MISSISSIPPI POWER & LIGHT COMPANY
Helping Build Mississippi
P. O. BOX 1640, JACKSON, MISSISSIPPI 39215-1640

July 3, 1985

NUCLEAR LICENSING & SAFETY DEPARTMENT

U. S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, D. C. 20555

Attention: Mr. Harold R. Denton, Director

Dear Mr. Denton:

SUBJECT: Grand Gulf Nuclear Station
Units 1 and 2
Docket Nos. 50-416 and 50-417
License No. NPF-29
File: 0260/0650
SRV In-Plant Test Plan,
Additional Information
AECM-85/0212

Mississippi Power & Light (MP&L) provided a summary of the Safety Relief Valve (SRV) test results conducted April 23 through April 25, 1985 at the Grand Gulf Nuclear Station (GGNS) by letter dated June 6, 1985 (AECM-85/0179). MP&L requested in this letter NRC concurrence with MP&L's position that no additional SRV testing is necessary. Additional information on this subject requested by the NRC staff was submitted by MP&L letter dated June 18, 1985 (AECM-85/0196). During a teleconference on June 26, 1985, the NRC staff requested further information regarding the GGNS test response spectra and comparison of GGNS with the Kuosheng Nuclear Plant test results.

The attached information is provided in response to the NRC staff's request. This data should be regarded as preliminary and is submitted to support your review of the above referenced MP&L letters. A final comprehensive test report will be submitted as required by license condition 2.C.(34).

As stated in AECM-85/0179, we believe the additional SRV tests would provide little additional information. In addition if the tests were to be performed, a plant shutdown and outage would be required to replace certain test valves which are currently exhibiting seat leakage. Further, the additional testing represents added duty on the SRV's and other components which would otherwise be avoided if additional testing is not conducted.

B021
1/A0

 Member Middle South Utilities System

If we can further assist your review of this matter, please contact this office.

Yours truly,

L. F. Dale
Director

MLC/JGC:vog
Attachment

cc: Mr. J. B. Richard (w/a)
Mr. O. D. Kingsley, Jr. (w/a)
Mr. R. B. McGehee (w/a)
Mr. N. S. Reynolds (w/a)
Mr. G. B. Taylor (w/o)
Mr. R. C. Butcher (w/a)

Mr. James M. Taylor, Director (w/a)
Office of Inspection & Enforcement
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dr. J. Nelson Grace, Regional Administrator (w/a)
U. S. Nuclear Regulatory Commission
Region II
101 Marietta St., N. W., Suite 2900
Atlanta, Georgia 30323

GGNS SRV IN-PLANT TEST
PRELIMINARY INFORMATION BASED ON RECORDED DATA REDUCTION

1. Background:

A summary of the SRV in-plant test results conducted April 23 through April 25, 1985 at GGNS was provided to the NRC in the MP&L letter dated June 6, 1985 (AECM-85/0179). MP&L has concluded that all test objectives have been met and additional testing to complete the test matrix is not necessary. The NRC concurrence was requested for the conclusion of the SRV in-plant testing. The additional information requested by the NRC Staff to support their review on this subject was provided in the MP&L letter dated June 18, 1985 (AECM-85/0196). In a teleconference held on June 26, 1985, the NRC Staff requested further information based on reduction of the recorded data in progress. The information provided here is preliminary since DC offsets, ringing effects, and noise responses have not been eliminated from various response spectra plots.

2. Instrumentation Summary:

The thirty-two (32) pressure sensors installed in the Grand Gulf plant are shown in Figures 2.1, 2.2 and 2.3. The thirty four (34) strain gauges mounted in the plant are shown in Figures 2.4 and 2.5. The fifty-six (56) accelerometers installed in the plant are listed in Tables 2.1, 2.2 and 2.3, and are shown in Figures 2.6 through 2.11.

3. Test Results and Discussion

3.1 Suppression Pool Pressure Data

The pressure data reported here was collected from sensors located on the basemat, drywell wall, and quencher supports. For each test, pressure sensors were located within a radius of $2r_o$ of the quencher to read peak bubble pressure.

A 100 Hz low pass filter was used in the playback to eliminate acoustic response, and provide results comparable to the analytical cut-off frequency used in the original plant design. The reduced pressures recorded for all tests, are presented in Table 3.1.

3.1.1 Single Valve Actuations (SVA)

Three SVA tests have been completed. The peak measured pressures during SVA was +4.88/-5.78 psid. A statistical evaluation on the measured data, Table 3.2, produces a 95-95 peak pressure of +5.37/-5.38 psid. These results compare very favorably with the design value of +18.2/-7.7 psid. Some typical pressure time histories for SVA are shown in Figures 3.1 through 3.5. The Power Spectral Density (PSD) plots are shown in Figures 3.6 through 3.10.

The pressure time histories at similar locations and PSD's for the Kuosheng test for SVA are shown in Figures 3.11 through 3.15.

The pressure time histories and PSD's clearly show repeatability of the Grand Gulf SVA test and sufficient data has been collected to perform statistical evaluation.

3.1.2 Consecutive Valve Actuations (CVA)

Even though not originally planned and required by the NRC approved plan, the optional CVA tests were performed to provide information to confirm the adequacy of the Grand Gulf design for which the most limiting SRV loading is the CVA. Each SVA was followed by a CVA test.

The peak measured pressures during CVA was +7.47/-4.47 psid. A statistical evaluation on the measured data, Table 3.3, produces a 95-95 pressure of +8.52/-4.62 psid. These results are easily bounded by the Grand Gulf CVA design value of +18.2/-7.7 psid (adjusted for the 75% power level test conditions). Some typical pressure time histories and PSD's for CVA are shown in Figures 3.16 through 3.25. Once again, repeatability of the Grand Gulf CVA tests is clearly established and sufficient data has been collected to confirm the adequacy of the Grand Gulf unique design.

The pressure time histories at similar locations and PSD's for the Kuosheng test for CVA are shown in Figures 3.26 through 3.29.

3.1.3 Multiple Valve Actuations (MVA)

One MVA (4-valve) test was conducted at GGNS. The test program was temporarily suspended following the single MVA test because test valves were exhibiting seat weepage, as anticipated.

Pressures measured during the MVA were less than or equal to those measured during various SVA's at GGNS. The peak measured pressures during MVA was +4.06/-2.60 psid. A statistical evaluation of the measured data, Table 3-4, produces a 95-95 pressure of +5.57/-3.46 psid. These results compare very favorably with the SVA results, and are well below the Grand Gulf design value of +18.2/-7.7 psid.

Some typical pressure time histories and PSD's for MVA are shown in Figures 3.30 through 3.41. The pressure time histories at similar locations and PSD's for the Kuosheng test for MVA are shown in Figures 3.42 through 3.45.

3.2 SRVDL and Quencher Internal Pressures

Pressure tranducers were located in the SRV Discharge Line (SRVDL), and in the quencher hub and arm, for quencher V-12 as shown on Figures 2.2 and 2.3. Pressure sensors P21 (SRVDL) and P23 (quencher hub) were recorded as real time data. The peak line pressure observed was a high frequency spike with a magnitude of 450 psi, compared to the 550 psi design. The peak hub pressure of 250 psi observed for both tests is less than half the design value of 550 psi.

3.3 Strain Data

The measured strains for all tests, are presented in Table 3.5.

The maximum recorded strain for the quencher support was 29 micro in/in, which is equivalent to a stress value of 870 psi. The maximum recorded strains for the basemat and the containment liners are 50 and 46 micro in/in, which is equivalent to stress values of 1400 and 1300 psi, respectively. The maximum recorded strain for the submerged piping was 12 micro in/in, which is equivalent to a stress value of 360 psi.

Typical strain time histories are shown in Figures 3.46 through 3.49. Also, some typical equivalent stress time histories based on measured strains for the Kuosheng test are shown in Figures 3.50 and 3.51.

The GGNS test strain data confirms the conclusions from the Kuosheng test results which showed that recorded strain data was always considerably less than expected values.

3.4 Accelerometer Data

The peak measured accelerations for all tests are presented in Table 3.6. There were twenty-six (26) accelerometers mounted on the Reactor Building structures and four (4) were mounted on the Auxiliary Building structures. Additionally, there were eleven (11) accelerometers mounted on equipment and fifteen (15) were mounted on valves and supports.

The peak measured accelerations at all locations are well below predicted and design values.

4. Response Spectra

Response Spectra have been generated utilizing measured acceleration time histories for various locations in the Reactor Building. The enveloped spectra for SVA, CVA and MVA are presented in Figures 4.1 through 4.20. The corresponding Grand Gulf SRV design spectra are also plotted on these curves. Most of the spectra are entirely enveloped by the Grand Gulf SRV Design Spectra. In a few cases there appears to be some minor exceedance at very high frequency (approximately above 70 Hz) which will have very minimal, if any, structural responses.

For a quick comparison envelopes of SVA, CVA and MVA for the GGNS test results are plotted with those from the Kuosheng test results. The Grand Gulf and Kuosheng plant SRV design spectra for similar locations are also shown in these plots. These results are shown in Figures 4.21 through 4.30. The various node locations for the GGNS is shown in Figure 4.31.

These results clearly show similarity between the GGNS and Kuosheng plant SRV test results and also show that most of the spectra are well below the design values.

5. Comparison With Kuosheng Plant SRV Test Data

A comparison of the suppression pool pressure is presented in Table 5.1. The peak pressures observed at GGNS were considerably lower than those observed at Kuosheng for SVA, CVA and MVA tests. The pressure time histories at similar locations compare favorably with the Kuosheng results.

The measured strains on the basemat and the containment liners, the quencher supports and the submerged structures also compare favorably with those measured during the Kuosheng test which showed that equivalent measured stresses were always considerably less than their expected values.

The enveloped spectra for SVA, CVA and MVA compare favorably with the Kuosheng SVA spectra at similar locations.

6. Conclusions

Major conclusions drawn from the data reduction of the SRV test conducted at GGNS are as follows:

- The measured peak pressures during SVA, MVA and CVA are well below the GGNS design values.
- The pressure time history data compare favorably to the GESSAR methodology. Air clearing/water spike is less pronounced at GGNS. The CVA time histories are very similar to that in GESSAR with the correct ratio of peak positive and negative pressures.

- o The measured strains in the basemat and the containment liners, the quencher supports and the submerged structures are considerably less than the predicted values.
- o The peak measured accelerations at all locations are well below predicted and design values.
- o The enveloped spectra for SVA, MVA and CVA are well below the GGNS SRV Design Spectra.
- o Based on the above it is concluded that the GESSAR methodology used for generating SRV discharge loadings is conservative and there is considerable margin in the GGNS design for SRV discharge loading.

7. Justification For Concluding The SRV In-Plant Testing

One MVA test was conducted at GGNS. The four test valves used for MVA are located about 90° from one another. It was expected that there would be very little interaction of hydrodynamic loads and MVA test would be similar to four valves actuated independently. Similar observations were made at the Kuosheng plant testing. The acceptance criteria used for MVA are identical to that of SVA for GGNS. The measured pressures confirm the above hypothesis. Pressures measured during MVA were less than or equal to those measured during various SVA's at GGNS. The 95-95 pressure based on measured MVA data are well below the GGNS design value. Spectra for MVA and SVA are of the same order of magnitude. The enveloped spectra for SVA, CVA and MVA are well below the GGNS SRV Design Spectra. Any additional testing would merely confirm this.

Based on above information, MP&L has concluded that all test objectives have been met and additional testing to complete the test matrix is not necessary.

TABLE 2.1
LOCATION OF ACCELEROMETERS - STRUCTURE

Sensor I.D.	Location Azimuth	Elev.	Radius	Environment	Direction(1)	NLAE Node Fig. 4.13
Reactor Building Sensors:						
A1	32°	93.0"	65'0"	E2	R	254
A2	32°	93.0"	65'0"	E2	V	254
A3	32°	109.12'	65'0"	E2	R	277
A4	32°	109.12'	65'0"	E2	V	277
A5	302°	109.12'	65'0"	E2	R	277
A6	302°	109.12'	65'0"	E2	T	277
A7	0°	147.58'	62'0"	E2	R	291
A8	0°	147.58'	62'0"	E2	V	291
A9	270°	147.58'	62'0"	E2	R	291
A10	270°	147.58'	62'0"	E2	T	291
A11	32°	237.0'	62'0"	E2	R	300
A12	32°	237.0'	62'0"	E2	V	300
A13	32°	302.25'	0'0"	E2	V	309
A14	32°	302.25'	0'0"	E2	R	309
A15	32°	120.83'	41'6"	E2	R	48
A16	32°	120.83'	41'6"	E2	V	48
A17	302°	120.83'	41'6"	E2	R	48
A18	302°	120.83'	41'6"	E2	T	48
A19	0°	147.58'	41'6"	E2	R	30
A20	0°	147.58'	41'6"	E2	V	30
A21	302°	184.5'	41'0"	E2	R	8
A22	302°	184.5'	41'0"	E2	T	8
A23	32°	208.83'	41'6"	E2	R	8
A24	32°	208.83'	41'6"	E2	V	8
A25	0°	100.75'	10'7"	E2	R	79
A26	0°	100.75'	10'7"	E2	V	79
A27	270°	100.75'	10'7"	E2	R	79
A28	270°	100.75'	10'7"	E2	T	79
Auxiliary Building Sensors:						
A53	32°	93.0'	68'0"	E2	R	N/A
A54	32°	93.0'	68'0"	E2	V	N/A
A55	32°	184.5'	66'0"	E2	V	N/A
A56	32°	184.5'	66'0"	E2	R	N/A

NOTES: (1) R = Horizontal, radial
V = Vertical
T = Horizontal, tangential

TABLE 2.2

LOCATION OF ACCELEROMETERS - EQUIPMENT

Sensor ID	Equipment Description	Location		Direction	Comments
		Azimuth	Elevation		
A29 A30 A31	Polar Crane Girder	0°	237'0"	R (0°-180°) V T (90-270°)	
A32 A33 A34	Base of Hydrogen Recombiner	130°	208'10"	R V T	
A35 A36 A37	Top of Hydrogen Recombiner	130°	208'10"	R V T	

Table 2.3

LOCATION OF ACCELEROMETERS - PIPING

SENSOR ID	BECHTEL DRAWING NO./Rev.	ELEVATION	DIRECTION (1) NO.	DATA POINT	PIPE CLASS	EQUIPMENT DESCRIPTION
A38 A39 A40	HL-1348E	101'-9"	X Y Z	140	18"-GBB-17	Valve Operator #Q1E12G014-F003B-B
A41 A42 A43	H-1328J/D	149'3-1/2"	X Y Z	30	12"-DBA-17	Snubber(X) #Q1B21G026R03
A44 A45 A46	HL-1348A	126'9-3/4"	X Y Z	135	20"-DBA-64	Valve Operator #Q1E12G012 -F009-B
A47 A48 A49	HL-1348F	167'1-1/2"	X Y Z	751	12"-GBB-115	Valve Operator #Q1E12G015 -F037A-A
A50 A51 A52	HL-1348F	170'9-1/2"	X Y Z	216	18"-GBB-118	Valve Oper. #Q1E12G015 -F028B-B

Notes:
1. X = horizontal, azimuth 90°
   Y = vertical up
   Z = horizontal, azimuth 180°
2. Environmental conditions are E2 for all sensors, with the exception that the maximum temperature is 450°F.

Table 3.1

MEASURED PEAK PRESSURE DATA (PSID)

Sensor	SVA Tests			MVA Test	CVA Tests		
	MT10	MT20	MT30	MT70	MT11	MT21	MT31
P1	+0.86/-0.41	+1.29/-1.51	+0.93/-1.29	+3.13/-2.10	+0.75/-0.59	+2.32/-1.68	+2.65/-2.04
P2	+0.88/-1.00	+1.89/-1.87	+1.30/-1.60	+1.46/-1.11	+0.98/-0.82	+2.23/-1.42	-2.46/-1.85
P3	+1.13/-0.80	+1.70/-1.76	+1.40/-1.59	+1.52/-1.48	+1.15/-0.70	+1.76/-1.24	+1.92/-1.57
P4	+0.51/-0.47	+0.97/-0.98	+1.14/-0.83	+0.55/-0.64	+0.54/-0.62	+1.60/-1.10	+2.07/-1.73
P5	+0.97/-0.71	+1.94/-3.06	+2.15/-2.04	+0.80/-0.89	+1.27/-0.76	+3.42/-2.63	+4.49/-3.29
P6	+1.20/-1.30	+4.05/-2.66	+3.08/-2.08	+1.07/-0.81	+1.68/-1.29	+5.48/-3.35	+7.44/-4.47
P7	+1.53/-1.63	+2.97/-3.26	+3.24/-2.58	+1.28/-1.05	+2.29/-1.10	+3.69/-3.27	+4.99/-3.68
P8	+0.76/-1.17	+2.47/-2.54	+2.58/-2.20	+1.59/-1.20	+1.33/-0.97	+3.68/-2.71	+4.27/-3.12
P9	+2.45/-2.28	+3.68/-3.23	+3.31/-2.87	+0.14/-0.96	+2.83/-1.70	+2.68/-2.00	+3.01/-2.47
P10	+1.58/-1.59	+2.25/-2.09	+1.82/-1.94	+1.08/-0.73	+1.70/-1.31	+2.18/-1.75	+2.58/-1.92
P11	+0.86/-0.46	+0.77/-0.85	+0.60/-0.94	+0.44/-0.33	+0.86/-0.42	+0.89/-0.74	+0.96/-1.02
P12	+4.63/-5.78	+4.12/-4.20	+4.18/-4.89	+1.48/-1.14	+7.47/-3.67	+4.56/-2.81	+5.17/-2.98
P13	+4.88/-2.30	+1.49/-1.58	+1.05/-1.49	+1.02/-0.99	+5.50/-3.50	+1.85/-1.33	+2.27/-1.53
P14	+3.34/-2.87	+2.04/-1.67	+1.63/-1.64	+1.15/-0.97	+3.28/-2.76	+1.53/-0.96	+1.91/-1.28
P15	+2.49/-2.26	+2.03/-1.54	+1.79/-1.52	+1.02/-1.02	+2.57/-1.74	+1.37/-1.14	+1.52/-1.22
P16	+1.42/-1.48	+1.08/-0.73	+0.93/-0.71	+1.30/-0.65	+1.70/-1.26	+0.70/-0.37	+0.79/-0.55
P17	+2.02/-1.66	+1.35/-1.15	+1.17/-1.20	+1.67/-1.07	+2.04/-1.15	+0.52/-0.36	+0.66/-0.60
P18	+0.36/-0.40	+0.05/-0.16	+0.10/-0.16	+1.55/-1.50	+0.29/-0.30	+0.15/-0.09	+0.14/-0.12
P19	+0.53/-0.34	+0.27/-0.38	+0.25/-0.41	+2.75/-2.40	+0.44/-0.28	+0.09/-0.18	+0.14/-0.21
P20	+0.09/-0.12	+0.14/-0.15	+0.09/-0.16	+2.77/-1.52	+0.08/-0.04	+0.20/-0.10	+0.12/-0.12
P26	+0.87/-0.64	+1.34/-1.51	+0.72/-0.89	+0.70/-0.67	+0.98/-1.07	+1.43/-1.30	+1.49/-1.66
P27	+1.09/-0.97	+1.86/-2.14	+1.28/-1.14	+0.88/-0.80	+1.25/-1.85	+2.10/-1.75	+2.33/-2.26
P29	+0.15/-0.10	+0.10/-0.18	+0.11/-0.12	+4.06/-2.60	+0.11/-0.05	+0.20/-0.09	+0.14/-0.18
P30	+0.82/-0.45	+0.31/-0.47	+0.40/-0.49	+3.32/-2.10	+0.54/-0.32	+0.19/-0.14	+0.24/-0.19
P31	+0.10/-0.56	+0.13/-0.15	+0.11/-0.14	+3.59/-1.94	+0.06/-0.05	+0.16/-0.09	+0.13/-0.15
P32	+0.12/-0.10	+0.11/-0.20	+0.11/-0.13	+3.56/-2.20	+0.07/-0.10	+0.14/-0.08	+0.13/-0.14
Peak Pressures	+4.88 -5.78	+4.12 -4.20	+4.18 -4.89	+4.06 -2.60	+7.47 -3.67	+5.48 -3.35	+7.44 -4.47

Table 3.2

SVA 95-95 PRESSURES (PSID)

Test	Sensor	Pressure	
		Positive	Negative
MT10	P12	+4.63	-5.78
	P13	+4.88	-2.30
	P14	+3.34	-2.87
MT20	P5	+1.94	-3.06
	P6	+4.05	-2.66
	P7	+2.97	-3.26
	P8	+2.47	-2.54
	P12	+4.12	-4.20
MT30	P5	+2.15	-2 04
	P6	+3.80	-2.08
	P7	+3.24	-2.58
	P8	+2.58	-2.20
	P12	+4.18	-4.89
MT70	P19	+2.75	-2.40
	P20	+2.77	-1.52
	P29	+4.06	-2.60
	P30	+3.32	-2.10
	P31	+3.59	-1.94
	P32	+3.56	-2.20

Positive Pressure

$\overline{X}$ = 3.39

S = 0.82

Negative Pressure

$\overline{X}$ = -2.80

S = -1.07

t_{19} = 2.41

95-95 pressure = 5.37 psid

95-95 pressure = -5.38 psid

PRELIMINARY

Table 3.3

CVA 95-95 PRESSURES (PSID)

Test	Sensor	Pressure	
		Positive	Negative
MT11	P12	+7.47	-3.67
	P13	+5.50	-3.50
	P14	+3.28	-2.76
MT21	P5	+3.42	-2.63
	P6	+5.48	-3.35
	P7	+3.69	-3.27
	P8	+3.68	-2.71
	P12	+4.56	-2.81
MT31	P5	+4.49	-3.29
	P6	+7.44	-4.47
	P7	+4.99	-3.68
	P8	+4.27	-3.12
	P12	+5.17	-2.98

Positive Pressure

$\overline{X} = 4.88$

$S = 1.36$

Negative Pressure

$\overline{X} = -3.25$

$S = -0.51$

$t_{13} = 2.68$

95-95 pressure = 8.52 psid

95-95 pressure = -4.62 psid

PRELIMINARY

Table 3.4

MVA 95-95 PRESSURES (PSID)

Test	Sensor	Pressure	
		Positive	Negative
MT70	P1	+3.13	-2.10
	P2	+1.46	-1.11
	P8	+1.59	-1.20
	P19	+2.75	-2.40
	P20	+2.77	-1.52
	P29	+4.06	-2.60
	P30	+3.32	-2.10
	P31	+3.59	-1.94
	P32	+3.56	-2.20

Positive Pressure

$\overline{X}$ = 2.91

S = 0.89

Negative Pressure

$\overline{X}$ = -1.91

S = -0.52

t_9 = 2.99

95-95 pressure = 5.57 psid

95-95 pressure = -3.46 psid

PRELIMINARY

Table 3.5

PEAK STRAIN DATA (μin/in)

Sensor	SVA Tests			MVA Test	CVA Tests			Expected
	MT10	MT20	MT30	MT70	MT11	MT21	MT31	Value
S1	2	4	3	16	2	5	5	(1)
S2	13	10	11	8	17	10	9	(1)
S3	18	12	11	7	15	8	11	(1)
S4	31	20	20	10	34	15	22	(1)
S5	3	2	3	12	2	4	5	98
S6	1	3	3	17	2	3	6	98
S7	25	17	15	12	29	14	17	98
S8	3	4	2	22	2	3	3	98
S10	2	4	2	9	2	3	4	(2)
S11	12	9	9	8	11	13	12	(1)
S12	43	50	41	18	42	32	31	(1)
S13	4	3	3	7	4	3	46	(1)
S14	5	5	5	5	3	4	5	(1)
S16	1	3	3	9	2	6	12	56
S17	3	4	5	5	3	6	12	56
S18	3	4	4	6	2	3	5	56
S19	2	4	4	5	2	3	5	44
S20	1	3	3	8	2	3	3	44
S21	4	5	5	5	5	4	4	44
S22	1	5	4	7	2	3	4	54
S23	2	3	3	5	2	4	3	(2)
S24	1	3	3	8	1	3	4	44
S25	4	4	3	5	3	4	5	(1)
S26	1	3	2	7	2	5	4	(1)
S27	3	4	4	5	3	5	4	(1)
S28	3	5	5	7	2	4	7	(1)
S29	4	5	5	7	3	4	6	(2)
S30	2	3	4	19	3	3	7	22
S31	9	7	8	10	6	5	7	45
S32	3	4	5	14	4	4	6	45
S33	5	7	4	20	3	5	5	45
S34	4	4	5	14	5	6	4	45

Notes: 1. Expected values not calculated, allowable strain is 980 μin/in.

2. Values not calculated - part of strain rosettes or insufficient information available.

Table 3.6

PEAK MEASURED ACCELERATIONS (g)

Sensor	SVA Tests			MVA Test	CVA Tests			Mean Value		SVA/CVA Design Value	SVA/CVA Predicted Value
	MT10	MT20	MT30	MT70	MT11	MT21	MT31	SVA	CVA		
A1	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.04	0.03
A3	0.05	0.09	0.08	0.09	0.05	0.05	0.06	0.07	0.05	0.35	0.28
A4	0.02	0.03	0.02	0.03	0.01	0.02	0.02	0.02	0.02	0.09	0.07
A5	0.05	0.03	0.05	0.17	0.04	0.01	0.03	0.04	0.03	0.35	0.28
A6	0.01	0.01	0.02	0.02	0.01	0.02	0.01	0.01	0.01	0.35	0.28
A7	0.02	0.03	0.02	0.05	0.03	0.05	0.07	0.02	0.05	0.20	0.16
A8	0.02	0.02	0.02	0.02	0.03	0.02	0.03	0.02	0.03	0.05	0.04
A9	0.03	0.04	0.03	0.03	0.03	0.01	0.01	0.03	0.02	0.20	0.16
A10	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.20	0.16
A11	0.14	0.10	0.12	0.19	0.12	0.05	0.05	0.12	0.07	N/A	N/A
A12	0.04	0.05	0.04	0.11	0.04	0.02	0.02	0.04	0.03	N/A	N/A
A13	0.02	0.02	0.02	0.06	0.02	0.02	0.02	0.02	0.02	0.09	0.07
A14	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.08	0.06
A15	0.04	0.04	0.06	0.05	0.05	0.03	0.02	0.05	0.03	0.16	0.13
A16	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.02
A17	0.08	0.05	0.04	0.06	0.03	0.02	0.01	0.06	0.02	0.16	0.13
A18	0.02	0.02	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.16	0.13
A19	0.002	0.002	0.002	0.005	0.002	0.002	0.002	0.002	0.002	0.11	0.09
A20	0.004	0.004	0.004	0.005	0.004	0.004	0.004	0.004	0.004	0.03	0.02
A21	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.02
A22	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.02
A23	0.01	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.02
A24	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.02
A25	0.004	0.005	0.003	0.004	0.002	0.002	0.003	0.004	0.002	0.02	0.02
A26	0.004	0.002	0.003	0.002	8.801	0.001	0.002	0.003	0.001	0.02	0.02
A27	0.003	0.002	0.003	0.005	0.002	0.005	0.004	0.003	0.004	0.02	0.02
A28	0.004	0.004	0.004	0.003	0.002	0.005	0.002	0.004	0.003	0.02	0.02
A29	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	N/A	N/A

Table 3.7

PEAK MEASURED ACCELERATIONS (g)

(Concluded)

Sensor	SVA Tests			MVA Test	CVA Tests			Mean Value		SVA/CVA Design Value	SVA/CVA Predicted Value
	MT10	MT20	MT30	MT70	MT11	MT21	MT31	SVA	CVA		
A30	0.001	0.001	0.001	0.002	0.00	0.001	0.001	0.001	0.001	N/A	N/A
A31	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	N/A	N/A
A32	0.01	0.03	0.02	0.02	0.01	0.01	0.01	0.02	0.01	N/A	N/A
A33	0.02	0.02	0.02	0.03	0.02	0.01	0.01	0.02	0.01	N/A	N/A
A34	0.01	0.02	0.02	0.03	0.01	0.01	0.01	0.02	0.01	N.A	N/A
A35	0.02	0.03	0.03	0.03	0.02	0.02	0.02	0.03	0.02	N/A	N/A
A36	0.02	0.02	0.03	0.03	0.03	0.01	0.02	0.02	0.02	N/A	N/A
A37	0.03	[illegible]	0.05	0.07	0.03	0.03	0.04	0.05	0.03	N/A	N/A
A38	0.03	0.03	0.03	0.05	0.02	0.02	0.03	0.03	0.02	0.36	0.29
A39	0.02	0.02	0.02	0.04	0.01	0.02	0.03	0.02	0.02	0.41	0.33
A40	0.004	0.005	0.004	0.07	0.005	0.005	0.007	0.004	0.005	0.25	0.20
A41	0.05	0.07	0.11	0.21	0.08	0.10	0.09	0.08	0.09	N/A	N/A
A42	0.09	0.11	0.10	0.38	0.16	0.08	0.11	0.10	0.12	1.21	0.97
A43	0.06	0.1	0.12	0.15	0.12	0.14	0.11	0.10	0.12	1.59	1.27
A44	0.04	0.06	0.04	0.05	0.04	0.04	0.04	0.05	0.04	2.00	1.60
A45	0.01	0.02	0.01	0.03	0.01	0.03	0.02	0.01	0.02	2.01	1.60
A46	0.07	0.06	0.04	0.04	0.07	0.05	0.05	0.06	0.06	2.81	2.25
A47	0.30	0.50	0.45	0.38	0.30	0.13	0.14	0.42	0.19	2.01	1.60
A49	0.01	0.03	0.02	0.04	0.01	0.02	0.03	0.02	0.02	1.97	1.56
A50	0.05	0.04	0.01	0.02	0.04	0.03	0.01	0.03	0.03	2.52	1.80
A51	0.13	0.10	0.03	0.06	0.13	0.06	0.03	0.09	0.07	1.20	0.96
A52	0.16	0.18	0.04	0.06	0.15	0.08	0.03	0.13	0.09	2.84	2.27
A53	0.01	0.02	0.02	0.04	0.01	0.02	0.02	0.02	0.02	N/A	N/A
A54	0.01	0.02	0.02	0.03	0.01	0.02	0.02	0.02	0.02	N/A	N/A
A55	0.01	0.01	0.01	0.005	0.01	0.003	0.004	0.01	0.01	N/A	N/A
A56	0.004	0.005	0.004	0.003	0.003	0.002	0.003	0.004	0.003	N/A	N/A

Table 5.1

Comparison of Pressure During SRV In-Plant Testing for GGNS and Kuosheng Nuclear Plant (1)

PLANT		SVA	MVA	CVA	DESIGN
GGNS	95-95%	+5.37/-5.38	+5.57/-3.46	+8.52/-4.62	+18.2/-7.7
	Max./Min.	+4.88/-5.78	+4.06/-2.60	+7.47/-4.47	
KUOSHENG	95-95	+7.62/-5.71	N/A	N/A	+16.6/-7.38
	Max./Min.	+12.05/-7.15	+10.11/-8.89	+9.81/-9.44	

NOTE: (1) All pressures are in psid

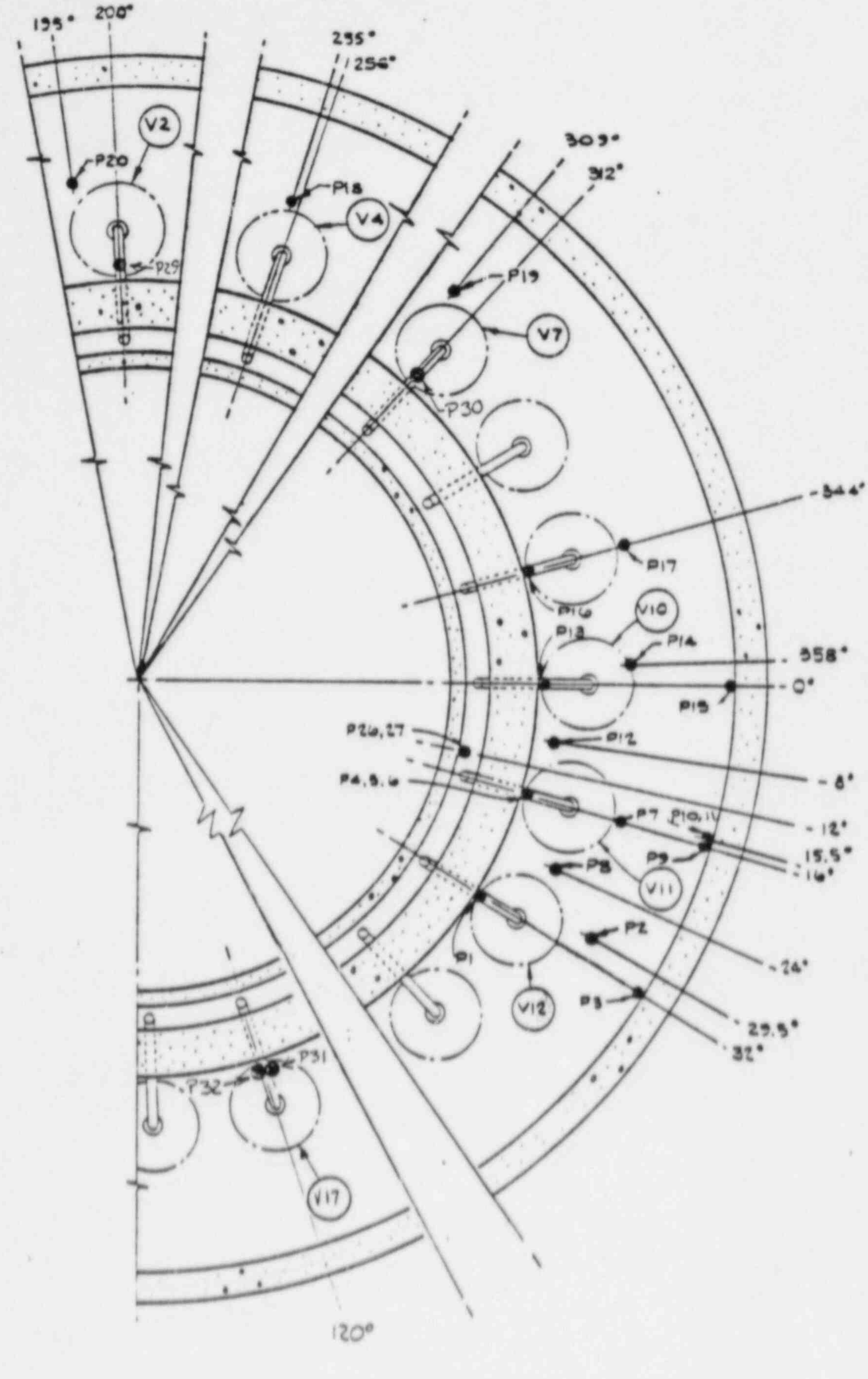


Figure 2.1 - Suppression Pool Pressure Transducer Locations - Plan View

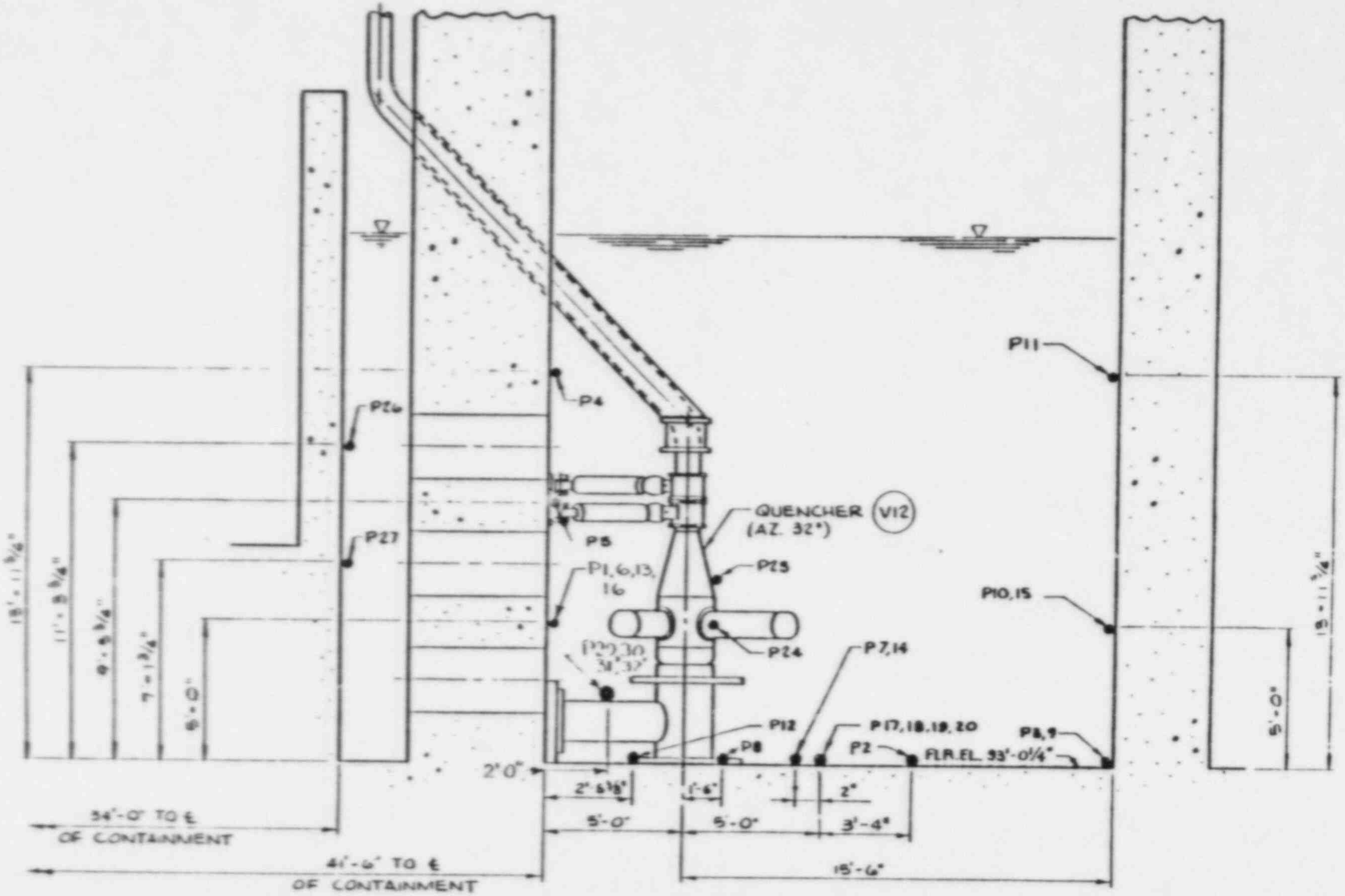


Figure 2.2 - Suppression Pool Pressure Transducers - Elevation View
(Sensors Rotated Into View)

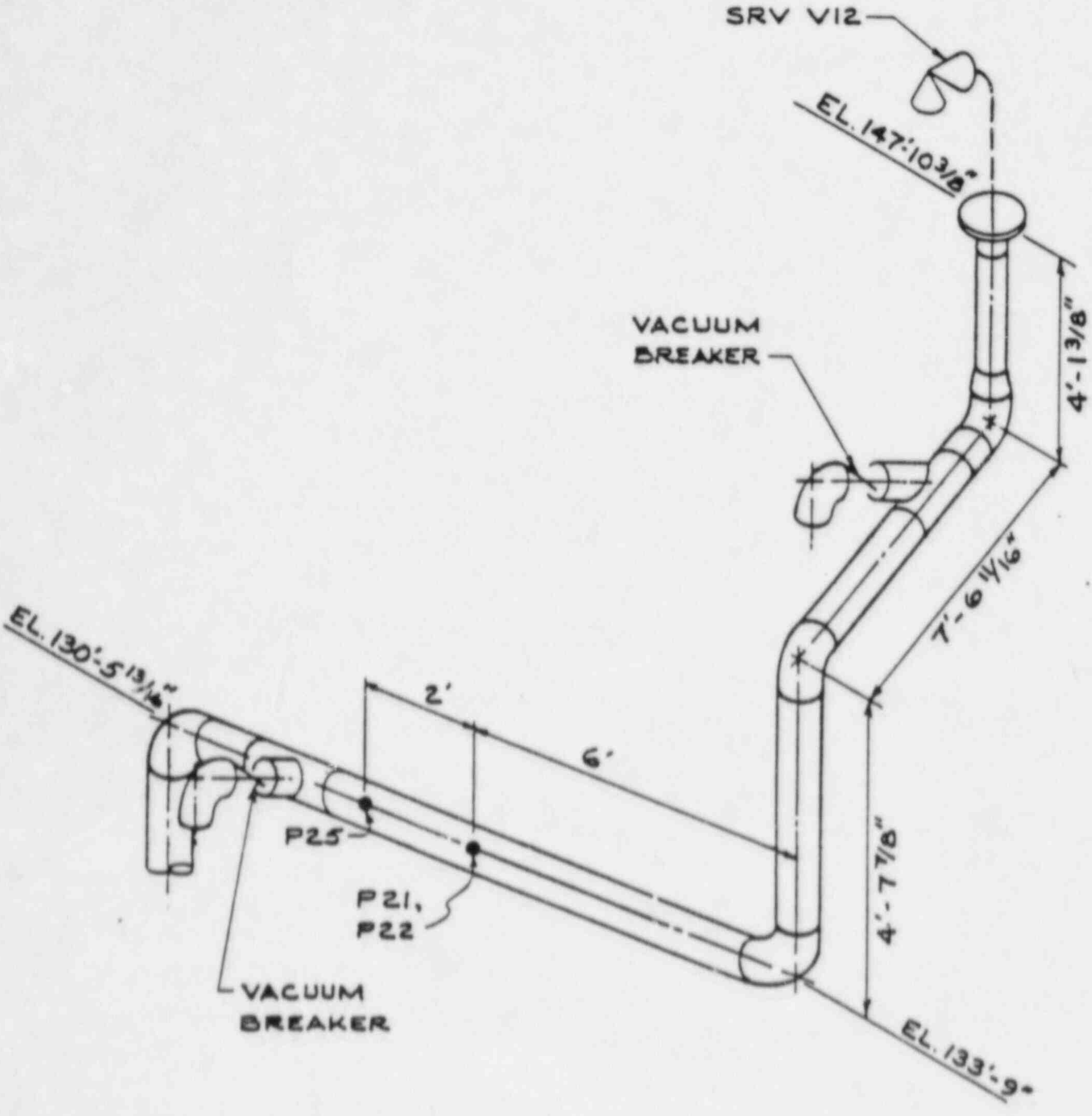


Figure 2.3 - SRV Discharge Line Pressure Transducers

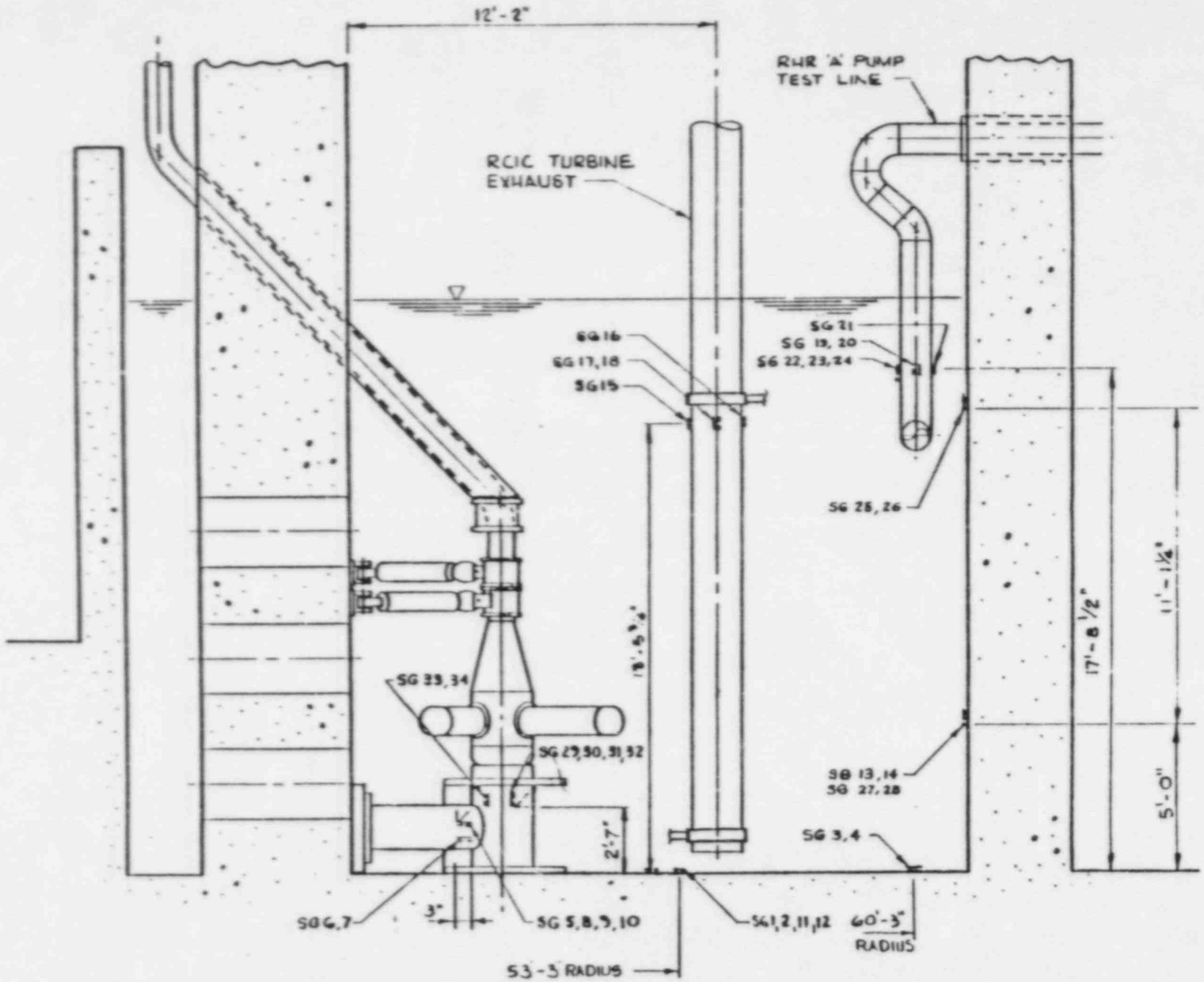


Figure 2.4 - Strain Gage Locations - Elevation
(Sensors Rotated Into View)

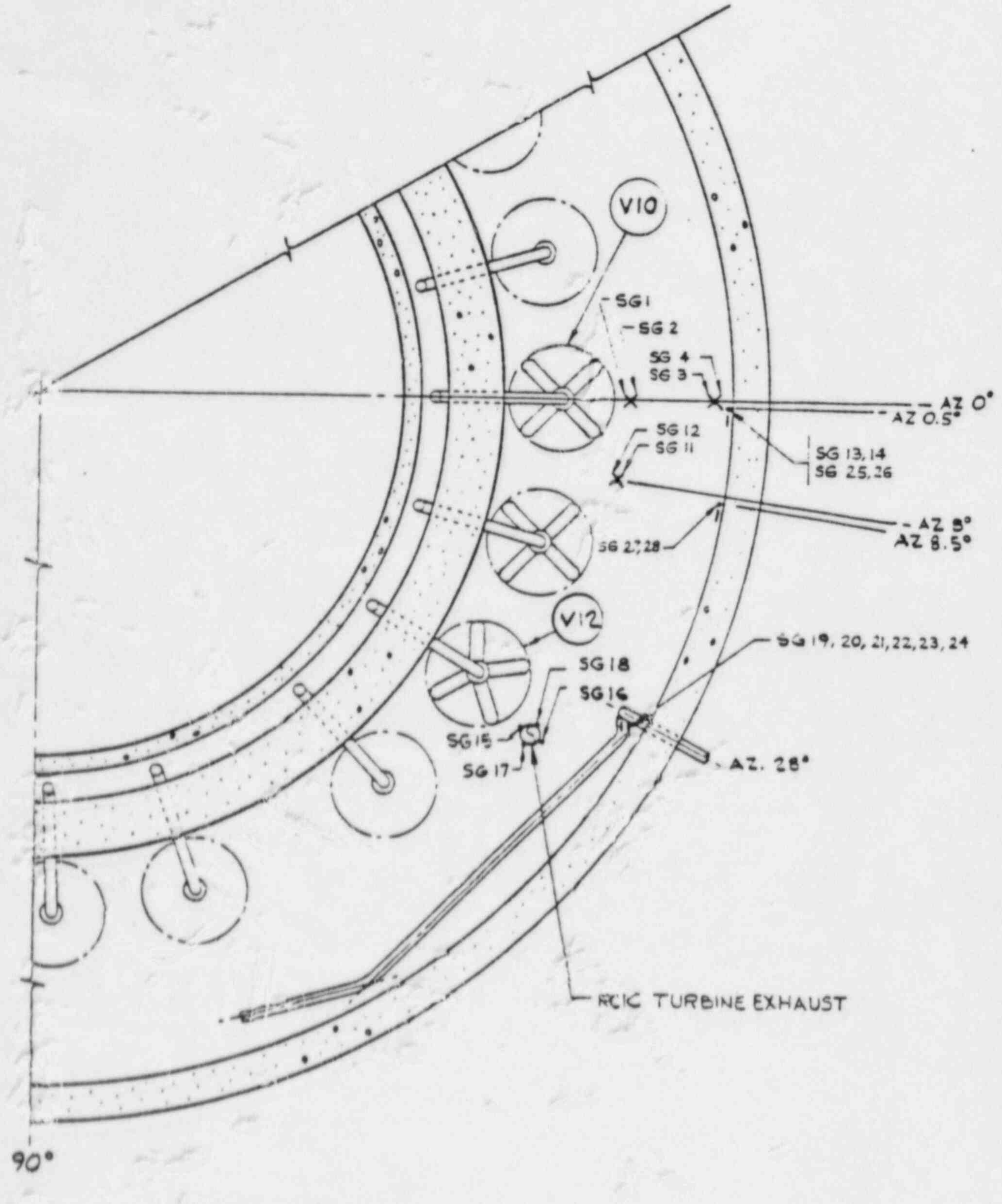


Figure 2.5 - Strain Gage Locations - Plan

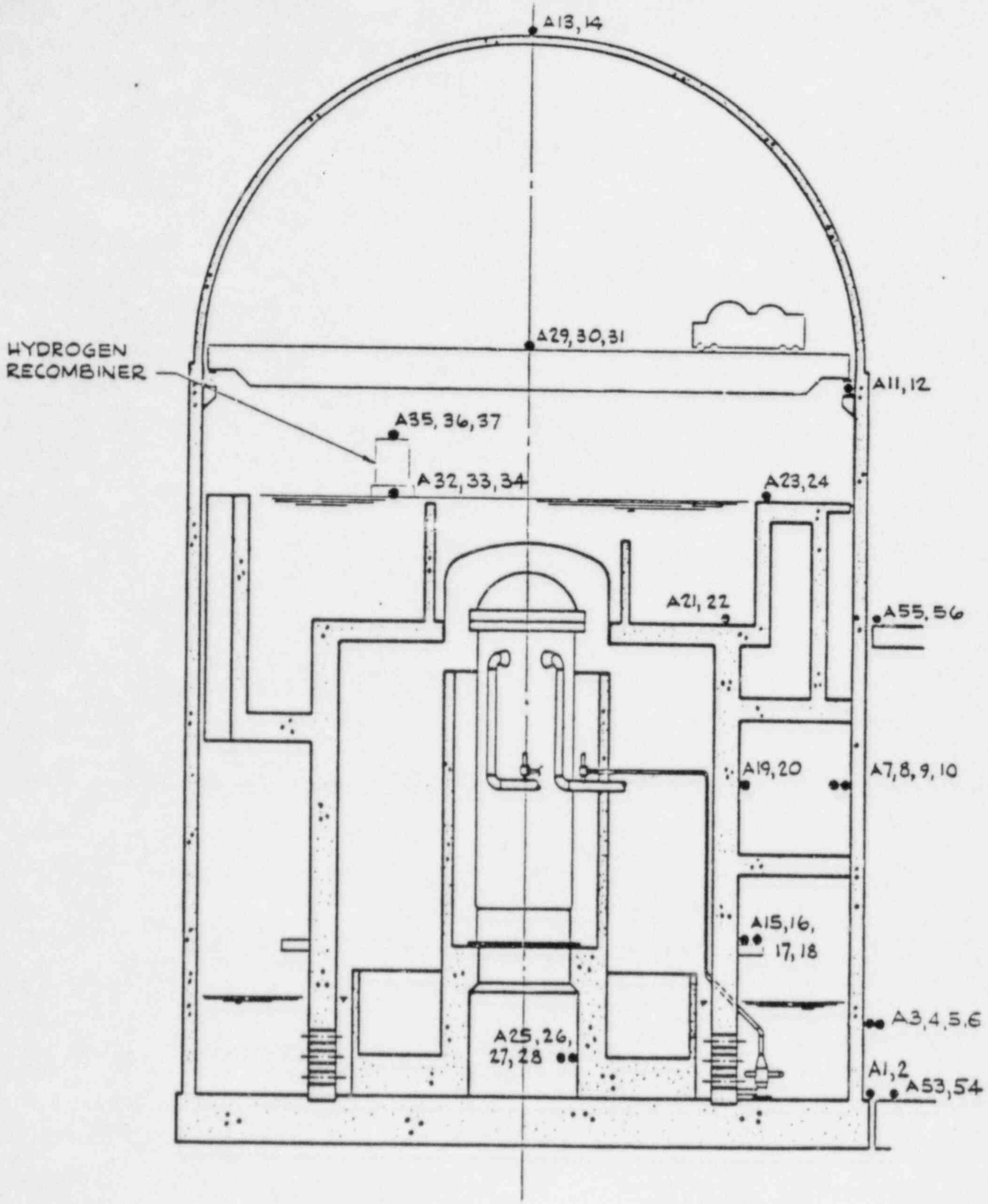


Figure 2.6 - Accelerometer Locations-Structure

(Elevation View - Accelerometers Rotated into View)

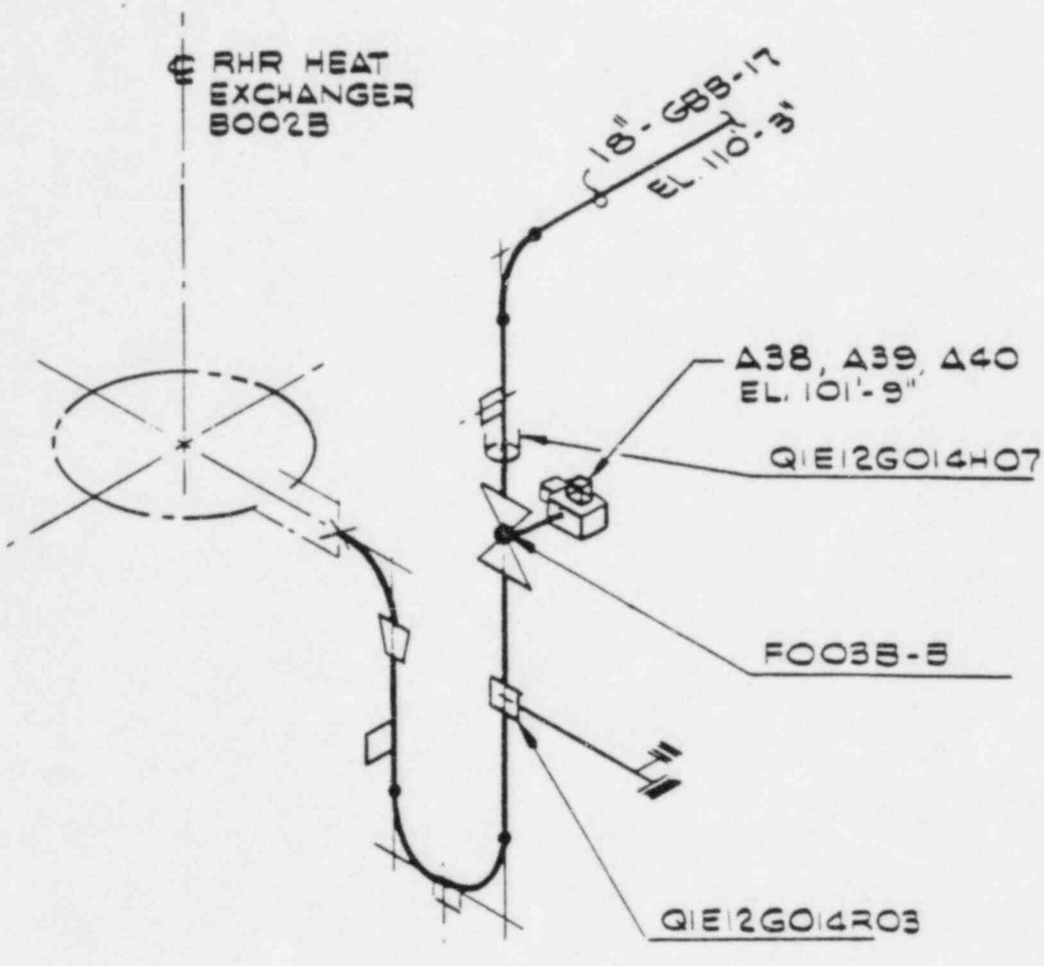


Figure 2.7 - Pipe Mounted Accelerometers A38, A39, A40

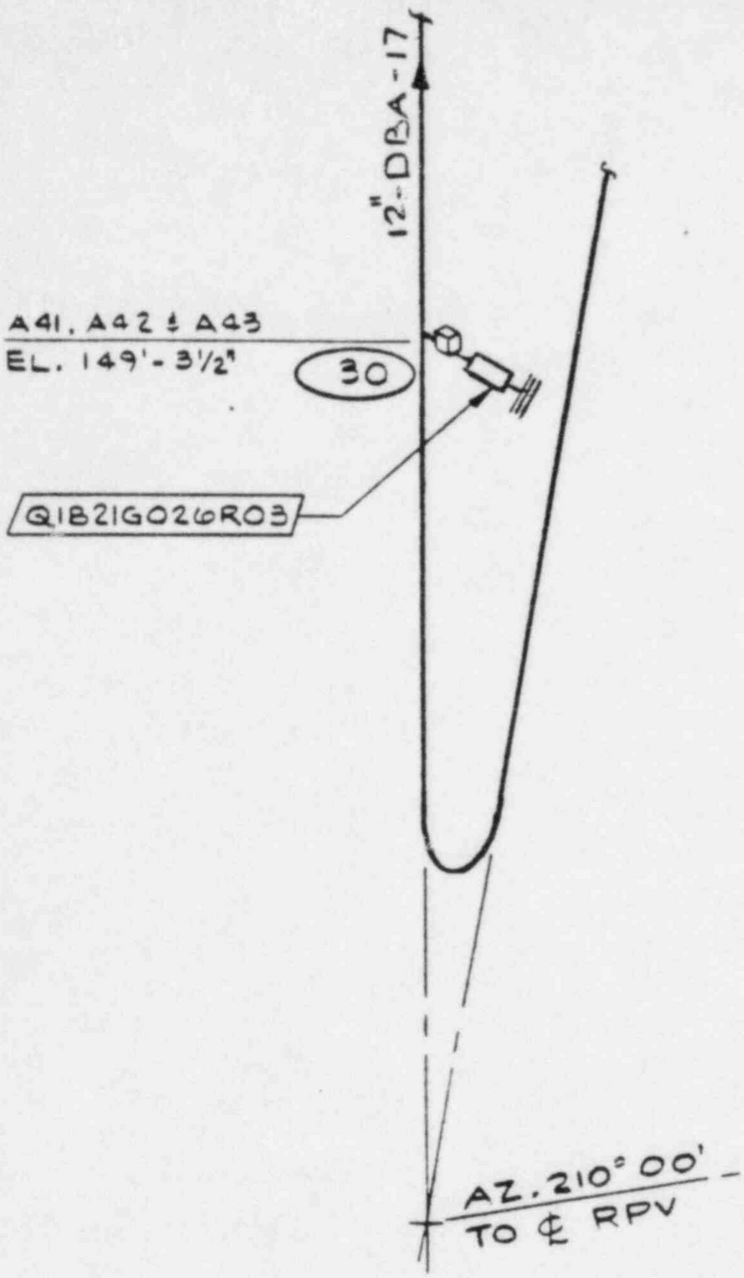


Figure 2.8 - Pipe Mounted Accelerometers A41, A42, A43

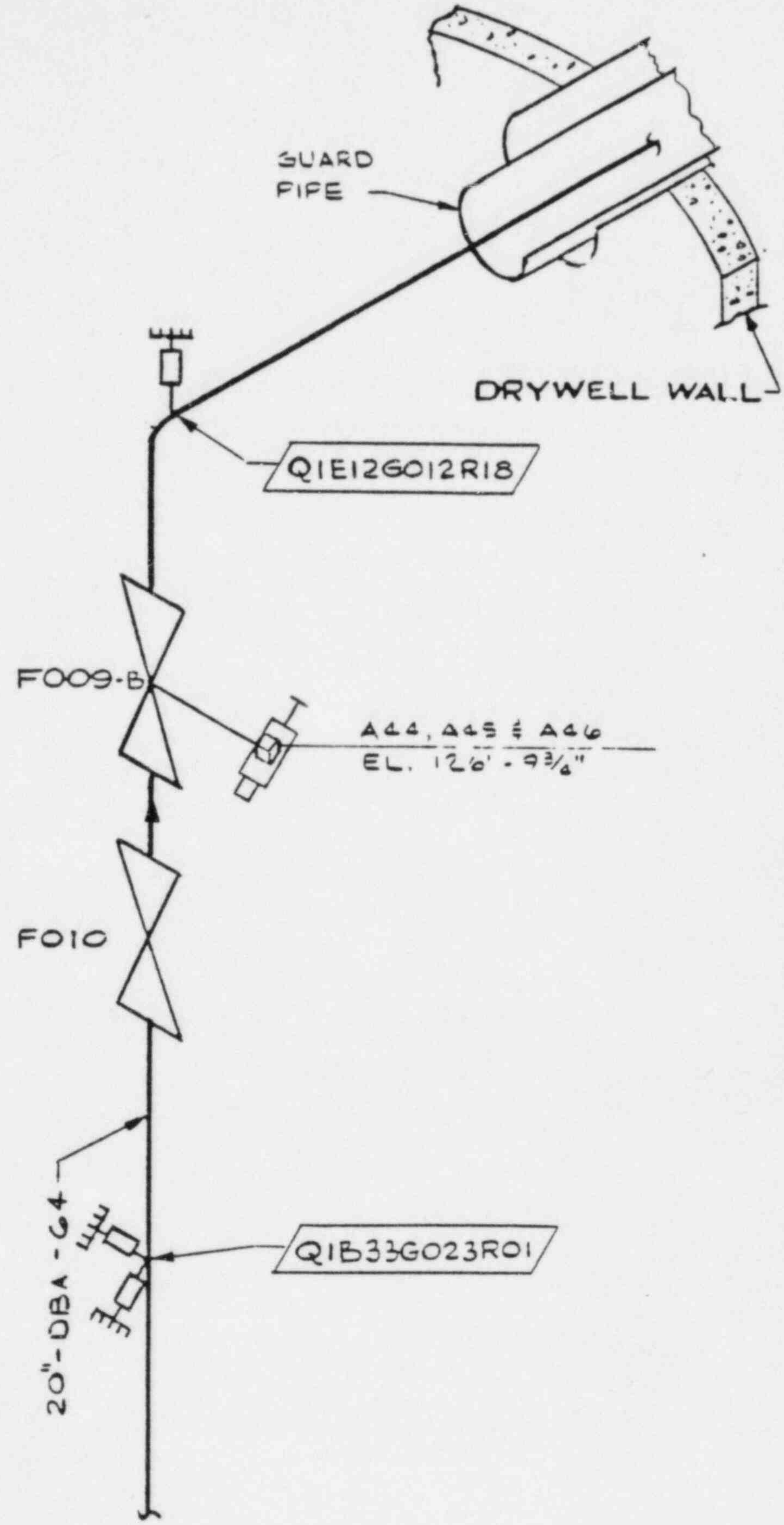


Figure 2.9 - Pipe Mounted Accelerometers A44, A45, A46

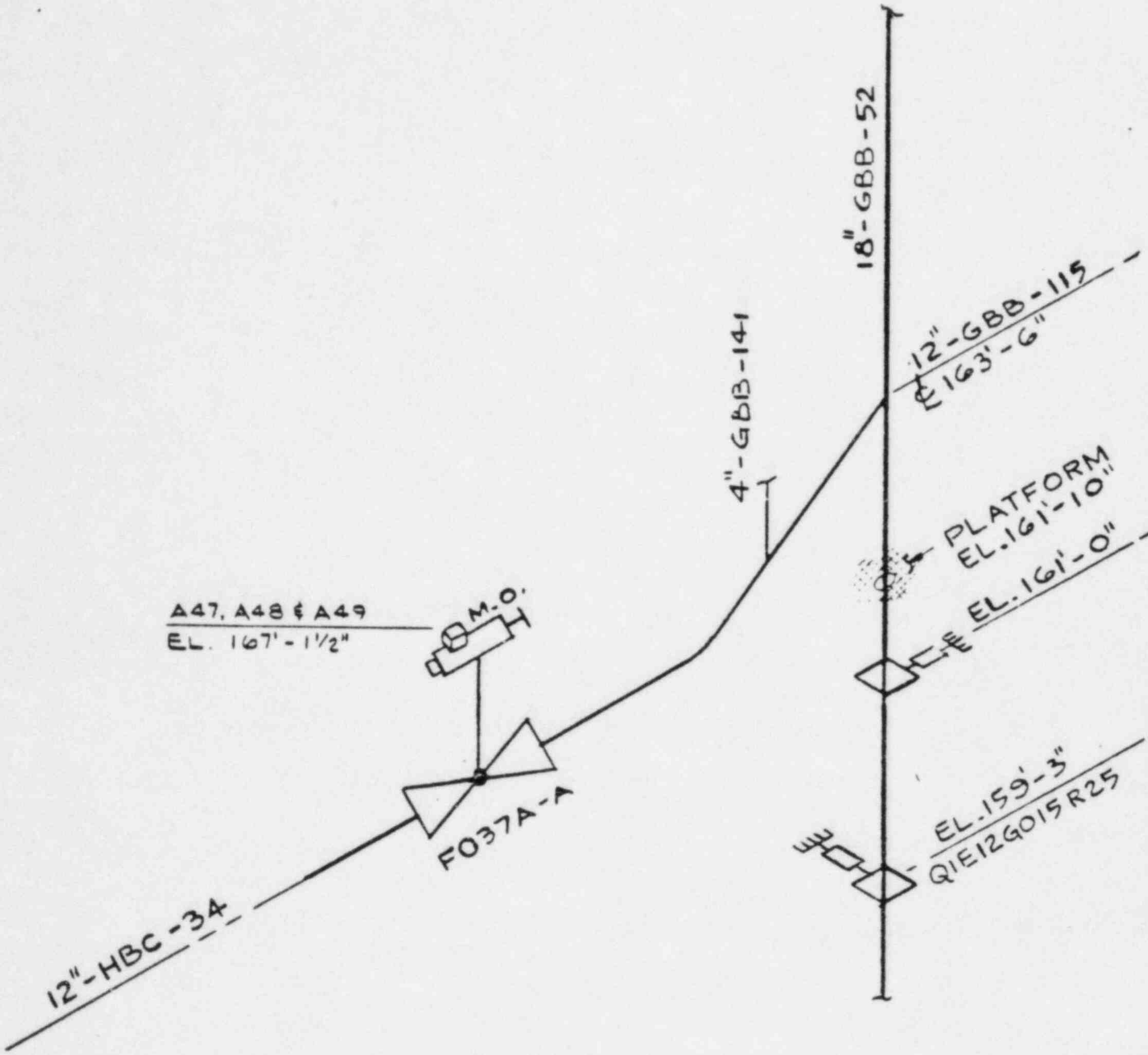


Figure 2.10 - Pipe Mounted Accelerometers A47, A48, A49

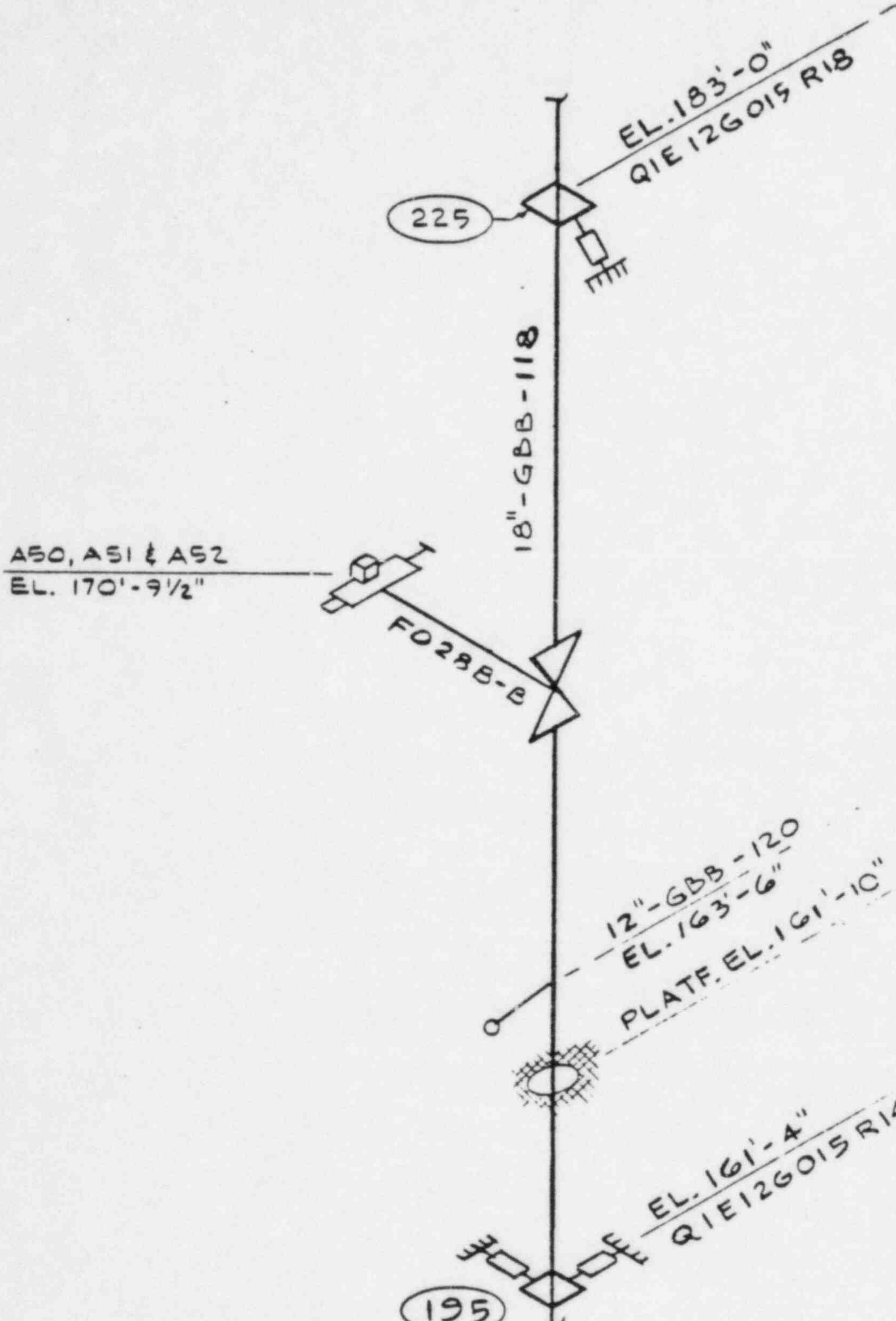
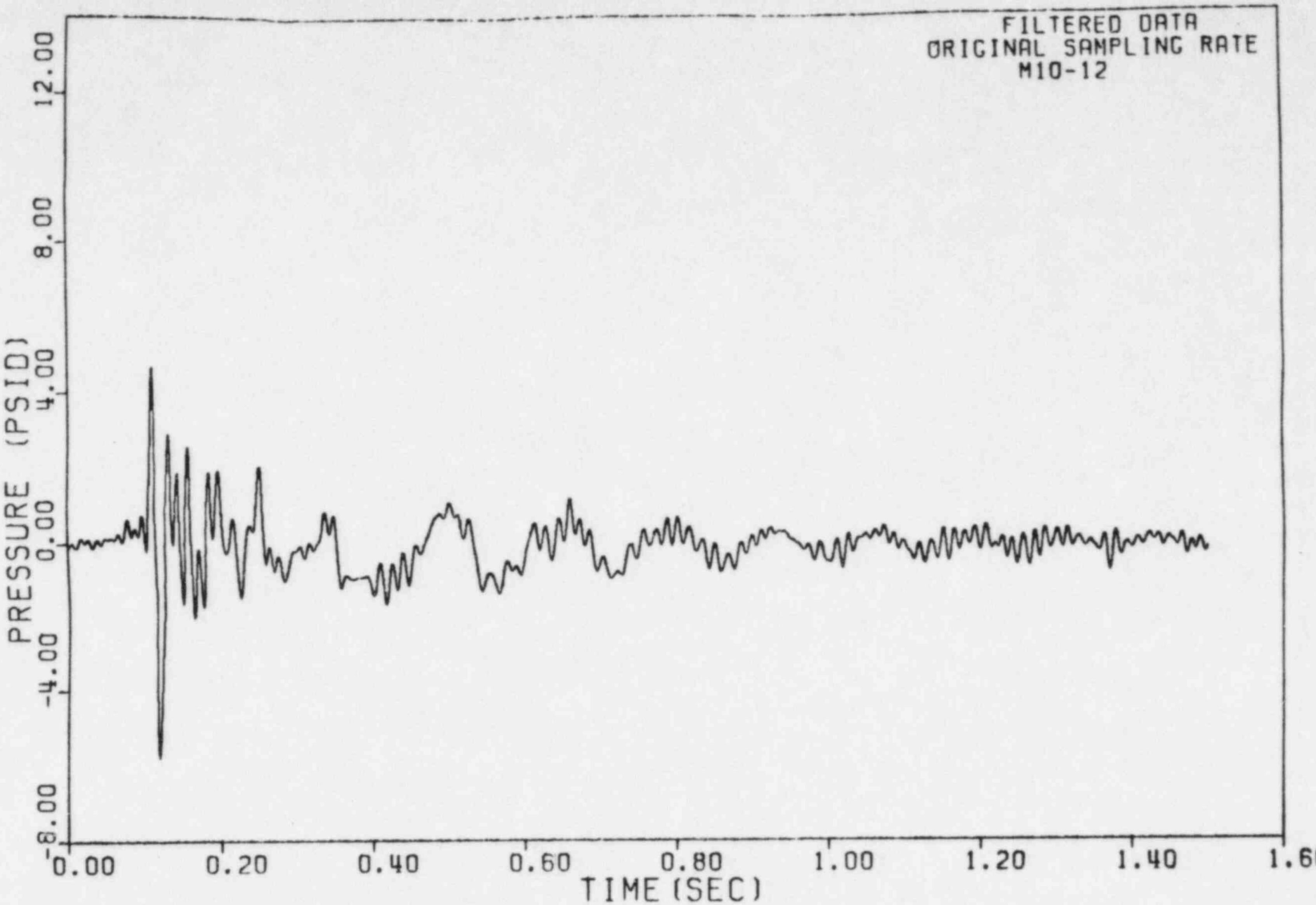


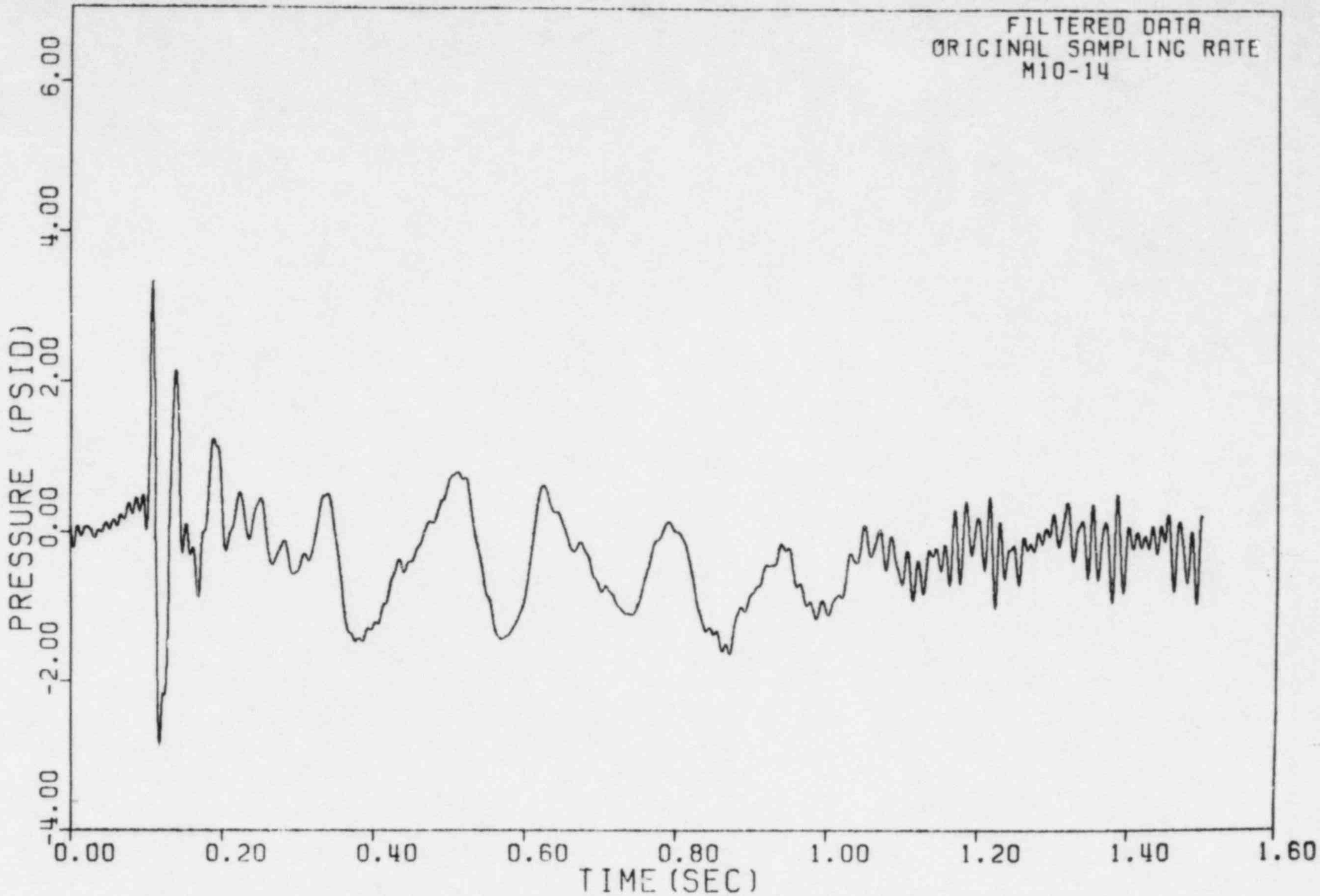
Figure 2.11 - Pipe Mounted Accelerometers A50, A51, A52



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-10

CHANNEL 12

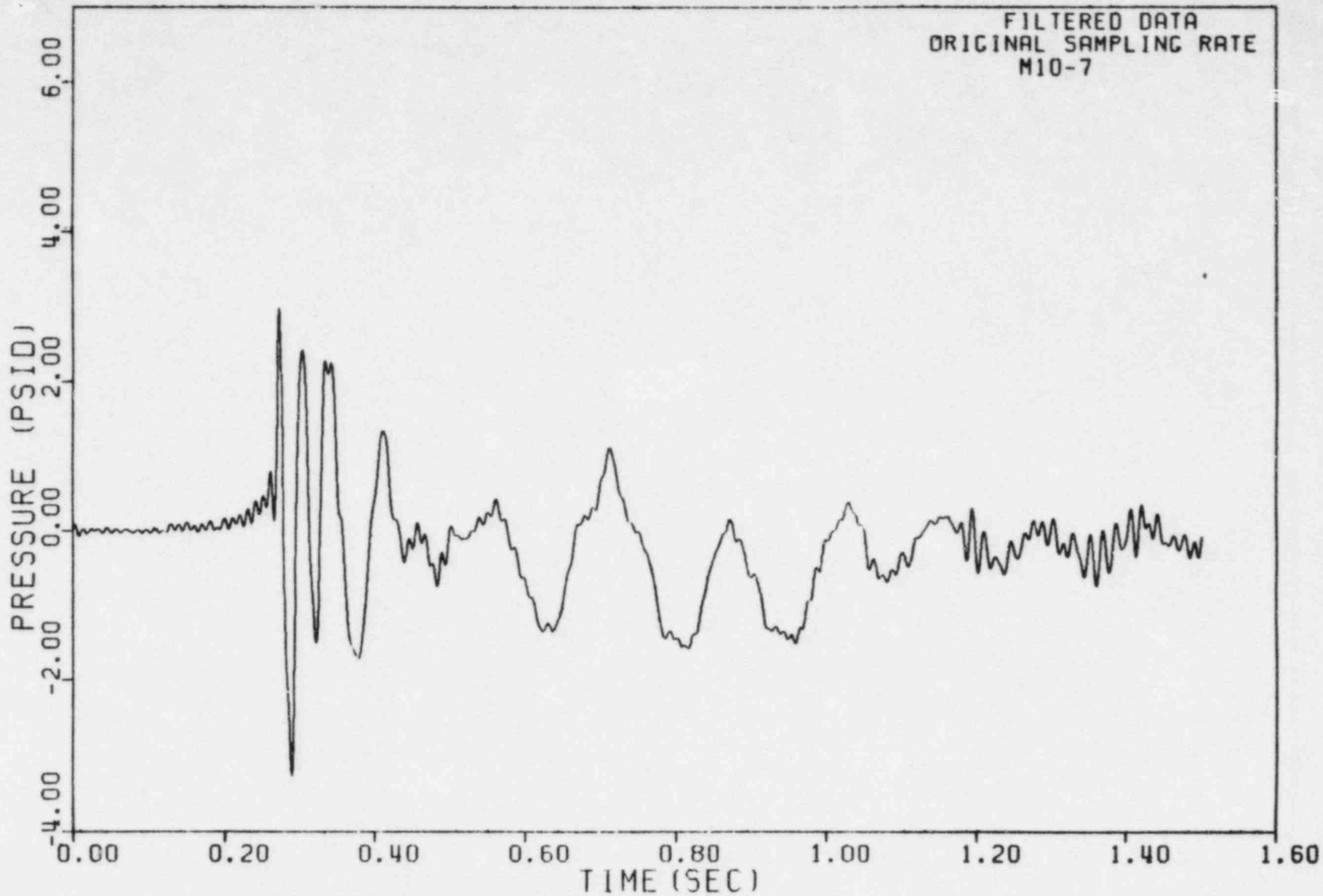
Figure 3.1



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-10

CHANNEL 14

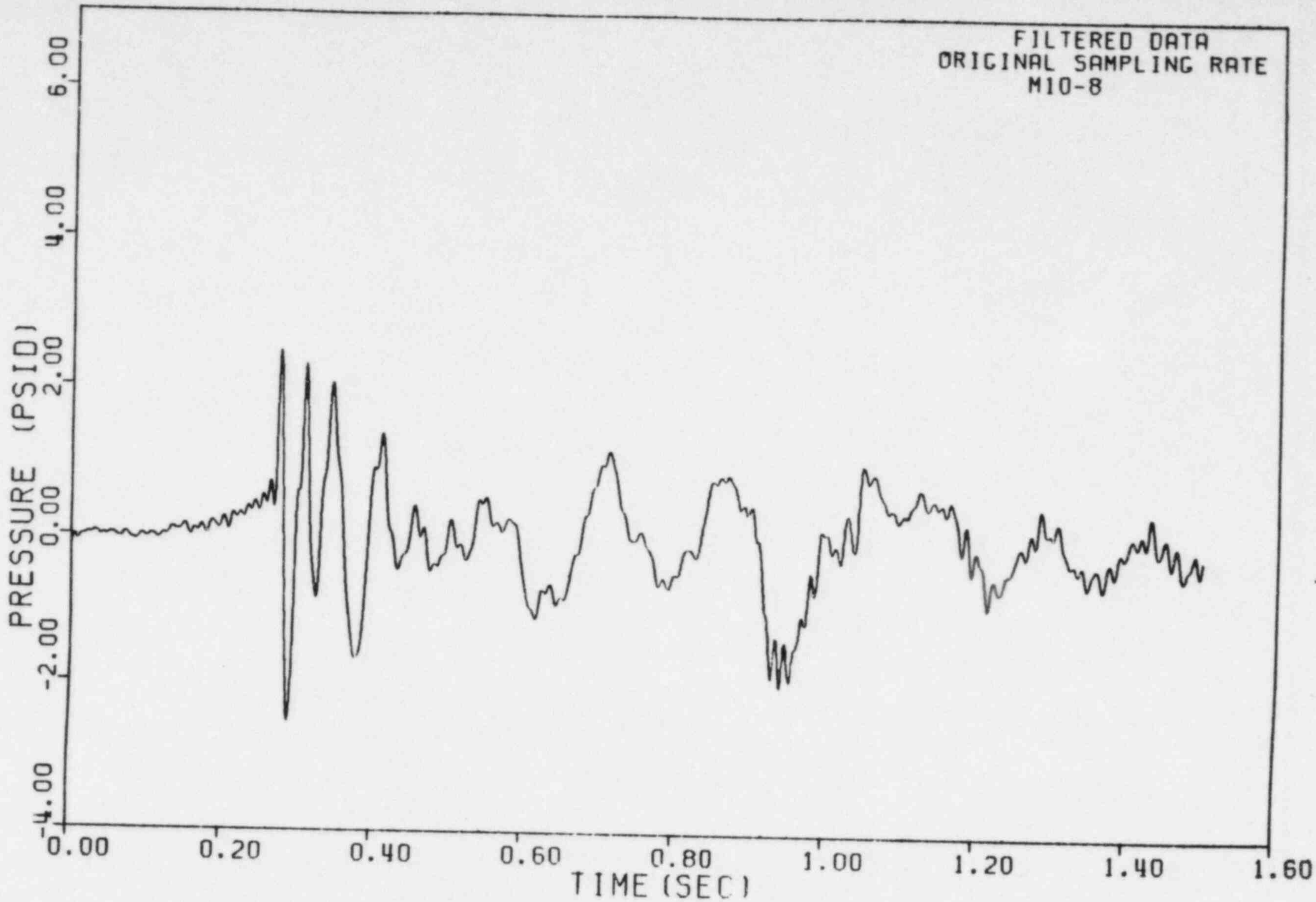
Figure 3.2



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-20

CHANNEL 7

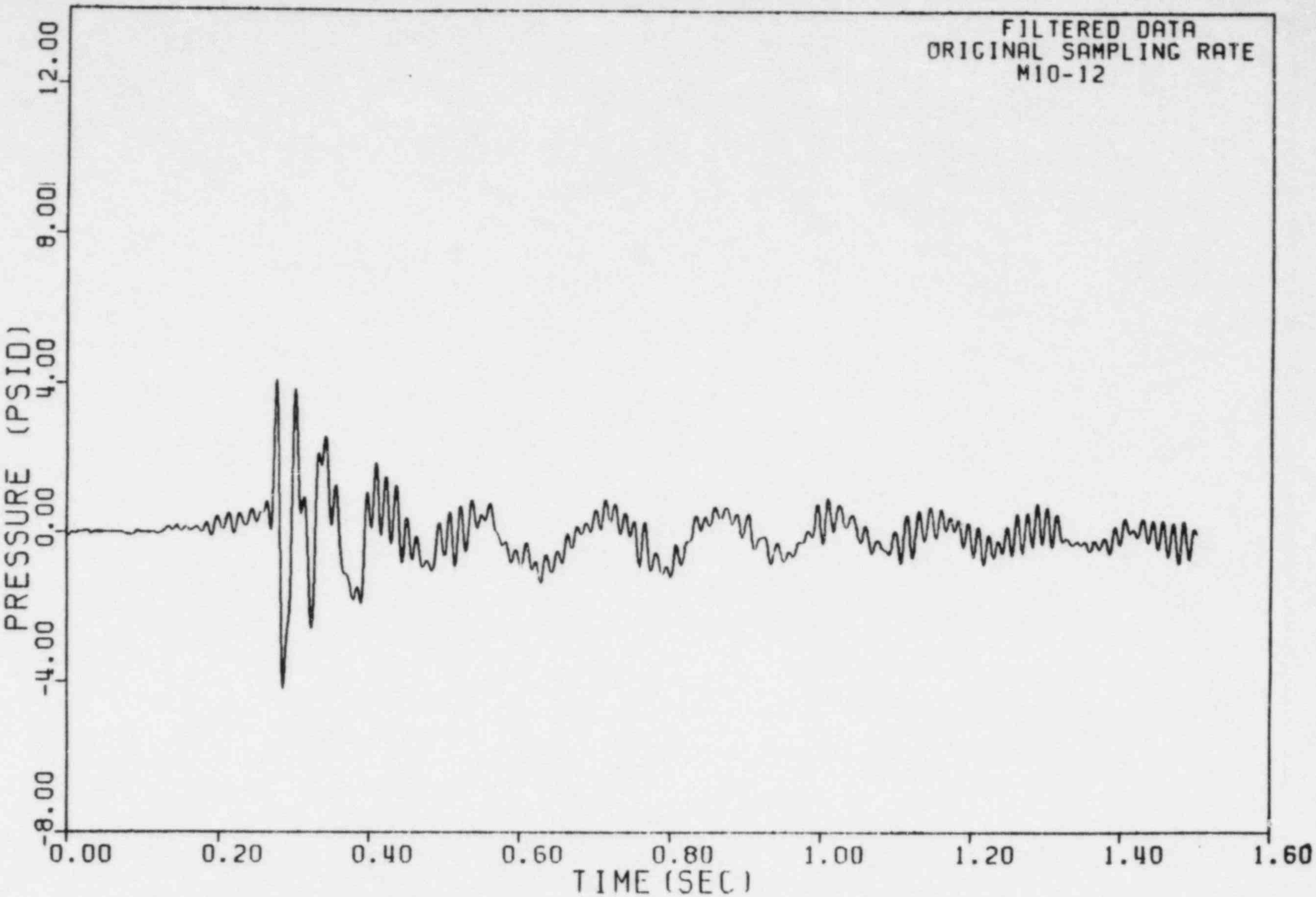
Figure 3.3



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-20

CHANNEL 8

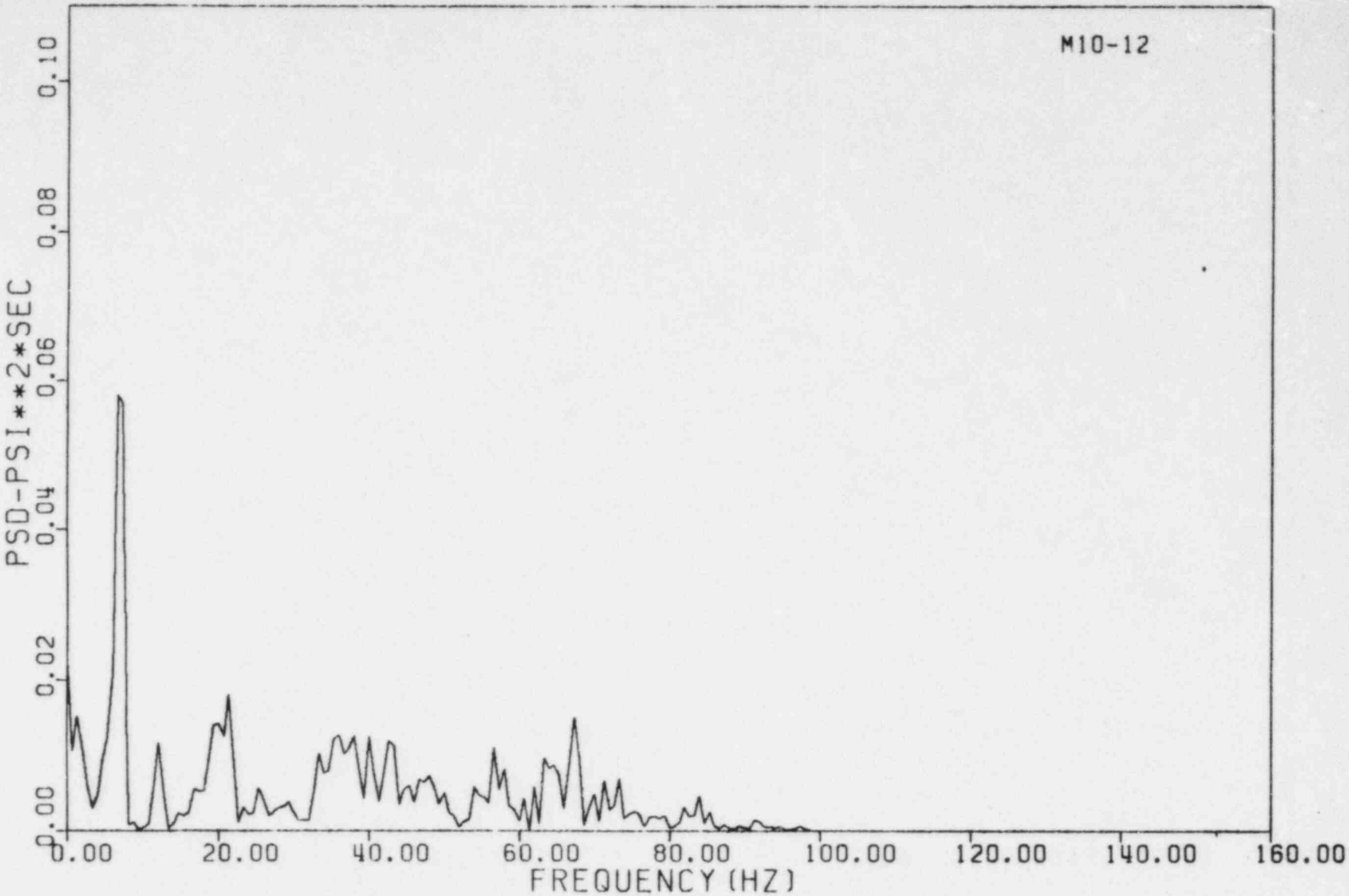
Figure 3.4



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-20

CHANNEL 12

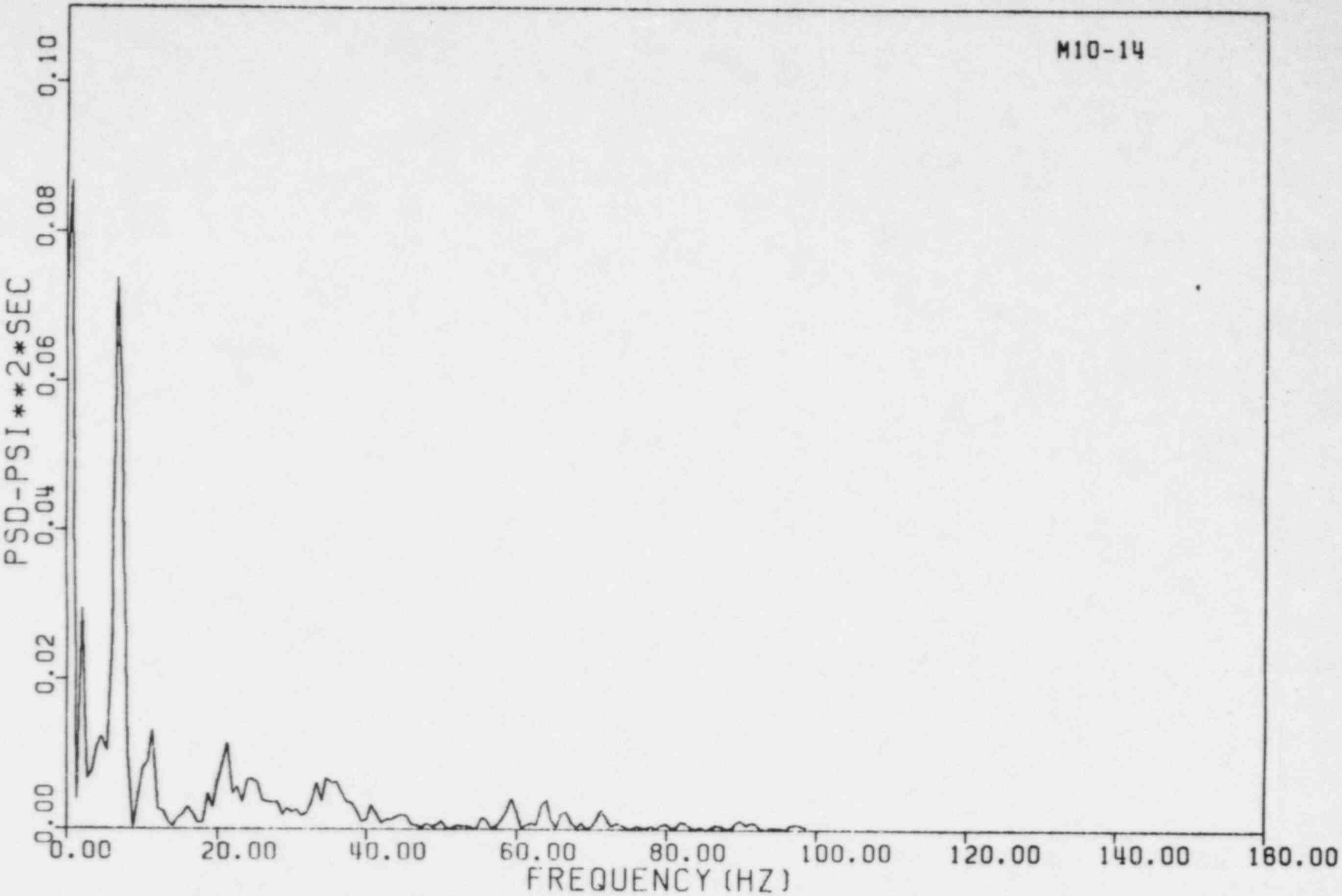
Figure 3.5



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-10

CHANNEL 12

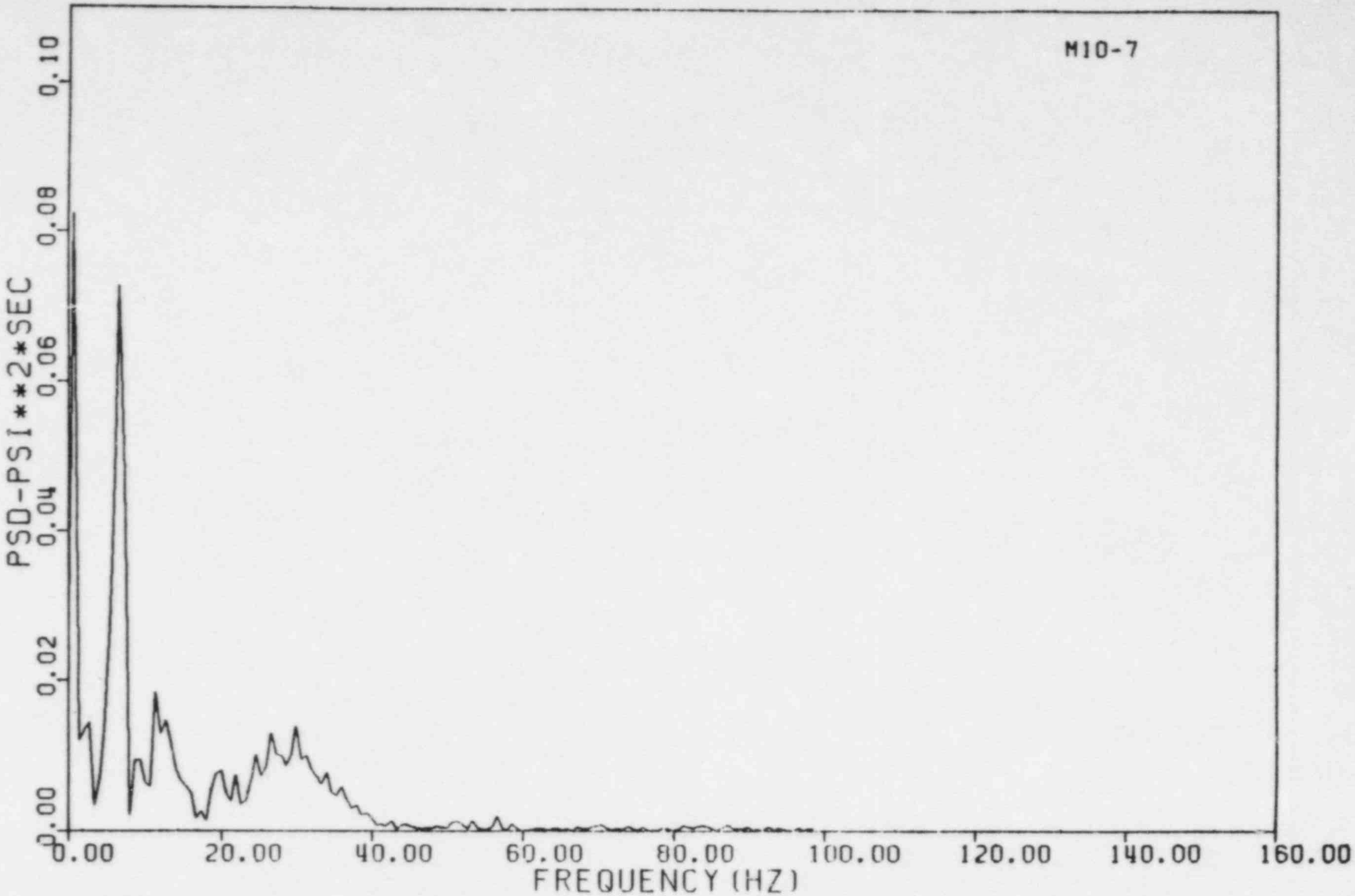
Figure 3.6



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-10

CHANNEL 14

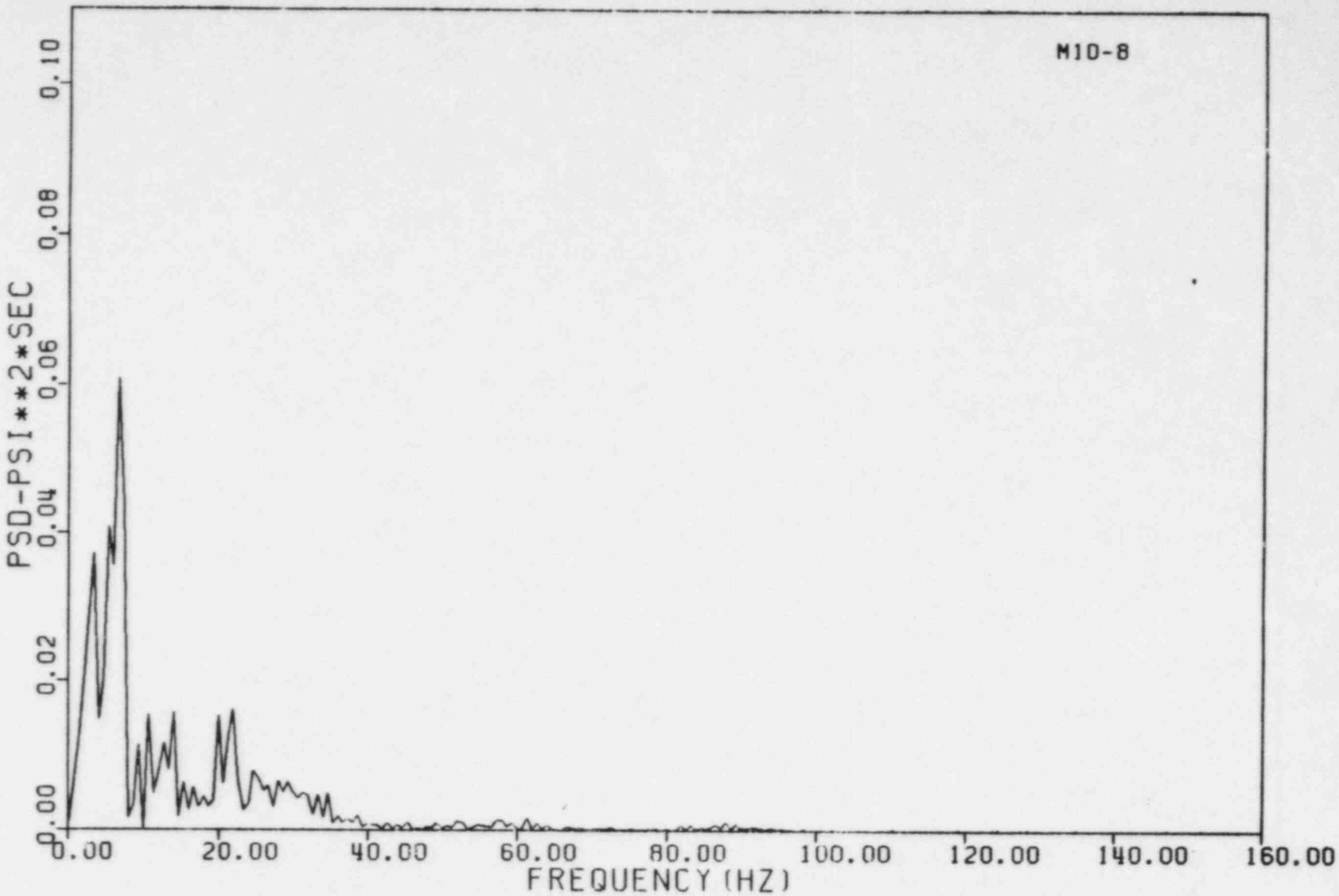
Figure 3.7



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-20

CHANNEL 7

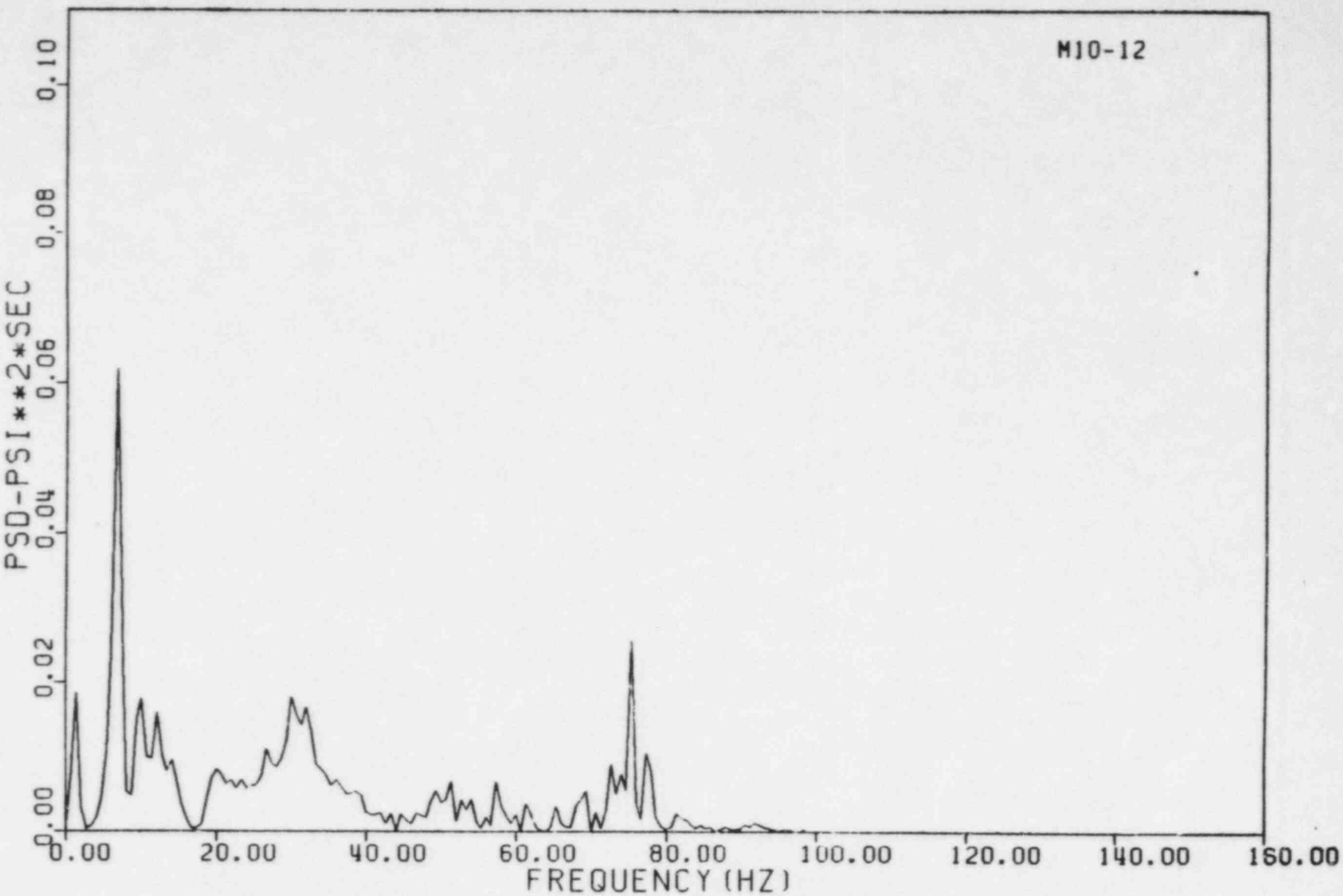
Figure 3.8



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-20

CHANNEL 8

Figure 3.9



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-20

CHANNEL 12

Figure 3.10

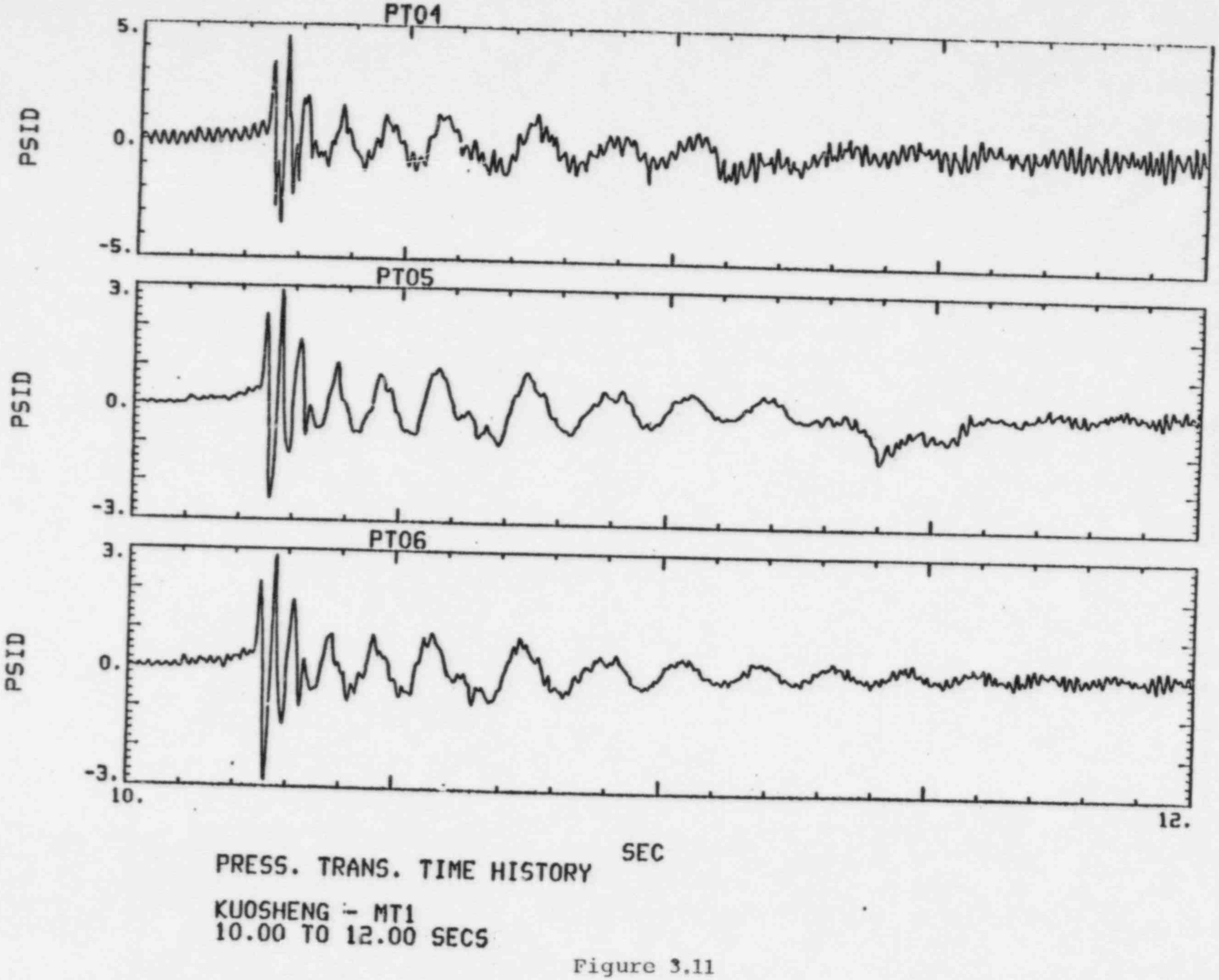

PT04
PT05
PT06
PSID
5.
0.
-5.
3.
-3.
10.
12.
SEC
PRESS. TRANS. TIME HISTORY
KUOSHENG - MT1
10.00 TO 12.00 SECS

Figure 3.11

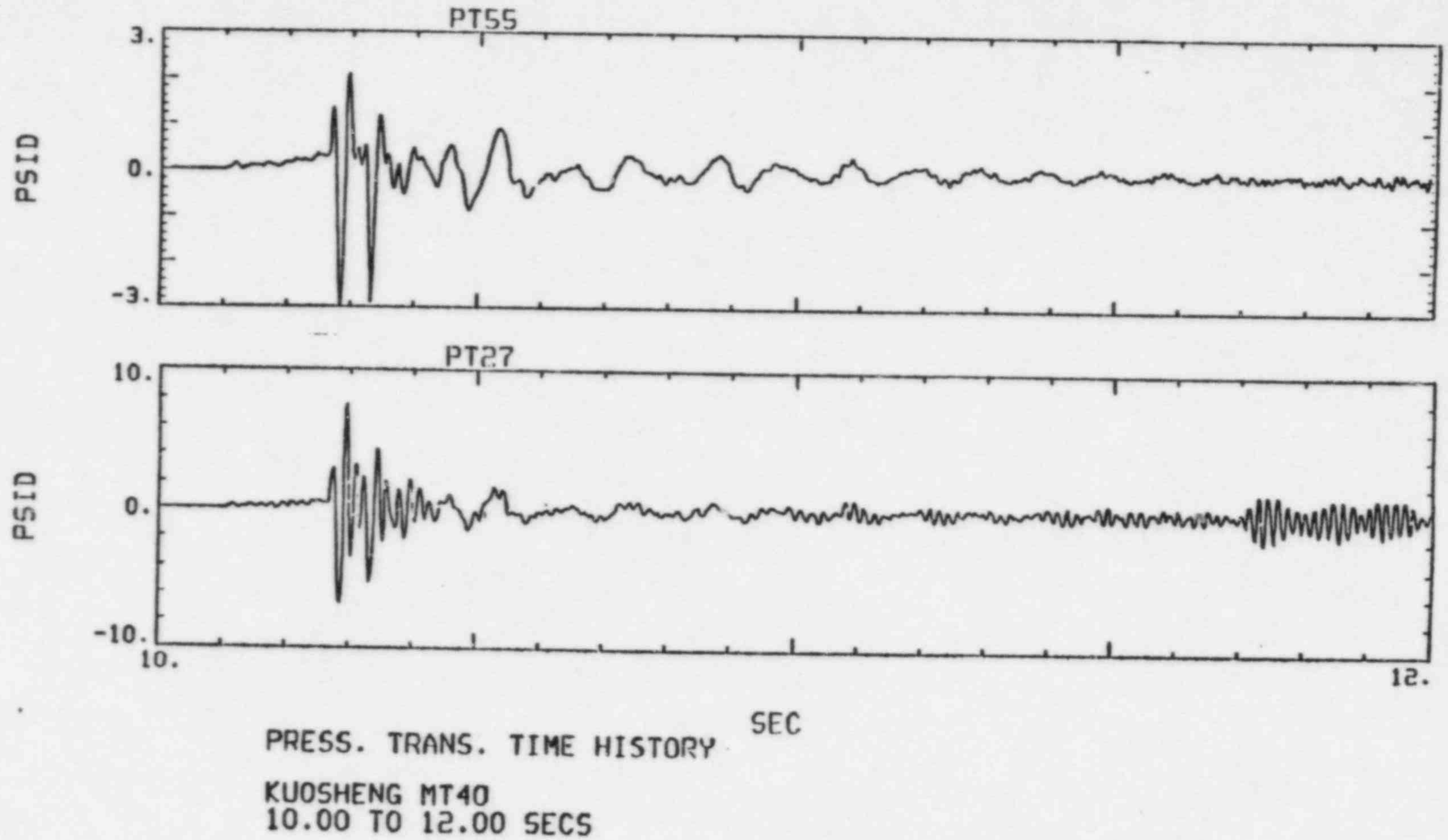
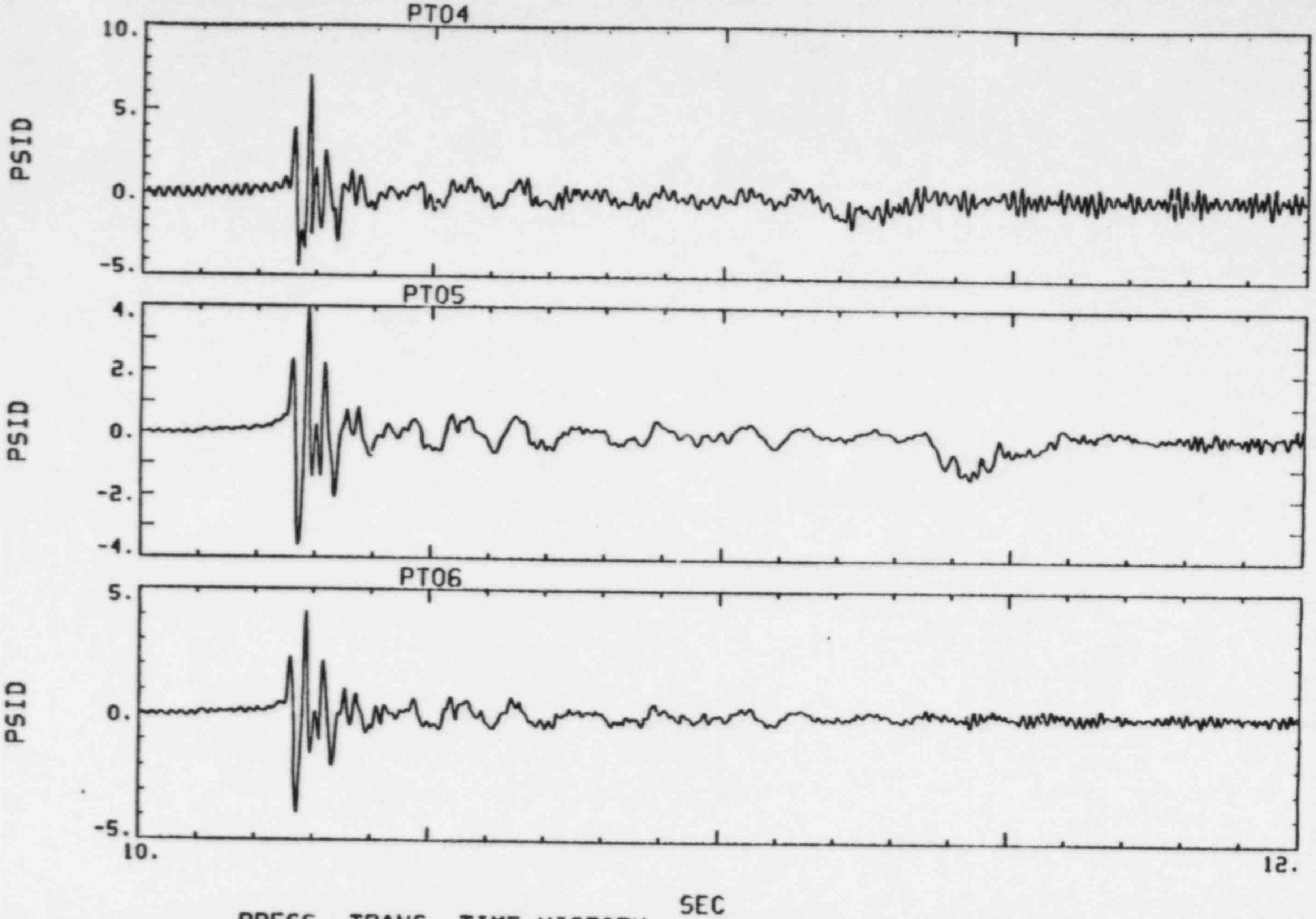

PT55
3.
0.
-3.
PSID
PT27
10.
0.
-10.
PSID
10.
12.
SEC
PRESS. TRANS. TIME HISTORY
KUOSHENG MT40
10.00 TO 12.00 SECS

Figure 3.12



PRESS. TRANS. TIME HISTORY

KUOSHENG MT100A
10.00 TO 12.00 SECS

Figure 3.13

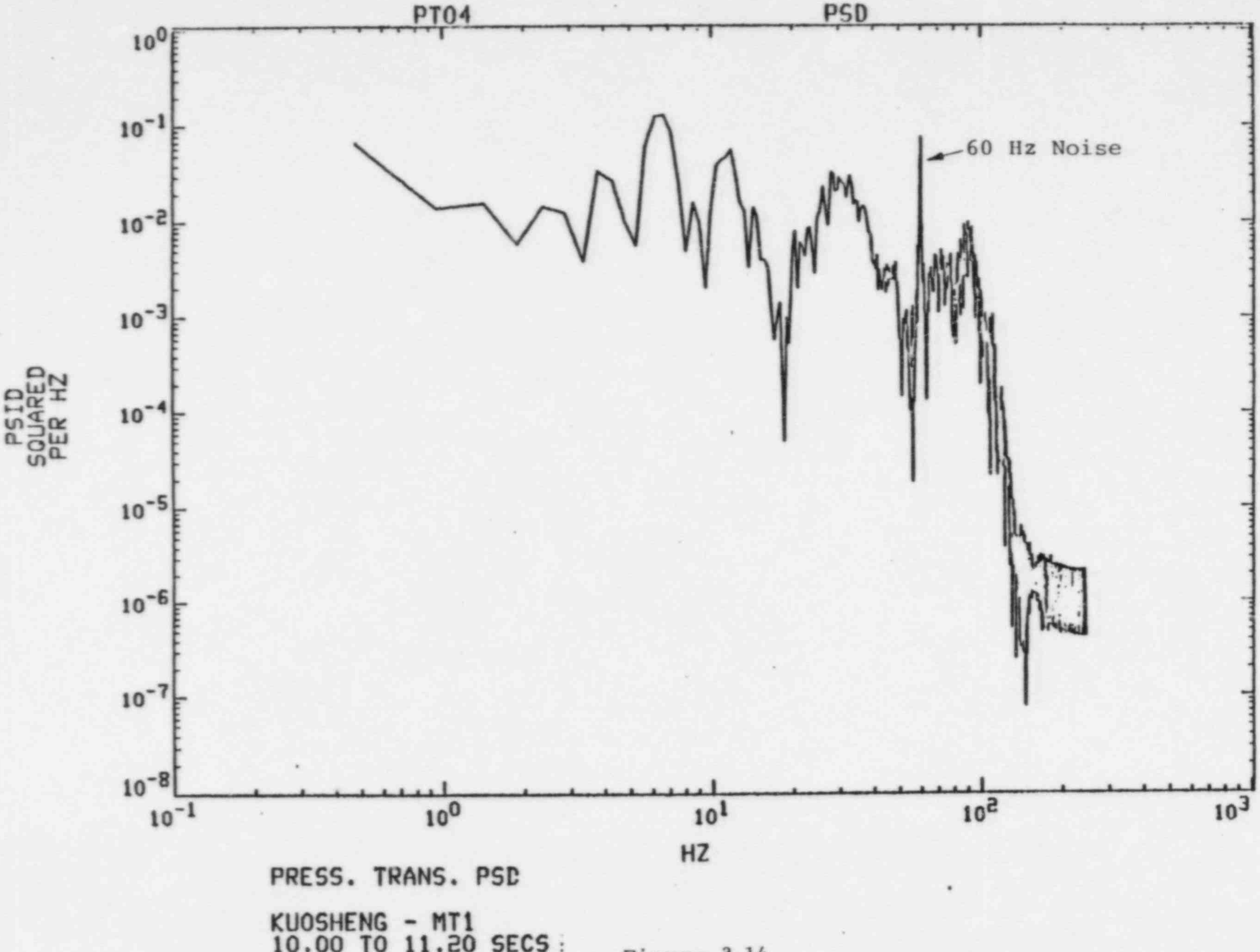

PT04
PSD
60 Hz Noise
PSID SQUARED PER HZ
HZ
PRESS. TRANS. PSD
KUOSHENG - MT1
10.00 TO 11.20 SECS :

Figure 3.14

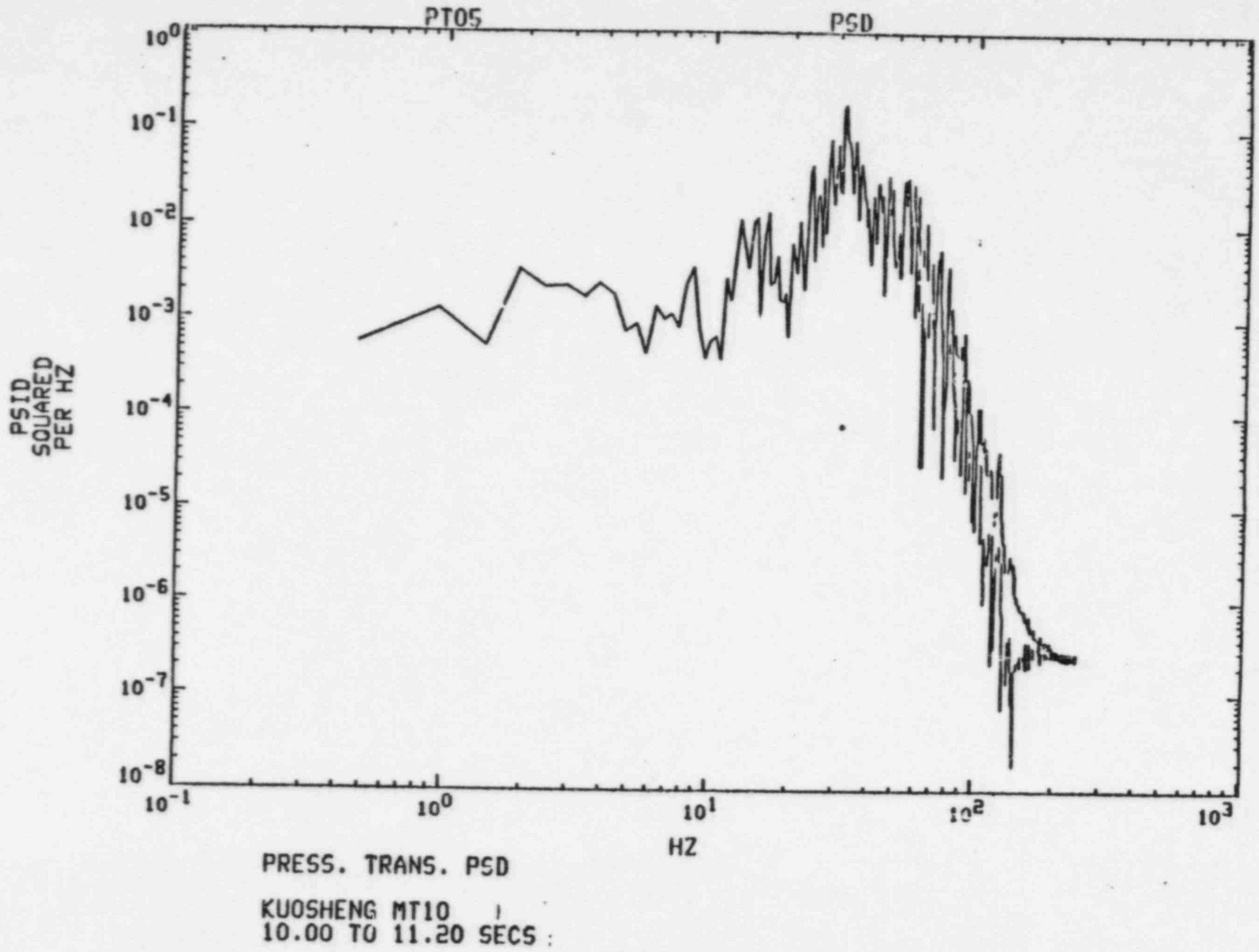
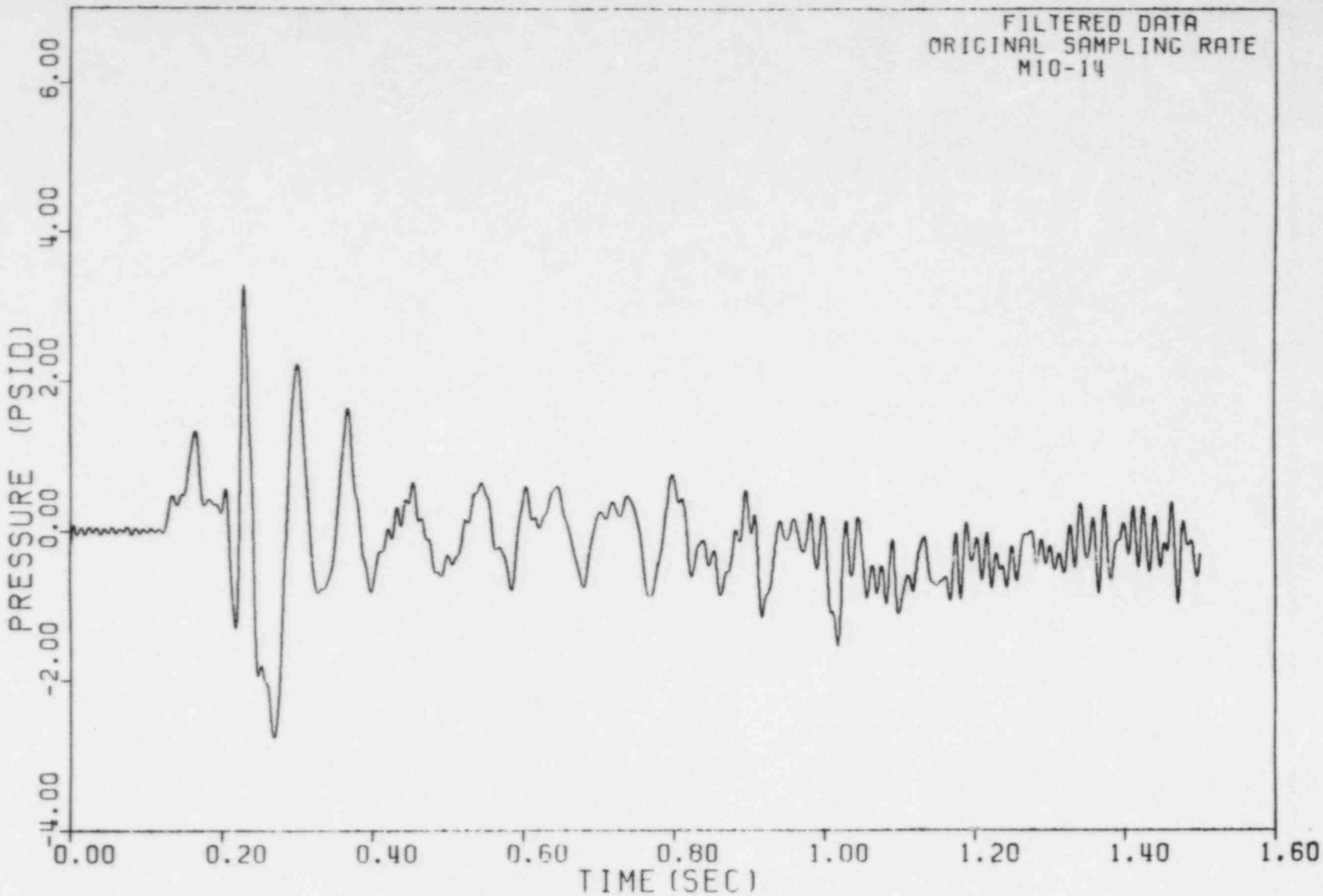

PT05
PSD
PSID
SQUARED
PER HZ
10^{0}
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
10^{-8}
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
HZ
PRESS. TRANS. PSD
KUOSHENG MT10
10.00 TO 11.20 SECS

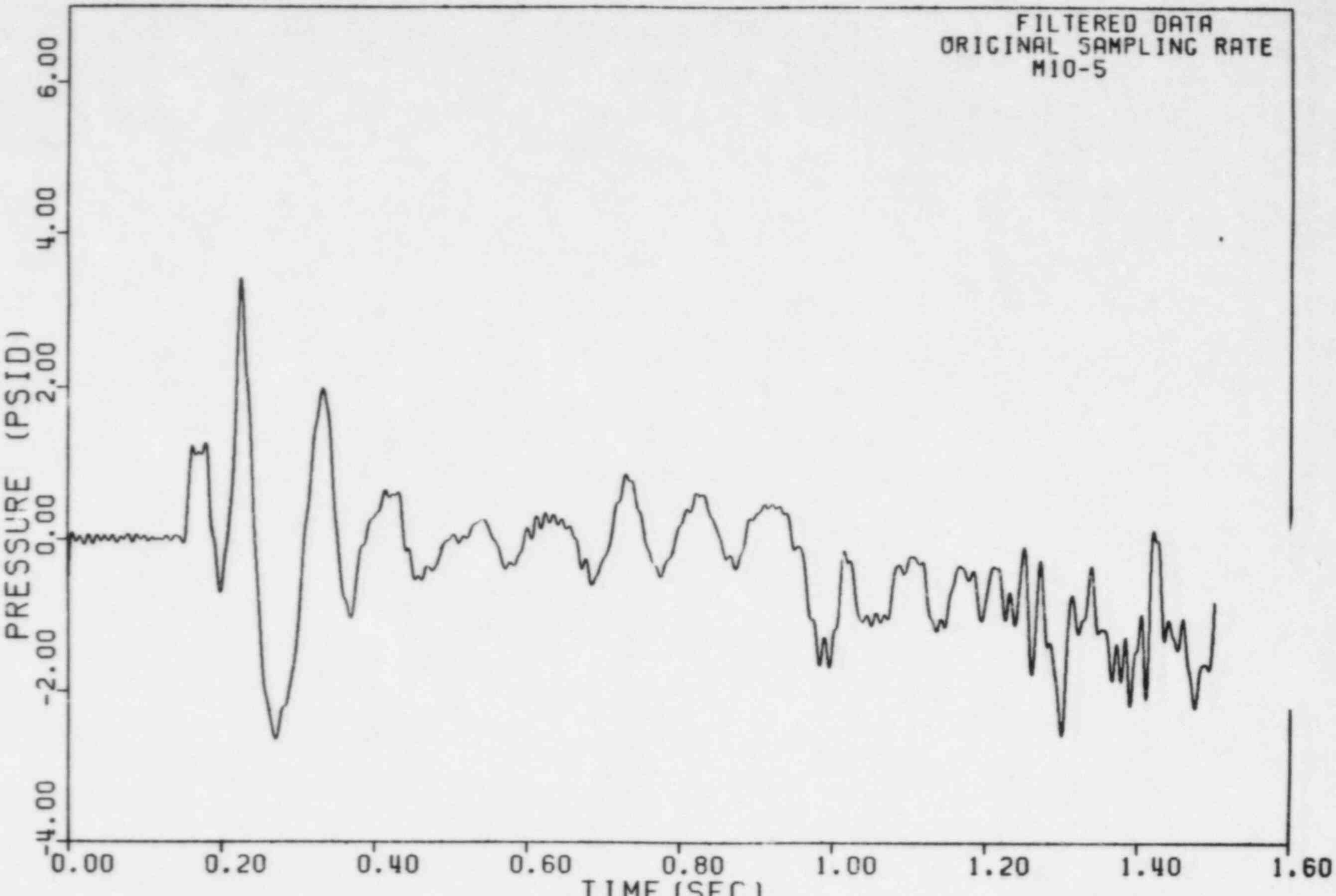
Figure 3.15



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-11

CHANNEL 14

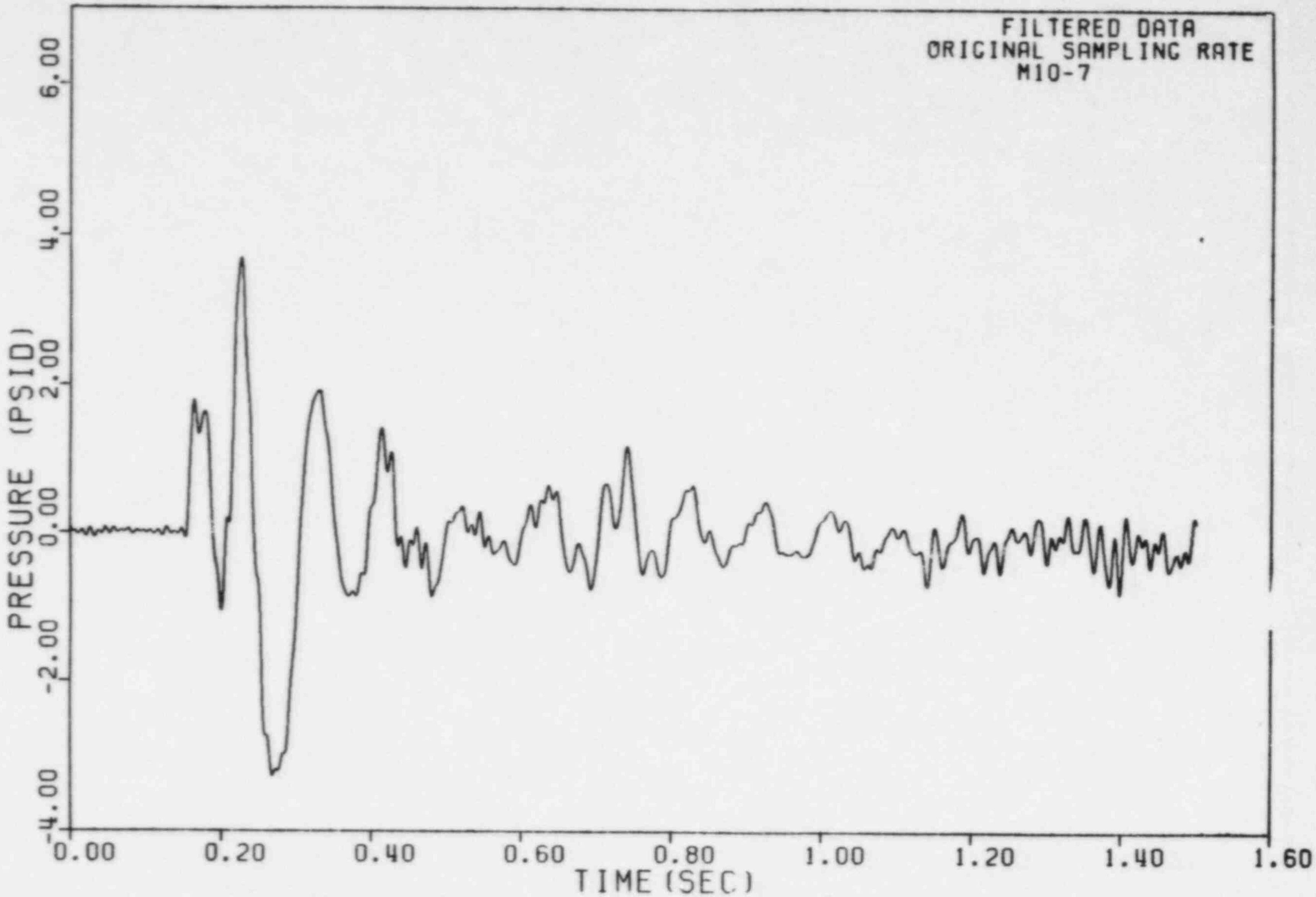
Figure 3.16



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-21

CHANNEL 5

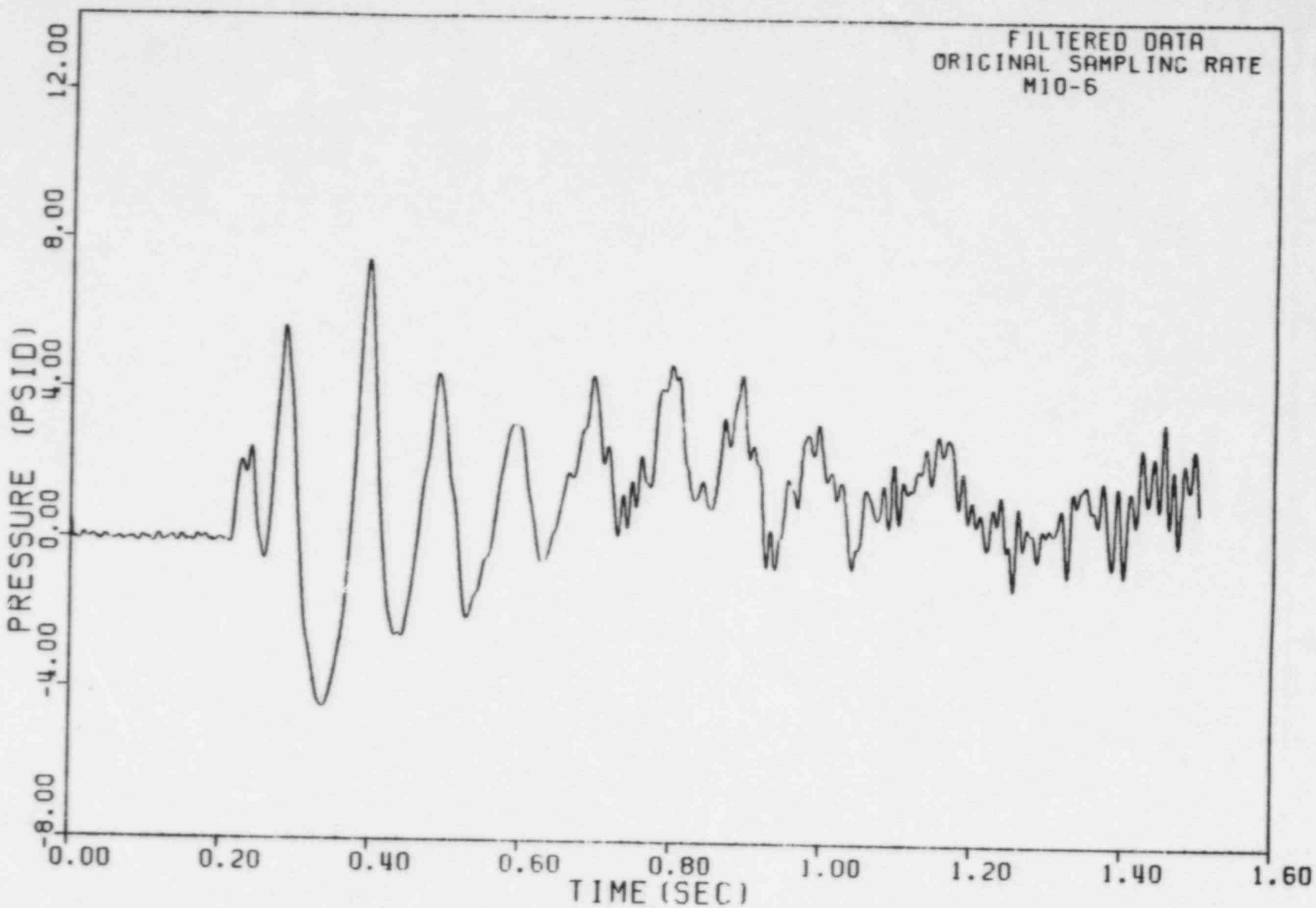
Figure 3.17



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-21

CHANNEL 7

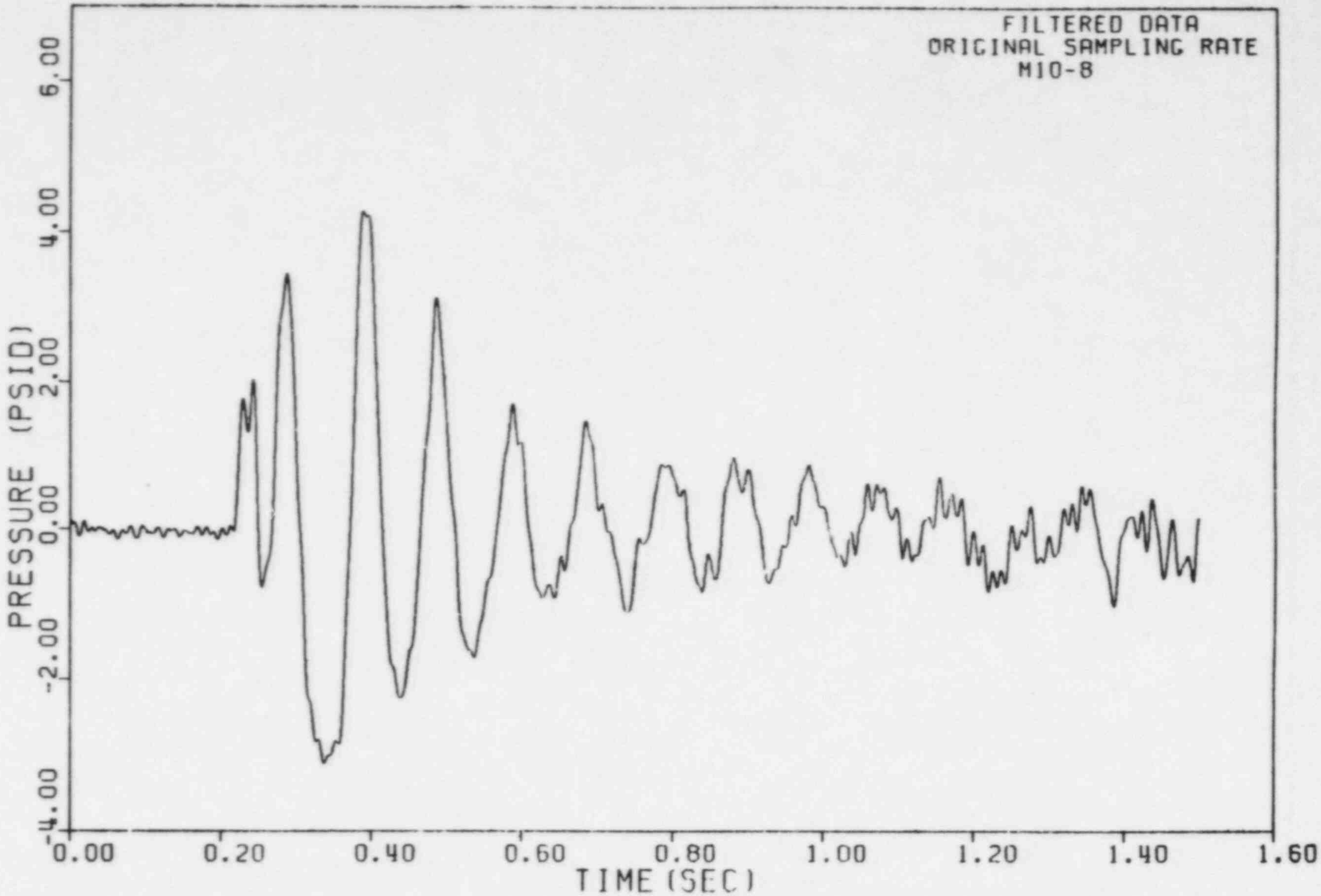
Figure 3.18



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-31

CHANNEL 6

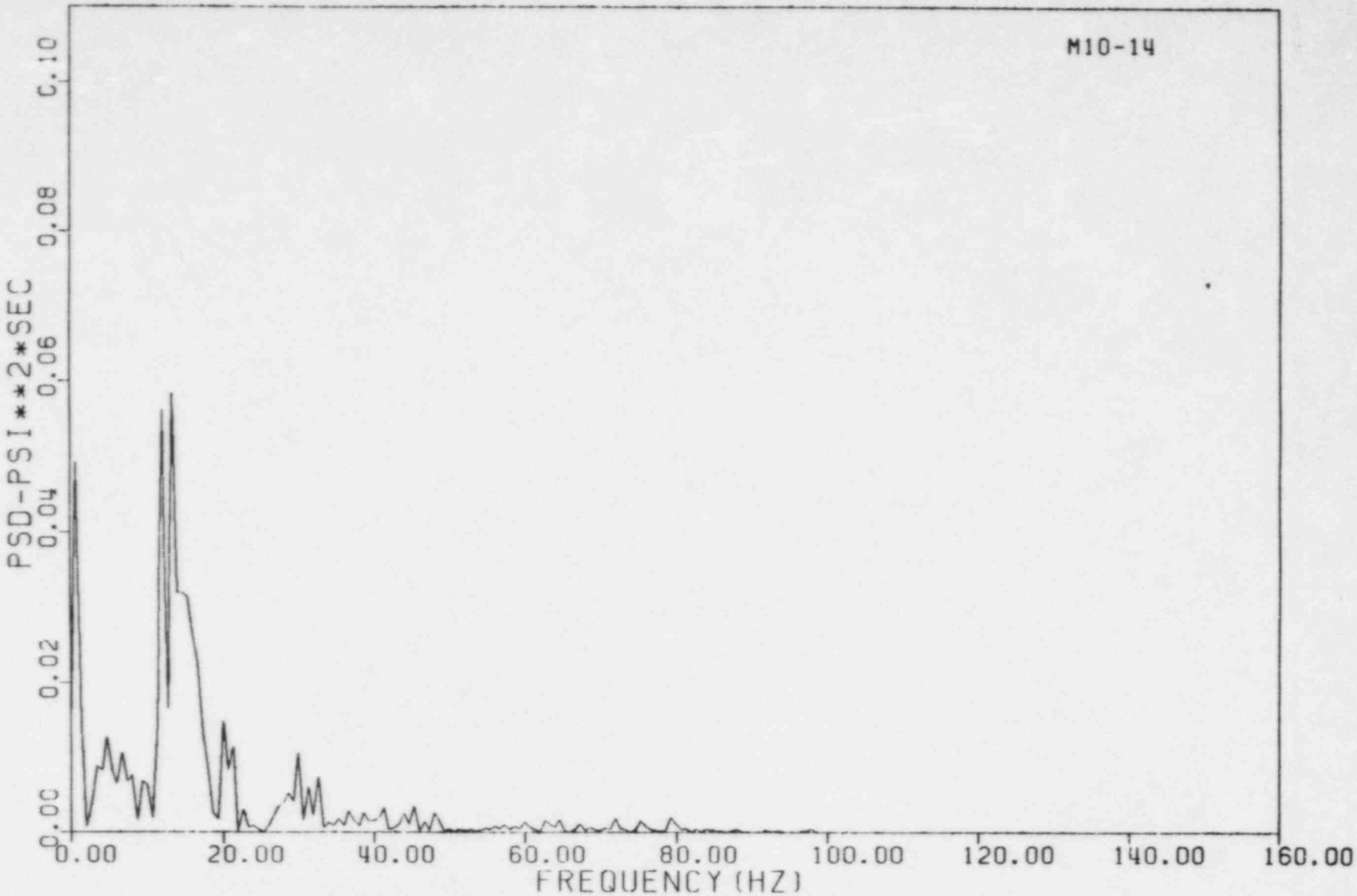
Figure 3.19



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-31

CHANNEL 8

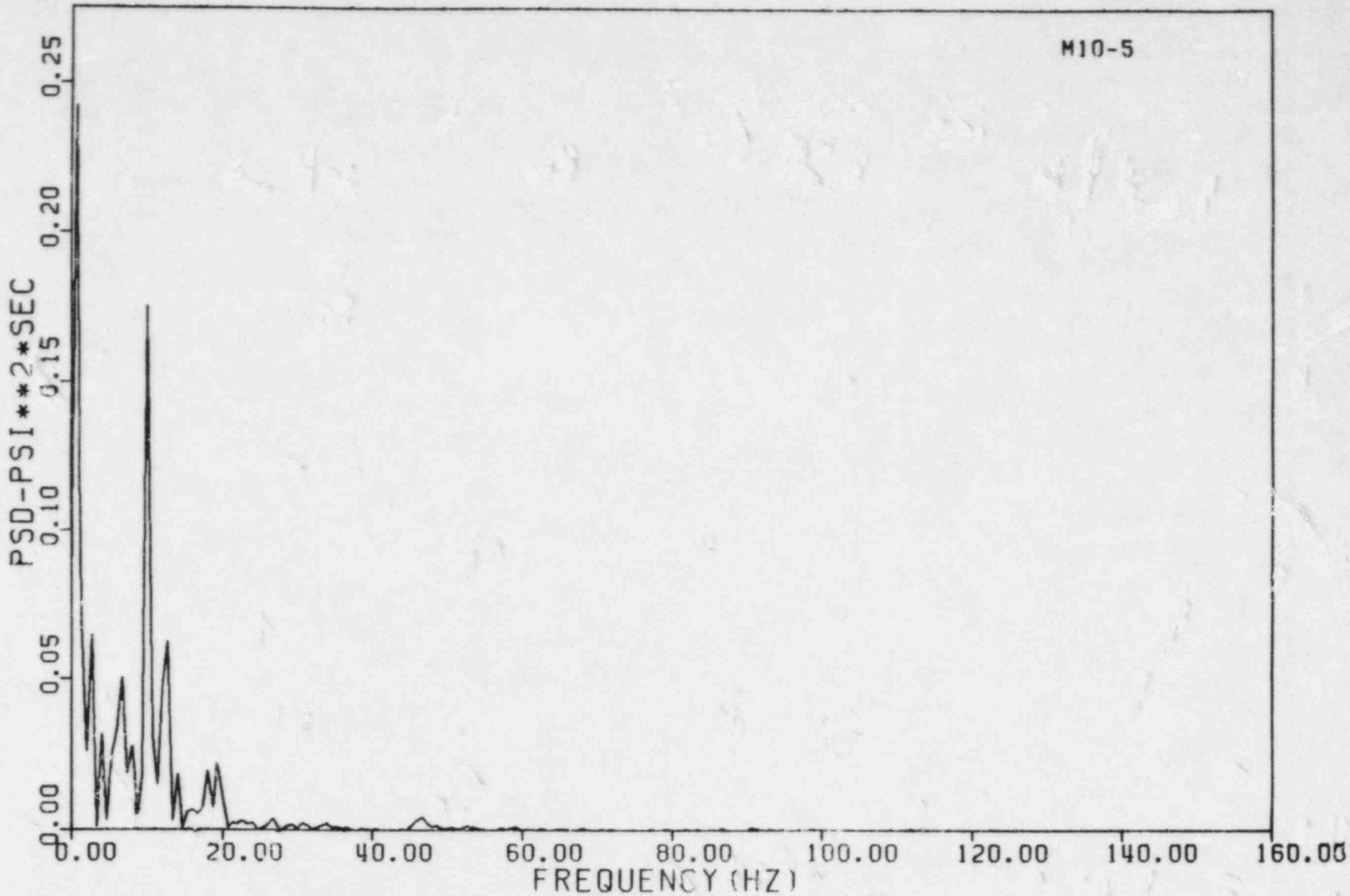
Figure 3.20



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-11

CHANNEL 14

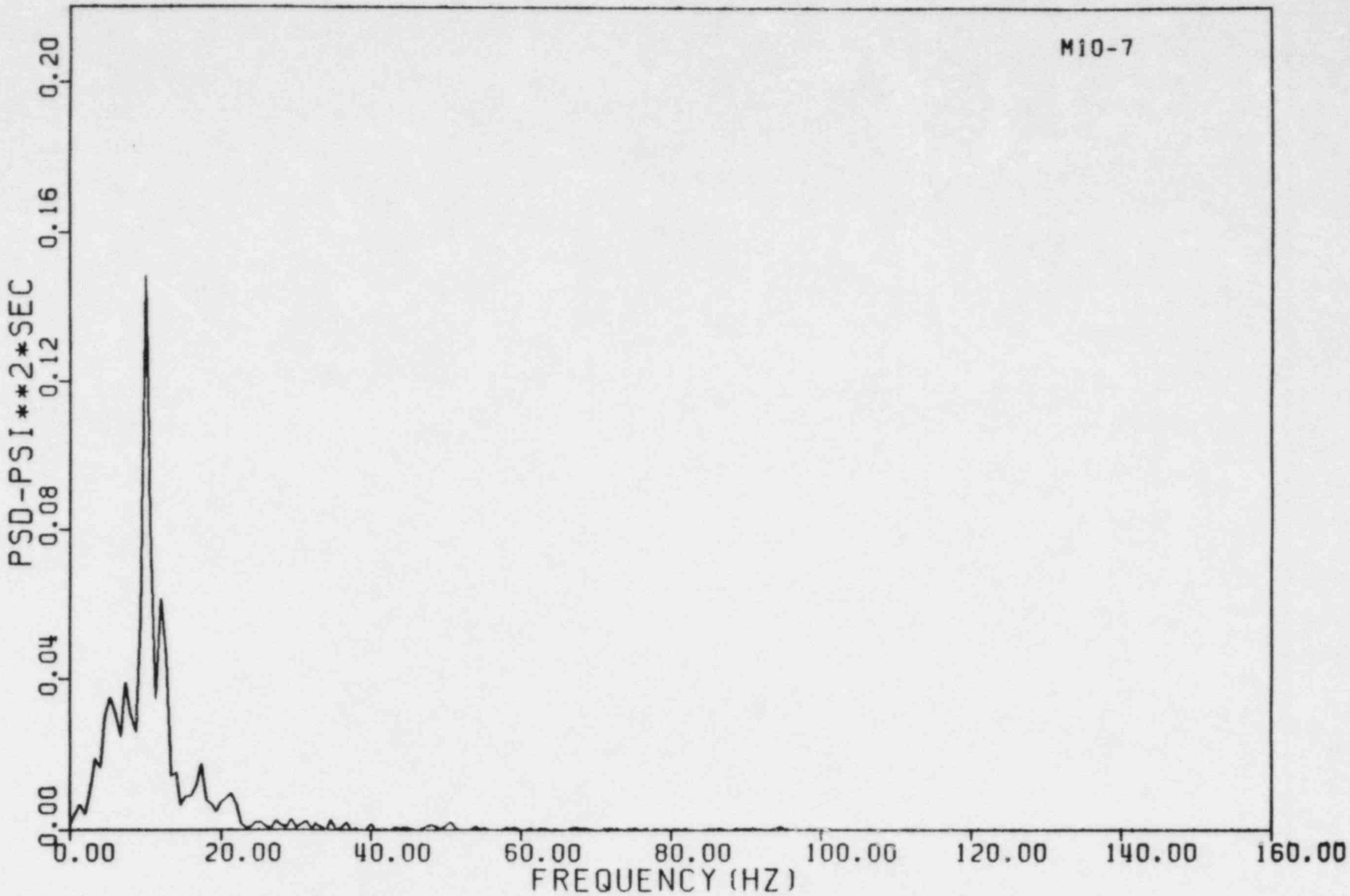
Figure 3.21



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-21

CHANNEL 5

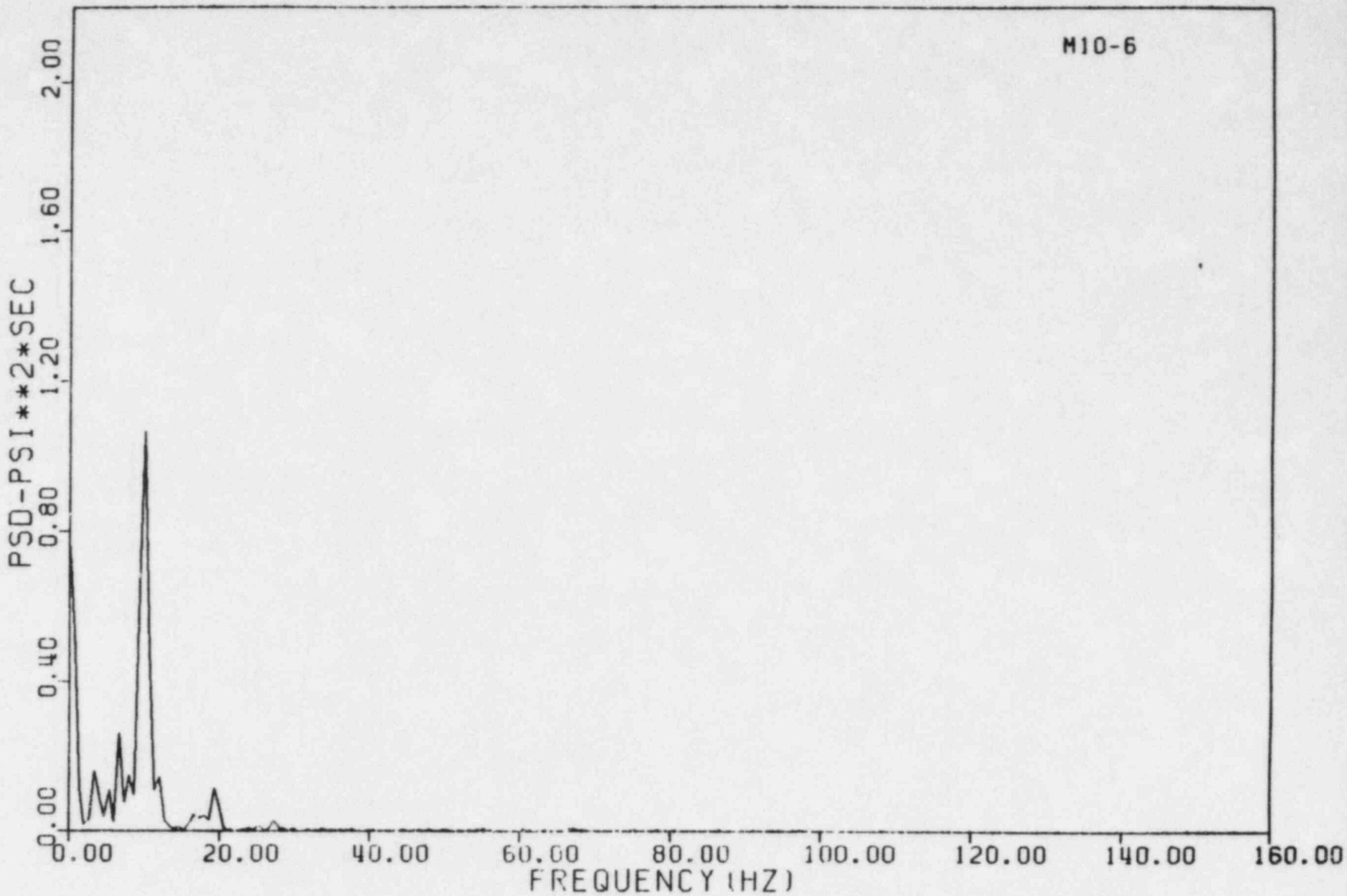
Figure 3.22



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-21

CHANNEL 7

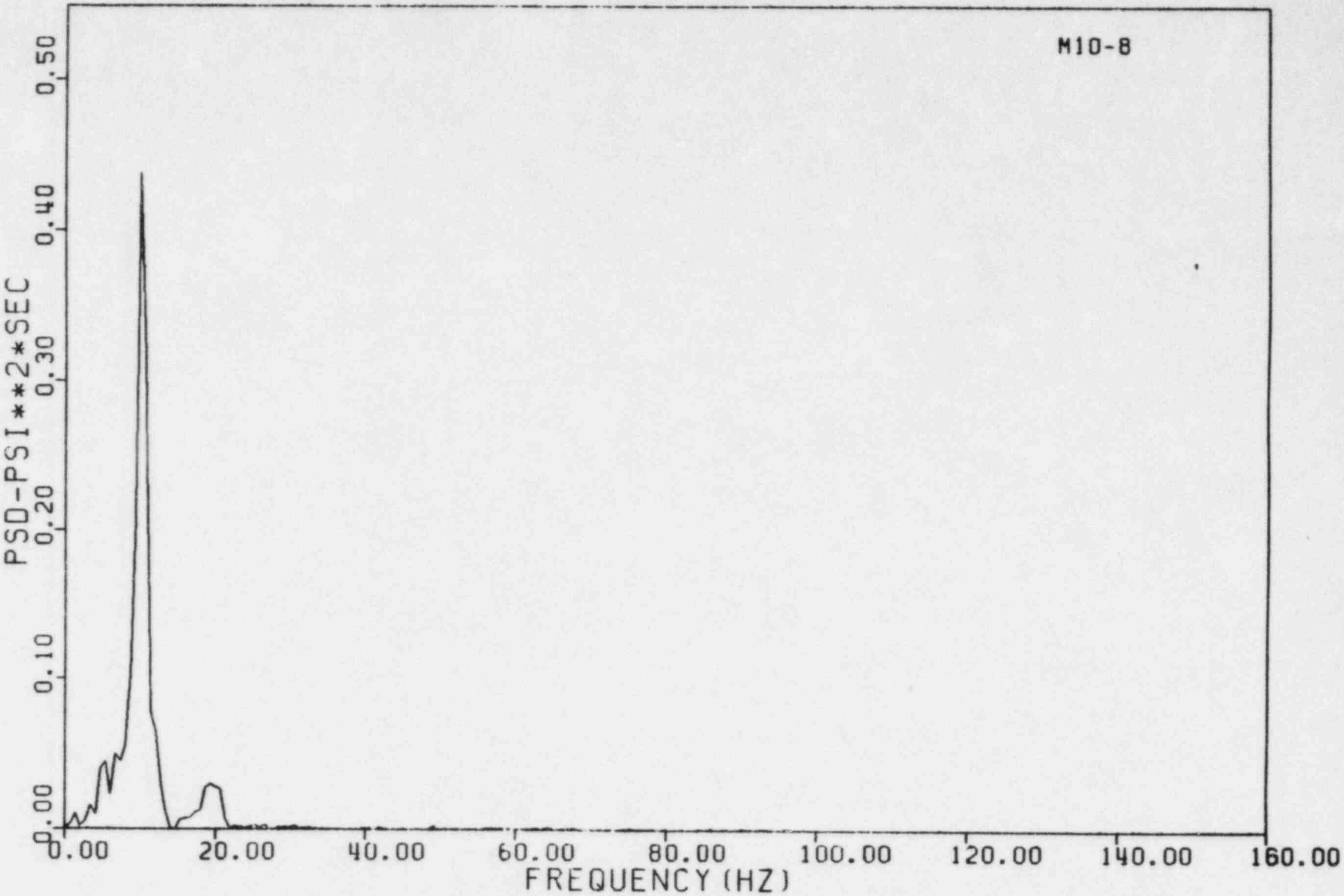
Figure 3.23



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-31

CHANNEL 6

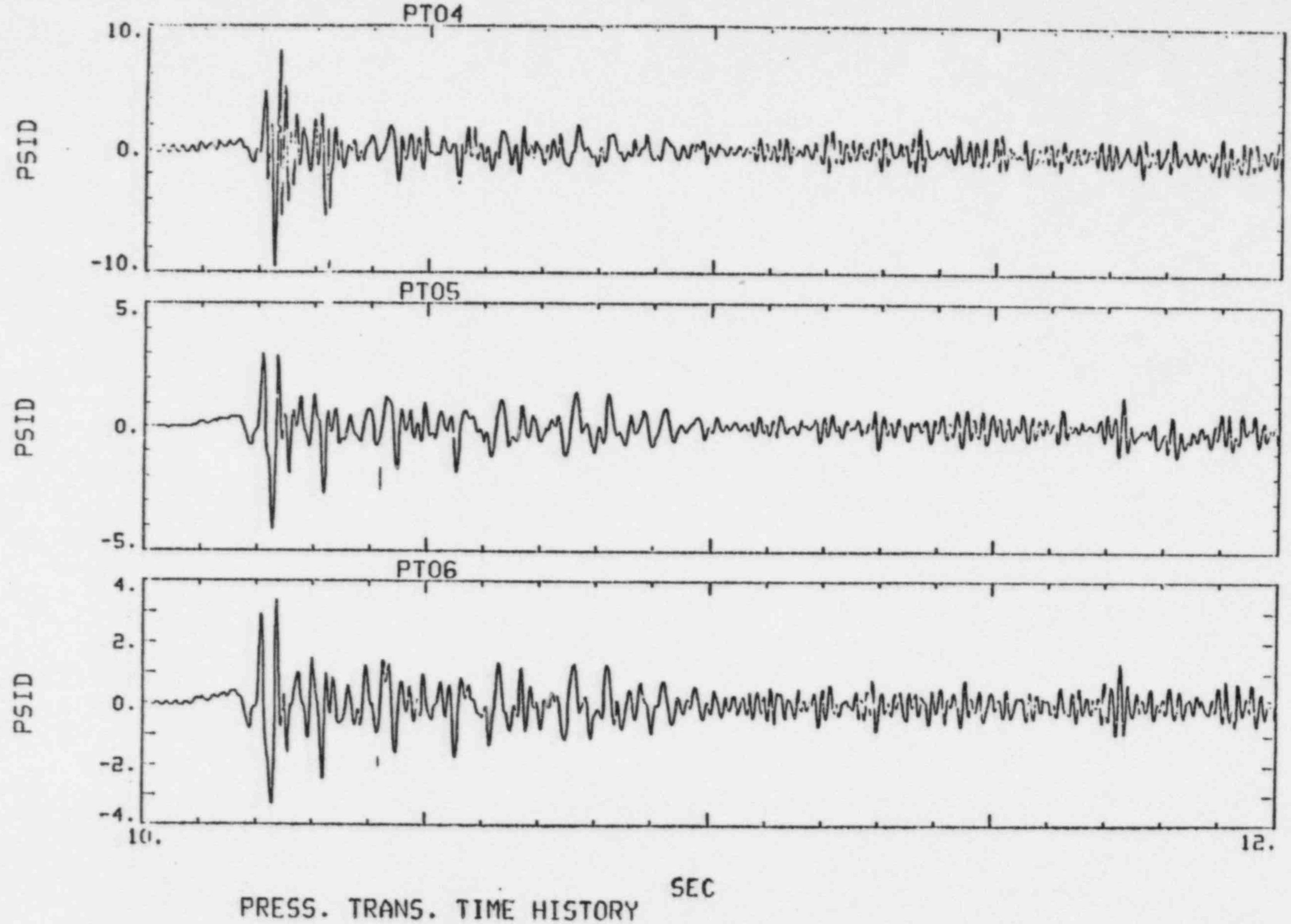
Figure 3.24



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-31

CHANNEL 8

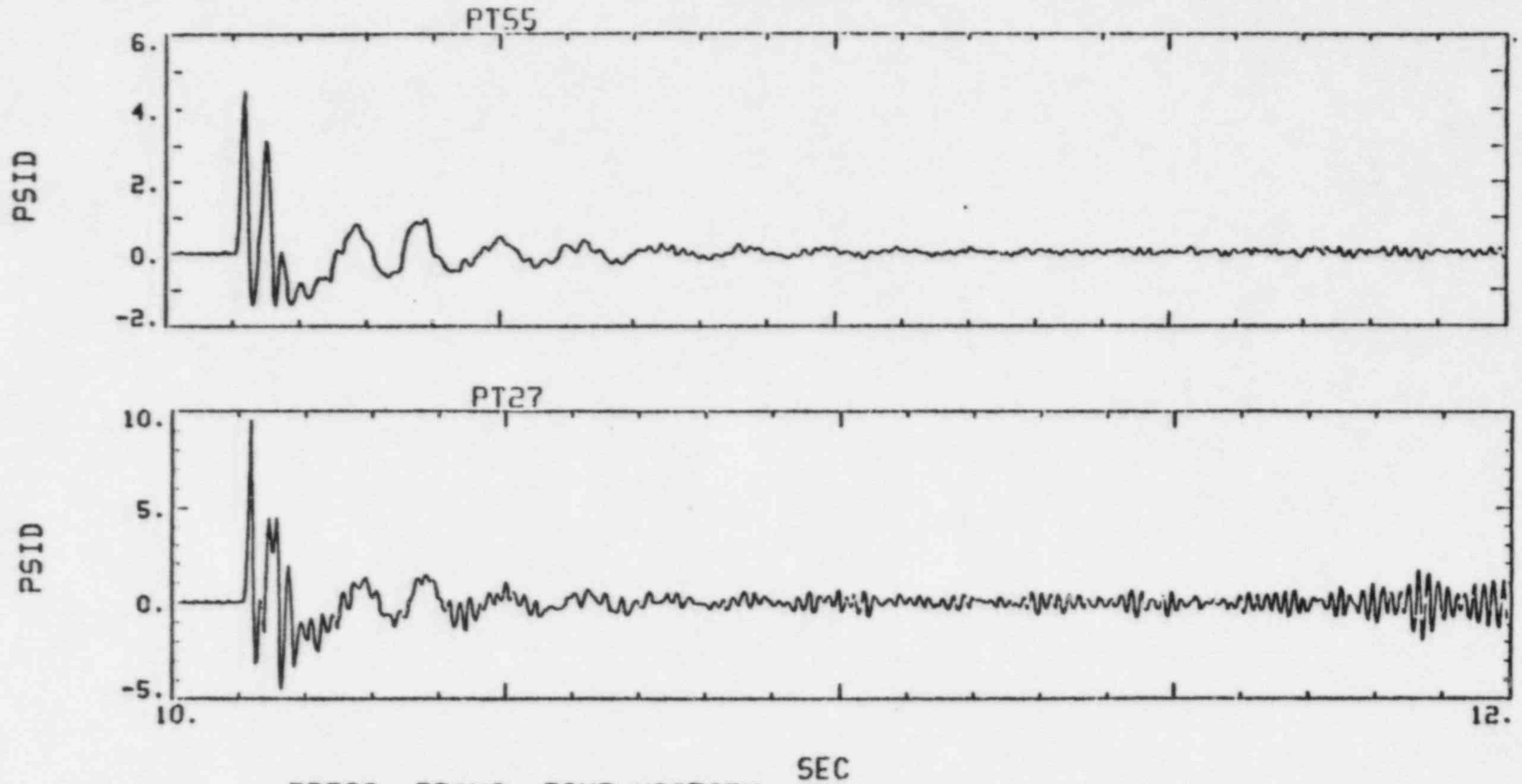
Figure 3.25



PRESS. TRANS. TIME HISTORY

KUOSHENG MT11
10.00 TO 12.00 SECS

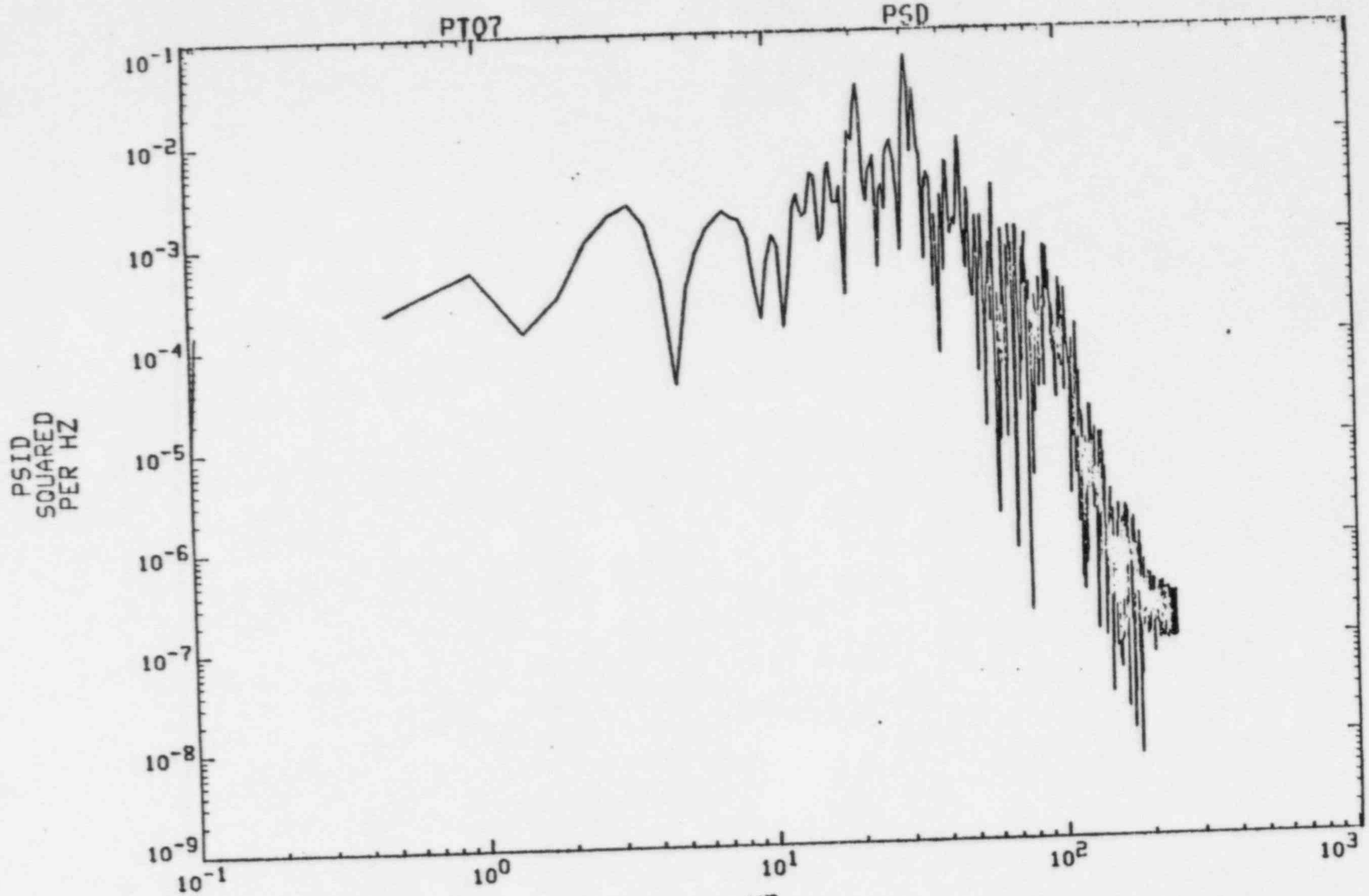
Figure 3.26



PRESS. TRANS. TIME HISTORY

KUOSHENG MT41
10.00 TO 12.00 SECS

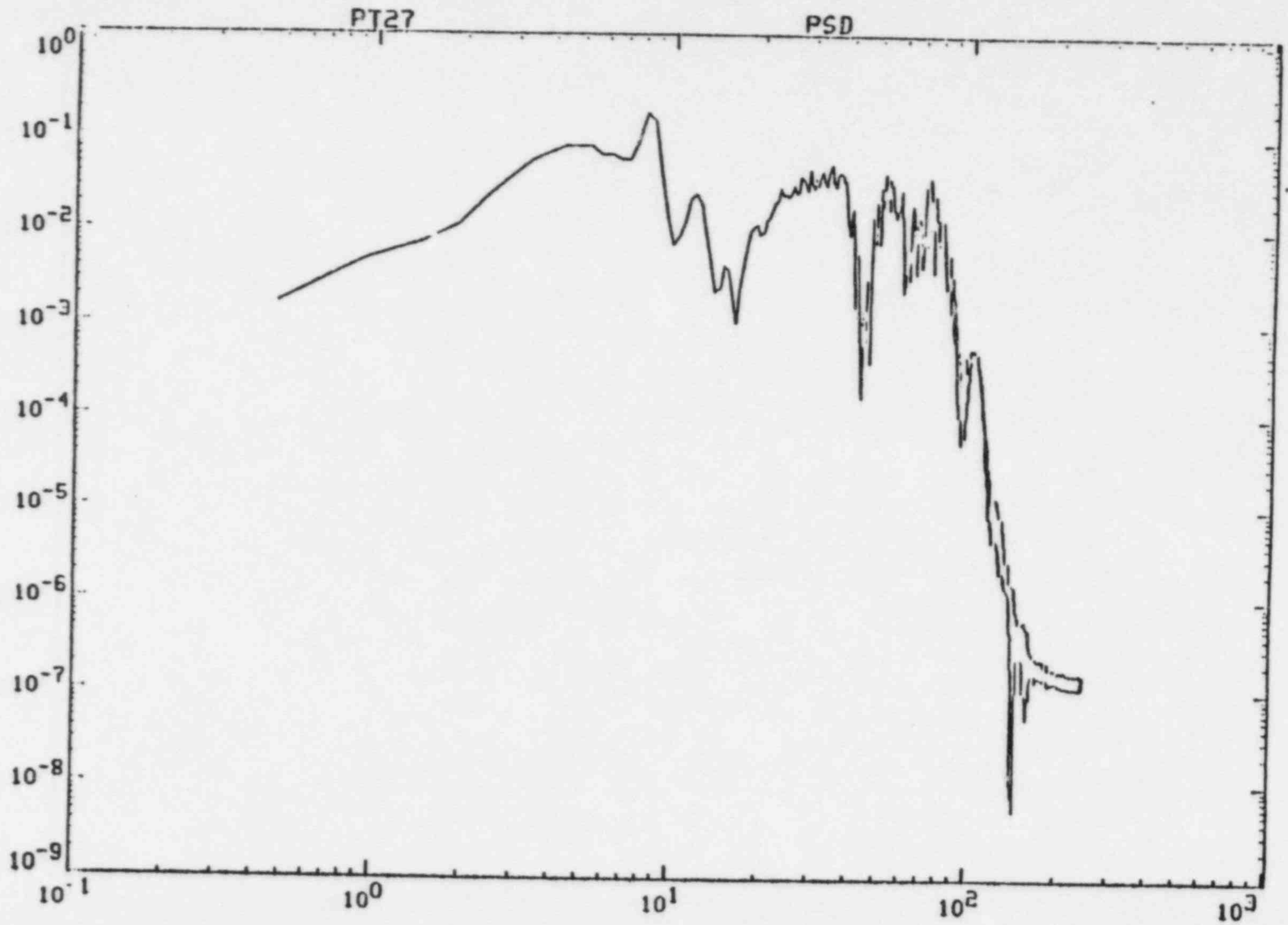
Figure 3.27



PRESS. TRANS. PSD

KUOSHENG MT11
10.00 TO 11.20 SECS

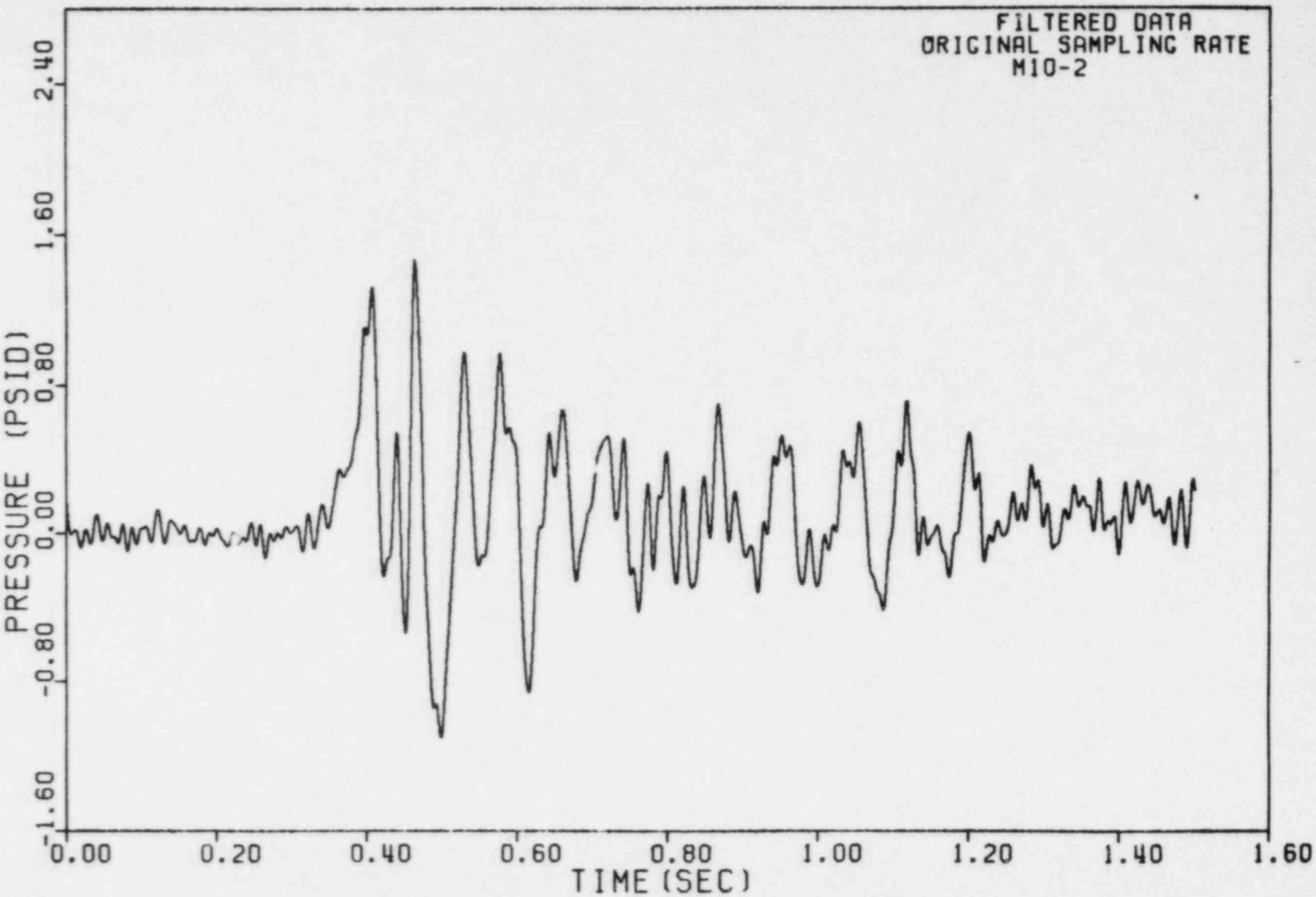
Figure 3.28



PRESS. TRANS. PSD

KUOSHENG MT41
10.00 TO 11.20 SECS

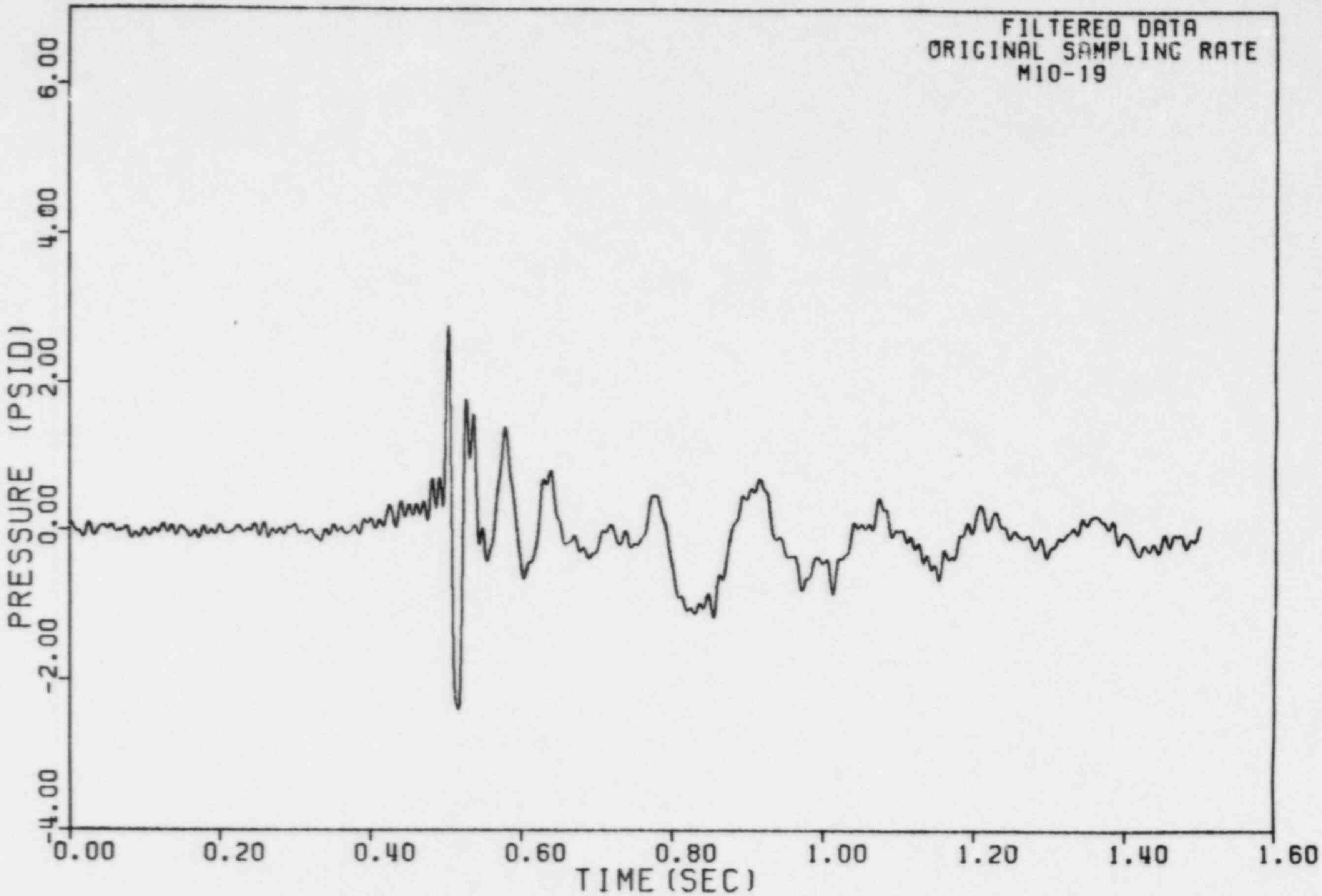
Figure 3.29



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-70

Figure 3.30

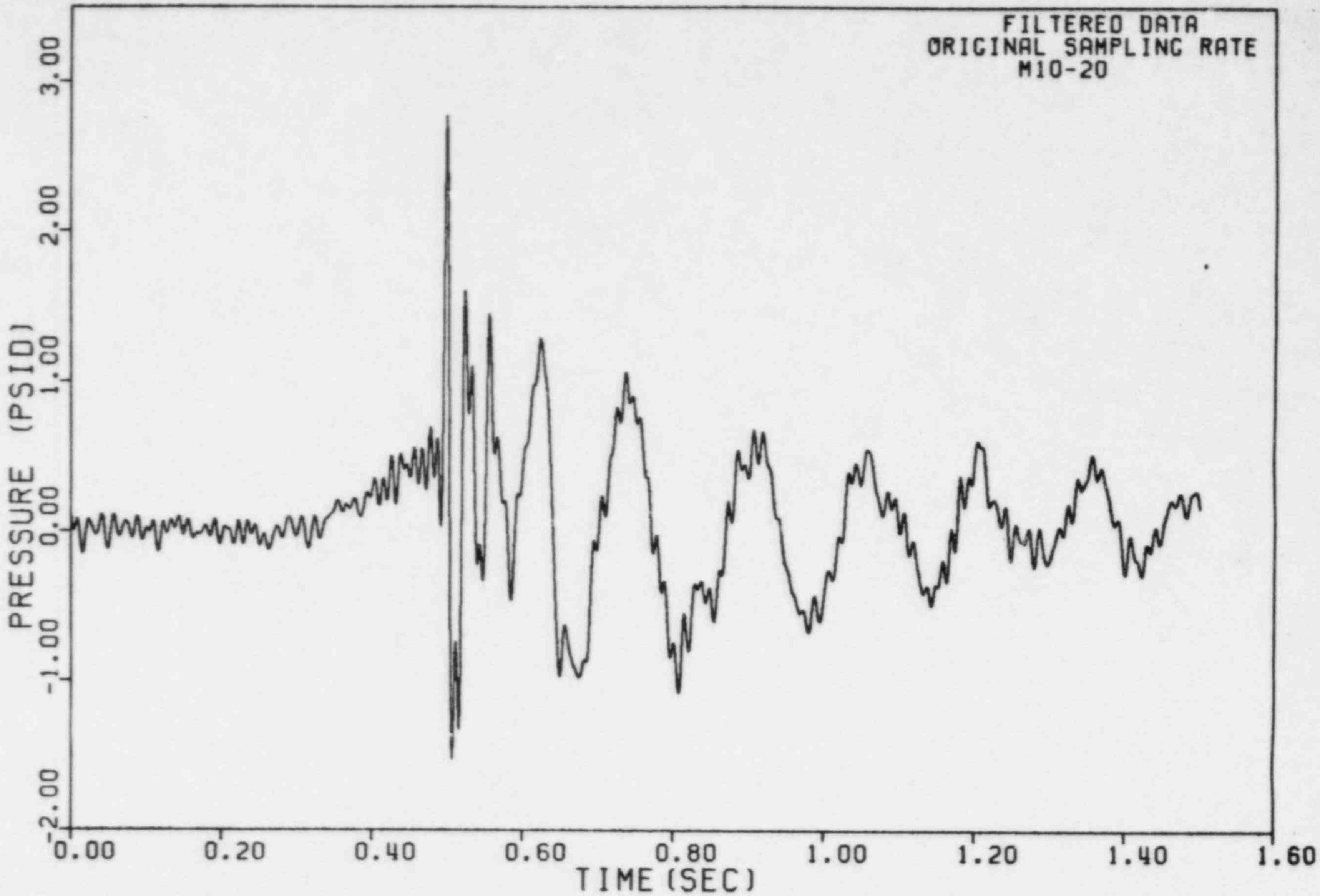
CHANNEL 2



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-70

CHANNEL 19

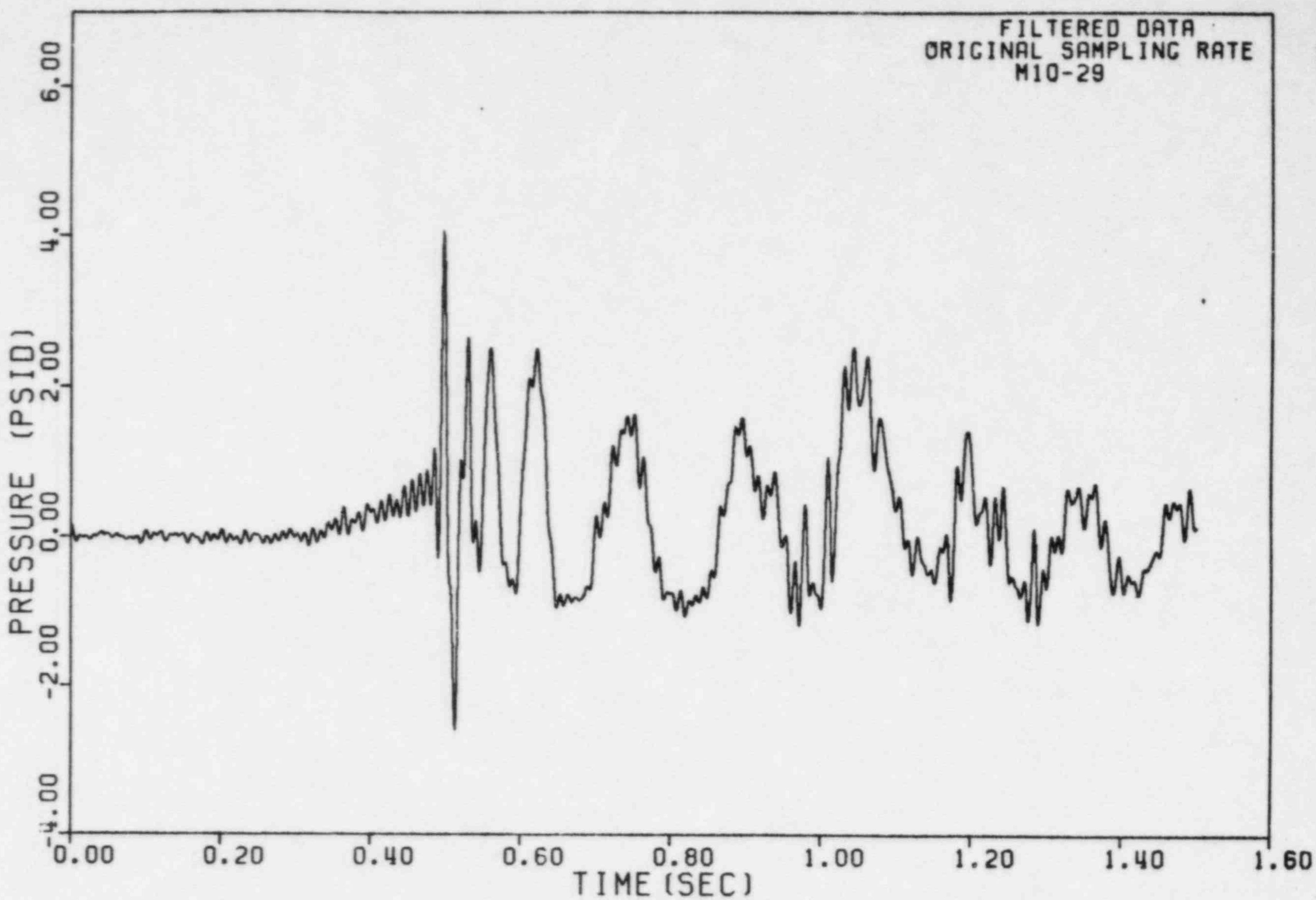
Figure 3.31



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-70

CHANNEL 20

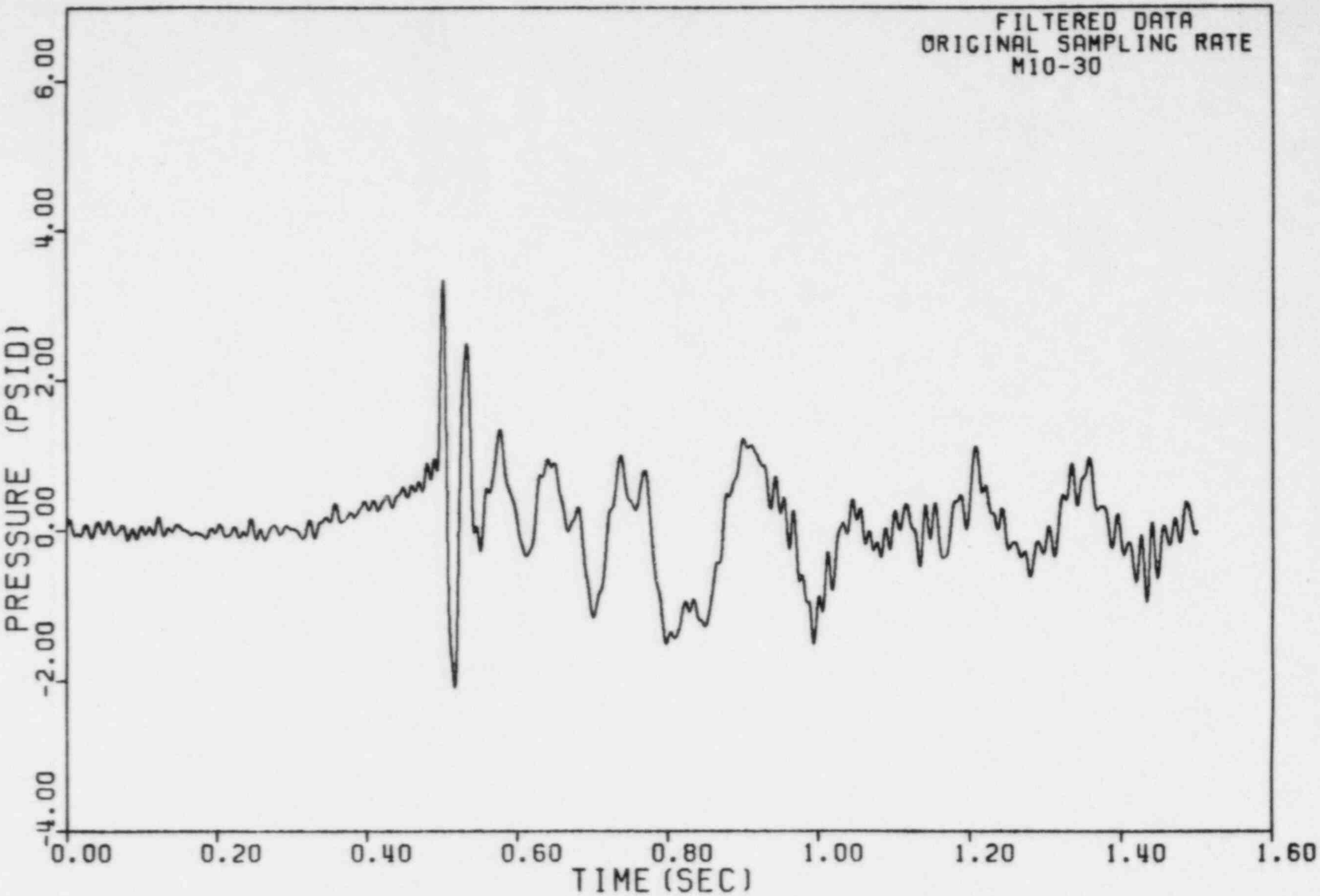
Figure 3.32



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-70

Figure 3.33

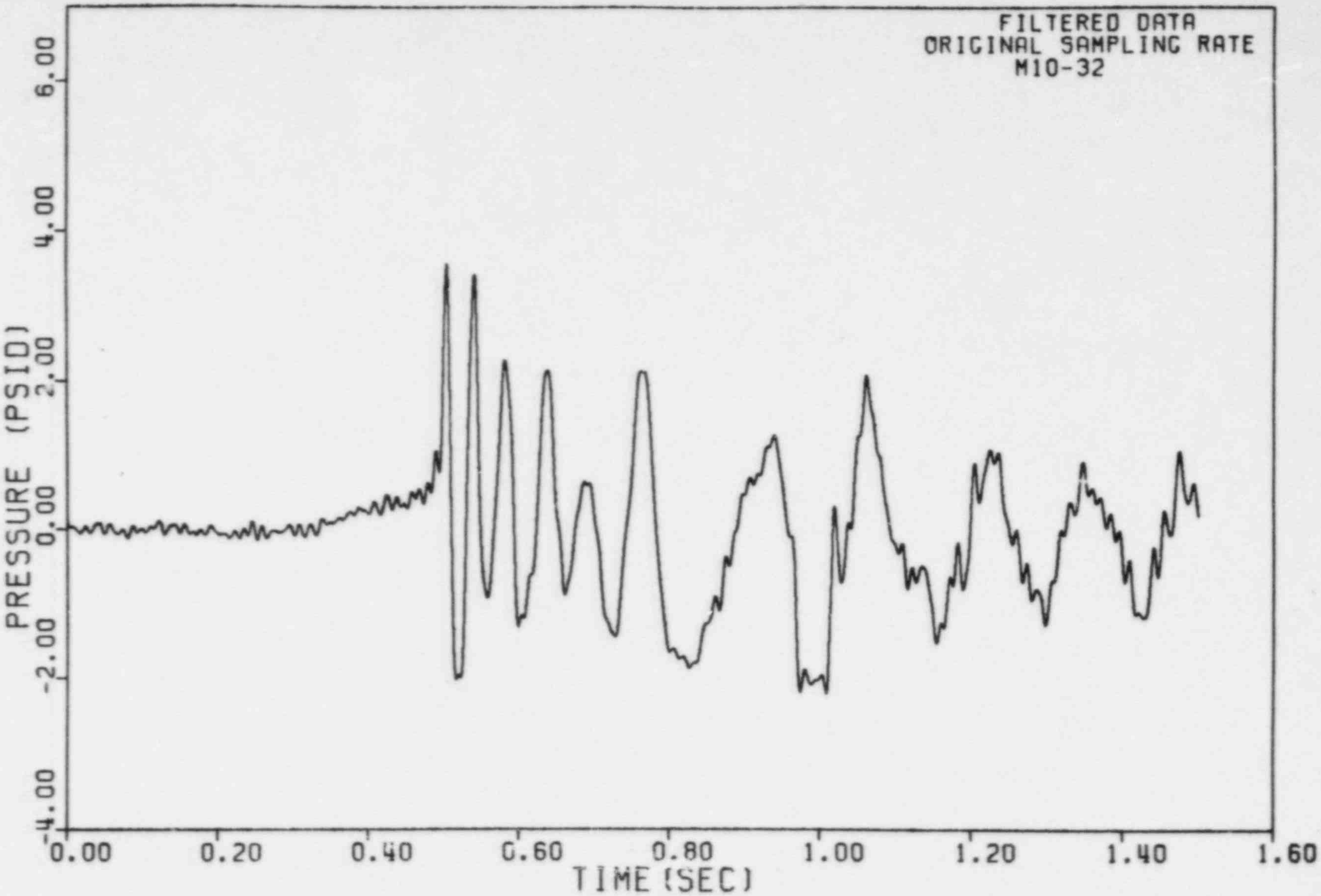
CHANNEL 28



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-70

CHANNEL 29

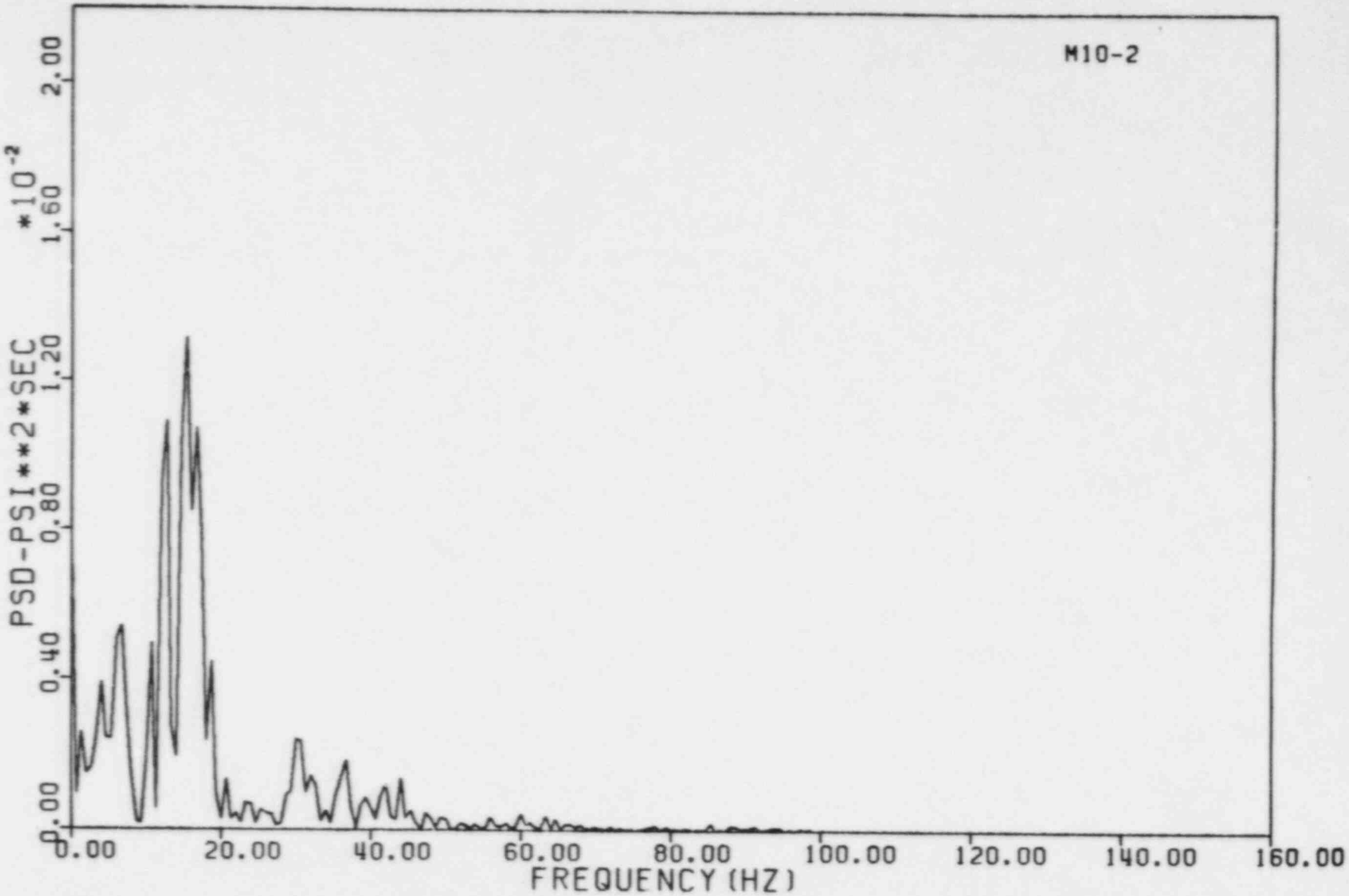
Figure 3.34



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-70

CHANNEL 31

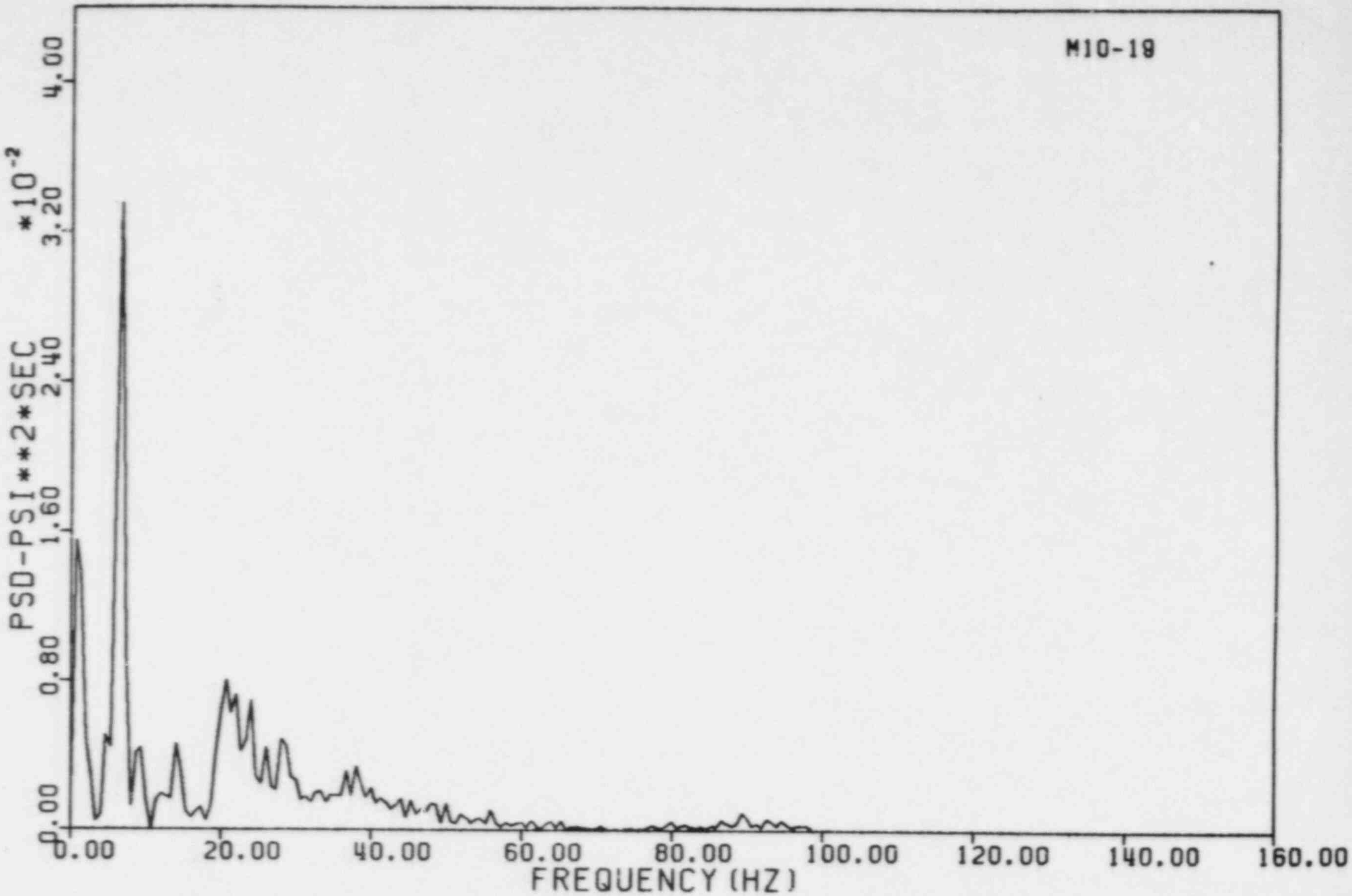
Figure 3.35



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-70

Figure 3.36

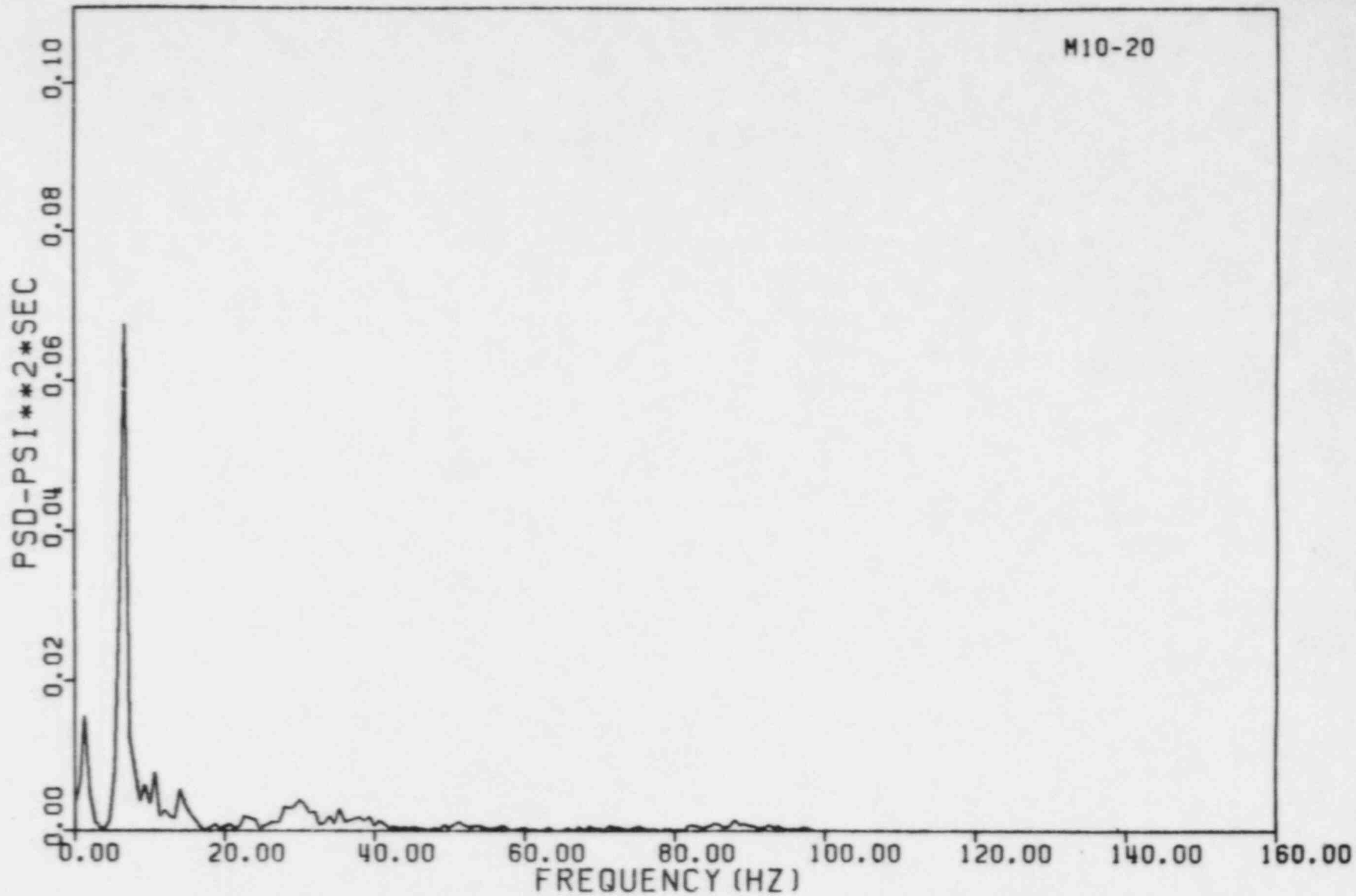
CHANNEL 2



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-70

Figure 3.37

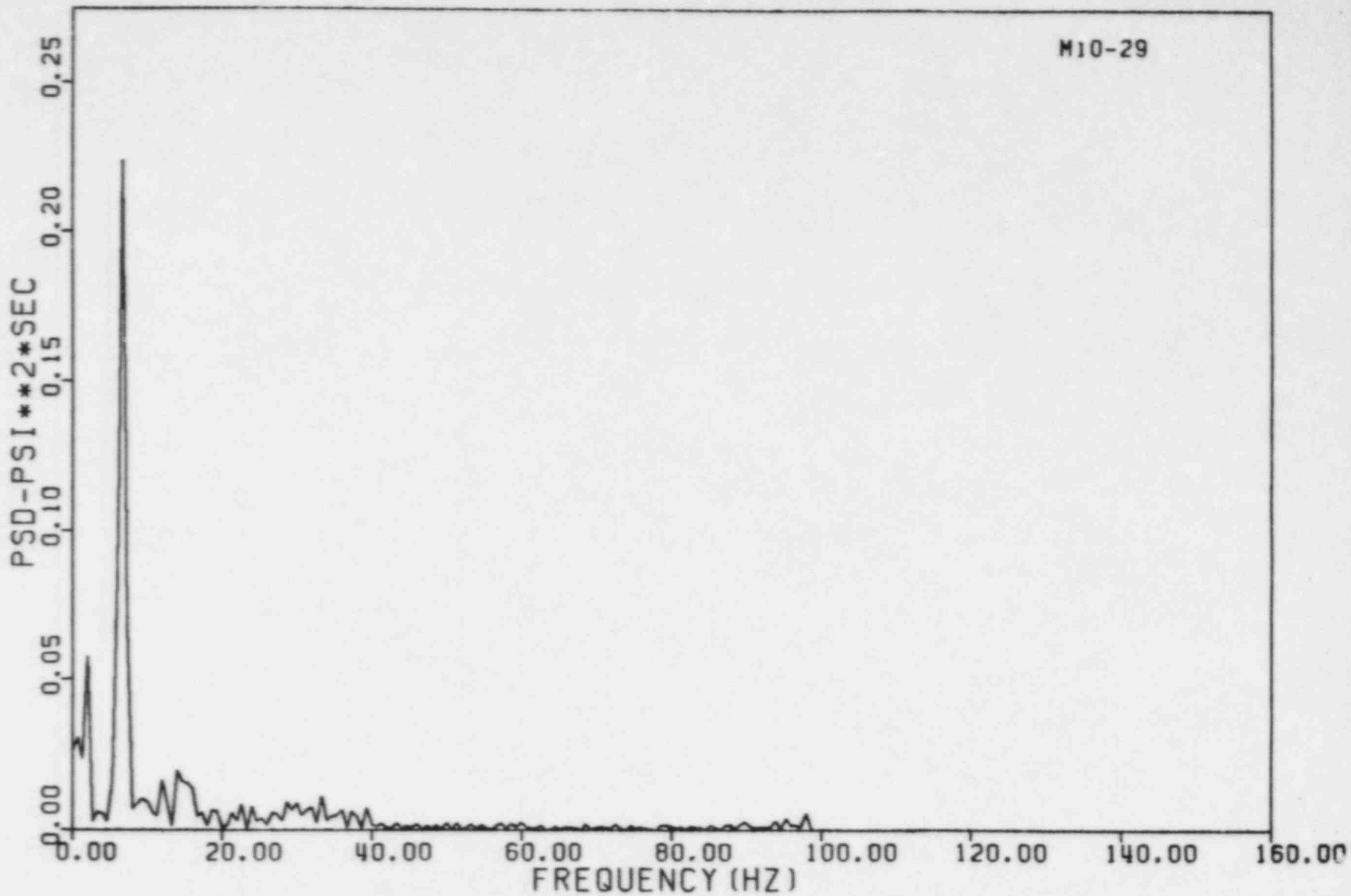
CHANNEL 19



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-70

CHANNEL 20

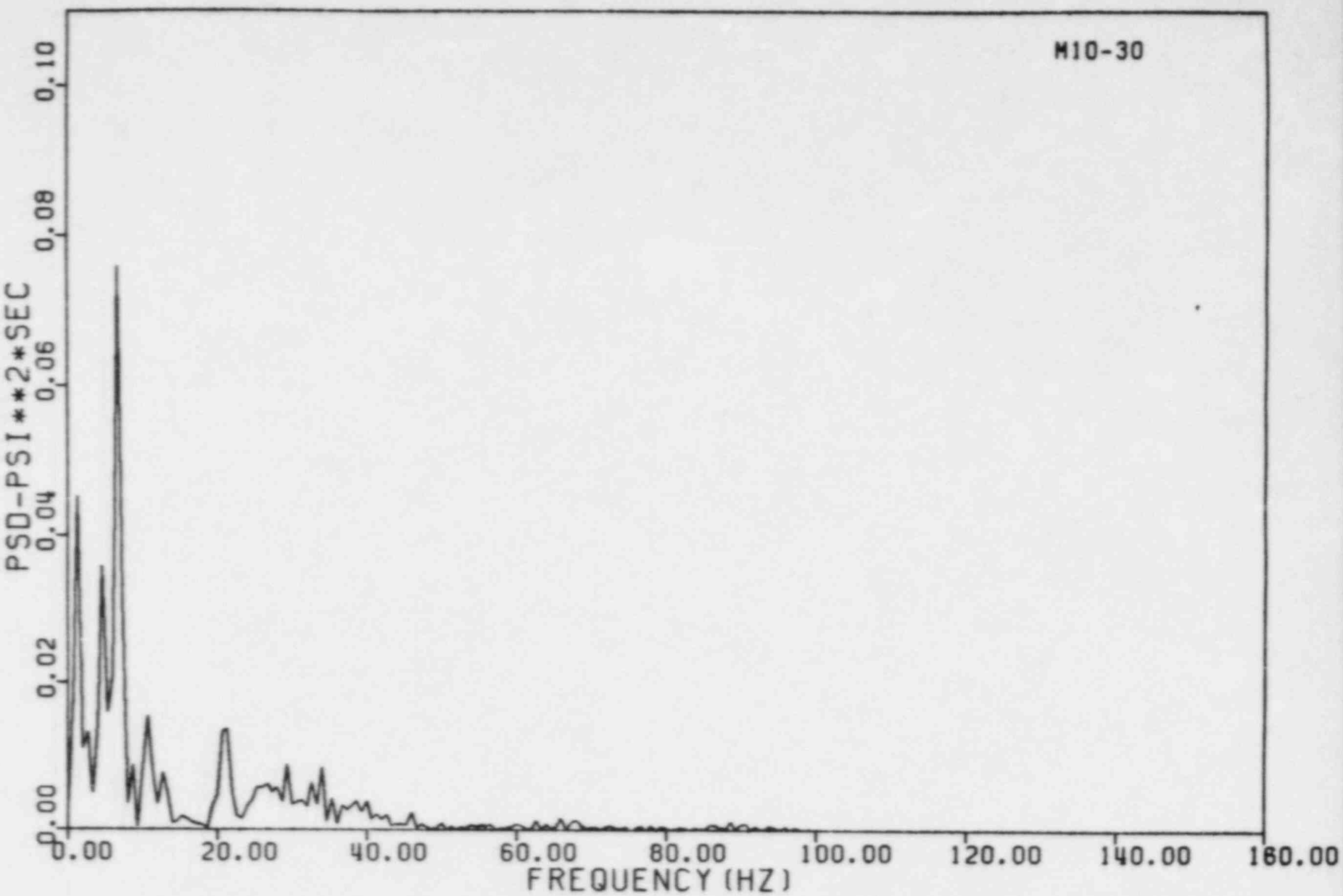
Figure 3.38



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-70

CHANNEL 28

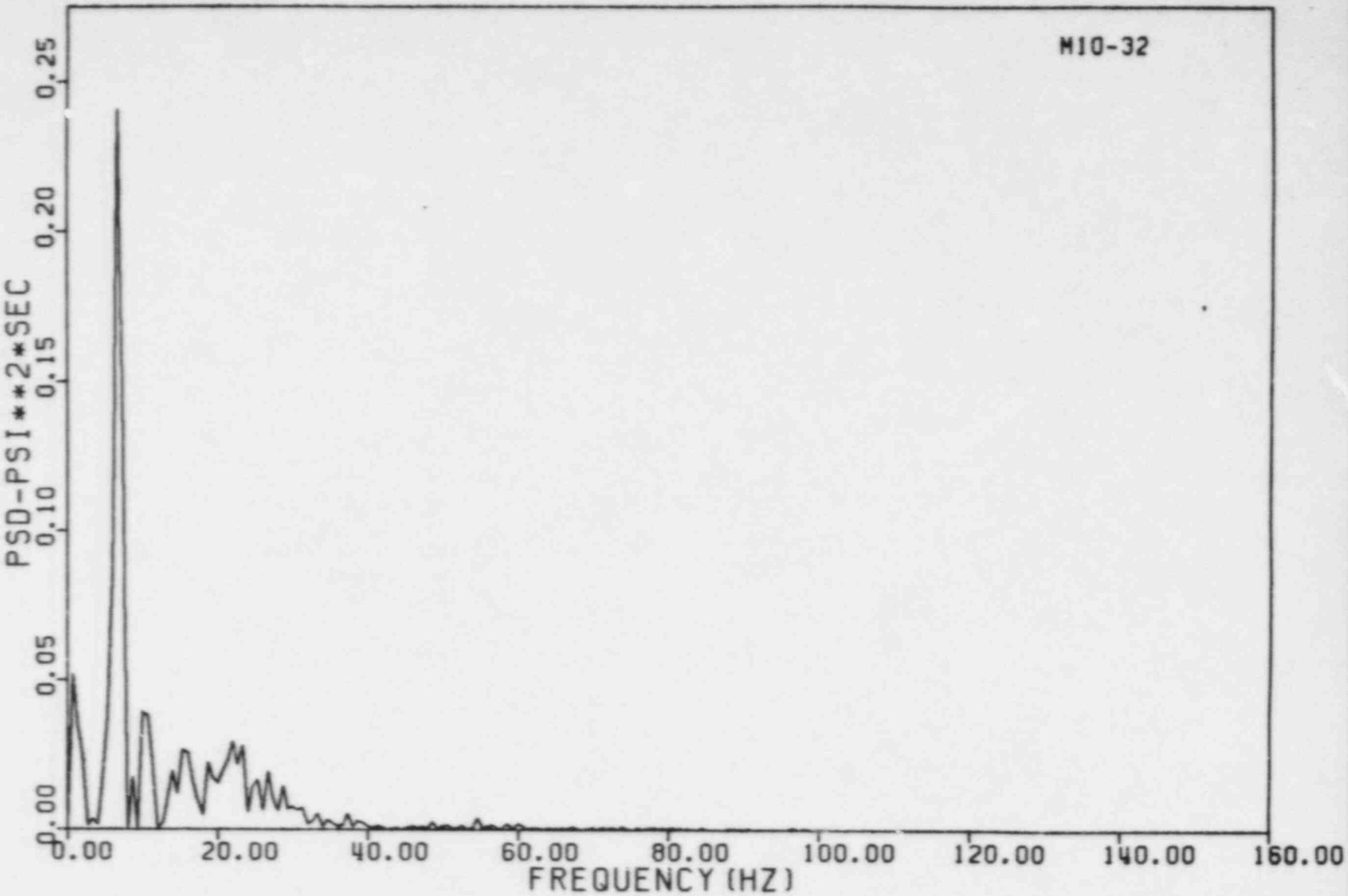
Figure 3.39



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-70

CHANNEL 29

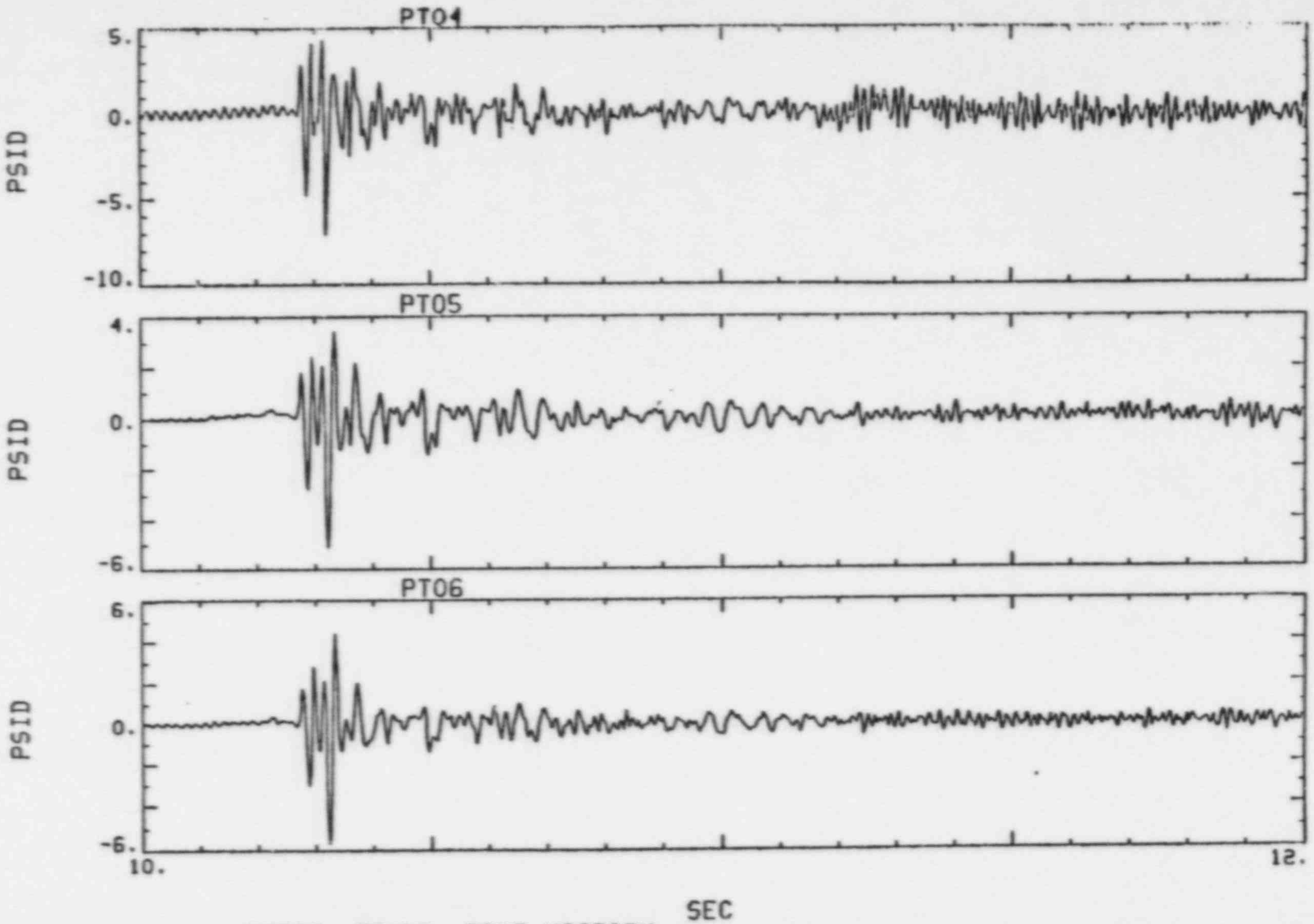
Figure 3.40



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-70

CHANNEL 31

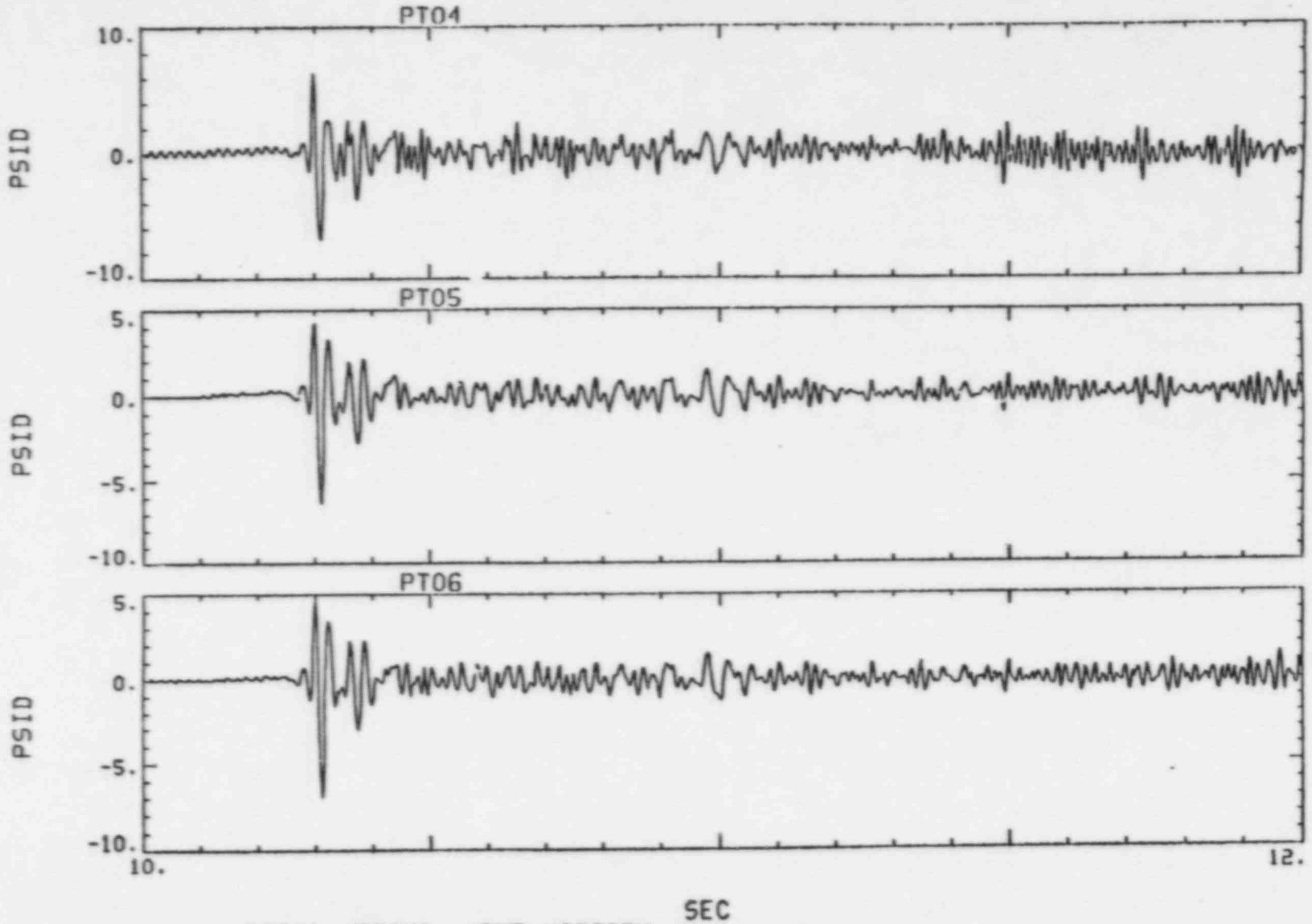
Figure 3.41



PRESS. TRANS. TIME HISTORY

KUOSHENG MT80
10.00 TO 12.00 SFCS

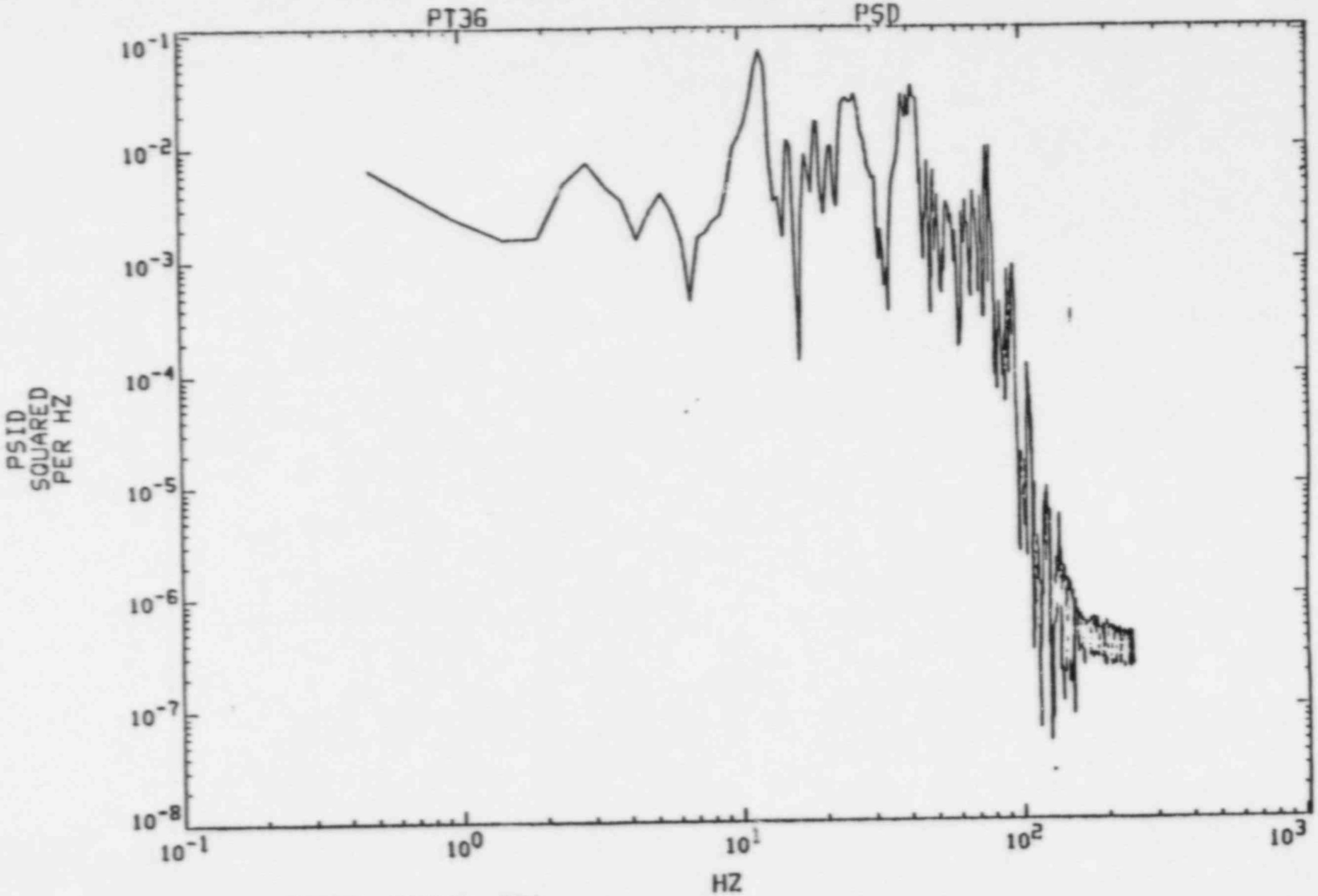
Figure 3.42



PRESS. TRANS. TIME HISTORY

KUOSHENG MT82
10.00 TO 12.00 SECS

Figure 3.43



PRESS. TRANS. PSD

KUOSHENG MT80
10.00 TO 11.20 SECS

Figure 3.44

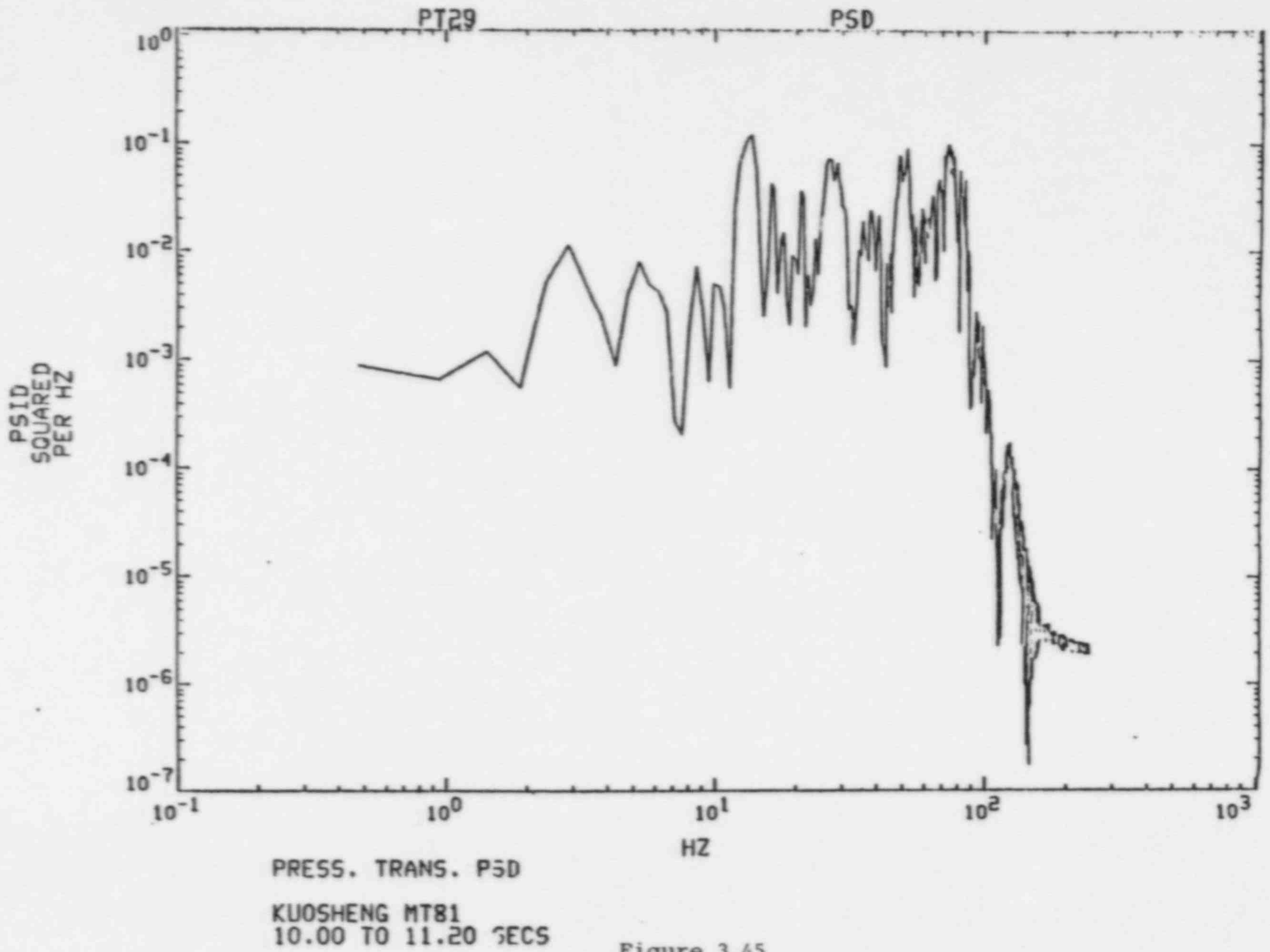
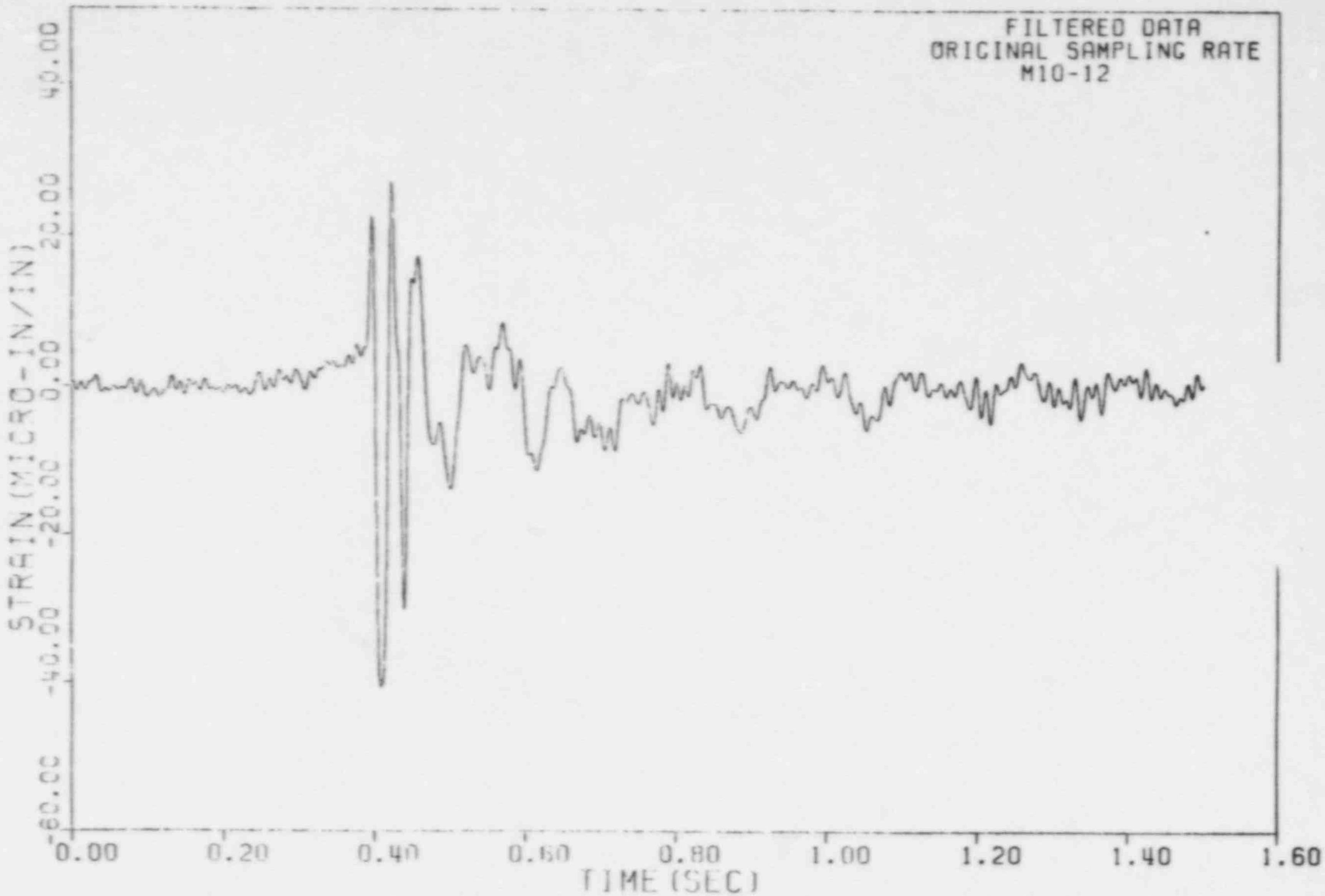

PT29
PSD
PSID
SQUARED
PER HZ
10^{0}
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
HZ
PRESS. TRANS. PSD
KUOSHENG MT81
10.00 TO 11.20 SECS

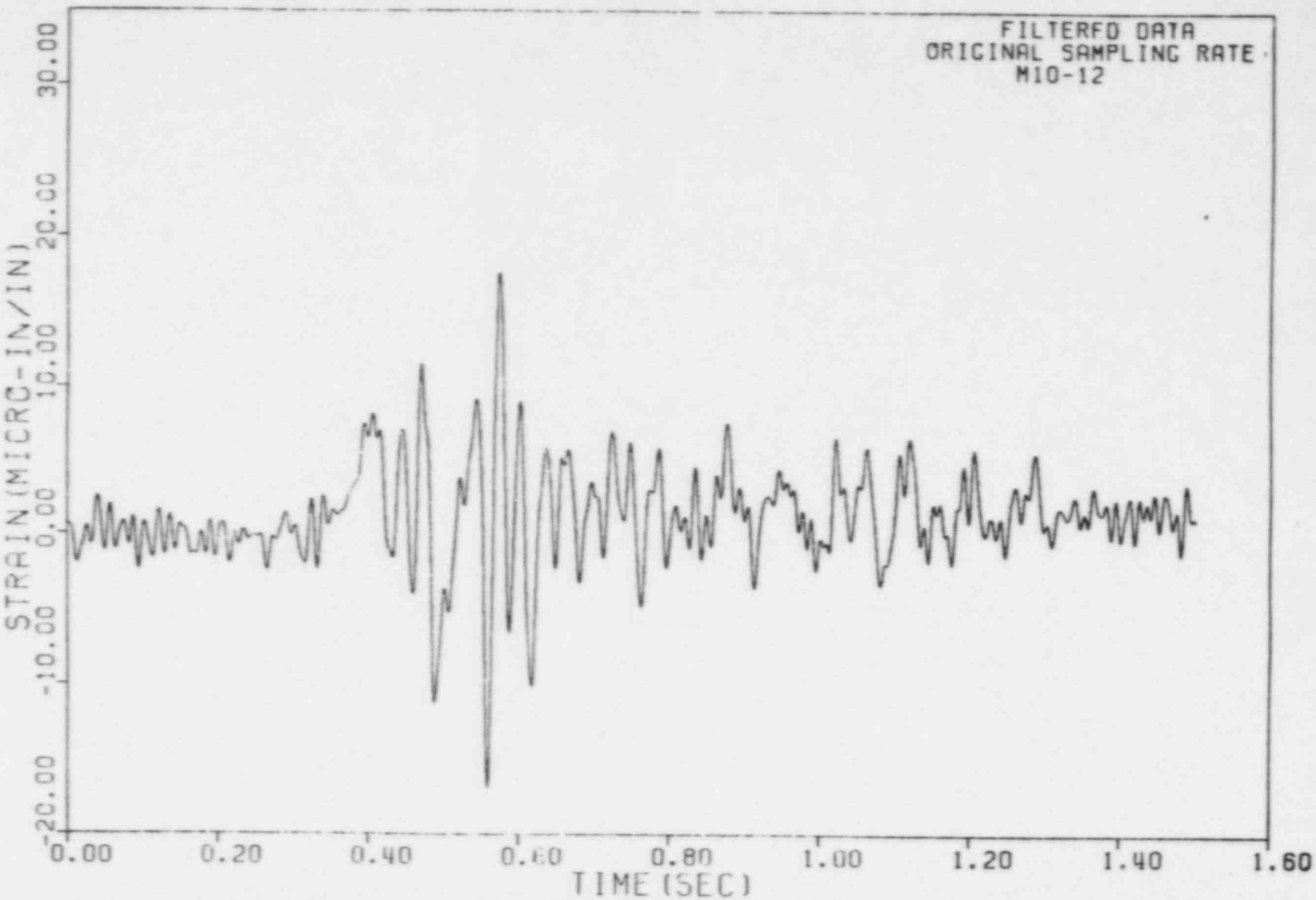
Figure 3.45



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-30

CHANNEL 42

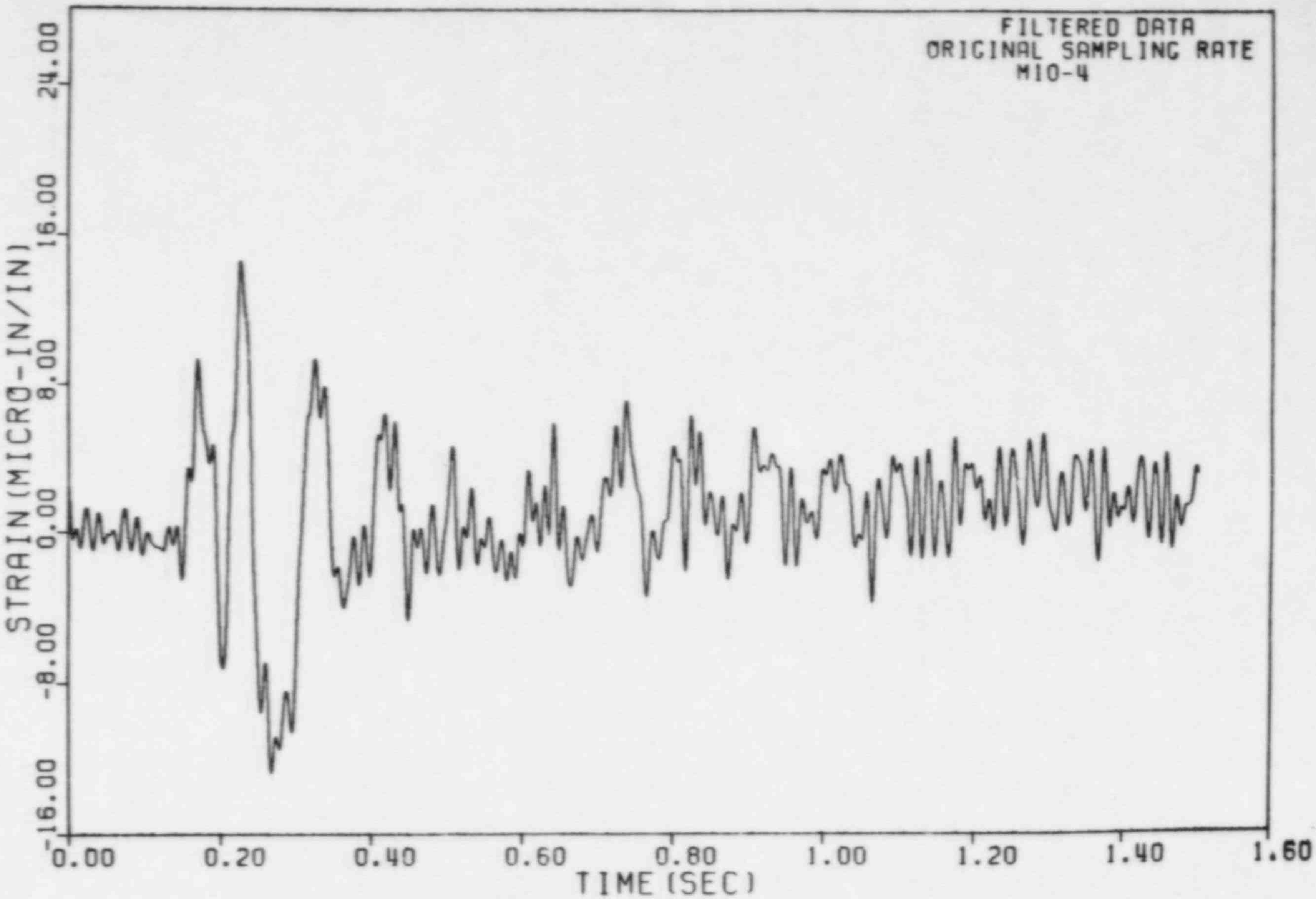
Figure 3.46



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-70

CHANNEL 42

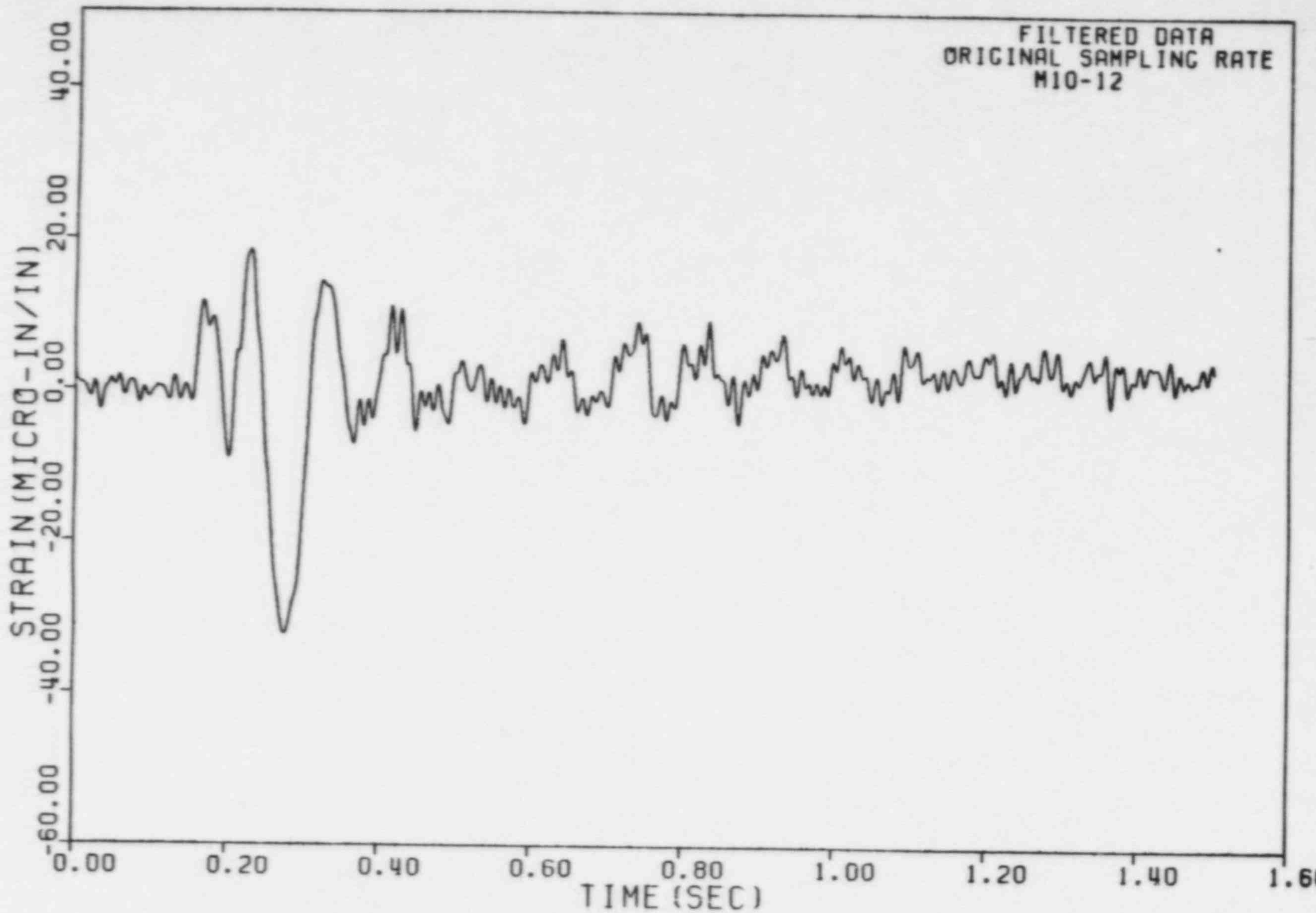
Figure 3.47



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-21

Figure 3.48

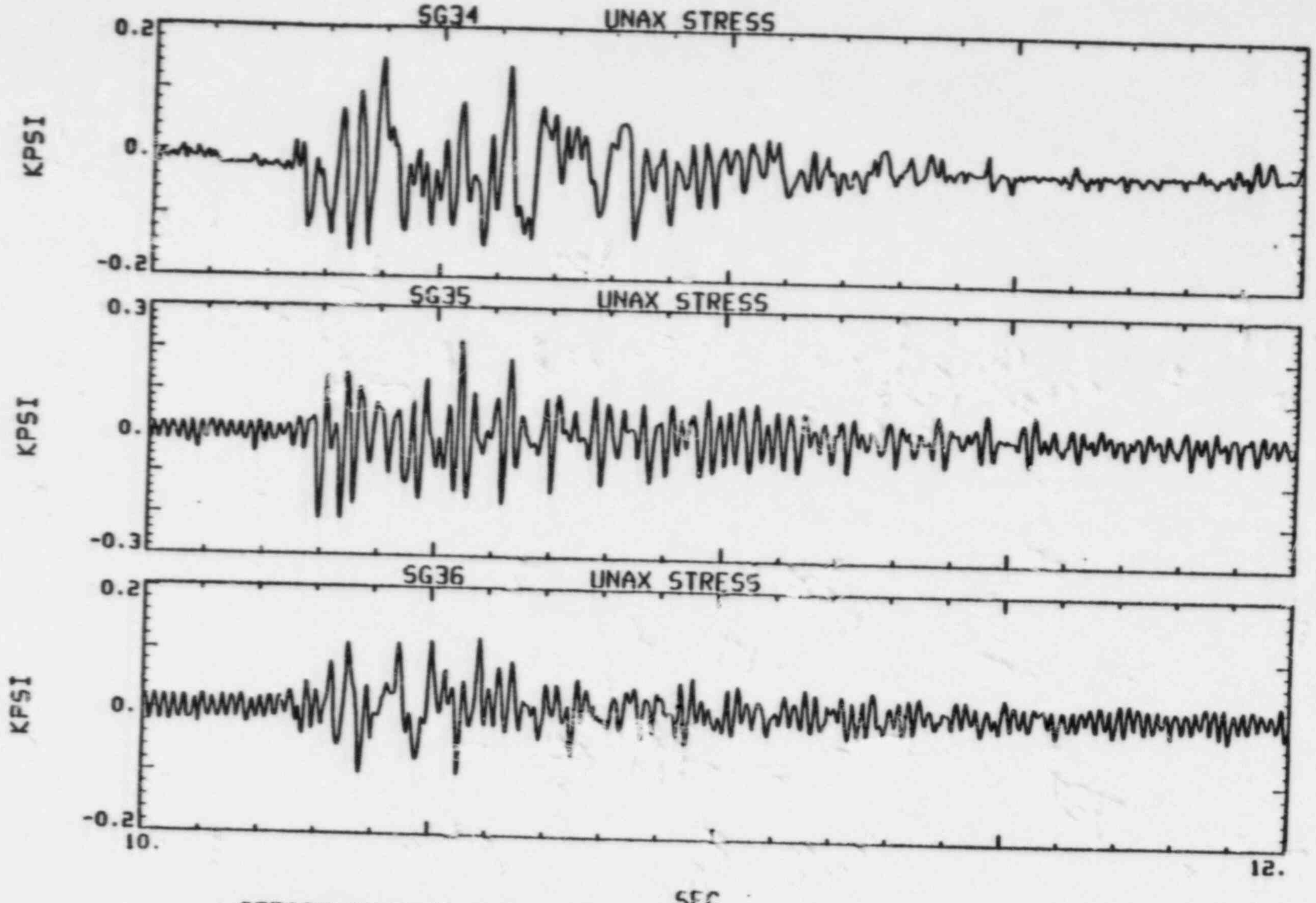
CHANNEL 35



GRAND GULF SRV IN-PLNT TEST, MATRIX TEST MT-21

CHANNEL 42

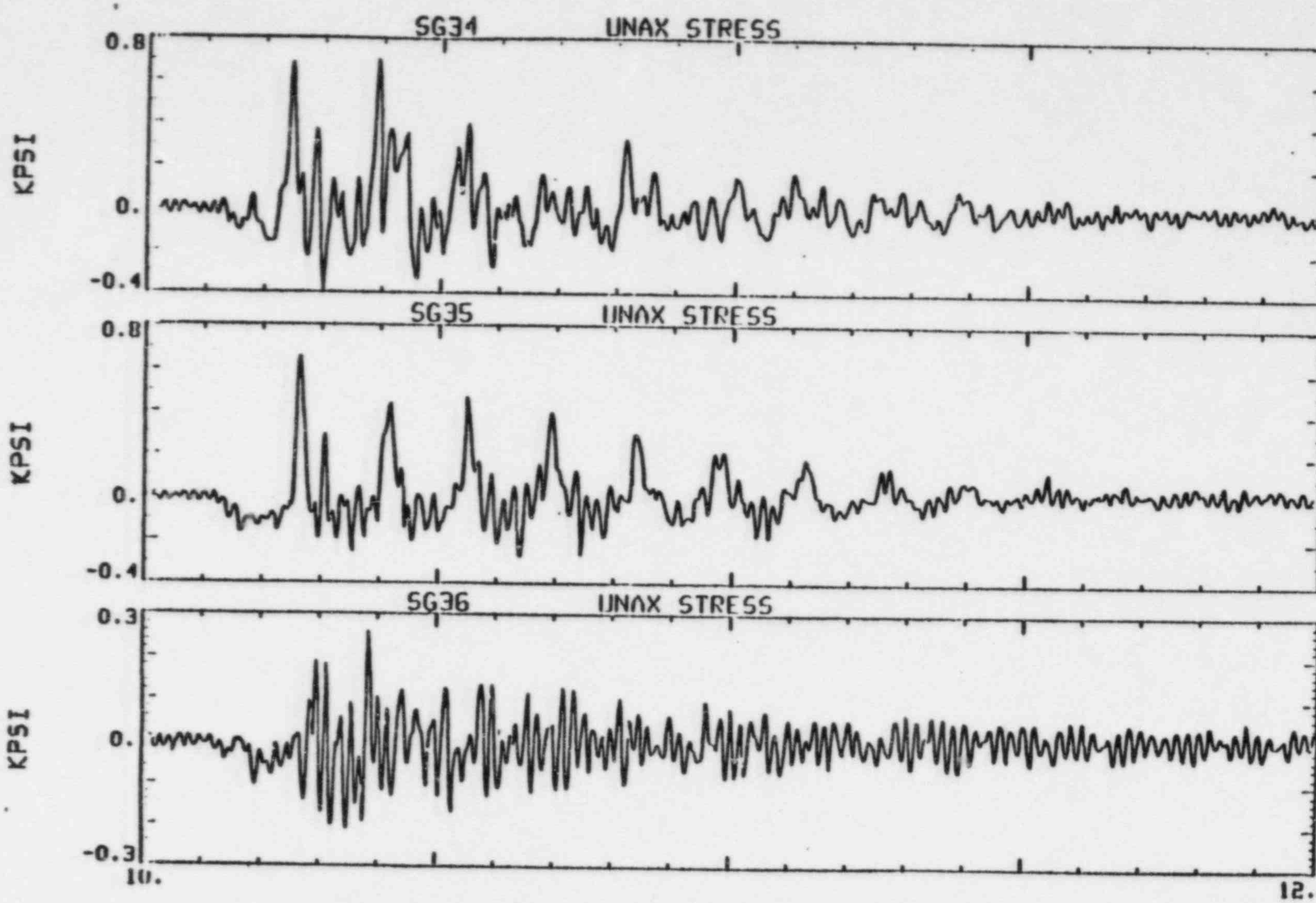
Figure 3.49



STRAIN GAGE STRESS CALC.

KUOSHENG MT32
10.00 TO 12.00 SECS

Figure 3.50



STRAIN GAGE STRESS CALC.

KUOSHENG MT52
10.00 TO 12.00 SECS

Figure 3.51

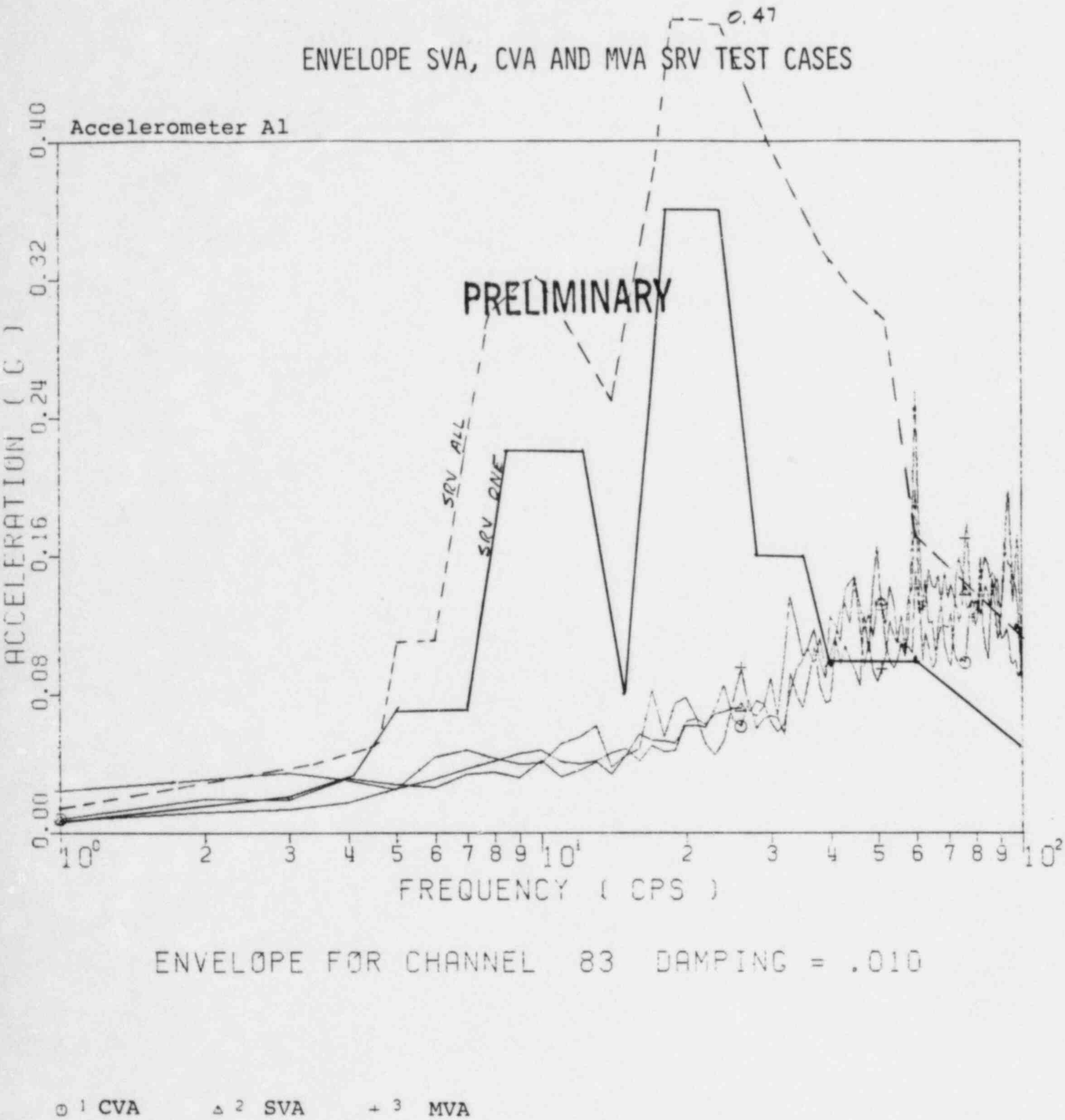
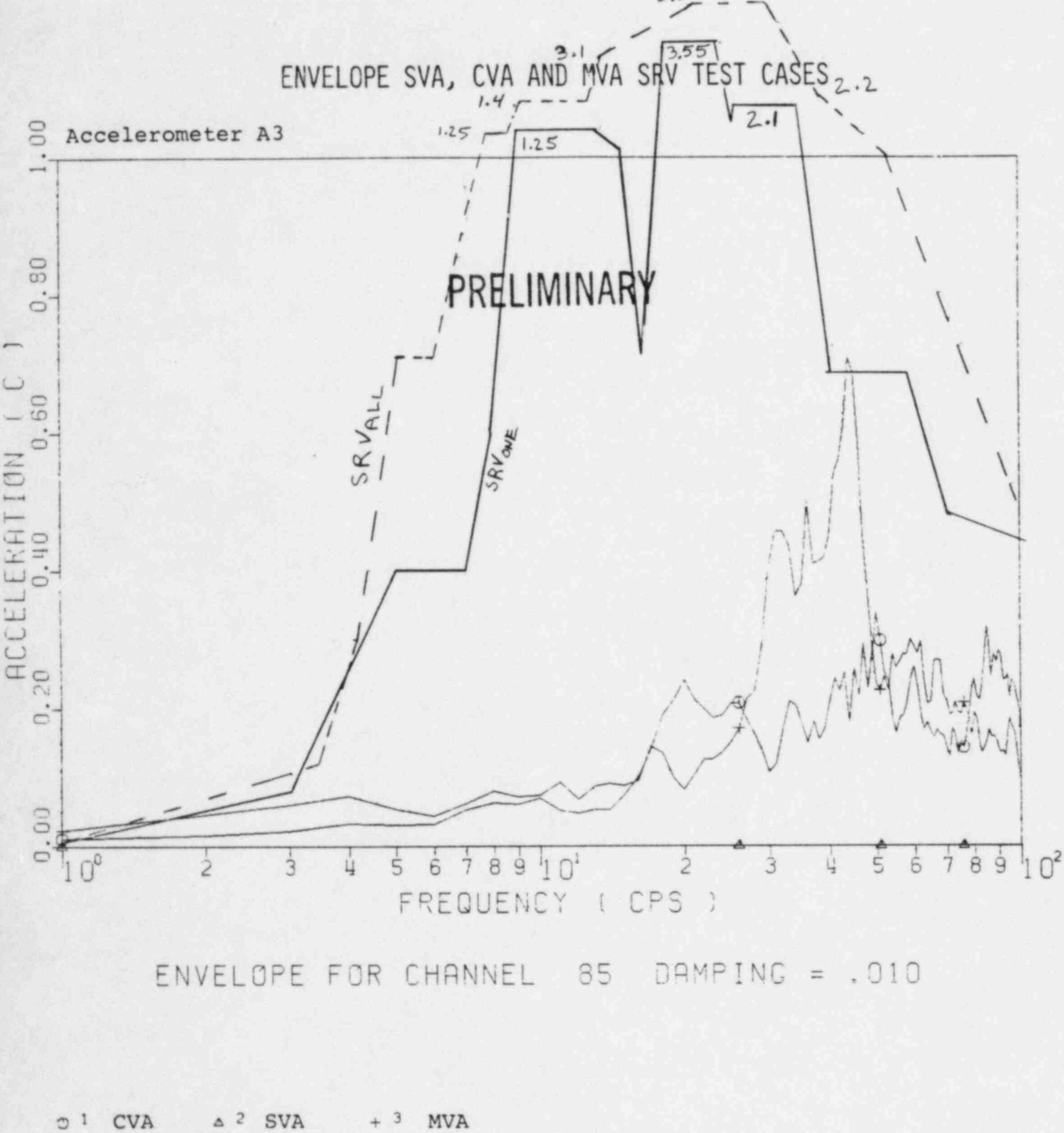

0.47
ENVELOPE SVA, CVA AND MVA SRV TEST CASES
Accelerometer A1
PRELIMINARY
SRV ALL
SRV ONE
ACCELERATION (G)
0.00
0.08
0.16
0.24
0.32
0.40
FREQUENCY (CPS)
ENVELØPE FØR CHANNEL 83 DAMPING = .010
1 CVA
2 SVA
3 MVA

Figure 4.1



ENVELOPE SVA, CVA AND MVA SRV TEST CASES
Accelerometer A3
PRELIMINARY
3.9
3.1
3.55
2.2
1.4
1.25
1.25
2.1
SRV_{ALL}
SRV_{ONE}
ACCELERATION (G)
0.00
0.20
0.40
0.60
0.80
1.00
FREQUENCY (CPS)
10^0
2
3
4
5
6
7
8
9
10^1
2
3
4
5
6
7
8
9
10^2
ENVELOPE FOR CHANNEL 85 DAMPING = .010
○ 1 CVA
△ 2 SVA
+ 3 MVA

Figure 4.2

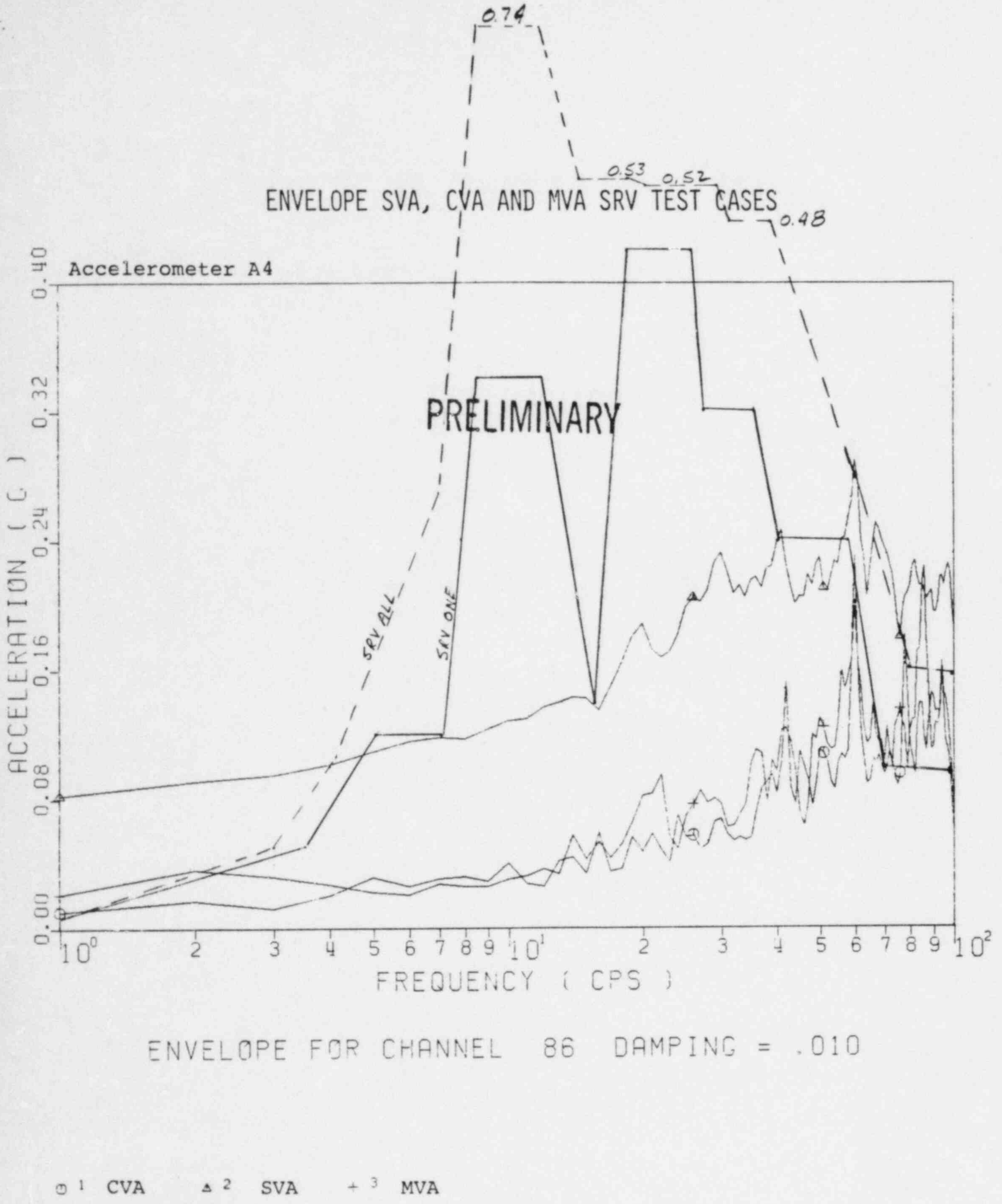
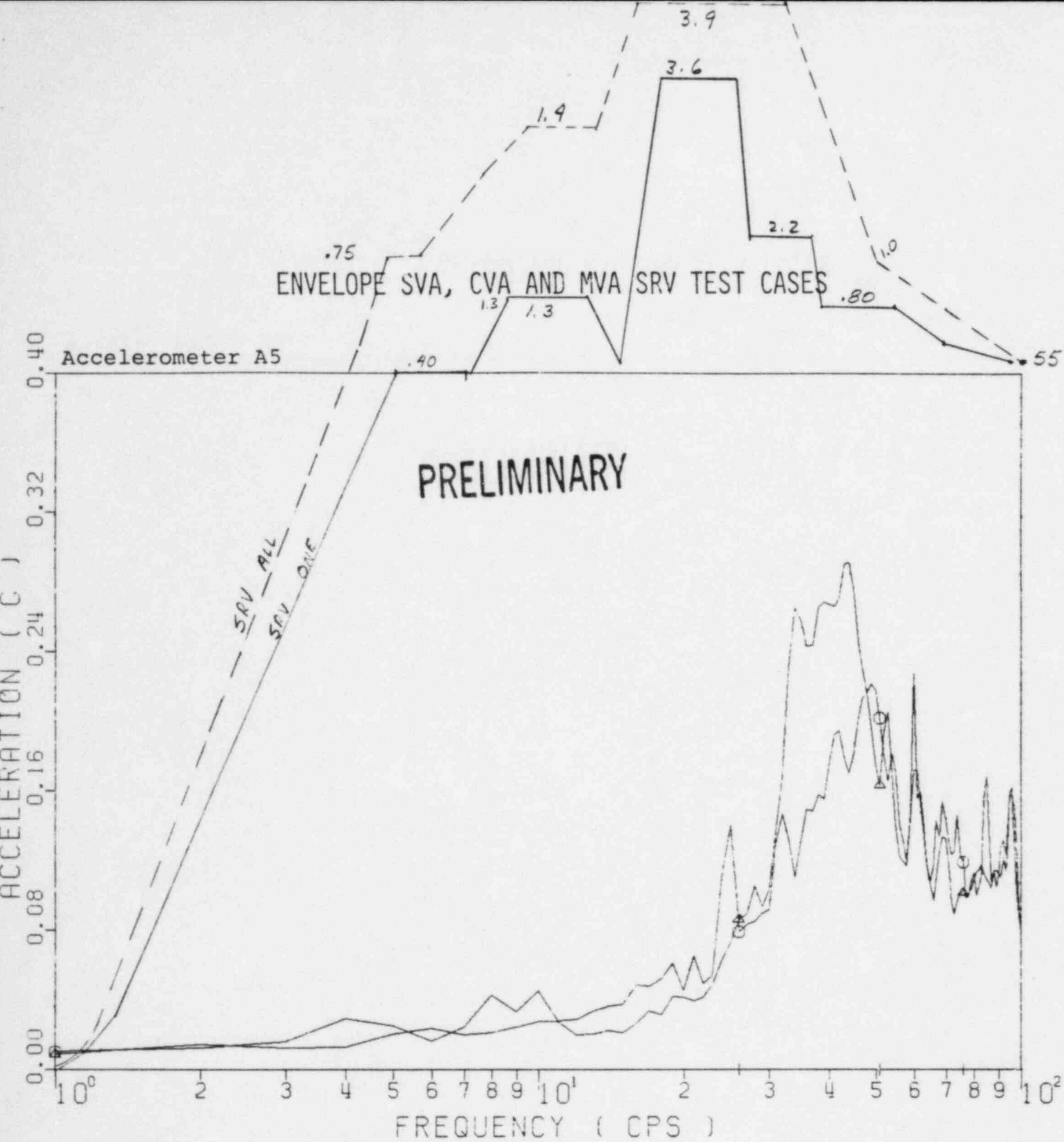

0.74
0.53
0.52
0.48
ENVELOPE SVA, CVA AND MVA SRV TEST CASES
Accelerometer A4
PRELIMINARY
SRV ALL
SRV ONE
ACCELERATION (G)
0.00
0.08
0.16
0.24
0.32
0.40
FREQUENCY (CPS)
ENVELOPE FOR CHANNEL 86 DAMPING = .010
1 CVA
2 SVA
3 MVA

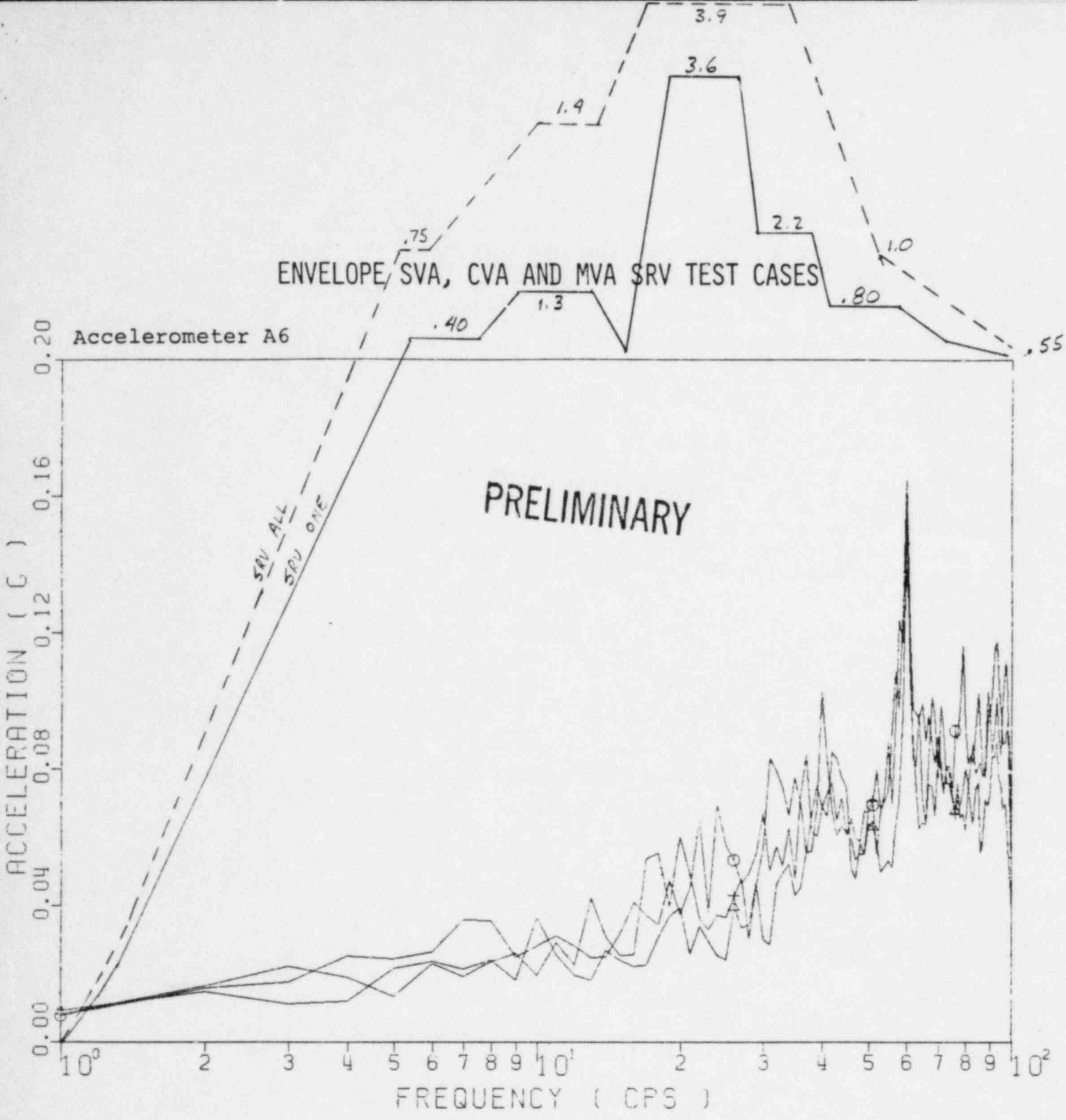
Figure 4.3



ENVELOPE FOR CHANNEL 87 DAMPING = .010

⊙ 1 CVA △ 2 SVA + 3 MVA

Figure 4.4



ENVELOPE FØR CHANNEL 88 DAMPING = .010

⊙ 1 CVA △ 2 SVA + 3 MVA

Figure 4.5

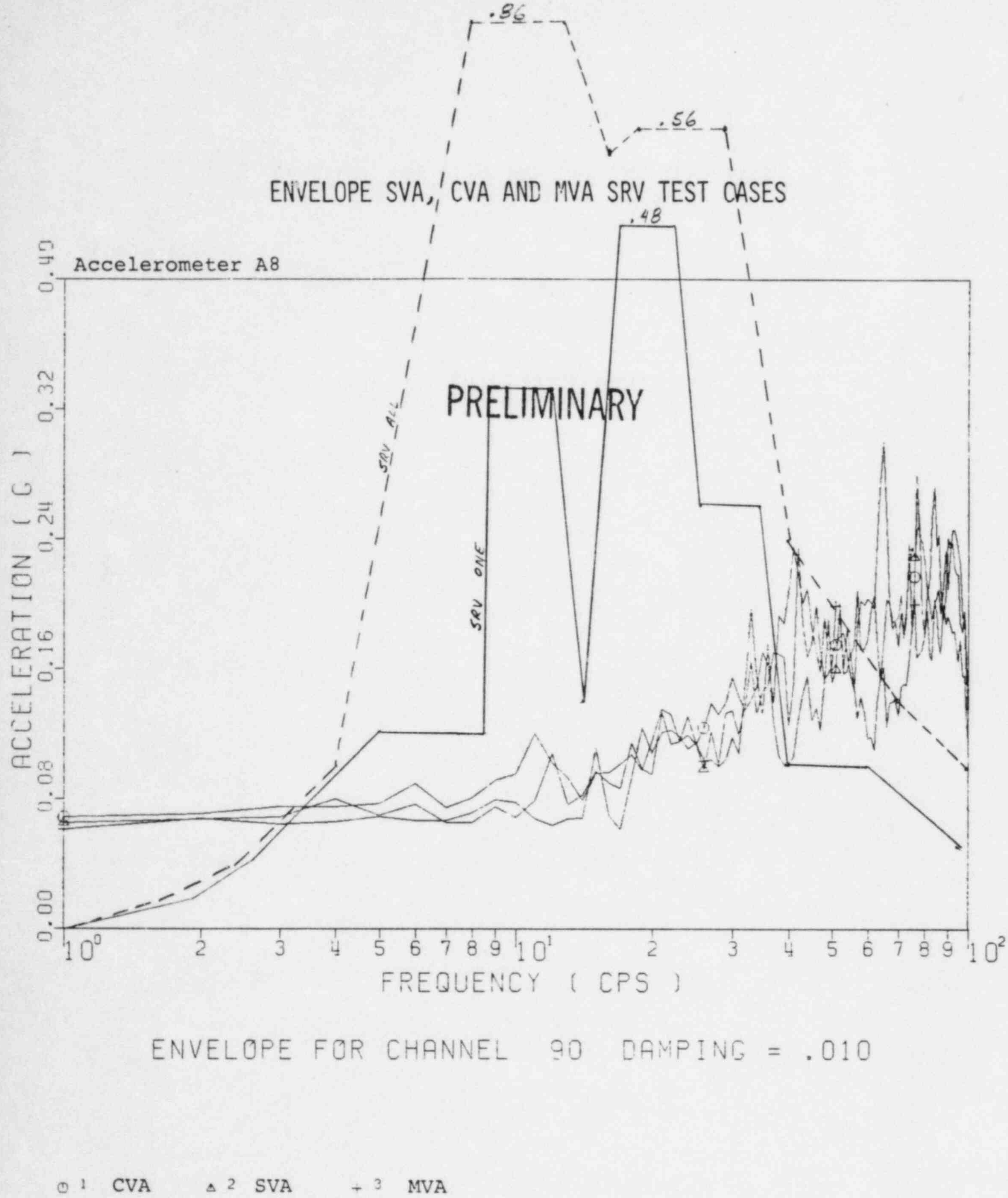

.86
.56
ENVELOPE SVA, CVA AND MVA SRV TEST CASES
.48
Accelerometer A8
PRELIMINARY
SRV ALL
SRV ONE
ACCELERATION (G)
0.00
0.08
0.16
0.24
0.32
0.40
FREQUENCY (CPS)
ENVELOPE FOR CHANNEL 90 DAMPING = .010
⊙ 1 CVA
△ 2 SVA
+ 3 MVA

Figure 4.6

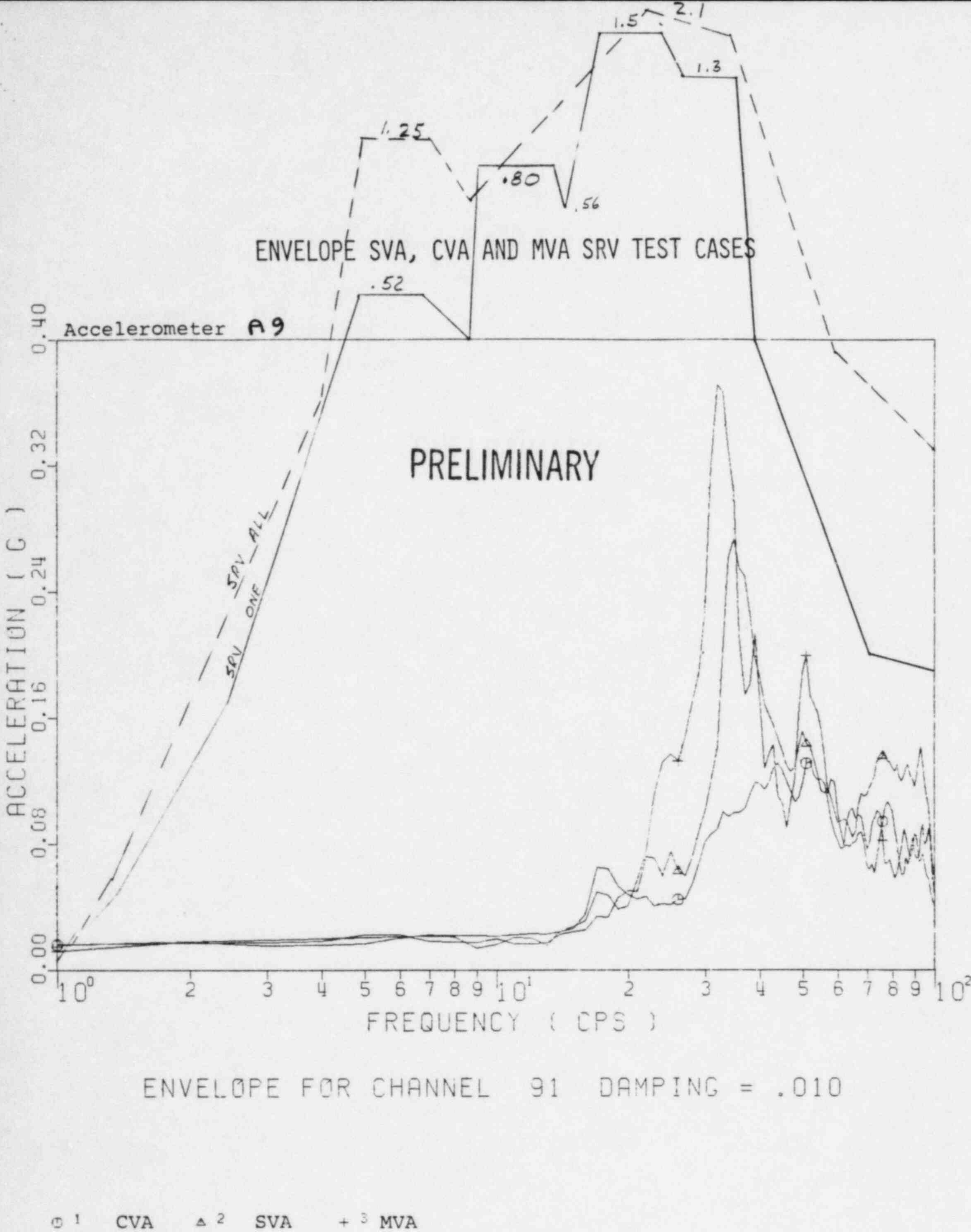

1.25
.80
.56
1.5
2.1
1.3
ENVELOPE SVA, CVA AND MVA SRV TEST CASES
.52
Accelerometer A9
PRELIMINARY
SRV ALL
SRV ONE
ACCELERATION (G)
0.00
0.08
0.16
0.24
0.32
0.40
FREQUENCY (CPS)
ENVELOPE FOR CHANNEL 91 DAMPING = .010
1 CVA 2 SVA 3 MVA

Figure 4.7

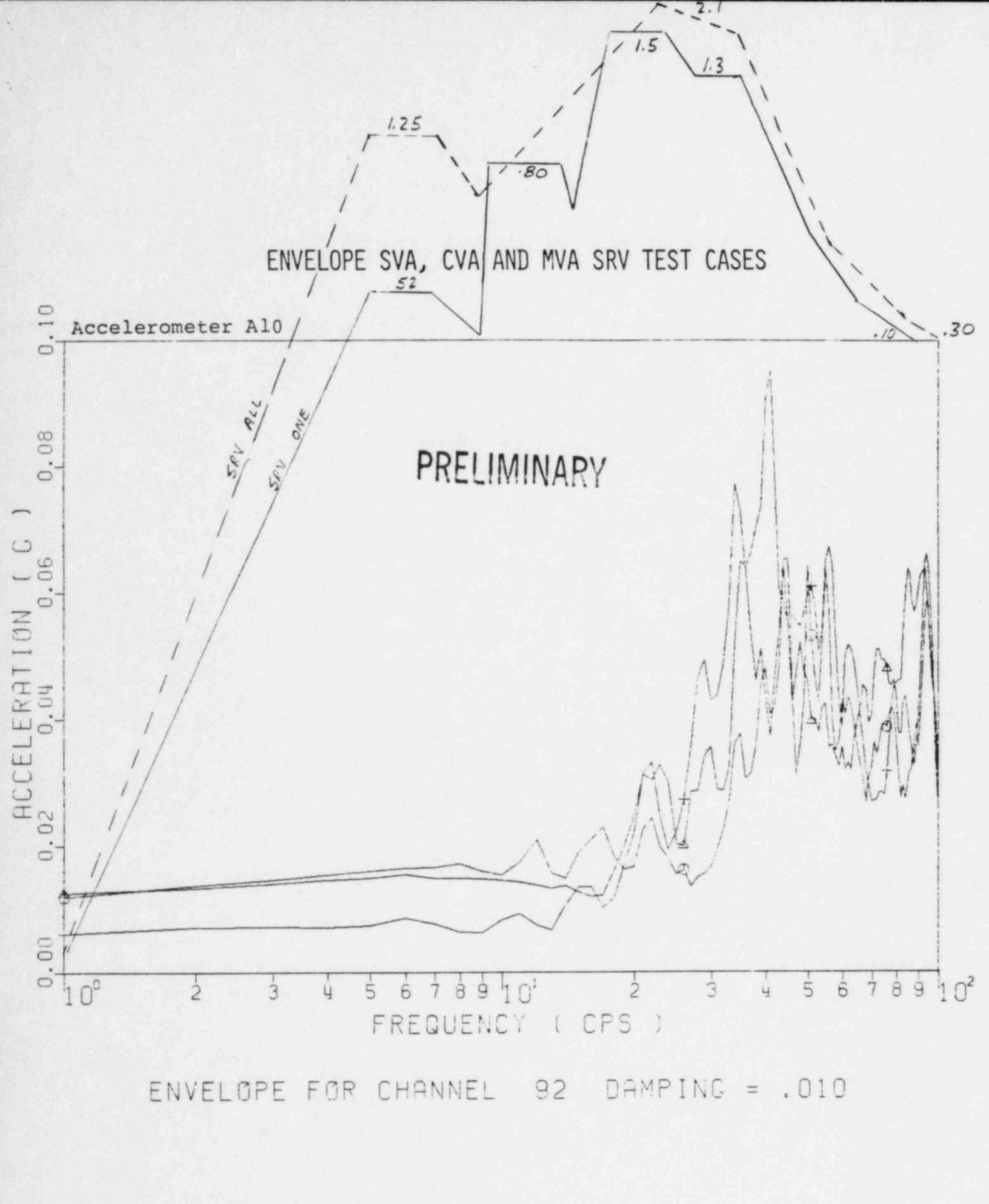
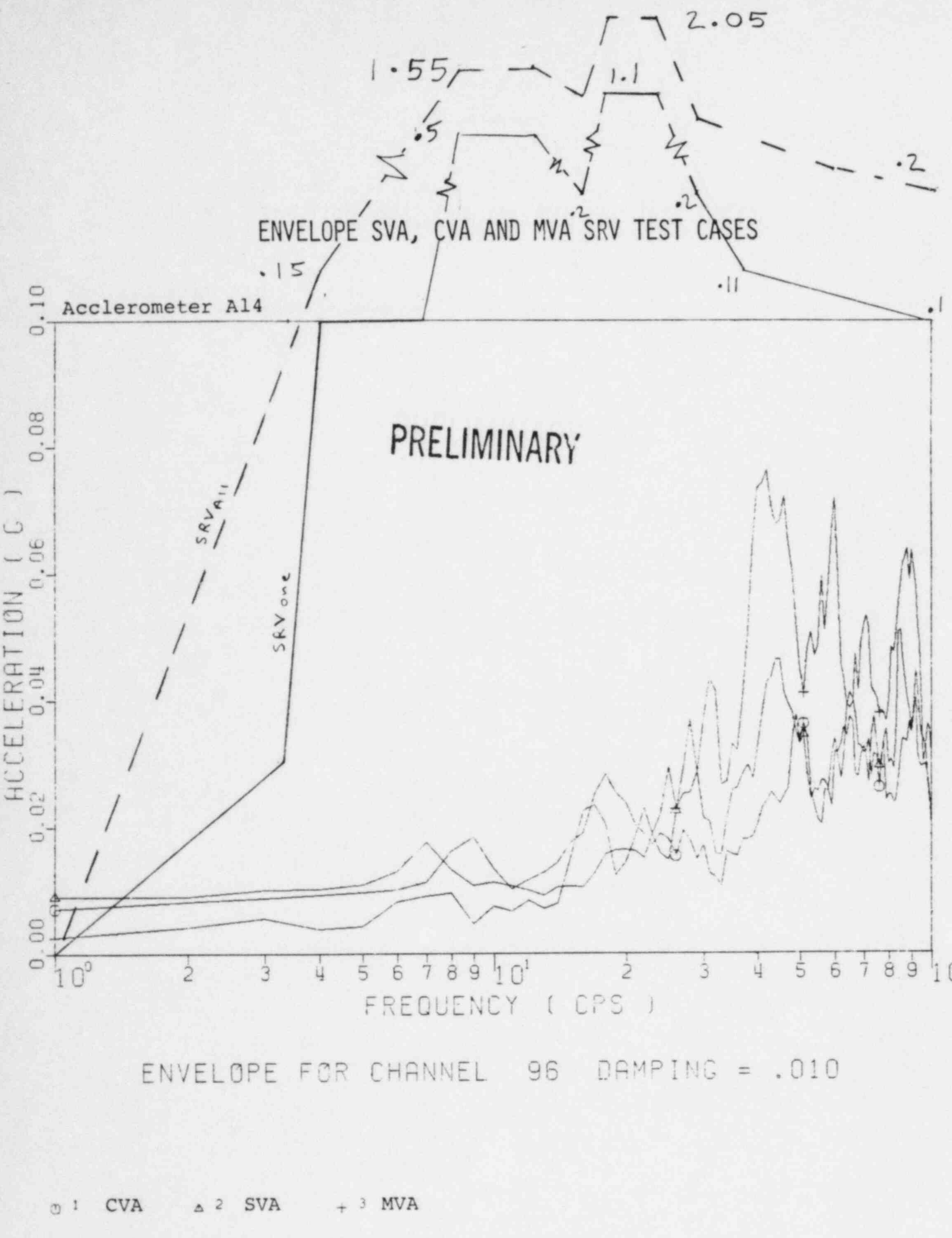

2.1
1.5
1.3
1.25
.80
ENVELOPE SVA, CVA AND MVA SRV TEST CASES
52
Accelerometer A10
.10
.30
SRV ALL
SRV ONE
PRELIMINARY
ACCELERATION (G)
0.00
0.02
0.04
0.06
0.08
0.10
FREQUENCY (CPS)
ENVELOPE FØR CHANNEL 92 DAMPING = .010
1 CVA
2 SVA
3 MVA

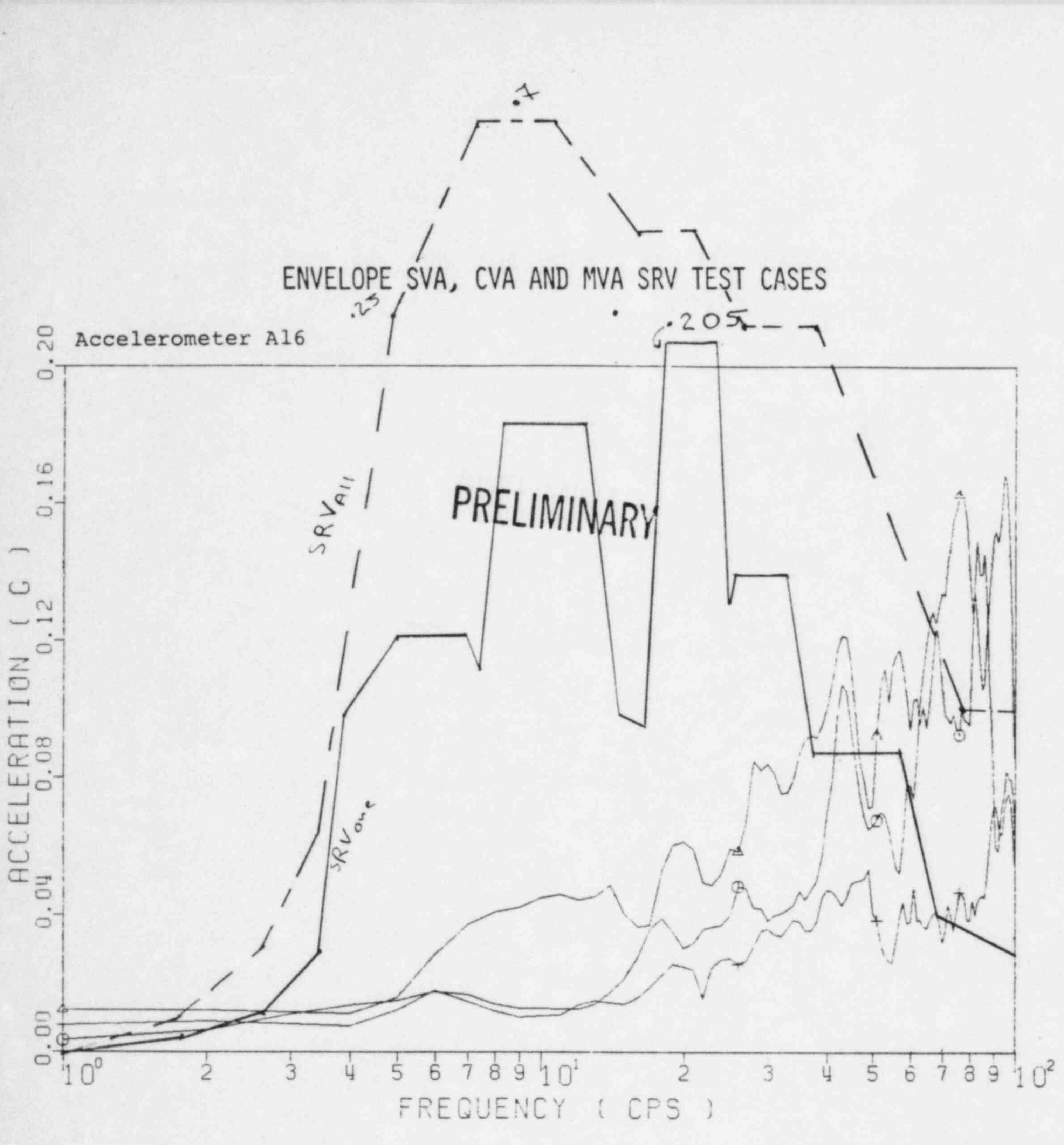
Figure 4.8



2.05
1.55
1.1
.5
.2
.2
.2
ENVELOPE SVA, CVA AND MVA SRV TEST CASES
.15
.11
.1
Acclerometer A14
PRELIMINARY
SRV All
SRV one
ACCELERATION (G)
0.00
0.02
0.04
0.06
0.08
0.10
FREQUENCY (CPS)
ENVELOPE FOR CHANNEL 96 DAMPING = .010
1 CVA
2 SVA
3 MVA

Figure 4.9

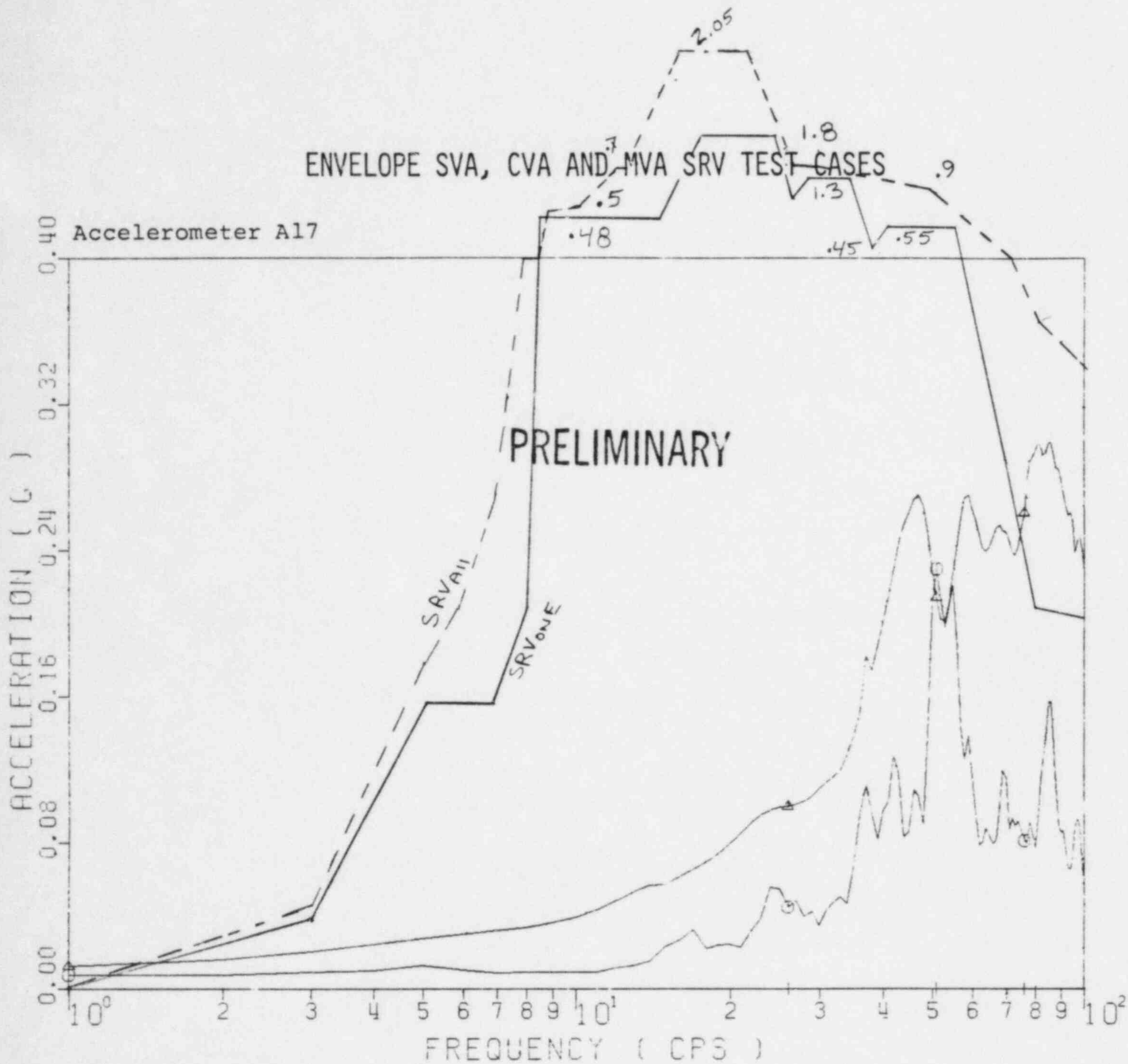
ENVELOPE SVA, CVA AND MVA SRV TEST CASES



ENVELOPE FOR CHANNEL 98 DAMPING = .010

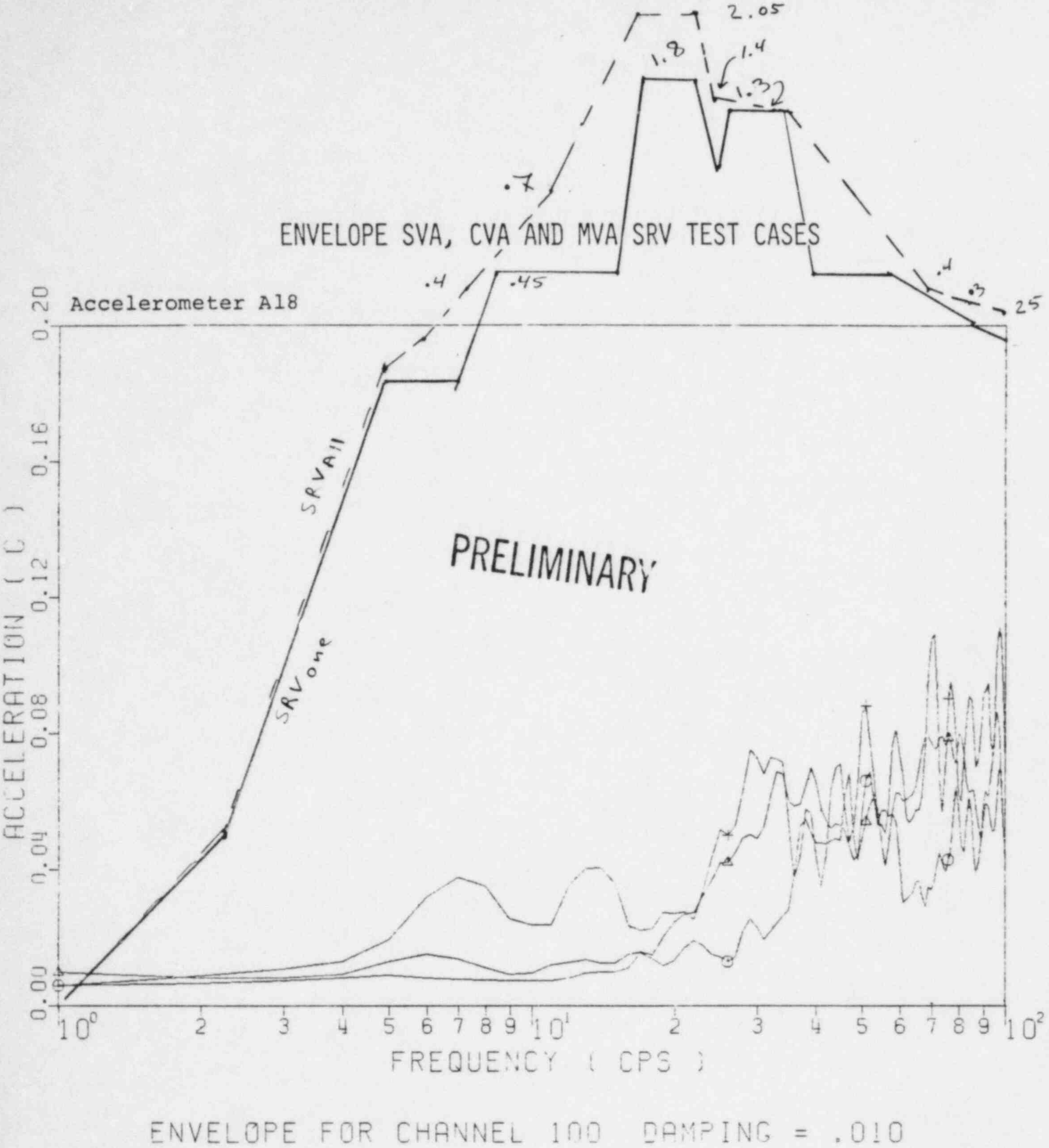
⊖ 1 CVA ▵ 2 SVA + 3 MVA

Figure 4.10



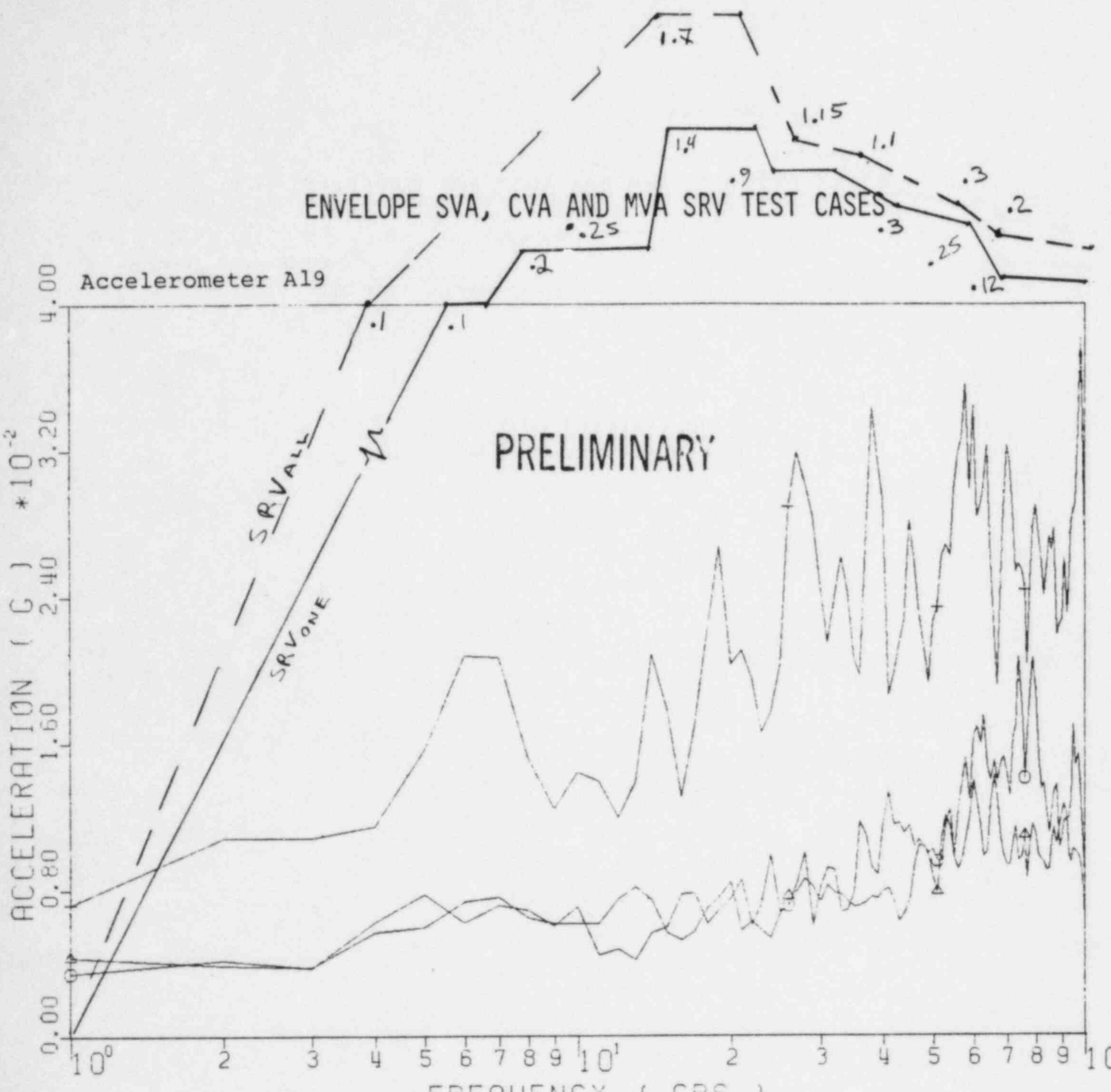
○ 1 CVA   △ 2 SVA   + 3 MVA

Figure 4.11



⊖ 1 CVA   △ 2 SVA   + 3 MVA

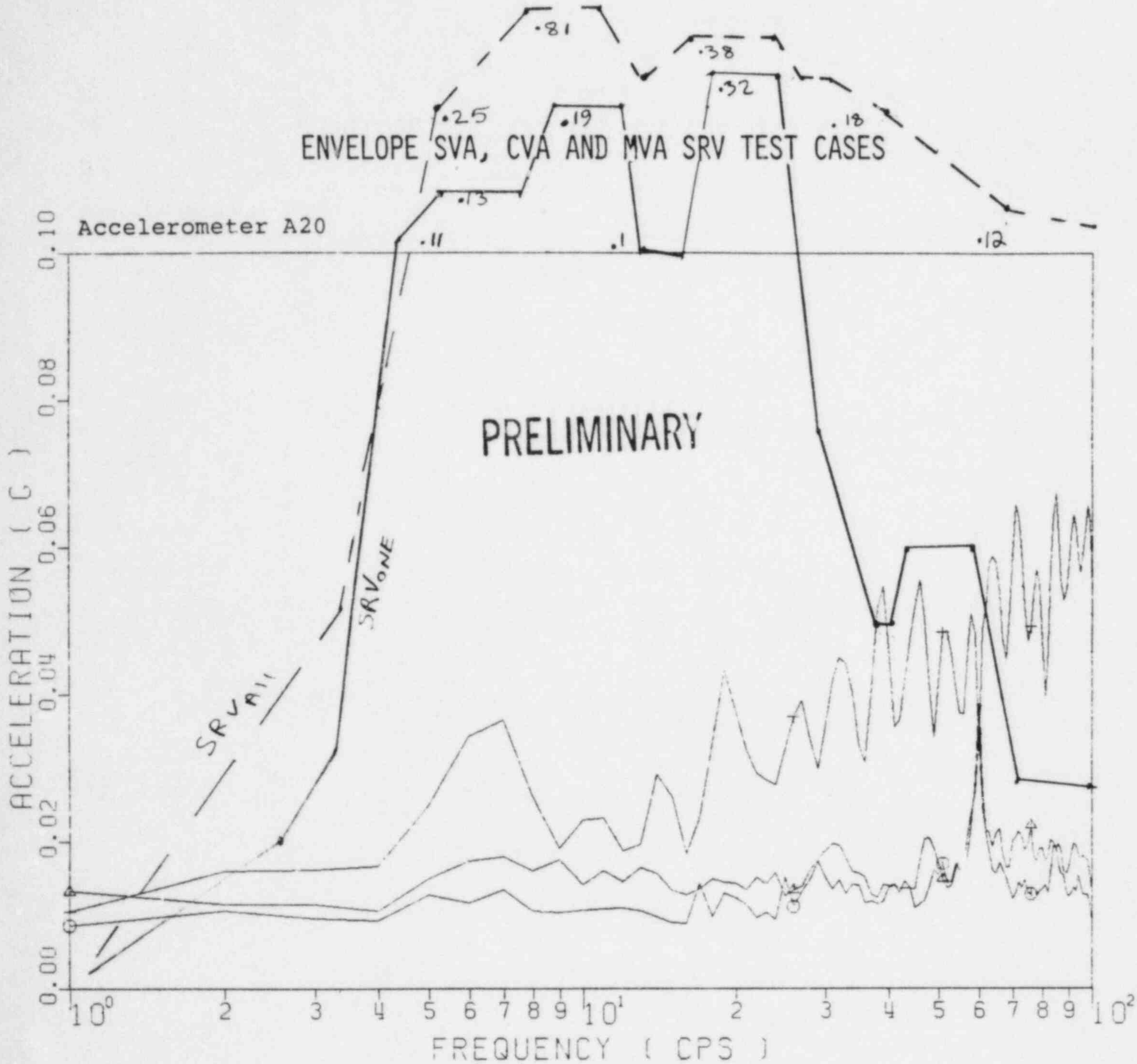
Figure 4.12



ENVELOPE FOR CHANNEL 101 DAMPING = .010

○ 1 CVA △ 2 SVA + 3 MVA

Figure 4.13



ENVELOPE FOR CHANNEL 102 DAMPING = .010

⊙ 1 CVA   △ 2 SVA   + 3 MVA

Figure 4.14

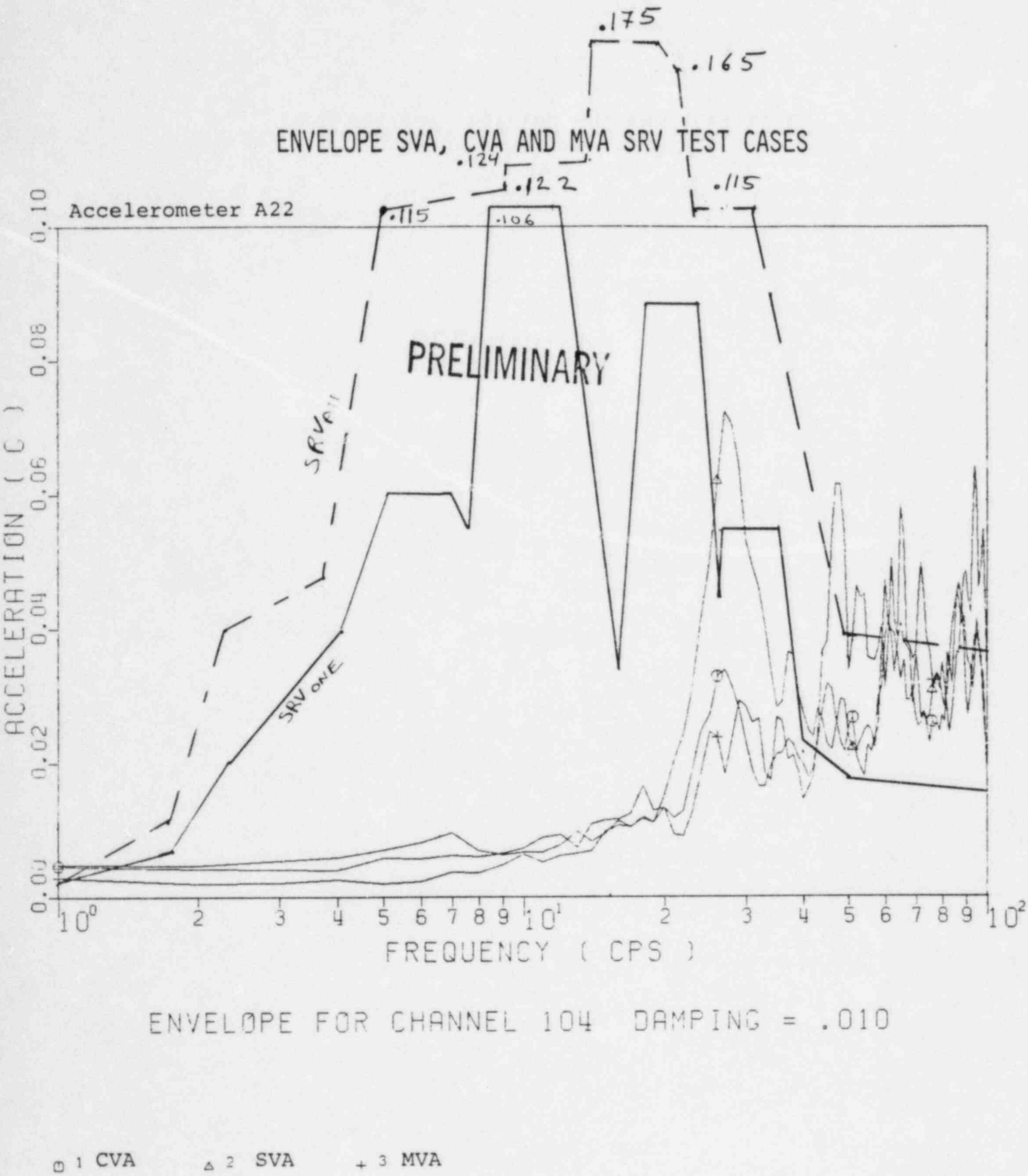
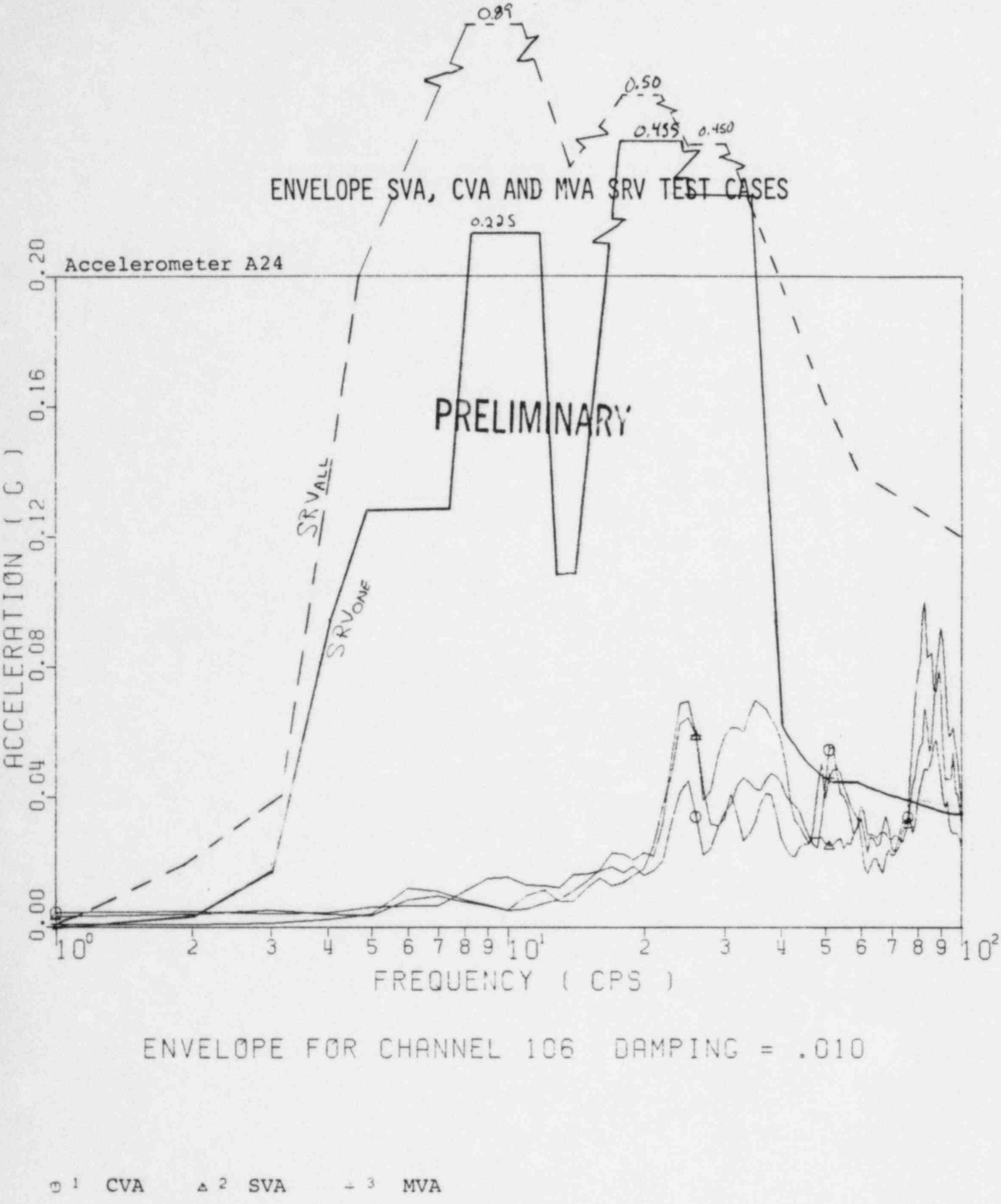
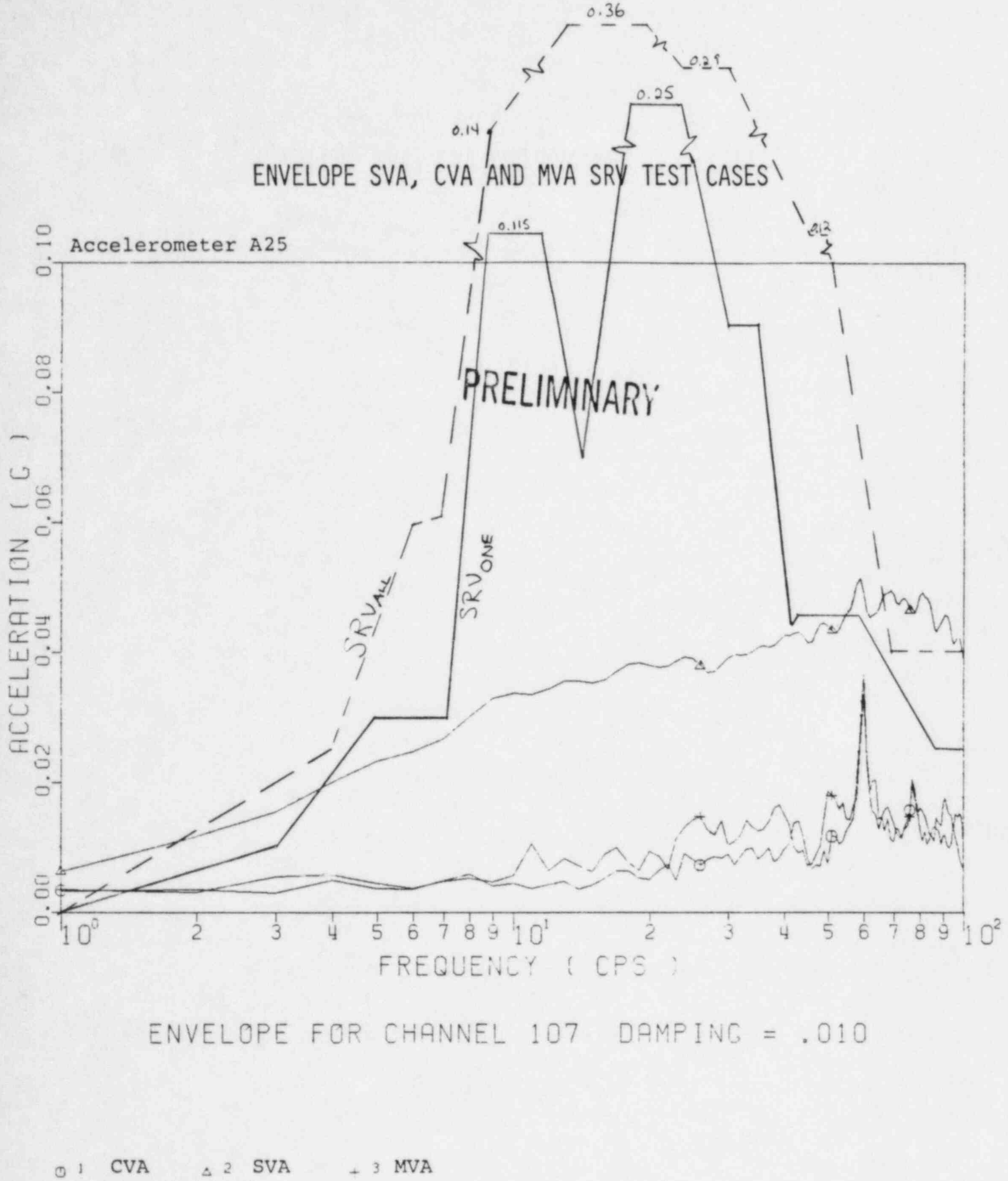

.175
.165
ENVELOPE SVA, CVA AND MVA SRV TEST CASES
.124
.122
.115
Accelerometer A22
.115
.106
PRELIMINARY
SRV ONE
ACCELERATION (G)
FREQUENCY (CPS)
ENVELOPE FOR CHANNEL 104 DAMPING = .010
1 CVA
2 SVA
3 MVA

Figure 4.15



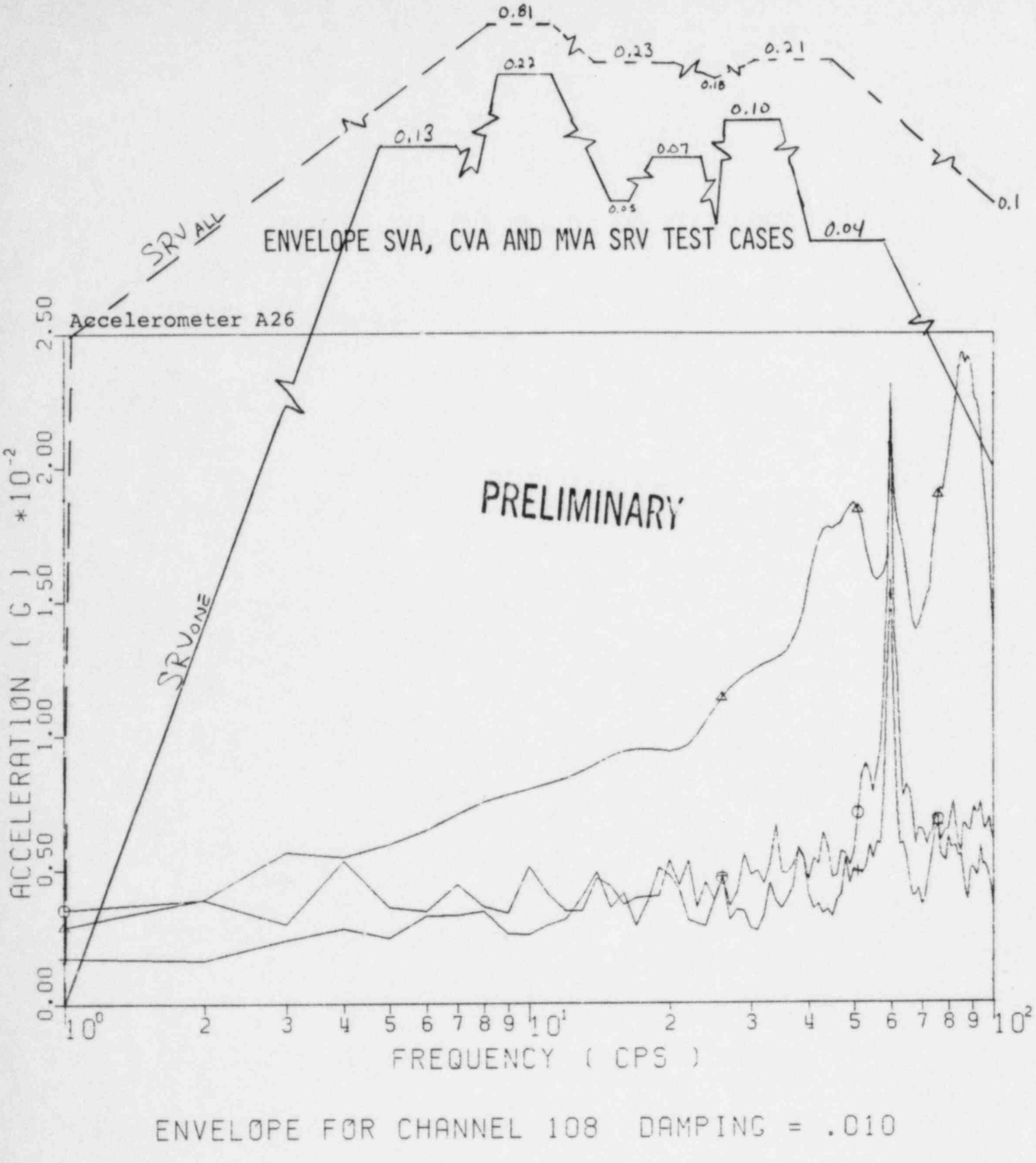
0.89
0.50
0.455
0.450
ENVELOPE SVA, CVA AND MVA SRV TEST CASES
0.225
Accelerometer A24
PRELIMINARY
SRV ALL
SRV ONE
ACCELERATION (G)
0.00
0.04
0.08
0.12
0.16
0.20
10^0
2
3
4
5
6
7
8
9
10^1
10^2
FREQUENCY (CPS)
ENVELOPE FOR CHANNEL 106 DAMPING = .010
1 CVA
2 SVA
3 MVA

Figure 4.16



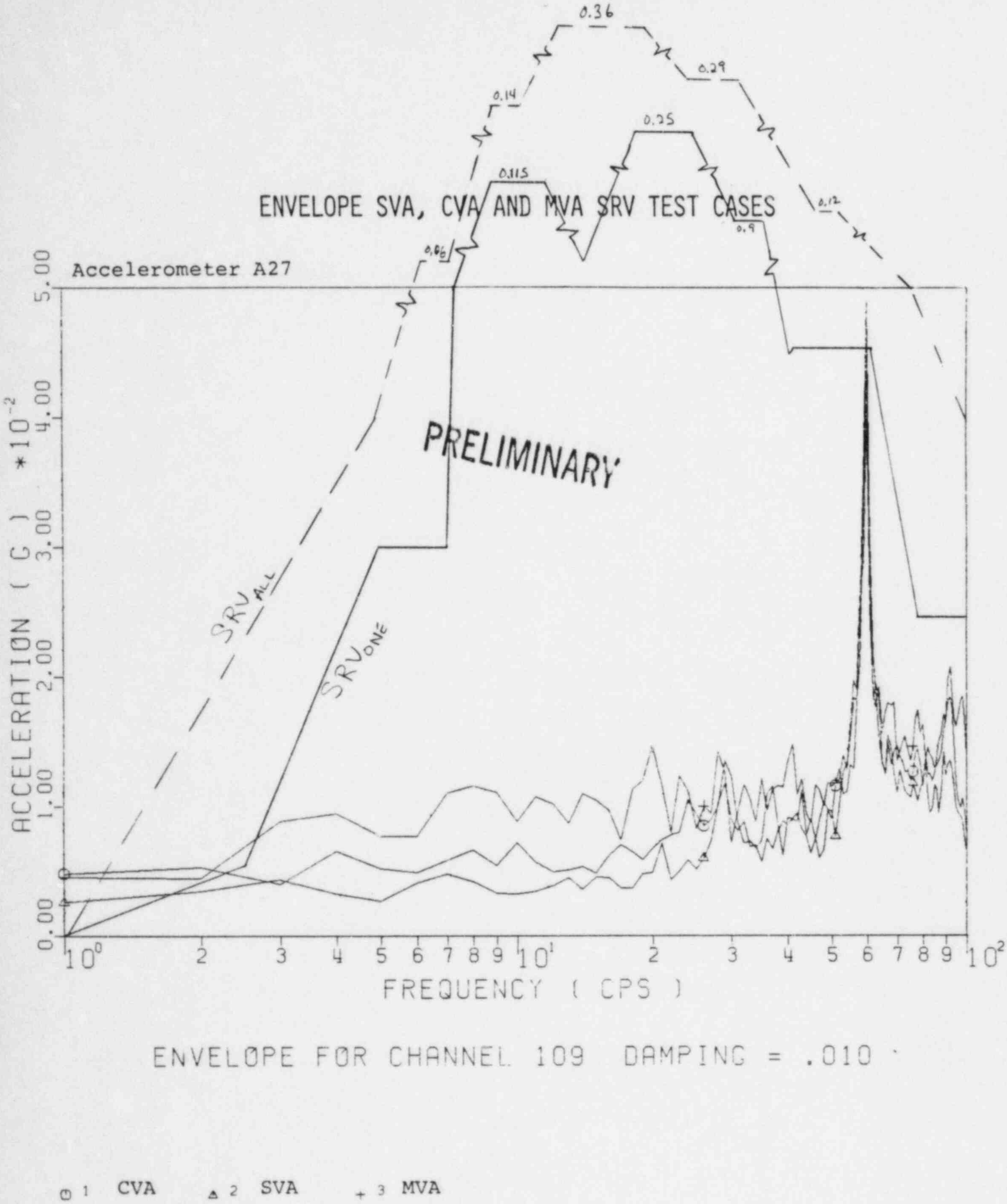
ENVELOPE SVA, CVA AND MVA SRV TEST CASES
Accelerometer A25
PRELIMINARY
0.36
0.29
0.25
0.14
0.115
0.12
SRV_{ALL}
SRV_{ONE}
ACCELERATION (G)
0.00
0.02
0.04
0.06
0.08
0.10
FREQUENCY (CPS)
ENVELOPE FOR CHANNEL 107 DAMPING = .010
1 CVA
2 SVA
3 MVA

Figure 4.17



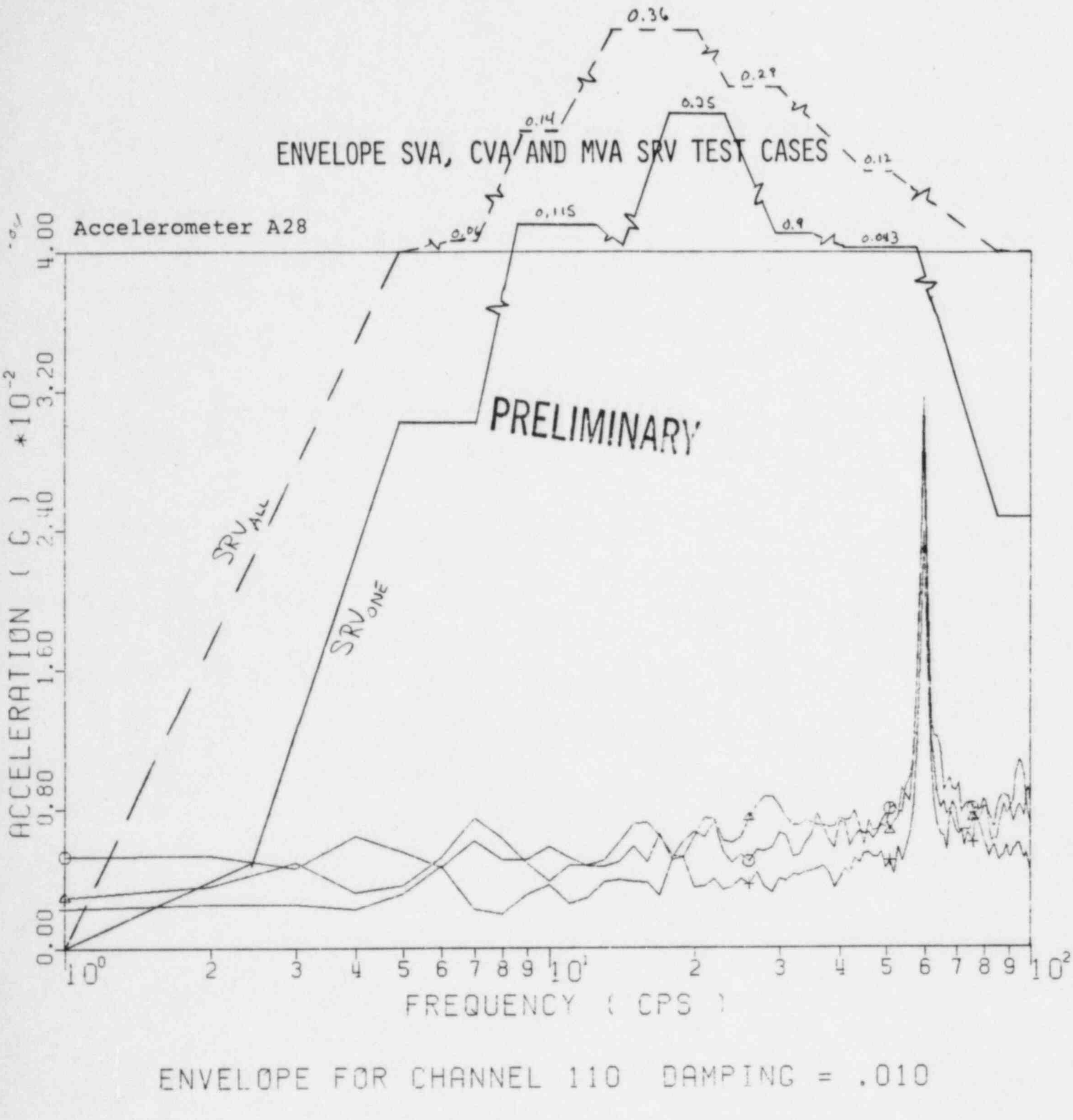
○ 1 CVA △ 2 SVA + 3 MVA

Figure 4.18



ENVELOPE SVA, CVA AND MVA SRV TEST CASES
Accelerometer A27
PRELIMINARY
SRV ALL
SRV ONE
0.36
0.29
0.14
0.25
0.115
0.12
0.9
0.06
ACCELERATION (G) *10^-2
FREQUENCY (CPS)
ENVELOPE FOR CHANNEL 109 DAMPING = .010
1 CVA
2 SVA
3 MVA

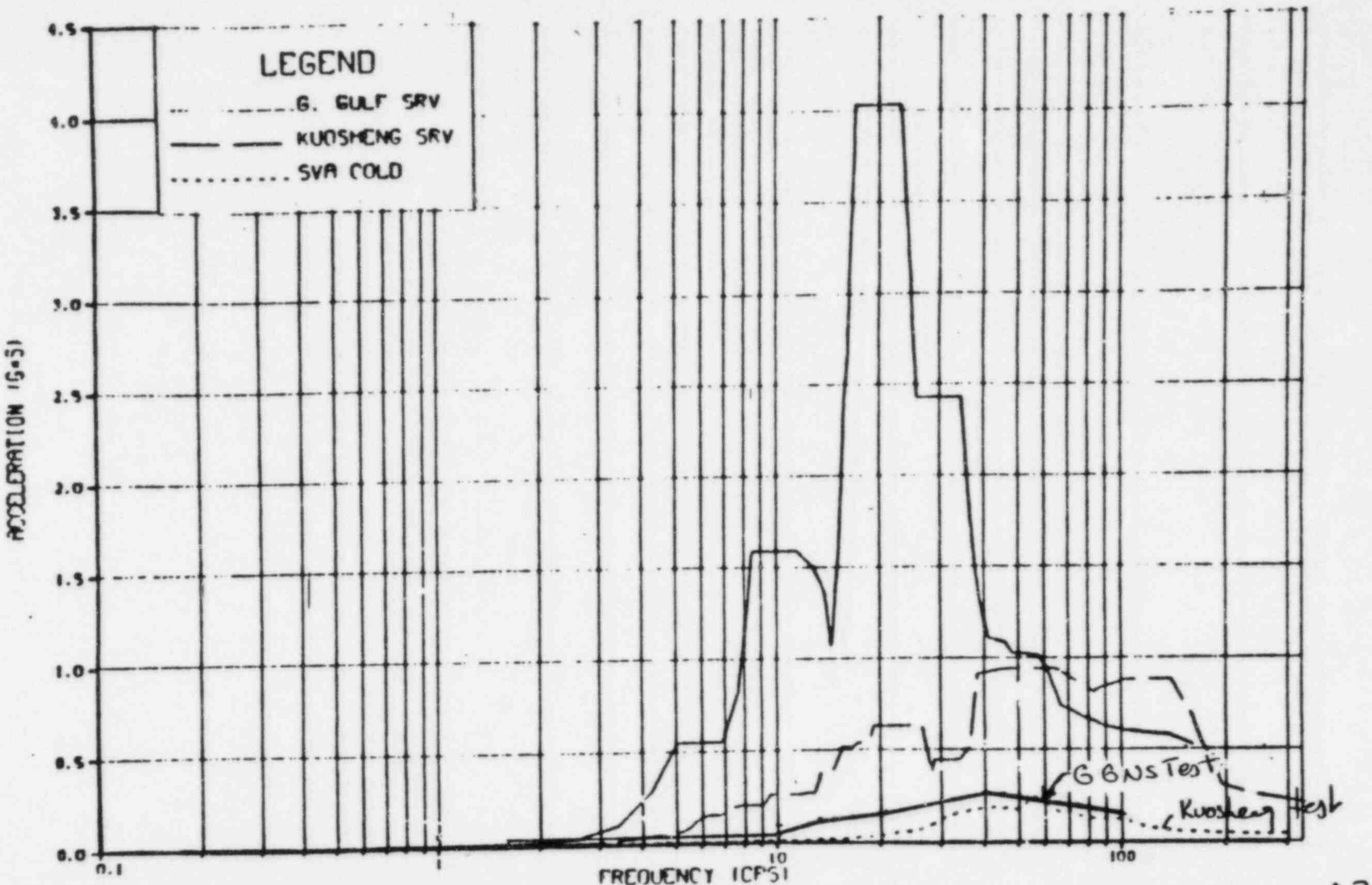
Figure 4.19



○ 1 CVA   △ 2 SVA   + 3 MVA

Figure 4.20

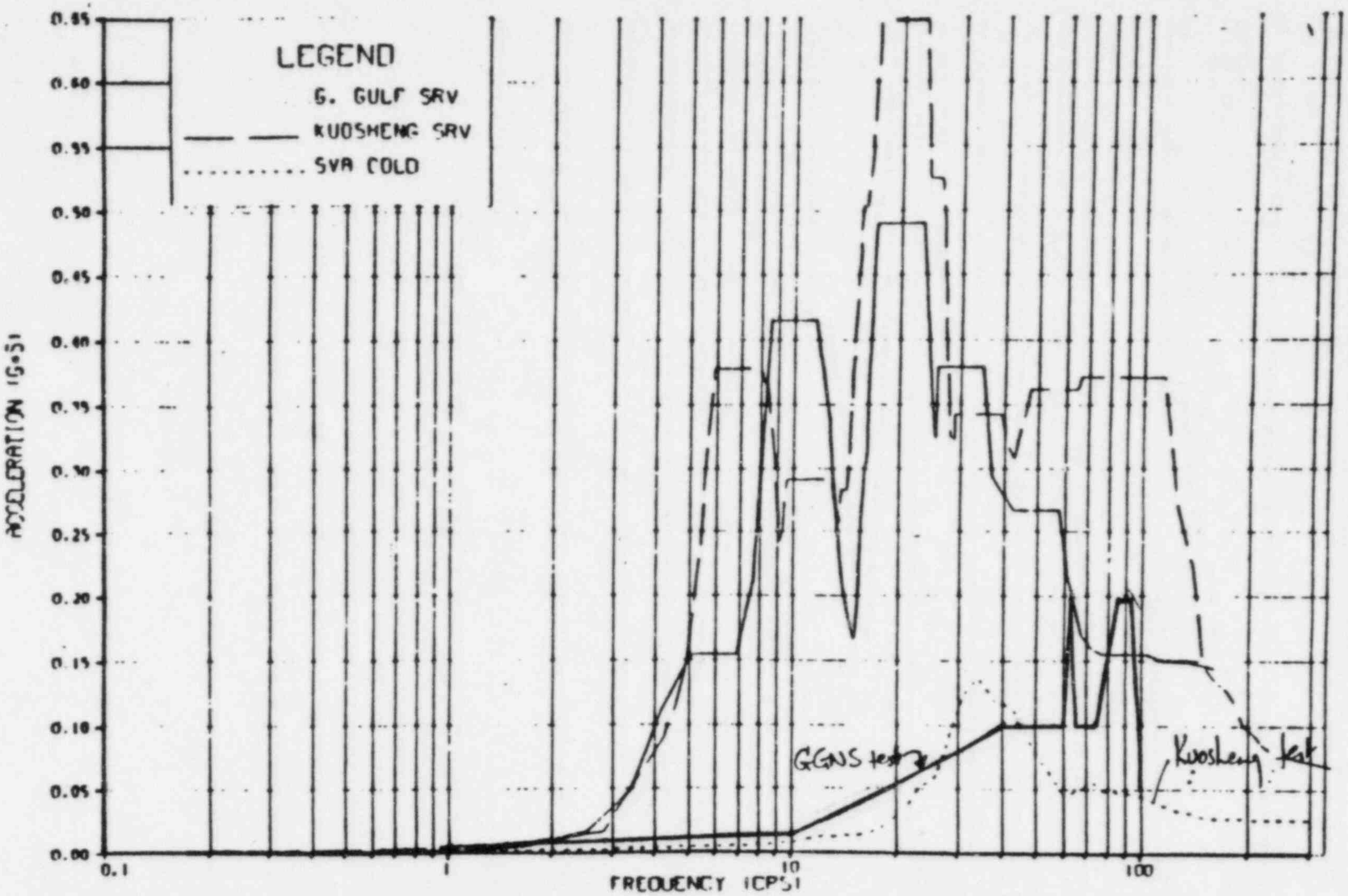
RESPONSE SPECTRA COMPARISON



ACCELEROMETER ENVELOP: A126 GGNS Accelerometer A3
VS. KSHG NODE 282 CONTNMT EL-28.08 HORIZ
VS. G.G. NODE 277 CONTNMT EL109.17 HORIZ

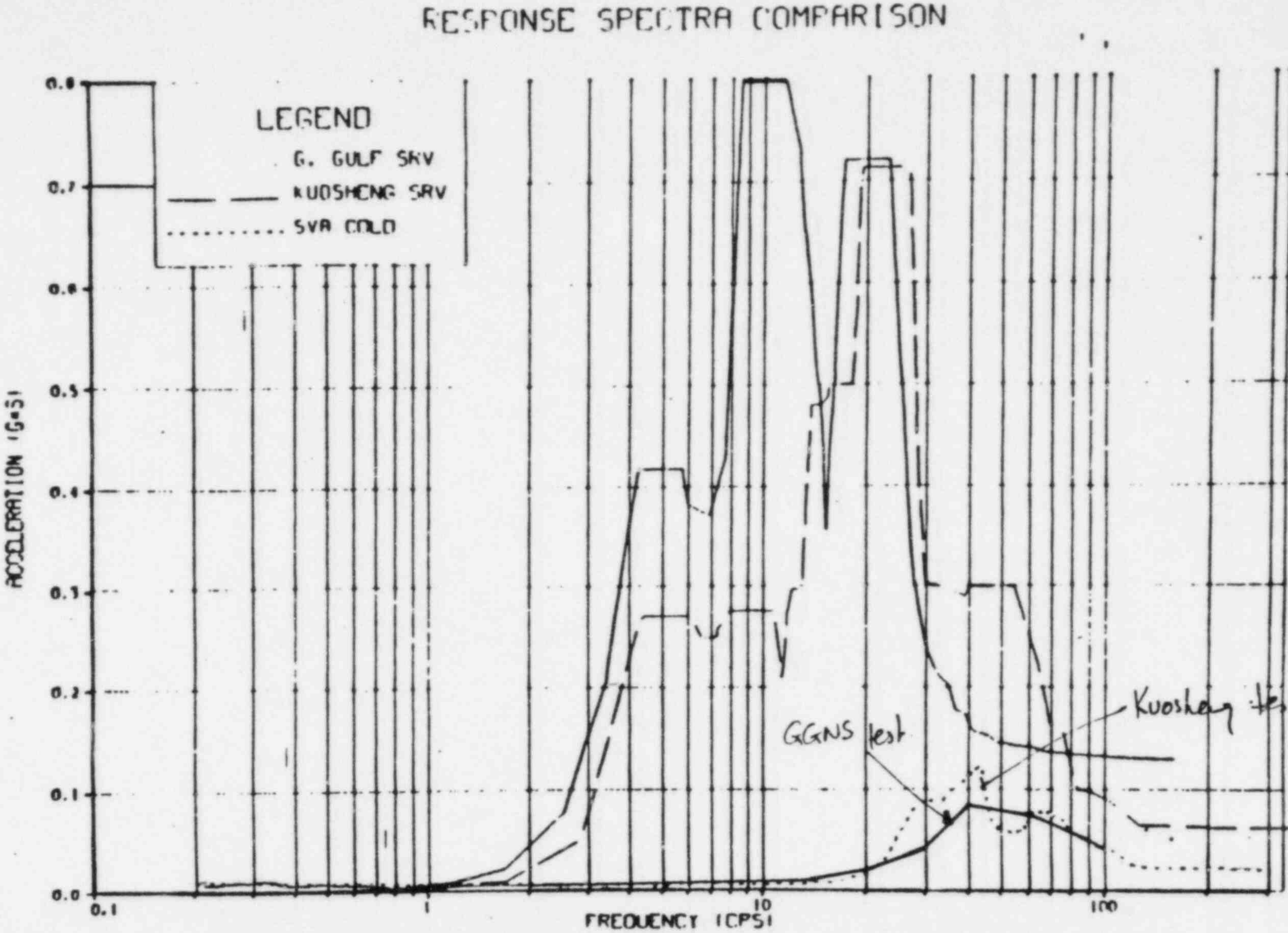
Figure 4.21

RESPONSE SPECTRA COMPARISON



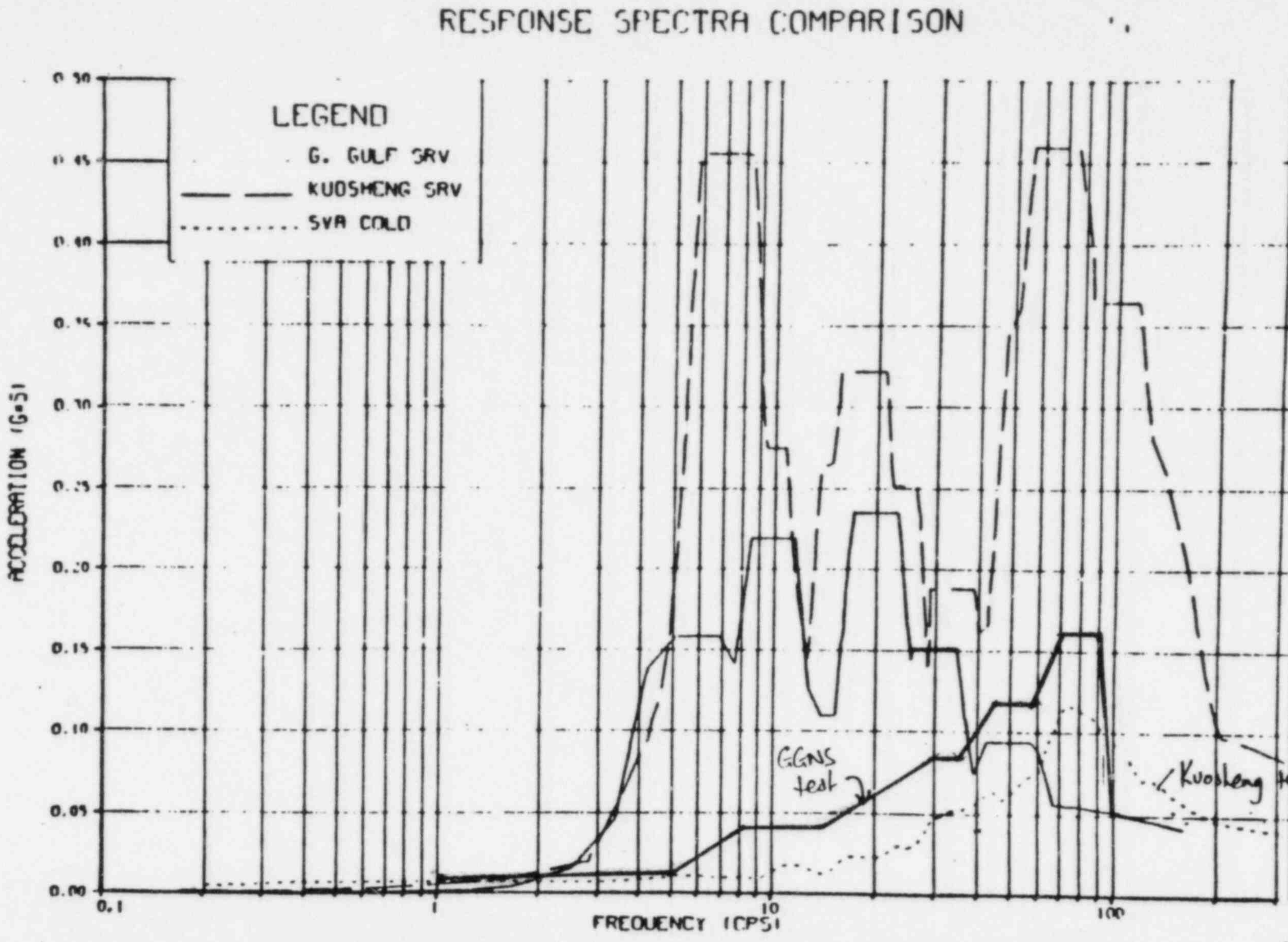
ACCELEROMETER ENVELOP: A125 GGNS Accelerometer A4
VS. KSHG NODE 282 CONTNMT EL-28.08 VERT
VS. G.G. NODE 277 CONTNMT EL109.17 VERT

Figure 4.22



ACCELEROMETER ENVELOP: A14.A15 GGNS Accelerometer A14
VS. KSHG NODE 329 CONTNMT EL169.30 HORIZ
VS. G.G. NODE 309 CONTNMT EL300.08 HORIZ

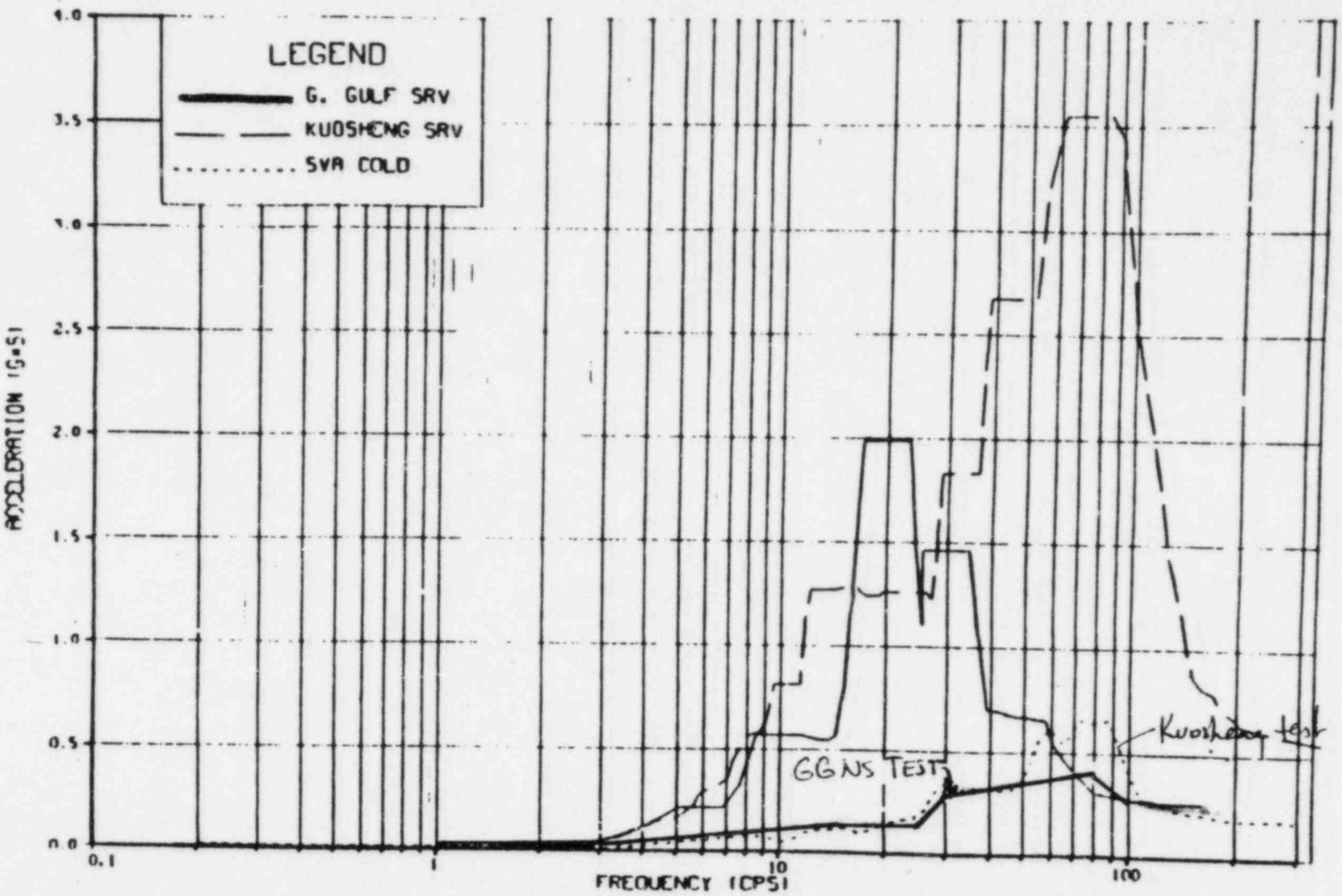
Figure 4.23



ACCELEROMETER ENVELOP: A43, A45 GGNS Accelerometer A16
VS. KSHG NODE 80 DRYWELL EL-14.83 VERT
VS. G.G. NODE 48 DRYWELL EL120.83 VERT

Figure 4.24

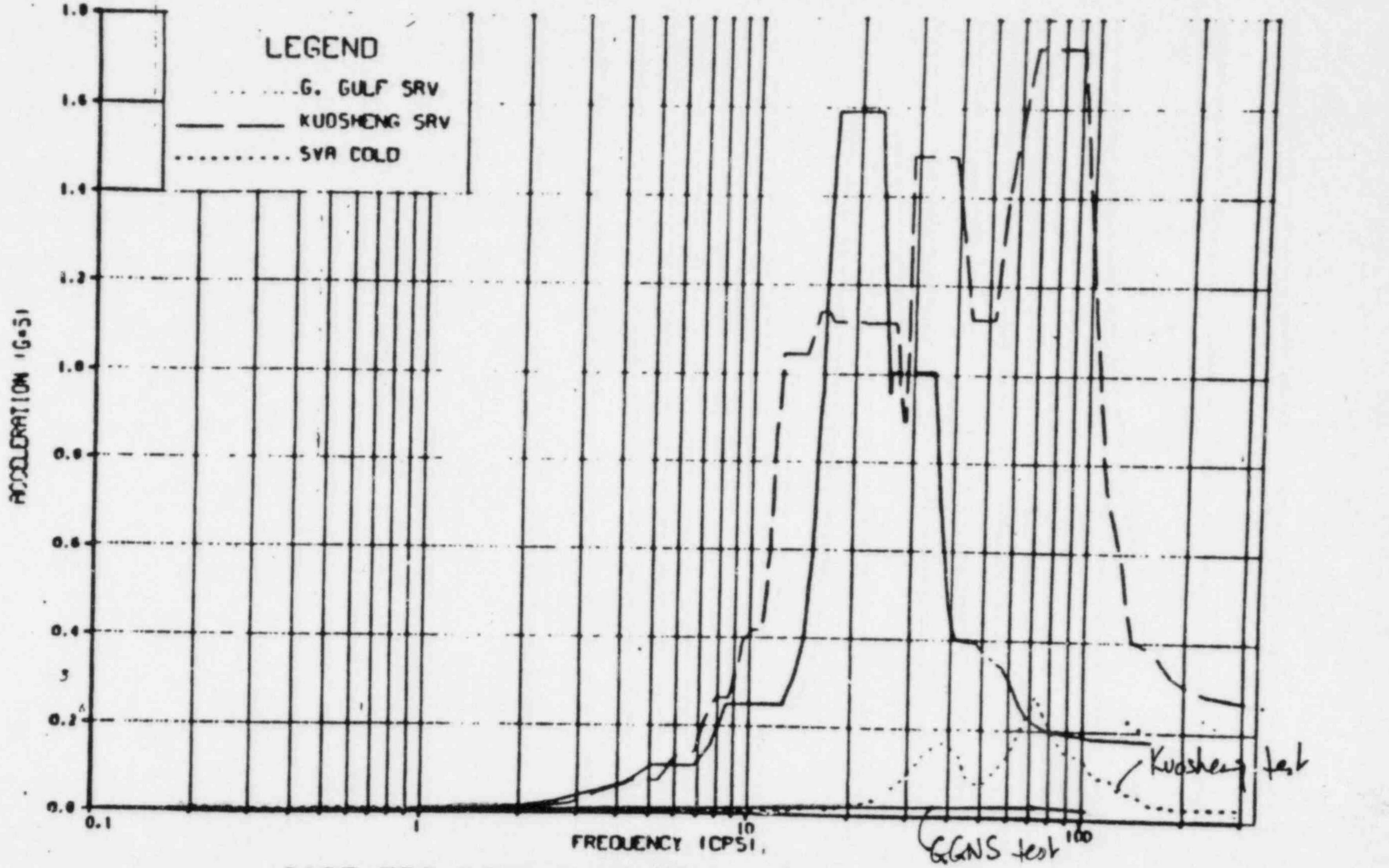
RESPONSE SPECTRA COMPARISON



ACCELEROMETER ENVELOP: A44,A46 GGNS Accelerometers A17/A18
VS. KSHG NODE 80 DRYWELL EL-14.83 HORIZ

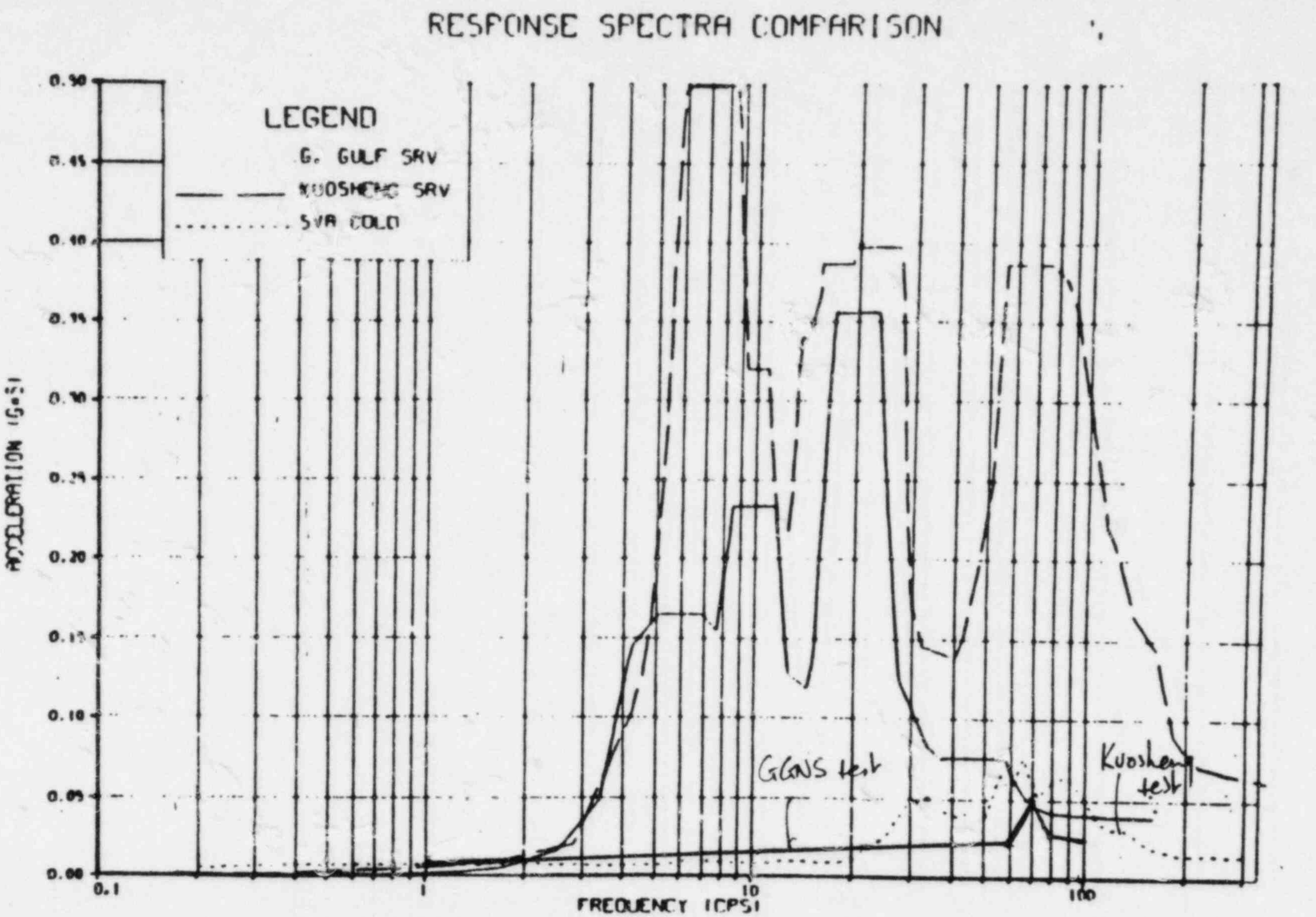
Figure 4.25 VS. G.G. NODE 48 DRYWELL EL120.83 HORIZ

RESPONSE SPECTRA COMPARISON



ACCELEROMETER ENVELOP: A54, A55, A57, A58 GGNS Accelerometer A19
VS. KSHG NODE 68 DRYWELL EL 17.00 HORIZ
VS. G.G. NODE 30 DRYWELL EL147.58 HORIZ

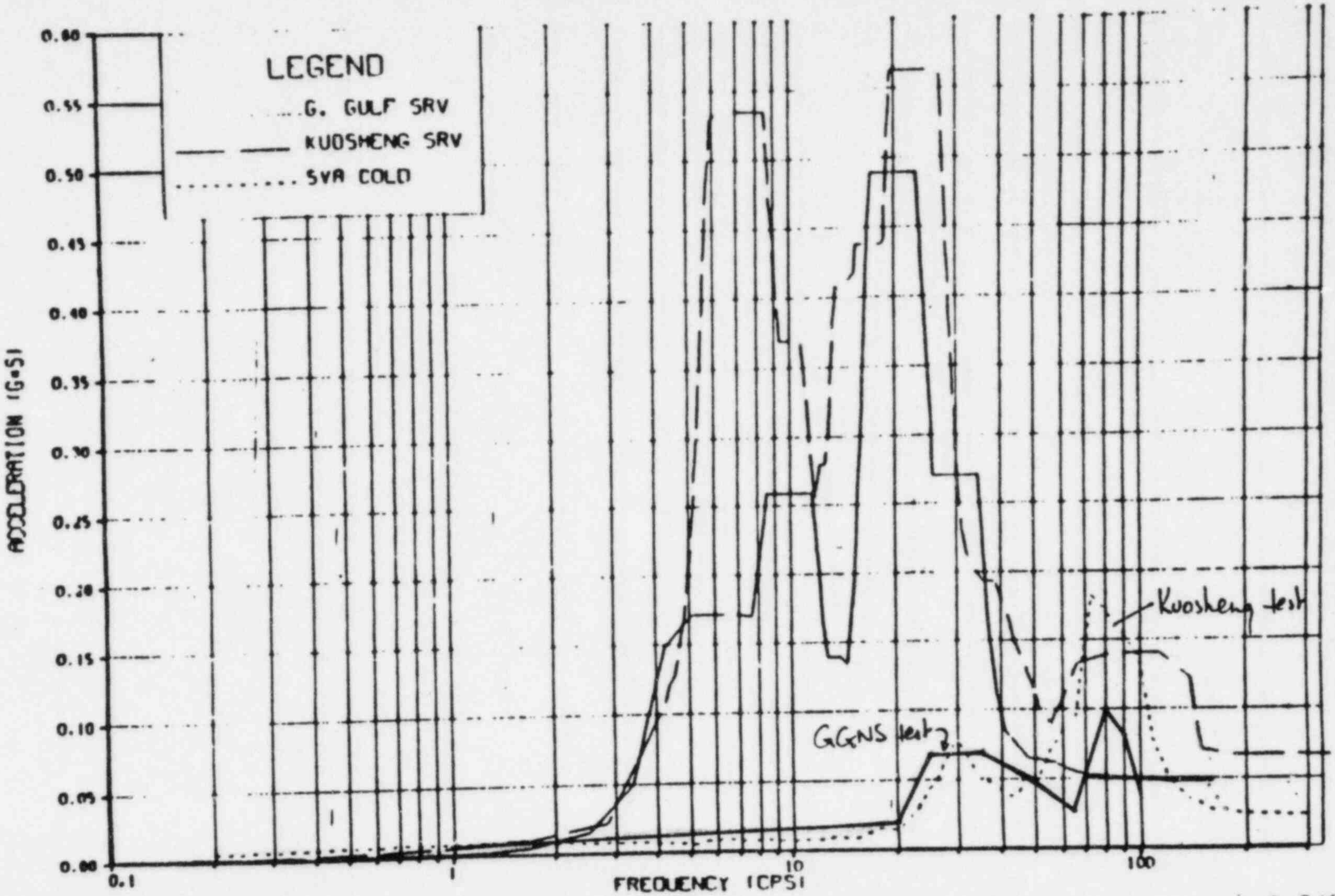
Figure 4.26



ACCELEROMETER ENVELOP: A53, A56 GGNS Accelerometer A20
VS. KSHG NODE 68 DRYWELL EL 17.00 VERT
VS. G.G. NODE 30 DRYWELL EL147.58 VERT

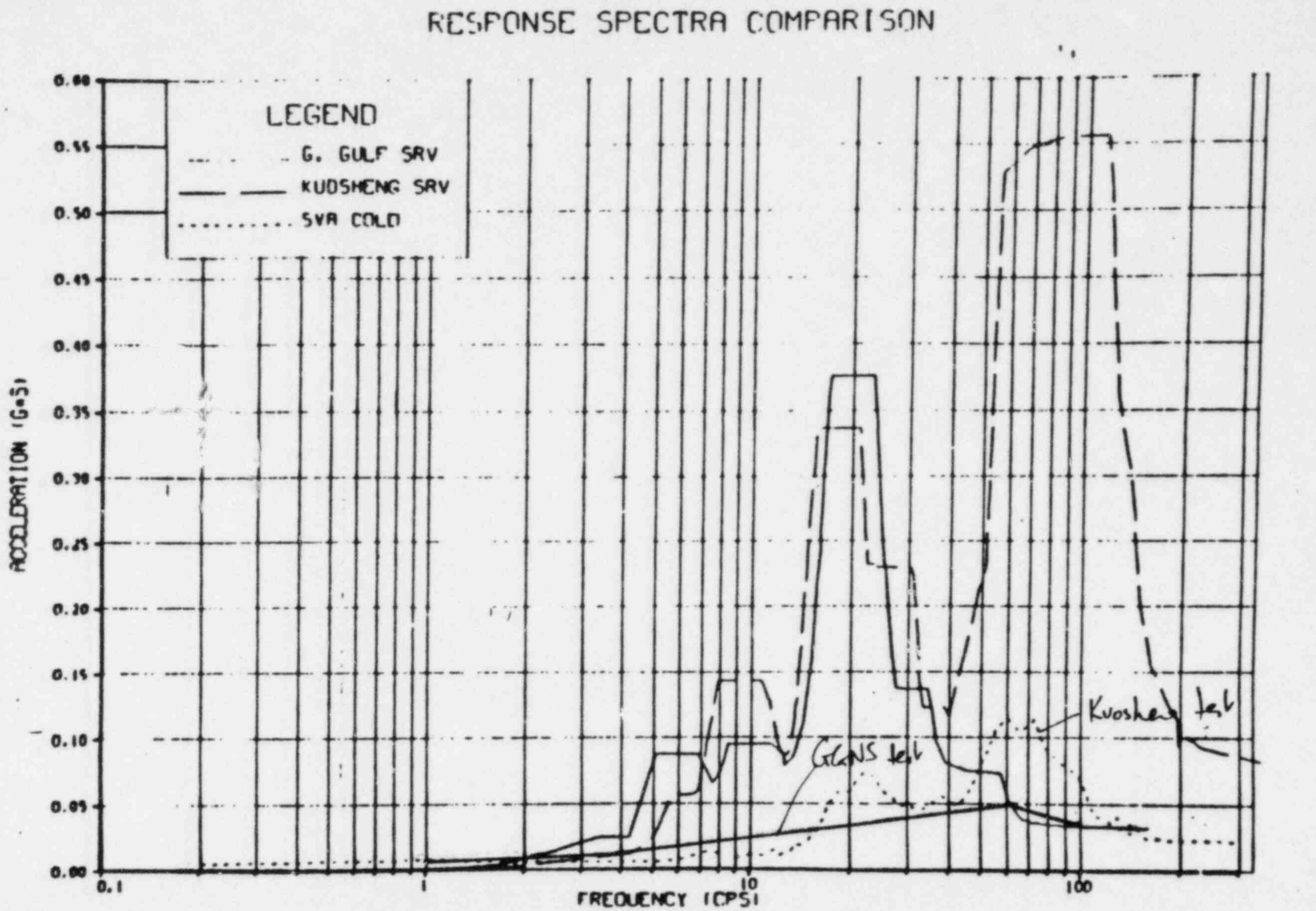
Figure 4.27

RESPONSE SPECTRA COMPARISON



ACCELEROMETER ENVELOP: A59, A62 GGNS Accelerometer A24
VS. KSHG NODE 31 DRYWELL EL 49.25 VERT
VS. G.G. NODE 8 DRYWELL EL182.17 VERT

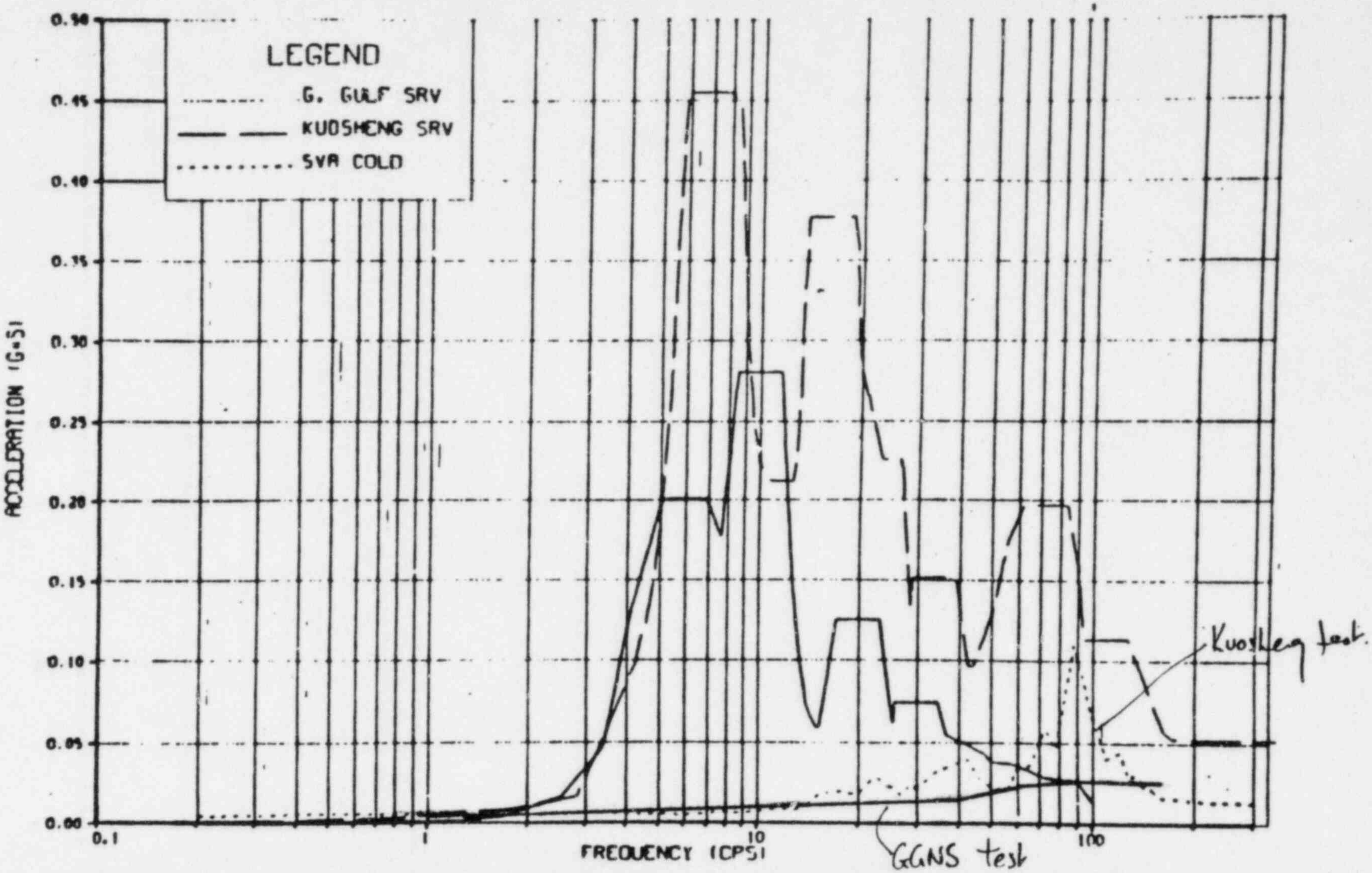
Figure 4.28



ACCELEROMETER ENVELOP: A72, A73, A75, A76
VS. KSHG NODE 82 PEDESTAL EL-9.33 HORIZ
VS. G.G. NODE 47 PEDESTAL EL121.42 HORIZ

Figure 4.29

RESPONSE SPECTRA COMPARISON



ACCELEROMETER ENVELOP: A71, A74 GGNS Accelerometer A26
VS. KSHG NODE 82 PEDESTAL EL-9.33 VERT
VS. G.G. NODE 47 PEDESTAL EL121.42 VERT

Figure 4.30

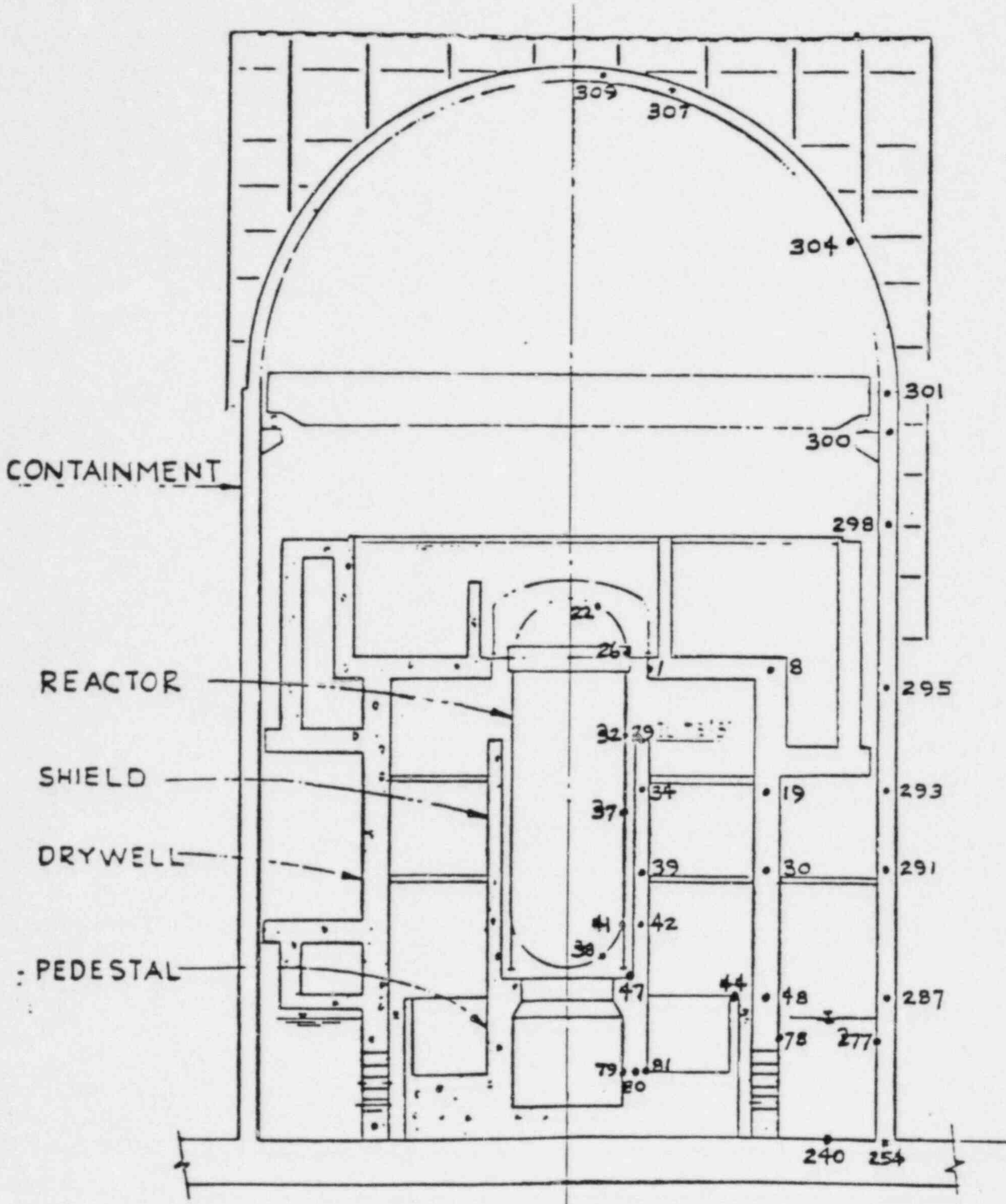


Figure 4.31 - Grand Gulf NLAE Model Node Locations