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May 16, 1979

Director of Nuclear Reactor Regulation
Attention: Mr. R. L. Baer, Chief
LWR Branch 2, DPM
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Gentlemen:

Subject: Docket Nos. 50-361 and 50-362
Seismic Qualification of Safety Related Equipment
San Onofre Nuclear Generating Station, Units 2 and 3

In preparation for a site visit to San Onofre, Units 2 and 3, equipment seismic qualification summary information was requested by NRC letter dated January 11, 1979. In response to your information request concerning the items selected for review by the Seismic Qualification Review Team (SQRT), listed in Enclosure I, seven (7) copies of the requested information, Enclosure II, are provided.

It is our understanding that the SQRT site visit will be scheudled upon receipt of the enclosed seismic qualification summary information.

If you have any questions or comments concerning the enclosed information, please contact me.

Sincerely yours,

KP Baskin

Enclosures

B001
SE
1/7

Encl to:
Reg File
Mech Eng Br (2)
I&C Sys Br
Power Sys Br
P.M. (2)

Docket # 50-361
7905210160
5/16/79 of Document
REGULATORY DOCKET FILE

7905210160

A

ENCLOSURE I

SAN ONOFRE UNITS 2 AND 3 EQUIPMENT LIST
FOR SQRT
DOCKET NO. 50-361 AND 50-362

BOP EQUIPMENT

1. 4160 V Class 1E Switchgear
2. 480 V Class 1E Motor Control Centers
3. 125 V DC Class 1E Distribution Switchboard
4. 600 V Electrical Penetration
5. 125 V DC Batteries
6. Class 1E Battery Charger
7. Control Room Instrument Racks
8. Motor Operated Valve Inverters
9. Evacuation Shutdown Panel
10. Transmitters
11. Converters
12. Control Switches
13. Auxiliary Feed Pump Motor
14. Diesel Fuel Transfer Pump Motor
15. Solenoid Valves (Valcov)
16. Soleniod Valves (Target Rock)
17. Globe - Motor Operated Valves (W-K-M, 4 in., Limitorque SMB-000)
18. Gate-Motor Operated Valves (24 in., Walworth Aloyco)
19. HV-4714 Valve
20. HV-6200 Valve
21. 2PSV-8401 Valve
22. NSSS Auxiliary Relay Cabinet
23. Salt Water Cooling Pumps
24. Auxiliary Feedwater Pumps (Turbine Driven and Motor Driven)
25. Component Cooling Water Heat Exchanger

NSSS EQUIPMENT

1. Plant Protection System Cabinet

   a. Nuclear Instrument
   b. Core Protection Calculator Test Module
   c. Matrix Test Module
   d. Relay Card Rack
   e. Bistable Control Panel
   F. Actuation Reset Panel
   g. Trip Path Panel
   h. AC Distribution Panel
   i. Power Supply Assembly
   j. RPS Initiation Relay
   k. Sola Transformer
   l. Cabinet Cooler Assembly

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2. Auxiliary Protective Cabinet

   A. CPC Mass Storage Unit
   b. CPC/CEAC Central Processing Unit
   c. CPC/CEAC Input/Output Chassis
   d. CPC/CEAC Power Supply
   e. CEA Position Isolation Amplifers
   f. Reactor Coolant Pump Singal Processor
   g. In-Core Amplifiers

3. Reactor Trip Switchgear Cabinet

4. ESFAS Auxiliary Relay Cabinet

5. Process Instrument Rack

   a. Controller
   b. Current to Voltage Converter
   c. Resistance to Voltage Converter
   d. Alarm
   e. Square Root Extractor
   f. Summing
   g. Contract Isolator
   h. Power Isolator
   i. Voltage to Current Converter
   j. Power Supply
   k. Power Distribtuion Module
   l. Signal Distribution Module
   m. Temperature Transmitter

6. Vital Bus Power Supply

7. Core Portection Calculator Operators Module

8. PPS Remote Control Module

9. Indicators

10. Controller

11. Recorder

12. Temperature Sensors

13. Pressure Transmitter

14. Differential Pressure Transmitters

15. Reactor Coolant Pump Speed Signal Sensor and Transmitter

16. Nuclear Instrument Detector

17. Nuclear Instrument Preamplifer
18. CEA Read Switch Position Transmitter
19. Magnetic Flow Detector
20. Magnetic Flow Transmitter
21. Containment Purge Isolation Detector
22. Containment Purge Isolation Transmitter
23. 3 HV 9323 Valve
24. 3 HV 9322 Valve
25. Charging Pump
26. Shutdown Heat Exchanger

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR ____

II. Component Name 4160 V. Class 1E Switchgear

1. Scope: [ ] NSSS , [X] BOP
2. Model Number: 5HK — Quantity: 4
3. Vendor: Gould/ITE Imperial
4. If the component is a cabinet or panel, name and model No. of the devices included: See Appendix "A"
5. Physical Description a. Appearance Cabinet Type-See App. "B"

   b. Dimensions See Appendix "B"

   c. Weight 46,017 pounds per switchgear assembly
6. Location: Building: Control Area (Auxiliary Bldg.)

   Elevation: 50'-0"
7. Field Mounting Conditions [ ] Bolt (No.____, Size____)

   [ ] Weld (Length____)

   [X] Plug Weld, .72 Diam Holes in Swgr. base to embedded channels
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S: 5,13,31 & 44HZ F/B: 15,19,30 & 42HZ V: 23 & 27HZ
9. a. Functional Description: Supplies 4.16 kV power to Class 1E motors and loadcenters

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

   [X] Both
10. Pertinent Reference Design Specifications: S023-302-02

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

IV. Equipment Qualification Method: Test: ______

Analysis: ______

Combination of Test and Analysis: X

Test and/or Analysis by Test Performed by Wyle Lab., Analysis and Report No. ITE Imperial S0703-50395 done by ITE Bechtel Log No. S023-302-2-112-1
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

   3. [ ] Explosive only 4. [ ] Other (Specify) ______

   5. [ ] Combination of ______

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

2. Required Response Spectra (attach the graphs): Appendix "C"

3. Required Acceleration in Each Direction: Appendix "C"

   S/S = 1.0g ZPA (SSE) F/B = 1.0g ZPA (SSE) V = 0.75g ZPA (SSE)

VI. If Qualification by Test, then Complete:

1. [ ] Single Frequency [X] Multi-Frequency: [X] random
   [ ] sine beat
   [X] 20 SEC. dwell at res. freq. (See Test Proced.)

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

3. No. of Qualification Tests: OBE 6 SSE 6 Other 4 -0.36g sine sweep (specify)

4. Frequency Range: 1-33 HZ

5. TRS enveloping RRS using Multi-Frequency Test [X] Yes (plot TRS on RRS graphs)
[ ] No See App. "D"

6. Input g-level Test at S/S = 2.0g F/B = 2.0g V = 1.0g

7. Laboratory Mounting:

1. [X] Bolt (No. * , Size *) [ ] Weld (Length) [ ] ____________

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

9. Test Results including modifications made: Eqpt. Qualified, No Modifications

10. Other tests performed (such as fragility test, including results):

See Appendix "A" for qualification of devices

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

1. Description of Test including Results: 3000 AMP bus duct analysed for stresses and resonances. No resonance or over stress found

2. Method of Analysis: Bus Duct Only

[ ] Static Analysis
[X] Dynamic Analysis

[ ] Equivalent Static Analysis
[ ] Time-History
[X] Response Spectrum

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: [X] Absolute Sum [ ] SRSS
[ ] Other: ____________ (specify)

6. Damping: 1% Basis for the damping used: Cust. Spec.

7. Support Considerations in the model: No relative motion between ends of duct.

*Not available from the report.

8. Critical Structural Elements: Bus Duct Only

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
5' Bus Duct	See App. "B"	Short Circuit and Seismic	741.5psi	741.5 psi	14,000psi
Vert. Elbows	See App. "B"	Short Circuit and Seismic	741.5psi	741.5 psi	14,000psi
Bus Bar	See App. "B"	Short Circuit and Seismic	309.7psi	1904.8 psi	22,000psi
2' Bus Duct	See App. "B"	Short Circuit and Seismic	3153psi	3153 psi	14,000psi
15.88" Duct	See App. "B"	Short Circuit and Seismic	3152psi	3153 psi	14,000psi

B.

Max. Deflection	Location	Effect Upon Functional Operability
Bus Bar, 1673.5x10-6 in		None
5' Bus Duct, 803.x10-6 in		None
2' Bus Duct, 76.7x10-6 in		None

appendix "A"

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TABLE 1
SEISMIC EVALUATION OF GROUP 1 RESALE COMPONENTS
BUS2A04 (I-T-E ITEM B)

B/M Pc. No.	Device Description	Device Model or Catalog Number	Reference Accelerometers		Reqd. Accel. "g" Level	Device Documentation		Device Comments	
			No. – Dir.	Amp		Test Report Reference No.	Avail. "g" Level	Certification	Cert. Notes
1	Circuit Breaker	5HK C-35231-777-03	–	–	.75V 1.0 H	R-09400 8.2.3-13A	0.8V 1.7H	Certified	4.1
2	Circuit Breaker	5HK C-35233-777-03	–	–	.75V 1.0H	R-09400 8.2.3-13A	0.8V 1.7H	Certified	4.1
8	Circuit Breaker	TYPE E EE3-B060	–	–	.75V 1.0H	Test Program 42686-1	1.5V 1.5H	Certified	4.15
	No Entry		–	–					
12	Circuit Breaker	Type E EE2-B030	–	–	.75V 1.0H	Test Program 42686-1	1.5V 1.5H	Certified	4.15
14	AC Ammeter	S73210220	7V 6H	1.0 1.0	.75V 1.0H	R-09161-CD	3.5V 3.5H	Certified	4.15
15	AC Voltmeter	S73103310	7V 6H	1.0 1.0	.75V 1.0H	R-09161-CC	3.5V 3.5H	Certified	4.15
16	AC Wattmeter	S73319311 I-T-E	–	–	.75V 1.0H	Test Program 43250	3.0V 3.0H	Certified	4.16
17	AC VAR Meter	S73419314 I-T-E	–	–	.75V 1.0H	Test Program 43250	3.0V 3.0H	Certified	4.16
18	Frequency Meter	S75501410 I-T-E	–	–	.75V 1.0H	Test Program 43250	3.0V 3.0H	Certified	4.16
19	Ammeter Switch	SBM 10AA013	7V 6H	1.0 1.0	.75V 1.0H	R-09161-DI	5.0V 5.0H	Certified	4.15
20	Voltmeter Switch	SBM 10AA004	7V 6H	1.0 1.0	.75V 1.0H	R-09161-DI	5.0V 5.0H	Certified	4.15

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TABLE 1
SEISMIC EVALUATION OF GROUP 1 RESALE COMPONENTS
BUS 2A04 (I-T-E ITEM B)

B/M Pc. No.	Device Description	Device Model or Catalog Number	Reference Accelerometers		Reqd. Accel. "g" Level	Device Documentation		Device Comments	
			No. — Dir.	Amp		Test Report Reference No.	Avail. "g" Level	Certification	Cert. Notes
21	Control Switch	SB1 16SB1B9	7V 6H	1.0 1.0	.75V 1.0H	R-09161-CS	5.0V 5.0H	Certified	4.15
22	Indicating Lamp	ET-16 0116B6708G3D	7V 6H	1.0 1.0	.75V 1.0H	R-09161-AS	3.6V 5.0H	Certified	4. 2
23	Indicating Lamp	ET-16 0116B6708G3E	7V 6H	1.0 1.0	.75V 1.0H	R-09161-AS	3.6V 5.0H	Certified	4.6
24	Indicating Lamp	ET-16 0116B6708G3W	7V 6H	1.0 1.0	.75V 1.0H	R-09161-AS	3.6V 5.0H	Certified	4.6
25	Current Transformer	MCS-25 401572-K2	-	-	.75V 1.0H	R-09400	0.8V 1.7H	Certified	4.9
26	Current Transformer	MCS-25 401572-K3	-	-	.75V 1.0H	R-09400	0.8V 1.7H	Certified	4.9
28	Current Transformer	MCS-25 401572-K6	-	-	.75V 1.0H	R-09400	0.8V 1.7H	Certified	4.9
29	Current Transformer	MC-5 401437-K7	-	-	.75V 1.0H	R-09400	0.8V 1.7H	Certified	4.15
30	Current Transformer	MCS-25 401572-K4	-	-	.75V 1.0H	R-09400	0.8V 1.7H	Certified	4.9
31	Current Transformer	MC-5 401437-K9	-	-	.75V 1.0H	R-09400	0.8V 1.7H	Certified	4.15
33	Current Transformer	MCB-5A 401024-T5	-	-	.75V 1.0H	Test Program 42686-3	1.2V 1.9H	Certified	4.12
34	Current Transformer	MCB-5AS 401048-T24	-	-	.75V 1.0H	Test Program 42686-3	1.2V 1.9H	Certified	4.12

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TABLE 1
SEISMIC EVALUATION OF GROUP 1 RESALE COMPONENTS
BUS 2A04 (I-T-E ITEM B)

B/M Pc. No.	Device Description	Device Model or Catalog Number	Reference Accelerometers No.—Dir.	Reference Accelerometers Amp	Reqd. Accel. "g" Level	Device Documentation: Test Report Reference No.	Device Documentation: Avail. "g" Level	Device Comments: Certification	Device Comments: Cert. Notes
35	Overcurrent Relay	CO-5 264C897A07	7V 6H	1.0 1.0	.75V 1.0H	WESTINGHOUSE CERT.LET.10-31-75	2.0V 2.0H	Certified	4.15
36	Current Transformer	MC-5 401437-K8	–	–	.75V 1.0H	R-09400	0.8V 1.7H	Certified	4.15
37	Overcurrent Relay	CO-11 1961504	7V 6H	1.0 1.0	.75V 1.0H	WESTINGHOUSE CERT.LET.3-26-76	2.0V 2.0H	Certified	4.15
38	Potential Transformer	JVM-3 643X94	–	–	.75V 1.0H	R-09400	0.8V 1.7H	Certified	4.15
	NO ENTRY								
40	Potential Transformer	JVM-3 643X94	–	–	.75V 1.0H	R-09400	0.8V 1.7H	Certified	4.15
	NO ENTRY								
42	P.T. Primary Fuse	EJ-1 9F60BBD001	–	–	.75V 1.0H	R-09400	0.8V 1.7H	Certified	4.15
43	Overcurrent Relay	CO-8 264C900A07	7V 6H	1.0 1.0	.75V 1.0H	WESTINGHOUSE CERT.LET.3-26-76	2.0V 2.0H	Certified	4.15
44	Overcurrent Relay	CO-8 264C900A05	7V 6H	1.0 1.0	.75V 1.0H	WESTINGHOUSE CERT.LET.3-26-76	2.0V 2.0H	Certified	4.15
45	Overcurrent Relay	CO-9 264C901A03	7V 6H	1.0 1.0	.75V 1.0H	WESTINGHOUSE CERT.LET.3-26-76	2.0V 2.0H	Certified	4.15
46	Motor Control Switch	SB-1 SIM to 16SB1CG15	7V 6H	1.0 1.0	.75V 1.0H	R-09161-CS	5.0V 5.0H	Certified	4.15

TABLE 1
SEISMIC EVALUATION OF GROUP 1 RESALE COMPONENTS
BUS 2A04 (I-T-E ITEM B)

B/M Pc. No.	Device Description	Device Model or Catalog Number	Reference Accelerometers No. – Dir.	Reference Accelerometers Amp	Reqd. Accel. "g" Level	Device Documentation: Test Report Reference No.	Device Documentation: Avail. "g" Level	Device Comments: Certification	Device Comments: Cert. Notes
	NO ENTRY								
49	Undervoltage Relay	SVF 1961843	7V 6H	1.0 1.0	.75V 1.0H	WESTINGHOUSE CERT.LET.3-26-76	2.12V 2.22H	Certified	4.15
50	Undervoltage Relay	CV2 1875516	7V 6H	1.0 1.0	.75V 1.0H	WESTINGHOUSE CERT. LET.2-17-76	2.02V 2.09H	Certified	4.15
51	Voltage Control O.C. Relay	IJCV 12IJCV51A13A	7V 6H	1.0 1.0	.75V 1.0H	R-09161-AL	.8V 1.1H	Certified	4.15
52	Reverse Power Relay	ICW 12ICW51A3A	7V 6H	1.0 1.0	.75V 1.0H	G. E. CERT. LET.7-29-75	1.5V 5.0H	Certified	4.15
	NO ENTRY								
54	Underfreq. Relay	SDF-1 717B920A10	-	-	.75V 1.0H	Test Program 43250	3.0V 3.0H	Certified	4.16
55	Undervoltage Relay	1AV 12IAV54E1A	7V 6H	1.0 1.0	.75V 1.0H	R-09161-BF	1.6V 2.2H	Certified	4.5
	NO ENTRY								
57	Loss of Field Relay	CEH 12CEH51A1A	7V 6H	1.0 1.0	.75V 1.0H	G.E. CERT.LET.2-3-76	1.6V 1.9H	Certified	4.15
58	Neg. Ph. Seq. O.C. Relay	INC 12INC77B3A	7V 6H	1.0 1.0	.75V 1.0H	G.E. CERT.LET.2-3-76	1.7V 3.0H	Certified	4.15
59	Gen. Diff. Relay	SBD 12SBD11A2A	-	-	.75V 1.0H	Test Program 43250	3.0V 3.0H	Certified	4.19

TABLE 1
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BUS 2A04 (I-T-E ITEM B)

B/M Pc. No.	Device Description	Device Model or Catalog Number	Reference Accelerometers		Reqd. Accel. "g" Level	Device Documentation		Device Comments	
			No. — Dir.	Amp		Test Report Reference No.	Avail. "g" Level	Certification	Cert. Notes
60	Auxiliary Relay	HFA 12HFA51A47F	7V 6H	1.0 1.0	.75V 1.0H	Test Program 42686-1	1.5V 2.5H	Certified	4.15
61	Auxiliary Relay	HFA 12HFA51A47F	7V 6H	1.0 1.0	.75V 1.0H	Test Program 42686-1	1.5V 2.5H	Certified	4.15
62	Auxiliary Relay	HFA 12HFA51A47F	7V 6H	1.0 1.0	.75V 1.0H	Test Program 42686-1	1.5V 2.5H	Certified	4.15
63	Auxiliary Relay	HFA 12HFA51A42H	7V 10H	1.0 1.6	.75V 1.6H	Test Program 42686-1	1.5V 2.5H	Certified	4.15
64	Auxiliary Relay	HFA 12HFA54E187H	7V 10H	1.0 1.6	.75V 1.6H	Test Program 42686-1	1.5V 2.5H	Certified	4.15
65	Auxiliary Relay	HFA 12HFA51A47F	7V 6H	1.0 1.0	.75V 1.0H	Test Program 42686-1	1.5V 2.5H	Certified	4.15
66	Auxiliary Relay	HGA 12HGA11S54	7V 10H	1.0 1.6	.75V 1.6H	G.E. CERT.LET.7-29-75	5.0V 5.0H	Certified	4.15
67	Auxiliary Relay	HGA 12HGA11S52	7V 10H	1.0 1.6	.75V 1.6H	G.E. CERT.LET.7-29-75	5.0V 5.0H	Certified	4.15
68	Time Delay Relay	7000 7012 PD	7V 10H	1.0 1.6	.75V 1.6H	R-09161-DR	5.0V 5.0H	Certified	4.15
69	Time Delay Relay	7000 7022 PC	7V 10H	1.0 1.6	.75V 1.6H	R-09161-DR	5.0V 5.0H	Certified	4.15
70	Auxiliary Relay	HFA 12HFA51A42H	7V 10H	1.0 1.6	.75V 1.6H	Test Program 42686-1	1.5V 2.5H	Certified	4.15
71	Auxiliary Relay	HFA 12HFA51A47F	7V 6H	1.0 1.0	.75V 1.0H	Test Program 42686-1	1.5V 2.5H	Certified	4.15

TABLE 1
SEISMIC EVALUATION OF GROUP 1 RESALE COMPONENTS
BUS 2A04 (I-T-E ITEM B)

B/M Pc. No.	Device Description	Device Model or Catalog Number	Reference Accelerometers		Reqd. Accel. "g" Level	Device Documentation		Device Comments	
			No. – Dir.	Amp		Test Report Reference No.	Avail. "g" Level	Certification	Cert. Notes
72	Current Transducer	V2 606B230A09	-	-	.75V 1.6H	Test Program 43250	3.0V 3.0H	Certified	4.16
73	Auxiliary Current Transformer	TA 400742-K23	-	-	.75V 1.6H	Test Program 43250	3.0V 3.0H	Certified	4.16
74	Test Switch	ROTO 404	-	-	.75V 1.0H	Test Program 43250	3.0V 3.0H	Certified	4.16
76	Resistor	MCOR (2) FR100-100	7V 9H	1.0 1.1	.75V 1.1H	R-09161-CI	3.5V 3.5H	Certified	4.15
77	Resistor	MCOR AR200-1000	7V 9H	1.0 1.1	.75V 1.1H	R-09161-CG	3.5V 3.5H	Certified	4.15
78	Resistor	MCOR AR100-1500	7V 9H	1.0 1.1	.75V 1.1H	R-09161-CI	3.5V 3.5H	Certified	4.15
79	Resistor	MCOR AR100-2500	7V 9H	1.0 1.1	.75V 1.1H	R-09161-CI	3.5V 3.5H	Certified	4.15
80A	Resistor	MCOR (1) FR160-250	7V 9H	1.0 1.1	.75V 1.1H	R-09161-CH	3.5V 3.5H	Certified	4.15
80B	Resistor	(1) FR100-150	7V 9H	1.0 1.1	.75V 1.1H	R-09161-CI	3.5V 3.5H	Certified	4.15
81	Resistor	MCOR AR50-300	7V 9H	1.0 1.1	.75V 1.1H	R-09161-CI	3.5V 3.5H	Certified	4.15
82	Time Delay Relay	7000 7012 PC	7V 10H	1.0 1.6	.75V 1.6H	R-09161-DR	5.0V 5.0H	Certified	4.15
83	Cable Lug	250 MCM YA29-2N	-	-	-	-	-	Certified	4.8

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TABLE 1
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BUS 2A04 (I-T-E ITEM B)

B/M Pc. No.	Device Description	Device Model or Catalog Number	Reference Accelerometers		Reqd. Accel. "g" Level	Device Documentation		Device Comments	
			No. — Dir.	Amp		Test Report Reference No.	Avail. "g" Level	Certification	Cert. Notes
	NO ENTRY								
	NO ENTRY								
89	Cable Lug	350 MCM YA31-2N	-	-	-	-	-	Certified	4.8
90	Cable Lug	500 MCM YA34-2N	-	-	-	-	-	Certified	4.8
91	Cable Lug	750 MCM YA39-2N	-	-	-	-	-	Certified	4.8
93	Auxiliary Transformer	Part No. 110507	-	-	.75V 1.6H	Test Program 43250	3.0V 3.0H	Certified	4.16
94	Watt Transducer	20WS100 20WS101	-	-	.75V 1.6H	Test Program 43250	3.0V 3.0H	Certified	4.16
95	VAR Transducer	20RS100 200RS101	-	-	.75V 1.6H	Test Program 43250	3.0V 3.0H	Certified	4.16
96	Frequency Transducer	6284A 6284A-S	7V 10H	1.0 1.6	.75V 1.6H	R-09404-A	5.0V 5.0H	Certified	4.15
97	Voltage Transducer	VE2-841 606B229A09	-	-	.75V 1.6H	Test Program 43250	3.0V 3.0H	Certified	4.16
98	Diode	GE-102L218G1-2	-	-	.75V 1.6H	Test Program 43250	3.0V 3.0H	Certified	4.16
99	Watthour Meter	DSW-63 SIM to 700X63G1	-	-	.75V 1.0H	Test Program 43250	3.0V 3.0H	Certified	4.16

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TABLE 1
SEISMIC EVALUATION OF GROUP 1 RESALE COMPONENTS
BUS 2A04 (I-T-E ITEM B)

B/M Pc. No.	Device Description	Device Model or Catalog Number	Reference Accelerometers No. – Dir.	Reference Accelerometers Amp	Reqd. Accel. "g" Level	Device Documentation: Test Report Reference No.	Device Documentation: Avail. "g" Level	Device Comments: Certification	Device Comments: Cert. Notes
100	Resistor	1-3/4 AAW/13A Leads	7V 9H	1.0 1.1	.75V 1.1H	R-09161-CI	3.5V 3.5H	Certified	4.1.5
102	Indicating Lamp	ET-16 0127B8108G2D	7V 6H	1.0 1.0	.75V 1.0H	R-09161-AS	3.6V 5.0H	Certified	4.7
103	Lockout Relay	HEA 12HEA61B236X2	7V 6H	1.0 1.0	.75V 1.0H	R-09161-AJ	3.6V 5.0H	Certified	4.15
105	Ground Protect. Relay	IAV 12IAV51D2A	-	-	.75V 1.0H	Test Program 43250	3.0V 3.0H	Certified	4.16
107	Test Switch	ROTO 808 8P.Curr	-	-	.75V 1.0H	Test Program 43250	3.0V 3.0H	Certified	4.16
108	Test Switch	ROTO 660 6P.Pot	-	-	.75V 1.0H	Test Program 43250	3.0V 3.0H	Certified	4.16
109	Test Switch	ROTO-1046 6P.Curr. 4P.Pot	-	-	.75V 1.0H	Test Program 43250	3.0V 3.0H	Certified	4.16
110	Test Switch	ROTO 440-4P.Pot	-	-	.75V 1.0H	Test Program 43250	3.0V 3.0H	Certified	4.16
111	Test Switch	ROTO 624-4P.Curr. 2P.Pot.	-	-	.75V 1.0H	Test Program 43250	3.0V 3.0H	Certified	4.16
112	Test Switch	ROTO 606-6P.Curr.	-	-	.75V 1.0H	Test Program 43250	3.0V 3.0H	Certified	4.16
115	Test Switch	Knife SIM to A-1520	7V 6H	1.0 1.0	.75V 1.0H	R-09161-CL	3.5V 3.5H	Certified	4.15
116	Test Switch	Knife SIM to A-1518	7V 6H	1.0 1.0	.75V 1.0H	R-09161-CL	3.5V 3.5H	Certified	4.15

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TABLE 1
SEISMIC EVALUATION OF GROUP 1 RESALE COMPONENTS
BUS 2A04 (I-T-E ITEM B)

B/M Pc. No.	Device Description	Device Model or Catalog Number	Reference Accelerometers		Reqd. Accel. "g" Level	Device Documentation		Device Comments	
			No. — Dir.	Amp		Test Report Reference No.	Avail. "g" Level	Certification	Cert. Notes
117	Test Switch	Knife SIM to A-1458	7V 10H	1.0 1.6	.75V 1.6H	R-09161-CL	3.5V 3.5H	Certified	4.15
118	Test Switch	Knife SIM to A-1458	7V 10H	1.0 1.6	.75V 1.6H	R-09161-CL	3.5V 3.5H	Certified	4.15
119	Test Switch	Knife SIM to A-2206	7V 10H	1.0 1.6	.75V 1.6H	R-09161-CL	3.5V 3.5H	Certified	4.15
120	Test Switch	Knife A-1559	7V 10H	1.0 1.6	.75V 1.6H	R-09161-CL	3.5V 3.5H	Certified	4.15
121	Test Switch	Knife SIM to A-1513	7V 6H	1.0 1.0	.75V 1.0H	R-09161-CL	3.5V 3.5H	Certified	4.15
122	Test Switch	Knife SIM to A-1512	7V 6H	1.0 1.0	.75V 1.0H	R-09161-CL	3.5V 3.5H	Certified	4.15
123	Test Switch	Knife A-1453	7V 10H	1.0 1.6	.75V 1.6H	R-09161-CL	3.5V 3.5H	Certified	4.15
124	Test Switch	Knife A-1533	7V 6H	1.0 1.0	.75V 1.0H	R-09161-CL	3.5V 3.5H	Certified	4.15
126	Time Delay Relay	7000 7012 PCLL	7V 10H	1.0 1.6	.75V 1.6H	R-09161-DZ	2.4V 2.4H	Certified	4.2
127	Push Button Switch	H32 H32BF1W(2)H32XNC	7V 6H	1.0 1.0	.75V 1.0H	R-09161-DS	5.0V 5.0H	Certified	4.15
128	Auxiliary Relay	HMA 12HMA11B6	7V 10H	1.0 1.6	.75V 1.6H	G.E. CERT.LET.7-29-75	3.5V 3.7H	Certified	4.11
129	Time Delay Relay	7000 7024PC	7V 10H	1.0 1.6	.75V 1.6H	R-09161-DY	2.2V 2.2H	Certified	4.2

302-2-112-1

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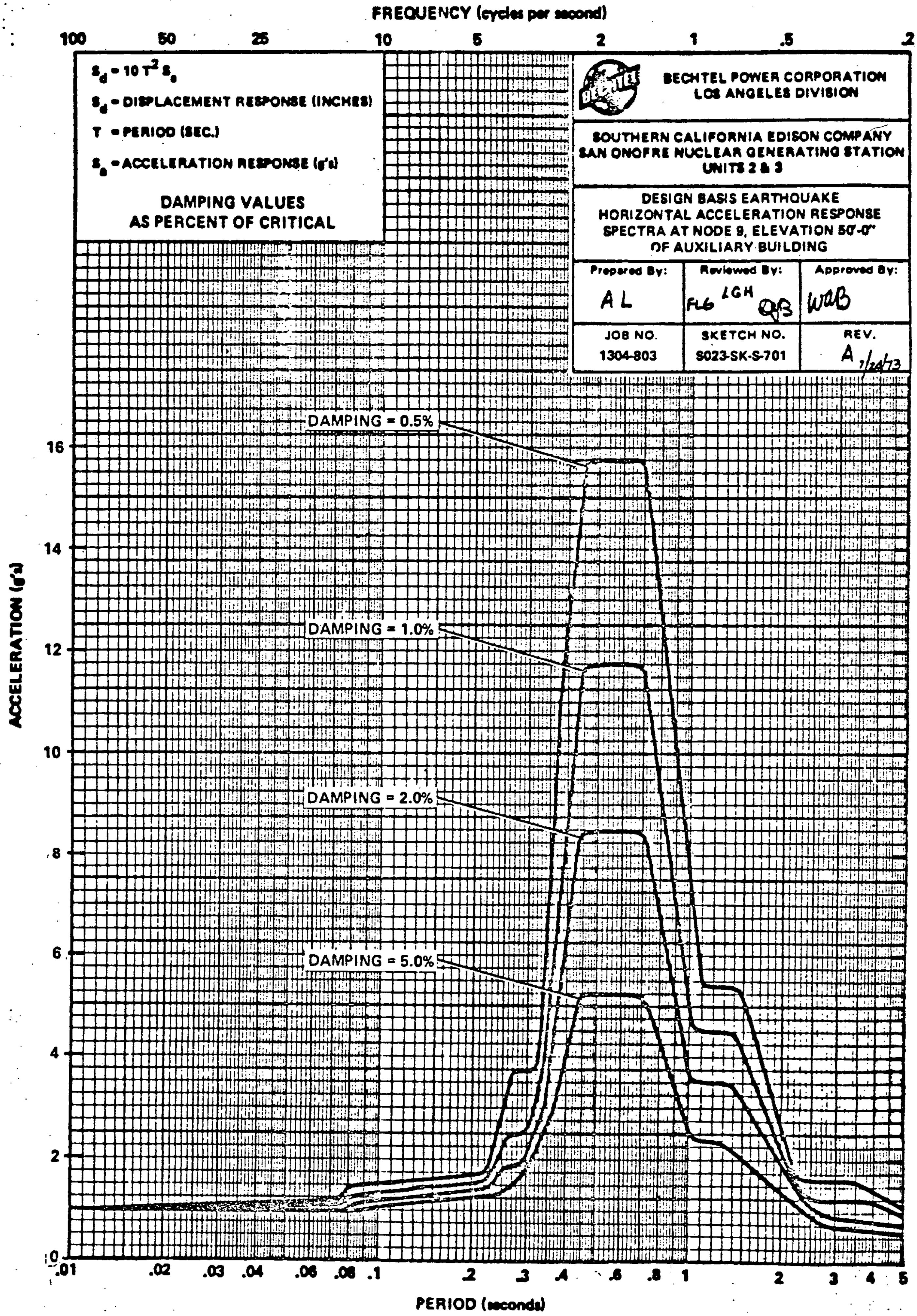
302-2-112-1

TABLE 1
SEISMIC EVALUATION OF GROUP 1 RESALE COMPONENTS
BUS 2A04 (I-T-E ITEM B)

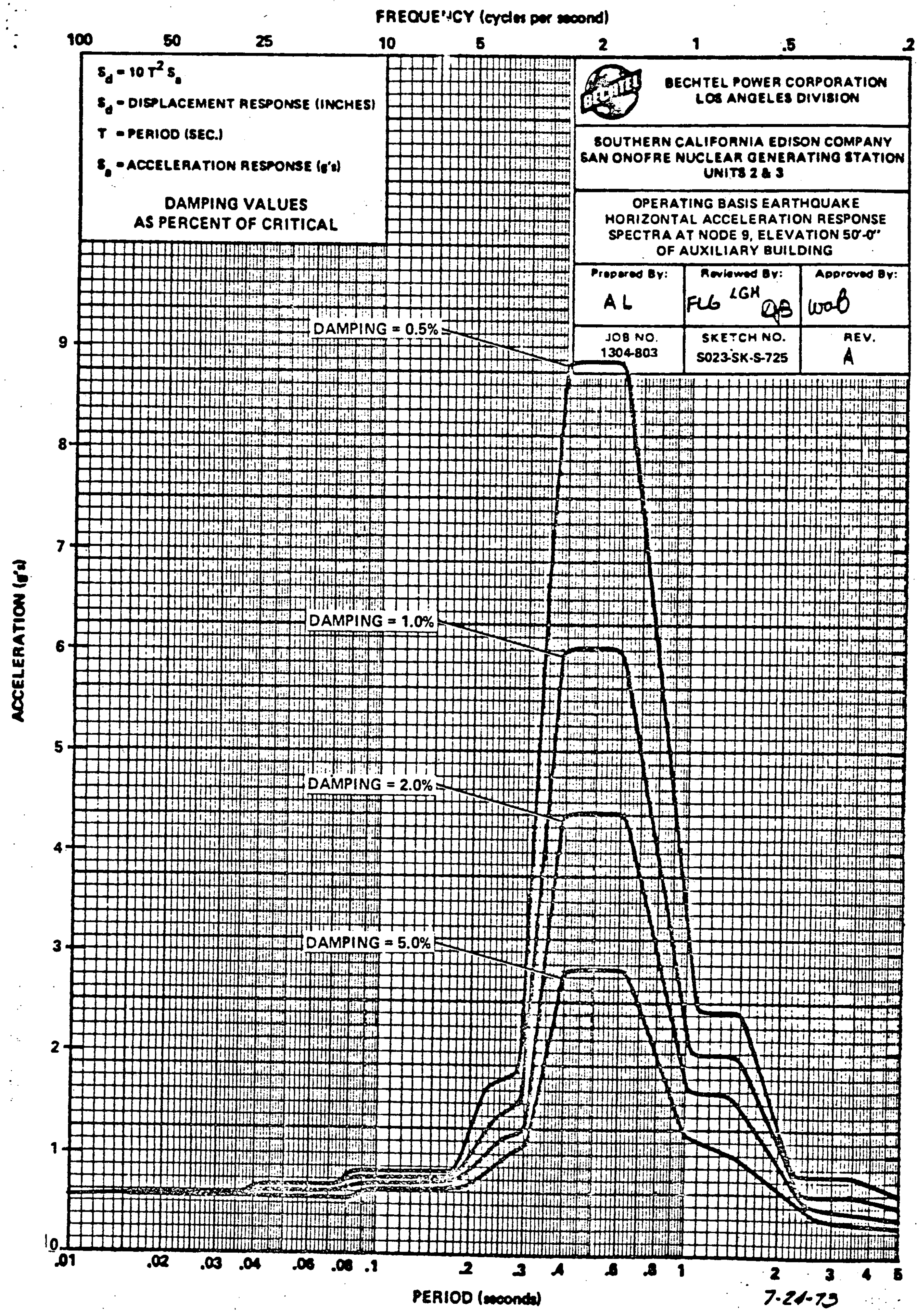
B/M Pc. No.	Device Description	Device Model or Catalog Number	Reference Accelerometers		Reqd. Accel. "g" Level	Device Documentation		Device Comments	
			No. – Dir.	Amp		Test Report Reference No.	Avail. "g" Level	Certification	Cert. Notes
130	Auxiliary Relay	HFA 12HFA51A42H	7V 10H	1.0 1.6	.75V 1.6H	Test Program 42686-1	1.5V 2.5H	Certified	4.15
131	Auxiliary Relay	HFA 12HFA51A42H	7V 10H	1.0 1.6	.75V 1.6H	Test Program 42686-1	1.5V 2.5H	Certified	4.15
132	Time Delay Relay	7000 7012 PCL	7V 10H	1.0 1.6	.75V 1.6H	R-09161-DZ	2.4V 2.4H	Certified	4.2
133	Time Delay Relay	7000 7032 PDC	7V 10H	1.0 1.6	.75V 1.6H	R-09161-EA	2.8V 2.8H	Certified	4.2
113	Auxiliary Relay	HFA 12HFA51A49H	7V 10H	1.0 1.6	.75V 1.6H	Test Program 42686-1	1.5H 2.5H	Certified	4.15
	NO ENTRY								
	NO ENTRY								
	NO ENTRY								
	NO ENTRY								
	NO ENTRY								
	NO ENTRY								
	NO ENTRY								

Appendix "B"

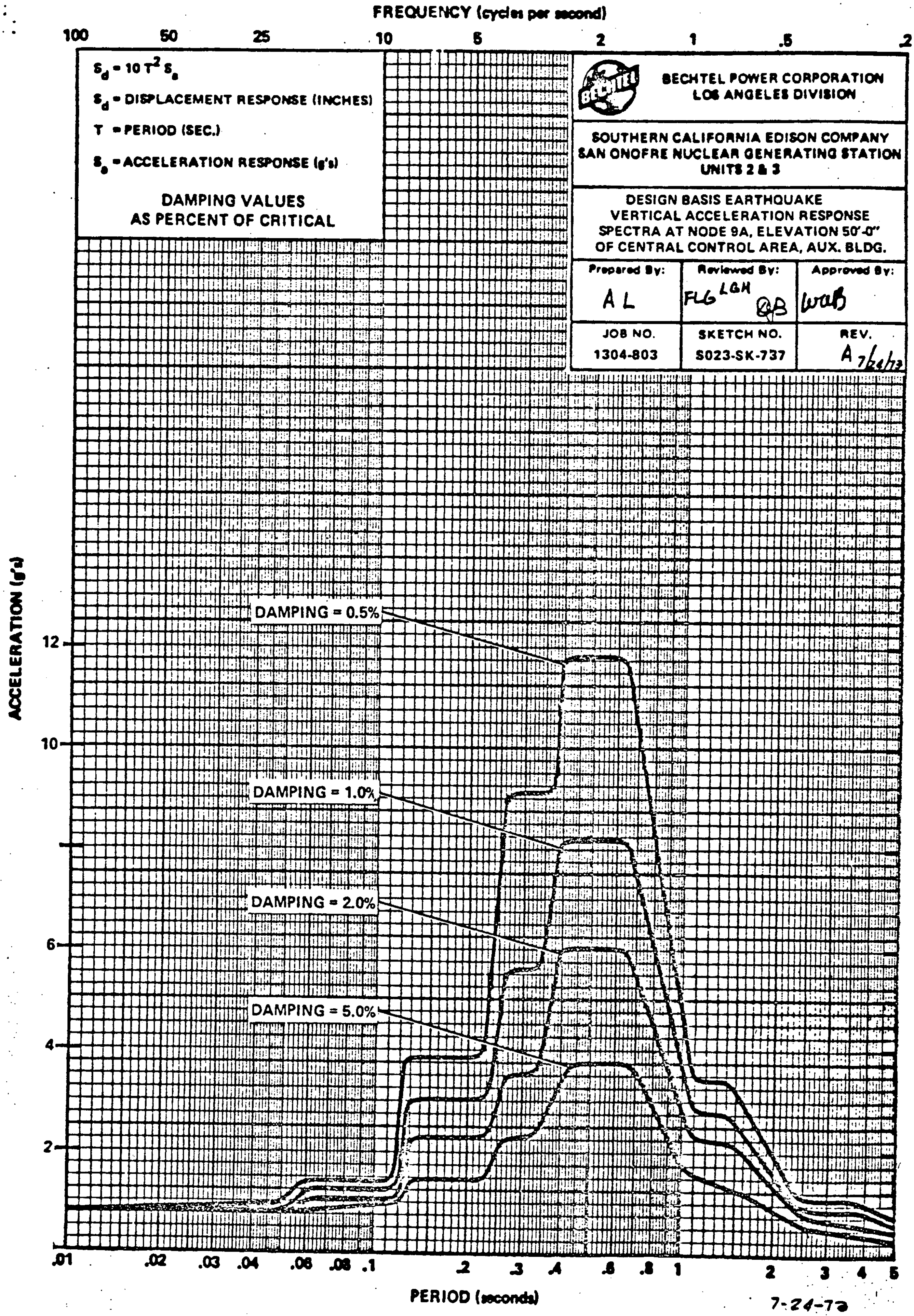
Appendix "C"



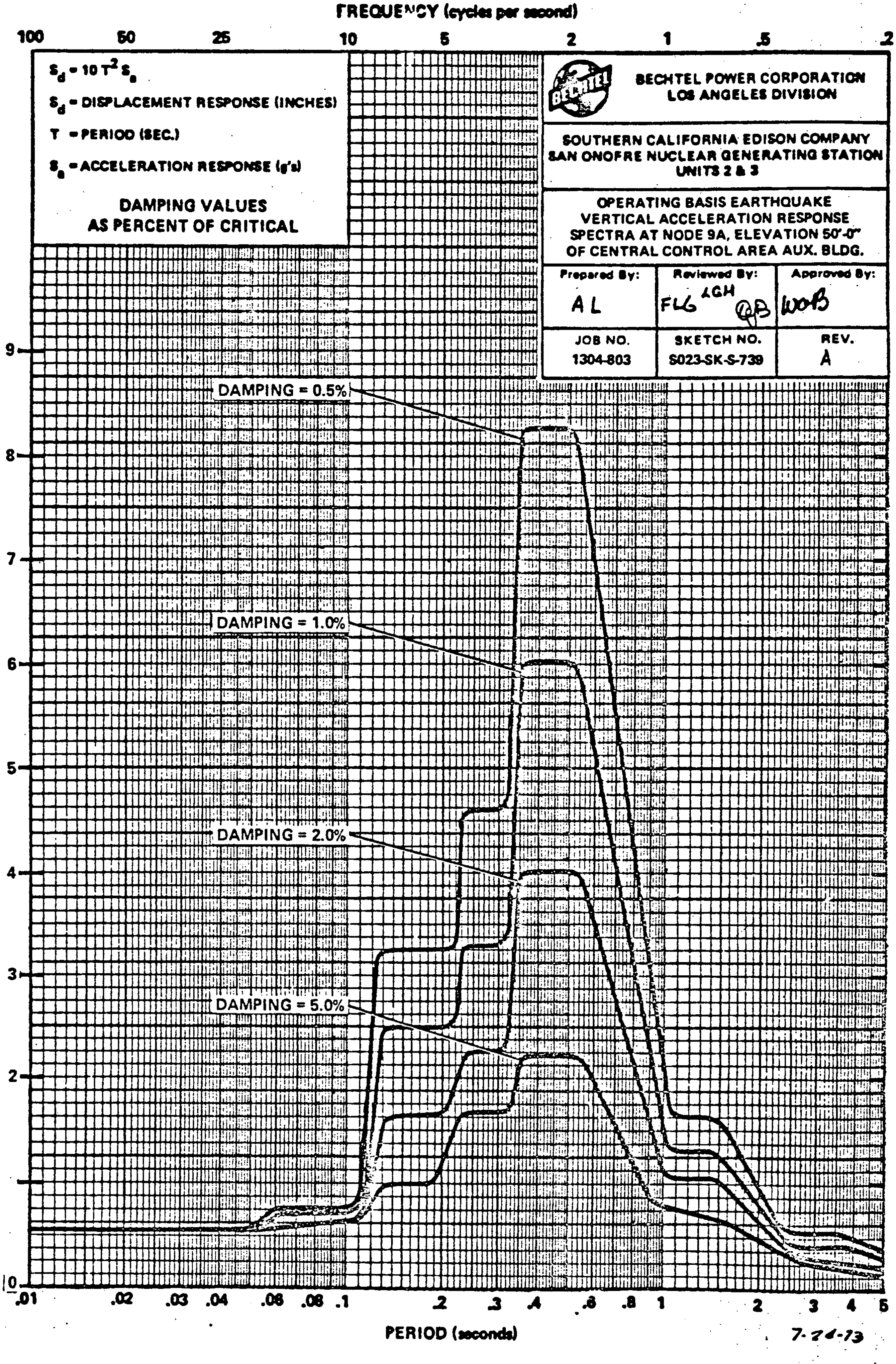
FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA AT NODE 9, ELEVATION 50'-0"
OF AUXILIARY BUILDING
Prepared By: AL
Reviewed By: FLG LGH QB
Approved By: WAB
JOB NO. 1304-803
SKETCH NO. S023-SK-S-701
REV. A 7/24/73
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
16
14
12
10
8
6
4
2
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)



FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
OPERATING BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA AT NODE 9, ELEVATION 50'-0"
OF AUXILIARY BUILDING
Prepared By:
A L
Reviewed By:
FLG LGH QB
Approved By:
WOB
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-725
REV.
A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
9
8
7
6
5
4
3
2
1
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)
7-21-75


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA AT NODE 9A, ELEVATION 50'-0"
OF CENTRAL CONTROL AREA, AUX. BLDG.
Prepared By: A L
Reviewed By: FLG LGH QB
Approved By: waB
JOB NO. 1304-803
SKETCH NO. S023-SK-737
REV. A 7/24/73
ACCELERATION (g's)
12
10
6
4
2
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

7-24-73


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
OPERATING BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA AT NODE 9A, ELEVATION 50'-0"
OF CENTRAL CONTROL AREA AUX. BLDG.
Prepared By:
AL
Reviewed By:
FLG
LGH
QB
Approved By:
WOB
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-739
REV.
A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
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8
7
6
5
4
3
2
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)
7-24-73

appendix "D"

Figure 1

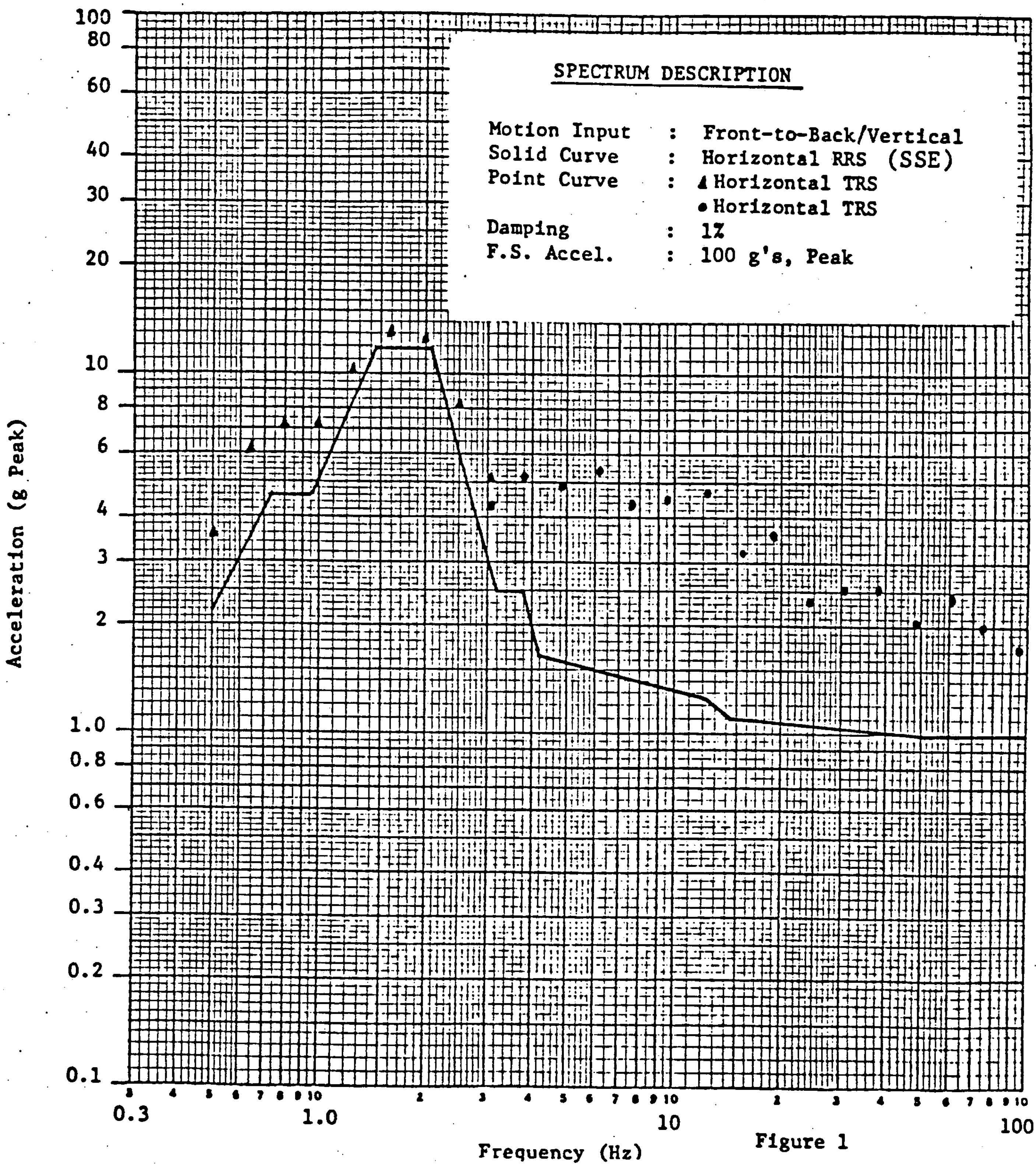


Figure 1

Comparison of customer's Horizontal RRS to the Front-to-Back TRS of the 5HK test specimen

Figure 2

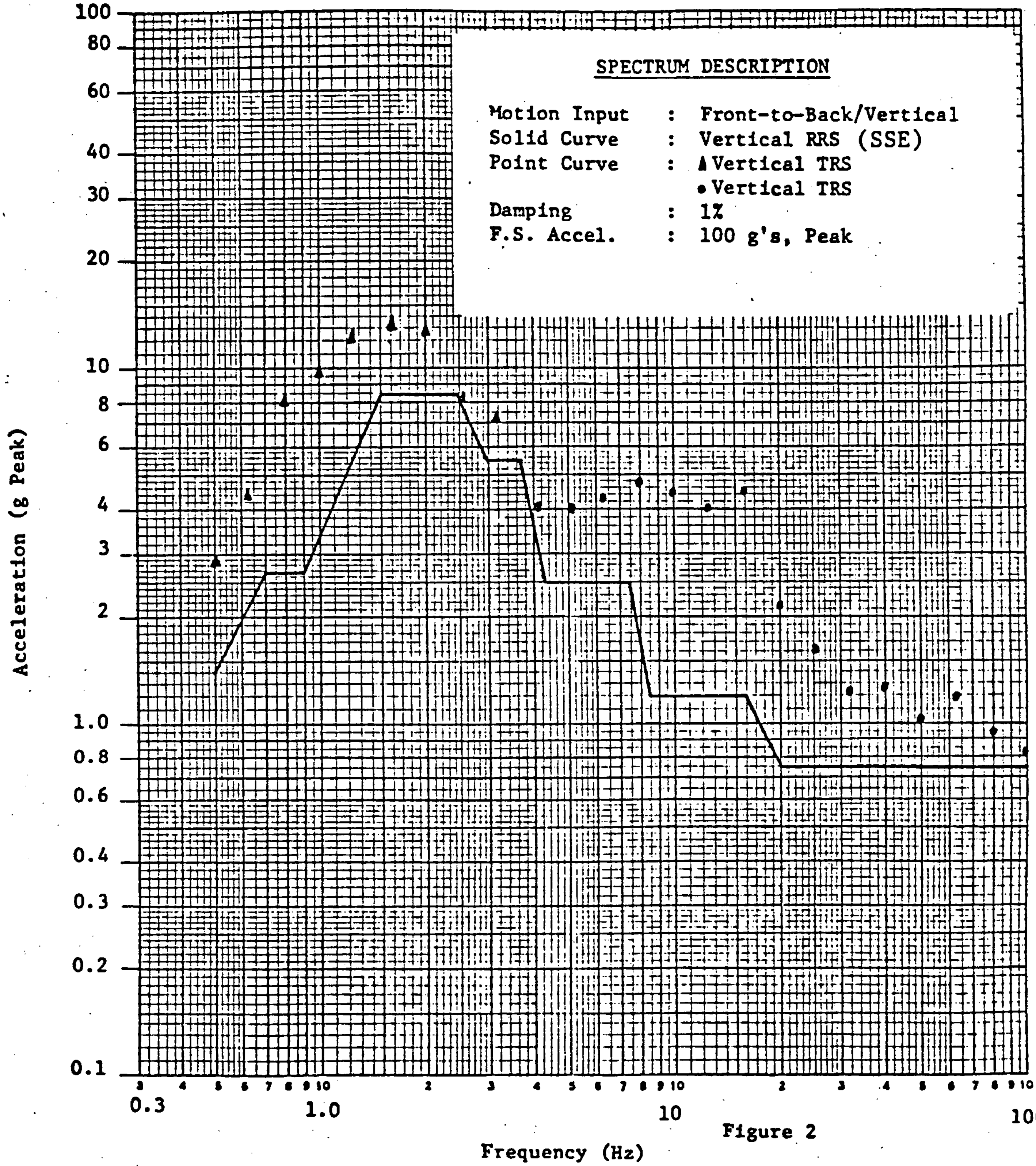


Figure 2

Comparison of customer's Vertical RRS to the Vertical TRS of the 5HK test specimen

Figure 3

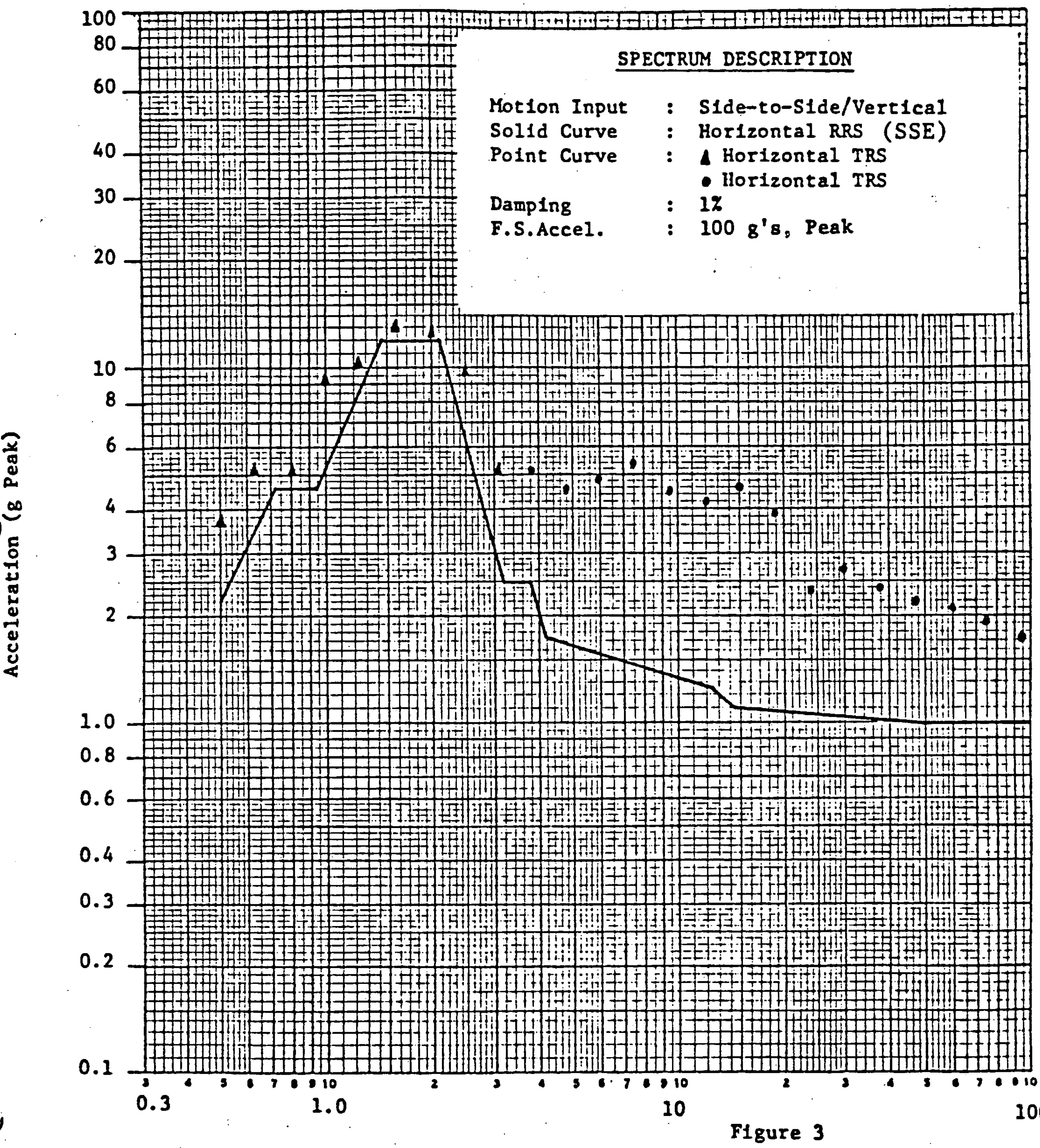
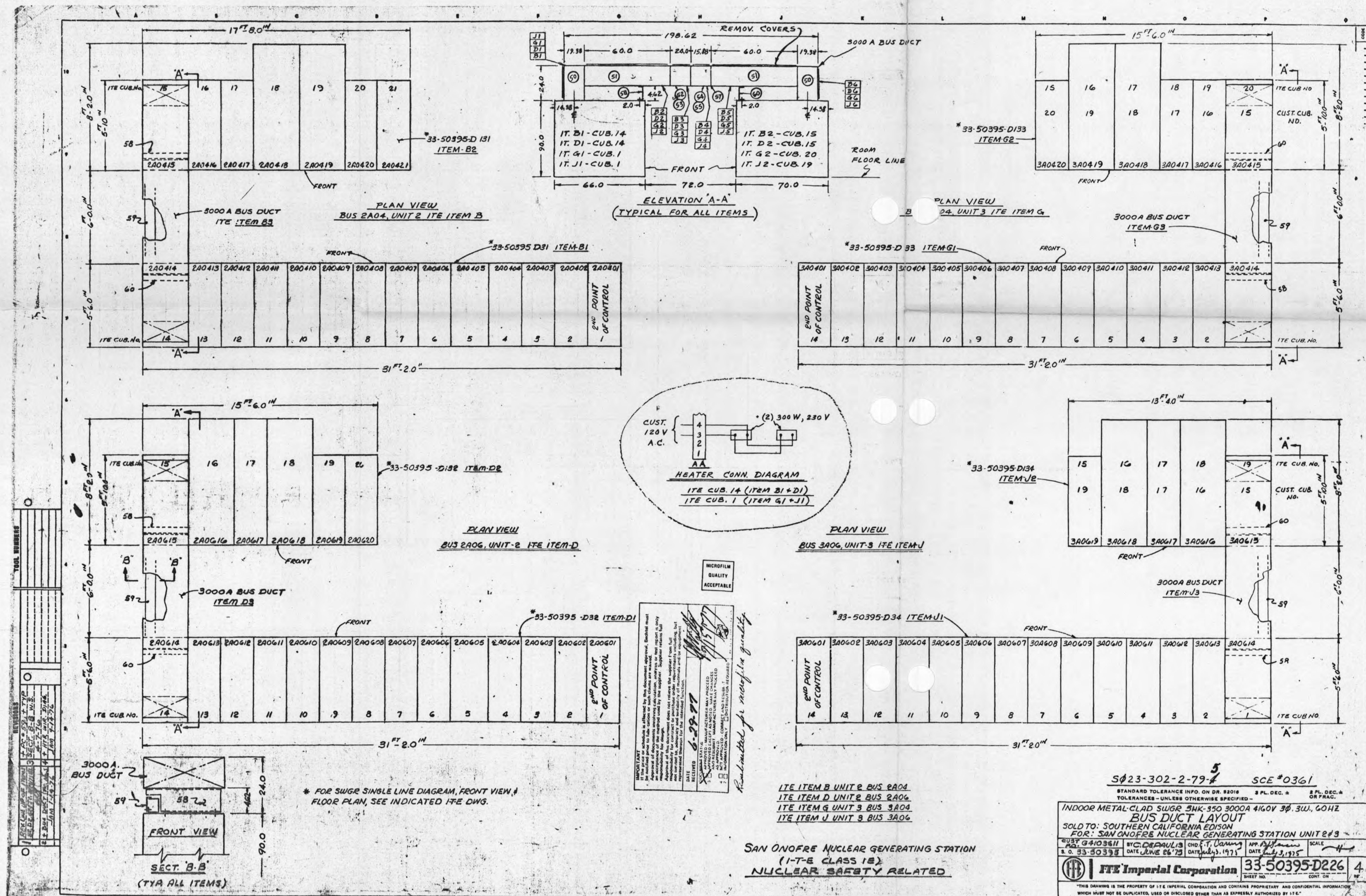


Figure 3

Comparison of the customer's Horizontal RRS to the Side-to-Side TRS of the 5HK test specimen

79

302-2-112-1



* FOR SWGR SINGLE LINE DIAGRAM, FRONT VIEW, & FLOOR PLAN, SEE INDICATED I-T-E DWG.

ITE ITEM B UNIT 2 BUS 2A04
ITE ITEM D UNIT 2 BUS 2A06
ITE ITEM G UNIT 3 BUS 3A04
ITE ITEM J UNIT 3 BUS 3A06

SAN ONOFRE NUCLEAR GENERATING STATION
(I-T-E CLASS 1E)
NUCLEAR SAFETY RELATED

S023-302-2-79-5 SCE #0361

STANDARD TOLERANCE INFO. ON DR. 52016
TOLERANCES - UNLESS OTHERWISE SPECIFIED

INDOOR METAL-CLAD SWGR 5HK-350 3000A 4160V 3Ø. 3W., 60HZ
BUS DUCT LAYOUT
SOLD TO: SOUTHERN CALIFORNIA EDISON
FOR: SAN ONOFRE NUCLEAR GENERATING STATION UNIT 2 & 3

CUST. P.O. G4103611 | BY C. DEPAUL | DATE JUNE 26 '75
S.O. 33-50395

I-T-E Imperial Corporation 33-50395-D226 4

"THIS DRAWING IS THE PROPERTY OF I-T-E IMPERIAL CORPORATION AND CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION WHICH MUST NOT BE DUPLICATED, USED OR DISCLOSED OTHER THAN AS EXPRESSLY AUTHORIZED BY I-T-E."

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR ____

II. Component Name: 480V Class IE Motor Control Center

1. Scope: [ ] NSSS [X] BOP
2. Model Number: Model 4 MCC — Quantity: 14
3. Vendor: Square "D"
4. If the component is a cabinet or panel, name and model No. of the devices included: See Appendix "A"
5. Physical Description a. Appearance See Appendix "B"
   b. Dimensions See Appendix "B"
   c. Weight See Appendix "B"
6. Location: Building: Control Area (Auxiliary Bldg)
   Elevation: 50'-0"
7. Field Mounting Conditions [ ] Bolt (No.____, Size____)
   [X] Weld (Length 2-1/2" on 10" center)
   [ ] ____
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
   S/S: 7, 18, 21Hz — F/B: 26HZ — V: 32Hz
9. a. Functional Description: Supplies 480V A.C. Power to Class 1E Motor Rated 50 H.P. & Lower
   b. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
   [X] Both
10. Pertinent Reference Design Specifications: SO23-302-4-2

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

IV. Equipment Qualification Method: Test: ____________

Analysis: ____________

Combination of Test and Analysis: X

Test and/or Analysis by Wyle Lab. 43220-1
Bechtel Log S023-302-4-2-55-3
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ____________

5. [ ] Combination of ____________

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS [ ] N/A (other, specify)

2. Required Response Spectra (attach the graphs); See Appendix "C"

3. Required Acceleration in Each Direction:

S/S = 1g F/B = 1g V = 1g

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)
*In each horizontal direction with vertical

4. Frequency Range: 1-35Hz

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[X] No**
See Appendix "D"

6. Input g-level Test at S/S = 3.2g F/B = 2.8g V = 1.6g

**TRS exceeds RRS above 4 Hz and at all natrual frequencies.

7. Laboratory Mounting:

   1. [ ] Bolt (No.____, Size____) [X] Weld(Length Tack-welded) [ ] ________
      (Length not provided in report)

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

9. Test Results including modifications made: The relay section door came open during exploratory search test in the F/B axis due to misalignment of the fastener screws. The mounting holes were relocated and the exploratory search test repeated without problems.

10. Other tests performed (such as fragility test, including results):

    Component Functional Test

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

1. Description of Test including Results: ________

2. Method of Analysis:

   [ ] Static Analysis [ ] Equivalent Static Analysis

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

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: ________ Basis for the damping used: ________

7. Support Considerations in the model: ________

8. Critical Structural Elements:

A.

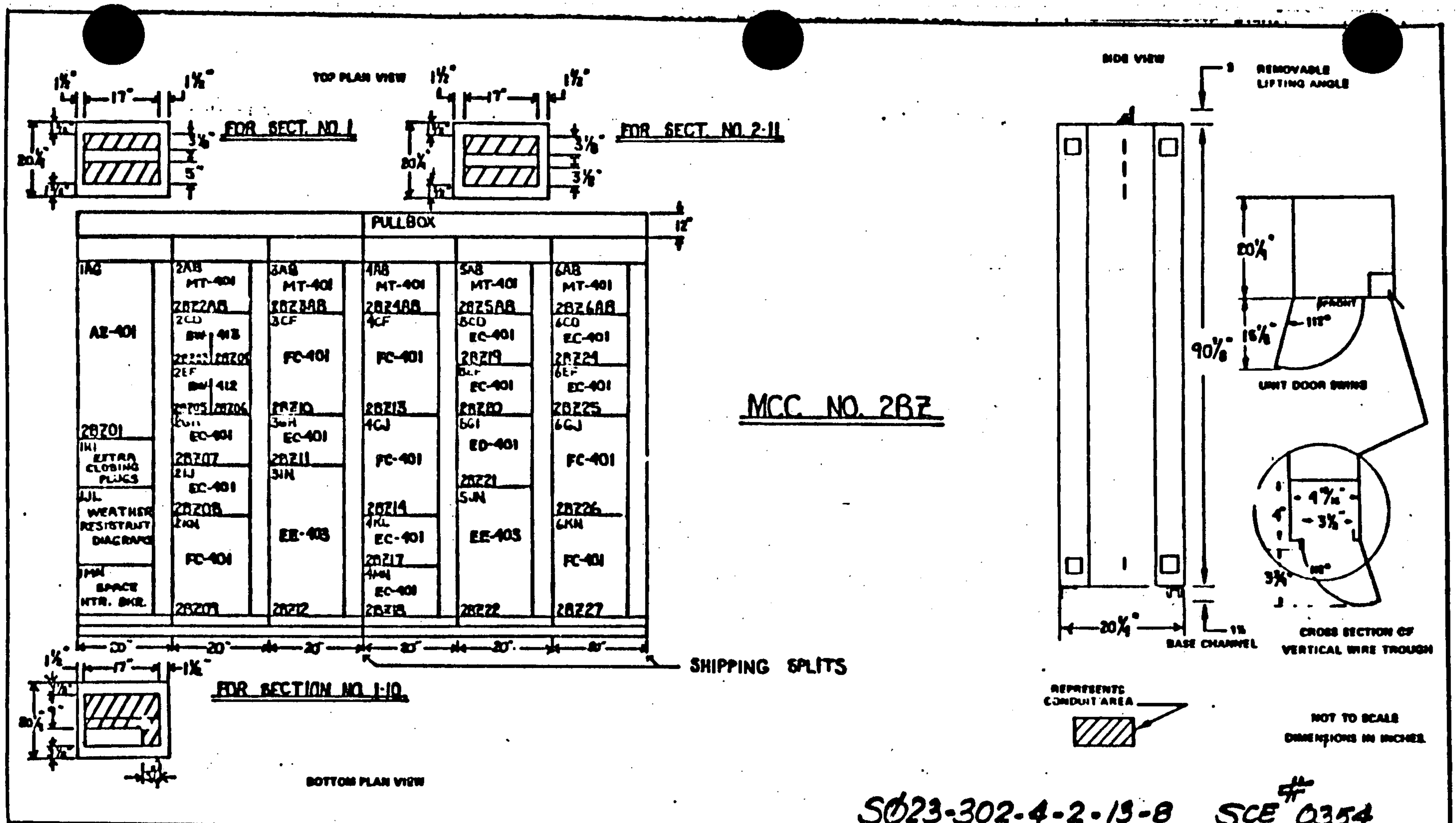
Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Deflection	Location	Effect Upon Functional Operability

APPENDIX "A"

APPENDIX "B"



SØ23-302-4-2-19-8 SCE # 0354

MODEL 4 MOTOR CONTROL CENTER	CLASS 8999		
NEMA WIRING CLASS II	TYPE B	ENCLOSURE NEMA: 2	
POWER SUPPLY DATA	480 VOLTS 3 PHASE 3 WIRES 60 HERTZ 120 CONTROL VOLTS		
	SUPPLY ENTERS SECTION(S): 1 ■ TOP □ BOTTOM		
	■ INCOMING CABLE (LUG) SIZE: 750 MCM NUMBER PER PHASE 2		
	□ INCOMING "I LINE" FLANGED END - CATALOG NUMBER:		
	■ GROUND (LUG) SIZE: #4-250 MCM □ NEUTRAL (LUG) SIZE		
BUS DATA	HORIZONTAL BUS 600 AMPERES PER PHASE TIN PLTD. CU.		
	VERTICAL BUS 300 AMPERES PER PHASE TIN PLTD. CU.		
	□ NEUTRAL, UNGROUNDED, 3 PHASE, 4 WIRE, HORIZONTAL ONLY AMPERES		
	BRACED FOR 42,000 RMS SYMMETRICAL AMPS		
	■ HORIZONTAL GROUND BUS: 600A COPPER (1) ¼" × 1½" BUS BARS		
	□ VERTICAL GROUND BUS		

SHIPPING DATA	65 HIGH 28 DEEP 96 WIDE 1900 WEIGHT
UNITS MOUNTED	■ FRONT OF BOARD ONLY [ ] BACK TO BACK
TERMINALS MOUNTED	■ IN UNIT [ ] IN VERTICAL WIRE TROUGH
TERMINAL TYPE	■ TRACK MOUNTED [ ] PULL APART
□ STANDARD PAINT SPECIFICATIONS	ANSI 49
■ SPECIAL FINISH	STRUCTURE AND UNIT DOORS TO BE ANSI 61. UNIT SADDLES TO BE YELLOW
MATERIALS	ALL STRUCTURAL PARTS, UNITS, DOORS AND COVERS ARE OF CODE GAUGE STEEL
REMARKS	SEE INTERCONNECTION DIA. 12-02690-8A3. SEE B12-02690-8A1 FOR ALL SPL. FEATURES.
CUSTOMER	SOUTHERN CALIFORNIA EDISON CO.
CUSTOMER ORDER NUMBER	J4103542
SQUARE D FACTORY ORDER NUMBERS	12-02690-8

□ APPROVAL ■ RECORDS

JOB TITLE SAN ONOFRE NUCLEAR GEN. STA. UNITS 2-3
JOB LOCATION SAN ONOFRE, CALIFORNIA
ARCH-ENGR S.C. EDISON / BECHTEL
ELECTRICAL CONTRACTOR S.C. EDISON

NO	KEY	REVISIONS	BY	DATE
1		REDRAWN	SJH	2-11-77
0		REDRAWN	MRR	10-26-77

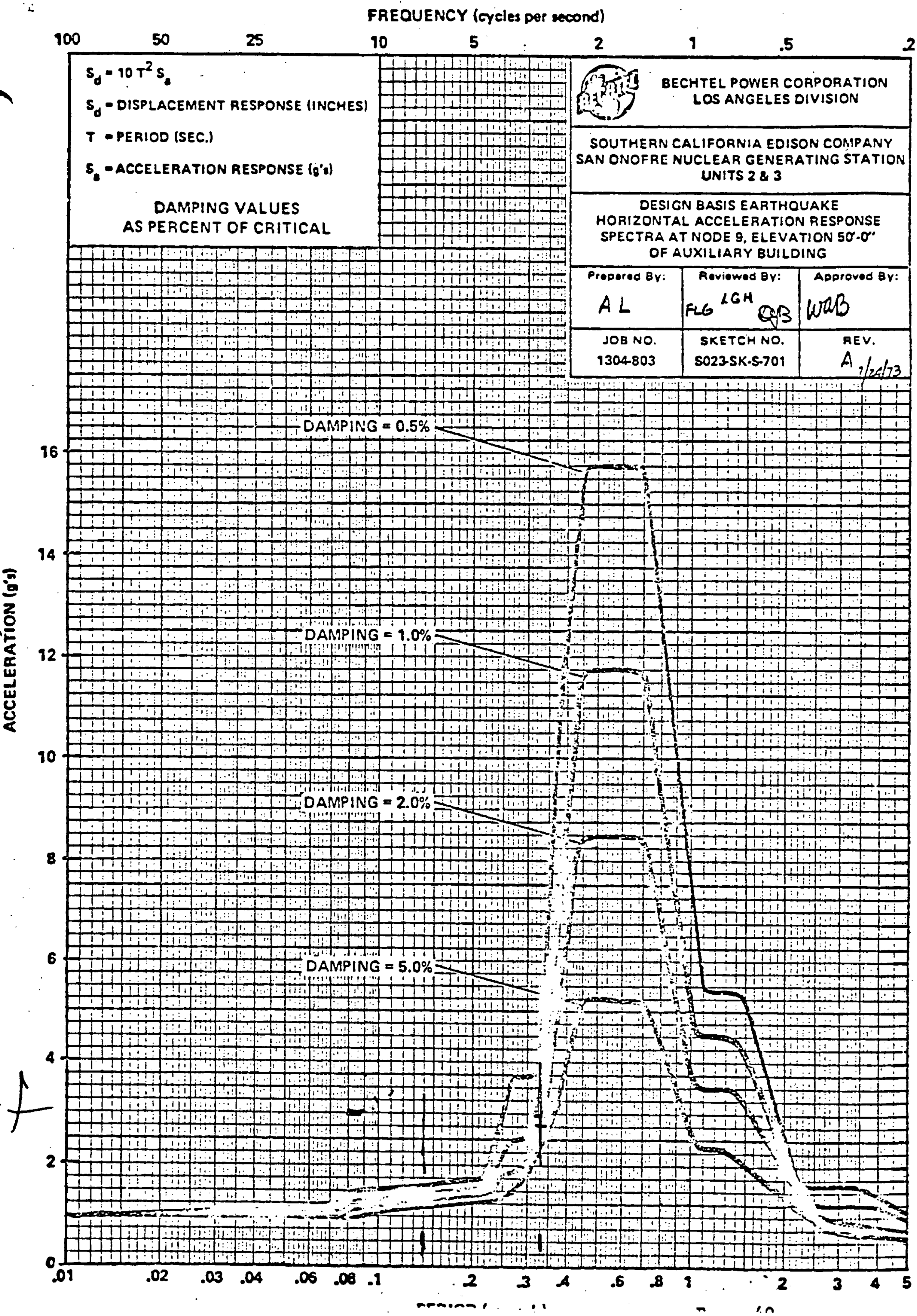
DRAWN	RICHTER
CHECKED	LBH
SCALE	N.T.S.
DATE	10-26-77

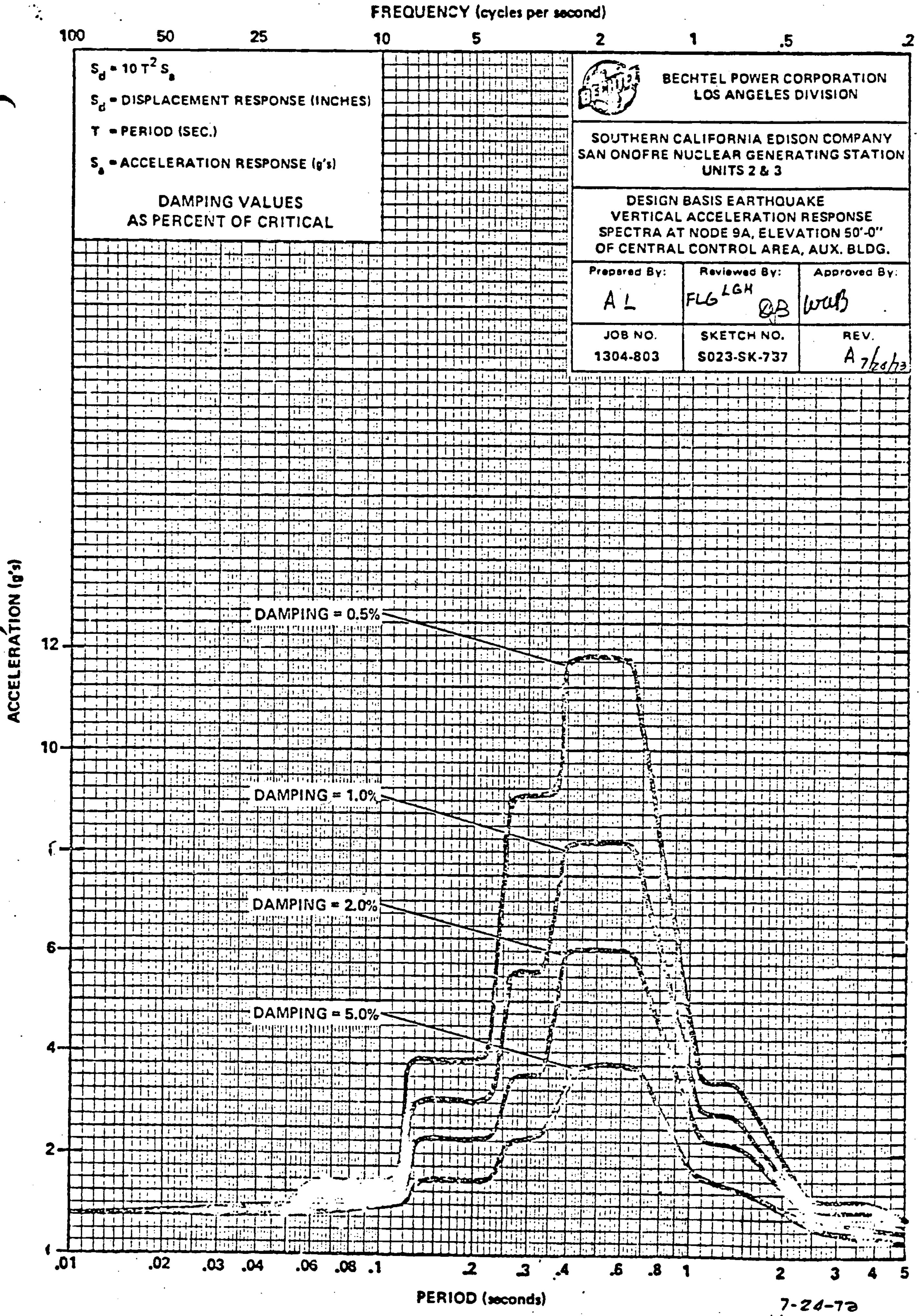
SQUARE D COMPANY
ASSEMBLY GROUP

DWG NO D12-02690-8A1 PG. 1 OF 5

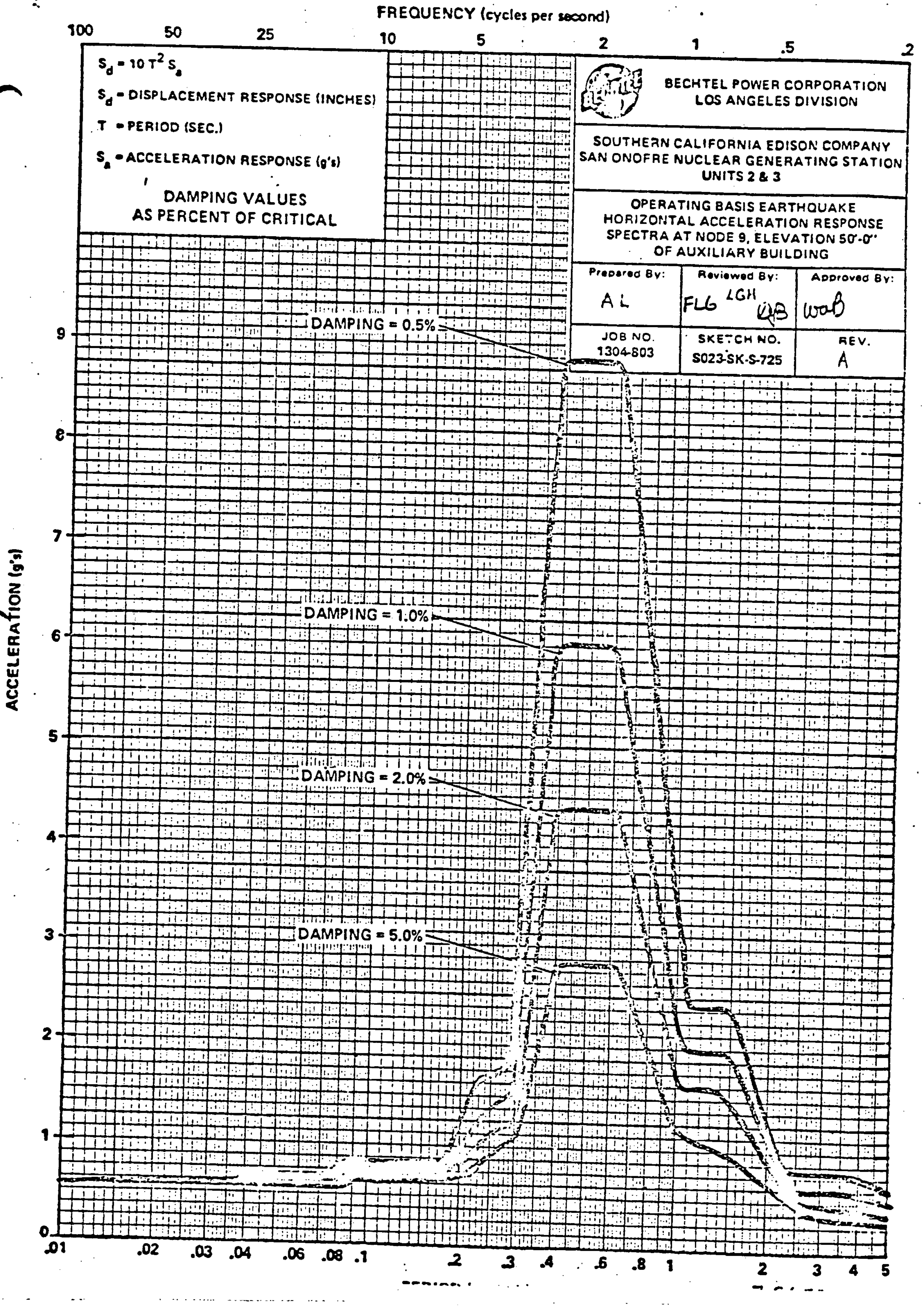
APPENDIX "B"

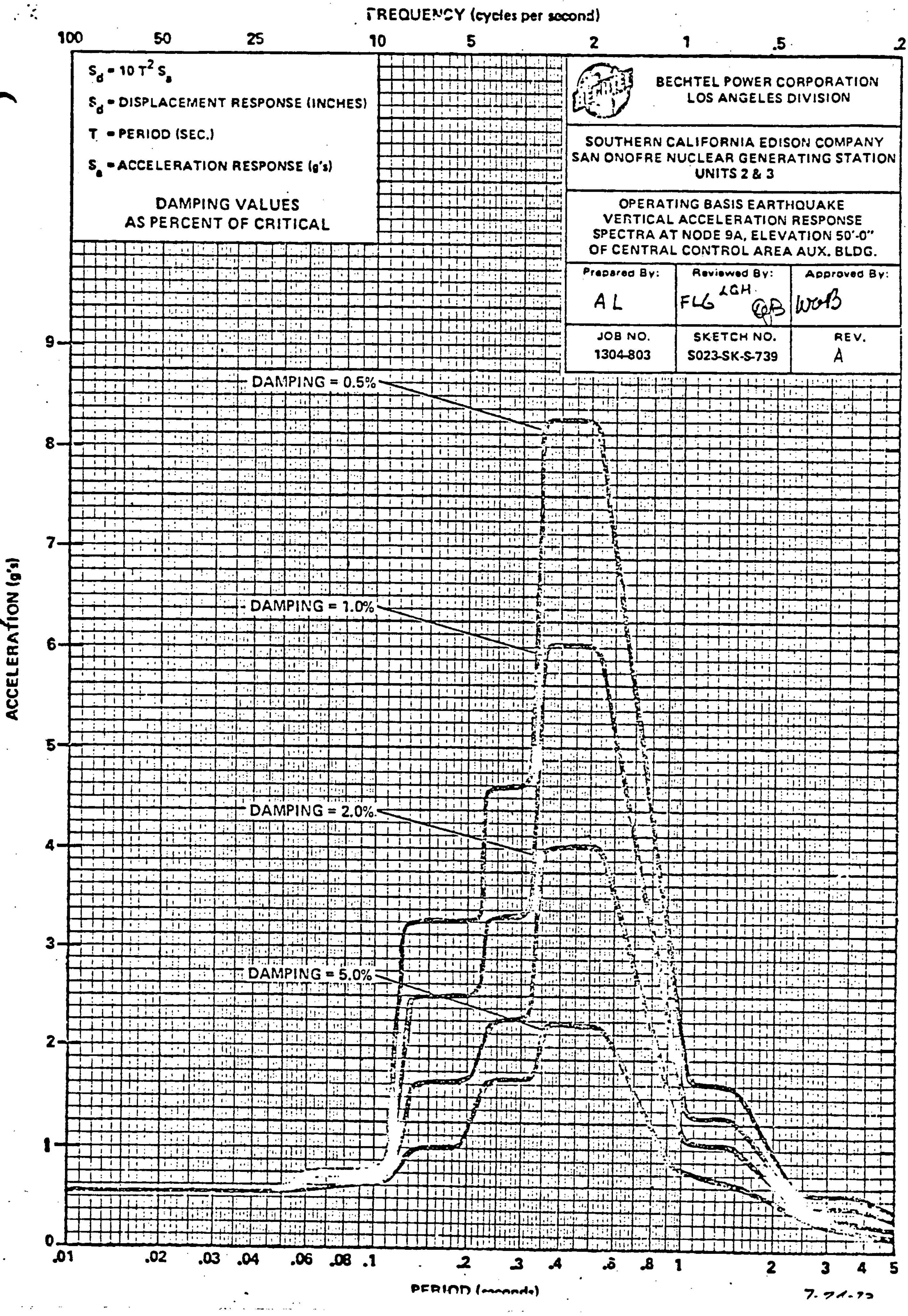
APPENDIX "C"


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA AT NODE 9, ELEVATION 50'-0"
OF AUXILIARY BUILDING
Prepared By: AL
Reviewed By: FLG LGH
Approved By: WAB
JOB NO. 1304-803
SKETCH NO. S023-SK-S-701
REV. A 7/24/73
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
16
14
12
10
8
6
4
2
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA AT NODE 9A, ELEVATION 50'-0"
OF CENTRAL CONTROL AREA, AUX. BLDG.
Prepared By: A L
Reviewed By: FLG LGH QB
Approved By: WAB
JOB NO. 1304-803
SKETCH NO. S023-SK-737
REV. A 7/20/73
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
12
10
6
4
2
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

7-24-73


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
OPERATING BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA AT NODE 9, ELEVATION 50'-0"
OF AUXILIARY BUILDING
Prepared By:
AL
Reviewed By:
FLG LGH
Approved By:
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-725
REV.
A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
9
8
7
6
5
4
3
2
1
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
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VERTICAL ACCELERATION RESPONSE
SPECTRA AT NODE 9A, ELEVATION 50'-0"
OF CENTRAL CONTROL AREA AUX. BLDG.
Prepared By: AL
Reviewed By: FLG LGH
Approved By: WOB
JOB NO. 1304-803
SKETCH NO. S023-SK-S-739
REV. A
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DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
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7
6
5
4
3
2
1
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

APPENDIX "D"

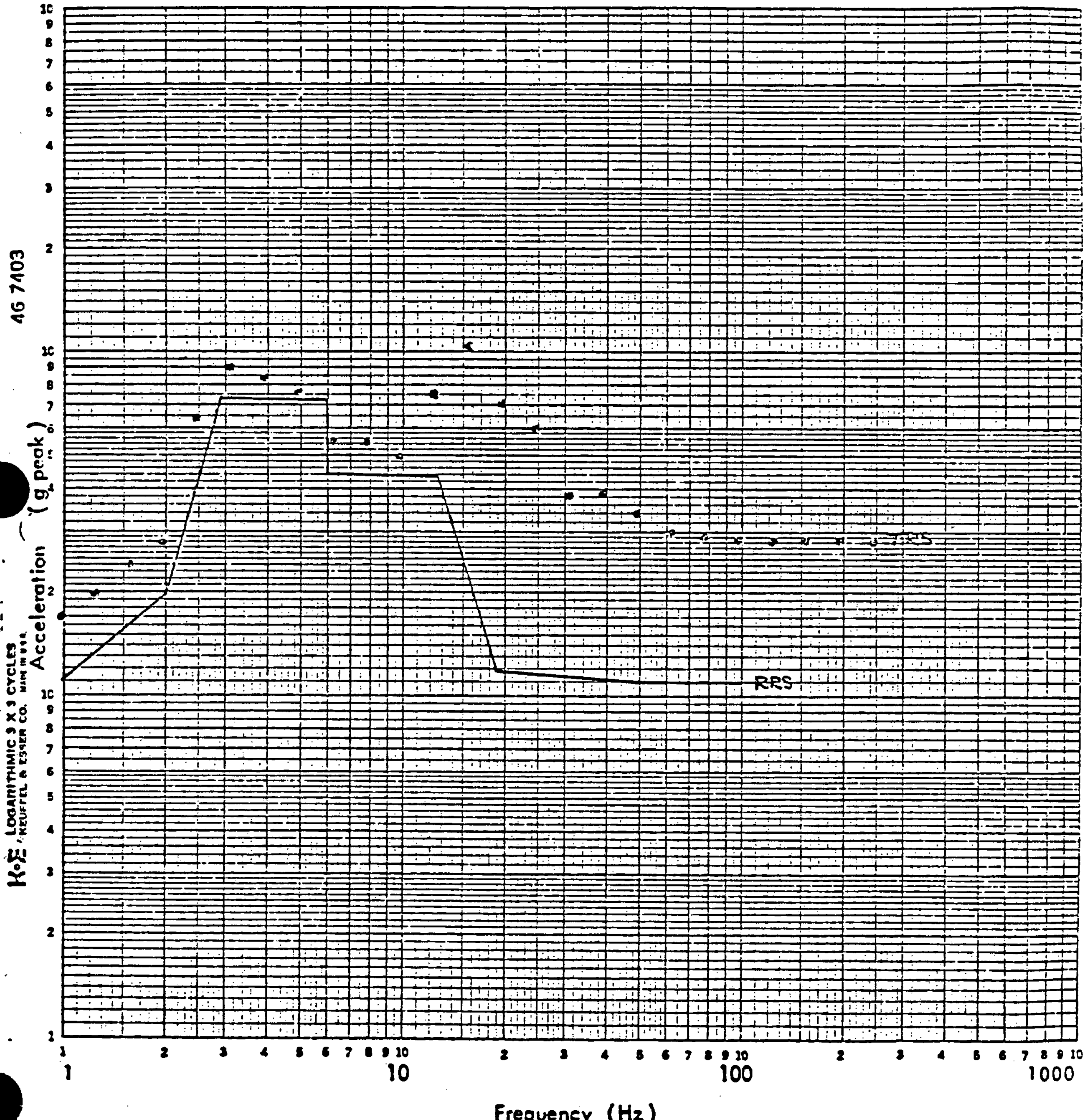
[redacted]

Report No. 43220-1

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING $\boxed{1\%}$



AXIS FB/V

LOCATION NO. HCA

TEST RUN NO. 14

FULL SCALE SHOCK SPECTRUM (g Peak)

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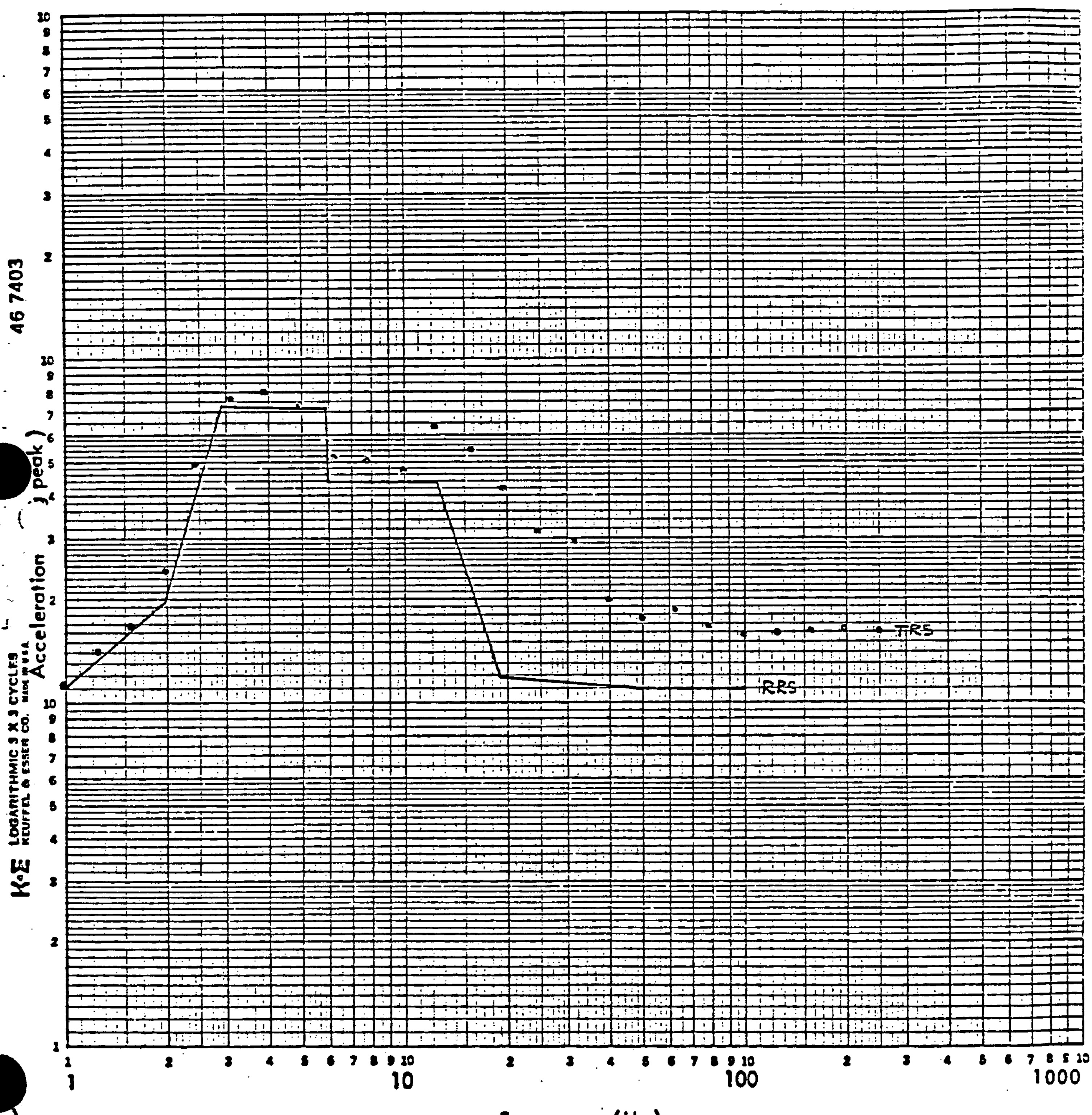
DAMPING 1 %



AXIS F-B & V

LOCATION NO. VCA

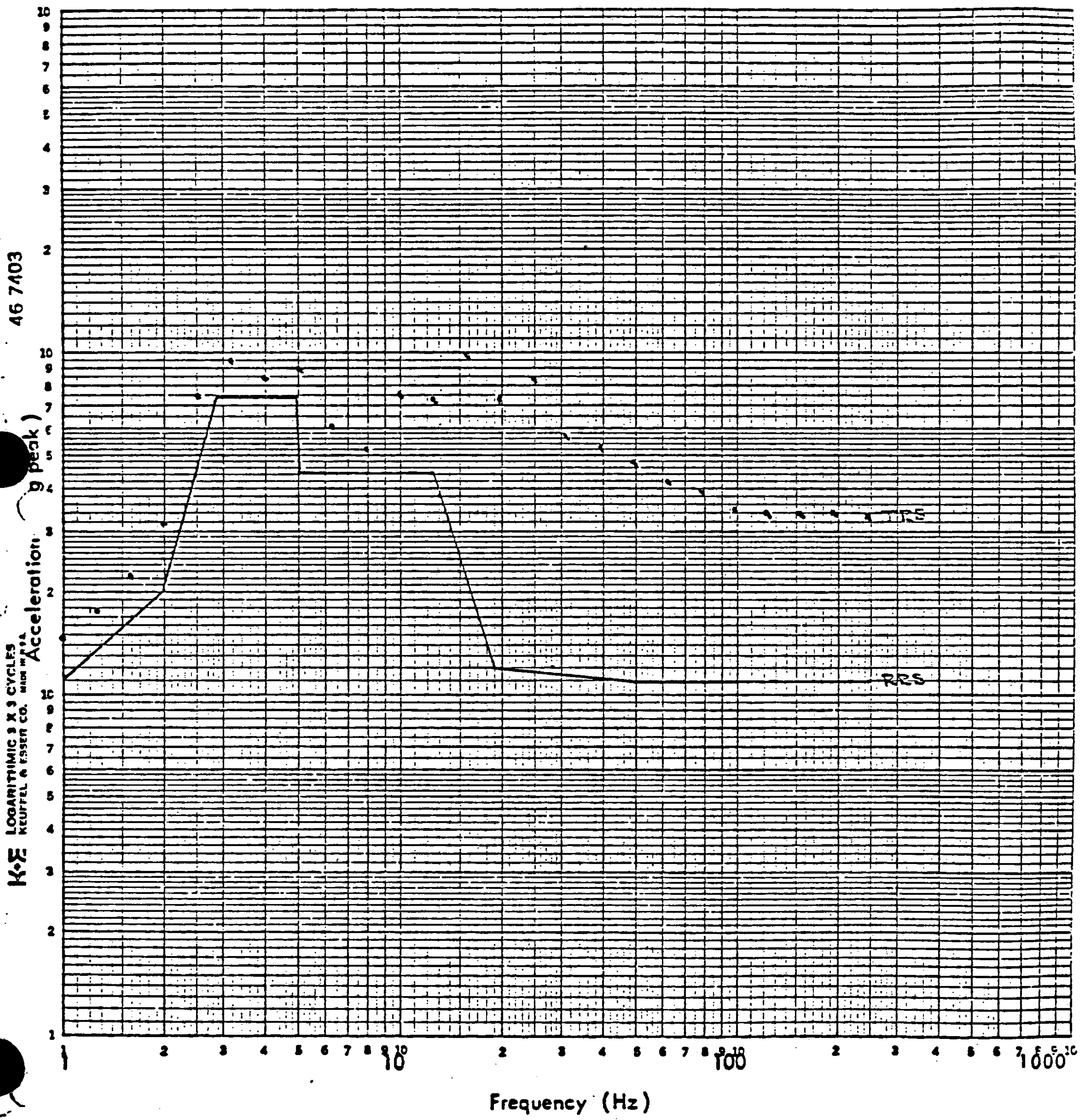
TEST RUN NO. 14

[redacted]

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING $\boxed{1\ \%}$



AXIS SS/V

LOCATION NO. HCA

TEST RUN NO. 44

[redacted]
Report No. 43220-1

FULL SCALE SHOCK SPECTRUM (g Peak)

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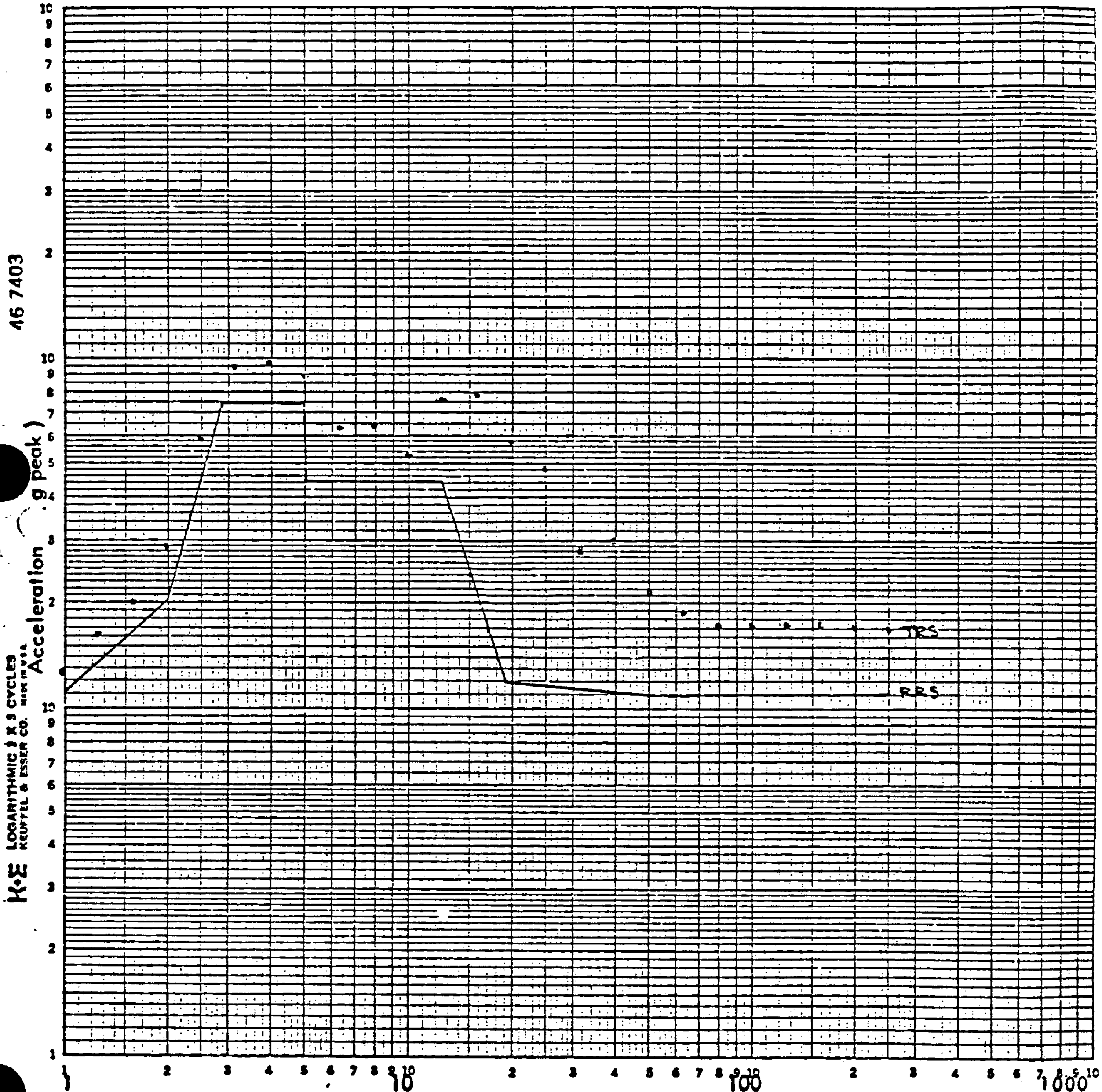
DAMPING [1 %]



Frequency (Hz)

AXIS SS/V

LOCATION NO. VCR

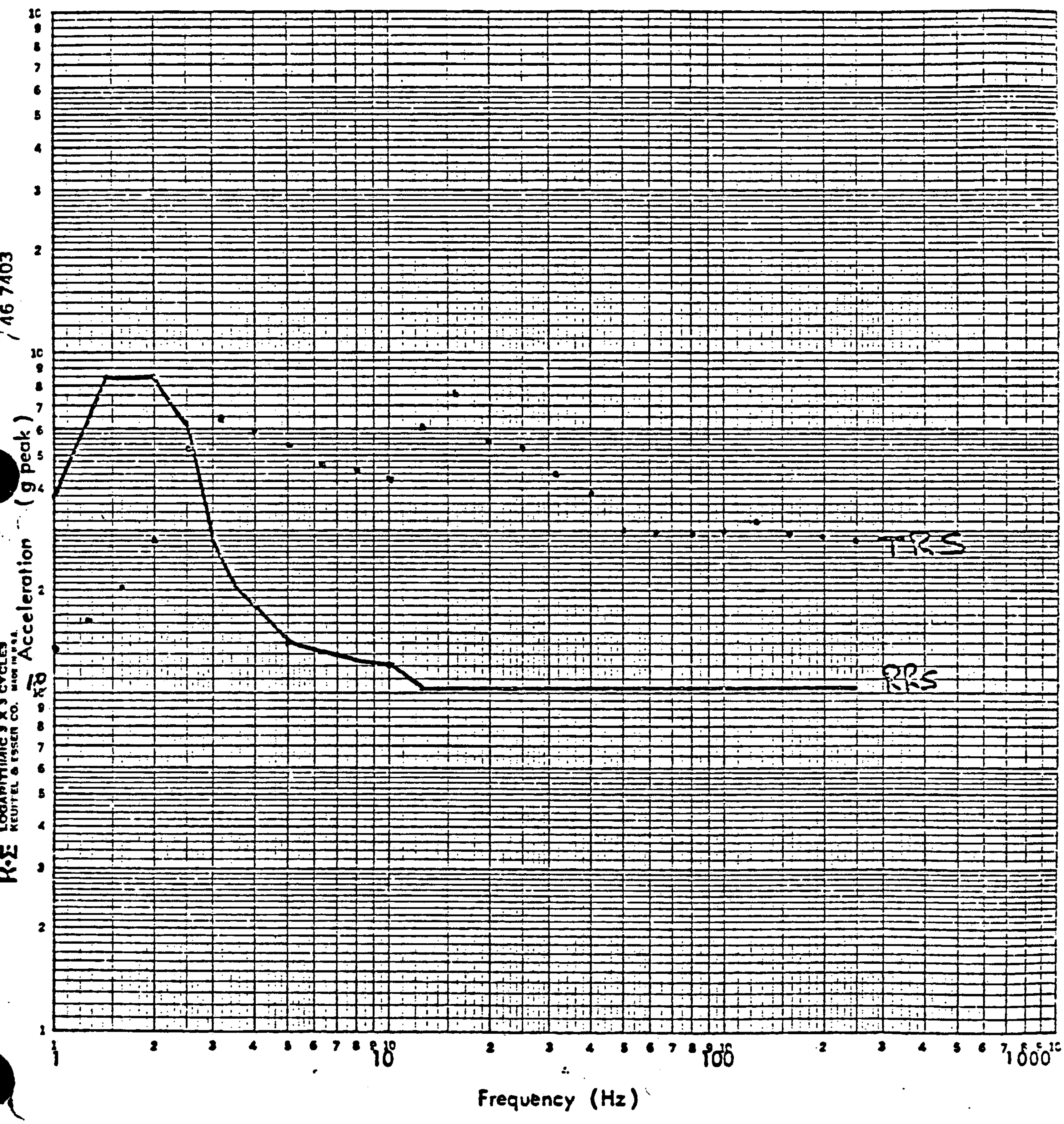
TEST RUN NO. 44

[redacted]
Report No. 43220-1

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING [2 %]



AXIS FB/V

LOCATION NO. HCA

TEST RUN NO. 14

FULL SCALE SHOCK SPECTRUM (g Peak)

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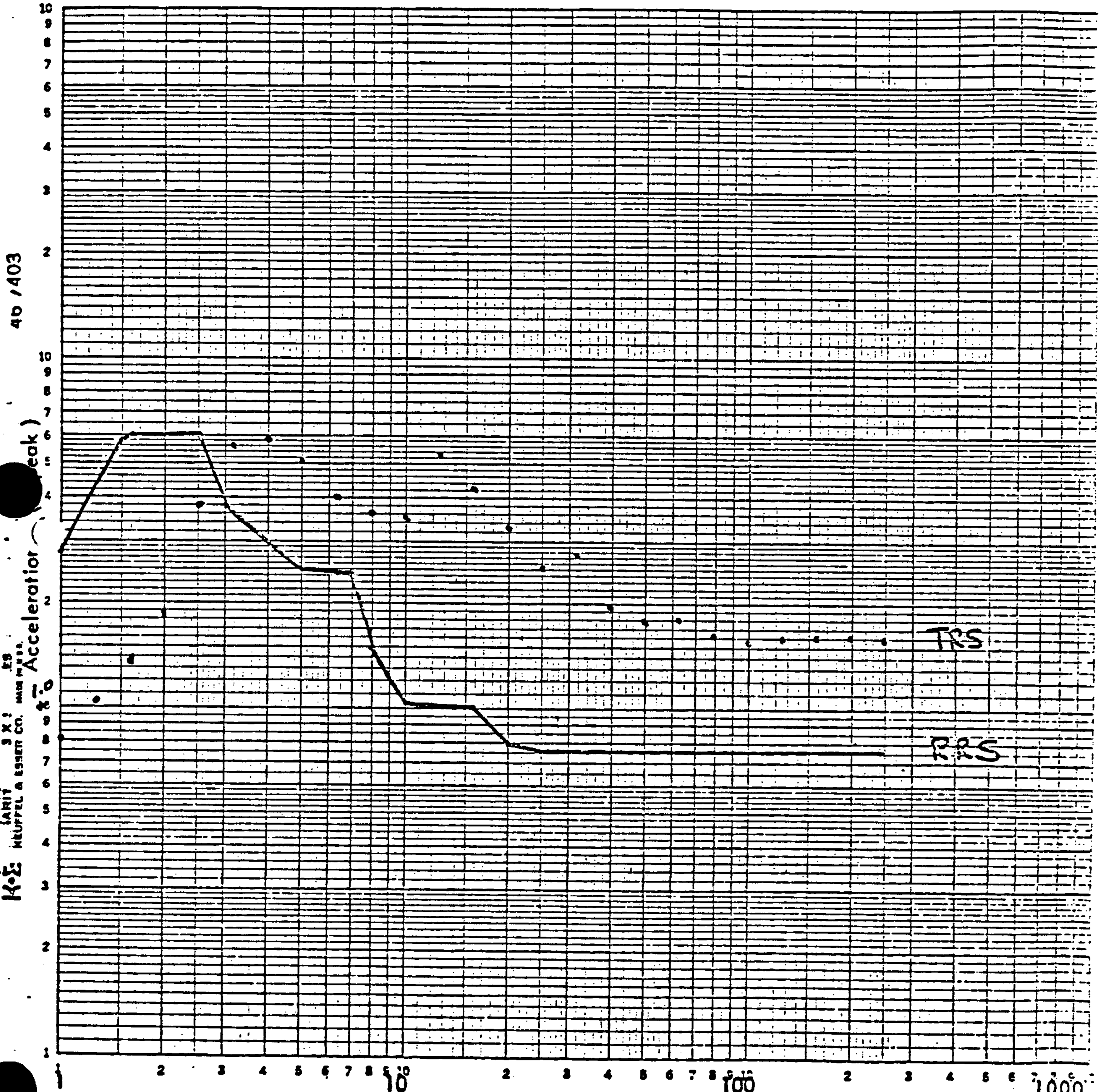
DAMPING 2 %



AXIS FB/V

LOCATION NO. VCA

TEST RUN NO. 14

FULL SCALE SHOCK SPECTRUM (g Peak)

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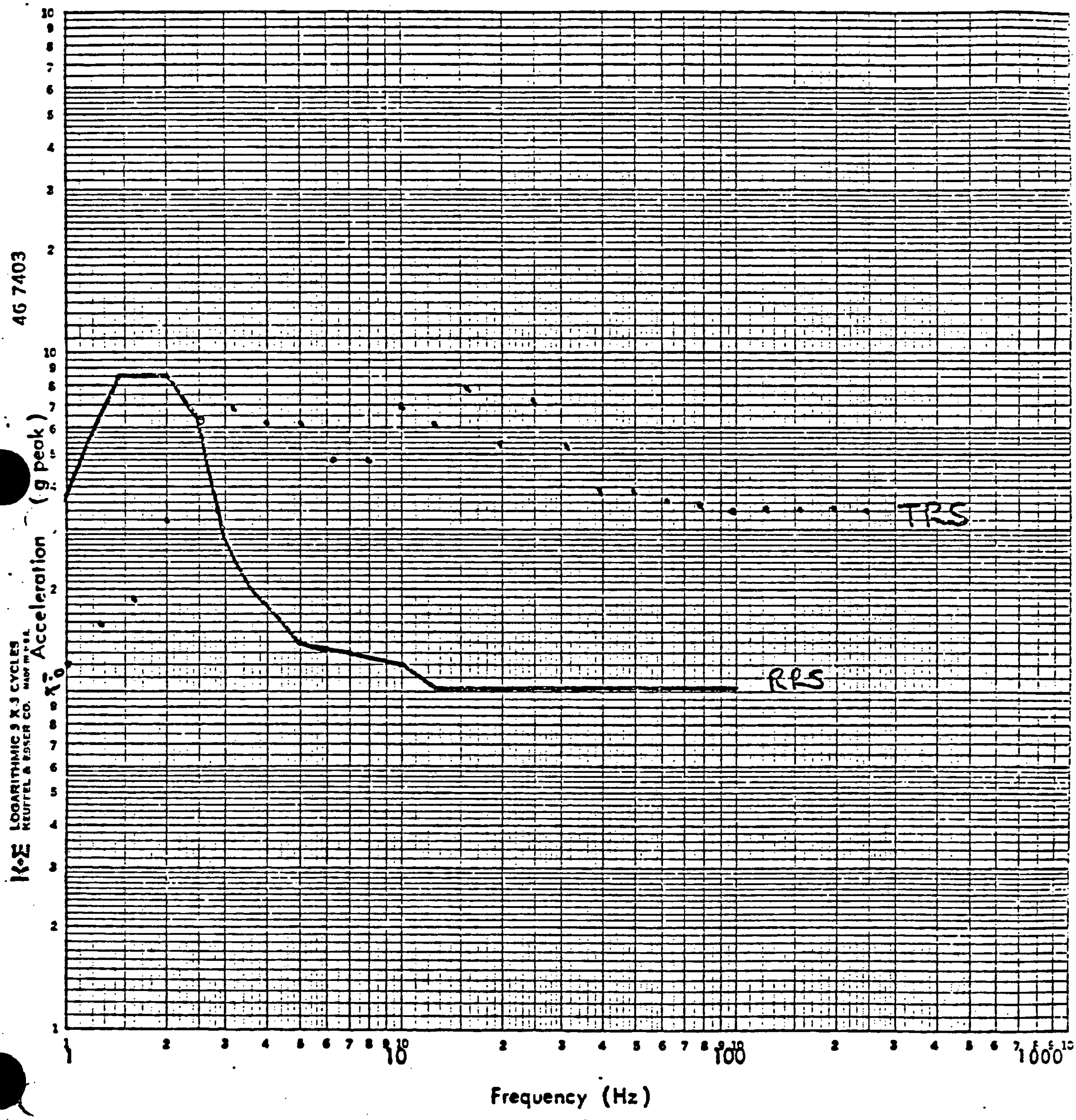
DAMPING $\boxed{2\%}$



AXIS SS/V

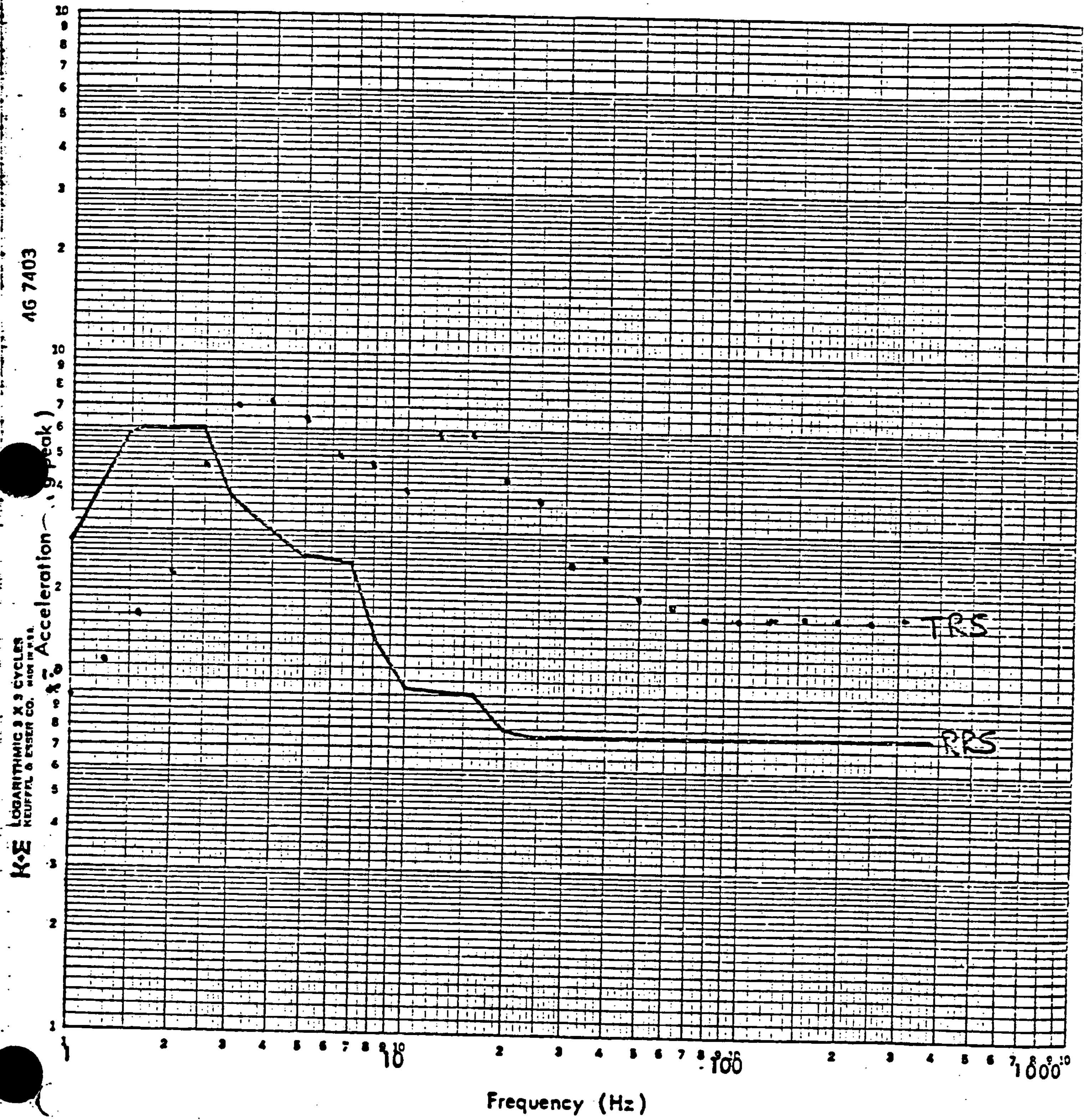
LOCATION NO. HCA

TEST RUN NO. 44

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING $\boxed{2\%}$



AXIS SS/V

LOCATION NO. VCA

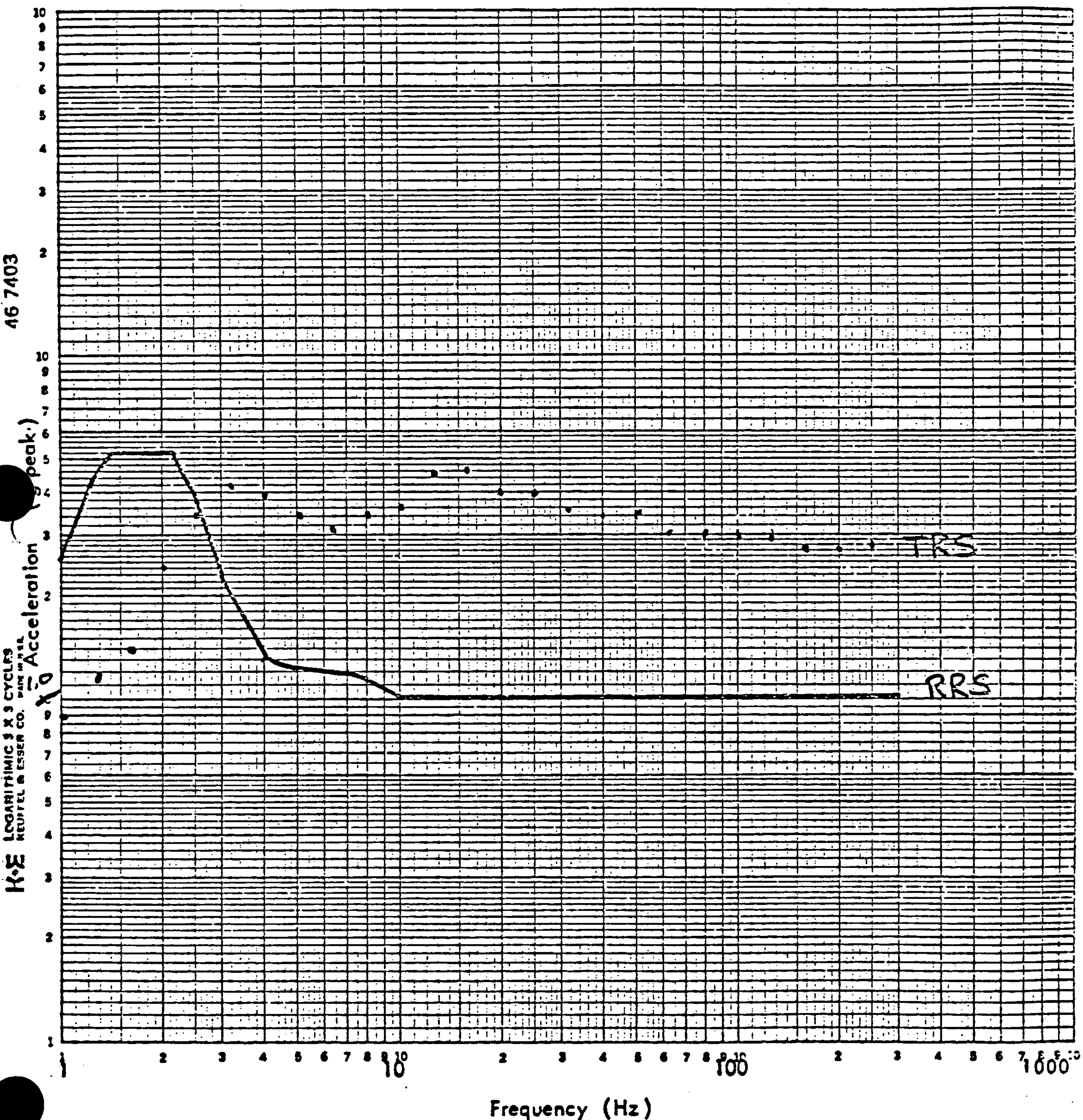
TEST RUN NO. 44

[redacted]
Report No. 43220-1

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING $\boxed{5\%}$



AXIS FB/V

LOCATION NO. HCA

TEST RUN NO. 14

[redacted]

FULL SCALE SHOCK SPECTRUM (g Peak)

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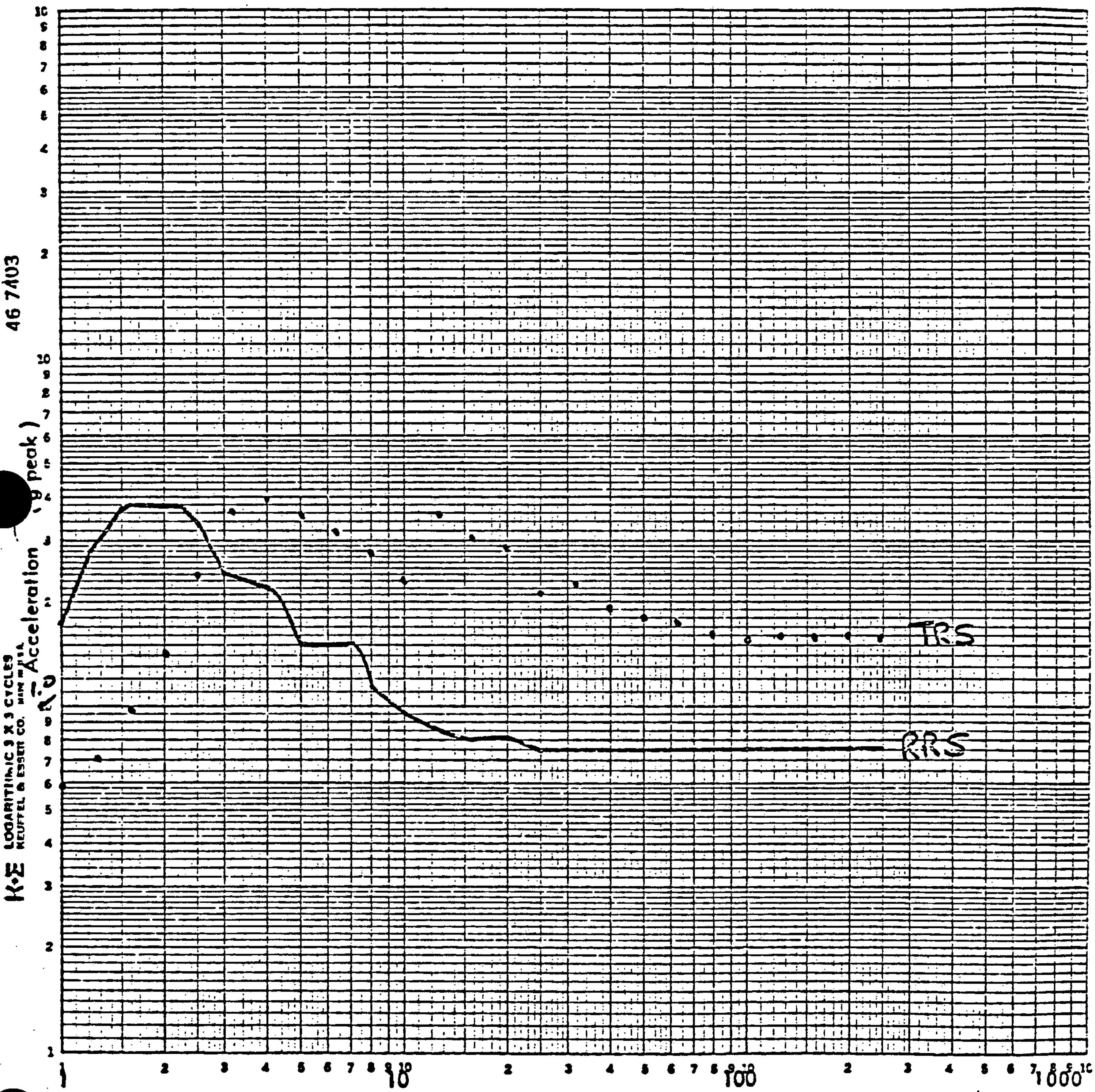
DAMPING $\boxed{5\%}$



Frequency (Hz)

AXIS FB/V

LOCATION NO. VCA

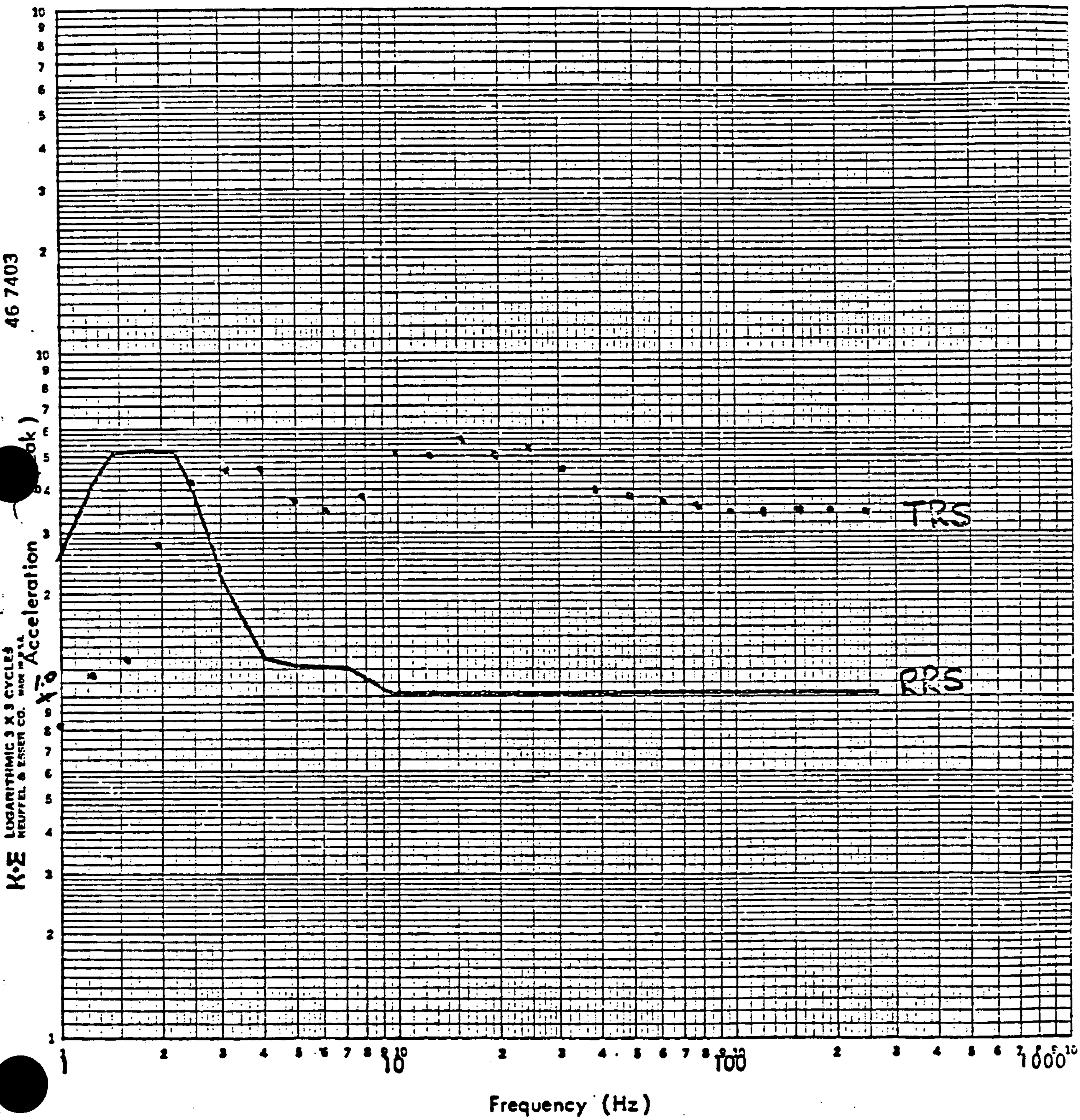
TEST RUN NO. 14

[redacted]
Report No. 43220-1

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING $\boxed{5\%}$



AXIS 8S/V

LOCATION NO. HCA

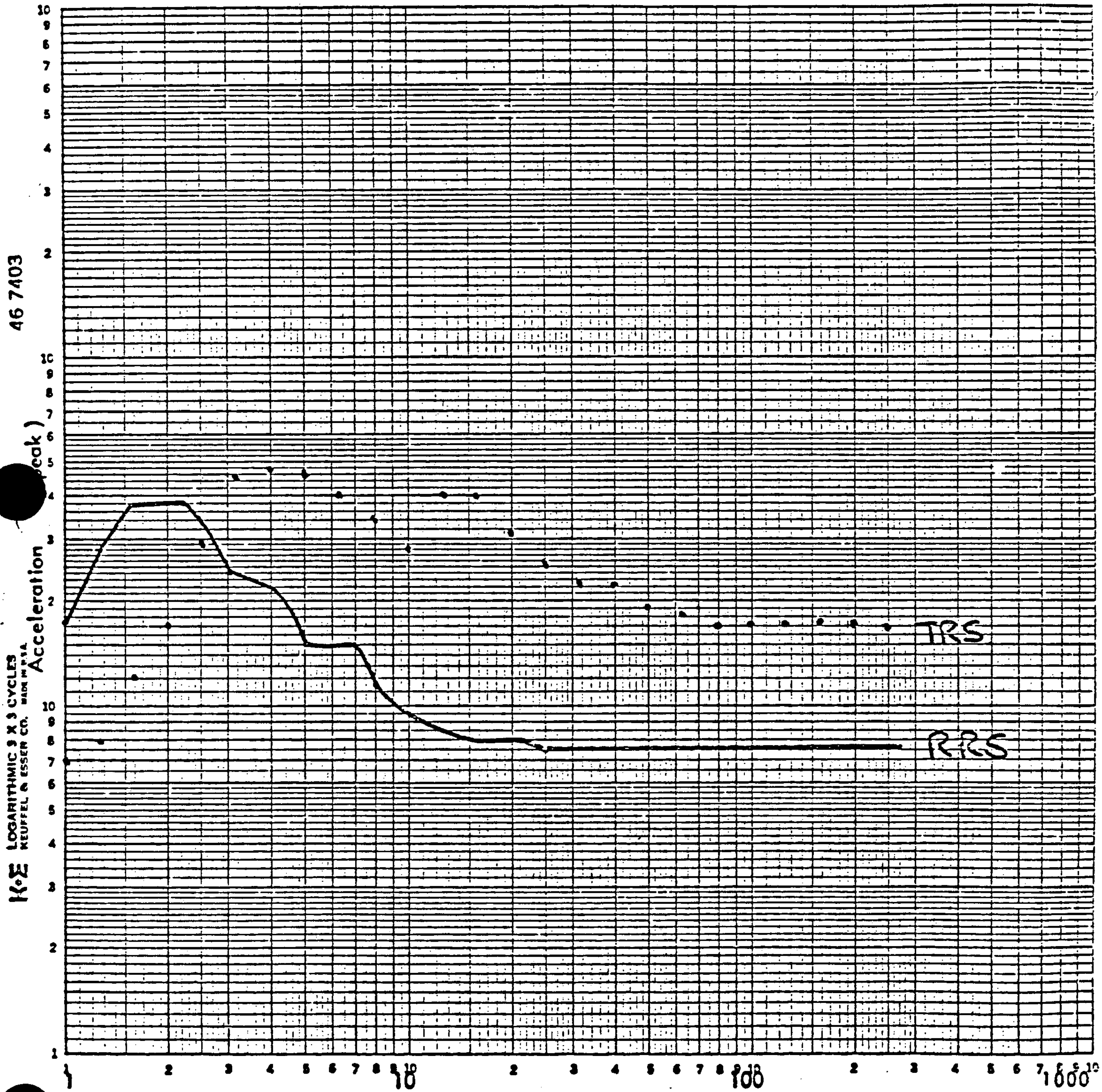
TEST RUN NO. 44

[redacted]
Report No. 43220-1

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 5 %



Frequency (Hz)

AXIS SS/V

LOCATION NO. VCA

TEST RUN NO. 44

IMPORTANT
If the price or schedule is effected by this document approval, Bechtel must be notified prior to fabrication or such claims are waived.
Approval of documents involving calculation, analysis or test report is only an acceptance of the method used by the supplier. Supplier retains full responsibility for design.
Approval of this document does not relieve the supplier from full responsibility for contract or purchase order requirements including, but not limited to, adequacy and suitability of materials and/or equipment represented thereon for the intended function.

DATE RECEIVED 11-11-76

DOCUMENT STATUS
1 ☐ APPROVED - MANUFACTURER MAY PROCEED
3 ☐ APPROVED EXCEPT AS NOTED. MAKE CHANGES AND RESUBMIT. MANUFACTURER MAY PROCEED AS APPROVED.
4 ☐ NOT APPROVED - CORRECT AND RESUBMIT
7 ☒ INFORMATION ONLY ☐ DISTRIBUTION REQUIRED

DOC STATUS BY
DATE 1/3/76

BECHTEL PF-1218 (10079) 12/75

~~BAR STANDARD ORIGINAL NOT SUITABLE FOR LEGIBLE REPRODUCTION~~

FORM NUMBERS

1. BP1, Y12-3, Y47, Y53-1, NON
2. BP1, FT, X1, Y47, Y76, Y53-1, Y53-2
3. BP1, FT1, X1, Y47, Y53-3, Y53-1, Y53-6
4. BP1, FT, X2, Y47, Y53-3, Y53-1, Y53-6
5. BP1, FT1, X2, Y47, Y53-3, Y53-1, Y53-6
6. BP1, Y47, Y53-2, Y53-1
7. BP1, BP1, Y47, Y53-2, Y53-1
8. BP1, FT1, X1, Y47, Y53-3, Y180, Y53-1, Y53-6
9. BP1, FT1, X1, Y47, Y76, Y53-1, Y53-2

UNIT MODIFICATIONS

AR - GENERAL ELECTRIC #HFA51A 120V ALARM RELAY W/5 NORMALLY OPEN & 1 NORMALLY CLOSED.
BP1 - WHITE PILOT LIGHT WHICH INDICATED CIRCUIT BREAKER TRIPPING.
CR - 8501 G040 120V 60 HZ CONTROL RELAY.
CSTAX - 8501 G040 120V 60 HZ CONTROL RELAY.
CSTBX - 8501 G040 120V 60 HZ CONTROL RELAY.
EF1 - 1 EXTRA TYPE FRN SECONDARY CONTROL FUSE.
EF2 - 2 EXTRA TYPE FRN SECONDARY CONTROL FUSE.
FT1 - EXTRA CAPACITY CONTROL CIRCUIT TRANSFORMER (480V/120V)
NON - 800A FRAME NON-AUTOMATIC CIRCUIT INTERRUPTER.
OC,RC - (1) 8501 L020-LL 120V 60 HZ MECHANICALLY HELD LATCHING RELAY
OR - 8501 G060 120V 60 HZ CONTROL RELAY.
PN - RED NEON PILOT LIGHT IN DOOR TO INDICATE VOLTAGE ON THE LOAD SIDE OF THE CONTACTORS 120V 60 HZ FED FROM TRIAD TRANSFORMER.
P37 - WHITE PILOT LIGHT IN DOOR TO INDICATE CONTROL CIRCUIT ON. 120V 60 HZ

RES - OHMITE DIVIDOHM TYPE 210 CATALOG NO. 0378 2500 OHMS 25 WATTS RESISTOR.
RES1 - OHMITE DIVIDOHM TYPE 210 CATALOG NO. 0376 1500 OHMS 25 WATTS RESISTOR.
RES2 - OHMITE TYPE 270 FIXED RESISTORS 400 OHMS 25 WATTS.
RES3 - OHMITE DIVIDOHM TYPE 210 CATALOG NO. 1163 2500 OHMS 160 WATTS RESISTOR.
RT - 25 KVA 480-120V SINGLE PHASE 60 HZ AND SHALL MAINTAIN AN OUTPUT VOLTAGE OF 120V ± 1 PERCENT WITH 480V ± 10 PERCENT AND 60 HZ ± 5 PERCENT ON THE INPUT. OUTPUT SHALL BE SINUSOIDAL WITH THE TOTAL RMS HARMONIC CONTENT OF 5 PERCENT MAXIMUM. EACH REGULATING TRANSFORMER SHALL CONSIST OF A DRY-TYPE TRANSFORMER AND A LINE-VOLTAGE REGULATOR. THE DRY-TYPE TRANSFORMERS SHALL MEET THE SAME REQUIREMENTS AS THE 3Ø 4W DISTRIBUTION TRANSFORMERS AND THE LINE-VOLTAGE REGULATOR SHALL BE SOLA NO. 33-16-325
TR2 - ACASTAT TIMER CAT. NO. 7022ACXT W/1.5 TO 15 SEC. TIMING RANGE AND 1 N.O. INST. CONTACT
TR - ACASTAT TIMER CAT. NO. 7022 ADX W/5 TO 50 SECOND TIME DELAY.
TR1 - ACASTAT TIMER CAT. NO. 7022 [illegible] SEC TIMING RANGE.
X1 - 1 NORMALLY OPEN & 1 NORMALLY CLOSED AUXILIARY CONTACTS ON FULL VOLTAGE NON-REVERSING STARTER
X2 - 2 NORMALLY OPEN & 2 NORMALLY CLOSED AUXILIARY CONTACTS ON FULL VOLTAGE REVERSING STARTER
Y12-3 - BURNDY TYPE YA LONG BARREL LUG FOR COPPER CONDUCTORS USING GRADE 5 BOLTS #21401-28551
Y53-1 - VISI-BLADE MOLDED CASE CIRCUIT BREAKER SUBSTITUTED FOR STANDARD BREAKER.
Y53-2 - HIGH INTERRUPTING CAPACITY BREAKER, 1-75,000 TYPE, USED ON ALL BRANCH BREAKER UNITS.
Y53-3 - MOTOR CIRCUIT PROTECTOR MAG-GARD (ADJUSTABLE MAGNETIC TRIP ONLY CIRCUIT BREAKER).
Y53-6 - MAG-GARD BREAKER BUILT IN A HIGH INTERRUPTING FRAME
Y141 - KIRK KEY INTERLOCK.
Y180 - SPECIAL SEISMIC MODIFICATIONS SIZE 3 & 4 STARTERS.
- NAMEPLATE WITH BRASS SCREWS AND NUTS.
- 9080 KCB-1 TERMINAL BLOCKS.
- AMP RING TONGUE TERMINALS FOR ALL CONTROL WIRE CATALOG NO. 320627.
- RED #14 GAUGE SIS CONTROL WIRE AND GROUND WIRE.
- BRADY WIRE LABELS.
- WEATHER RESISTANT DIAGRAMS.
- ALL UNUSED CONTACTS ON RELAYS ETC. SHALL BE CONNECTED TO TERMINAL BLOCKS FOR FUTURE USE.
XFR - TRIAD #F-18X 117 to 6.3 VOLT 6.0 AMPERES FILIMENT TYPE TRANSFORMERS.
Y47 - GASKETED NEMA 1 ENCLOSURE
Y35 - BREAKER UNIT WHICH FEEDS A DISTRIBUTION TRANSFORMER.
C6 - ON-OFF SELECTOR SWITCH

STRUCTURE MODIFICATIONS

- END CLOSING PLATES TO BE FURNISHED ON ALL SHIPPING SPLITS.
- OMEGA ~~S-566~~ SPACE HEATER ONE PER SECTION 720W 240V (OPERATING ON 180W 120V)
- SPECIAL FINISH ANSI 61 LIGHT GRAY, SADDLES TO RED OR YELLOW, DEPENDING ON WHICH MCC IS BEING BUILT.

U2 - BUS BARRIERS FOR HORIZONTAL & VERTICAL BUS BARS
U3 - PLASTIC CLOSING PLATES TO UNUSED PLUG-ON OPENINGS IN VERTICAL BUS BAR BARRIERS WITH EXTRA PLUGS LOCATED IN BARRIER COMPARTMENT.
U5 - ADD WIRE GUARDS, GROMMETS & BLOCK OFFS TO ALL WIRE ACCESS PORTS BETWEEN UNITS & VERTICAL.
U7 - PULL BOX ON TOP FOR OUT GOING CABLES WITH DRIP HOLD.
U8 - HORIZONTAL GROUND BUS. (NOTE) EACH UNIT IS TO BE WIRED FROM GROUND ON SADDLE TO TERMINAL BLOCK & THEN TO GROUND BUS. GROUND BUS TO BE (4) 1/8 X 1 1/8.
U11 - 42,000 AMPS SYMMETRICAL BUS BAR BRACING.
U26 - STRUCTURES ARE MODIFIED FOR SEISMIC REQUIREMENTS.
- GASKETED RENOVABLE BACKPLATES

FOR INFORMATION ON BASE CHANNEL MOUNTING HOLES SEE DRAWING C12-02690-A2

F. REV. SPACE HEATER 4/5
E - REVISED PER CUSTOMER [illegible] - WLT - 8/26/76

S023-302-4-2-270-2 SCE #0364

REV.	DN	DATE	BY	REV.	DN	DATE	BY
A.	ADDED	FORMS					
—		3/31/76	JLST				
B.	DELETED	FORMS OC AND	RC AND ADDED	FORM			
	OC,RC	4-2-76	JLST				
C.	ADDED	FORM	TR2 JLST 4/27/76				
D.	CHANGED FROM BI-METAL TO MELTING ALLOY STARTERS JLST.						

SCALE	DRAWN	CHKD.	DATE	S.N.
N.T.S	MRR	JLST	2-24-76	

TITLE: DATA SCHEDULE

REMARKS: SUPERCEDES B12-C2690-A1

KAWSTOCK 1/20/76

PERU

B12-02690-2A1 PAGE 3 OF 3

SQUARE D COMPANY
POWER EQUIPMENT GROUP

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X

2. NSSS: CE — 3. A/E: Bechtel — BWR ______

II. Component Name: 125 VDC Class 1E Distribution Switchboard

1. Scope: [ ] NSSS [X] BOP

2. Model Number: CBC-Special — Quantity: 8

3. Vendor: GTE Sylvania

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

5. Physical Description a. Appearance Floor Mounted Switchboard

   b. Dimensions 90"H x 36"W x 19-1/4"D

   c. Weight 2400 lbs

6. Location: Building: Control Area (Auxiliary Bldg)

   Elevation: 50'-0"

7. Field Mounting Conditions [ ] Bolt (No.____, Size____)
   [X] Weld (Length 2" Fillet, 6"O.C.)
   [ ] ______

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

   S/S: * F/B: * V: *

9. a. Functional Description: Distributes 125VDC power to Class 1E loads and panels

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

   [X] Both

10. Pertinent Reference Design Specifications: Spec. No. S023-302-5A

*Results not furnished by GTE-Sylvania. Information requested.

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

IV. Equipment Qualification Method: Test: X

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Wyle Laboratories #58026
Bechtel Log S023-302-5A-20
(Name of Company of Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [ ] Combination of ______

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS [ ] NA (other, specify)

2. Required Response Spectra (attach the graphs): See Appendix "B"

3. Required Acceleration in Each Direction:

S/S = 1.0g F/B = 1.0g V = .75g

VI. If Qualification by Test, then Complete:

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

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

3. No. of Qualification Tests: OBE 5 SSE 1 Other None (specify)
Each horizontal direction with vertical

4. Frequency Range: 1.25 - 35 HZ

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs) [ ] No

______

6. Input g-level Test at S/S = 1.4 g F/B = 1.8 g V = 1.8 g

7. Laboratory Mounting: ______________________________

   1. [ ] Bolt (No._______, Size_______) [X] Weld (Length 2" @ 6" O.C.)
      [ ] _____________

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

9. Test Results including modifications made: Contact chatter noted on over and under voltage alarm relays. Since both relays do not affect the safety function of the equipment, the contact chatter is acceptable.

10. Other tests performed (such as fragility test, including results): None

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

1. Description of Test including Results:

2. Method of Analysis:

   [ ] Static Analysis [ ] Equivalent Static Analysis

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

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: _________ 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

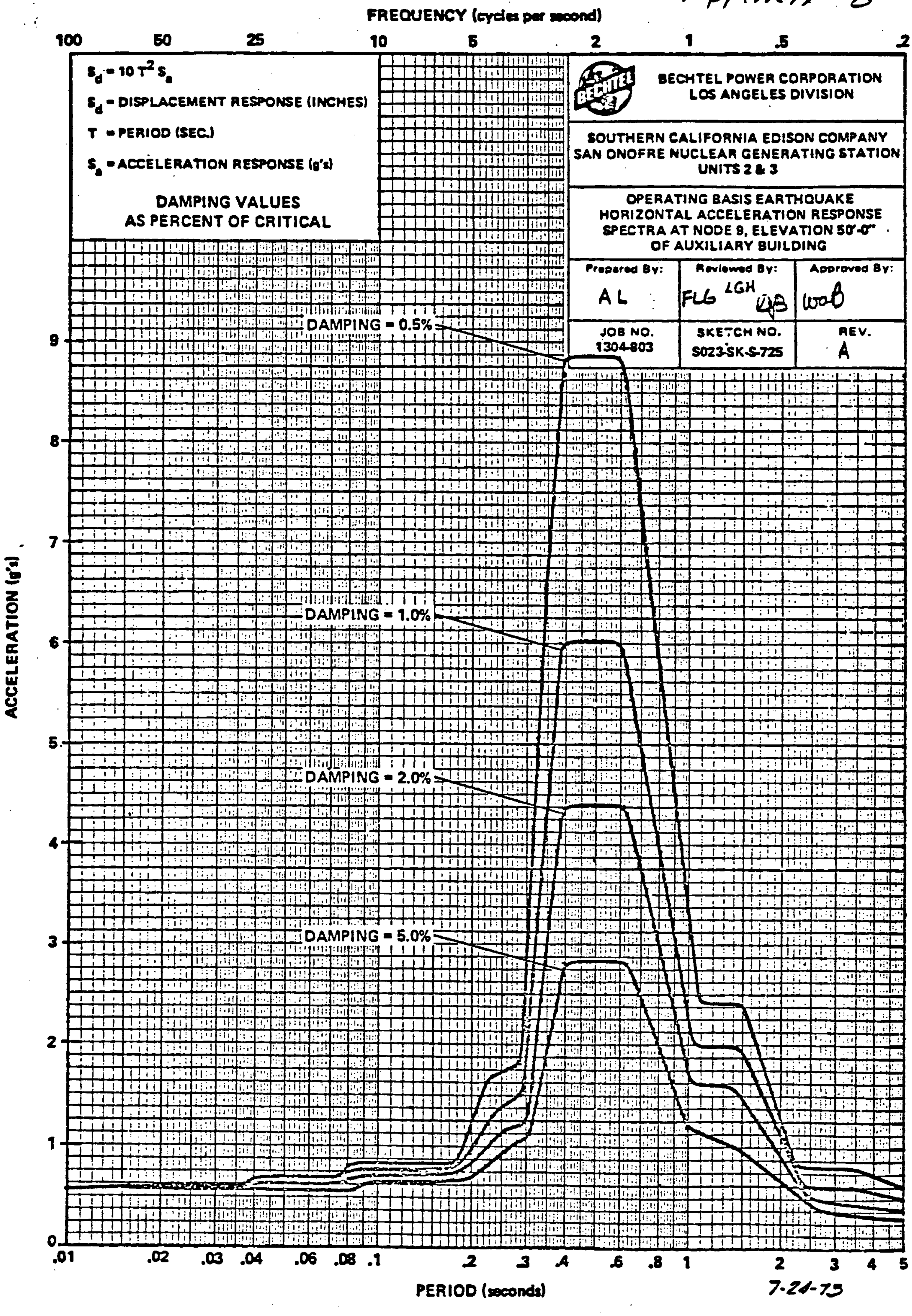
B.

Max. Deflection	Location	Effect Upon Functional Operability

APPENDIX A

APPENDIX B

Appendix "B"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$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
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UNITS 2 & 3
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HORIZONTAL ACCELERATION RESPONSE
SPECTRA AT NODE 9, ELEVATION 50'-0"
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Reviewed By: FLG LGH
Approved By:
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SKETCH NO. S023-SK-S-725
REV. A
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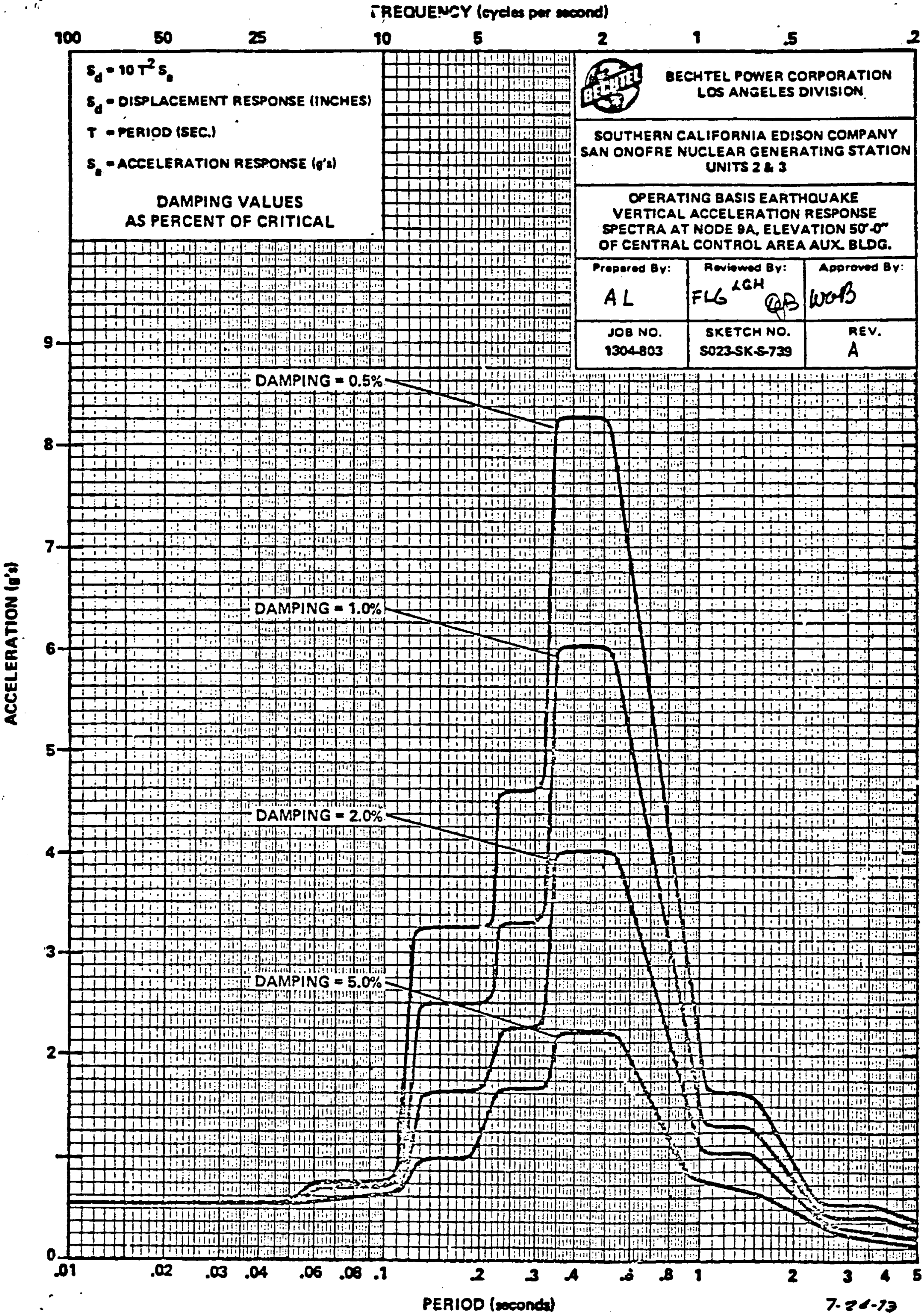
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
0 1 2 3 4 5 6 7 8 9
.01 .02 .03 .04 .06 .08 .1 .2 .3 .4 .6 .8 1 2 3 4 5
PERIOD (seconds)
7-24-75


FREQUENCY (cycles per second)
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$S_d = 10 T^2 S_a$
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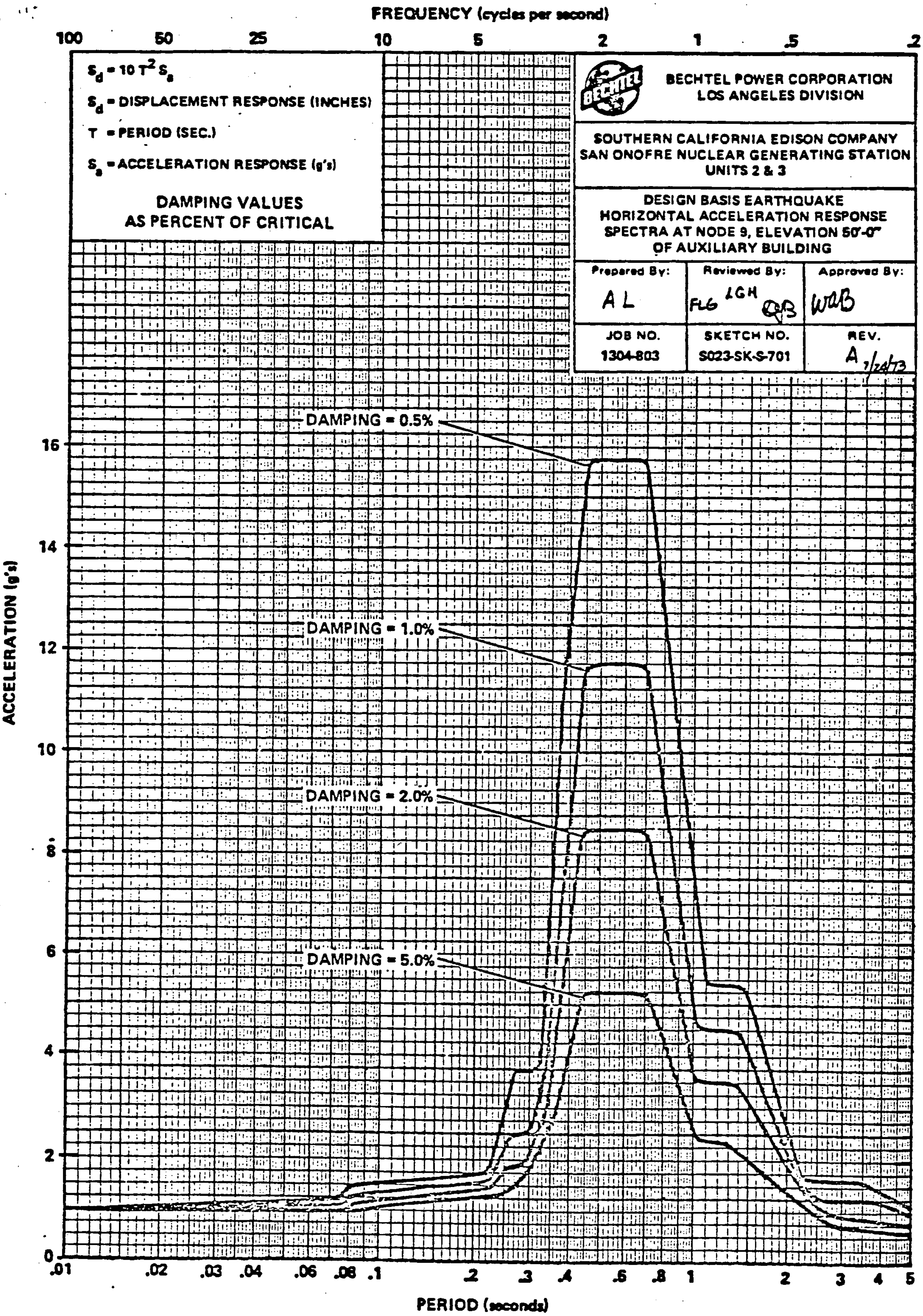
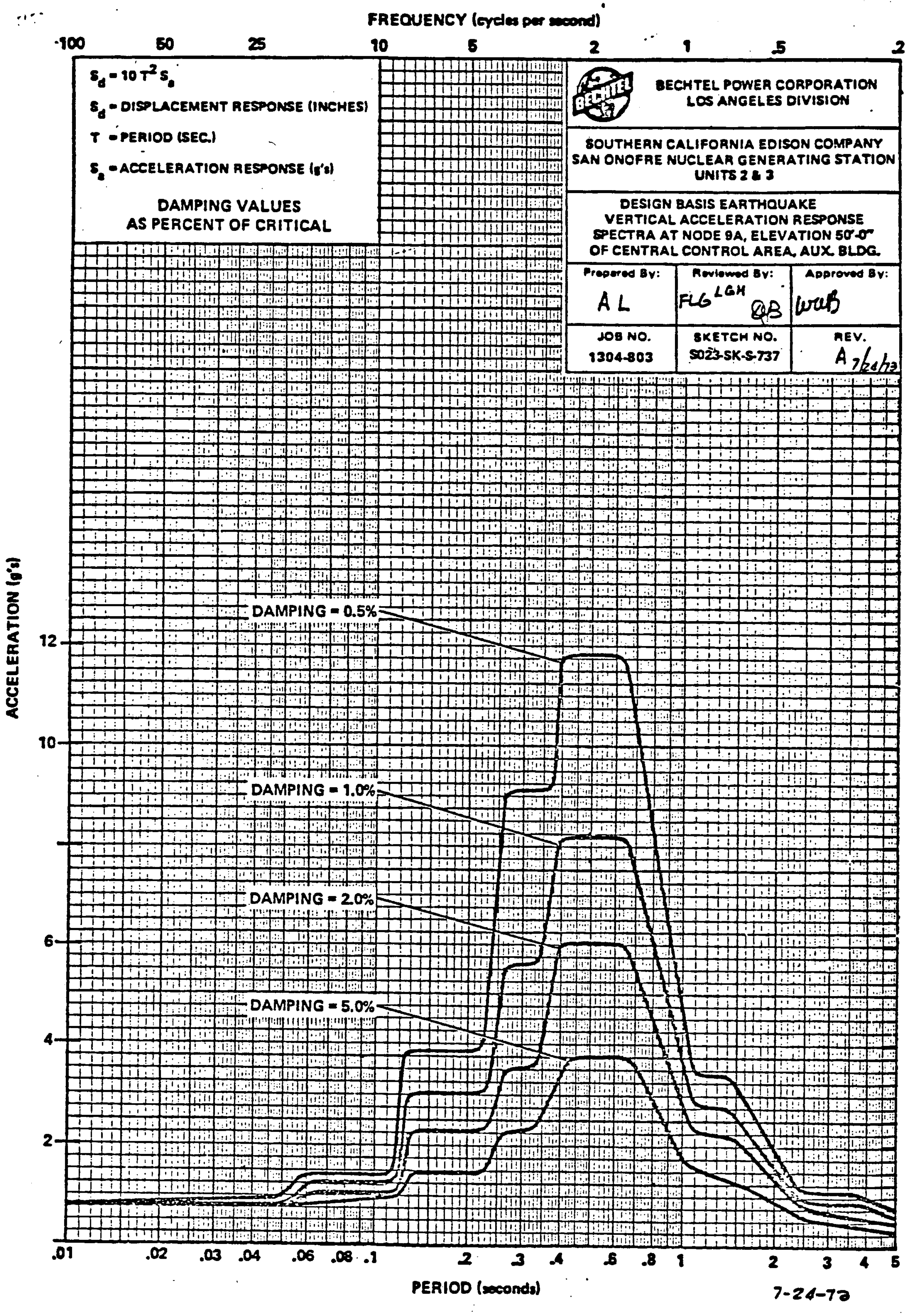
SKETCH NO.
S023-SK-S-739
REV.
A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
9
8
7
6
5
4
3
2
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

7-24-73


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA AT NODE 9, ELEVATION 50'-0"
OF AUXILIARY BUILDING
Prepared By:
A L
Reviewed By:
FLG LGH QB
Approved By:
WAB
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-701
REV.
A 7/24/73
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
16
14
12
10
8
6
4
2
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

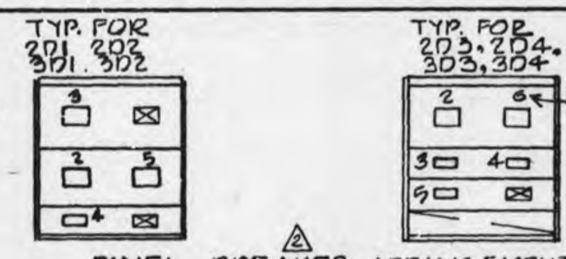

FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA AT NODE 9A, ELEVATION 50'-0"
OF CENTRAL CONTROL AREA, AUX. BLDG.
Prepared By:
A L
Reviewed By:
FLG LGH QB
Approved By:
WAB
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-737
REV.
A 7/24/73
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
12
10
6
4
2
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

7-24-73

BILL OF MATERIALS

Rev	UNIT QUAN. & EQUIP. DESIGNATION 2D1	2D2	2D3	2D4	3D1	3D2	3D3	3D4	TOT QUAN.	MFR.	CATALOG NO.	DESCRIPTION	SPEC. REF. SECT.	
			1	1			1	1	4	G.E.CO.	TPS202F-TS202DTIG-	DUAL MAGNETIC O/C TRIPS, 250V.D.C. 20KAIC,	4.12.2.2	4-17
			D301	D401			D301	D401			TSST12B-TSAS6AB4-	LONG TIME FIXED, SHORT-TIME ADJ.,		
											TSBAAB-TPSLDA	INSTANTANEOUS OVERRIDE FIXED 42KA		
												SHUNT-TRIP 125V. D.C., AUX. SWITCH 4PDT,		
											1600/2/250DC	BELL ALARM IND, PUSH-TO-OPEN RESET,		
											CIRC. BKR	BUS CONNECTORS LINE AND LOAD,		
△3												PADLOCKING DEVICE.		
	1	1			1	1			4	GE.CO.	TPS202F-TS202DT12-	SAME AS ABOVE		
	D101	D201			D101	D201					TSST12B-TSASGAB4-			
											TSBAAS-TPSLDA			
											1200/2/250DC			
											CIRC. BKR			
												CIRCUIT BREAKERS		
												FRAME / AMP / POLE / VOLT / LOAD LUGS / K.A.I.C. / REMARKS		
	2	2	2	2	2	2	2	2	16	G.E.CO.	THJK426400	THJK / 400 / 2 / 250DC / 500MCM / 20	4.12.2.2	4-17, 4-18
	D102	D202	D302	D402	D102	D202	D302	D402						
	D105	D205	D306	D406	D105	D205	D306	D406						
△3△2	1	1			1	1			4	G.E.CO.	THJK636600	THJK / 600 / 2 / 250DC / 750MCM / 20		
	D103	D203			D103	D203								
	1	1	1	1	1	1	1	1	8	G.E.CO.	THFK226225	THFK / 225 / 2 / 250DC / 250MCM / 20		
	D104	D204	D304	D404	D104	D204	D304	D404						
			1	1			1	1	4	G.E.CO	THFK226100	THFK / 100 / 2 / 250DC / #1/0 / 20		
			D303	D403			D303	D403						
			1	1			1	1	4	G.E.CO	THED126015	THED / 15 / 2 / 250DC / #6 / 20		
			D305	D405			D305	D405					4.13.6.3	4-21
	1	1	1	1	1	1	1	1	8	G.E.CO	THED126020	THED / 20 / 2 / 250VDC / #12 / 20 / CONTROLS		
	1	1	1	1	1	1	1	1	8	G.E.CO	TE111020	TE / 20 / 1 / 120VAC / #12 / 10 / HEATERS	4.11.13.5	4-8
	1	1	1	1	1	1	1	1	8	G.E.CO.	12NGV17A2-F	125V.D.C., 100-140V DROPOUT RANGE, HIGH DO,	4.13.1	4-19
	27	27	27	27	27	27	27	27			(UV RELAY)	MOLDED CASE SEMI-FLUSH MOUNTED, SGL.		
												UNIT, NO TD, NO TARGET, 2 CONTACT 1-NO 1-NC		
	1	1	1	1	1	1	1	1	8	GE.CO.	12PJV11AM1A	250V.D.C. 100-320V. PICK-UP RANGE, DRAWOUT		
	59	59	59	59	59	59	59	59			(OV RELAY)	SI CASE, SGL UNIT, 2 CONTACT, CODE II IND INC		
	1	1	1	1	1	1	1	1	8	GUARDIAN	7132-0915-9004	125-140V DC NOMINAL, 2 COIL, 2.5W MAX, 1-a &	4.13.1	4-19
	64 PN	64 PN	64 PN	64 PN	64 PN	64 PN	64 PN	64 PN			(GND DETECTOR P&N)	2-b CONTACTS, CONTINUOUS DUTY COILS IN SERIES,		
												PU 1K TO 2K Ω ON P OR N, 9 PIN PLUG-IN, METAL COVER.		
△2	1	1	1	1	1	1	1	1	9	AMPHENOL	77MIP9	9 CONTACT RELAY SOCKET, CHASSIS MNTD,		
											(GND. DET. BASE)	MOLDED BAKELITE WITH SOLDER TERMINALS		
			1	1			1	1	4	G.E.CO.	50-103-121CATC	TYPE DB-40 0-1500A SCALE 50MV SHUNT RATED	4.13.2	4-19 4-20
			AM	AM			AM	AM			(AMMETER)			
	1	1			1	1			4	G.E.CO	50-103-121CASU	TYPE DB-40 0-1200A, SCALE 50MV SHUNT RATED		
	AM	AM			AM	AM					(AMMETER)			
			1	1			1	1	4	G.E.CO.	50-140014TCAA	SHUNT TYPE 140 1500A 100MV, WITHOUT BASE	4.13.2	4-20
	1	1			1	1			4	GE.CO.	50-140014SUAA	" " " 1200A. " " "		
△4	1	1	1	1	1	1	1	1	8	G.E.CO.	7605K12722	SHUNT LEADS 0.035 Ω, 10 FT. PAIR FOR SWBD AMM.		
			1	1			1	1	4	G.E.CO.	50-140011TCAA	SHUNT TYPE 140 1500A 50MV, W/O BASE		
	1	1			1	1			4	G.E.CO.	50-140011SUAA	" " " 1200A " " "	4.13.2	4-19 4-20
	1	1	1	1	1	1	1	1	8	G.E.CO	50-103011PZPZ	TYPE DB-40 0-150V SCALE, SELF-CONTAINED		
	VM	VM	VM	VM	VM	VM	VM	VM			(VOLTMETER			
△3	1	1	1	1	1	1	1	1	8	G.E.CO.	10CA910	TYPE SBM, 4PST, 4 POSITION SPRING RETURN TO OFF,	4.13.3	4-20
	VS	VS	VS	VS	VS	VS	VS	VS			(VM SWITCH)	'P GROUND-OFF-N GROUND-BATTERY'		
	2	2	2	2	2	2	2	2	16	G.E.CO	0116B6708G3	125V DC INDICATING LAMP TYPE ET-16, WITH BULB	4.13.4	4-20
	IL	IL	IL	IL	IL	IL	IL	IL			(INDIC. LIGHT)	#1835, RESISTOR & COLOR CAP.		
	1	1	1	1	1	1	1	1	8	G.E.CO.	208A3768P3	GREEN TRANSLUCENT COLOR CAP		
	1	1	1	1	1	1	1	1	8	G.E.CO.	208A3768P2	RED " " "		
	5	5	5	5	5	5	5	5	40	BUSSMANN	2604	30A, 2P, 250V PORCELAIN FUSE BLOCK W/		
												#10-32 SCREWS		
	10	10	10	10	10	10	10	10	80	BUSSMANN	FRN20	FUSETRON DUAL ELEMENT 20A. 250V.D.C. W/	4.13.5	4-21
												200KAIC @ 125V.D.C.		
△3	5	5	5	5	5	5	5	5	40	BUCHANAN	B112	TERMINAL BLOCK, 12 POLE, #10 SCREWS.	4.13.7.4.4	4-24
	1	1	1	1	1	1	1	1	8	CHROMALOX	SE-1025-240	STRIP HEATER TYPE SE 240V. 60HZ	4.11.13	4-7
												250 WATTS @ 240V. IRON SHEATH, ON 120V		
												60HZ CIRC.		
	4	4	6	6	4	4	6	6	40	BURNDY	YA39-2N	750MCM TYPE 'YA' COPPER MAIN LUGS	4.11.20.5	4-13
	2	2	2	2	2	2	2	2	16	WILLIAMS	78-463-02	LIFTING EYES	4.11.11	4-7
△4	1	1	1	1	1	1	1	1	8	PANDUIT	E2X2LG6	PANDUCT WIRE DUCT CHANNEL 2" x 2" WITH	4.13.7.2	4-22
	1	1	1	1	1	1	1	1	8	"	C2LG6	COVER		

FORM 63 2



△2 PANEL BREAKER ARRANGEMENT

MICROFILM QUALITY ACCEPTABLE

IMPORTANT
If the price or schedule is affected by this document approval, Bechtel must be notified prior to fabrication or such claims are waived.
Approval of documents involving calculation, analysis or test report is only an acceptance of the method used by the supplier. Supplier retains full responsibility for design.
Approval of this document does not relieve the supplier from full responsibility for contract or purchase order requirements including, but not limited to, adequacy and suitability of materials and/or equipment represented thereon for the intended function.

DATE RECEIVED 7-13-77

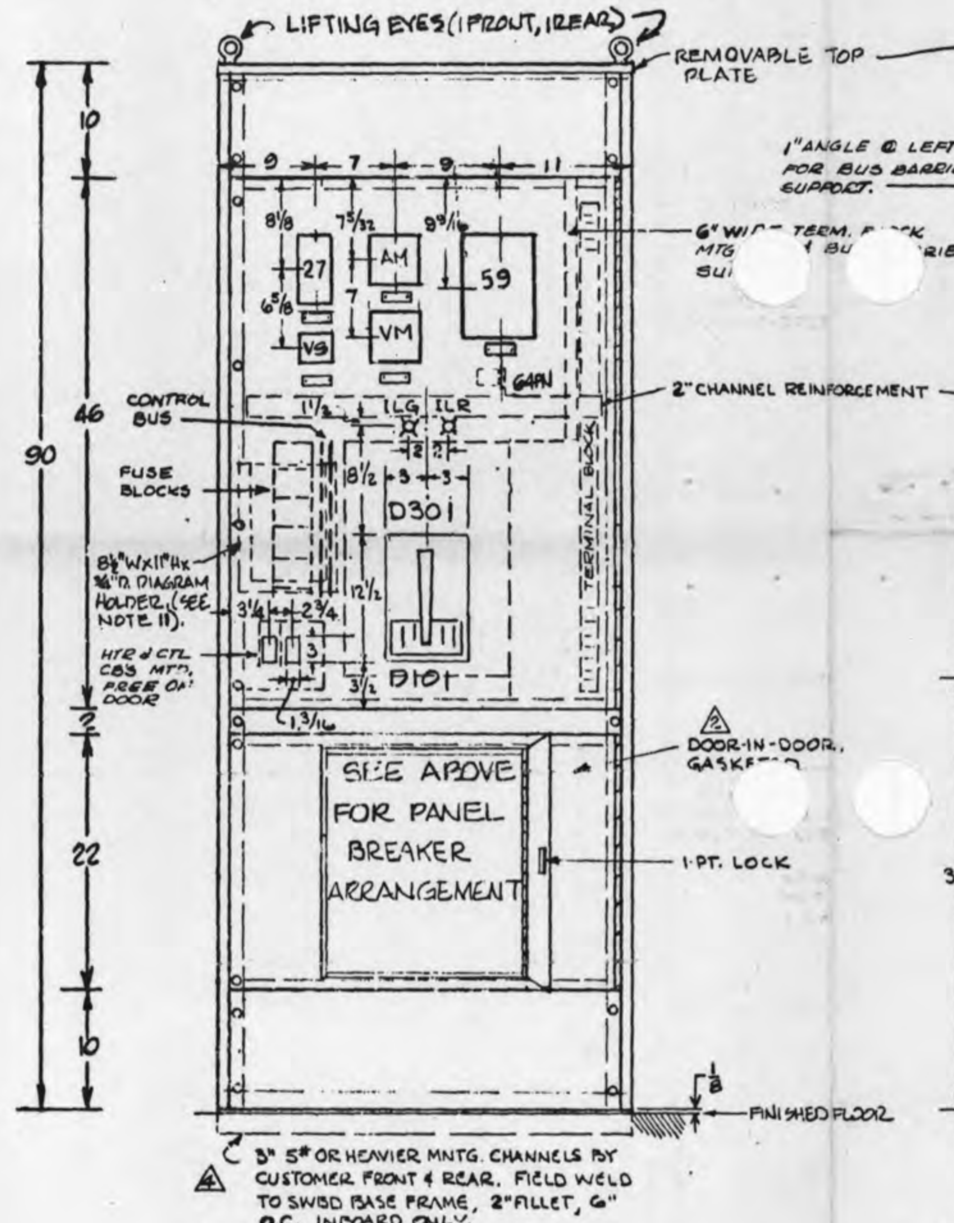
DOCUMENT STATUS
1 ☒ APPROVED - MANUFACTURER MAY PROCEED
3 ☐ APPROVED EXCEPT AS NOTED. MAKE CHANGES AND RESUBMIT. MANUFACTURER MAY PROCEED AS APPROVED.
4 ☐ NOT APPROVED - CORRECT AND RESUBMIT
7 ☐ INFORMATION ONLY ☐ DISTRIBUTION REQUIRED

DOC STATUS BY
DATE 7/18/77
PE-1218 (1007) 12/75

REV	DESCRIPTION	DATE	BY/APPROVED
△1	PER APPROVED DWG & CORRECTIONS	1/30	RW
△2	VERBAL C/O FROM BECHTEL & CORRECTIONS	3/2	RW
△3	STATUS 3 REV 3/9/76. DCN 3/13/76. CORRECTIONS.	3/24	RW.
△4	STATUS 1 APPROVAL 4/23/76. BASE WELD PER SEISMIC TEST. DIMENSIONS. CORRECTIONS.	9/7	RW

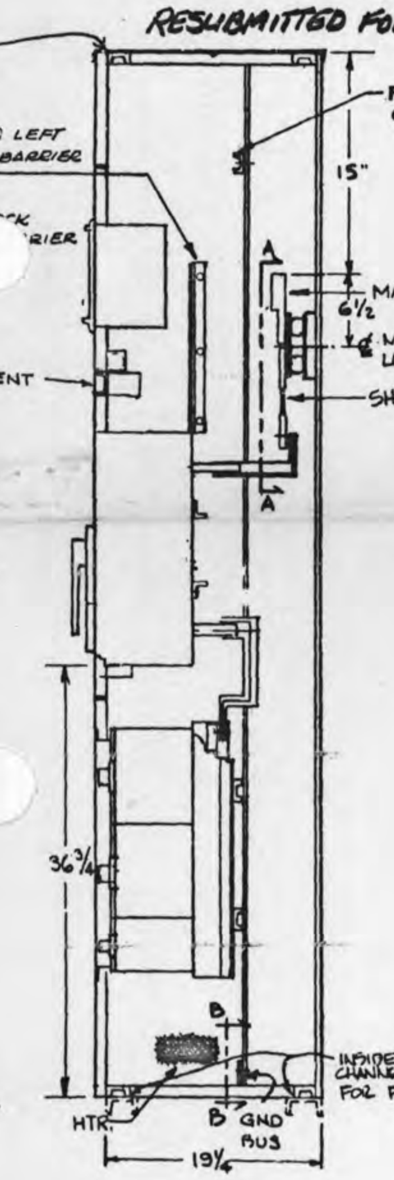
RESUBMITTED FOR MICROFILM QUALITY

NUCLEAR SAFETY RELATED
QUALITY CLASS II
SEISMIC CLASS I

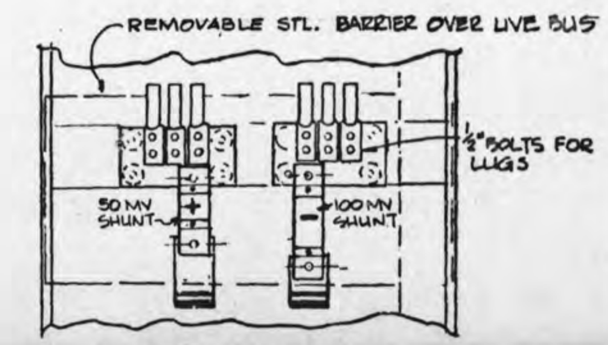


△3 FRONT ELEVATION

WEIGHT - 2400 POUNDS (APPROX)

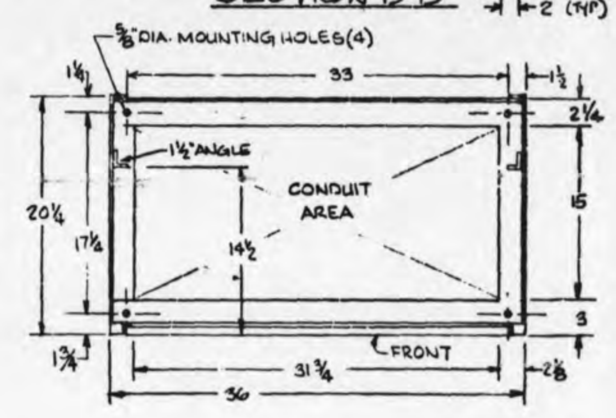


△3 CROSS-SECTIONAL DETAIL



△3 SECTION A-A

SECTION B-B

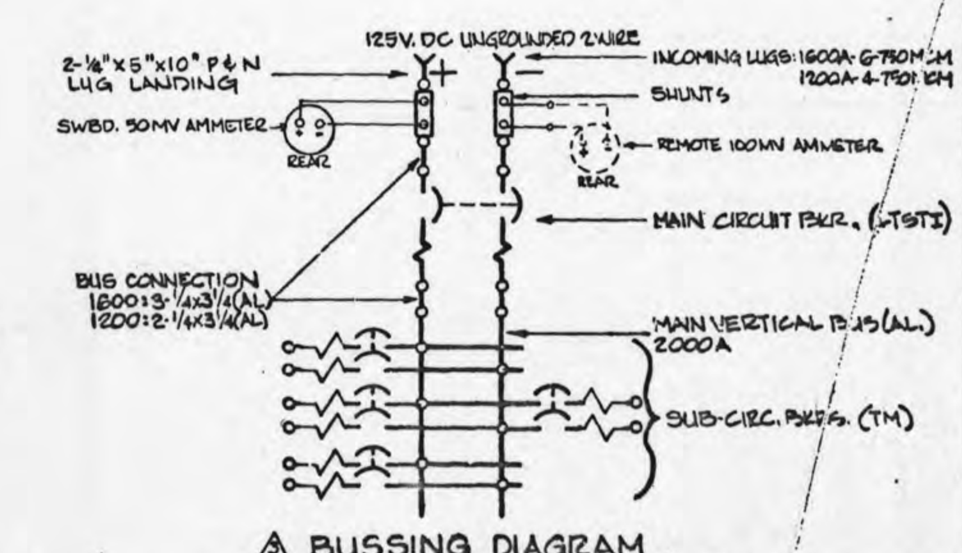


FLOOR PLAN

NOTES:

1. SWITCHBOARD TO BE DEAD-FRONT DEAD REAR OF FORMED 12 GA. ZGPG STEEL CONSTRUCTION, FRONTS & ALL COVERS, INDOOR, NEMA I NON-VENTED. NEOPRENE GASKETED △4 COVERS. 1/4-20 WING-NUT CAPTIVE FASTENERS ON DOORS.
2. △2 FINISH - ANSI #61 GRAY BAKED ENAMEL OVER PHOSPHATE TREATMENT AND PRIMER. REF. SPEC. 4.18, APP. 4C & JE-19.
3. MANUFACTURER OF DEVICES NOTED IN BILL OF MATERIALS.
4. ALL DISCONNECTS PROVIDED WITH PADLOCKING DEVICES.
5. CONSTRUCTION WILL BE IN ACCORDANCE WITH UNDERWRITERS' LABORATORIES INC. U.L. 891 REQUIREMENTS & WILL BEAR THE U.L. LABEL WHERE APPLICABLE.
6. SWITCHBOARD IS FRONT ACCESSIBLE ONLY.
7. LINE CABLES TO ENTER TOP. LOAD CABLE TO EXIT TOP.
8. CIRCUIT IDENTIFICATION - PROVIDE 1/8" THICK 3"x1" COLOR WITH WHITE LETTERS, ENGRAVED PHENOLIC NAMEPLATES SECURE WITH #4 SCREWS. SEE DWGS A-4 TO A-11 FOR DESIGNATION & COLOR. 6' MAX HEIGHT.
9. ALL BUS TO BE U.L. RATED TIN PLATED ALUMINUM BRACED FOR 20KA. SHORT CIRCUIT. AVAILABLE SHORT CIRCUIT IS 19KA. 750A./IN² CURRENT DENSITY, MAXIMUM. 50°C RISE, MAX. SUPPORTS ARE MOLDED GLASS POLYESTER. RAMP CONICAL WASHERS AT EACH BOLT. ANTI-OXIDANT INHIBITOR INTERFACE AT ALL CONNECTIONS.
10. ADDITIONAL STANDARDS THAT APPLY:
    IEEE 323-1974
    IEEE 344-1975
    IEEE 383-[illegible]
    ANSI N45[illegible]2
    NEMA PB [illegible]
    NEMA AB 1-[illegible]9
    NEMA CC 1-1972, CC1-4.05 & 4.06
11. ADDITIONAL REQUIREMENTS NOT SHOWN ON DWGS. (REF. SPEC. PARAGRAPHS AS MODIFIED AND AMENDED):
    4.6.2 - TESTS AND CERTIFICATION.
    4.8.1 - ENVIRONMENT.
    4.9.2 - SEISMIC QUALIFICATION PER APPENDIX 4F.
    4.9.3 - DESIGN LIFE.
    4.11.7 - WIREWAY PROTECTION & ISOLATION.
    4.11.19.2 - BOLT STRESSES.
    4.13.26 - PROTECTION DURING SHIPMENT.
    4.13.7.5 - WIRING TESTS.
    4.14 - FACTORY INSPECTION.
    4.17 - SHIPPING REQUIREMENTS.
    4.17.1.5 - INSTRUCTION MANUAL SHIPPED W/ EACH SWBD.
    4.19.2 - DIAGRAM WITHIN EACH SWBD.
    4.20 - CERTIFICATE OF COMPLIANCE.
12. △3 REFERENCE DWG. C-13 FOR WIRING DIAGRAMS.
13. TERMINATIONS ACCESSIBLE THRU HINGED & SCREW COVERS.

PER BECHTEL PLAN SHEETS: 30302 REV. 1, 32302 REV. 1, 30096 REV. , 30173 REV.0, 30174 REV.0, 30175 REV.0, 30176 REV.0, 32173 REV.0, 32174 REV.0, 32175 REV.0, 32176 REV.0.



△3 BUSSING DIAGRAM

S023-302-5A-2-5 SCE# 0335

TITLE	125V. D.C. DISTRIBUTION SWITCHBOARDS 2D1, 2D2, 2D3, 2D4, 3D1, 3D2, 3D3, 3D4. CONTROL BLDG. AREA CA7 — TYPE: CBC-SPCL. 1600/1200A 125V. D.C. 2W.
JOB NAME AND ADDRESS	S.C.E. SAN ONOFRE NUCLEAR GEN. STA. UNITS 2 & 3
ARCHITECT	BECHTEL SPEC S023-302-5A
ENGINEER	BECHTEL JOB 10079
INSTALLED BY	BECHTEL
P.O. NO.	
SOLD TO	S.C.E. SPEC. 0335 P.O. NO. V4103351
GTE SYLVANIA ELECTRICAL EQUIPMENT GROUP ZINSCO ELECTRICAL PRODUCTS LOS ANGELES	DRAWN: [illegible] DATE 12-23-75; CHECKED RW DATE 12/23
SHOP ORDER NO.	D28917-1
SHEET	
REV.	△4

IT. 1-8

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR

II. Component Name: 600 V Electrical Penetration Assembly

1. Scope: [ ] NSSS [X] BOP
2. Model Number: E-2866 — Quantity: 138
3. Vendor: Westinghouse Electric Corp
4. If the component is a cabinet or panel, name and model No. of the devices included: NA
5. Physical Description a. Appearance: See Appendix "A"
   b. Dimensions: See Appendix "A"
   c. Weight: 680 pounds
6. Location: Building: Penetration Room (Containment Wall)
   Elevation: From 51'-0" through 87'-0"
7. Field Mounting Conditions [X] Bolt (No. 16, Size 1-1/8")
   [ ] Weld (Length ____)
   [ ] ____
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical)*:

   Outboard Box:

   S/S: 18 Hz & above F/B: 18 Hz & above V: 18 Hz
   Module: >33Hz in all 3 directions
9. a. Functional Description: To allow passage of electrical wires through the containment while acting as a continuation of the containment vessel pressure boundary.

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

   [X] Both
10. Pertinent Reference Design Specifications: S023-304-1

* Only the penetration outboard termination box and the penetration module were seismically tested. The other components were qualified by analysis. See Appendix "B".

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

IV. Equipment Qualification Method: Test: See Appendix "B"

Analysis: See Appendix "B"

Combination of Test and Analysis: ______

Test and/or Analysis by: Westinghouse: PEN-TR-76-31, PEN-TR-76-08
(Name of Company or Laboratory & Report No.)

V. Vibration Input:*

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ____________

5. [ ] Combination of ______________________________

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS [ ] ____________ (other, specify)

2. Required Response Spectra (attach the graphs): See Appendix "C"

3. Required Acceleration in Each Direction: N/A

S/S = 1g F/B = 1g V = 1g

VI. If Qualification by Test, then Complete:*

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

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

3. No. of Qualification Tests: OBE N/A SSE N/A Other See App. "B" (specify)

4. Frequency Range: Box: 1 to 80 Hz
Module: 5 to 50 Hz

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[X] No TRS requested from vendor

6. Input g-level Test at Box: S/S = 3g F/B = 3g V = 3g
Module: 1g in each 3 directions

7. Laboratory Mounting: Box: Resting on the floor (portable shaker used)
Module: Mounted in test fixture which is bolted to shake table

1. [ ] Bolt (No.____, Size_____) [ ] Weld(Length_____) [] __________

* Only the penetration outboard termination box and the penetration module were seismically tested. The other components were qualified by analysis. See Appendix "B".

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

9. Test Results including modifications made: See Appendix "D"

10. Other tests performed (such as fragility test, including results):

    Steam test, thermal cycling, pre-age 40 years at 70°c, radiation tested 2.1 x 10^2 rads. A leak, allowed per IEEE 317, of <10^6 cc developed.

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: (See Appendix "B")

   [X] Static Analysis [ ] Equivalent Static Analysis

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

3. Model Type: [ ] 3D [X] 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 [ ] SRSS
   [ ] Other: ______ (specify)

6. Damping: ______ 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

See Appendix "E"

B.	Max. Deflection	Location	Effect Upon Functional Operability

None

APPENDIX "A"

APPENDIX "B"

APPENDIX "B"

EQUIPMENT QUALIFICATION METHOD:

Combination of test and analysis:

A. Tests performed were as follows:

1. Termination Box (outboard box only)

   a. Termination Box Housing - tested for natural frequency only by portable shaker.

   b. Terminal Strips Inside Termination Box - tested by portable shaker at terminal strip resonance frequency to 3g for 3 minutes.

2. Electrical Penetration Module - tested by single frequency sweep test, uniaxial, at 1g in each direction from 5 to 50' Hz.

B. The following components were structurally analyzed:

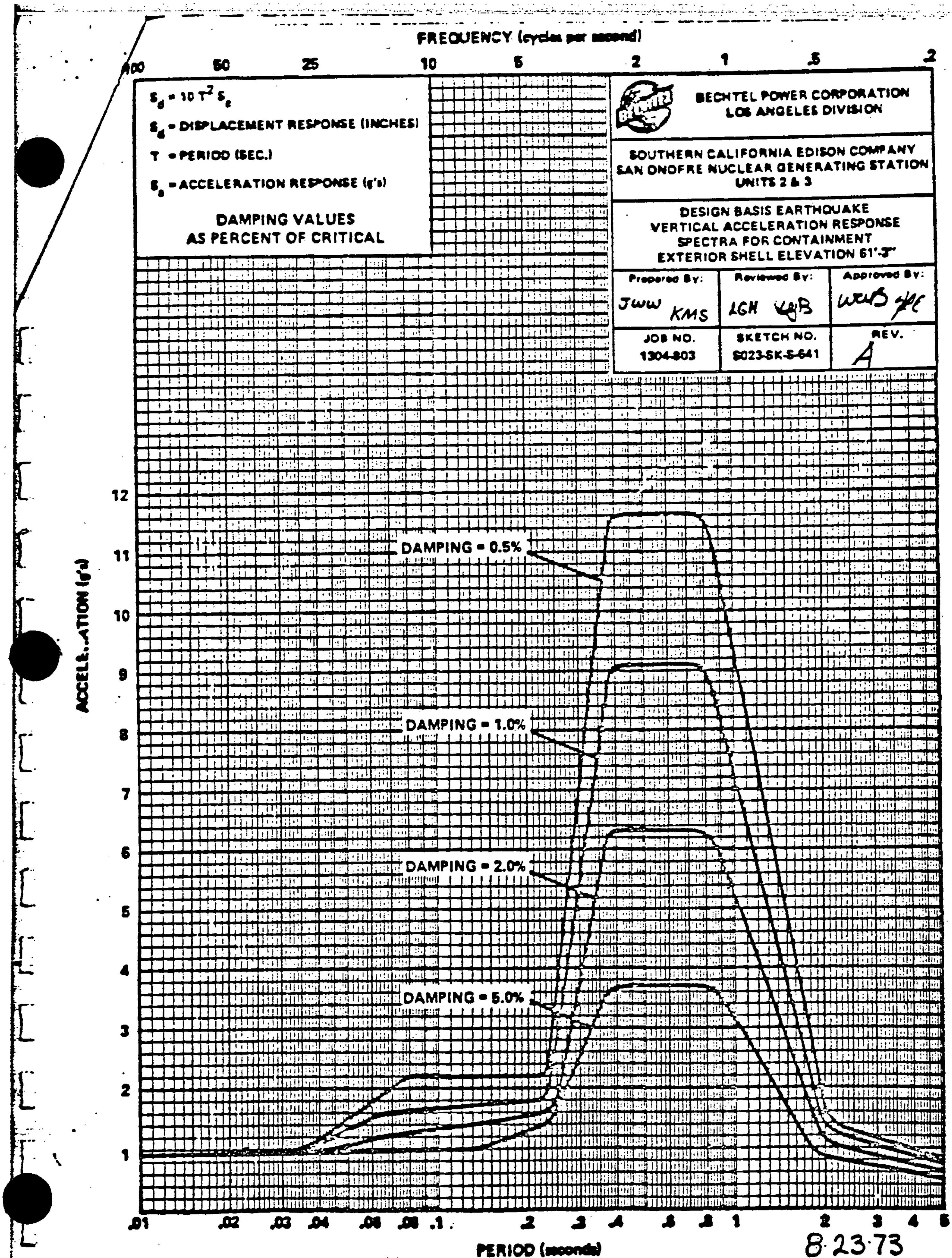
1. Hold-down bolts for outboard box and penetration.

2. Wiring and structures inside the termination box.

3. Bulkhead which supports the modules.

4. Hold-down bolts for inboard box (Note: The inboard box is considered as a nonpressure boundary. The box has an implosion disk which, during a LOCA, will open a hole in the box to prevent the differential pressure from exceeding a valve which would collapse the box walk. The analysis was done to prove that the inboard box will maintain its structural integrity during a seismic event.)

APPENDIX "C"


FREQUENCY (cycles per second)
100
50
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5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA FOR CONTAINMENT
EXTERIOR SHELL ELEVATION 61'-3"
Prepared By:
JWW KMS
Reviewed By:
LGH
Approved By:
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-641
REV.
A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
12
11
10
9
8
7
6
5
4
3
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1
.01
.02
.03
.04
.06
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.4
.6
.8
1
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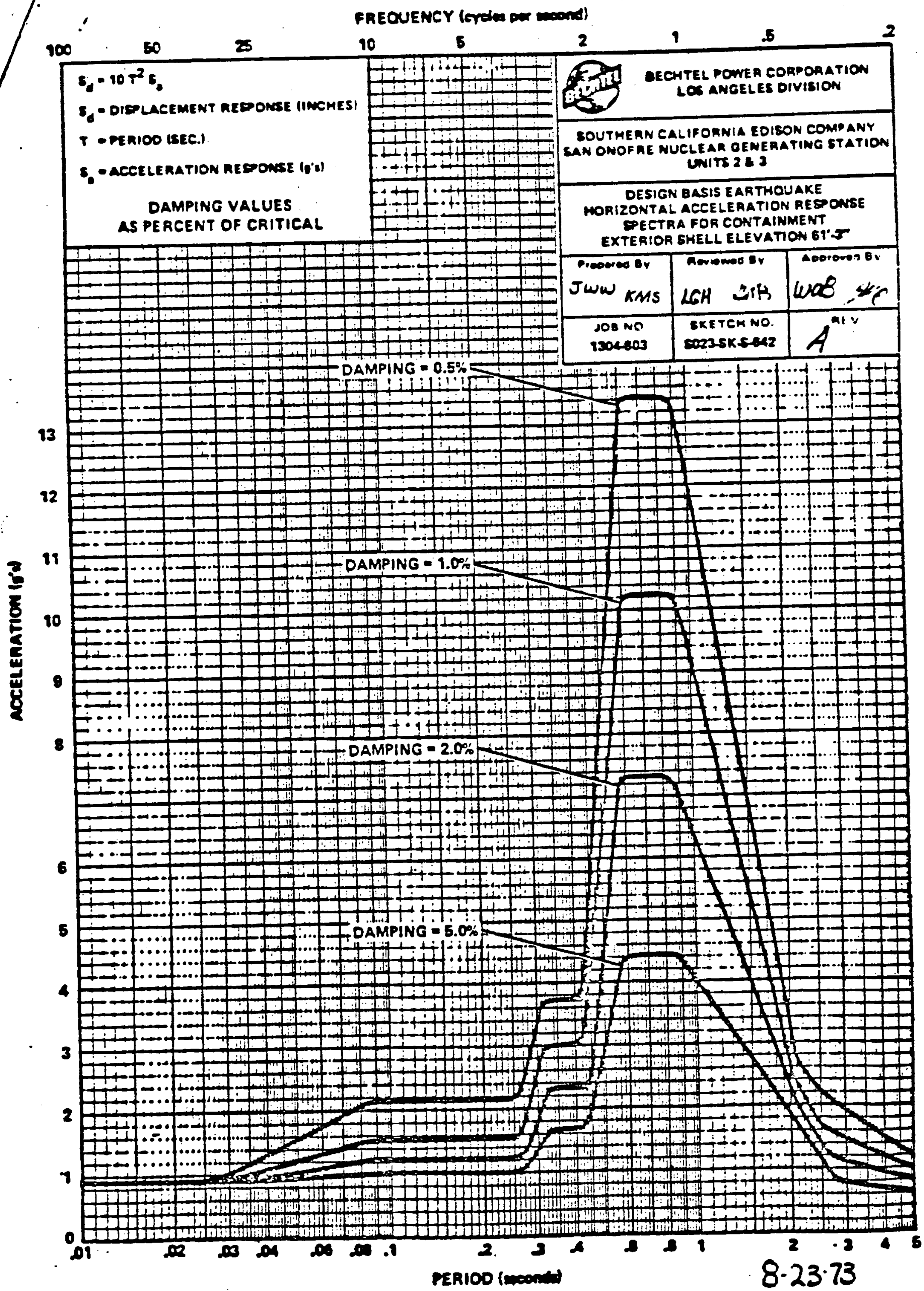
3
4
5
PERIOD (seconds)

8-23-73



FREQUENCY (cycles per second)
100
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1
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.2
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA FOR CONTAINMENT
EXTERIOR SHELL ELEVATION 61'-3"
Prepared By
JWW KMS
Reviewed By
LGH
Approved By
WAB
JOB NO
1304-603
SKETCH NO.
S023-SK-S-642
REV
A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
13
12
11
10
9
8
6
5
4
3
2
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.04
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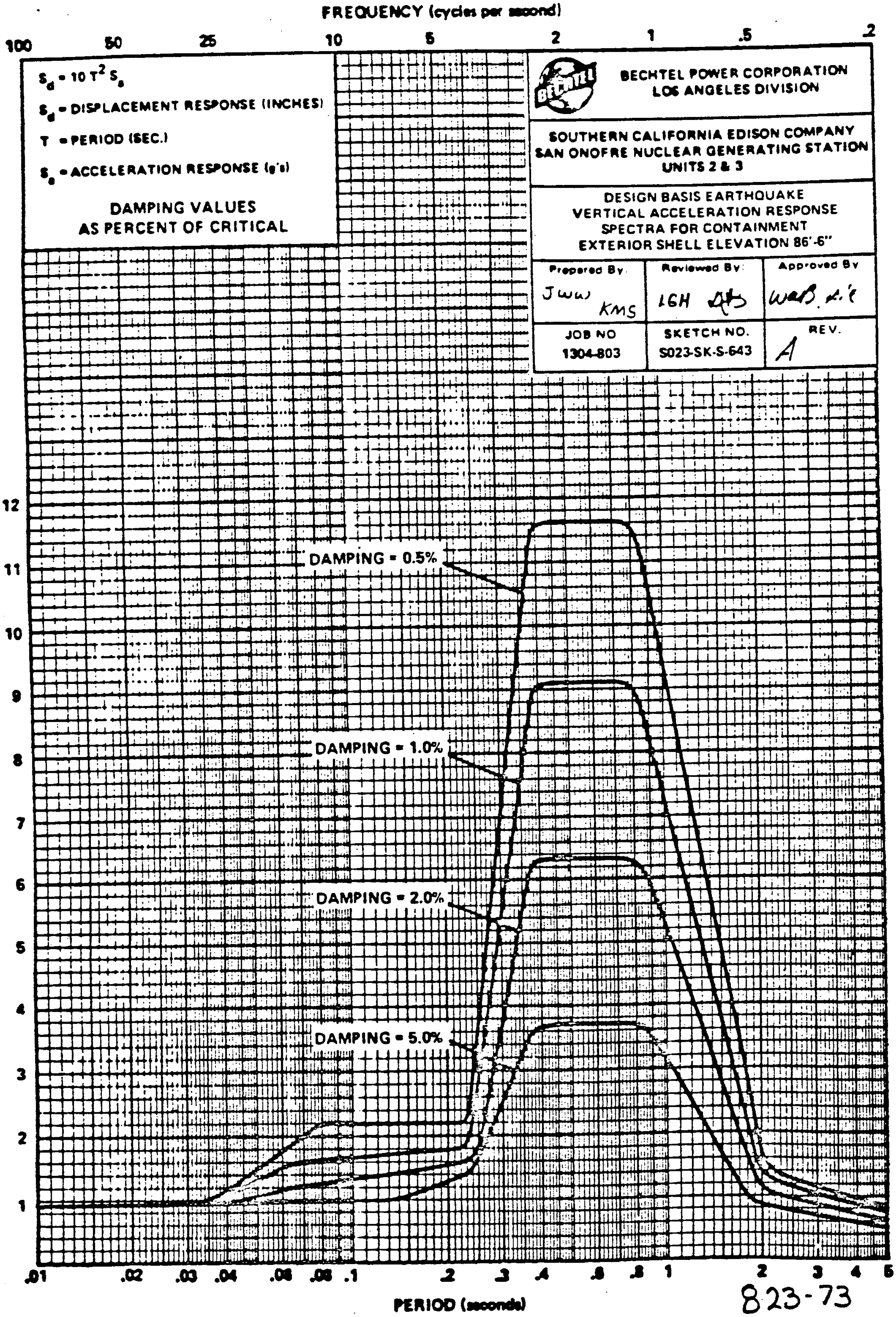
5
PERIOD (seconds)
8-23-73

8


FREQUENCY (cycles per second)
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.5
.2
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S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA FOR CONTAINMENT
EXTERIOR SHELL ELEVATION 86'-6"
Prepared By
JWW KMS
Reviewed By
LGH
Approved By
JOB NO
1304-803
SKETCH NO.
S023-SK-S-643
REV.
A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCEL
12
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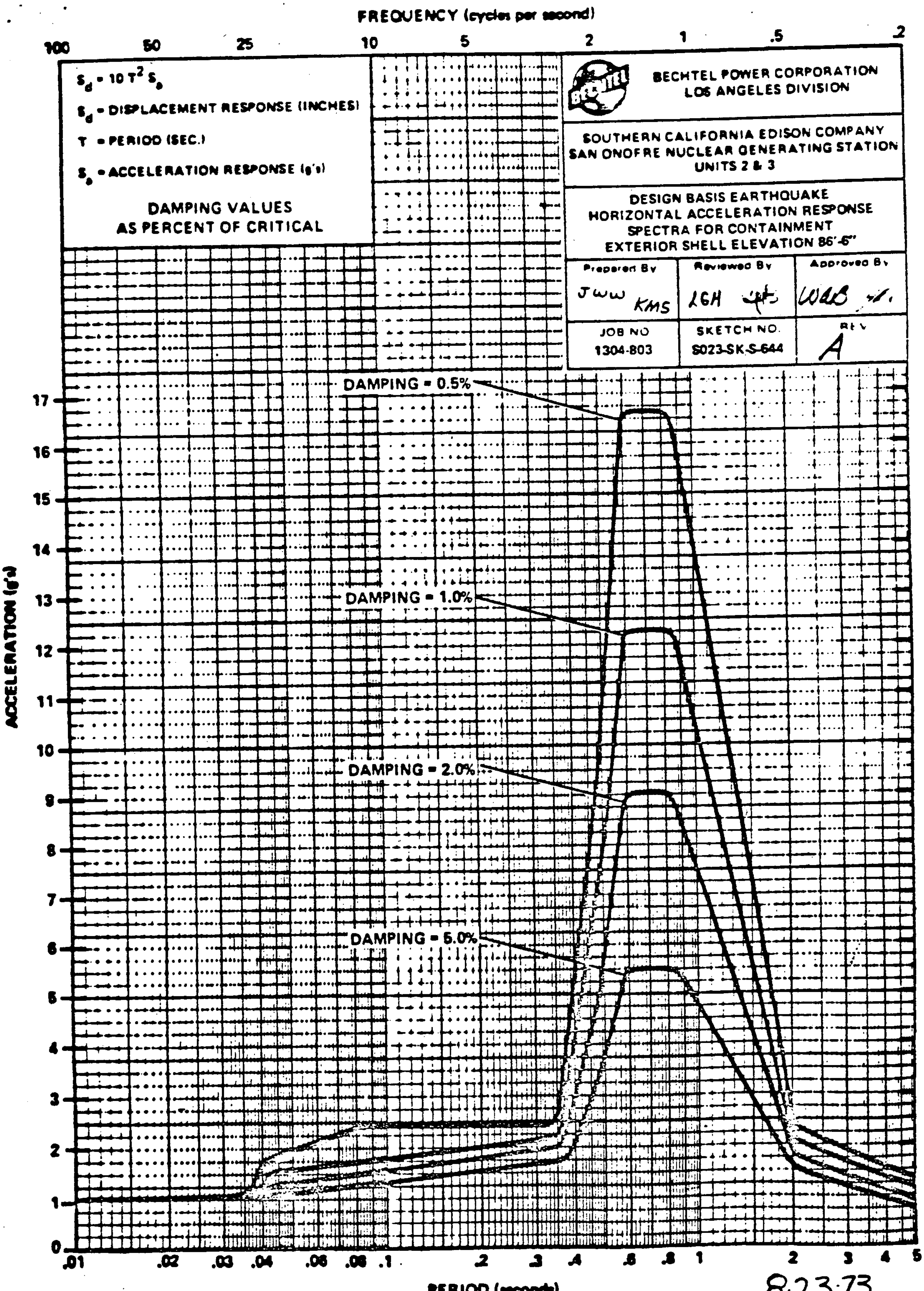
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

823-73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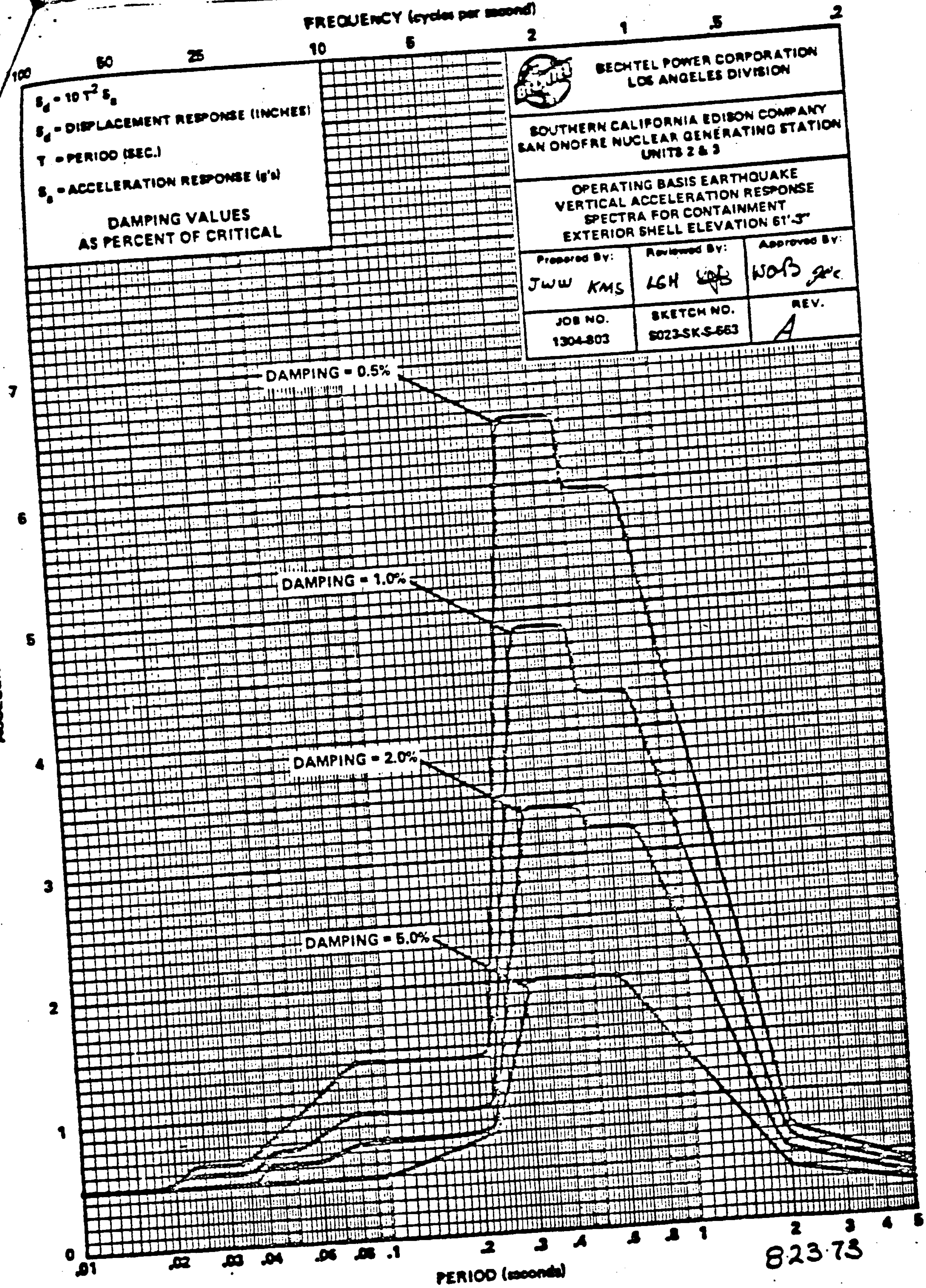
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA FOR CONTAINMENT
EXTERIOR SHELL ELEVATION 86'-6"
Prepared By
JWW KMS
Reviewed By
LGH
Approved By
WAB
JOB NO
1304-803
SKETCH NO.
S023-SK-S-644
REV
A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
.01 .02 .03 .04 .06 .08 .1 .2 .3 .4 .6 .8 1 2 3 4 5
PERIOD (seconds)

8·23·73


FREQUENCY (cycles per second)
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$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
OPERATING BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA FOR CONTAINMENT
EXTERIOR SHELL ELEVATION 61'-3"
Prepared By: JWW KMS
Reviewed By: LGH
Approved By: WOB
JOB NO. 1304-803
SKETCH NO. S023-SK-S-663
REV. A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
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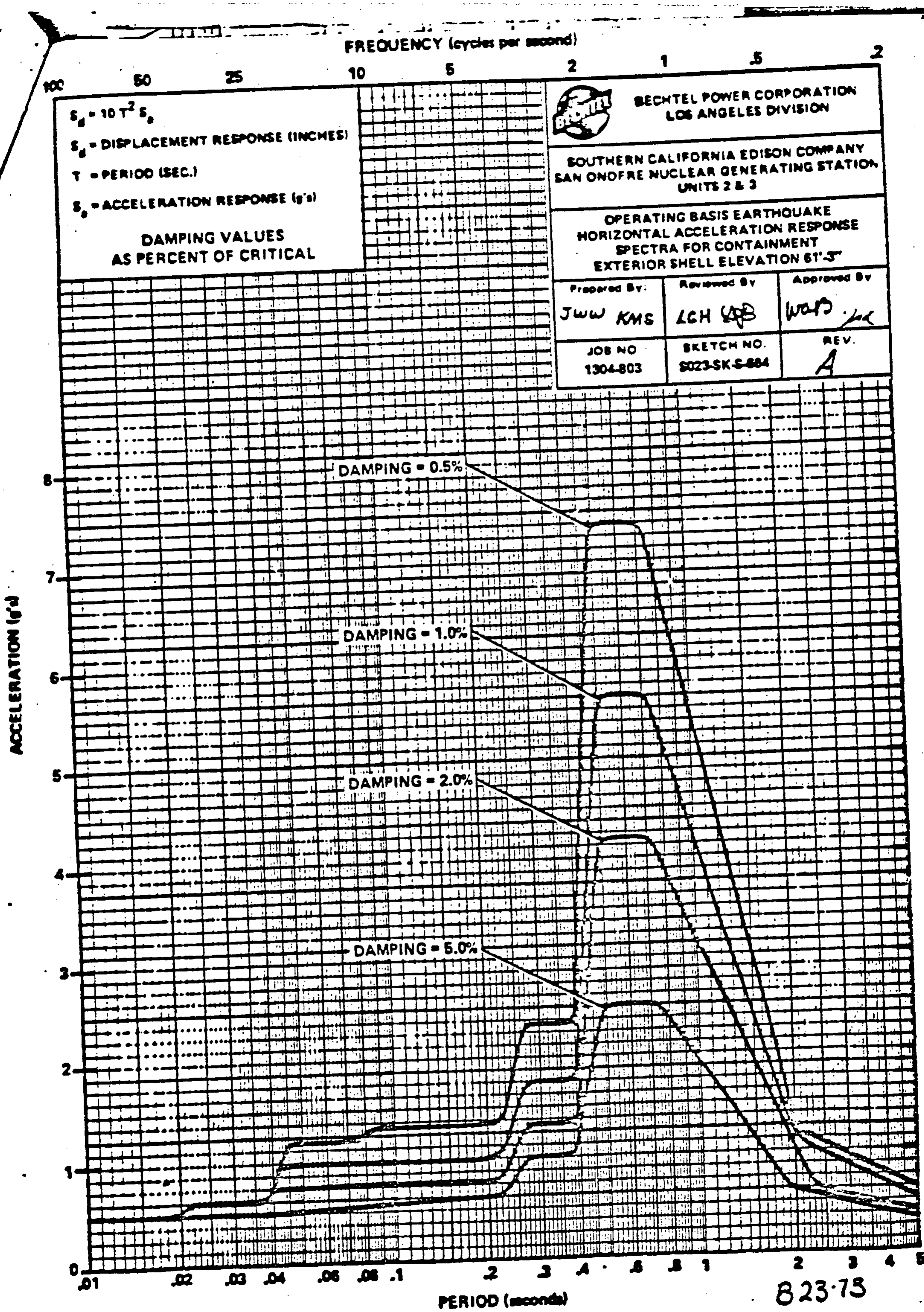
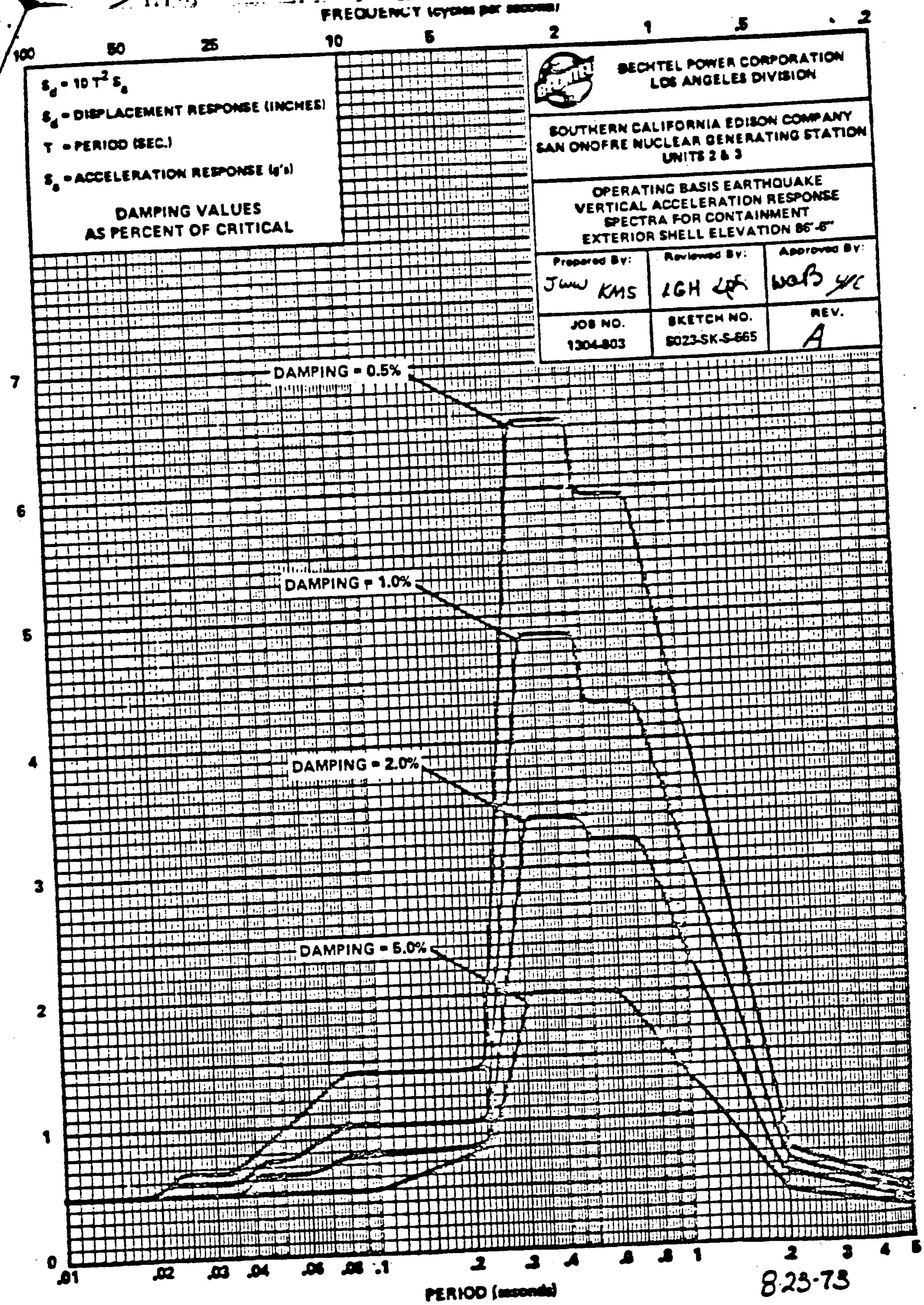
.01 .02 .03 .04 .06 .08 .1 .2 .3 .4 .6 .8 1 2 3 4 5
PERIOD (seconds)
8.23.73


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
OPERATING BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA FOR CONTAINMENT
EXTERIOR SHELL ELEVATION 61'-3"
Prepared By:
JWW KMS
Reviewed By
LCH
Approved By
JOB NO
1304-803
SKETCH NO.
S023-SK-S-884
REV.
A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
0
1
2
3
4
5
6
7
8
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

8·23·75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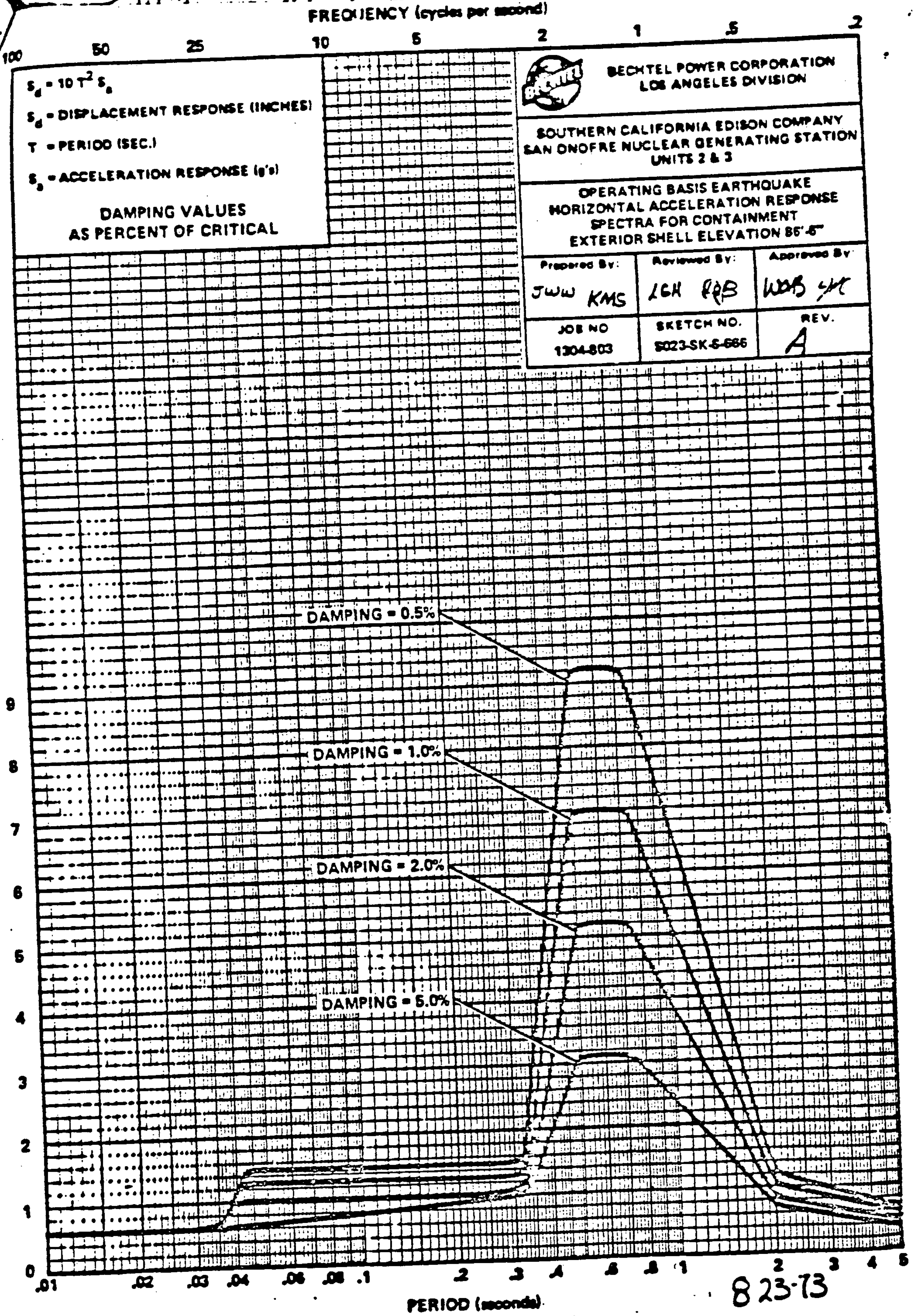
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
OPERATING BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA FOR CONTAINMENT
EXTERIOR SHELL ELEVATION 86'-6"
Prepared By: JWW KMS
Reviewed By: LGH
Approved By: WOB
JOB NO. 1304-803
SKETCH NO. 5023-SK-S-665
REV. A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
0 1 2 3 4 5 6 7
.01 .02 .03 .04 .06 .08 .1 .2 .3 .4 .6 .8 1 2 3 4 5
PERIOD (seconds)
8-23-73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S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
OPERATING BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA FOR CONTAINMENT
EXTERIOR SHELL ELEVATION 86'-8"
Prepared By: JWW KMS
Reviewed By: LGH RRB
Approved By: WOB
JOB NO 1304-803
SKETCH NO. S023-SK-S-666
REV. A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
0 1 2 3 4 5 6 7 8 9
.01 .02 .03 .04 .06 .08 .1 .2 .3 .4 .6 .8 1 2 3 4 5
PERIOD (seconds)

8 23-73

12

APPENDIX "D"

APPENDIX "D"

Test results including modifications made:

1. TERMINATION BOX

   The test results showed that the termination box assemblies are capable of withstanding the DBE without damage or loss of function.

2. ELECTRICAL PENETRATION MODULE

   The prototype module which had a small leak rate (less than allowable per IEEE317, 10^{-6} std. cc) after all previous tests, were monitored during vibration test. Unit was pressurized to 15 PSIG and during vibration test, no added loss of pressure through module or "O" rings was observed.

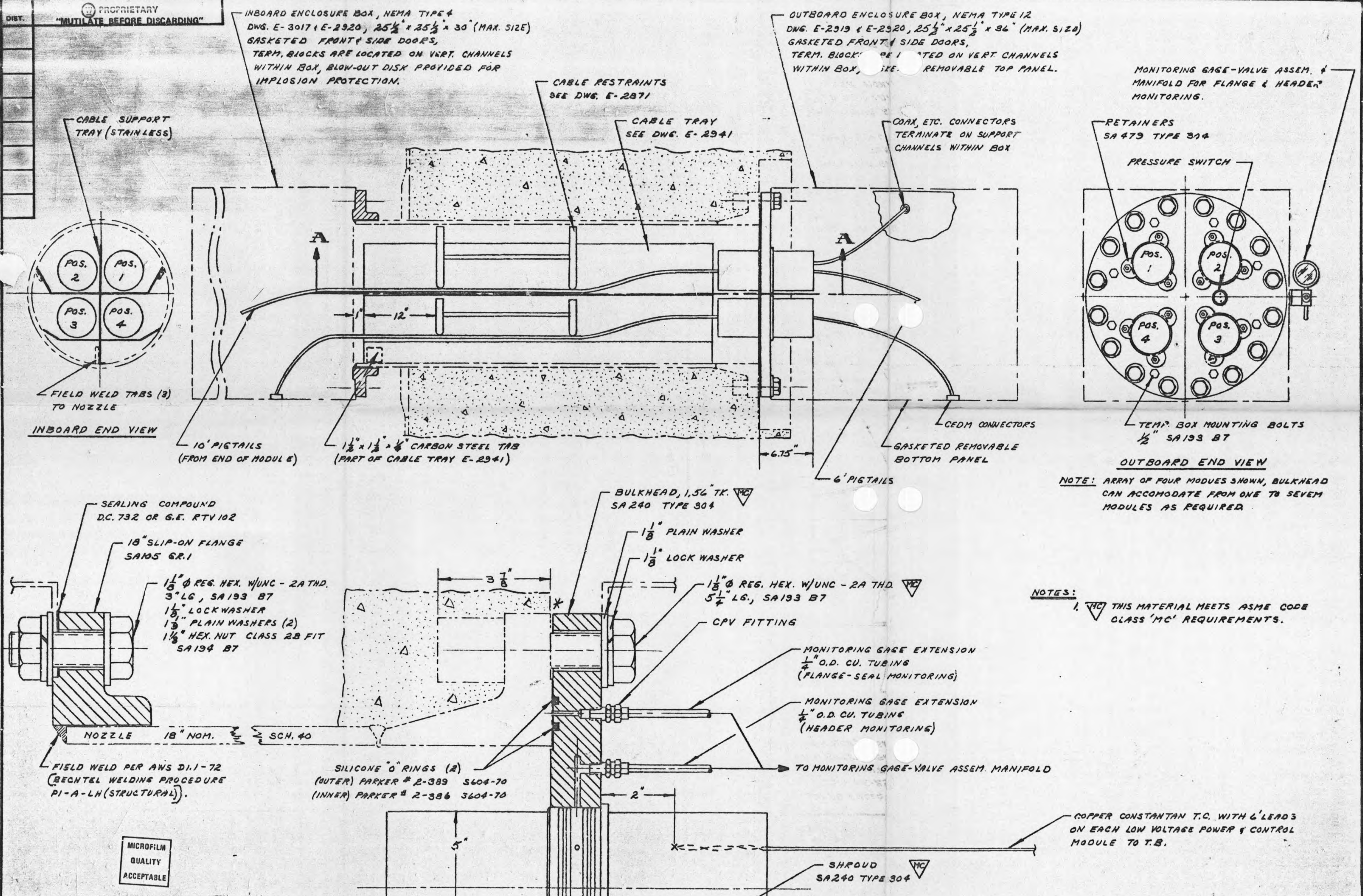
   The absence of resonances and retention of pressure show that the module is not affected adversely by seismic vibration.

APPENDIX "E"

APPENDIX "E"

CRITICAL STRUCTURAL ELEMENTS

IDENTIFICATION	LOCATION	GOVERNING LAND	SEISMIC STRESS (PSI)	TOTAL STRESS (PSI)	STRESS ALLOW-ABLE (PSI)
Electrical Pene-tration Assembly	Penetration (Aux. Bldg.) Elev. 51'-0" Through 87'-0"				
1. 16 Hold Down Bolts	Outboard Box and Penetration to Nozzle Flange	•Containment LOCA Pressure •Dead Loads •Seismic •Jet Force	1,951 287	10,480 1,395	94,500 27,500
2. Structures Inside Termin-ation Box	Termination Box	•Dead Load •Seismic	470	940	27,000
3. Bulkhead	Penetration	•Containment •LOCA Ptessure •Dead Load •Seismic	37	-	27,000
4. 16 Hold Down Bolts	Inboard Box to Nozzle Flange	•Jet Force •Seismic •Dead Load	2,170	9,125	94,000



MICROFILM QUALITY ACCEPTABLE

IMPORTANT
If the price or schedule is affected by this document approval, Bechtel must be notified prior to fabrication or such claims are waived.
Approval of documents involving calculation, analysis or test report is only an acceptance of the method used by the supplier. Supplier retains full responsibility for design.
Approval of this document does not relieve the supplier from full responsibility for contract or purchase order requirements including, but not limited to, adequacy and suitability of materials and/or equipment represented thereon for the intended function.

DATE RECEIVED 8/25/77

DOCUMENT STATUS
1 ☐ APPROVED - MANUFACTURER MAY PROCEED
3 ☐ APPROVED EXCEPT AS NOTED. MAKE CHANGES AND RESUBMIT. MANUFACTURER MAY PROCEED AS APPROVED.
4 ☐ NOT APPROVED - CORRECT AND RESUBMIT
7 ☐ INFORMATION ONLY ☐ DISTRIBUTION REQUIRED

DOC STATUS BY
DATE 9/15/77
PP-1216 (10/9) 12/75

SO23-304-1-3-~~12~~ 14 SCE # 3832

WESTINGHOUSE ELECTRIC CORPORATION ELECTRONIC TUBE DIVISION HORSEHEADS, N.Y.	DATE 7-7-77 SPEC. NO. E - 2866
SUBJECT: MODULAR PENETRATION 18" NOZZLE	SUPSD. DATE 6/16/77

NUCLEAR PLANT: SAN ONOFRE #2 & #3
BUILT FOR: SOUTHERN CALIF. EDISON Co

UNLESS OTHERWISE SPECIFIED: ALL THDS CL 2A OR 2B, CONC. .004 T.I.R., F.A.O. SEE ALSO STD ET 10 THRU 28

DENOTES CHANGES

C SIZE DWG.

SCALE NTS							
SUB	P.C. NO.	DRAWN	CHK'D	APPR.	DATE
M		P.J.C.		RCL	4-29-77

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 Type:

1. Utility: Southern California Edison Company PWR X

2. NSSS: CE 3. A/E: Bechtel BWR ____

II. Component Name: 125 VDC Batteries

1. Scope: [ ] NSSS [X] BOP

2. Model Number: 2GC-13 (4) / 2GC-17 (4) / (8) Quantity: 8

3. Vendor: Exide

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

5. Physical Description a. Appearance Two step rack

b. Dimensions 2GC-13-108" x 49" x 38"/2GC-17-145" x 49" x 38"

c. Weight ____

6. Location: Building: Control Bldg.

Elevation: 50'-0"

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

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

S/S: * F/B: * V: *

9. a. Functional Description: Provides 125 VDC Class 1E Power

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

[X] Both

10. Pertinent Reference Design Specifications: S023-301-2

* Seismic Qualification of this equipment has not been completed.

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

IV. Equipment Qualification Method: Test: Exide Type 2GC-17'

Analysis: ____

Combination of Test and Analysis: Exide 2GC-13 qualified by similarity to 2GC-17

Test and/or Analysis by Test/Analysis not complete
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

 3. [ ] Explosive only 4. [ ] Other (Specify) ____

 5. [ ] Combination of ____

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

2. Required Response Spectra (attach the graphs): S023-SK-S-739, 725, NRIM 737, 701

3. Required Acceleration in Each Direction:

 S/S = 1g F/B = 1g V = 0.75g

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: 1-33 Hz.

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
 [ ] No

 Test not completed

*In each horizontal direction

6. Input g-level Test at S/S = __*__ F/B = __*__ V = __*__

7. Laboratory Mounting: ____________

   1. [ ] Bolt (No.___, Size ___) [X] Weld (Length___) [ ] __________

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

9. Test Results including modifications made: Tests are not complete, report expected January 1980.

10. Other tests performed (such as fragility test, including results):

    Radiation and thermal aging prior to seismic

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

1. Description of Test including Results: Not Applicable

2. Method of Analysis: ____________

   [ ] Static Analysis
   [ ] Dynamic Analysis
   [ ] Equivalent Static Analysis
   [ ] Time-History
   [ ] Response Spectrum

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: ________ Basis for the damping used: ____________

7. Support Considerations in the model: ____________

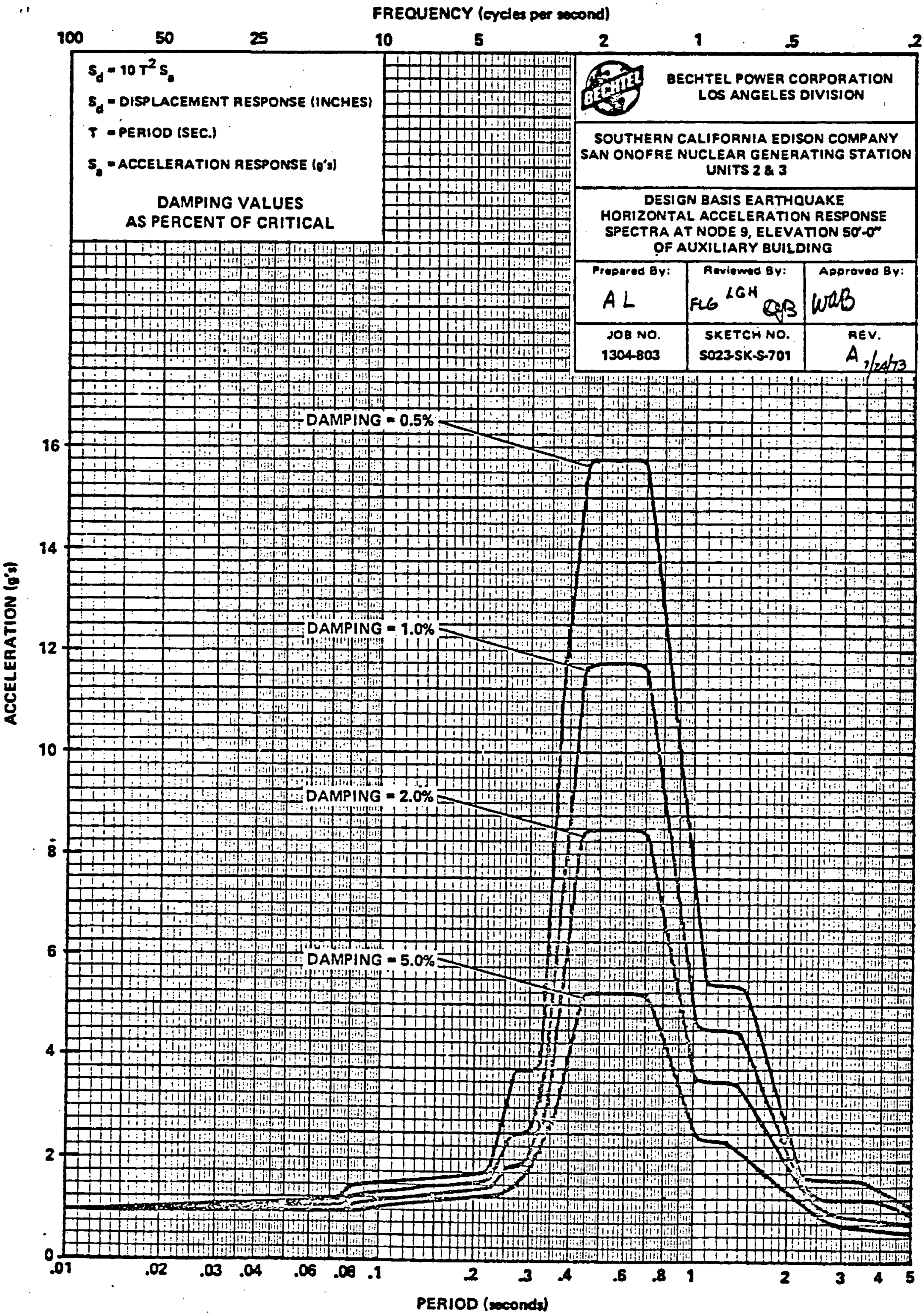
*Test not completed

8. Critical Structural Elements: ______________________________

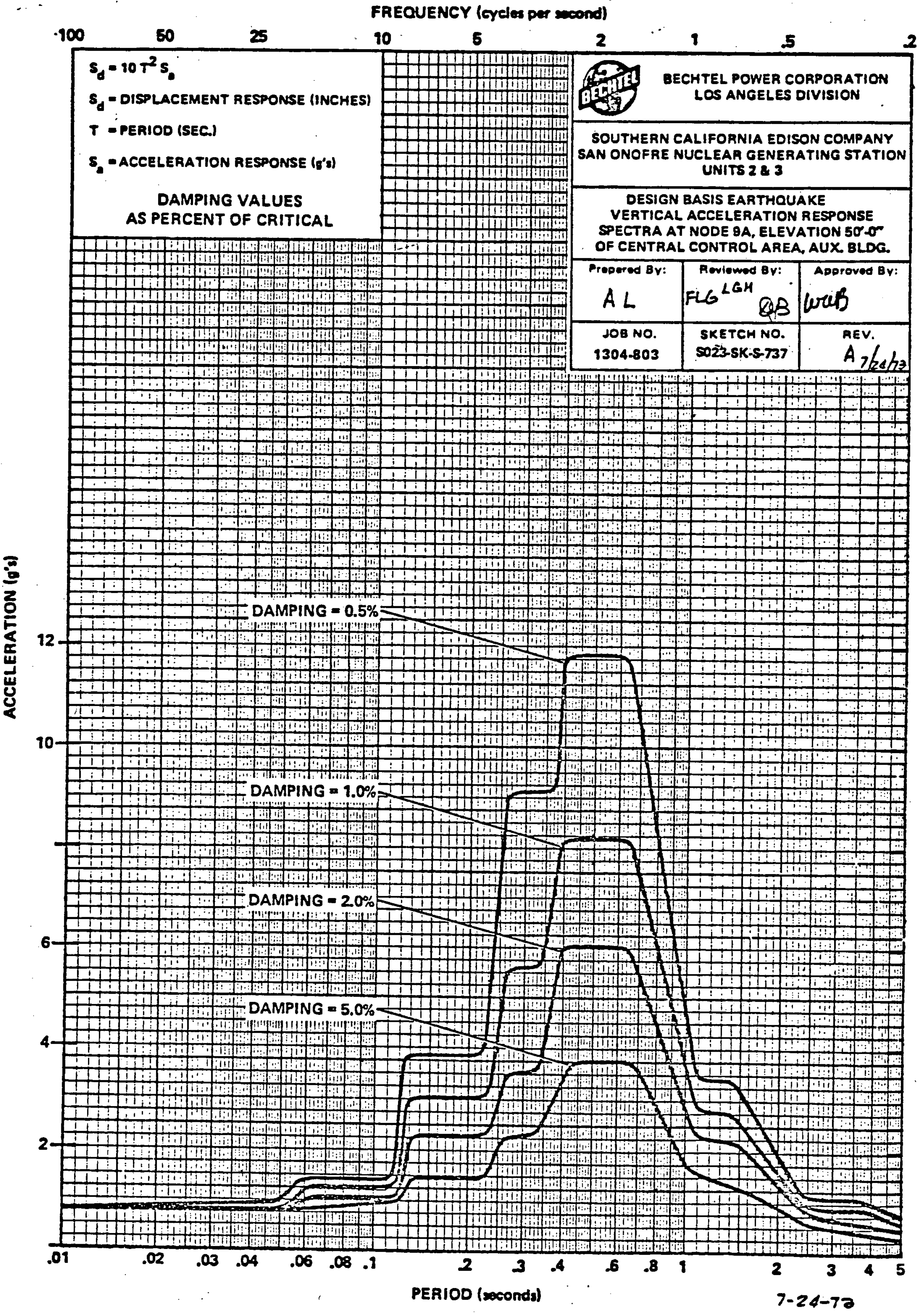
A.	Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.	Max. Deflection	Location	Effect Upon Functional Operability

APPENDIX A



BECHTEL POWER CORPORATION LOS ANGELES DIVISION		
SOUTHERN CALIFORNIA EDISON COMPANY SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3		
DESIGN BASIS EARTHQUAKE HORIZONTAL ACCELERATION RESPONSE SPECTRA AT NODE 9, ELEVATION 50'-0" OF AUXILIARY BUILDING		
Prepared By:	Reviewed By:	Approved By:
AL	FLG LGH QB	WAB
JOB NO.	SKETCH NO.	REV.
1304-803	S023-SK-S-701	A 7/24/73



FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10\,T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA AT NODE 9A, ELEVATION 50'-0"
OF CENTRAL CONTROL AREA, AUX. BLDG.
Prepared By: A L
Reviewed By: FLG LGH QB
Approved By: WaB
JOB NO. 1304-803
SKETCH NO. S023-SK-S-737
REV. A 7/24/73
ACCELERATION (g's)
12
10
6
4
2
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

7-24-73

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 Type:

1. Utility: Southern California Edison Company PWR X

2. NSSS: CE 3. A/E: Bechtel BWR

II. Component Name: Class 1E Battery Charger

1. Scope: [ ] NSSS [X] BOP

2. Model Number: ARR130K300 Quantity: 9

3. Vendor: C&D Batteries

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

5. Physical Description a. Appearance Cabinet

b. Dimensions 48" W x 36" D x 78" H

c. Weight 1700 lbs

6. Location: Building: Control Area (Auxiliary Bldg.)

Elevation: 50'-0"

7. Field Mounting Conditions [X] Bolt (No. 4, Size 1-/2")
[ ] Weld (Length)
[ ]

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

S/S: 9 Hz. F/B: 8 Hz. V: 8 & 23 Hz.

9. a. Functional Description: Supplies 125 VDC to change Class 1E station batteries.

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

[X] Both

10. Pertinent Reference Design Specifications: S023-301-3*

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

IV. Equipment Qualification Method: Test: ______

Analysis: ______

Combination of Test and Analysis: By similarity to C and D Model ARR 130 K 400

Test and/or Analysis by Wyle Labs #43330-1
Bechtel Log S023-301-3-44-0
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

   3. [ ] Explosive only 4. [ ] Other (Specify) ______

   5. [ ] Combination of ______

   6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS [ ] N/A (other, specify)

2. Required Response Spectra (attach the graphs): See Appendix "B"

3. Required Acceleration in Each Direction:

   S/S = 1.0g F/B = 1.0g V = 0.75g

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 10 Each Horizontal Direction with Vertical.
   SSE 2 Each Horizontal Direction with Vertical.
   Other N/A (Specify)

4. Frequency Range: 1-40 Hz See Appendix "C"

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs) [X] No*

*Lowest natural frequency is 8 Hz, TRS exceeds TRS above 4Hz

6. Input g-level Test at S/S = 2.0g F/B = 1.8g V = 1.3g

7. Laboratory Mounting: ______

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

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

9. Test Results including modifications made: Equipment not yet qualified.

10. Other tests performed (such as fragility test, including results):

    Component Functional tests. A parallel test is being performed by C&D on a 24 Amp ARR 130 AC 25F single phase charger. This unit is first radiated then seismically tested and is to be used for on-going qualification. Test results for the ARR 130 AC 25F charger are found in Bechtel vendor Log No. S023-301-3-67-1. The 25 Amp charger is constructed and uses materials similar to the ARR 130K 300 charger.

VII. If Qualification by Analysis or by the Combination of Test and Analysis, then Complete: Not Applicable

1. Description of Test including Results: ______

2. Method of Analysis: ______

   [ ] Static Analysis [ ] Equivalent Static Analysis
   [ ] Dynamic Analysis [ ] Time-History
   [ ] Response Spectrum

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: __________ 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. Deflection	Location	Effect Upon Functional Operability

APPENDIX "A"

Appendix "A"

DESIGN DATA

C&D BATTERIES
DIVISION OF ELTRA CORPORATION
Manufacturers of Batteries and Automatic Chargers

3043 WALTON ROAD, PLYMOUTH MEETING, PENNA. 19462
TELEPHONE: 215-828-9000 TELETYPE: 510-660-8436

SHEET 1 OF 5

CUSTOMER:
ORDER # 7-30129
SHIP TO:

MODEL ARR130K400 BATTERY CHARGER

SIZE: 48"Wx36"Dx78"H WEIGHT 2100 LBS NET MTG. Floor

RATED AC INPUT 480 VAC DC OUTPUT 132/140 ± 1/2 %

RIPPLE 1% on Bat. (RMS) CURRENT LIMIT 115 % AMBIENT TEMP 50 °C

EFFICIENCY: 90 % POWER FACTOR .55 TYPE OF CONTROL SCR

PROTECTION

AC INPUT CIRCUIT BREAKER (PART NO. JR-372 POLE 3 AMP 175 AUX CONTACT)
DC OUTPUT CIRCUIT BREAKER (PART NO. JR-432 POLE 2 AMP 600 AUX CONTACT)
DC FUSE RT-91 Amptrap 150A ANODE FUSE RT-91 Amptrap 150A
CONTROL FUSE JL-85 1 AMP SURGE PROTECTOR JC-8 Cap. & 100 Ω 12W Res.

AMMETER JM-193 0-500 KX241 VOLTMETER JM-179 0-150 KX241
RECTIFIER (PRV) 500V TIMER JR-376 (3Day)
CONTROL WIRE SIS POWER CABLE Hypalon Jacket
ALARMS:
KBC-2914 Time Delay
JR-346 Disconnect Relay
KBC-2136A H.V.S.D.
(2) MBC-1992 Load Sharing
JR-367 Phase Loss Monitor
JL-134 Eq. Pilot Light

TEST DATA REQUIRED:

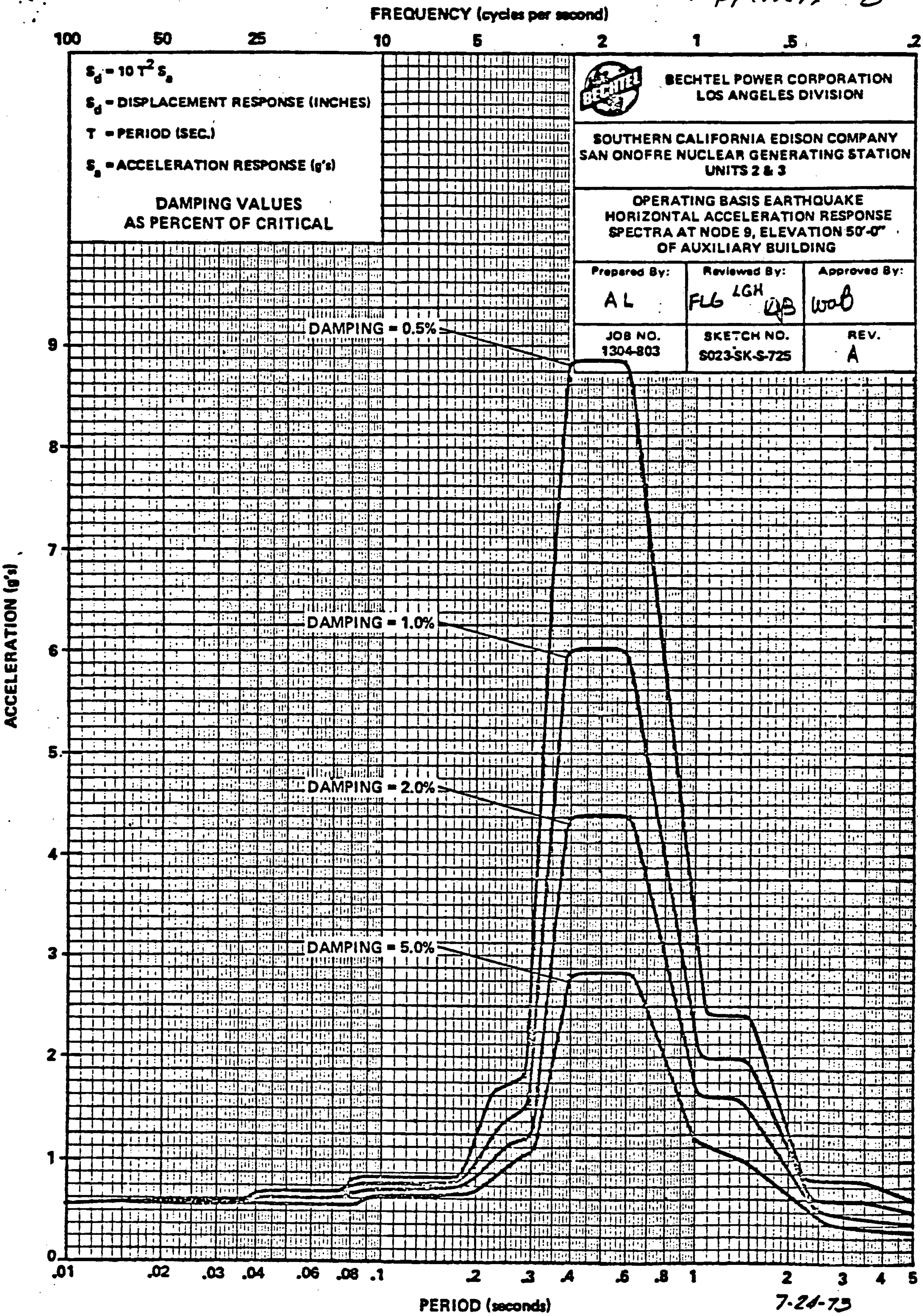
DIELECTRIC TEST YES RIPPLE TEST YES (on battery only)
CURRENT LIMIT TEST 115% NO LOAD TEST YES
REGULATION TEST YES
HEAT RUN N/R HOURS N/R LOAD N/R
OTHER Seismic on Serial # ES7637

an Eltra company QCD614-1 FIGURE 4

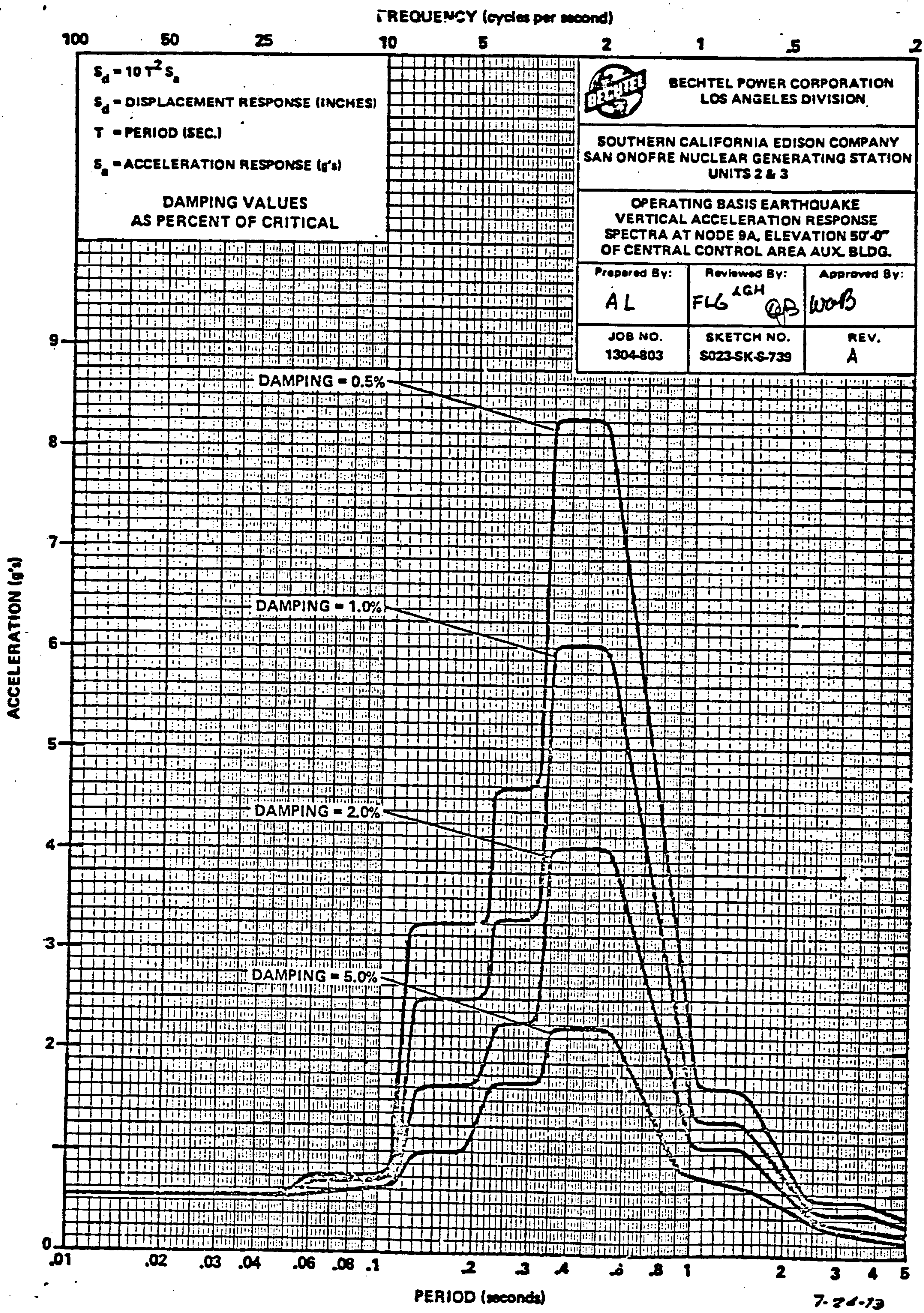
5023-301-3-44-0

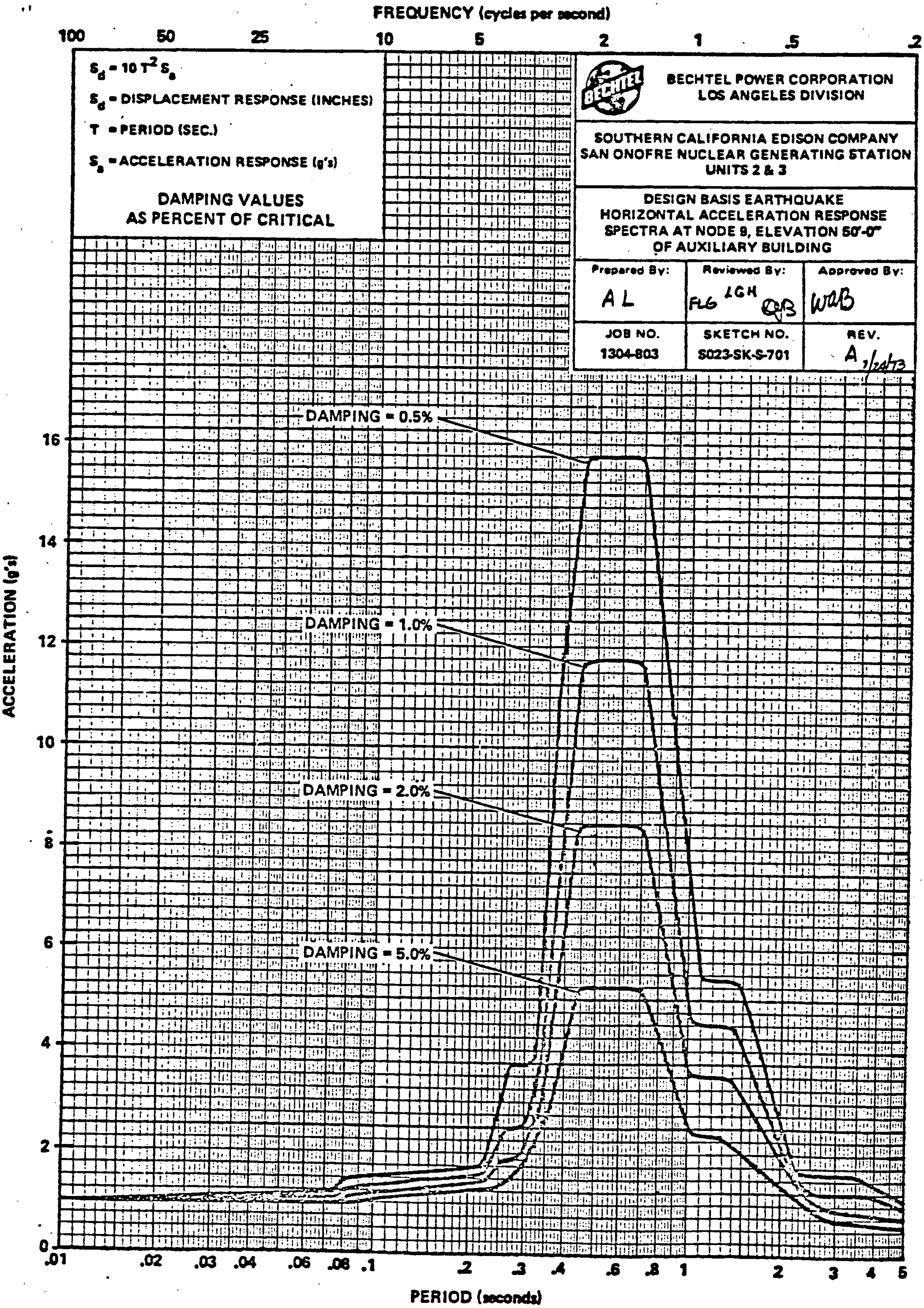
APPENDIX "B"

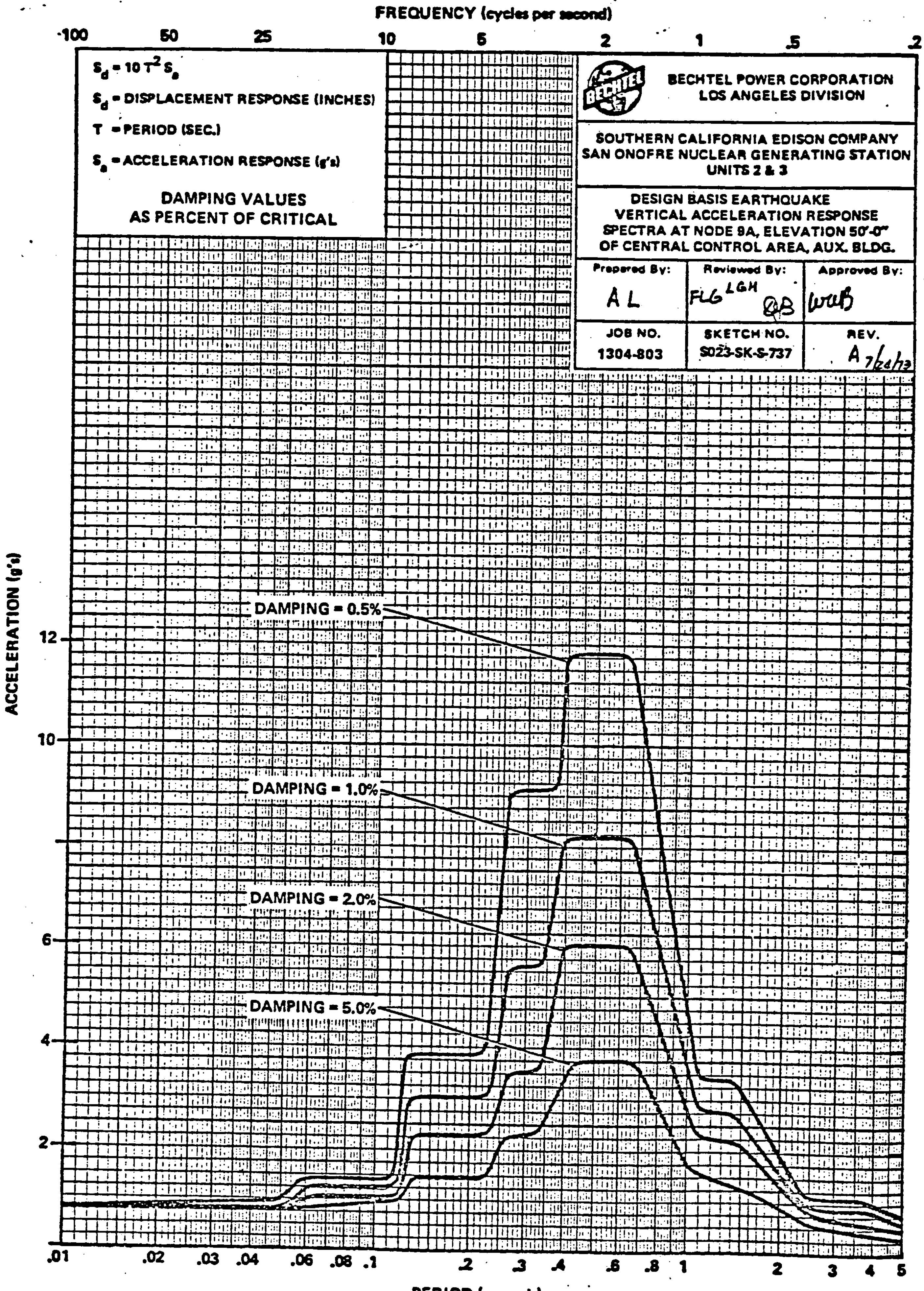
Appendix "B"



7-24-73


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
OPERATING BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA AT NODE 9A, ELEVATION 50'-0"
OF CENTRAL CONTROL AREA AUX. BLDG.
Prepared By:
AL
Reviewed By:
FLG
LGH
QB
Approved By:
WOB
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-739
REV.
A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
9
8
7
6
5
4
3
2
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)
7-24-73


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA AT NODE 9, ELEVATION 50'-0"
OF AUXILIARY BUILDING
Prepared By:
AL
Reviewed By:
FLG LGH QB
Approved By:
WAB
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-701
REV.
A 1/24/73
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
16
14
12
10
8
6
4
2
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA AT NODE 9A, ELEVATION 50'-0"
OF CENTRAL CONTROL AREA, AUX. BLDG.
Prepared By:
A L
Reviewed By:
FLG LGH QB
Approved By:
WUB
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-737
REV.
A 7/24/73
ACCELERATION (g's)
12
10
6
4
2
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

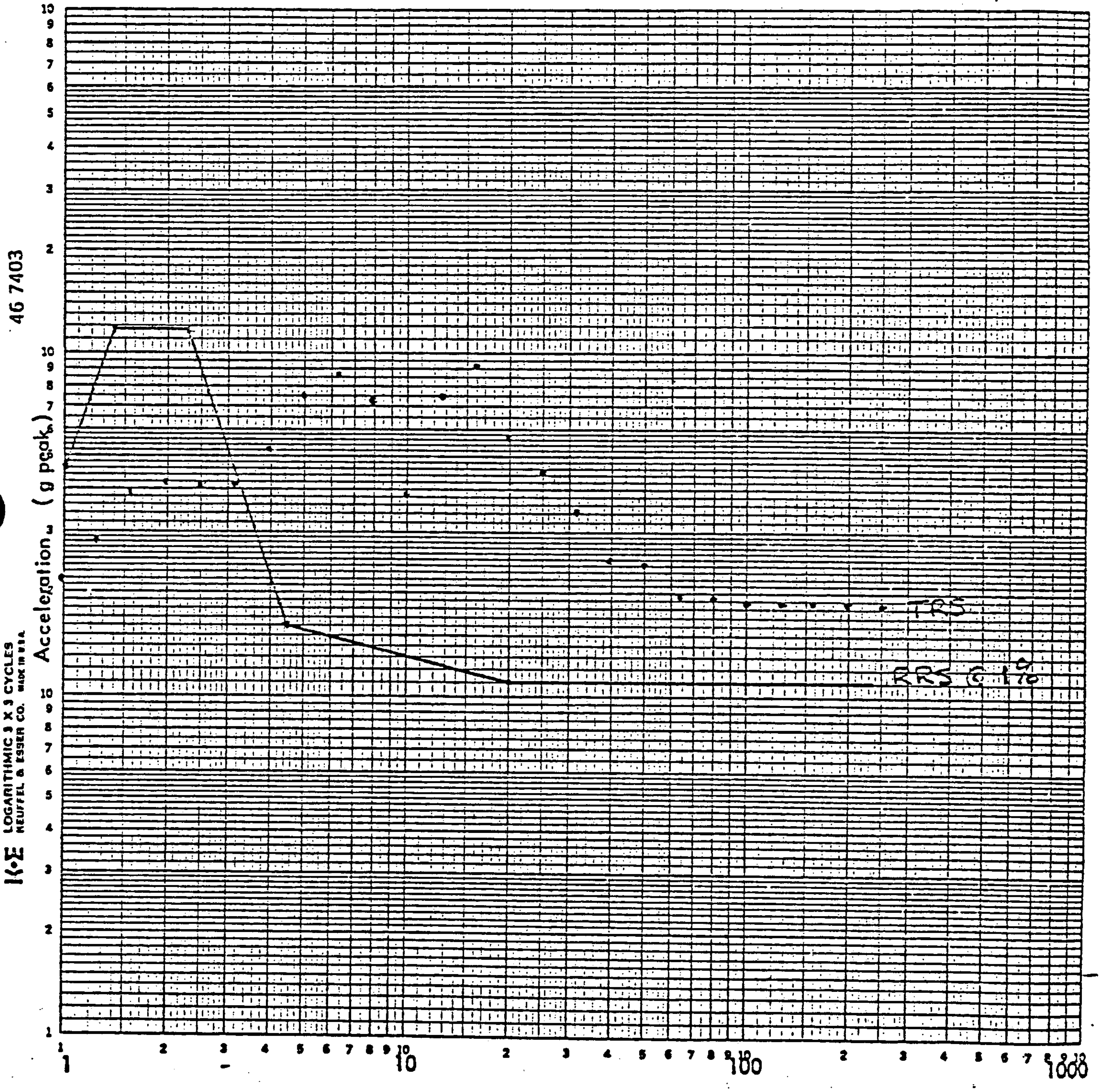
7-24-73

APPENDIX "C"

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING $\boxed{1\ \%}$



AXIS FRONT-TO-BACK/VERTICAL

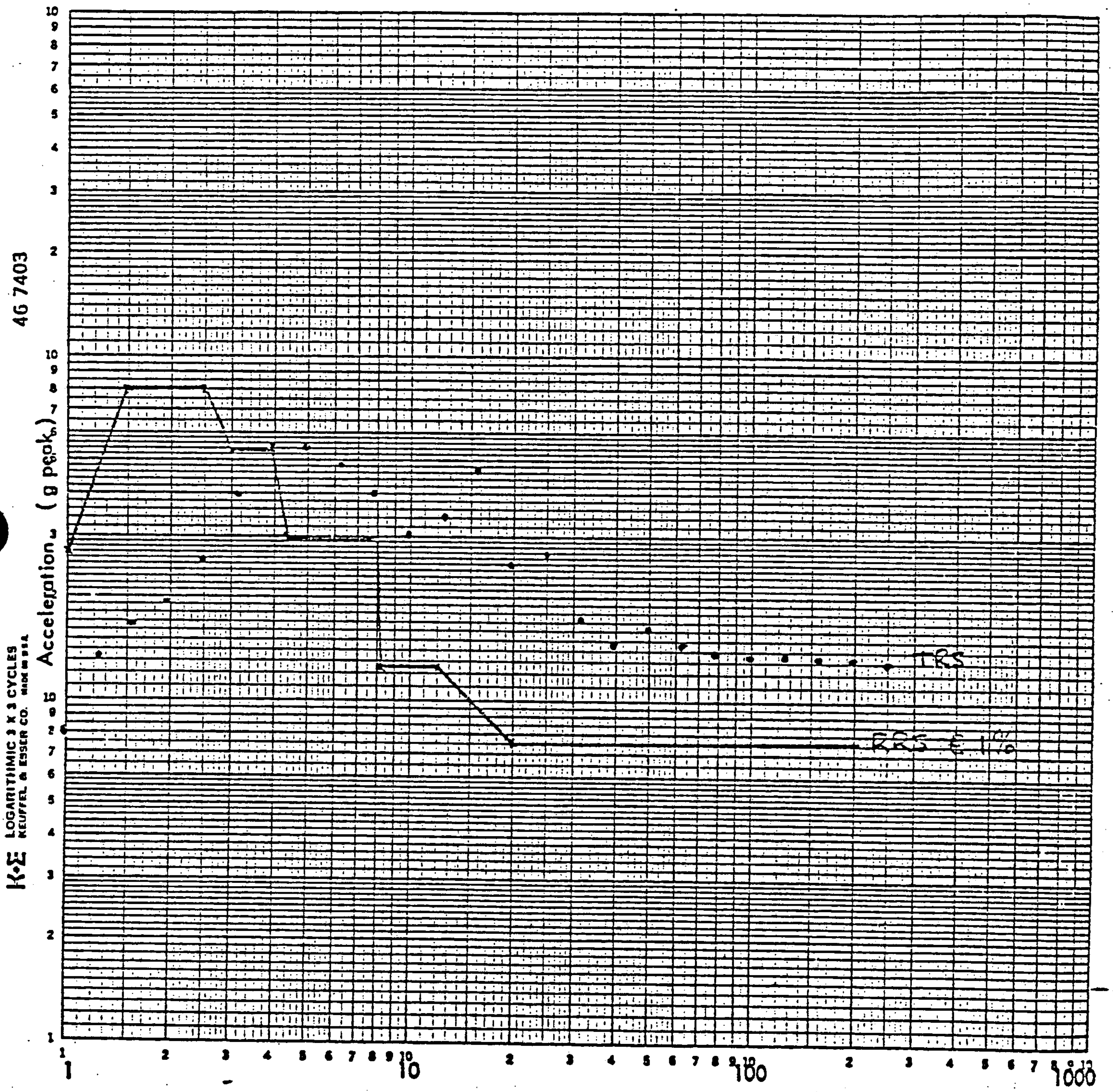
LOCATION NO. HCB

TEST RUN NO. 7

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING $\boxed{1\ \%}$

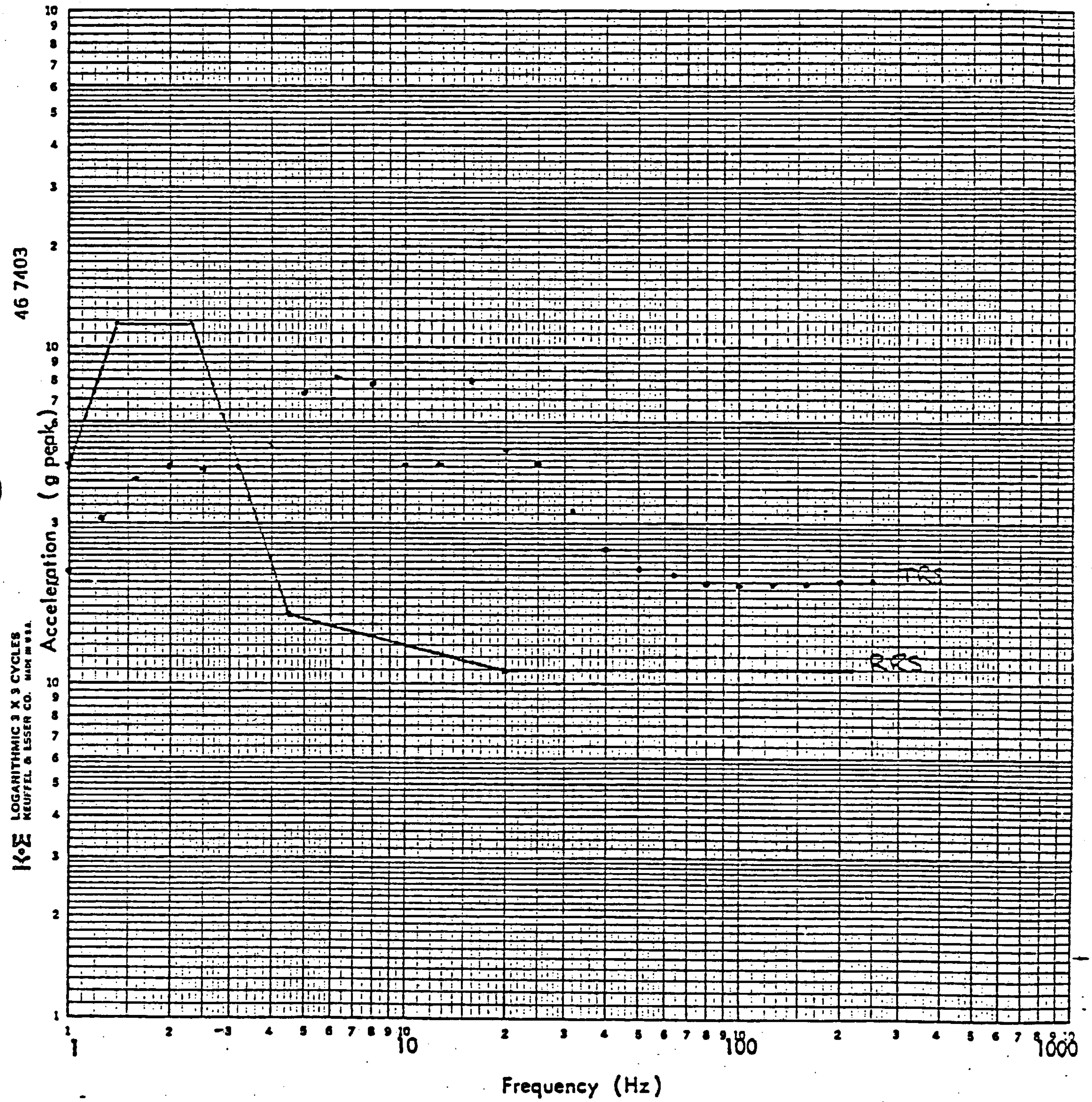


AXIS Front-to-Back/Vertical
LOCATION NO. VCA
TEST RUN NO. 7

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING $\boxed{1\%}$



AXIS Side-to-Side/Vertical

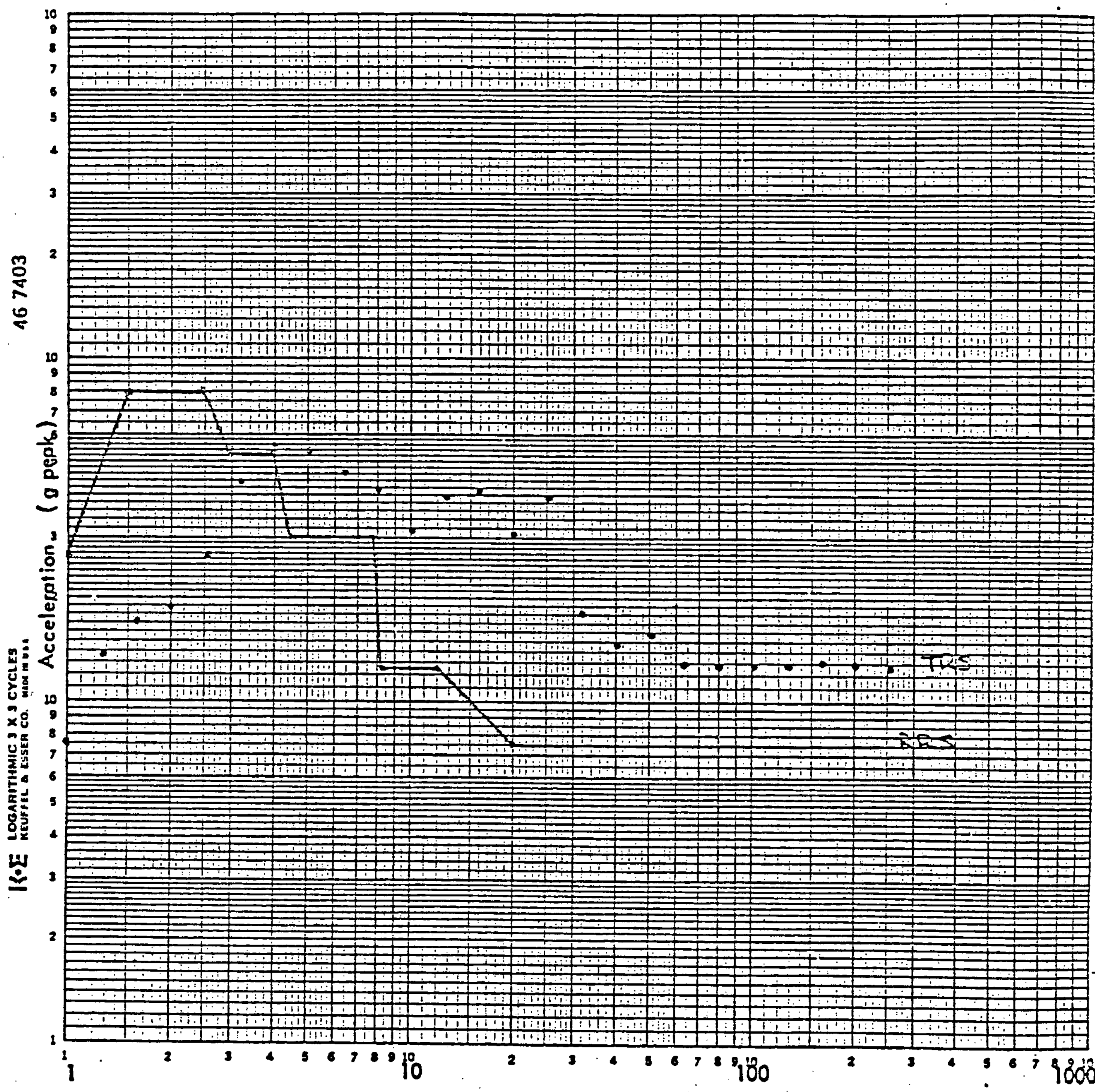
LOCATION NO. HCA

TEST RUN NO. 17

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING [1 %]



AXIS Side-to-Side/Vertical

LOCATION NO. VCA

TEST RUN NO. 14

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR ____

II. Component Name: Main Control Panel - Sections 1-6 & 12-16

1. Scope: [ ] NSSS [X] BOP
2. Model Number: Custom Made — Quantity: 1
3. Vendor: Circle AW Products Co.
4. If the component is a cabinet or panel, name and model No. of the devices included: See Appendix A
5. Physical Description a. Appearance "W" shape cubicle

   b. Dimensions 107" H x 132" W x 72" deep (Section 3 only)

   c. Weight 5082 lbs (Section 3 only)
6. Location: Building: Control area in aux. bldg.

   Elevation: 30'-0"
7. Field Mounting Conditions [ ] Bolt (No.___, Size___)
   [X] Weld (Length 4" @ 7" O.C.)
   [ ] ____
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S: >33 HZ F/B: *7.8HZ; *17.5HZ** V: >33 HZ
9. a. Functional Description: The controls and instrumentation for monitoring and operation of the plant equipment are housed in the main control panel

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

   [X] Both
10. Pertinent Reference Design Specifications: S023-502-5

*Single Section
**28 Hz Entire Panel. See VII 1

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

IV. Equipment Qualification Method: Test: ______

Analysis: ______

Combination of Test and Analysis: X

Test and/or Analysis by Wyle Labs. Reports 54498-1 & 54498-2
(Name of Company or Laboratory & Report No.)

V. Vibration Input: (For Section 3 only) The components were qualified independently. (See Appendix "A")

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

   3. [ ] Explosive only 4. [ ] Other (Specify) ______

   5. [ ] Combination of ______

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

2. Required Response Spectra (attach the graphs): See Appendix "B"

3. Required Acceleration in Each Direction: ______

   S/S = 1g F/B = 1g V = 0.75g

VI. If Qualification by Test, then Complete: (Data applies to Section 3 only)

1. [ ] Single Frequency [X] Multi-Frequency: [ ] random [ ] sine beat [X] Random with Bi-axial Sine Beat super-imposed at specific frequencies

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

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

4. Frequency Range: 1-35 HZ

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs) [X] *No See Appendix "C"

*TRS exceeds RRS above 2Hz and at natural frequencies.

6. Input g-level Test at S/S = 2g F/B = 2g V = 1.6g

7. Laboratory Mounting: ______

   1. [ ] Bolt (No.___, Size___) [X] Weld (Length 2" @ 8" O.C. F&B) [ ] ______

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

9. Test Results including modifications made: Section 3 (2CR-50, 2CR-51 & 2CR-58) when tested was found to be structurally sound when subjected to seismic test program.

10. Other tests performed (such as fragility test, including results): None

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

1. Description of Test including Results: Frequency search in situ test was conducted on main control panel assembly and 28HZ was found at Section 1 and 33HZ was at Section 3 during insitu test.

2. Method of Analysis: Shipping Section 3 was modeled & verified by testing then the full "W" control panel was analyzed as a group.

   [ ] Static Analysis
   [ ] Dynamic Analysis
   [X] Equivalent Static Analysis
   [ ] Time-History
   [ ] Response Spectrum

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

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

4. [X] Computer Codes: TRW systems groups "Two Dimensional and CDC Publication No. 86612000 Three Dimensional Frame Model Analysis Programs"

   Frequency Range and No. of modes considered: 1-35 HZ Two (2)

   [ ] Hand Calculations

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

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

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
1)Stiffner Angle	Bottom	SSE	--	26,995	32,400
2)Bolts	Support	SSE	--	24,022	82,800
3)Stiffner Angle	Side of Section 1	SSE	--	27,047	32,400
4)X-Bracing Angle	Bet. Plates	SSE	--	2,713	32,400
5)Weld	&Bracing Angle	SSE	--	9,745	13,600

B.

Max. Deflection	Location	Effect Upon Functional Operability
N/A		

APPENDIX A

BECHTEL

CALCULATION SHEET

NORWALK, CALIFORNIA

SIGNATURE G. K. Nagaraj DATE 2-15-79 CALCULATION NO. ______

CHECKED ______ DATE ______

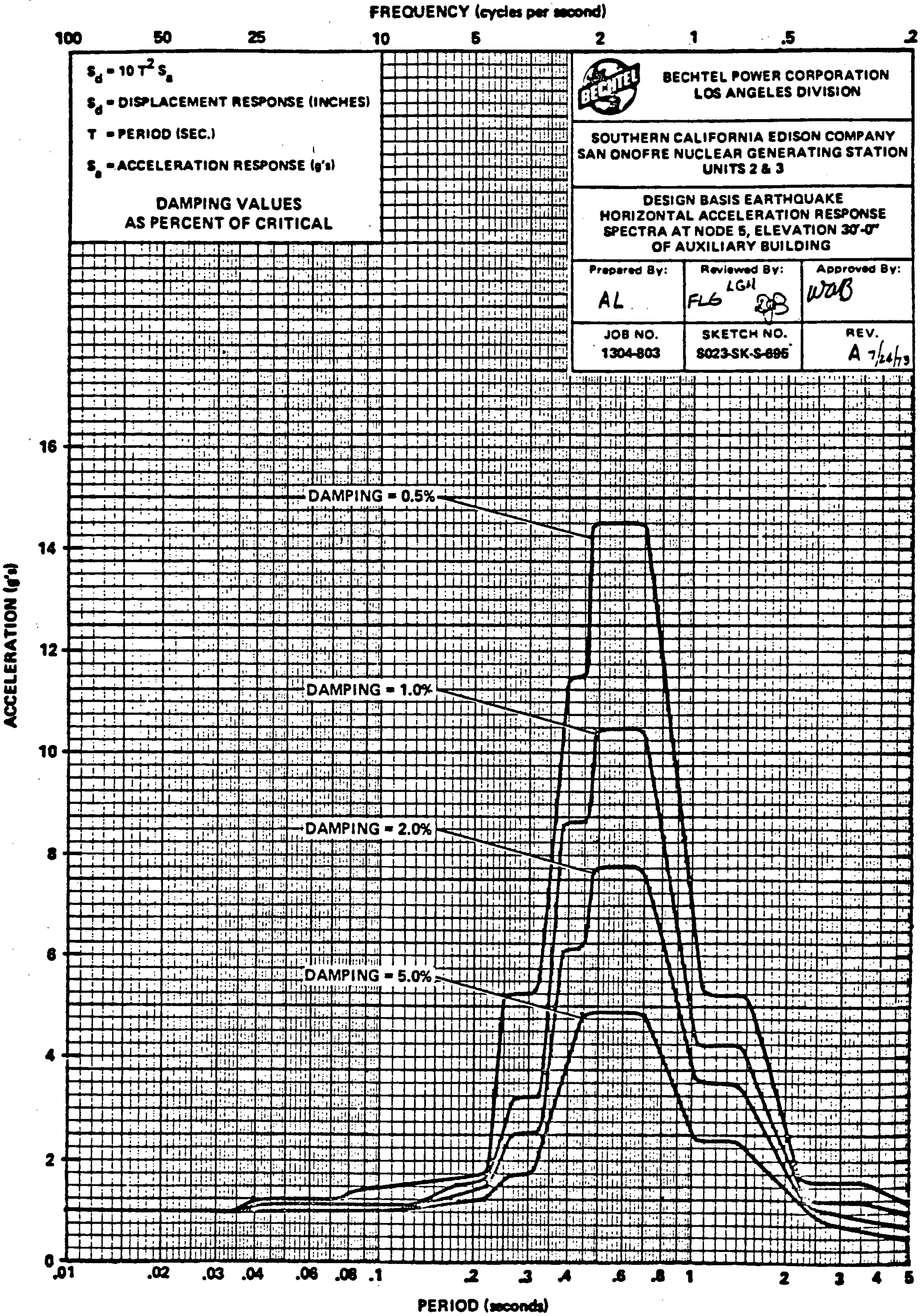
PROJECT SONGS 2&3 PROJECT JOB NO. 10079-003

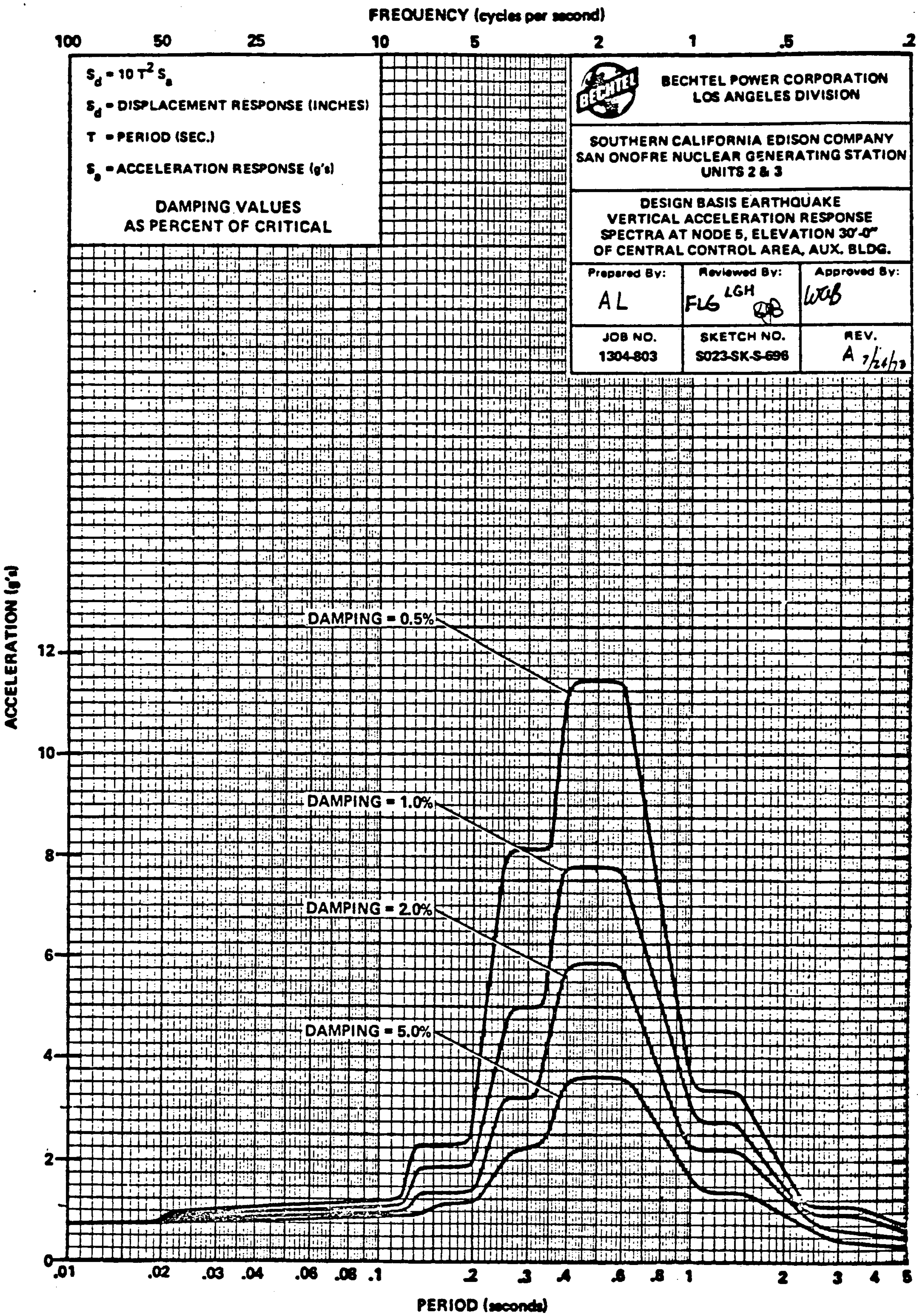
SUBJECT MAIN CONTROL ROOM PANEL SEISMIC QUAL CR-57 SHEET 1 OF 1 SHEETS

APPENDIX "A"

ITEM NO	DESCRIPTION	TOTAL NO IN PANEL	VENDOR	MODEL	TYPICAL TESTED	(*) IS EQPT QUALIFIED FOR CLASS IE SERVICE OR STRUCT SEISMIC	EQPT QUALIFIED BY TEST/ANALYSIS	TEST "G"	(**) REQUIRED G	TYPE OF INPUT USED	REPORT NO	REMARKS
1	BACK LIGHTED PUSHBUTTON SWITCHES	100	MASTER SPECIALTIES CO	10 H	4 POSITION VERTICAL SWITCH	CLASS IE	TYPICAL WAS TESTED REST WERE ANALYZED	5 G	3	SINE DWELL	5023-506-2-32-2 [MSC NO 058-1165-75A]	CONFIGURATIONS USED ON THIS PANEL ARE 2, 3 & 4 POSITIONS. THIS ITEM IS REFEARED TO AS CONTROL SWITCHES
2	KEY LOCKED SELECTOR SWITCHES	30	MASTER SPECIALTIES CO	PT	SELECTOR SWITCH WITH 4 LIGHTS	CLASS IE	TYPICALS TESTED OTHERS ANALYZED	5G	3	SINE DWELL	5023-506-2-32-2 [MSC NO 058-1165-75A]	CONFIGURATION USED ON THIS PANEL ARE SELECTOR SWITCHES WITH 2 LIGHTS. THIS ITEM ALSO REFERRED TO AS CONTROL SWITCHES
3	INDICATING LIGHT MODULES	89	MASTER SPECIALTIES CO	10 H	SEE REMARKS	CLASS IE	ANALYSIS	N/A	3	N/A	5023-505-5-22-1 [MSC NO 058-1166-75]	THE REPORT SHOWS THAT THESE ARE SIMILIAR TO THOSE QUALIFIED IN 5023-506-2-32-2 AND HAVE NO RESONANCES BELOW 33 HZ
4	RECEIVER TYPE INDICATORS	41	SIGMA	9270	9270	CLASS IE	TEST	3.5G	3	SINE BEAT	5023-505-7-10-2 [SIGMA NO SBI-3]	
5	RECEIVER TYPE INDICATORS	8	SIGMA VIA CE	9270					3			CE REPORT REFERENCED PROVIDES COMPLETE SEISMIC QUALIFICATION DATA FOR CE SUPPLIED ITEMS
6	ESF BYPASS STATUS PANEL	2	MASTER SPECIALTIES CO	10 H	10 H	STRUCTURAL SEISMIC ONLY	TEST	3	3	SINE SWEEP	5023-506-2-63-0 [WYLE NO 58114]	
7	FLOODING INDICATION LIGHT MATRIX	2	MASTER SPECIALTIES CO	10 H	SEE REMARKS	CLASS IE	ANALYSIS	5G	3	SINE DWELL	5023-505-5-22-1 [MSC NO 058-1166-75]	THE REPORT SHOWS THAT THESE ARE SIMILIAR TO THOSE QUALIFIED IN 5023-506-2-32-2 AND HAVE NO RESONANCES BELOW 33 HZ
8	RECEIVER TYPE INDICATORS	8	SIGMA VIA CE	1136		CLASS IE			3			CE REPORT REFERENCED PROVIDES COMPLETE SEISMIC QUALIFICATION DATA FOR CE SUPPLIED ITEMS
9	MANUAL AUTO LOADING STATION	2	FOXBORO VIA CE			CLASS IE			3			
10	ANNUNCIATOR WINDOW BOXES	3	ROCHESTER INSTRUMENTS	5-14035		STRUCTURAL SEISMIC ONLY	ANALYSIS	5G	3		5023-502-6-25-1 [INNOVATION TEC. II NO 7606-22]	STATIC ANALYSIS
									(**) REQ'D BY SPEC. ACTUAL EXPERIENCE < 29			(*) CLASS IE IMPLIES THAT THE EQUIPMENT IS QUALIFIED FOR IE SERVICE. TOTAL NO IN PANEL MAY OR MAY NOT BE ALL CLASS IE

APPENDIX B


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA AT NODE 5, ELEVATION 30'-0"
OF AUXILIARY BUILDING
Prepared By:
AL
Reviewed By:
FLG LGH
Approved By:
WAB
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-695
REV.
A 7/24/73
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
16
14
12
10
8
6
4
2
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA AT NODE 5, ELEVATION 30'-0"
OF CENTRAL CONTROL AREA, AUX. BLDG.
Prepared By:
AL
Reviewed By:
FLG LGH
Approved By:
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-696
REV.
A 7/24/73
ACCELERATION (g's)
12
10
8
6
4
2
0
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

APPENDIX C

(REPRESENTATIVE SAMPLES)

WYLE LABORATORIES

Report No. 54498-1

Customer JELCO Job No. 54498

Page No. 24 1 OF 2

Channel Identification: T/R 1 Trk. No. 1 Accel. No. 1

Transducer S/N 1171 Control (X), Response ( )

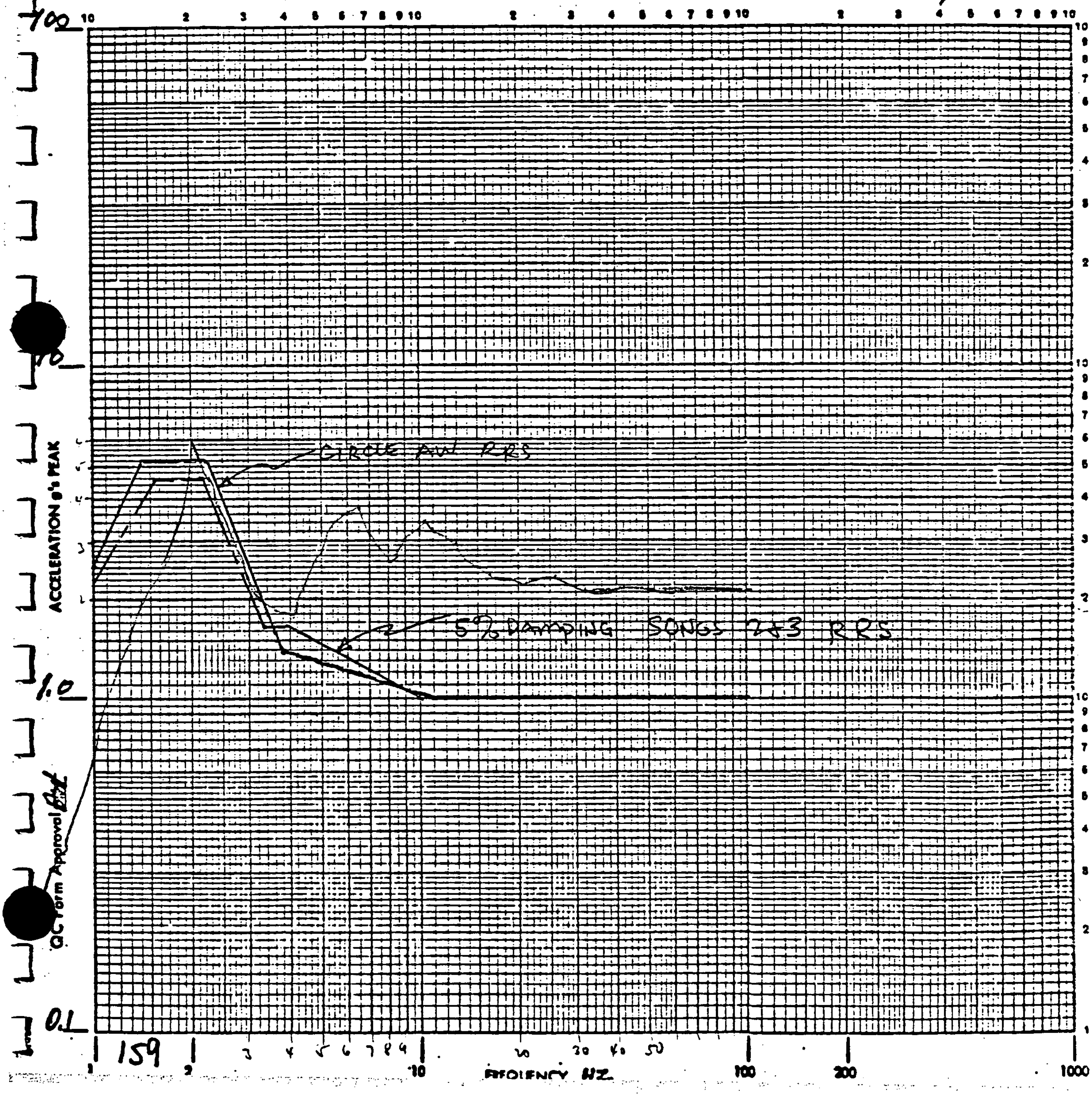
Full Scale 100 G Cal Voltage 500 MVPK/ 1.0 G

Mode PRIMARY Specimen CONTROL PANEL

Operator Knoll P/N 2CR-58,50,51 (#3)

Date 6-16-76 Polarity + Q 5% Axis of Test X-Y

HORIZONTAL RESPONSE SPECTRA 2.0 HR. IN Ø



APPENDIX C
(REPRESENTATIVE SAMPLE)

WYLE LABORATORIES

Report No. 54498-1

Customer JELCO Job No. 54498 Page No. 25

Channel Identification: T/R 1 Trk. No. 2 Accel. No. 2 2 OF 2

Transducer S/N 1034 Control (X), Response ( )

Full Scale 100 G Cal Voltage 500 MVPK/ 1.0 G

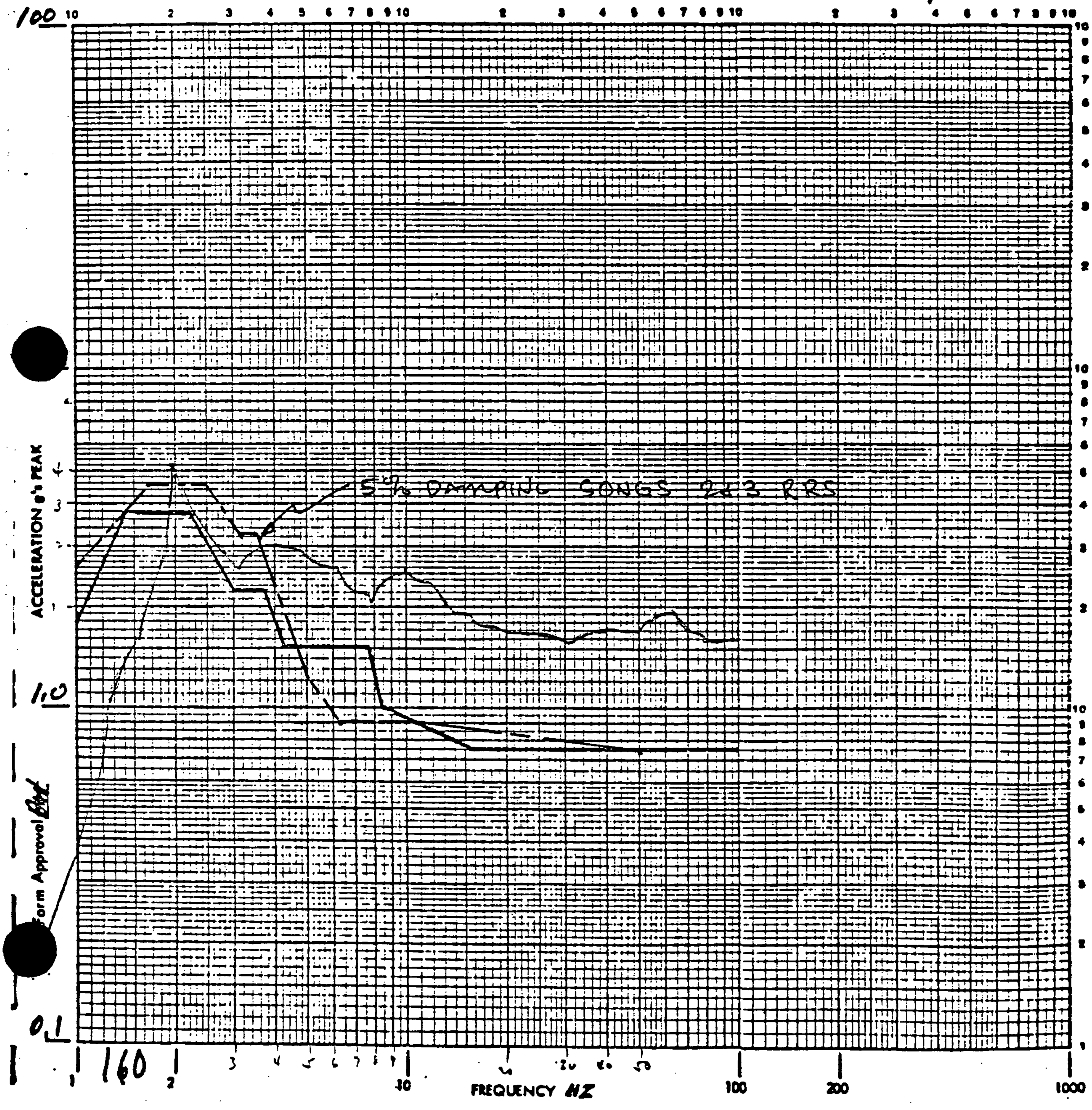
Mode PRIMARY Specimen CONTROL PANEL

Operator KNOU P/N 2CR-58, 50, 51 (#3)

Date 6-16-76 Polarity + Q 5%

Axis of Test X-Y

VERTICAL RESPONSE SPECTRA 2.0 HZ. IN Ø



Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR

II. Component Name: Motor Operated Valve Inverters

1. Scope: [ ] NSSS [X] BOP
2. Model Number: INV502-3 Quantity: 4
3. Vendor: Elgar
4. If the component is a cabinet or panel, name and model No. of the devices included: N/A
5. Physical Description a. Appearance Cabinet
   b. Dimensions 70"H x 50"W x 24"D
   c. Weight 1500 lbs approx.
6. Location: Building: Control Area (Auxiliary Bldg.)
   Elevation: 50'-0"
7. Field Mounting Conditions [ ] Bolt (No.___, Size___)
   [X] Weld (Length Continuous 3/8")
   [ ] ___
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
   S/S: 29 HZ F/B: 13, 28, 35 HZ V: None found
9. a. Functional Description: 125VDC to 120 VAC inverter for Class 1E MOV power
   b. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown [X] Both
10. Pertinent Reference Design Specifications: S023-301-6

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

IV. Equipment Qualification Method: Test: X

Analysis: __________

Combination of Test and Analysis: __________

Test and/or Analysis by Wyle Labs #60005B
Bechtel Log S023-301-6-23-2, S023-301-6-3-2, S023-301-6-4-3
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

   3. [ ] Explosive only 4. [ ] Other (Specify) __________

   5. [ ] Combination of __________

   6. Method of combining RRS: [ ] Absolute Sum [X] SRSS [ ] __________ (other, specify)

2. Required Response Spectra (attach the graphs): See Appendix "A"

3. Required Acceleration in Each Direction: __________

   S/S = 1.0g F/B = 1.0g V = 0.75g

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 Each horizontal direction with vert.
   SSE 1 Other None (specify)

4. Frequency Range: 1-35 HZ

5. TRS enveloping RRS using Multi-Frequency Test [X] Yes (plot TRS on RRS graphs)
   [ ] No

*See Appendix "B"

6. Input g-level Test at S/S = 2.1g F/B = 2.1g V = 1.5g

7. Laboratory Mounting: ____________________

1. [ ] Bolt (No.___, Size___) [X] Weld (Length Continuous 3/8") [ ] ______

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

9. Test Results including modifications made: During the DBE in the X-Y axis the vertical exciter hit the stops, causing a fuse to blow. Fuse was replaced and test repeated with no change in the specimen.

10. Other tests performed (such as fragility test, including results): None

VII. If Qualification by Analysis or by the Combination of Test and Analysis, then Complete: Not Applicable

1. Description of Test including Results: ____________________

2. Method of Analysis: ____________________

[ ] Static Analysis
[ ] Dynamic Analysis

[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: __________ Basis for the damping used: ____________________

7. Support Considerations in the model: ____________________

8. Critical Structural Elements: ______________________________

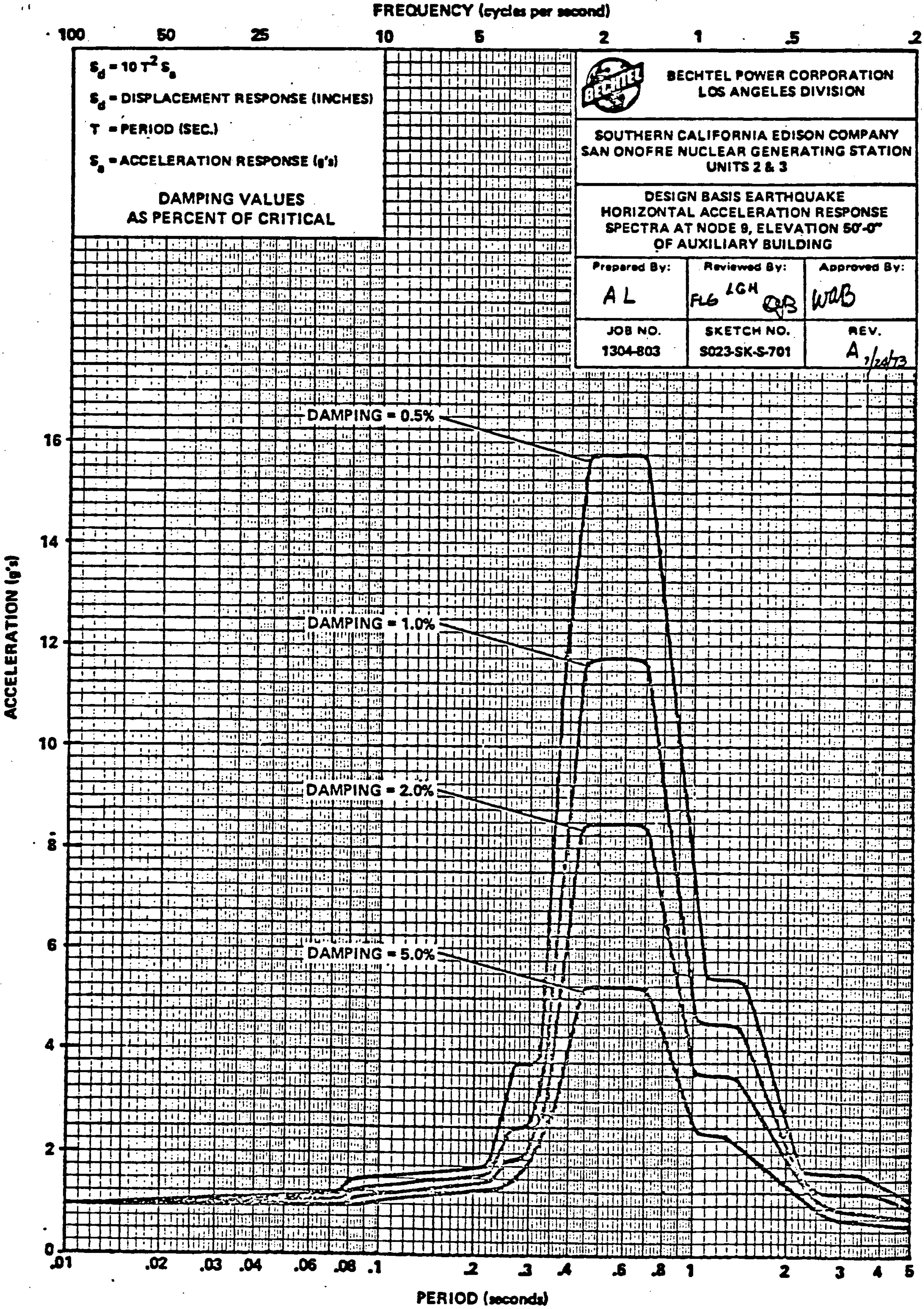
A.

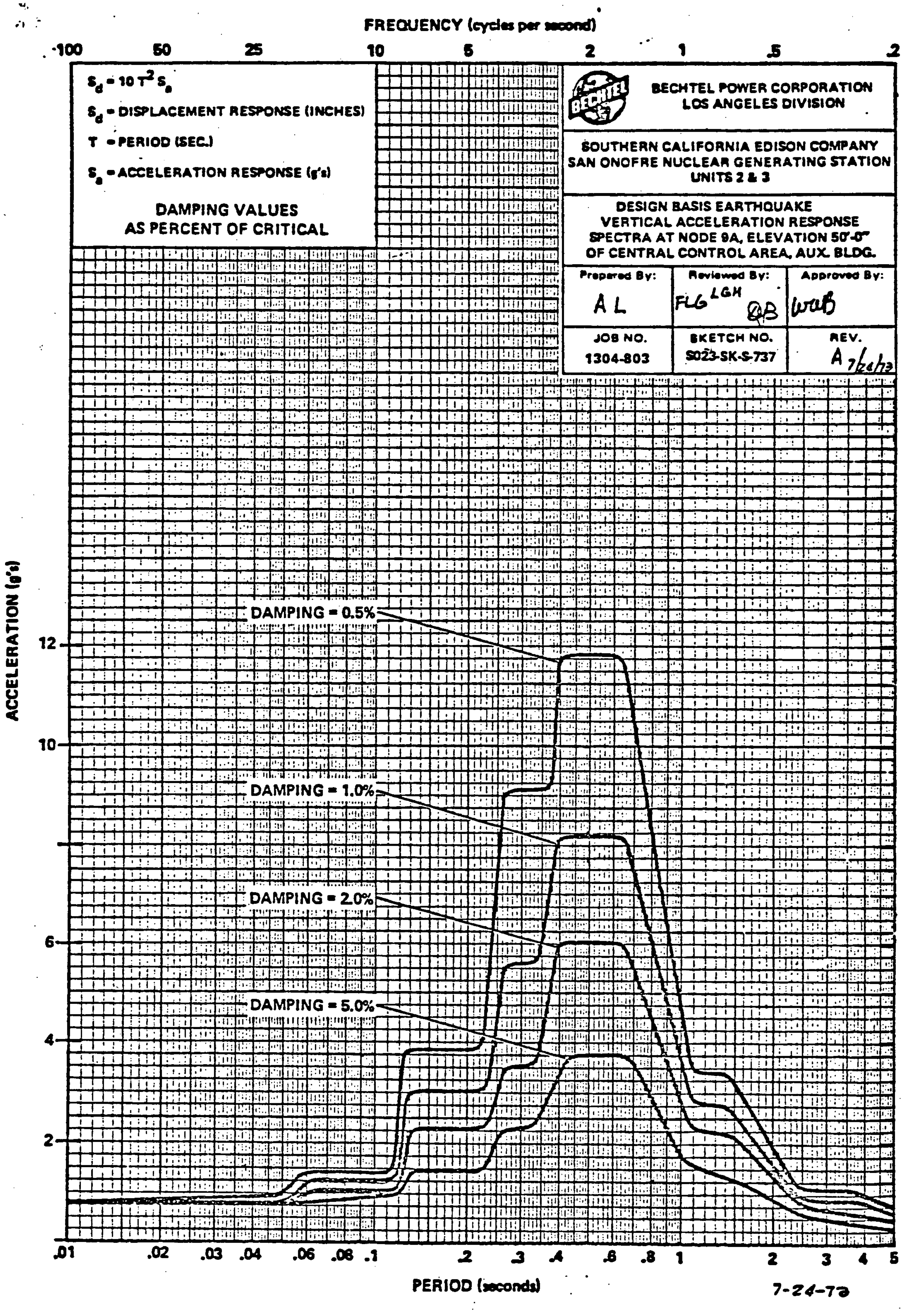
Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

Max. Deflection	Location	Effect Upon Functional Operability

APPENDIX "A"


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10\,T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA AT NODE 9, ELEVATION 50'-0"
OF AUXILIARY BUILDING
Prepared By:
AL
Reviewed By:
FLG LGH QB
Approved By:
WAB
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-701
REV.
A 7/24/73
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
16
14
12
10
8
6
4
2
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)


FREQUENCY (cycles per second)
100 50 25 10 5 2 1 .5 .2
$S_d = 10\,T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA AT NODE 9A, ELEVATION 50'-0"
OF CENTRAL CONTROL AREA, AUX. BLDG.
Prepared By: AL
Reviewed By: FLG LGH QB
Approved By: WAB
JOB NO. 1304-803
SKETCH NO. S023-SK-S-737
REV. A 7/24/73
ACCELERATION (g's)
12
10
6
4
2
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
.01 .02 .03 .04 .06 .08 .1 .2 .3 .4 .6 .8 1 2 3 4 5
PERIOD (seconds)
7-24-73

APPENDIX "B"

WYLE LABORATORIES

Report No. 58145

CUSTOMER ELCAR　　Job No. 58145　　Page No. 33

REVISION A

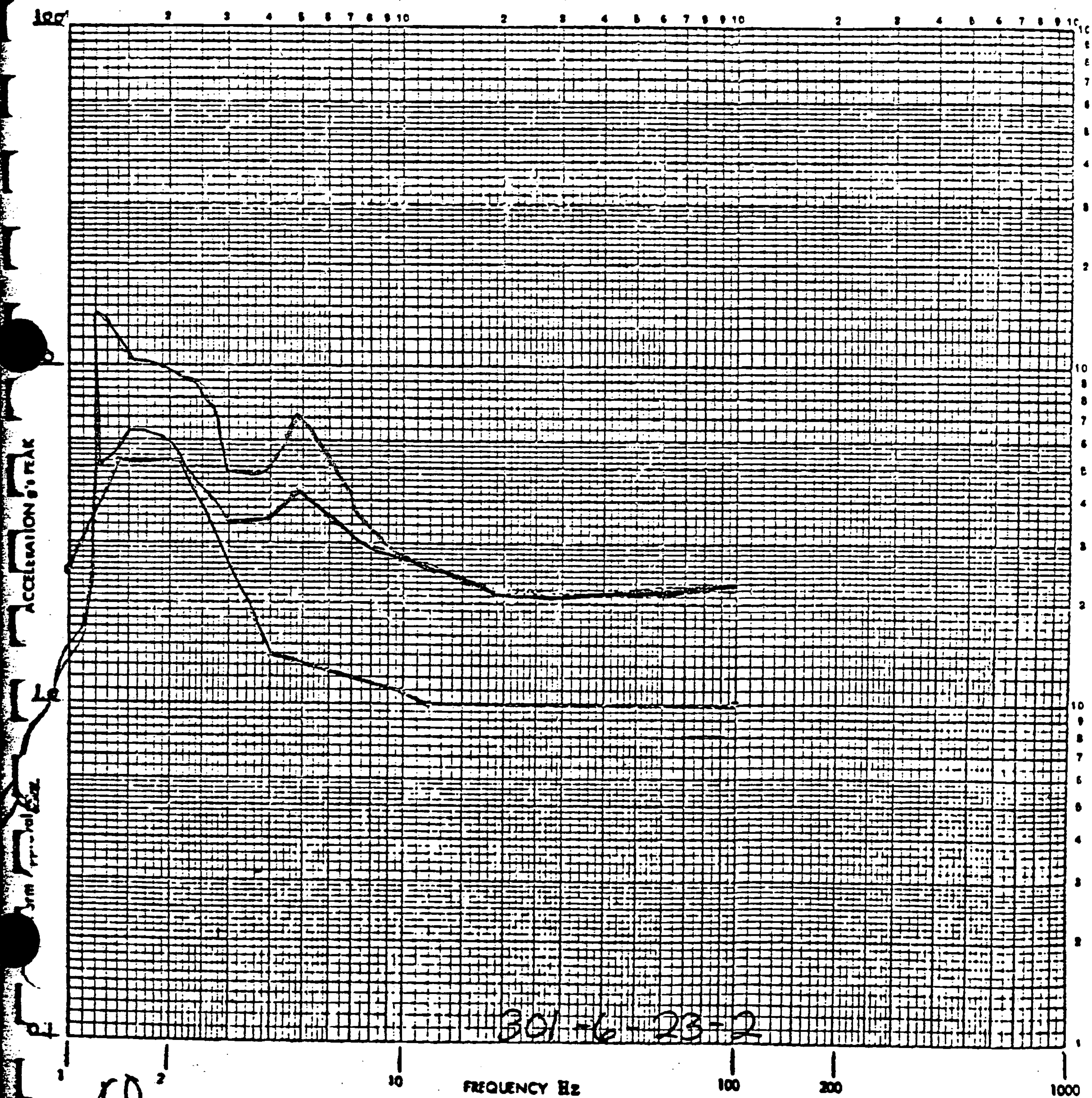
Full Scale 100 g　　Accel. No. 1　　Control (✓)　　Response ( )

Operator MEEHAN　　Specimen 3 PHASE INVERTER

Date 6-1-77　　Damping 1 & 5 %　　Axis of Test HORIZ. X-Y

1ST DBE

RESPONSE SPECTRA



WYLE LABORATORIES

Report No. 58145

CUSTOMER ELCAR   Job No. 58145   Page No. 34

REVISION A

Full Scale 100 g   Accel. No. 2   Control (✓)   Response ( )

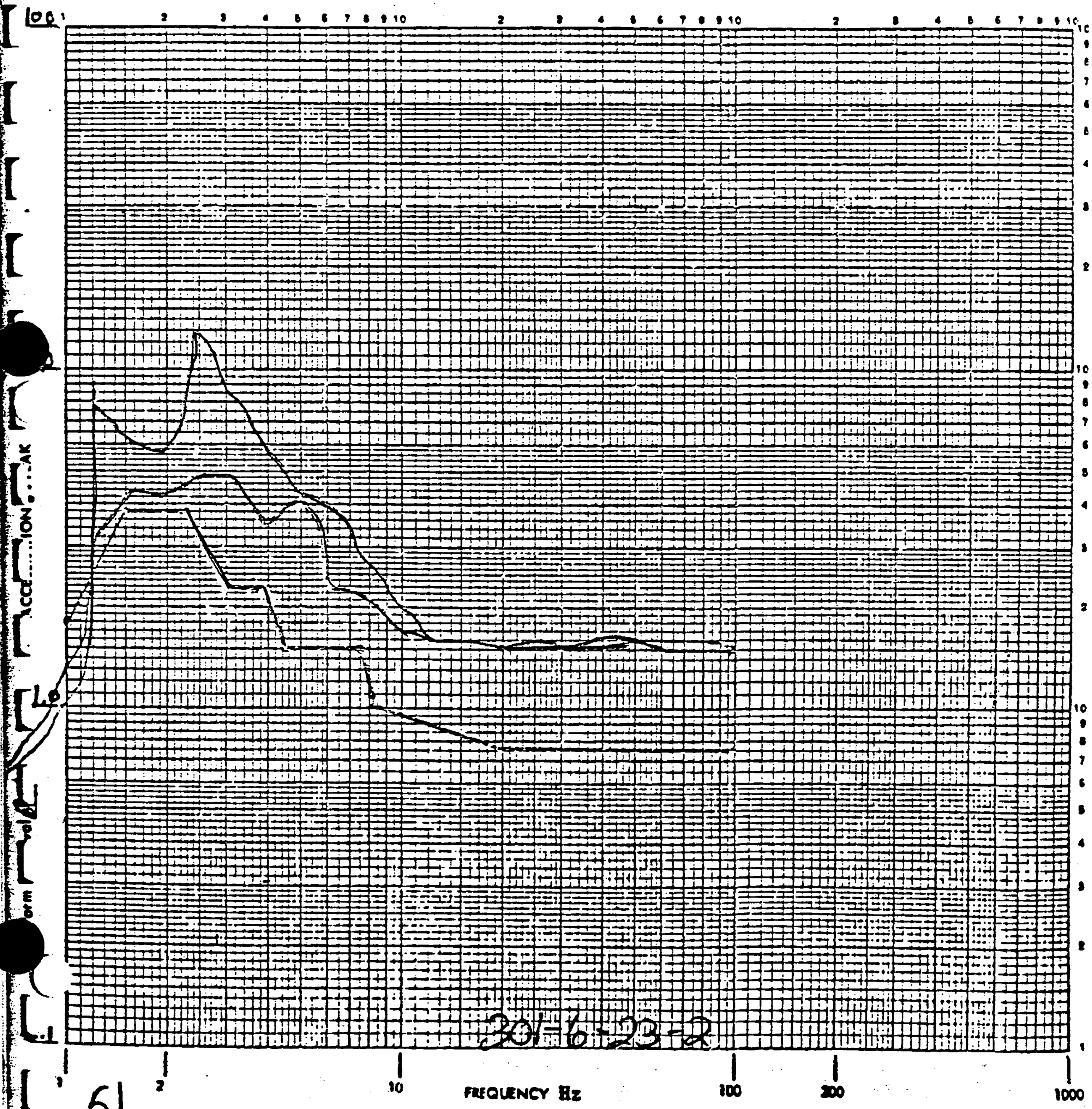
Operator MEEHAN   Specimen 3 PHASE INVERTER

Date 6-1-77   Damping 1.5 %   Axis of Test VERT. X-Y

1ST DDE

JH

RESPONSE SPECTRA



301-6-23-2

61

WYLE LABORATORIES

Report No. 58145

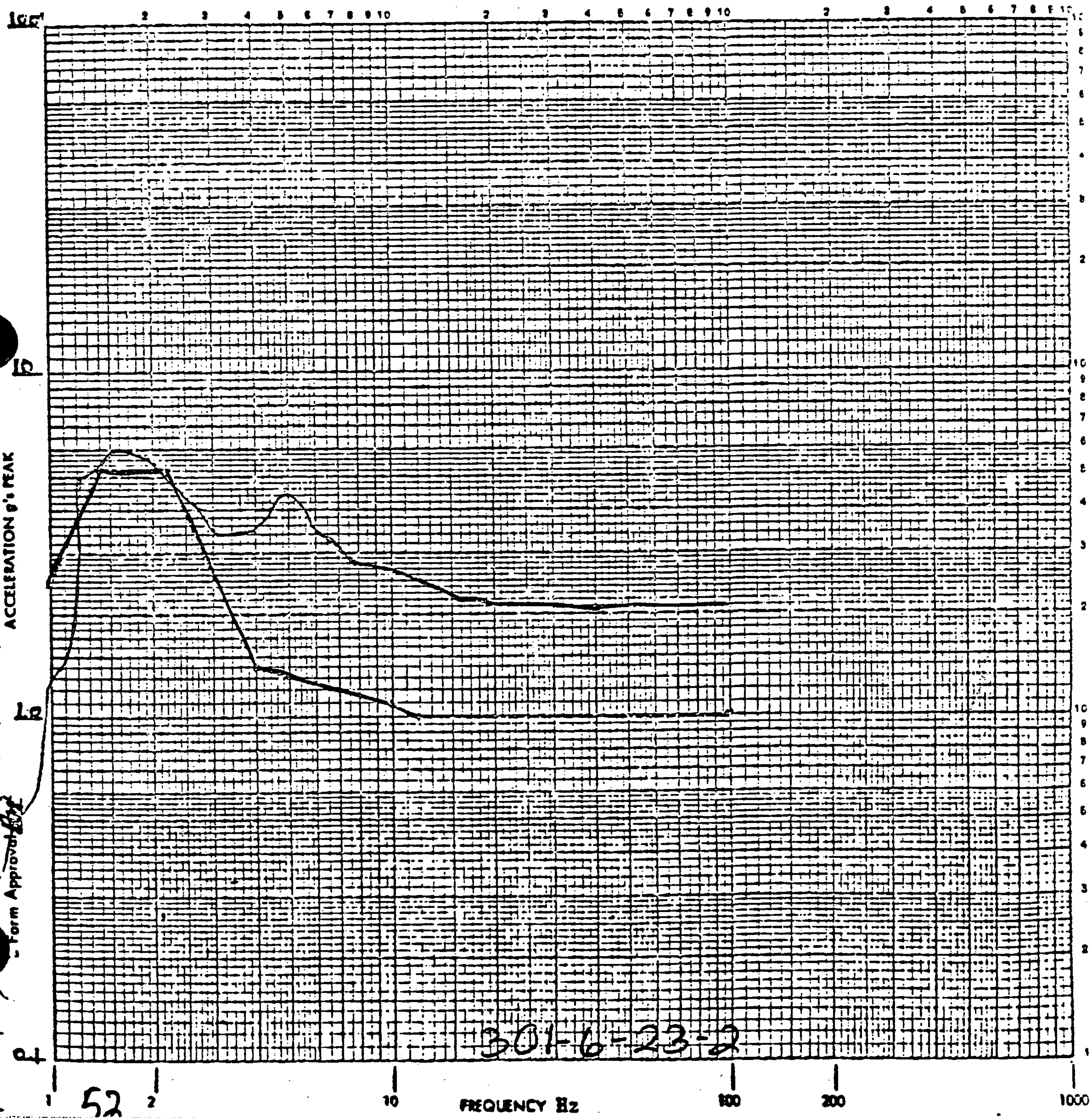
CUSTOMER ELCAR Job No. 58145 Page No. 35

Full Scale 100 g Accel. No. 1 Control (✓) Response ( )

Operator MEEHAN Specimen 3 PHASE INVERTER

Date 6-1-77 Damping 5 % Axis of Test HORIZ. X-Y DBE #2

RESPONSE SPECTRA



52

WYLE LABORATORIES

Report No. 58145

CUSTOMER ELCAR Job No. 58145 Page No. 36

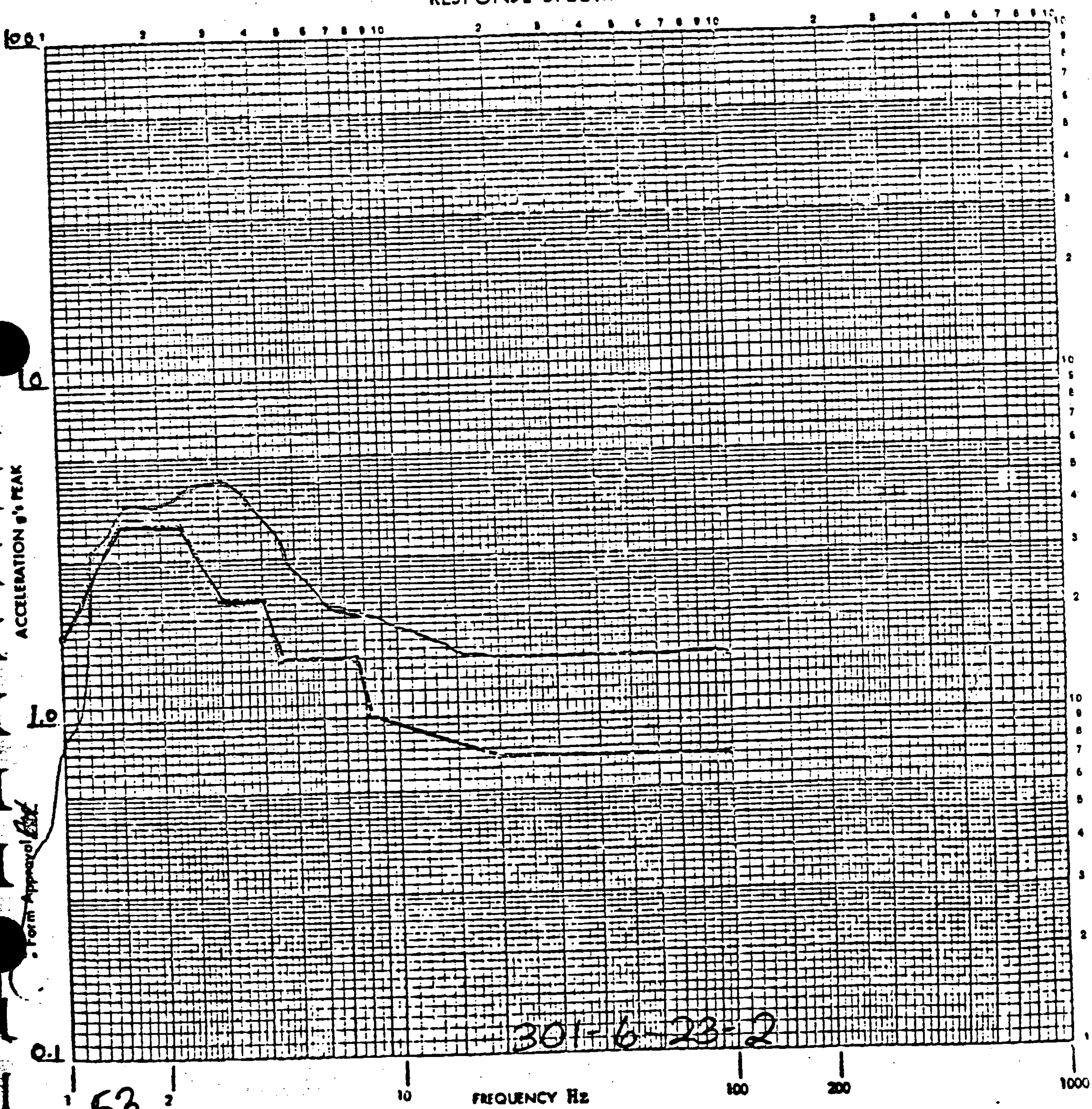
Full Scale 100 g Accel. No. 2 Control (✓) Response ( )

Operator MEEHAN Specimen 3 PHASE INVERTER

Date 6-1-77 Damping 5 % Axis of Test VERT. X-Y

DBE ~~1~~ #2

RESPONSE SPECTRA



Form Approval

62

WYLE LABORATORIES

Report No. ~~58145~~

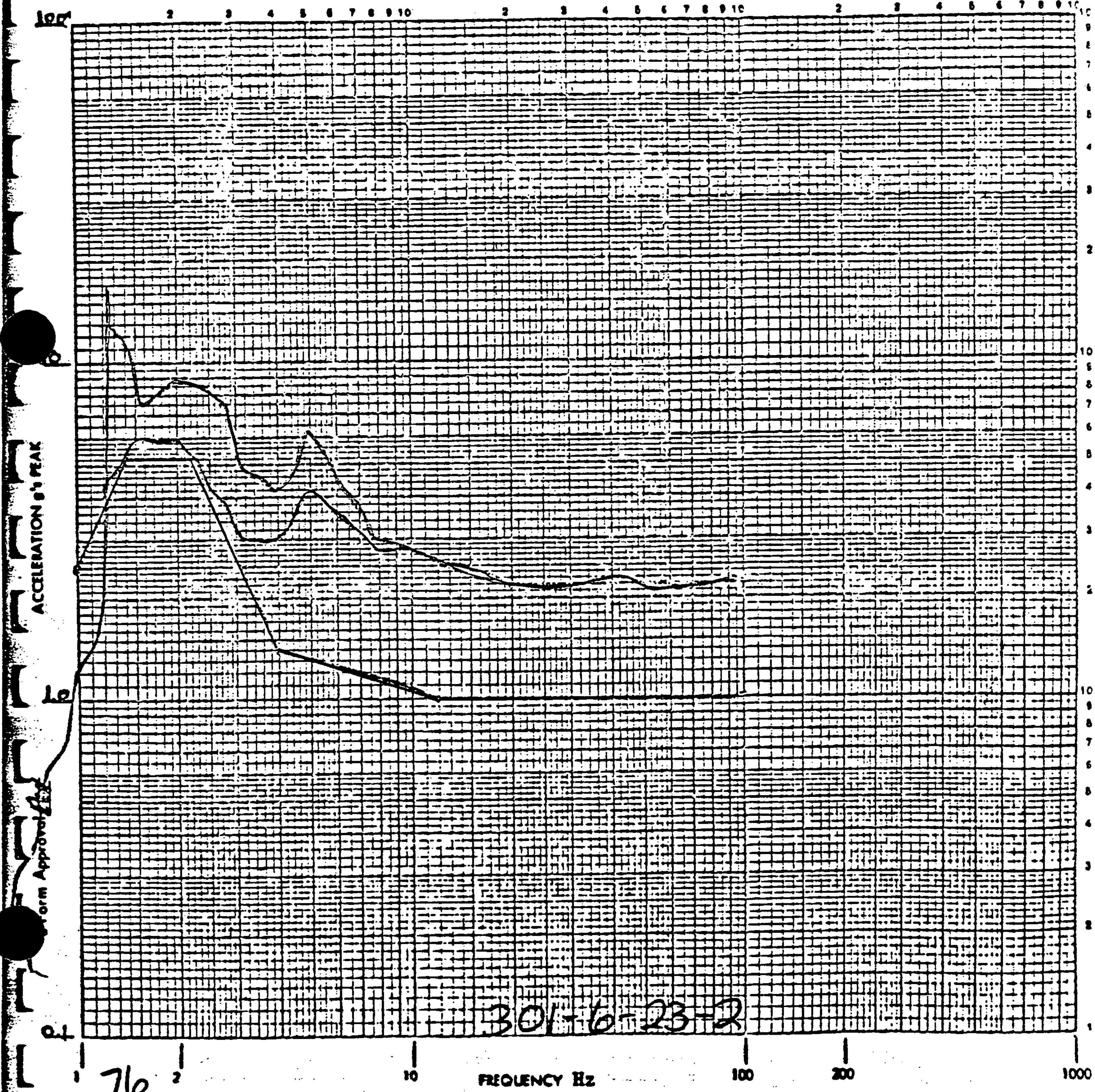
CUSTOMER ELCAR Job No. 58145 Page No. 59

Full Scale 100 g Accel. No. 1 Control (✓) Response ( )

Operator MEEHAN Specimen 3 PHASE INVERTER

Date 6-1-77 Damping 1 & 5 % Axis of Test HORIZ. Z-Y DBE

RESPONSE SPECTRA



76

WYLE LABORATORIES

Report No. ~~58145~~

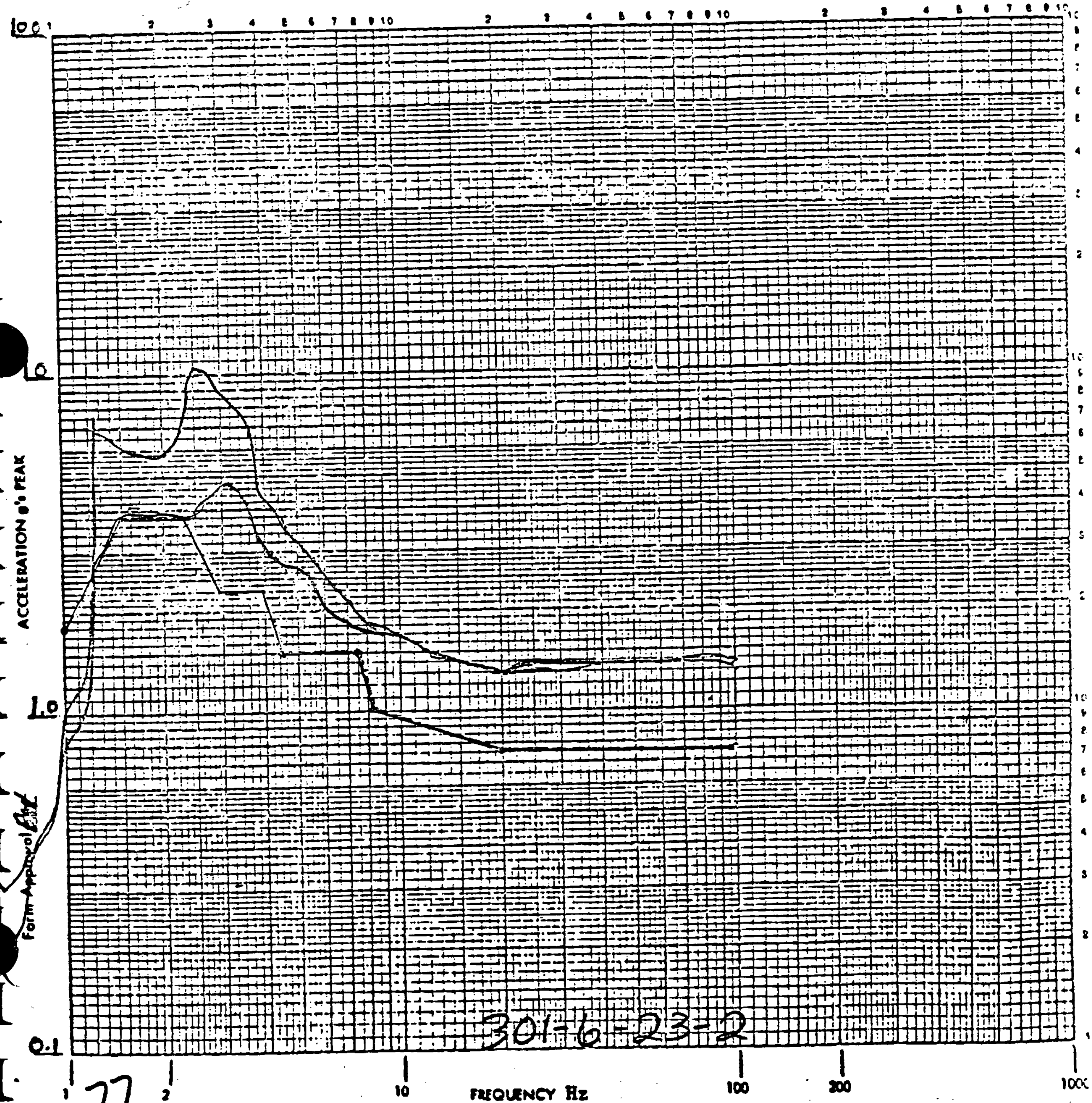
CUSTOMER ELCAR Job No. 58145 Page No. 60

Full Scale 100 g Accel. No. 2 Control (✓) Response ( )

Operator MEEHAN Specimen 3 PHASE INVERTER

Date 6-1-77 Damping 1/5 % Axis of Test VERT. Z-Y DBE

RESPONSE SPECTRA



301-6-23-2

77

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR ____

II. Component Name: 2L-42 Remote Shutdown Panel

1. Scope: [ ] NSSS [X] BOP
2. Model Number: Custom Made — Quantity: 2
3. Vendor: Circle A. W.
4. If the component is a cabinet or panel, name and model No. of the devices included: See Appendix (A)
5. Physical Description a. Appearance Rectangular Shape Cubicle
   b. Dimensions 90"H x 120"W x 42" Deep
   c. Weight 3500 lbs.
6. Location: Building: Control Area in Aux. Bldg.
   Elevation: 45'-0"
7. Field Mounting Conditions [ ] Bolt (No.____, Size____)
   [X] Weld (Length 2" per 5"o.c.)
   [ ] ____
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
   S/S: * F/B: 17.8, 28.6, 29.4Hz V: *
9. a. Functional Description: Control Room Evacuation Shutdown Panel
   b. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
   [X] Both
10. Pertinent Reference Design Specifications: S023-502-5

*Test of Panel 2CR-62 (Similar Panel) had no Resonance Frequencies Below 33Hz.

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

IV. Equipment Qualification Method: Test: ______

Analysis: ______

Combination of Test and Analysis: XX

Test and/or Analysis by Wyle Labs. Report #54498-3 and 54498.
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [ ] Combination of ______

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

2. Required Response Spectra (attach the graphs); See Appendix B

3. Required Acceleration in Each Direction: For Devices See Appendix A

S/S = 1g F/B = 1g V = 1g

VI. If Qualification by Test, then Complete: Test on similar panel 2CR-62. Device qualification by independent test.

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

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

3. No. of Qualification Tests: OBE ______ SSE ______ Other 17 Random W/SB (specify)

4. Frequency Range: 1.25 to 35 Hz

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[X] No
TRS exceeds RRS above 2 Hz and at natural frequencies. See Appendix "C"

6. Input g-level Test at S/S = 1.6g F/B = 1.6g V = 1.4g

7. Laboratory Mounting: Welded to 1" plate, plate bolted to table

1. [ ] Bolt (No.____, Size____) [X] Weld (Length 2" @ 8"o.c.) [ ] ______

8. Functional operability verified: [X] Yes [ ] No [X] Not Applicable
DEVICES PANEL

9. Test Results including modifications made: Cabinet had resonance frequency Z17.5Hz. No significant strain measured Z100 micro inch/inch. No modification required. Device operability test satisfactory.

10. Other tests performed (such as fragility test, including results):

Devices had environmental testing.

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

1. Description of Test including Results: Devices tested, see Appendix (A). This panel is being qualified as similar to panel 2CR-62 (Wyle Labs. Report #54498) which was tested. First fundamental frequency measured in test was 17.5Hz.

2. Method of Analysis:

[ ] Static Analysis [ ] Equivalent Static Analysis

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

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

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

4. [ ] Computer Codes: TRW System Group Computer Program. Three Dimensional Frame Modal Analysis Program.
CDC Publication #86612000

Frequency Range and No. of modes considered: ____________

[ ] Hand Calculations

5. Method of Combining Dynamic Responses: [ ] Absolute Sum [ ] SRSS
[X] Other: Compared to test panel 2CR-62
(specify)

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

7. Support Considerations in the model: Same as 2CR-62

8. Critical Structural Elements:

A.

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

B.

Max. Deflection	Location	Effect Upon Functional Operability

NOTE: Panel 2CR-62 was tested. The analysis demonstrates the test of panel 2CR-62 also qualifies panel 2L-42 since the construction of the panels are similar and the frequency responses are comparable.

APPENDIX (A)

APPENDIX "A"

CALCULATION SHEET

LAO 0016 11-70

12400 E. IMPERIAL HWY
NORWALK, CALIFORNIA 90650

CALCULATION NO. ________

SIGNATURE ________ DATE ________ CHECKED ________ DATE ________

PROJECT SONGS 2 & 3 PROJECT JOB NO. 10079-003

SUBJECT REMOTE SHUTDOWN PANEL SEISMIC QUAL SHEET 1 OF 1 SHEETS

ITEM NO	DESCRIPTION	TOTAL NO IN PANEL	VENDOR	MODEL	TYPICAL TESTED	(*) IS EQPT QUALIFIED FOR CLASS IE SERVICE OR STRUCT SEIS	EQPT QUALIFIED BY TEST/ANALYSIS	TEST G	(†) REQUIRED G	TYPE OF INPUT USED	REPORT NO	REMARKS
1	PUSHBUTTON SWITCHES	8	MASTER SPECIALTIES CO	PT	SINGLE PUSH BUTTON SAME AS USED	CLASS IE	TEST	4.5G	3	SINE DWELL	5023-506-2-61-0 [MSC NO 058-1172-76]	
2	SELECTOR SWITCHES	49	MASTER SPECIALTIES CO	PT	SELECTOR SWITCH WITH 4 LIGHTS	CLASS IE	TYPICALS TESTED REST ANALYZED	5G	3	SINE DWELL	5023-506-2-32-2 [MSC NO 058-1165-75]	CONFIGURATION OF SWITCHES USED IN THIS PANEL ARE SELECTOR SWITCHES WITH 2 LIGHTS
3	INDICATING LIGHTS	114	MASTER SPECIALTIES CO	GE 1835	—	CLASS IE	TEST	5G	3	SINE DWELL	5023-505-5-29 [WYLE # 58114-1]	
4	RECEIVER TYPE INDICATOR	18	SIGMA	9270	9270	CLASS IE	TEST	3.5G	3	SINE BEAT	5023-505-7-10-2 [SIGMA NO 583-3]	
5	RECEIVER TYPE INDICATOR	7	SIGMA VIA CE			CLASS IE			3		CEN-94(S)	CE REPORT REFERENCED PROVIDES COMPLETE SEISMIC QUALIFICATION DATA FOR CE SUPPLIED ITEMS
6	BORONOMETER	1	CE			STRUCTURAL SEISMIC ONLY			3		CEN-94(S)	
7	MANUAL AUTO LOADING STATION	2	FOXBORO	250 PM	250 PM	CLASS IE	TEST	3G	3	SINE BEAT	5023-505-10-12	REFERRED TO AS CONTROLLER

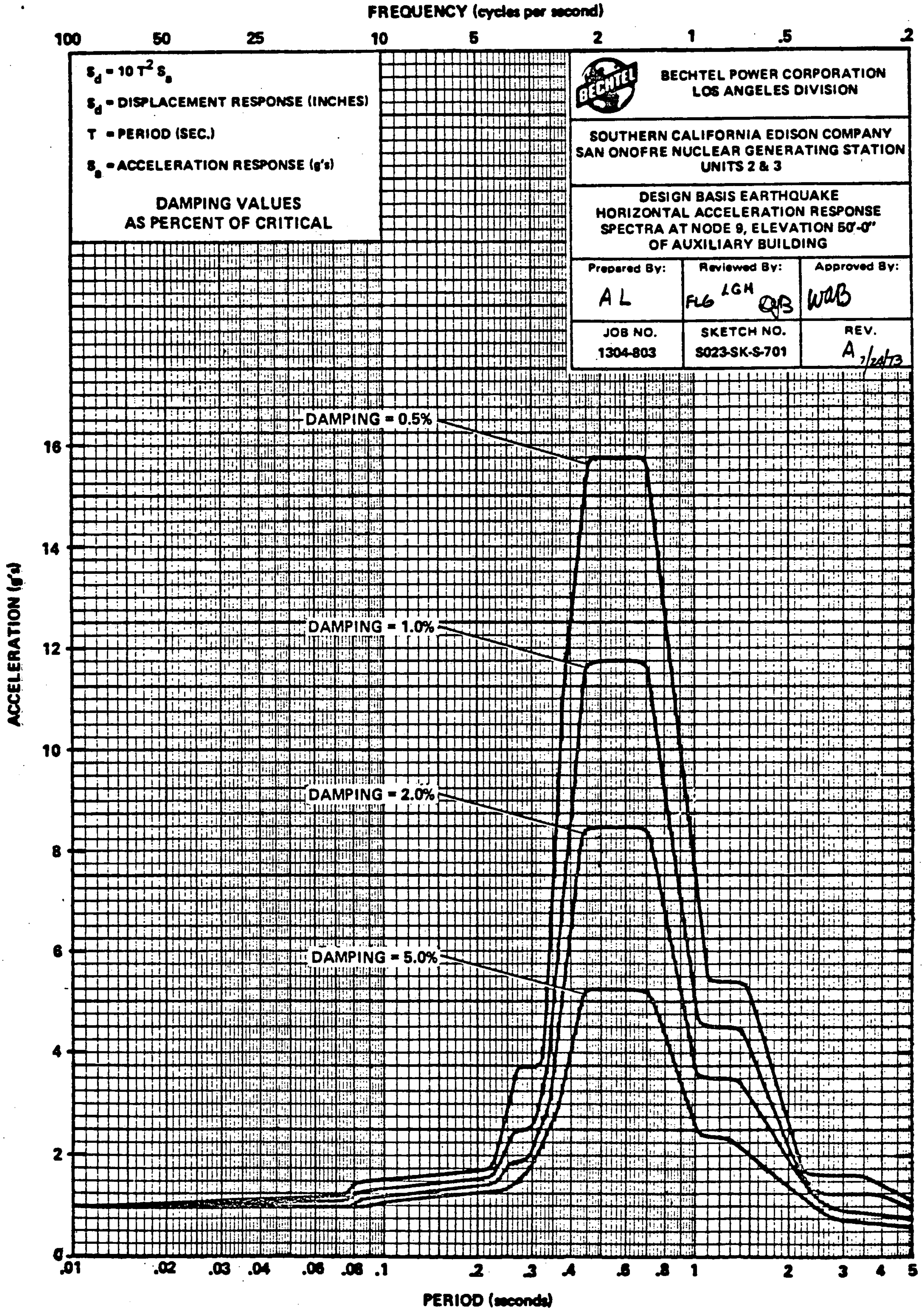
(†) REQ'D BY SPEC. ACTUAL EXPERIENCE ≤ 2g.

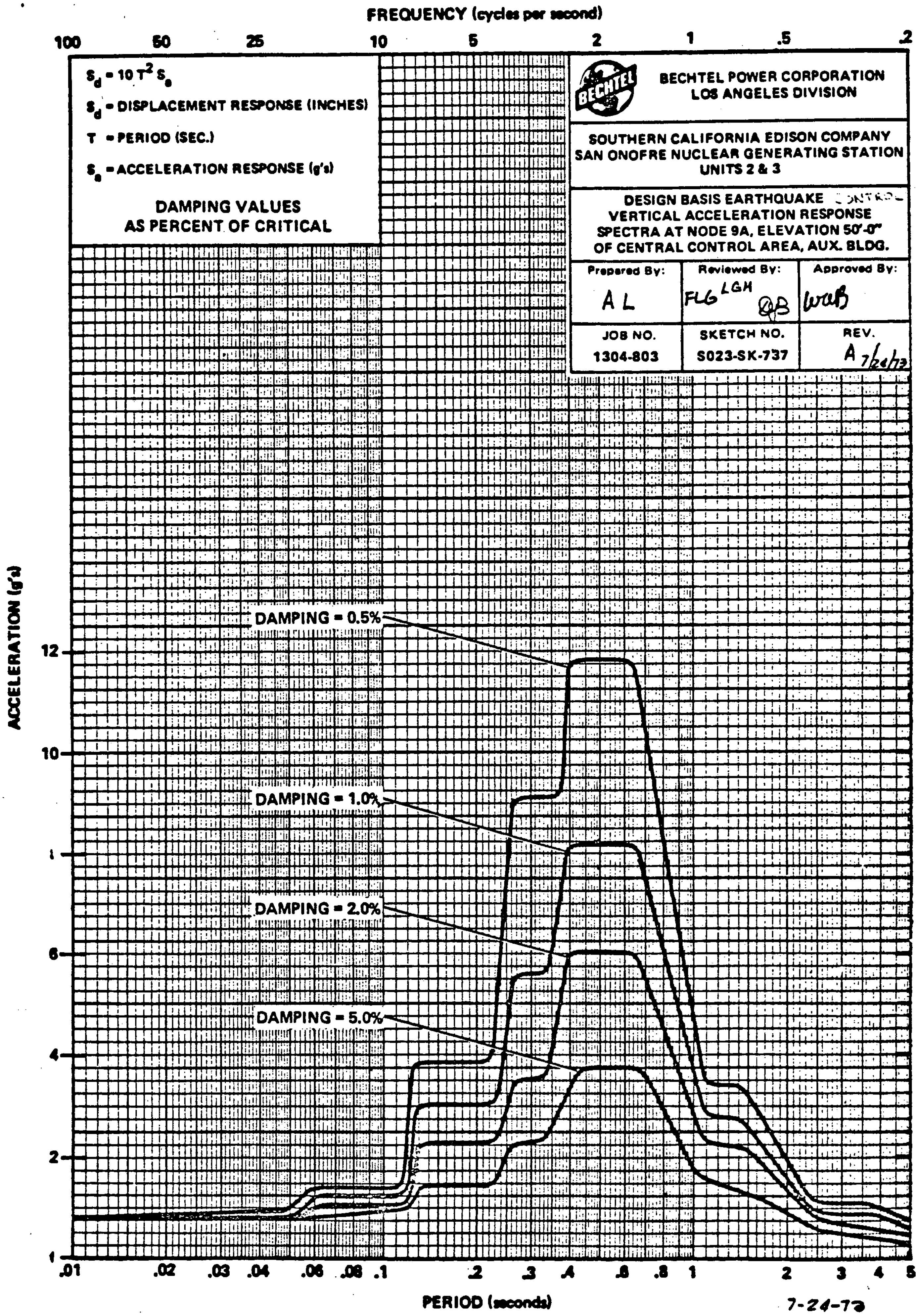
(*) CLASS IE IMPLIES THAT THE EQUIPMENT IS QUALIFIED FOR IE SERVICE. TOTAL NO IN PANEL MAY OR MAY NOT BE ALL CLASS IE.

APPENDIX (B)

(2 PAGES)

APPENDIX (B)


FREQUENCY (cycles per second)
100 50 25 10 5 2 1 .5 .2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA AT NODE 9, ELEVATION 50'-0"
OF AUXILIARY BUILDING
Prepared By: AL
Reviewed By: FLG LGH QB
Approved By: WAB
JOB NO. 1304-803
SKETCH NO. S023-SK-S-701
REV. A 7/24/73
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
0 2 4 6 8 10 12 14 16
.01 .02 .03 .04 .06 .08 .1 .2 .3 .4 .6 .8 1 2 3 4 5
PERIOD (seconds)


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA AT NODE 9A, ELEVATION 50'-0"
OF CENTRAL CONTROL AREA, AUX. BLDG.
Prepared By:
A L
Reviewed By:
FLG LGH
Approved By:
JOB NO.
1304-803
SKETCH NO.
S023-SK-737
REV.
A
ACCELERATION (g's)
12
10
6
4
2
1
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

7-24-73

ATTACHMENT "C"

(2 PAGES)

ATTACHMENT "C"

WYLE LABORATORIES

Report No. 54498

Customer JELCO Job No. 54498

Page No. 39

Channel Identification: T/R 1 Trk. No. 1 Accel. No. 1

Transducer S/N 1143 Control (X). Response ( )

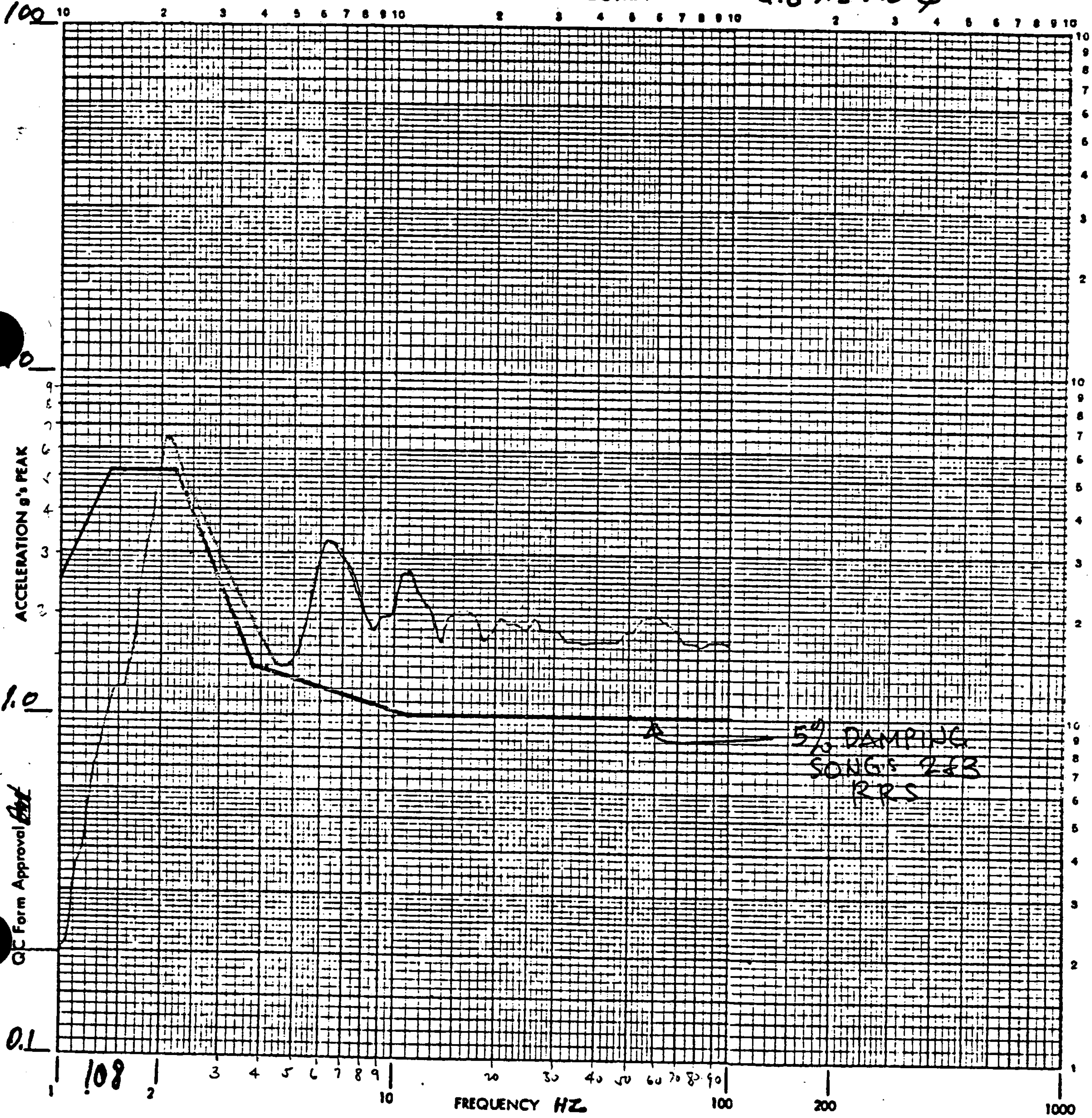
Full Scale 100 G Cal Voltage 500 MVPK/ 1.0 G

Mode PRIMARY Specimen CONTROL PANEL

Operator MEEHAN P/N 2/3CR-62 (UNIT 7)

Date 3/23/76 Polarity + Q 5% Axis of Test Z-Y

HORIZONTAL RESPONSE SPECTRA 2.0 HZ IN Ø



QC Form Approval

WYLE LABORATORIES

Report No. ~~54498~~ 2 OF 2

Customer JELCO Job No. 54498

Page No. ~~40~~

Channel Identification: T/R 1 Trk. No. 2 Accel. No. 2

Transducer S/N 1168 Control (X), Response ( )

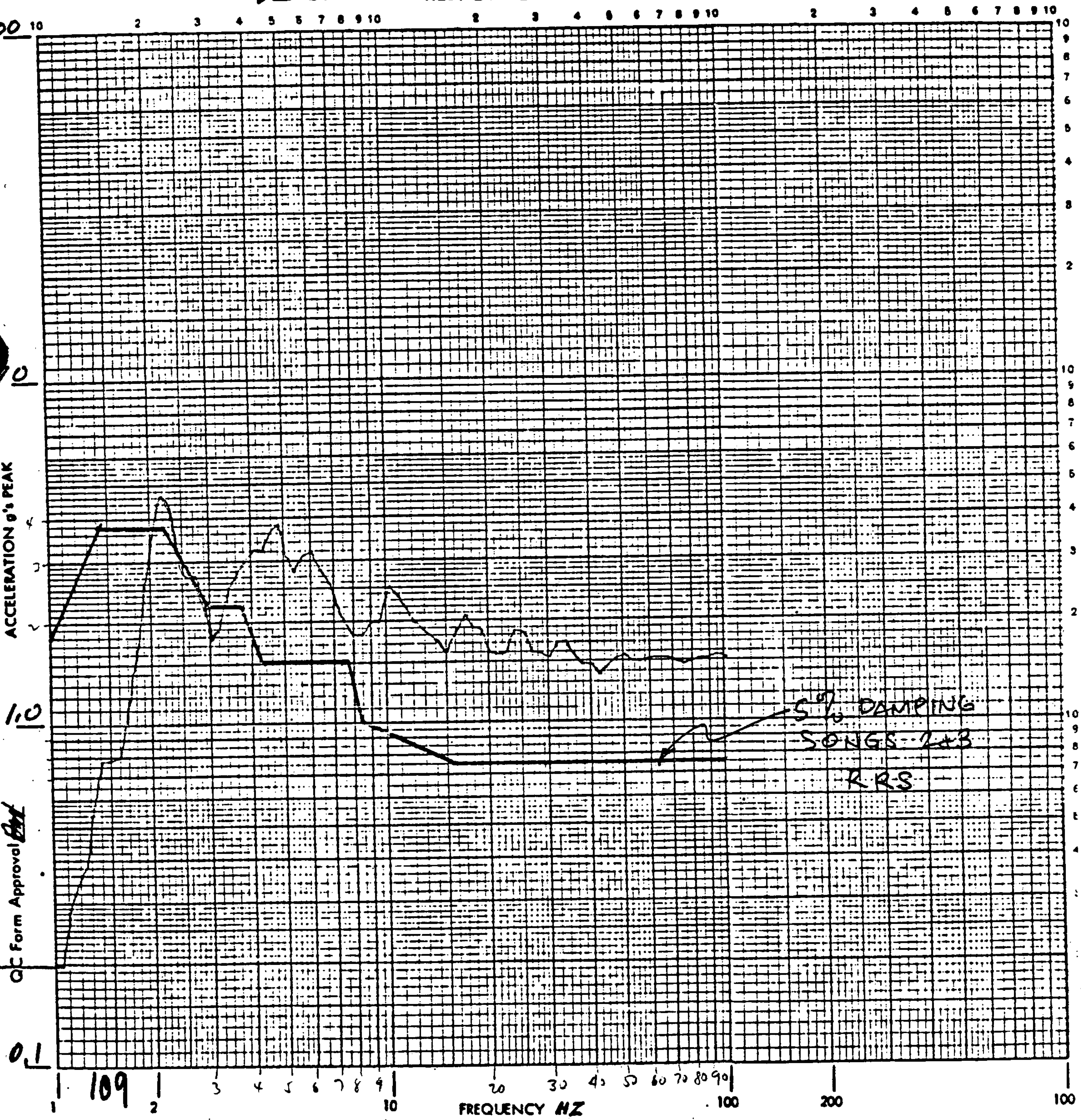
Full Scale 100 G Cal Voltage 500 MVPK/ 1.0 G

Mode PRIMARY Specimen CONTROL PANEL

Operator MEEHAN P/N 2/3CR-62 (UNIT 7)

Date 3/23/76 Polarity + Q 5% Axis of Test Z-Y

VERTICAL RESPONSE SPECTRA 2.0 HZ in Ø



Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X

2. NSSS: CE 3. A/E: Bechtel — BWR ____

II. Component Name: 2FIT-4720-1 Transmitters

1. Scope: [ ] NSSS [X] BOP

2. Model Number: E13DM-1Sam2 Quantity: 4

3. Vendor: Foxboro

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

5. Physical Description a. Appearance See Appendix "A"

   b. Dimensions 13-1/4"H x 6-7/8"W

   c. Weight 25 lbs.

6. Location: Building: Piping Tunnel - Outside Area

   Elevation: 17'-10"

7. Field Mounting Conditions [X] Bolt (No. 2, Size 1")
   [ ] Weld (Length ____)
   [ ] ____

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

   S/S: None Found F/B: 3.5 & 14Hz. V: 35Hz.

9. a. Functional Description: Aux. feedwater to steam gen. E088 flow transmitter

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

   [X] Both

10. Pertinent Reference Design Specifications: S023-504-1

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

IV. Equipment Qualification Method: Test: X

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Foxboro Report ET3-1091
Action Test Report #10486
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

   3. [ ] Explosive only 4. [ ] Other (Specify) ______

   5. [ ] Combination of ______

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

2. Required Response Spectra (attach the graphs): See Appendix "B"

3. Required Acceleration in Each Direction:

   S/S = 1.0g F/B = 1.0g V = 1.0g

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 4 SSE 2 Other ______ (specify)

4. Frequency Range: 1-35Hz

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs) [ ] No

   Not Applicable

6. Input g-level Test at S/S = 10g F/B = 10g V = 10g

   See Appendix "C"

7. Laboratory Mounting: Not available (See Appendix "A")

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

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

9. Test Results including modifications made: See Appendix "C" and "D"

10. Other tests performed (such as fragility test, including results):

    Radiation Test (Report #T3-1097), Pressure Integrity Test, Maximum Credible Accident (MCA) Test (Report #T3-1013)

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

1. Description of Test including Results: ______

2. Method of Analysis:

   [ ] Static Analysis
   [ ] Dynamic Analysis
   [ ] Equivalent Static Analysis
   [ ] Time-History
   [ ] Response Spectrum

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: ______ Basis for the damping used: ______

7. Support Considerations in the model: ______

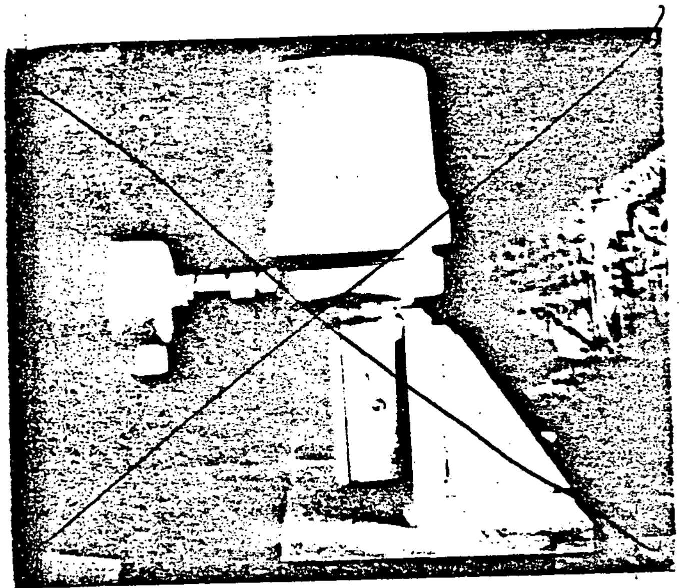
8. Critical Structural Elements: ______________________

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

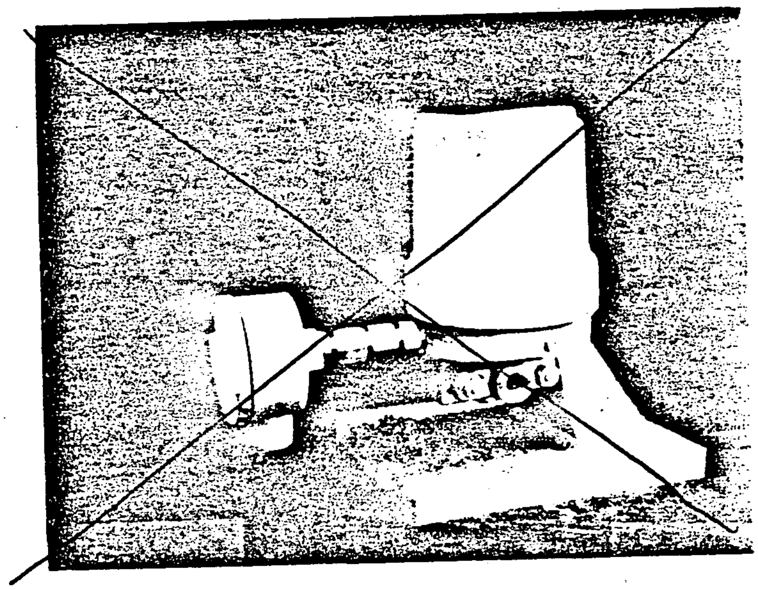
B. Max. Deflection	Location	Effect Upon Functional Operability

APPENDIX A

Figure No. 4
Photographs
of
Test Units and Test Fixtures

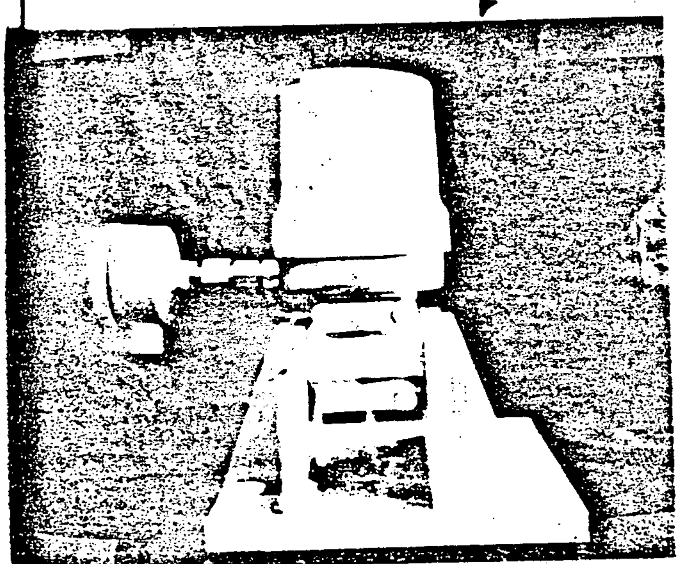


E11GH-IINM2 X
Gauge Pressure Transmitter

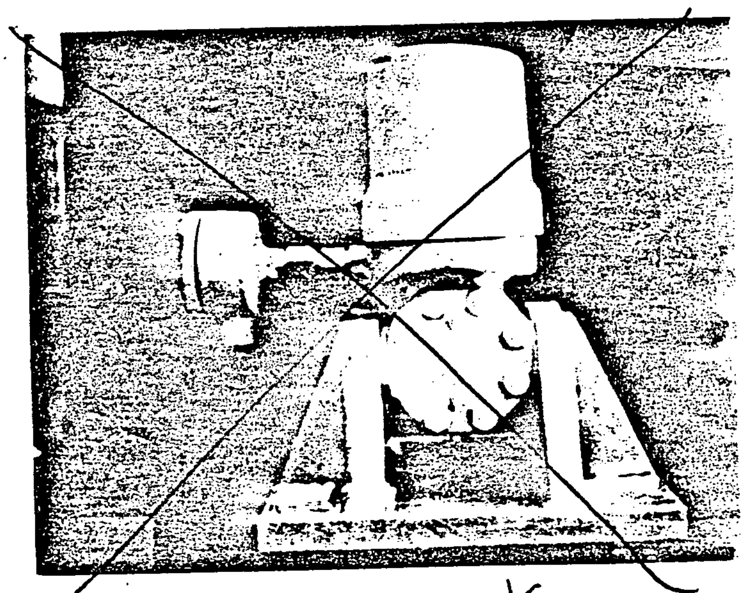


E11GM-ISAE2 X
Gauge Pressure Transmitter

X'MITTER TEST SPECIMEN, USED TO QUALIFY FOR PROJECT

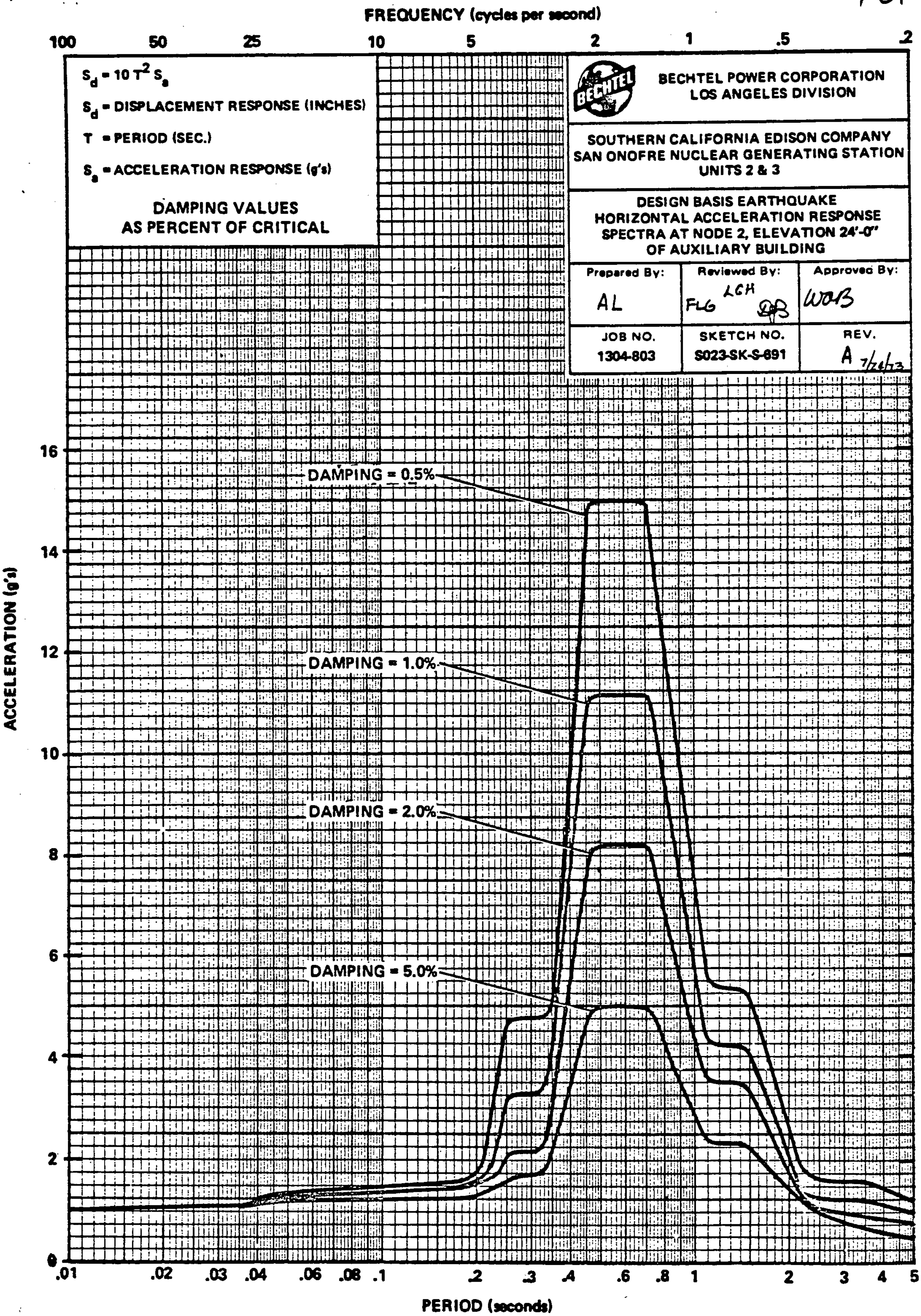


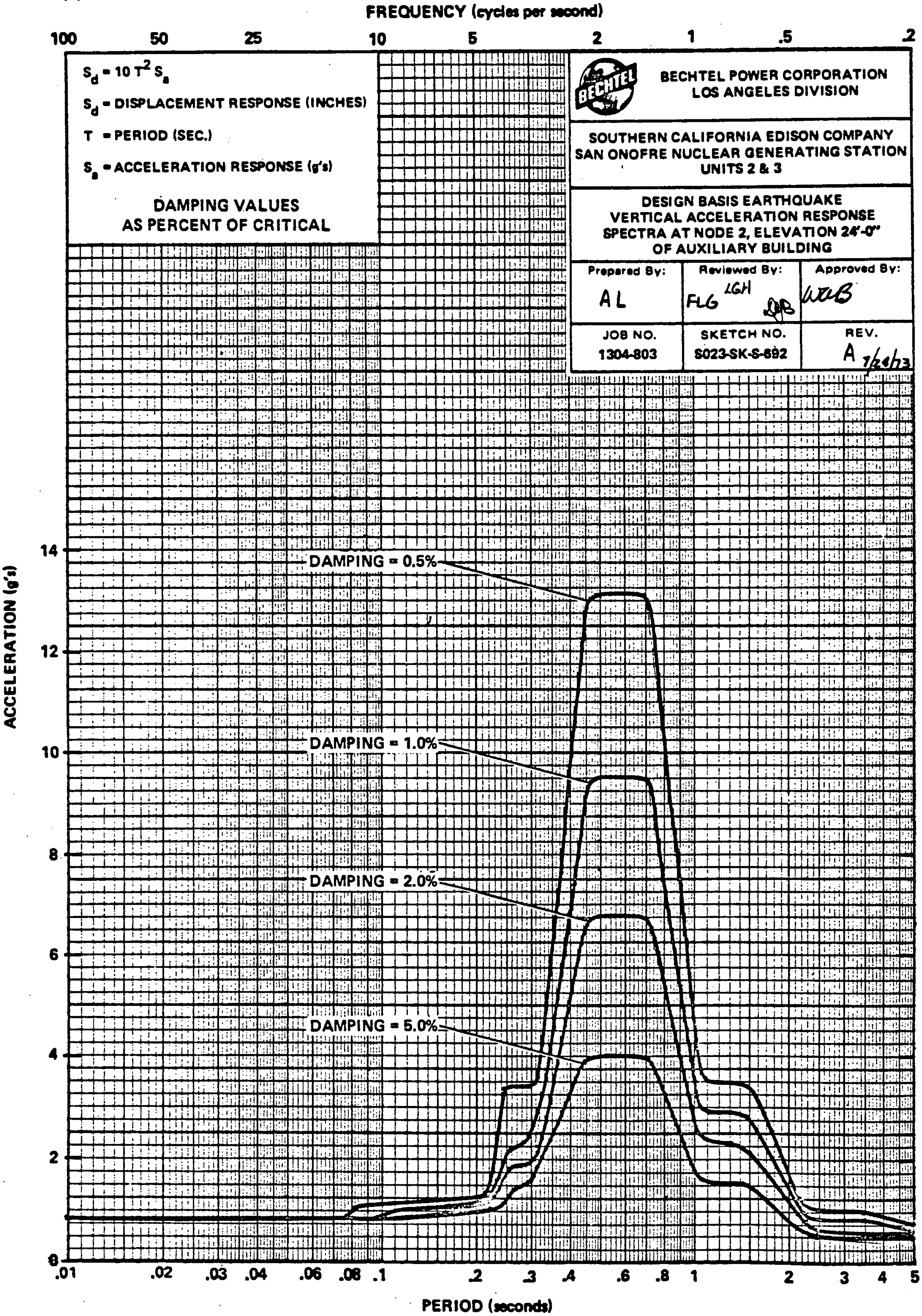
E13DM-ISAMX ✓
d/p Transmitter



E13DH-ISAM5 X
d/p Transmitter

APPENDIX B


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA AT NODE 2, ELEVATION 24'-0"
OF AUXILIARY BUILDING
Prepared By: AL
Reviewed By: FLG LCH
Approved By: WOB
JOB NO. 1304-803
SKETCH NO. S023-SK-S-691
REV. A 7/26/73
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
16
14
12
10
8
6
4
2
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA AT NODE 2, ELEVATION 24'-0"
OF AUXILIARY BUILDING
Prepared By:
AL
Reviewed By:
FLG LGH
Approved By:
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-692
REV.
A 7/24/73
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
14
12
10
8
6
4
2
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

APPENDIX C

APPENDIX C

3.0 Summary and Conclusions

The four test transmitters operated without loss of function during all tests. The pressure integrity of all transmitters was maintained thru all tests.

Test results by unit are as follows:

E13DM PICKED AS REPRESENTATIVE ITEM.

Maximum calibration shifts following individual seismic runs of zero, span and the five check points were generally <0.5%.

Output shifts in any plane during any test acceleration level were generally <-7.2%. Output bandwidths were ±7.0% in any plane or acceleration level.

Visual examination of the transmitter after all tests found no loose parts or screws.

The junction box assembly did not produce any amplified motions during the tests.

Process connectors were not used with the differential pressure transmitters during these tests. Signal connections were made directly into the transmitter bodies per the required fitting.

Where 5 sine beats are normally used under IEEE Std 344-1971 10 sine beats at each frequency were used in this test. Five sine beats at the test levels of 3.5 and 5.0g could be considered 1/2 SSE (Safety Shutdown Earthquakes) tests, therefore 10 sine beats would constitute two 1/2 SSE events at each level or four 1/2 SSE events. The 10g level could be considered an SSE event, therefore with 10 sine beats this would be equivalent to two SSE events. Viewed in this manner these units functioned through four 1/2 SSE and two SSE events at very high levels. Reference guideline IEEE 344-1971 Draft Revision 3, 2-13-74.

THE TRANSMITTER WERE TESTED FOR 3.5 g, 5 g AND 10 g. THE ERROR IN THE TRANSMITTER OUTPUT AFTER 3.5 g AND 5 g TESTS WAS LESS THAN OR EQUAL TO THE SPECIFIED ERROR OF 0.5%. THE ERROR IN THE TRANSMITTER OUTPUT AFTER 10 g TEST WAS 0.55% WHICH IS 0.05% MORE THAN THE SPECIFIED ERROR.

THE TRANSMITTER MEETS THE REQUIREMENTS OF THE SPECIFICATION FOR ITS INTENDED USE.

APPENDIX D

APPENDIX D

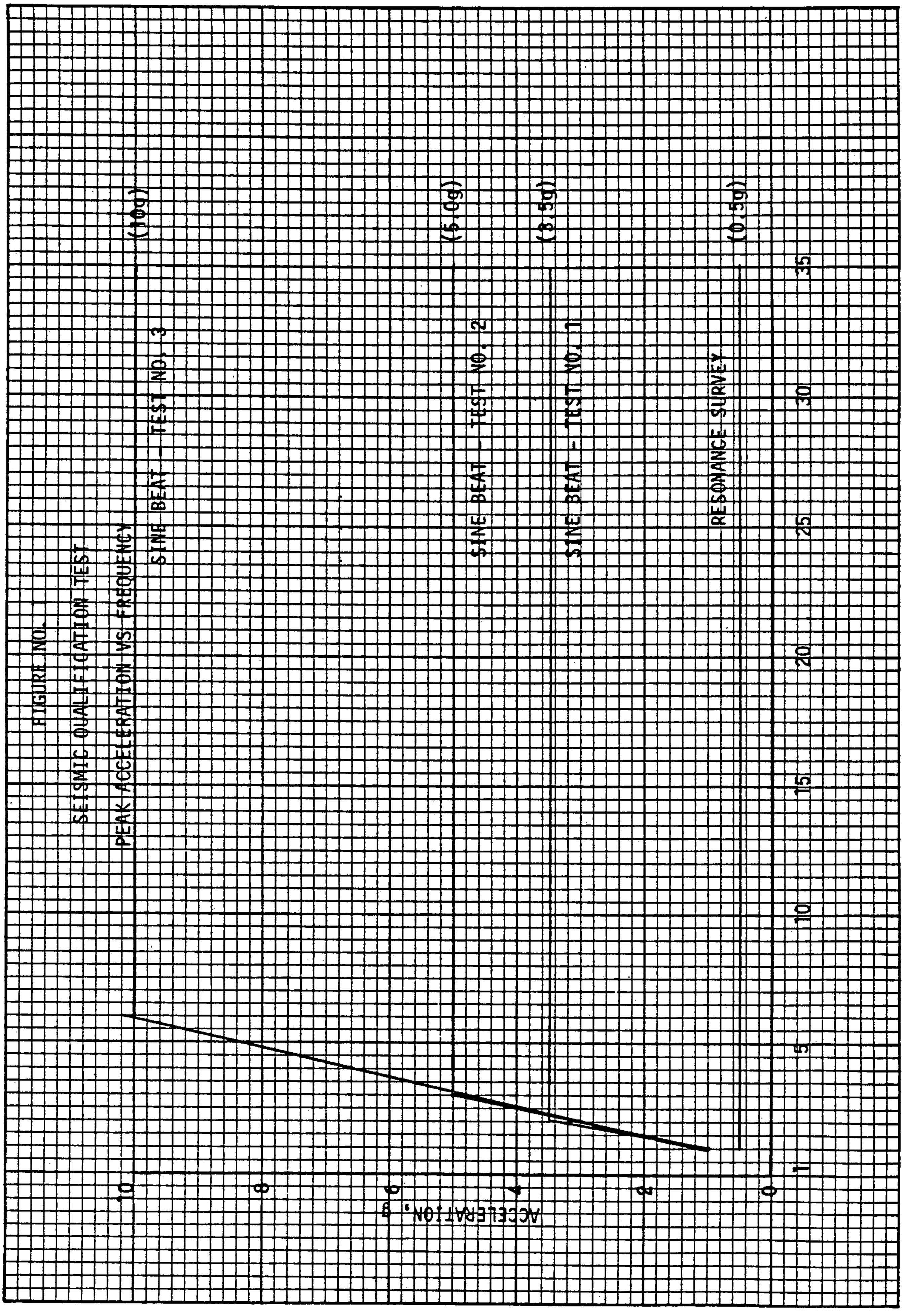


FIGURE NO.
SEISMIC QUALIFICATION TEST
PEAK ACCELERATION VS FREQUENCY
SINE BEAT - TEST NO. 3
(10g)
SINE BEAT - TEST NO. 2
(5.0g)
SINE BEAT - TEST NO. 1
(3.5g)
RESONANCE SURVEY
(0.5g)
ACCELERATION, g
10
8
6
4
2
0
1
5
10
15
20
25
30
35

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR ______

II. Component Name: Electronic Converters in Panel 2L-188

1. Scope: [ ] NSSS [X] BOP
2. Model Number: 2ES-N Spec. 200 — Quantity: 2
3. Vendor: The Foxboro Co.
4. If the component is a cabinet or panel, name and model No. of the devices included: See Appendix "A"
5. Physical Description a. Appearance Nested module for vertical rack mounting

   b. Dimensions 1-3/4" x 8-3/4" x 13-1/2"

   c. Weight ≅1 lb.
6. Location: Building: Control Area In Aux. Bldg.

   Elevation: 30'-0"
7. Field Mounting Conditions [ ] Bolt (No._____, Size_____)
   [X] Weld (Length 3" per 3")
   [ ] __________
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S: 12 HZ; 18 HZ F/B: 22 HZ; 11 HZ V: 22 HZ
9. a. Functional Description: Interface Cabinet for BOP 1E Instrumentation

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

   [X] Both
10. Pertinent Reference Design Specifications: S023-504-3

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

IV. Equipment Qualification Method: Test: X

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Foxboro Test Reports T4-1025 & T3-1077
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [ ] Combination of ______

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

2. Required Response Spectra (attach the graphs): See Appendix "B"

3. Required Acceleration in Each Direction:

S/S = 1g F/B = 1g V = 0.75g

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 ______ Other App. "C"
(specify)

4. Frequency Range: 1-35 HZ

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[ ] No N/A

6. Input g-level Test at S/S = 3.5g F/B = 3.5g V = 3.5g

7. Laboratory Mounting: ______

1. [X] Bolt (No. 6, Size .5" Dia) [ ] Weld (Length ______) [ ] ______

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

9. Test Results including modifications made: See Appendix "C"

10. Other tests performed (such as fragility test, including results):

____

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

1. Description of Test including Results: ______________________________

2. Method of Analysis: ______________________________

   [ ] Static Analysis
   [ ] Dynamic Analysis
   [ ] Equivalent Static Analysis
   [ ] Time-History
   [ ] Response Spectrum

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: __________ 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. Deflection	Location	Effect Upon Functional Operability

APPENDIX A

BECHTEL

CALCULATION SHEET

12400 E. IMPERIAL HWY
NORWALK, CALIFORNIA 90650

LAO 0012 11-70

APPENDIX 'A'

SIGNATURE ______ DATE ______

CALCULATION NO. ______

CHECKED ______ DATE 2-14-79

PROJECT SONGS 2&3

JOB NO. 10079-003

SUBJECT [NSSS PROCESS I/C CONVERTERS RACK]

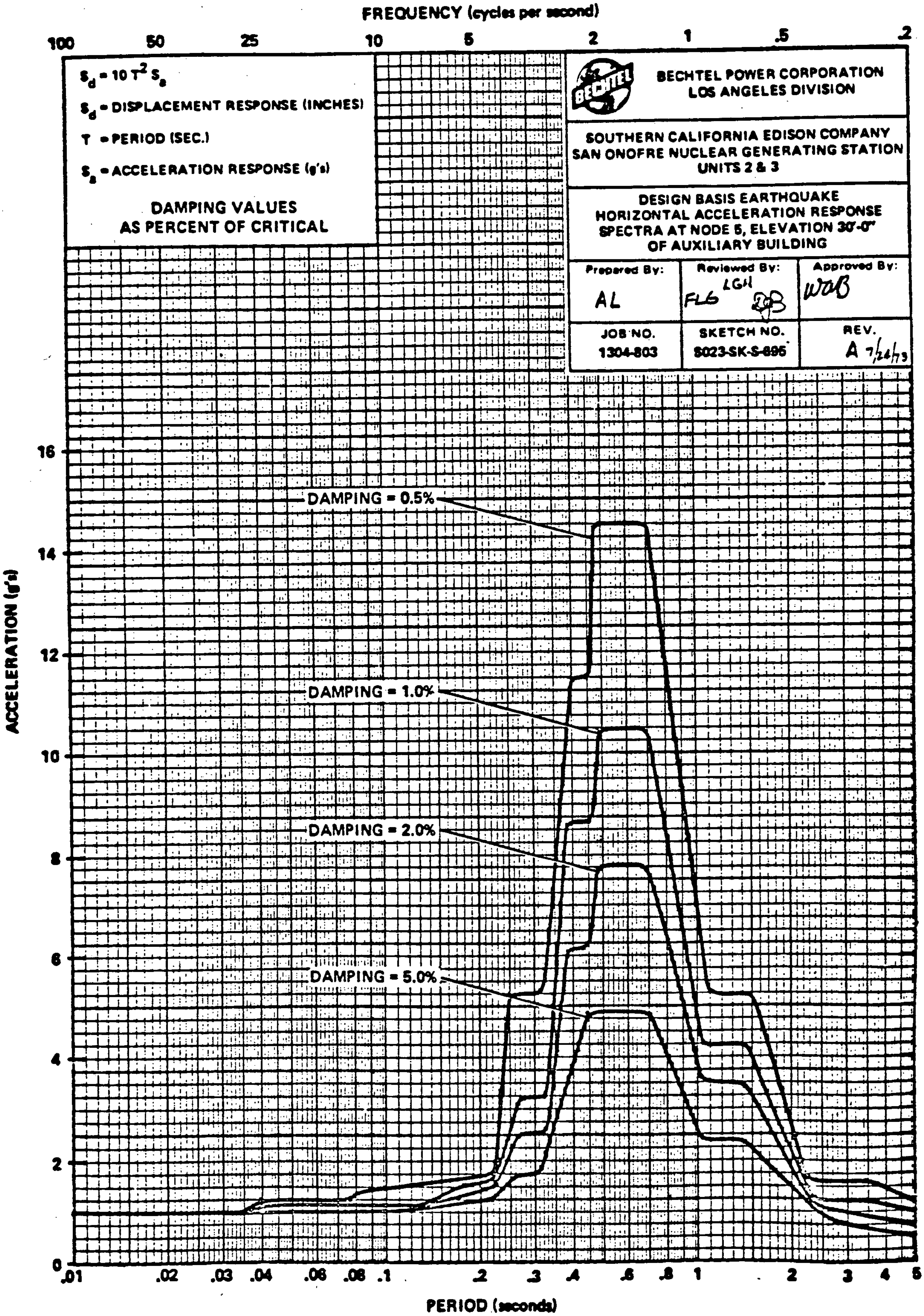
SHEET 1 OF 1 SHEETS

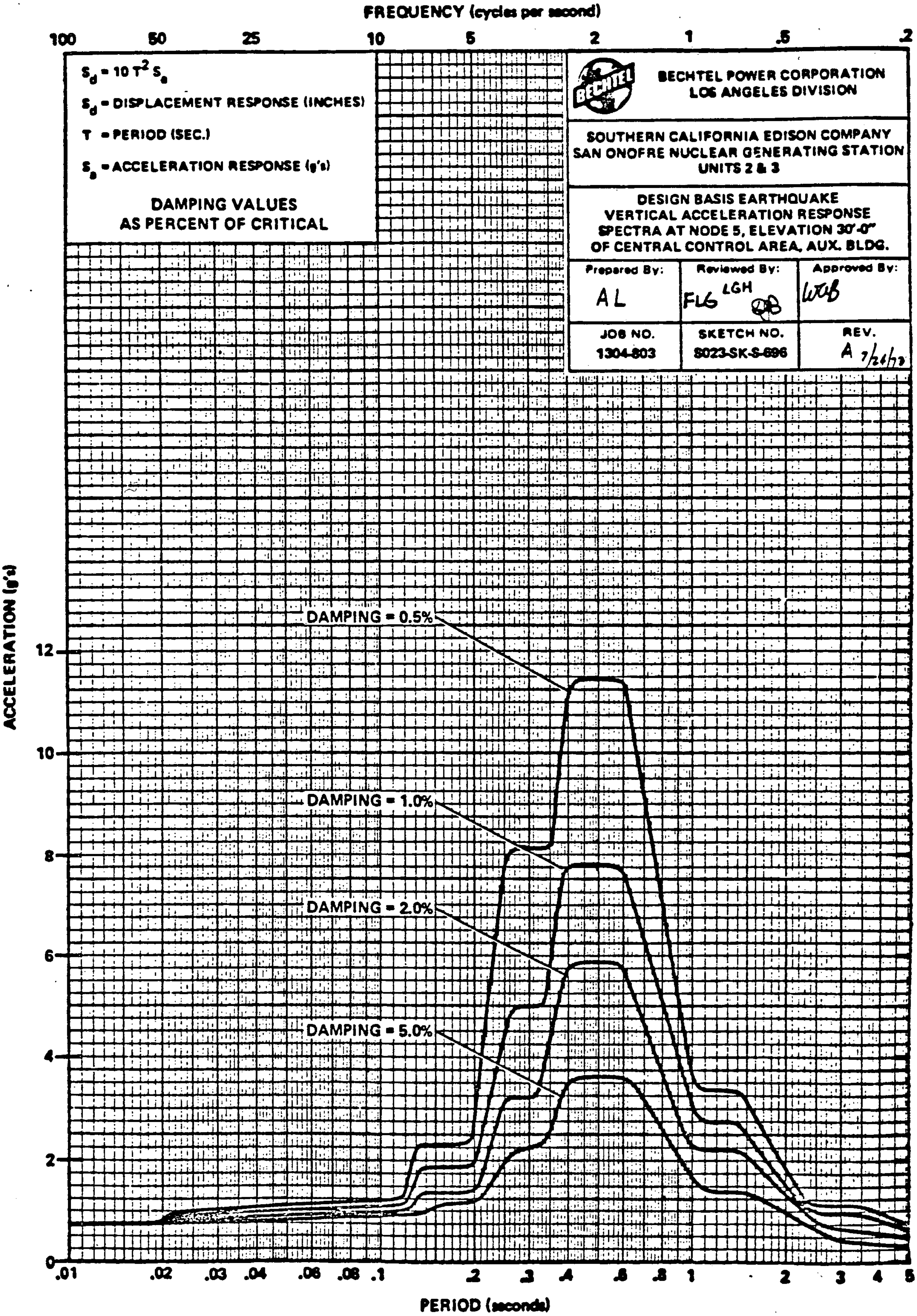
ITEM NO	DESCRIPTION	TOTAL NO IN PANEL	VENDOR	MODEL	TYPICAL TESTED	(*) IS EQPT QUALIFIED FOR CLASS IE SERVICE OR START SEISMIC	EQPT QUALIFIED BY TEST/ANALYSIS	TEST G	REQUIRED G	TYPE OF INPUT USED	REPORT NO	REMARKS
1	CURRENT TO VOLTAGE CONVERTER	6	FOXBORO	2AI-I3V	2AI-I3V	CLASS IE	TEST	3.5G	1.2G	SINE BEAT	5023-506-3-23-0 FOXBORO NO T2-1077 4023-506-3-2-2 FOXBORO NO T4-1025	THE 2 REPORTS QUALIFY THE RACK AND THE INSTRUMENTS MOUNTED INSIDE THE RACK
2	VOLTAGE TO CURRENT CONVERTER	4	FOXBORO	2AI-V2I	2AI-V2I	CLASS IE	TEST	3.5G	1.2G			
3	ALARM UNITS	6	FOXBORO	2AP+ALM-AR	2AP+ALM-AR	CLASS IE	TEST	3.5G	1.2G			
4	CONTACT OUTPUT ISOLATORS	2	FOXBORO	2AO-L2C-R	2AO-L2C-R	CLASS IE	TEST	3.5G	1.2G			
5	POWER DISTRIBUTION MODULES	8	FOXBORO	2AX+DPID	2AX+DPID	CLASS IE	TEST	3.5G	1.2G			
6	SIGNAL DISTRIBUTION MODULES	4	FOXBORO	2AX+DSP	2AX+DSP	CLASS IE	TEST	3.5G	1.2G			
7	SQUARE ROOT EXTRACTOR	2	FOXBORO	2AP+SQE	2AP+SQE	CLASS IE	TEST	3.5G	1.2G			
8	RESISTANCE TO CURRENT CONVERTER	2	FOXBORO	2AI-T2V	2AI-T2V	CLASS IE	TEST	3.5G	1.2G			
9	POWER DISTRIBUTION MODULE	2	FOXBORO	2AX+DPID-E	2AX+DPID-E	CLASS IE	TEST	3.5G	1.2G			
10	SIGNAL DISTRIBUTION MODULES	2	FOXBORO	2AX+DSI	2AX+DSI	CLASS IE	TEST	3.5G	1.2G			

(*) CLASS IE IMPLIES THAT THE EQUIPMENT IS QUALIFIED FOR IE SERVICE. TOTAL NO IN PANEL MAY OR MAY NOT BE ALL CLASS IE

APPENDIX B

APPENDIX B


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA AT NODE 5, ELEVATION 30'-0"
OF AUXILIARY BUILDING
Prepared By:
AL
Reviewed By:
FLG LGH
Approved By:
WAB
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-695
REV.
A 7/24/73
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
16
14
12
10
8
6
4
2
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA AT NODE 5, ELEVATION 30'-0"
OF CENTRAL CONTROL AREA, AUX. BLDG.
Prepared By:
AL
Reviewed By:
FLG LGH
Approved By:
WAB
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-696
REV.
A 7/26/73
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
12
10
8
6
4
2
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

APPENDIX C

APPENDIX C

1OF2

3.0 Observations & Conclusions

In general all of the input/output and computing cards performed well, even at 10g's. Exceptions are stated below, along with other observations and comments. In reviewing these several exceptions, the endurance testing aspect of the test sequence should be kept in mind, from the standpoint that these occurrences took place among 38 functioning modules, each of which was subjected to more than 1000 ten-cycle sine beats of vibration.

1. The mechanical integrity of the 2ANU nests and mounting hardware appears to be adequate at 3.5g's, but it is evident that additional measures must be taken for use at 5.0g and 10g levels.

   The nylon bushings on the mounting screws of the 2ANU nests and Power Supply are too soft and can be distorted by vibration to the point where the mounting screws become loose allowing the nests and power supply to slide in these mounting slots and/or rack opening.

   The nest-to-rack mounting brackets on the nests containing 2AP modules as opposed to the nest containing the input/output modules held at acceleration levels of 5.0g's or less; but when tested at 10g acceleration level, the brackets flexed considerably (compounded by the problem listed above) causing one nest's brackets to develop cracks along the 90° bend.

   The following design modifications are suggested for consideration:

   a. The use of all-metal locking hardware for mounting the nests.

   b. Using holes instead of slots in the front of the mounting brackets in order to reduce the amount of side-play available.

   c. Repositioning of the bracket-to-nest fastening hardware closer to the front of the nest in order to reduce the amount of side-play available.

   d. Using a heavier-gauge steel for the mounting brackets.

   e. Alteration of the design of the "pressed nuts" in the nest into which the mounting screws for the mounting brackets go would be desirable. In the present design the mounting bracket is kept from mounting flush to the nest by the lip on the "pressed nut" body. This allows flexing and eventually leads to failure of the fastener at 5 and 10g levels.

2. The mercury-wetted relays of the two 2AO-IPD-R's frequently chattered at various frequencies during all of the sine beat tests, and occasionally during the resonant searches at 0.4g's.

3. Several one-of-a-kind problems were encountered. They are as follows:

   a. Output spikes of up to -15% were observed on the output of the 2AP+SUM summer and 2AC+A5 controller of loop 2, group 1 at 3.5g's in the horizontal plane. At 5g's these spikes began appearing on the outputs of all the loop 2 units, but did not occur at any time from any of the units at 10g's.

504-3-23-0

4.0 Observations & Conclusions (Cont.)

No output spikes were observed in the other, identical group of equipment (loop 1, group 1) during testing.

b. Output A of the 2AO-L2C-R No. 2 failed at 20 Hz in the side-to-side plane @ 10g's. The fault was traced to two broken wires on the relay socket of K1.

c. The 2AP+ALM-A No. 2 failed at 28 Hz in the side-to-side plane @ 5g's. The fault was traced to operational amplifier, U2 (LM301A).

d. Diode CR2 (IN914) of the 2AP+SLM No. 1 failed (shorted) at 32 Hz in the vertical plane at 5g's. This caused the output to follow the low limit setting regardless of input signal level.

e. One suitcase jumper fell out of its position on the 2AP+SGC No. 2, at 10g's in the side-to-side plane, and all of the other suitcase jumpers were found to be partially withdrawn from their pins at the completion of testing.

f. At 3.5g's the alarm set point of one 2AP-ALM-AS shifted causing the output to fire.

g. Cards 2AX+INT No. 1 and 2AX+ALM No. 2, repeatedly came from their 2AP modules during 5g and 10g tests. This occurred because the retaining clips on the cards did not line up with the holes in the 2AP modules. After completion of testing, inspection revealed that many of the cards which did not come out were held by only one retaining clip.

504-3-23-0

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR

II. Component Name: 2HS-0227 B2 Control Switches

1. Scope: [ ] NSSS [X] BOP
2. Model Number: 10H Series — Quantity: 1
3. Vendor: Master Specialties 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 1 x 4 Horiz. Display
   b. Dimensions 1.2"W x 3.785"H
   c. Weight 2 lbs. Approx.
6. Location: Building: Main Control Panel in Control Area. Auxiliary Bldg.
   Elevation: 34'-0"
7. Field Mounting Conditions [ ] Bolt (No._____, Size_____)
   [ ] Weld (Length__________)
   [X] Screwed with Bezel Around
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
   S/S: >33Hz F/B: >33Hz V: >33Hz
9. a. Functional Description: Remote control of volume control tank outlet valve.
   b. Is the equipment required for [ ] Hot Standby [ ] Cold Shutdown
   [X] Both
10. Pertinent Reference Design Specifications: S023-506-2

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

IV. Equipment Qualification Method: Test: ________

Analysis: ________

Combination of Test and Analysis: X

Test and/or Analysis by Master Specialties Company Report No. 058-1165-75B
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

   3. [ ] Explosive only 4. [ ] Other (Specify) ________

   5. [ ] Combination of ________

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

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

3. Required Acceleration in Each Direction:

   S/S = 3g F/B = 3g V = 3g

VI. If Qualification by Test, then Complete:

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

2. [ ] Single Axis [X] Multi-Axis (Bi-Axial)

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

4. Frequency Range: Sinusodial Dwell @ Interger Frequencies 1 to 50 Hz

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs) [ ] No N/A

*Actual requirement (2g) per main control panel test. See circle AW report by Whole Lab. #54498-1 & 54498-2.

6. Input g-level Test at S/S = *(5g max. F/B = *(5g max. V = *(5g max.
*(See Appendix "A")

7. Laboratory Mounting: (Used Std. Screw for Std. Field Mounting

1. [ ] Bolt (No._____, Size_____) [ ] Weld (Length_____) [X] Connected to book end type fixture

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

9. Test Results including modifications made: See Appendix "B" The switches meet the requirements of the spec. for their intended service.

10. Other tests performed (such as fragility test, including results):

Functional test - No switch lights failed to operate during the seismic testing. All switches operated correctly upon completion of testing.

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

1. Description of Test including Results: The testing consists of subjecting the specimens to a series of sinusoidal dwell tests in the frequency range of 1Hz to 50Hz biaxially. Prior to testing the specimens were wired to a chatter-transfer detector and the contacts were monitored for chatter of 10 micro seconds or greater during all testing. There was no structural degradation noted during or after testing

2. Method of Analysis:

[X] Static Analysis
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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 [ ] SRSS
[ ] Other: N/A
(specify)

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

7. Support Considerations in the model: None

8. Critical Structural Elements: ______________________

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Base Plate		Seismic		10,139 psi	30,000 psi
Switch		Seismic		37,171 psi	70,000 psi

B.

Max. Deflection	Location	Effect Upon Functional Operability
N/A		

APPENDIX A

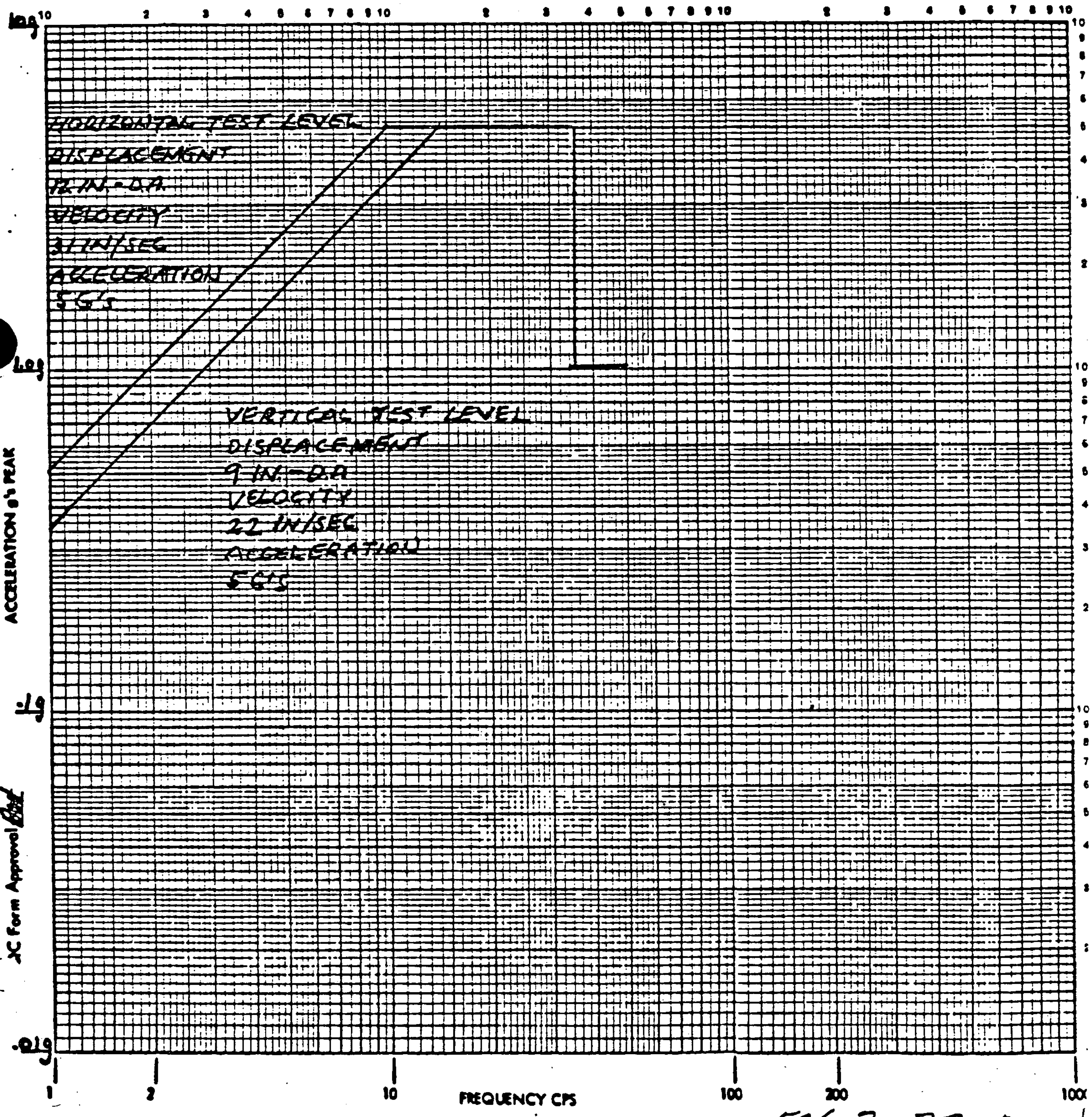
ATTACHMENT II
Part of 058-1165-75B

APPENDIX A

WYLE LABORATORIES Norco, California

FIGURE 3-1

INPUT TEST LEVELS FOR THE BIAXIAL TESTING



506-2-32-2

APPENDIX B

APPENDIX "B"

5.0 SUMMARY OF RESULTS

5.1 SEISMIC VIBRATION TEST

5.1.1 Definition of a mechanical resonance is arbitrary, and is commonly set at a ratio of 2 to 1 (response to input) throughout industry in testing of this nature. There were no significant resonances over the frequency range of 1 to 35 Hz except at 27 Hz as indicated in Attachment V, pages 28 and 29, where the ratio reached 2.18 to 1. It should be noted that this small resonance was insignificant compared to the main resonance at 46 Hz, and that this was with covers removed: A condition that will not occur in actual application.

5.1.2 There was no evidence of structural damage.

5.1.3 There was no contact chatter exceeding 10 microseconds on the MSC 10H Series lighted pushbutton panel mounted switches except for one isolated incidence at $<$100 microseconds. This occured on the Wyle "G" machine, which was exhibiting a considerable amount of "3rd-axis" vibration during this biaxial test. It is the opinion of Master Specialties that this chatter was due to the addition of the "3rd-axis" element in the vibration. This opinion is based further on the fact that in subsequent testing no chatter occured on these units.

5.1.4 The lamps lighted and remained lighted before, during and after the seismic vibration tests.

5.1.5 All switches maintained their mechanical and electrical selection positions.

5.1.6 The normal mounting hardware retained the assemblies in the panels before, during, and after the seismic test.

5.1.7 The Micro Switch heavy duty oil-tight switches exhibited contact chatter and an open condition up to 1.3 milliseconds.

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR ____

II. Component Name: Auxiliary Feedwater Pump Motor

1. Scope: [ ] NSSS [X] BOP
2. Model Number: 3020SS6 Type AZ Quantity: 1/Unit
3. Vendor: Byron Jackson (Pump)/Allis Chalmers (Motor)
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 800 HP Motor

   b. Dimensions 83.62" Long x 47.25" in Dia.

   c. Weight 9700 lbs
6. Location: Building: Storage Tank Area

   Elevation: 31'-8 5/16"
7. Field Mounting Conditions [X] Bolt (No. 4, Size 1 1/4 Motor to Pump Baseplate)

   [ ] Weld (Length ____)

   [ ] ____
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S: >100 HZ F/B: 92.5 HZ V: >100 HZ
9. a. Functional Description: Driver for Auxiliary Feedwater Pump

   b. Is the equipment required for [X] Hot Standby [ ] Cold Shutdown [ ] Both ____
10. Pertinent Reference Design Specifications: S023-405-6 QCII Auxiliary Feedwater Pumps and Drivers

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

IV. Equipment Qualification Method: Test: N/A

Analysis: Static

Combination of Test and Analysis: N/A

Analysis by Allis-Chalmers
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [ ] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ____________

5. [X] Combination of Seismic & Operating

6. Method of combining RRS: [ ] Absolute Sum [X] SRSS [ ] ____________ (other, specify)

2. Required Response Spectra (attach the graphs): S023-SK-S-986, 987, 988, 989

3. Required Acceleration in Each Direction: ZPA

S/S = 1.2g F/B = 1.2g V = 1.3g

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. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[ ] No

____

6. Input g-level Test at S/S = ______ F/B = ______ V = ______

7. Laboratory Mounting: ______

   1. [ ] Bolt (No.___, Size___) [ ] Weld (Length___) [ ] ______

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

9. Test Results including modifications made: ______

10. Other tests performed (such as fragility test, including results):

______

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: ______

   [X] Static Analysis
   [ ] Dynamic Analysis
   [ ] Equivalent Static Analysis
   [ ] Time-History
   [X] Response Spectrum

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

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

4. [X] Computer Codes: In-house program of the Rayleigh Principle

   Frequency Range and No. of modes considered: freq. >33 HS

   [X] Hand Calculations

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

6. Damping: N/A Basis for the damping used: Rigid

7. Support Considerations in the model: 2-shaft bearings (pinned supports)

8. Critical Structural Elements:

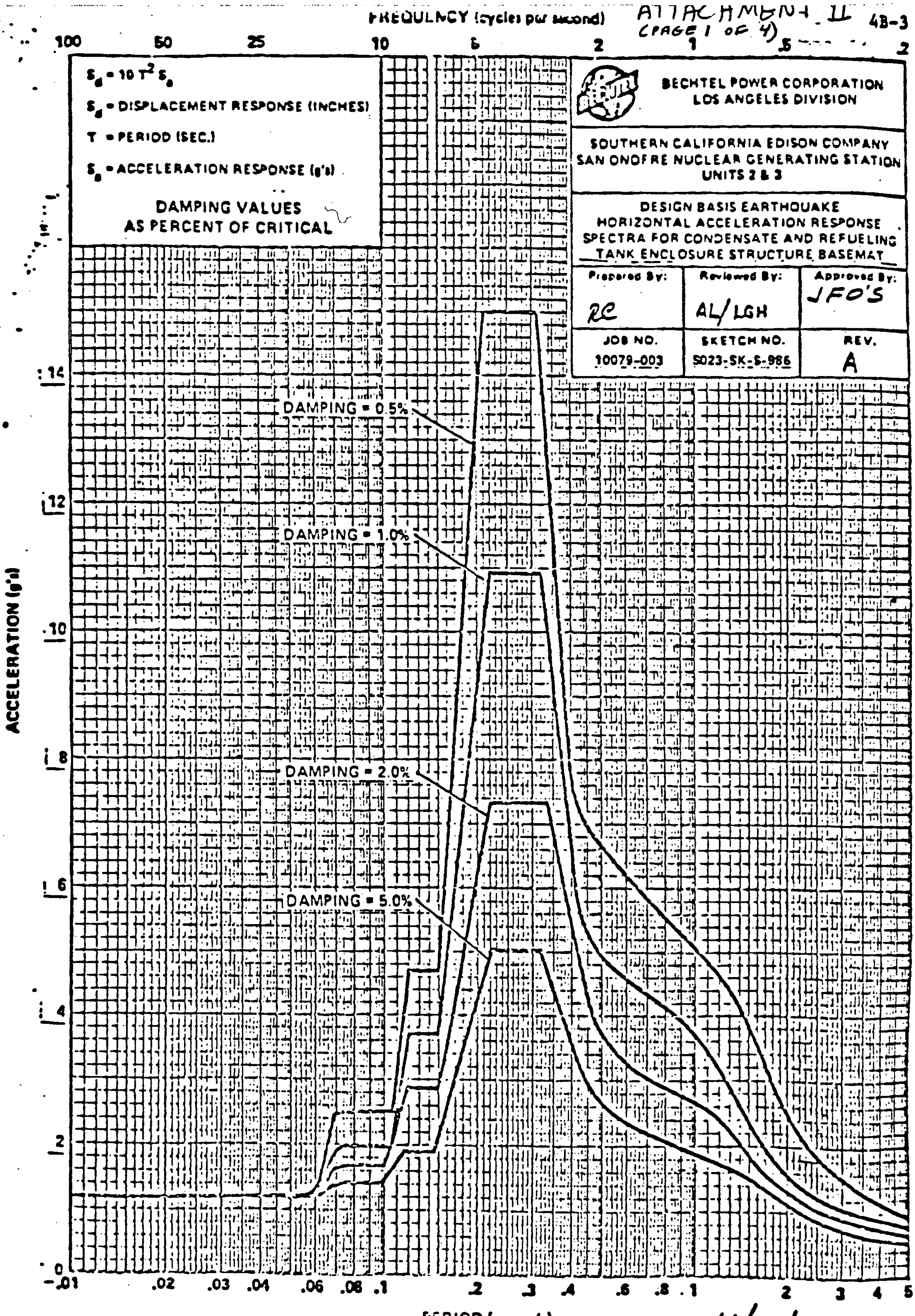
A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Motor Mounting Bolts	Between Pump Base-plate and Motor	Weight	Not Broken Out	Shear 2127 Tension Ø	10,000psi 20,000psi
Bearing Reactions	Ends of Shaft	Rotor Offset	1074 lbs	2447lbs	2447 lbs

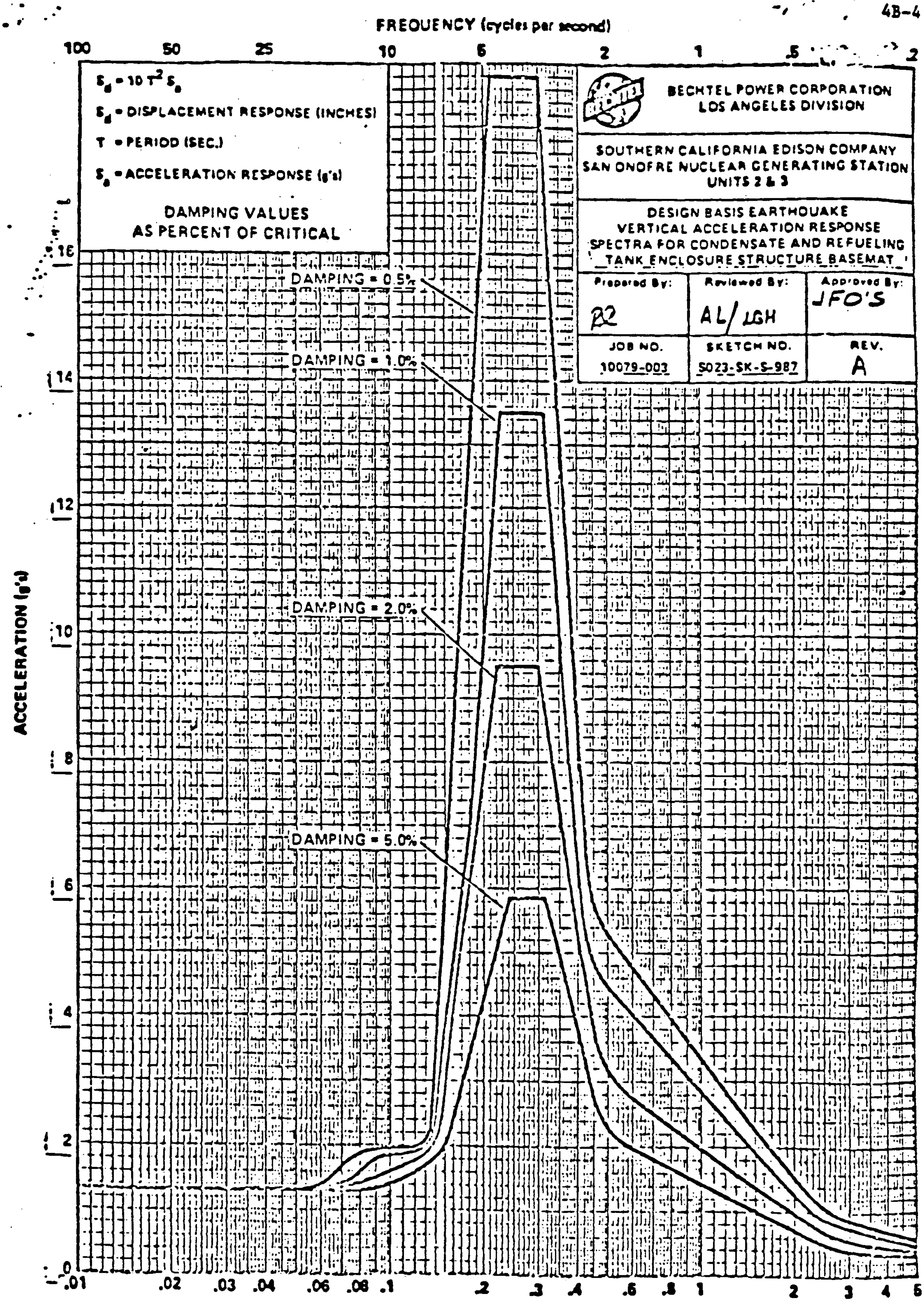
B.

Max. Deflection	Location	Effect Upon Functional Operability
0.1067	Between Rotor and Stator	This is 24% of the deflection that would cause loss of function.

APPENDIX A


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA FOR CONDENSATE AND REFUELING
TANK ENCLOSURE STRUCTURE BASEMAT
Prepared By: RC
Reviewed By: AL/LGH
Approved By: JFO'S
JOB NO. 10079-003
SKETCH NO. S023-SK-S-986
REV. A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
1.4
1.2
1.0
.8
.6
.4
.2
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

11/4/77


FREQUENCY (cycles per second)
100 50 25 10 5 2 1 .5 .2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA FOR CONDENSATE AND REFUELING
TANK ENCLOSURE STRUCTURE BASEMAT
Prepared By: B2
Reviewed By: AL/LGH
Approved By: JFO'S
JOB NO. 10079-003
SKETCH NO. SO23-SK-S-987
REV. A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
16 14 12 10 8 6 4 2 0
.01 .02 .03 .04 .06 .08 .1 .2 .3 .4 .6 .8 1 2 3 4 5

ok

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X

2. NSSS: CE — 3. A/E: Bechtel — BWR ____

II. Component Name: Diesel Fuel Oil Transfer Pump Motor

1. Scope: [ ] NSSS [X] BOP

2. Model Number: AC Motor Frame 180 HP Type T Quantity: 8

3. Vendor: Pump (Goulds)/Motor (Westinghouse)

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 Cylinder 1-HP Motor

b. Dimensions ≅10" Diameter x 15" Tall

c. Weight ≅10 lb. Motor Only

6. Location: Building: Diesel Fuel Oil Storage Tank Vault

Elevation: ≅26'-6"

7. Field Mounting Conditions [X] Bolt (No. 4, Size 3/8)Motor to Pump

[ ] Weld (Length ____)

[ ] ____

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

S/S: None Provided F/B: ____ V: ____

9. a. Functional Description: Diesel Fuel Oil Pump Driver. Pump transfers fuel from storage tanks to day tanks.

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

[X] Both Emergency & Test Condition

10. Pertinent Reference Design Specifications: SO23-405-12 QC II Diesel Fuel Oil Transfer Pumps

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

IV. Equipment Qualification Method: Test: ______

Analysis: Static

Combination of Test and Analysis: ______

Test and/or Analysis by Westinghouse Electric (Log S023-405-12-38-0)
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [ ] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [X] Combination of Seismic and Operating

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

2. Required Response Spectra (attach the graphs): S023-SK-S-756-B, 757-B

3. Required Acceleration in Each Direction:

S/S = 3.0 F/B = 3.0 V = 2.0

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. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[ ] No

______

6. Input g-level Test at S/S = ______ F/B = ______ V = ______

7. Laboratory Mounting: ______

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

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

9. Test Results including modifications made: ______

10. Other tests performed (such as fragility test, including results):

______

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

1. Description of Test including Results: N/A

2. Method of Analysis: ______

   [X] Static Analysis
   [ ] Dynamic Analysis
   [ ] Equivalent Static Analysis
   [ ] Time-History
   [ ] Response Spectrum

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

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

4. [ ] Computer Codes: N/A

   Frequency Range and No. of modes considered: >33Hz

   [X] Hand Calculations

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

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

7. Support Considerations in the model: Thrust Bearing at Bottom
   Guide Bearing at Top

8. Critical Structural Elements: ______

A.

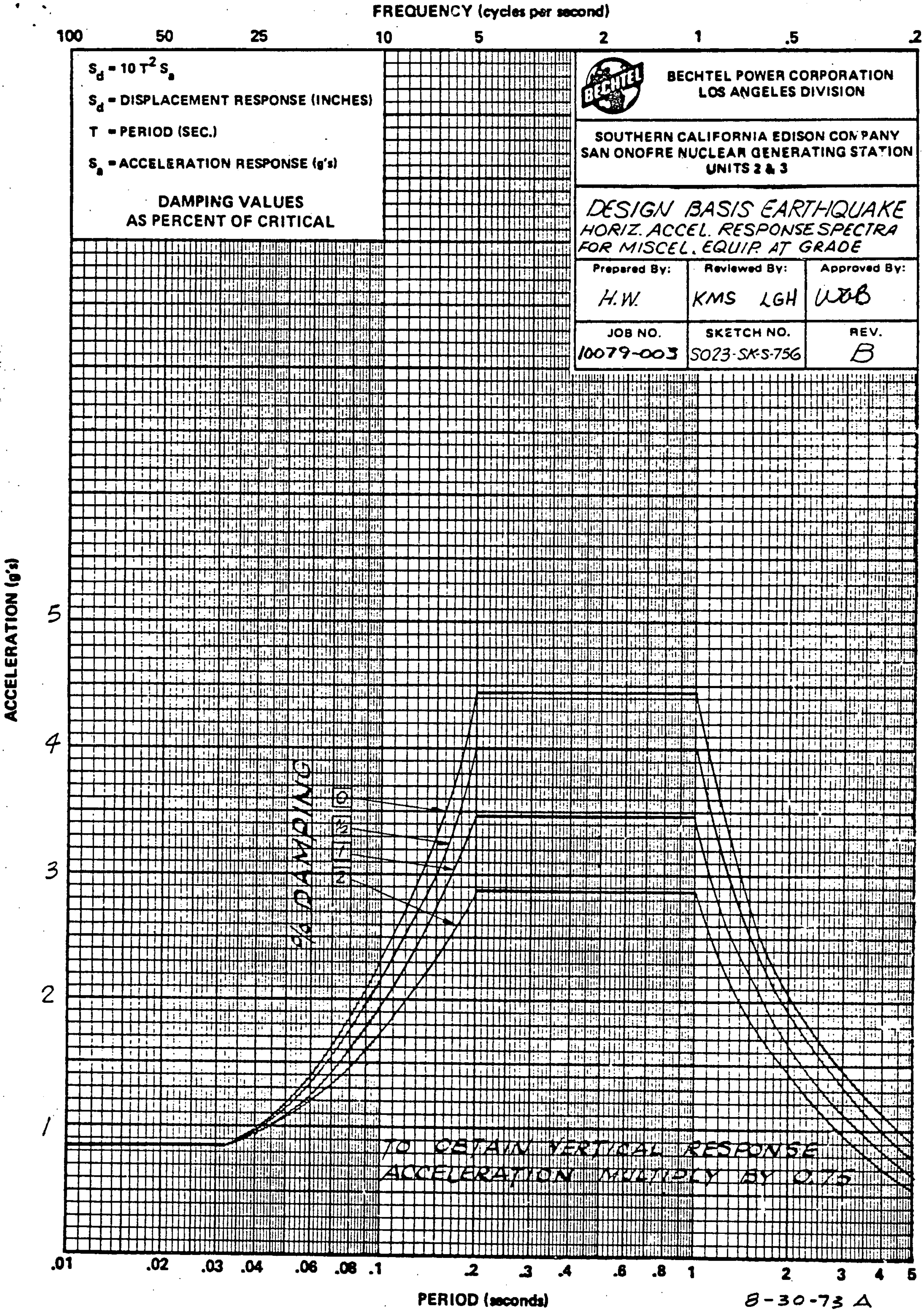
Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Bottom Bearing	Bottom of Motor	Siesmic + Normal Operating Load	270 lbs	390 lbs	3070 lbs
Shaft	Center of Motor	Seismic + Normal Operating Load	1721 psi	1855 psi	58,500 psi

B.

Max. Deflection	Location	Effect Upon Functional Operability
0.00034 in.	Between stator and rotor	None, Allowable = 0.0212"

APPENDIX A

86-952 SS



8-30-73 A

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR ____

II. Component Name: 2HV-0352A Solenoid Valves

1. Scope: [ ] NSSS [X] BOP
2. Model Number: V52600-539 — Quantity: 8
3. Vendor: Valcor Engineering 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 3/4" size, 2-way w/latching type operator
   b. Dimensions 12.61"H x 6.5"W
   c. Weight 21 lbs.
6. Location: Building: Penetration Room
   Elevation: 37'-4-1/2"
7. Field Mounting Conditions [ ] Bolt (No.____, Size____)
   [X] Weld (Length Continuous)
   [ ] ____________
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
   S/S: >33Hz. F/B: >33Hz. V: >33Hz.
9. a. Functional Description: Containment pressure sensing line isolation valve.
   b. Is the equipment required for [X] Hot Standby [ ] Cold Shutdown
   [ ] Both ____________
10. Pertinent Reference Design Specifications: S023-507-4

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

IV. Equipment Qualification Method: Test: X (By Similarity)

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Valcor Test Report #V52600-539
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

   3. [ ] Explosive only 4. [ ] Other (Specify) ______

   5. [ ] Combination of ______

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

2. Required Response Spectra (attach the graphs): See Appendix "A"

3. Required Acceleration in Each Direction:

   S/S = 0.9g F/B = 0.9g V = 0.9g

VI. If Qualification by Test, then Complete:

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

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

3. No. of Qualification Tests: OBE Ten (10) SSE Six (6) Other ______ (specify)

4. Frequency Range: 1-50Hz

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs) [X] No (See Appendix "B")

   TRS exceeds RRS above 3.5 Hz

6. Input g-level Test at S/S = 2.7g F/B = 2.7g V = 4.0g

7. Laboratory Mounting: ____________________

   1. [ ] Bolt (No.___, Size___) [X] Weld (Length Continuous) [ ] ____________

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

9. Test Results including modifications made: By similarity and test, the subject valve performance or operation is not affected by acceleration level of 5gs min. and all structural resonances are greater than 33Hz.

10. Other tests performed (such as fragility test, including results):

    Operability test - 5 times at 125 VDC.

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

1. Description of Test including Results: ____________________

2. Method of Analysis: ____________________

   [ ] Static Analysis
   [ ] Dynamic Analysis
   [ ] Equivalent Static Analysis
   [ ] Time-History
   [ ] Response Spectrum

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: __________ 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

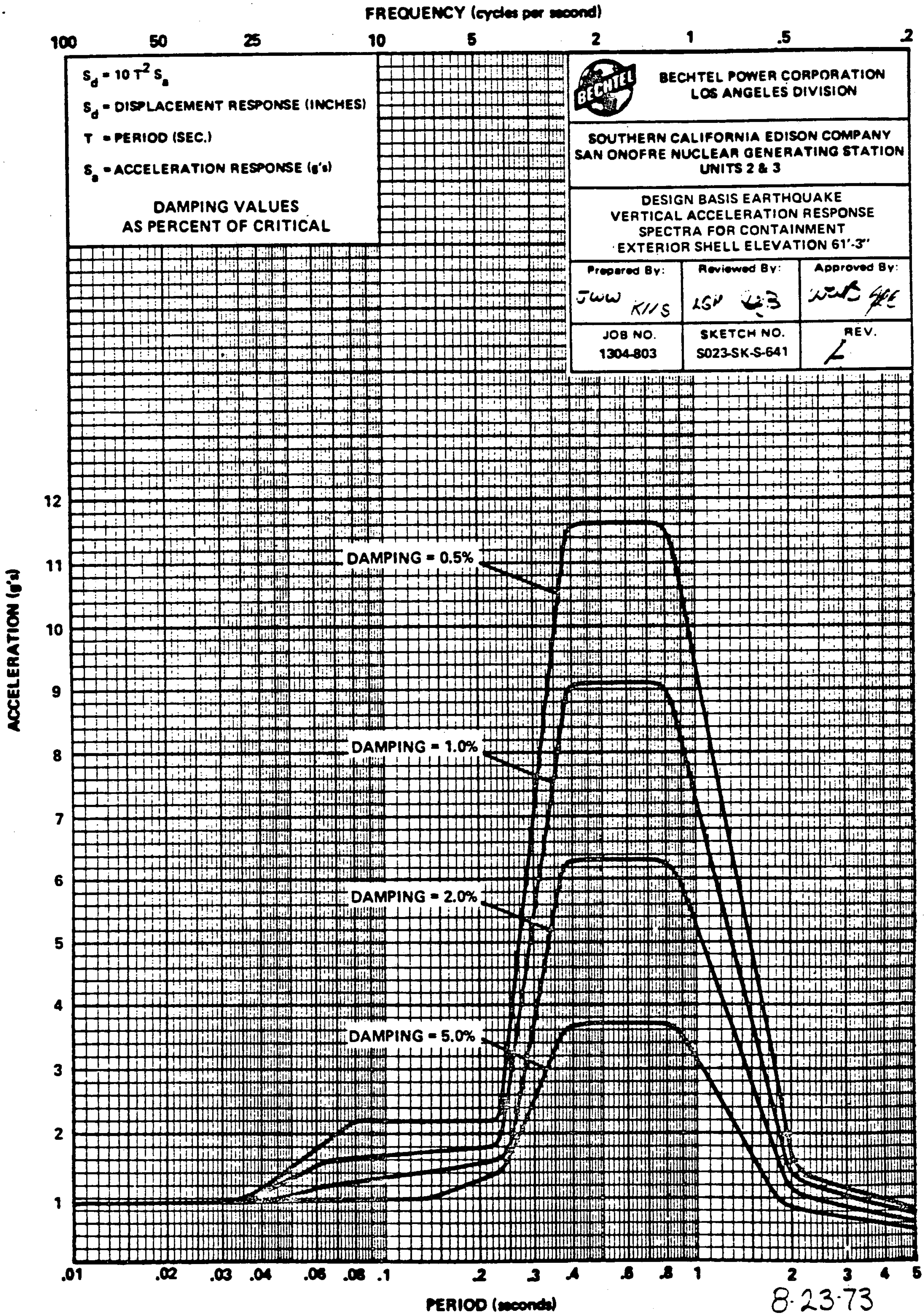
B.

Max. Deflection	Location	Effect Upon Functional Operability

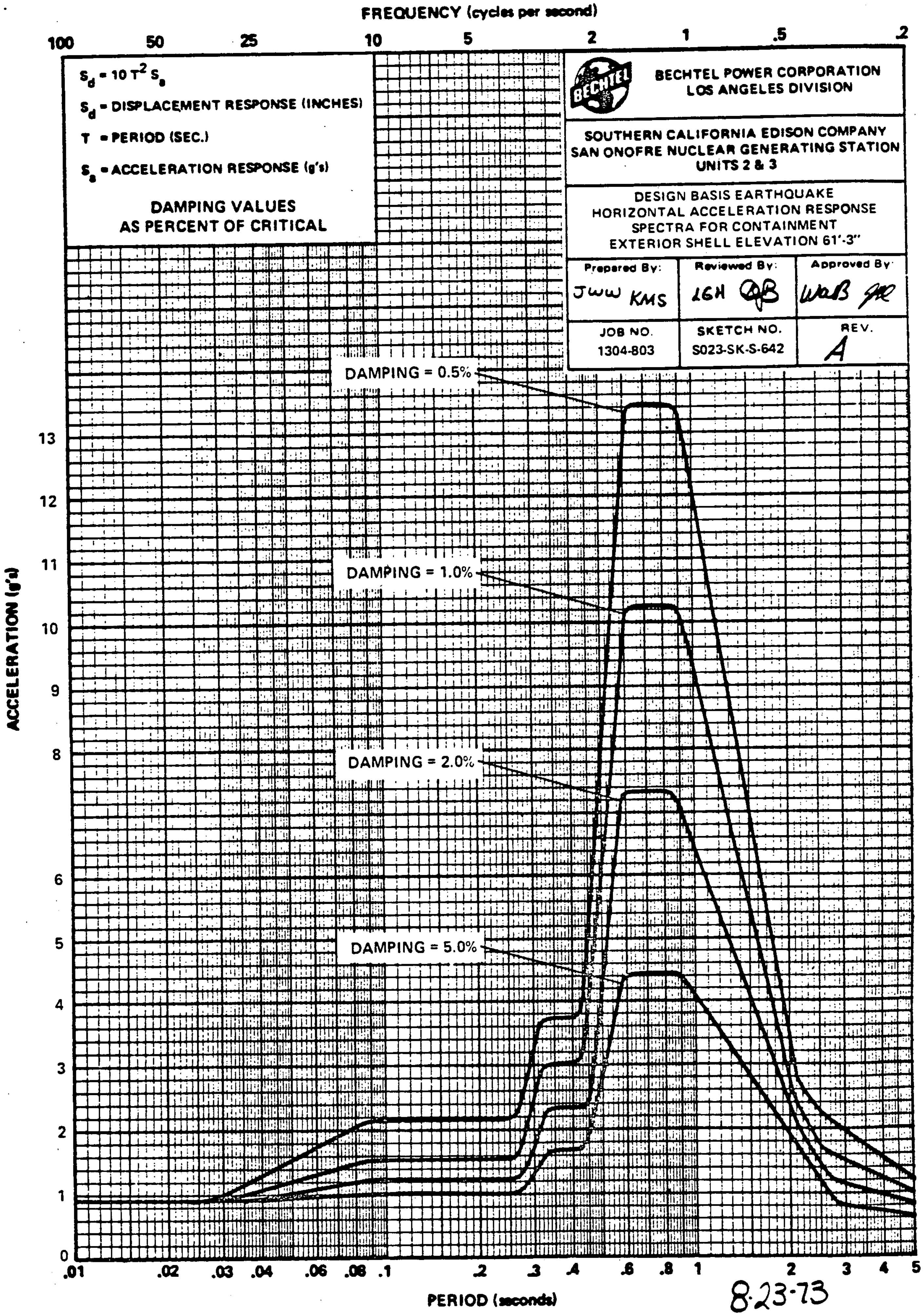
APPENDIX "A"

(2 PAGES)

ATTACHMENT "A"



8-23-73


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA FOR CONTAINMENT
EXTERIOR SHELL ELEVATION 61'-3"
Prepared By:
JWW KMS
Reviewed By:
LGH
Approved By:
WaB
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-642
REV.
A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
13
12
11
10
9
8
6
5
4
3
2
1
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)
8-23-73

ATTACHMENT "B"

(4 PAGES)

105

Plotted by: Wm. Clendinnen

Checked by: WC

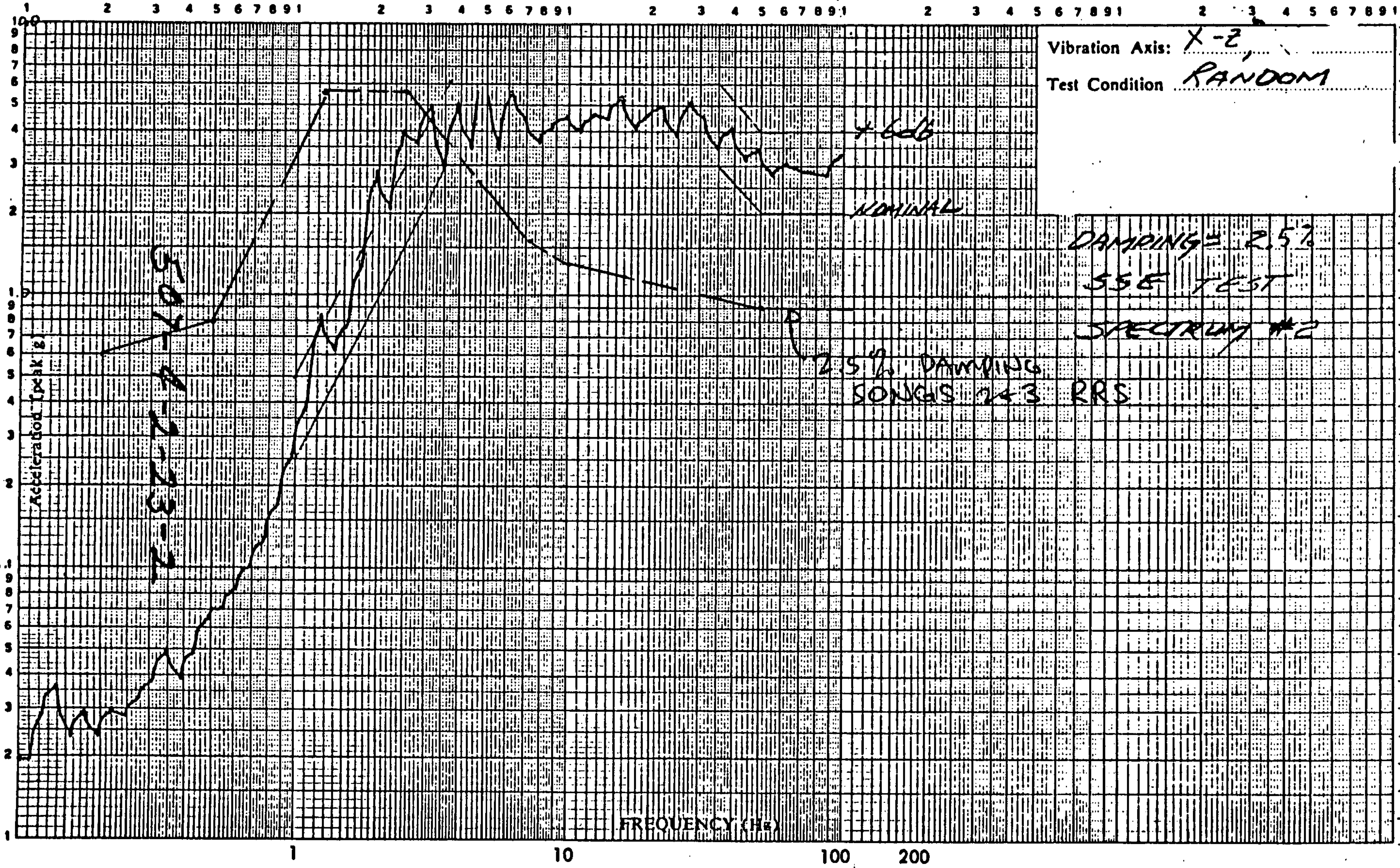
DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES 2" & 3/4

Serial Number(s): 1 & 2

Unit: Operational ☒ Non-operational ☐

1466 Enc 1 Pg 59



ATTACHMENT "B"

Graph Number: 87

Lab Form D-24

Pickup Serial Number: 459

Pickup Sensitivity: 100.0 mv peak / g peak

Job Number: 401418-00-000

Pickup Location: CONT

Date: 14 Oct 76

Pickup Sensing Axis: X

☐ Live ☒ Tape

Time: 1202

1 OF 4

113

Plotted by: R RANKIN.

Checked by:

DAYTON T. BROWN INC.
Testing Laboratories

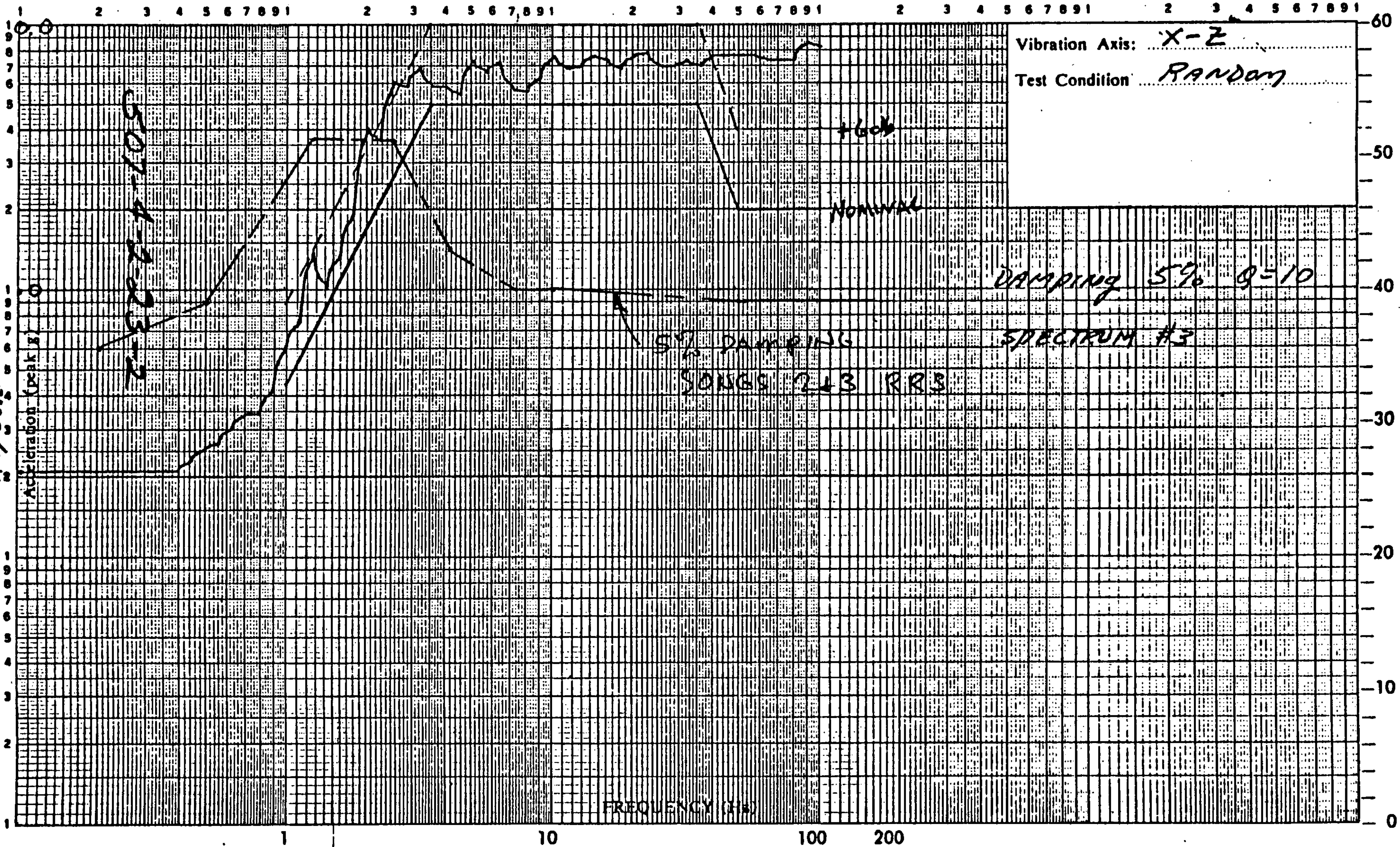
Test Item: VALUES 2" & 3/4"

Serial Number(s): 1 & 2

Unit: Operational ☒ Non-operational ☐

Vibration Axis: X-Z

Test Condition: RANDOM



1466 Enc 1 Pg 67

Lab Form D-24

Graph Number: 96

2 OF 4

Pickup Serial Number: 459

Pickup Sensitivity: 100.0 mv peak / g peak

Job Number: 401418-00-000

Pickup Location: CONT

Date: 14OCT96

Pickup Sensing Axis: X

☐ Live ☒ Tape

Time: 1440

Plotted by: R. RANKIN

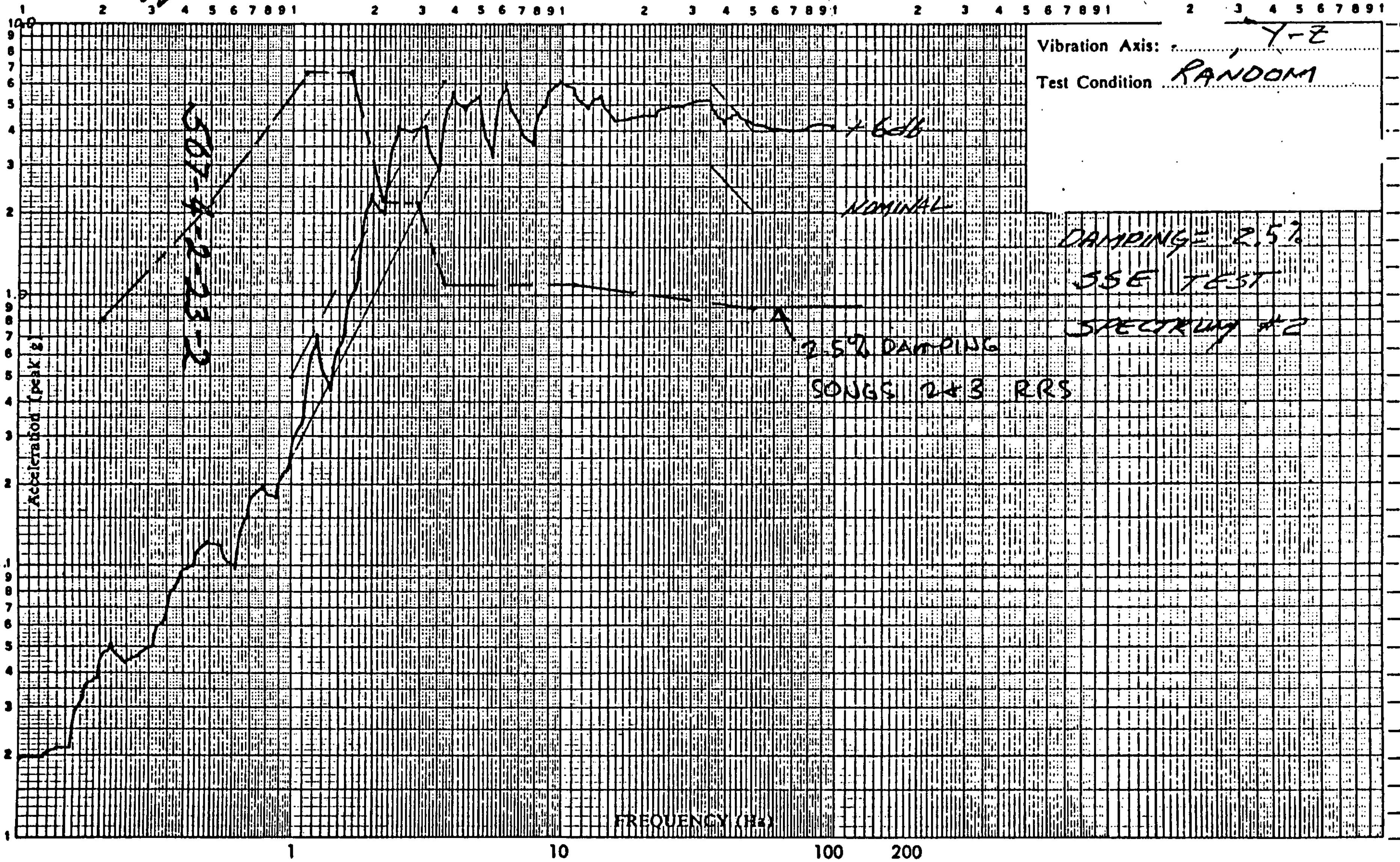
Checked by: WB

DAYTON T. BROWN INC.
Testing Laboratories

Test Item: VALVES 2" & 1/2

Serial Number(s): 1 & 2

Unit: Operational ☒ Non-operational ☐



Vibration Axis: Y-Z

Test Condition: RANDOM

1466 Enc 1 Pg 53

Lab Form D-24

Graph Number: 7U

Pickup Serial Number: 457

Pickup Sensitivity: 100.0 mv peak / g peak

Job Number: 401418-00-000

Pickup Location: CONT

Date: 14 Oct 76

Pickup Sensing Axis: VERT

☐ Live ☒ Tape

Time: 1112

3 of 4

Plotted by: R. RANKIN

Checked by: WB

DAYTON T. BROWN INC.
Testing Laboratories

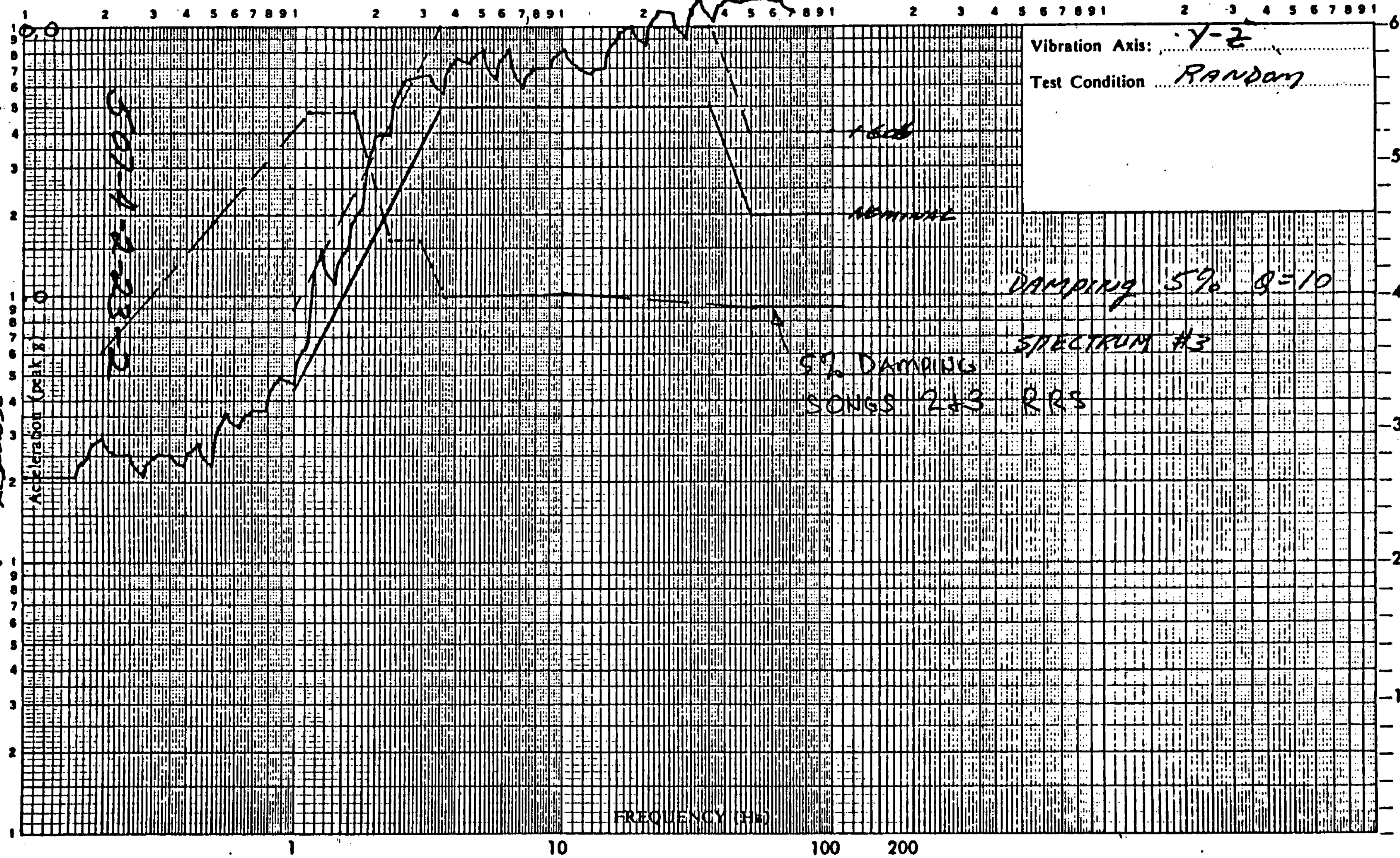
Test Item: VALVES 2" & 3/4"

Serial Number(s): 1 & 2

Unit: Operational ☒ Non-operational ☐

Vibration Axis: Y-Z

Test Condition: RANDOM



Graph Number: 10A

Pickup Serial Number: 457

Pickup Sensitivity: 100.0 mv peak / g peak

Job Number: 401418-00-000

Pickup Location: CONT

Date: 14 OCT 76

Pickup Sensing Axis: VERT Z

☐ Live ☒ Tape

Time: 1600

1466 Enc 1 Pg 69

Lab Form D-24

4 OF 4

115

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR ____

II. Component Name: 2HV-0502 Solenoid Valves

1. Scope: [ ] NSSS [X] BOP
2. Model Number: 75G-002 — Quantity: 54
3. Vendor: Target Rock Corporation
4. If the component is a cabinet or panel, name and model No. of the devices included: Not Applicable
5. Physical Description a. Appearance 1" Y-Pattern, Globe Body
   b. Dimensions 15"H x 21"W
   c. Weight 42 lbs.
6. Location: Building: Containment Bldg.
   Elevation: 34'-7"
7. Field Mounting Conditions [ ] Bolt (No.____, Size____)
   [X] Weld (Length Continuous)
   [ ] ____
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S: Jct. Box - 20Hz, Main Vlve. - 137.5Hz; F/B: Jct. Box - 18 Hz, Mn.Vlve. - 137.5HZ; V: Jct. Box - 33Hz, Mn. Vlve. - 137.5Hz
9. a. Functional Description: Containment atmosphere sample isolation valve.
   b. Is the equipment required for [X] Hot Standby [ ] Cold Shutdown [ ] Both ____
10. Pertinent Reference Design Specifications: S023-507-4.

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

IV. Equipment Qualification Method: Test: X

Analysis: ____________

Combination of Test and Analysis: ____________

Test and/or Analysis by TRC Report # 1674, TRC Report #1931A
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

   3. [ ] Explosive only 4. [ ] Other (Specify) ____________

   5. [ ] Combination of ____________

   6. Method of combining RRS: [ ] Absolute Sum [X] SRSS [ ] ____________
   (other, specify)

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

3. Required Acceleration in Each Direction:

   S/S = 3g F/B = 3g V = 3g

VI. If Qualification by Test, then Complete:

1. [X] Single Frequency 1/2 Octave Intervals

   [ ] Multi-Frequency: [ ] random
   [ ] sine beat
   [X] Continuous sine (30 sec. @ ea. frequency

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

3. No. of Qualification Tests: OBE ______ SSE ______ Other N/A
   (specify)

4. Frequency Range: 1-35Hz

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
   [ ] No

   Not Applicable

6. Input g-level Test at S/S = 4.5g F/B = 4.5g V = 4.5g and 8" double amplitude below 4hz.

7. Laboratory Mounting: ______

   1. [ ] Bolt (No.___, Size___) [X] Weld (Length Continuous) [X] Supported only by end connections

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

9. Test Results including modifications made: See Appendix "A"

10. Other tests performed (such as fragility test, including results):

    Aging, radiation, leak test, functional test

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

1. Description of Test including Results: ______

2. Method of Analysis: ______

   [ ] Static Analysis
   [ ] Dynamic Analysis
   [ ] Equivalent Static Analysis
   [ ] Time-History
   [ ] Response Spectrum

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: ______ 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. Deflection	Location	Effect Upon Functional Operability

APPENDIX A

6.0 CONCLUSIONS

The tests and test results described herein demonstrates that the solenoid valves tested are capable of withstanding the extreme environs of both before and after accident simulation. The valve thus qualifies for use in both inside and outside containment applications. The valve design is mechanically rugged and ideally suited for the intended applications.

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 Type:

1. Utility: Southern California Edison Company PWR X
2. NSSS: CE 3. A/E: Bechtel BWR ____

II. Component Name: 2HV-4712 Control Valve

1. Scope: [ ] NSSS [X] BOP
2. Model Number: 70-28-2 Quantity: Four (4)
3. Vendor: W-K-M, ACF Industries, 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 4" Globe Body, Motor Operated

   b. Dimensions 23.5"H x 19"W x 22" Deep

   c. Weight 340 lbs.
6. Location: Building: Refueling Water Storage Tank Building

   Elevation: 45'-0"
7. Field Mounting Conditions [ ] Bolt (No.____, Size____)
   [X] Weld (Length Continuous)
   [ ] ____
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S: 26; 57Hz F/B: 19.5Hz V: 80; 97Hz
9. a. Functional Description: Aux. Feedwater Pump Discharge to Steam Generator

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

   [ ] Both ____
10. Pertinent Reference Design Specifications: S023-507-5

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

IV. Equipment Qualification Method: Test: X

Analysis:

Combination of Test and Analysis:

Test and/or Analysis by Southwest Research Institute
Report #02-4958-002
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [ ] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [X] Combination of Hydrostatic & seismic loads.

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

2. Required Response Spectra (attach the graphs): See Appendix "A"

3. Required Acceleration in Each Direction:

S/S = .9g F/B = .9g V = .9g

VI. If Qualification by Test, then Complete:

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

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

3. No. of Qualification Tests: OBE Five(5) SSE Two(2) Per each Horiz Direction Other ______ (specify

4. Frequency Range: 1-100 Hz

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[X] No

*TRS exceeds RRS above 2-1/2 Hz and all natural frequencies.

6. Input g-level Test at S/S = APP B F/B = APP B V = APP B

7. Laboratory Mounting: *

1. [ ] Bolt (No.____, Size_____) [ ] Weld (Length____) [X] Pipe Circumference

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

9. Test Results including modifications made: See Appendix "C"

10. Other tests performed (such as fragility test, including results):

Seat Leak Test - See Appendix "C"

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

1. Description of Test including Results: ____________________

2. Method of Analysis: ____________________

[ ] Static Analysis
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: __________ Basis for the damping used: ____________________

7. Support Considerations in the model: ____________________

*Valve welded to flange. Flange bolted to bookends. Bookends bolted to shake table.

8. Critical Structural Elements: ______________________________

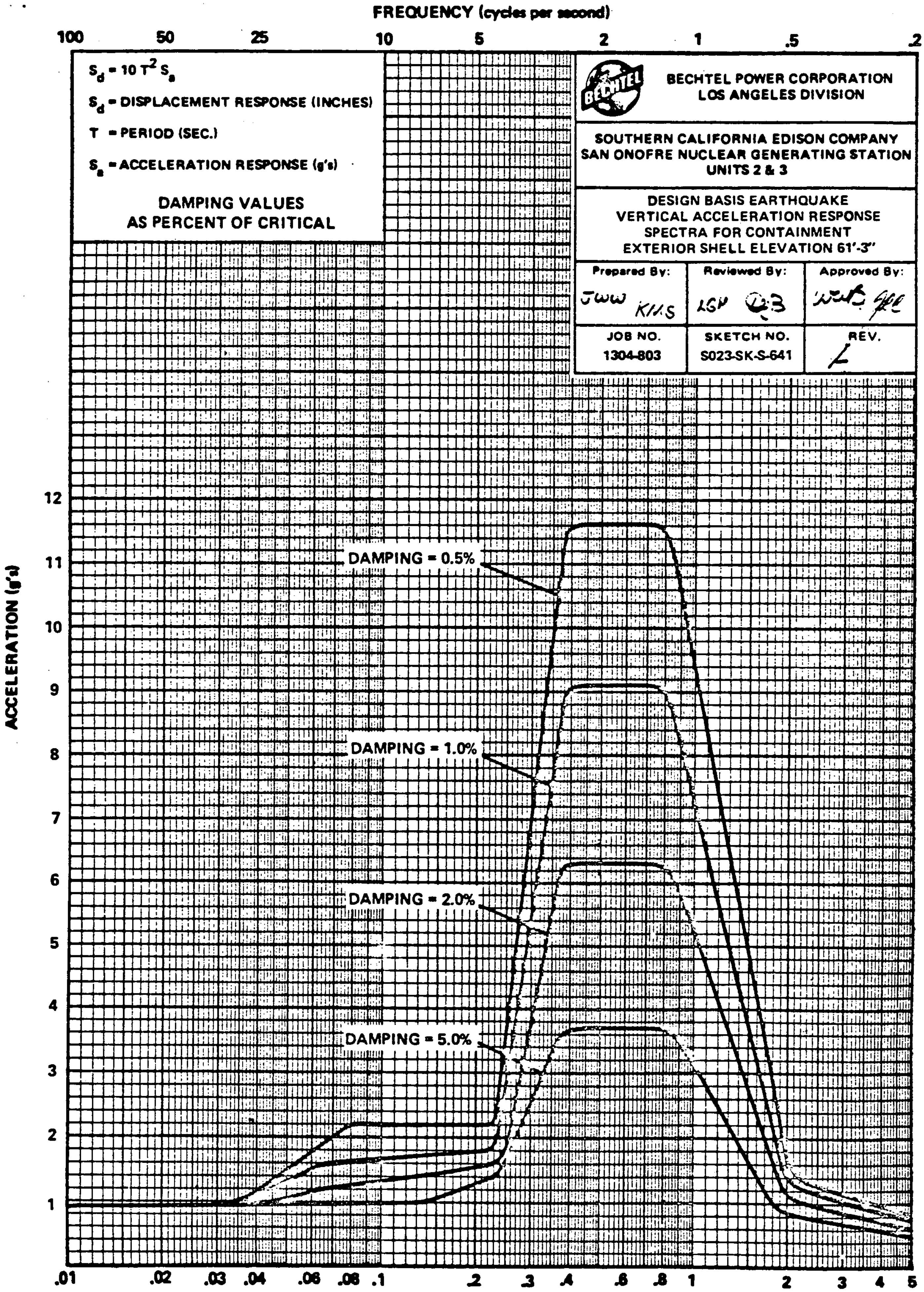
A.	Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.	Max. Deflection	Location	Effect Upon Functional Operability

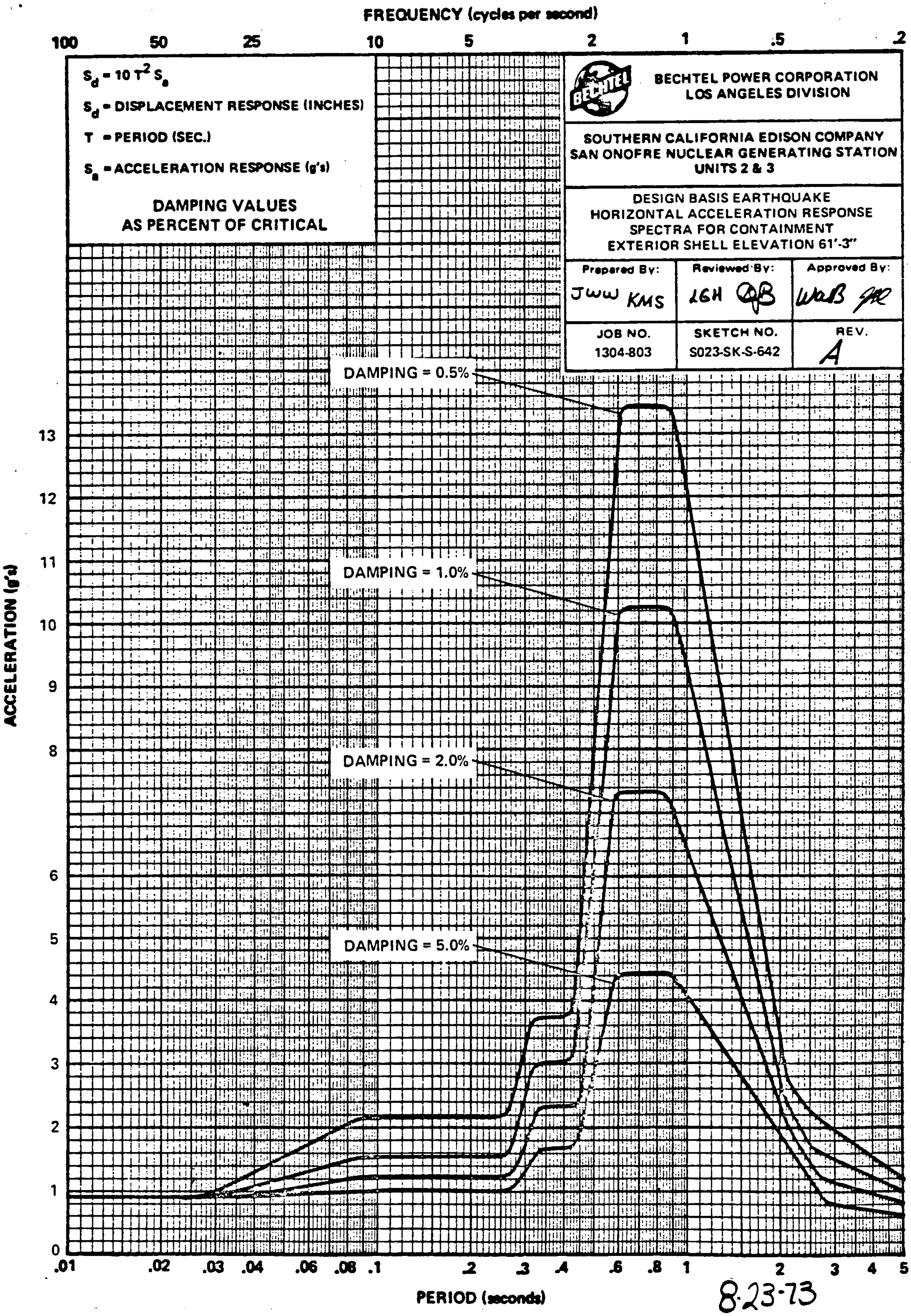
APPENDIX A

ATTACHMENT "A"

(2 PAGES)


FREQUENCY (cycles per second)
100 50 25 10 5 2 1 .5 .2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA FOR CONTAINMENT
EXTERIOR SHELL ELEVATION 61'-3"
Prepared By: JWW KMS
Reviewed By: LGP
Approved By:
JOB NO. 1304-803
SKETCH NO. S023-SK-S-641
REV. 1
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
12 11 10 9 8 7 6 5 4 3 2 1
.01 .02 .03 .04 .06 .08 .1 .2 .3 .4 .6 .8 1 2 3 4 5
PERIOD (seconds)

8-23-73

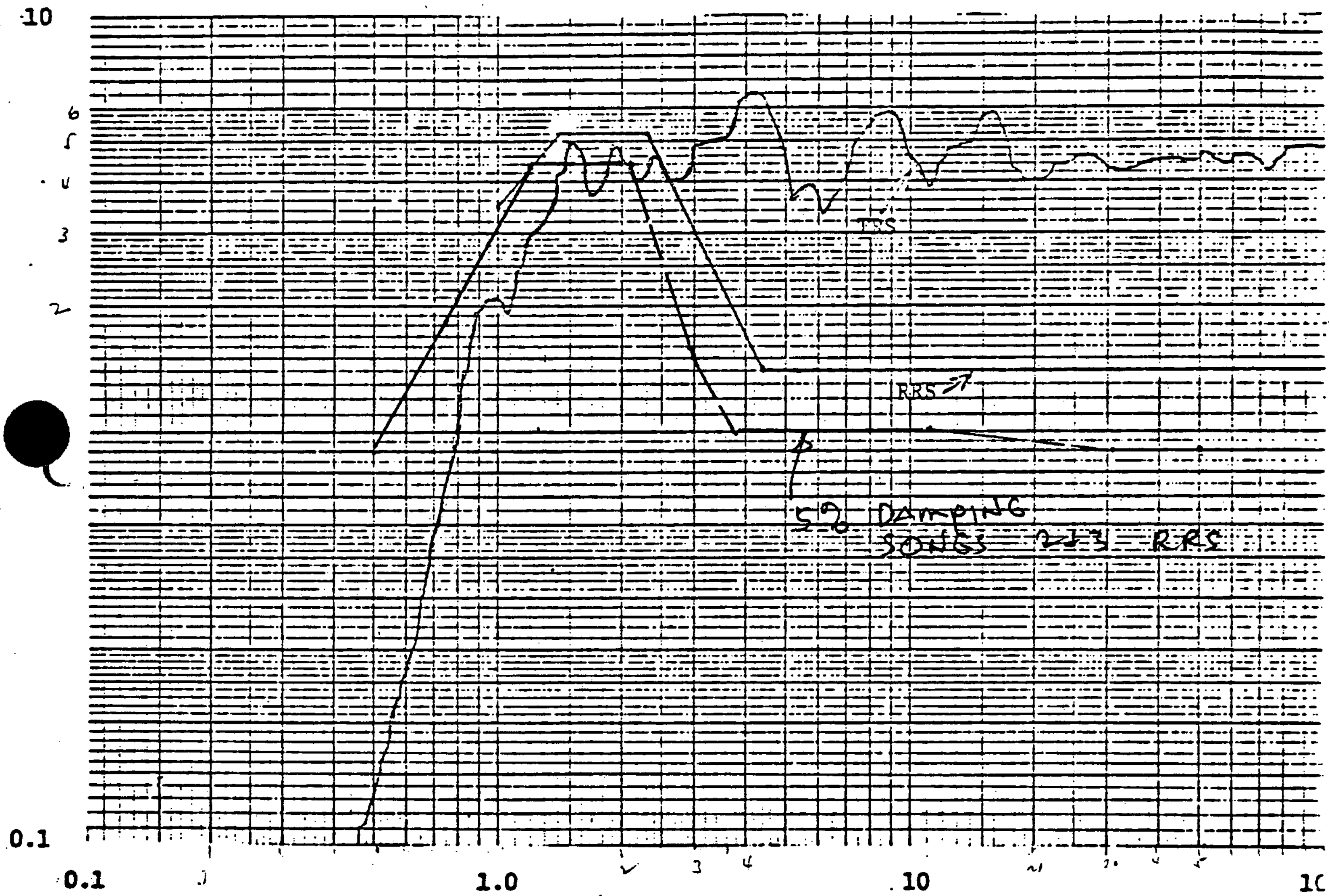

FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA FOR CONTAINMENT
EXTERIOR SHELL ELEVATION 61'-3"
Prepared By:
JWW KMS
Reviewed By:
LGH QB
Approved By:
WaB
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-642
REV.
A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
13
12
11
10
9
8
6
5
4
3
2
1
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

8-23-73

ATTACHMENT "B"

(2 PAGES)

ATTACHMENT "B"



Frequency, Hz

Figure 10-3. Horizontal Excitation at the Table, DBE, 5% Damping

507-5-264-0

2 OF 2

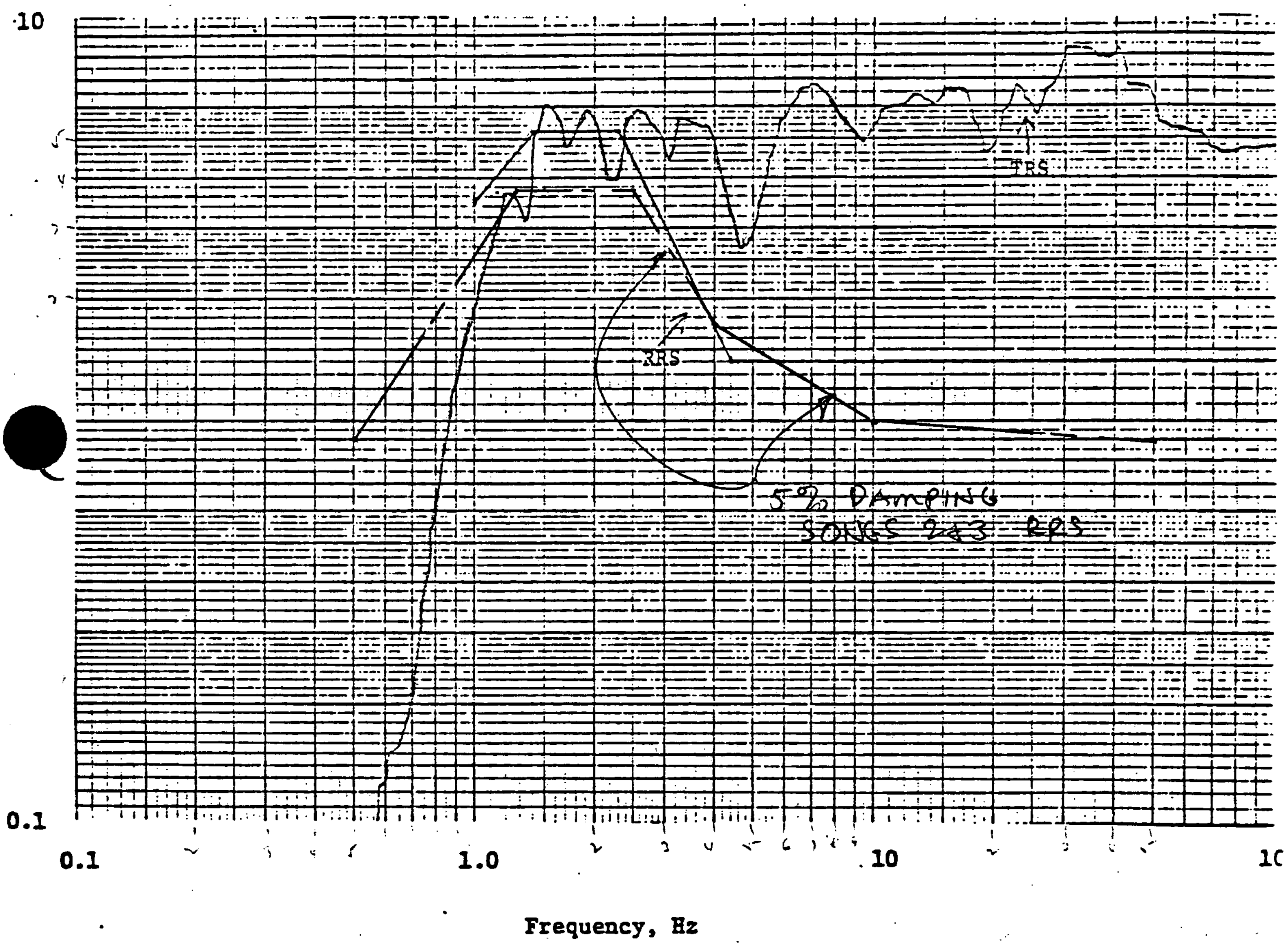


Figure 10-4. Vertical Excitation at the Table, DBE, 5% Damping

507-5-1-264-0

ATTACHMENT "C"

ATTACHMENT "C"

8.0 Results and Conclusions

Section 10.0 shows the TRS's and RRS's for horizontal and vertical OBE's and DBE's at 5% damping. Section 11.0 contains copies of the SwRI laboratory data logs describing in detail the test performance. The salient feature of these tests is that at no time was hydro leakage greater than 33 cc's per hour. This is less than the requirement of 40 cc's per hour as given in the WKM Seismic qualification Procedural Outline referenced in Section 3.0. It should be pointed out that the valve was open and closed during test for every test, and leakage measured after each test without reseating the valve. Air seat leakage tests before and after testing indicated the maximum air seat leakage was 125 cc's per minute. This is well below the 164 cc's per minute given in the Air Seat Leak Test Specification referenced in Section 3.0. The valve shaft displaced normally during each OBE and DBE without any indication of hesitation for interrupted displacement. Because the time to open or close the valve was approximately 20 seconds, it was not possible to cycle the valve completely during each test. To demonstrate that actuation was normal, the valve was cycled as much as possible during test, alternately starting from an open and closed position for each test. To assure that actuation would be unaffected by the SSE levels, regardless of whether the valve was opening or closing, two SSE's were run. In SSE No. 1 the valve was open. In SSE No. 2 the valve was closed during test. No cracks or signs of structural failure were observed during or after the tests. Monitoring for functionality indicated that the valve behaved normally before, during and after all the tests.

Section 10.0 contains the resonant frequency search data. Resonant frequency searches were performed at 1/2 octave per minute sweep rate in the range 1 - 100 Hz. The input level for all axes, except the X-axis was .2 g's. The X-axis input level was reduced .1 g at the resonance found at 19.5 Hz to prevent potential prequalification test stressing of the valve. The plots show the following resonances: for the Y-axis excitation, 26 Hz and 57 Hz; for X-axis excitation, 19.5 Hz; for Z-axis excitation, 80 and 97 Hz. All resonant searches were performed for the valve open and the valve closed positions. The results showed no substantial change and resonant frequencies were obtained as a result of valve position.

Section 10.0 contains the Test Response Spectrum plots obtained for the OBE's and DBE's in both vertical and horizontal directions at the base of the motor operator. These TRS's may be used for a device qualification test in the future, in the event the motor operator is replaced.

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR ____

II. Component Name: 2HV-9300 Control Valve

1. Scope: [ ] NSSS [X] BOP
2. Model Number: N9126-EMO-SP — Quantity: Four (4)
3. Vendor: Walworth Co., Aloyco
4. If the component is a cabinet or panel, name and model No. of the devices included: N/A
5. Physical Description a. Appearance 24", Gate Valve, Motor Operated
   b. Dimensions 91"H x 39"W
   c. Weight 2860 lbs.
6. Location: Building: Refueling Water Bldg. in Auxiliary Bldg.
   Elevation: 32'-0"
7. Field Mounting Conditions [ ] Bolt (No.____, Size____)
   [X] Weld (Length Continuous)
   [ ] ________
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
   S/S: 13Hz F/B: 17Hz; 29Hz V: >33Hz
9. a. Functional Description: Refueling Water Tank Outlet.
   b. Is the equipment required for [ ] Hot Standby [X] Cold Shutdown
   [ ] Both ________
10. Pertinent Reference Design Specifications: SO23-507-5

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

IV. Equipment Qualification Method: Test: X

Analysis: ____

Combination of Test and Analysis: ____

Test and/or Analysis by Wyle Labs. Report # 44242-1
Walworth Report #223
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [ ] Seismic only 2. [ ] Hydrodynamic only

   3. [ ] Explosive only 4. [ ] Other (Specify) ____

   5. [X] Combination of Seismic & Internal Pressure

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

2. Required Response Spectra (attach the graphs): See Appendix "A"

3. Required Acceleration in Each Direction:

   S/S = 1.0 F/B = 1.0 V = 0.75

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 Five(5) SSE One(1) for each Horiz. direction Other - (specify)

4. Frequency Range: 1-40Hz

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs) [X] No

   TRS exceeds RRS above 2.5 Hz and at natural frequencies.

   See Appendix "B"

6. Input g-level Test at S/S = 3g F/B = 3g V = 3g

7. Laboratory Mounting: ______

   1. [ ] Bolt (No.___, Size___) [X] Weld (Length___) [X] Bookends bolted to shake table

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

9. Test Results including modifications made: The specimen tested demonstrated sufficient - integrity to withstand, without compromise to structure or function, the prescribed seismic environment.

10. Other tests performed (such as fragility test, including results):

    Seat leak test.

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

1. Description of Test including Results: Not Applicable

2. Method of Analysis: ______

   [ ] Static Analysis
   [ ] Dynamic Analysis
   [ ] Equivalent Static Analysis
   [ ] Time-History
   [ ] Response Spectrum

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: ______ Basis for the damping used: ______

7. Support Considerations in the model: ______

8. Critical Structural Elements: ______________________________

A.

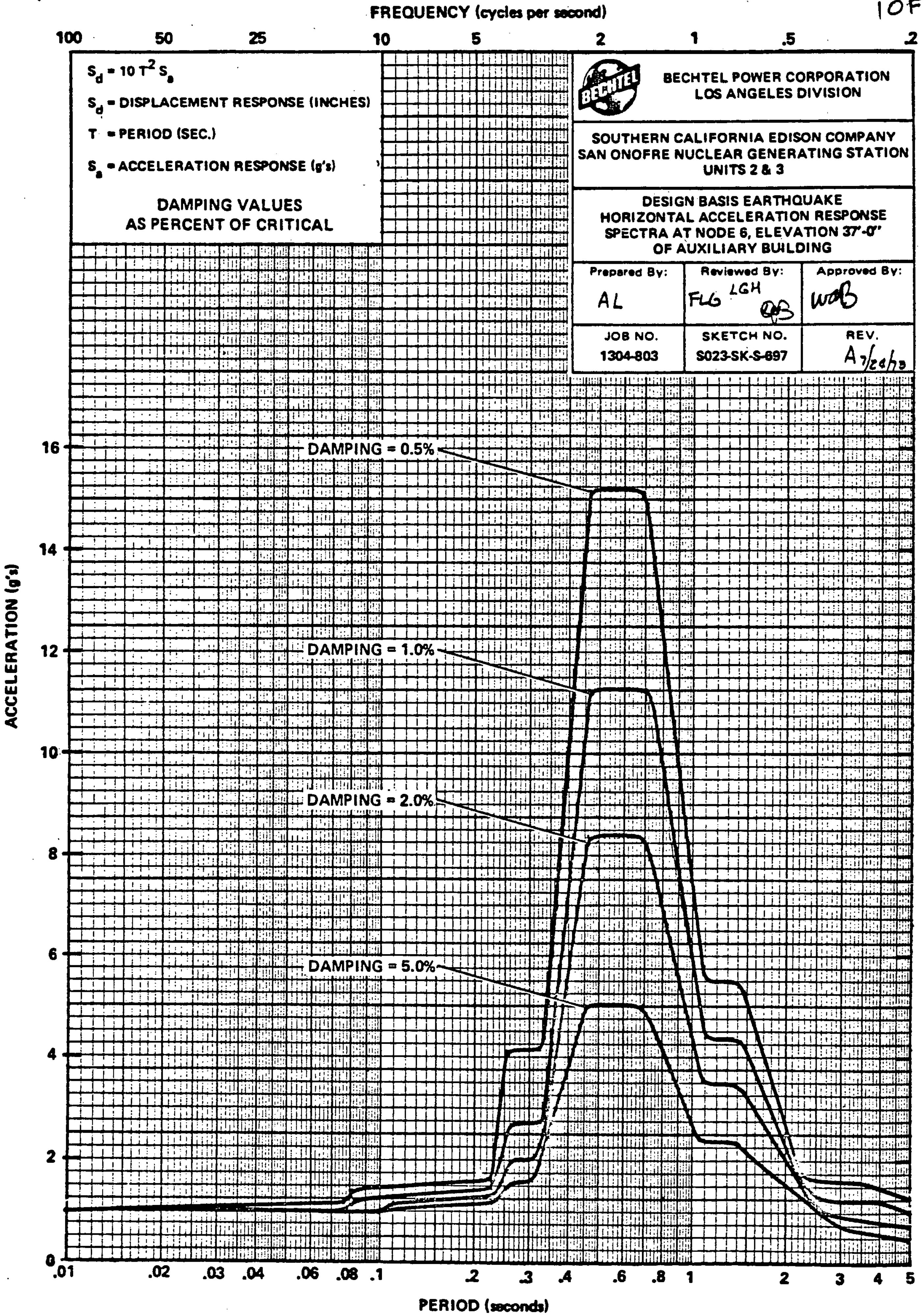
Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

B.

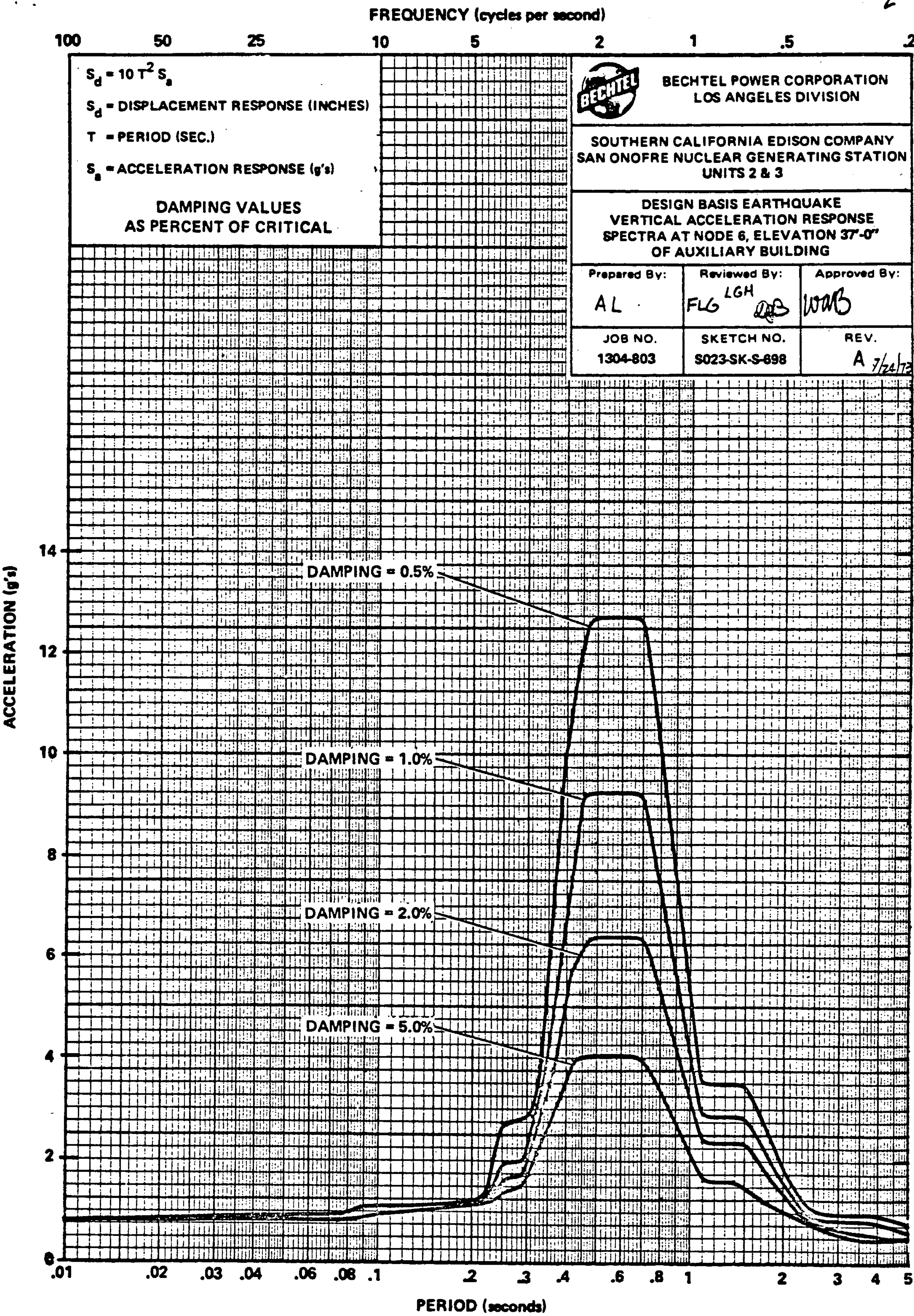
Max. Deflection	Location	Effect Upon Functional Operability

ATTACHMENT "A"

ATTACHMENT "A"



ATTACHMENT "A"



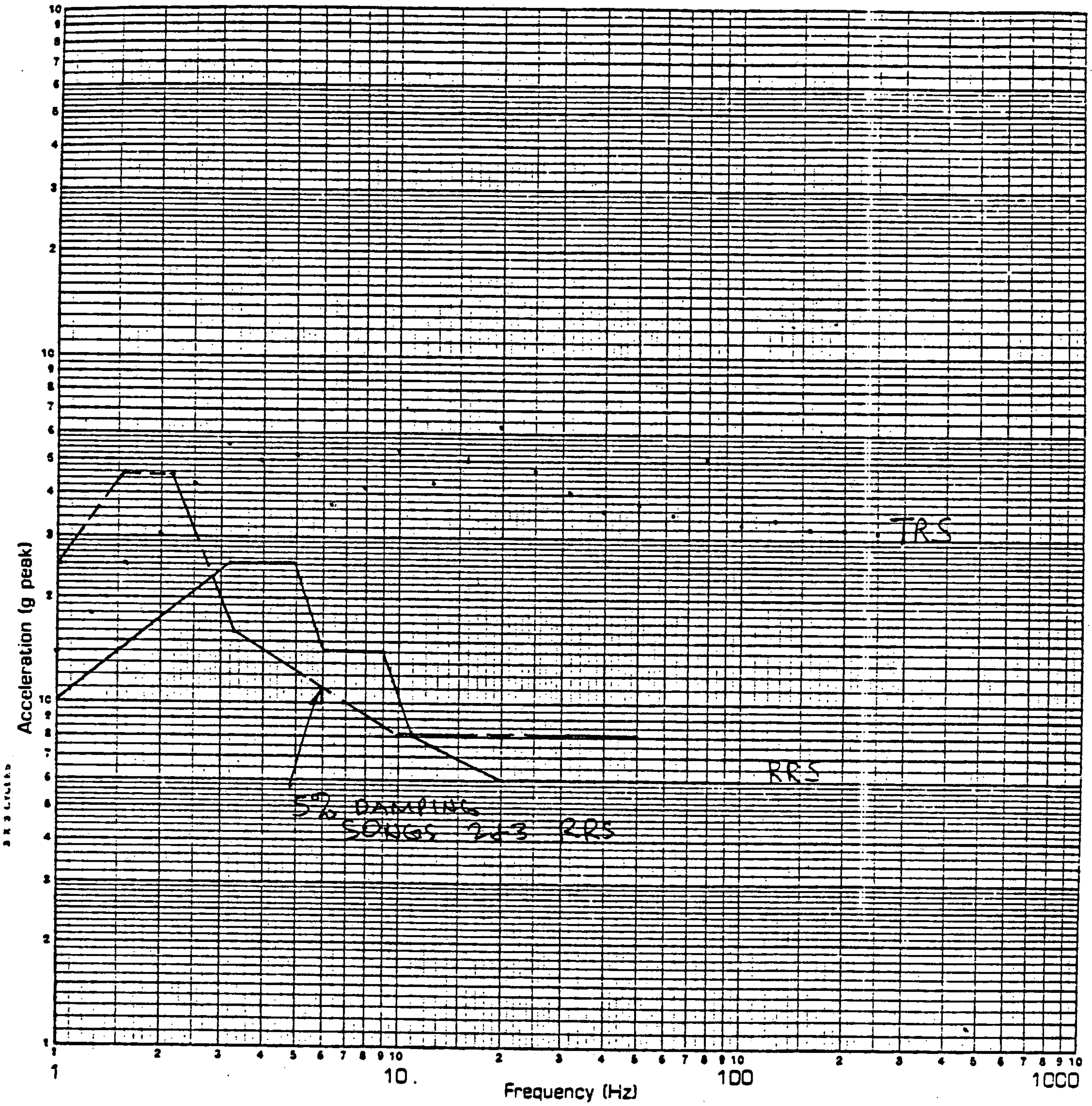
ATTACHMENT "B"

FULL SCALE SHOCK SPECTRUM (g Peak)

ATTACHMENT "B"

1.0 ☐ 10 ☐ 100 ☒ 1000☐

DAMPING $\boxed{5\%}$



SPECIMEN __________

LOCATION NO. HCA

AXIS LONG/VERT

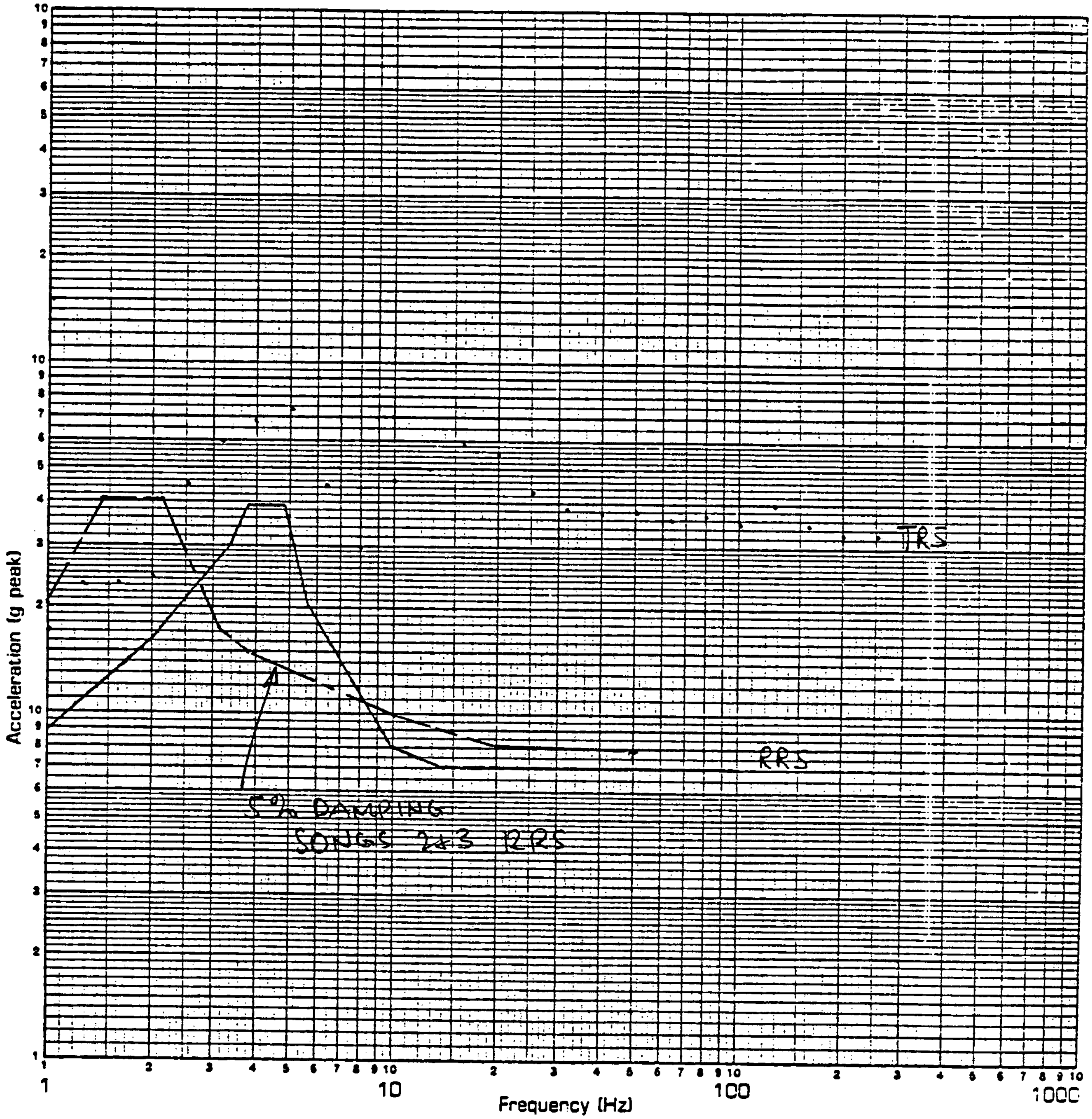
TEST RUN NO. 12

507-5-2-123-0

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING $\boxed{5\%}$



SPECIMEN ______

AXIS LONG/VERT

LOCATION NO. VCA

TEST RUN NO. 12

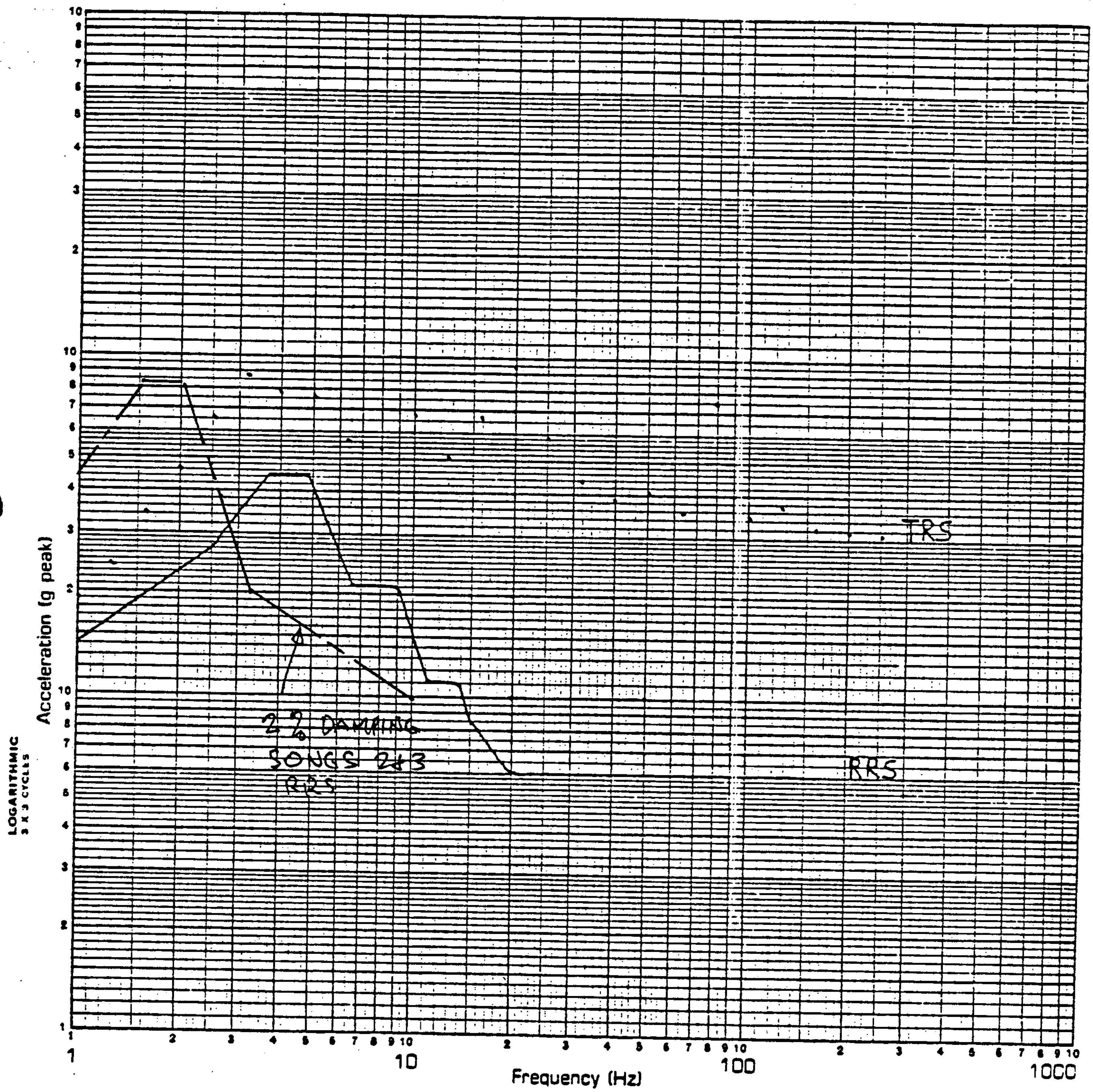
507-5-2-123-0

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000☐

DAMPING 2 %

3 OF 4



SPECIMEN ____________

AXIS LONG/VERT

LOCATION NO. HCA

TEST RUN NO. 12

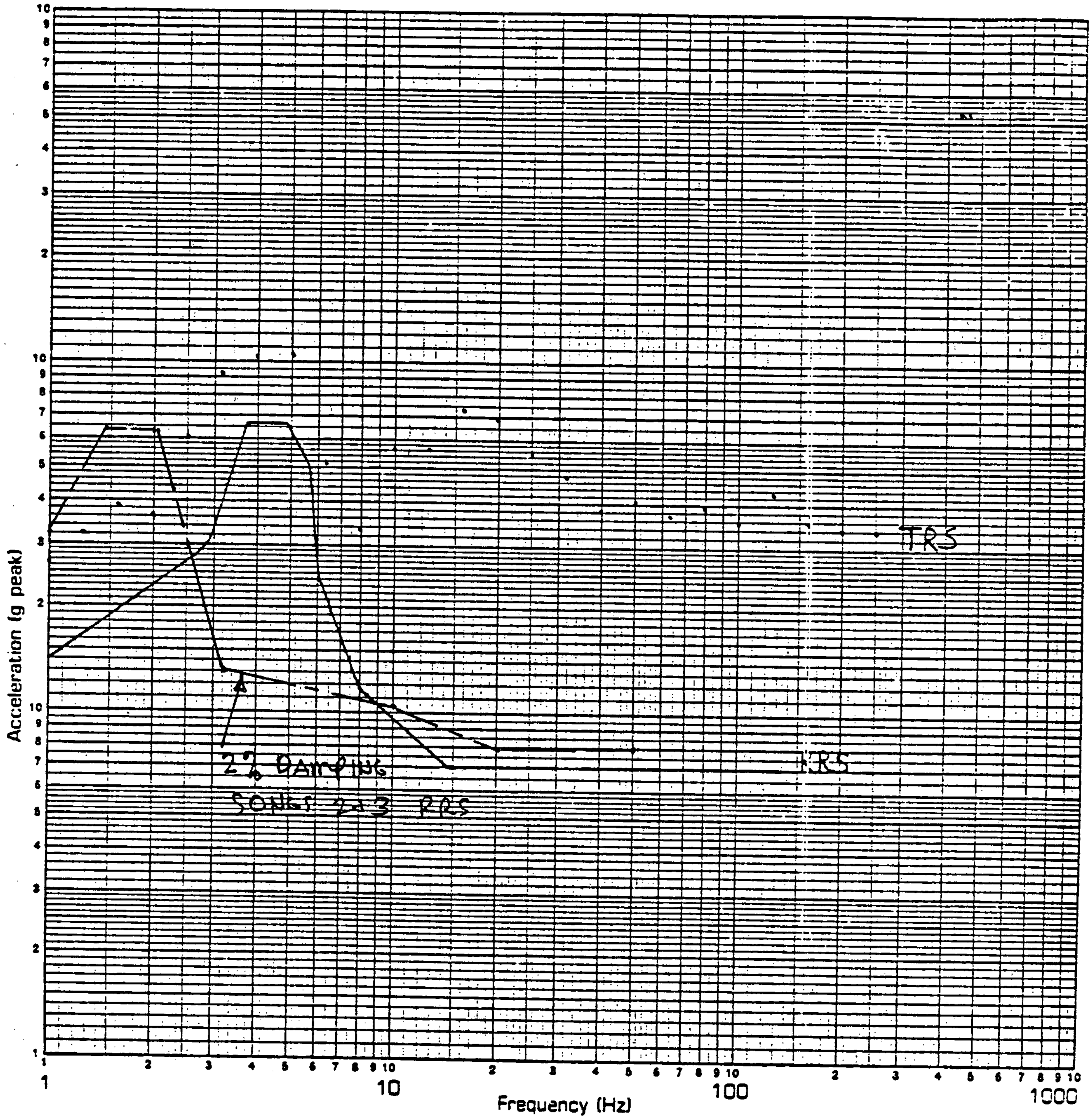
507-5-2-123-0

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 2%

4 OF 4



SPECIMEN ____________

AXIS LONG/VERT

LOCATION NO. VCA

TEST RUN NO. 12

507-52-1220

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 Type:

1. Utility: Southern California Edison Company PWR X

2. NSSS: CE 3. A/E: Bechtel BWR ____

II. Component Name: 2HV-4714 Control Valve

1. Scope: [ ] NSSS [X] BOP

2. Model Number: 7-4058-EP-SS-120 Quantity: Four (4)

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 6" size, Motor Operated Valve

b. Dimensions 65.12"H x 42.5"W

c. Weight 1500 lbs. (Operator & Body)

6. Location: Building: Aux Feedwater Tunnel

Elevation: 17'-10"

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

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

S/S: >52Hz F/B: >52Hz V: >52Hz

9. a. Functional Description: Aux. Feedwater to Steam Gen. E088 Isolation Valve.

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

[X] Both

10. Pertinent Reference Design Specifications: S023-503-7-1

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

IV. Equipment Qualification Method: Test: ______

Analysis: ______

Combination of Test and Analysis: X

Test and/or Analysis by Fisher Report #FQP-2A-8
Wyle Lab. Report #58271-2
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [ ] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [X] Combination of Seismic Load & Operating Load

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS [ ] N/A
(other, specify)

2. Required Response Spectra (attach the graphs): See Appendix "B"

3. Required Acceleration in Each Direction:

S/S = 0.8 F/B = 0.8 V = 0.9

VI. If Qualification by Test, then Complete: (Actuator Operability)

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

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

3. No. of Qualification Tests: OBE 0 SSE 18 Other ______
(specify)

4. Frequency Range: 1-60Hz

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[X] No

TRS exceeds RRS above 2.7 Hz. See Appendix "A"

6. Input g-level Test at S/S = 2.9 F/B = 2.9 V = 2.4

7. Laboratory Mounting: (Valve welded to flange; flange bolted to table through bookends.)

   1. [ ] Bolt (No.___, Size___) [ ] Weld (Length___) [X] Rigidly attached to test table

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

9. Test Results including modifications made: The seismic qualification documentation presented for this valve group meets the intent and requirements of the specification for its application.

10. Other tests performed (such as fragility test, including results):

    Aging, Radiation and Accident Condition (Wyle Labs. Report #58271-2.)

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

1. Description of Test including Results: Seismic analysis calculates a lowest resonant frequency of 52Hz for this valve group, thus qualifying the group as rigid/active. Max. load is 5g in all three directions. This valve group is found to be capable of maintaining its structural integrity when subjected to static load in excess of 5g in three directions Bi-axially.

2. Method of Analysis:

   [X] Static Analysis
   [ ] Dynamic Analysis
   [ ] Equivalent Static Analysis
   [ ] Time-History
   [ ] Response Spectrum

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

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

4. [X] Computer Codes: Fisher Seismic 3

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

   [X] Hand Calculations

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

6. Damping: N/A Basis for the damping used: ________

7. Support Considerations in the model: Special machining on yoke. Yoke's are "Seismic Steel"

8. Critical Structural Elements: ______

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Act. Yoke	Leg Stress	Static Seismic and Operational	*	8,518.3	26,250.0
Bolts	Actuator to Bonnet	Static Seismic and Operational		28,002	60,000

*Included in total stress

B.

Max. Deflection	Location	Effect Upon Functional Operability
0.017	Node 1	None

APPENDIX "A"

(4 PAGES)

APPENDIX "A"

WYLE LABORATORIES

Report No. 58271-2

CUSTOMER FISHER CONTROLS Job No. 58271 Page No. 153

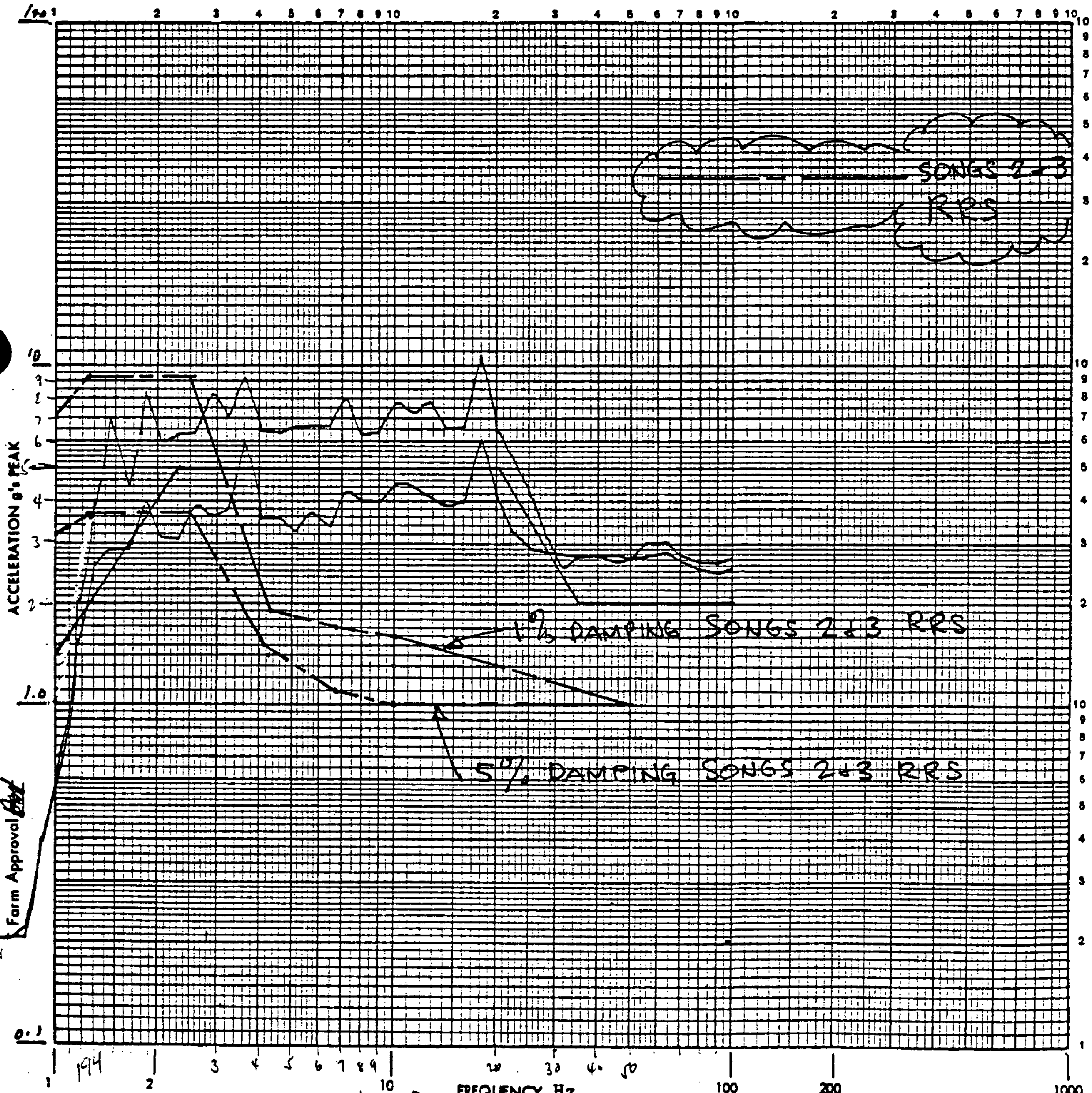
Full Scale 100 g Accel. No. 2 Control (✓) Response ( )

Operator MEEHAN Specimen 0008

Date 6-20-78 Damping 1 % / 5 % Axis of Test Y-Z VERT

9TNSSE

RESPONSE SPECTRUM



503-7-1-924-0

WYLE LABORATORIES

Report No. 58271-2

CUSTOMER FISHER CONTROLS Job No. 58271 Page No. 175

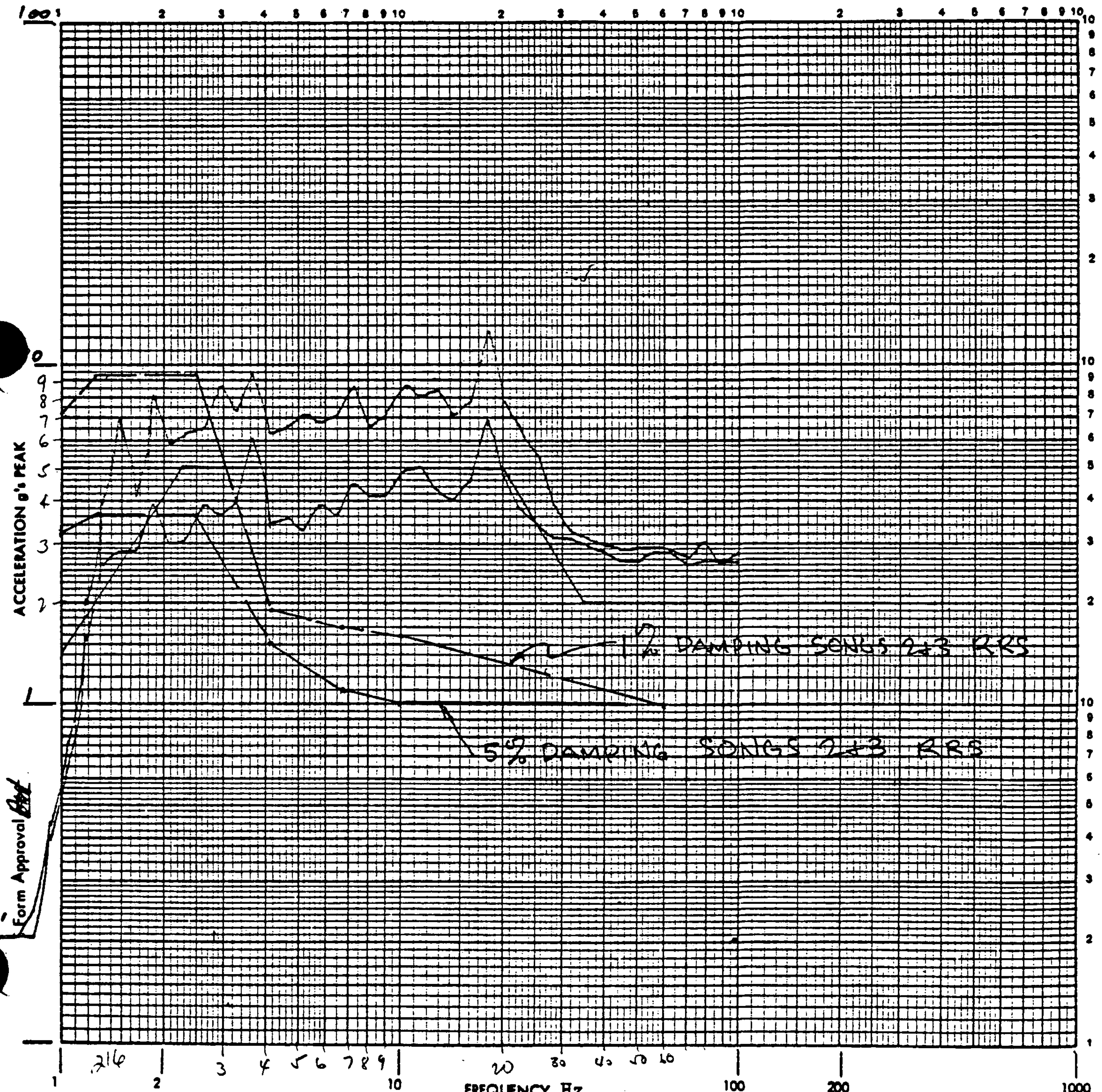
Full Scale 100 g Accel. No. 2 Control (✓) Response ( )

Operator MEEHAN Specimen 008

Date 6-21-78 Damping 1 % 5 % Axis of Test Y-Z VERT

18TH SSE

RESPONSE SPECTRUM



503-7-1-924-0

WYLE LABORATORIES

Report No. 58271-2

CUSTOMER FISHER CONTROLS Job No. 58271 Page No. 152

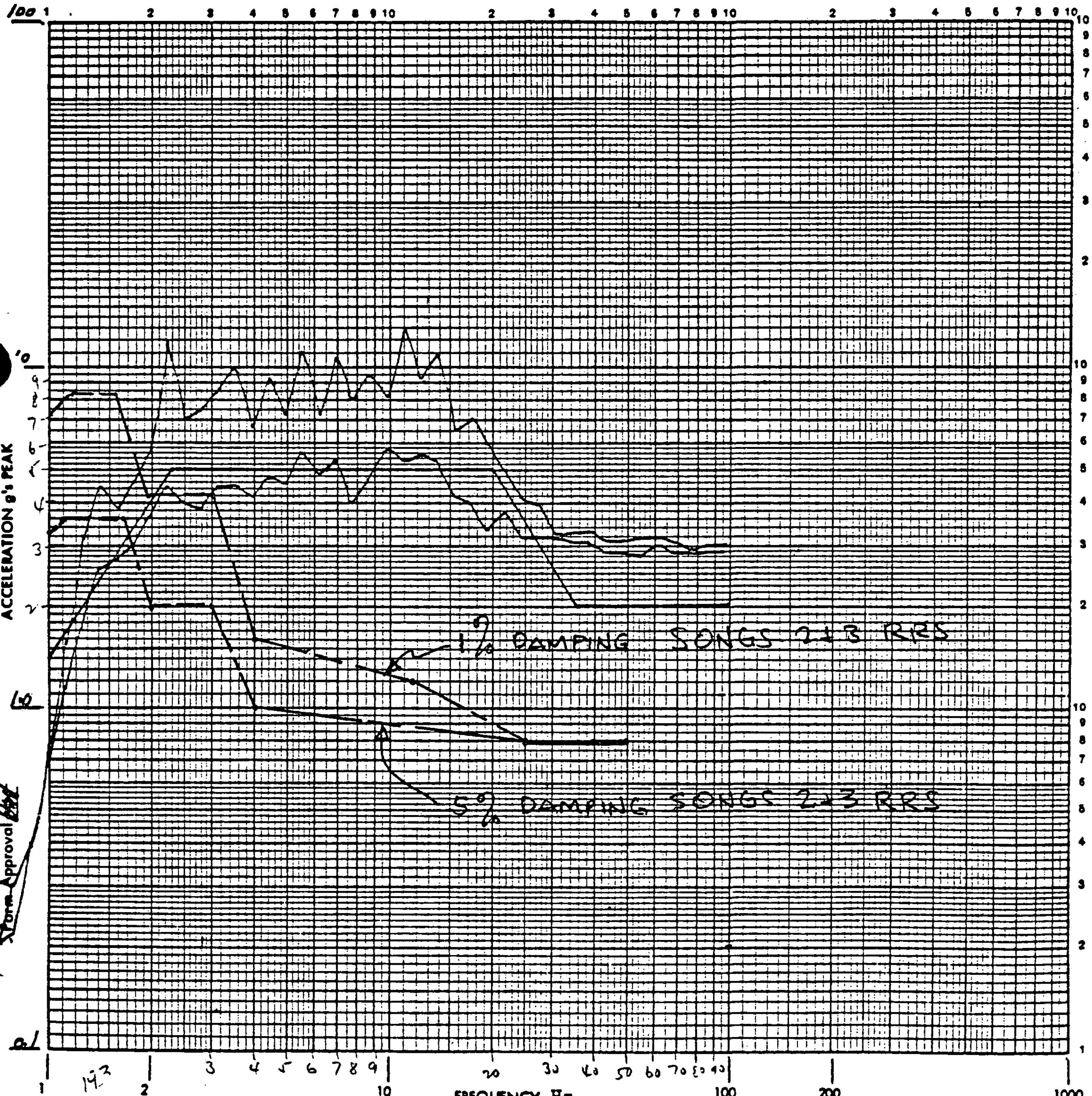
Full Scale 100 g Accel. No. 1 Control (✓) Response ( )

Operator MEEHAN Specimen 0008

Date 6-20-78 Damping 1 % 5 % Axis of Test X-Z Horiz

97N SSG

RESPONSE SPECTRUM



503-7-1-924-0

WYLE LABORATORIES

Report No. 58271-2

CUSTOMER FISHER CONTROLS Job No. 58271 Page No. 174

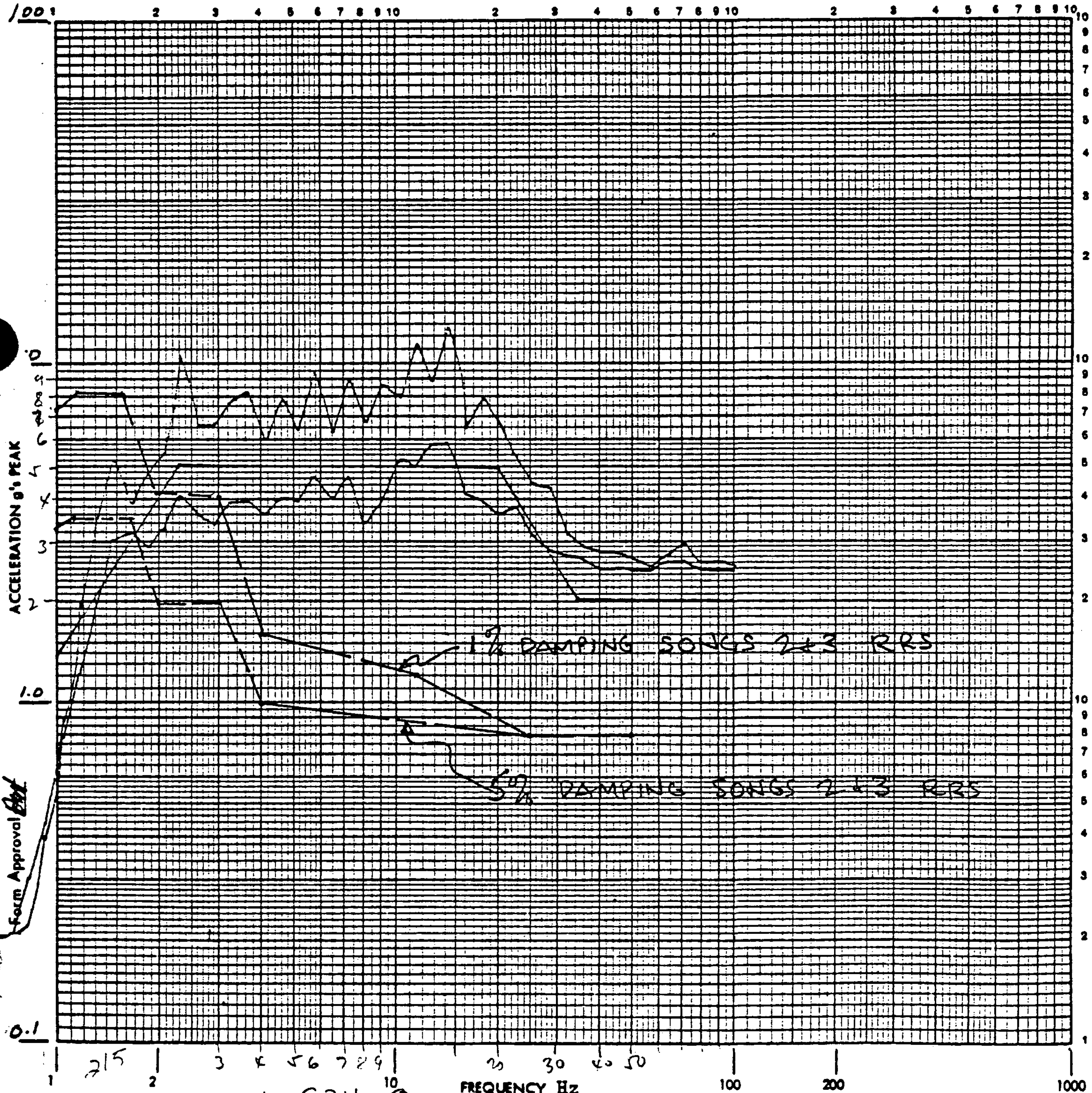
Full Scale 100 g Accel. No. 1 Control (✓) Response ( )

Operator MEEHAN Specimen 0008

Date 6-21-78 Damping 1 % / 5 % Axis of Test Y-Z HORZ

18TH SSE

RESPONSE SPECTRUM

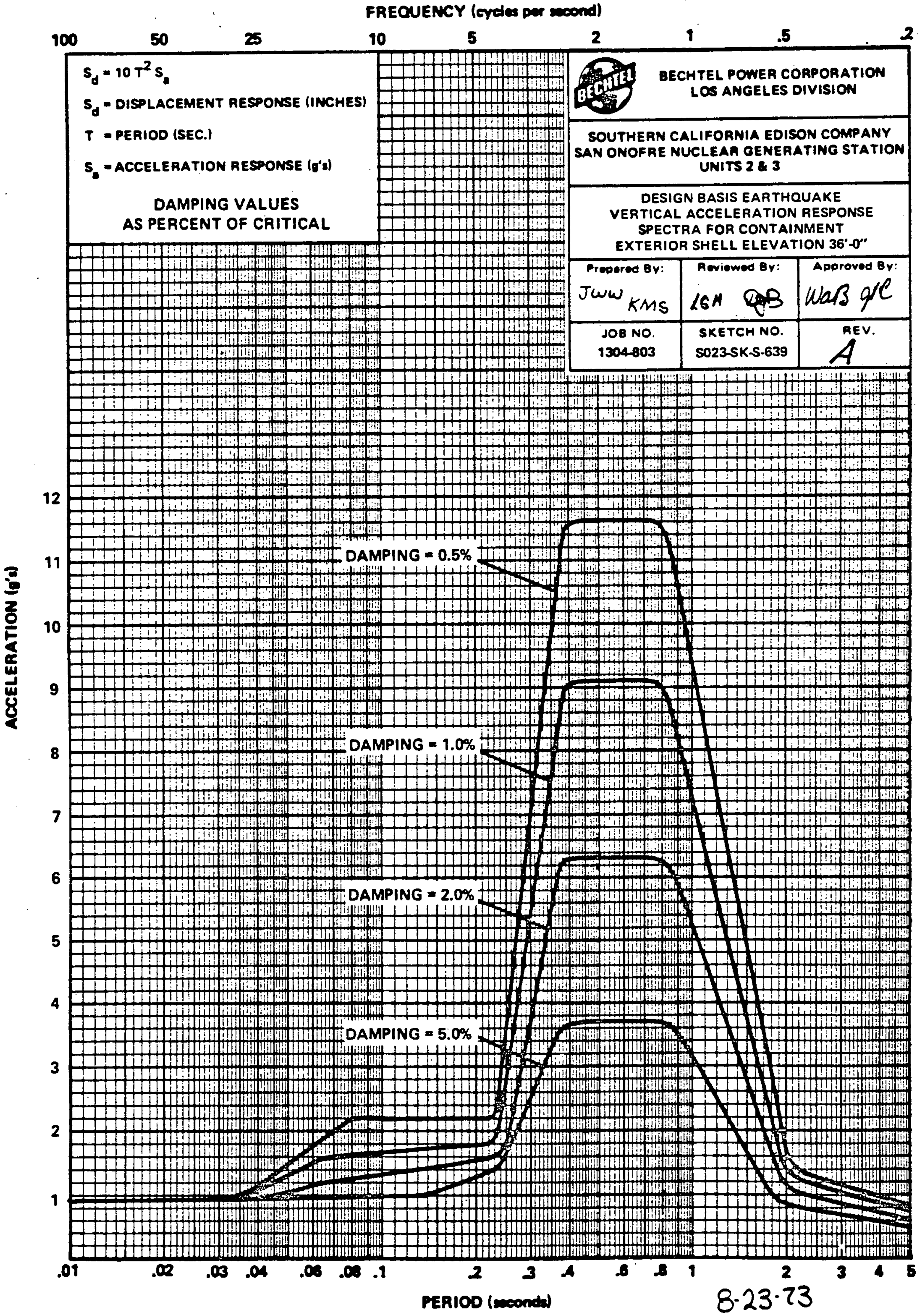


503-7-1-924-0

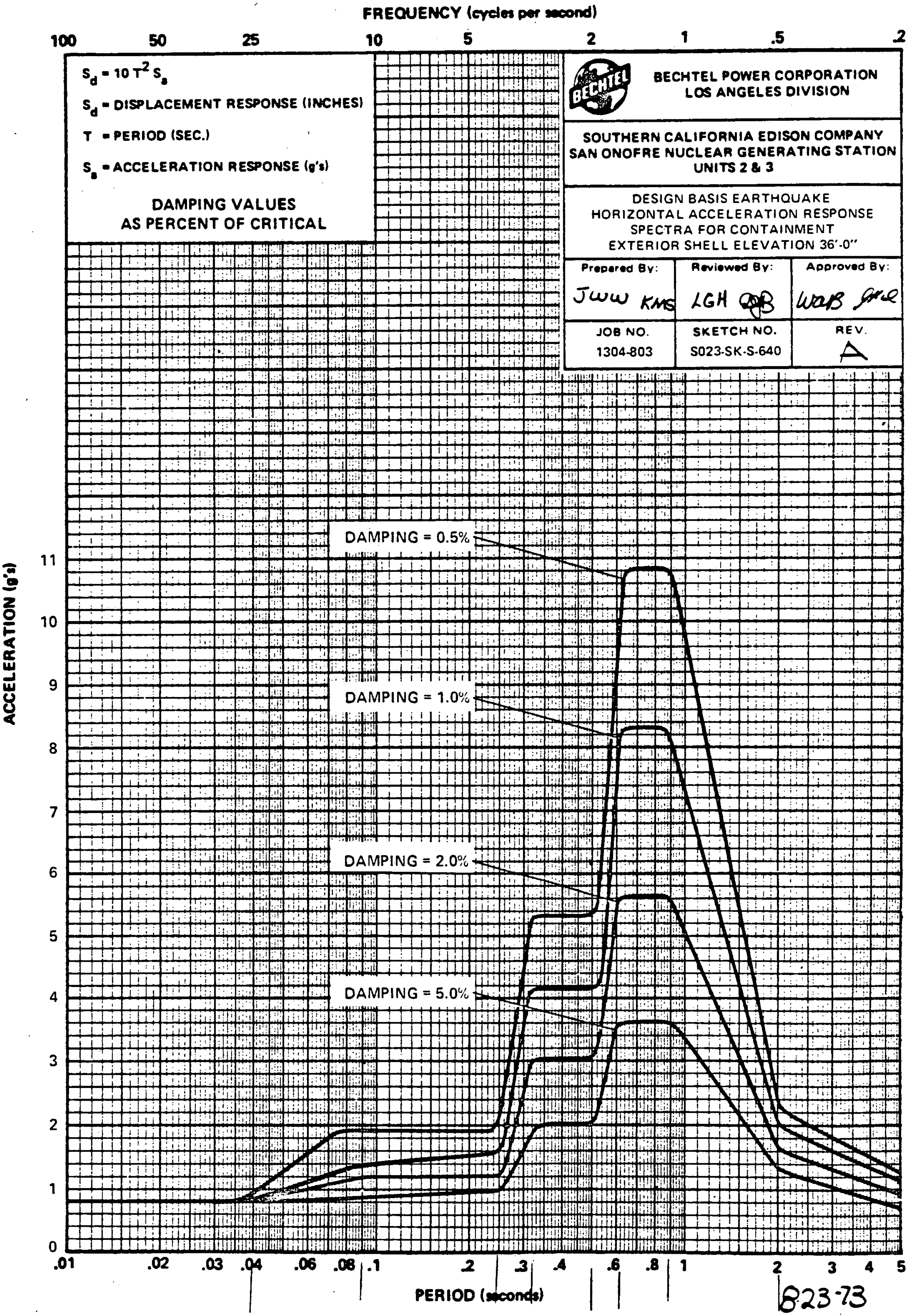
APPENDIX "B"

(2 PAGES)

APPENDIX "B"



FREQUENCY (cycles per second)
100 50 25 10 5 2 1 .5 .2
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA FOR CONTAINMENT
EXTERIOR SHELL ELEVATION 36'-0"
Prepared By: JWW KMS
Reviewed By: LGH
Approved By:
JOB NO. 1304-803
SKETCH NO. S023-SK-S-639
REV. A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
12 11 10 9 8 7 6 5 4 3 2 1
.01 .02 .03 .04 .06 .08 .1 .2 .3 .4 .6 .8 1 2 3 4 5
PERIOD (seconds)
8-23-73


FREQUENCY (cycles per second)
100 50 25 10 5 2 1 .5 .2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA FOR CONTAINMENT
EXTERIOR SHELL ELEVATION 36'-0"
Prepared By: JWW KMS
Reviewed By: LGH
Approved By: WAB
JOB NO. 1304-803
SKETCH NO. S023-SK-S-640
REV. A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
0 1 2 3 4 5 6 7 8 9 10 11
.01 .02 .03 .04 .06 .08 .1 .2 .3 .4 .6 .8 1 2 3 4 5
PERIOD (seconds)

823-73

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR ____

II. Component Name: 2HV-6200 Control Valve

1. Scope: [ ] NSSS [X] BOP
2. Model Number: 7640 w/486-U-1-16-80 Actuator Quantity: Eight (8)
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 30" Butterfly w/pneumatic operator
   - b. Dimensions 60.31"H x 81.67"W
   - c. Weight 1641 lbs. (Total Valve Assembly)
6. Location: Building: Intake Structure Area
   Elevation: 10'-0"
7. Field Mounting Conditions [X] Bolt (No. 4 , Size 1-1/4")
   [ ] Weld (Length ____)
   [ ] ____
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
   S/S: ____ F/B: *45.3Hz V: ____
9. a. Functional Description: Saltwater Cooling Pump P-112, Discharge Control Valve
   b. Is the equipment required for [ ] Hot Standby [X] Cold Shutdown
   [ ] Both ____
10. Pertinent Reference Design Specifications: S023-507-2-1

*Lowest frequency determined by analysis.

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

IV. Equipment Qualification Method: Test: ______

Analysis: X (Static)

Combination of Test and Analysis: ______

Test and/or Analysis by Fisher Report #s CD-75-156; -161
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [ ] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [X] Combination of Seismic and Operational

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

2. Required Response Spectra (attach the graphs): Not Applicable

3. Required Acceleration in Each Direction: (Req'd by specification)

S/S = 5g F/B = 5g V = 5g

VI. If Qualification by Test, then Complete:

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. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[ ] No

______

6. Input g-level Test at S/S = ______ F/B = ______ V = ______

7. Laboratory Mounting: ________________________________

1. [ ] Bolt (No.___, Size___) [ ] Weld (Length ____) [ ] __________

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

9. Test Results including modifications made: ____________________

10. Other tests performed (such as fragility test, including results):

____

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

1. Description of Test including Results: NOTE: Resonant test was conducted and resonant frequency measured at 40.5Hz to qualification reports for equipment supplied by subvendors: (1) Sol. Valve Asco report #AQS-21678, (2) Limit Switch Namco report #EA-180

2. Method of Analysis: ____________________

[X] Static Analysis
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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

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

4. [X] Computer Codes: Fisher Seismic 4

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

[ ] Hand Calculations

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

6. Damping: N/A Basis for the damping used: __________

7. Support Considerations in the model: Valve assumed horizontally mtd. on pipe with valve shaft mounted horizontal to simulate actual field mounting

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Steel	Elem. #20		-	13.2 ksi	27 ksi
Steel	Elem. #46		-	16.1 ksi	27 ksi
Bolts	Joint 4, Location B		-	31.9 ksi	94.5 ksi

B.

Max. Deflection	Location	Effect Upon Functional Operability
0.033"	Node 33	None

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 Type:

1. Utility: Southern California Edison Company PWR X

2. NSSS: CE 3. A/E: Bechtel BWR

II. Component Name: 2PSV-8401 Relief Valve*

1. Scope: [ ] NSSS [X] BOP

2. Model Number: 6R10 HA-75-FN Quantity: 36

3. Vendor: Crosby Valve & Gage 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 6"x10" Size (See App. "A"

b. Dimensions 61.75" H x 34"W

c. Weight 1550 lbs.

6. Location: Building: Main Steam Isolation Valve Area

Elevation: 42'-0"

7. Field Mounting Conditions [X] Bolt (No. 12, Size 1-3/8) INLET
(No. 16, Size 1") OUTLET
[ ] Weld (Length ____)
[ ] ____________

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

S/S: 34 Hz. F/B: 36 Hz V: >35 Hz.

9. a. Functional Description: Safety Valve For Main Steam Service

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

[ ] Both ____________

10. Pertinent Reference Design Specifications: S023-507-3

* Vent Stacks are not installed.

III. Is Equipment Available for Inspection in the Plant: [X] Yes [ ] No
Vent Stack Not Installed

IV. Equipment Qualification Method: Test: ______

Analysis: ______

Combination of Test and Analysis: X

Test and/or Analysis by Crosby Report #5 3718, 3719
Crosby Report #5 EC-276 & EC-187
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [ ] Combination of ______

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

2. Required Response Spectra (attach the graphs): See Appendix "B"

3. Required Acceleration in Each Direction:

S/S = 5g F/B = 5g V = 5g

VI. If Qualification by Test, then Complete:

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

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

3. No. of Qualification Tests: OBE ______ SSE ______ Other * 3 Test Cycles (specify)

4. Frequency Range: 28, 32 & 35 Hz.

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs) [ ] No N/A

6. Input g-level Test at S/S = 5g F/B = 5g V = 5g

* A Test Cycle is opening, reseating and pop lifting.

7. Laboratory Mounting: On Test Apparatus (See Appendix "A")

   1. [X] Bolt (No. 12, Size 1-3/8") [ ] Weld(Length ____) [ ] ____________
      (No. 16, Size 1") [ ] Weld (Length ____) [ ] ____________

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

9. Test Results including modifications made: The Ability of the subject Valve to operate before, during and after a simulated seismic disturbance has been demonstrated properly without irregularities in its performance and damage to its parts.

10. Other tests performed (such as fragility test, including results):

    Operability Test

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

1. Description of Test including Results: With the Simulated Seismic Load applied, the valve was cycled 3 times following the test procedure. There was no evidence of unacceptable valve operation, instability or inconsistency in valve performance observed.

2. Method of Analysis:

   [ ] Static Analysis [X] Equivalent Static Analysis

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

3. Model Type: [ ] 3D [ ] 2D [X] 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: N/A Basis for the damping used: N/A

7. Support Considerations in the model: Fixed

8. Critical Structural Elements:

A.

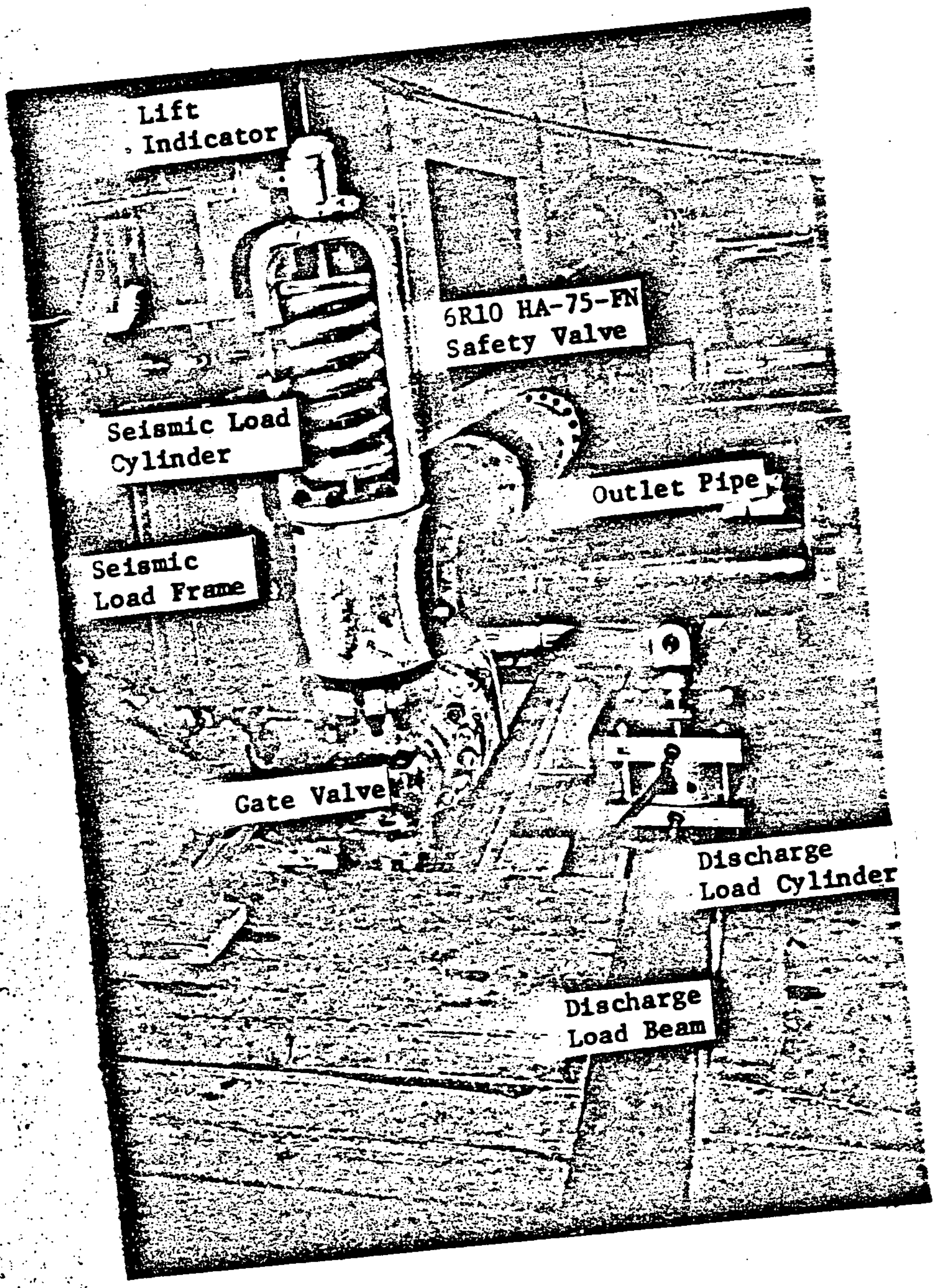
Identification	Location	Governing Load or Response Combination	Seismic Stress	PSI Total Stress	PSI Stress Allowable
Body	-	Operating & Seismic	-	8,302	17,500
Inlet Stud	-	Hydrostatic & Operating & Seismic	-	20,681	25,000
Bonnet Arm	-	Operating & Seismic	-	8,609	17,500

B.

Max. Deflection	Location	Effect Upon Functional Operability
N/A		

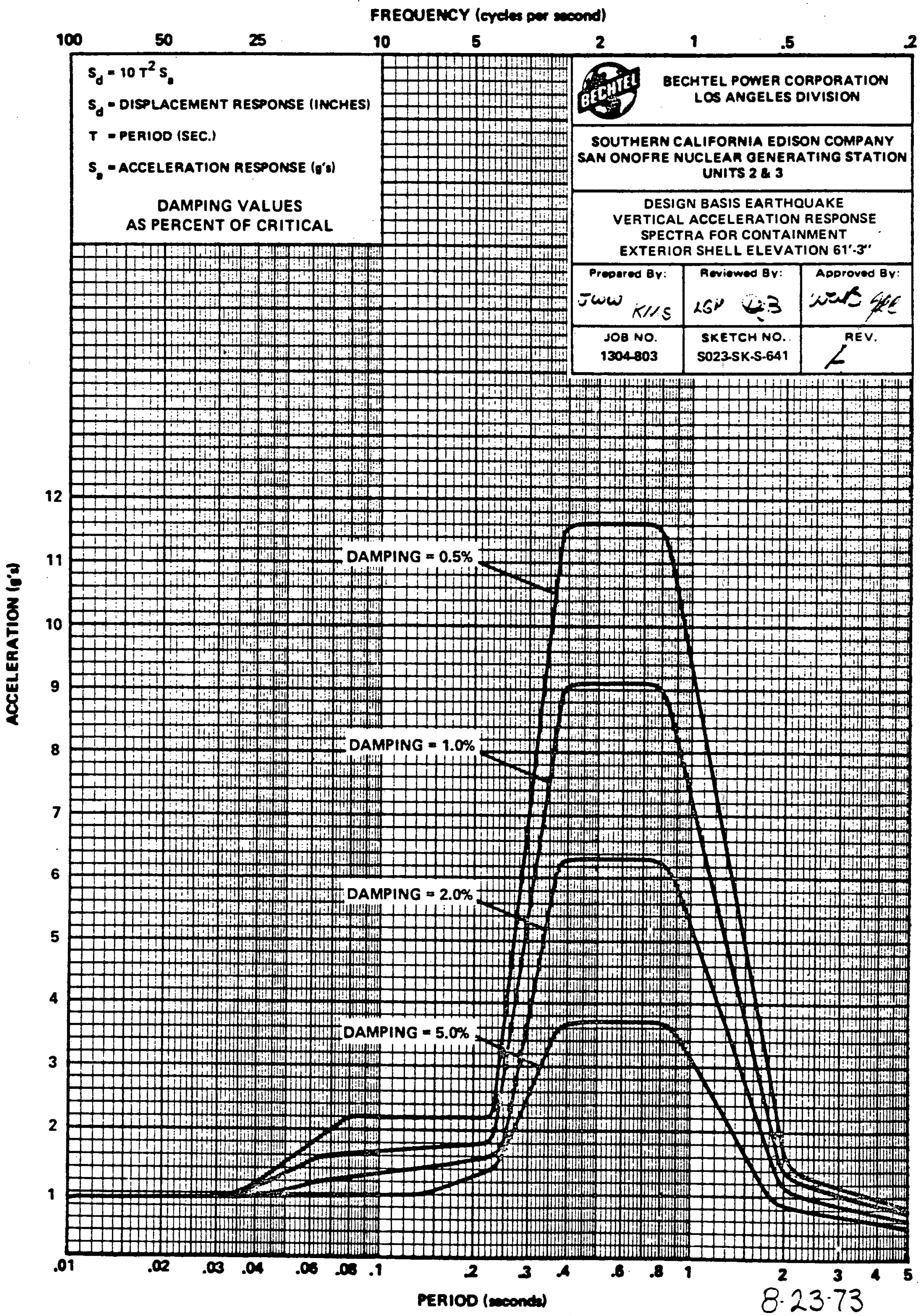
APPENDIX A

APPENDIX A



Photograph 1. Valve and Loading Apparatus Installed in Test Area.

APPENDIX B


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA FOR CONTAINMENT
EXTERIOR SHELL ELEVATION 61'-3"
Prepared By:
JWW KIIS
Reviewed By:
LGP
Approved By:
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-641
REV.
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
12
11
10
9
8
7
6
5
4
3
2
1
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

8-23-73

BECHTEL POWER CORPORATION
LOS ANGELES DIVISION

SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3

DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA FOR CONTAINMENT
EXTERIOR SHELL ELEVATION 61'-3"

Prepared By:	Reviewed By:	Approved By:
JWW KMS	LGH QB	WaB JM
JOB NO. 1304-803	SKETCH NO. S023-SK-S-642	REV. A

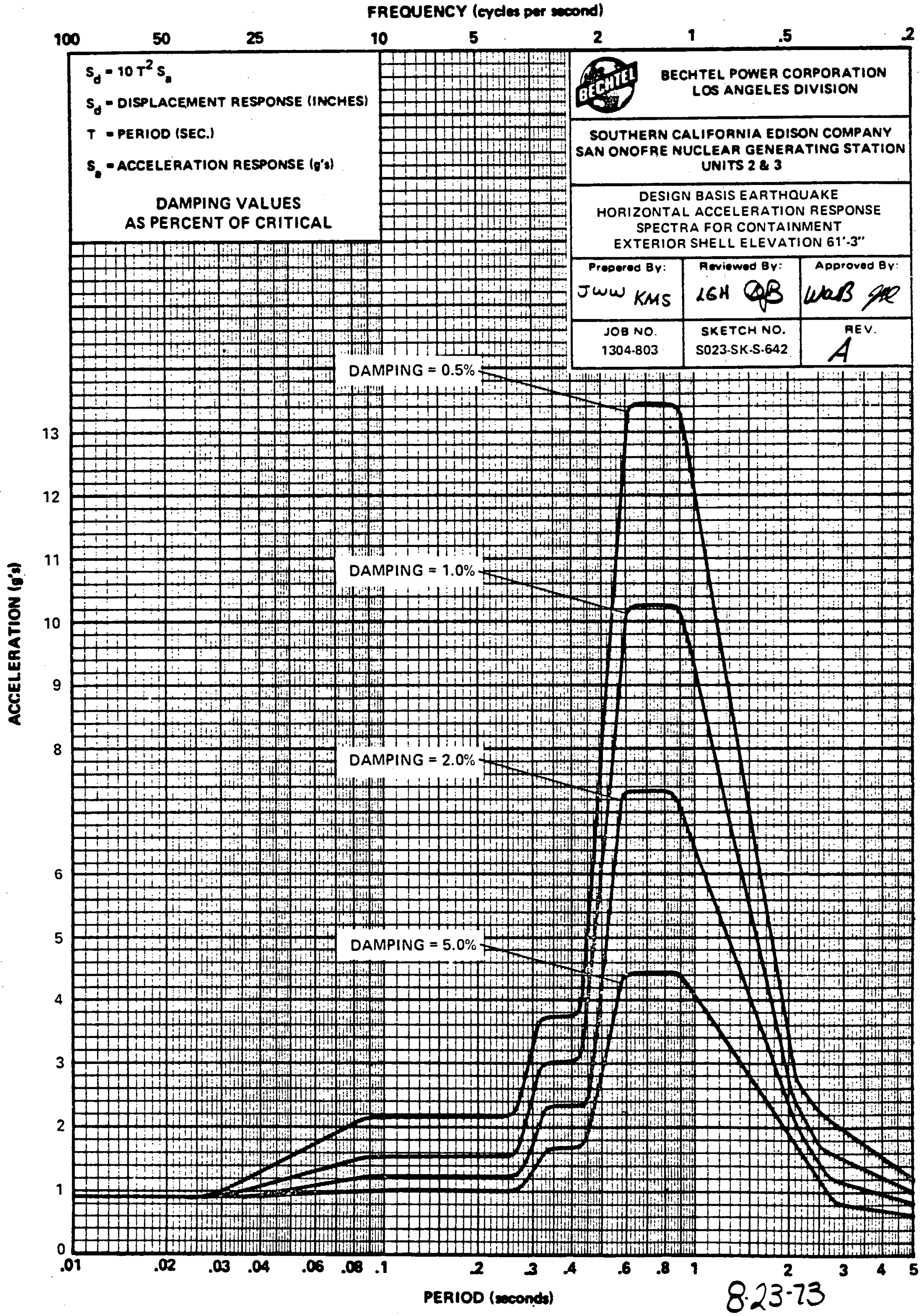
$S_d = 10\,T^2 S_a$

S_d = DISPLACEMENT RESPONSE (INCHES)

T = PERIOD (SEC.)

S_a = ACCELERATION RESPONSE (g's)

DAMPING VALUES
AS PERCENT OF CRITICAL



8-23-73

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR ______

II. Component Name NSSS Auxiliary Relay Cabinet

1. Scope: [ ] NSSS [X] BOP
2. Model Number: N/A (Custom Made) Quantity: 4
3. Vendor: NMC Controls, Inc.
4. If the component is a cabinet or panel, name and model No. of the devices included: See Appendix "A"
5. Physical Description a. Appearance Cabinet with bays "A," "B", & Bay "A" & "B" - 156" Long, 56" Wide and 90" high.

   b. Dimensions Bay "X" - 84" Long, 56" Wide and 90" High.

   c. Weight 6858 Lbs.
6. Location: Building: Control Room (Auxiliary Bldg.)

   Elevation: 30'-0"
7. Field Mounting Conditions [ ] Bolt (No.____, Size____)
   [ ] Weld (Length 6") Welds on
   [ ] ________ 12-1/2"Centers

Centers

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

   S/S: None Below 35Hz F/B: 13.1,20.7,29.0Hz V: None Below 35Hz
9. a. Functional Description: Cabinet Houses Different Aux. Relays Switches & Resistors For The NSSS Systems.

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

   [X] Both ______
10. Pertinent Reference Design Specifications: S023-306-1

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

IV. Equipment Qualification Method: Test: ______

Analysis: ______

Combination of Test and Analysis: X

Test and/or Analysis by Analysis - 12461-2 Acton Lab. Test - 12888 & 12461-1
(Name of Company or Laboratory & Report No.)
Bechtel Log: S023-306-1-37

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [ ] Combination of ______

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

2. Required Response Spectra (attach the graphs): See Appendix "B"

3. Required Acceleration in Each Direction: ______

S/S = 1 F/B = 1 V = 1

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 * Other ______ (specify)

4. Frequency Range: 1-35 Hz

*5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)

6. Input g-level Test at S/S = 2g F/B = 2.0g V = 1.75g.

7. Laboratory Mounting: ______

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

* Information not given in the report.

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

9. Test Results including modifications made: Equipment Qualified No Modifications.

10. Other tests performed (such as fragility test, including results):

    Component Functional Test

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

1. Description of Test including Results: Bays "A" & "B" Tested on a shake Table and Verified that the Data necessary to show that mathematical model used for analysis of the cabinet is correct.

2. Method of Analysis:

   [ ] Static Analysis
   [X] Dynamic Analysis

   [ ] Equivalent Static Analysis
   [ ] Time-History
   [X] Response Spectrum

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

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

4. [X] Computer Codes: MRl/Stardyne CDC 6600

   Frequency Range and No. of modes considered: 1-35 Hz, 7 Modes/5 of Significanc

   [ ] Hand Calculations

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

6. Damping: 4% Basis for the damping used: Reg. Guide 1.61

7. Support Considerations in the model: Fixed

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Panel Stiffness		Operational & Seismic	14,992	16,382	33,000
Panel Relays		Operational & Seismic	2,864	4180	33,000

B.

Max. Deflection	Location	Effect Upon Functional Operability
X1 = 0.002" X2 = 0.089" X3 - 0.39"		None

APPENDIX "A"

EQUIPMENT TESTED

Seventeen (17) different panel mounted equipment were tested. The panel mounted equipment were divided into three groups, and each group was mounted to a test fixture and tested separately as a group. The groups were divided in the following manner:

GROUP A

NMC NO.	DESCRIPTION
1002202	MDR 131-1 P&B Relay
1002206	MDR 5060 P&B Relay
1002204	MDR 137-8 P&B Relay
1002207	MDR 5061 P&B Relay
1002205	MDR 138-7 P&B Relay
1002203	MDR 134-1 P&B Relay
------	MDR 163-1 P&B Relay
222858	GE#CR15162 Terminal Block

GROUP B

224827	MTS-202B Ganged DPSW
1002210	Model 7014PD Agastat Relay
1002212	MF4122 P&B Relay
------	MDR 141-1 Relay

GROUP C

233325	Ohmite 2.5K 25 W Resistor
223414	14K, 5W Fixed Resistor
238516	100K, 2W Variable Resistor

LAO 0513 8-73

BECHTEL

CALCULATION SHEET

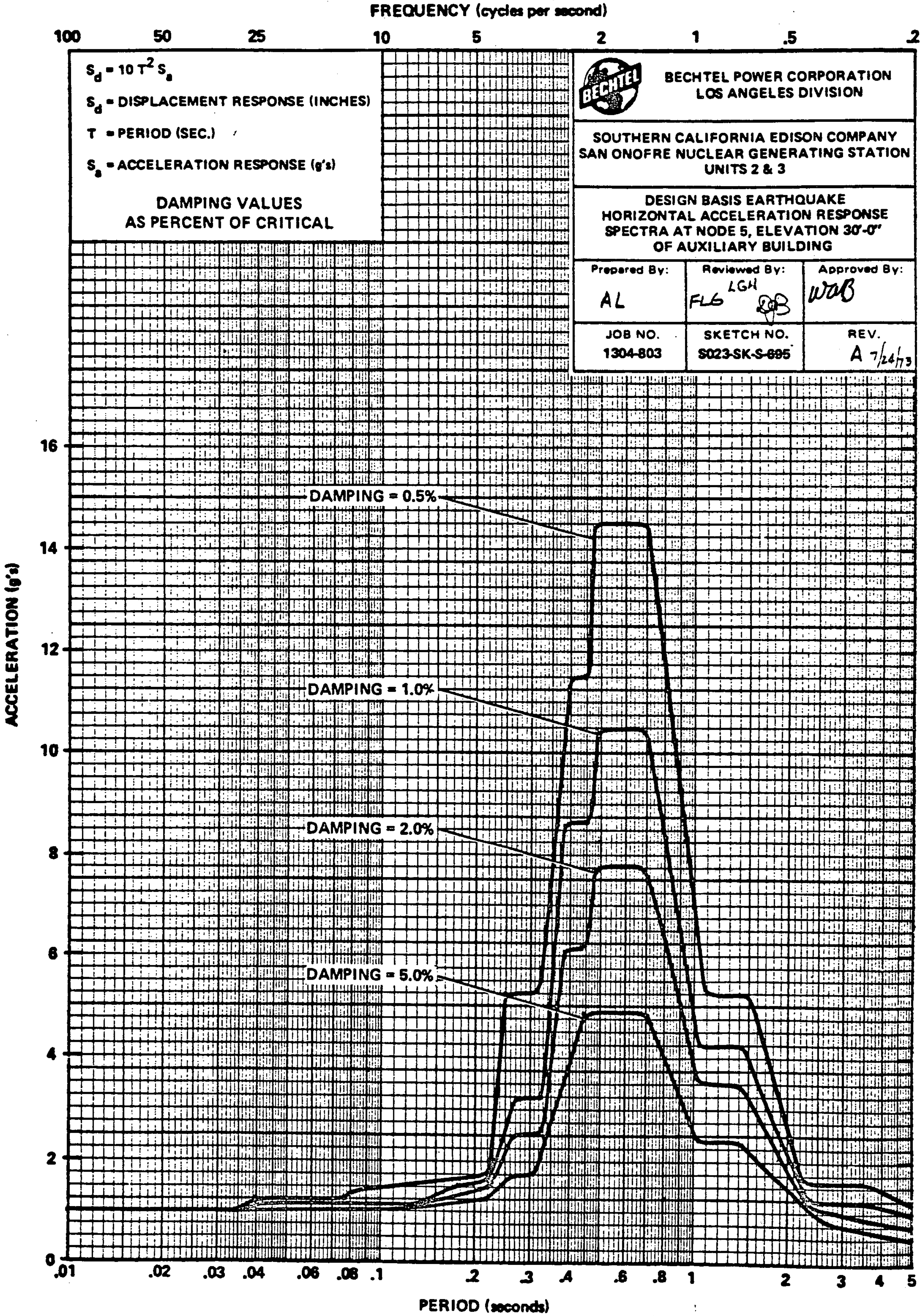
CALC. NO. ______

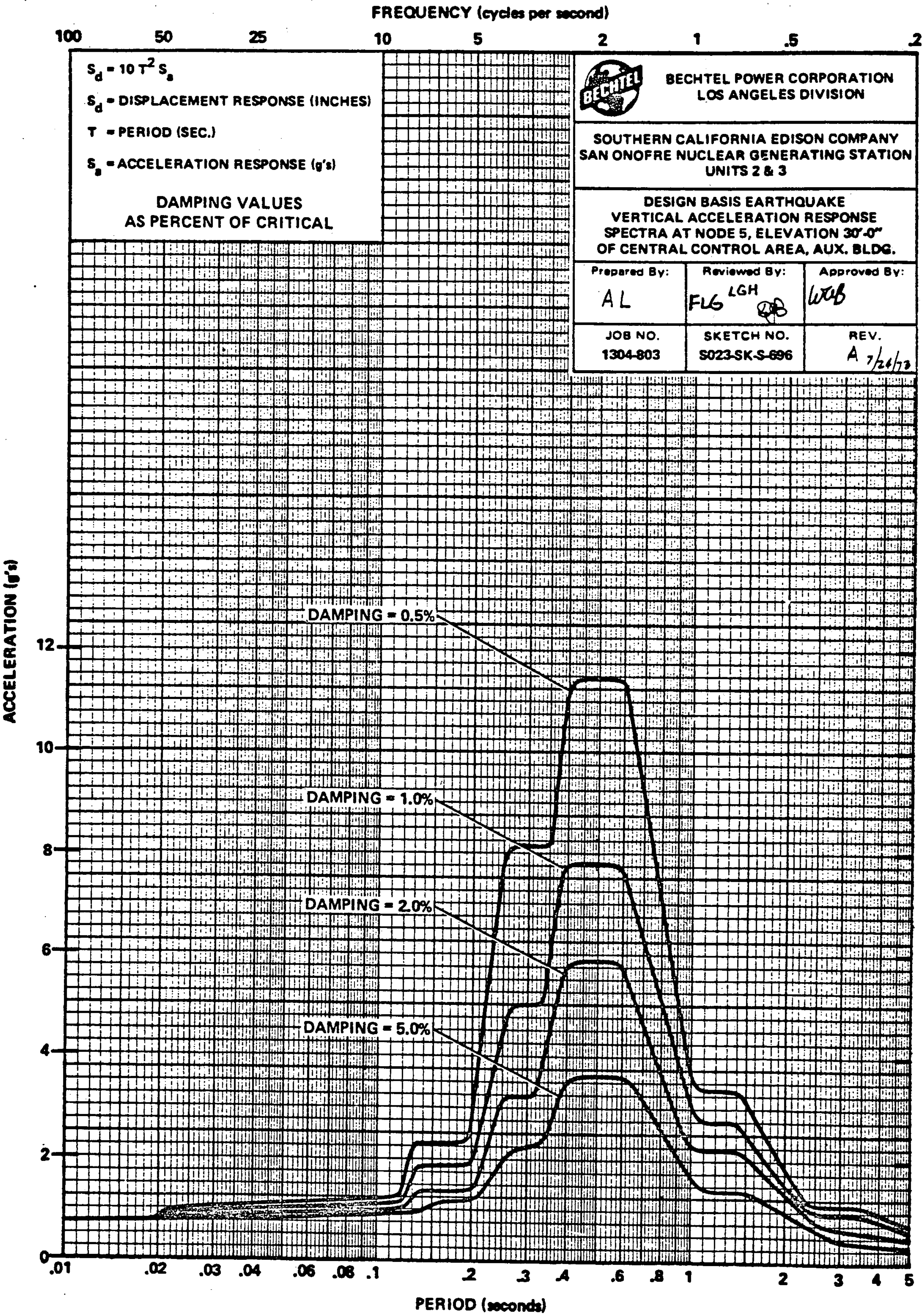
SIGNATURE ______ DATE ______ CHECKED ______ DATE ______

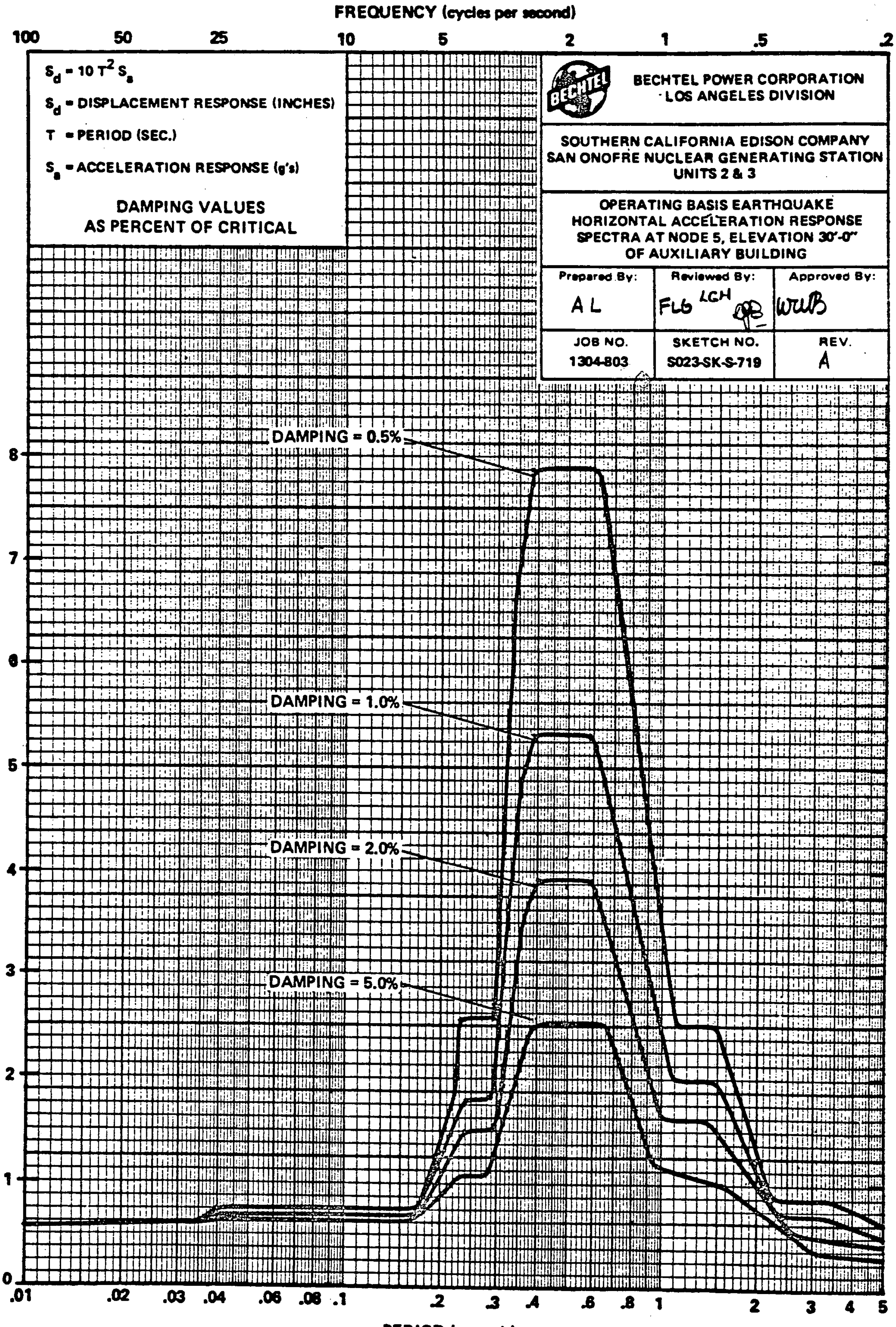
PROJECT ______ JOB NO. ______

SUBJECT ______ SHEET ______ OF ______ SHEETS

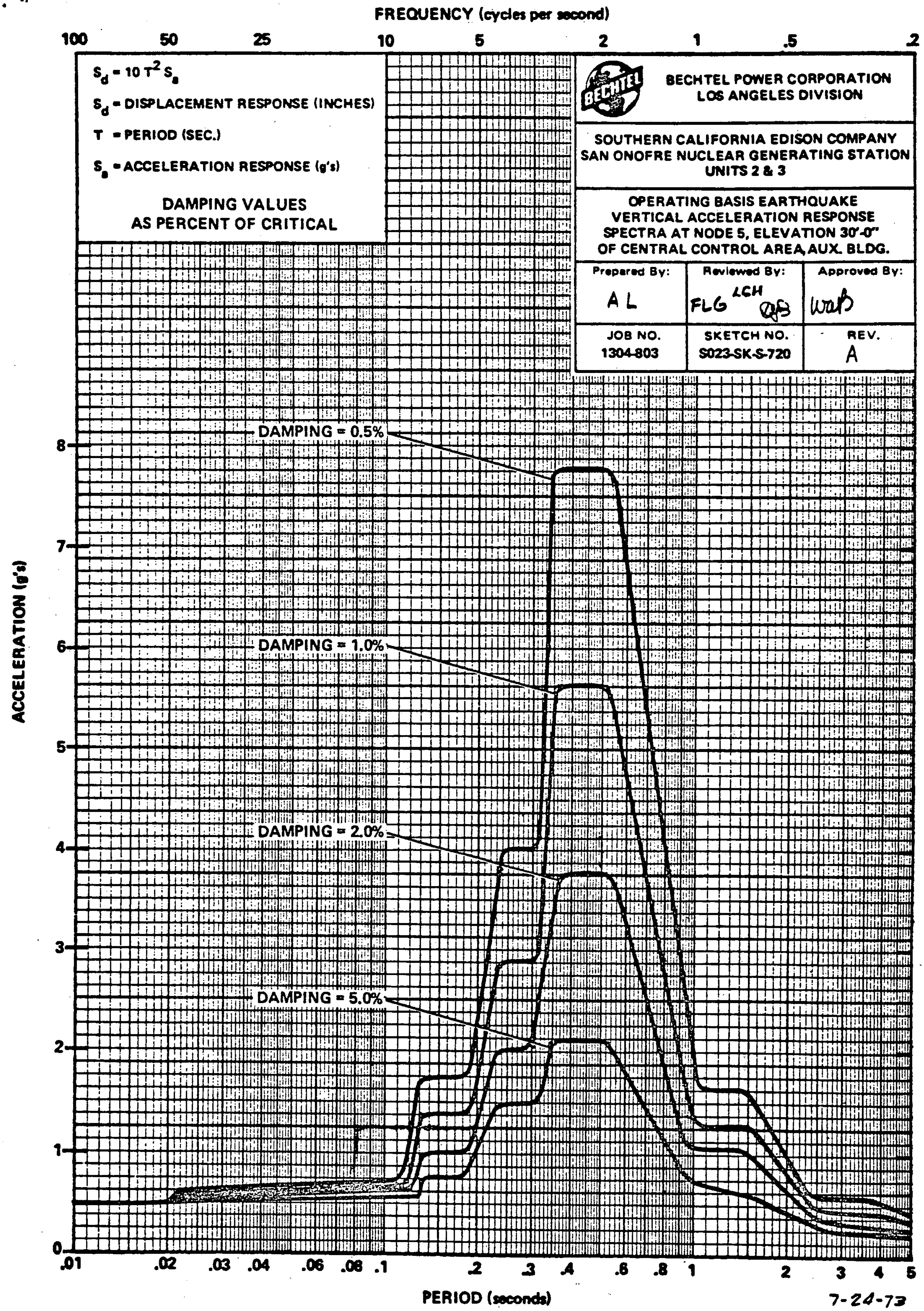
APPENDIX "B"


FREQUENCY (cycles per second)
100 50 25 10 5 2 1 .5 .2
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA AT NODE 5, ELEVATION 30'-0"
OF AUXILIARY BUILDING
Prepared By: AL
Reviewed By: FLG LGH
Approved By: WAB
JOB NO. 1304-803
SKETCH NO. S023-SK-S-695
REV. A 7/24/73
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
0 2 4 6 8 10 12 14 16
.01 .02 .03 .04 .06 .08 .1 .2 .3 .4 .6 .8 1 2 3 4 5
PERIOD (seconds)


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA AT NODE 5, ELEVATION 30'-0"
OF CENTRAL CONTROL AREA, AUX. BLDG.
Prepared By:
AL
Reviewed By:
FLG LGH
Approved By:
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-696
REV.
A 7/26/73
ACCELERATION (g's)
12
10
8
6
4
2
0
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
OPERATING BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA AT NODE 5, ELEVATION 30'-0"
OF AUXILIARY BUILDING
Prepared By: A L
Reviewed By: FLG LGH
Approved By: WRB
JOB NO. 1304-803
SKETCH NO. S023-SK-S-719
REV. A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
8
7
6
5
4
3
2
1
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

7-24-73


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
OPERATING BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA AT NODE 5, ELEVATION 30'-0"
OF CENTRAL CONTROL AREA, AUX. BLDG.
Prepared By: A L
Reviewed By: FLG LCH
Approved By:
JOB NO. 1304-803
SKETCH NO. S023-SK-S-720
REV. A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
8
7
6
5
4
3
2
1
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)
7-24-73

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR

II. Component Name: Salt Water Cooling Pumps

1. Scope: [ ] NSSS [X] BOP
2. Model Number: 33 WX - 1-Stage, Vert. Quantity: 4/Unit
3. Vendor: Byron Jackson
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 Cylinder

   b. Dimensions ≅42' Long x 3'-2" Diameter

   c. Weight 17,400 lb Total (Pump and Motor)
6. Location: Building: Intake Structure

   Elevation: + 9'-0"
7. Field Mounting Conditions [X] Bolt (No. 16, Size 1-1/8)
   [ ] Weld (Length ___)
   [ ] ______
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   *S/S: 22.6 F/B: 24.6, 27.2 V: 60.22
9. a. Functional Description: Pumps seawater through Tube side of component cooling water heat exchangers.

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

   [ ] Both ______
10. Pertinent Reference Design Specifications: S023-405-3A QC II Saltwater Cooling Pumps

* Other frequencies 33 Hz.

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

IV. Equipment Qualification Method: Test: ______

Analysis: Dynamic

Combination of Test and Analysis: ______

Test and/or Analysis by Douglas B. Nickerson P.E.
Bechtel Log S023-405-3A-Z-3
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [ ] Seismic only 2. [ ] Hydrodynamic only

   3. [ ] Explosive only 4. [ ] Other (Specify) ______

   5. [X] Combination of Seismic, Hydrodynamic, Dead Weight

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

2. Required Response Spectra (attach the graphs): S023-SK-S-671-C, 672-C

3. Required Acceleration in Each Direction:

   S/S = 1.18 F/B = 1.18 V = 0.64

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. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
   [ ] No

______

6. Input g-level Test at S/S = ______ F/B = ______ V = ______

7. Laboratory Mounting: ____________________

   1. [ ] Bolt (No.___, Size___) [ ] Weld (Length___) [ ] ____________

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

9. Test Results including modifications made: ____________________

10. Other tests performed (such as fragility test, including results):

    ____

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
   [X] Dynamic Analysis

   [ ] Equivalent Static Analysis
   [ ] Time-History
   [X] Response Spectrum

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

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

4. [X] Computer Codes: BMDAT, CANBM, MDLDF, STRESS

   Frequency Range and No. of modes considered: 1-1000Hz, 4 Modes

   [X] Hand Calculations

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

6. Damping: 1% Basis for the damping used: R.G. 1.61 None Specified

7. Support Considerations in the model: Trunion Loaded Flat Plate
   2-Seismic Restraints

8. Critical Structural Elements: See Appendix "B"

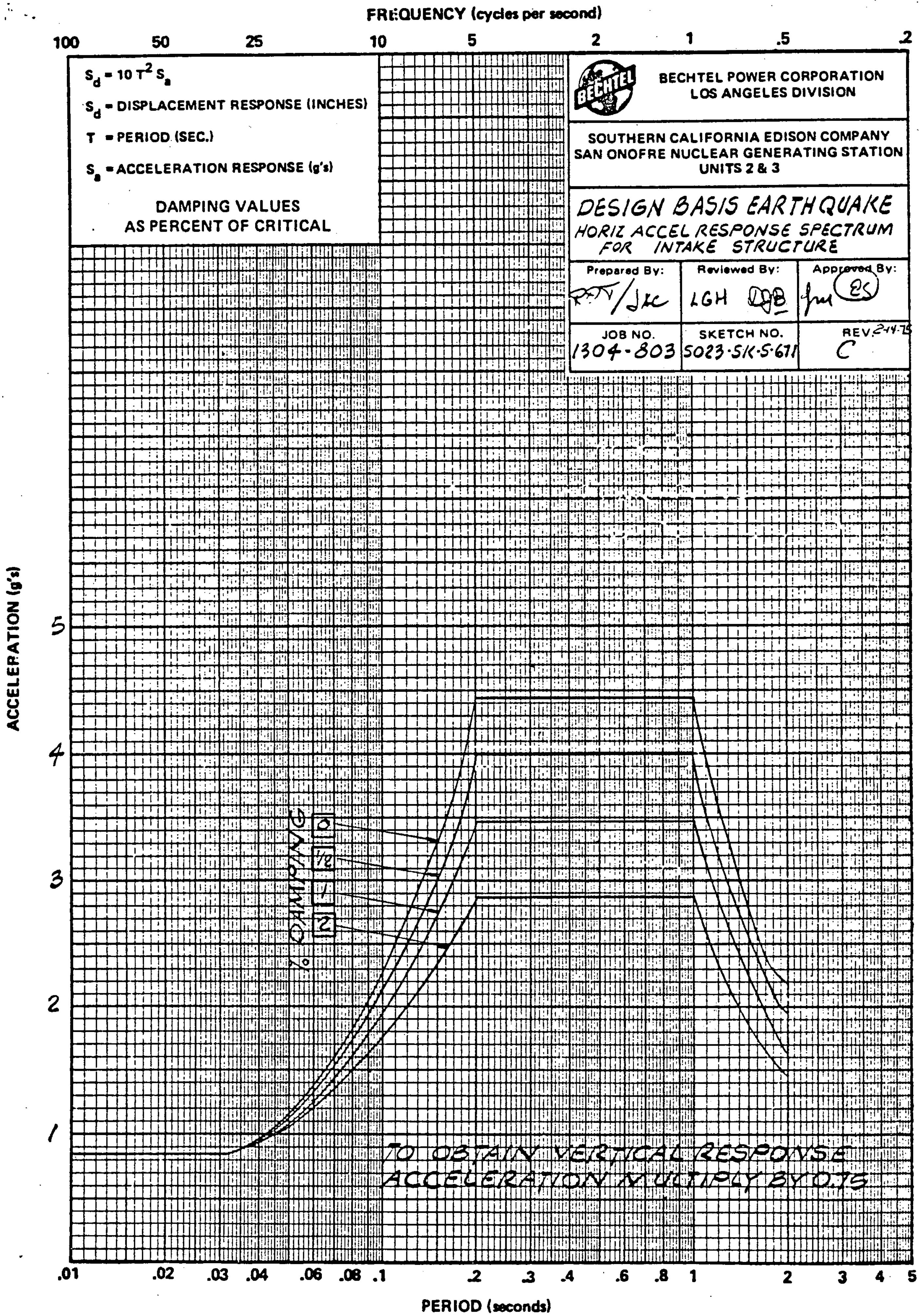
A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Discharge Nozzle	Discharge of Pump	Pressure	Not Provided	137	275
Motor Mounting Bolts	Connect Motor to Pump	Seismic & Normal Op.	13,499	13,576	27,000
Bearings	Every 56 - 57"	Seismic & Normal Op.	0.69	0.69	20 = 30

B.

Max. Deflection	Location	Effect Upon Functional Operability
0.00868"	Wear Rings	None Clearance = 0.00682 No. Binding

APPENDIX A



FREQUENCY (cycles per second)
100 50 25 10 5 2 1 .5 .2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZ ACCEL RESPONSE SPECTRUM
FOR INTAKE STRUCTURE
Prepared By: RTV/JKC
Reviewed By: LGH
Approved By:
JOB NO. 1304-803
SKETCH NO. 5023-SK-S-671
REV. C
ACCELERATION (g's)
1 2 3 4 5
% DAMPING
0
1/2
1
2
TO OBTAIN VERTICAL RESPONSE
ACCELERATION MULTIPLY BY 0.75
.01 .02 .03 .04 .06 .08 .1 .2 .3 .4 .6 .8 1 2 3 4 5
PERIOD (seconds)

APPENDIX B

16

TA... II

MATERIALS AND STRESS TABLE

Item	Material	Allow. Stress	Calc. Stress (DBE)	Margin	Calc. Page
Discharge Head					
Nozzle- Discharge	ANSI B16.5	275 psi Wkg. Press	137 psi	1.01	A1.10
Nozzle- Air Relief	ANSI B16.5	275 psi Wkg. Press	144	.91	A1.8
Shell	SB-169 CDA 614	18 000	2 229	5.81	A1.10
Base Plate	SB-169 CDA 614	18 000	3 152	4.71	A1.14
Cycl. Sep. Mtg. Bkt.	SB-169 CDA 614	18 000	521	High	A1.20
Cycl. Sep. Mtg. Bolts	SB-150 CDA 630	12 500	229	High	A1.21
Mounting Bolts	ASTM A-193 B8M	27 000	10 302	1.62	A1.16
Motor Mounting Bolts	ASTM A-193 B8M	27 000	13 576	.99	A1.17
Foundation Bolts	Unknown- Customer Furnished		9 830		A1.16
Column - Top Flange					
Flange	SB-169 CDA 614	18 000	6 157	1.92	A2.19
Hub	SB-169 CDA 614	18 000	4 993	2.61	A2.19
Bolts	SB-150 CDA 630	12 500	3 930	2.18	A2.19
Column - Maximum Stress Flange					
Flange	SB-169 CDA 614	18 000	6 319	1.85	A2.19
Hub	SB-169 CDA 614	18 000	5 125	2.51	A2.19
Bolts	SB-150 CDA 630	12 500	4 033	2.10	A2.19
Shaft Tube	SB-169 CDA 614	18 000	605	High	A3.22
Lineshaft	ASTM A-479 XM19	25 000	5 198	3.81	A4.3

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR ____

II. Component Name: Auxiliary Feedwater Pumps

1. Scope: [ ] NSSS [X] BOP
2. Model Number: 4 x 6 x 9 D 8-Stage DVMX — Quantity: 4
3. Vendor: Byron Jackson
4. If the component is a cabinet or panel, name and model No. of the devices included: N/A
5. Physical Description a. Appearance 8-Stage Centrifugal Pump
   b. Dimensions ≅90" x 46"
   c. Weight ≅6500 lbs
6. Location: Building: Storage Tank Area
   Elevation: 31' - 8-5/16"
7. Field Mounting Conditions [X] Bolt (No. 8 , Size 1")
   [ ] Weld (Length ____)
   [ ] ____
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S: Turb. Driv. 232 Hz, Mtr. Driv. 139 Hz — F/B: Turb. Driv. 266 Hz, Mtr. Driv. 159 Hz — V: Turb. Driv. 626 Hz, Mtr. Driv. 528 Hz
9. a. Functional Description: Provides feedwater to the steam generators during emergency conditions, hot standby.
   b. Is the equipment required for [X] Hot Standby [ ] Cold Shutdown
   [ ] Both ____
10. Pertinent Reference Design Specifications: S023-405-6

    QCII Auxiliary Feedwater Pumps and Drivers.

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

IV. Equipment Qualification Method: Test: ____________

Analysis: Static

Combination of Test and Analysis: ________

Test and/or Analysis by Byron Jackson DC 1102 Rev. C
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [ ] Seismic only 2. [ ] Hydrodynamic only

   3. [ ] Explosive only 4. [ ] Other (Specify) ____________

   5. [X] Combination of Nozzle, Dead Weight, Seismic

   6. Method of combining RRS: [X] Absolute Sum [ ] SRSS [ ] ____________ (other, specify)

2. Required Response Spectra (attach the graphs): S023-SK-S-986, 987, 988, 989

3. Required Acceleration in Each Direction: ZPA

   S/S = 1.2 F/B = 1.2 V = 1.3

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. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs) [ ] No

____

6. Input g-level Test at S/S = ______ F/B = ______ V = ______

7. Laboratory Mounting: ______________________________

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

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

9. Test Results including modifications made: ____________________

10. Other tests performed (such as fragility test, including results):

    ____

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

1. Description of Test including Results: N/A

2. Method of Analysis: ______________________________

   [X] Static Analysis
   [ ] Dynamic Analysis
   [ ] Equivalent Static Analysis
   [ ] Time-History
   [X] Response Spectrum

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

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

4. [X] Computer Codes: MULTISPAN, Lomakin

   Frequency Range and No. of modes considered: 33 Hz

   [X] Hand Calculations

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

6. Damping: N/A Basis for the damping used: ZPA (Rigid)

7. Support Considerations in the model: Pinned supports at the two end bearings and a spring support at the center.

8. Critical Structural Elements: ______________________

A.

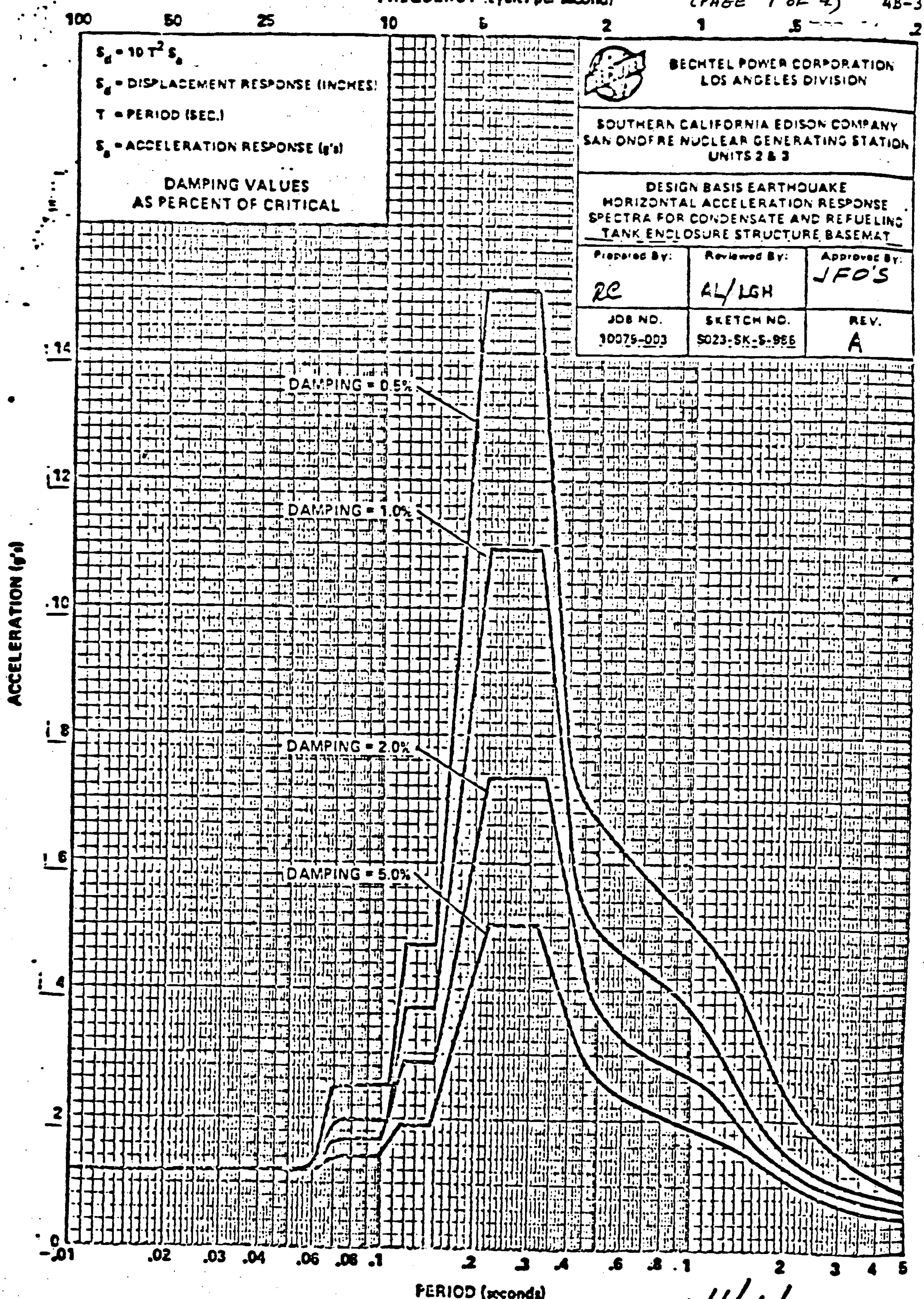
Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable

See Appendix "B"

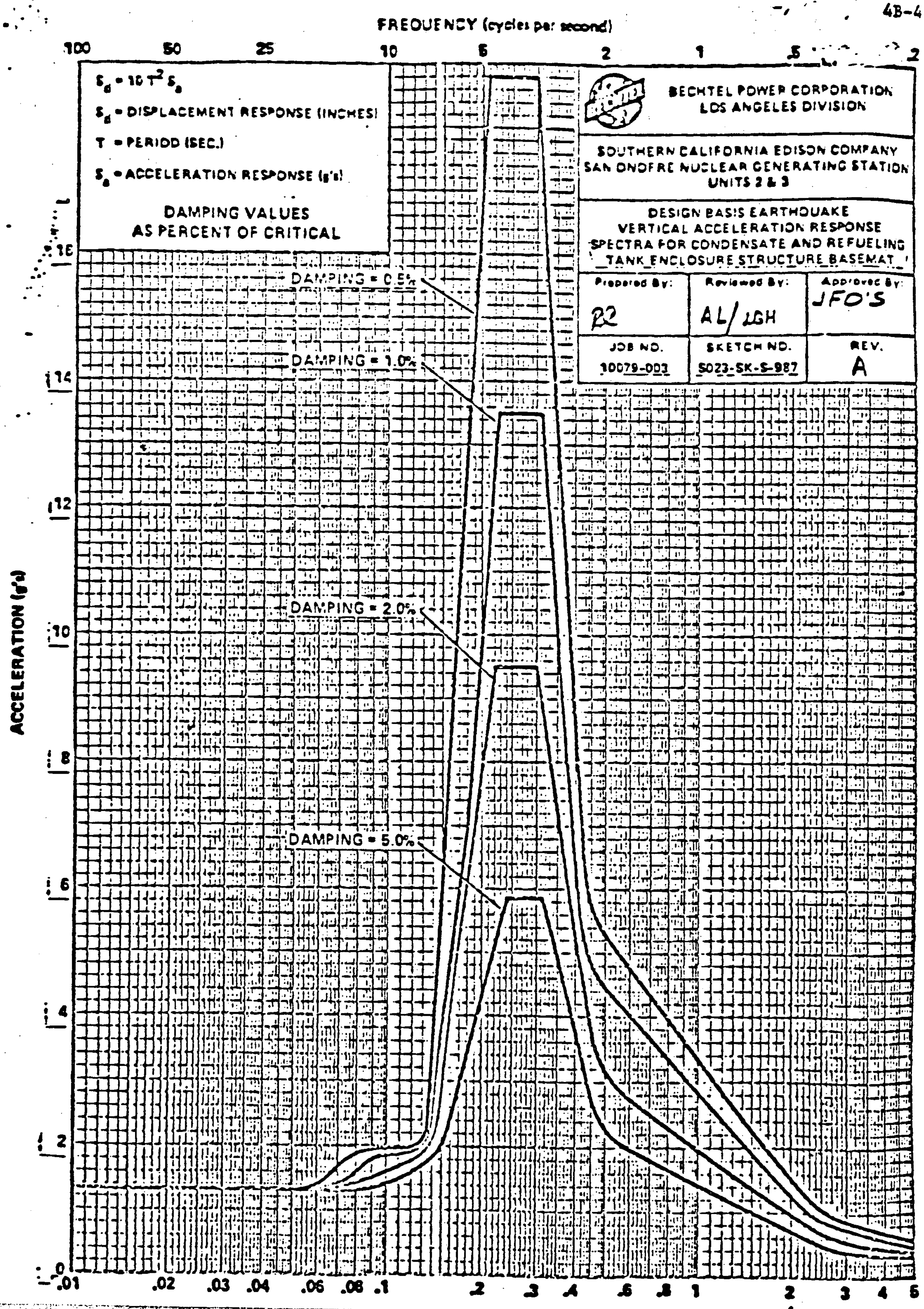
B.

Max. Deflection	Location	Effect Upon Functional Operability
0.00261	Rotor	Min. Clearance = 0.006 No binding will occur.

APPENDIX A


FREQUENCY (cycles per second)
100 50 25 10 5 2 1 .5 .2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA FOR CONDENSATE AND REFUELING
TANK ENCLOSURE STRUCTURE BASEMAT
Prepared By: RC
Reviewed By: AL/LGH
Approved By: JFO'S
JOB NO. 10075-003
SKETCH NO. S023-SK-S-986
REV. A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
.14 .12 .10 .8 .6 .4 .2 0
.01 .02 .03 .04 .06 .08 .1 .2 .3 .4 .6 .8 1 2 3 4 5
PERIOD (seconds)

11/4/77


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA FOR CONDENSATE AND REFUELING
TANK ENCLOSURE STRUCTURE BASEMAT
Prepared By:
RR
Reviewed By:
AL/LGH
Approved By:
JFO'S
JOB NO.
10079-003
SKETCH NO.
SO23-SK-S-987
REV.
A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
16
14
12
10
8
6
4
2
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5

APPENDIX B

MOTOR-DRIVEN PUMP

IDENTIFICATION	LOCATION	GOV. LOAD OR RESPONSE COMB.	SEISMIC STRESS (PSI)		TOTAL STRESS (PSI)		STRESS ALLOWABLE (PSI)	
			OBE	DBE	OBE	DBE	OBE	DBE
HOLD-DOWN BOLTS	Pump Foot (see Fig. 3 ATTACHED)	Seismic + Normal Operating + Nozzle Loads	TENSILE 46	TENSILE 1,402	TENSILE 1,129	TENSILE 3090	TENSILE 25,000	TENSILE 94,500
			SHEAR —	SHEAR —	SHEAR —	SHEAR —	SHEAR —	SHEAR —
ALIGNMENT DOWELS	Pump Foot (see Fig. 3 ATTACHED)	Seismic + Normal Operating + Nozzle Loads	TENSILE —	TENSILE —	TENSILE —	TENSILE —	TENSILE —	TENSILE —
			SHEAR 9,558	SHEAR 26,198	SHEAR 16,784	SHEAR 29,883	SHEAR 20,000	SHEAR 75,600
FOUNDATION BOLTS (supplied by Bechtel)	BASEPLATE	Seismic + Normal Operating + Nozzle Loads	TENSILE 2262	TENSILE 7483	TENSILE 3078	TENSILE 8,548	TENSILE 20,000	TENSILE 20,000
			SHEAR 3,188	SHEAR 6,377	SHEAR 4,232	SHEAR 7,820	SHEAR 10,000	SHEAR 10,000

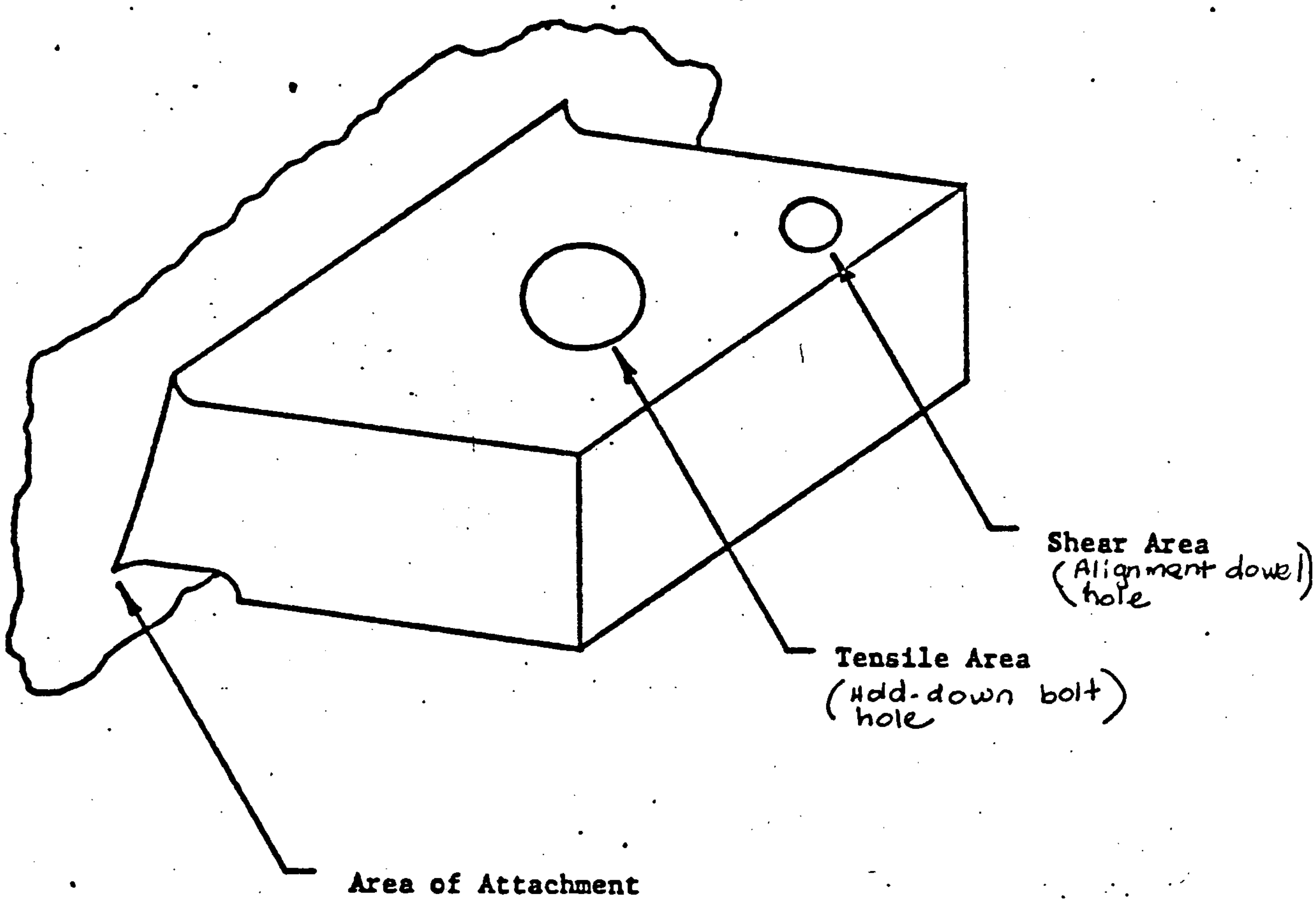


FIGURE 3 TYPICAL PUMP FOOT

405-6-81-2

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 Type:

1. Utility: Southern California Edison Company PWR X

2. NSSS: CE 3. A/E: Bechtel BWR

II. Component Name: Component Cooling Water Heat Exchanger

1. Scope: [ ] NSSS [X] BOP

2. Model Number: N/A Quantity: 4

3. Vendor: Struthers Wells

4. If the component is a cabinet or panel, name and model No. of the devices included: Not Applicable

5. Physical Description a. Appearance Horizontal Cylinder with 3 support legs.

b. Dimensions 48'-6" Overall Length by 63" OD

c. Weight 178,000 lb. Flooded

6. Location: Building: Safety Equipment Bldg. (CCW HE & Rooms)

Elevation: 8'-0"

7. Field Mounting Conditions [X] Bolt (No. 12, Size 2")
[ ] Weld (Length)
[X] Bolt (No. 4, Size 1.25" (Center Support)

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

S/S: >33 Hz F/B: >33 Hz V: 31.3 pg 98

9. a. Functional Description: Single pass counter flow heat exchanger, transfers component cooling water system heat to the saltwater cooling system.

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

[X] Both

10. Pertinent Reference Design Specifications: S023-404-4 QC II specification for component cooling water and spent fuel Pool Heat Exchangers.

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

IV. Equipment Qualification Method: Test: N/A

Analysis: Yes Bechtel Log S023-404-4-79-2

Combination of Test and Analysis: N/A

Test and/or Analysis by Struthers Wells
No Report No., Order No. 1-74-06-32404
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [ ] Seismic only 2. [ ] Hydrodynamic only

   3. [ ] Explosive only 4. [ ] Other (Specify) ____________

   5. [X] Combination of Seismic, Nozzle, Dead Weight, Pressure

   6. Method of combining RRS: [X] Absolute Sum [ ] SRSS [ ] ____________ (other, specify)

2. Required Response Spectra (attach the graphs): S023-SK-S-929, 934, 943

3. Required Acceleration in Each Direction:

   S/S = DBE = 1.0 F/B = DBE = 1.0 V = DBE = 1.0

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. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
   [ ] No

6. Input g-level Test at S/S = ______ F/B = ______ V = ______

7. Laboratory Mounting: ______________________________

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

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

9. Test Results including modifications made: ______________________

10. Other tests performed (such as fragility test, including results):

    ____

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

1. Description of Test including Results: N/A

2. Method of Analysis: ______________________________

   [X] Static Analysis [ ] Equivalent Static Analysis
   [ ] Dynamic Analysis [ ] Time-History
   [X] Response Spectrum

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

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

4. [X] Computer Codes: TUSUP, TRESUP, ANSYS (Struthers Wells Proprietary)

   Frequency Range and No. of modes considered: 31.29 to 239.44 Hz, 5 Modes

   [X] Hand Calculations

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

6. Damping: N/A Basis for the damping used: Lowest Freq. is on ZPA

7. Support Considerations in the model: Anchor and 2-Guides

8. Critical Structural Elements: ______________________________

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Anchor Bolt Stresses	Support A (Fixed)	Nozzle, Pressure Dead Weight Seismic	25,214 9,074	25,214 12,506	40K tension 15K shear.
Shell	All	Nozzle, Pressure, Dead Weight and Seismic	15,153	23,530	30K
Support Stress	Support A	Nozzle, Pressure, Dead Weight and Seismic	13,120	18,551	30K

B.

Max. Deflection	Location	Effect Upon Functional Operability
± 0.125 inch. (worst case)	Ends of heat exchanger	Deflection at Tube Sheets is ≅0.060 inches vertically.

APPENDIX A

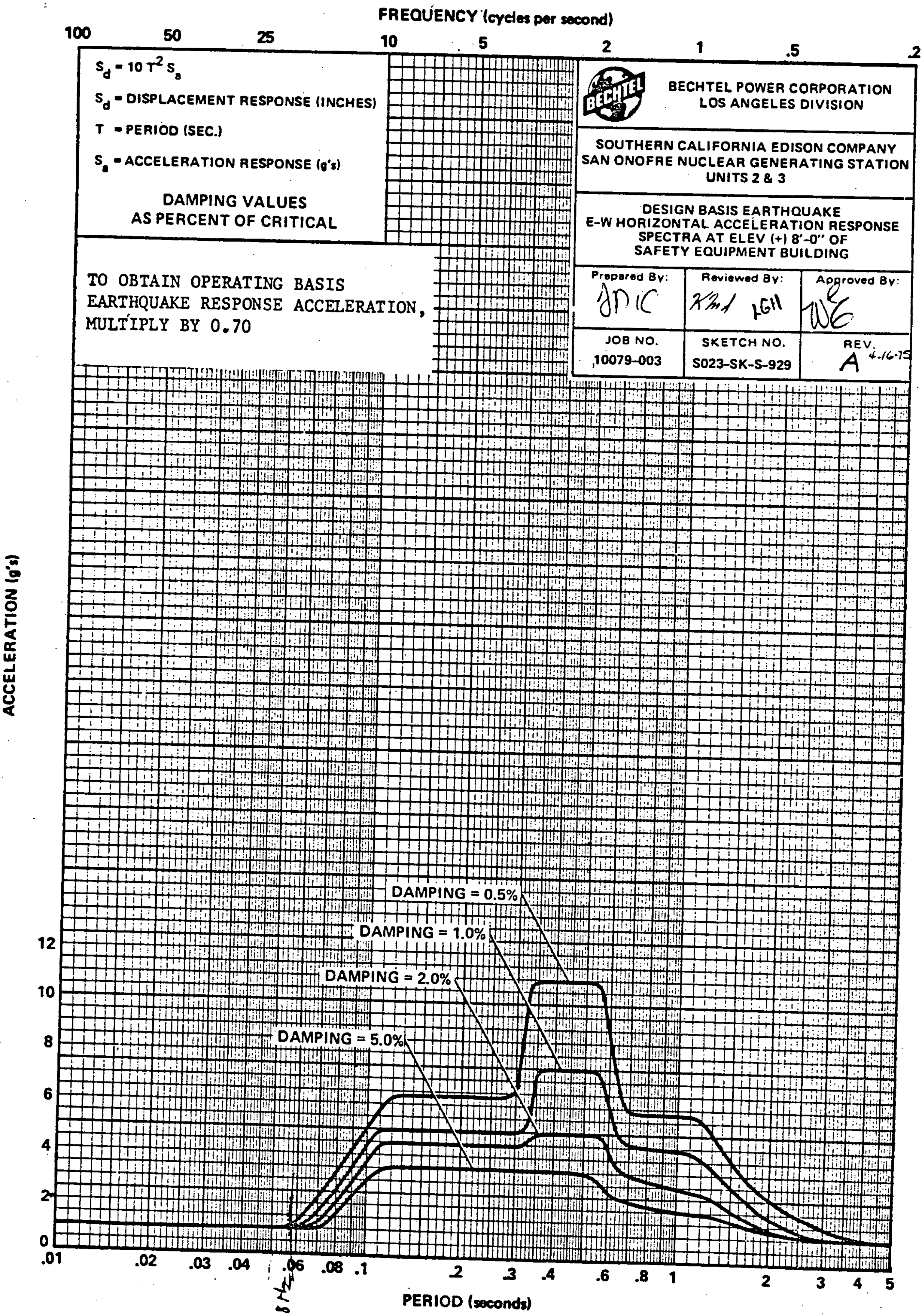
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION

SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3

DESIGN BASIS EARTHQUAKE
E-W HORIZONTAL ACCELERATION RESPONSE
SPECTRA AT ELEV (+) 8'-0" OF
SAFETY EQUIPMENT BUILDING

Prepared By:	Reviewed By:	Approved By:
JOB NO.	SKETCH NO.	REV.
10079-003	S023-SK-S-929	A 4-16-75

TO OBTAIN OPERATING BASIS EARTHQUAKE RESPONSE ACCELERATION, MULTIPLY BY 0.70



$S_d = 10\,T^2\,S_a$

S_d = DISPLACEMENT RESPONSE (INCHES)

T = PERIOD (SEC.)

S_a = ACCELERATION RESPONSE (g's)

DAMPING VALUES
AS PERCENT OF CRITICAL

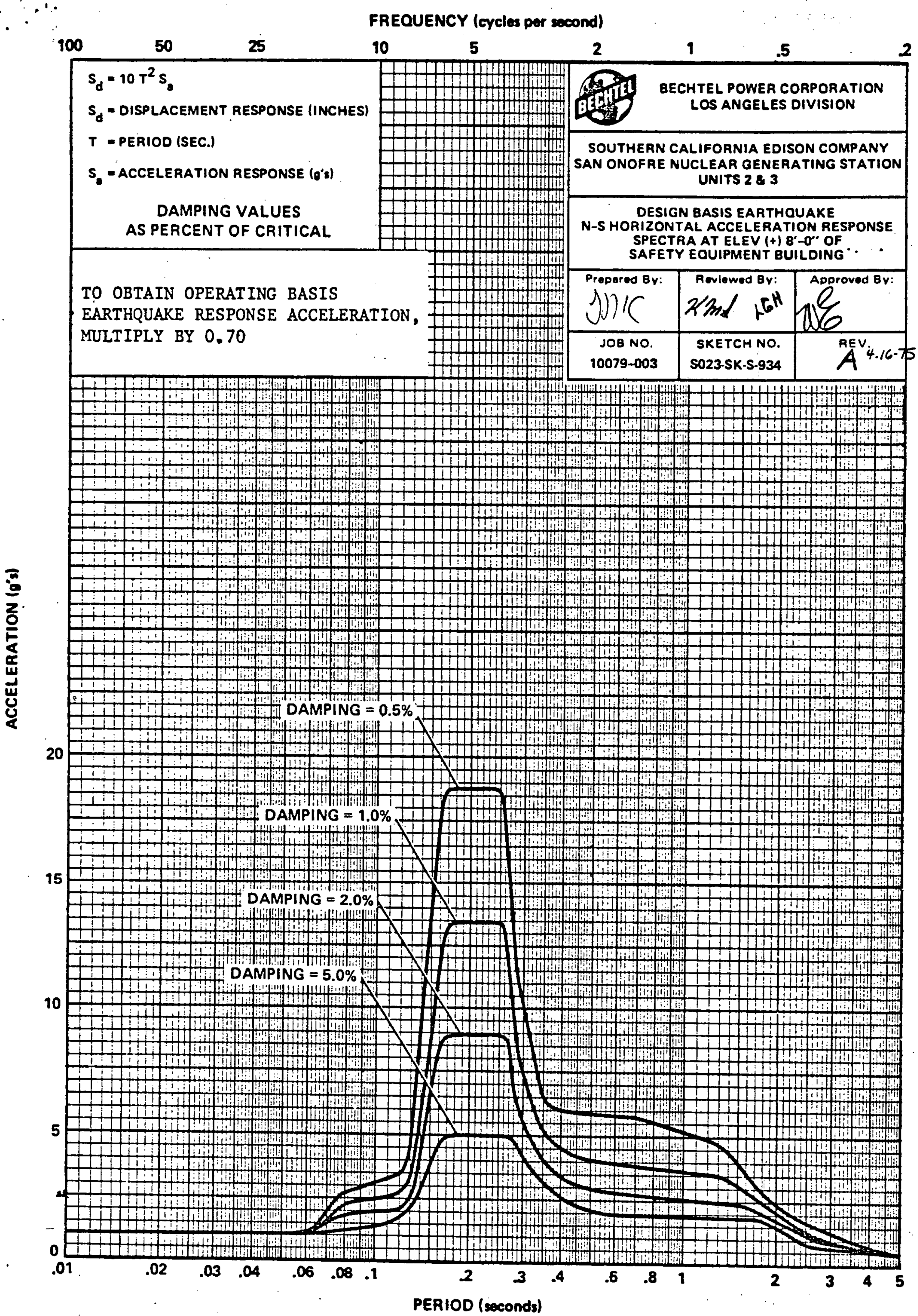
TO OBTAIN OPERATING BASIS
EARTHQUAKE RESPONSE ACCELERATION,
MULTIPLY BY 0.70

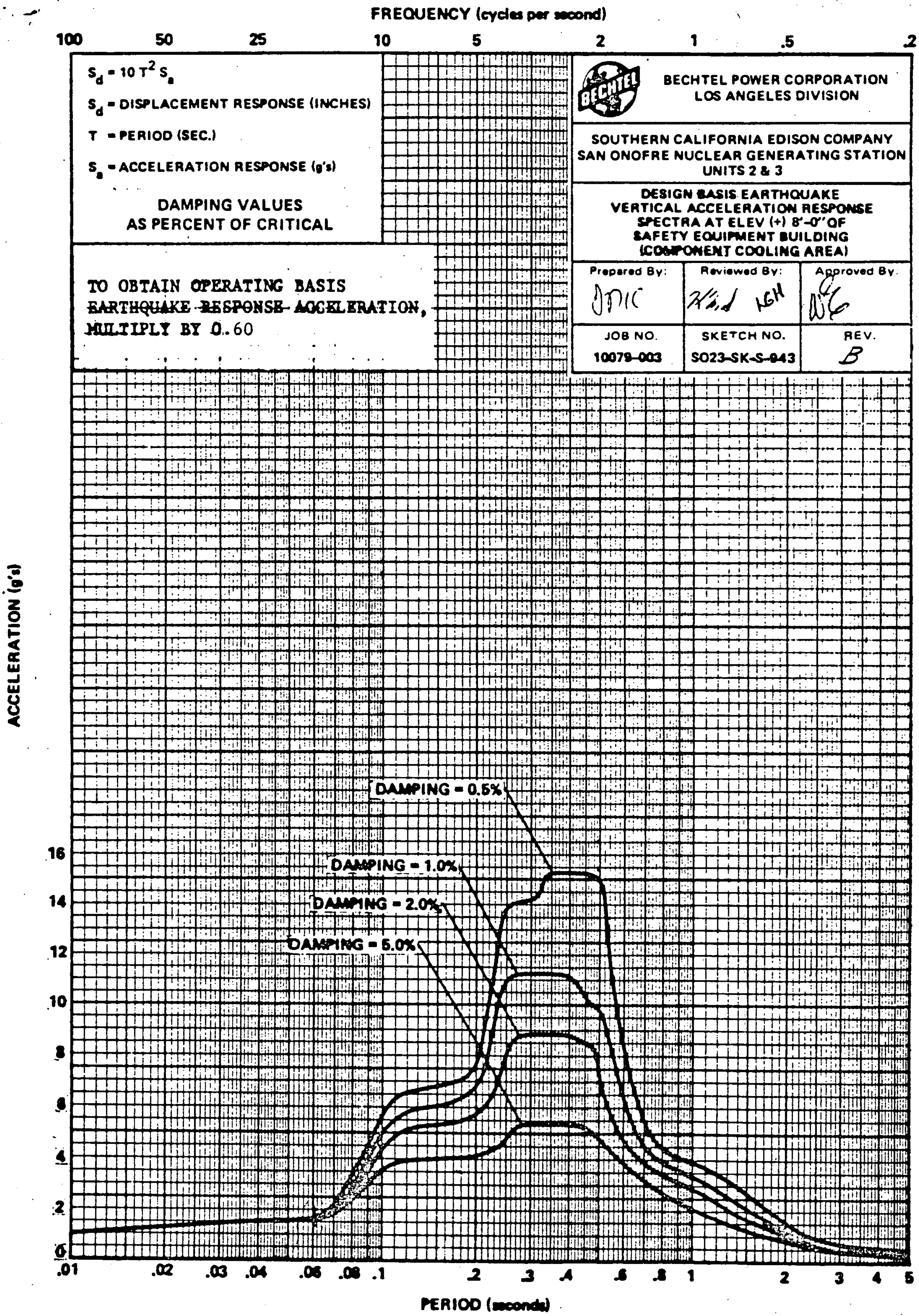
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION

SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3

DESIGN BASIS EARTHQUAKE
N-S HORIZONTAL ACCELERATION RESPONSE
SPECTRA AT ELEV (+) 8'-0" OF
SAFETY EQUIPMENT BUILDING

Prepared By:	Reviewed By:	Approved By:
JJIC	KMd LGH	NG
JOB NO. 10079-003	SKETCH NO. S023-SK-S-934	REV. A 4-16-75




FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES AS PERCENT OF CRITICAL
TO OBTAIN OPERATING BASIS EARTHQUAKE RESPONSE ACCELERATION, MULTIPLY BY 0.60
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA AT ELEV (+) 8'-0" OF
SAFETY EQUIPMENT BUILDING
(COMPONENT COOLING AREA)
Prepared By:
Reviewed By:
Approved By:
JOB NO.
10079-003
SKETCH NO.
SO23-SK-S-943
REV.
B
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
16
14
12
10
8
6
4
2
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

APPENDIX B

FROM STRUTHERS WELLS PROPOSAL
No. 6828-L6 DATED Nov. 8, 1973

5.01.4 ENGINEERING DATA

5.01.4.1 Heat Exchanger Materials

Materials to be specified by ASME number.

Item	Component Cooling Water HX	Spent Fuel Pool HX
Shell	A-285-C	A-285-C
Shell Cover	---	---
Shell Mounting Support	A-36 or Eq.	A-36 or Eq.
Shell Flange: Front/Rear	---	---
Stationary Head/Channel	A-516-70	A-240 TP 304L
Channel Cover	A-516-70	A-240 TP 304L
Nozzles: Shell/Head	A-106-B	A-106-B/A-312
Nozzle Flanges: Shell/Head	A-105-II	A-105-II/A-240
Pass Partition	---	---
Channel Lining	Not Available	---
Tubes	B-111	A-249
Tube Plugs	B-164	A-479
Tube Sheet	B-402	A-240
Transverse Baffles/Support Tube Plates	A-36 or Eq.	A-36 or Eq.
Longitudinal Baffles	---	---
Tie Rods and Spacers	A-575-1020/A-214	A-575-1020/A-214
Impingement Plate	A-240 TP 304	A-240 TP 304
Lifting Lugs	A-515-70	A-515-70
Nuts and Bolts	A-193-B7	A-193-B7
Packing	---	---
Gasket	1330	Not Available
Cradle for Tube Bundle Removal	---	---

5.01.4.2 Physical Data

Item	Component Cooling Water HX	Spent Fuel Pool HX
Type: Front End Head Horiz. Shell No. of Passes Rear End Head	TEMA C TEMA E 1 TEMA C	TEMA C TEMA E 1 TEMA C
Shell Outside Dia./Thickness	62" / 1/2"	28-3/4" / 3/8"
Shell Overall Length	38'-1 3/4"	16'-10 3/4"
Tube: Quantity/O.D./BWG	2956/3/4/18	490/3/4/22
Tube: Straight or U/Length EFF.	37'-6"	16'-8"
Tube: Stationary or Floating	---	---
Liquid Volume: Shell Side Tube Side	420 Ft.^{3} 460 Ft.^{3}	46 Ft.^{3} 33 Ft.^{3}
Total Surface Area	22,062	1,624
Effective Surface Area	21,760	1,602
Minimum Clearance for Tube Replacement, Ft.-In.	38'-1 3/4"	16'-10 3/4"
Shell Connection: Size/Rating/Facing	28"/150#/RF	12"/150#/RF
Channel Conn.: Size/Rating/Facing	30"/150#/RF	10"/150#/RF
Dry Weight: 1. Shell 2. Tube Bundle*	26,700 78,800	3,800 7,500
Total Operating Weight	170,400	16,900
Shipping Dimensions and Weight	6'x8'x52'/106,300	4'x5'x21'/11,500
Manufacturer's/Size/Model No.	61-38N11-6H	28-17N11-6H

* Not Removable

5.01.4.3 Data Sheets

Bidders shall complete the attached heat exchanger data sheets and fill in the blank spaces indicated by asterisks on S023-SK-M-330-A and S023-SK-M-332-A.

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X

2. NSSS: CE — 3. A/E: Bechtel — BWR

II. Component Name: Plant Protection System Cabinet

1. Scope: [X] NSSS [ ] BOP

2. Model Number: None — Quantity: 1

3. Vendor: Electro Mechanics

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

5. Physical Description a. Appearance 4 Bay Vertical Cabinet

   b. Dimensions 150" L x 54" W x 90" H

   c. Weight 13000#

6. Location: Building: Control Area, Auxiliary Bldg.

   Elevation: 30'

7. Field Mounting Conditions [X] Bolt (No. 12, Size 1")
   [ ] Weld (Length)
   [ ]

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

   S/S: 11, 32 — F/B: 8.5
   V: Various 10-33

9. a. Functional Description: Enclosure for modules of the PPS

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

   [X] Both

10. Pertinent Reference Design Specifications: 00000-ICE-3001, Rev. 03, 1370-ICE-3001, Rev. 01

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

IV. Equipment Qualification Method: Test: With dummy loads

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Electro-Mechanics, Inc., QR-5330-1
Lab. - Wyle Laboratory Report 42836-1
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

   3. [ ] Explosive only 4. [ ] Other (Specify) ______

   5. [ ] Combination of ______

   6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
      [ ] ______
      (Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ______

   S/S = 1.0g input F/B = 1.0g input V = 0.75g input

VI. If Qualification by Test, then Complete: ______

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

2. [ ] Single Axis [X] Multi-Axis (Bi-Axial)

3. No. of Qualification Tests: OBE 5 SSE 2
   Other ______
   (Specify)

4. Frequency Range: See TRS attached

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
   [X] No*
   *TRS envelops RRS at natural frequencies

6. Input g-level Test at:

S/S = 1.15
F/B = 1.35
V = 0.85

7. Laboratory Mounting: __________

1. [X] Bolt (No. 12, Size 1") [ ] Weld (Length N/A)
[ ] __________

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

9. Test Results including modifications made: See attaches sheet

10. Other tests performed (such as fragility test, including results):

N/A

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

1. Description of Test including Results: __________

2. Method of Analysis: __________

[ ] Static Analysis
[ ] Dynamic Analysis

[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: __________ 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. Deflection	Location	Effect Upon Functional Operability

II.4 Devices Included

Nuclear Instrument
CPC Test Module
Matrix Test Module
Relay Card Rack
Bistable Control Panel
Actuation Reset Panel
Trip Path Panel
AC Distribution Panel
Power Supply Panel
RPS Initiation Relay
Sola Transformer
Cabinet Cooler Assembly
Tested separately.

VI. Test Results

NATURAL FREQUENCIES: VERTICAL various 10-33 Hz SIDE / SIDE 11, 32 Hz FRONT / BACK 8.5 Hz

ELECTRICAL OPERATION NA

PHYSICAL INTEGRITY Satisfactory with 1) loosening of power supply mounting screws and (2) slapping of cabinet doors; no other physical effects

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS 6,000 psi

MAXIMUM EXTERIOR DEFLECTION less than 3/4 inch

DYNAMIC LOAD TO MOUNTING Not Calculated

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES Less than 2.1 to 1

VI. DISCUSSION

The Plant Protection System Cabinet was tested with equivalent dummy modules in place of functional electronic modules. During the full level (SSE) tests the mounting points of the supported (dummy) modules are monitored by accelerometers whose outputs were evaluated by spectrum analysis to yield the response spectra to which the functional modules must be qualified.

Lockwashers were incorporated as a design modification to the power supply mounting screws to prevent loosening.

The cabinet was tested without the door gaskets in place. Door gaskets are a standard feature on all production cabinets and will prevent door slapping.

1c

TEST RESPONSE SPECTRA

DATA SHEET No. 1

DATE November, 197

REVISION No.

SPECTRUM FULL SCALE: ACCELERATION ☐ 10 gs ☒ 100 gs

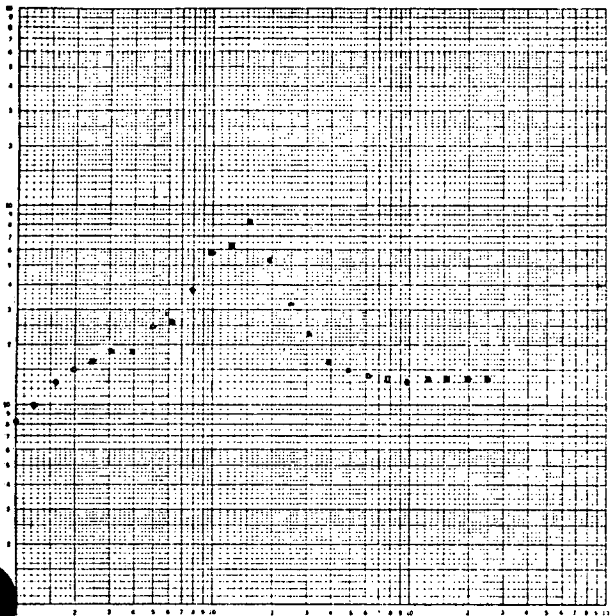
FREQUENCY ☐ 100 Hz ☒ 1000 Hz

1 % CRITICAL DAMPING

TEST PLANE	
☐ FRONT TO BACK	☐ SIDE TO SIDE
☒ FRONT TO BACK / VERTICAL	☒ SIDE TO SIDE / VERTICAL

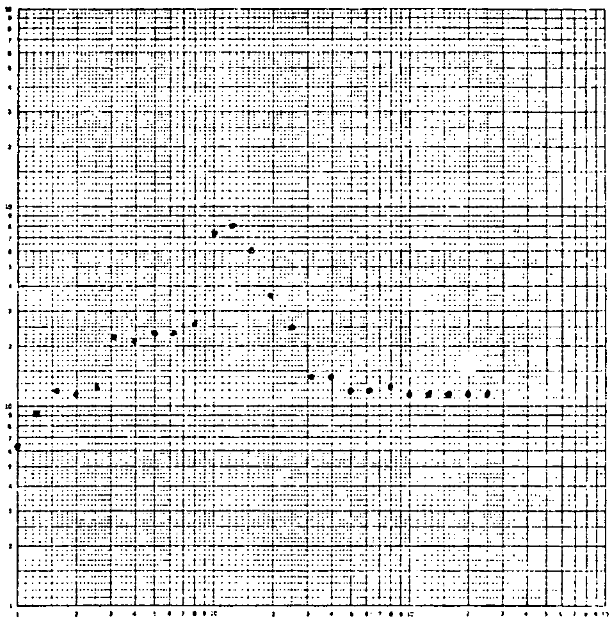
RESPONSE DIRECTION	
☒ FRONT TO BACK	☒ SIDE TO SIDE
☐ FRONT TO BACK (180° SHIFT)	☐ SIDE TO SIDE (180° SHIFT)

ACCELERATION (gs)



FREQUENCY (Hz)

ACCELERATION (gs)

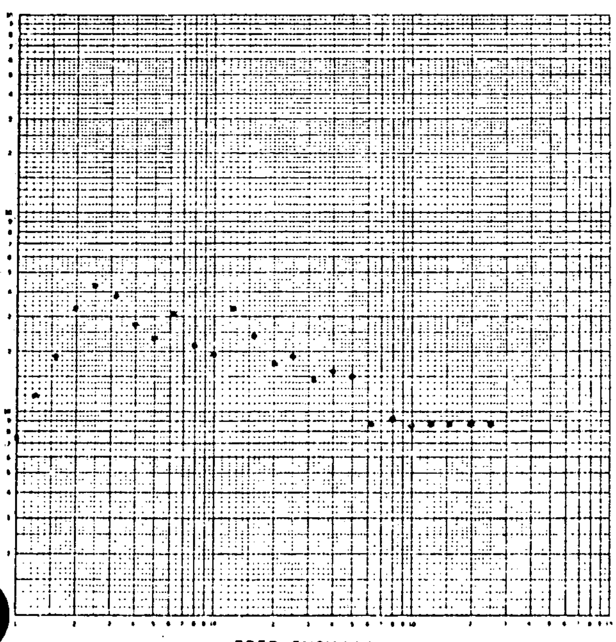


FREQUENCY (Hz)

TEST PLANE	
☐ VERTICAL	☒ SIDE TO SIDE / VERTICAL
☒ FRONT TO BACK / VERTICAL	

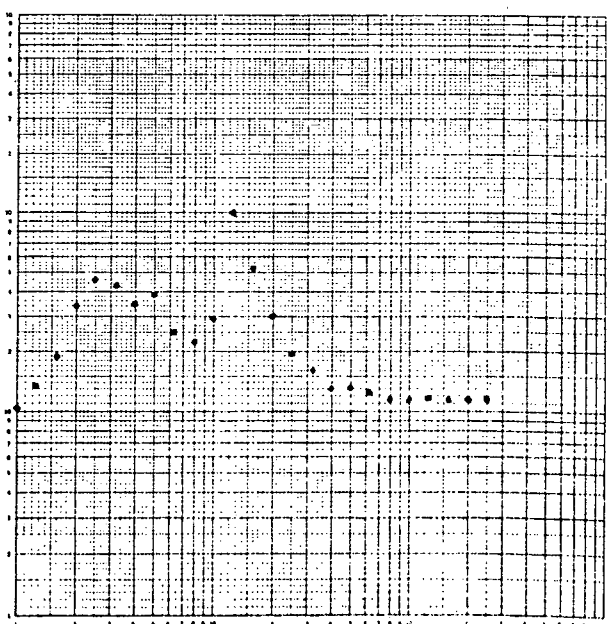
RESPONSE DIRECTION	
☒ VERTICAL	☒ VERTICAL
☐ VERTICAL (180° SHIFT)	☐ VERTICAL (180° SHIFT)

ACCELERATION (gs)



FREQUENCY (Hz)

ACCELERATION (gs)

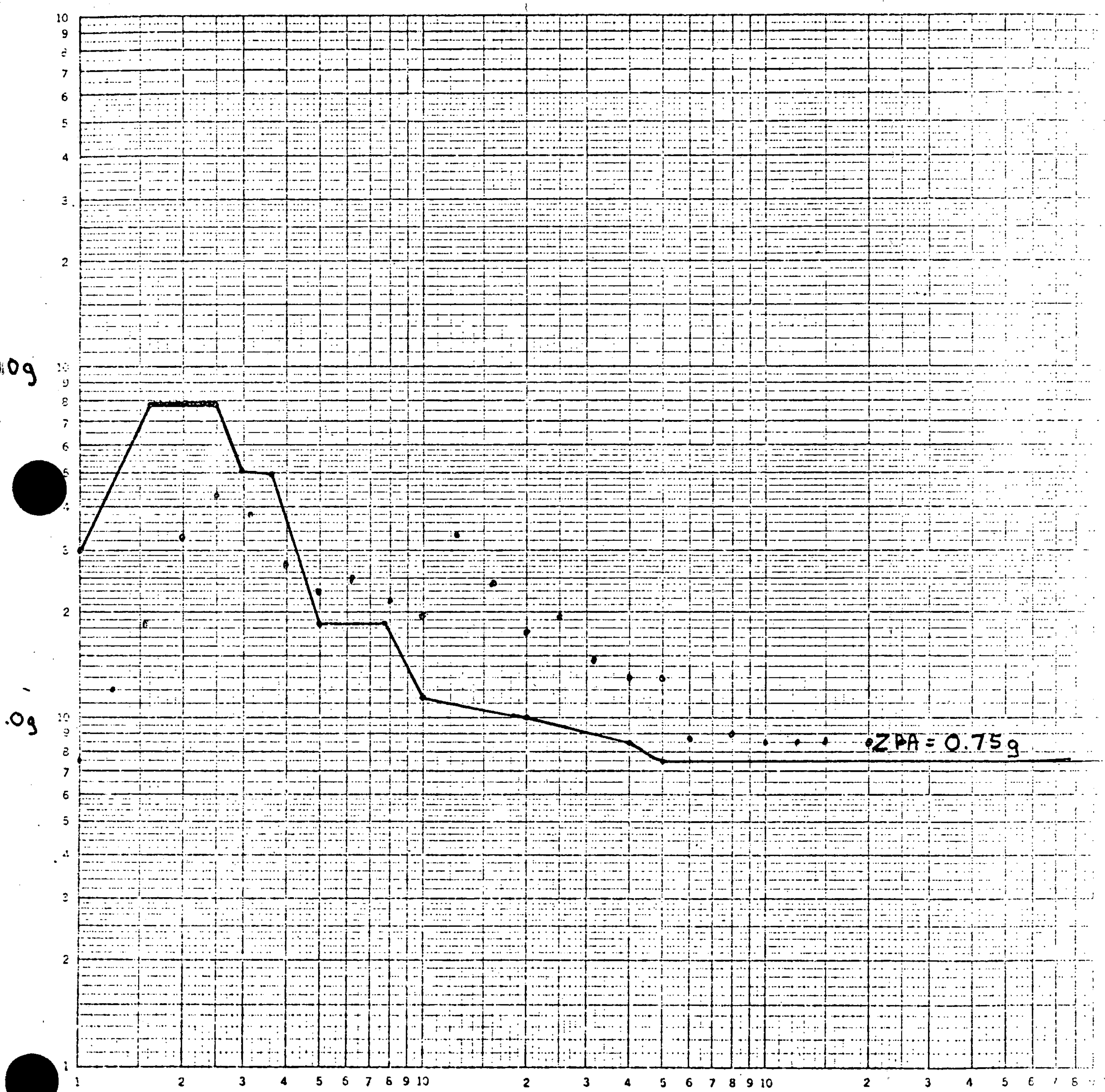


FREQUENCY (Hz)

SCE Control Room Response Spectra

San Onofre station

SSE - Vertical - 1% β



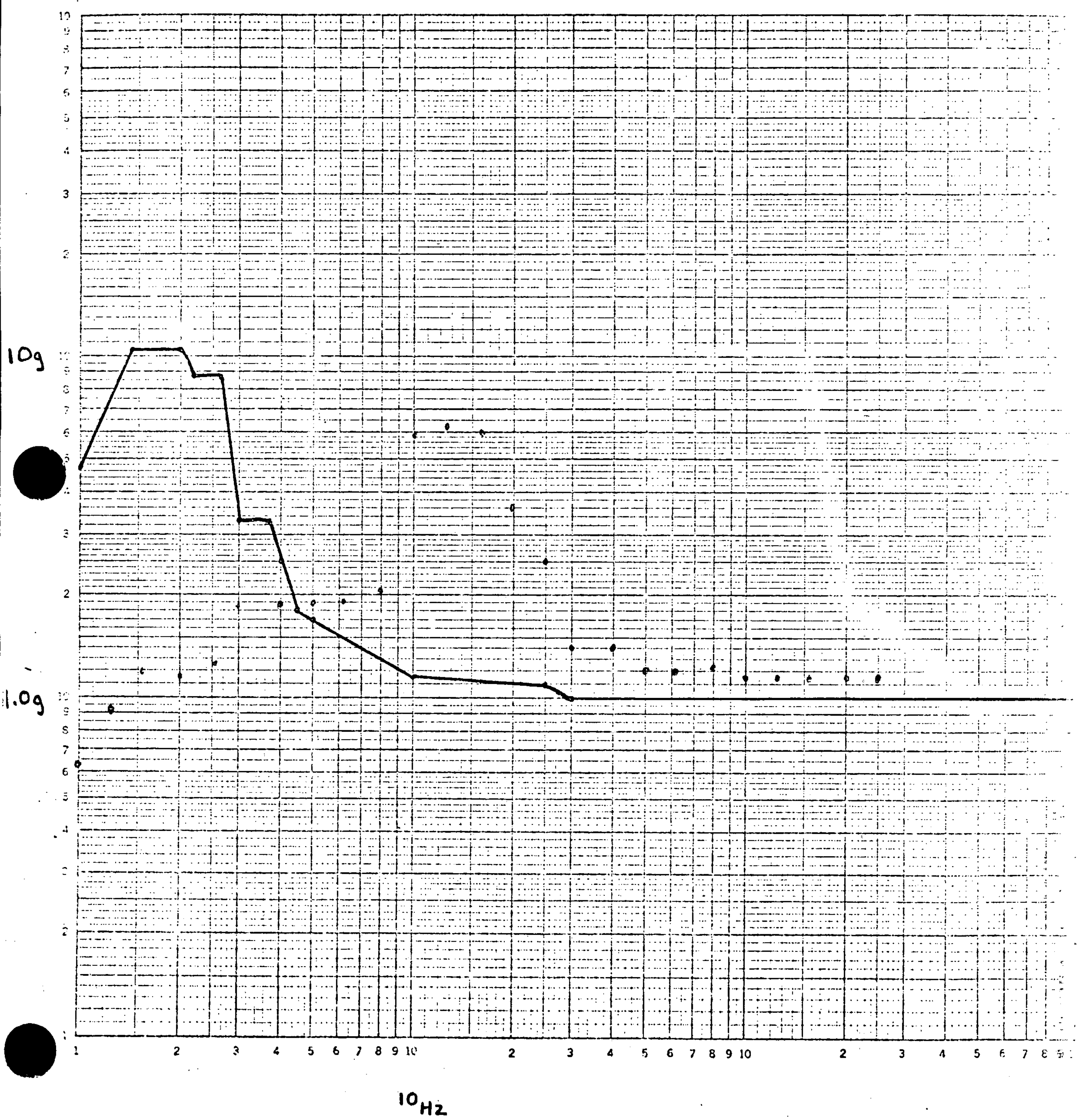
10 Hz

PPS Cabinet: minimum of two vertical tests

SCE Control Room Response Spectra

San Onofre Station

SSE - Horizontal - 1% β



[illegible] minimum of two horizontal tests (F/B & S/S)

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR

II. Component Name: Nuclear Instrument Safety Channels

1. Scope: [X] NSSS [ ] BOP
2. Model Number: ELE 304-3002 Quantity: 4
3. Vendor: General Atomic
4. If the component is a cabinet or panel, name and model No. of the devices included: NA
5. Physical Description a. Appearance Chassis-Rack Mounted
   b. Dimensions 10.8" x 24" x 24"
   c. Weight 70#
6. Location: Building: Control Area Aux. Bldg.
   Elevation: 30'
7. Field Mounting Conditions [ ] Bolt (No. 2, Size 10-32)
   [ ] Weld (Length)
   [ ]
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
   S/S: 26, 33 F/B: 32 V: 29
9. a. Functional Description: Provide neutrol flux level signal to PPS
   b. Is the equipment required for [X] Hot Standby [X] Cold Shutdown
   [X] Both
10. Pertinent Reference Design Specifications: 00000-ICE-3006 Rev. 03
    1310-ICE-3006

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

IV. Equipment Qualification Method: Test: X

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Wyle Laboratories, Report 54406
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [ ] Combination of ______

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ______
(Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ______

S/S = 2.1g input F/B = 1.8g input V = 1.0g input

VI. If Qualification by Test, then Complete: ______

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

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

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

4. Frequency Range: See TRS attached

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[X] No*

*TRS envelops RRS at natural frequencies.

6. Input g-level Test at:

   S/S = 2.1 F/B = 2.5 V = 1.8

7. Laboratory Mounting: ______

   1. [X] Bolt (No. 2, Size 10-32) [ ] Weld (Length ______)
      [X] Slides

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

    NA

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

1. Description of Test including Results: NA

2. Method of Analysis: ______

   [ ] Static Analysis [ ] Equivalent Static Analysis
   [ ] Dynamic Analysis [ ] Time-History
   [ ] Response Spectrum

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: ______ 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. Deflection	Location	Effect Upon Functional Operability

NATURAL FREQUENCIES VERTICAL	29 Hz	SIDE - SIDE	26.33 Hz	FRONT - BACK	32 Hz

ELECTRICAL OPERATION Proper Operation Verified; Outputs monitored verified operation within specified limits

PHYSICAL INTEGRITY Intact; no physical effects

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS

MAXIMUM EXTERIOR DEFLECTION

DYNAMIC LOAD TO MOUNTING

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES

VI. DISCUSSION

During resonance survey the front panel resonated and a brace was attached. Test was continued verifying brace corrected problem. No other problems encountered. This brace has been incorporated into this generic design.

The Safety Drawer was mounted to the test fixture using drawer slides identical to those in the actual permanent mounting assembly. It was connected to a power source and to the preamplifier/filter assembly, located external to the test fixture, through five hundred feet of cable. The entire mounting arrangement was intended to closely duplicate the actual field installation. Prior to performing the seismic test, the assembly was calibrated to ensure proper circuit operation. All safety related functions of the drawer were monitored by the visicorder. These included the rate of change of power signal, the log power, calibrated linear sum and all three linear subchannel outputs. In addition, proper bistable operation was verified by monitoring the "15%" bistable and "10^{-4}%" bistable on the visicorder.

The three linear subchannels received a simulated 200% power signal, from an external power source, which resulted in a ten volt output to the visicorder. The log power circuitry received a test input via the preamplifier, by placing the "LOG CALIBRATE" Switch, on the Safety Drawer front panel, in the "TEST 3" Position. This simulated a power level of approximately 10^{-2}%, and resulted in an output to the visicorder of approximately six volts. The 10^{-4}% bistable, which was energized during the test, and the 15% bistable, which was deenergized, each had a ten volt signal fed through the closed portions of their respective form C output contacts, to the visicorder input.

All monitored outputs behaved as specified prior to, during, and subsequent to the seismic test. In addition to monitoring the log output during the seismic test, the "LOG CALIBRATE" Switch was checked in all six test positions prior to and after testing. A Calibration Check was performed on the Drawer after testing, and proper operation verified.

/ 9.

TEST RESPONSE SPECTRA

DATA SHEET No. 1a

DATE March, 1977

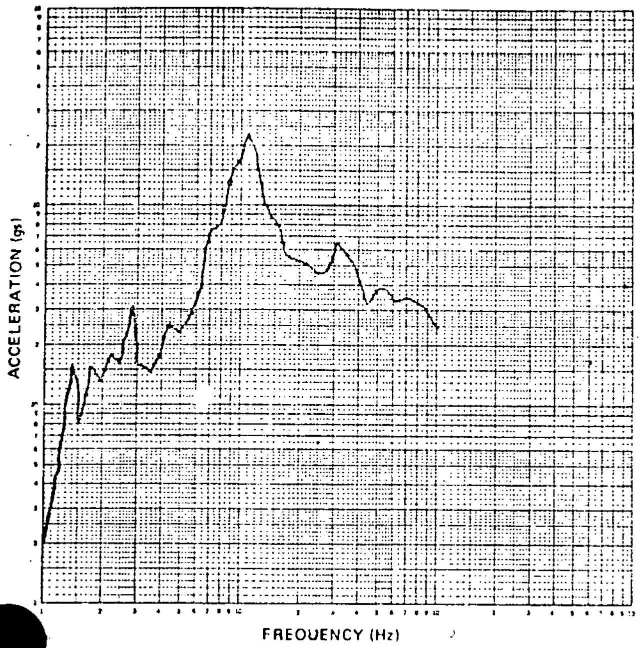
REVISION No. 01

SPECTRUM FULL SCALE: ACCELERATION ☐ 10 gs ☒ 100 gs
FREQUENCY ☐ 100 Hz ☒ 1000 Hz

1 % CRITICAL DAMPING

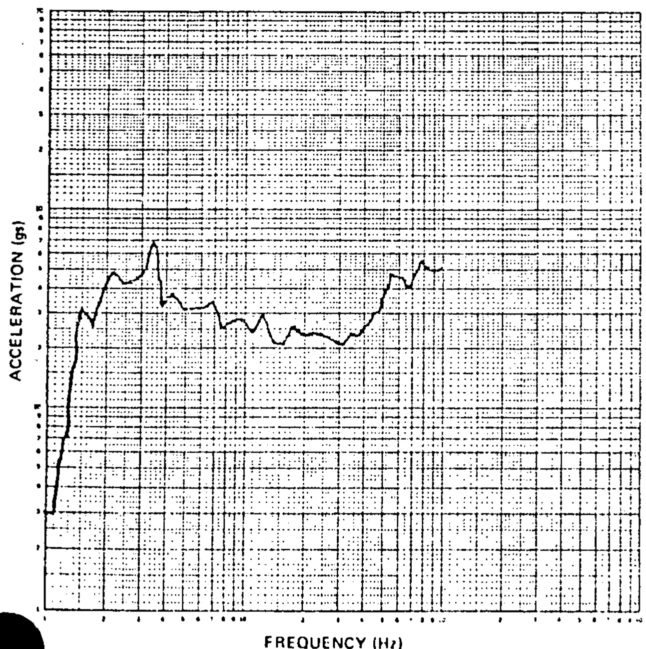
TEST PLANE: ☐ FRONT TO BACK ☒ FRONT TO BACK / VERTICAL | ☐ SIDE TO SIDE ☒ SIDE TO SIDE / VERTICAL

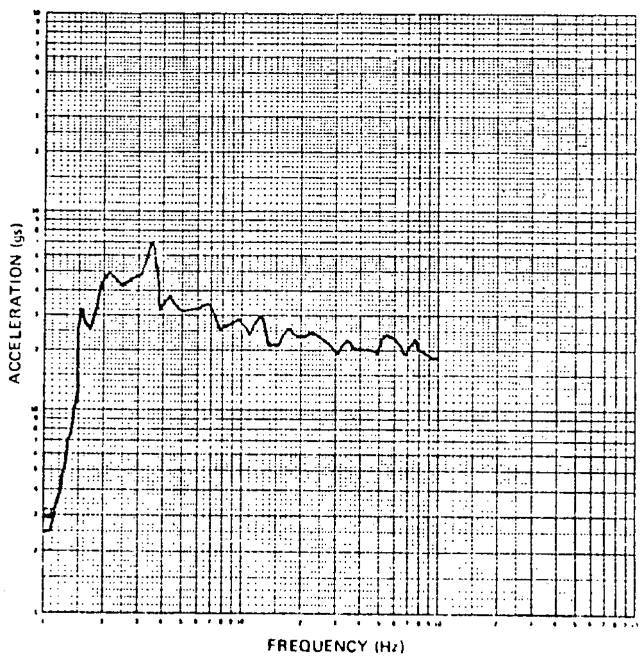
RESPONSE DIRECTION: ☒ FRONT TO BACK ☐ FRONT TO BACK (180° SHIFT) | ☒ SIDE TO SIDE ☐ SIDE TO SIDE (180° SHIFT)



TEST PLANE: ☐ VERTICAL ☒ FRONT TO BACK / VERTICAL | ☒ SIDE TO SIDE / VERTICAL

RESPONSE DIRECTION: ☒ VERTICAL ☐ VERTICAL (180° SHIFT) | ☒ VERTICAL ☐ VERTICAL (180° SHIFT)





CL 0090234 (9/75) BACK

N I SAFETY CHANNEL DRAWER

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

J/N
Page
Date

DAMPING 1 %

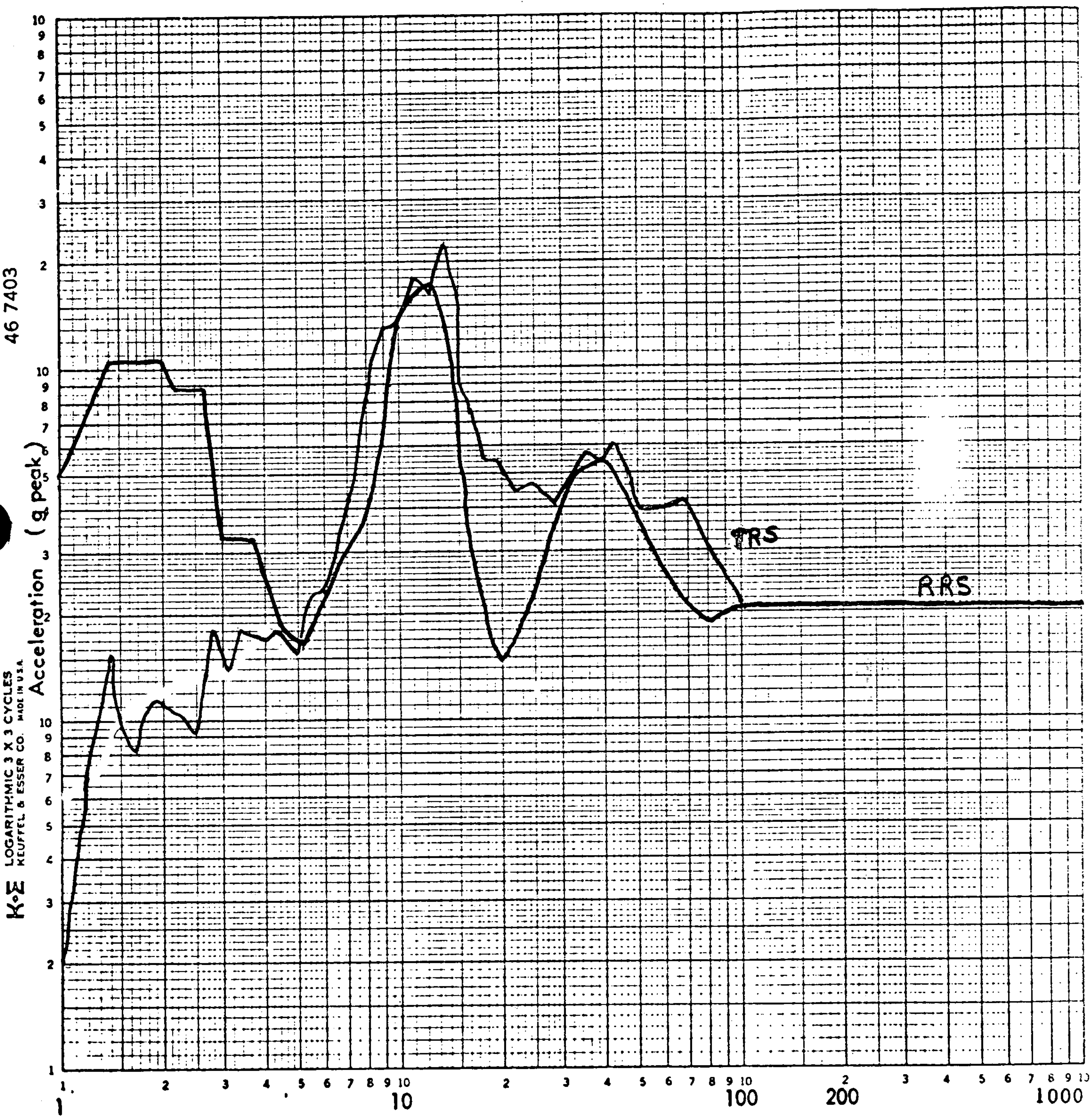


FIGURE 11

PREDICTED COMPOSITE RESPONSE SPECTRA FOR HORIZONTALLY ORIENTED SPECIMEN ACCELEROMETERS IF THE TEST RESPONSE SPECTRA OF THE HORIZONTAL CONTROL ACCELEROMETER HAD EQUALED THE HORIZONTAL REQUIRED RESPONSE SPECTRA DURING SS/V RANDOM MULTI-FREQUENCY TEST (RUN #10)

N I SAFETY CHANNEL DRAWER

J/N
Page
Date

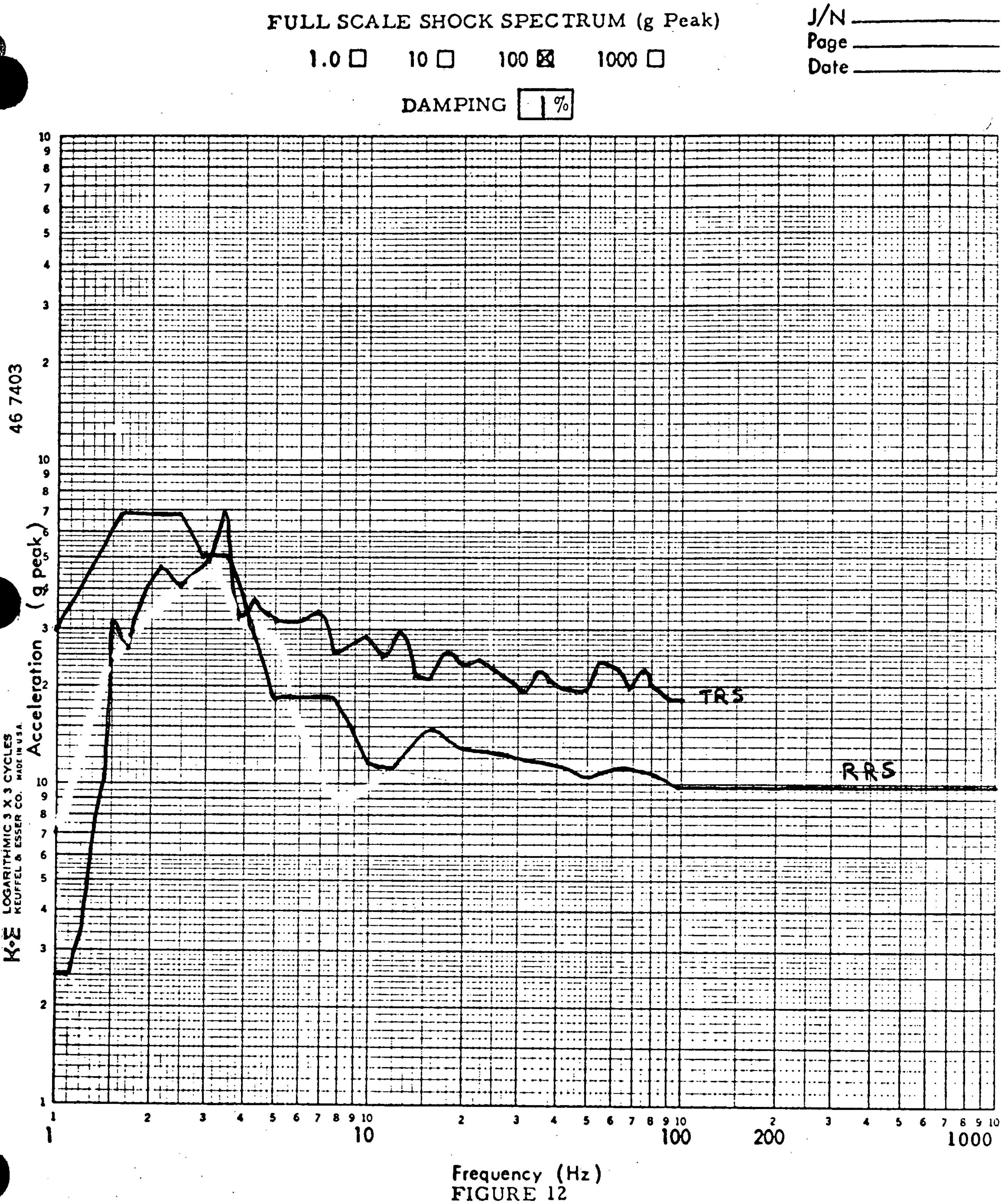


FIGURE 12

PREDICTED COMPOSITE RESPONSE SPECTRA FOR VERTICALLY ORIENTED SPECIMEN ACCELEROMETERS IF THE TEST RESPONSE SPECTRA OF VERTICAL CONTROL ACCELEROMETERS HAD EQUALED THE VERTICAL REQUIRED RESPONSE SPECTRA DURING SS/V RANDOM MULTI-FREQUENCY TEST (RUN #13)

N I SAFETY CHANNEL DRAWER

J/N
Page
Date

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 1%

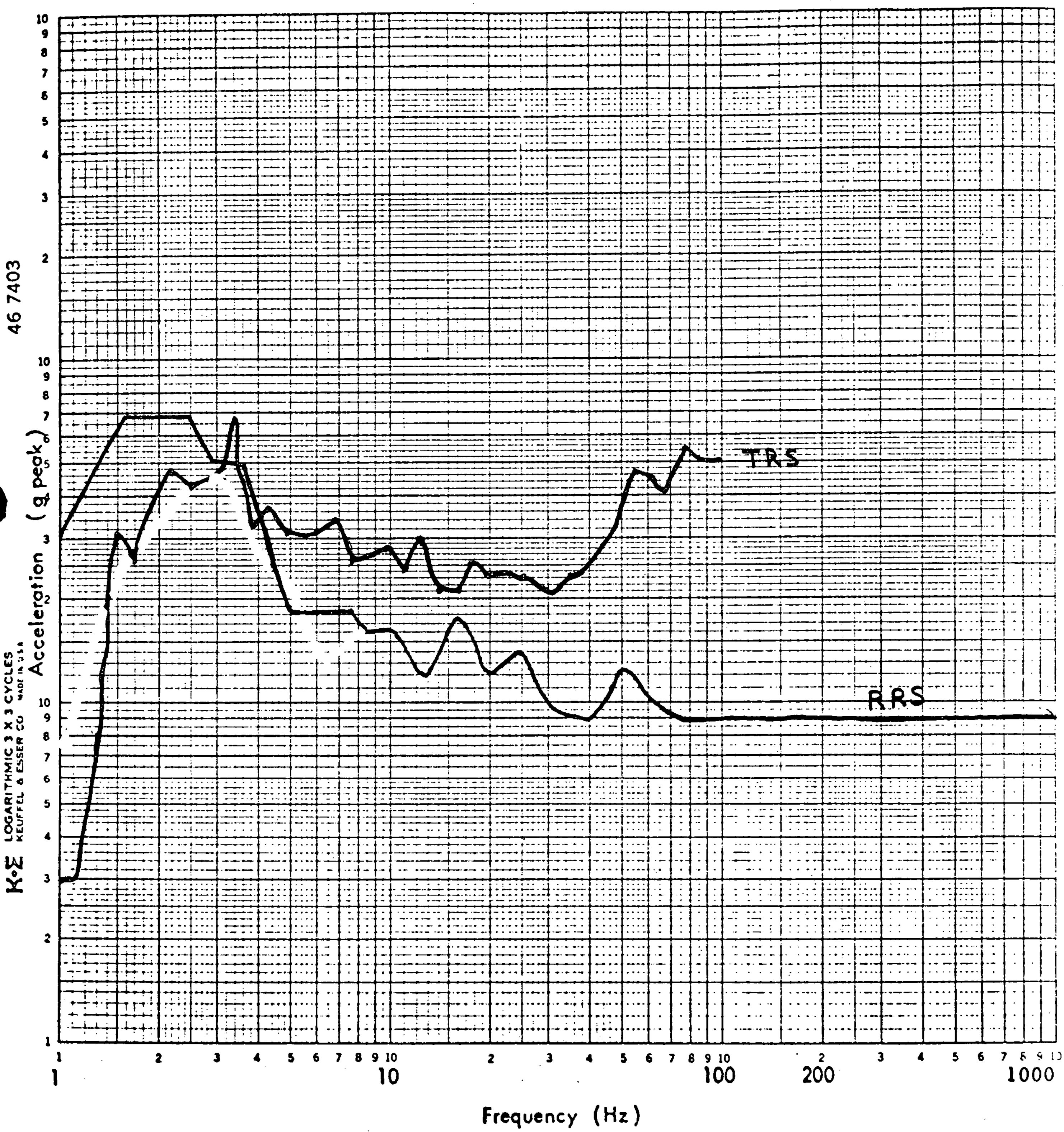


FIGURE 13

PREDICTED COMPOSITE RESPONSE SPECTRA FOR VERTICALLY ORIENTED SPECIMEN ACCELEROMETERS IF THE TEST RESPONSE SPECTRA OF VERTICAL CONTROL ACCELEROMETERS HAD EQUALED THE VERTICAL REQUIRED RESPONSE SPECTRA DURING FB/V RANDOM MULTI-FREQUENCY TEST (RUN #24)

NI SAFETY CHANNEL DRAWER

J/N
Page
Date

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 1%

FIGURE 14

PREDICTED COMPOSITE RESPONSE SPECTRA FOR HORIZONTALLY ORIENTED SPECIMEN ACCELEROMETERS IF THE TEST RESPONSE SPECTRA OF THE HORIZONTAL CONTROL ACCELEROMETER HAD EQUALED THE HORIZONTAL REQUIRED RESPONSE SPECTRA DURING FB/V RANDOM MULTI-FREQUENCY TEST (RUN #27)

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 Type:

1. Utility: Southern California Edison Company PWR X

2. NSSS: CE 3. A/E: Bechtel BWR

II. Component Name: PPS CPC Test Module

1. Scope: [X] NSSS [ ] BOP

2. Model Number: NA Quantity: 4

3. Vendor: Electro-Mechanics

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

5. Physical Description a. Appearance Two section panel assembly

   b. Dimensions 24" x 11" x 8-3/4"

   c. Weight ≅30#

6. Location: Building: Control Area Auxiliary Building

   Elevation: 30 - 0

7. Field Mounting Conditions [ ] Bolt (No. 8, Size 1/4-20)
   [ ] Weld (Length)
   [ ]

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

   S/S: >40 F/B: >40 V: >40

9. a. Functional Description: Provides CPC interface for periodic off-line testing.

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

   [X] Both

10. Pertinent Reference Design Specifications: 00000-ICI-3001, Rev. 03 1370-ICE-3001 Rev. 01

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

IV. Equipment Qualification Method: Test: X

Analysis: ____

Combination of Test and Analysis: ____

Test and/or Analysis by Electro-Mechanics Inc. QR-5330-1
(Name of Company or Laboratory & Report No.)
Lab - Wyle Laboratories Report No. 43386-1

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ____

5. [ ] Combination of ____

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ____
(Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ____

S/S = 2.4g input F/B = 2.4g V = 2.0g input

VI. If Qualification by Test, then Complete: ____

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

2. [ ] Single Axis [X] Multi-Axis (Bi-axial)

3. No. of Qualification Tests: OBE 5 SSE 2
Other ____
(Specify)

4. Frequency Range: See TRS attached

5. TRS enveloping RRS using Multi-Frequency Test [X] Yes (plot TRS on RRS graphs)
[ ] No

6. Input g-level Test at: S/S = 5.1 F/B = 5.8 V = 3.5

7. Laboratory Mounting: ____________

   1. [X] Bolt (No. 8 , Size 1/4-20) [ ] Weld (Length ____________)
      [ ] ____________

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

    NA

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 [ ] Equivalent Static Analysis
   [ ] Dynamic Analysis [ ] Time-History
   [ ] Response Spectrum

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: ________ 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. Deflection	Location	Effect Upon Functional Operability

VI TEST RESULTS

V. RESULTS

NATURAL FREQUENCIES: VERTICAL ______ SIDE / SIDE ______ FRONT / BACK ______

ELECTRICAL OPERATION: Performance as required; no output perturbations before during or after the test.

PHYSICAL INTEGRITY: Intact; no physical effects.

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS ______

MAXIMUM EXTERIOR DEFLECTION ______

DYNAMIC LOAD TO MOUNTING ______

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES ______

/6.

TEST RESPONSE SPECTRA

DATA SHEET No. 1b

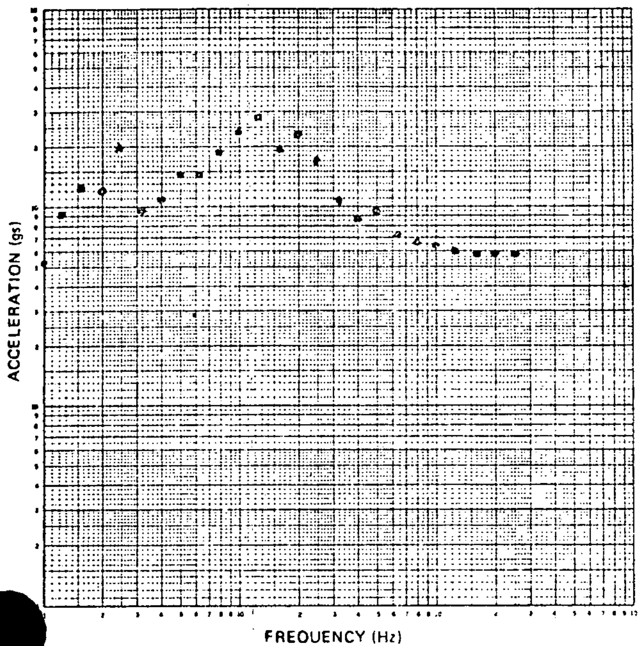
DATE MARCH 1977

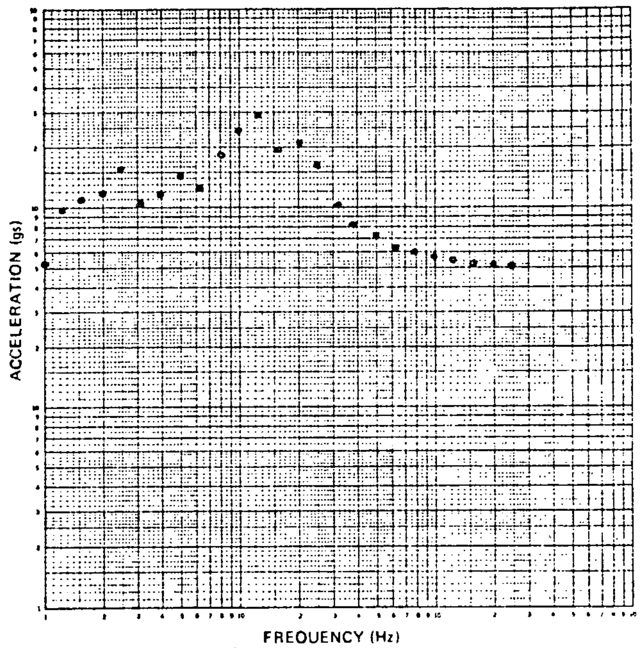
SPECTRUM FULL SCALE: ACCELERATION ☐ 10 gs ☒ 100 gs FREQUENCY ☐ 100 Hz ☒ 1000 Hz

1 % CRITICAL DAMPING REVISION No. 01

☐ FRONT TO BACK
☒ FRONT TO BACK / VERTICAL — TEST PLANE — ☐ SIDE TO SIDE
☒ SIDE TO SIDE / VERTICAL

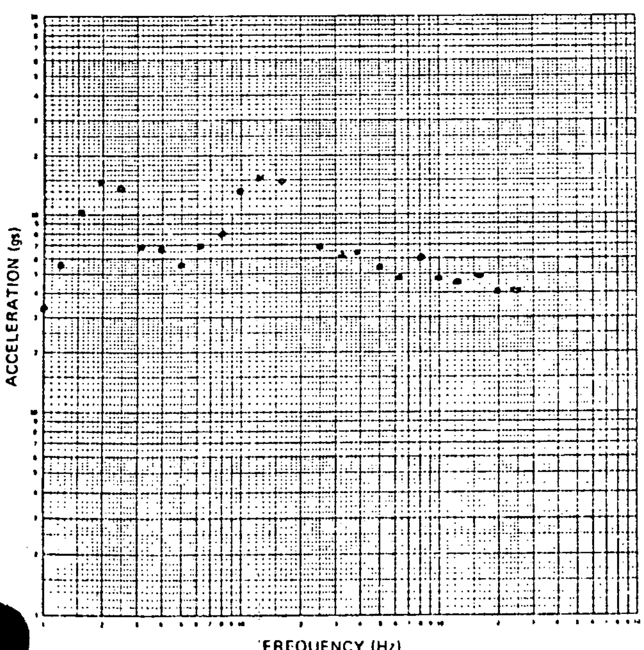
☒ FRONT TO BACK
☐ FRONT TO BACK (180° SHIFT) — RESPONSE DIRECTION — ☒ SIDE TO SIDE
☐ SIDE TO SIDE (180° SHIFT)

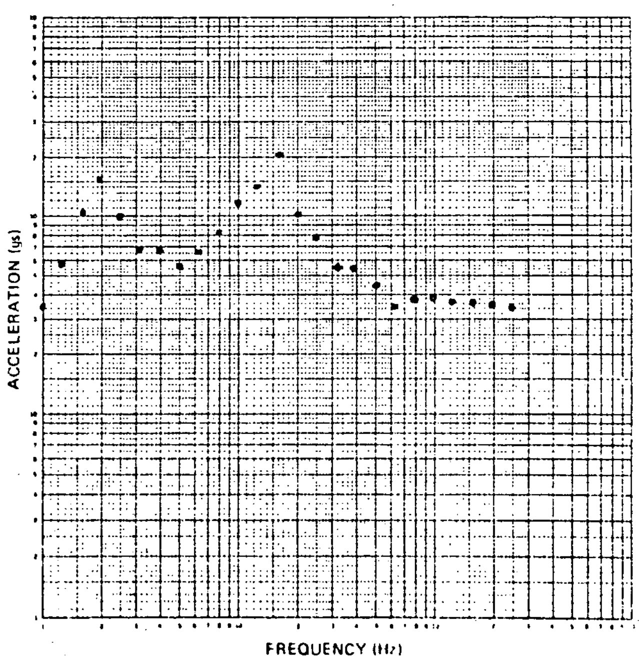




☐ VERTICAL
☒ FRONT TO BACK / VERTICAL — TEST PLANE — ☒ SIDE TO SIDE / VERTICAL

☒ VERTICAL
☐ VERTICAL (180° SHIFT) — RESPONSE DIRECTION — ☒ VERTICAL
☐ VERTICAL (180° SHIFT)



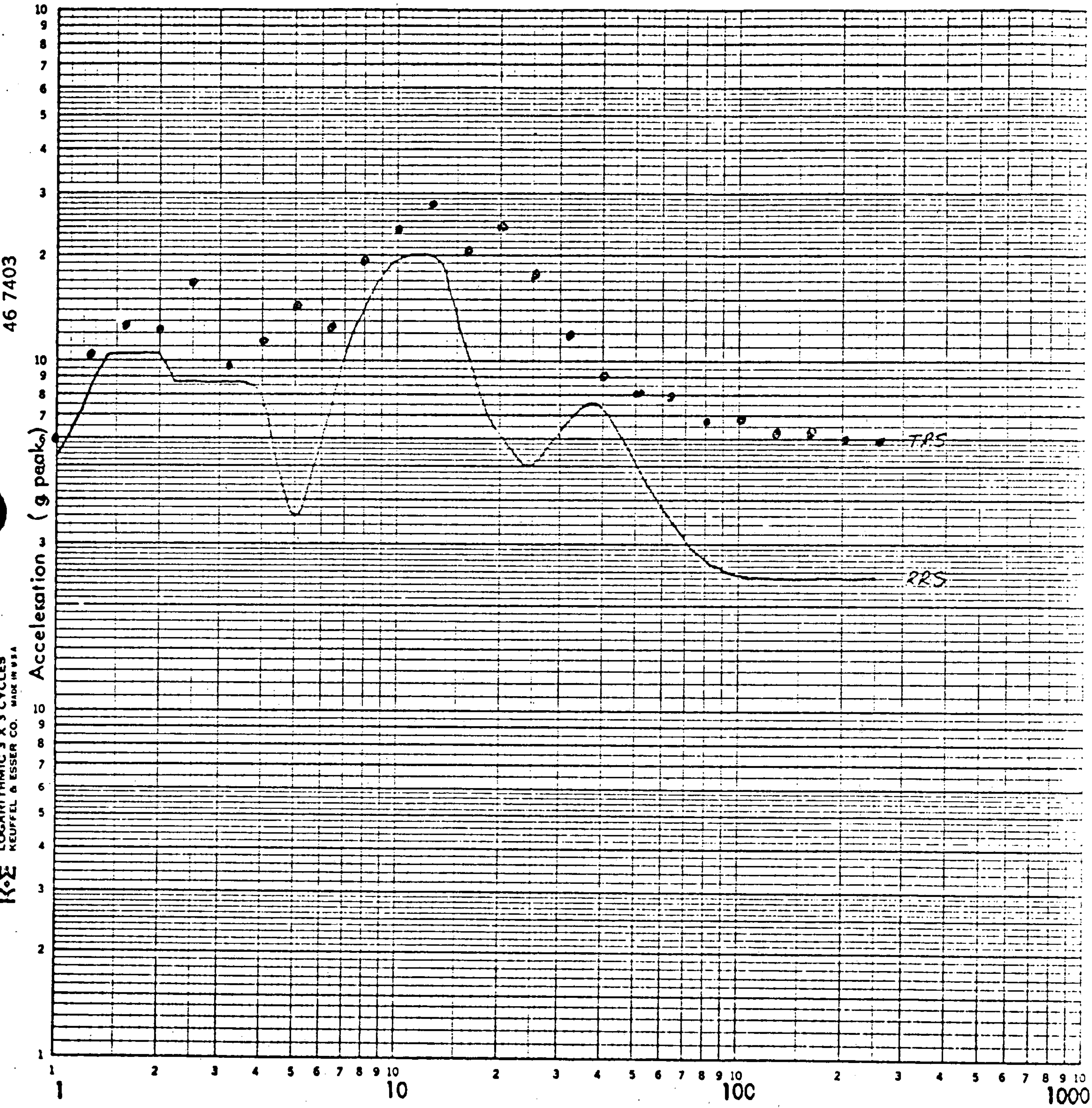


C E 00X0244 (8 75) BACK

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 1 %



AXIS FB/V

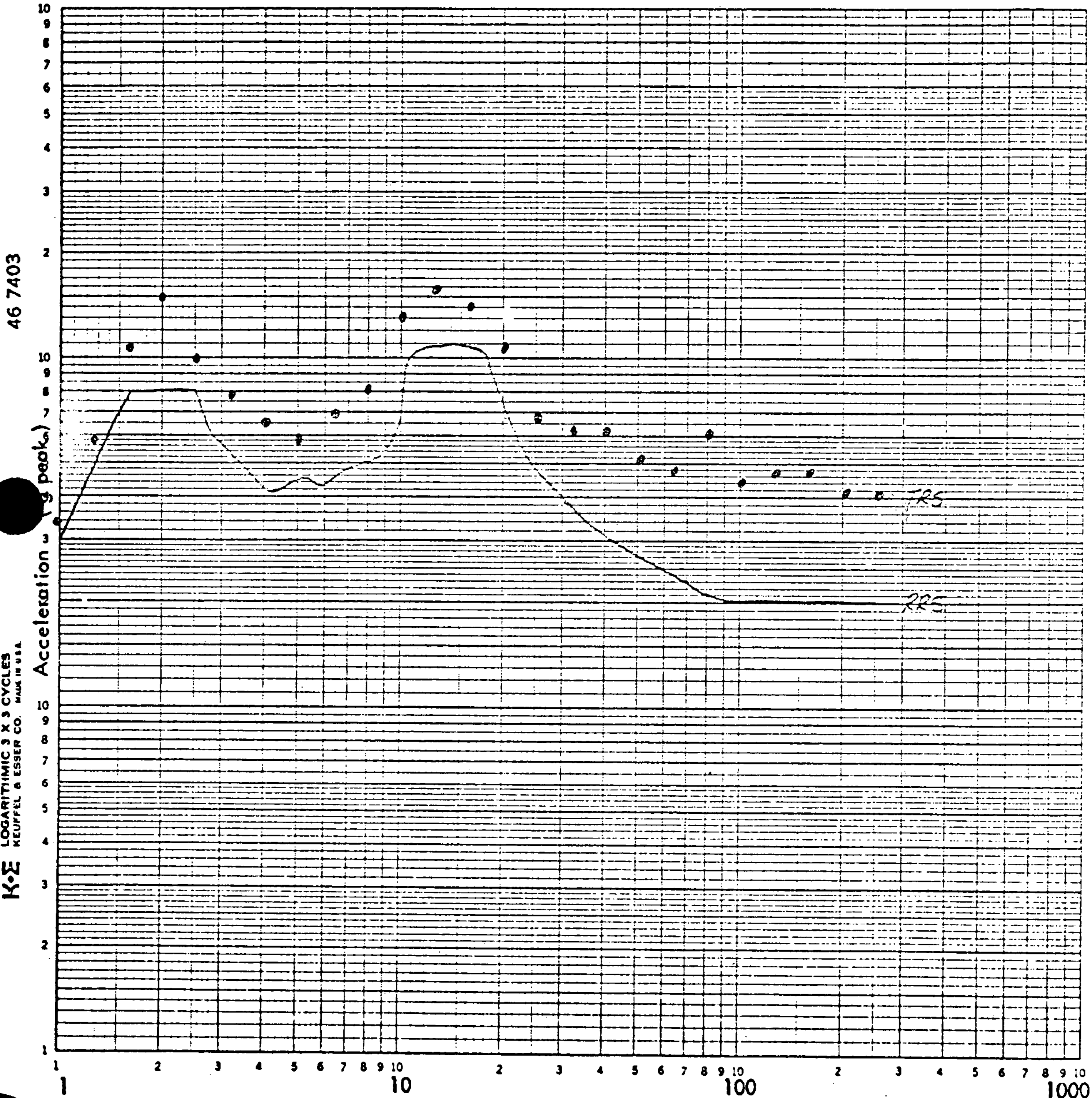
LOCATION NO. HCA

TEST RUN NO. 37

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING | 1 % |



AXIS FB/V

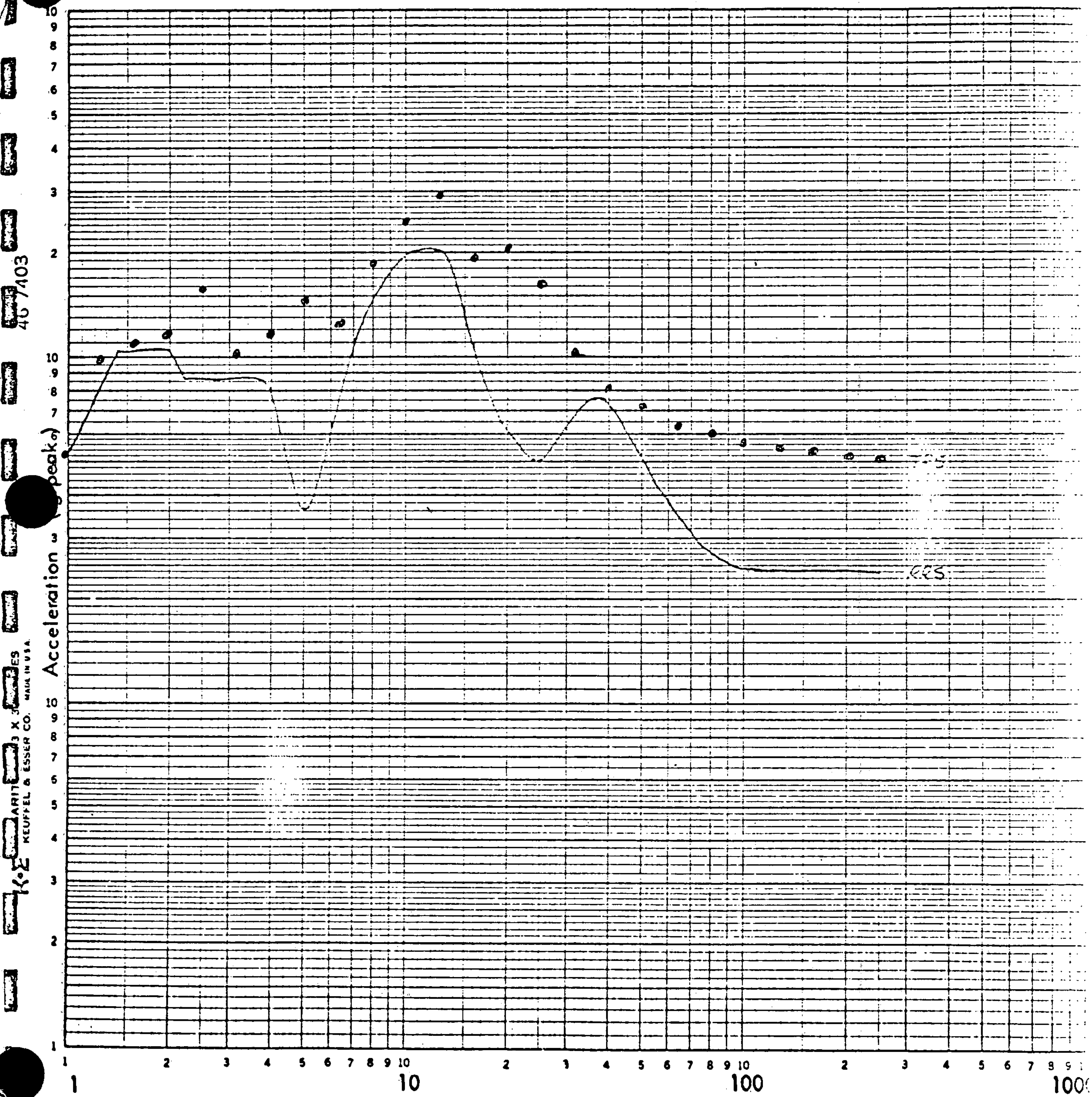
LOCATION NO. VCR

TEST RUN NO. 37

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 1 %



AXIS SS/V

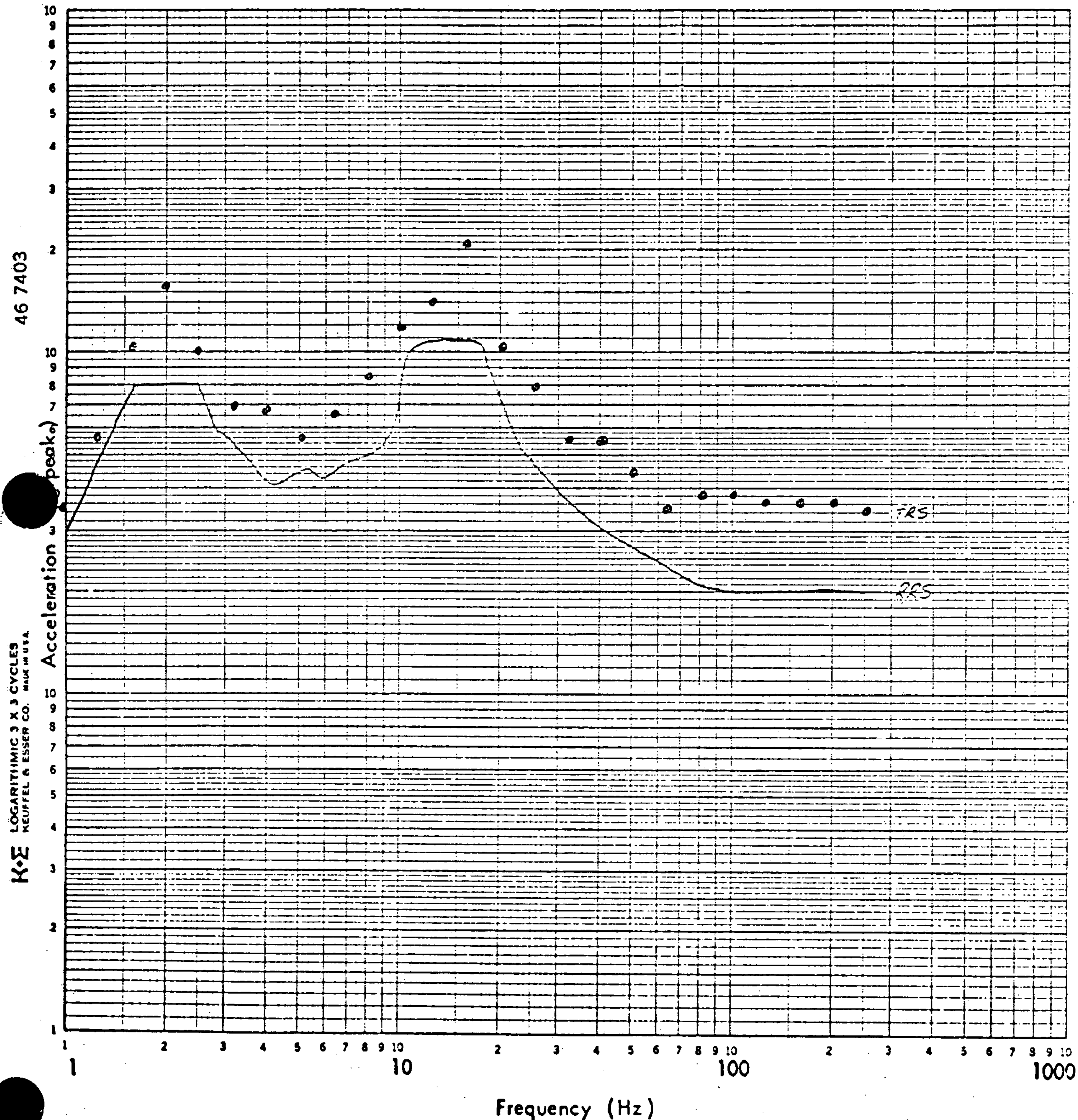
LOCATION NO. HCØ

TEST RUN NO. 1-5

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING | 1 % |



AXIS SS/V

LOCATION NO. VCP

TEST RUN NO. 45

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR

II. Component Name: PPS - Matrix Test Module

1. Scope: [X] NSSS [ ] BOP
2. Model Number: None — Quantity: 4
3. Vendor: Electro-Mechanics
4. If the component is a cabinet or panel, name and model No. of the devices included: NA
5. Physical Description a. Appearance Two section module

   b. Dimensions 24" x 8" x 5-7/32"

   c. Weight ≅40#
6. Location: Building: Control Area Aux. Bldg

   Elevation: 30'
7. Field Mounting Conditions [X] Bolt (No. 8, Size 1/4-20)

   [ ] Weld (Length)

   [ ]
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S: >40 F/B: >40

   V: >40
9. a. Functional Description: Test system for matrices and trip paths

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

   [X] Both
10. Pertinent Reference Design Specifications: 00000-ICE-3001 Rev. 03 1370-ICE-3001 Rev. 01

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

IV. Equipment Qualification Method: Test: X

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Electro-Mechanics, QR-5330-1
Lab. - Wyle Laboratories, Report No. 43386-1
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [ ] Combination of ______

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ______
(Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ______

S/S = 2.4g input F/B = 2.4g input V = 2.0g input

VI. If Qualification by Test, then Complete: ______

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

2. [ ] Single Axis [X] Multi-Ax[Bi-axial]

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

4. Frequency Range: See TRS attached

5. TRS enveloping RRS using Multi-Frequency Test [X] Yes (plot TRS on RRS graphs)
[ ] No

6. Input g-level Test at:

S/S = 5.7
F/B = 5.4
V = 3.3

7. Laboratory Mounting: ____________________

1. [X] Bolt (No. 8 , Size 1/4-20) [ ] Weld (Length ____________)
   [ ] ____________________

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

____

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 [ ] Equivalent Static Analysis
   [ ] Dynamic Analysis [ ] Time-History
   [ ] Response Spectrum

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: __________ 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. Deflection	Location	Effect Upon Functional Operability

NSSS 1C

NATURAL FREQUENCIES: VERTICAL	SIDE / SIDE FRONT / BACK
ELECTRICAL OPERATION	See Below
PHYSICAL INTEGRITY	Intact; No physical effect

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY):

MAXIMUM STRUCTURAL STRESS

MAXIMUM EXTERIOR DEFLECTION

DYNAMIC LOAD TO MOUNTING

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES

VI. DISCUSSION

The matrix test modules are used during preventative maintenance to test the six matricies within the PPS. These modules provide test output voltages to selectively energize and/or deenergize the appropriate matrix hold relays and the bistable dropout relays.

Matrix testing is accomplished by energizing a test power supply and depression of the module matrix test pushbutton. Actuation of this pushbutton will allow testing of that matrix and will prevent the remaining matrices from receiving their required test power.

Before, during, and after seismic excitation the matrix hold relays and bistable dropout relays were simulated and the matrix test module pushbutton output was continuously monitored.

During seismic excitation the only perturbation found was the chattering (1 millisecond duration) of the matrix test pushbutton normally closed contacts (NC). This is not considered a failure since the chatter will only prevent the matricies from being tested.

/c.

TEST RESPONSE SPECTRA

DATA SHEET No. 1c

DATE MARCH 1977

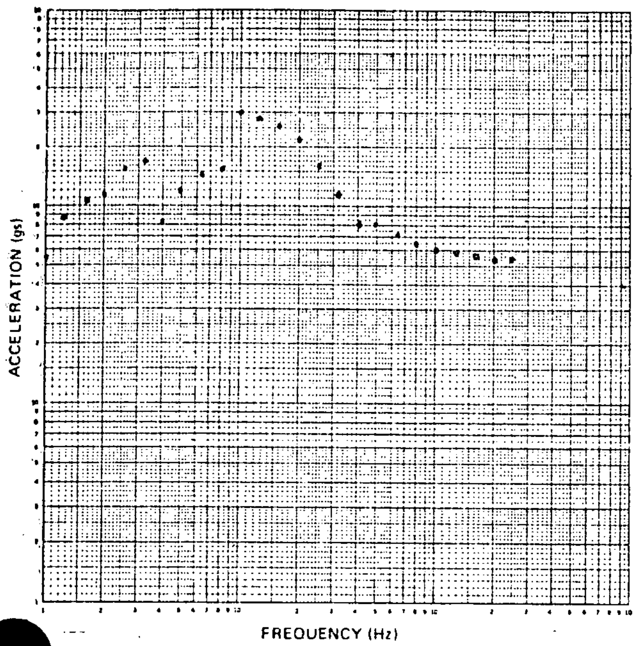
SPECTRUM FULL SCALE: ACCELERATION ☐ 10 gs ☒ 100 gs

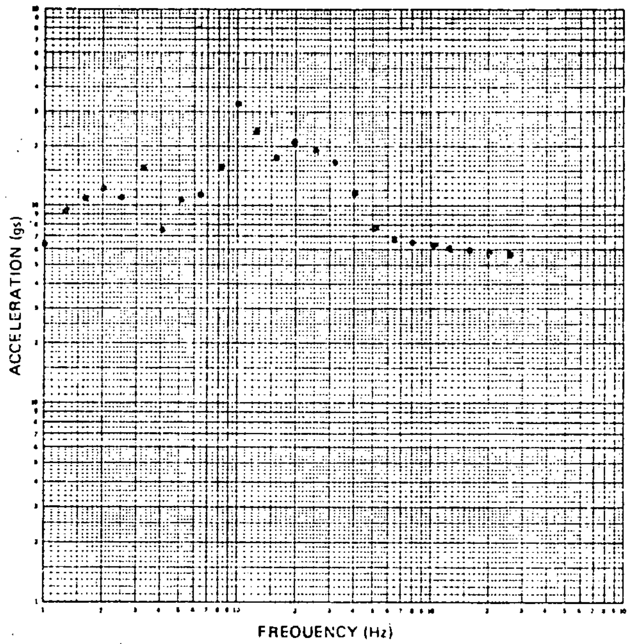
FREQUENCY ☐ 100 Hz ☒ 1000 Hz

1 % CRITICAL DAMPING REVISION No. 01

TEST PLANE: ☐ FRONT TO BACK ☒ FRONT TO BACK / VERTICAL — ☐ SIDE TO SIDE ☒ SIDE TO SIDE / VERTICAL

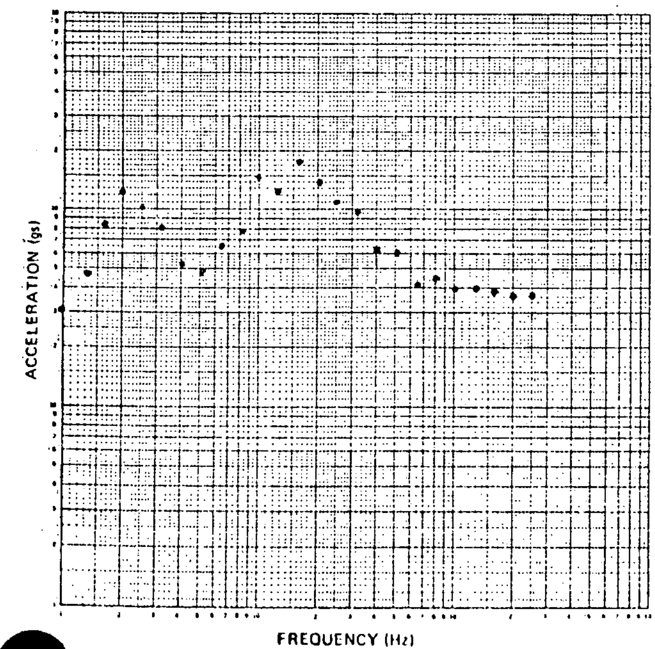
RESPONSE DIRECTION: ☒ FRONT TO BACK ☐ FRONT TO BACK (180° SHIFT) — ☒ SIDE TO SIDE ☐ SIDE TO SIDE (180° SHIFT)

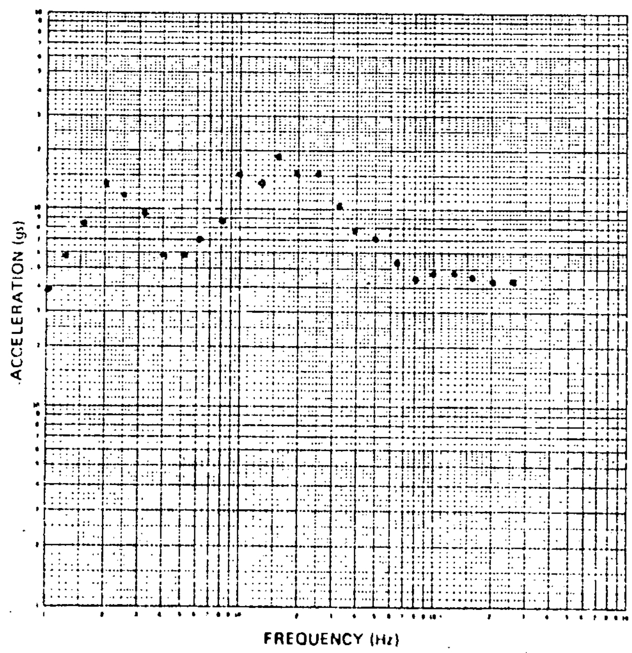




TEST PLANE: ☐ VERTICAL ☒ FRONT TO BACK / VERTICAL — ☒ SIDE TO SIDE / VERTICAL

RESPONSE DIRECTION: ☒ VERTICAL ☐ VERTICAL (180° SHIFT) — ☒ VERTICAL ☐ VERTICAL (180° SHIFT)

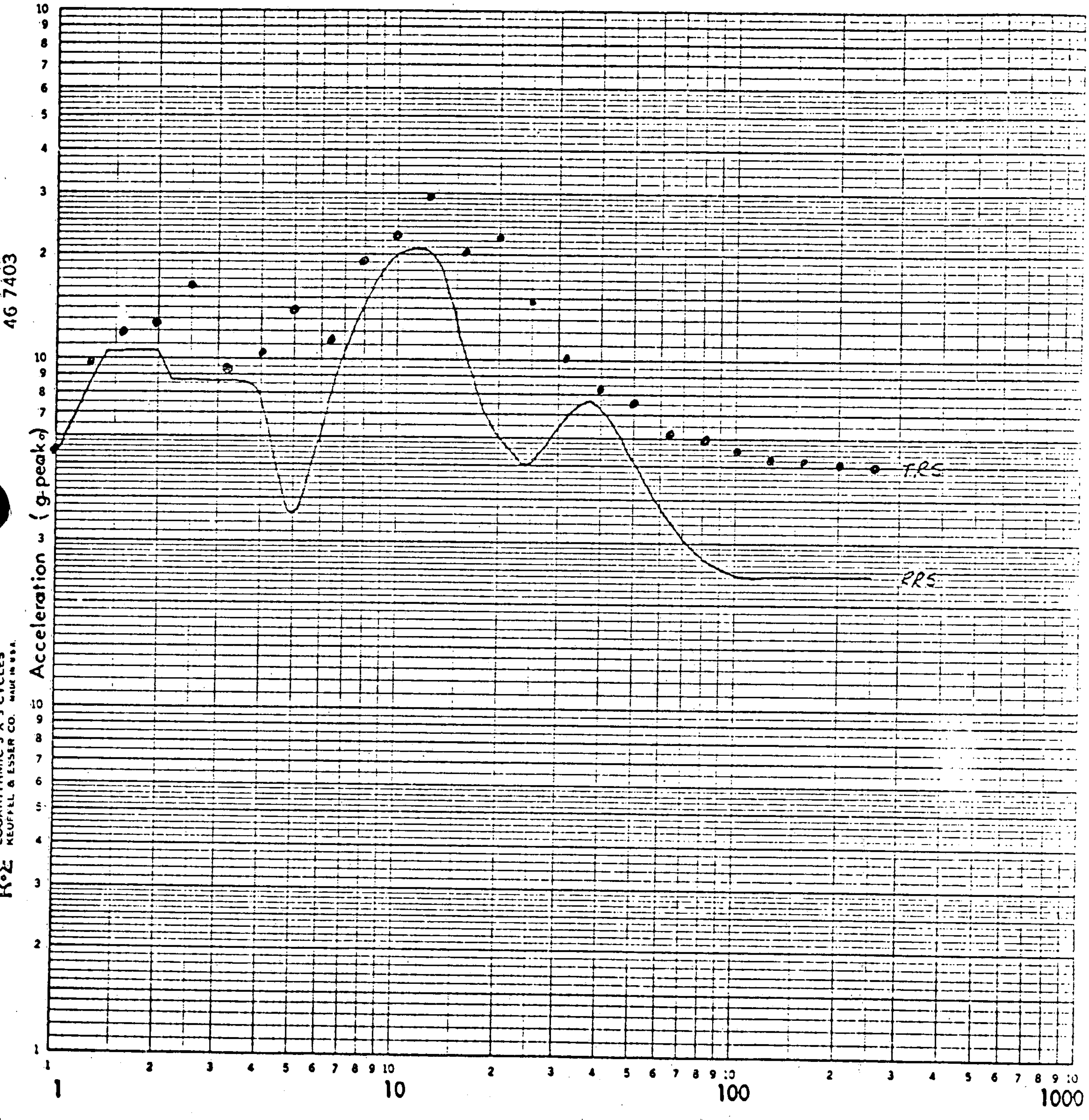




FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING | 1 % |



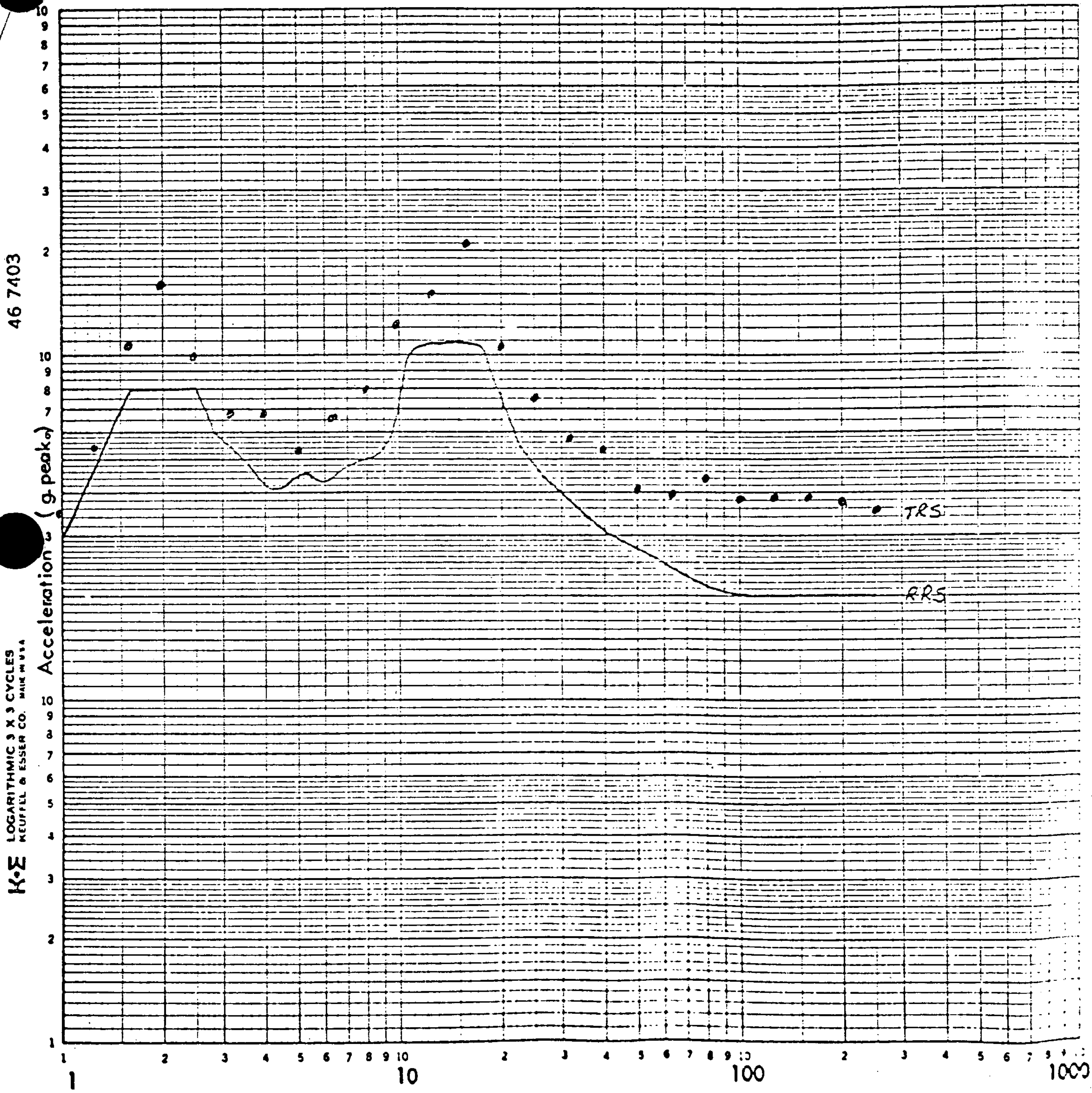
SS/V FB/V
AXIS MTM+PS RR & ARP
LOCATION NO. HCR
TEST RUN NO. 59

ge No. 266
port No. 43386-1

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING | 1 % |



AXIS SSIV MTM & PS FSIV RR & ARP

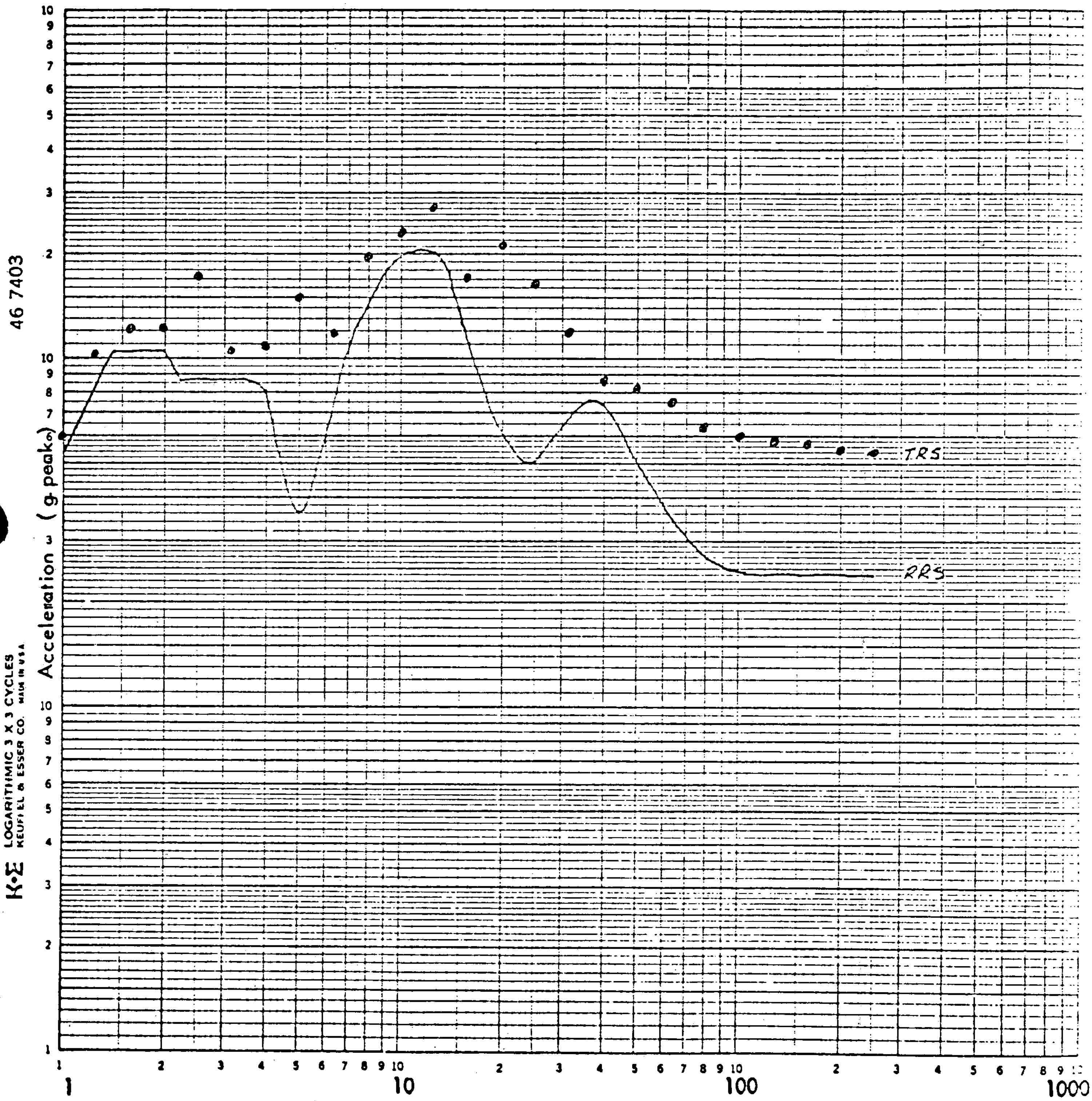
LOCATION NO. VCA

TEST RUN NO. 59

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING [1 %]



Frequency (Hz)

AXIS SS/V RR & ACP FB/V NTM & PS

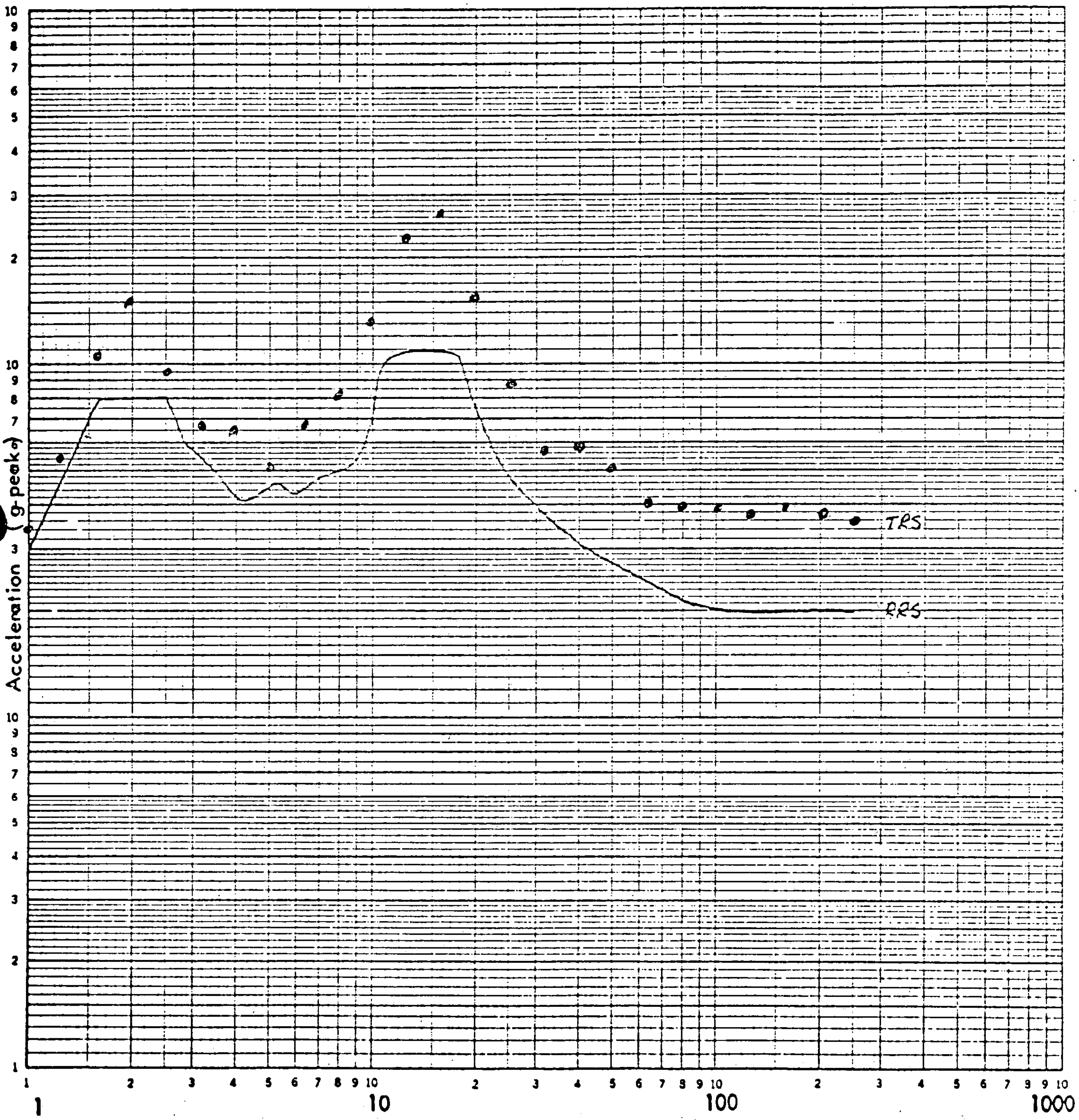
LOCATION NO. HCA

TEST RUN NO. 68

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING [1 %]



Frequency (Hz)

AXIS SSIV RR+ARP FBIV MTM&PS

LOCATION NO. VCA

TEST RUN NO. 68

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 Type:

1. Utility: Southern California Edison Company PWR X
2. NSSS: CE 3. A/E: Bechtel BWR

II. Component Name: PPS - Relay Card Rack

1. Scope: [X] NSSS [ ] BOP
2. Model Number: None Quantity: 4
3. Vendor: Electro-Mechanics
4. If the component is a cabinet or panel, name and model No. of the devices included: NA
5. Physical Description a. Appearance Two section panel assembly
   b. Dimensions 24" x 27" x 21"
   c. Weight 400#
6. Location: Building: Control Area Aux. Bldg.
   Elevation: 30'
7. Field Mounting Conditions [X] Bolt (No. 10, Size 1/4-20)
   [ ] Weld (Length)
   [ ]
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
   S/S: >40 F/B: >40
   V: >40
9. a. Functional Description: Enclosure for all relay card functions
   b. Is the equipment required for [X] Hot Standby [X] Cold Shutdown
   [X] Both
10. Pertinent Reference Design Specifications: 00000-ICE-3001 Rev. 03
    1370-ICE-3001 Rev. 01

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

IV. Equipment Qualification Method: Test: X

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Electro-Mechanics Inc. QR-5330-1
Lab. - Wyle Laboratories, Report No. 43386-1
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [ ] Combination of ______

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ______
(Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ______

S/S = 2.4g input F/B = 2.4g input V = 2.0g input

VI. If Qualification by Test, then Complete: ______

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

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

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

4. Frequency Range: See TRS attached

5. TRS enveloping RRS using Multi-Frequency Test [X] Yes (plot TRS on RRS graphs)
[ ] No

6. Input g-level Test at:

   S/S = 5.2
   F/B = 5.2
   V = 4.1

7. Laboratory Mounting: ______

   1. [X] Bolt (No. 10, Size 1/4-20) [ ] Weld (Length ______)
      [ ] ______

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

    NA

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
   [ ] Dynamic Analysis
   [ ] Equivalent Static Analysis
   [ ] Time-History
   [ ] Response Spectrum

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: ______ 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. Deflection	Location	Effect Upon Functional Operability

NSSS 1d

NATURAL FREQUENCIES VERTICAL ____ SIDE - SIDE ____ FRONT BACK ____

ELECTRICAL OPERATION Performance as required; all relays energized and deenergized properly, without contact perturbations before, during and after the test.

PHYSICAL INTEGRITY Intact; no physical effects

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS ____

MAXIMUM EXTERIOR DEFLECTION ____

DYNAMIC LOAD TO MOUNTING ____

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES ____

1d.

TEST RESPONSE SPECTRA

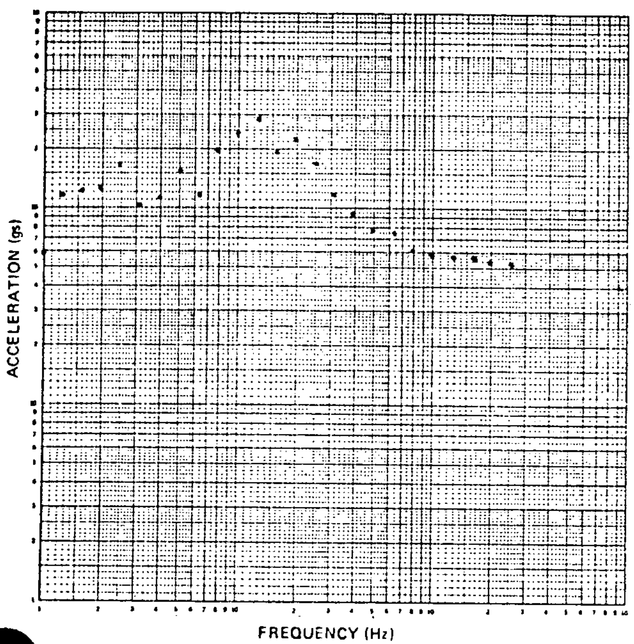
DATA SHEET No. 1d

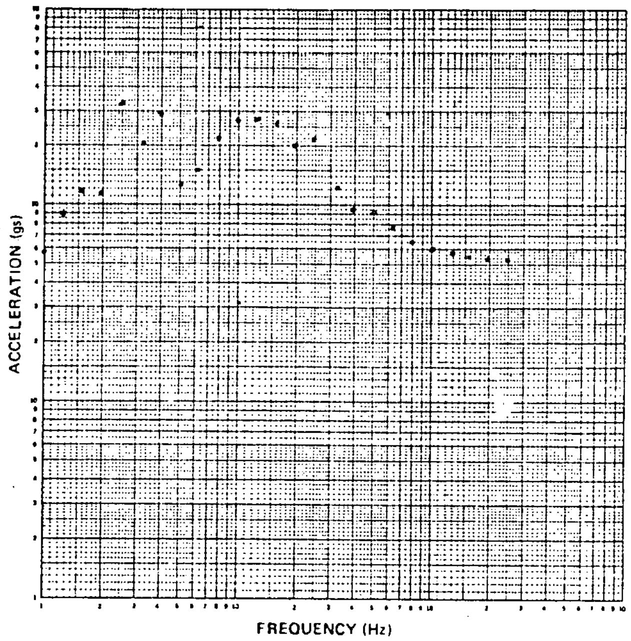
DATE MARCH 1977

SPECTRUM FULL SCALE: ACCELERATION ☐ 10 gs ☒ 100 gs
FREQUENCY ☐ 100 Hz ☒ 1000 Hz

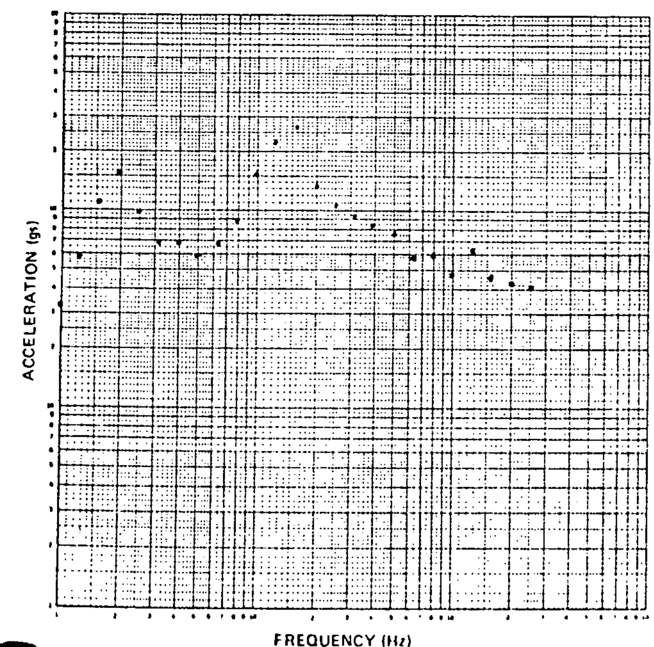
1 % CRITICAL DAMPING REVISION No. 01

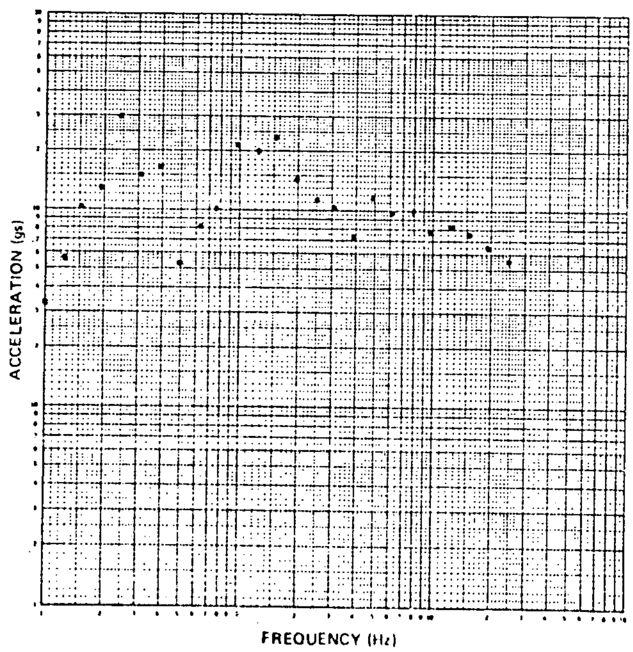
	TEST PLANE	
☐ FRONT TO BACK ☒ FRONT TO BACK / VERTICAL	TEST PLANE	☐ SIDE TO SIDE ☒ SIDE TO SIDE / VERTICAL
☒ FRONT TO BACK ☐ FRONT TO BACK (180° SHIFT)	RESPONSE DIRECTION	☒ SIDE TO SIDE ☐ SIDE TO SIDE (180° SHIFT)





☐ VERTICAL ☒ FRONT TO BACK / VERTICAL	TEST PLANE	☒ SIDE TO SIDE / VERTICAL
☒ VERTICAL ☐ VERTICAL (180° SHIFT)	RESPONSE DIRECTION	☒ VERTICAL ☐ VERTICAL (180° SHIFT)

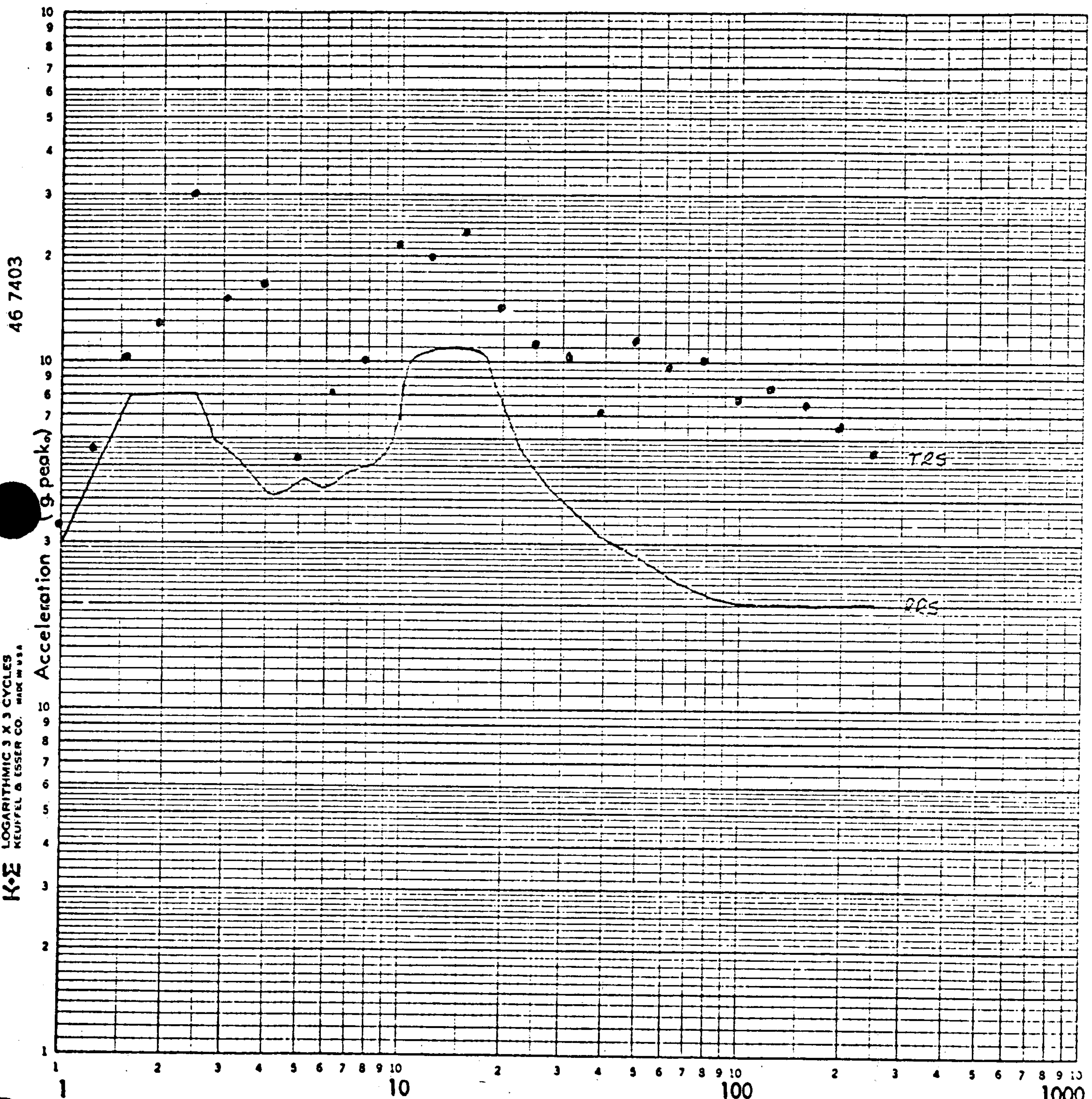




FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING | 1% |



AXIS SS/V

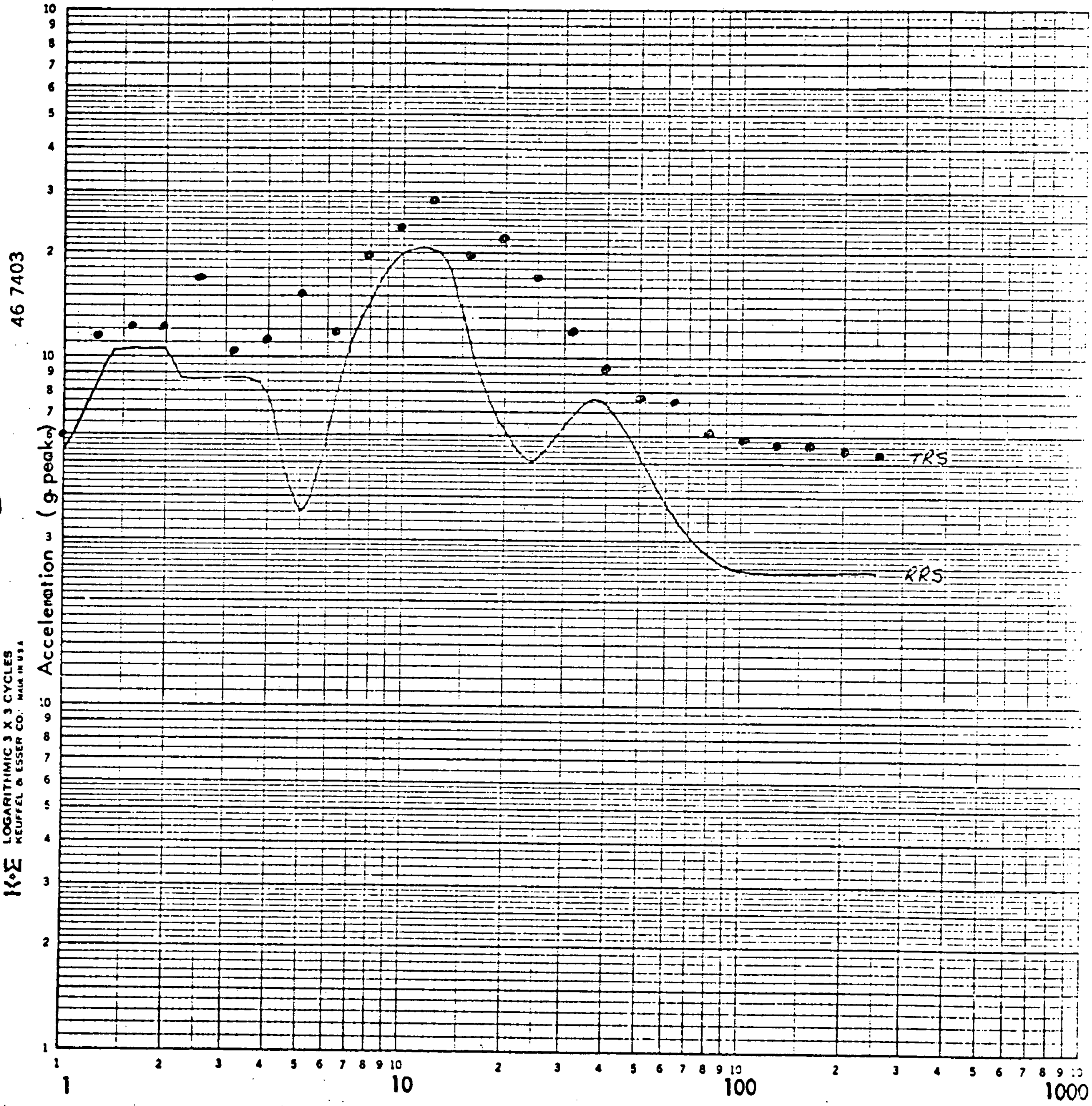
LOCATION NO. VCP

TEST RUN NO. 83

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING | 1 % |



AXIS FB/V

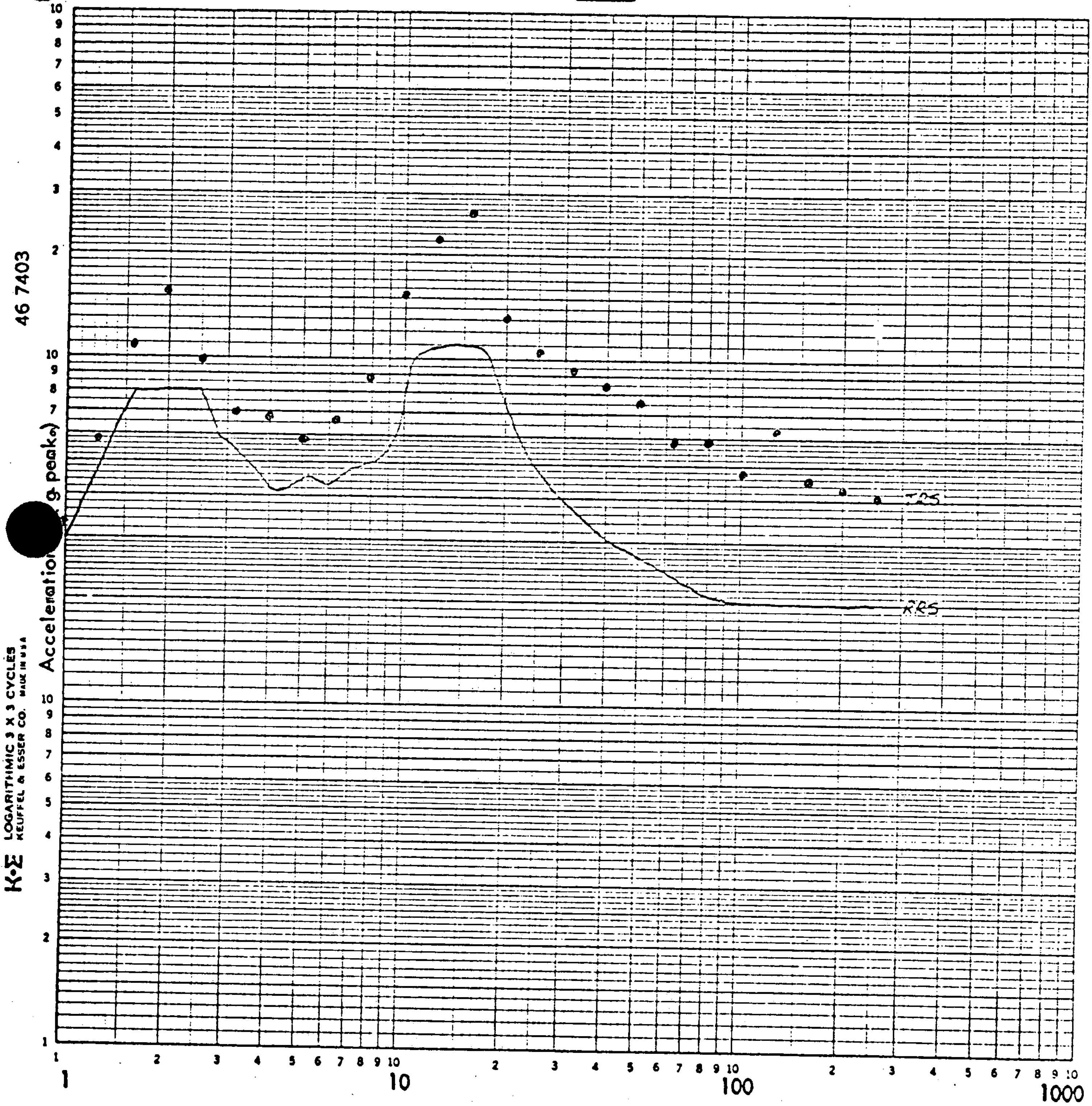
LOCATION NO. HCA

TEST RUN NO. 76

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 1 %



AXIS FB/V

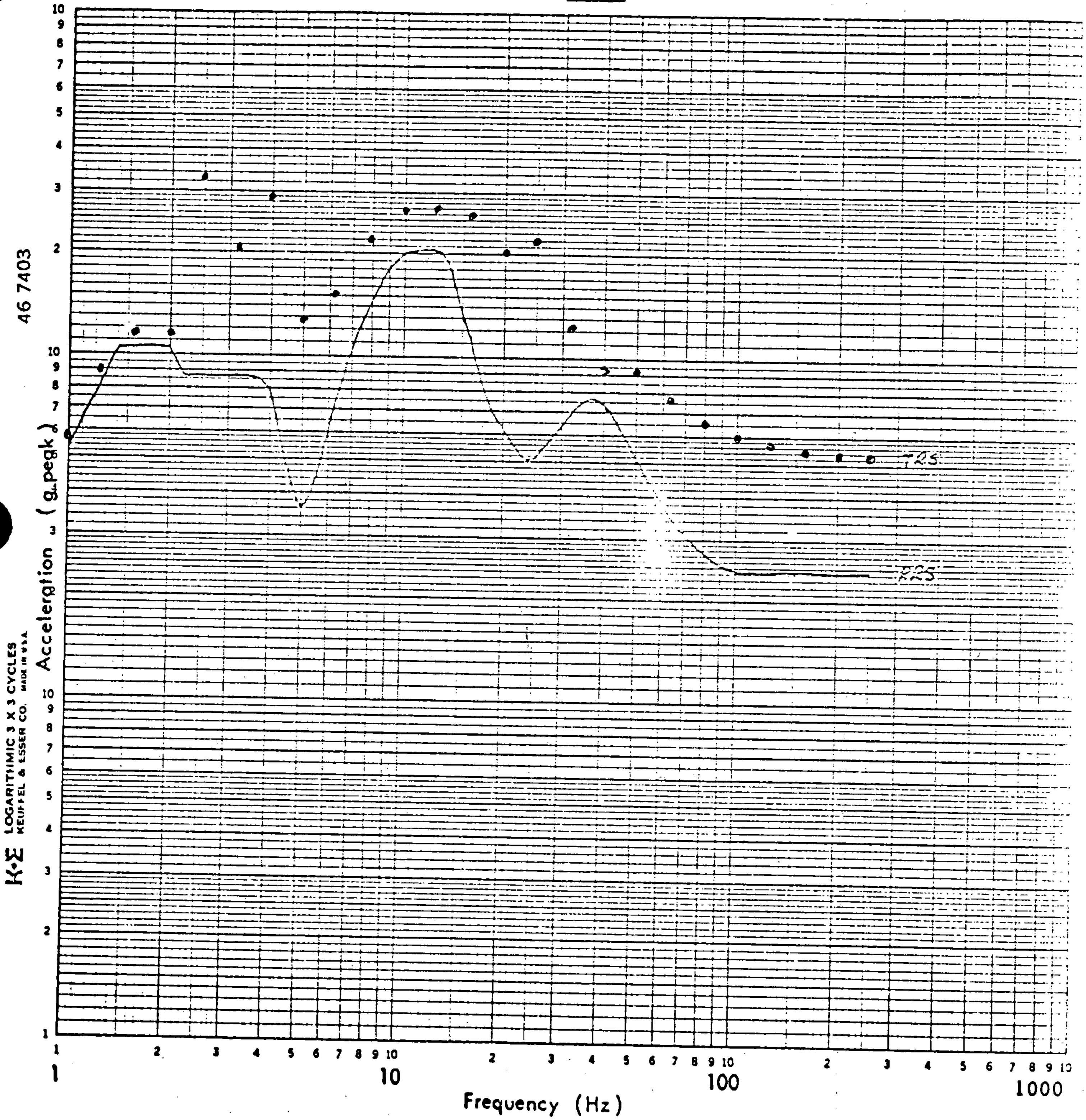
LOCATION NO. VCB

TEST RUN NO. 76

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING | 1 % |



AXIS SS/V

LOCATION NO. HCA

TEST RUN NO. 83

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X

2. NSSS: CE — 3. A/E: Bechtel — BWR

II. Component Name: PPS - Bistable Control Panel

1. Scope: [X] NSSS [ ] BOP

2. Model Number: None — Quantity: 4

3. Vendor: Electro-Mechanics

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

5. Physical Description a. Appearance Drawer Assembly

   b. Dimensions 24" x 26" x 21"

   c. Weight ≅400#

6. Location: Building: Control Area Aux. Bldg.

   Elevation: 30'

7. Field Mounting Conditions [X] Bolt (No. 8 , Size 10-32)
   [ ] Weld (Length)
   [ ]

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

   S/S: >40 — F/B: 30
   V: >40

9. a. Functional Description: Enclosure for Bistable Differential Bistable, Variable Setpoint and Bypass Functions

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

   [X] Both

10. Pertinent Reference Design Specifications: 00000-ICE-3001 Rev. 03
1370-ICE-3001 Rev. 01

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

IV. Equipment Qualification Method: Test: X

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Electro Mechanics Inc. QR-5330-1
Lab. - Wyle Laboratories , Report No. 43386-1
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [ ] Combination of ______

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ______
(Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ______

S/S = 2.4g input F/B = 2.4g input V = 2.0g input

VI. If Qualification by Test, then Complete: ______

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

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

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

4. Frequency Range: See TRS attached

5. TRS enveloping RRS using Multi-Frequency Test [X] Yes (plot TRS on RRS graphs)
[ ] No

______

6. Input g-level Test at:

S/S = 5.1
F/B = 5.4
V = 3.9

7. Laboratory Mounting: ____________________

1. [X] Bolt (No. 8 , Size 10-32) [ ] Weld (Length ____________)
[ ] ____________________

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

N/A

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

1. Description of Test including Results: NA

2. Method of Analysis: ____________________

[ ] Static Analysis
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: __________ 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. Deflection	Location	Effect Upon Functional Operability

NSSS 1-e

NATURAL FREQUENCIES VERTICAL ____ SIDE / SIDE ____ FRONT BACK ____

ELECTRICAL OPERATION Performance as required; no signal or contact perturbation; all circuit cards performed within specifications.

PHYSICAL INTEGRITY Satisfactory; vibration of a retaining rod caused the retaining rod screw to come loose. No other physical effects. See discussion Item 2 below.

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS ____

MAXIMUM EXTERIOR DEFLECTION ____

DYNAMIC LOAD TO MOUNTING ____

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES ____

VI. DISCUSSION

1. Functional Testing

   A. Variable Setpoint Card - The input signal to the card was simulated using a ramp generator. Increasing the input signal results in an increase in the trip setpoint output. Decreasing the input signal will result in the trip setpoint output remaining constant. While the input was decreased the reset function of the card was verified. A reset will result in the trip setpoint decreasing to a predetermined margin below the input signal.

   B. Bistable and Differential Bistable Comparators - A simulated input signal was used to verify proper comparator function over its full range. This consisted of initiating comparator trips at various trip setpoints and monitoring the input and setpoint voltages and output contacts.

   C. Trip Channel Bypass Switches - A voltage was applied via a loading resistor. The resulting voltage drop across the resistor was monitored to ensure proper switch operation. This verified that no inadvertant bypass would occur during the SSE.

   D. Trip Channel Bypass Relays - These relays were energized and deenergized. The output contacts were continuously monitored to verify proper operation.

   E. The above listed tests were performed prior to, during, and after seismic excitation. Evaluation of test data verified that all of these components functioned within their design specifications.

2. The bistable control panel retaining rod was taped in place to simulate a retaining clamp. Retaining clamps have been incorporated as a design modification to the bistable control panel.

1e.

TEST RESPONSE SPECTRA

DATA SHEET No. 1e

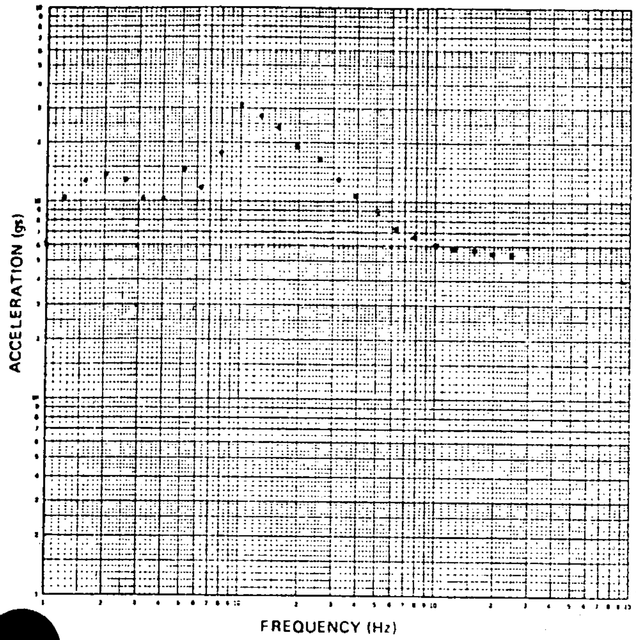
DATE MARCH 1977

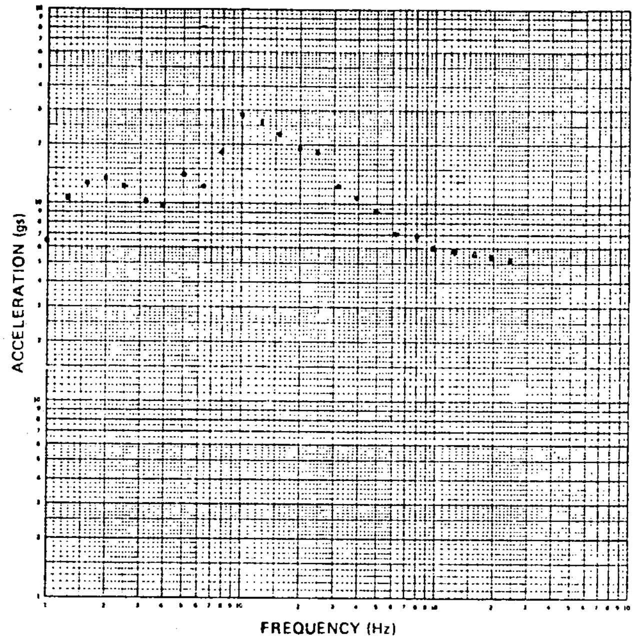
SPECTRUM FULL SCALE: ACCELERATION ☐ 10 gs ☒ 100 gs
FREQUENCY ☐ 100 Hz ☒ 1000 Hz

1 % CRITICAL DAMPING REVISION No. 01

TEST PLANE: ☐ FRONT TO BACK ☒ FRONT TO BACK / VERTICAL — ☐ SIDE TO SIDE ☒ SIDE TO SIDE / VERTICAL

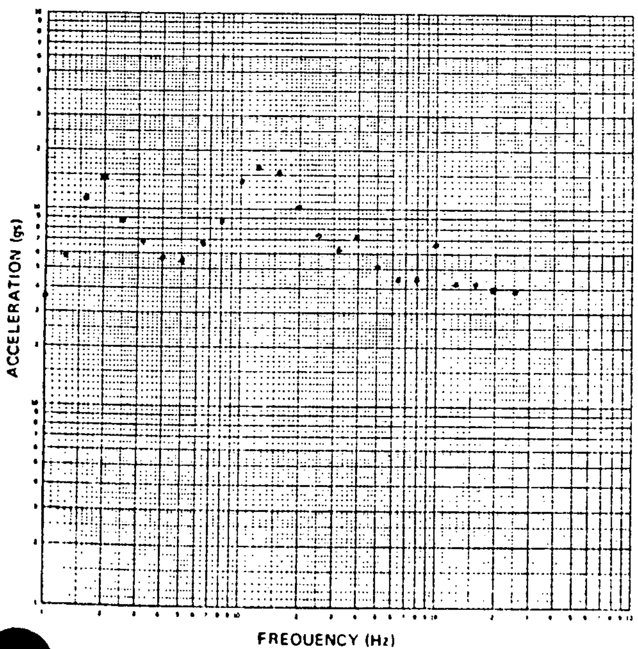
RESPONSE DIRECTION: ☒ FRONT TO BACK ☐ FRONT TO BACK (180° SHIFT) — ☒ SIDE TO SIDE ☐ SIDE TO SIDE (180° SHIFT)

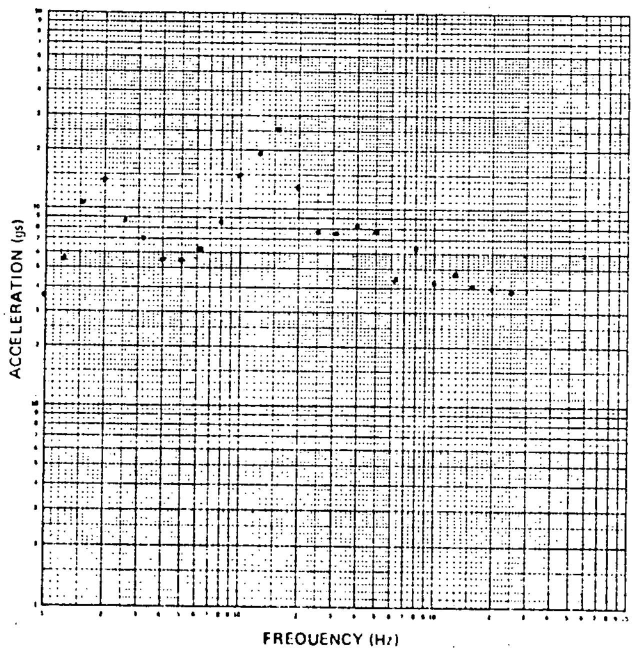




TEST PLANE: ☐ VERTICAL ☒ FRONT TO BACK / VERTICAL — ☒ SIDE TO SIDE / VERTICAL

RESPONSE DIRECTION: ☒ VERTICAL ☐ VERTICAL (180° SHIFT) — ☒ VERTICAL ☐ VERTICAL (180° SHIFT)

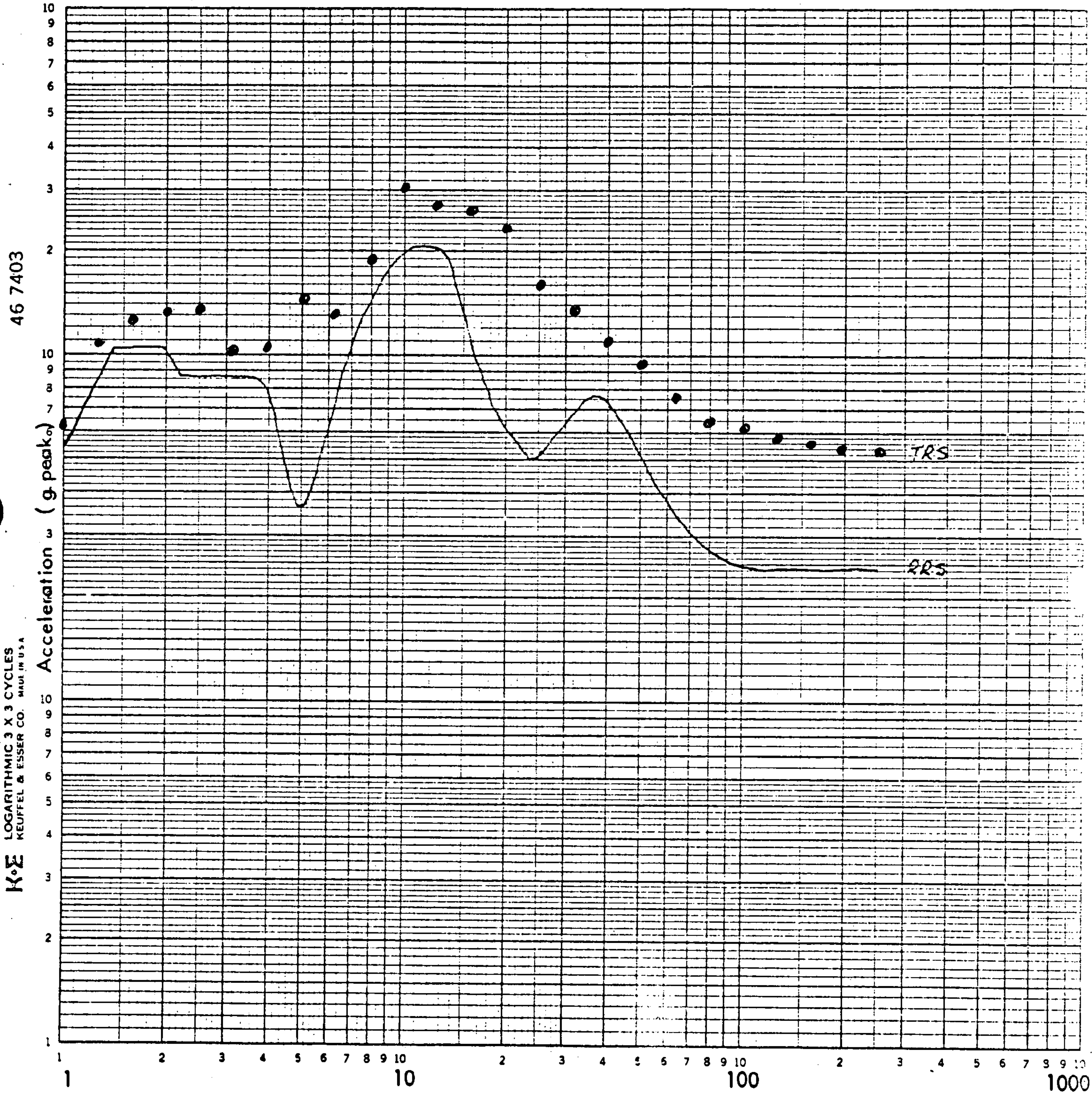




FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 1 %



AXIS S-S/V

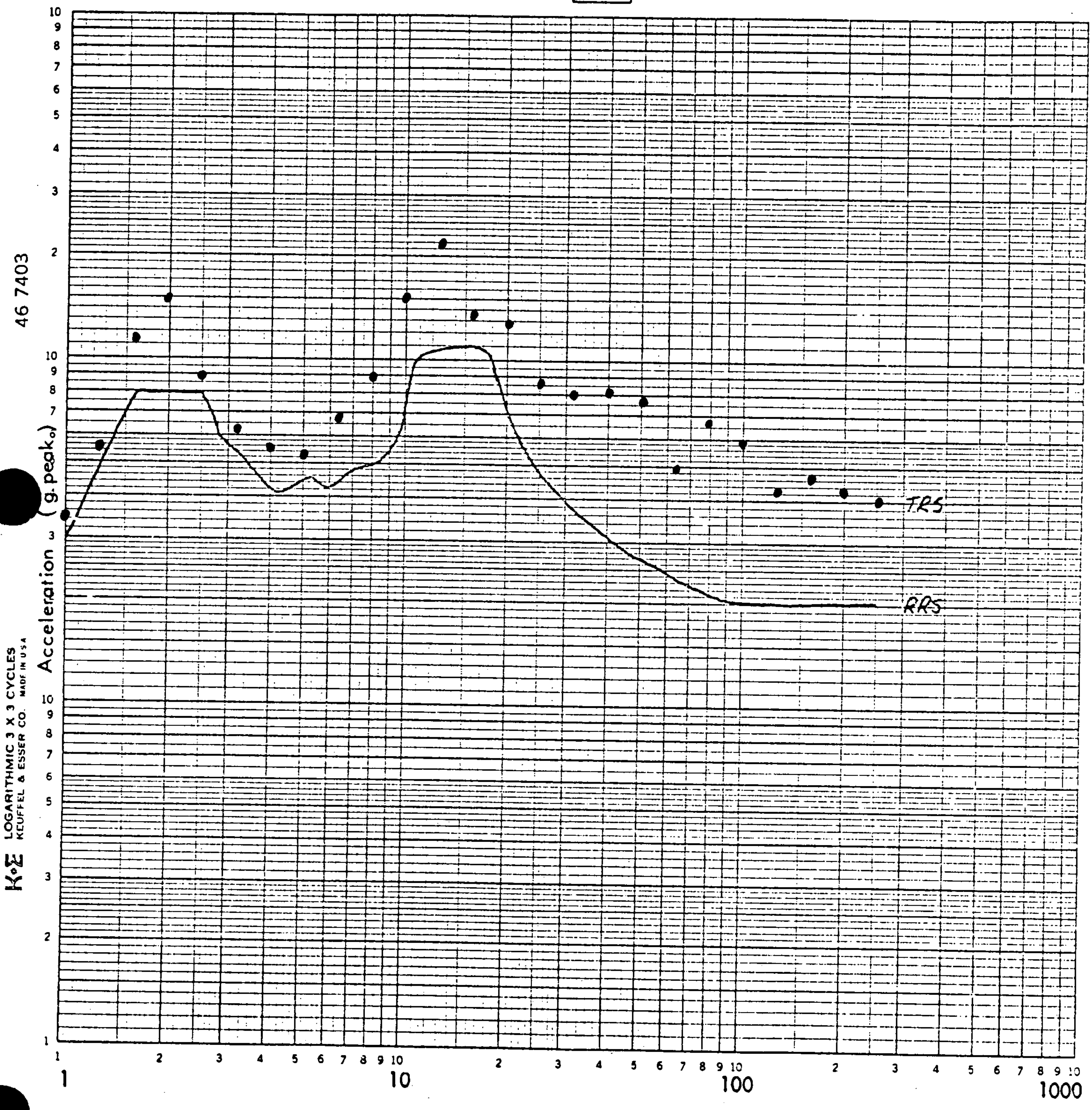
LOCATION NO. HcA

TEST RUN NO. 92

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 1 %



AXIS S-S/V

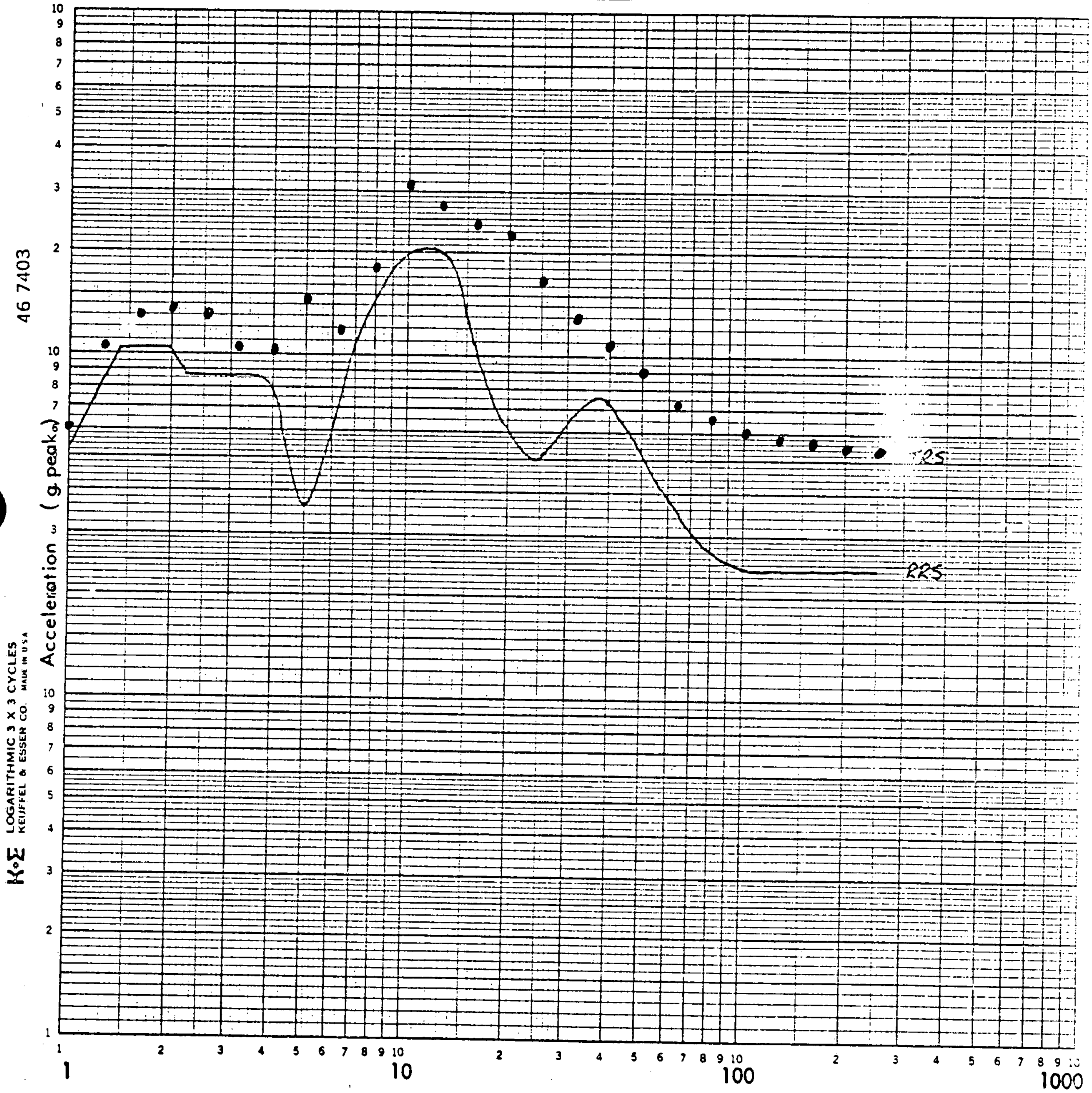
LOCATION NO. VCP

TEST RUN NO. 92

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING [1 %]



AXIS FB/V

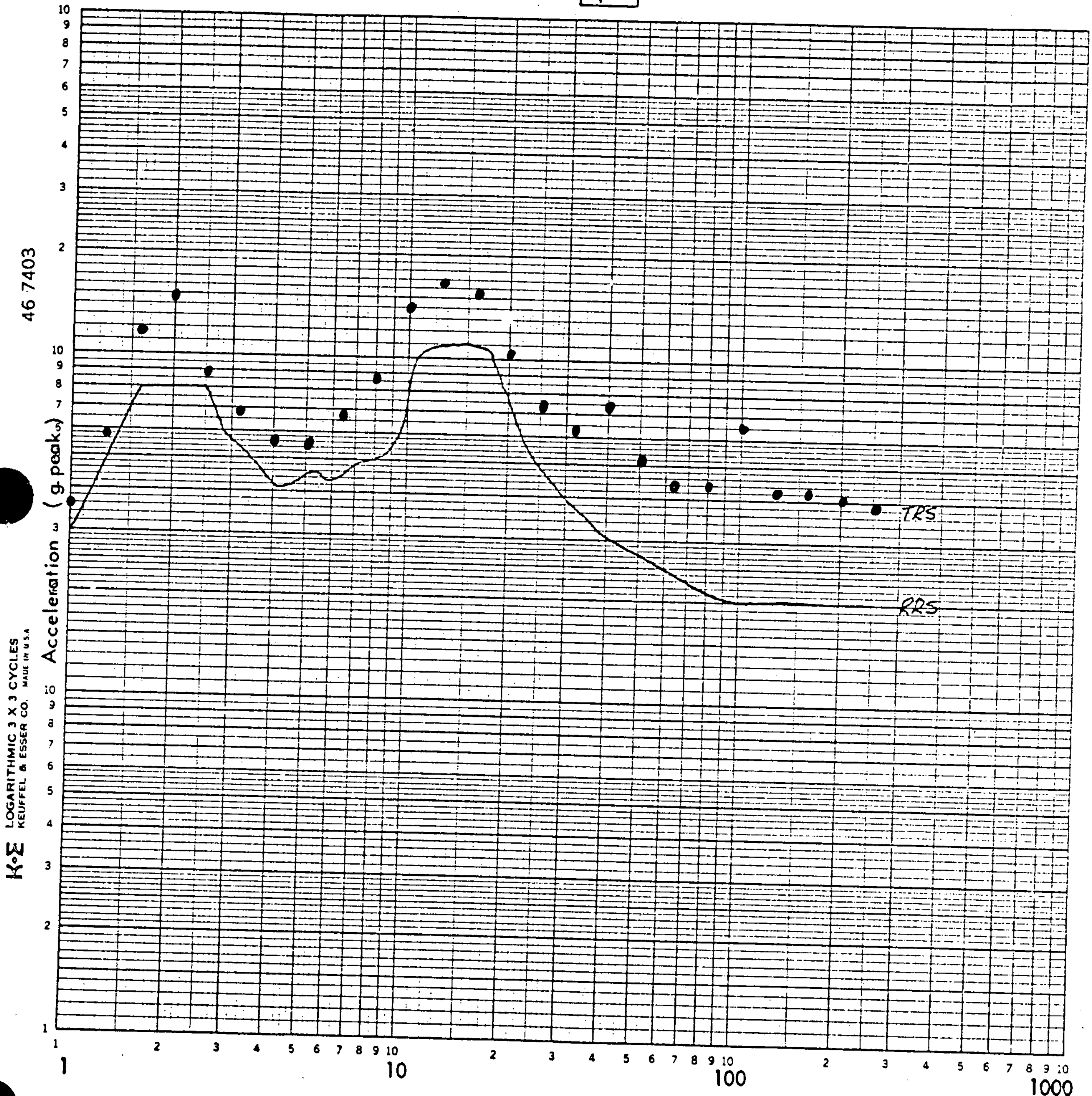
LOCATION NO. HCA

TEST RUN NO. 94

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING $\boxed{1\ \%}$



AXIS FB/V

LOCATION NO. VCA

TEST RUN NO. 94

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X

2. NSSS: CE — 3. A/E: Bechtel — BWR

II. Component Name: PPS Actuation Reset Panel

1. Scope: [X] NSSS [ ] BOP

2. Model Number: None — Quantity: 4

3. Vendor: Electro-Mechanics

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

5. Physical Description a. Appearance Vertical panel

   b. Dimensions 3" x 3-3/4" x 30"

   c. Weight ≅20#

6. Location: Building: Control Area: Aux. Bldg.

   Elevation: 30'

7. Field Mounting Conditions [X] Bolt (No. 10, Size 10-32)
   [ ] Weld (Length)
   [ ]

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

   S/S: >40 F/B: >40
   V: >40

9. a. Functional Description: Provides manual reset for RPS and ESF functions

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

   [X] Both

10. Pertinent Reference Design Specifications: 00000-ICE-3001 Rev. 03
    1370-ICE-3001 Rev. 01

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

IV. Equipment Qualification Method: Test: X

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Electro Mechanics Inc., QR-5330-1
Lab. - Wyle Laboratories, Report No. 43386-1
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [ ] Combination of ______

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ______
(Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ______

S/S = 2.4g input F/B = 2.4g input V = 2.0g input

VI. If Qualification by Test, then Complete: ______

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

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

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

4. Frequency Range: See TRS attached

5. TRS enveloping RRS using Multi-Frequency Test [X] Yes (plot TRS on RRS graphs)
[ ] No

6. Input g-level Test at:

S/S = 5.3
F/B = 4.9
V = 3.5

7. Laboratory Mounting: ______

1. [X] Bolt (No. 10 , Size 10-32) [ ] Weld (Length ______)
[ ] ______

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

NA

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
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: ______ 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. Deflection	Location	Effect Upon Functional Operability

NSSS 1f

NATURAL FREQUENCIES. VERTICAL ______ SIDE / SIDE ______ FRONT / BACK ______

ELECTRICAL OPERATION Performed as required; no contact perturbations occurred before, during or after the test.

PHYSICAL INTEGRITY Intact; No physical effects

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS ______

MAXIMUM EXTERIOR DEFLECTION ______

DYNAMIC LOAD TO MOUNTING ______

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES ______

VI. DISCUSSION

/F

TEST RESPONSE SPECTRA

DATA SHEET No. 1f

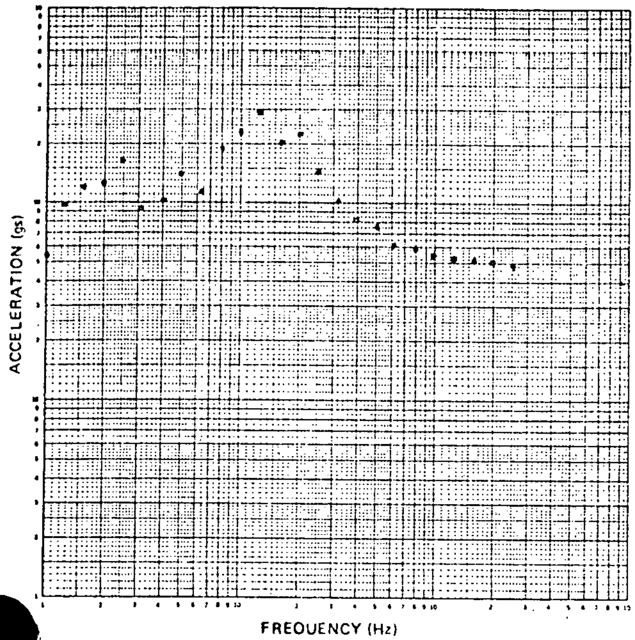
DATE MARCH 1977

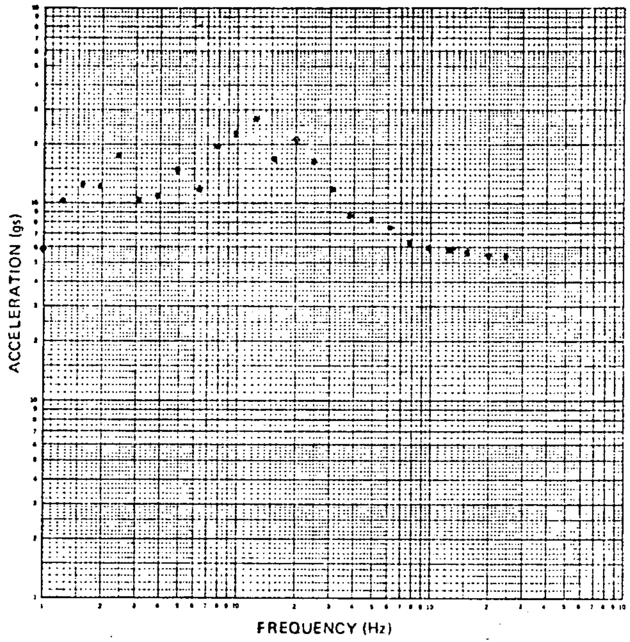
SPECTRUM FULL SCALE: ACCELERATION ☐ 10 gs ☒ 100 gs
FREQUENCY ☐ 100 Hz ☒ 1000 Hz

1 % CRITICAL DAMPING REVISION No. 01

☐ FRONT TO BACK
☒ FRONT TO BACK / VERTICAL — TEST PLANE — ☐ SIDE TO SIDE
☒ SIDE TO SIDE / VERTICAL

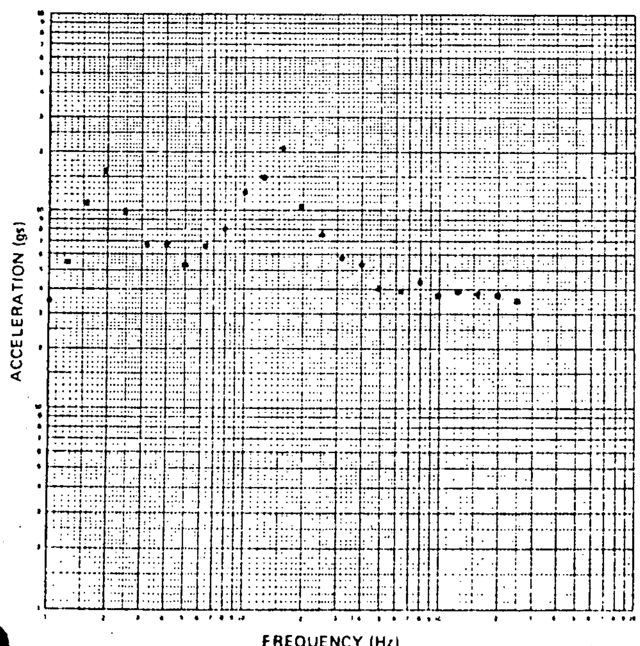
☒ FRONT TO BACK
☐ FRONT TO BACK (180° SHIFT) — RESPONSE DIRECTION — ☒ SIDE TO SIDE
☐ SIDE TO SIDE (180° SHIFT)

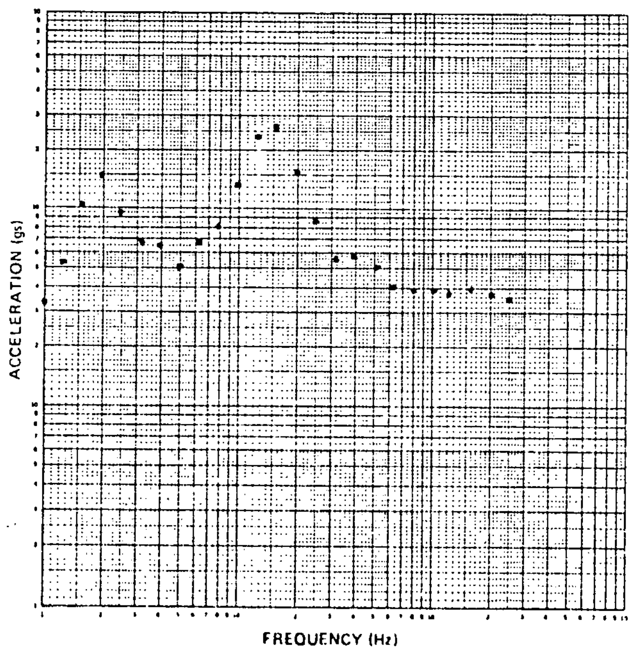




☐ VERTICAL
☒ FRONT TO BACK / VERTICAL — TEST PLANE — ☒ SIDE TO SIDE / VERTICAL

☒ VERTICAL
☐ VERTICAL (180° SHIFT) — RESPONSE DIRECTION — ☒ VERTICAL
☐ VERTICAL (180° SHIFT)



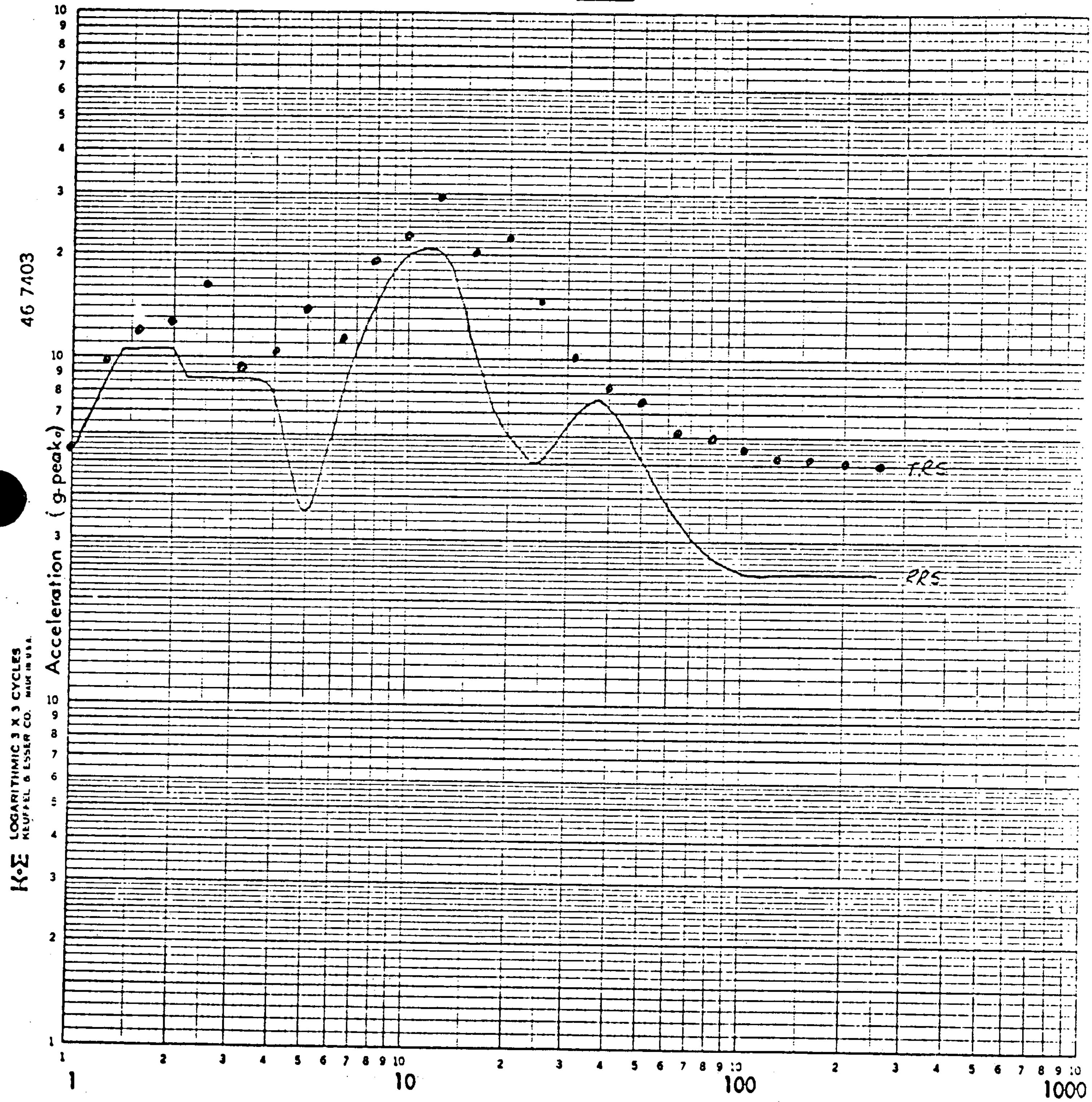


CE 00:0234 (0/75) BACK

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING | 1 % |



SS/V	FB/V

AXIS MTM&PS RR & ARP

LOCATION NO. 4A

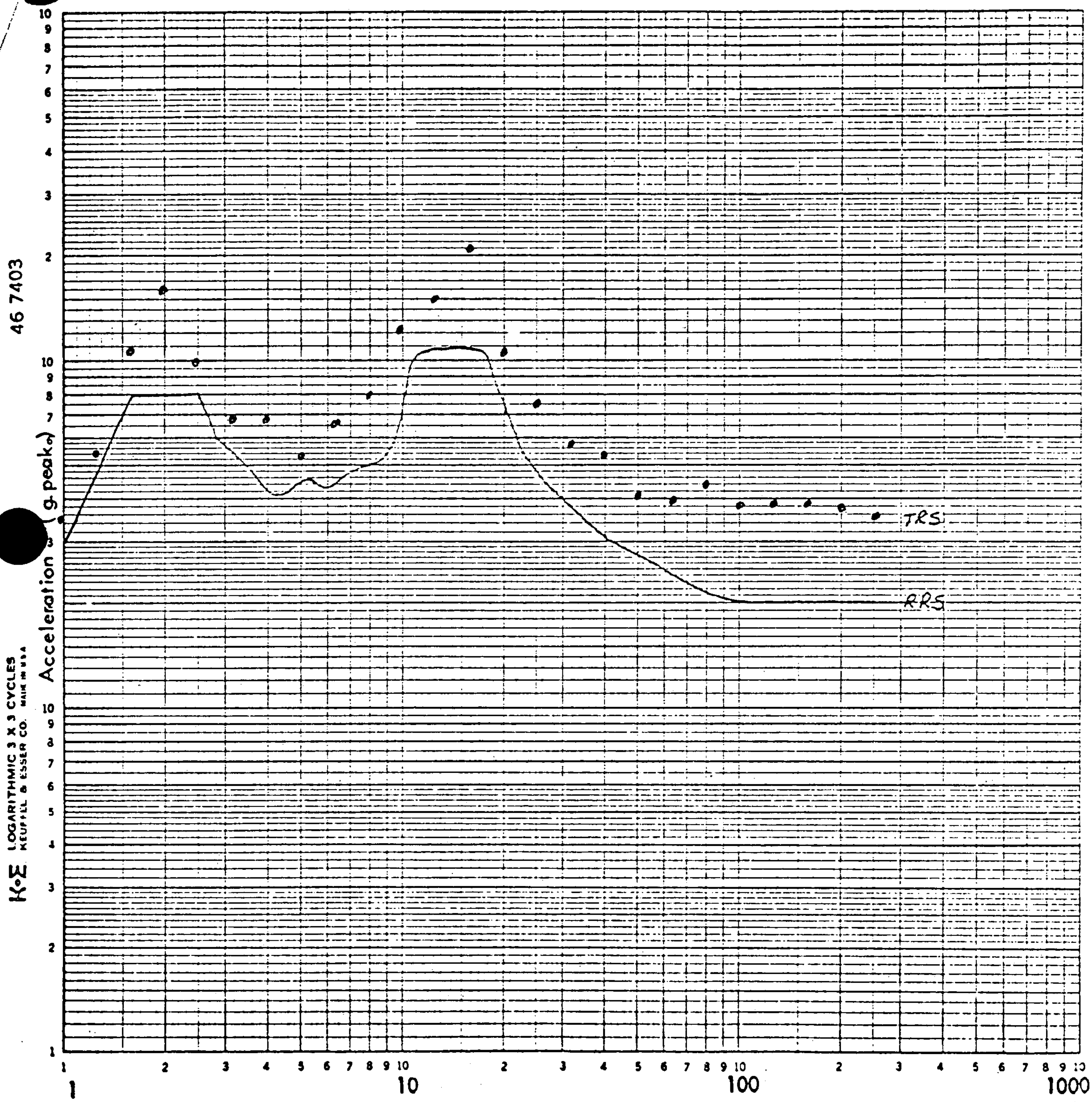
TEST RUN NO. 59

ge No. 266
port No. 43386-1

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 1 %



AXIS SSIV MTM & PS FRIV RR & ARP

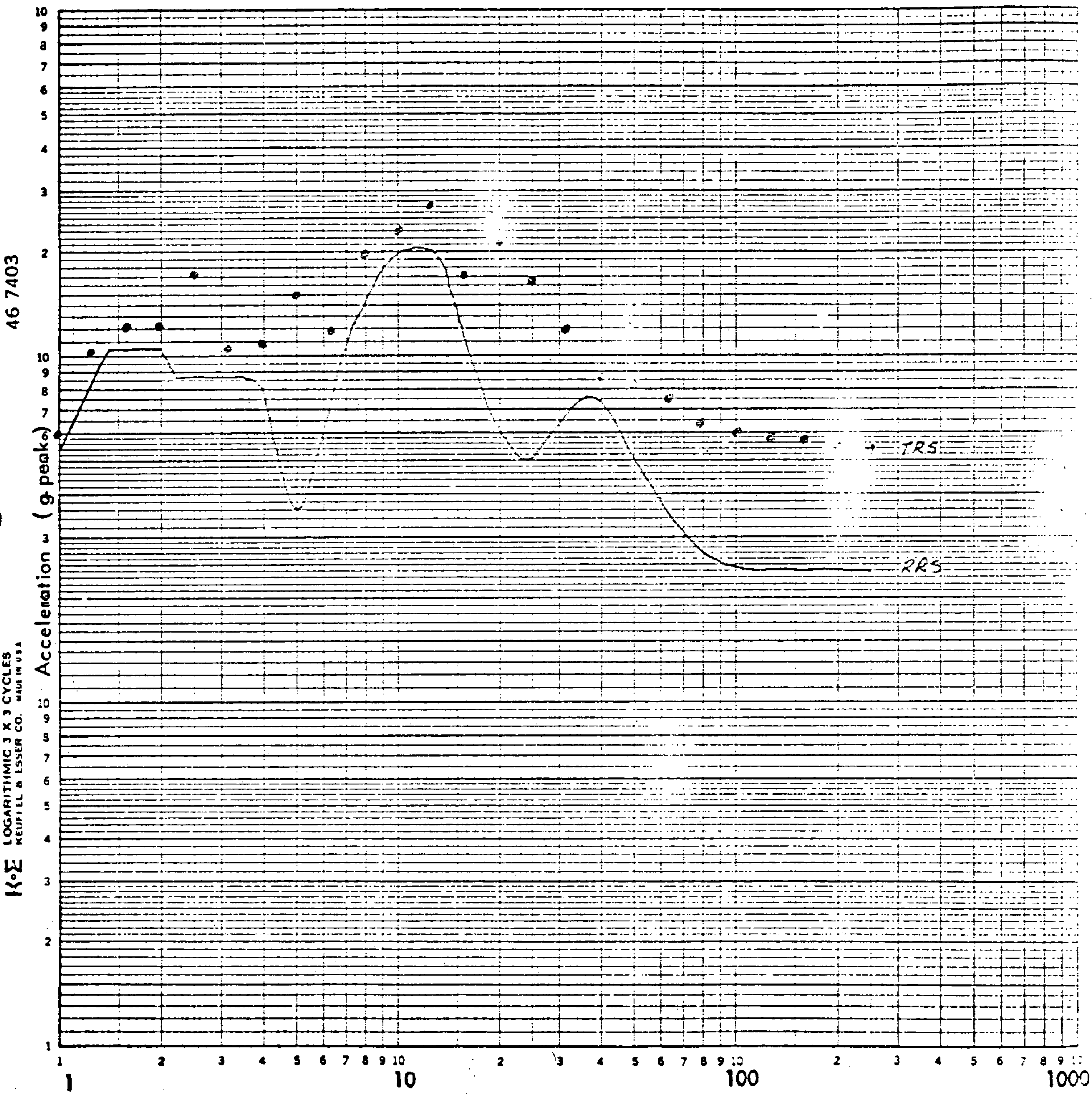
LOCATION NO. VCA

TEST RUN NO. 59

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING | 1 % |



AXIS SS/V RR & ACP FB/V NTM & PS

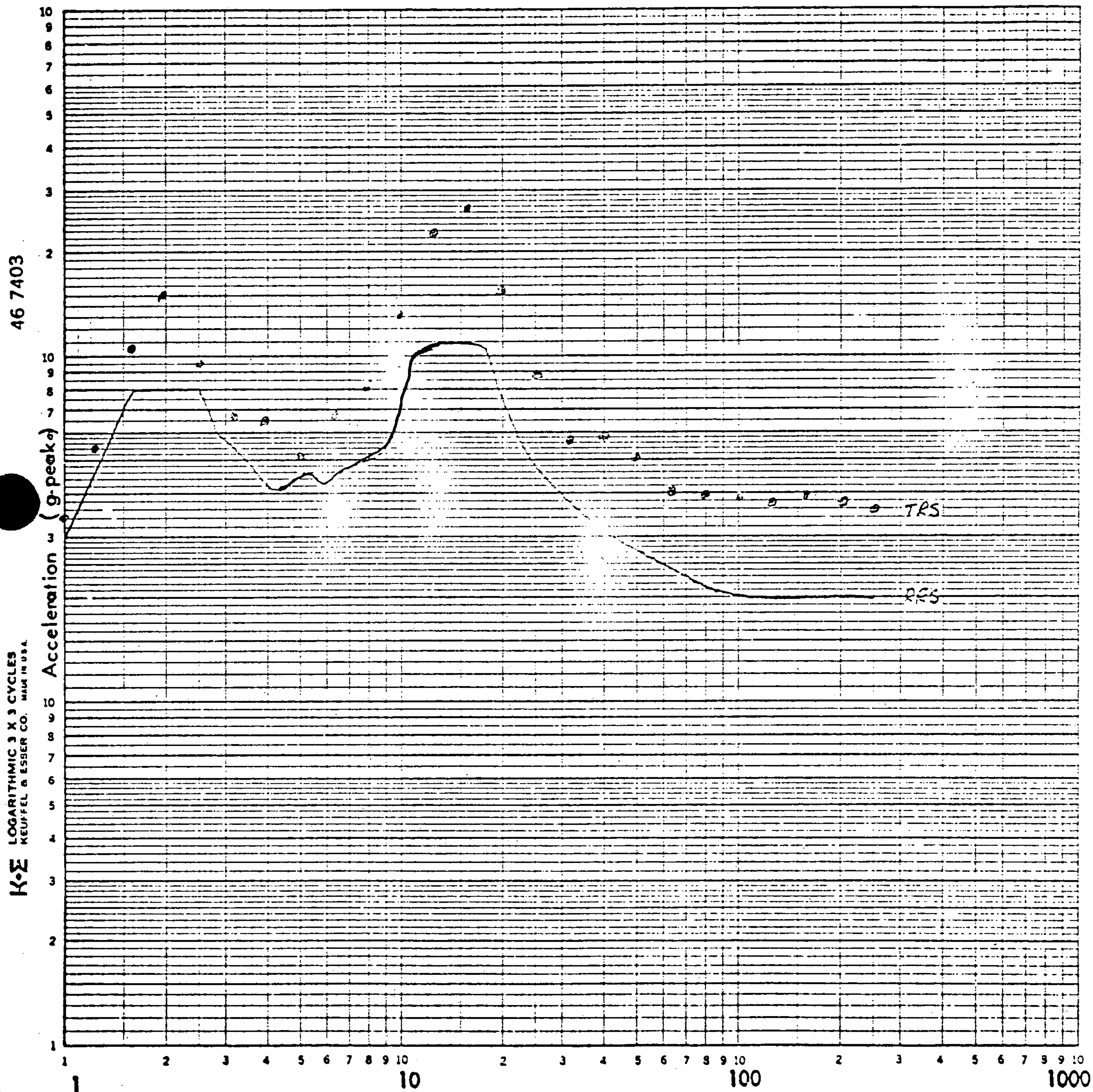
LOCATION NO. HCP

TEST RUN NO. 68

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 1 %



AXIS SSIV RR+ARP FBIV MTM&PS

LOCATION NO. VCA

TEST RUN NO. 68

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 Type:

1. Utility: Southern California Edison Company PWR X

2. NSSS: CE 3. A/E: Bechtel BWR

II. Component Name: PPS Trip Path Panel

1. Scope: [X] NSSS [ ] BOP

2. Model Number: None Quantity: 8

3. Vendor: Electro-Mechanics

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

5. Physical Description a. Appearance Box-like assembly

   b. Dimensions 14-3/8" x 4-5/32" x 18"

   c. Weight ≅50#

6. Location: Building: Control Area, Auxiliary Building

   Elevation: 30'

7. Field Mounting Conditions [X] Bolt (No. 4, Size 1/4-28)
   [ ] Weld (Length)
   [ ]

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

   S/S: 36 F/B: >40 V: >40

9. a. Functional Description: Enclosure for RPS interposing and ESF initiation relays.

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

   [X] Both

10. Pertinent Reference Design Specifications: 00000-ICI-3001, Rev. 03
    1370-ICE-3001 Rev. 01

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

IV. Equipment Qualification Method: Test: X

Analysis: ________

Combination of Test and Analysis: ________

Test and/or Analysis by Electro-Mechanics Inc. QR-5330-1
(Name of Company or Laboratory & Report No.)
Lab - Wyle Laboratories Report No. 43386-1

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

   3. [ ] Explosive only 4. [ ] Other (Specify) ________

   5. [ ] Combination of ________

   6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
   [ ] ________
   (Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ________

   S/S = 2.4g input F/B = 2.4g input V = 2.4g input

VI. If Qualification by Test, then Complete: ________

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

2. [ ] Single Axis [X] Multi-Axis (Bi-axial)

3. No. of Qualification Tests: OBE 5 SSE 1
   Other ________
   (Specify)

4. Frequency Range: See TRS attached

5. TRS enveloping RRS using Multi-Frequency Test [X] Yes (plot TRS on RRS graphs)
   [ ] No

6. Input g-level Test at: S/S = 5.2 F/B = 5.6 V = 3.5

7. Laboratory Mounting: ____________

   1. [X] Bolt (No. 4, Size 1/4-28) [ ] Weld (Length ____________)

   [ ] ____________

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

    NA

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
   [ ] Dynamic Analysis
   [ ] Equivalent Static Analysis
   [ ] Time-History
   [ ] Response Spectrum

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: ________ 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. Deflection	Location	Effect Upon Functional Operability

VI TEST RESULTS

NATURAL FREQUENCIES VERTICAL ______ SIDE - SIDE ______ FRONT - BACK ______

ELECTRICAL OPERATION Performed as required; no contact perturbations before, during and after the tests.

PHYSICAL INTEGRITY Intact; no physical effect

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS ______

MAXIMUM EXTERIOR DEFLECTION ______

DYNAMIC LOAD TO MOUNTING ______

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES ______

VI. DISCUSSION

U.S. [illegible] 9-75

1g.

TEST RESPONSE SPECTRA

DATA SHEET No. 1g

DATE MARCH 1977

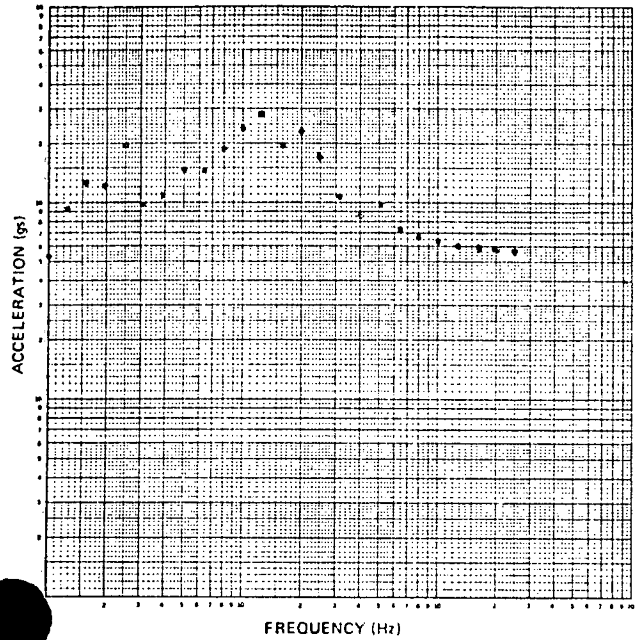
SPECTRUM FULL SCALE: ACCELERATION ☐ 10 gs ☒ 100 gs

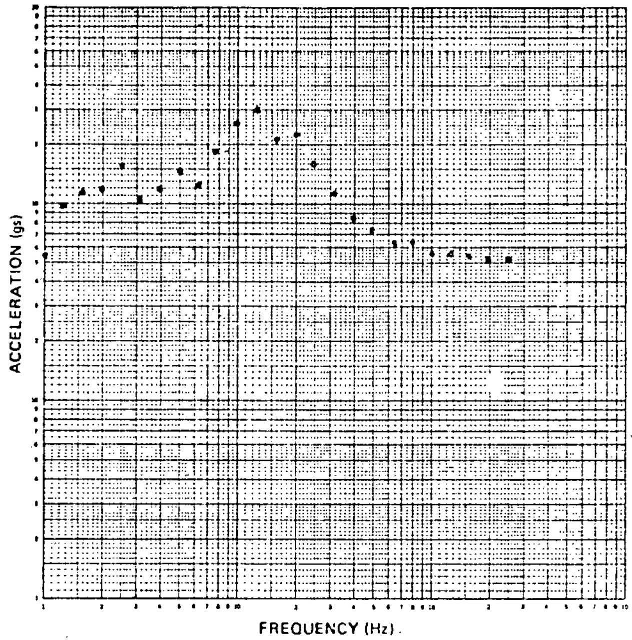
FREQUENCY ☐ 100 Hz ☒ 1000 Hz

1 % CRITICAL DAMPING REVISION No. 01

TEST PLANE: ☐ FRONT TO BACK ☒ FRONT TO BACK / VERTICAL — ☐ SIDE TO SIDE ☒ SIDE TO SIDE / VERTICAL

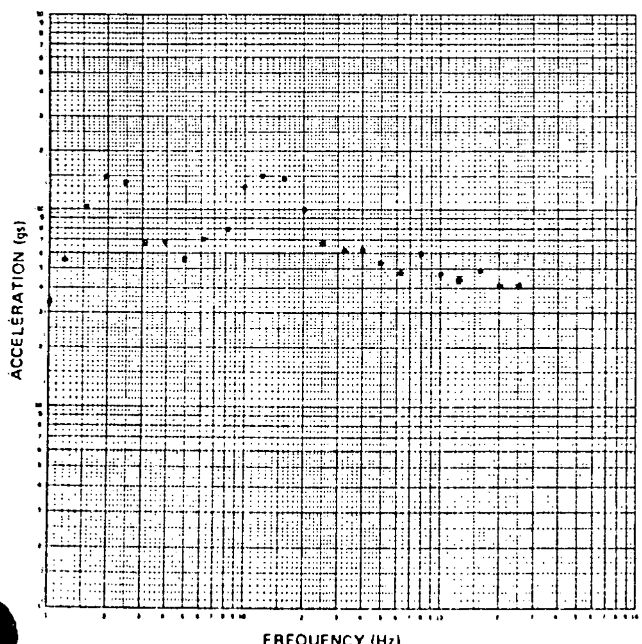
RESPONSE DIRECTION: ☒ FRONT TO BACK ☐ FRONT TO BACK (180° SHIFT) — ☒ SIDE TO SIDE ☐ SIDE TO SIDE (180° SHIFT)

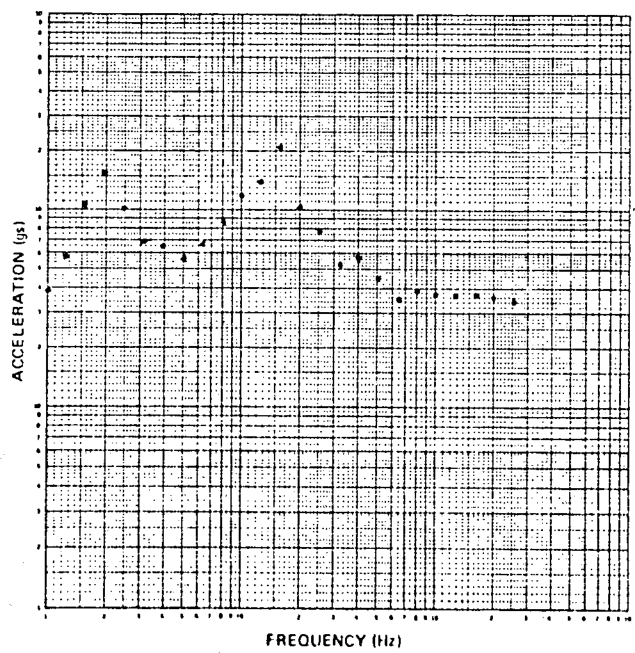




TEST PLANE: ☐ VERTICAL ☒ FRONT TO BACK / VERTICAL — ☒ SIDE TO SIDE / VERTICAL

RESPONSE DIRECTION: ☒ VERTICAL ☐ VERTICAL (180° SHIFT) — ☒ VERTICAL ☐ VERTICAL (180° SHIFT)

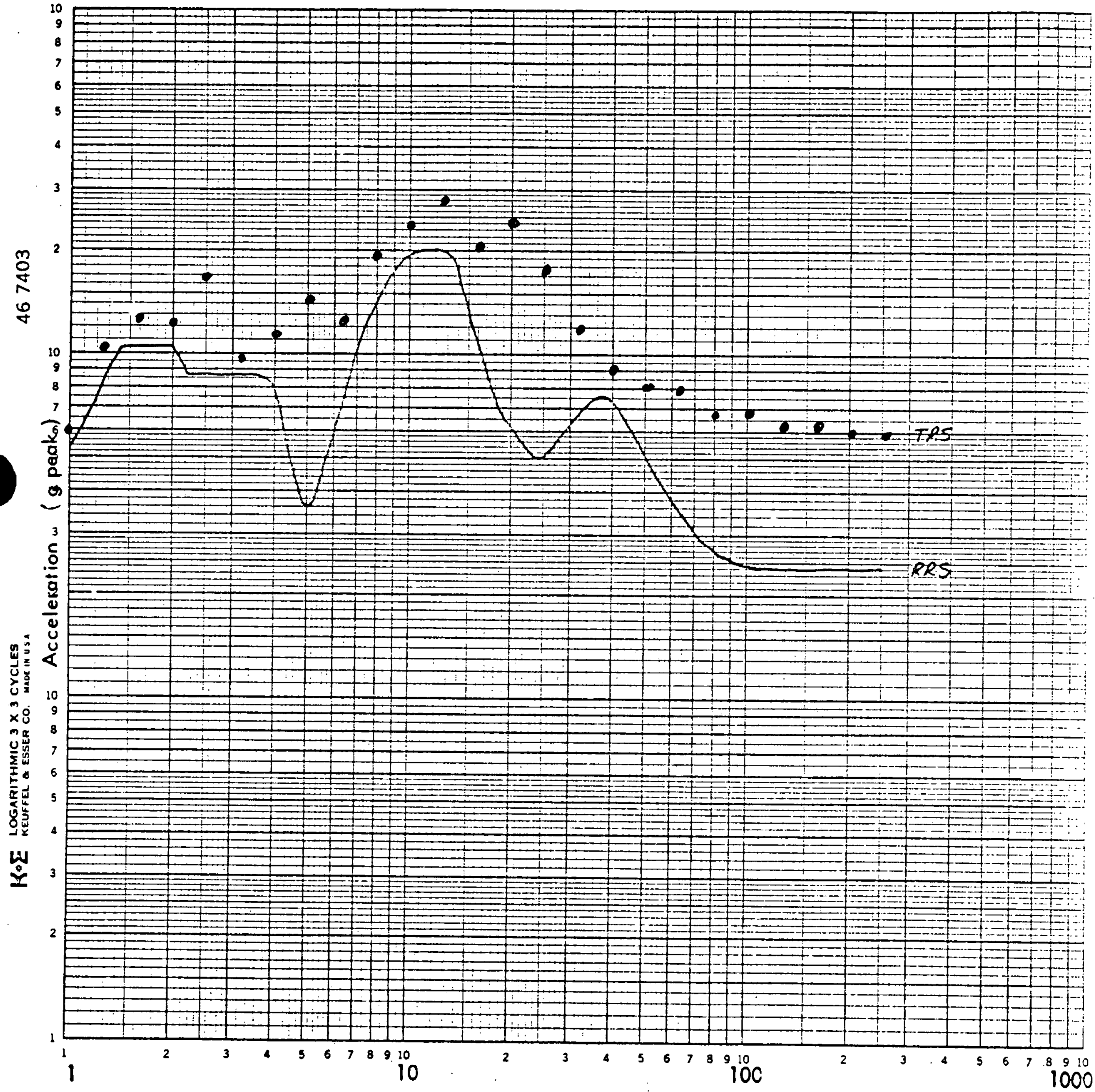




FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING [1 %]



AXIS FB/V

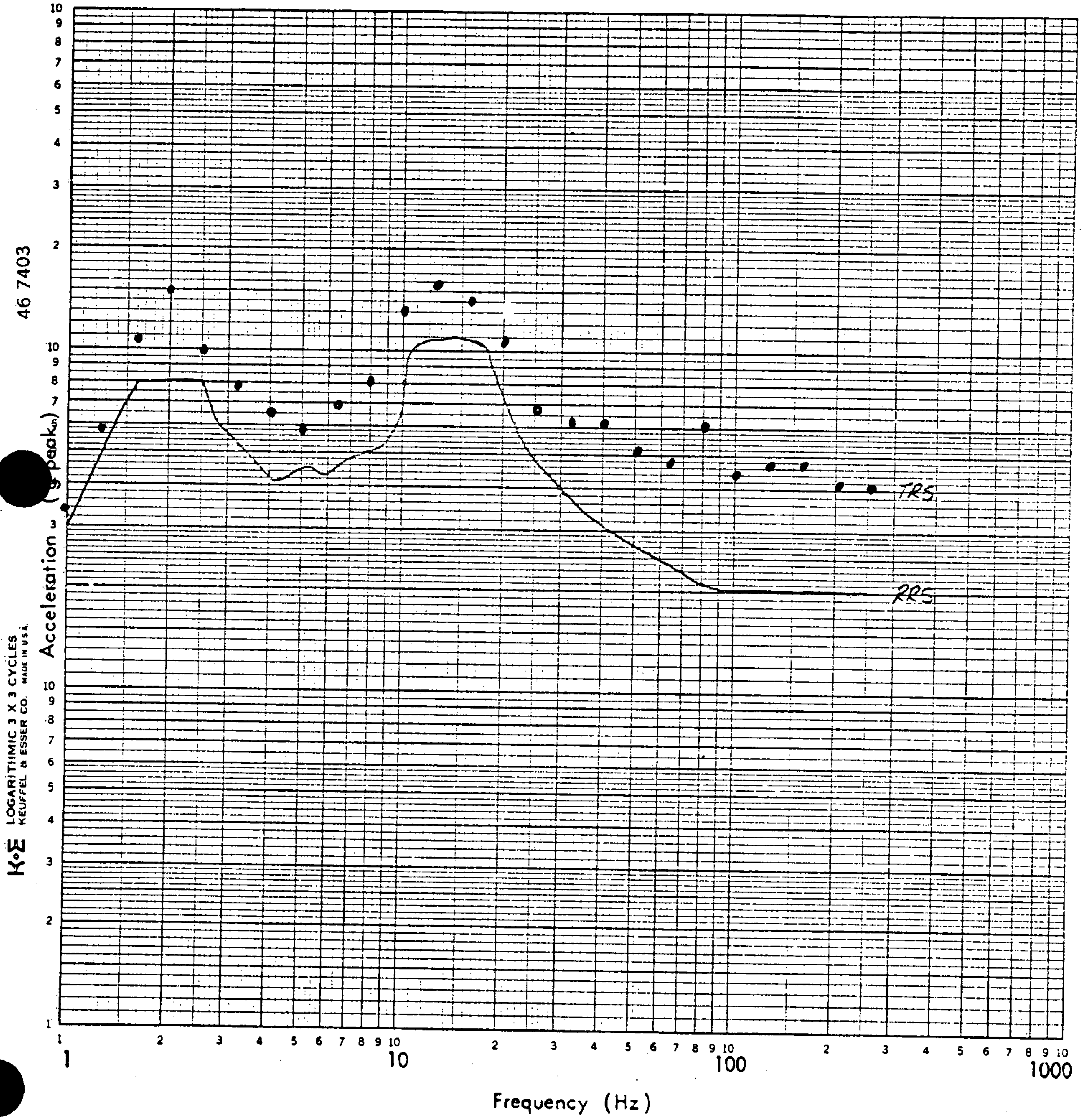
LOCATION NO. HCA

TEST RUN NO. 37

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 1 %



AXIS FB/V

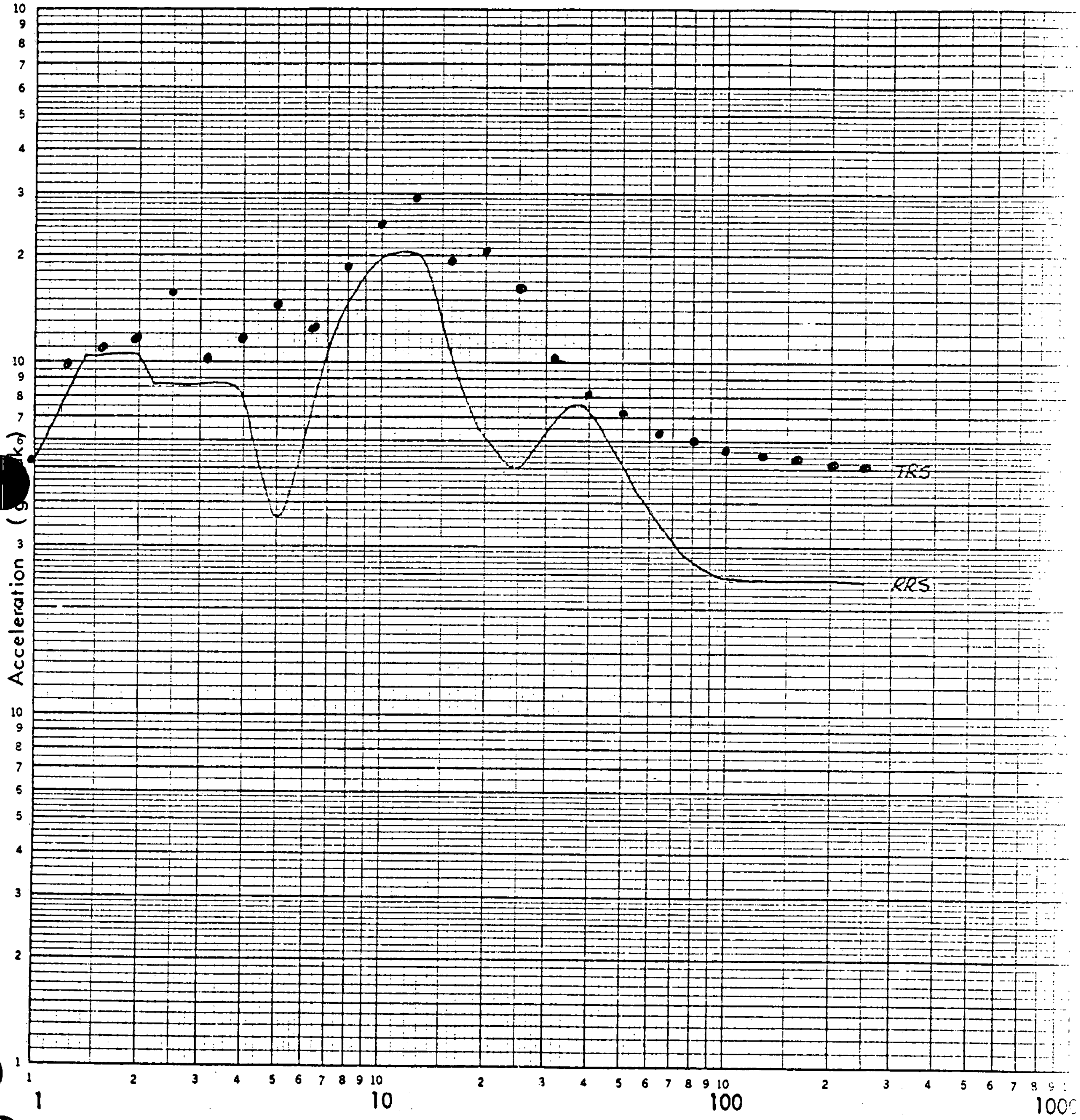
LOCATION NO. VCR

TEST RUN NO. 37

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING | 1 % |



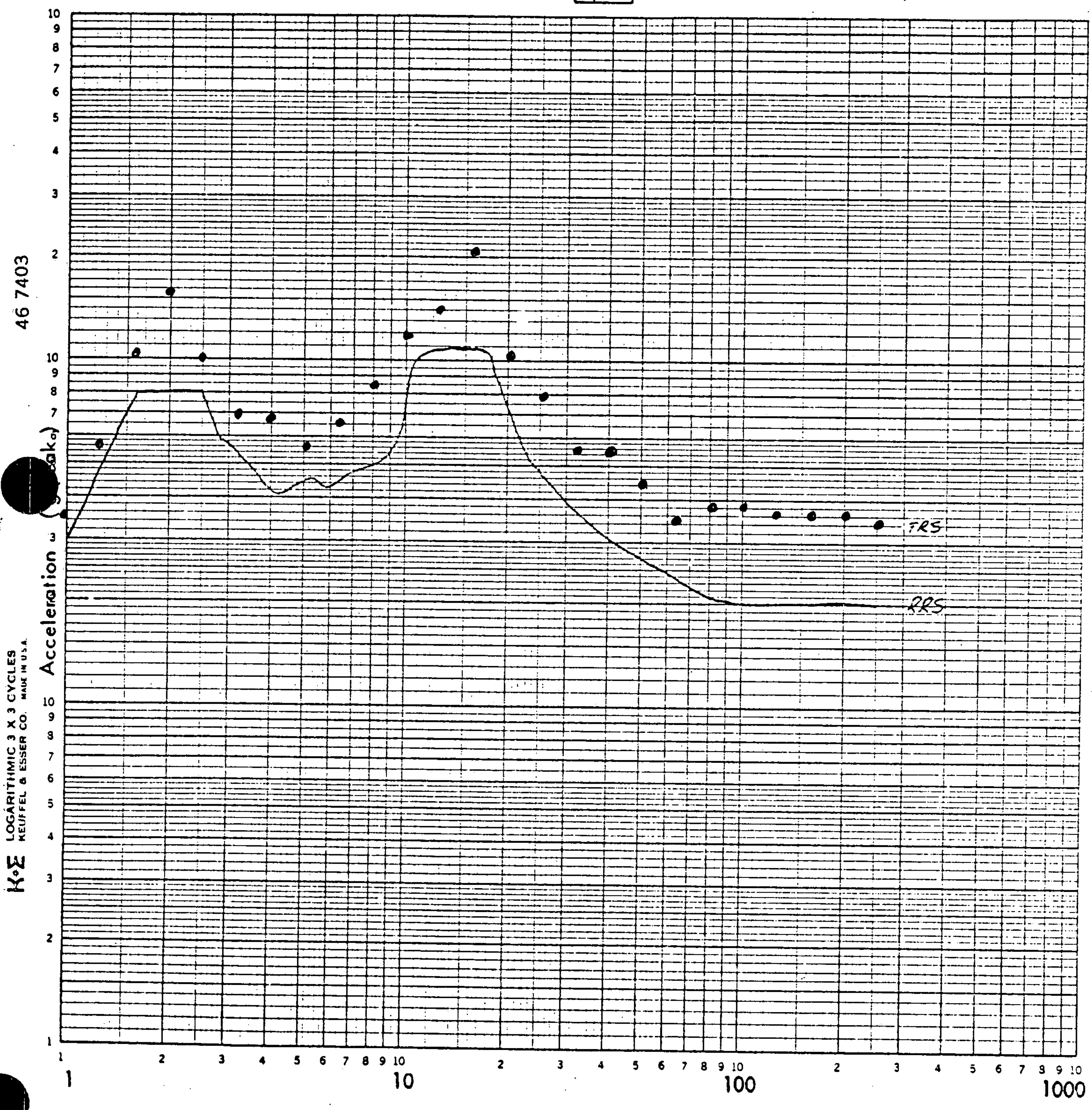
AXIS SS/V

LOCATION NO. HCA

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING | 1 % |



AXIS SS/V

LOCATION NO. VCA

TEST RUN NO. 45

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR ____

II. Component Name: PPS - AC Distribution Panel

1. Scope: [X] NSSS [ ] BOP
2. Model Number: None — Quantity: 4
3. Vendor: Electro-Mechanics
4. If the component is a cabinet or panel, name and model No. of the devices included: NA
5. Physical Description a. Appearance Box-like assembly

   b. Dimensions 10" x 4" x 9"

   c. Weight ≅10#
6. Location: Building: Control Area, Auxiliary Building

   Elevation: 30'
7. Field Mounting Conditions [ ] Bolt (No. 2, Size 10-24)

   [ ] Weld (Length ____)

   [ ] ____
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S: 36 F/B: >40 V: >40
9. a. Functional Description: Distribute 120 V AC to PPS channels.

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

   [X] Both ____
10. Pertinent Reference Design Specifications: 00000-ICI-3001, Rev. 03 . 1370-ICE-3001 Rev. 01

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

IV. Equipment Qualification Method: Test: X

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Electro-Mechanics Inc., QR-5330-1
(Name of Company or Laboratory & Report No.)
Lab - Wyle Laboratories Report No. 43386-1

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [ ] Combination of ______

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ______
(Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ______

S/S = 2.4g input F/B = 2.4g input V = 2.0g input

VI. If Qualification by Test, then Complete: ______

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

2. [ ] Single Axis [X] Multi-Axis (Bi-axial)

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

4. Frequency Range: See TRS attached

5. TRS enveloping RRS using Multi-Frequency Test [X] Yes (plot TRS on RRS graphs)
[ ] No

6. Input g-level Test at: S/S = See TRS F/B = ________ V = ________

7. Laboratory Mounting: ______________________________

1. [X] Bolt (No. 2 ______________, Size 10-24 X 3/4 ______________)

[ ] Weld (Length ______________) [ ] ______________

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

NA

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

1. Description of Test including Results: NA

2. Method of Analysis: ______________________________

[ ] Static Analysis
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: ________ 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. Deflection	Location	Effect Upon Functional Operability

NSS51h

VI.9 Test Results

NATURAL FREQUENCIES: VERTICAL ________ SIDE / SIDE ________ FRONT / BACK ________

ELECTRICAL OPERATION Performed as required; No output signal perturbations.

PHYSICAL INTEGRITY Intact; no physical effects.

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY). ________

MAXIMUM STRUCTURAL STRESS ________

MAXIMUM EXTERIOR DEFLECTION ________

DYNAMIC LOAD TO MOUNTING ________

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES ________

1h.

TEST RESPONSE SPECTRA

DATA SHEET No. 1h

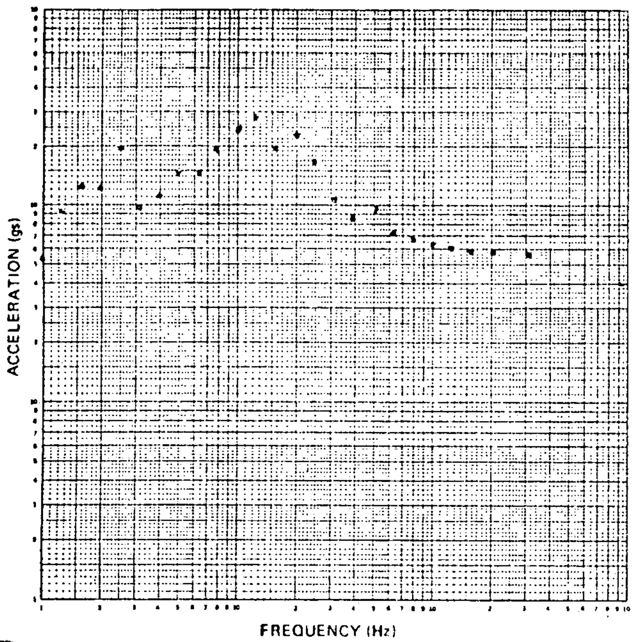
DATE MARCH 1977

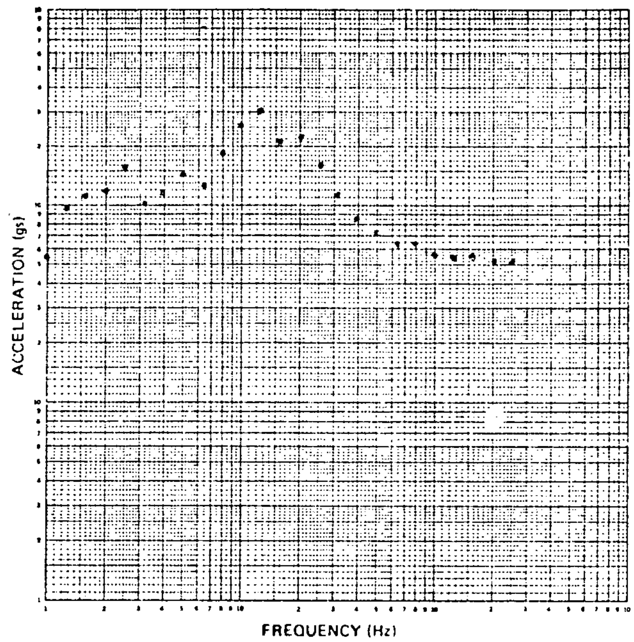
SPECTRUM FULL SCALE: ACCELERATION ☐ 10 gs ☒ 100 gs — FREQUENCY ☐ 100 Hz ☒ 1000 Hz

1 % CRITICAL DAMPING

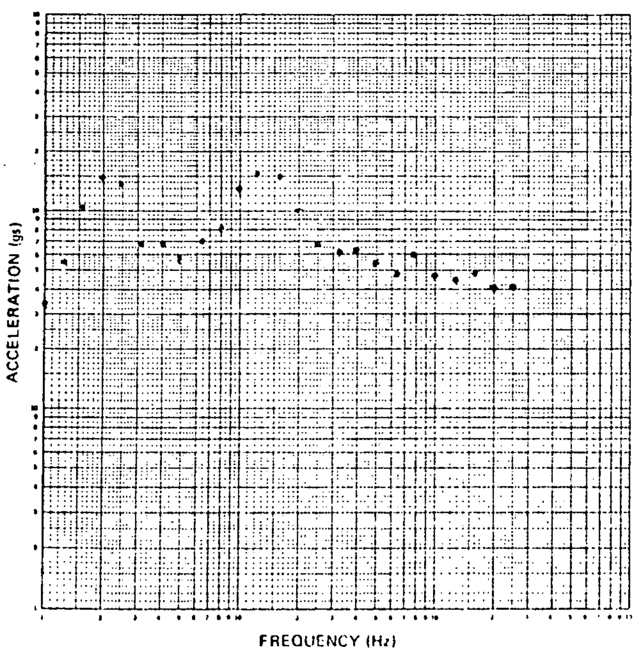
REVISION No. 01

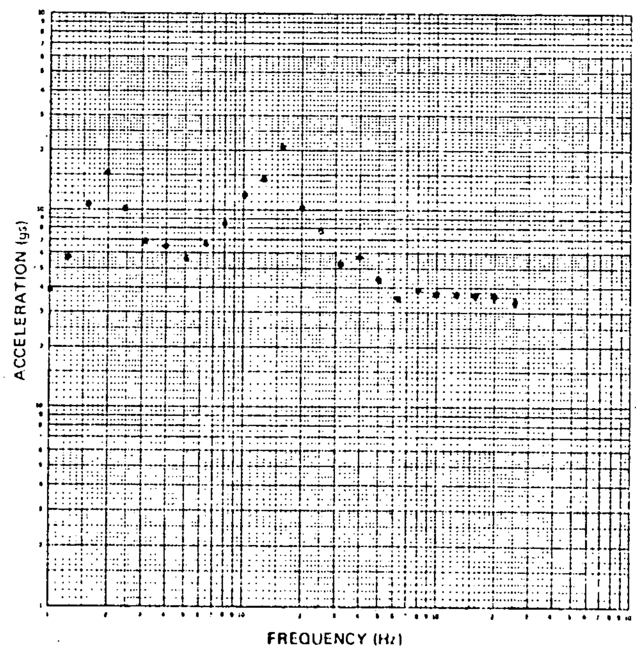
☐ FRONT TO BACK ☒ FRONT TO BACK / VERTICAL	TEST PLANE	☐ SIDE TO SIDE ☒ SIDE TO SIDE / VERTICAL
☒ FRONT TO BACK ☐ FRONT TO BACK (180° SHIFT)	RESPONSE DIRECTION	☒ SIDE TO SIDE ☐ SIDE TO SIDE (180° SHIFT)





☐ VERTICAL ☒ FRONT TO BACK / VERTICAL	TEST PLANE	☒ SIDE TO SIDE / VERTICAL
☒ VERTICAL ☐ VERTICAL (180° SHIFT)	RESPONSE DIRECTION	☒ VERTICAL ☐ VERTICAL (180° SHIFT)

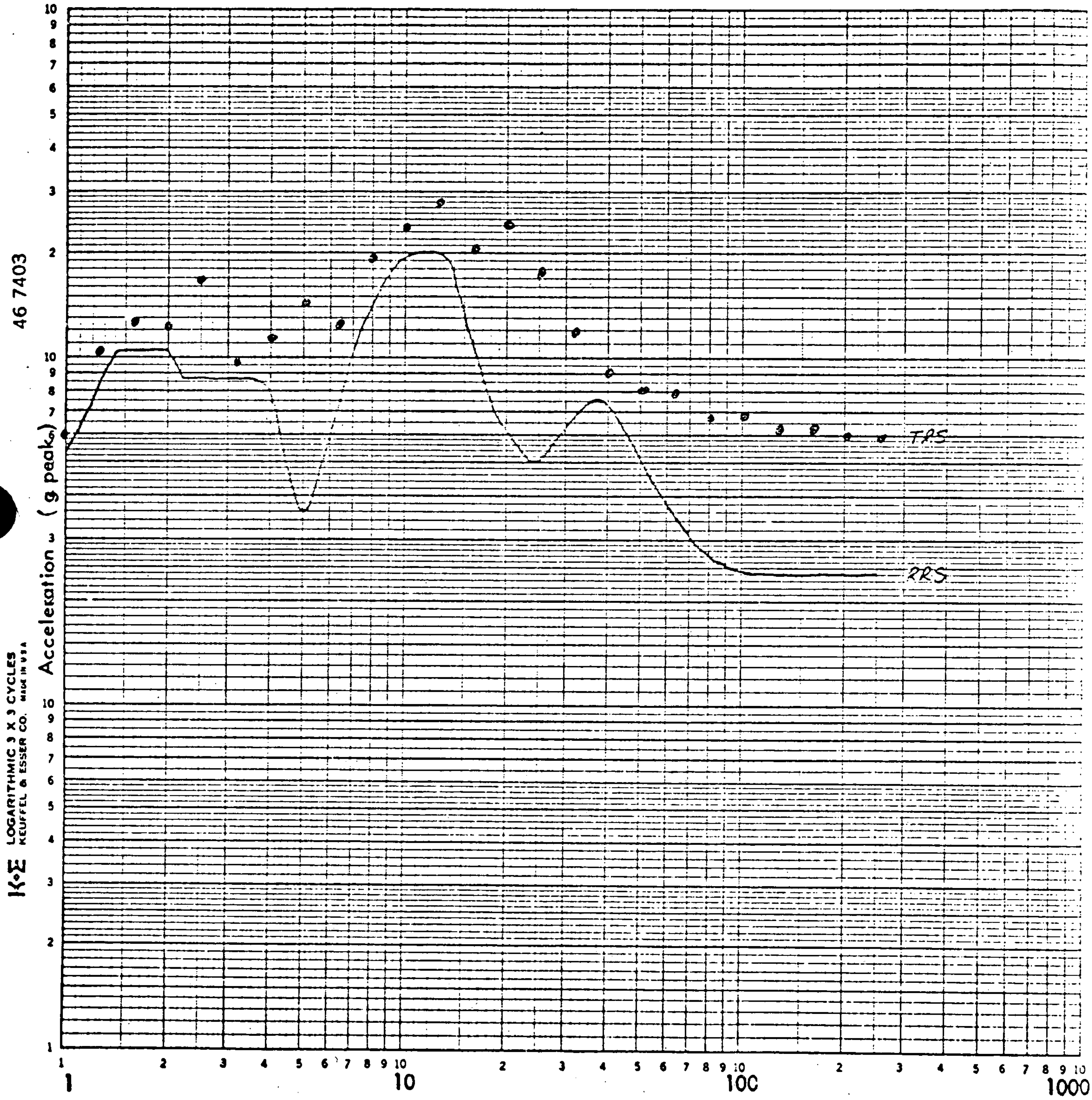




FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 1 %



AXIS FB/V

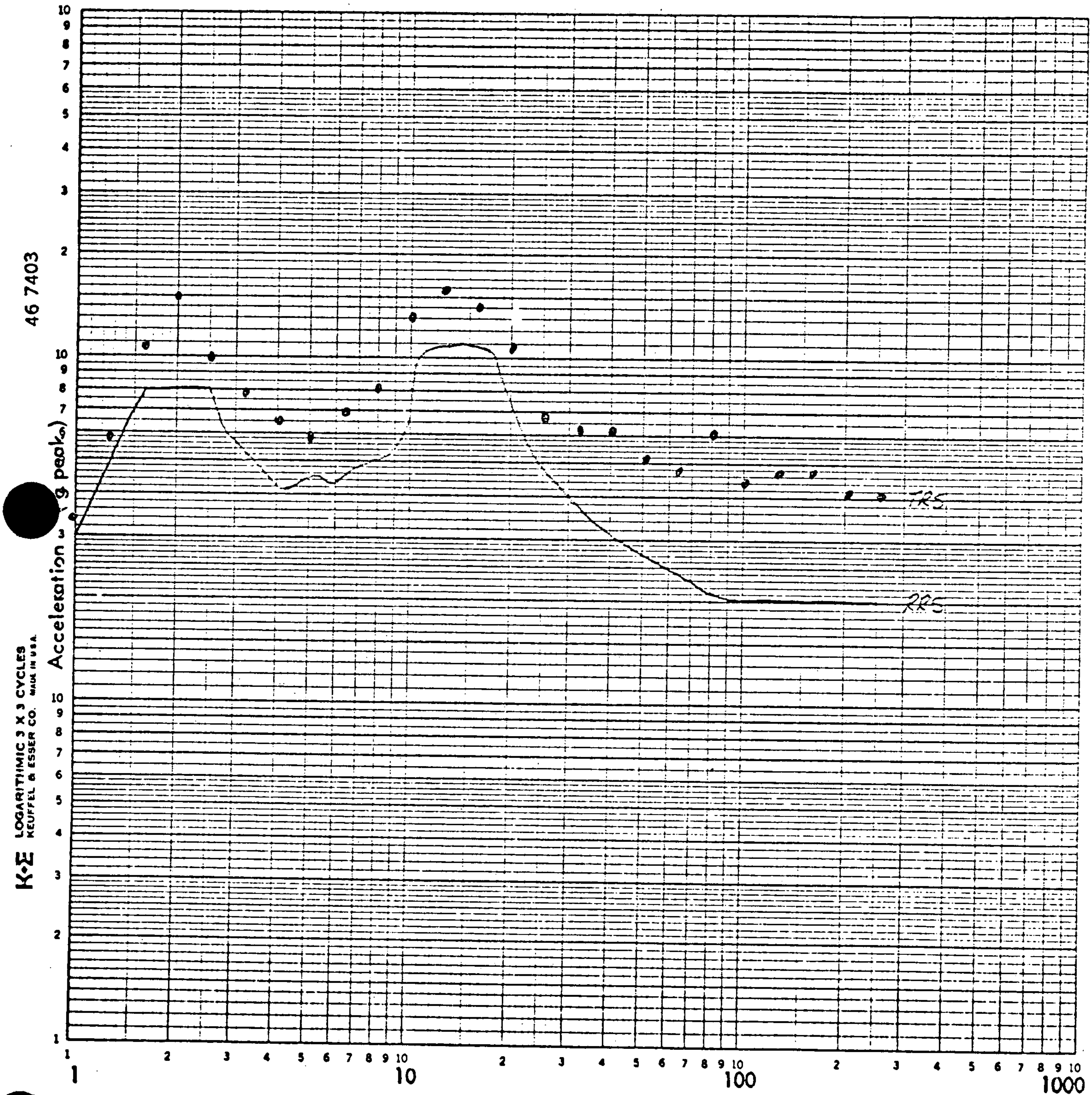
LOCATION NO. HCA

TEST RUN NO. 37

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING | 1 % |



AXIS FB/V

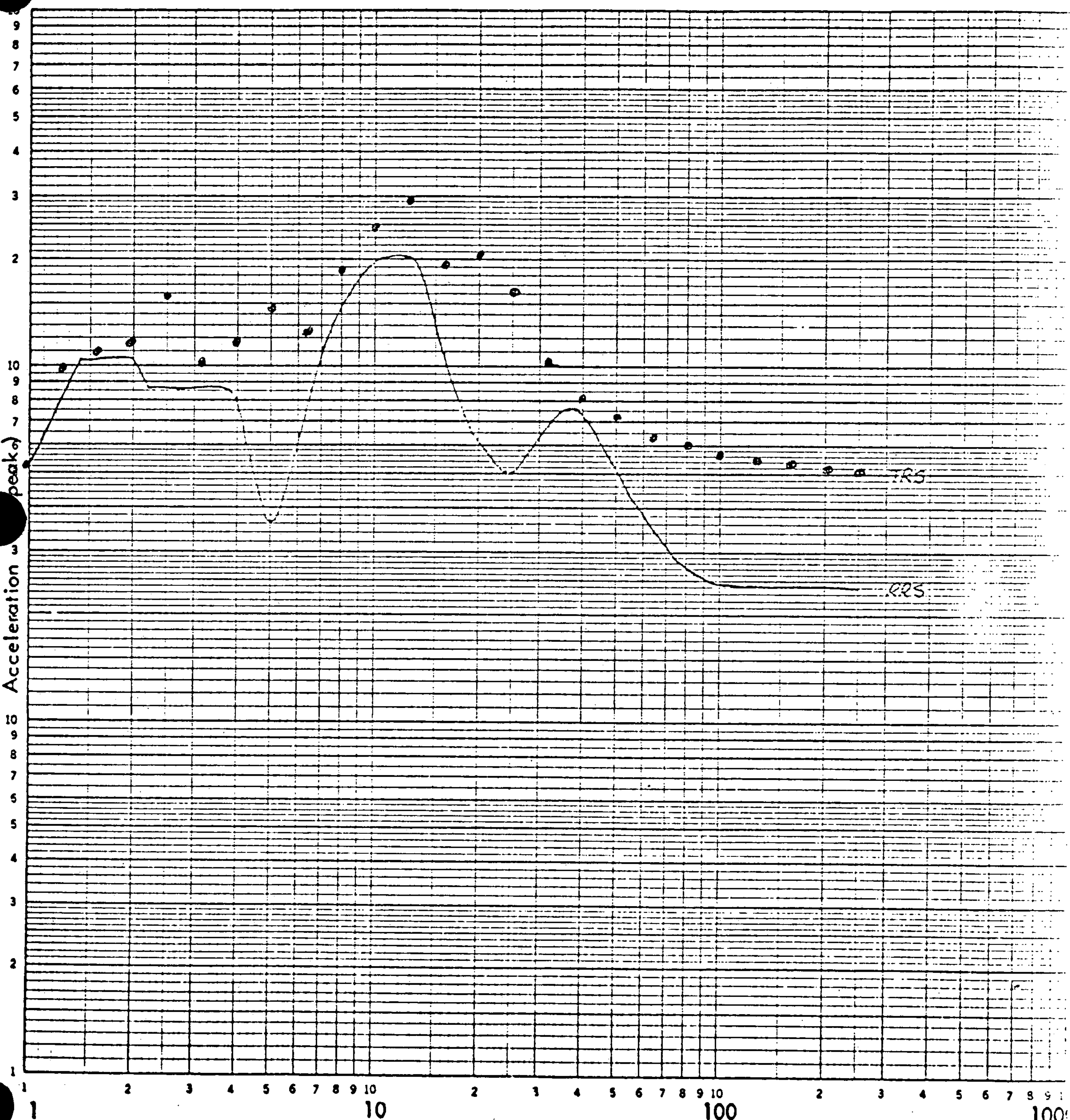
LOCATION NO. VCR

TEST RUN NO. 37

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING | 1 % |



AXIS SS/V

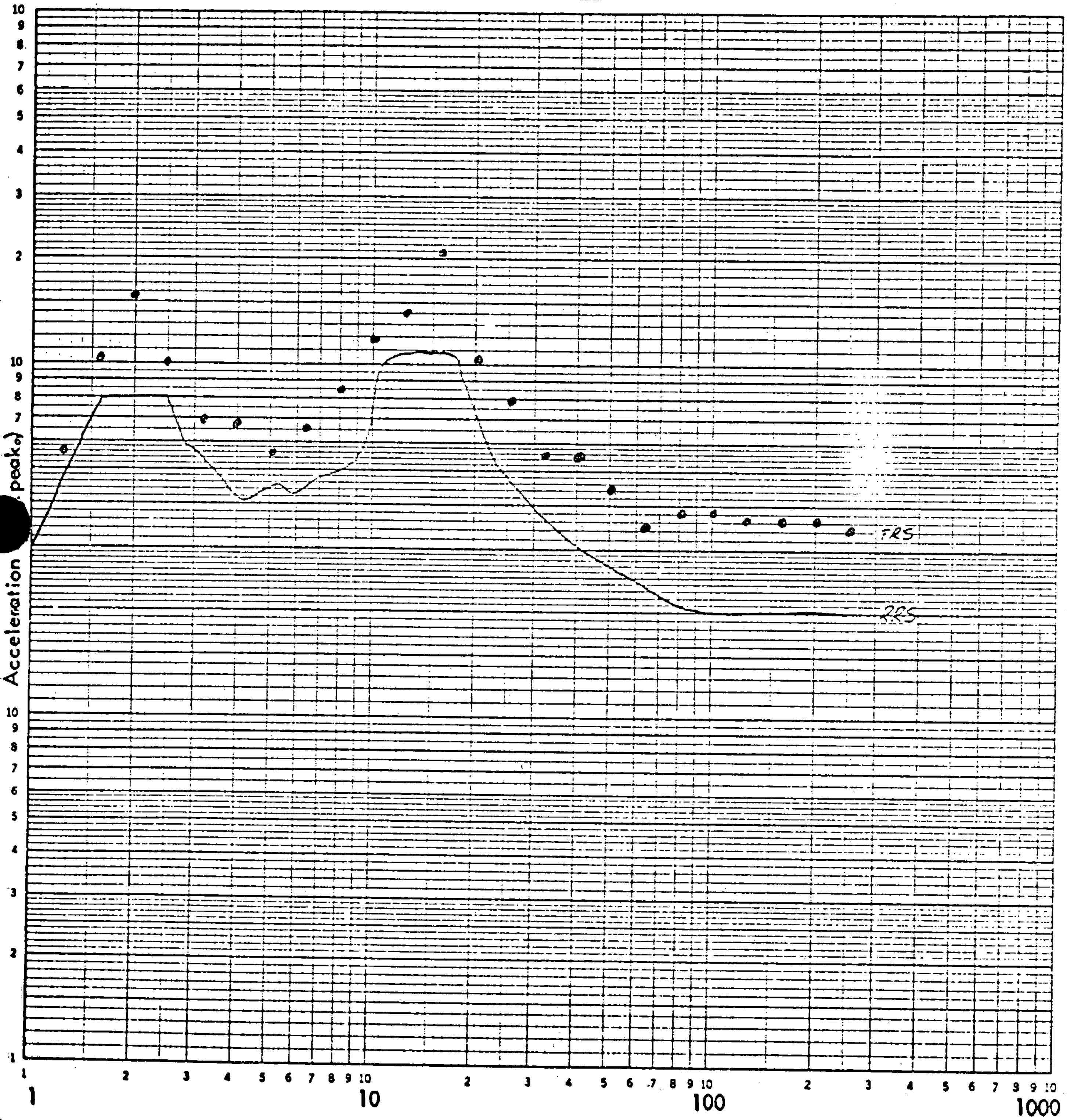
LOCATION NO. HCA

TEST RUN NO. 146

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 1 %



AXIS SS/V

LOCATION NO. VCP

TEST RUN NO. 45

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR

II. Component Name: PPS Power Supply Panel

1. Scope: [X] NSSS [ ] BOP
2. Model Number: None — Quantity: 4
3. Vendor: Electro Mechanics
4. If the component is a cabinet or panel, name and model No. of the devices included: NA
5. Physical Description a. Appearance Door with power supplies attached

   b. Dimensions 27-3/4" x 4-1/2" x 66-1/4"

   c. Weight ≅700#
6. Location: Building: Control Area: Aux. Bldg.

   Elevation: 30'
7. Field Mounting Conditions [X] Bolt (No. 25, Size 10-32)
   [ ] Weld (Length)
   [ ]
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S: >40 — F/B: 23

   V: >40
9. a. Functional Description: Provide dc power to PPS channels

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

   [X] Both
10. Pertinent Reference Design Specifications: 00000-ICE-3001 Rev. 03
    1370-ICE-3001 Rev. 01

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

IV. Equipment Qualification Method: Test: X

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Electro-Mechanical Inc. QR-5330-1
Lab. - Wyle Laboratories, Report No. 43386-1
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

   3. [ ] Explosive only 4. [ ] Other (Specify) ______

   5. [ ] Combination of ______

   6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
   [ ] ______
   (Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ______

   S/S = 2.4g input F/B = 2.4g input V = 2.0g input

VI. If Qualification by Test, then Complete: ______

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

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

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

4. Frequency Range: See TRS attached

5. TRS enveloping RRS using Multi-Frequency Test [X] Yes (plot TRS on RRS graphs)
   [ ] No

6. Input g-level Test at:

S/S = 4.9
F/B = 5.3
V = 3.5

7. Laboratory Mounting: ______

1. [X] Bolt (No. 25, Size 10-32) [ ] Weld (Length ______)
[ ] ______

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

NA

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

1. Description of Test including Results: NA

2. Method of Analysis: ______

[ ] Static Analysis
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: ______ 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. Deflection	Location	Effect Upon Functional Operability

NSSS 1i

NATURAL FREQUENCIES VERTICAL ______ SIDE / SIDE ______ FRONT BACK ______

ELECTRICAL OPERATION Performed as required; See section VI (Discussion)

PHYSICAL INTEGRITY All power supplies remained structurally intact, See discussion below.

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS ______

MAXIMUM EXTERIOR DEFLECTION ______

DYNAMIC LOAD TO MOUNTING ______

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES ______

VI DISCUSSION

1. During the half level tests three anomalies occurred and were corrected.

   A. Anomaly - The base of the power supply panel deflected which caused the power supply output signals to deviate.
      Correction - The base of the power supply panel was stiffened by bolting a section of angle iron to the bottom of the assembly and welding the angle iron to the test fixture floor and testing continued with no further problem.

      An angle iron stiffening bracket has been incorporated as a design modification to the power supply panel.

   B. Anomaly - Wire chafing occurred in the vicinity of the power supply input fuses.
      Correction - The cable harness was found to be chafing on the fuse holders. The cable harness was pulled away and testing continued with the problem not re-occurring. Wire harness standoffs have been incorporated as a design modification to the power supply panel.

   C. Anomaly - Various screw and nuts loosened which did not effect power supply performance.
      Correction - Screws and nuts were periodically tightened during remainder of tests. As a final modification to the power supply panel, "Locktite" will be incorporated into the mounting hardware design.

TEST RESPONSE SPECTRA

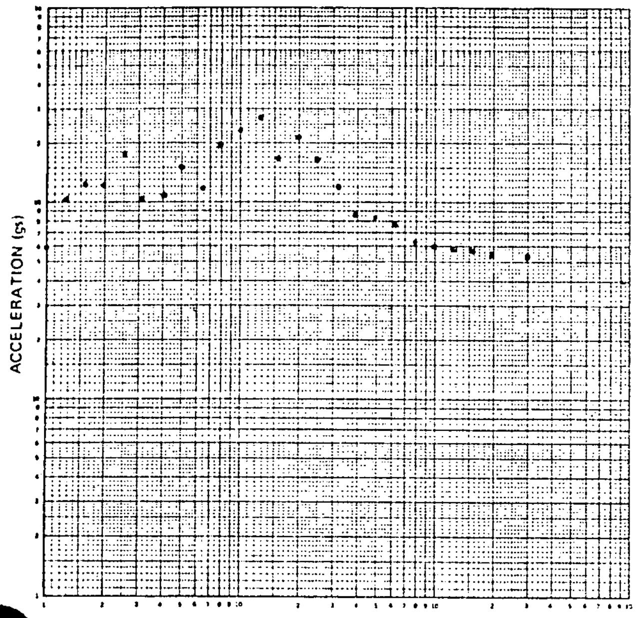
DATA SHEET No. 11
DATE MARCH 1977

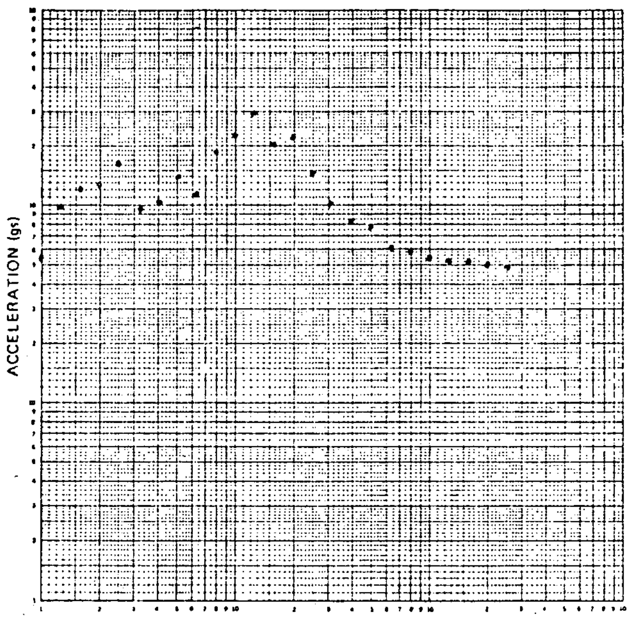
SPECTRUM FULL SCALE: ACCELERATION ☐ 10 gs ☒ 100 gs
FREQUENCY ☐ 100 Hz ☒ 1000 Hz

1 % CRITICAL DAMPING REVISION No. 01

TEST PLANE: ☐ FRONT TO BACK ☒ FRONT TO BACK / VERTICAL — ☐ SIDE TO SIDE ☒ SIDE TO SIDE / VERTICAL

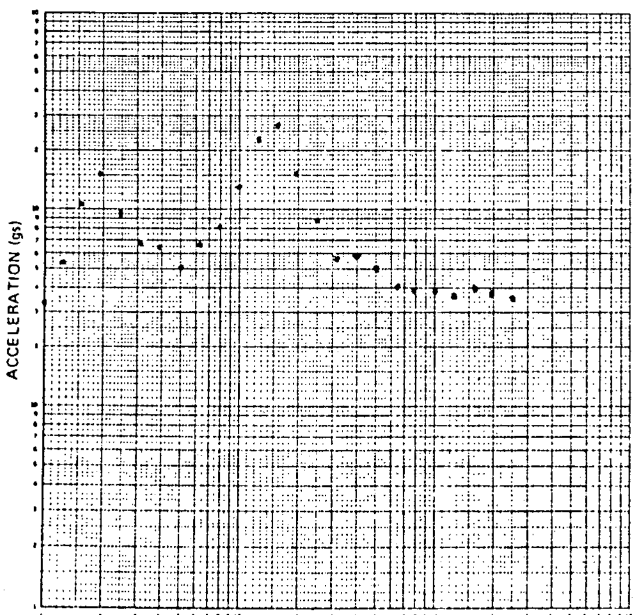
RESPONSE DIRECTION: ☒ FRONT TO BACK ☐ FRONT TO BACK (180° SHIFT) — ☒ SIDE TO SIDE ☐ SIDE TO SIDE (180° SHIFT)

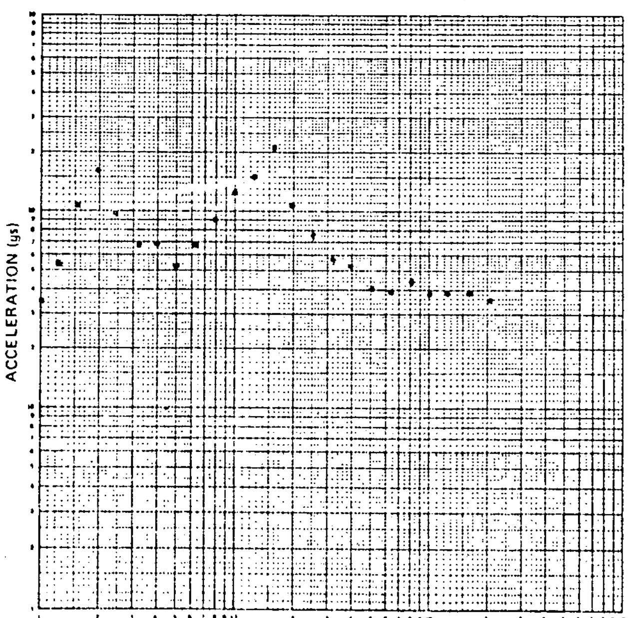




TEST PLANE: ☐ VERTICAL ☒ FRONT TO BACK / VERTICAL — ☒ SIDE TO SIDE / VERTICAL

RESPONSE DIRECTION: ☒ VERTICAL ☐ VERTICAL (180° SHIFT) — ☒ VERTICAL ☐ VERTICAL (180° SHIFT)

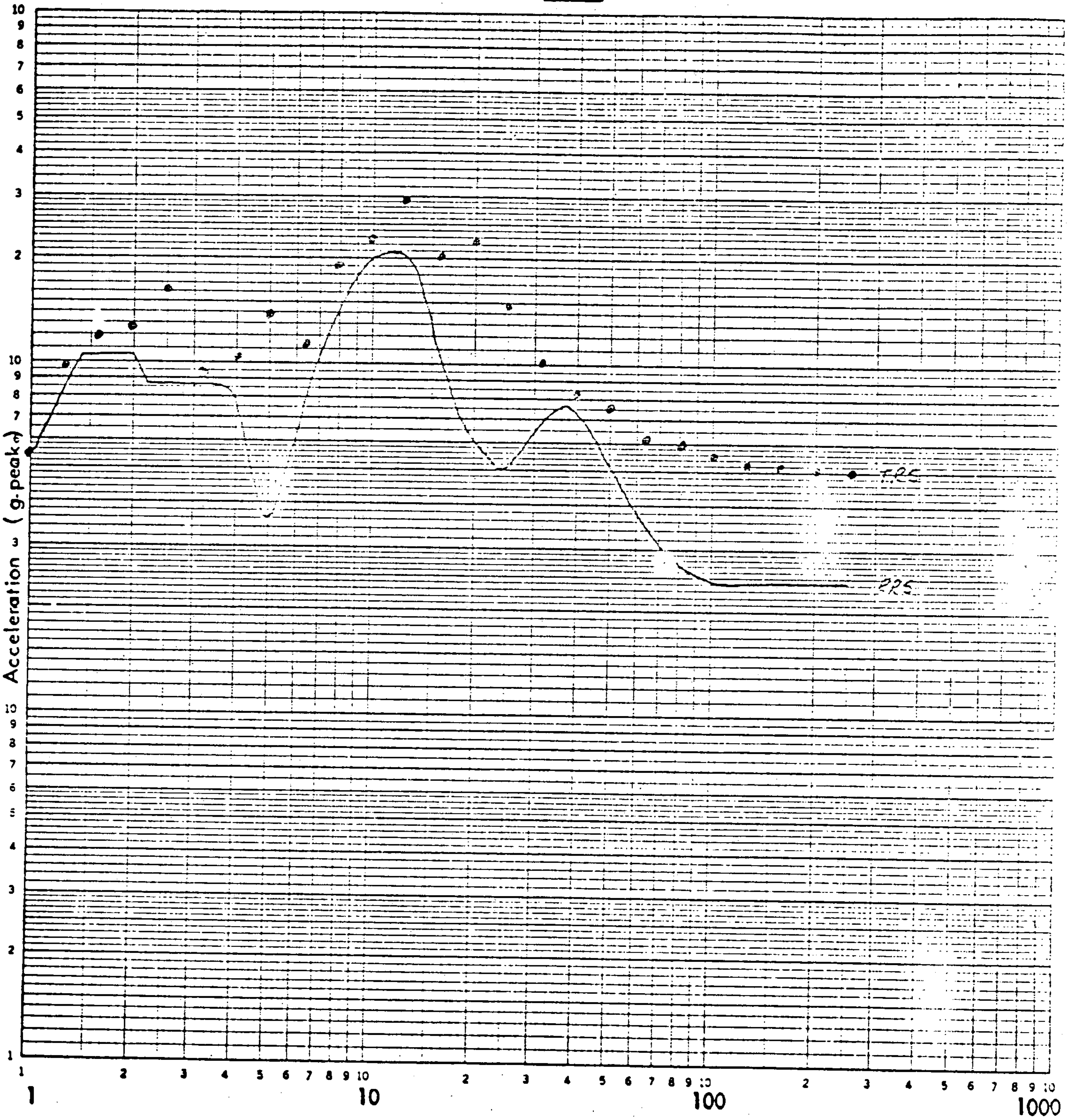




FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 1 %



AXIS SS/V MTM&PS FB/V RR & ARP

LOCATION NO. 14-A

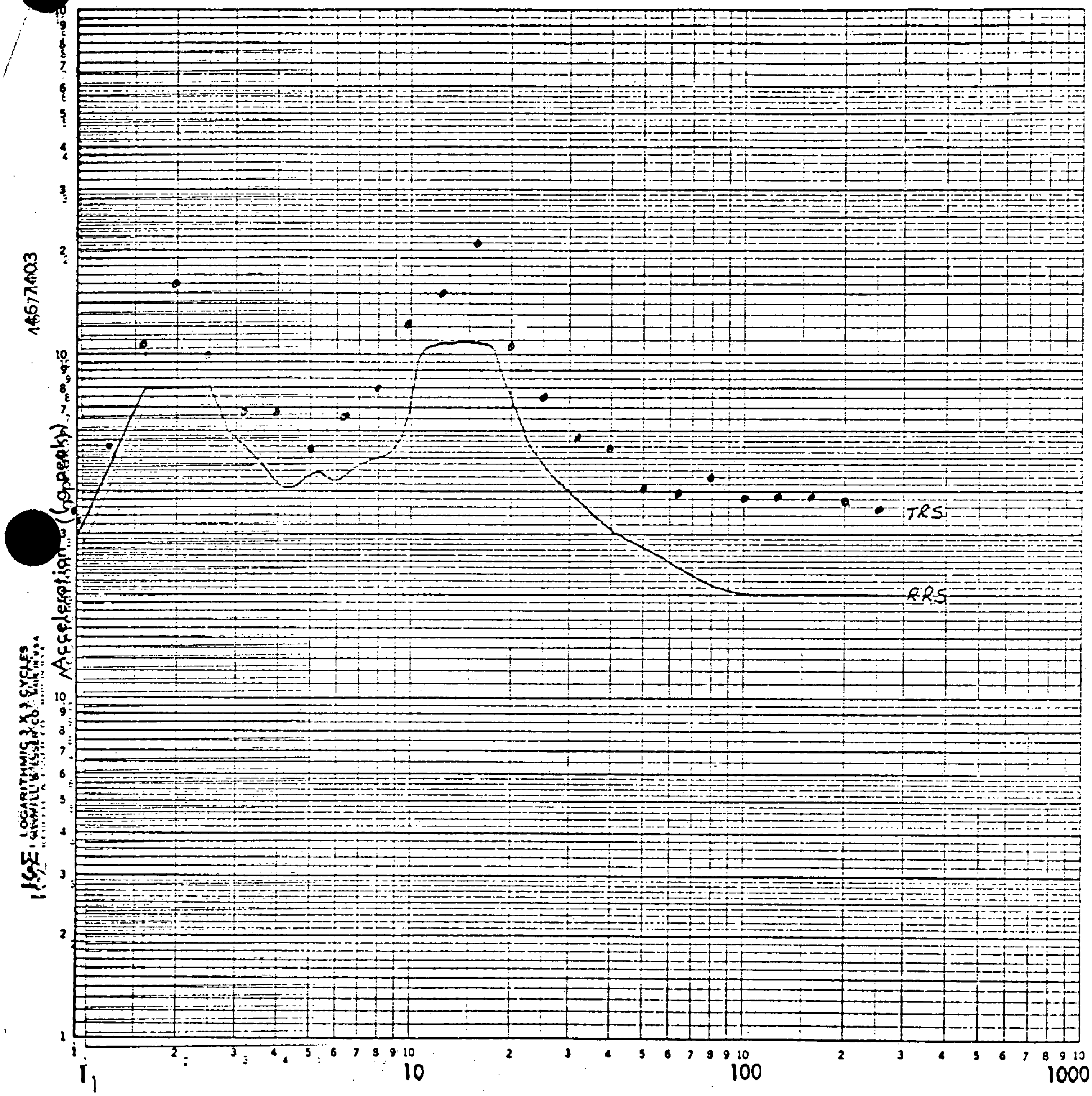
TEST RUN NO. 59

ge No. 266
port No. 43386-1

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 1 %



Frequency (Hz)

AXIS SSIV MTM & PS FBIV RR & ARP

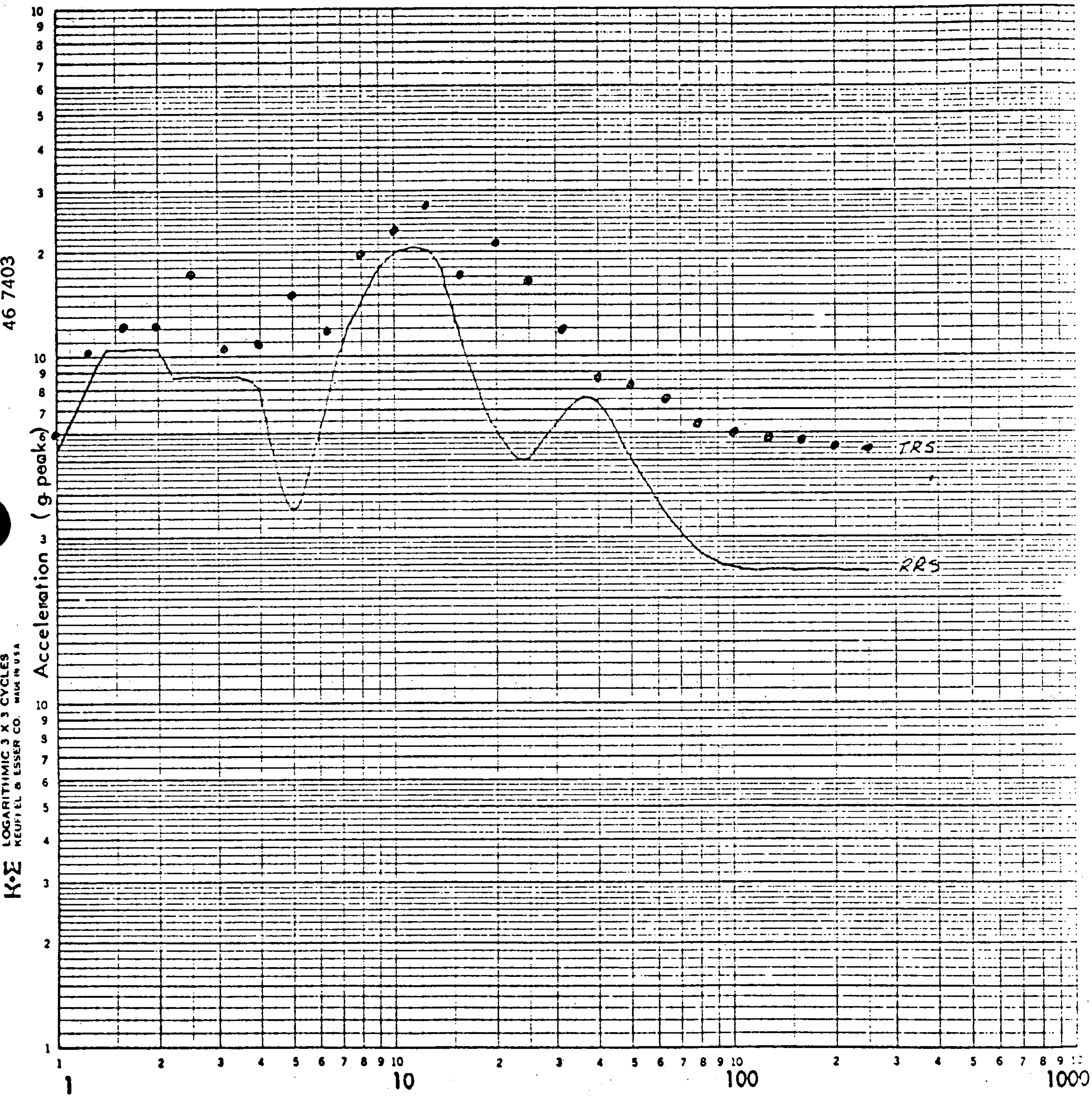
LOCATION NO. VCA

TEST RUN NO. 59

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING | 1 % |



AXIS SS/V RR & ACP FB/V NTM & PS

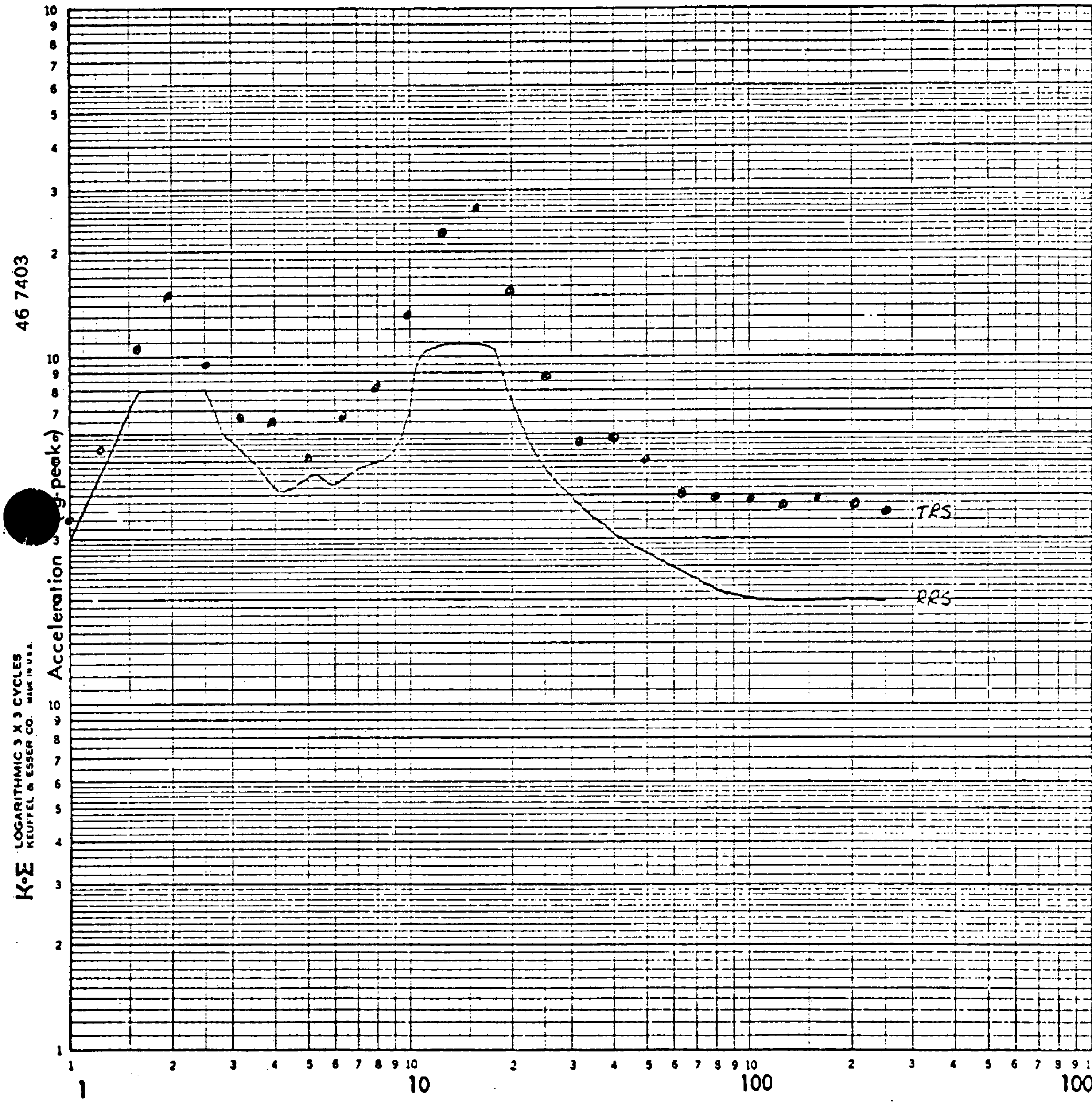
LOCATION NO. HCP

TEST RUN NO. 68

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING [1 %]



SSIV FBIV

AXIS RR+ARP MTM&PS

LOCATION NO. VCR

TEST RUN NO. 68

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 Type:

1. Utility: Southern California Edison Company PWR X

2. NSSS: CE 3. A/E: Bechtel BWR

II. Component Name: PPS Rotary Relay

1. Scope: [X] NSSS [ ] BOP

2. Model Number: MOR-170-1 Quantity: 4

3. Vendor: Potter Brumfield

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

5. Physical Description a. Appearance Wall Mounted Relay

b. Dimensions 4.19" x 4.19" x 5"

c. Weight ≅3#

6. Location: Building: Control Area, Aux. Bldg.

Elevation: 30'

7. Field Mounting Conditions [X] Bolt (No. 2 , Size 5/16-8)
[ ] Weld (Length)
[ ]

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

S/S: 24 F/B: >40
V: >40

9. a. Functional Description: RPS initiations Relay

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

[X] Both

10. Pertinent Reference Design Specifications: 00000-ICE-3001 Rev. 03
1370-ICE-3001 Rev. 01

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

IV. Equipment Qualification Method: Test: X

Analysis: ____

Combination of Test and Analysis: ____

Test and/or Analysis by Electro Mechanics Inc., QR-5330-1
Lab. - Wyle Laboratories, Report No. 43386-1
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ____

5. [ ] Combination of ____

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ____
(Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ____

S/S = 2.4g input F/B = 2.4g input V = 2.0g input

VI. If Qualification by Test, then Complete: ____

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

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

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

4. Frequency Range: See TRS attached

5. TRS enveloping RRS using Multi-Frequency Test [X] Yes (plot TRS on RRS graphs)
[ ] No

6. Input g-level Test at:

   S/S = 5.3
   F/B = 4.9
   V = 3.5

7. Laboratory Mounting: ______

   1. [X] Bolt (No. 2, Size 5/16-8) [ ] Weld (Length ______)
      Unistrut, Nut, Spring
      [ ] ______

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

    NA

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

1. Description of Test including Results: NA

2. Method of Analysis: ______

   [ ] Static Analysis
   [ ] Dynamic Analysis
   [ ] Equivalent Static Analysis
   [ ] Time-History
   [ ] Response Spectrum

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: ______ 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. Deflection	Location	Effect Upon Functional Operability

NSSS 1j

NATURAL FREQUENCIES: VERTICAL ______ SIDE / SIDE ______ FRONT / BACK ______

ELECTRICAL OPERATION Performed as required; No contact malfunctions were detected during, before or after test

PHYSICAL INTEGRITY Intact; No physical effects.

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS ______

MAXIMUM EXTERIOR DEFLECTION ______

DYNAMIC LOAD TO MOUNTING ______

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES ______

VI. DISCUSSION

C E 0060234 (9/75)

15.

TEST RESPONSE SPECTRA

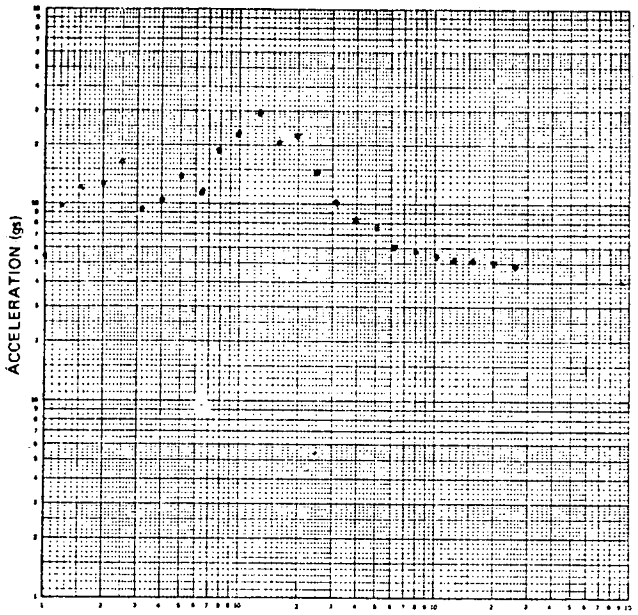
DATA SHEET No. 11
DATE MARCH 1977

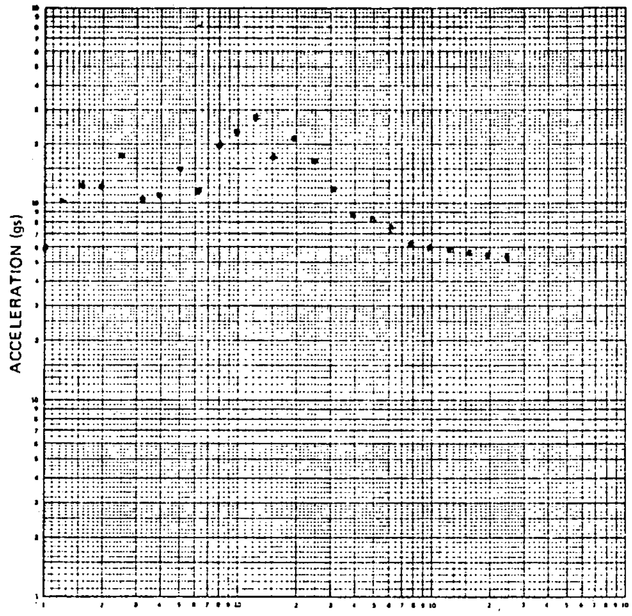
SPECTRUM FULL SCALE: ACCELERATION ☐ 10 gs ☒ 100 gs
FREQUENCY ☐ 100 Hz ☒ 1000 Hz

1 % CRITICAL DAMPING REVISION No. 01

TEST PLANE: ☐ FRONT TO BACK ☒ FRONT TO BACK / VERTICAL | ☐ SIDE TO SIDE ☒ SIDE TO SIDE / VERTICAL

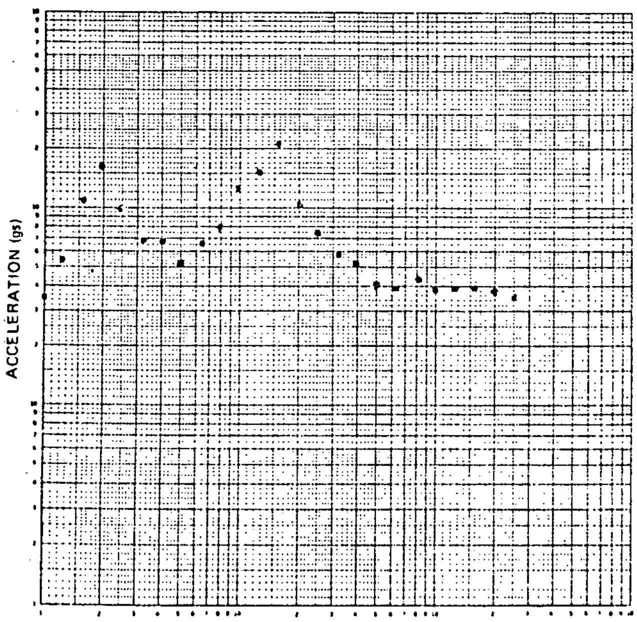
RESPONSE DIRECTION: ☒ FRONT TO BACK ☐ FRONT TO BACK (180° SHIFT) | ☒ SIDE TO SIDE ☐ SIDE TO SIDE (180° SHIFT)

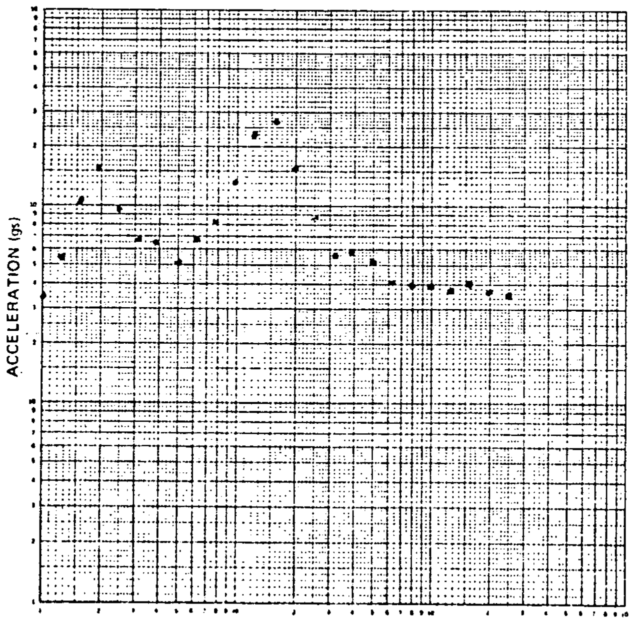




TEST PLANE: ☐ VERTICAL ☒ FRONT TO BACK / VERTICAL | ☒ SIDE TO SIDE / VERTICAL

RESPONSE DIRECTION: ☒ VERTICAL ☐ VERTICAL (180° SHIFT) | ☒ VERTICAL ☐ VERTICAL (180° SHIFT)



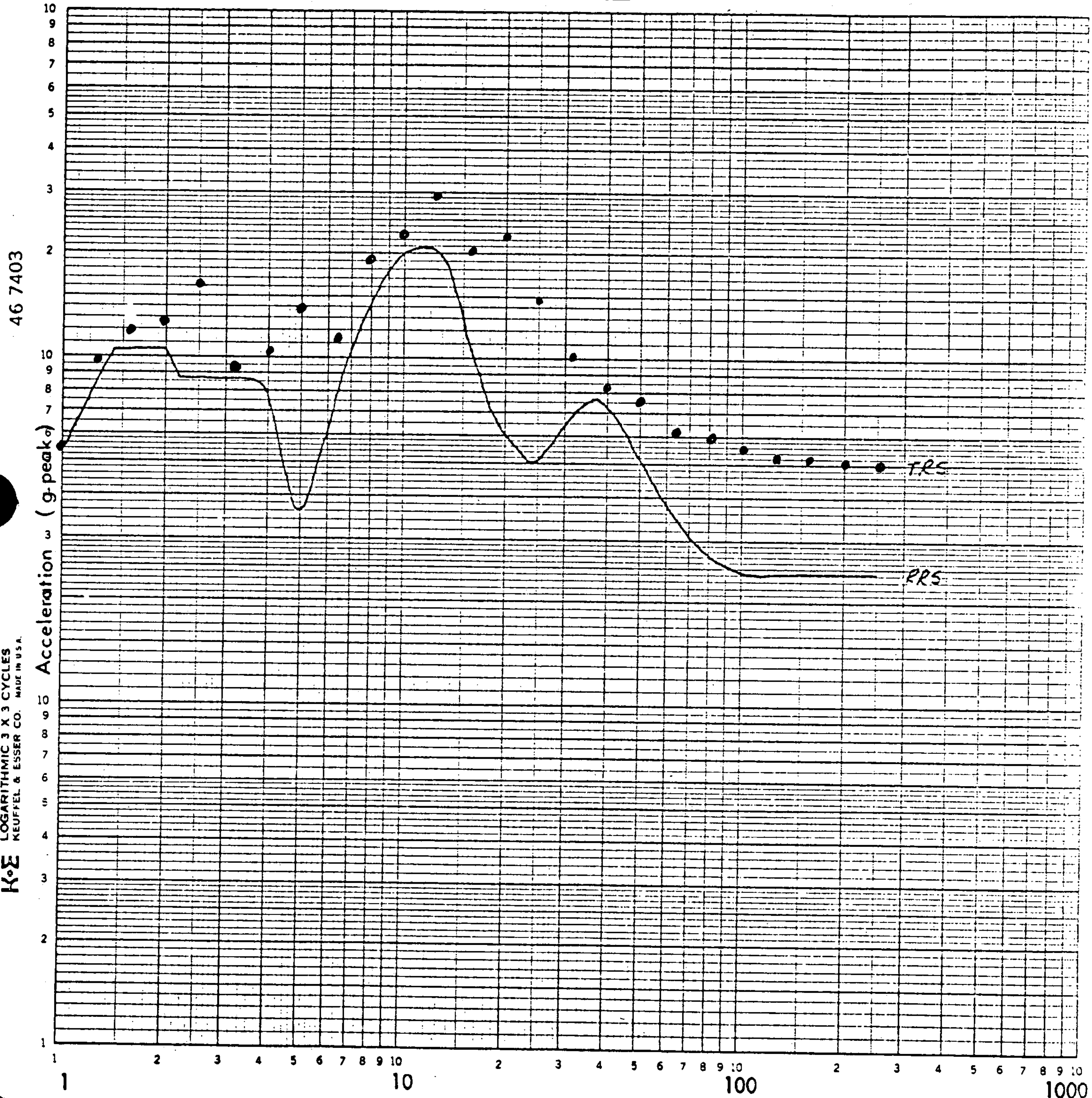


CE 0090234 (9/75) BACK

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING | 1 % |



SS/V FB/V
AXIS MTM&PS RR & ARP

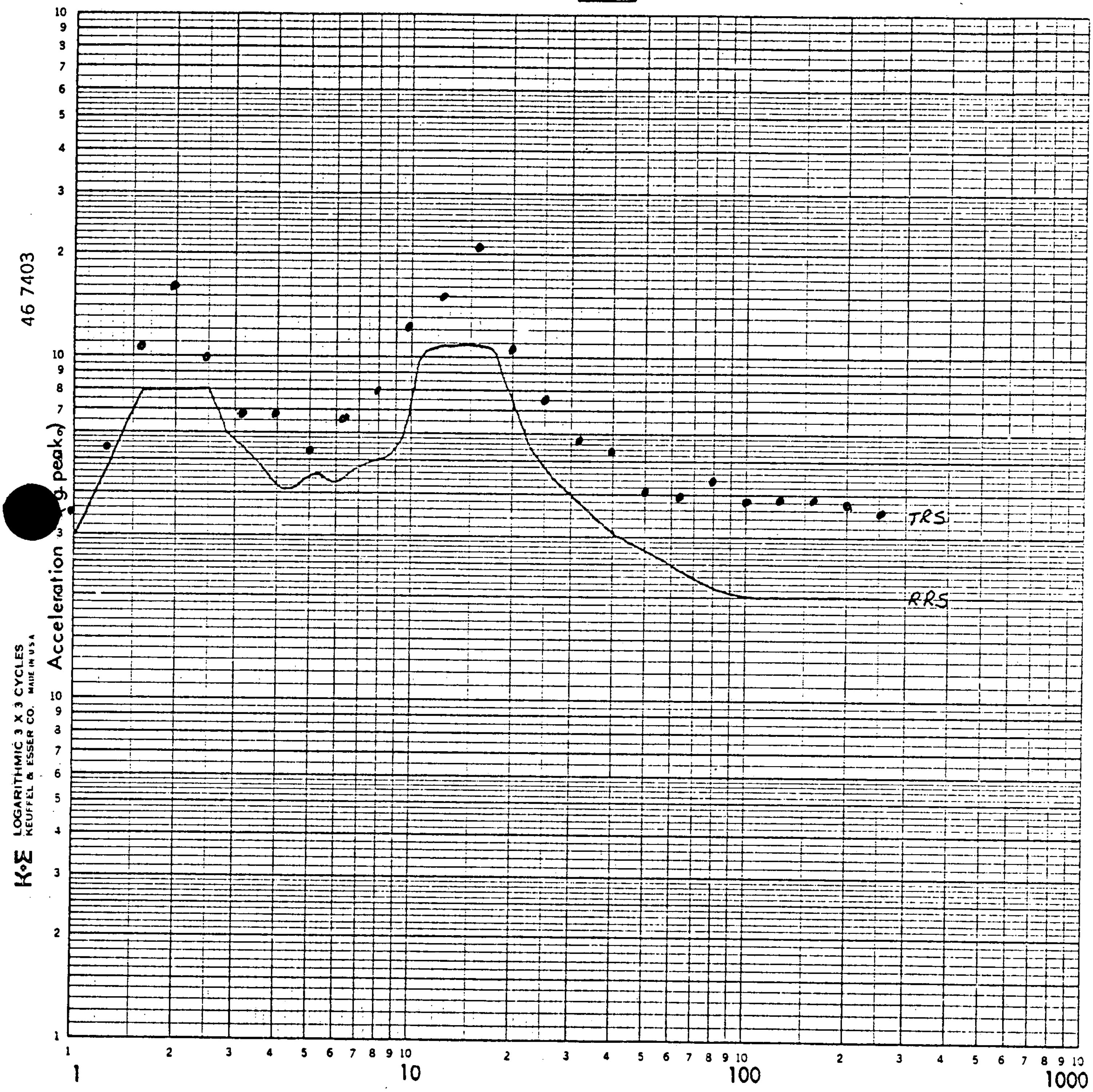
LOCATION NO. 1LCR

TEST RUN NO. 59

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING | 1 % |



	SSIV	FBIV
AXIS	MTM & PS	RR & ARP

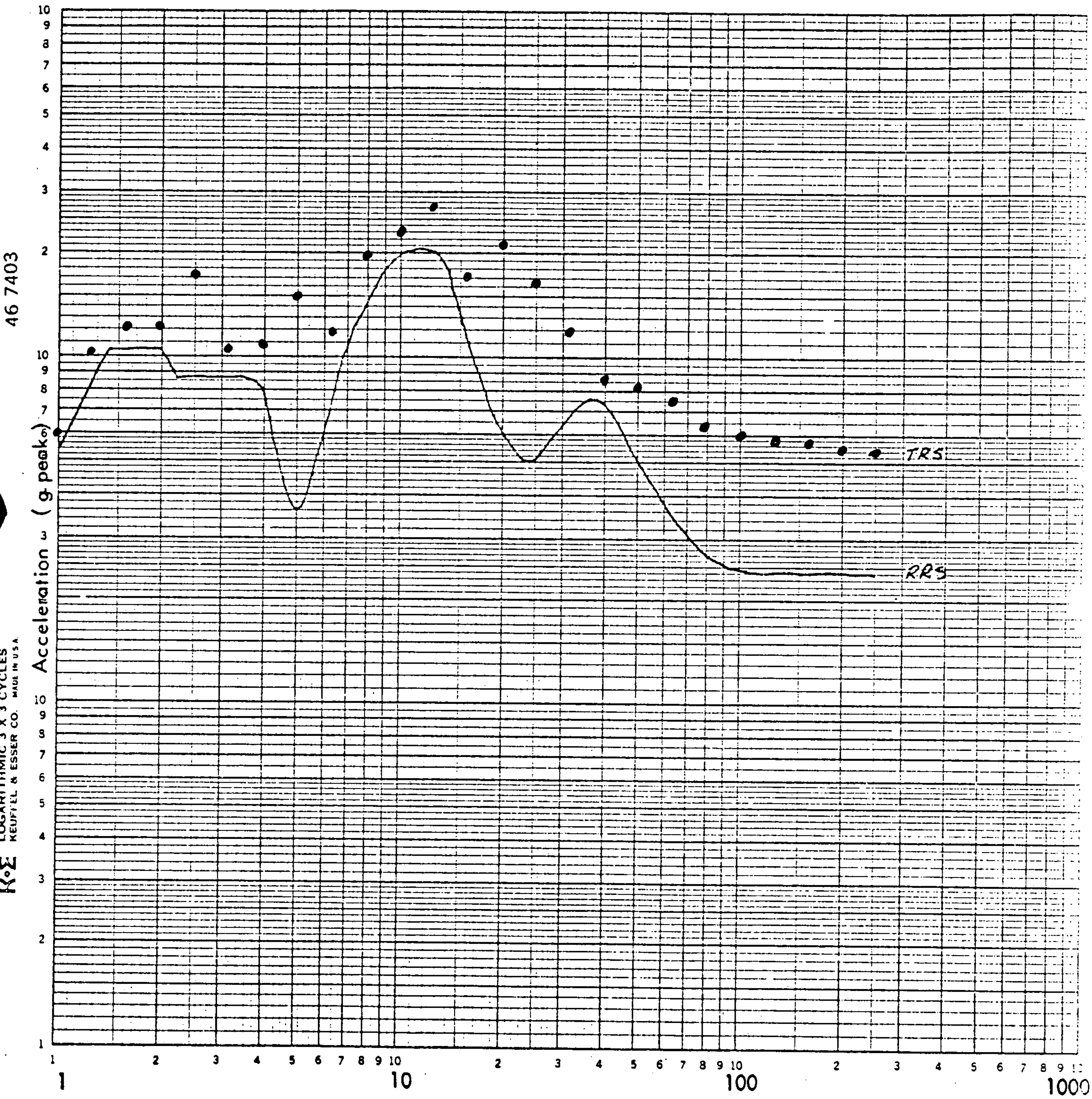
LOCATION NO. VCA

TEST RUN NO. 59

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING [1 %]



AXIS SS/V RR & ARP   FB/V NTM & PS

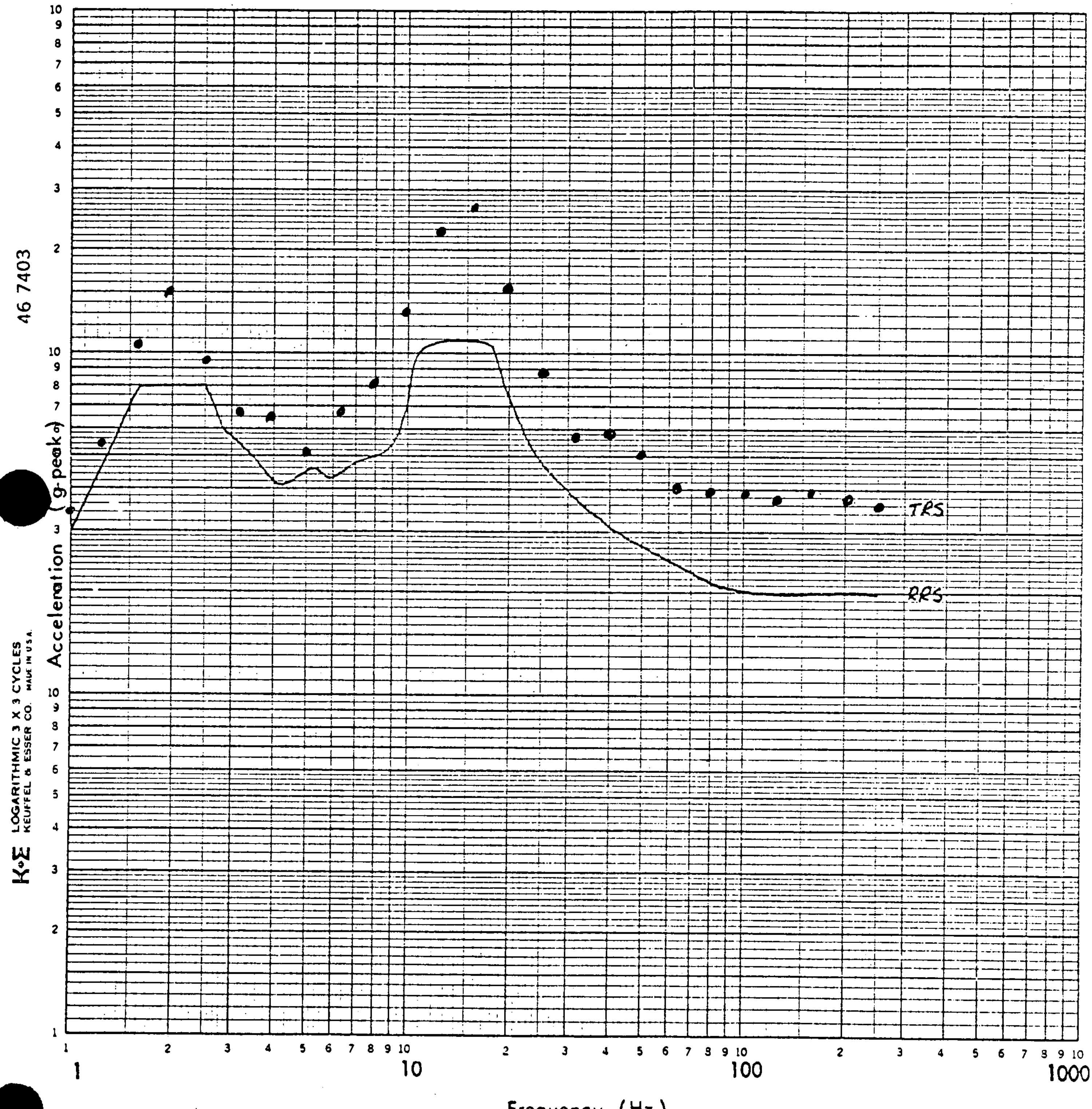
LOCATION NO. HCA

TEST RUN NO. 68

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 1 %



SSIV FBIV

AXIS RR+ARP MTM&PS

LOCATION NO. VCR

TEST RUN NO. 68

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X

2. NSSS: CE 3. A/E: Bechtel — BWR ______

II. Component Name: PPS Sola Transformer

1. Scope: [X] NSSS [ ] BOP

2. Model Number: 23-13-060-2 Quantity: 4

3. Vendor: Sola

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

5. Physical Description a. Appearance Rectangular Box

   b. Dimensions 3-1/4" x 7" x 4-3/4"

   c. Weight ≅5#

6. Location: Building: Control Area Aux. Bldg.

   Elevation: 30'

7. Field Mounting Conditions [X] Bolt (No. 4, Size 10-32)
   [ ] Weld (Length ______)
   [ ] ______

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

   S/S: >33Hz F/B: >33Hz
   V: >33Hz

9. a. Functional Description: Isolates 120 Vac power to redundant cabinet cooler fans

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

   [X] Both ______

10. Pertinent Reference Design Specifications: 00000-ICE-3001 Rev. 03 1370-ICE-3001 Rev. 01

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

IV. Equipment Qualification Method: Test: X

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Electro-Mechanics, Inc. QR-5330-1
Lab. - Wyle Laboratories Report No. 43386-1
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

   3. [ ] Explosive only 4. [ ] Other (Specify) ______

   5. [ ] Combination of ______

   6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
      [ ] ______
      (Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ______

   S/S = 2.4g input F/B = 2.4g input V = 2.0g input

VI. If Qualification by Test, then Complete: ______

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

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

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

4. Frequency Range: See TRS attached

5. TRS enveloping RRS using Multi-Frequency Test [X] Yes (plot TRS on RRS graphs)
   [ ] No

6. Input g-level Test at:

S/S = 5.2
F/B = 5.3
V = 4.1

7. Laboratory Mounting: ____________________

1. [X] Bolt (No. 4, Size 10-32 x 1/2) [ ] Weld (Length ____________)
[ ] ____________________

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

N/A

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

1. Description of Test including Results: N/A

2. Method of Analysis: ____________________

[ ] Static Analysis
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: __________ 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. Deflection	Location	Effect Upon Functional Operability

NSSS 1K

NATURAL FREQUENCIES: VERTICAL ______ SIDE / SIDE ______ FRONT / BACK ______

ELECTRICAL OPERATION Performed as required; No output signal perturbations

PHYSICAL INTEGRITY Intact; No physical effect

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS ______

MAXIMUM EXTERIOR DEFLECTION ______

DYNAMIC LOAD TO MOUNTING ______

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES ______

VI. DISCUSSION

C-E 0090234 (9/75)

I K.

TEST RESPONSE SPECTRA

DATA SHEET No. 1k

DATE MARCH 1977

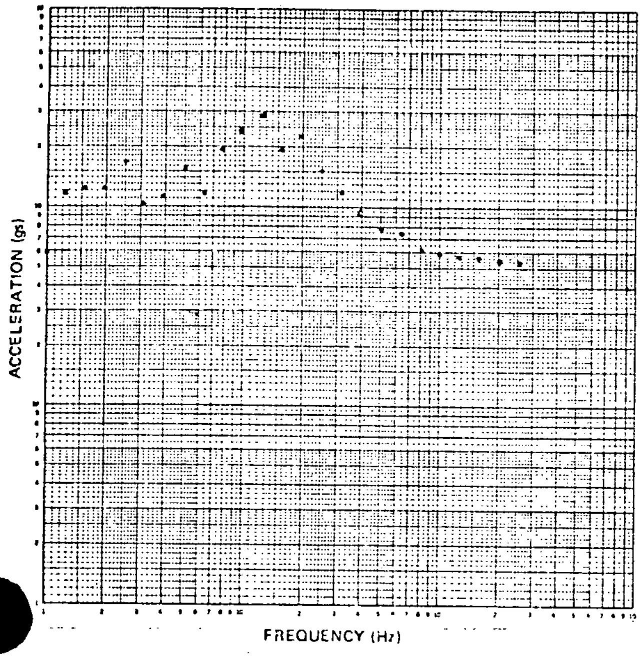
SPECTRUM FULL SCALE: ACCELERATION ☐ 10 gs ☒ 100 gs

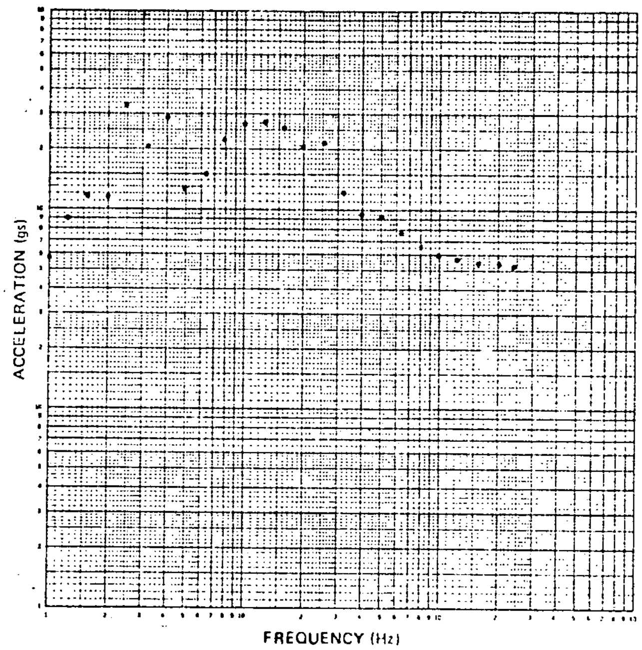
FREQUENCY ☐ 100 Hz ☒ 1000 Hz

1 % CRITICAL DAMPING REVISION No. 01

TEST PLANE: ☐ FRONT TO BACK ☒ FRONT TO BACK / VERTICAL — ☐ SIDE TO SIDE ☒ SIDE TO SIDE / VERTICAL

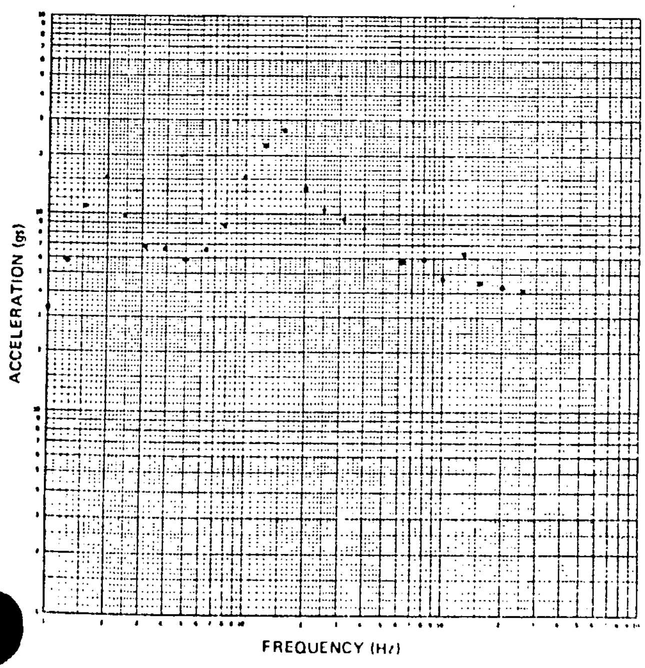
RESPONSE DIRECTION: ☒ FRONT TO BACK ☐ FRONT TO BACK (180° SHIFT) — ☒ SIDE TO SIDE ☐ SIDE TO SIDE (180° SHIFT)

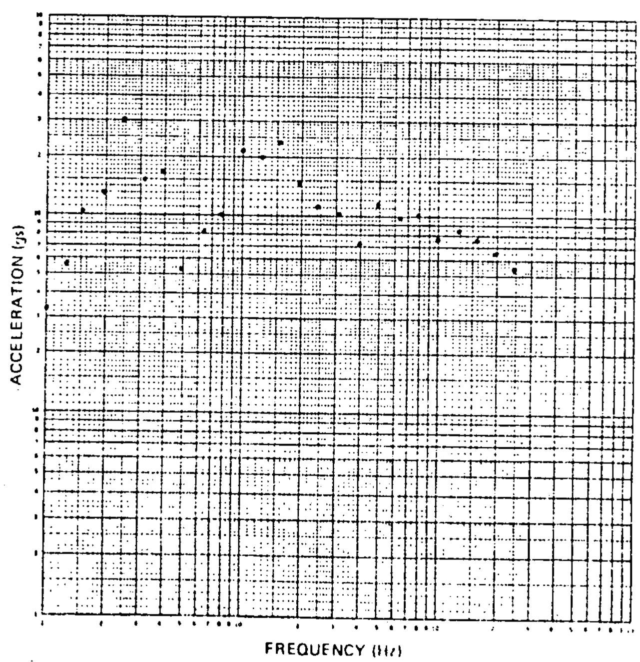




TEST PLANE: ☐ VERTICAL ☒ FRONT TO BACK / VERTICAL — ☒ SIDE TO SIDE / VERTICAL

RESPONSE DIRECTION: ☒ VERTICAL ☐ VERTICAL (180° SHIFT) — ☒ VERTICAL ☐ VERTICAL (180° SHIFT)

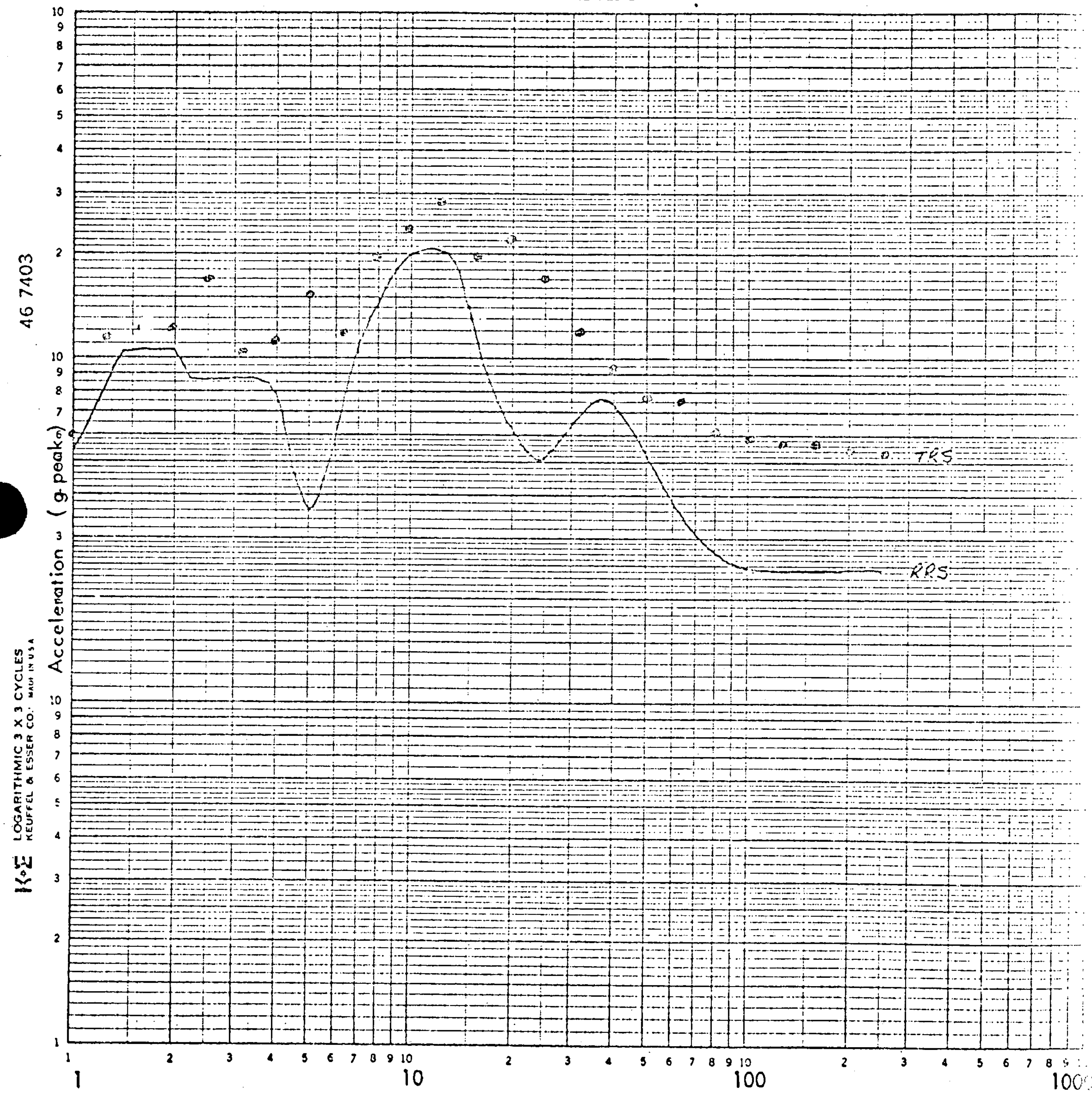




FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING | 1 % |



AXIS FB/V

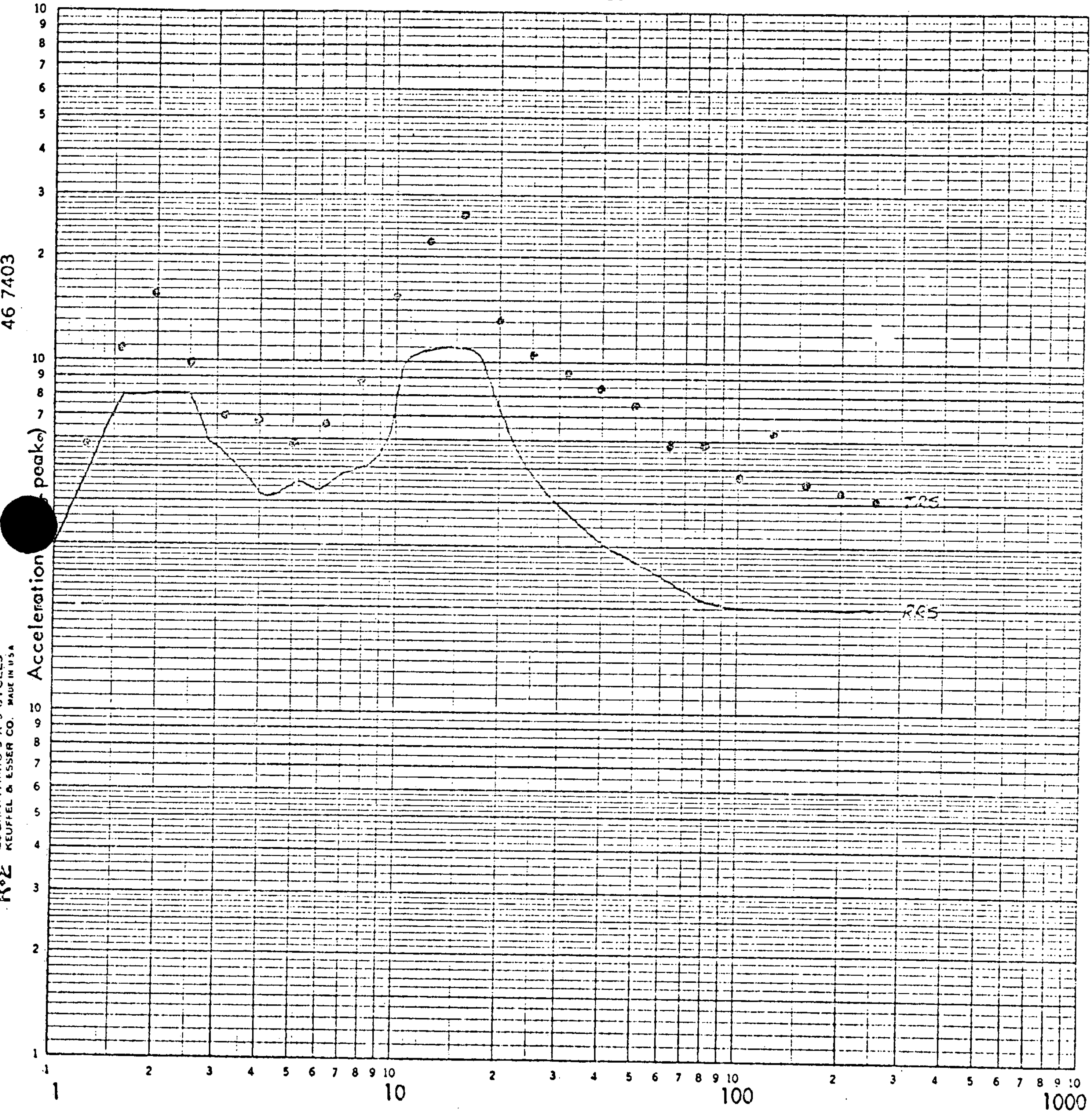
LOCATION NO. HCA

TEST RUN NO. 76

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING [1 %]



AXIS FB/V

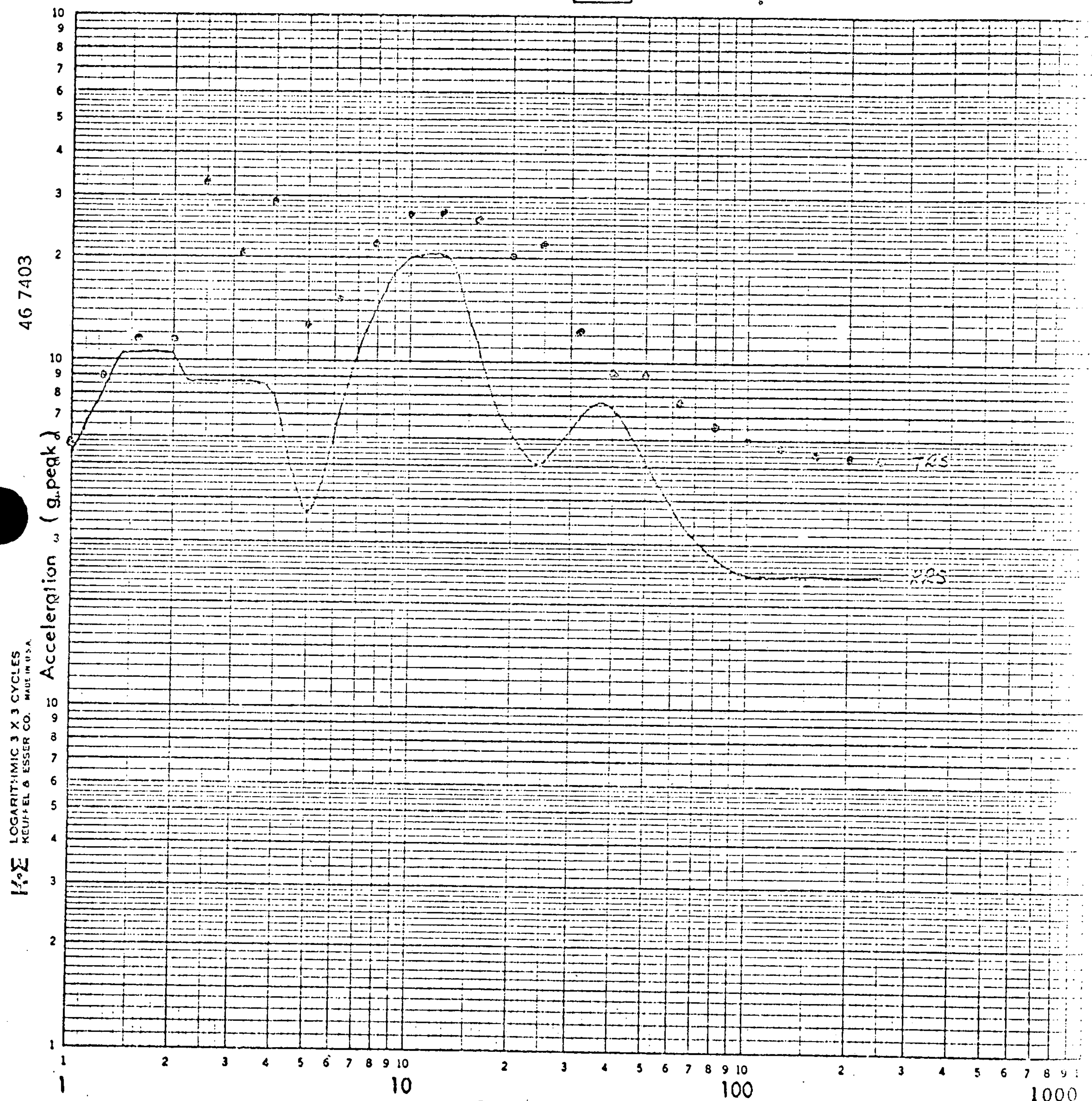
LOCATION NO. VCP

TEST RUN NO. 76

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING | 1 % |



AXIS SS/V

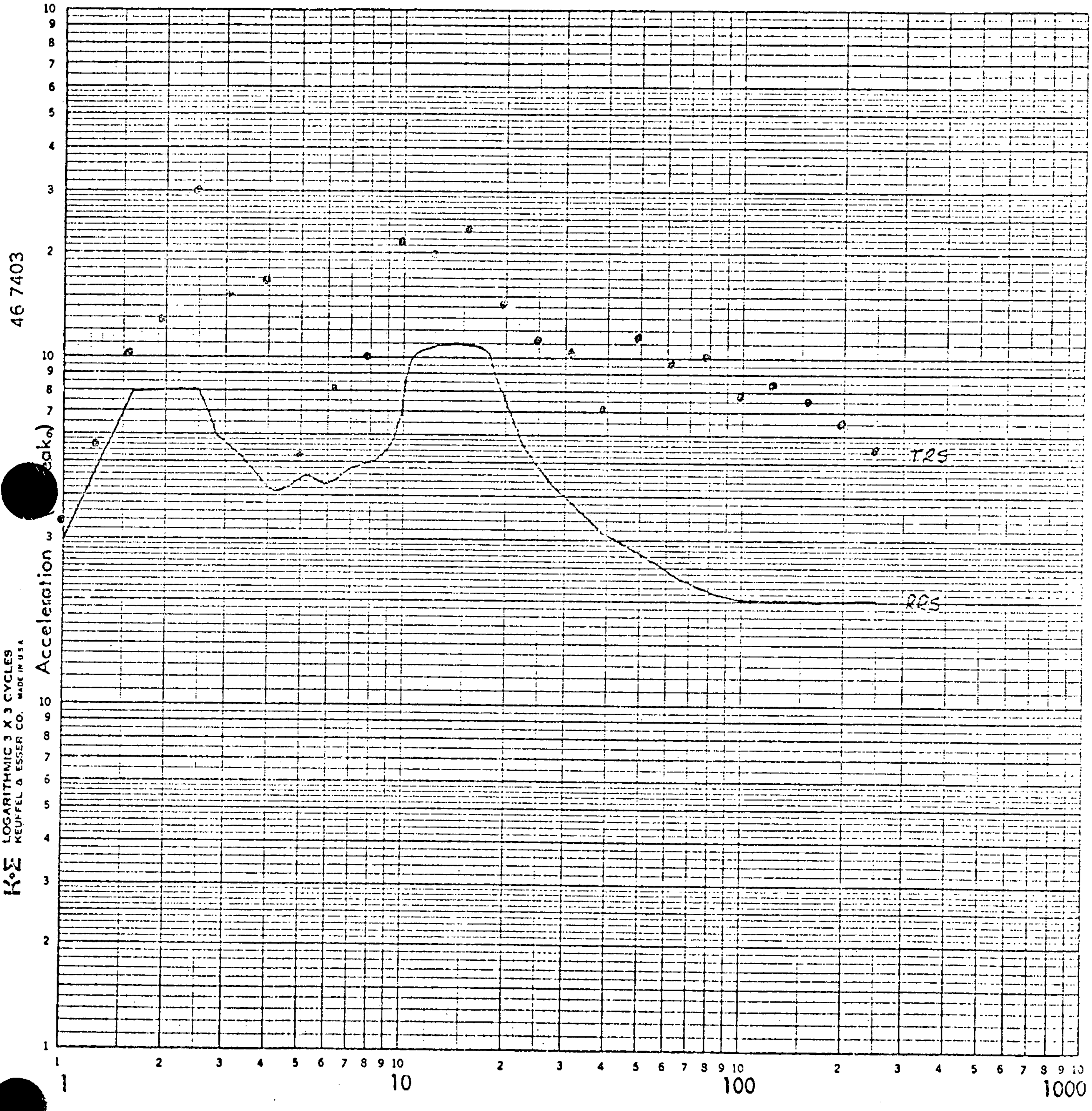
LOCATION NO. HCA

TEST RUN NO. 83

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING | 1 % |



AXIS SS/V

LOCATION NO. VCP

TEST RUN NO. 83

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 Type:

1. Utility: Southern California Edison Company PWR X

2. NSSS: CE 3. A/E: Bechtel BWR ____

II. Component Name: PPS Cabinet Cooler Assembly

1. Scope: [X] NSSS [ ] BOP

2. Model Number: None Quantity: 4

3. Vendor: Electro-Mechanics

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

5. Physical Description a. Appearance Trough Assembly

   b. Dimensions 24" x 26.6" x 7"

   c. Weight ≅30#

6. Location: Building: Control Area, Auxiliary Bldg.

   Elevation: 30'

7. Field Mounting Conditions [X] Bolt (No. 4, Size 1/4-20)
   [ ] Weld (Length ____)
   [ ] ____

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

   S/S: >40 F/B: >40
   V: >40

9. a. Functional Description: Ventilation of cabinet bay

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

   [X] Both ____

10. Pertinent Reference Design Specifications: 00000-ICE-3001, Rev. 03
    1370-ICE-3001, Rev. 01

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

IV. Equipment Qualification Method: Test: X

Analysis: ____

Combination of Test and Analysis: ____

Test and/or Analysis by Electro-Mechanics, Iuc. QR-5330-1
Lab. - Wyle Laboratories, Report No. 43386-1
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ____

5. [ ] Combination of ____

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ____
(Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ____

S/S = 2.4g input F/B = 2.4g input V = 2.0g input

VI. If Qualification by Test, then Complete: ____

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

2. [ ] Single Axis [X] Multi-Axis (Bi-Axial)

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

4. Frequency Range: See TRS attached

5. TRS enveloping RRS using Multi-Frequency Test [X] Yes (plot TRS on RRS graphs)
[ ] No

6. Input g-level Test at:

S/S = 5.2
F/B = 5.3
V = 4.1

7. Laboratory Mounting: ______

1. [X] Bolt (No. 4, Size 1/4-20) [ ] Weld (Length ______)
[ ] ______

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

N/A

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
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: ______ 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. Deflection	Location	Effect Upon Functional Operability

NSSS 12

NATURAL FREQUENCIES: VERTICAL ______ SIDE / SIDE ______ FRONT / BACK ______

ELECTRICAL OPERATION Performance as required; No perturbations, the fan and flow sensors operated before, during and after the test.

PHYSICAL INTEGRITY Intact, no physical effects

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS ______

MAXIMUM EXTERIOR DEFLECTION ______

DYNAMIC LOAD TO MOUNTING ______

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES ______

VI. DISCUSSION

The air flow switch which was monitored is used only for annunciator purposes.

16.

TEST RESPONSE SPECTRA

DATA SHEET No. 11

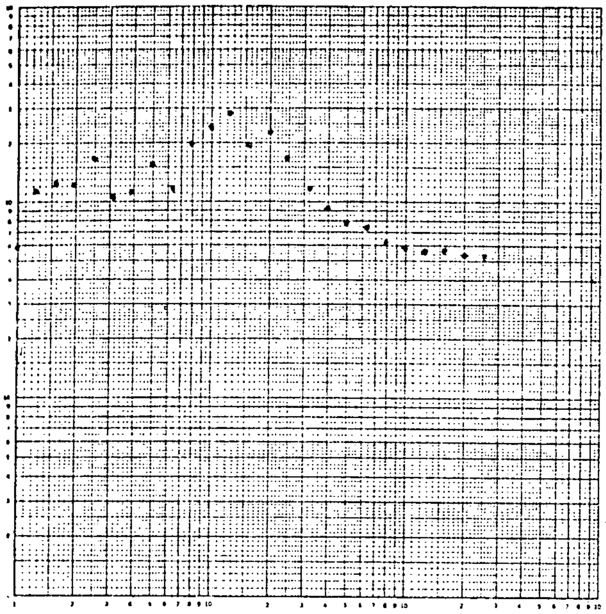
DATE MARCH 1977

SPECTRUM FULL SCALE: ACCELERATION ☐ 10 gs ☒ 100 gs
FREQUENCY ☐ 100 Hz ☒ 1000 Hz

1 % CRITICAL DAMPING REVISION No. 01

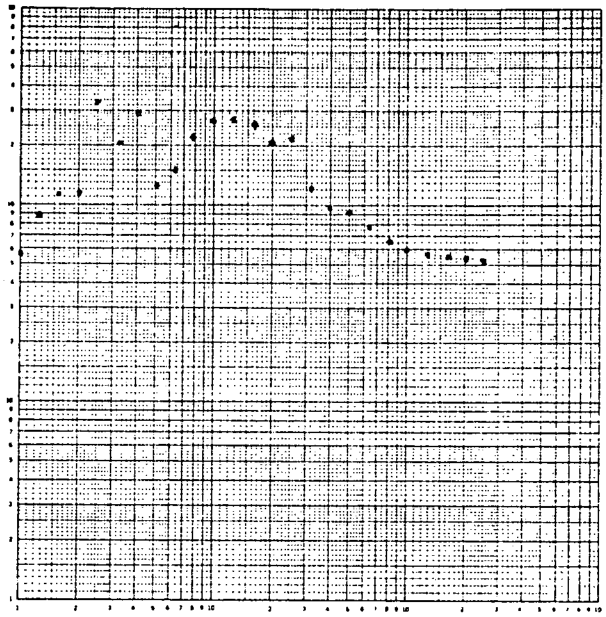
TEST PLANE: ☐ FRONT TO BACK ☒ FRONT TO BACK / VERTICAL — ☐ SIDE TO SIDE ☒ SIDE TO SIDE / VERTICAL

RESPONSE DIRECTION: ☒ FRONT TO BACK ☐ FRONT TO BACK (180° SHIFT) — ☒ SIDE TO SIDE ☐ SIDE TO SIDE (180° SHIFT)



ACCELERATION (gs)

FREQUENCY (Hz)

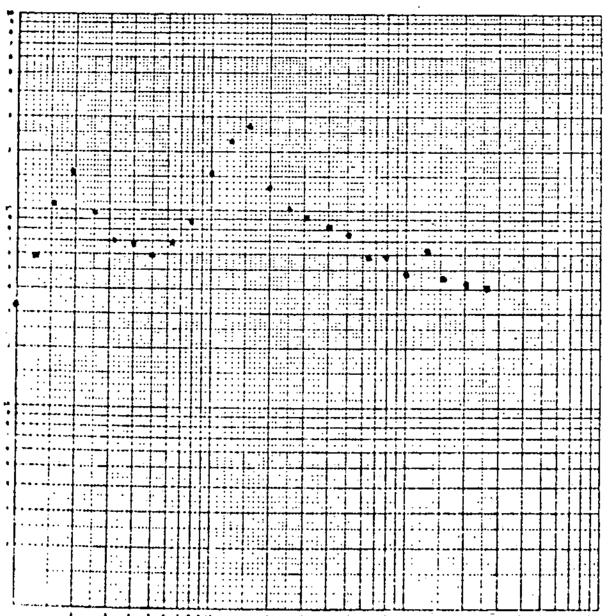


ACCELERATION (gs)

FREQUENCY (Hz)

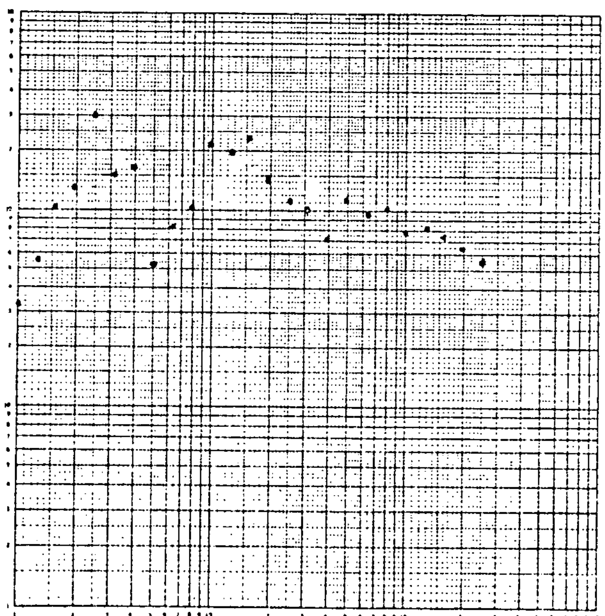
TEST PLANE: ☐ VERTICAL ☒ FRONT TO BACK / VERTICAL — ☒ SIDE TO SIDE / VERTICAL

RESPONSE DIRECTION: ☒ VERTICAL ☐ VERTICAL (180° SHIFT) — ☒ VERTICAL ☐ VERTICAL (180° SHIFT)



ACCELERATION (gs)

FREQUENCY (Hz)



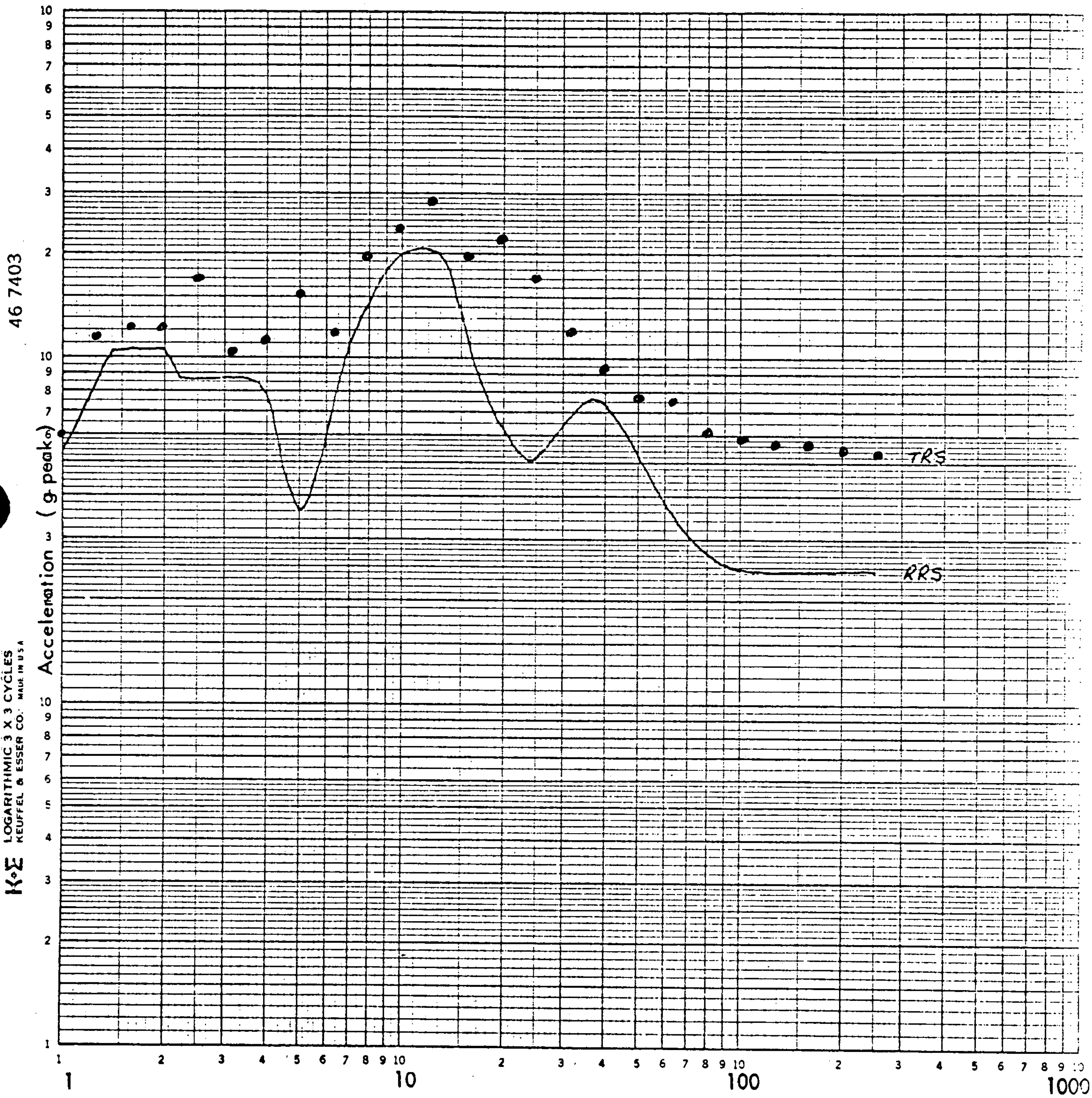
ACCELERATION (gs)

FREQUENCY (Hz)

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING | 1 % |



AXIS FB/V

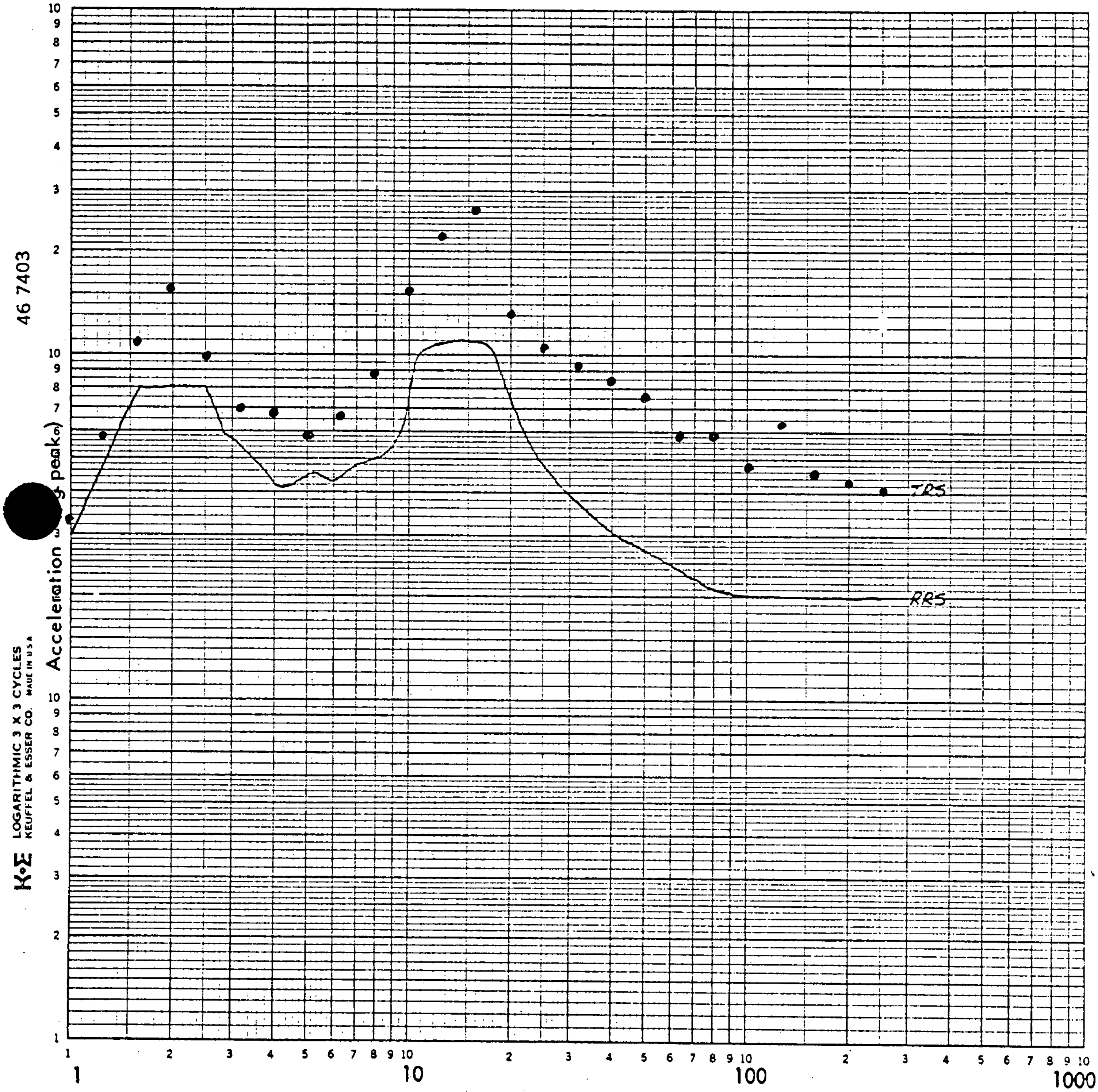
LOCATION NO. HCA

TEST RUN NO. 76

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING | 1 % |



AXIS FB/V

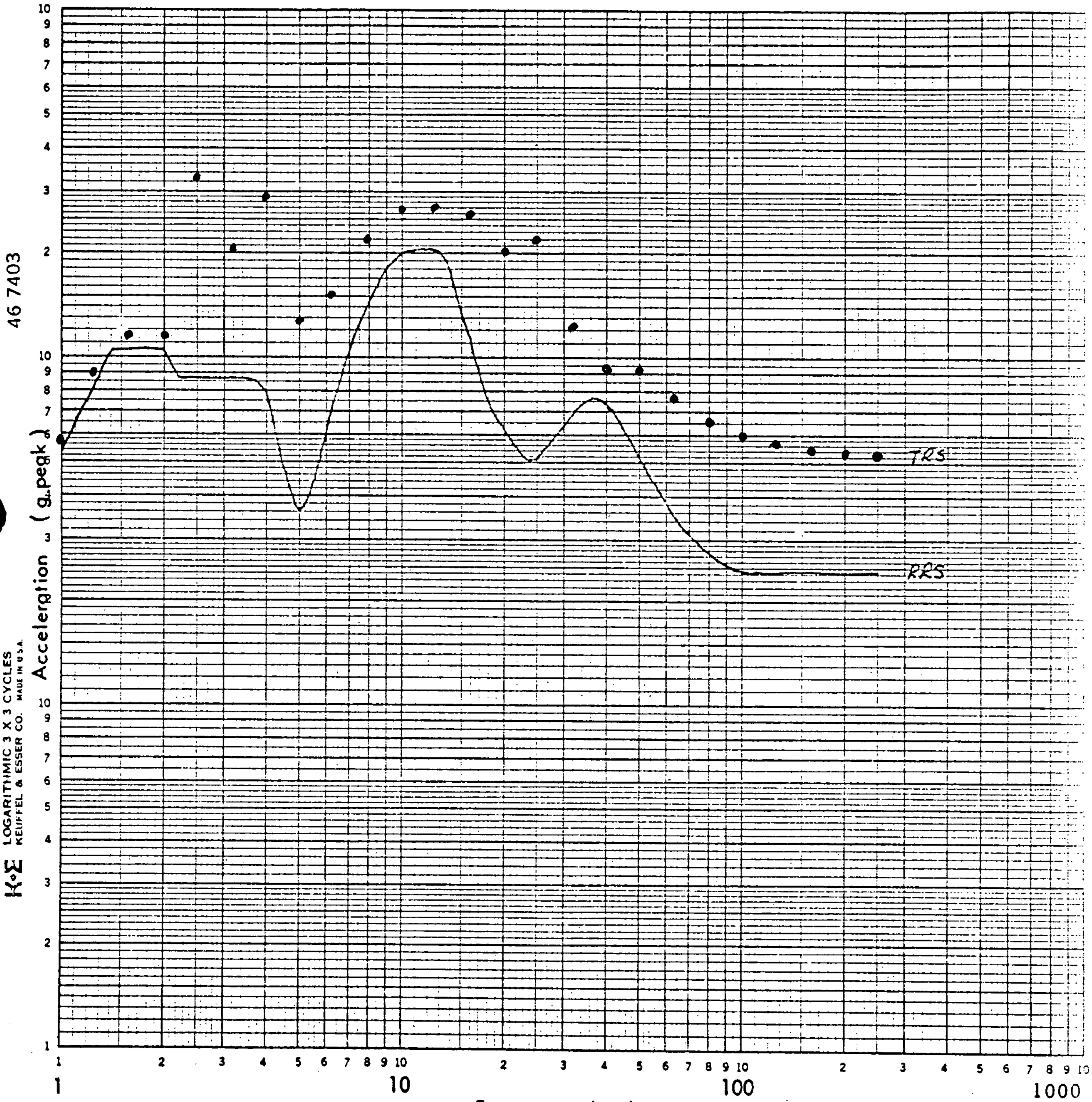
LOCATION NO. VCB

TEST RUN NO. 76

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 1 %



AXIS SS/V

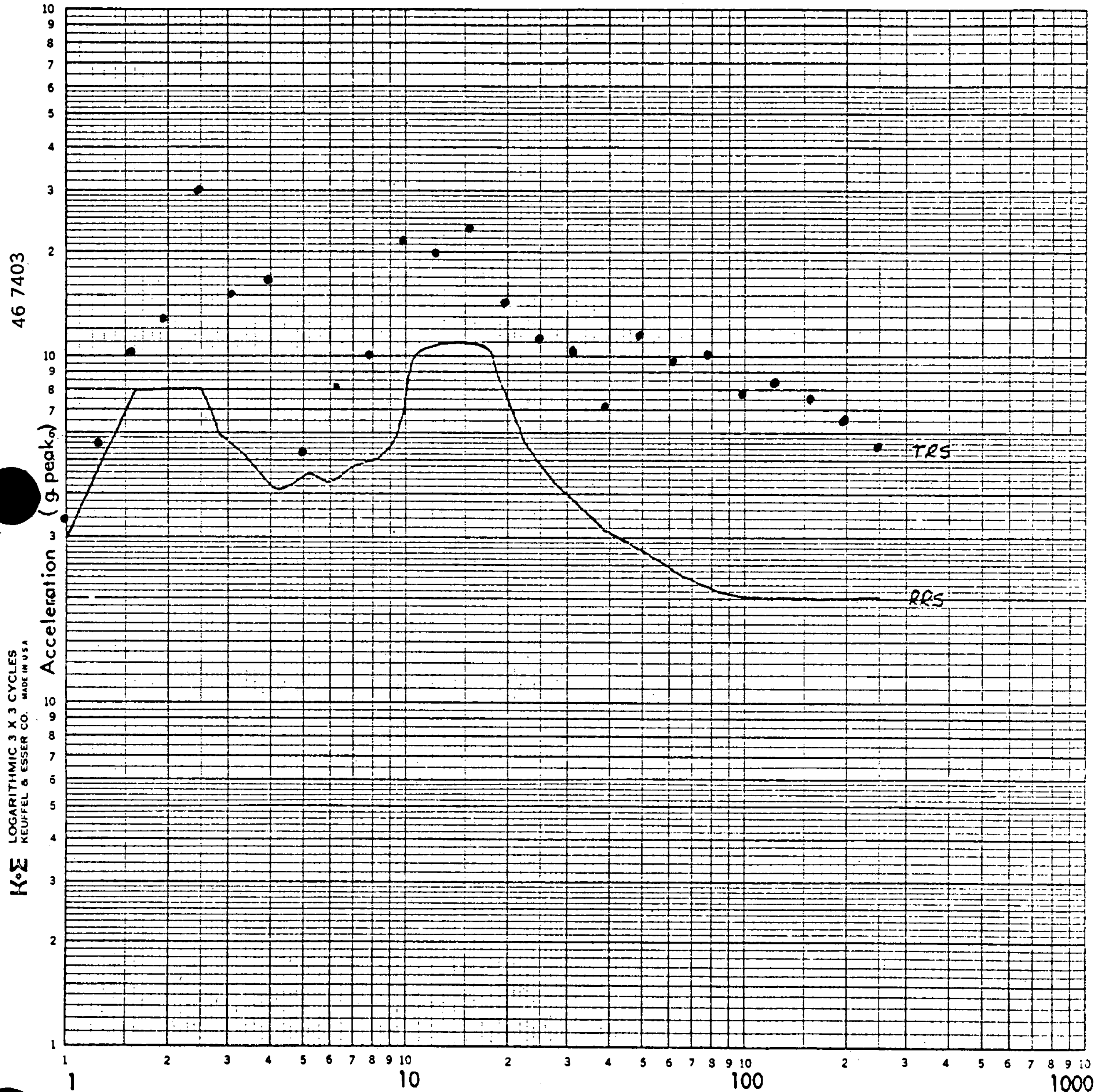
LOCATION NO. HCA

TEST RUN NO. 83

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING | 1 % |



AXIS SS/V

LOCATION NO. VCA

TEST RUN NO. 83

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR

II. Component Name: Auxiliary Protective Cabinet

1. Scope: [X] NSSS [ ] BOP
2. Model Number: None — Quantity: 1
3. Vendor: Reliance Electric Company
4. If the component is a cabinet or panel, name and model No. of the devices included: Devices included in cabinet are those Listed as Items 2a - 2q in NSSS Equipment List.
5. Physical Description a. Appearance Vertical 4-bay cabinet
   b. Dimensions 192" x 50" x 90" (L x W x H)
   c. Weight 12000#
6. Location: Building: Control Area Auxiliary Building
   Elevation: 30'
7. Field Mounting Conditions [ ] Bolt (No.______, Size______)
   [X] Weld (Length 2-1/2" on 10" centers)
   [X] Length 5" on 10" centers front of Channel A and 1/3 Channel B
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
   S/S: 9.5, 29 F/B: 13.5, 27, 32 V: >40
9. a. Functional Description: Houses components in Plant Protection System
   b. Is the equipment required for [X] Hot Standby [X] Cold Shutdown
   [X] Both
10. Pertinent Reference Design Specifications: 1370-ICE-3019 Rev. 0
    00000-ICE-3019 Rev. 0

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

IV. Equipment Qualification Method: Test: Cabinet filled with Dummy Modules except for ventillation fan.

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Wyle Labs, 43482
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only
   3. [ ] Explosive only 4. [ ] Other (Specify) ______
   5. [ ] Combination of ______
   6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
      [ ] ______
      (Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ______

   S/S = 1.0g input F/B = 1.0g input V = 0.75g input

VI. If Qualification by Test, then Complete: ______

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

2. [ ] Single Axis [X] Multi-Axis (Bi-axial)

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

4. Frequency Range: See TRS attached

5. TRS enveloping RRS using Multi-Frequency Test [X] Yes (plot TRS on RRS graphs)
   [ ] No

6. Input g-level Test at: S/S = 3.5 F/B = 3.1 V = 1.9

7. Laboratory Mounting: ____

   1. [X] Bolt (No. 20 ____, Size 5/8-11 UNC ____)

      [ ] Weld (Length ____) [ ] ____

8. Functional operability verified: [X] Yes Vent fans only

   [ ] No ____ [ ] Not Applicable ____

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

    NA

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
   [ ] Dynamic Analysis
   [ ] Equivalent Static Analysis
   [ ] Time-History
   [ ] Response Spectrum

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: ____ 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. Deflection	Location	Effect Upon Functional Operability

VI.9 [illegible]

NATURAL FREQUENCIES: VERTICAL 40 Hz SIDE / SIDE 9.5, 29 Hz FRONT / BACK 13.5,27,32 Hz

ELECTRICAL OPERATION Fans operational except for one failure noted below. No other electrical malfunctions were noted.

PHYSICAL INTEGRITY During the testing a door switch vibrated loose.

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS 3625 psi

MAXIMUM EXTERIOR DEFLECTION

DYNAMIC LOAD TO MOUNTING

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES

VI. DISCUSSION

One fan failed. Subsequent investigation indicated failure was from a loose set screw. All other fans were checked to verify that the same condition did not exist in those units.

One door switch vibrated loose. Susequently, locking devices were placed on all door switches.

The cabinet was loaded with dummy modules to duplicate the in-service conditions.

2

TEST RESPONSE SPECTRA

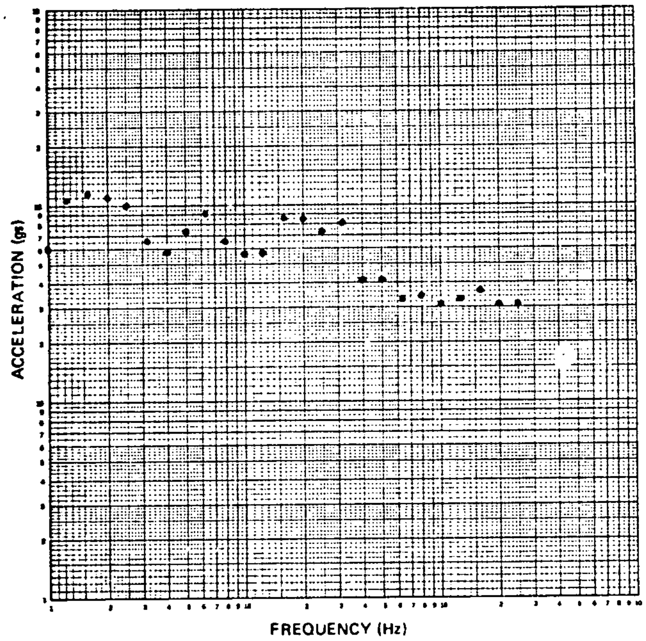
DATA SHEET No. 5
DATE April 3, 1978
REVISION No.

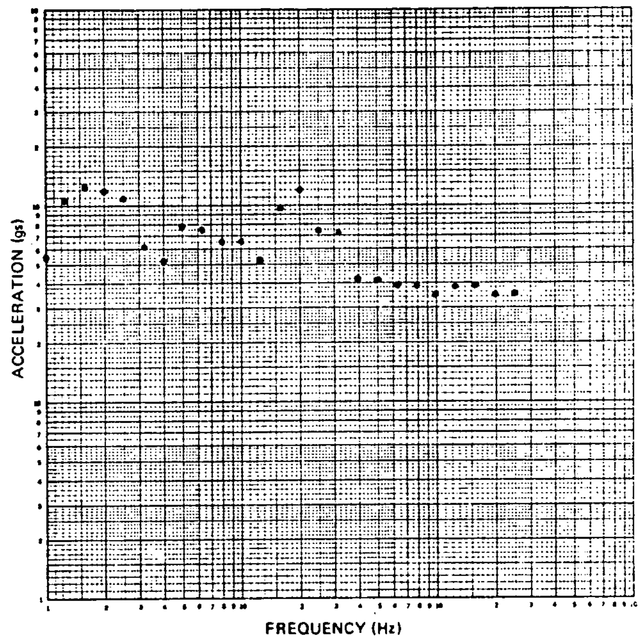
SPECTRUM FULL SCALE: ACCELERATION ☐ 10 gs ☒ 100 gs
FREQUENCY ☐ 100 Hz ☒ 1000 Hz

1 % CRITICAL DAMPING

TEST PLANE: ☐ FRONT TO BACK ☒ FRONT TO BACK / VERTICAL — ☐ SIDE TO SIDE ☒ SIDE TO SIDE / VERTICAL

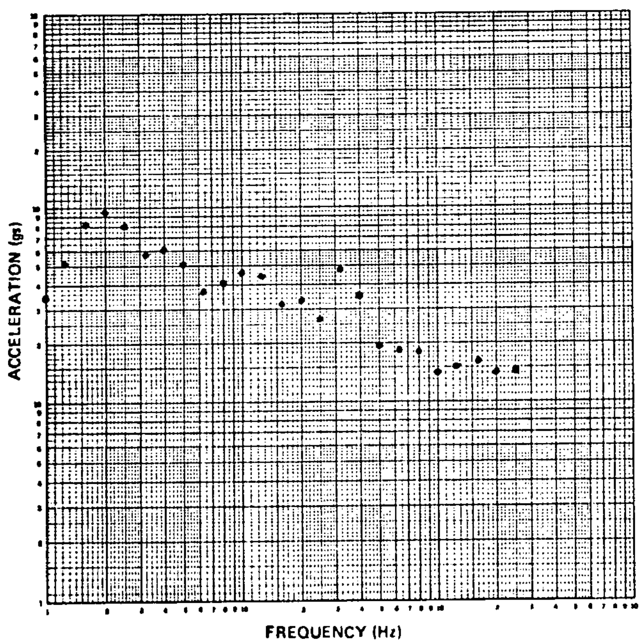
RESPONSE DIRECTION: ☒ FRONT TO BACK ☐ FRONT TO BACK (180° SHIFT) — ☒ SIDE TO SIDE ☐ SIDE TO SIDE (180° SHIFT)

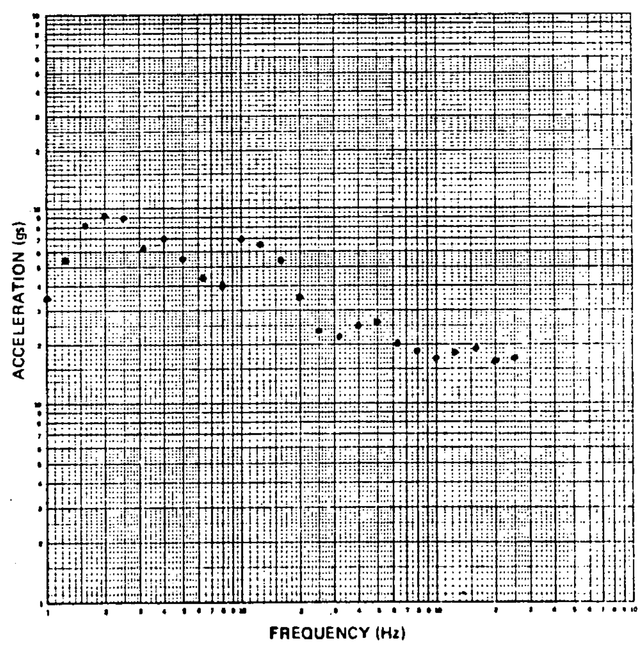




TEST PLANE: ☐ VERTICAL ☒ FRONT TO BACK / VERTICAL — ☒ SIDE TO SIDE / VERTICAL

RESPONSE DIRECTION: ☒ VERTICAL ☐ VERTICAL (180° SHIFT) — ☒ VERTICAL ☐ VERTICAL (180° SHIFT)



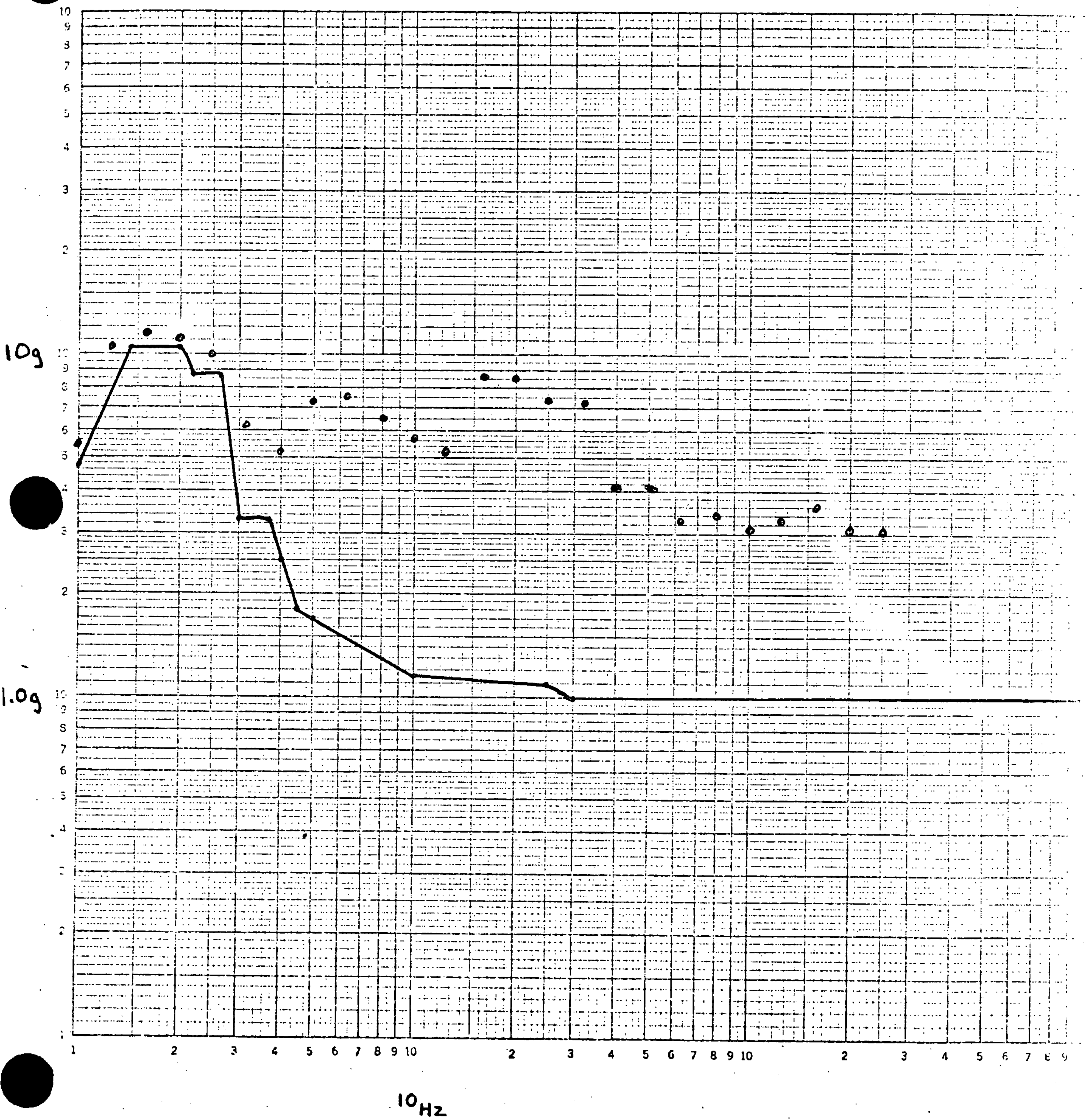


C-E 0090234 (Rev. 5/77) BACK

SCE Control Room Response Spectra

San Onofre Station

SSE - Horizontal - 1% β

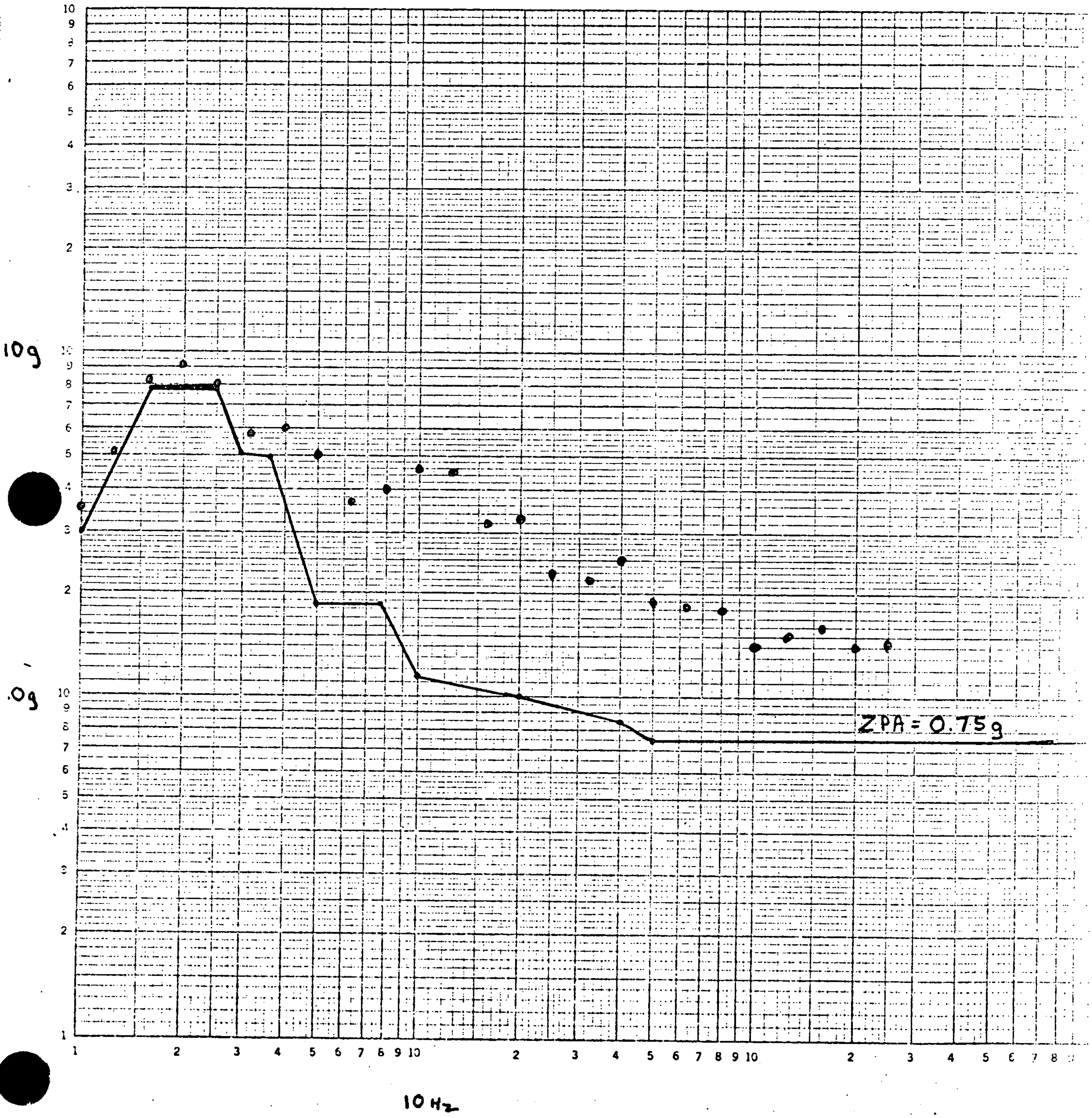


Aux. Protective Cabinet: minimum of two horizontal tests (F/B & SS)

SCE Control Room Response Spectra

San Onofre station

SSE - Vertical - 1% β



Aux Protective Cabinet: minimum of two vertical tests

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR

II. Component Name: CPC Mass Storage Unit

1. Scope: [X] NSSS [ ] BOP
2. Model Number: None — Quantity: 4
3. Vendor: Systems Engineering Laboratories
4. If the component is a cabinet or panel, name and model No. of the devices included: N/A
5. Physical Description a. Appearance Rack Mounted Chasis
   b. Dimensions 28" x 19" x 10-1/2"
   c. Weight 70 #
6. Location: Building: Control Area: Aux. Bldg.

   Elevation: 30'
7. Field Mounting Conditions [X] Bolt (No. 10, Size 10-32)
   [ ] Weld (Length)
   [ ]
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S: >40 F/B: 26
   V: 26
9. a. Functional Description: Facilitate periodic testing & maintenance

   b. Is the equipment required for [X] Hot Standby [ ] Cold Shutdown [ ] Both
10. Pertinent Reference Design Specifications: 00000-ICE-3004 Rev. 3

    1370-ICE-3004, Rev. 01

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

IV. Equipment Qualification Method: Test: X

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Systems Engineering Tabs; 524280-019
Wyle Laboratories, Report 42915-1
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [ ] Combination of ______

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ______
(Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ______

S/S = 1.4g input F/B = 1.4g input V = 1.3g input

VI. If Qualification by Test, then Complete: ______

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

2. [ ] Single Axis [X] Multi-Axis (Bi-axial)

3. No. of Qualification Tests: OBE ______ SSE 7
Other ______
(Specify)

4. Frequency Range: See TRS attached

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[X] No*
*TRS exceeds RRS above 8Hz and at natural frequencies except at 25 and 40Hz horizontal.

6. Input g-level Test at S/S = 2.8 F/B = 2.6 V = 1.5

7. Laboratory Mounting:

1. [X] Bolt (No. 10 , Size 10-32) [ ] Weld (Length ______) [ ] _____

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

9. Test Results including modivications made: See attached Sheet

____

10. Other tests performed (such as fragility test, including results): N/A

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
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: _________ 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. Deflection	Location	Effect Upon Functional Operability

VI.9. Test Results

NATURAL FREQUENCIES VERTICAL	26 Hz · SIDE SIDE 26 Hz · FRONT BACK None below 40 Hz
ELECTRICAL OPERATION	Performance as required - no degradation of input signal - post test diagnostics performed successfully.
PHYSICAL INTEGRITY	Intact; no physical effects
DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY) -	
MAXIMUM STRUCTURAL STRESS	
MAXIMUM EXTERIOR DEFLECTION	
DYNAMIC LOAD TO MOUNTING	
MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES	

VI. DISCUSSION

This equipment was subjected to seven (7) series of full-level sine-beat tests. The duration of each series (in each of two biaxial test directions) was 30 seconds. The frequency of each of the seven series was different. Based on the equipment natural frequencies, which were all determined to be above 25 Hz by the resonance survey, the test series involving the highest frequency sine-beats is sufficient for qualification. This test excited all equipment modes to ample acceleration levels, as indicated by the test response spectra on the reverse side of this sheet. The excitation frequencies of this test were 16 Hz in the horizontal direction and 8 Hz in the vertical direction.

2 d.

TEST RESPONSE SPECTRA

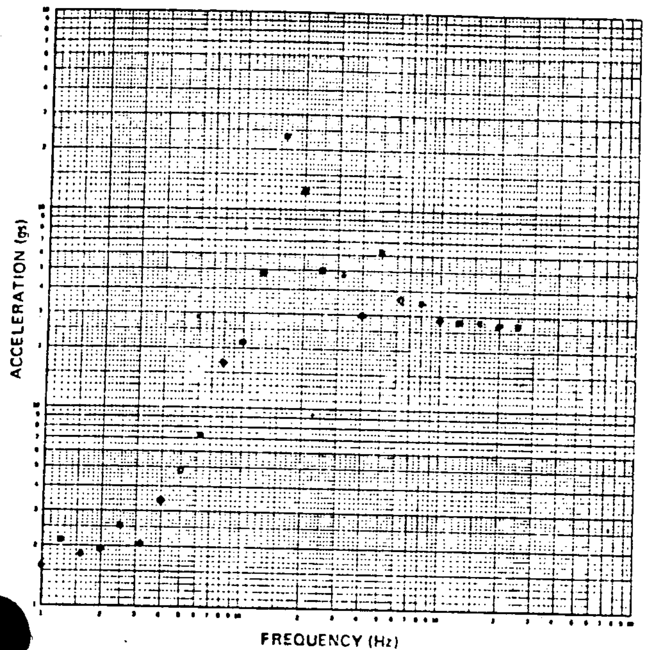
DATA SHEET No 2g
DATE November, 1976
REVISION No. 00

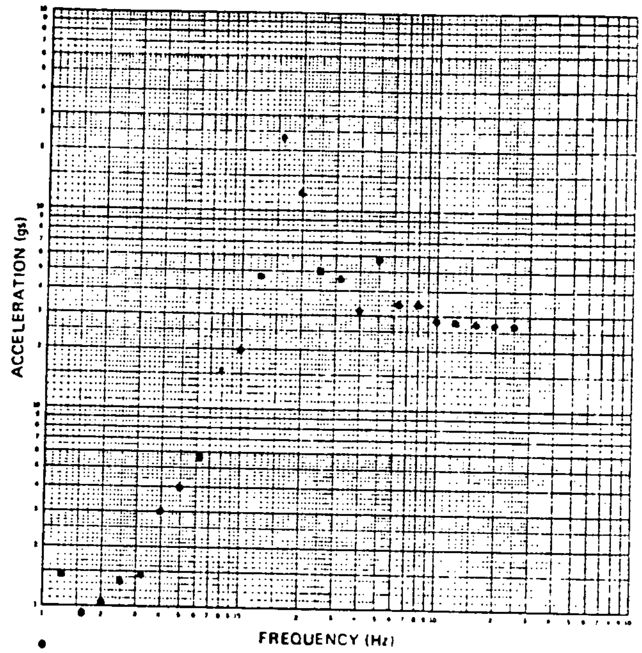
SPECTRUM FULL SCALE: ACCELERATION ☐ 10 gs ☒ 100 gs
FREQUENCY ☐ 100 Hz ☒ 1000 Hz

1 % CRITICAL DAMPING

TEST PLANE	
☐ FRONT TO BACK ☒ FRONT TO BACK / VERTICAL	☐ SIDE TO SIDE ☒ SIDE TO SIDE / VERTICAL

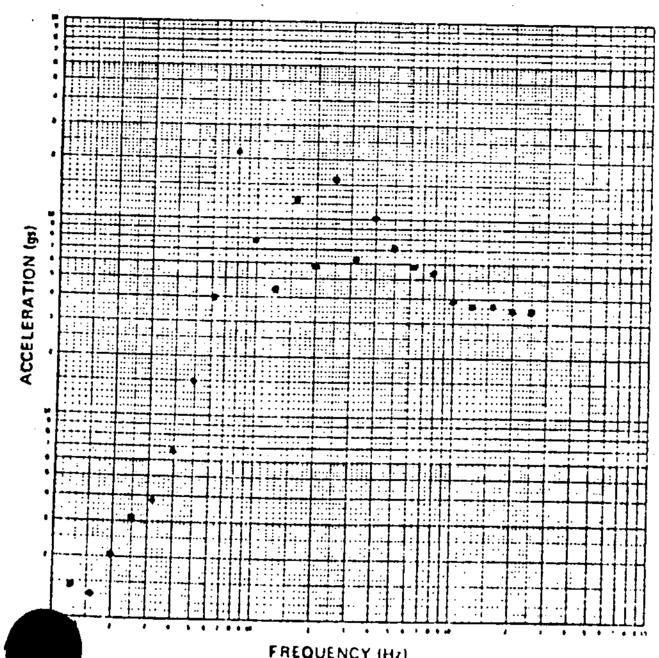
RESPONSE DIRECTION	
☒ FRONT TO BACK ☐ FRONT TO BACK (180° SHIFT)	☒ SIDE TO SIDE ☐ SIDE TO SIDE (180° SHIFT)

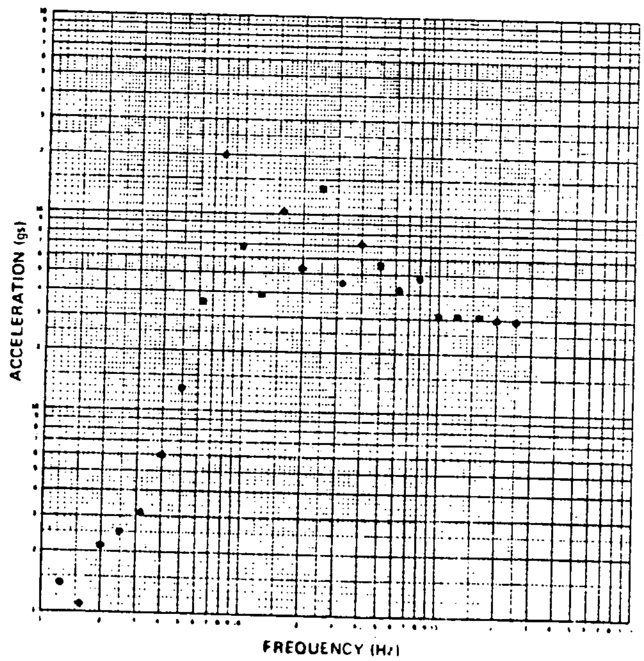




TEST PLANE	
☐ VERTICAL ☒ FRONT TO BACK / VERTICAL	☒ SIDE TO SIDE / VERTICAL

RESPONSE DIRECTION	
☒ VERTICAL ☐ VERTICAL (180° SHIFT)	☒ VERTICAL ☐ VERTICAL (180° SHIFT)





APC Modules RRS

MACS, CPU, DISK, Power Supply TRS

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING | 1 % |

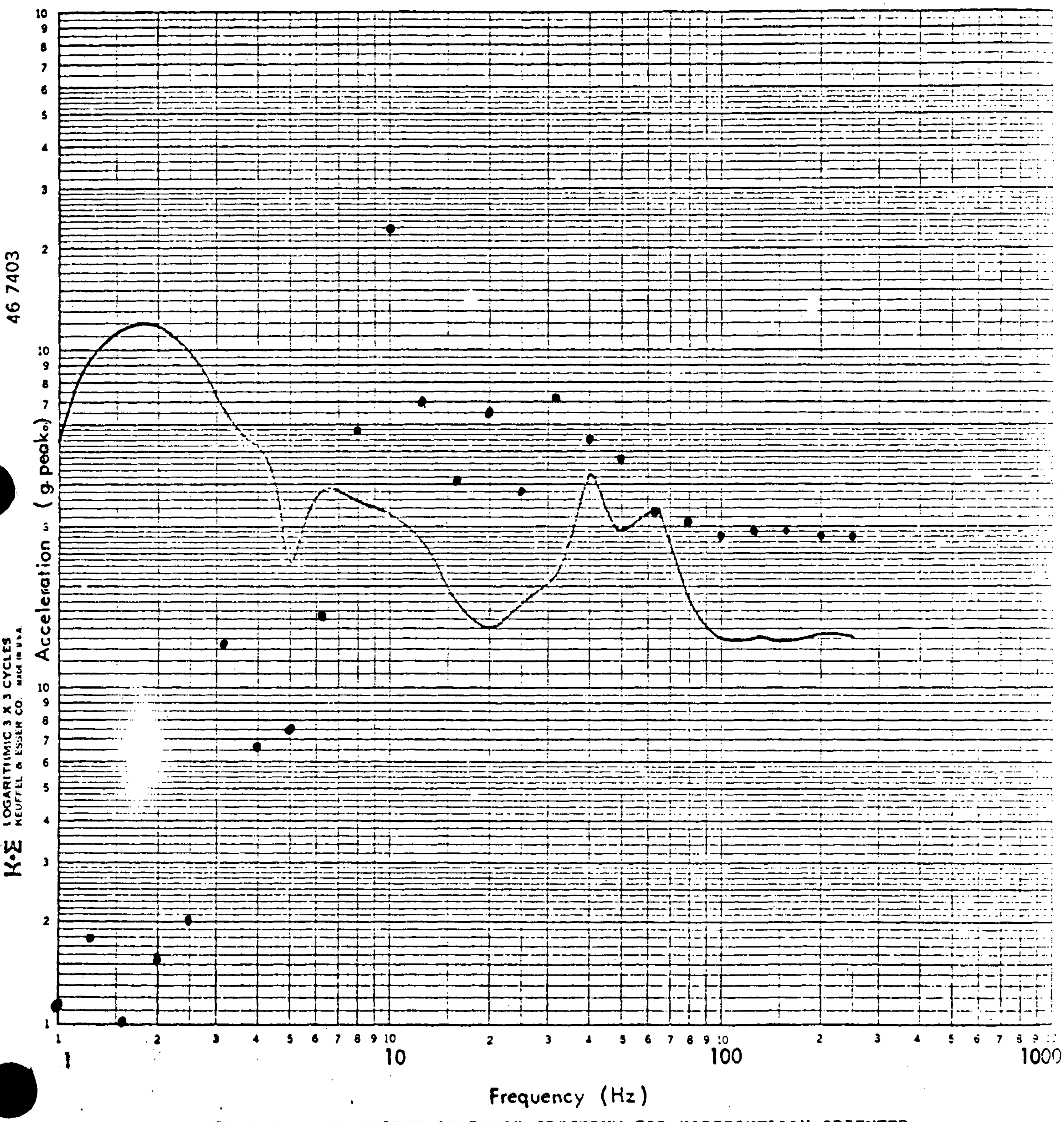


FIGURE 13 PREDICTED COMPOSITE RESPONSE SPECTRUM FOR HORIZONTALLY ORIENTED SPECIMEN ACCELEROMETERS IF THE TEST RESPONSE SPECTRA OF THE HORIZONTAL CONTROL ACCELEROMETER HAD EQUALED THE HORIZONTAL REQUIRED RESPONSE SPECTRA DURING SS/V RANDOM MULTI-FREQUENCY TEST (RUN # 19)

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING | 1 % |

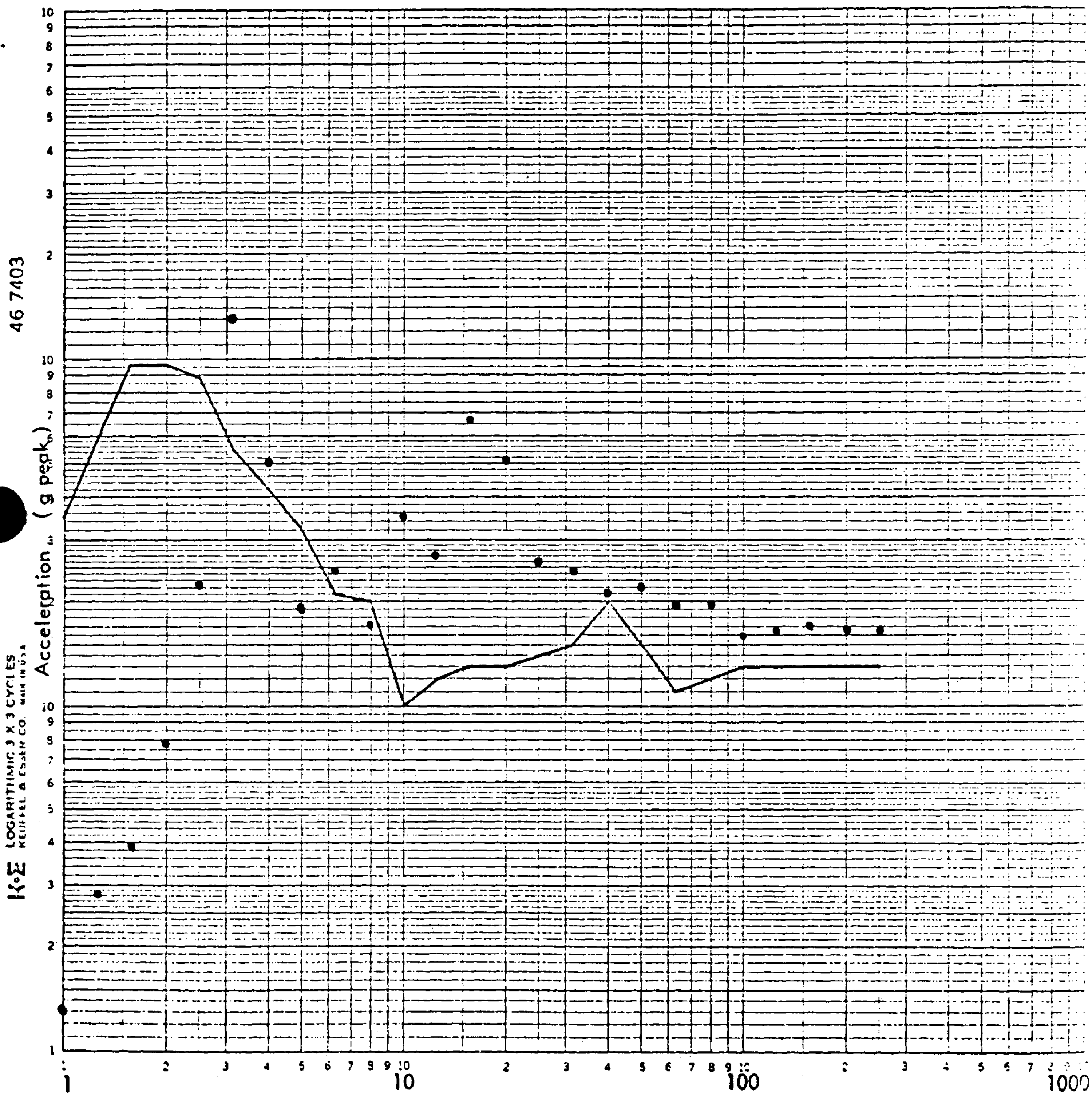


FIGURE 14 PREDICTED COMPOSITE RESPONSE SPECTRUM FOR VERTICALLY ORIENTED SPECIMEN ACCELEROMETERS IF THE TEST RESPONSE SPECTRA OF THE VERTICAL CONTROL ACCELEROMETERS HAD EQUALED THE VERTICAL REQUIRED RESPONSE SPECTRA DURING SS/V RANDOM MULTIFREQUENCY TEST (RUN #19)

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING [1 %]

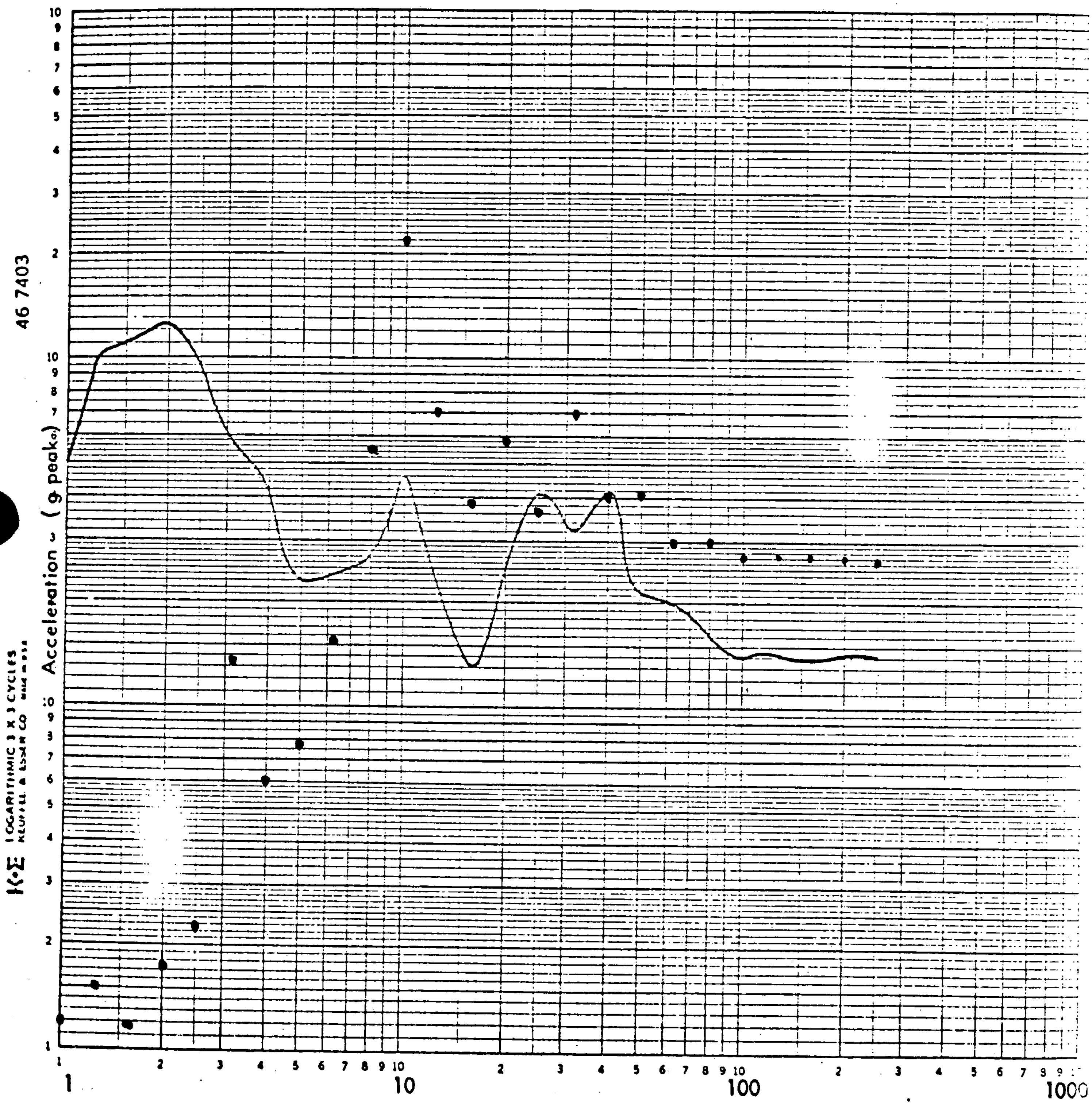


FIGURE 15 PREDICTED COMPOSITE RESPONSE SPECTRUM FOR HORIZONTALLY ORIENTED SPECIMEN ACCELEROMETERS IF THE TEST RESPONSE SPECTRA OF THE HORIZONTAL CONTROL ACCELEROMETER HAD EQUALED THE HORIZONTAL REQUIRED RESPONSE SPECTRA DURING FB/V RANDOM MULTI-FREQUENCY TEST (RUN # 32)

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING [1 %]

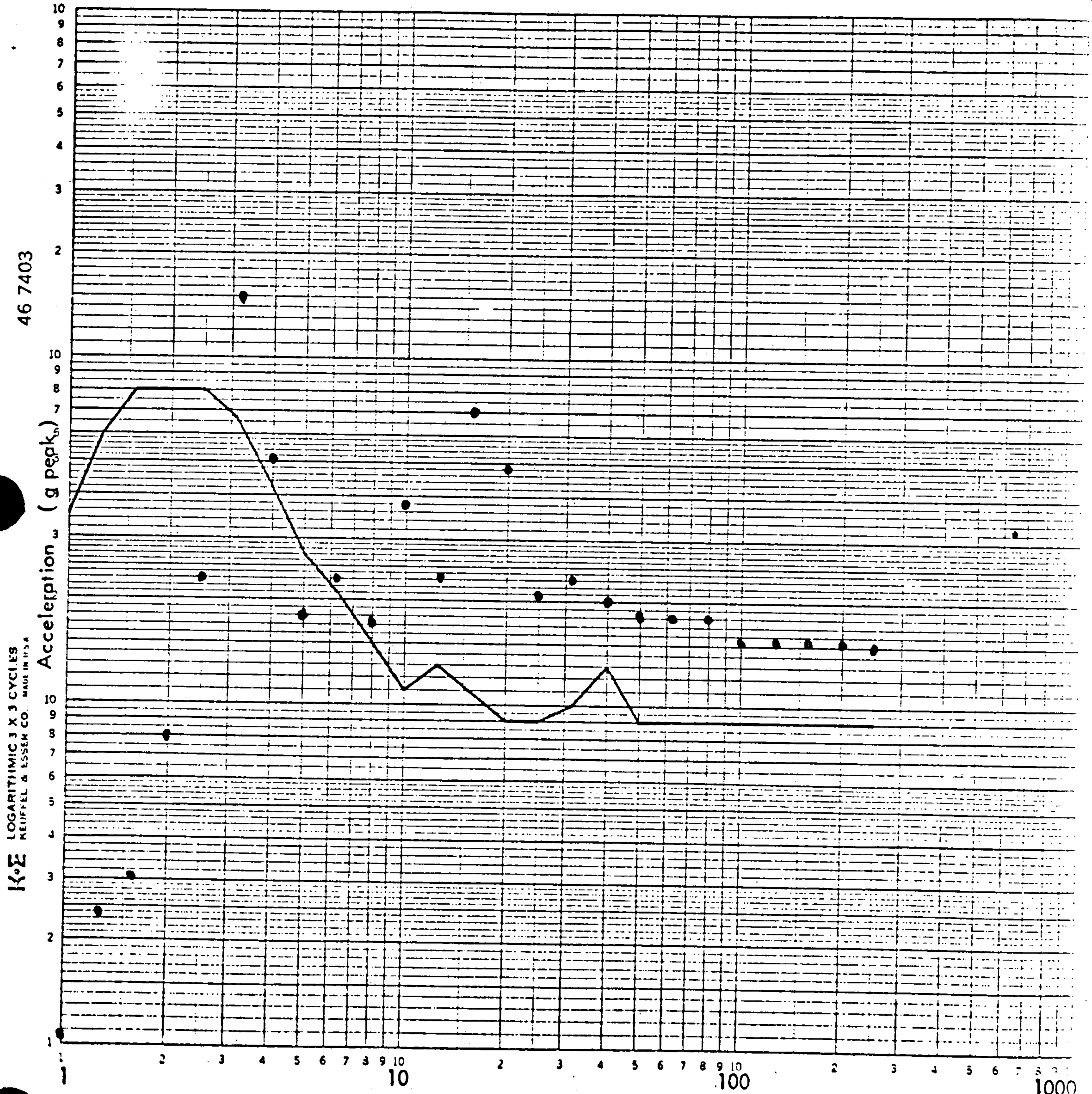


FIGURE 16 PREDICTED COMPOSITE RESPONSE SPECTRA FOR VERTICALLY ORIENTED SPECIMEN ACCELEROMETERS IF THE TEST RESPONSE SPECTRA OF THE VERTICAL CONTROL ACCELEROMETERS HAD EQUALED THE VERTICAL REQUIRED RESPONSE SPECTRA DURING FB/V RANDOM MULTIFREQUENCY TEST (RUN #32)

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE 3. A/E: Bechtel — BWR ____

II. Component Name: CPC Central Processing Unit

1. Scope: [x] NSSS [ ] BOP
2. Model Number: None Quantity: 4
3. Vendor: System Engineering Laboratories
4. If the component is a cabinet or panel, name and model No. of the devices included: N/A
5. Physical Description a. Appearance Rack mounted chassis

   b. Dimensions 28" x 19" x 8"

   c. Weight 70#
6. Location: Building: Control Area Aux. Bldg.

   Elevation: 30'
7. Field Mounting Conditions [X] Bolt (No. 8, Size 10-32)

   [ ] Weld (Length ____)

   [ ] ____
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S: 40 F/B: 30

   V: 30, 32
9. a. Functional Description: Calculates and Compares Core Parameters with set limits, generates trip if limit exceeded.

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

   [ ] Both ____
10. Pertinent Reference Design Specifications: 00000-ICE-3004 Rev. 3 1370-ICE-3004 Rev. 1

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

IV. Equipment Qualification Method: Test: X

Analysis: ____

Combination of Test and Analysis: ____

Test and/or Analysis by System Engineering Laboratories, 524280-019
Wyle Laboratories, 42915-1
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ____

5. [ ] Combination of ____

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ____
(Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ____

S/S = 1.4g input F/B = 1.4g input V = 1.3g input

VI. If Qualification by Test, then Complete: ____

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

2. [ ] Single Axis [X] Multi-Axis (Bi-axial)

3. No. of Qualification Tests: OBE ____ SSE 7
Other ____
(Specify)

4. Frequency Range: See TRS attached

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[X] No*
*TRS equals or exceeds RRS above 8Hz and at natural frequencies except at 25 and 40Hz.

6. Input g-level Test at:

S/S = 2.8
F/B = 2.6
V = 1.5

7. Laboratory Mounting: ____________

1. [X] Bolt (No. 8, Size 10-32) [ ] Weld (Length ________)
[ ] ____________

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

None

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
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: ________ 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. Deflection	Location	Effect Upon Functional Operability

NATURAL FREQUENCIES VERTICAL 30, 32 Hz	SIDE / SIDE None below 40 Hz FRONT BACK 30 Hz
ELECTRICAL OPERATION	All features operated properly; no errors recorded
PHYSICAL INTEGRITY	Intact; no physical effects
DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)	
MAXIMUM STRUCTURAL STRESS	
MAXIMUM EXTERIOR DEFLECTION	
DYNAMIC LOAD TO MOUNTING	
MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES	

VI. DISCUSSION

This equipment was subjected to seven (7) series of full-level sine-beat tests. The duration of each series (in each of two biaxial test directions) was 30 seconds. The frequency of each of the seven series was different. Based on the equipment natural frequencies, which were all determined to be above 25 Hz by the resonance survey, the test series involving the highest frequency sine-beats is sufficient for qualification. This test excited all equipment modes to ample acceleration levels, as indicated by the test response spectra on the reverse side of this sheet. The excitation frequencies of this test were 16 Hz in the horizontal direction and 8 Hz in the vertical direction.

2d

TEST RESPONSE SPECTRA

DATA SHEET No 2g

DATE November, 1976

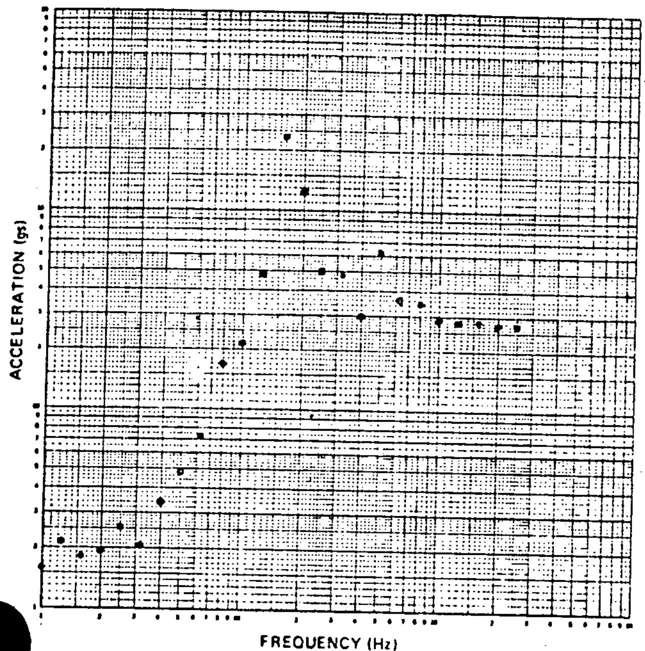
REVISION No. 00

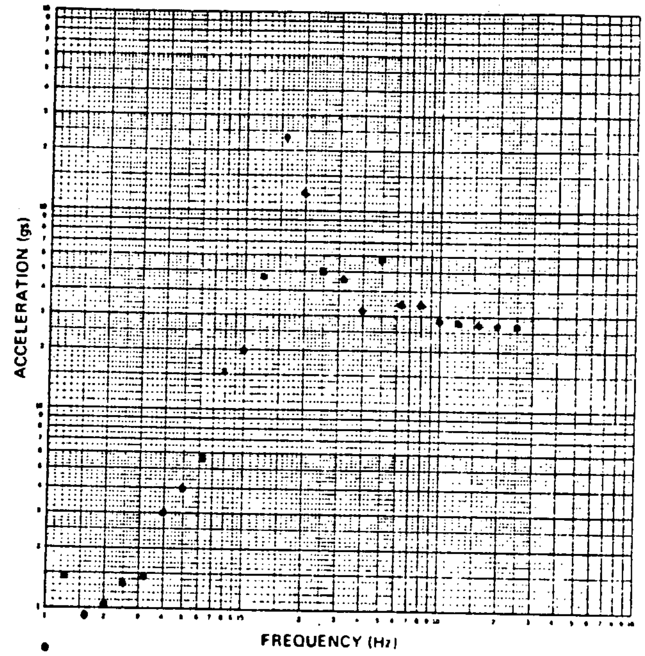
SPECTRUM FULL SCALE: ACCELERATION ☐ 10 gs ☒ 100 gs; FREQUENCY ☐ 100 Hz ☒ 1000 Hz

1 % CRITICAL DAMPING

TEST PLANE: ☐ FRONT TO BACK ☒ FRONT TO BACK / VERTICAL — ☐ SIDE TO SIDE ☒ SIDE TO SIDE / VERTICAL

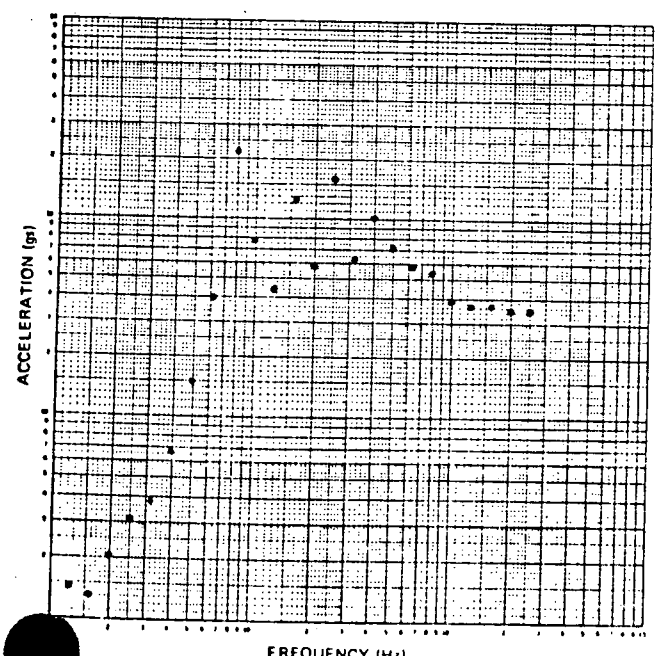
RESPONSE DIRECTION: ☒ FRONT TO BACK ☐ FRONT TO BACK (180° SHIFT) — ☒ SIDE TO SIDE ☐ SIDE TO SIDE (180° SHIFT)

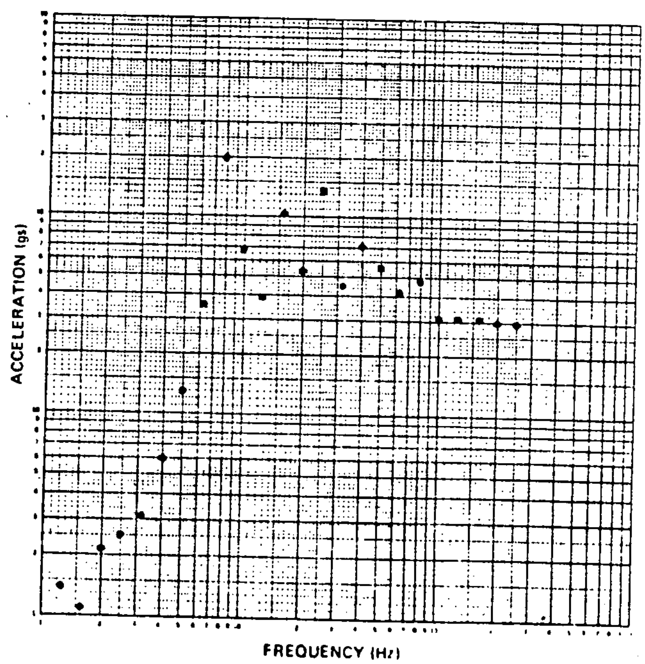




TEST PLANE: ☐ VERTICAL ☒ FRONT TO BACK / VERTICAL — ☒ SIDE TO SIDE / VERTICAL

RESPONSE DIRECTION: ☒ VERTICAL ☐ VERTICAL (180° SHIFT) — ☒ VERTICAL ☐ VERTICAL (180° SHIFT)





APC Modules RRS

MACS, CPU, DISK, Power Supply TRS

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING [1 %]

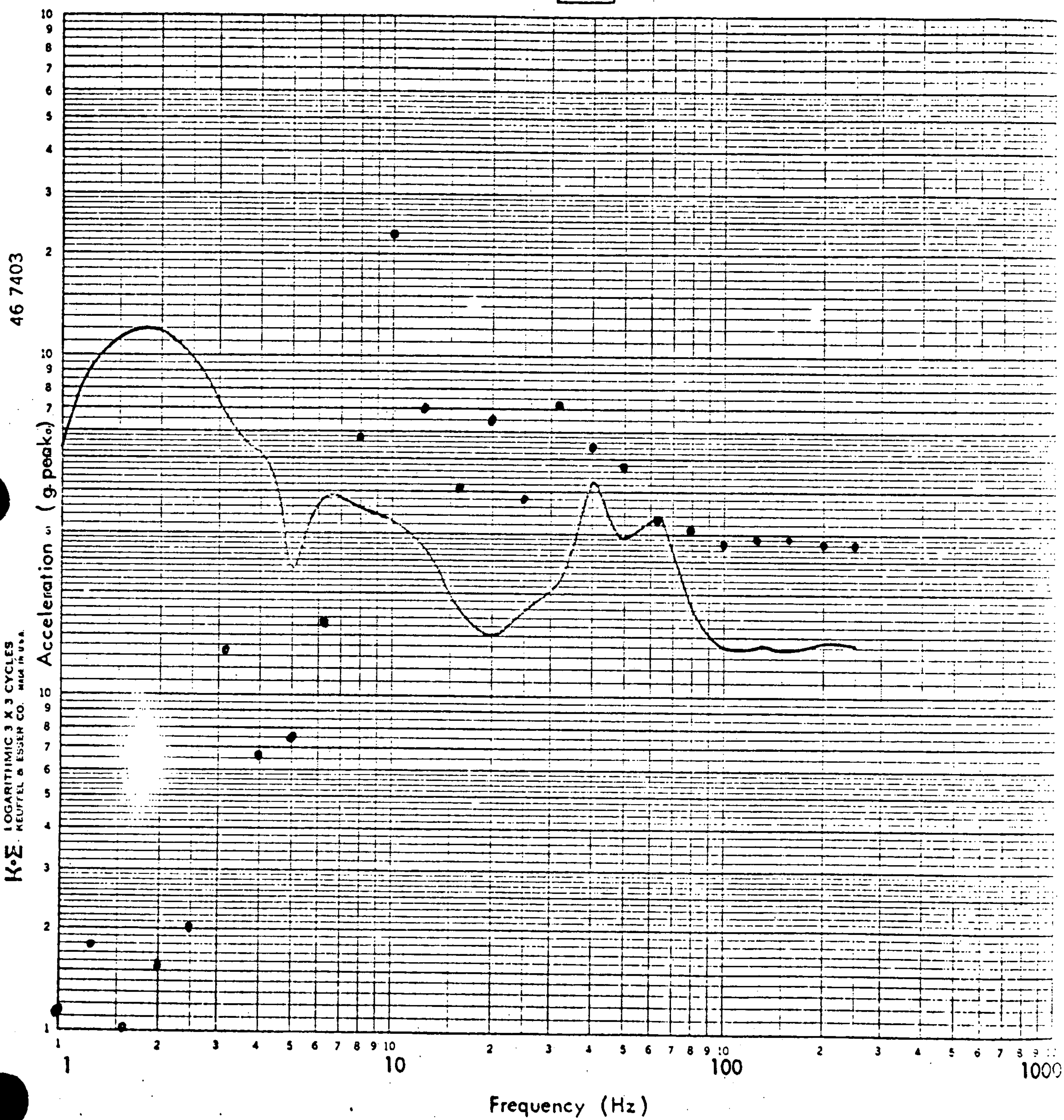


FIGURE 13 PREDICTED COMPOSITE RESPONSE SPECTRUM FOR HORIZONTALLY ORIENTED SPECIMEN ACCELEROMETERS IF THE TEST RESPONSE SPECTRA OF THE HORIZONTAL CONTROL ACCELEROMETER HAD EQUALED THE HORIZONTAL REQUIRED RESPONSE SPECTRA DURING SS/V RANDOM MULTI-FREQUENCY TEST (RUN # 19)

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING $\boxed{1\ \%}$

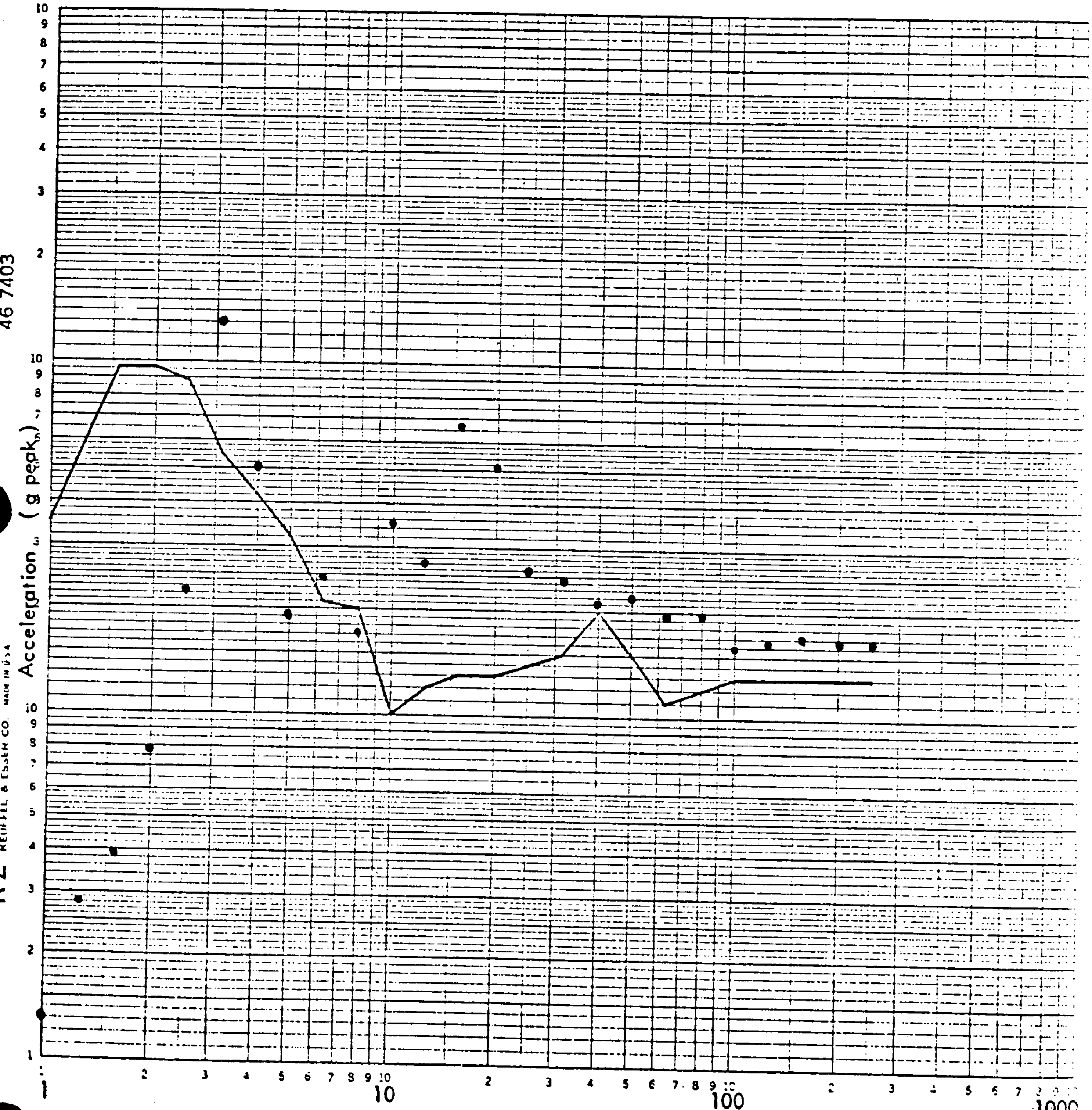


FIGURE 14 PREDICTED COMPOSITE RESPONSE SPECTRUM FOR VERTICALLY ORIENTED SPECIMEN ACCELEROMETERS IF THE TEST RESPONSE SPECTRA OF THE VERTICAL CONTROL ACCELEROMETERS HAD EQUALED THE VERTICAL REQUIRED RESPONSE SPECTRA DURING SS/V RANDOM MULTIFREQUENCY TEST (RUN #19)

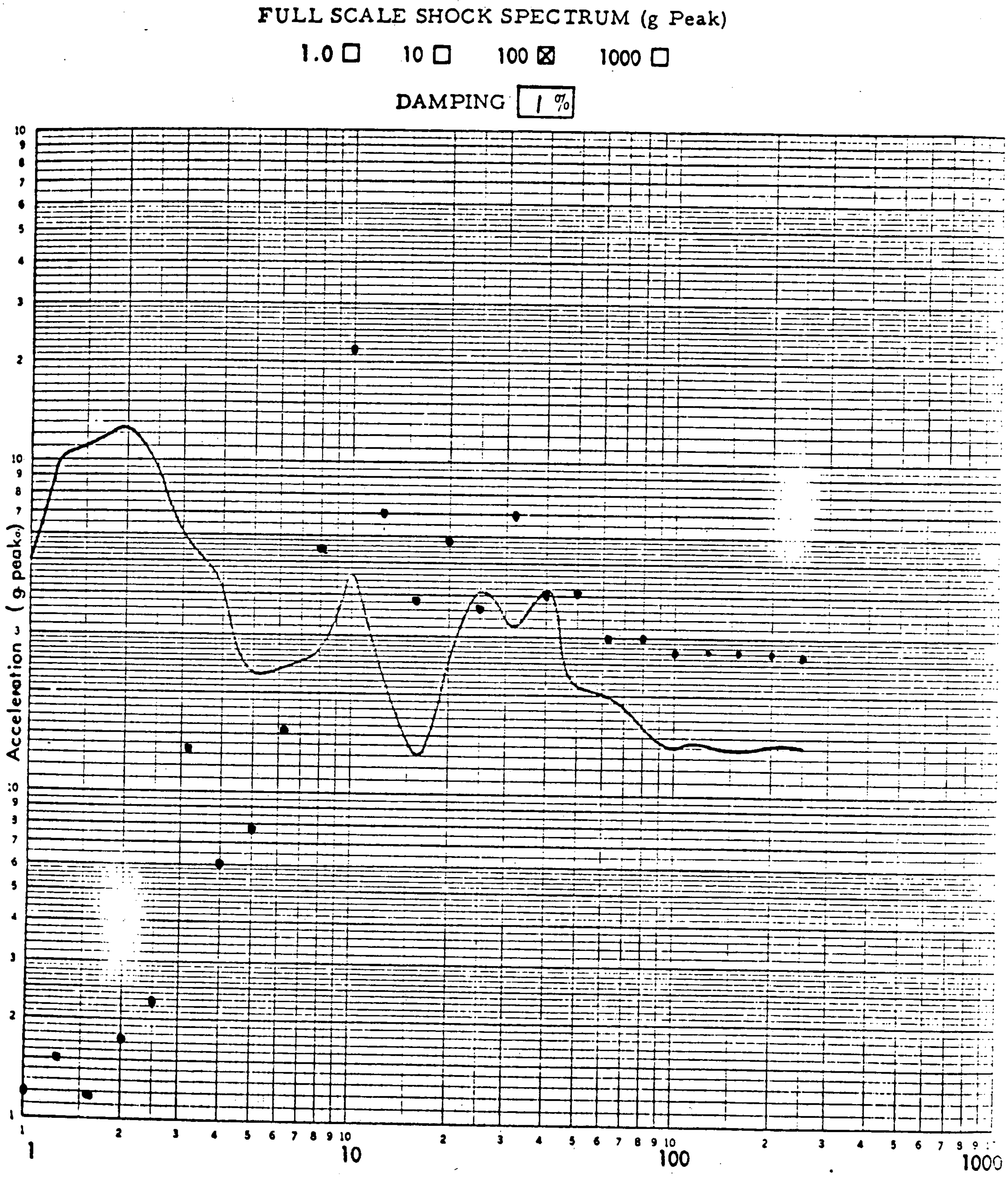


FIGURE 15 PREDICTED COMPOSITE RESPONSE SPECTRUM FOR HORIZONTALLY ORIENTED SPECIMEN ACCELEROMETERS IF THE TEST RESPONSE SPECTRA OF THE HORIZONTAL CONTROL ACCELEROMETER HAD EQUALED THE HORIZONTAL REQUIRED RESPONSE SPECTRA DURING FB/V RANDOM MULTI-FREQUENCY TEST (RUN # 32)

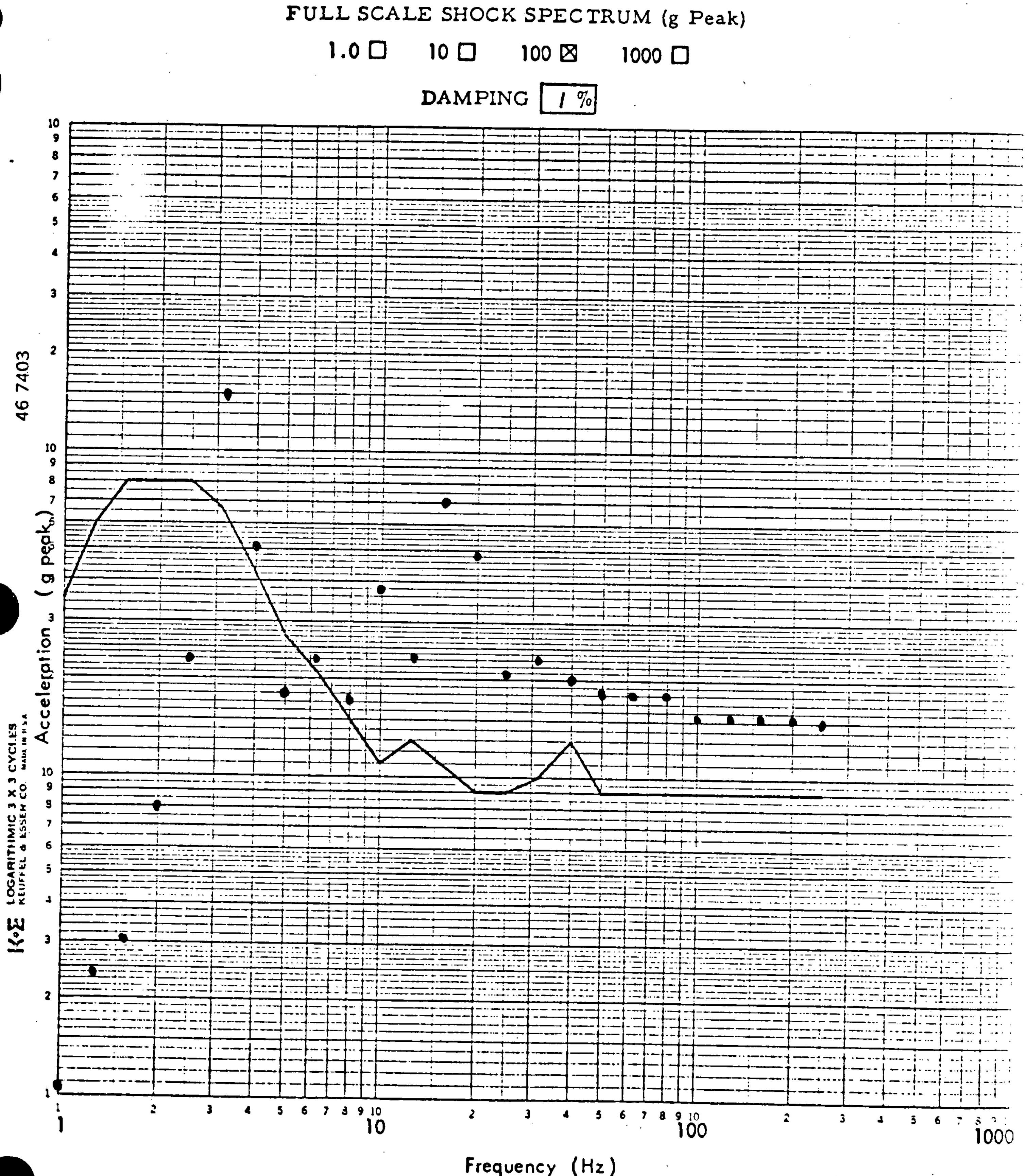


FIGURE 16 PREDICTED COMPOSITE RESPONSE SPECTRA FOR VERTICALLY ORIENTED SPECIMEN ACCELEROMETERS IF THE TEST RESPONSE SPECTRA OF THE VERTICAL CONTROL ACCELEROMETERS HAD EQUALED THE VERTICAL REQUIRED RESPONSE SPECTRA DURING FB/V RANDOM MULTIFREQUENCY TEST (RUN #32)

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 Type:

1. Utility: Southern California Edison Company PWR X

2. NSSS: CE 3. A/E: Bechtel BWR

II. Component Name: CP MACS Chasis

1. Scope: [X] NSSS [ ] BOP

2. Model Number: None Quantity: 4

3. Vendor: Systems Engineering Laboratories

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

5. Physical Description a. Appearance Rack Mounted Chasis

   b. Dimensions 28" x 19" x 9-1/4"

   c. Weight 70#

6. Location: Building: Control Area Aux. Bldg.

   Elevation: 30'

7. Field Mounting Conditions [X] Bolt (No. 8, Size 10-32)
   [ ] Weld (Length)
   [ ]

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

   S/S: 29,37 F/B: 30,33
   V: 26,30,34,38

9. a. Functional Description: Computer interface (I/O) for all computer communication

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

10. Pertinent Reference Design Specifications: 00000-ICE-3004 Rev. 03
    1370-ICE-3004 Rev. 1

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

IV. Equipment Qualification Method: Test: X

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Systems Engineering Laboratories, N-524280-019
Wyle Laboratories, 42915-1
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [ ] Combination of ______

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ______
(Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ______

S/S = 1.4 g input F/B = 1.4 g input V = 1.3 g input

VI. If Qualification by Test, then Complete: ______

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

2. [ ] Single Axis [X] Multi-Axis (Bi-axial)

3. No. of Qualification Tests: OBE ______ SSE 7
Other ______
(Specify)

4. Frequency Range: See TRS attached

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[X] No
TRS equals or exceeds RRS at natural frequencies above 8Hz except at 25 and 40 Hz.

6. Input g-level Test at:

S/S = 2.8
F/B = 2.6
V = 1.5

7. Laboratory Mounting: ______

1. [X] Bolt (No. 8, Size 10-32) [ ] Weld (Length ____) [ ] ____

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

N/A

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

1. Description of Test including Results: N/A

2. Method of Analysis: ______

[ ] Static Analysis
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: ______ 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. Deflection	Location	Effect Upon Functional Operability

VI Test Results

NATURAL FREQUENCIES VERTICAL 26, 30, 34, 38 Hz SIDE / SIDE 29, 37 Hz FRONT / BACK 30, 33 Hz

ELECTRICAL OPERATION Proper operations verified; no failures

PHYSICAL INTEGRITY Intact; no physical effects

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS

MAXIMUM EXTERIOR DEFLECTION

DYNAMIC LOAD TO MOUNTING

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES

VI. DISCUSSION

This equipment was subjected to seven (7) series of full-level sine-beat tests. The duration of each series (in each of two biaxial test directions) was 30 seconds. The frequency of each of the seven series was different. Based on the equipment natural frequencies, which were all determined to be above 25 Hz by the resonance survey, the test series involving the highest frequency sine-beats is sufficient for qualification. This test excited all equipment modes to ample acceleration levels, as indicated by the test response spectra on the reverse side of this sheet. The excitation frequencies of this test were 16 Hz in the horizontal direction and 8 Hz in the vertical direction.

2c.

TEST RESPONSE SPECTRA

DATA SHEET No. 2f

DATE November, 1976

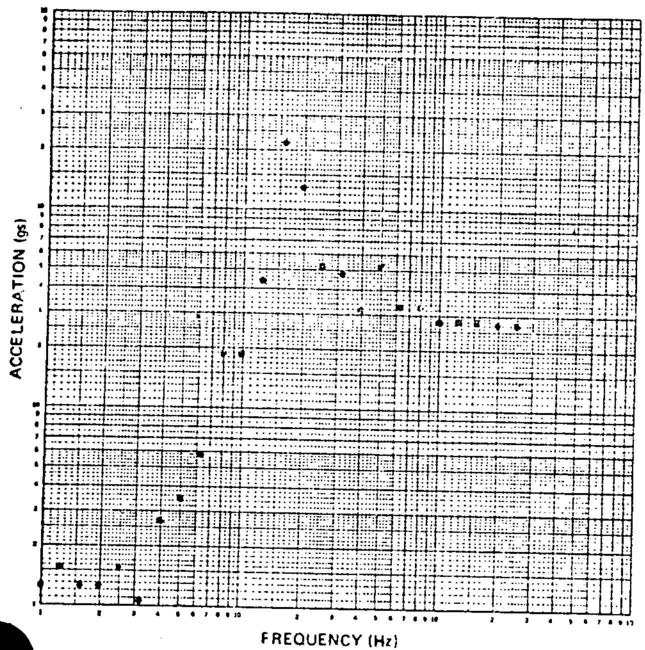
SPECTRUM FULL SCALE: ACCELERATION ☐ 10 gs ☒ 100 gs
FREQUENCY ☐ 100 Hz ☒ 1000 Hz

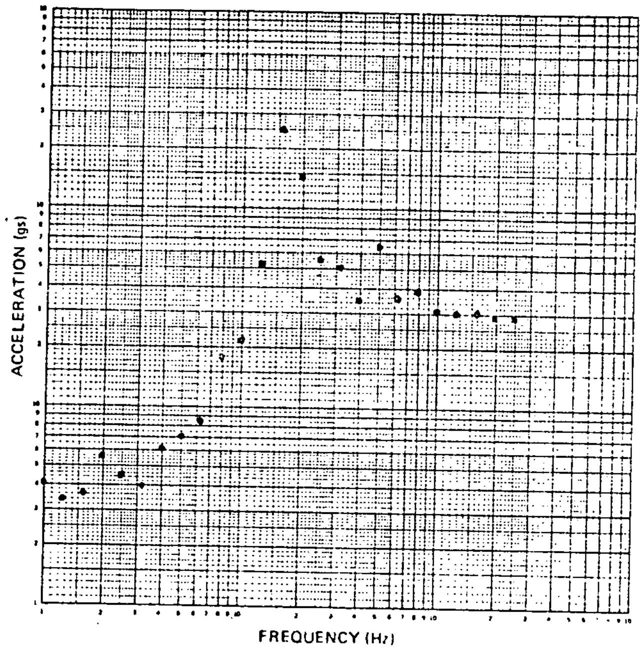
1 % CRITICAL DAMPING

REVISION No. 00

TEST PLANE: ☐ FRONT TO BACK ☒ FRONT TO BACK / VERTICAL — ☐ SIDE TO SIDE ☒ SIDE TO SIDE / VERTICAL

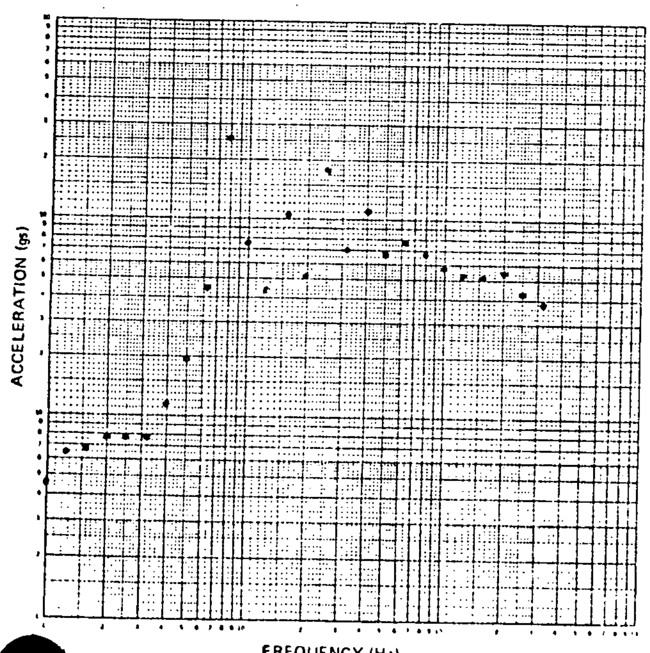
RESPONSE DIRECTION: ☒ FRONT TO BACK ☐ FRONT TO BACK (180° SHIFT) — ☒ SIDE TO SIDE ☐ SIDE TO SIDE (180° SHIFT)

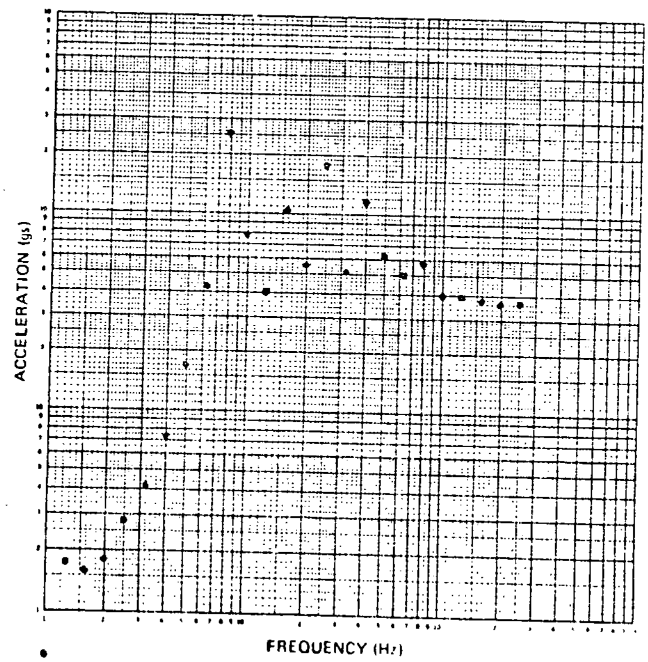




TEST PLANE: ☐ VERTICAL ☒ FRONT TO BACK / VERTICAL — ☒ SIDE TO SIDE / VERTICAL

RESPONSE DIRECTION: ☒ VERTICAL ☐ VERTICAL (180° SHIFT) — ☒ VERTICAL ☐ VERTICAL (180° SHIFT)





CE 0002 (4-9-76) BACK

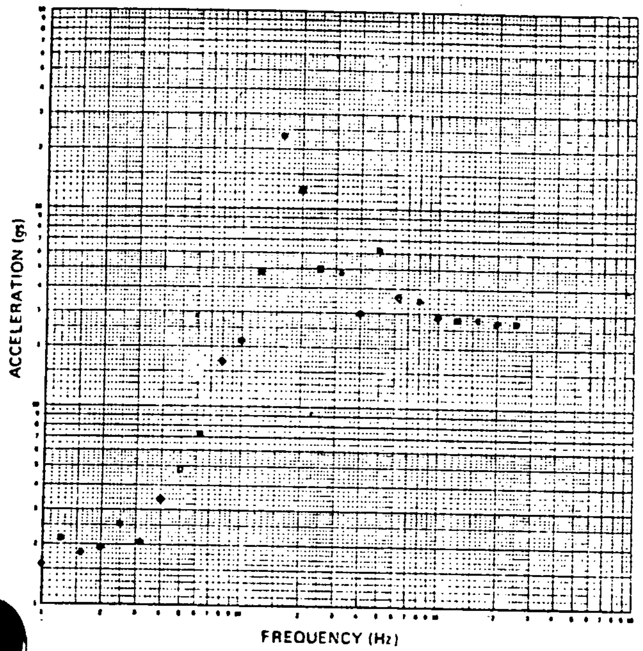
TEST RESPONSE SPECTRA

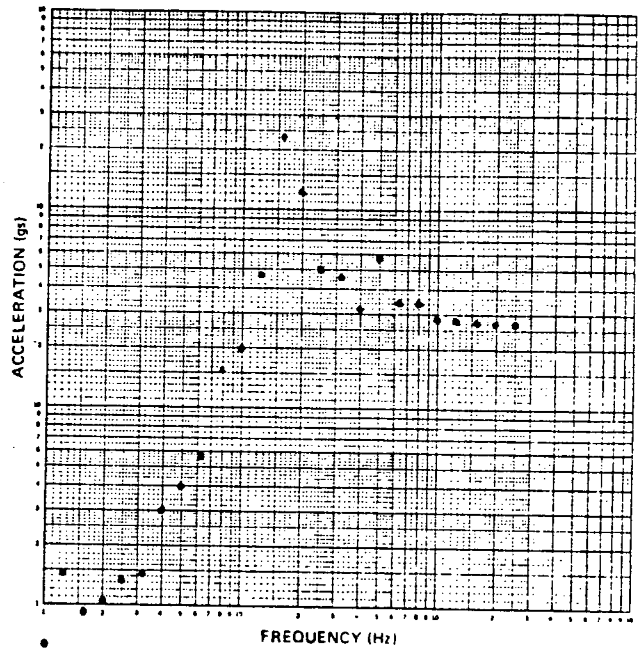
DATA SHEET No 2g
DATE November, 1976
REVISION No. 00

SPECTRUM FULL SCALE: ACCELERATION ☐ 10 gs ☒ 100 gs
FREQUENCY ☐ 100 Hz ☒ 1000 Hz

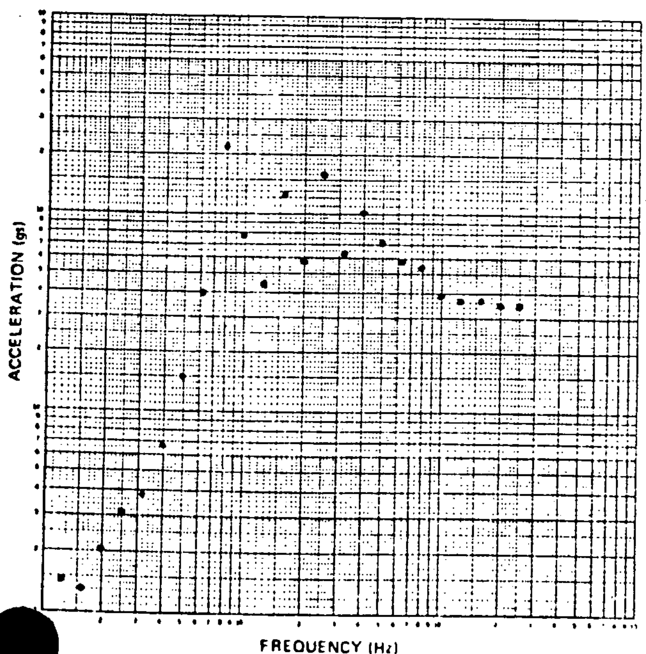
1 % CRITICAL DAMPING

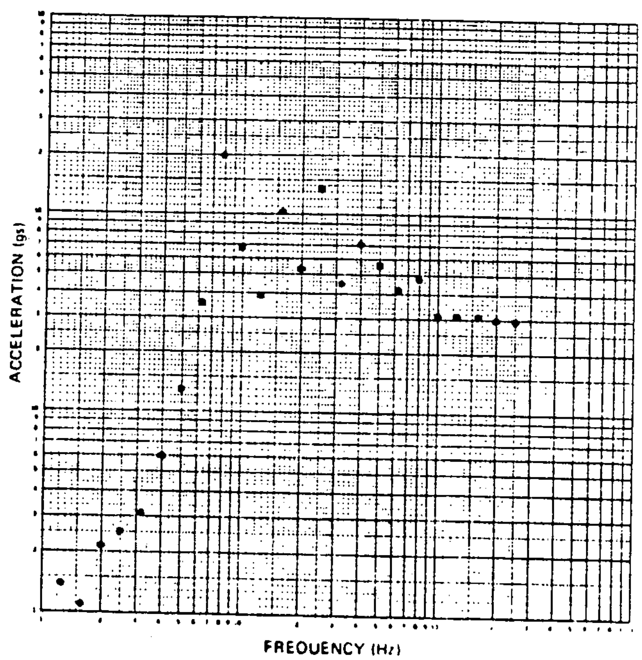
☐ FRONT TO BACK ☒ FRONT TO BACK / VERTICAL	TEST PLANE	☐ SIDE TO SIDE ☒ SIDE TO SIDE / VERTICAL
☒ FRONT TO BACK ☐ FRONT TO BACK (180° SHIFT)	RESPONSE DIRECTION	☒ SIDE TO SIDE ☐ SIDE TO SIDE (180° SHIFT)





☐ VERTICAL ☒ FRONT TO BACK / VERTICAL	TEST PLANE	☒ SIDE TO SIDE / VERTICAL
☒ VERTICAL ☐ VERTICAL (180° SHIFT)	RESPONSE DIRECTION	☒ VERTICAL ☐ VERTICAL (180° SHIFT)





APC Modules RRS

MACS, CPU, DISK, Power Supply TRS

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING $\boxed{1\ \%}$

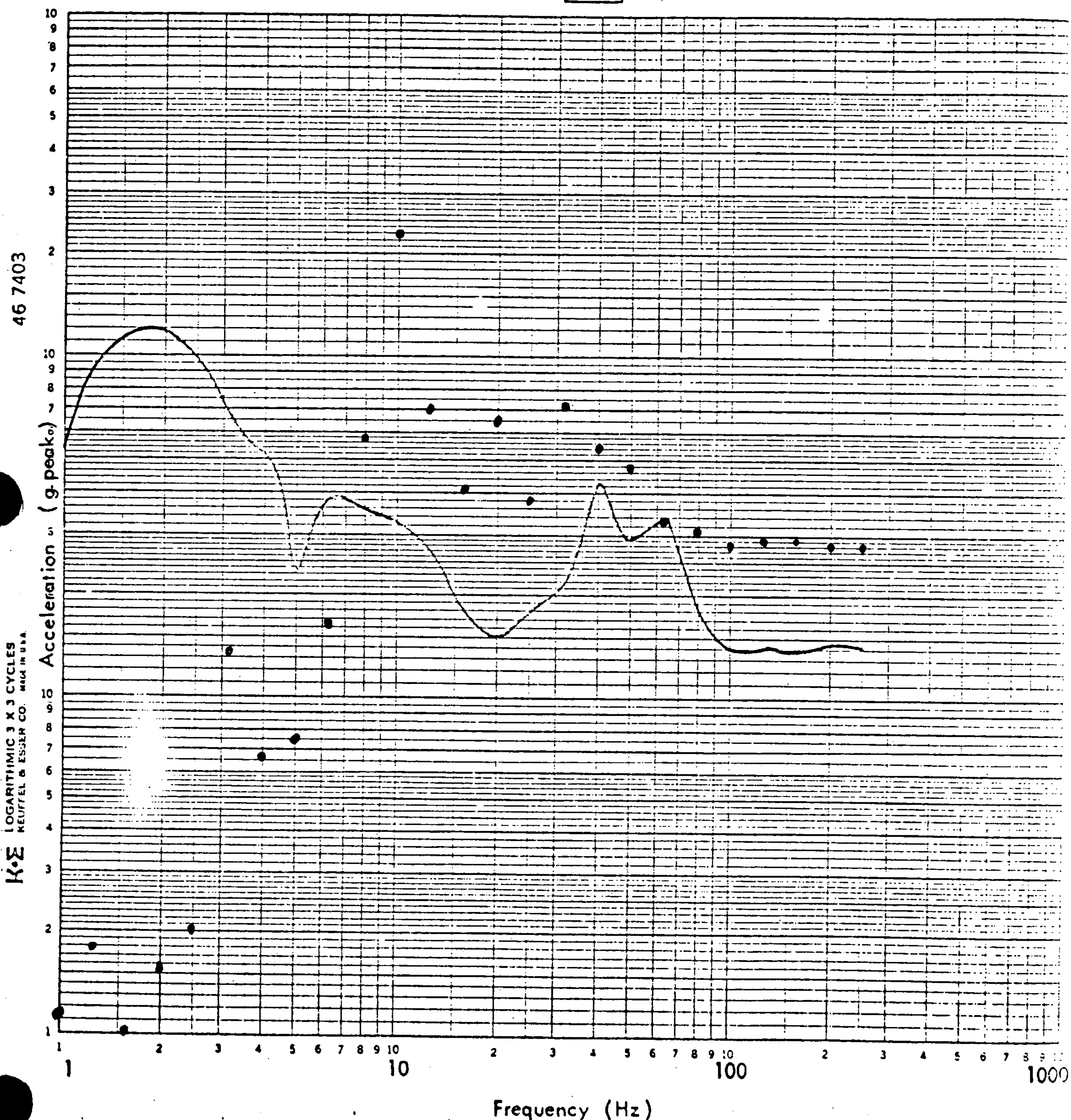


FIGURE 13 PREDICTED COMPOSITE RESPONSE SPECTRUM FOR HORIZONTALLY ORIENTED SPECIMEN ACCELEROMETERS IF THE TEST RESPONSE SPECTRA OF THE HORIZONTAL CONTROL ACCELEROMETER HAD EQUALED THE HORIZONTAL REQUIRED RESPONSE SPECTRA DURING SS/V RANDOM MULTI-FREQUENCY TEST (RUN # 19)

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 1 %

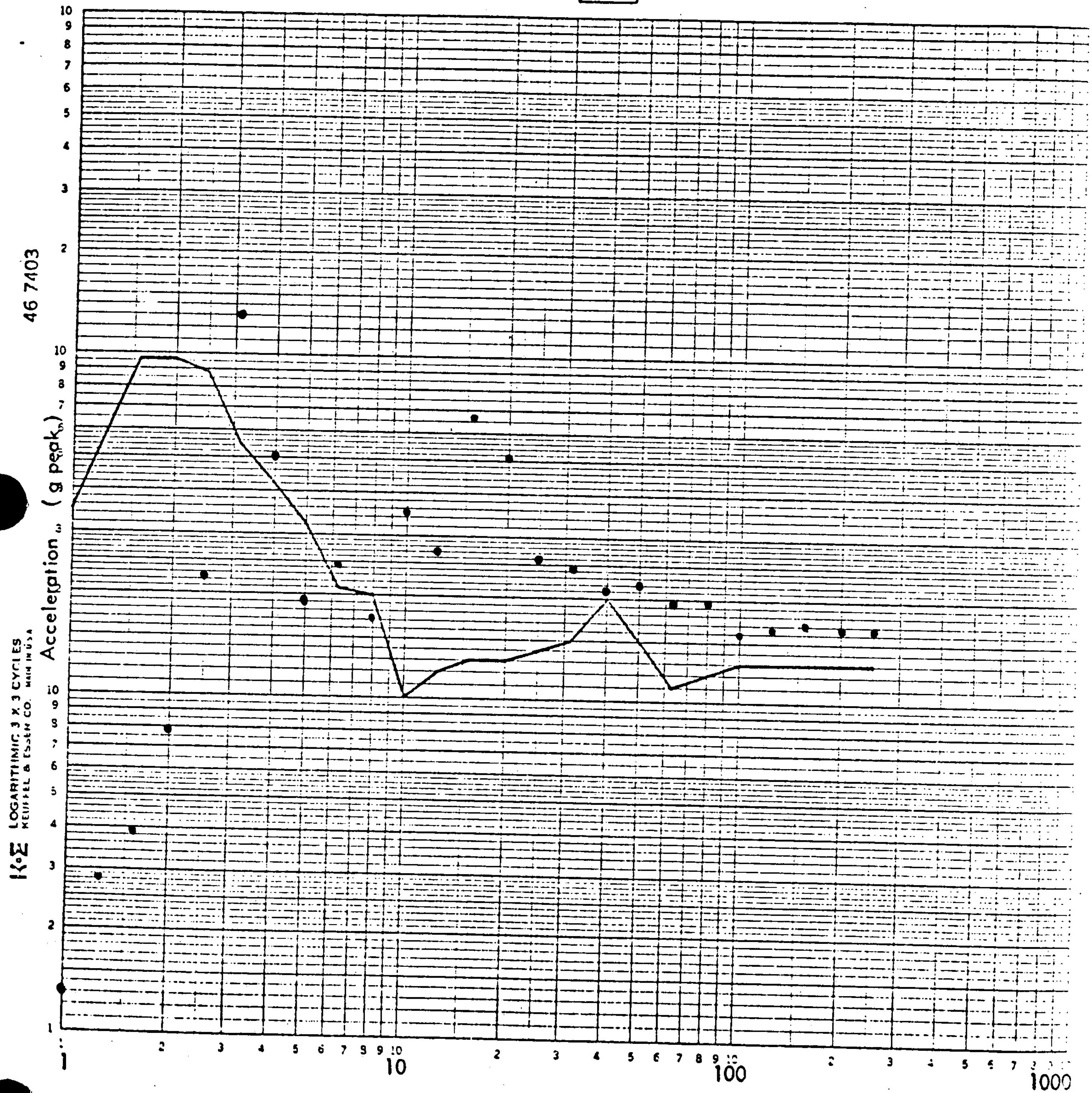


FIGURE 14 PREDICTED COMPOSITE RESPONSE SPECTRUM FOR VERTICALLY ORIENTED SPECIMEN ACCELEROMETERS IF THE TEST RESPONSE SPECTRA OF THE VERTICAL CONTROL ACCELEROMETERS HAD EQUALED THE VERTICAL REQUIRED RESPONSE SPECTRA DURING SS/V RANDOM MULTIFREQUENCY TEST (RUN #19)

FULL SCALE SHOCK SPECTRUM (g Peak)

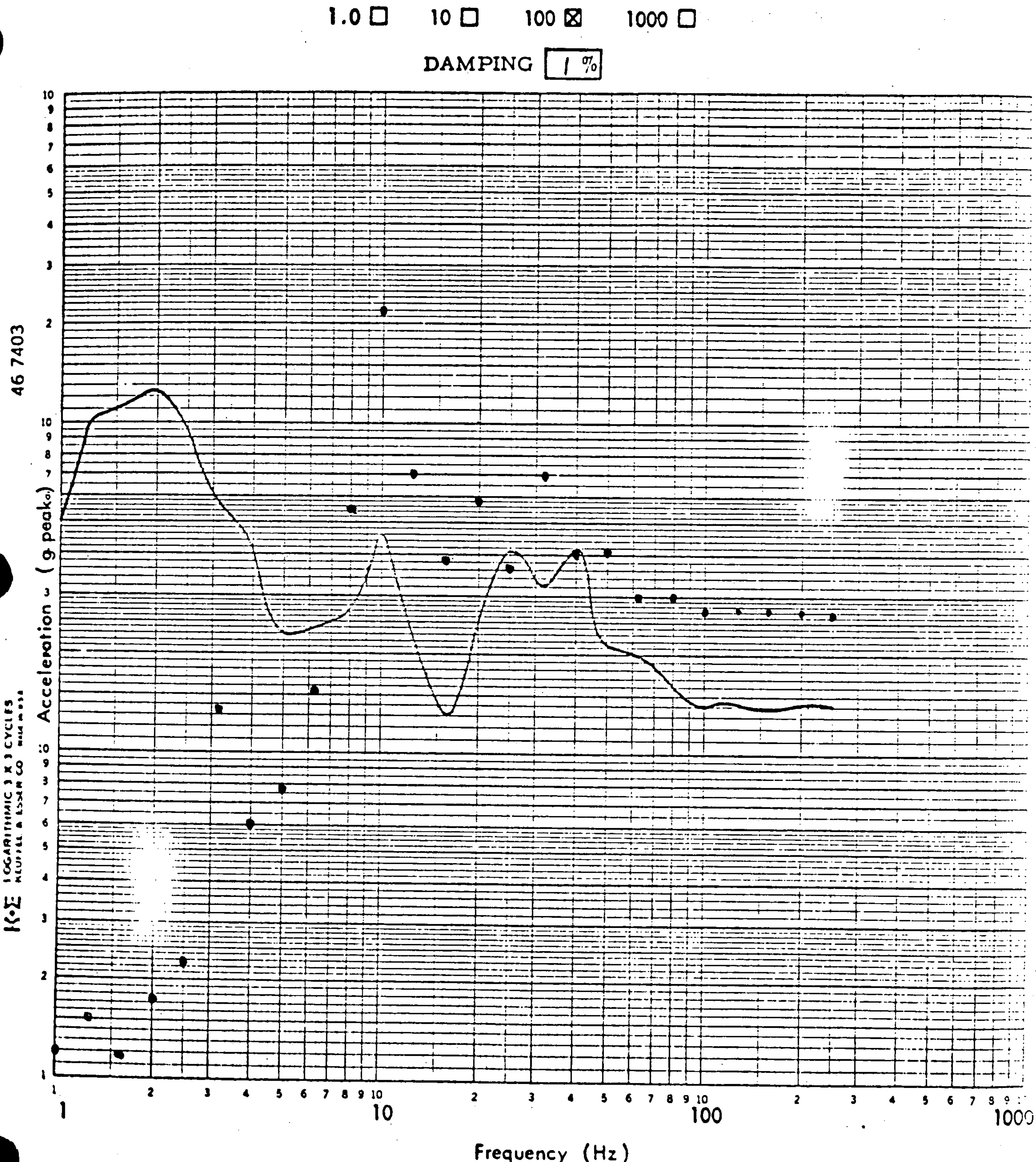


FIGURE 15 PREDICTED COMPOSITE RESPONSE SPECTRUM FOR HORIZONTALLY ORIENTED SPECIMEN ACCELEROMETERS IF THE TEST RESPONSE SPECTRA OF THE HORIZONTAL CONTROL ACCELEROMETER HAD EQUALED THE HORIZONTAL REQUIRED RESPONSE SPECTRA DURING FB/V RANDOM MULTI-FREQUENCY TEST (RUN # 32)

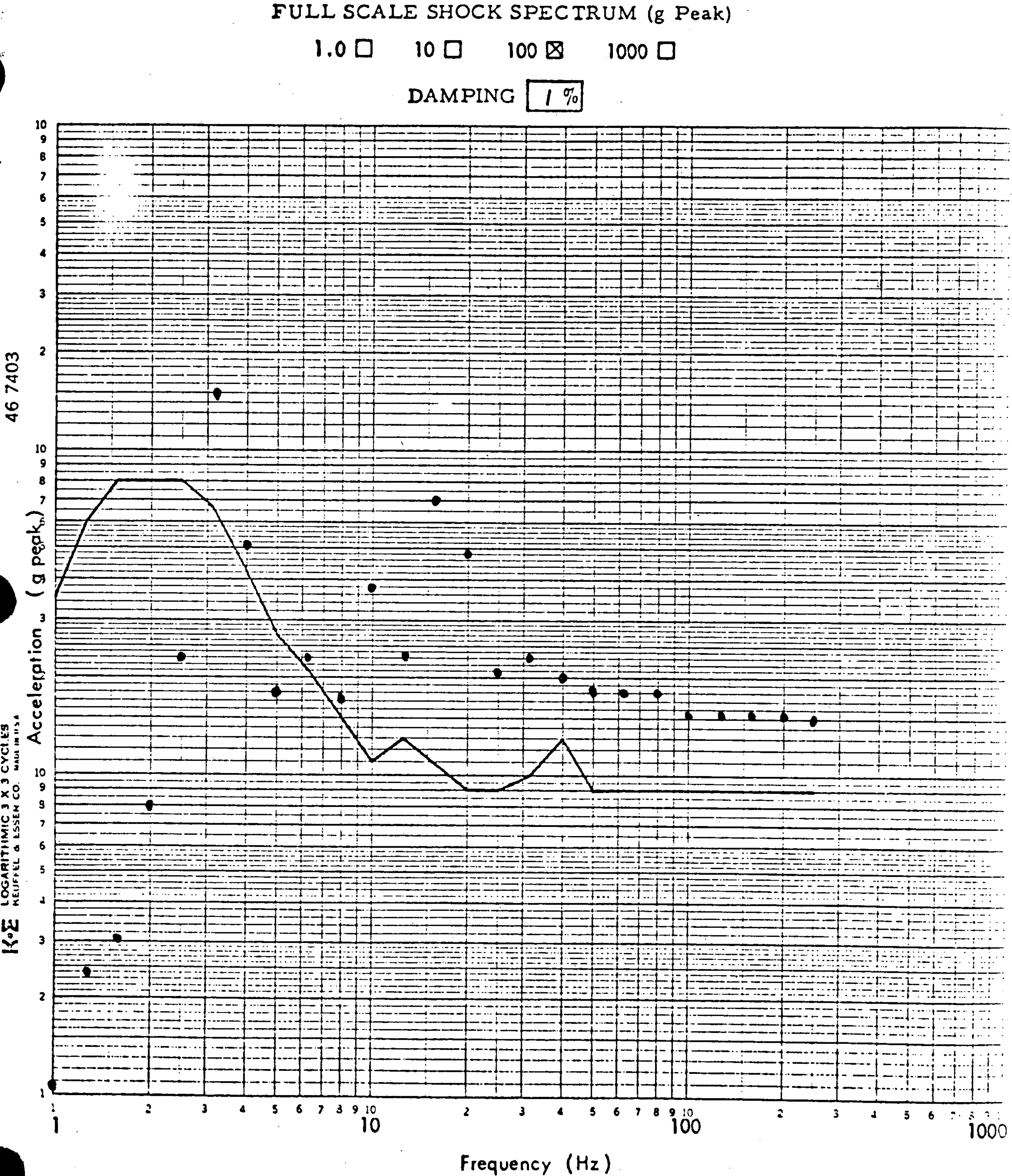


FIGURE 16 PREDICTED COMPOSITE RESPONSE SPECTRA FOR VERTICALLY ORIENTED SPECIMEN ACCELEROMETERS IF THE TEST RESPONSE SPECTRA OF THE VERTICAL CONTROL ACCELEROMETERS HAD EQUALED THE VERTICAL REQUIRED RESPONSE SPECTRA DURING FB/V RANDOM MULTIFREQUENCY TEST (RUN #32)

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR

II. Component Name: CPC Power Supply

1. Scope: [X] NSSS [ ] BOP
2. Model Number: None — Quantity: 4
3. Vendor: Systems Engineering Laboratories
4. If the component is a cabinet or panel, name and model No. of the devices included: NA
5. Physical Description a. Appearance Rock mounted chassis

   b. Dimensions 28" x 19" x 5 1/4"

   c. Weight 60#
6. Location: Building: Control Area Aux. Bldg

   Elevation: 30'
7. Field Mounting Conditions [X] Bolt (No. 8, Size 10-32)

   [ ] Weld (Length)

   [ ]
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S: 25, 33, 39 F/B: 40

   V: 26, 35, 39
9. a. Functional Description: Provides power supply and voltage reference for CPC

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

   [ ] Both
10. Pertinent Reference Design Specifications: 00000-ICE-3004 Rev 3
    1370-ICE-3004 Rev. 1

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

IV. Equipment Qualification Method: Test: X

Analysis: ____

Combination of Test and Analysis: ____

Test and/or Analysis by Systems Engineering Laboratories, No. 524280-019
Wyle Laboratories, 42915-1
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ____

5. [ ] Combination of ____

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ____
(Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ____

S/S = 1.4g input F/B = 1.4g input V = 1.3g input

VI. If Qualification by Test, then Complete: ____

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

2. [ ] Single Axis [X] Multi-Axis (Bi-axial)

3. No. of Qualification Tests: OBE 0 SSE 7
Other ____
(Specify)

4. Frequency Range: See TRS attached

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[X] No*

*TRS envelops RRS at natural frequencies.

6. Input g-level Test at:

S/S = 2.8
F/B = 2.6
V = 1.5

7. Laboratory Mounting: ______

1. [X] Bolt (No. 8, Size 10-32) [ ] Weld (Length ______)
[ ] ______

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

NA

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

1. Description of Test including Results: NA

2. Method of Analysis: ______

[ ] Static Analysis
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: ______ 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. Deflection	Location	Effect Upon Functional Operability

NSSS 2d

VI Test Results

NATURAL FREQUENCIES VERTICAL 26, 35, 39 Hz SIDE / SIDE 25, 33, 39 Hz FRONT / BACK None below 40 Hz

ELECTRICAL OPERATION Performance as required - output voltage remained constant

PHYSICAL INTEGRITY intact - no physical effects

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS

MAXIMUM EXTERIOR DEFLECTION

DYNAMIC LOAD TO MOUNTING

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES

VI DISCUSSION

This equipment was subjected to seven (7) series of full-level sine-beat tests. The duration of each series (in each of two biaxial test directions) was 30 seconds. The frequency of each of the seven series was different. Based on the equipment natural frequencies, which were all determined to be above 25 Hz by the resonance survey, the test series involving the highest frequency sine-beats is sufficient for qualification. This test excited all equipment modes to ample acceleration levels, as indicated by the test response spectra on the reverse side of this sheet. The excitation frequencies of this test were 16 Hz in the horizontal direction and 8 Hz in the vertical direction.

2d.

TEST RESPONSE SPECTRA

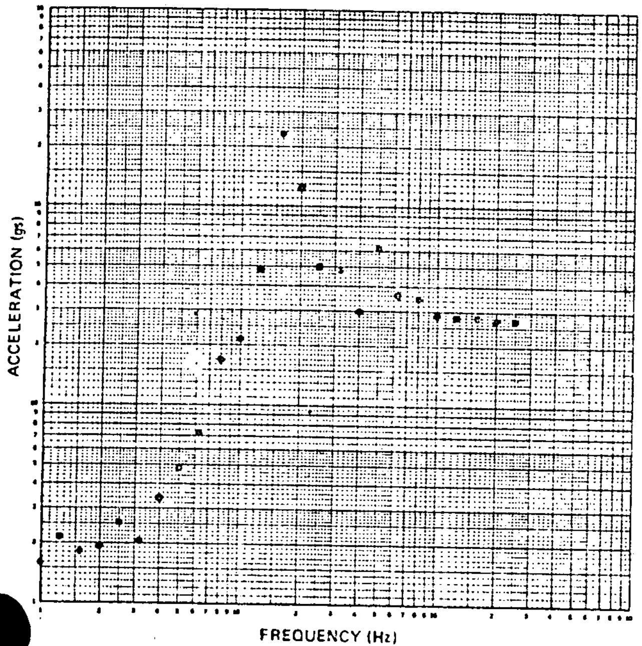
DATA SHEET No 2g
DATE November, 1976
REVISION No. 00

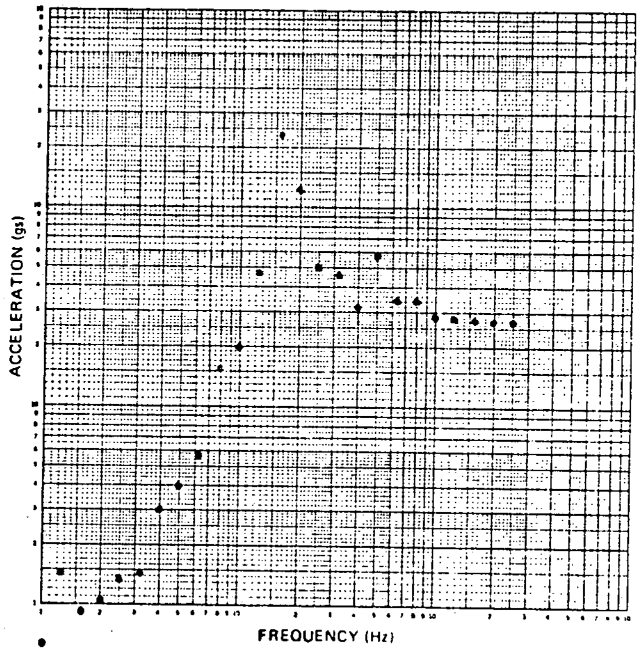
SPECTRUM FULL SCALE: ACCELERATION ☐ 10 gs ☒ 100 gs
FREQUENCY ☐ 100 Hz ☒ 1000 Hz

1 % CRITICAL DAMPING

☐ FRONT TO BACK
☒ FRONT TO BACK / VERTICAL
— TEST PLANE —
☐ SIDE TO SIDE
☒ SIDE TO SIDE / VERTICAL

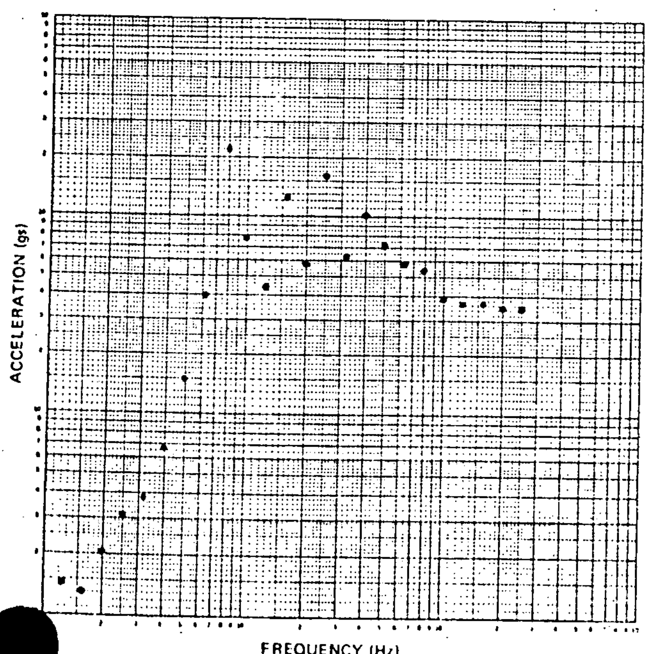
☒ FRONT TO BACK
☐ FRONT TO BACK (180° SHIFT)
— RESPONSE DIRECTION —
☒ SIDE TO SIDE
☐ SIDE TO SIDE (180° SHIFT)

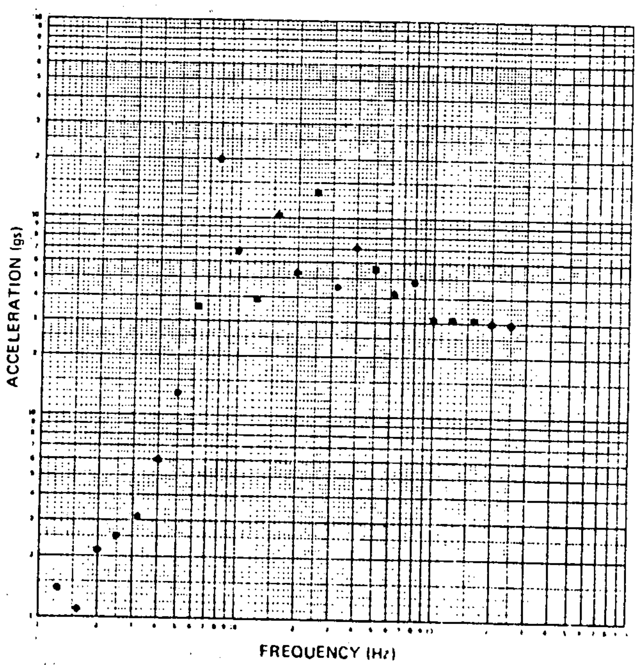




☐ VERTICAL
☒ FRONT TO BACK / VERTICAL
— TEST PLANE —
☒ SIDE TO SIDE / VERTICAL

☒ VERTICAL
☐ VERTICAL (180° SHIFT)
— RESPONSE DIRECTION —
☒ VERTICAL
☐ VERTICAL (180° SHIFT)





APC Modules RRS

MACS, CPU, DISK, Power Supply TRS

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING 1%

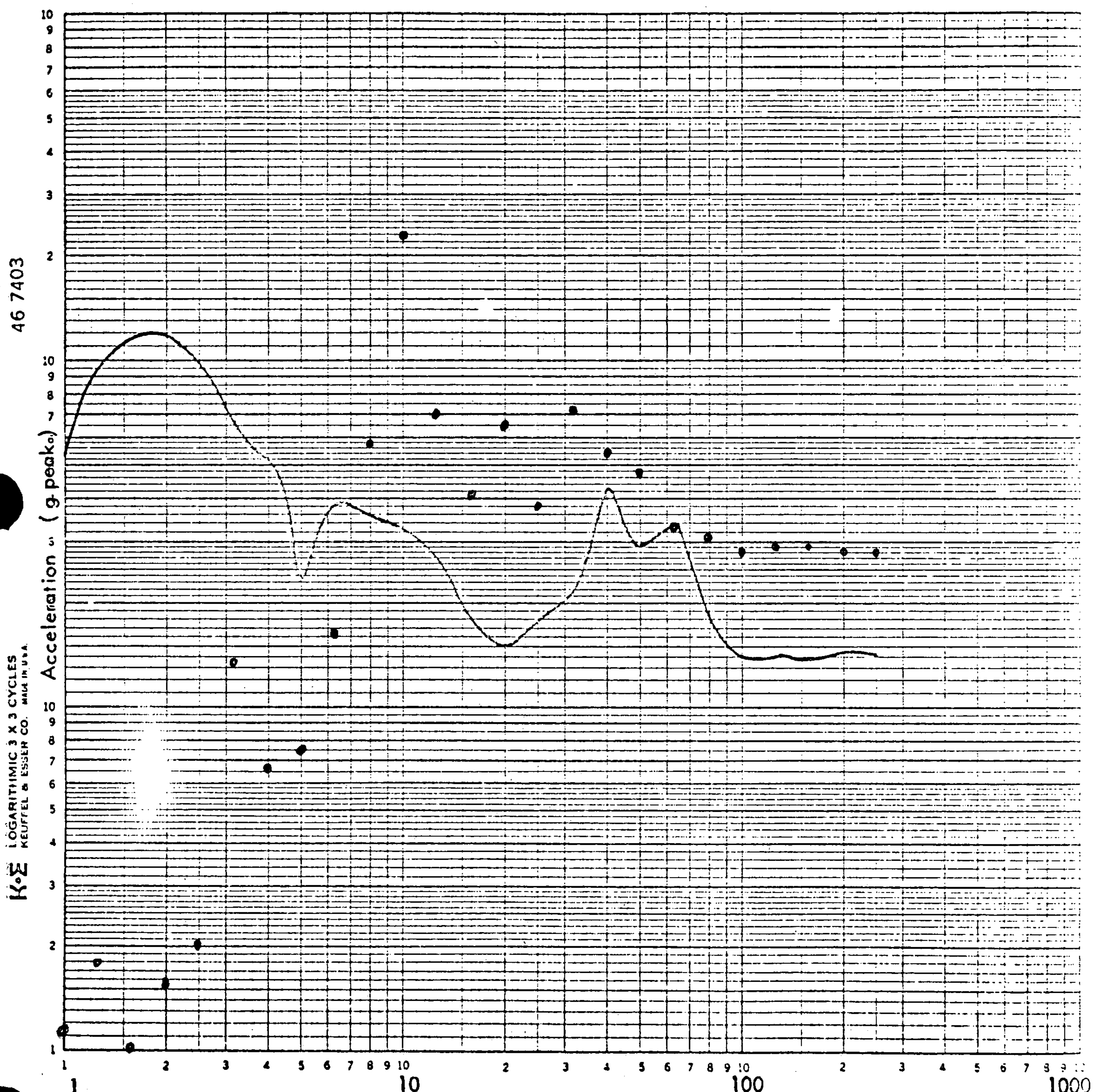


FIGURE 13 PREDICTED COMPOSITE RESPONSE SPECTRUM FOR HORIZONTALLY ORIENTED SPECIMEN ACCELEROMETERS IF THE TEST RESPONSE SPECTRA OF THE HORIZONTAL CONTROL ACCELEROMETER HAD EQUALED THE HORIZONTAL REQUIRED RESPONSE SPECTRA DURING SS/V RANDOM MULTI-FREQUENCY TEST (RUN # 19)

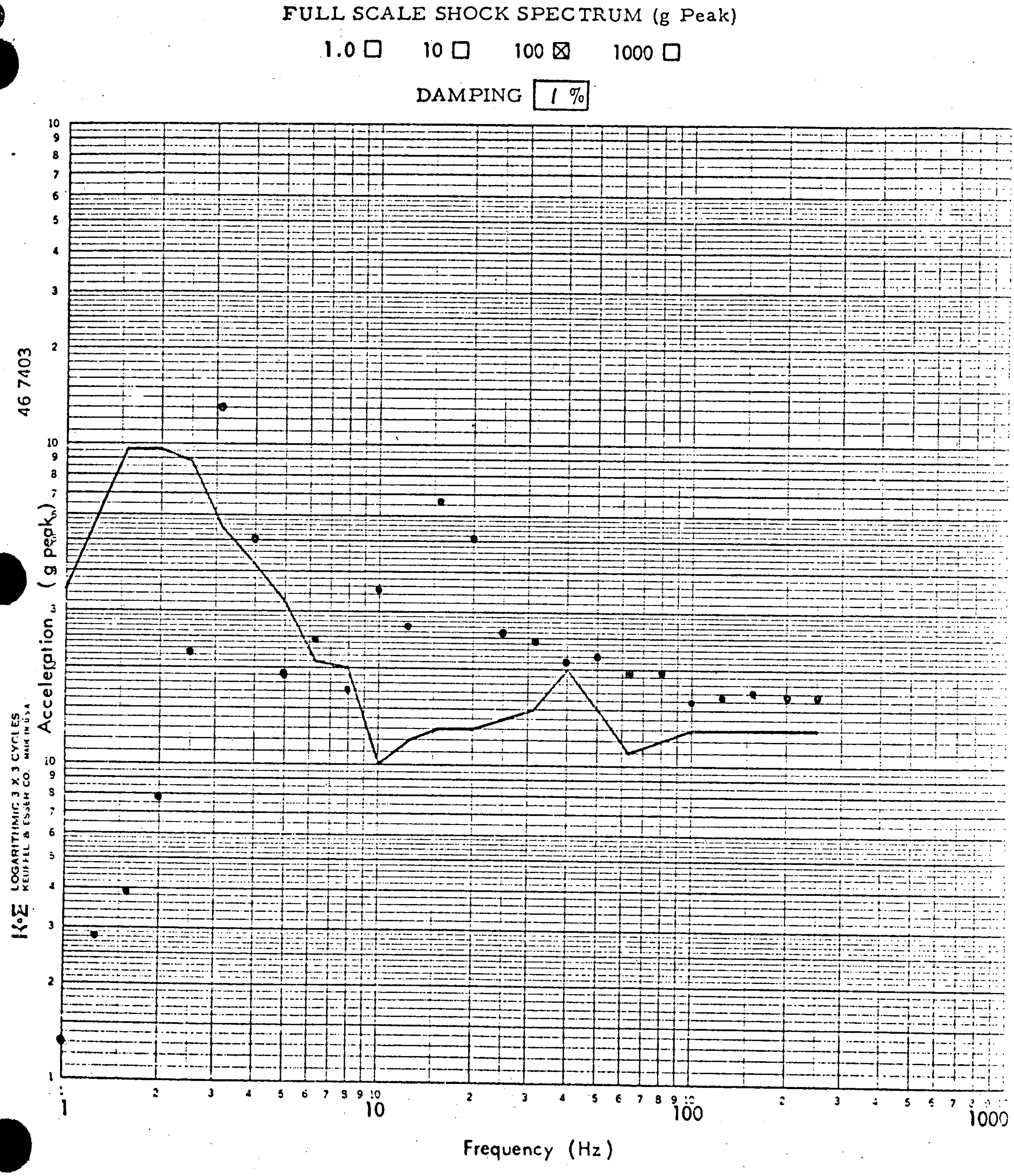


FIGURE 14 PREDICTED COMPOSITE RESPONSE SPECTRUM FOR VERTICALLY ORIENTED SPECIMEN ACCELEROMETERS IF THE TEST RESPONSE SPECTRA OF THE VERTICAL CONTROL ACCELEROMETERS HAD EQUALED THE VERTICAL REQUIRED RESPONSE SPECTRA DURING SS/V RANDOM MULTIFREQUENCY TEST (RUN #19)

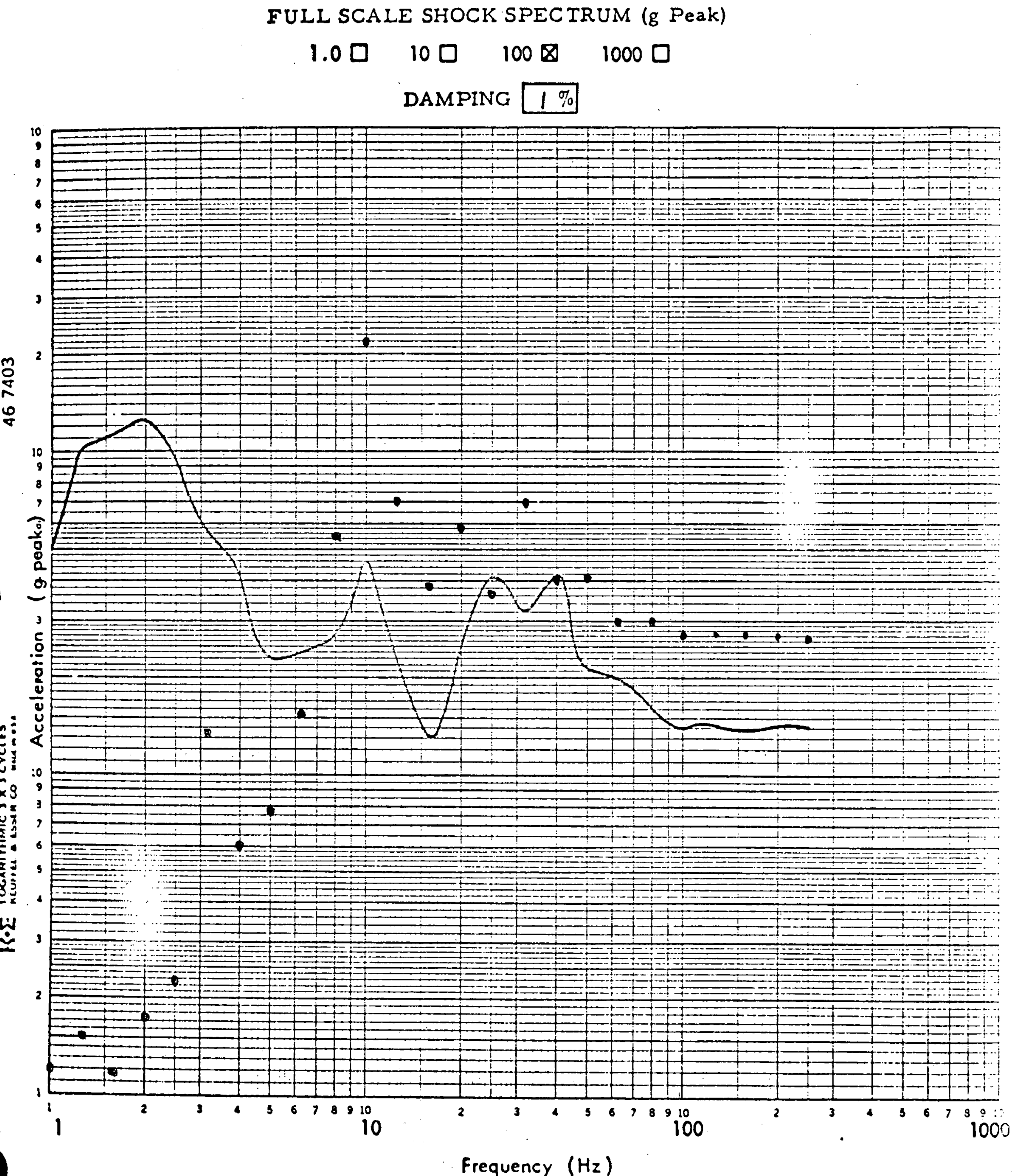


FIGURE 15 PREDICTED COMPOSITE RESPONSE SPECTRUM FOR HORIZONTALLY ORIENTED SPECIMEN ACCELEROMETERS IF THE TEST RESPONSE SPECTRA OF THE HORIZONTAL CONTROL ACCELEROMETER HAD EQUALED THE HORIZONTAL REQUIRED RESPONSE SPECTRA DURING FB/V RANDOM MULTI-FREQUENCY TEST (RUN # 32)

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING [1 %]

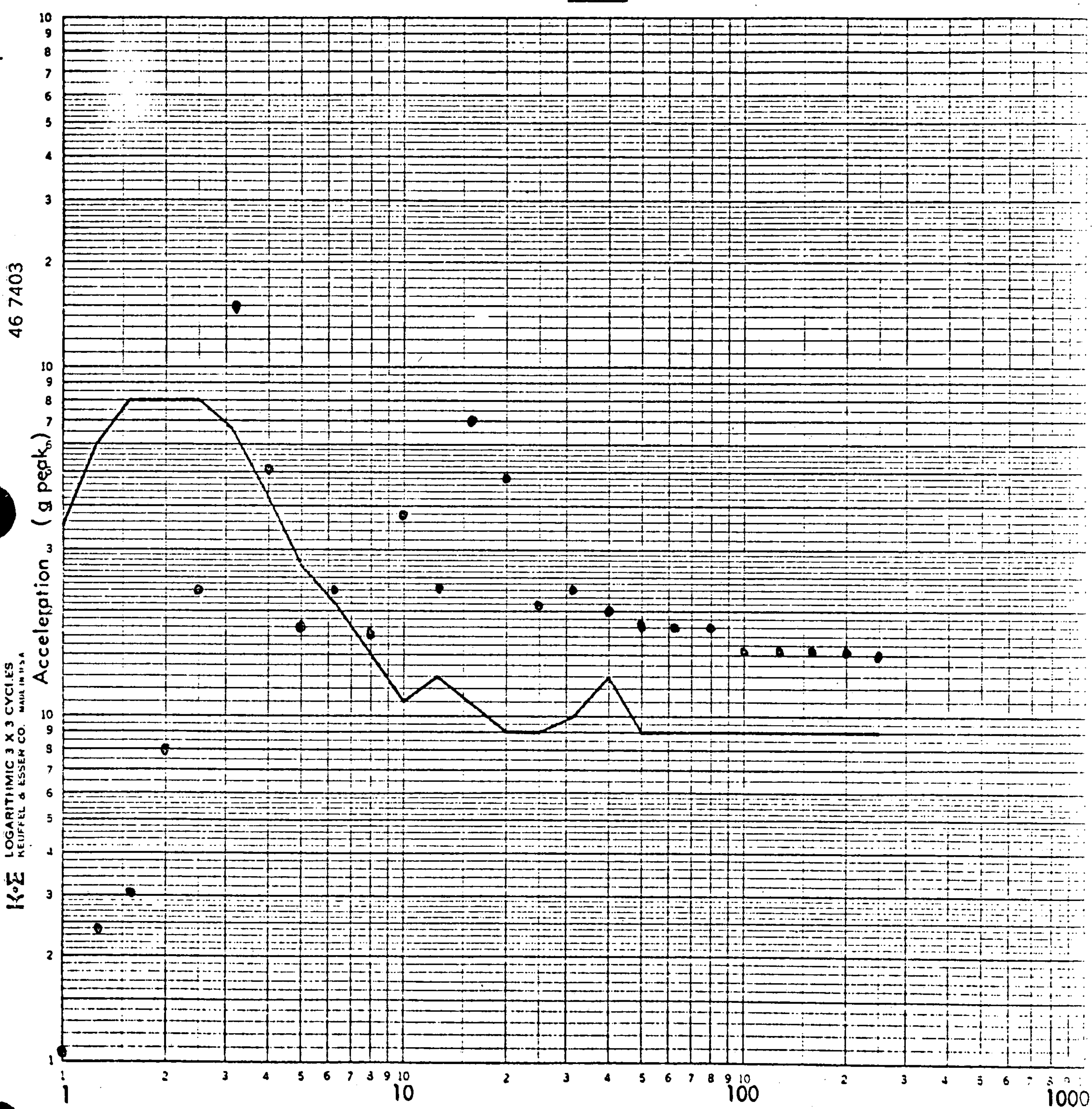


FIGURE 16 PREDICTED COMPOSITE RESPONSE SPECTRA FOR VERTICALLY ORIENTED SPECIMEN ACCELEROMETERS IF THE TEST RESPONSE SPECTRA OF THE VERTICAL CONTROL ACCELEROMETERS HAD EQUALED THE VERTICAL REQUIRED RESPONSE SPECTRA DURING FB/V RANDOM MULTIFREQUENCY TEST (RUN #32)

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 | Type:

1. Utility: Southern California Edison Company | PWR X

2. NSSS: CE 3. A/E: Bechtel | BWR ____

II. Component Name: CEA Position Isolation Assembly (CPIA)

1. Scope: [X] NSSS [ ] BOP

2. Model Number: None Quantity: 2

3. Vendor: Electro-Mechanics Inc.

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

5. Physical Description a. Appearance Rack mounted chassis

   b. Dimensions 17" x 17.5" x 12.219"

   c. Weight ≅70#

6. Location: Building: Control Area, Auxiliary Building

   Elevation: 30'

7. Field Mounting Conditions:

   [X] Bolt (No. Back 2, 8 , Size 10-32 1/4-20) Front

   [ ] Weld (Length ____) [ ] ____

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

   S/S: >40 F/B: >40 V: >40

9. a. Functional Description: Transfer and isolate analog signals between protective channels.

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

   [ ] Both ____

10. Pertinent Reference Design Specifications: 00000-ICE-3009 Rev. 2
    1370-ICE-3009 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: ________

Test and/or Analysis by Wyle Laboratories, #43349-1
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

   3. [ ] Explosive only 4. [ ] Other (Specify) ________

   5. [ ] Combination of ________

   6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
   [ ] ________
   (Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ________

   S/S = 1.4g input F/B = 1.4g input V = 1.3g input

VI. If Qualification by Test, then Complete: ________

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

2. [ ] Single Axis [X] Multi-Axis (Bi-axial)

3. No. of Qualification Tests: OBE 10 SSE 1
   Other ________
   (Specify)

4. Frequency Range: See TRS attached

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
   [X] No*
   *TRS exceeds RRS above 2.5 hz.

6. Input g-level Test at: S/S = 13.5 F/B = 12.5 V = 13.0

7. Laboratory Mounting: ______

   1. [X] Bolt (No. Front 8, Back 2, Size 1/4-20 10-32)

      [ ] Weld (Length ______) [ ] ______

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

    NA

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

1. Description of Test including Results: NA

2. Method of Analysis: ______

   [ ] Static Analysis [ ] Equivalent Static Analysis
   [ ] Dynamic Analysis [ ] Time-History
   [ ] Response Spectrum

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: ______ 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. Deflection	Location	Effect Upon Functional Operability

VI Test Results

NATURAL FREQUENCIES VERTICAL No Resonance below 40 Hz SIDE / SIDE No Resonance below 40 Hz FRONT / BACK No Resonance below 40 Hz

ELECTRICAL OPERATION Equipment operated successfully

PHYSICAL INTEGRITY After the accumulative effects of several tests the lower separation plate and relay bracket loosened. The items were re-fastened and the test was then continued.

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS

MAXIMUM EXTERIOR DEFLECTION

DYNAMIC LOAD TO MOUNTING

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES

VI. DISCUSSION

During testing in the side to side and vertical axes an electrical anomaly occurred. The anomaly consisted of a 20 mv, 3 msec voltage spike located on the low output side of the three differential amplifiers being monitored. The test was then re-run three times and the anomaly did not reoccur. During further testing the seismic test table hit its mechanical stops causing the CPIA to experience a peak g level of approximately 110 g's and a ZPA of 32 g's. Once the stops were hit the same three amplifiers mentioned above were found to have intermittent voltage spikes of approximately 100 mv in amplitude on their low output side. The electrical anomaly continued to appear intermittently throughout the front to back and vertical axes. At this point the test was stopped to determine the cause of the electrical anomaly. The problem was found to be in the -15V power supply . An external ±15V power supply was used to provide voltage through the same connections used by the internal ±15V power supply and the entire front-to-back and vertical axis seismic test was rerun without any problems.

A new ±15V power supply of the same type was later tested to the same RRS without any problems. The failure of this power supply was attributed to the hitting of the mechanical stops and accumulative effect of the large number of seismic tests required by the test procedure.

2c.

TEST RESPONSE SPECTRA

DATA SHEET No. 2i

DATE MARCH 1977

SPECTRUM FULL SCALE: ACCELERATION ☐ 10 gs ☒ 100 gs
FREQUENCY ☐ 100 Hz ☒ 1000 Hz

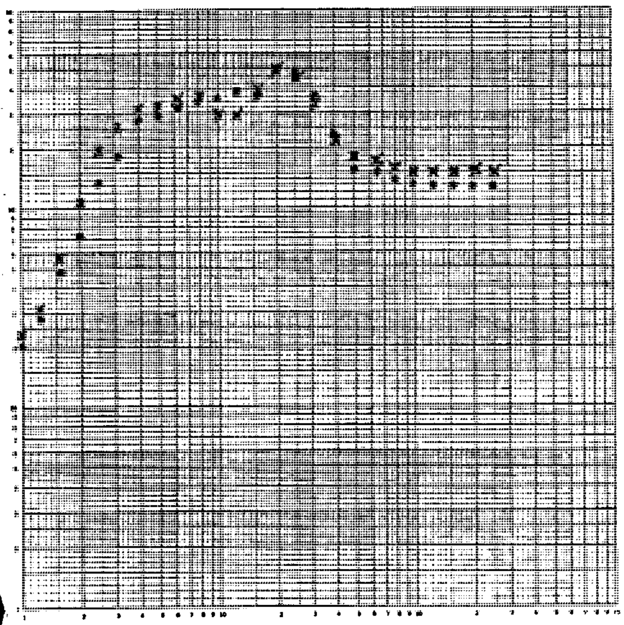
1 % CRITICAL DAMPING REVISION No. 01

TEST PLANE
☐ FRONT TO BACK
☒ FRONT TO BACK / VERTICAL

☐ SIDE TO SIDE
☒ SIDE TO SIDE / VERTICAL

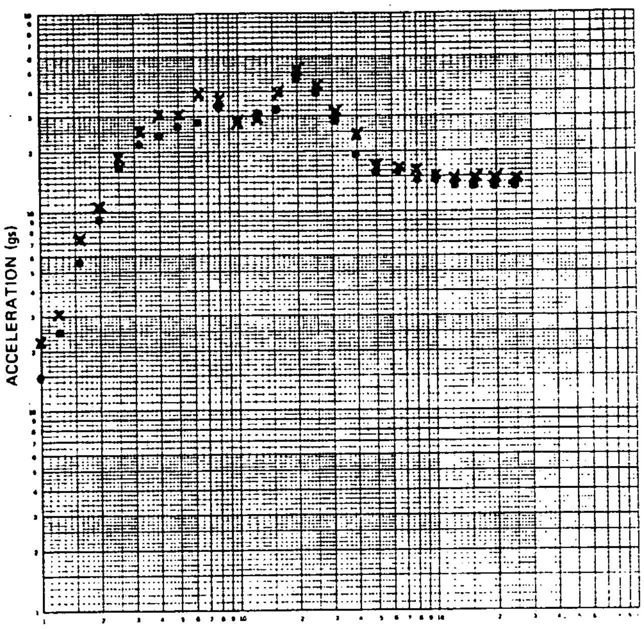
RESPONSE DIRECTION
(•) ☒ FRONT TO BACK
(X) ☒ FRONT TO BACK (180° SHIFT)

☒ SIDE TO SIDE (•)
☒ SIDE TO SIDE (180° SHIFT) (X)



ACCELERATION (gs)

FREQUENCY (Hz)



ACCELERATION (gs)

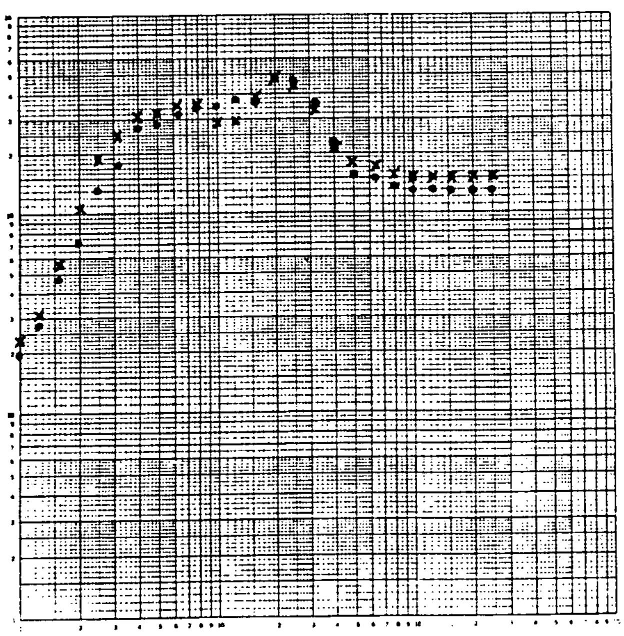
FREQUENCY (Hz)

TEST PLANE
☐ VERTICAL
☒ FRONT TO BACK / VERTICAL

☒ SIDE TO SIDE / VERTICAL

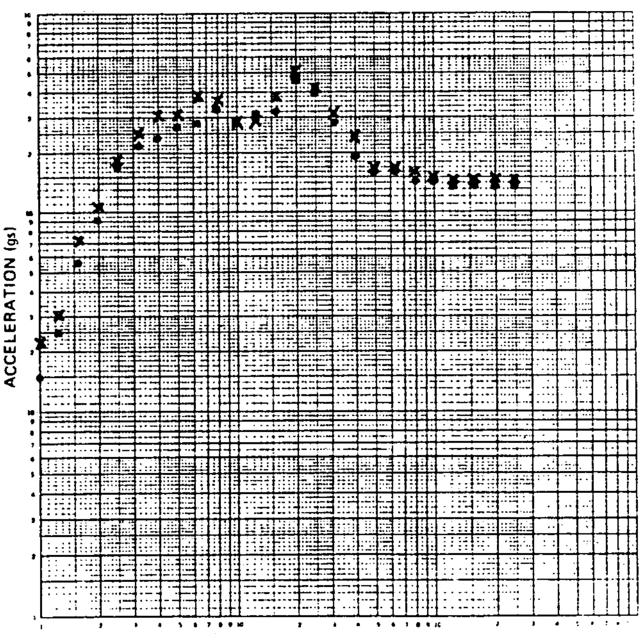
RESPONSE DIRECTION
(•) ☒ VERTICAL
(X) ☒ VERTICAL (180° SHIFT)

☒ VERTICAL (•)
☒ VERTICAL (180° SHIFT) (X)



ACCELERATION (gs)

FREQUENCY (Hz)



ACCELERATION (gs)

FREQUENCY (Hz)

APC Products RRS
(CPIA TRS

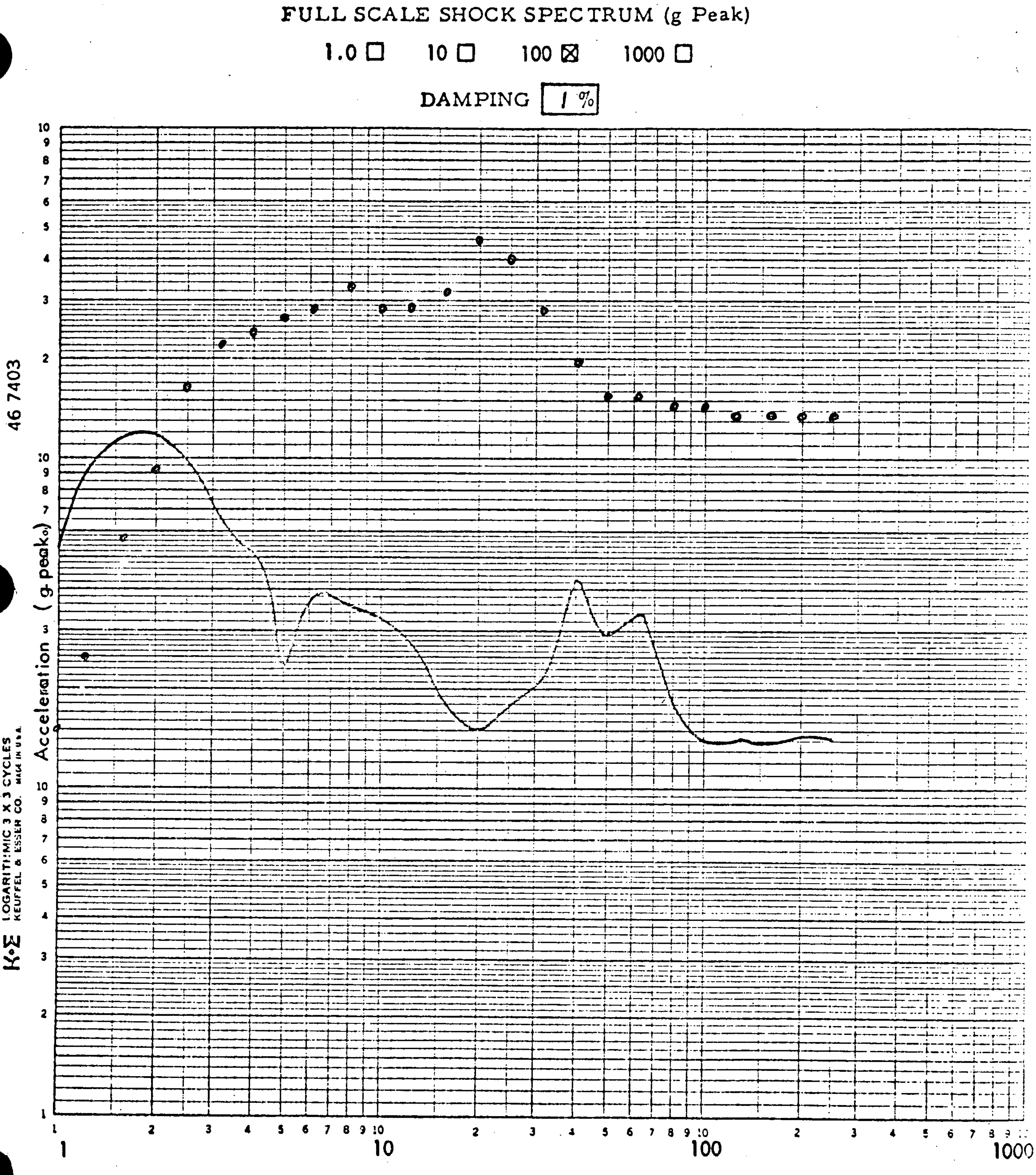


FIGURE 13 PREDICTED COMPOSITE RESPONSE SPECTRUM FOR HORIZONTALLY ORIENTED SPECIMEN ACCELEROMETERS IF THE TEST RESPONSE SPECTRA OF THE HORIZONTAL CONTROL ACCELEROMETER HAD EQUALED THE HORIZONTAL REQUIRED RESPONSE SPECTRA DURING SS/V RANDOM MULTI-FREQUENCY TEST (RUN # 19)

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING $\boxed{1\ \%}$

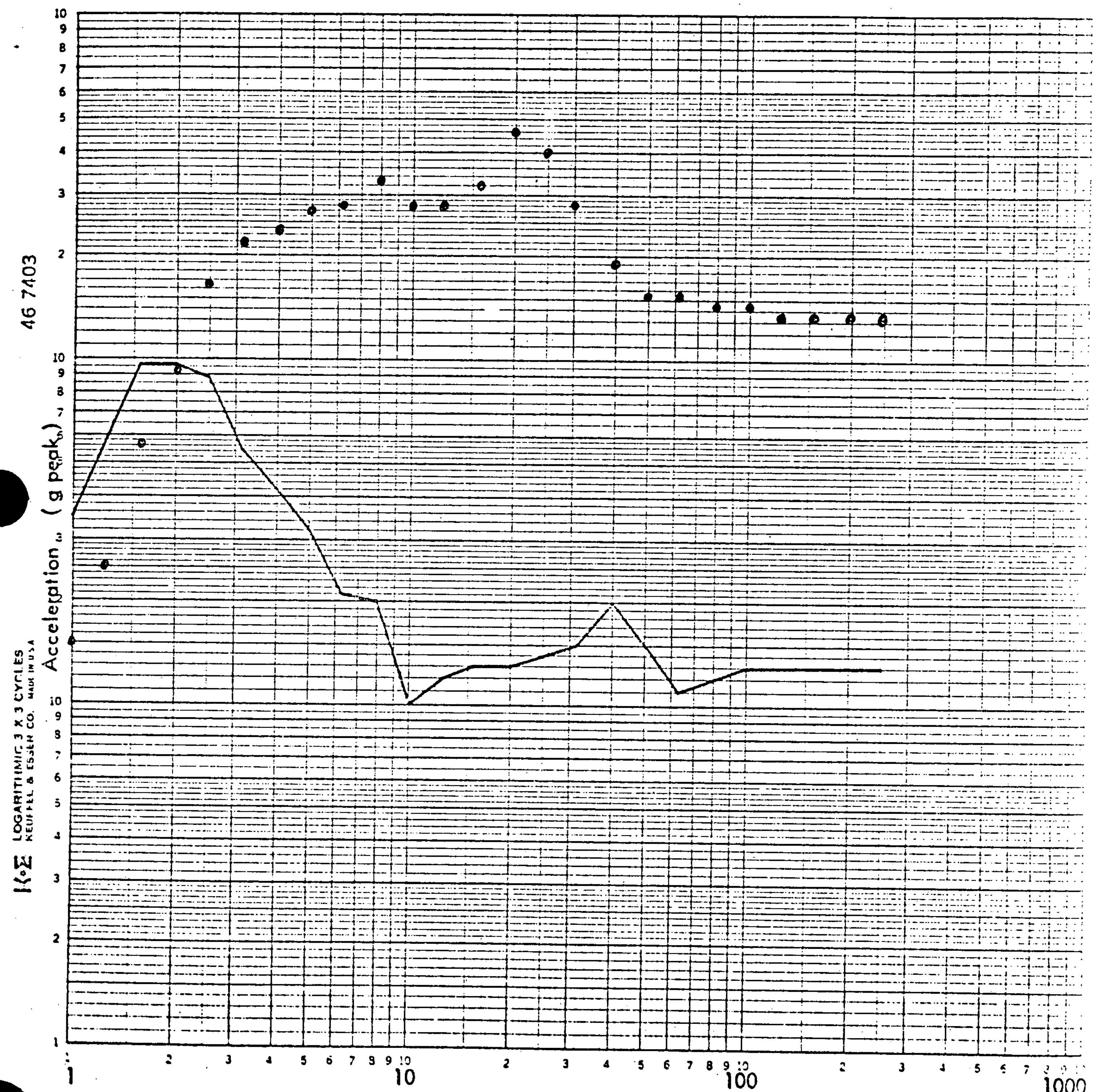
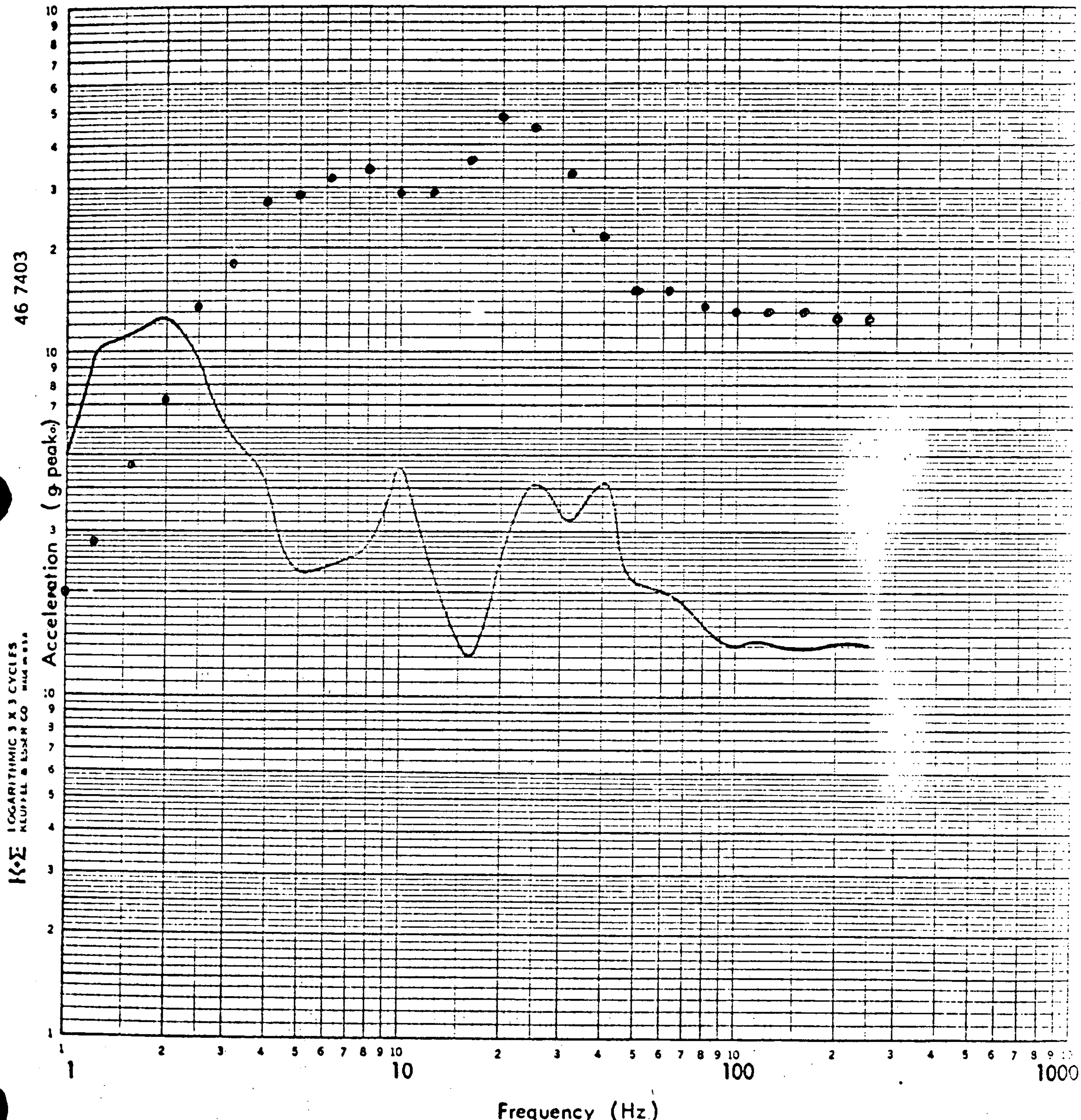


FIGURE 14 PREDICTED COMPOSITE RESPONSE SPECTRUM FOR VERTICALLY ORIENTED SPECIMEN ACCELEROMETERS IF THE TEST RESPONSE SPECTRA OF THE VERTICAL CONTROL ACCELEROMETERS HAD EQUALED THE VERTICAL REQUIRED RESPONSE SPECTRA DURING SS/V RANDOM MULTIFREQUENCY TEST (RUN #19)

FULL SCALE SHOCK SPECTRUM (g Peak)

1.0 ☐ 10 ☐ 100 ☒ 1000 ☐

DAMPING $\boxed{1\ \%}$



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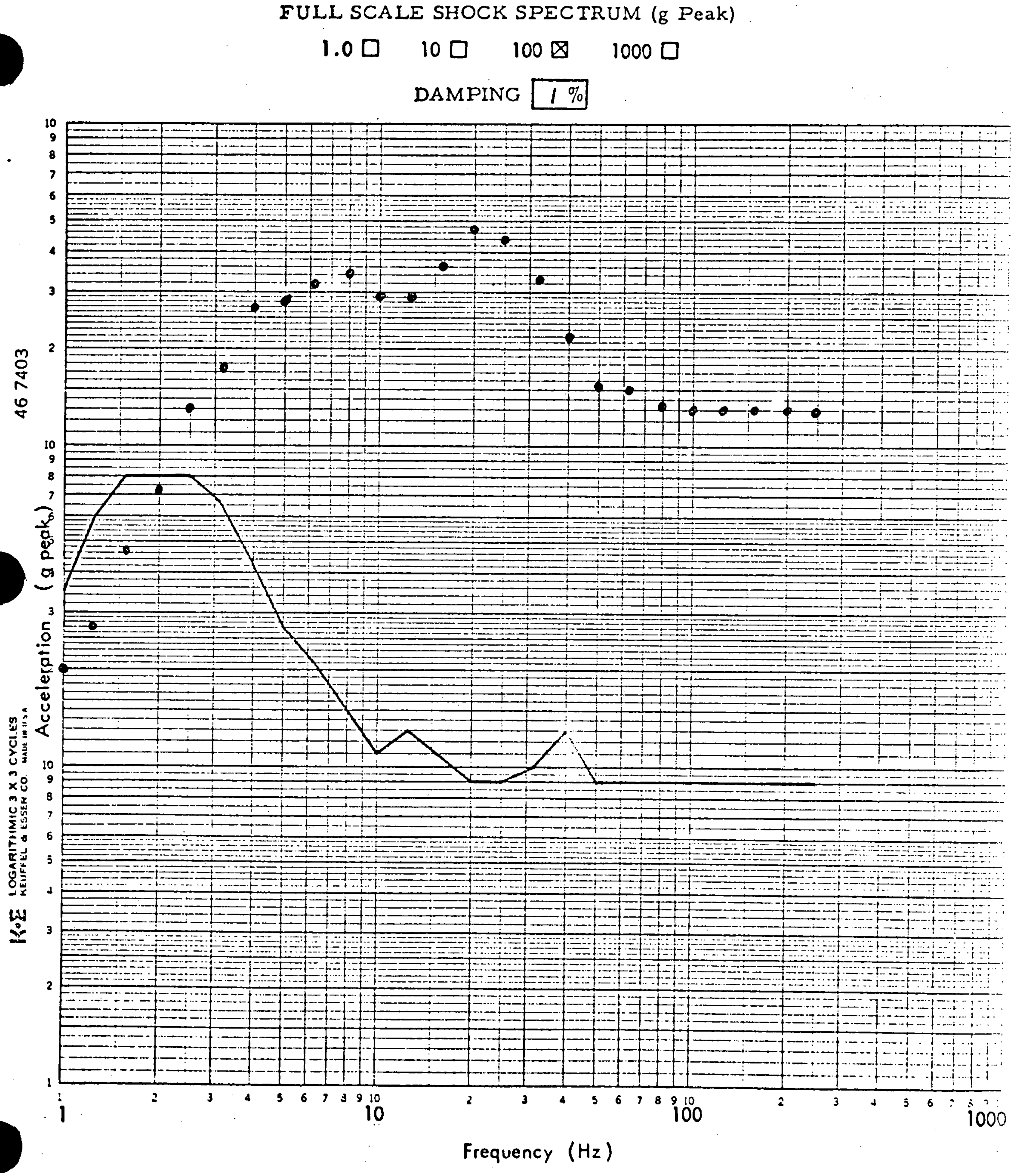


FIGURE 16 PREDICTED COMPOSITE RESPONSE SPECTRA FOR VERTICALLY ORIENTED SPECIMEN ACCELEROMETERS IF THE TEST RESPONSE SPECTRA OF THE VERTICAL CONTROL ACCELEROMETERS HAD EQUALED THE VERTICAL REQUIRED RESPONSE SPECTRA DURING FB/V RANDOM MULTIFREQUENCY TEST (RUN #32)

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR ____

II. Component Name: RCP SSSS Signal Processor

1. Scope: [X] NSSS [ ] BOP
2. Model Number: None — Quantity: 4
3. Vendor: Bently - Nevada
4. If the component is a cabinet or panel, name and model No. of the devices included: NA
5. Physical Description a. Appearance Rock mounted chassis

   b. Dimensions 17.2" x 12.0" x 8.79"

   c. Weight 30#
6. Location: Building: Control Area Aux. Bldg

   Elevation: 30'
7. Field Mounting Conditions [X] Bolt (No. 8, Size 10-32)

   [ ] Weld (Length ____)

   [ ] ____
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S: 35 F/B: 35

   V: 35
9. a. Functional Description: Process shaped pulses which are proportional to RCP speed

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

   [ ] Both ____
10. Pertinent Reference Design Specifications: 00000-ICE-6003 Rev. 2 1370-ICE-6003 Rev. 2

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

IV. Equipment Qualification Method: Test: X

Analysis: ____

Combination of Test and Analysis: ____

Test and/or Analysis by Wyle Laboratories, Report 54602
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ____

5. [ ] Combination of ____

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ____
(Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ____

S/S = 1.4g input F/B = 1.4g input V = 1.3g input

VI. If Qualification by Test, then Complete: ____

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

2. [ ] Single Axis [X] Multi-Axis (Bi-axial)

3. No. of Qualification Tests: OBE 0 SSE 6
Other ____
(Specify)

4. Frequency Range: See TRS attached

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[X] No*
*TRS envelops RRS at natural frequencies.

6. Input g-level Test at:

S/S = 2.5
F/B = 3.2
V = 2.2

7. Laboratory Mounting: ______

1. [X] Bolt (No. Front 4 Rev. 4, Size 10-32 10-32) [ ] Weld (Length ______)
   [ ] ______

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

    NA

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

1. Description of Test including Results: NA

2. Method of Analysis: ______

   [ ] Static Analysis
   [ ] Dynamic Analysis
   [ ] Equivalent Static Analysis
   [ ] Time-History
   [ ] Response Spectrum

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: ______ 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. Deflection	Location	Effect Upon Functional Operability

NSSS 2f

VI Test Results

NATURAL FREQUENCIES VERTICAL See Discussion Below SIDE / SIDE FRONT / BACK
ELECTRICAL OPERATION

PHYSICAL INTEGRITY Intact; no physical effects.

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)
MAXIMUM STRUCTURAL STRESS
MAXIMUM EXTERIOR DEFLECTION
DYNAMIC LOAD TO MOUNTING
MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES

VI. DISCUSSION

(a) Mounting: Signal Processor - (4) 10-32 bolt on front and (2) 1/4-20 bolt on back
Pulse Transmitter - (4) 10-24 bolts

(b) Natural Frequencies: Signal Processor - No Resonance below 35 Hz.
Transmitter - Resonance found at 30 Hz in the front-to-back and side-to-side directions.
No resonance was found below 35 Hz in vertical.

(c) Full Level Tests: The TRS indicated on the reverse side of this data sheet resulted from the 16 Hz tests. The other TRSs are similar except the frequency is shifted accordingly.

2F.

TEST RESPONSE SPECTRA

DATA SHEET No 2j

DATE MARCH 1977

SPECTRUM FULL SCALE
ACCELERATION ☐ 10 gs ☒ 100 gs
FREQUENCY ☐ 100 Hz ☒ 1000 Hz

1 % CRITICAL DAMPING

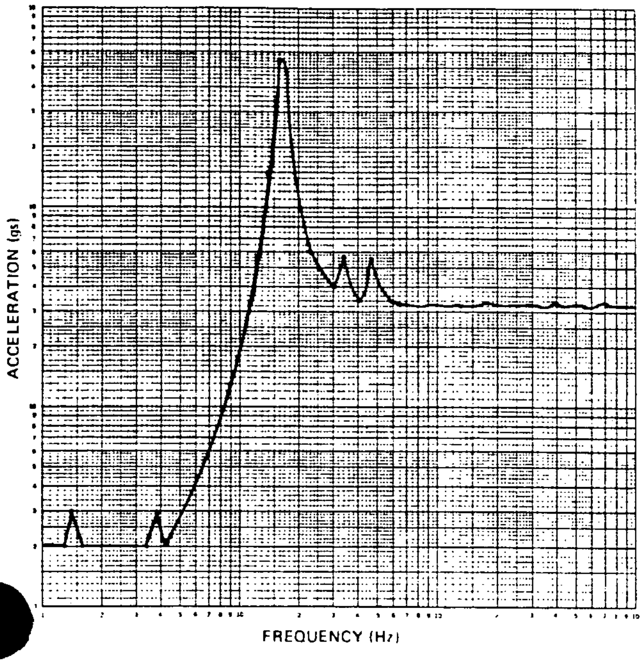
REVISION No. 01

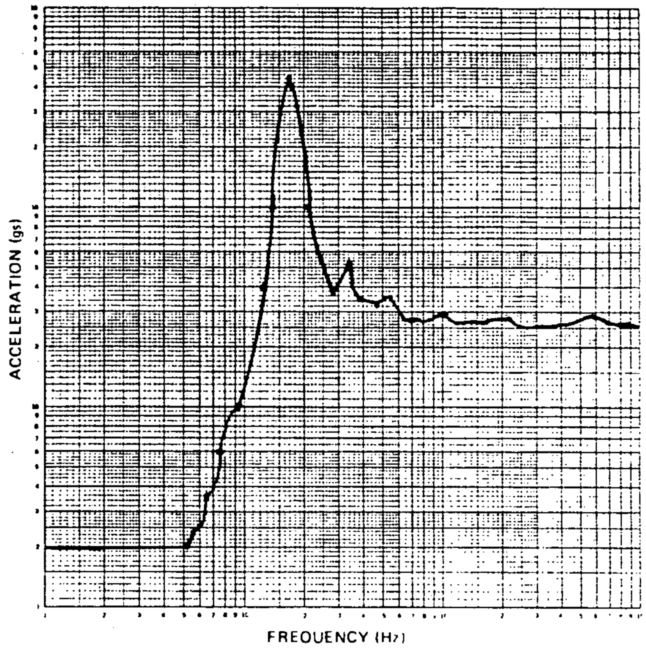
TEST PLANE:
- ☐ FRONT TO BACK
- ☒ FRONT TO BACK / VERTICAL

RESPONSE DIRECTION:
- ☒ FRONT TO BACK
- ☒ FRONT TO BACK (180° SHIFT)

TEST PLANE:
- ☐ SIDE TO SIDE
- ☒ SIDE TO SIDE / VERTICAL

RESPONSE DIRECTION:
- ☒ SIDE TO SIDE
- ☒ SIDE TO SIDE (180° SHIFT)



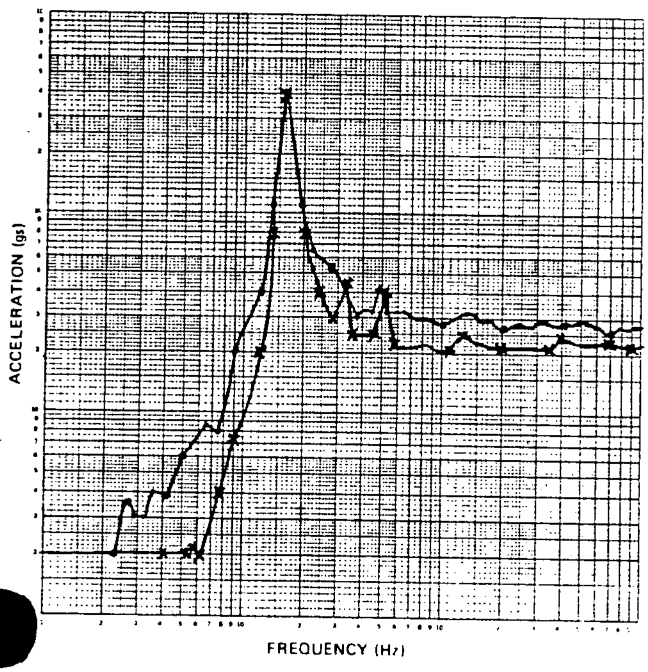


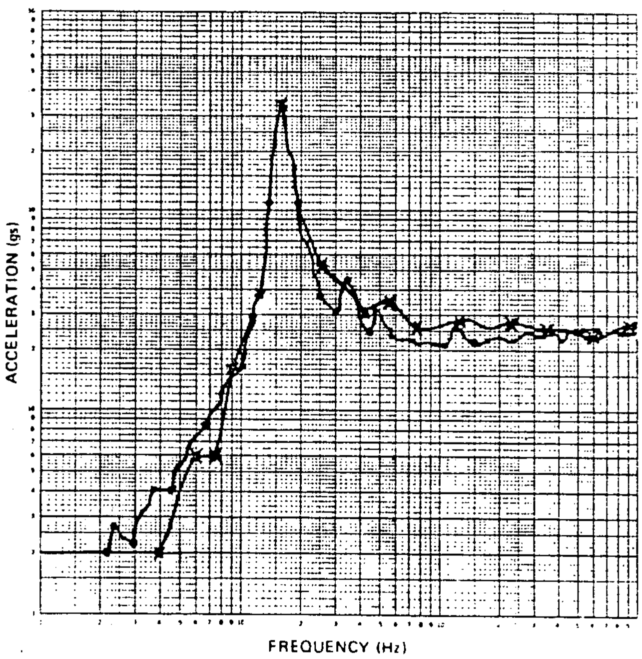
TEST PLANE:
- ☐ VERTICAL
- ☒ FRONT TO BACK / VERTICAL

RESPONSE DIRECTION:
- (—•—) ☒ VERTICAL
- (—✱—) ☒ VERTICAL (180° SHIFT)

TEST PLANE:
- ☒ SIDE TO SIDE / VERTICAL

RESPONSE DIRECTION:
- ☒ VERTICAL (—•—)
- ☒ VERTICAL (180° SHIFT) (—✱—)





RCPSSSS Processor

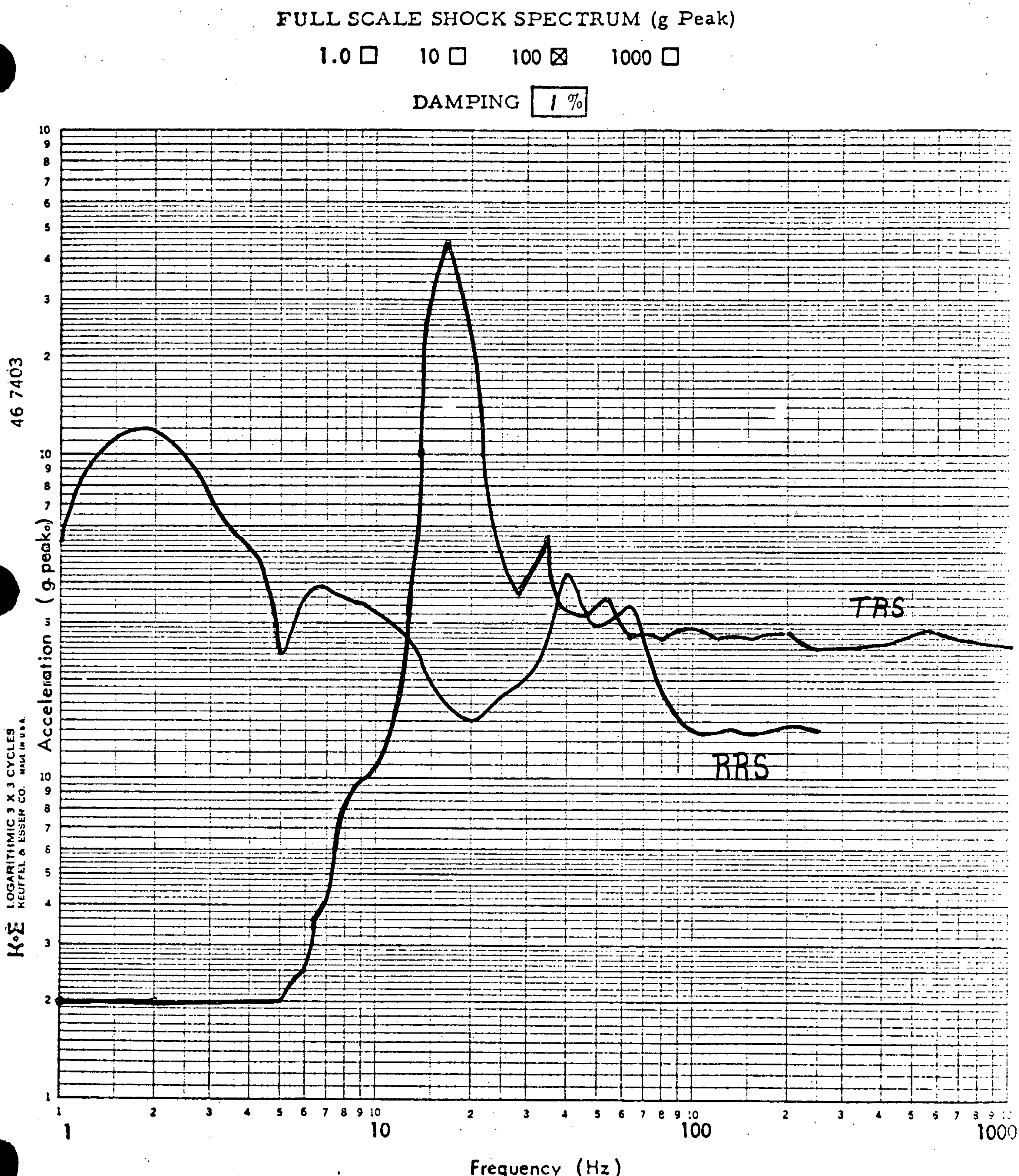


FIGURE 13 PREDICTED COMPOSITE RESPONSE SPECTRUM FOR HORIZONTALLY ORIENTED SPECIMEN ACCELEROMETERS IF THE TEST RESPONSE SPECTRA OF THE HORIZONTAL CONTROL ACCELEROMETER HAD EQUALED THE HORIZONTAL REQUIRED RESPONSE SPECTRA DURING SS/V RANDOM MULTI-FREQUENCY TEST (RUN # 19)

4

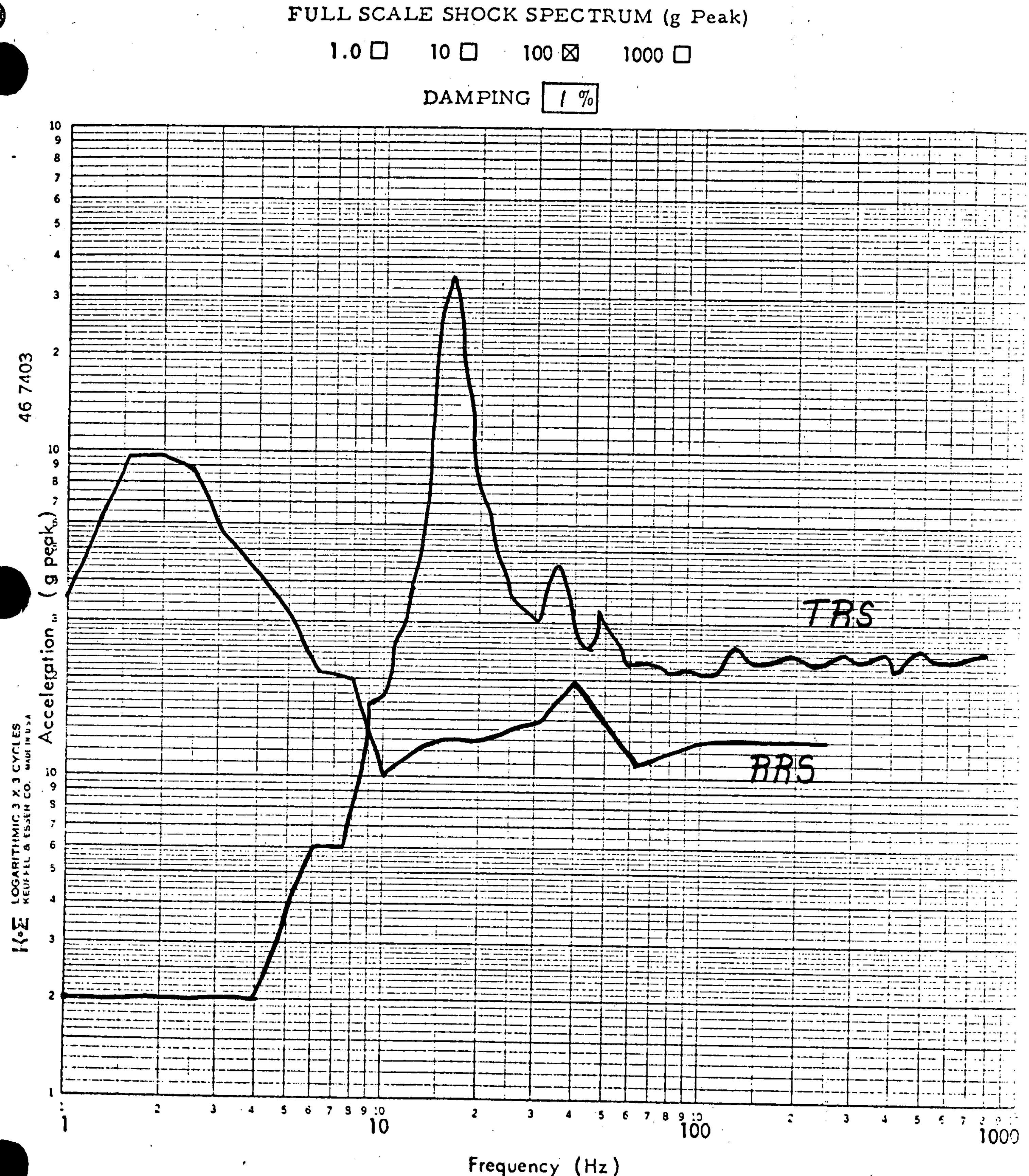


FIGURE 14 PREDICTED COMPOSITE RESPONSE SPECTRUM FOR VERTICALLY ORIENTED SPECIMEN ACCELEROMETERS IF THE TEST RESPONSE SPECTRA OF THE VERTICAL CONTROL ACCELEROMETERS HAD EQUALED THE VERTICAL REQUIRED RESPONSE SPECTRA DURING SS/V RANDOM MULTIFREQUENCY TEST (RUN #19)

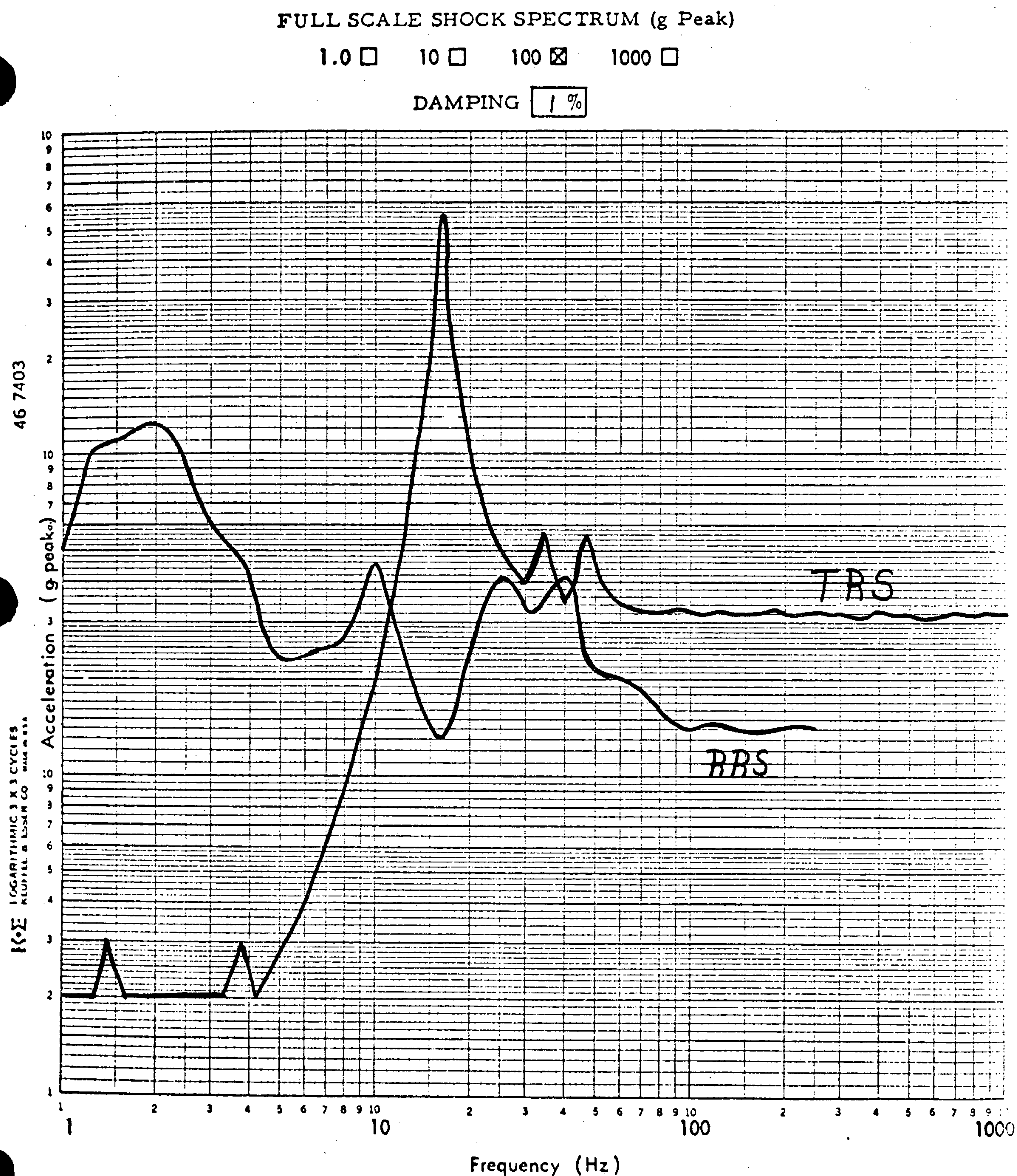


FIGURE 15 PREDICTED COMPOSITE RESPONSE SPECTRUM FOR HORIZONTALLY ORIENTED SPECIMEN ACCELEROMETERS IF THE TEST RESPONSE SPECTRA OF THE HORIZONTAL CONTROL ACCELEROMETER HAD EQUALED THE HORIZONTAL REQUIRED RESPONSE SPECTRA DURING FB/V RANDOM MULTI-FREQUENCY TEST (RUN # 32)

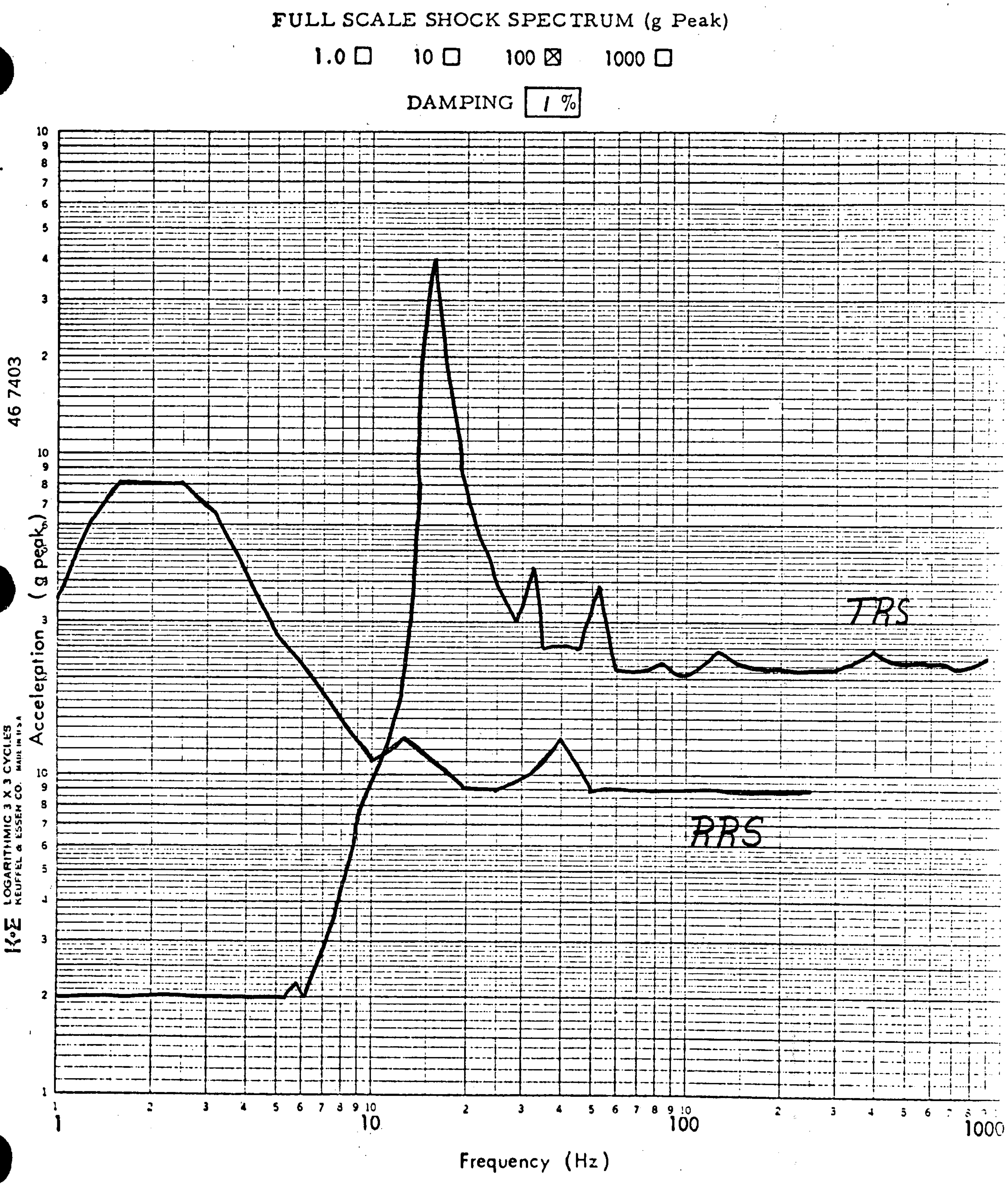


FIGURE 16 PREDICTED COMPOSITE RESPONSE SPECTRA FOR VERTICALLY ORIENTED SPECIMEN ACCELEROMETERS IF THE TEST RESPONSE SPECTRA OF THE VERTICAL CONTROL ACCELEROMETERS HAD EQUALED THE VERTICAL REQUIRED RESPONSE SPECTRA DURING FB/V RANDOM MULTIFREQUENCY TEST (RUN #32)

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X

2. NSSS: CE — 3. A/E: Bechtel — BWR ____

II. Component Name: In-Core Amplifier

1. Scope: [X] NSSS [ ] BOP

2. Model Number: RY-010 — Quantity: 4

3. Vendor: Electro-Mechanics, Inc.

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

5. Physical Description a. Appearance Panel mounted rack

   b. Dimensions 17" x 19" x 24"

   c. Weight 77#

6. Location: Building: Control Area Aux Bldg
   Elevation: 30'

7. Field Mounting Conditions [X] Bolt (No. 2, 8 , Size 10-32, 1/4-20)
   [ ] Weld (Length ____)
   [ ] ____

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

   S/S: ____ F/B: ____
   V: ____

9. a. Functional Description: No safety related function

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

10. Pertinent Reference Design Specifications: 1370-1CE 5012 Rev 0

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

IV. Equipment Qualification Method: Test: ______

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Not yet tested
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [ ] Combination of ______

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ______
(Other, Specify)

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

3. Required Acceleration in Each Direction: ______

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

VI. If Qualification by Test, then Complete: ______

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: Not yet tested

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[ ] No

______

6. Input g-level Test at:

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

7. Laboratory Mounting: ______

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

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

9. Test Results including modifications made: ______

10. Other tests performed (such as fragility test, including results):

NA

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

1. Description of Test including Results: NA

2. Method of Analysis: ______

[ ] Static Analysis
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: ______ 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. Deflection	Location	Effect Upon Functional Operability

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR

II. Component Name: Reactor Trip Switchgear Cabinet

1. Scope: [X] NSSS [ ] BOP
2. Model Number: None — Quantity: 1
3. Vendor: Unit Electric Control
4. If the component is a cabinet or panel, name and model No. of the devices included: See attached sheet
5. Physical Description a. Appearance Vertical cabinet

   b. Dimensions 118" x 60" x 96" (L x W x H)

   c. Weight 8400#
6. Location: Building: Radwaste Area (Auxiliary Bldg.)

   Elevation: 37'-0"
7. Field Mounting Conditions [X] Bolt (No. 20, Size 1/2" 8307 Bolt)

   [ ] Weld (Length)

   [ ]
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S: 14.5 — F/B: 14.5

   V: 12, 15, 20, 30
9. a. Functional Description: Interrupts power to CEDM latching mechanisms

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

   [ ] Both
10. Pertinent Reference Design Specifications: 00000-ICE-3008 Revision 00, 1370-ICE-3008, Revision 02

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

IV. Equipment Qualification Method: Test: X

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Wyle Laboratories Report #42835-1
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [ ] Combination of ______

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ______
(Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ______

S/S = 1.0g input F/B = 1.0g input V = 0.8g input

VI. If Qualification by Test, then Complete: ______

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

2. [ ] Single Axis [X] Multi-Axis (Bi-Axial)

3. No. of Qualification Tests: OBE 5 SSE 2
Other ______
(Specify)

4. Frequency Range: See TRS attached

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[X] No*

*TRS envelops RRS at natural frequencies/

6. Input g-level Test at:

S/S = 1.1
F/B = 1.3
V = 0.9

7. Laboratory Mounting: ______

1. [X] Bolt (No. 20, Size 1/2") [ ] Weld (Length ______)
[ ] ______

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

N/A

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

1. Description of Test including Results: N/A

2. Method of Analysis: ______

[ ] Static Analysis
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: ______ 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. Deflection	Location	Effect Upon Functional Operability

NSSS 3

II. 4 Devices Included

Circuit breakers GE AK-25

Push buttons PTP43FF

VI 9 Test Results

NATURAL FREQUENCIES VERTICAL 12, 15, 20, 30 Hz SIDE / SIDE 14.5 Hz FRONT BACK 14.5 Hz

ELECTRICAL OPERATION The closing circuit of one breaker failed; one wire broke at its termination point; equipment performed as required - all breakers opened as required.

PHYSICAL INTEGRITY Intact; no physical effects except as noted above.

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS Not available

MAXIMUM EXTERIOR DEFLECTION Less than ½ inch

DYNAMIC LOAD TO MOUNTING 44,000 lbs. distributed among the 20 mounting bolts.

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES Not determined

VI. DISCUSSION

The closing circuit of the breakers is not required to operate during a seismic event. The failure of the closing circuit is not related to the tripping function and has no effect on the trip circuit operation. The circuit breakers were successfully tripped as required.

The operation of the safety-related circuits of this equipment was successfully completed during seismic qualification testing. At the completion of this testing and prior to delivering this equipment to the nuclear station, a full functional test was performed as assurance the equipment was prepared for delivery. The full functional test evaluates all equipment features, including those not related to safety. During this test, discontinuity was found in an auxiliary circuit which feeds the plant computer. The discontinuity was traced to a wire broken at its termination, which is a crimped lug. The break occurred within the lug at the crimp, and it is believed the wire was weakened by overcrimping.

Section IV Continued

simulate reactor trip signals and undervoltage conditions in the circuit breaker control circuits. The simulated reactor trip signals actuated the shunt trip coils and the undervoltage conditions actuated the undervoltage trip devices in the nine reactor trip circuit breakers.

DATA SHEET No. 3

DATE MARCH 1977

TEST RESPONSE SPECTRA

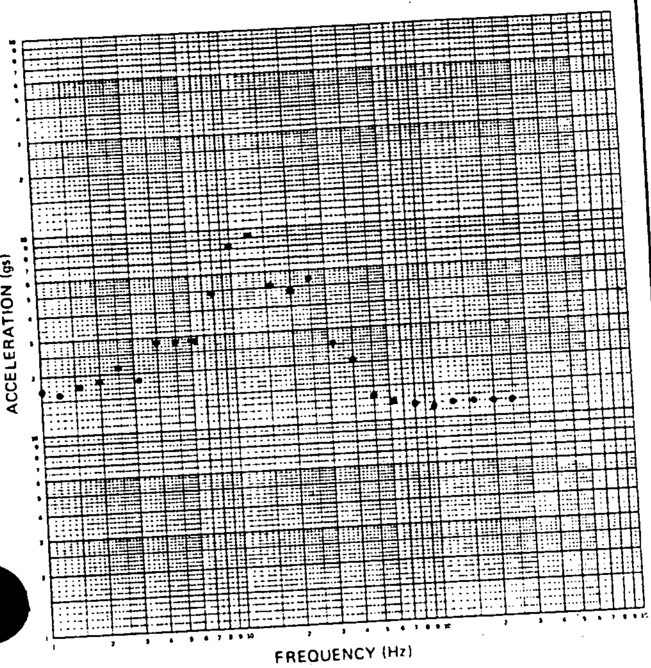
SPECTRUM FULL SCALE. ACCELERATION ☐ 10 gs ☒ 100 gs FREQUENCY ☐ 100 Hz ☒ 1000 Hz

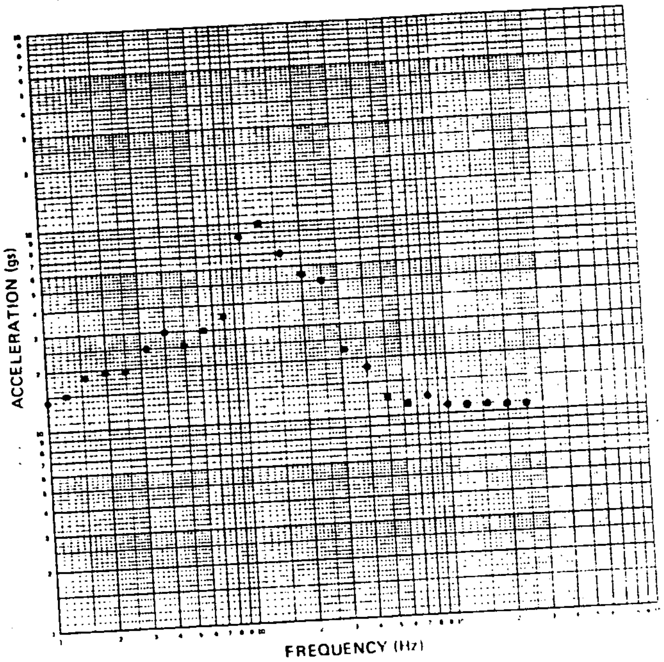
1 % CRITICAL DAMPING

REVISION No. 01

TEST PLANE: ☐ FRONT TO BACK ☒ FRONT TO BACK / VERTICAL — ☐ SIDE TO SIDE ☒ SIDE TO SIDE / VERTICAL

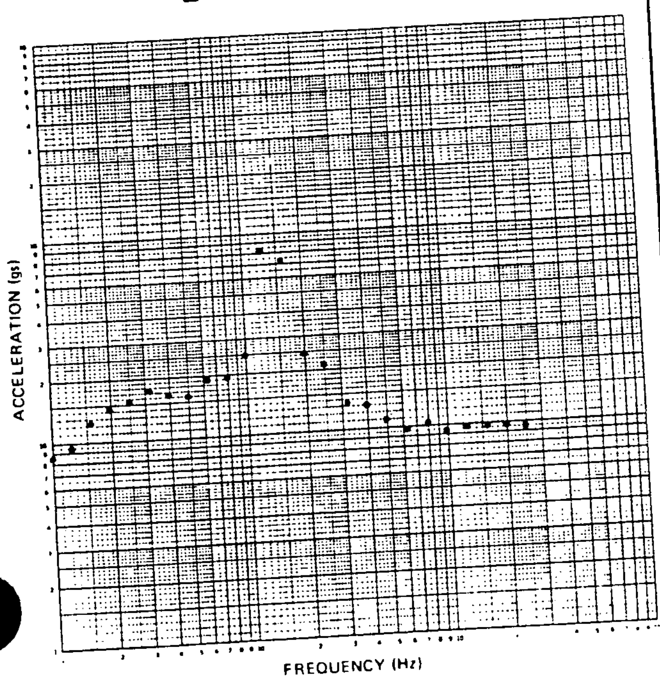
RESPONSE DIRECTION: ☒ FRONT TO BACK ☐ FRONT TO BACK (180° SHIFT) — ☒ SIDE TO SIDE ☐ SIDE TO SIDE (180° SHIFT)

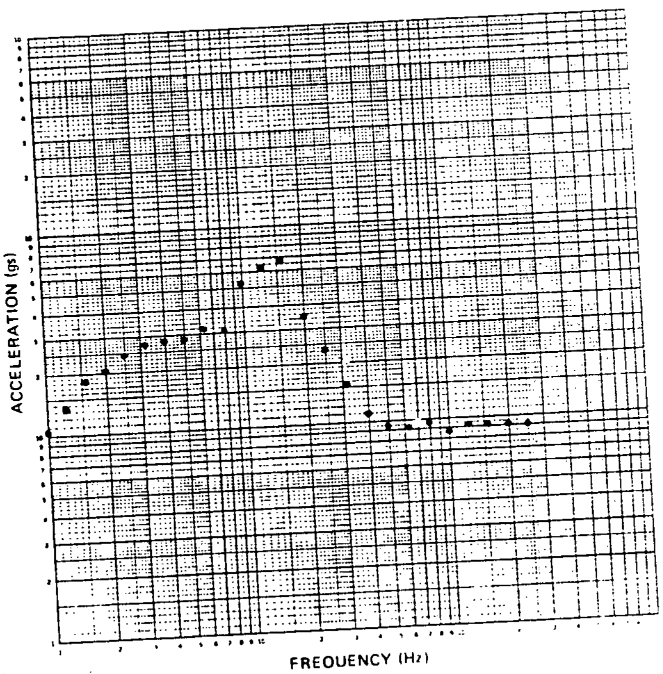




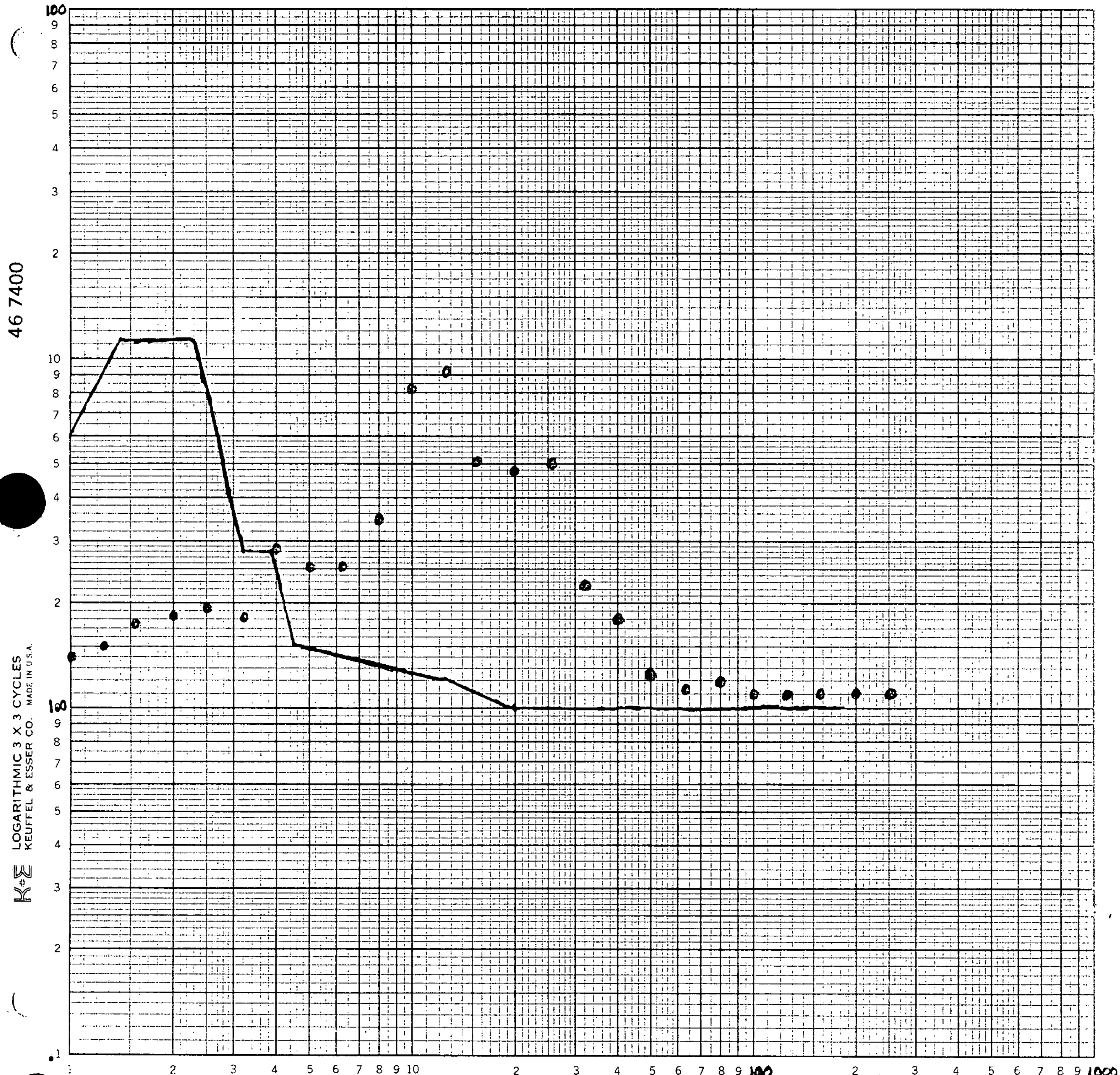
TEST PLANE: ☐ VERTICAL ☒ FRONT TO BACK / VERTICAL — ☒ SIDE TO SIDE / VERTICAL

RESPONSE DIRECTION: ☒ VERTICAL ☐ VERTICAL (180° SHIFT) — ☒ VERTICAL ☐ VERTICAL (180° SHIFT)



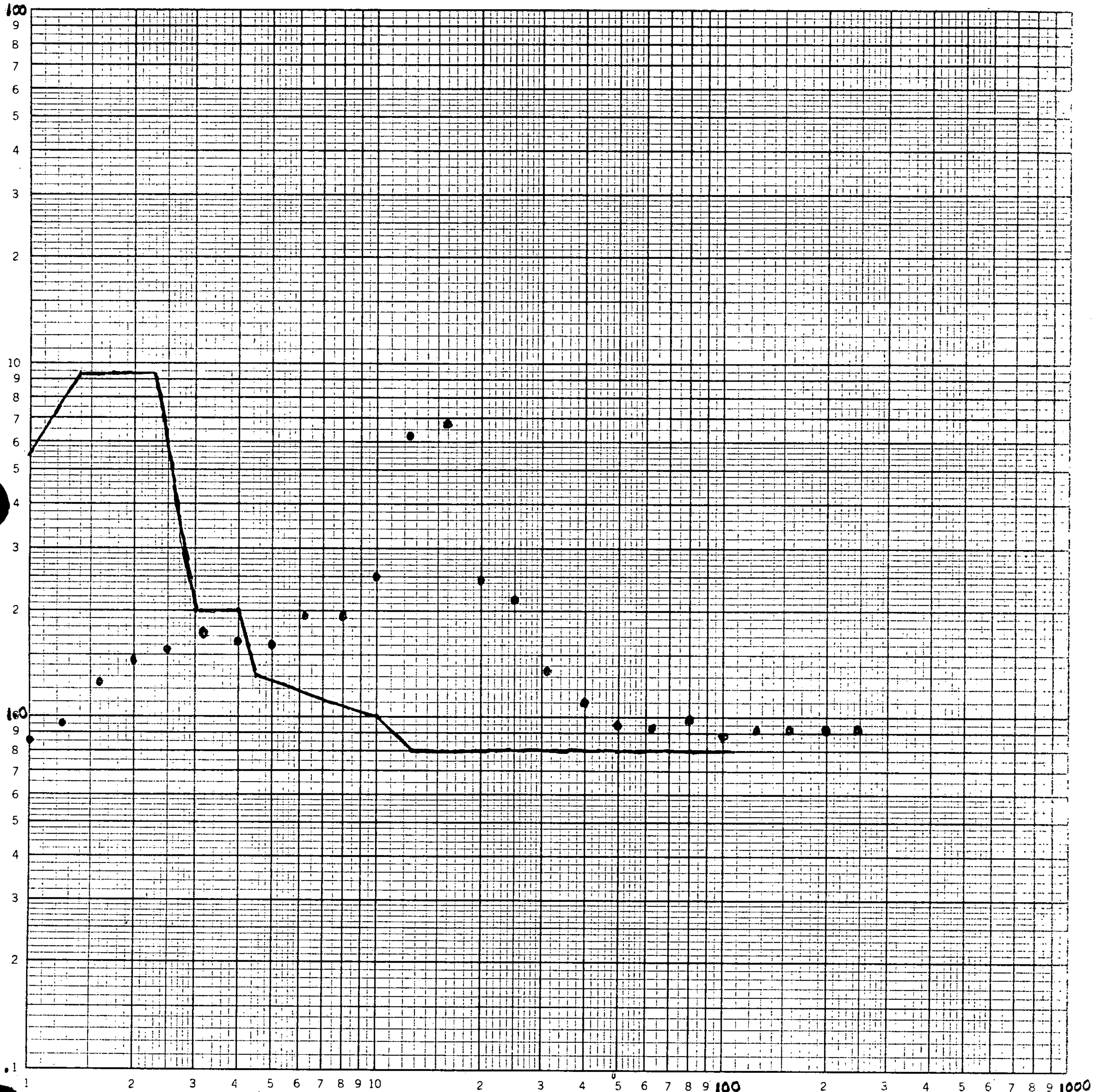


Reactor Trip Switchgear
Required Response Spectrum
SSE - Horizontal - 1% β



TRS: minimum of two horizontal tests (F/B & S/S)

Reactor Trip Switchgear
Required Response Spectrum
SSE - Vertical - 1% β



The minimum of two vertical tests

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR

II. Component Name: ESFAS Auxiliary Relay Cabinet

1. Scope: [X] NSSS [ ] BOP
2. Model Number: None — Quantity: 1
3. Vendor: ACCO
4. If the component is a cabinet or panel, name and model No. of the devices included: See attached sheet
5. Physical Description a. Appearance 4 Bay Vertical Cabinet

   b. Dimensions 144" x 56" x 90" (L x W x H)

   c. Weight 13000#
6. Location: Building: Control Room Auxiliary Building

   Elevation: 30'-0"
7. Field Mounting Conditions [X] Bolt (No. 12, Size 7/8 8307 Bolt)

   [ ] Weld (Length)

   [ ]
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S: 12 F/B: 9.5, 10.5, 13, 18, 27, 34, 39

   V: 18, 25, 27, 34, 39
9. a. Functional Description: Engineered Safety Features Relay Actuation

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

   [X] Both
10. Pertinent Reference Design Specifications: 1370-ICE-3002 Rev. 0 00000-ICE-3002, Revision 04

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

IV. Equipment Qualification Method: Test: X

Analysis: ____________

Combination of Test and Analysis: ____________

Test and/or Analysis by Wyle Laboratories, Report 42913-1
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ____________

5. [ ] Combination of ____________

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ____________
(Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ____________

S/S = 1.0g input F/B = 1.0g input V = 0.75

VI. If Qualification by Test, then Complete: ____________

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

2. [ ] Single Axis [X] Multi-Axis (Bi-Axial)

3. No. of Qualification Tests: OBE 5 SSE 1
Other ____________
(Specify)

4. Frequency Range: See TRS attached

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[X] No*

*TRS envelops RRS at natural frequencies.

6. Input g-level Test at:

S/S = 1.3
F/B = 1.5
V = 1.0

7. Laboratory Mounting: ______

1. [X] Bolt (No. 12 , Size 7/8") [ ] Weld (Length ______)
[ ] ______

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

N/A

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
[ ] Dynamic Analysis

[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: ______ 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. Deflection	Location	Effect Upon Functional Operability

NSSS 4

V Devices Included

Circuit breakers	CD1-B3-DU-25-28VDC-1
Circuit breakers	CD2-B3-DU-15-120-1
Connectors	MS3102R36
Diodes	1N4004
Diodes	1N649
Ground detector	Model PR-2000
Power supply	FPS-28-26
Power supply	GD-8.0-1.5 F/6.0
Push button	PTP42F, PTP43G
Push button	PMP32R8WK
Relays	KHS11D12-6
Relays	20P36AF
Relays	KHS17D12-6
Relays, rotary	MDR-7033, MDR-7034
Relays, rotary	MDR-7032, MDR136-1

VI Test Results

NATURAL FREQUENCIES VERTICAL 18, 25, 27, 34, 39 Hz SIDE - SIDE 12 Hz FRONT - BACK 9.5,10.5, 13,18,27,34,39 Hz

ELECTRICAL OPERATION All components deenergized and reenergized as required. No spurious, intermittent operation or contact chatter was observed.

PHYSICAL INTEGRITY Intact; no physical effects.

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS Less than 2300 psi

MAXIMUM EXTERIOR DEFLECTION Less than ½ inch.

DYNAMIC LOAD TO MOUNTING Not calculated

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES Not determined

VI. DISCUSSION

Equipment Operation

The ESFAS Auxiliary Relay was powered with 120 VAC, 60 HZ, single-phase power during the seismic test. All safety actuation circuits in the ESFAS Auxiliary Relay cabinet were energized during the seismic test.

Twenty-five (25) channels of electrical monitoring were recorded on an oscillograph recorder during the Seismic Test Program. These channels were used to ascertain electrical continuity, spurious operation, contact chatter, before, during and after the seismic excitation. The components that were monitored were selected at random. The monitored components were comprised of various relays, switches, and manual trip pushbuttons located in different sections of the ESFAS Cabinet. Along with the 25 electrical channels, a test bench for the ESFAS Auxiliary Relay Cabinet was wired to one contact on each subgroup relay. The test bench had a light wired to show whether each subgroup relay was either energized or de-energized. A preliminary operational test was run prior to the seismic testing. The actuation circuits were deenergized 10 seconds into the seismic test. The MSIS EFAS I and EFAS II circuits were reenergized as soon as all components were verified tripped. After about 20 seconds into the seismic test the MSIS, EFAS I and EFAS II were again de-energized. At the completion of all seismic testing the complete ESFAS cabinet was operationally tested to insure that all safety circuits operated.

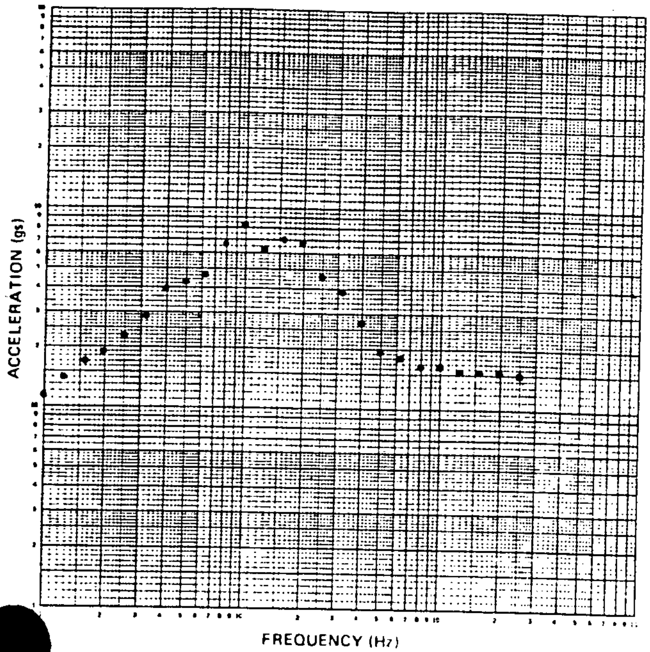
TEST RESPONSE SPECTRA

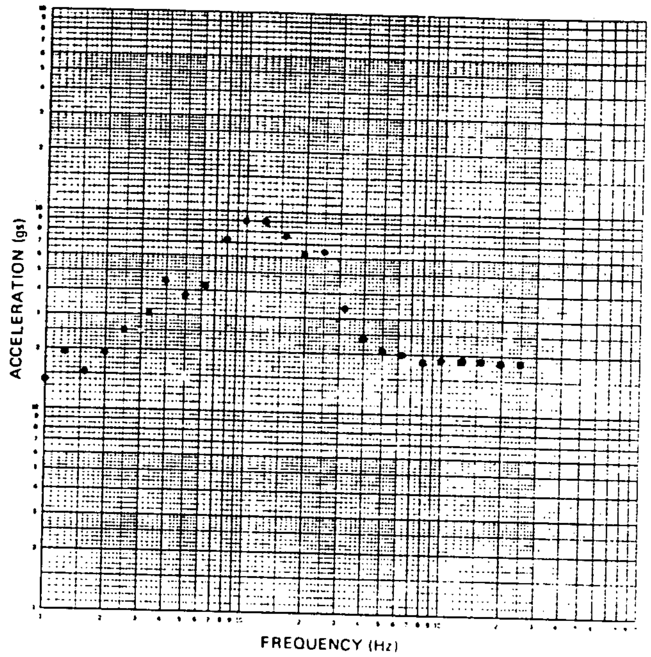
DATA SHEET No. 4
DATE MARCH 1977

SPECTRUM FULL SCALE. ACCELERATION ☐ 10 gs ☒ 100 gs
FREQUENCY ☐ 100 Hz ☒ 1000 Hz

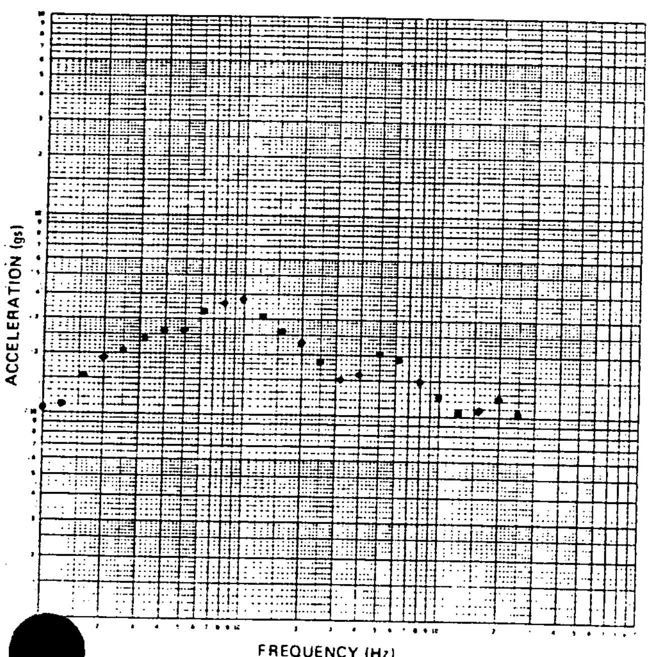
1 % CRITICAL DAMPING REVISION No. 01

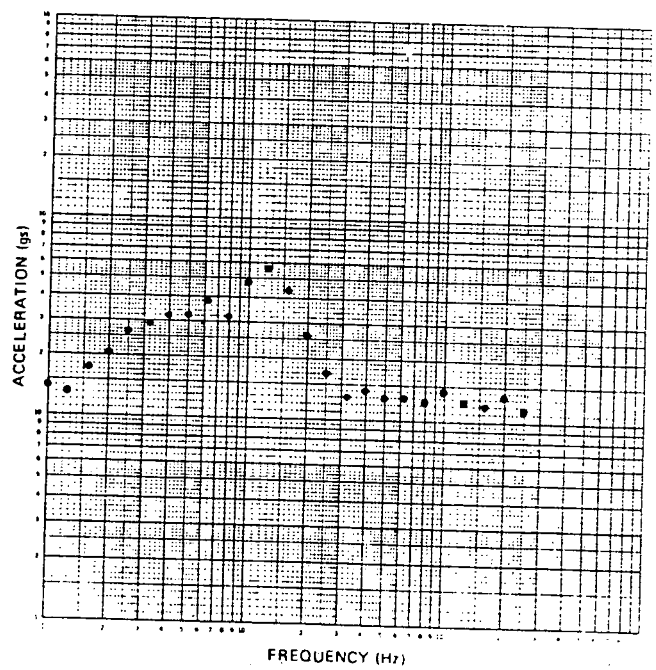
☐ FRONT TO BACK ☒ FRONT TO BACK / VERTICAL	TEST PLANE	☐ SIDE TO SIDE ☒ SIDE TO SIDE / VERTICAL
☒ FRONT TO BACK ☐ FRONT TO BACK (180° SHIFT)	RESPONSE DIRECTION	☒ SIDE TO SIDE ☐ SIDE TO SIDE (180° SHIFT)





☐ VERTICAL ☒ FRONT TO BACK / VERTICAL	TEST PLANE	☒ SIDE TO SIDE / VERTICAL
☒ VERTICAL ☐ VERTICAL (180° SHIFT)	RESPONSE DIRECTION	☒ VERTICAL ☐ VERTICAL (180° SHIFT)

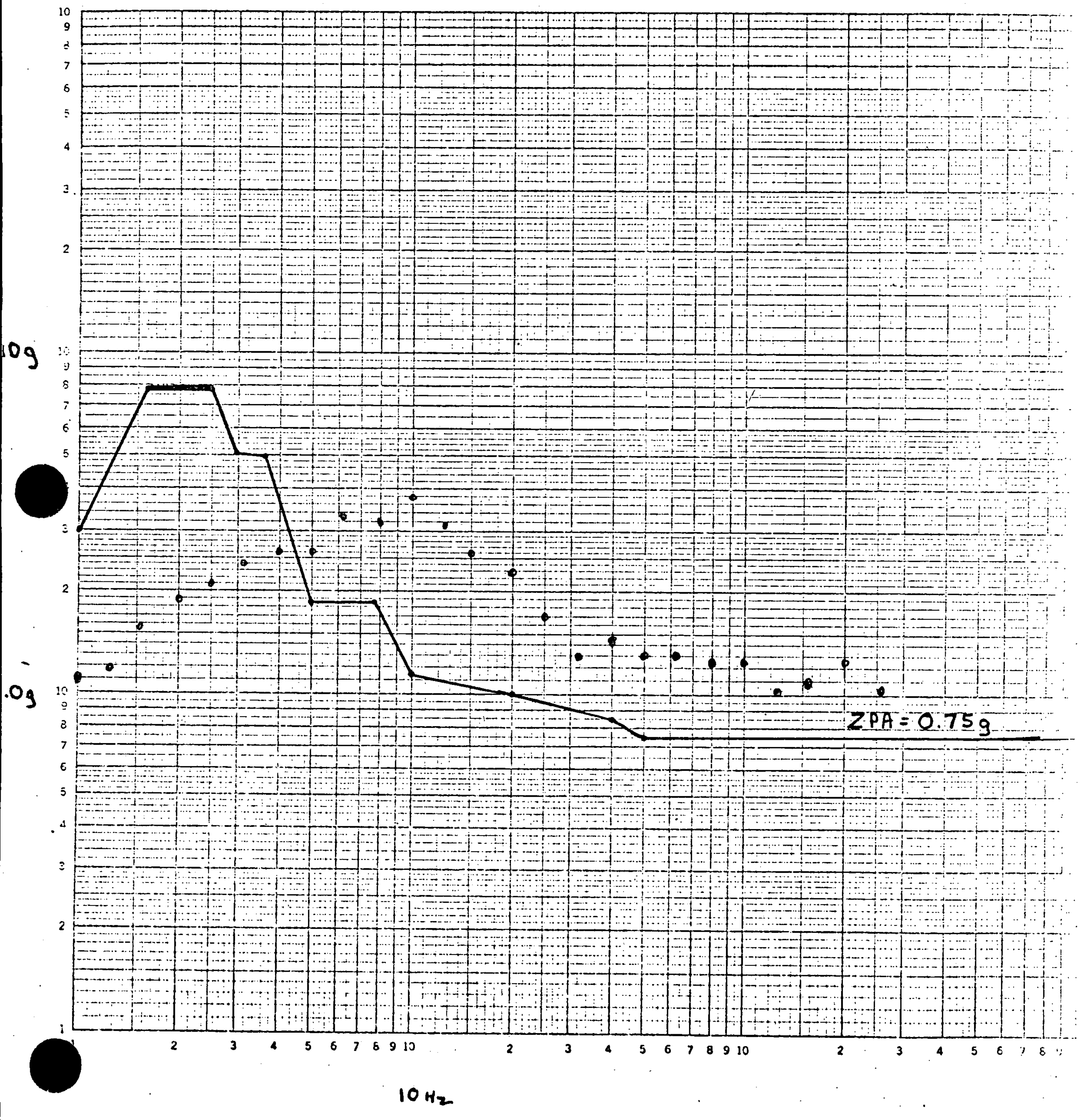




SCE Control Room Response Spectra

San Onofre station

SSE - Vertical - 1% β

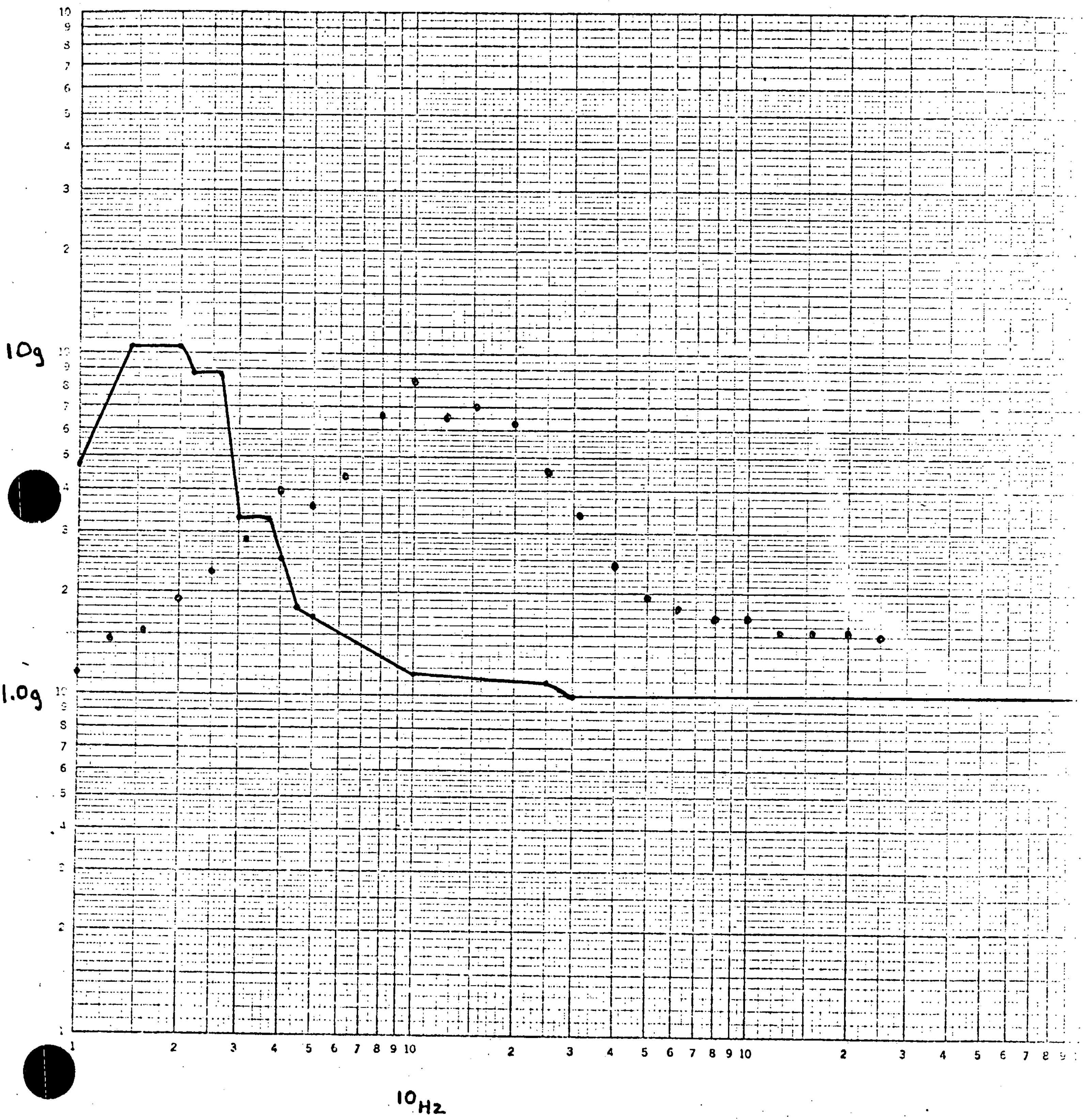


ARC: minimum of two vertical tests.

SCE Control Room Response Spectra

San Onofre Station

SSE - Horizontal - 1% β



ARC: minimum of two horizontal tests (F/B & S/S)

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR

II. Component Name: Process Instrument Rack

1. Scope: [X] NSSS [ ] BOP
2. Model Number: 2ES-N Quantity: 28
3. Vendor: Foxboro
4. If the component is a cabinet or panel, name and model No. of the devices included: See attached sheet
5. Physical Description a. Appearance Single bay vertical cabinet
   b. Dimensions 88.75" x 24" x 28
   c. Weight 575#
6. Location: Building: Control Area, Aux. Bldg.
   Elevation: 30'
7. Field Mounting Conditions [X] Bolt (No. 6, Size 1/2 for double cabinet)
   [ ] Weld (Length)
   [ ]
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
   S/S: 10 F/B: 18
   V: >35
9. a. Functional Description: Provide support for process electronics modules
   b. Is the equipment required for [X] Hot Standby [X] Cold Shutdown
   [X] Both
10. Pertinent Reference Design Specifications: 1370-ICE-0005 Sheet 001, Rev. 01

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

IV. Equipment Qualification Method: Test: X

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Foxboro, Report T4-1025, Rev. 1
Lab: Action Laboratory Report No. 11977
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [ ] Combination of ______

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ______
(Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ______

S/S = 1.0g input F/B = 1.0g input V = 0.75g input

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 ______
Other 10 cycles/beat, 10 beats full level at each integer freq. from 1 to 35 Hz for 3 axis.
(Specify)

4. Frequency Range: 1 to 35 Hz.

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[ ] No
Not acceptable

6. Input g-level Test at:
S/S = 1
F/B = 1
V = 1

7. Laboratory Mounting: ______

1. [X] Bolt (No. 6 , Size 0.50 dia.) [ ] Weld (Length ______)
[ ] ______

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

9. Test Results including modifications made: See attached sheets

10. Other tests performed (such as fragility test, including results):

N/A

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
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: ______ 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. Deflection	Location	Effect Upon Functional Operability

II 4. Devices Included *

Controller	2AC-D+A5+RM
Current to Voltage Converters	2AI-I2V
Resistance to Voltage Converter	2AI-R2V
Alarm	2AP-ALM-AS
Square Root Extractor	2AP-SQE
Summer	2AP-+SUM
Contact Isolator	2AO-L2C-R
Voltage to Current Converter	2AO-V2I
Power Supply	2ARPS
Power Distribution Module	2AX-DP10-EH
Signal Distribution Module	2AX-DSI
Temperature Transmitter	442H-RP-A

* tested separately

V I Test Results

NATURAL FREQUENCIES: VERTICAL none below 35 Hz SIDE / SIDE 10Hz FRONT / BACK 18Hz

ELECTRICAL OPERATION NA

PHYSICAL INTEGRITY Intact; no loosening, damage or deformation.

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS

MAXIMUM EXTERIOR DEFLECTION

DYNAMIC LOAD TO MOUNTING

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES using sine-beat input motion maximum amplification as follows: At top of rack - 6.0 (F/B) and 6.1 (S/S); at center of rack - 4.0 (F/B) and 4.5 (S/S). No amplification in vertical direction.

VI. DISCUSSION

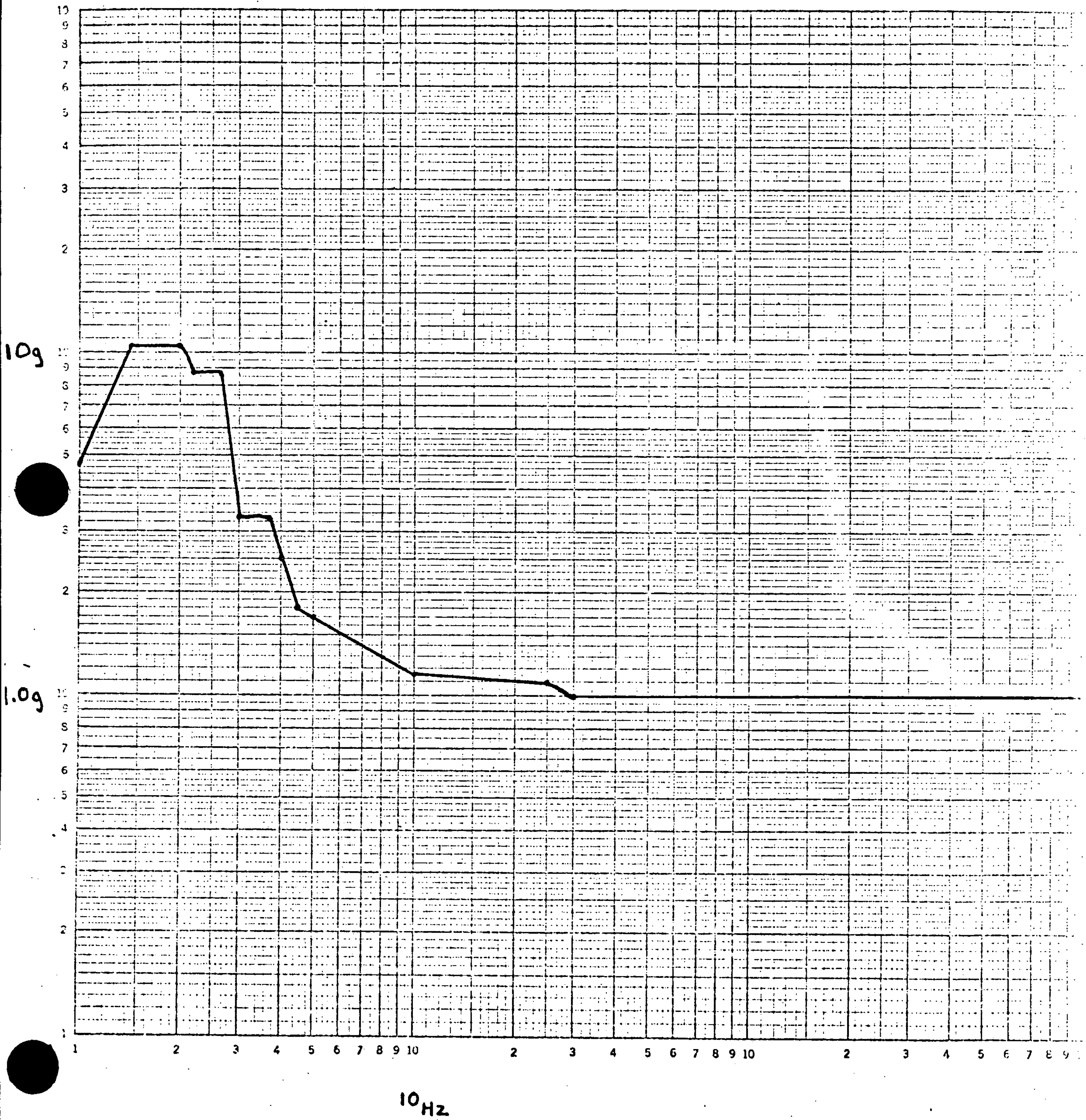
The specimen was loaded with non-operating functional electronic modules to duplicate the in-service conditions. The specimen response (input to functional modules) was monitored and is noted above in Results. The seismic qualification of the functional modules is documented on data sheets 6a, 6b, 6c, etc. IN CEN-94(S), JULY, 1978.

C-E 0090234 (9/75)

SCE Control Room Response Spectra

San Onofre Station

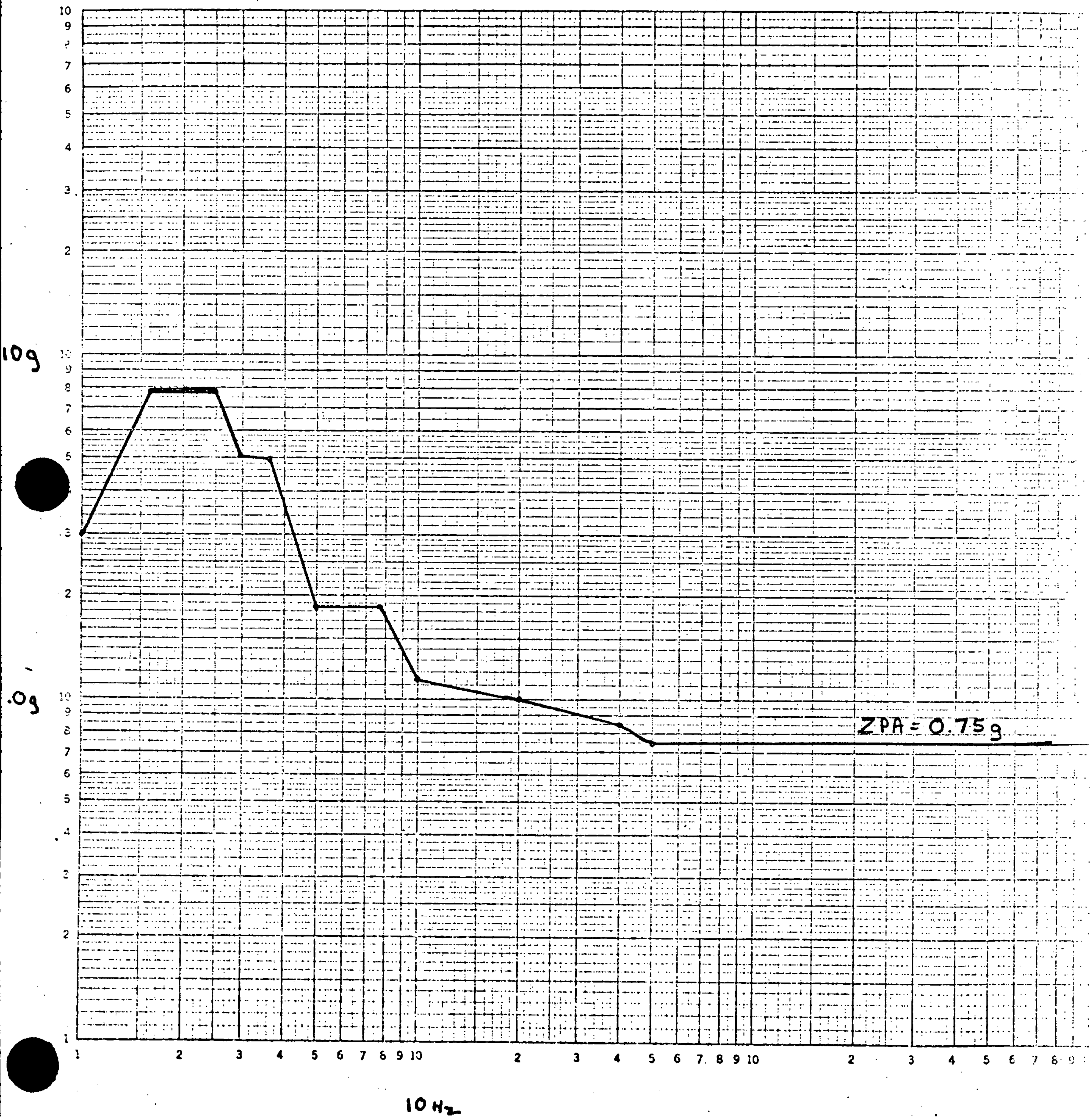
SSE - Horizontal - 1% β



SCE Control Room Response Spectra

San Onofre station

SSE - Vertical - 1% β



Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X

2. NSSS: CE — 3. A/E: Bechtel — BWR

II. Component Name: Controller, Removable Manual

1. Scope: [X] NSSS [ ] BOP

2. Model Number: 2AC-D+A5+RM* — Quantity: 2

3. Vendor: Foxboro

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

5. Physical Description a. Appearance Nested Module for Rack Mounting

   b. Dimensions 1 3/4" x 8 3/4" x 13 1/2"

   c. Weight ≅1#

6. Location: Building: Control Area Aux. Bldg.

   Elevation: 30'

7. Field Mounting Conditions [ ] Bolt (No._____, Size_____)
   [ ] Weld (Length_____)
   [X] Nest Slot

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

   S/S: * F/B: *
   V: *
   *Resonance Search Not Completed

9. a. Functional Description: Produces output signal as function of difference between inputs.

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

   [ ] Both

10. Pertinent Reference Design Specifications: 1370-ICE-0005 Sheet 346 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: ____

Test and/or Analysis by Foxboro, Report PERS 75-113
Lab: Acton Laboratory Rpt. No. 1197
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ____

5. [ ] Combination of ____

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ____
(Other, Specify)

2. Required Response Spectra (attach the graphs): No RRS

3. Required Acceleration in Each Direction: ____

S/S = 6.1g input F/B = 6.0g input V = 0.75g input

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 ____
Other 10 cycles/beat, 10 beats full level dwell at each integer freq. from 1 to 35 Hz
(Specify)

4. Frequency Range: 1 to 35 HZ

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[ ] No
Not Acceptable

6. Input g-level Test at:
S/S = 3.5, 5, 10
F/B = 3.5, 5, 10
V = 3.5, 5, 10

7. Laboratory Mounting: Normal Spec. 200 equipment mounting

1. [ ] Bolt (No._______, Size_______) [ ] Weld (Length______________)
[X] Nest Assembly

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

NA

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

1. Description of Test including Results: NA

2. Method of Analysis: ____________________

[ ] Static Analysis
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: __________ 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. Deflection	Location	Effect Upon Functional Operability

V I Test Results

NATURAL FREQUENCIES VERTICAL ______ SIDE / SIDE ______ FRONT BACK ______

ELECTRICAL OPERATION performed properly at 10.0 g's with less than 0.5% output shift

PHYSICAL INTEGRITY Intact, No physical damage.

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS ______

MAXIMUM EXTERIOR DEFLECTION ______

DYNAMIC LOAD TO MOUNTING ______

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES ______

VI. DISCUSSION

C L 0090234 (9 75)

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR ____

II. Component Name: Current to Voltage Converter

1. Scope: [X] NSSS [ ] BOP
2. Model Number: 2AI-I2V — Quantity: 16
3. Vendor: Foxboro
4. If the component is a cabinet or panel, name and model No. of the devices included: NA
5. Physical Description a. Appearance Nested Module for Rock Mounting
   b. Dimensions 1 3/4" x 8 3/4" x 13 1/2"
   c. Weight ≅1#
6. Location: Building: Control Area Aux. Bldg.
   Elevation: 30'
7. Field Mounting Conditions [ ] Bolt (No.____, Size____)
   [ ] Weld (Length____)
   [X] Nest Slot
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
   S/S: * F/B: *
   V: *
   *Resonance Search Not Concluded
9. a. Functional Description: Convert input current to output voltage
   b. Is the equipment required for [X] Hot Standby [X] Cold Shutdown
   [X] Both
10. Pertinent Reference Design Specifications: 1370-ICE-0005
    Sheets 160 Rev. 1, 355 Rev. 2, 415 Rev. 1

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

IV. Equipment Qualification Method: Test: X

Analysis: ____

Combination of Test and Analysis: ____

Test and/or Analysis by Foxboro, Report PERS 75-113
Lab: Aston Laboratory Rpt. No. 11977
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ____

5. [ ] Combination of ____

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ____
(Other, Specify)

2. Required Response Spectra (attach the graphs): No RRS

3. Required Acceleration in Each Direction: ____

S/S = 6.1g input F/B = 6.0g input V = 0.75g input

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 ____
Other 10 cycles/beat, 10 beats full level at each integer. freq. from 1 to 35 Hz
(Specify)

4. Frequency Range: 1 to 35 HZ

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[ ] No

Not Acceptable

6. Input g-level Test at:
   S/S = 3.5, 5, 10
   F/B = 3.5, 5, 10
   V = 3.5, 5, 10

7. Laboratory Mounting: Normal Spec. Equipment Mounting

   1. [ ] Bolt (No.______, Size______) [ ] Weld (Length____________)
      [X] Nest Assembly

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

    NA

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

1. Description of Test including Results: NA

2. Method of Analysis:______________________

   [ ] Static Analysis [ ] Equivalent Static Analysis
   [ ] Dynamic Analysis [ ] Time-History
   [ ] Response Spectrum

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: ________ 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. Deflection	Location	Effect Upon Functional Operability

VI Test Results

NATURAL FREQUENCIES: VERTICAL ______ SIDE / SIDE ______ FRONT / BACK ______

ELECTRICAL OPERATION Performance as required; output deviation less than 0.5% of full range.

PHYSICAL INTEGRITY Intact; no physical damage.

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS ______

MAXIMUM EXTERIOR DEFLECTION ______

DYNAMIC LOAD TO MOUNTING ______

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES ______

VI. DISCUSSION

C-E 0090234 (9/75)

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR ____

II. Component Name: Resistance to Voltage Converter

1. Scope: [X] NSSS [ ] BOP
2. Model Number: 2AI-P2V Quantity: 3
3. Vendor: Foxboro
4. If the component is a cabinet or panel, name and model No. of the devices included: NA
5. Physical Description a. Appearance Nested Module for Rock Mounting
   b. Dimensions 1 3/4" x 8 3/4" x 13 1/2"
   c. Weight ≅1#
6. Location: Building: Control Area Aux. Bldg.
   Elevation: 30'
7. Field Mounting Conditions [ ] Bolt (No.____, Size________)
   [ ] Weld (Length____________)
   [X] Nest Slot
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
   S/S: * F/B: *
   V: *
   *Resonance Search Not Concluded
9. a. Functional Description: Provides output voltage proportional to input resistance
   b. Is the equipment required for [X] Hot Standby [X] Cold Shutdown
   [X] Both
10. Pertinent Reference Design Specifications: 1370-ICE-0005
    Sheet 356, Rev. 1

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

IV. Equipment Qualification Method: Test: X

Analysis: ____________

Combination of Test and Analysis: ________

Test and/or Analysis by Foxboro, Report PERS 75-113
Lab: Aston Laboratory Rpt. No. 11977
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ____________

5. [ ] Combination of ____________

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ____________
(Other, Specify)

2. Required Response Spectra (attach the graphs): No RRS

3. Required Acceleration in Each Direction: ____________

S/S = 6.1g input F/B = 6.0g input V = 0.75g input

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 ____________
Other 10 cycles/beat, 10 beats full level at each integer. freq. from 1 to 35 HZ
(Specify)

4. Frequency Range: 1 to 35 HZ

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[ ] No N/A

6. Input g-level Test at:
   S/S = 3.5, 5, 10
   F/B = 3.5, 5, 10
   V = 3.5, 5, 10

7. Laboratory Mounting: Normal Spec. 200 Equipment Mounting

   1. [ ] Bolt (No.______, Size______) [ ] Weld (Length____________)
      [X] Nest Assembly

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

    NA

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

1. Description of Test including Results: NA

2. Method of Analysis:________________

   [ ] Static Analysis [ ] Equivalent Static Analysis
   [ ] Dynamic Analysis [ ] Time-History
   [ ] Response Spectrum

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: ________ 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. Deflection	Location	Effect Upon Functional Operability

VI Test Results

NATURAL FREQUENCIES: VERTICAL ______ SIDE / SIDE ______ FRONT / BACK ______

ELECTRICAL OPERATION: Performance as required; output deviation less than 0.5% of full range.

PHYSICAL INTEGRITY: Intact, no physical damage.

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

- MAXIMUM STRUCTURAL STRESS ______
- MAXIMUM EXTERIOR DEFLECTION ______
- DYNAMIC LOAD TO MOUNTING ______
- MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES ______

VI. DISCUSSION

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE 3. A/E: Bechtel — BWR ____

II. Component Name: Absolute Alarm

1. Scope: [X] NSSS [ ] BOP
2. Model Number: 2AP-ALM-AS Quantity: 8
3. Vendor: Foxboro
4. If the component is a cabinet or panel, name and model No. of the devices included: NA
5. Physical Description a. Appearance Nested Module for Rack Mounting
   b. Dimensions 1 3/4" x 8 3/4" x 13 1/2"
   c. Weight ≅1#
6. Location: Building: Control Area Aux. Bldg.
   Elevation: 30'
7. Field Mounting Conditions [ ] Bolt (No.____, Size____)
   [ ] Weld (Length____)
   [X] Nest Slot
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
   S/S: * F/B: *
   V: *
   *Resonance Search Not Concluded
9. a. Functional Description: Provide dual alarms with input, output and setpoint
   b. Is the equipment required for [X] Hot Standby [X] Cold Shutdown
   [X] Both
10. Pertinent Reference Design Specifications: 1370-ICE-0005, Sheet 177 Revision 2, 355 Revision 2

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

IV. Equipment Qualification Method: Test: X

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Foxboro, PERS 75-113
Lab: Aston Laboratory Rpt. No. 11977
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

 3. [ ] Explosive only 4. [ ] Other (Specify) ______

 5. [ ] Combination of ______

 6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
 [ ] ______
 (Other, Specify)

2. Required Response Spectra (attach the graphs): No RRS

3. Required Acceleration in Each Direction: ______

 S/S = 6.1g input F/B = 6.0g input V = 0.75g input

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 ______
 Other 10 cycles/beat, 10 beats full level at each integer. freq. from 1 to 35 HZ
 (Specify)

4. Frequency Range: 1 to 35 HZ

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
 [ ] No N/A

6. Input g-level Test at:
   S/S = 3.5, 5, 10
   F/B = 3.5, 5, 10
   V = 3.5, 5, 10

7. Laboratory Mounting: Normal Spec. 200 Equipment

   1. [ ] Bolt (No._______, Size_______) [ ] Weld (Length_____________)
      [X] Nest Assembly

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

    NA

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 [ ] Equivalent Static Analysis
   [ ] Dynamic Analysis [ ] Time-History
   [ ] Response Spectrum

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: __________ 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. Deflection	Location	Effect Upon Functional Operability

VI Test Results

NATURAL FREQUENCIES VERTICAL	SIDE / SIDE FRONT BACK
ELECTRICAL OPERATION	Performance as required when testing at 10 g peak input amplitude. See discussion for anomalies at lower test amplitudes.
PHYSICAL INTEGRITY	Intact, no physical effects.

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS

MAXIMUM EXTERIOR DEFLECTION

DYNAMIC LOAD TO MOUNTING

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES

VI. DISCUSSION

The specimen was tested at each integer frequency from 1 to 35 Hz at 3.5g, 5.0 g, and 10.0 g. During the 3.5 g test one of four alarms fired without cause (two specimens were tested). This anomaly did not occur when testing at 5g and 10g, and therefore is not considered cause for disqualification.

When testing at 5.0g, an operational amplifier failed. An investigation found a loose particle of conducting material resting on the chip within the amplifier case. The material was removed and testing was resumed successfully.

GE 0040234 (9 75)

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR ____

II. Component Name: Square Root Extractor

1. Scope: [X] NSSS [ ] BOP
2. Model Number: 2AP-SQE — Quantity: 8
3. Vendor: Foxboro
4. If the component is a cabinet or panel, name and model No. of the devices included: NA
5. Physical Description a. Appearance Nested Module for Rack Mounting

   b. Dimensions 1 3/4" x 8 3/4" x 13 1/2"

   c. Weight ≅1#
6. Location: Building: Control Area Aux. Bldg.

   Elevation: 30'
7. Field Mounting Conditions [ ] Bolt (No.____, Size____)

   [ ] Weld (Length____)

   [X] Nest Slot
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S: * F/B: *

   V: *

   *Resonance Search Not Concluded
9. a. Functional Description: Provide output proportional to square root of input

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

   [X] Both ____
10. Pertinent Reference Design Specifications: 1370-ICE-0005 Sheet 358 Rev. 0, Sheet 366 Rev. 01, Sheet 364 Rev. 02

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

IV. Equipment Qualification Method: Test: X

Analysis: ________

Combination of Test and Analysis: ________

Test and/or Analysis by Foxboro, Report PERS 75-113
Lab: Acton Laboratory Rpt. No. 11977
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

   3. [ ] Explosive only 4. [ ] Other (Specify) ________

   5. [ ] Combination of ________

   6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
   [ ] ________
   (Other, Specify)

2. Required Response Spectra (attach the graphs): No RRS

3. Required Acceleration in Each Direction: ________

   S/S = 6.1g input F/B = 6.0g input V = 0.75g input

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 ________
   Other 10 cycles/beat, 10 beats full level at each integer. freq. from 1 to 35 HZ
   (Specify)

4. Frequency Range: 1 to 35 HZ

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
   [ ] No N/A

6. Input g-level Test at:
S/S = 3.5, 5, 10
F/B = 3.5, 5, 10
V = 3.5, 5, 10

7. Laboratory Mounting: ____________________

1. [ ] Bolt (No.______, Size______) [ ] Weld (Length____________)
[X] Nest Assembly

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

NA

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

1. Description of Test including Results: NA

2. Method of Analysis: ____________________

[ ] Static Analysis
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: __________ 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. Deflection	Location	Effect Upon Functional Operability

VI Test Results

NATURAL FREQUENCIES. VERTICAL ______ SIDE / SIDE ______ FRONT / BACK ______

ELECTRICAL OPERATION: Performance as required; output deviation less than 0.5% of full scale

PHYSICAL INTEGRITY: Intact, no physical damage.

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS ______

MAXIMUM EXTERIOR DEFLECTION ______

DYNAMIC LOAD TO MOUNTING ______

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES ______

VI. DISCUSSION

C-E 0090234 (8/75)

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 Type:

1. Utility: Southern California Edison Company PWR X

2. NSSS: CE 3. A/E: Bechtel BWR

II. Component Name: Electronic Summer

1. Scope: [X] NSSS [ ] BOP

2. Model Number: 2AP & SUM Quantity: 2

3. Vendor: Foxboro

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

5. Physical Description a. Appearance Nested Module for Rack Mounting

   b. Dimensions 1 3/4" x 8 3/4" x 13 1/2"

   c. Weight ≅1#

6. Location: Building: Control Area Aux. Bldg.

   Elevation: 30'

7. Field Mounting Conditions [ ] Bolt (No.______, Size__________)
   [ ] Weld (Length______________)
   [X] Nest Slot

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

   S/S: * F/B: *
   V: *

9. a. Functional Description: Provides output proportional to sum of input signals

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

   [ ] Both

10. Pertinent Reference Design Specifications: 1370-ICE-0005 Sheet 340 Rev 01

*Resonance Search Not Conducted.

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

IV. Equipment Qualification Method: Test: X

Analysis: ________

Combination of Test and Analysis: ________

Test and/or Analysis by Foxboro, Report TS-6089
Lab: Acton Laboratory Rpt. No. 11977
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

   3. [ ] Explosive only 4. [ ] Other (Specify) ________

   5. [ ] Combination of ________

   6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
   [ ] ________
   (Other, Specify)

2. Required Response Spectra (attach the graphs): No RRS

3. Required Acceleration in Each Direction: ________

   S/S = 6.1g input F/B = 6.0g input V = 0.75g input

VI. If Qualification by Test, then Complete: ________

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

2. [ ] Single Axis [X] Multi-Axis (Bi-axial)

3. No. of Qualification Tests: OBE ________ SSE ________
   Other 10 cycles/beats, 10 beat full level at each integer. freq. from 1 to 35 Hz
   (Specify)

4. Frequency Range: 1 to 35 HZ

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
   [ ] No N/A

6. Input g-level Test at:
   S/S = 3.5, 5, 10
   F/B = 3.5, 5, 10
   V = 3.5, 5, 10

7. Laboratory Mounting: Normal Spec 200 equipment mounting

   1. [ ] Bolt (No._______, Size_______) [ ] Weld (Length______________)
      [ ] ____________________

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

    NA

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   [ ] Equivalent Static Analysis
   [ ] Dynamic Analysis   [ ] Time-History
   [ ] Response Spectrum

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: __________ 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. Deflection	Location	Effect Upon Functional Operability

V I Test Results

NATURAL FREQUENCIES: VERTICAL ______ SIDE / SIDE ______ FRONT / BACK ______

ELECTRICAL OPERATION Output signals deviated less than 0.1% during and after testing

PHYSICAL INTEGRITY Intact, no Physical damage.

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS ______

MAXIMUM EXTERIOR DEFLECTION ______

DYNAMIC LOAD TO MOUNTING ______

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES ______

VI. DISCUSSION

C-E 0090234 (9/75)

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR

II. Component Name: Contact Output Isolation

1. Scope: [X] NSSS [ ] BOP
2. Model Number: 2A0-L2C-R — Quantity: 6
3. Vendor: Foxboro
4. If the component is a cabinet or panel, name and model No. of the devices included: NA
5. Physical Description a. Appearance Nested Module for Rack Mounting

   b. Dimensions 1 3/4" x 8 3/4" x 13 1/2"

   c. Weight ≅1#
6. Location: Building: Control Area Aux. Bldg.

   Elevation: 30'
7. Field Mounting Conditions [ ] Bolt (No.____, Size____)
   [ ] Weld (Length____)
   [X] Nest Slot
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S: * F/B: *
   V: *
   *Resonance Search Not Concluded
9. a. Functional Description: Interface between low level and high power load

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

   [ ] Both
10. Pertinent Reference Design Specifications: 1370-ICE-0005 Sheet 171, Rev. 02, 350 Rev. 02

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

IV. Equipment Qualification Method: Test: X

Analysis: ____________

Combination of Test and Analysis: ________

Test and/or Analysis by Foxboro, Report 75-113
Lab: Acton Laboratory Rpt. No. 11977
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ____________

5. [ ] Combination of ____________

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ____________
(Other, Specify)

2. Required Response Spectra (attach the graphs): No RRS

3. Required Acceleration in Each Direction: ____________

S/S = 6.1g input F/B = 6.0g input V = 0.75g input

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 ____________
Other 10 cycles/beat, 10 beats full level at each integer. freq. from 1 to 35 Hz
(Specify)

4. Frequency Range: 1 to 35 Hz

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[ ] No N/A

6. Input g-level Test at:
   S/S = 3.5, 5, 10
   F/B = 3.5, 5, 10
   V = 3.5, 5, 10

7. Laboratory Mounting: Normal Spec. 200 Equipment Mounting

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

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

    NA

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　　[ ] Equivalent Static Analysis
   [ ] Dynamic Analysis　　[ ] Time-History
   [ ] Response Spectrum

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: __________ 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. Deflection	Location	Effect Upon Functional Operability

VI Test Results

NATURAL FREQUENCIES: VERTICAL ______ SIDE / SIDE ______ FRONT / BACK ______

ELECTRICAL OPERATION The contact outputs operated properly except for the failure noted in the discussion.

PHYSICAL INTEGRITY Intact, no physical damage

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS ______

MAXIMUM EXTERIOR DEFLECTION ______

DYNAMIC LOAD TO MOUNTING ______

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES ______

VI. DISCUSSION

Output A of the 2 AO-L2C-R No. 2 failed at 20 Hz in the side to side plane @ 10 g's. The fault was traced to two broken wires on the relay socket of K1. The broken wires occurred as a result of excessive displacement of wire bundle during testing. To correct this, a design modification has been incorporated which restrains the wire bundle in seven places, thus precluding wire damage due to bundle displacement.

C-E 0090234 (9/75)

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR ______

II. Component Name: Voltage to Current Converter

1. Scope: [X] NSSS [ ] BOP
2. Model Number: 2A0-V2I — Quantity: 2
3. Vendor: Foxboro
4. If the component is a cabinet or panel, name and model No. of the devices included: NA
5. Physical Description a. Appearance Nested Module for Vertical Rack Mounting

   b. Dimensions 1 3/4" x 8 3/4" x 13 1/2"

   c. Weight ≅1#
6. Location: Building: Control Area Aux. Bldg.

   Elevation: 30'
7. Field Mounting Conditions [ ] Bolt (No.______, Size______)

   [ ] Weld (Length______)

   [X] Nest Slot
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S: * — F/B: *

   V: *

   *Resonance Search Not Concluded
9. a. Functional Description: Converts 0-10 VDC Input to 4-20 MA Output

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

   [ ] Both
10. Pertinent Reference Design Specifications: 1370-ICE-0005 Sheet 357 Rev. 03

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

IV. Equipment Qualification Method: Test: X

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Foxboro, Report PERS 75-113
Lab: Acton Laboratory Rpt. No. 11977
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

   3. [ ] Explosive only 4. [ ] Other (Specify) ______

   5. [ ] Combination of ______

   6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
   [ ] ______
   (Other, Specify)

2. Required Response Spectra (attach the graphs): No RRS

3. Required Acceleration in Each Direction: ______

   S/S = 6.1g input F/B = 6.0g input V = 0.75g input

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 ______
   Other 10 cycles/beat, 10 beats full level at each integer. freq. from 1 to 35 HZ
   (Specify)

4. Frequency Range: 1 to 35 HZ

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
   [ ] No N/A

6. Input g-level Test at:
S/S = 3.5, 5, 10
F/B = 3.5, 5, 10
V = 3.5, 5, 10

7. Laboratory Mounting: Normal Spec. 200 Equipment Mounting

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

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

NA

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
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: __________ 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. Deflection	Location	Effect Upon Functional Operability

V I Test Results

NATURAL FREQUENCIES. VERTICAL ______ SIDE / SIDE ______ FRONT / BACK ______

ELECTRICAL OPERATION Performance as required; output deviation less than 0.5% of full range

PHYSICAL INTEGRITY Intact, no physical damage.

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS ______

MAXIMUM EXTERIOR DEFLECTION ______

DYNAMIC LOAD TO MOUNTING ______

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES ______

VI. DISCUSSION

C-E 0090234 (8/75)

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 Type:

1. Utility: Southern California Edison Company PWR X

2. NSSS: CE 3. A/E: Bechtel BWR

II. Component Name: Power Supply

1. Scope: [X] NSSS [ ] BOP

2. Model Number: 2ARPS Quantity: 6

3. Vendor: Foxboro

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

5. Physical Description a. Appearance Module for Rack Mounting

   b. Dimensions 19" x 8-3/4" x 13-1/4"

   c. Weight 82#

6. Location: Building: Control Area Aux. Bldg.

   Elevation: 30'

7. Field Mounting Conditions [ ] Bolt (No.______, Size__________)
   [ ] Weld (Length__________________)
   [X] Nest Slot

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

   S/S: 29 F/B: >35
   V: 14, 17, 20, 25,30

9. a. Functional Description: Provide power supply to process instruments (15, + 25VDC)

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

   [X] Both

10. Pertinent Reference Design Specifications: 1370-ICE-0005 Sheet 162 Rev. 02

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

IV. Equipment Qualification Method: Test: X

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Foxboro, Report T6-6020
Lab: Action Laboratory Report No. 12539
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [ ] Combination of ______

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ______
(Other, Specify)

2. Required Response Spectra (attach the graphs): No RRS

3. Required Acceleration in Each Direction: ______

S/S = 4.5g input F/B = 4.0g input V = 0.75g input

VI. If Qualification by Test, then Complete: ______

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

2. [ ] Single Axis [X] Multi-Axis (Bi-Axial)

3. No. of Qualification Tests: OBE ______ SSE ______
Other 10 cycles/beat, 10 beats full level at each integer freq. from 1 to 35 Hz.
(Specify)

4. Frequency Range: 1-35 Hz.

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[ ] No N/A

6. Response g-level Test at:
   S/S = 1 to 5
   F/B = 1 to 5
   V = 1 to 5

7. Laboratory Mounting: Normal Spec. 200 Equipment Mounting

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

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

    N/A

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

1. Description of Test including Results: N/A

2. Method of Analysis: ____________________

   [ ] Static Analysis [ ] Equivalent Static Analysis
   [ ] Dynamic Analysis [ ] Time-History
   [ ] Response Spectrum

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: ________ 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. Deflection	Location	Effect Upon Functional Operability

V I Test Results

NATURAL FREQUENCIES: VERTICAL 14, 17, 20, 25-30 Hz SIDE / SIDE 29 Hz FRONT / BACK none below 35 Hz

ELECTRICAL OPERATION Performance as required; output deviations less than 0.1% full range except as noted in discussion.

PHYSICAL INTEGRITY Intact; no physical anomalies.

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS

MAXIMUM EXTERIOR DEFLECTION

DYNAMIC LOAD TO MOUNTING

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES

VI. DISCUSSION

Testing at frequencies above 20 Hz caused a loss of -15 VDC. The problem was traced to an unsoldered connection in series with the -15 VDC overvoltage protection circuit. Each time the connection opened, overvoltage protection was initiated and the -15 VDC output was removed. The subject relay was removed and a retesting was conducted at all frequencies from 20 to 35 Hz without failure. The unsoldered connection has been addressed by teh vendor as a manufacturing quality control problem and steps have been taken to prevent the reoccurance of unsolder connections.

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 Type:

1. Utility: Southern California Edison Company PWR X

2. NSSS: CE 3. A/E: Bechtel BWR

II. Component Name: Power Distribution Module

1. Scope: [X] NSSS [ ] BOP

2. Model Number: 2AX-DP10-EH Quantity: 27

3. Vendor: Foxboro

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

5. Physical Description a. Appearance Module for Rack Mounting

   b. Dimensions 1 1/2" x 8 3/4" x 3"

   c. Weight ≅3#

6. Location: Building: Control Area Aux. Bldg.

   Elevation: 30'

7. Field Mounting Conditions [ ] Bolt (No. ____, Size ____)
   [ ] Weld (Length ____)
   [X] Nest Slot

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

   S/S: * F/B: *
   V: *
   *Resonance Search Not Conducted

9. a. Functional Description: Connect external power to rest of power bus

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

   [X] Both

10. Pertinent Reference Design Specifications: 1370-ICE-0005 Sheet 167 Rev. 04

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

IV. Equipment Qualification Method: Test: X

Analysis: ________

Combination of Test and Analysis: ________

Test and/or Analysis by Foxboro, Report PERS 75-113
Lab: Acton Laboratory Rpt. No. 11977
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

   3. [ ] Explosive only 4. [ ] Other (Specify) ________

   5. [ ] Combination of ________

   6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
      [ ] ________ (Other, Specify)

2. Required Response Spectra (attach the graphs): No RRS

3. Required Acceleration in Each Direction: ________

   S/S = 6.1g input F/B = 6.0g input V = 0.75g input

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 ________
   Other 10 cycles/beat, 10 beats full level at each integer freq. from 1 to 35 Hz
   (Specify)

4. Frequency Range: 1 to 35 HZ

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
   [ ] No N/A

6. Input g-level Test at:

S/S = 3.5, 5, 10
F/B = 3.5, 5, 10
V = 3.5, 5, 10

7. Laboratory Mounting: Normal spec 200 equipment mounting

1. [ ] Bolt (No._______, Size_______) [ ] Weld (Length_____________)
[ ] ____________________

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

NA

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

1. Description of Test including Results: NA

2. Method of Analysis: ____________________

[ ] Static Analysis
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: __________ 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. Deflection	Location	Effect Upon Functional Operability

V I Test Results

NATURAL FREQUENCIES. VERTICAL ______ SIDE / SIDE ______ FRONT / BACK ______

ELECTRICAL OPERATION functional properly throughout all tests

PHYSICAL INTEGRITY Intact, No physical damage.

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS ______

MAXIMUM EXTERIOR DEFLECTION ______

DYNAMIC LOAD TO MOUNTING ______

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES ______

VI. DISCUSSION

C-E 0090234 (9/75)

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR

II. Component Name: Signal Distribution Module

1. Scope: [X] NSSS [ ] BOP
2. Model Number: 2AX-DSI — Quantity: 20
3. Vendor: Foxboro
4. If the component is a cabinet or panel, name and model No. of the devices included: NA
5. Physical Description a. Appearance Nested Module for Rack Mounting
   b. Dimensions 1 1/2" x 8 3/4" x 3"
   c. Weight ≅3#
6. Location: Building: Control Area Aux. Bldg.
   Elevation: 30'
7. Field Mounting Conditions [ ] Bolt (No.______, Size________)
   [ ] Weld (Length________)
   [X] Nest Slot
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
   S/S: * F/B: *
   V: *
   *Resonance Search Not Conducted
9. a. Functional Description: Provide terminals for termination of signal connections
   b. Is the equipment required for [X] Hot Standby [X] Cold Shutdown
   [X] Both
10. Pertinent Reference Design Specifications: 1370-ICE-0005
    Sheet 161 Rev. 04

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

IV. Equipment Qualification Method: Test: X

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Foxboro, Report PERS 75-113
Lab: Acton Laboratory Rpt. No. 11977
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [ ] Combination of ______

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ______
(Other, Specify)

2. Required Response Spectra (attach the graphs): No RRS

3. Required Acceleration in Each Direction: ______

S/S = 6.1 input F/B = 6.0g input V = 0.75g input

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 ______
Other 10 cycles/beat, 10 beats full level at each integer freq. from 1 to 35 HZ
(Specify)

4. Frequency Range: 1 to 35 HZ

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[ ] No N/A

6. Input g-level Test at:

   S/S = 10
   F/B = 10
   V = 10

7. Laboratory Mounting: Normal spec 200 equipment mounting

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

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

    NA

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

1. Description of Test including Results: NA

2. Method of Analysis: ____________________

   [ ] Static Analysis — [ ] Equivalent Static Analysis
   [ ] Dynamic Analysis — [ ] Time-History
   [ ] Response Spectrum

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: ________ 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. Deflection	Location	Effect Upon Functional Operability

I. Test Results

NATURAL FREQUENCIES: VERTICAL NA SIDE / SIDE NA FRONT / BACK NA

ELECTRICAL OPERATION Function properly througnout all tests

PHYSICAL INTEGRITY Intact, no physical damage

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS

MAXIMUM EXTERIOR DEFLECTION

DYNAMIC LOAD TO MOUNTING

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES

VI. DISCUSSION

C-E 0090234 (9/75)

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR ____

II. Component Name: Temperature Transmitter

1. Scope: [X] NSSS [ ] BOP
2. Model Number: 442H-RP-A — Quantity: 16
3. Vendor: Rosemount
4. If the component is a cabinet or panel, name and model No. of the devices included: NA
5. Physical Description a. Appearance Rack Mounted Module

   b. Dimensions 3 21/32" x 3 3/8" Diam.

   c. Weight 1#
6. Location: Building: Control Area Aux. Bldg.

   Elevation: 30'
7. Field Mounting Conditions
   [ ] Bolt (No.____, Size____)
   [ ] Weld (Length____)
   [X] Nest Slot
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S: >35 — F/B: >35
   V: >35
9. a. Functional Description: Provide output current proportional to RTD input resistance

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

   [X] Both
10. Pertinent Reference Design Specifications: 1370-ICE-0005 Sheet 164 Rev. 2, 165 Rev. 2

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

IV. Equipment Qualification Method: Test: X

Analysis: ____________________

Combination of Test and Analysis: __________

Test and/or Analysis by Rosemount Report 77628E
Lab: Dayton T. Brown Laboratory DTB04R76-0902
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ____________________

5. [ ] Combination of ____________________

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ____________________
(Other, Specify)

2. Required Response Spectra (attach the graphs): No RRS for mounting location. Floor RRS is attached.

3. Required Acceleration in Each Direction: ____________________

S/S = 6.1g input F/B = 6.0g input V = 0.75g input

VI. If Qualification by Test, then Complete: ____________________

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

2. [ ] Single Axis [X] Multi-Axis (Bi-axial)

3. No. of Qualification Tests: OBE 3 SSE 2
Other ____________________
(Specify)

4. Frequency Range: See TRS attached

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[X] No RRS

6. Input g-level Test at:

   S/S = 7.0
   F/B = 6.1
   V = 5.5

7. Laboratory Mounting: ____________________

   1. [x] Bolt (No. 2, Size 8-32) [ ] Weld (Length ________)
      [ ] ____________________

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

    NA

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

1. Description of Test including Results: NA

2. Method of Analysis: ____________________

   [ ] Static Analysis [ ] Equivalent Static Analysis
   [ ] Dynamic Analysis [ ] Time-History
   [ ] Response Spectrum

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: __________ 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. Deflection	Location	Effect Upon Functional Operability

V. Test Results

NATURAL FREQUENCIES: VERTICAL None below 35 Hz SIDE / SIDE None below 35Hz FRONT / BACK None below 35Hz

ELECTRICAL OPERATION Performance as required; no deviations during testing. The only change in calibration data was an improvement of the temperature effect (ambient, not sensed) by 0.15% of span.

PHYSICAL INTEGRITY Intact; no physical effects other than a slight bending of the mounting screws (about 5°).

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

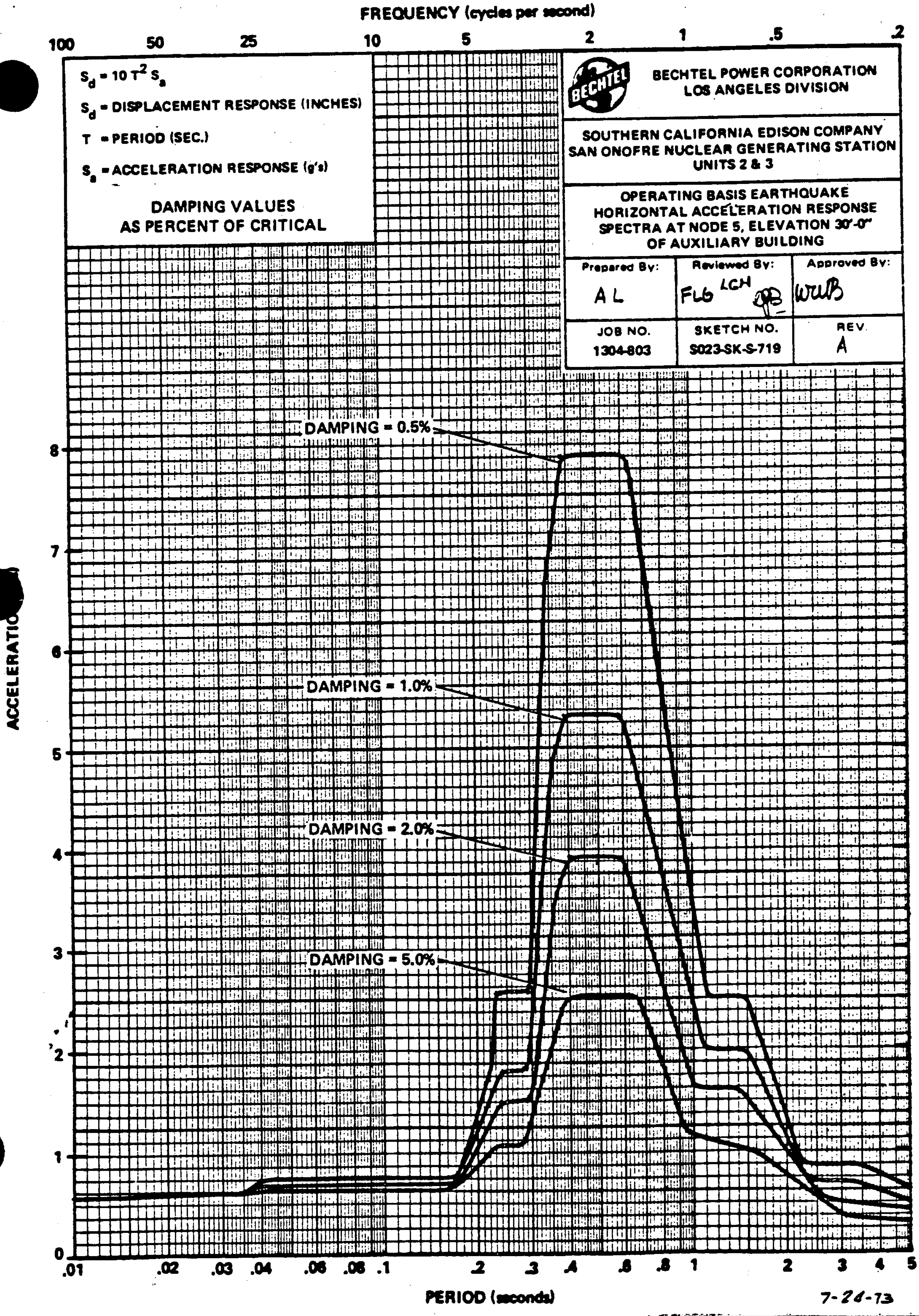
MAXIMUM STRUCTURAL STRESS

MAXIMUM EXTERIOR DEFLECTION

DYNAMIC LOAD TO MOUNTING

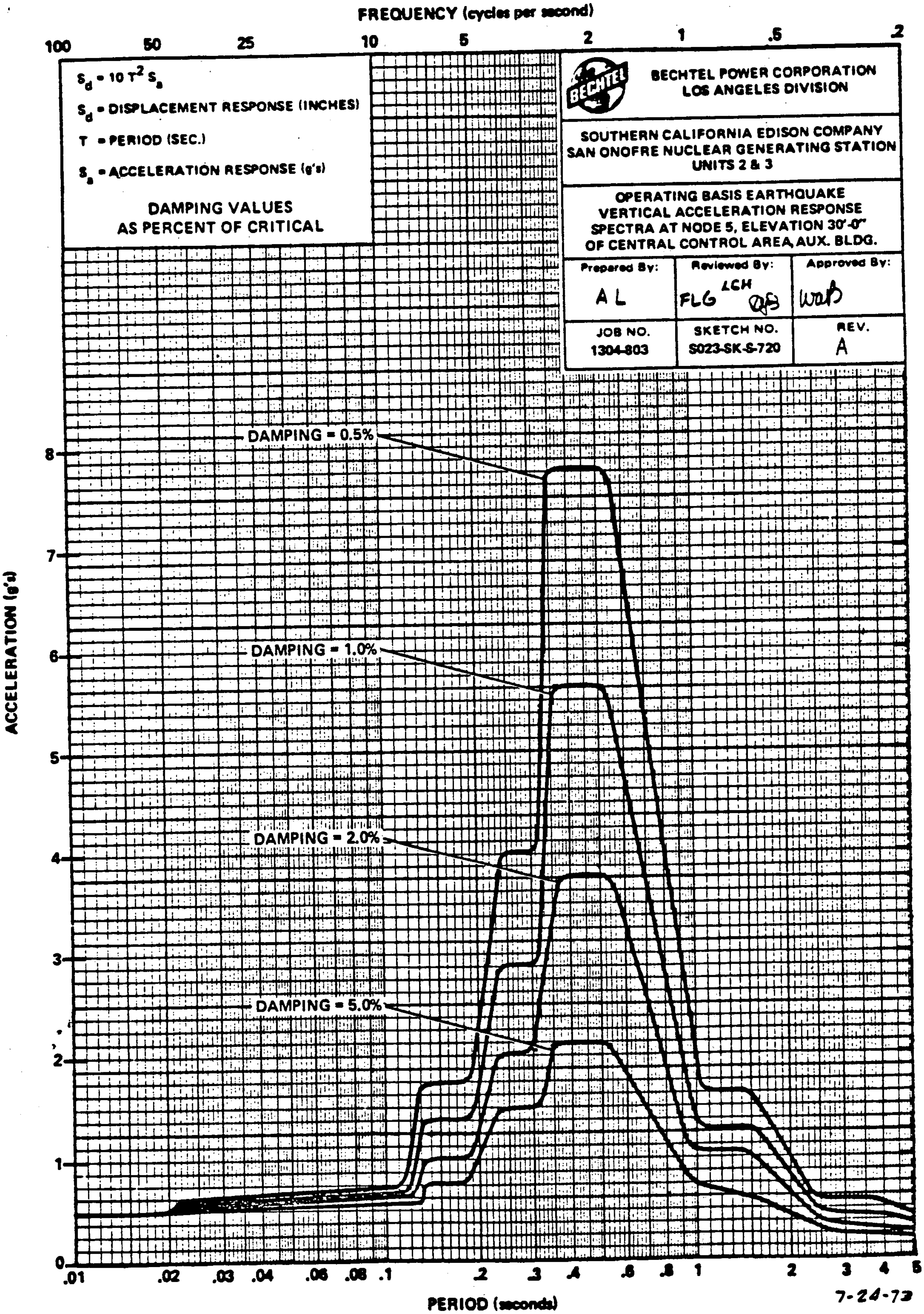
MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES

VI. DISCUSSION



FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
OPERATING BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA AT NODE 5, ELEVATION 30'-0"
OF AUXILIARY BUILDING
Prepared By: A L
Reviewed By: FLG LCH
Approved By: WRB
JOB NO. 1304-803
SKETCH NO. S023-SK-S-719
REV. A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION
0
1
2
3
4
5
6
7
8
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

7-24-73


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
OPERATING BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA AT NODE 5, ELEVATION 30'-0"
OF CENTRAL CONTROL AREA, AUX. BLDG.
Prepared By: AL
Reviewed By: FLG LCH
Approved By:
JOB NO. 1304-803
SKETCH NO. S023-SK-S-720
REV. A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
8
7
6
5
4
3
2
1
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)
7-24-73

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR

II. Component Name: Vital Bus Power Supply

1. Scope: [X] NSSS [ ] BOP
2. Model Number: None — Quantity: 4
3. Vendor: Cyberex
4. If the component is a cabinet or panel, name and model No. of the devices included: NA
5. Physical Description a. Appearance Vertical two-bay cabinet
   b. Dimensions 85" x 36" x 50" (LxWxH)
   c. Weight 3300#
6. Location: Building: Control Area (Aux. Bldg.)
   Elevation: 50' - 9"
7. Field Mounting Conditions [X] Bolt (No. 6 , Size 7/8" 8.325 Bolt)
   [ ] Weld (Length)
   [ ]
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
   S/S: 12.5 F/B: 20
   V: 20
9. a. Functional Description: Provide electrical power and voltage reference
   b. Is the equipment required for [X] Hot Standby [X] Cold Shutdown
   [X] Both
10. Pertinent Reference Design Specifications: 1370-ICE-3017 Rev. 2
    00000-ICE-3017 Rev. 1

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

IV. Equipment Qualification Method: Test: X

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Wyle Labs, Report 43474
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

   3. [ ] Explosive only 4. [ ] Other (Specify) ______

   5. [ ] Combination of ______

   6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
   [ ] ______
   (Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ______

   S/S = 1.0g input F/B = 1.0g input V = 0.8g input

VI. If Qualification by Test, then Complete: ______

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

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

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

4. Frequency Range: See TRS attached

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
   [X] No*

*TRS exceeds the RRS at natural frequencies and <3 Hz and >9 Hz.

6. Input g-level Test at:

S/S = 3.9
F/B = 3.4
V = 1.0

7. Laboratory Mounting: ____________

1. [X] Bolt (No. 6 , Size 7/8 SAE 5) [ ] Weld (Length ____________)
[ ] ____________

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

NA

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

1. Description of Test including Results: NA

2. Method of Analysis: ____________

[ ] Static Analysis
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: ________ 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. Deflection	Location	Effect Upon Functional Operability

VI. 4. [illegible]

NATURAL FREQUENCIES: VERTICAL 2 , 20 Hz	SIDE / SIDE 2 , 12.5 Hz	FRONT / BACK 2 , 20 Hz
ELECTRICAL OPERATION The Vital Bus Power Supply maintained power and continuity to the output of the Distribution Panel circuits, except as noted below.		
PHYSICAL INTEGRITY Intact. No physical effects except as noted below.		
DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)		
MAXIMUM STRUCTURAL STRESS 9000 psi		
MAXIMUM EXTERIOR DEFLECTION		
DYNAMIC LOAD TO MOUNTING		
MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES		

VI. DISCUSSION

A piece of debris caused an electrical short circuit and subsequent shutdown of the Vital Bus Power Supply inverter during one seismic run. The debris was a washer used in mounting the unit to a shipping skid which was inadvertantly left in the inverter during test preparation. After removal of the washer testing was resumed with no other anomalies.

TEST RESPONSE SPECTRA

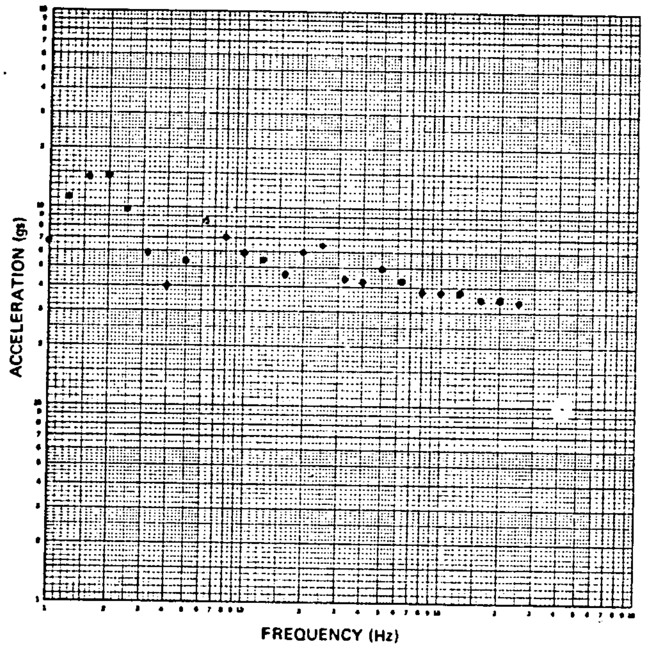
DATA SHEET No. 7 7
DATE March 18 1978
REVISION No. ______

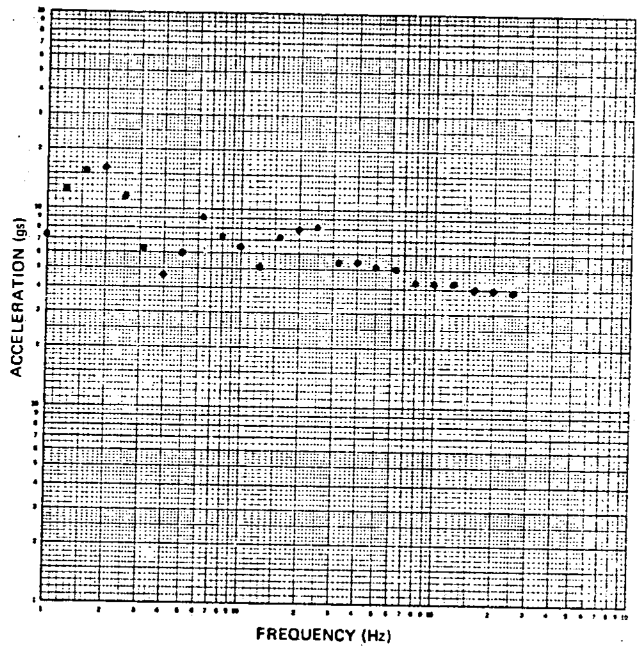
SPECTRUM FULL SCALE: ACCELERATION ☐ 10 gs ☒ 100 gs
FREQUENCY ☐ 100 Hz ☒ 1000 Hz

1 % CRITICAL DAMPING

TEST PLANE — ☐ FRONT TO BACK ☒ FRONT TO BACK / VERTICAL | ☐ SIDE TO SIDE ☒ SIDE TO SIDE / VERTICAL

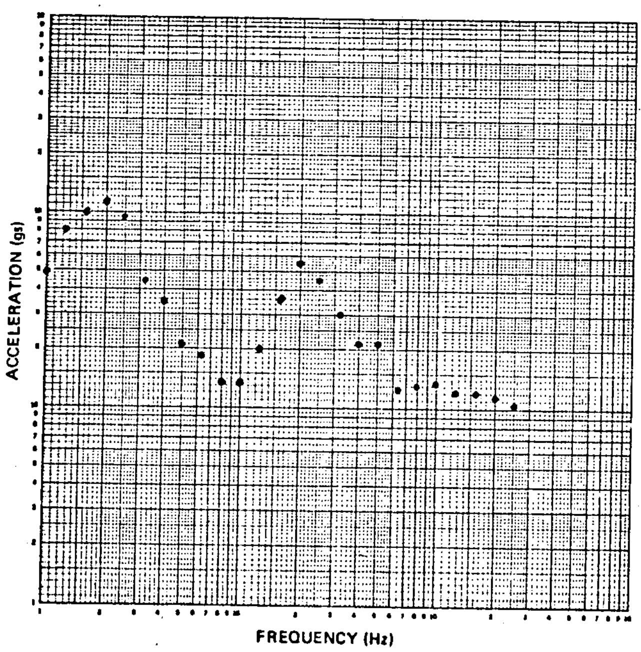
RESPONSE DIRECTION — ☒ FRONT TO BACK ☐ FRONT TO BACK (180° SHIFT) | ☒ SIDE TO SIDE ☐ SIDE TO SIDE (180° SHIFT)

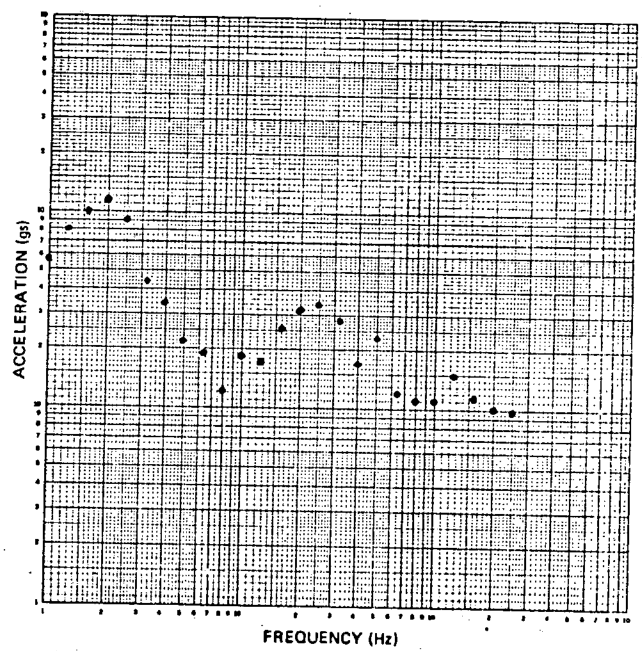




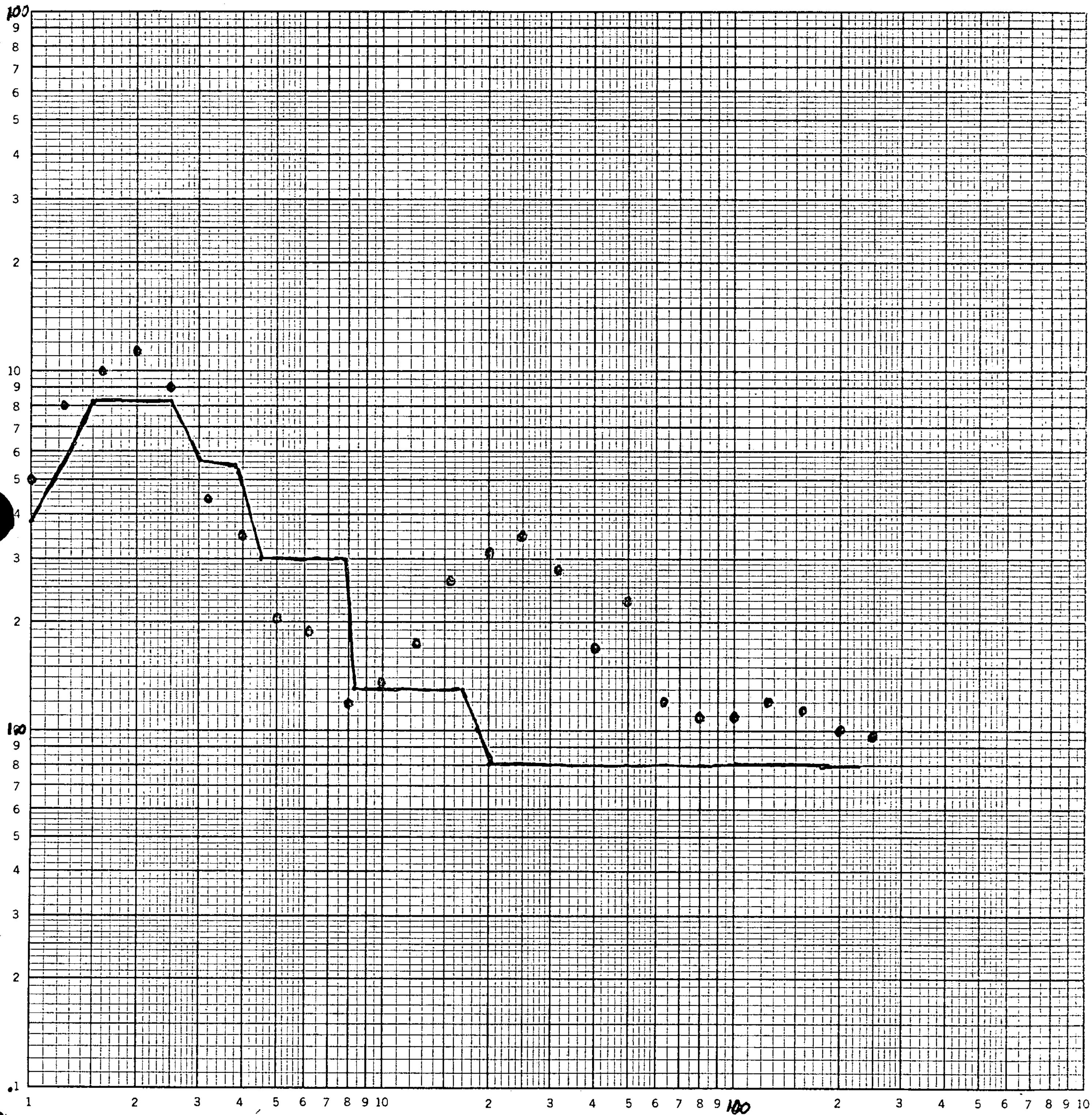
TEST PLANE — ☐ VERTICAL ☒ FRONT TO BACK / VERTICAL | ☒ SIDE TO SIDE / VERTICAL

RESPONSE DIRECTION — ☒ VERTICAL ☐ VERTICAL (180° SHIFT) | ☒ VERTICAL ☐ VERTICAL (180° SHIFT)



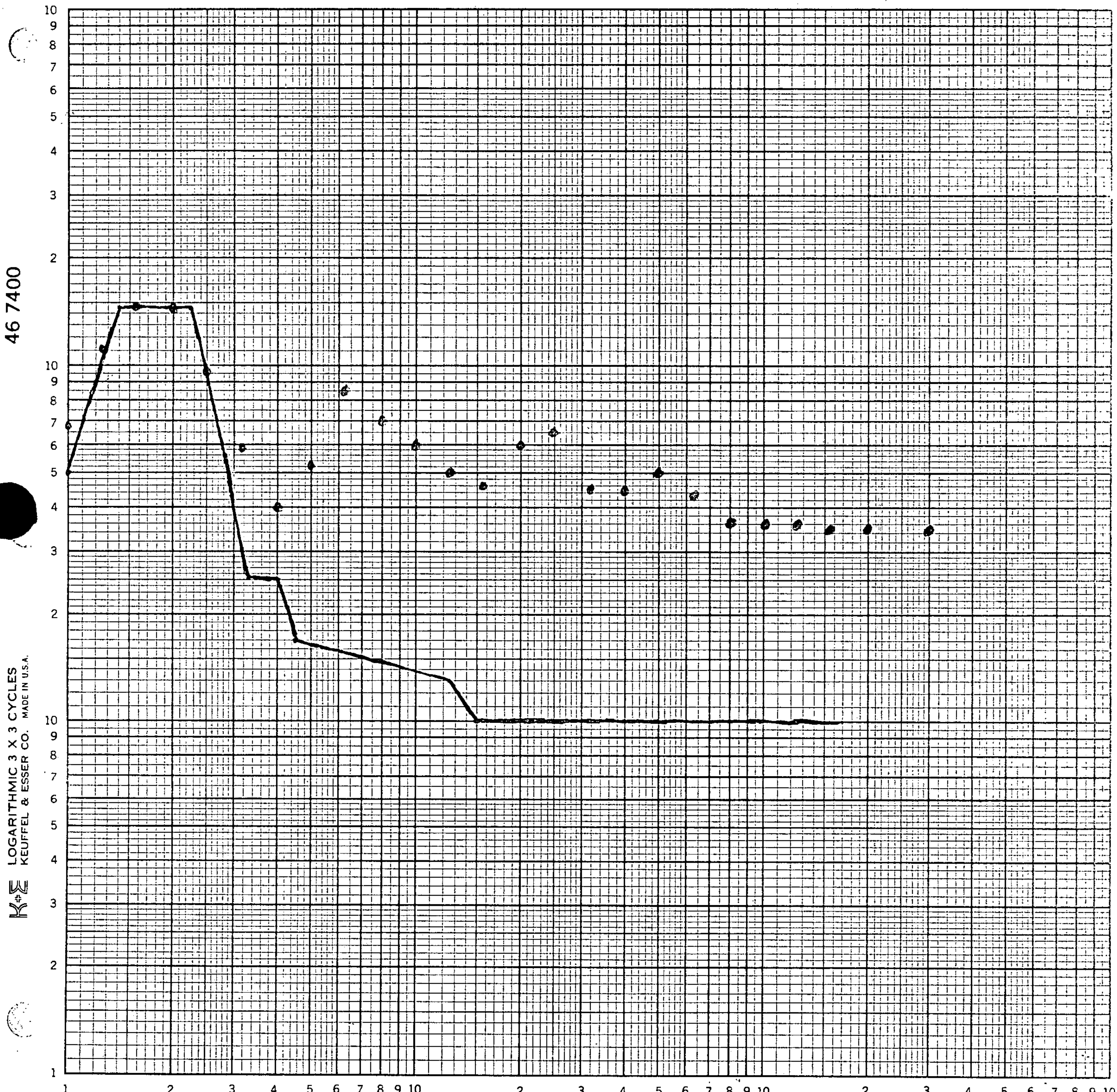


Vital Bus Power Supply
Required Response Spectrum
SSE - Vertical - 1%β



TRS: minimum of two vertical tests

Vital Bus Power Supply
Required Response Spectrum
SSE - Horizontal - 1% β



TRS: minimum of two horizontal tests (F/B & S/S)

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X

2. NSSS: CE — 3. A/E: Bechtel — BWR ____

II. Component Name: CPC Operator's Module

1. Scope: [X] NSSS [ ] BOP

2. Model Number: None — Quantity: 4

3. Vendor: Systems Engineering Laboratory

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

5. Physical Description a. Appearance Module inserted on control panel

   b. Dimensions 12" x 10" x 8"

   c. Weight 20#

6. Location: Building: Control Area, Auxiliary Bldg.

   Elevation: 30'

7. Field Mounting Conditions [X] Bolt (No. 12, Size 3/8")
   [ ] Weld (Length ____)
   [ ] ____

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

   S/S: 24, 34 — F/B: 35
   V: 24, 32, 34

9. a. Functional Description: Permits operation of CPC system from main control panel

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

   [ ] Both ____

10. Pertinent Reference Design Specifications: 1370-ICE-3004, Rev. 0
    00000-ICE-3004, Revision 3

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

IV. Equipment Qualification Method: Test: X

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Wyle Laboratories, 43130-1
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [ ] Combination of ______

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ______
(Other, Specify)

2. Required Response Spectra (attach the graphs): No RRS

3. Required Acceleration in Each Direction: ______

S/S = 3.0g input F/B = 3.0g input V = 3.0g input

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 ______
Other Full level at natural freqs. and 10, 15, 20, 25, 30, 35Hz
(Specify)

4. Frequency Range: 1 to 35Hz

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[ ] No

Not Applicable

6. Input g-level Test at:

S/S = 3
F/B = 3
V = 3

7. Laboratory Mounting: ______

1. [X] Bolt (No. 8 , Size 10-32) [ ] Weld (Length ______)
[ ] ______

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

N/A

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

1. Description of Test including Results: N/A

2. Method of Analysis: ______

[ ] Static Analysis
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: ______ 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. Deflection	Location	Effect Upon Functional Operability

NS557

I, Test Results

NATURAL FREQUENCIES	VERTICAL 24, 32, 34 Hz SIDE / SIDE 24, 34 Hz FRONT / BACK 35 Hz
ELECTRICAL OPERATION	Performance as required, no spurious or interrupted signals; key switches operated normally before and after each seismic excitation.
PHYSICAL INTEGRITY	Intact; no loosening or deformation of any part of specimen.

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS	NA
MAXIMUM EXTERIOR DEFLECTION	NA
DYNAMIC LOAD TO MOUNTING	NA
MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES	NA

VI. DISCUSSION

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR ____

II. Component Name: PPS Remote Control Module

1. Scope: [X] NSSS [ ] BOP
2. Model Number: None — Quantity: 4
3. Vendor: Electro-Mechanics
4. If the component is a cabinet or panel, name and model No. of the devices included: N/A
5. Physical Description a. Appearance Panel Mounted Drawer

   b. Dimensions 13-3/4" x 12" x 15-3/4"

   c. Weight 50#
6. Location: Building: Control Area, Auxiliary Bldg.

   Elevation: 30'
7. Field Mounting Conditions [X] Bolt (No. 14, Size 3/8")
   [ ] Weld (Length ____)
   [ ] ____
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical): No resonance survey conducted.

   S/S: ____ F/B: ____
   V: ____
9. a. Functional Description: Remote bistable status display and bypass operation

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

   [X] Both ____
10. Pertinent Reference Design Specifications: 1370-ICE-3001, Rev. 0 00000-ICE-3001, Revision 03

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

IV. Equipment Qualification Method: Test: X

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Wyle Laboratiries, 43386-1
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [ ] Combination of ______

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ______
(Other, Specify)

2. Required Response Spectra (attach the graphs): No RRS for mounting location. Floor RRS attached.

3. Required Acceleration in Each Direction: ______

S/S = 3.0g input F/B = 3.0g input V = 3.0g input

VI. If Qualification by Test, then Complete: ______

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

2. [ ] Single Axis [X] Multi-Axis (Bi-axial)

3. No. of Qualification Tests: OBE ______ SSE 6
Other ______
(Specify)

4. Frequency Range: See TRS attached

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[X] No RRS

6. Input g-level Test at:

S/S = 16.0
F/B = 16.5
V = 16.0

7. Laboratory Mounting: ____________

1. [X] Bolt (No. ~~20~~ 14, Size 3/8-16) [ ] Weld (Length ____________)
[ ] ____________

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

N/A

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
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: ________ 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. Deflection	Location	Effect Upon Functional Operability

I, Test Results

NATURAL FREQUENCIES: VERTICAL ______ SIDE / SIDE ______ FRONT / BACK ______

ELECTRICAL OPERATION Performance as required; See discussion item 2 below

PHYSICAL INTEGRITY Intact; no physical effects

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS ______

MAXIMUM EXTERIOR DEFLECTION ______

DYNAMIC LOAD TO MOUNTING ______

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES ______

VI. DISCUSSION

1. To qualify different mounting angles and operating modes of the module, a total of 26 full level tests were performed; 24 tests were required by combinations of three mounting angles, testing in four quadrants (consistent with phase-locked biaxial test requirements), and 2 modes of electrical operation. Although only one full level test was performed for each situation, the energy imparted to the module by 26 full level tests greatly exceeds that generated by 5-1/2 level and 1 full level SSE.

2. The remote control module provides various functions. These are operating bypasses, variable setpoint resets, calibration of safety channel nuclear instruments, and annunciation.

   The operating bypasses are the High Log Power Bypass and RPS/ESFAS Pressurizer Pressure Bypass. The High Log Power Bypass was tested in both operating conditions (normal and bypass). The RPS/ESFAS Pressurizer Pressure Bypass is a spring return switch and therefore was tested in the "mid" position. Contacts of both switches were continuously monitored throughout the test.

   With the Remote Control Module mounted in the 45° orientation a High Log Power Bypass Switch output contact anomaly was observed while the switch was in the bypass position. This anomaly was approximately one (1) millisecond in duration with the switch remaining in the bypass position. This one (1) millisecond duration is not sufficient to remove the bypass and propagate a channel trip and therefore is acceptable.

   The variable setpoint reset pushbutton contacts were continuously monitored before, during, and after seismic excitation to verify no reset occurred.

   A test voltage was applied across the safety channel nuclear instrumentation calibration potentiometer via a test resistor. The resultant voltage drop across the test resistor was continuously monitored and verified proper operation of the calibration potentiometer.

TEST RESPONSE SPECTRA

DATA SHEET No. 102

DATE MARCH 1977

SPECTRUM FULL SCALE: ACCELERATION ☐ 10 gs ☒ 100 gs
FREQUENCY ☐ 100 Hz ☒ 1000 Hz

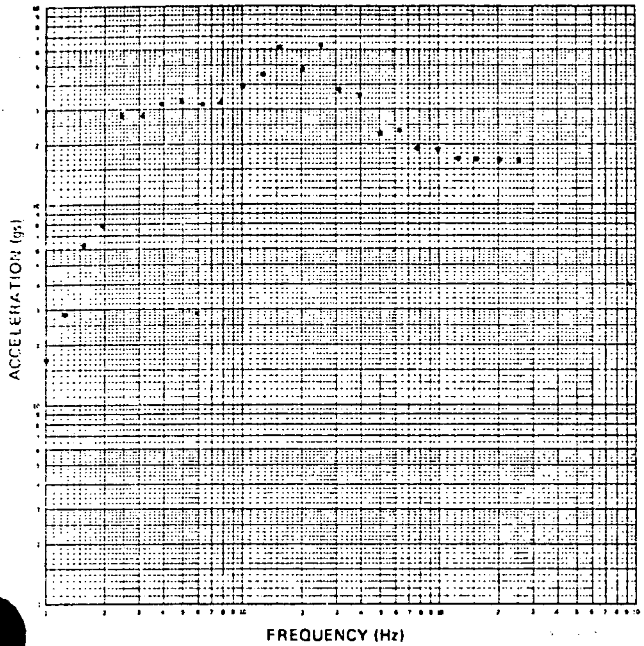
1 % CRITICAL DAMPING

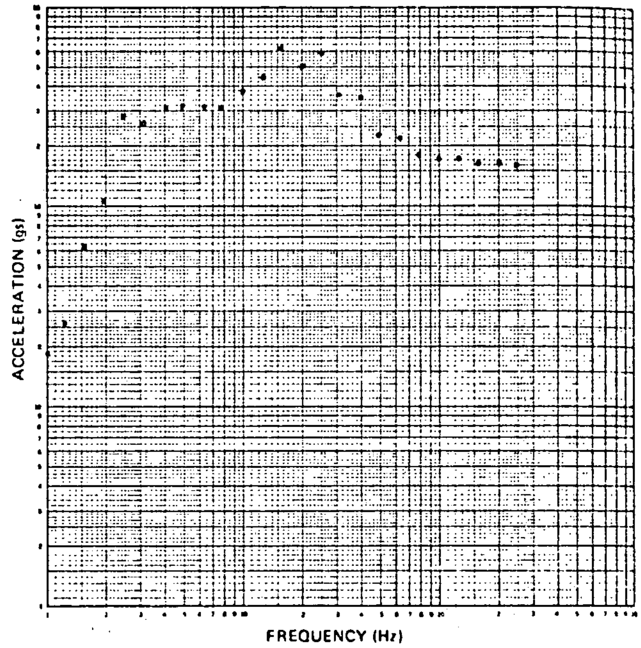
REVISION No. 01

EQUIPI

TEST PLANE: ☐ FRONT TO BACK ☒ FRONT TO BACK / VERTICAL — ☐ SIDE TO SIDE ☒ SIDE TO SIDE / VERTICAL

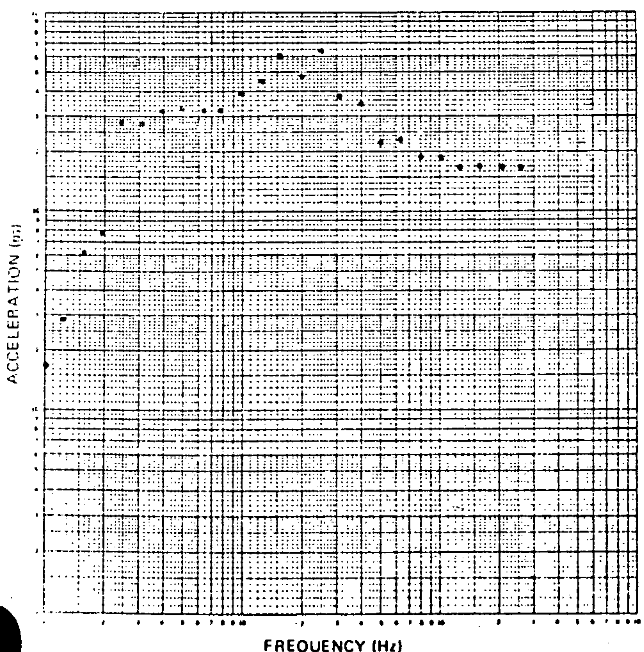
RESPONSE DIRECTION: ☒ FRONT TO BACK ☒ FRONT TO BACK (180° SHIFT) — ☒ SIDE TO SIDE ☒ SIDE TO SIDE (180° SHIFT)

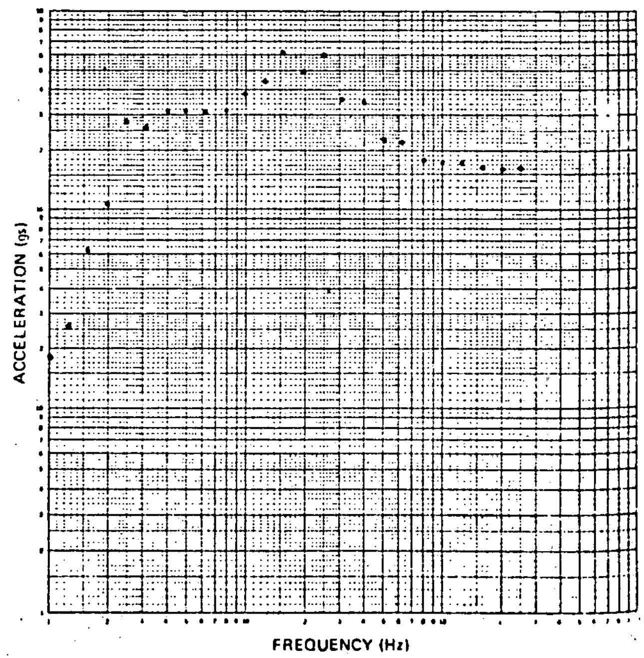




TEST PLANE: ☐ VERTICAL ☒ FRONT TO BACK / VERTICAL — ☒ SIDE TO SIDE / VERTICAL

RESPONSE DIRECTION: ☒ VERTICAL ☒ VERTICAL (180° SHIFT) — ☒ VERTICAL ☒ VERTICAL (180° SHIFT)





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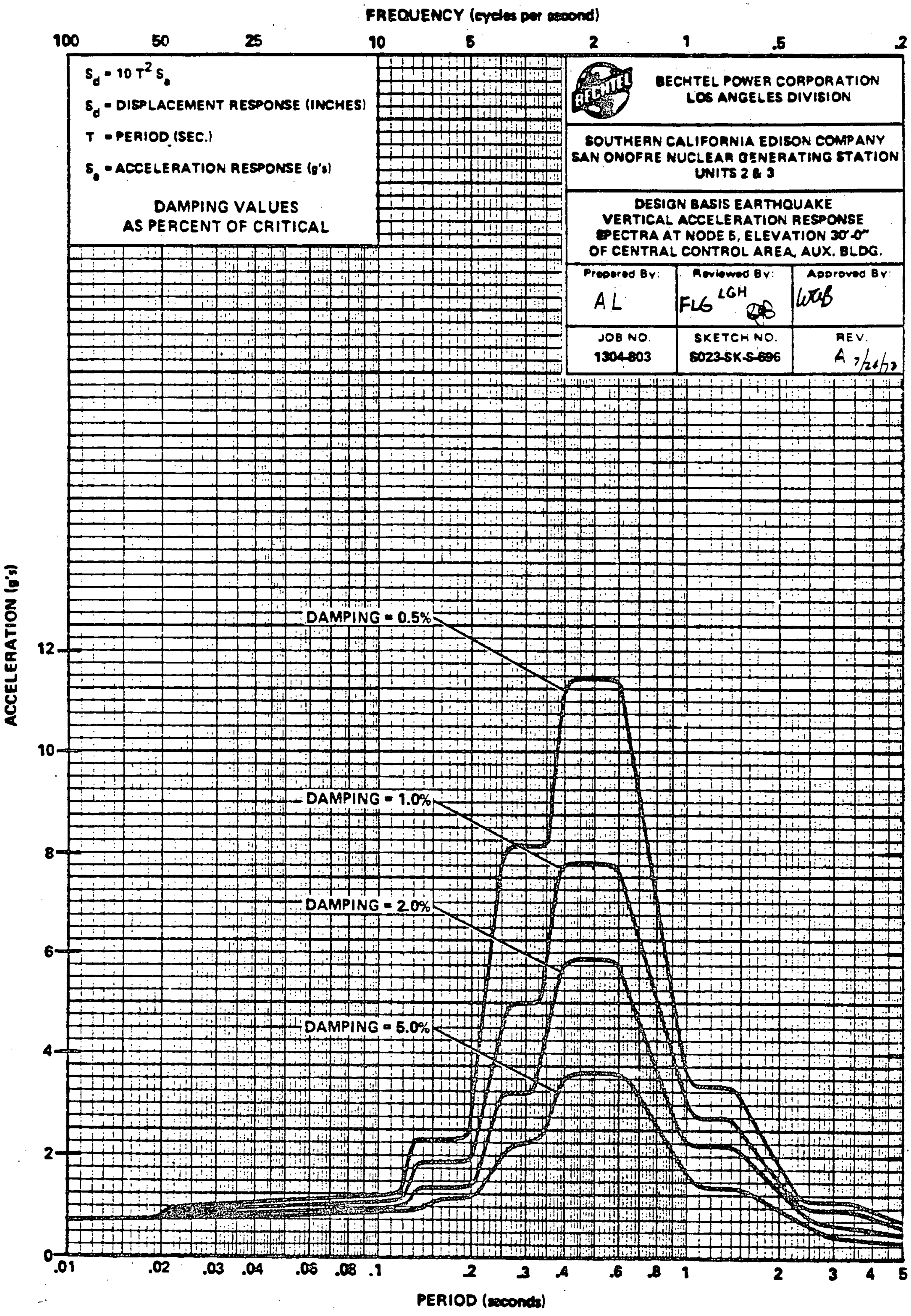
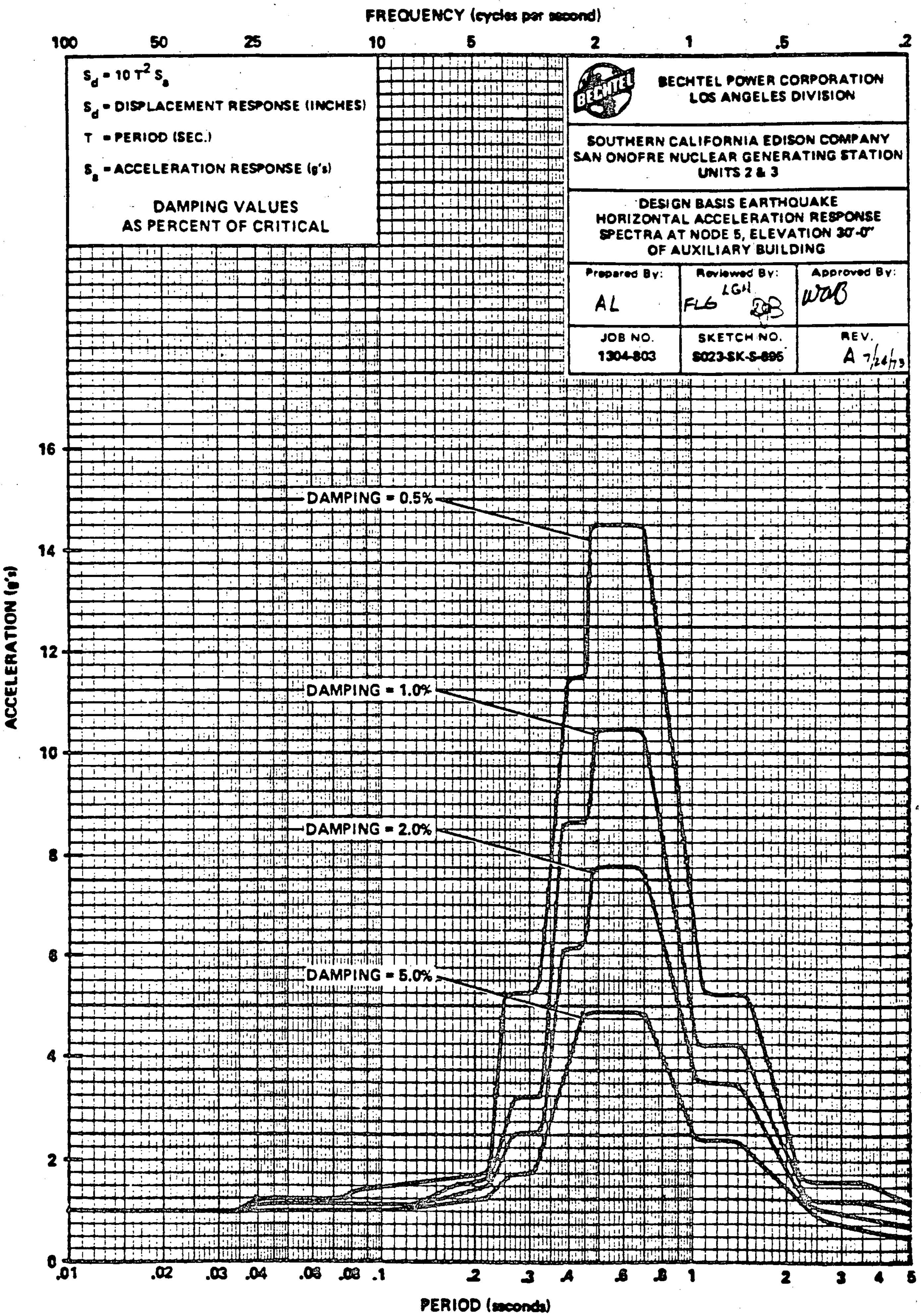


FREQUENCY (cycles per second)
100 50 25 10 5 2 1 .5 .2
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA AT NODE 5, ELEVATION 30'-0"
OF CENTRAL CONTROL AREA, AUX. BLDG.
Prepared By: AL
Reviewed By: FLG LGH
Approved By:
JOB NO. 1304-803
SKETCH NO. S023-SK-S-696
REV. A 7/26/73
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
0 2 4 6 8 10 12
.01 .02 .03 .04 .06 .08 .1 .2 .3 .4 .6 .8 1 2 3 4 5
PERIOD (seconds)


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA AT NODE 5, ELEVATION 30'-0"
OF AUXILIARY BUILDING
Prepared By:
AL
Reviewed By:
FLG LGH
Approved By:
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-896
REV.
A 7/24/73
ACCELERATION (g's)
16
14
12
10
8
6
4
2
0
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR

II. Component Name: Indicator

1. Scope: [X] NSSS [ ] BOP
2. Model Number: 1136 — Quantity: 8
3. Vendor: Sigma
4. If the component is a cabinet or panel, name and model No. of the devices included: NA
5. Physical Description a. Appearance Panel Mounted Indicator

   b. Dimensions 2 1/2" x 3 1/3" x 3/4"

   c. Weight 5 oz
6. Location: Building: Control Area, Aux. Bldg.

   Elevation: 30'
7. Field Mounting Conditions [ ] Bolt (No.______, Size______)

   [ ] Weld (Length______)

   [X] Screwed on mounting plate
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S: 27, 34 F/B: >35

   V: >35
9. a. Functional Description: Indication

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

   [ ] Both
10. Pertinent Reference Design Specifications: 1370-ICE-0005

    Sheet 365, Rev. 1

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

IV. Equipment Qualification Method: Test: X

Analysis: ____

Combination of Test and Analysis: ____

Test and/or Analysis by Sigma SBI-3
Lab: Acton Laboratories Rpt. No. 11879
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

   3. [ ] Explosive only 4. [ ] Other (Specify) ____

   5. [ ] Combination of ____

   6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
   [ ] ____
   (Other, Specify)

2. Required Response Spectra (attach the graphs): No RRS for mounting. Floor RRS attached

3. Required Acceleration in Each Direction: ____

   S/S = 3.0g input F/B = 3.0g input V = 3.0g input

VI. If Qualification by Test, then Complete: ____

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

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

3. No. of Qualification Tests: OBE ____ SSE 35
   Other Full level at each integer freq. from 1 to 35 HZ
   (Specify)

4. Frequency Range: 1 to 35 HZ

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
   [X] No RRS or TRS

6. Input g-level Test at:

   S/S = 3.5 F/B = 3.5 V = 3.5

7. Laboratory Mounting: ____

   1. [x] Bolt (No. 4 , Size 2-56) [ ] Weld (Length ____)
      [ ] ____

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

    NA

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 [ ] Equivalent Static Analysis
   [ ] Dynamic Analysis [ ] Time-History
   [ ] Response Spectrum

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: ____ 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. Deflection	Location	Effect Upon Functional Operability

I. Test Results

NATURAL FREQUENCIES: VERTICAL	None below 35 Hz	SIDE / SIDE	27, 34 Hz	FRONT / BACK	None below 35 Hz

ELECTRICAL OPERATION Maximum change in accuracy was 1.6% of full scale.

PHYSICAL INTEGRITY No mechanical damage or deterioration.

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS

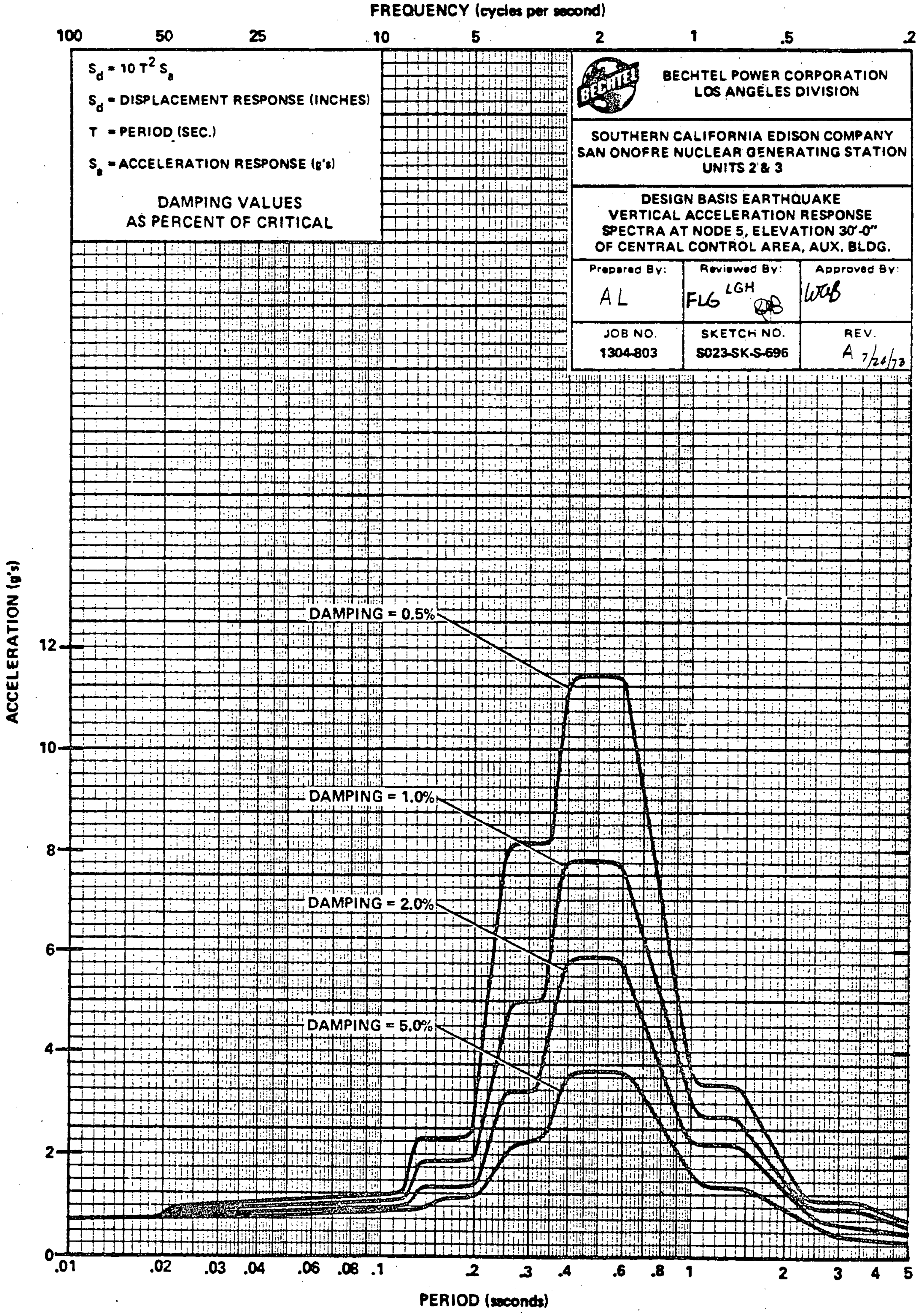
MAXIMUM EXTERIOR DEFLECTION

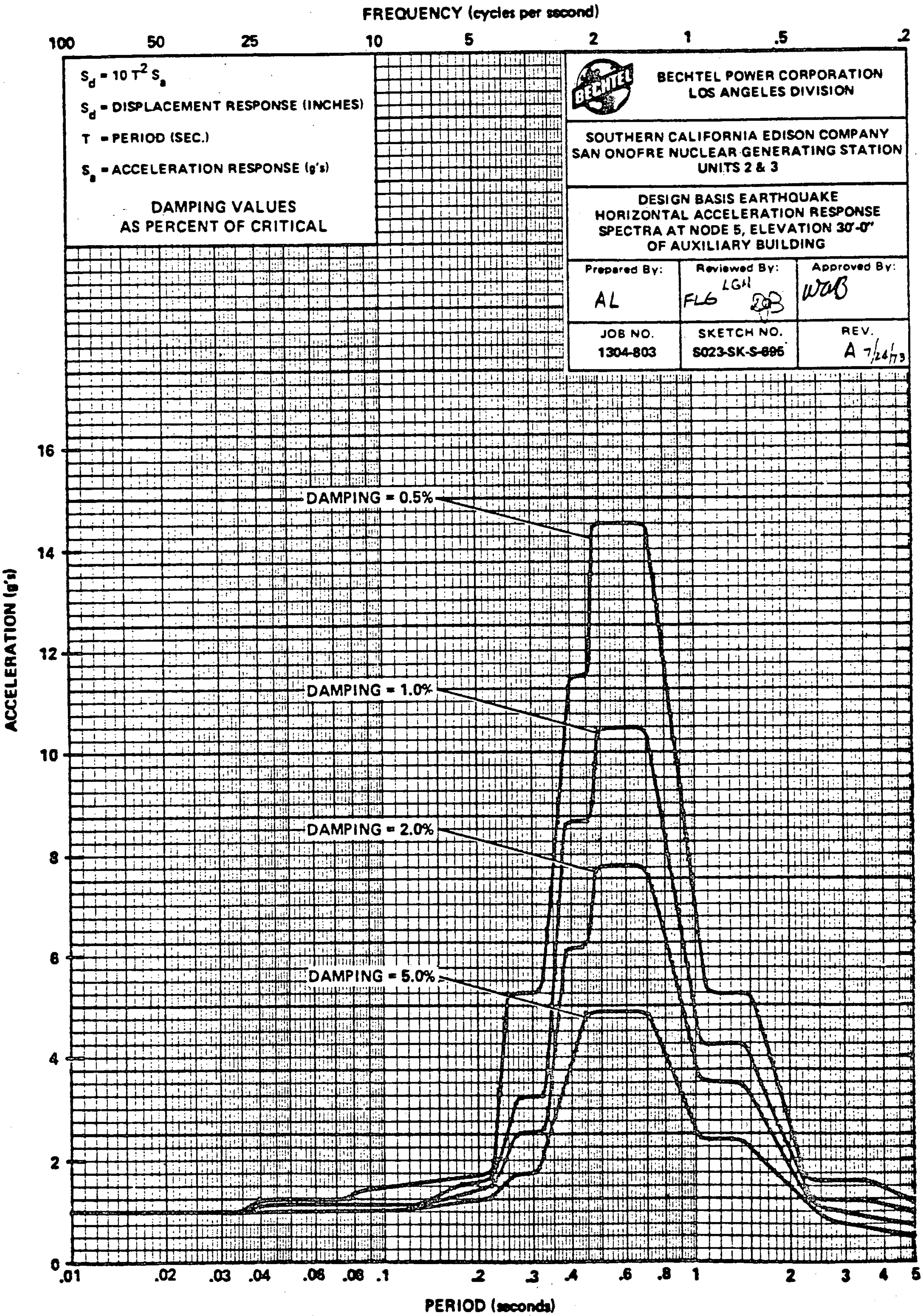
DYNAMIC LOAD TO MOUNTING

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES

VI. DISCUSSION

C-E 0090234 (9/75)


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA AT NODE 5, ELEVATION 30'-0"
OF CENTRAL CONTROL AREA, AUX. BLDG.
Prepared By: AL
Reviewed By: FLG LGH
Approved By: WAB
JOB NO. 1304-803
SKETCH NO. S023-SK-S-696
REV. A 7/26/73
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
12
10
8
6
4
2
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)



FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA AT NODE 5, ELEVATION 30'-0"
OF AUXILIARY BUILDING
Prepared By:
AL
Reviewed By:
FLG LGH
Approved By:
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-895
REV.
A 7/24/73
ACCELERATION (g's)
16
14
12
10
8
6
4
2
0
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 Type:

1. Utility: Southern California Edison Company PWR X

2. NSSS: CE 3. A/E: Bechtel BWR ______

II. Component Name: Indicator

1. Scope: [X] NSSS [ ] BOP

2. Model Number: 9270 Quantity: 80

3. Vendor: Sigma

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

5. Physical Description a. Appearance Panel Mounted Indicator

   b. Dimensions 2 1/2" x 7" x 8 1/2"

   c. Weight 4#

6. Location: Building: Control Area, Aux. Bldg.

   Elevation: 30'

7. Field Mounting Conditions [ ] Bolt (No.______, Size__________)
   [ ] Weld (Length______________)
   [X] Screwed on mounting plate

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

   S/S: 27, 34 F/B: >35 V: >35

9. a. Functional Description: Indication

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

   [X] Both ______

10. Pertinent Reference Design Specifications: 1370-ICE-0005 Sheet 151 Rev. 0, 168 Rev. 2, 179 Rev. 00, 169 Rev. 2, 347 Rev. 1, 348 Rev. 3, 414 Rev. 01, 413 Rev. 01, 421 Rev. 01

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

IV. Equipment Qualification Method: Test: X

Analysis: ____________

Combination of Test and Analysis: ________

Test and/or Analysis by Sigma Report SBI-3
Lab: Acton Laboratories Rpt. No. 11879
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ____________

5. [ ] Combination of ____________

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ____________
(Other, Specify)

2. Required Response Spectra (attach the graphs): No RRS for mounting.
Floor RRS attached

3. Required Acceleration in Each Direction: ____________

S/S = 3.0g input F/B = 3.0g input V = 3.0g input

VI. If Qualification by Test, then Complete: ____________

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

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

3. No. of Qualification Tests: OBE ________ SSE ________
Other Full level at each integer freq. from 1 to 35 HZ
(Specify)

4. Frequency Range: 1 to 35

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[X] No RRS or TRS

6. Input g-level Test at:

   S/S = 3.5 F/B = 3.5 V = 3.5

7. Laboratory Mounting: Simulated Normal Rack Mounting

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

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

9. Test Results including modifications made: See Attached Sheet

10. Other tests performed (such as fragility test, including results):

    NA

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

1. Description of Test including Results: NA

2. Method of Analysis:____________________

   [ ] Static Analysis [ ] Equivalent Static Analysis
   [ ] Dynamic Analysis [ ] Time-History
   [ ] Response Spectrum

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: ________ 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. Deflection	Location	Effect Upon Functional Operability

I. Test Results

NATURAL FREQUENCIES: VERTICAL None below 35 Hz SIDE / SIDE 27 34 Hz FRONT / BACK None below 35 Hz

ELECTRICAL OPERATION Maximum accuracy change of .65% of full scale

PHYSICAL INTEGRITY No mechanical damage or deterioration

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS

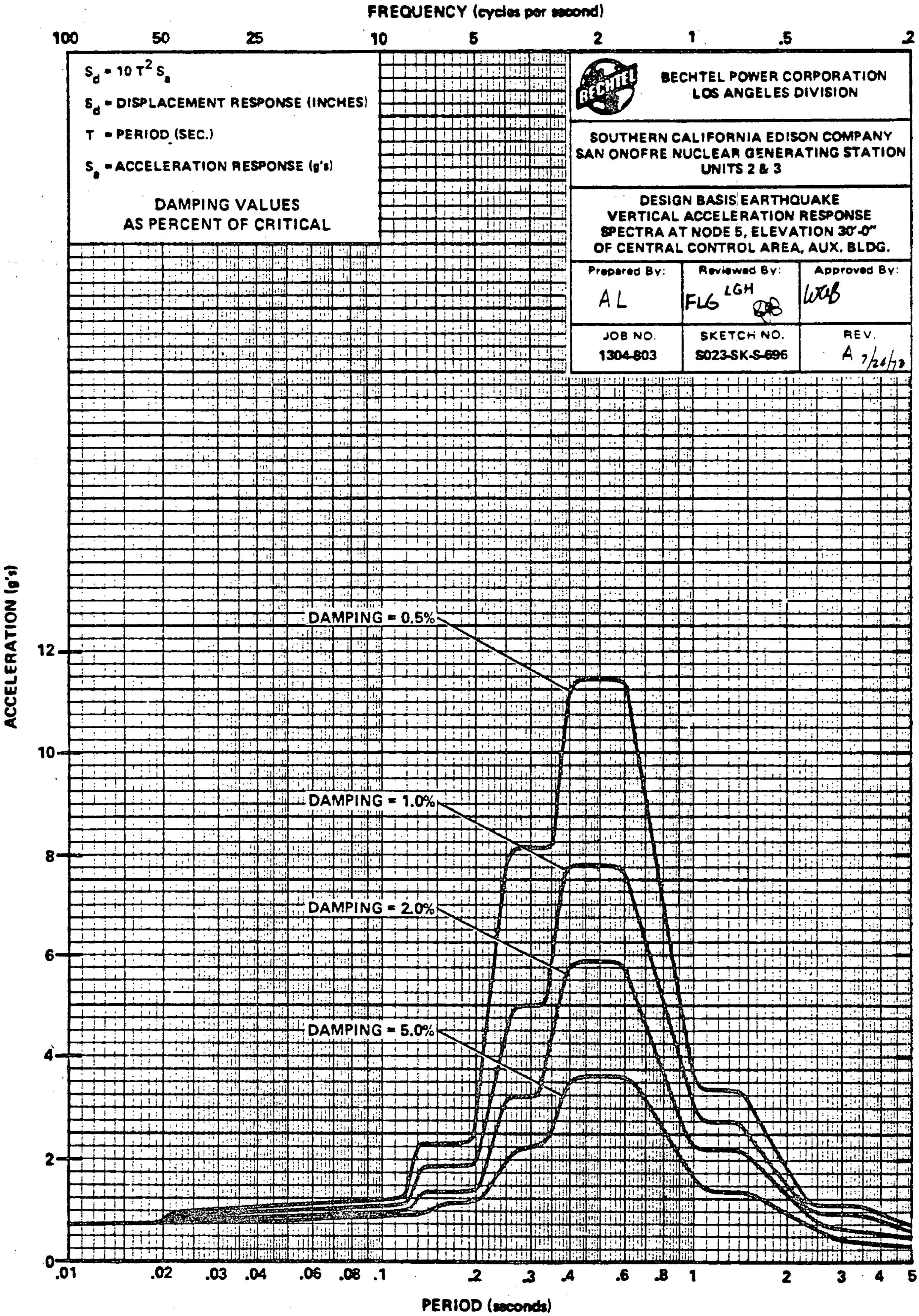
MAXIMUM EXTERIOR DEFLECTION

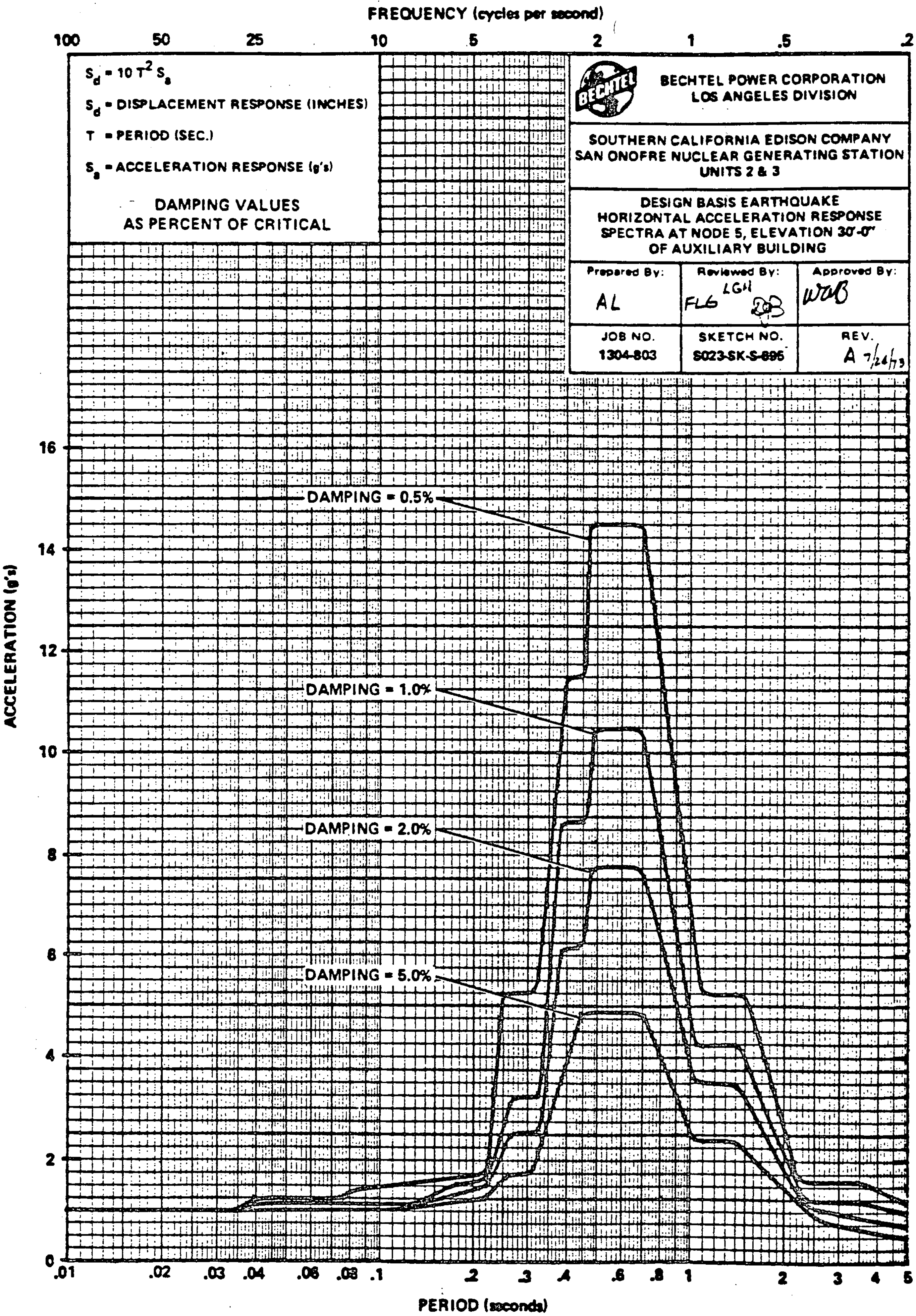
DYNAMIC LOAD TO MOUNTING

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES

VI. DISCUSSION

Commercial steel screws were found to be bending during testing so hardened steel mounting screws were substituted and testing was completed. The hardened mounting screws are new standard mounting hardware.


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA AT NODE 5, ELEVATION 30'-0"
OF CENTRAL CONTROL AREA, AUX. BLDG.
Prepared By:
AL
Reviewed By:
FLG LGH
Approved By:
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-696
REV.
A 7/26/73
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
12
10
8
6
4
2
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA AT NODE 5, ELEVATION 30'-0"
OF AUXILIARY BUILDING
Prepared By: AL
Reviewed By: FLG LGH
Approved By: WAB
JOB NO. 1304-803
SKETCH NO. S023-SK-S-895
REV. A 7/26/73
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
16
14
12
10
8
6
4
2
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR

II. Component Name: Indicating Controller

1. Scope: [X] NSSS [ ] BOP
2. Model Number: 250 — Quantity: 2
3. Vendor: Foxboro 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 Module for Shelf Mounting
   b. Dimensions 1.89" x 8.56 x 3.6"
   c. Weight 3#
6. Location: Building: Control Area, Aux Bldg.
   Elevation: 30'
7. Field Mounting Conditions [ ] Bolt (No._______, Size____________)
   [ ] Weld (Length_______________________)
   [X] In shelves, clamped in both sides
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
   S/S:__________________ F/B:__________________
   V:____________________________________
9. a. Functional Description: Indication and control of input and setpoint
   b. Is the equipment required for [X] Hot Standby [X] Cold Shutdown
   [ ] Both________________
10. Pertinent Reference Design Specifications: 00000-ICE-005, 1370-ICE-005 Rev. 1 Sheet 346 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: ______

Test and/or Analysis by Equipment not tested yet
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [ ] Combination of ______

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ______
(Other, Specify)

2. Required Response Spectra (attach the graphs): No RRS for panel; floor response attached

3. Required Acceleration in Each Direction: ______

S/S = 3.0 F/B = 3.0 V = 3.0

VI. If Qualification by Test, then Complete: ______

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. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[ ] No

______

6. Input g-level Test at:

S/S = ______________________________
F/B = ______________________________
V = ______________________________

7. Laboratory Mounting: ______________________________

1. [ ] Bolt (No._______, Size_______) [ ] Weld (Length______________)
[ ] ______________________________

8. Functional operability verified: [✓] Yes [ ] No [ ] Not Applicable

9. Test Results including modifications made: ______________________________

10. Other tests performed (such as fragility test, including results):

____

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 [ ] Equivalent Static Analysis
[ ] Dynamic Analysis [ ] Time-History
[ ] Response Spectrum

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)

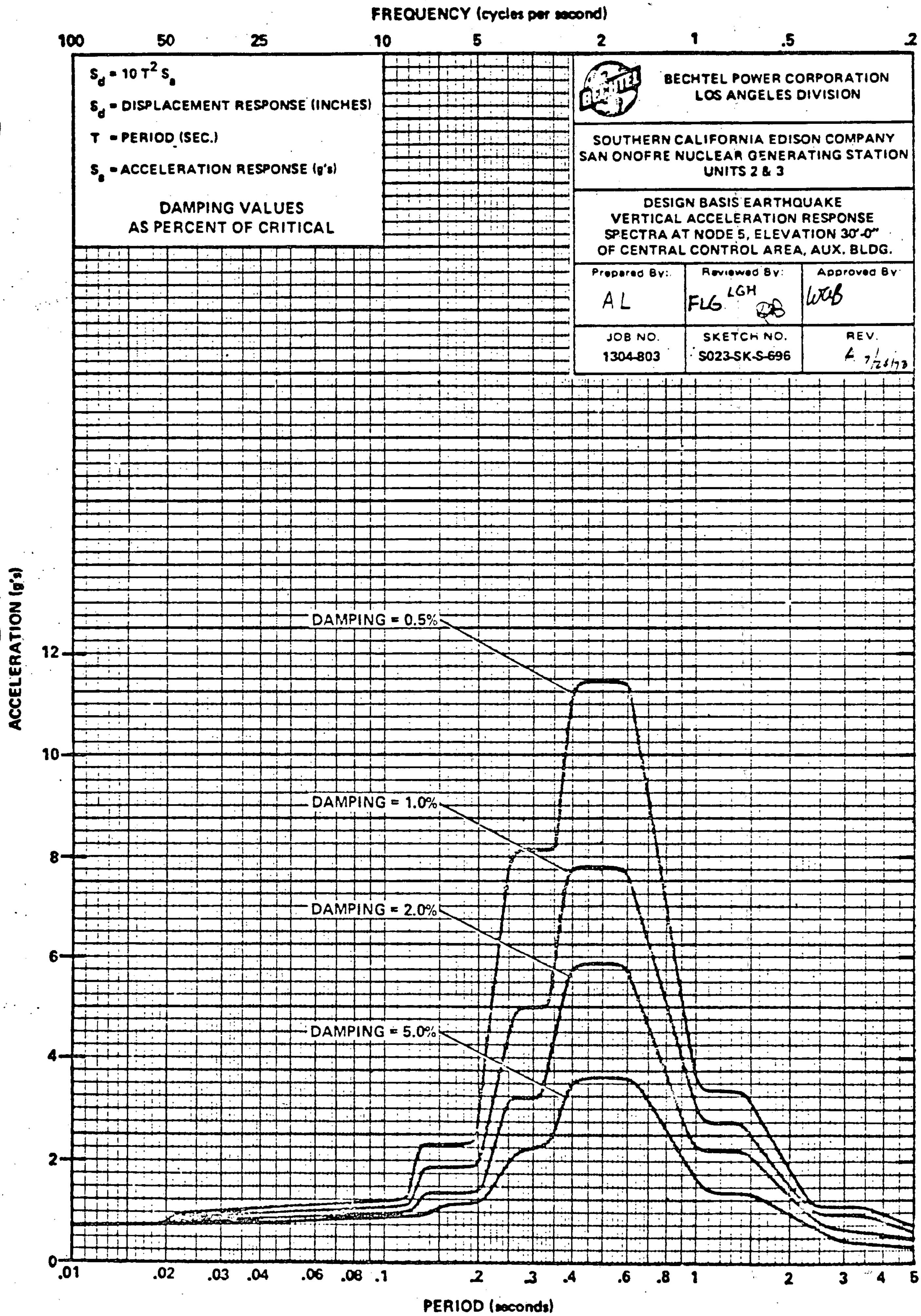
6. Damping: __________ Basis for the damping used: ______________________________

7. Support Considerations in the model: ______________________________

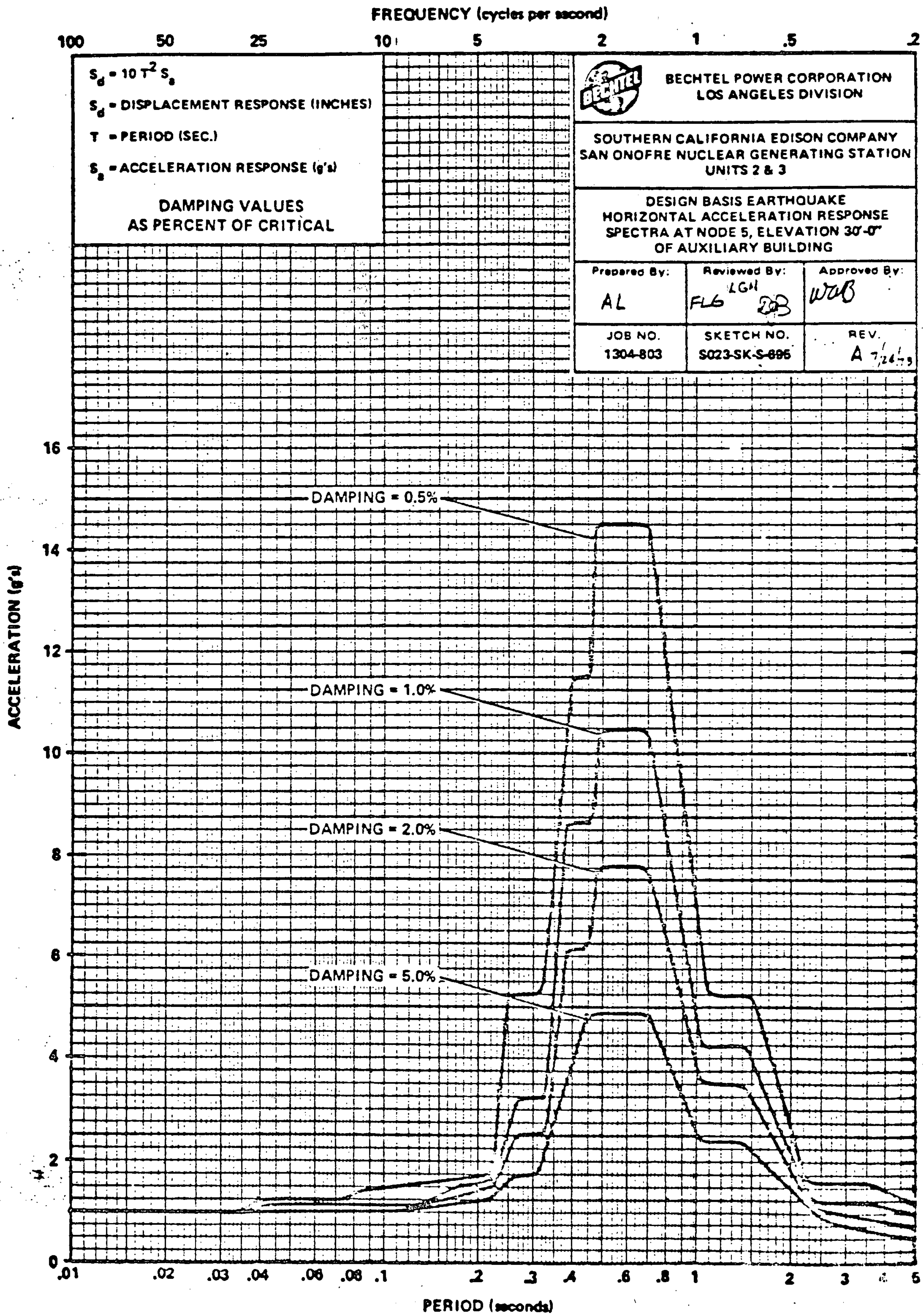
8. Critical Structural Elements: ______________________________

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

B.	Max. Deflection	Location	Effect Upon Functional Operability



FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA AT NODE 5, ELEVATION 30'-0"
OF CENTRAL CONTROL AREA, AUX. BLDG.
Prepared By:
A L
Reviewed By:
FLG LGH
Approved By:
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-696
REV.
4 7/28/78
ACCELERATION (g's)
12
10
8
6
4
2
0
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)



FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA AT NODE 5, ELEVATION 30'-0"
OF AUXILIARY BUILDING
Prepared By:
AL
Reviewed By:
FLG LGH
Approved By:
WAB
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-695
REV.
A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
0
2
4
6
8
10
12
14
16
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 Type:

1. Utility: Southern California Edison Company PWR X
2. NSSS: CE 3. A/E: Bechtel BWR

II. Component Name: Recorder

1. Scope: [X] NSSS [ ] BOP
2. Model Number: 226 Quantity: 3
3. Vendor: Foxboro
4. If the component is a cabinet or panel, name and model No. of the devices included: NA
5. Physical Description a. Appearance Nested Module for Rack Mounting

   b. Dimensions 8 1/8" x 26" x 3"

   c. Weight 5#
6. Location: Building: Control Area, Aux. Bldg.

   Elevation: 30'
7. Field Mounting Conditions [ ] Bolt (No.______, Size________)
   [ ] Weld (Length________)
   [X] In shelves, clamped in both sides
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S: * F/B: *
   V: *
   *No Resonance Survey Conducted
9. a. Functional Description: Records value of input process variable on strip chart

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

   [X] Both
10. Pertinent Reference Design Specifications: 1370-ICE-0005 Sheet 173 Rev. 5, 328 Rev. 6, 420 Rev. 3

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

IV. Equipment Qualification Method: Test: X

Analysis:

Combination of Test and Analysis:

Test and/or Analysis by Foxboro, Report T6-6015
Lab - Acton Laboratories Rpt. No. 12447
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify)

5. [ ] Combination of

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ]
(Other, Specify)

2. Required Response Spectra (attach the graphs): No RRS for mounting location. Floor RRS attached.

3. Required Acceleration in Each Direction:

S/S = 3.0g input F/B = 3.0g input V = 3.0g input

VI. If Qualification by Test, then Complete:

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

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

3. No. of Qualification Tests: OBE SSE
Other Full level at each integer freq. from 1 to 35 HZ
(Specify)

4. Frequency Range: 1 to 35 HZ

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[X] No TRS or RRS

6. Input g-level Test at:

   S/S = 3 F/B = 3 V = 3

7. Laboratory Mounting: Standard shelf hardware (to simulate field insulation)

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

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

    NA

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 [ ] Equivalent Static Analysis
   [ ] Dynamic Analysis [ ] Time-History
   [ ] Response Spectrum

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: __________ 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. Deflection	Location	Effect Upon Functional Operability

I. Test Results

NATURAL FREQUENCIES: VERTICAL ______ SIDE / SIDE ______ FRONT / BACK ______

ELECTRICAL OPERATION Maximum calibration shift of 0.4% full scale, except for 2 failures whose corrections are noted in Discussion.

PHYSICAL INTEGRITY Intact; no physical anomalies other than those noted below as electrical anomalies

DYNAMIC RESPONSE TO FULL-LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS ______

MAXIMUM EXTERIOR DEFLECTION ______

DYNAMIC LOAD TO MOUNTING ______

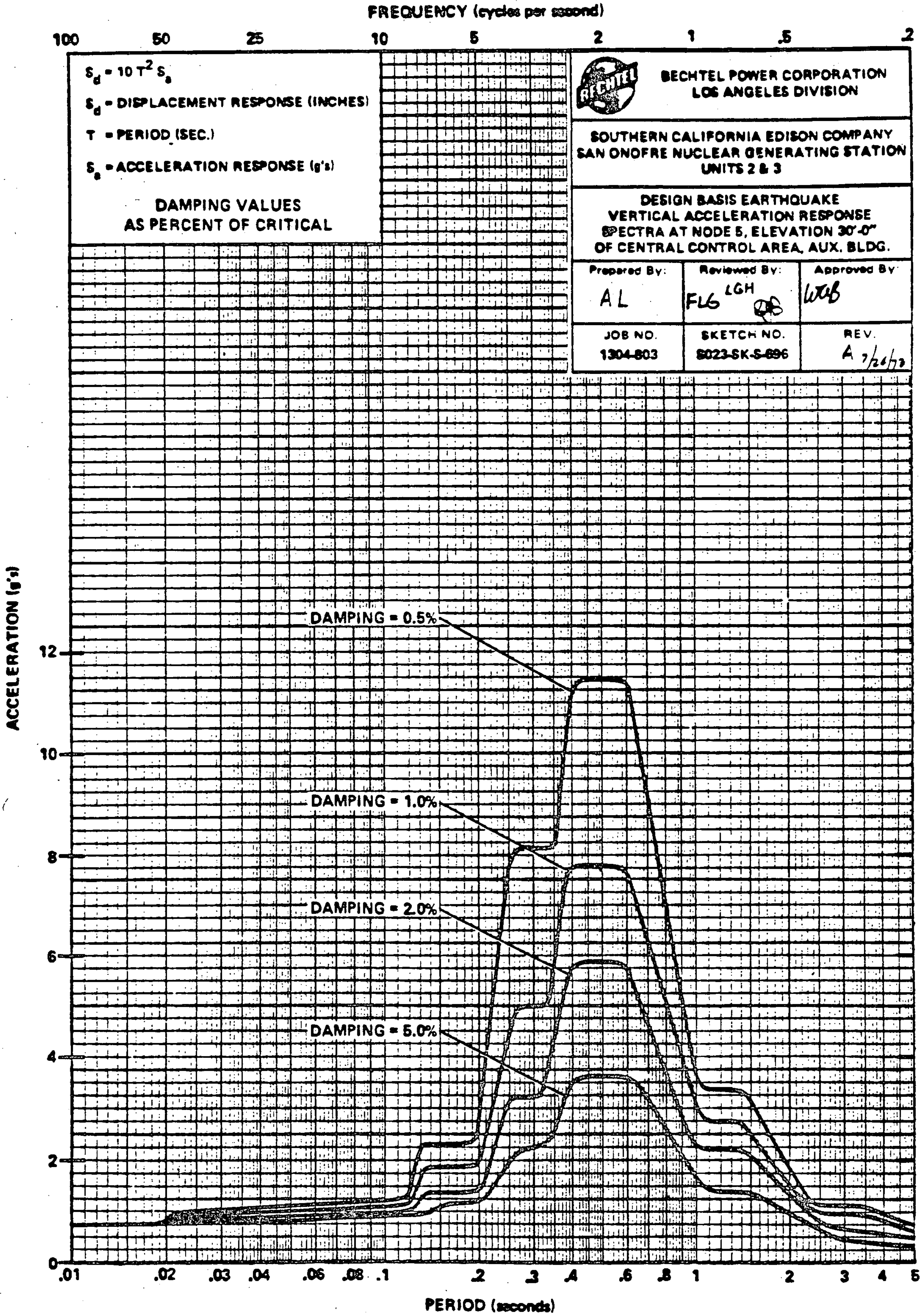
MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES ______

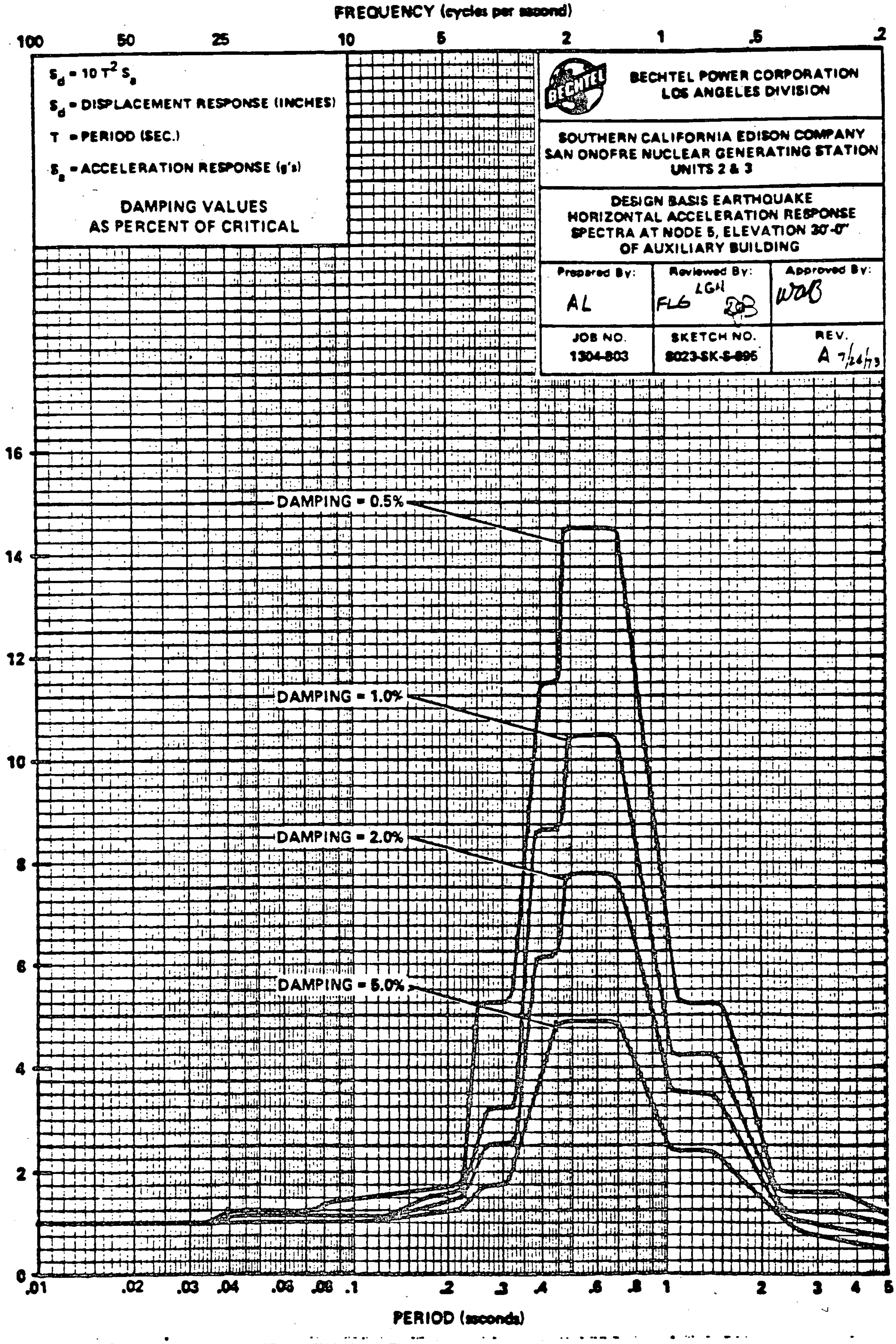
VI. DISCUSSION

1) A wire on a printed circuit board broke at the solder joint. This break caused a pen to read incorrectly. The board was redesigned to incorporate this and other similar (loose) wires as part of the printed circuit thus eliminating loose wiring on the PC board.

2) The drive belt of one of the pens slipped off the idler wheel cause the pen to read incorrectly. The shoulder of the idler wheel was enlarged to prevent reoccurrence of this problem.

9,


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA AT NODE 5, ELEVATION 30'-0"
OF CENTRAL CONTROL AREA, AUX. BLDG.
Prepared By:
AL
Reviewed By:
FLG LGH
Approved By:
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-696
REV.
A 7/26/77
ACCELERATION (g's)
12
10
8
6
4
2
0
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA AT NODE 5, ELEVATION 30'-0"
OF AUXILIARY BUILDING
Prepared By:
AL
Reviewed By:
FLG LGH
Approved By:
WAB
JOB NO.
1304-803
SKETCH NO.
8023-SK-S-895
REV.
A 7/26/73
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
16
14
12
10
8
6
4
2
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 Type:

1. Utility: Southern California Edison Company PWR X

2. NSSS: CE 3. A/E: Bechtel BWR

II. Component Name: Temperature Sensor (RTD)

1. Scope: [X] NSSS [ ] BOP

2. Model Number: 104A Quantity: 2

3. Vendor: Rosemount

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

5. Physical Description a. Appearance Narrow well RTD

   b. Dimensions 22" x 1/2", 5-1/2" Diam. head

   c. Weight 10#

6. Location: Building: Safety Equipment Building

   Elevation: -15'-6"

7. Field Mounting Conditions [ ] Bolt (No.______, Size______)
   [ ] Weld (Length______)
   [X] Install in well

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

   S/S: 20, 25, 33, 44 F/B: 20, 25, 33, 44
   V: No resonance survey conducted in the axial direction of the RTD

9. a. Functional Description: Convert temperature to electrical signal

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

   [X] Both

10. Pertinent Reference Design Specifications: 1370-ICE-0005 Sheet 337 Revision 3

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

IV. Equipment Qualification Method: Test: X

Analysis: ____

Combination of Test and Analysis: ____

Test and/or Analysis by Rosemount, 273020, Revision A
MTS Laboratory, Report #73
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

   3. [ ] Explosive only 4. [ ] Other (Specify) ____

   5. [ ] Combination of ____

   6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
   [ ] ____
   (Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ____

   S/S = 0.8g input F/B = 0.8g input V = 0.5g input

VI. If Qualification by Test, then Complete: ____

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

2. [ ] Single Axis [X] Multi-Axis (Bi-Axial)

3. No. of Qualification Tests: OBE ____ SSE ____
   Other Full level dwell at 20, 25, 33, 44 Hz
   (Specify)

4. Frequency Range: 1 to 100 Hz

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
   [X] No TRS

6. Input g-level Test at:

S/S = 3.6
F/B = 3.6
V = 3.0

7. Laboratory Mounting: See test results, VI below

1. [X] Bolt (No. 4, Size 3/8-24) [ ] Weld (Length)
[X] Sensor secured with gripper assembly at center to simulate in-service deep well mounting

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

N/A

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
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: ______ 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. Deflection	Location	Effect Upon Functional Operability

NSSS 12-1

II. Test Results

NATURAL FREQUENCIES VERTICAL	See discussion
SIDE / SIDE	20, 25, 33, 44 Hz
FRONT BACK	20, 25, 33, 44 Hz
ELECTRICAL OPERATION	No change in output; no shift in calibration
PHYSICAL INTEGRITY	Intact; no physical effects

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS

MAXIMUM EXTERIOR DEFLECTION

DYNAMIC LOAD TO MOUNTING

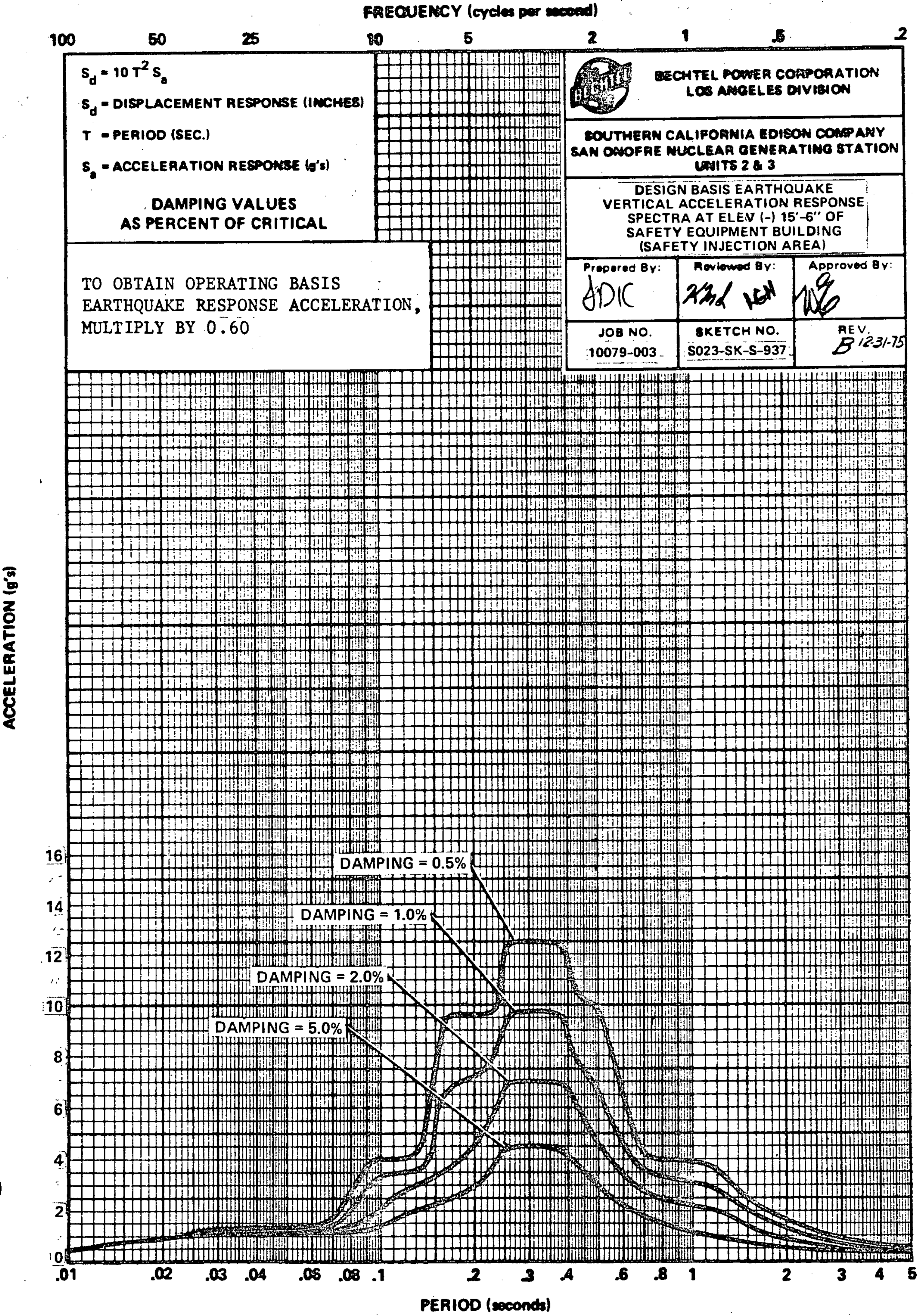
MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES

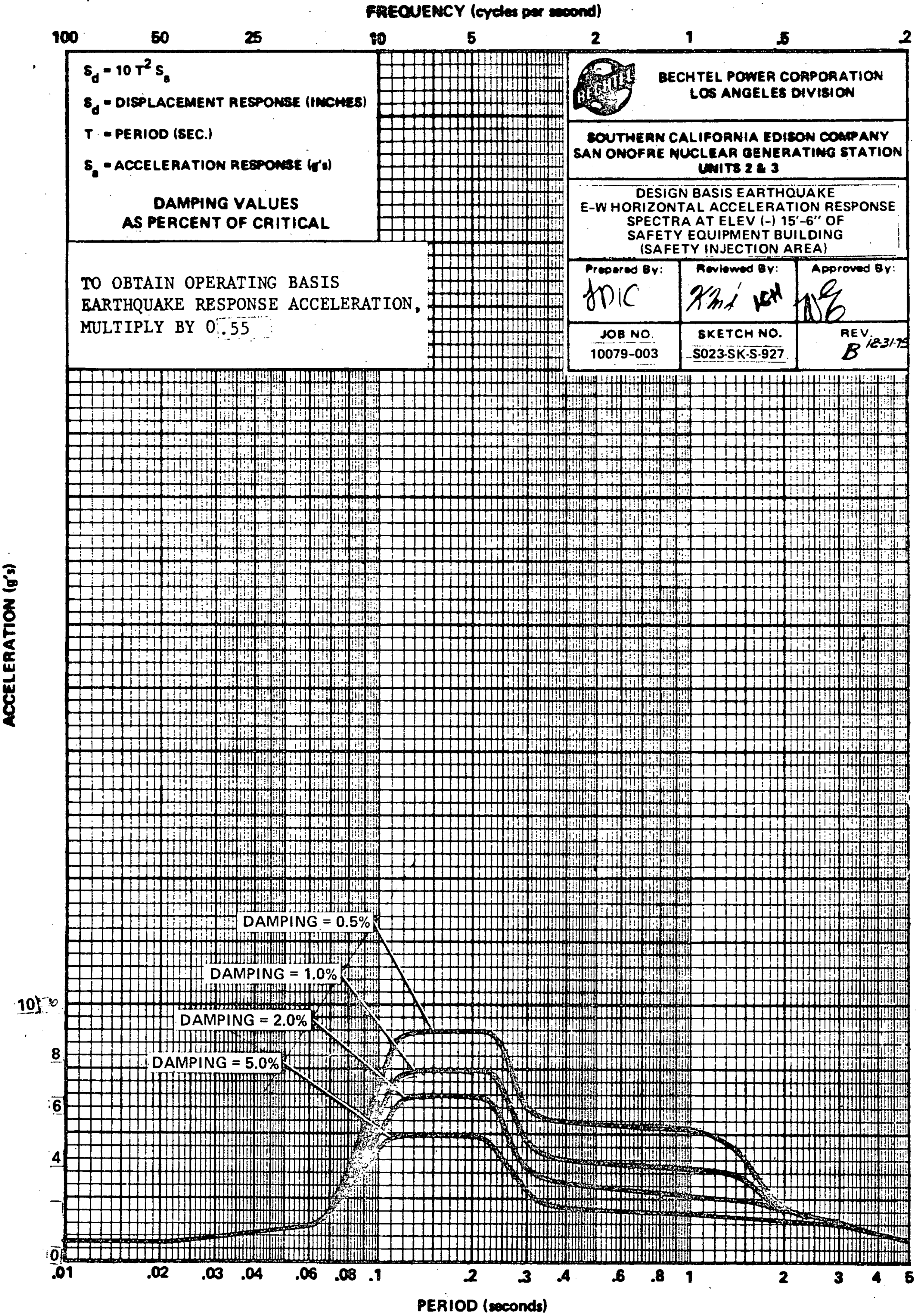
VI. DISCUSSION

1. This sensor is used in deepwell applications. To simulate this, the sensor was fixed into a rigid pipe which was attached to the shaker. The head of the sensor is massive with respect to the rest of the sensor, and is located at one end of the instrument, and was located about 12 inches from the point of attachment to the shaker. The sensor is a symmetrical beam and was tested only in the direction perpendicular to the major axis.

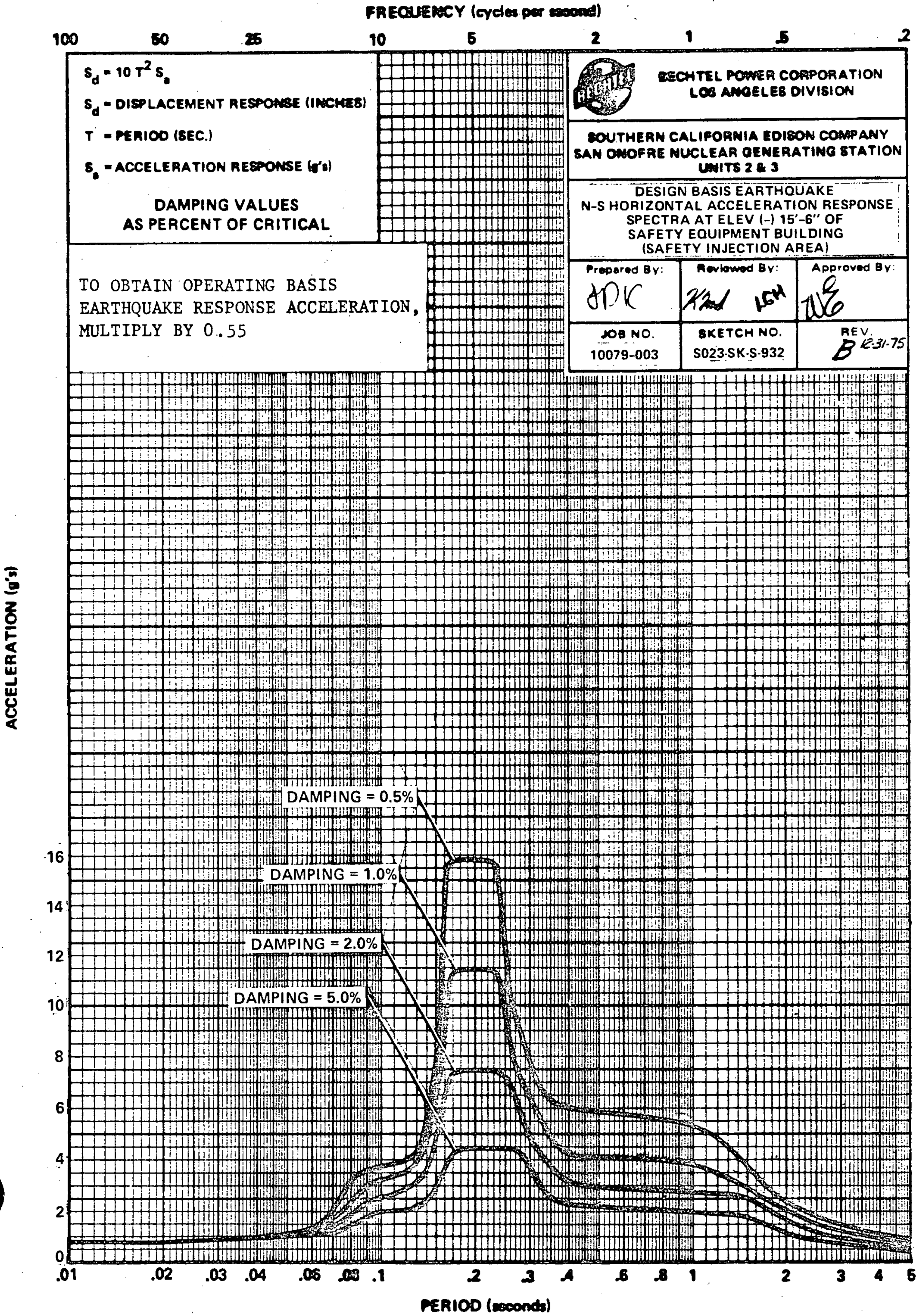
2. The RTD was checked at temperatures of 32°F, 212°F, 515°F, and 615°F, before and after testing. During the seismic test the resistance was monitored to detect sudden resistance changes or failures.

   The RTD accuracy was found to be within the manufacturer's normal tolerances after the test. No failures or other disturbances were detected during the test.


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES AS PERCENT OF CRITICAL
TO OBTAIN OPERATING BASIS EARTHQUAKE RESPONSE ACCELERATION, MULTIPLY BY 0.60
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA AT ELEV (-) 15'-6" OF
SAFETY EQUIPMENT BUILDING
(SAFETY INJECTION AREA)
Prepared By:
Reviewed By:
Approved By:
JOB NO.
10079-003
SKETCH NO.
S023-SK-S-937
REV.
B 12-31-75
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
16
14
12
10
8
6
4
2
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)



FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
TO OBTAIN OPERATING BASIS
EARTHQUAKE RESPONSE ACCELERATION,
MULTIPLY BY 0.55
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
E-W HORIZONTAL ACCELERATION RESPONSE
SPECTRA AT ELEV (-) 15'-6" OF
SAFETY EQUIPMENT BUILDING
(SAFETY INJECTION AREA)
Prepared By:
Reviewed By:
Approved By:
JOB NO.
10079-003
SKETCH NO.
S023-SK-S-927
REV.
B 12-31-75
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
10
8
6
4
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
TO OBTAIN OPERATING BASIS
EARTHQUAKE RESPONSE ACCELERATION,
MULTIPLY BY 0.55
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
N-S HORIZONTAL ACCELERATION RESPONSE
SPECTRA AT ELEV (-) 15'-6" OF
SAFETY EQUIPMENT BUILDING
(SAFETY INJECTION AREA)
Prepared By:
Reviewed By:
Approved By:
JOB NO.
10079-003
SKETCH NO.
S023-SK-S-932
REV.
B 12-31-75
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
16
14
12
10
8
6
4
2
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR ______

II. Component Name: Temperature Sensor (RTD)

1. Scope: [X] NSSS [ ] BOP
2. Model Number: 104AFC — Quantity: 22
3. Vendor: Rosemount
4. If the component is a cabinet or panel, name and model No. of the devices included: N/A
5. Physical Description a. Appearance Narrow RTD
   b. Dimensions 22" x 1/2" Diam., 5-1/2" Diam. Head
   c. Weight ≅10#
6. Location: Building: Containment Building
   Elevation: 80'-6"
7. Field Mounting Conditions [ ] Bolt (No.______, Size__________)
   [ ] Weld (Length______________)
   [X] Installed in well
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
   S/S: 20, 25, 33, 44 — F/B: 20, 25, 33, 44
   V: No resonance survey conducted in the axial direction of the RTD.
9. a. Functional Description: Convert temperature to electrical signal
   b. Is the equipment required for [X] Hot Standby [ ] Cold Shutdown
   [ ] Both______
10. Pertinent Reference Design Specifications: 1370-ICE-0005 Sheet 163 Revision 4

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

IV. Equipment Qualification Method: Test: X - Model 104A

Analysis: X - Similiarity analysis

Combination of Test and Analysis: ________

Test and/or Analysis by Rosemount 27320A, 77522A
MTS Laboratory, Report No. 73
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ________

5. [ ] Combination of ________

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ________
(Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ________

S/S = 1.0g input F/B = 1.0g input V = 1.0g input

VI. If Qualification by Test, then Complete: ________

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

2. [ ] Single Axis [X] Multi-Axis (Bi-Axial)

3. No. of Qualification Tests: OBE ________ SSE ________
Other Full level dwell at 20, 25, 33, 44 Hz.
(Specify)

4. Frequency Range: 1 to 100 Hz

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[X] No TRS

6. Input g-level Test at:
   S/S = 3.6
   F/B = 3.6
   V = 3.0

7. Laboratory Mounting: ______

   1. [X] Bolt (No. 4 , Size 3/8-24) [ ] Weld (Length ______)
      [X] Sensor gripped at center, simulating in-service deepwell mounting.

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

    N/A

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
   [ ] Dynamic Analysis
   [ ] Equivalent Static Analysis
   [ ] Time-History
   [ ] Response Spectrum

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: ______ 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. Deflection	Location	Effect Upon Functional Operability

NSSS 12-2

VI Test Results

NATURAL FREQUENCIES VERTICAL	See discussion
SIDE / SIDE	20, 25, 33, 44 Hz
FRONT / BACK	20, 25, 33, 44 Hz
ELECTRICAL OPERATION	No change in output; no shift in calibration
PHYSICAL INTEGRITY	Intact; no physical effects

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS

MAXIMUM EXTERIOR DEFLECTION

DYNAMIC LOAD TO MOUNTING

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES

VI. DISCUSSION

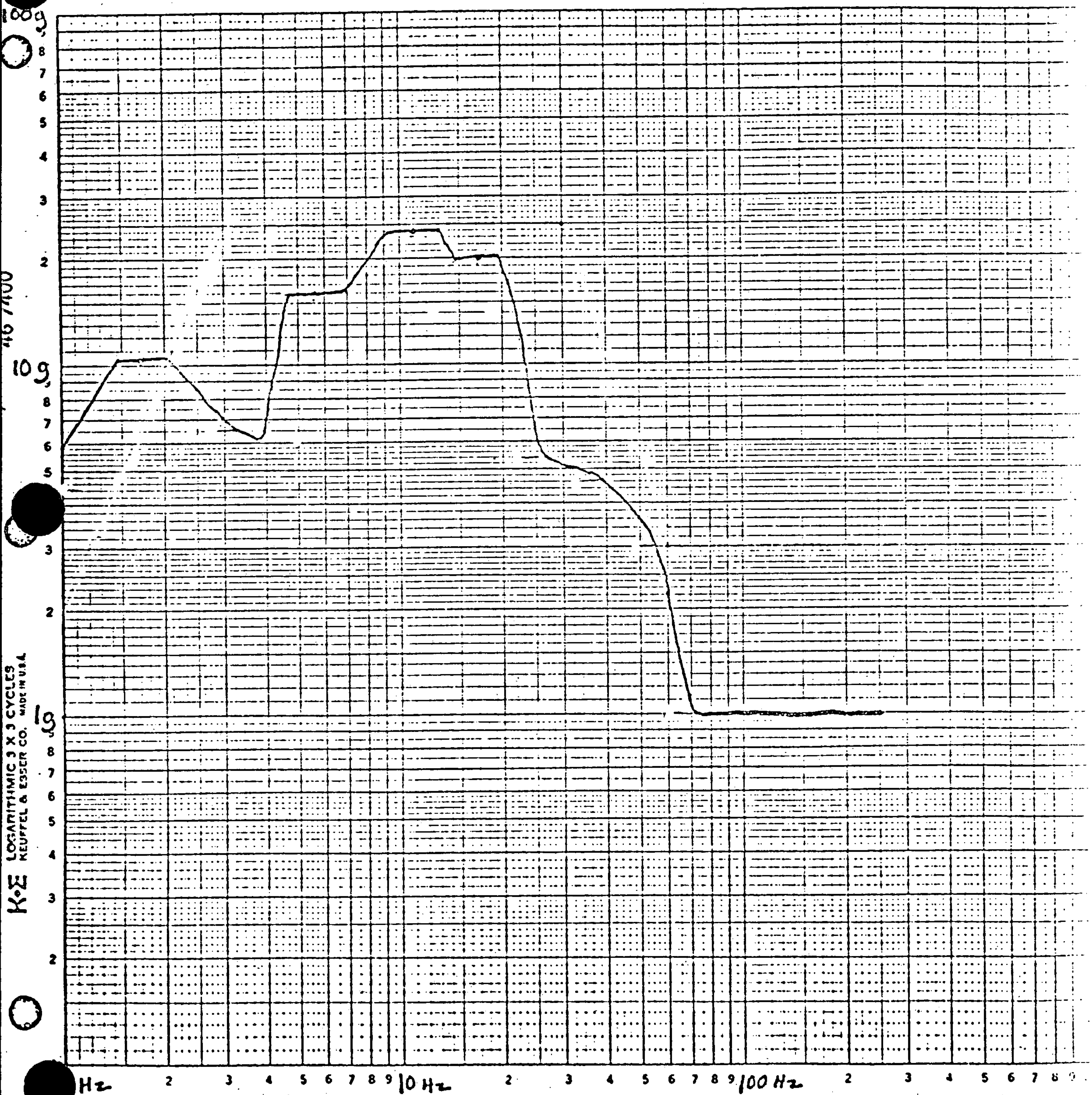
1. This sensor is used in deepwell applications. To simulate this, the sensor was fixed into a rigid pipe which was attached to the shaker. The head of the sensor is massive with respect to the rest of the sensor, and is located at one end of the instrument, and was located about 12 inches from the point of attachment to the shaker. The sensor is a symmetrical beam and was tested only in the direction perpendicular to the major axis.

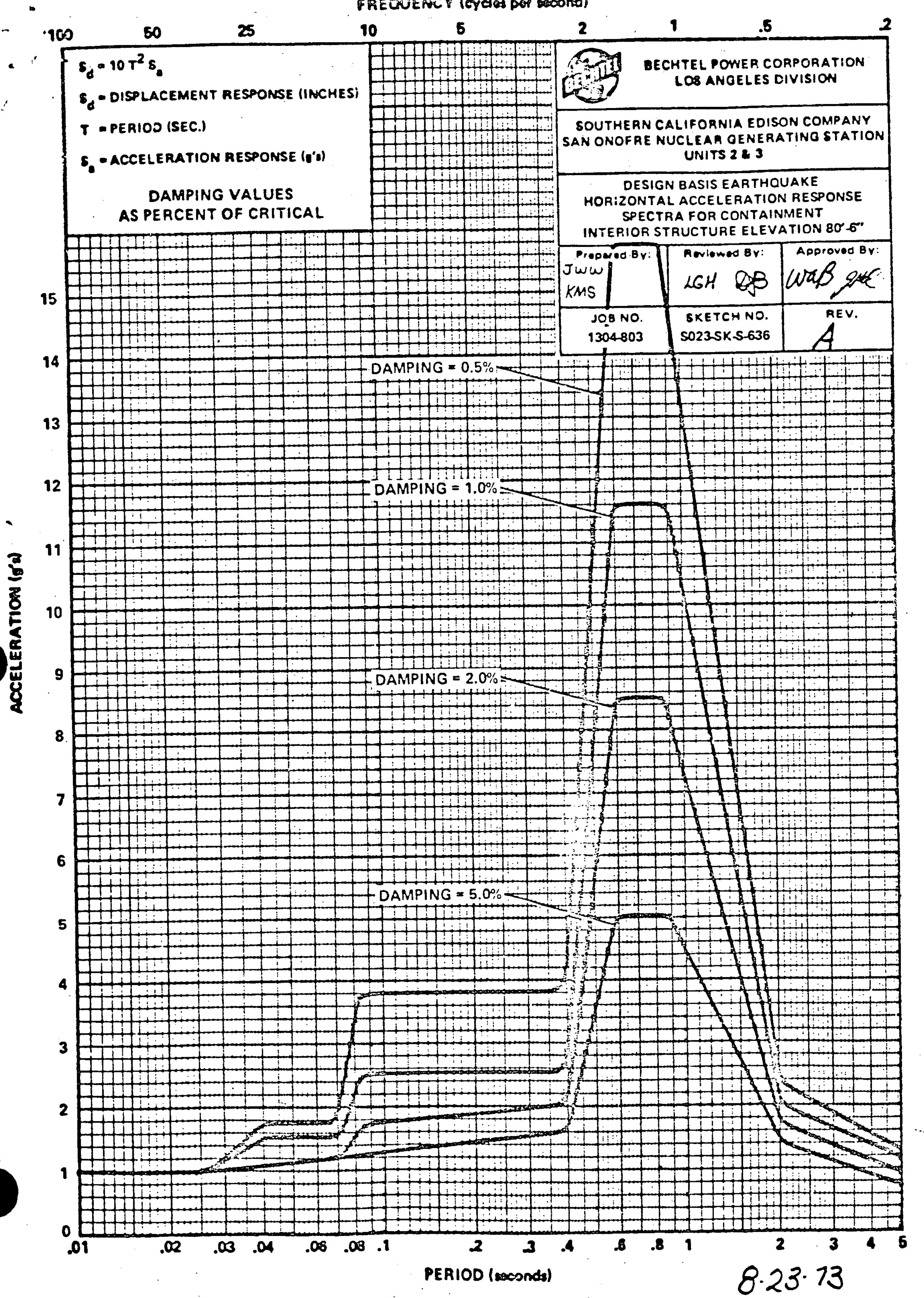
2. The RTD was checked at temperatures of 32°F, 212°F, 515°F, and 615°F, before and after testing. During the seismic test the resistance was monitored to detect sudden resistance changes or failures.

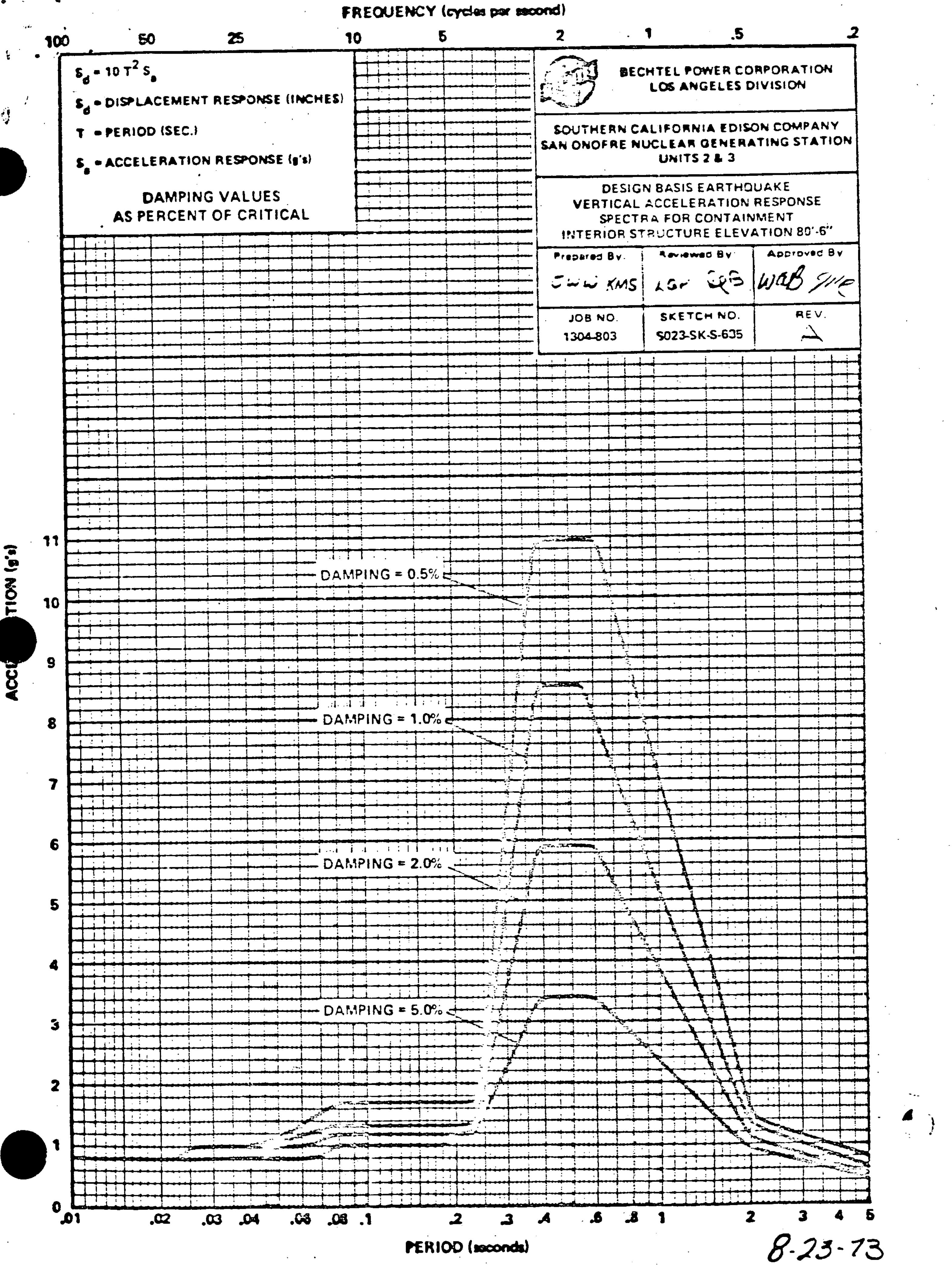
   The RTD accuracy was found to be within the manufacturer's normal tolerances after the test. No failures or other disturbances were detected during the test.

Required Response Spectrum
for RTDs attached to hot
and cold leg main coolant
piping.

SSE - 1%β - Horizontal & Vertical




FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA FOR CONTAINMENT
INTERIOR STRUCTURE ELEVATION 80'-6"
Prepared By: JWW KMS
Reviewed By: LGH
Approved By:
JOB NO. 1304-803
SKETCH NO. S023-SK-S-636
REV. A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)
8-23-73


FREQUENCY (cycles per second)
100 50 25 10 5 2 1 .5 .2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA FOR CONTAINMENT
INTERIOR STRUCTURE ELEVATION 80'-6"
Prepared By
JWW KMS
Reviewed By
LGr
Approved By
WAB
JOB NO.
1304-803
SKETCH NO.
SO23-SK-S-635
REV.
ACCELERATION (g's)
0 1 2 3 4 5 6 7 8 9 10 11
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
.01 .02 .03 .04 .06 .08 .1 .2 .3 .4 .6 .8 1 2 3 4 5
PERIOD (seconds)
8-23-73

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 Type:

1. Utility: Southern California Edison Company PWR X

2. NSSS: CE 3. A/E: Bechtel BWR

II. Component Name: Pressure Transmitter

1. Scope: [X] NSSS [ ] BOP

2. Model Number: E11GM Quantity: 26

3. Vendor: Foxboro

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

5. Physical Description a. Appearance Separately Mounted Module

b. Dimensions 11 1/3" x 6 7/8"

c. Weight 20#

6. Location: Building: Radwaste Area Aux. Bldg.

Elevation: 24'

7. Field Mounting Conditions [X] Bolt (No. 2, Size 3/8"-24)
[ ] Weld (Length)
[ ]

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

S/S: See VI.9 below F/B:
V:

9. a. Functional Description: Transmit outsignals proportional to input pressure

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

[X] Both

10. Pertinent Reference Design Specifications: 1370-ICE-0005 Sheet 123 Rev. 2, 128 Rev. 4, 176 Rev. 2, 338 Rev. 0, 353 Rev. 1, 354 Rev. 2, 418 Rev. 2

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

IV. Equipment Qualification Method: Test: X

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Foxboro; T3-1091
Lab - Acton Laboratories Rpt. No. 10486
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [ ] Combination of ______

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ______
(Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ______

S/S = 1.0g input F/B = 1.0g input V = 0.80g input

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 ______
Other Full level at each integer freq from 1 to 35 HZ
(Specify)

4. Frequency Range: 1 to 35 HZ

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[X] No TRS

6. Input g-level Test at:

S/S = 3.5
F/B = 3.5
V = 3.5

7. Laboratory Mounting: ______

1. [X] Bolt (No. 2, Size 10-32) [ ] Weld (Length ______)
[ ] ______

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

NA

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

1. Description of Test including Results: NA

2. Method of Analysis: ______

[ ] Static Analysis
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: ______ 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. Deflection	Location	Effect Upon Functional Operability

II. Test Results

NATURAL FREQUENCIES VERTICAL See discussion SIDE / SIDE ______ FRONT / BACK ______

ELECTRICAL OPERATION Electrical output oscillations at all frequencies. Maximum DC level Shift - 3.2%. Maximum oscillation amplitude - + 9%

PHYSICAL INTEGRITY No significant mechanical resonance; no loosening or damage

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS ______

MAXIMUM EXTERIOR DEFLECTION ______

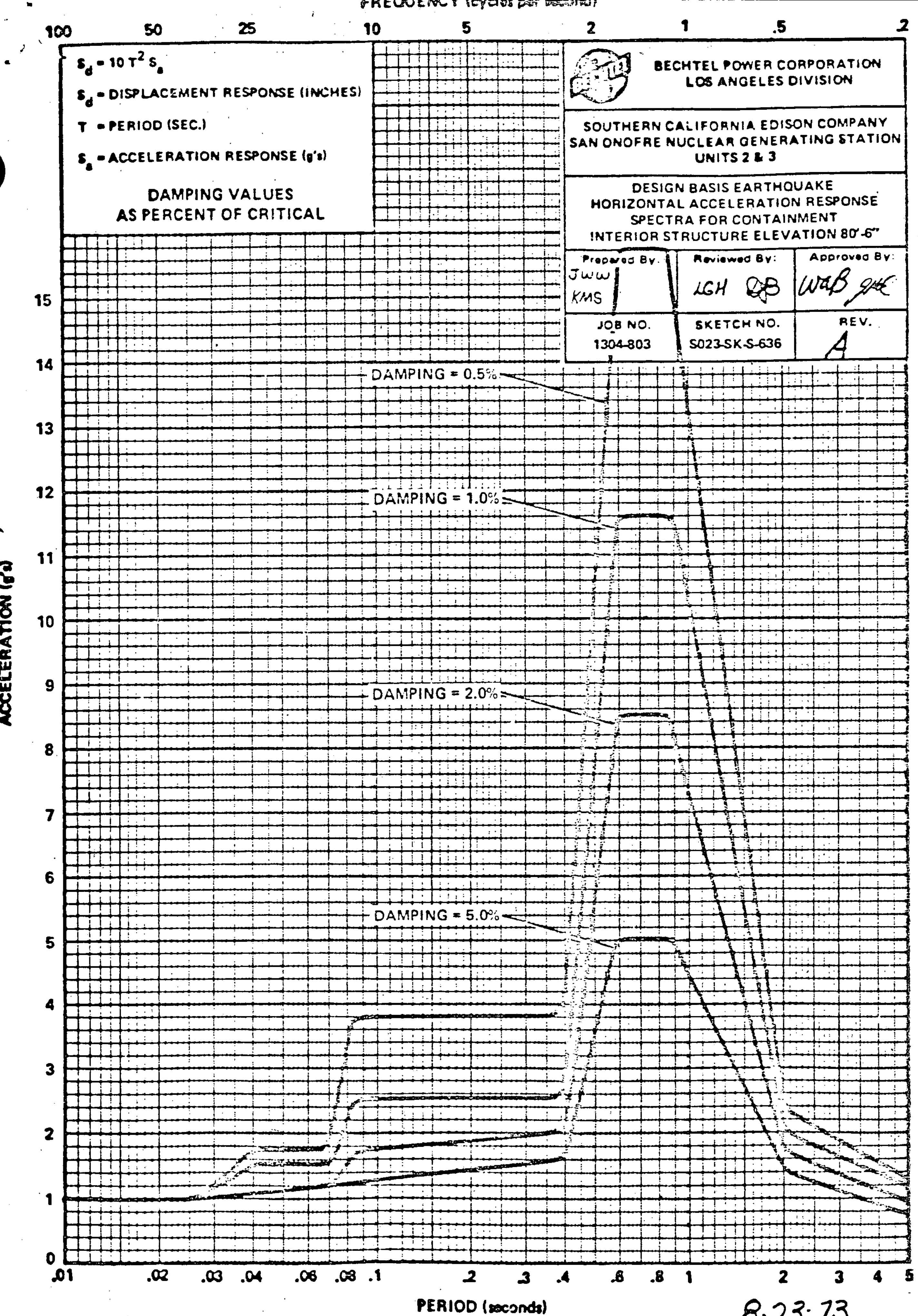
DYNAMIC LOAD TO MOUNTING ______

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES ______

VI. DISCUSSION

The transmitter was tested in same manner (sine-beat) to 10.0 gs with no effects other than larger output signal oscillations. Following testing the transmitter was hydro tested to maximum overrange pressure rating without any leakage.

Resonance, exhibited as oscillations of the electrical output, occurred at all frequencies from 1 to 35 Hz. No structural resonance of the transmitter occurred below 35 Hz.


100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA FOR CONTAINMENT
INTERIOR STRUCTURE ELEVATION 80'-6"
Prepared By: JWW KMS
Reviewed By: LGH
Approved By: WAB
JOB NO. 1304-803
SKETCH NO. S023-SK-S-636
REV. A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
.01
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.6
.8
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4
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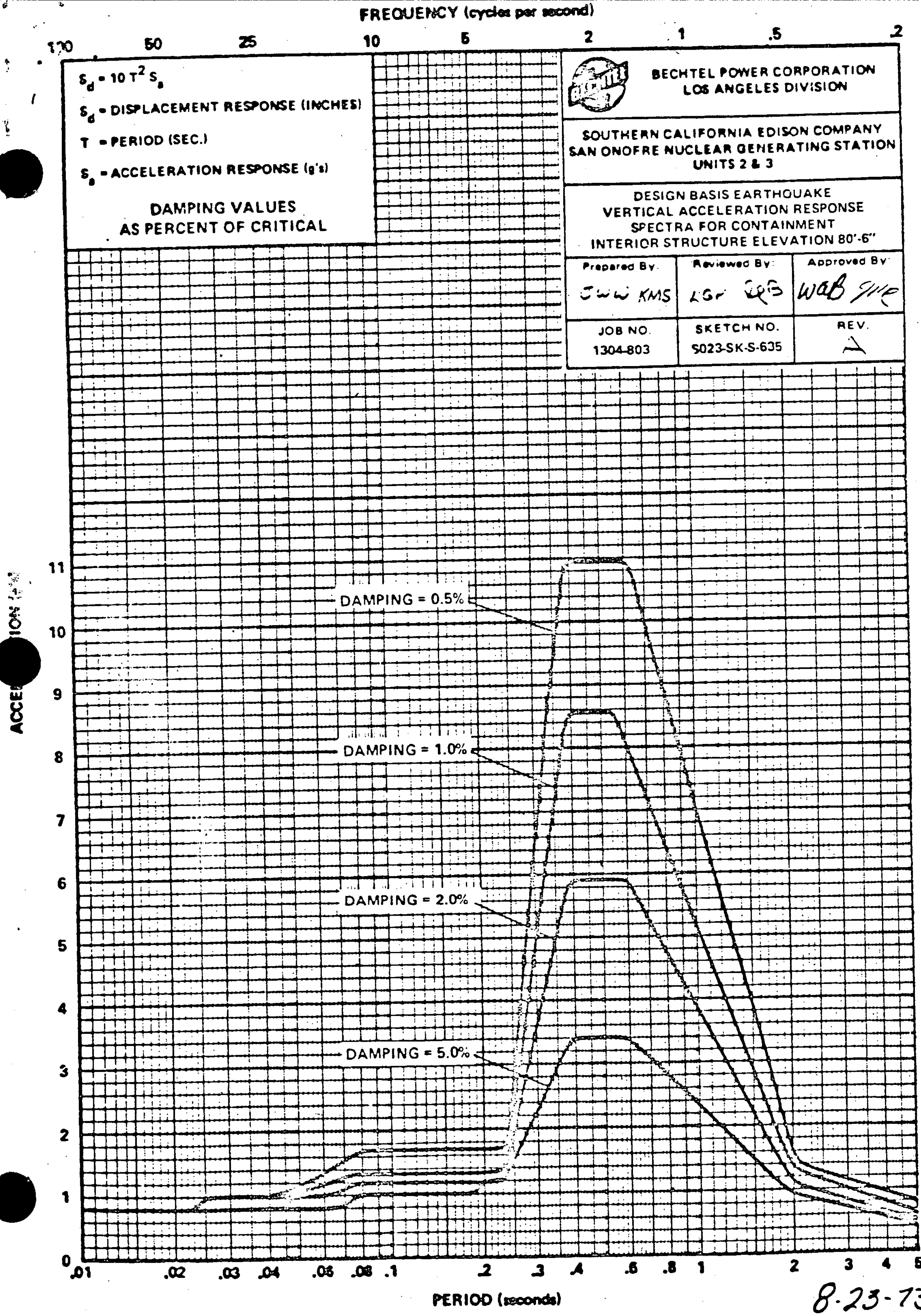
PERIOD (seconds)

8-23-73


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA FOR CONTAINMENT
INTERIOR STRUCTURE ELEVATION 80'-6"
Prepared By: JWW KMS
Reviewed By: LGF
Approved By: WAB
JOB NO.
1304-803
SKETCH NO.
SO23-SK-S-635
REV.
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
0
1
2
3
4
5
6
7
8
9
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.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

8-23-73

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 Type:

1. Utility: Southern California Edison Company PWR X
2. NSSS: CE 3. A/E: Bechtel BWR ______

II. Component Name: Pressure Transmitter

1. Scope: [X] NSSS [ ] BOP
2. Model Number: 1153GP Quantity: 6
3. Vendor: Rosemount
4. If the component is a cabinet or panel, name and model No. of the devices included: NA
5. Physical Description a. Appearance Locally mounted transmitter
   b. Dimensions 9" x 4 1/2"
   c. Weight 21#
6. Location: Building: Containment Bldg.
   Elevation: 80-6'
7. Field Mounting Conditions [X] Bolt (No. 4 , Size 7/16")
   [ ] Weld (Length ______)
   [ ] ______
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
   S/S: >40 F/B: >40
   V: 40
9. a. Functional Description: Provide output signal proportional to input pressure
   b. Is the equipment required for [X] Hot Standby [ ] Cold Shutdown
   [ ] Both ______
10. Pertinent Reference Design Specifications: 1370-ICE-0005 Sheet 144 Rev. 3, Sheet 166 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: ____

Test and/or Analysis by Rosemount, 3788
Lab - Dayton T. Brown Laboratories
(Environ Engineer Rpt. No. 972B)
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

   3. [ ] Explosive only 4. [ ] Other (Specify) ____

   5. [ ] Combination of ____

   6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
   [ ] ____
   (Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ____

   S/S = 1.0g input F/B = 1.0g input V = 0.8g input

VI. If Qualification by Test, then Complete: ____

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

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

3. No. of Qualification Tests: OBE ____ SSE ____
   Other Full level at 10, 20, 30, 40 HZ
   (Specify)

4. Frequency Range: 1 to 33

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
   [X] No TRS

6. Input g-level Test at:

S/S = 3.5
F/B = 3.5
V = 3.5

7. Laboratory Mounting: ______

1. [X] Bolt (No. 4 ,Size 5/16"-18) [ ] Weld (Length ______)
Vendor provided bolts
[ ] ______

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

NA

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

1. Description of Test including Results: NA

2. Method of Analysis: ______

[ ] Static Analysis [ ] Equivalent Static Analysis
[ ] Dynamic Analysis [ ] Time-History
[ ] Response Spectrum

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: ______ 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. Deflection	Location	Effect Upon Functional Operability

VI Test Results

NATURAL FREQUENCIES: VERTICAL 40 Hz SIDE / SIDE FRONT / BACK

ELECTRICAL OPERATION Test units were continuously powered and pressurized at 80% full scale throughout seisimic vibration tests, with uotput signals recorded. Pre- and post-test results were within limits.

PHYSICAL INTEGRITY Three test units remained intact and performed satisfactorily after the tests.

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS

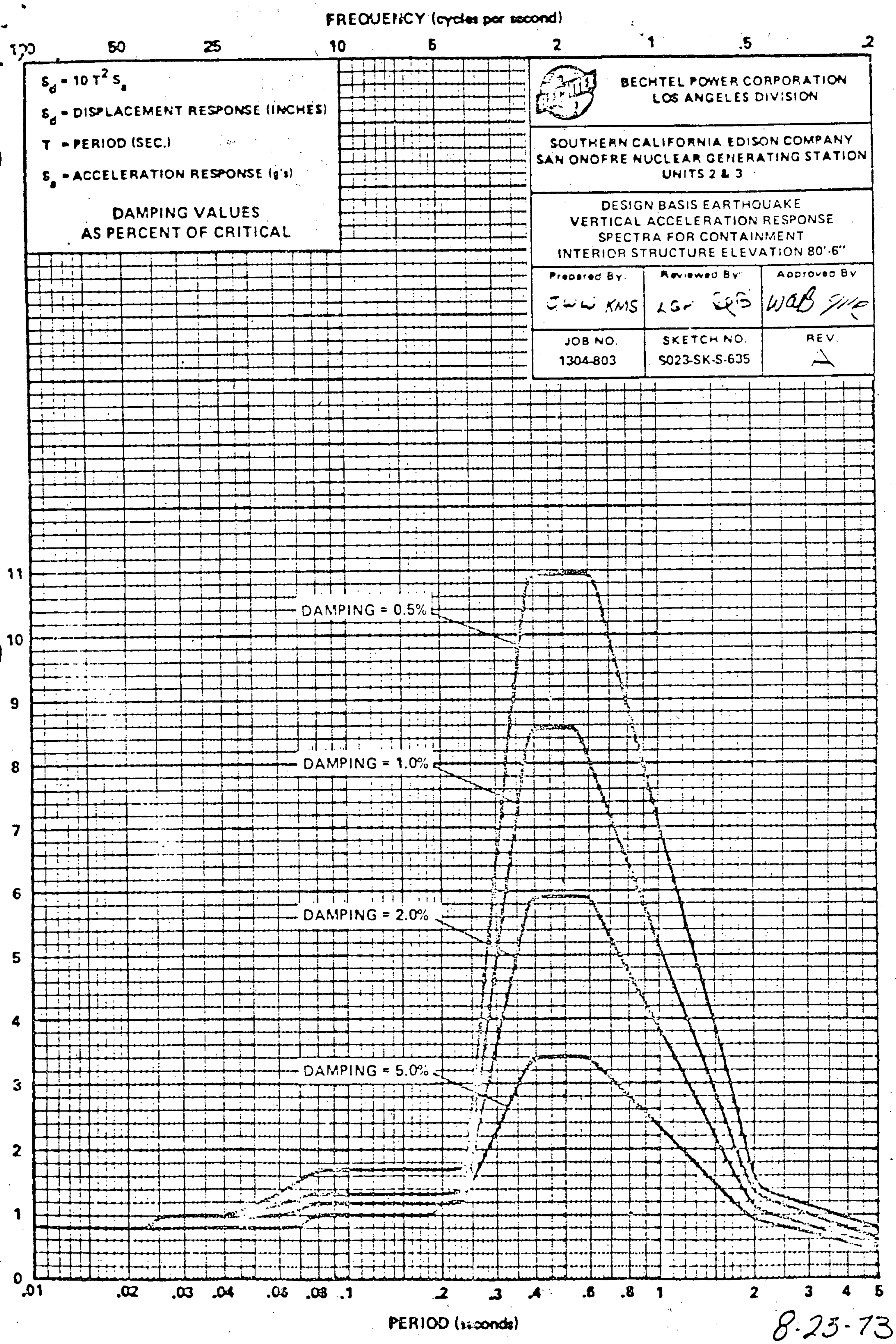
MAXIMUM EXTERIOR DEFLECTION

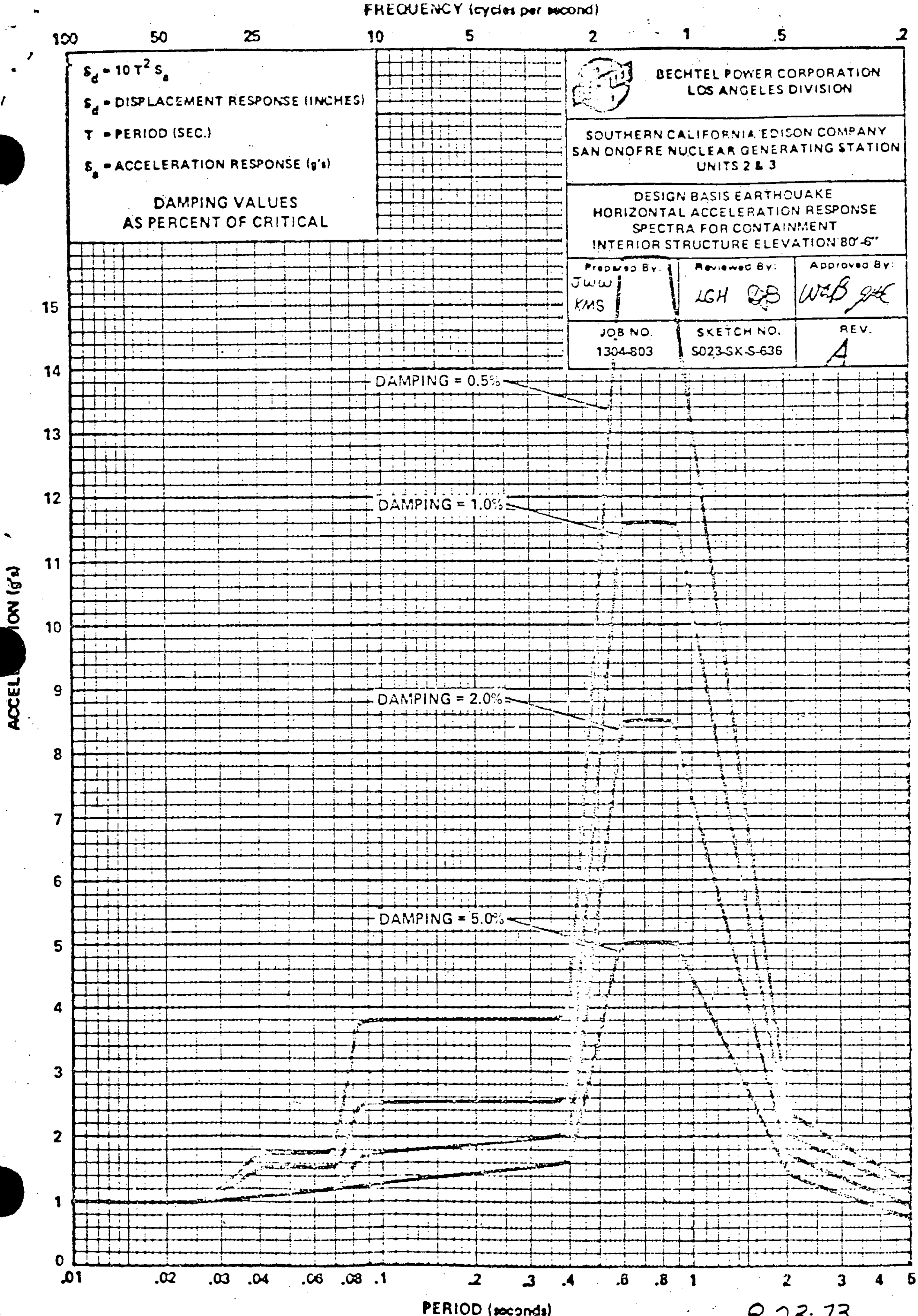
DYNAMIC LOAD TO MOUNTING

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES

VI. DISCUSSION

Only one resonance frequency was noted, at 40 Hz in the vertical direction. There was no evidence of any resonance below 10 Hz. Accuracy was within .5%, exhibiting only .1% deviation from readings taken prior to the test, with the exception of unit 106186 at a deviation of 2% from zero during the final sine/sweep dwell in the horizontal axis. This appeared to be a random failure. The unit was tested several days later with deviation less than .1%. The other units tested did not experience any similar problem.


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA FOR CONTAINMENT
INTERIOR STRUCTURE ELEVATION 80'-6"
Prepared By
JWW KMS
Reviewed By
LGF
Approved By
WAB
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-635
REV.
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELE
11
10
9
8
7
6
5
4
3
2
1
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)
8-23-73


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA FOR CONTAINMENT
INTERIOR STRUCTURE ELEVATION 80'-6"
Prepared By: JWW KMS
Reviewed By: LGH
Approved By:
JOB NO. 1304-803
SKETCH NO. S023-SK-S-636
REV. A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

8-23-73

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR

II. Component Name: Differential Pressure Transmitter

1. Scope: [X] NSSS [ ] BOP
2. Model Number: E13DH — Quantity: 2
3. Vendor: Foxboro
4. If the component is a cabinet or panel, name and model No. of the devices included: NA
5. Physical Description a. Appearance Separately Mounted Module
   b. Dimensions 14 1/2" x 6 7/8"
   c. Weight 40#
6. Location: Building: Containment Building
   Elevation: 34'-0"
7. Field Mounting Conditions [X] Bolt (No. 2, Size 1")
   [ ] Weld (Length)
   [ ]
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
   S/S: See VI.9 below F/B:
   V:
9. a. Functional Description: Transmit output signal proportional to input differential pressure
   b. Is the equipment required for [X] Hot Standby [X] Cold Shutdown
   [X] Both
10. Pertinent Reference Design Specifications: 1370-ICE-0005 Sheet 312, Rev. 2

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

IV. Equipment Qualification Method: Test: X

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Foxboro, T3-1091
Lab: Acton Laboratory Rpt. No. 10486

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [ ] Combination of ______

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ______
(Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ______

S/S = 1.0g input F/B = 1.0g input V = 0.80g input

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 ______
Other Full level at each integer freq from 1 to 35 HZ
(Specify)

4. Frequency Range: 1 to 35 HZ

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[X] No TRS

6. Input g-level Test at:

S/S = 3.5
F/B = 3.5
V = 3.5

7. Laboratory Mounting: ____

1. [X] Bolt (No. 3.5, Size 10-32) [ ] Weld (Length ____)
[ ] ____

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

NA

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
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: ____ 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. Deflection	Location	Effect Upon Functional Operability

V. Test Results

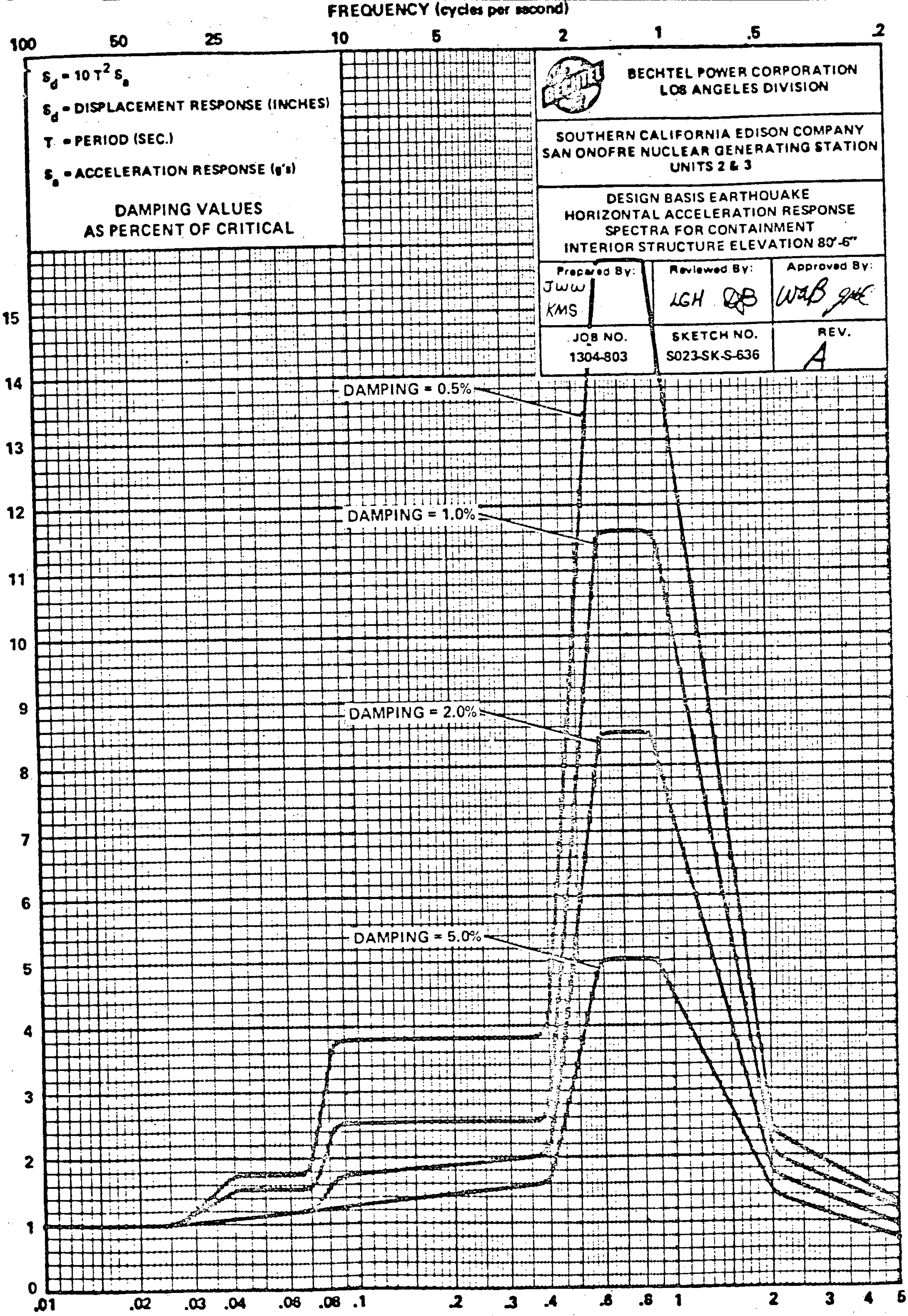
NATURAL FREQUENCIES: VERTICAL See Discussion SIDE / SIDE FRONT / BACK
ELECTRICAL OPERATION Electrical Output oscillations at all frequencies. Maximum DC level shift of -2.0%. Maximum oscillation amplitude of 9%, Maximum calibration shift of -2.42%
PHYSICAL INTEGRITY No anomalies during 3.5g testing, no significant structural resonance. See Discussion.

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)
MAXIMUM STRUCTURAL STRESS
MAXIMUM EXTERIOR DEFLECTION
DYNAMIC LOAD TO MOUNTING
MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES

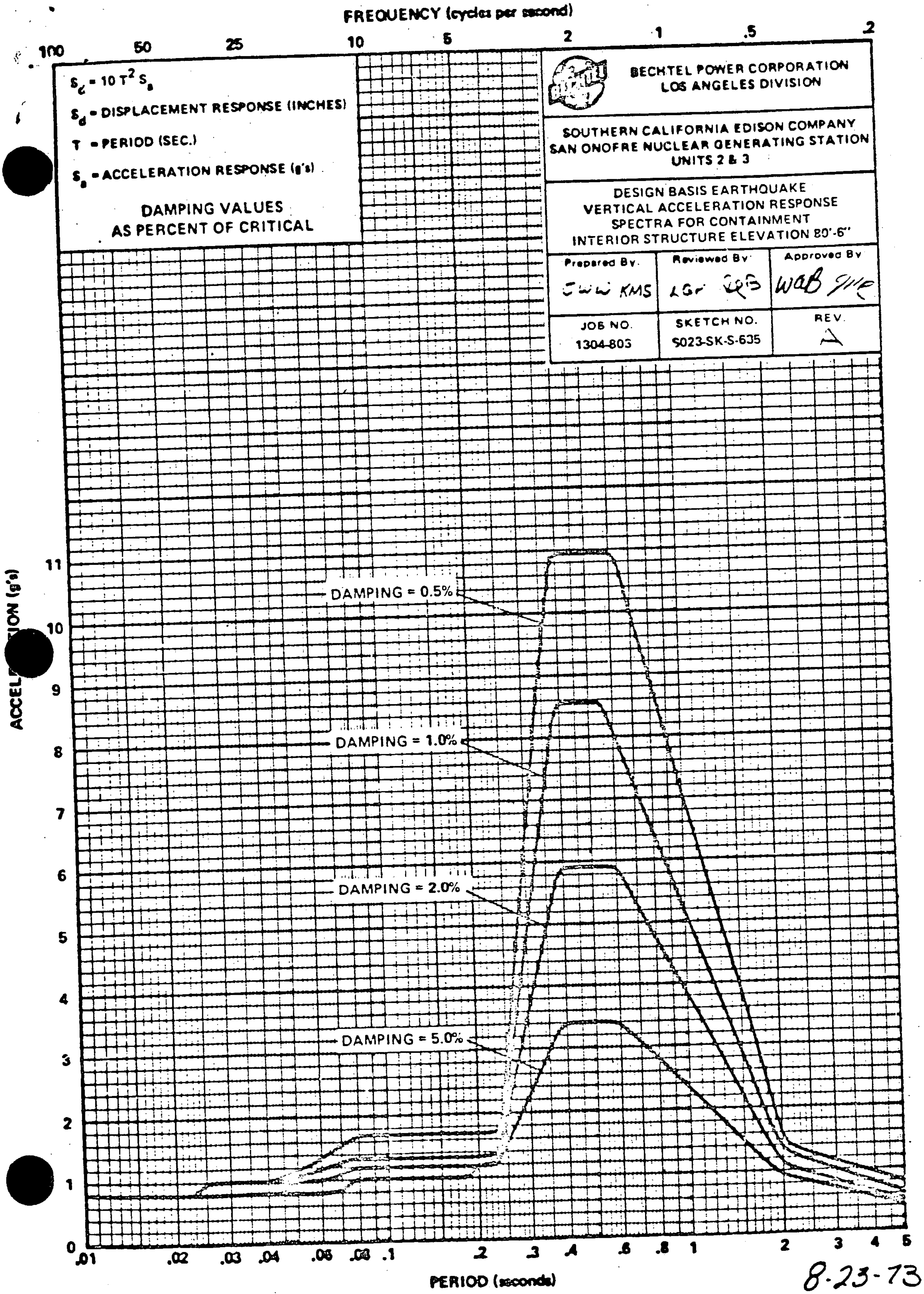
VI. DISCUSSION

The transmitter was tested in a similar manner using 5.0g inputs, and then again with 10.0g inputs. During 10.0g testing a crack was noted in the force motor assembly. A new force motor was installed and testing with 10.0g was repeated without mechanical failure. Following testing the transmitter was hydro-tested to maximum overrange pressure rating without any leakage.

Resonance, exhibited as oscillations of the electrical output, occurred at all frequencies from 1 to 35 Hz.


FREQUENCY (cycles per second)
100 50 25 10 5 2 1 .5 .2
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA FOR CONTAINMENT
INTERIOR STRUCTURE ELEVATION 80'-6"
Prepared By: JWW KMS
Reviewed By: LGH
Approved By: WAB
JOB NO. 1304-803
SKETCH NO. S023-SK-S-636
REV. A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
.01 .02 .03 .04 .06 .08 .1 .2 .3 .4 .6 .8 1 2 3 4 5
PERIOD (seconds)

8-23-73


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA FOR CONTAINMENT
INTERIOR STRUCTURE ELEVATION 80'-6"
Prepared By
Reviewed By
Approved By
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-635
REV.
A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
0
1
2
3
4
5
6
7
8
9
10
11
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

8-23-73

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR

II. Component Name: Differential Pressure Transmitter

1. Scope: [X] NSSS [ ] BOP
2. Model Number: E13DM Quantity: 14
3. Vendor: Foxboro
4. If the component is a cabinet or panel, name and model No. of the devices included: NA
5. Physical Description a. Appearance Separately Mounted Module
   b. Dimensions 11 1/8" x 6 7/8"
   c. Weight 20#
6. Location: Building: Radwaste Area, Aux. Bldg.
   Elevation: 24"
7. Field Mounting Conditions [X] Bolt (No. 2, Size 1")
   [ ] Weld (Length)
   [ ]
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
   S/S: See VI.9 below F/B:
   V:
9. a. Functional Description: Transmit output signal proportional to input differential pressure
   b. Is the equipment required for [X] Hot Standby [X] Cold Shutdown
   [X] Both
10. Pertinent Reference Design Specifications: 1370-ICE-0005 Sheet 344 Rev. 01, 352 Rev. 01, 417 Rev. 02

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

IV. Equipment Qualification Method: Test: X

Analysis: ____

Combination of Test and Analysis: ____

Test and/or Analysis by Foxboro T3-1091
Lab - Acton Laboratories Rpt. 10486
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

   3. [ ] Explosive only 4. [ ] Other (Specify) ____

   5. [ ] Combination of ____

   6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
      [ ] ____
      (Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ____

   S/S = 1.0g input F/B = 1.0g input V = 0.80g input

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 ____
   Other Full level at each integer freq from 1 to 35 HZ
   (Specify)

4. Frequency Range: 1 to 35 HZ

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
   [X] No TRS

6. Input g-level Test at:

   S/S = 3.5   F/B = 3.5   V = 3.5

7. Laboratory Mounting: ______

   1. [X] Bolt (No. 2, Size 10-32) [ ] Weld (Length ______)
      [ ] ______

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

9. Test Results including modifications made: See attached list

10. Other tests performed (such as fragility test, including results):

    NA

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   [ ] Equivalent Static Analysis
   [ ] Dynamic Analysis   [ ] Time-History
   [ ] Response Spectrum

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: ______ 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. Deflection	Location	Effect Upon Functional Operability

NSSS 14-2

F. Test Results

NATURAL FREQUENCIES: VERTICAL See Discussion SIDE / SIDE FRONT / BACK

ELECTRICAL OPERATION Electrical output oscillations at all test frequencies. Maximum DC level shift of + 0.4%, maximum oscillation amplitude of 5.0%. Maximum calibration shift less than 0.5% full scale.

PHYSICAL INTEGRITY No significant structural resonance, no loosening or damage.

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS

MAXIMUM EXTERIOR DEFLECTION

DYNAMIC LOAD TO MOUNTING

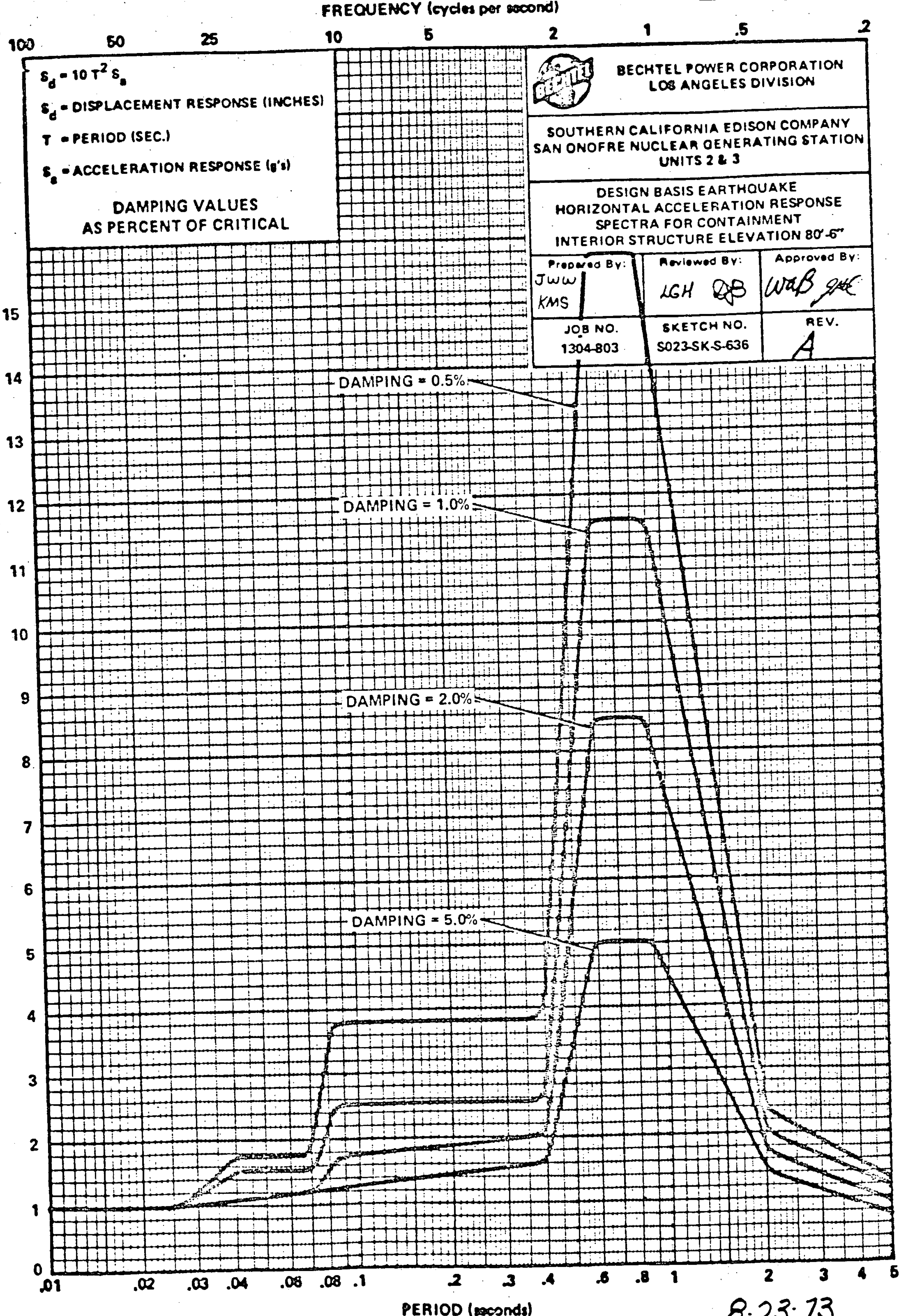
MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES

VI. DISCUSSION

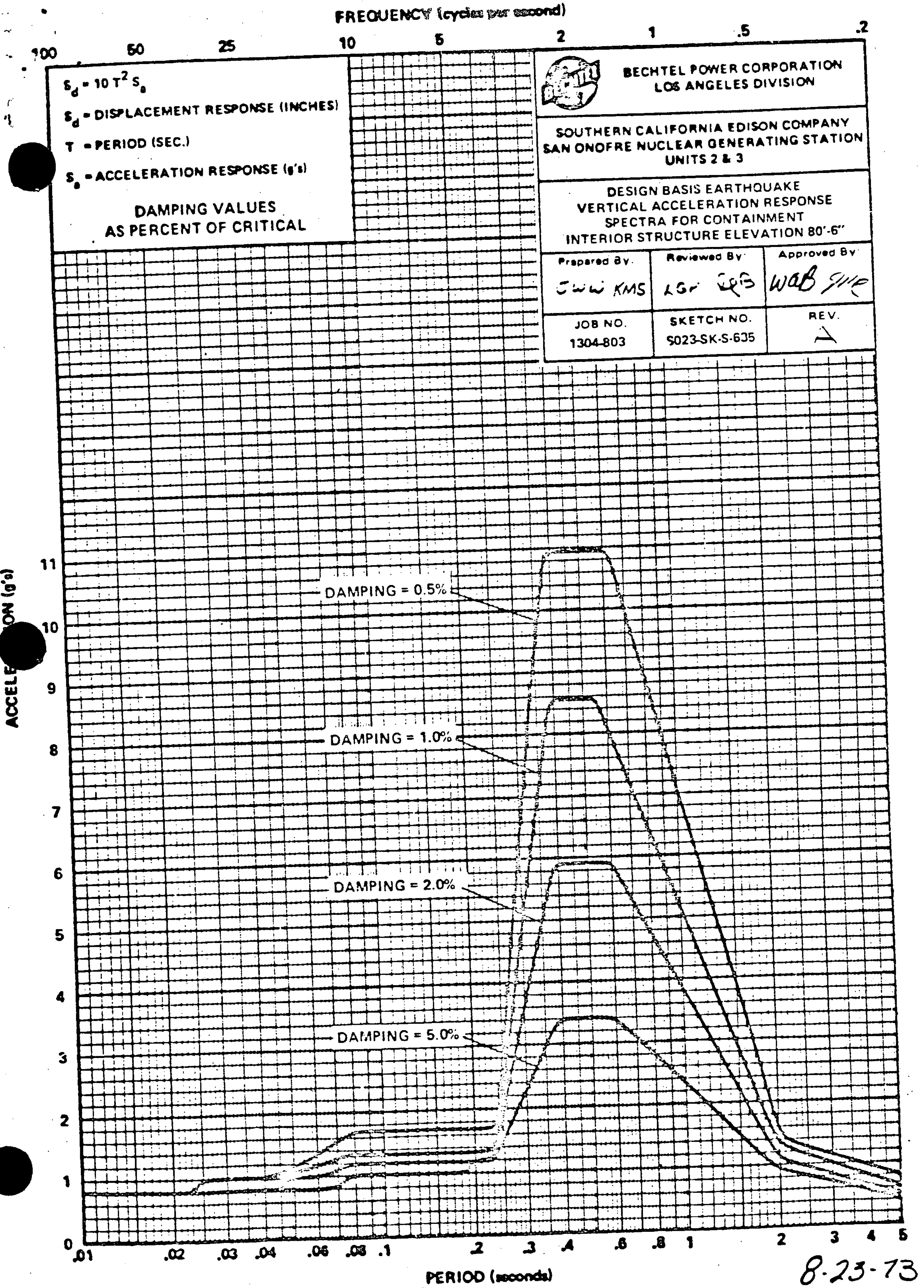
The transmitter was tested in a similar manner using 5.0 g inputs, and then using 10.0 g inputs with no effects other than larger output signal oscillations. Following testing, the transmitter was hydro-tested to maximum overrange pressure rating without any leakage.

Resonance, exhibited as oscillations of the electrical output , occurred at all test frequencies. No significant structural resonance occurred.

C-E 00902?(?/75)


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA FOR CONTAINMENT
INTERIOR STRUCTURE ELEVATION 80'-6"
Prepared By: JWW KMS
Reviewed By: LGH
Approved By:
JOB NO. 1304-803
SKETCH NO. S023-SK-S-636
REV. A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

8-23-73


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10\,T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA FOR CONTAINMENT
INTERIOR STRUCTURE ELEVATION 80'-6"
Prepared By: JWW KMS
Reviewed By: LGr
Approved By: WAB
JOB NO. 1304-803
SKETCH NO. S023-SK-S-635
REV. A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
0
1
2
3
4
5
6
7
8
9
10
11
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)
8-23-73

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X

2. NSSS: CE — 3. A/E: Bechtel — BWR ____

II. Component Name: RCP SSSS Pulse Transmitter

1. Scope: [X] NSSS [ ] BOP

2. Model Number: None — Quantity: 16

3. Vendor: Bently - Nevada

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

5. Physical Description a. Appearance Wall mounted module

   b. Dimensions 8.9" x 6.12" x 4.0"

   c. Weight 5#

6. Location: Building: Containment Bldg.

   Elevation: 45' + up

7. Field Mounting Conditions [ ] Bolt (No.____, Size________)
   [ ] Weld (Length________)
   [X] Screwed 0.31" dia. hole, 4 places

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

   S/S: 30 — F/B: 30
   V: >35

9. a. Functional Description: Provide shaped pulses which are proportional to RCP speed.

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

   [ ] Both

10. Pertinent Reference Design Specifications: 00000-ICE-6003, Rev. 2
1370-ICE-6003, Rev. 2

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

IV. Equipment Qualification Method: Test: X

Analysis: ____

Combination of Test and Analysis: ____

Test and/or Analysis by Wyle Laboratories, Report 54602
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

   3. [ ] Explosive only 4. [ ] Other (Specify) ____

   5. [ ] Combination of ____

   6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
      [ ] ____
      (Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ____

   S/S = 0.95g input F/B = 0.95g input V = 0.8g input

VI. If Qualification by Test, then Complete: ____

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

2. [ ] Single Axis [X] Multi-Axis (Bi-Axial)

3. No. of Qualification Tests: OBE 0 SSE 6
   Other ____
   (Specify)

4. Frequency Range: See TRS attached

5. TRS enveloping RRS ~~using Multi-Frequency Test~~ [ ] Yes (plot TRS on RRS graphs)
   [X] No*
   *TRS exceeds RRS at natural frequencies and above 12 Hz.

6. Input g-level Test at:

S/S = 3.5
F/B = 3.2
V = 2.1

7. Laboratory Mounting: ______

1. [X] Bolt (No. 4, Size 10-24) [ ] Weld (Length ______)
[ ] ______

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

N/A

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
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: ______ 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. Deflection	Location	Effect Upon Functional Operability

NSSS 15-1

VI Test Results

NATURAL FREQUENCIES VERTICAL See Discussion Below SIDE / SIDE FRONT / BACK

ELECTRICAL OPERATION

PHYSICAL INTEGRITY Intact; no physical effects.

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS

MAXIMUM EXTERIOR DEFLECTION

DYNAMIC LOAD TO MOUNTING

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES

VI. DISCUSSION

(a) Mounting: Signal Processor - (4) 10-32 bolt on front and (2) 1/4-20 bolt on back
Pulse Transmitter - (4) 10-24 bolts

(b) Natural Frequencies: Signal Processor - No Resonance below 35 Hz.
Transmitter - Resonance found at 30 Hz in the front-to-back and side-to-side directions.
No resonance was found below 35 Hz in vertical.

(c) Full Level Tests: The TRS indicated on the reverse side of this data sheet resulted from the 16 Hz tests. The other TRSs are similar except the frequency is shifted accordingly.

L E 0(H0234 (9 75)

TEST RESPONSE SPECTRA

DATA SHEET No. 2j

DATE MARCH 1977

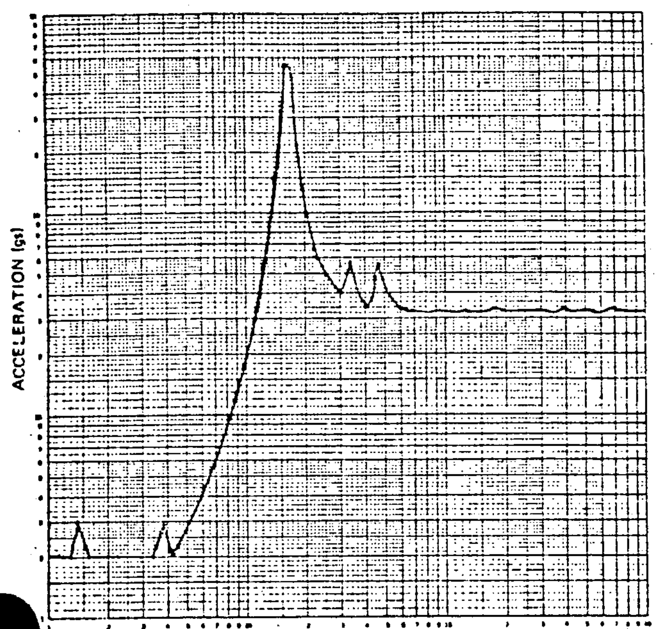
SPECTRUM FULL SCALE: ACCELERATION ☐ 10 gs ☒ 100 gs
FREQUENCY ☐ 100 Hz ☒ 1000 Hz

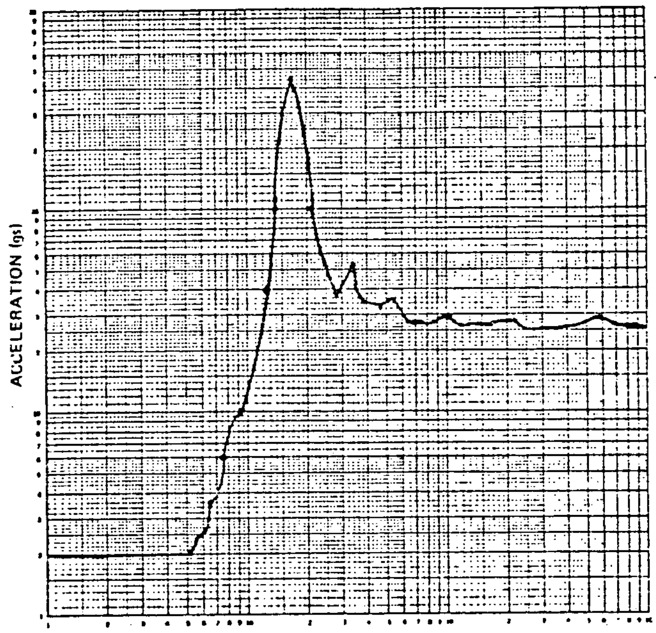
1 % CRITICAL DAMPING

REVISION No. 01

TEST PLANE: ☐ FRONT TO BACK ☒ FRONT TO BACK / VERTICAL — ☐ SIDE TO SIDE ☒ SIDE TO SIDE / VERTICAL

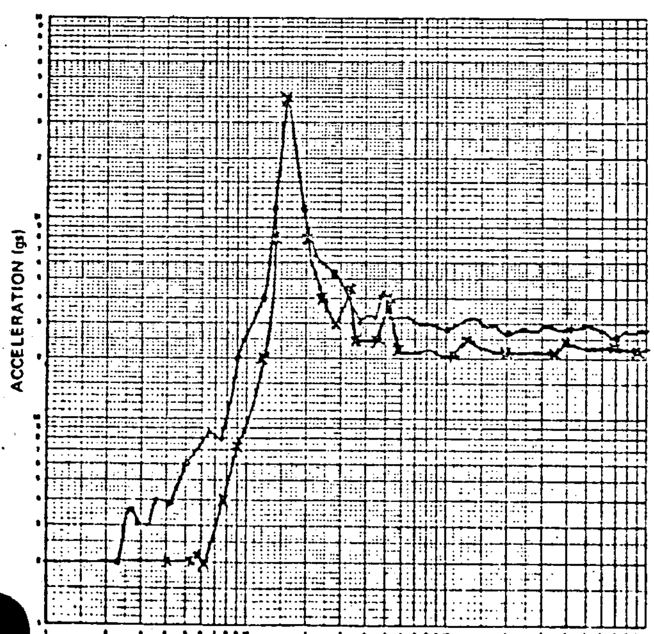
RESPONSE DIRECTION: ☒ FRONT TO BACK ☒ FRONT TO BACK (180° SHIFT) — ☒ SIDE TO SIDE ☒ SIDE TO SIDE (180° SHIFT)

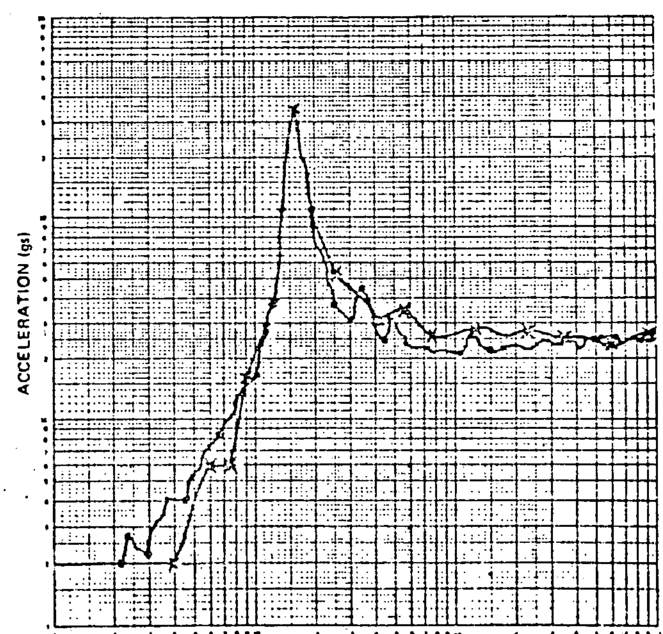




TEST PLANE: ☐ VERTICAL ☒ FRONT TO BACK / VERTICAL — ☒ SIDE TO SIDE / VERTICAL

RESPONSE DIRECTION: (—•—) ☒ VERTICAL (—✱—) ☒ VERTICAL (180° SHIFT) — ☒ VERTICAL (—•—) ☒ VERTICAL (180° SHIFT) (—✱—)





CL 0030234 (9/75) BACK

63'-6"
Interior Cont.
Horizontal.

RCPSSSS Seismic Response Spectra

SSE - Horizontal - 1% β

(probe & transmitter)

Minimum of Two Horizontal Tests (F/B & S/S)

RCPSSSS Seismic Response Spectra
SSE - Vertical - 1% β
(probe and transmitter)

• 63'-6"
Interior Cont.
Vert.

Frequency (Hz)

Minimum of Two Vertical Tests

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 Type:

1. Utility: Southern California Edison Company PWR X
2. NSSS: CE 3. A/E: Bechtel BWR

II. Component Name: Proximity Probe and Connector

1. Scope: [X] NSSS [ ] BOP
2. Model Number: 21955-01, 21954-01 Quantity: 16
3. Vendor: Bently - Nevada
4. If the component is a cabinet or panel, name and model No. of the devices included: N/A
5. Physical Description a. Appearance Rigidly mounted proximity probe

   b. Dimensions 1.25" L, .375" diam.

   c. Weight 2 oz.
6. Location: Building: Containment Bldg.

   Elevation: 45' + up
7. Field Mounting Conditions [ ] Bolt (No._____, Size_____)
   [ ] Weld (Length_____)
   [X] Mounting clips to fit 1/4" holes
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S: See VI 9 below F/B:
   V:
9. a. Functional Description: Detect speed of RCP

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

   [ ] Both
10. Pertinent Reference Design Specifications: 1370-ICE-6003, Rev. 2
    00000-ICE-6003

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

IV. Equipment Qualification Method: Test: X

Analysis:

Combination of Test and Analysis:

Test and/or Analysis by Wyle Laboratories, Report #54602
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify)

5. [ ] Combination of

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ]
(Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction:

S/S = 0.95g input F/B = 0.95g input V = 0.8g input

VI. If Qualification by Test, then Complete:

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

2. [ ] Single Axis [X] Multi-Axis (Bi-Axial)

3. No. of Qualification Tests: OBE SSE
Other Full level at 6, 8, 10, 12, 14, 16 Hz
(Specify)

4. Frequency Range: See TRS attached

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[X] No*

*TRS exceeds RRS above 12Hz.

6. Input g-level Test at:

S/S = 3.5
F/B = 3.6
V = 3.5

7. Laboratory Mounting: Simulated pump mounting

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

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

N/A

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
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: ________ 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. Deflection	Location	Effect Upon Functional Operability

NSS15-2

II. Test Results

NATURAL FREQUENCIES VERTICAL	See Discussion Below
SIDE / SIDE	
FRONT / BACK	
ELECTRICAL OPERATION	Performed as required - no degradation of output signal
PHYSICAL INTEGRITY	Intact; no physical effects
DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)	
MAXIMUM STRUCTURAL STRESS	
MAXIMUM EXTERIOR DEFLECTION	
DYNAMIC LOAD TO MOUNTING	
MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES	

VI. DISCUSSION

Due to its small size an accelerometer could not be placed on the probe.

TEST RESPONSE SPECTRA

DATA SHEET No. 205

DATE March, 1977

REVISION No. 01

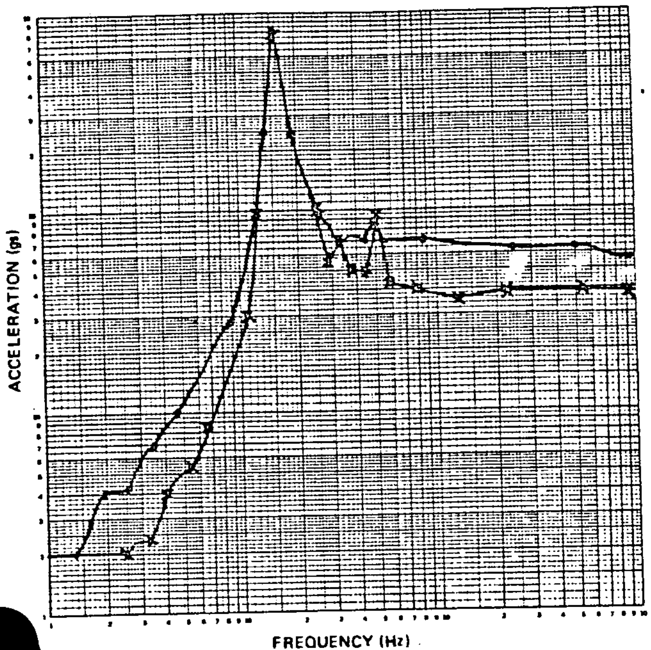
SPECTRUM FULL SCALE: ACCELERATION ☐ 10 gs ☒ 100 gs

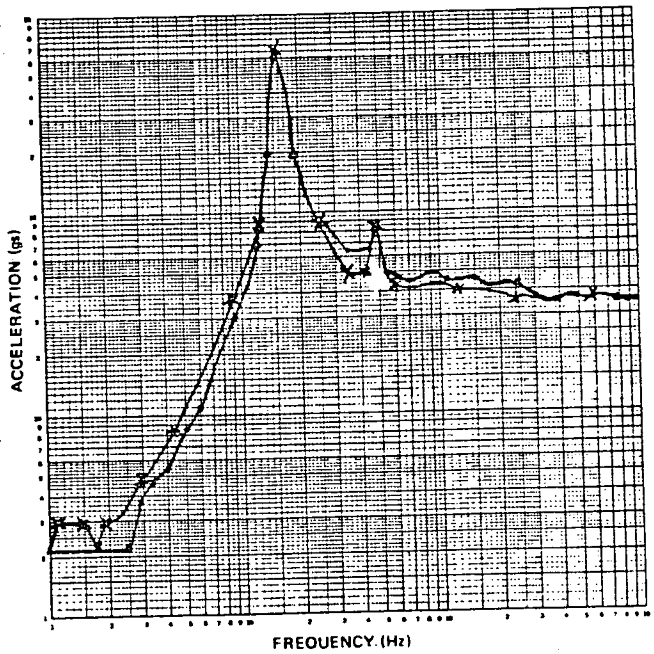
FREQUENCY ☐ 100 Hz ☒ 1000 Hz

1 % CRITICAL DAMPING

TEST PLANE: ☐ FRONT TO BACK ☒ FRONT TO BACK / VERTICAL — ☐ SIDE TO SIDE ☒ SIDE TO SIDE / VERTICAL

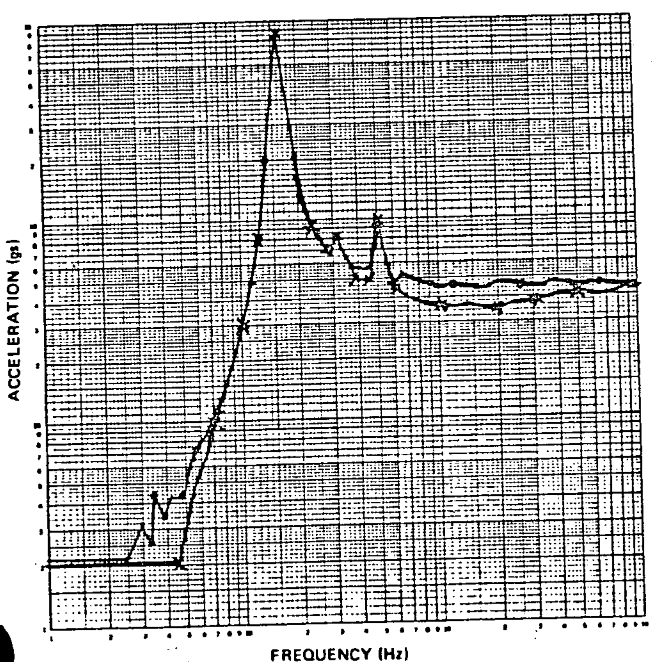
RESPONSE DIRECTION: (-•-) ☒ FRONT TO BACK (-✳-) ☒ FRONT TO BACK (180° SHIFT) — ☒ SIDE TO SIDE (-•-) ☒ SIDE TO SIDE (180° SHIFT) (-✳-)

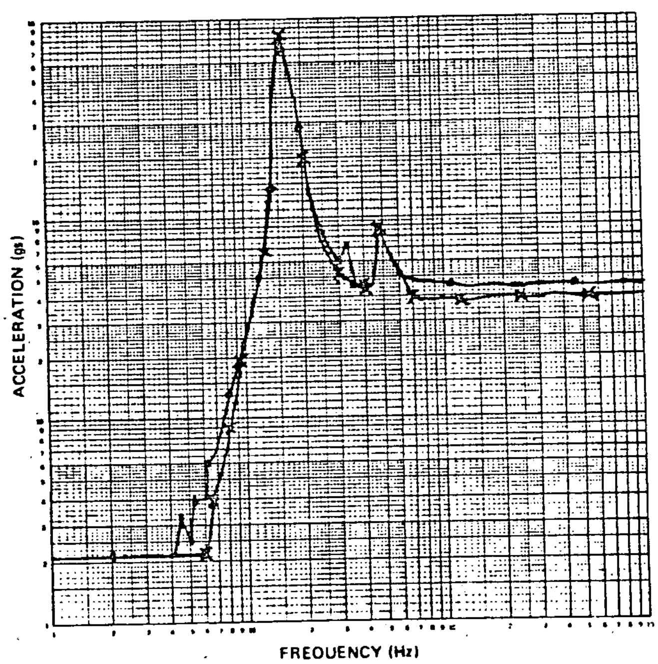




TEST PLANE: ☐ VERTICAL ☒ FRONT TO BACK / VERTICAL — ☒ SIDE TO SIDE / VERTICAL

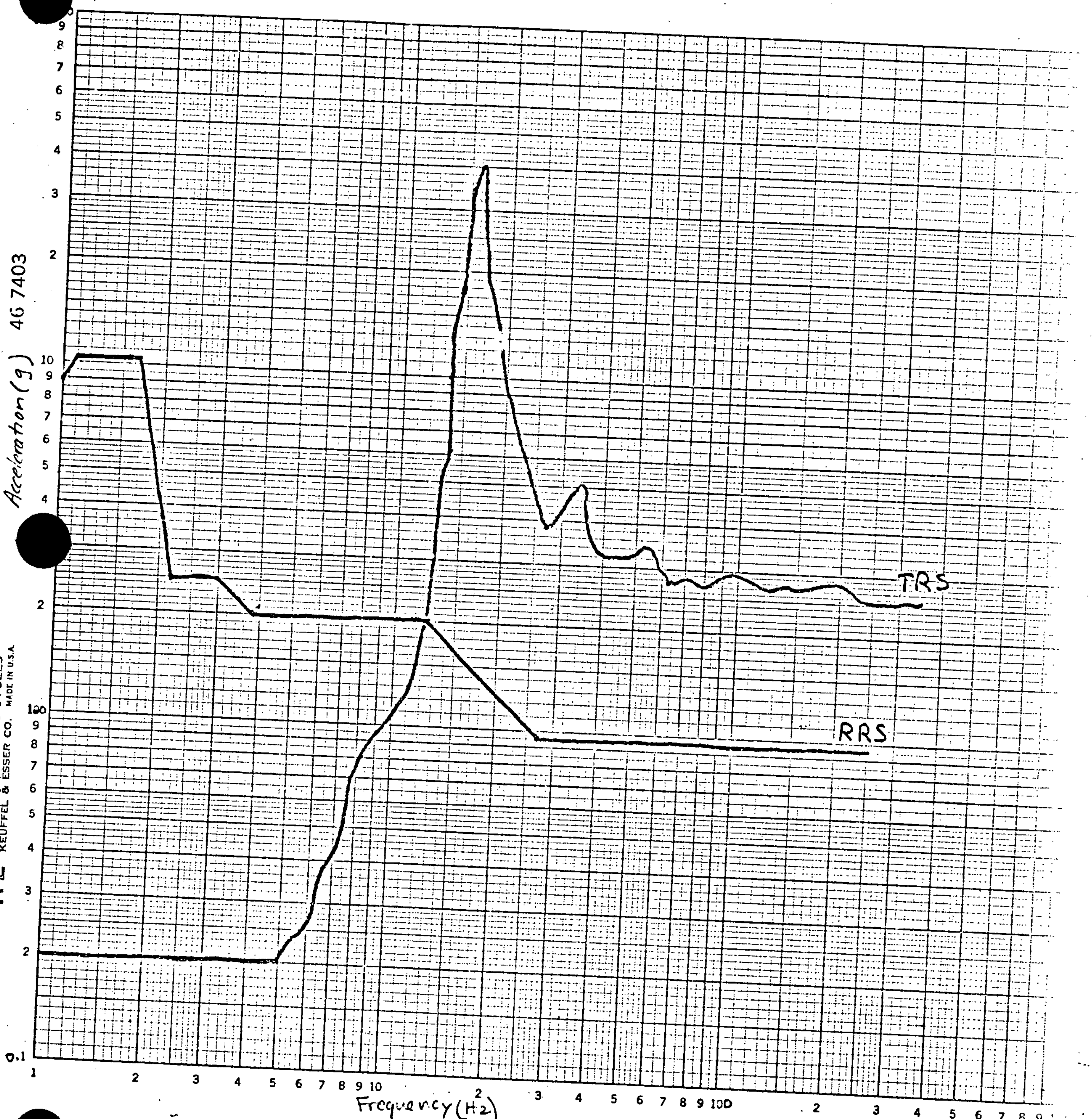
RESPONSE DIRECTION: (-•-) ☒ VERTICAL (-✳-) ☒ VERTICAL (180° SHIFT) — ☒ VERTICAL (-•-) ☒ VERTICAL (180° SHIFT) (-✳-)





RCPSSSS Seismic Response Spectra
SSE - Horizontal - 1% β
(probe & transmitter)

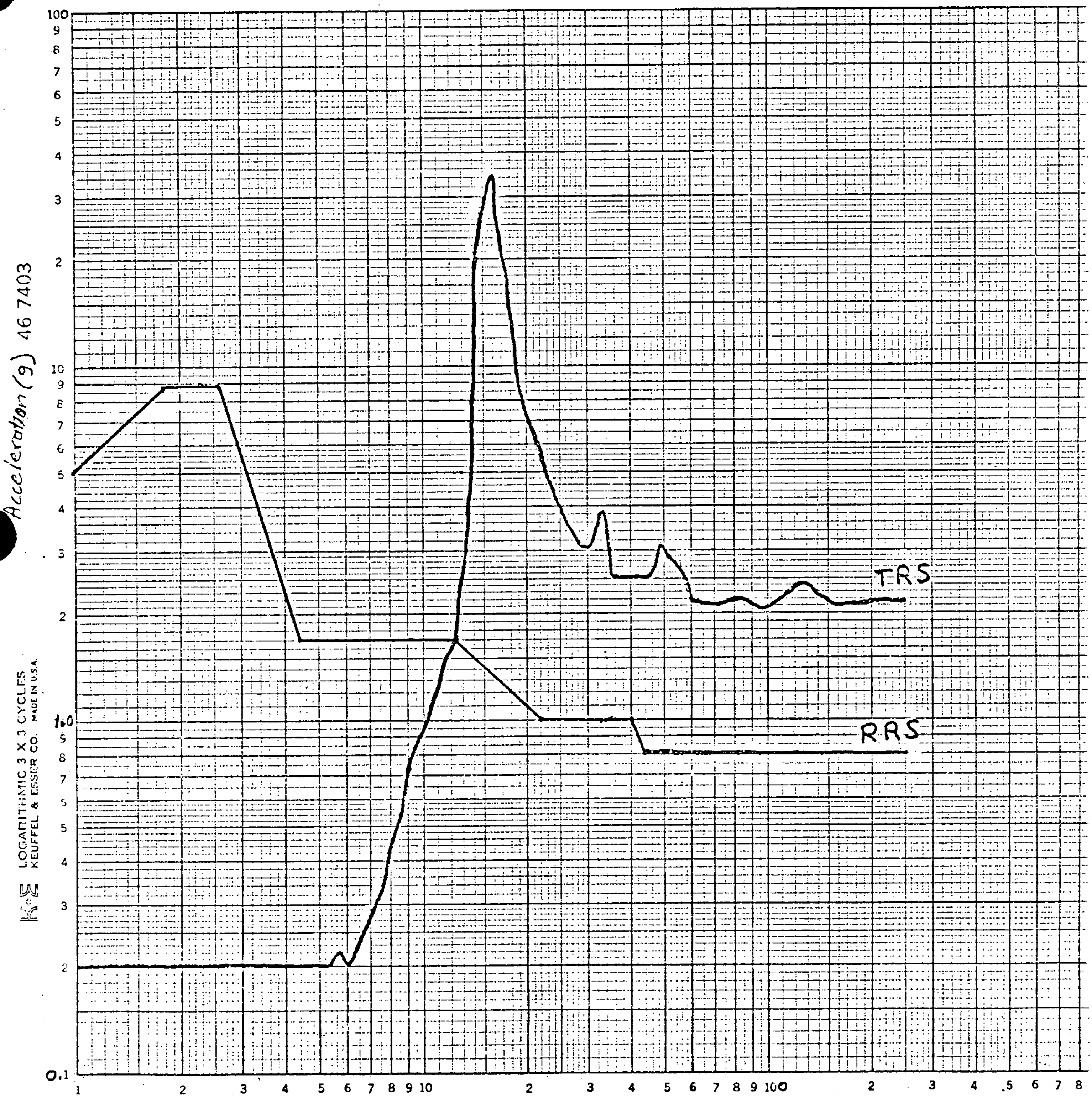
63'-6"
Interior Cont.
Horizontal



Minimum of Two Horizontal Tests (F/B & S/S)

RCPSSSS Seismic Response Spectra
SSE - Vertical - 1% β
(probe and transmitter)

- 63'-6"
Interior Cont.
Vert.



Minimum of Two Vertical Tests

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 Type:

1. Utility: Southern California Edison Company PWR X
2. NSSS: CE 3. A/E: Bechtel BWR

II. Component Name: Nuclear Instrument Detector Assembly

1. Scope: [X] NSSS [ ] BOP
2. Model Number: ELE 304-5000-1 Quantity: 4
3. Vendor: General Atomic/Reuter Stokes
4. If the component is a cabinet or panel, name and model No. of the devices included: NA
5. Physical Description a. Appearance Cylindrical Neutron Detector

   b. Dimensions 183" L, 5 3/4" Diam

   c. Weight 155#
6. Location: Building: Containment (Bldg. Interior Structure)

   Elevation: 18'
7. Field Mounting Conditions [X] Bolt (No. 26, Size 1/4"- 28 x 1" long)
   [ ] Weld (Length)
   [ ]
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S: 16-33 F/B: 6, 10, 14 - 33
   V: 31
9. a. Functional Description: Neutron detector

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

   [X] Both
10. Pertinent Reference Design Specifications: 1370-ICE-3006
    00000-ICE-3006 Rev. 03

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

IV. Equipment Qualification Method: Test: X

Analysis:

Combination of Test and Analysis:

Test and/or Analysis by Wyle; 54534
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

   3. [ ] Explosive only 4. [ ] Other (Specify)

   5. [ ] Combination of

   6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
   [ ] (Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction:

   S/S = 0.8g input F/B = 0.8g input V = 0.8g input

VI. If Qualification by Test, then Complete:

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

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

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

4. Frequency Range: See TRS attached

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
   [X] No*

   *TRS exceeds RRS at natural frequencies and above 4Hz except between 30 and 45Hz.

6. Input g-level Test at:

S/S = 1.0
F/B = 1.0
V = 0.8

7. Laboratory Mounting: ______

1. [ ] Bolt (No. 26 , Size 1/4-28) [ ] Weld (Length ______)
[ ] ______

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

NA

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

1. Description of Test including Results: NA

2. Method of Analysis: ______

[ ] Static Analysis
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: ______ 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. Deflection	Location	Effect Upon Functional Operability

V. Test Results

NATURAL FREQUENCIES VERTICAL 31 Hz SIDE-SIDE 16 thru 33 Hz FRONT BACK 6, 10, 14 thru 33 Hz

ELECTRICAL OPERATION Proper operation verified by alpha current measurement.

PHYSICAL INTEGRITY Intact; No Physical Effects

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS

MAXIMUM EXTERIOR DEFLECTION

DYNAMIC LOAD TO MOUNTING

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES

VI. DISCUSSION

This detector assembly and a preamplifier (Data Sheet 207) were required to be interconnected to enable proper functional parameters to be recorded. Resonance frequencies noted include frequencies of mechanical resonance and frequencies of variations in electrical output.

See data sheet 207 for test response spectras and explanation of functional testing complete on both the neutron detector and preamplifier/filter assemblies.

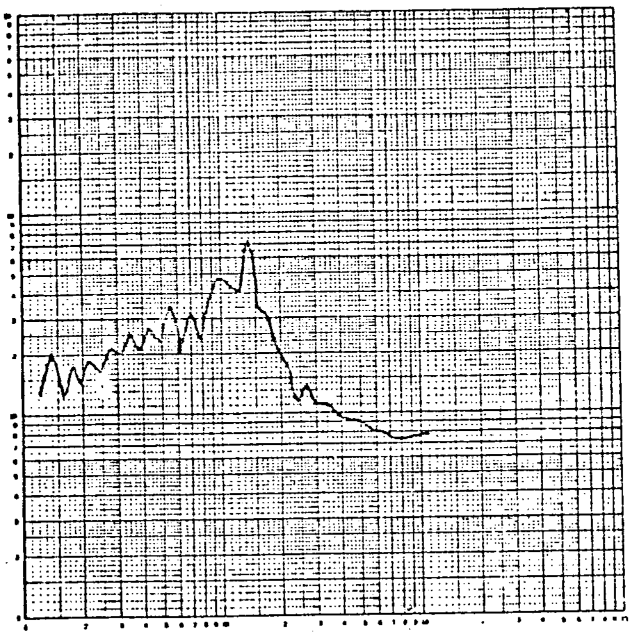
TEST RESPONSE SPECTRA

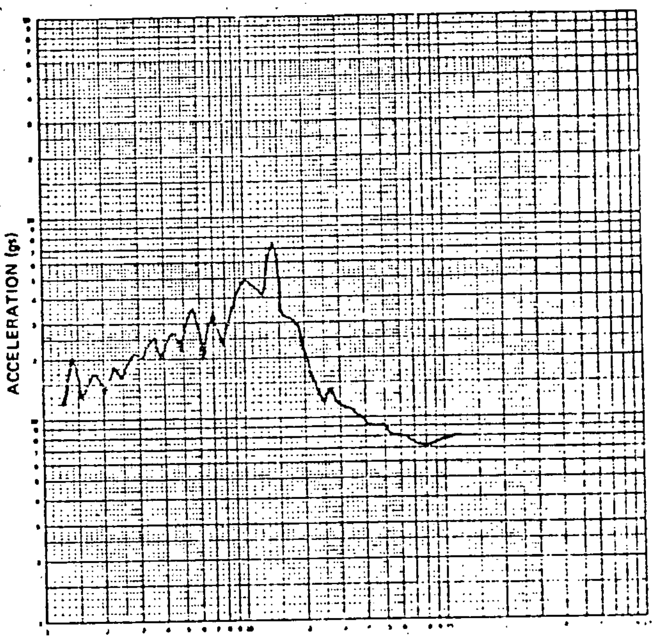
DATA SHEET No. 207
DATE March, 1977

SPECTRUM FULL SCALE: ACCELERATION ☐ 10 gs ☒ 100 gs
FREQUENCY ☐ 100 Hz ☒ 1000 Hz

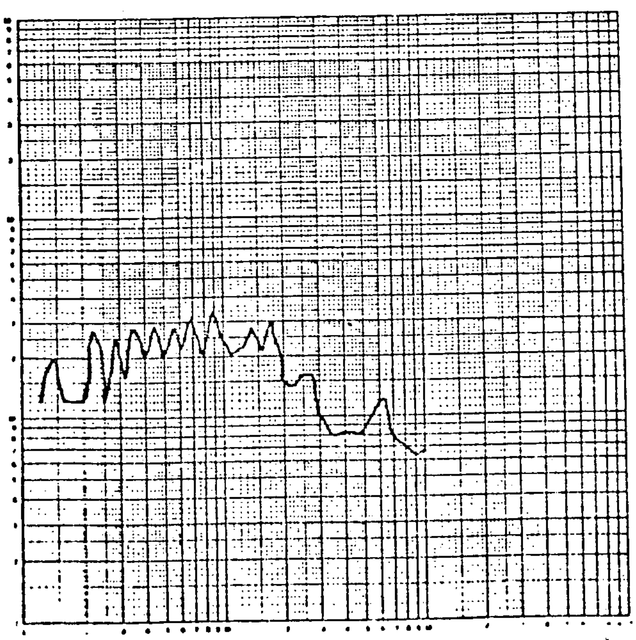
1 % CRITICAL DAMPING   REVISION No. 01

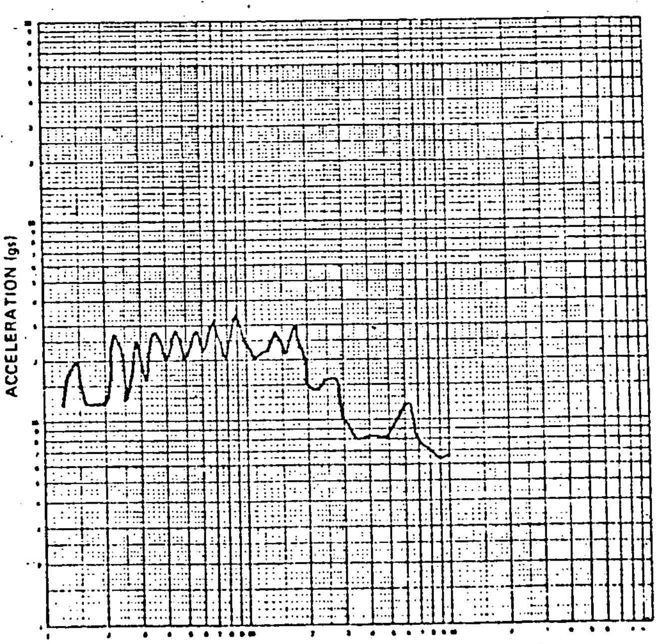
	TEST PLANE	
☐ FRONT TO BACK ☒ FRONT TO BACK / VERTICAL	TEST PLANE	☐ SIDE TO SIDE ☒ SIDE TO SIDE / VERTICAL
☒ FRONT TO BACK ☐ FRONT TO BACK (180° SHIFT)	RESPONSE DIRECTION	☒ SIDE TO SIDE ☐ SIDE TO SIDE (180° SHIFT)





☐ VERTICAL ☒ FRONT TO BACK / VERTICAL	TEST PLANE	☒ SIDE TO SIDE / VERTICAL
☒ VERTICAL ☐ VERTICAL (180° SHIFT)	RESPONSE DIRECTION	☒ VERTICAL ☐ VERTICAL (180° SHIFT)

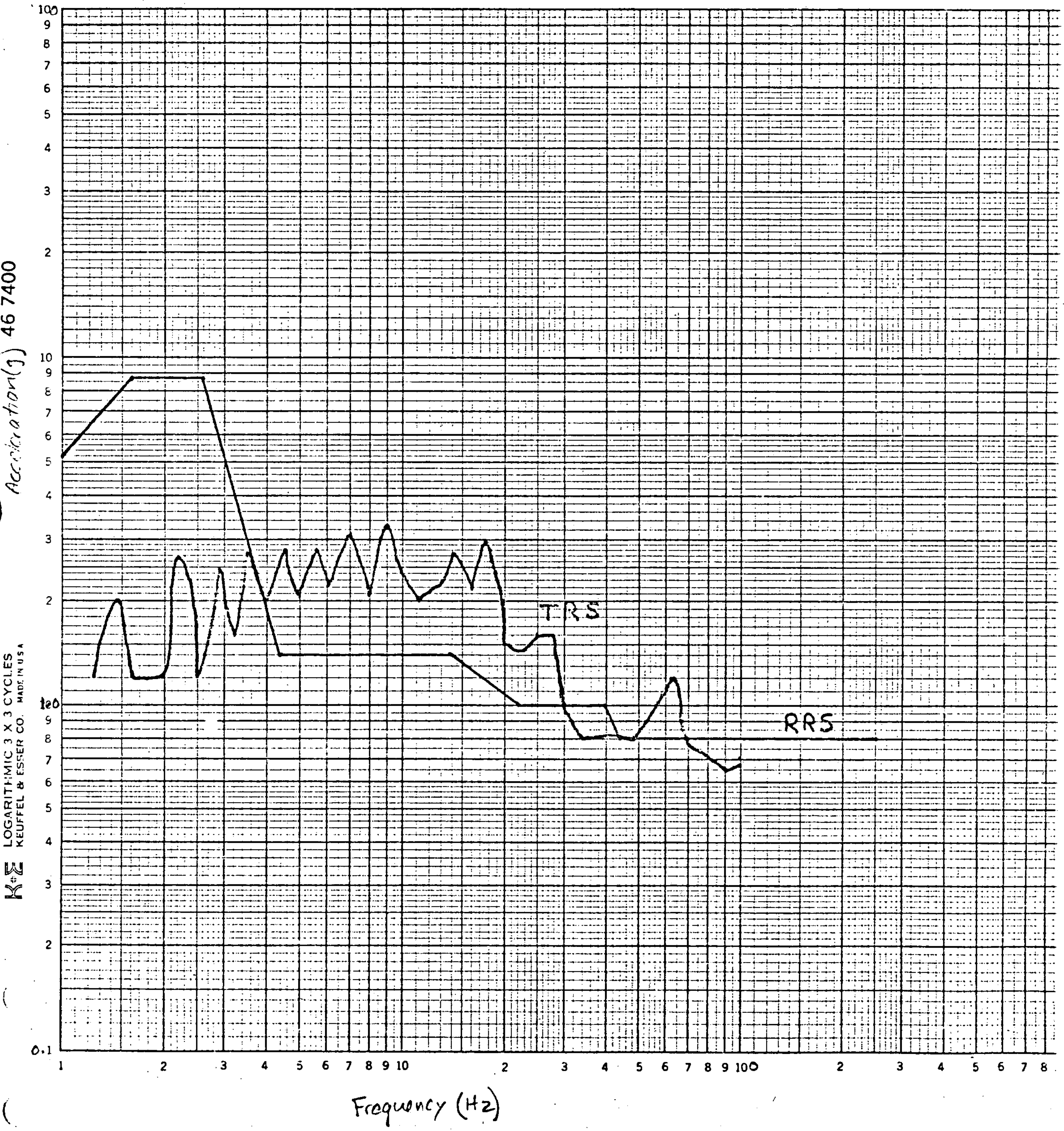




Excore Seismic Response Spectra
(Detector & Preamp)
SSE - Horizontal - 1% β

Excore Seismic Response Spectra
(Detector & Preamp)
SSE - Vertical - 1% β

30'
Interior cont.
vert.



Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3

Type:

1. Utility: Southern California Edison Company — PWR X

2. NSSS: CE — 3. A/E: Bechtel — BWR ______

II. Component Name: Nuclear Instrument Preamplifier/Filter

1. Scope: [X] NSSS [ ] BOP

2. Model Number: PA5Q1 — Quantity: 4

3. Vendor: General Atomic

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

5. Physical Description a. Appearance Wall Mounted Module

   b. Dimensions 5" x 5" x 9"

   c. Weight 10#

6. Location: Building: Containment Bldg. (Interior Structure)

   Elevation: 23'

7. Field Mounting Conditions [ ] Bolt (No.______, Size______)
   [ ] Weld (Length______)
   [X] Mounting Clamp

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

   S/S: 16-33 — F/B: 14-33
   V: 31

9. a. Functional Description: Amplify nuclear detector signal

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

10. Pertinent Reference Design Specifications: 1370-ICE-3006
    00000-ICE-3006 Rev. 03

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

IV. Equipment Qualification Method: Test: X

Analysis: ____

Combination of Test and Analysis: ____

Test and/or Analysis by Wyle Laboratories, Report 54534
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

   3. [ ] Explosive only 4. [ ] Other (Specify) ____

   5. [ ] Combination of ____

   6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
      [ ] ____
      (Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ____

   S/S = 0.8g input F/B = 0.8g input V = 0.8g input

VI. If Qualification by Test, then Complete: ____

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

2. [ ] Single Axis [X] Multi-Axis (Bi-axial)

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

4. Frequency Range: See TRS attached

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
   [X] No*

   *TRS exceeds RRS from 4Hz to 30Hz.

6. Input g-level Test at:

S/S = See TRS
F/B = ____
V = ____

7. Laboratory Mounting: Mounting Clamp as intended for service

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

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

NA

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

1. Description of Test including Results: NA

2. Method of Analysis: ____

[ ] Static Analysis
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: ____ 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. Deflection	Location	Effect Upon Functional Operability

V. Test Results

NATURAL FREQUENCIES VERTICAL	31 Hz SIDE - SIDE 16 thru 33 Hz FRONT - BACK 14 thru 33 Hz
ELECTRICAL OPERATION	Proper operation verified, outputs monitored verified proper operation within specified limits
PHYSICAL INTEGRITY	Intact; No Physical Effects
DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)	
MAXIMUM STRUCTURAL STRESS	
MAXIMUM EXTERIOR DEFLECTION	
DYNAMIC LOAD TO MOUNTING	
MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES	

VI. DISCUSSION

The preamplifier/filter assembly was rigidly mounted to the same thimble that contained the detector holder assembly (data sheet 206). All electrical interconnections between the detector assembly, preamplifier/filter assembly, and Safety Drawer were intended to closely mimic the actual field mounting of these components. Prior to the actual performance of the seismic test, the "LOG CALIBRATE" Switch, located on the Safety Drawer front panel, was placed in the "Test 3" Position. This substituted test pulses from the Safety Drawer electronics into the preamplifier input. These test pulses were in turn processed by the preamplifier, and the resulting output transmitted through five hundred feet of signal cable to the Log input of the Safety Drawer. The Log output of the Safety Drawer was connected to the visicorder, such that any fluctuations in the log power output could be detected.

Proper operation of the filter portion of the preamplifier/filter assembly was verified by monitoring the linear outputs of the three detectors. The natural alpha decay present within the fission chamber provided a current of approximately 2.5 nanoamperes. All monitored outputs operated within the specified limits prior to, during, and after the seismic test.

TEST RESPONSE SPECTRA

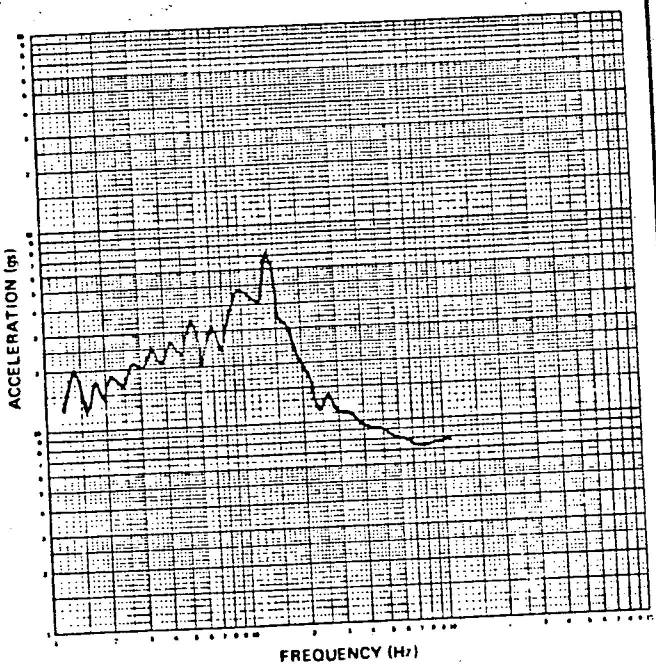
DATA SHEET No. 207
DATE March, 1977
REVISION No. 01

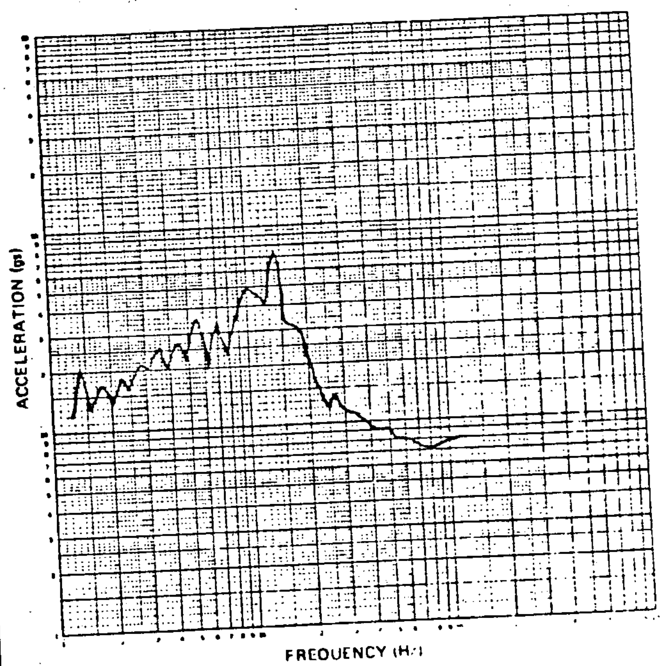
SPECTRUM FULL SCALE: ACCELERATION ☐ 10 gs ☒ 100 gs — FREQUENCY ☐ 100 Hz ☒ 1000 Hz

1 % CRITICAL DAMPING

TEST PLANE: ☐ FRONT TO BACK ☒ FRONT TO BACK / VERTICAL — ☐ SIDE TO SIDE ☒ SIDE TO SIDE / VERTICAL

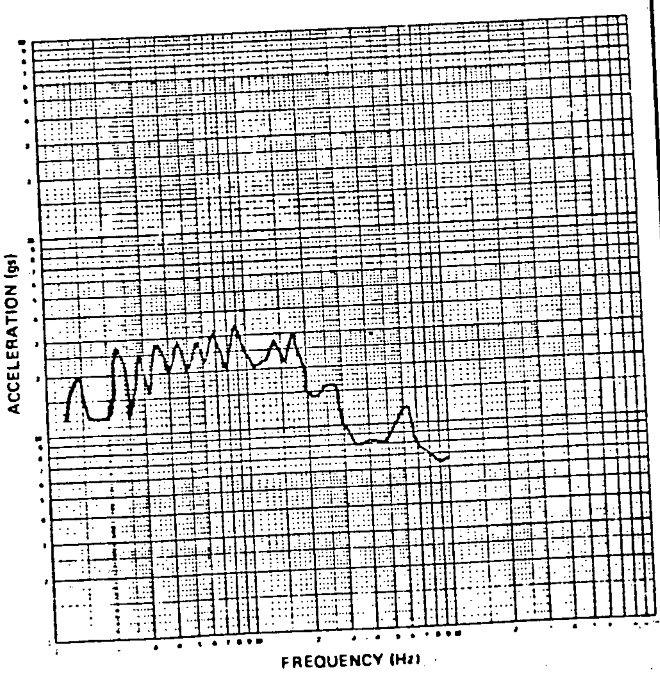
RESPONSE DIRECTION: ☒ FRONT TO BACK ☐ FRONT TO BACK (180° SHIFT) — ☒ SIDE TO SIDE ☐ SIDE TO SIDE (180° SHIFT)

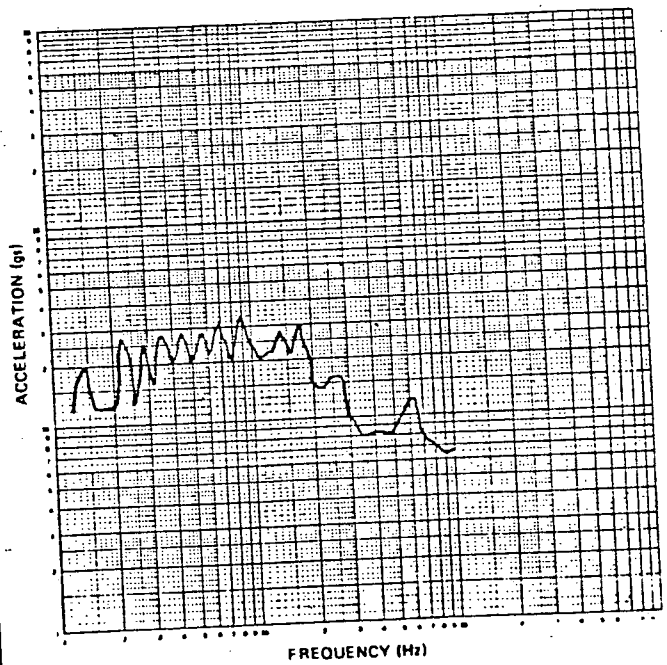




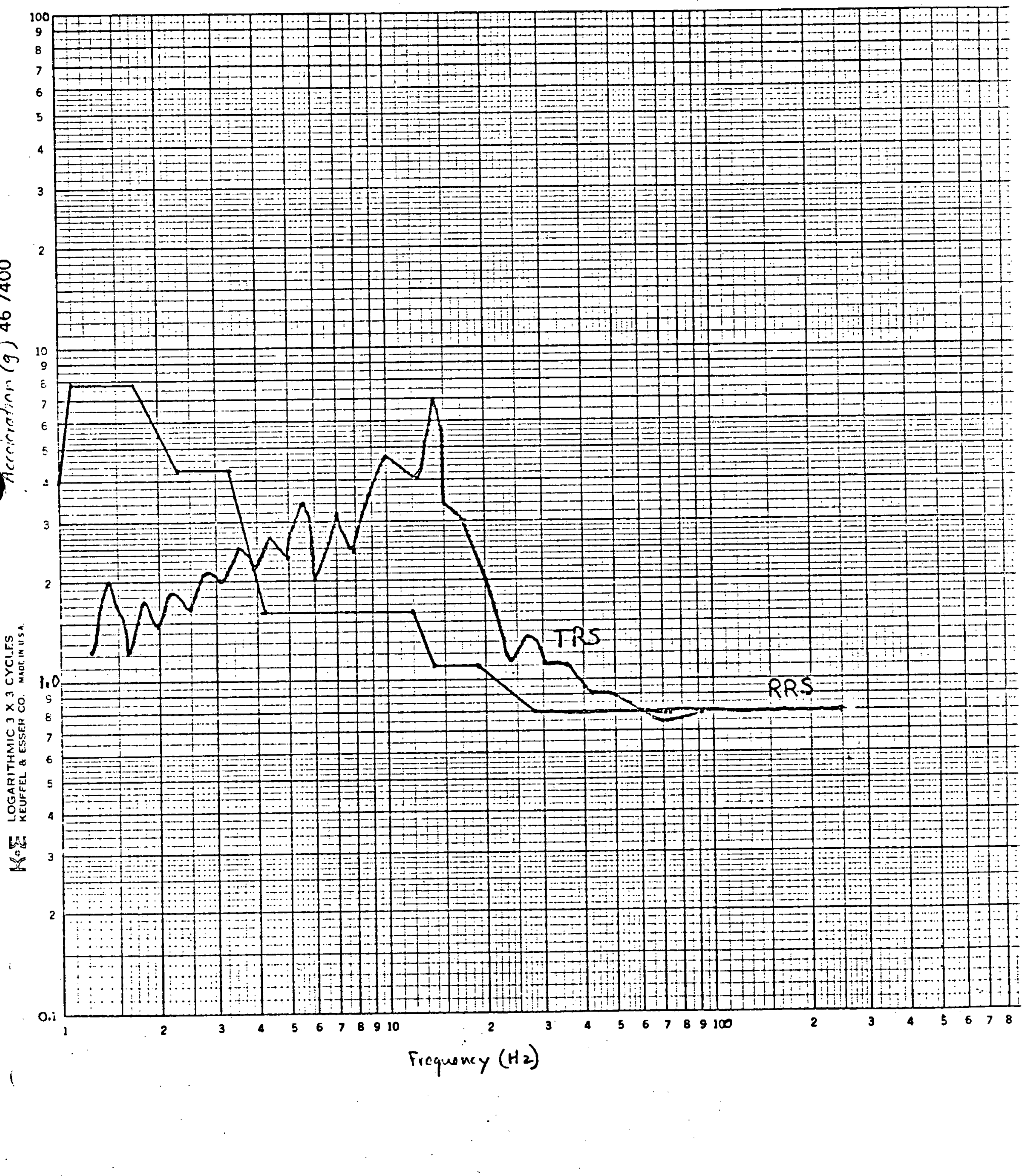
TEST PLANE: ☐ VERTICAL ☒ FRONT TO BACK / VERTICAL — ☒ SIDE TO SIDE, VERTICAL

RESPONSE DIRECTION: ☒ VERTICAL ☐ VERTICAL (180° SHIFT) — ☒ VERTICAL ☐ VERTICAL (180° SHIFT)



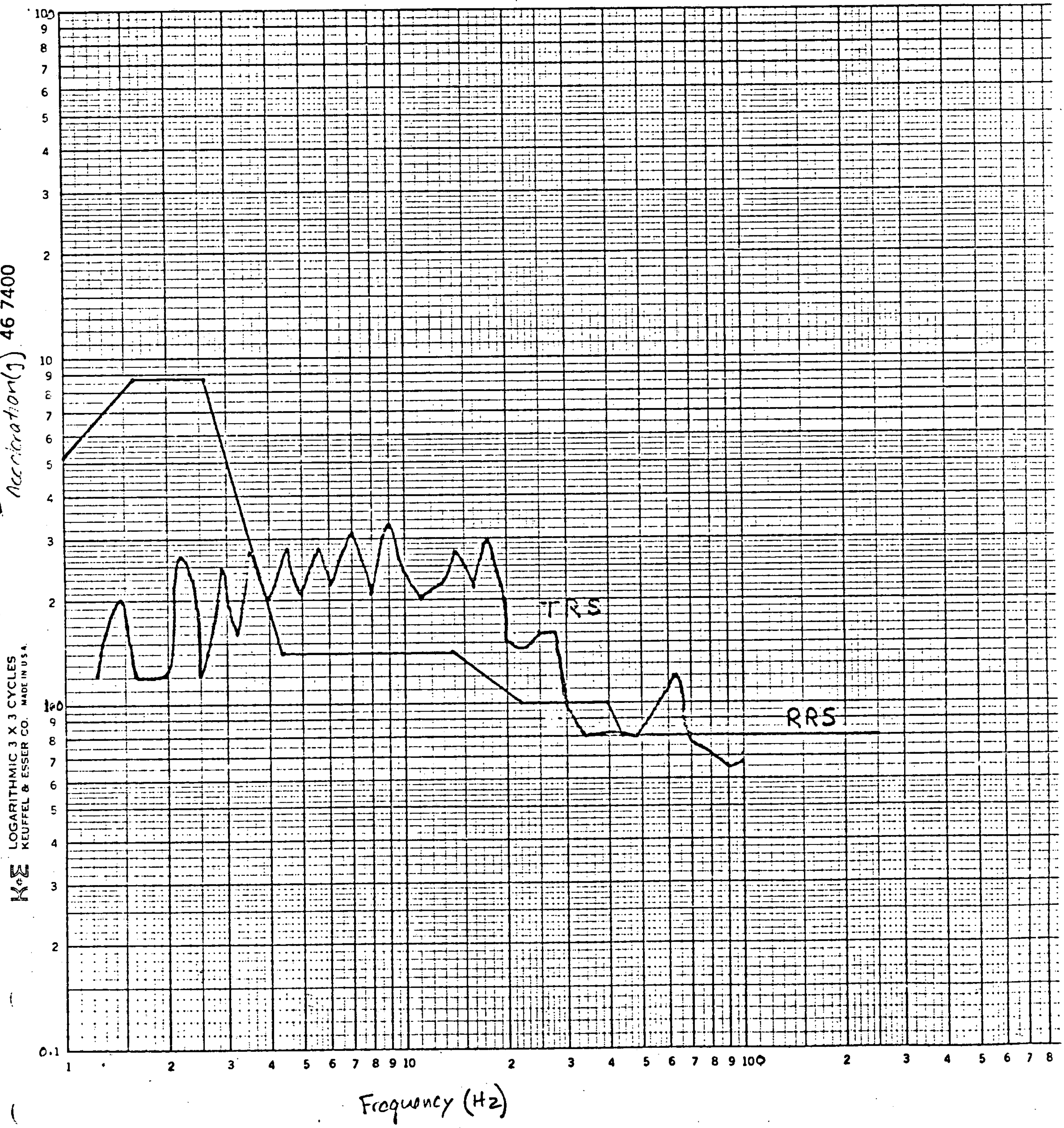


Excore Seismic Response Spectra
(Detector & Preamp)
SSE - Horizontal - 1% β



Excore Seismic Response Spectra
(Detector & Preamp)
SSE - Vertical - 1% β

30'
Interior cont.
vert.



Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR

II. Component Name: CEDM Reed Switch Position Transmitter

1. Scope: [X] NSSS [ ] BOP
2. Model Number: 150" Type — Quantity: 182 Per Plant
3. Vendor: Combustion Engineering, 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 Slender Tube
   b. Dimensions 150" x approx. 1" dia.
   c. Weight Approx. 15 lbs.
6. Location: Building: Containment
   Elevation: 51 ft. to 63.5 ft. approx.
7. Field Mounting Conditions [X] Bolt (No. 4, Size 1/4-20)
   [ ] Weld (Length)
   [X] Clamped with 3" friction collar secured with 2 bolts
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
   S/S: >33 Hz F/B: >33 Hz
   V: >33 Hz
9. a. Functional Description: To transmit control element assembly position signals.
   b. Is the equipment required for [X] Hot Standby [ ] Cold Shutdown
   [ ] Both
10. Pertinent Reference Design Specifications: CE Specifications STD-485-311, Rev. 04 and 1370-485-311, Rev. 01

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

IV. Equipment Qualification Method: Test: Multifrequency input

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Combustion Engineering TR-ESE-285
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [ ] Combination of ______

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[X] Biaxial input
(Other, Specify)

2. Required Response Spectra (attach the graphs): Figs. 1 and 2 attached

3. Required Acceleration in Each Direction: ______

S/S = 1.1g F/B = 1.1g V = 0.8g

VI. If Qualification by Test, then Complete: ______

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

2. [ ] Single Axis [X] Multi-Axis (Bi-axial)

3. No. of Qualification Tests: OBE ______ SSE ______
Other Total of 60 OBE + DBE
(Specify)

4. Frequency Range: See TRS

5. TRS enveloping RRS using Multi-Frequency Test [X] Yes (plot TRS on RRS graphs)
(over applicable range)
[ ] No

6. Input g-level Test at:

S/S = >1.1 (Over applicable range)
F/B = >1.1
V = >0.8

7. Laboratory Mounting: Clamped to Control Element Drive Mechanism Upper Pressure Housing - identical to in-plant mounting.

1. [ ] Bolt (No. 4, Size 1/4-20) [ ] Weld (Length ______)
[ ] ______

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

9. Test Results including modifications made: Equipment met all requirements, no modifications required. (See attachment)

10. Other tests performed (such as fragility test, including results):

None

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

1. Description of Test including Results: ______

2. Method of Analysis: ______

[ ] Static Analysis
[ ] Dynamic Analysis

[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: ______ 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. Deflection	Location	Effect Upon Functional Operability

VI. Test Results

NATURAL FREQUENCIES VERTICAL See Discussion SIDE/SIDE See Discussion FRONT/BACK See Discussion

ELECTRICAL OPERATION Proper operation verified, no failures.

PHYSICAL INTEGRITY Intact; no physical effects

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS

MAXIMUM EXTERIOR DEFLECTION

DYNAMIC LOAD TO MOUNTING

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES

VI. DISCUSSION

(a) Mounting: The RSPT assembly was installed inside the shroud of the 150" CEDM. The CEDM was mounted on top of a biaxial shaker table with equal, phase coherent input motion in the horizontal and vertical axes.

(b) Full Level Seismic Test: Due to symmetry about the vertical axes of the RSPT the system was not tested in the side-to-side direction.

(c) Electrical Operation: The electrical performance of the RSPT assembly was verified with the actuating magnet held inside the shroud at the mid-position of the CEA travel range.

(d) Natural Frequencies: Due to the physical inaccessibility of the RSPT the natural frequencies of the RSPT could not be measured. However, the CEDM's fundamental natural frequency was found at 3.2 Hz and at about 200 Hz for the horizontal and vertical directions respectively.

2% DAMPING
Horizontal Response Spectrum

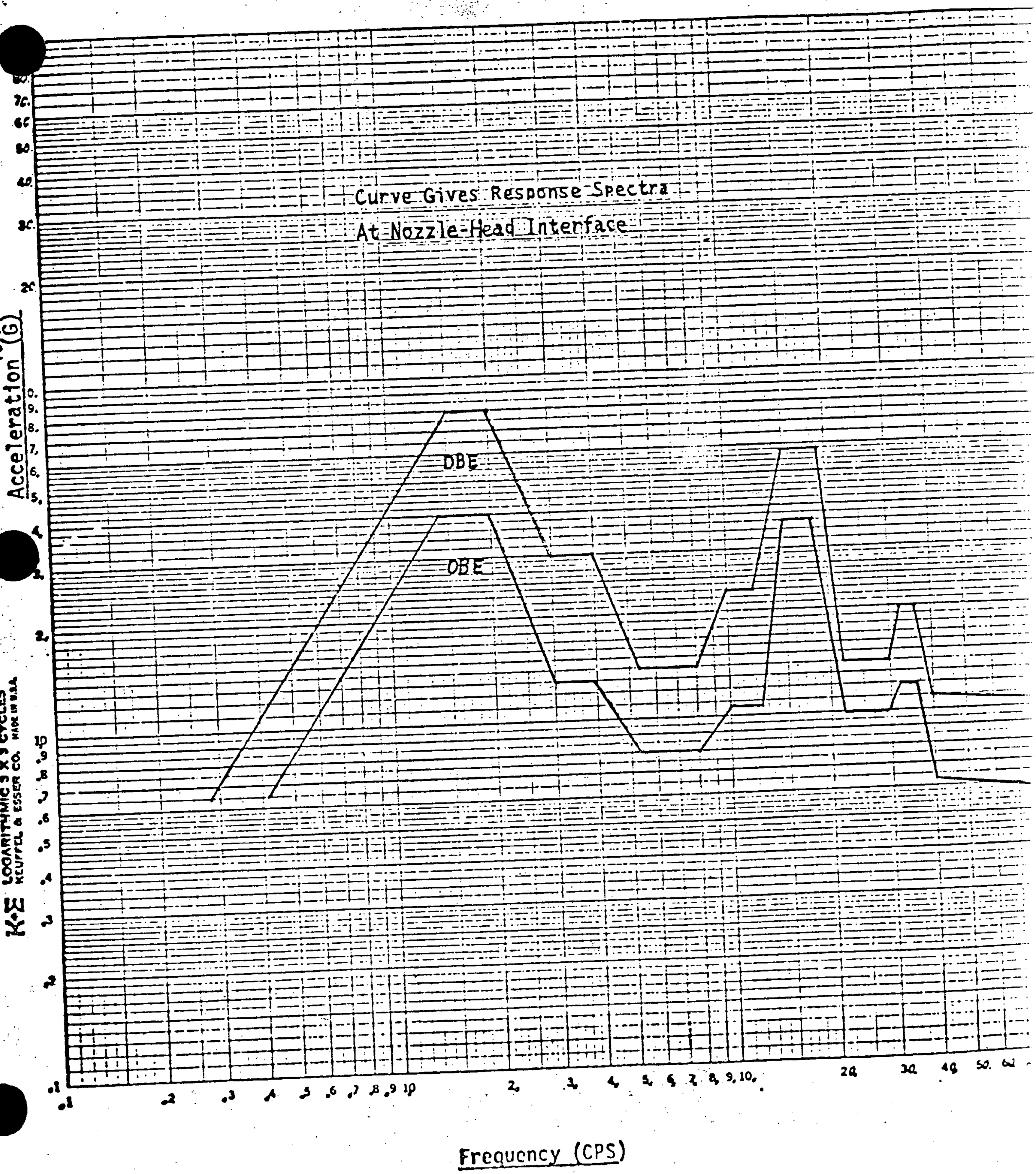
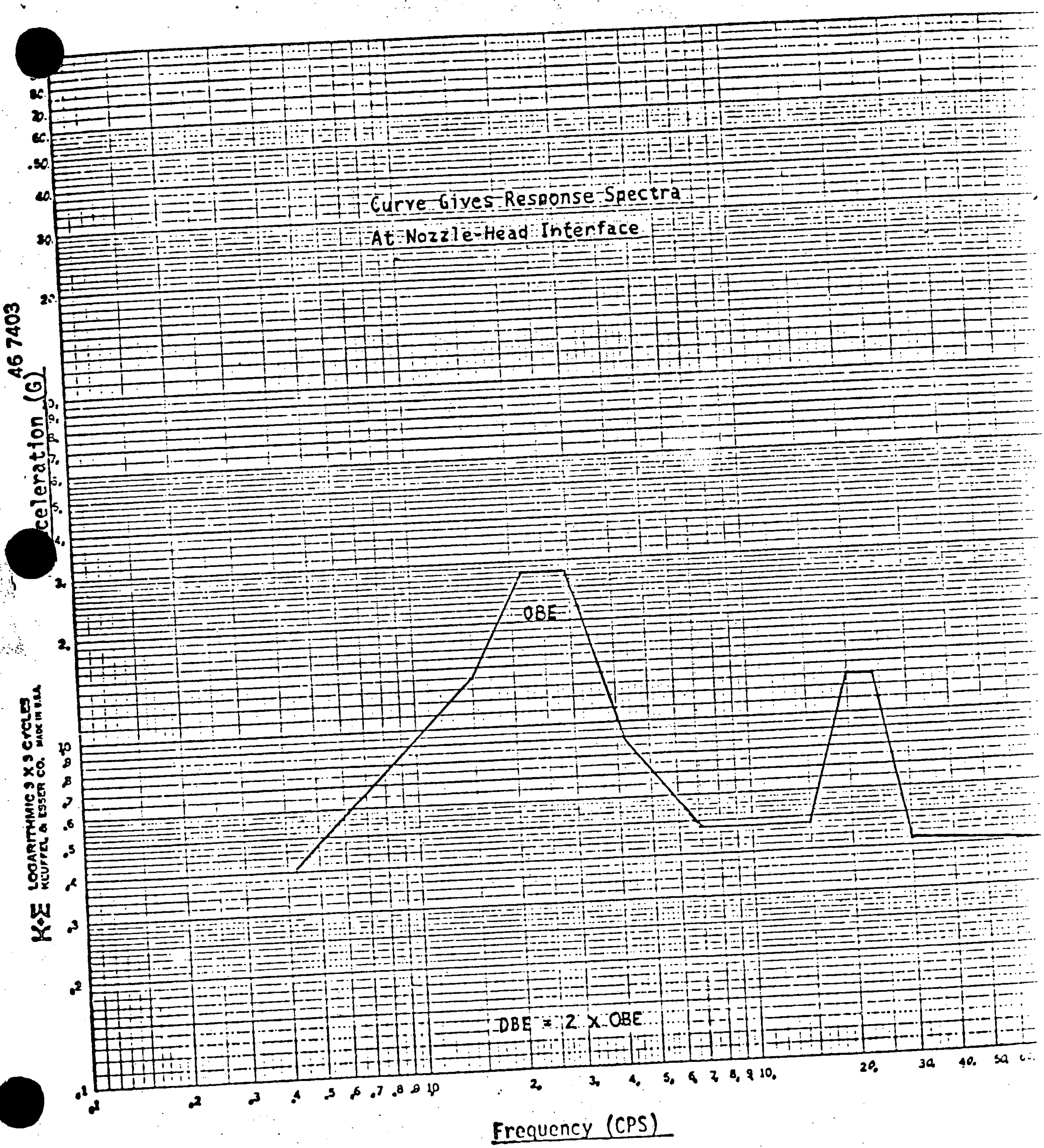


FIGURE 2

2% DAMPING
VERTICAL RESPONSE SPECTRUM



ATTACHMENT

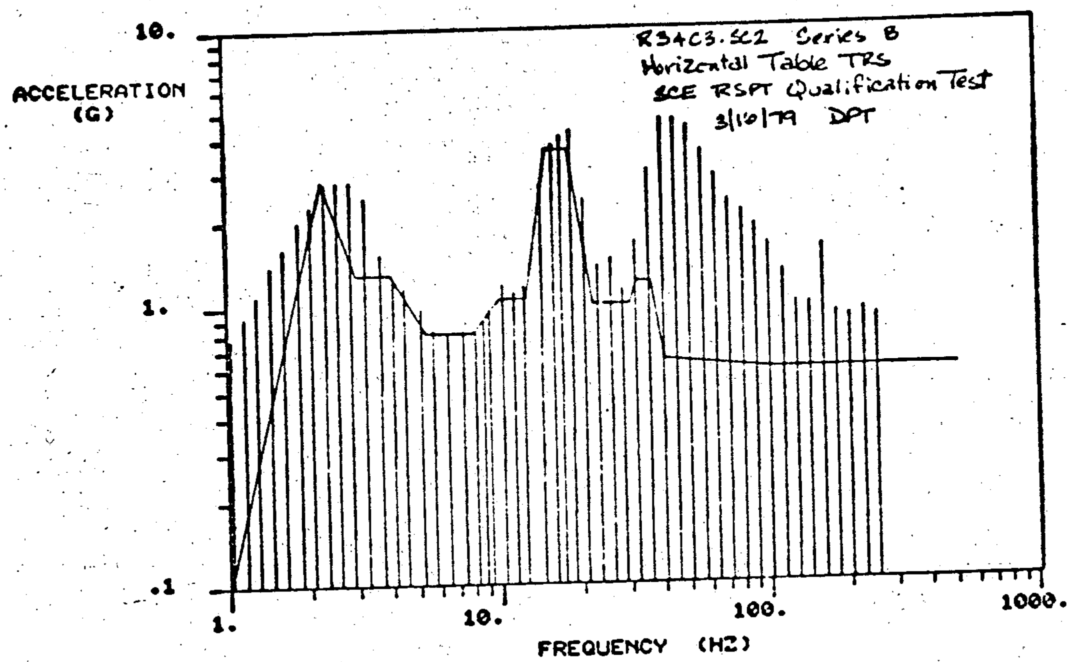
Qualification Summary of Equipment
- SAN ONOFRE RSPTs Test Response Spectra

Attached are graphs of horizontal and vertical Test Response Spectra (TRS) from the San Onofre Control Element Drive Mechnism (CEDM) Reed Switch Position Transmitter (RSPT) qualification test program. The TRSs indicate the actual seismic intensities achieved during random multi frequency bi-axial testing of the RSPT mounted inside a CEDM which was supported in a simulated SCE fashion. The spectra were developed for the simulated reactor head elevation (shaker table surface).

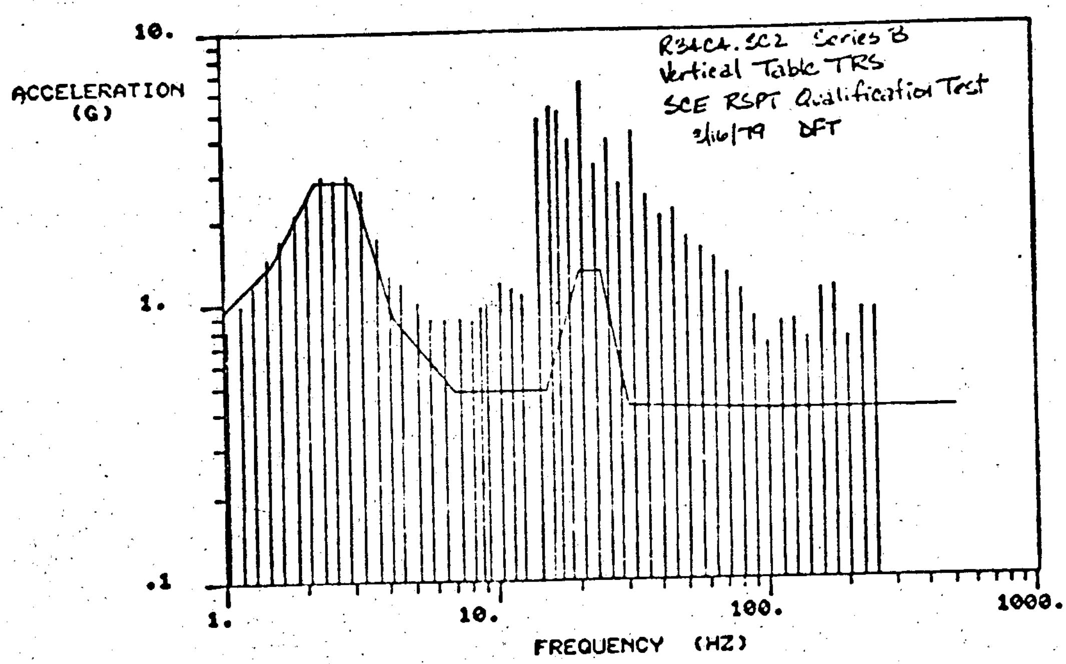
The vertical lines on the graphs indicate the actual achieved intensities of frequencies spaced no more than 1/6 octave apart. The solid lines indicate the Required Respnse Spectra (RRS). Whereas the vertical RRS is shown as specified, the horizontal RRS is shown modified below 2.25 Hertz (20% below lowest natural frequency of free standing CEDM). This modification is permissible according to Guidelines IEEE-344-1975, which only requires envelopment of the RRS over the "applicable" frequency range. The applicable range is defined as the frequency band in which support structure or specimen resonances are found. In the case of the SCE RSPT qualification test, the lowest support structure (CEDM) resonance was found at 5.6 Hertz and the reed switch assembly resonances are well above this frequency value.

Due to an asymmetric design condition of the RSPT, it was tested in two orientations. During Test Series A the RSPT was mounted inside the shroud in the rear position (facing the shaker table) and during Test Series B the RSPT was mounted in a side position.

The RSPT was found capable to withstand a minimum of 5 OBE and 1 DBE events for each test orientation without indicating any transient upset conditions or malfunctioning. Typical horizontal and vertical response spectra are attached for one DBE and two OBE events.



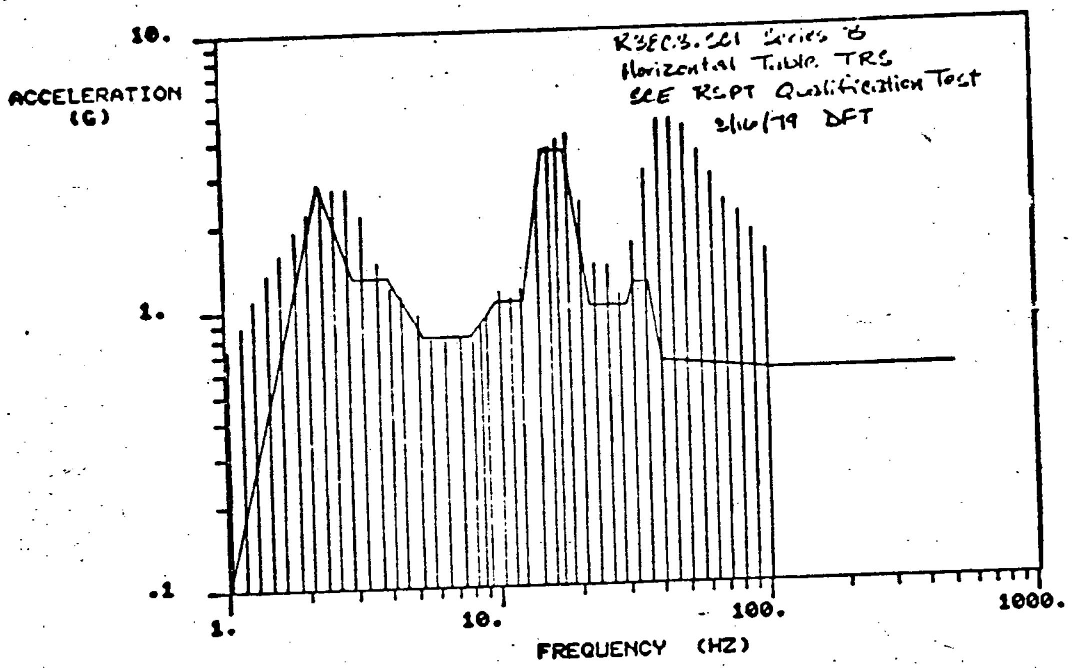
Horizontal
T.R.S.



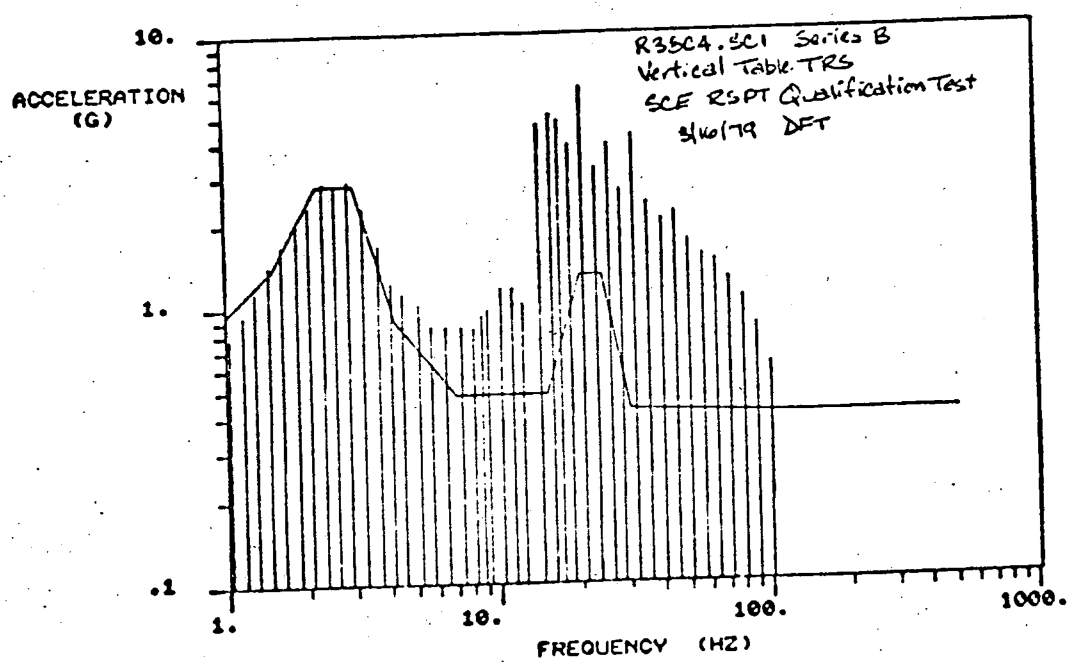
Vertical
T.R.S.

Series B OBE Event

Test Run No. 34



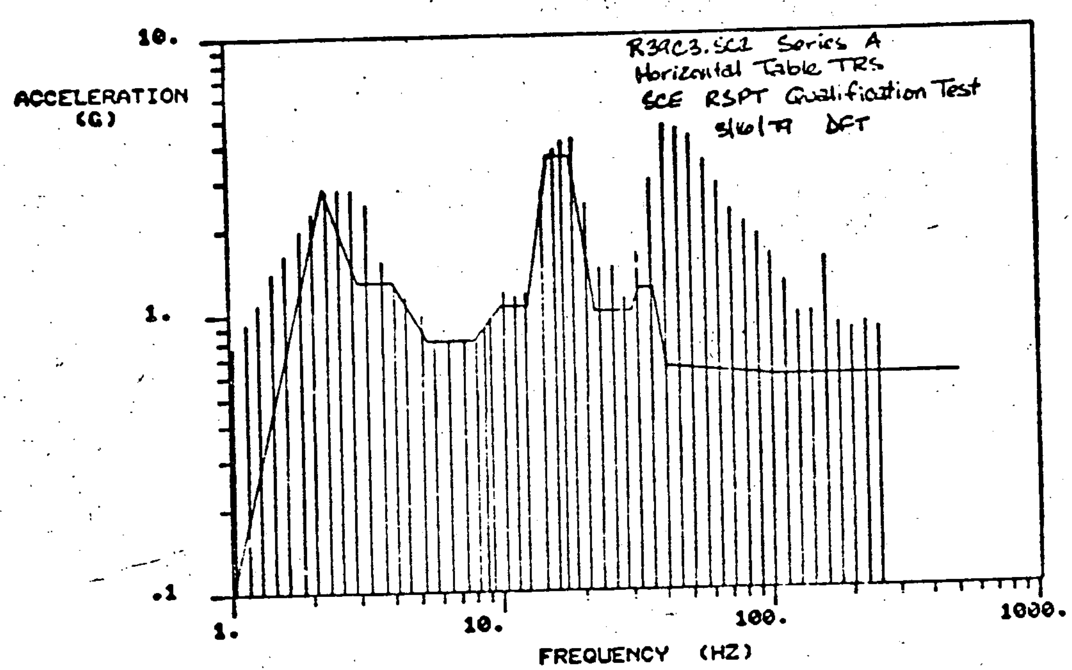
Horizontal
T.R.S.



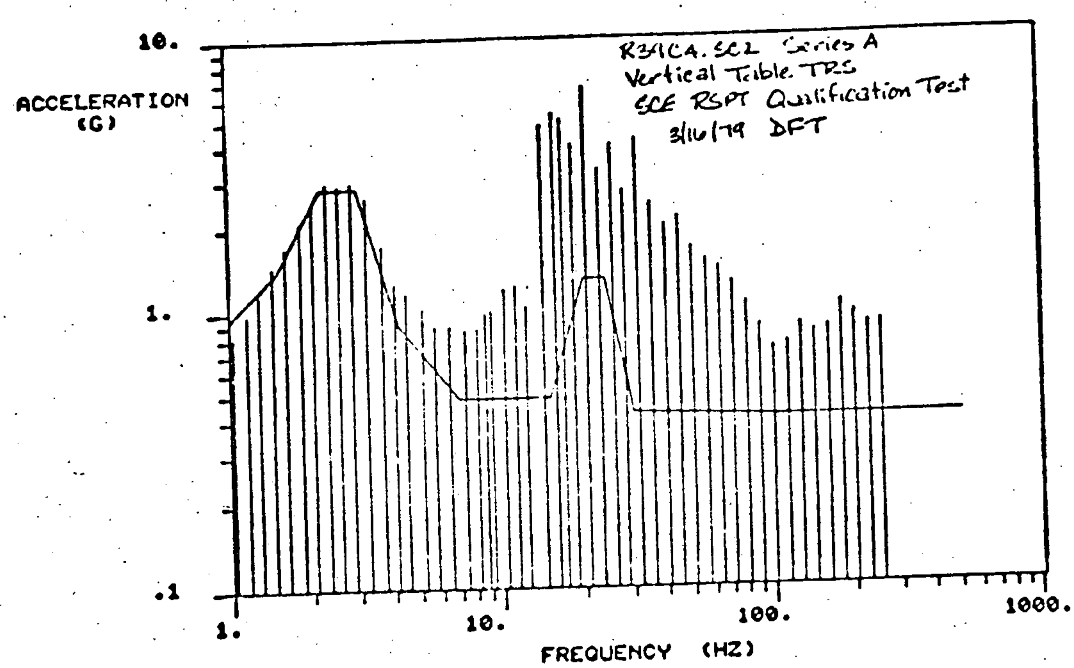
Vertical
T.R.S.

Series B OBE Event

Test Run No. 38



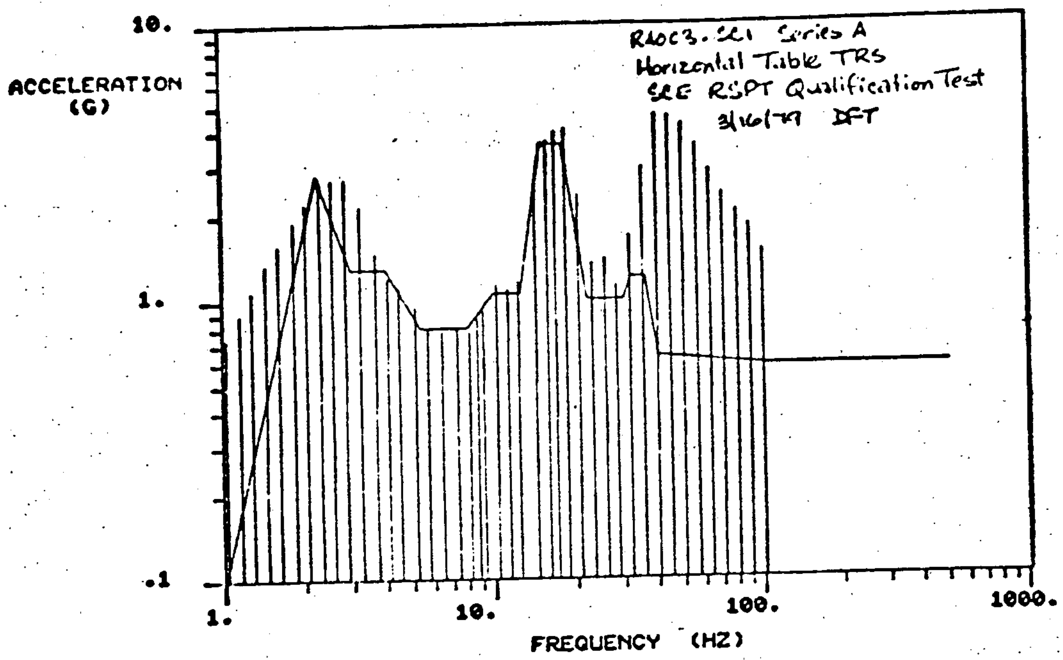
Horizontal
T.R.S.



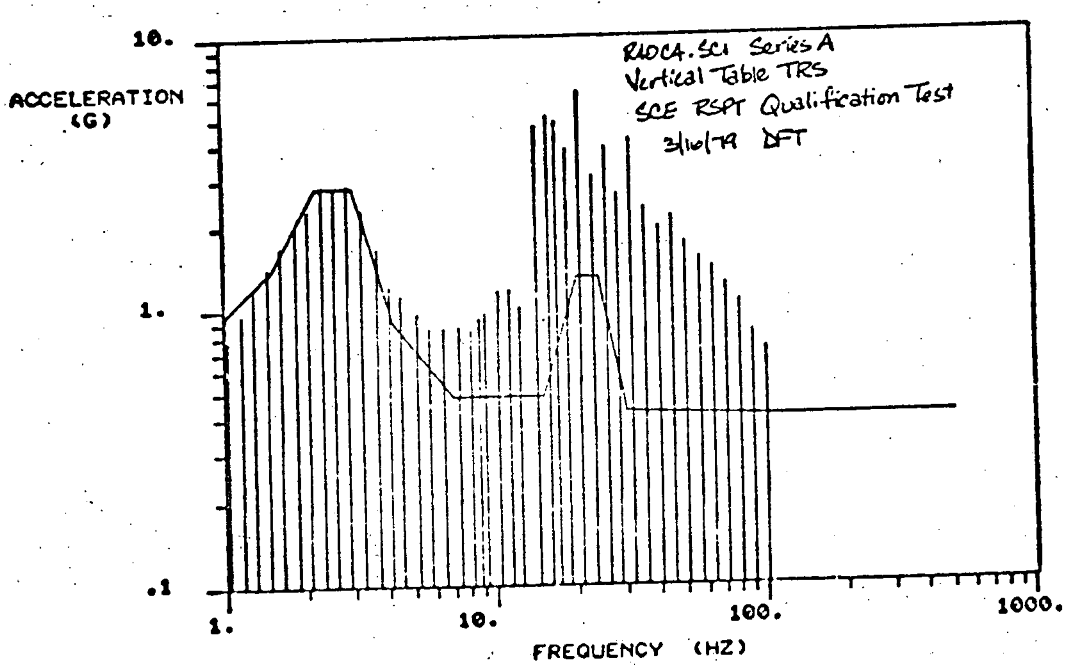
Vertical
T.R.S.

Series A OBE Event

Test Run No. 39



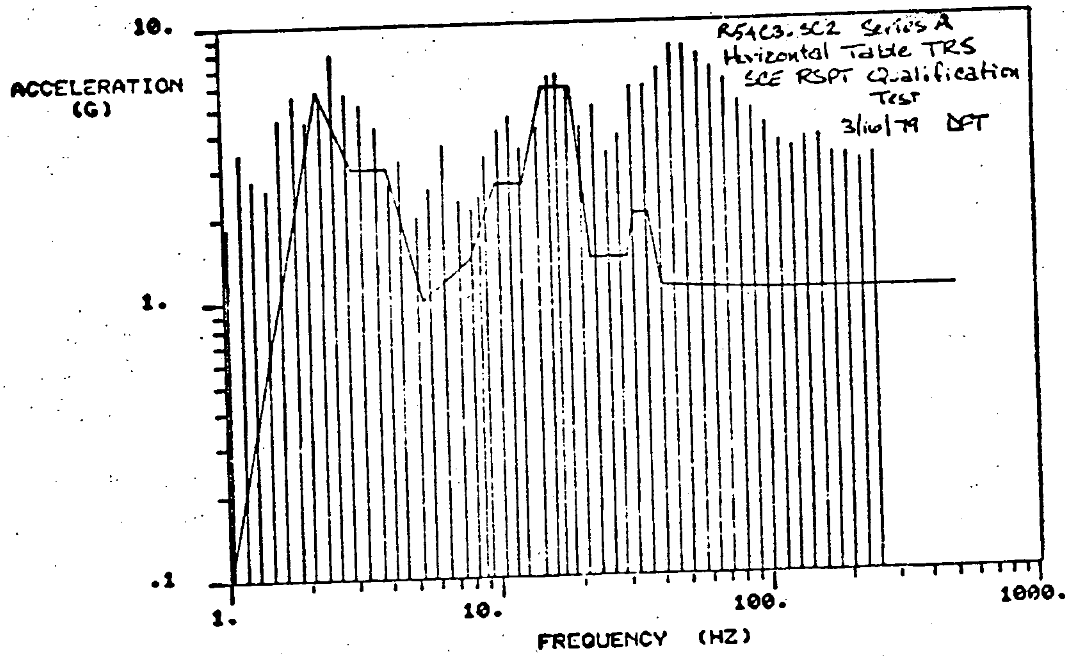
Horizontal T.R.S.



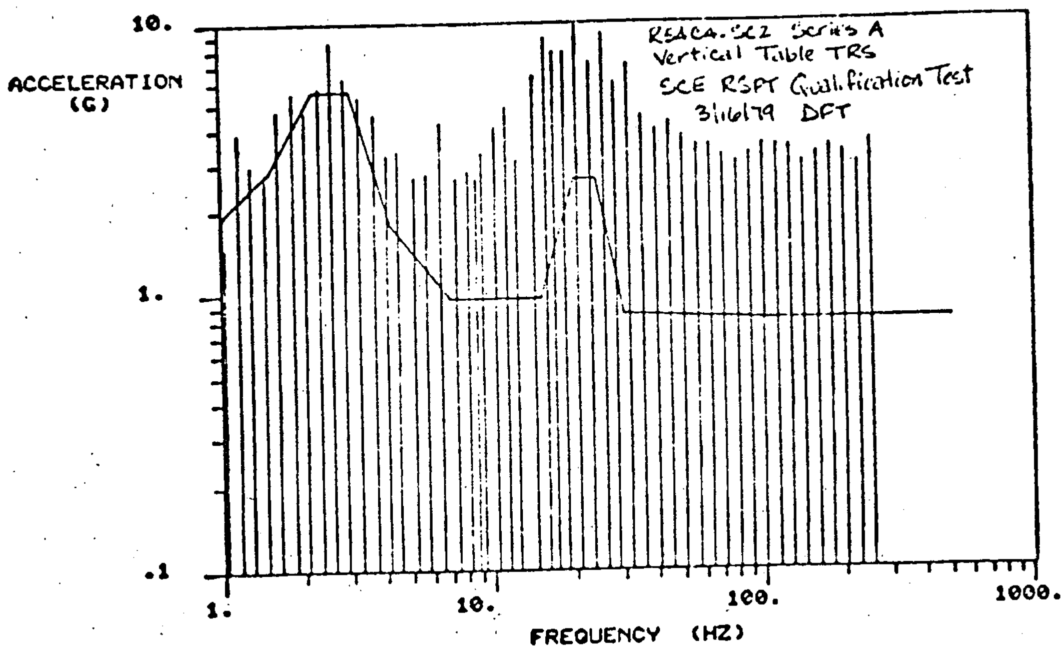
Vertical T.R.S.

Series A OBE Event

Test Run No. 40



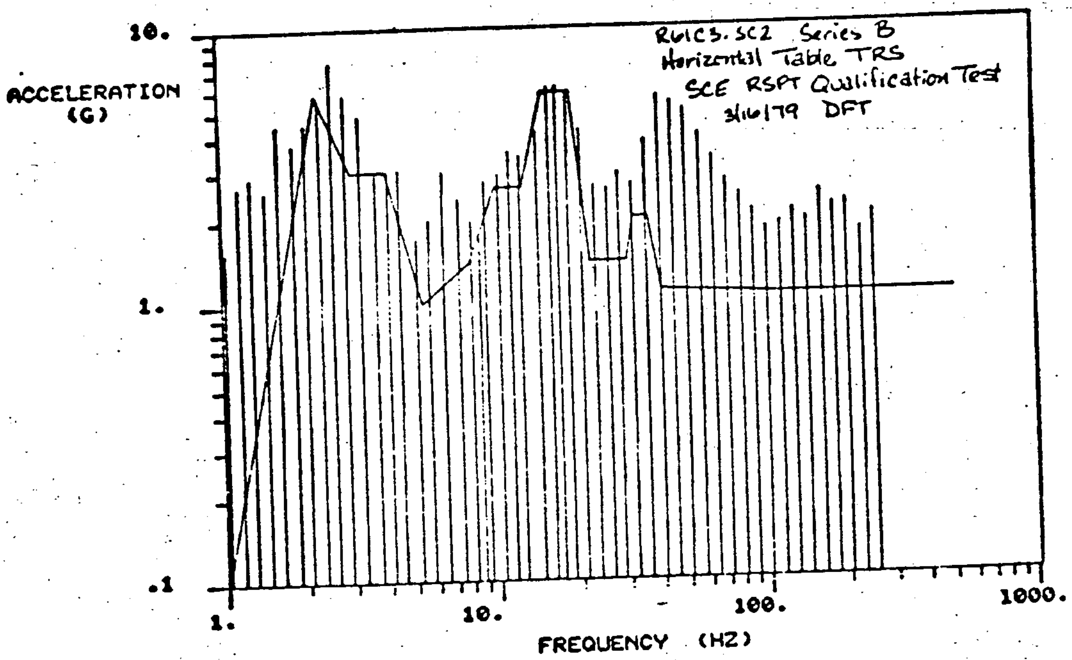
Horizontal T.R.S.



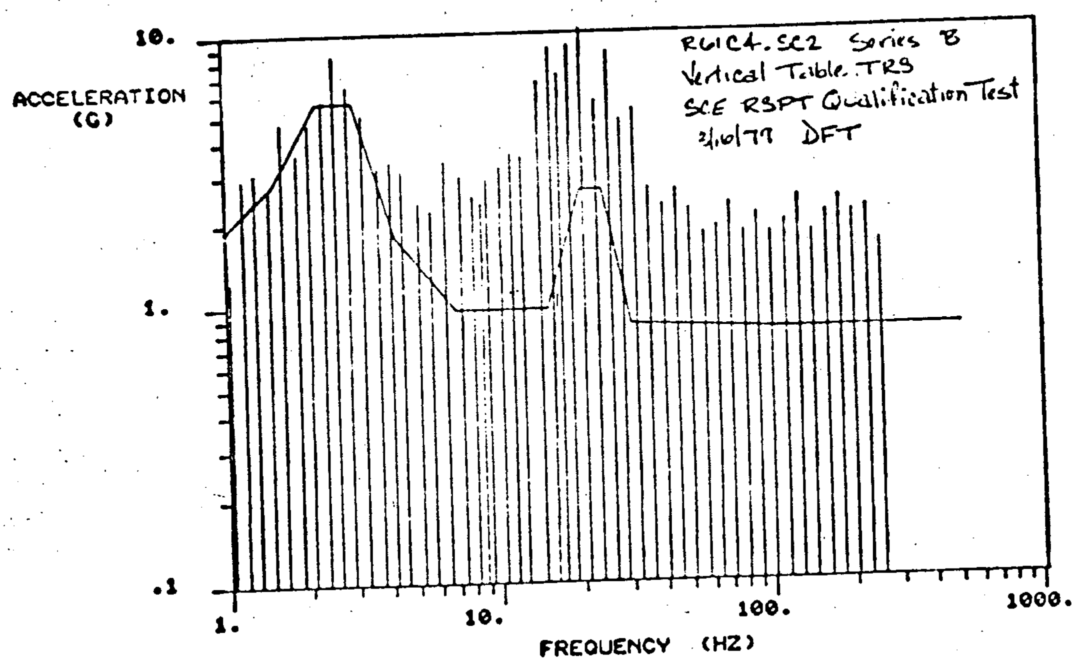
Vertical T.R.S.

Series A DBE Event

Test Run No. 54



Horizontal T.R.S.



Vertical T.R.S.

Series B DBE Event

Test Run No. 61

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR

II. Component Name: Magetic Flow Tube

1. Scope: [X] NSSS [ ] BOP
2. Model Number: 2800 — Quantity: 2
3. Vendor: Foxboro
4. If the component is a cabinet or panel, name and model No. of the devices included: NA
5. Physical Description a. Appearance Pipe section w/windings
   b. Dimensions 11 9/16" x 10 3/4" 14 5/8"
   c. Weight 44#
6. Location: Building: Safety Equipment Bldg.
   Elevation: 10"
7. Field Mounting Conditions [X] Bolt (No. 4, Size 1/2 per Flange End) Flange connection
   [ ] Weld (Length ______)
   [ ] ______
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
   S/S: >35 F/B: >35 V: >35
9. a. Functional Description: Develop output signal proportional to fluid flow rate through tube
   b. Is the equipment required for [X] Hot Standby [ ] Cold Shutdown
   [ ] Both ______
10. Pertinent Reference Design Specifications: 1370-ICE-0005 Sheet 342 Rev. 2

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

IV. Equipment Qualification Method: Test: X

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Foxboro, Report T5-6092
Lab - Action Laboratory Rpt. No. 12137
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [ ] Combination of ______

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ______
(Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ______

S/S = 1.1g input F/B = 1.1g input V = 1.4g input

VI. If Qualification by Test, then Complete: ______

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

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

3. No. of Qualification Tests: OBE ______ SSE ______
Other Full level at each integer freq from 1 to 35 HZ
(Specify)

4. Frequency Range: 1 to 35 HZ

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[ ] No

Not Acceptable

6. Input g-level Test at: (See test results attachment)

   S/S = 3 F/B= 3 V = 3

7. Laboratory Mounting: Simulating in-service mounting

   1. [ ] Bolt (No.______, Size______) [ ] Weld (Length____________)
      [X] Flanged into mock-up pipes

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

    NA

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

1. Description of Test including Results: NA

2. Method of Analysis:____________

   [ ] Static Analysis [ ] Equivalent Static Analysis
   [ ] Dynamic Analysis [ ] Time-History
   [ ] Response Spectrum

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: ________ 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. Deflection	Location	Effect Upon Functional Operability

NSSS 19

I. Test Results

ATURAL FREQUENCIES VERTICAL None below 35 Hz SIDE / SIDE None below 35 Hz FRONT / BACK None below 35 Hz

ECTRICAL OPERATION All shifts in calibration data and output signal level during testing less than 0.1% full scale.

PHYSICAL INTEGRITY Intact; no physical effects; no observable fluid leakage.

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS

MAXIMUM EXTERIOR DEFLECTION

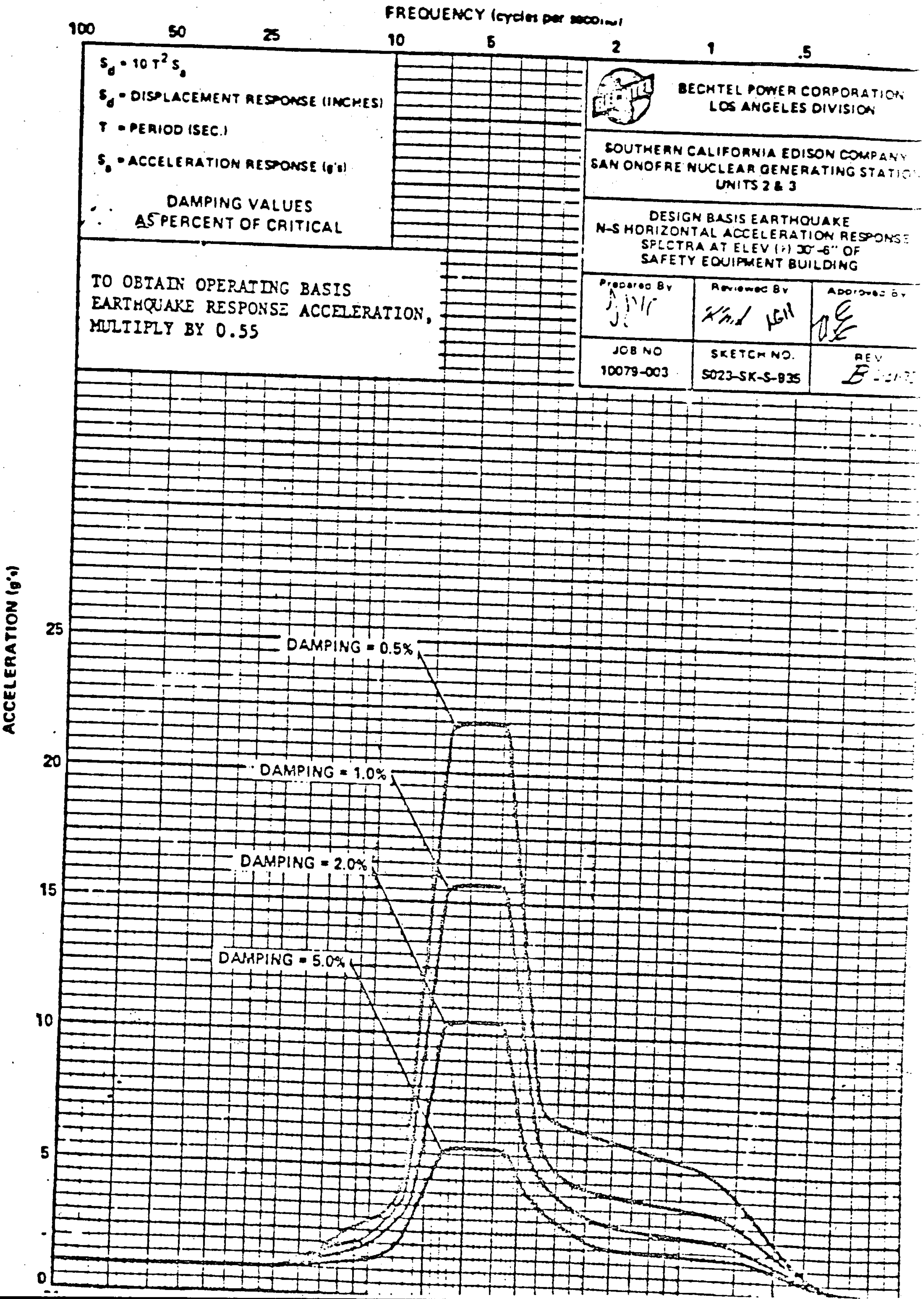
DYNAMIC LOAD TO MOUNTING

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES

VI. DISCUSSION

The test table acceleration (input motion to specimen) decreased to less than 3.0 g (but stayed greater than 1.0 g) at frequencies above 20 Hz due to test table non linearity.

C-E 0090234 (9/78)


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
$S_d = 10\ T^2\ S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
TO OBTAIN OPERATING BASIS
EARTHQUAKE RESPONSE ACCELERATION,
MULTIPLY BY 0.55
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
N-S HORIZONTAL ACCELERATION RESPONSE
SPECTRA AT ELEV (+) 30'-6" OF
SAFETY EQUIPMENT BUILDING
Prepared By
Reviewed By
Approved By
JOB NO
10079-003
SKETCH NO.
S023-SK-S-B35
REV
B
ACCELERATION (g's)
25
20
15
10
5
0
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%

$S_d = 10\,T^2\,S_a$

S_d = DISPLACEMENT RESPONSE (INCHES)

T = PERIOD (SEC.)

S_a = ACCELERATION RESPONSE (g's)

DAMPING VALUES
AS PERCENT OF CRITICAL

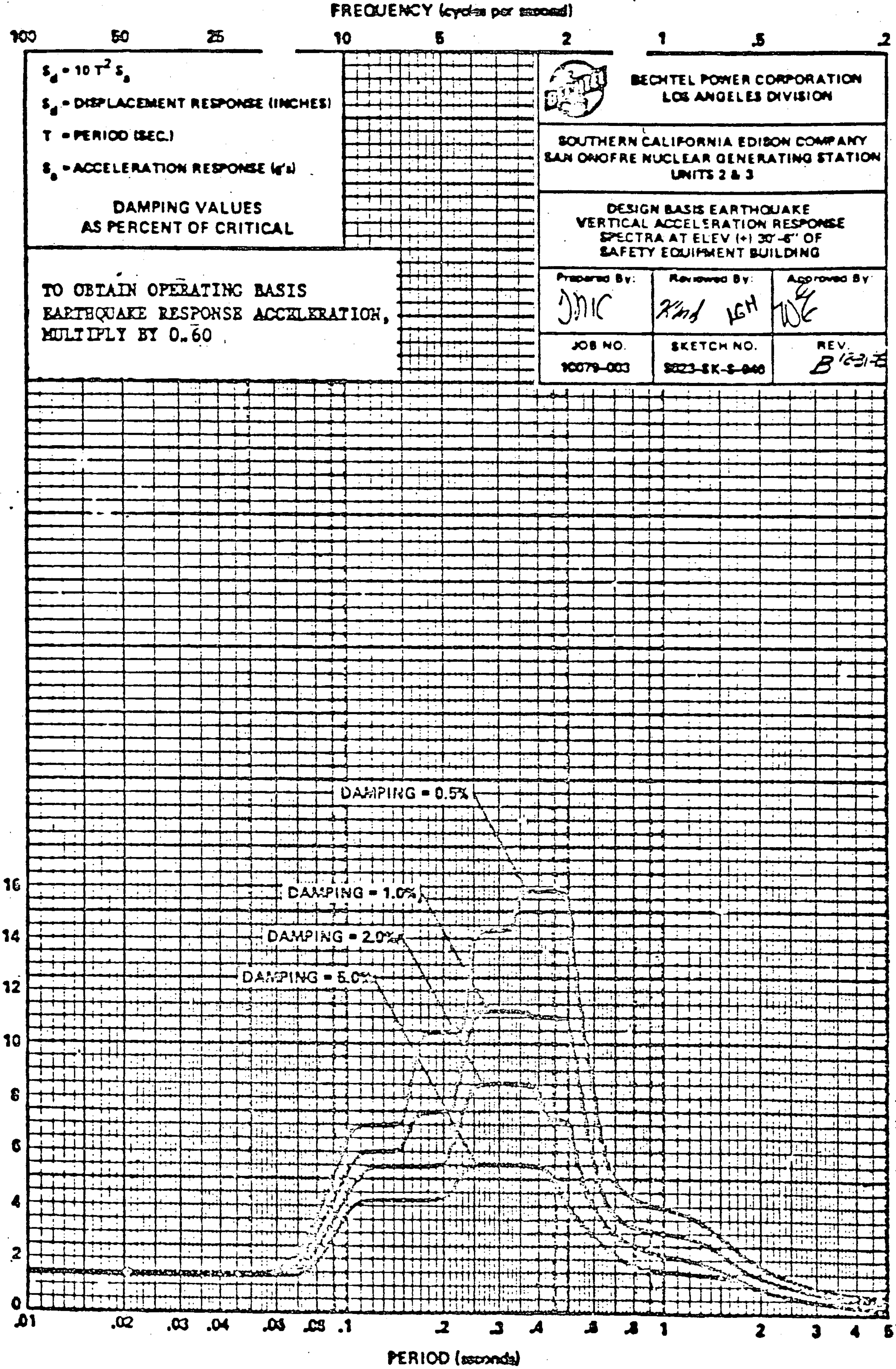
TO OBTAIN OPERATING BASIS EARTHQUAKE RESPONSE ACCELERATION, MULTIPLY BY 0.60

BECHTEL POWER CORPORATION
LOS ANGELES DIVISION

SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3

DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA AT ELEV (+) 30'-6" OF
SAFETY EQUIPMENT BUILDING

Prepared By:	Reviewed By:	Approved By:
JMC	[illegible] LGH	[illegible]
JOB NO.	SKETCH NO.	REV.
10079-003	S023-SK-S-040	B 12-31-[illegible]



Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 Type:

1. Utility: Southern California Edison Company PWR X

2. NSSS: CE 3. A/E: Bechtel BWR

II. Component Name: Magetic Flow Transmitter

1. Scope: [X] NSSS [ ] BOP

2. Model Number: E96 Quantity: 2

3. Vendor: Foxboro

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

5. Physical Description a. Appearance Enclosed Module

b. Dimensions 10 1/4" x 12" x 4 3/4"

c. Weight 20#

6. Location: Building: Safety Equipment Bldg.

Elevation: 11'

7. Field Mounting Conditions [X] Bolt (No. 2, Size 1/2")
[ ] Weld (Length)
[ ]

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

S/S: >35 F/B: >35 V: >35

9. a. Functional Description: Converts input siganl to output siganl (4-20 MA)

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

[ ] Both

10. Pertinent Reference Design Specifications: 1370-ICE-0005
Sheet 343 Rev. 1

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

IV. Equipment Qualification Method: Test: X

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Foxboro, Report T5-6092
Lab - Acton Laboratories Rpt. No. 12137
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [ ] Combination of ______

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ______
(Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ______

S/S = 1.1g F/B = 1.4g V = 1.4g

VI. If Qualification by Test, then Complete: ______

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

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

3. No. of Qualification Tests: OBE ______ SSE ______
Other Full level at each integer freq. from 1 to 35 HZ
(Specify)

4. Frequency Range: 1 to 35 HZ

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[ ] No

Not Applicable

6. Input g-level Test at: (See test results attachment)

S/S = 3 F/B = 3 V = 3

7. Laboratory Mounting: Simultating in service mounting

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

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

9. Test Results including modifications made: See attached sheet

10. Other tests performed (such as fragility test, including results):

NA

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

1. Description of Test including Results: NA

2. Method of Analysis: ____________________

[ ] Static Analysis
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

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: ________ 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. Deflection	Location	Effect Upon Functional Operability

NSSS 20

II. Test Results

NATURAL FREQUENCIES: VERTICAL None below 35 Hz	SIDE / SIDE None below 35 Hz FRONT / BACK None below 35 Hz
ELECTRICAL OPERATION	All shifts of calibration and instrument output during testing less than 0.1% of full scale.
PHYSICAL INTEGRITY	Intact; no physical effects.

DYNAMIC RESPONSE TO FULL LEVEL TEST (LARGE OR SUPPORT STRUCTURES ONLY)

MAXIMUM STRUCTURAL STRESS

MAXIMUM EXTERIOR DEFLECTION

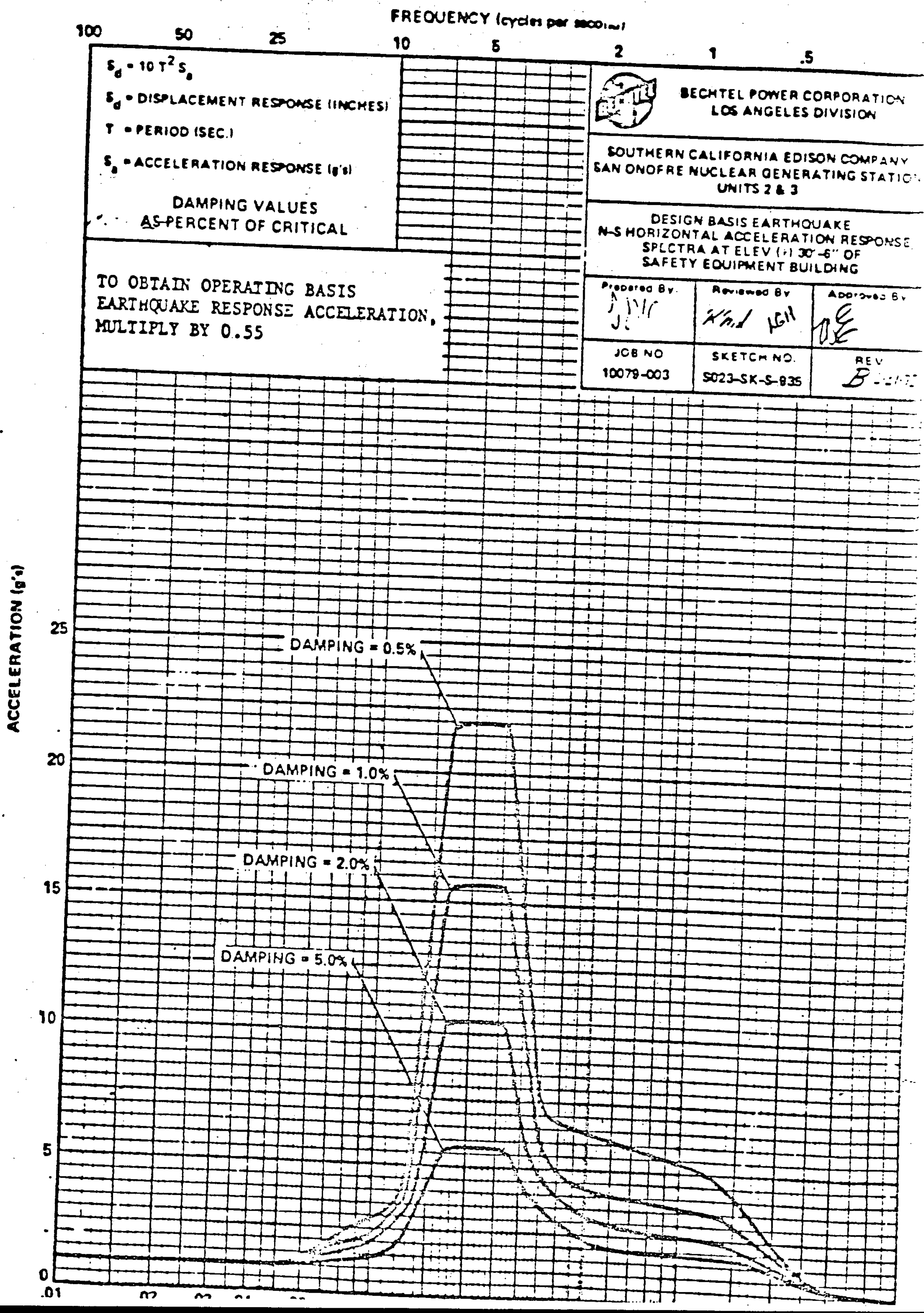
DYNAMIC LOAD TO MOUNTING

MAXIMUM TRANSMISSIBILITY TO SUPPORTED DEVICES

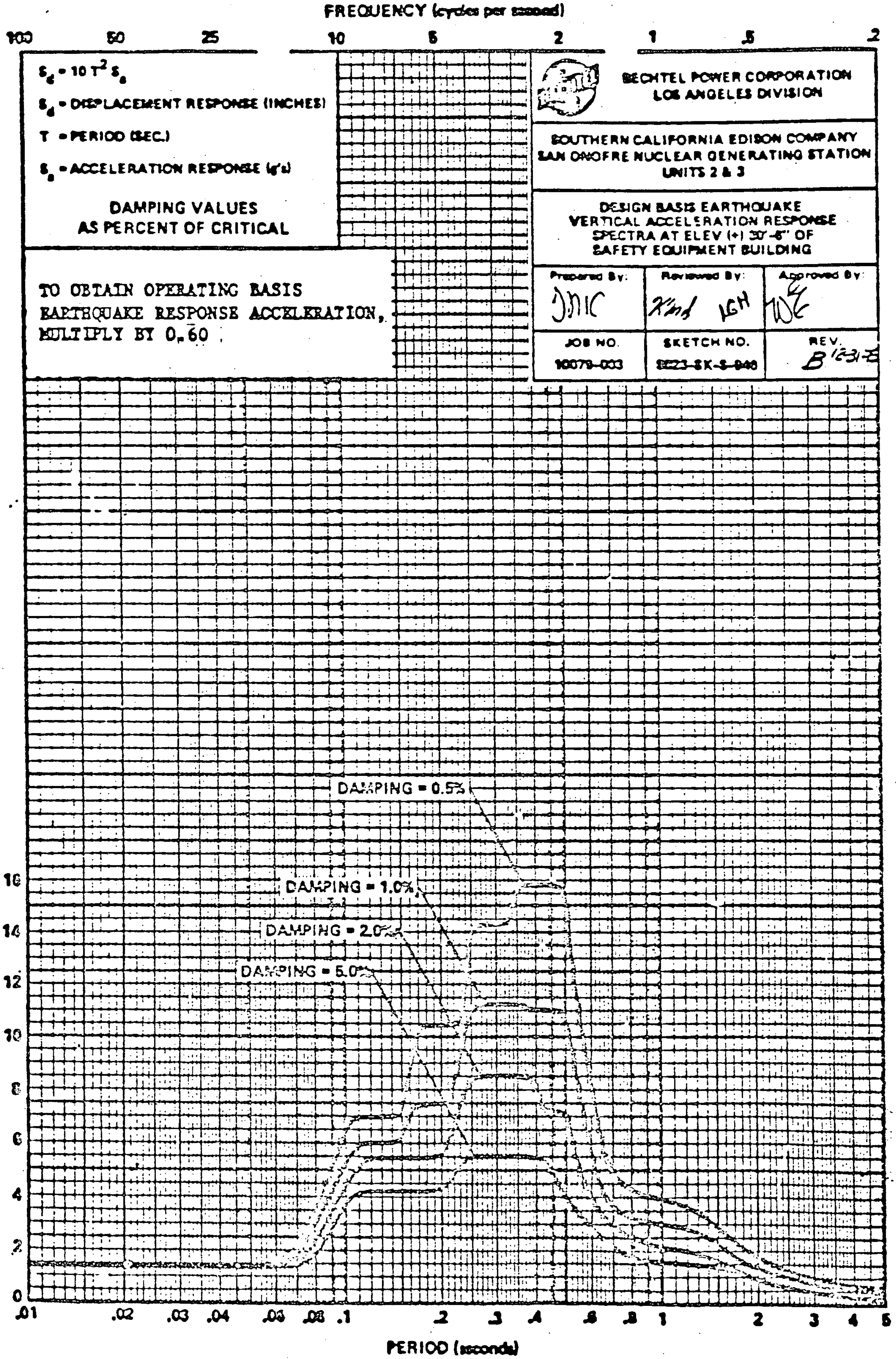
VI. DISCUSSION

The test table acceleration (input motion to specimen) decreased to less than 3g. (but stayed greater than 1.0g.) at frequencies beyond 20 Hz due to test table control difficulty.

C-E 0090234 (9/75)



FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
TO OBTAIN OPERATING BASIS EARTHQUAKE RESPONSE ACCELERATION, MULTIPLY BY 0.55
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
N-S HORIZONTAL ACCELERATION RESPONSE SPECTRA AT ELEV (+) 30'-6" OF SAFETY EQUIPMENT BUILDING
Prepared By
Reviewed By
Approved By
JOB NO
10079-003
SKETCH NO.
S023-SK-S-835
REV
B
ACCELERATION (g's)
25
20
15
10
5
0
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
.01


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
TO OBTAIN OPERATING BASIS EARTHQUAKE RESPONSE ACCELERATION, MULTIPLY BY 0.60
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA AT ELEV (+) 30'-6" OF
SAFETY EQUIPMENT BUILDING
Prepared By:
Reviewed By:
Approved By:
JOB NO.
10079-003
SKETCH NO.
REV.
B
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
16
14
12
10
8
6
4
2
0
.01
.02
.03
.04
.05
.06
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE — 3. A/E: Bechtel — BWR ____

II. Component Name: Containment Purge Isolation Detector

1. Scope: [X] NSSS [ ] BOP
2. Model Number: GA-3M-652-1-21-X-5-0 Quantity: 2
3. Vendor: Nuclear Measurements 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 Wall mounted detector ass'y
   b. Dimensions 16" x 14" x 5'
   c. Weight ≅10#
6. Location: Building: Penetration Bldg.
   Elevation: 45'
7. Field Mounting Conditions [X] Bolt (No. 4 , Size 1/4-20)
   [ ] Weld (Length ____)
   [ ] Not yet mounted
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):
   S/S: ____ F/B: ____
   V: ____
9. a. Functional Description: Detect high radiation level, sends analog signal to transmitter
   b. Is the equipment required for [X] Hot Standby [X] Cold Shutdown
   [X] Both ____
10. Pertinent Reference Design Specifications: 1370-ICE-5003, Rev. 1

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

IV. Equipment Qualification Method: Test: X

Analysis: ____

Combination of Test and Analysis: ____

Test and/or Analysis by Test report not received.
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ____

5. [ ] Combination of ____

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ____
(Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ____

S/S = 0.9g input F/B = 0.9g input V = 0.9g input

VI. If Qualification by Test, then Complete: ____

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

2. [ ] Single Axis [ ] Multi-Axis (Bi-Axial)

3. No. of Qualification Tests: OBE ____ SSE ____
Other ____
(Specify)

4. Frequency Range: ____

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[ ] No

6. Input g-level Test at:

S/S = ______________________________
F/B = ______________________________
V = ______________________________

7. Laboratory Mounting: ______________________________

1. [ ] Bolt (No.______, Size______) [ ] Weld (Length____________)
Commercial
[ ] ______________________________

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

9. Test Results including modifications made: ______________________________

10. Other tests performed (such as fragility test, including results):

N/A ______________________________

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

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

2. Method of Analysis: ______________________________

[ ] Static Analysis [ ] Equivalent Static Analysis
[ ] Dynamic Analysis [ ] Time-History
[ ] Response Spectrum

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: __________ Basis for the damping used: ______________________________

7. Support Considerations in the model: ______________________________

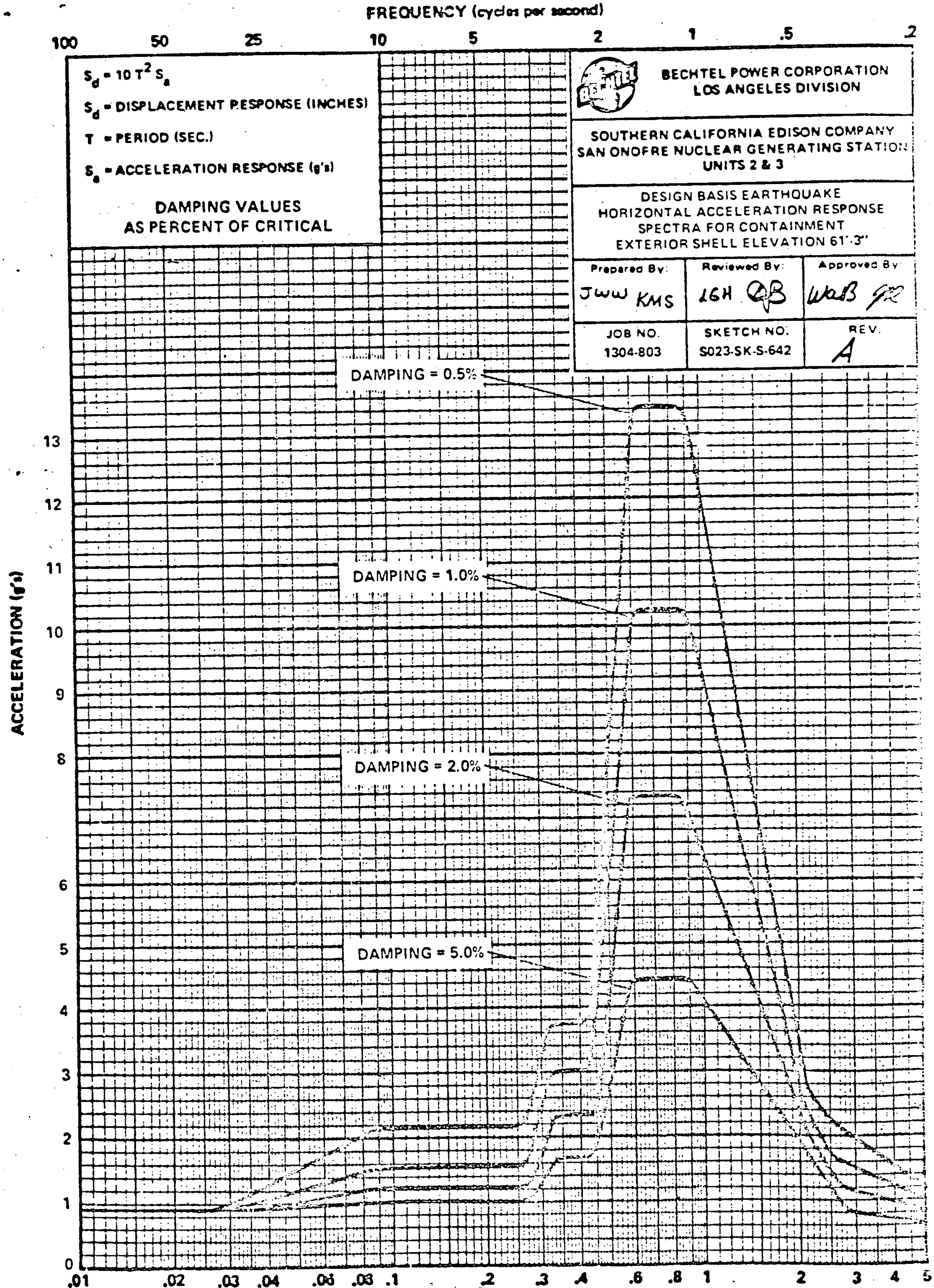
8. Critical Structural Elements: ______________________________

A.

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

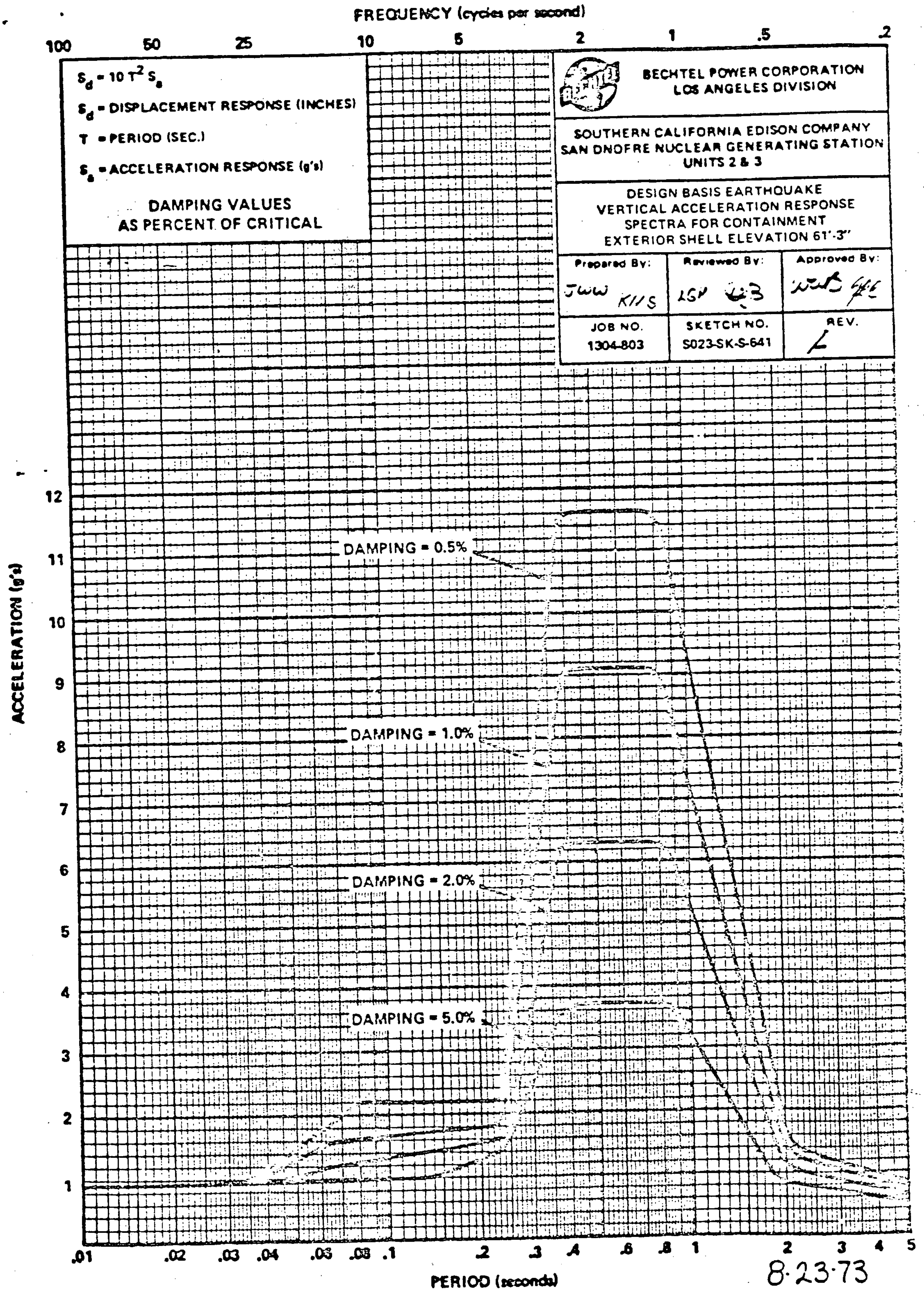
B.

Max. Deflection	Location	Effect Upon Functional Operability



FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA FOR CONTAINMENT
EXTERIOR SHELL ELEVATION 61'-3"
Prepared By: JWW KMS
Reviewed By: LGH QB
Approved By: WaB
JOB NO. 1304-803
SKETCH NO. S023-SK-S-642
REV. A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
13
12
11
10
9
8
6
5
4
3
2
1
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

8-23-73


FREQUENCY (cycles per second)
100 50 25 10 5 2 1 .5 .2
$S_d = 10\,T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA FOR CONTAINMENT
EXTERIOR SHELL ELEVATION 61'-3"
Prepared By: JWW KHS
Reviewed By:
Approved By:
JOB NO. 1304-803
SKETCH NO. S023-SK-S-641
REV.
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
12 11 10 9 8 7 6 5 4 3 2 1
.01 .02 .03 .04 .06 .08 .1 .2 .3 .4 .6 .8 1 2 3 4 5
PERIOD (seconds)
8·23·73

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X

2. NSSS: CE — 3. A/E: Bechtel — BWR ______

II. Component Name: Containment Purge Isolation Transmitter

1. Scope: [X] NSSS [ ] BOP

2. Model Number: GA-3M-652-1-21-X-5-0 — Quantity: 2

3. Vendor: Nuclear Measurements 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 Wall mounted assembly

   b. Dimensions 14-1/4" x 17-1/2" x 8"

   c. Weight ≅20#

6. Location: Building: Penetration Bldg.

   Elevation: 45'

7. Field Mounting Conditions [X] Bolt (No. 4, Size 1/2-20)
   [ ] Weld (Length ______)
   [ ] ______

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

   S/S: ______ F/B: ______
   V: ______

9. a. Functional Description: Generate actuation signal from input analog signal

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

   [X] Both ______

10. Pertinent Reference Design Specifications: 1370-ICE-5003, Rev. 1

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

IV. Equipment Qualification Method: Test: ______

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by Test report not received.
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [ ] Combination of ______

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ______
(Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ______

S/S = 0.9g input F/B = 0.9g input V = 0.9g input

VI. If Qualification by Test, then Complete: ______

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. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[ ] No

______

6. Input g-level Test at:

   S/S = ______________________
   F/B = ______________________
   V   = ______________________

7. Laboratory Mounting: ______________________

   1. [ ] Bolt (No.______, Size______) [ ] Weld (Length____________)
      Commercial
      [ ] ______________________

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

9. Test Results including modifications made: ______________________

10. Other tests performed (such as fragility test, including results):

    N/A

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

1. Description of Test including Results: N/A

2. Method of Analysis: ______________________

   [ ] Static Analysis   [ ] Equivalent Static Analysis
   [ ] Dynamic Analysis   [ ] Time-History
   [ ] Response Spectrum

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: ________ Basis for the damping used: ______________________

7. Support Considerations in the model: ______________________

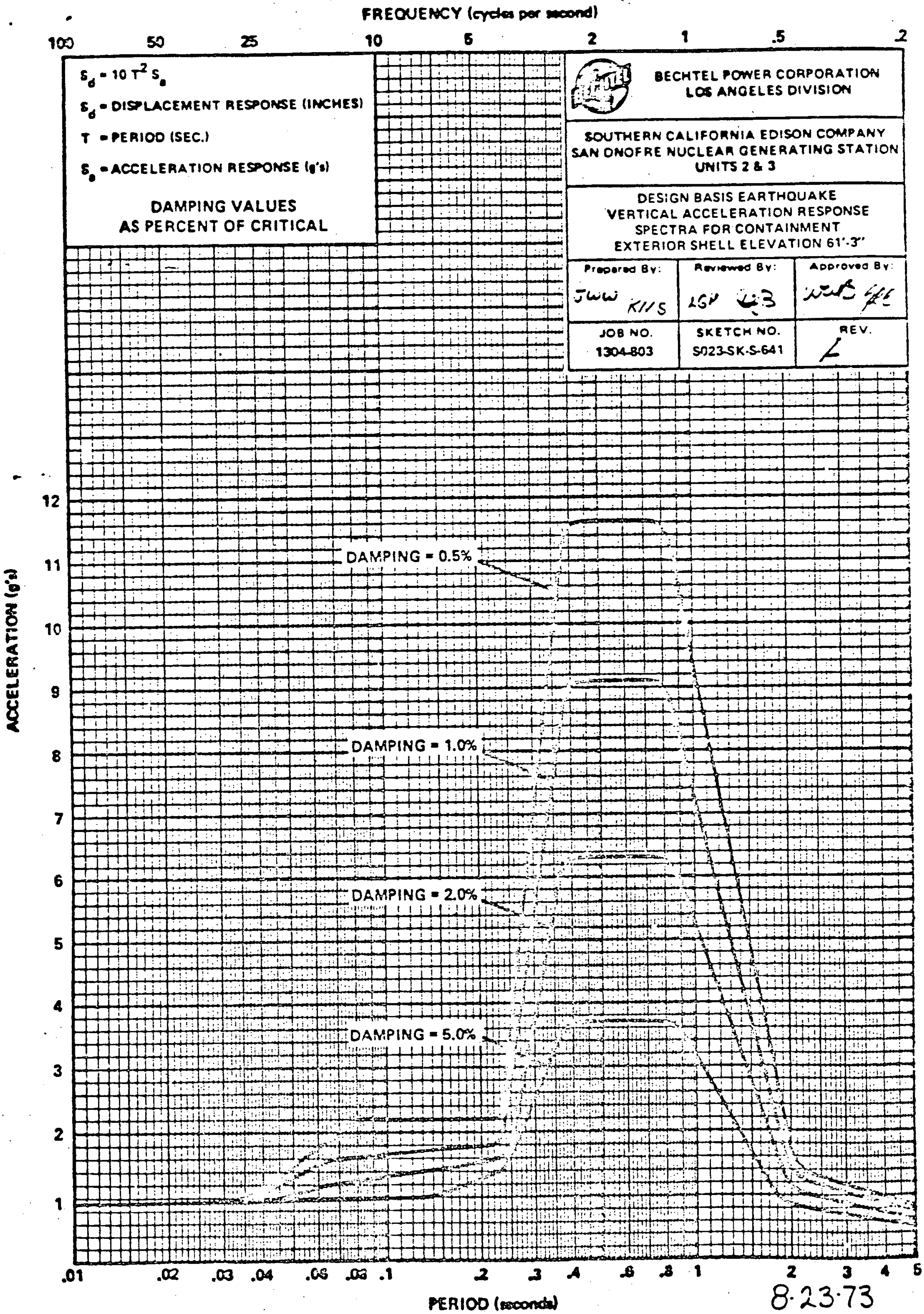
8. Critical Structural Elements: ______________________

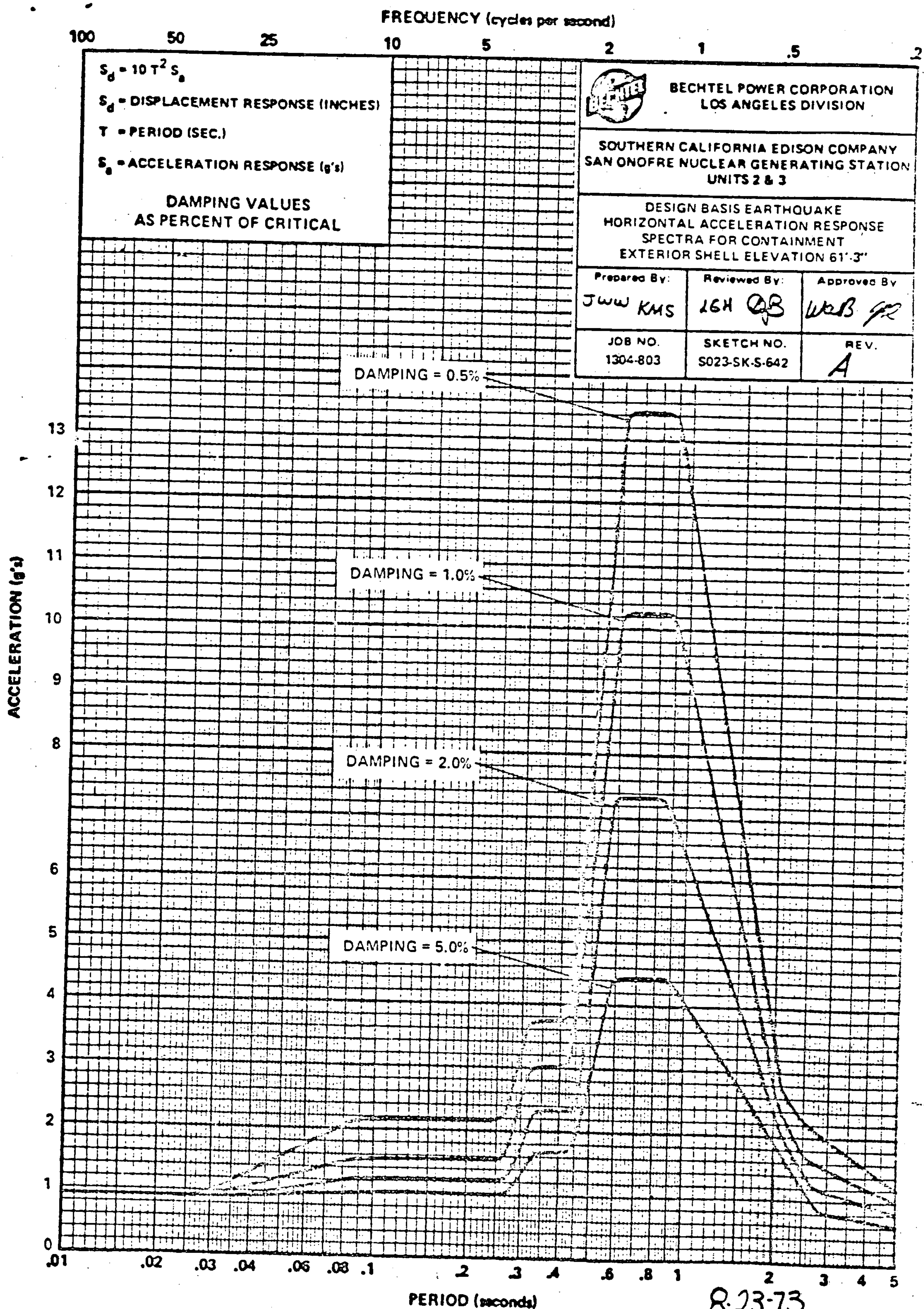
A.

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

B.

Max. Deflection	Location	Effect Upon Functional Operability


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA FOR CONTAINMENT
EXTERIOR SHELL ELEVATION 61'-3"
Prepared By:
Reviewed By:
Approved By:
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-641
REV.
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
12
11
10
9
8
7
6
5
4
3
2
1
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)
8·23·73


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA FOR CONTAINMENT
EXTERIOR SHELL ELEVATION 61'-3"
Prepared By: JWW KMS
Reviewed By: LGH QJB
Approved By: WaB
JOB NO. 1304-803
SKETCH NO. S023-SK-S-642
REV. A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
13
12
11
10
9
8
6
5
4
3
2
1
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

8-23-73

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 Type:

1. Utility: Southern California Edison Company PWR X

2. NSSS: CE 3. A/E: Bechtel BWR

II. Component Name: 3HV9323 2" HPSI Globe Motor Op. Valve (SI 616)

1. Scope: [X] NSSS [ ] BOP

2. Model Number: TRC DWG 74R-002 Quantity: 8

3. Vendor: Target Rock Corp.

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

5. Physical Description a. Appearance "Y" Pattern Globe Valve

   b. Dimensions Body = 10 1/2" long x 25 15/16" (height to top of motor)

   c. Weight 252 lbs

6. Location: Building: Auxiliary

   Elevation: 33'-45'

7. Field Mounting Conditions [ ] Bolt (No.______, Size______)
   [X] Weld (Length Continuous)
   [ ]

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

   S/S: >35Hz F/B: >35Hz.
   V: >35Hz.

9. a. Functional Description: High Pressure Savety Injection in the Emergency Core Cooling System

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

   [ ] Both

10. Pertinent Reference Design Specifications: 1370-PE-705

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

IV. Equipment Qualification Method: Test: X

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by East-West Technology Corp/Report #7905-7
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [ ] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [X] Combination of Seismic + Pipe end loading + Design Press.

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ______
(Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ______

S/S = 3.0 F/B = 3.0 V = 3.0

VI. If Qualification by Test, then Complete: ______

1. [X] Single Frequency [ ] Multi-Frequency: [ ] random
[ ] sine beat
[X] 30 sec. continuous sine
[Consisted of 3 tests; 1 in each direction]

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

3. No. of Qualification Tests: OBE ______ SSE ______
Other 12 @ 1, 1.5, 2, 3, 4, 6, 8, 12, 16, 24, 32, 35Hz.
(Specify)

4. Frequency Range: 1-35Hz

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[ ] No
Not Applicable

6. Input g-level Test at:

   S/S = 3.0g
   F/B = 3.0g
   V = 3.0g

7. Laboratory Mounting: In Horizontal Pipe Run:

   1. [ ] Bolt (No.______, Size______) [X] Weld (Length * __________)
      [ ] ____________________

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

9. Test Results including modifications made: The natural frequency is greater than 33Hz and the valve is operable at loaded conditions

10. Other tests performed (such as fragility test, including results):

    None

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

1. Description of Test including Results: ____________________

2. Method of Analysis: ____________________

   [ ] Static Analysis
   [ ] Dynamic Analysis
   [ ] Equivalent Static Analysis
   [ ] Time-History
   [ ] Response Spectrum

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: __________ Basis for the damping used: ____________________

7. Support Considerations in the model: ____________________

* Valve inlet and outlet welded to pipe sections which were attached to flanged connections.

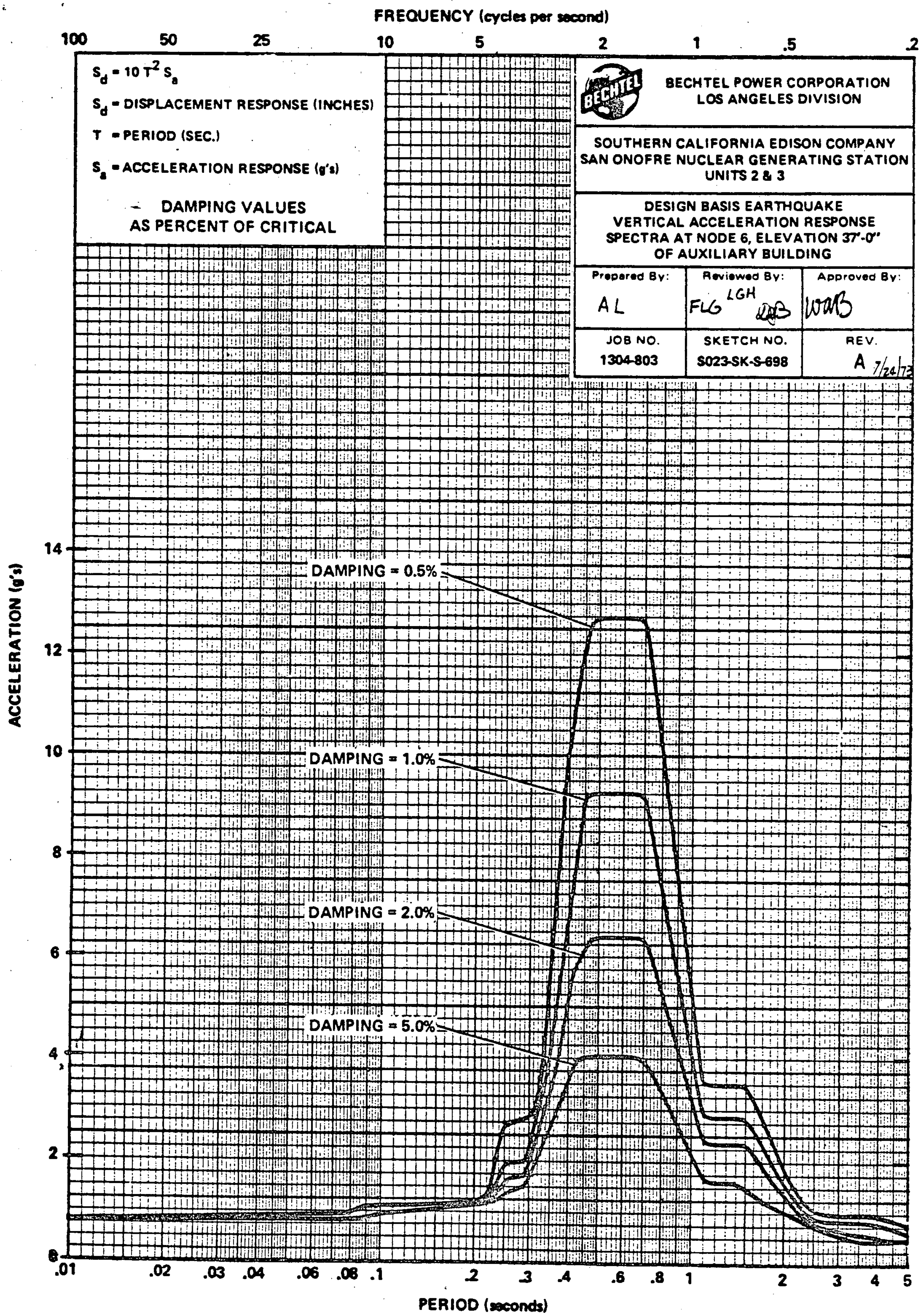
8. Critical Structural Elements: ____________________

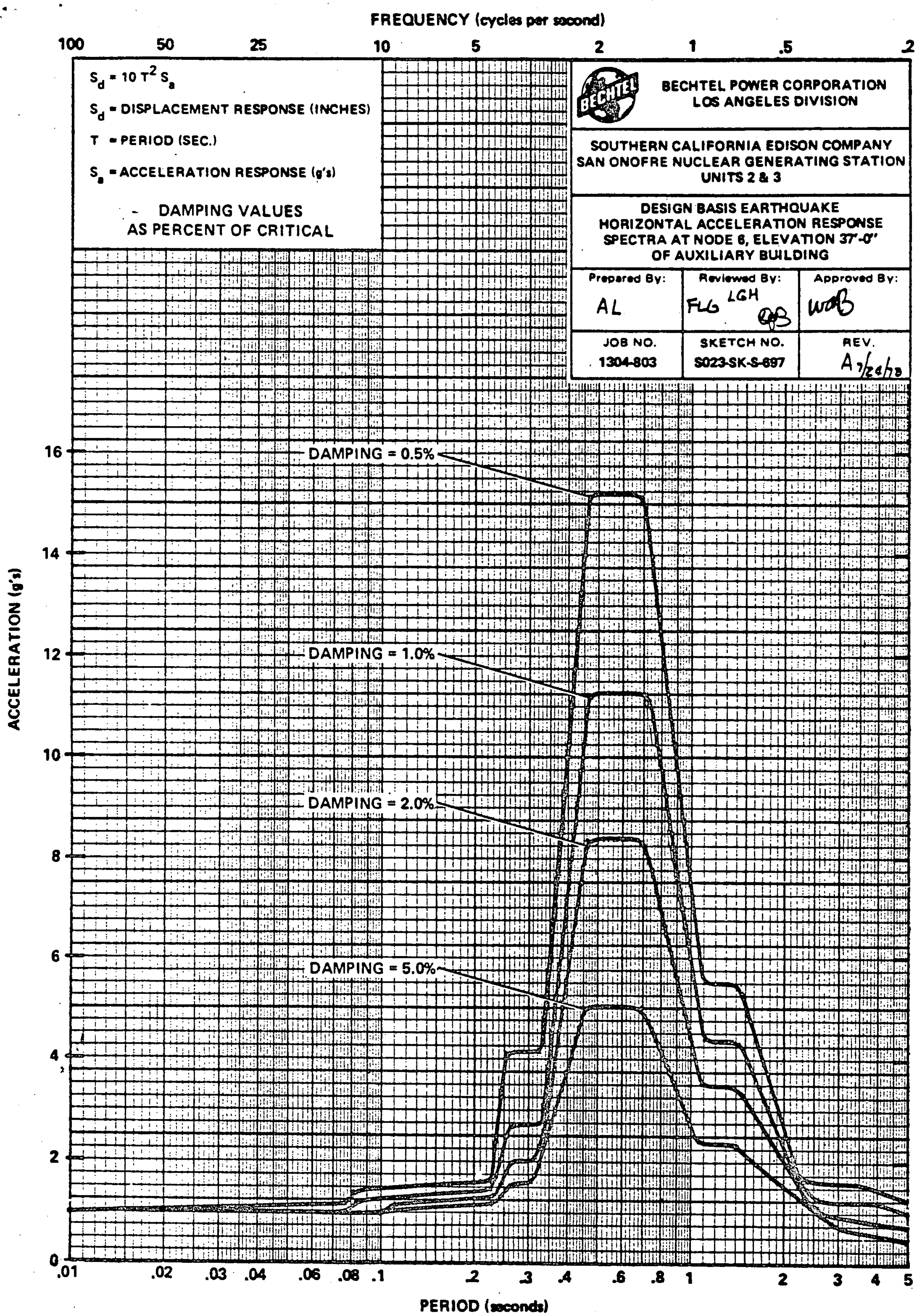
A.

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

B.

Max. Deflection	Location	Effect Upon Functional Operability


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10 T^2 S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA AT NODE 6, ELEVATION 37'-0"
OF AUXILIARY BUILDING
Prepared By:
AL
Reviewed By:
FLG LGH
Approved By:
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-698
REV.
A 7/24/73
ACCELERATION (g's)
14
12
10
8
6
4
2
0
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
Sd = 10 T2 Sa
Sd = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
Sa = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA AT NODE 6, ELEVATION 37'-0"
OF AUXILIARY BUILDING
Prepared By:
AL
Reviewed By:
FLG LGH
Approved By:
JOB NO.
1304-803
SKETCH NO.
S023-SK-S-697
REV.
A
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
16
14
12
10
8
6
4
2
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 Type:

1. Utility: Southern California Edison Company PWR X

2. NSSS: CE 3. A/E: Bechtel BWR

II. Component Name: 3HV 9322 8" LPSI Globe Motor Op. Valve (SI 615)

1. Scope: [X] NSSS [ ] BOP

2. Model Number: TRC Dwg 74R-008 Quantity: 4

3. Vendor: Target Rock Corp.

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

5. Physical Description a. Appearance "Y" Pattern Globe Valve

   b. Dimensions Body = 27 3/4" long x 36 5/16" (height to top of motor)

   c. Weight 992 lbs

6. Location: Building: Auxiliary

   Elevation: 17' - 33'

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

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

   S/S: Greater than 35Hz F/B: Greater than 35Hz
   V: Greater than 35Hz.

9. a. Functional Description: Low Pressure Safety Injection in the Emergency Core Cooling System

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

   [ ] Both

10. Pertinent Reference Design Specifications: 1370-PE-705

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

IV. Equipment Qualification Method: Test: X

Analysis: ______

Combination of Test and Analysis: ______

Test and/or Analysis by East-West Technology Corp/Report #7812-7
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [ ] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ______

5. [X] Combination of Seismic + Pipe end loading + Design Pressure

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[ ] ______
(Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ______

S/S = 3.0 F/B = 3.0 V = 3.0

VI. If Qualification by Test, then Complete: ______

1. [X] Single Frequency [ ] Multi-Frequency: [ ] random
[ ] sine beat
[X] 30 sec. continuous sine
[Consisted of 3 tests in each direction]

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

3. No. of Qualification Tests: OBE ______ SSE ______
Other 12 @ 1, 1.5, 2, 3, 4, 6, 8, 12, 16, 24, 32, 35 Hz
(Specify)

4. Frequency Range: 1-35 Hz

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[ ] No
Not Applicable

6. Input g-level Test at:

   S/S = 3.0g
   F/B = 3.0g
   V = 3.0g

7. Laboratory Mounting: In Horizontal Pipe Run:

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

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

9. Test Results including modifications made: The natural frequency is greater than 33Hz and the valve is operable at loaded conditions.

10. Other tests performed (such as fragility test, including results):

    None

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

1. Description of Test including Results:

2. Method of Analysis:

   [ ] Static Analysis
   [ ] Dynamic Analysis
   [ ] Equivalent Static Analysis
   [ ] Time-History
   [ ] Response Spectrum

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: Basis for the damping used:

7. Support Considerations in the model:

*Valve inlet and outlet welded to pipe sections which were attached to flanged connections.

8. Critical Structural Elements: ____________________

A.

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

B.

Max. Deflection	Location	Effect Upon Functional Operability

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3

Type:

1. Utility: Southern California Edison Company — PWR X

2. NSSS: CE 3. A/E: Bechtel — BWR

II. Component Name: Charging Pump

1. Scope: [X] NSSS [ ] BOP

2. Model Number: DWG D14851 Quantity: 3

3. Vendor: Gaulin 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 Low Profile, Rectangular

   b. Dimensions Overall, 98" L, 68" W, 37" H

   c. Weight 8400 lbs.

6. Location: Building: Aux. Equip.

   Elevation: 9 ft.

7. Field Mounting Conditions [X] Bolt (No. 14, Size 3/4)
   [ ] Weld (Length)
   [ ]

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

   S/S: >35 Hz F/B: >35 Hz
   V: >35 Hz

9. a. Functional Description: To inject borated water into the reactor coolant system

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

   [X] Both

10. Pertinent Reference Design Specifications: CE Project Spec. No. 1370-PE-403, Rev. 04 and CE General Engineering Spec. No. 00000-PE-403, Rev. 04

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

IV. Equipment Qualification Method: Test: ____________

Analysis: ____________

Combination of Test and Analysis: X

Type Test By AETC Rpt. No. 11785, 7/2/75 Act on Environmental Test Corp.
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [ ] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ____________

5. [X] Combination of Seismic, Operating and Nozzle Loads

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[X] N/A
(Other, Specify)

2. Required Response Spectra (attach the graphs): X

3. Required Acceleration in Each Direction: ____________

S/S = 1.5 F/B = 1.5 V = 1.0

VI. If Qualification by Test, then Complete: ____________

1. [X] Single Frequency [ ] Multi-Frequency: [ ] random
[ ] sine beat
[X] 30 sec. continuous sine

2. [ ] Single Axis [X] Multi-Axis(Bi-axial)

3. No. of Qualification Tests: OBE ____________ SSE ____________
Other 4 continuous sine in each horiz. and vert. at 2.5, 10, 20, 30 Hz
(Specify)

4. Frequency Range: 2.5-33 Hz

5. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[ ] No N/A

6. Input g-level Test at:

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

7. Laboratory Mounting: ______

1. [ ] Bolt (No.______, Size______) [ ] Weld (Length____________)
[X] 12 "C" Clamps

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

9. Test Results including modifications made: Demonstrated successful operability during and after simultaneous horizontal and vertical seismic acceleration. Demonstrated press. boundary integrity.

10. Other tests performed (such as fragility test, including results):

Pump operating and non-operating during SSE tests. Nozzle loads applied during all tests.

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

1. Description of Test including Results: Type Test conducted on pump assembly almost identical to San Onofre Pump (which has a heavier baseplate, and drive motor frame one size larger than test pump).

2. Method of Analysis: ______

[X] Static Analysis
[ ] Dynamic Analysis
[ ] Equivalent Static Analysis
[ ] Time-History
[ ] Response Spectrum

3. Model Type: [ ] 3D [X] 2D Absolute Sum Combination of Loads

[ ] 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 [ ] SRSS
[X] Other: N/A
(specify)

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

7. Support Considerations in the model: N/A

8. Critical Structural Elements: Not Tested

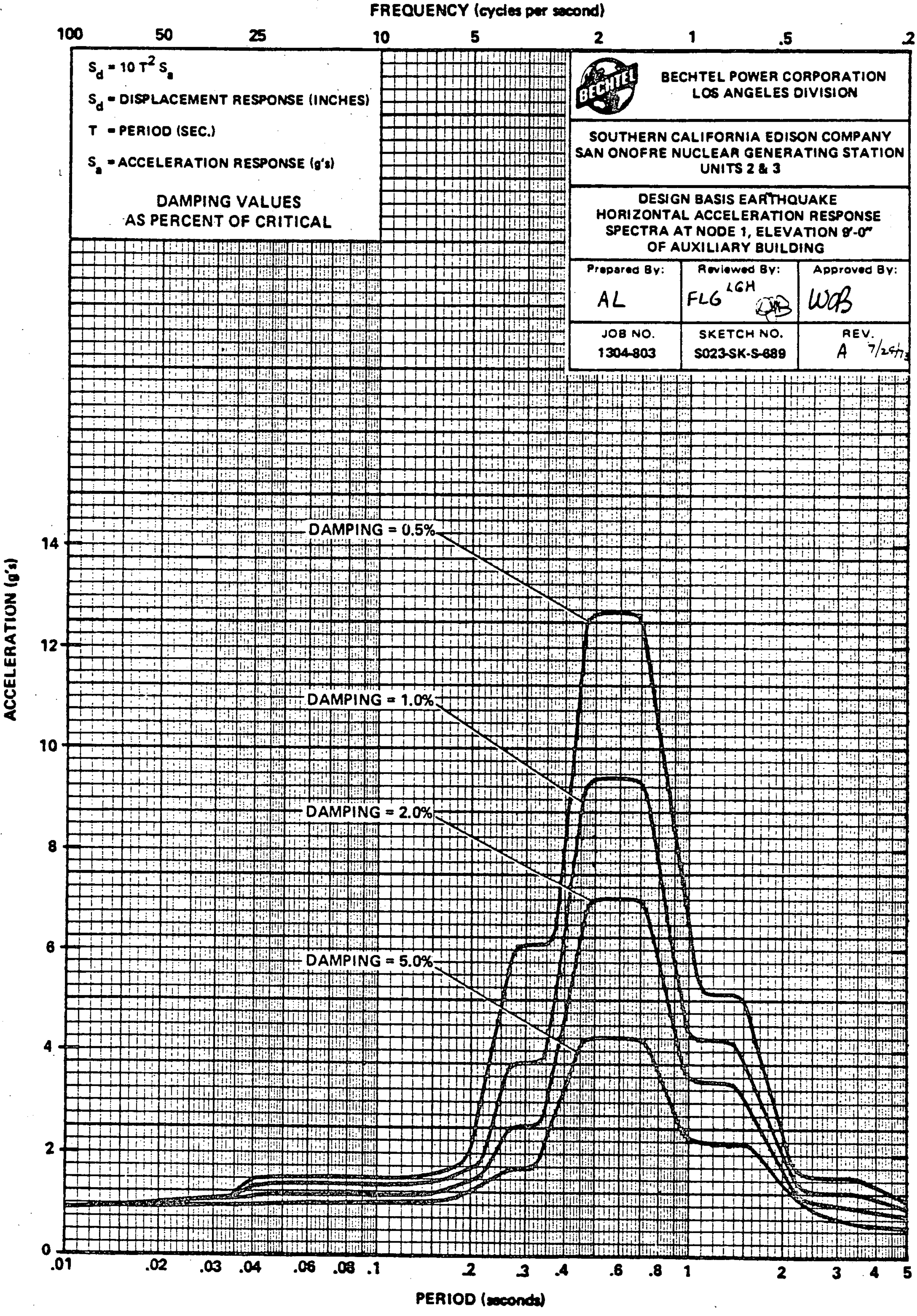
A.

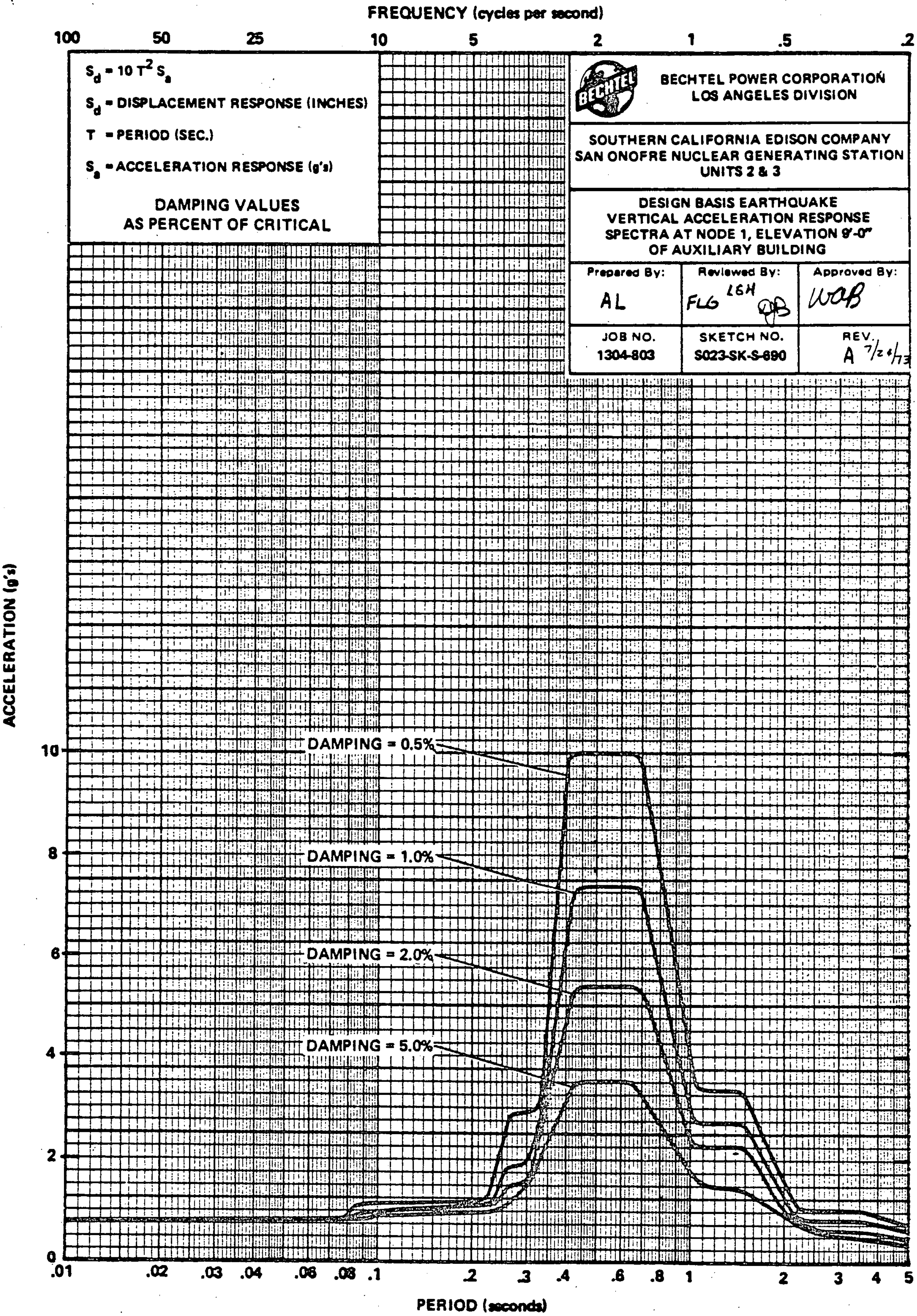
Identification	Location	Governing Load or Response Combination	Seismic Stress	* Total Stress	Stress Allowable
Anchor Bolts	+ 9ft.	Seismic Deadweight, and Nozzle Loads	inc. in Total	20,905 psi	25,000 psi

*Combined Shear & Tensile

B.

Max. Deflection	Location	Effect Upon Functional Operability
N/A		


FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10\,T^2\,S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
HORIZONTAL ACCELERATION RESPONSE
SPECTRA AT NODE 1, ELEVATION 9'-0"
OF AUXILIARY BUILDING
Prepared By: AL
Reviewed By: FLG LGH
Approved By: WOB
JOB NO. 1304-803
SKETCH NO. S023-SK-S-689
REV. A 7/29/7
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
ACCELERATION (g's)
14
12
10
8
6
4
2
0
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)



FREQUENCY (cycles per second)
100
50
25
10
5
2
1
.5
.2
$S_d = 10\ T^2\ S_a$
S_d = DISPLACEMENT RESPONSE (INCHES)
T = PERIOD (SEC.)
S_a = ACCELERATION RESPONSE (g's)
DAMPING VALUES
AS PERCENT OF CRITICAL
BECHTEL
BECHTEL POWER CORPORATION
LOS ANGELES DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY
SAN ONOFRE NUCLEAR GENERATING STATION
UNITS 2 & 3
DESIGN BASIS EARTHQUAKE
VERTICAL ACCELERATION RESPONSE
SPECTRA AT NODE 1, ELEVATION 9'-0"
OF AUXILIARY BUILDING
Prepared By: AL
Reviewed By: FLG LGH
Approved By: WOB
JOB NO. 1304-803
SKETCH NO. S023-SK-S-690
REV. A 7/26/73
ACCELERATION (g's)
10
8
6
4
2
0
DAMPING = 0.5%
DAMPING = 1.0%
DAMPING = 2.0%
DAMPING = 5.0%
.01
.02
.03
.04
.06
.08
.1
.2
.3
.4
.6
.8
1
2
3
4
5
PERIOD (seconds)

Qualification Summary of Equipment

I. Plant Name: San Onofre Units 2&3 — Type:

1. Utility: Southern California Edison Company — PWR X
2. NSSS: CE 3. A/E: Bechtel — BWR

II. Component Name: Shutdown Heat Exchanger

1. Scope: [X] NSSS [ ] BOP
2. Model Number: DWG CE-16644, 16645 Quantity: 4
3. Vendor: EFCO
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 HX, exterior painted carbon steel

   b. Dimensions 30'1" long x 56" max OD, 32 3/4" tube nozzles, 36" shell nozzles

   c. Weight Dry 42,000 lbs; Operating 61,000 lbs
6. Location: Building: Safety Equipment Building

   Elevation: 15 ft. elev.
7. Field Mounting Conditions [X] Bolt (No. 16, Size 1 1/4" Ø)
   [ ] Weld (Length)
   [X] Seismic Lugs
8. Natural Frequencies in Each Direction (Side/Side, Front/Back, Vertical):

   S/S: >33 Hz F/B: >33 Hz
   V: >33 Hz
9. a. Functional Description: cool reactor coolant, cool ECCS sump water

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

   [ ] Both
10. Pertinent Reference Design Specifications: CE Specification No. 1370-PE-301, Revision 03

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

IV. Equipment Qualification Method: Test: ____________

Analysis: X

Combination of Test and Analysis: ____________

Test and/or Analysis by NUS Corp. TR-75-74 Report No. 1514 Rev. 1
(Name of Company or Laboratory & Report No.)

V. Vibration Input:

1. Loads considered: 1. [X] Seismic only 2. [ ] Hydrodynamic only

3. [ ] Explosive only 4. [ ] Other (Specify) ____________

5. [ ] Combination of ____________

6. Method of combining RRS: [ ] Absolute Sum [ ] SRSS
[X] NA
(Other, Specify)

2. Required Response Spectra (attach the graphs): NA

3. Required Acceleration in Each Direction: ____________

____________ Horiz=DBE $\pm$ 1.2g V = DBE $\pm$ 1.1g

VI. If Qualification by Test, then Complete: NA

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. TRS enveloping RRS using Multi-Frequency Test [ ] Yes (plot TRS on RRS graphs)
[ ] No

6. Input g-level Test at:

S/S = ____________________
F/B = ____________________
V = ____________________

7. Laboratory Mounting: ____________________

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

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

9. Test Results including modifications made: ____________________

10. Other tests performed (such as fragility test, including results):
____

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

1. Description of Test including Results: NA

2. Method of Analysis: ____________________

[X] Static Analysis * [ ] Equivalent Static Analysis
[ ] Dynamic Analysis [ ] Time-History
[ ] Response Spectrum

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

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

** For Natural Frequency Determination

4. [X] Computer Codes: CDC's Stardyne. NUS's PRECOM, COMBINE, and SANSAR

Frequency Range and No. of modes considered: f_N >33 Hz

[ ] Hand Calculations

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

6. Damping: NA Basis for the damping used: NA

7. Support Considerations in the model: supports - fixed, seismic lugs - slotted

*Separate analyses were performed to determine the response in the horizontal and vertical directions. The resultant loads were combined on an absolute sum basis (2 components).

8. Critical Structural Elements:

A.

Identification	Location	Governing Load or Response Combination	Seismic Stress	Total Stress	Stress Allowable
Upper Seismic Lug Bolts 1 1/2" Ø SA-325	Elevation 14' 9 1/8"	Seismic + Deadweight + Nozzle loads + Pressure	***	13911 psi (shear)	15390 psi (shear)

*** Included in Total

B.

Max. Deflection	Location	Effect Upon Functional Operability
NA		