



APPROVED ENGINEERING TEST LABORATORIES

NATIONAL TEST LABORATORIES

Report No. 548-8934

P.O. No. 90215

Date: 19 November 1980

61-Page Report

Revision A

12 February 1981

Report Number 548-8934

Qualification Test

on

Flex Metal Hose Assembly

Part Number 77750

TESTED FOR:

METAL BELLOWS CORPORATION
20960 Knapp Street
Chatsworth, CA 91311

TESTED BY:

APPROVED ENGINEERING TEST LABORATORIES
9551 Canoga Avenue
Chatsworth, CA 91311

STATE OF CALIFORNIA
COUNTY OF LOS ANGELES

RICHARD FORBES, SR. Project Manager, being duly sworn,
deposes and says: That the information contained in this report is the result of
complete and carefully conducted tests and is to the best of his knowledge true
and correct in all respects.

Subscribed and sworn to before me this _____ day of _____, 1981.

Notary Public in and for the County of Los Angeles, State of California

8202010343 811125
PDR ADOCK 09000327
PDR

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1.0 PURPOSE

The purpose of this report is to present the test procedure used and the test results obtained during a test program. The objective of the test program was to determine the conformance of one (1) Flex Metal Hose Assembly, Part Number 77750, to the Qualification Test requirements specified in Reference 2.1, in accordance with Reference 2.2.

2.0 REFERENCES

- 2.1 Metal Bellows Corporation Qualification Test Procedure Number QPT 77750 Revision A, dated: 7 August 1980.
- 2.2 Metal Bellows Corporation Purchase Order Number 90215.

3.0 SUMMARY

3.1 One (1) Flex Metal Hose Assembly, described in Paragraph 1.0 and hereafter referred to as "Assembly", has been subjected to Qualification Testing as described in this report. The following anomalies were noted during testing:

- a) The specific resonance scan from 3.5 Hz to 100 Hz at an input level of 1 g peak was not attainable in the horizontal direction. The customer was notified of the deviation and the customer directed that testing be continued on a best effort basis to approximately 60 Hz (refer to Notice of Deviation Number 1).
- b) The customer noted that the axis definition in the test specification (Reference 2.1) was incorrect and the customer redefined the X-Y and Y-Z axes as the X-Z and X-Y axes (refer to Notice of Deviation Number 2).

3.2 All results are presented for evaluation.



4.0 TEST CONDITIONS AND TEST EQUIPMENT

4.1 Test Conditions

Unless otherwise specified herein, all tests were performed at room ambient conditions: defined as a temperature of $73 \pm 18^{\circ}\text{F}$ ($23 \pm 10^{\circ}\text{C}$), a relative humidity of 50 ± 30 percent, and a barometric pressure of $28.5 \pm 2.0, -3.0$ inches of mercury absolute ($725 \pm 50, -75$ mm of mercury absolute).

4.2 Test Equipment

The test equipment presented in Appendix A was calibrated, as required, in accordance with MIL-C-45662A and traceable to the National Bureau of Standards (NBS). The NBS traceability records are maintained on file in the AETL Quality Control Office.



5.0 TEST PROCEDURE AND TEST RESULTS

5.1 Proof Pressure Test

Reference 2.1, Paragraph 4.2

Date Performed: 23 September 1980

5.1.1 The Assembly was installed in a Proof Pressure Test setup, filled with water, and bled free of all entrapped air. The Assembly inlet pressure was increased to 180 psig and maintained for a period of 10 minutes. The Assembly was inspected during testing for leakage or permanent deformation. There was no evidence of leakage or permanent deformation.



5.2 Seismic Qualification Test

Reference 2.1, Paragraphs 4.3 and 4.4

Date Commenced: 23 September 1980

Date Completed: 21 October 1980

- 5.2.1 The Assembly was installed in a test fixture which was rigidly bolted to the biaxial seismic simulator in the X-Z axis (refer to Notice of Deviation Number 2 and Figure 1), as exemplified in Photograph 1. The Assembly was filled with deionized water and pressurized to 120 psig.
- 5.2.2 The Assembly was then subjected to a continuous sine wave resonance scan in the X direction from 3.5 to 100 Hz and in the Z direction from 3.5 to 60 Hz (refer to Notice of Deviation Number 1). The applied input level was 1.0 g and the sweep rate was one octave per minute. The resonance scan results are presented in Table I. Resonance points were defined as having a Q factor greater than or equal to two.
- 5.2.3 The Assembly was then subjected to two biaxial seismic events at the Safe Shutdown Earthquake (SSE) level. Each seismic event consisted of 1 minute of biaxial random motion which was amplitude controlled in 1/6-octave bandwidths from 1 Hz to 33 Hz. The electronic signals from two piezoresistive accelerometers, mounted on the seismic simulator in the two active axes, were analyzed in 1/12-octave bandwidths between 0.1 Hz and 100 Hz, with a spectrum analyzer, at a damping ratio of 2 percent. The True Response Spectra (TRS) met or exceeded the SSE Required Response Spectra (RRS) shown in Figures 2 and 3. The Assembly was filled with deionized water and unpressurized (0 psig) for the first SSE and filled with deionized water and pressurized to 120 psig for the second SSE.
- 5.2.4 On completion of testing in the X-Z axis the fixture was rotated 90°, about its vertical axis, to the X-Y axis and the test procedure described in Paragraph 5.2.3 was repeated.
- 5.2.5 On completion of testing, the tape recorded signals from the two piezoresistive accelerometers, mounted on the seismic simulators in the two active axes of both orientations tested, were analyzed in 1/12-octave bandwidths between 0.1 Hz and 100 Hz, with a spectrum analyzer, at damping ratios of 0.5, 1.0, and 5.0 percent.



- 5.2.6 The Assembly was tested on a hydraulic biaxial seismic simulator. Each horizontal axis was excited separately and simultaneously with the vertical axis. Independent signal sources for the horizontal and vertical axes provided random phasing of input motion.
- 5.2.7 On completion of the biaxial seismic testing the Assembly was subjected to a Proof Pressure Test, as described in Paragraph 5.1.1. There was no evidence of leakage or permanent deformation.
- 5.2.8 The Assembly was visually examined on test completion and no sign of physical damage was noted. TRS plots were recorded during testing and are presented in Appendix B. This concluded testing and the Assembly was returned to Metal Bellows Corporation.



AETL

APPROVED ENGINEERING TEST LABORATORIES
A NATIONAL TECHNICAL SERVICE CO.

NOTICE OF DEVIATION

DATE: 2/10/80

- LOS ANGELES DIVISION / 8320 WEST 104TH STREET / LOS ANGELES, CALIFORNIA 90048 / (213) 776-3209
- VALLEY DIVISION / 9851 CANOGA AVENUE / CHATSWORTH, CALIFORNIA 91311 / (818) 341-0830
- SAN DIEGO DIVISION / 20000 W. GOLDEN TRIANGLE RD. / SAN DIEGO, CALIFORNIA 92160 / (609) 299-8184
- EL MONTE DIVISION / 1421 POTHERO AVENUE / SO. EL MONTE, CALIFORNIA 91733 / (818) 444-9811
- FULLERTON DIVISION / 1536 EAST VALENCIA / FULLERTON, CALIFORNIA 92631 / (714) 879-8110

CUSTOMER: METAL SOLUTIONS CORP. MID NO: 5-18-8734
 PART NO: 77250 NOD NO: 1
 SERIAL NO: GENC UNIT P.O. NO: 90215
 TEST PROCEDURE: QTP 77250 PARAGRAPH: 43

REQUIREMENT: CONDUCT RESONANT SCAN FROM 3.5 TO 100HZ
WITH AN INPUT OF ± 1g PEAK.

DEVIATION: IN THE HORIZONTAL DIRECTION, THE ABOVE
LEVELS ARE NOT OBTAINABLE ABOVE 60 HZ.

DISPOSITION: CONDUCT TEST ON A BEST EFFORT BASIS
DURING THE ABOVE RESONANT SCANS AS PER
REQUIREMENT BAND IS MISC. INFO ONLY

APPROVAL: [Signature]
 (Customer Representative)

CUSTOMER NOTIFICATION:

Advised to: E. VIKARIK. E. How: TELEPHONE
 Date & Time: 10/20/80 By: [Signature]
 AS Notified: YES NO DATE: _____
 A.E.T.L. Dept. Supervisor



AETL

NOTICE OF DEVIATION

APPROVED ENGINEERING TEST LABORATORIES

A NATIONAL TECHNICAL SERVICE CO.

DATE: 01 OCT 50

LOS ANGELES DIVISION / 5320 WEST 104TH STREET / LOS ANGELES, CALIFORNIA 90045 / (213) 776-3302
 VALLEY DIVISION / 9551 CANOGA AVENUE / CHATSWORTH, CALIFORNIA 91311 / (213) 341-0830
 SAUGUS DIVISION / 70988 W. GOLDEN TRIANGLE RD / SAUGUS, CALIFORNIA 91350 / (805) 299-8184
 EL MONTE DIVISION / 1431 POTTERO AVENUE / SO. EL MONTE, CALIFORNIA 91733 / (213) 444-9811
 FULLERTON DIVISION / 1536 EAST VALENCIA / FULLERTON, CALIFORNIA 92631 / (714) 879-6110

CUSTOMER GENERAL ELECTRIC CO. MJO NO 5543-5737

PART NO 12250 NOD. NO 2

SERIAL NO 5026 P.O. NO. 40215

TEST PROCEDURE 3112130 PARAGRAPH: 4.4

REQUIREMENT: PERFORM VIBRATION IN THE X, Z & X.Y
AXES

DEVIATION: W/ 4 SINUS PERFORM SE-150X VIBRATION
IN THE X.Y AND Z & AXES.

DISPOSITION: PERFORM TEST IN THE X, Z & X.Y AXES
W/ 4 IN CLASH.

APPROVAL [Signature]
(Customer Representative)

CUSTOMER NOTIFICATION:

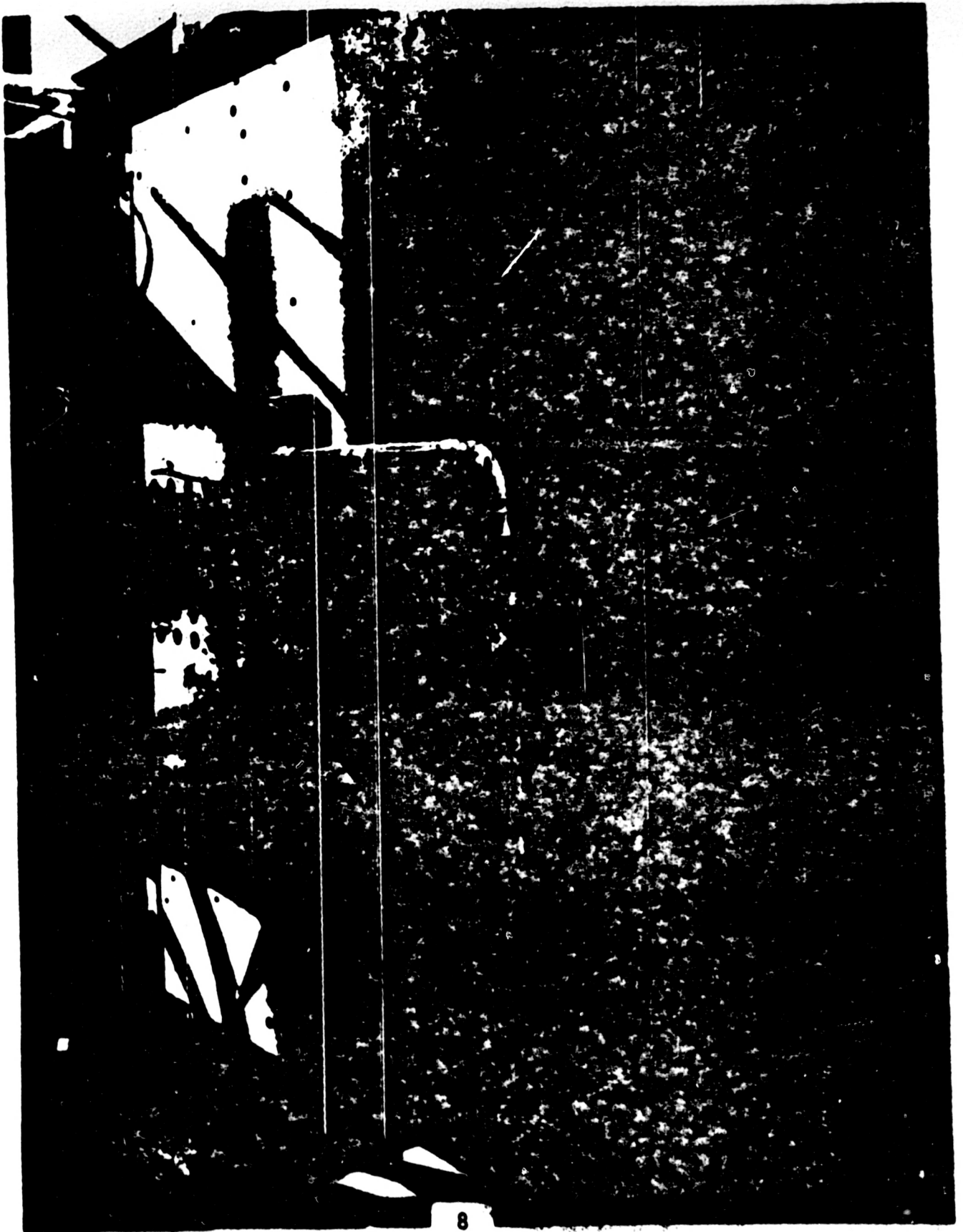
Made to GEN. ELECTRIC How RECEIVED

Date & Time 10/1/50 By [Signature]

CAS Notified YES NO NA DATE 7 A.E.T.L. Dept. Supervisor



REPORT NO. 548-8934
PHOTOGRAPH 1
SEISMIC TEST SETUP
X-Y AXIS



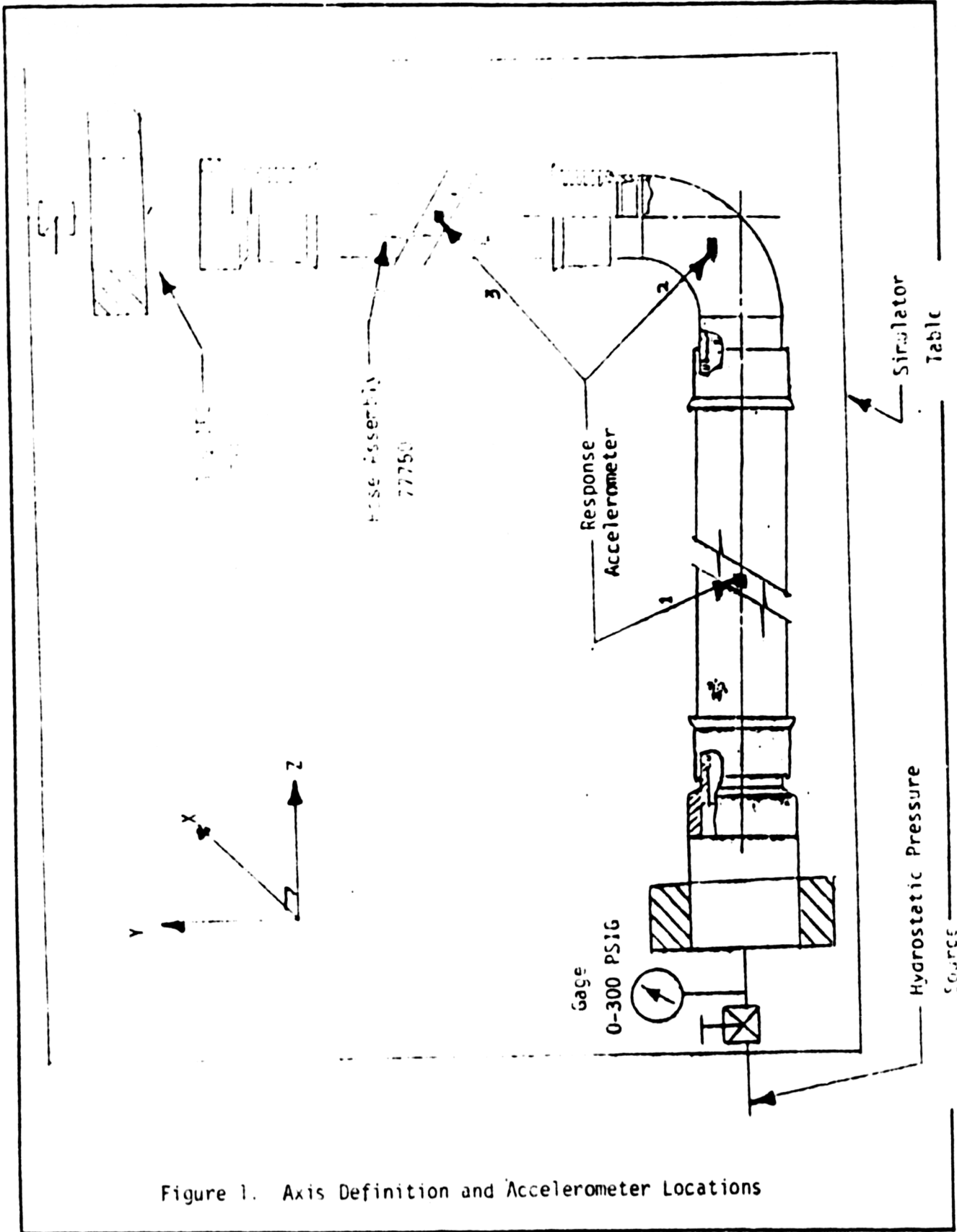


Figure 1. Axis Definition and Accelerometer Locations



EARTHQUAKE RESPONSE SPECTRA H_2O @ 8 psi
120 psi

SPECTRUM Horizontal

POLARITY +

DAMPING (ZETA) 2%

ANALYSIS BAND 1/12-octave

CUSTOMER Metal Bellows Corp

MJO 548-8934

ITEM Flex Metal

Hose Assembly

P/N 77750

S/N N/A

AXIS

PLOT NO.

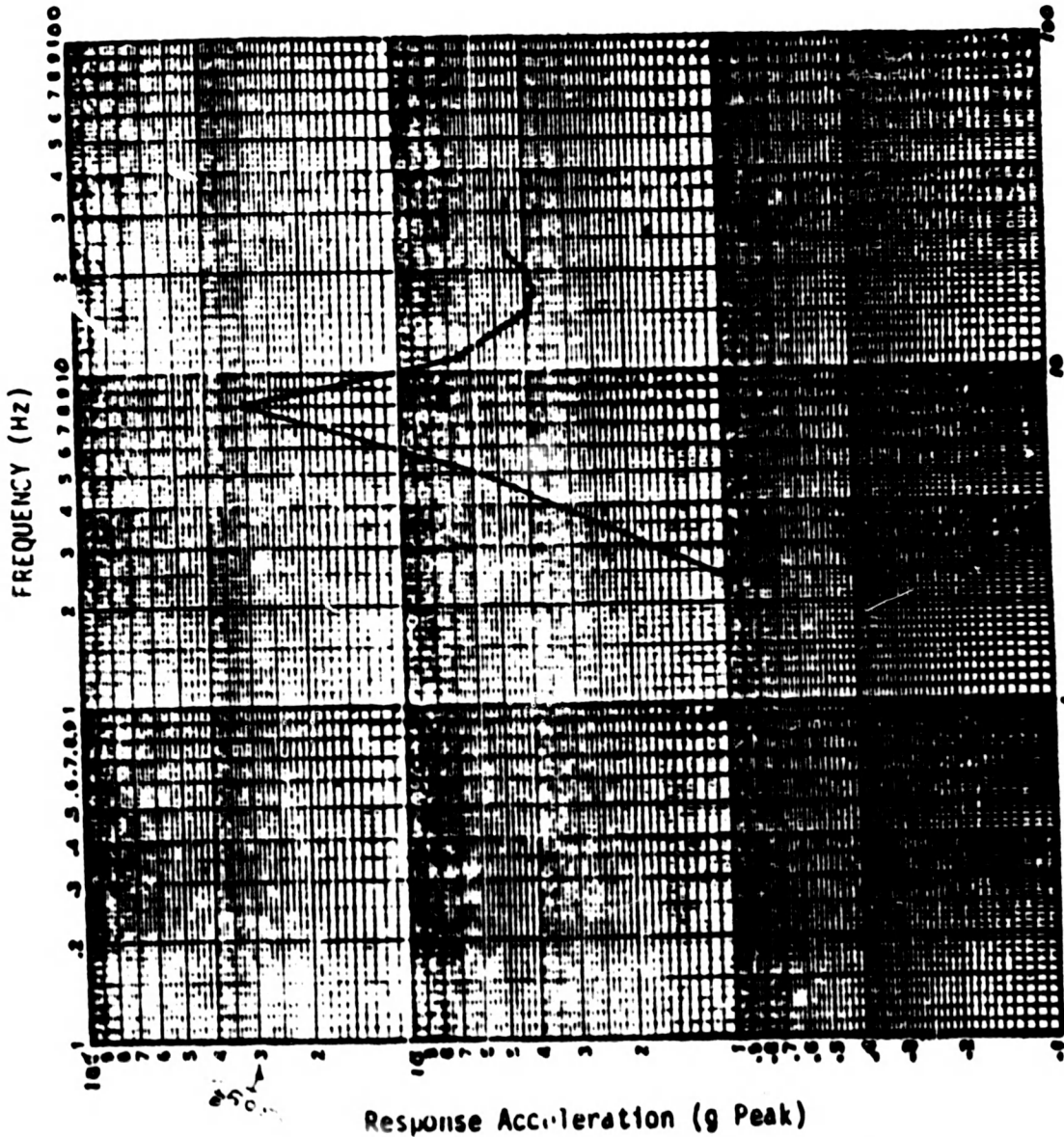


Figure 2. Required Response Spectrum (RRS)
Horizontal Axis

TIME

DATE

SIGNATURE



EARTHQUAKE RESPONSE SPECTRA $H_2O @ 0 \text{ psi}$ 120 psi

SPECTRUM: Vertical

POLARITY: +

DAMPING (ZETA): 2%

ANALYSIS BAND: 1/12-octave

CUSTOMER: Metal Bellows Corp

NO: 548-8934

ITEM: Flex Metal

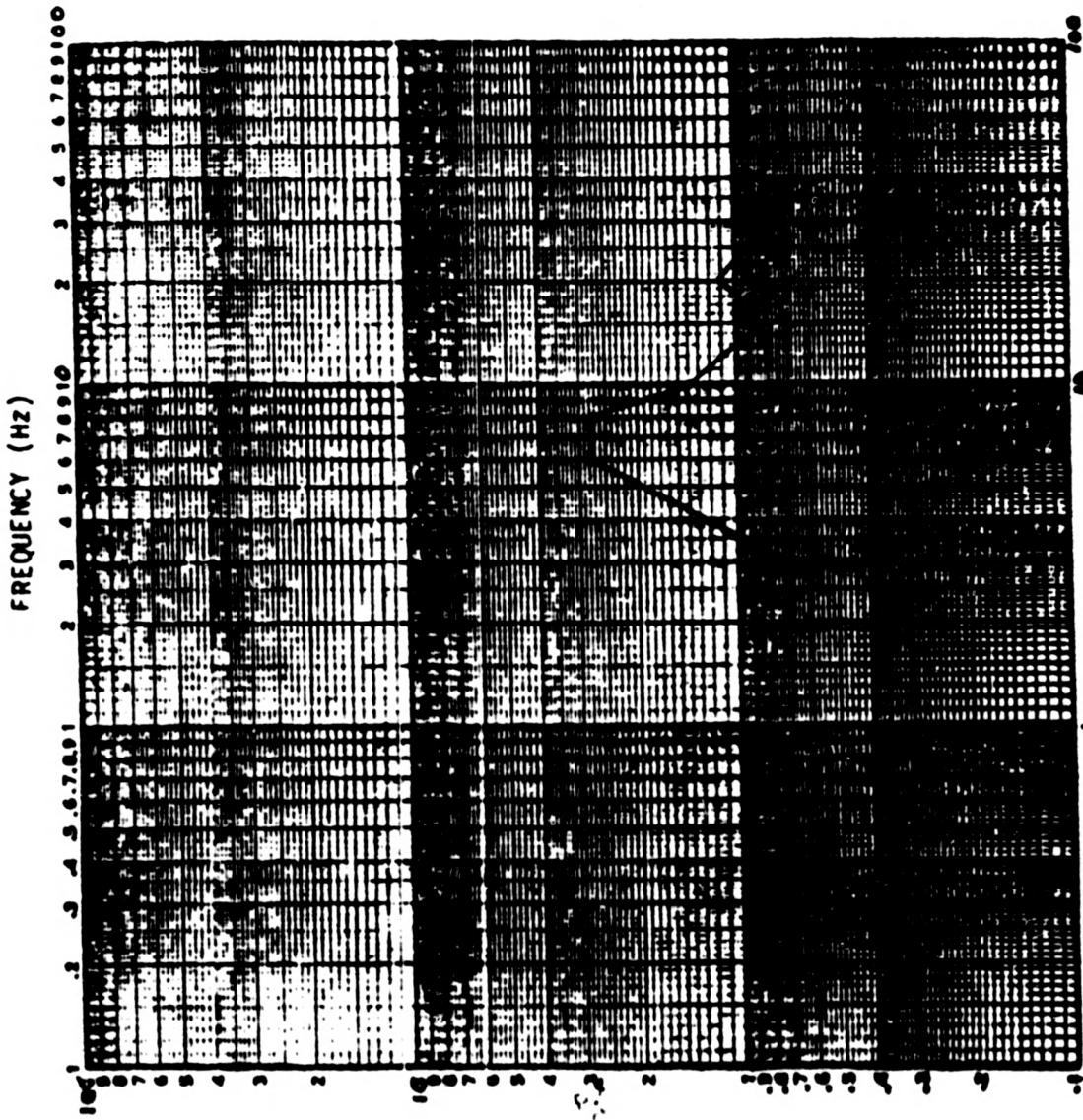
Hose Assembly

P/N: 77750

S/N: N/A

AXIS:

PLOT NO.:



Response Acceleration (g Peak)
Figure 3. Required Response Spectrum (RRS)
Vertical Axis

SIGNATURE _____ DATE _____ TIME _____



TABLE I
Resonance Scan Results

| <u>Axis</u> | <u>Accelerometer Position</u> | <u>Frequency (hz)</u> | <u>Control Input (g)</u> | <u>Table Response (g)</u> | <u>Specimen Response (g)</u> |
|-------------|-------------------------------|-----------------------|--------------------------|---------------------------|------------------------------|
| X | 1 | 40 | 1.0 | 2.0 | 8.0 |
| | 2 | 40 | 1.0 | 2.0 | 3.5 |
| | 1 | 95 | 1.0 | 4.0 | 10.0 |
| | 2 | 95 | 1.0 | 4.0 | 9.0 |
| | 3 | 95 | 1.0 | 4.0 | 9.0 |
| | Z | 1 | 55 | 1.0 | 6.0 |
| 2 | | 55 | 1.0 | 6.0 | 13.0 |
| 3 | | 55 | 1.0 | 6.0 | 4.0 |
| 1 | | 90 | 1.0 | 6.5 | 5.0 |
| 2 | | 90 | 1.0 | 6.5 | 14.5 |
| 3 | | 90 | 1.0 | 6.5 | 4.0 |

APPENDIX A

Test Equipment

Proof Pressure Test

| | |
|--------------------|-----------------------------|
| AETL Number | P571V |
| Instrument | Pressure Gauge |
| Manufacturer | Ashcroft |
| Model Number | 1373 |
| Serial Number | None |
| Calibration Period | 3 months (Cal due 12-23-80) |
| Range and Accuracy | 0 to 600 psi; $\pm 0.25\%$ |

Seismic Test

| | |
|--------------------|---|
| AETL Number | D748V |
| Instrument | X-Y Plotter |
| Manufacturer | F.L. Moseley Co. |
| Model Number | 135 A-02 |
| Serial Number | 531-00580 |
| Calibration Period | 6 months (Cal due 2-23-81) |
| Range and Accuracy | Input: 0 to 50 Vdc/inch in 16 ranges; Time sweeps (X axis only): 0 to 50 inch/sec in 7 ranges; $\pm 0.2\%$ full scale |

| | |
|--------------------|--|
| AETL Number | D752V |
| Instrument | Sweep Oscillator |
| Manufacturer | Spectral Dynamics Corp |
| Model Number | SD104A-5 |
| Serial Number | 91 |
| Calibration Period | 6 months (Cal due 2-16-81) |
| Range and Accuracy | 0.005 Hz to 50 kHz in 5 three decade ranges; $\pm 1\%$ |

| | |
|--------------------|---------------------------------------|
| AETL Number | D932V |
| Instrument | Servo Controller |
| Manufacturer | Shore Western Mfg. Co. |
| Model Number | SC1329C |
| Serial Number | N/A |
| Calibration Period | Prior to test |
| Range and Accuracy | 0 to 10" stroke; $\pm 5\%$ full scale |

| | |
|--------------------|----------------------------|
| AETL Number | D963V |
| Instrument | Tape Recorder |
| Manufacturer | Precision Instruments, Co. |
| Model Number | 2114 |
| Serial Number | 218 |
| Calibration Period | Prior to test |
| Range and Accuracy | dc to 20 kHz |
| Speed | Choice of 6 to 60 ips |



AETL Number D963V
Instrument Dynamic Analyzer
Manufacturer Spectral Dynamics Corp
Model Number SD-101A
Serial Number 372
Calibration Period 6 months (Cal due 3-8-81)
Range and Accuracy dc output: 40 dB; FSO output: 60 dB \pm 0.25 dB

AETL Number D991V
Instrument X-Y Display
Manufacturer Spectral Dynamics Corp
Model Number 13116
Serial Number 400
Calibration Period N/A
Type Cathode Ray Tube
Linearity 3%

AETL Number D992V
Instrument Shock Spectrum Analyzer
Manufacturer Spectral Dynamics Corp
Model Number 13231
Serial Number 21
Calibration Period 12 months (Cal due 3-26-81)
Resolution 0 to 100 V

AETL Number D993V
Instrument Transient Memory
Manufacturer Spectral Dynamics Corp
Model Number 13192
Serial Number 24
Calibration Period 12 months (Cal due 3-26-81)



AETL Number D994S
Instrument Oscillograph, Visicorder
Manufacturer Honeywell, Inc.
Model Number 1108-206780HK00
Serial Number 11-1085
Calibration Period Prior to use
Range Depends on galvos used
Chart Speed 80 inches/sec
Timing Marks 1.0 sec to 0.01 sec

AETL Number D1022V
Instrument Amplitude Servo Monitor
Manufacturer Spectral Dynamics Corp
Model Number SD 105-C-1
Serial Number 627
Calibration Period 6 months (Cal due 11-18-80)
Range and Accuracy 1 to 10 kHz in 2 ranges; $\pm 4\%$

AETL Number D1051V
Instrument Charge and Voltage Amplifier
Manufacturer Unholtz-Dickie Corp
Model Number 8 PNCV
Serial Number None
Calibration Period 6 Months (Cal due 12-13-80)
Range and Accuracy 0 to 1000 g in 7 ranges; output voltage: $\pm 1\%$,
meter: $\pm 2\%$

AETL Number D1052V
Instrument Charge and Voltage Amplifier
Manufacturer Unholtz-Dickie Corp
Model Number 8 PNCV
Serial Number None
Calibration Period 6 months (Cal due 12-13-80)
0 to 1000 g in 7 ranges; output voltage: $\pm 1\%$,
meter: $\pm 2\%$



AETL Number D1053V
Instrument Charge and Voltage Amplifier
Manufacturer Unholtz-Dickie Corp
Model Number 8 P1CV
Serial Number None
Calibration Period 6 months (Cal due 12-13-80)
0 to 100C g in 7 ranges; output voltage: $\pm 1\%$,
meter; $\pm 2\%$

AETL Number D1060Y
Instrument Accelerometer
Manufacturer B&K Instruments
Model Number 4335
Serial Number 176502
Calibration Period 6 months (Cal due 3-29-81)
2 to 7000 Hz; $\pm 5\%$

AETL Number D1061V
Instrument Accelerometer
Manufacturer B&K Instruments
Model Number 4335
Serial Number 176520
Calibration Period 6 months (Cal due 3-29-81)
2 to 7000 Hz; $\pm 5\%$

AETL Number D1062V
Instrument Accelerometer
Manufacturer B&K Instruments
Model Number 4335
Serial Number 176529
Calibration Period 6 months (Cal due 3-29-81)
2 to 7000 Hz; $\pm 5\%$



ALI Number D1071V
Instrument Seismic Signal Synthesizer
Manufacturer Bird Enterprises
Model Number None
Serial Number 102
Calibration Period Prior to test
Range 0.92 to 32 Hz
Bandwidth 1/6-octave

AETL Number D1078V
Instrument Seismic Signal Synthesizer
Manufacturer Bird Enterprises
Model Number None
Serial Number 103
Calibration Period Prior to Test
Range and Accuracy 1/6-octave

AETL Number D1081V
Instrument Vibration Exciter Calibration System
Manufacturer MB Electronics
Model Number C11C
Serial Number 44C
Calibration Period Prior to test
0 to 2000 Hz; $\pm 1\%$

AETL Number D1108V
Instrument Accelerometer
Manufacturer Endevco Corp
Model Number 2262-25
Serial Number EB34
Calibration Period 6 months (Cal due 3-30-81)
Range and Accuracy ± 25 g
Excitation Voltage 10 Vdc
Type Full bridge piezoresistive



AETL Number D1113V
Instrument Servo Controller
Manufacturer Akashi Seisakusho, Ltd.
Model Number SC-1
Serial Number 0110
Calibration Period Prior to use
dc to 1 kHz; ± 3 dB

AETL Number D1193V
Instrument Accelerometer
Manufacturer Endevco Corp
Model Number 2262-25
Serial Number HE75H
Calibration Period 6 months (Cal due 3-30-81)
Range and Accuracy ± 25 g
Excitation Voltage 10 Vdc
Type Full bridge piezoresistive

AETL Number E1164V
Instrument Galvanometer-Driver Amplifier: 7 Channel
Manufacturer Consolidated Electrodynamics Corp
Model Number Type 1-162A
Serial Number 801
Calibration Period Prior to test
Range and Accuracy dc to 10 kHz
Gain 0 to 2.5
Output Voltage ± 3.6 volts, 65 mA

AETL Number E1177V
Instrument Oscilloscope
Manufacturer Tektronix, Inc.
Model Number T922
Serial Number B010331
Calibration Period 6 months (Cal due 2-23-81)
Range and Accuracy Depends on Plug-ins used



AETL Number E1180V
Instrument Wide Range Oscillator
Manufacturer Hewlett-Packard
Model Number 20000
Serial Number 4464
Calibration Period 6 months (Cal due 2-11-81)
Range and Accuracy 5 Hz to 600 kHz in 5 overlapping decades; $\pm 2\%$

AETL Number E1195V
Instrument Differential Instrumentation Amplifier
Manufacturer Trig-Tek, Inc.
Model Number 205A
Serial Number 106
Calibration Period N/A

AETL Number E1198V
Instrument Digital Multimeter
Manufacturer Micronta
Model Number Cat. No. 22-198
Serial Number 7AB
Calibration Period For indication only
0 to 1000 Vdc in 4 ranges; 0 to 500 Vac in 4 ranges,
0 to 200 mA in 3 ranges, 0 to 20 mohm in 6 ranges

AETL Number E1219V
Instrument Bridge Balance
Manufacturer Calico
Model Number X1101
Serial Number None
Calibration Period N/A
Type Bridge Type



AETL Number E1353S
Instrument Signal Conditioner
Manufacturer Calico
Model Number X1101
Serial Number None
Calibration Period N/A
Type Bridge Type

AETL Number G614V
Instrument Closed Circuit Television Camera
Manufacturer Panasonic
Model Number WV-401
Serial Number 774646
Calibration Period N/A
Resolution 500 lines at center
Aperature F1.6
Focal Length 16 mm

AETL Number G617V
Instrument Video Monitor
Manufacturer Panasonic
Model Number WV-411
Serial Number 770849
Calibration Period N/A
Size 9-inch
Resolution 500 lines at center
Channels 3

AETL Number G613V
Instrument Remote Control Box
Manufacturer Panasonic
Model Number WV-433
Serial Number 6Y0002
Calibration Period N/A
Channels 3
Special Features Controls Panning Head



APPROVED ENGINEERING TEST LABORATORIES
AETL

Report No. 548-8934

| | |
|---------------|--------------------|
| AETL Number | GC19V |
| Instrument | Pan Head |
| Manufacturer | Panasonic |
| Model Number | WV-431 |
| Serial Number | 680060 |
| Range | 300° Panning Angle |

APPENDIX B

TRS Plots



EARTHQUAKE RESPONSE
SPECTRA-H20R Gps.i
120psi

SPECTRUM Vertical

POLARITY +

DAMPING (ZETA)
0.5

ANALYSIS BAND
1/12 octave

CUSTOMER
Metal Bellows Corp.

NO
548-8934

ITEM
Hose Assy. Flex Metal

P/N 77750

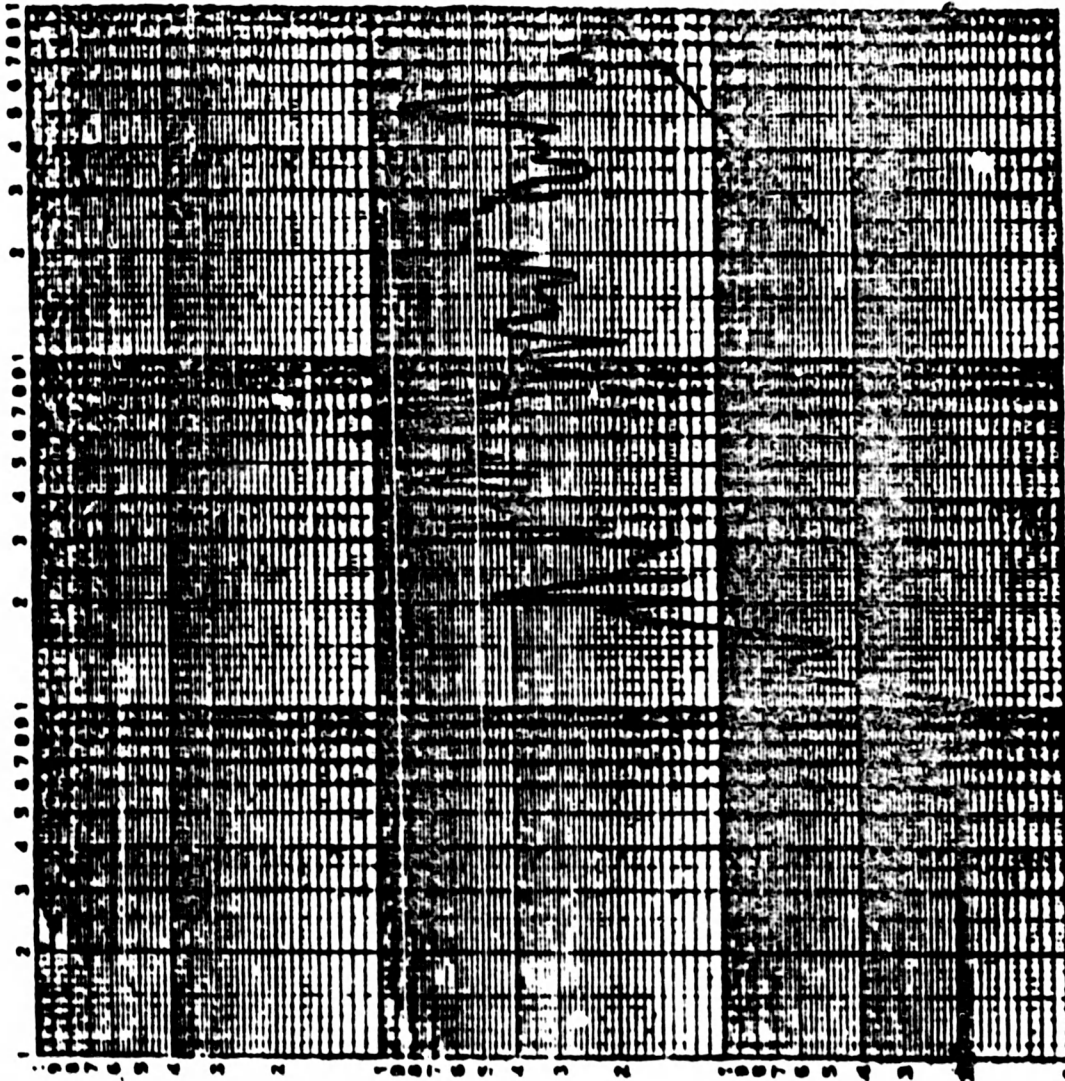
S/N

AXIS EQUALIZATION

DATE 10/20/80

TIME 13:58

PLOT NO.



Response Acceleration (g Peak)

FREQUENCY (HZ)

SIGNATURE M.A. Pigoon



EARTHQUAKE RESPONSE
SPECTRA $\pm 20\%$ Opsl
20psi

SPECTRUM Vertical

POLARITY +

DAMPING (ZETA) 1

ANALYSIS BAND
1/12 octave

CUSTOMER
Metal Bellows Corp.

NO 548-8934

ITEM
Hose Assy. Flex Metal

P/N 77750

S/N

AXIS ORIENTATION

DATE 12/20/80

TIME 14:00

PLOT NO.



Response Acceleration (g Peak)

FREQUENCY (HZ)

SIGNATURE *M.A. Flynn*



EARTHQUAKE RESPONSE
SPECTRA- H200 Ops
120psi

SPECTRUM Vertical

POLARITY +

DAMPING (ZETA)
2%

ANALYSIS BAND
1/12 octave

CUSTOMER
Metal Bellows Corp.

WJO
548-8934

ITEM
Hose Assy., Flex Metal

P/N 77750

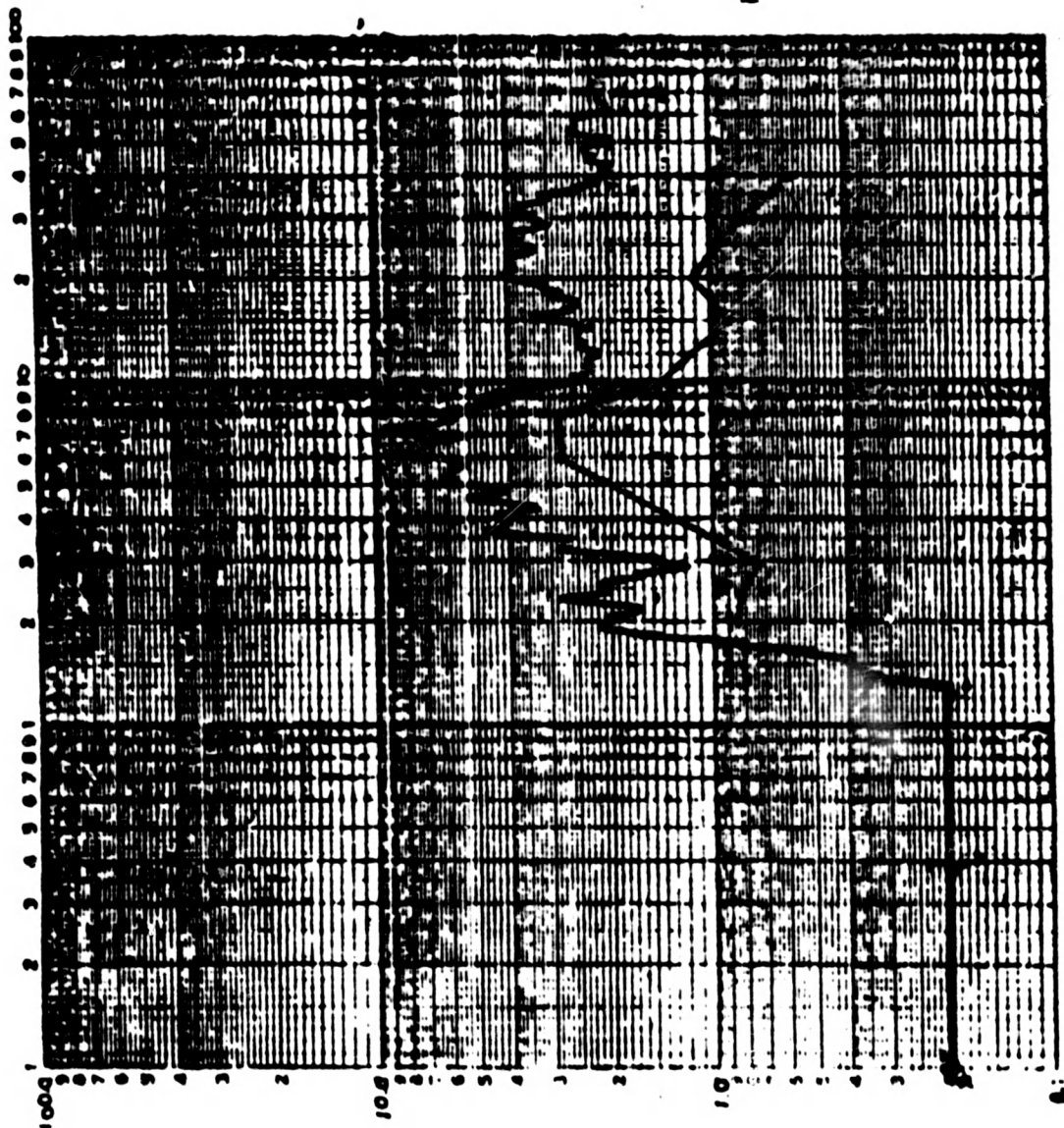
S/N _____

AXIS Vertical

DATE 10/20/80

TIME 13:53

PLOT NO. _____



Response Acceleration (g Peak)

FREQUENCY (HZ)

SIGNATURE M. A. Pilgauer



EARTHQUAKE RESPONSE
SPECTRA-HZOR 00s1
120psi

SPECTRUM Vertical

POLARITY +

DAMPING (ZETA) 5

ANALYSIS BAND
1/12 octave

CUSTOMER
Metal Bellows Corp.

NO 548-8934

ITEM
Hose Assy. Flex Metal

P/N 77750

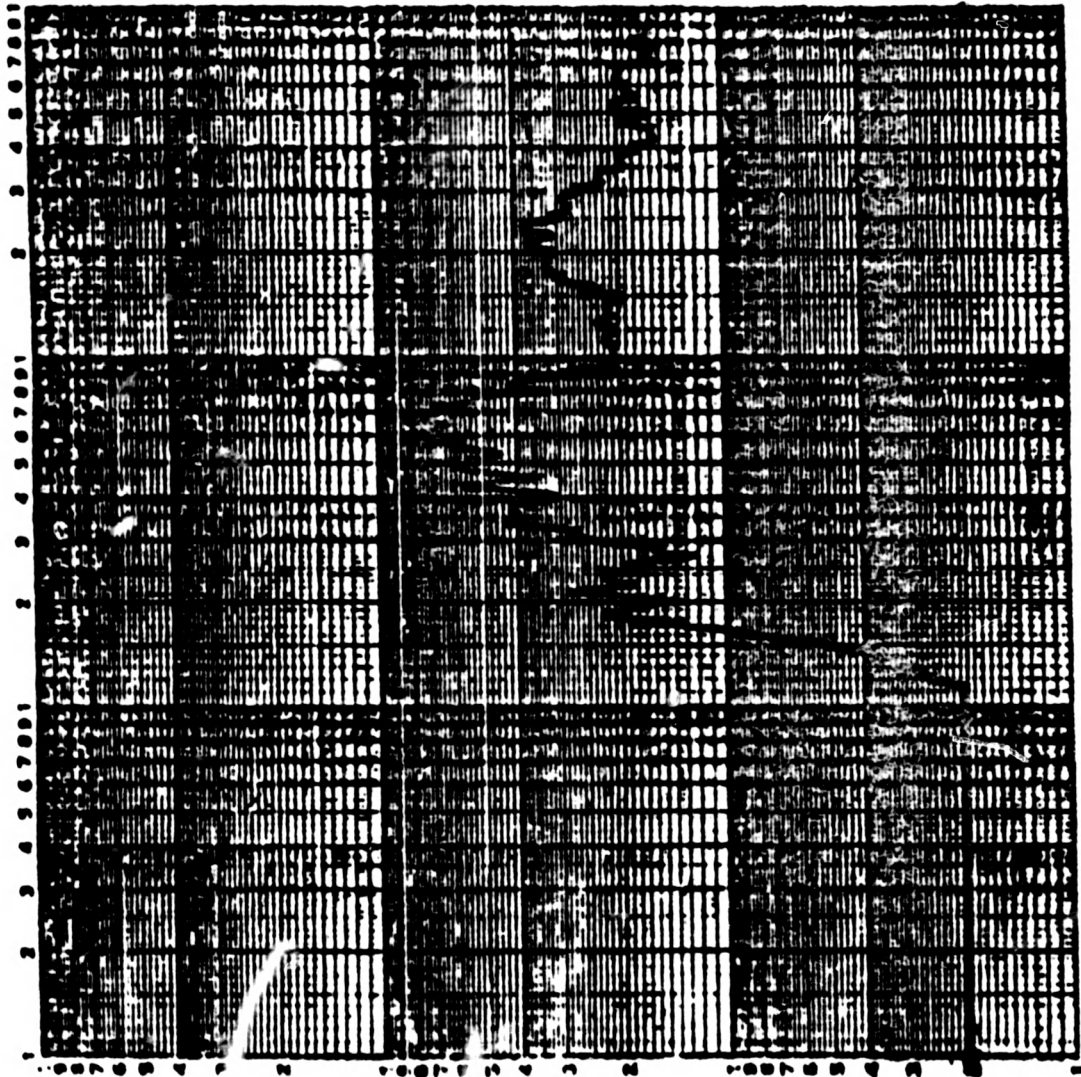
S/N _____

AXIS Vertical

DATE 10/20/80

TIME 14:02

PLOT NO. _____



Response Acceleration (g Peak)

FREQUENCY (HZ)

SIGNATURE M.A. Palaganov



EARTHQUAKE RESPONSE
SPECTRA: H20R Ops1
120PSY

SPECTRUM Horizontal

POLARITY +

DAMPING (ZETA) .5

ANALYSIS BAND
8/12 octave

CUSTOMER
Metal Bellows Corp.

NO. 548-8934

ITEM
Hose Assy, Flex Metal

P/N J7750

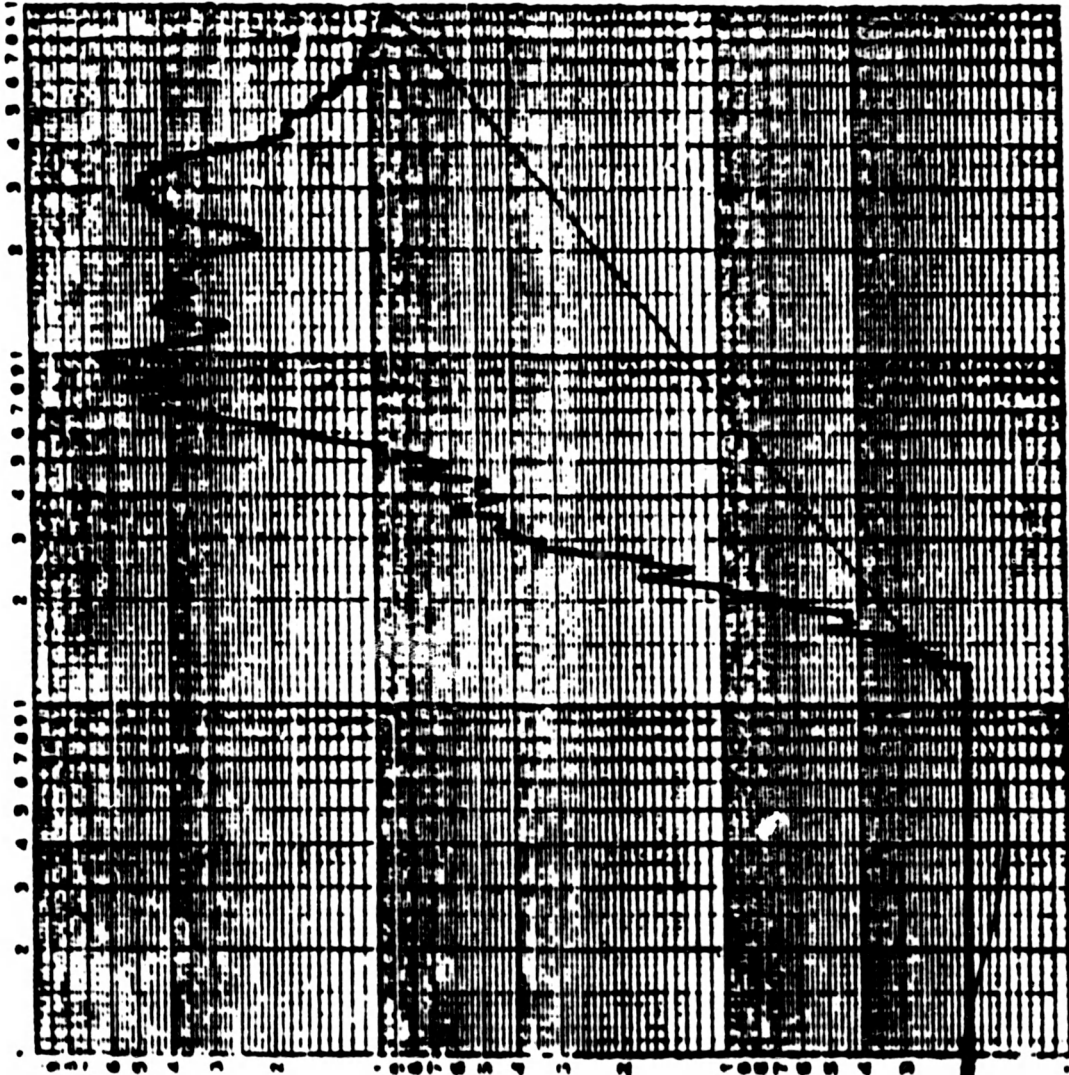
S/N

AXIS Equi.

DATE 10/20/80

TIME

PLOT NO.



Response Acceleration (g Peak)

FREQUENCY (HZ)

SIGNATURE *M.O. Palgocan*



EARTHQUAKE RESPONSE
SPECTRA-H209 0D51
120psi

SPECTRUM Horizontal

POLARITY +

DAMPING (ZETA)
1.76

ANALYSIS BAND
1/12 octave

TESTER
Metal Buildings Corp.

NO
548-8934

ITEM
Hose Assy, Flex Metal

P/N 77750

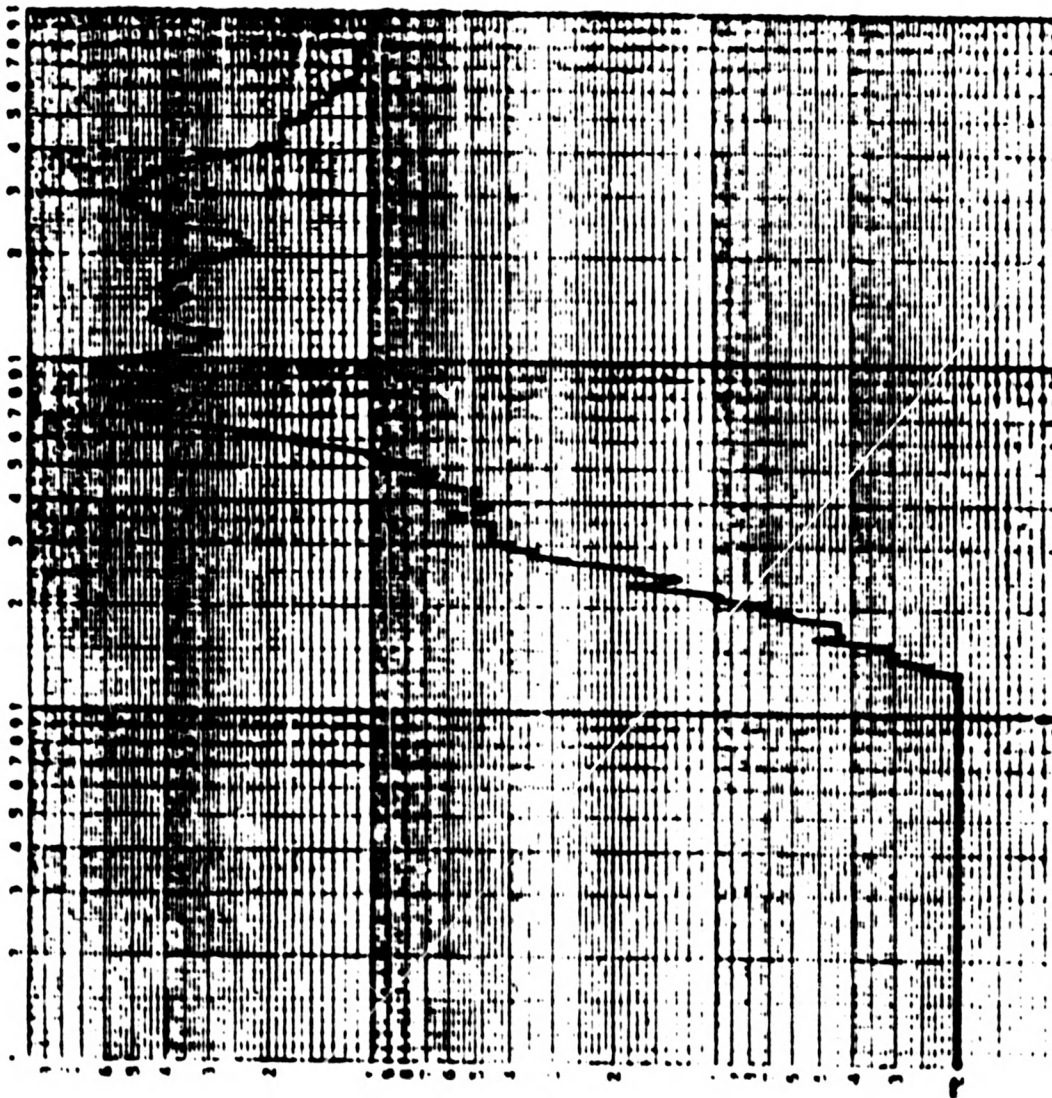
S/N

AXIS Equal

DATE 10/20/80

TIME

PLOT NO.



Response Acceleration (g Peak)

FREQUENCY (HZ)

SIGNATURE *M. A. Pilgosa*



EARTHQUAKE RESPONSE
SPECTRA-H200 0051
120psi

SPECTRUM Horizontal

POLARITY +

DAMPING (ZETA) $\frac{2}{3}$

ANALYSIS BAND
1/12 octave

CUSTOMER
Metal Bellows Corp.

NO
548-8934

ITEM
Hose Assy., Flex Meta

P/N 77750

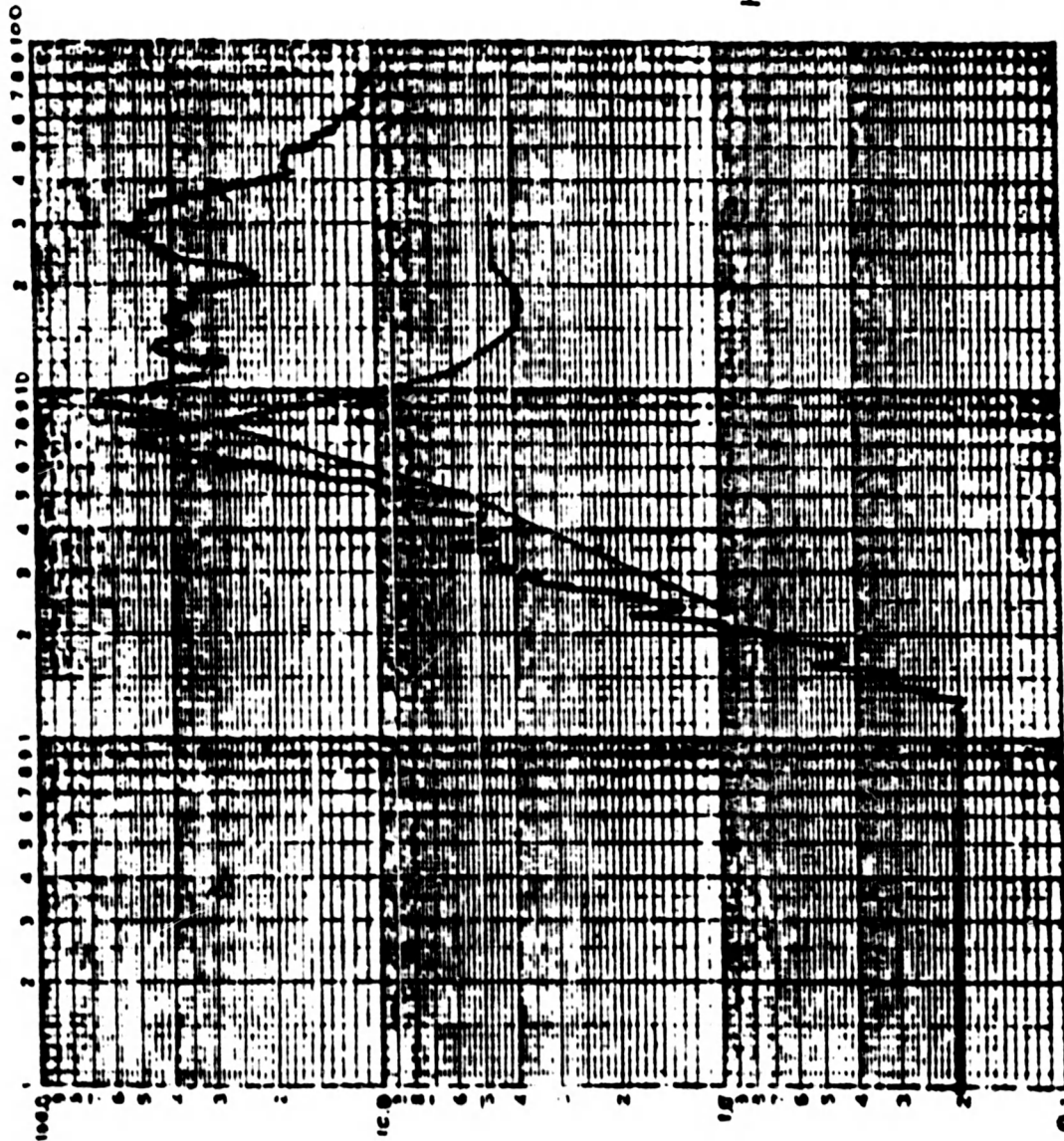
S/N

AXIS Eqv.

DATE 10/20/80

TIME 14:26

PLOT NO.



Response Acceleration (g Peak)

FREQUENCY (HZ)

SIGNATURE *M.A. Pilgannon*



EARTHQUAKE RESPONSE
SPECTRA-H200 Ops1
120psi

SPECTRUM Horizontal

POLARITY +

DAMPING (ZETA) $\frac{5}{8}$

ANALYSIS BAND
 $\frac{1}{12}$ octave

CUSTOMER
Metal Bellows Corp.

NO 548-8934

ITEM
Hose Assy, Flex Metal

P/N 77750

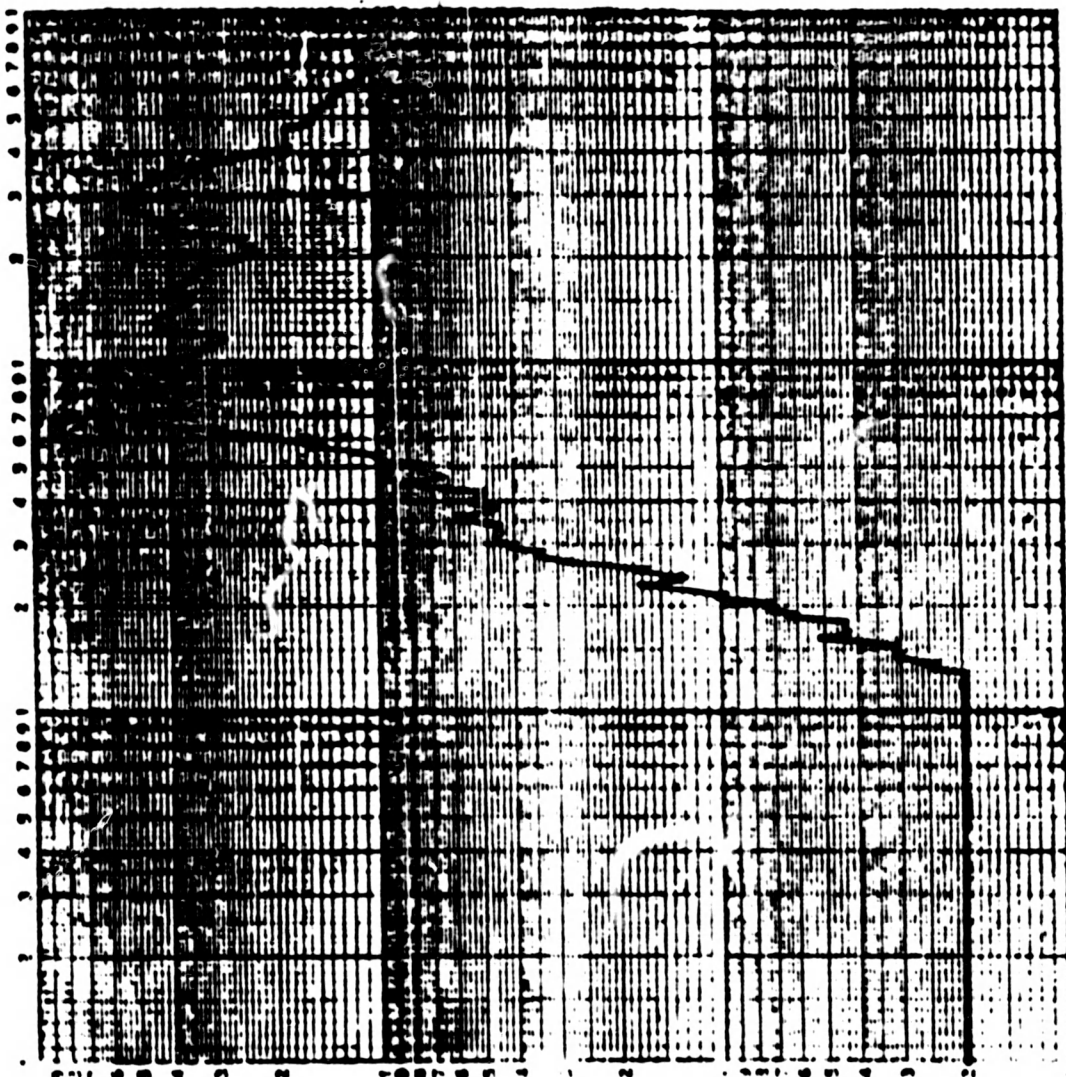
S/N

AXIS Equal

DATE 10/20/80

TIME

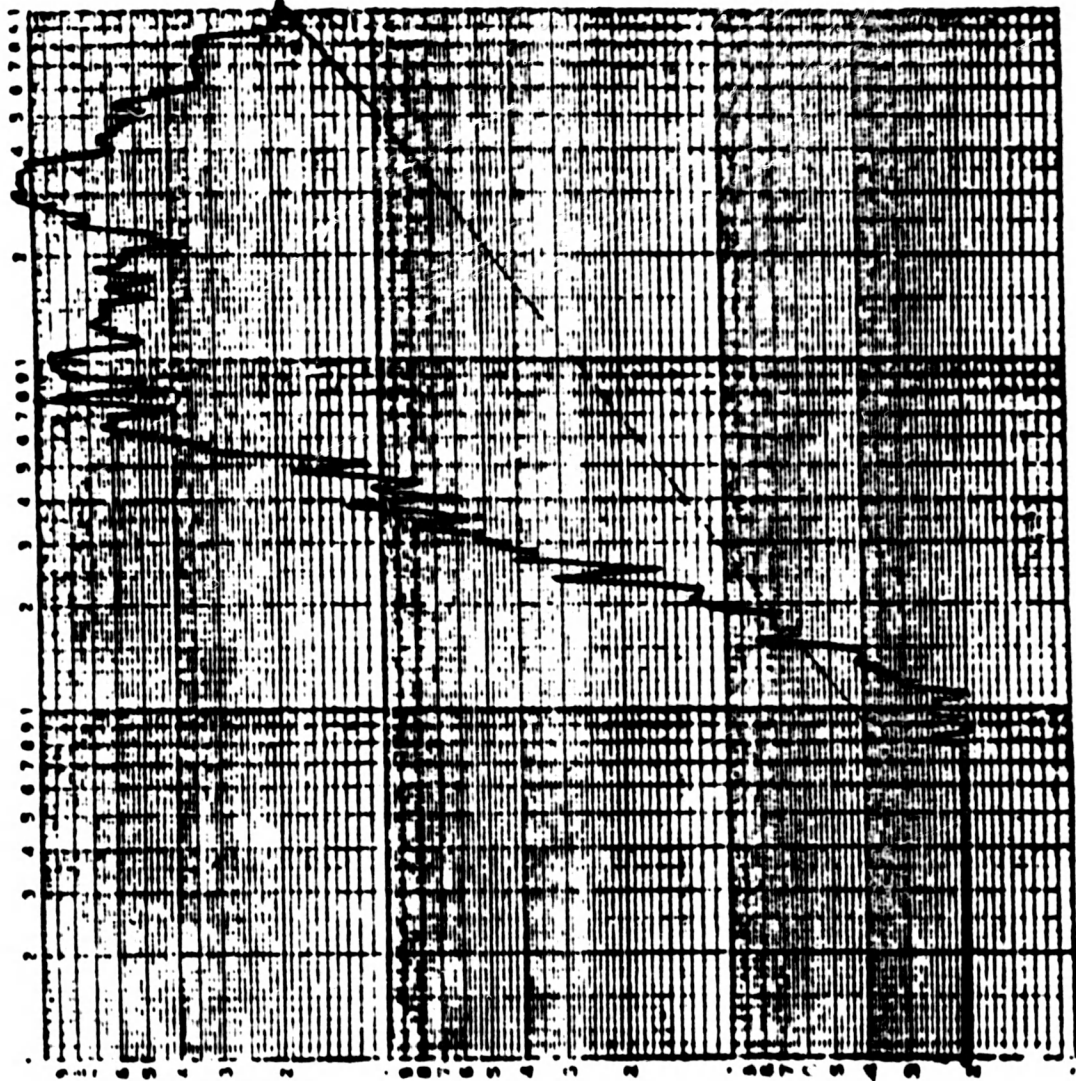
PLOT NO.



Response Acceleration (g Peak)

FREQUENCY (HZ)

SIGNATURE M.A. Pilgoman



Response Acceleration (g Peak)

EARTHQUAKE RESPONSE
SPECTRUM 0.20g 0.05g
12000

SPECTRUM MOORE

POLARITY +

DAMPING 5%

ANALYSIS BAND
1/12 OCTAVE

CUSTOMER
Metal Buildings Corp.

NO. 548-8934

SYSTEM
Hose Assy, Flex Metal

P/N 27750

S/N QUINL UNIT

AXIS X-Z

DATE 12/15/52

TIME 1:30

PLOT NO. 1

FREQUENCY (HZ)

SIGNATURE M.A. Pilegan



EARTHQUAKE RESPONSE
SPECTRA HORIZONTAL
OPD
120PST

SPECTRUM Horizontal

POLARITY +

DAMPING (ZETA)
1/20

ANALYSIS BAND
1/12 octave

CUSTOMER
Metal Bellows Corp.

WJO
548-8934

ITEM
Hose Assy, Flex Metal

P/N 77750

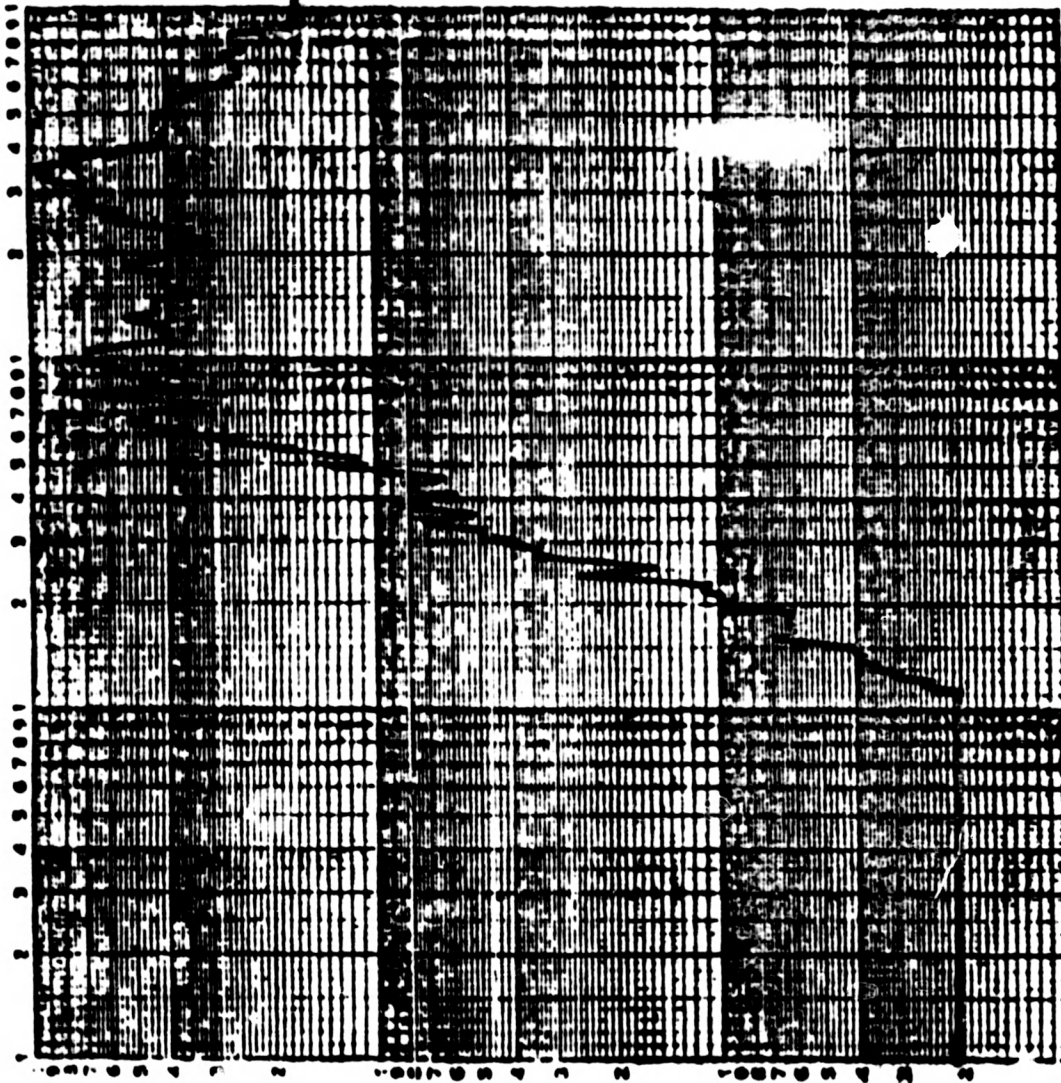
S/P QUILIMIT

AXIS XZ

DATE 10/20/80

TIME 10:15

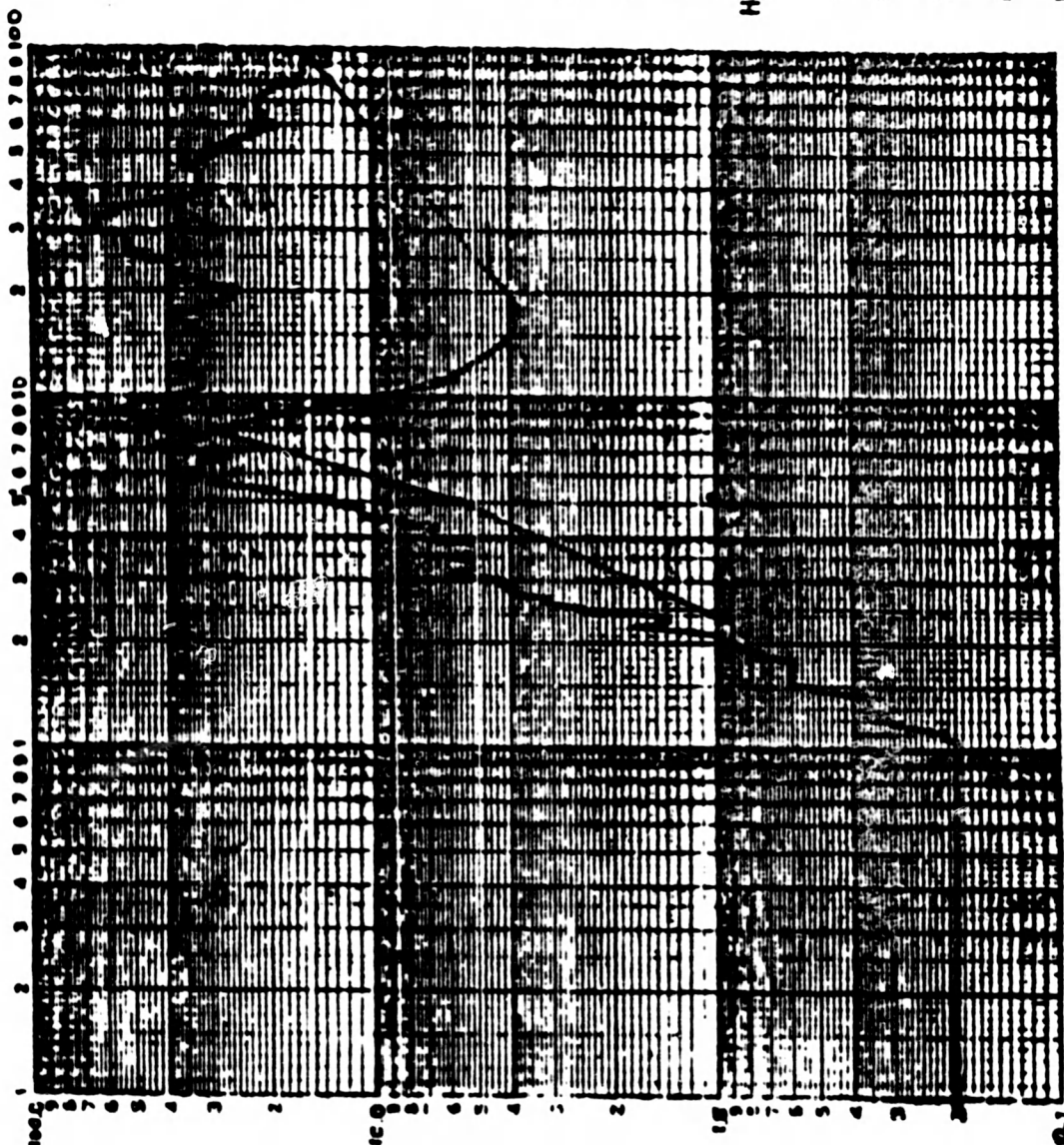
PLOT NO. _____



Response Acceleration (g Peak)

FREQUENCY (HZ)

SIGNATURE M. R. Pilgram



Response Acceleration (g Peak)

EARTHQUAKE RESPONSE
SPECTRA-H200 (psi)
120psi

SPECTRUM Horizontal

POLARITY +

DAMPING (ZETA) 2%

ANALYSIS BAND 1/12 octave

CUSTOMER Metal Bellows Corp.

WJO 548-8934

ITEM Hose Assy., Flex Meta

P/N 77750

S/M Qual Unit

AXIS XZ

DATE 11/21/50

TIME 1015

PLOT NO.

FREQUENCY (HZ)

SIGNATURE *M.J. Pileganov*



EARTHQUAKE RESPONSE
SPECTRA H2000opsi
120psi

SPECTRUM Horizontal

POLARITY +

DAMPING (ZETA) $\frac{2}{\%}$

ANALYSIS BAND
1/12 octave

CUSTOMER
Metal Bellows Corp.

NO. 548-8934

ITEM
Hose Assy, Flex Metal

P/N 11150

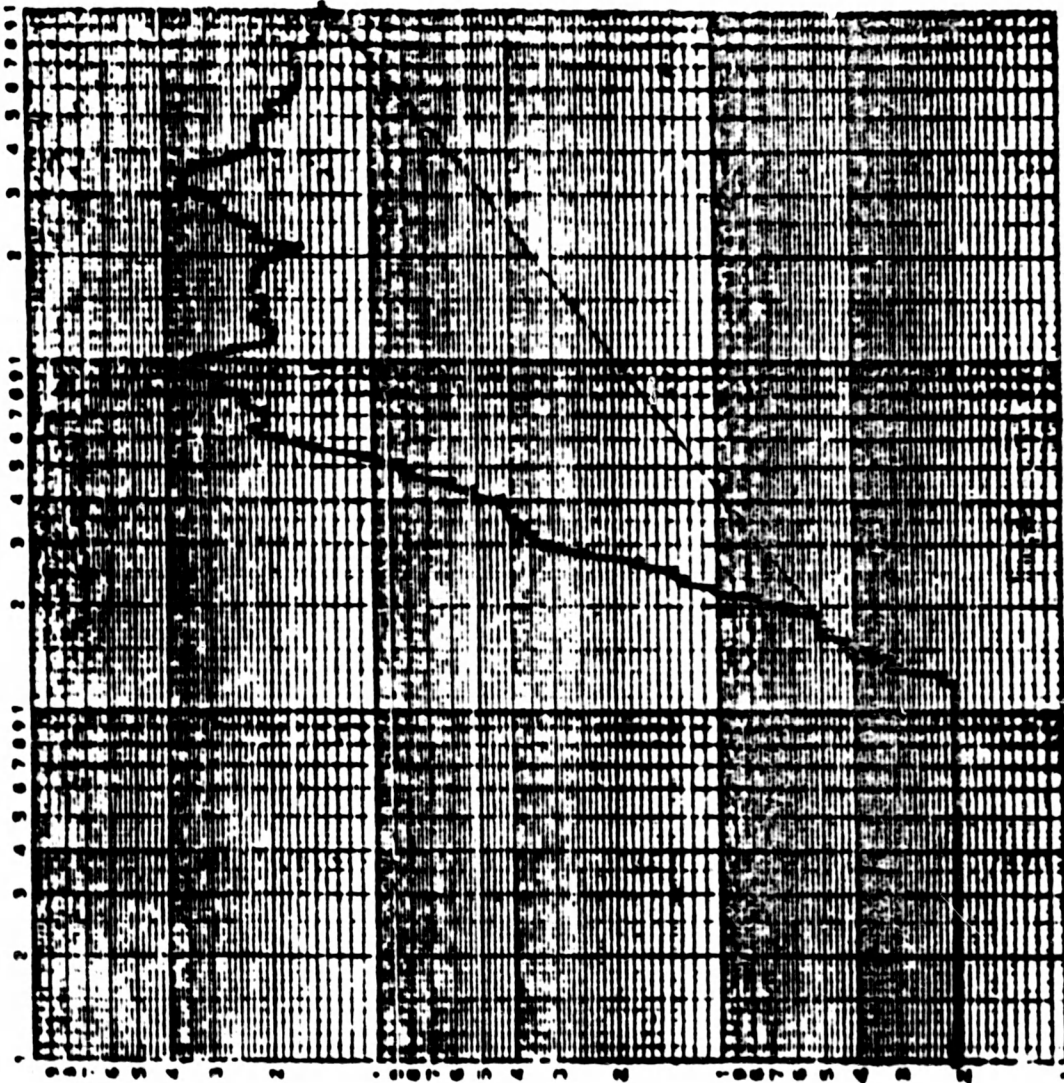
SIN Qual. Unit

AXIS XZ

DATE 10/20

TIME 1:15

PLOT NO.



Response Acceleration (g Peak)

FREQUENCY (HZ)

SIGNATURE M. A. Palgocny



EARTHQUAKE RESPONSE
SPECTRA - 2000
12/25/80

SPECTRUM Versica

POLARITY +

DAMPING (ZETA) 0.5

ANALYSIS BAND 1/12 OCTAVE

CUSTOMER Metal Bellows Corp.

NO 548-8934

ITEM Hose Assy, Flex Metal

P/N 77750

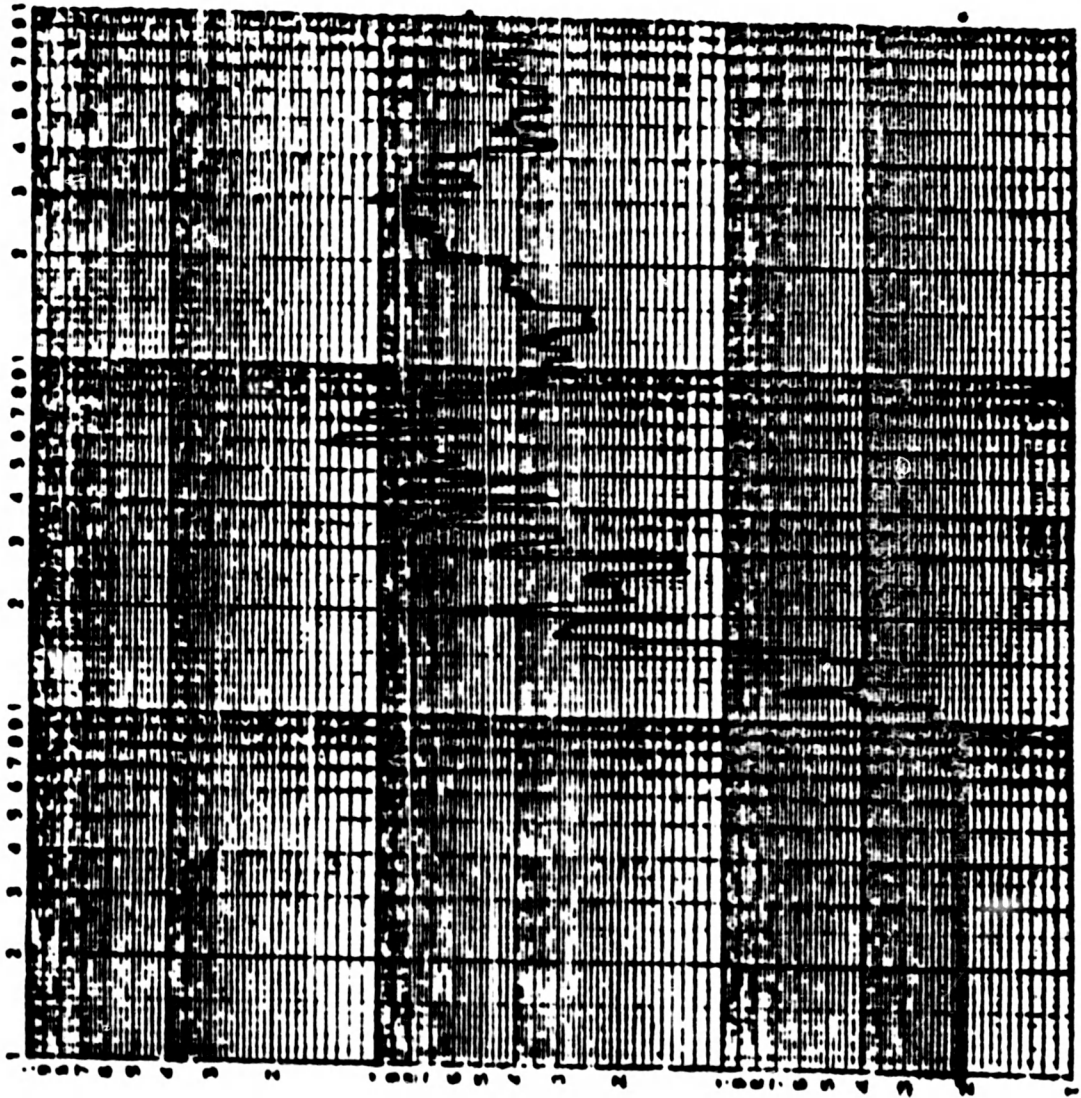
S/N 77750

AXIS X-Y

DATE 10/21/80

TIME 10:07

PLOT NO.



Response Acceleration (g Peak)

FREQUENCY (HZ)

SIGNATURE *M.A. Filippov*



EARTHQUAKE RESPONSE
SPECTRA - 2000

SPECTRUM Vertical

POLARITY +

DAMPING (ZETA) 1.90

ANALYSIS BAND
1000-10000

CUSTOMER
Metal Editions Corp.

QJO
54E-8936

ITEM
Hose Assy, Flex Metal

P/N 77750

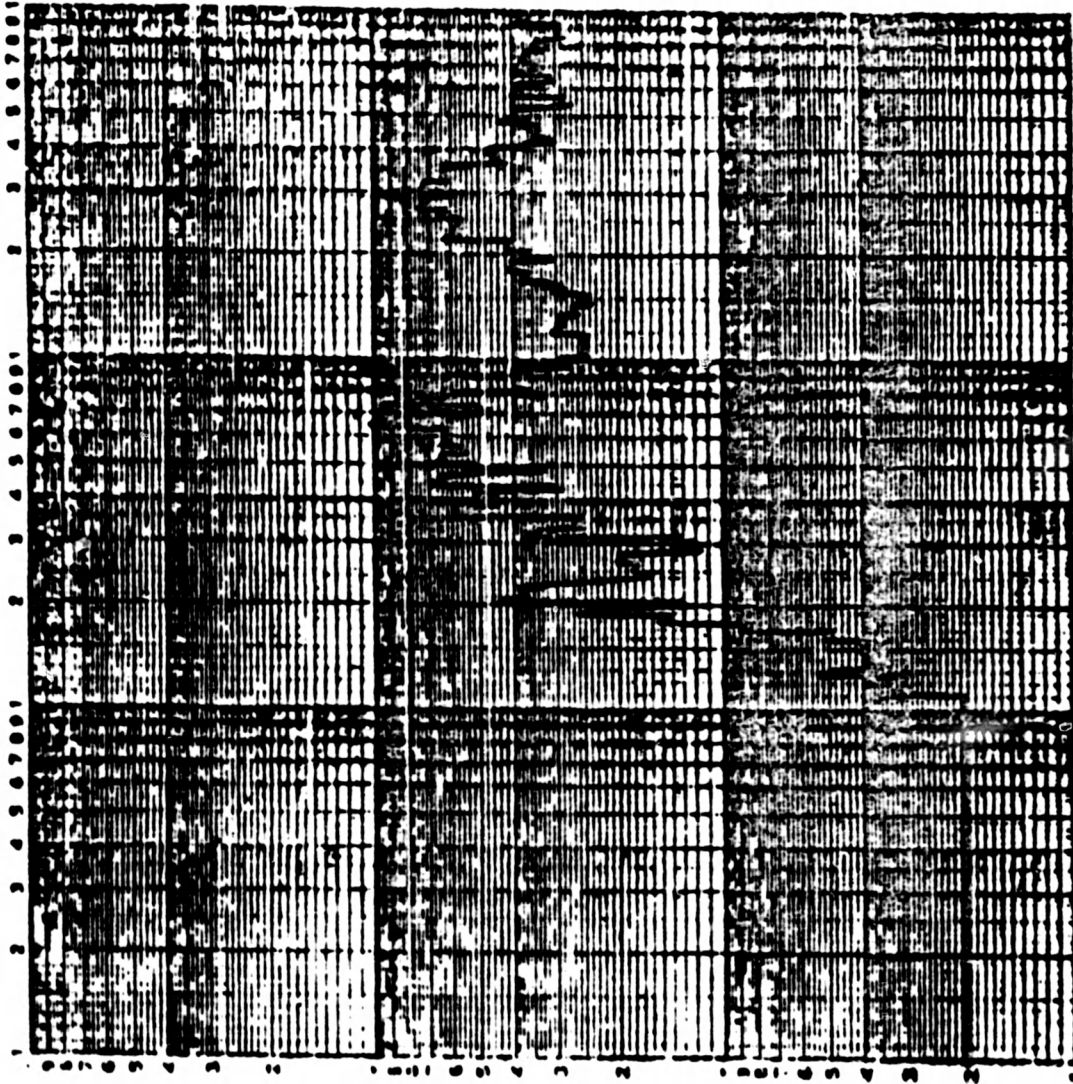
S/N 77750

AXIS X-Z

DATE 10/21/80

TIME 10:07

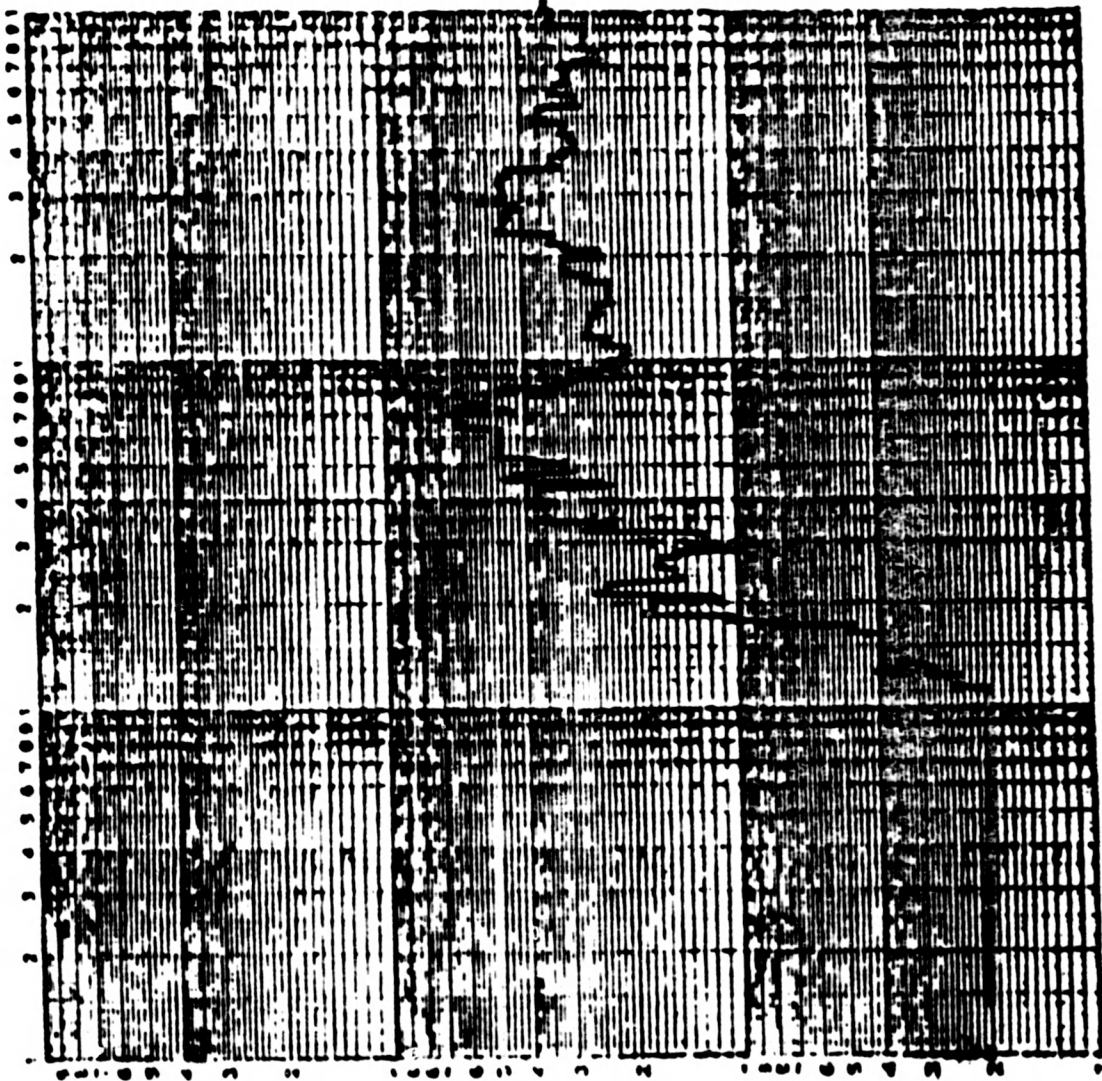
PLOT NO. _____



FREQUENCY (HZ)

SIGNATURE M. A. Polysarn

Response Acceleration (g Peak)



Response Acceleration (g Peak)

PART NO. _____
 SPEC. NO. _____
 QUANTITY _____
 DAMPING _____
 ANAL. VIB. ENV. _____
 CUSTOMER _____
 MFG. REGION _____
 MJC _____
 545-8534
 ITEM _____
 HOSE ASSY. FIB. MESH _____
 P/N 77750
 S/N 77750
 AXIS X-Z
 DATE AXIS
 TIME 10:07
 PLOT NO. _____

FREQUENCY (HZ)

SIGNATURE *M.R. Pijpood*



LABORATORY
SPECTROSCOPE

SPECTRUM

AMPLITUDE +

DAMPING 5%

ANALYSIS BAND
100-2000

CUSTOMER
Metal Ballroom Corp.

NO. 548-8934

ITEM
Hose Assy. Field Meter

P/N 77750

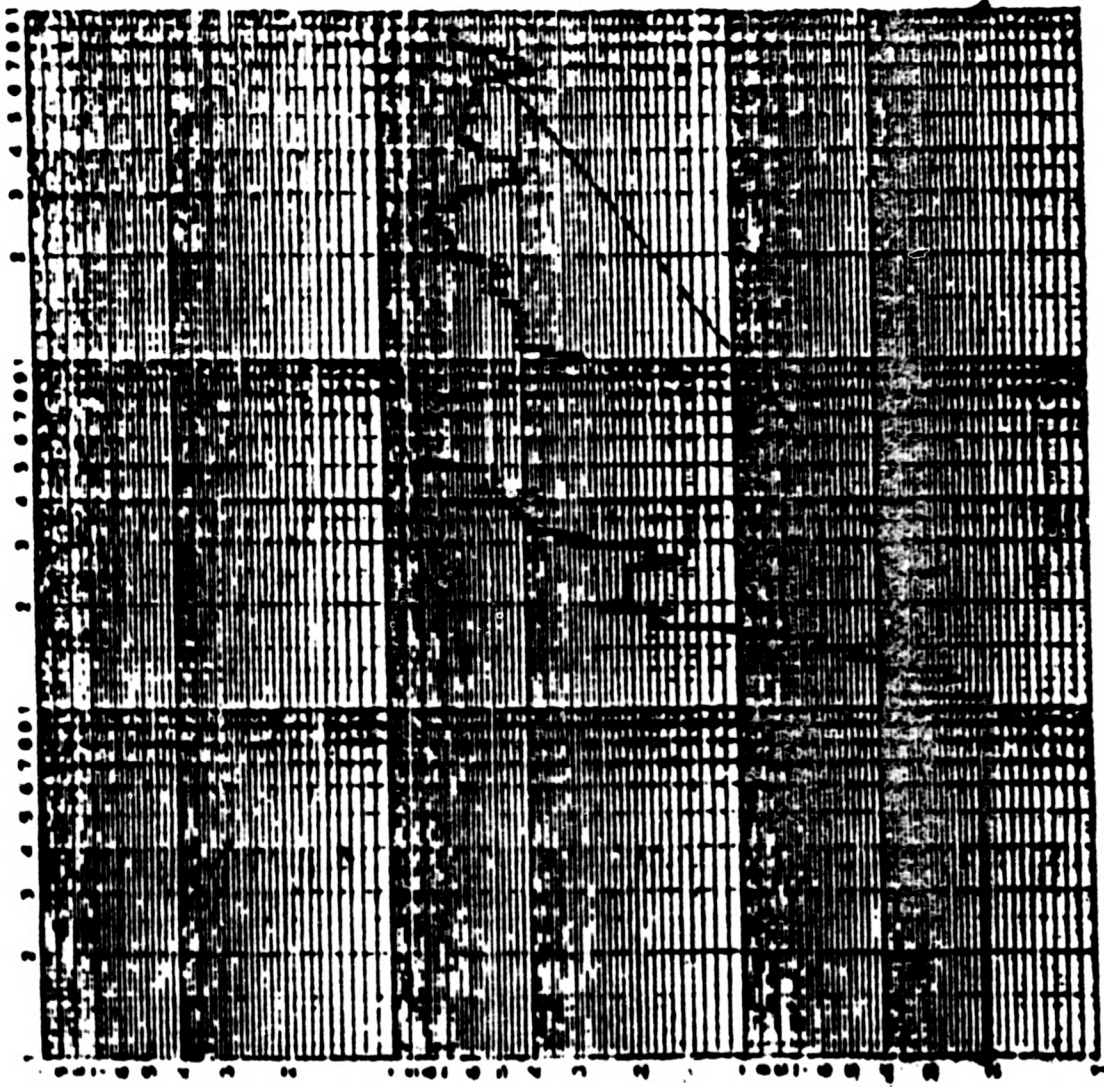
S/N 71750

AXIS X-Z

DATE 10/21/82

TIME 10:07

PLOT NO. _____



Response Acceleration (g Peak)

FREQUENCY (HZ)

SIGNATURE M.A. Pilgram



EARTHQUAKE RESPONSE
SPECTRA H208 0P51

SPECTRUM ^{120PST}
HORIZONTAL

POLARITY +

DAMPING (ZETA) 0.05

ANALYSIS BAND
1/12 octave

CUSTOMER
Metal Bellows Corp.

NO. 548-8934

ITEM
Hose Assy. Flex Metal

P/N 77750

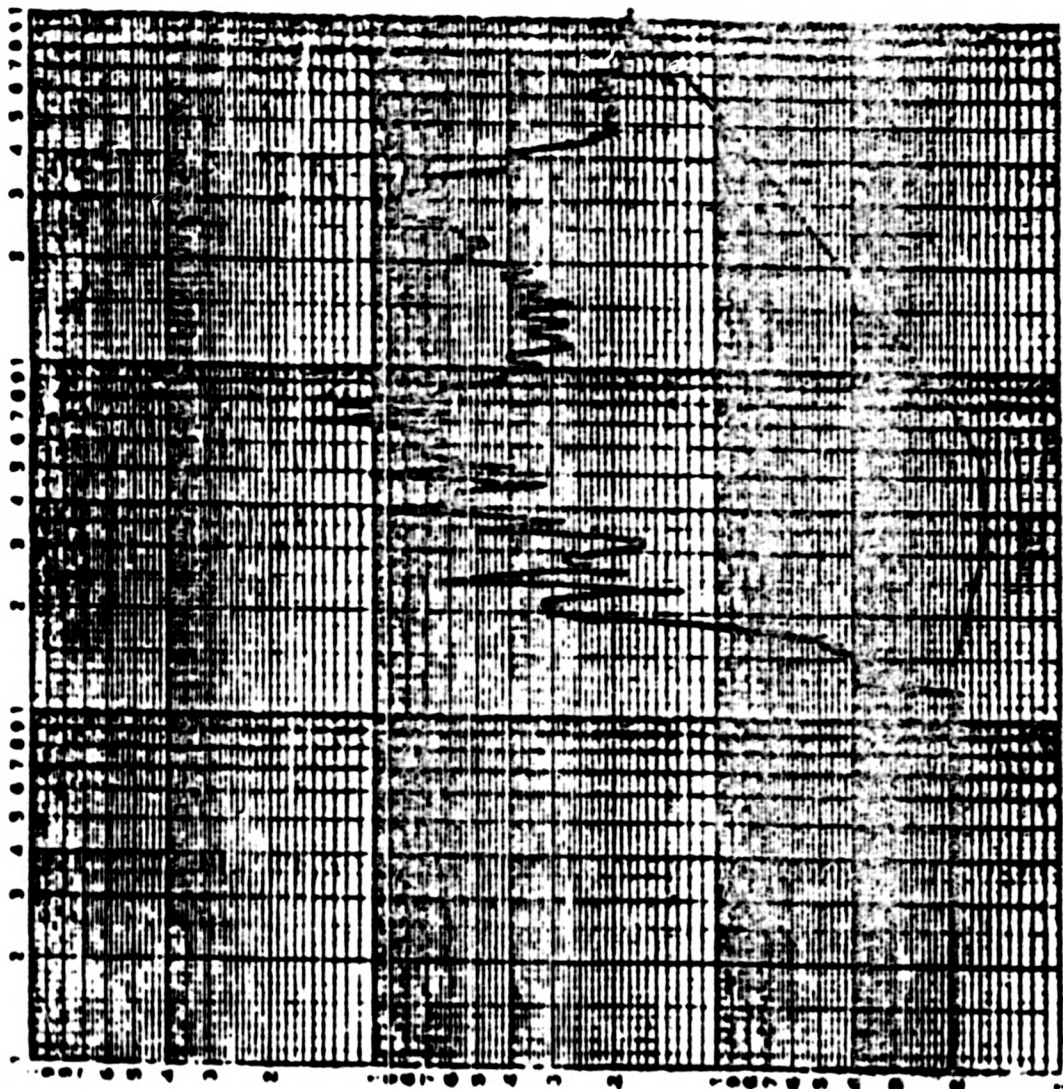
S/N QUAL UNIT

AXIS X-Z

DATE 10/28/58

TIME 10:21

PLOT NO.



FREQUENCY (HZ)

SIGNATURE M. A. Pilgorny

Response Acceleration (g Peak)



EARTHQUAKE RESPONSE
SPECTRA-H20R 0Ds1

120psi

SPECTRUM VECT
HORIZONTAL

POLARITY +

DAMPING (ZETA) 0.2

ANALYSIS BAND
8/12 octave

CUSTOMER
Metal Bellows Corp.

MJO
548-8934

ITEM
Hose Assy, Flex Metal

P/R 77750

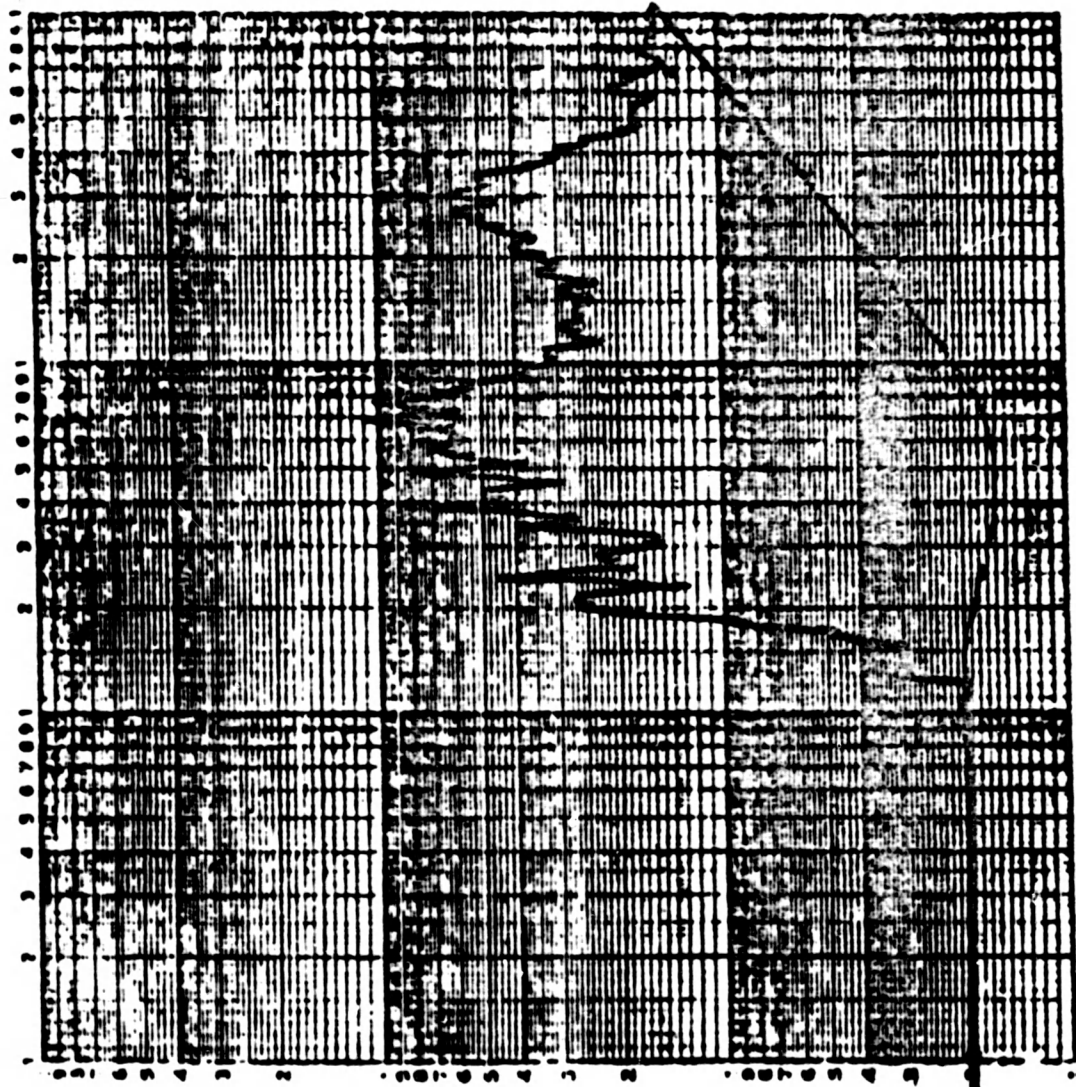
S/N QUAL UNIT

AXIS X.Z

DATE 10/20/50

TIME 10:30

PLOT NO.



Response Acceleration (g Peak)

FREQUENCY (HZ)

SIGNATURE M.A. Pilgore



EARTHQUAKE RESPONSE SPECTRA - H20E Opel 120psi

SPECTRUM Vertical

POLARITY +

DAMPING (ZETA) 2%

ANALYSIS BAND 1/12 octave

CUSTOMER Metal Bellows Corp.

PN 548-8934

ITEM Hose Assy., Flex Metal

P/N 11150

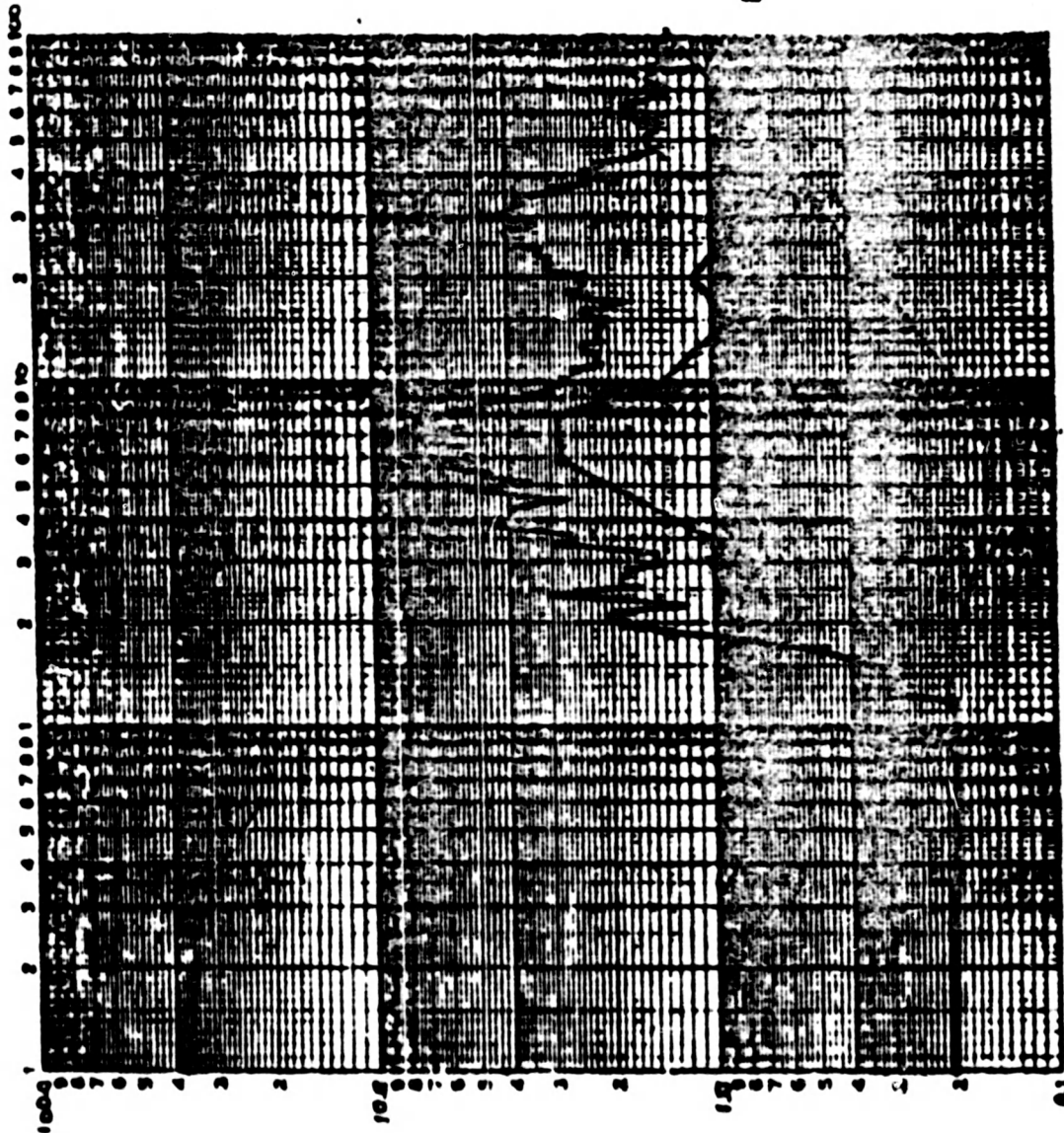
S/R GRFC UNIT

AXIS X, Z

DATE 10/20/50

TIME 10:30

PLOT NO. _____



Response Acceleration (g Peak)

FREQUENCY (HZ)

SIGNATURE M.A. Pilgoc



EARTHQUAKE RESPONSE
SPECTRA H208 (DAS)

VERT
SPECTRUM HORIZONTAL

POLARITY +

DAMPING (ZETA) 5%

ANALYSIS BAND
8/12 Octave

CUSTOMER
Metal Bellows Corp.

NO. 548-8934

ITEM
Hose Assy, Flex Metal

P/N 71750

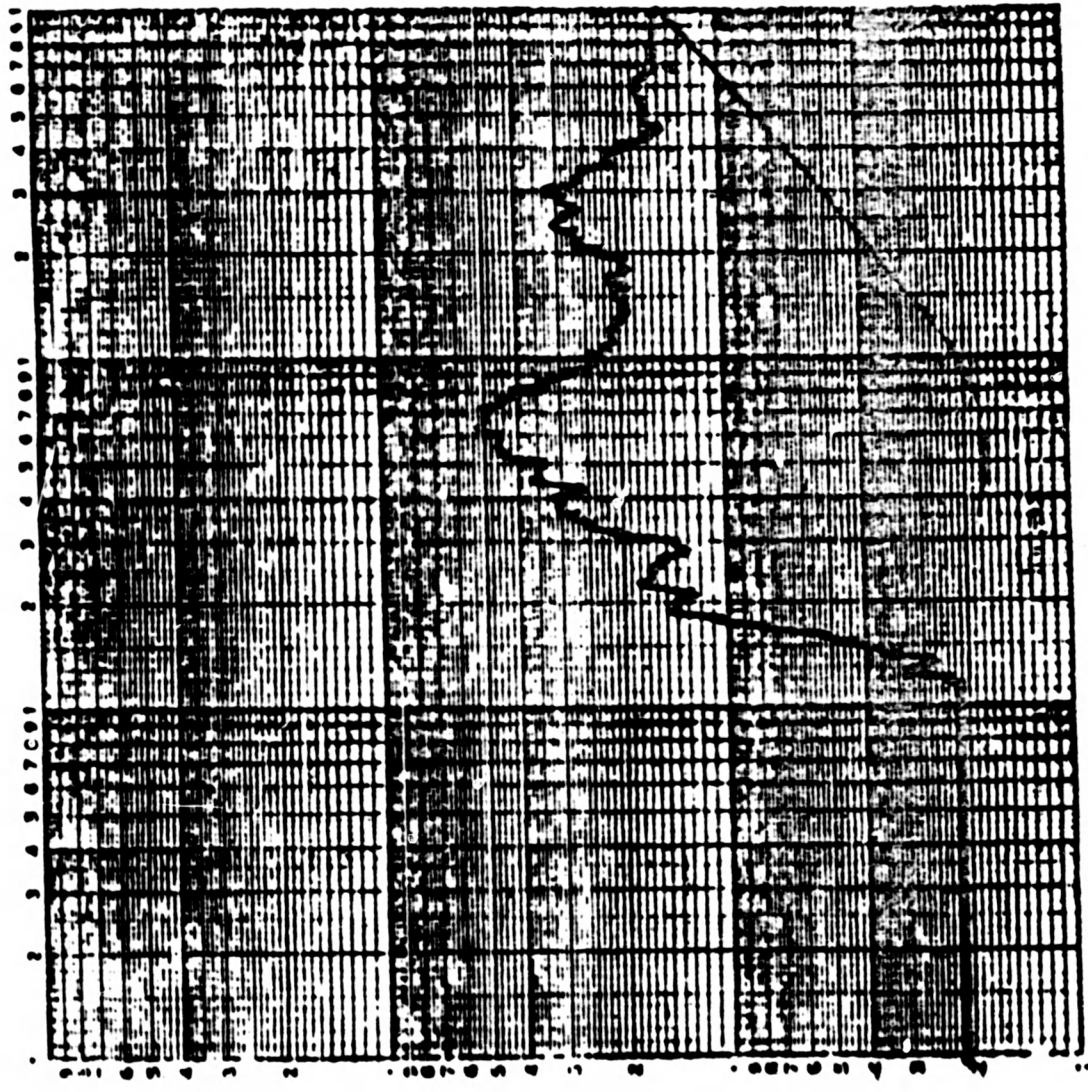
S/N QUAL UNIT

AXIS X, Z

DATE 10/20/50

TIME 10:21

PLOT NO. _____



FREQUENCY (HZ)

SIGNATURE M. A. P. [Signature]



EARTHQUAKE RESPONSE SPECTRAC FILE

120 P. 16
SPECTRUM Harmonic

POLARITY +

DAMPING (ZETA) .5%

ANALYSIS BAND Via Octave

CUSTOMER Metal Bellows Corp.

NO 548-8934

ITEM Hose Assy.

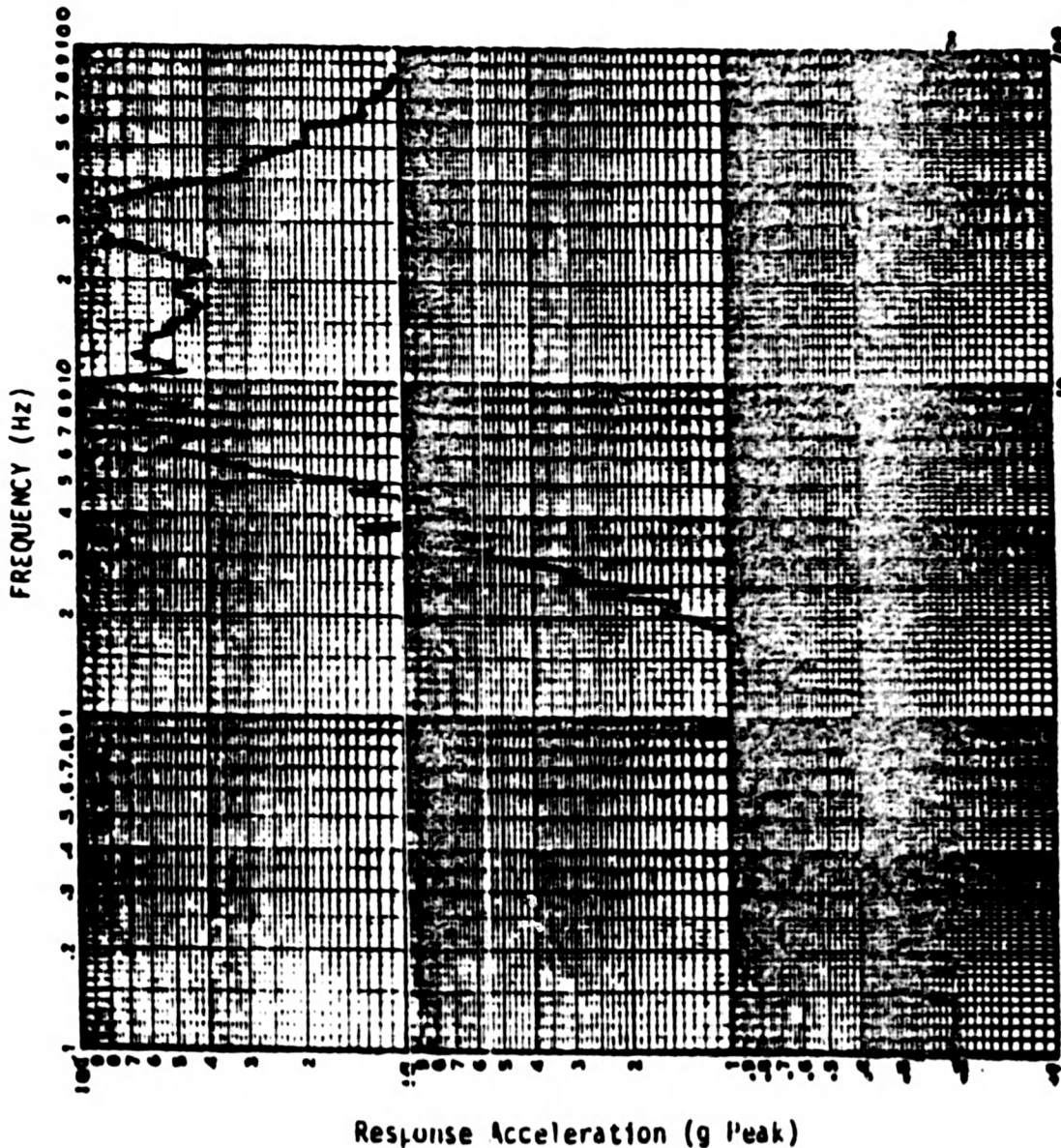
Flex Metal

P/N 77750

S/N Qual. Unit

AXIS X-Z

PLOT NO. _____



SIGNATURE M. G. Pellegrino DATE 10/21/80 TIME _____



APPROVED ENGINEERING TEST LABORATORIES

EARTHQUAKE RESPONSE SPECTRUM FILE

SPECTRUM FILE NO. 1010

POLARITY +1

DAMPING (ZETA) 1%

ANALYSIS BAND 1/2 octave

CUSTOMER Metal Bellows Corp.

NO. 548-8934

ITEM Hose Assy

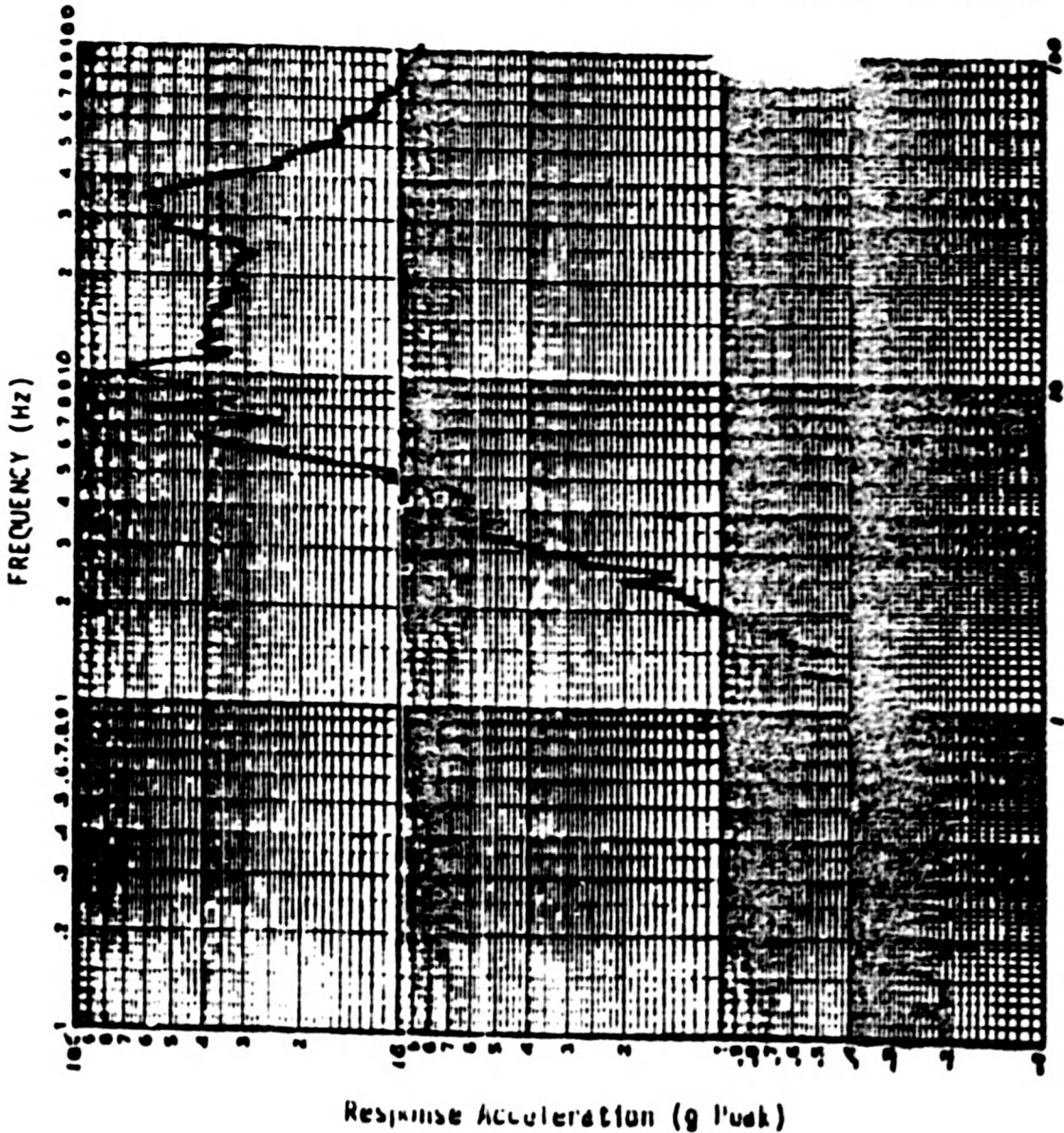
Flex Metal

P/N 77750

S/N Qual. Unit

AXIS X-Z

PLOT NO. _____



SIGNATURE M. A. Pilgras DATE 10/21/80 TIME _____



EARTHQUAKE RESPONSE
SPECTRA-H200 OPSI

(120psi)

SPECTRUM HORIZONTAL

POLARITY →

DAMPING (ZETA)
2%

ANALYSIS BAND
1/12 octave

CUSTOMER
Metal Bellows Corp.

NO. 548-8934

ITEM
Hose Assy., Flex Meta

F/N 77750

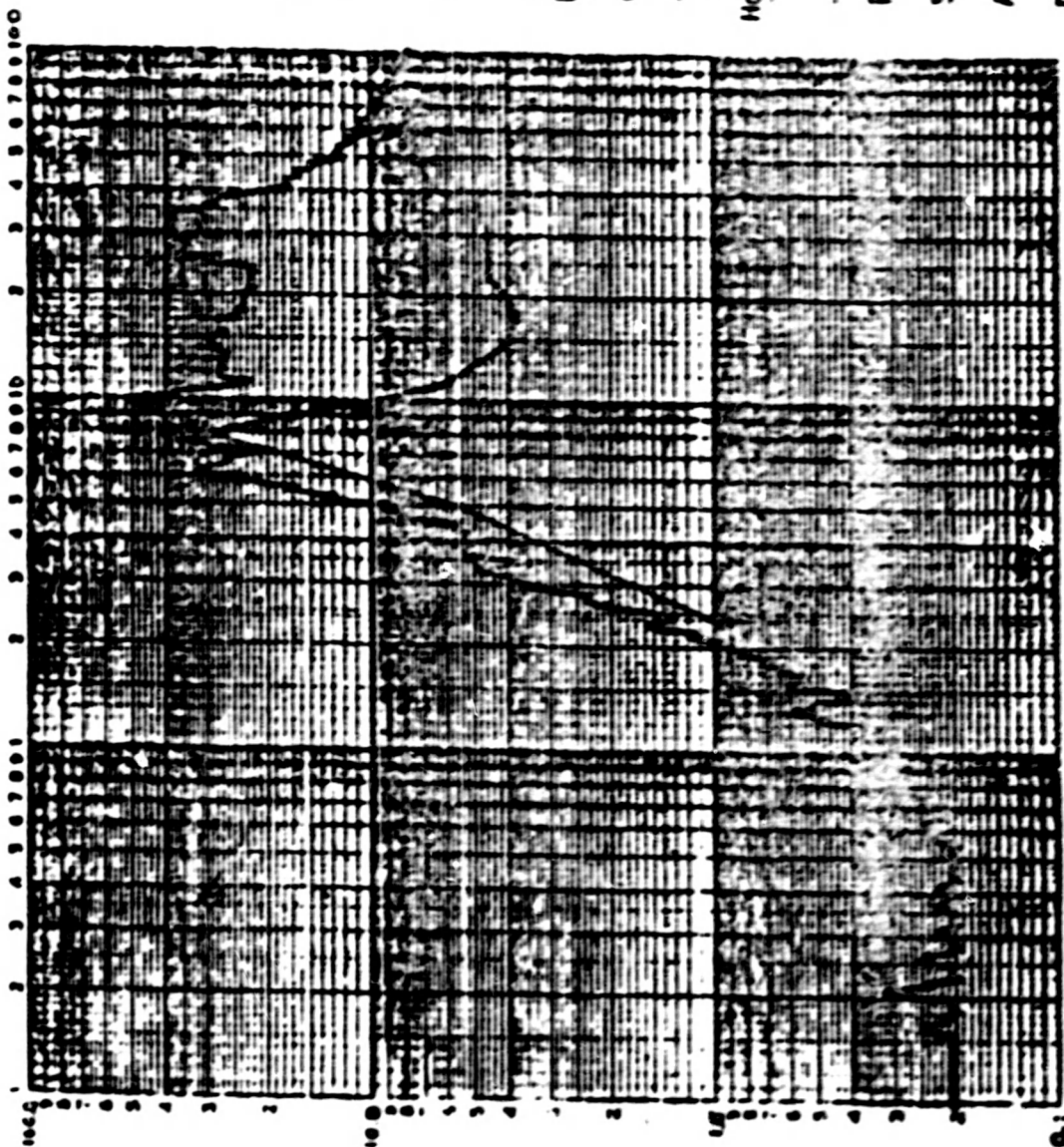
S/R Qual. Unit

AXIS X-Z

DATE 10/21/80

TIME

PLOT NO.



FREQUENCY (HZ)

SIGNATURE *M. A. Pilgorn*



APPROVED ENGINEERING TEST LABORATORIES

EARTHQUAKE RESPONSE SPECTRA



SPECTRUM

POLARITY +

DAMPING (ZETA) 5%

ANALYSIS BAND 1/2 octave

CUSTOMER Metal Ballast Corp.

NO 548-8924

ITEM Hose Assy.

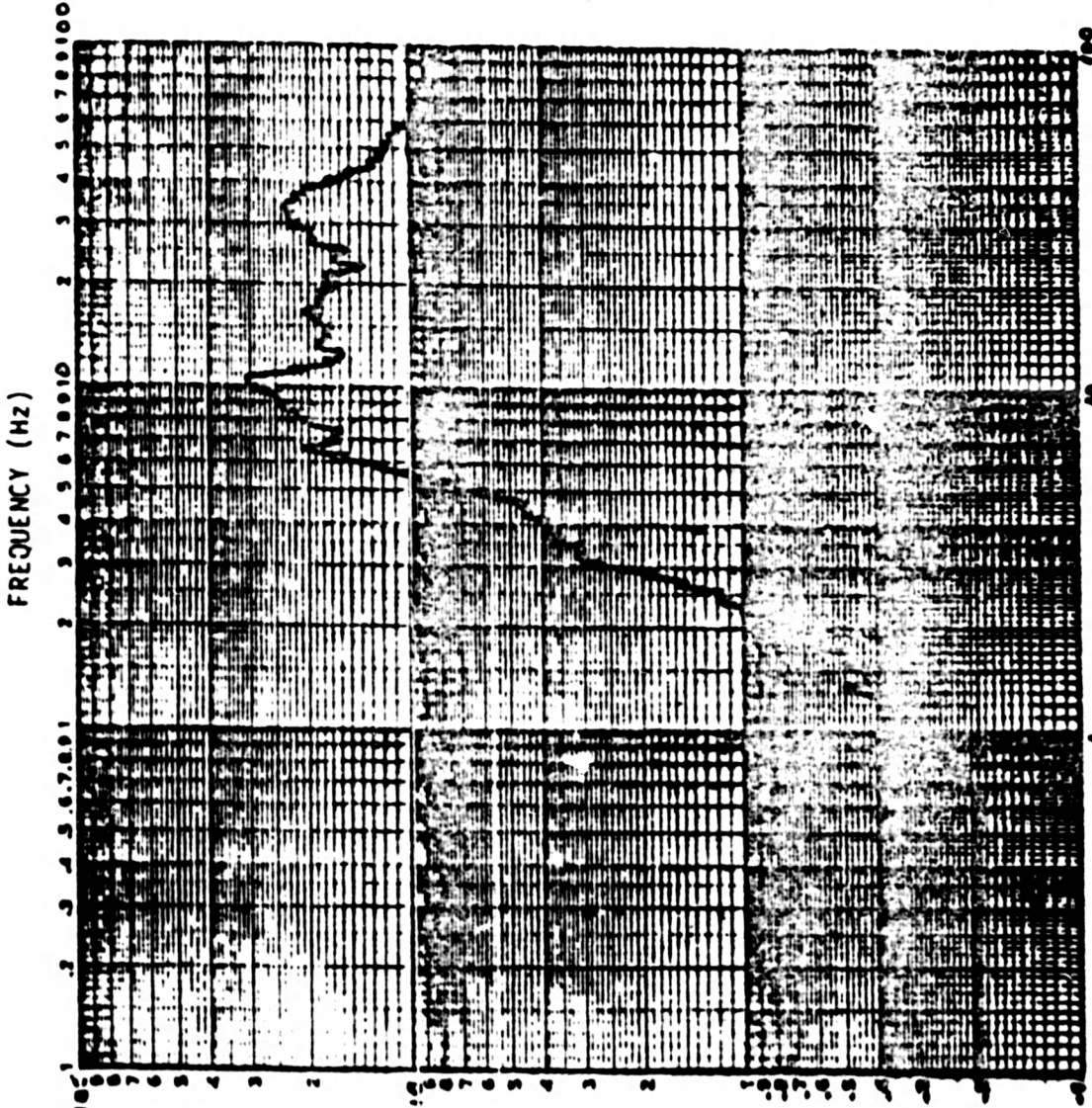
Flex Metal

P/N 7775C

S/N Qual. Unit

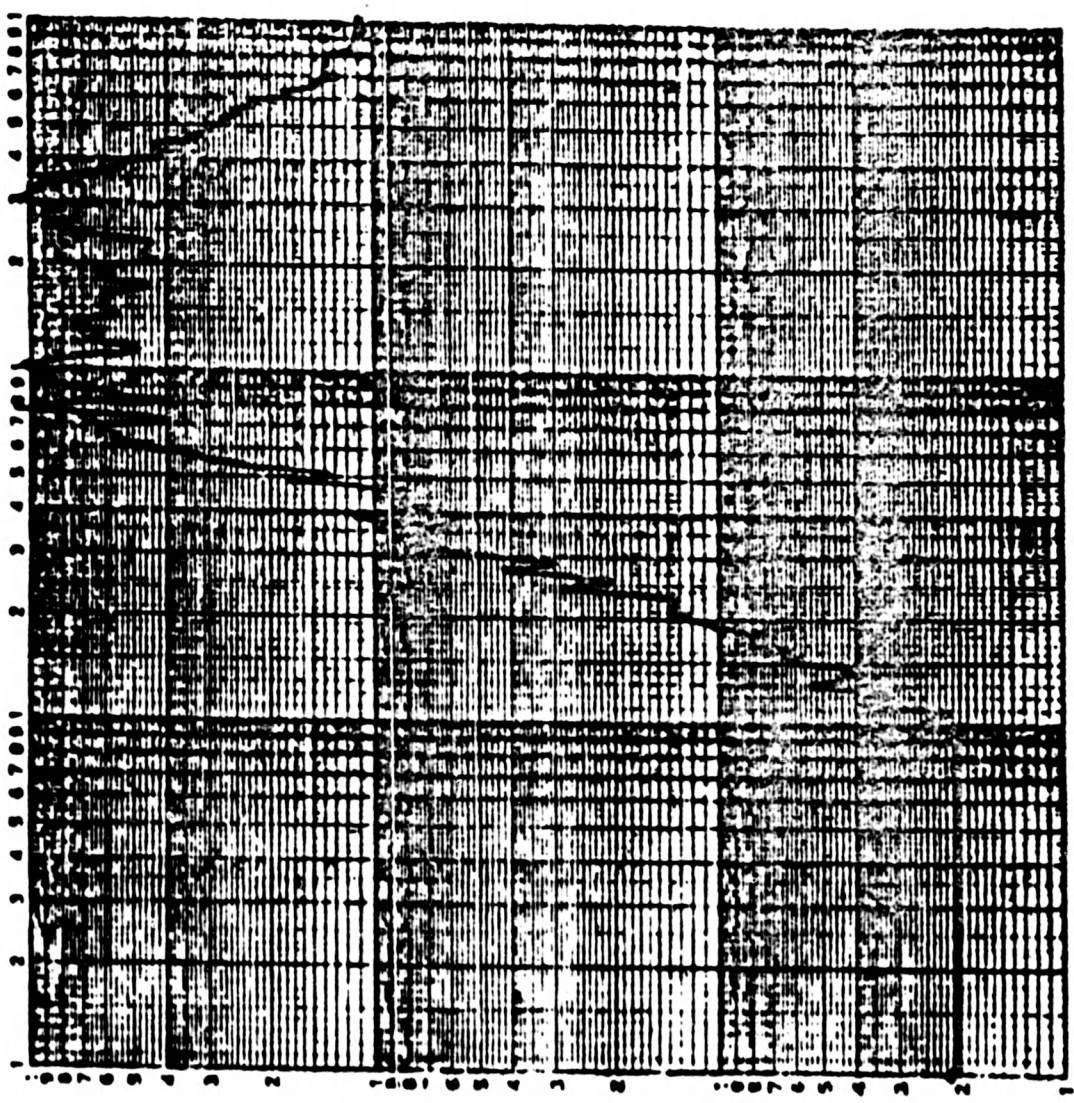
AXIS X-Z

PLOT NO. _____



Response Acceleration (g Peak)

SIGNATURE M.A. Pilgson DATE 10/21/80 TIME _____



Response Acceleration (g Peak)

EARTHQUAKE RESEARCH
SPECTRA-H208 (Gesi)
120951
HUE12

SPECTRUM ~~Horizontal~~

POLARITY +

DAMPING (ZETA)
5%

ANALYSIS BAND
1/12 octave

CUSTOMER
Metal Bellows Corp.

NO
548-8934

ITEM
Hose Assy, Flex Metal

P/N 77750

S/M QUAL UNIT

AXIS X-Y

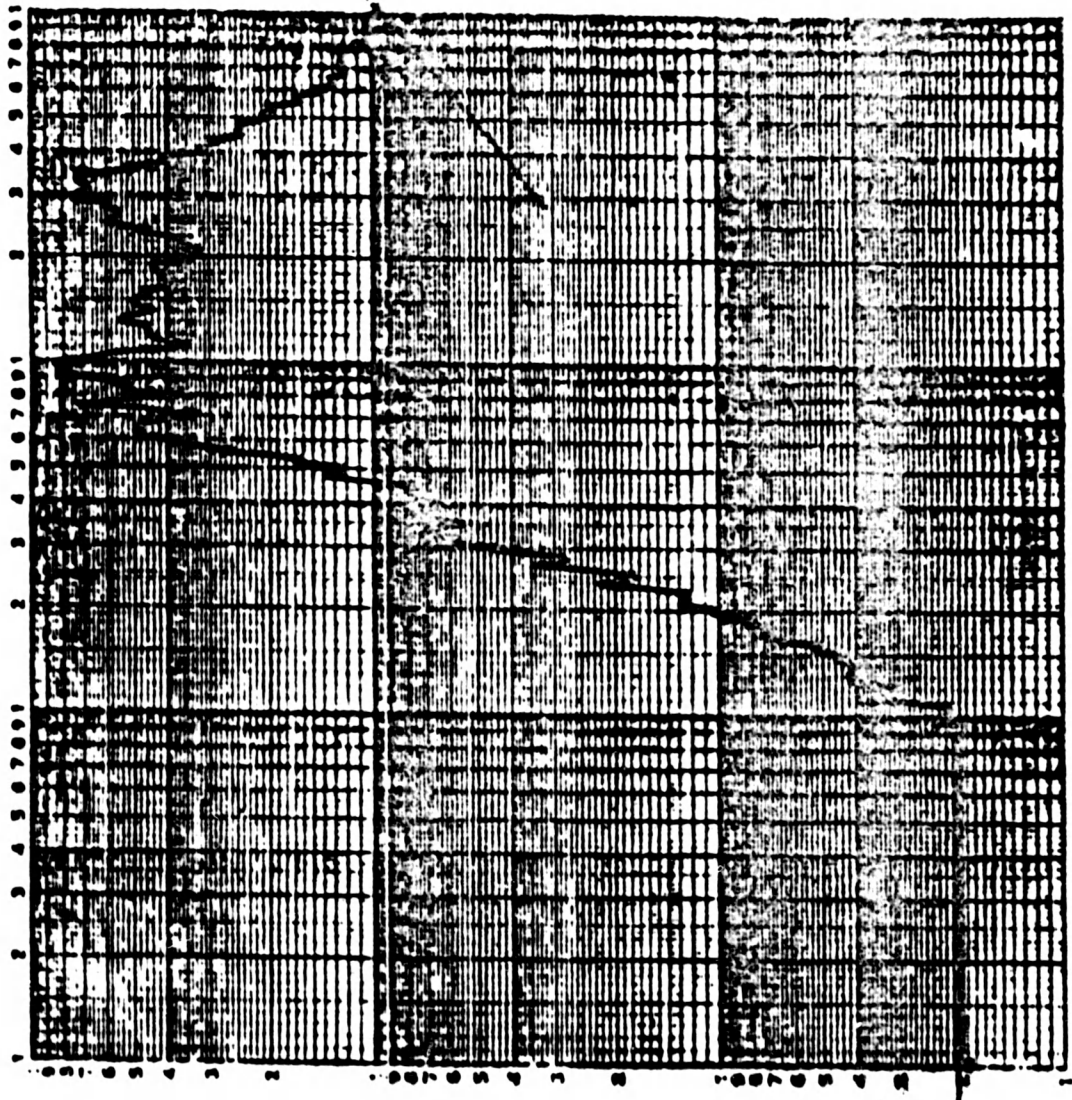
DATE 10/21/52

TIME 10:01

PLOT NO.

FREQUENCY (HZ)

SIGNATURE *M.A. Pilsbury*



Response Acceleration (g Peak)

EARTHQUAKE RESPONSE SPECTRA H200 Ops1, 120psi
SPECTRUM Horizontal
POLARITY +
DAMPING (ZETA) 1/10
ANALYSIS BAND 1/12 octave
CUSTOMER Metal Bellows Corp.
NO 548-8934
ITEM Hose Assy. Flex Metal
P/N 11150
S/M QUER UNIT
AXIS X Y
DATE 10/21/50
TIME 10 41
PLOT NO.

FREQUENCY (HZ)

SIGNATURE *M. A. Pilgrain*



EARTHQUAKE RESPONSE
SPECTRA-H200 (Ops)

120psi

SPECTRUM Horizontal

POLARITY +

DAMPING (7ETA)
2%

ANALYSIS BAND
1/12 octave

CUSTOMER
Metal Bellows Corp.

MJO
548-8934

ITEM
Hose Assy., Flex Meta

P/N 77750

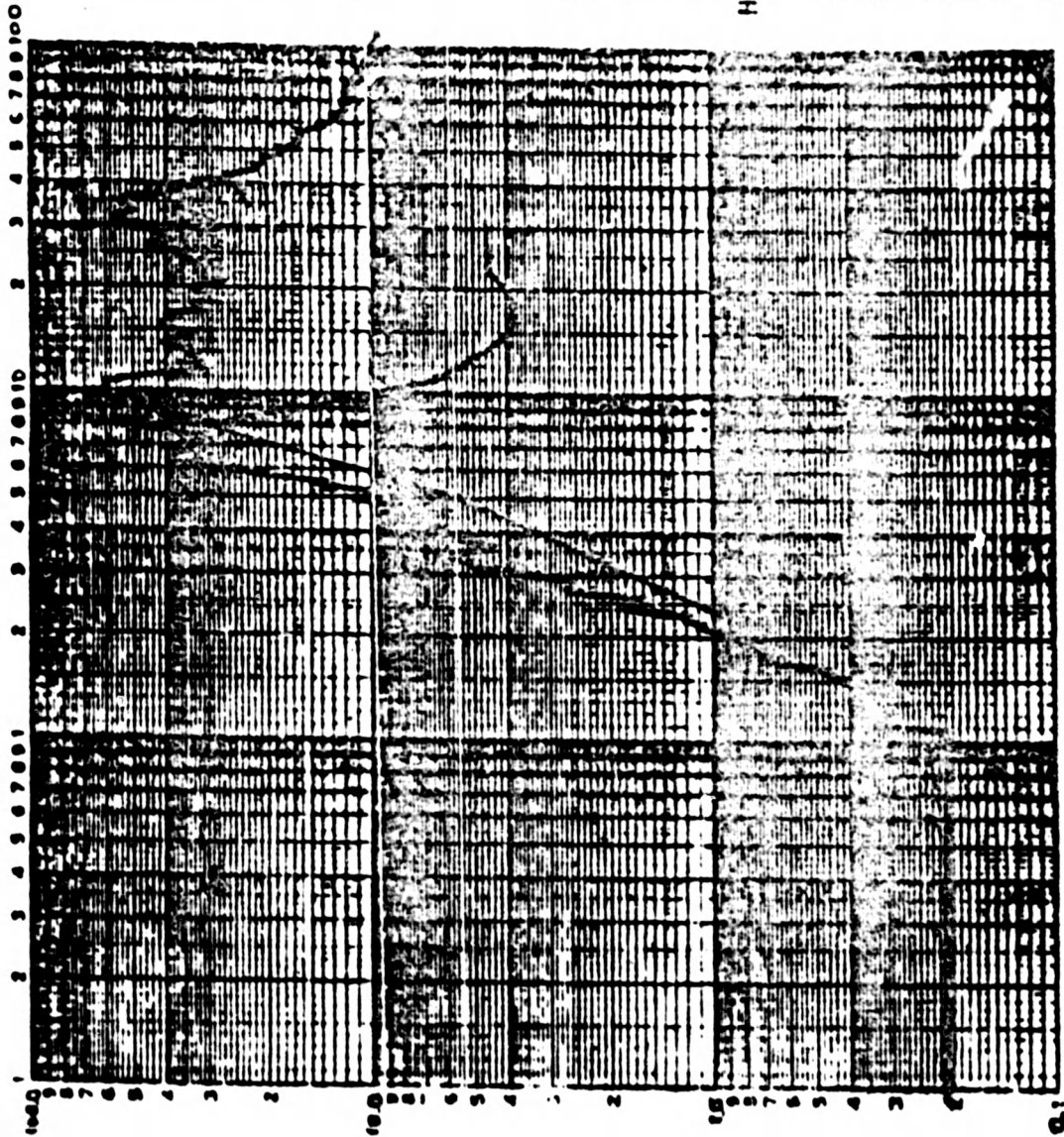
S/N QUIL UNIT

AXIS X-Y

DATE 10/29/52

TIME 10-11

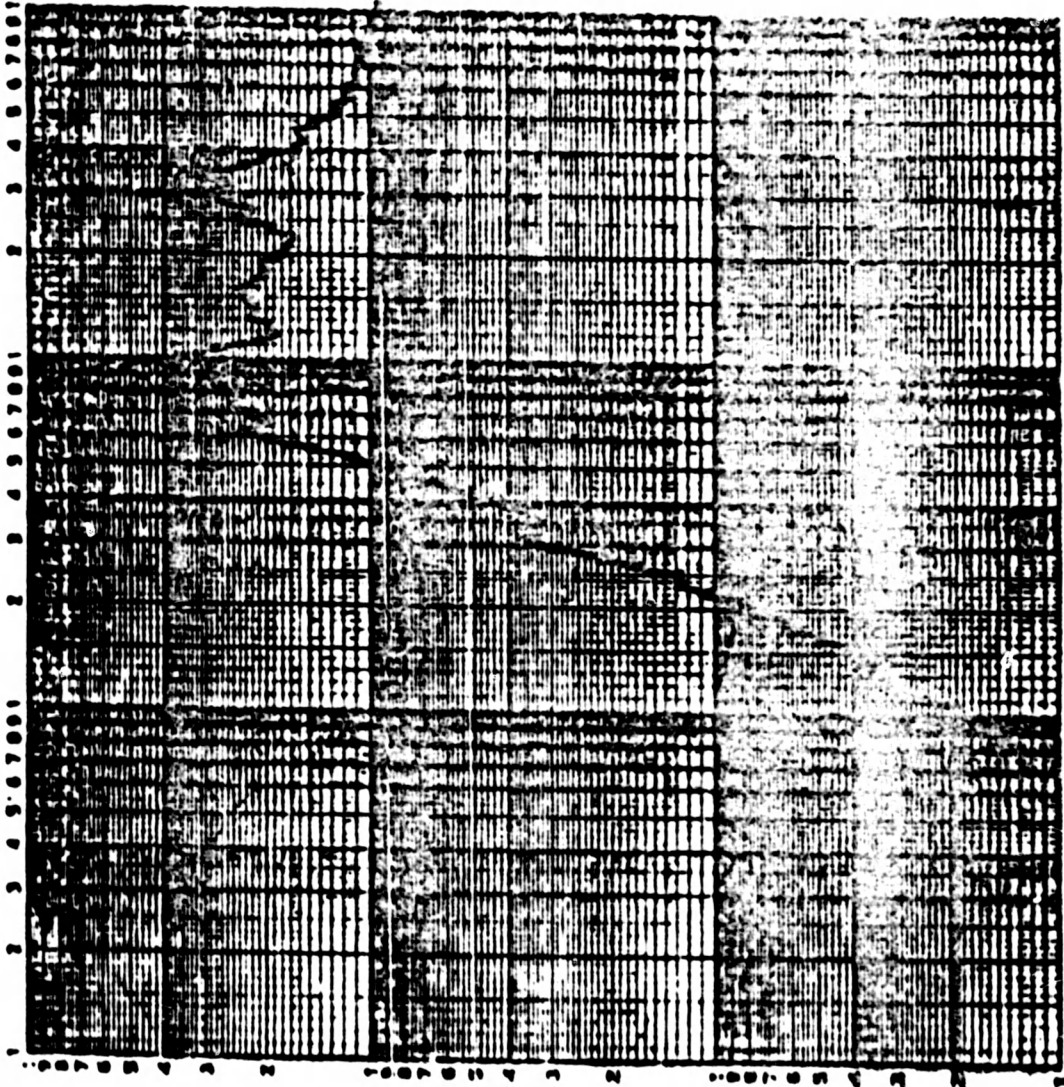
PLOT NO.



Response Acceleration (g Peak)

FREQUENCY (HZ)

SIGNATURE *M. A. Fitzgerald*



EARTHQUAKE RESPONSE
SPECTRA-H20R UDS1
120psi

SPECTRUM HORIZ
Vertical

POLARITY +

DAMPING (ZETA) 5%

ANALYSIS BAND
1/12 octave

CUSTOMER
Metal Bellows Corp.

POJO
548-8934

ITEM
Hose Assy, Flex Metal

P/N 77750

S/FIGURE UNIT

AXIS X-Y

DATE 10/21/50

TIME 1041

PLOT NO.

FREQUENCY (HZ)

SIGNATURE *M. B. Pilgerson*

Response Acceleration (g Peak)

LABORATORY SPECIFICATION

SPECTRUM

POLARITY +

DAMPING 5%

ANALYSIS BAND

CUSTOMER Metal Fatigue

NO 548-8934

ITEM HOSE ASSY. TEST

P/N 77750

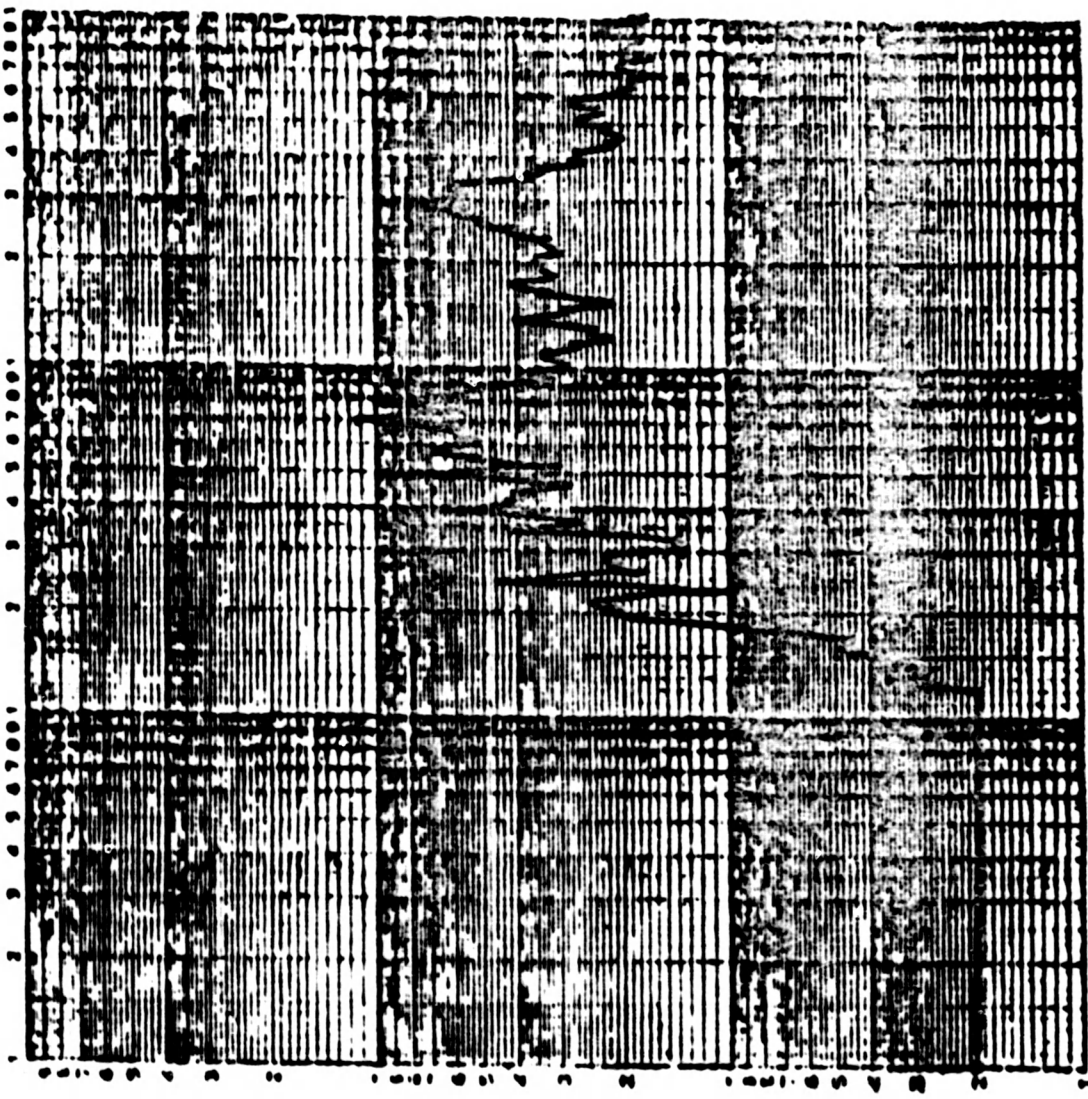
S/N Qual Limit

AXIS X-Y

DATE 10/21/80

TIME

PLOT NO.



Response Acceleration (g Peak)

FREQUENCY (HZ)

SIGNATURE *N.A. Polyzou*



EARTHQUAKE
SPECTRUM

SPECTRUM

DURATION 4

DAMPING 19%

ANALYSIS BASE
FIXED TO BASE

CUSTOMER
METAL BOTTOM

NO. 54E-8934

ITEM
ROSC. ASSY. STEEL

P/N 77750

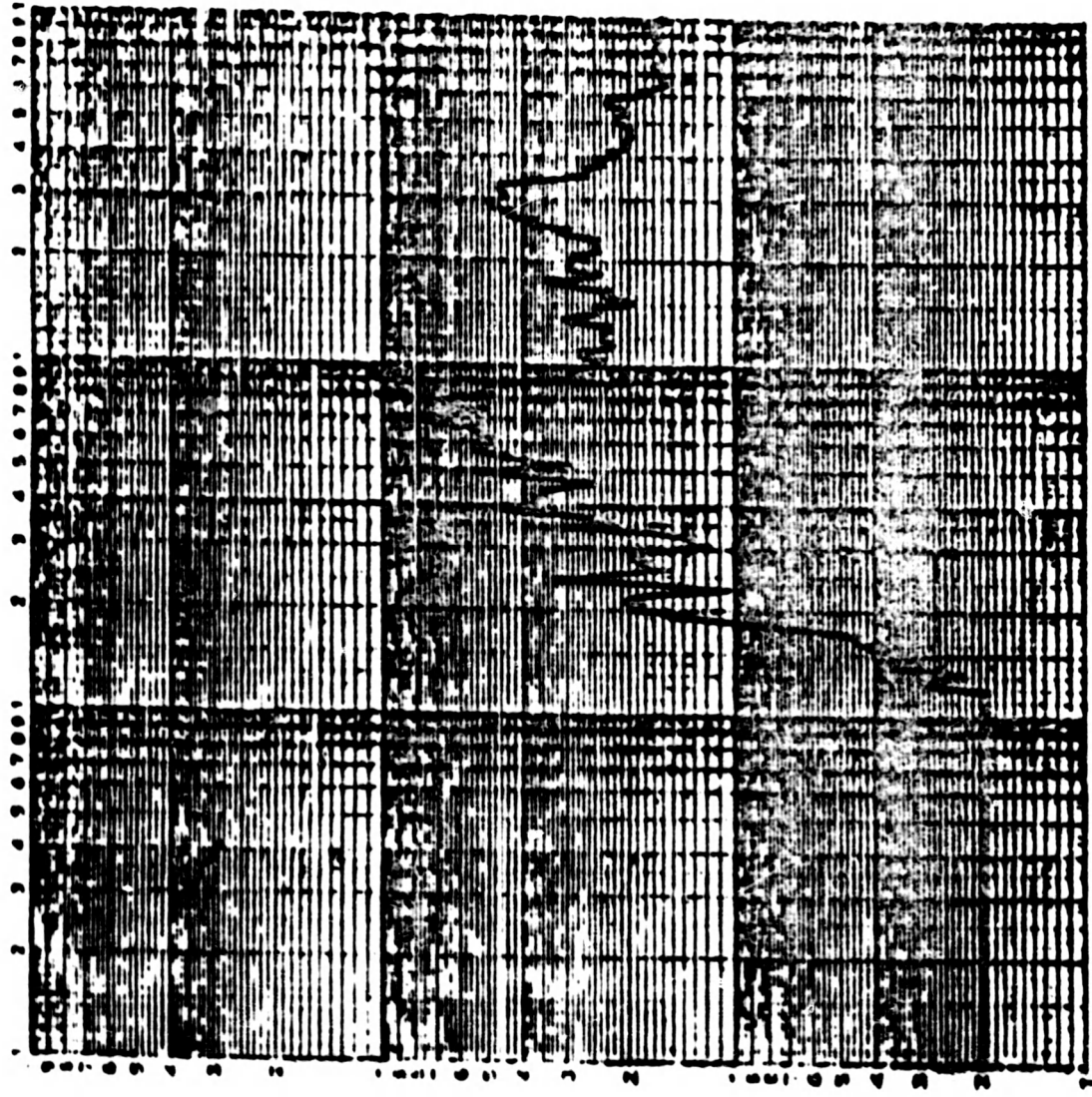
S/M Qualit

AXIS X-Y

DATE 10/21/50

TIME

PLOT NO.



Response Acceleration (g Peak)

FREQUENCY (HZ)

SIGNATURE *M.A. Pilgrom*



EARTHQUAKE RESPONSE
SPECTRA- Hz (0.05)
120psi

SPECTRUM Vertical

POLARITY +

DAMPING (ZETA) 2%

ANALYSIS BAND 1/12 octave

CUSTOMER Metal Bellows Corp

MOJO 548-893A

ITEM Hose Assy., Flex Metal

P/N 77750

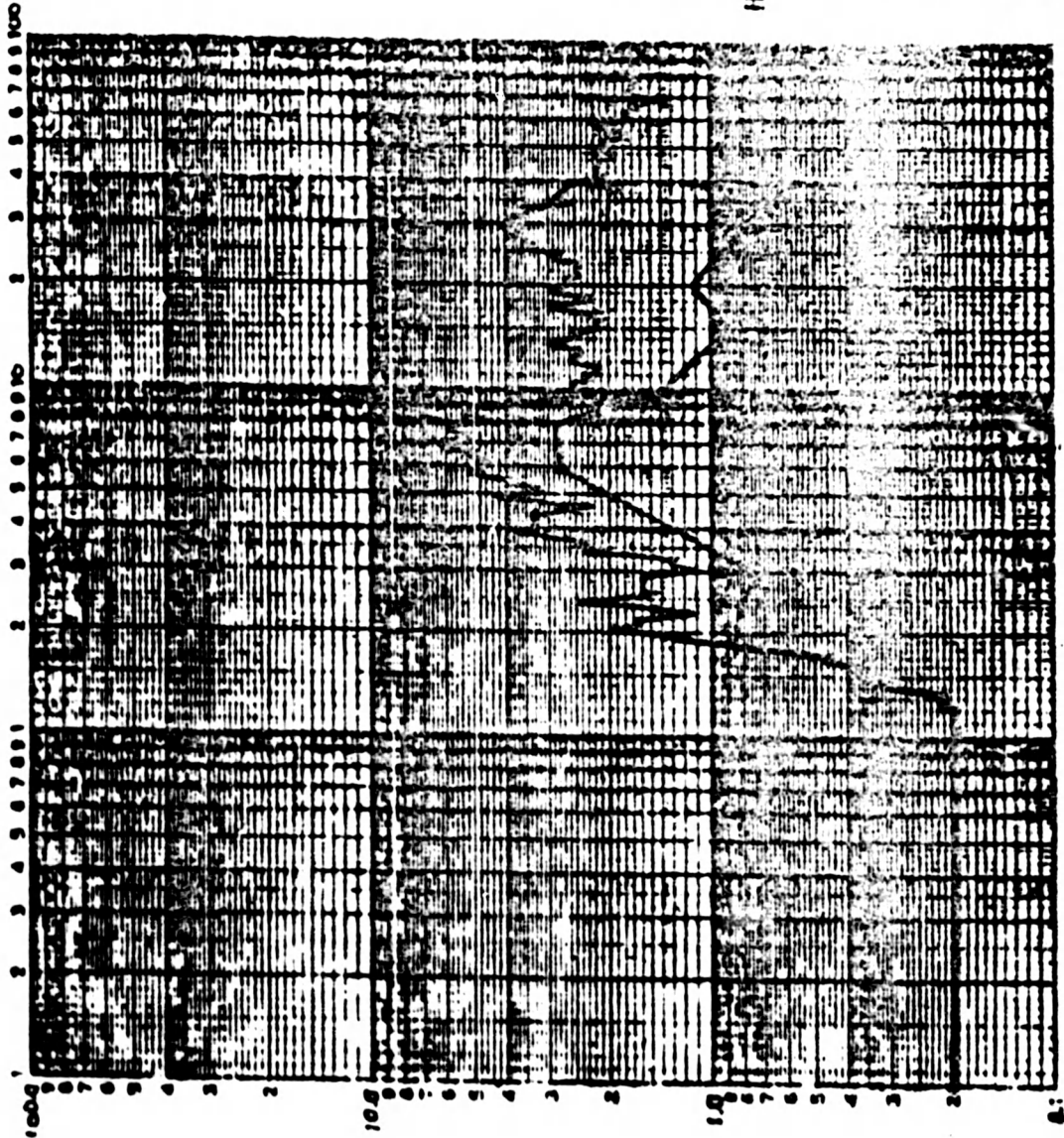
S/N Qual Unit

AXIS X-Y

DATE _____

TIME _____

PLOT NO. _____



Response Acceleration (g Peak)

FREQUENCY (HZ)

SIGNATURE M.A. Polyzos

13

EMERGENCY
SPEC

SPECTRUM

SLOPE +

DAMPING 5%

ANALOG

CUSTOMER

MODEL

QJC 548-893C

ITEM

HOSE ASSY, FIBER GLEN

P/N 7775C

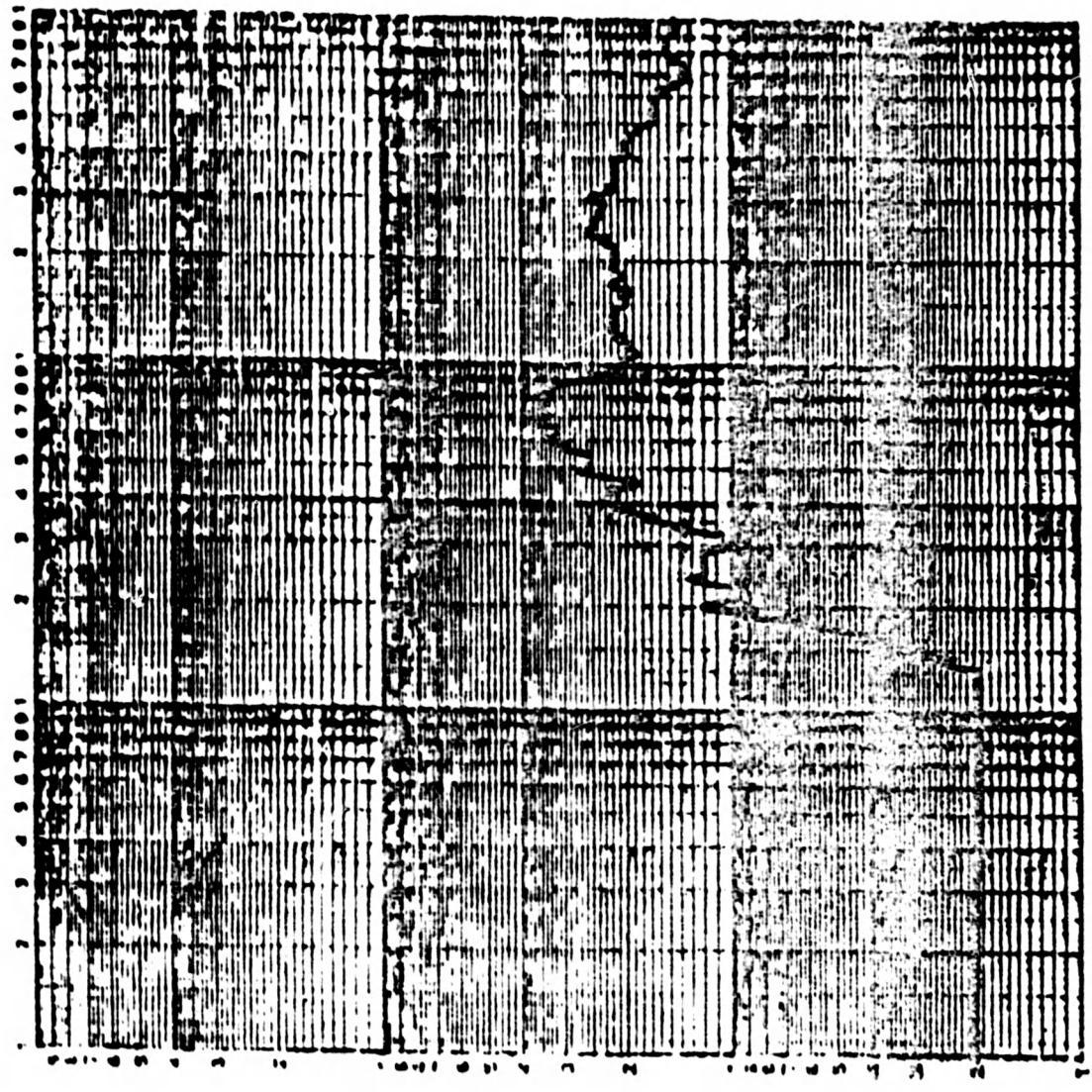
S/N Dual Unit

AXIS X-Y

DATE 10/21/80

TIME

PLOT NO.



Response Acceleration (g Peak)

FREQUENCY (HZ)

SIGNATURE *M. A. Pelgram*



EARTHQUAKE RESPONSE SPECTRA-2000

SPECTRUM SERVICE

POLARITY +

DAMPING (ZETA) 5%

ANALYSIS BAND 1/12 octave

CUSTOMER Metal Bellows Corp.

NO. 548-8934

ITEM Hose Assy, Flex Metal

P/N 77750

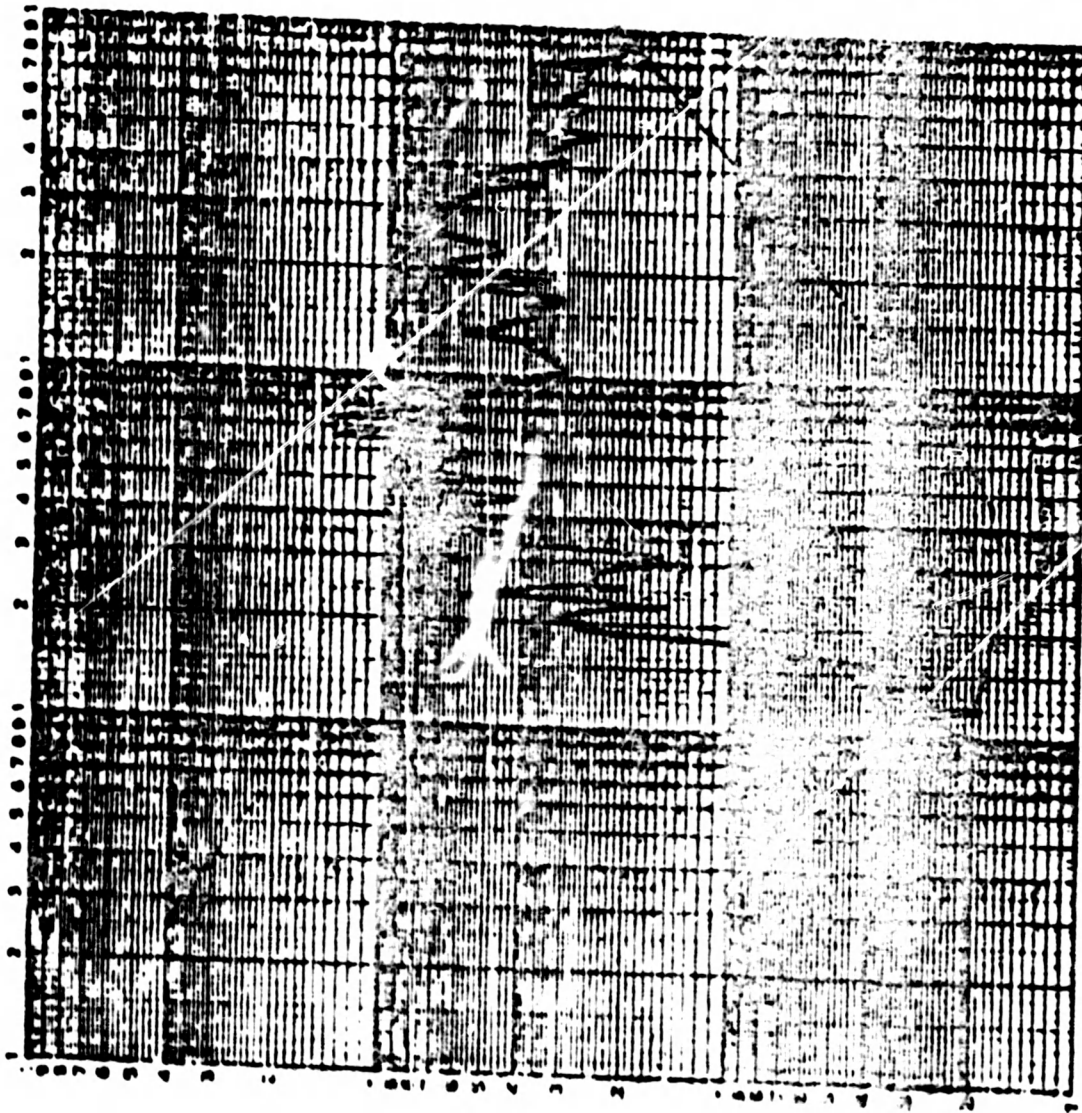
S/N QDA 02017

AXIS X, Y

DATE 10/01/50

TIME 1047

PLOT NO.



Response Acceleration (g Peak)

FREQUENCY (HZ)

SIGNATURE *Mark A. Filagore*



EARTHQUAKE RESPONSE
SPECTRA

SPECTRUM SERVICE

POLARITY +

DAMPING 10%

ANALYSIS BAND
1/12 octave

CUSTOMER
Metal Bellows Corp.

NO. 548-8934

ITEM
Hose Assy, Field Metal

P/N 77750

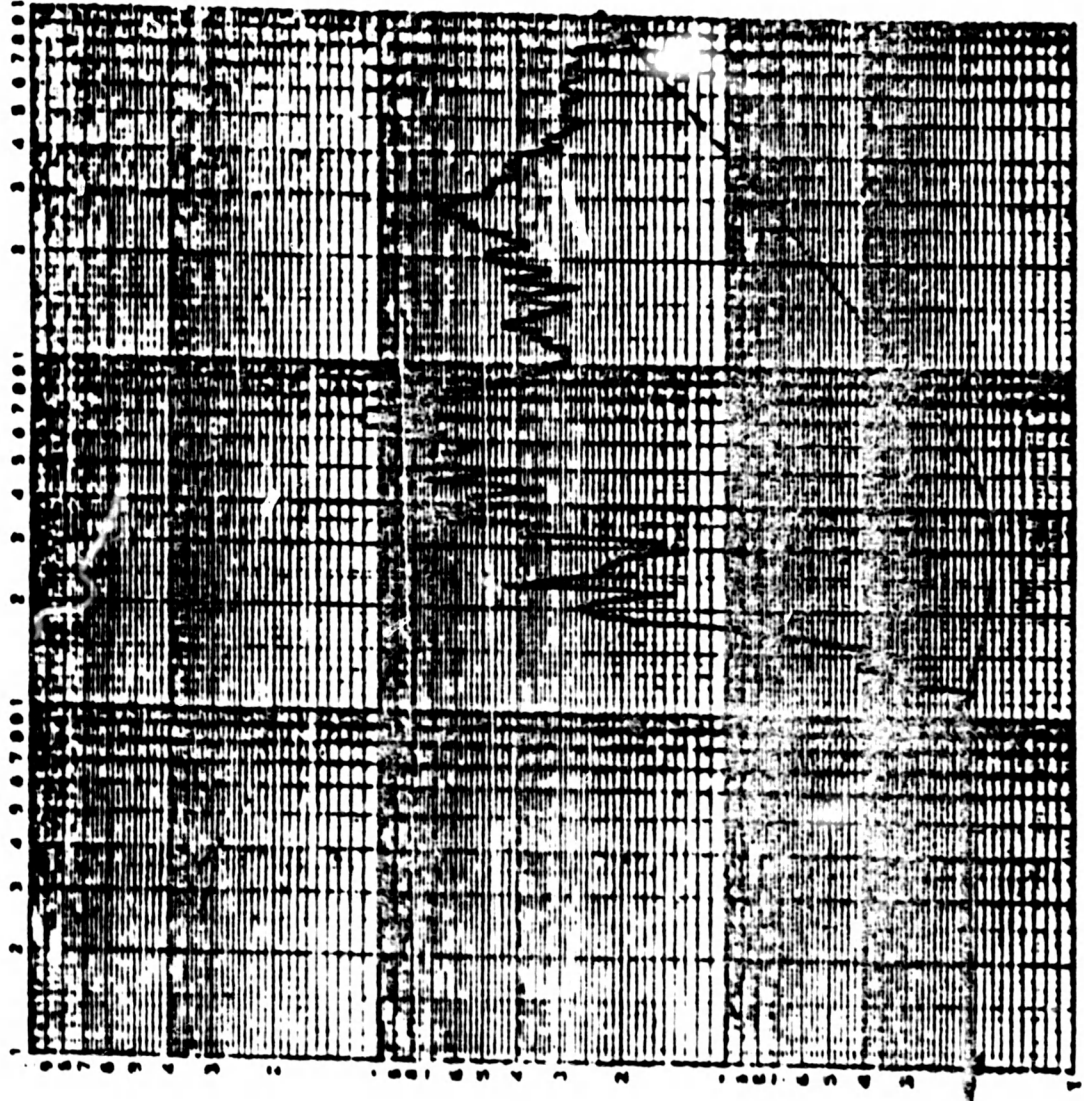
S/N QUAL UNIT

AXIS X, Y

DATE 10/21/50

TIME 1547

PLOT NO.



Response Acceleration (g Peak)

FREQUENCY (HZ)

SIGNATURE *M. O. Pilyarov*



EARTHQUAKE RESPONSE
SPECTRA- H200 Dpsi

-1
120psi

SPECTRUM Vertical

POLARITY +

DAMPING (ZETA) 2%

ANALYSIS BAND 1/12 octave

CUSTOMER Metal Bellows Corp.

NO. 548-8934

ITEM Hose Assy., Flex Metal

P/N 11150

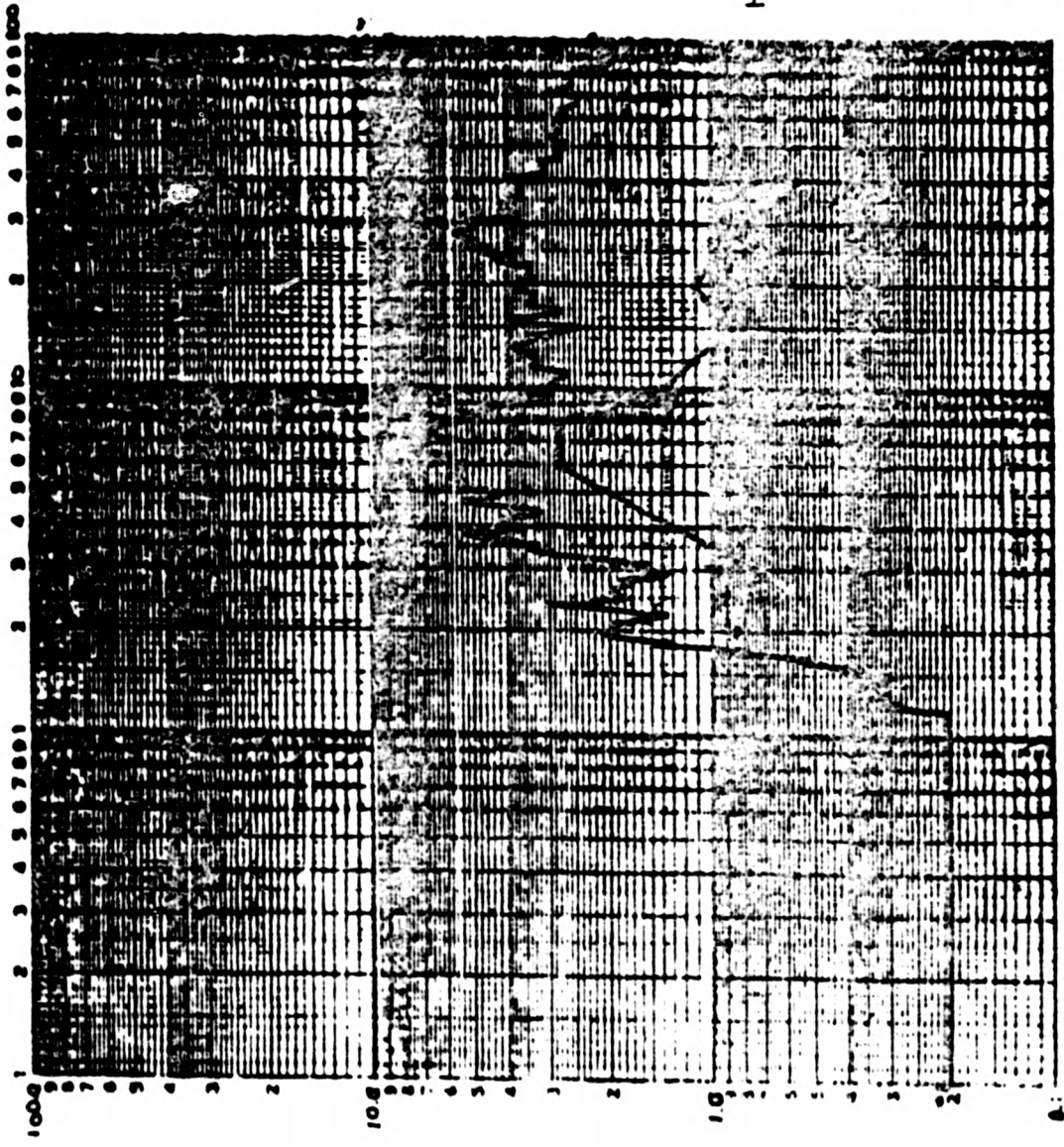
S/N QUVAL UNIT

AXIS LY

DATE 10/31/52

TIME 1047

PLOT NO. _____



FREQUENCY (HZ)

SIGNATURE M.A. Pilgosa



EARTHQUAKE RESPONSE
SPECTRA-1200 120psi
Dps1

SPECTRUM Vertical

POLARITY +

DAMPING (ZETA) $\frac{0.12}{0.16}$

ANALYSIS BAND
1/12 octave

CUSTOMER
Metal Bellows Corp.

QJJO 548-8934

ITEM
Hose Assy, Flex Metal

P/N 7775G

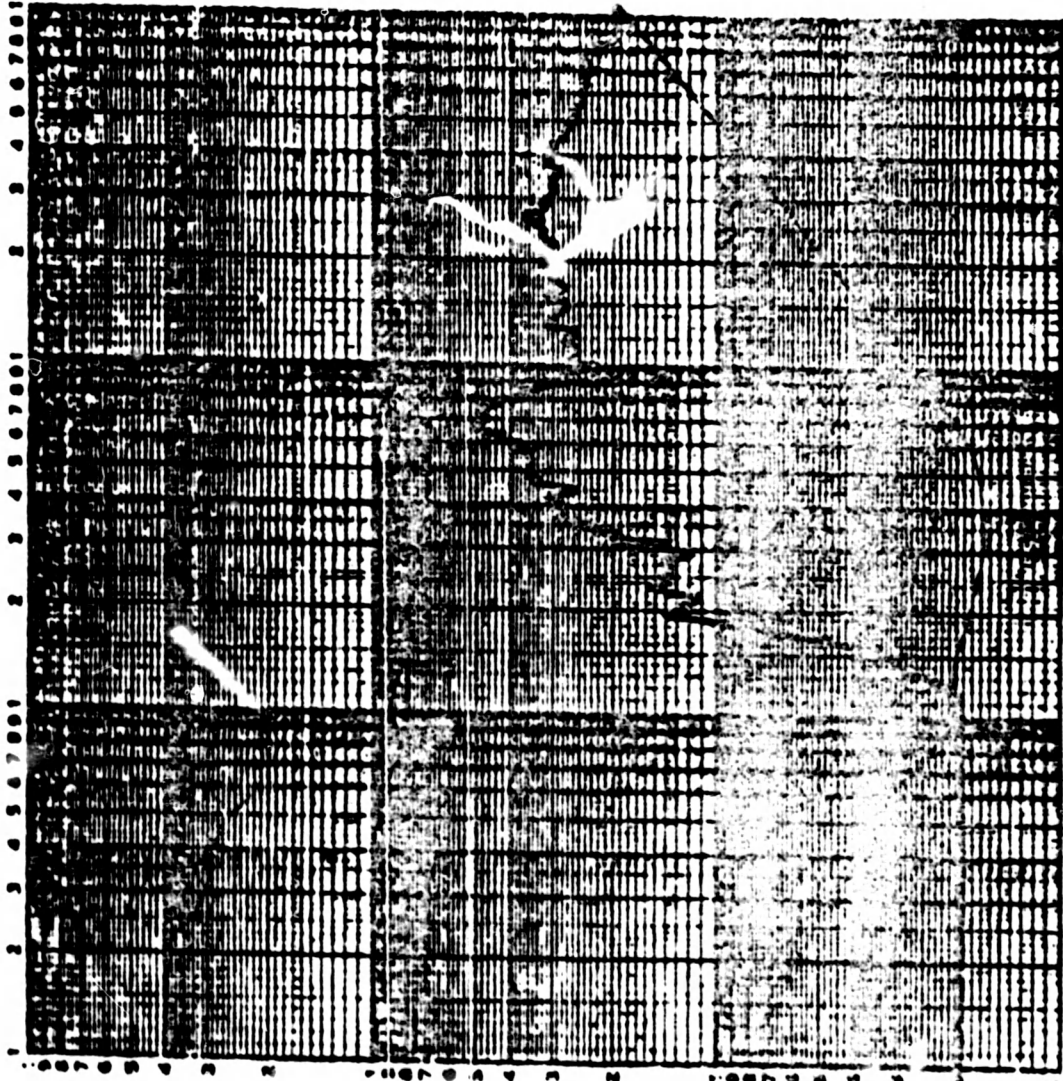
SIGNAL UNIT

AXIS X-Y

DATE 10/21/50

TIME 1047

PLOT NO.



Response Acceleration (g Peak)

FREQUENCY (HZ)

SIGNATURE M. A. Pileporec



APPROVED ENGINEERING TEST LABORATORIES

EARTHQUAKE RESPONSE SPECTRUM

SPECTRUM

POLARITY

DAMPING (ZETA)

0.59g

ANALYSIS BAND

1/6 octave

CUSTOMER

Metal Builders Corp

NO

548-8924

ITEM

Hose Assy

Flex Metal

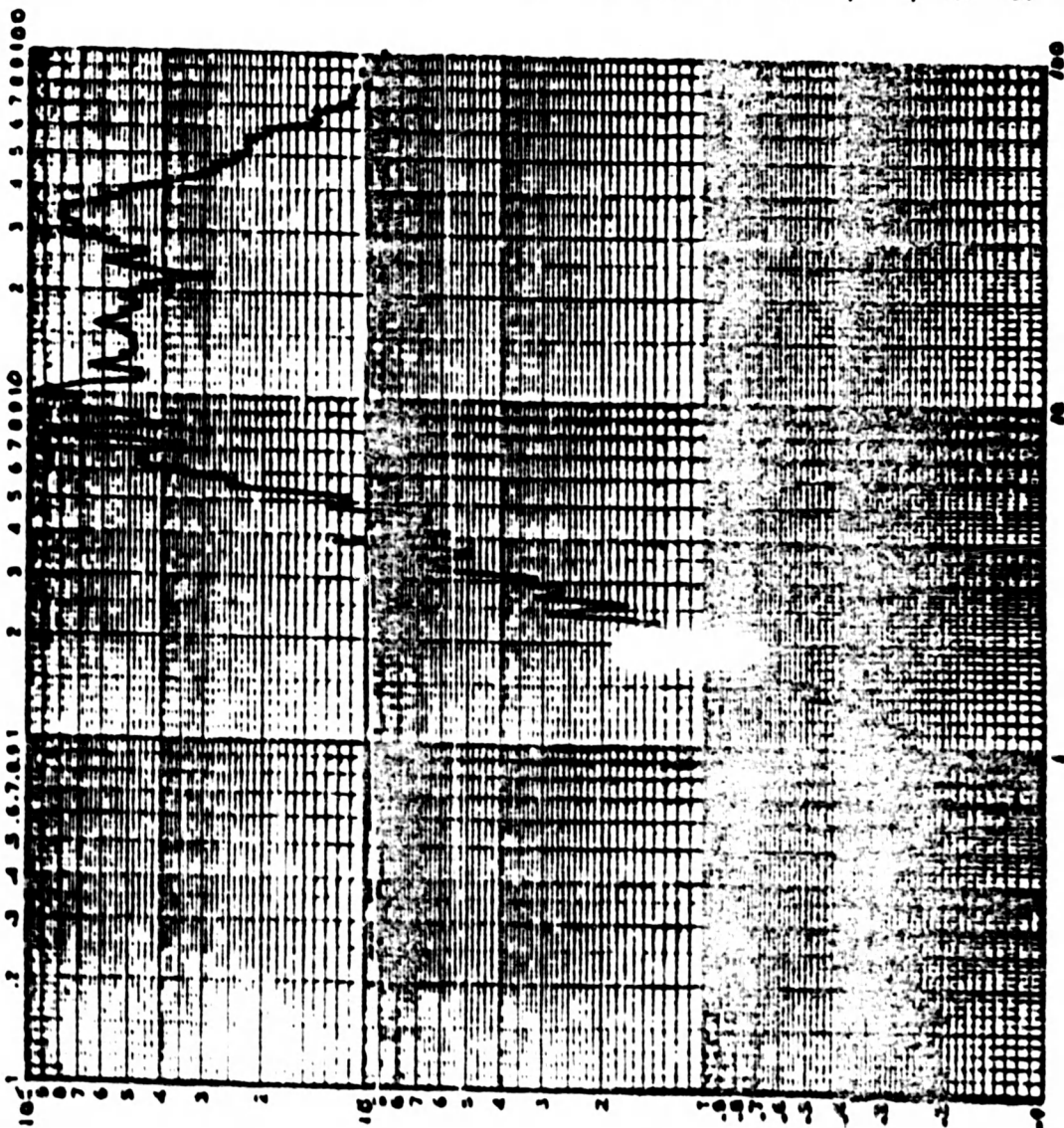
P/N 7775C

S/N Qual. test

AXIS X-Y

PLOT NO.

FREQUENCY (Hz)



Response Acceleration (g Peak)

SIGNATURE M. A. Pilgorn DATE 10/21/80 TIME



APPROVED ENGINEERING TEST LABORATORIES

EARTHQUAKE RESPONSE SPECTRUM

SPECTRUM 10/21/80

POLARITY +

DAMPING (ZETA) 19%

ANALYSIS BAND 1/2 octave

CUSTOMER Metal Bellows Corp.

NO 548-8934

ITEM Hose Assy.

Flex Metal

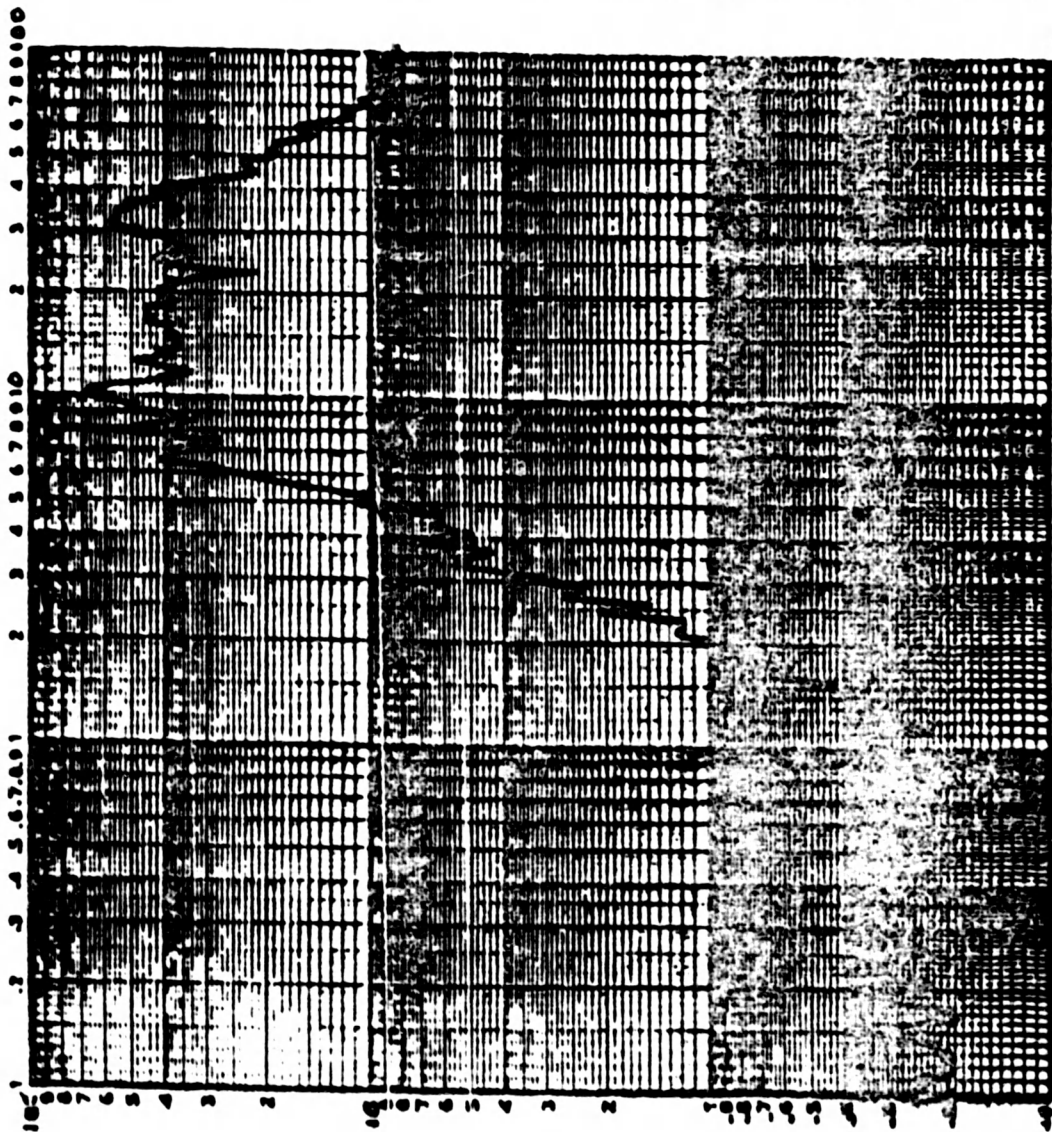
P/N 77750

S/N Qual. Unit

AXIS X-Y

PLOT NO. _____

FREQUENCY (Hz)



Response Acceleration (g Peak)

SIGNATURE M. A. Pilgosa DATE 10/21/80 TIME _____



EARTHQUAKE RESPONSE
SPECTRA-1200 psi

120psi

SPECTRUM Horizontal

POLARITY +

DAMPING (ZETA)
2%

ANALYSIS BAND
1/12 octave

CUSTOMER
Metal Bellows Corp.

WJO
548-8934

ITEM
Hose Assy., Flex Meta

P/N 77750

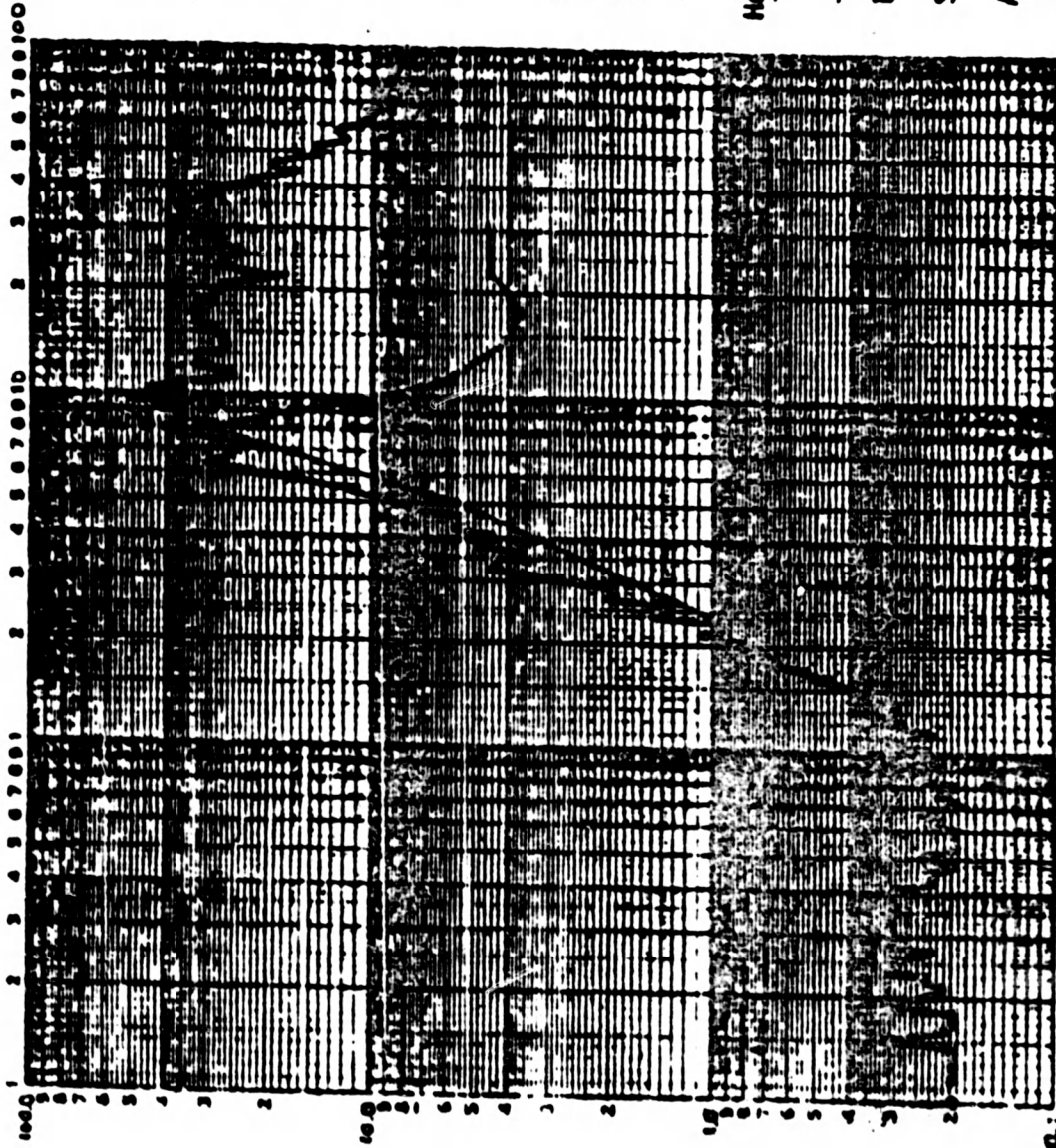
S/N Qual Unit

AXIS X-Y

DATE 10/21/80

TIME

PLOT NO.



FREQUENCY (HZ)

SIGNATURE M.A. Polyan

Response Acceleration (g Peak)



APPROVED ENGINEERING TEST LABORATORIES

EARTHQUAKE RESPONSE SPECTRA

5.0

SPECTRUM

POLARITY +

DAMPING (ZETA) 5%

ANALYSIS BAND via octave

CUSTOMER Metal Bellows Corp.

NO 548-8934

ITEM Hose Assy.

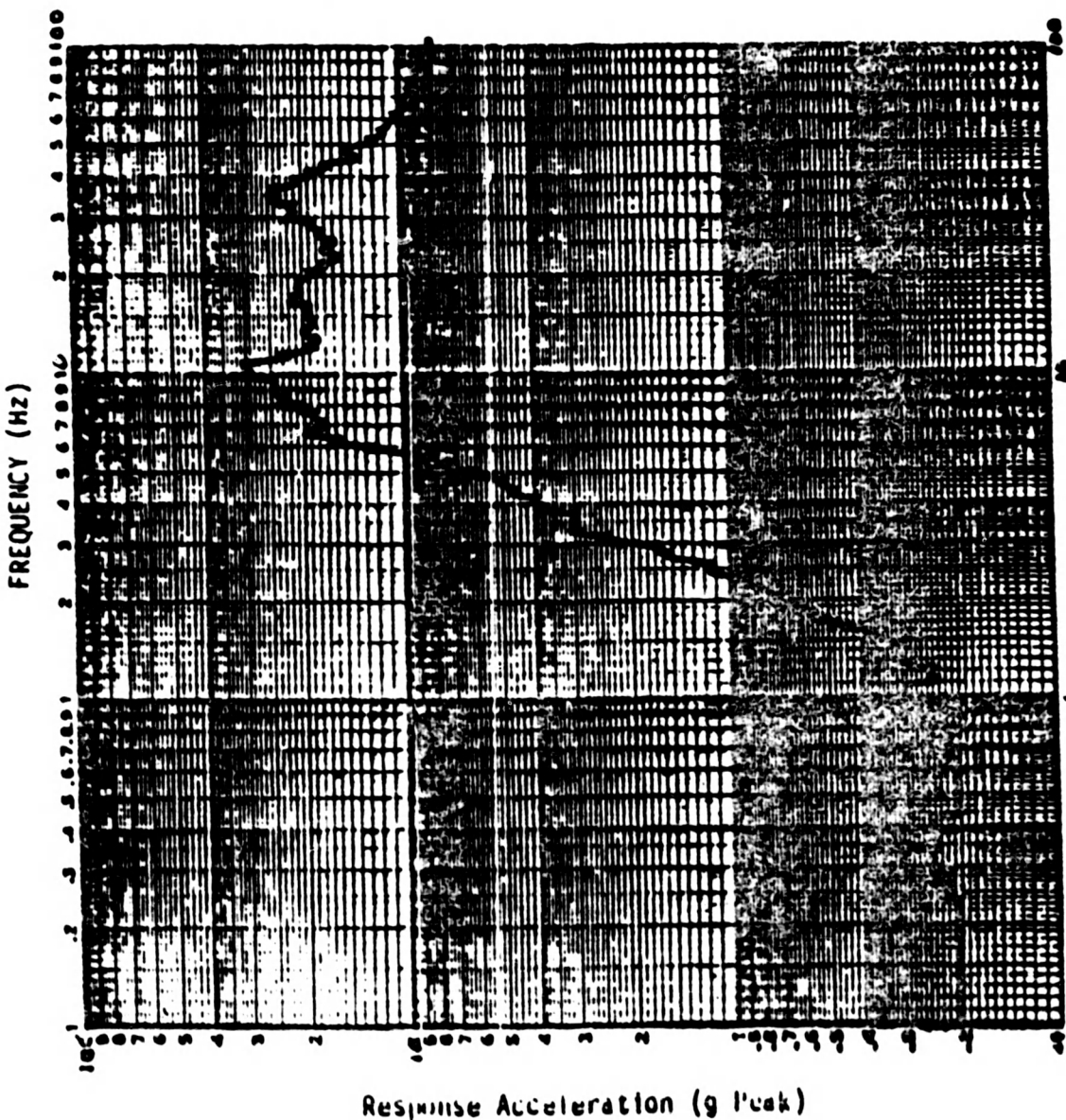
Flex Metal

P/N 7775C

S/N Qual. Unit

AXIS X-Y

PLOT NO. _____



SIGNATURE M. C. Polycans DATE 10/21/80 TIME _____