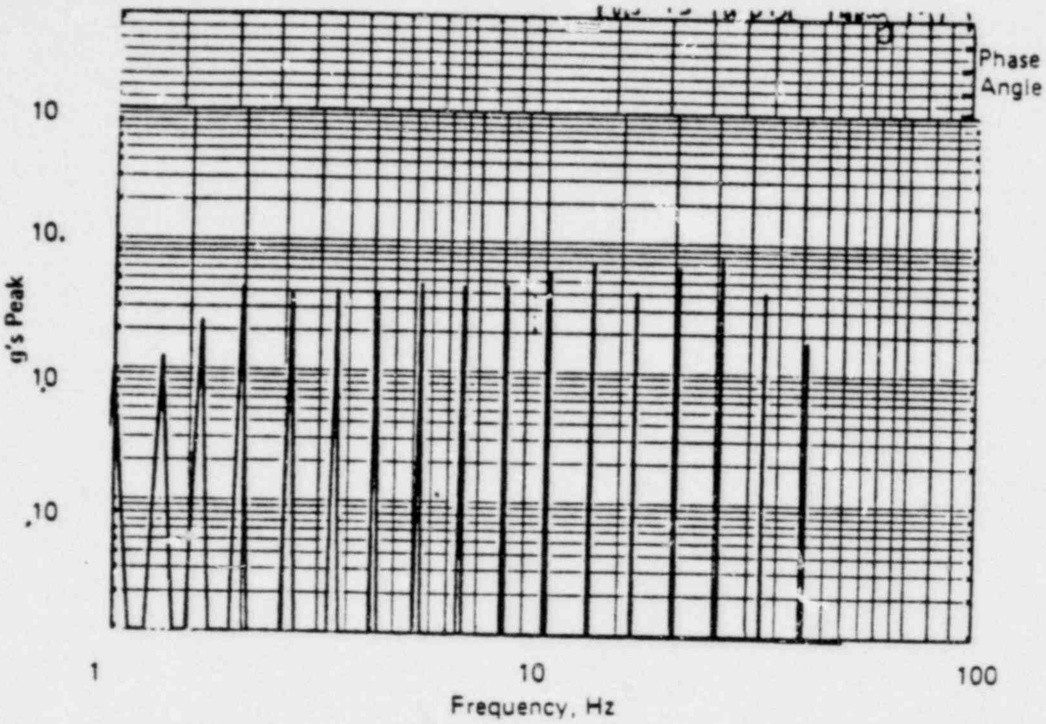

Figure No. IV.652 Test Run No. 13 Orientation 2 OBE ____ DBE 1

Transmissibility ____ or TRS √ % Damping 3 Direction (Horizontal) Vertical

Test Item(s) Motor Driven Jacket Water Pump

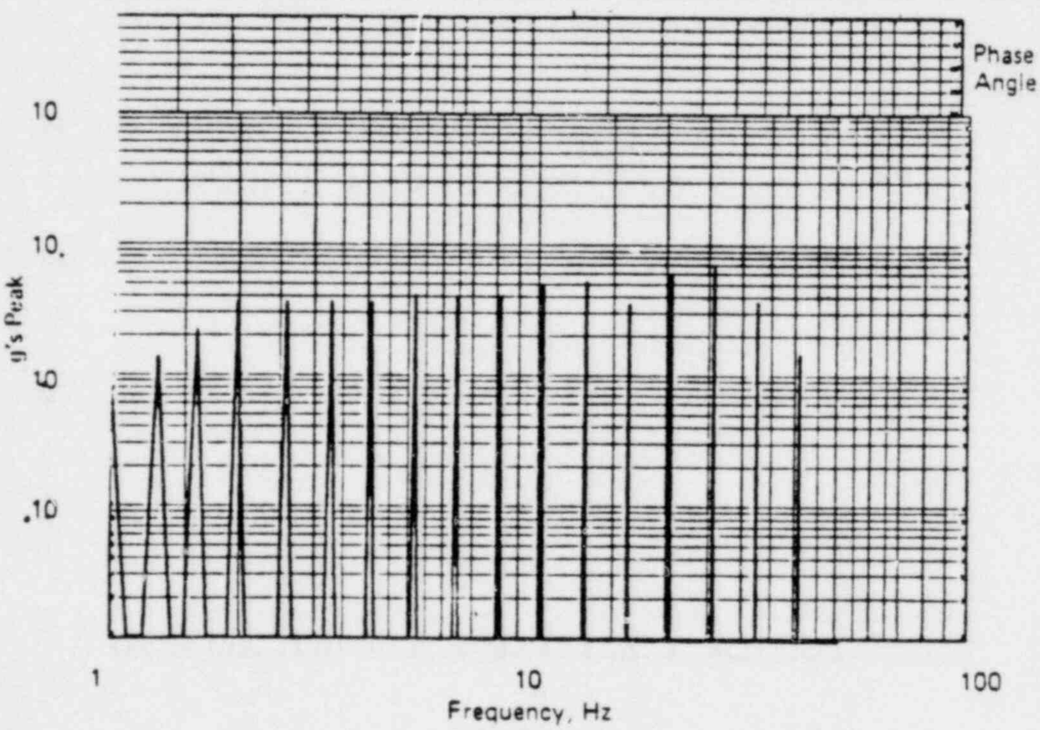

Figure No. IV.653 Test Run No. 13 Orientation 2 OBE ____ DBE 1

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal (Vertical)

Test Item(s) Motor Driven Jacket Water Pump

01598-0592

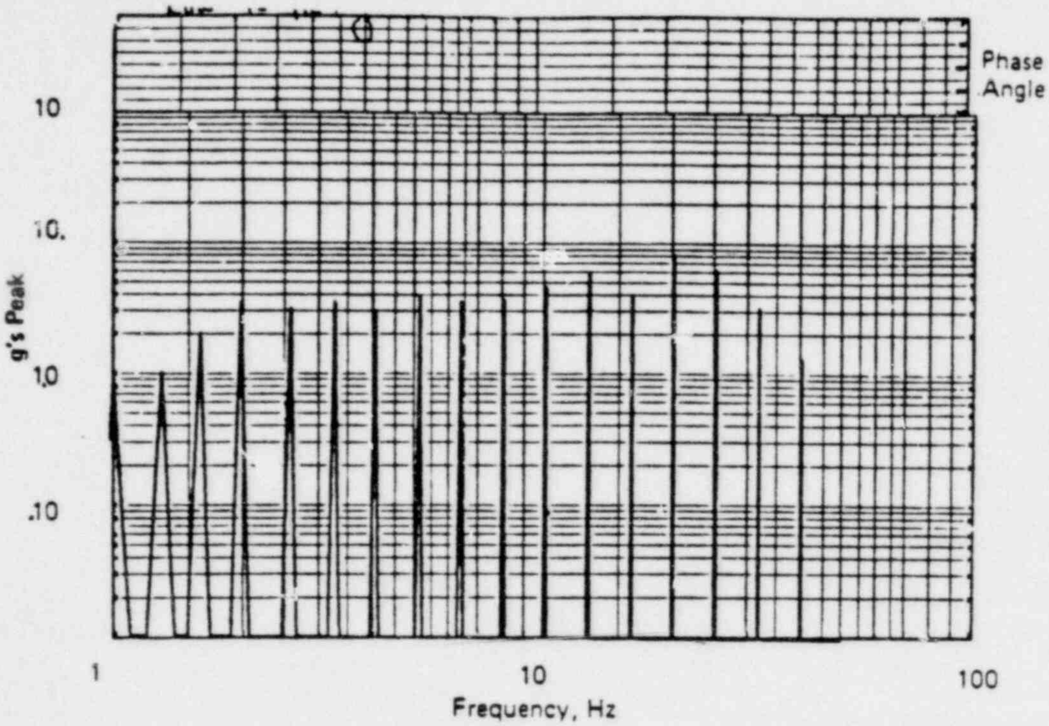

Figure No. IV.656 Test Run No. 15 Orientation 3 OBE 1 DBE ____

Transmissibility ____ or TRS ✓ % Damping 3 Direction (Horizontal) Vertical

Test Item(s) Motor Driven Jacket Water Pump

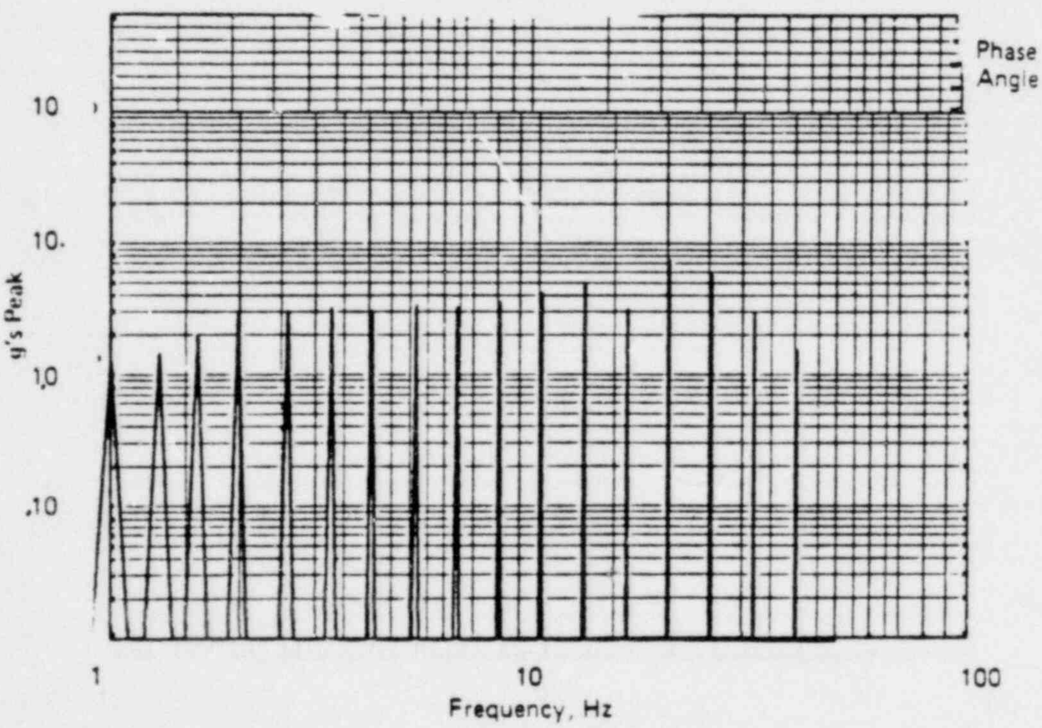

Figure No. IV.657 Test Run No. 15 Orientation 3 OBE 1 DBE ____

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal (Vertical)

Test Item(s) Motor Driven Jacket Water Pump

01598-0594

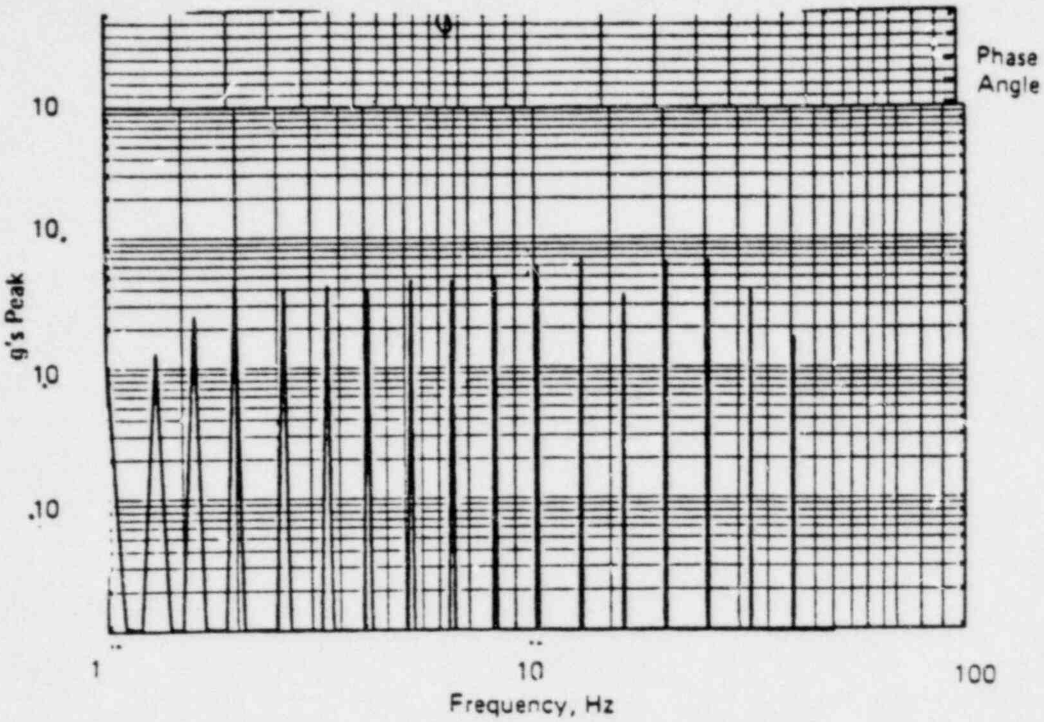

Figure No. IV.666 Test Run No. 20 Orientation 3 OBE ____ DBE 1

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Motor Driven Jacket Water Pump

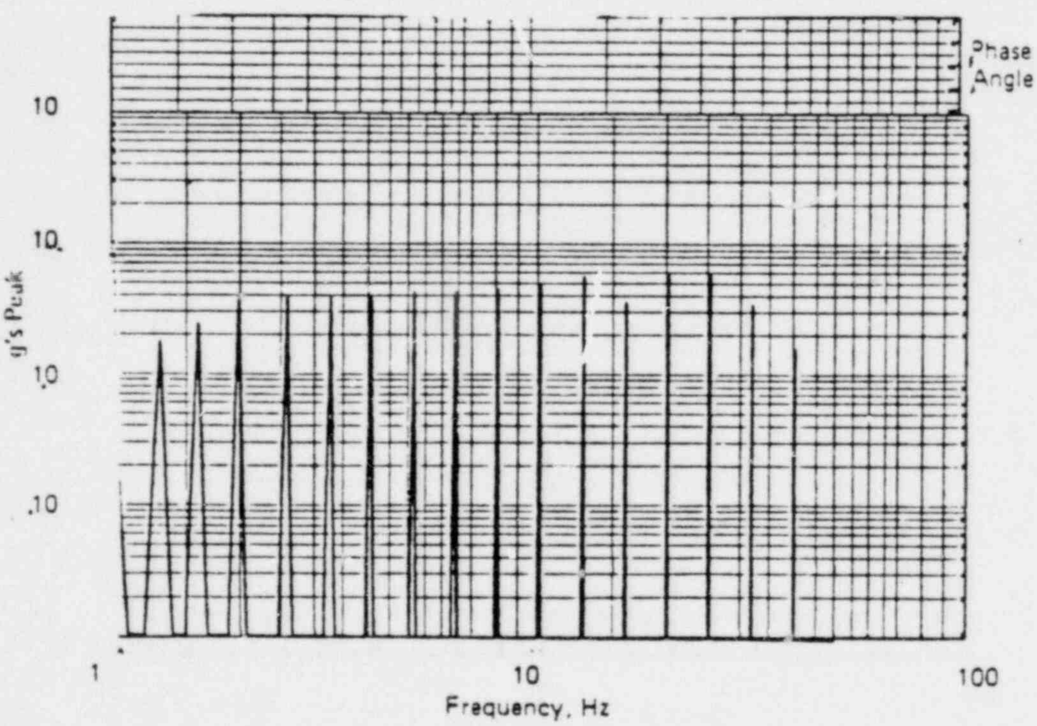

Figure No IV.667 Test Run No. 20 Orientation 3 OBE ____ DBE 1

Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical

Test Item(s) Motor Driven Jacket Water Pump

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0159 0599

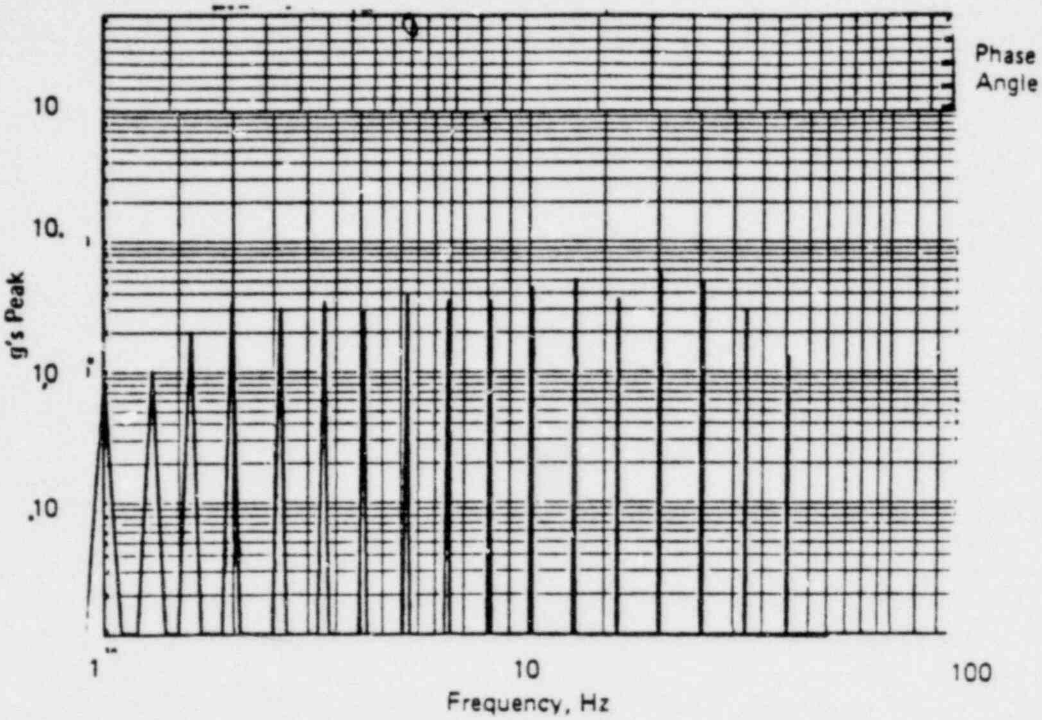

Figure No. IV.670 Test Run No. 22 Orientation 4 OBE 1 DBE ____

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical

Test Item(s) Motor Driven Jacket Water Pump

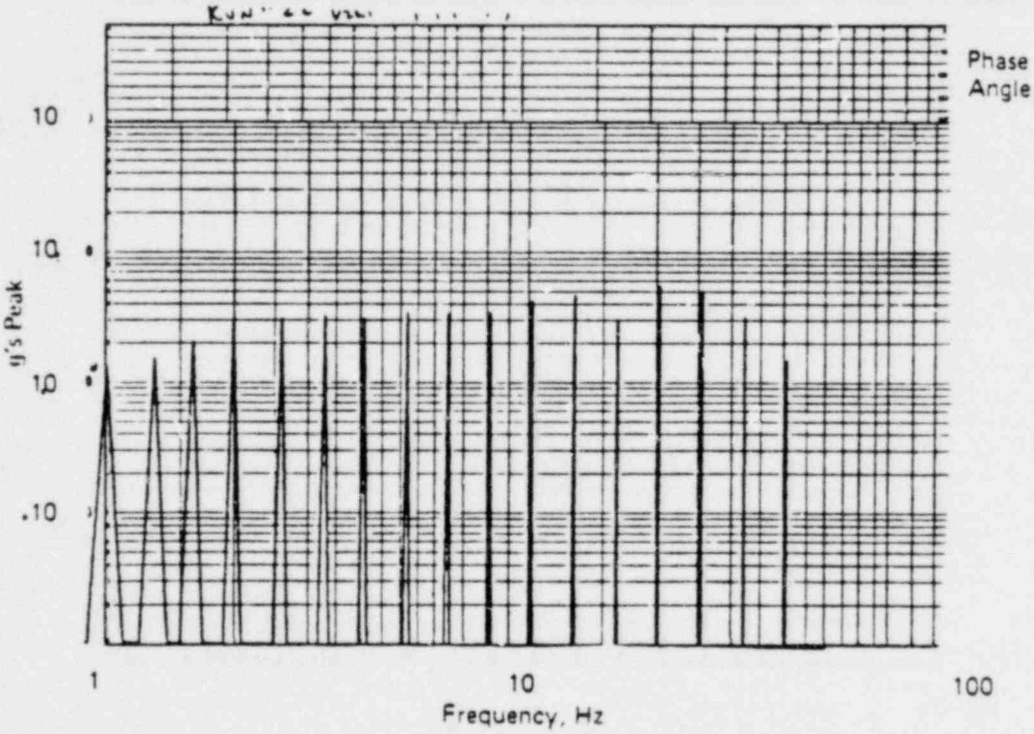

Figure No. IV.671 Test Run No. 22 Orientation 4 OBE 1 DBE ____

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical

Test Item(s) Motor Driven Jacket Water Pump

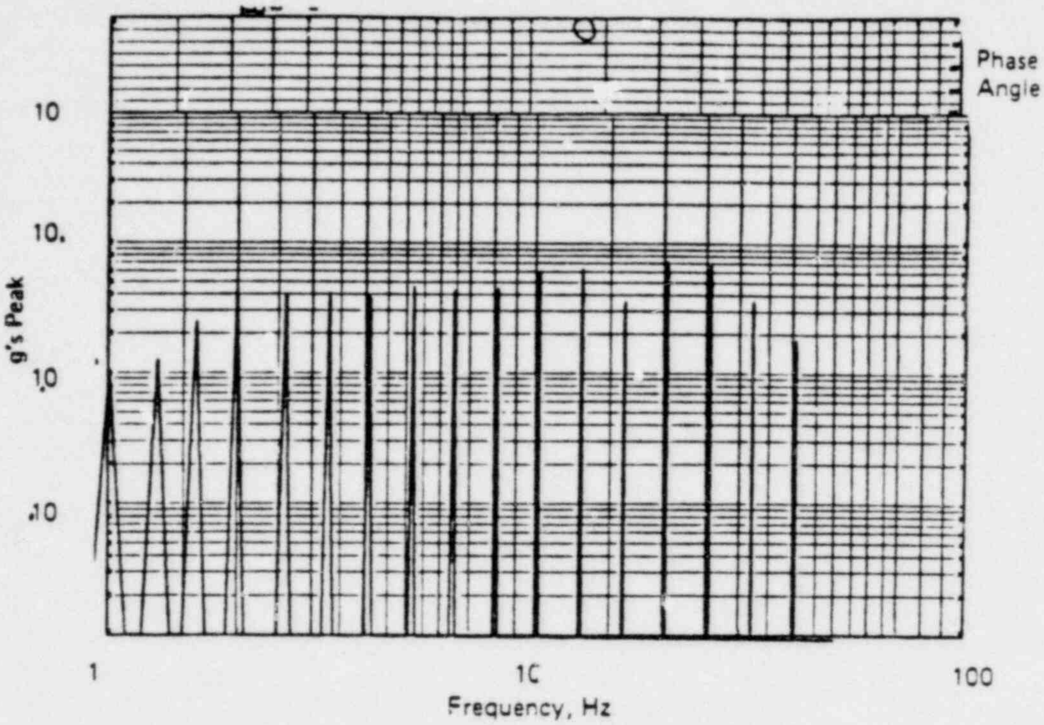

Figure No. IV.680 Test Run No. 27 Orientation 4 OBE ____ DBE 1

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical

Test Item(s) Motor Driven Jacket Water Pump

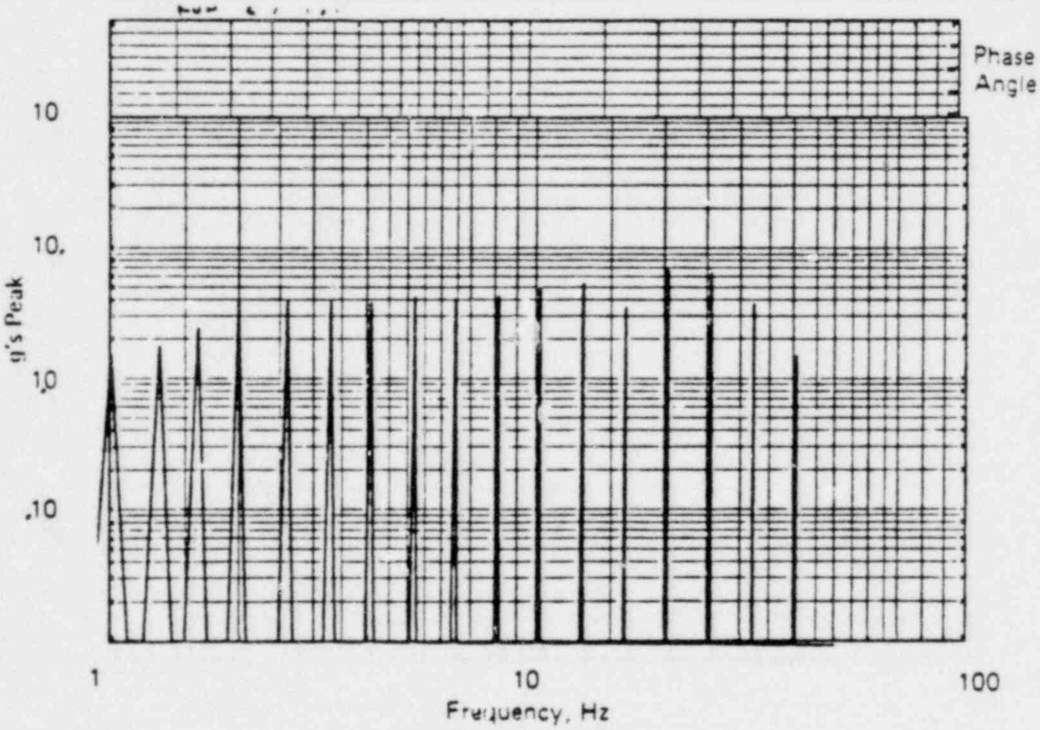

Figure No. IV.681 Test Run No. 27 Orientation 4 OBE ____ DBE 1

Transmissibility ____ or TRS √ % Damping 3 Direction Horizontal Vertical

Test Item(s) Motor Driven Jacket Water Pump

01598 0606

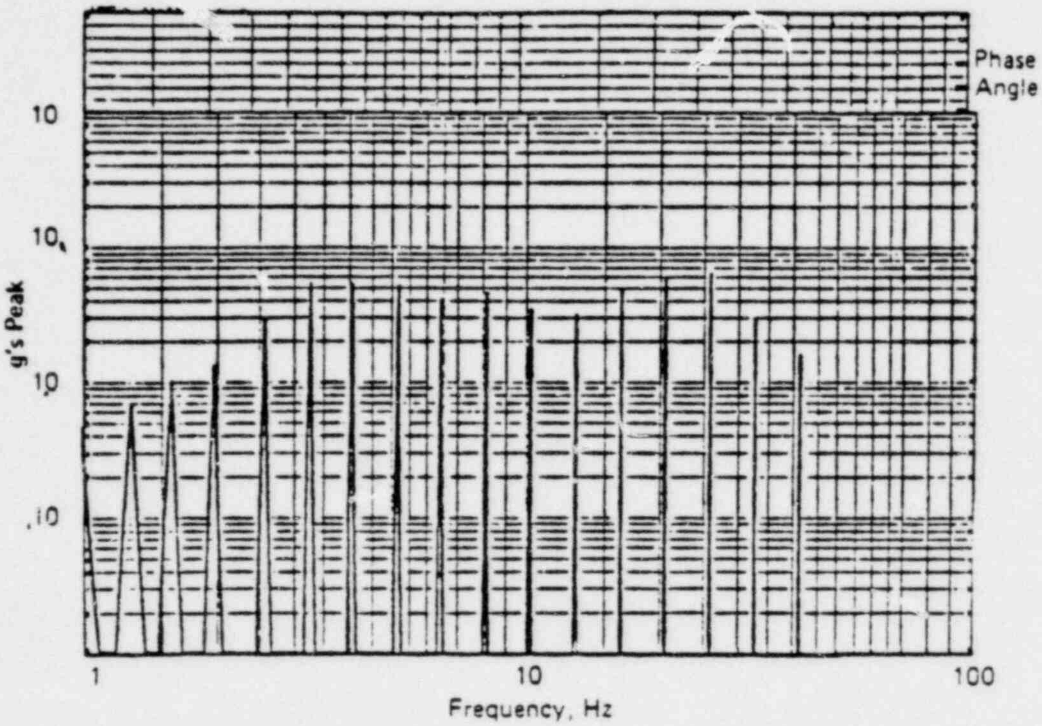

Figure No. IV.721 Test Run No. 1 Orientation 1 OBE ✓ DBE ____

Transmissibility ____ or TRS ✓ % Damping 2 Direction Horizontal Vertical

Test Item(s) Overspeed Trip

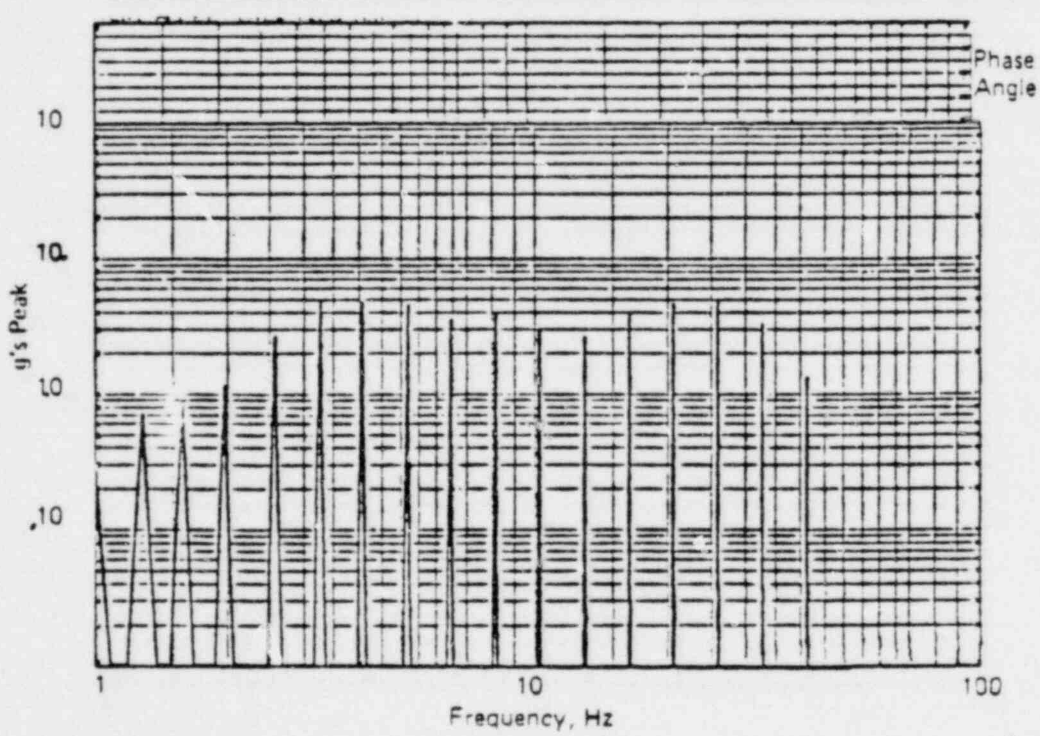

Figure No. IV.722 Test Run No. 1 Orientation 1 OBE ✓ DBE ____

Transmissibility ____ or TRS ✓ % Damping 2 Direction Horizontal Vertical

Test Item(s) Overspeed Trip

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01598 0631

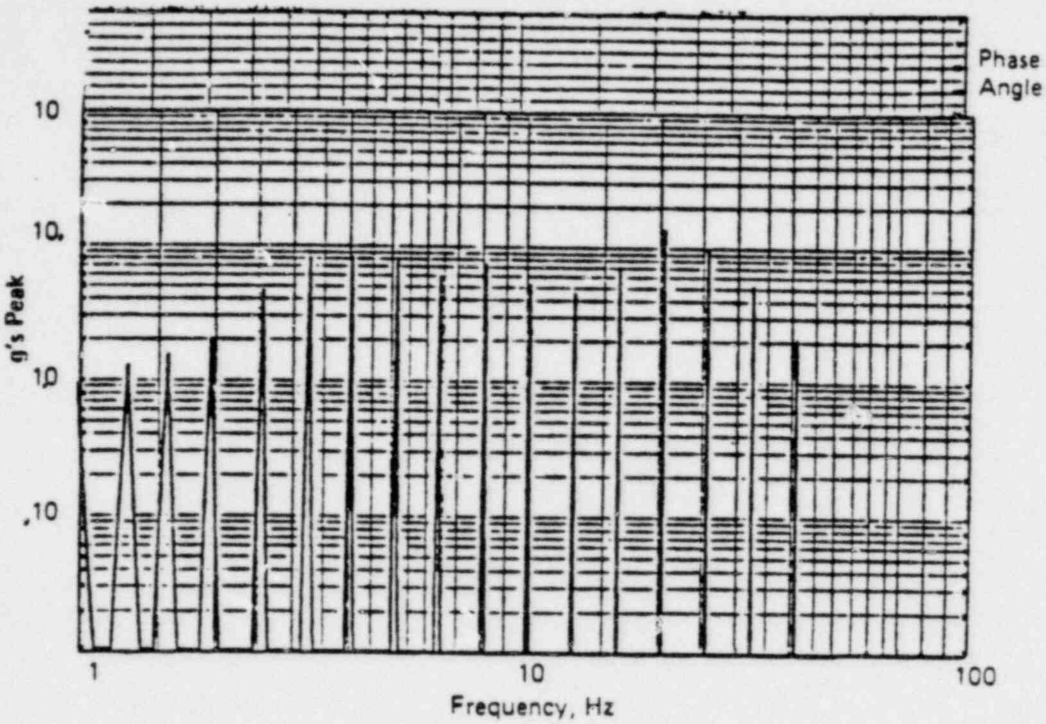

Figure No. IV.735 Test Run No. 7 Orientation 1 OBE ____ DBE ✓

Transmissibility ____ or TRS ✓ % Damping 2 Direction Horizontal Vertical

Test Item(s) Overspeed Trip

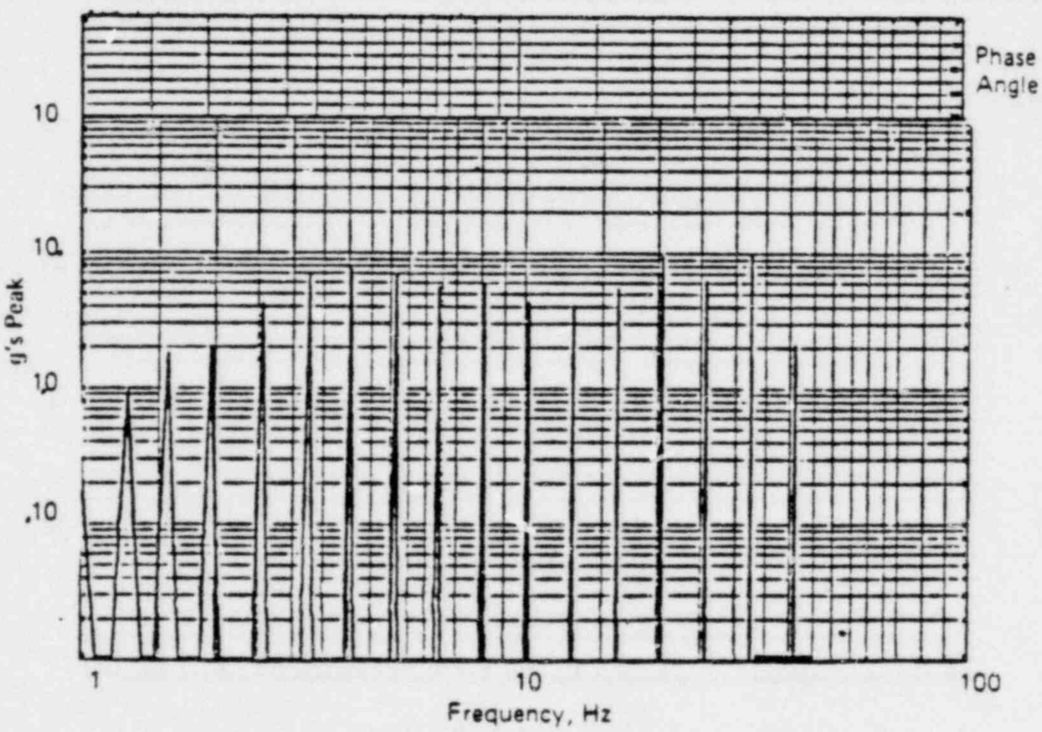

Figure No. IV.736 Test Run No. 7 Orientation 1 OBE ____ DBE ✓

Transmissibility ____ or TRS ✓ % Damping 2 Direction Horizontal Vertical

Test Item(s) Overspeed Trip

0159 0638

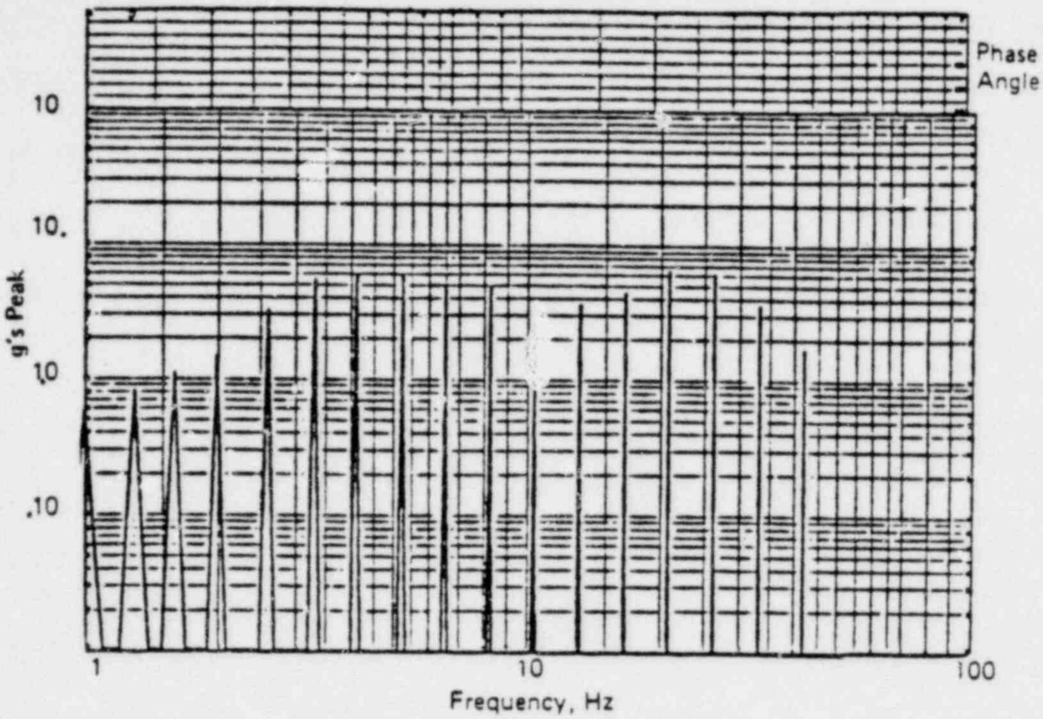

Figure No. IV.743 Test Run No. 9 Orientation 2 OBE ✓ DBE ___
Transmissibility ___ or TRS ✓ % Damping 3 Direction Horizontal Vertical
Test Item(s) Overspeed Trip

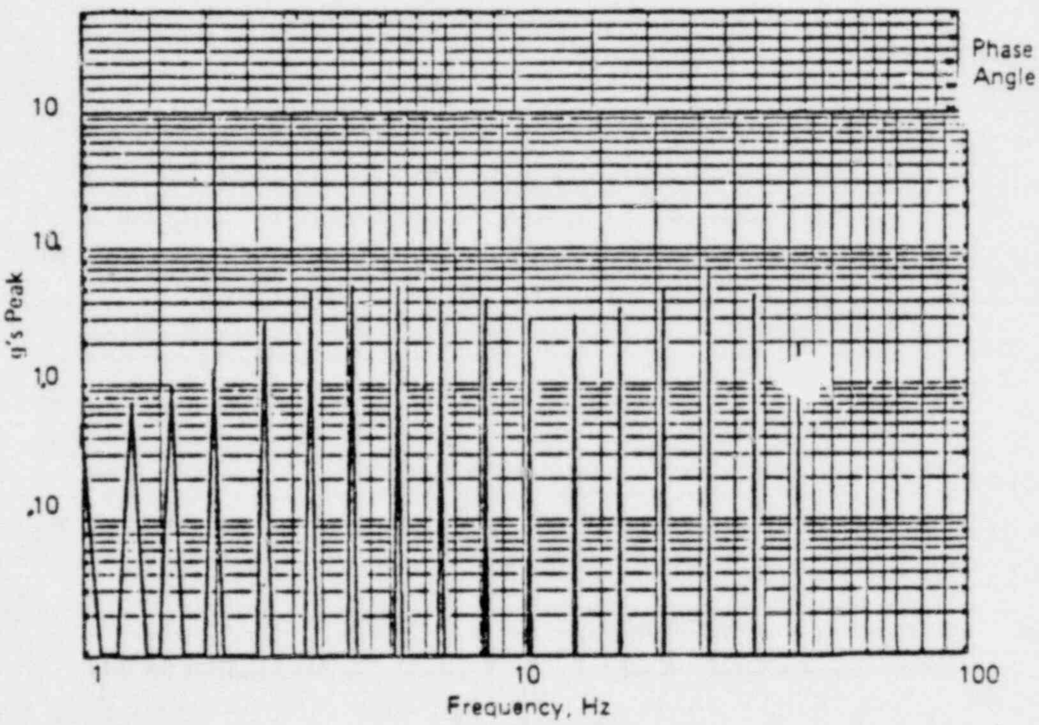

Figure No. IV.744 Test Run No. 9 Orientation 2 OBE ✓ DBE ___
Transmissibility ___ or TRS ✓ % Damping 3 Direction Horizontal Vertical
Test Item(s) Overspeed Trip

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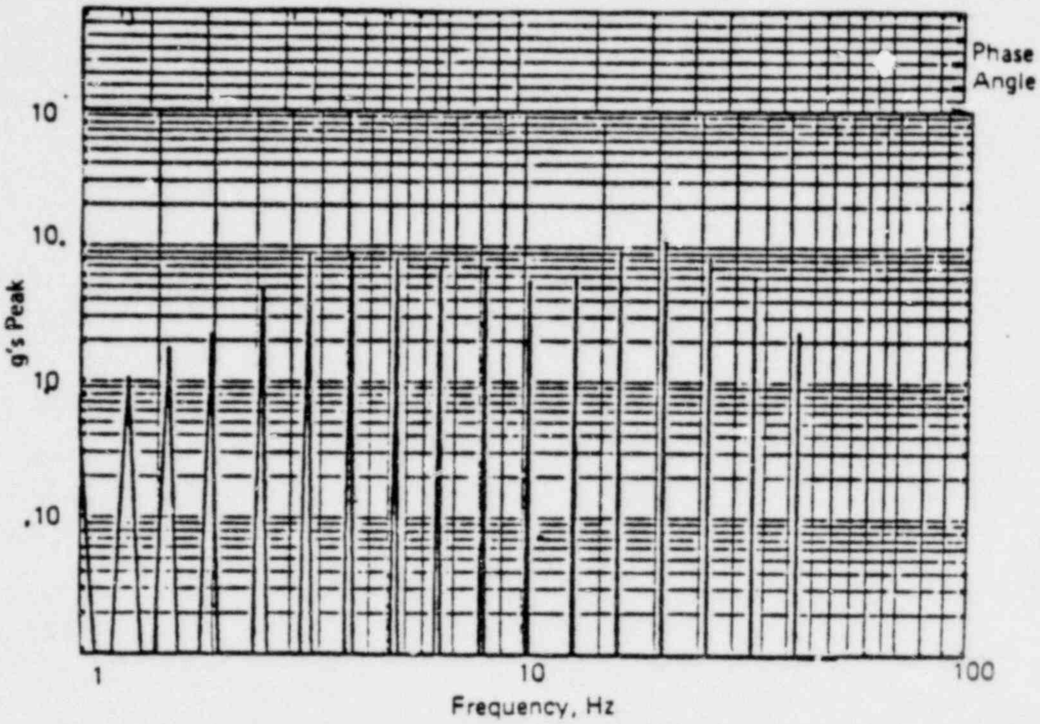


Figure No. IV.753 Test Run No. 14 Orientation 2 OBE ____ DBE ✓

Transmissibility ____ or TRS ✓ % Damping 2 Direction Horizontal Vertical

Test Item(s) Overspeed Trip

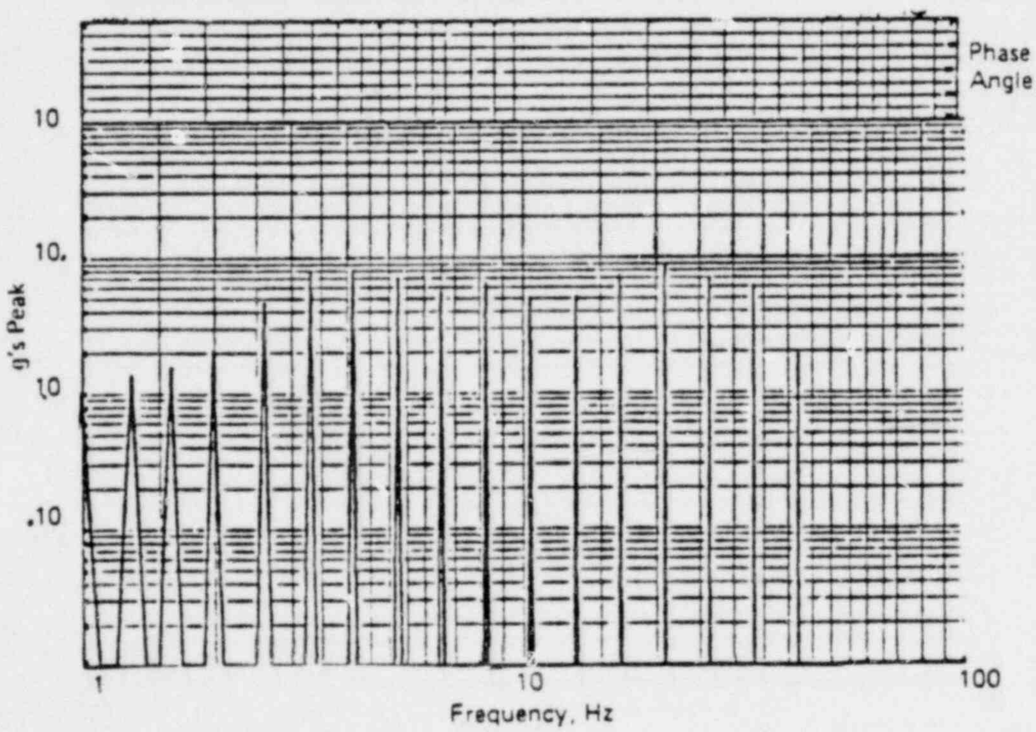


Figure No. IV.754 Test Run No. 14 Orientation 2 OBE ____ DBE ✓

Transmissibility ____ or TRS ✓ % Damping 2 Direction Horizontal Vertical

Test Item(s) Overspeed Trip

1598 0647

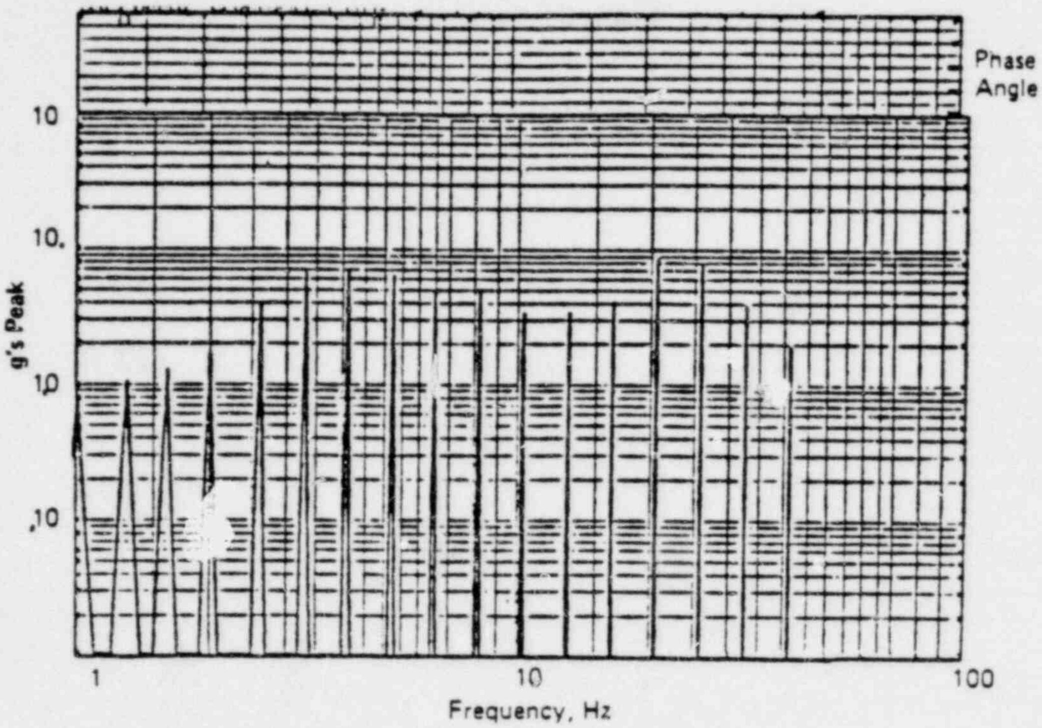


Figure No. IV.757 Test Run No. 15 Orientation 3 OBE ✓ DBE ____

Transmissibility ____ or TRS ✓ % Damping 2 Direction Horizontal Vertical

Test Item(s) Overspeed Trip

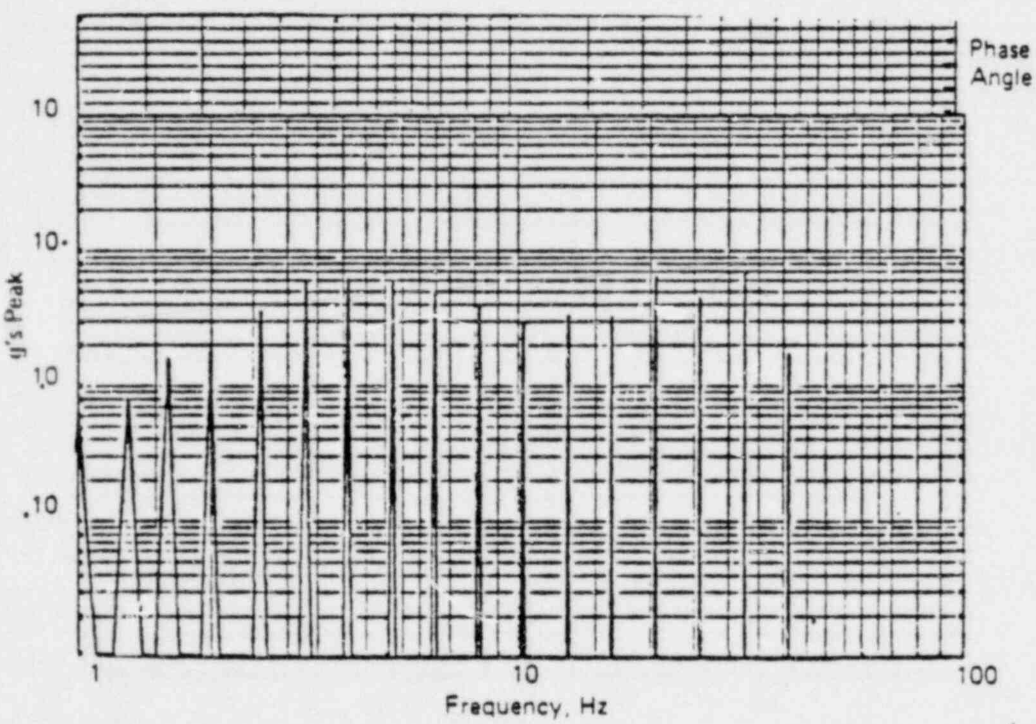


Figure No. IV.758 Test Run No. 15 Orientation 3 OBE ✓ DBE ____

Transmissibility ____ or TRS ✓ % Damping 2 Direction Horizontal Vertical

Test item(s) Overspeed Trip

1598 0649

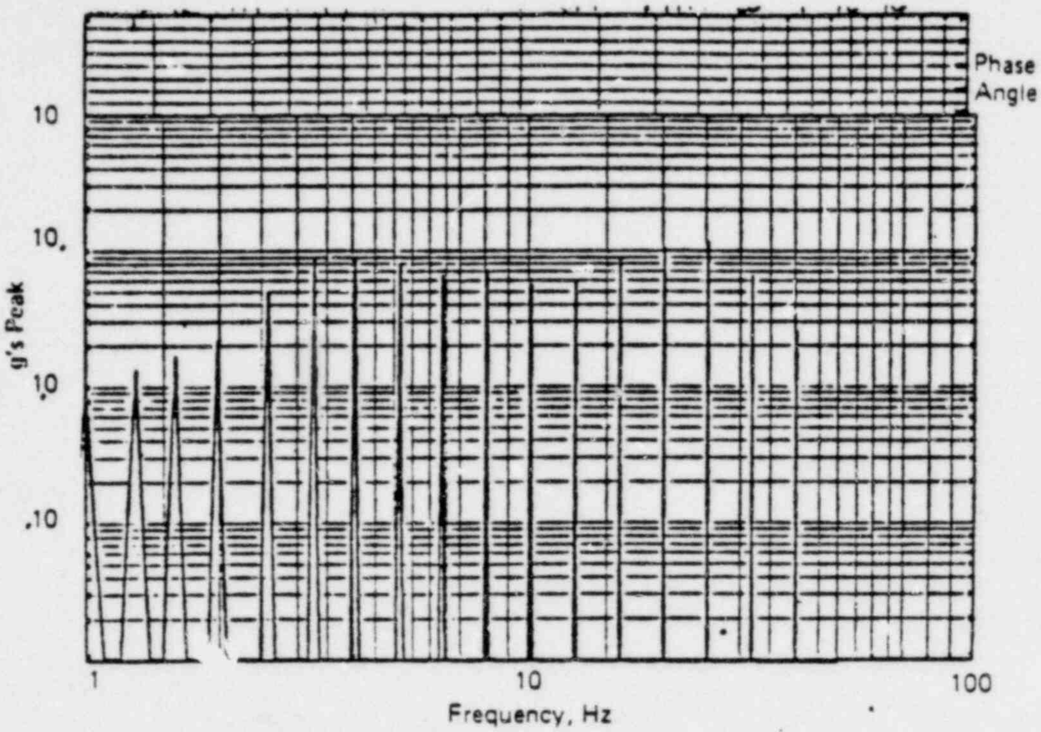


Figure No. IV.769 Test Run No. 20 Orientation 3 OBE ____ DBE ✓

Transmissibility ____ or TRS ✓ % Damping 2 Direction Horizontal Vertical

Test Item(s) Overspeed Trip

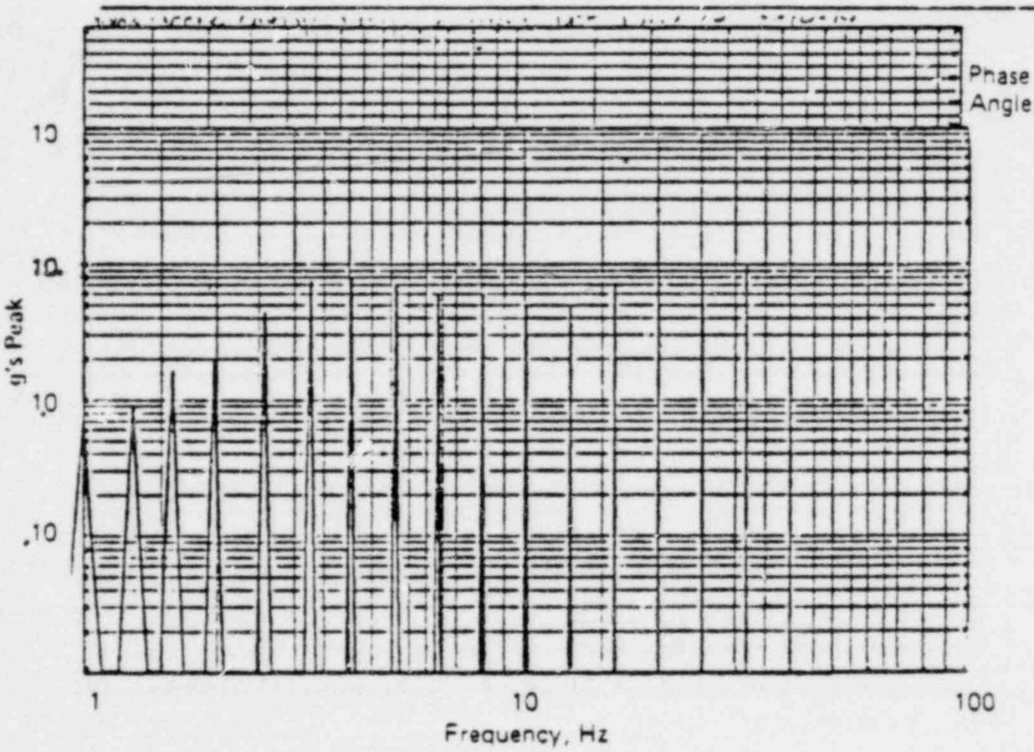


Figure No. IV.770 Test Run No. 20 Orientation 3 OBE ____ DBE ✓

Transmissibility ____ or TRS ✓ % Damping 2 Direction Horizontal Vertical

Test Item(s) Overspeed Trip

01598 0655

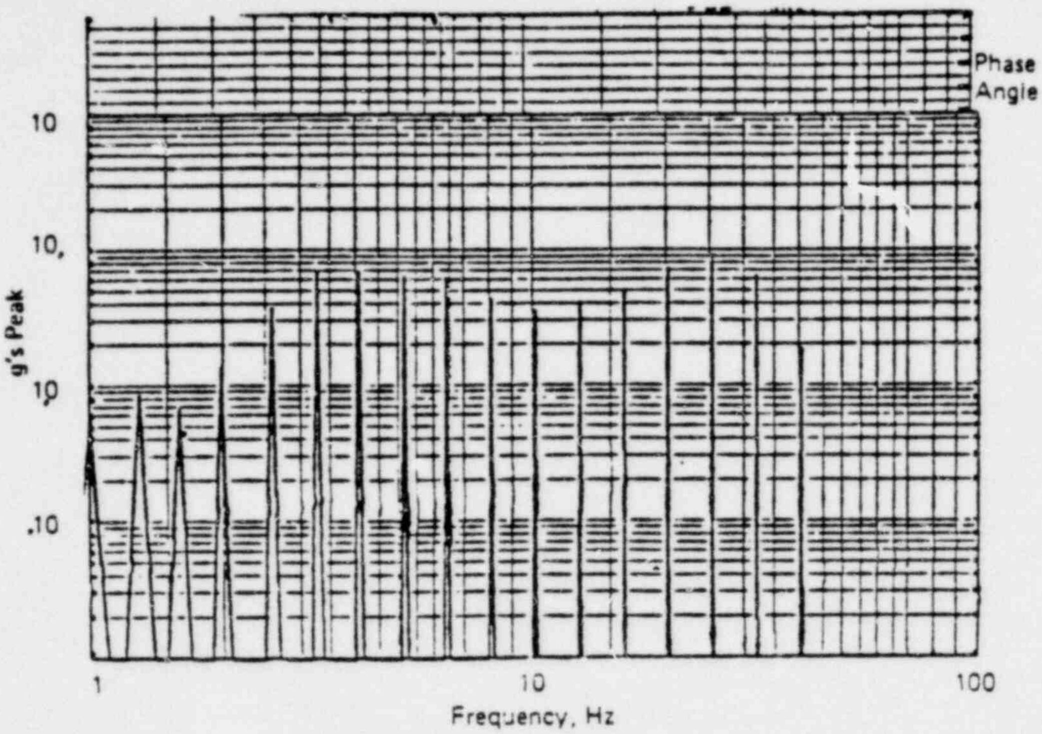


Figure No. IV.773 Test Run No. 21 Orientation 4 OBE ✓ DBE ____

Transmissibility ____ or TRS ✓ % Damping 2 Direction Horizontal Vertical

Test Item(s) Overspeed Trip

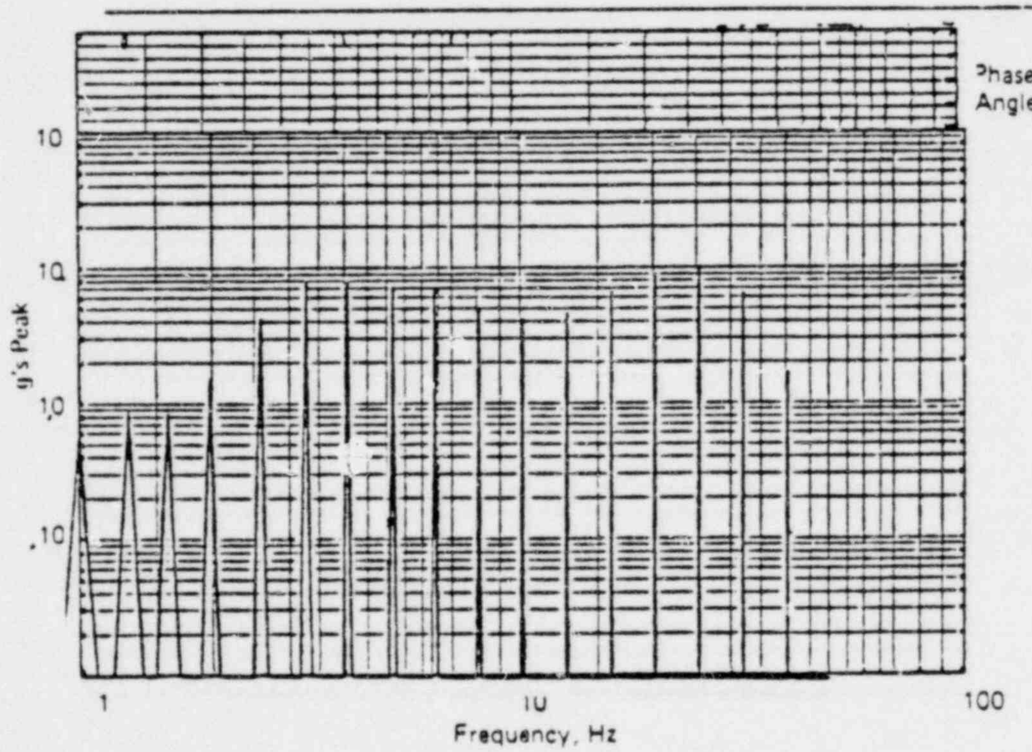


Figure No. IV.774 Test Run No. 21 Orientation 4 OBE ✓ DBE ____

Transmissibility ____ or TRS ✓ % Damping 2 Direction Horizontal Vertical

Test Item(s) Overspeed Trip

9159 0657

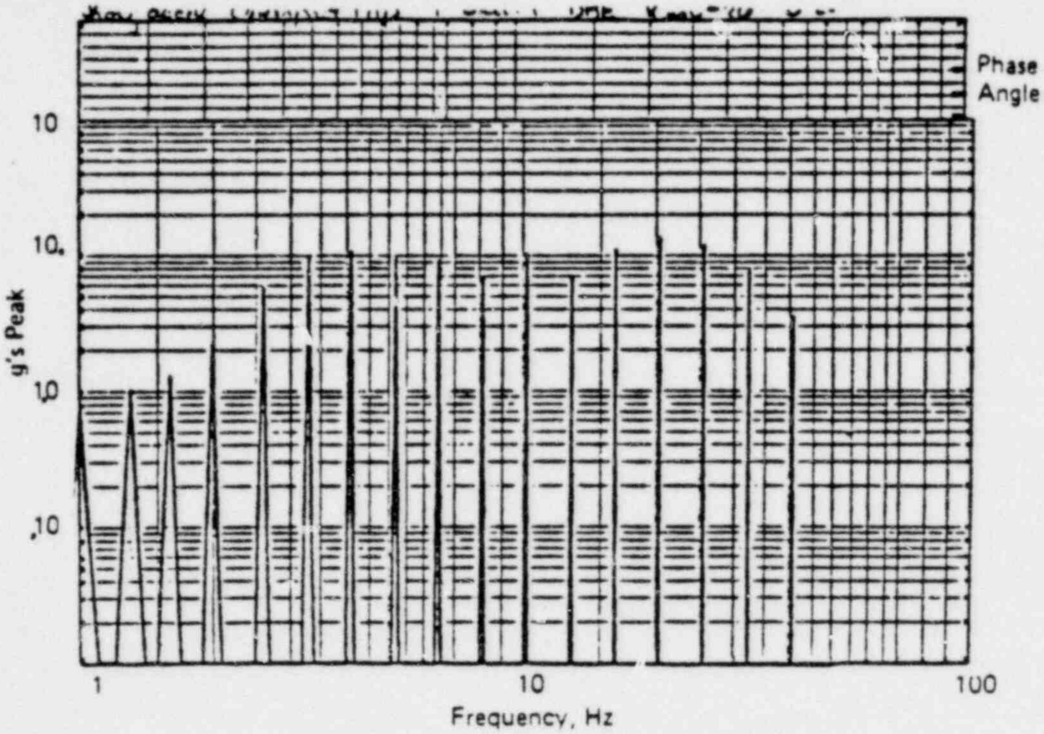


Figure No. IV.785 Test Run No. 26 Orientation 4 OBE ____ DBE ✓

Transmissibility ____ or TRS ✓ % Damping 2 Direction Horizontal Vertical

Test Item(s) Overspeed Trip

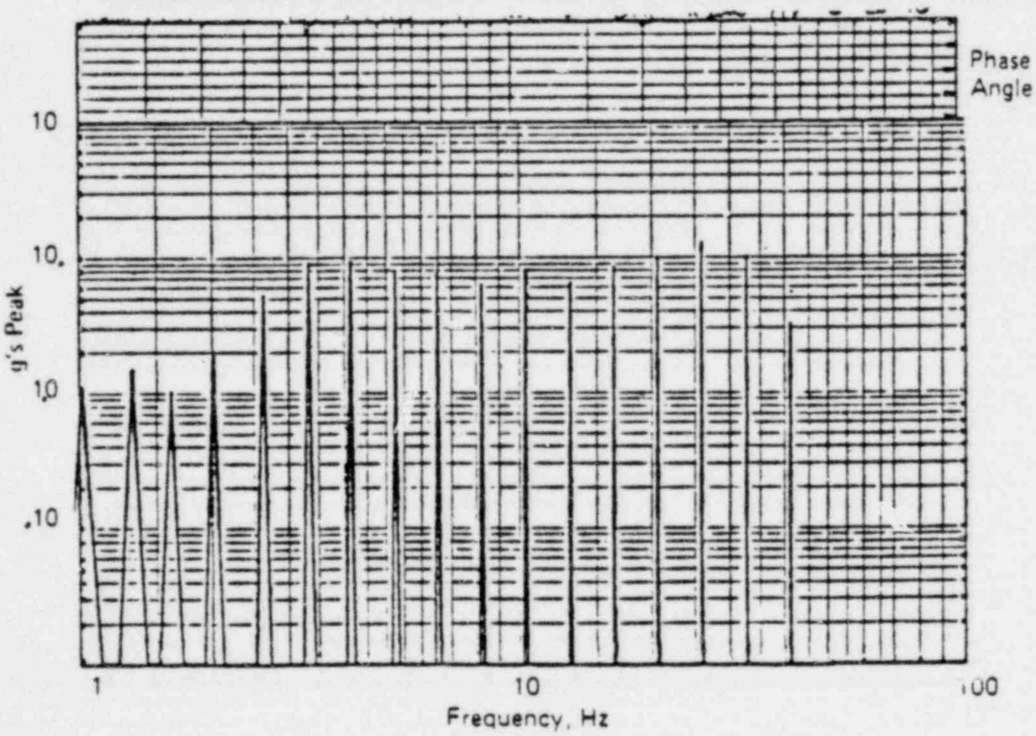


Figure No. IV.786 Test Run No. 26 Orientation 4 OBE ____ DBE ✓

Transmissibility ____ or TRS ✓ % Damping 2 Direction Horizontal Vertical

Test Item(s) Overspeed Trip

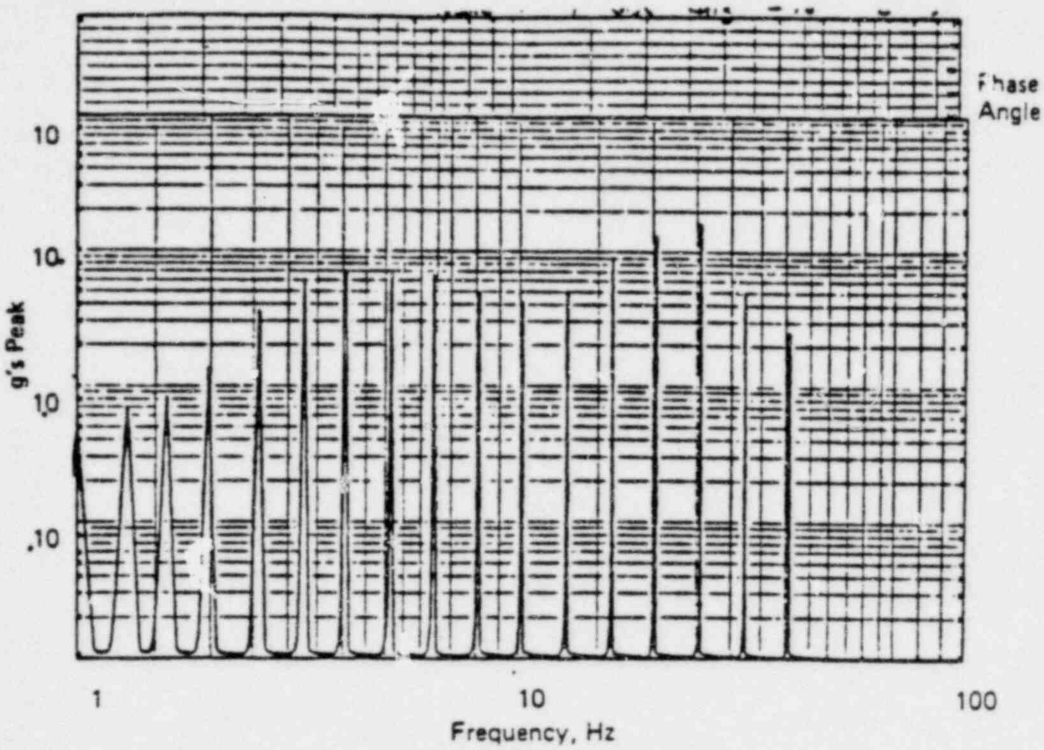


Figure No. N.807 Test Run No. 1 Orientation 1 OBE ✓ DBE ____
Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical
Test Item(s) Governor

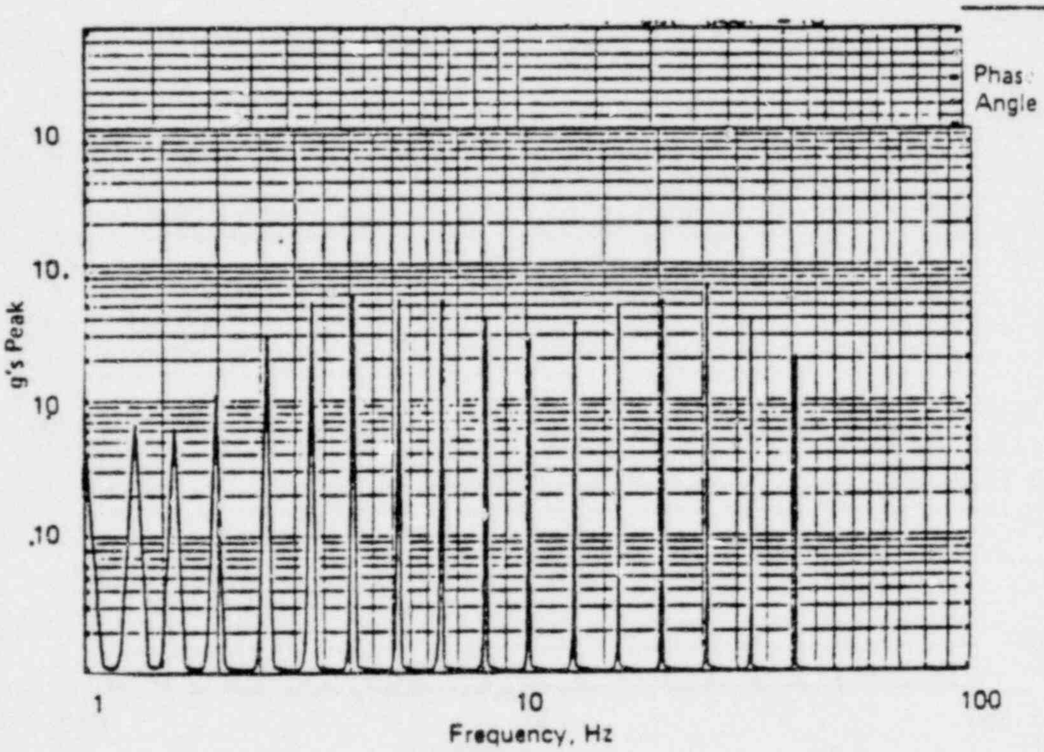


Figure No. N.808 Test Run No. 1 Orientation 1 OBE ✓ DBE ____
Transmissibility ____ or TRS ✓ % Damping 3 Direction Horizontal Vertical
Test Item(s) Governor

n1598-0678

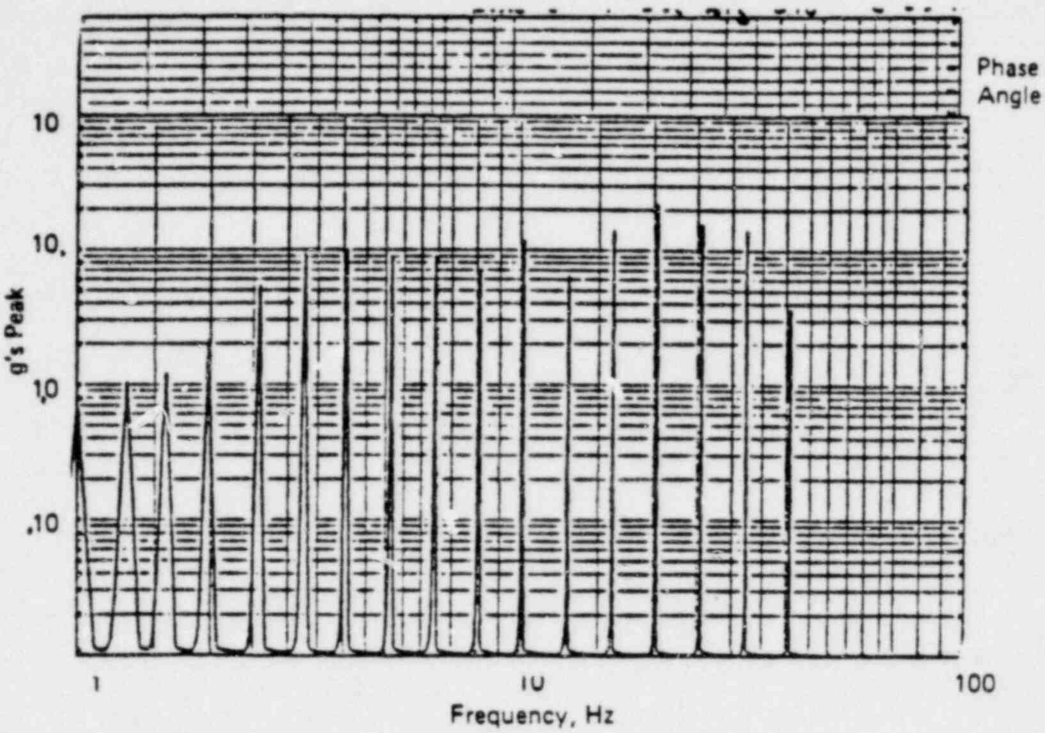


Figure No. IV.823 Test Run No. 6 Orientation 1 OBE ____ DBE ✓

Transmissibility ____ or TRS ✓ % Damping 2 Direction Horizontal Vertical

Test Item(s) Governor

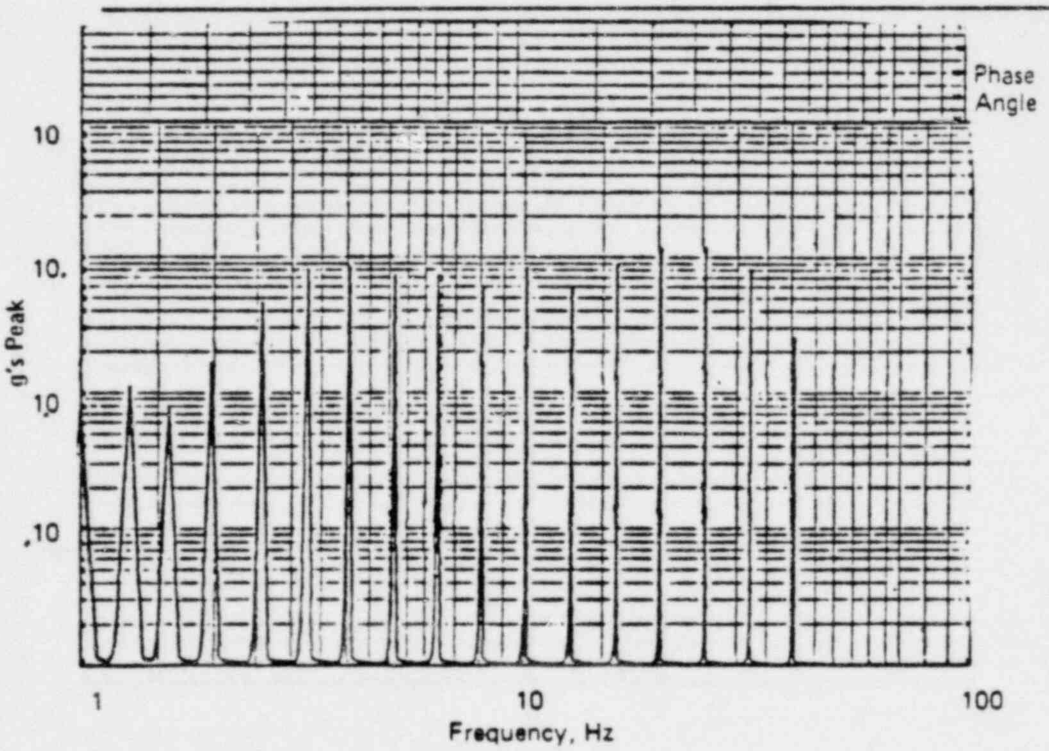


Figure No. IV.824 Test Run No. 6 Orientation 1 OBE ____ DBE ✓

Transmissibility ____ or TRS ✓ % Damping 2 Direction Horizontal Vertical

Test Item(s) Governor

0159 0606

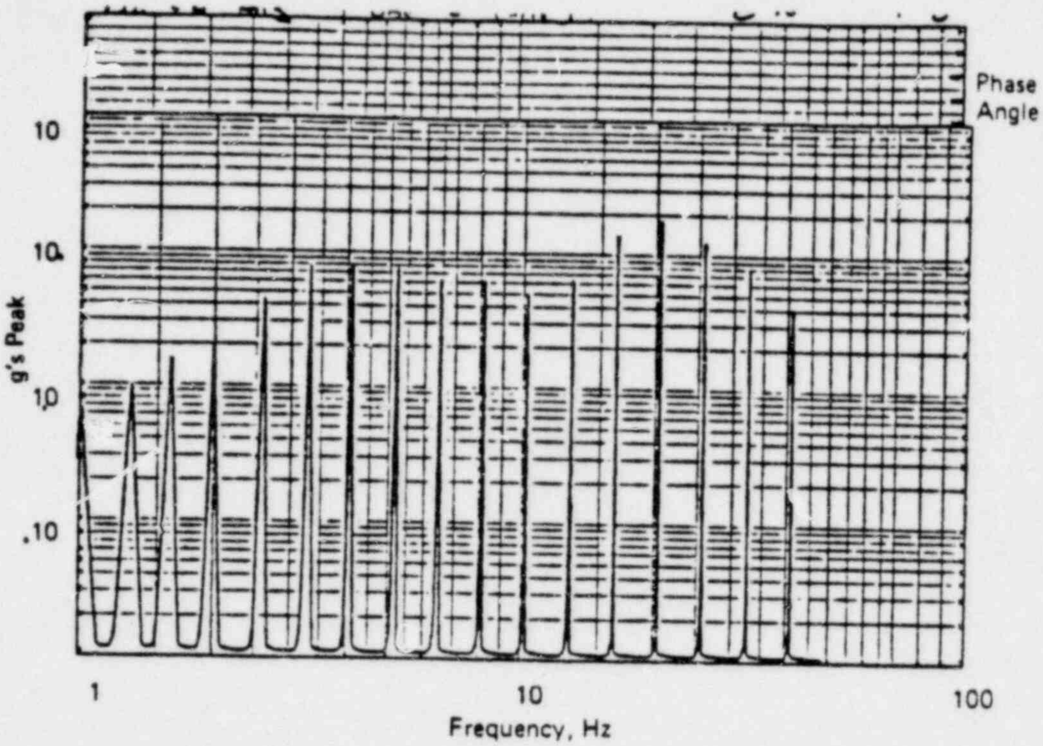


Figure No. IV.827 Test Run No. 8 Orientation 2 OBE ✓ DBE ____

Transmissibility ____ or TRS ✓ % Damping 2 Direction Horizontal Vertical

Test Item(s) Governor

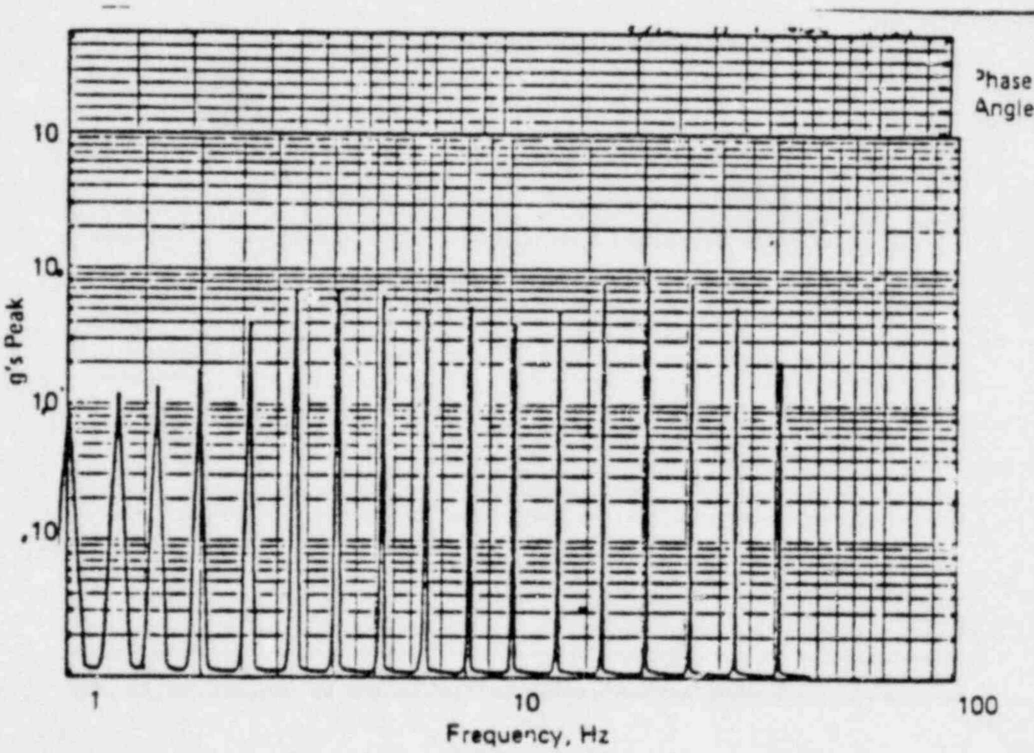


Figure No. IV.828 Test Run No. 8 Orientation 2 OBE ✓ DBE ____

Transmissibility ____ or TRS ✓ % Damping 2 Direction Horizontal Vertical

Test Item(s) Governor

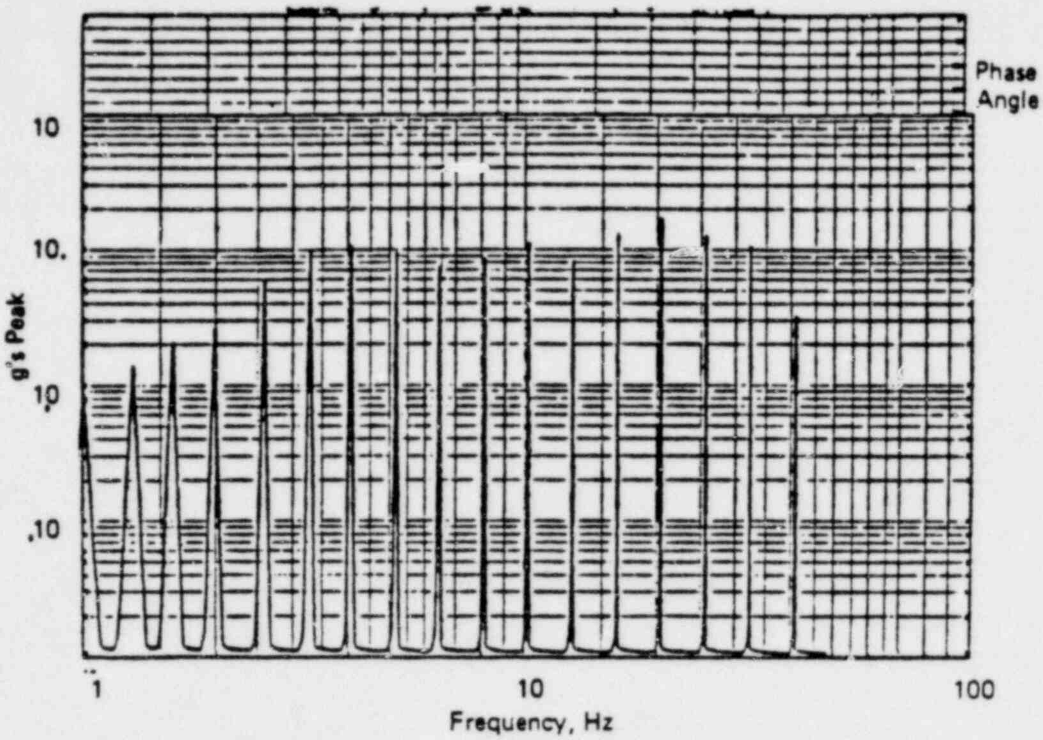


Figure No. IV.837 Test Run No. 13 Orientation 2 OBE ___ DBE √

Transmissibility ___ or TRS √ % Damping 2 Direction Horizontal Vertical

Test Item(s) Governor

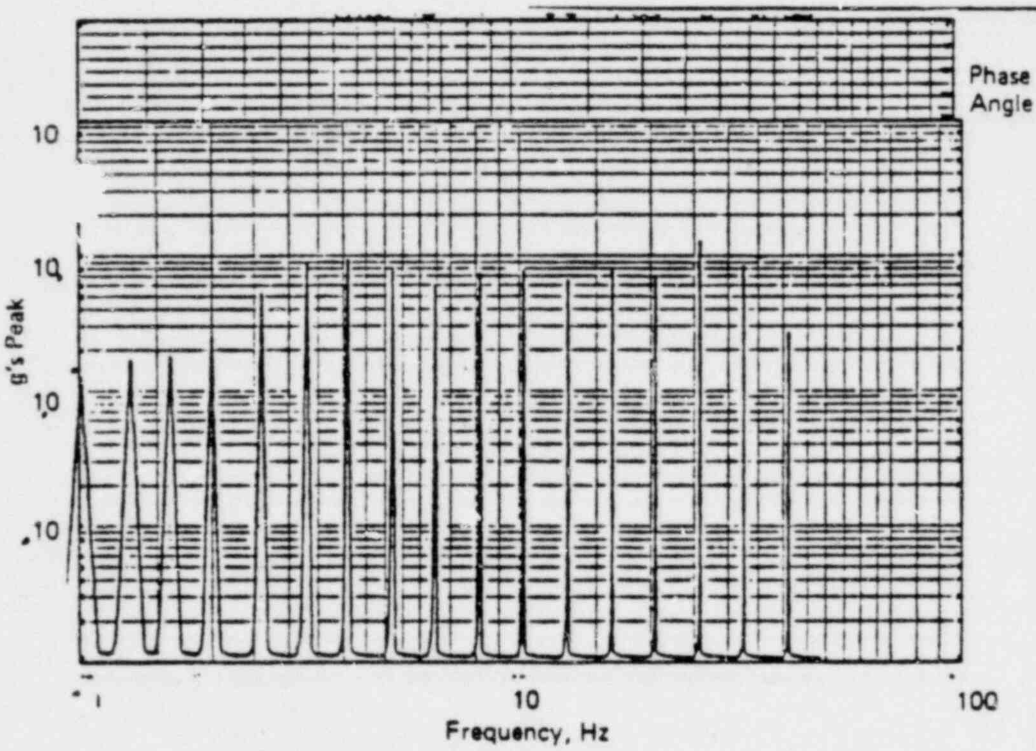


Figure No. IV.838 Test Run No. 13 Orientation 2 OBE ___ DBE √

Transmissibility ___ or TRS √ % Damping 2 Direction Horizontal Vertical

Test Item(s) Governor

Structural Dynamics Research Corporation

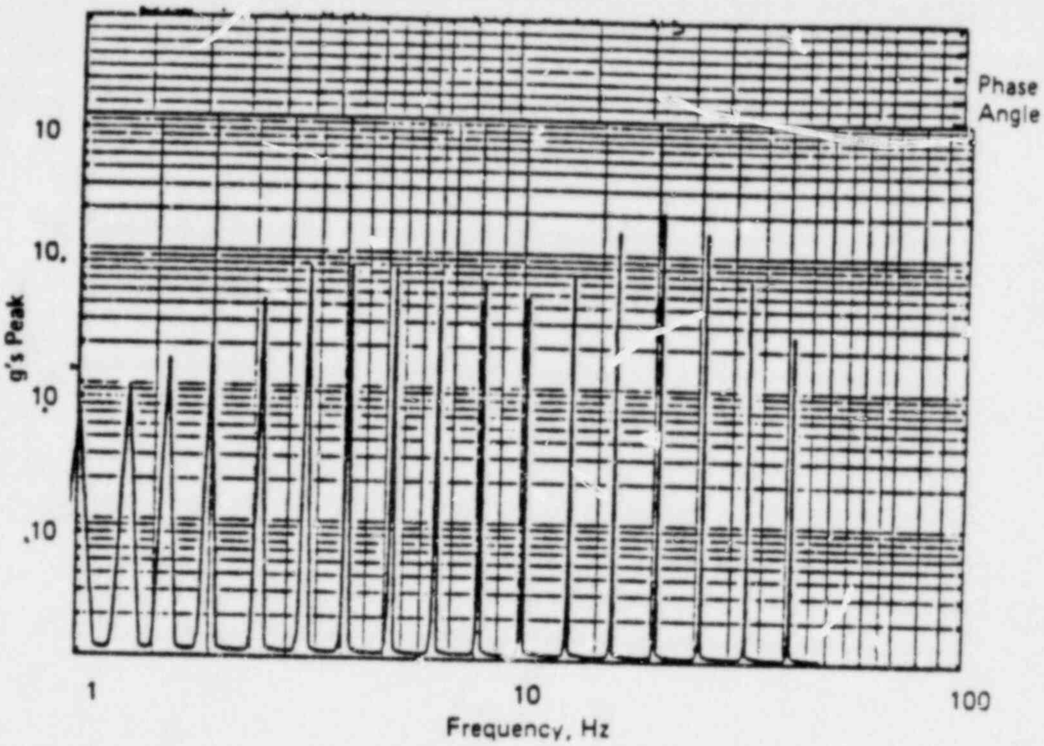


Figure No. IV.839 Test Run No. 14 Orientation 3 OBE ✓ DBE ____

Transmissibility ____ or TRS ✓ % Damping 2 Direction Horizontal Vertical

Test Item(s) Governor

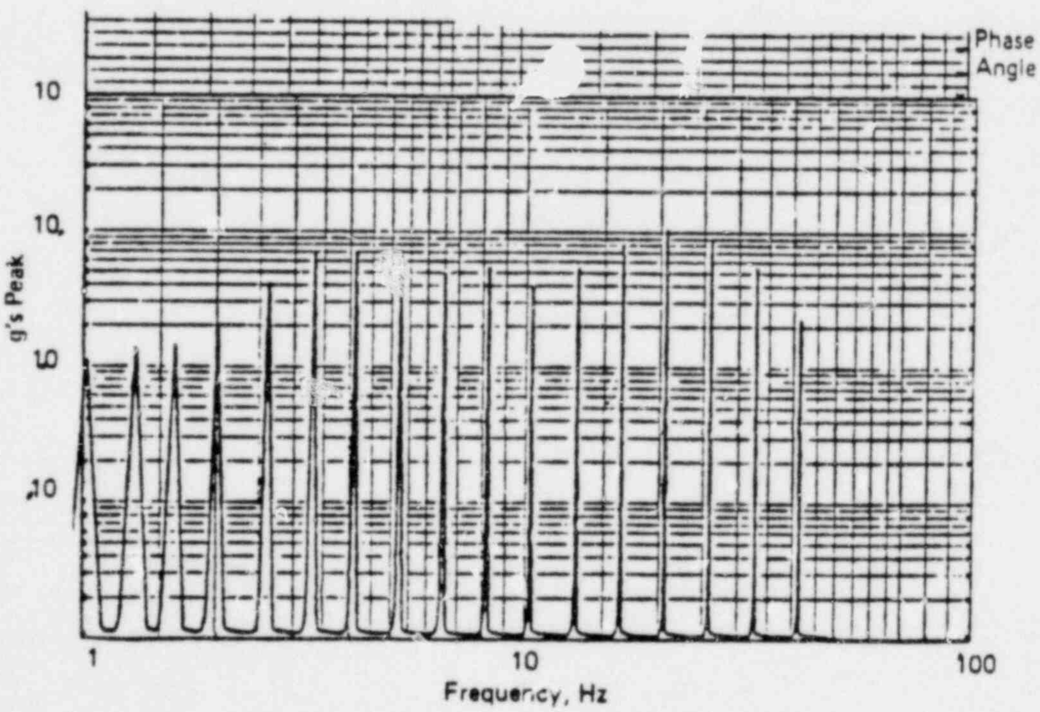


Figure No. IV.840 Test Run No. 14 Orientation 3 OBE ✓ DBE ____

Transmissibility ____ or TRS ✓ % Damping 2 Direction Horizontal Vertical

Test Item(s) Governor

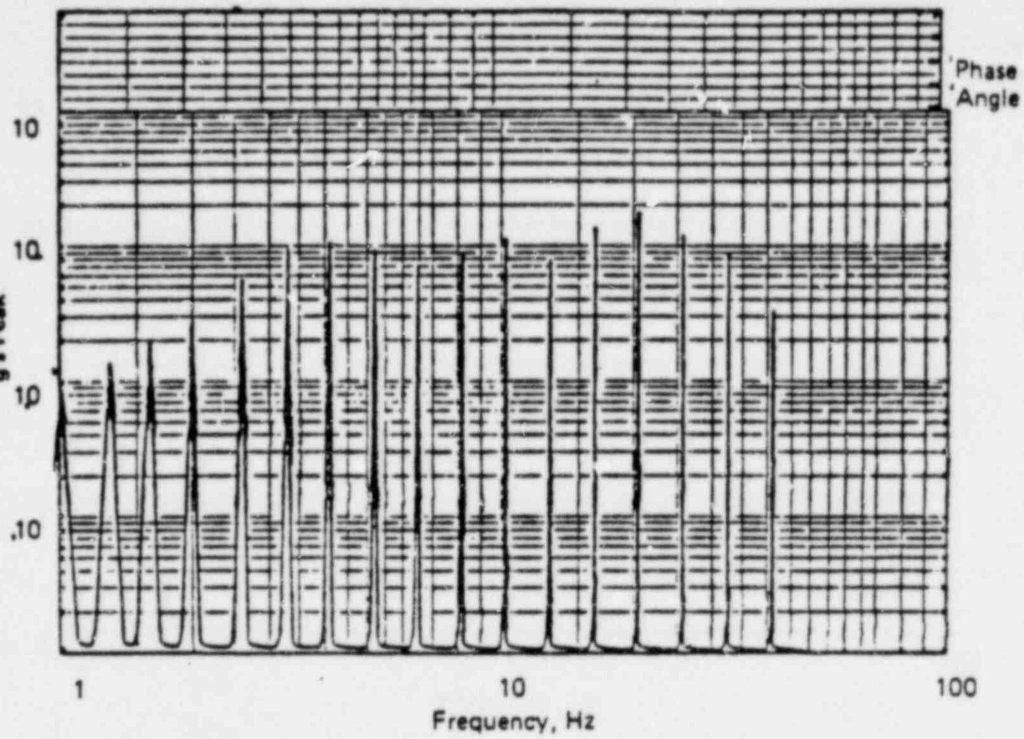


Figure No. IV.849 Test Run No. 19 Orientation 3 OBE ___ DBE √

Transmissibility ___ or TRS √ % Damping 2 Direction Horizontal Vertical

Test Item(s) Governor

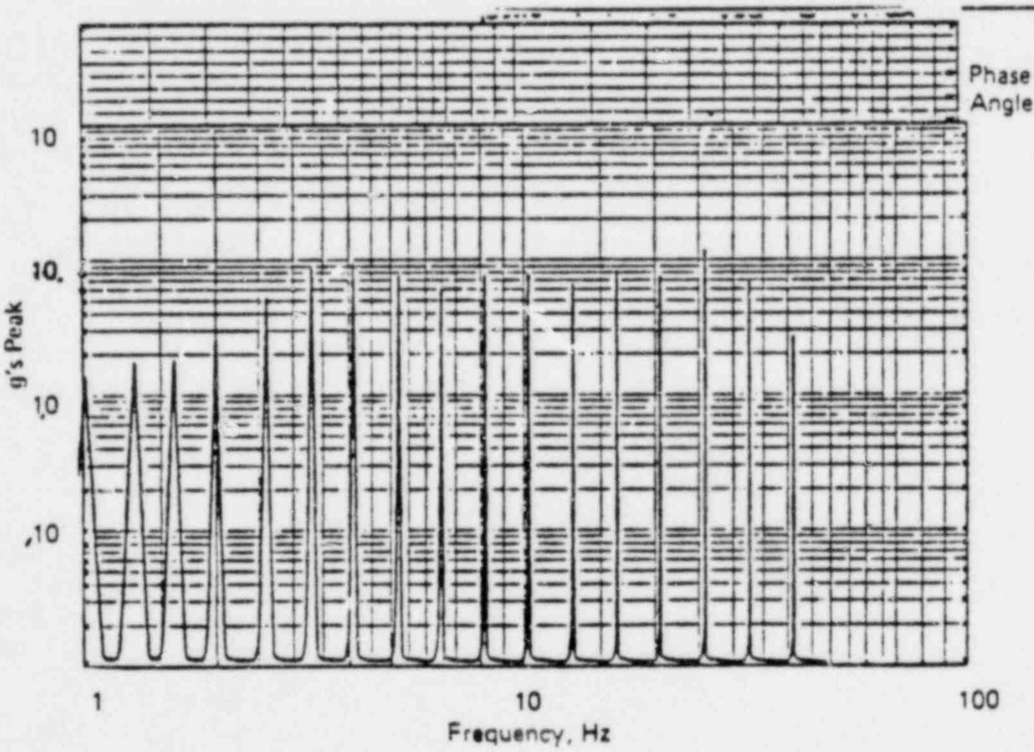


Figure No. IV.850 Test Run No. 19 Orientation 3 OBE ___ DBE √

Transmissibility ___ or TRS √ % Damping 2 Direction Horizontal Vertical

Test Item(s) Governor

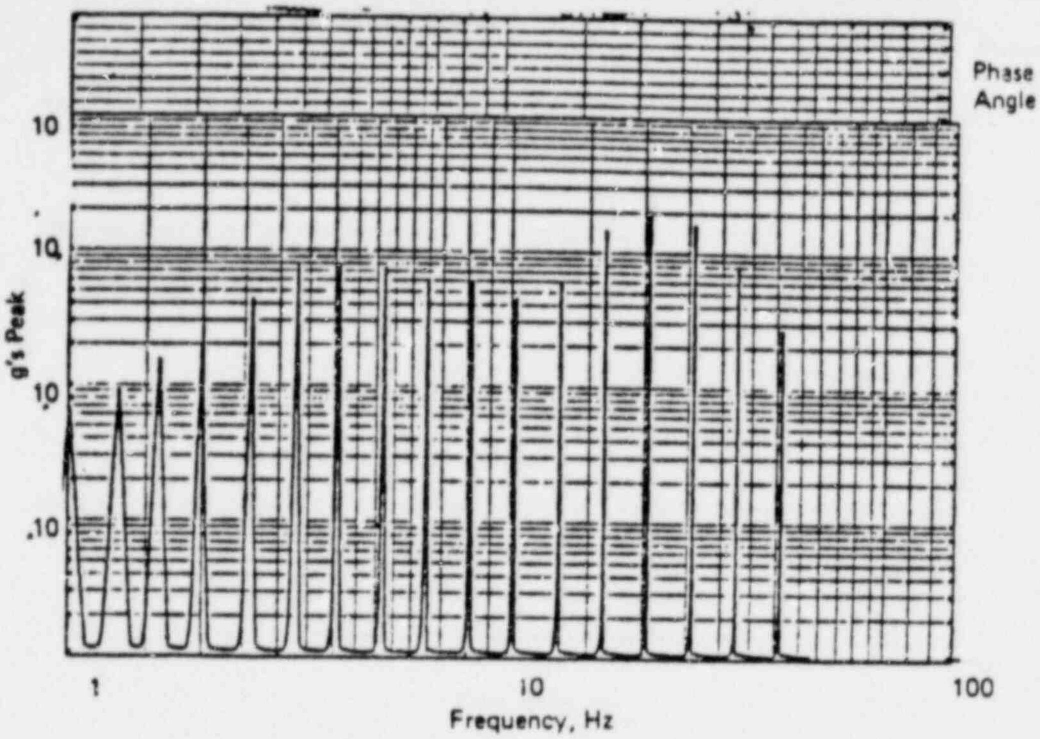


Figure No. IV.851 Test Run No. 20 Orientation 4 OBE ✓ DBE ____

Transmissibility ____ or TRS ✓ % Damping 2 Direction Horizontal Vertical

Test Item(s) Governor

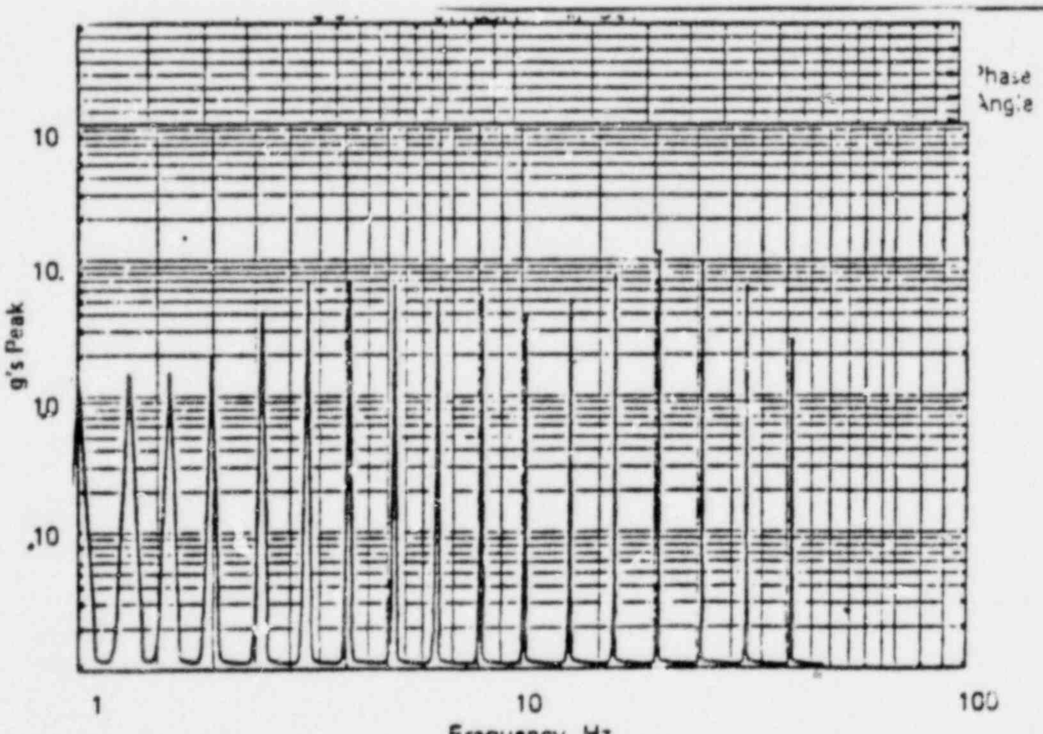


Figure No. IV.852 Test Run No. 20 Orientation 4 OBE ✓ DBE ____

Transmissibility ____ or TRS ✓ % Damping 2 Direction Horizontal Vertical

Test Item(s) Governor

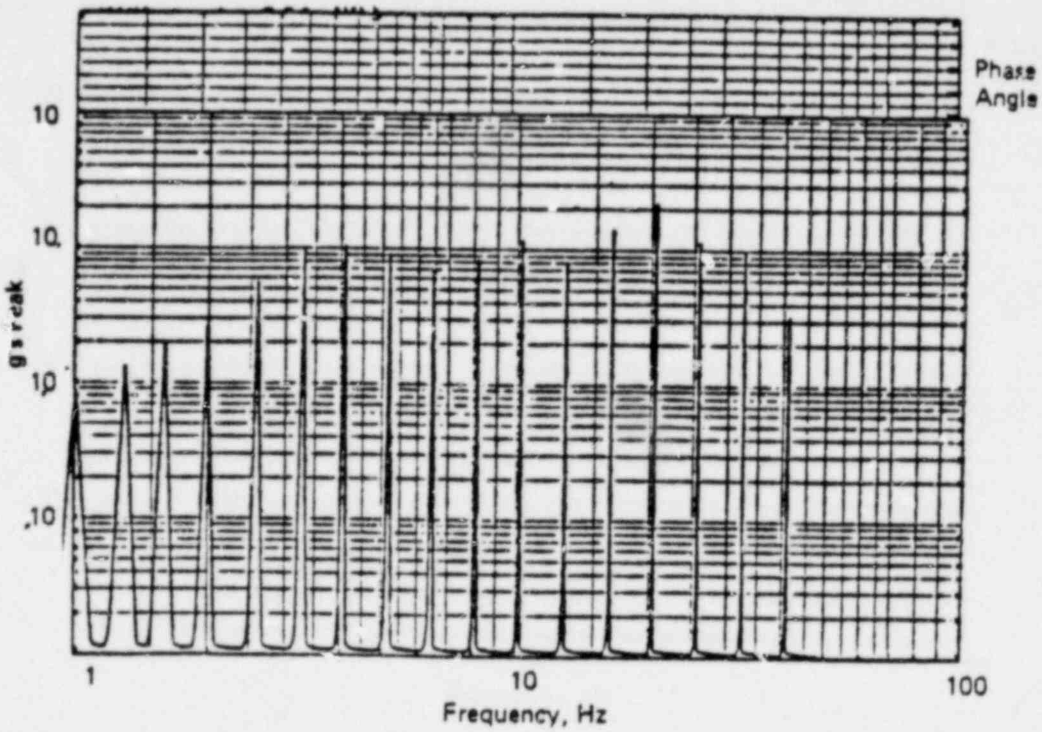


Figure No. IV.861 Test Run No. 25 Orientation 4 OBE ____ DBE ✓

Transmissibility ____ or TRS ✓ % Damping 2 Direction Horizontal Vertical

Test Item(s) Governor

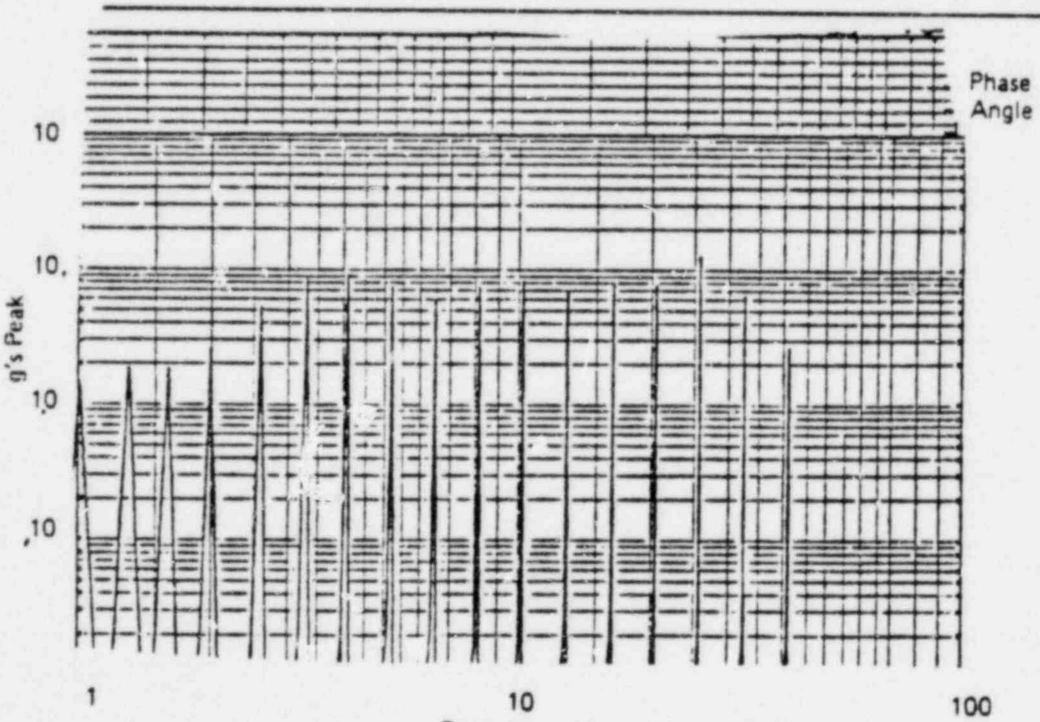


Figure No. IV.862 Test Run No. 25 Orientation 4 OBE ____ DBE ✓

Transmissibility ____ or TRS ✓ % Damping 2 Direction Horizontal Vertical

Test Item(s) Governor

Structural Dynamics Research Corporation

0159 80705

GRAND GULF
NUCLEAR STATION
UNIT 1

SEISMIC AND HYDRODYNAMIC LOADS

REQUALIFICATION CERTIFICATION

JOB NO. MPL-02

EQUIPMENT NAME: Standby Diesel Generator Generator Cabinet/Control Panel — SPEC. NO:9645-M-018.0

EQUIPMENT NO: 1H22P113,1H22P115

LOCATION: Diesel Generator Bldg., El. 136' - 0"

EQUIPMENT CLASSIFICATION: [X] ACTIVE [ ] PASSIVE

SEISMIC QUALIFICATION REPORT REFERENCE:

9645-M-018.0-Q1P75E001A-7.0-7-0, Report No. 58109, Seismic Testing of One D. G. Cabinet & One Control Panel, 12/13/76, by Wyle Laboratories.

9645-M-018.0-Q1P75E001A-7.0-10-0, Report No. 58180, Seismic Testing of Time Overcurrent Relay, 5/25/77, by Wyle Laboratories.

THE ABOVE SEISMIC QUALIFICATION REPORT(S) HAVE BEEN REEVALUATED AND REQUALIFIED WHERE NECESSARY TO SHOW THAT THE ABOVE-MENTIONED COMPONENT IS CAPABLE OF PERFORMING ITS INTENDED SAFETY FUNCTION UNDER ALL THE APPLICABLE LOADING COMBINATIONS INCLUDING THE POOL DYMANIC LOADS.

PREPARED: T R Mager
T. R. Mager

APPROVED: J. C. Rawlings for
V. J. Brocato

DATE: 7-10-81

GRAND GULF NUCLEAR STATION UNIT 1

QUALIFICATION SUMMARY

1. Equipment Name Standby Diesel Generator Generator Cabinet/Control Panel
2. Equipment No. 1H22P113,1H22P115
3. Qualification Documentation (Enclosed with this report.)

A. Qualification Summary of Equipment (SQRT form), including required response spectra with TRS plotted on RRS graph as appropriate.

B. Reference Documents

Reference Number	Document Identification	Revision or Date	Title/Subject
9645-M-018.0-Q1P75-E001A-7.0-7-0	58109	12/13/76	Wyle Laboratories Seismic Testing of One D. G. Cabinet & One Control Panel
9645-M-018.0-Q1P75-E001A-7.0-10-0	58180	5/25/77	Wyle Laboratories Seismic Testing of Time Overcurrent Relay
0266/M-018.0	VB-76/0751	12/9/76	Bechtel Letter on Seismic Qualification Test of Generator Control Panel

C. Additional Supporting Documents

Document Identification	Revision or Date	Title/Subject
9645-M-018.0	Rev. 21	Design Specification For Standby Diesel Generators For Mississippi Power & Light Company Grand Gulf Nuclear Station Units 1 and 2

EQUIPMENT NO. 1H22P113, 1H22P115

4. Functional Requirements

The Standby Diesel Generator Generator Cabinet must remain functional during and after the Operating Basis Earthquake and remain functional during and after the Safe Shutdown Earthquake.

5. Demonstration Capability

Multi-axis, multi-frequency random input testing was used to qualify the generator cabinet to SQRT requirements. Contact chatter was encountered on the Lockout Relay during testing at one (1) μsec interval but was OK at (10) μsec interval setting. The Ground Overcurrent Relay malfunctioned during testing and was replaced with a different relay which operated during testing without failure. Five OBE tests with input accelerations of 0.6g horizontal and 0.54g vertical, and three SSE tests with input accelerations of 1.2g horizontal and 2.3g vertical were run.

6. Rationale for Qualification Certification

(Include Decision analysis with comparison to acceptance criteria, approach for demonstrating operability, and consideration of high-frequency response.)

Multi-axis, multi-frequency testing is an acceptable method of qualifying instrumentation to SQRT requirements. The test frequency range of 1-100 hz was adequate to consider all significant responses. The control panel operability was verified during testing. The ground overcurrent relay malfunctioned during seismic testing and was replaced with a different type of overcurrent relay. The new time overcurrent relays operability was demonstrated during seismic testing. The maximum acceptable contact chatter for the Control Panel was stated to be 10 μsec.

1H22P113
1H22P115

Qualification Summary of Equipment

I. **Plant Name:** Grand Gulf Nuclear Station Unit I

Type:

1. Utility: Mississippi Power and Light Co.

PWR

2. NSSS: G.E. 3. A/E: Bechtel Power Corp.

BWR 6, Mark III

II. **Component Name** Standby D. G. Generator Cabinet/Control Panel

1. Scope: [ ] NSSS [x] BOP

2. Model Number: 74033-119,-122 Quantity: 2

3. Vendor: Delta Switchboard/Delaval

4. If the component is a cabinet or panel, name and model No. of the devices included: Various Relays

5. Physical Description a. Appearance

b. Dimensions 108" X 52" X 82" high

c. Weight 8000 lbs

6. Location: Building: Diesel Generator Bldg.

Elevation: 136' - 0"

7. Field Mounting Conditions [X] Bolt (No. 8, Size 3/4")
[ ] Weld (Length)
[ ]

8. a. System in which located: Standby Diesel Generator System

b. Functional Description: House relays required for operation of standby Diesel Generators.

c. Is the equipment required for [ ] Hot Standby [X] Cold Shutdown

[ ] Both [ ] Neither

9. Pertinent Reference Design Specifications:

BPC 9645-M018.0, Rev. 21

Prepared by: TRM 4/27/81

Verified by: TL 5/7/81

12/80

III. Is Equipment Available for Inspection in the Plant: [x] Yes [ ] No

IV. Equipment Qualification Method:

[x] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: 9645-M-018.0-Q1P75E001A-7.0-7-0

(No., Title and Date) 58109, Seismic Testing of One DG Cabinet & One Control Panel, 12/13/76

Company that Prepared Report: Wyle Laboratories

Company that Reviewed Report: Bechtel/NUTECH

V. Vibration Input:

1. Loads considered: a. [X] Seismic only

   b. [ ] Hydrodynamic only

   c. [ ] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [ ] SRSS [X] RRS Envelope (other, specify)

3. Required Response Spectra (attach the graphs): RRS Envelope

4. Damping Corresponding to RRS: OBE ______ SSE 3%

5. Required Acceleration in Each Direction: [x] ZPA [ ] Other ______ (specify)

OBE	S/S =	F/B =	V =
SSE	S/S = 0.55g	F/B = 0.55g	V = 0.55g

6. Were fatigue effects or other vibration loads considered?

   [ ] Yes [x] No

   If yes, describe loads considered and how they were treated in overall qualification program: ______

*NOTE: If more than one report complete items IV thru VII for each report.

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency [X] Multi-Frequency: [X] random [ ] sine beat [ ] ______

2. [ ] Single Axis [X] Multi-Axis

3. No. of Qualification Tests: OBE (X-Y)-6 (Z-Y)-5 SSE (X-Y)-3 (Z-Y)-5 Other ______ (specify)

4. Frequency Range: 1.1-100Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ______ F/B = ______ V = ______

6. Method of Determining Natural Frequencies

[X] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [X] Yes (Attach TRS & RRS graph [ ] No

8. Input g-level Test: OBE S/S = 0.6g F/B = 0.6g V = 0.54g

SSE S/S = 1.2g F/B = 1.2g V = 2.3g

9. Laboratory Mounting:

1. [X] Bolt (No. 8 , Size 3/4") [ ] Weld (Length ______) [ ] ______

10. Functional operability verified: [X] Yes** [ ] No [ ] Not Applicable

11. Test Results including modifications made: Ground Overcurrent Relay malfunctioned during seismic testing

12. Other test performed (such as aging or fragility test, including results):

______

______

*Note: If qualification by a combination of test and analysis also complete Item VII.

** Lockout Relay experienced chatter at 1 μsec interval but OK at 10 μsec interval setting.

VII. If Qualification by Analysis, then complete: N/A

1. Method of Analysis:

   [ ] Static Analysis   [ ] Equivalent Static Analysis

   [ ] Dynamic Analysis: [ ] Time-History   [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = ______________   F/B = ______________   V = ______________

3. Model Type: [ ] 3D   [ ] 2D   [ ] 1D

   [ ] Finite Element   [ ] Beam   [ ] Closed Form Solution

4. [ ] Computer Codes: ____

   Frequency Range and No. of modes considered: ______________________

   [ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
   [ ] Other: ______________ (specify)

6. Damping: OBE_________ SSE______ Basis for the damping used: ______________

7. Support Considerations in the model: ______________________________

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

III. Is Equipment Available for Inspection in the Plant: [x] Yes [ ] No

IV. Equipment Qualification Method:

[xx] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: 9645-M-018.0-Q1P75E001A-7.0-10-0

(No., Title and Date) 58180 Seismic Testing of Time Overcurrent Relay, 5/25/77

Company that Prepared Report: Wyle Laboratories

Company that Reviewed Report: Bechtel/NUTECH

V. Vibration Input:

1. Loads considered: a. [x] Seismic only

   b. [ ] Hydrodynamic only

   c. [ ] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [ ] SRSS [X] See Note ** (other, specify)

3. Required Response Spectra (attach the graphs): See Note **

4. Damping Corresponding to RRS: OBE 3% SSE 3%

5. Required Acceleration in Each Direction: [x] ZPA [ ] Other (specify)

OBE	S/S = 1.5g	F/B = 1.5g	V = 3.0g
SSE	S/S = 3.0g	F/B = 3.0g	V = 6.0g

6. Were fatigue effects or other vibration loads considered?

   [ ] Yes [x] No

   If yes, describe loads considered and how they were treated in overall qualification program:

*NOTE: If more than one report complete items IV thru VII for each report.

** RRS used for seismic test not specifically for Grand Gulf. Level of acceleration is higher than required for Grand Gulf. 12/80

Time Overcurrent Relay (G.E. Model #125FC151A1A)

VI. If Qualification by Test, then Complete*:

1. [ ] Single Frequency [x] Multi-Frequency: [x] random [x] sine beat [ ] ________

2. [ ] Single Axis [x] Multi-Axis

3. No. of Qualification Tests: OBE 5 SSE 7-(Z-Y) 9-(X-Y) Other ________ (specify)

4. Frequency Range: 1-100 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ________ F/B = ________ V = ________

6. Method of Determining Natural Frequencies

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [x] Yes (Attach TRS & RRS graph
[ ] No

8. Input g-level Test: OBE S/S = ∿4g F/B = ∿4g V = ∿5g

SSE S/S = ∿5g F/B = ∿5g V = ∿7g

9. Laboratory Mounting:

1. [x] Bolt (No. 4**, Size ____) [ ] Weld (Length ____) [ ] ____

10. Functional operability verified: [x] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: contact chatter (1-10u sec) during SSE when energized

12. Other test performed (such as aging or fragility test, including results):

none

*Note: If qualification by a combination of test and analysis also complete Item VII.

**NOTE: The unit was attached to a bookend type fixture in a panel cut out to simulate actual in-service mounting.

VII. If Qualification by Analysis, then complete: N/A

1. **Method of Analysis:**

   [ ] Static Analysis [ ] Equivalent Static Analysis

   [ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = ________ F/B = ________ V = ________

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

   [ ] Finite Element [ ] Beam [ ] Closed Form Solution

4. [ ] Computer Codes: ________

   Frequency Range and No. of modes considered: ________

   [ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
   [ ] Other: ________
   (specify)

6. Damping: OBE ________ SSE ________ Basis for the damping used: ________

7. Support Considerations in the model: ________

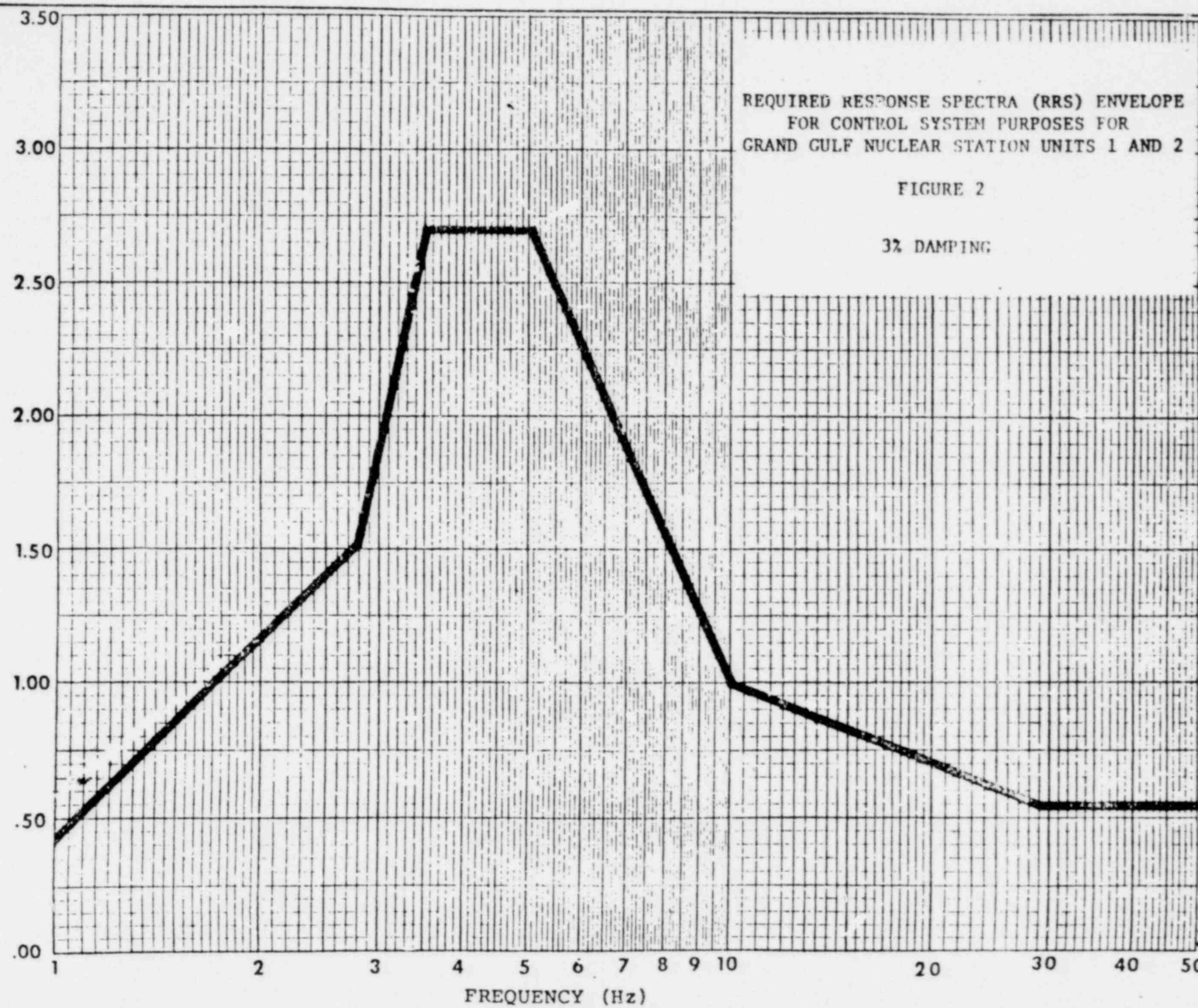
8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability



REQUIRED RESPONSE SPECTRA (RRS) ENVELOPE
FOR CONTROL SYSTEM PURPOSES FOR
GRAND GULF NUCLEAR STATION UNITS 1 AND 2
FIGURE 2
3% DAMPING
ACCELERATION (g)
3.50
3.00
2.50
2.00
1.50
1.00
.50
.00
1
2
3
4
5
6
7
8
9
10
20
30
40
50
FREQUENCY (Hz)

WYLE LABORATORIES

Report No. 58109

CUSTOMER DELAVAL Job No. 58109 Page No. 36

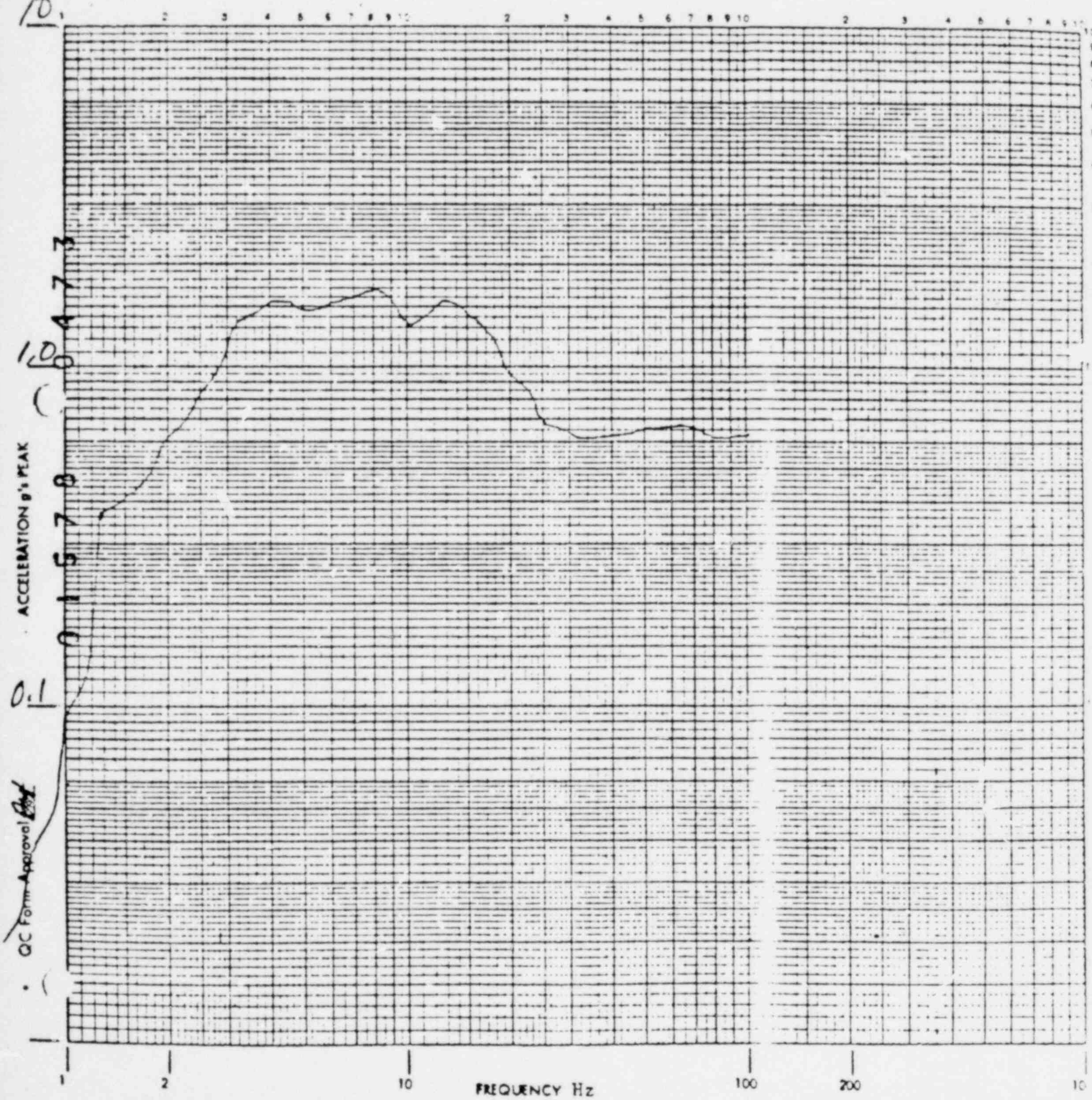
Full Scale 10 g Accel. No. 8 Control ( ) Response (X)

Operator KNOLL Specimen GENERATOR CABINET

Date 11-17-76 Damping 3 % Axis of Test Z-Y

5 EQ OBE

RESPONSE SPECTRA



QC Form Approval

WYLE LABORATORIES

Report No. 58109

CUSTOMER DECALAL Job No. 58109 Page No. 78

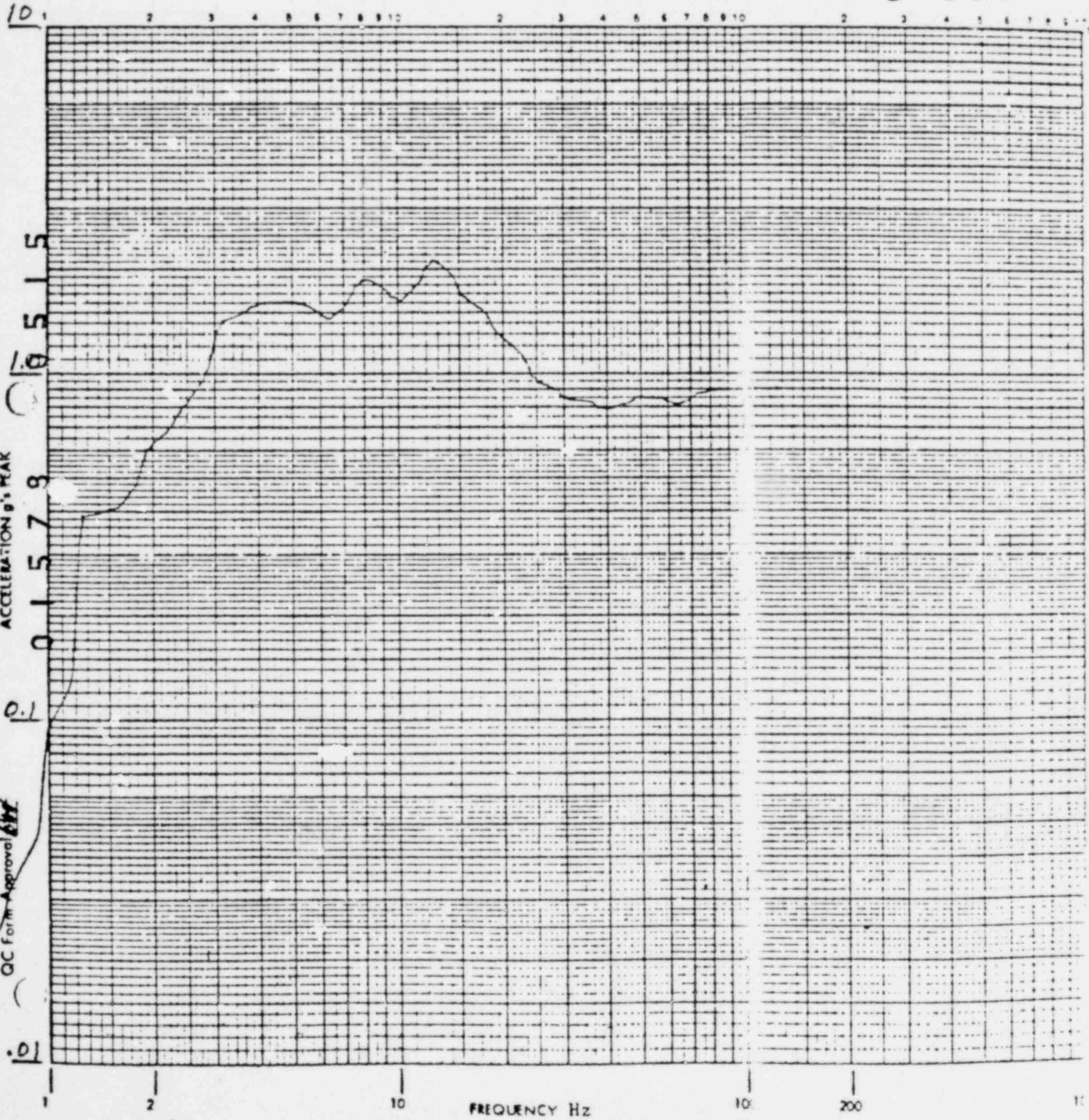
Full Scale 10 g Accel. No. 8 Control ( ) Response (X)

Operator Knoll Specimen GENERATOR CABINET

Date 11-17-76 Damping 3.0 % Axis of Test X-Y

RESPONSE SPECTRA

6th OBE



WYLE LABORATORIES

Report No. 58109

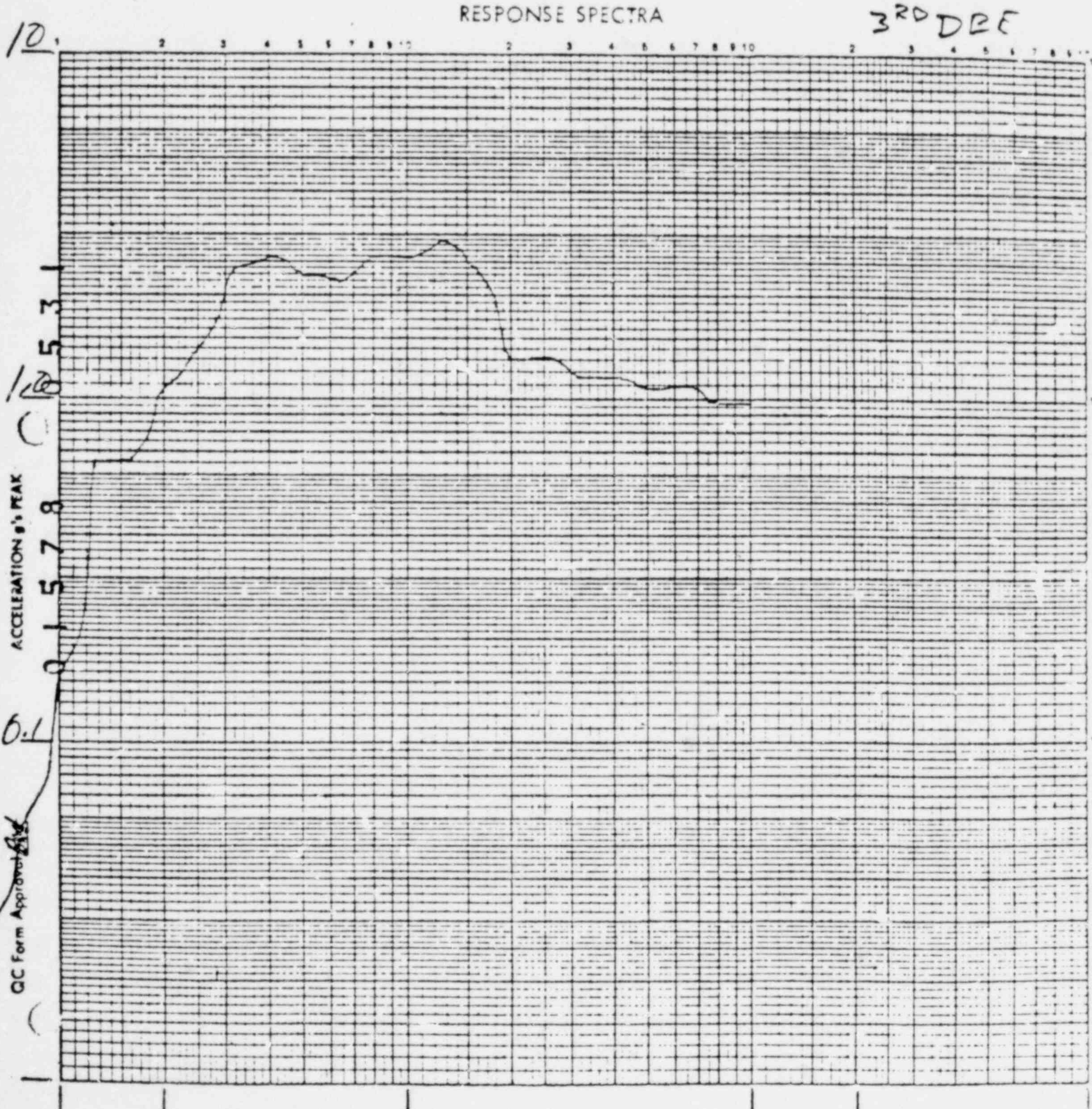
CUSTOMER DELAVAL Job No. 58109 Page No. 94

Full Scale 10 g Accel. No. 8 Control ( ) Response (x)

Operator KNOLL Specimen GENERATOR CABINET

Date 11-17-76 Damping 3.0 % Axis of Test X-Y

RESPONSE SPECTRA 3RD DBE



QC Form Approval

FIGURE 1

HORIZONTAL AXIS
3% Damping

RESPONSE SPECTRA

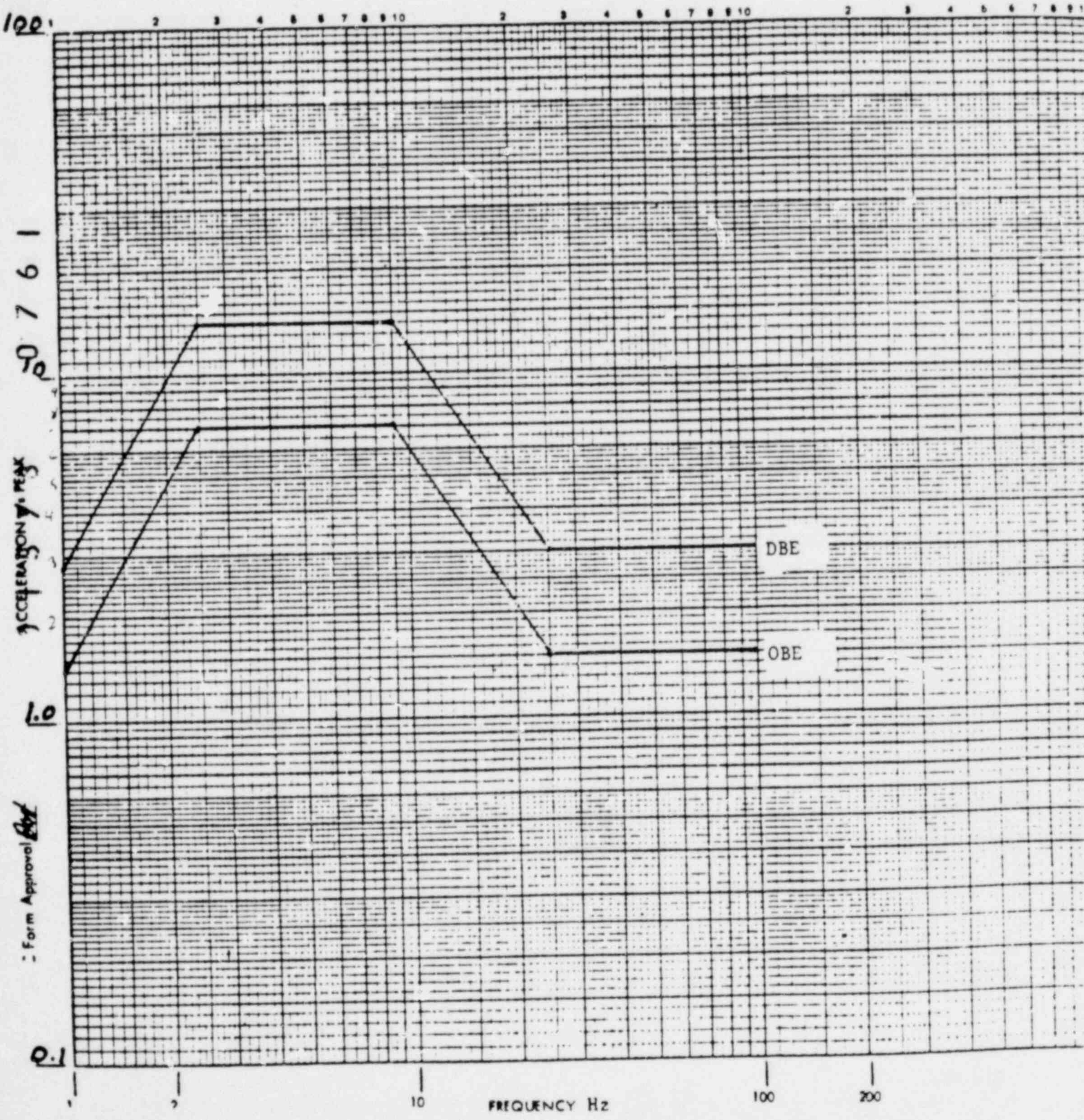
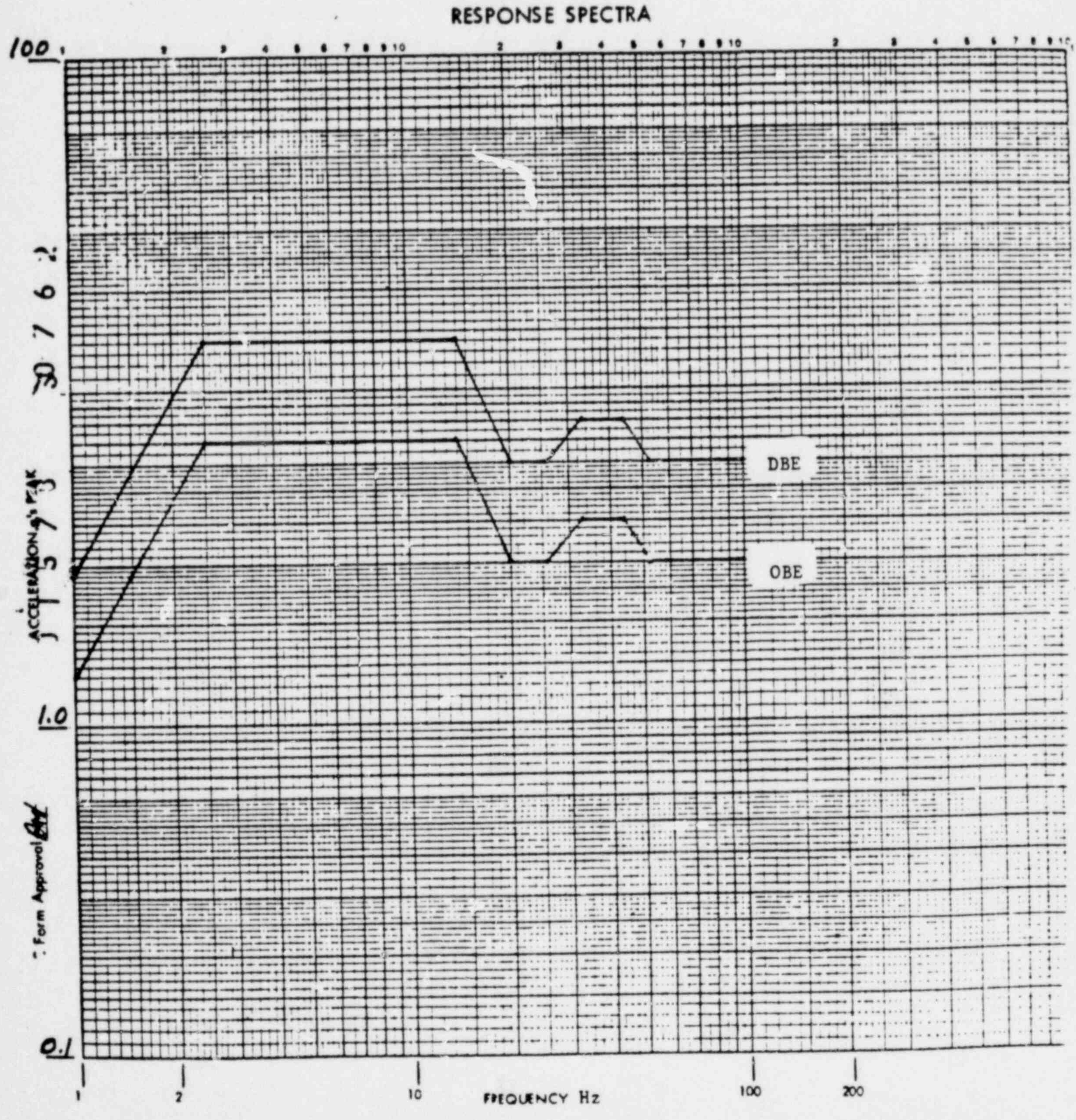


FIGURE 2

VERTICAL AXIS
3% Damping



WYLE LABORATORIES

Report No. 58180

CUSTOMER DeLAVAL Job No. 58180 Page No. 24

Full Scale 100 g Accel. No. 4 Control ( ) Response (✔)

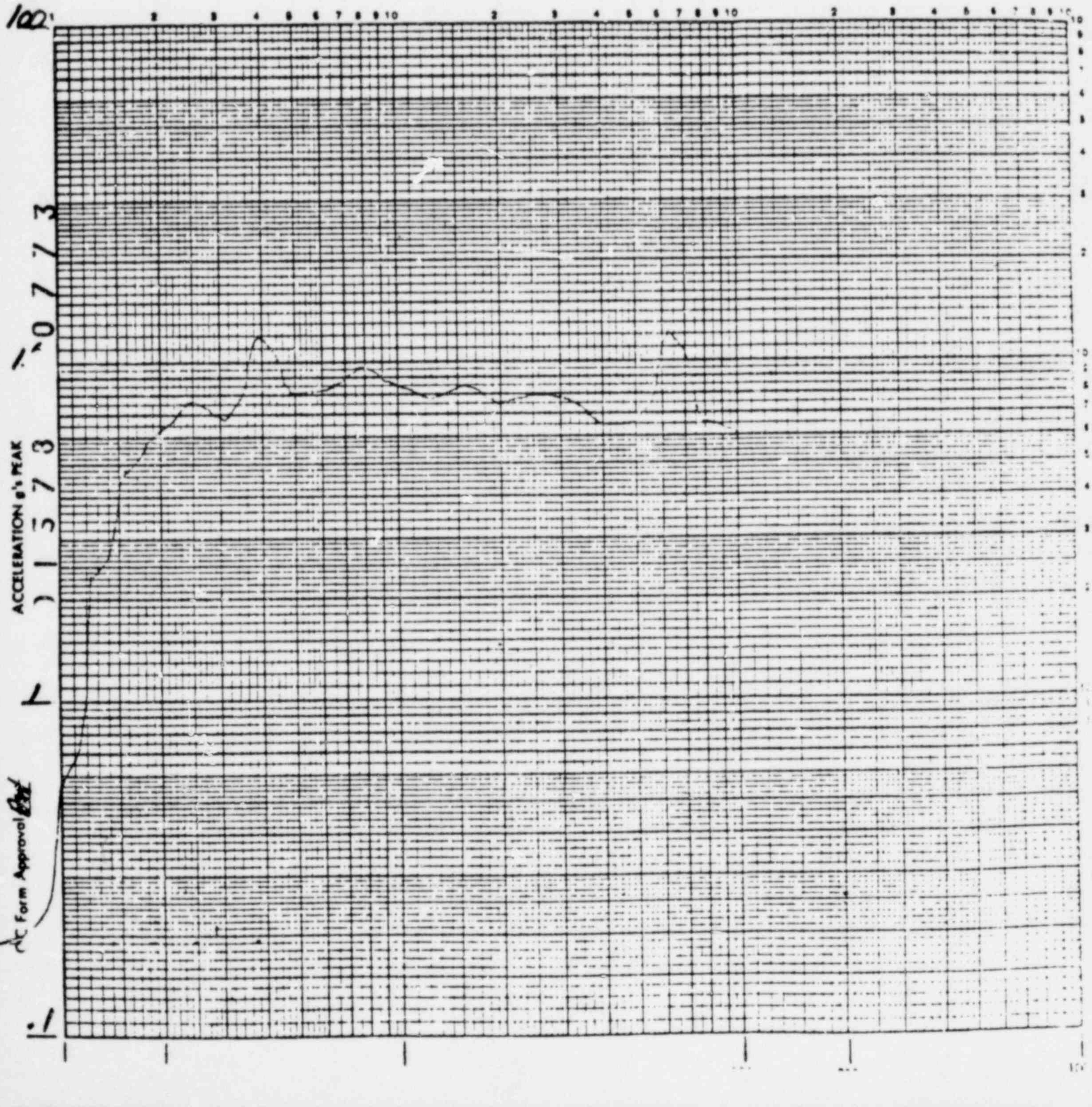
Operator Meehan Specimen RELAY

Date 5-7-77 Damping 3.0 % Axis of Test X-Y

3RD OBE

ENERGIZED

RESPONSE SPECTRA



WYLE LABORATORIES

Report No. 58180

CUSTOMER DeLAVAL Job No. 58180 Page No. 74

Full Scale 100 g Accel. No. 4 Control ( ) Response (X)

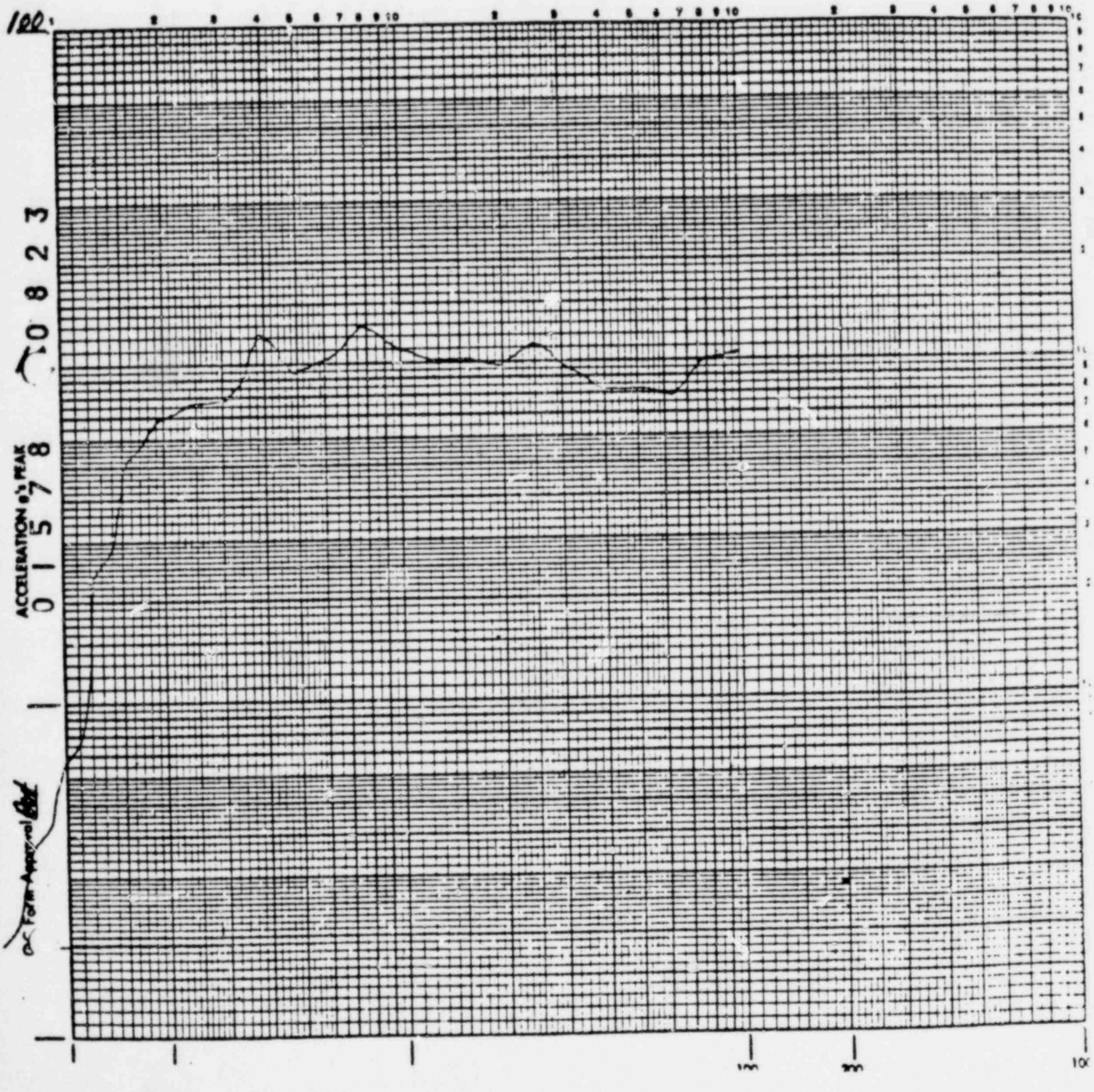
Operator Meehan Specimen RELAY

Date 5-8-77 Damping 3.0 % Axis of Test Z-V

4th OBE

Energized

RESPONSE SPECTRA



WYLE LABORATORIES

Report No. 58180

CUSTOMER Delaval Job No. 58180 Page No. 36

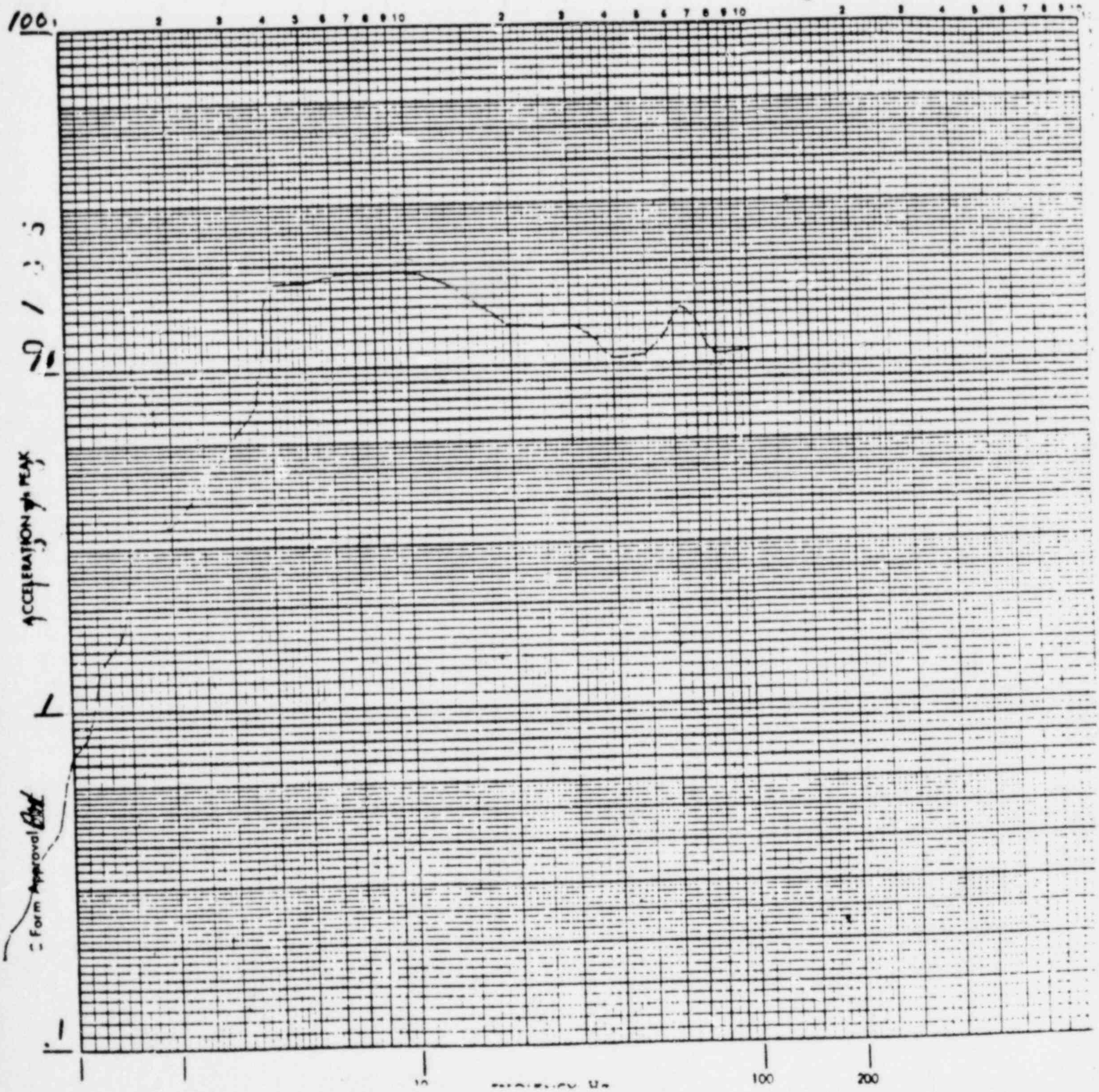
Full Scale 100 g Accel. No. 4 Control ( ) Response (x)

Operator Meehan Specimen RELAY

Date 5-7-77 Damping 3.0 % Axis of Test X-Y

1.6 Hz DBE
ENERGIZED

RESPONSE SPECTRA



Form Approval

WYLE LABORATORIES

Report No. 58180

CUSTOMER Delaval Job No. 58180 Page No. 86

Full Scale 100 g Accel. No. 4 Control ( ) Response (✓)

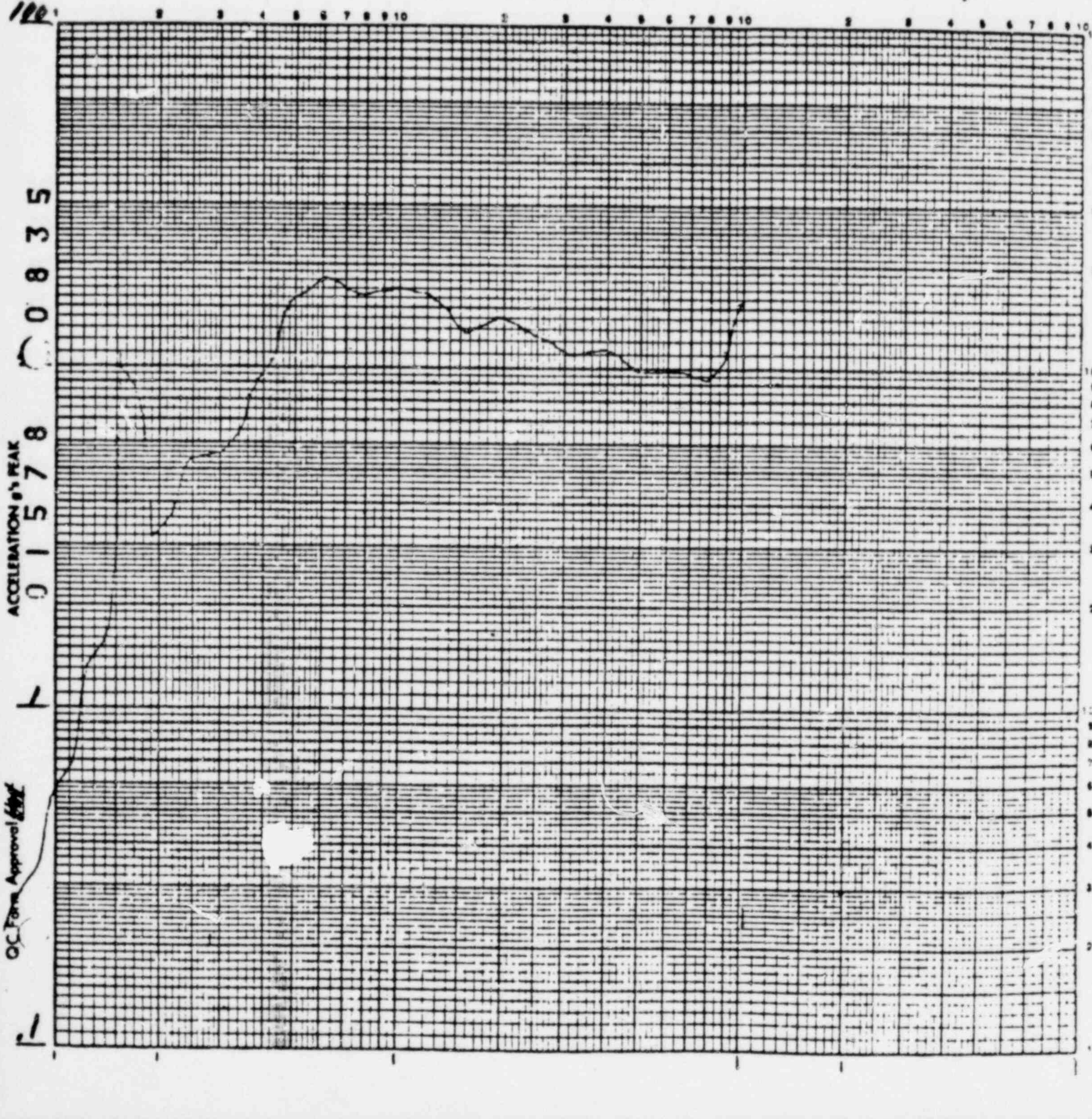
Operator Meehan Specimen RELAY

Date 5-8-77 Damping 3.0 % Axis of Test Z-Y

1.6 Hz DBE

Energized

RESPONSE SPECTRA



GRAND GULF
NUCLEAR STATION
UNIT 1

SEISMIC AND HYDRODYNAMIC LOADS

REQUALIFICATION CERTIFICATION

JOB NO. MFL-02

EQUIPMENT NAME: Safety Relief Valve Air Accumulator

SPEC. NO: 9645-M-102.0 Rev. 27

EQUIPMENT NO: Q1B21A004A thru H, J thru N, P, R thru W

LOCATION: Drywell, El. 161' 10"

EQUIPMENT CLASSIFICATION: ☐ ACTIVE ☒ PASSIVE

SEISMIC QUALIFICATION REPORT REFERENCE:

9645-M-102.0-Q1B21A004-8.0-1-2, Contract No. F2-2008NC, Safety Relief Valve Air Accumulator, 9-18-80, by Buffalo Tank Div., Bethlehem Steel.

THE ABOVE SEISMIC QUALIFICATION REPORT(S) HAVE BEEN REEVALUATED AND REQUALIFIED WHERE NECESSARY TO SHOW THAT THE ABOVE-MENTIONED COMPONENT IS CAPABLE OF PERFORMING ITS INTENDED SAFETY FUNCTION UNDER ALL THE APPLICABLE LOADING COMBINATIONS INCLUDING THE POOL DYMANIC LOADS.

PREPARED: M.P. Voutyras
M. P. Voutyras

APPROVED: J.C. Rawling for
V. J. Brocato

DATE: 7-10-8

GRAND GULF NUCLEAR STATION UNIT 1

QUALIFICATION SUMMARY

1. Equipment Name Safety Relief Valve Air Accumulator

2. Equipment No. Q1B21A004A thru H, J thru N, P, R thru W

3. Qualification Documentation (Enclosed with this report.)

   A. Qualification Summary of Equipment (SQRT form), including required response spectra with TRS plotted on RRS graph as appropriate.

   B. Reference Documents

Reference Number	Document Identification	Revision or Date	Title/Subject
Q1B21A004A-8.0-1-2	Contract No. F2-2008NC	9-18-80	Safety Relief Valve Air Accumulator

   C. Additional Supporting Documents

Document Identification	Revision or Date	Title/Subject
9645-M-102.0	Rev. 27 6-2-80	Bechtel Design Specification for Miscellaneous Tanks and Pressure Vessels

EQUIPMENT NO. Q1B21A004A thru H, J thru N, P, R thru W

4. Functional Requirements

Equipment should maintain structural integrity during and after OBE and hydrodynamic events and also maintain structural integrity during and after SSE and hydrodynamic events.

5. Demonstration Capability

Natural frequency was calculated to be above 33 Hz. Static analysis was performed resulting in large stress margins.

6. Rationale for Qualification Certification

(Include Decision analysis with comparison to acceptance criteria, approach for demonstrating operability, and consideration of high-frequency response.)

Accumulator was found to be rigid. Seismic coefficients were slightly below RRS values for the range 33 - 100 Hz. However, all stresses calculated had large margins so this shouldn't be a problem.

Q1B21A004A thru H, J
thru N, P, R thru W

Qualification Summary of Equipment

I. Plant Name: Grand Gulf Nuclear Station Unit I — Type:

1. Utility: Mississippi Power and Light Co. — PWR ______

2. NSSS: G.E. 3. A/E: Bechtel Power Corp. — BWR 6, Mark III

II. Component Name Safety Relief Valve Air Accumulator

1. Scope: [ ] NSSS [x] BOP

2. Model Number: ______ Quantity: 20

3. Vendor: Buffalo Tank

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance Vertical Tank

b. Dimensions 3'-2" x 12 3/4" O.D.

c. Weight 220 lbs.

6. Location: Building: Reactor Bldg. DRYWELL

Elevation: 161'-10"

7. Field Mounting Conditions [ ] Bolt (No.____, Size____)
[x] Weld 3/16x10" length leg to shell, 5/16x16 length leg to base, 4 legs
[ ]

8. a. System in which located: Nuclear Boiler System

b. Functional Description: Handle Dry Oil Free Air

c. Is the equipment required for [ ] Hot Standby [x] Cold Shutdown
[ ] Both [ ] Neither

9. Pertinent Reference Design Specifications: Bechtel Spec. No. 9645-M-102.0 (Rev. 27) 6-2-80

Prepared by: mpv 4/22/81

Verified by: Akm 5/21/81

12/80

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method:

[ ] Test [X] Analysis [ ] Combination of Test and Analysis

Qualification Report*: 9645-M-102.0-Q1B21A004A-8.0-1-2

(No., Title and Date) Contract #F2-2008NC, Safety/Relief Valve Air Accumulator, 9/18/80

Company that Prepared Report: Buffalo Tank-Bethlehem Steel

Company that Reviewed Report: Nutech/Bechtel

V. Vibration Input:

1. Loads considered: a. [ ] Seismic only

   b. [ ] Hydrodynamic only

   c. [X] Combination of (a) and (b)

2. Method of Combining RRS: [X] Absolute Sum [ ] SRSS [ ] ______ (other, specify)

3. Required Response Spectra (attach the graphs): Combined RSS attached

4. Damping Corresponding to RRS: OBE ______ SSE 3%

5. Required Acceleration in Each Direction: [X] ZPA [ ] Other ______ (specify)

OBE	S/S =	F/B =	V =
SSE	S/S = 0.78g	F/B = 0.78g	V = 0.25g

6. Were fatigue effects or other vibration loads considered?

   [ ] Yes [X] No

   If yes, describe loads considered and how they were treated in overall qualification program: ______

*NOTE: If more than one report complete items IV thru VII for each report.

VI. If Qualification by Test, then Complete*: N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random
[ ] sine beat
[ ] ________

2. [ ] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE________ SSE________ Other________
(specify)

4. Frequency Range: ________________

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ________ F/B = ________ V = ________

6. Method of Determining Natural Frequencies

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graphs
[ ] No

8. Input g-level Test: OBE S/S = ________ F/B = ________ V = ________

SSE S/S = ________ F/B = ________ V = ________

9. Laboratory Mounting:

1. [ ] Bolt (No.____, Size____) [ ] Weld (Length____) [ ]____

10. Functional operability verified: [ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: ________________

____

12. Other test performed (such as aging or fragility test, including results):

____

____

*Note: If qualification by a combination of test and analysis also complete Item VII.

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

   [ ] Static Analysis [x] Equivalent Static Analysis

   $g_h = 0.875$, $g_v = .335$

   [ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   N/S
   S/S = 48.5 Hz* E/W = 48.5 Hz* V = ________

3. Model Type: [x] 3D [ ] 2D [ ] 1D

   [ ] Finite Element [ ] Beam [x] Closed Form Solution

4. [ ] Computer Codes: N/A

   Frequency Range and No. of modes considered: ________

   [X] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
   [x] Other: Static coefs. not combine
   (specify)

6. Damping: OBE 1% SSE 1% Basis for the damping used: Per Bechtel Spec.

7. Support Considerations in the model: Assumed fixed - effective length 1.5 ℓ

8. Critical Structural Elements:

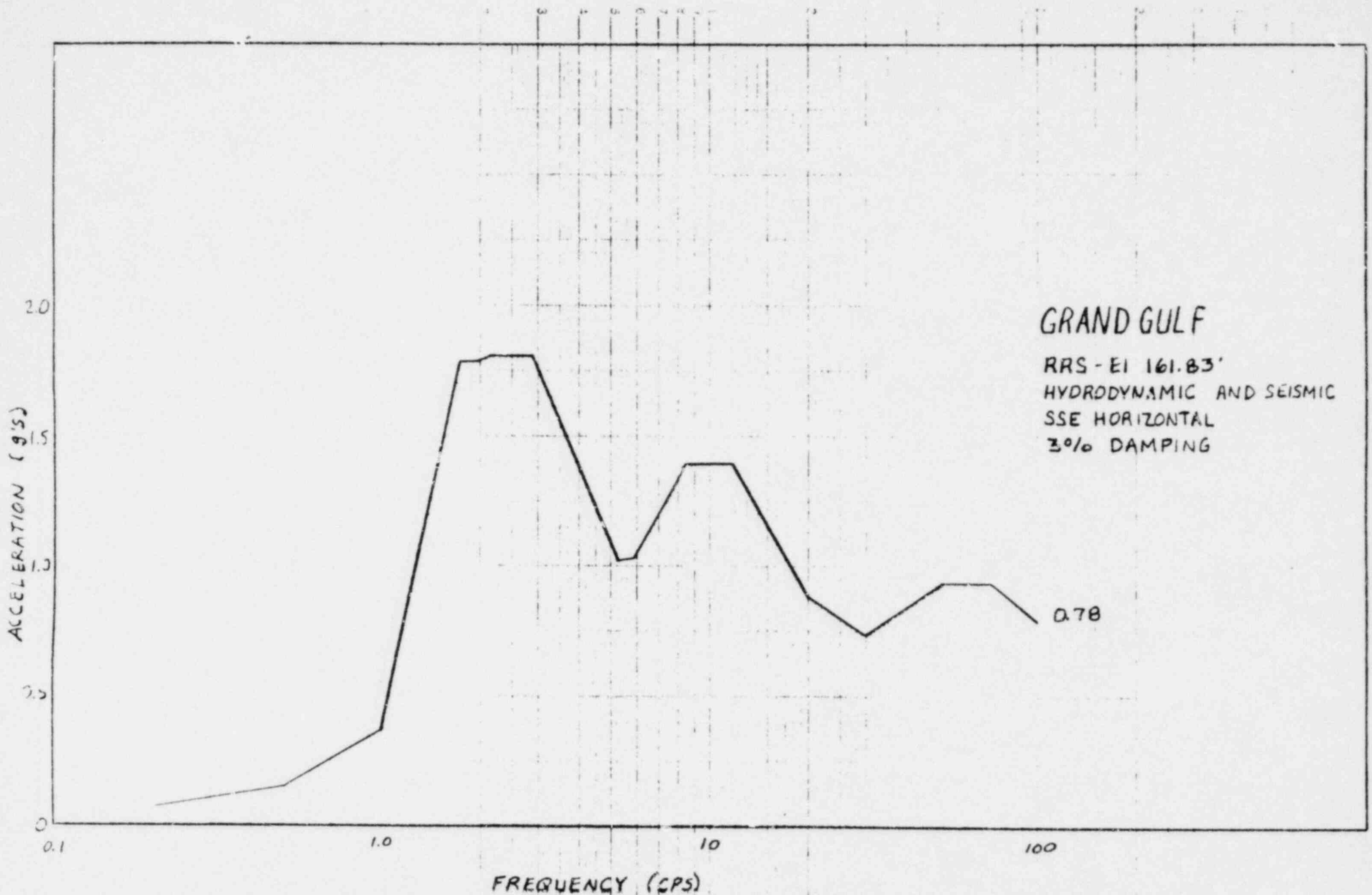
A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Max. combined	Shell			3721	12000
Combined	Head			3914	14000
Bending	Support			936	21600

B.

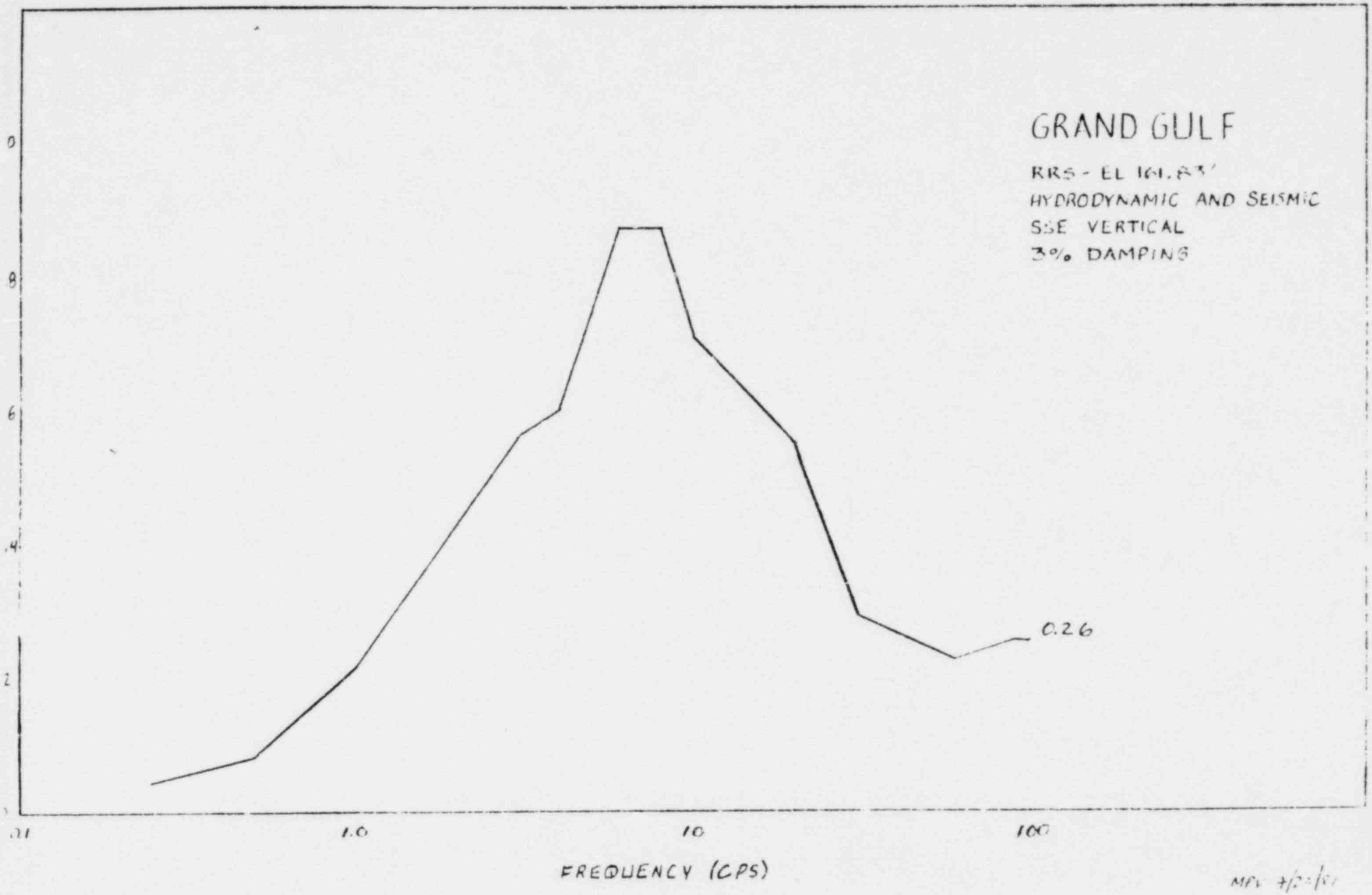
Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
none calculated		

*Calculated by NUTECH using vendor methodology as shown in ADS Valve Air Receiver Report #Q1B21A100A-7.0-1-3.



GRAND GULF
RRS - El 161.83'
HYDRODYNAMIC AND SEISMIC
SSE HORIZONTAL
3% DAMPING
0.78
ACCELERATION (g's)
2.0
1.5
1.0
0.5
0
0.1
1.0
10
100
FREQUENCY (CPS)

MPV 4/23/81


GRAND GULF
RRS - EL 161.83'
HYDRODYNAMIC AND SEISMIC
SSE VERTICAL
3% DAMPING
0.26
.01
1.0
10
100
FREQUENCY (CPS)

MPV 7/21/81

GRAND GULF
NUCLEAR STATION
UNIT 1

SEISMIC AND HYDRODYNAMIC LOADS

REQUALIFICATION CERTIFICATION

JOB NO. MPL-02

EQUIPMENT NAME: 6" CRD Gate Valve

SPEC. NO: 9645-M-242.0

EQUIPMENT NO: SQ-6-HBC-GTF-MO-F322-UWY

LOCATION: Auxiliary Building, 119' 0"

EQUIPMENT CLASSIFICATION: [X] ACTIVE [ ] PASSIVE

SEISMIC QUALIFICATION REPORT REFERENCE:

9645-M-242.0-QS-26.0-5-0, Operability Test Report NLAE (New Loads) Program for Mississippi Power and Light, 6/15/81, by the Wm. Powell Company

THE ABOVE SEISMIC QUALIFICATION REPORT(S) HAVE BEEN REEVALUATED AND REQUALIFIED WHERE NECESSARY TO SHOW THAT THE ABOVE-MENTIONED COMPONENT IS CAPABLE OF PERFORMING ITS INTENDED SAFETY FUNCTION UNDER ALL THE APPLICABLE LOADING COMBINATIONS INCLUDING THE POOL DYMANIC LOADS.

PREPARED: TRMager
T.R. Mager

APPROVED: JC Rawling for
J. Brocato

DATE: 7-10-81

GRAND GULF NUCLEAR STATION UNIT 1

QUALIFICATION SUMMARY

1. Equipment Name 6" CRD Gate Valve

2. Equipment No. SQ-6-HBC-GTF-MO-F322-UWY

3. Qualification Documentation (Enclosed with this report.)

   A. Qualification Summary of Equipment (SQRT form), including required response spectra with TRS plotted on RRS graph as appropriate.

   B. Reference Documents

Reference Number	Document Identification	Revision or Date	Title/Subject
9645-M-242.0-QS-26.0-5-0		6/15/81	Operability Test Report NLAE (New Loads) Program

   C. Additional Supporting Documents

Document Identification	Revision or Date	Title/Subject
Spec. 9645-M-242.0	Rev. 35	Design Specification for Nuclear Service Valves 2½" and Larger for Mississippi Power & Light Company, Grand Gulf Nuclear Station, Units No. 1 and 2

4. Functional Requirements

The valve must function during and after an operating basis earthquake and during and after a safe shutdown earthquake.

5. Demonstration Capability

A static test with simultaneously applied loads of six (6) g horizontal and five (5) g vertical was used to qualify the valve to SQRT requirements. The rated hydraulic pressure was applied to the valve during testing. Four (4) inch and eight (8) inch valves were tested to generically qualify the six (6) inch valve of identical design. The tested valves opened and closed without failure during testing.

6. Rationale for Qualification Certification

(Include Decision analysis with comparison to acceptance criteria, approach for demonstrating operability, and consideration of high-frequency response.)

The static test is sufficient to qualify the valve to SQRT requirements. The deflection caused by the applied static loads did not hinder the operation of the valve.

The actuator has been qualified separately.

Qualification Summary of Equipment

I. Plant Name: Grand Gulf Nuclear Station Unit I — Type:

1. Utility: Mississippi Power and Light Co. — PWR ______
2. NSSS: G.E. 3. A/E: Bechtel Power Corp. — BWR 6, Mark III

II. Component Name 6" - 150# Gate Valve

1. Scope: [ ] NSSS [x] BOP
2. Model Number: Fig. No. 1523 W.E. Quantity: 1
3. Vendor: Wm. Powell Company
4. If the component is a cabinet or panel, name and model No. of the devices included: N/A
5. Physical Description a. Appearance Valve with actuator mounted on top of yoke
   b. Dimensions 41" x 18 3/4" x 20½" (Including Actuator)
   c. Weight 430 lb. (Total including Actuator)
6. Location: Building: Auxiliary Building
   Elevation: 119' 0"
7. Field Mounting Conditions [ ] Bolt (No.____, Size____)
   [XX] Weld (Length 19") per flange
   [ ] ______
8. a. System in which located: Control Rod Drive
   b. Functional Description: Auxiliary Building Isolation Valve
   c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
   [xx] Both [ ] Neither
9. Pertinent Reference Design Specifications: 9645-M-242.0, Rev. 35

Prepared by: TRM 7/10/81

Verified by: MPI 7/10/81

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method:

[X] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: 9645-M-242.0-QS-26.0-5-0

(No., Title and Date) Operability Test Report NLAE (New Loads) Program 6/15/81

Company that Prepared Report: Wm. Powell Company

Company that Reviewed Report: NUTECH/Bechtel

V. Vibration Input:

1. Loads considered: a. [X] Seismic only

   b. [ ] Hydrodynamic only

   c. [ ] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [ ] SRSS [X] N/A (other, specify)

3. Required Response Spectra (attach the graphs): N/A

4. Damping Corresponding to RRS: OBE ______ SSE N/A

5. Required Acceleration in Each Direction: [ ] ZPA [X] Other Per Bechtel Spec. (specify)

OBE	S/S =	F/B =	V =
SSE	S/S = 6g	F/B = 6g	V = 6g

6. Were fatigue effects or other vibration loads considered?

   [ ] Yes [X] No

   If yes, describe loads considered and how they were treated in overall qualification program: ______

*NOTE: If more than one report complete items IV thru VII for each report.

12/80

VI. If Qualification by Test, then Complete*: Static Test (See Note**)

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [X] Static D.L. Test

2. [ ] Single Axis [X] Multi-Axis

3. No. of Qualification Tests: OBE______ SSE 1 Other______ (specify)

4. Frequency Range: N/A

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
S/S = Not Determined F/B = ______ V = ______

6. Method of Determining Natural Frequencies

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test N/A [ ] Yes (Attach TRS & RRS graph
[ ] No

8. Input g-level Test: OBE S/S = ______ F/B = ______ V = ______

SSE S/S = 6g F/B = ______ V = 5g

9. Laboratory Mounting: ***

1. [ ] Bolt (No.______, Size______) [ ] Weld (Length______) [ ]______

10. Functional operability verified: [X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Valves opened and closed without failure while a 5g vertical and 6g horizontal static load were applied simultaneously.

12. Other test performed (such as aging or fragility test, including results):

The rated hydraulic pressure was applied to the valve during seismic testing.

*Note: If qualification by a combination of test and analysis also complete Item VII.

**Note: A 4" gate valve and an 8" gate valve were tested to generically qualify a 6" gate valve of identical design.

***Note: Valve supported at weld ends by hinged V-blocks and at 1/3 of total length between centerline of waterway and center of gravity of operator by a narrow saddle.

VII. If Qualification by Analysis, then complete: N/A

1. Method of Analysis:

   [ ] Static Analysis [ ] Equivalent Static Analysis

   [ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = ________________ F/B = ________________ V = ________________

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

   [ ] Finite Element [ ] Beam [ ] Closed Form Solution

4. [ ] Computer Codes: ____

   Frequency Range and No. of modes considered: ______________________

   [ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
   [ ] Other: ____________________ (specify)

6. Damping: OBE_________ SSE______ Basis for the damping used: ______________

7. Support Considerations in the model: ____________________________________

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

GRAND GULF
NUCLEAR STATION
UNIT 1

SEISMIC AND HYDRODYNAMIC LOADS

REQUALIFICATION CERTIFICATION

JOB NO. MPL-02

EQUIPMENT NAME: 6" CRD Gate Valve Actuator SPEC. NO: 9645-M-242.0

EQUIPMENT NO: SQ-6-HBC-GTF-MO-F322-UWY

LOCATION: Auxiliary Building, 119' 0"

EQUIPMENT CLASSIFICATION: [X] ACTIVE [ ] PASSIVE

SEISMIC QUALIFICATION REPORT REFERENCE:

Report No. 5771, Report of Seismic Test on SMB-000-5 Motor Actuator for Limitorque Corporation, 10/17/75, by Aero Nav Laboratories.

THE ABOVE SEISMIC QUALIFICATION REPORT(S) HAVE BEEN REEVALUATED AND REQUALIFIED WHERE NECESSARY TO SHOW THAT THE ABOVE-MENTIONED COMPONENT IS CAPABLE OF PERFORMING ITS INTENDED SAFETY FUNCTION UNDER ALL THE APPLICABLE LOADING COMBINATIONS INCLUDING THE POOL DYMANIC LOADS.

PREPARED: TRMager
T.R. Mager

APPROVED: JC Rawlings for
V.J. Brocato

DATE: 7-10-81

GRAND GULF NUCLEAR STATION UNIT 1

QUALIFICATION SUMMARY

1. Equipment Name 6" CRD Gate Valve Actuator

2. Equipment No. SQ-6-HBC-GTF-MO-F322-UWY

3. Qualification Documentation (Enclosed with this report.)

   A. Qualification Summary of Equipment (SQRT form), including required response spectra with TRS plotted on RRS graph as appropriate.

   B. Reference Documents

Reference Number	Document Identification	Revision or Date	Title/Subject
	5771	10/17/75	Report of Seismic Test on SMB-000-5 Motor Actuator for Limitorque Corporation

   C. Additional Supporting Documents

Document Identification	Revision or Date	Title/Subject
Spec. 9645-M-242.0	Rev. 35	Design Specification for Nuclear Service Valves 2½" and Larger for Mississippi Power & Light Company, Grand Gulf Nuclear Station, Units No. 1 and 2

4. Functional Requirements

The valve actuator must function during and after an operating basis earthquake and during and after a safe shutdown earthquake.

5. Demonstration Capability

Single-axis, single-frequency testing was used to qualify the actuator to SQRT requirements. A resonance search found no natural frequencies below 33 Hz. Five (5) OBE's and one (1) SSE were run at input acceleration levels of approximately 3.1g and 6.1g, respectively, in three directions. The actuator performed all functions at seismic dwells and tripped at the preset torque setting with no indication of malfunction.

6. Rationale for Qualification Certification

(Include Decision analysis with comparison to acceptance criteria, approach for demonstrating operability, and consideration of high-frequency response.)

The single-axis, single-frequency test is an acceptable method of qualifying the actuator to SQRT requirements. The actuator was shown to be rigid to justify single-axis testing. The test input acceleration levels are very high to account for the single frequency test. The actuator operability was demonstrated during seismic testing.

SQ-6-HBC-GTF-MO-F322-UWY
(Actuator)

Qualification Summary of Equipment

I. Plant Name: Grand Gulf Nuclear Station Unit I — Type:

1. Utility: Mississippi Power and Light Co. — PWR ______
2. NSSS: G.E. 3. A/E: Bechtel Power Corp. — BWR 6, Mark III

II. Component Name: 6" Gate Valve Actuator

1. Scope: [ ] NSSS [x] BOP
2. Model Number: SMB-000-5 Quantity: 1
3. Vendor: Limitorque Corp.
4. If the component is a cabinet or panel, name and model No. of the devices included: N/A
5. Physical Description a. Appearance Rectangular Shape with Handwheel

   b. Dimensions 18 3/4" x 20½" x 13 3/4"

   c. Weight 150 lb.
6. Location: Building: Auxiliary Bldg.

   Elevation: ?' 0"
7. Field Mounting Conditio. [x] Bolt (No. 4, Size ____)

   [ ] Weld (Length ____)

   [ ] ______
8. a. System in which located: Control Rod Drive

   b. Functional Description: Actuator for Auxiliary Bldg. Isolation Valve

   c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown [x] Both [ ] Neither
9. Pertinent Reference Design Specifications: 9645-M-242.0, Rev. 35

Prepared by: TRM 7/8/81

Verified by: MPV 7/10/81

12/80

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method:

[X] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*:

(No., Title and Date) 5771, Seismic Test on SMB-000-5 Actuator, 10/17/75

Company that Prepared Report: Aero Nav Laboratories

Company that Reviewed Report: Bechtel/NUTECH

V. Vibration Input:

1. Loads considered: a. [X] Seismic only

   b. [ ] Hydrodynamic only

   c. [ ] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [ ] SRSS [X] N/A (other, specify)

3. Required Response Spectra (attach the graphs): N/A

4. Damping Corresponding to RRS: OBE ______ SSE N/A

5. Required Acceleration in Each Direction: [ ] ZPA [X] Other Per Bechtel Spec. (specify)

OBE	S/S =	F/B =	V =
SSE	S/S = 6g	F/B = 6g	V = 6g

6. Were fatigue effects or other vibration loads considered?

   [ ] Yes [X] No

   If yes, describe loads considered and how they were treated in overall qualification program: ______

*NOTE: If more than one report complete items IV thru VII for each report.

VI. If Qualification by Test, then Complete*:

1. [X] Single Frequency (Sine Dwell - 33^{O})   [ ] Multi-Frequency: [ ] random [ ] sine beat [X] Resonance Search

2. [X] Single Axis   [ ] Multi-Axis

3. No. of Qualification Tests: OBE 5 SSE 1 Other ____ (specify)

4. Frequency Range: 1-33 Hz

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = >33 Hz   F/B = >33 Hz   V = >33 Hz

6. Method of Determining Natural Frequencies

[X] Lab Test   [ ] In-Situ Test   [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graph
[ ] No

8. Input g-level Test: OBE S/S = 3.05g   F/B = 3.15g   V = 3:05g

SSE S/S = 6.1g   F/B = 6.3g   V = 6.1g

9. Laboratory Mounting: **

1. [X] Bolt (No. 4 , Size ____) [ ] Weld (Length ____) [ ] ____

10. Functional operability verified: [X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: Actuator performed all functions at seismic dwells and tripped at preset torque switch setting with no indication of malfunction.

12. Other test performed (such as aging or fragility test, including results):

____

____

*Note: If qualification by a combination of test and analysis also complete Item VII.

**Note: Actuator mounted on a baseplate fixture supplied by Limitorque Corp. assumed to simulate field mounting condition

VII. If Qualification by Analysis, then complete: N/A

1. Method of Analysis:

   [ ] Static Analysis [ ] Equivalent Static Analysis

   [ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = ________ F/B = ________ V = ________

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

   [ ] Finite Element [ ] Beam [ ] Closed Form Solution

4. [ ] Computer Codes: ________

   Frequency Range and No. of modes considered: ________

   [ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
   [ ] Other: ________ (specify)

6. Damping: OBE ________ SSE ______ Basis for the damping used: ________

7. Support Considerations in the model: ________

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

GRAND GULF
NUCLEAR STATION
UNIT 1

SEISMIC AND HYDRODYNAMIC LOADS

REQUALIFICATION CERTIFICATION

JOB NO. MPL-02

EQUIPMENT NAME: Flexible Pipe Connection

SPEC. NO: 9645-M-158.0 Rev. 6

EQUIPMENT NO: Q1B21D030A-H,J-N,P,R-W, and Q1B21D031A-H

LOCATION: Drywell, El. 161'

EQUIPMENT CLASSIFICATION: ☐ ACTIVE ☒ PASSIVE

SEISMIC QUALIFICATION REPORT REFERENCE:

9645-M-158.0-QS-7.0-1-0, Report No. CR520, Design Report for Hose Assembly, Flexible Metal, 11/15/78, by Metal Bellows Corporation.

THE ABOVE SEISMIC QUALIFICATION REPORT(S) HAVE BEEN REEVALUATED AND REQUALIFIED WHERE NECESSARY TO SHOW THAT THE ABOVE-MENTIONED COMPONENT IS CAPABLE OF PERFORMING ITS INTENDED SAFETY FUNCTION UNDER ALL THE APPLICABLE LOADING COMBINATIONS INCLUDING THE POOL DYMANIC LOADS.

PREPARED: C. W. Allen

APPROVED: J C Rawlings for V. J. Brocato

DATE: 7-10-81

GRAND GULF NUCLEAR STATION UNIT 1

QUALIFICATION SUMMARY

1. Equipment Name Flexible Pipe Connection

2. Equipment No. Q1B21D030A-H,J-N,P,R-W, and Q1B21D031A-H

3. Qualification Documentation (Enclosed with this report.)

   A. Qualification Summary of Equipment (SQRT form), including required response spectra with TRS plotted on RRS graph as appropriate.

   B. Reference Documents

Reference Number	Document Identification	Revision or Date	Title/Subject
QS-7.0-1-0	CR520	11/15/78	Design Report for Hose Assembly, Flexible Metal

   C. Additional Supporting Documents

Document Identification	Revision or Date	Title/Subject
9645-M-158.0	Rev. 6 3/25/80	Bechtel Design Specification for Flexible Pipe Connections.

4. Functional Requirements

Flexible pipe connections shall maintain their structural integrity during and after both operating basis and safe shutdown earthquakes.

5. Demonstration Capability

Equivalent static multi-axis analysis was used to qualify the flexible pipe connections to SQRT requirements. Natural frequencies were calculated for the lateral and axial directions. Total stress as a result of fluid pressure was determined and compared to stress allowable, and additionally, cummulative life and usage was calculated.

6. Rationale for Qualification Certification

(Include Decision analysis with comparison to acceptance criteria, approach for demonstrating operability, and consideration of high-frequency response.)

Natural frequencies calculated were 30.2 hz for the lateral direction and 254 hz for the axial direction parallel to the center line axis. Total stress resulting from axial fluid pressure was calculated to be 13,600 psi, which is below the 18,400 psi stress allowable. Based on these results, the flexible pipe connections are qualified to SQRT requirements.

Q1B21D030A-H,J-N,P,
R-W, and
Q1B21D031A-H

Qualification Summary of Equipment

I. Plant Name: Grand Gulf Nuclear Station Unit I

Type:

1. Utility: Mississippi Power and Light Co.

PWR

2. NSSS: G.E.

3. A/E: Bechtel Power Corp.

BWR 6, Mark III

II. Component Name Flexible Pipe Connection

1. Scope: [ ] NSSS [x] BOP

2. Model Number: N/A Quantity: 28

3. Vendor: Metal Bellows Corporation

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance Flexible Metal Hose (Braided)

b. Dimensions O.D. = 2.0 in., L = 46.97 in.

c. Weight 6.11 lbs. (Excluding media & braid)

6. Location: Building: Drywell

Elevation: 161'-10"

7. Field Mounting Conditions [ ] Bolt (No.____, Size____)
[ ] Weld (Length____)
End Connections [X] 150# R.F. Flanged ends bored to match 2"/Sch.40

8. a. System in which located: Nuclear Boiler System

b. Functional Description: Safety/Relief Valve Air Accumulators

c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
[X] Both [ ] Neither

9. Pertinent Reference Design Specifications: Bechtel Spec. 9645-M-158.0, Rev. 6 (3/25/80)

Prepared by: DAM for CWA 7/9/81

12/80

Verified by: MPI 4/29/81

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method:

[ ] Test [X] Analysis [ ] Combination of Test and Analysis

Qualification Report*: 9645-M-158.0-QS-7.0-1-C

(No., Title and Date) CR520, Design Report for Hose Assembly, Flexible Metal, Nov. 15, 1978

Company that Prepared Report: Metal Bellows Corporation

Company that Reviewed Report: NUTECH/Bechtel Power Corporation

V. Vibration Input:

1. Loads considered: a. [X] Seismic only

   b. [ ] Hydrodynamic only

   c. [ ] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [ ] SRSS [X] not combined (other, specify)

3. Required Response Spectra (attach the graphs): Attached

4. Damping Corresponding to RRS: OBE 0.020 SSE 0.030

5. Required Acceleration in Each Direction: [X] ZPA [ ] Other (specify)

	E-W	N-S	
OBE	~~S/S~~ = 0.205	~~F/B~~ = 0.202	V = 0.126
SSE	~~S/S~~ = 0.376	~~F/B~~ = 0.373	V = 0.226

6. Were fatigue effects or other vibration loads considered?

   [x] Yes [ ] No

   If yes, describe loads considered and how they were treated in overall qualification program: Movements: Thermal & vibration (Including flow vibration). Vendor calculated equivalent axial motion due to offset and equivalent axial motion per convulusion and then determined stresses developed within the component. Total cyclic stresses were then determined from which a cumulative life and usage were derived.
   Design Cycles: OBE - 600, SSE - 200, 15 cps

*NOTE: If more than one report complete items IV thru VII for each report.

VI. If Qualification by Test, then Complete*: N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] ________

2. [ ] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE ________ SSE ________ Other ________ (specify)

4. Frequency Range: ______________________

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = ____________ F/B = ____________ V = ____________

6. Method of Determining Natural Frequencies

   [ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graph
   [ ] No

8. Input g-level Test: OBE S/S = ________ F/B = ________ V = ________

   SSE S/S = ________ F/B = ________ V = ________

9. Laboratory Mounting:

   1. [ ] Bolt (No.____, Size____) [ ] Weld (Length____) [ ]____

10. Functional operability verified: [ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: ______________________

    ____

12. Other test performed (such as aging or fragility test, including results):

    ____

    ____

*Note: If qualification by a combination of test and analysis also complete Item VII.

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [X] Equivalent Static Analysis

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical): Including effects of media & braid

Lateral, S/S = f_1 = 30.2 Hz (lowest) F/B = ________ Axial (Parallel to ℄ axis), V = f_1 = 254 Hz (lowest)

3. Model Type: [ ] 3D [X] 2D [ ] 1D

[ ] Finite Element [ ] Beam [x] Closed Form Solution

4. [ ] Computer Codes: ________

Frequency Range and No. of modes considered: ________

[x] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
[X] Other: N/A (specify)

6. Damping: OBE N/A SSE N/A Basis for the damping used: ________

7. Support Considerations in the model: ________

8. Critical Structural Elements:

A. Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Axial	Braid	Fluid Press.		13600	18400 psi

B. Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
N/A		

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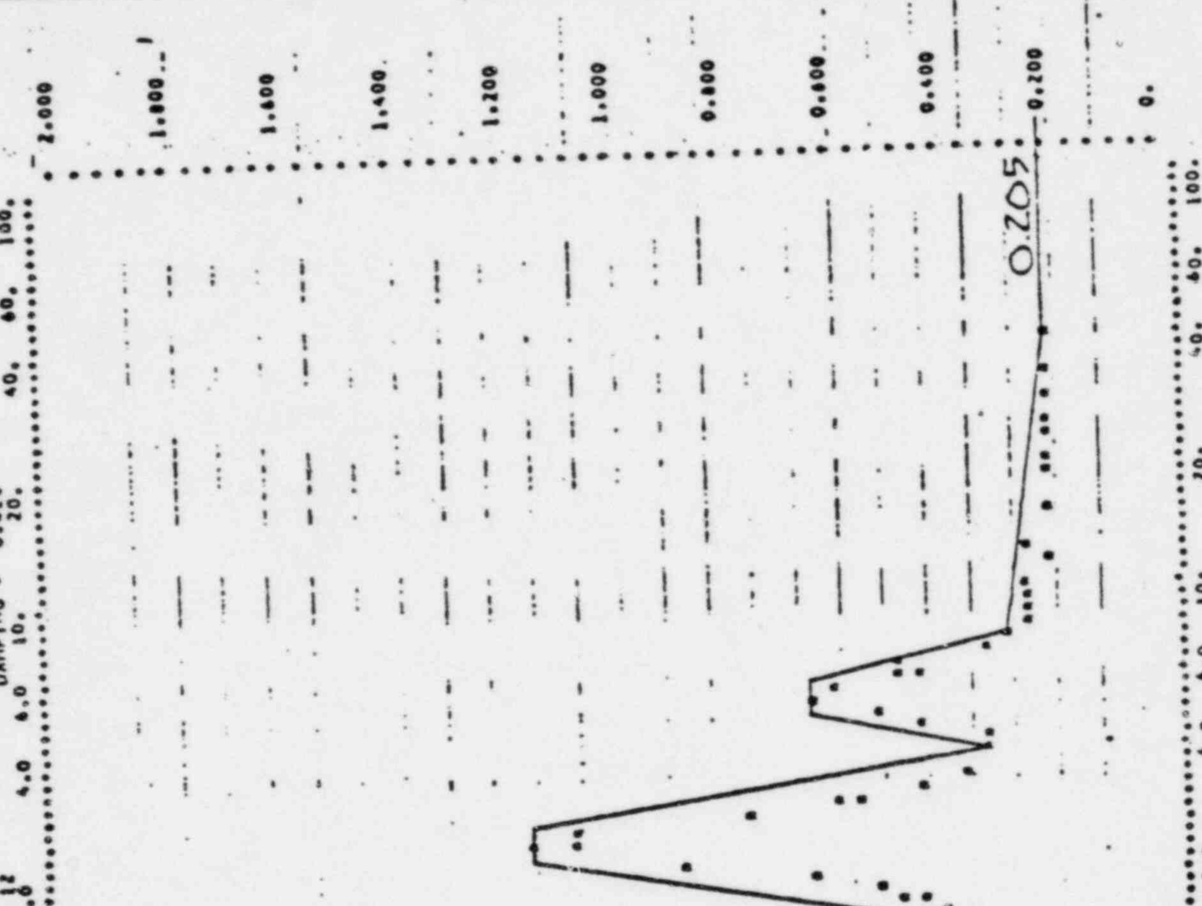

No.	DATE	REVISIONS	BY	CH'K
0	7/2/73	ISSUED FOR USE		

DRYWELL FLOOR SPECTRUM
½SSE, E-W, EL. 161 .83', 2%
GRAND GULF NUCLEAR STATION UNITS 1&2

JOB No. 9645-M-158.0
E1203
Appendix X
Page 16

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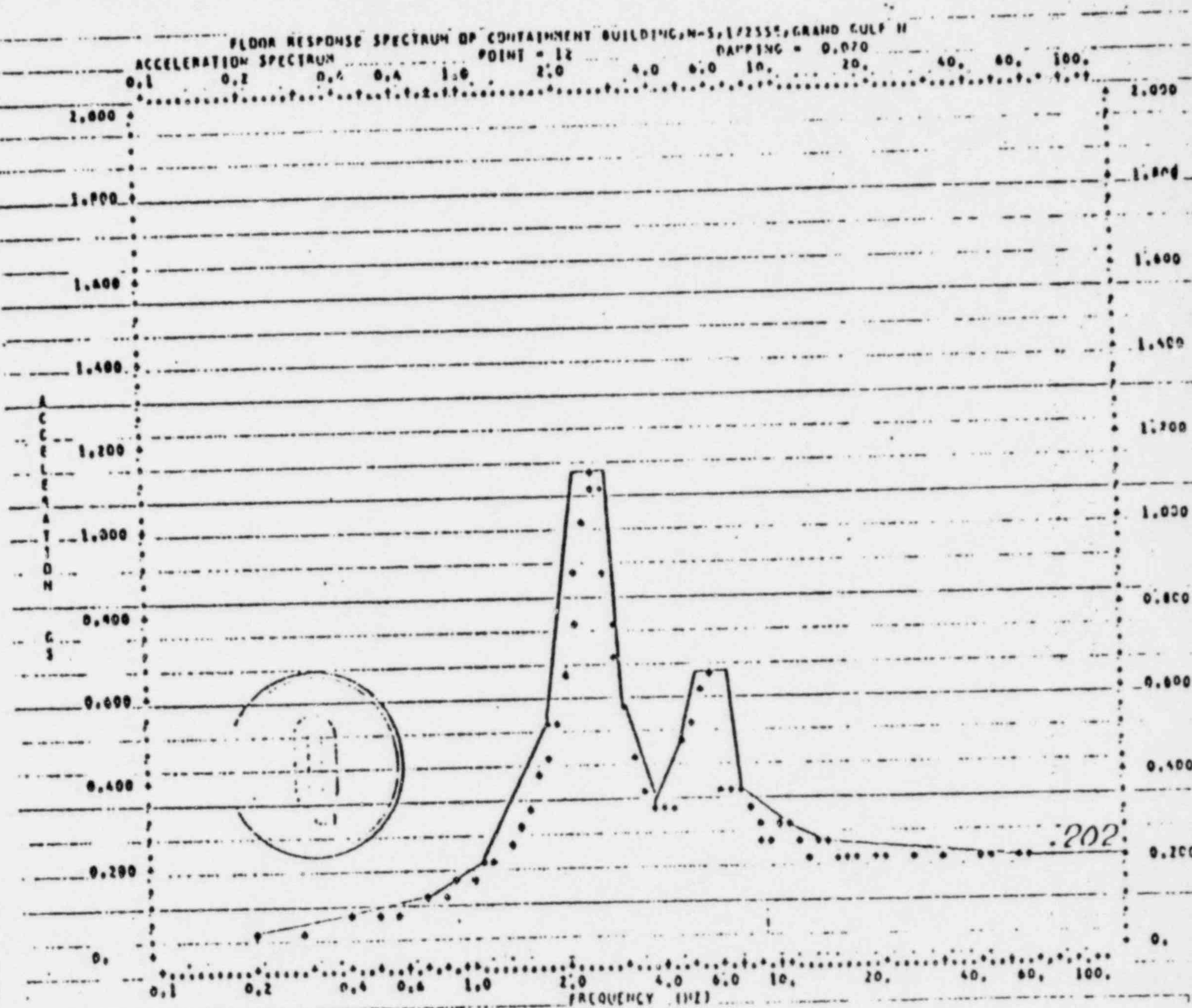

NO.	DATE	REVISIONS	BY	CHK
0	8/14/73	ISSUED FOR USE		

DRYWELL FLOOR SPECTRUM

½SSE, N-S, EL. 161.83', 2%

GRAND GULF NUCLEAR STATION UNITS 1&2

JOB No. 9645-M-158.

N1203

Appendix X

Page 14

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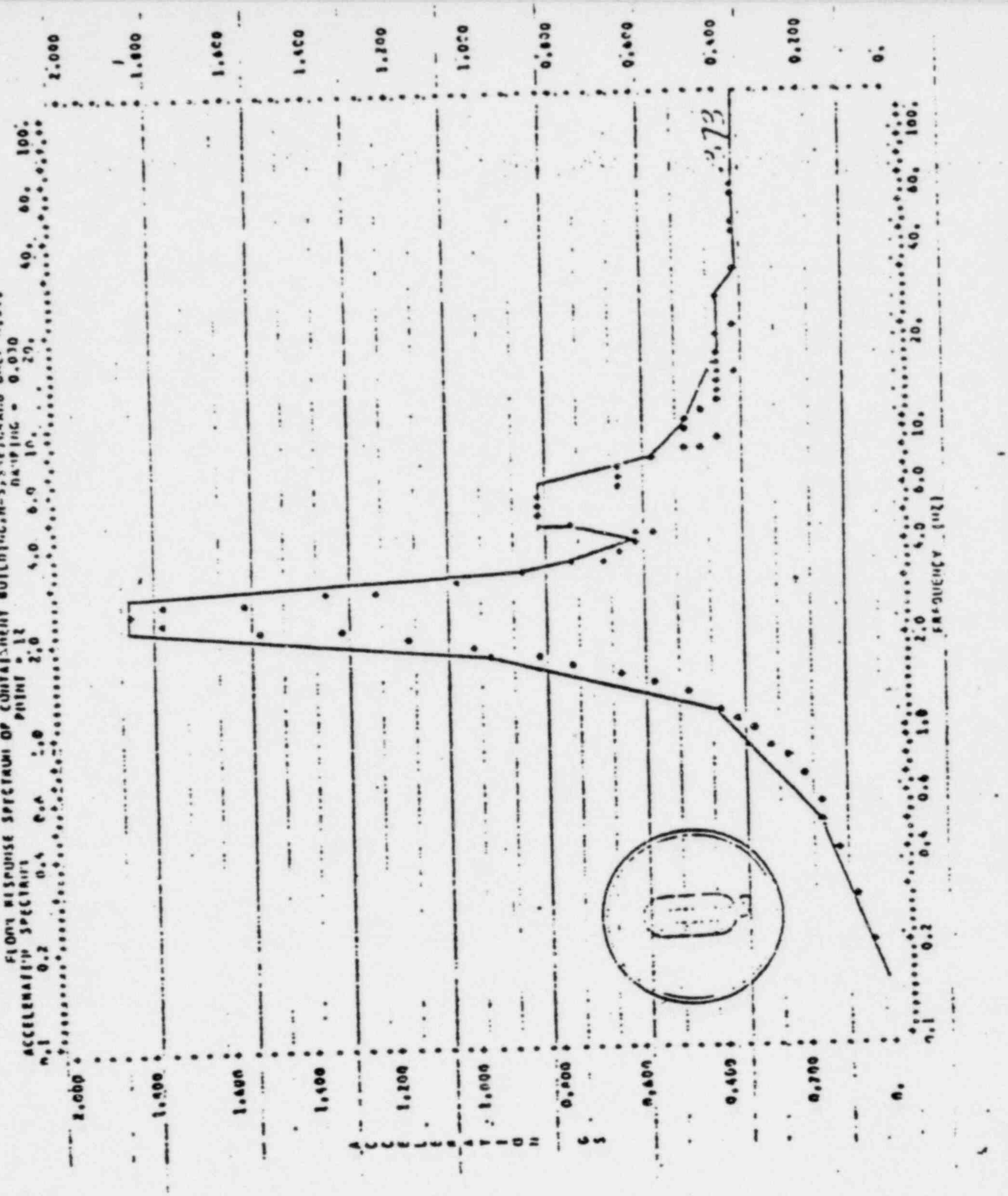

No.	DATE	REVISIONS	BY	CHK.
0	8/14/73	ISSUED FOR USE		

DRYWELL FLOOR SPECTRUM

SSE, N-S, EL. 161.83', 3%

GRAND GULF NUCLEAR STATION UNITS 1&2

JOB No. 9645 M-158.0

N 12/4

Appendix X

Page 15

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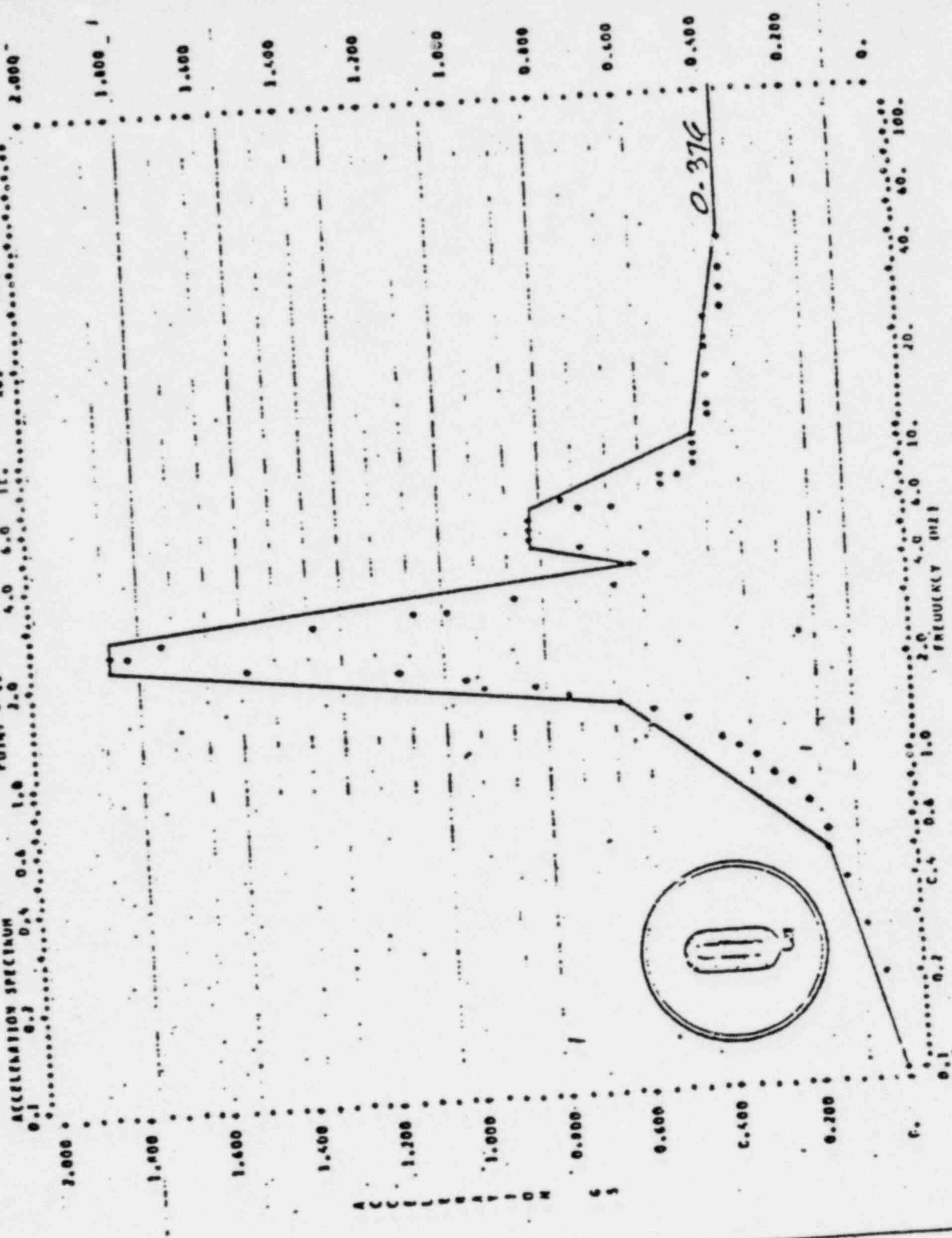

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DRYWELL FLOOR SPECTRUM
SSE, E-W, EL. 161 .83', 3%
GRAND GULF NUCLEAR STATION UNITS 1&2

JOB No. 9645-M-158.4
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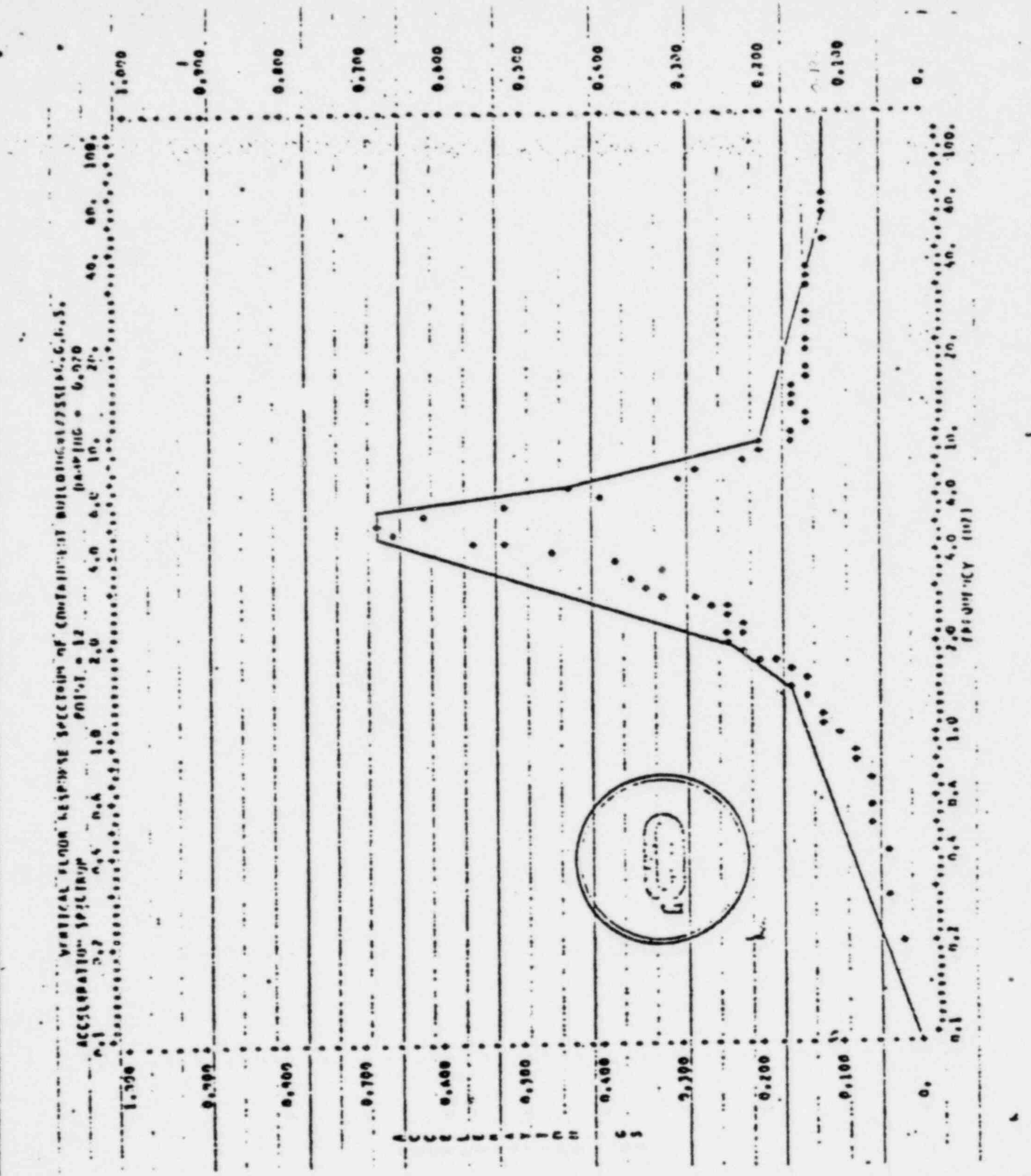

No	DATE	REVISIONS	BY	CHK	APP
	10/2/73	ISSUED FOR USE			

DRYWELL FLOOR SPECTRUM
1/2 SSE, VERT., EL. 161.83', ...
GRAND GULF NUCLEAR STATION UNITS 1&2

JOB No. 9645-M-150...
V 1203
Appendix X 0

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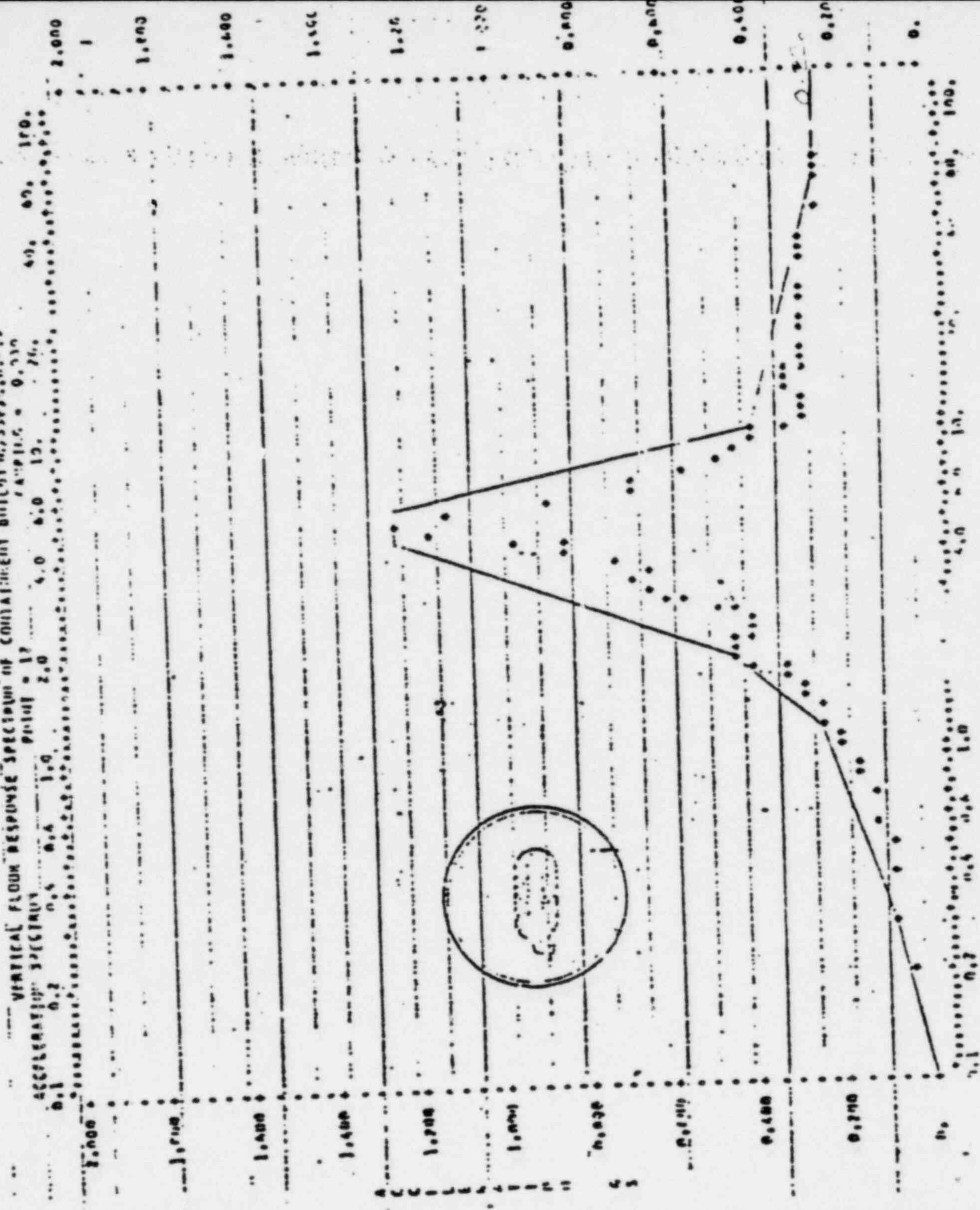

No.	DATE	REVISIONS	BY	CHK
	10/3/78	ISSUED FOR USE		

DRYWELL FLOOR SPECTRUM
SSE, VERT., EL. 161.33', 5%

GRAND GULF NUCLEAR STATION UNITS 1&2

JOB No. 9645-M-158.
V 1214
Appendix X
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GRAND GULF
NUCLEAR STATION
UNIT 1

SEISMIC AND HYDRODYNAMIC LOADS

REQUALIFICATION CERTIFICATION

JOB NO. MPL-02

EQUIPMENT NAME: Fan (Control Rm. Stdby. Air)

SPEC. NO: 9645-M-633.0 Rev. 13

EQUIPMENT NO: QSZ51D002A-A, B-B

LOCATION: Control Bldg., El. 133'

EQUIPMENT CLASSIFICATION: [X] ACTIVE [ ] PASSIVE

SEISMIC QUALIFICATION REPORT REFERENCE:

9645-M-633.0-QS-7.0-6-B, Order no. 76J-1167, Rev. B, Seismic Calculations, 6-28-77, by McMahon Engineering Co.

THE ABOVE SEISMIC QUALIFICATION REPORT(S) HAVE BEEN REEVALUATED AND REQUALIFIED WHERE NECESSARY TO SHOW THAT THE ABOVE-MENTIONED COMPONENT IS CAPABLE OF PERFORMING ITS INTENDED SAFETY FUNCTION UNDER ALL THE APPLICABLE LOADING COMBINATIONS INCLUDING THE POOL DYMANIC LOADS.

PREPARED: M.P. Voutyras
M. P. Voutyras

APPROVED: JC Rawlings for
V.J. Brocato

DATE: 7-10-81

GRAND GULF NUCLEAR STATION UNIT 1

QUALIFICATION SUMMARY

1. Equipment Name Fan (Control Rm. Stdby. Fresh Air)

2. Equipment No. QSZ51D002A-A, B-B

3. Qualification Documentation (Enclosed with this report.)

   A. Qualification Summary of Equipment (SQRT form), includ'ng required response spectra with TRS plotted on RRS grap'' as appropriate.

   B. Reference Documents

Reference Number	Document Identification	Revision or Date	Title/Subject
QS-7.. 6-B	76J-1167	Rev. B 6-28-77	Seismic Calculations

   C. Additional Supporting Documents

Document Identification	Revision or Date	Title/Subject
9645-M-633.0	Rev. 13 7-3-79	Technical Spec. for Control Room Standby Fresh Air System

QUALIFICATION SUMMARY (CONTINUED)

EQUIPMENT NO. QSZ51D002A-A
QSZ51D002B-B

4. Functional Requirements

Equipment should maintain operability during and after both operating basis and safe shutdown earthquakes.

5. Demonstration Capability

Lowest natural frequency calculated to be 66 Hz. Static analysis performed using ZPA values. Shaft deflection calculated to be within allowable.

6. Rationale for Qualification Certification

(Include Decision analysis with comparison to acceptance criteria, approach for demonstrating operability, and consideration of high-frequency response.)

Resonant frequencies calculated. Applicable loads used. Operability demonstrated. IEEE 344-1975 criteria met.

QSZ51D002A-A
QSZ51D002B-B

Qualification Summary of Equipment

I. Plant Name: Grand Gulf Nuclear Station Unit I — Type:

1. Utility: Mississippi Power and Light Co. — PWR ________

2. NSSS: G.E. — 3. A/E: Bechtel Power Corp. — BWR 6, Mark III

II. Component Name: 40 MW Fan

1. Scope: [ ] NSSS [x] BOP

2. Model Number: 40 MW Fan — Quantity: 2

3. Vendor: Buffalo Forge Co./G.E.

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance: Horizontal motor and Centrifugal fan

b. Dimensions: 34" x 44" x 48" (approx.)

c. Weight: 846 lbs.

6. Location: Building: Control Bldg.

Elevation: 133'0"

7. Field Mounting Conditions [X] Bolt (No. 4, Size 5/8-11 nc)
[ ] Weld (Length ____)
[ ] ________

8. a. System in whi located: Control Room Standby Fresh Air System

b. unctional scription: Propel Standby Fresh Air.

c. Is the equipment required for [ ] Hot Standby [X] Cold Shutdown
[ ] Both [ ] Neither

9. Pertinent Reference Design Specifications: 9645-M-633.0, Rev. 13

Prepared by: mpr 4/4/81

Verified by: IDMY for EDoliMe. 6/3/81

12/80

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method:

[ ] Test [X] Analysis [ ] Combination of Test and Analysis

Qualification Report*: 9645-M-633.0-QS-7.(-6-B

(No., Title and Date) 76J-1167, Rev. B, Seismic Calculations, 6-28-77

Company that Prepared Report: McMahon Engrg. Co.

Company that Reviewed Report: NUTECH/BECHTEL

V. Vibration Input:

1. Loads considered: a. [X] Seismic only

   b. [ ] Hydrodynamic only

   c. [ ] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [ ] SRSS [ ] N/A (other, specify)

3. Required Response Spectra (attach the graphs): attached

4. Damping Corresponding to RRS: OBE 1% SSE 1%

5. Required Acceleration in Each Direction: [X] ZPA [ ] Other (specify)

   OBE S/S = .146g F/B = .162g V = .111g
   SSE S/S = .292g F/B = .323g V = .223g

6. Were fatigue effects or other vibration loads considered?

   [ ] Yes [X] No

   If yes, describe loads considered and how they were treated in overall qualification program: ______

*NOTE: If more than one report complete items IV thru VII for each report.

VI. <u>If Qualification by Test, then Complete*:</u> N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] ________

2. [ ] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE ________ SSE ________ Other ________ (specify)

4. Frequency Range: ________________

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ________ F/B = ________ V = ________

6. Method of Determining Natural Frequencies

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graph [ ] No

8. Input g-level Test: OBE S/S = ________ F/B = ________ V = ________

SSE S/S = ________ F/B = ________ V = ________

9. Laboratory Mounting:

1. [ ] Bolt (No.______, Size______) [ ] Weld (Length______) [ ]______

10. Functional operability verified: [ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: ________________

____

12. Other test performed (such as aging or fragility test, including results):

____

____

*Note: If qualification by a combination of test and analysis also complete Item VII.

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[x] Static Analysis [ ] Equivalent Static Analysis
0.323g both horizontal, 0.223 vertical
[ ] Dynamic Analysis [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
Motor Shaft — S/S = 83.6 Hz; Motor Base — F/B = 74.8 Hz; Combined — V = 66.5 Hz

3. Model Type: [x] 3D [ ] 2D [ ] 1D

[ ] Finite Element [x] Beam [ ] Closed Form Solution

4. [x] Computer Codes: not specified

Frequency Range and No. of modes considered: ______

[x] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
[X] Other: Seismic Coef. Combined by SRSS (specify)

6. Damping: OBE N/A SSE N/A Basis for the damping used: ______

7. Support Considerations in the model: ______

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Normal Stress	Motor Shaft			2,189	17,250 psi
Bending	Inlet Stand Bottom Flange			8,781	24,000
Normal Stress	Foundation Bolts			5,330	27,000

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
.00373"	Motor Shaft	.1406"

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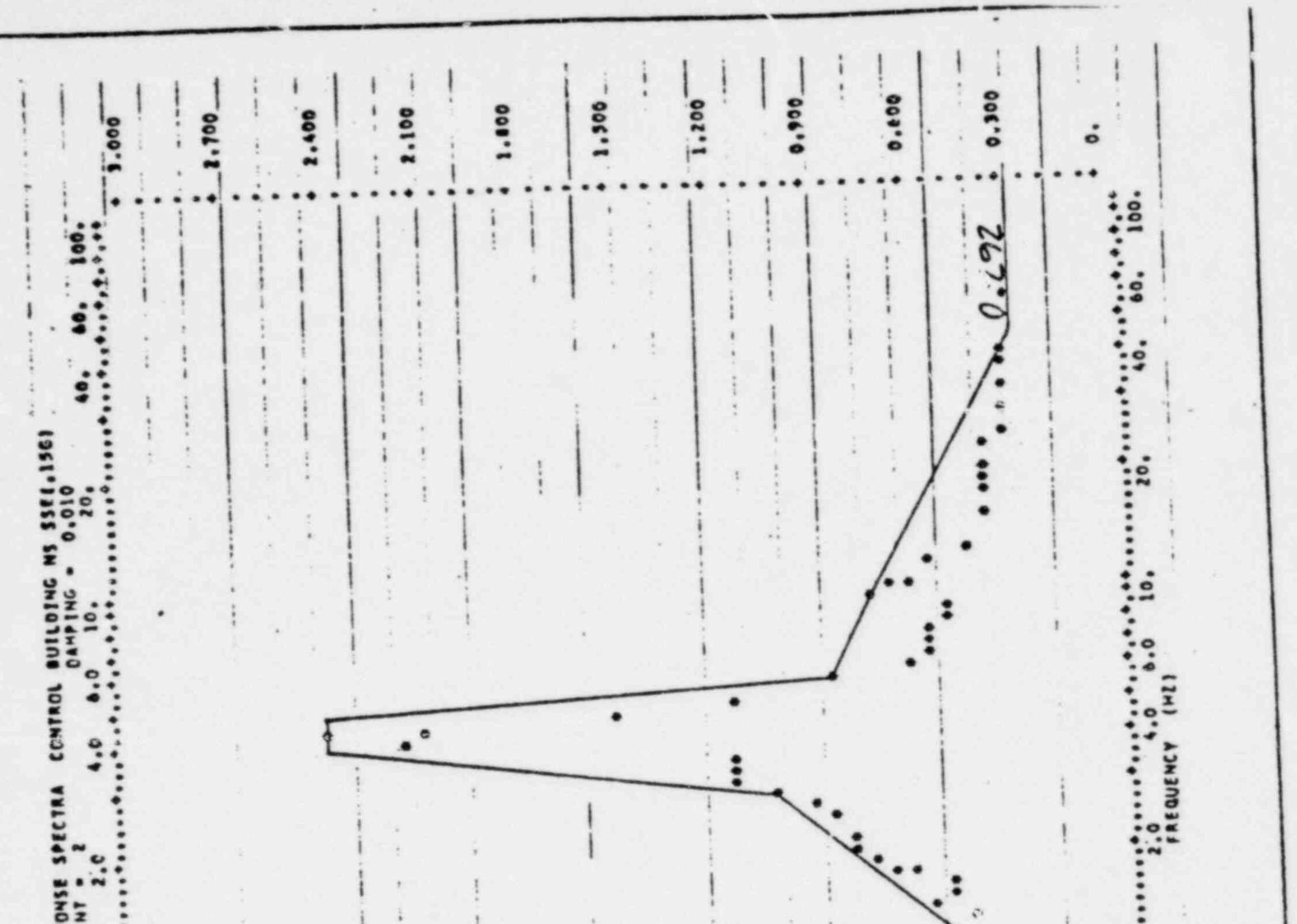

No.	DATE	REVISIONS	BY	CH'K	APPR
0	7/2/73	ISSUED FOR USE			

CONTROL BUILDING FLOOR SPECTRUM
SSE, N-S, EL. 133'-0", 1%

GRAND GULF NUCLEAR STATION UNITS 1&2

JOB No. 9645-M-133.0

N 312

Appendix W

SHEET 5

GG-39

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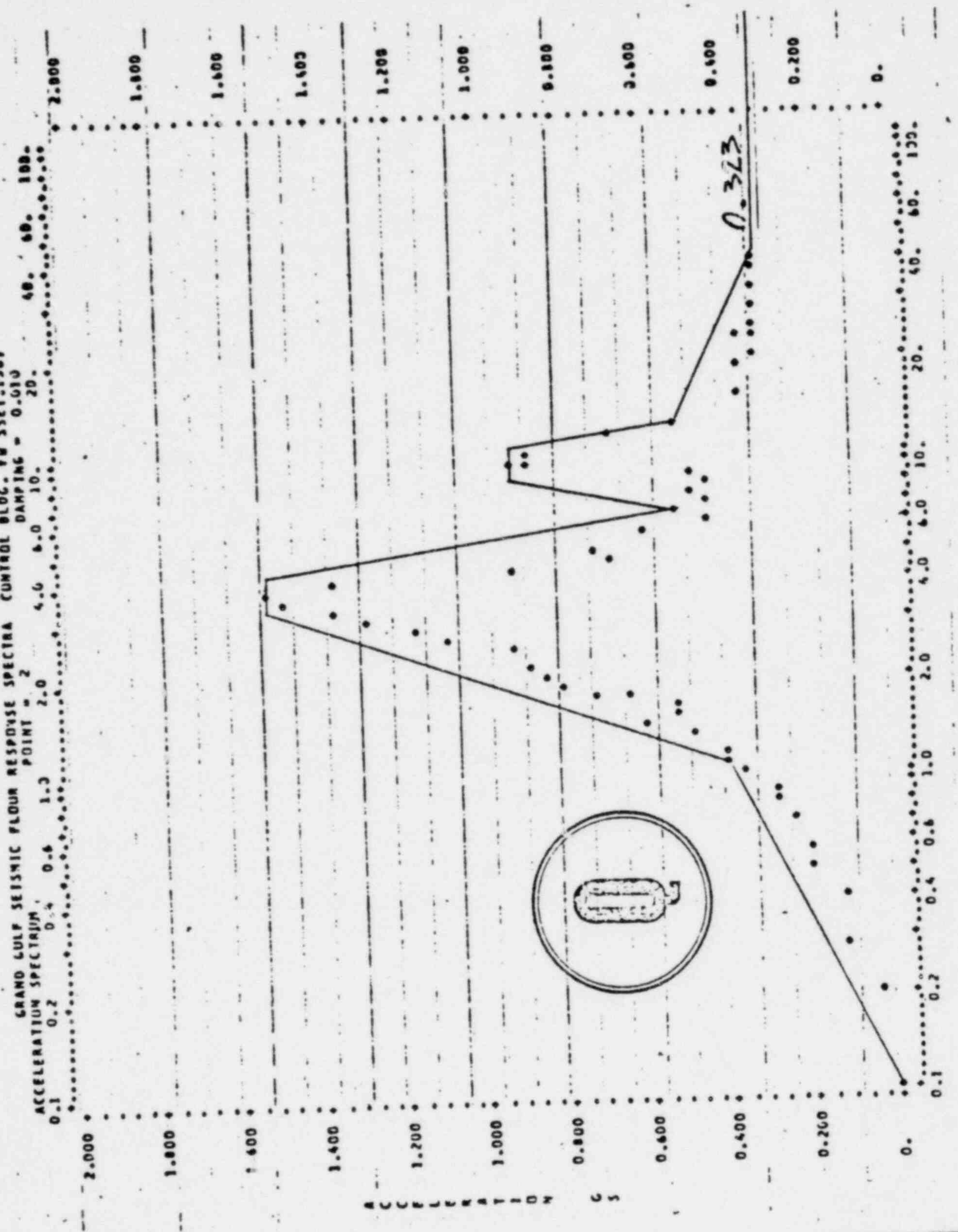

No.	DATE	REVISIONS	BY	CHK	APP
6	7/2/73	ISSUED FOR USE			

CONTROL BUILDING FLOOR SPECTRUM
SSE, E-W, EL. 133'-0", 1%

JOB No 9645-M 6330

E312

Appendix W

SHEET 6

G-39

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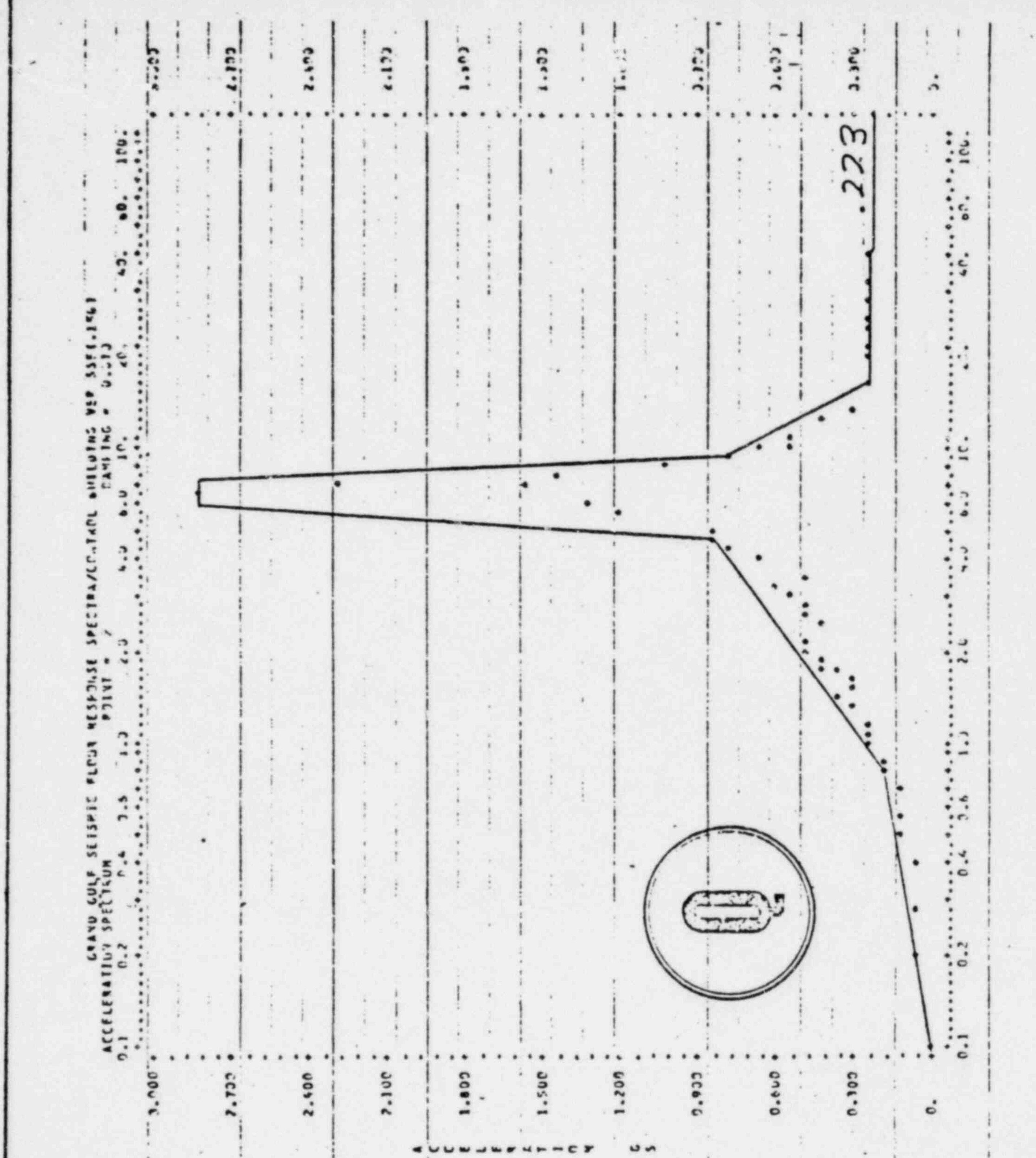


No.	DATE	REVISIONS	BY	CH'K	APPR
0	7/23/73	ISSUED FOR USE			

CONTROL BUILDING FLOOR SPECTRUM
SSE, VERTICAL, EL. 133' - 0", 1%

GRAND GULF NUCLEAR STATION UNITS 1&2

JOB No. 9645-M-633.0
V 312
Appendix W
SHEET 7
REV 1

GG-39

GRAND GULF
NUCLEAR STATION
UNIT 1

SEISMIC AND HYDRODYNAMIC LOADS

REQUALIFICATION CERTIFICATION

JOB NO. MPL-02

EQUIPMENT NAME: Containment Polar Crane SPEC. NO:9645-M-063.0

EQUIPMENT NO: Q1F13E001

LOCATION: Containment Bldg., El. 238 ft.

EQUIPMENT CLASSIFICATION: ☐ ACTIVE ☒ PASSIVE

SEISMIC QUALIFICATION REPORT REFERENCE:

9645-M-063.0-QS-8.01-1-0, Report 80N-134329, Bridge Structural Calculations, 12/18/80, by Harnischfeger Corp. Report 80N-134329, Trolley Structural Calculations, 2/17/81, by Harnischfeger Corp.

THE ABOVE SEISMIC QUALIFICATION REPORT(S) HAVE BEEN REEVALUATED AND REQUALIFIED WHERE NECESSARY TO SHOW THAT THE ABOVE-MENTIONED COMPONENT IS CAPABLE OF PERFORMING ITS INTENDED SAFETY FUNCTION UNDER ALL THE APPLICABLE LOADING COMBINATIONS INCLUDING THE POOL DYMANIC LOADS.

PREPARED: TRMager
T.R. Mager

APPROVED: JC Rawlings for
V.J. Brocato

DATE: 7-10-81

EQUIPMENT NO. Q1F13E001

4. Functional Requirements

The crane must not structurally fail, fall, collapse, or drop the load during an SSE. The crane must function subsequent to an OBE and hydrodynamic loads.

5. Demonstration Capability

Dynamic response spectrum analysis was used to qualify the crane to SQRT requirements. 20 modes were considered in the frequency range from 0-30 hz. Several natural frequencies were shown throughout the range from 0-30 hz. The maximum critical deflection was calculated to assure structural integrity during a seismic event. Several components had no stress margin and some components were slightly overstressed.

6. Rationale for Qualification Certification

(Include Decision analysis with comparison to acceptance criteria, approach for demonstrating operability, and consideration of high-frequency response.)

Dynamic response spectrum analysis is an acceptable method of SQRT qualification for flexible equipment. All significant modal responses were considered and combined per U.S. NRC Reg. Guide 1.92. Deflection calculations were performed to assure the functional requirements. The component overstresses are being rectified in accordance with the manufacturer's instructions. However, the observed overstresses are well within the elastic limits of the materials and will not affect crane functional requirements or endanger the safety of the plant.

GRAND GULF NUCLEAR STATION UNIT 1

QUALIFICATION SUMMARY

1. Equipment Name Containment Polar Crane (125/35 Ton)
2. Equipment No. Q1F13E001
3. Qualification Documentation (Enclosed with this report.)

   A. Qualification Summary of Equipment (SQRT form), including required response spectra with TRS plotted on RRS graph as appropriate.

   B. Reference Documents

Reference Number	Document Identification	Revision or Date	Title/Subject
9645-M-063.0-QS-8.01-1-0	80N-134329	12/18/80	Bridge Structural Calculations
	80N-134329	2/17/81	Trolley Structural Calculations

   C. Additional Supporting Documents

Document Identification	Revision or Date	Title/Subject
9645-M-063.0	Rev. 16	Technical Specification For Containment Polar Crane For Mississippi Power & Light Company Grand Gulf Nuclear Station Units 1 and 2

Qualification Summary of Equipment

I. **Plant Name:** Grand Gulf Nuclear Station Unit I

Type:

1. Utility: Mississippi Power and Light Co. PWR

2. NSSS: G.E. 3. A/E: Bechtel Power Corp. BWR 6, Mark III

II. **Component Name** Containment Polar Crane (125/35 Ton)

1. Scope: [ ] NSSS [x] BOP

2. Model Number: CN-25035 Quantity: 1

3. Vendor: Harnischfeger Corp.

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance

   b. Dimensions Trolley: ~ 22' X 12' X 15' high, Rail Span: 18' D

   c. Weight Trolley - 78,900 lbs, Bridge Girder - 138,000 lbs

6. Location: Building: Containment Bldg.

   Elevation: 238 ft

7. Field Mounting Conditions [x] Bolt (No. 80, Size 1") per End Tie
   [ ] Weld (Length)
   [x] Trolley on Rails

8. a. System in which located: Reactor Vessel Servicing Equipment

   b. Functional Description: Lift Vessel head & strongback, Shroud Head & Separator, & Dryer Assembly for Maintenance & Construction

   c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown

   [ ] Both [x] Neither

9. Pertinent Reference Design Specifications:

   9645-M-063.0, Rev. 16

Prepared by: TRM 4 / 8/81

Verified by: TL 5 / 4/81

12/80

III. Is Equipment Available for Inspection in the Plant: [x] Yes [ ] No

IV. Equipment Qualification Method:

[ ] Test [x] Analysis [ ] Combination of Test and Analysis

Qualification Report*: 9645-M-0630-QS-8.0-1-0

(No., Title and Date) 80N-134329, Bridge Structural Calc. 12/18/80

Company that Prepared Report: Harnischfeger Corp.

Company that Reviewed Report: NUTECH/Bechtel

V. Vibration Input:

1. Loads considered: a. [ ] Seismic only

   b. [ ] Hydrodynamic only

   c. [x] Combination of (a) and (b)

2. Method of Combining RRS: [x] Absolute Sum [ ] SRSS [ ] ________ (other, specify)

3. Required Response Spectra (attach the graphs): ________

4. Damping Corresponding to RRS: OBE ________ SSE 3%

5. Required Acceleration in Each Direction: [x] ZPA [ ] Other ________ (specify)

OBE	S/S = 0.37g	F/B = 0.37g	V = 0.14g
SSE	S/S = 0.73g	F/B = 0.73g	V = 0.28g

6. Were fatigue effects or other vibration loads considered?

   [ ] Yes [x] No

   If yes, describe loads considered and how they were treated in overall qualification program: ________

*NOTE: If more than one report complete items IV thru VII for each report.

VI. If Qualification by Test, then Complete*: N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] ________

2. [ ] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE ________ SSE ________ Other ________ (specify)

4. Frequency Range: ________

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = ________ F/B = ________ V = ________

6. Method of Determining Natural Frequencies

   [ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graph [ ] No

8. Input g-level Test: OBE S/S = ________ F/B = ________ V = ________

   SSE S/S = ________ F/B = ________ V = ________

9. Laboratory Mounting:

   1. [ ] Bolt (No.______, Size______) [ ] Weld (Length______) [ ] ______

10. Functional operability verified: [ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: ________

____

12. Other test performed (such as aging or fragility test, including results):

____

____

*Note: If qualification by a combination of test and analysis also complete Item VII.

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

[x] Dynamic Analysis: [ ] Time-History [x] Response Spectrum

* 2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = 0.74, 0.181,5.777Hz F/B = 0.74,0.181,3.114hz V = 1.402,2.441,3.113hz

3. Model Type: [x] 3D [ ] 2D [ ] 1D

[x] Finite Element [ ] Beam [ ] Closed Form Solution

4. [x] Computer Codes: Stardyne

Frequency Range and No. of modes considered: 0-30hz, 20 modes

[ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [x] SRSS
[ ] Other: ________ (specify)

6. Damping: OBE 2% SSE 2% Basis for the damping used: Reg. Guide 1.61

7. Support Considerations in the model: ________

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	(ksi) Seismic Stress	(ksi) Total Stress	(ksi) Stress Allowable
Max. Stress	Girder	OBE + SRV	15.64	26.93	26.95
Max. Stress	Girder	SSE + SRV	26.43	37.72	38.34
Max. Stress	Critical Bolt	@ End Tie,SSE+SRV		49.06	49.08
Bending Stress	End Trucks	OBE + SRV		16.14	18.0
Max. Stress	Bridge Uplift Restraint	SSE + SRV		32.3	32.4

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
1.385"	Girder	1.744"

*NOTE: Several natural frequencies throughout range from 0 - 30 hz

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

   [ ] Static Analysis   [ ] Equivalent Static Analysis

   [x] Dynamic Analysis: [ ] Time-History   [x] Response Spectrum

* 2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = 0.74,0.181,5.777hz F/B = 0.74,0.181,3.114hz V = 1.402,2.441,3.113hz

3. Model Type: [x] 3D   [ ] 2D   [ ] 1D

   [x] Finite Element   [ ] Beam   [ ] Closed Form Solution

4. [xx] Computer Codes: Stardyne

   Frequency Range and No. of modes considered: 0-30hz 20 modes

   [ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [x] SRSS
   [ ] Other: ________ (specify)

6. Damping: OBE 2% SSE 3% Basis for the damping used: Reg. Guide 1.6

7. Support Considerations in the model: ________

8. Critical Structural Elements:

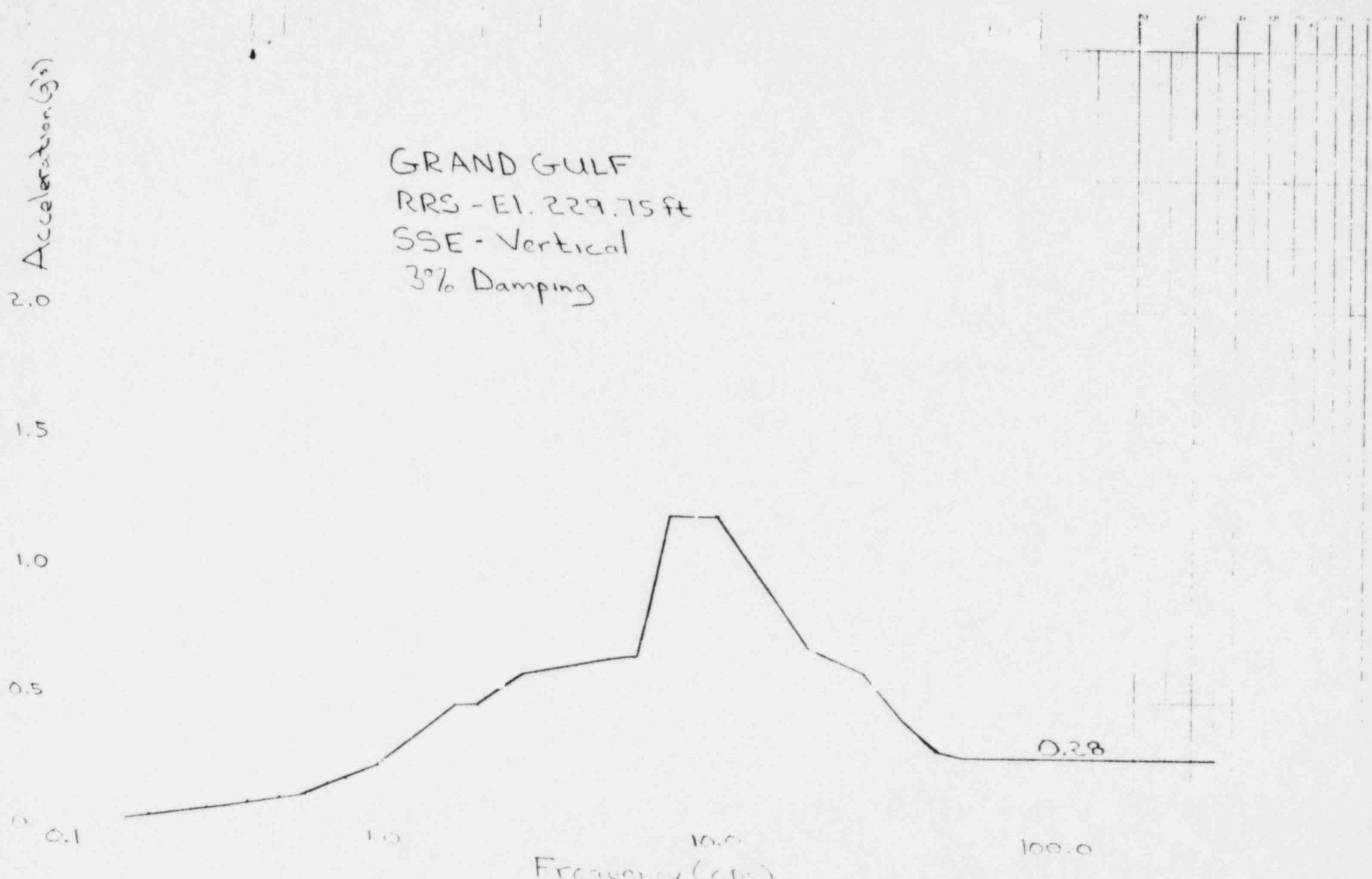
A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	(ksi) Total Stress	(ksi) Stress Allowable
Shear Stress	Trolley Side	SSE + SRV		16.27	25.0
Bearing Stress	Eq. Restraints Shear Bar	SSE + SRV		36.0	32.4
Bending Stress	Eq. Restraints	SSE + SRV		32.17	32.4
Bending Stress	Locking Pins	OBE + SRV		59.10	61.25
Max. Stress	Shear Bar Welds	SSE + SRV		30.54	[illegible]

* B.

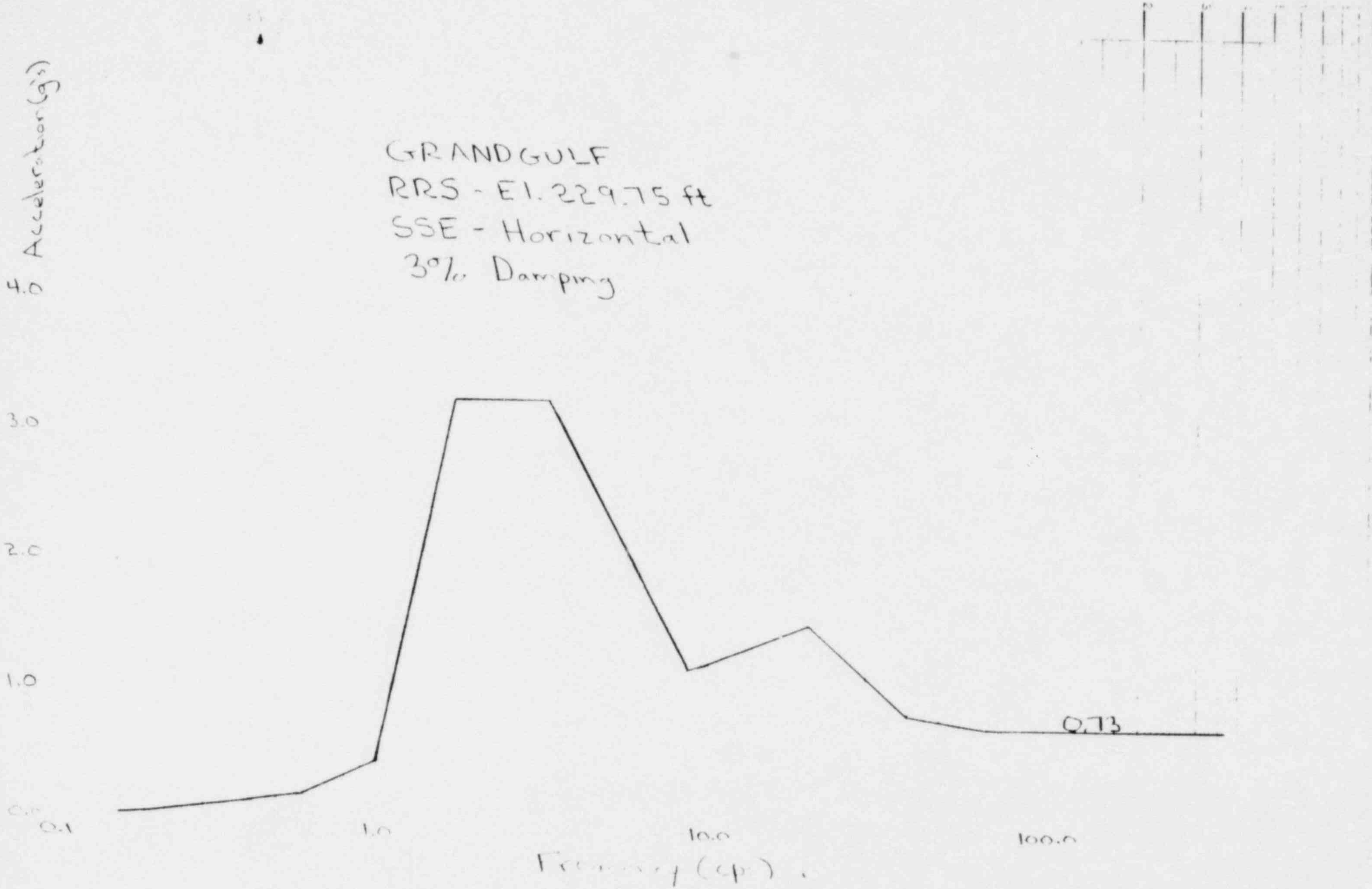
Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

*NOTE: Several natural frequencies throughout range from 0-30 hz



GRAND GULF
RRS - El. 229.75 ft
SSE - Vertical
3% Damping
Acceleration (g's)
2.0
1.5
1.0
0.5
0.1
1.0
10.0
100.0
0.28
Frequency (cps).

TRM
4/8/81


GRANDGULF
RRS - El. 229.75 ft
SSE - Horizontal
3% Damping
Acceleration (g's)
4.0
3.0
2.0
1.0
0.0
0.1
1.0
10.0
100.0
0.73
Frequency (cps)

TRM
4/9/91

GRAND GULF
NUCLEAR STATION
UNIT 1

SEISMIC AND HYDRODYNAMIC LOADS

REQUALIFICATION CERTIFICATION

JOB NO. MPL-02

EQUIPMENT NAME: Solenoid Valve

SPEC. NO: 9645-M-617.1
Rev. 3

EQUIPMENT NO: See attached list.

LOCATION: Control Bldg., El. 111 & 133 Ft.

EQUIPMENT CLASSIFICATION: [X] ACTIVE [ ] PASSIVE

SEISMIC QUALIFICATION REPORT REFERENCE:

9645-M-61'.1-QS-29.0-2-0, AQS21678/TR, Qualification Data for Safety Related Service, March 1979, by ISOMEDIX

THE ABOVE SEISMIC QUALIFICATION REPORT(S) HAVE BEEN REEVALUATED AND REQUALIFIED WHERE NECESSARY TO SHOW THAT THE ABOVE-MENTIONED COMPONENT IS CAPABLE OF PERFORMING ITS INTENDED SAFETY FUNCTION UNDER ALL THE APPLICABLE LOADING COMBINATIONS INCLUDING THE POOL DYMANIC LOADS.

PREPARED: M.P. Voutyras
M.P. Voutyras

APPROVED: J.C. Rawlings for
N.J. Brocato

DATE: 7-10-81

GRAND GULF NUCLEAR STATION UNIT 1

QUALIFICATION SUMMARY

1. Equipment Name Solenoid Valve

2. Equipment No. See attached list

3. Qualification Documentation (Enclosed with this report.)

   A. Qualification Summary of Equipment (SQRT form), including required response spectra with TRS plotted on RRS graph as appropriate.

   B. Reference Documents

Reference Number	Document Identification	Revision or Date	Title/Subject
QS-29.0-2-0	AQS21678/TR	March 1978	Qualification Data for Safety Related Service

   C. Additional Supporting Documents

Document Identification	Revision or Date	Title/Subject
9645-M-617.1	Rev. 3 11/2/79	Bechtel Technical Spec. for Automatic Dampers (Safety-Related)

QUALIFICATION SUMMARY (CONTINUED)

EQUIPMENT NO. See attached list

4. Functional Requirements

Automatic dampers should remain functional during and after both operating basis and safe shutdown earthquakes.

5. Demonstration Capability

Single-axis single-frequency sinusoidal fragility testing used. Inputs of 10g's were applied in range of 1-33 Hz at one third octave intervals. Operability was verified during and after testing on eight of the nine tested.

6. Rationale for Qualification Certification

(Include Decision analysis with comparison to acceptance criteria, approach for demonstrating operability, and consideration of high-frequency response.)

Testing performed as noted above. Reduced loading of 7.14g's to account for cross coupling fa[illegible] exceeds peak RRS value of 2.7g's. Operability was demonstrated on a generically similar valve.

Equipment Name: Solenoid Valve

Equipment Nos.: Q1Z77-F001A
Q1Z77-F001B
Q1Z77-F002A
Q1Z77-F002B
Q1Z77-F003A
Q1Z77-F003B
Q1Z77-F004A
Q1Z77-F004B

Q1Z77-F001A
Q1Z77-F001B
Q1Z77-F002A
Q1Z77-F002B
Q1Z77-F003A
Q1Z77-F003B
Q1Z77-F004A
Q1Z77-F004B

Qualification Summary of Equipment

I. Plant Name: Grand Gulf Nuclear Station Unit I

Type:

1. Utility: Mississippi Power and Light Co.

PWR

2. NSSS: G.E. 3. A/E: Bechtel Power Corp.

BWR 6, Mark III

II. Component Name Solenoid Valve

1. Scope: [ ] NSSS [x] BOP
2. Model Number: HT8320 Quantity: 8
3. Vendor: Automatic Switch Company
4. If the component is a cabinet or panel, name and model No. of the devices included: N.A.
5. Physical Description a. Appearance Solenoid Valve
   b. Dimensions approx. 8" long x 2" dia.
   c. Weight
6. Location: Building: Control
   Elevation: 111 & 133 Ft.
7. Field Mounting Conditions [X] Bolt (No.____, Size____)
   [ ] Weld (Length____)
   [ ] ________
8. a. System in which located: Safeguards, Switchgear & Battern Rm. Vent.
   b. Functional Description: Controls air flow
   c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
   [X] Both [ ] Neither
9. Pertinent Reference Design Specifications:
   9645-M-617.1 Rev. 3

Prepared by: MPV 4/1/81

Verified by: AKM 4/29/81

12/80

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method:

[X] Test [ ] Analysis [ ] Combination of Test and Analysis

Qualification Report*: 9645-M-617.1-Qs-29.0-2-0

(No., Title and Date) AQS21678/TR, Qualification, March 1978

Company that Prepared Report: ISOMEDIX

Company that Reviewed Report: NUTECH/Bechtel

V. Vibration Input:

1. Loads considered: a. [X] Seismic only

   b. [ ] Hydrodynamic only

   c. [ ] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [ ] SRSS [X] N/A (other, specify)

3. Required Response Spectra (attach the graphs): Attached

4. Damping Corresponding to RRS: OBE ______ SSE 3%

5. Required Acceleration in Each Direction: [ ] ZPA [XX] Other Peak (specify)

	S/S	F/B	V
OBE			
SSE	2.70g	2.70g	2.70g

6. Were fatigue effects or other vibration loads considered?

   [ ] Yes [X] No

   If yes, describe loads considered and how they were treated in overall qualification program: ______

*NOTE: If more than one report complete items IV thru VII for each report.

VI. If Qualification by Test, then Complete*:

1. [X] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [X] sinusoidal fragility

2. [X] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE________ SSE________ Other________ (specify)

4. Frequency Range: 1-33

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = None Provided F/B = ________ V = ________

6. Method of Determining Natural Frequencies

   [ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graph
   [ ] No

8. Input g-level Test: OBE S/S = ________ F/B = ________ V = ________

   SSE S/S = 10g F/B = 10g V = 10g

9. Laboratory Mounting:**

   1. [X] Bolt (No.______, Size______) [ ] Weld (Length______) [ ]______

10. Functional operability verified: [X] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made:________________

12. Other test performed (such as aging or fragility test, including results):

    Several environmental aging tests accompanied the seismic testing.

*Note: If qualification by a combination of test and analysis also complete Item VII.

**Note: Mounting is assumed to be that of a typical installation, although it is not stated.

VII. If Qualification by Analysis, then complete: N/A

1. Method of Analysis:

   [ ] Static Analysis   [ ] Equivalent Static Analysis

   [ ] Dynamic Analysis: [ ] Time-History   [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = ________________   F/B = ________________   V = ________________

3. Model Type: [ ] 3D   [ ] 2D   [ ] 1D

   [ ] Finite Element   [ ] Beam   [ ] Closed Form Solution

4. [ ] Computer Codes: ____

   Frequency Range and No. of modes considered: ______________________

   [ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
   [ ] Other: ____________________
   (specify)

6. Damping: OBE_________ SSE______ Basis for the damping used: ______________

7. Support Considerations in the model: ____________________________________

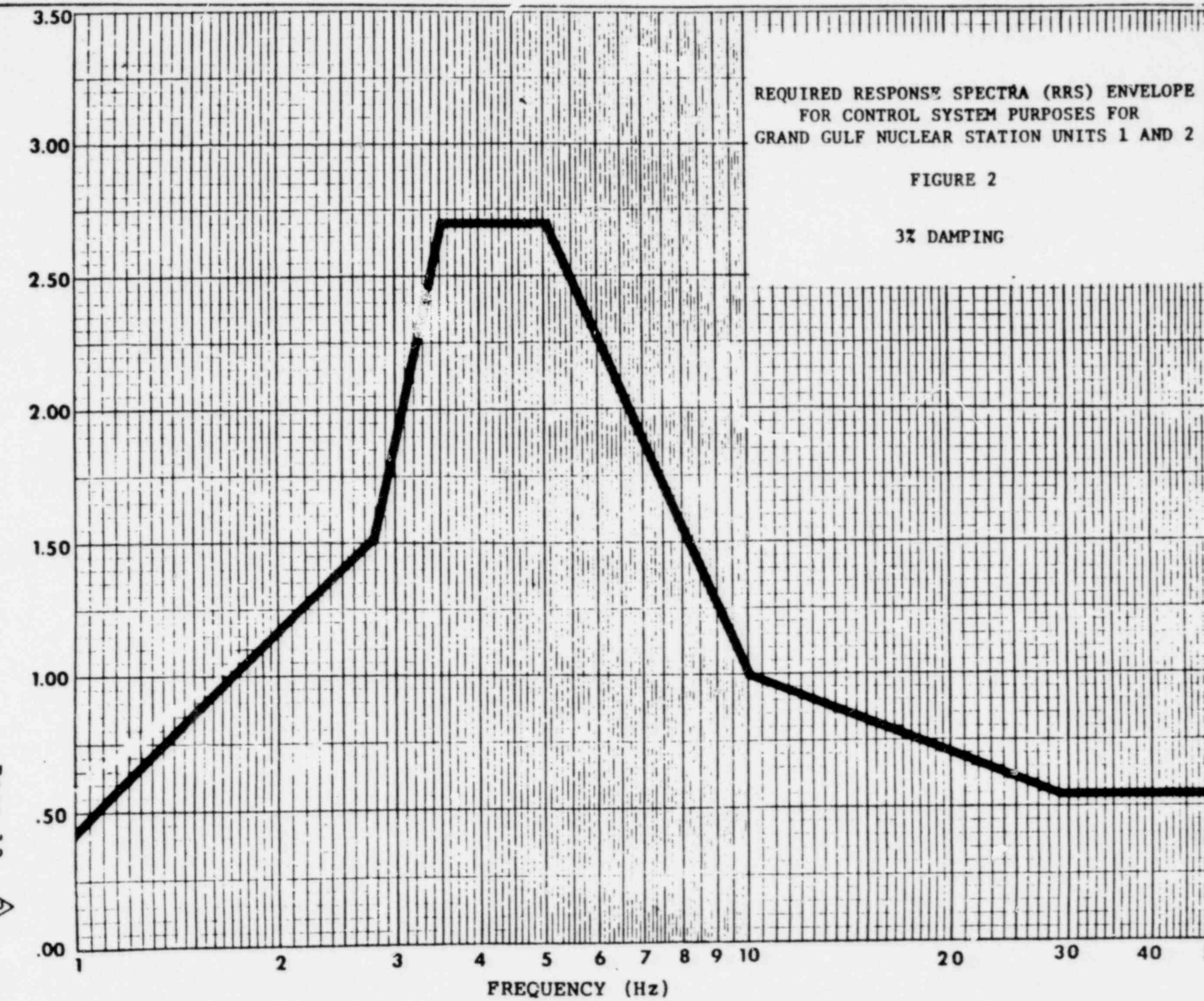
8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability



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Rev. 3 3

Specification 9645-J-820.0

GRAND GULF
NUCLEAR STATION
UNIT 1

SEISMIC AND HYDRODYNAMIC LOADS

REQUALIFICATION CERTIFICATION

JOB NO. MPL-02

EQUIPMENT NAME: HPCS Service Water Pump Motor

SPEC. NO: 9645-M-087.0 Rev. 15

EQUIPMENT NO: Q1P41C002-C

LOCATION: Service Water Pump House, El. 140'

EQUIPMENT CLASSIFICATION: [X] ACTIVE [ ] PASSIVE

SEISMIC QUALIFICATION REPORT REFERENCE:

9645-M-087.0-Q1P41C002C-7.0-2-1, ME-292, Seismic Stress Analysis Report of Motor (100 Hp), 3-9-76, by McDonald Engineering Analysis Co.

THE ABOVE SEISMIC QUALIFICATION REPORT(S) HAVE BEEN REEVALUATED AND REQUALIFIED WHERE NECESSARY TO SHOW THAT THE ABOVE-MENTIONED COMPONENT IS CAPABLE OF PERFORMING ITS INTENDED SAFETY FUNCTION UNDER ALL THE APPLICABLE LOADING COMBINATIONS INCLUDING THE POOL DYMANIC LOADS.

PREPARED: M.P. Voutyras
M. P. Voutyras

APPROVED: V. J. Brocato
V. J. Brocato

DATE: 7/5/81

GRAND GULF NUCLEAR STATION UNIT 1

QUALIFICATION SUMMARY

1. Equipment Name HPCS Service Water Pump Motor
2. Equipment No. Q1P41C002-C
3. Qualification Documentation (Enclosed with this report.)

   A. Qualification Summary of Equipment (SQRT form), including required response spectra with TRS plotted on RRS graph as appropriate.

   B. Reference Documents

Reference Number	Document Identification	Revision or Date	Title/Subject
Q1P41C002-C-7.0-2-1	ME-292	3-9-76	Seismic Stress Analysis Report of Motor (100 Hp)

   C. Additional Supporting Documents

Document Identification	Revision or Date	Title/Subject
9645-M-087.0	Rev. 15 3-24-80	Bechtel Design Specification for Vertical Centrifugal Pumps

QUALIFICATION SUMMARY (CONTINUED)

EQUIPMENT NO. QIP41C002-6

4. Functional Requirements

Equipment shall remain functional during and after both operating basis and safe shutdown earthquakes.

5. Demonstration Capability

Critical speed of the motor was calculated to be 58 Hz. This value is within the ZPA range. Static analysis was performed using applicable loading. Operability was demonstrated by analysis of the rotor/stator clearance.

6. Rationale for Qualification Certification

(Include Decision analysis with comparison to acceptance criteria, approach for demonstrating operability, and consideration of high-frequency response.)

Applicable loading used. Both deflections and stresses were calculated to be within allowables. IEEE344-1975 criteria met.

Qualification Summary of Equipment

I. **Plant Name:** Grand Gulf Nuclear Station Unit I

Type:

1. Utility: Mississippi Power and Light Co. PWR
2. NSSS: G.E. 3. A/E: Bechtel Power Corp. BWR 6, Mark III

II. **Component Name** HPCS Service Water Pump Motor

1. Scope: [ ] NSSS [x] BOP
2. Mod' Number: 5K6267XH4012A Quantity: 1
3. Vendor: General Electric Company
4. If the component is a cabinet or panel, name and model No. of the devices included: Not Applicable
5. Physical Description a. Appearance

   b. Dimensions Height - 38 3/4", Diameter - 20 1/8"

   c. Weight 990 lbs.
6. Location: Building: Service Water Pump House (Seismic Catagory 1)

   Elevation: 140'
7. Field Mounting Conditions [X] Bolt (No. 4, Size 5/8") SA193 B7 MTL.
   [ ] Weld (Length)
   [ ]
8. a. System in which located: HPCS Service Water

   b. Functional Description: Cooling Water for Normal and Emergency Reactor Shutdown System

   c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown [x] Both [ ] Neither
9. Pertinent Reference Design Specifications: Bechtel Spec 9645-M-087.0 Rev. 15

Prepared by: MCl 4/7/81

Verified by: AKM 4/17/81

12/80

III. Is Equipment Available for Inspection in the Plant: [x] Yes [ ] No

IV. Equipment Qualification Method:

[ ] Test [X] Analysis [ ] Combination of Test and Analysis

Qualification Report*: 9645-M-087.0-Q1P41C002-C-7.0-2-1

(No., Title and Date) ME-292, Seismic Stress Analysis Report of Motor (100 HP) March 9, 1976

Company that Prepared Report: McDonald Engineering Analysis Company

Company that Reviewed Report: NUTECH/Bechtel

V. Vibration Input:

1. Loads considered: a. [x] Seismic only

   b. [ ] Hydrodynamic only

   c. [ ] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [ ] SRSS [x] Not combined (other, specify)

3. Required Response Spectra (attach the graphs): Attached

4. Damping Corresponding to RRS: OBE 2% SSE 2%

5. Required Acceleration in Each Direction: [X] ZPA [ ] Other (specify)

OBE	S/S = .08	F/B = .08	V = .05
SSE	S/S = .16	F/B = .16	V = .10

6. Were fatigue effects or other vibration loads considered?

   [x] Yes [ ] No

   If yes, describe loads considered and how they were treated in overall qualification program: Reduced bearing life due to seismic vibratory loads was considered.

*NOTE: If more than one report complete items IV thru VII for each report.

VI. If Qualification by Test, then Complete*: N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random
[ ] sine beat
[ ] ________________

2. [ ] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE__________ SSE_________ Other________________ (specify)

4. Frequency Range:______________________________________

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = __________________ F/B = ________________ V = ________________

6. Method of Determining Natural Frequencies

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graph
[ ] No

8. Input g-level Test: OBE S/S = _________ F/B = __________ V = ________

SSE S/S = _________ F/B = __________ V = ________

9. Laboratory Mounting:

1. [ ] Bolt (No.______, Size______) [ ] Weld (Length_______) [ ]______

10. Functional operability verified: [ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made:______________________________

____

12. Other test performed (such as aging or fragility test, including results):

____

____

*Note: If qualification by a combination of test and analysis also complete Item VII.

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

   [ ] Static Analysis [x] Equivalent Static Analysis

   3.0g lateral, 2.0g vertical

   [ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = 58 hz F/B = ________ V = ________

3. Model Type: [ ] 3D [x] 2D [ ] 1D

   [ ] Finite Element [ ] Beam [ ] Closed Form Solutio

4. [x] Computer Codes: ICES-STRUDL

   Frequency Range and No. of modes considered: ________

   [ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS

   [x] Other: Seismic coef. combined by SRSS (specify)

6. Damping: OBE N/A SSE N/A Basis for the damping used: ________

7. Support Considerations in the model: Fixed support at one end.

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	(psi) Total Stress	(psi) Stress Allowable
Bolt Tensile	Stator frame			18228	53200
Combined	Shaft			4981	20000

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
0.00348"	Rotor/Stator clearance	0.030"

RESPONSE SPECTRUM ANALYSIS FOR GRAND GULF SSW COOLING TOWER AND MAKEUP BASIN UNIT 2 VERTICAL SSE

VERTICAL MOTION AT NODAL POINT 16-EL.141'-0"

ABSOLUTE SPECTRAL ACCELERATIONS (G)

CURVE 1 IS FOR .005 DAMPING AMAX= 1.041 AT FRQ= 6.340
CURVE 2 IS FOR .010 DAMPING AMAX= .929 AT FRQ= 6.340
CURVE 3 IS FOR .020 DAMPING AMAX= .804 AT FRQ= 7.113

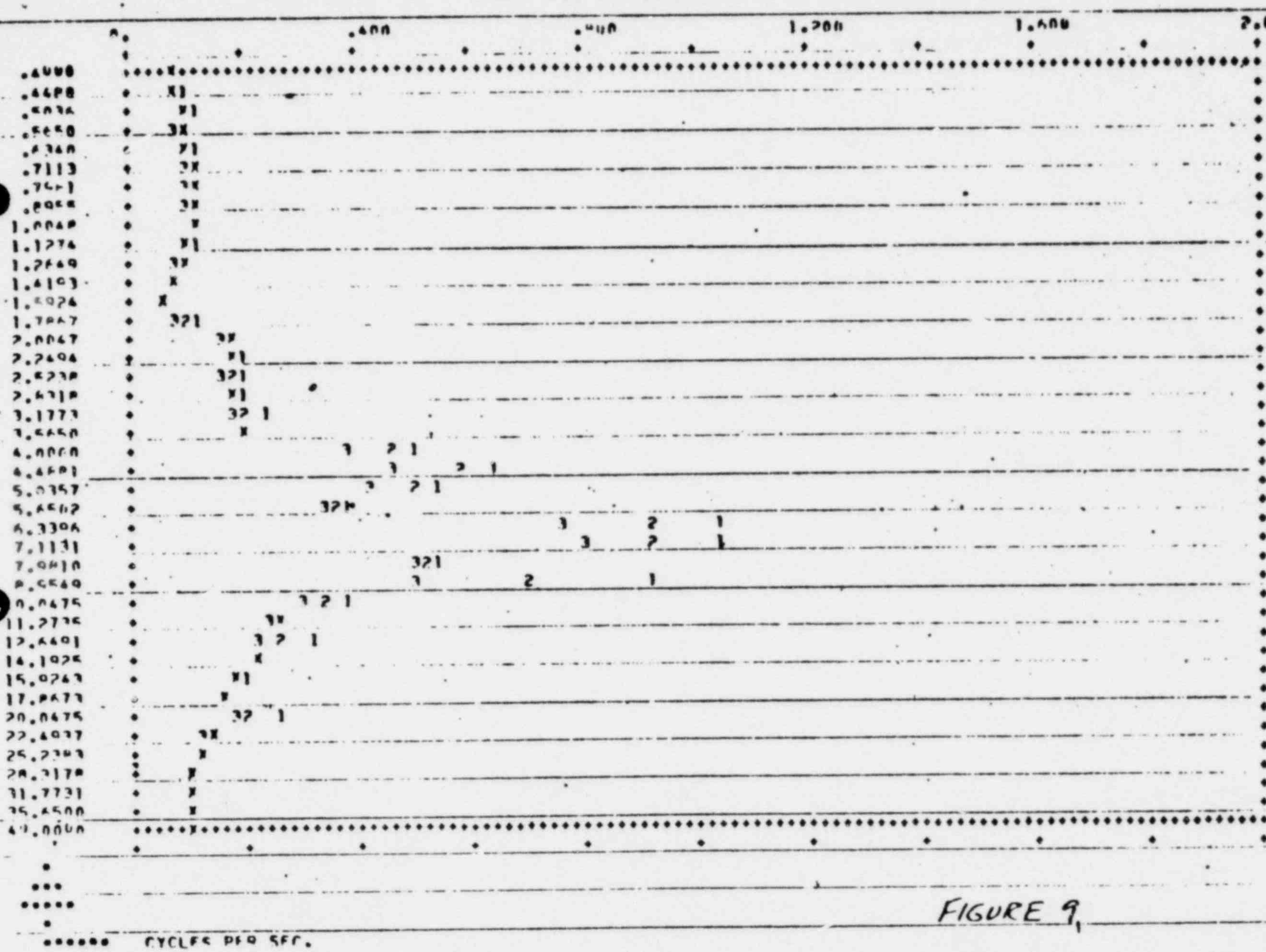

FIGURE 9

SPONSE SPECTRUM ANALYSIS FOR GRAND GULF SSW COOLING TOWER AND BASIN UNIT & ...

HORIZONTAL MOTION AT 00 . POINT 16-EL.141'-0"

ABSOLUTE SPECTRAL ACCELERATIONS (G)

CURVE 1 IS FOR .005 DAMPING AMAX= .961 AT FRQ= 3.565
CURVE 2 IS FOR .010 DAMPING AMAX= .795 AT FRQ= 3.565
CURVE 3 IS FOR .020 DAMPING AMAX= .627 AT FRQ= 4.000
CURVE 4 IS FOR .050 DAMPING AMAX= .442 AT FRQ= 4.000

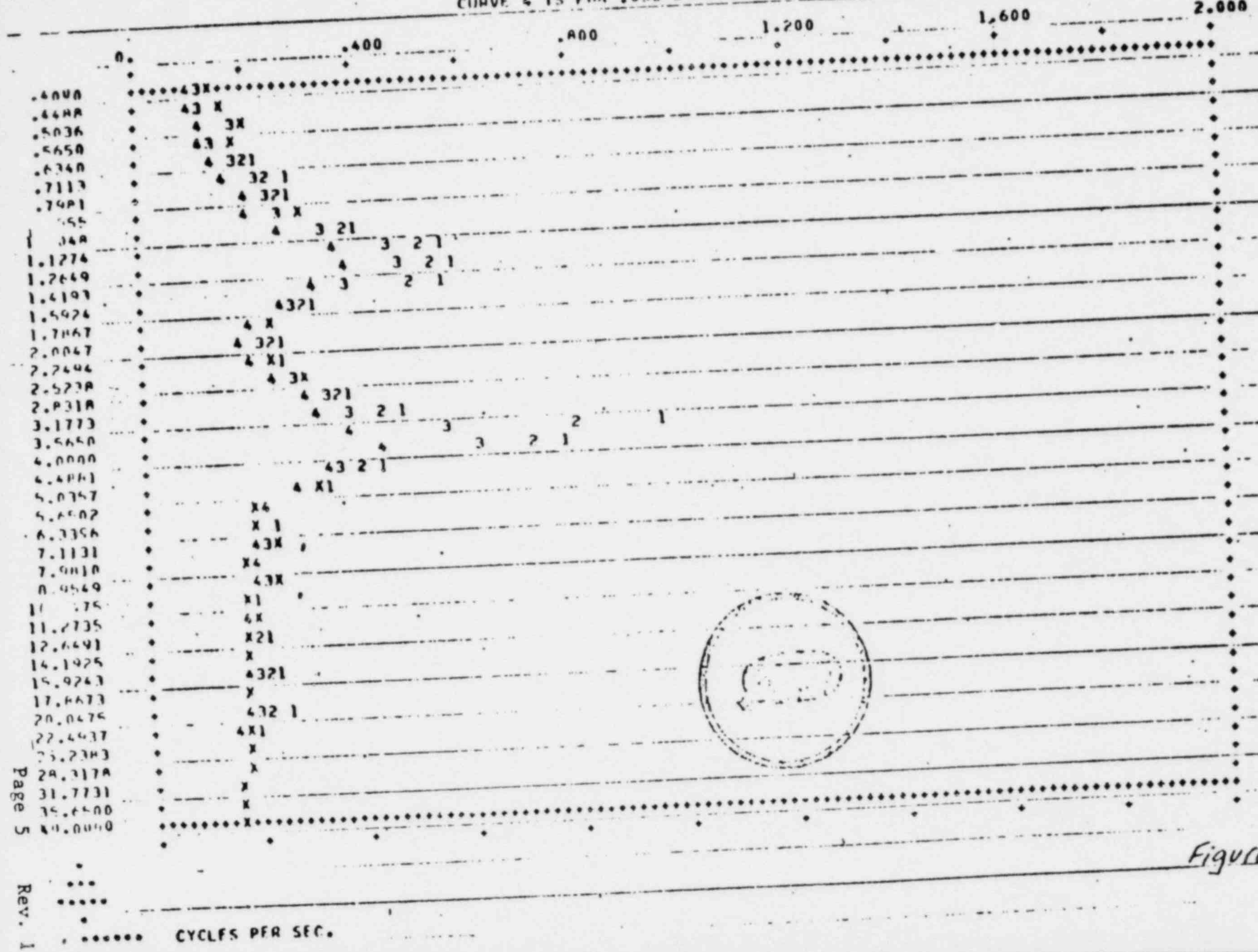

Figure 4

GRAND GULF
NUCLEAR STATION
UNIT 1

SEISMIC AND HYDRODYNAMIC LOADS

REQUALIFICATION CERTIFICATION

JOB NO. MPL-02

EQUIPMENT NAME: HPCS Service Water Pump SPEC. NO: 9645-M-087.0 Rev. 15

EQUIPMENT NO: Q1P41C002-C

LOCATION: Service Water Pump House, El. 80' - 133'

EQUIPMENT CLASSIFICATION: [X] ACTIVE [ ] PASSIVE

SEISMIC QUALIFICATION REPORT REFERENCE:

9645-M-087.0-Q1P41C002-C-7.0-1-3, ME-207, Seismic Stress Analysis Report, 5-25-75, by McDonald Engineering Analysis Co.

THE ABOVE SEISMIC QUALIFICATION REPORT(S) HAVE BEEN REEVALUATED AND REQUALIFIED WHERE NECESSARY TO SHOW THAT THE ABOVE-MENTIONED COMPONENT IS CAPABLE OF PERFORMING ITS INTENDED SAFETY FUNCTION UNDER ALL THE APPLICABLE LOADING COMBINATIONS INCLUDING THE POOL DYMANIC LOADS.

PREPARED: M. P. Voutyras
M. P. Voutyras

APPROVED: V. J. Brocato
V. J. Brocato

DATE: 7/5/81

GRAND GULF NUCLEAR STATION UNIT 1

QUALIFICATION SUMMARY

1. Equipment Name HPCS Service Water Pump
2. Equipment No. Q1P41C002-C
3. Qualification Documentation (Enclosed with this report.)

   A. Qualification Summary of Equipment (SQRT form), including required response spectrum with TRS plotted on RRS graph as appropriate.

   B. Reference Documents

Reference Number	Document Identification	Revision or Date	Title/Subject
Q1P41C002-C-7.0-1-3	ME-207	12-28-76	Seismic Stress Analysis Report

   C. Additional Supporting Documents

Document Identification	Revision or Date	Title/Subject
9645-M-087.0	Rev. 15 3-24-80	Bechtel Design Specification for Vertical Centrifugal Pumps

QUALIFICATION SUMMARY (CONTINUED)

EQUIPMENT NO. Q1P41C002-C

4. Functional Requirements

Equipment shall remain functional during and after both the operating basis earthquakes and the safe shutdown earthquakes.

5. Demonstrated Capability

Operability was demonstrated by analysis of shaft and impeller deflections. Both deflections and stresses were calculated to be within allowables.

6. Rationale for Qualification Certification

(Include Decision analysis with comparison to acceptance criteria, approach for lemonstrating operability, and consideration of high-frequency response.)

Modal analysis performed. Seismic loads were above RRS acceleration values at resonant frequencies. Stresses and deflections were within allowables.

Qualification Summary of Equipment

I. **Plant Name:** Grand Gulf ear Station Unit I — **Type:**

1. Utility: Mississippi Power and Light Co. — PWR ______

2. NSSS: G.E. — 3. A/E: Bechtel Power Corp. — BWR 6, Mark III

II. **Component Name** HPCS Service Water Pump

1. Scope: [ ] NSSS [x] BOP

2. Model Number: VITX-SD-10X14JHC-2 Stage Pumps — Quantity: 1

3. Vendor: Goulds, Vertical Pump Division

4. If the component is a cabinet or panel, name and model No. of the devices included: N/A

5. Physical Description a. Appearance 2-Stage Vertical Motor

   b. Dimensions Approx. 55' length, 3' diameter

   c. Weight 4000 lb.

6. Location: Building: Standby Service Water Pumphouse

   Elevation: 80' - 133'

7. Field Mounting Conditions [X] Bolt (No. 4, Size 3/4") SA-325 Mtl
   [ ] Weld (Length ____)
   [ ] ______

8. a. System in which located: HPCS Service Water System

   b. Functional Description: Cooling water supply for HPCS system

   c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
   [X] Both [ ] Neither

9. Pertinent Reference Design Specifications: Bechtel spec. 9645-M-087.0, Rev 15 (3/24/80)

Prepared by: MFV 4/7/81

Verified by: AKM 4/17/81

III. Is Equipment Available for Inspection in the Plant: [x] Yes [ ] No

IV. Equipment Qualification Method:

[ ] Test [x] Analysis [ ] Combination of Test and Analysis

Qualification Report*: 9645-M-087.0 Q1P41C002-C-7.0-1-3

(No., Title and Date) ME-207 Seismic-Stress Analysis Report, 5/25/75 (Revised 2/27/76 and 12/28/76)

Company that Prepared Report: McDonald Engineering Analysis Co.

Company that Reviewed Report: Nutech/Bechtel

V. Vibration Input:

1. Loads considered: a. [X] Seismic only

   b. [ ] Hydrodynamic only

   c. [ ] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [ ] SRSS [x] Not Combined (other, specify)

3. Required Response Spectra (attach the graphs): Attached

4. Damping Corresponding to RRS: OBE 2% SSE 2%

5. Required Acceleration in Each Direction: [X] ZPA [ ] Other (specify)

   OBE S/S = 0.08 F/B = 0.08 V = 0.05
   SSE S/S = 0.16 F/B = 0.16 V = 0.10

6. Were fatigue effects or other vibration loads considered?

   [ ] Yes [X] No

   If yes, describe loads considered and how they were treated in overall qualification program: ______

*NOTE: If more than one report complete items IV thru VII for each report.

VI. If Qualification by Test, then Complete*: N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] __________________

2. [ ] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE__________ SSE________ Other__________ (specify)

4. Frequency Range: ____________________________________

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = ________________ F/B = ________________ V = ________________

6. Method of Determining Natural Frequencies

   [ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graph
   [ ] No

8. Input g-level Test: OBE S/S = _________ F/B = __________ V = _________

   SSE S/S = _________ F/B = __________ V = _________

9. Laboratory Mounting:

   1. [ ] Bolt (No._____, Size_____) [ ] Weld (Length______) [ ]______

10. Functional operability verified: [ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made:______________________________

    ____

12. Other test performed (such as aging or fragility test, including results):

    ____

    ____

*Note: If qualification by a combination of test and analysis also complete Item VII.

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

   [ ] Static Analysis   [ ] Equivalent Static Analysis

   [X] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = See Attached Table F/B = ________ V = ________

3. Model Type: [ ] 3D [X] 2D [ ] 1D

   [ ] Finite Element [ ] Beam [ ] Closed Form Solution

4. [X] Computer Codes: ICES-STRUDL

   Frequency Range and No. of modes considered: 0.4-1090Hz (Lat.), 16 modes 36-2086Hz (Vert), 16 modes

   [ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [X] SRSS
   [ ] Other: ________ (specify)

6. Damping: OBE 1% SSE 1% Basis for the damping used: Reg. Guide 1.6

7. Support Considerations in the model: Fixed support

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Maximum Stress	Column Flange			39,231	42,000 psi
Combined	Nozzle			29,256	36,000
Flange Stress	Discharge			24,789	30,240

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
.015	Shaft	.05
.00001	Impeller	.012

nutech
San Jose, California

Project Grand Gulf Nuclear Station File No.

Owner Mississippi Power and Light Co.

Client Mississippi Power and Light Co.

NATURAL FREQUENCY GOULD PUMP V1TX-SD-10N 4 JHC- 2 STAGE

MODE	Frequency LATERAL	VERTICAL
1	.43	36
2	2.98	110
3	6.99	177
4	8.72	186
5	17.5	261
6	29.6	332
7	44.6	395
8	62.2	450
9	81.5	494
10	100	527
11	113	546
12	145	680
13	242	1022
14	463	1742
15	654	1812
16	1090	2086

Revision						Page
Prepared By/Date						
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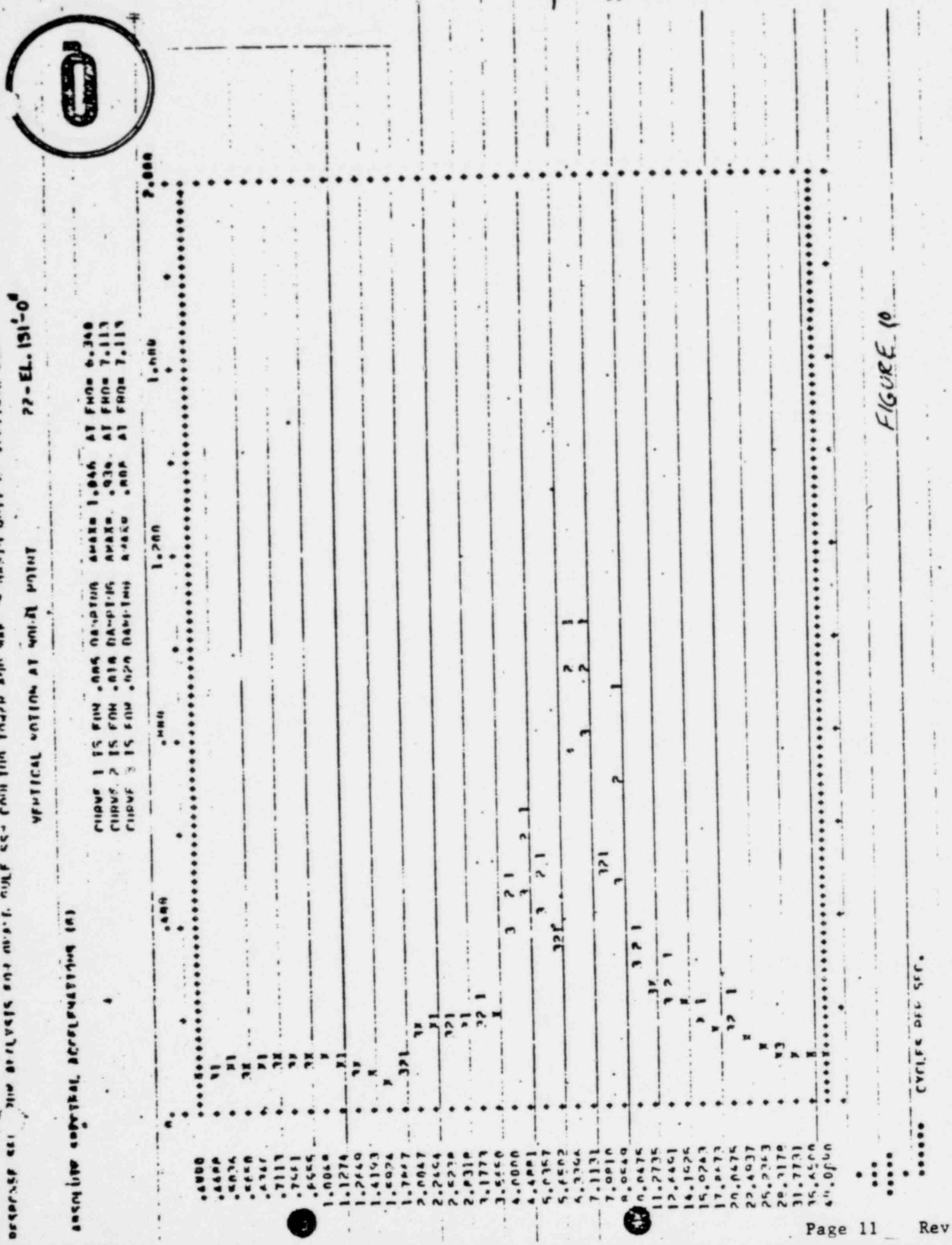

FIGURE 10

RESPONSE SPECTRUM ANALYSIS FOR GRAND GULF SSW COOLING TOWER AND MAKEUP BASIN UNIT 2 FULL MODEL CLOSE

HORIZONTAL MOTION AT JAL POINT 22-EL. 131'-0"

ABSOLUTE SPECTRAL ACCELERATIONS (G)

CURVE 1 IS FOR .005 DAMPING AMAX= .879 AT FRQ= 3.565
CURVE 2 IS FOR .010 DAMPING AMAX= .720 AT FRQ= 3.565
CURVE 3 IS FOR .020 DAMPING AMAX= .558 AT FRQ= 4.000
CURVE 4 IS FOR .050 DAMPING AMAX= .400 AT FRQ= 4.000

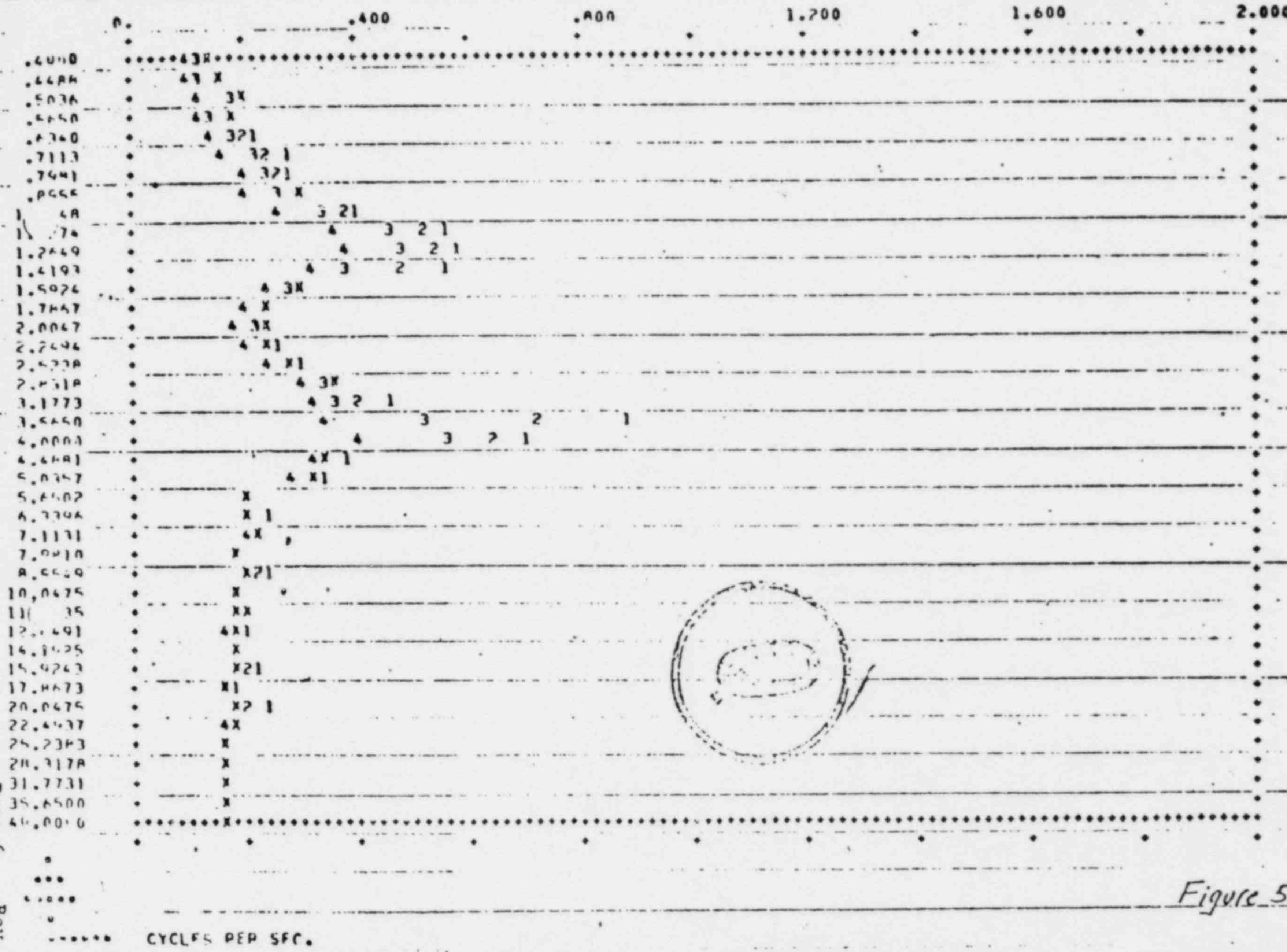

Figure 5

GRAND GULF
NUCLEAR STATION
UNIT 1

SEISMIC AND HYDRODYNAMIC LOADS

REQUALIFICATION CERTIFICATION

JOB NO. MPL-02

EQUIPMENT NAME: Automatic Damper

SPEC. NO: 9645-M-617.1
Rev. 3

EQUIPMENT NO: See attached list

LOCATION: See attached list

EQUIPMENT CLASSIFICATION: ☒ ACTIVE ☐ PASSIVE

SEISMIC QUALIFICATION REPORT REFERENCE:

9645-M-617.1-QS-7.0-2-1, E79-32, Damper Seismic Analysis, 5-9-79, by Robert Lawson, Structural Engineer

THE ABOVE SEISMIC QUALIFICATION REPORT(S) HAVE BEEN REEVALUATED AND REQUALIFIED WHERE NECESSARY TO SHOW THAT THE ABOVE-MENTIONED COMPONENT IS CAPABLE OF PERFORMING ITS INTENDED SAFETY FUNCTION UNDER ALL THE APPLICABLE LOADING COMBINATIONS INCLUDING THE POOL DYMANIC LOADS.

PREPARED: M.P. Voutyras
M.P. Voutyras

APPROVED: J C Rawlings for
V.J. Brocato

DATE: 7-10-81

GRAND GULF NUCLEAR STATION UNIT 1

QUALIFICATION SUMMARY

1. Equipment Name Automatic Damper
2. Equipment No. See attached list
3. Qualification Documentation (Enclosed with this report.)

   A. Qualification Summary of Equipment (SQRT form), including required response spectra with TRS plotted on RRS graph as appropriate.

   B. Reference Documents

Reference Number	Document Identification	Revision or Date	Title/Subject
QS-7.0-2-1	E79-32	5-9-79	Damper Seismic Analysis

   C. Additional Supporting Documents

Document Identification	Revision or Date	Title/Subject
9645-M-617.1	Rev. 3 11-2-79	Technical Specification for Automatic Dampers (Safety-Related)

EQUIPMENT NO. See attached list

4. Functional Requirements

Automatic dampers are required to maintain operability during and after both operating basis and safe shutdown earthquakes.

5. Demonstration Capability

Several natural frequencies calculated including ones below 33 Hz. Static analysis performed using 5.4g's. Operability was addressed.

6. Rationale for Qualification Certification

(Include Decision analysis with comparison to acceptance criteria, approach for demonstrating operability, and consideration of high-frequency response.)

Static analysis is justified for non-rigid components when they are frame type structures and when applicable loading is used. Seismic loading used in this analysis fulfills the design specification requirements for non-rigid components.

Qualification Summary of Equipment

I. **Plant Name:** Grand Gulf Nuclear Station Unit I

Type:

1. Utility: Mississippi Power and Light Co.

PWR ______

2. NSSS: G.E.

3. A/E: Bechtel Power Corp.

BWR 6, Mark III

II. **Component Name** Automatic Dampers

1. Scope: [ ] NSSS [x] BOP
2. Model Number: N/A Quantity: 43
3. Vendor: Pacific Air
4. If the component is a cabinet or panel, name and model No. of the devices included: N/A
5. Physical Description a. Appearance Rectangular and Round Dampers
   b. Dimensions *
   c. Weight *
6. Location: Building: *
   Elevation: *
7. Field Mounting Conditions [*] Bolt (No.____, Size____)
   [ ] Weld (Length____)
   [ ] ______
8. a. System in which located: *
   b. Functional Description: Control of ventilation air.
   c. Is the equipment required for* [ ] Hot Standby [ ] Cold Shutdown
   [ ] Both [ ] Neither
9. Pertinent Reference Design Specifications: 9645-M-617.1 Rev. 3

Prepared by: mpr 4/1/81

Verified by: 6/8/81

12/80

*See attached list

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method:

[ ] Test [X] Analysis [ ] Combination of Test and Analysis

Qualification Report*: 9645-M-617.1-QS-7.0-2-1

(No., Title and Date) E79-32, Damper Seismic Analysis, 5-9-79

Company that Prepared Report: Robert Lawson, Structural Engineer

Company that Reviewed Report: NUTECH/BECHTEL

V. Vibration Input:

1. Loads considered: a. [X] Seismic only

   b. [ ] Hydrodynamic only

   c. [ ] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [ ] SRSS [X] Not combined (other, specify)

3. Required Response Spectra (attach the graphs): ______

4. Damping Corresponding to RRS: OBE ______ SSE ______

5. Required Acceleration in Each Direction: [ ] ZPA [X] Other See note** (specify)

   OBE S/S = ______ F/B = ______ V = ______
   SSE S/S = 5.4g F/B = 5.4g V = 5.4g

6. Were fatigue effects or other vibration loads considered?

   [ ] Yes [X] No

   If yes, describe loads considered and how they were treated in overall qualification program: ______

*NOTE: If more than one report complete items IV thru VII for each report.

**Note: Design Spec. requires above seismic loading if natural frequency cannot be verified to be greater than 33 Hz.

12/80

VII. If Qualification by Analysis, then complete:

Rectangular Dampers

1. Method of Analysis:

   [x] Static Analysis   [ ] Equivalent Static Analysis
   5.4g used
   [ ] Dynamic Analysis: [ ] Time-History   [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
   S/S = Blade = 33.6 Hz Mullion=53.2 Hz   F/B = Sleeve = 111 Hz Mullion=25.3 Hz   V = ________

3. Model Type: [ ] 3D   [x] 2D   [ ] 1D

   [ ] Finite Element   [x] Beam   [ ] Closed Form Solution

4. [ ] Computer Codes: ________

   Frequency Range and No. of modes considered: ________

   [X] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
   [ ] Other: N/A
   (specify)

6. Damping: OBE N/A SSE N/A Basis for the damping used: ________

7. Support Considerations in the model: ________

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Bending Stress	Blade			20895 psi	21334 psi
Bending Stress	Mullion (10")			3276 psi	21334 psi
Bending Stress	Mullion (3")			12912 psi	21334 psi
Bending Stress	Side Plates			4775 psi	21334 psi

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
.216"	Blade	
.0446"	Mullion (10")	
.285"	Mullion (3")	
.0118"	Side Plates	

VII. If Qualification by Analysis, then complete: Round Dampers, 3/4" Ø Shaft

1. Method of Analysis:

   [x] Static Analysis 5.4g used [ ] Equivalent Static Analysis

   [ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = Blade = 69 Hz Shaft = 37.4 Hz F/B = Sleeve = 50.8 Hz V = ____

3. Model Type: [ ] 3D [X] 2D [ ] 1D

   [ ] Finite Element [x] Beam [ ] Closed Form Solution

4. [ ] Computer Codes: ____

   Frequency Range and No. of modes considered: ____

   [x] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
   [ ] Other: N/A (specify)

6. Damping: OBE N/A SSE N/A Basis for the damping used: ____

7. Support Considerations in the model: ____

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Bending Stress	Blade			2040 psi	21334 psi
Bending Stress	Shaft			3194 psi	21334 psi

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
.0416"	Blade	
.142"	Shaft	

VII. If Qualification by Analysis, then complete: Round Dampers, ½" Ø Shaft

1. Method of Analysis:

[x] Static Analysis [ ] Equivalent Static Analysis
5.4g used

[ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = Blade = 43 Hz, Shaft = 19.1 Hz F/B = Sleeve = 50.8 Hz V = ________

3. Model Type: [ ] 3D [x] 2D [ ] 1D

[ ] Finite Element [x] Beam [ ] Closed Form Solution

4. [ ] Computer Codes: ________

Frequency Range and No. of modes considered: ________

[x] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
[ ] Other: N/A
(specify)

6. Damping: OBE N/A SSE N/A Basis for the damping used: ________

7. Support Considerations in the model: ________

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Bending Stress	Blade			8382 psi	
Bending Stress	Shaft			9918 psi	
Bending Stress	Side Plates			21514 psi	

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
.107"	Blade	
.145"	Shaft	
.043"	Side Plate	

VI. If Qualification by Test, then Complete*: N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] ________

2. [ ] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE ________ SSE ________ Other ________ (specify)

4. Frequency Range: ________________________

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

S/S = ____________ F/B = ____________ V = ____________

6. Method of Determining Natural Frequencies

[ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS grap
[ ] No

8. Input g-level Test: OBE S/S = ________ F/B = ________ V = ________

SSE S/S = ________ F/B = ________ V = ________

9. Laboratory Mounting:

1. [ ] Bolt (No. _____, Size _____) [ ] Weld (Length ______) [ ] ______

10. Functional operability verified: [ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: ________________________

____

12. Other test performed (such as aging or fragility test, including results):

____

____

*Note: If qualification by a combination of test and analysis also complete Item VII.

nutech
San Jose, California

Project Grand Gulf Nuclear Station
File No.
Owner Mississippi Power and Light Co.
Client Mississippi Power and Light Co.

AUTOMATIC DAMPER DISCRIPTION & LOCATION

Damper No.	Size	Damper Wt #	Location		System	Equipment Rigid For
			Building	Elevation		
QSZ51F005 A	20"Ø	80 lbs	Control	133'	Control Rm Vent	Both
QSZ51F013 B	20"Ø	80 lbs	Control	133'	Control Rm Vent	Both
Q1T48F001 A	6"Ø	25 lbs	Auxiliary	93'	Standby Gas Treatment Vent	Cold Shutdown
Q1T48F002 B	6"Ø	25 lbs	Auxiliary	93'	Standby Gas Treatment Vent	Cold Shutdown
Q1T48F003 B	6"Ø	25 lbs	Auxiliary	119'	Standby Gas Treatment Vent	Cold Shutdown
Q1T48F044 A	6"Ø	25 lbs	Auxiliary	119'	Standby Gas Treatment Vent	Cold Shutdown
Q1T48F007 A	12"Ø	45 lbs	Auxiliary	139'	Standby Gas Treatment Vent	Cold Shutdown
Q1T48F008 B	12"Ø	45 lbs	Auxiliary	139'	Standby Gas Treatment Vent	Cold Shutdown
Q1T48F009 A	6"Ø	25 lbs	Auxiliary	166'	Standby Gas Treatment Vent	Cold Shutdown
Q1T48F010 B	6"Ø	25 lbs	Auxiliary	166'	Standby Gas Treatment Vent	Cold Shutdown
Q1T48F011 A	6"Ø	25 lbs	Auxiliary	166'	Standby Gas Treatment Vent	Cold Shutdown
Q1T48F012 B	6"Ø	25 lbs	Auxiliary	166'	Standby Gas Treatment Vent	Cold Shutdown
Q1T48F019 A	8"Ø	30 lbs	Auxiliary	208'10"	Standby Gas Treatment Vent	Cold Shutdown
Q1T48F020 B	8"Ø	30 lbs	Auxiliary	208'10"	Standby Gas Treatment Vent	Cold Shutdown
Q1T48F021 A	36"Ø	180 lbs	Enclosure	260' 2"	Standby Gas Treatment Vent	Cold Shutdown
Q1T48F022 B	36"Ø	180 lbs	Enclosure	260' 2"	Standby Gas Treatment Vent	Cold Shutdown

Revision
Prepared By/Date
Checked By/Date
Page ___ of ___

nutech
San Jose, California

Project Grand Gulf Nuclear Station
Owner Mississippi Power and Light Co.
Client Mississippi Power and Light Co.
File No.

Revision
Prepared By/Date
Checked By/Date

AUTOMATIC DAMPER DISCRIPTION & LOCATION

Damper No.	Size	Damper Wt #	Location: Building	Location: Elevation	System	Equipment Rigid For
Q1T48F013 A	6"Ø	25 lbs	Auxiliary	166'	Standby Gas Treatment Vent	Cold Shutdown
Q1T48F014 B	6"Ø	25 lbs	Auxiliary	166'	Standby Gas Treatment Vent	Cold Shutdown
Q1T48F015 A	6"Ø	25 lbs	Auxiliary	166'	Standby Gas Treatment Vent	Cold Shutdown
Q1T48F016 B	6"Ø	25 lbs	Auxiliary	166'	Standby Gas Treatment Vent	Cold Shutdown
Q1T48F017 A	6"Ø	25 lbs	Auxiliary	185'	Standby Gas Treatment Vent	Cold Shutdown
Q1T48F018 B	6"Ø	25 lbs	Auxiliary	185'	Standby Gas Treatment Vent	Cold Shutdown
Q1Y47F001A-A	81x78	877 lbs	SSW Pumphouse	133'	Standby Service Wtr PH Vent	Cold Shutdown
Q1Y47F001B-B	81x78	877 lbs	SSW Pumphouse	133'	Standby Service Wtr PH Vent	Cold Shutdown
Q1Y47F002A-A	81x78	877 lbs	SSW Pumphouse	133'	Standby Service Wtr PH Vent	Cold Shutdown
Q1Y47F002B-B	81x78	877 lbs	SSW Pumphouse	133'	Standby Service Wtr PH Vent	Cold Shutdown
Q1Y47F003A-A	50x50	340 lbs	SSW Pumphouse	133'	Standby Service Wtr PH Vent	Cold Shutdown
Q1X77F001A-A	144x 156	3300 lbs	Diesel Gen Rm	133'	Diesel Gen Rm Vent	Cold Shutdown
Q1X77F001B-B	144x 156	3300 lbs	Diesel Gen Rm	133'	Diesel Gen Rm Vent	Cold Shutdown
Q1X77F003-C	144x 156	3300 lbs	Diesel Gen Rm	133'	Diesel Gen Rm Vent	Cold Shutdown
QSZ51F017 A	50x40	290 lbs	Control	133'	Control Rm Vent	Both
QSZ51F018 B	50x40	290 lbs	Control	133'	Control Rm Vent	Both

Page ___ of ___

AUTOMATIC DAMPER DISCRIPTION & LOCATION

Damper No.	Size	Damper Wt #	Location		System	Equipment Rigid For
			Building	Elevation		
Q1Z77F002 A	66x36	330 lbs	Control	111'	Safeguards, Switchgear & Battery Rm Vent	Both
Q1Z77F003 A	120x96	1600 lbs	Control	133'		Both
Q1Z77F003 B	60x48	380 lbs	Control	133'		Both
Q1Z77F004 A	56x44	290 lbs	Control	133'		Both
Q1Z77F004 B	56x44	290 lbs	Control	133'		Both
Q1Z77F001A & 1B	48x30	100 lbs	Control	111'		Both
Q1Z77F002 B	42x42	120 lbs	Control	111'		Both
QSZ51F009 A	16x16	38 lbs	Control	133'	Control Rm Vent	Both
QSZ51F012 B	16x16	38 lbs	Control	133'	Control Rm Vent	Both

Revision

Prepared By/Date

Checked By/Date

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nutech
San Jose, California

Project Grand Gulf Nuclear Station

Owner Mississippi Power and Light Co.

Client Mississippi Power and Light Co.

File No. ___

**GRAND GULF
NUCLEAR STATION
UNIT 1**

SEISMIC AND HYDRODYNAMIC LOADS

REQUALIFICATION CERTIFICATION

JOB NO. MPL-02

EQUIPMENT NAME: Standby Service Water Cooling Towers Piping SPEC. NO: 9645-M-015.1

EQUIPMENT NO: QSP41B001A/B

LOCATION: El. 131'-0" to 165'-0" Outdoors

EQUIPMENT CLASSIFICATION: ☐ ACTIVE ☒ PASSIVE

SEISMIC QUALIFICATION REPORT REFERENCE:

9645-M-015.1-QSP41B001A-8.0-6-1, ASME Code Qualification and Analysis of Standby Service Water Cooling Tower Piping, Ceramic Cooling Tower Company, Job No. CT-647, 11/22/76

9645-M-015.1-QSP41B001A-7.0-4-0/7.0-1-1, Report No. 1115-2A & 2E, Dynamic Structural Models and Seismic Analysis of Standby Service Water Cooling Tower, by Applied Nucleonics Company, July, 1976.

THE ABOVE SEISMIC QUALIFICATION REPORT(S) HAVE BEEN REEVALUATED AND REQUALIFIED WHERE NECESSARY TO SHOW THAT THE ABOVE-MENTIONED COMPONENT IS CAPABLE OF PERFORMING ITS INTENDED SAFETY FUNCTION UNDER ALL THE APPLICABLE LOADING COMBINATIONS INCLUDING THE POOL DYNAMIC LOADS.

PREPARED: TRMager
T. R. Mager

APPROVED: V. J. Brocato
V. J. Brocato

DATE: 9/27/81

GRAND GULF NUCLEAR STATION UNIT 1

QUALIFICATION SUMMARY

1. Equipment Name Standby Service Water Cooling Towers Piping

2. Equipment No. QSP41B001A/B

3. Qualification Documentation (Enclosed with this report.)

   A. Qualification Summary of Equipment (SQRT form), including required response spectra with TRS plotted on RRS graph as appropriate.

   B. Reference Documents

Reference Number	Document Identification	Revision or Date	Title/Subject
9645-M-015.1-QSP41-B001A-8.0-6-1	CT-647	11/22/76	ASME Code Qualification and Analysi of Standby Service Water Cooling Towe Piping
9645-M-015.1-QSP41-B001A-7.0-1-1	1115-2A	July, 1976	Dynamic Structural Models and Seismic Analysis of Stand Service Water Cooling Tower
9645-M-015.1-QSP41-B001A-7.0-4-0	1115-2E	July, 1976	Addendum - Dynamic Structural Models and Seismic Analys of Standby Service Water Cooling Towe

   C. Additional Supporting Documents

Document Identification	Revision or Date	Title/Subject
Spec. 9645-M-015.1	Rev. 11	Design Specification for Standby Service Water [illegible] Towers [illegible] [illegible] Nuclear Station, Units [illegible]

Qualification Summary of Equipment

I. **Plant Name:** Grand Gulf Nuclear Station Unit I

1. Utility: Mississippi Power and Light Co.
2. NSSS: G.E. 3. A/E: Bechtel Power Corp.

Type:
PWR ____
BWR 6, Mark III

II. **Component Name** Standby Service Water Cooling Towers Piping

1. Scope: [ ] NSSS [x] BOP
2. Model Number: 4 Cell Quantity: 2
3. Vendor: Ceramic Cooling Tower Co.
4. If the component is a cabinet or panel, name and model No. of the devices included: N/A
5. Physical Description a. Appearance ____
   b. Dimensions 82'x82'x60'
   c. Weight ____
6. Location: Building: Outdoors
   Elevation: 131'-0" to 165'-0"
7. Field Mounting Conditions [ ] Bolt (No. ____, Size ____)
   [ ] Weld (Length ____)
   [x] Piping Restraints
8. a. System in which located: Standby Service Water System
   b. Functional Description: Cools residual heat removal heat exchanger and other auxiliaries required for safe shutdown
   c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
   [x] Both [ ] Neither
9. Pertinent Reference Design Specifications: 9645-M-015.1, Rev. 11

Prepared by: TRM 4/1/81

Verified by: AKM 4/27/81

12/80

III. Is Equipment Available for Inspection in the Plant: [x] Yes [ ] No

IV. Equipment Qualification Method:

[ ] Test [x] Analysis [ ] Combination of Test and Analysis

Qualification Report*: 9645-M-015.1-QSP41B001A-8.0-6-1
9645-M-015.1-QSP41B001A-7.0-4-0/7.0-1-1

(No., Title and Date) 1115-2A&2E, Dynamic Model & Seismic Anal, 7-76/NCT-647-29, 11-22-76

Company that Prepared Report: Applied Nucleonics Co./Ceramic Cooling Tower Co.

Company that Reviewed Report: Nutech/Bechtel

V. Vibration Input:

1. Loads considered: a. [x] Seismic only
   b. [ ] Hydrodynamic only
   c. [ ] Combination of (a) and (b)
2. Method of Combining RRS: [ ] Absolute Sum [ ] SRSS [x] not combined (other, specify)
3. Required Response Spectra (attach the graphs) El.165'0",151'-0",14[illegible]'-0",[illegible]
4. Damping Corresponding to RRS: OBE ______ SSE 0.5,1.0,2.0,5.0%
5. Required Acceleration in Each Direction: [x] ZPA [ ] Other (specify)

OBE	S/S = 0.100g	F/B = 0.100g	V = 0.050g
SSE	S/S = 0.200g	F/B = 0.200g	V = 0.100g

6. Were fatigue effects or other vibration loads considered?

   [ ] Yes [x] No

   If yes, describe loads considered and how they were treated in overall qualification program: ______

*NOTE: If more than one report complete items IV thru VII for each report.

VI. <u>If Qualification by Test, then Complete*:</u> N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] ________

2. [ ] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE________ SSE________ Other________ (specify)

4. Frequency Range:________________________

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S =________________ F/B =________________ V =________________

6. Method of Determining Natural Frequencies

   [ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graph) [ ] No

8. Input g-level Test: OBE S/S =________ F/B =________ V =________

   SSE S/S =________ F/B =________ V =________

9. Laboratory Mounting:

   1. [ ] Bolt (No.______, Size______) [ ] Weld (Length______) [ ]______

10. Functional operability verified: [ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made:________________________

    ____

12. Other test performed (such as aging or fragility test, including results):

    ____

    ____

*Note: If qualification by a combination of test and analysis also complete Item VII.

VII. If Qualification by Analysis, then complete: Piping System

1. Method of Analysis:

   [ ] Static Analysis [ ] Equivalent Static Analysis

   [x] Dynamic Analysis: [ ] Time-History [x] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = 3.6 Hz F/B = 3.6 Hz V = 3.6 Hz

3. Model Type: [x] 3D [ ] 2D [ ] 1D

   [x] Finite Element [ ] Beam [ ] Closed Form Solution

4. [x] Computer Codes: PIPESD & SAP - IV

   Frequency Range and No. of modes considered: 0-33 Hz 29 modes

   [ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [x] SRSS
   [ ] Other: ____________
   (specify)

6. Damping: OBE 1% SSE 2% Basis for the damping used: Reg. Guide 1.6

7. Support Considerations in the model: ____________

8. Critical Structural Elements:

A. Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Max. Stress Ratio	Upper Piping		0.37887		1.0

B. Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability

RESPONSE SPECTRUM ANALYSIS FOR GRAND GULF SSW COOLING TOWER AND HAKIUP BASIN UNIT 2

HORIZONTAL MOTION AT NODAL POINT

ABSOLUTE SPECTRAL ACCELERATIONS (G)

CURVE 1 IS FOR .005 DAMPING AMAX= 1.153 AT FRQ= 2.565
CURVE 2 IS FOR .010 DAMPING AMAX= .967 AT FRQ= 4.000
CURVE 3 IS FOR .020 DAMPING AMAX= .843 AT FRQ= 4.000
CURVE 4 IS FOR .050 DAMPING AMAX= .602 AT FRQ= 4.000

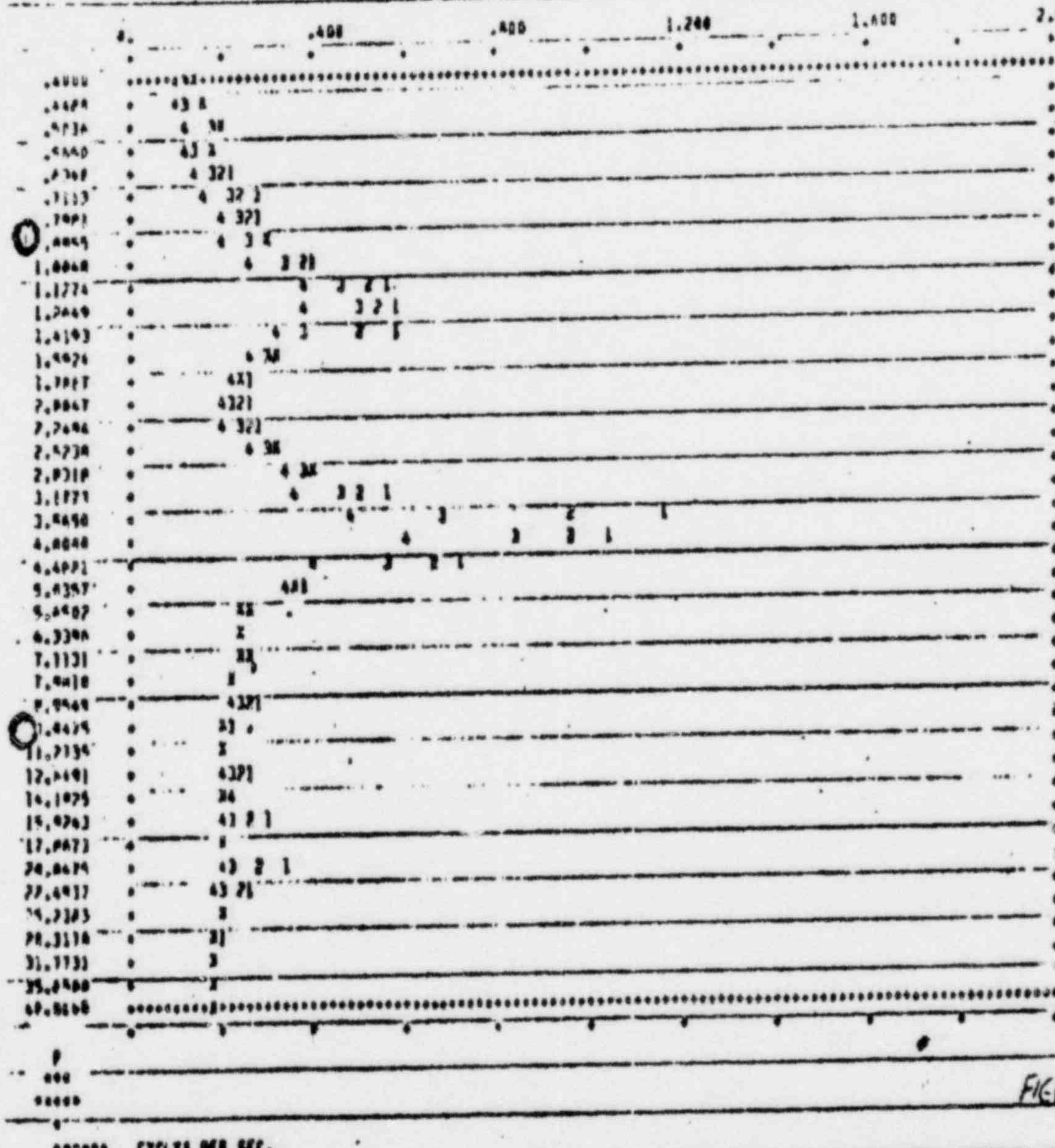

FIGURE 1

Appendix Z1
9645-M-415.1
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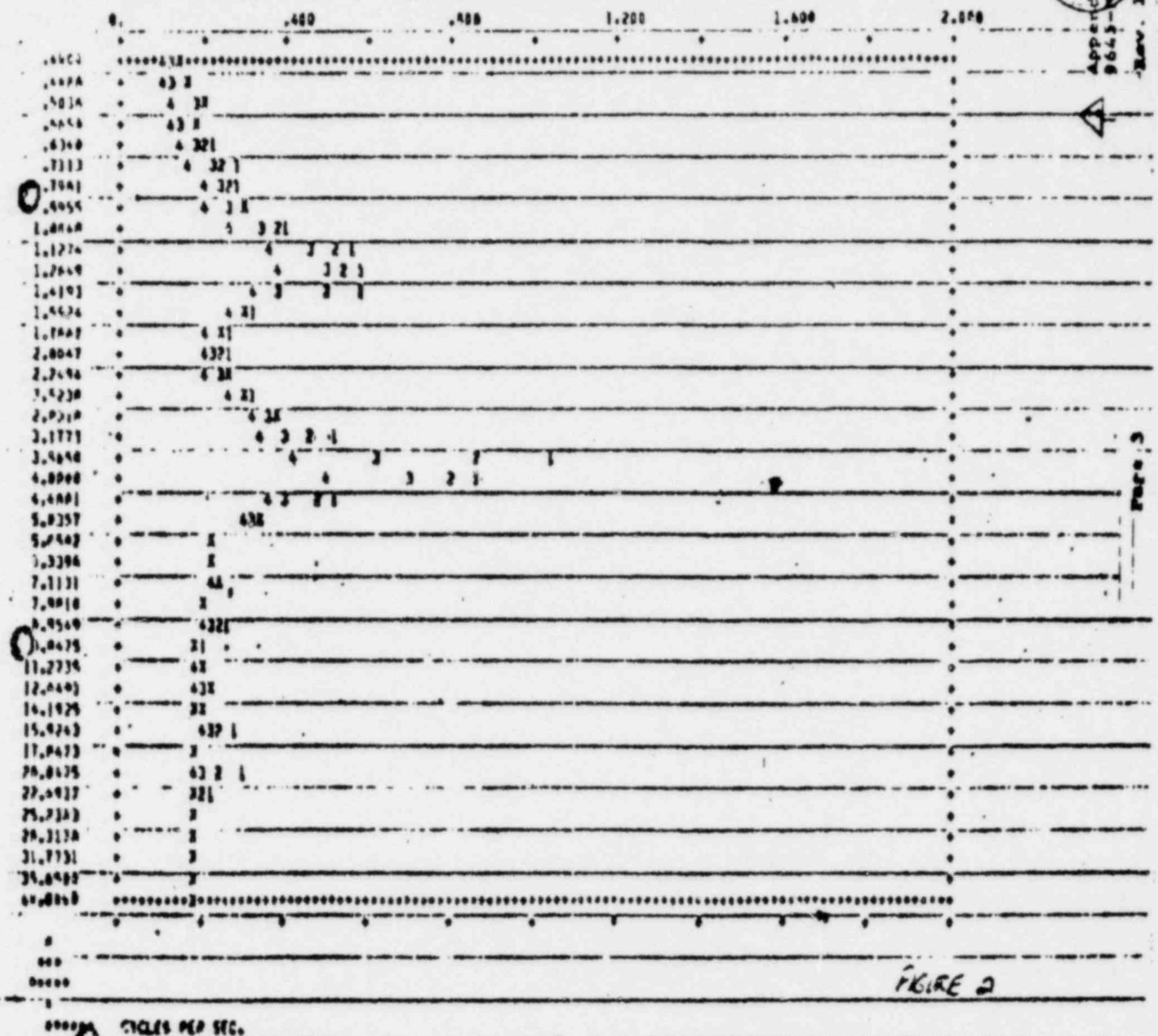
Page 2

RE... SPECTRUM ANALYSIS FOR GRAND GULF SSW COOLING TOWER AND MAKEUP BASIN UNIT 2 FULL ...

HORIZONTAL MOTION AT NODAL POINT 13 ... EL. 1... 0"

... SPECTRAL ACCELERATIONS (G)

CURVE 1 IS FOR .005 DAMPING AMAX= 1.044 AT FRQ= 3.565
CURVE 2 IS FOR .010 DAMPING AMAX= .862 AT FRQ= 3.565
CURVE 3 IS FOR .020 DAMPING AMAX= .694 AT FRQ= 4.030
CURVE 4 IS FOR .050 DAMPING AMAX= .498 AT FRQ= 4.800



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Rev. 1

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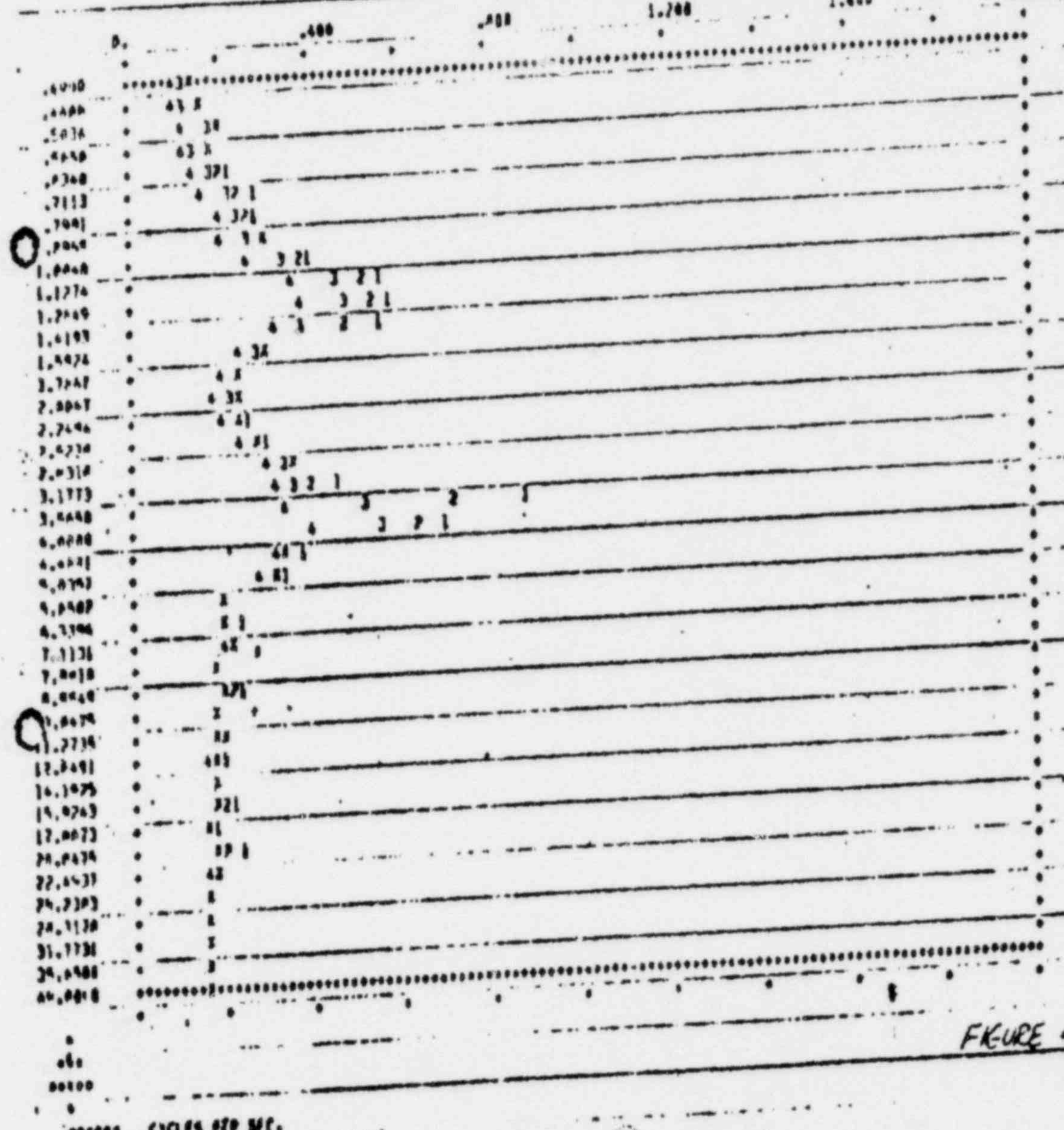
FIGURE 2

RESPONSE SPECTRUM ANALYSIS FOR GRAND GULF SSW COOLING TOWER AND MAKEUP BASIN UNIT 2 FULL ...

HORIZONTAL MOTION AT NODAL POINT 22-EL.133'0"

ABSOLUTE SPECTRAL ACCELERATIONS (G)

CURVE 1 IS FOR .005 DAMPING AMAX= .819 AT FRQ= 3.765
CURVE 2 IS FOR .010 DAMPING AMAX= .728 AT FRQ= 3.565
CURVE 3 IS FOR .020 DAMPING AMAX= .558 AT FRQ= 4.530
CURVE 4 IS FOR .050 DAMPING AMAX= .400 AT FRQ= 4...8



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Rev. 1

Page 5

FIGURE 4

RESPONSE SPECTRUM ANALYSIS FOR GRAND GULF SSW COOLING TOWER AND MAKEUP BASIN UNIT 2 FULL MODEL ... SSE

HORIZONTAL MOTION AT NODAL POINT 16-EL.141'0"

ABSOLUTE SPECTRAL ACCELERATIONS (G)

CURVE 1 IS FOR .005 DAMPING AMAX= .961 AT FRQ= 3.565
CURVE 2 IS FOR .010 DAMPING AMAX= .795 AT FRQ= 3.565
CURVE 3 IS FOR .020 DAMPING AMAX= .627 AT FRQ= 4.000
CURVE 4 IS FOR .050 DAMPING AMAX= .442 AT FRQ= 4.000

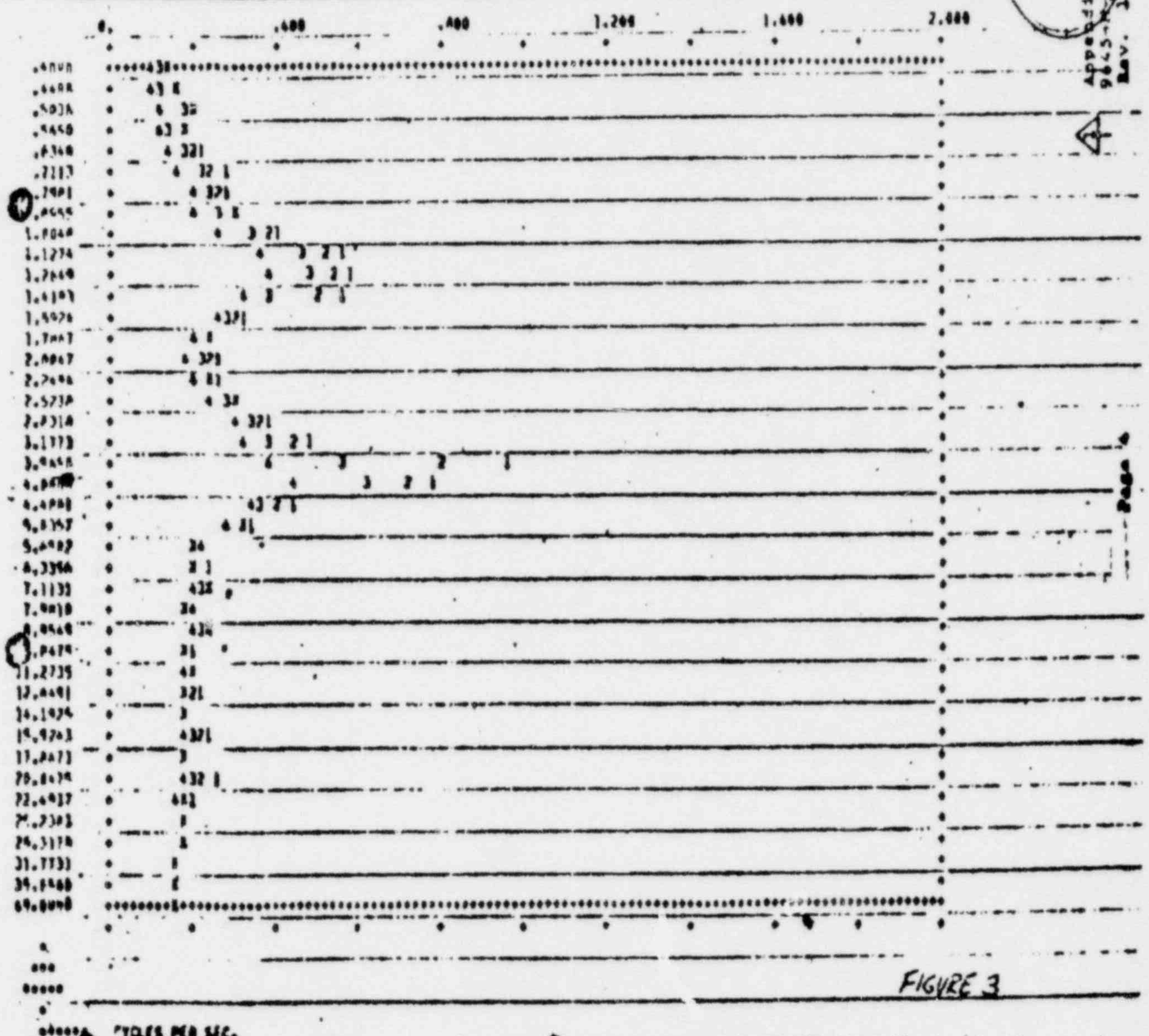

FIGURE 3

RESPONSE SPECTRUM ANALYSIS FOR GRAND GULF SSW COOLING TOWER AND MAKEUP BASIN UNIT 2 VERTICAL SSE

VERTICAL MOTION AT NODAL POINT

Y-EL. 165'-0"

ABSOLUTE SPECTRAL ACCELERATIONS (G)

CURVE 1 IS FOR .005 DAMPING AMAX= 1.042 AT FREQ 6.340
CURVE 2 IS FOR .010 DAMPING AMAX= .930 AT FREQ 6.340
CURVE 3 IS FOR .020 DAMPING AMAX= .886 AT FREQ 7.113

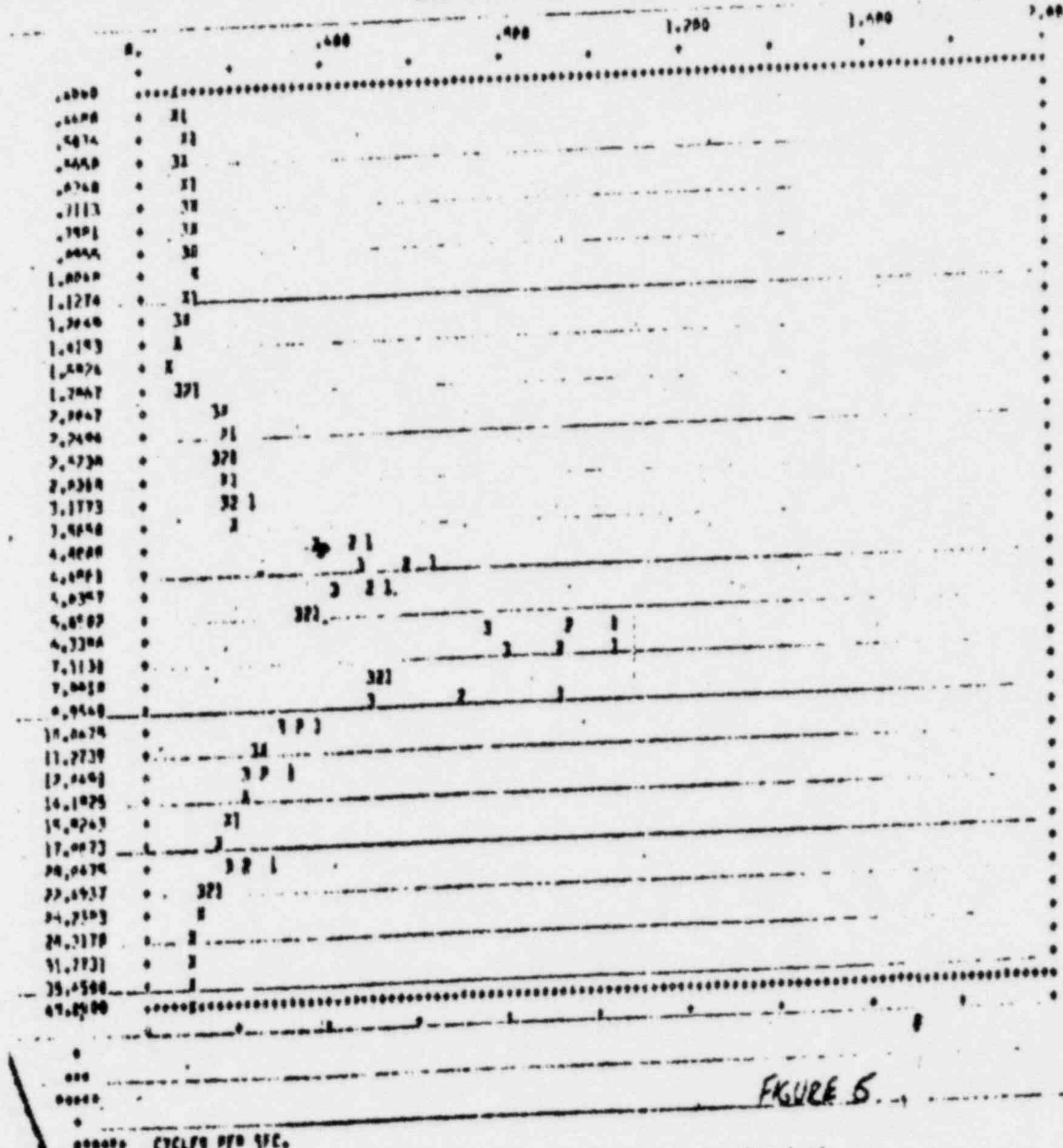

FIGURE 6.

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RESPONSE SPECTRUM ANALYSIS FOR GRAND GULF SSW COOLING TOWER AND RESERVOIR BASIN UNIT 2 VERTICAL SSE

VERTICAL MOTION AT NODAL POINT 13-EL.151'-0"

ABSOLUTE SPECTRAL ACCELERATIONS (G)

CURVE 1 IS FOR .005 DAMPING AMAX 1.041 AT FREQ 5.348
CURVE 2 IS FOR .010 DAMPING AMAX .930 AT FREQ 5.348
CURVE 3 IS FOR .020 DAMPING AMAX .804 AT FREQ 7.113

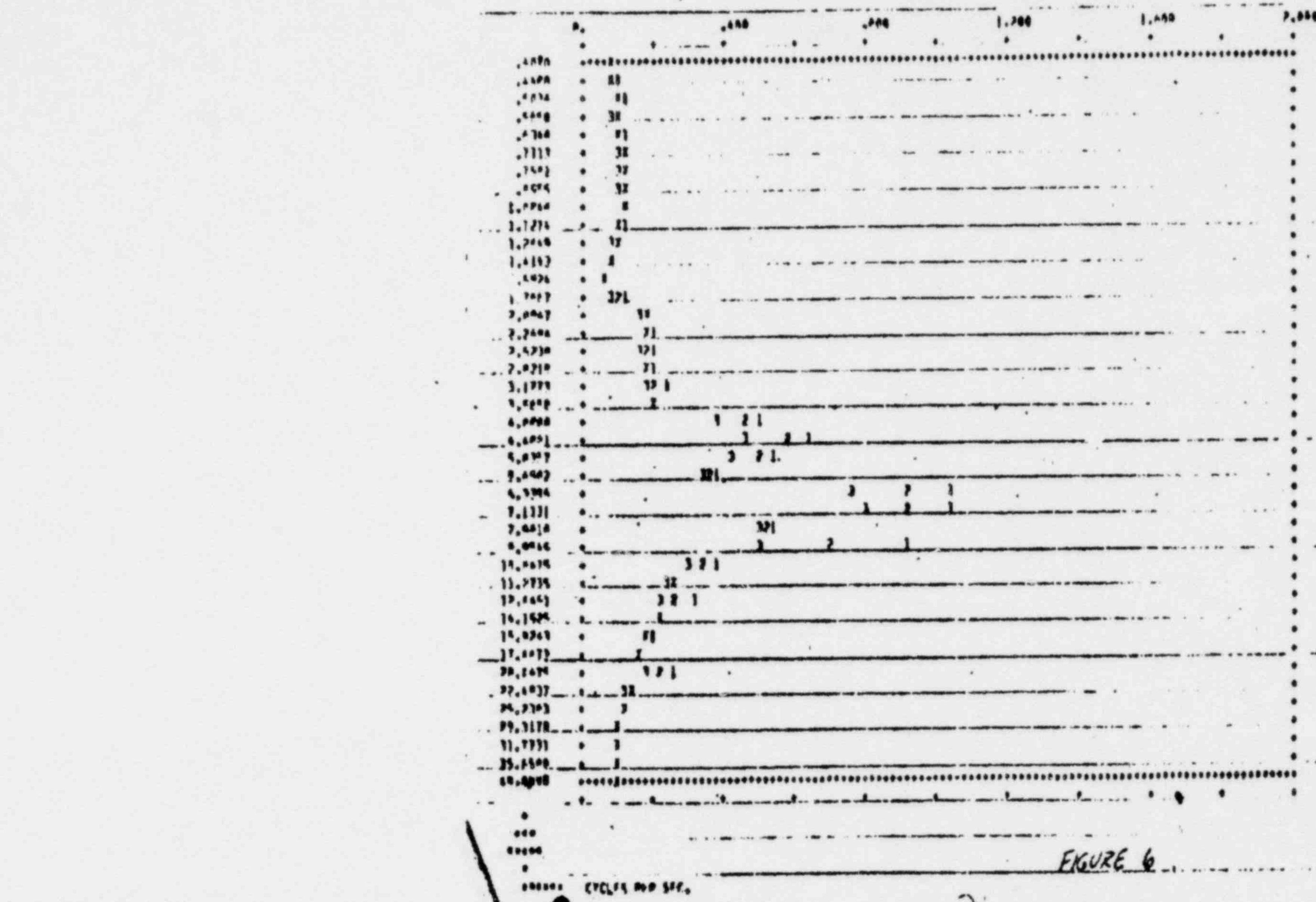

FIGURE 6

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Rev. 1

Page 7

RESPONSE SPECTRUM ANALYSIS FOR [illegible] COOLING TOWER FOR [illegible] UNIT 2 VERTICAL SSE

VERTICAL MOTION AT NODAL POINT IN-EL.341'-0"

ABSOLUTE SPECTRAL ACCELERATIONS (G)

CURVE 1 IS FOR .005 DAMP [illegible] 1.041 AT FREQ 6.160
CURVE 2 IS FOR .010 DAMP [illegible] .929 AT FREQ 6.160
CURVE 3 IS FOR .020 DAMP [illegible] .804 AT FREQ 7.113

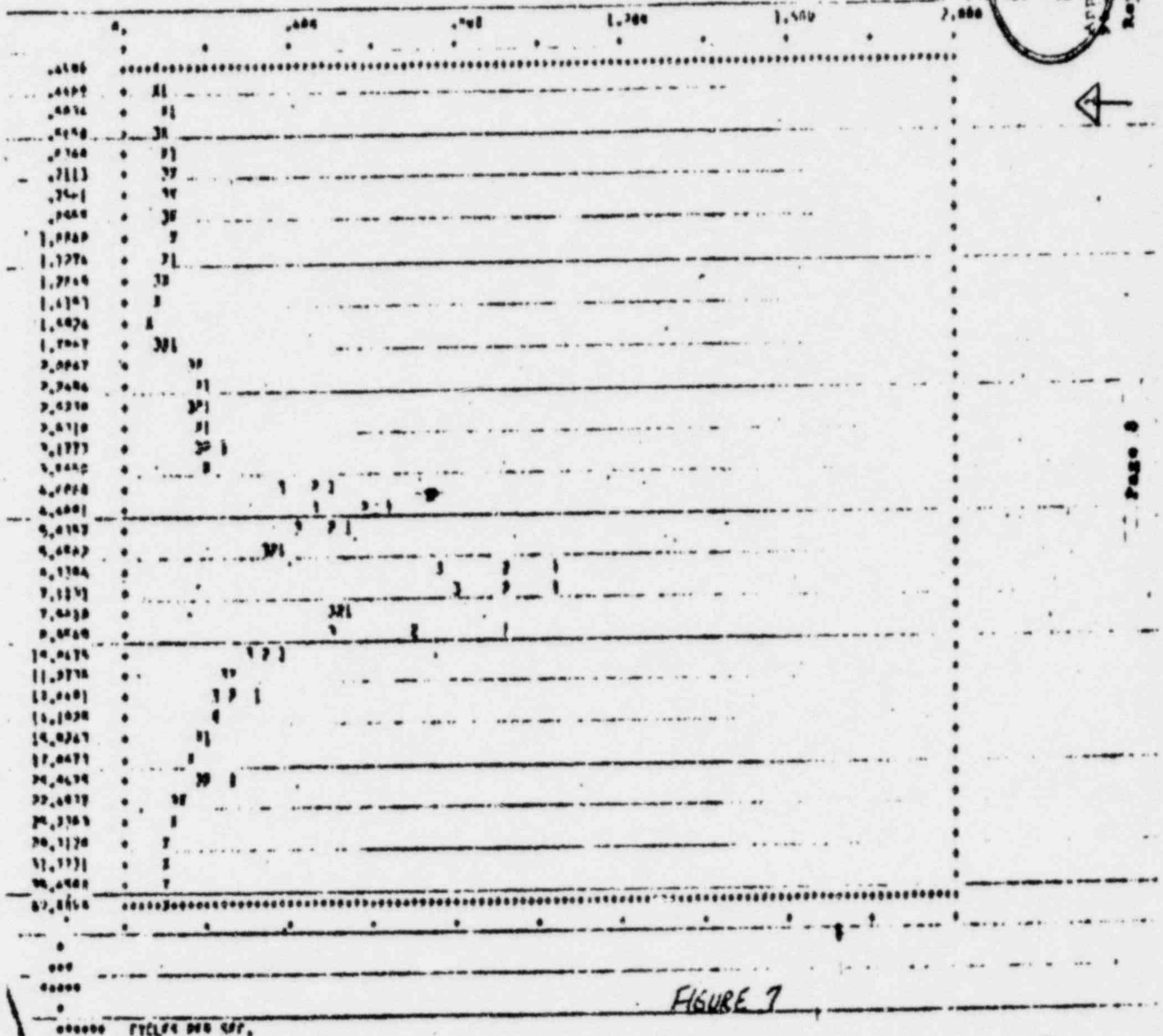

FIGURE 7

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VERTICAL MOTION AT NODE POINT 77-EL. 131'-0"

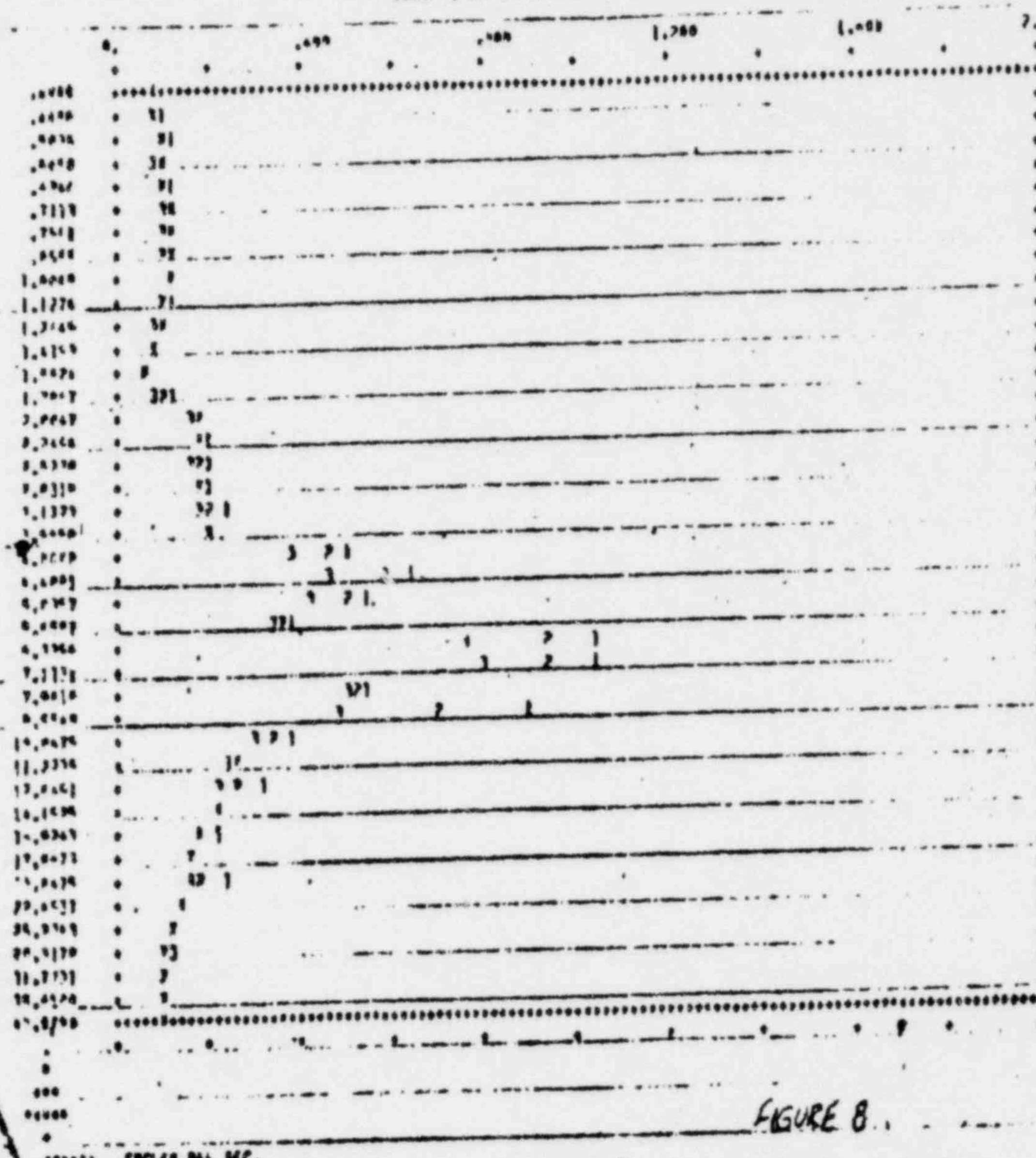

FIGURE 8

GRAND GULF
NUCLEAR STATION
UNIT 1

SEISMIC AND HYDRODYNAMIC LOADS

REQUALIFICATION CERTIFICATION

JOB NO. MPL-02

EQUIPMENT NAME: Trap Door Fire Damper

SPEC. NO: 9645-M-617.5

EQUIPMENT NO: Q1Z77F007,15-21,25A/B,26A/B,28A/B,31

LOCATION: Control Bldg. 111',133',148',177',189', Aux. Bldg. 93', 119',139',166',185',208', Encl. Bldg. 228'

EQUIPMENT CLASSIFICATION: ☐ ACTIVE ☒ PASSIVE

SEISMIC QUALIFICATION REPORT REFERENCE:

9645-M-617.5-QS-7.0-10-0, Report No. 80287-10, Seismic Qual. of Model No. 2217 Fire Dampers, 9/30/80, by American Warming and Ventilating, Inc.

THE ABOVE SEISMIC QUALIFICATION REPORT(S) HAVE BEEN REEVALUATED AND REQUALIFIED WHERE NECESSARY TO SHOW THAT THE ABOVE-MENTIONED COMPONENT IS CAPABLE OF PERFORMING ITS INTENDED SAFETY FUNCTION UNDER ALL THE APPLICABLE LOADING COMBINATIONS INCLUDING THE POOL DYNAMIC LOADS.

PREPARED: T R Mager
T. R. Mager

APPROVED: J.C. Rawlings for
V. J. Brocato

DATE: 7/10/81

GRAND GULF NUCLEAR STATION UNIT 1

QUALIFICATION SUMMARY

1. Equipment Name Trap Door Fire Dampers
2. Equipment No. Q1Z77F007,15-21,25A/B,26A/B,28A/B,31
3. Qualification Documentation (Enclosed with this report.)

A. Qualification Summary of Equipment (SQRT form), including required response spectra with TRS plotted on RRS graph as appropriate.

B. Reference Documents

Reference Number	Document Identification	Revision or Date	Title/Subject
9645-M-617.5-QS-7.0-10-0	80287-10	9/30/80	Seismic Qualification Report Of Model #2217 Trap Door Fire Dampers

C. Additional Supporting Documents

Document Identification	Revision or Date	Title/Subject
Spec. No. 9645-M-617.5	Rev. 6	Technical Specification For Miscellaneous HVAC Specialties (Safety Related) For Mississippi Power & Light Company Grand Gulf Nuclear Station Units 1 & 2

Qualification Summary of Equipment

I. **Plant Name:** Grand Gulf Nuclear Station Unit 1 — **Type:**

1. Utility: Mississippi Power and Light Co. — PWR ______
2. NSSS: G.E. — 3. A/E: Bechtel Power Corp. — BWR 6, Mark III

II. **Component Name** Trap Door Fire Damper

1. Scope: [ ] NSSS [x] BOP
2. Model Number: #2217 — Quantity: 35
3. Vendor: American Warming and Ventilating, Inc. (AWV)
4. If the component is a cabinet or panel, name and model No. of the devices included: N/A
5. Physical Description a. Appearance ______
   b. Dimensions 8" X 12", 10" x 14", 14" x 20", 30" x 48", 40"X40"
   c. Weight 9 lb, 13 lb, 25 lb, 130 lb, 144 lb
6. Location: Building: See attached table
   Elevation: See attached table
7. Field Mounting Conditions [x] Bolt (No. Varies Size 3/8")
   [ ] Weld (Length ______)
   [ ] ______
8. a. System in which located: See attached table
   b. Functional Description: Prevent fire from spreading to different areas of building thru HVAC ducts
   c. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
   [ ] Both [x] Neither
9. Pertinent Reference Design Specifications: 9645-M-617.5 Rev. 6

Prepared by: TRM 2/23/81

Verified by: mPV 4/28/81

12/80

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No

IV. Equipment Qualification Method:

[ ] Test [X] Analysis [ ] Combination of Test and Analysis

Qualification Report*: NPL#9645-M-617.5-Q6-7.0-10-0

(No., Title and Date) Doc. #80287-10, Seismic Qual. of Model #2217 Fire Dampers 9/30/80

Company that Prepared Report: AWV

Company that Reviewed Report: NUTECH/Bechtel

V. Vibration Input:

1. Loads considered: a. [x] Seismic only

   b. [ ] Hydrodynamic only

   c. [ ] Combination of (a) and (b)

2. Method of Combining RRS: [ ] Absolute Sum [ ] SRSS [X] not combined (Other, specify)

3. Required Response Spectra (attach the graphs): Worst Case Cntl & Aux. Bldg.

4. Damping Corresponding to RRS: OBE 3% SSE 3%

5. Required Acceleration in Each Direction: [X] ZPA [ ] Other (specify)

   OBE S/S = 0.285g F/B = 0.276g V = 0.120g
   SSE S/S = 0.571g F/B = 0.552g V = 0.239g
   N-S E-W

6. Were fatigue effects or other vibration loads considered?

   [ ] Yes [XX] No

   If yes, describe loads considered and how they were treated in overall qualification program: ________________

*NOTE: If more than one report complete items IV thru VII for each report.

VI. If Qualification by Test, then Complete*: N/A

1. [ ] Single Frequency [ ] Multi-Frequency: [ ] random [ ] sine beat [ ] ________

2. [ ] Single Axis [ ] Multi-Axis

3. No. of Qualification Tests: OBE________ SSE________ Other________ (specify)

4. Frequency Range: ____________________

5. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S = ____________ F/B = ____________ V = ____________

6. Method of Determining Natural Frequencies

   [ ] Lab Test [ ] In-Situ Test [ ] Analysis

7. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (Attach TRS & RRS graph
   [ ] No

8. Input g-level Test: OBE S/S = ________ F/B = ________ V = ________

   SSE S/S = ________ F/B = ________ V = ________

9. Laboratory Mounting:

   1. [ ] Bolt (No.______, Size______) [ ] Weld (Length______) [ ]______

10. Functional operability verified: [ ] Yes [ ] No [ ] Not Applicable

11. Test Results including modifications made: ____________________

    ____

12. Other test performed (such as aging or fragility test, including results):

    ____

    ____

*Note: If qualification by a combination of test and analysis also complete Item VII.

VII. If Qualification by Analysis, then complete:

1. Method of Analysis:

   [x] Static Analysis
   5.4g Horiz. & Vertical
   [ ] Equivalent Static Analysis

   [ ] Dynamic Analysis: [ ] Time-History [ ] Response Spectrum

2. Natural Frequencies in Each Direction (Side/Side, Front/Bac . Vertical):

   S/S = Not calculated F/B = ________ V = ________

3. Model Type: [ ] 3D [ ] 2D [ ] 1D

   [ ] Finite Element [xx] Beam [ ] Closed Form Solution

4. [ ] Computer Codes: N/A

   Frequency Range and No. of modes considered: ________

   [xx] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS

   [xx] Other: Abs sum of seismic co
   (Specify) for pivot pin
   stres

6. Damping: OBE N/A SSE ______ Basis for the damping used: ZPA used as
   equipment is rig

7. Support Considerations in the model: ________

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	(psi) Total Stress	(psi) Stress Allowable
Shear Stress	Pivot Pins (76X60 door)			2496	17,500
Bending Stress	Door Angles (42X60 door)			14426	30,000 (yield)
Shear Load	Thermal Link Bolds (42x55 door)			450 lbs	510 lbs

B.

Max. Critical Deflection	Location	Maximum Allowable Deflection to Assure Functional Operability
Not calculated		

nutech
San Jose, California

Project Grand Gulf Nuclear Station
File No.
Owner Mississippi Power and Light Co.
Client Mississippi Power and Light Co.

BECHTEL MPL NUMBER	*BUILDING	ELEVATION	SYSTEM	FUNCTION	EQUIPMENT REQUIRED FOR
Q1Z77F007	Control	111'	Safeguard, Switchgear & Battery Rm.Vent.		Neither
Q1Z77F015	Control	111'	Safeguard, Switchgear & Battery Rm.Vent.		Neither
Q1Z77F016	Control	111'	Safeguard, Switchgear & Battery Rm.Vent.		Neither
Q1Z77F017	Control	111'	Safeguard, Switchgear & Battery Rm.Vent.		Neither
Q1Z77F018	Control	111'	Safeguard, Switchgear & Battery Rm.Vent.		Neither
Q1Z77F019	Control	111'	Safeguard, Switchgear & Battery Rm.Vent.		Neither
Q1Z77F020	Control	111'	Safeguard, Switchgear & Battery Rm.Vent.		Neither
Q1Z77F021	Control	111'	Safeguard, Switchgear & Battery Rm.Vent.		Neither
Q1Z77F025A	Control	111'	Safeguard, Switchgear & Battery Rm.Vent.		Neither
Q1Z77F025B	Control	111'	Safeguard, Switchgear & Battery Rm.Vent.		Neither
Q1Z77F026A	Control	111'	Safeguard, Switchgear & Battery Rm.Vent.		Neither

Revision
Prepared By/Date
Checked By/Date
Page of

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San Jose, California

Project Grand Gulf Nuclear Station

Owner Mississippi Power and Light Co.

Client Mississippi Power and Light Co.

File No.

BECHTEL MPL NUMBER	BUILDING	ELEVATION	SYSTEM	FUNCTION	EQUIPMENT REQUIRED FOR
Q1Z77F026B	Control	111'	Safeguard, Switchgear & Battery Rm.Vent		Neither
Q1Z77F028A	Control	111'	Safeguard, Switchgear & Battery Rm.Vent		Neither
Q1Z77F028B	Control	111'	Safeguard, Switchgear & Battery Rm.Vent		Neither
Q1Z77F031	Control	111'	Safeguard, Switchgear & Battery Rm.Vent		Neither
	Control	111'	Safeguard, Switchgear & Battery Rm.Vent		Neither
	Control	133'	Safeguard, Switchgear & Battery Rm.Vent		Neither
	Control	148'	Safeguard, Switchgear & Battery Rm.Vent		Neither
	Control	189'	Safeguard, Switchgear & Battery Rm.Vent		Neither
	Control	189'	Control Room HVAC System		Neither
	Control	177'	Control Room HVAC System		Neither
	Control	177'	Safeguard, Switchgear & Battery Rm.Vent		Neither

Revision	0
Prepared By/Date	TRM 2/23/81
Checked By/Date	WPV 2/24/81

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Project Grand Gulf Nuclear Station
Owner Mississippi Power and Light Co.
Client Mississippi Power and Light Co.
File No. ______

BECHTEL MPL NUMBER	BUILDING	ELEVATION	SYSTEM	FUNCTION	EQUIPMENT REQUIRED FOR
	Auxiliary	093'	Standby Gas Treatment		Neither
	Auxiliary	119'	Standby Gas Treatment		Neither
	Auxiliary	139'	Standby Gas Treatment		Neither
	Auxiliary	139'	Auxiliary Bldg. Ventilation		Neither
	Auxiliary	166'	Standby Gas Treatment		Neither
	Auxiliary	166'	Fuel Handling Area Ventilation		Neither
	Auxiliary	166'	Auxiliary Bldg. Ventilation		Neither
	Auxiliary	185'	Auxiliary Bldg. Ventilation		Neither
	Auxiliary	185'	Fuel Handling Area Ventilation		Neither
	Auxiliary	185'	Standby Gas Treatment		Neither
	Auxiliary	208'	Standby Gas Treatment		Neither

Revision	Prepared By/Date	Checked By/Date
0	TBM [illegible]	MFV 4/23/[illegible]

Page ____ of ____

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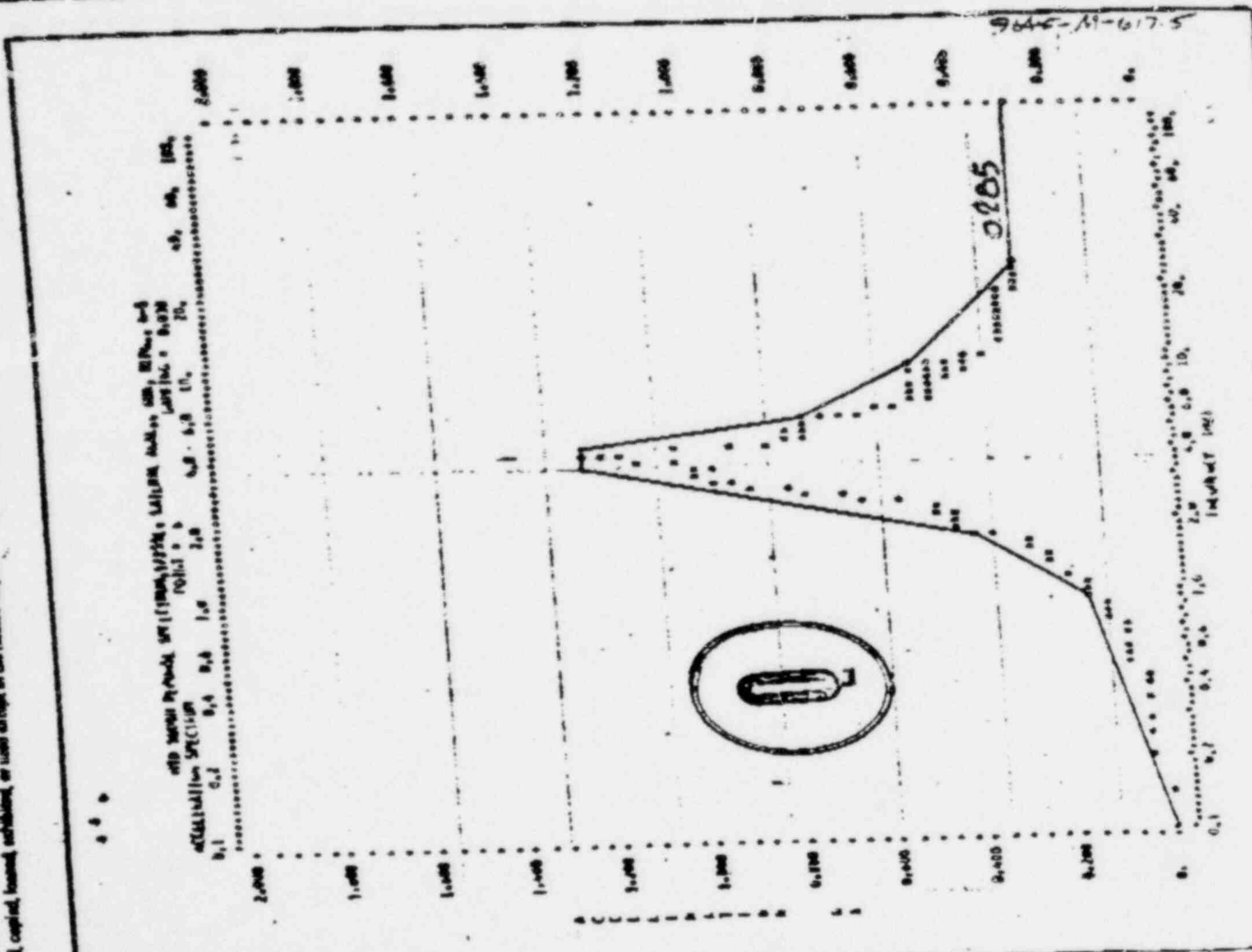
Project Grand Gulf Nuclear Station
File No. ____
Owner Mississippi Power and Light Co.
Client Mississippi Power and Light Co.

BECHTEL MPL NUMBER	** BUILDING	ELEVATION	SYSTEM	FUNCTION	EQUIPMENT REQUIRED FOR
	Auxiliary	208'	Fuel Handling Ventilation		Neither
	Enclosure	228'	Standby Gas Treatment		Neither

Revision	0					
Prepared By/Date	TRM 2/13/81					Page ____
Checked By/Date	MPV 2/20/81					of ____

9645-M-617.5



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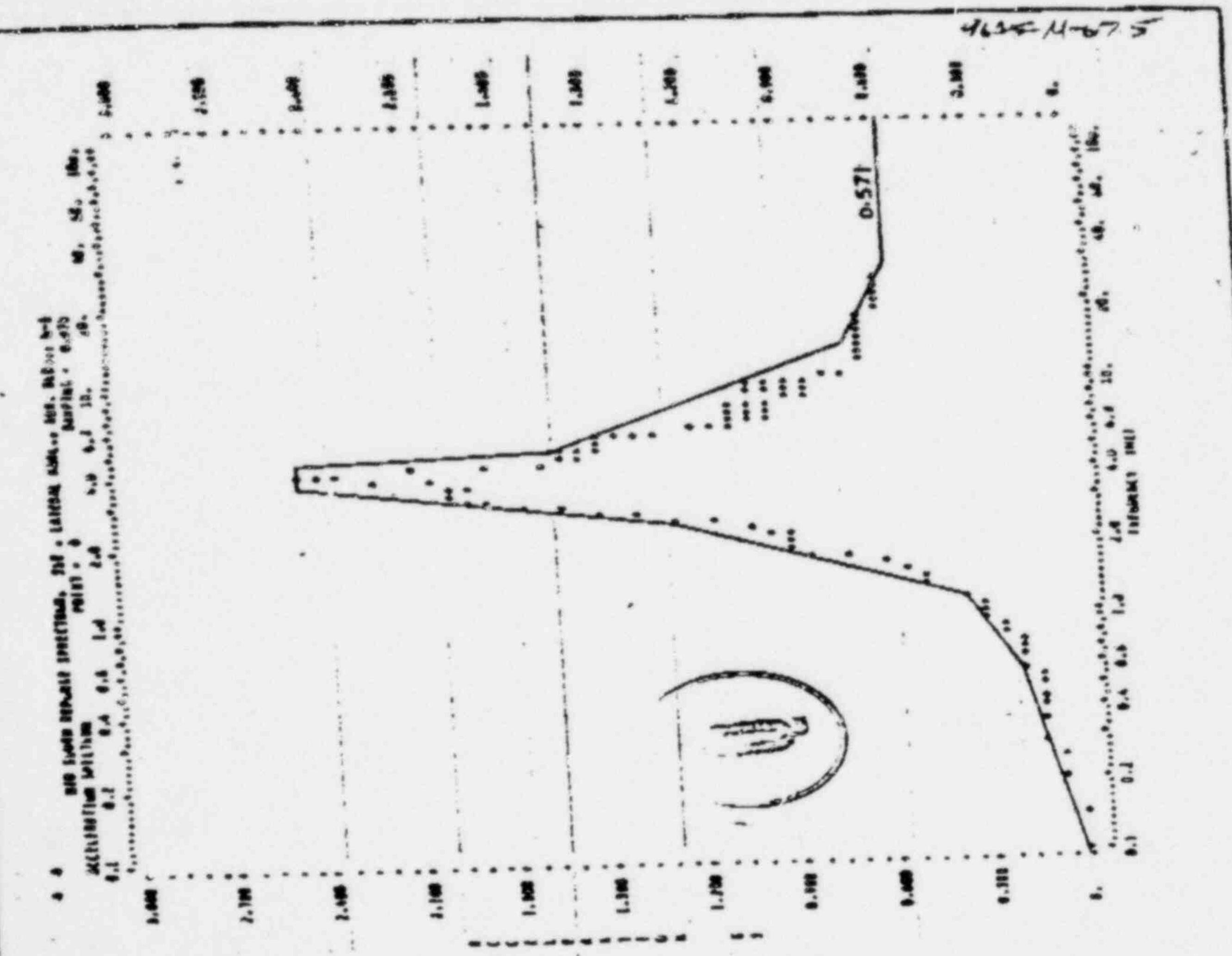
AUX. BLDG. FLOOR SPECTRUM
½ SSE, N-S, EL. 247'-0', 3%
... STATION UNITS 1&2

JOB No. 9645

NEC3

APPENDIX

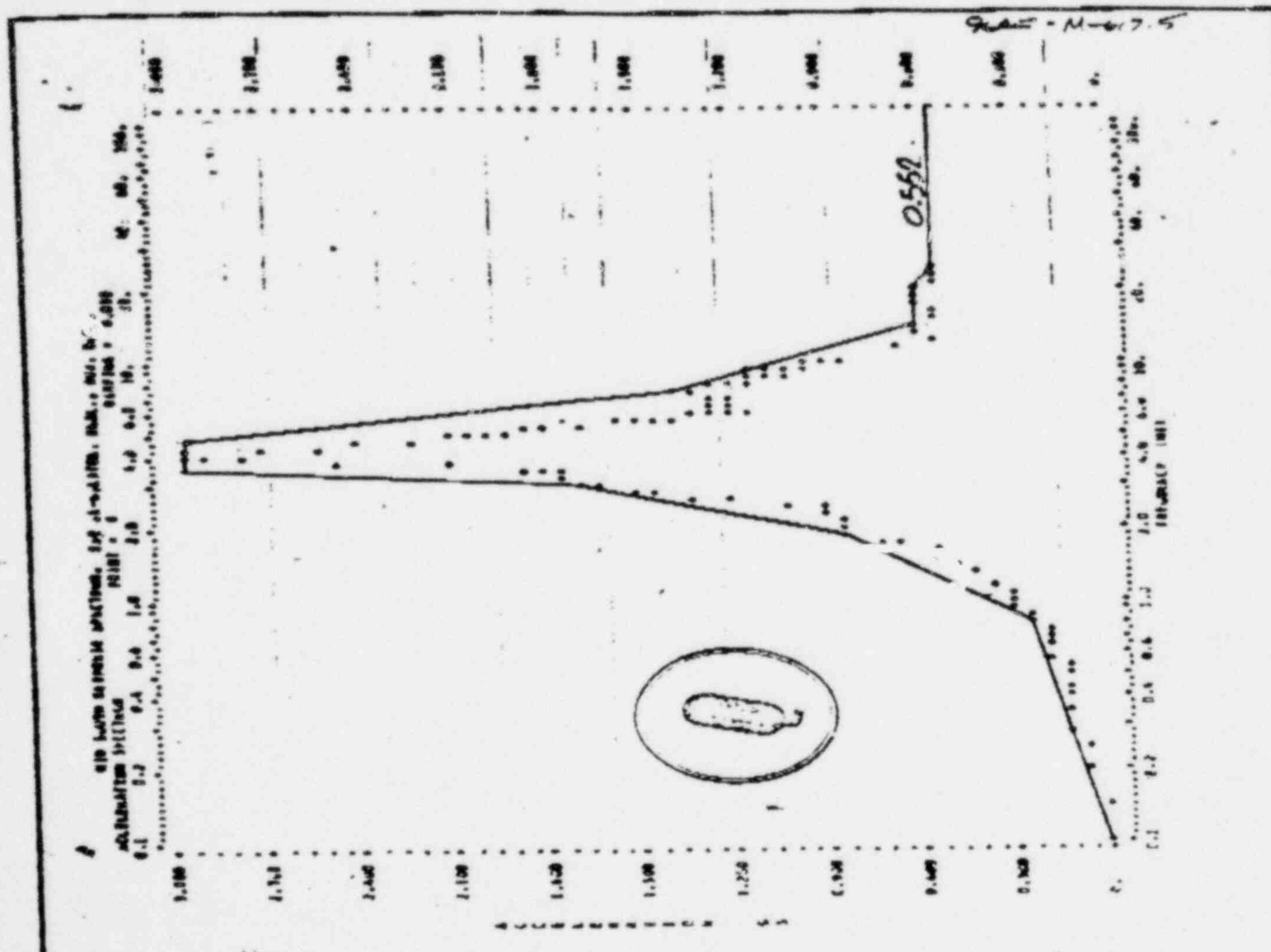
4635-M-67.5



No	DATE	REVISIONS	BY	CHK	APPR
0	6/11/73	ISSUED FOR USE		T.H.	

AUX. BLDG. FLOOR SPECTRUM
SSE, N-S, EL. 247'-0", 3%
GRAND GULF NUCLEAR STATION UNITS 1&2

JOB No. 9645
N-S/4
SHEET 12 OF



No.	DATE	REVISIONS	BY	CHK	APPR
0	6/11/73	ISSUED FOR USE		TFH	

AUX. BLDG. FLOOR SPECTRUM
SSE, E-W, EL. 247'-0", 3%
GRAND GULF NUCLEAR STATION UNITS 1&2

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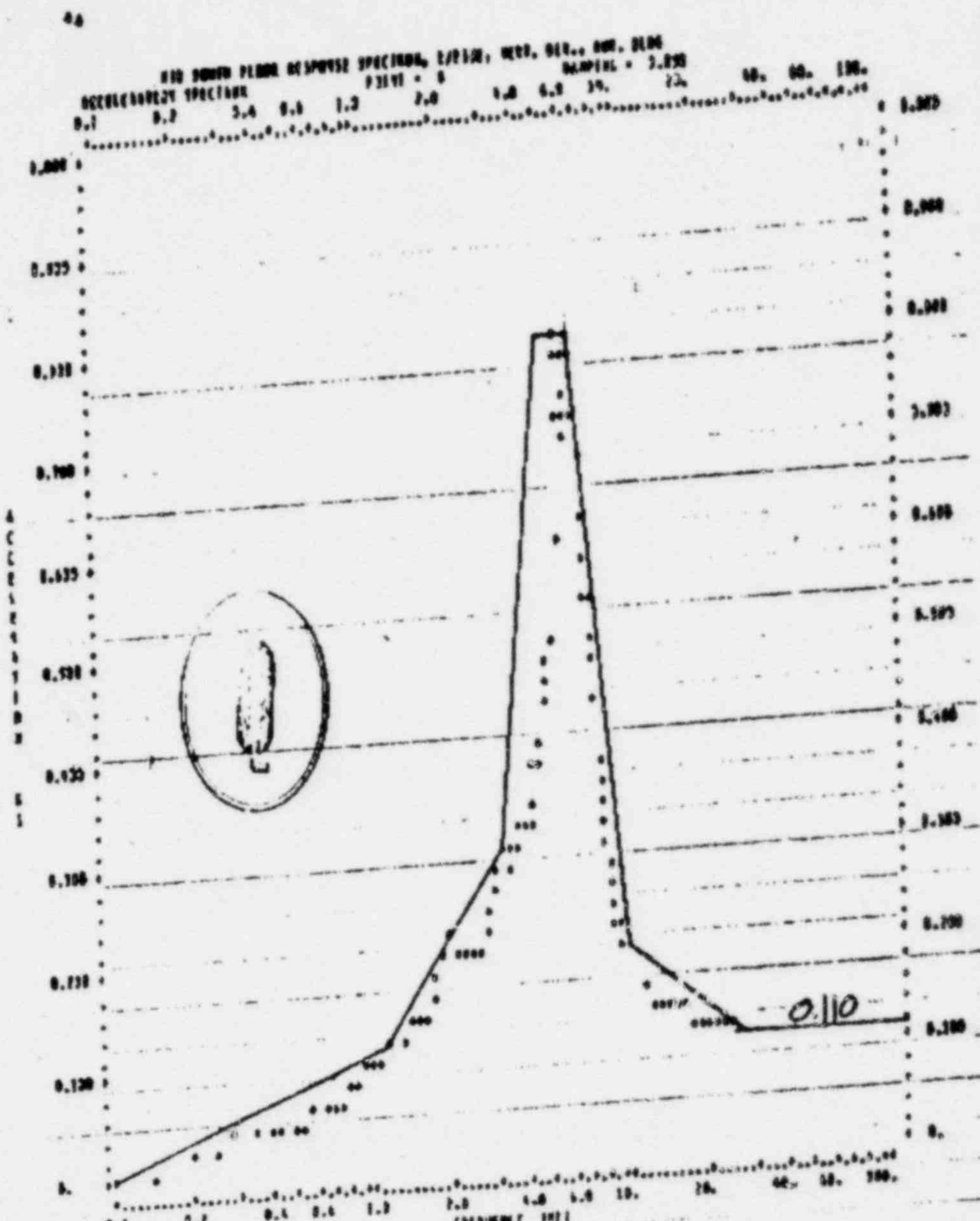

Rev.	Date	Revisions	By	Chk	Appr
0	6/11/73	ISSUED FOR USE	[illegible]	[illegible]	[illegible]

AUX. BLDG. FLOOR SPECTRUM
½ SSE, VERT., EL. 247'-0", 3%
GRAND GULF NUCLEAR STATION UNITS 1&2

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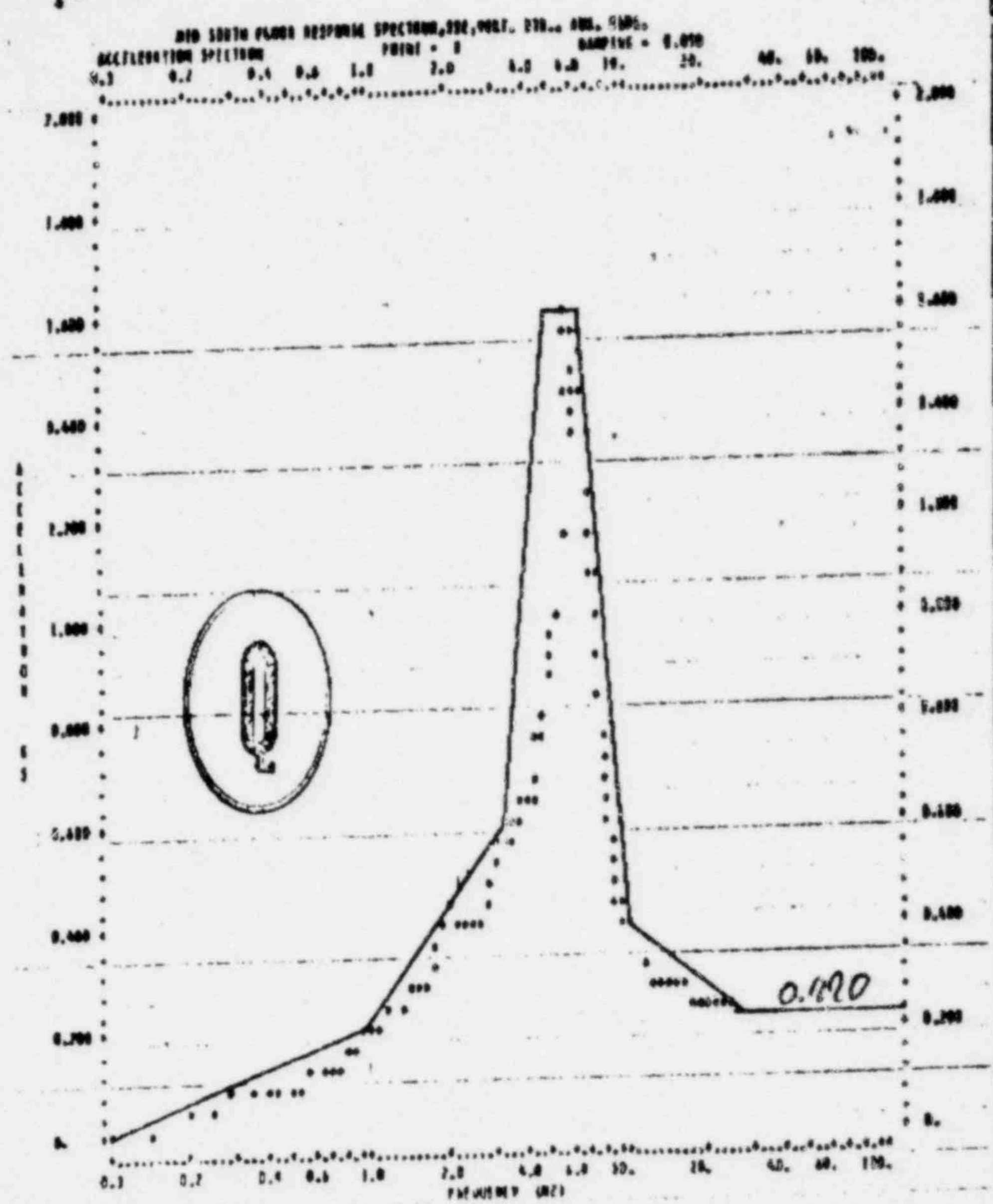

No.	DATE	REVISIONS	BY	CHK	APPR
0	6/11/73	ISSUED FOR USE			

AUX. BLDG. FLOOR SPECTRUM
SSE, VERT., EL. 247'-0", 3%
GRAND GULF NUCLEAR STATION UNITS 1&2

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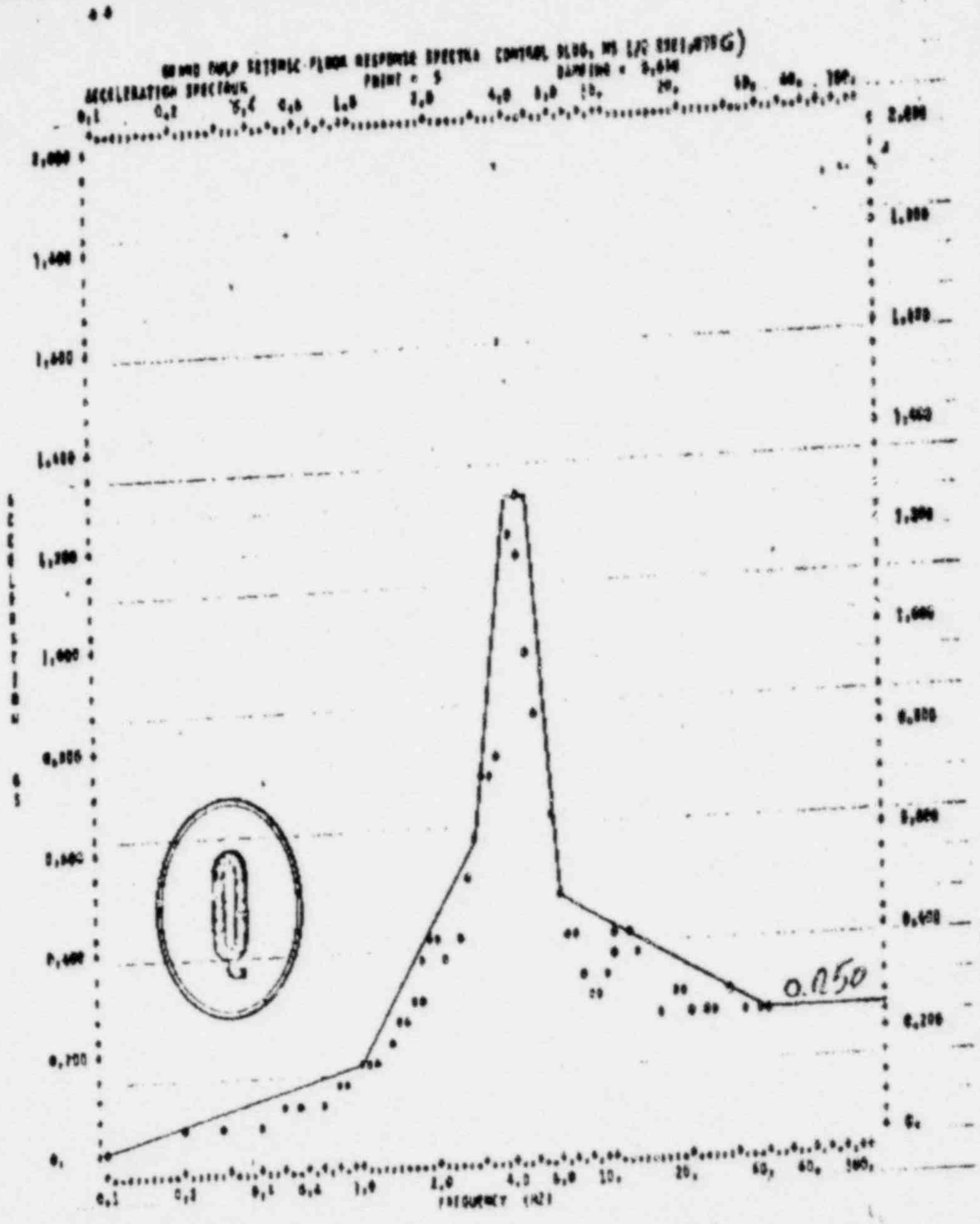

No.	DATE	REVISIONS	BY	CHK
0	7/2/73	ISSUED FOR USE		

CONTROL BUILDING FLOOR SPECTRUM
½SSE, N-S, EL. 189'-0", 3%

... STATION UNITS 1&2

JOB No. 9645

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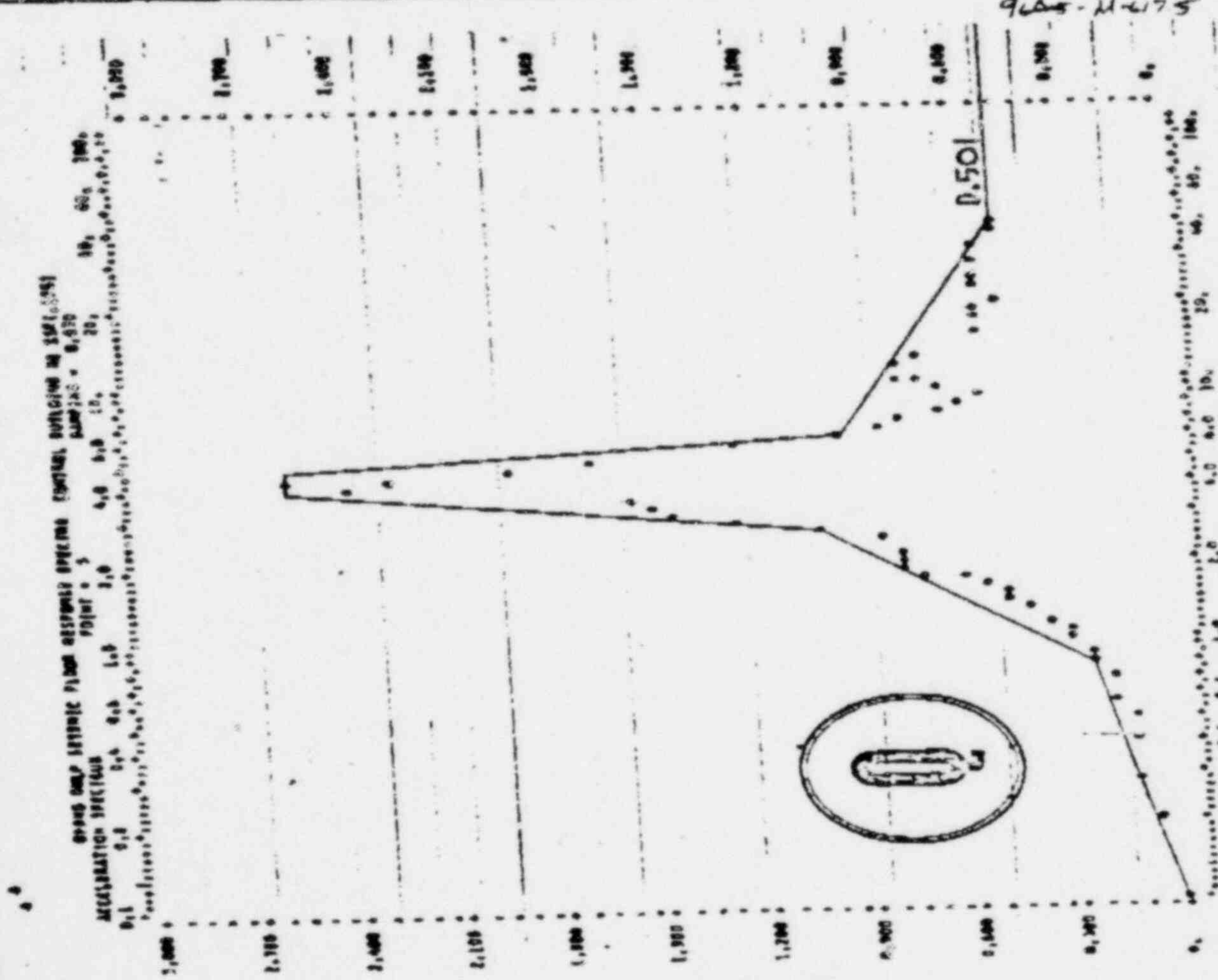

No.	DATE	REVISIONS	BY	CHK	APPD
0	7/2/73	ISSUED FOR USE			

CONTROL BUILDING FLOOR SPECTRUM
SSE. N-S, EL. 189'-0", 3%

JOB No. 9645

APPENDIX 5

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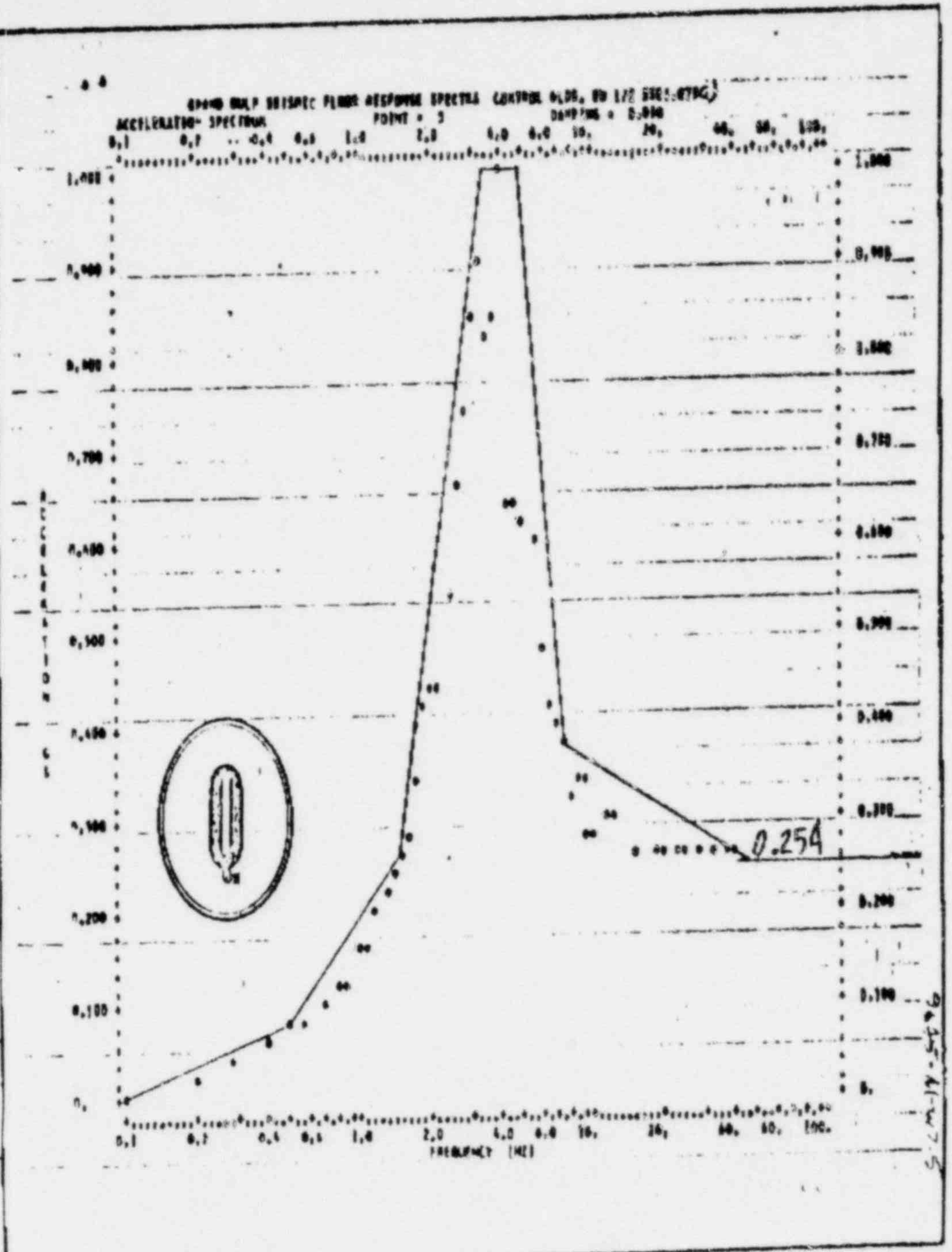
CG-39



No.	DATE	REVISIONS	BY	CHK	ENGR
0	7/2/73	ISSUED FOR USE			

CONTROL BUILDING FLOOR SPECTRUM
½SSE, E-W, EL. 189'-0", 3%

GRAND GULF NUCLEAR STATION UNITS 1&2

JOB No. 9645
SHEET 3 OF

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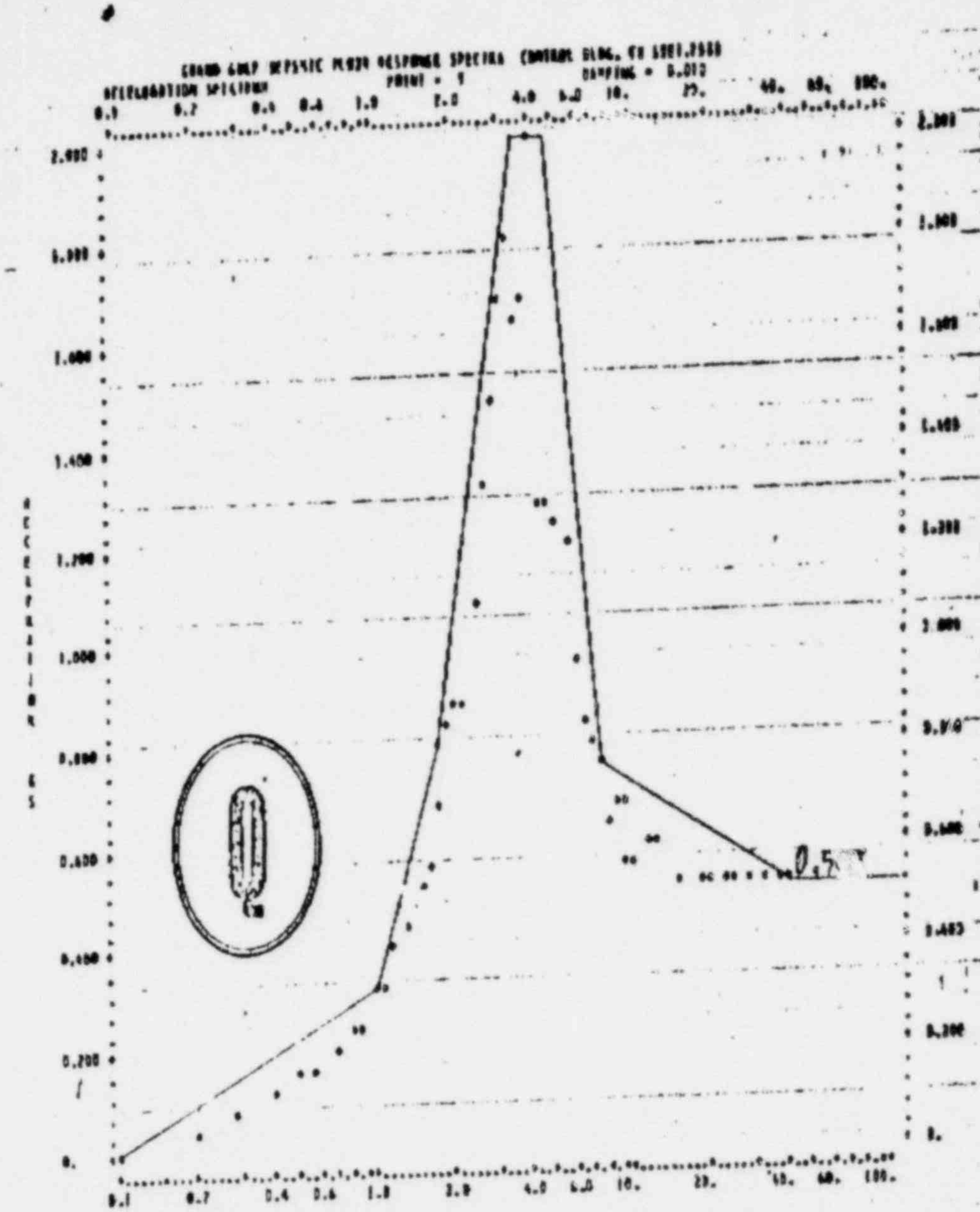
E-39

9645-M-617.5



No.	DATE	REVISIONS	BY	CHK	APPD
0	7/2/73	ISSUED FOR USE			

CONTROL BUILDING FLOOR SPECTRUM
SSE, E-W, EL. 189'-0", 3%

GRAND GULF NUCLEAR STATION UNITS 1&2

JOB No. 9645

E614

APPENDIX C

SHEET 4 OF

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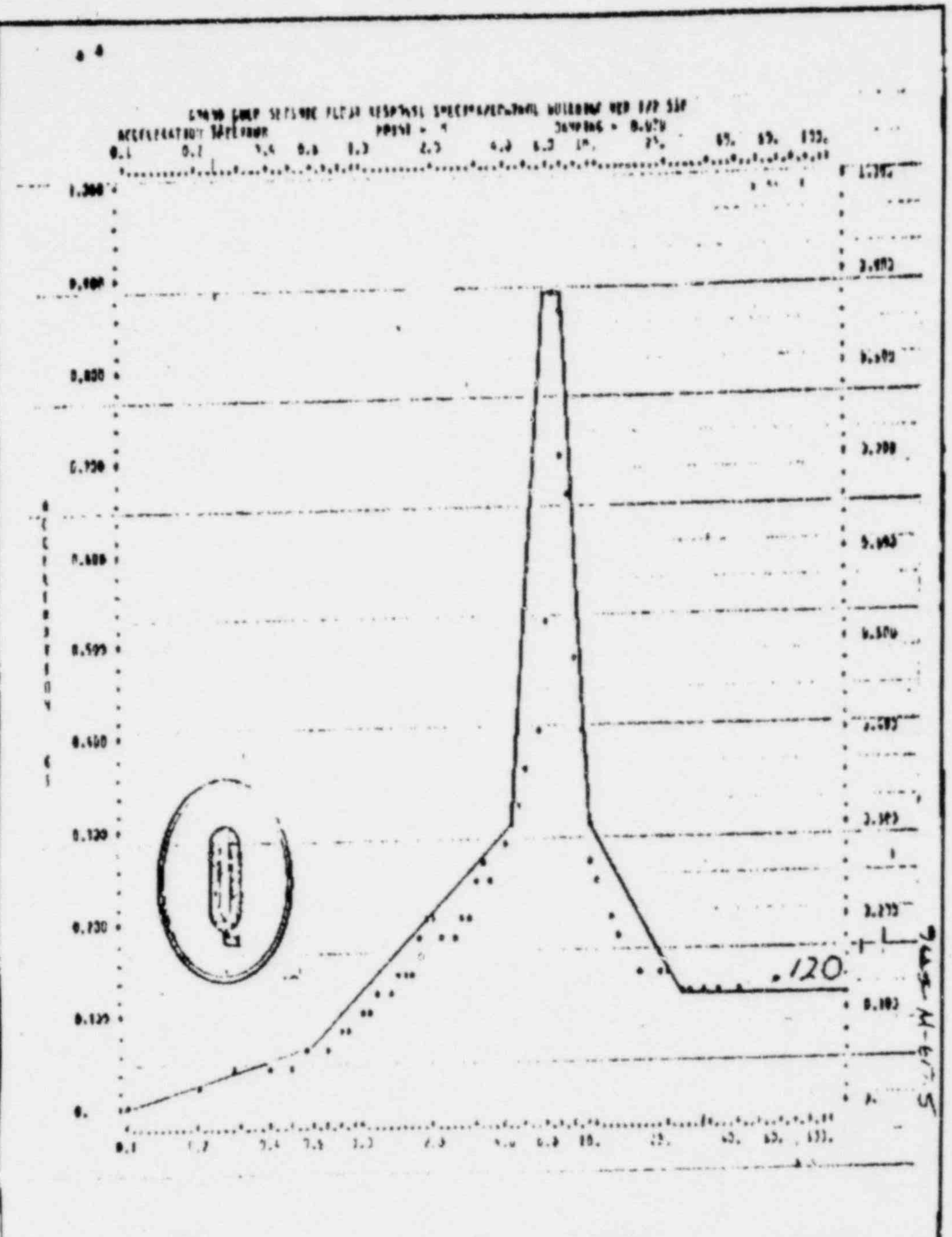
GG-39



No	DATE	REVISIONS	BY	CH'K	APPR
0	7/23/73	ISSUED FOR USE			

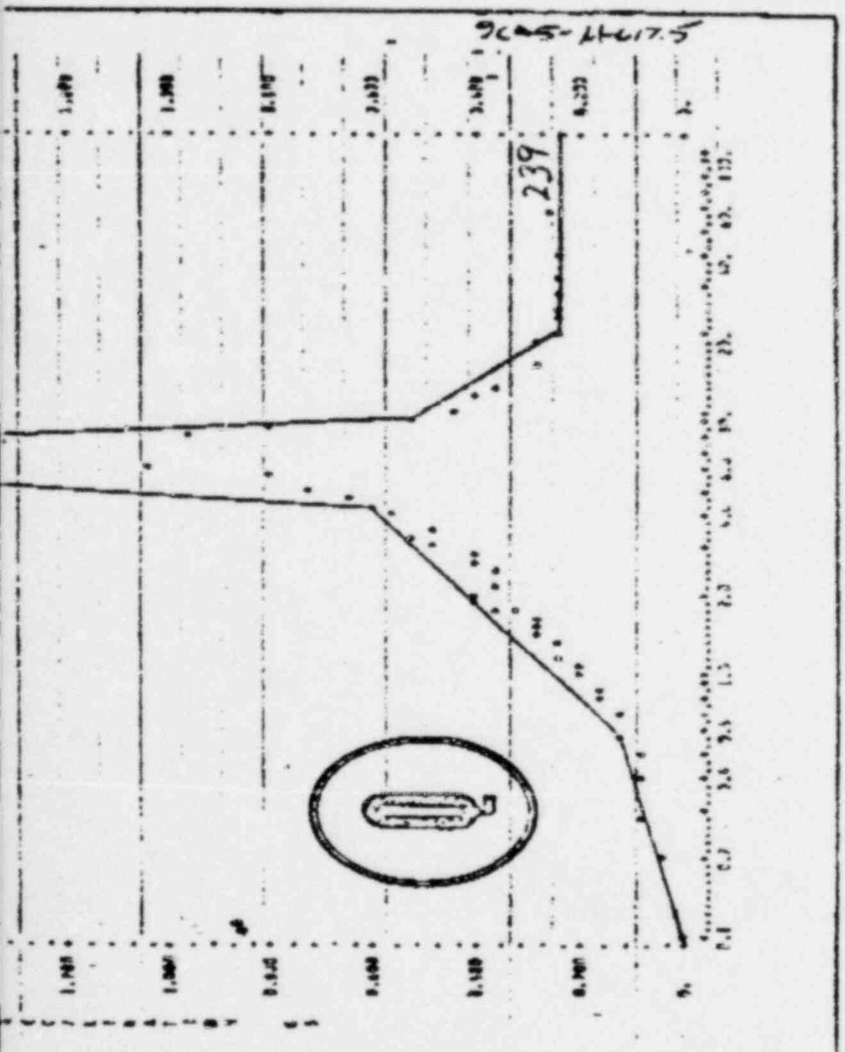
CONTROL BUILDING FLOOR SPECTRUM
½SSE, VERTICAL, EL. 189' - 0", 3%

GRAND GULF NUCLEAR STATION UNITS 1&2

JOB No 9645

APPENDIX

SHEET 5 OF



REVISIONS	BY	CH'K	APPR

BUILDING FLOOR SPECTRUM
TICAL, EL. 189' - 0", 32
LR NUCLEAR STATION UNITS 1&2

JOB No. 9645
V614
APPENDIX 3
SHEET 6 OF

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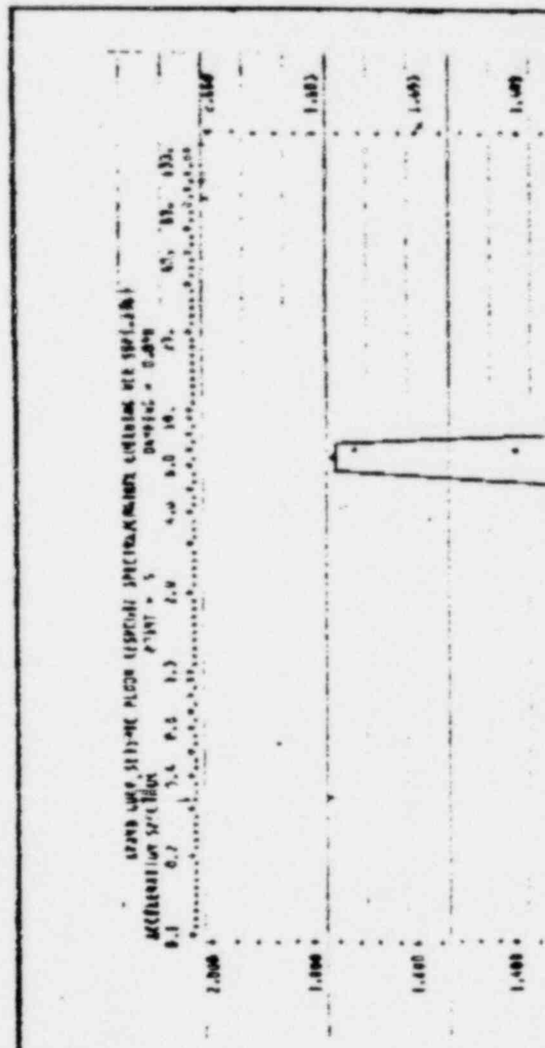

No	DATE	
0	7/23/73	ISSUED FOR USE

CONTROL
SSE, VER
GRAPH

FSAR

TABLE 3.10-6

SEISMIC QUALIFICATION REVIEW

FOR NON-NSSS EQUIPMENT

SPECIFICATION NUMBER: 9645-M-617.5 Rev. 6

EQUIPMENT/COMPONENT: Safeguard Switchgear and Battery Room Ventilation System - Fire Dampers - ARF Model #7713 [illegible]

QUALIFICATION METHOD:

a. Company/Report Number/Date:

American Warming & Ventilating/[illegible]

b. Qualification by: __x__ Analysis; ______ Test

c. Qualification Information[1,2]

ARF Model #7713 qualified by Static Analysis (SAF) 5.4g's applied in Horizontal & Vertical directions. Natural Frequencies: Assumed Rigid Fusible Links tested to safety factor of 5 by Globe Mfg. Co.

SQRT REVIEW RESULTS:

a. SQRT Criteria Met: __x__ Yes; ______ No

b. Reason for Conclusion:

Static analyses sufficient to meet SQRT criteria.

c. Plans for Reevaluation/Requalification:

None

ORIGINAL QUALIFICATION REQUIREMENTS MET: __x__ YES; ____ NO

SHEET ___ OF ___