CONTRACT NAS5-15208

Aerospace Systems Pyrotechnic Shock Data

(Ground Test and Flight)

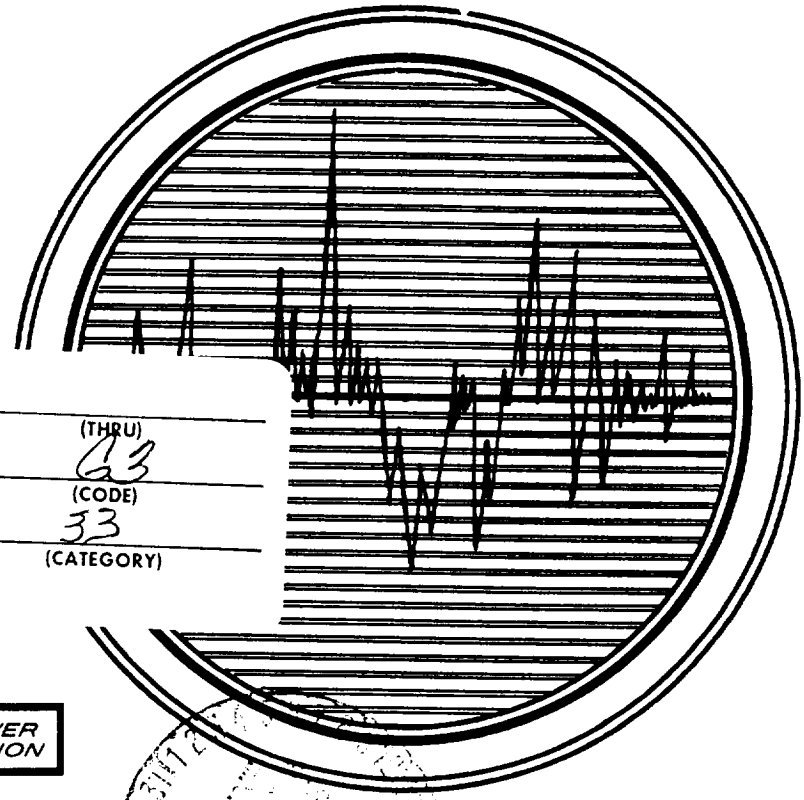
NOT REPRODUCIBLE

Final Report

7 March 1970

Volume II

Data



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FINAL REPORT

For

Aerospace Systems Pyrotechnic Shock Data (Ground Test and Flight)

June 1968 to March 1970

Contract No.: NAS5-15208

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Foreword to Volume II

The pyrotechnic shock data for aerospace systems compiled under Contract NAS5-15208 is contained in two volumes. The two volumes are divided into five divisions and the divisions are further subdivided into parts. The separation of data among the five divisions is as follows:

VOLUME II

Division I - Pyrotechnic shock data associated with structure cutting charges such as mild detonating fuse (MDF) and flexible linear shaped charge (FLSC).

VOLUME III

Division II - Pyrotechnic shock data associated with explosive nuts and bolts.

Division III- Pyrotechnic shock data associated with pressure cartridge actuated devices such as pin pullers and cable cutters.

Division IV - Pyrotechnic shock data associated with extensive test programs on three space vehicles.

Division V - Pyrotechnic shock data from flight events.

The first three divisions are further subdivided into three parts each depending on the type of structure on which the data were measured. These subdivisions are as follows:

Part A - Data from skin-ring- frame structures.

Part B - Data from truss structures.

Part C - Data from structures other than skin-ring-frame or truss structure.

The separate parts are further divided into sections and each section is a complete unit of data.

Division IV contains shock data from three extensive test programs on three different space vehicles. Each test program is a separate part of Division IV and contains data from several different types of pyrotechnic devices on the particular vehicle. These data are contained in a separate division for ease in comparing the effects of different pyrotechnic devices on a space vehicle.

Division V contains flight data from four flight programs. Because of the limitations inherent in flight telemetry systems, the quantity and quality of available data is limited.

Each volume of data contains a complete table of contents for all the data. Each of the five divisions contains a table of contents describing the data within that division except Division I, which has a table of contents for each Part.

The numbering system used in these data volumes is as follows: each section within a part is given a three character identification. The first character is a Roman Numeral which associates the section with one of the five divisions that make up the two data volumes.

The second character is a capital letter (A, B, or C) that associates the section with one of the three Parts in a given Division. The third character is the number of the section in a particular Part. The first section of Part A in Division I would be numbered I.A.1. The tables and figures in a section are identified by the section number followed by the number of the figure or table in the section. For example, the third figure in section I.B.2 would be cited as Figure I.B.2-3.

The data within a section is presented in such a manner that it can stand by itself. Generally, pertinent information about a Section is presented in outline form consisting of brief descriptions of the purpose, the test configuration, the pyrotechnic, the structure, and the data acquisition/reduction systems. Additional information and remarks are sometimes included to further describe the data. These discussions are not analyses or conclusions: they are intended to complete the description of the data. The analyses are contained in a separate volume. The descriptive summary is followed by the necessary tables and figures. Finally, the data are presented in the form of shock spectra with their corresponding acceleration - time histories.

In some cases the data from a single test program may logically fit at two or more locations within the data volumes. This happens when either a single structure is subjected to more than one type of pyrotechnic device or when the shock from a single explosive device is measured in more than one type of structure. In these cases, the data is presented in one of the logical Parts, and reference to it

is made in the other logical Part(s).

Under a subcontract to this study Lockheed Missiles and Space Company compiled shock data that summarized their experience in the field of shock testing and analysis. This report is contained in Volumes IV and V entitled "Compilation of Pyrotechnic Data". Each part in Volume II and III contains a list citing areas of the Lockheed report which would apply to that Part.

The data in each section is presented in the form of shock spectra and the associated time histories when available. Unless otherwise stated the shock spectra in each section are absolute acceleration shock spectra; i.e. the absolute acceleration of a mass when subjected to a base acceleration plotted as a function of the natural frequency of the damped single degree of freedom system.

The shock spectra data were analyzed by both analog and digital techniques. The type of analysis for each set of data is stated in the description of data for that section. The majority of spectra were analyzed using a damping factor of Q = 10. The damping factor (Q) is stated in the description of data for each section and is not presented on the individual data sheets.

Whenever possible the data is presented in such a manner as to afford a measure of repeatability between similar and/or identical tests.

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LIST OF ABBREVIATIONS

USED IN VOLUME II

FLSC	-	Flexible linear shaped charge
IMU	-	Inertial measurement unit
LAT	-	Lateral
LONG	-	Longitudinal
MDF	-	Mild detonating fuse
MGS	-	Missile guidance system
MMIII	-	Minuteman III
MSS	-	Multi-mission support stage
PBPS	-	Post boost propulsion system
RAD	-	Radial
R/S	-	Re-entry system
RV	-	Re-entry vehicle
SBA	-	Satellite basic assembly
SSA	-	Shock spectrum analyzer
S-IVB	-	Saturn IVB
TANG	-	Tangential
UPLF	-	Universal payload fairing
VERT	-	Vertical

DIVISION I

STRUCTURE CUTTING CHARGES

FOREWORD TO DIVISION I - STRUCTURE CUTTING CHARGES

The data in Volume II is associated with Division I - Structure Cutting Charges and is presented in three parts, each associated with a type of structure as follows:

Part I.A	Skin-Ring-Frame Structure
Part I.B.	Truss Structures
Part I.C	Structures Other Than Skin-Ring-Frame or Truss

The volume is comprised of 13 separate sections of data totaling 966 shock spectra. Each Part in Division I contains its own table of contents that lists the type of pyrotechnic for each section.

The location of additional data from other divisions and of related Lockheed data is listed at the end of each part for cross reference.

PART I.A

PYROTECHNIC SHOCK DATA COMPILED FOR STRUCTURE CUTTING CHARGES FOR PROPAGATION IN A SKIN-RING-FRAME STRUCTURE

TABLE OF CONTENTS

PART I.A

Skin-Ring-Frame Structures

SECTION	TITLE	PYROTECHNIC DEVICE	NUMBER OF SHOCK SPECTRA	PAGE NO.
I.A.1	Spartan Short Cylinder Separation Test	MDF	22	5
I.A.2	Spartan Long Cylinder Separation Test	MDF	19	38
I.A.3	Spartan Second/Thrid Stage Separation Test	MDF	55	65
I.A.4	Minuteman III R/S Shock Determination Tests	Prima-chord	94	137
I.A.5	Minuteman III PBV Shock Determination Tests			
	Umbilical Separation	Bolt cutters	151	200
	Stage III/PBV Separation	Prima-chord	315	273
I.A.6	Centaur Insulation Panel Separation Tests	FLSC & MDF	52	404
I.A.7	SBA Booster Separation Tests	MDF	13	424
	Location of Additional Data			439
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SECTION I.A.1

SPARTAN SHORT CYLINDER SEPARATION TEST

PURPOSE OF TEST

This test was performed to simulate second/third stage separation of the Spartan vehicle.

DESCRIPTION OF EVENT

A 42 inch diameter hollow cylinder 6 feet long was severed using a separation shaped charge of MDF at 50 grains per foot. The cylinder was suspended longitudinally, and following the pyrotechnic activity the lower end of the cylinder, having been separated, was allowed to fall freely to the ground. Figures I.A.1-1 and -2 are before and after photographs of the separation event.

DESCRIPTION OF DATA

Twelve accelerometers were monitored during the test. Digital shock spectra and time histories are presented for analysis of the data at two different digital sample rates as itemized below:

	Analysis 1	Analysis 2
Number of time histories	12	10
Duration	(Table I.A.1-1)	(Table I.A.1-1)
Number of shock spectra	12	10

Type of analysis	digital	digital
Sample rate	40,000/sec	160,000/sec
Frequency range	0.4-10 K Hz	6.4-16 K Hz
Frequency increment	10 points/octave	10 points/octave
Damping	Q = 5	Q = 5

The shock spectra are presented with their corresponding time histories in Figures I.A.1-6 through I.A.1-27.

DESCRIPTION OF PYROTECHNIC

Type: Split-ring assembly with MDF

Size of Charge: 50 grains per foot

Explosive propagation rate: 20,000 feet per second

Explosive core: RDX

Blasting cap: No. 6

Location: Figures I.A.1-3 and I.A.1-4

DESCRIPTION OF STRUCTURE

An aluminum cylinder 48 inches long was riveted to another aluminum cylinder 24 inches long. Both cylinders had a 42 inch diameter and 0.160 inch skin thicknesses. The attachment of the two cylinders formed a double-ring joint (Figure I.A.1-4 view A) having the same cross sectional area as the joint to be used in the prototype vehicle. A 3/4-inch thick aluminum plate weighing 100 pounds was

fastened to the double-ring joint to represent the prototype telemetry rack. Equipment weighing 5.75 pounds was fastened to the rack. A honeycomb ring was also attached to the inside of the cylinder at a location 18.5 inches above the separation plane. This configuration is shown in Figure I.A.1-4.

DESCRIPTION OF ACCELEROMETERS

Type: Endevco model 2225-M5

Location: Figure I.A.1-4

Axis of sensitivity: Table I.A.1-1

DESCRIPTION OF DATA ACQUISITION SYSTEM

This information was not available.

FAILURES

No structural failure was evident during this test. However, five previous tests were run under similar conditions, and all five runs exhibited failure associated with the data acquisition system. These anomalies are itemized below:

Test 1 - All accelerometer mounting bonds failed and no data were obtained.

Test 2 - All accelerometer mounting bonds loosened and no data were obtained.

Test 3 - All accelerometer cables loosened, one mounting stud failed, three more mounting studs loosened, and the other two accelerometers loosened. As a result, no data were obtained.

Test 4 - Of six accelerometers, one mounting stud failed, four cables loosened, and the data from the other accelerometer appeared questionable and was not reduced.

Test 5 - One accelerometer cable was broken. The others functioned properly, but the signal-to-noise ratio was too low to allow useable data.

Test 6 - One accelerometer cable failed. All other channels produced good data.

After the failures associated with Test 1, Tests 2 through 4 were run to determine a satisfactory accelerometer mounting system. The results of Test 5 indicate that an acceptable mounting system had been realized. Tests 1 through 5 were associated with 42-inch diameter cylinders of various lengths all having a skin thickness of 0.250 inches while the skin thickness in Test 6 was 0.160 inches. It is the results of Test 6 that are presented in this section.

COMMENTS

Notice that each shock spectrum plot consists of two curves: one curve is associated with the largest positive response while the other is associated with largest negative response, but no distinction can be made as to the precise identity of either curve.

Under "Description of Data" the frequency range for the 40,000/second sample rate is indicated as 400-10,000 Hz. However, due to the low sampling rate, these shock spectra are probably not valid for frequencies above 4,000 to 5,000 Hz.

It would be anticipated that in comparing the data for a particular accelerometer at two different sample rates, the results would show higher levels associated with the greater sample rate. Generally this was the case; however, accelerometer No. 1 exhibits a classic deviation from this hypothesis which cannot be explained.

TABLE I.A.1-1

INFORMATION ABOUT ACCELEROMETER DATA USED IN SHOCK SPECTRUM ANALYSIS

Accelerometer Number	Axis of Sensitivity	Duration of Time History (milliseconds) Used in Shock Spectrum Analysis	
		Analysis 1	Analysis 2
1	radial	17.5	6.3
2	radial	57.5	6.0
3	radial	17.5	6.3
4	radial	17.5	6.3
5	radial	17.5	3.3
6	radial	13.75	3.3
7	radial	6.4	6.4
8	radial	13.75	6.4
9	radial	6.4	6.4
10	radial	2.8	2.8
13	axial	15.0	---
14	axial	13.75	---

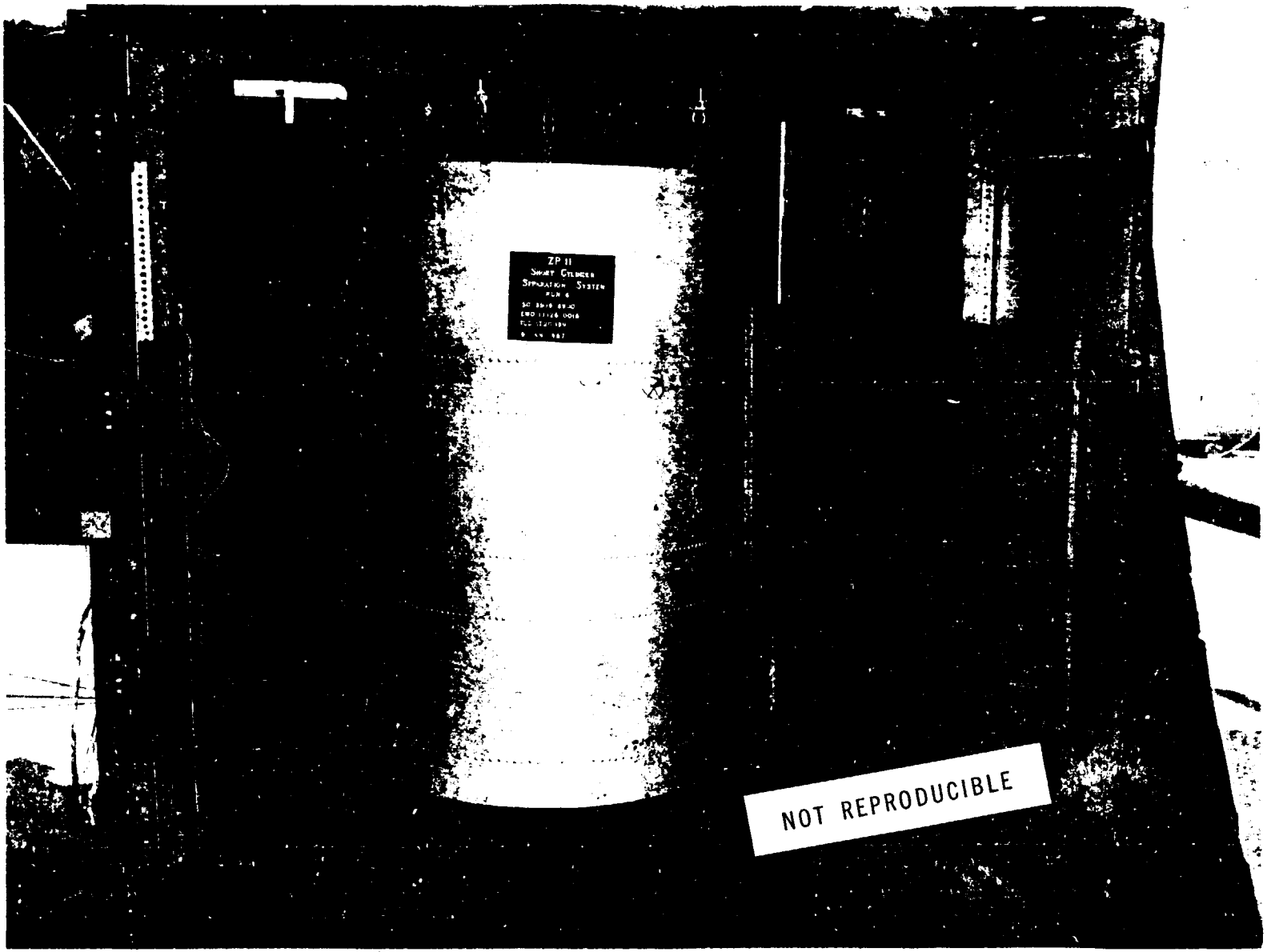


Figure I.A.1-1. Test Specimen Before Separation

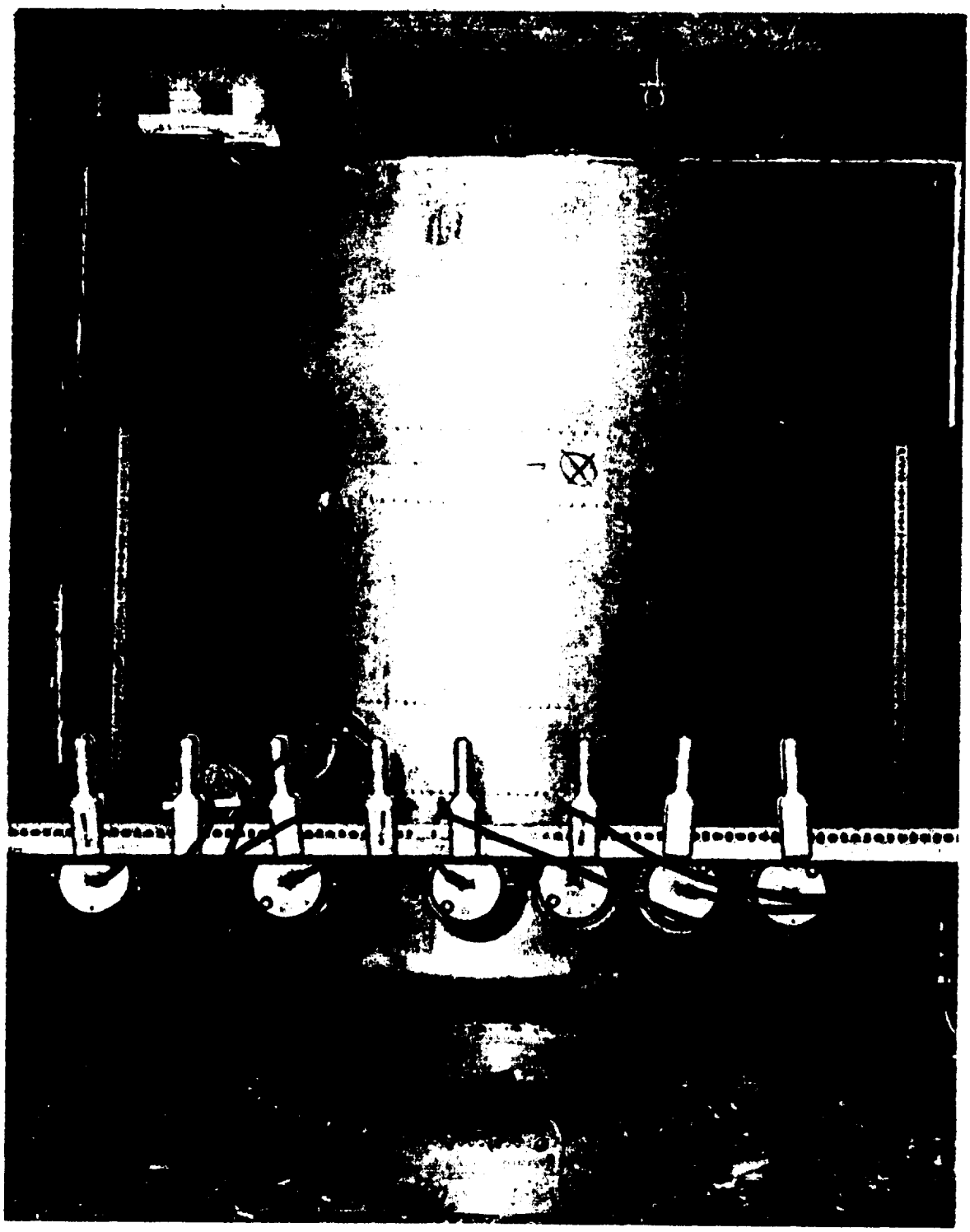


Figure I.A.1-2. Test Specimen After Separation

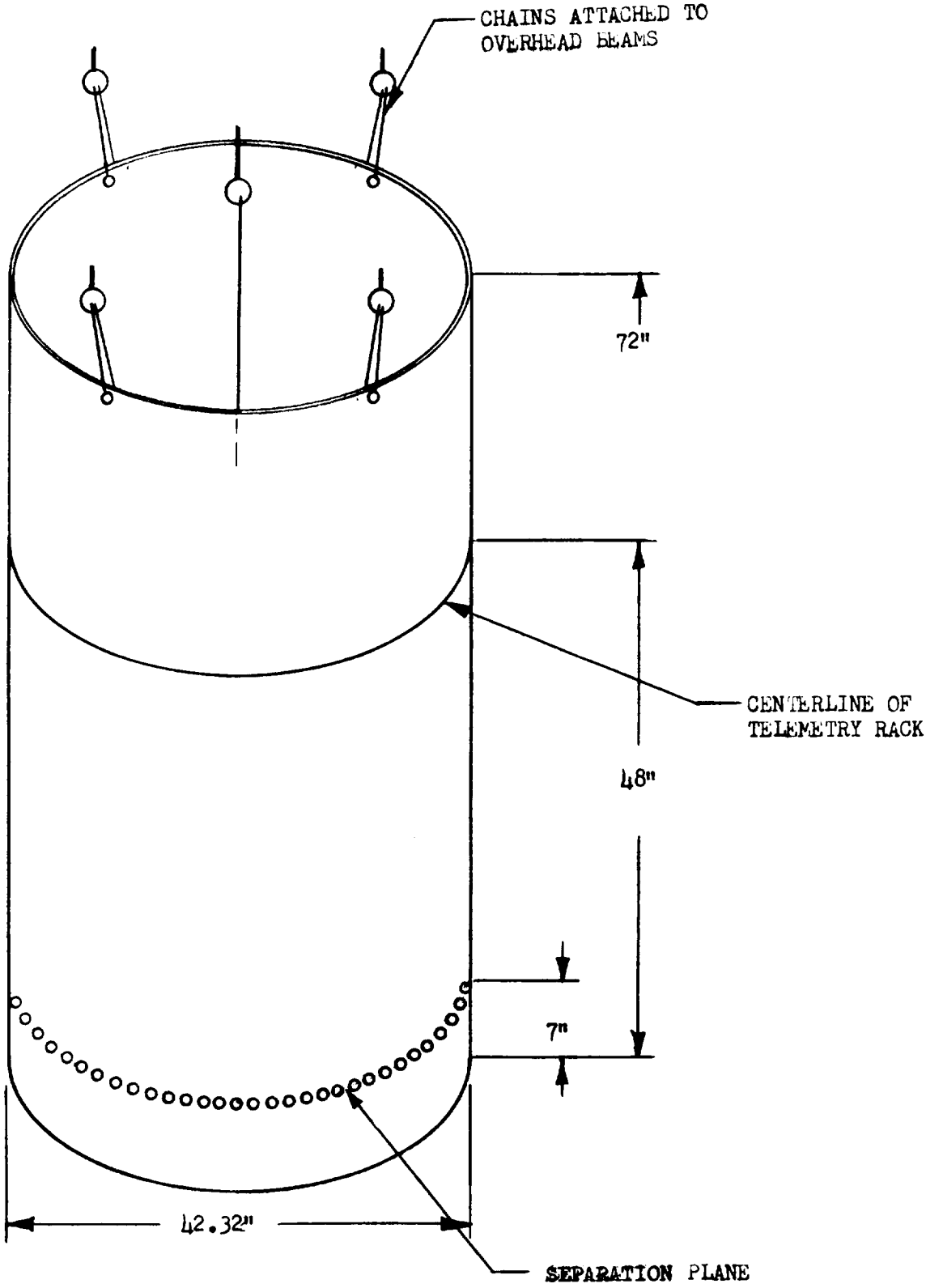


FIGURE I.A.1-3

DIAGRAM OF SPARTAN SHORT CYLINDER TEST SET-UP

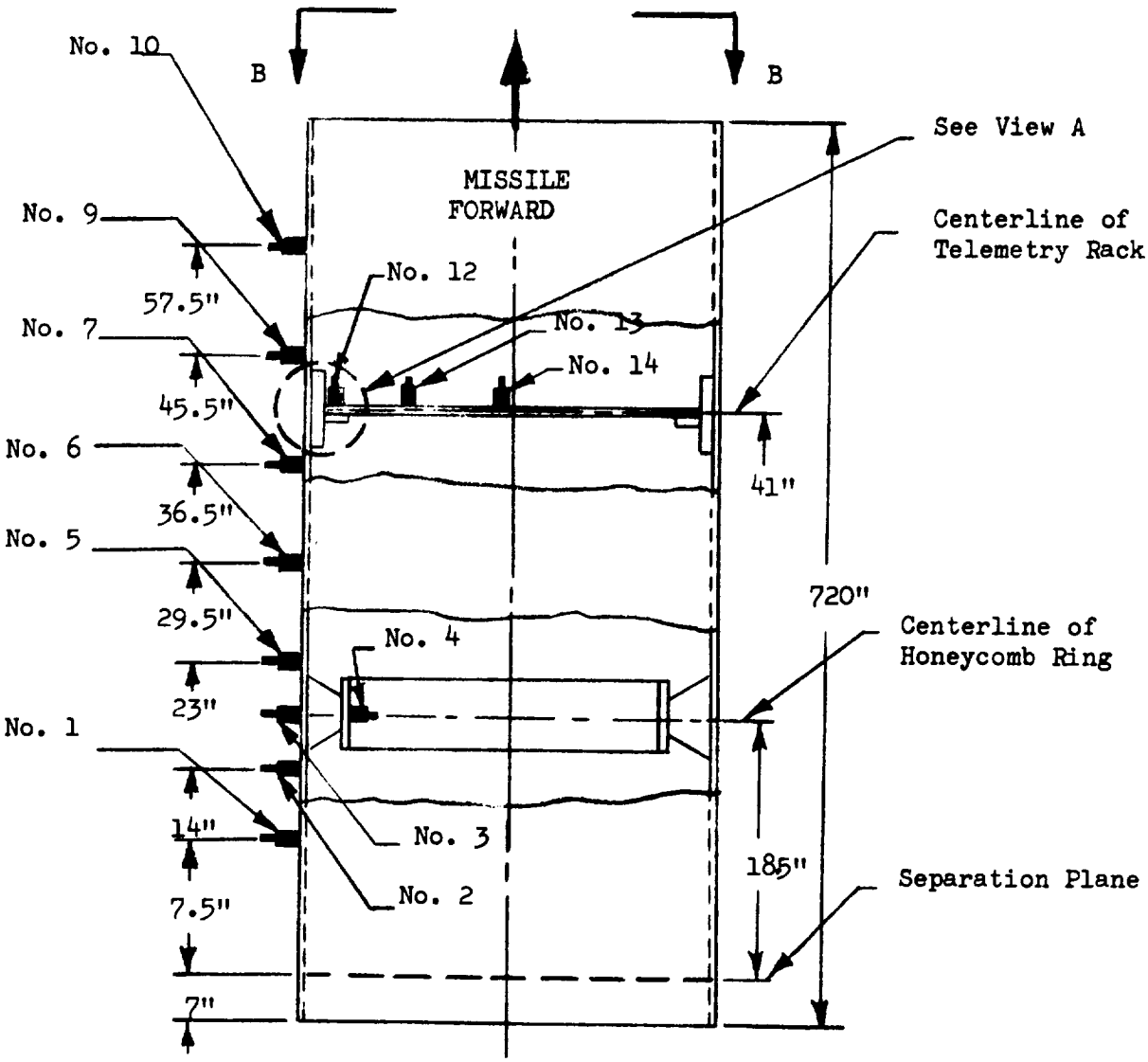
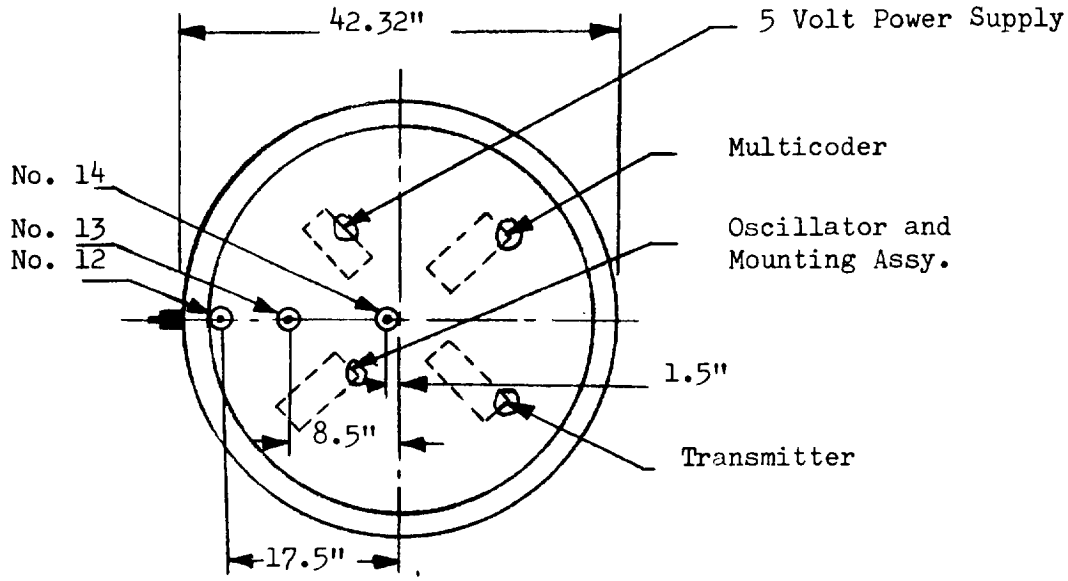
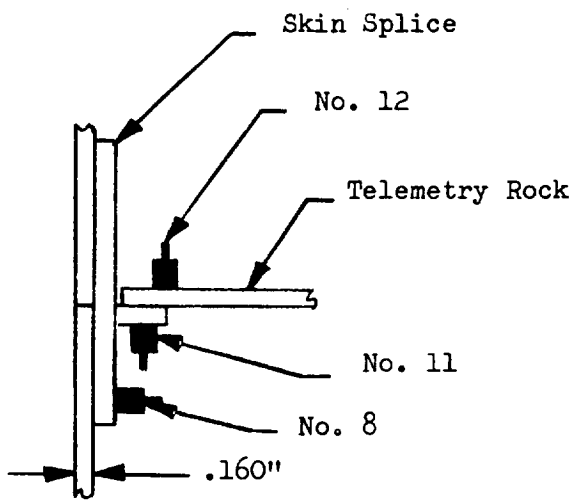


Figure I.A.1-4. Accelerometer Locations

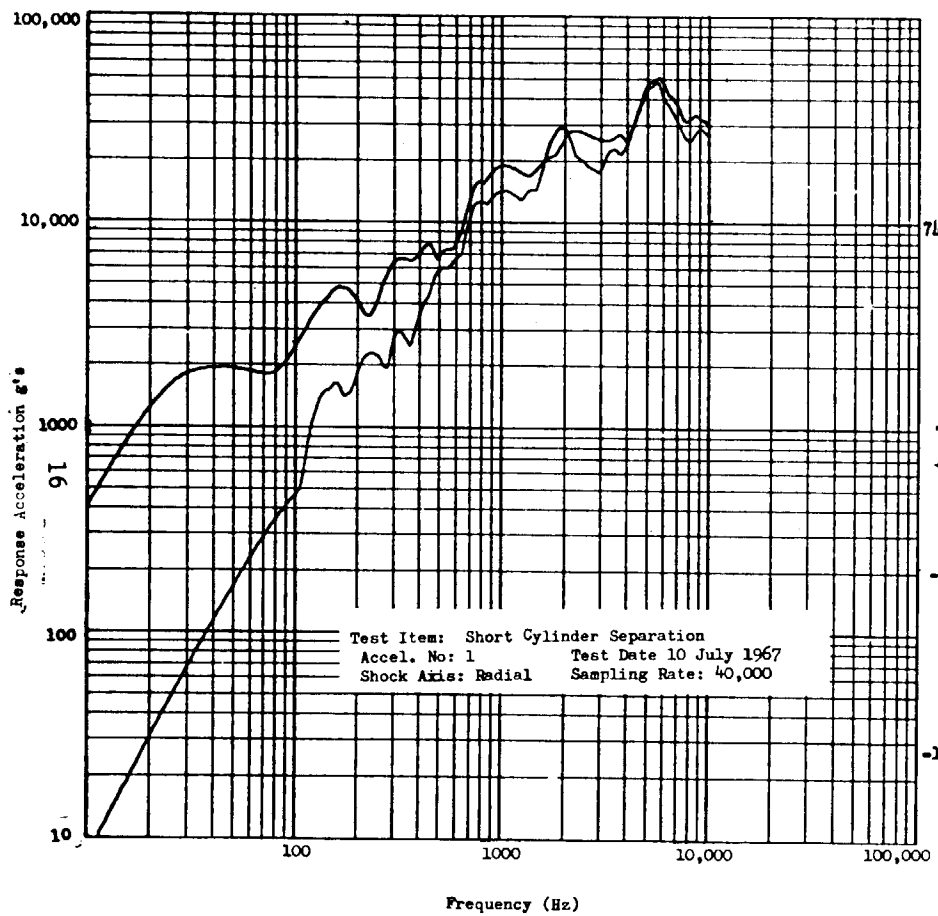


VIEW B-B



VIEW A

Figure I.A.1-5. Accelerometer Locations


100,000
10,000
1000
100
10
Response Acceleration g's
100
1000
10,000
100,000
Frequency (Hz)
Test Item: Short Cylinder Separation
Accel. No: 1
Test Date 10 July 1967
Shock Axis: Radial
Sampling Rate: 40,000

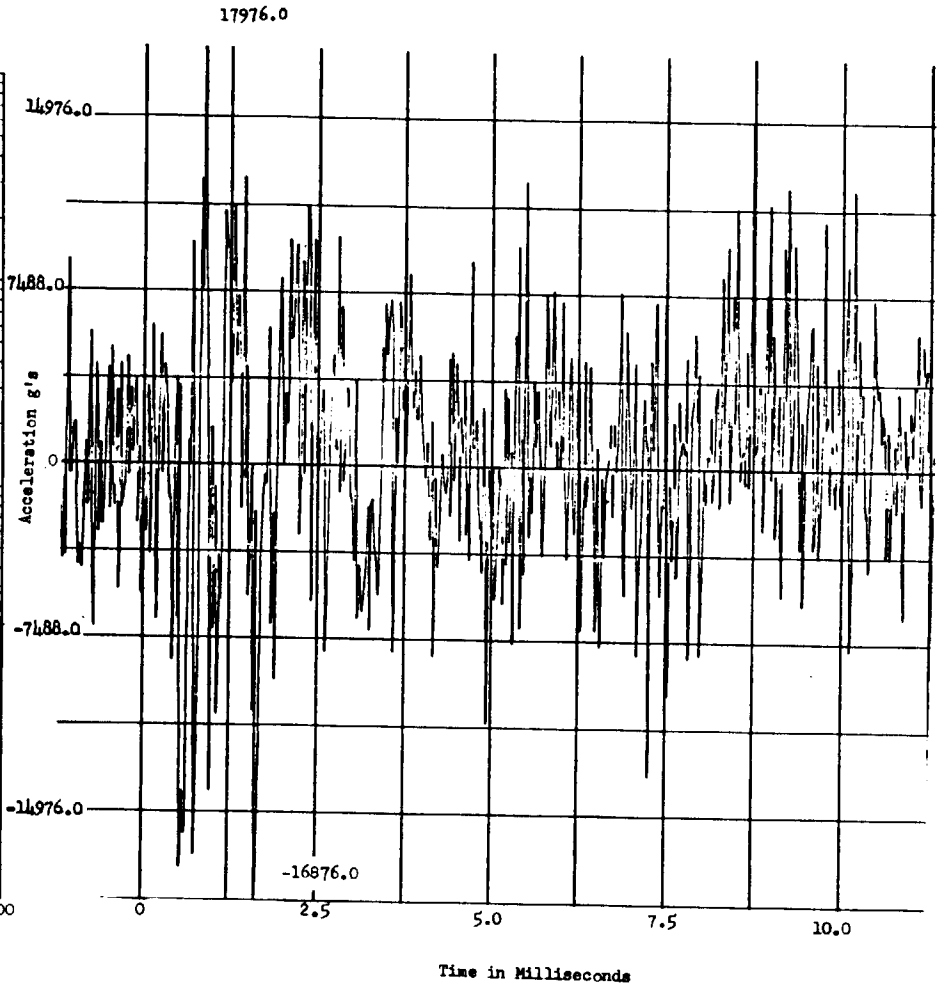
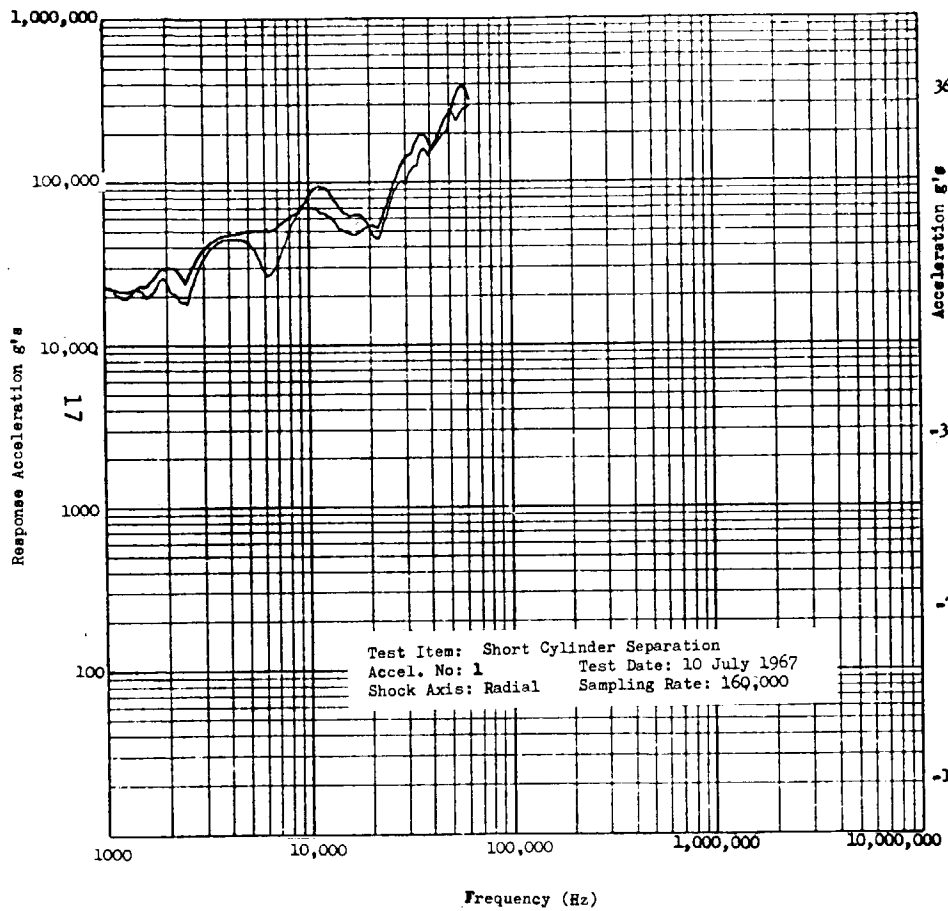

17976.0
14976.0
7488.0
0
-7488.0
-14976.0
-16876.0
Acceleration g's
0
2.5
5.0
7.5
10.0
Time in Milliseconds

FIGURE I.A.1-6


1,000,000
100,000
10,000
1000
100
Response Acceleration g's
1000
10,000
100,000
1,000,000
10,000,000
Frequency (Hz)
Test Item: Short Cylinder Separation
Accel. No: 1
Test Date: 10 July 1967
Shock Axis: Radial
Sampling Rate: 160,000

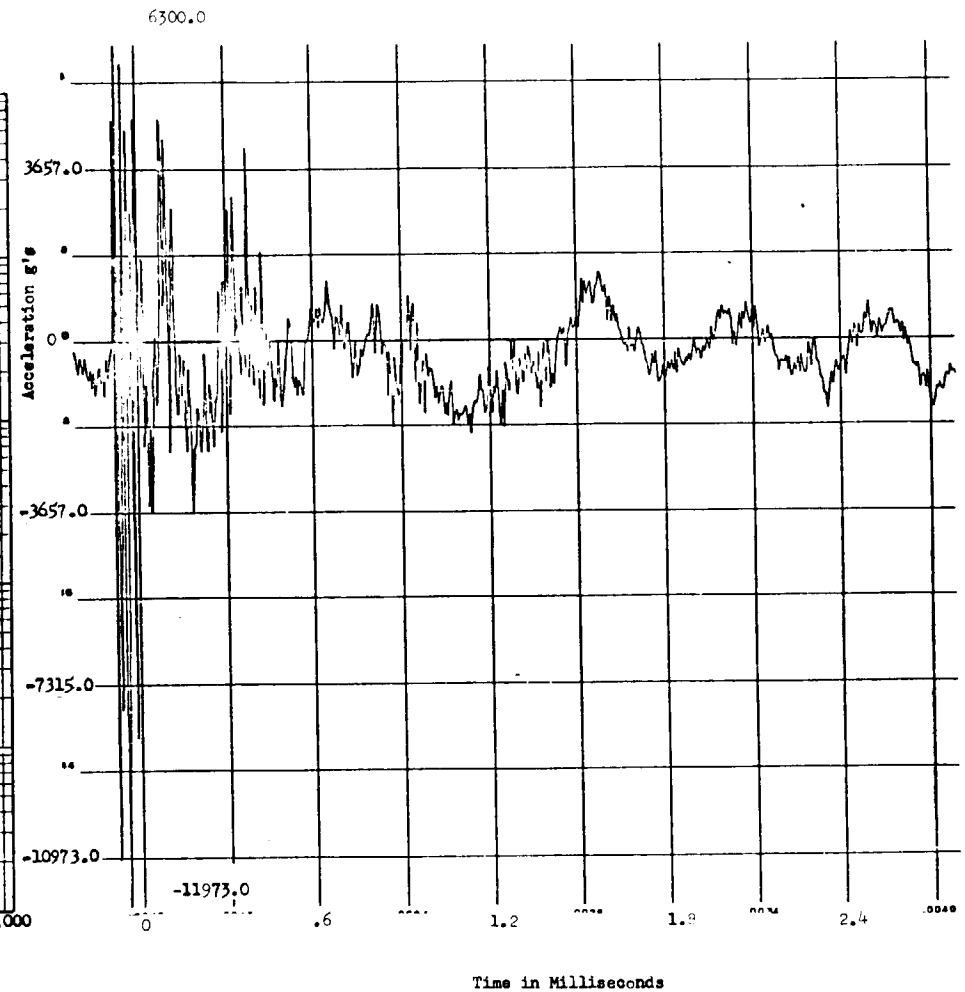

6300.0
3657.0
0
-3657.0
-7315.0
-10973.0
-11973.0
Acceleration g's
0
.6
1.2
1.8
2.4
Time in Milliseconds

FIGURE 1.A.1-7

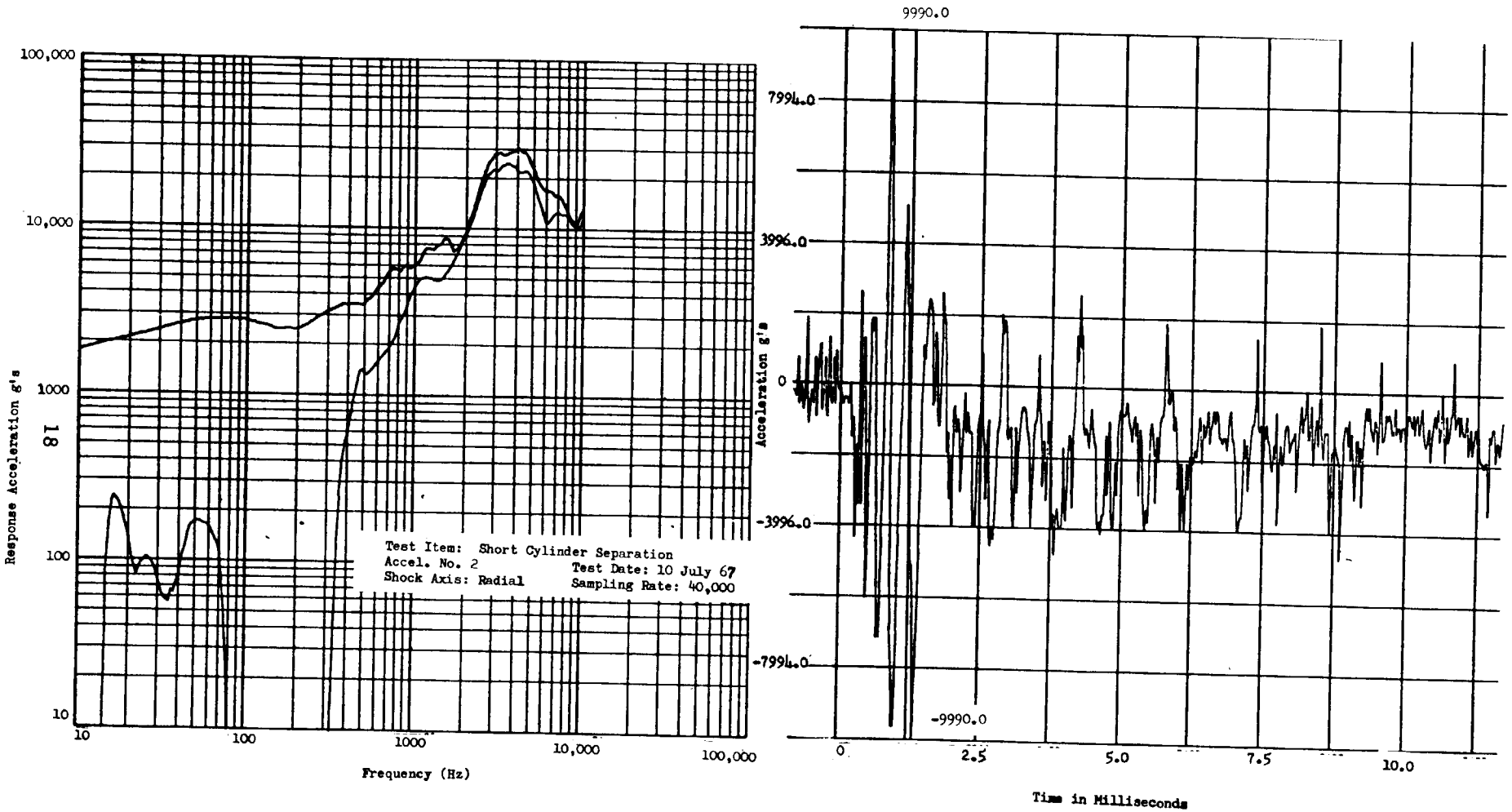
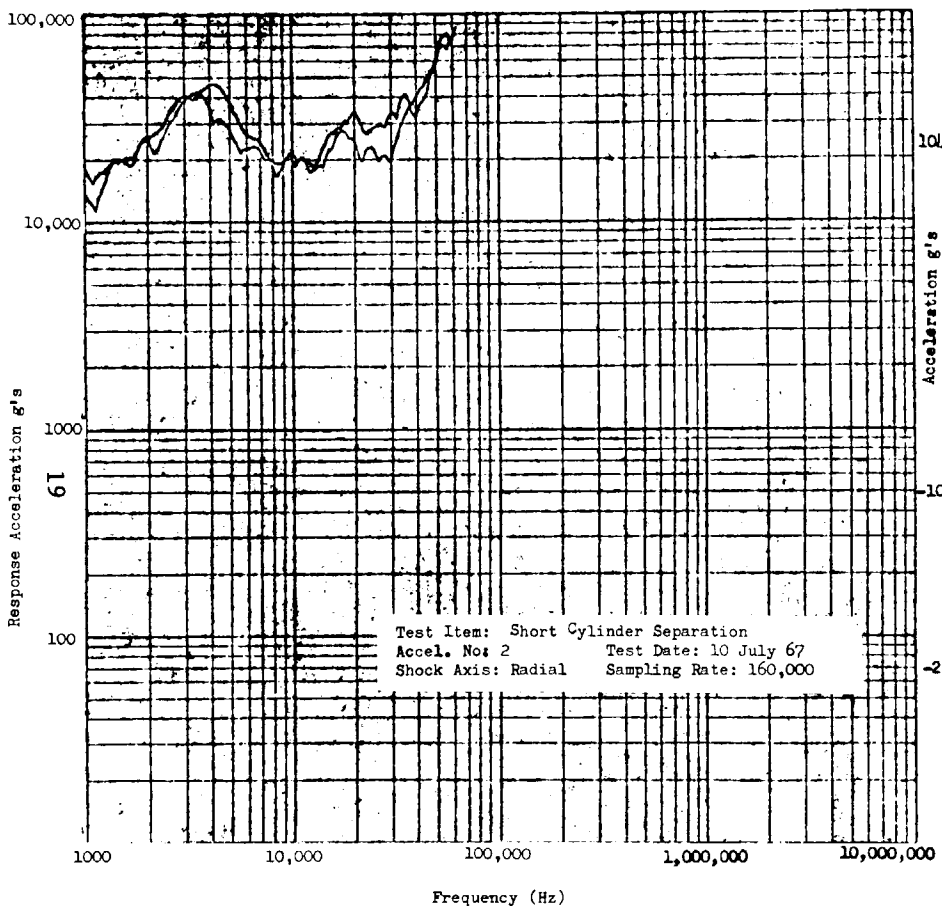

100,000
10,000
1000
100
10
Response Acceleration g's
10
100
1000
10,000
100,000
Frequency (Hz)
Test Item: Short Cylinder Separation
Accel. No. 2
Shock Axis: Radial
Test Date: 10 July 67
Sampling Rate: 40,000
9990.0
7994.0
3996.0
0
-3996.0
-7994.0
-9990.0
Acceleration g's
0
2.5
5.0
7.5
10.0
Time in Milliseconds

FIGURE I.A.1-8


100,000
10,000
1000
100
Response Acceleration g's
1000
10,000
100,000
1,000,000
10,000,000
Frequency (Hz)
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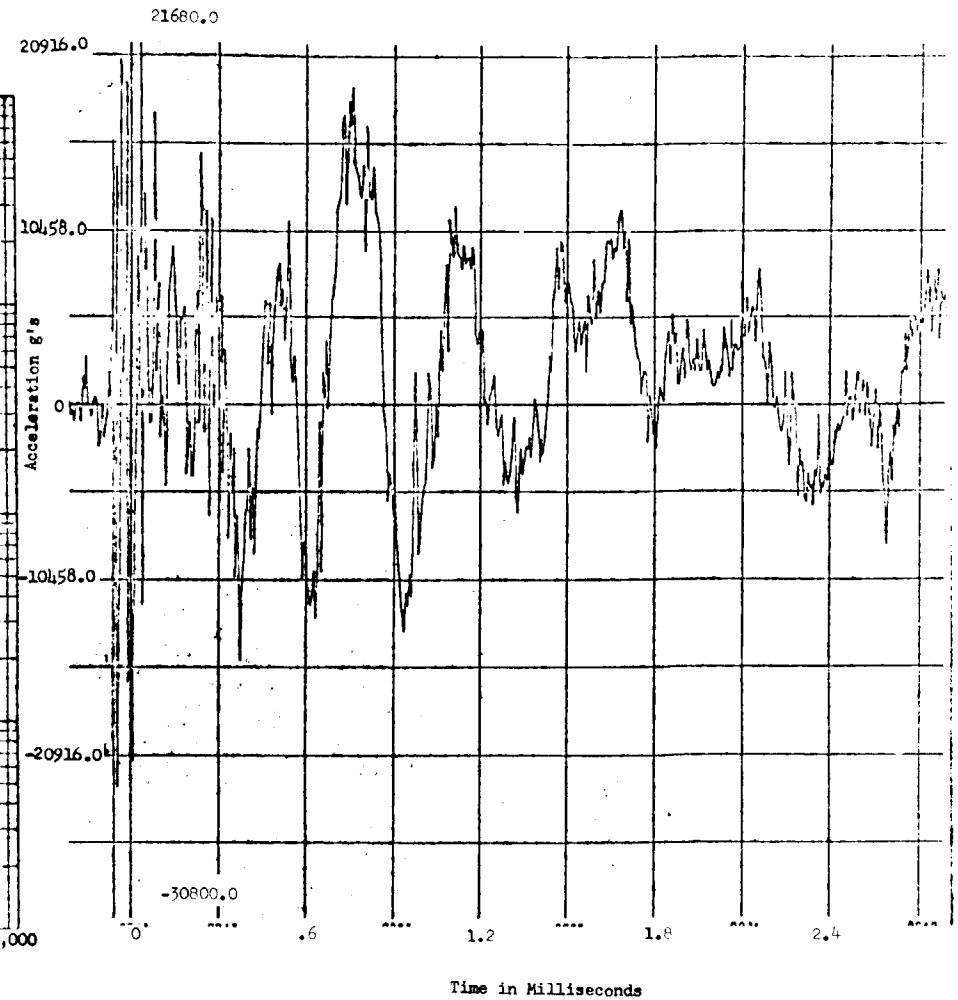
Accel. No: 2
Test Date: 10 July 67
Shock Axis: Radial
Sampling Rate: 160,000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10458.0
0
-10458.0
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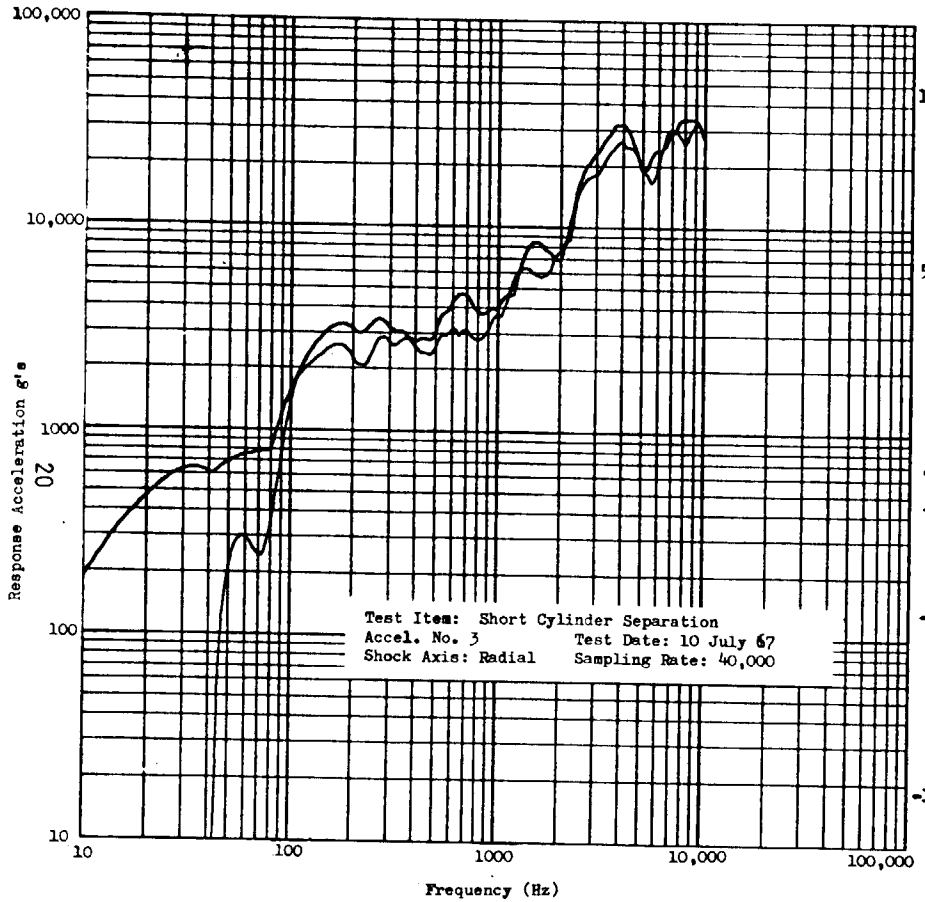
-30800.0
Acceleration g's
0
.6
1.2
1.8
2.4
Time in Milliseconds

FIGURE I.A.1-9



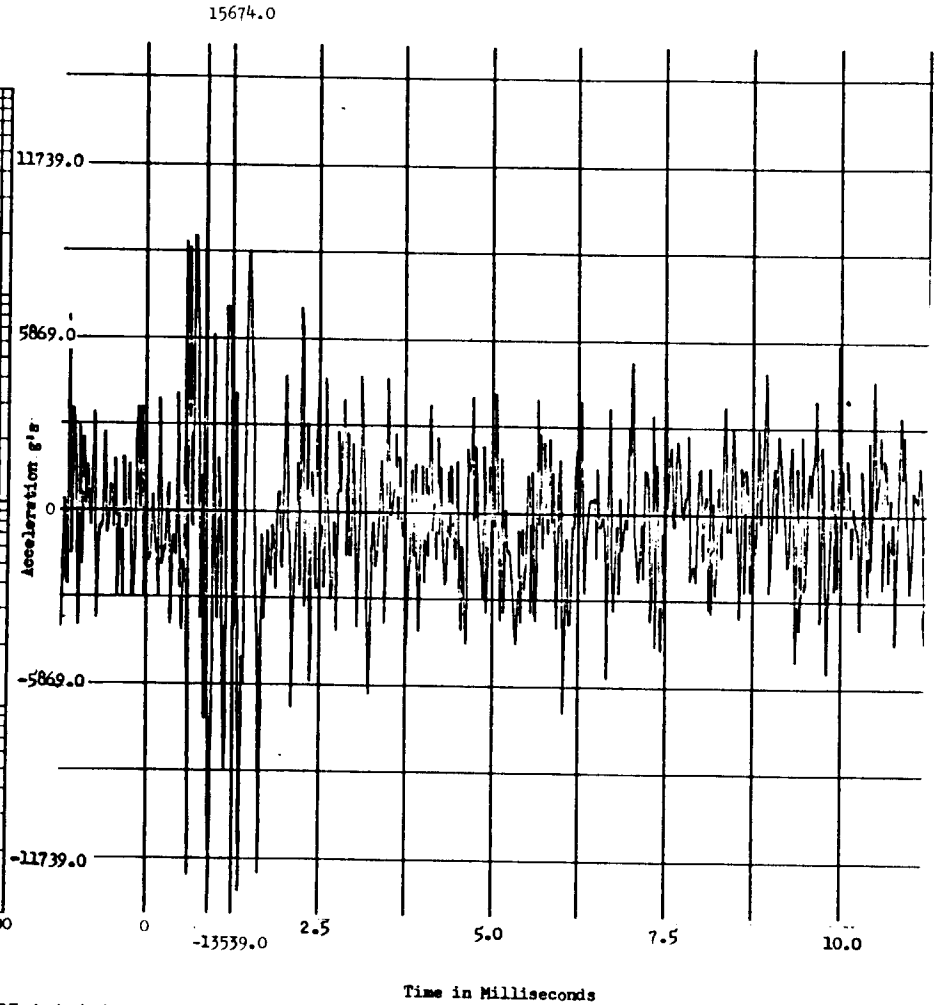
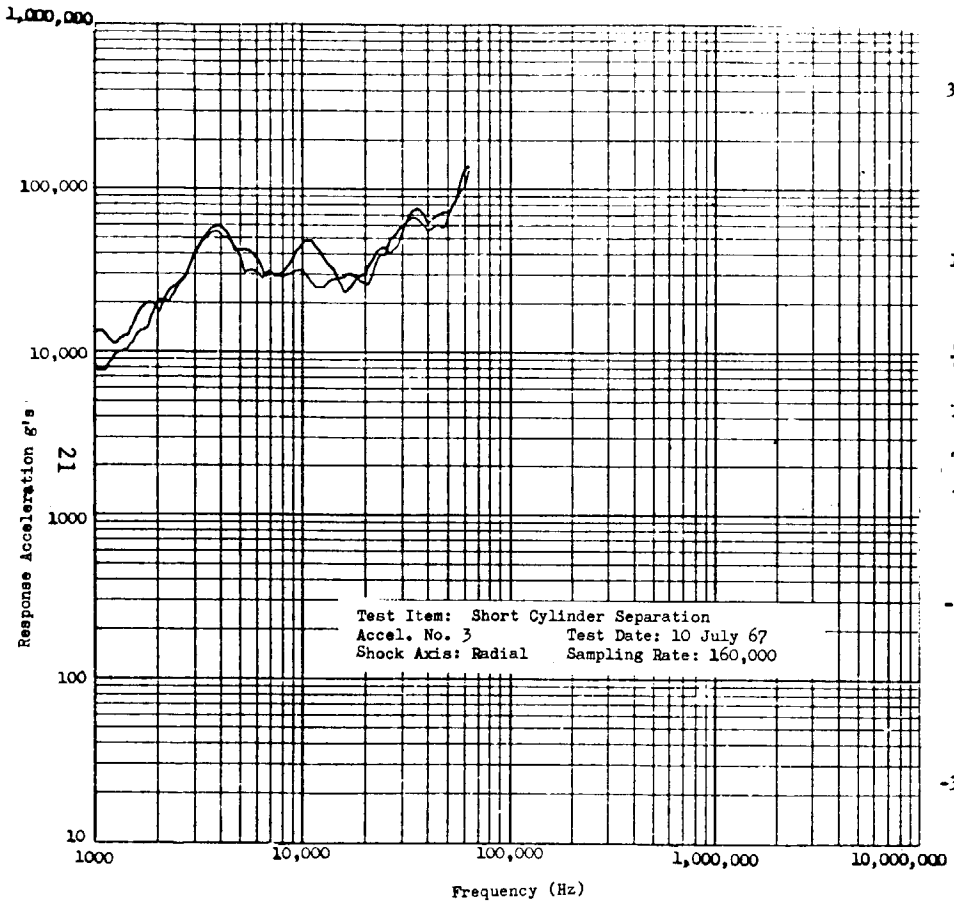


FIGURE I.A.1-10



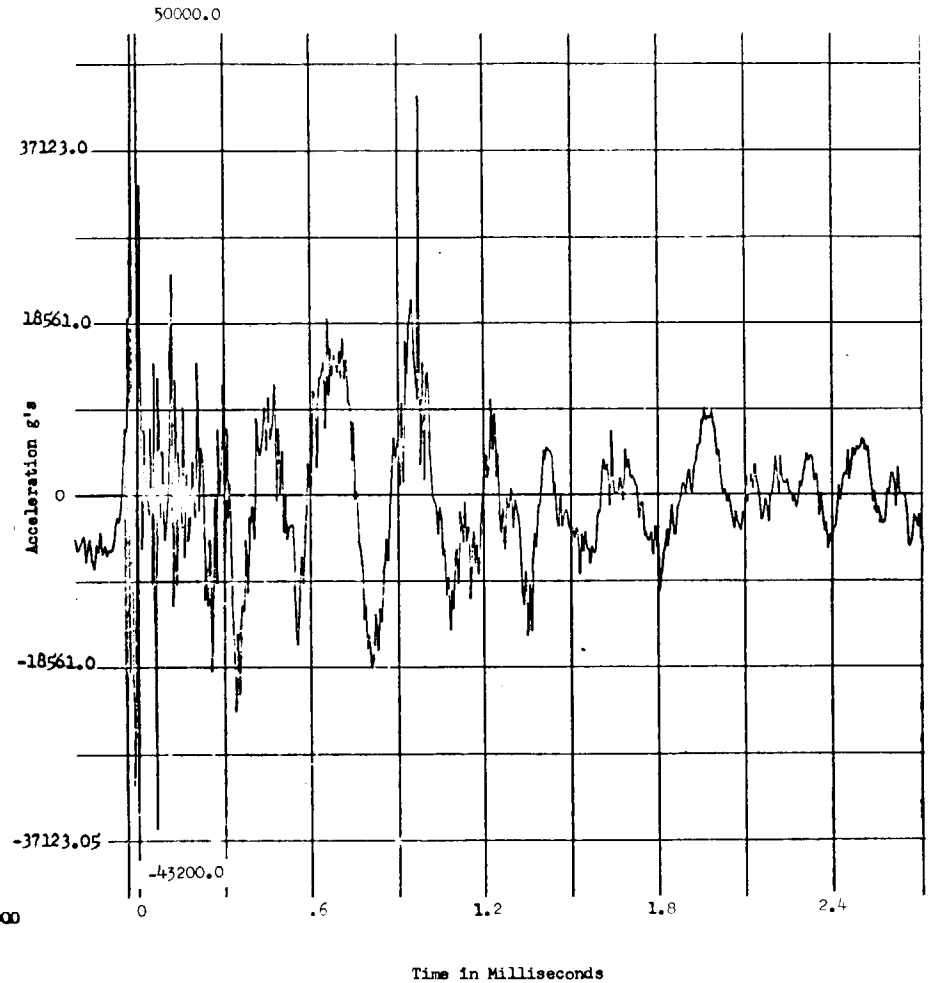
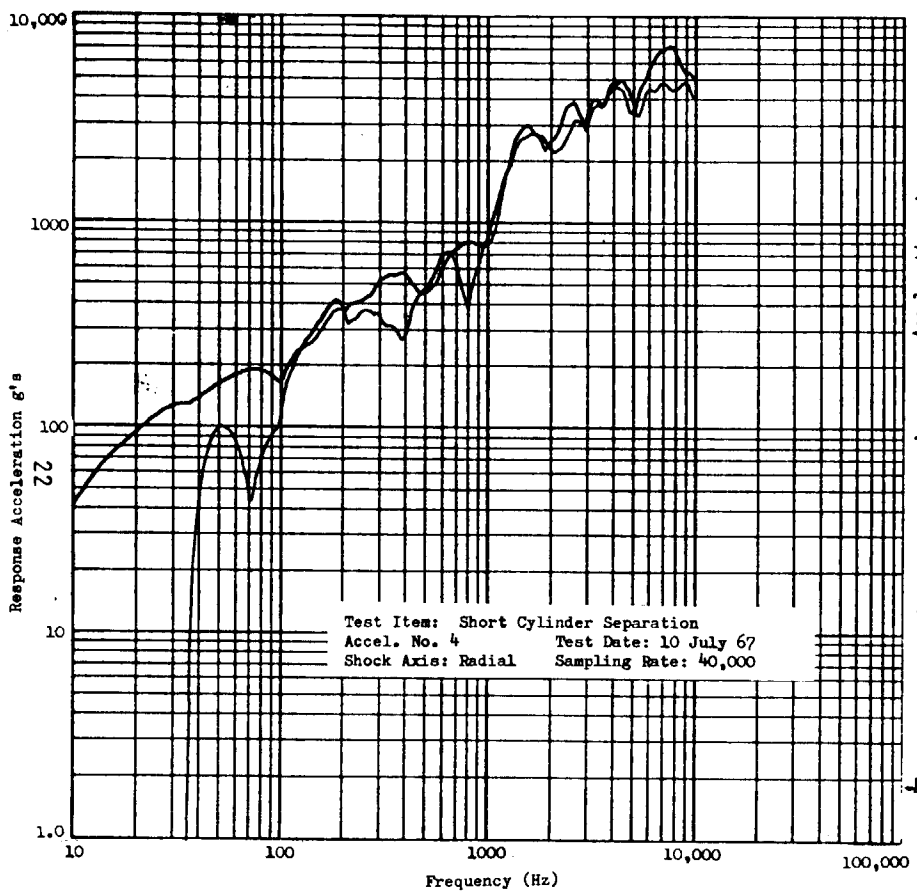


FIGURE I.A.1-11



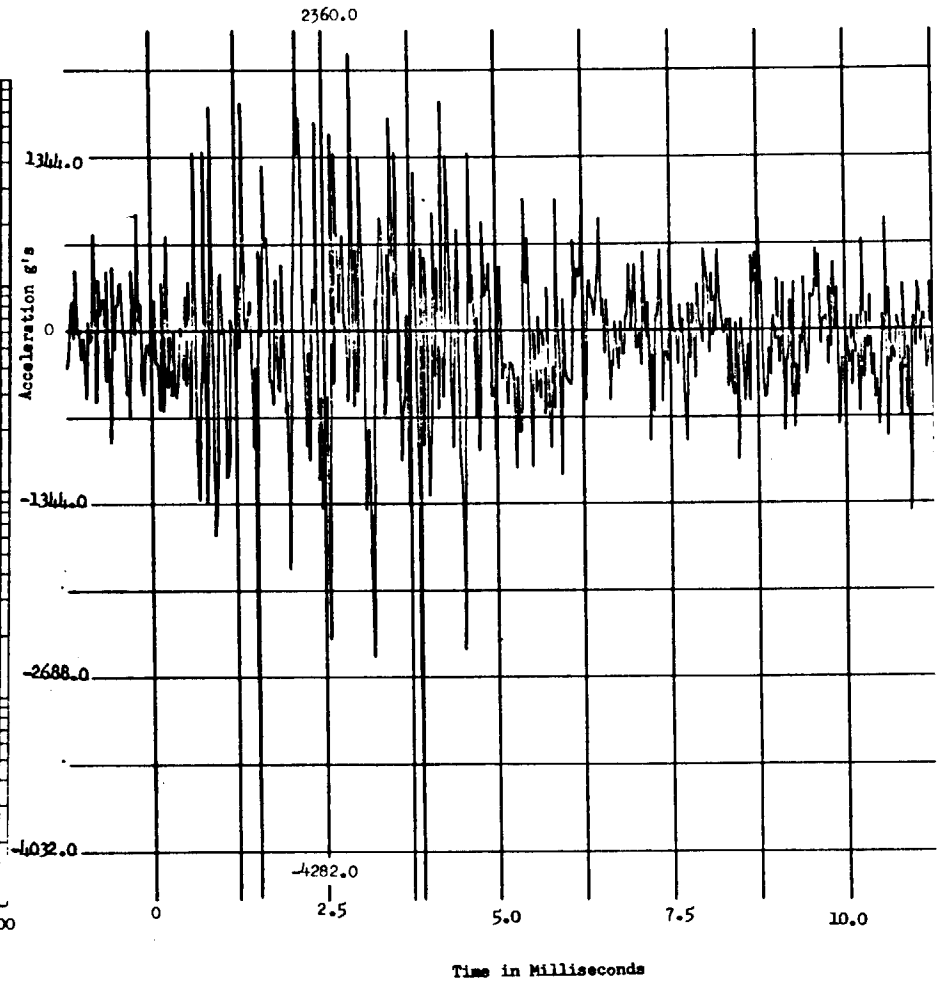
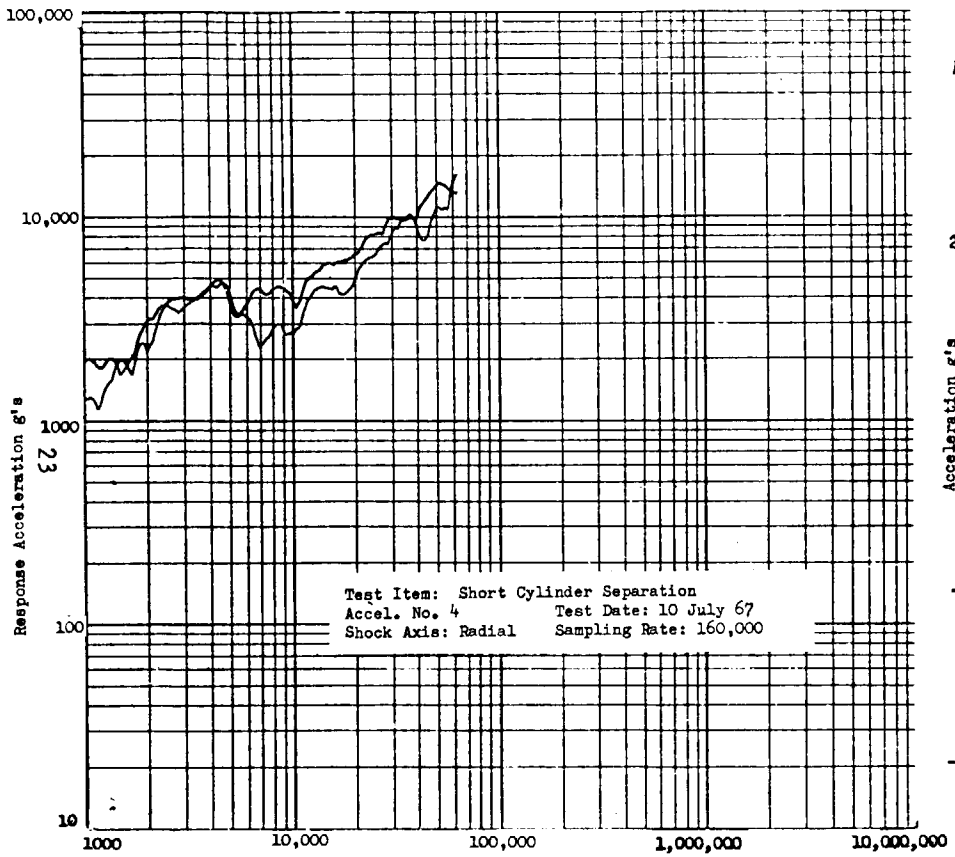


FIGURE I.A.1-12



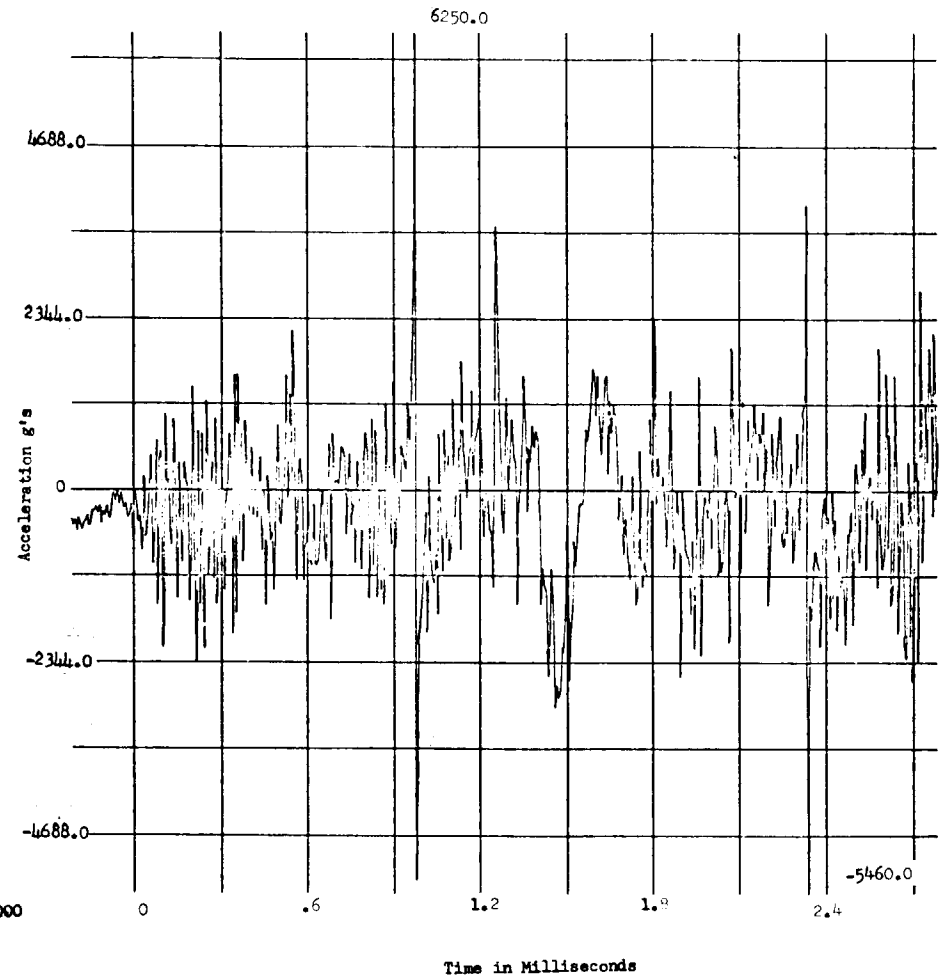
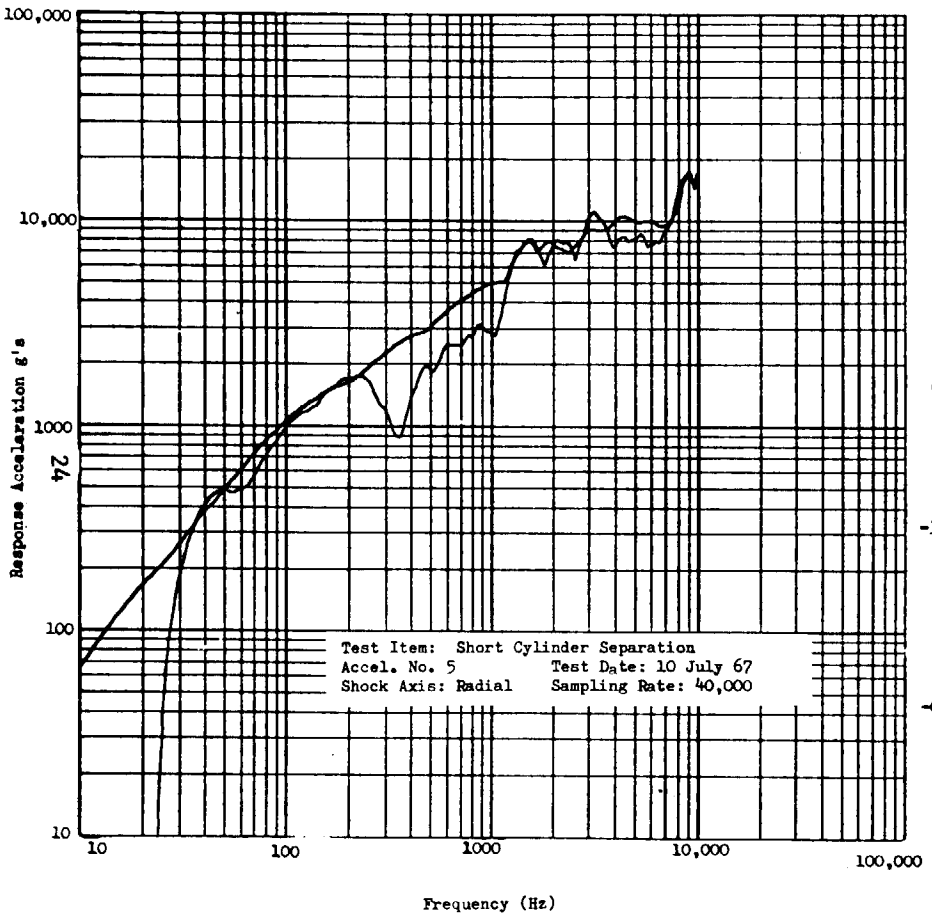


FIGURE I.A.1-13



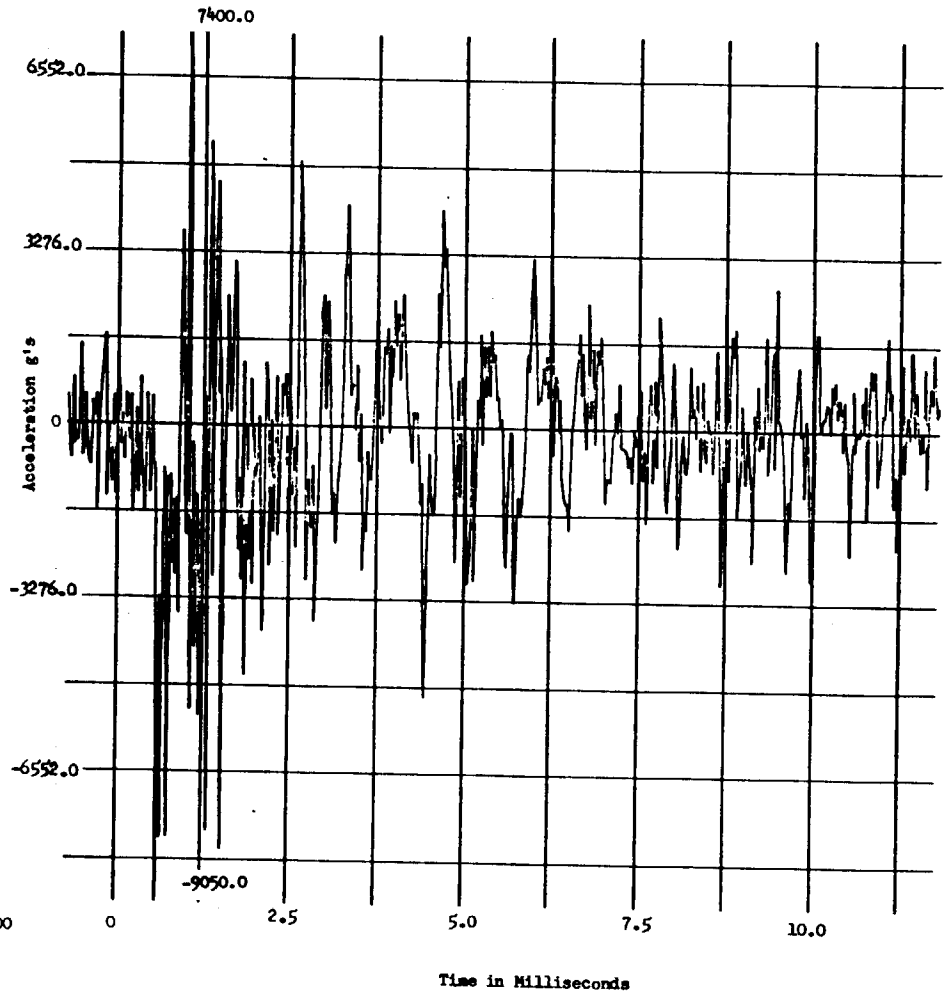
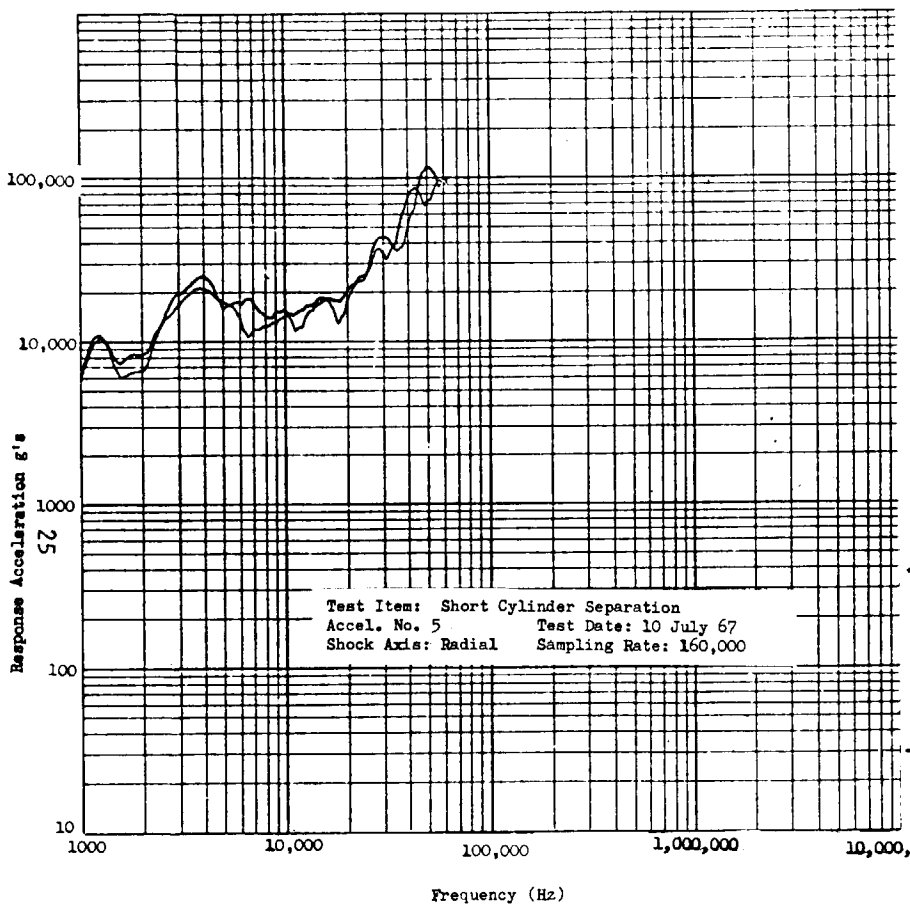


FIGURE I.A.1-14



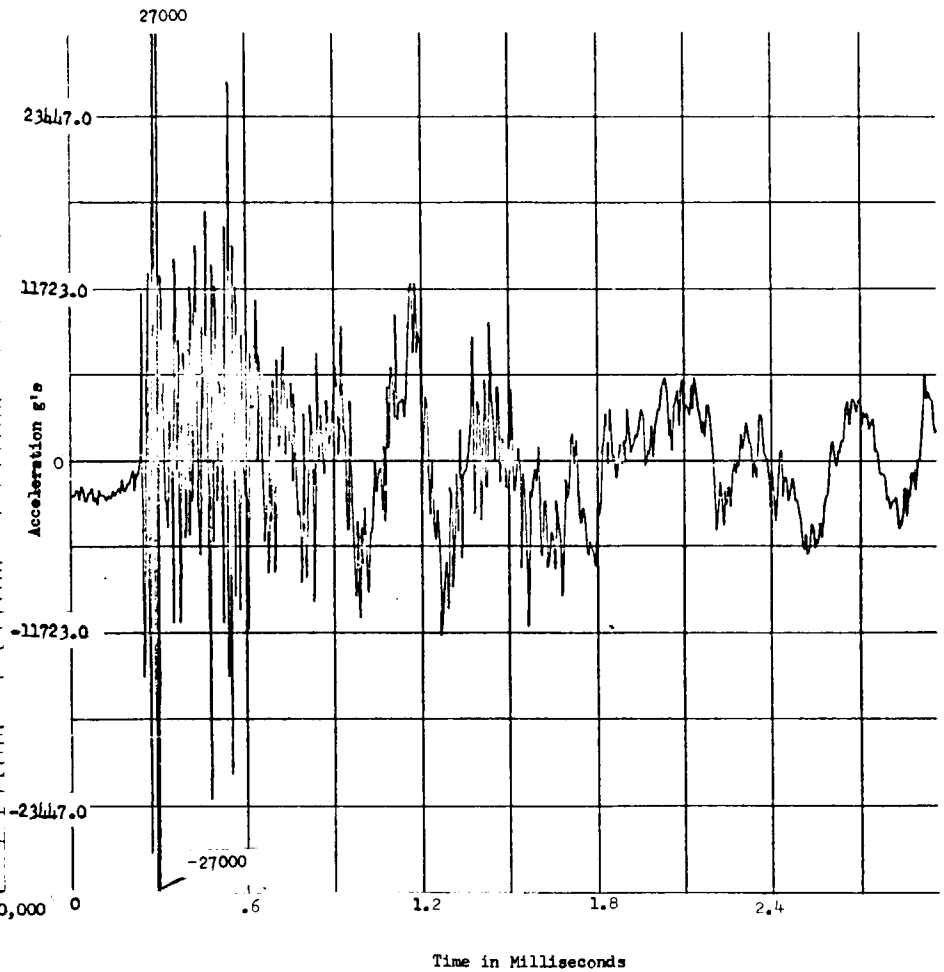
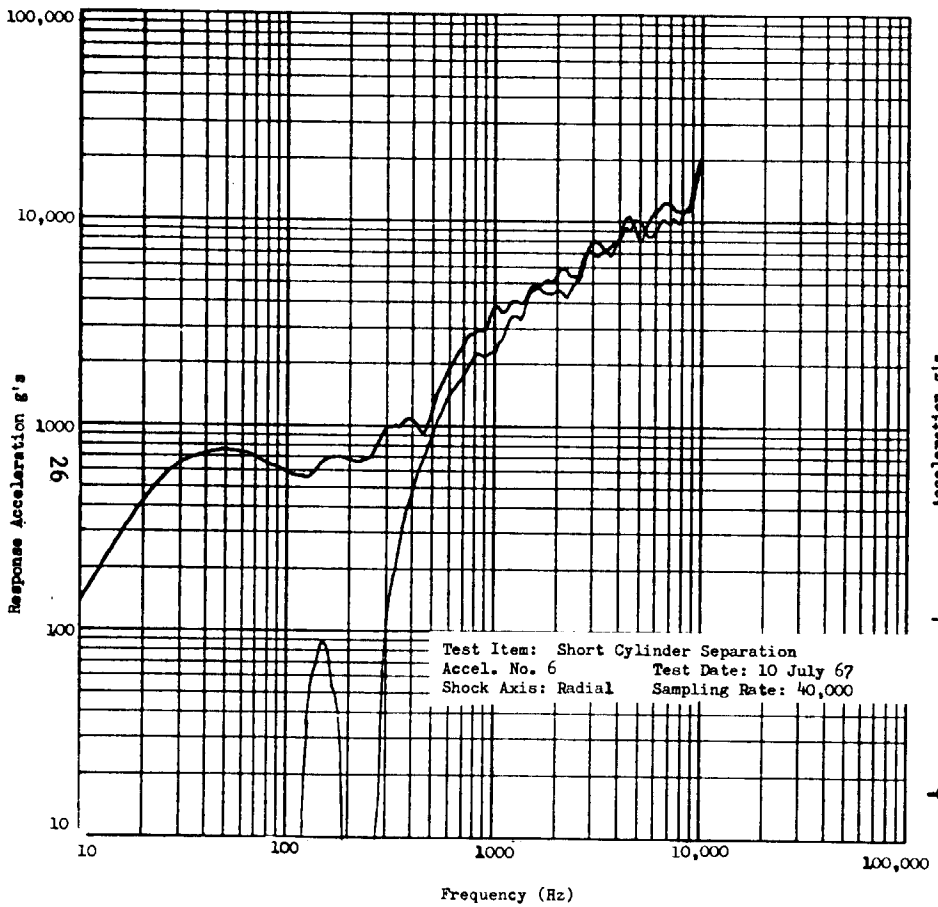


FIGURE 1.A.1-15



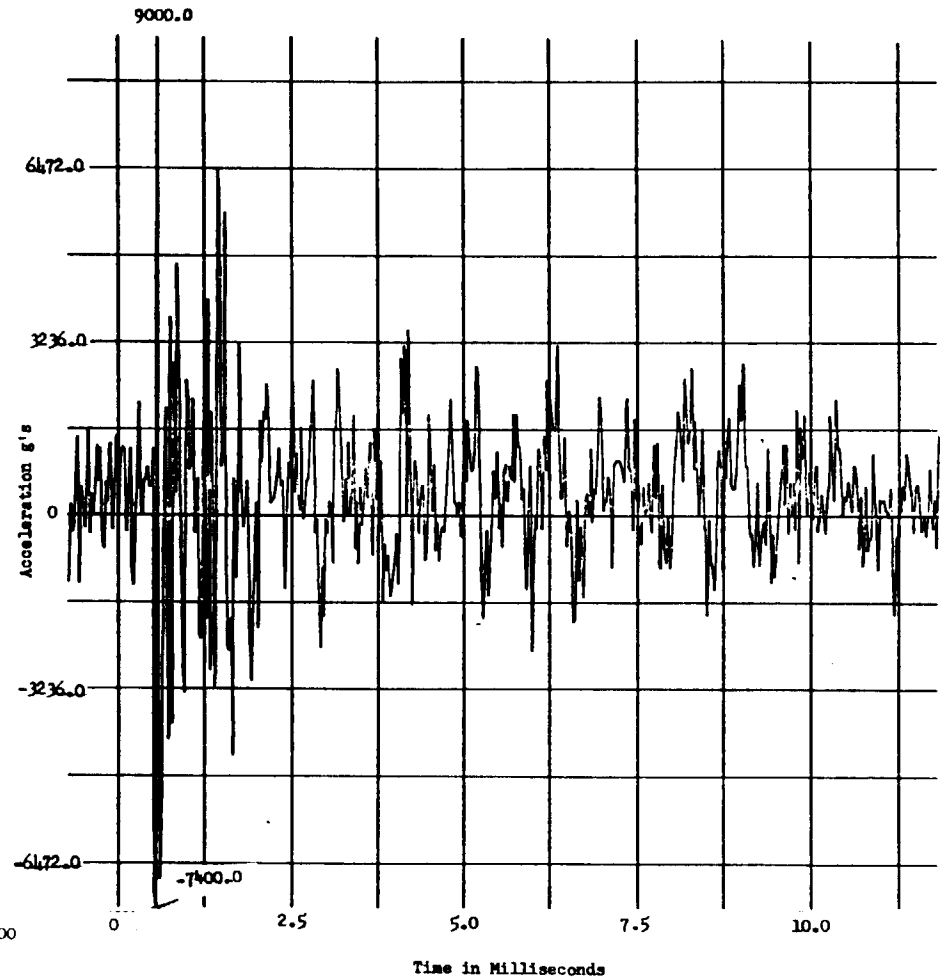


FIGURE I.A.1-16

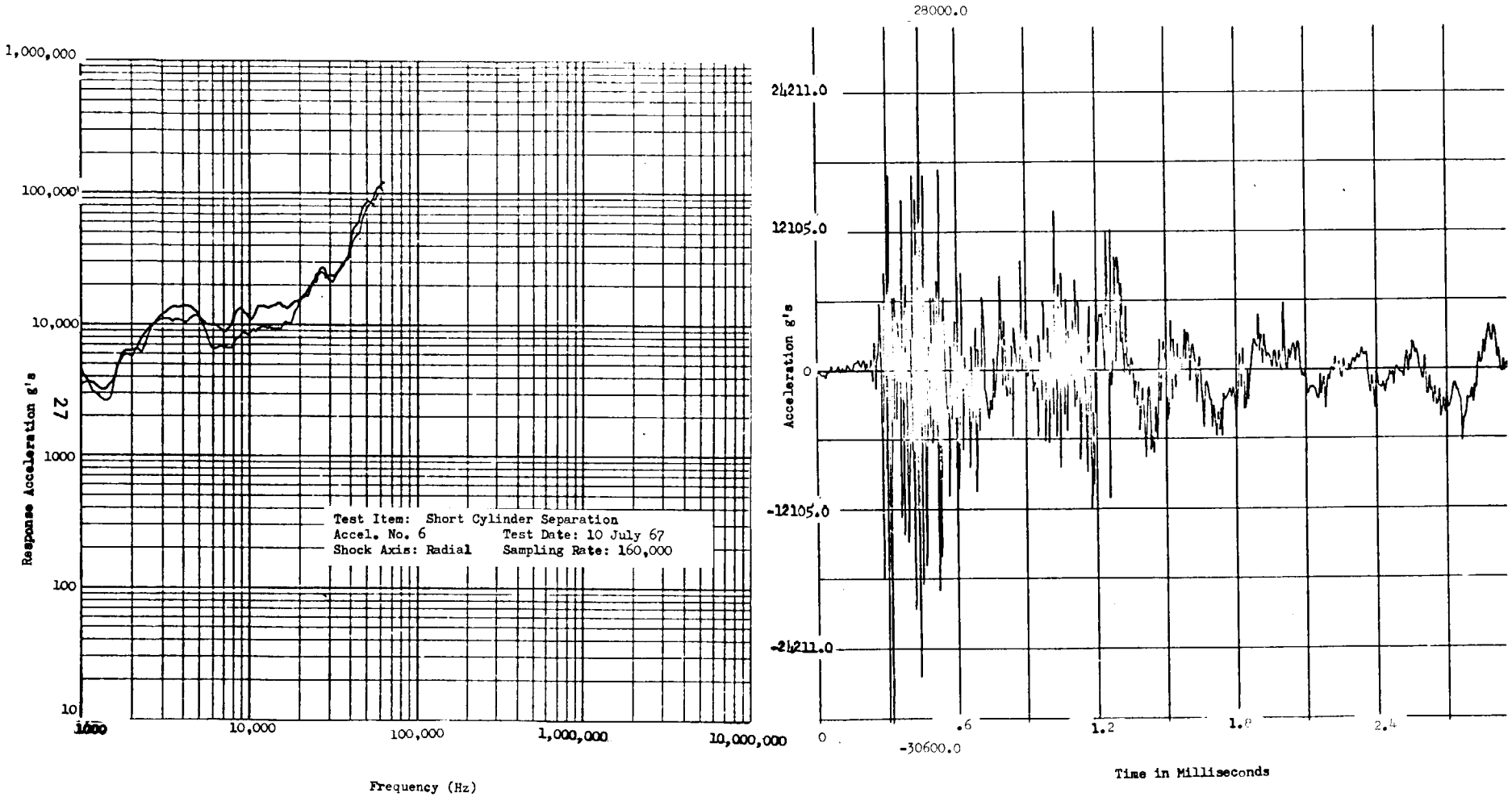


FIGURE I.A.1-17

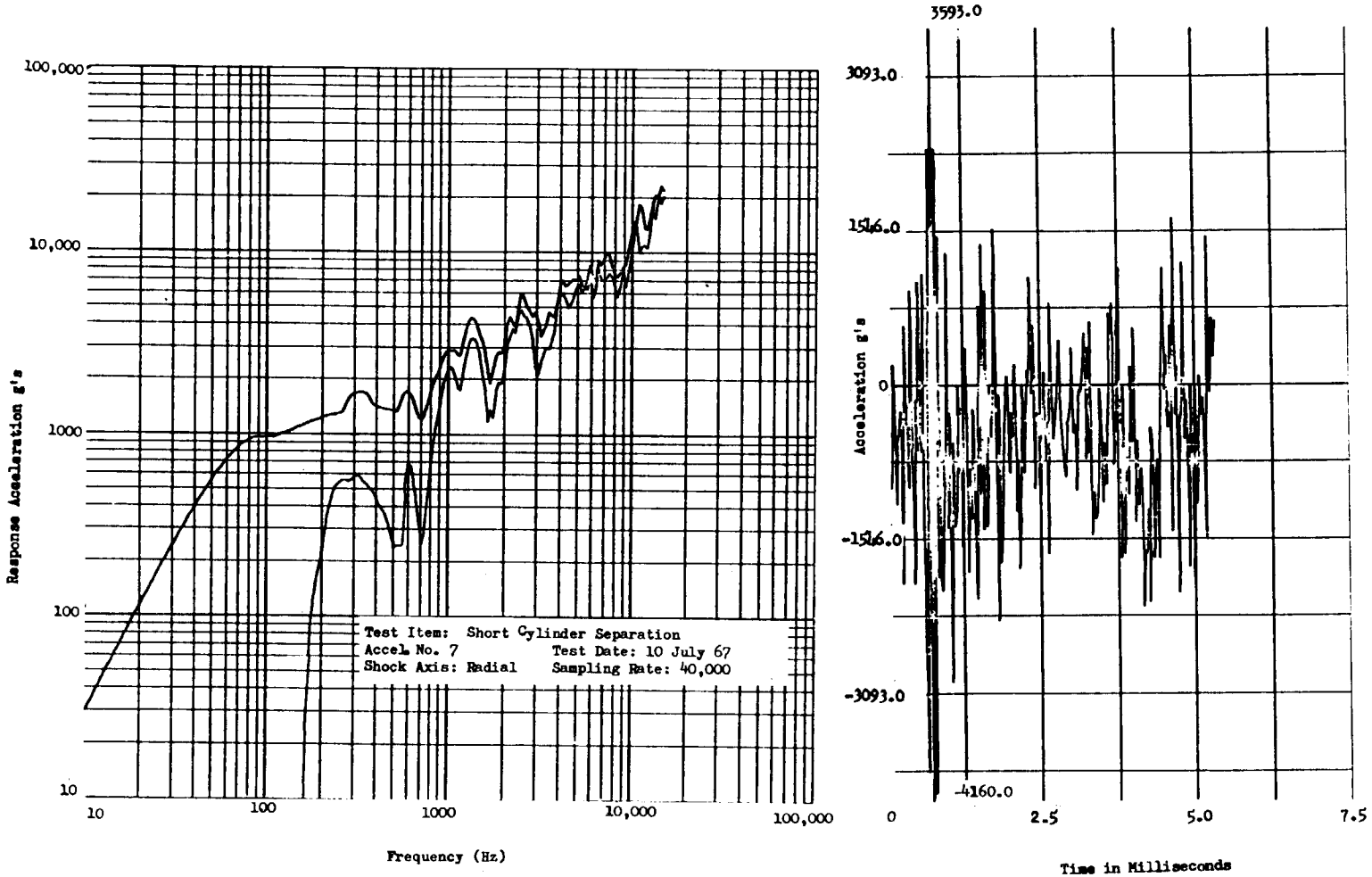
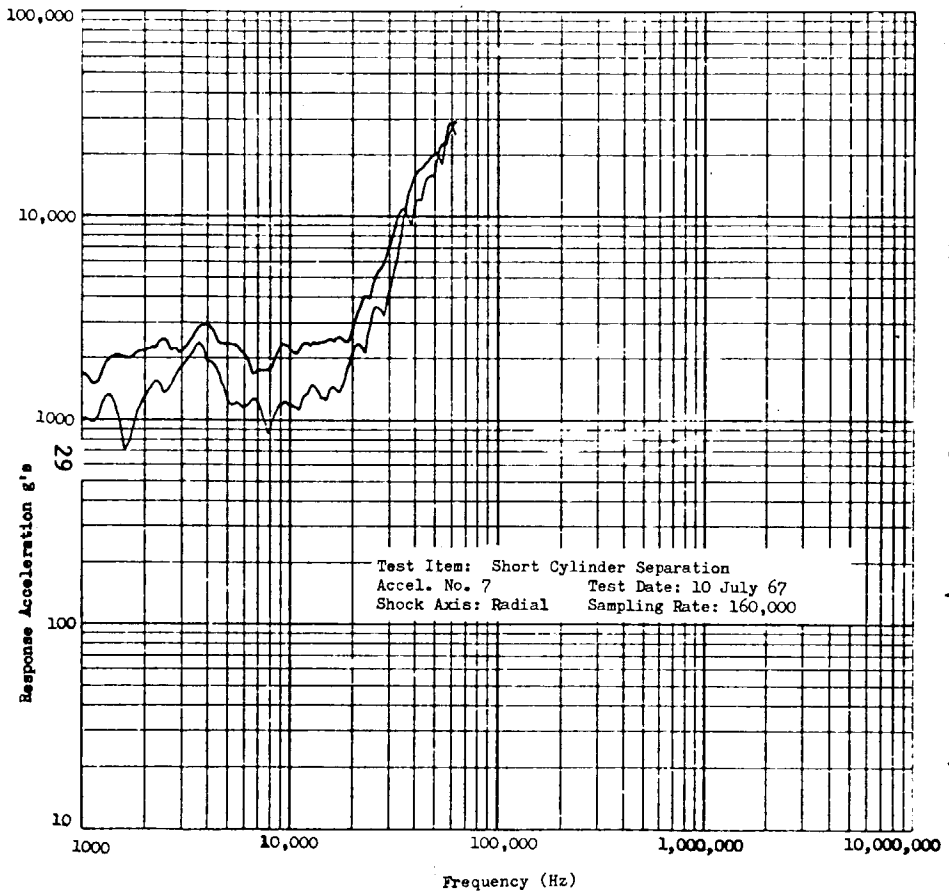


FIGURE I.A.1-18



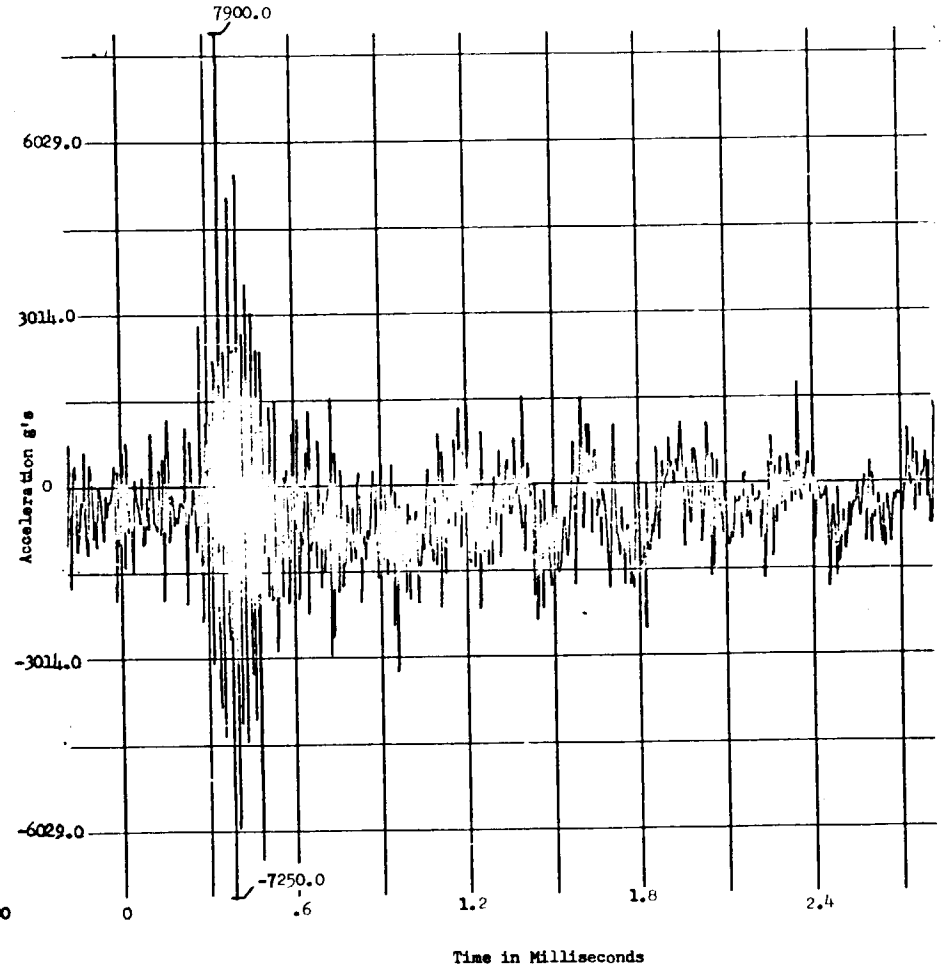
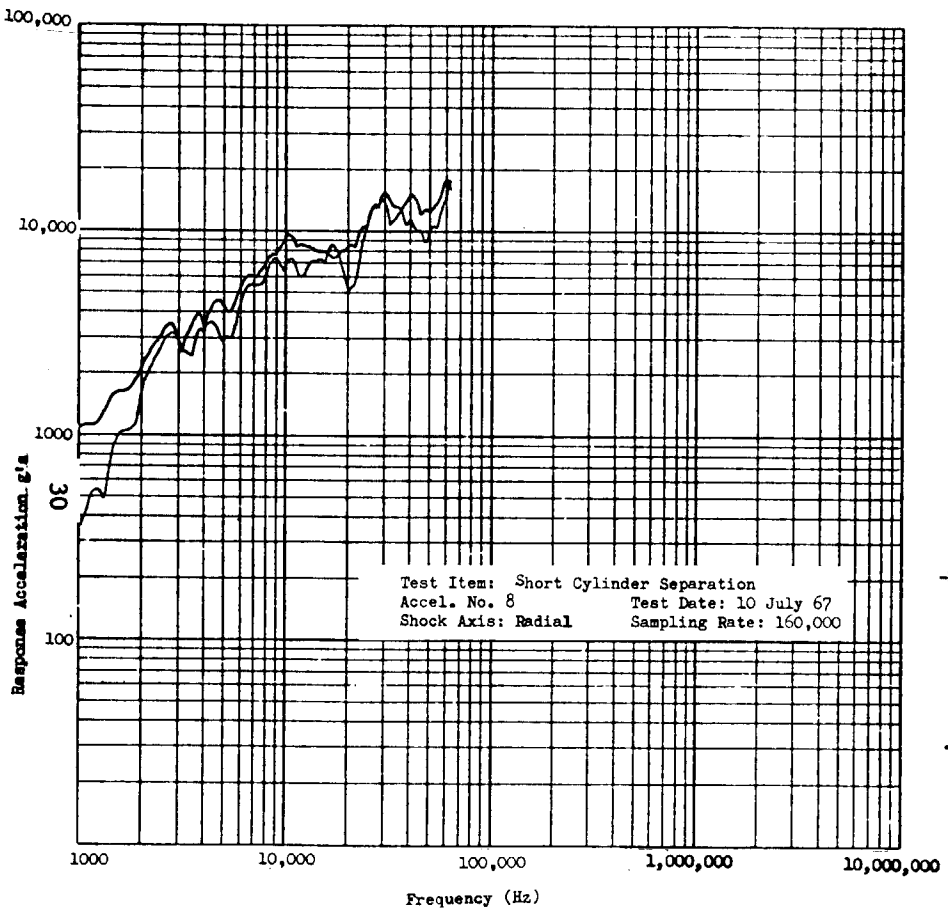


FIGURE 1.A.1-19



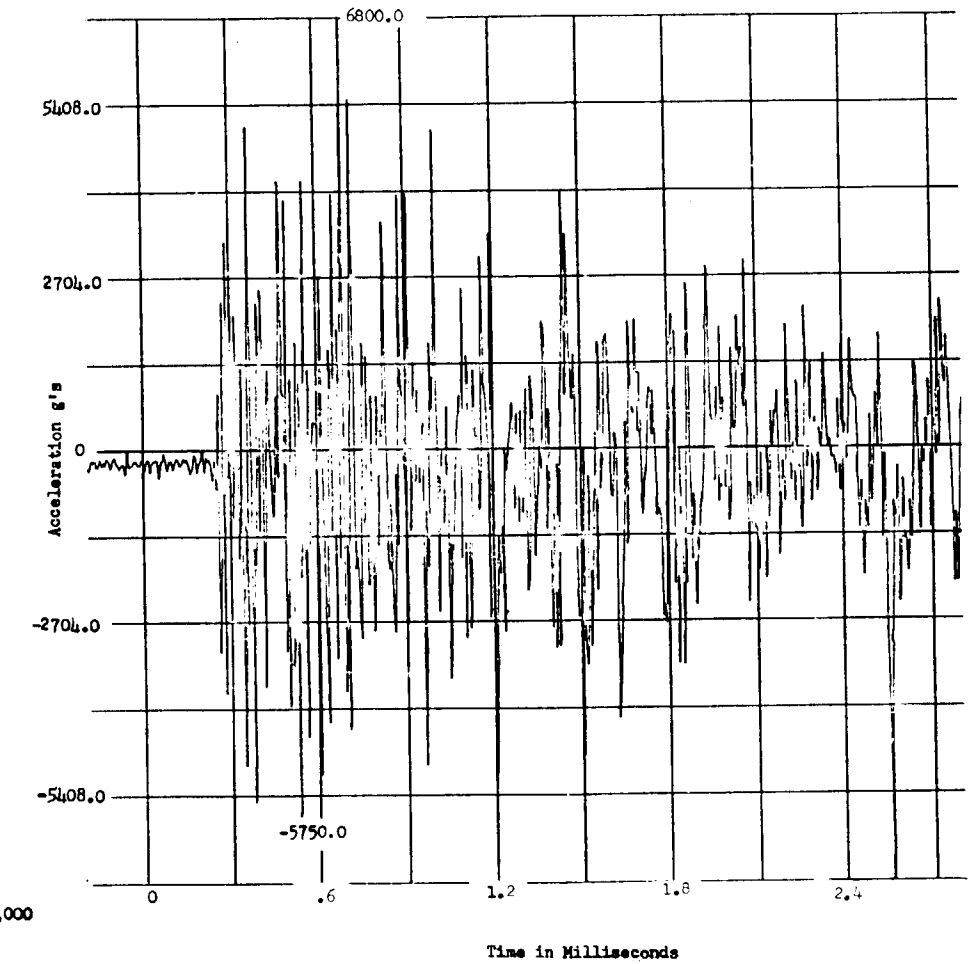
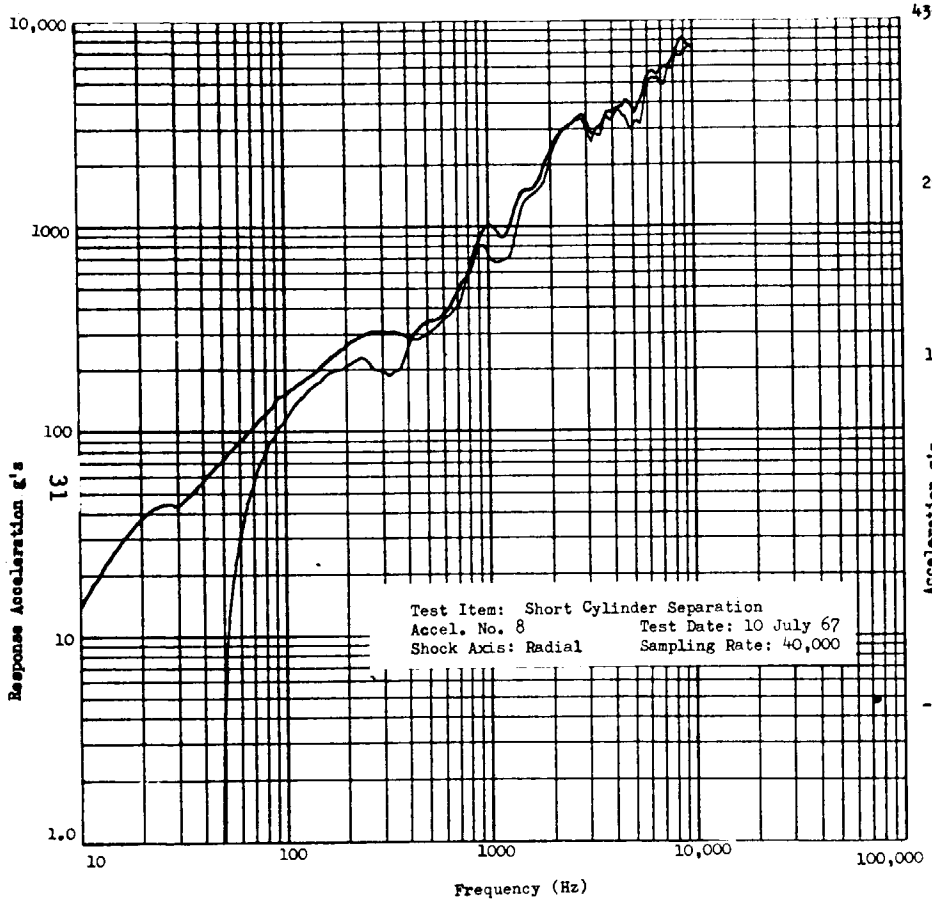


FIGURE I.A.1-20



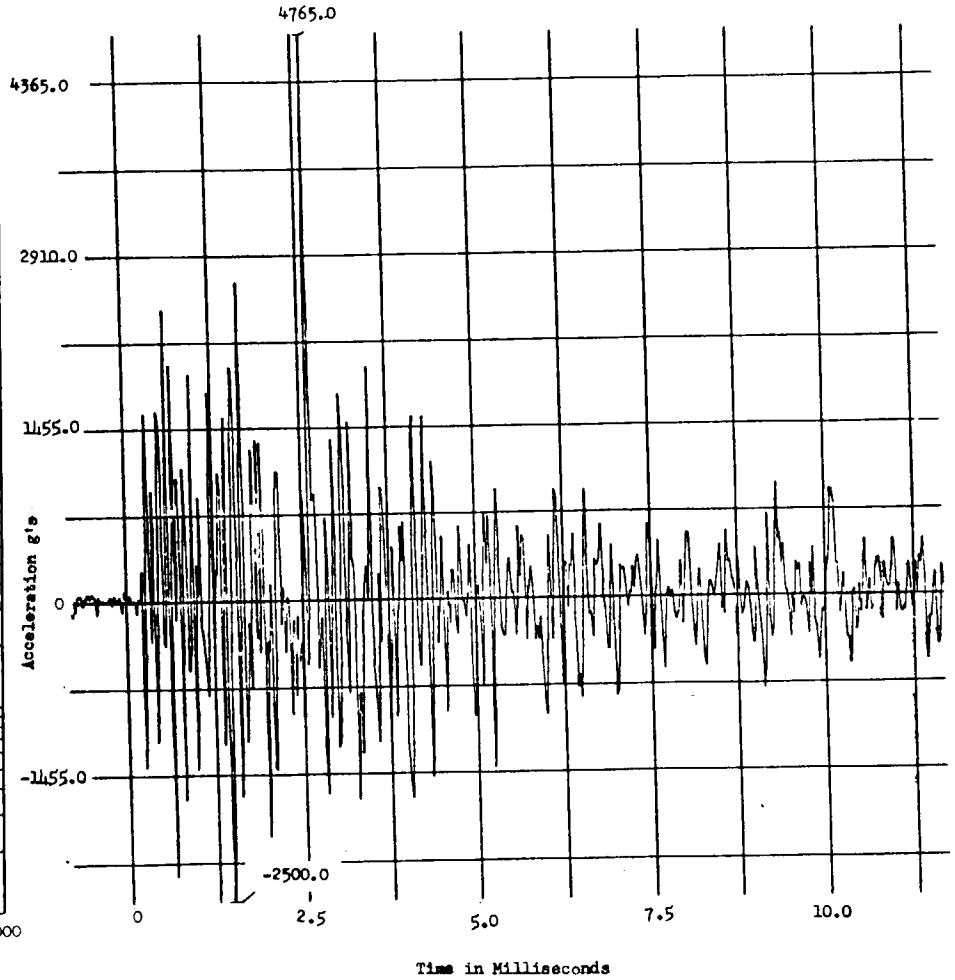
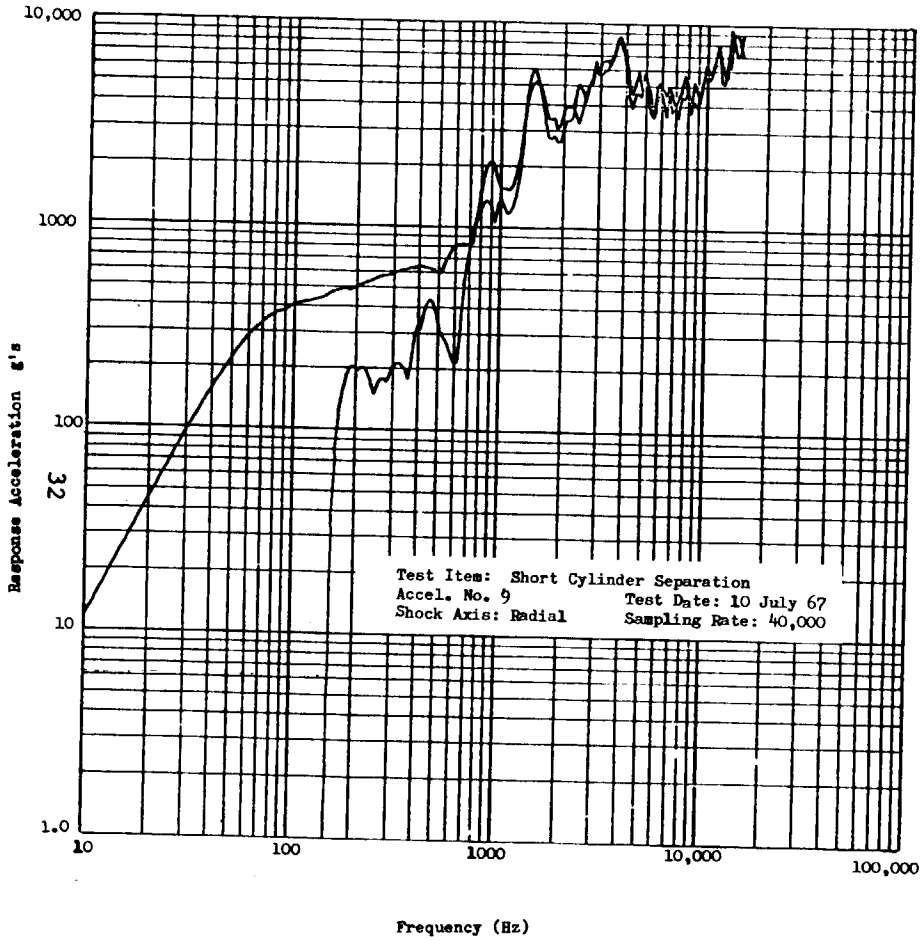


FIGURE I.A.1-21



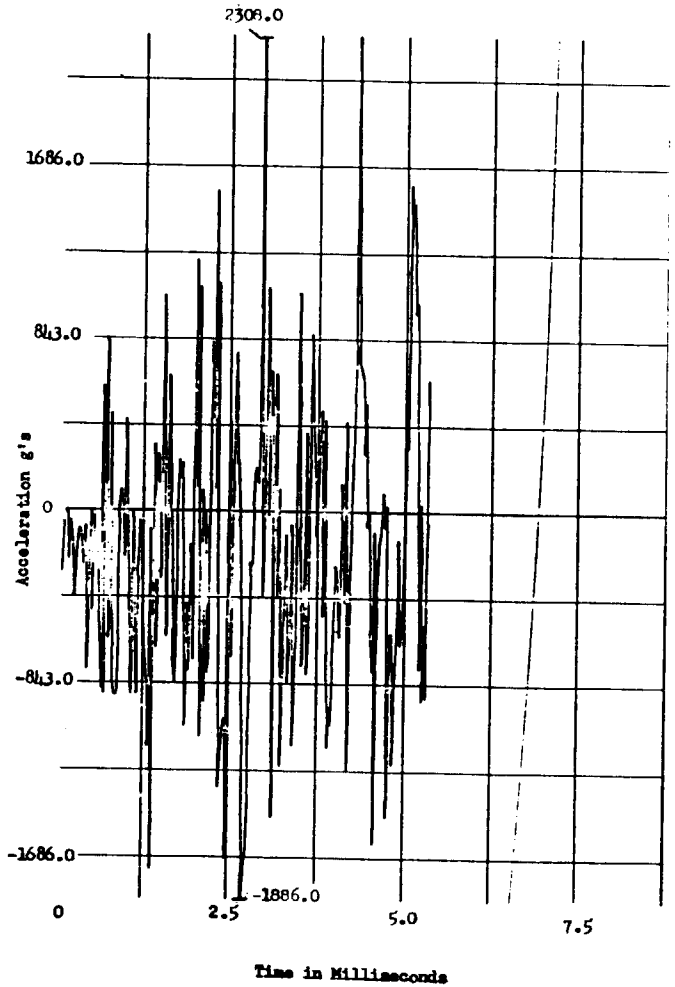
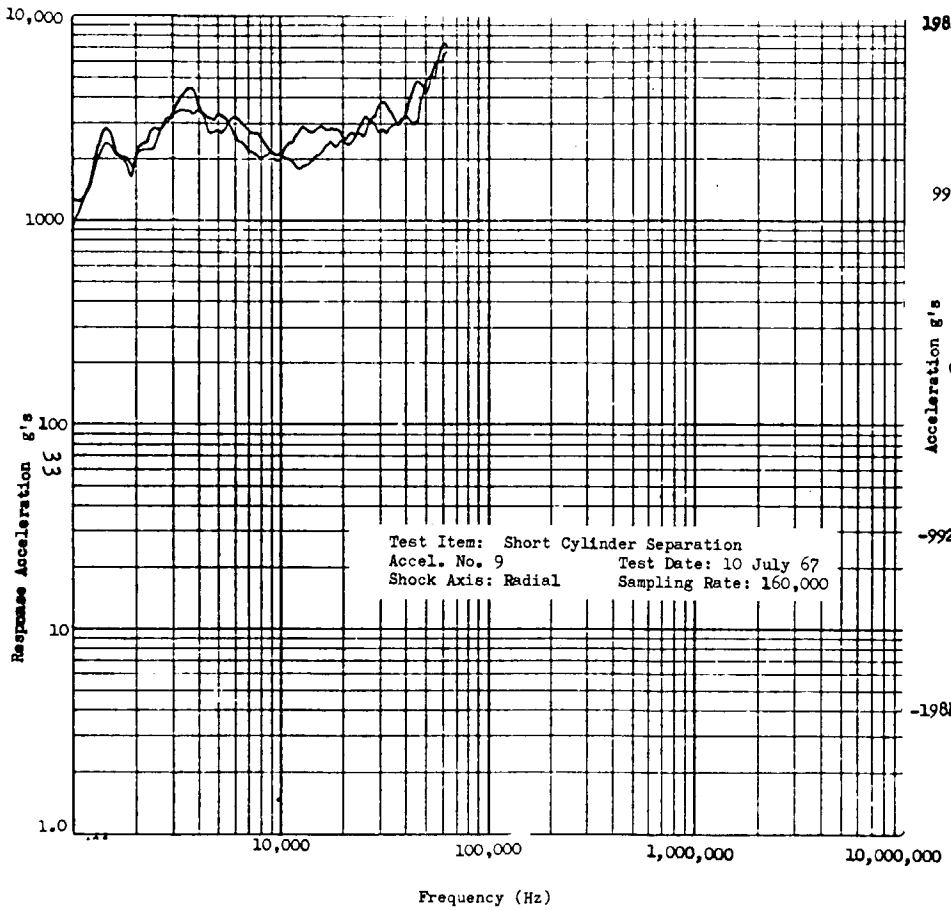


FIGURE I.A.1-22



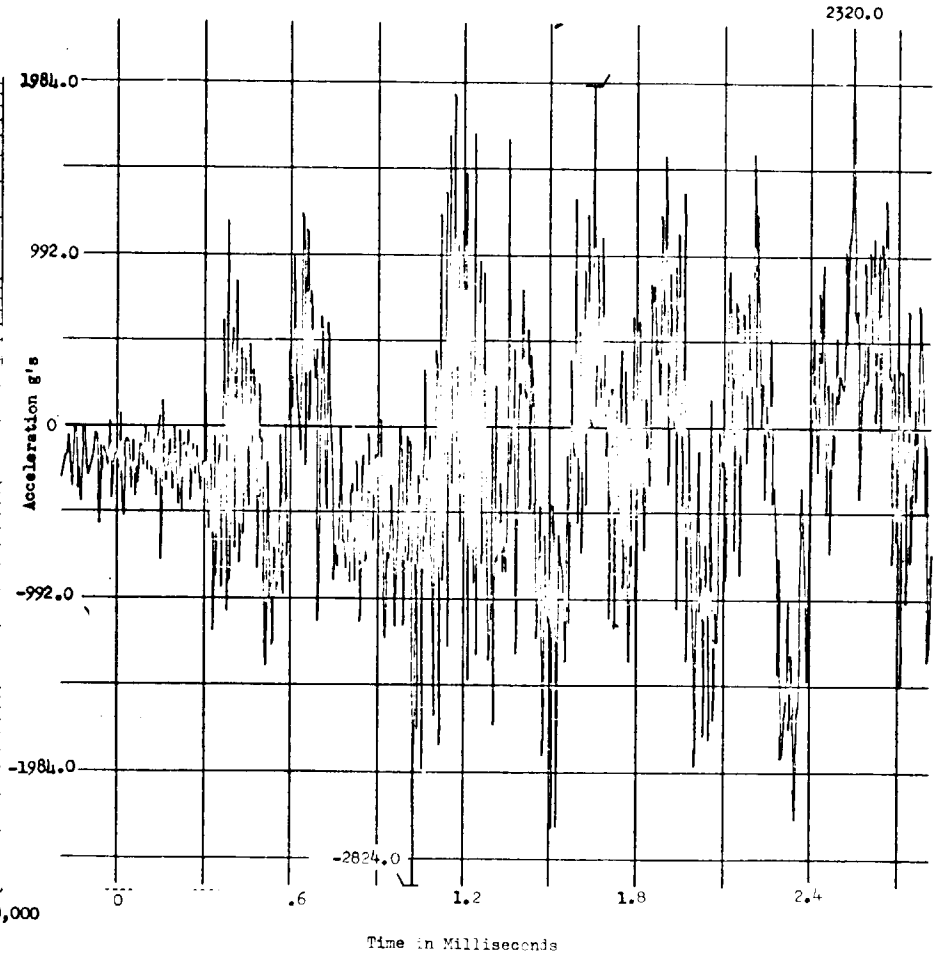
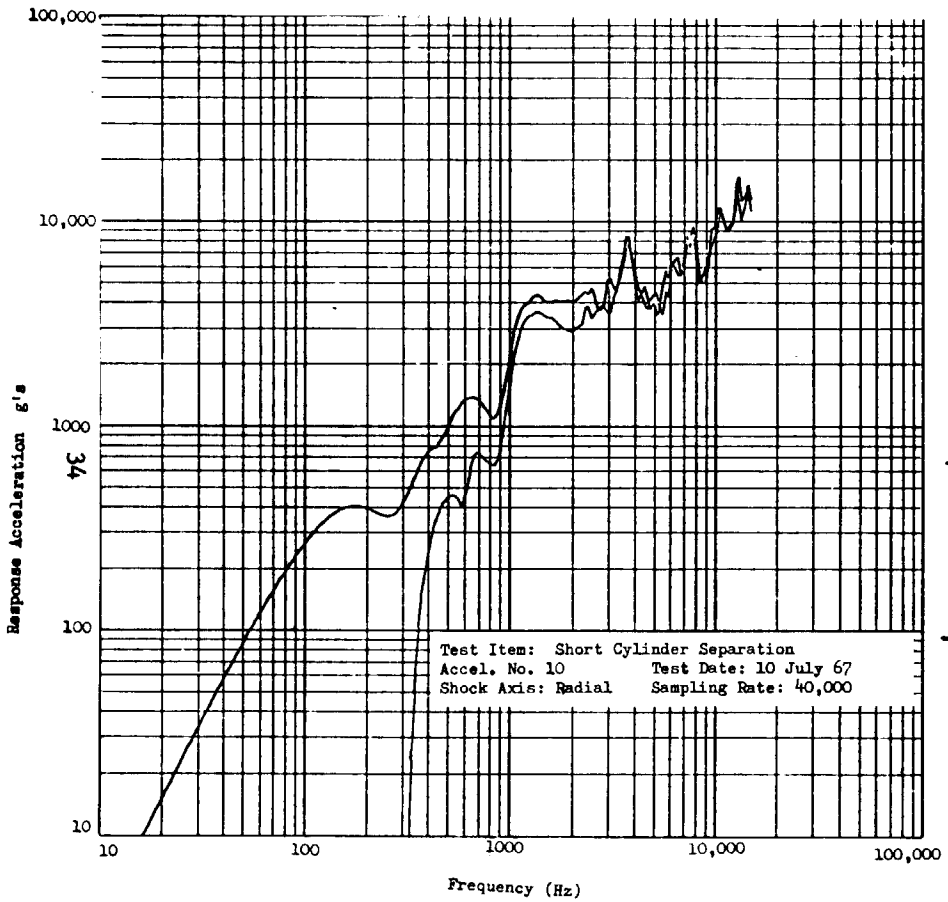


FIGURE 1.A.1-23



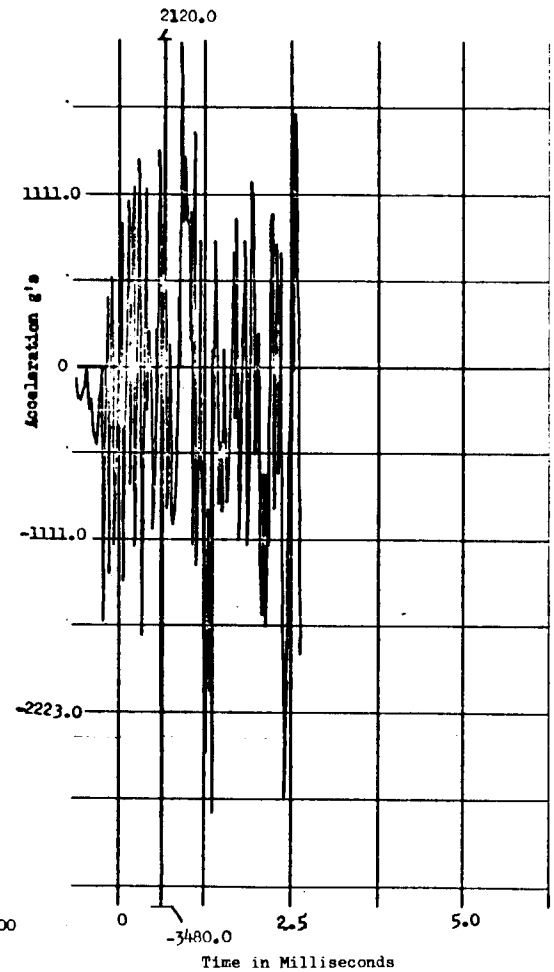
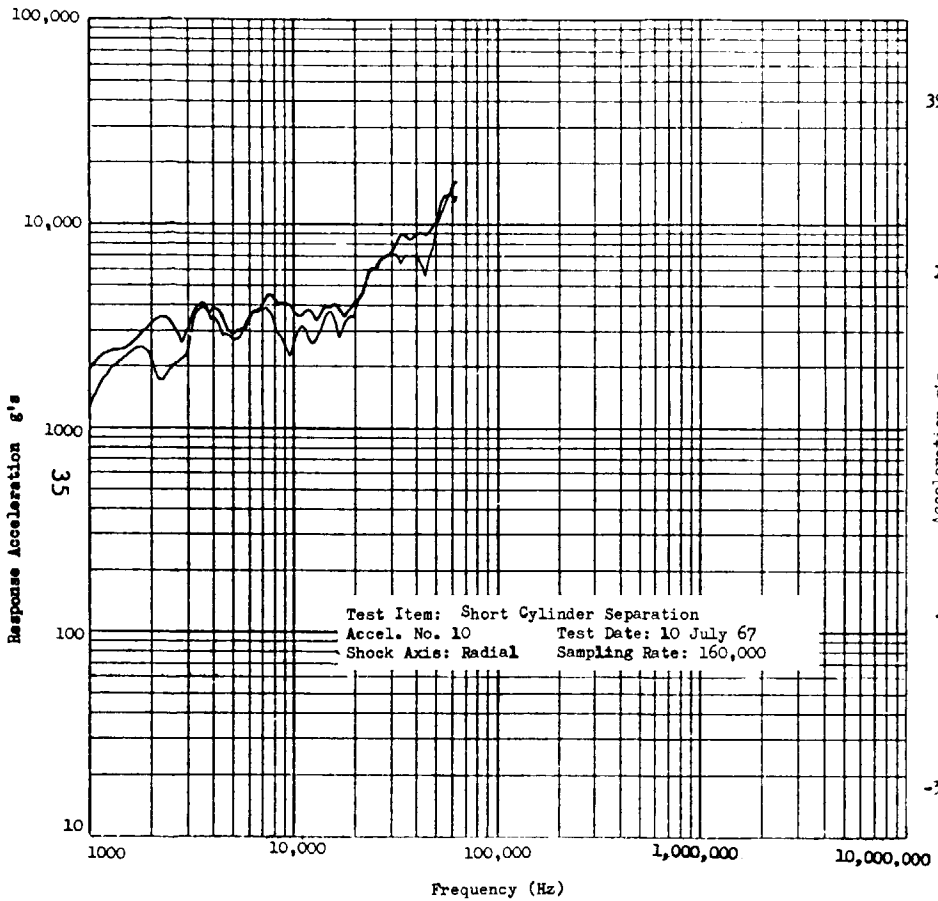


FIGURE 1.A.1-24



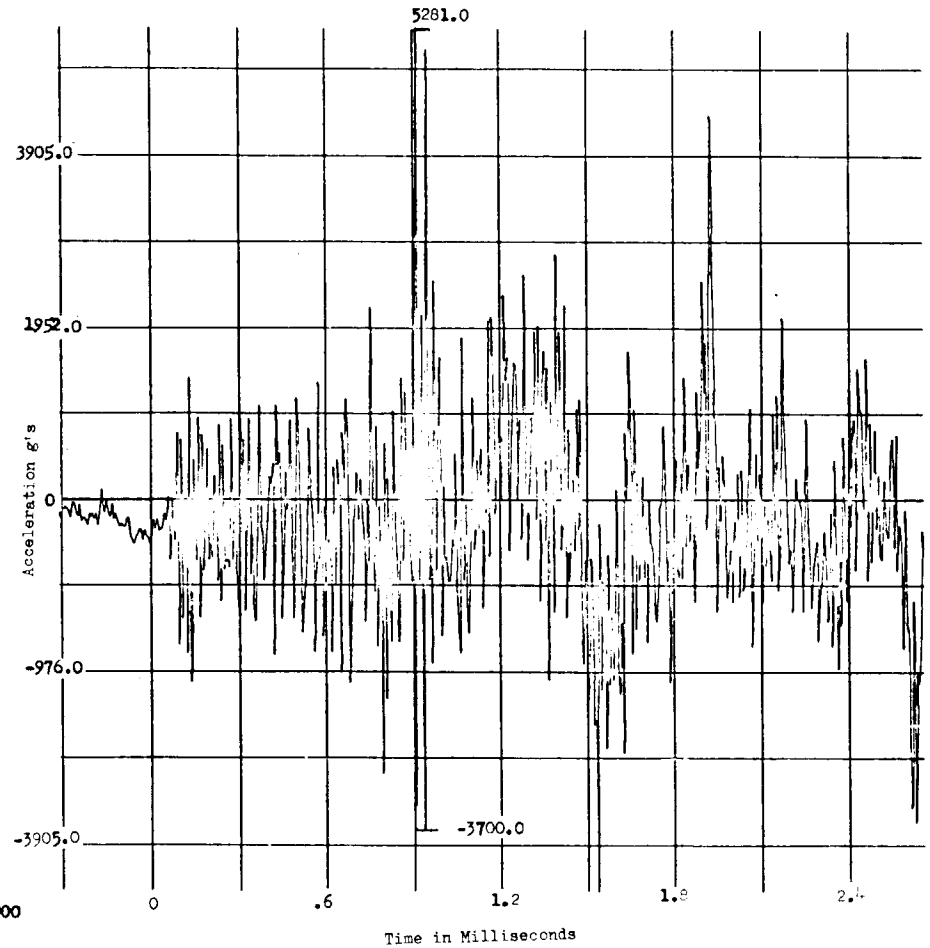


FIGURE I.A.1-25

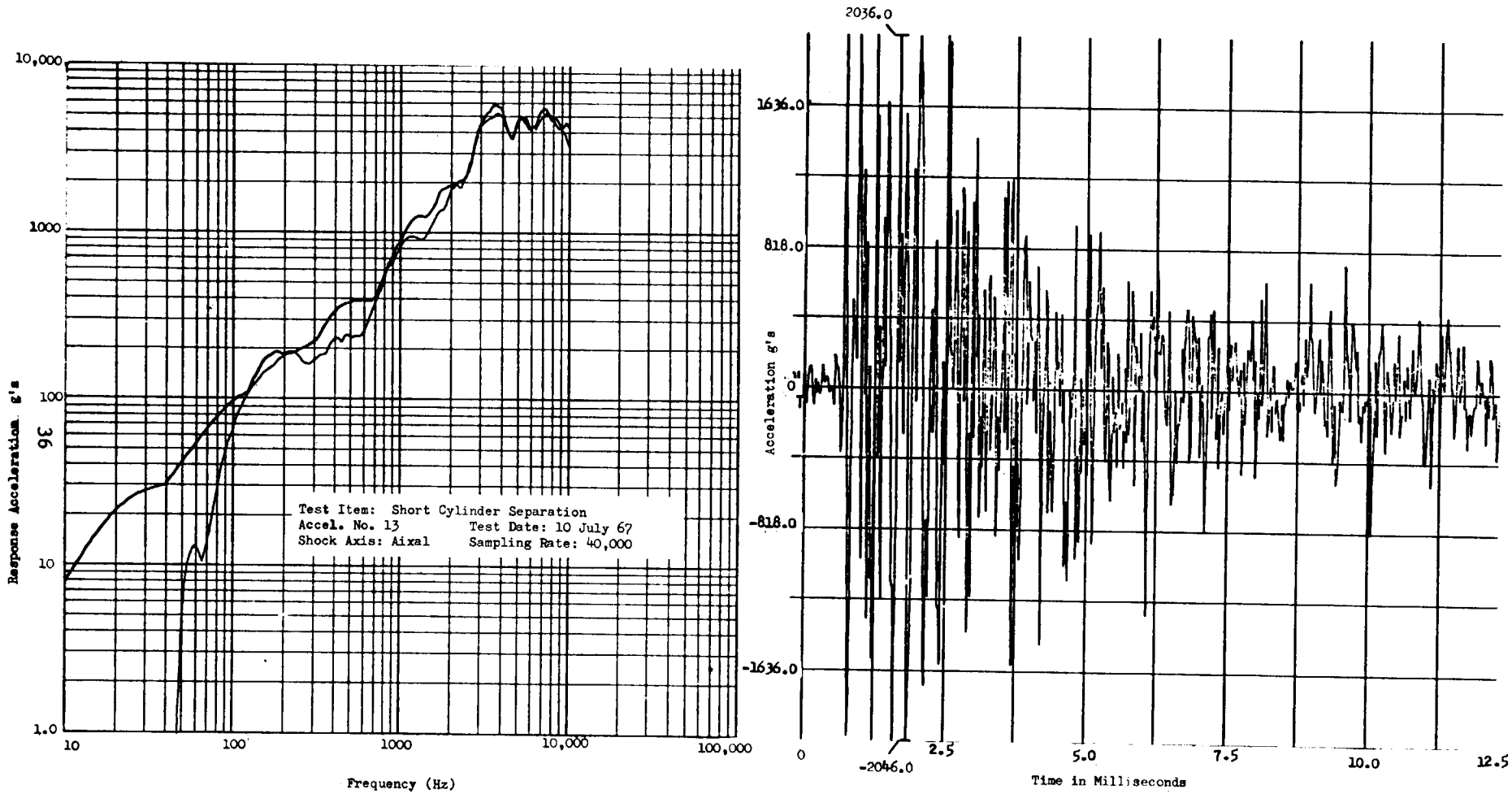
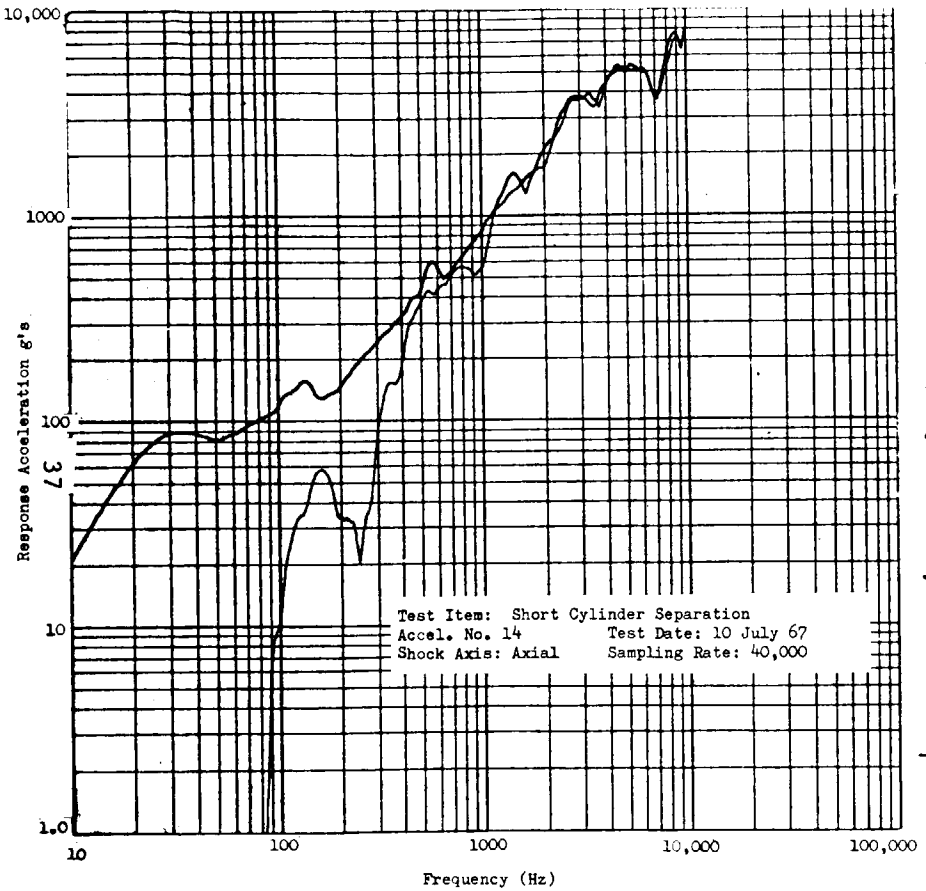
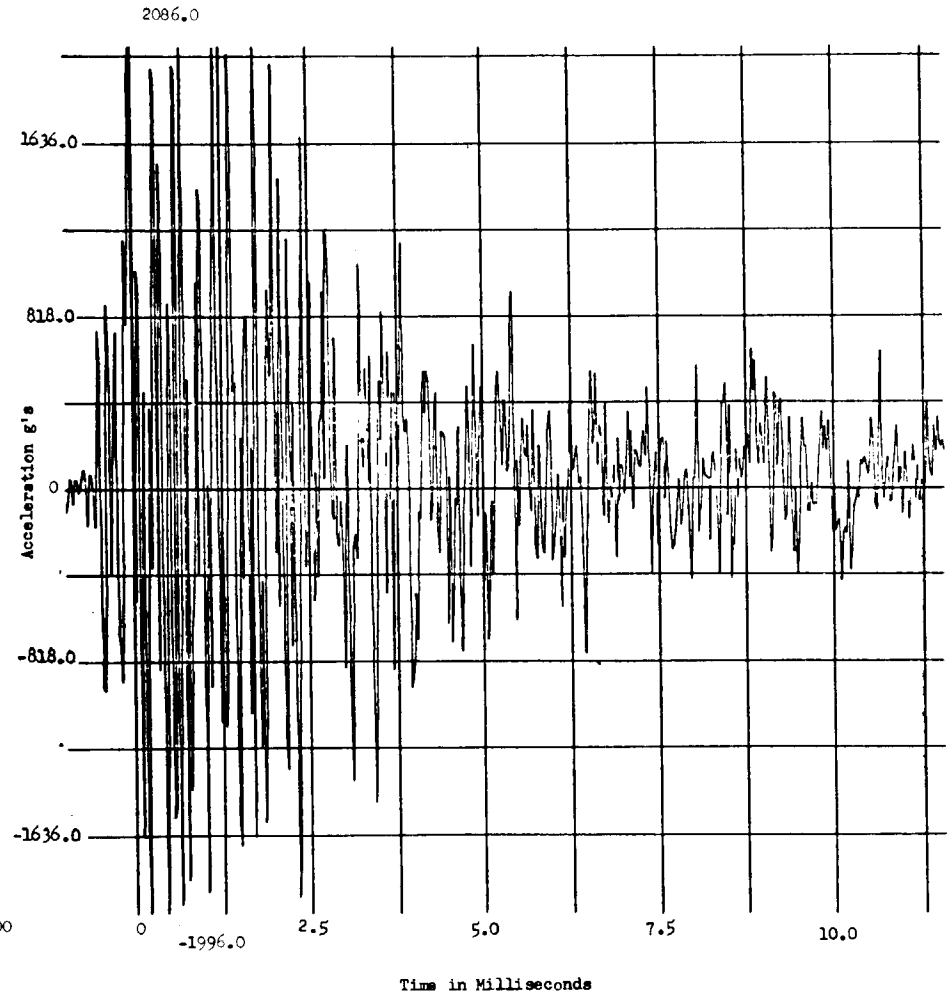


FIGURE I.A.1-26


10,000
1000
100
10
1.0
Response Acceleration g's
10
100
1000
10,000
100,000
Frequency (Hz)
Test Item: Short Cylinder Separation
Accel. No. 14
Test Date: 10 July 67
Shock Axis: Axial
Sampling Rate: 40,000


2086.0
1636.0
818.0
0
-818.0
-1636.0
-1996.0
Acceleration g's
0
2.5
5.0
7.5
10.0
Time in Milliseconds

SECTION I.A.2

SPARTAN LONG CYLINDER SEPARATION TEST

PURPOSE OF TEST

This test was performed primarily to test electronic components (especially telemetry equipment) to the shock levels produced during Spartan second/third stage separation.

DESCRIPTION OF EVENT

A 42 inch diameter hollow cylinder 11 feet long was severed using a separation shaped charge of MDF at 50 grains per foot. The cylinder was suspended longitudinally, and following the pyrotechnic activity the lower end of the cylinder, having been separated, was allowed to fall freely to the ground. Figures I.A.2-1 and I.A.2-2 are before and after photographs of the separation event.

DESCRIPTION OF DATA

Seventeen accelerometers were monitored during this test. For two of the accelerometers (11 and 16), results are presented for two different lengths of records. The shorter record lengths are denoted as accelerometers 11A and 16A.

No. of time histories	19
Duration	See Table I.A.2-1
No. of shock spectra	19
Type of analysis	digital
Sample rate	40,000/sec
Frequency range	0.4-7 K Hz
Frequency increment	10 points/octave
Damping	Q = 5

The shock spectra are presented with their corresponding time histories in Figures I.A.2-5 through I.A.2-23. Notice that each shock spectrum plot consists of two curves: one curve is associated with the largest positive response while the other is associated with the largest negative response, but no distinction can be made as to the identity of either curve.

DESCRIPTION OF PYROTECHNIC

Type: Split-ring assembly with MDF

Size of charge: 50 grains/foot

Explosive propagation rate: 20,000 feet per sec

Explosive core: RDX

Blasting cap: No. 6

Location: Figures I.A.2-3 and I.A.2-4

DESCRIPTION OF STRUCTURE

The test specimen was a 42-inch diameter aluminum cylinder 11 feet long with 0.160 skin thickness. A simulated telemetry rack containing several flight components was mounted 101 inches above the separation plane as shown in Figure I.A.2-4.

DESCRIPTION OF ACCELEROMETERS

Type: Endevco 2225 and 2225 M5 as indicated in Table I.A.2-1.

Location: Figure I.A.2-4

Axis of sensitivity: Table I.A.2-1.

DESCRIPTION OF DATA ACQUISITION SYSTEM

Tape recorder: Mincom H-100

Charge amplifier: Endevco

COMMENTS

Under "Description of Data" the frequency range is indicated as 400-7,000 Hz. However, due to the 40,000/second sampling rate, these shock spectra are probably not valid for frequencies above 4,000 to 5,000 Hz.

TABLE I.A.2-1. INFORMATION ABOUT ACCELEROMETER DATA USED IN SHOCK SPECTRUM ANALYSES

Accelerometer Number	Axis of Sensitivity	Duration of Time History Used in Shock Spectrum Analysis (milliseconds)	Type of Endevco Accelerometer
1	radial	60.	2225 M5
2	radial	7.5	2225 M5
3	radial	45	2225 M5
4	radial	40	2225 M5
5	radial	2.0	2225 M5
6	radial	70	2225
7	radial	30	2225
8	radial	10.5	2225 M5
9	radial	5.0	2225 M5
10	radial	50	2225 M5
11	tangential	40	2225 M5
11A	tangential	5.5	2225 M5
12	longitudinal	17	2225 M5
13	longitudinal	20	2225 M5
14	longitudinal	20	2225 M5
15	longitudinal	20	2225 M5
16	radial	4.5	2225 M5
16A	radial	2.0	2225 M5
17	radial	12.5	2225 M5

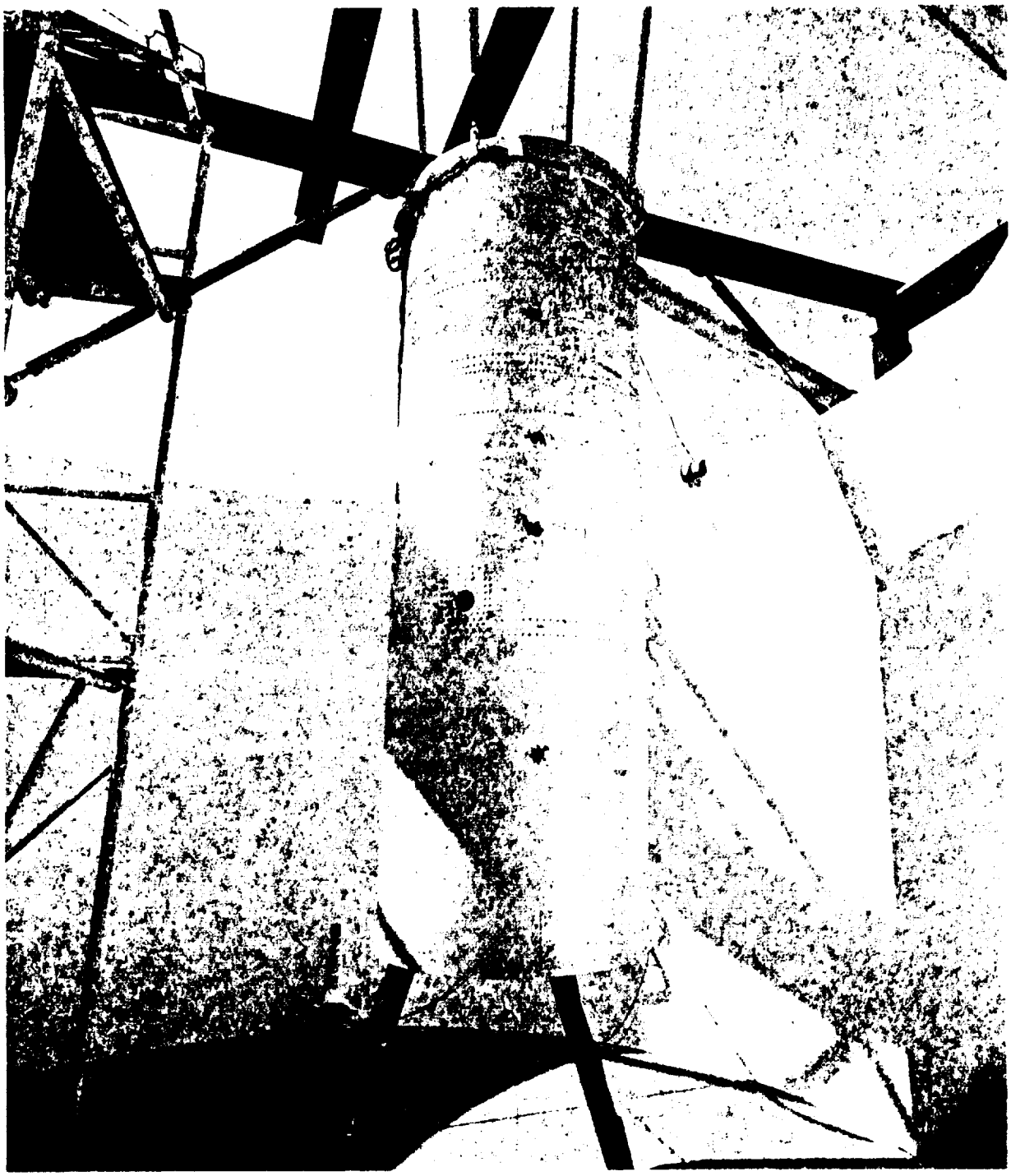


FIGURE I.A.2-1 SPARTAN LONG CYLINDER BEFORE SEPARATION

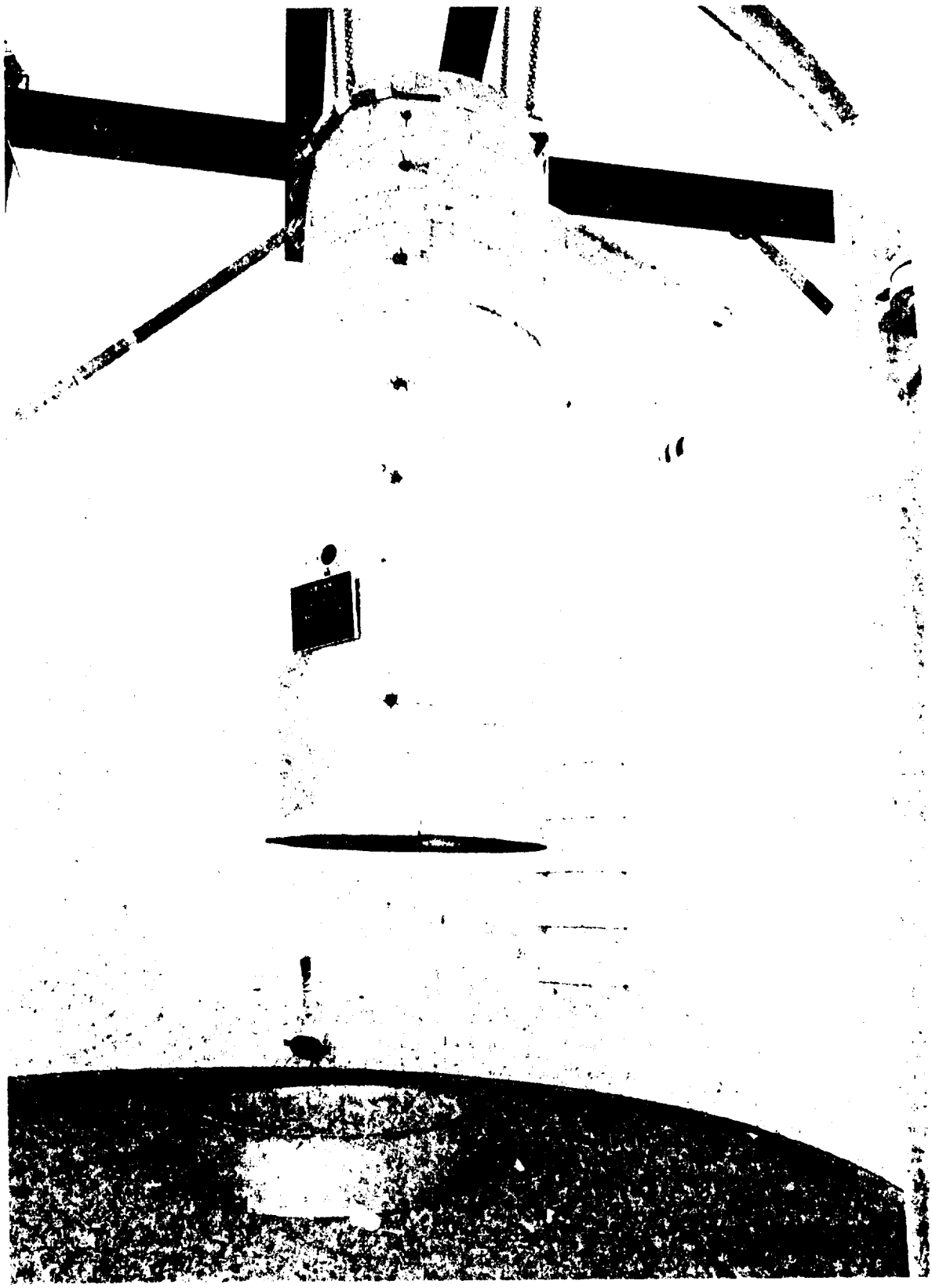


FIGURE I.A.2-2 SPARTAN LONG CYLINDER AFTER SEPARATION

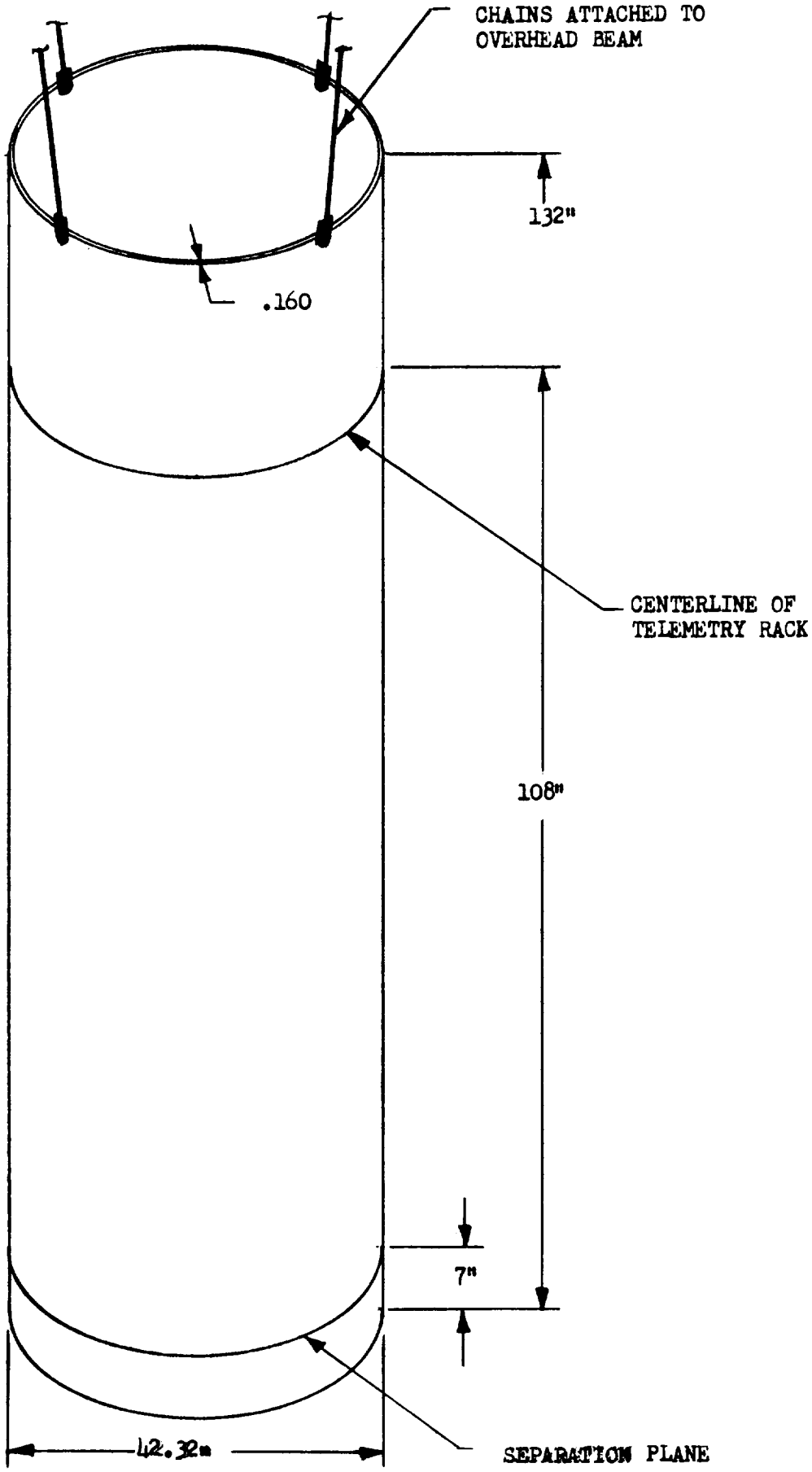


FIGURE I.A.2-3 DIAGRAM OF SPARTAN LONG CYLINDER TEST SET-UP

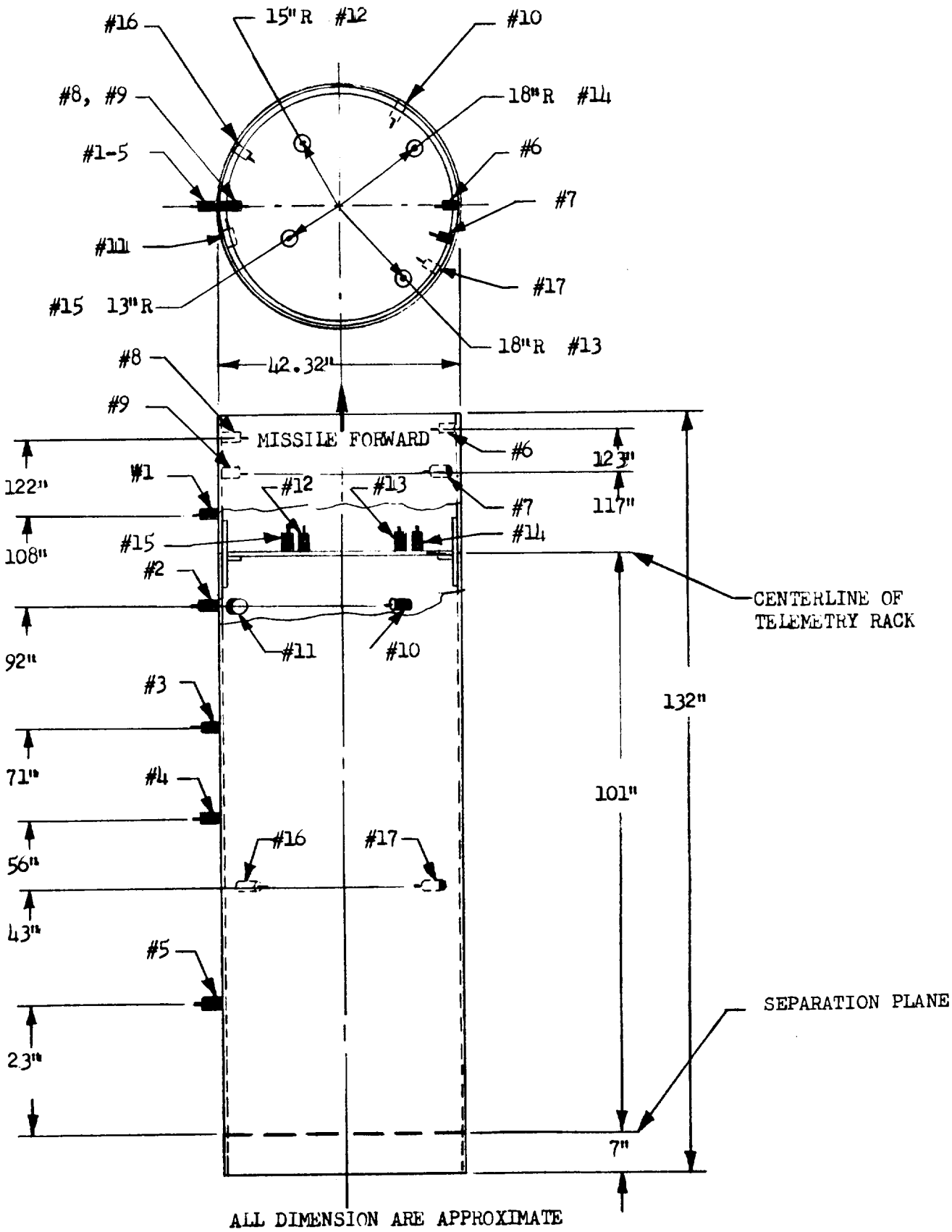


Figure I.A.2-4. Accelerometer Locations

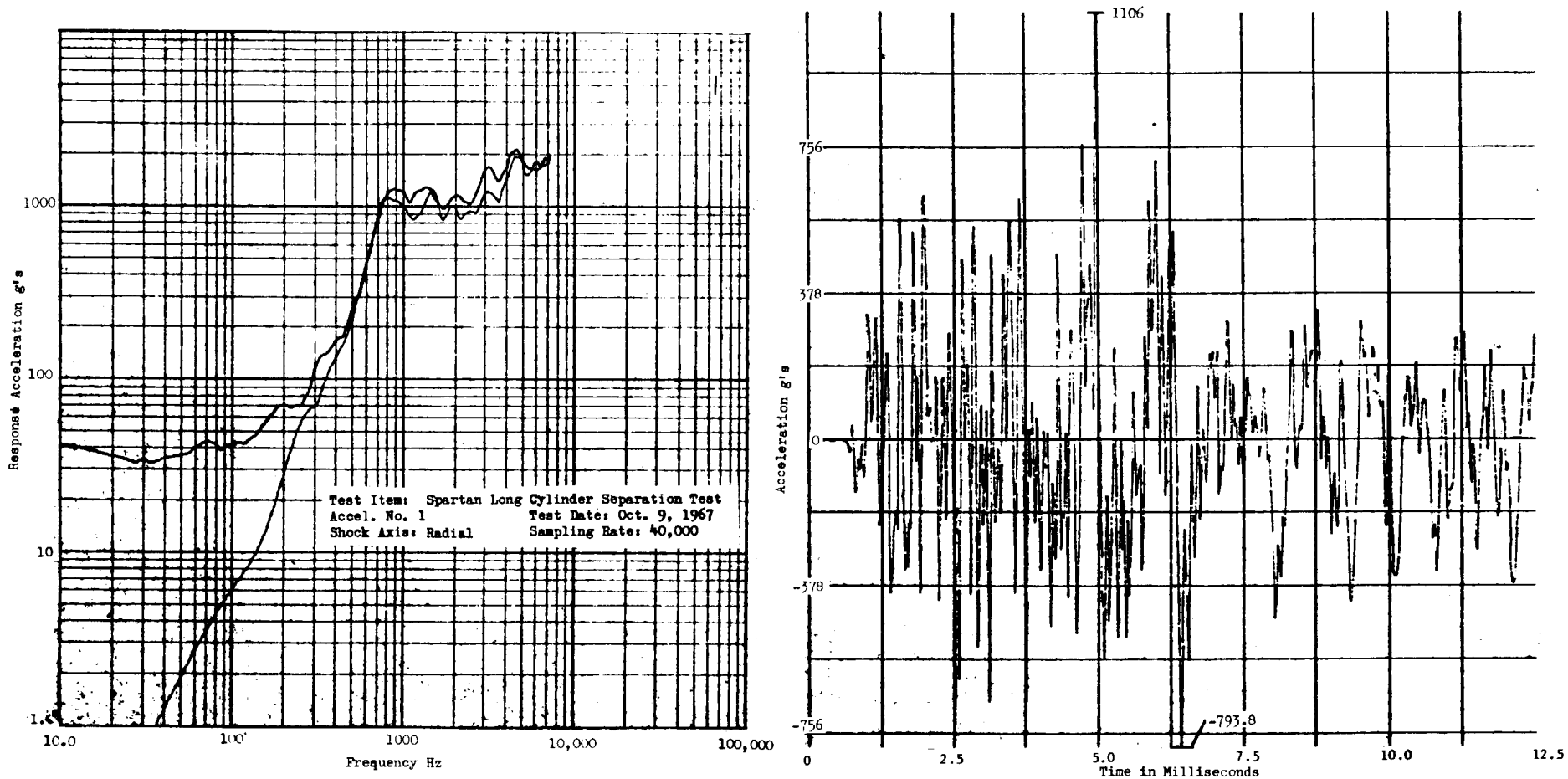
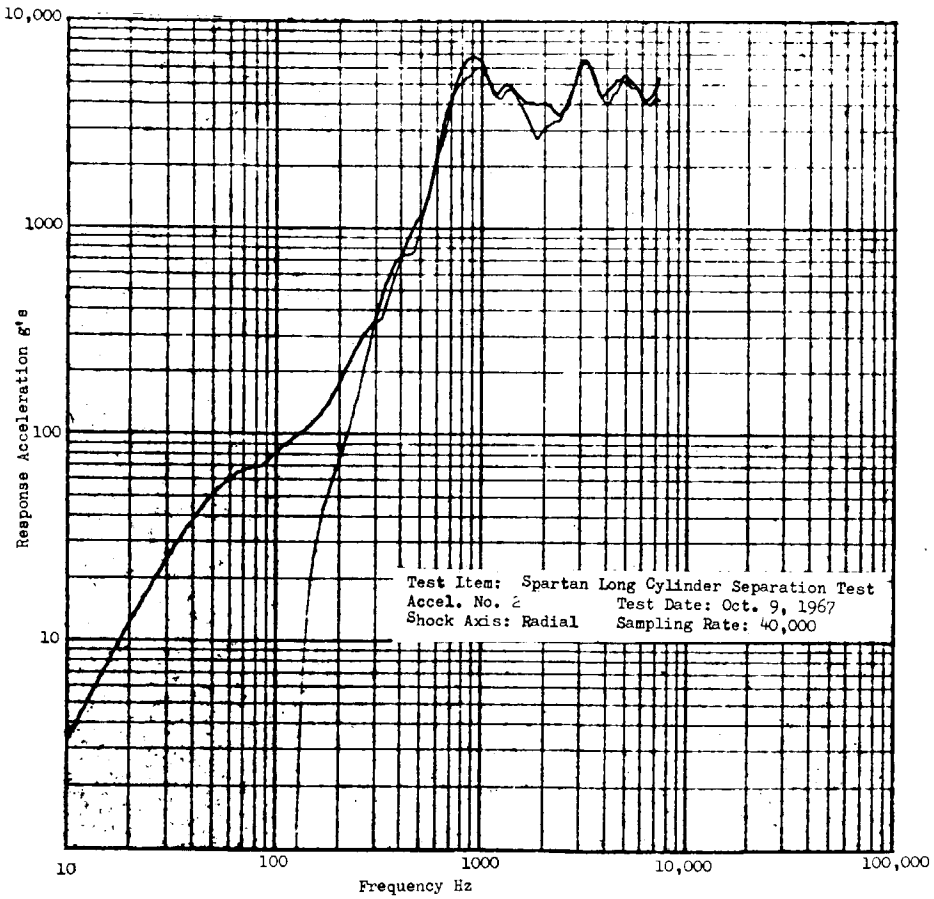

Response Acceleration g's
1000
100
10
1.0
10.0
100
1000
10,000
100,000
Frequency Hz
Test Item: Spartan Long Cylinder Separation Test
Accel. No. 1
Test Date: Oct. 9, 1967
Shock Axis: Radial
Sampling Rate: 40,000
Acceleration g's
1106
756
378
0
-378
-756
-793.8
0
2.5
5.0
7.5
10.0
12.5
Time in Milliseconds

FIGURE I.A.2-5


10,000
1000
100
10
Response Acceleration g's
10
100
1000
10,000
100,000
Frequency Hz
Test Item: Spartan Long Cylinder Separation Test
Accel. No. 2
Test Date: Oct. 9, 1967
Shock Axis: Radial
Sampling Rate: 40,000

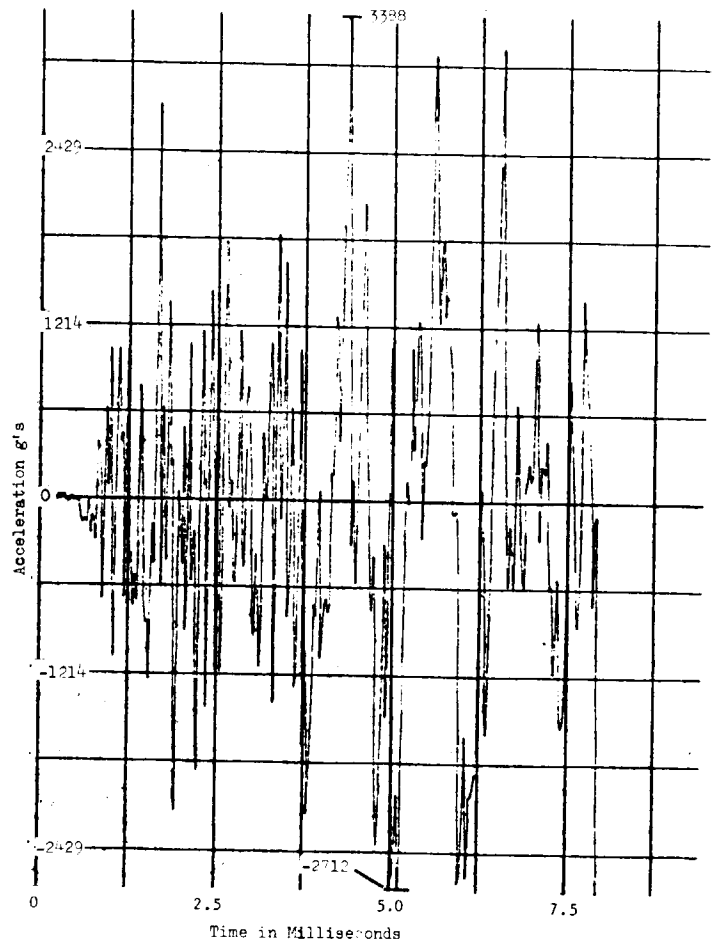

3388
2429
1214
0
-1214
-2429
-2712
Acceleration g's
0
2.5
5.0
7.5
Time in Milliseconds

FIGURE I.A.2-6

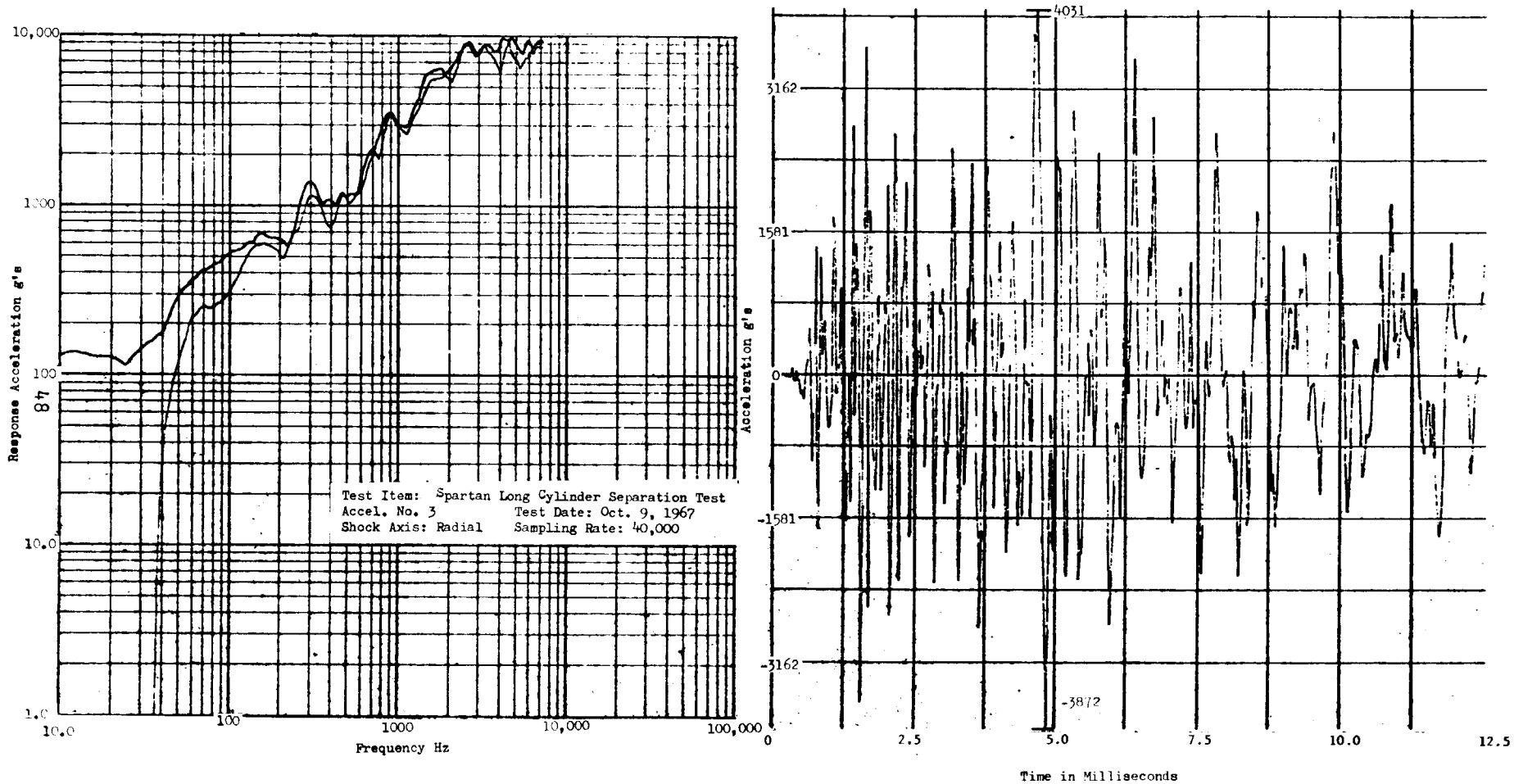

10,000
1000
100
10.0
1.0
Response Acceleration g's
10.0
100
1000
10,000
100,000
Frequency Hz
Test Item: Spartan Long Cylinder Separation Test
Accel. No. 3
Test Date: Oct. 9, 1967
Shock Axis: Radial
Sampling Rate: 40,000
4031
3162
1581
0
-1581
-3162
-3872
Acceleration g's
0
2.5
5.0
7.5
10.0
12.5
Time in Milliseconds

FIGURE 1.A.2-7

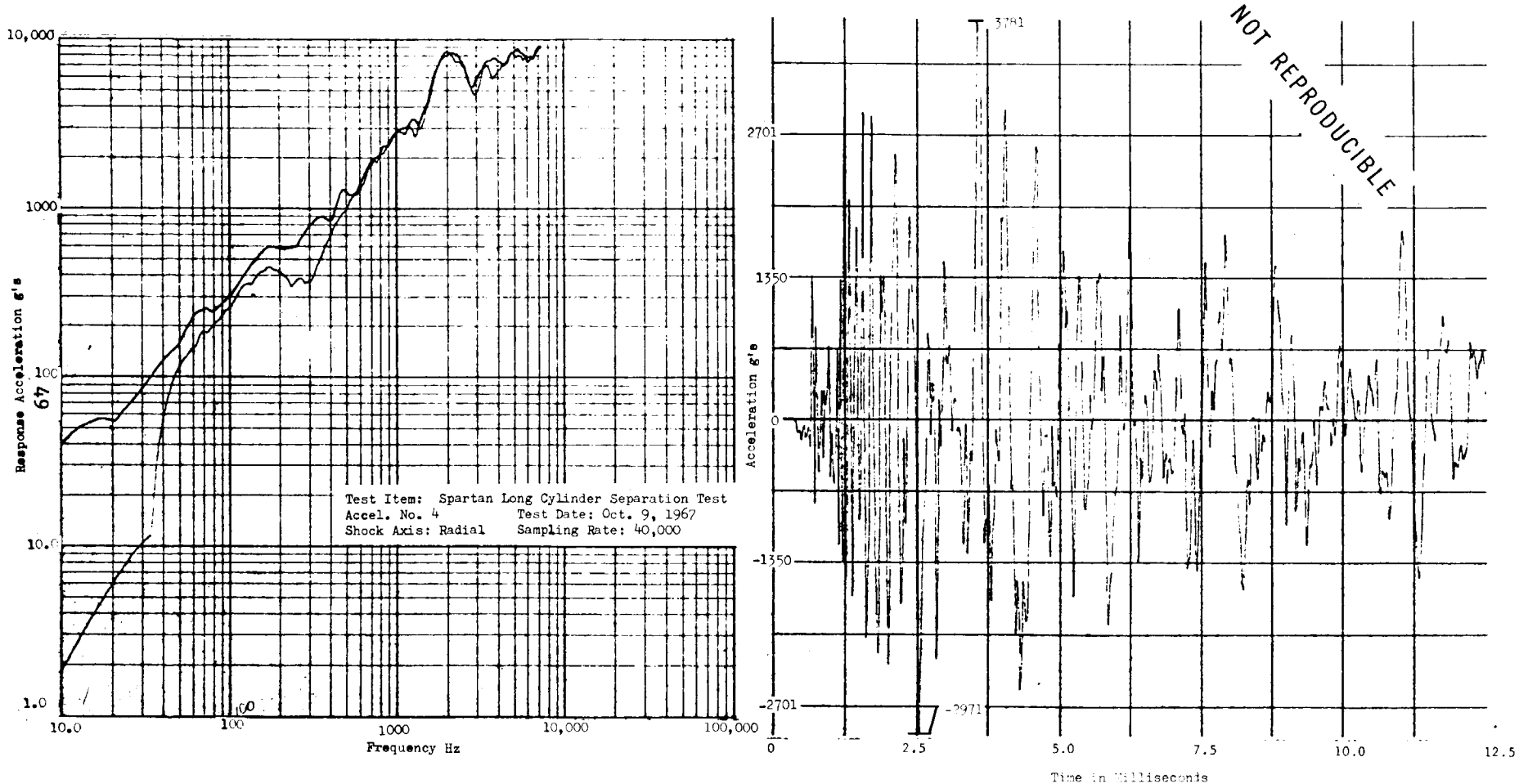
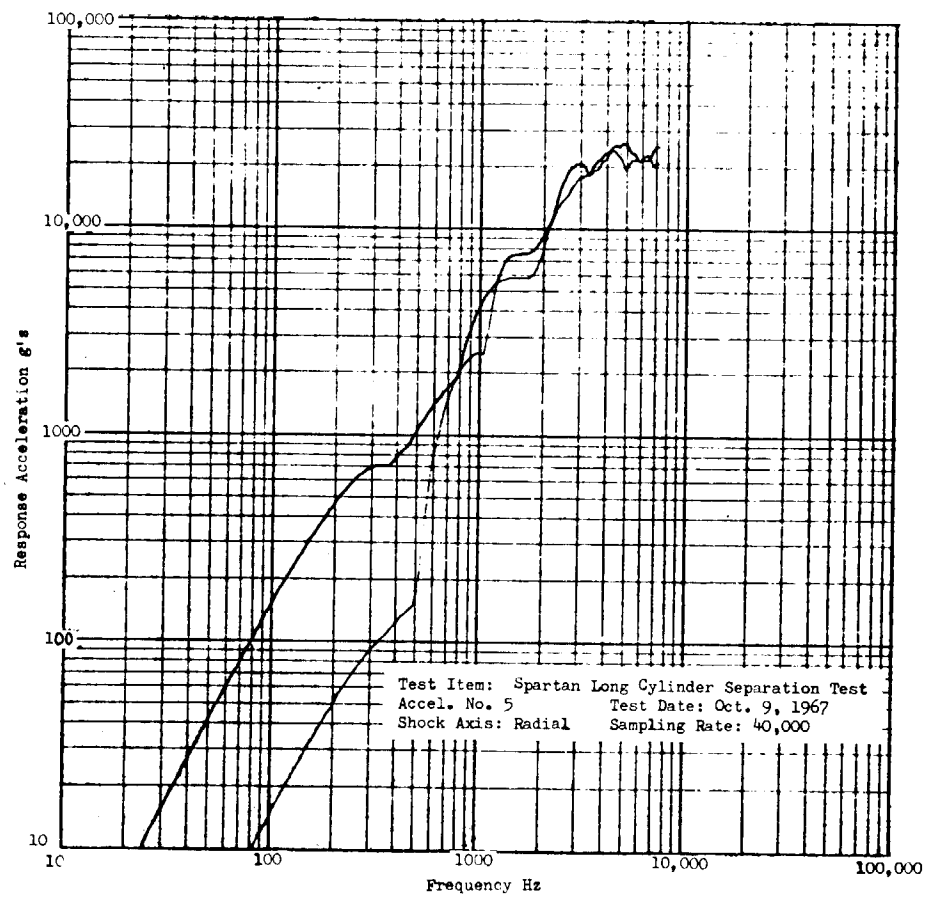

10,000
1000
100
10.0
1.0
Response Acceleration g's
10.0
100
1000
10,000
100,000
Frequency Hz
Test Item: Spartan Long Cylinder Separation Test
Accel. No. 4
Test Date: Oct. 9, 1967
Shock Axis: Radial
Sampling Rate: 40,000
3781
2701
1350
0
-1350
-2701
-2971
Acceleration g's
0
2.5
5.0
7.5
10.0
12.5
Time in Milliseconds
NOT REPRODUCIBLE

FIGURE I.A.2-8


100,000
10,000
1000
100
10
Response Acceleration g's
10
100
1000
10,000
100,000
Frequency Hz
Test Item: Spartan Long Cylinder Separation Test
Accel. No. 5
Test Date: Oct. 9, 1967
Shock Axis: Radial
Sampling Rate: 40,000

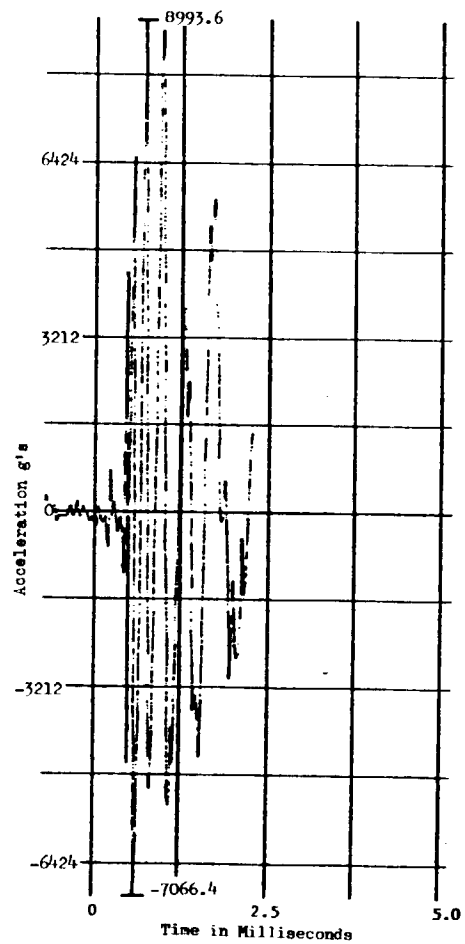
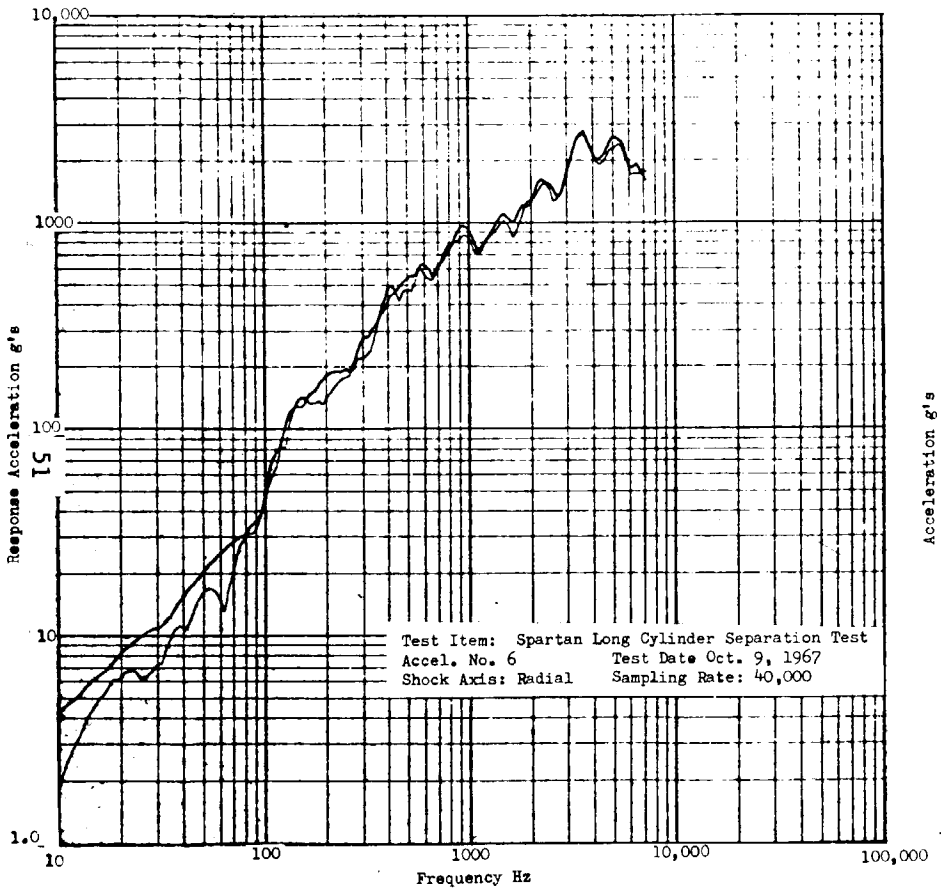

8993.6
6424
3212
0
-3212
-6424
-7066.4
Acceleration g's
0
2.5
5.0
Time in Milliseconds

FIGURE I.A.2-9



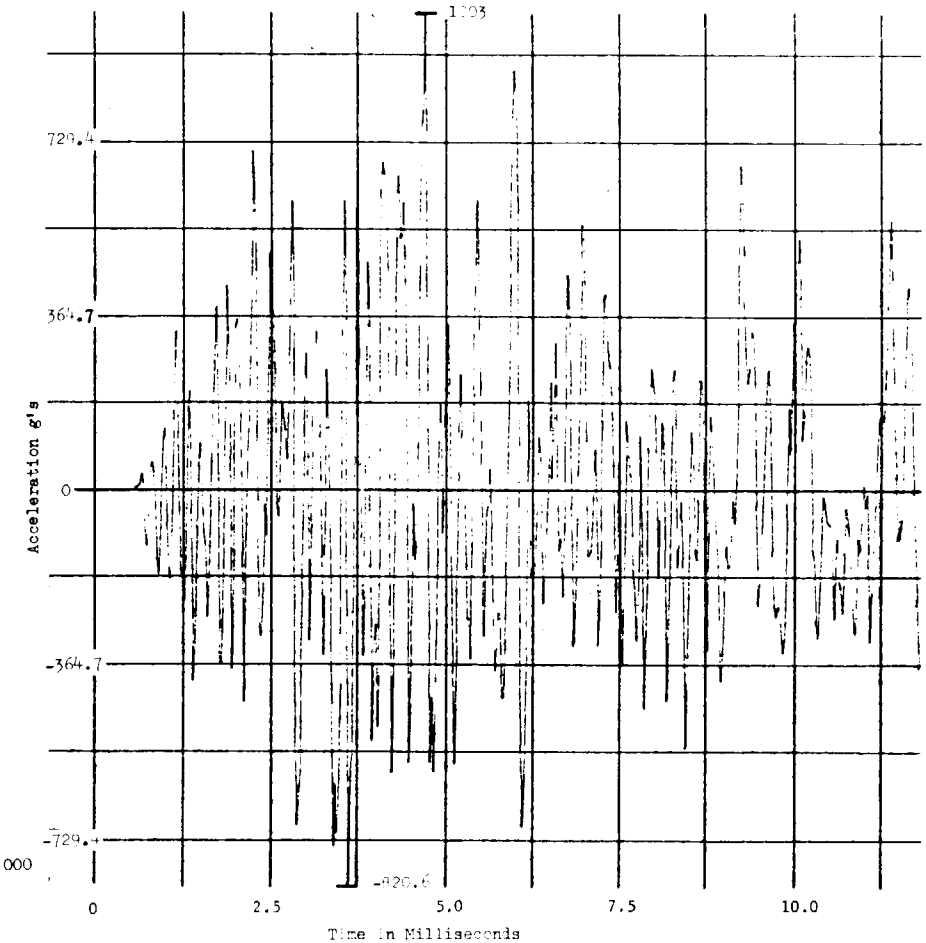
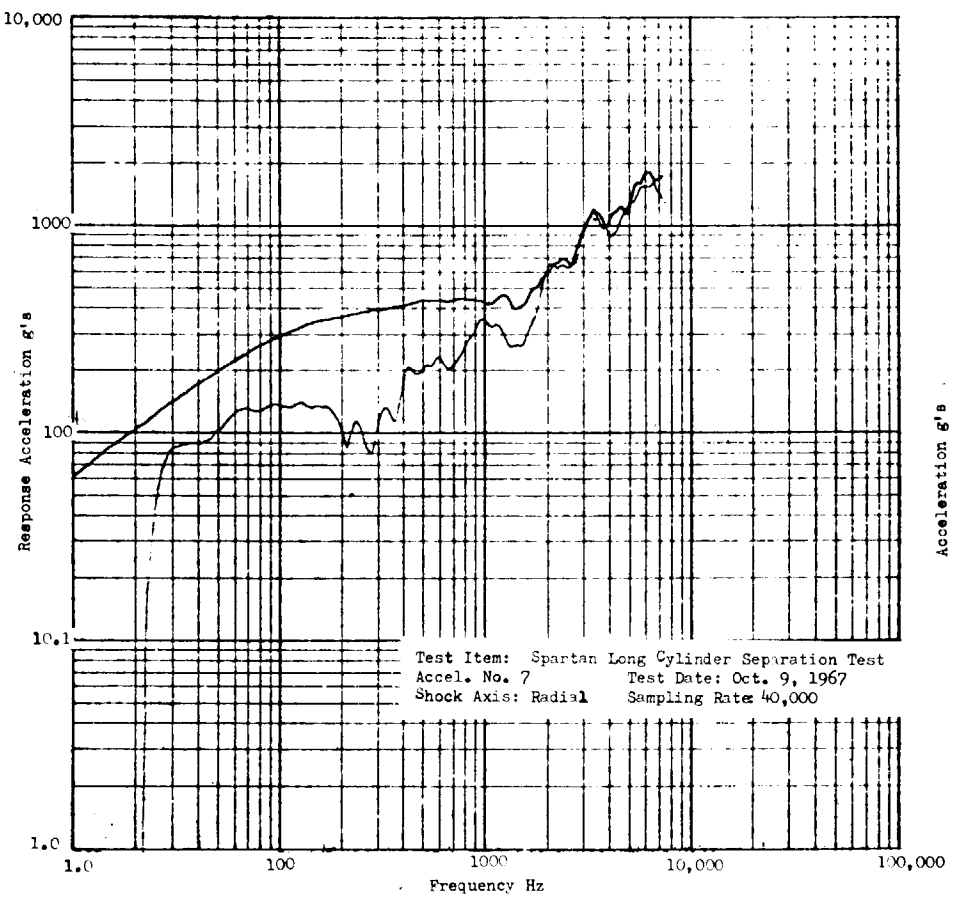


FIGURE I.A.2-10



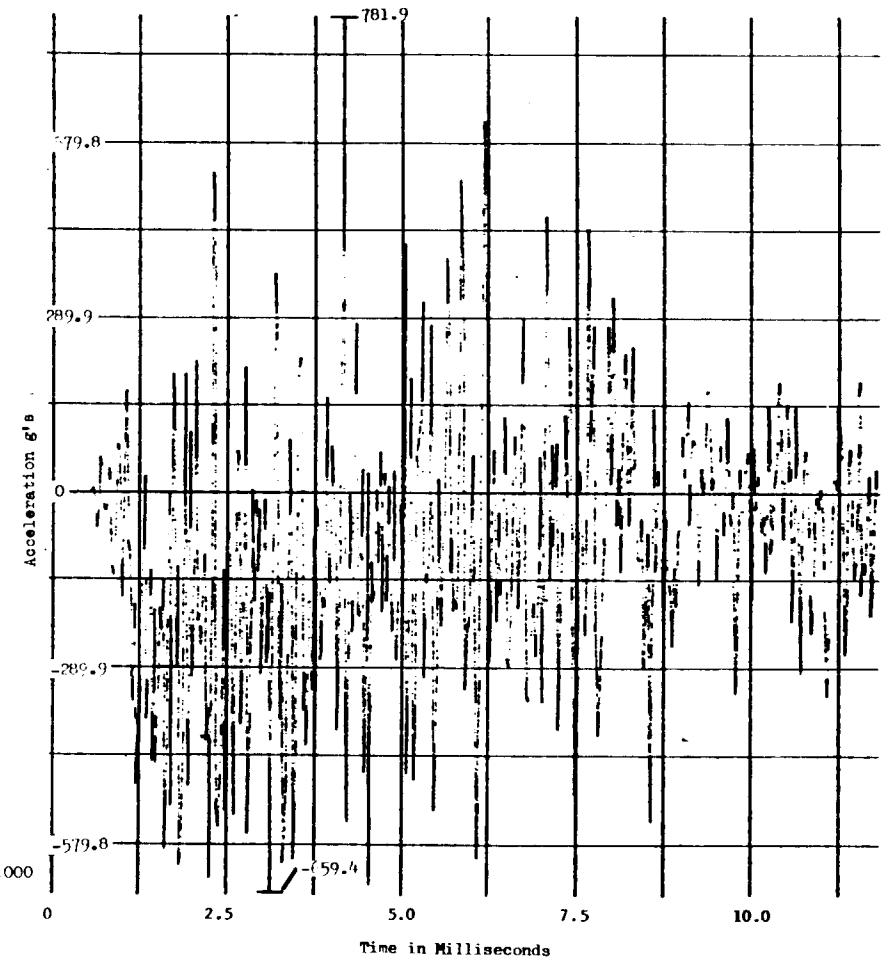
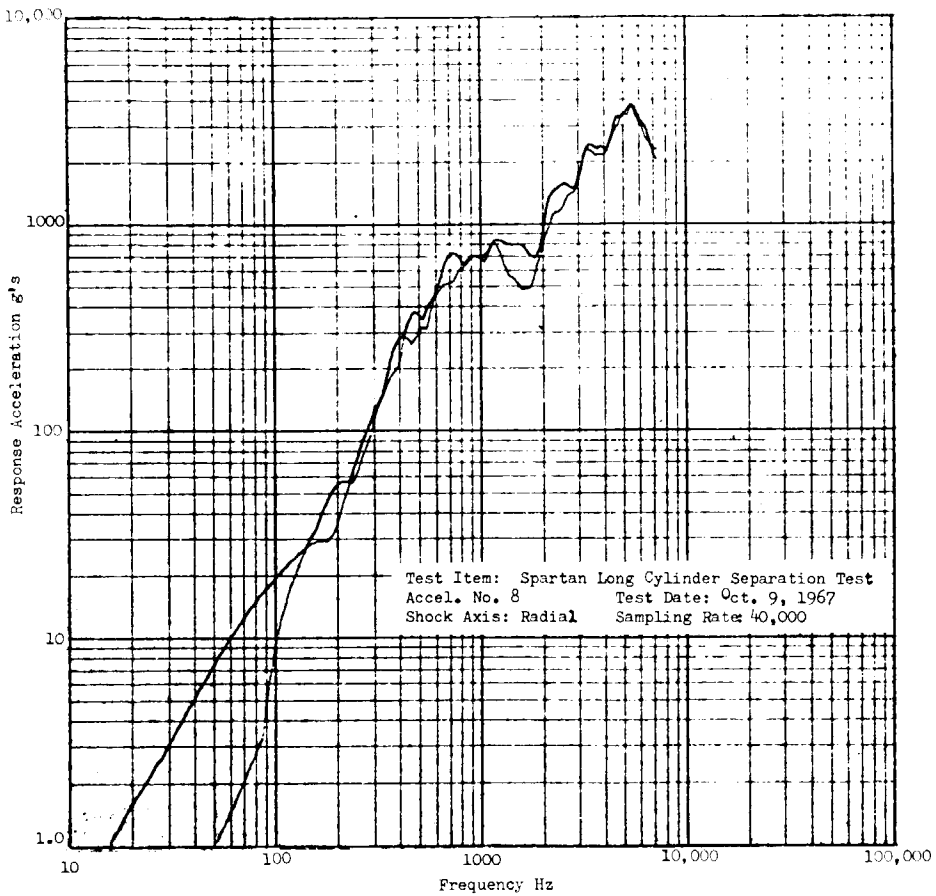


FIGURE 1.A.2-11



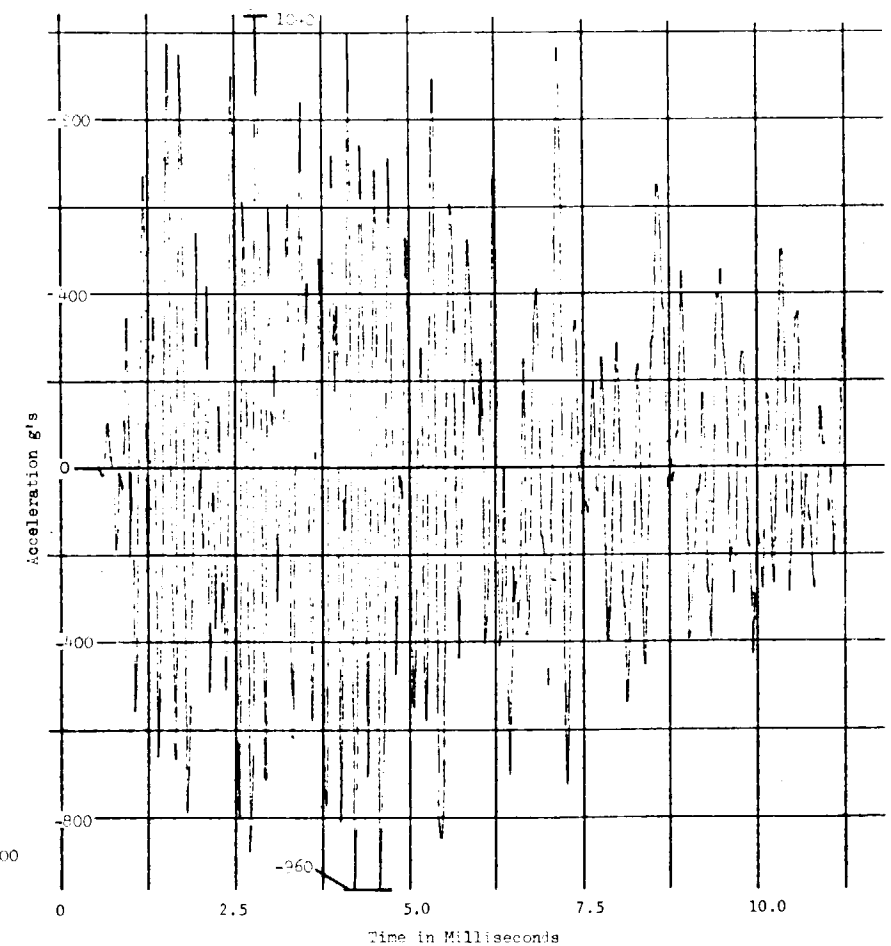
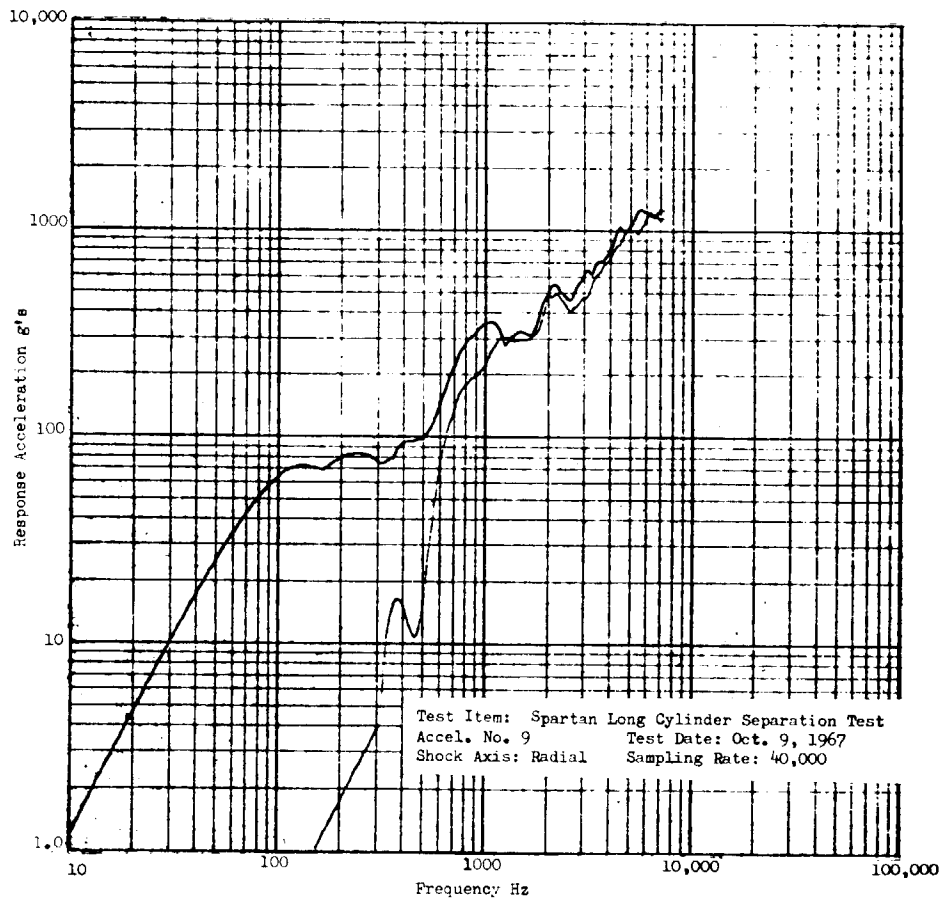


FIGURE I.A.2-12



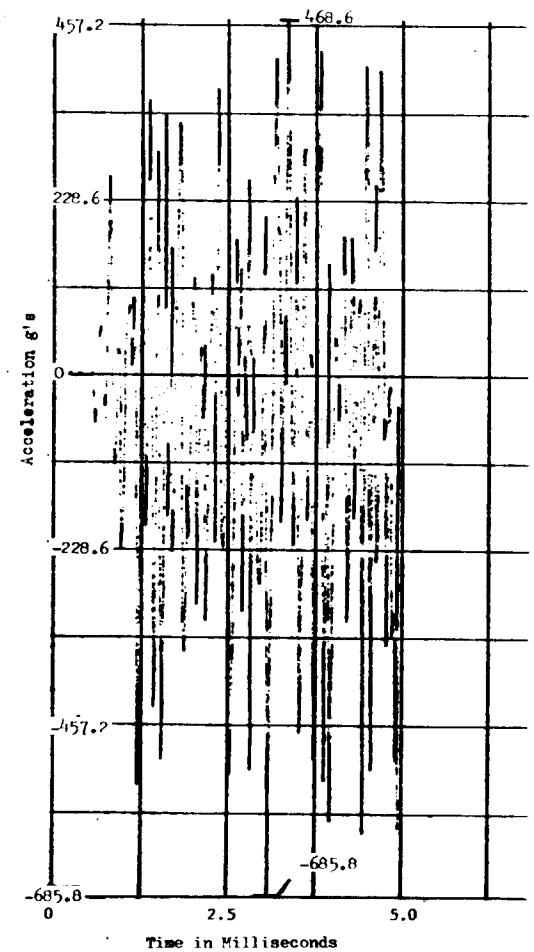


FIGURE I.A.2-13

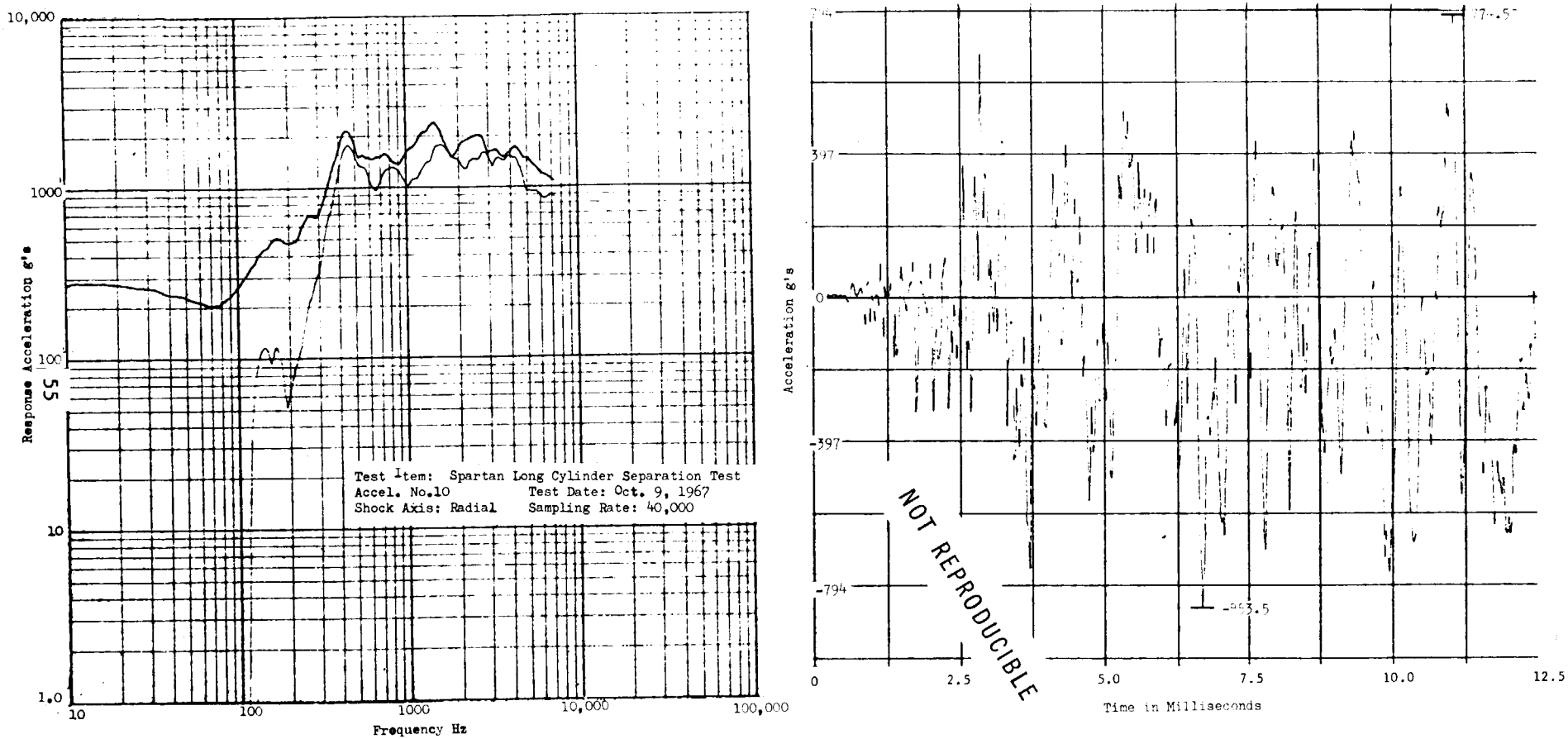
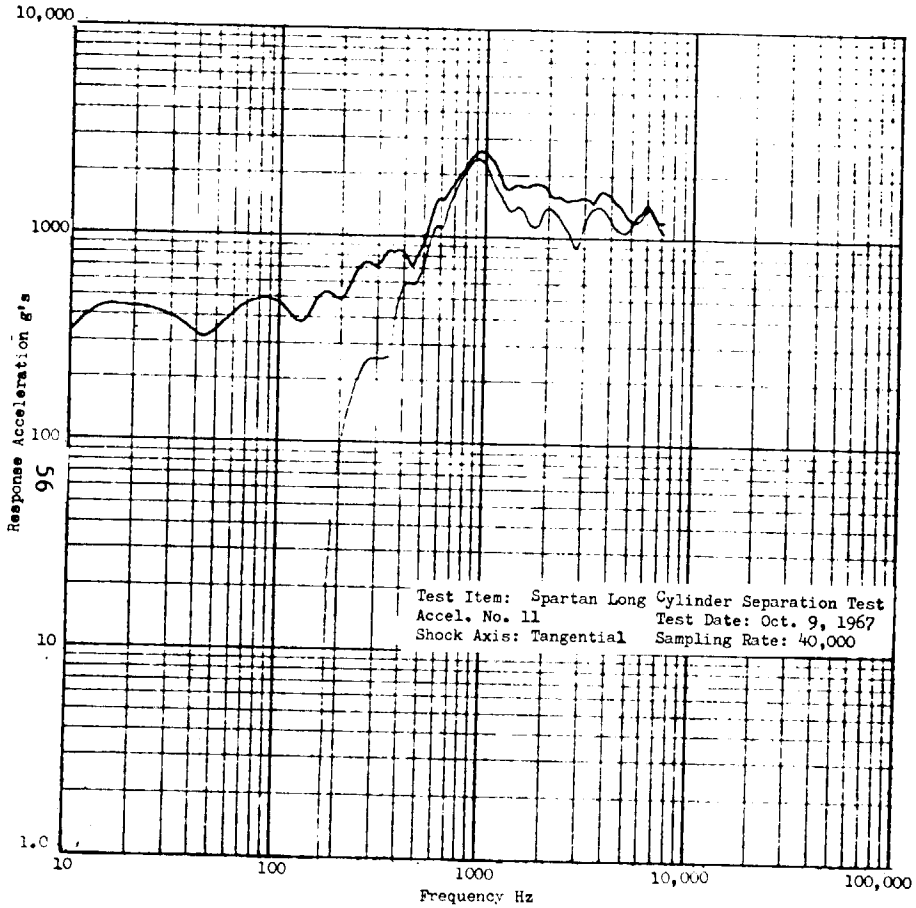


FIGURE I.A.2-14



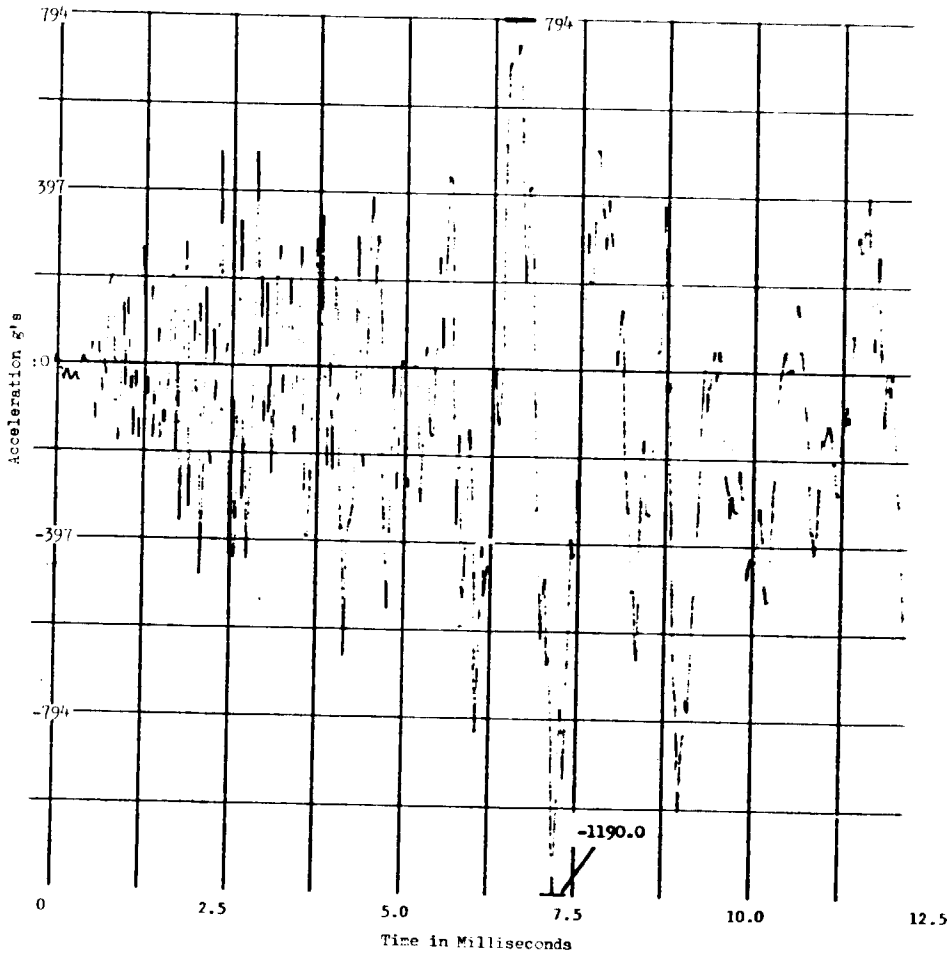


FIGURE I.A.2-15

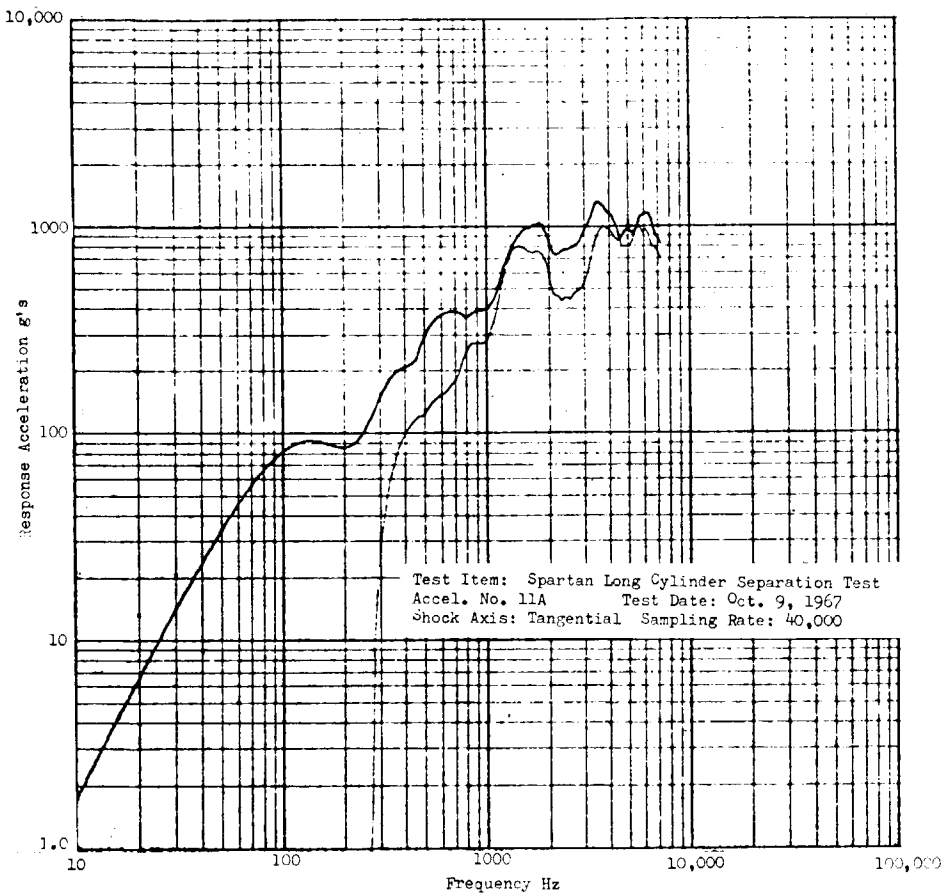
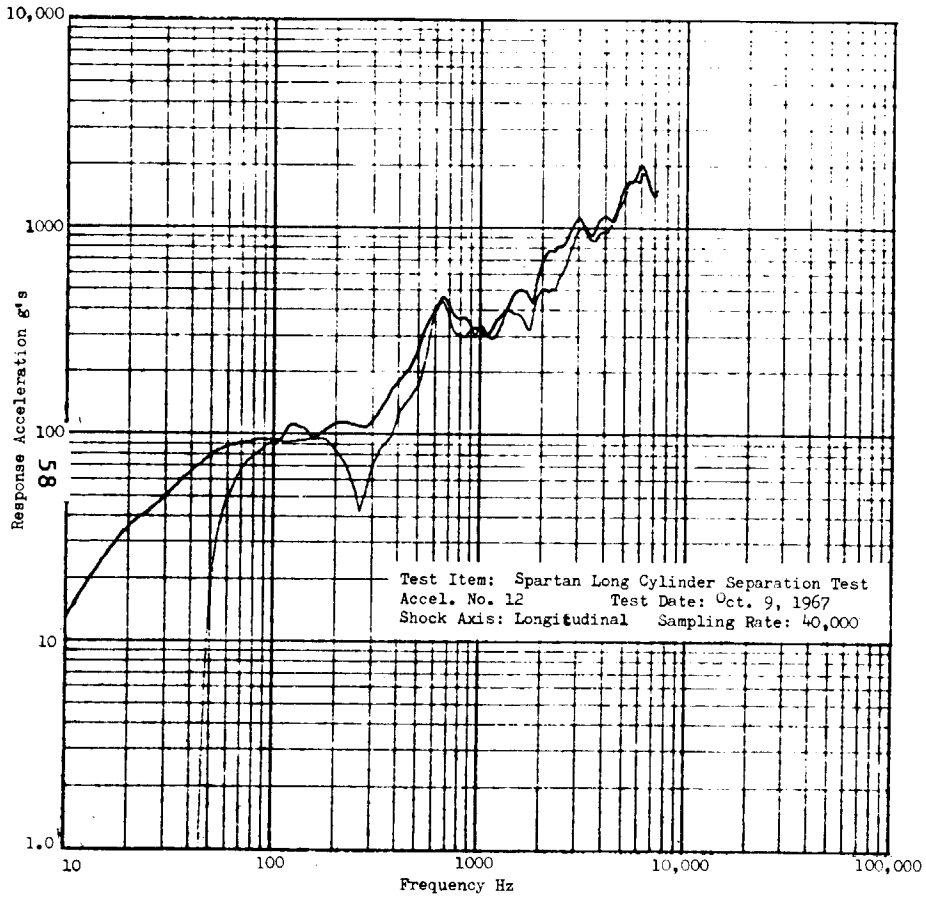


FIGURE I.A.2-16



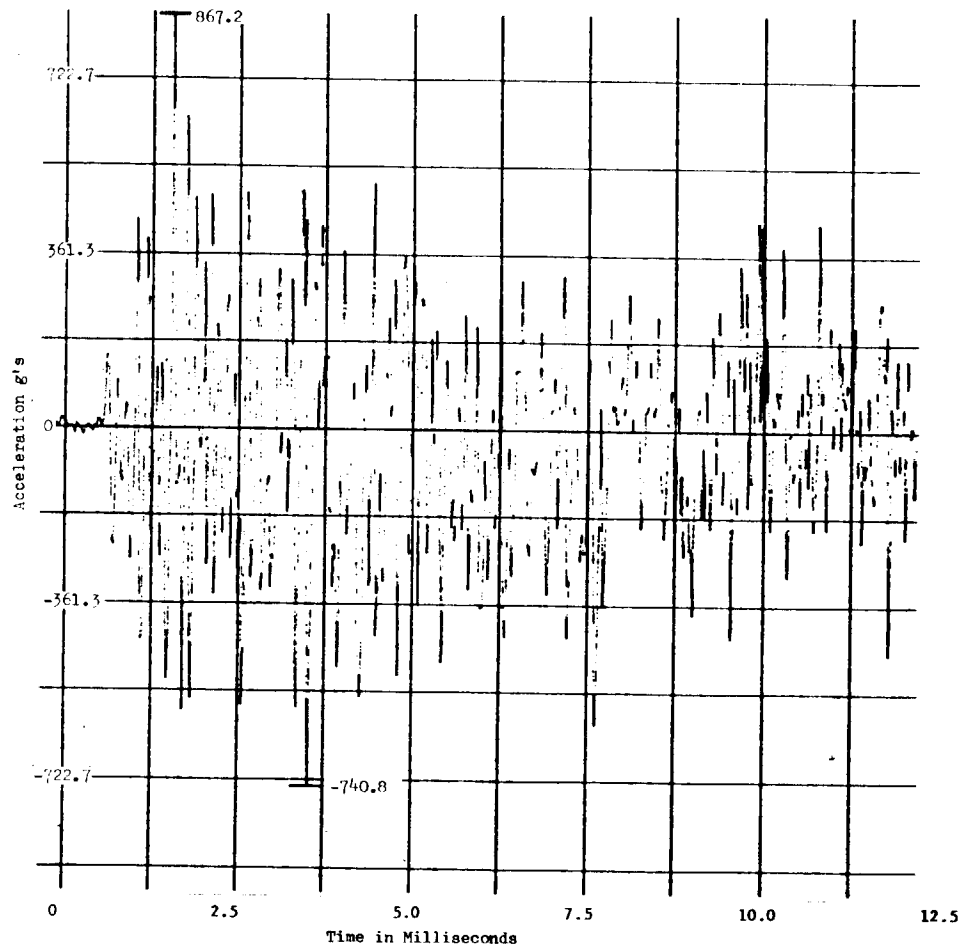
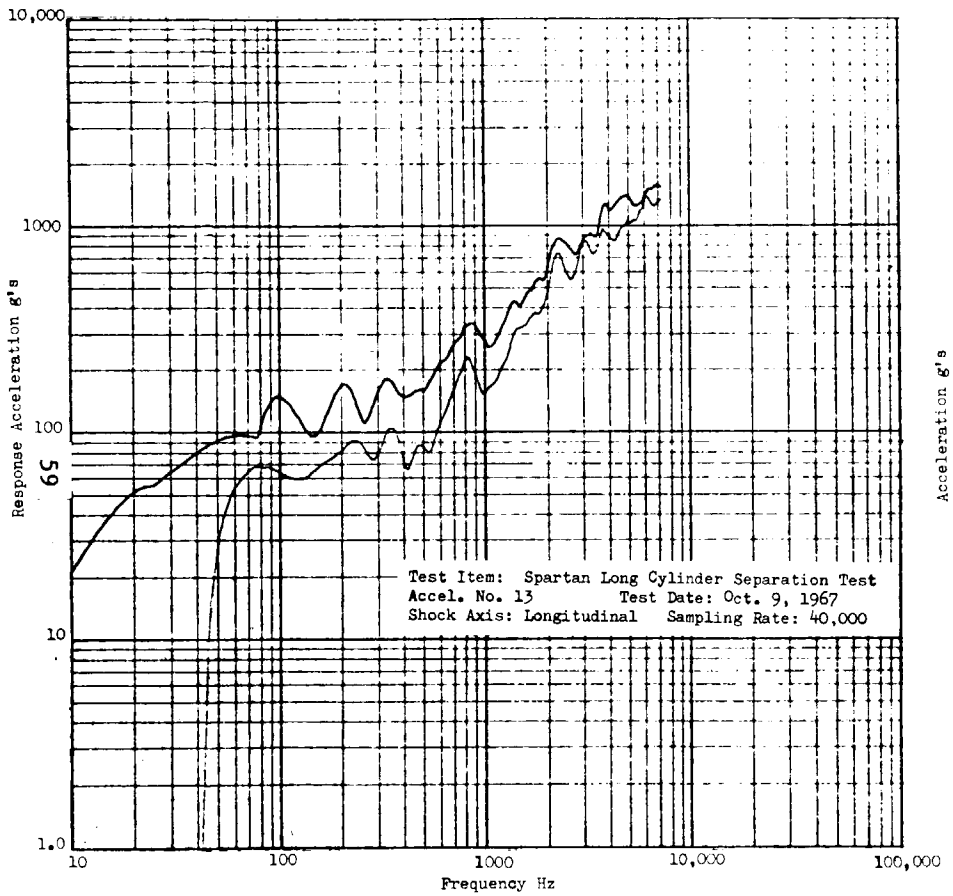


FIGURE I.A.2-17



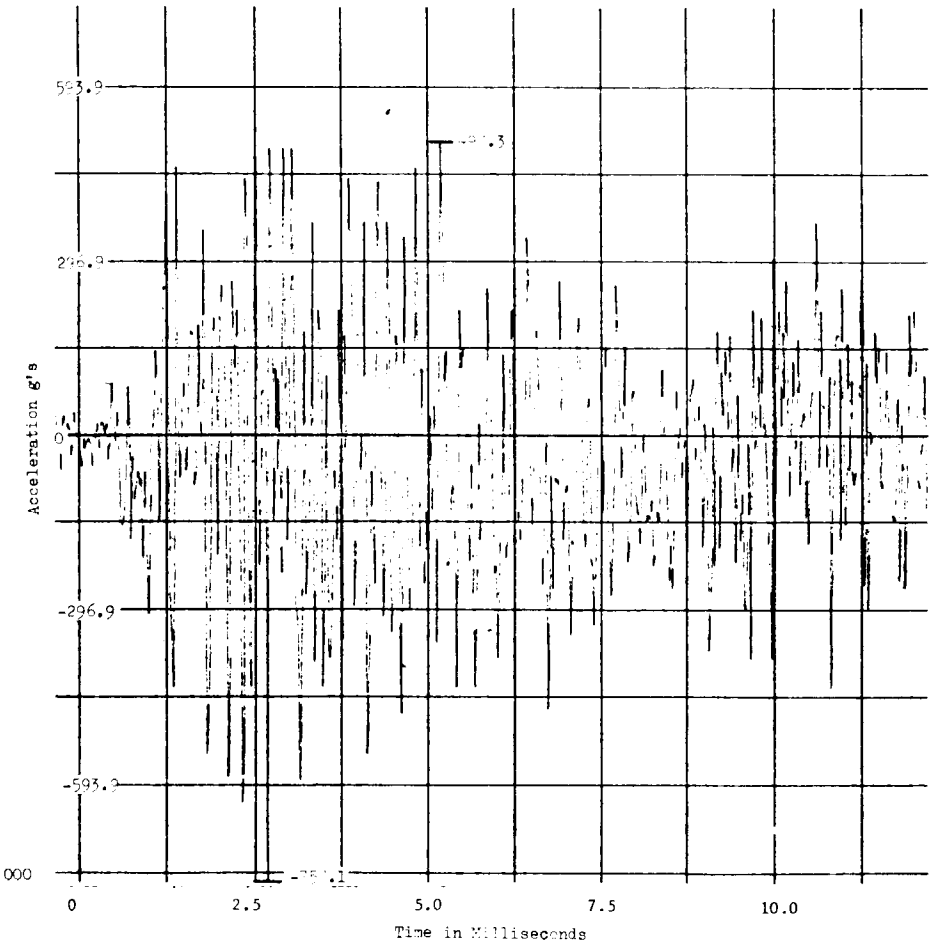
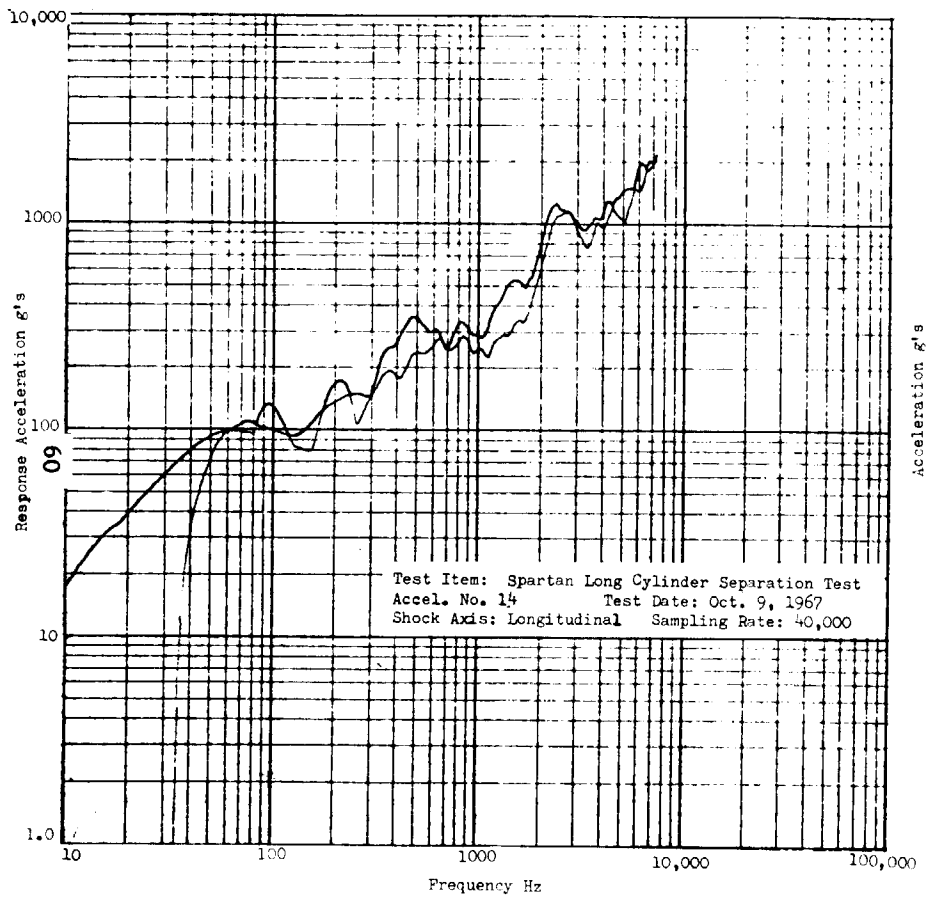


FIGURE I.A.2-18



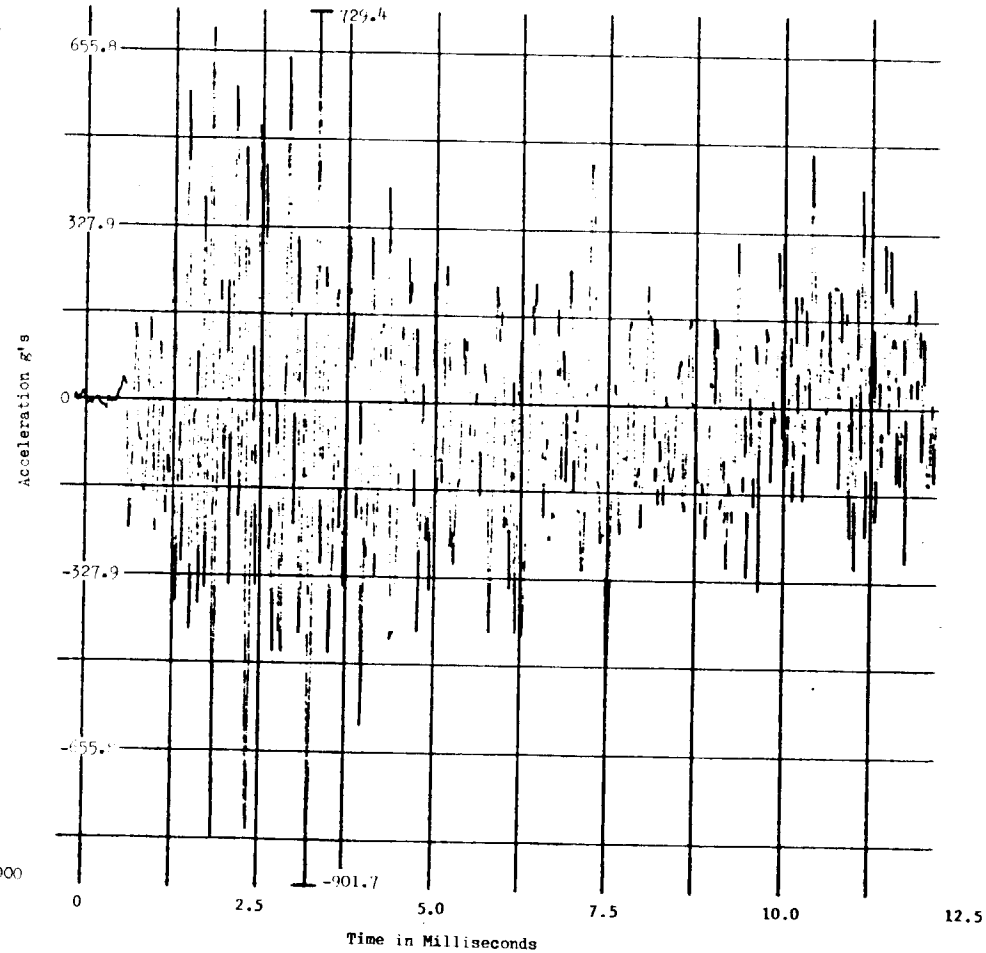
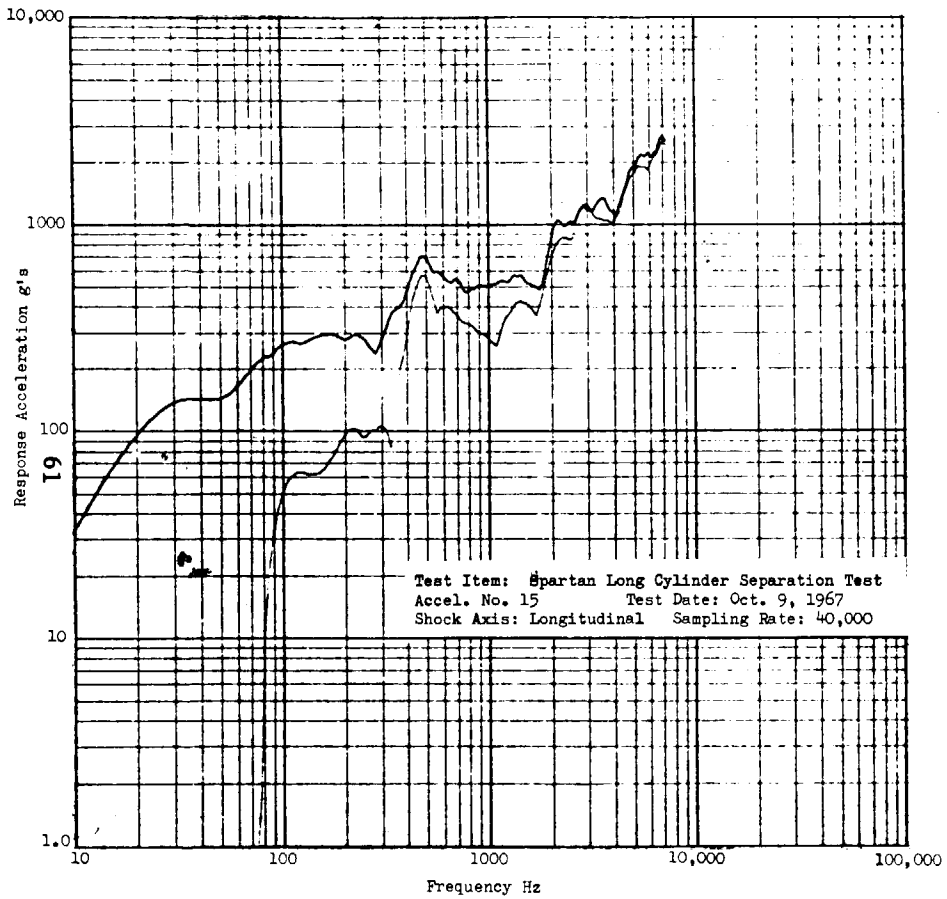


FIGURE I.A.2-19



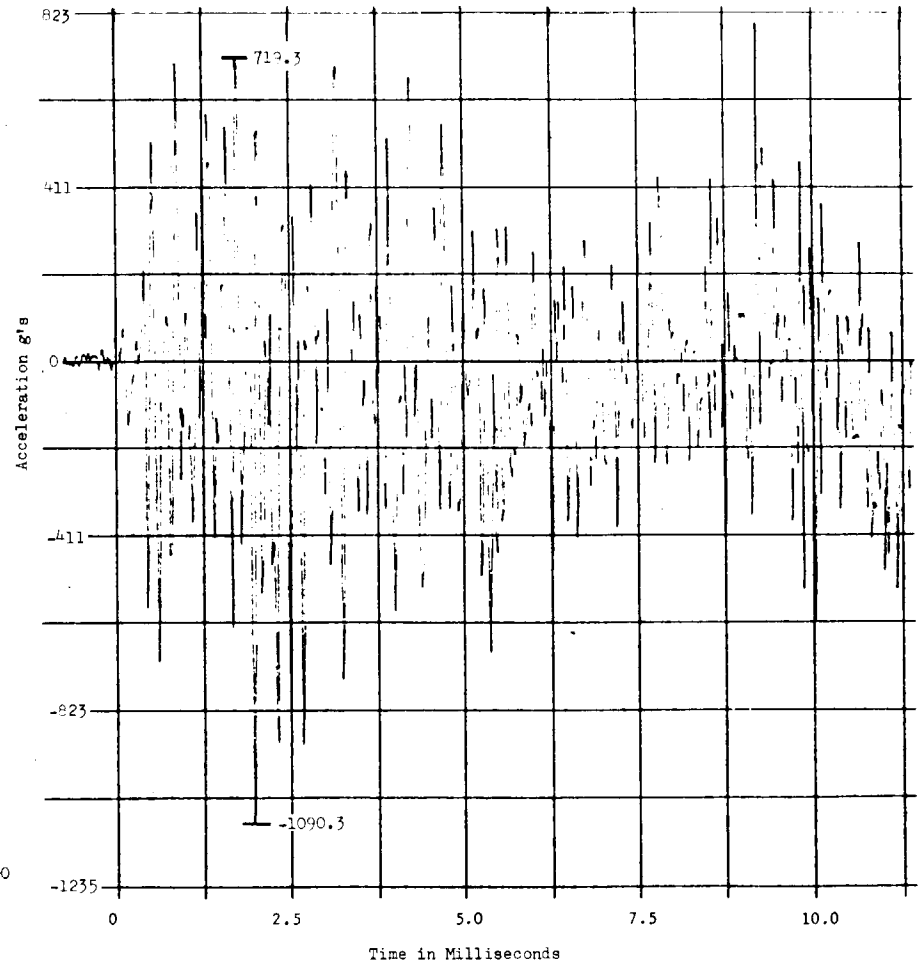
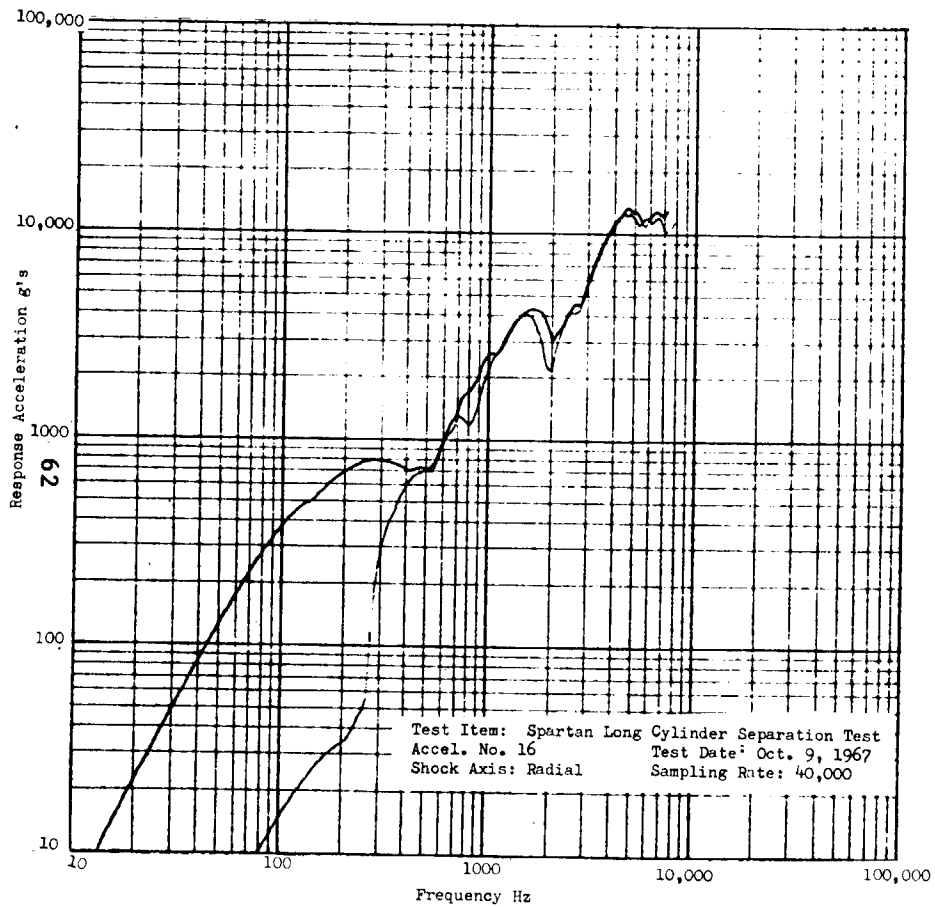


FIGURE I.A.2-20



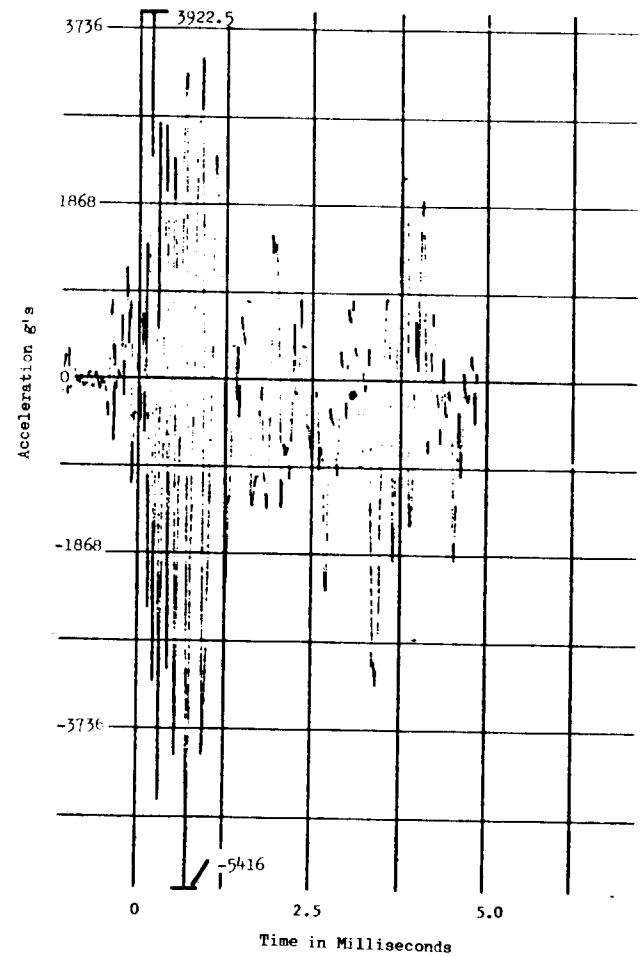
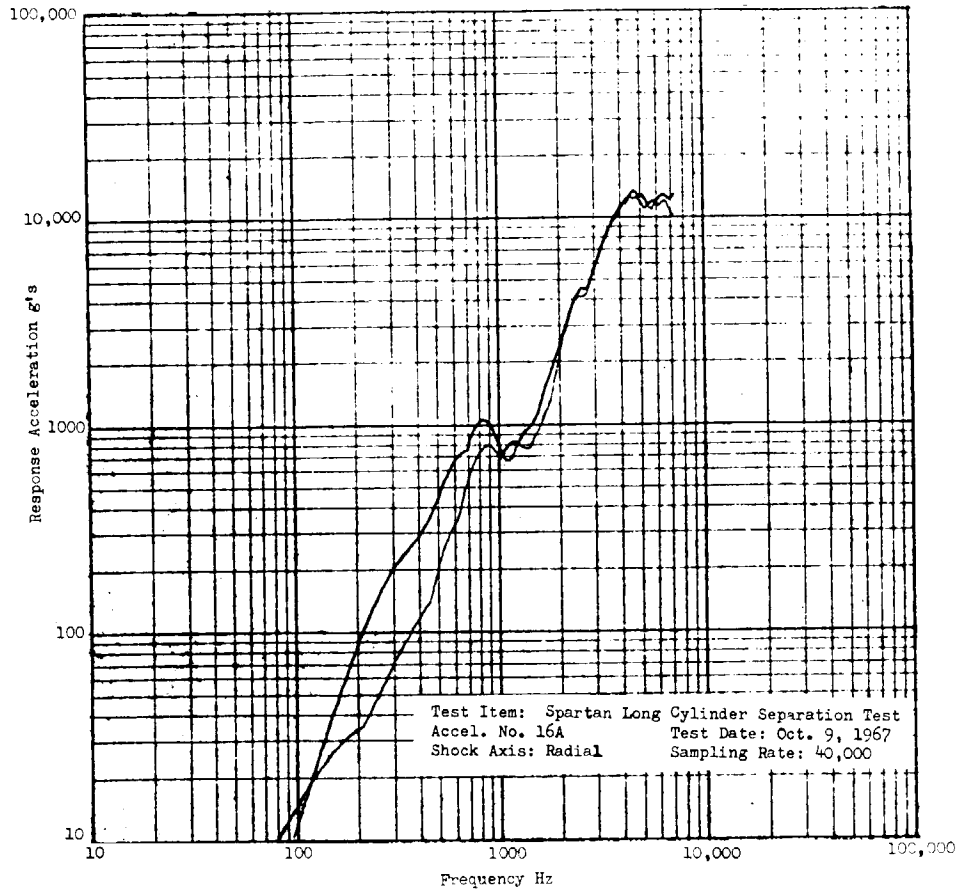


FIGURE I.A.2-21



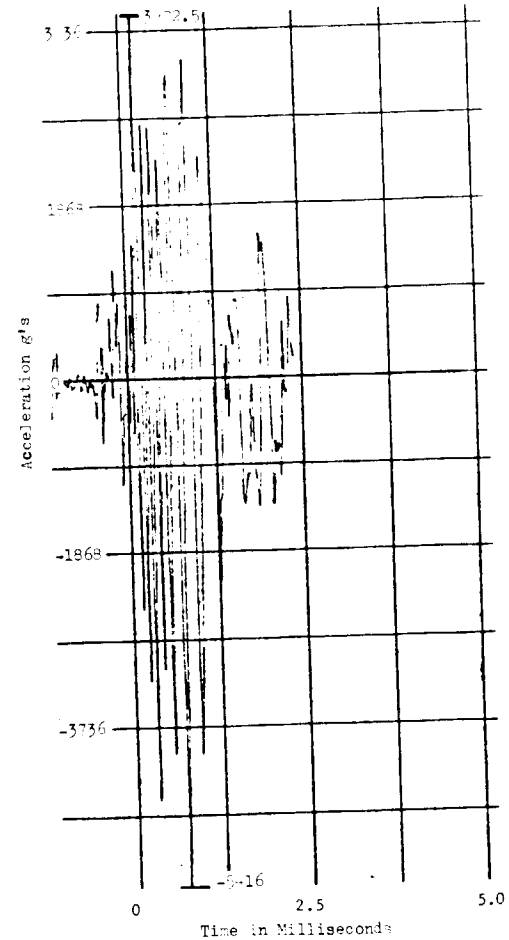
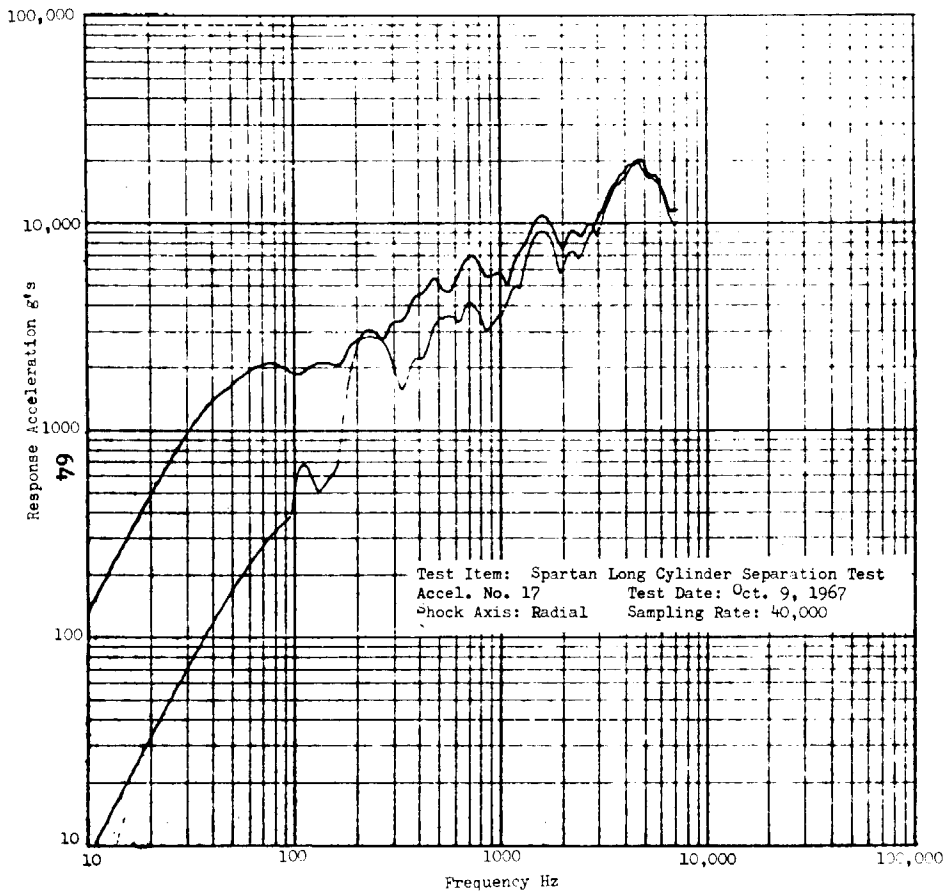


FIGURE I.A.2-22



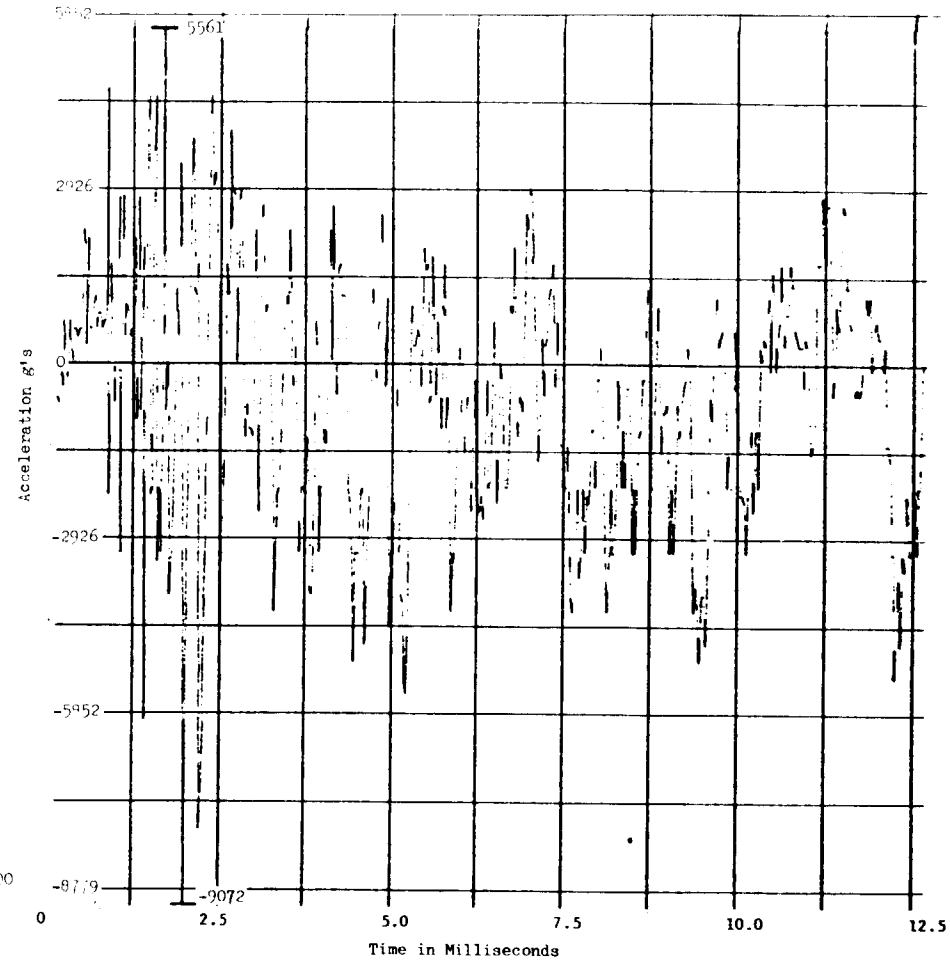


FIGURE I.A.2-23

SECTION I.A.3

SPARTAN FULL SCALE SECOND/THIRD STAGE SEPARATION TEST

PURPOSE OF TEST

The purpose of this test was to determine the ability of the test specimen (flight configuration) to function properly during and after exposure to a pyrotechnic shock environment which simulated the conditions to be encountered in flight.

DESCRIPTION OF EVENT

A separation shaped charge at 50 grains/foot was used for the Spartan second/third stage full scale separation test. For testing, the third stage equipped with warhead and some live and dummy components was attached to the second stage adapter section and suspended as illustrated in Figure I.A.3-1. After the pyrotechnic event, the second stage adapter section was allowed to fall freely to the ground of the test area. Figures I.A.3-2 and I.A.3-3 are before and after photographs of the separation event.

DESCRIPTION OF DATA

Sixty accelerometers were monitored during this test. Useable data were obtained for forty-nine of these mea-

surements. The data from accelerometer 13 is analyzed for two different time durations; for the shorter duration the accelerometer is denoted as 13A. Also, two different analyses of the data for accelerometers 9, 10, 11, 17, and 49 are presented: the first analysis of these measurements considers the actual data while the shock spectra presented for accelerometers 9A, 10A, 11A, 17A, and 49A illustrate the effect of passing the same data through a 200 Hz high pass filter.

No. of time histories	55
Duration	See Table I.A.3-1
No. of shock spectra	55
Type of analysis	digital
Sample rate	40,000/sec
Frequency range	0.4-15 K Hz
Valid range	0.4-6 K Hz
Frequency increment	10 points/octave
Damping	Q = 5

These shock spectra are presented with their corresponding time histories in Figures I.A.3-7 through I.A.3-61. Notice that each shock spectrum plot consists of two curves: one curve is associated with the largest positive response while the other is associated with the largest negative response, but no distinction can be made as to the identity of either curve.

DESCRIPTION OF PYROTECHNIC

Type: Split-ring- assembly with MDF

Size of charge: 50 grains/foot

Explosive propagation rate: 20,000 feet per second

Explosive core: RDX

Blasting cap: No. 6

Location: Figure I.A.3-4

DESCRIPTION OF STRUCTURE

The structure as illustrated in Figure I.A.3-4 was primarily aluminum. An interstage adapter plate and ballast were installed in the aft warhead ballast section (total weight 750 lb) to simulate the weight of the third stage engine.

The approximate size of structure is as follows:

diameter: variable 32 inches to 43 inches

length: approximately 15 feet

skin thickness: 0.170 inch at separation plane

0.125 inch at guidance section

0.135 to 0.185 inch at warhead section

DESCRIPTION OF ACCELEROMETERS

Type: Endevco 2225 M5, 2225, 2211, 2220, or 2272 as indicated in Table I.A.3-1.

Location: Figures I.A.3-4, I.A.3-5, and I.A.3-6. Also Table I.A.3-2

Axis of sensitivity: Table I.A.3-1.

DESCRIPTION OF DATA ACQUISITION SYSTEM

Amplifiers: Endevco 2713A

Unholtz Dickie 11MG

Tape recorders: Mincom H

Ampex CP100

PI 2114

PI 214

FAILURES

1) Bolt failure of three telemetry connector brackets. (Accel. No.s 26 and 28)

FAILURES (CONT.)

2) The functional failure of the separation instrumentation due to three sheared nylon rods. (Accel. No. 3)

3) The occurrence of a five-inch crack at the skin weld of the warhead section.

4) The erratic performance of the FM/FM No. 2 transmitter. (Accel. No. 27)

5) The change in the gain of the output of the vibration flight amplifier located on the aft warhead ballast. (Accel. Nos. 9, 11, and 12).

COMMENTS

Under "Description of Data" the valid frequency range is indicated as 400-6,000 Hz. However, due to 40,000/second sampling rate, the shock spectra are probably not valid for frequencies above 4,000 to 5,000 Hz.

TABLE I.A.3-1. INFORMATION ABOUT ACCELEROMETER DATA USED IN SHOCK SPECTRUM ANALYSES

Accelerometer Number	Axis of Sensitivity	Duration of Time History Used in Shock Spectrum Analysis (milliseconds)	Type of Endevco Accelerometer	Data Location Figure Number
3	radial	6	2225 M5	I.A.3-7
4	radial	6	2225 M5	I.A.3-8
5	radial	4	2225 M5	I.A.3-9
6	radial	3	2225 M5	I.A.3-10
9	radial	40	2225 M5	I.A.3-11
9A	radial	40	2225 M5	I.A.3-12
10	radial	35	2225 M5	I.A.3-13
10A	radial	35	2225 M5	I.A.3-14
11	radial	35	2225 M5	I.A.3-15
11A	radial	35	2225 M5	I.A.3-16
12	radial	8	2225 M5	I.A.3-17
13	radial	8	2225 M5	I.A.3-18
13A	radial	4	2225 M5	I.A.3-19
14	radial	30	2225	I.A.3-20
15	axial	20	2225	I.A.3-21
16	radial	7	2225	I.A.3-22
17	axial	2	2225	I.A.3-23
17A	axial	2	2225	I.A.3-24
18	radial	6	2211	I.A.3-25
19	radial	17.5	2225	I.A.3-26
20	axial	55	2211	I.A.3-27
22	radial	50	2225	I.A.3-28
23	radial	40	2225	I.A.3-29
24	radial	8	2225	I.A.3-30
25	axial	6	2225	I.A.3-31
26	axial	7	2225	I.A.3-32
27	axial	8	2225	I.A.3-33
28	axial	40	2225	I.A.3-34
29	axial	6	2225	I.A.3-35
30	axial	6	2225	I.A.3-36
31	axial	7	2225	I.A.3-37
32	axial	6	2225	I.A.3-38
33	axial	8	2225	I.A.3-39
34	axial	9	2225	I.A.3-40

TABLE I.A.3-1 (CONTINUED)

Accelerometer Number	Axis of Sensitivity	Duration of Time History Used in Shock Spectrum Analysis (milliseconds)	Type of Endevco Accelerometer	Data Location Figure Number
35	radial	8	2211	I.A.3-41
36	axial	8	2225	I.A.3-42
38	axial	40	2225	I.A.3-43
39	radial	60	2225	I.A.3-44
40	radial	6	2211	I.A.3-45
41	radial	3.5	2211	I.A.3-46
43	radial	7.5	2211	I.A.3-47
44	radial	70	2225	I.A.3-48
47	radial	25	2225	I.A.3-49
48	radial	6	2225	I.A.3-50
49	radial	25	2225	I.A.3-51
49A	radial	25	2225	I.A.3-52
50	axial	9	2225	I.A.3-53
52	axial	8	2272	I.A.3-54
53	axial	7	2272	I.A.3-55
54	axial	6	2272	I.A.3-56
56	radial	7.5	2272	I.A.3-57
57	axial	7.5	2220	I.A.3-58
58	tangential	7.5	2220	I.A.3-59
59	tangential	50	2220	I.A.3-60
60	axial	6	2220	I.A.3-61

TABLE I.A.3-2. DESCRIPTION OF ACCELEROMETER LOCATIONS

Accelerometer Number	Description of Location	Response Axis
3	Outside Skin - Ref. Fin #1; Sta. 234	Radial
4	Outside Skin - Ref. Fin #2; Sta. 234	Radial
5	Outside Skin - Ref. Fin #3; Sta. 234	Radial
6	Outside Skin - Ref. Fin #4; Sta. 234	Radial
9	Skin - Warhead Antenna No. 1: Sta. 202	Radial
10	Outside Skin - Ref. Fin #4; Sta. 204	Radial
11	Outside Skin - Ref. Fin #4 Sta. 202 (Across Skin Splice)	Radial
12	Outside Skin - Ref. Fin #4; Sta 153	Radial
13	Outside Skin - Ref. Fin #4; Sta. 146 (Across Field Joint)	Radial
14	Outside Skin - Ref. Fin #4; Sta. 144 (Across Field Joint)	Radial
15	T/M Rack Support Frame - Ref. Fin #1; Sta. 146	Axial
16	T/M Rack Mount Block - 2" from Support Frame; Sta. 146	Radial
17	Ballast - Adjacent to flight Vibration Accel.; Between Fins #3 & 4; Sta. 168	Axial

TABLE I.A.3-2 (CONT.)

Accelerometer Number	Description of Location	Response Axis
18	Ballast - Adjacent to Flight Vibration Accel. - Between Fins #3 & 4; Sta. 167	Radial
19	Ballast - Adjacent to Shock Vibration Accel. - Between Fins #3 & 4; Sta. 169	Radial
20	Input to Multi-channel Power Supply - Between Fins #1 & 2; Sta. 168	Axial
22	Response of Telemetry Battery	Radial
23	Input to Bi-Directional Detector, Power Divider, and R.F. Multiplexer	Radial
24	Fwd. Warhead Support - Between Fins #3 & 4; Sta. 166	Radial
25	Input to FM/FM #1 Transmitter and PCM Multicoder - Between Fins #2 & 3; Sta. 146	Axial
26	Input to PDM Multicoder #1 & 2 and FM/FM Signal Conditioning Network Assembly - Near Fin #1; Sta. 146	Axial
27	Input to FM/FM #2 Transmitter and PDM Multicoder #1 - Near Fin #1; Sta. 146	Axial
28	Input to Pitch Rate Gyro and FM/FM Signal Conditioning Network Assembly - Near Fin #4; Sta. 146	Axial
29	Input to PCM Transmitter, VCO Assembly, T/M Reference Power Supply and Pitch Accel. - Ref. Fin #4; Sta. 146	Axial

TABLE I.A.3-2 (CONT.)

Accelerometer Number	Description of Location	Response Axis
30	Input to Thrust Accel. and PCM Signal Conditioning Network Assembly - Near Fin #3; Sta. 146	Axial
31	Input to 15VDC Power Supply and PCM Signal Conditioning Network Assembly - Between Fins #3 & 4; Sta. 144	Axial
32	Input to VCO Assembly and FM/FM Transmitter No. 2 - Between Fins #1 & 4; Sta. 144	Axial
33	Input to PCM Multicoder and Current Sensor - Near Fin #2; Sta. 144	Axial
34	Input to PCM Signal Conditioning Network Assembly and FM/FM Transmitter No. 1; Sta. 144	Axial
35	FCS Support Mount - Ref. Fin #1; Sta. 131 (Accelerometer on Block)	Radial
36	FCS Support Mount - Ref. Fin #1; Sta. 131	Axial
38	MGS Mount - Adjacent to Flight Vibration Accel; Sta. 131	Axial
39	Outside Skin - Ref. Fin #3; Sta. 128	Radial
40	Inside Skin - Ref. Fin #1; Sta. 137	Radial
41	Input to Guidance Battery - Ref. Fin #2; Sta. 124	Radial

TABLE I.A.3-2. (CONT.)

Accelerometer Number	Description of Location	Response Axis
43	Input to S&A Device - Ref. Fin #4; Sta. 123	Radial
44	Outside Skin - Ref. Fin #3; Sta. 120	Radial
47	Outside Skin - Field Joint (Aft); Sta. 102.5	Radial
48	Outside Skin - Field Joint (Fwd); Sta. 100.5	Radial
49	Outside Skin - Fwd. End of Control Section	Radial
50	Interstage Mating Plate; Sta. 101.5	Axial
52	In FCS - A101 - (Ref. Figure 17)	Axial
53	In FCS - A102 - (Ref. Figure 17)	Axial
54	In FCS - A103 (Ref. Figure 17)	Axial
56	In FCS - A105 - (Ref. Figure 17)	Radial
57	In FCS - A106 - (Ref. Figure 17)	Axial
58	In FCS - A107 - (Ref. Figure 17)	Tangential
59	In FCS - A108 - (Ref. Figure 17)	Tangential
60	In FCS - A109 - (Ref. Figure 17)	Axial

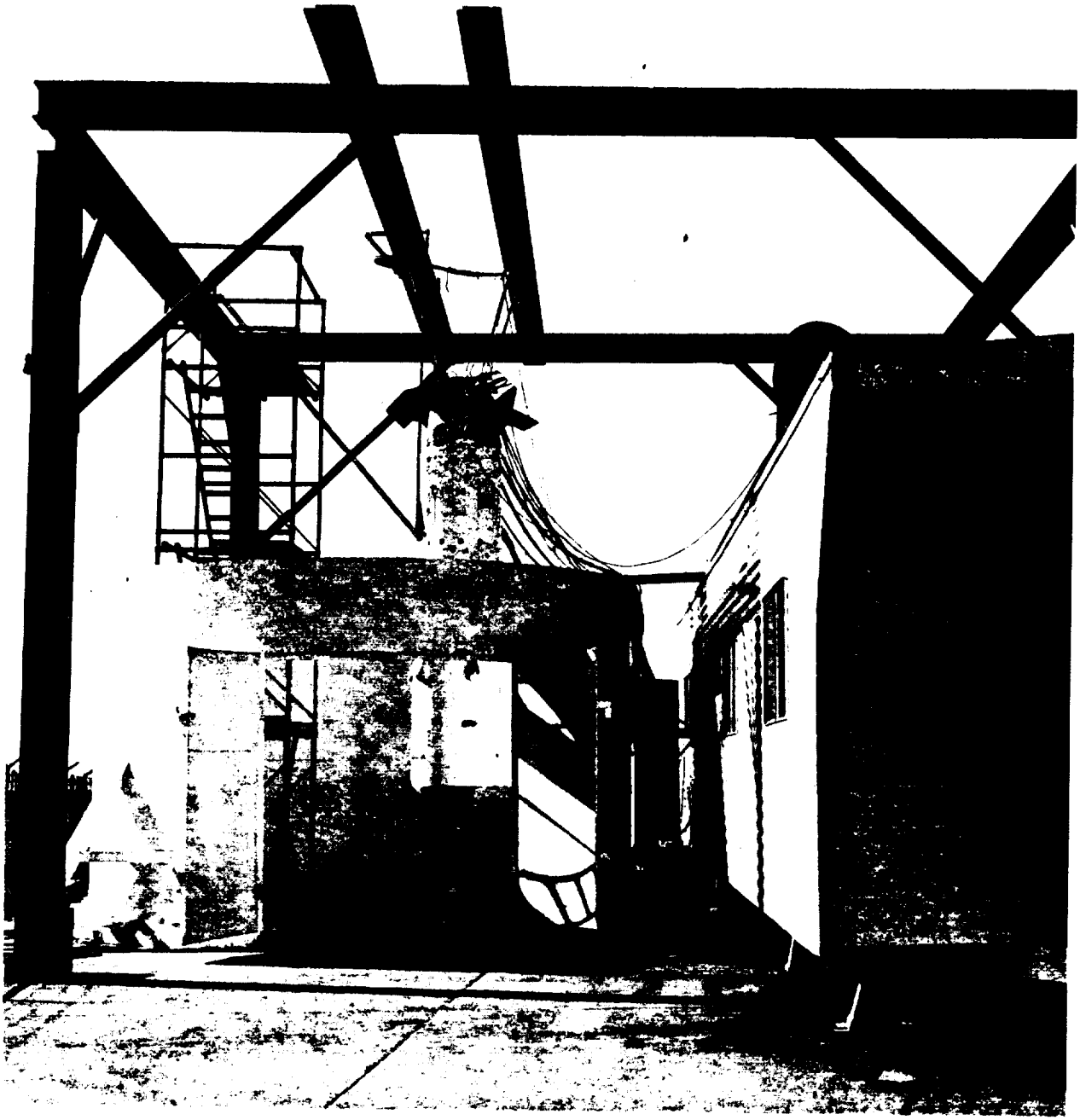


FIGURE I.A.3.1 SPARTAN FULL SCALE TEST SET-UP

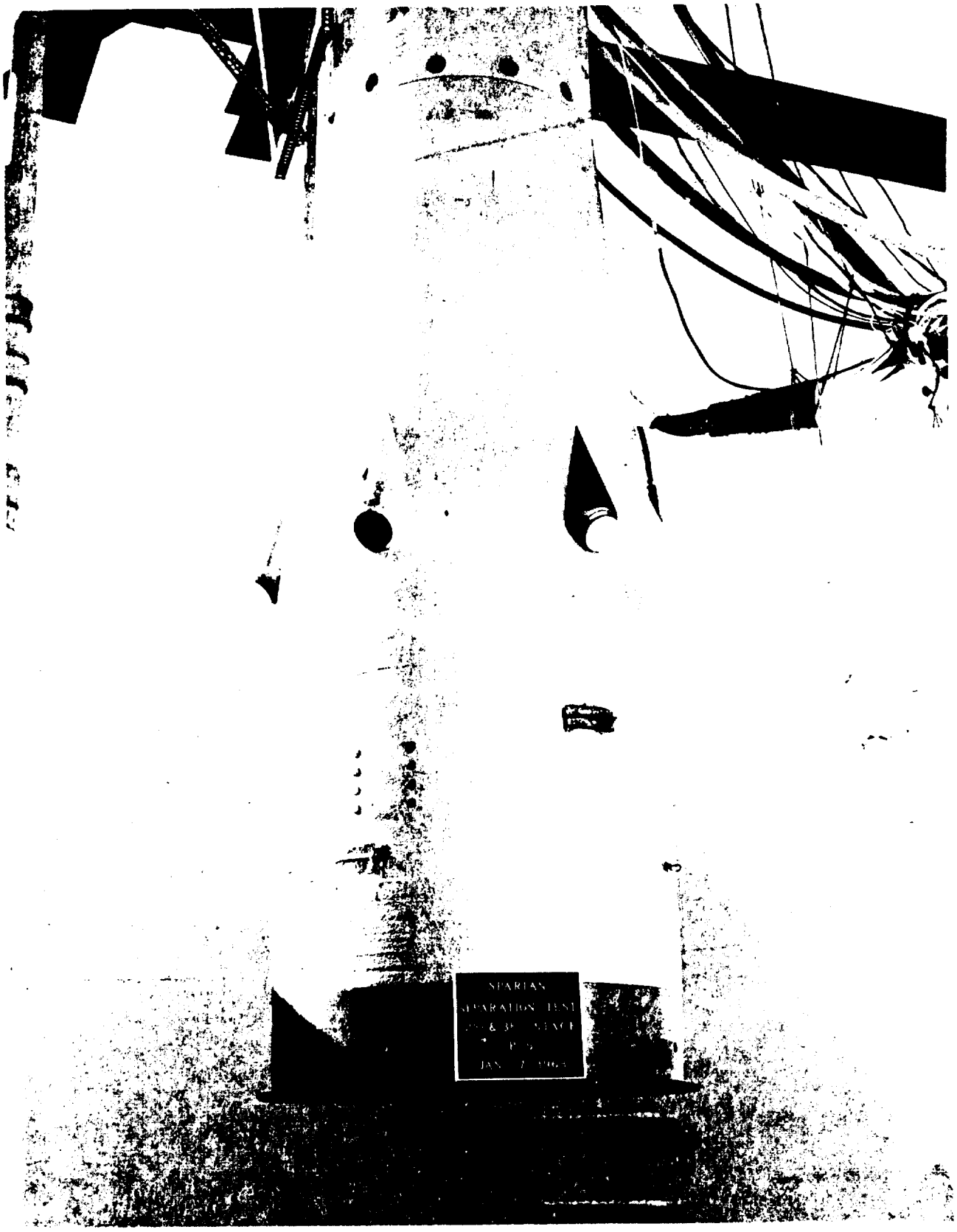


FIGURE I.A.3-2 SPARTAN FULL SCALE BEFORE SEPARATION

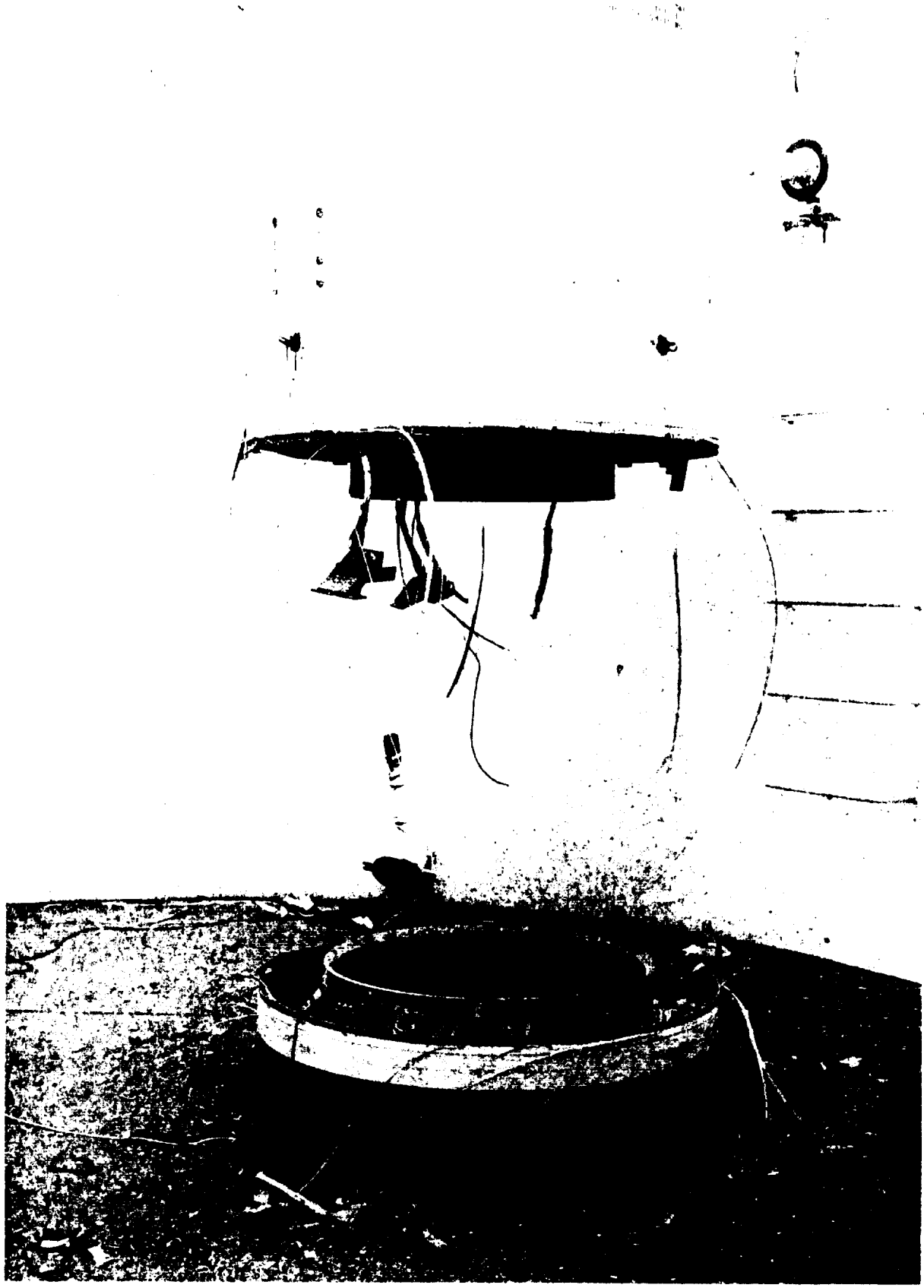


FIGURE I.A.3-3 SPARTAN FULL SCALE AFTER SEPARATION

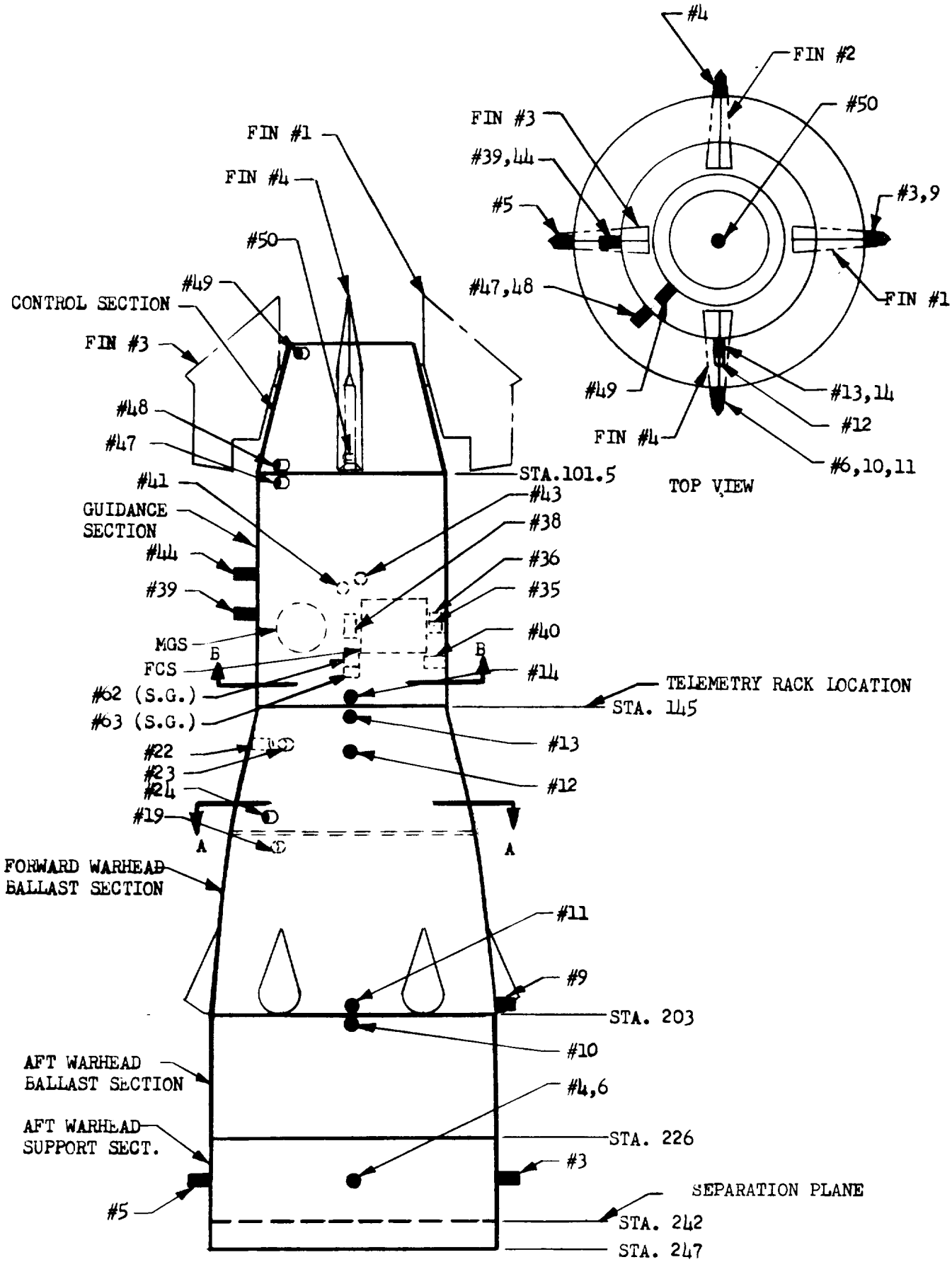
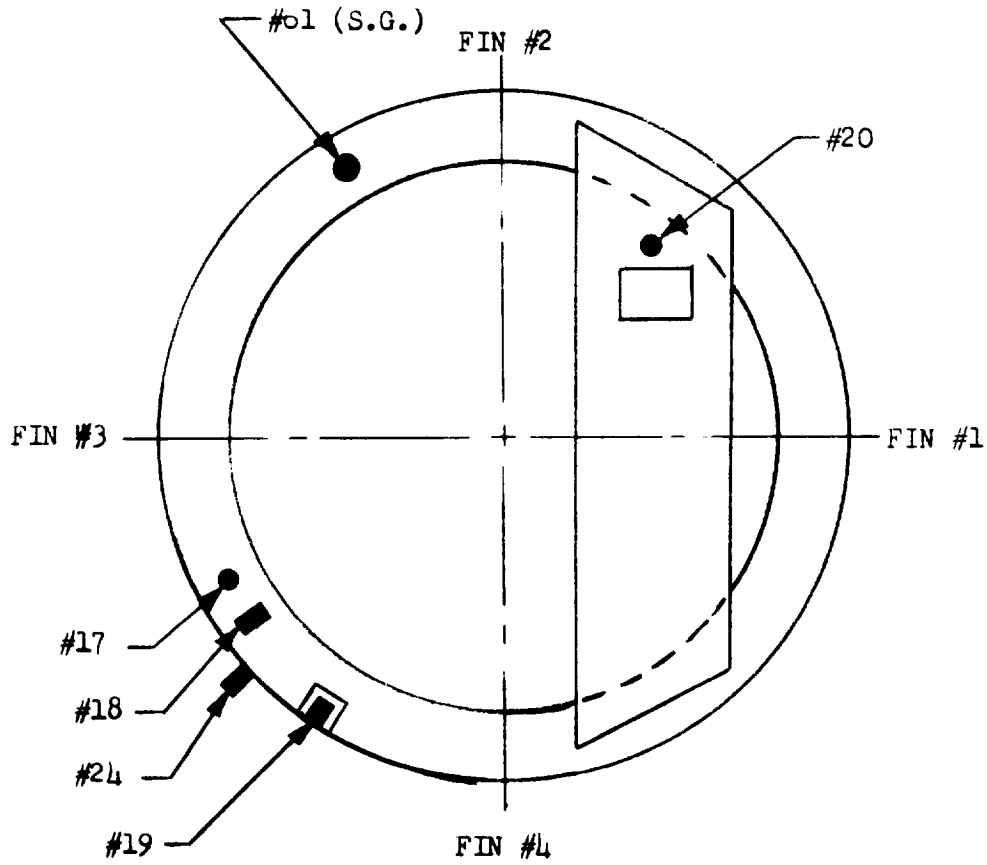
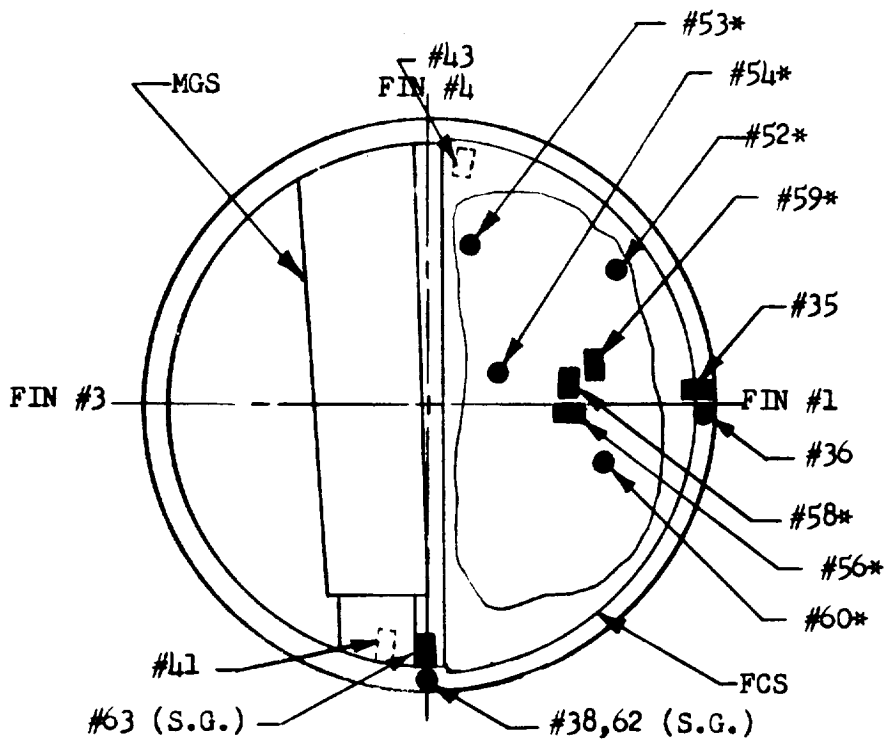


Figure I.A.3-4. Accelerometer Locations



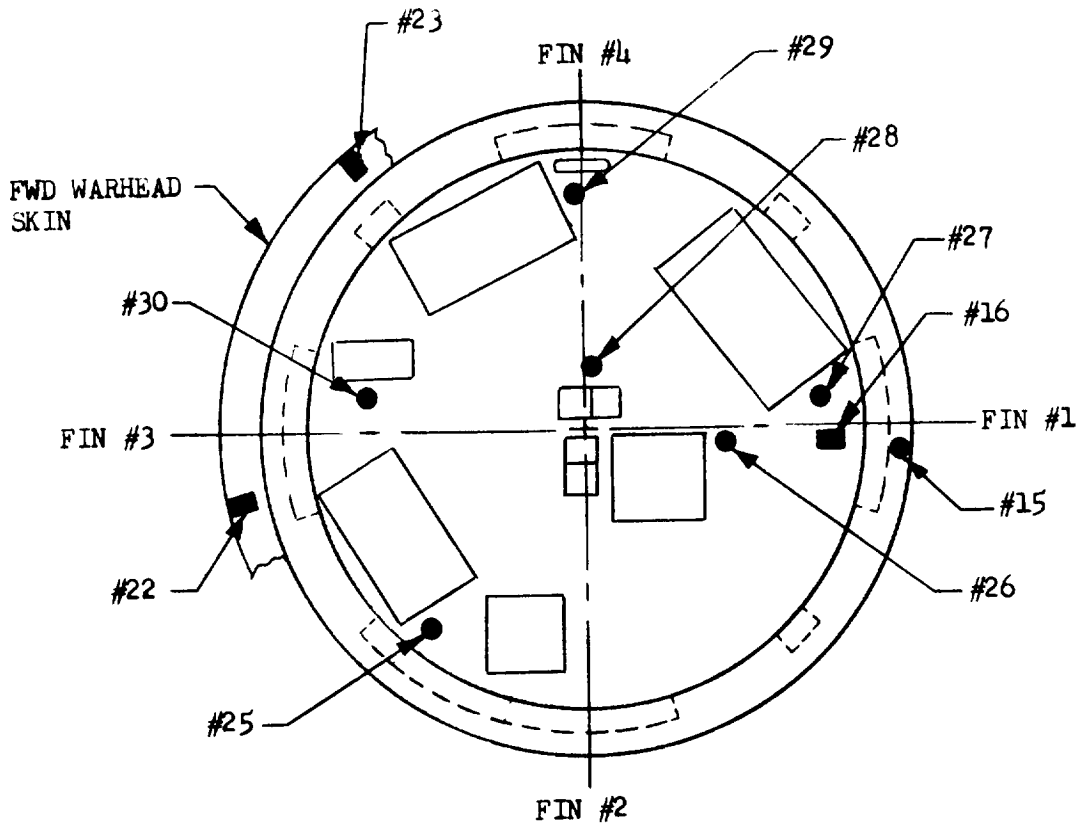
SECTION A-A
WARHEAD SECTION



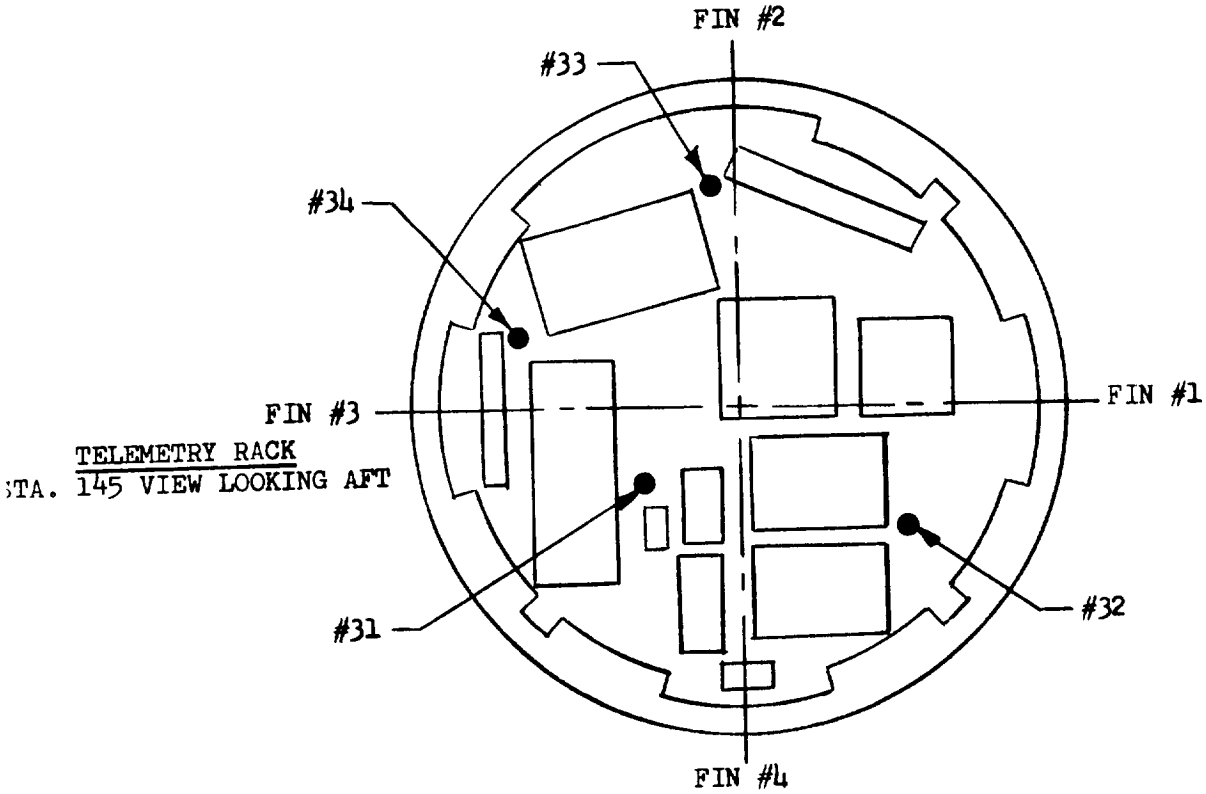
SECTION B-B
GUIDANCE SECTION

* THESE ACCELEROMETERS LOCATED INSIDE FCS

Figure I.A.3-5. Accelerometer Locations

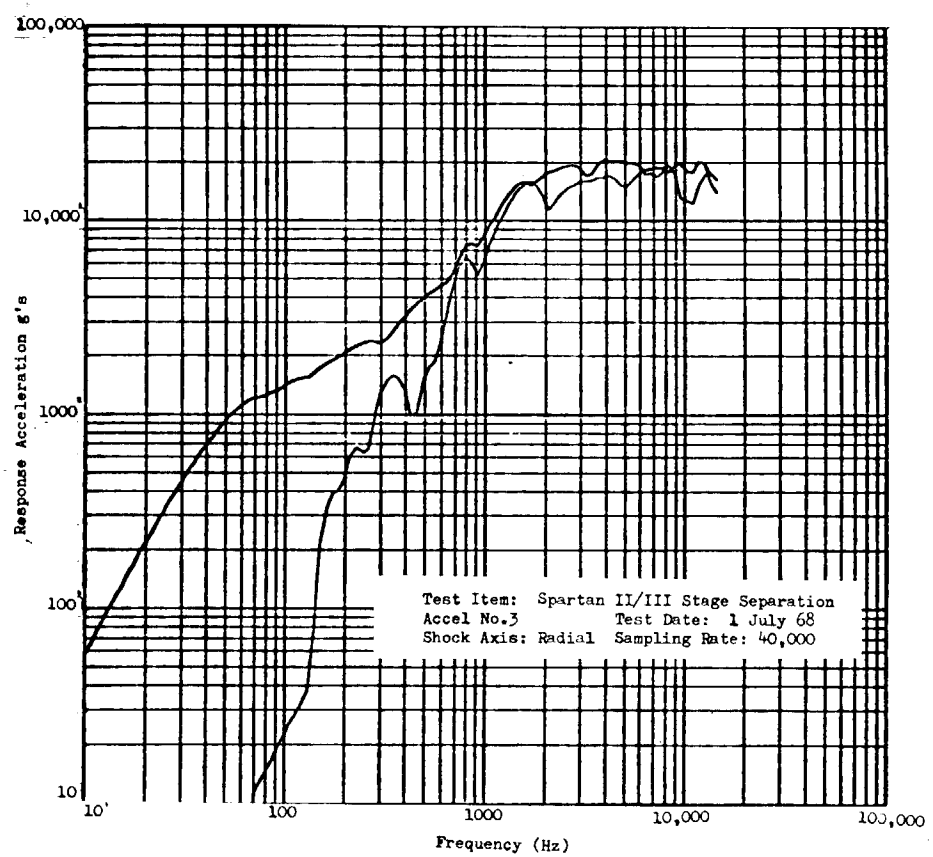


TELEMETRY RACK
STA. 145 VIEW LOOKING FORWARD



TELEMETRY RACK
STA. 145 VIEW LOOKING AFT

Figure I.A.3-6. Accelerometer Locations


100,000
10,000
1000
100
10
Response Acceleration g's
10
100
1000
10,000
100,000
Frequency (Hz)
Test Item: Spartan II/III Stage Separation
Accel No.3
Test Date: 1 July 68
Shock Axis: Radial
Sampling Rate: 40,000

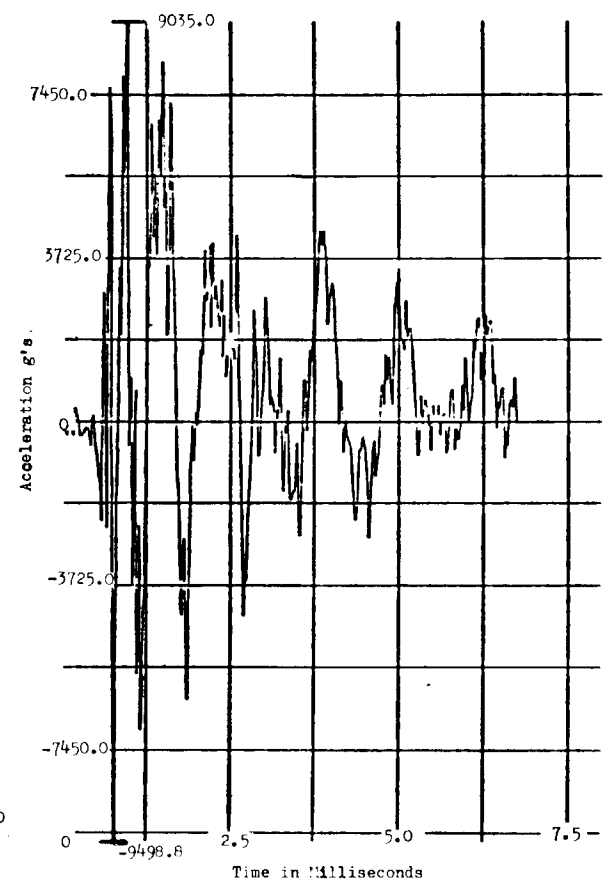
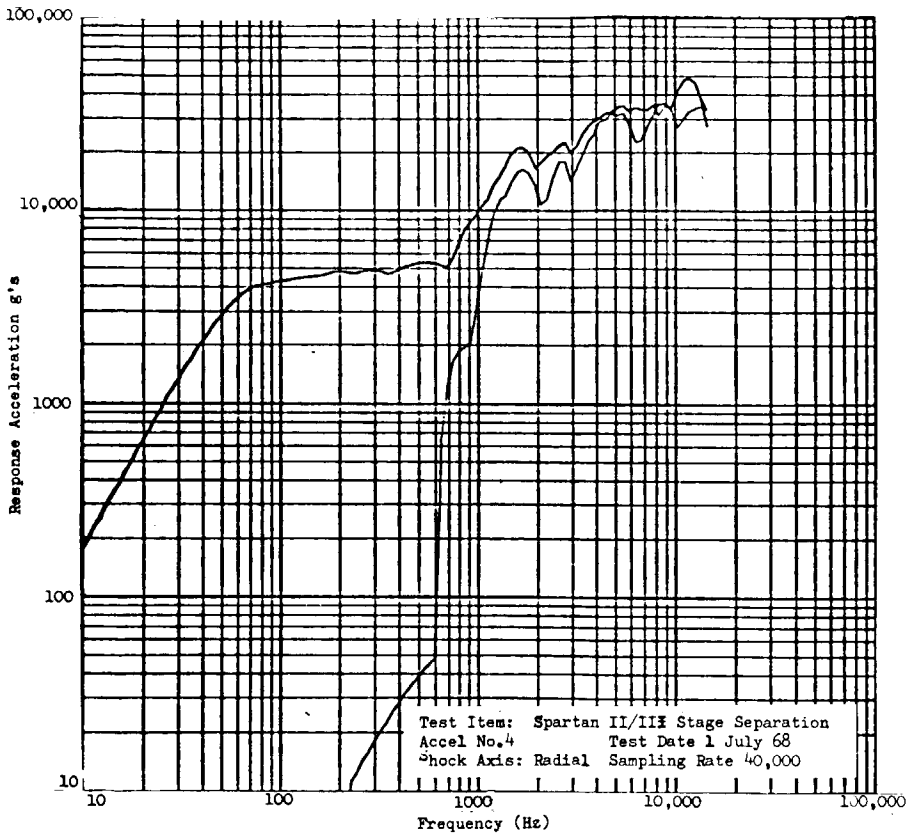

9035.0
7450.0
3725.0
0.0
-3725.0
-7450.0
Acceleration g's
0
-9498.8
2.5
5.0
7.5
Time in Milliseconds

FIGURE I.A.3-7


100,000
10,000
1000
100
10
Response Acceleration g's
10
100
1000
10,000
100,000
Frequency (Hz)
Test Item: Spartan II/III Stage Separation
Accel No.4 Test Date 1 July 68
Shock Axis: Radial Sampling Rate 40,000

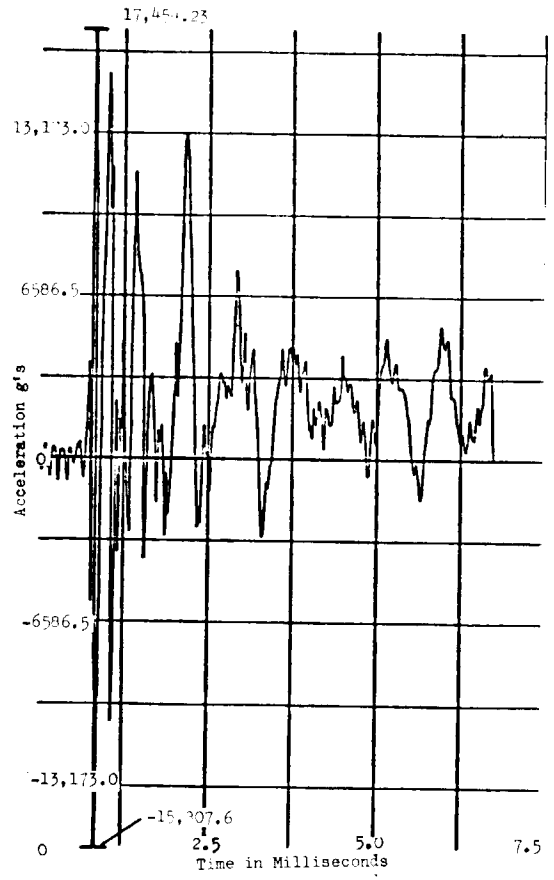
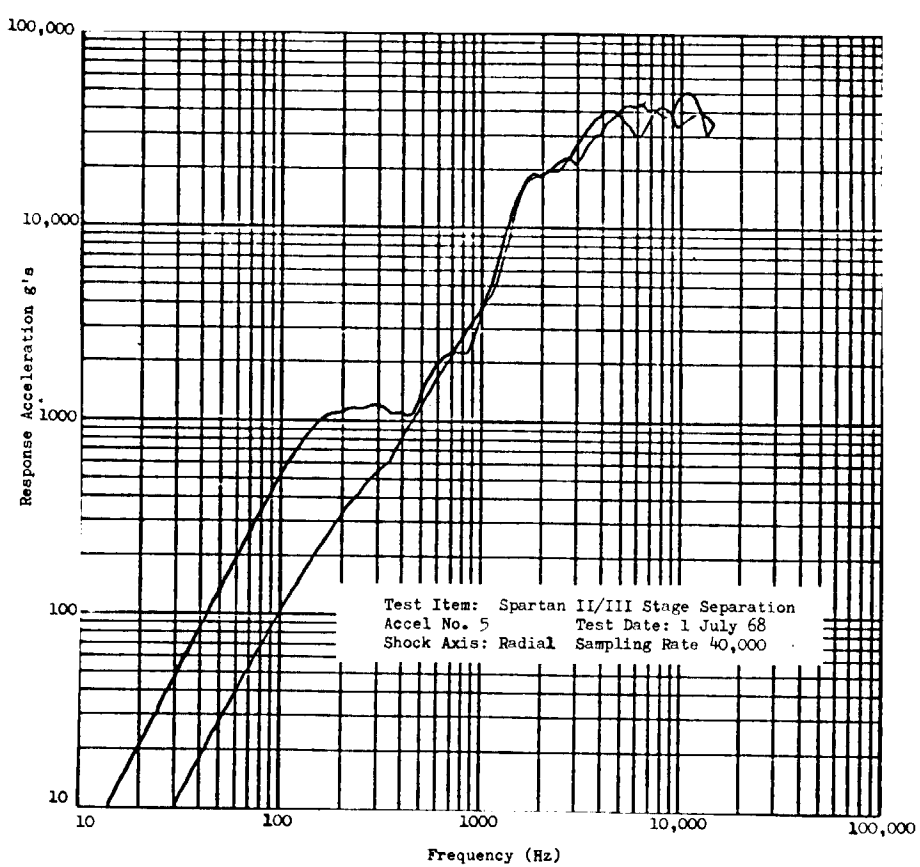

17,454.23
13,173.0
6586.5
0
-6586.5
-13,173.0
-15,307.6
Acceleration g's
0
2.5
5.0
7.5
Time in Milliseconds

FIGURE I.A.3-8


100,000
10,000
1000
100
10
Response Acceleration g's
10
100
1000
10,000
100,000
Frequency (Hz)
Test Item: Spartan II/III Stage Separation
Accel No. 5
Test Date: 1 July 68
Shock Axis: Radial
Sampling Rate 40,000

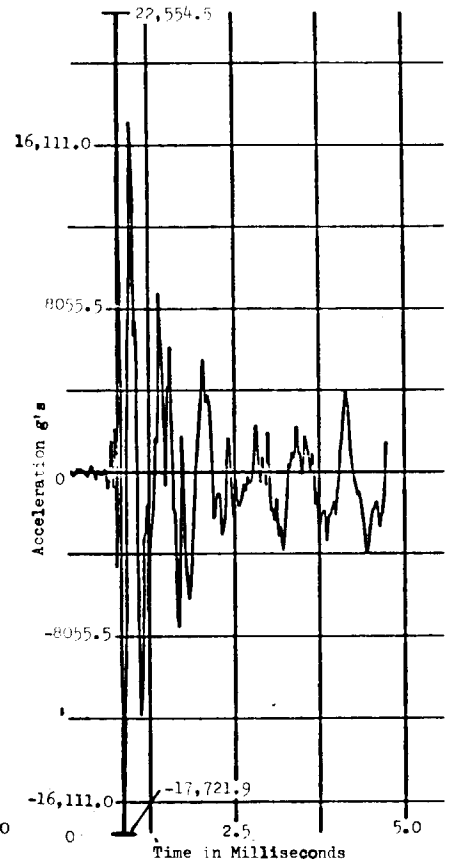
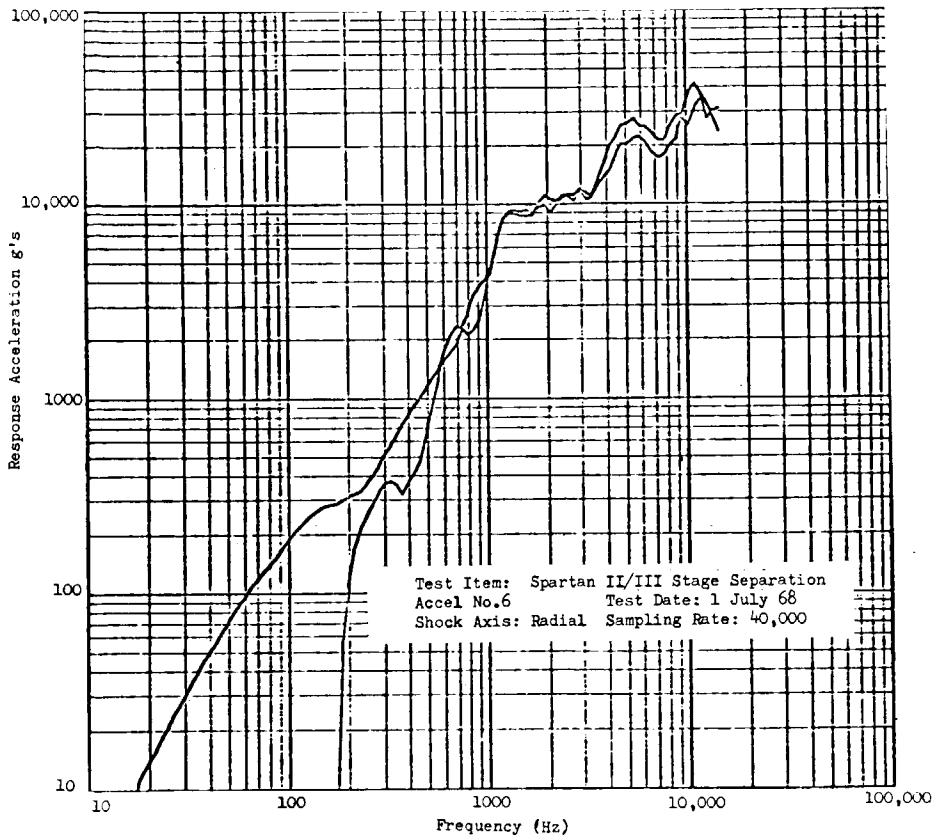

22,554.5
16,111.0
8055.5
0
-8055.5
-16,111.0
-17,721.9
Acceleration g's
0
2.5
5.0
Time in Milliseconds

FIGURE I.A.3-9



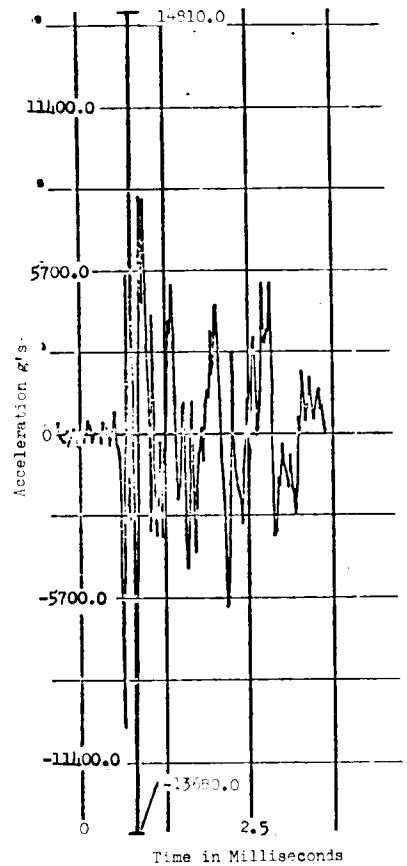


FIGURE I.A.3-10

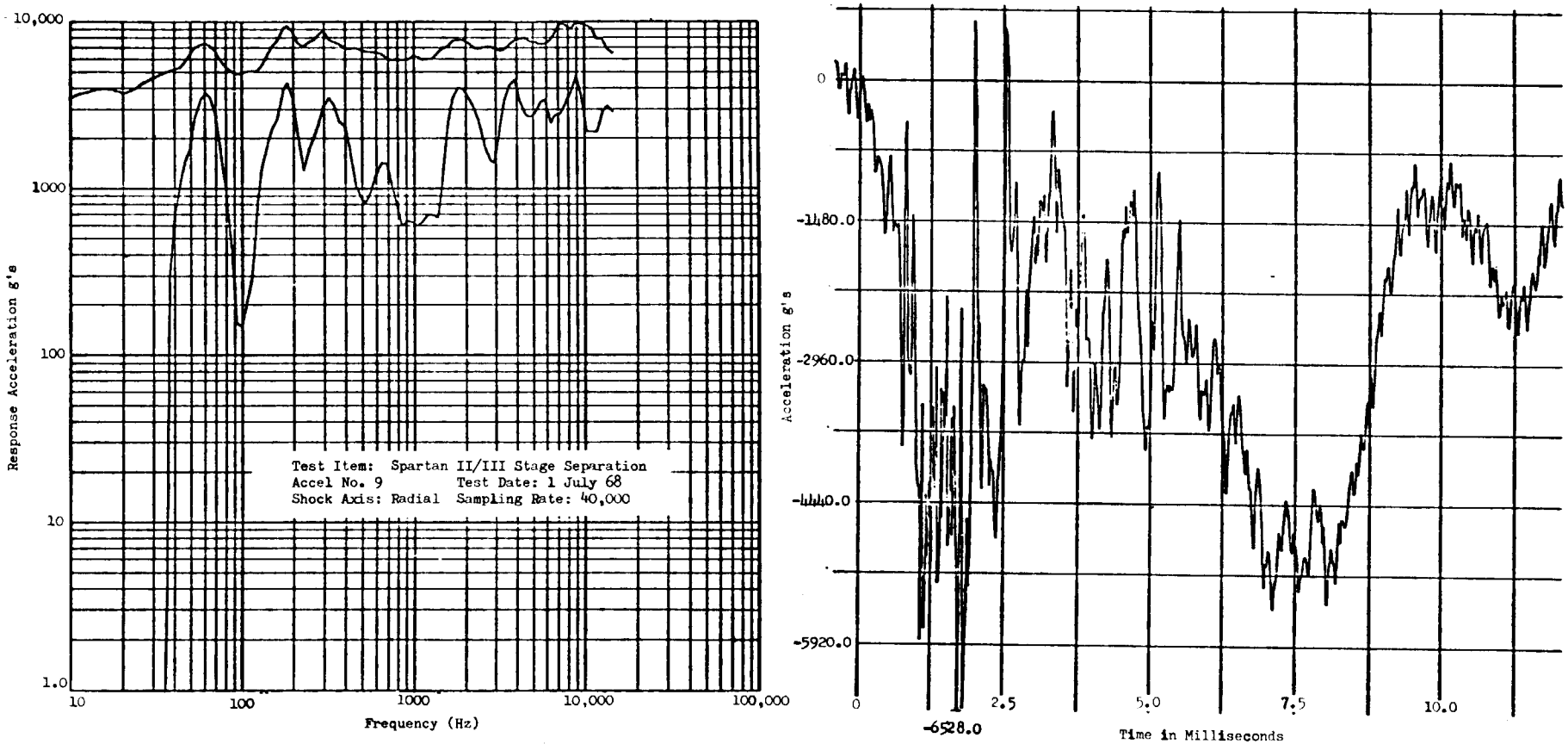
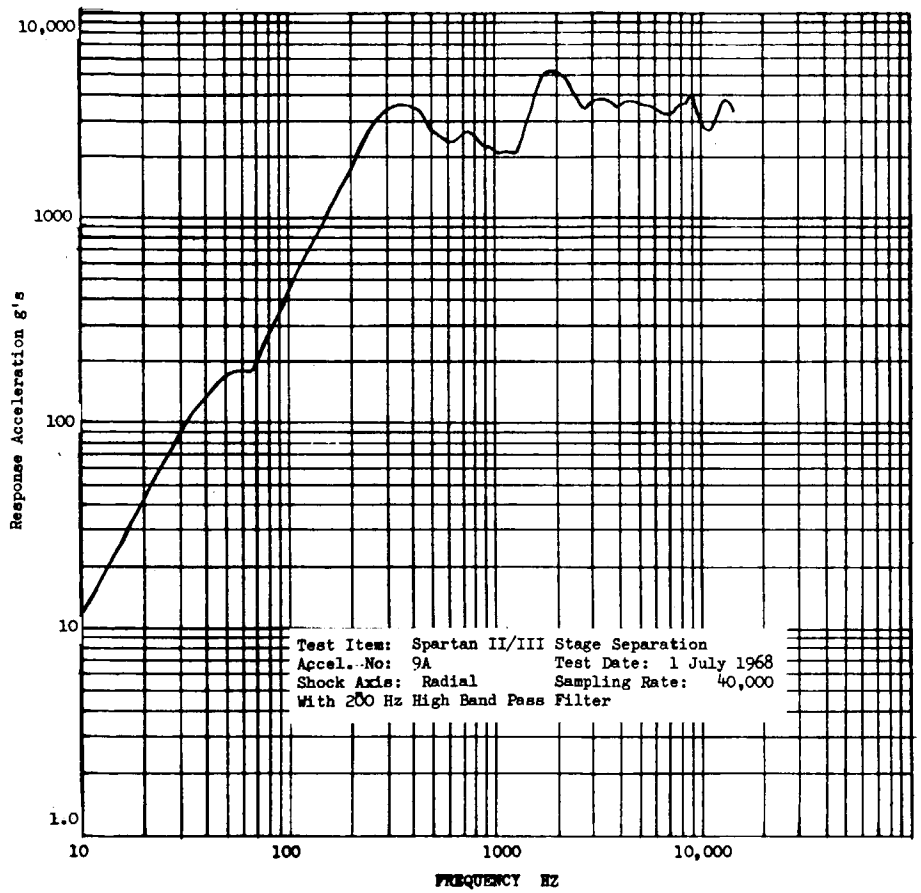


FIGURE 1.A.3-11



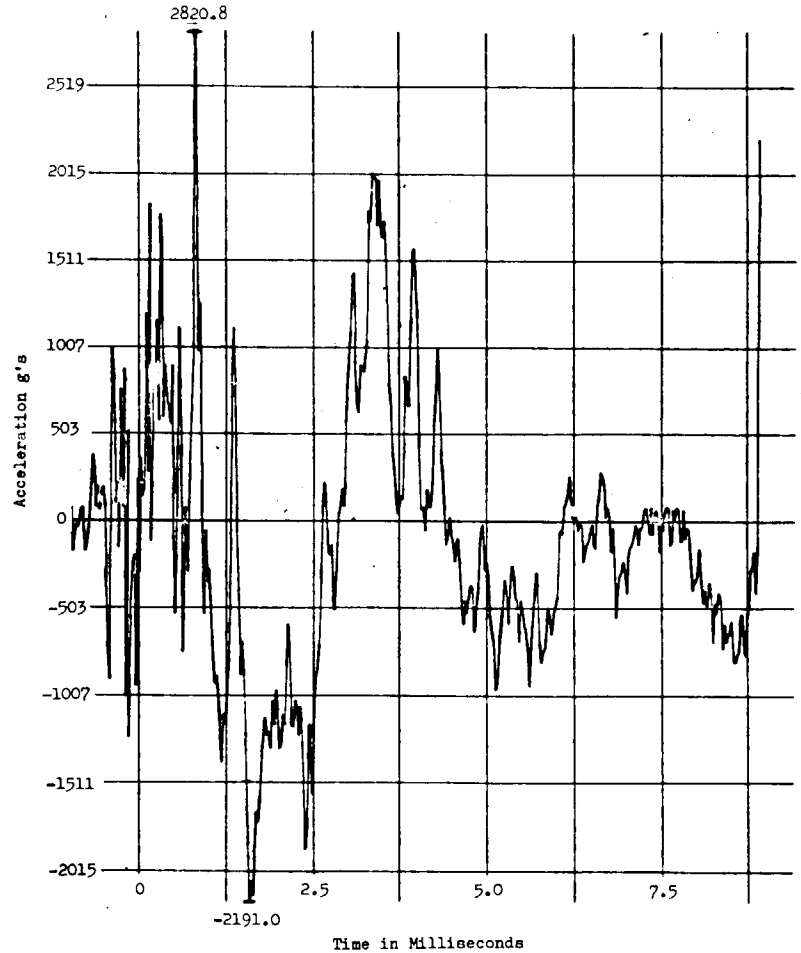
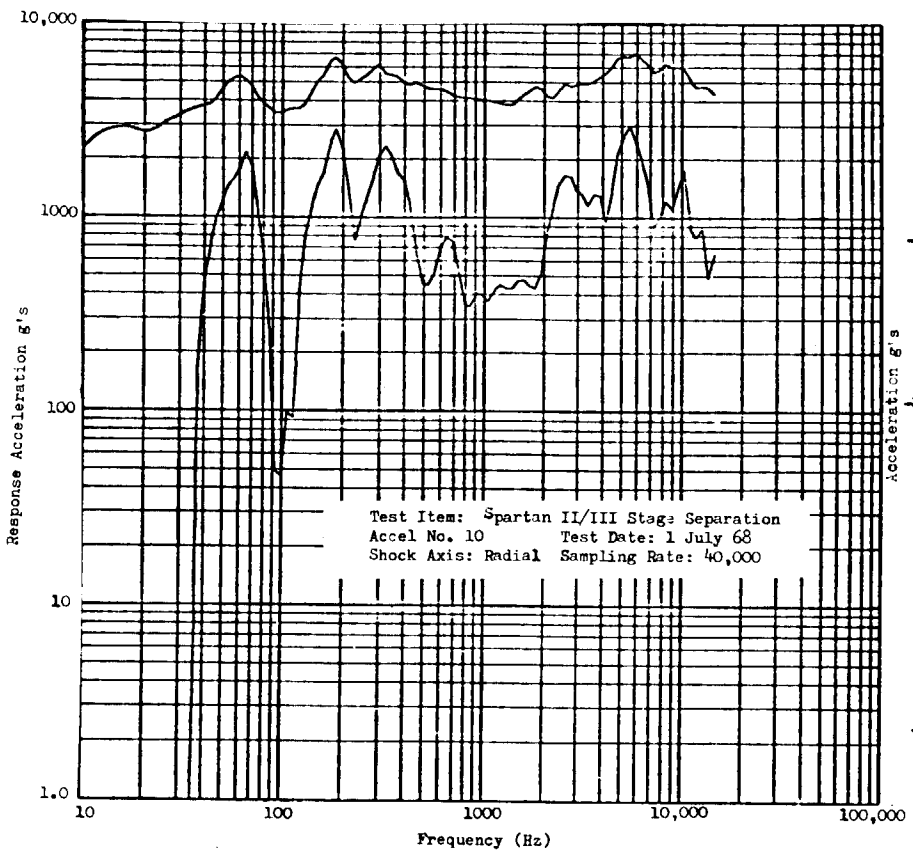


FIGURE 1.A.3-12



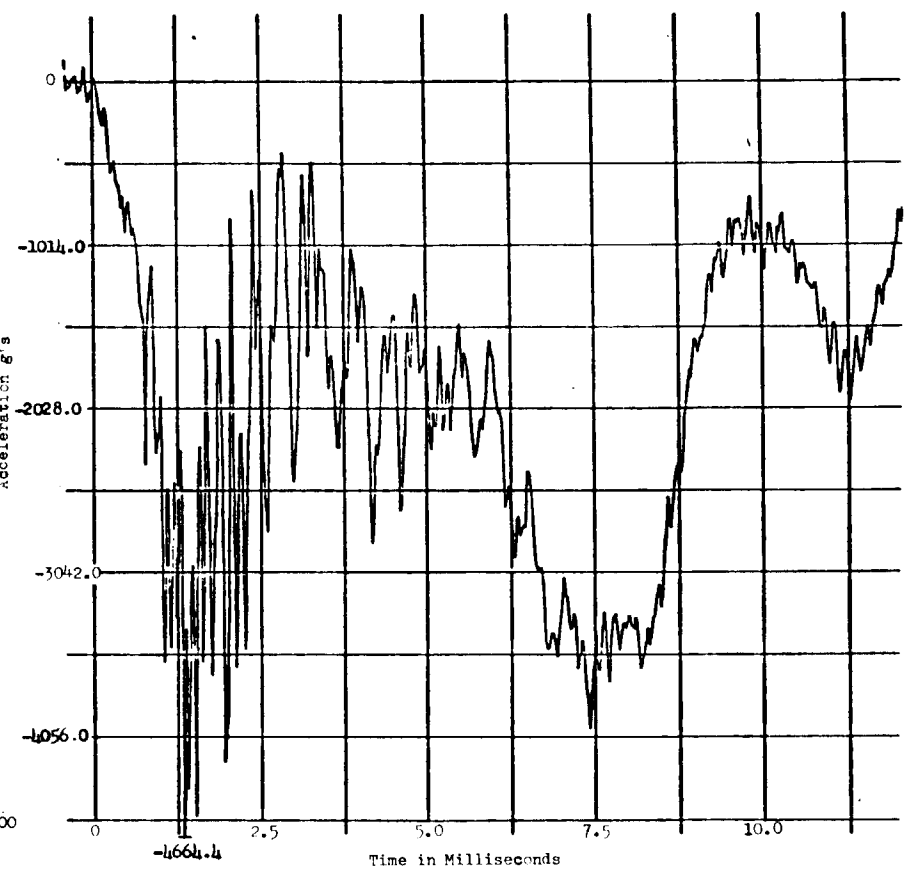
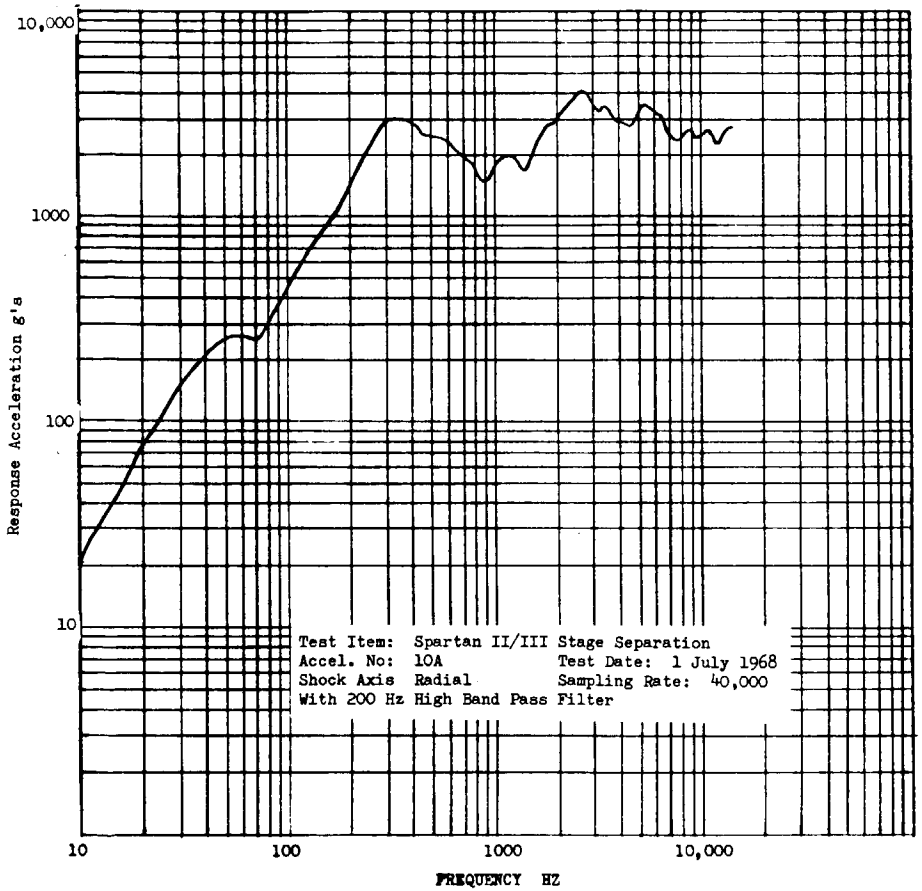


FIGURE I.A.3-13



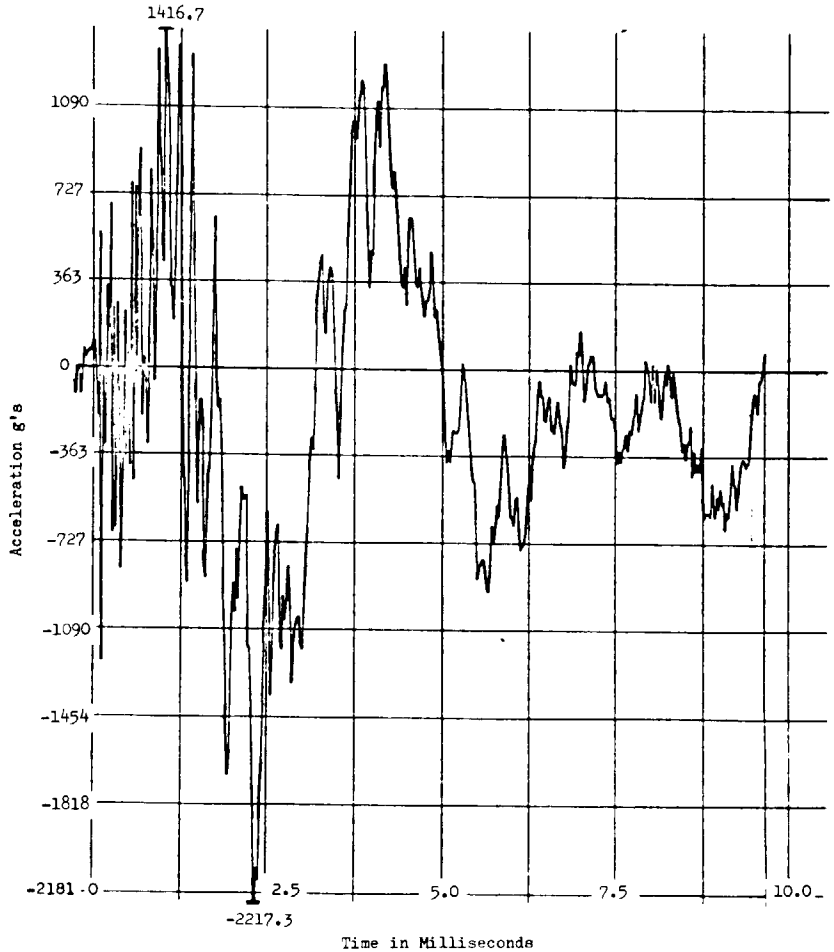


FIGURE 1.A.3-14

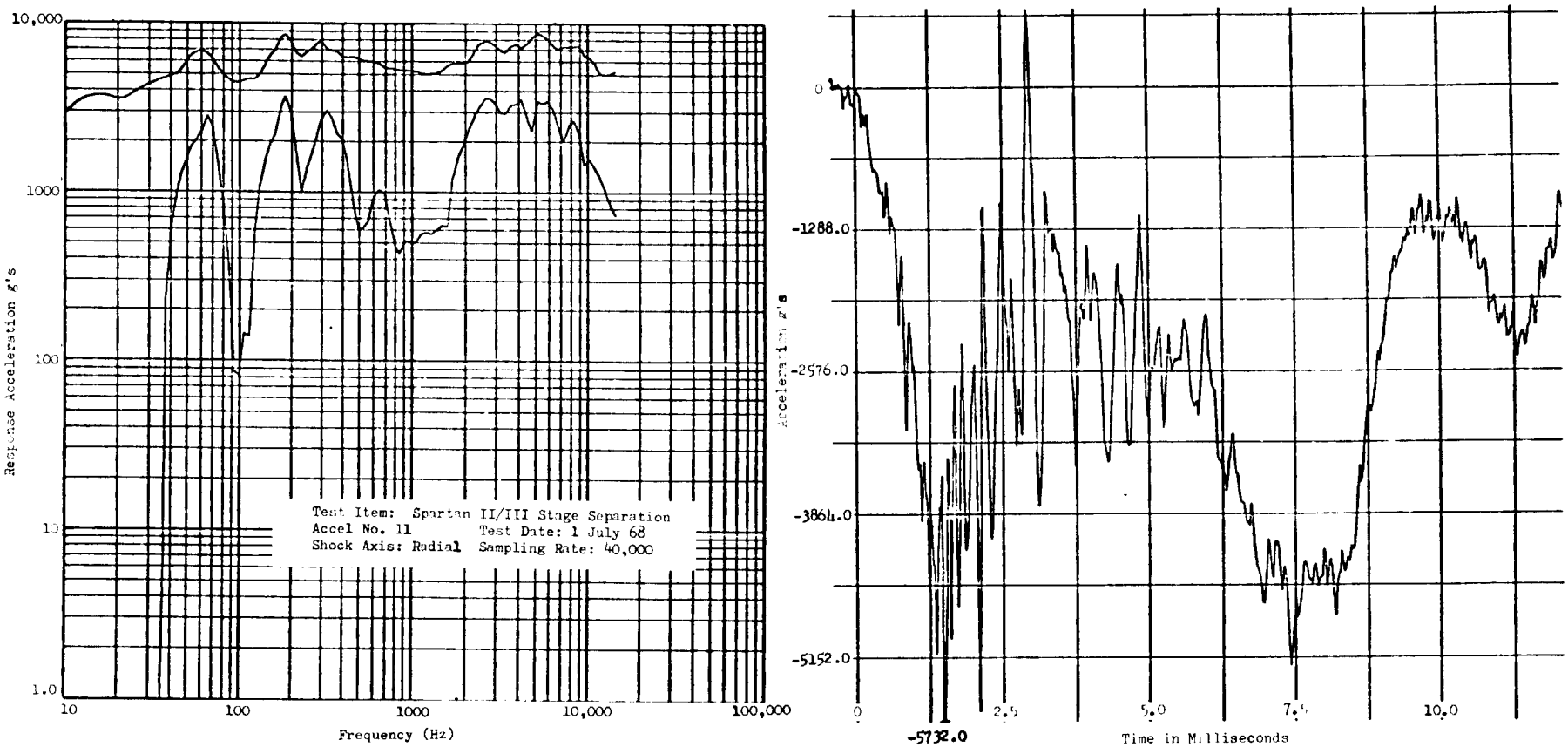
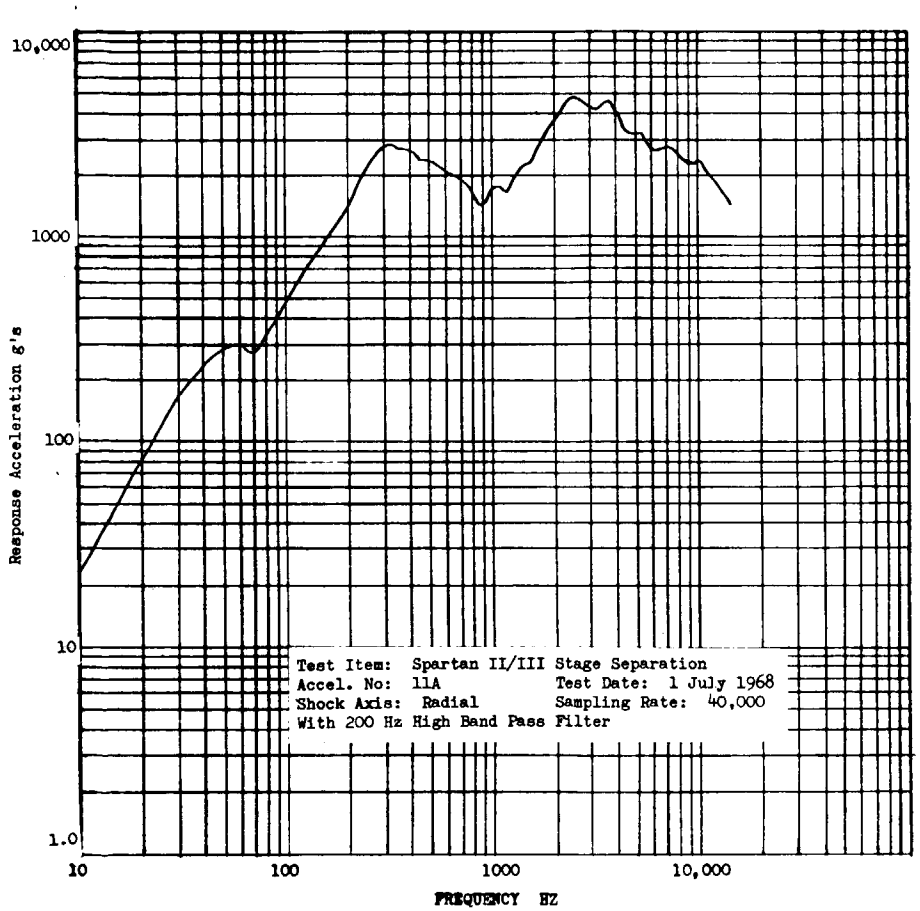


FIGURE I.A.3-15



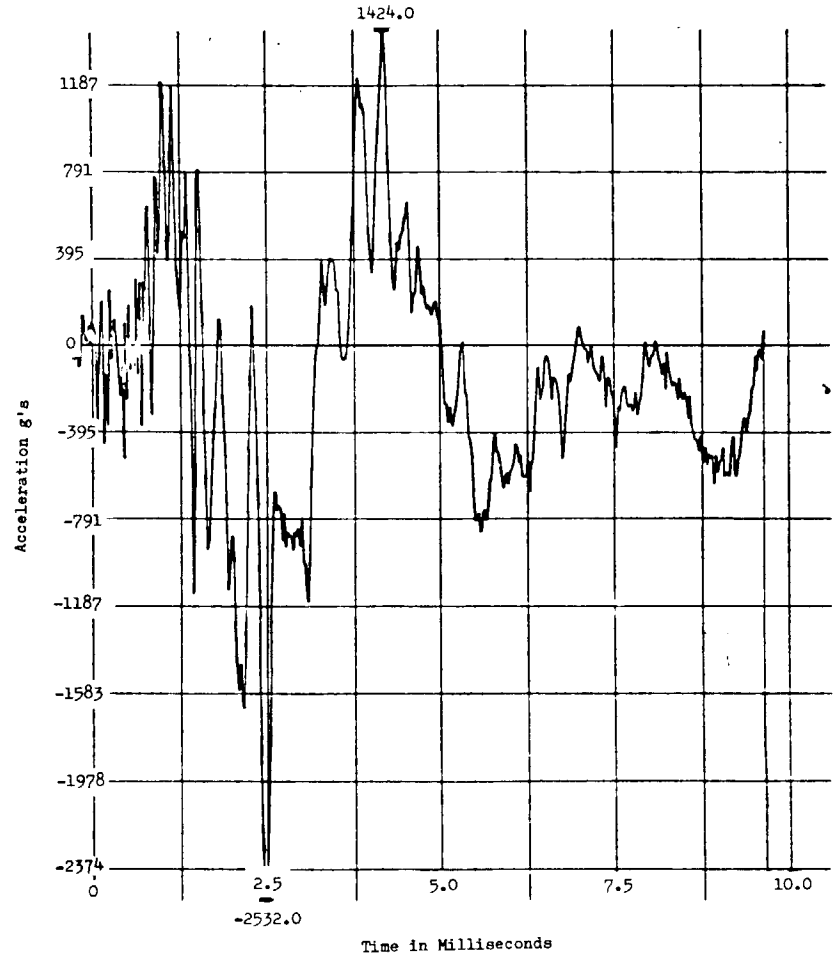
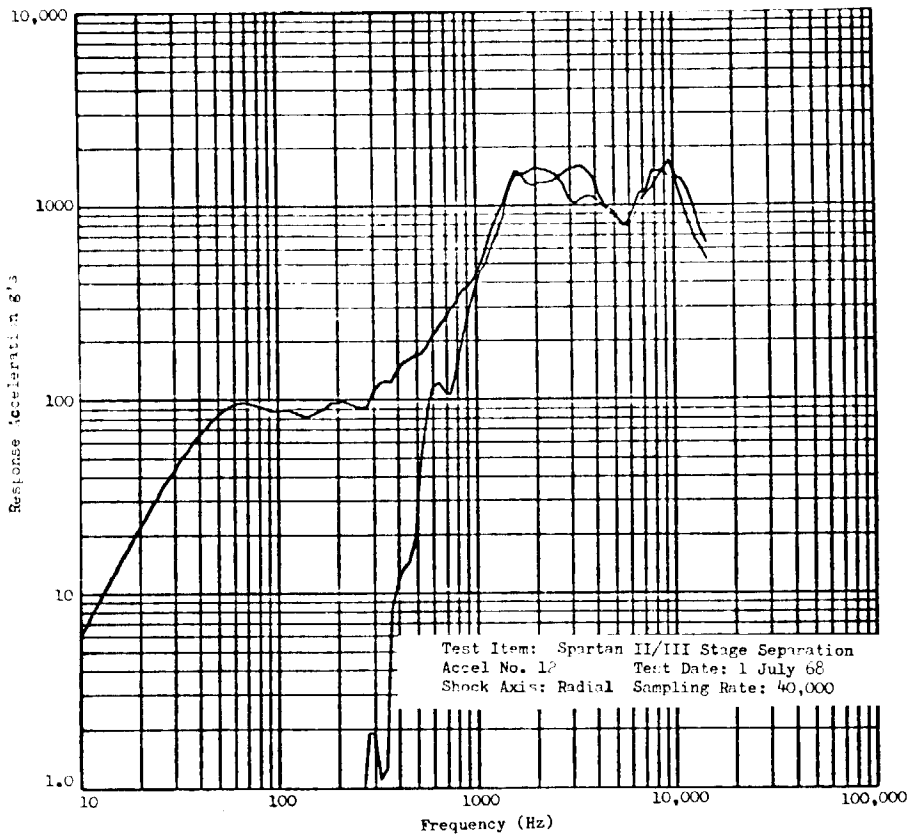


FIGURE I.A.3-16



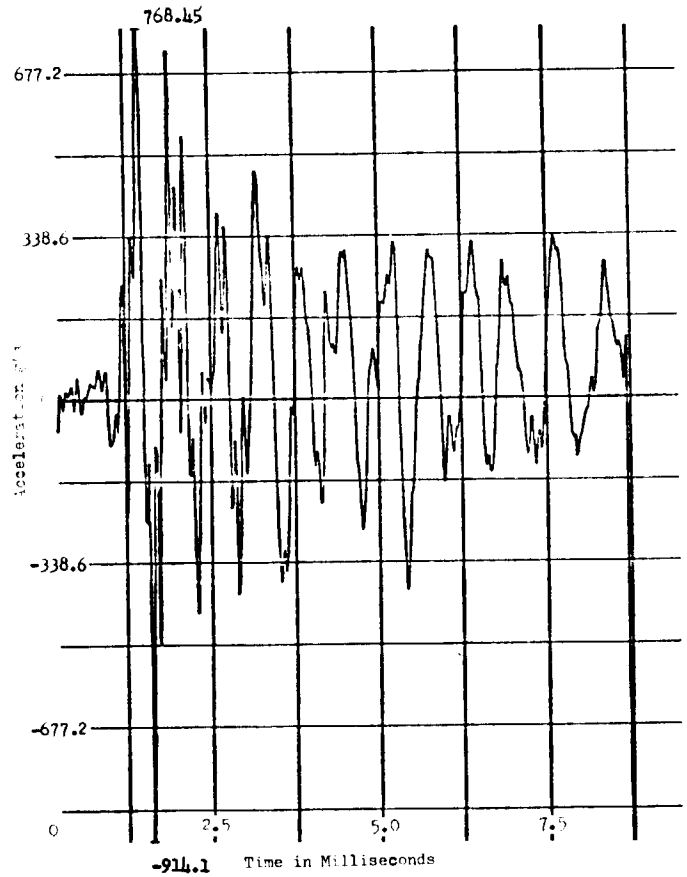
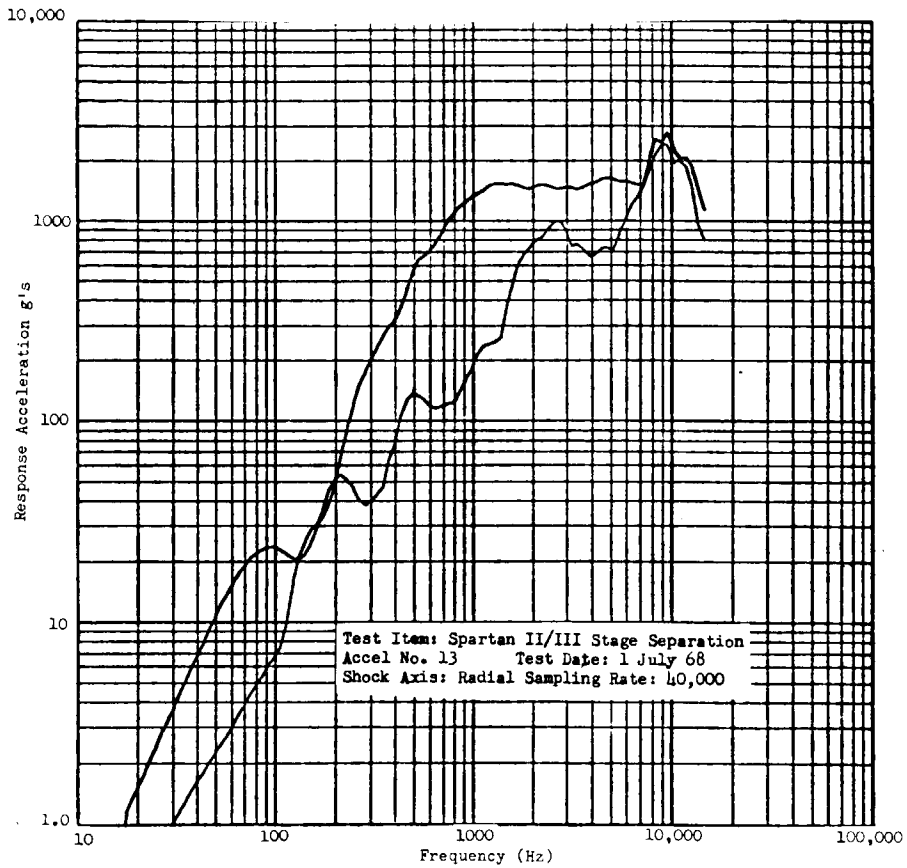


FIGURE 1.A.3-17



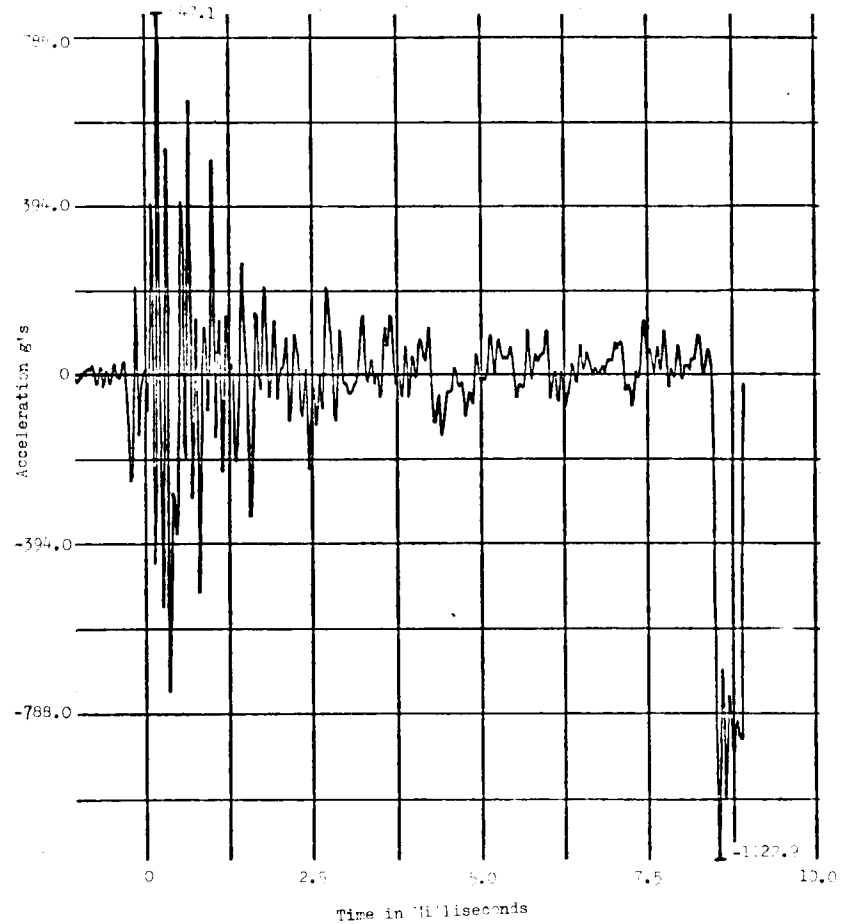
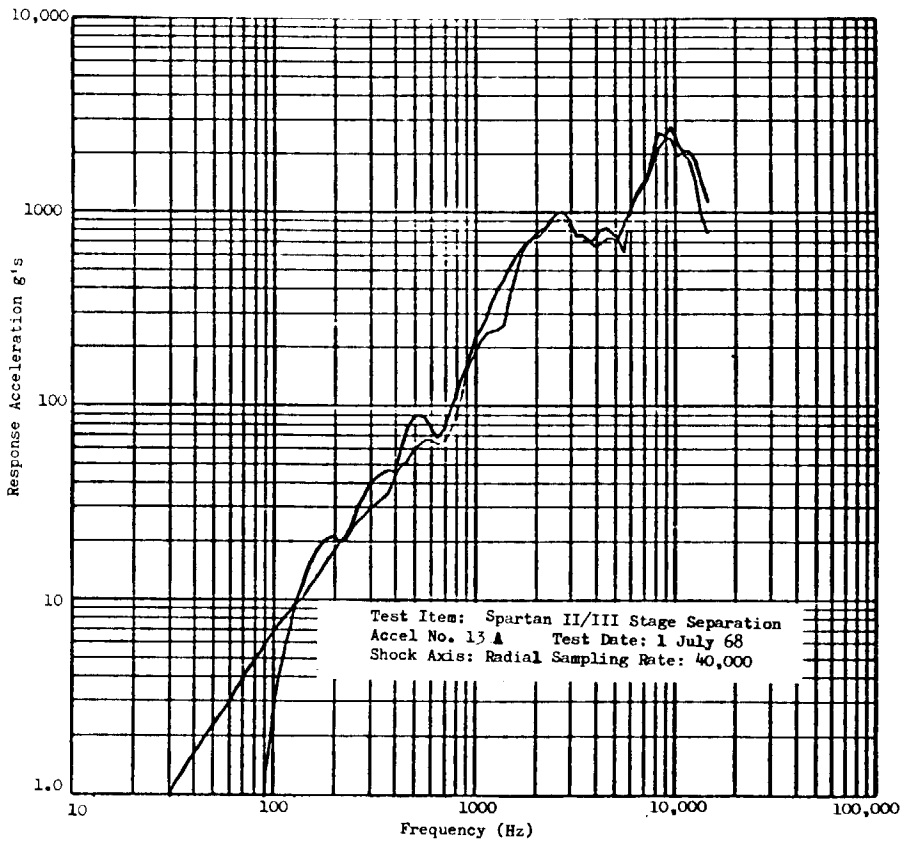


FIGURE I.A.3-18



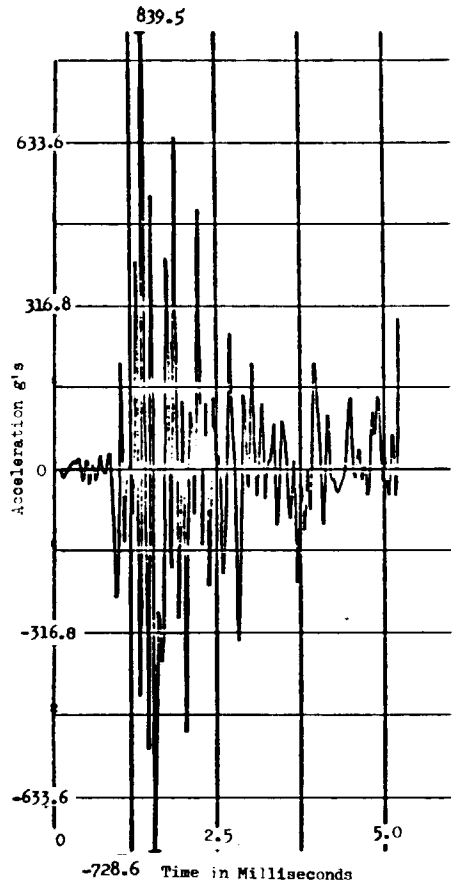
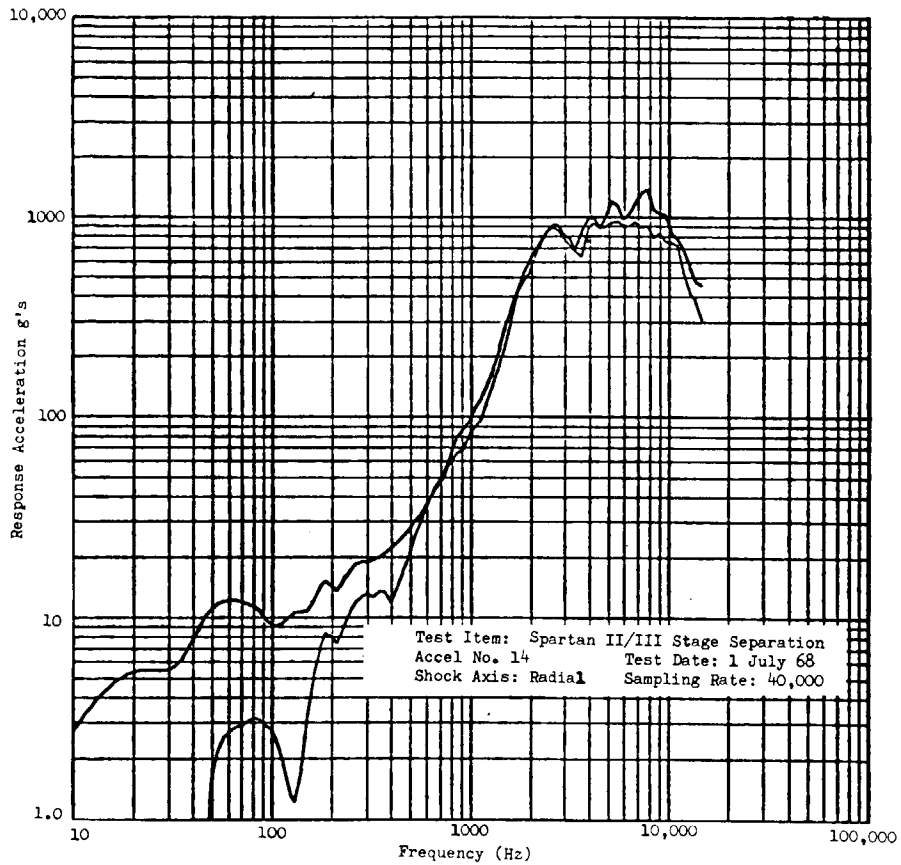


FIGURE I.A.3-19



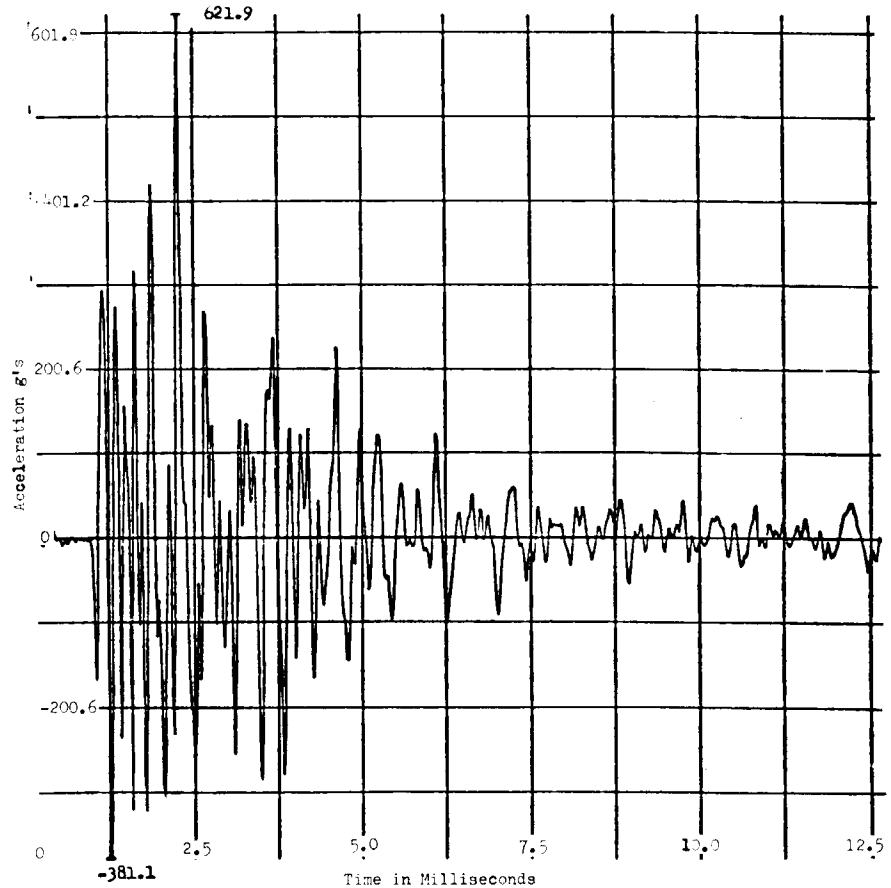


FIGURE I.A.3-20

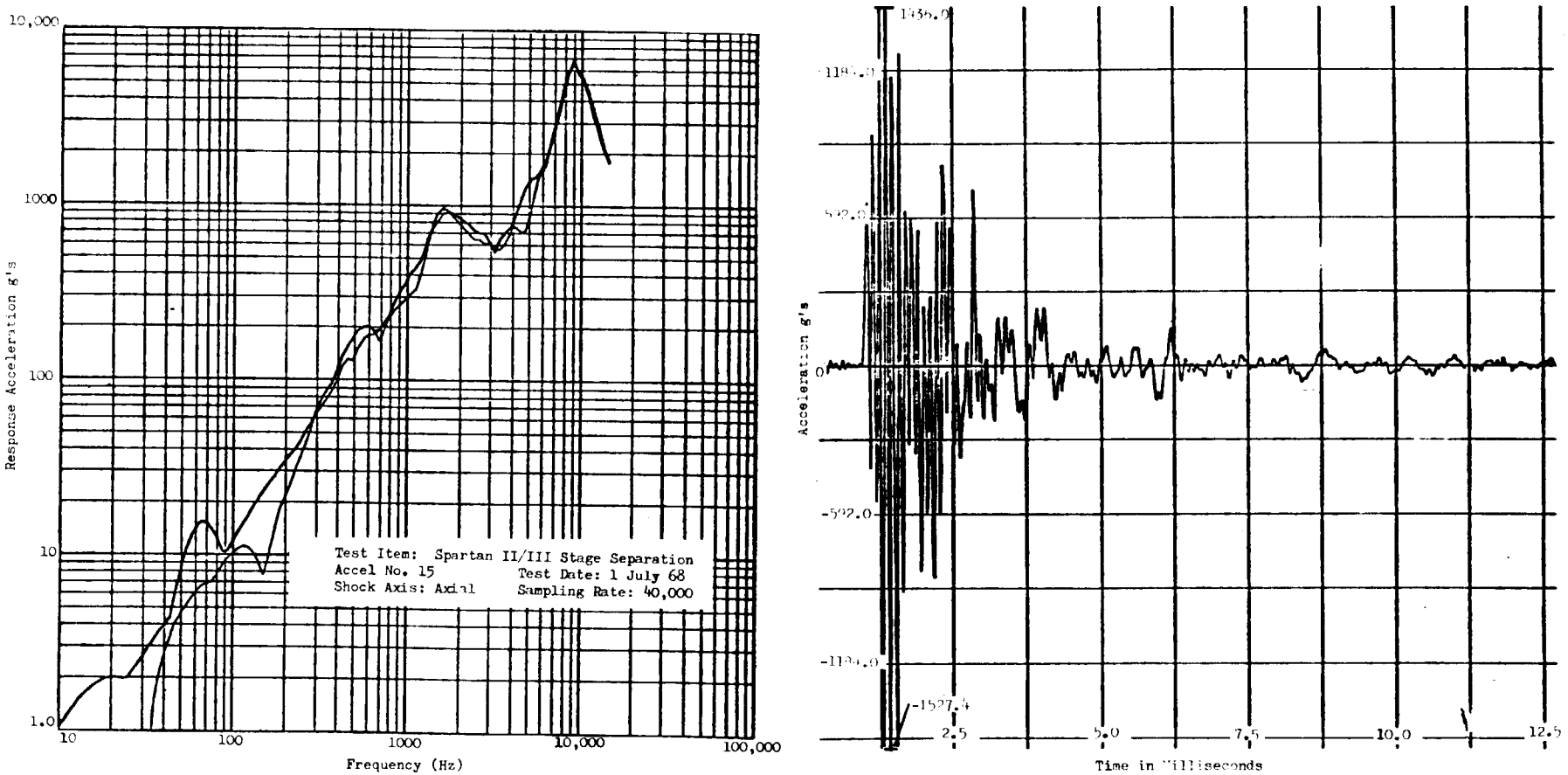
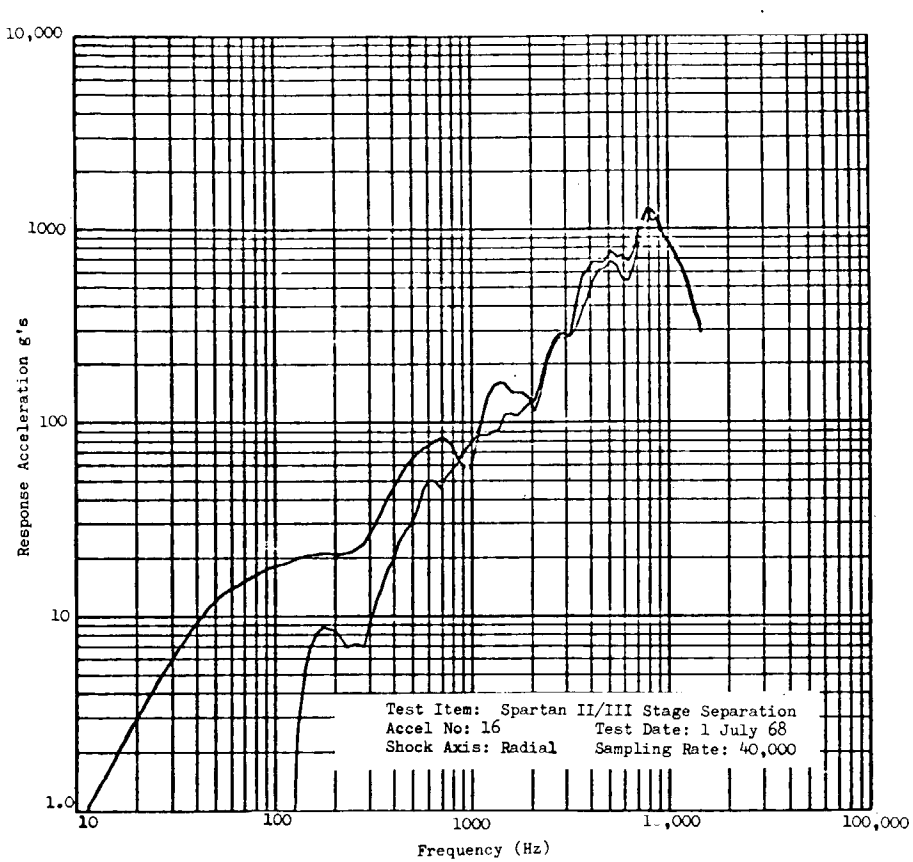


FIGURE I.A.3-21



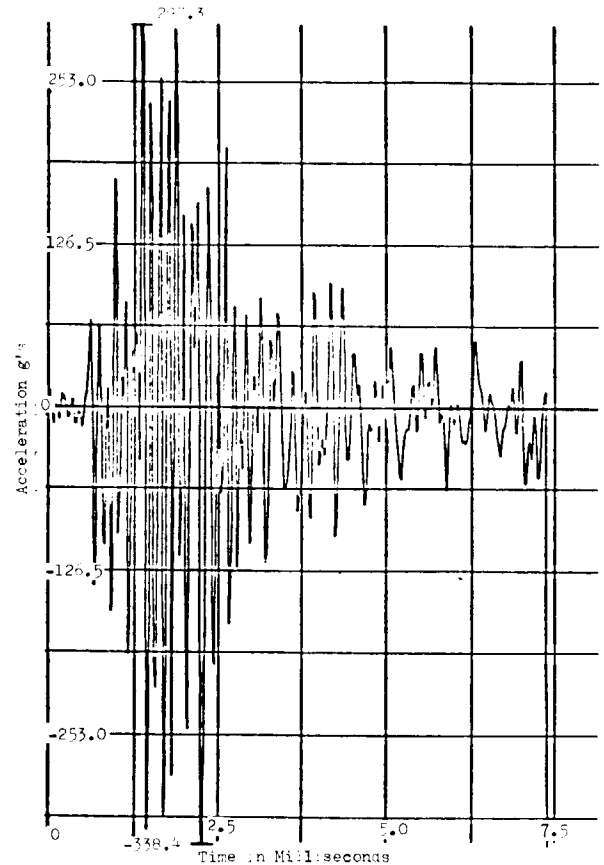
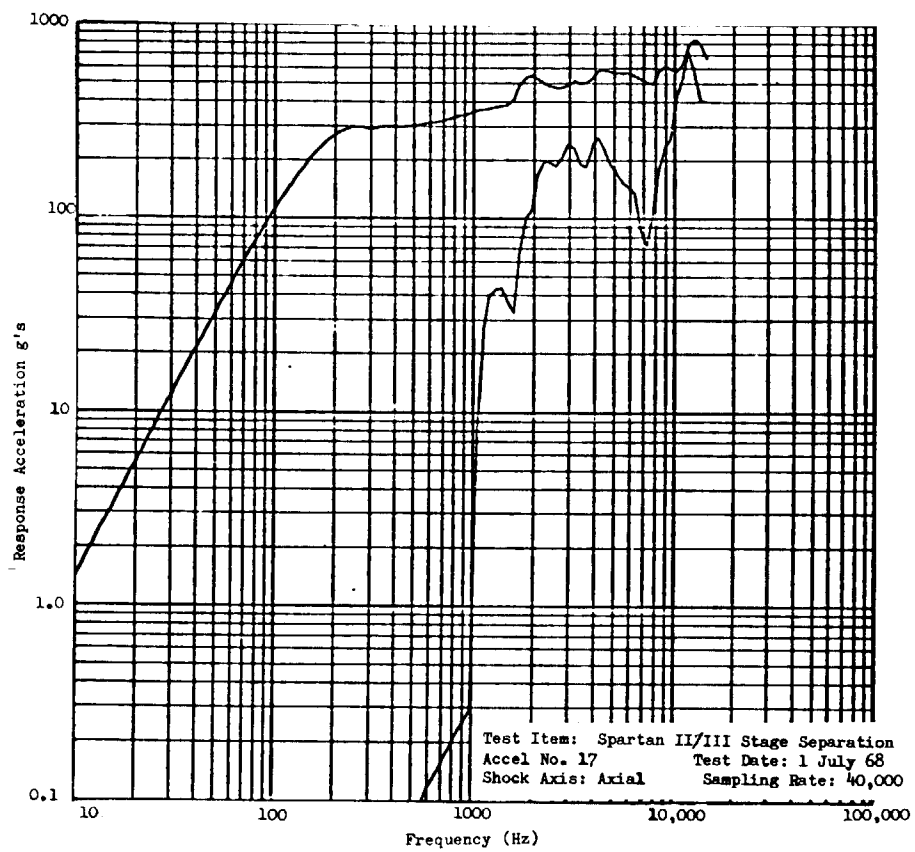


FIGURE I.A.3-22



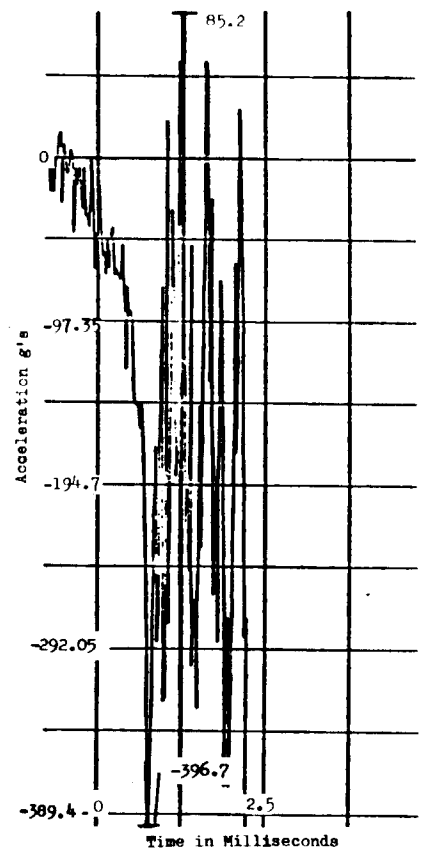
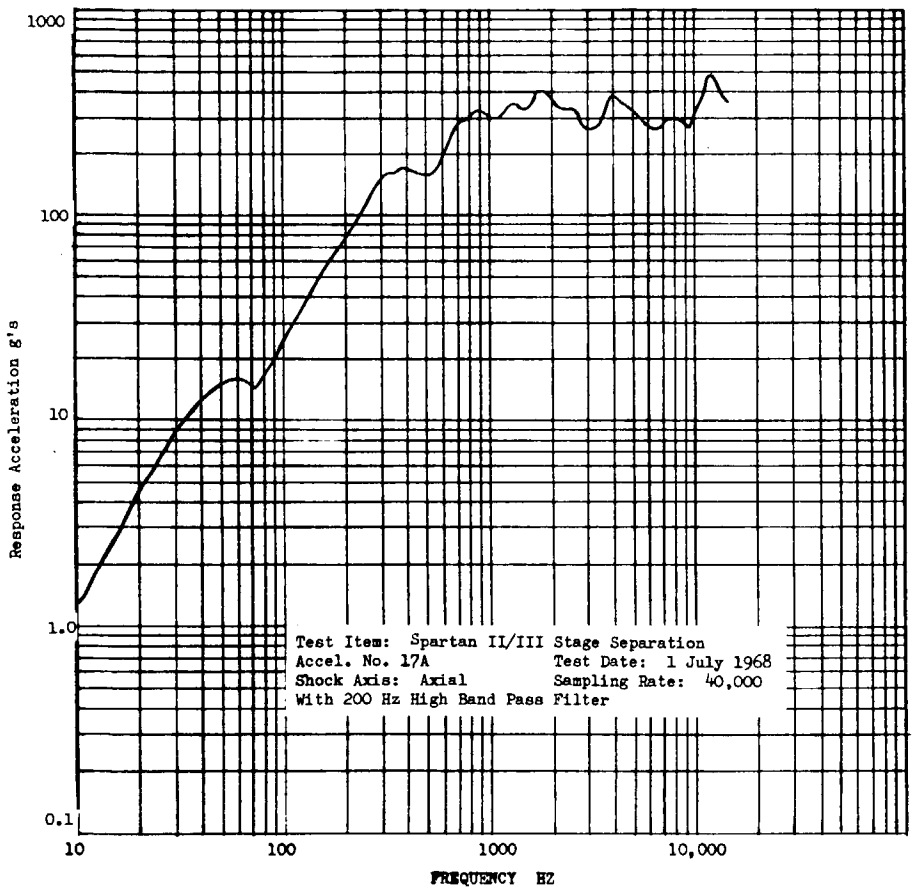


FIGURE I.A.3-23



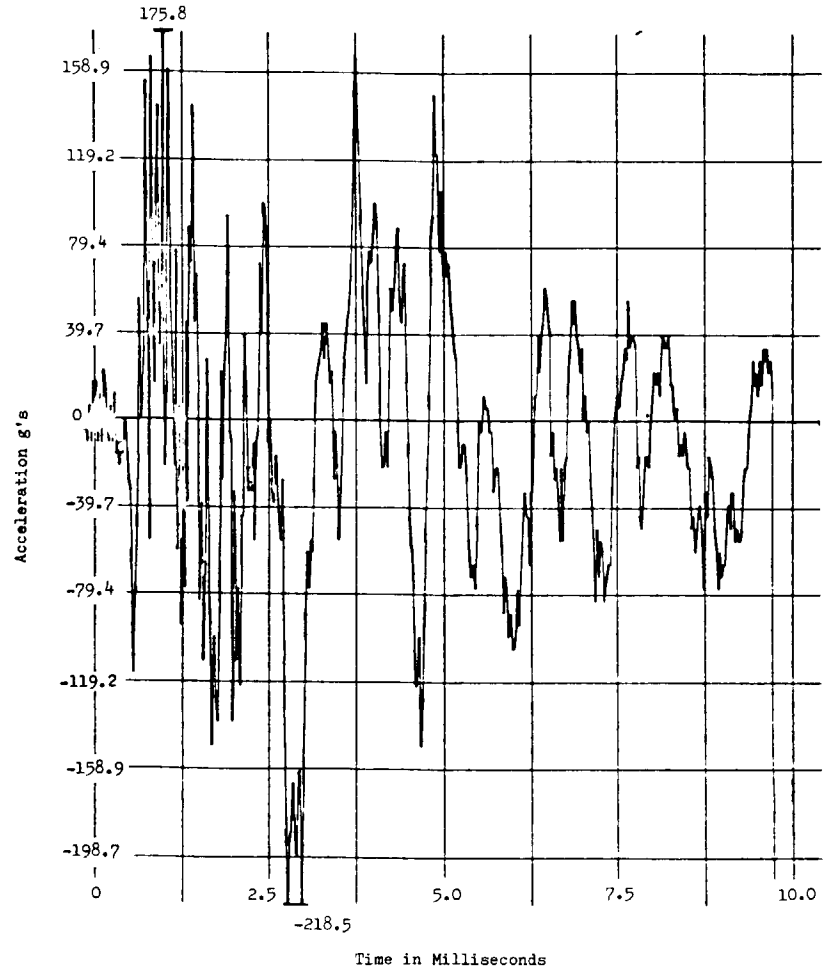
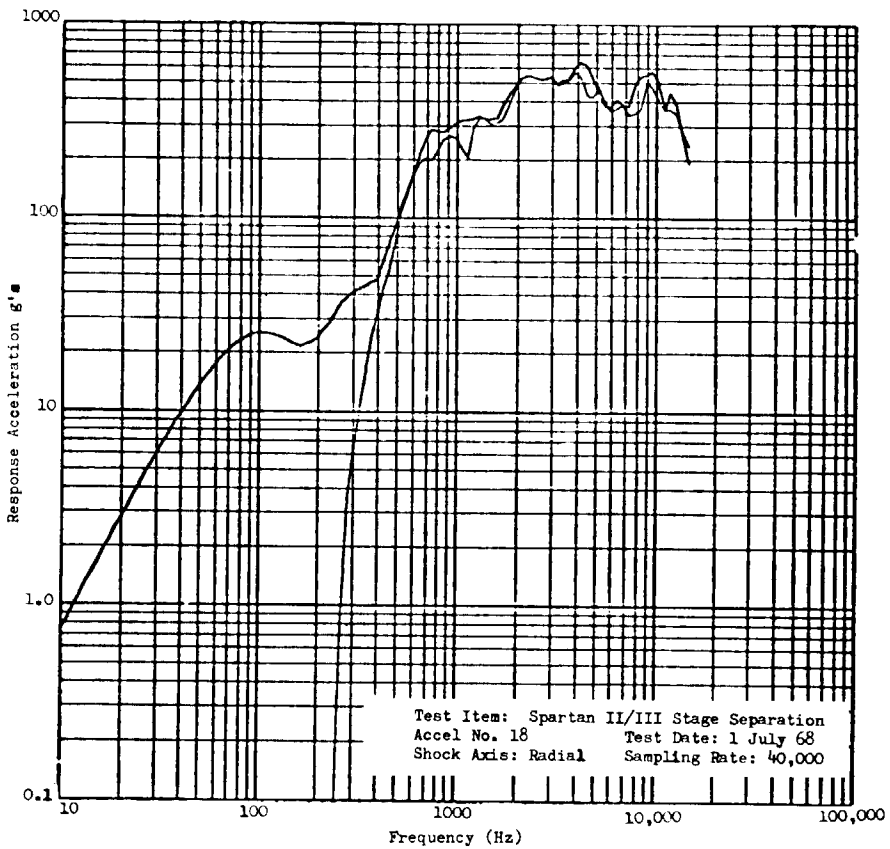


FIGURE I.A.3-24



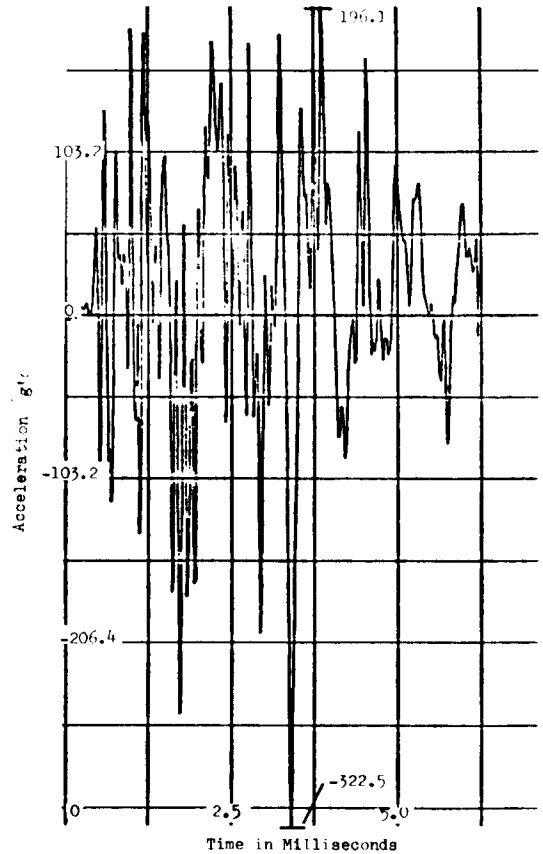
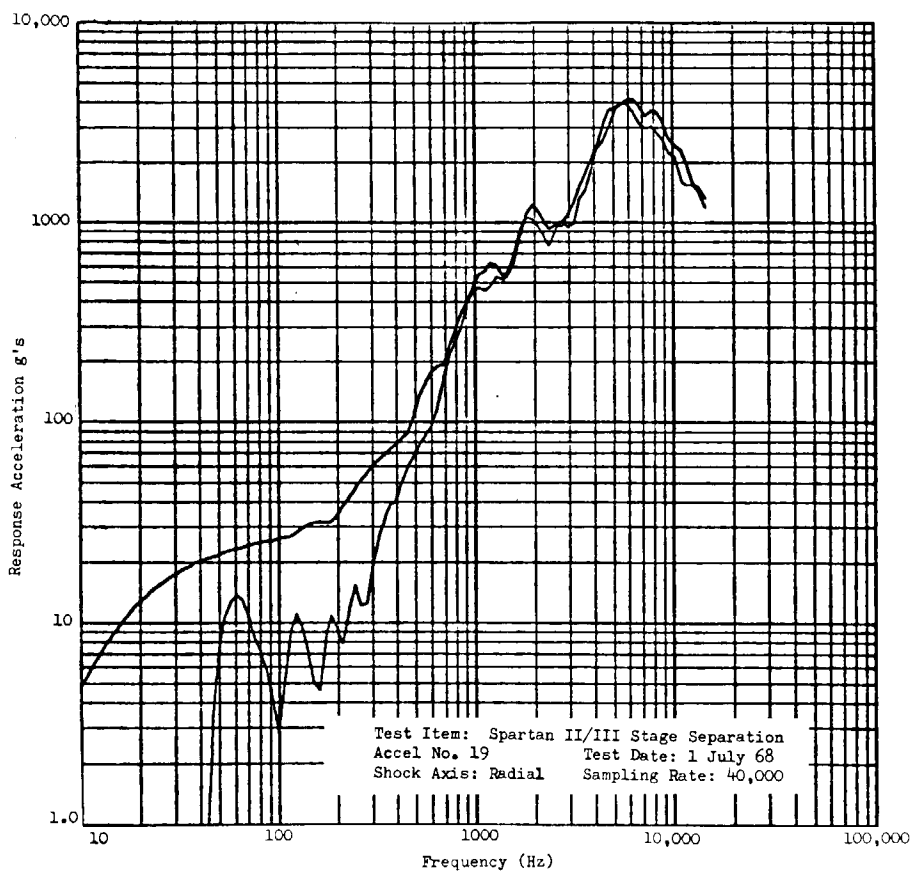


FIGURE I.A.3-25



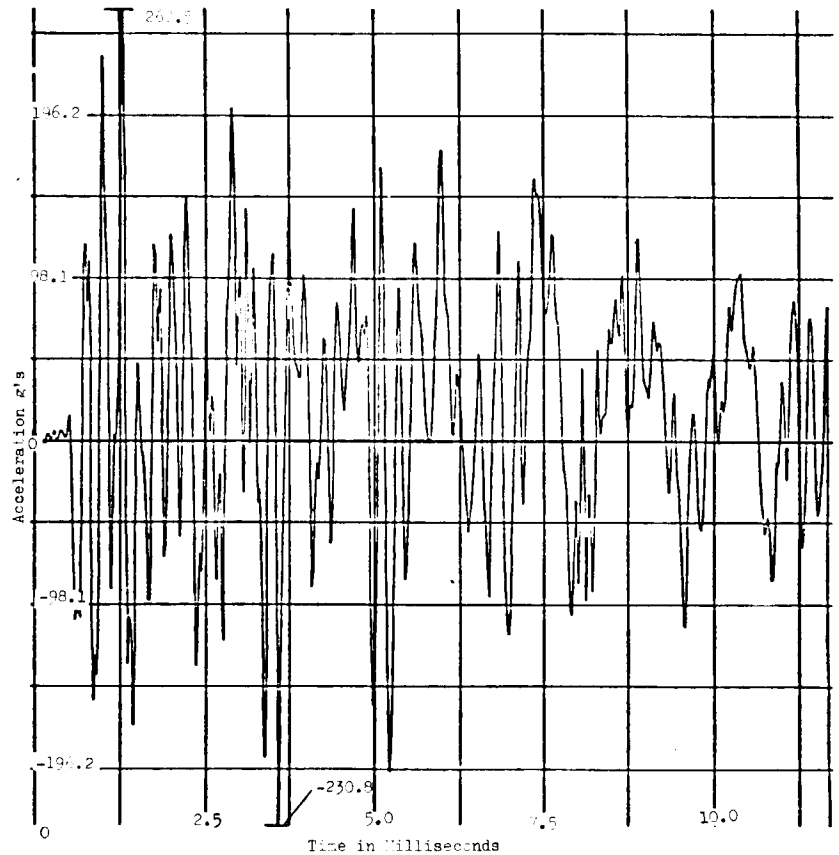


FIGURE I.A.3-26

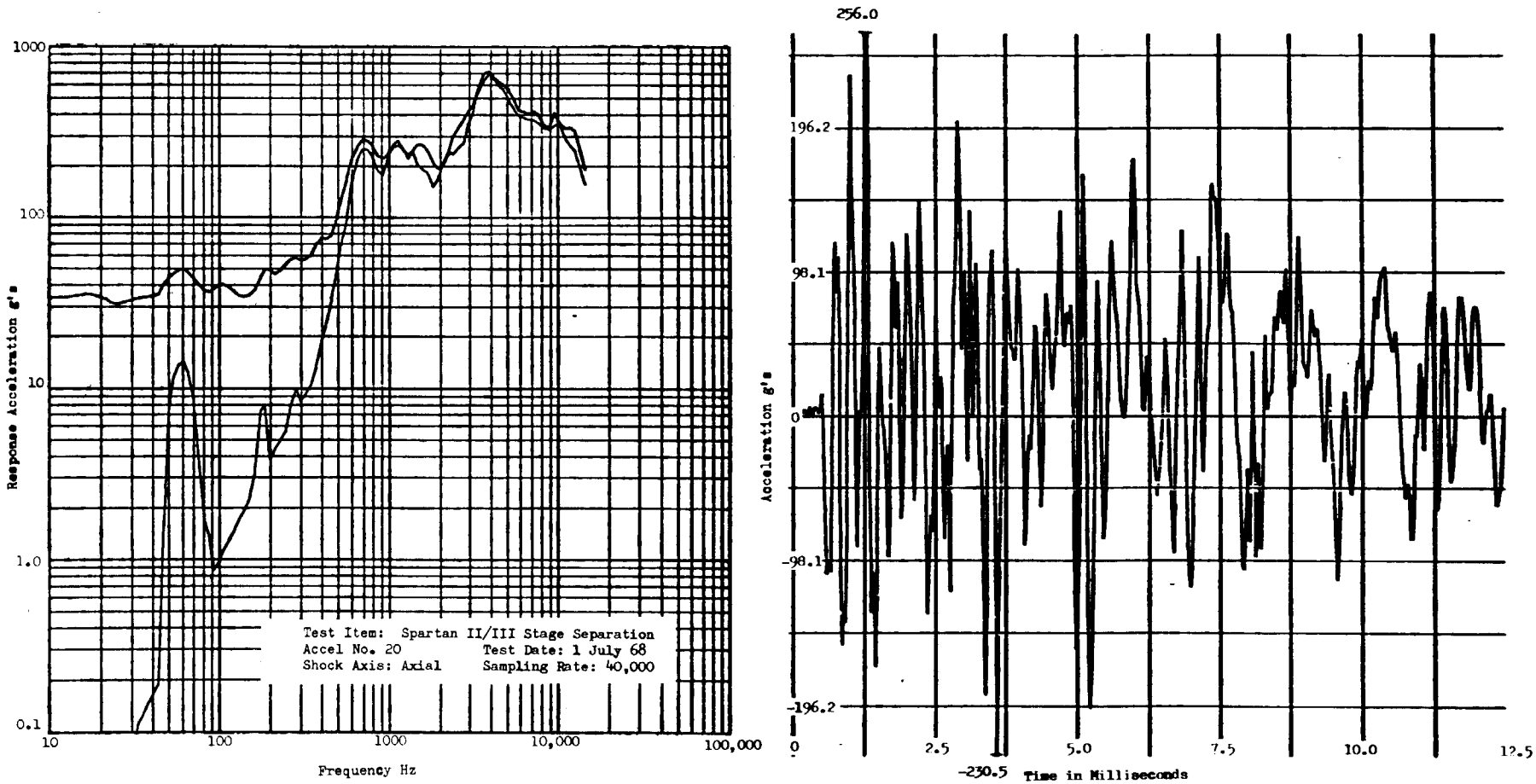


FIGURE I.A.3-27

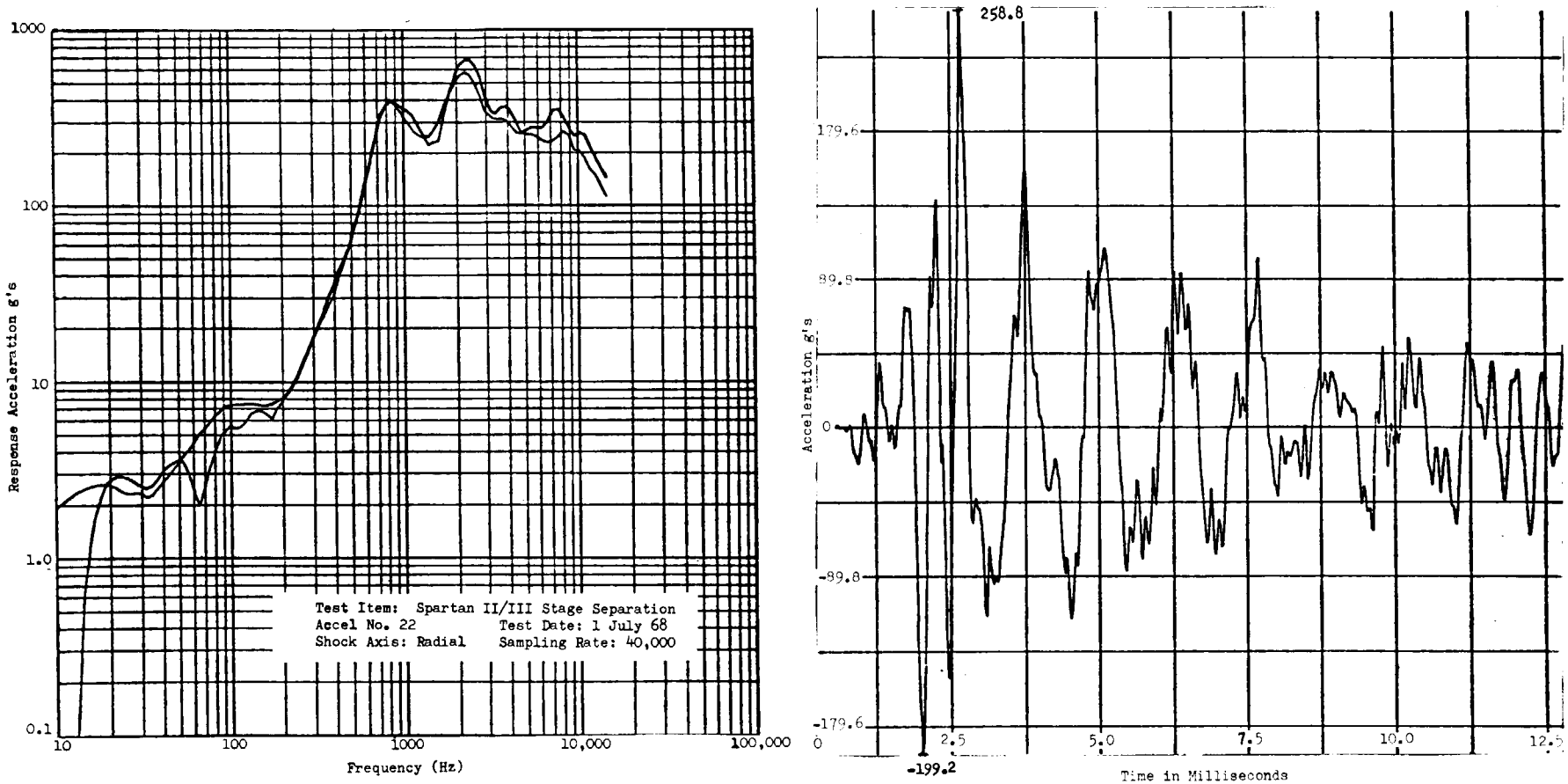
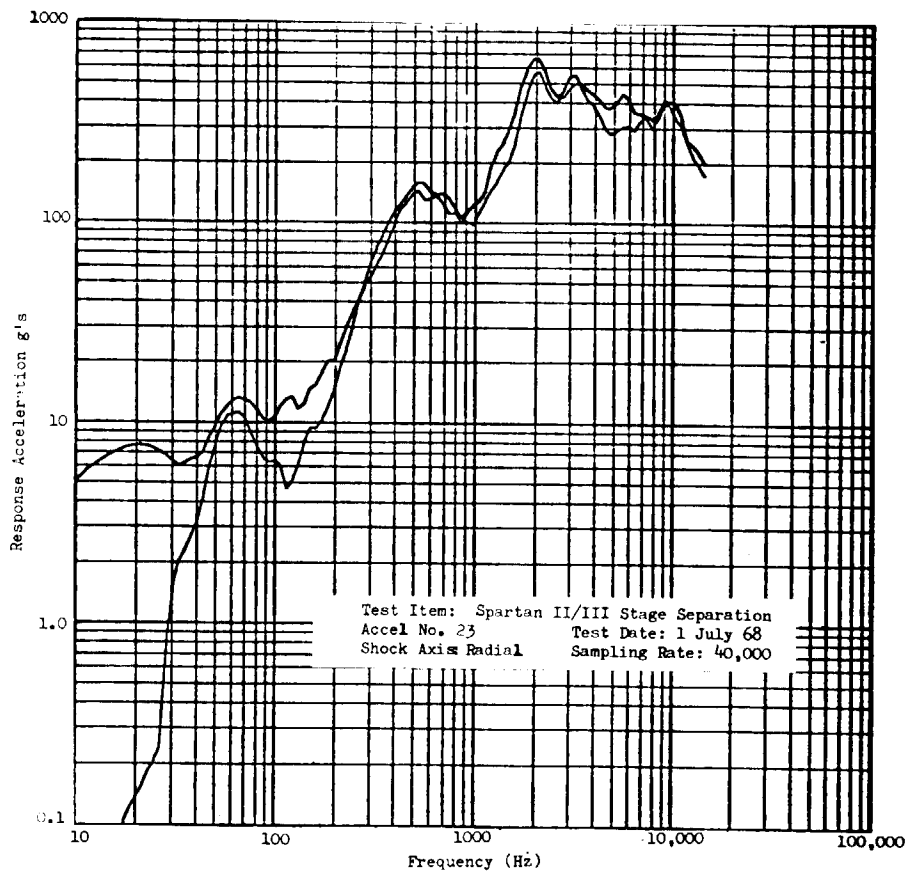


FIGURE I.A.3-28



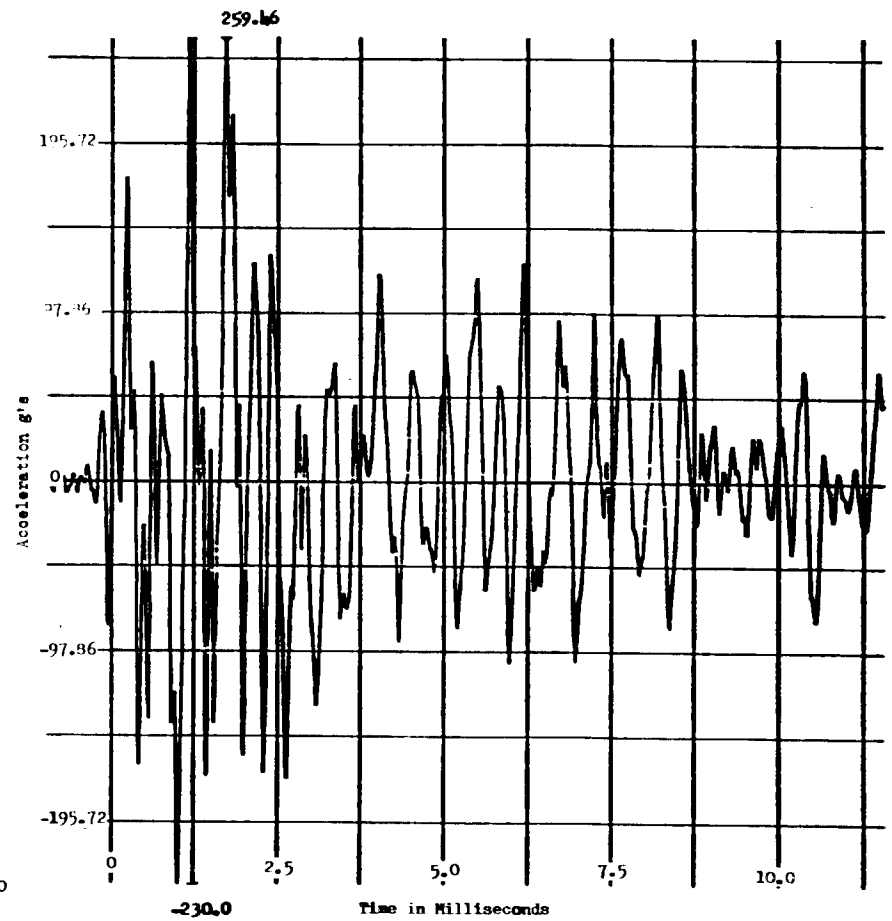
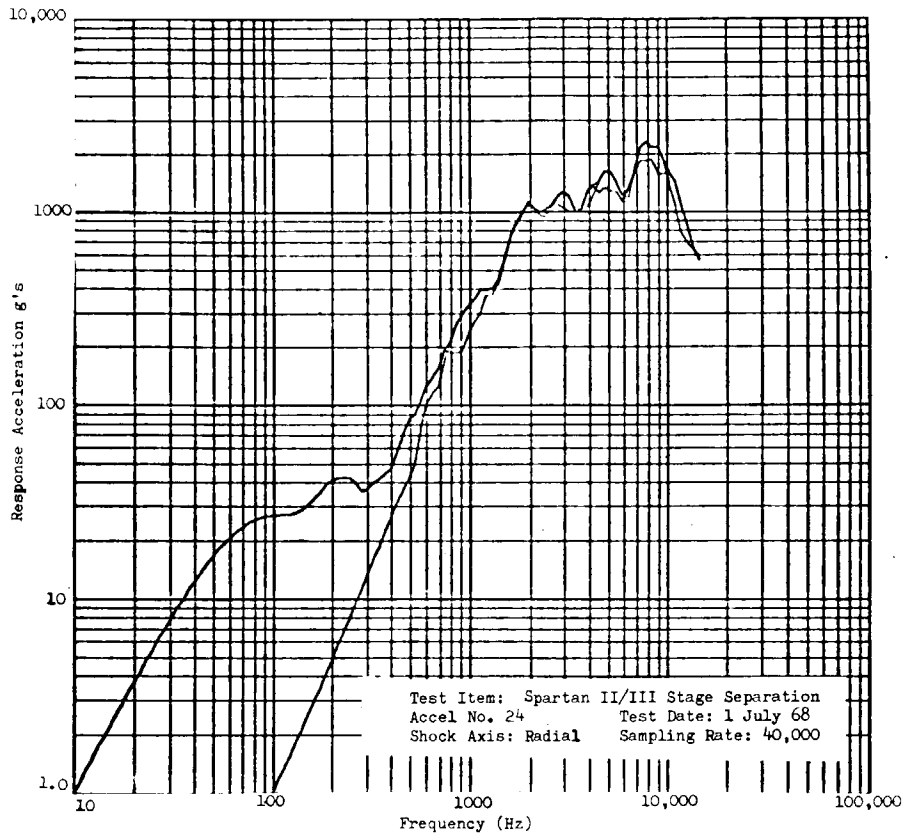


FIGURE I.A.3-29



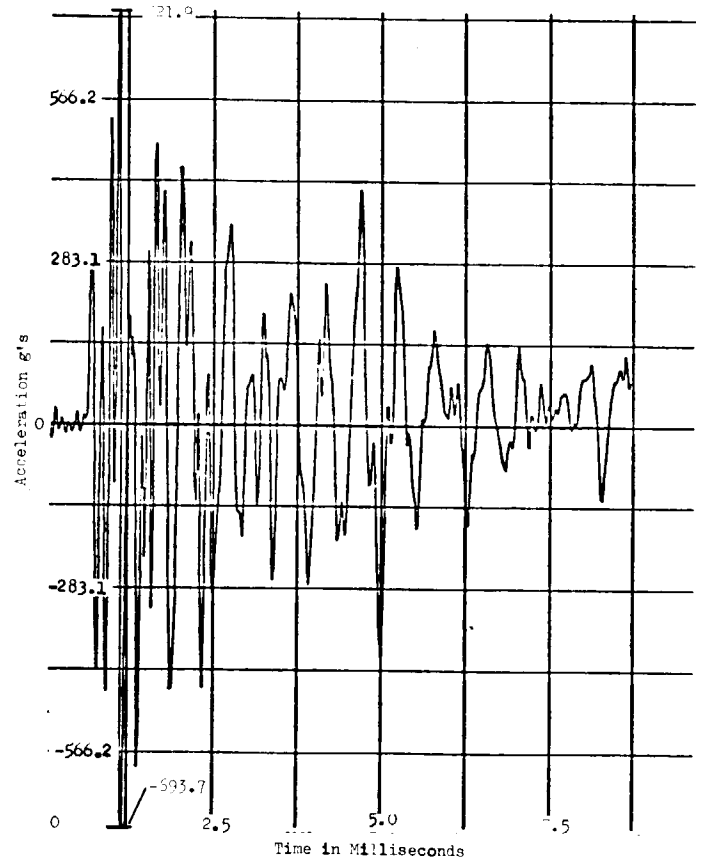
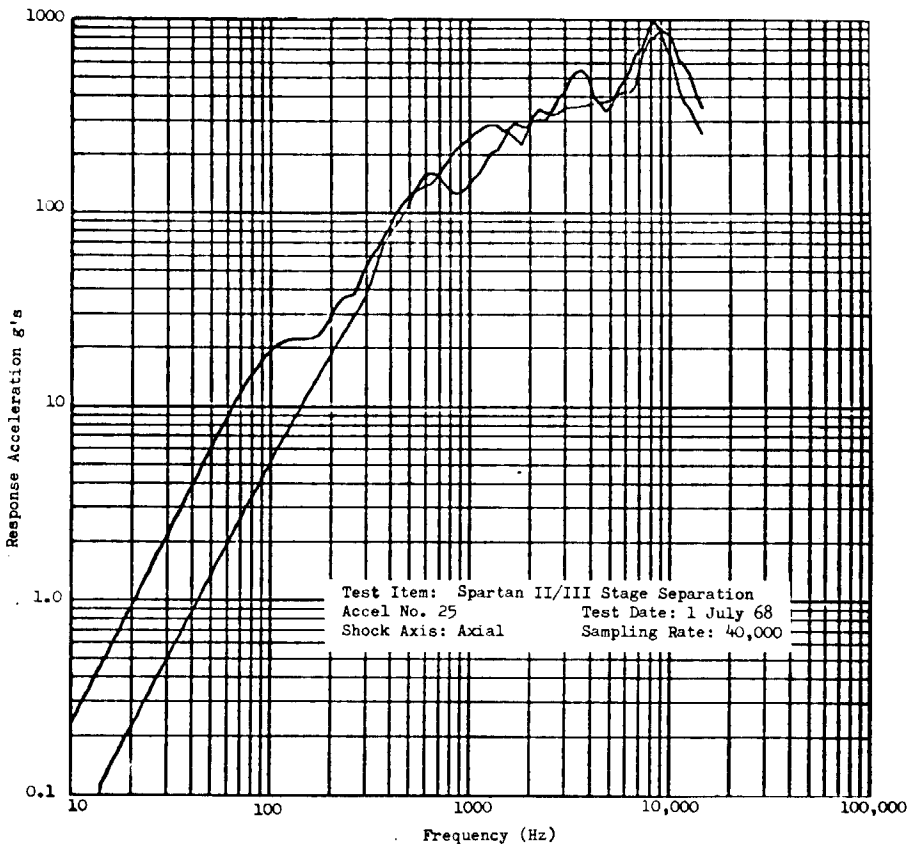


FIGURE 1.A.3-30



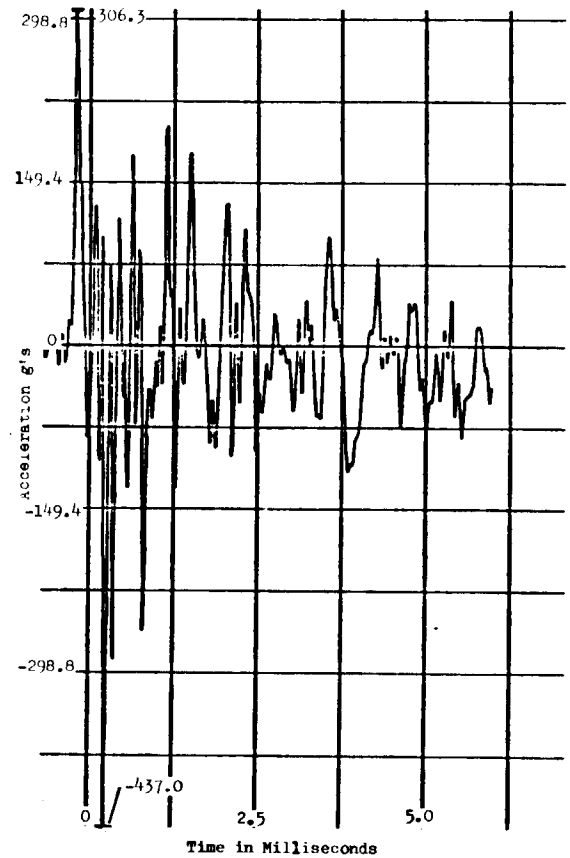


FIGURE I.A.3-31

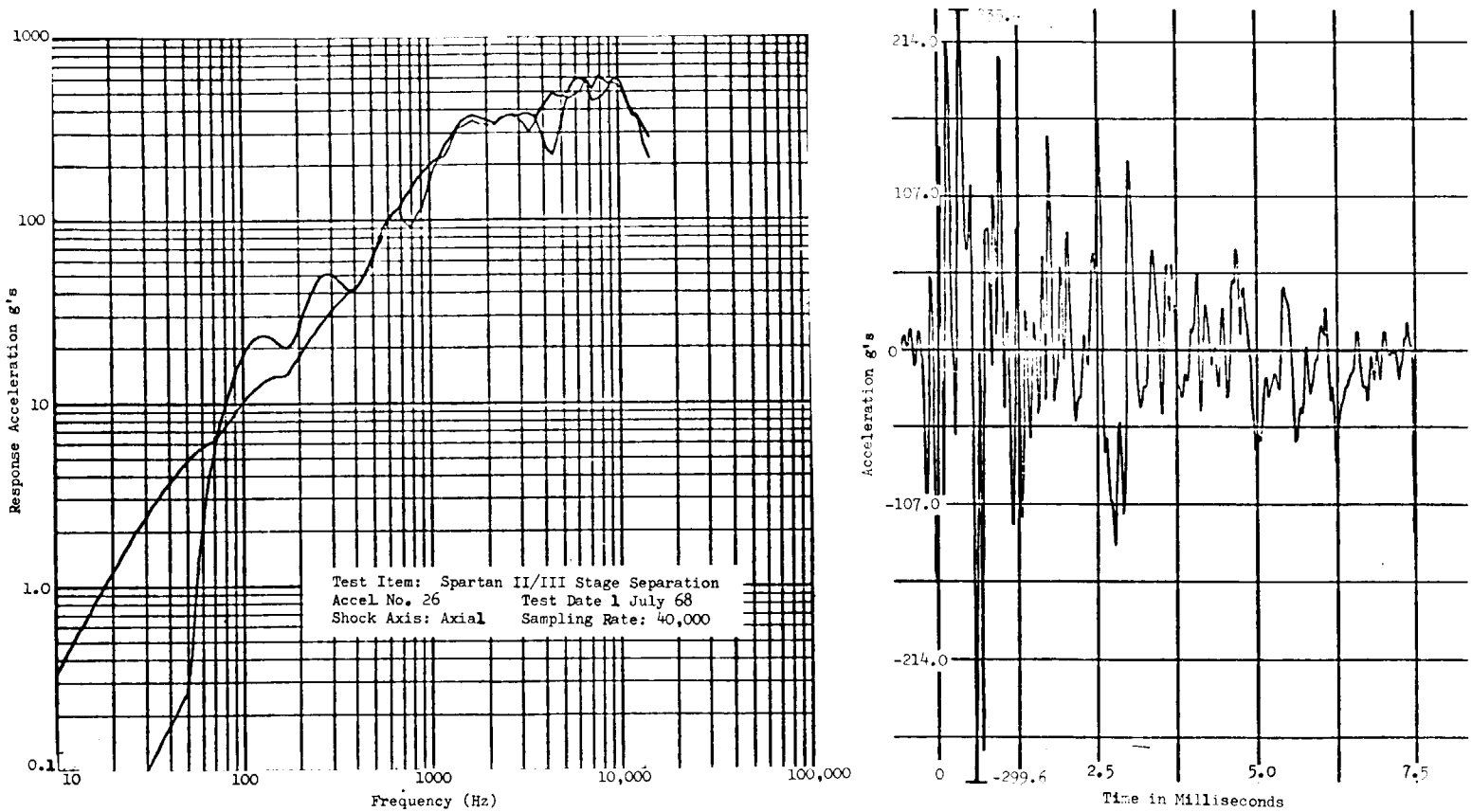
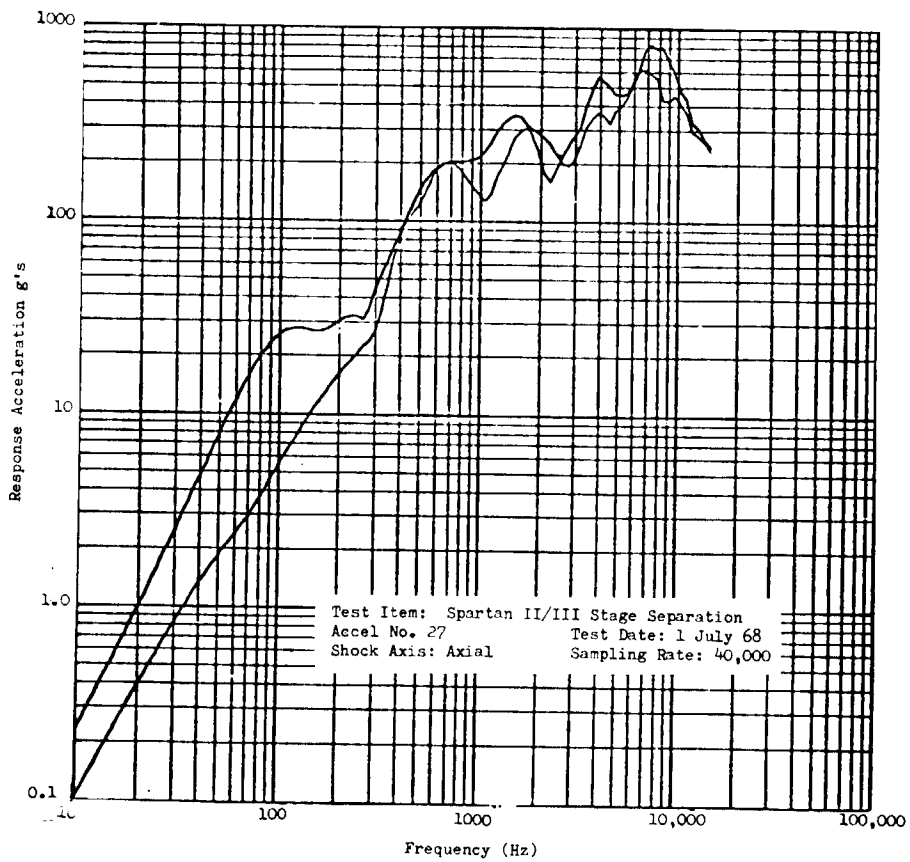


FIGURE I.A.3-32



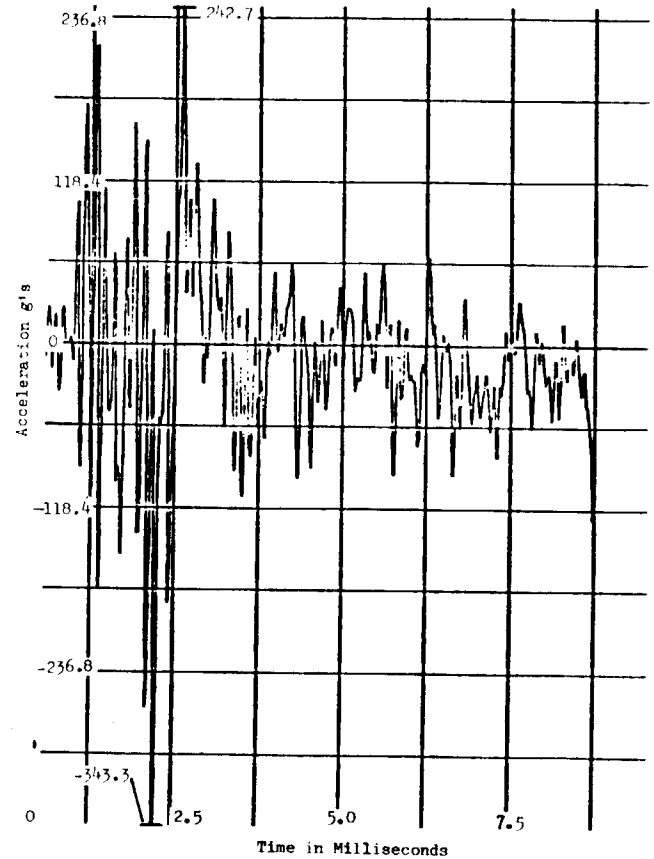
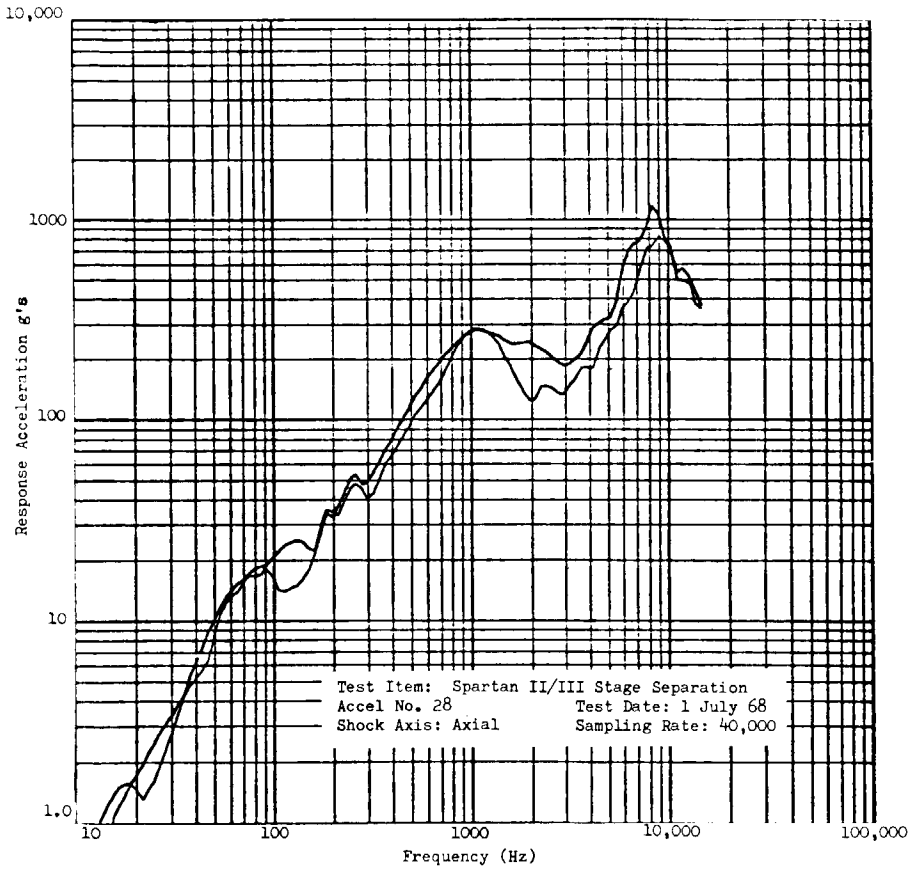


FIGURE I.A.3-33



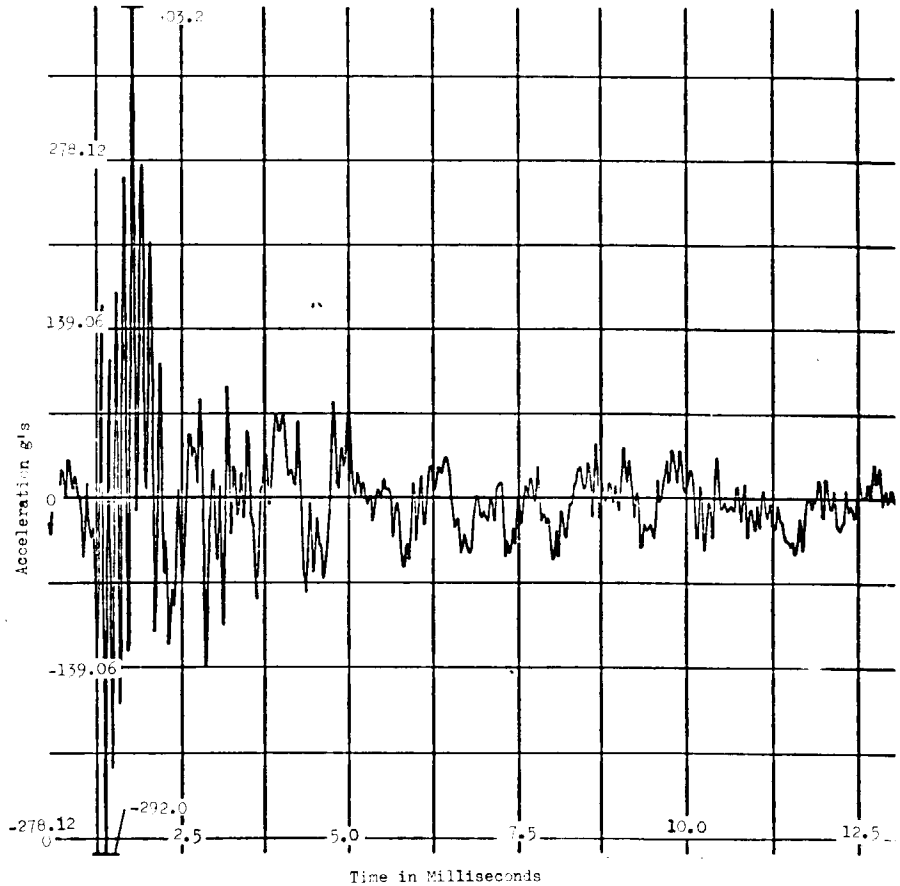
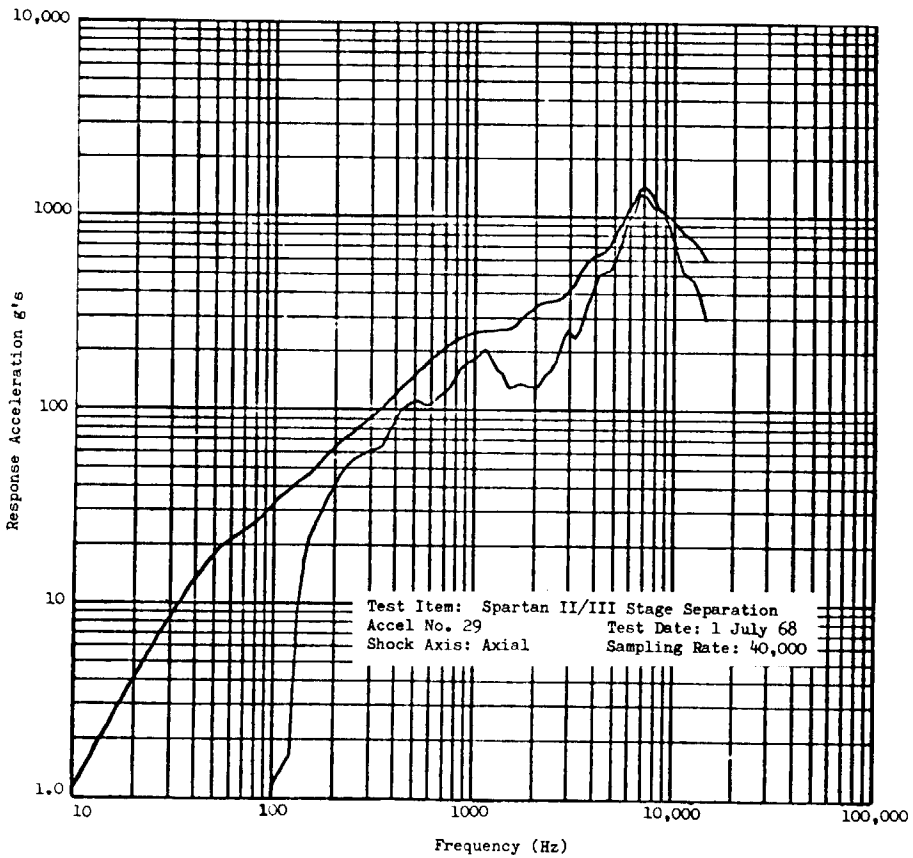


FIGURE I.A.3-34



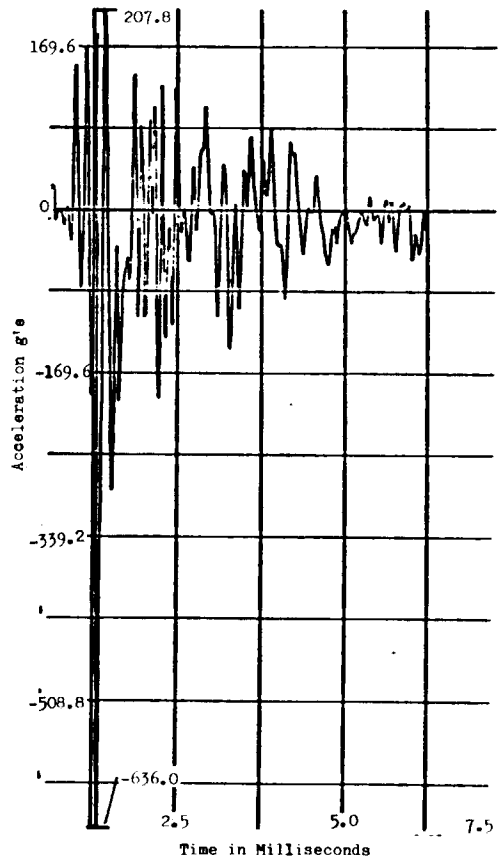
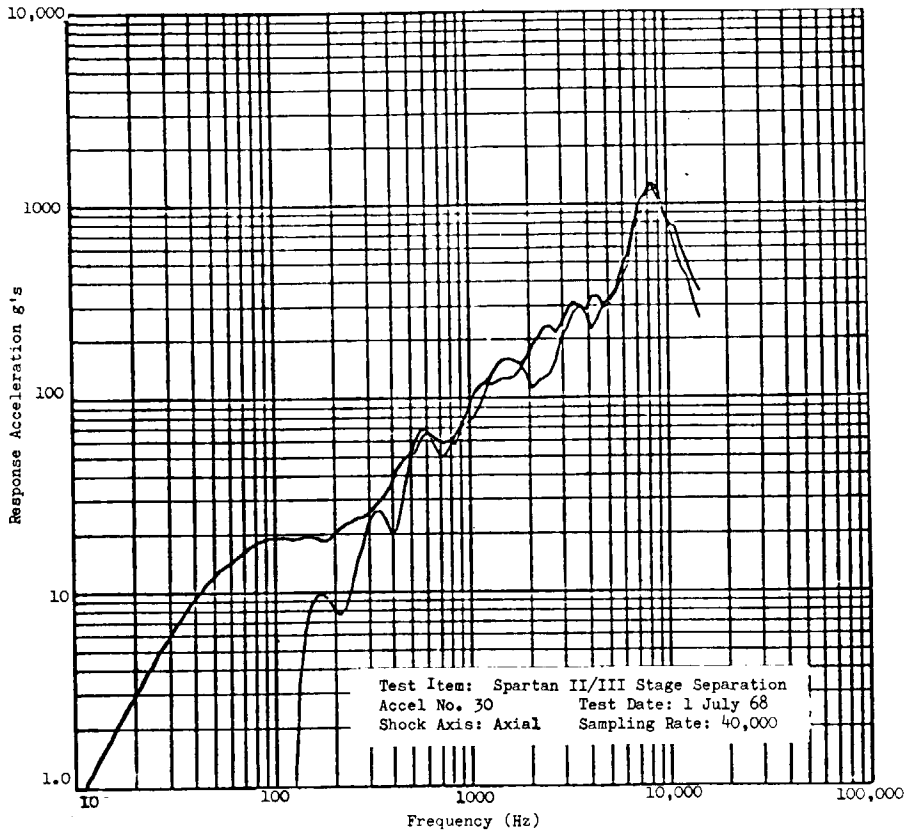


FIGURE I.A.3-35



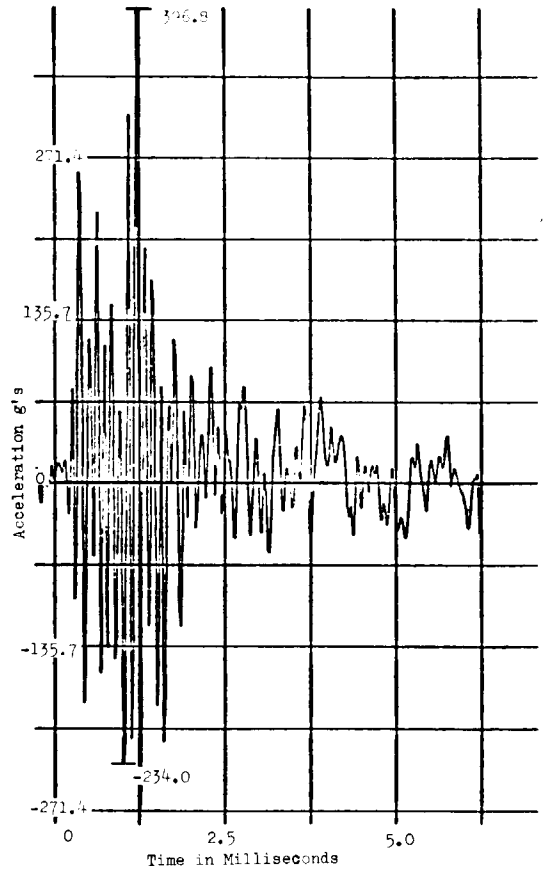
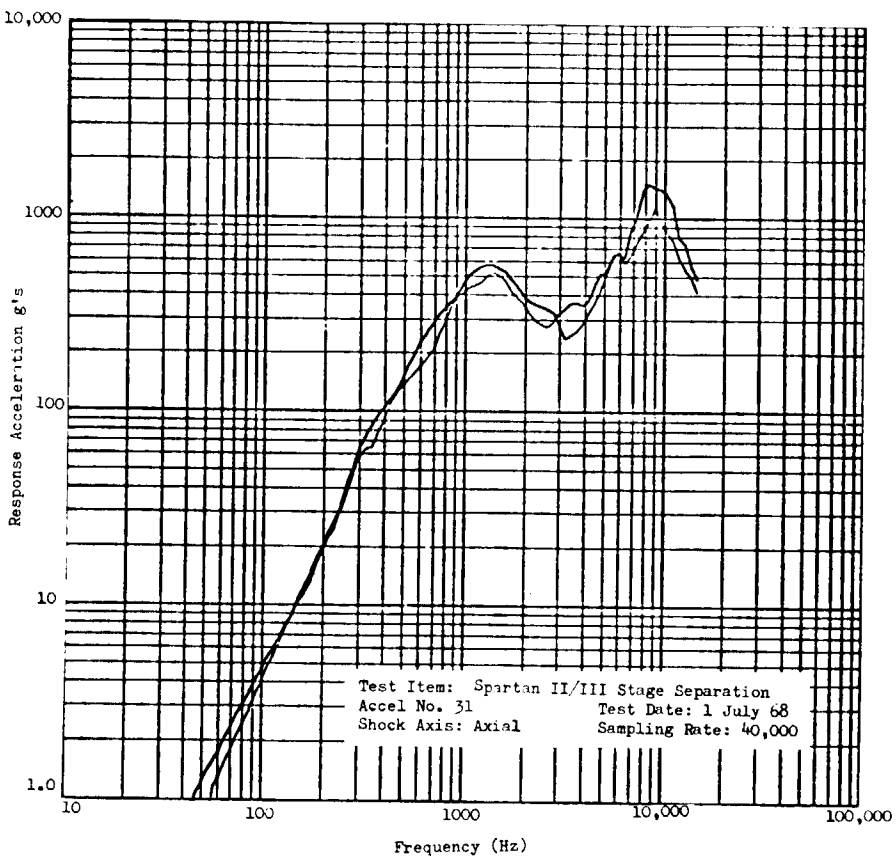


FIGURE I.A.3-36



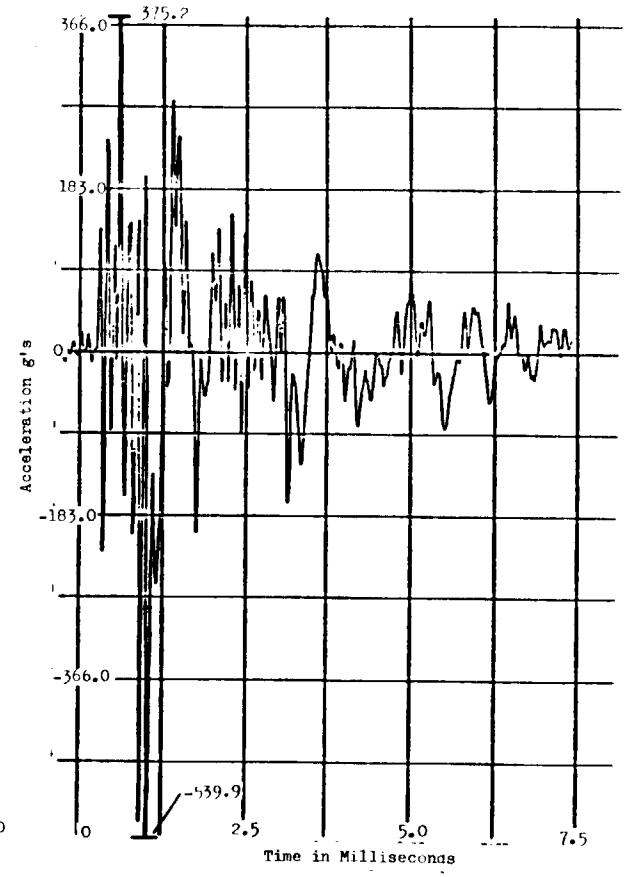


FIGURE I.A.3-37

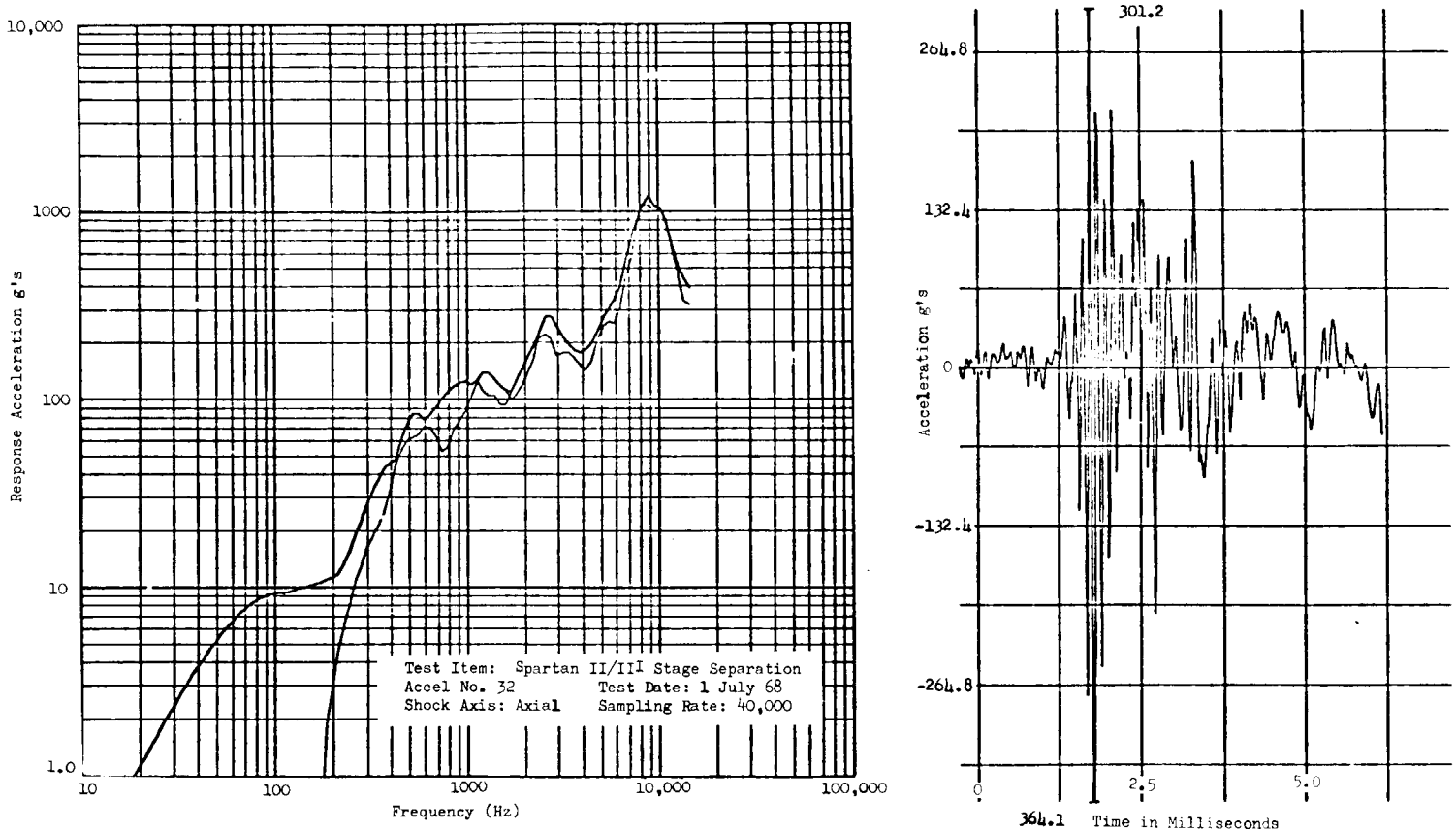
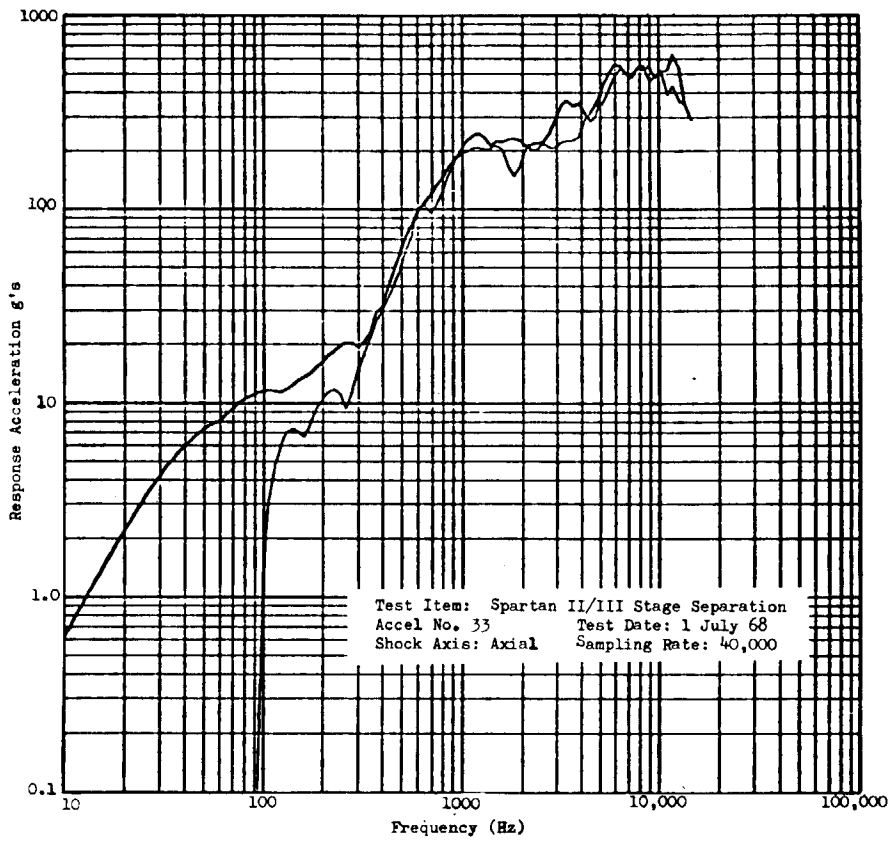


FIGURE I.A.3-38



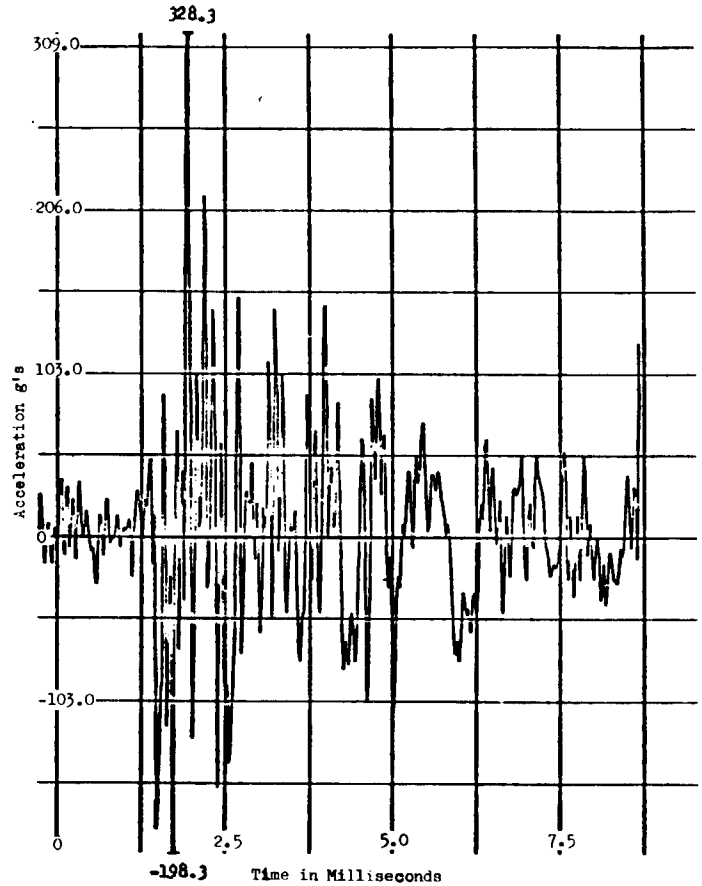
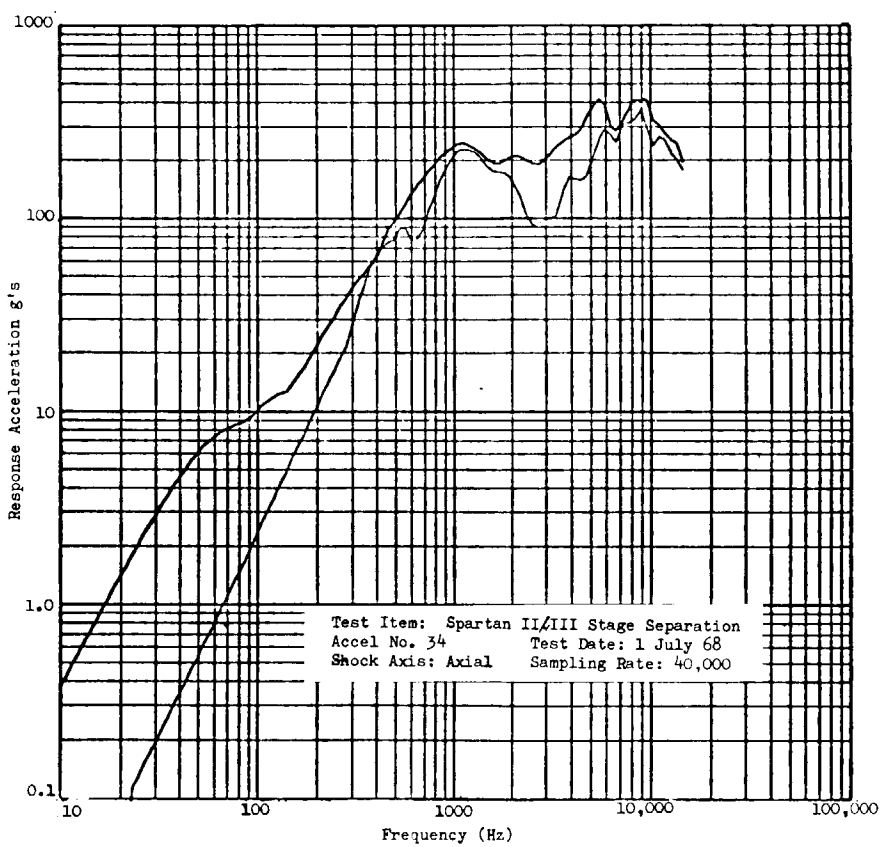


FIGURE I.A.3-39



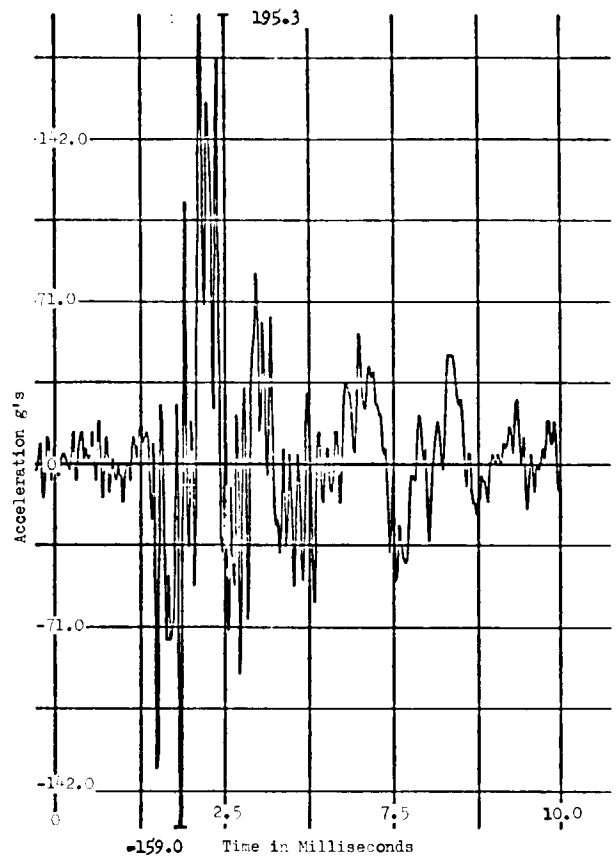
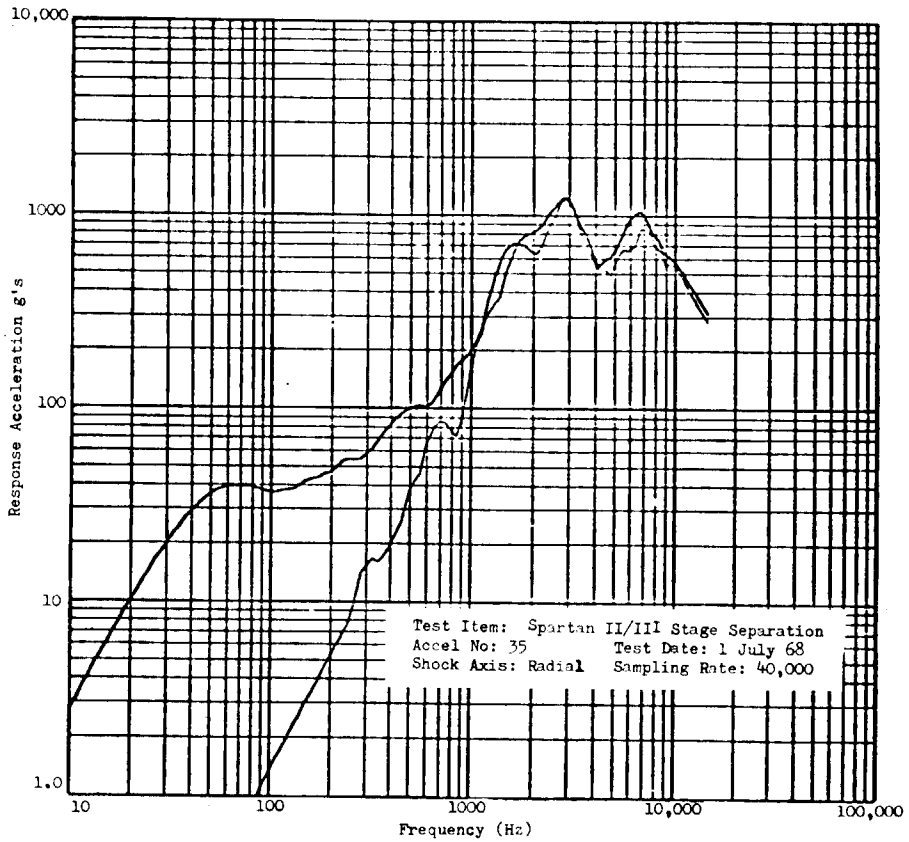


FIGURE 1.A.3-40



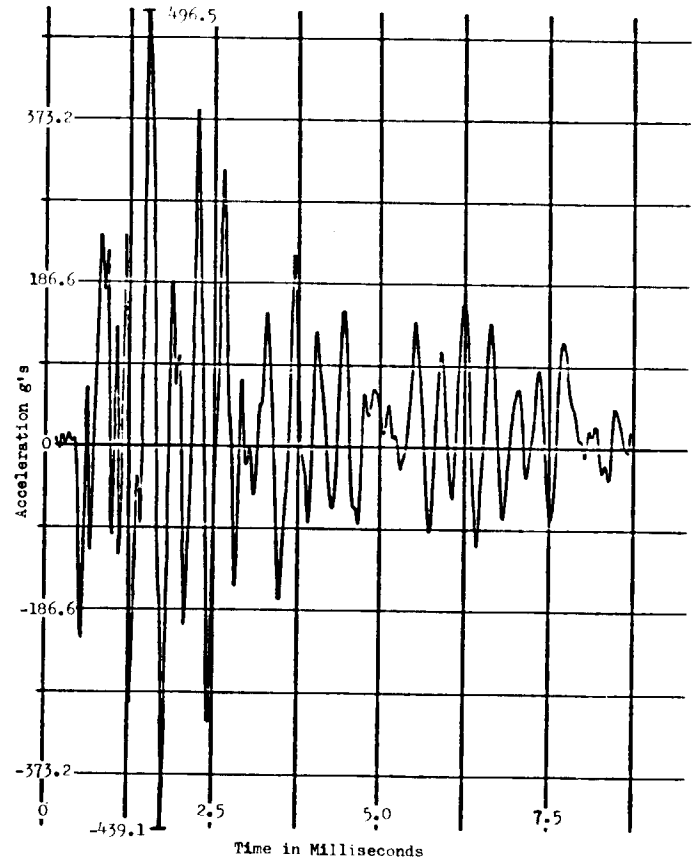
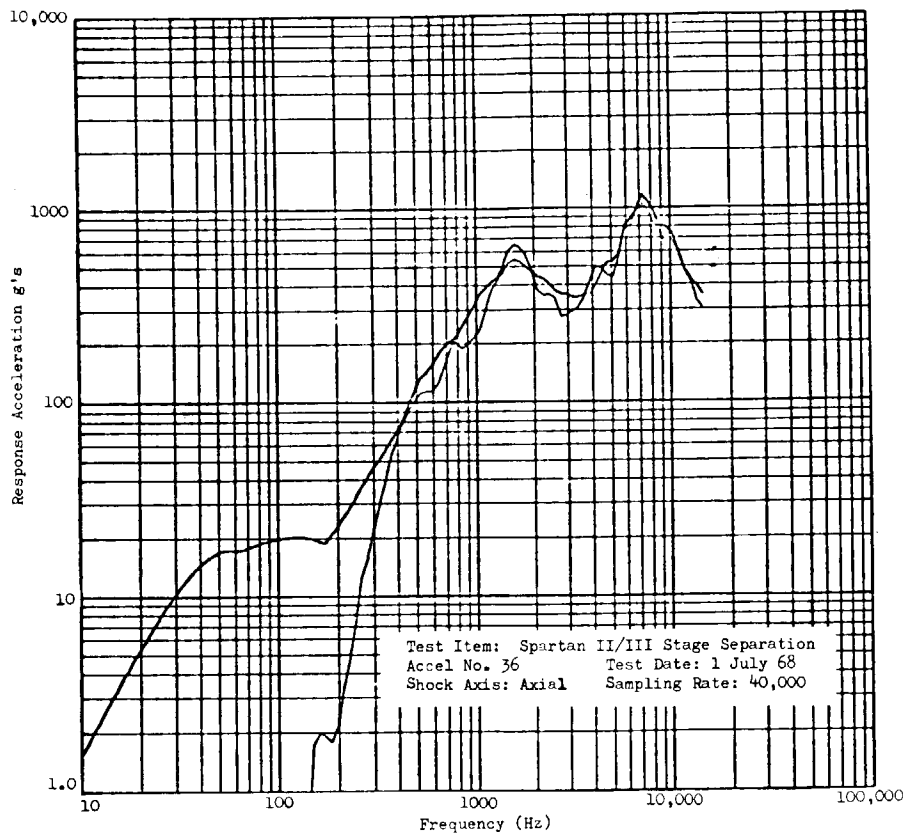


FIGURE I.A.3-41



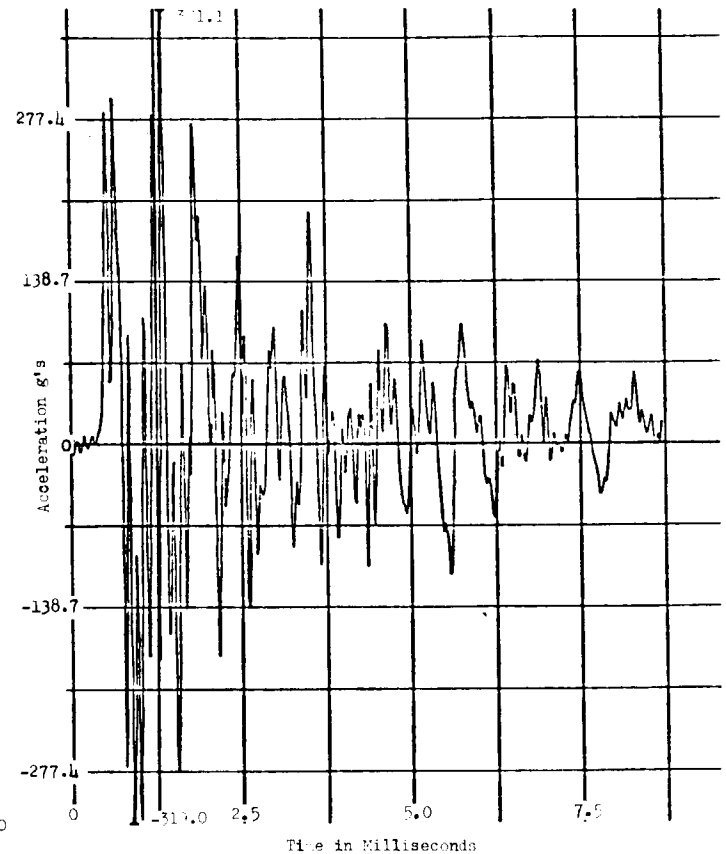
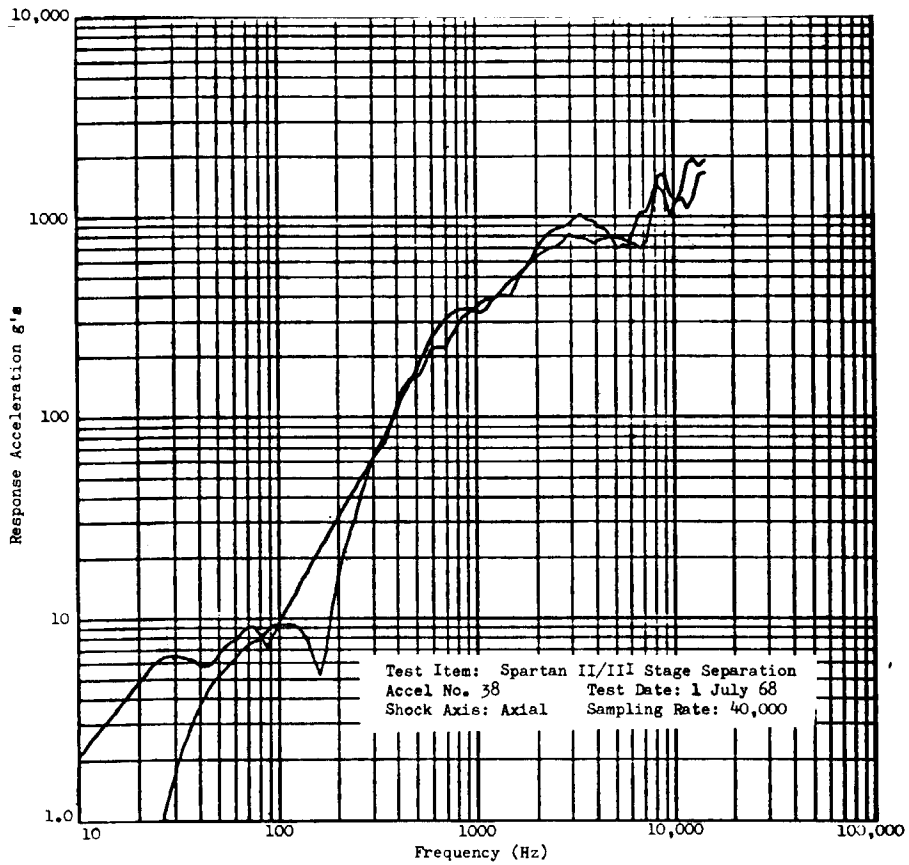


FIGURE I.A.3-42



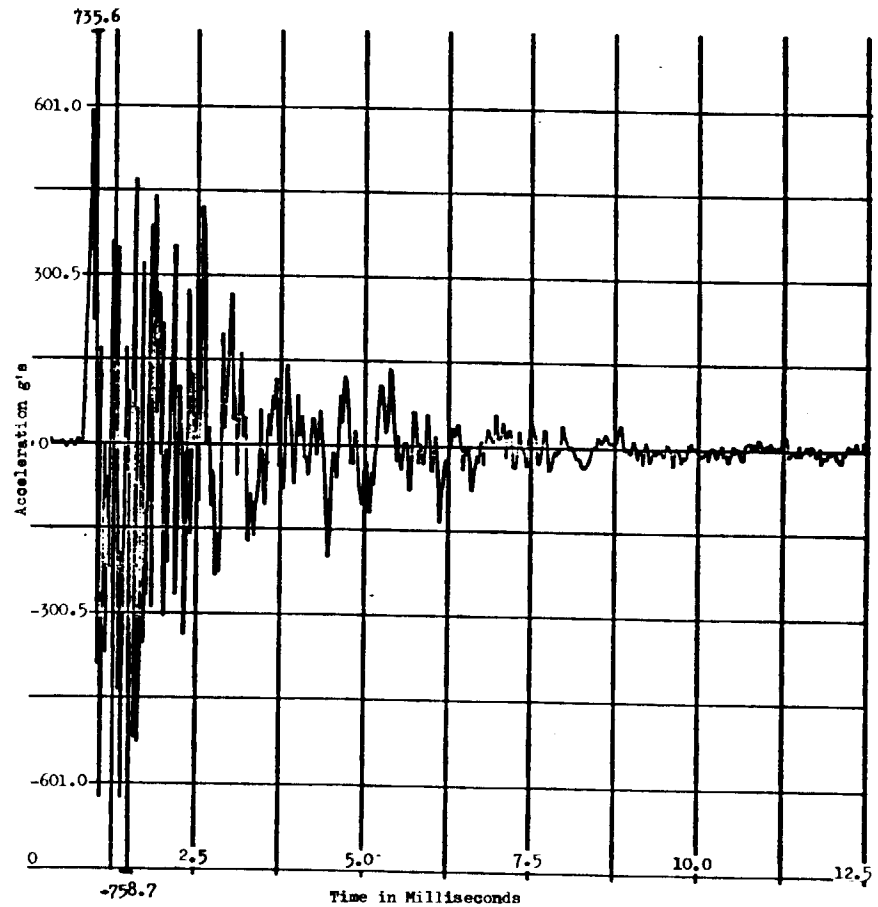


FIGURE I.A.3-43

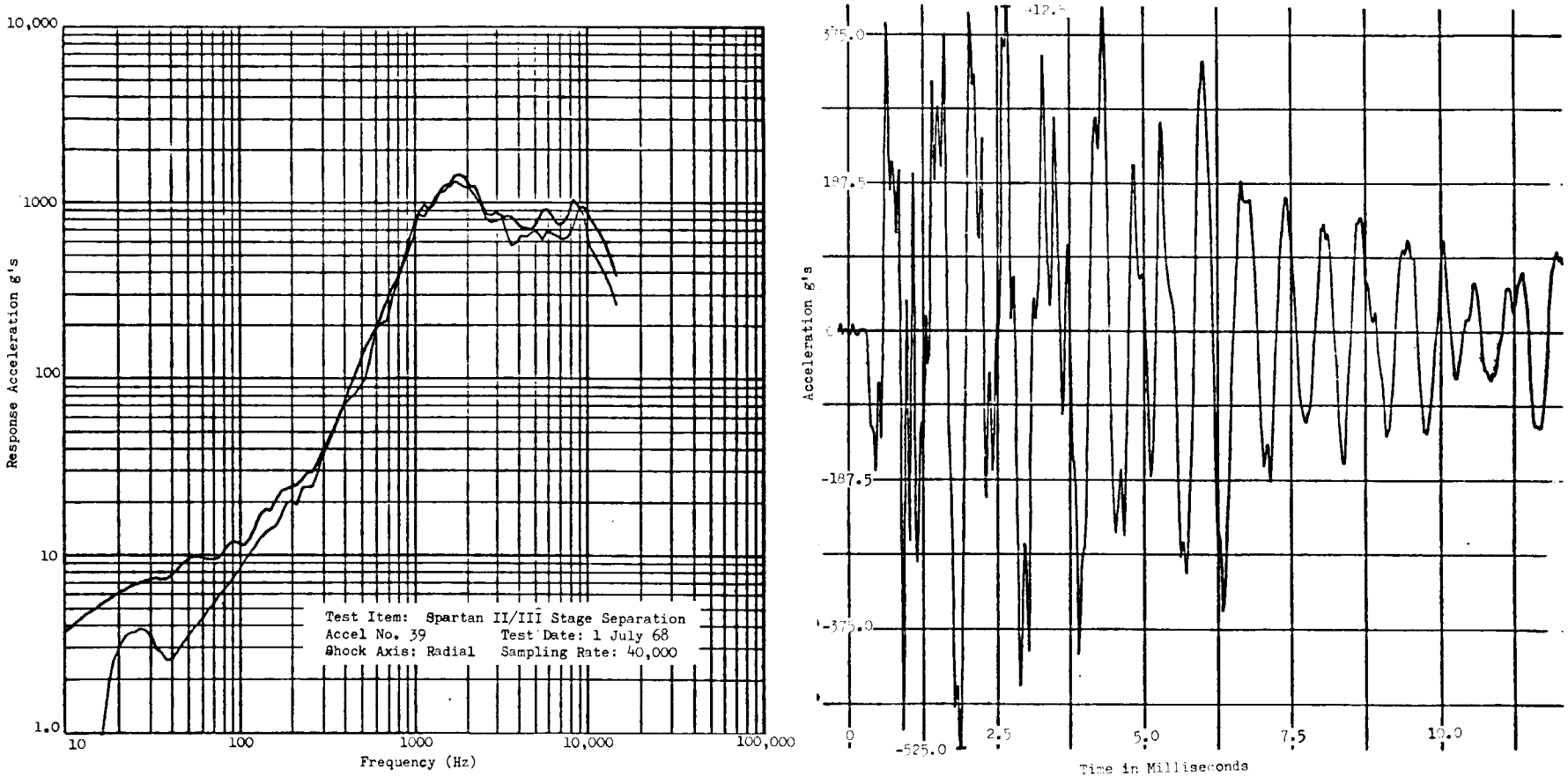
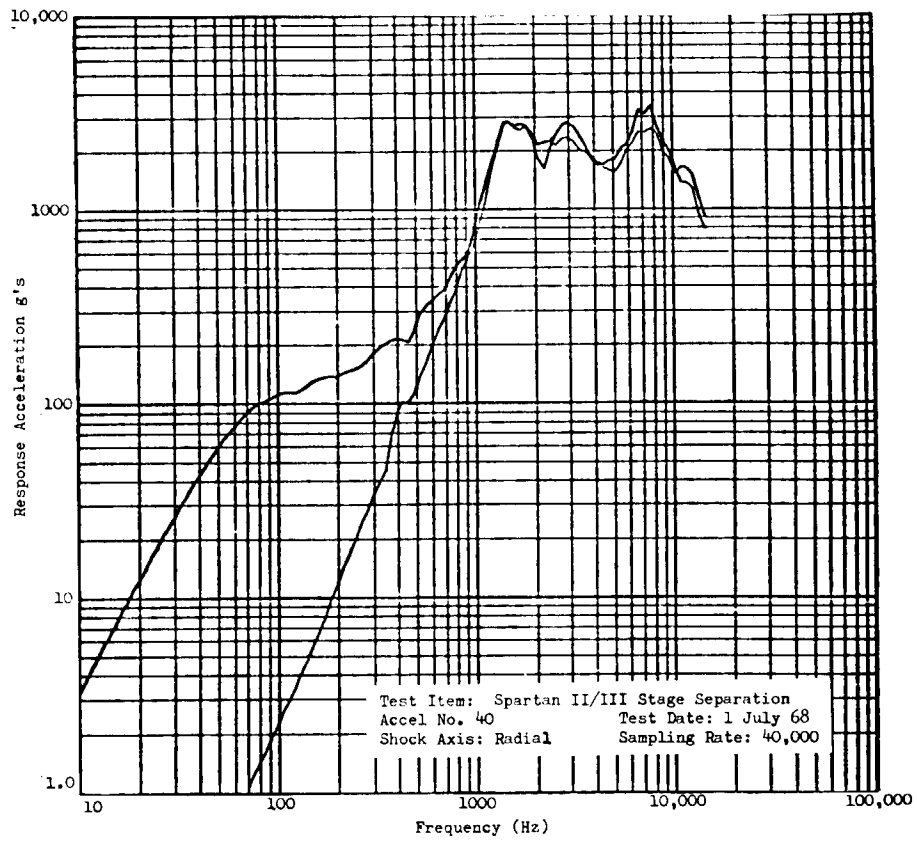


FIGURE I.A.3-44



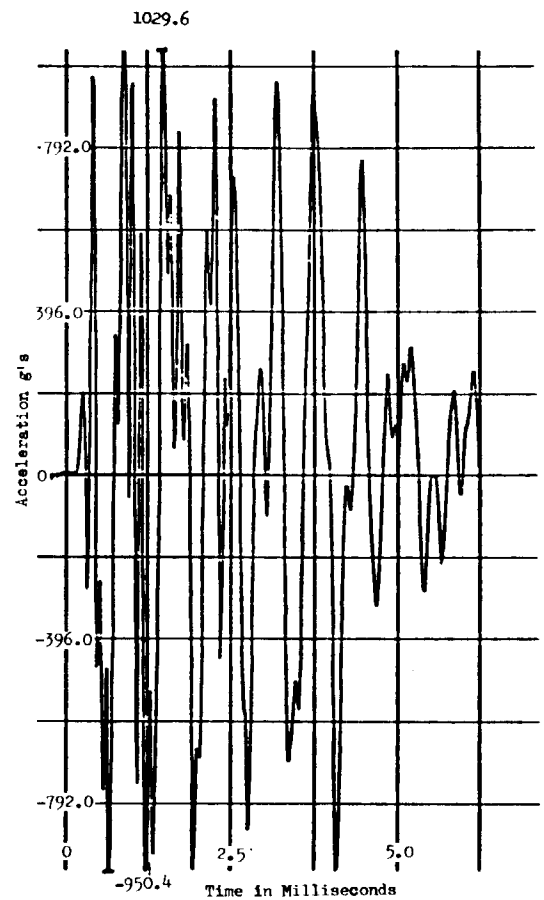
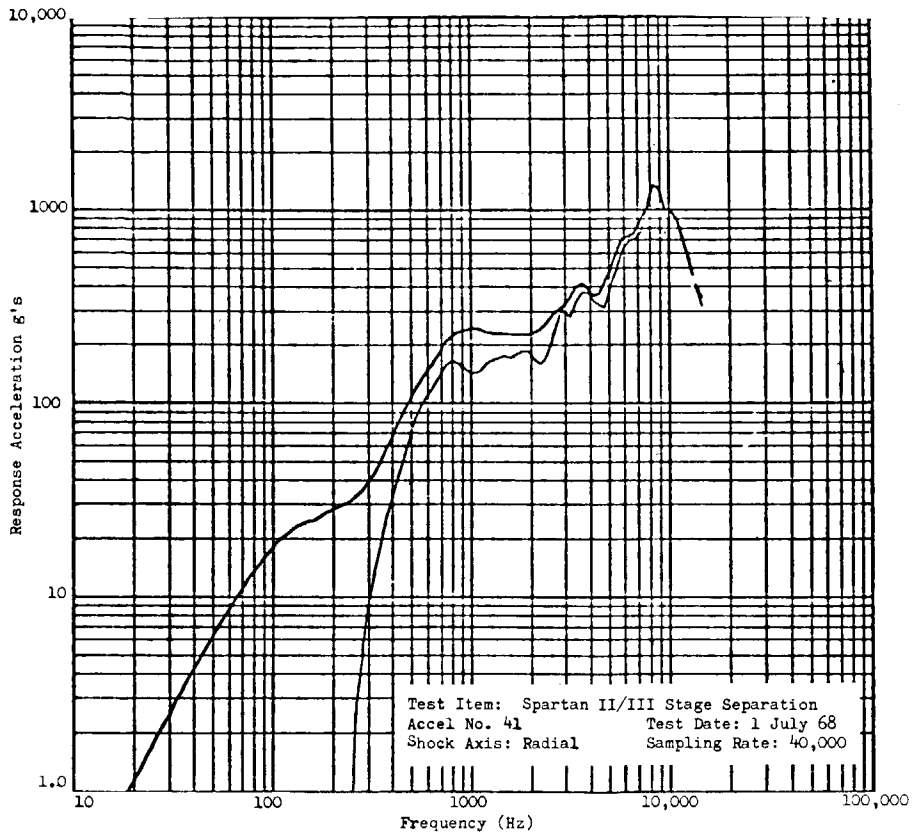


FIGURE 1.A.3-45



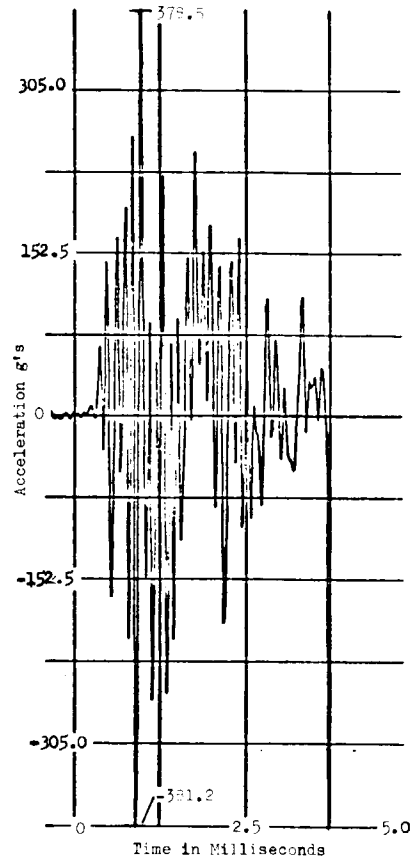
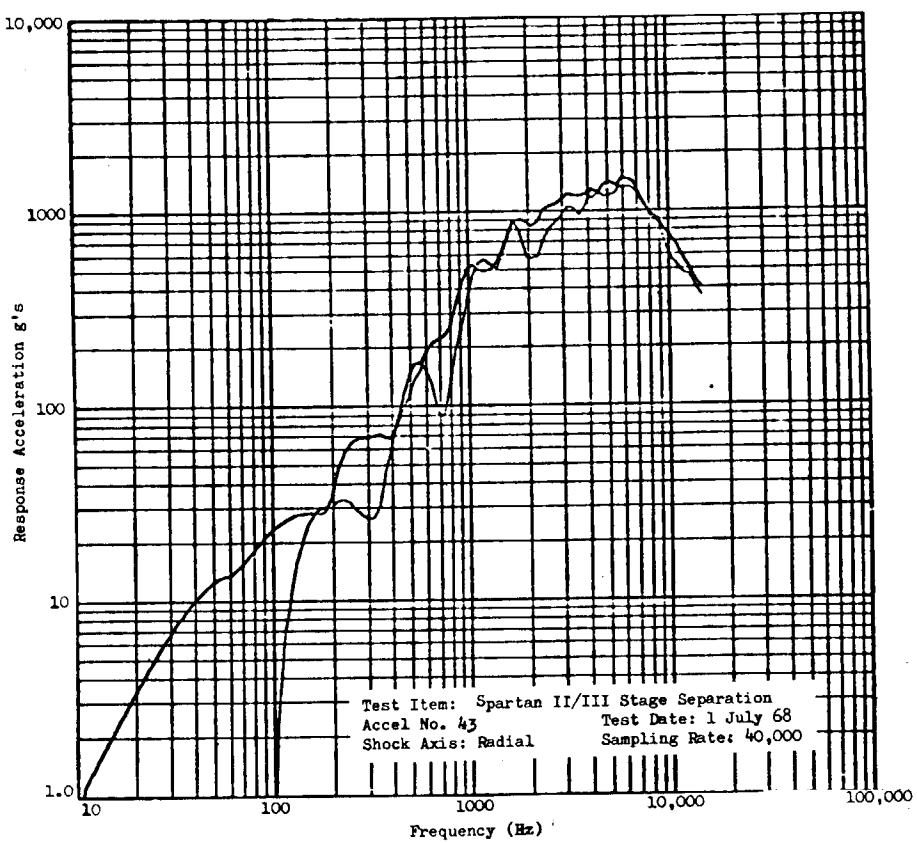


FIGURE I.A.3-46



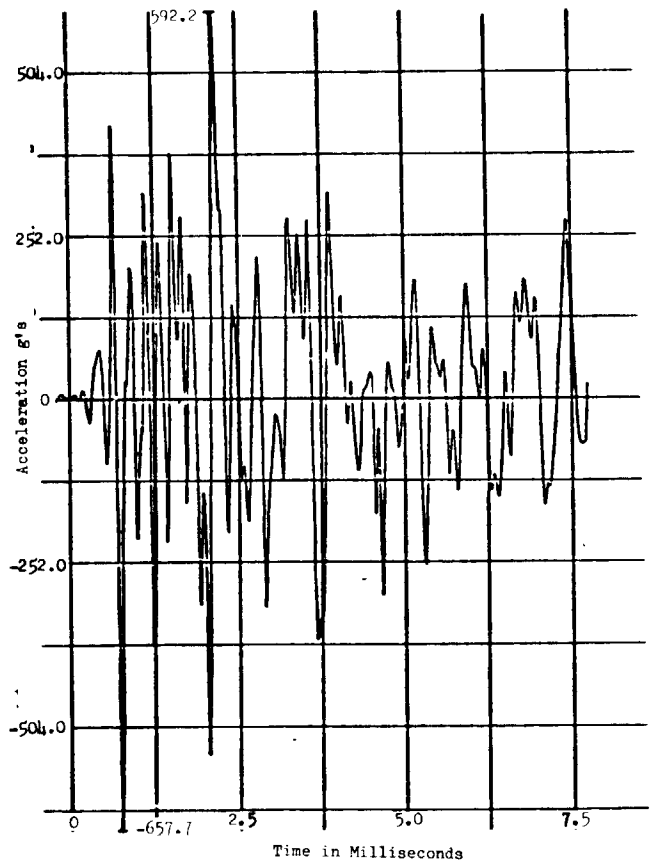
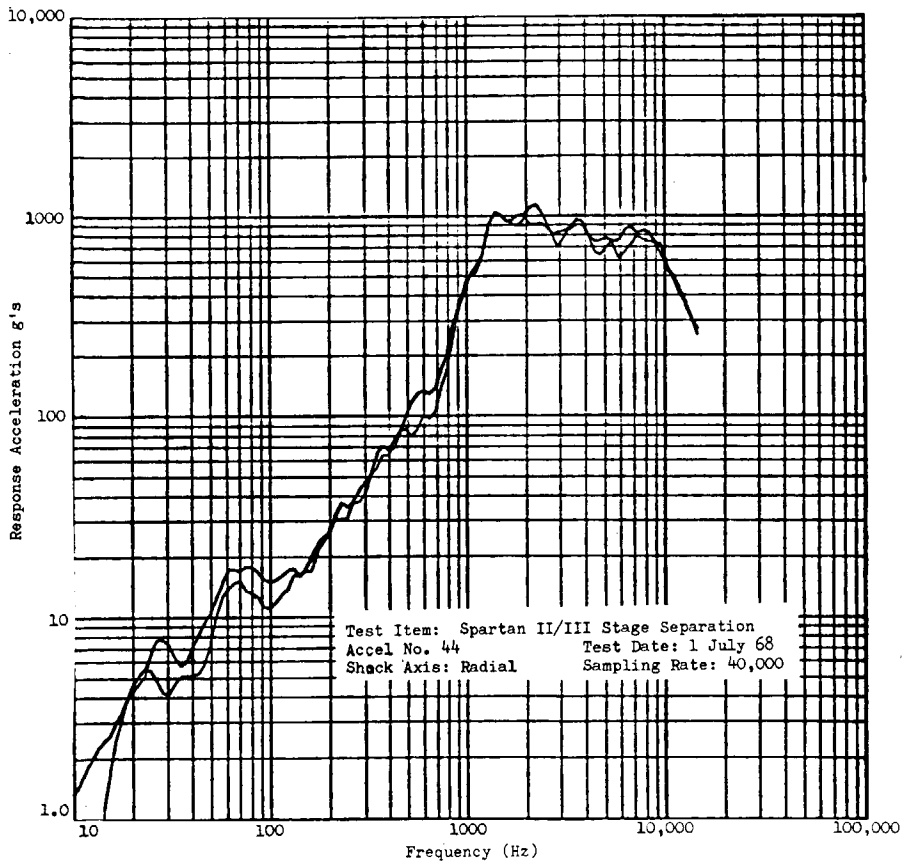


FIGURE 1.A.3-47



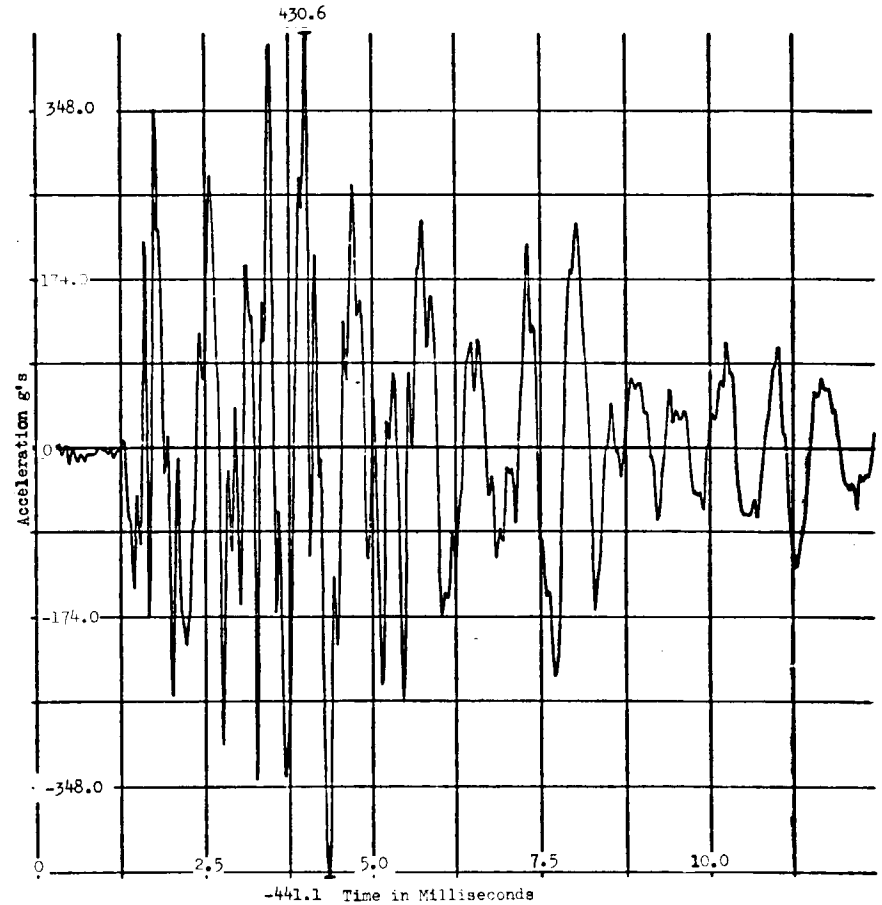
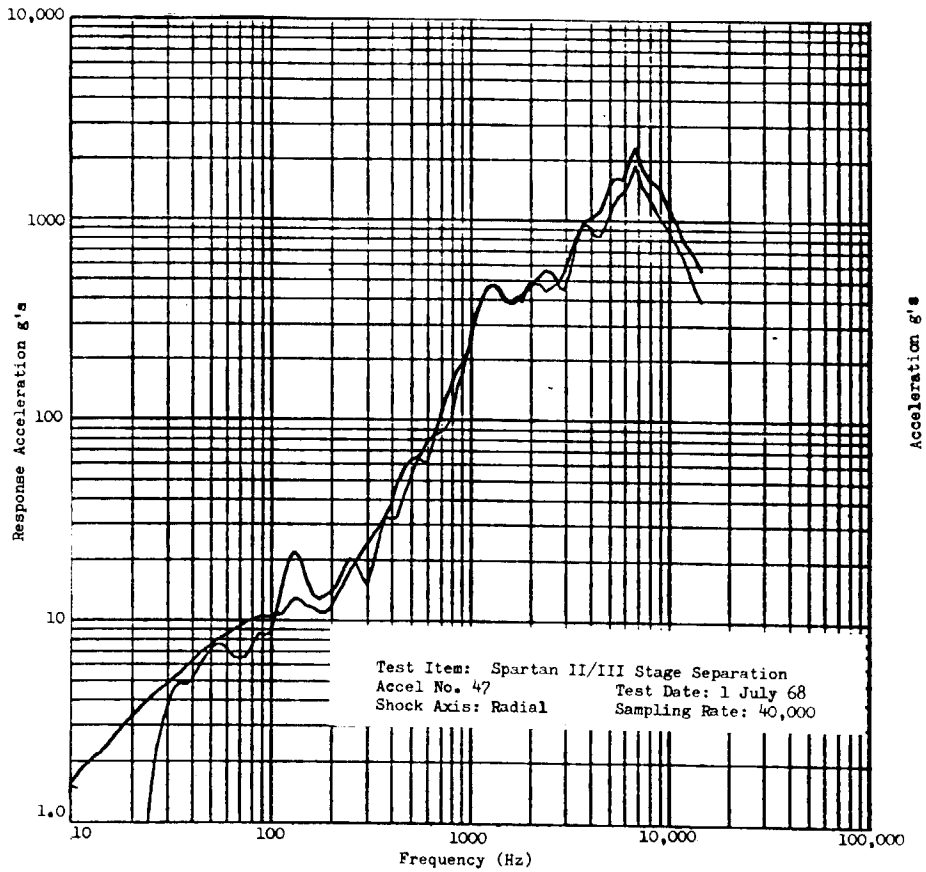


FIGURE I.A.3-48



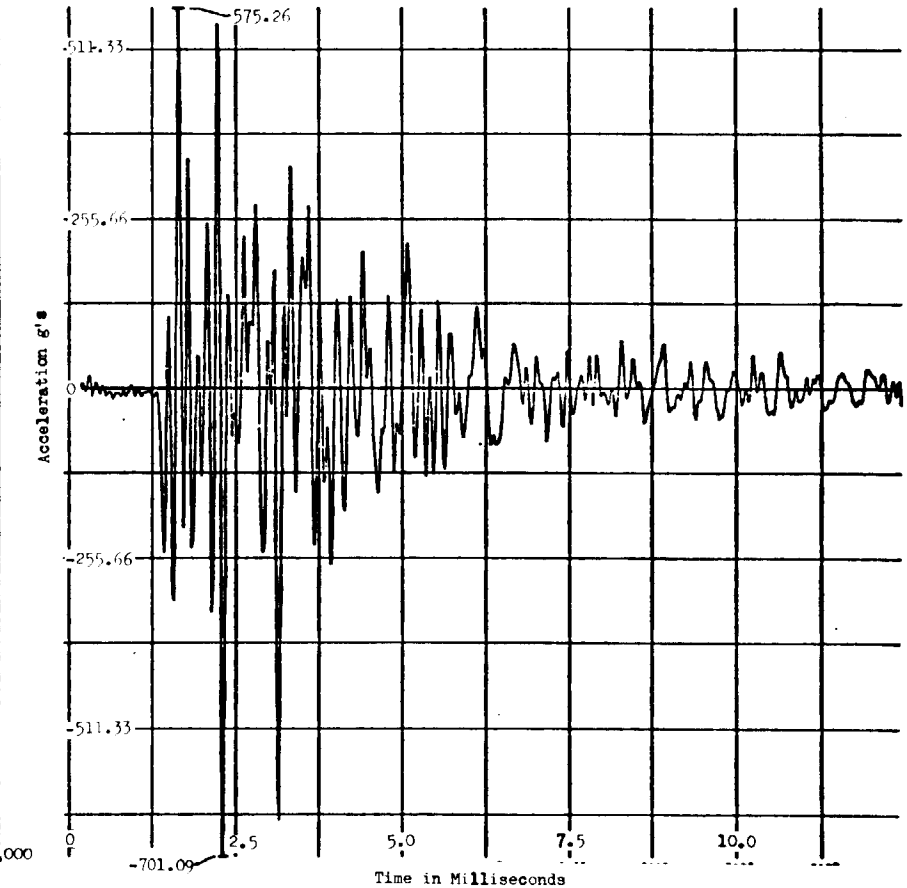
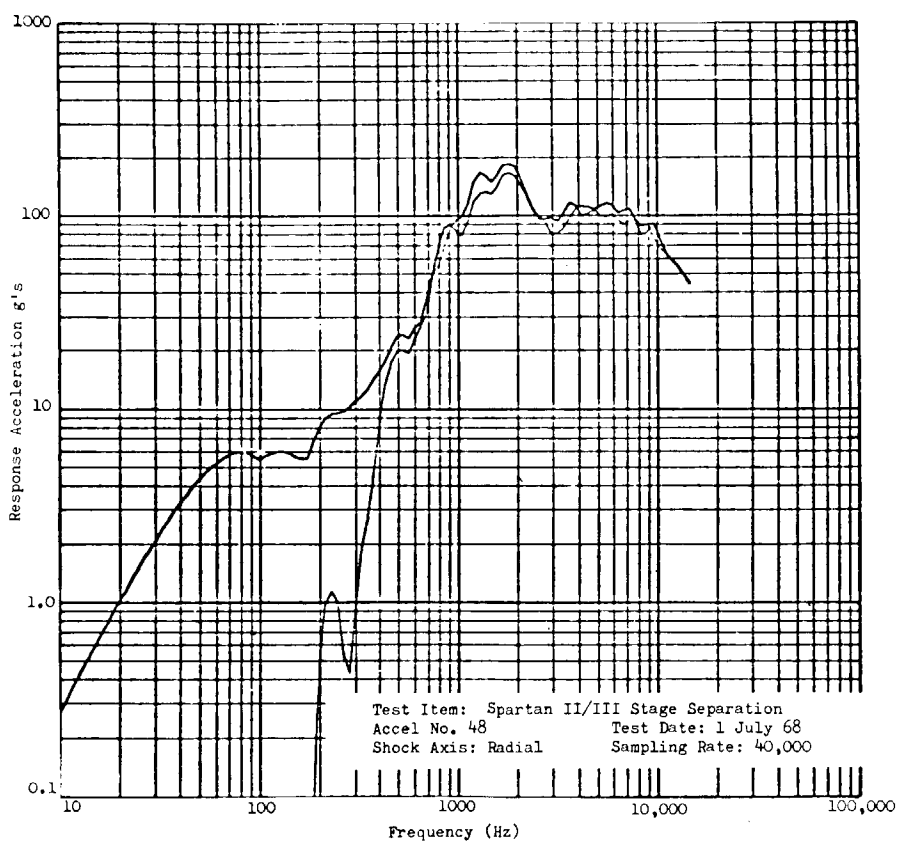


FIGURE I.A.3-49



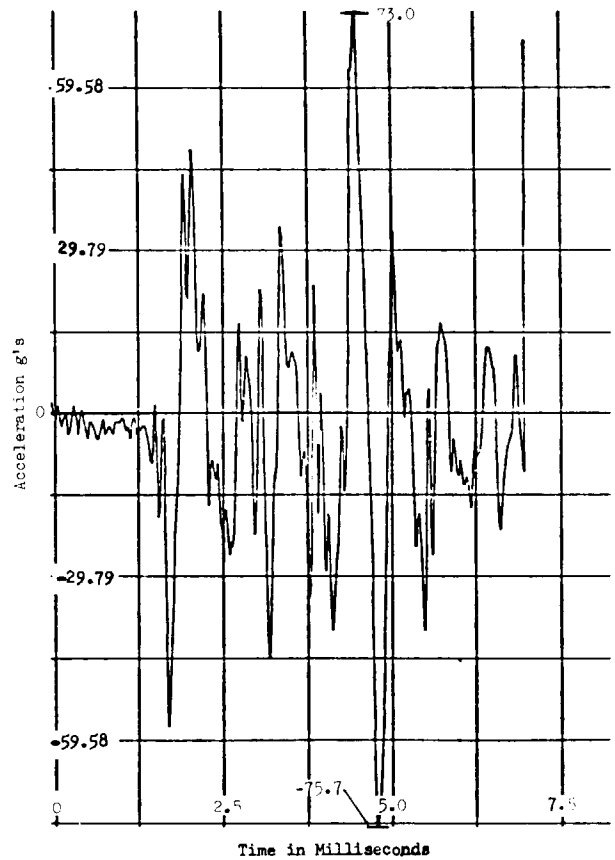
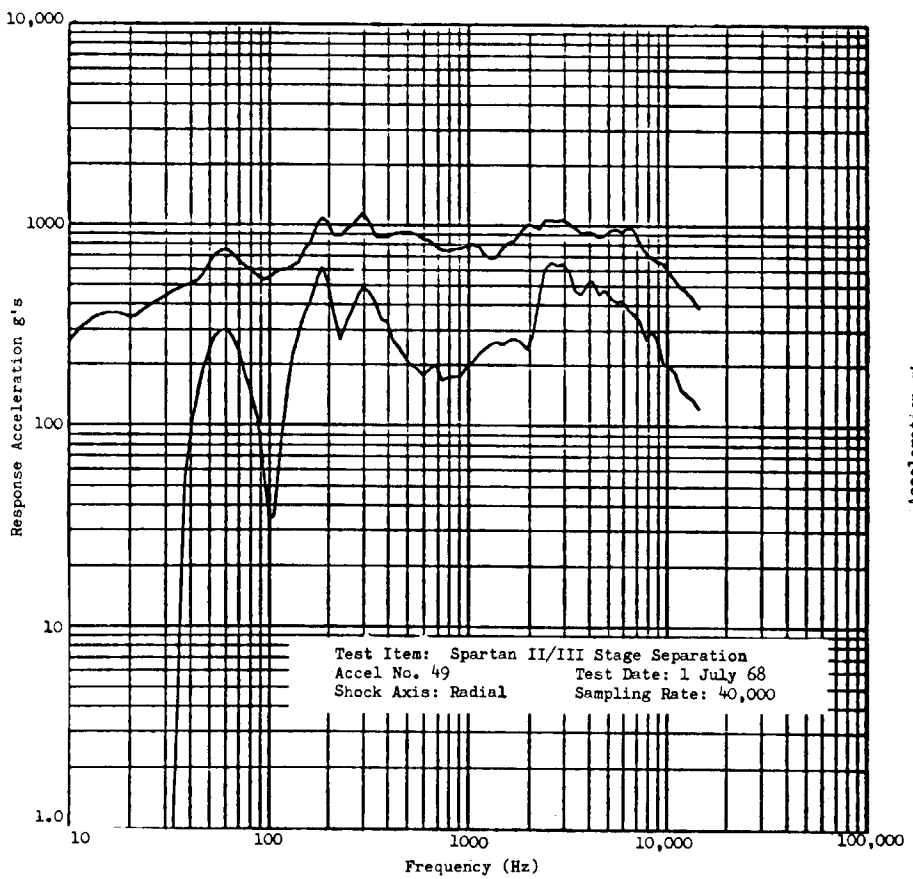


FIGURE 1.A.3-50



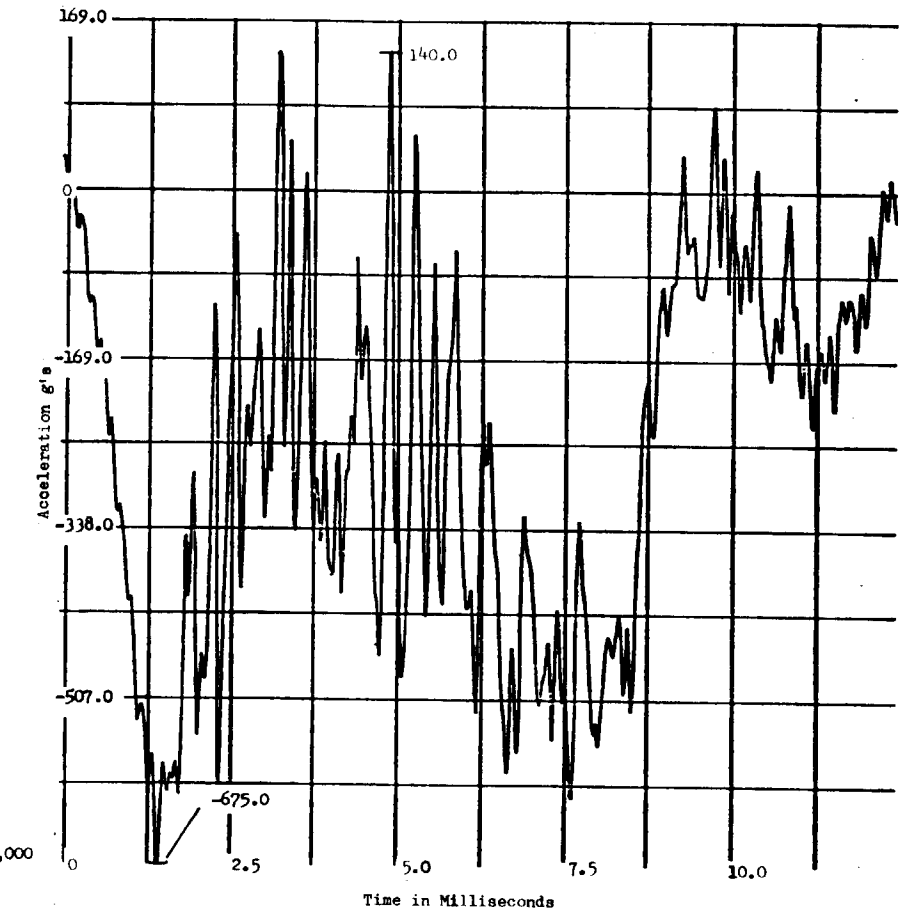
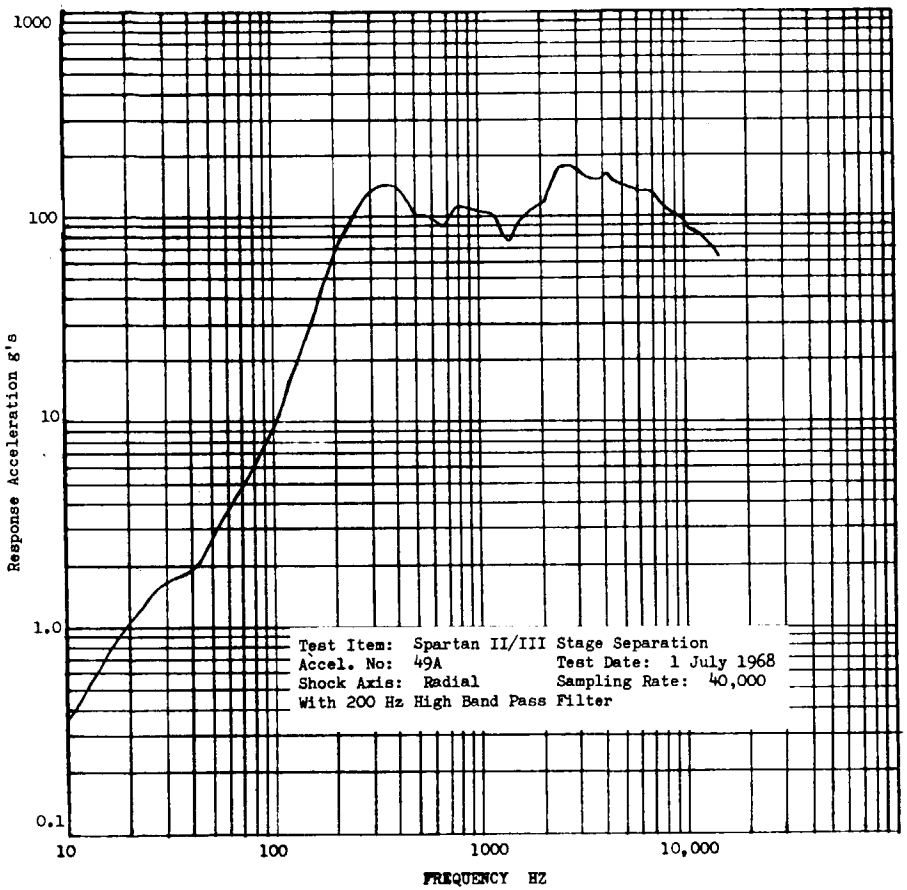


FIGURE I.A.3-51



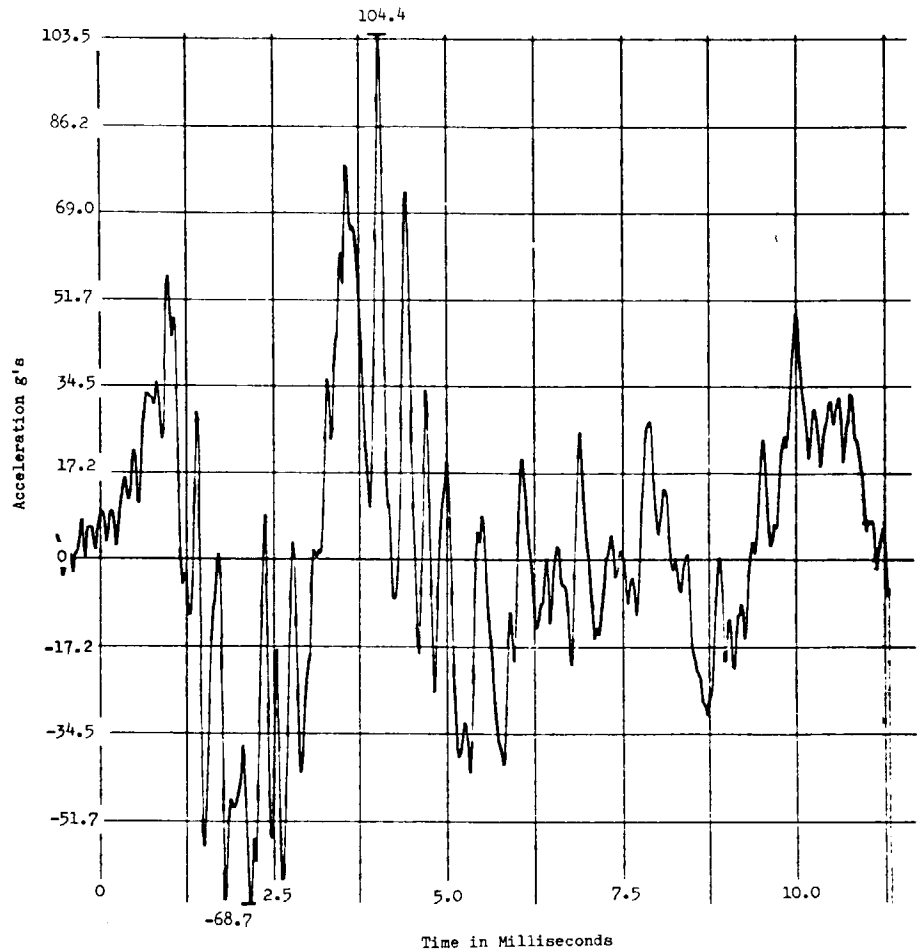
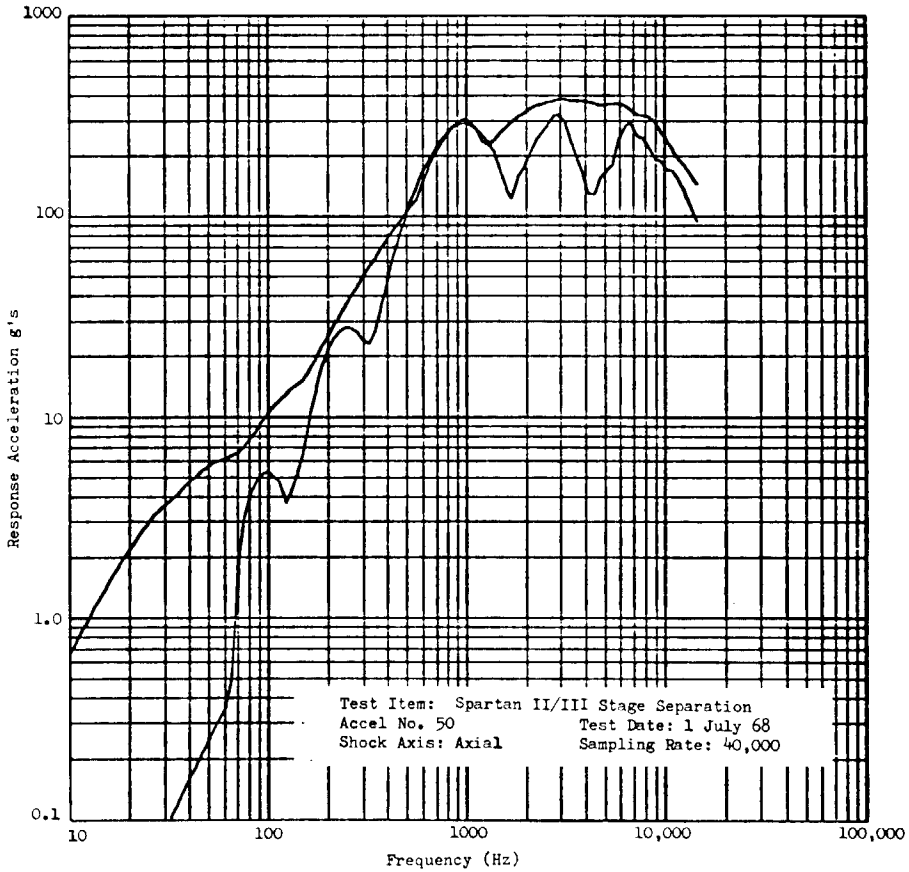


FIGURE I.A.3-52



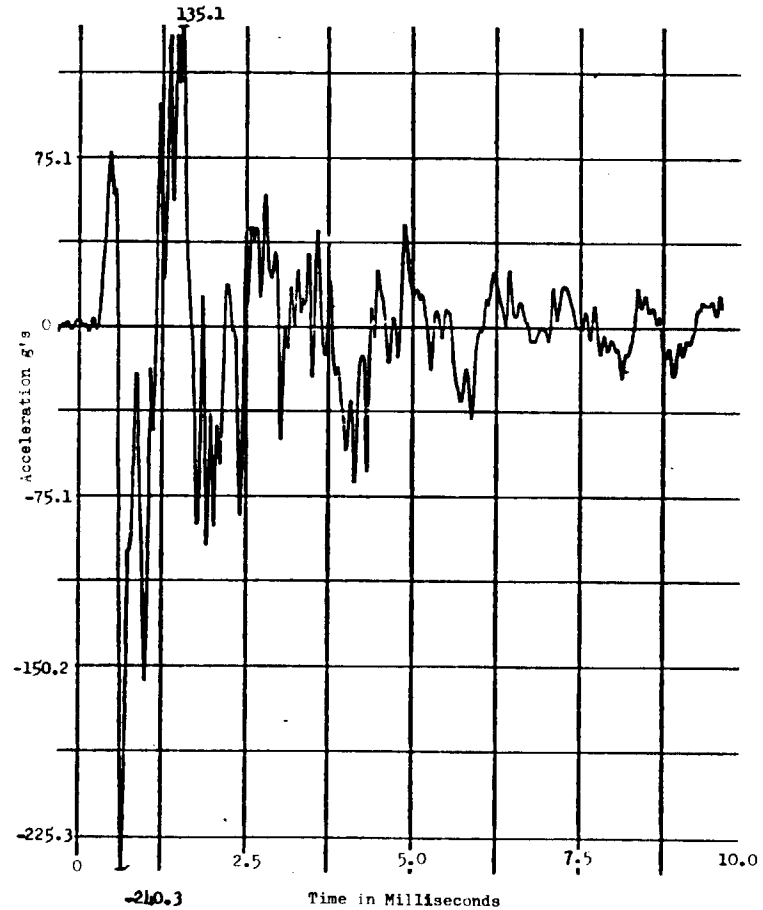
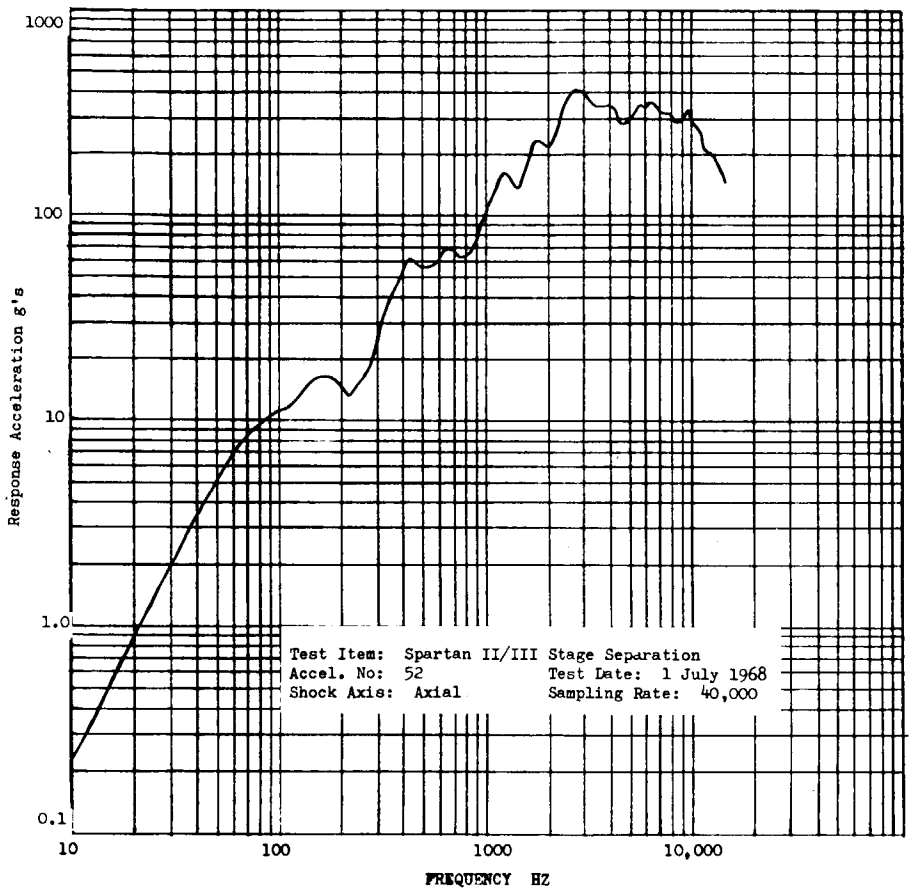


FIGURE I.A.3-53



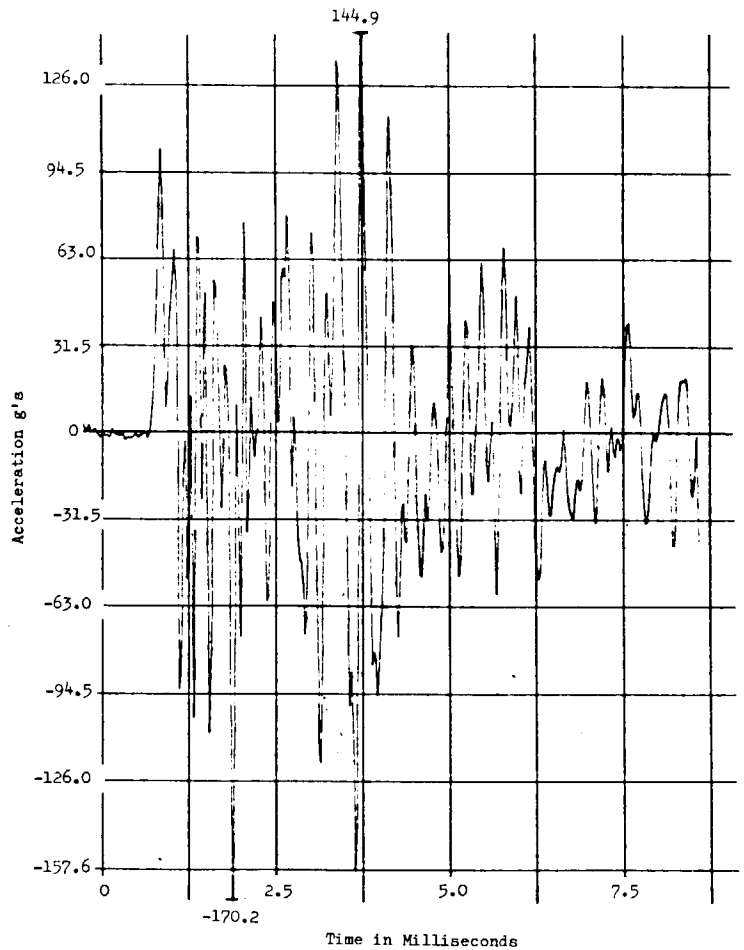
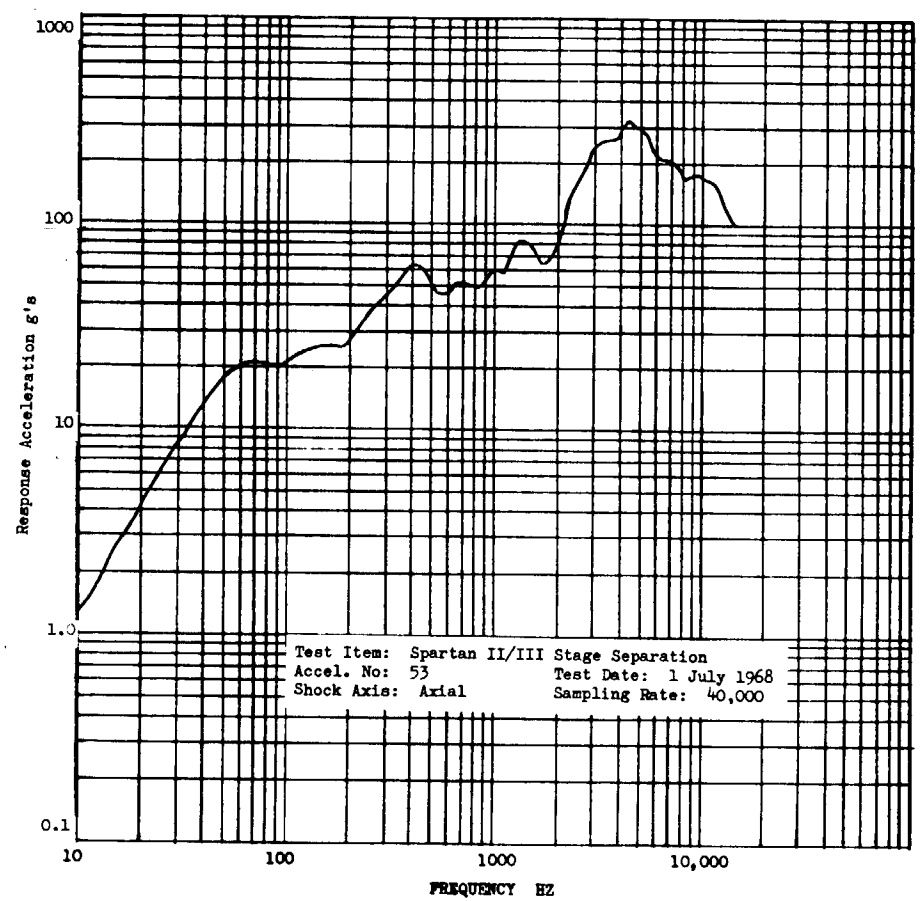


FIGURE I.A.3-54



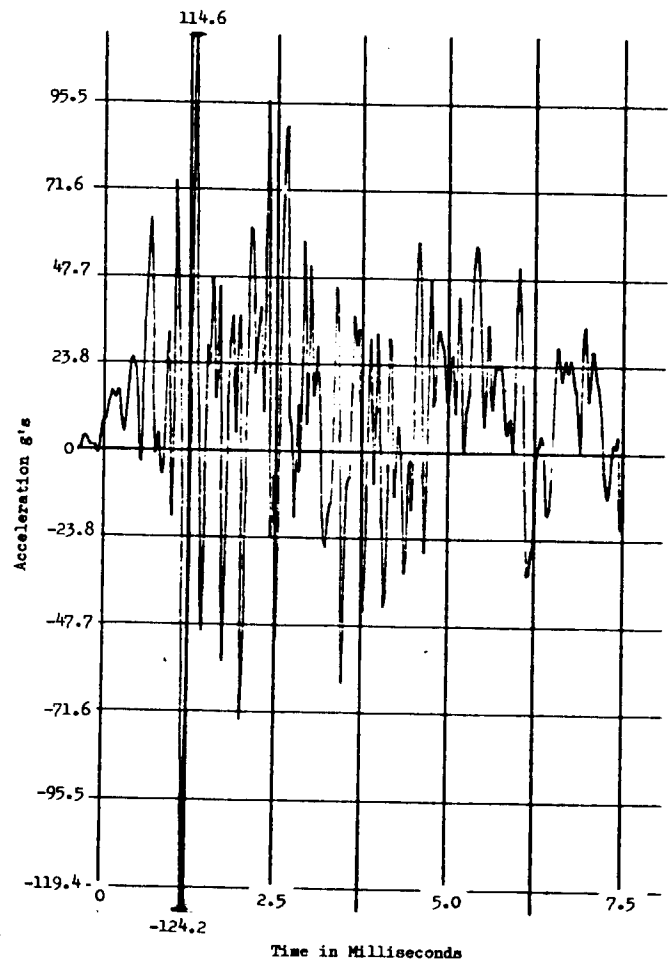
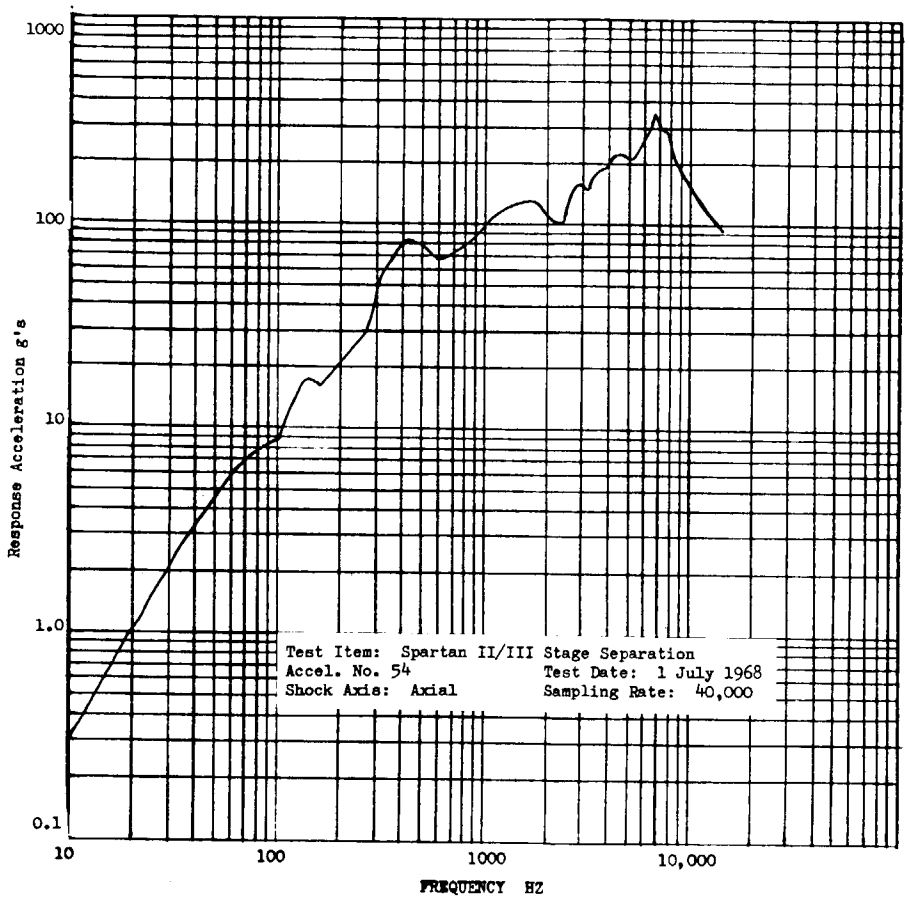


FIGURE 1.A.3-55



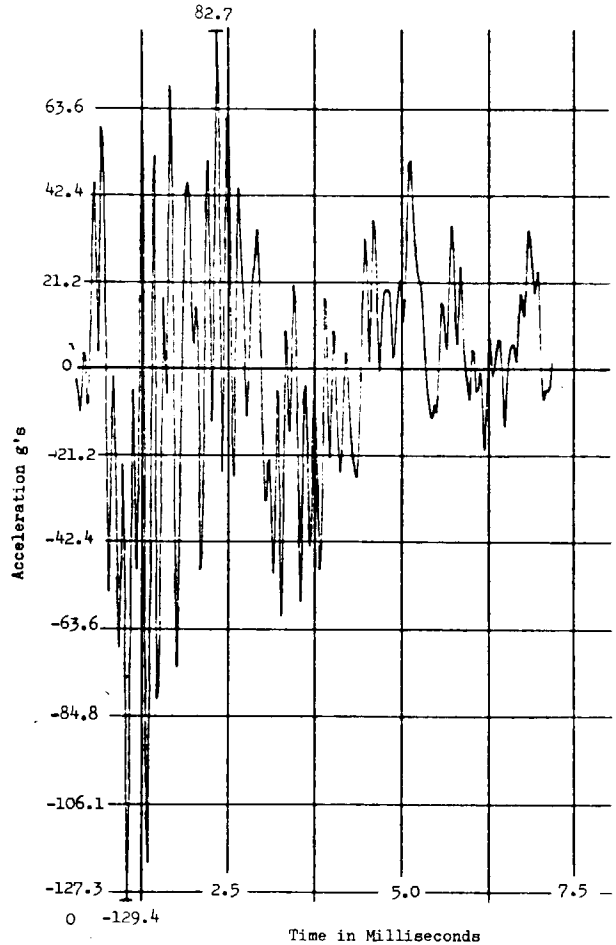
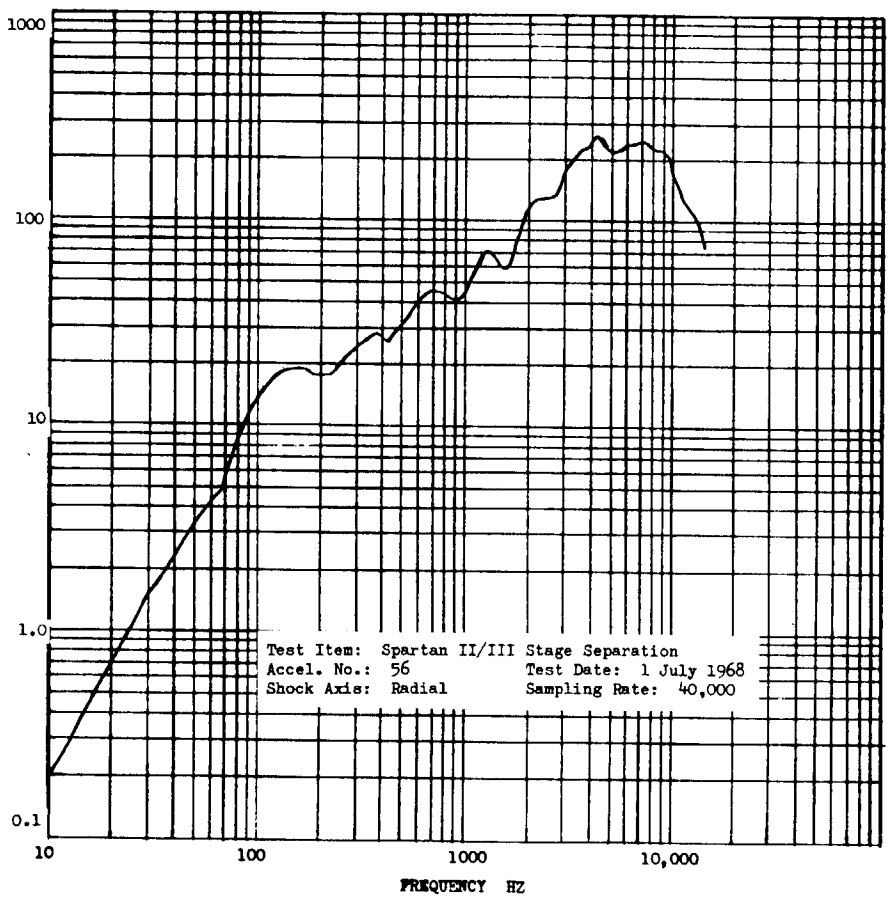


FIGURE 1.A.3-56



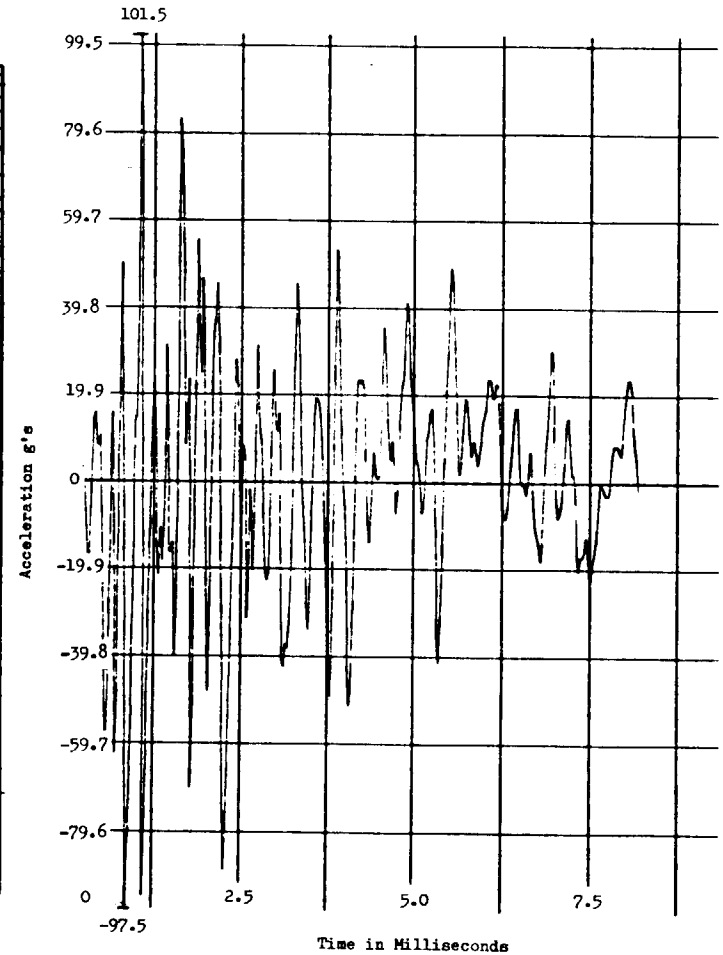
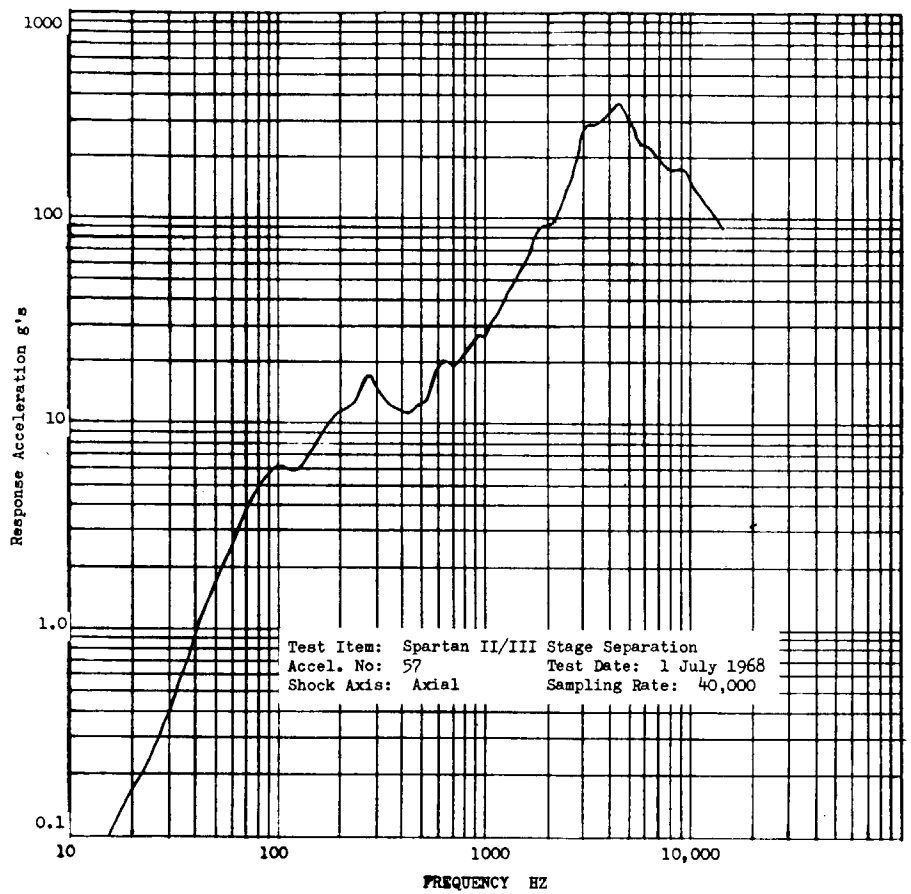


FIGURE I.A.3-57



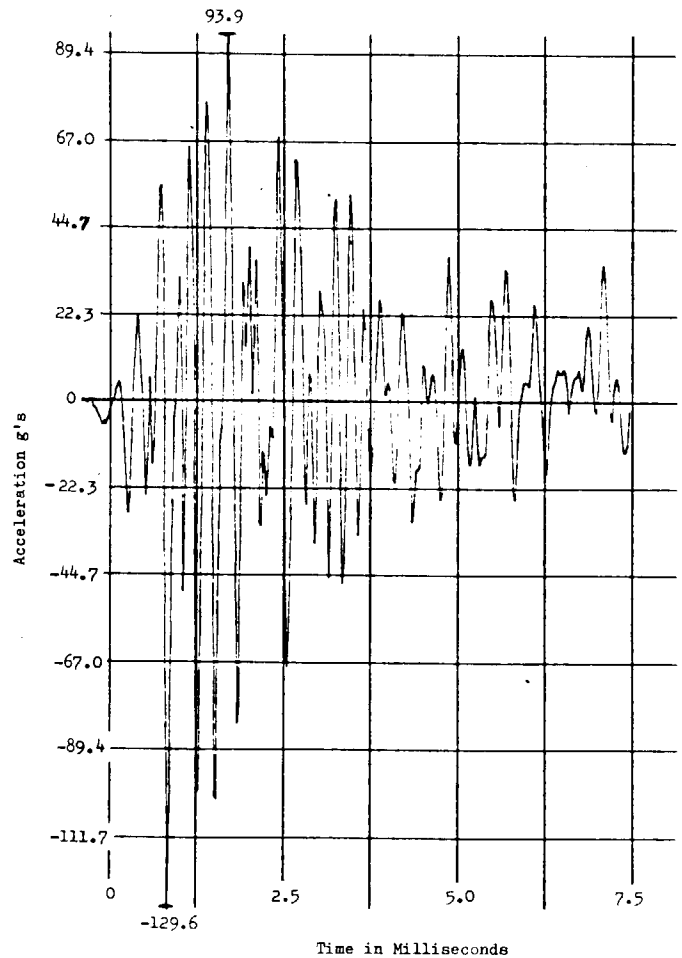
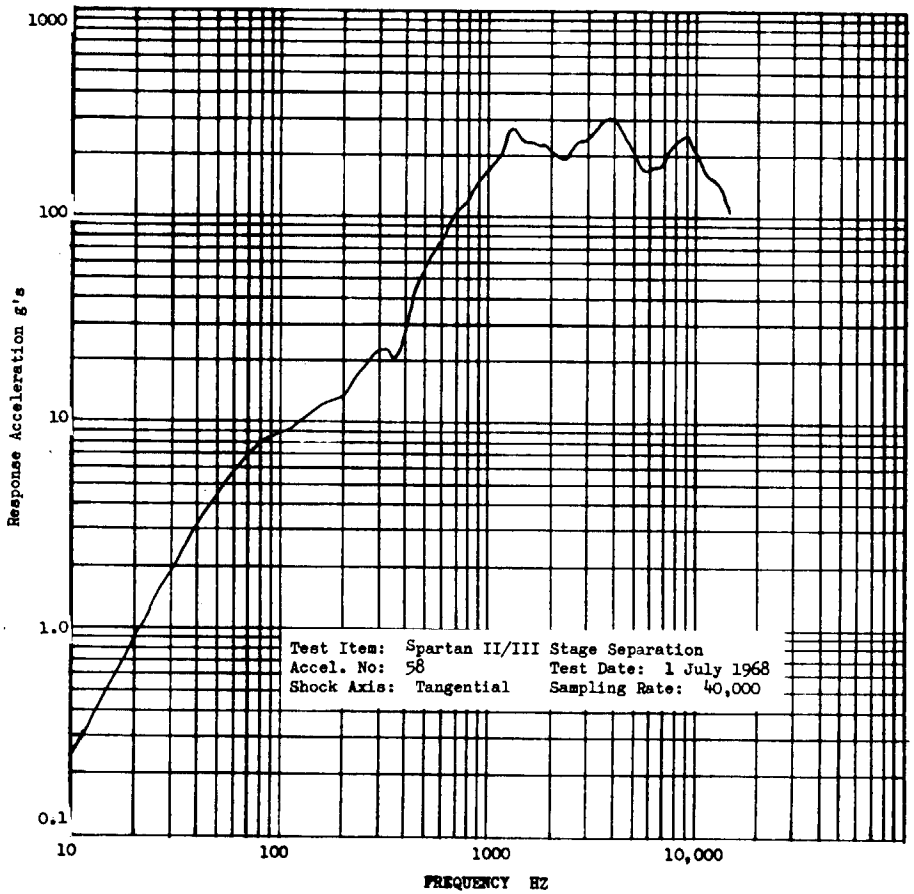


FIGURE I.A.3-58



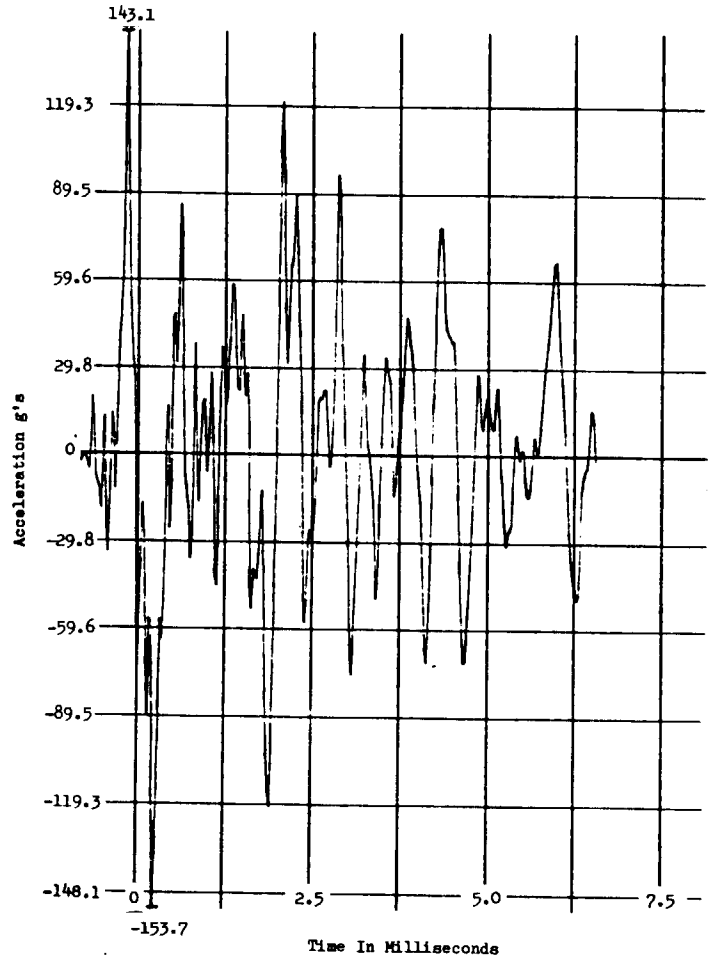
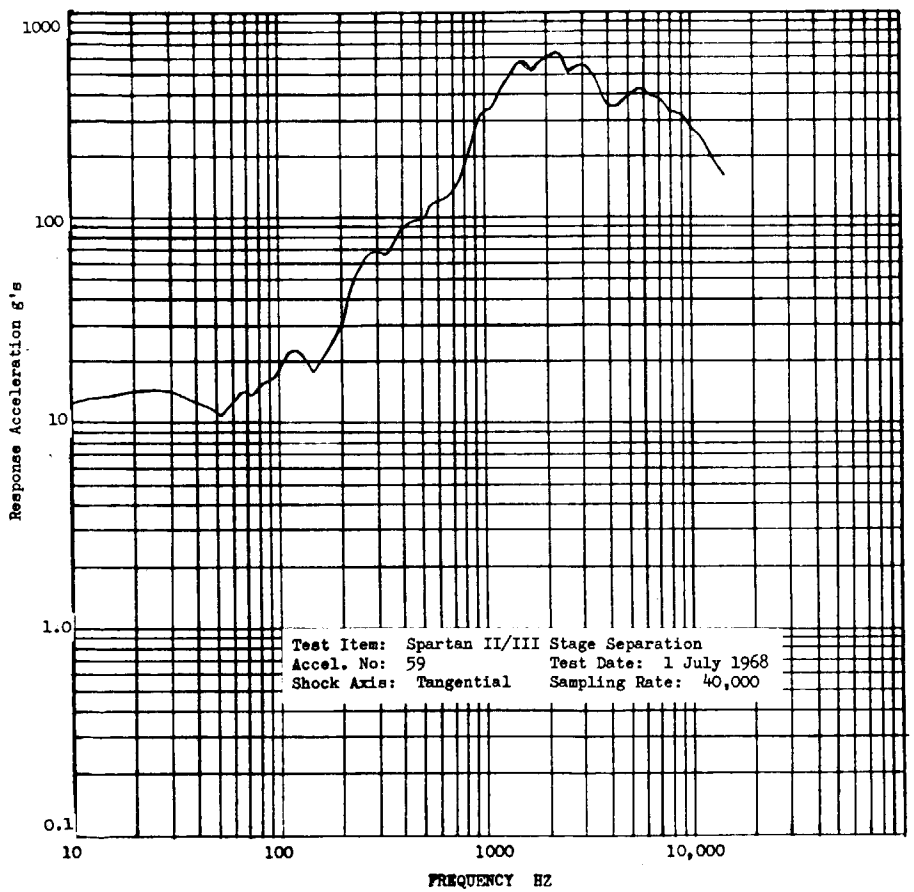


FIGURE I.A.3-59



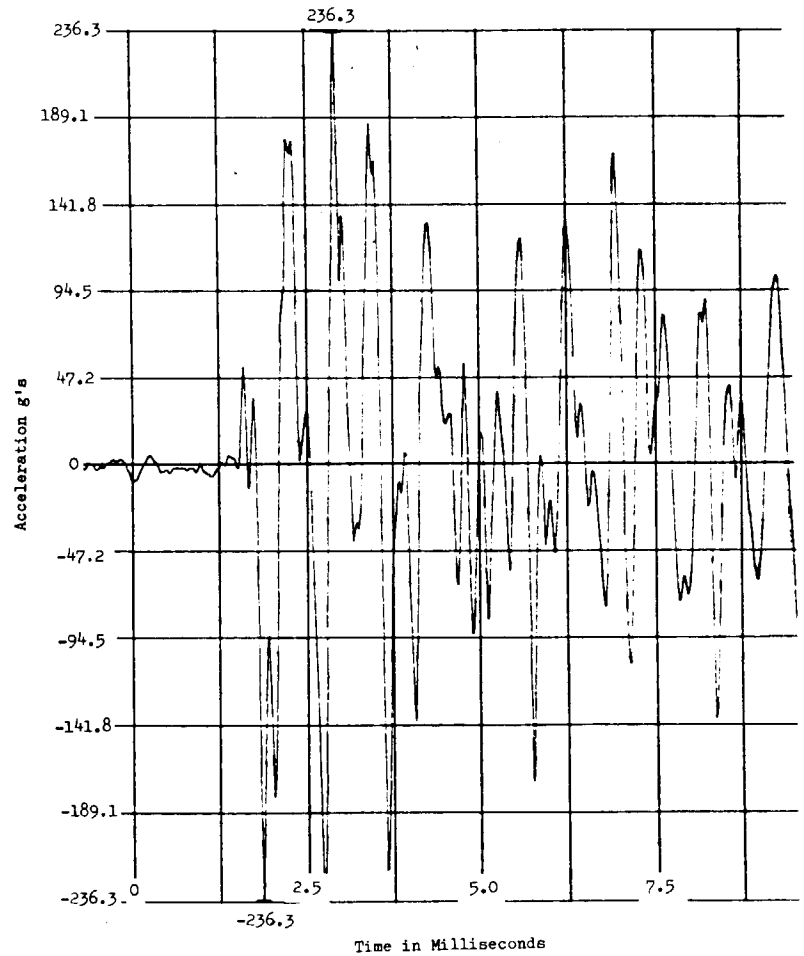
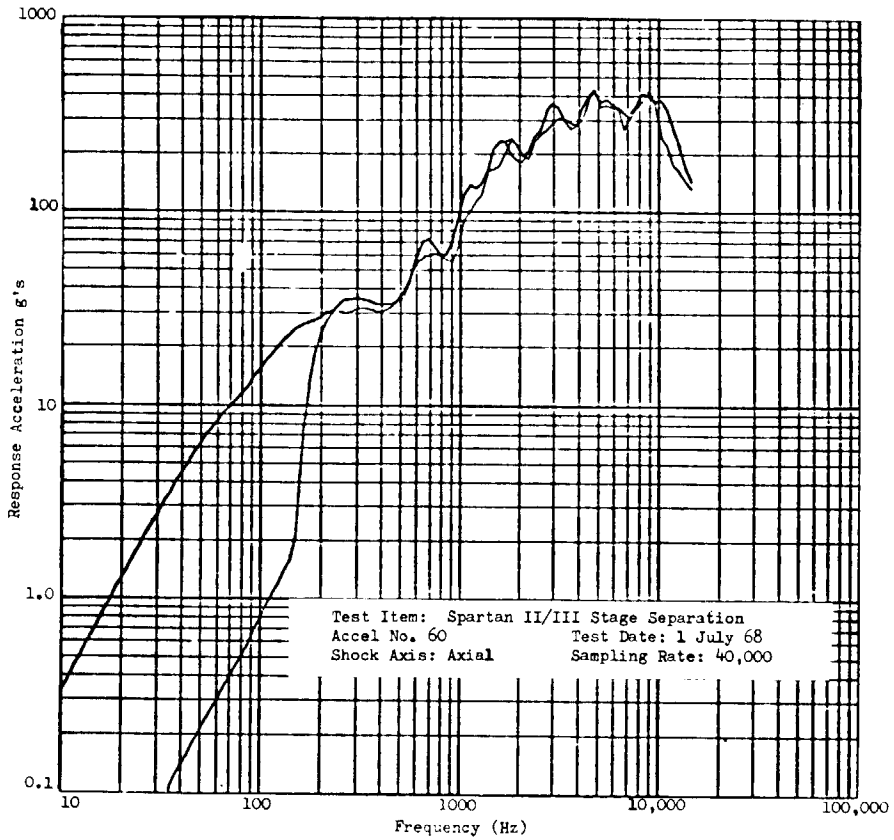


FIGURE 1.A.3-60



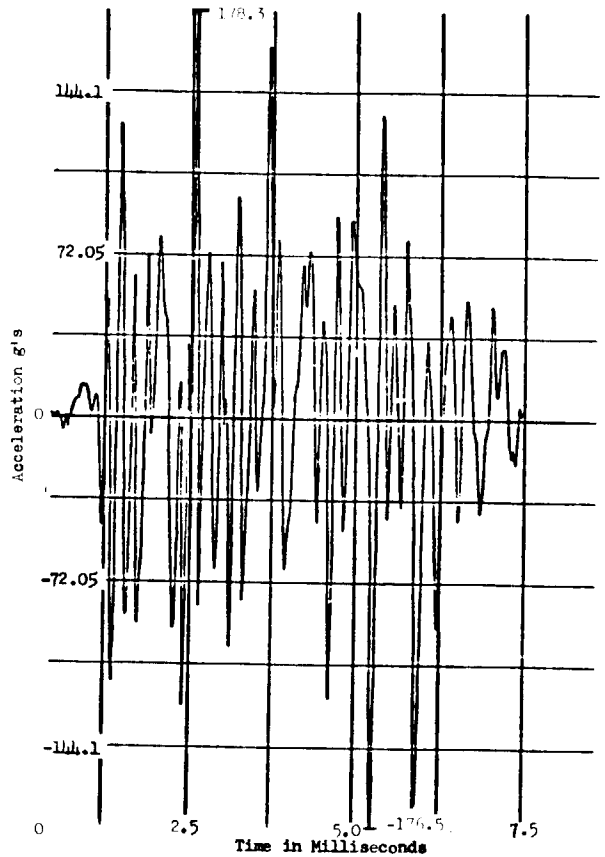


FIGURE I.A.3-61

SECTION I.A.4

MINUTEMAN III RE-ENTRY SYSTEMS SHOCK DETERMINATION TESTS

PURPOSE OF TESTS

The purpose of this test is to obtain shock data on MM III Re-entry Systems (R/S) configurations, C-2 and B-3, required to verify shock design criteria resulting from Stage III/Post Boost Vehicle (PBV) joint separation.

DESCRIPTION OF EVENTS

For the ground tests of the Minuteman III Stage III/PBV staging, the separation was affected using primachord at 12.5 grains per foot. Two very similar tests were conducted. The first test configuration included some dummy equipment items that were not present for the second test. (See Table I.A.4-1) Also, some of the accelerometer locations were unchanged to afford a measure of repeatability.

Both separation tests, C-2 and B-3, were conducted by suspending the test specimen horizontally with steel straps as shown in Figure I.A.4-1. After separation the adapter section simulating Stage III was disconnected and was forced to swing away from the PBV by a rope. The C-2 configuration used an adapter section weighing approximately 50 pounds while B-3 configuration utilized a 218 pound adapter section.

DESCRIPTION OF DATA

The description below is a composite summary of the data from both tests.

No. of time histories	94
No. of shock spectra	94
Type of analysis	analog (absolute response spectra)
Frequency range	to 5000 Hz
Frequency increments	5 points per octave
Damping	Q = 10

These shock spectra are presented with their corresponding time histories as Figures I.A.4-11 through I.A.4-57.

DESCRIPTION OF PYROTECHNIC

Type: primachord

Joint configuration: Figure I.A.4-2

Size of charge: 12.5 grains per foot

Explosive core: RDX

Location: Figure I.A.4-1

DESCRIPTION OF STRUCTURE

The test configuration consisted of basically skin-ring-frame structure with transducer locations at equipment mounting points primarily on lateral beams. A laterally oriented honeycomb rack was located near the aft end of the re-entry vehicle (R/V)

DESCRIPTION OF ACCELEROMETERS

Type: Endevco model 2225

Location: Table I.A.4-2 and Figures I.A.4-3 Through I.A.4-10

DESCRIPTION OF DATA ACQUISITION SYSTEM

Tape Recorder: Ampex FR 1300

Amplifiers: both voltage and charge type amplifiers flat to 10 K Hz and above

COMMENTS

One possible source of further information was contacted regarding these tests. However, due to the classified nature of the Minuteman III program no information beyond that presented above could be furnished. For this reason, the accelerometers depicted in Figure I.A.4-9 and I.A.4-10 are difficult to locate.

TABLE I.A.4-1. HARDWARE LIST

DESCRIPTION	B3 CONFIG.	C2 CONFIG.
Support Struct. Assy.	X	X
A&D Device*	X	X
Decoder*	X	X
Programmer R/S*	X	X
Support Struct. Frustum	X	X
Bulkhead Assembly	X	X
Roller Bracket	X	X
Roller	X	X
Supp. Fitt. Bush Assy.	X	X
Catcher Bracket	X	X
Bolt Zero Imp. Rel.	X	X
Nut Preload	X	X
Dispenser Dyn Mod* 1 Set	X	X
Decoy Plat. Instl.	-	X
Dummy Decoys* 1 Set	-	X
R/V Mod 6B Sim.* 1 Set	X	X
Power Distribution Mod*	-	X
P/A Programmer*	-	X
Settingmodule*	-	X

* Sumulated Components

TABLE I.A.4-2. MEASUREMENT LOCATIONS

STATION	R/S	LOCATION	R/S CONFIGURATION B3	R/S CONFIGURATION C2	FIGURE NO.s
1	AFT RING	145°	L,R	L,R	I.A.4-11,-12
2	AFT RING	235°	L,R,T	L	-12,-13
3	AFT RING	270°	L	L	-14
4	AFT RING	325°	L,R,T	L,R,T	-15,-16-17
5	BULKHEAD EDGE	270°	L,R,T		-15,-18
6	BULKHEAD EDGE	325°	L,R,T	L,R,T	-19,-20,-21
7	BULKHEAD CL	325°		L,P,Y	-22,-23
8	BALLAST NO. 1 @ CG ON EXTERNAL SURFACE AT ANY AZIMUTH		L,P,Y	L,P,Y	-24,-25,-26
9	BALLAST NO. 2 @ CG ON EXTERNAL SURFACE AT ANY AZIMUTH		L,P,Y		-23,-27
10	PEDESTAL BASE (BALLAST NO. 1)		3L	3L	-28,-29,-30
11	PEDESTAL BASE (BALLAST NO.2)		3L		-31,-32
12	DISP. NO. 2-SUPT. PT B-ON BLKHD.		L,P,Y	L,P,Y	-33,-34,-35
13	DISP. NO. 2-SUPT PT B-ON DNP.		L,P,Y		-32,-36
14	DISP, NO. 2-FWD END		L,P,Y		-37,-38
15	DISP. NO. 2-CENTER		L,P,Y	L,P,Y	-39,-40,-41
16	PLATFORM NO. 2-NEAR DECOY F			L,P,Y	-38,-42
17	PLATFORM NO. 2-NEAR DECOY H			L,P,Y	-43,-44
18	DECOY F @ CG ON EXTERNAL SURFACE AT ANY AZIMUTH			L,P,Y	
19	DECOY H @ CG ON EXTERNAL SURFACE			L,P,Y	
20	DEVICE		L,R,T	L	-44,-45,-46
21	DECODER		L,P,Y	L	-47,-48
22	R/S PROG.		L,P,Y	L,P,Y	-48,-49
23	P/A SETTING MOD			L,P,Y	-50,-51
24	PWR. DISP, MOD			L,P,Y	-51,-52
25	P/A PROG.			L,P,Y	-53,-54
26	DISP. NO. 2-SUPT. PT. A ON DISP.		L		-54

TABLE I.A.4-2 (CONTINUED)

STATION	R/S	LOCATION	R/S CONFIGURATION B3	R/S CONFIGURATION C2	FIGURE NO.s
27	DISP. NO. 2-SUPT. PT. C ON DISP.		L		I.A.4-55
28	DISP. NO. 2-SUPT. PT. D ON DISP.		L		-55
	PBCS				
29	CD2-3 (SKIN AT APPROX. 0°)		L,R	L,R	-56
30	CD2-4 (SKIN AT APPROX. 260°)		L,R	L,R	
31			L,T		-57

L - Longitudinal Direction
P - Pitch Direction (90° - 270°)
Y - Yaw Direction (0° - 180°)
R - Radial
T - Tangential

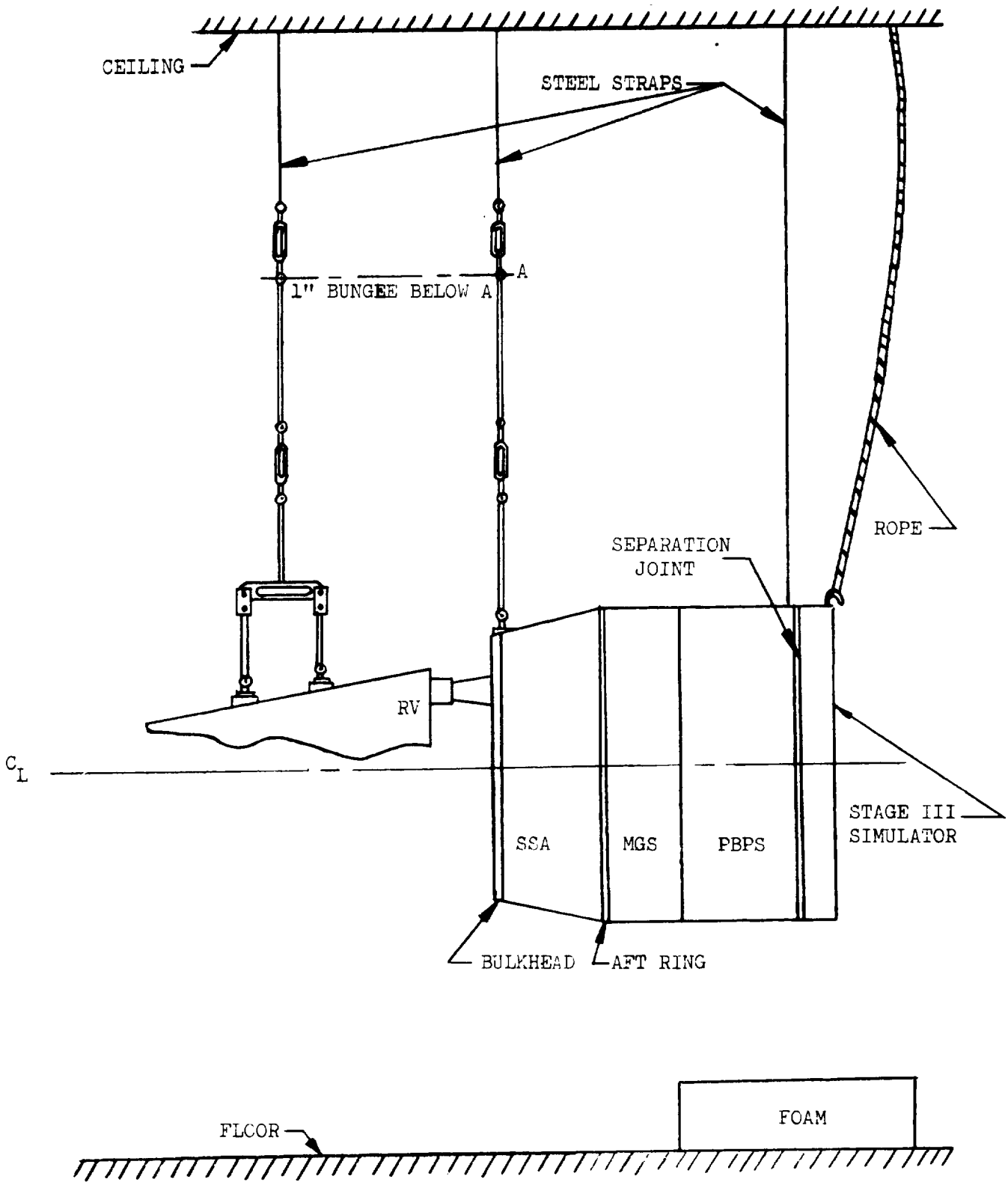


FIGURE I.A.4-1. TEST CONFIGURATION

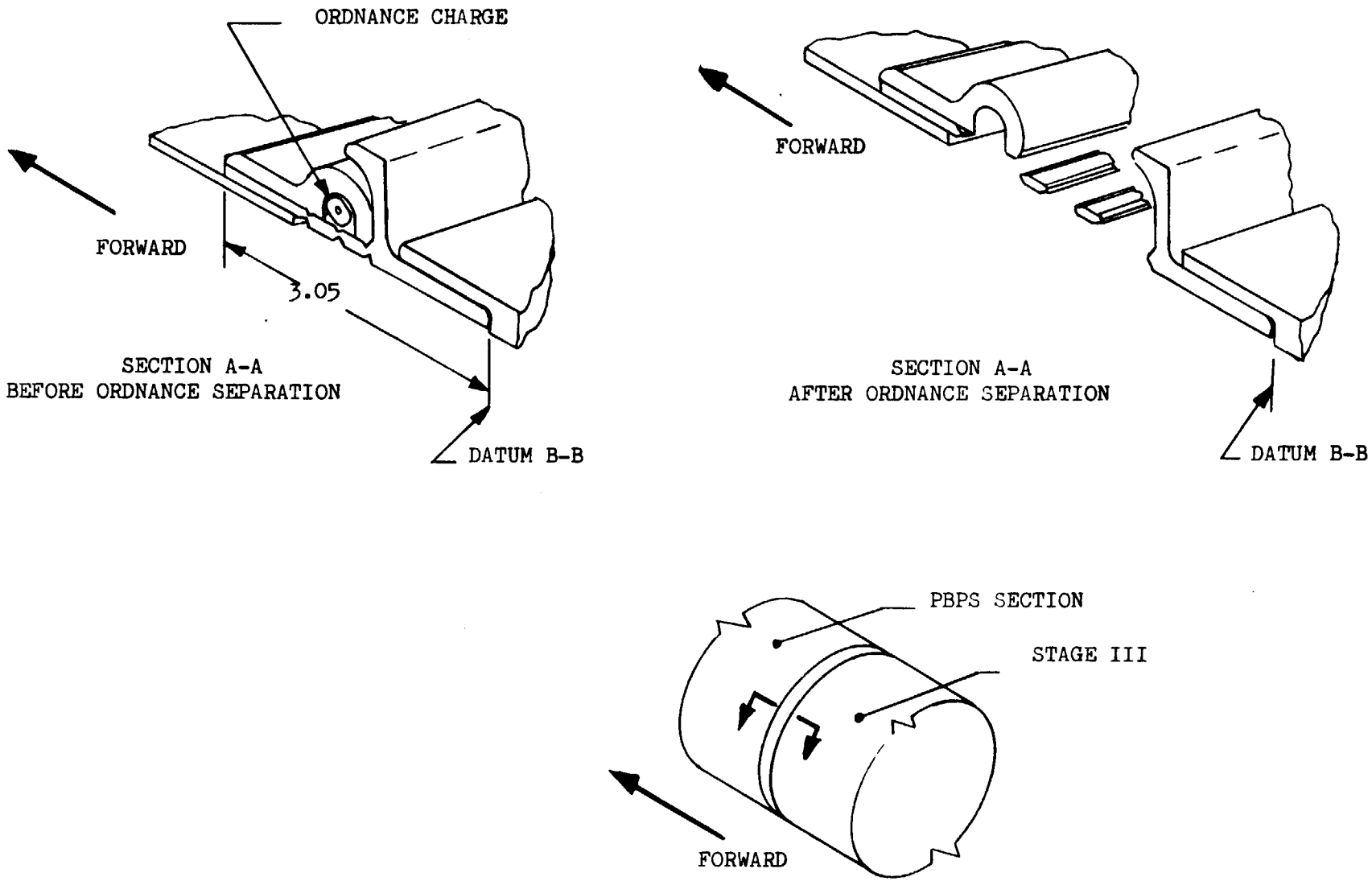


FIGURE I.A.4-2. SCHEMATIC DIAGRAM OF STAGE III/PBV SEPARATION JOINT

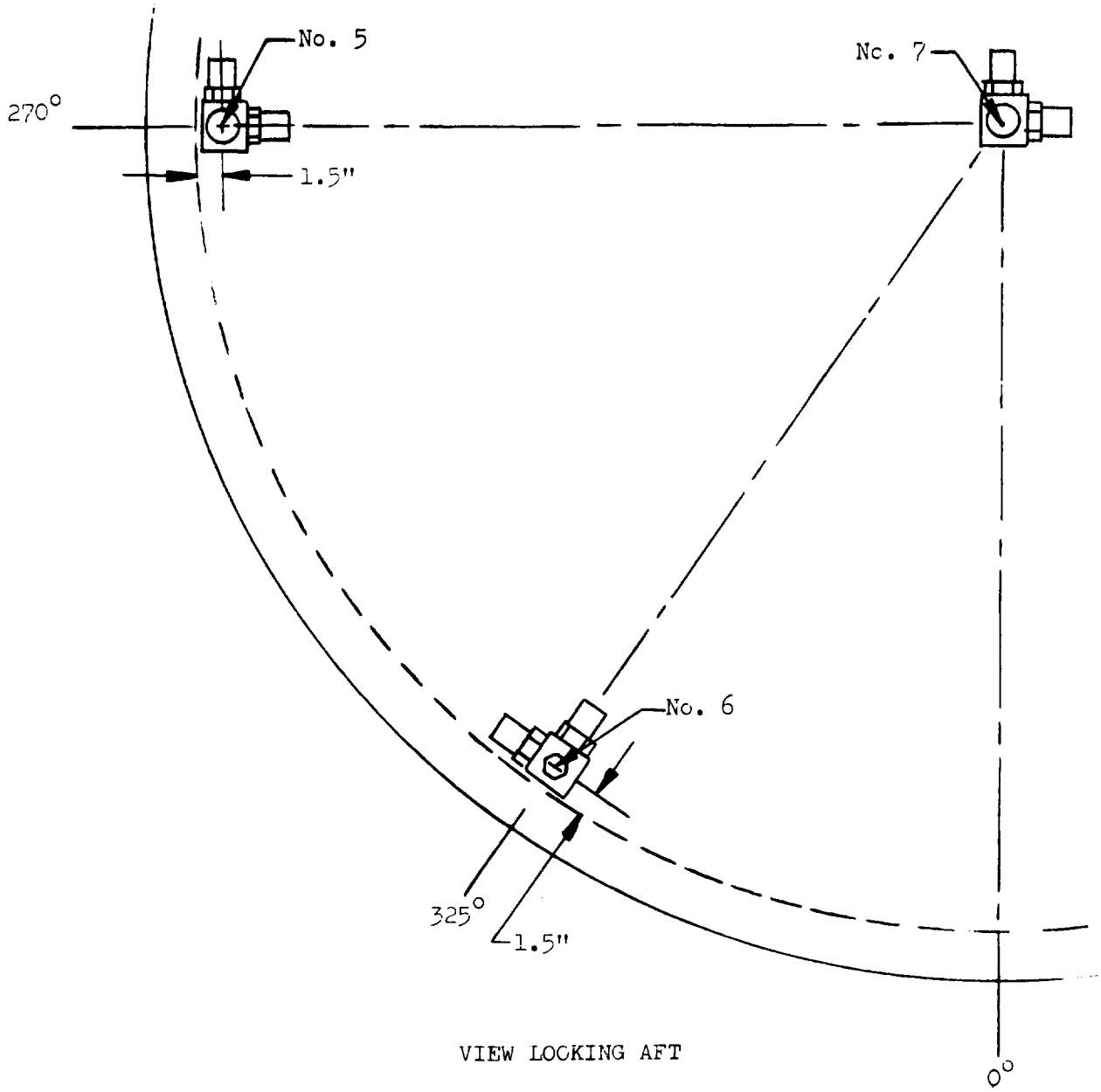


Figure I.A.4-3. Accelerometer Locations on Bulkhead - Topside

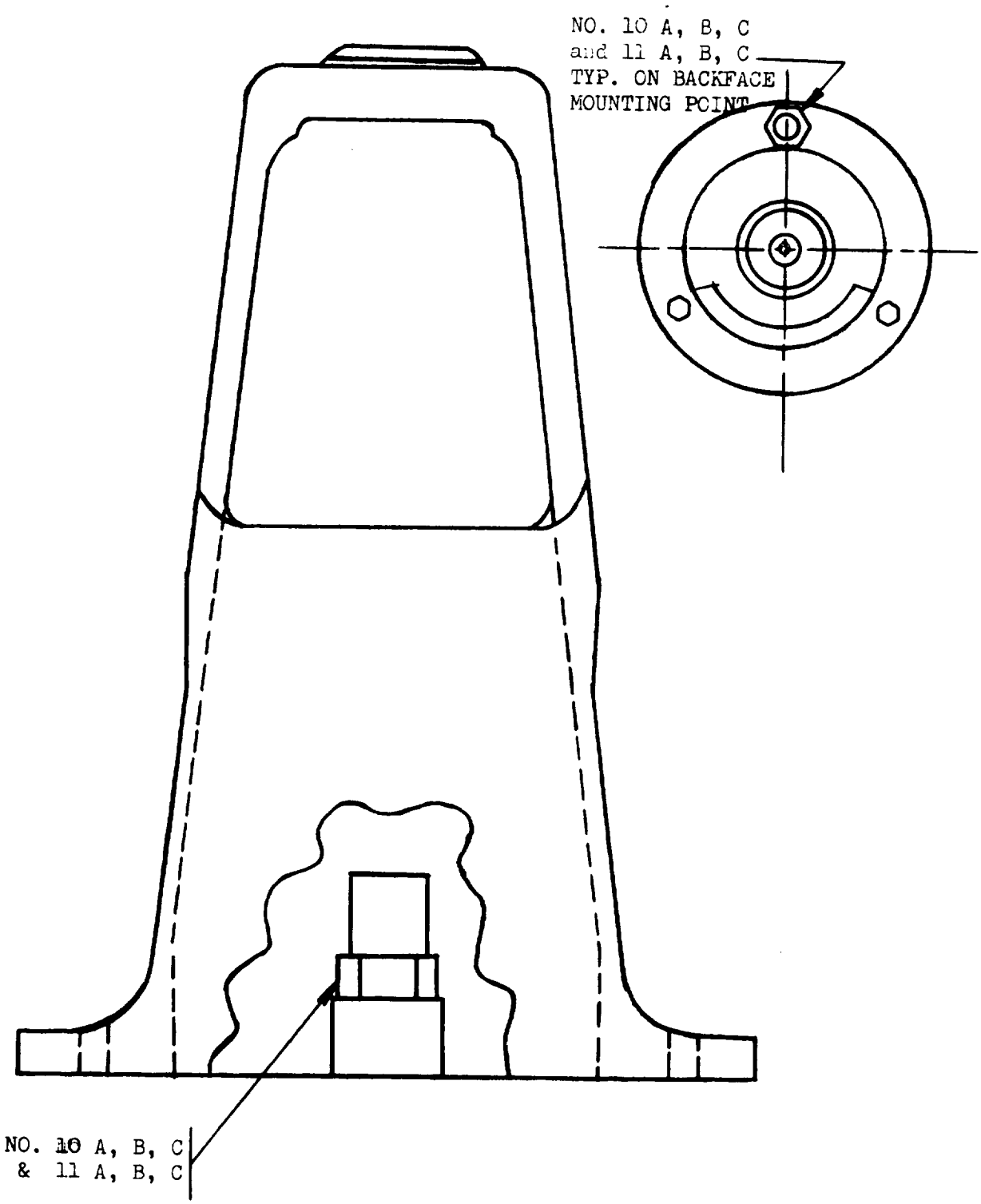


Figure I.A.4-4. Accelerometer Locations on Pedestal
(Pedestal mounted to topside of Bulkhead)

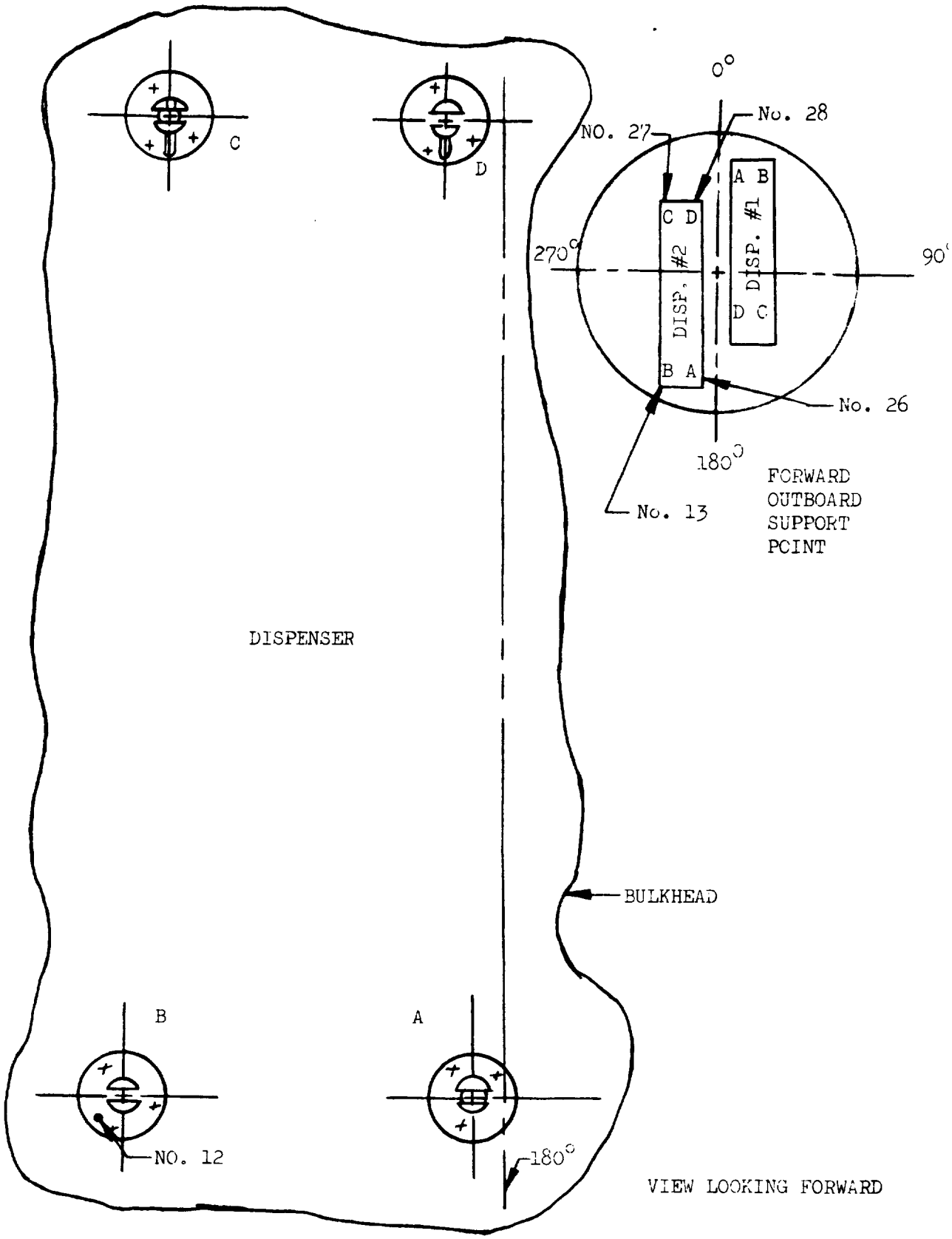
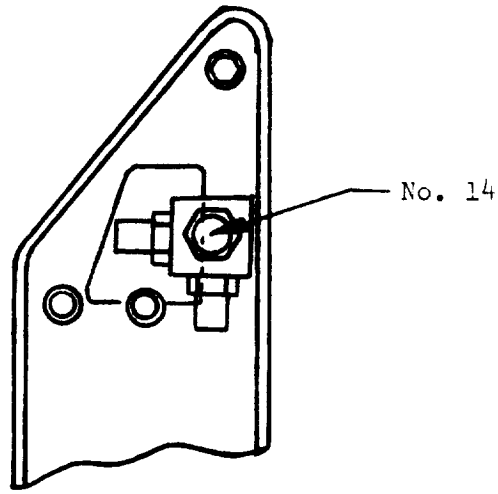
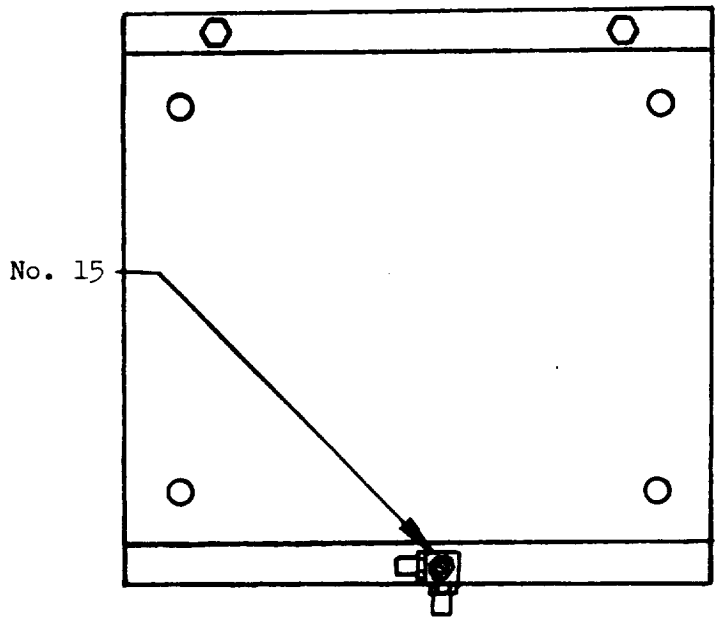


Figure I.A.4-5. Accelerometer Locations on Bulkhead - Aft Side

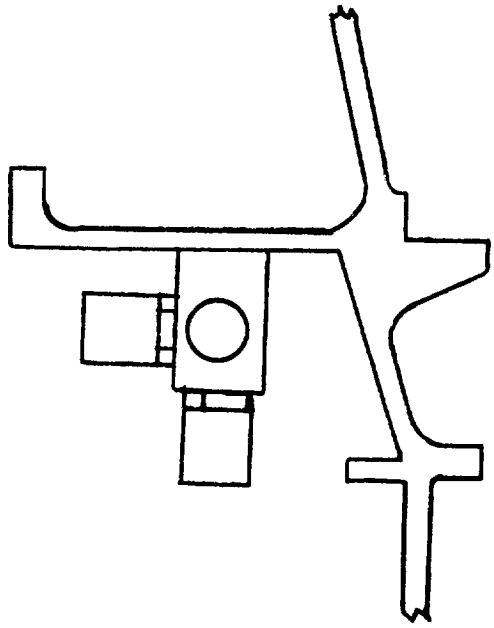


HEAD END OF DISPENSER



CONTROLLER

Figure I.A.4-6. Accelerometer Locations on Dispenser



TYPICAL FOR NO. 1, 2, 3, and 4

Figure I.A.4-7. Accelerometer Locations on Aft Ring

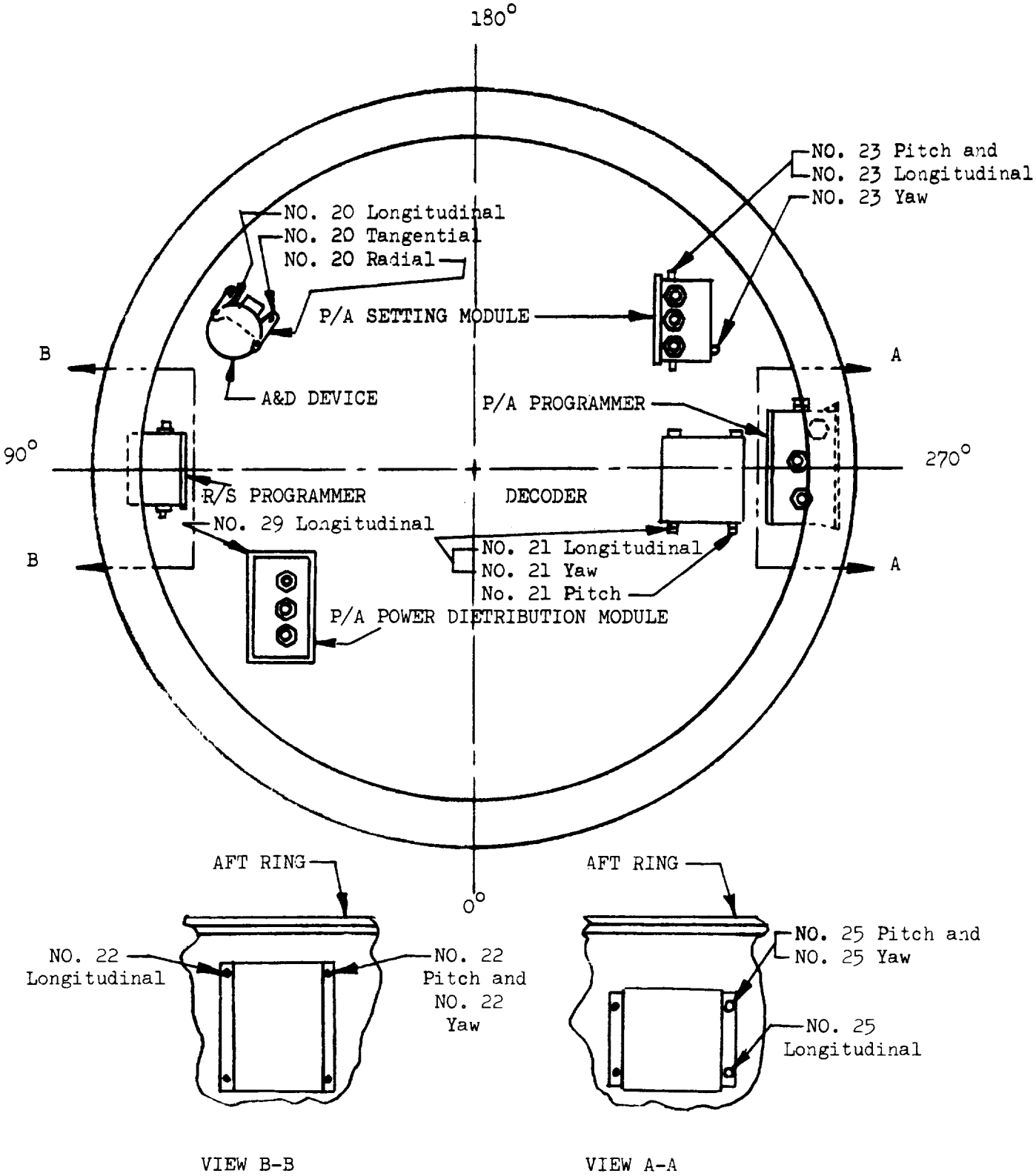
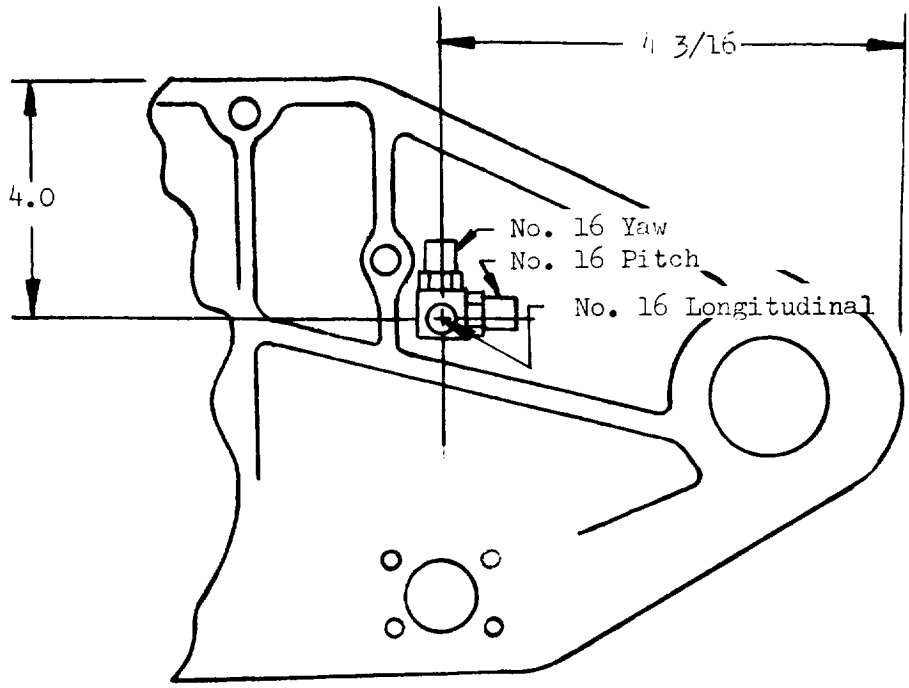


Figure I.A.4-8. Accelerometer Locations on Components in MGS Section



VIEW LOOKING FORWARD

Figure I.A.4-9. Accelerometer Locations on Platform

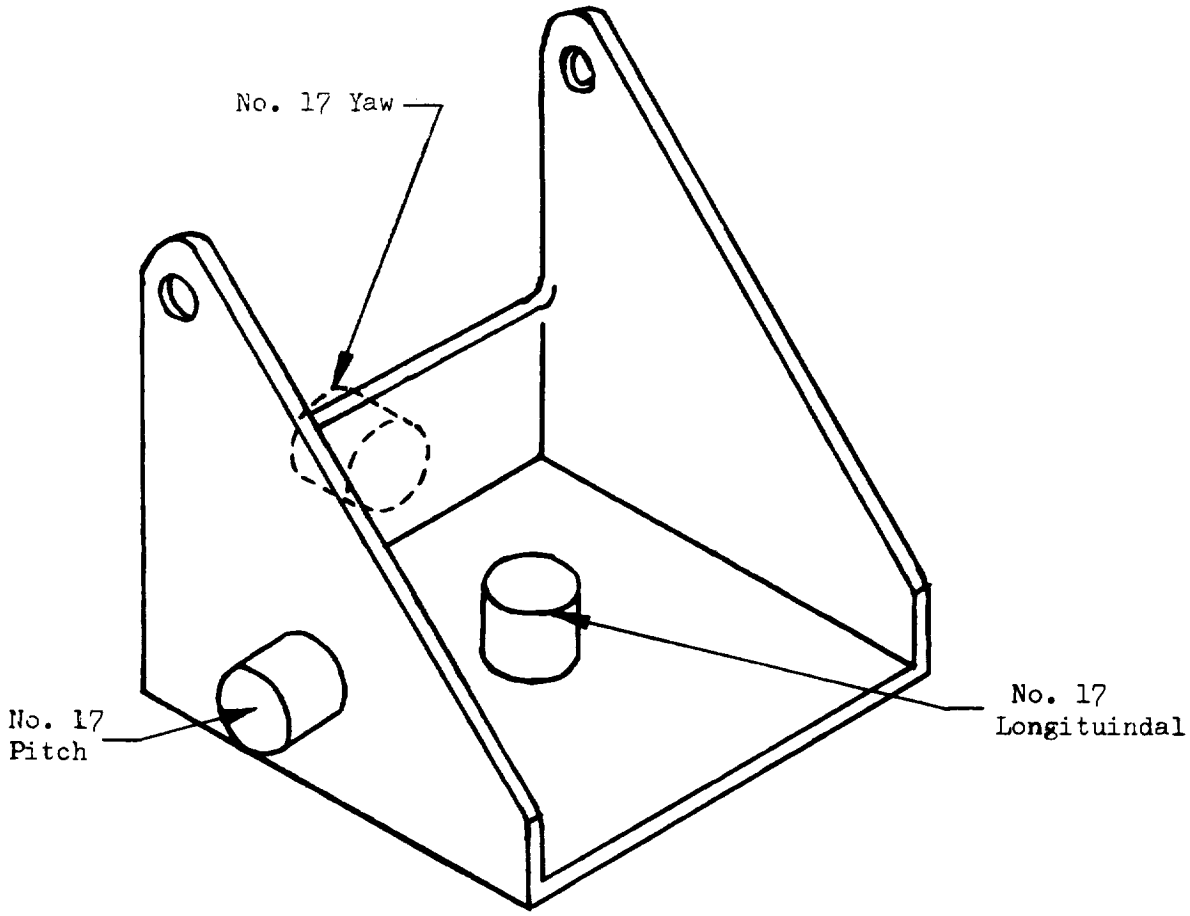
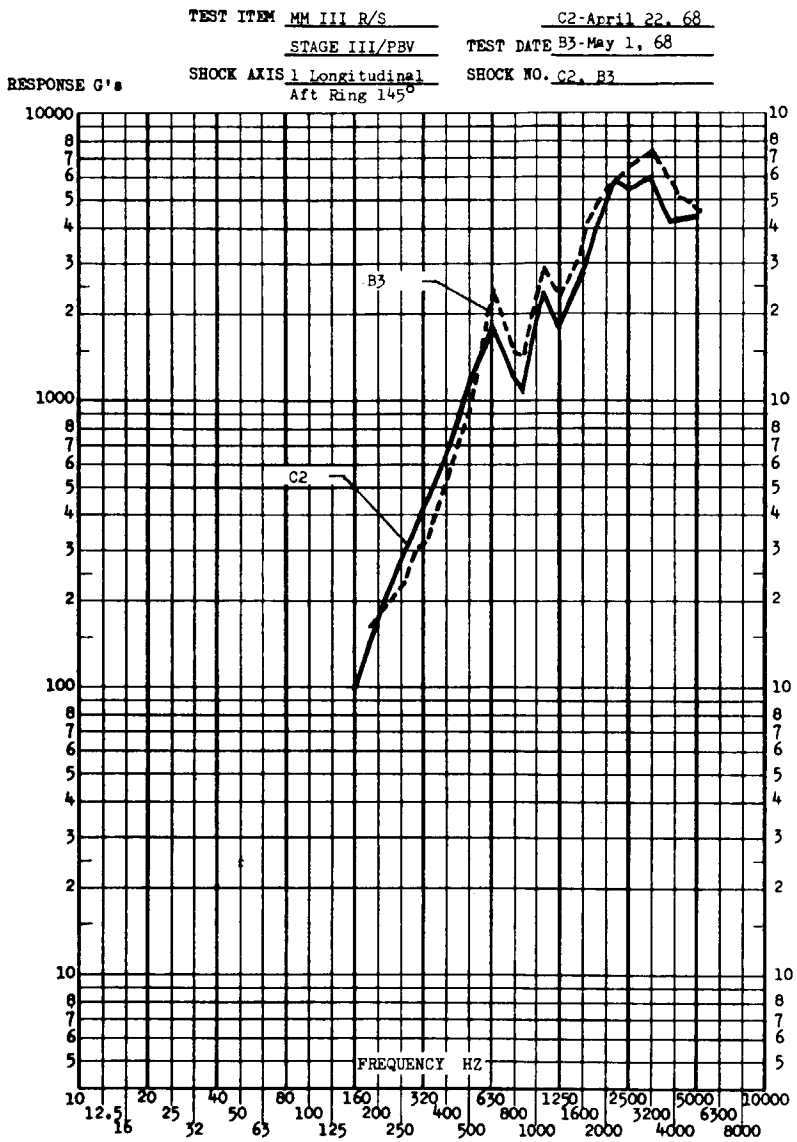
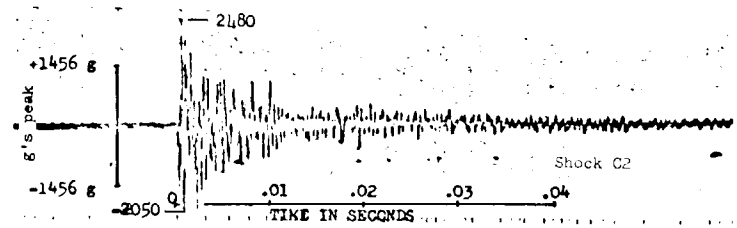


Figure I.A.4-10. Accelerometer Locations on Decoy Bracket





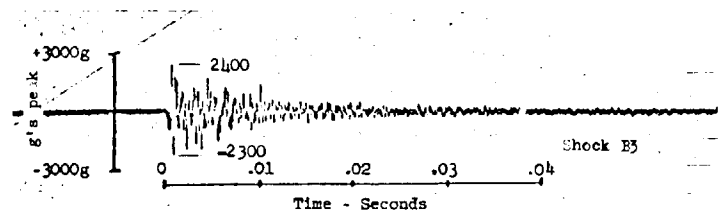
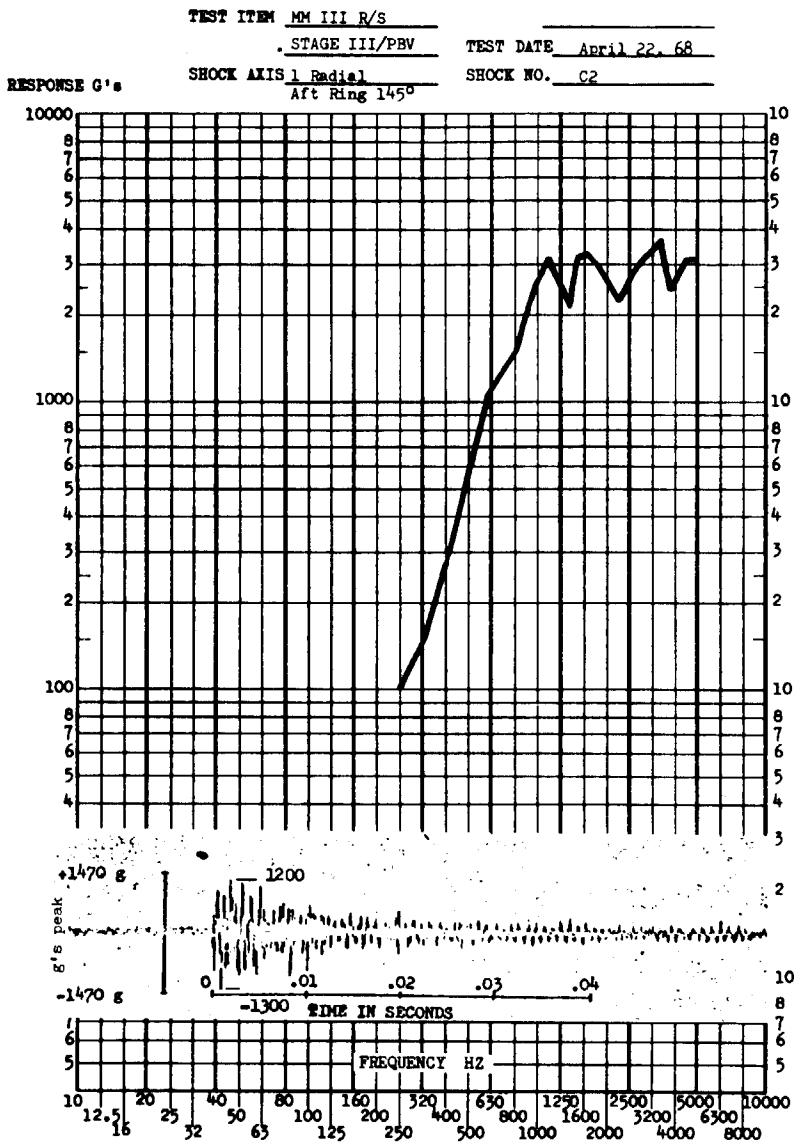


FIGURE I.A.4-11



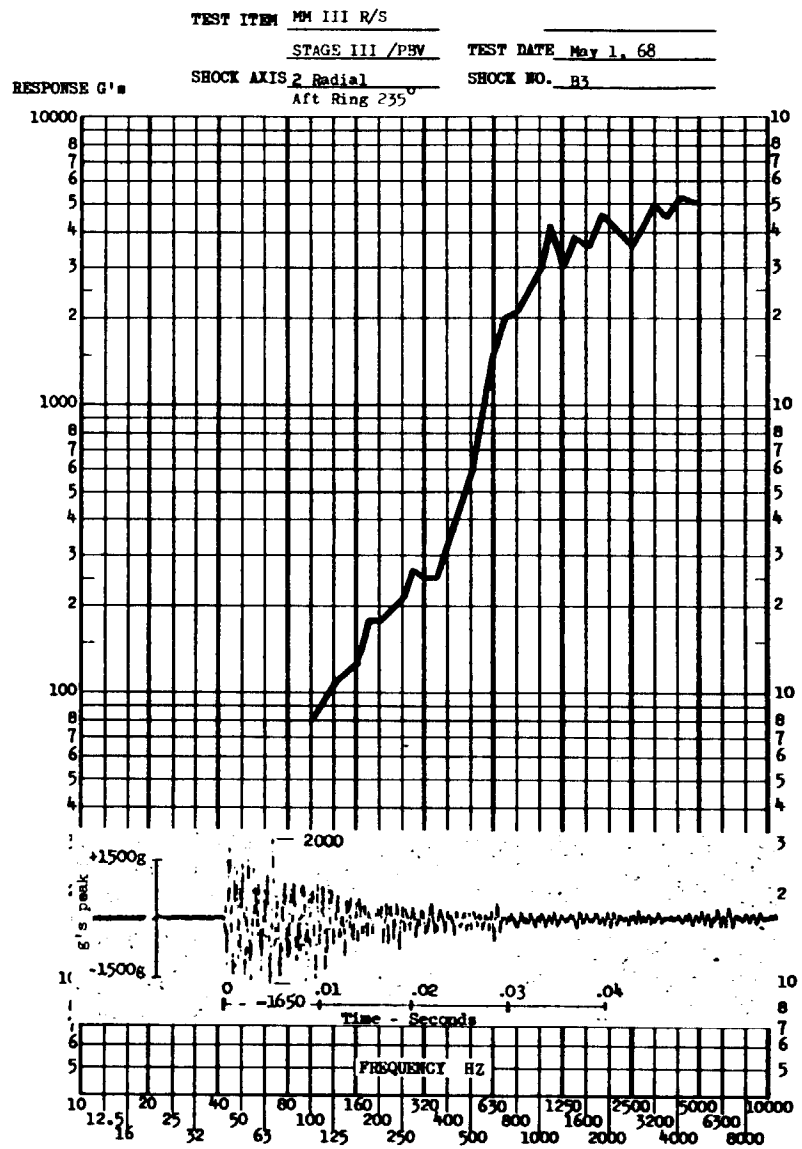
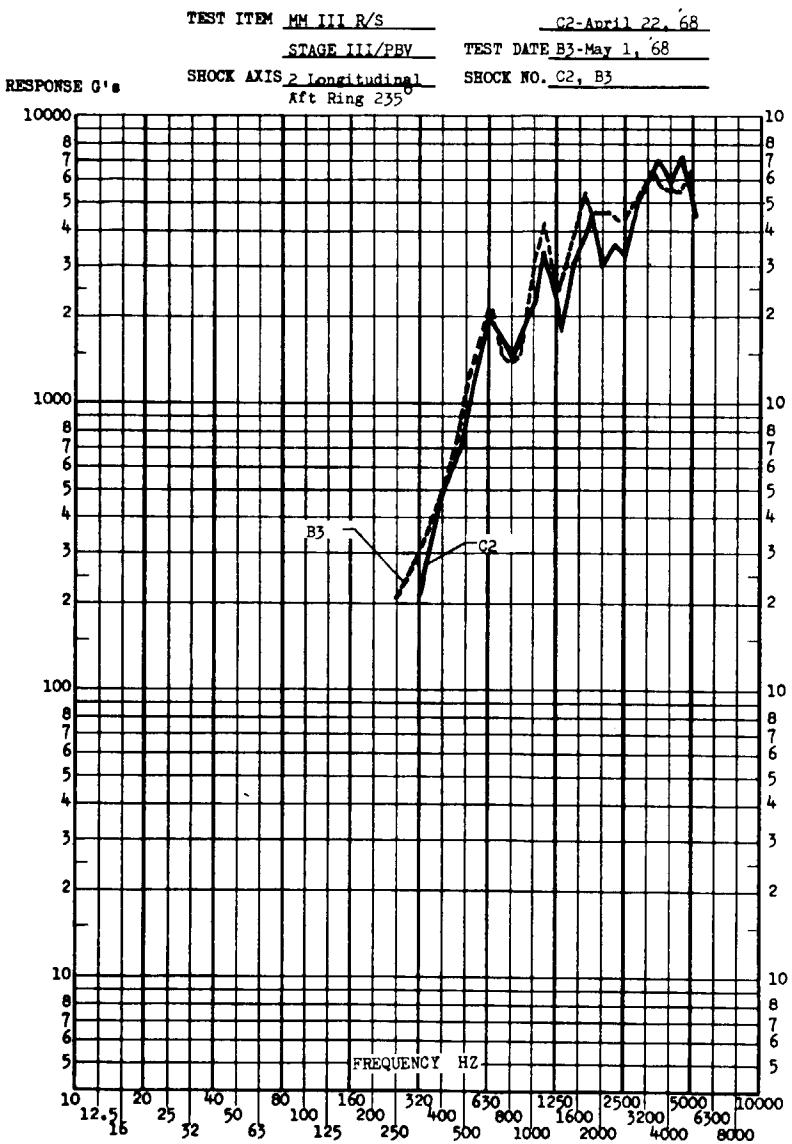
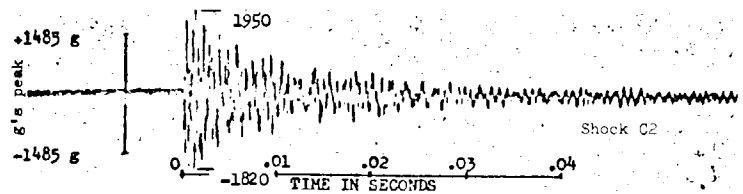


FIGURE I.A.4-12





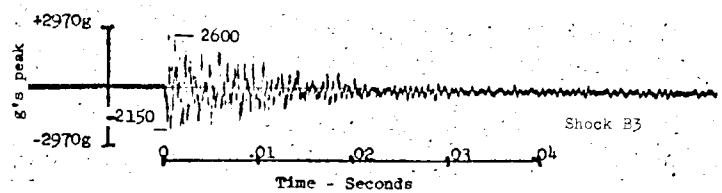
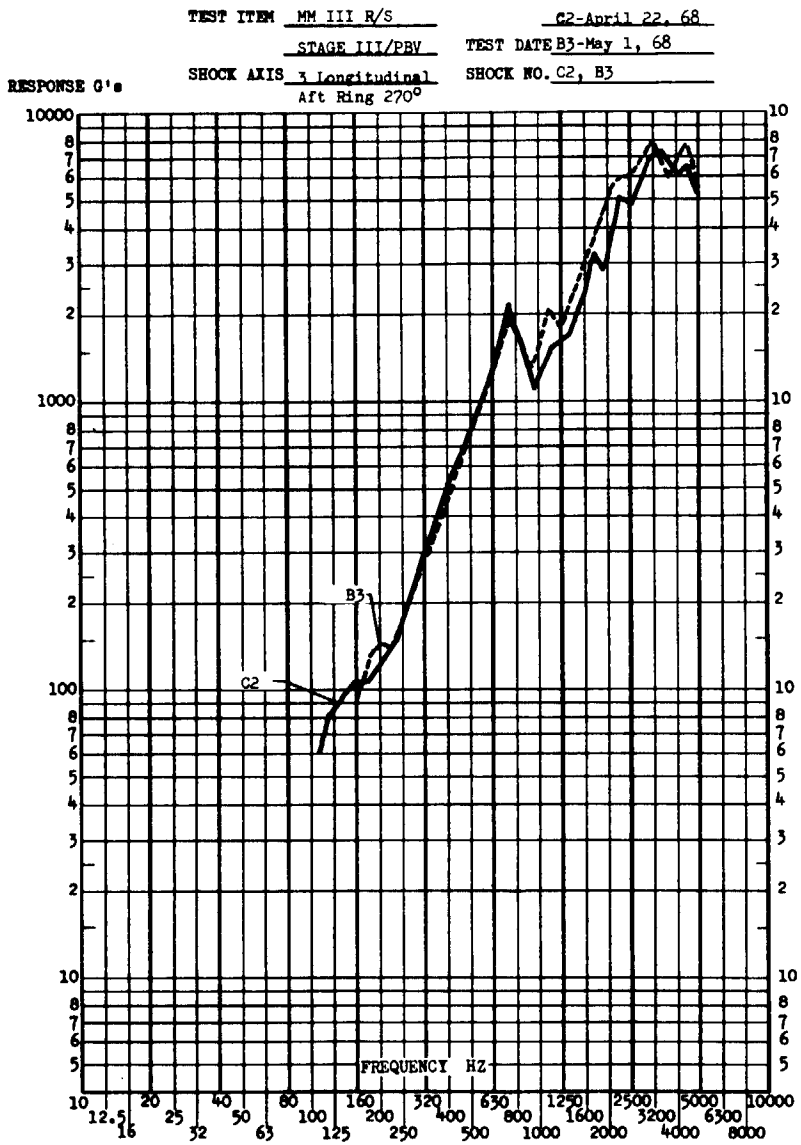
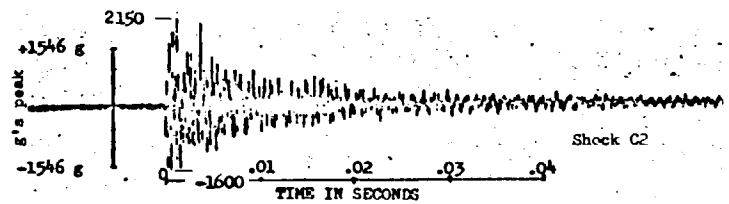


FIGURE I.A.4-13





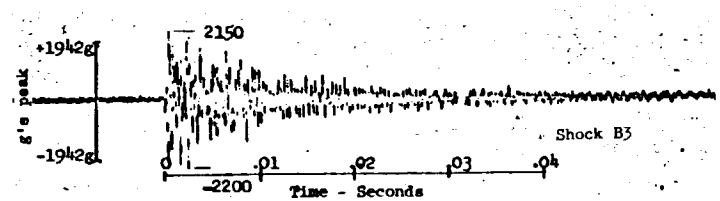
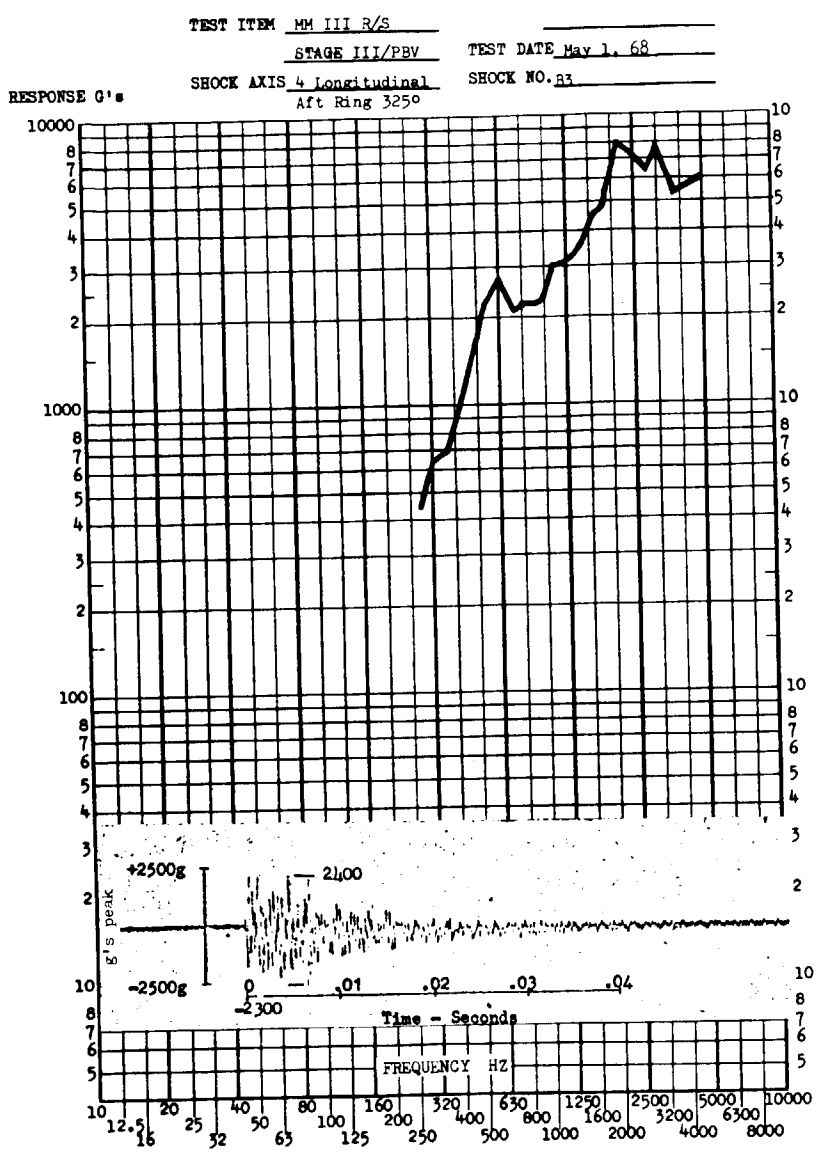


FIGURE I.A.4-14



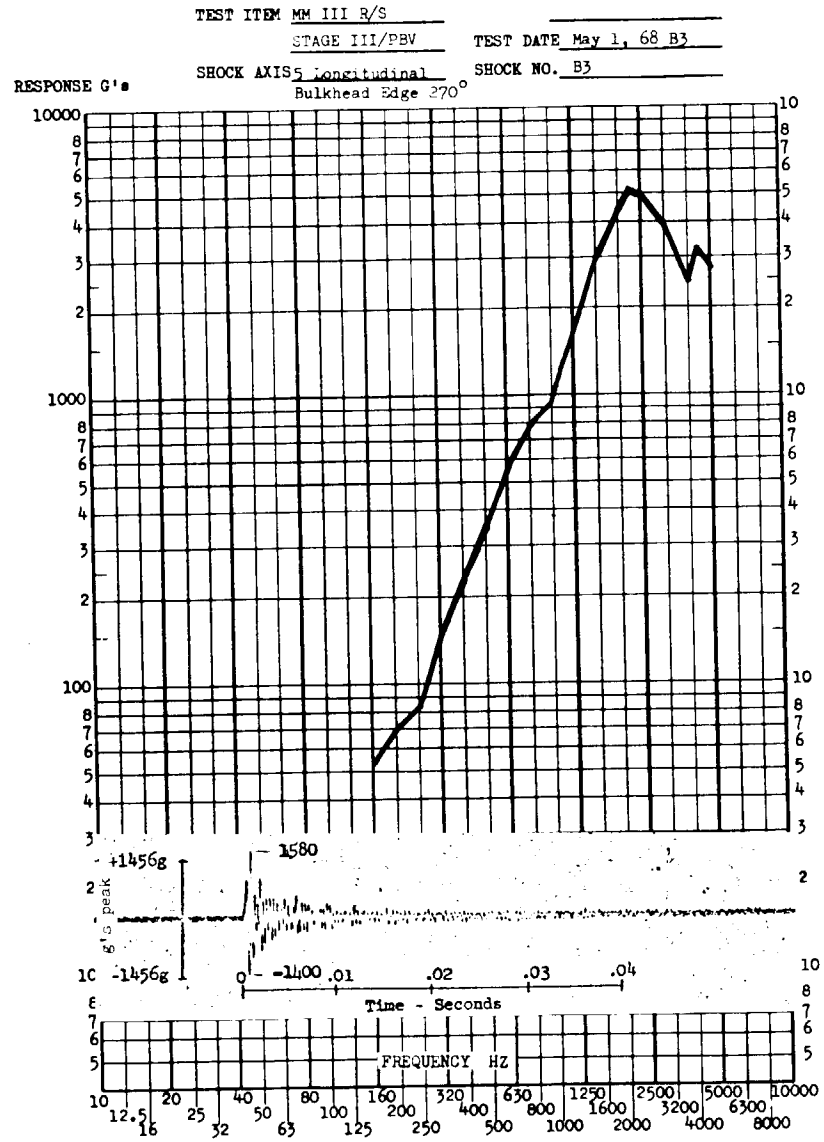
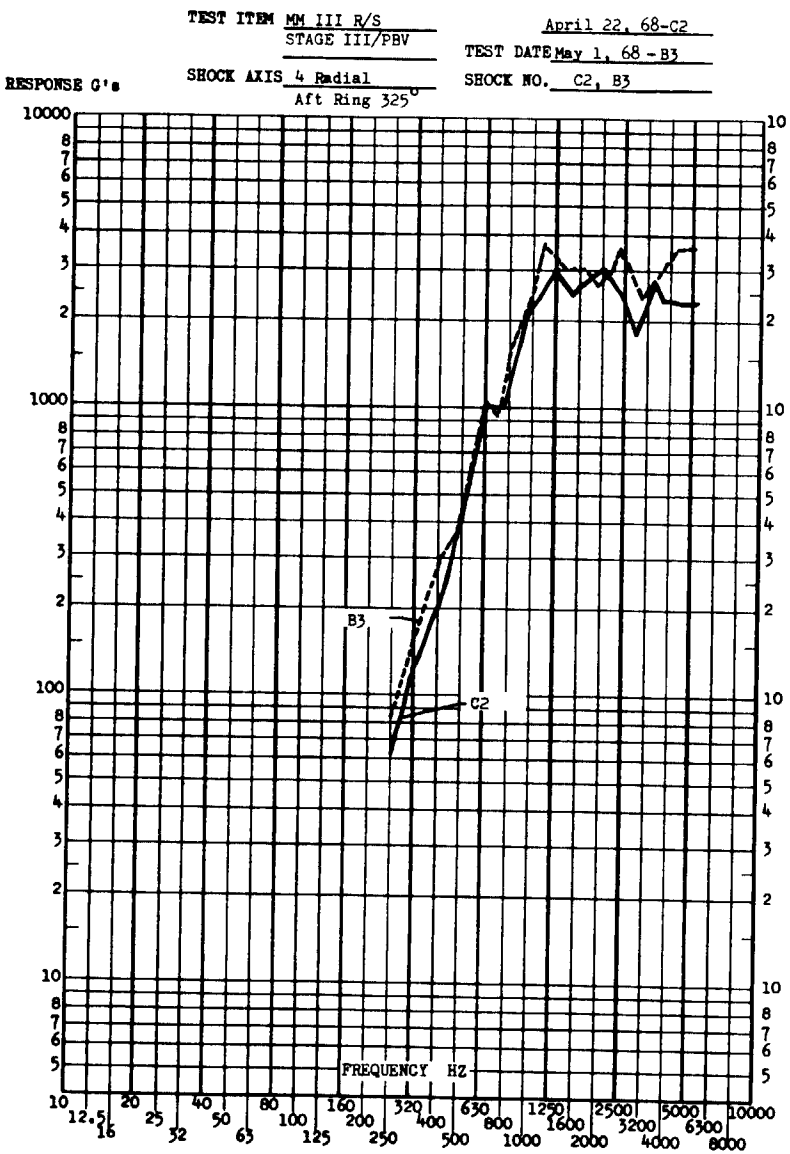
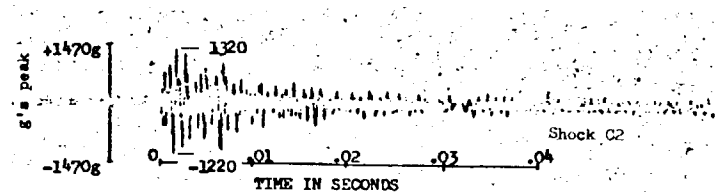


FIGURE I.A.4-15





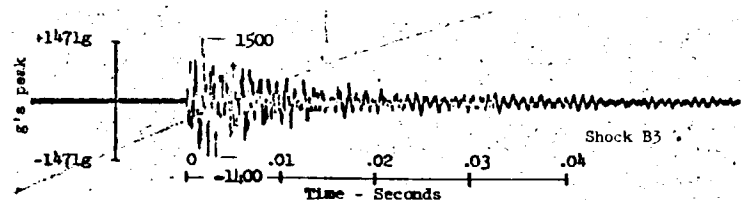
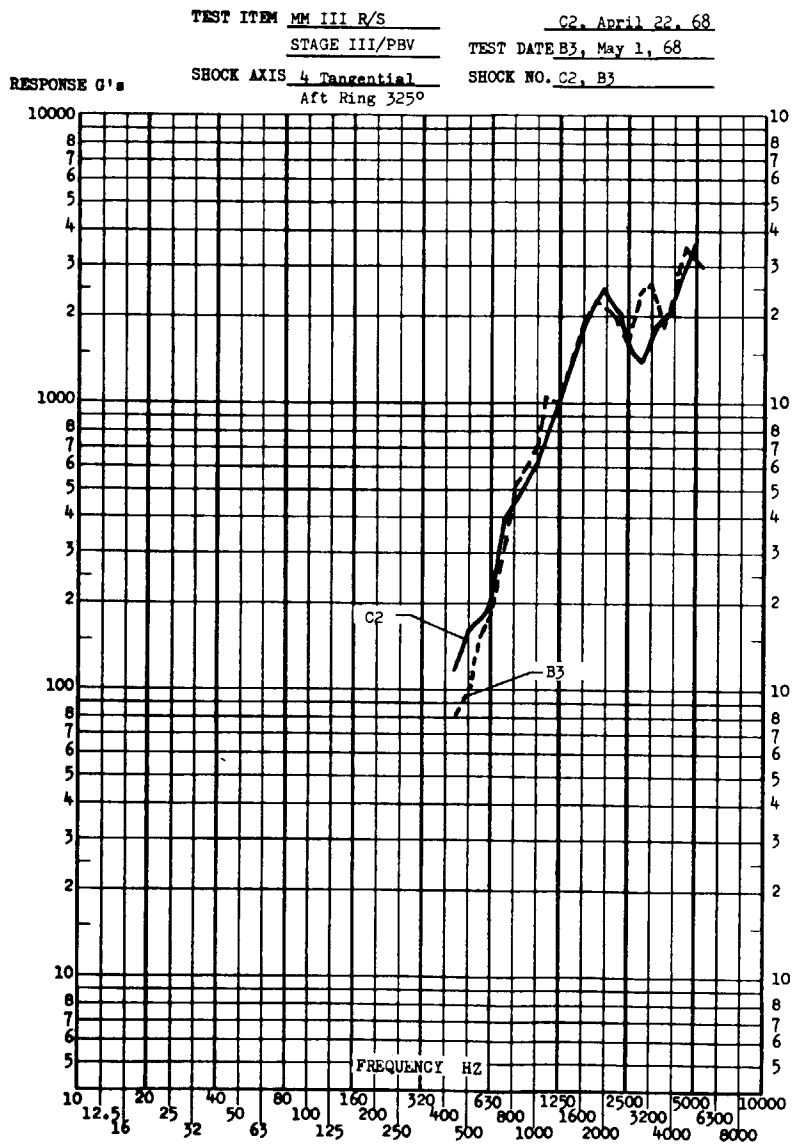
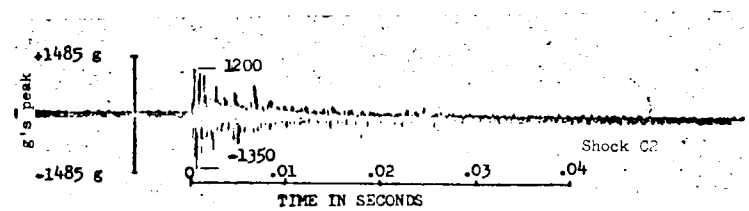


FIGURE I.A.4-16





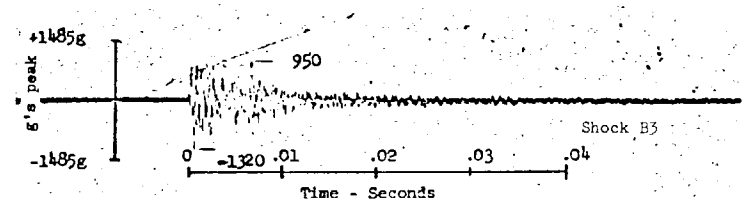
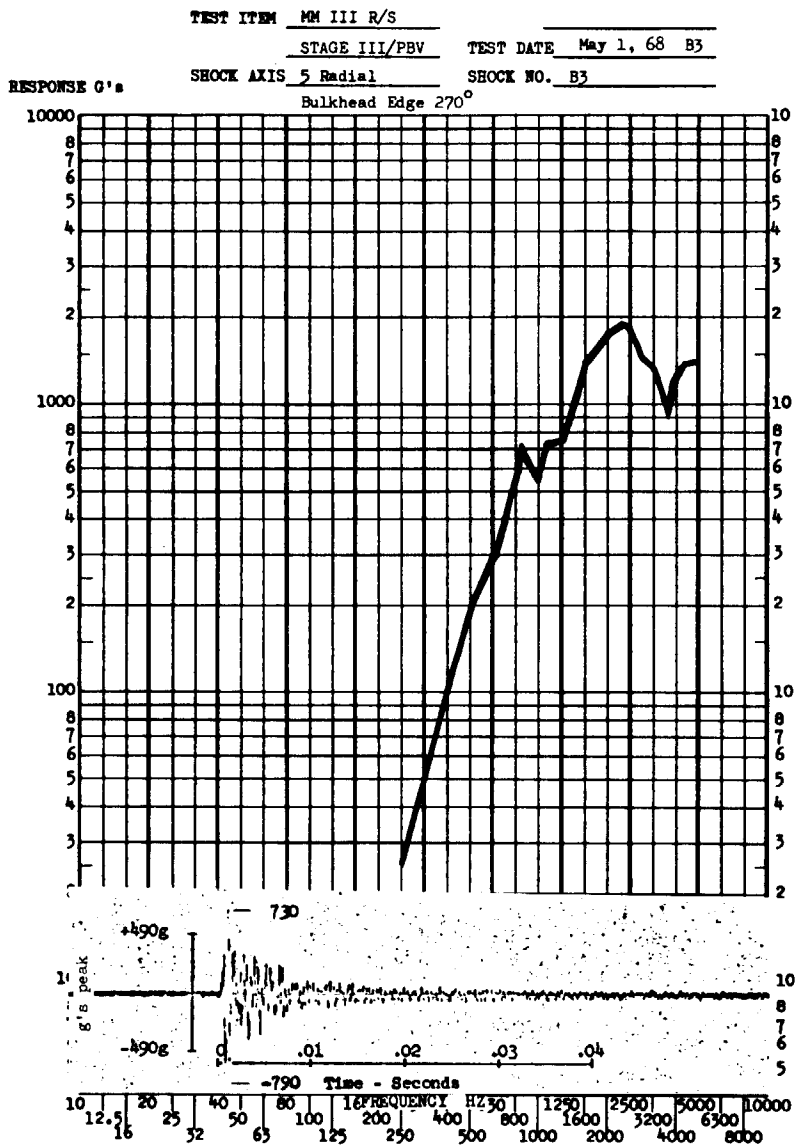


FIGURE I.A.4-17



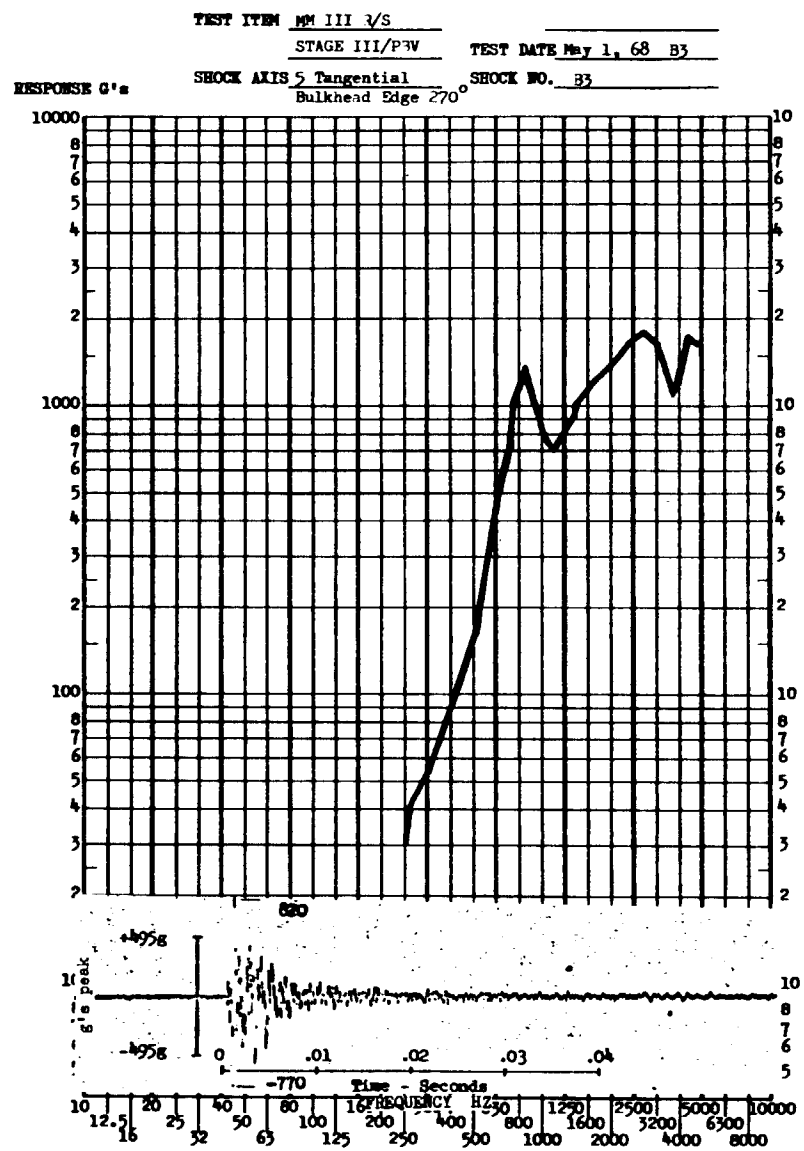
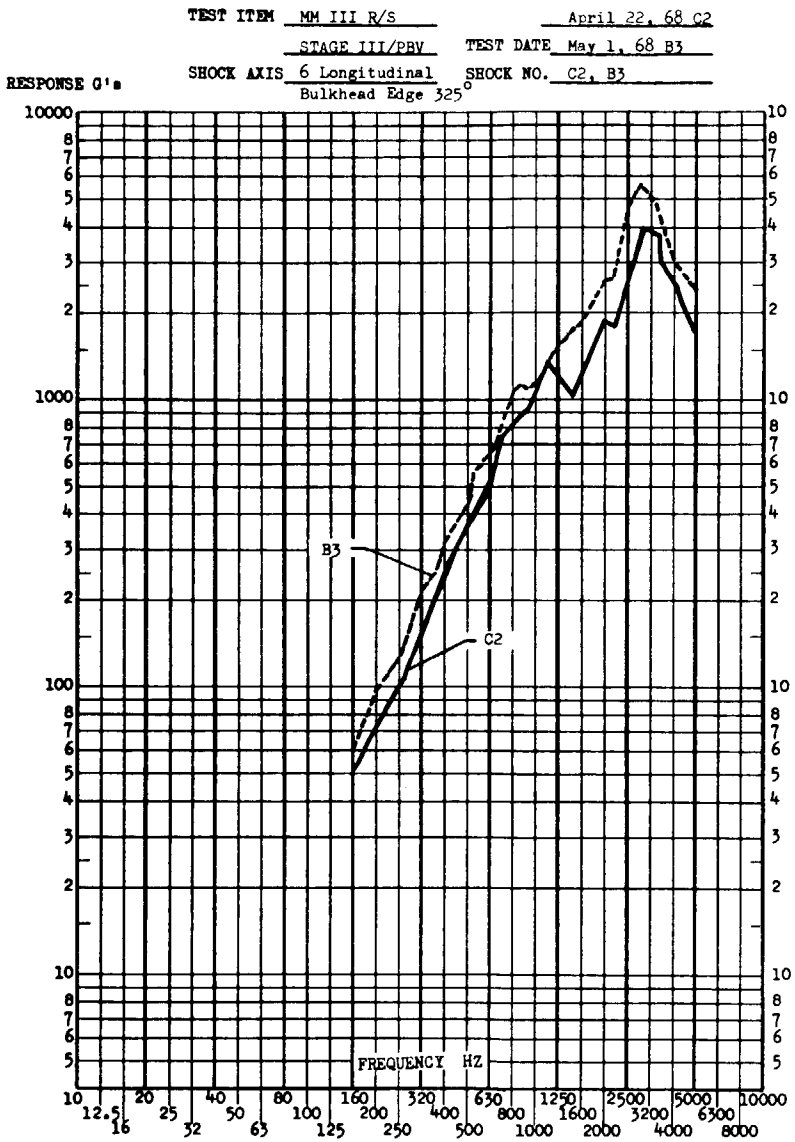
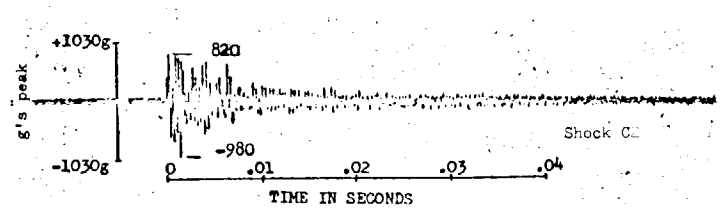


FIGURE I.A.4-18





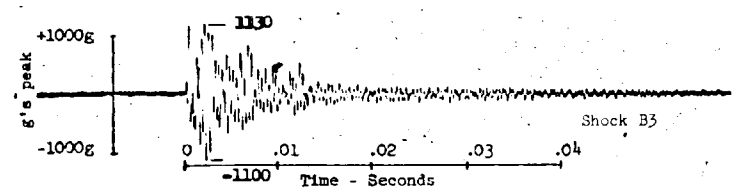
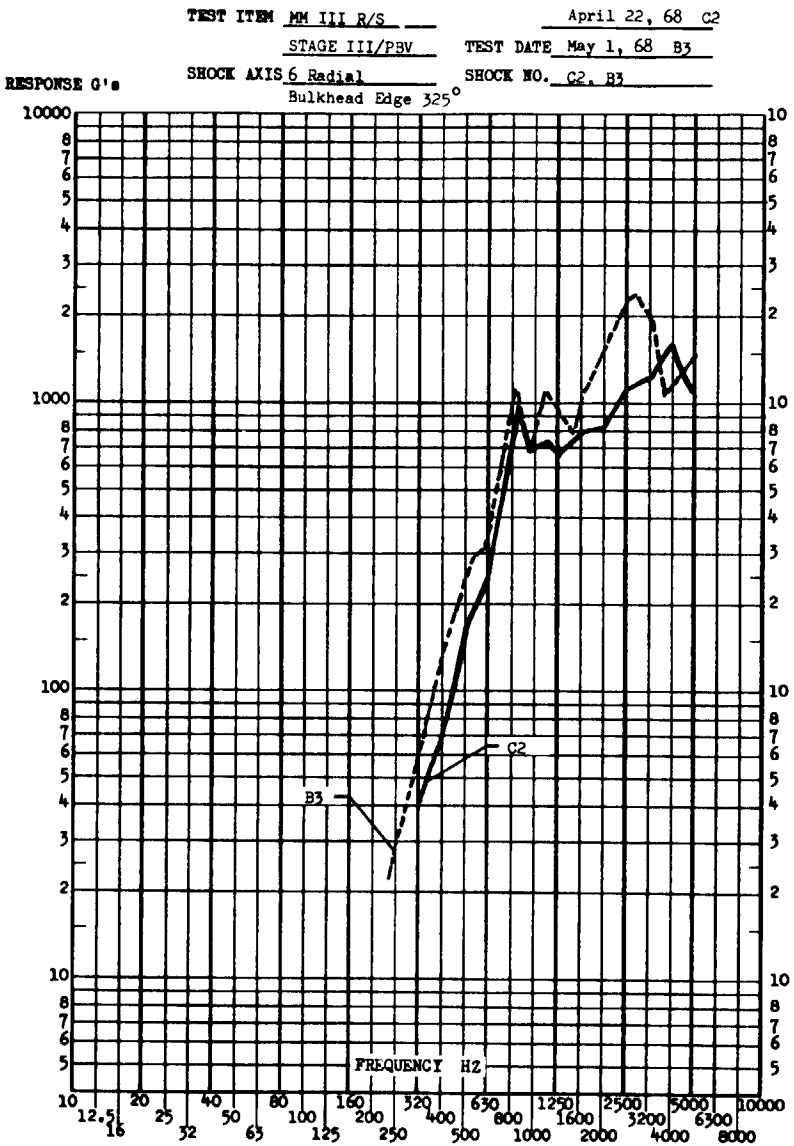


FIGURE I.A.4-19



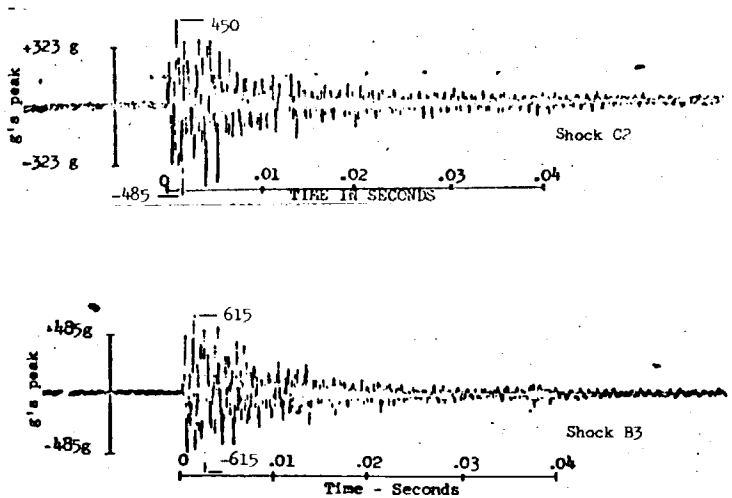
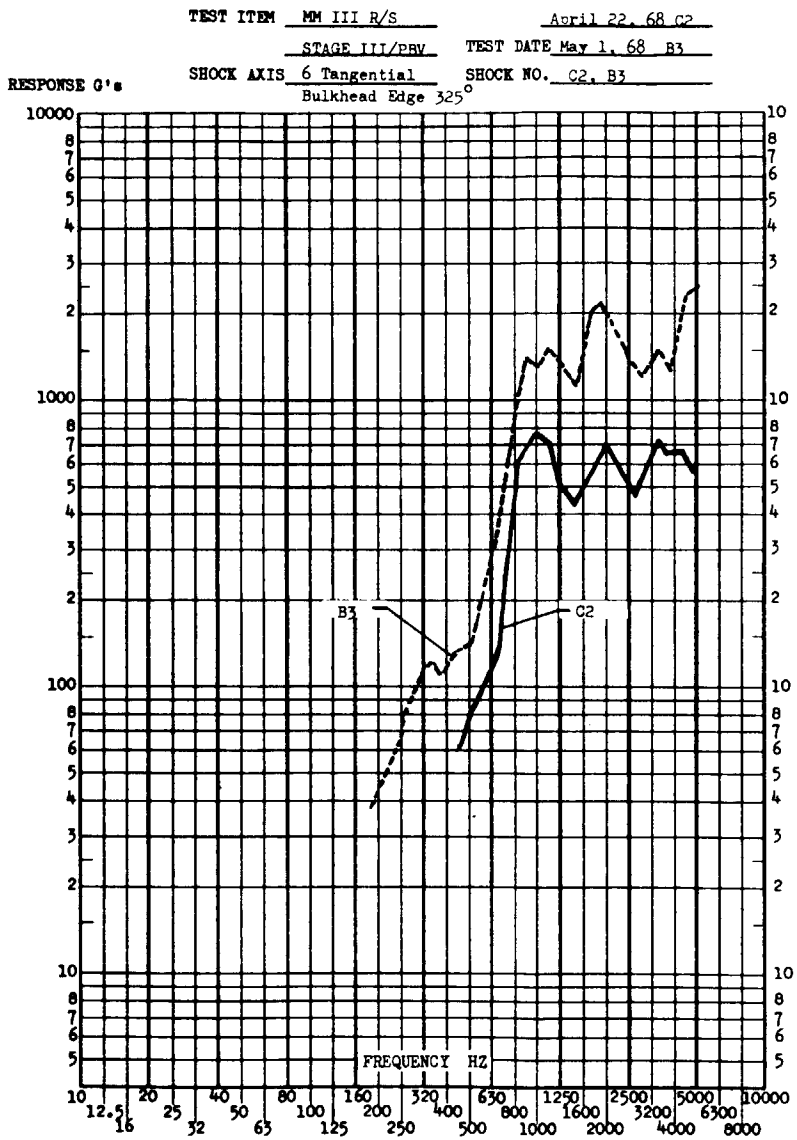
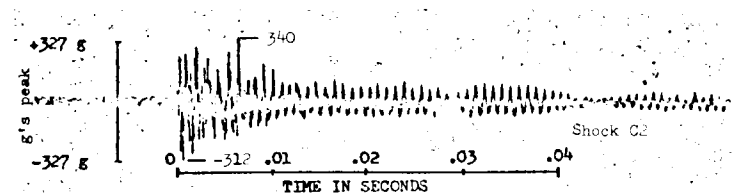


FIGURE I.A.4-20





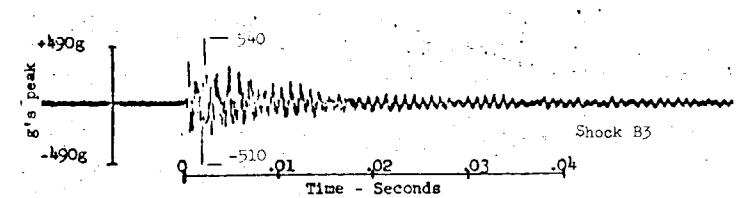
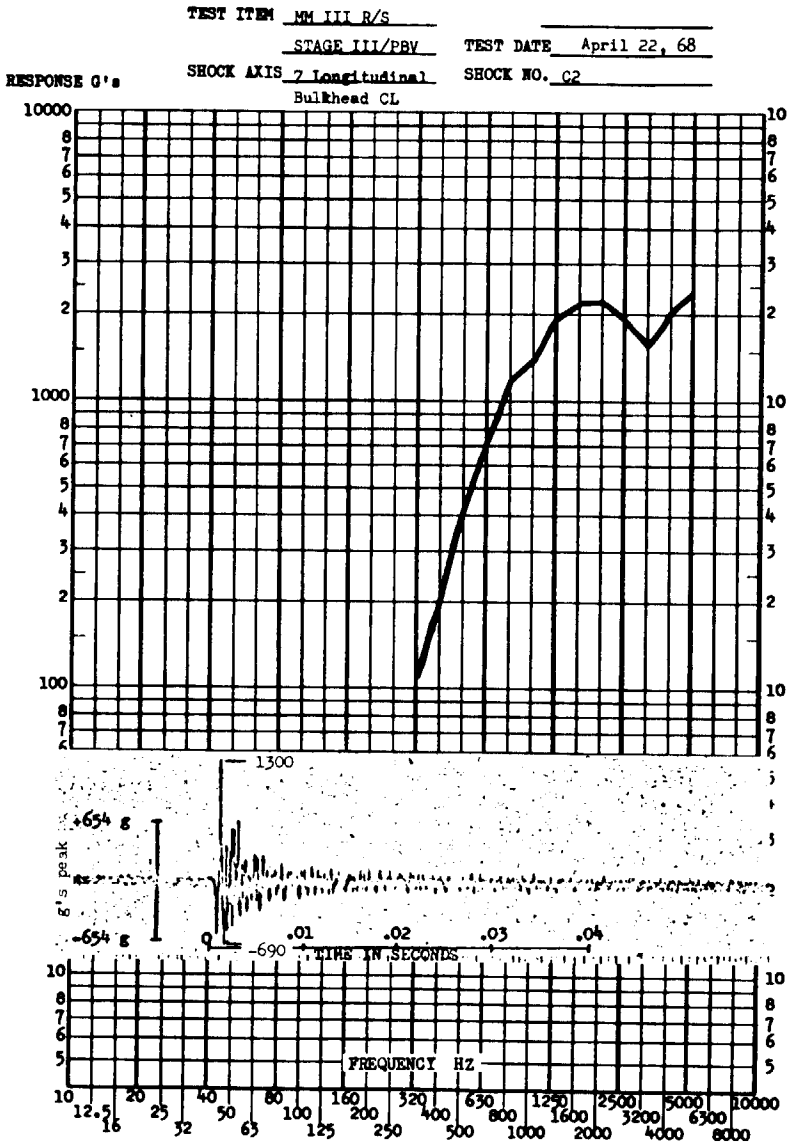


FIGURE I.A.4-21



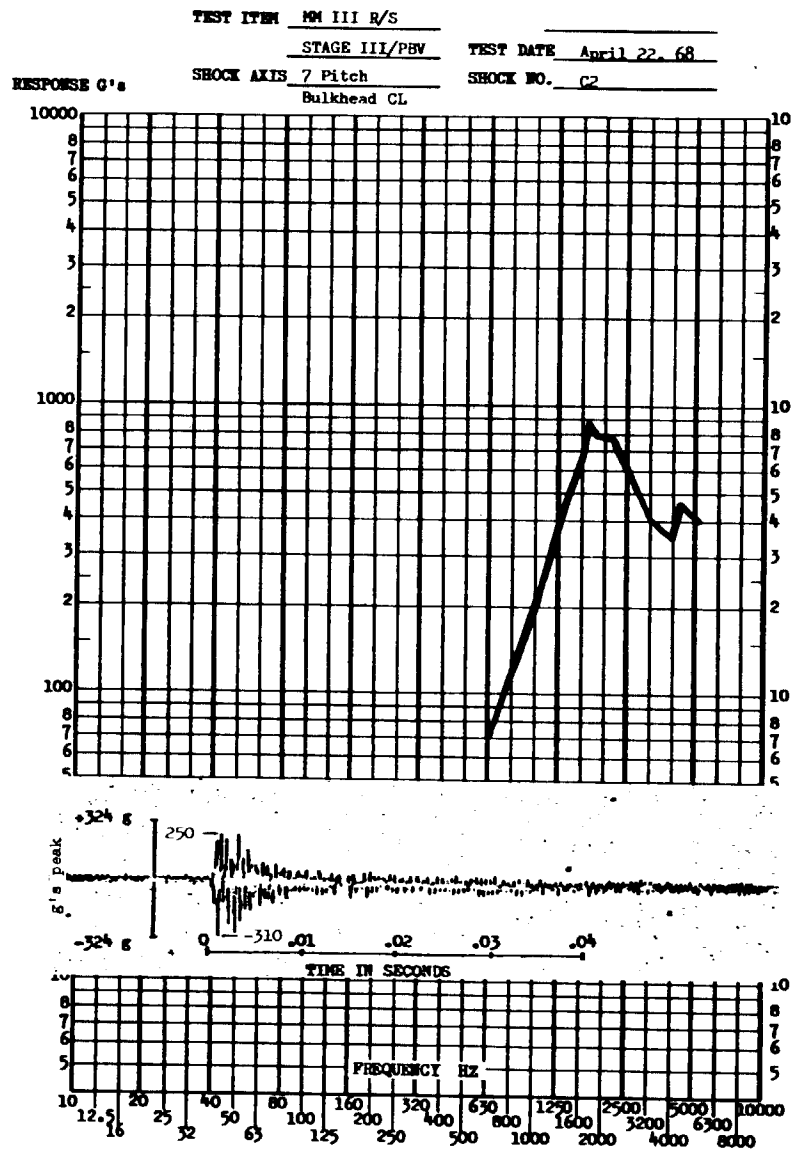
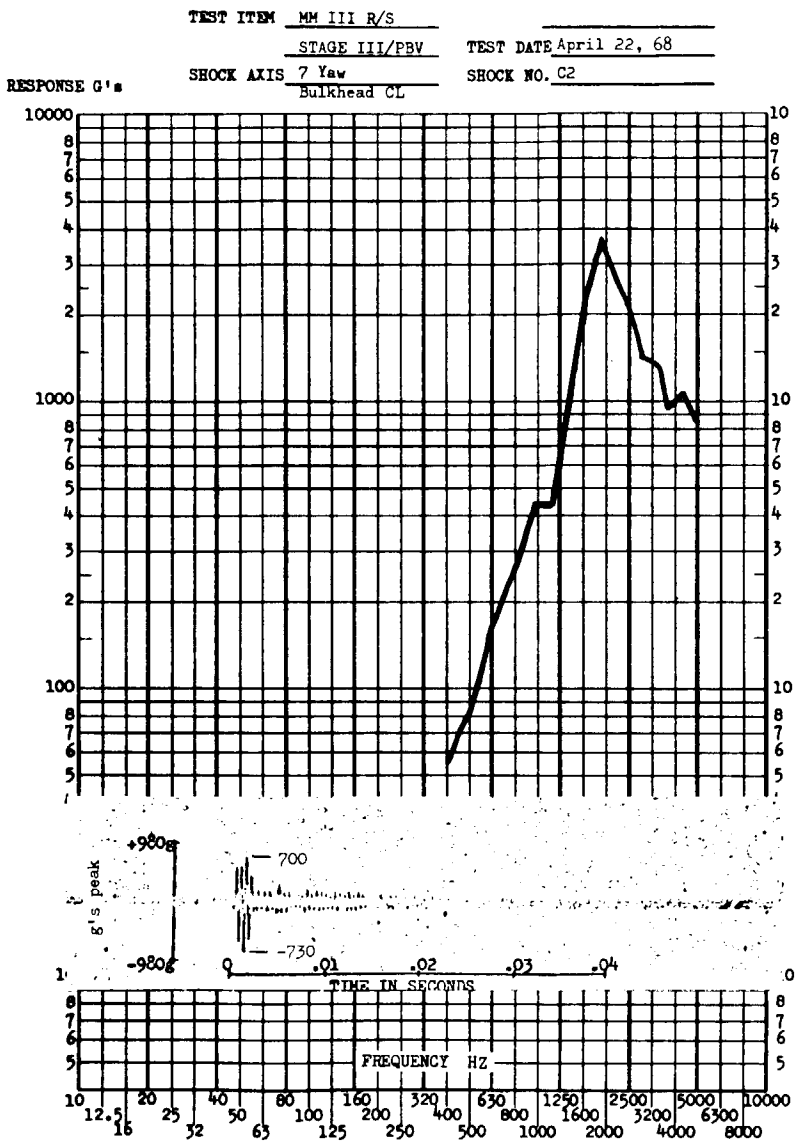


FIGURE I.A.4-22



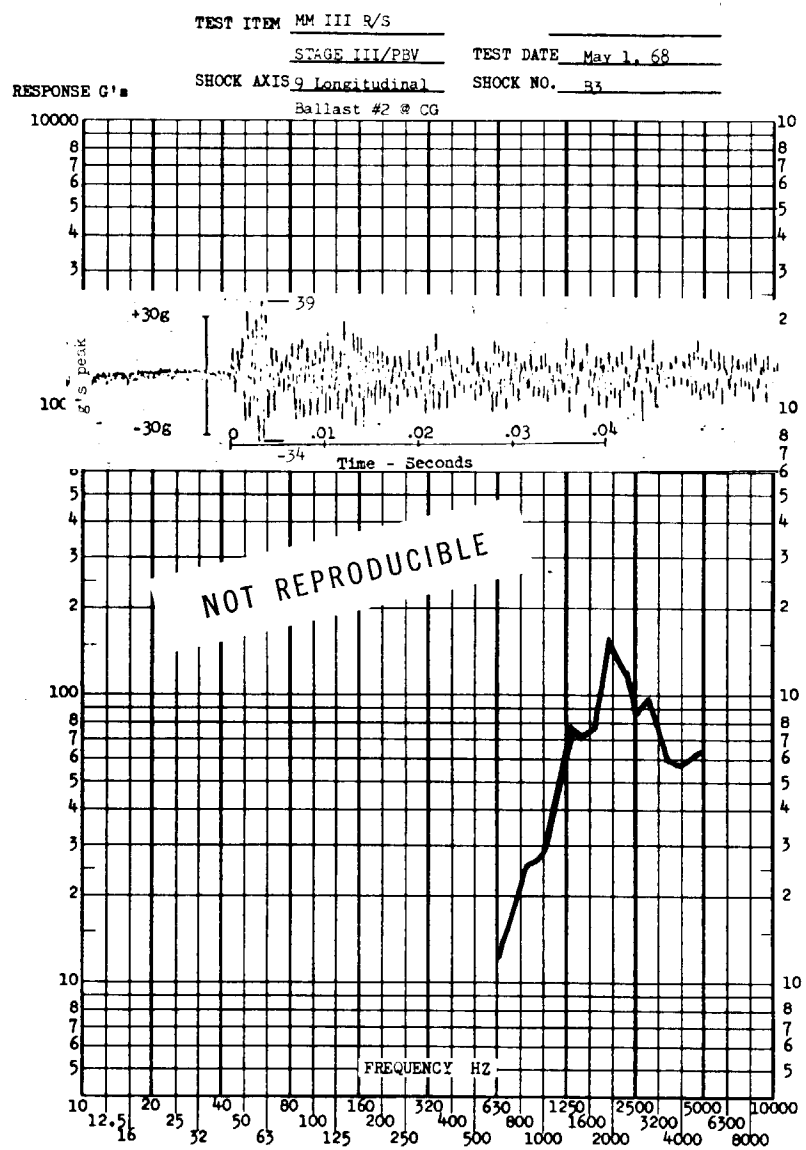
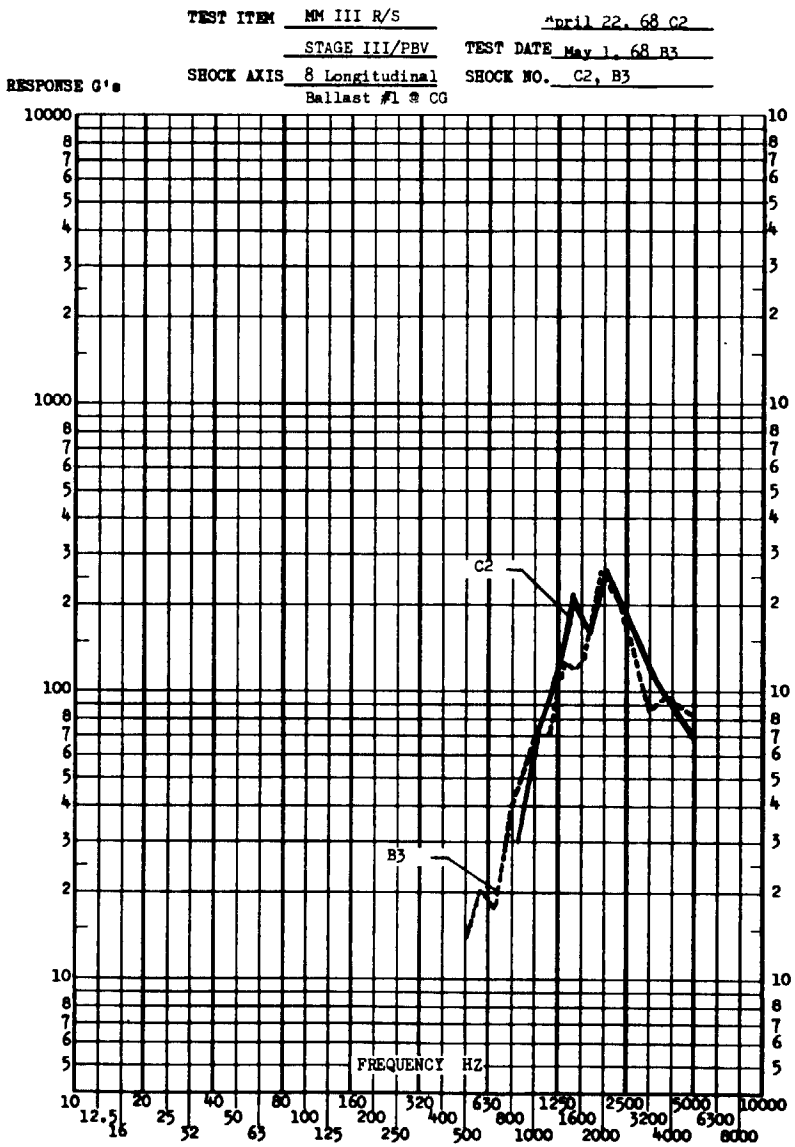
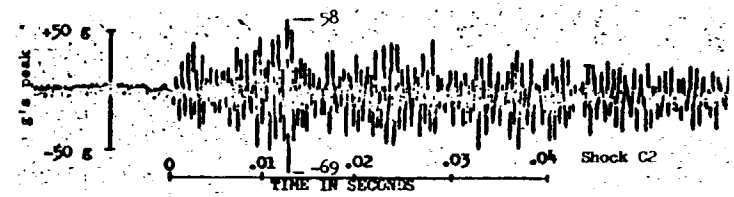


FIGURE I.A.4-23





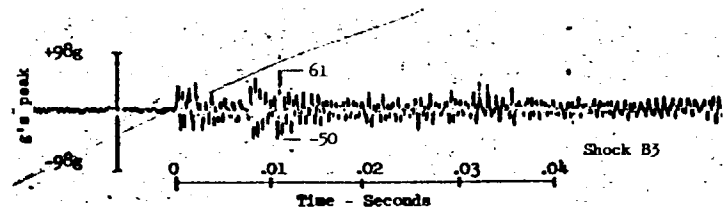
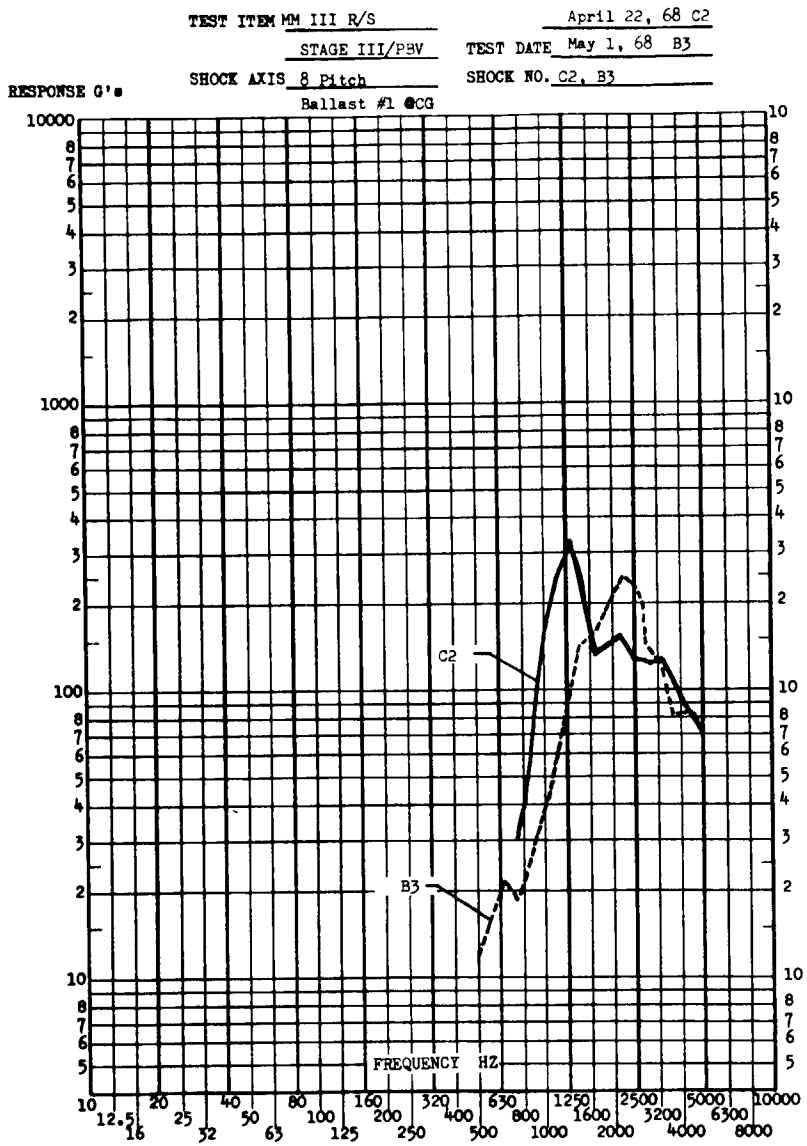
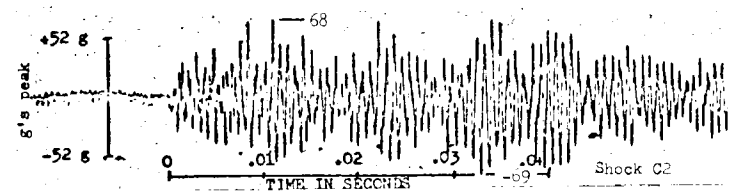


FIGURE I.A.4-24





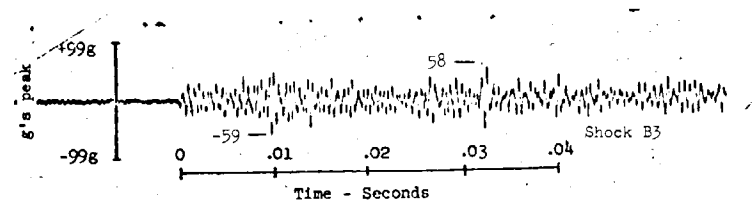
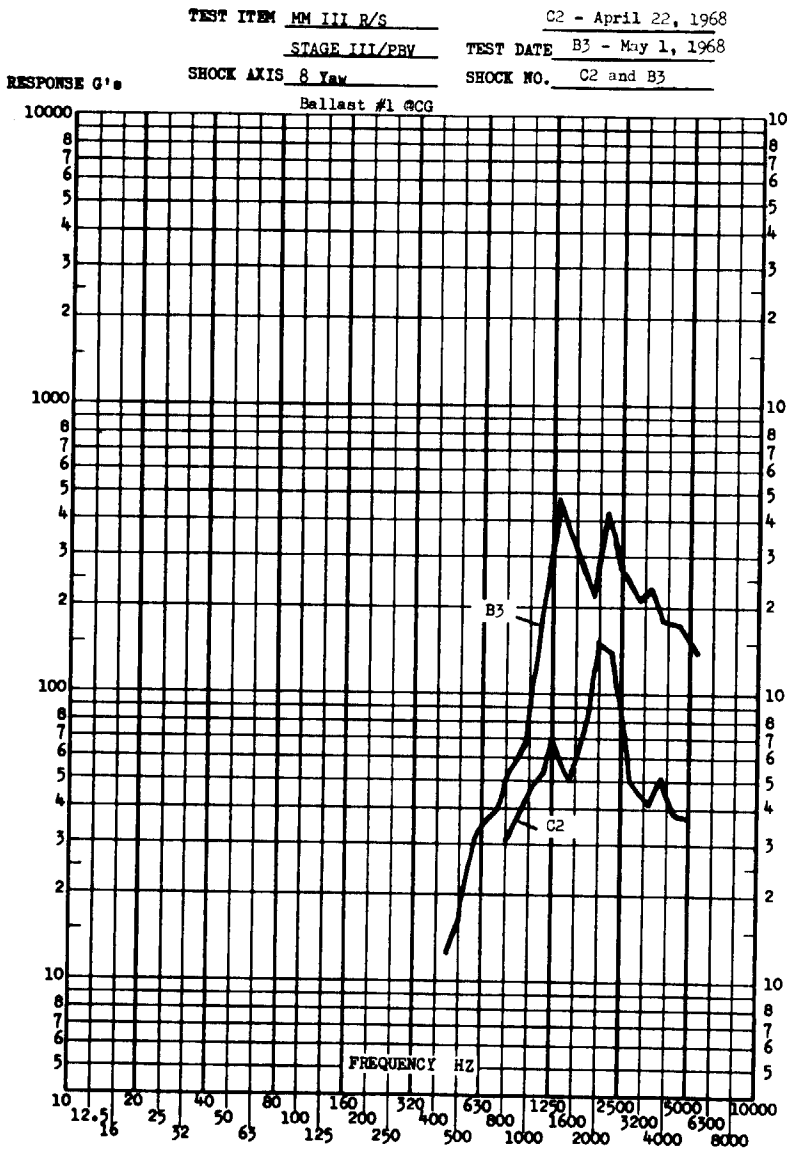
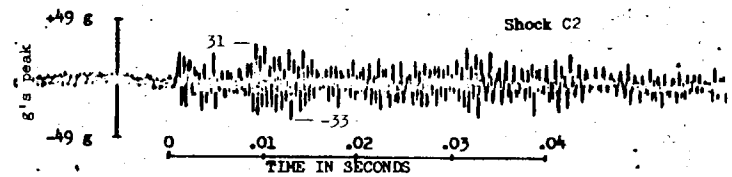


FIGURE I.A.4-25





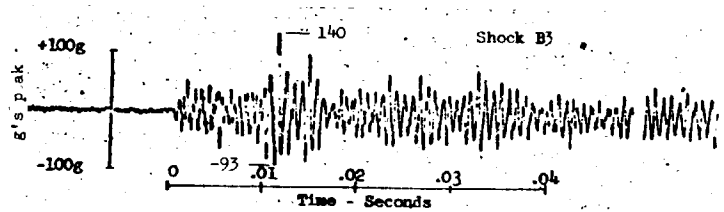
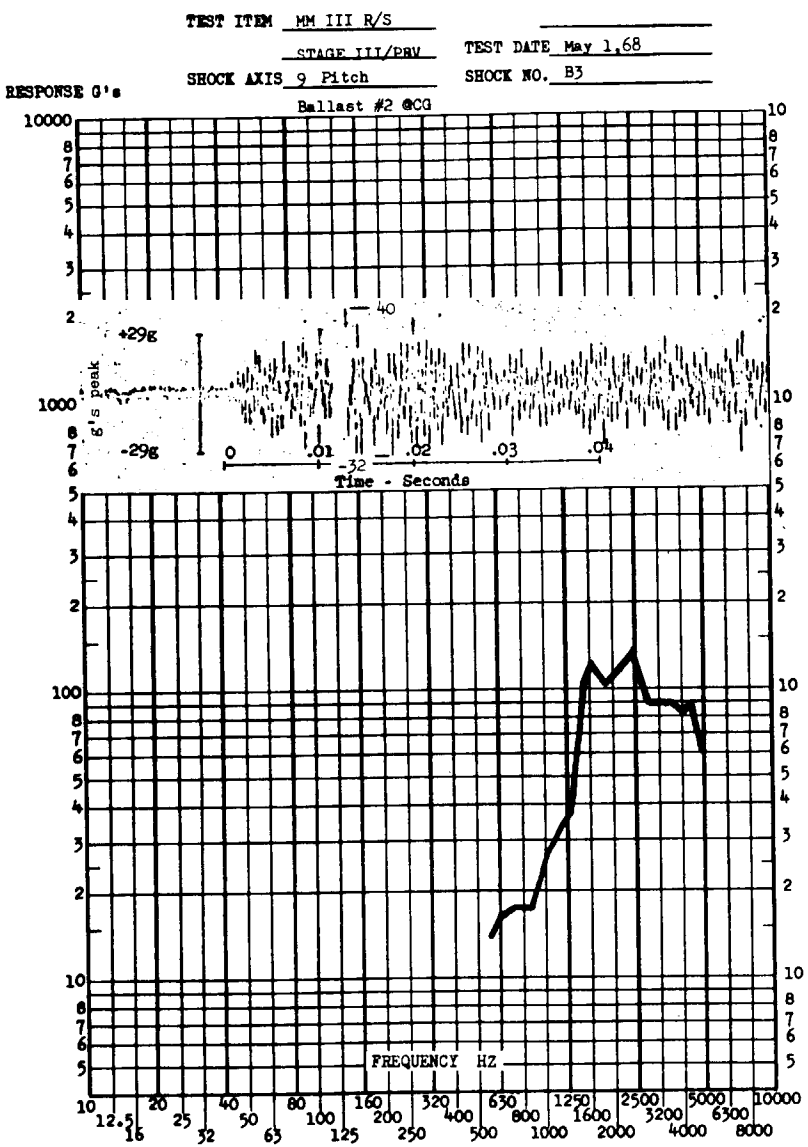


FIGURE I.A.4-26



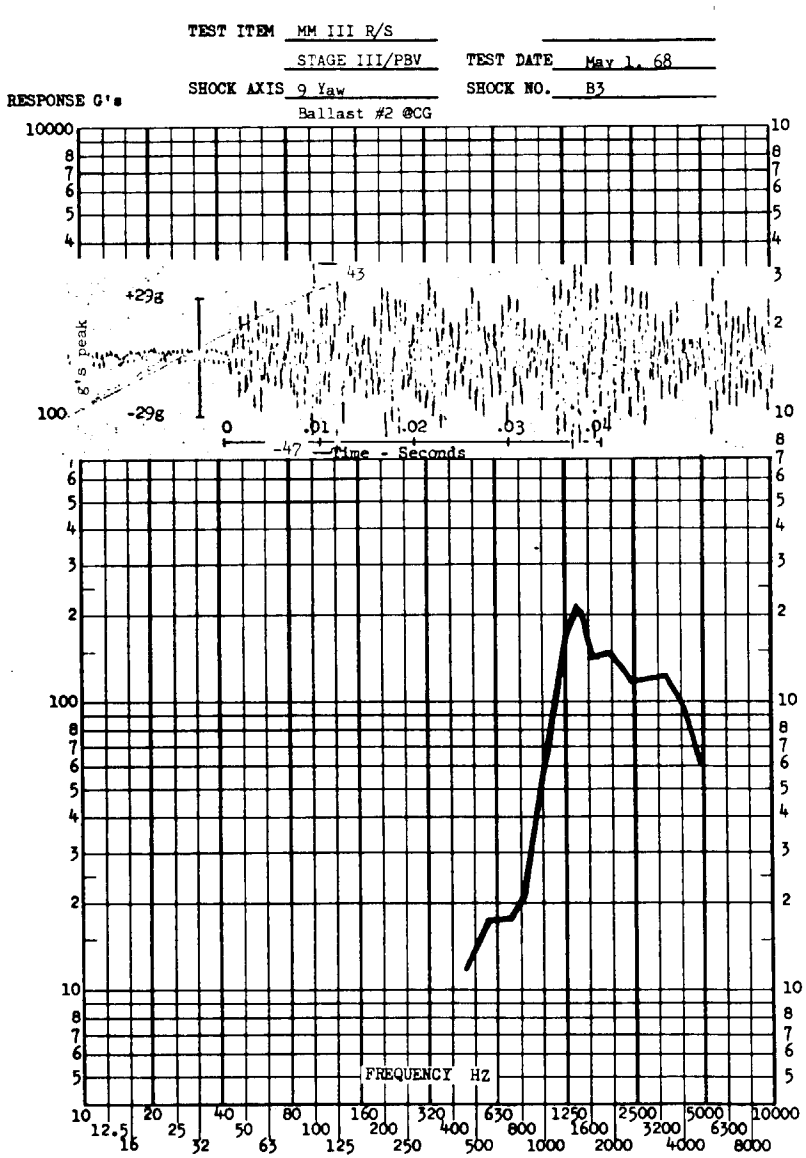
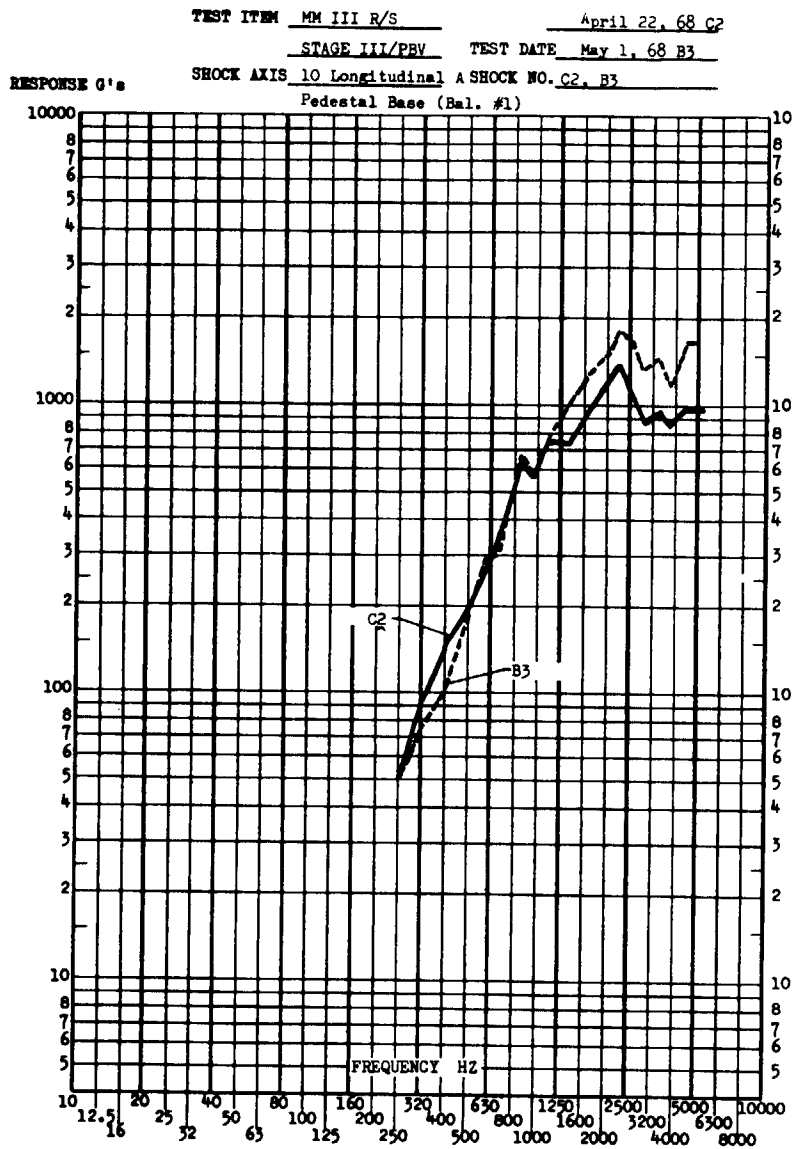
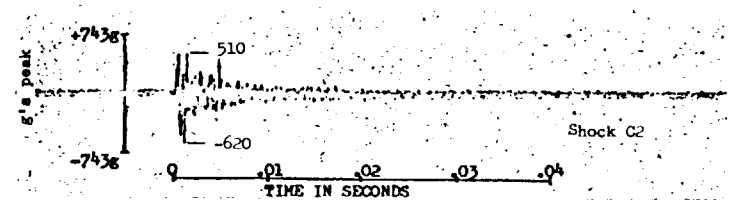


FIGURE I.A.4-27





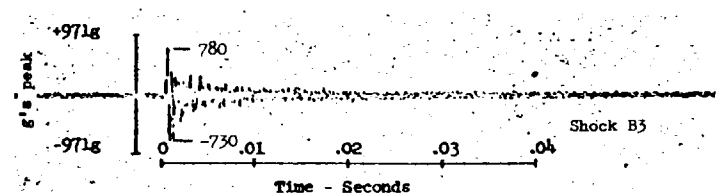
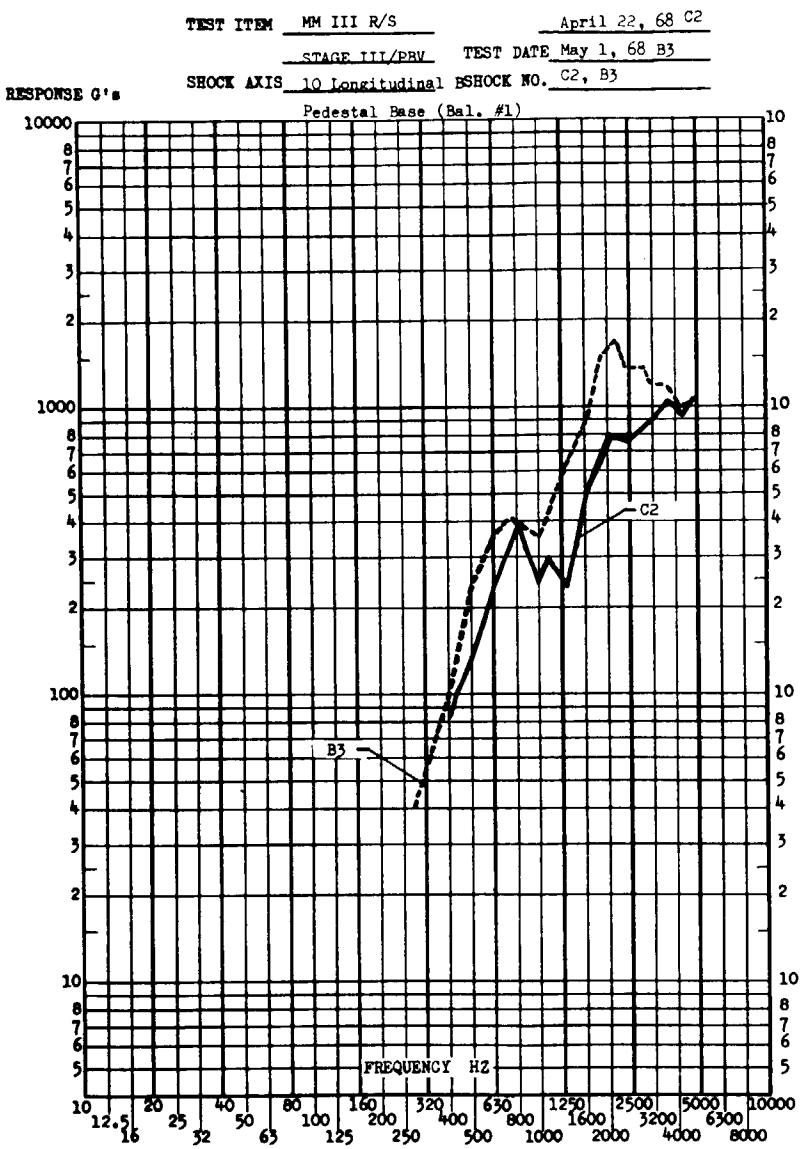
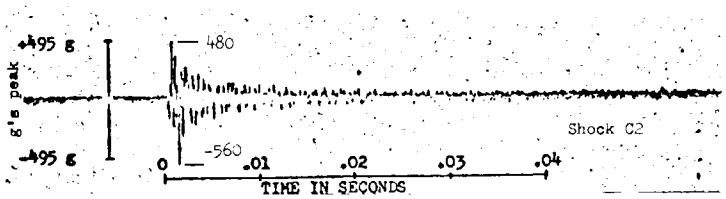


FIGURE I.A.4-28





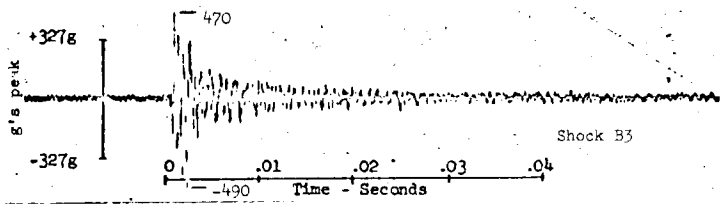
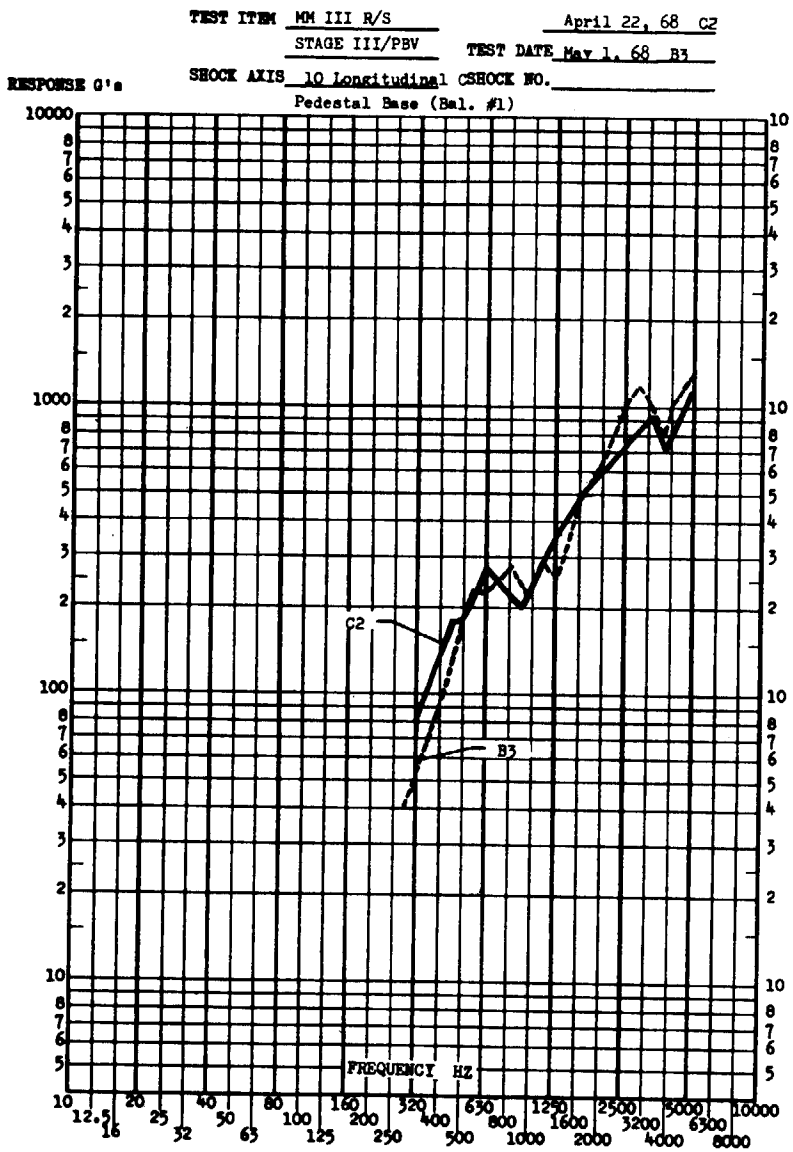
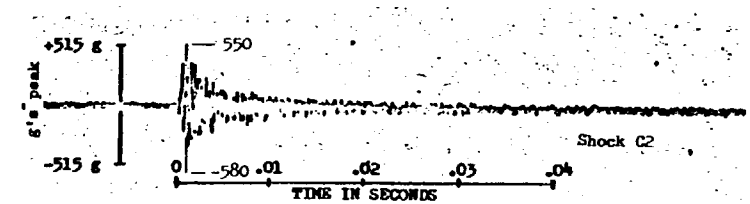


FIGURE I.A.4-29





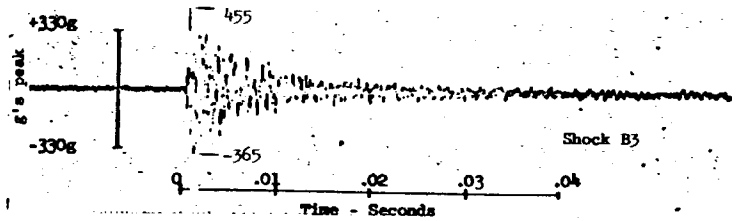
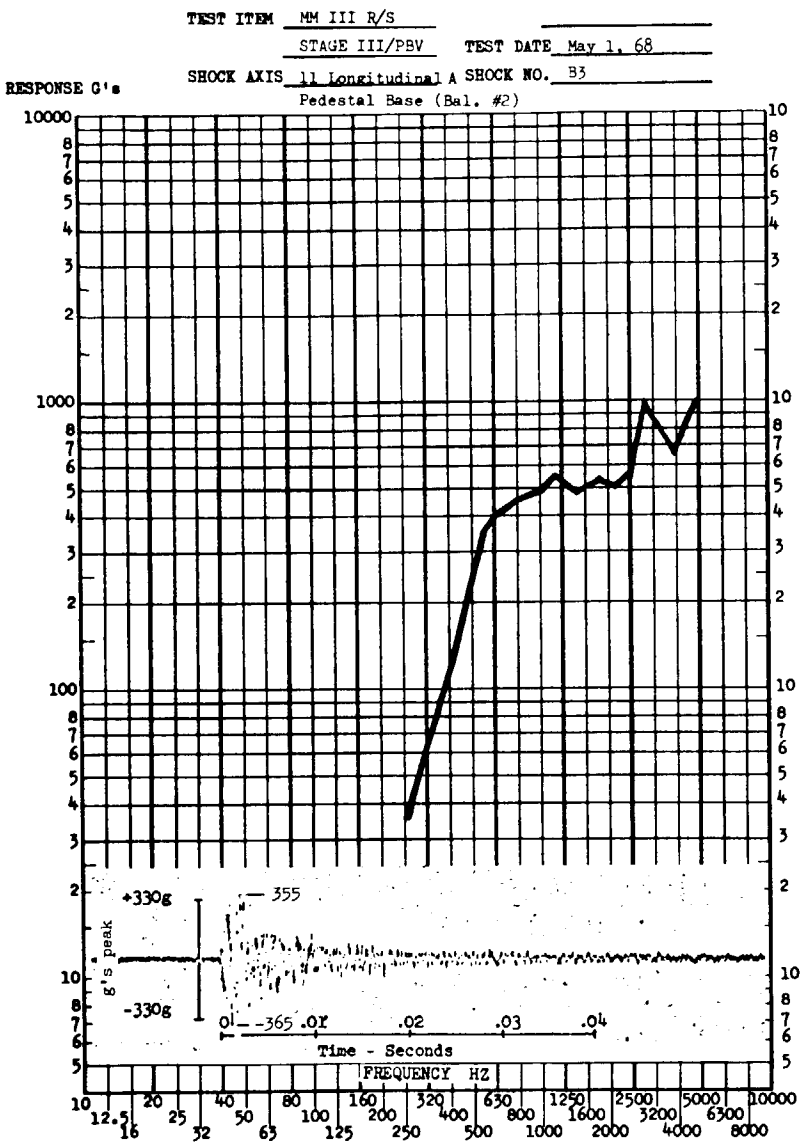


FIGURE I.A.4-30



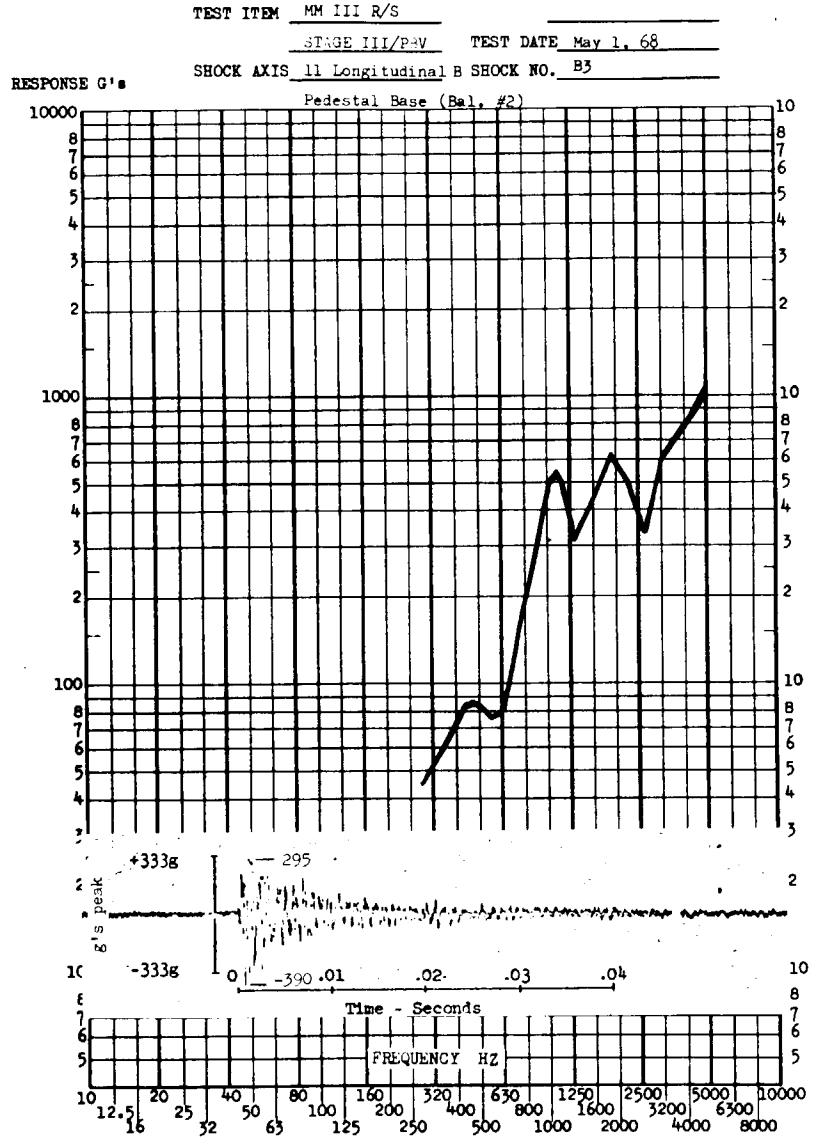
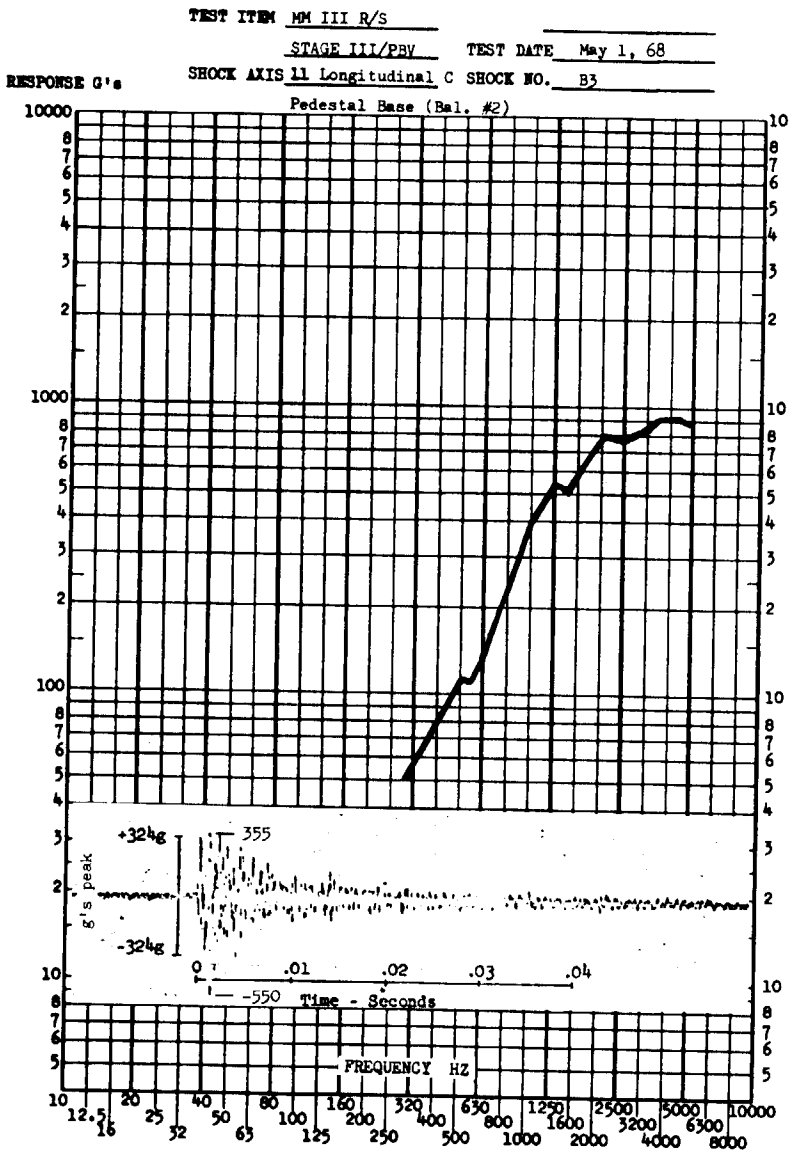


FIGURE 1.A.4-31



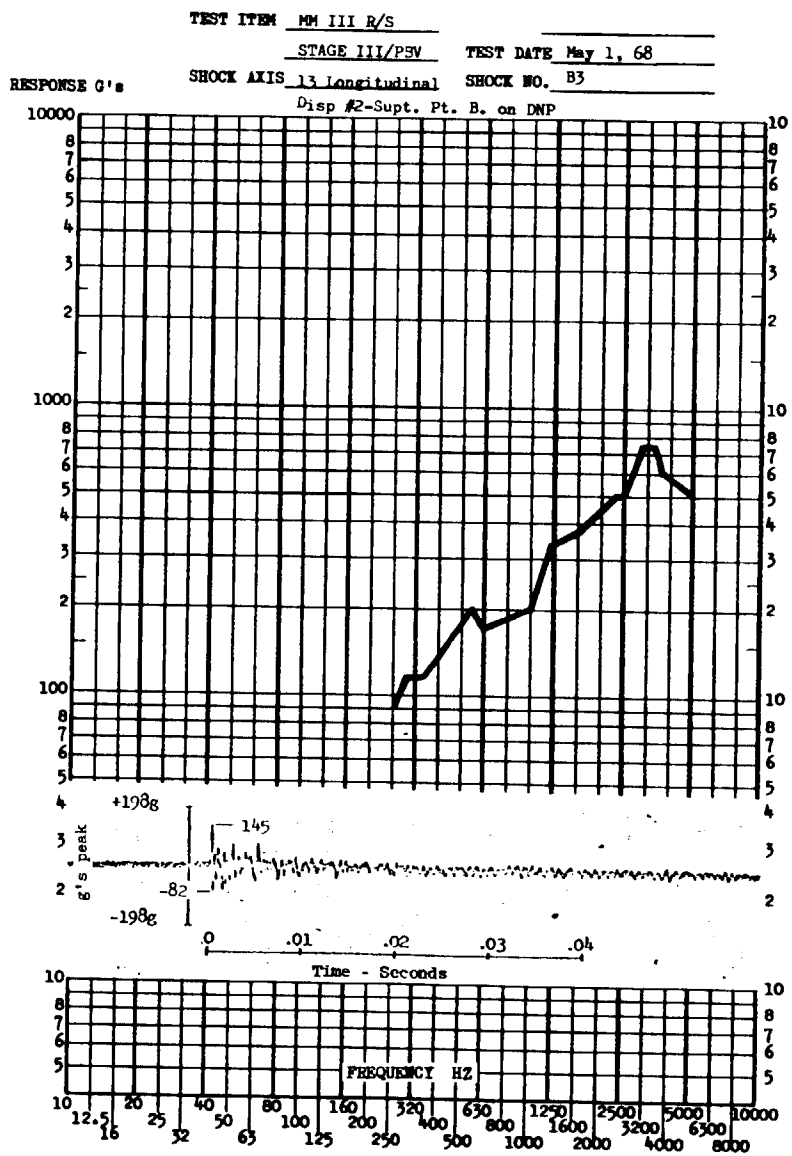
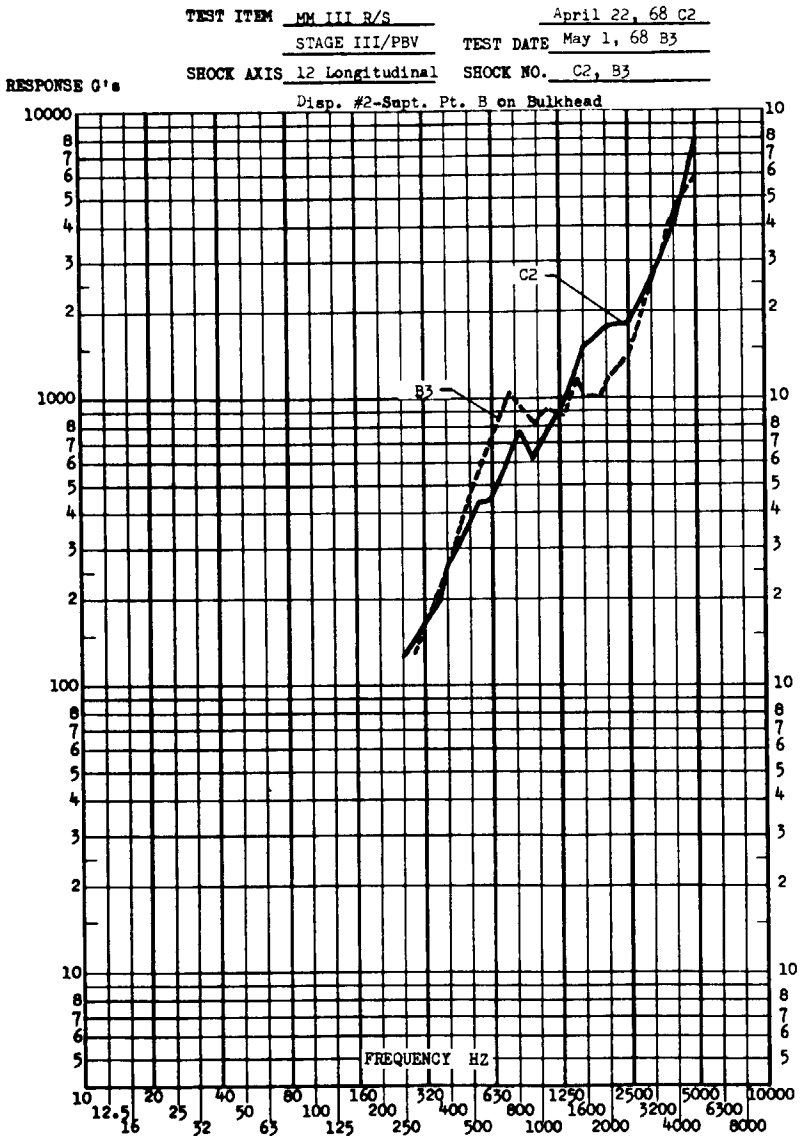
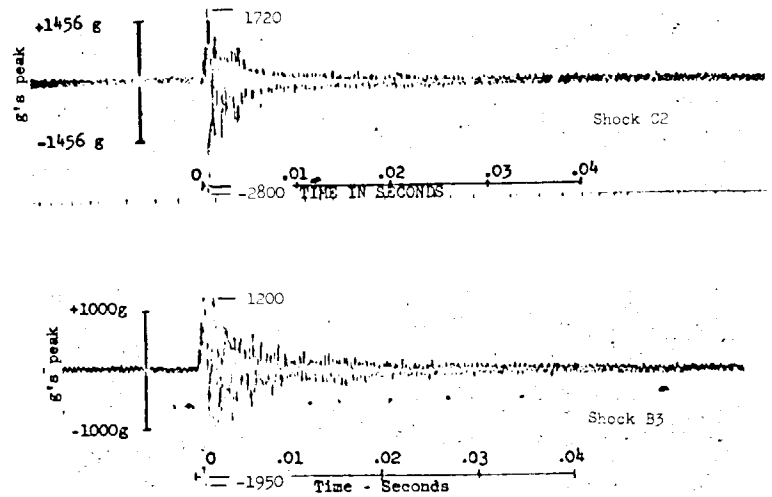


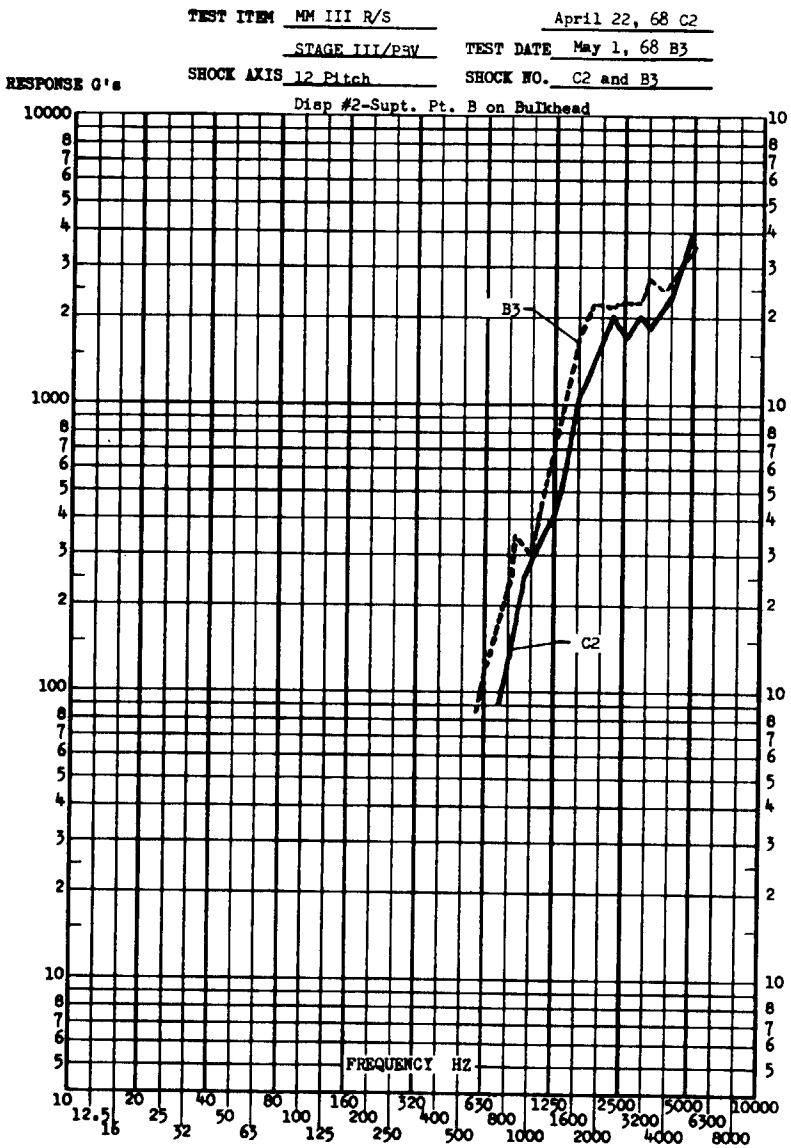
FIGURE I.A.4-32

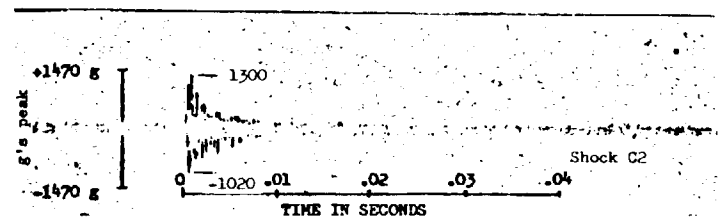




NOT REPRODUCIBLE

FIGURE I.A.4-33





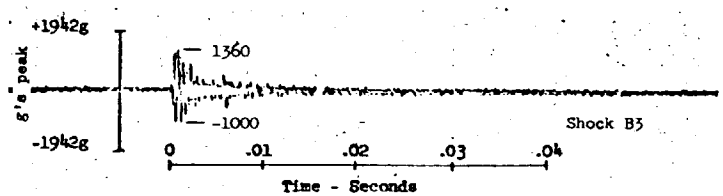
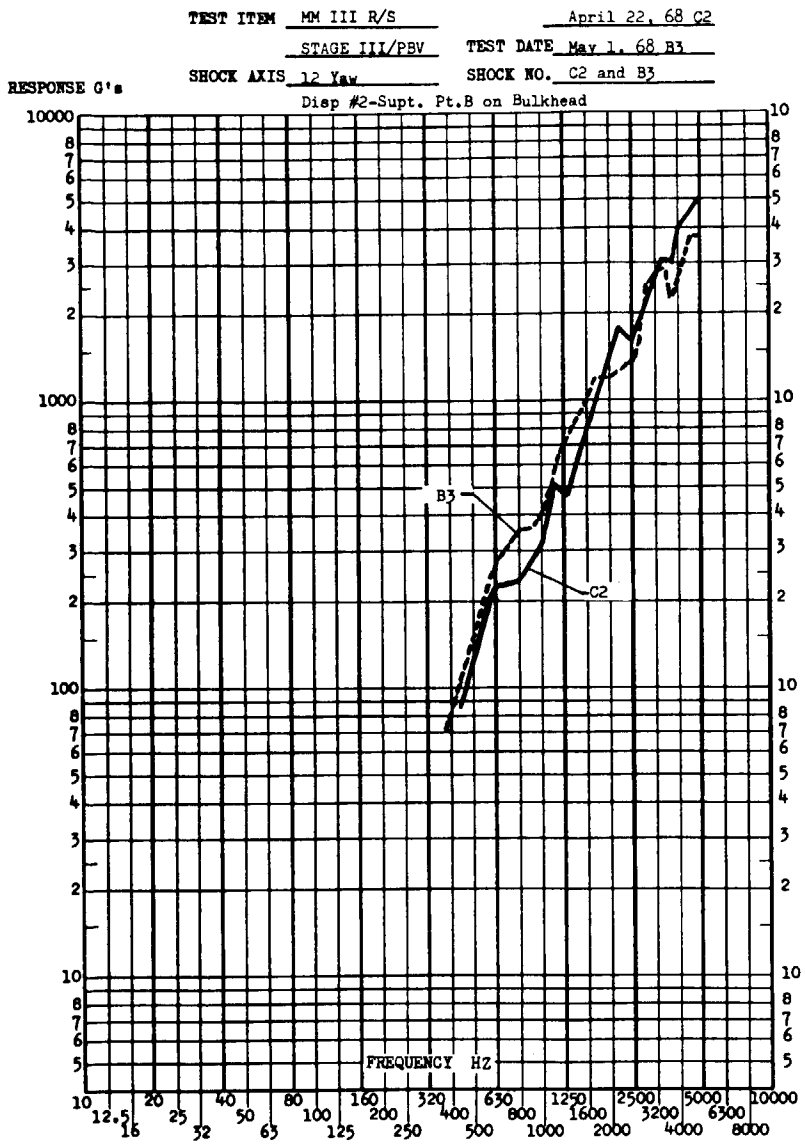
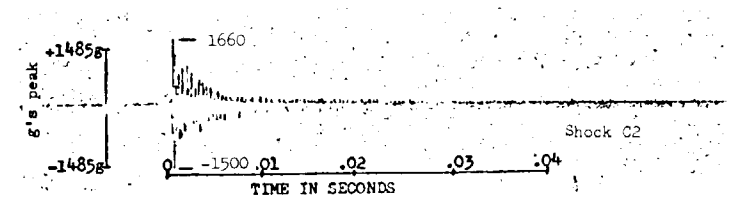


FIGURE I.A.4-34





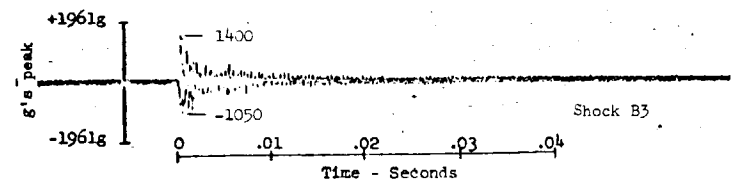
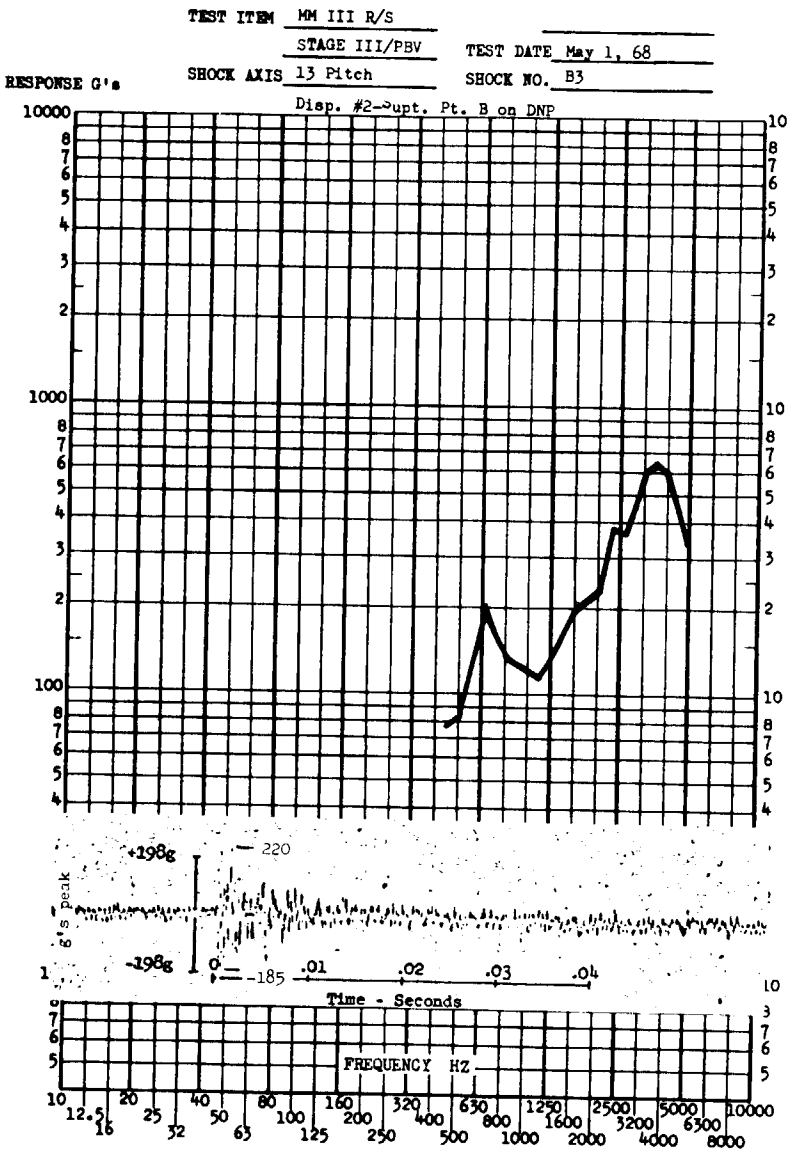
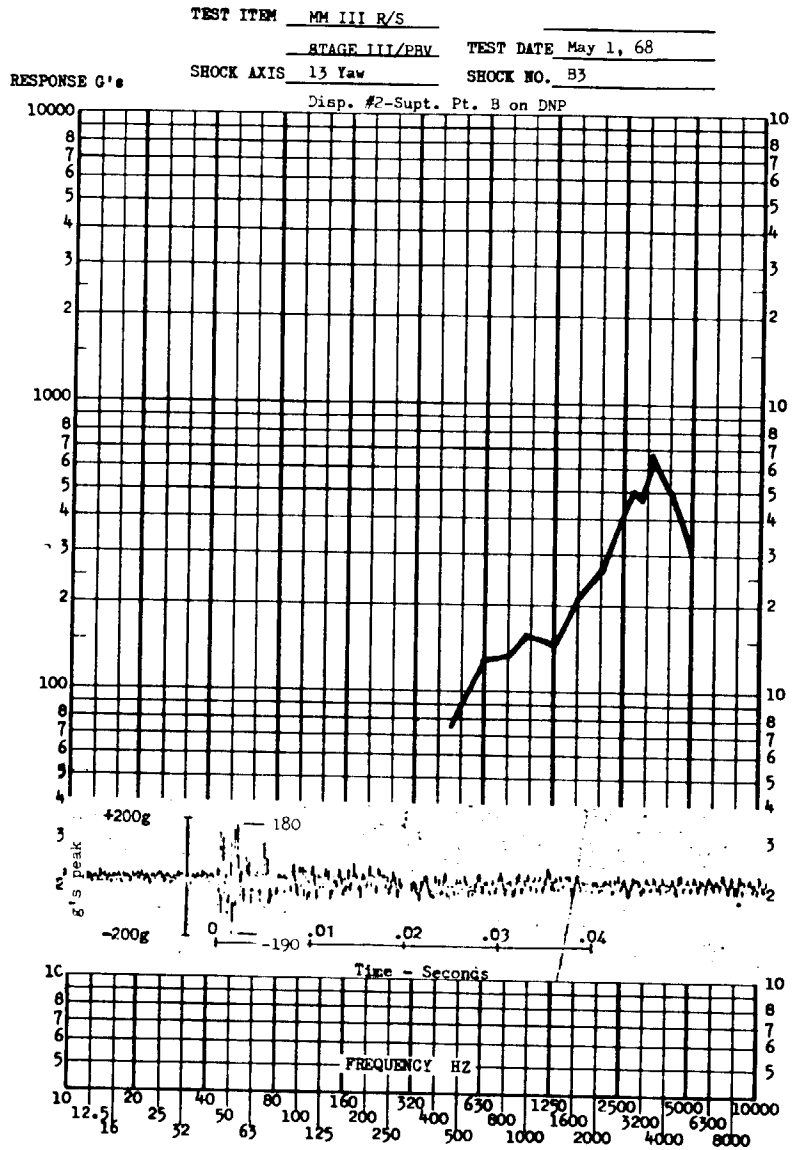


FIGURE 1.A.4-35





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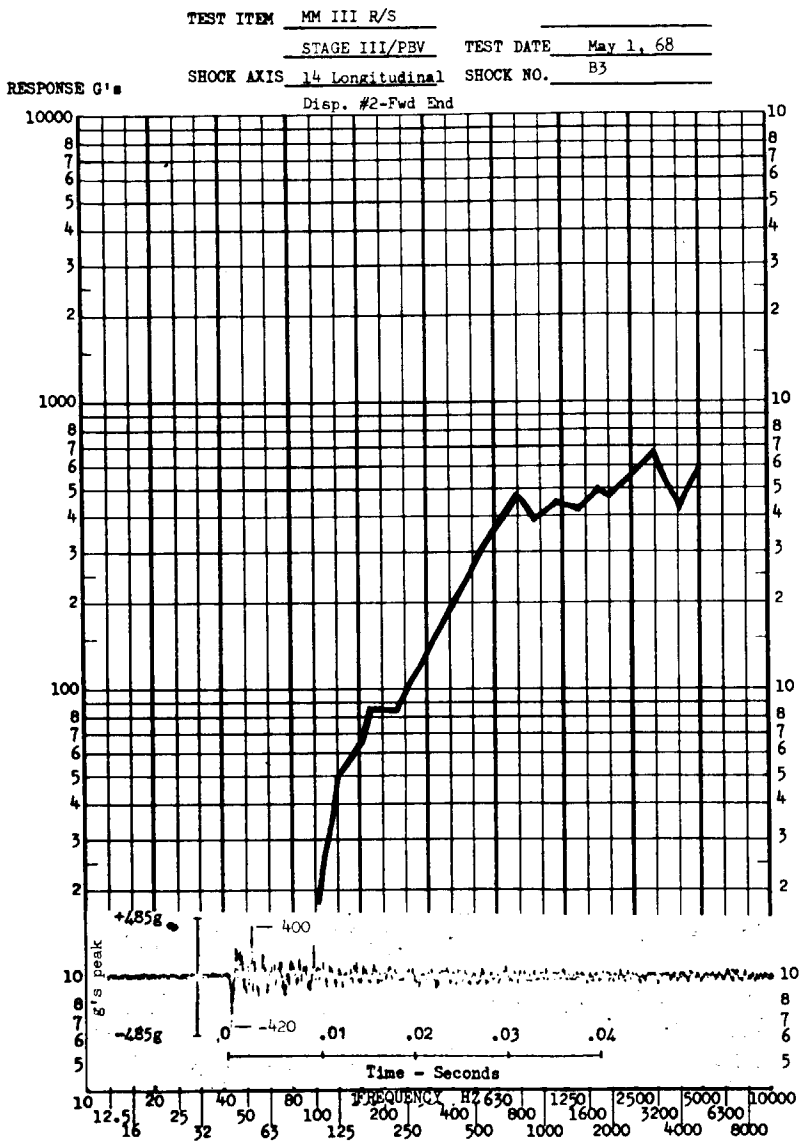

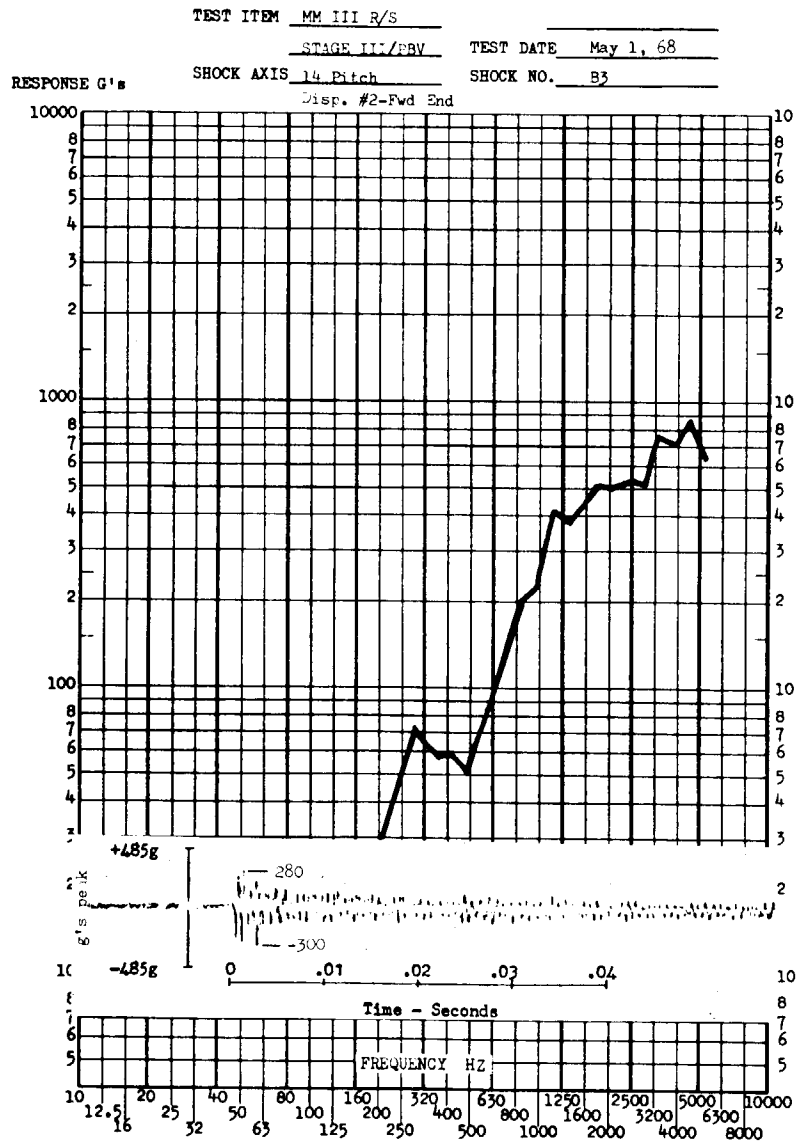

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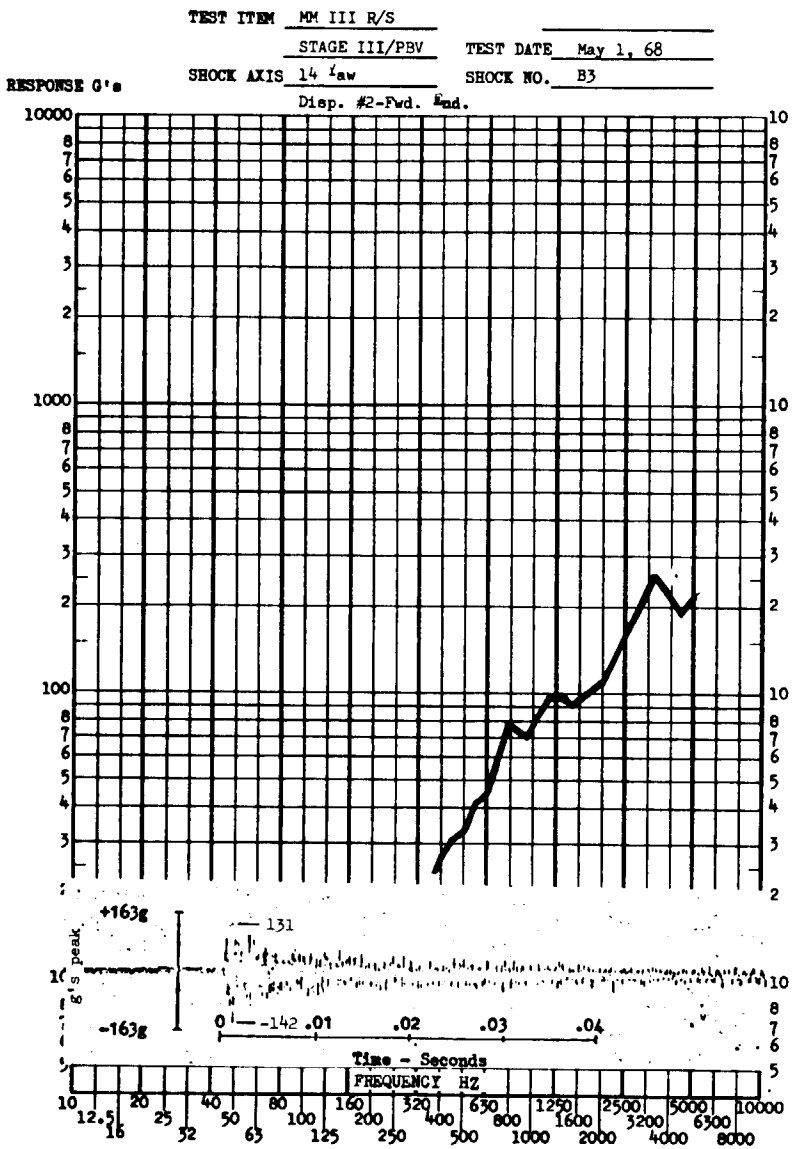

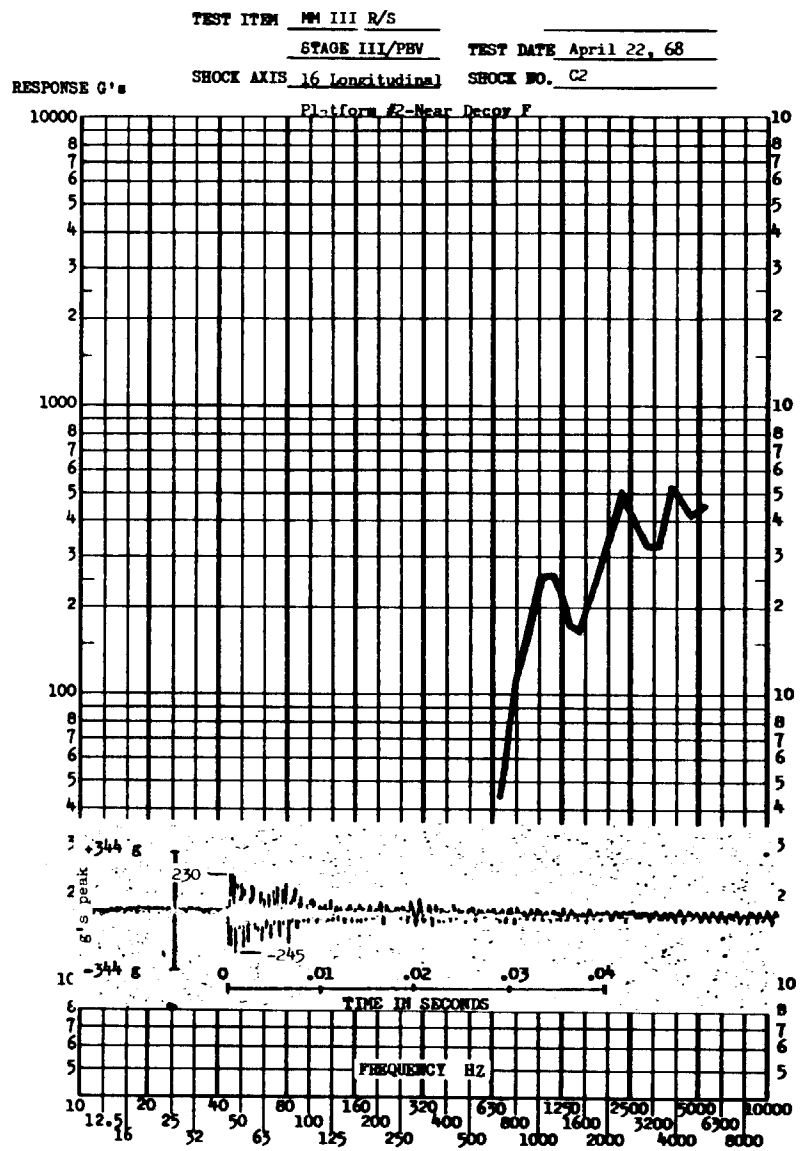

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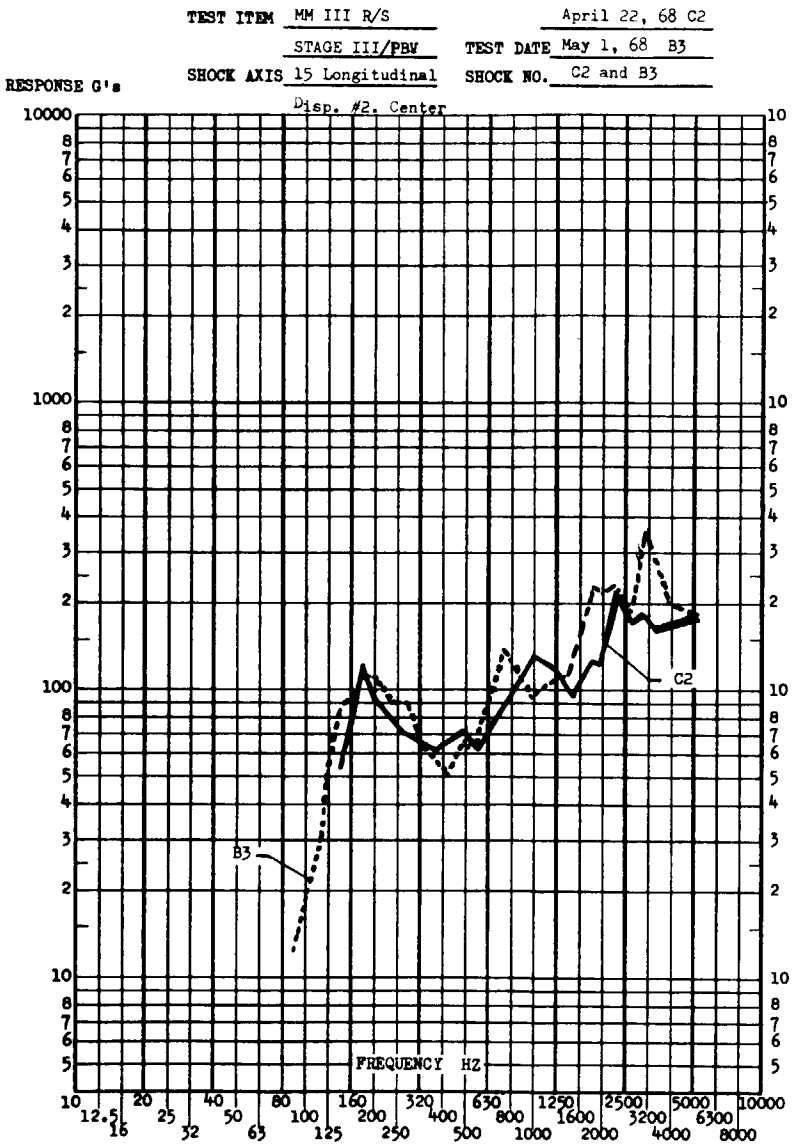

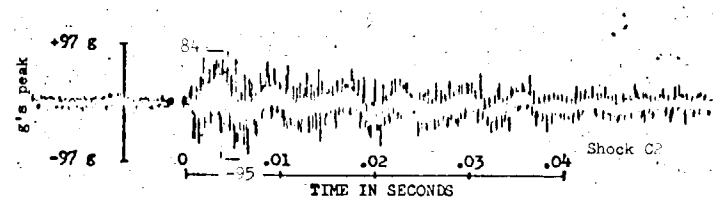

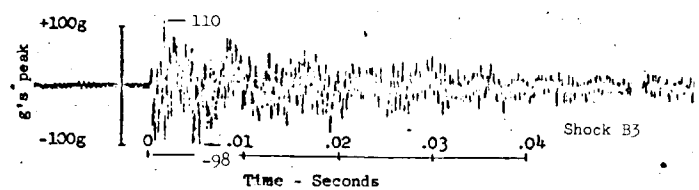

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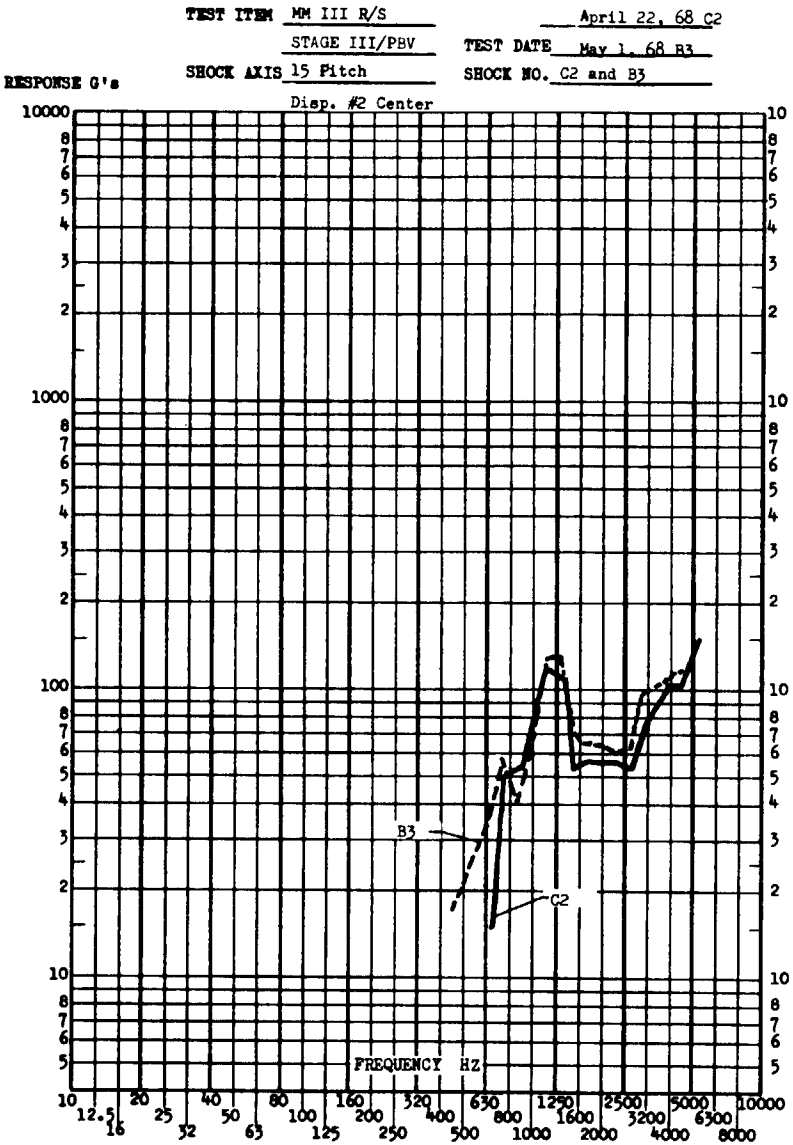
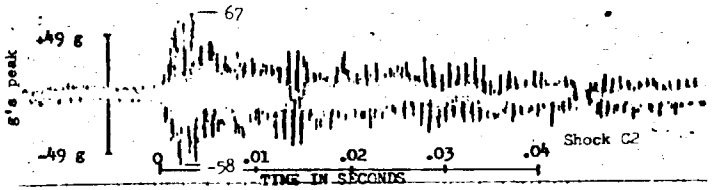




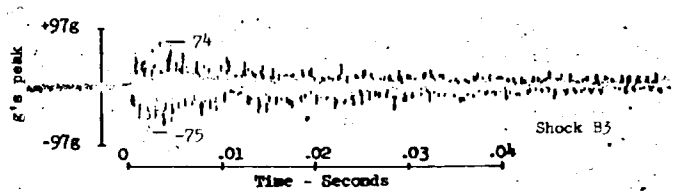
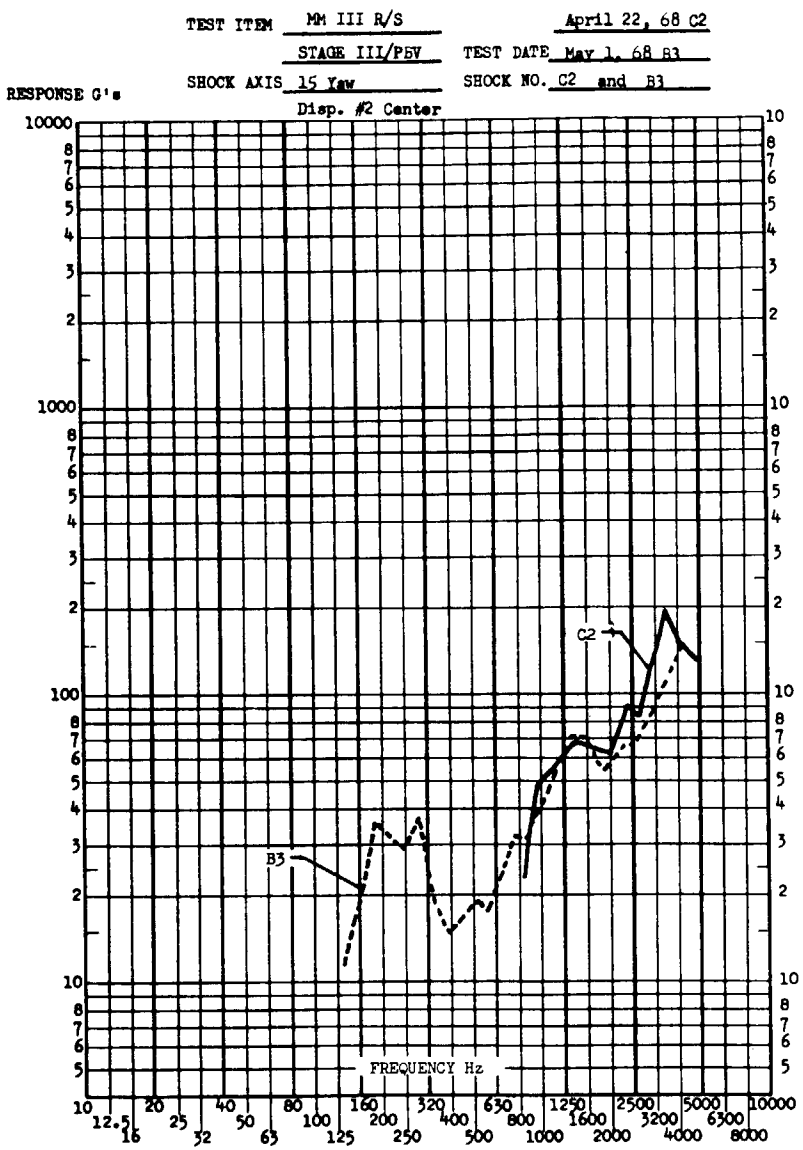
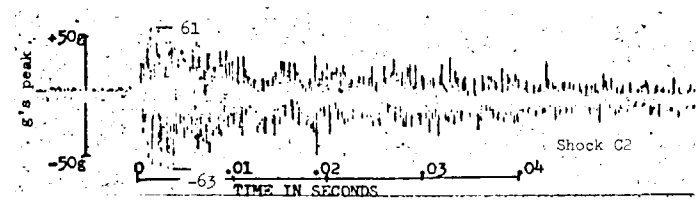


FIGURE I.A.4-40





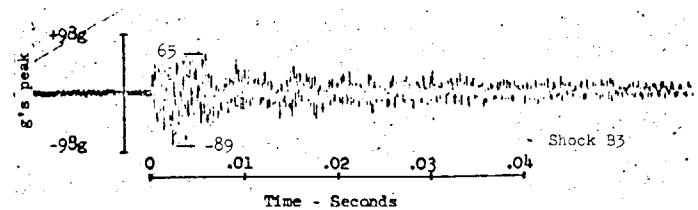
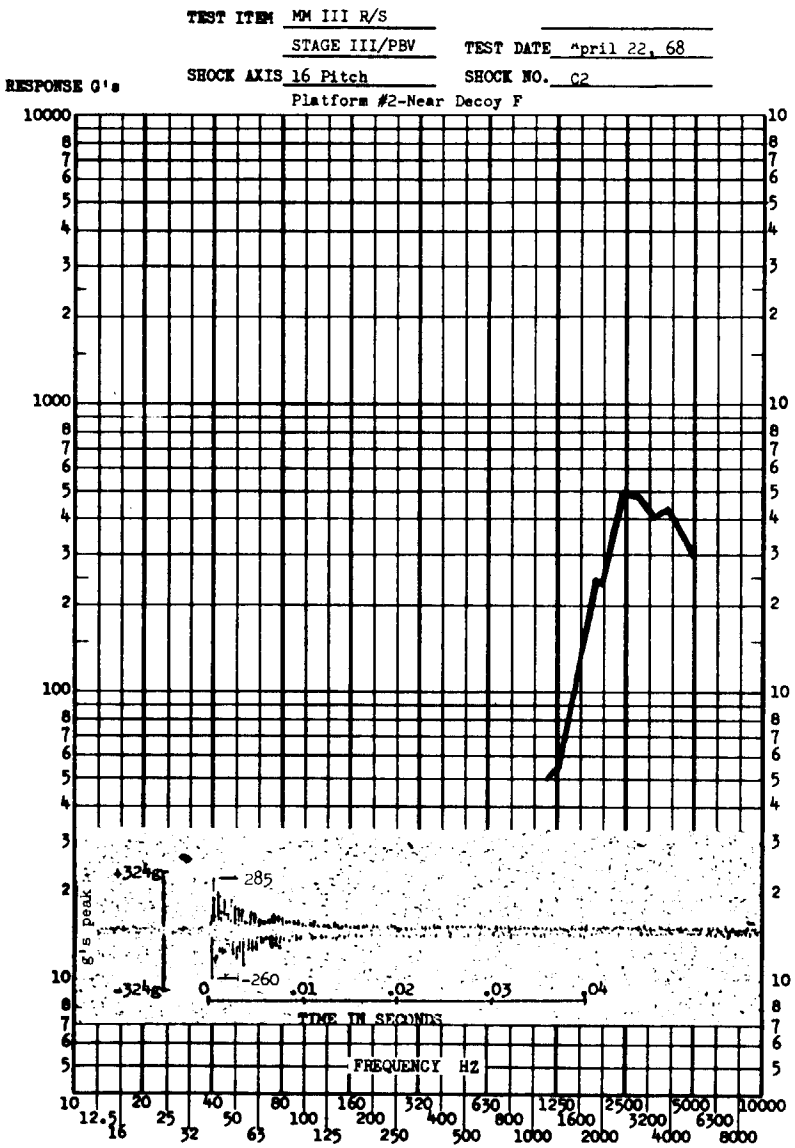


FIGURE I.A.4-41



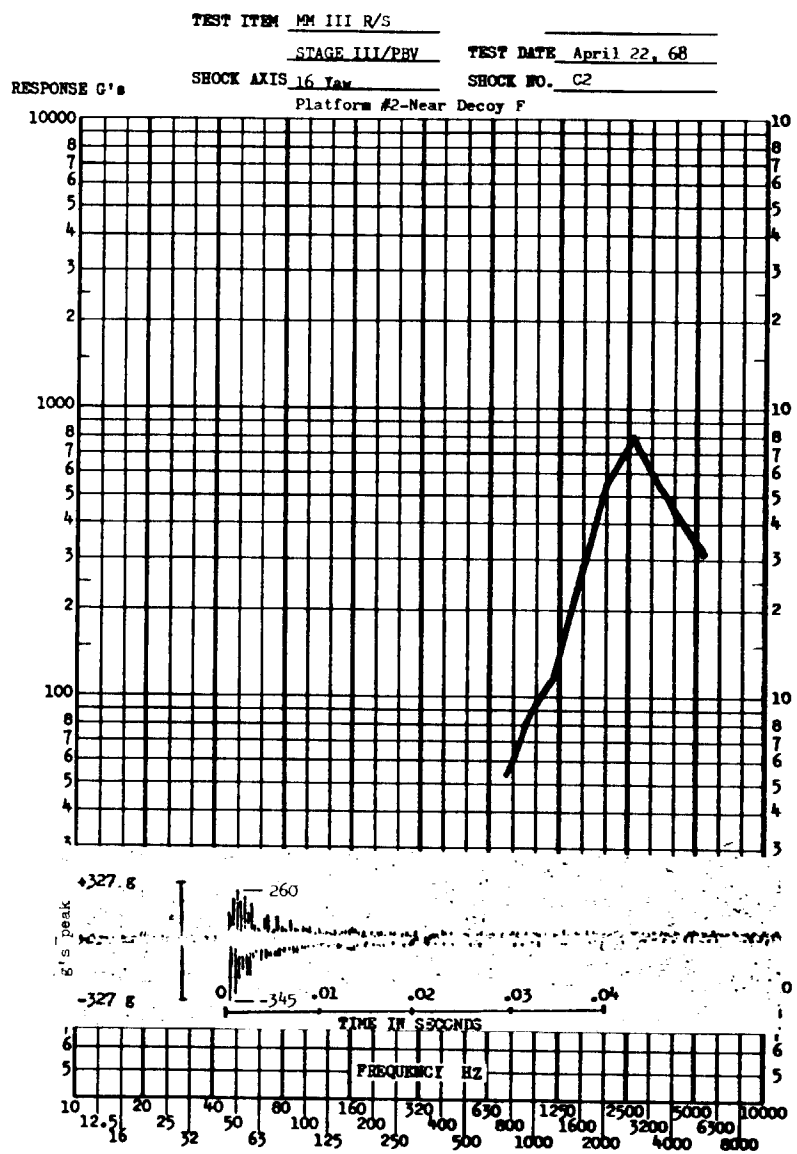
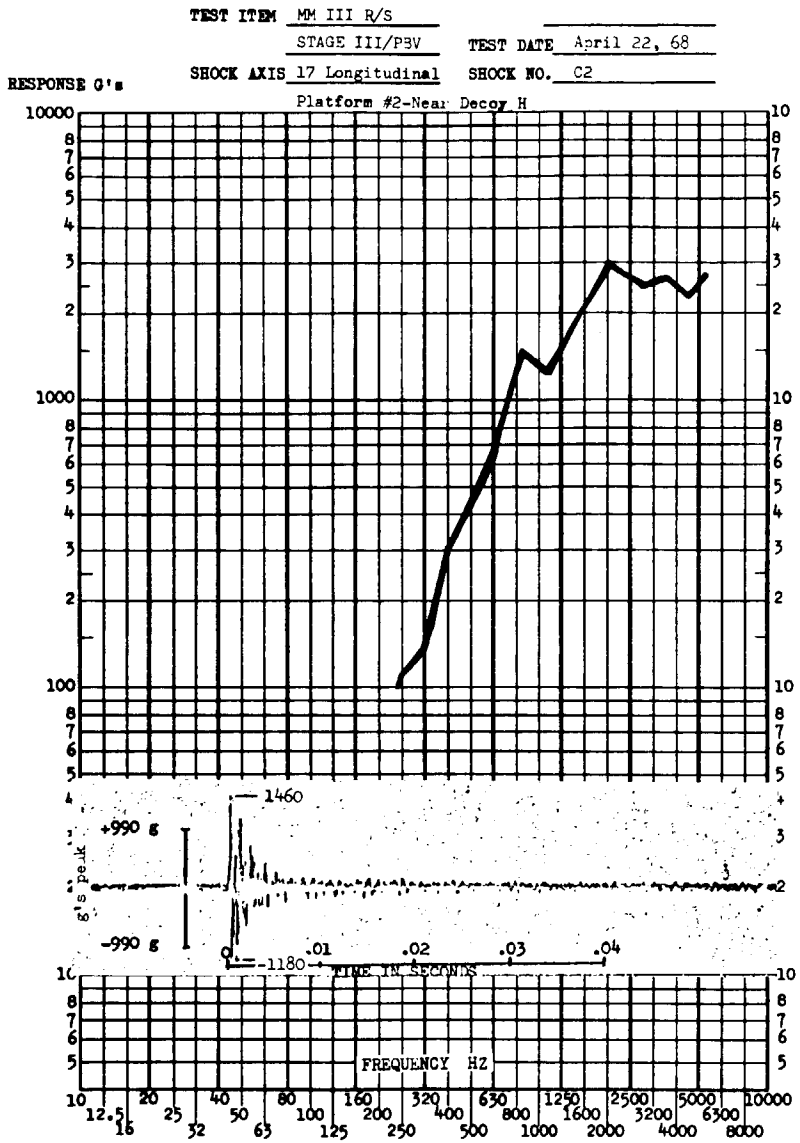


FIGURE I.A.4-42



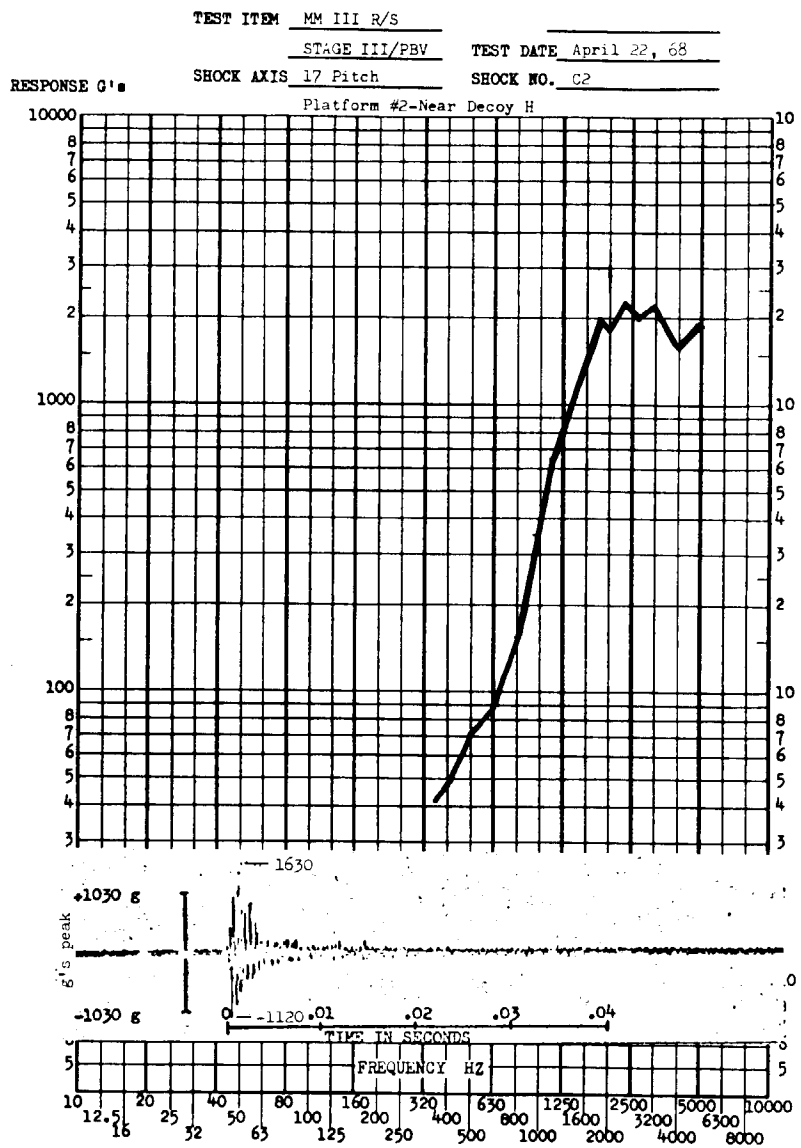
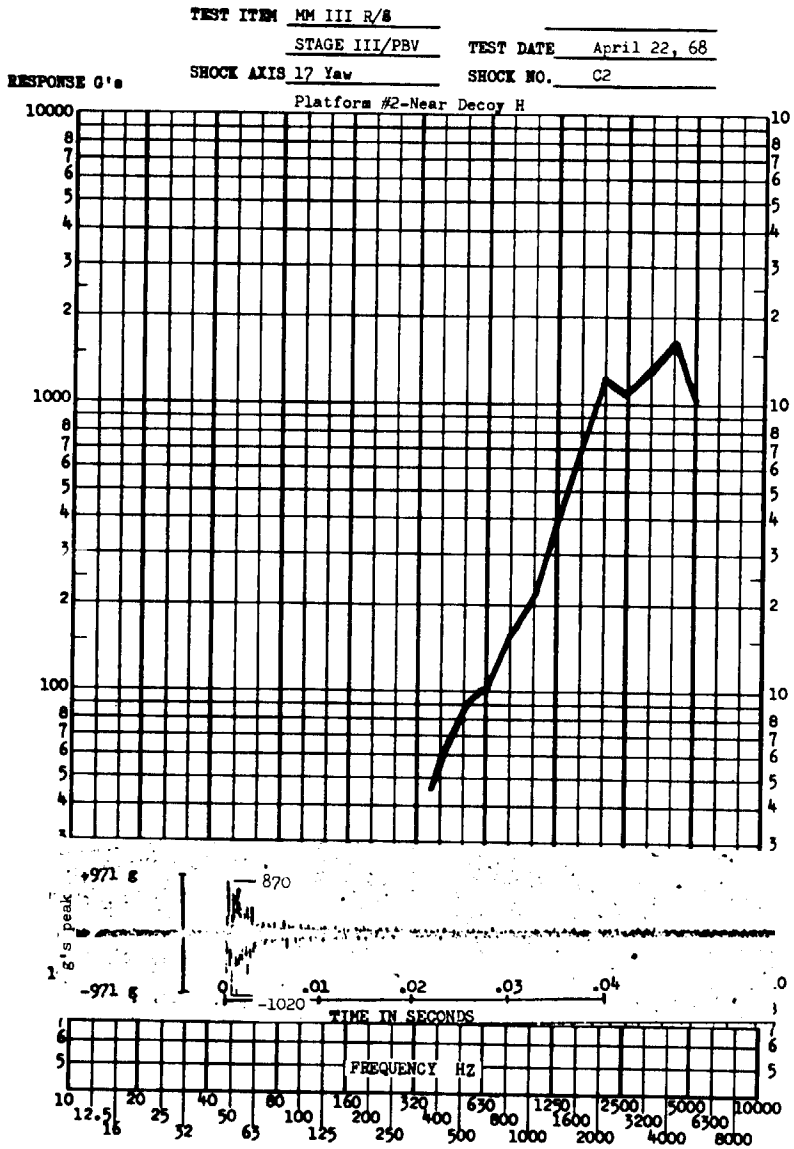


FIGURE I.A.4-43



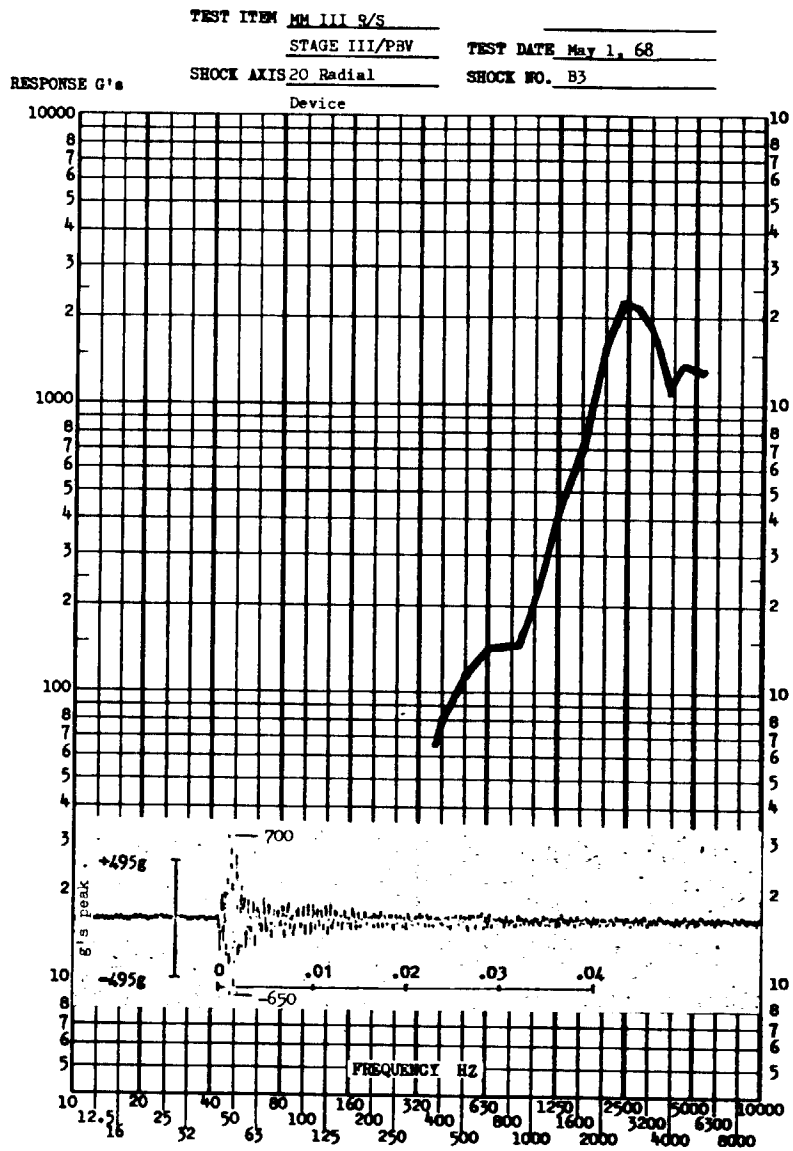
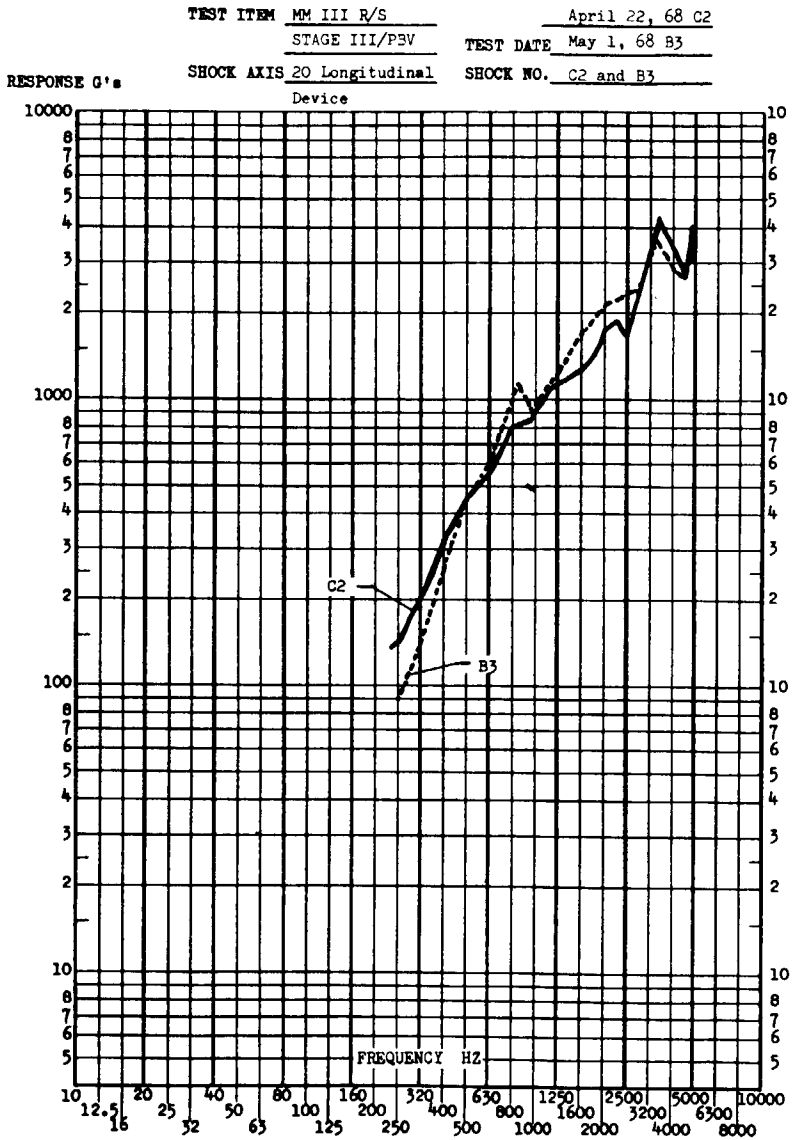
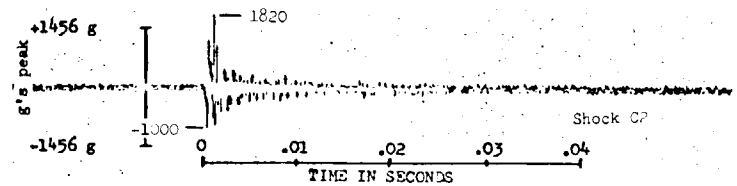
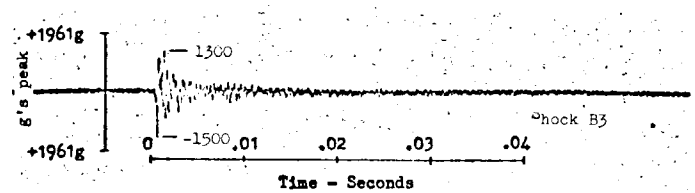


FIGURE I.A.4-44

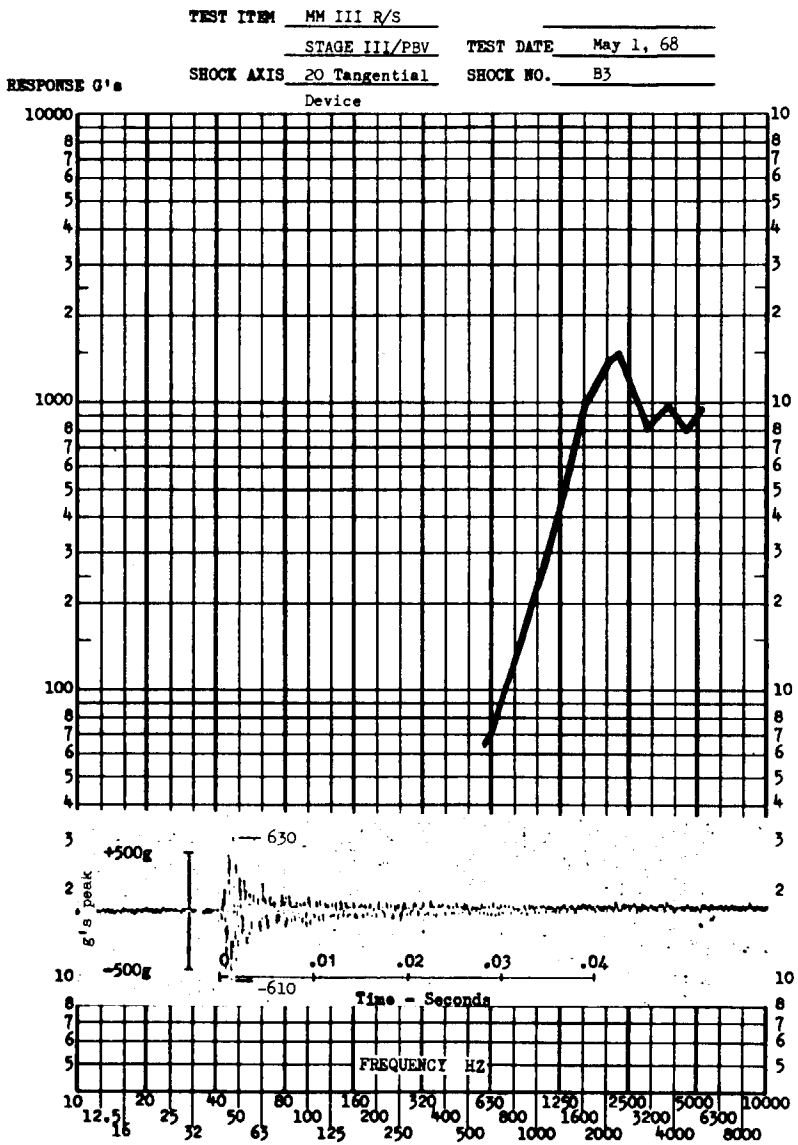






NOT REPRODUCIBLE

FIGURE I.A.4-45



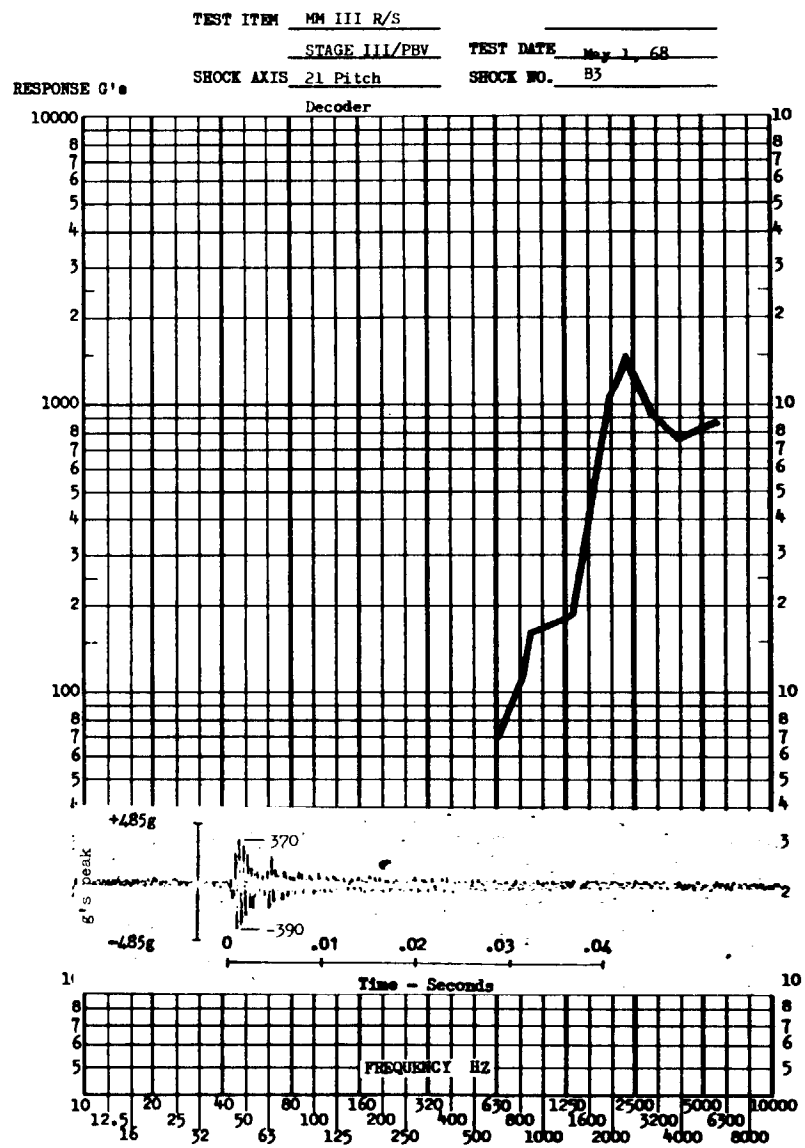
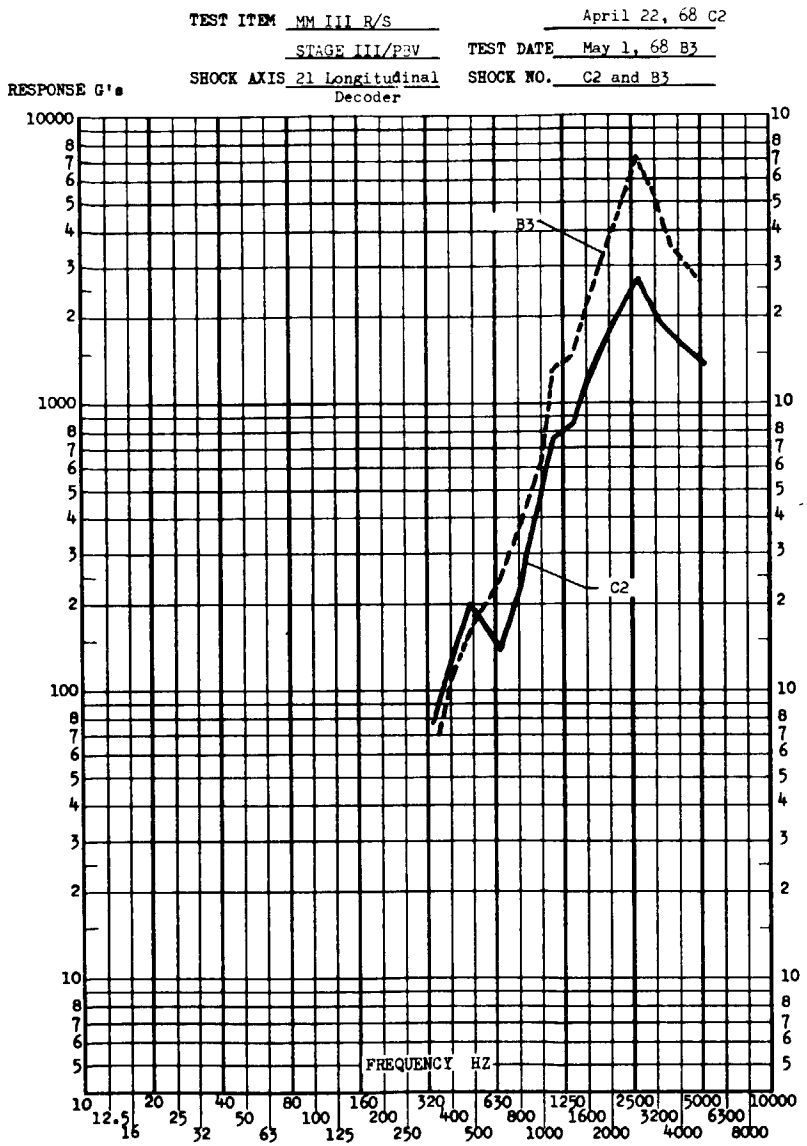
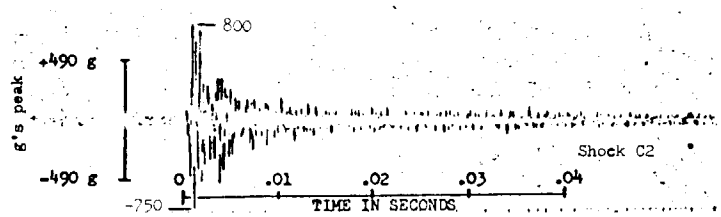


FIGURE I.A.4-46





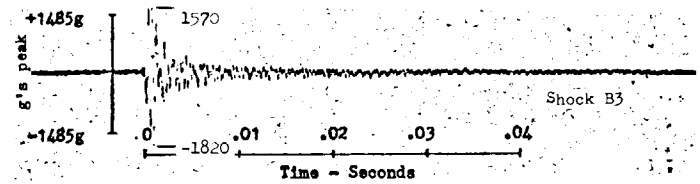
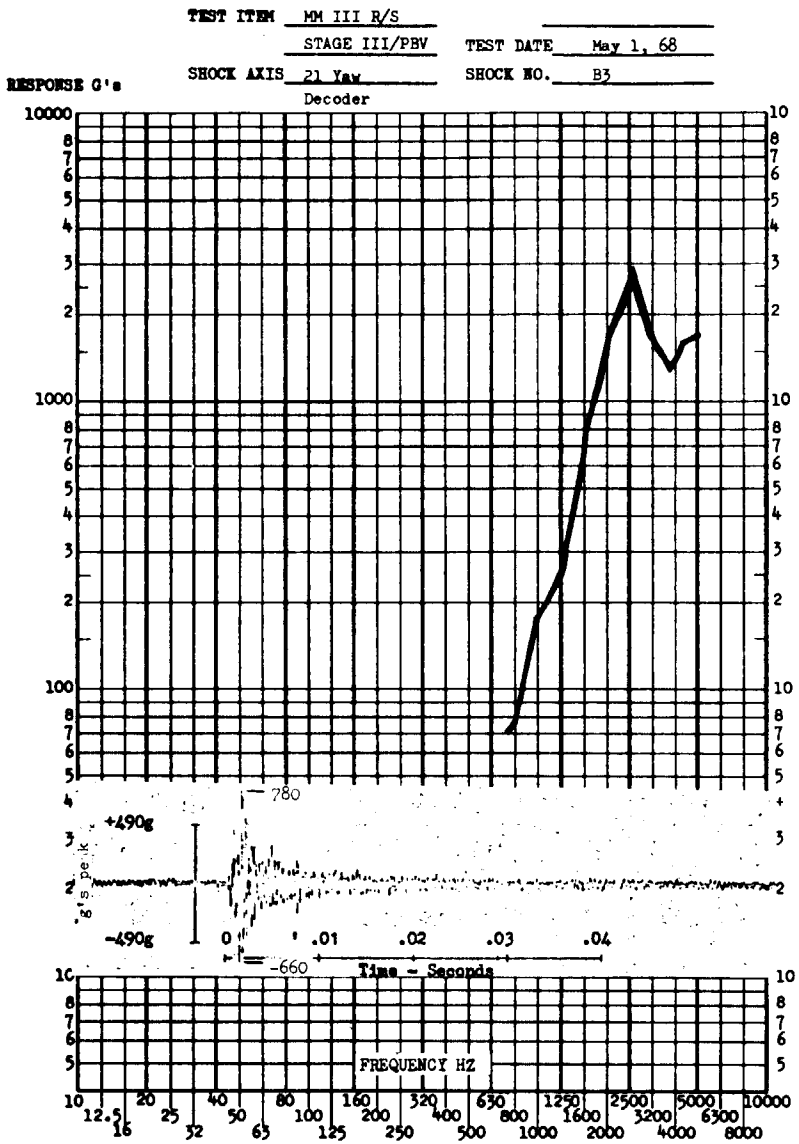


FIGURE I.A.4-47



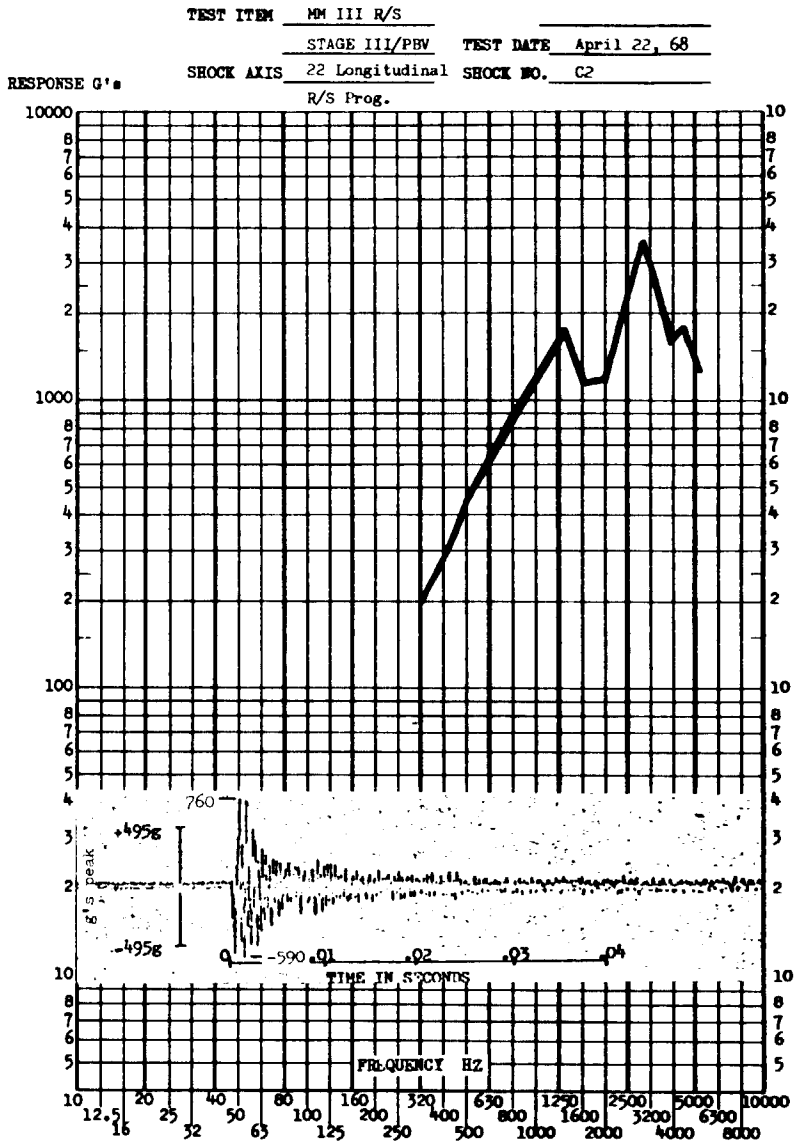
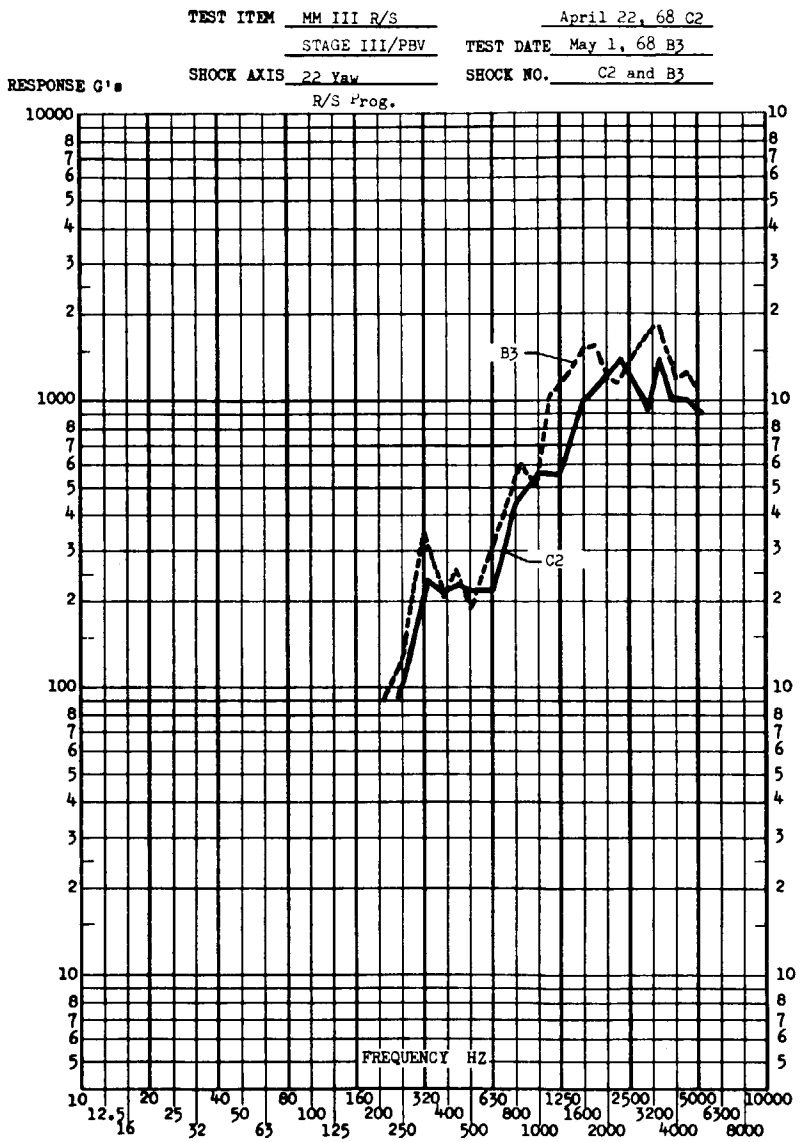
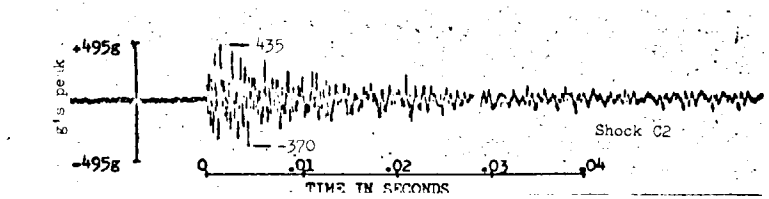


FIGURE I.A.4-48





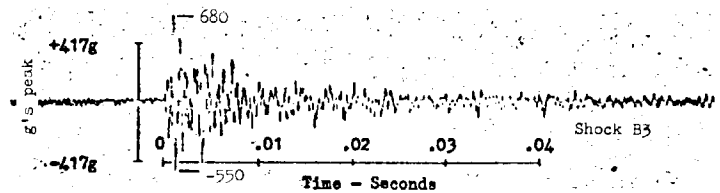
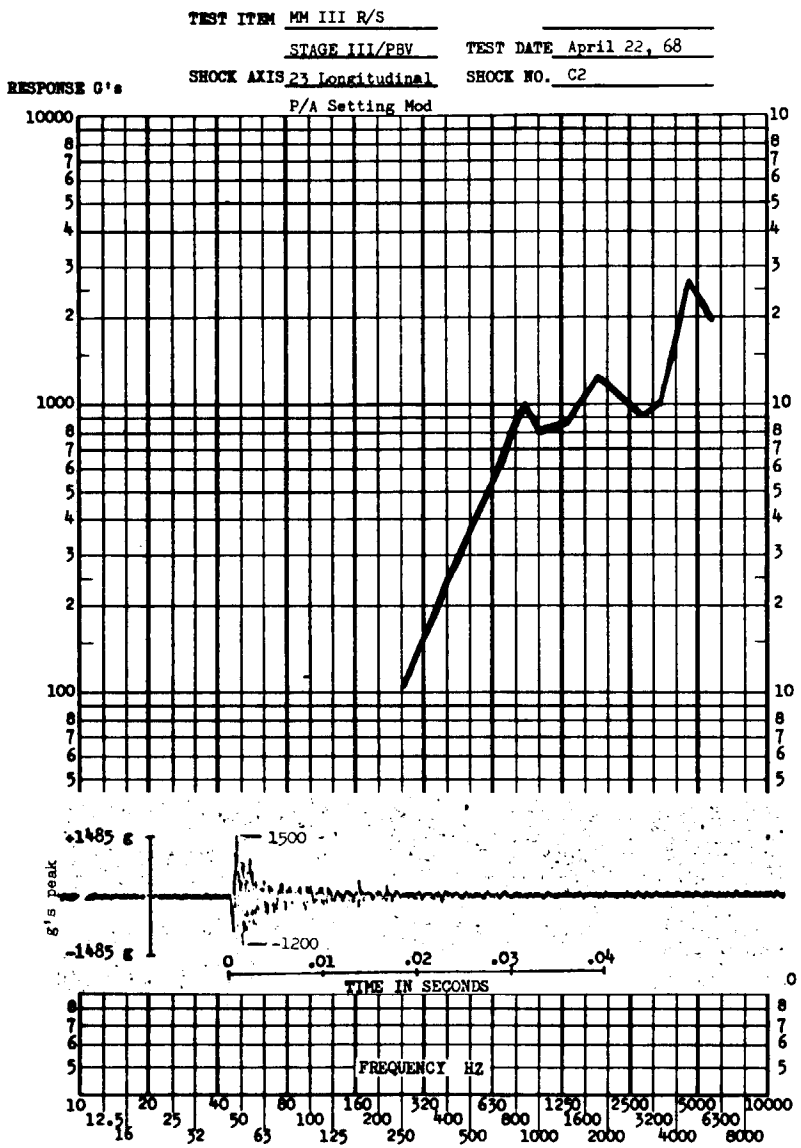


FIGURE 1.A.4-49



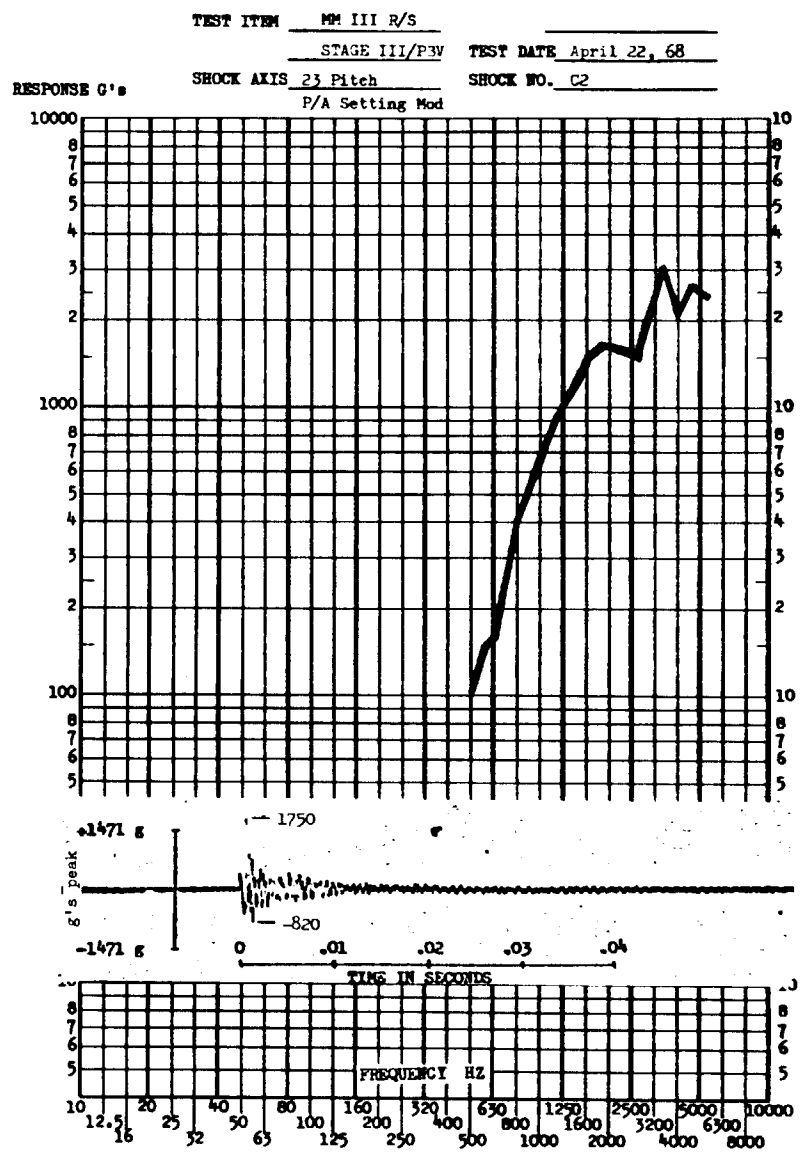
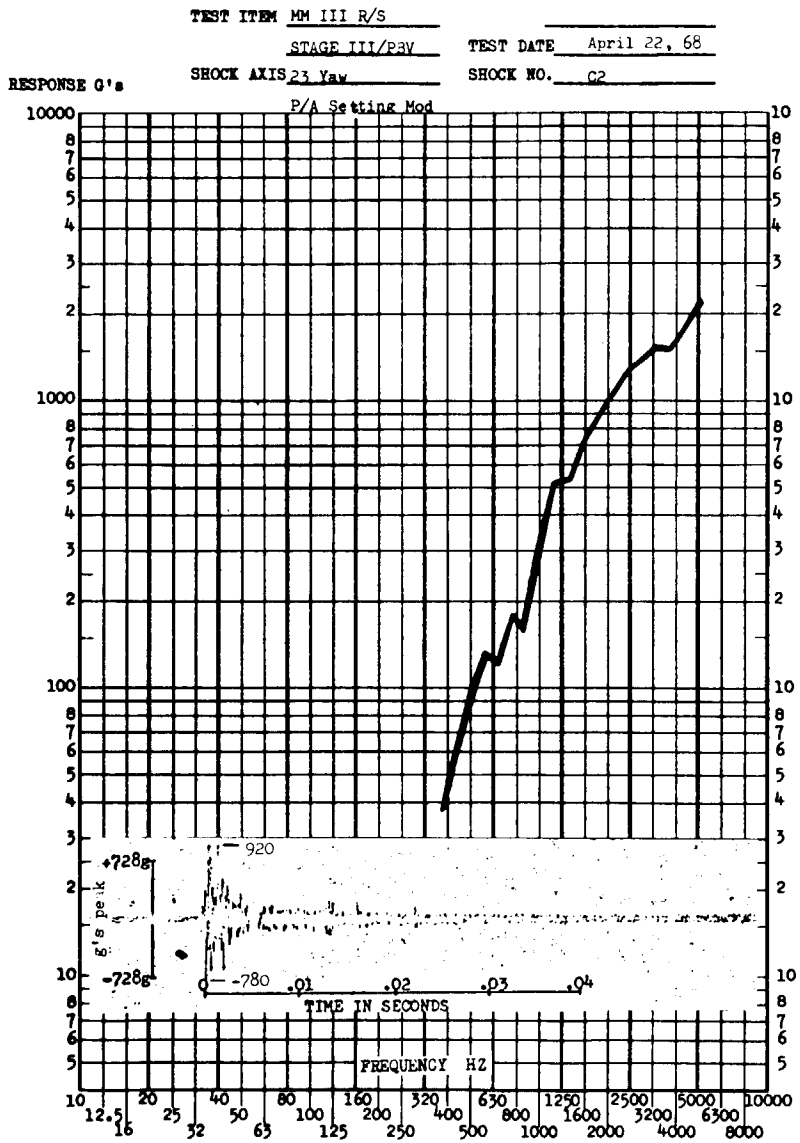


FIGURE I.A.4-50



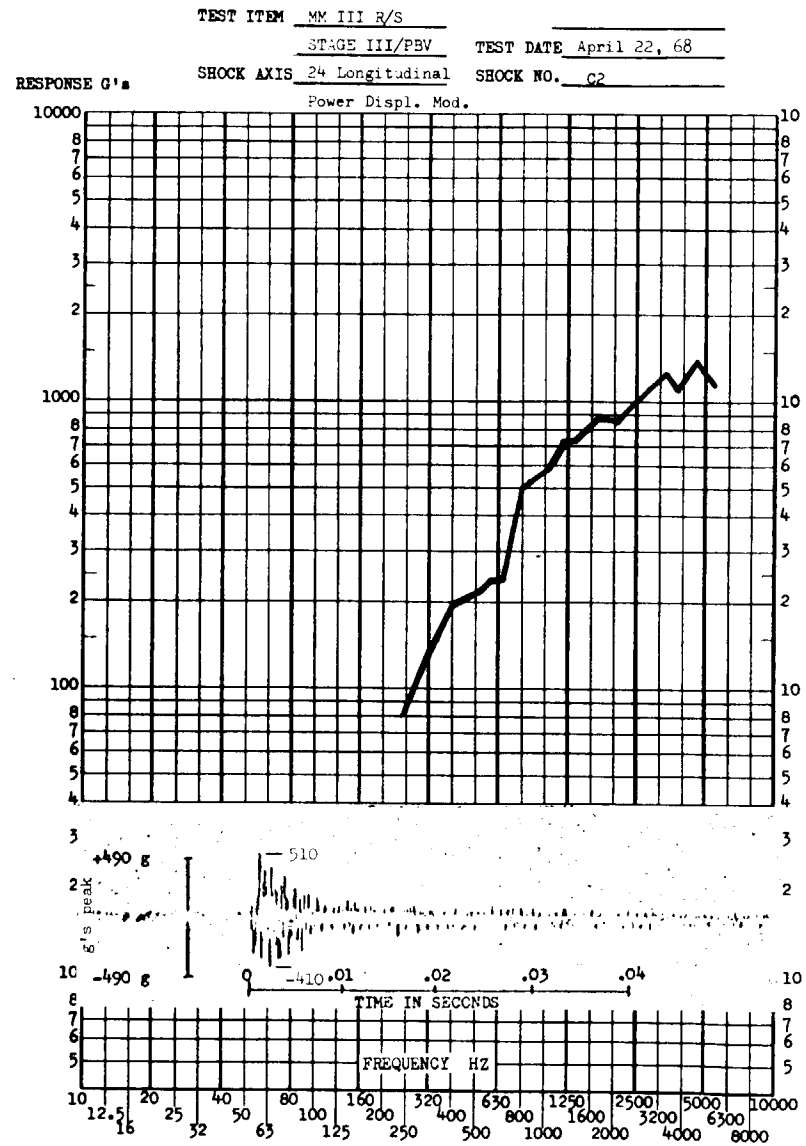
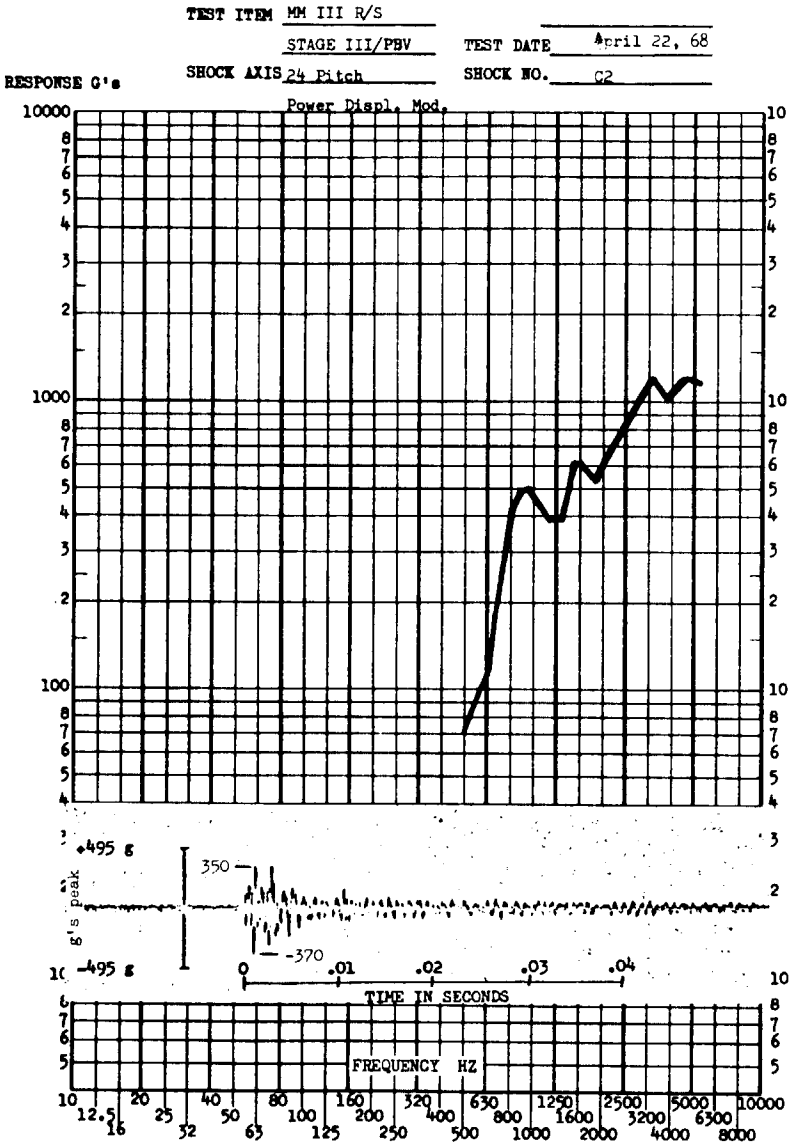


FIGURE I.A.4-51



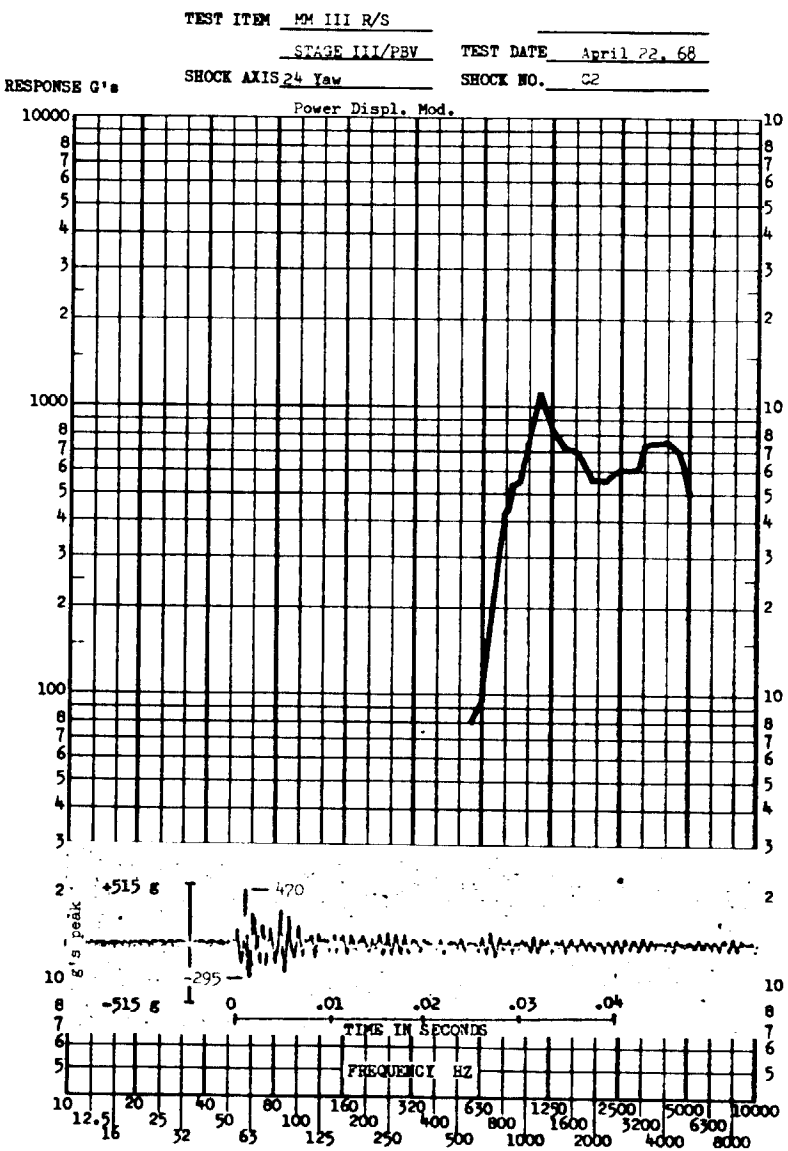
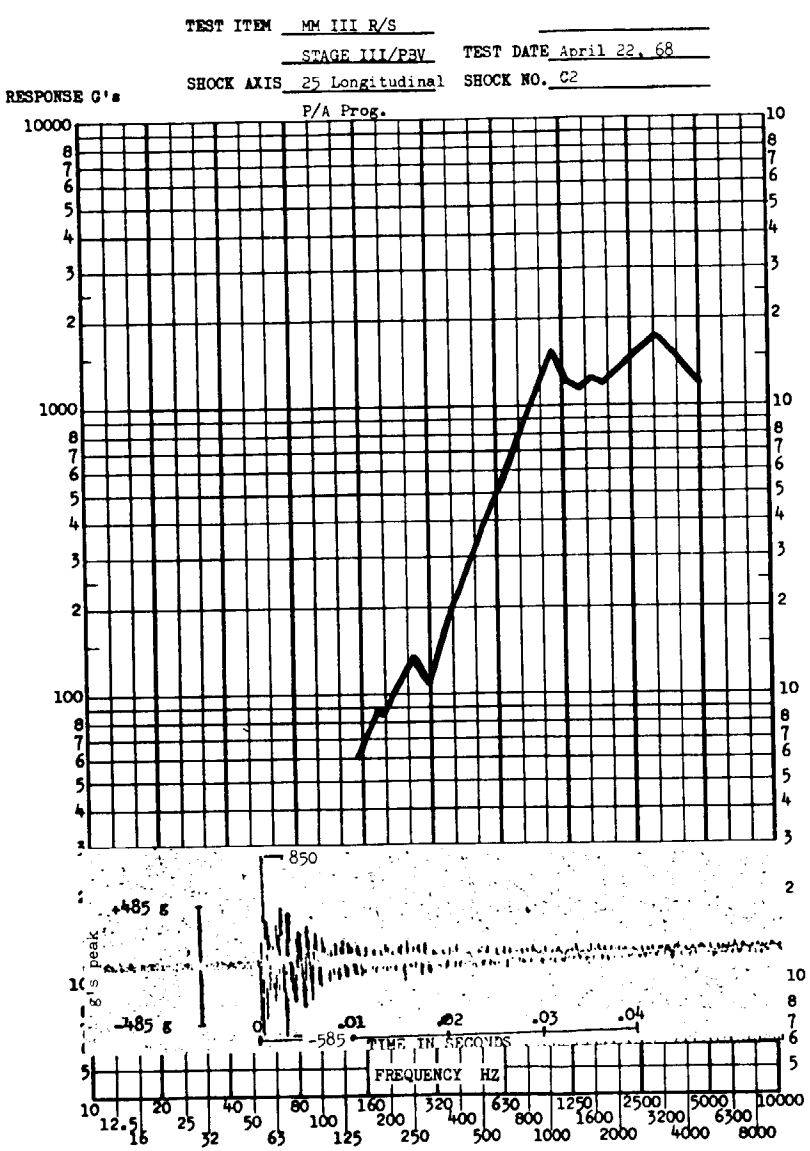


FIGURE I.A.4-52



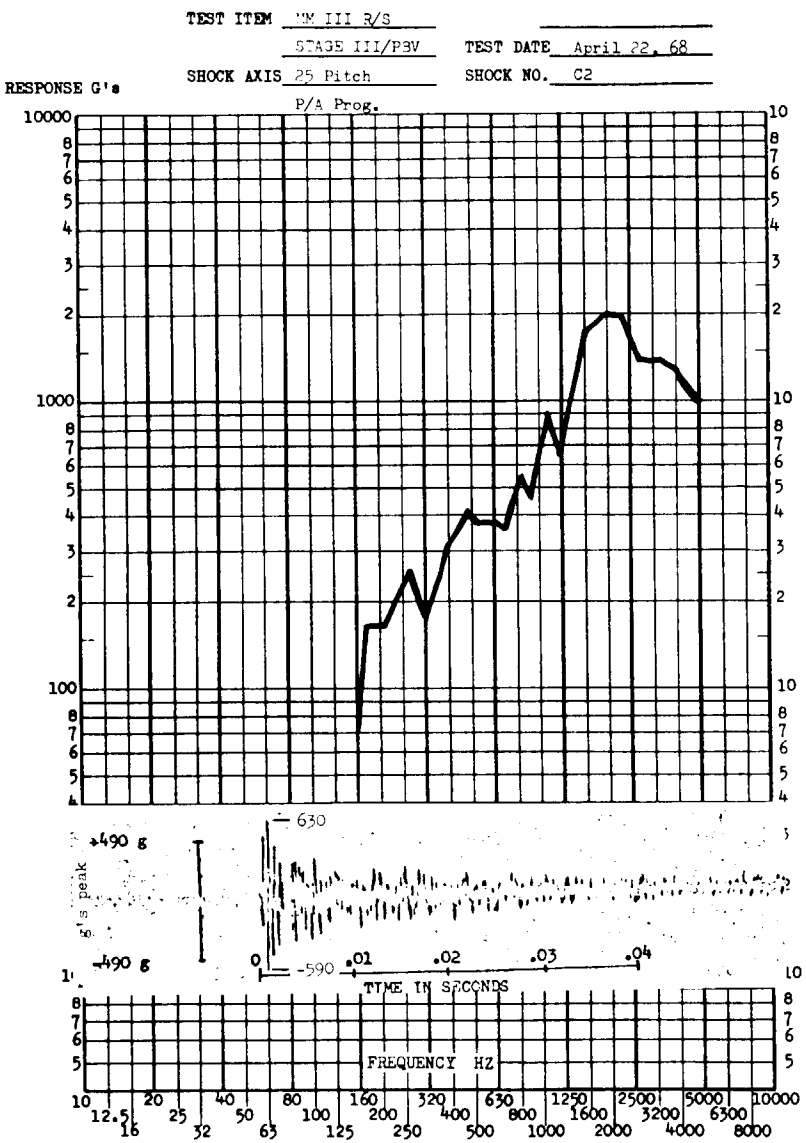
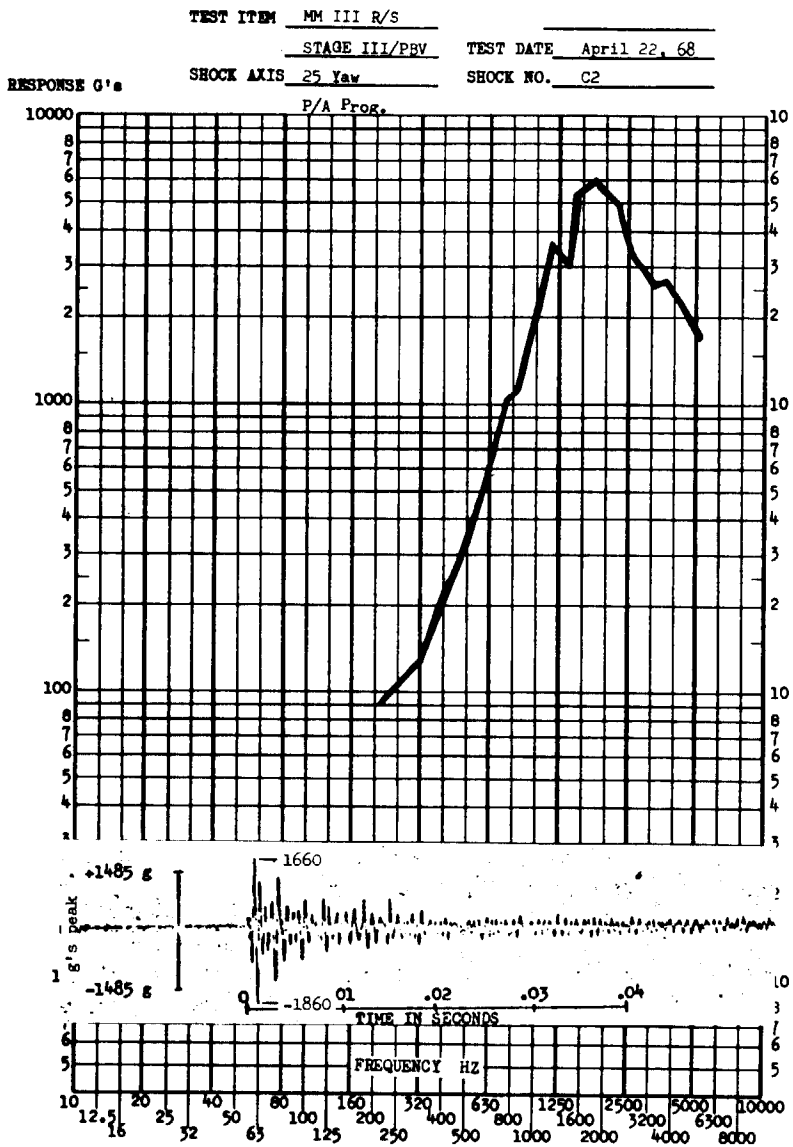


FIGURE I.A.4-53



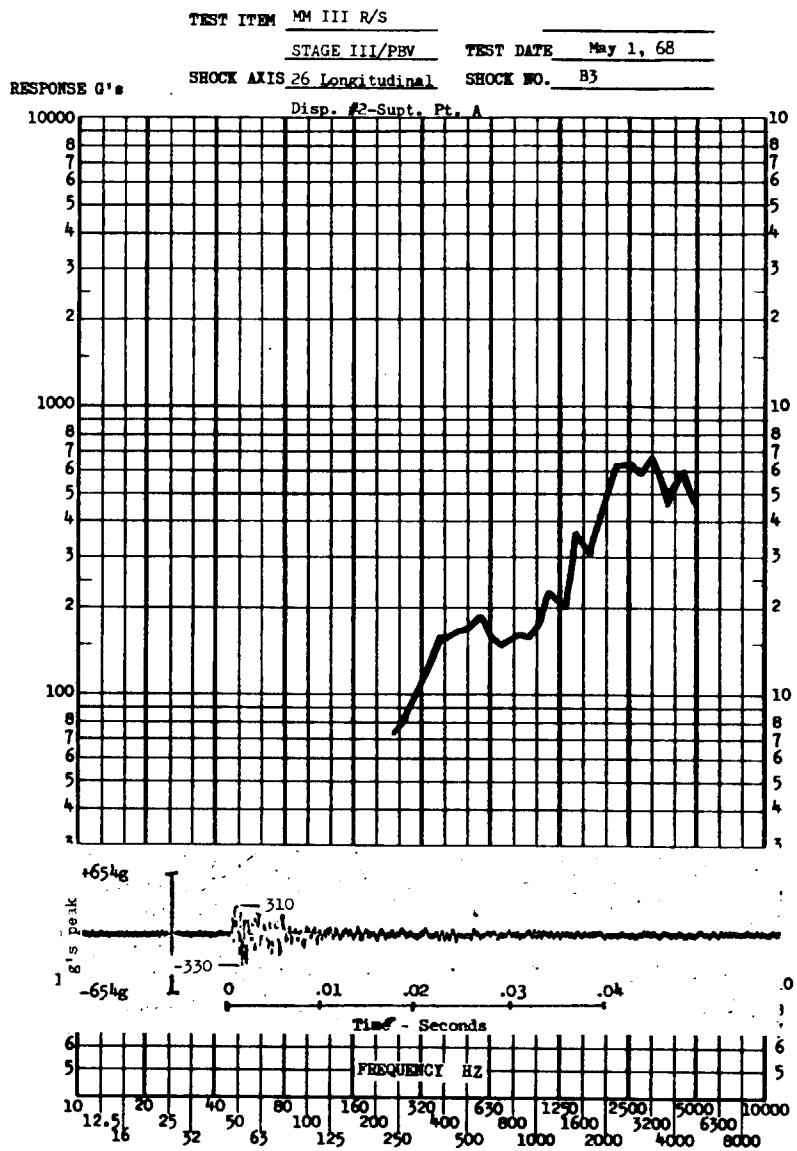
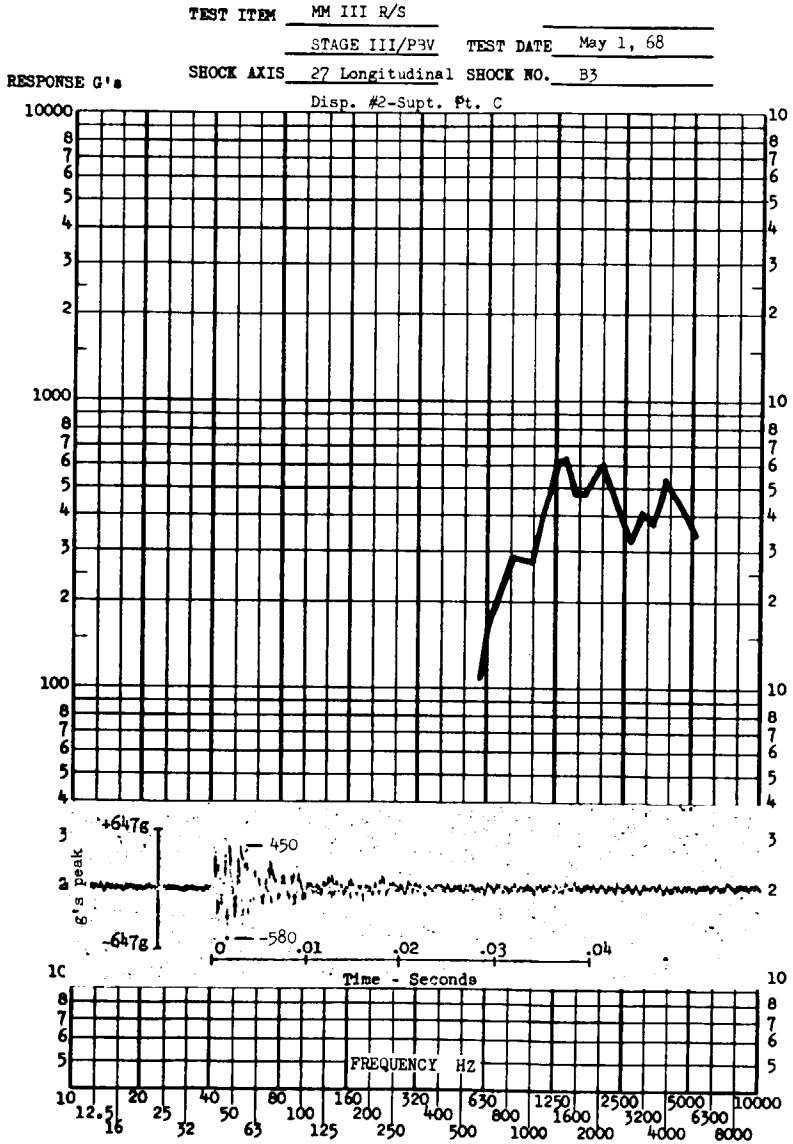


FIGURE I.A.4-54



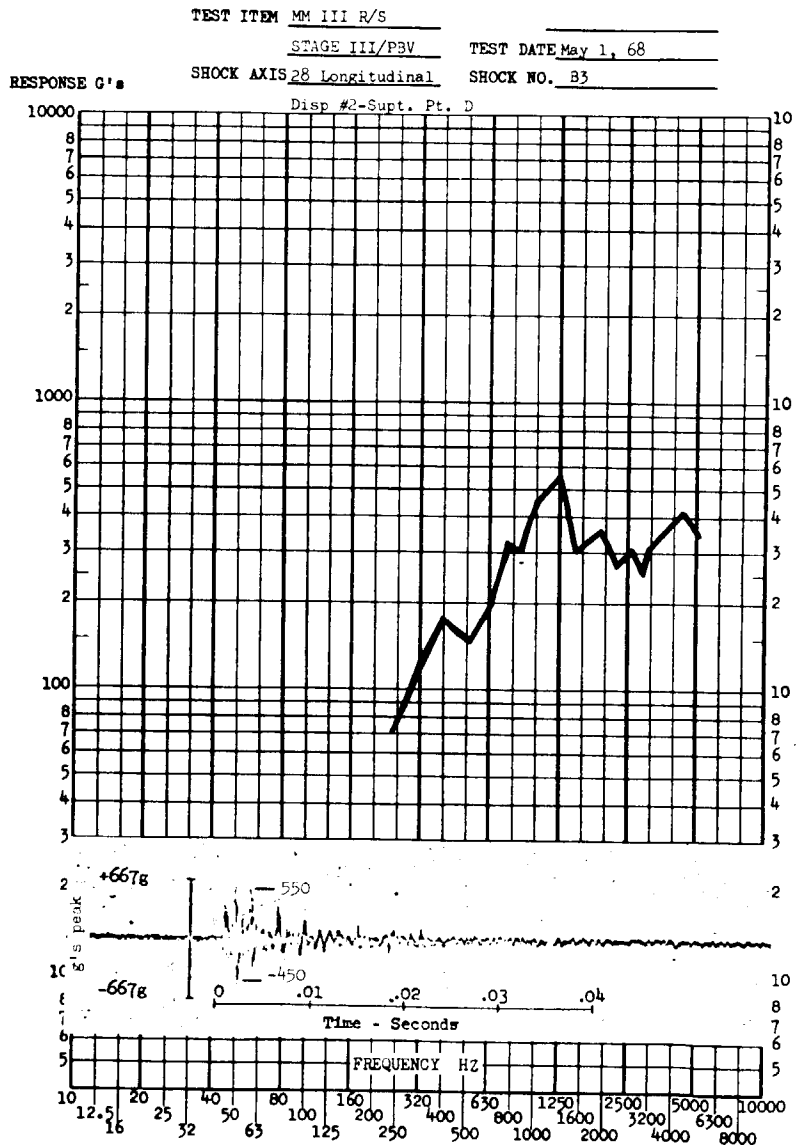
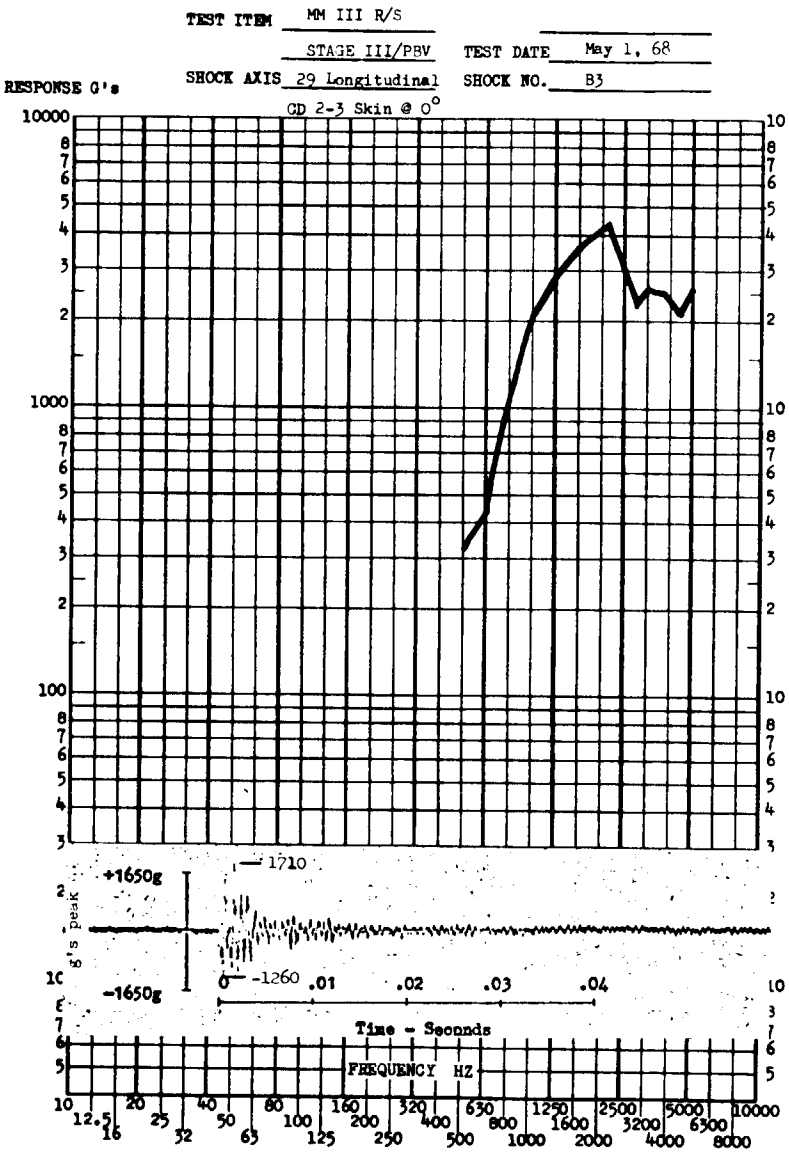


FIGURE I.A.4-55



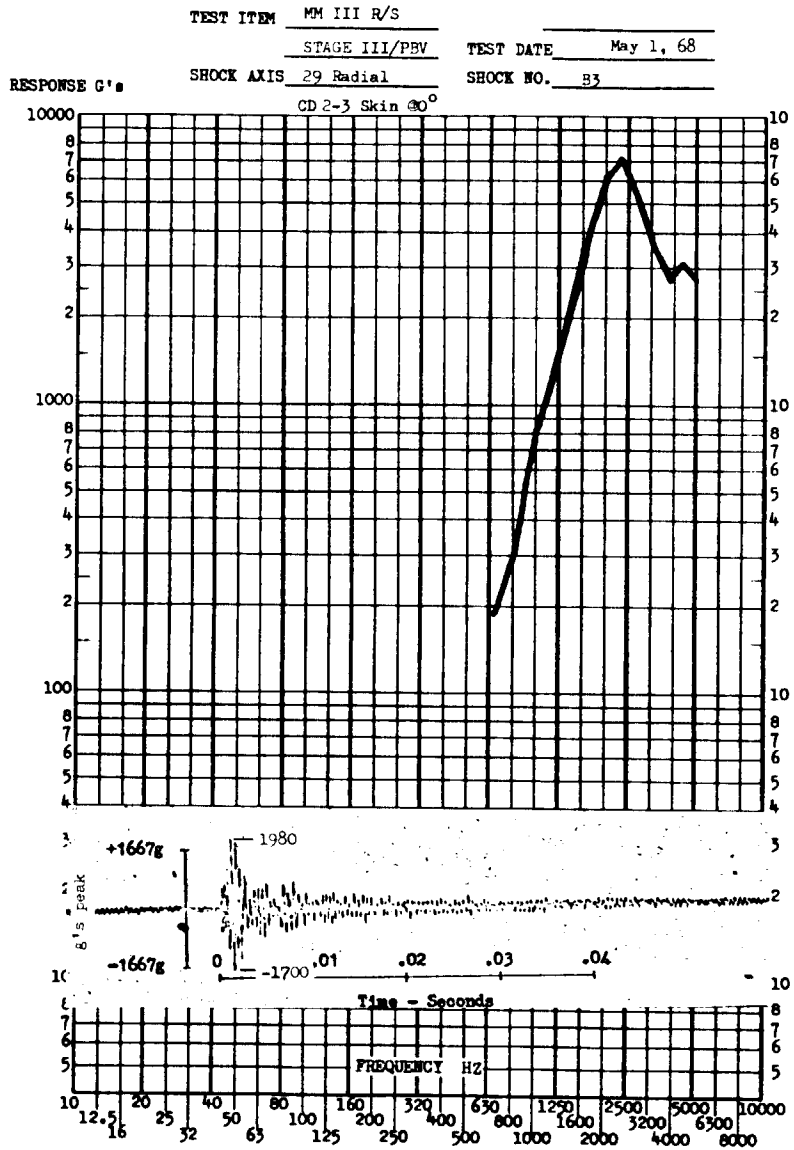
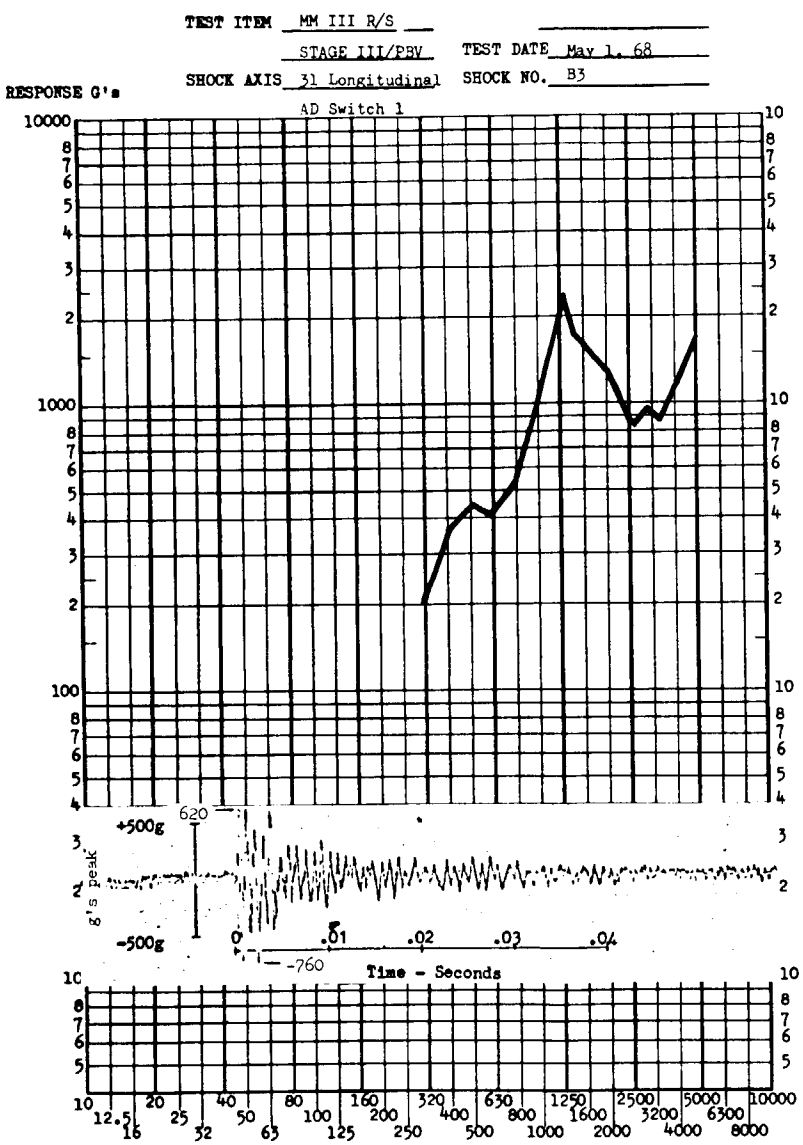


FIGURE I.A.4-56



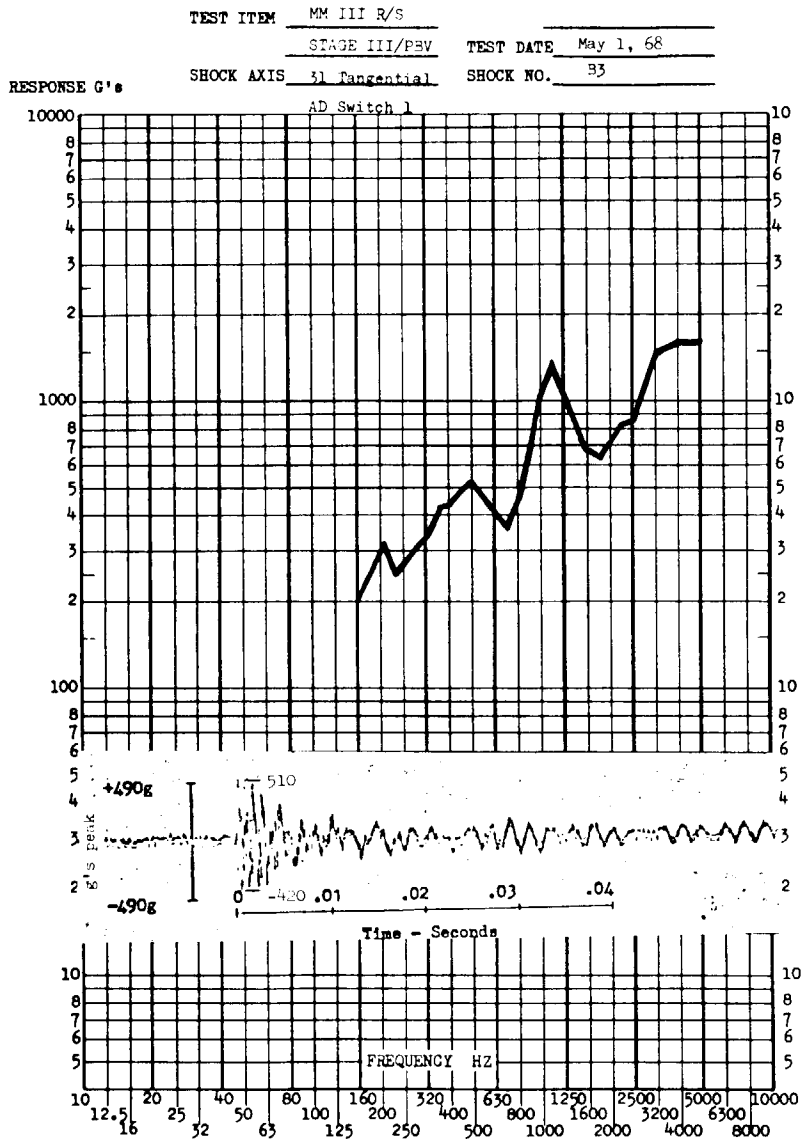


FIGURE I.A.4-57

SECTION I.A.5

MINUTEMAN III POST BOOST VEHICLE SHOCK DETERMINATION TESTS

PURPOSE OF TESTS

The purpose of these tests was to determine the pyrotechnic shock levels to be experienced by the post boost vehicle (PBV) equipment locations during flight.

DESCRIPTIONS OF EVENTS

Nine tests were conducted to examine two pyrotechnic events during flight. The first three tests were umbilical separations while the remaining six tests involved Stage III/PBV separation.

UMBILICAL SEPARATION TESTS

Two umbilicals were separated simultaneously for each test, and each separation ocurred at a point on the umbilical slightly outboard of the vehicle. Figure I.A.5-1 shows the approximate umbilical location and illustrates that the post boost vehicle was standing vertically during the umbilical tests. The separation ordnance was a squib actuated pressure cartridge which first removed a shear pin from the connecting bolt, and the

continued stroke of the piston tended to push apart the umbilical joint.

STAGE III/PBV SEPARATION EVENT

For these tests the PBV configuration shown in Figure I.A.5-1 was turned to the horizontal and suspended by steel straps as depicted in Figure I.A.5-2. The separation was affected using a separation joint (Figure I.A.5-3) containing primachord at 12.3 grains per foot. After separation the adapter section simulating Stage III is disconnected and is forced to swing away from the PBV by a rope. Besides minor changes in the transducer locations monitored, the six tests were identical.

DESCRIPTION OF DATA

UMBILICAL SEPARATION EVENT

No. of time histories	152
No. of shock spectra	151
Type of analysis	analog (absolute response spectra)
Analog system	local equipment adapted to shock data

Frequency range	100-5000 Hz
Frequency increment	5 points per octave
Damping	Q = 10

Although these shock spectra are presented here along with their corresponding time histories as Figures I.A.5-7 through I.A.5-58, they would logically fit in Part III.A of this report due to the type of pyrotechnic involved. Table I.A.5-1 is effectively a table of contents indicating what data are contained in each of the above figures.

STAGE III/PBV SEPARATION EVENT

No. of time histories	315
No. of shock spectra	315
Type of analysis	analog (absolute response spectra)
Analog machine	local equipment adapted to shock data
Frequency range	to 5000 Hz
Frequency increment	5 points per octave
Damping	Q = 10

These shock spectra are presented along with their corresponding time histories as Figures I.A.5-59 through I.A.5-189. Table I.A.5-2 is effectively

a table of contents indicating what data are contained in each of the above figures.

DESCRIPTION OF PYROTECHNIC

UMBILICAL SEPARATION EVENT

All available information regarding the pressure cartridge separation device is discussed under the "Description of Events".

STAGE III/PBV SEPARATION EVENT

Type: Primachord

Joint configuration: Figure I.A.5-3

Size of charge: 12.3 grains per foot

Explosive core: RDX

Location: Figures I.A.5-1 and I.A.5-2 locate the separation plane.

DESCRIPTION OF STRUCTURE

The test configuration consisted of basically skin-ring-frame structure with transducer locations at equipment mounting points primarily on lateral beams. A laterally oriented honeycomb rack was located near the aft end of the re-entry vehicle (RV).

DESCRIPTION OF ACCELEROMETERS

Type: Endevco models 2225 and 2221 M1

Locations: Table I.A.5-3 and Figures I.A.5-4 through I.A.5-6.

DESCRIPTION OF DATA ACQUISITION SYSTEM

Tape recorders: Ampex FR 1300 and CP 100's

Amplifiers: both voltage and charge type amplifiers flat to 10 K Hz and above.

COMMENTS

Due to the classified nature of the Minuteman III program the exact locations of some of the accelerometers are unknown. However, in all cases Table I.A.5-3 gives the section location of the accelerometer and the sections are shown in Figure I.A.5-1.

Examination of these data revealed several discrepancies. First, the high levels of high frequency content in the time histories of Figures I.A.5-79, -115, -119, -138, -179, -180, and -182 do not appear in their respective shock spectra because the spectra are only carried out to 5000 Hz. Others are itemized below:

Figure I.A.5-75 - Run 7 is a higher level than runs 8 and 9.

Figure I.A.5-77 - The time history of run 8 appears to be annotated incorrectly.

Figure I.A.5-80, -82 - The levels for run 7 appear to be much too low.

Figure I.A.5-140 - The time histories seem to be completely inconsistant with the shock spectra.

Figure I.A.5-182, -183 - There are two very different presentations of accelerometer 35R for run 6.

TABLE I.A.5-1

LOCATIONS OF DATA FOR UMBILICAL SEPARATION EVENT

Figure No.	Test No.(s)	Accelerometer No.(s)
I.A.5-7	1,2,3	1-X
I.A.5-8	1,2,3	1-Y
I.A.5-9	1,2,3*	1-Z
I.A.5-10	1,2,3	2-X
I.A.5-11	1,2,3	2-Y
I.A.5-12	1,2,3	2-Z
I.A.5-13	1,2,3	3-X
I.A.5-14	1,2,3	3-Y
I.A.5-15	1,2,3	3-Z
I.A.5-16	1,2,3	4-Z
I.A.5-17	1,2,3	4-R
I.A.5-18	1,2,3	4-T
I.A.5-19	1,2,3	5-X
I.A.5-20	1,2,3	5-Y
I.A.5-21	1,2,3	5-Z
I.A.5-22	1,2,3	6-X
I.A.5-23	1,2,3	6-Y
I.A.5-24	1,2,3	6-Z
I.A.5-25	1,2,3	7-Z
I.A.5-26	1,2,3	7-R
I.A.5-27	1,2,3	7-T
I.A.5-28	1,2,3	8-Z
I.A.5-29	1,2,3	8-R
I.A.5-30	1,2,3	8-T
I.A.5-31	1,2,3	9-Z
I.A.5-32	1,2,3	9-R
I.A.5-33	1,2,3	10-Z
I.A.5-34	1,2,3	10-R
I.A.5-35	1,2,3	11-Z
I.A.5-36	1,2,3	11-R
I.A.5-37	1,2,3	12-Z
I.A.5-38	1,2,3	14-Z
I.A.5-39	3	14-R
I.A.5-40	1,2,3	16-Z
I.A.5-41	1,2,3	23-X
I.A.5-42	1,2,3	23-Y
I.A.5-43	1,2,3	23-Z

* The shock spectra for test 2 is not presented.

TABLE I.A.5-1 (continued)

Figure No.	Test No.(s)	Accelerometer No.(s)
I.A.5-44	1,2,3	24-X
I.A.5-45	1,2,3	24-Y
I.A.5-46	1,2,3	24-Z
I.A.5-47	1,2,3	25-X
I.A.5-48	1,2,3	25-Y
I.A.5-49	1,2,3	25-Z
I.A.5-50	1,2,3	26-X
I.A.5-51	1,2,3	26-Y
I.A.5-52	1,2,3	26-Z
I.A.5-53	1,2,3	27-X
I.A.5-54	1,2,3	27-Y
I.A.5-55	1,2,3	27-Z
I.A.5-56	1,2,3	28-X
I.A.5-57	2,3	28-Y
I.A.5-58	1,2,3	28-Z

TABLE I.A.5-2

LOCATIONS OF DATA FOR STAGING EVENT

Figure No.	Run No.(s)	Accelerometer No.(s)
I.A.5-59	4	1-X, 1-Y
I.A.5-60	4	1-Z, 2-X
I.A.5-61	4	2-Y, 2-Z
I.A.5-62	4,5	3-X
I.A.5-63	4,5	3-Y
I.A.5-64	4,5	3-Z
I.A.5-65	4,5	4-R
I.A.5-66	4	4-Z, 4-T
I.A.5-67	4	5-X, 5-Y
I.A.5-68	4	5-Z, 6-X
I.A.5-69	4	6-Y, 6-Z
I.A.5-70	4,5	7-R
I.A.5-71	4	7-Z, 7-T
I.A.5-72	4,5	8-Z
I.A.5-73	4	8-R, 8-T
I.A.5-74	5,6	9-Z
I.A.5-75	7,8,9	9-Z
I.A.5-76	8,9	9-R
I.A.5-77	8,9	9-T
I.A.5-78	5,6	11-Z
I.A.5-79	5,6	11-R
I.A.5-80	7,8,9	11-R
I.A.5-81	5,6	11-T
I.A.5-82	7,8,9	11,T
I.A.5-83	4,5,6	12-Z
I.A.5-84	7,8	12-Z
I.A.5-85	4,5,6	12-R
I.A.5-86	7,8,9	12-R
I.A.5-87	5,6	12-T
I.A.5-88	7,8	12-T
I.A.5-89	4,5,6	13-Z
I.A.5-90	7,8	13-Z
I.A.5-91	5,6	13-R
I.A.5-92	7,8,9	13-R
I.A.5-93	5,6	13-T
I.A.5-94	7,8,9	13-T
I.A.5-95	4,5,6	14-Z
I.A.5-96	7,8	14-Z
I.A.5-97	4,5,6	14-R
I.A.5-98	7,8,9	14-R
I.A.5-99	5,6	14-T

TABLE I.A.5-2
(Continued)

Figure No.	Run No.(s)	Accelerometer No.(s)
I.A.5-100	7,8	14-T
I.A.5-101	4,5,6	15-Z
I.A.5-102	7,8,9	15-Z
I.A.5-103	5,6	15-R
I.A.5-104	7,8,9	15-R
I.A.5-105	5,6	15-T
I.A.5-106	7,9	15-T
I.A.5-107	4,5,6	16-Z
I.A.5-108	7,8,9	16-Z
I.A.5-109	4,5,6	16-R
I.A.5-110	7,8,9	16-R
I.A.5-111	5,6	16-T
I.A.5-112	7,9	15-T
I.A.5-113	5,6	17-Z
I.A.5-114	7,8,9	17-Z
I.A.5-115	5,6	17-R
I.A.5-116	7,8,9	17-R
I.A.5-117	5,6	17-T
I.A.5-118	7,8,9	17-T
I.A.5-119	5,6	18-Z
I.A.5-120	7,8,9	18-Z
I.A.5-121	5,6	19-Z
I.A.5-122	7,8,9	19-Z
I.A.5-123	5,6	20-X
I.A.5-124	7,8,9	20-X
I.A.5-125	5,6	20-Y
I.A.5-126	7,8,9	20-Y
I.A.5-127	5,6	20-Z
I.A.5-128	7,8,9	20-Z
I.A.5-129	5,6	21-X
I.A.5-130	7,9	21-X
I.A.5-131	5,6	21-Y
I.A.5-132	7,8,9	21-Y
I.A.5-133	5,6	21-Z
I.A.5-134	7,8,9	21-Z
I.A.5-135	8,9	22-X
I.A.5-136	8,9	22-Y
I.A.5-137	8,9	22-Z
I.A.5-138	4,5,6	23-X
I.A.5-139	8,9	23-X
I.A.5-140	4,5,6	23-Y
I.A.5-141	7,8	23-Y

TABLE I.A.5-2
(Continued)

Figure No.	Run No.(s)	Accelerometer No.(s)
I.A.5-142	4,5,6	23-Z
I.A.5-143	7,8	23-Z
I.A.5-144	4,5,6	24-X
I.A.5-145	7,8,9	24-X
I.A.5-146	4,56	24-Y
I.A.5-147	7,8,9	24-Y
I.A.5-148	5,6	24-Z
I.A.5-149	7,8,9	24-Z
I.A.5-150	8,9	25-Z
I.A.5-151	4,5,6	26-X
I.A.5-152	7,8,9	26-X
I.A.5-153	4	26-Y
I.A.5-154	8,9	26-Y
I.A.5-155	4,5,6	26-Z
I.A.5-156	7,8	26-Z
I.A.5-157	4,5,6	27-X
I.A.5-158	7,8,9	27-X
I.A.5-159	4,5,6	27-Y
I.A.5-160	7,8,9	27-Y
I.A.5-161	4,5,6	27-Z
I.A.5-162	7,8,9	27-Z
I.A.5-163	4,5,6	28-X
I.A.5-164	7,8,9	28-X
I.A.5-165	4,5,6	28-Y
I.A.5-166	7,8,9	28-Y
I.A.5-167	5,6	28-Z
I.A.5-168	7,8,9	28-Z
I.A.5-169	5,6	30-Z
I.A.5-170	7,8,9	30-Z
I.A.5-171	9,6	25-Y, 30-R
I.A.5-172	7,8	30-R
I.A.5-173	5,6	30-T
I.A.5-174	7,8	30-T
I.A.5-175	8,9	31-Z
I.A.5-176	8,9	31-R
I.A.5-177	5,6	31-T
I.A.5-178	7,8,9	31-T
I.A.5-179	5,6	32-X, 33-R
I.A.5-180	7,6	33-R, 34-R

TABLE I.A.5-2
(Continued)

Figure No.	Run No.(s)	Accelerometer No.(s)
I.A.5-181	7,8	34-R
I.A.5-182	6,7	35-R
I.A.5-183	6,9	35-R, 101-T
I.A.5-184	7,8	36-R
I.A.5-185	9	101-Z, 102-Z
I.A.5-186	9	104-T, 105-Z
I.A.5-187	9	105-R, 107-X
I.A.5-188	9	111-Z, 112-X
I.A.5-189	9	112-Y, 116-Z

TABLE I.A.5-3
Accelerometer Locations

Accelerometer Number	Section	Component
1X,1Y,1Z	MOD7	Multiplexer-Programmer
2X,2Y,2Z	MOD7	C-Band Transponder
3X,3Y,3Z	MOD7	D93 SC AMP.
4R,4T,4Z	MOD7	C/D ANTENNA
5X,5Y,5Z	MOD7	PCM SC
6X,6Y,6Z	MOD7	UDOP Transponder
7R,7T,7Z	MOD7	C-Band Antenna
8R,8T,8Z	MOD7	UDOP Antenna
9R,9T,9Z	PBPS	Roll Engine #2
10R,10T,10Z	PBPS	Roll Engine #4
11R,11T,11Z	PBPS	Yaw Engine #2
12R,12T,12Z	PBPS	Fuel Tank @ Gas End
13R,13T,13Z	PBPS	Fuel Tank @ Prop. End
14R,14T,14Z	PBPS	PS Ass-Reg.
15R,15T,15Z	PBPS	PS Ass-Web.
16R,16T,16Z	PBPS	Yaw Actuator
17R,17T,17Z	PBPS	CD2-4

TABLE I.A.5-3
(Continued)

Accelerometer Number	Section	Component
18Z	PBPS	Oxidizer Tank @ Gas End
19Z	PBPS	Oxidizer Tank @ Prop. End
20X,20Y,20Z	NS17	Computer
21X,21Y,21Z	NS17	Computer, Memory Housing
22X,22Y,22Z	NS17	Computer, Diagonal foot
23X,23Y,23Z	NS17	MGSC
24X,24Y,24Z	NS17	P92
25X,25Y,25Z	NS17	Computer, Foot
26X,26Y,26Z	NS17	Battery
27X,27Y,27Z	NS17	GSP
28R,28T,28Z	NS17	CD2-3A Skin
NO LOCATION 29		
30R,30T,30Z	R/V	Fwd. End
31R,31T,31Z	PBPS	Pitch Engine #4
32X	MOD7	Mistram Transponder
33R	PBPS	
34R,34Z	PBPS	
35R,	PBPS	
36R,36T,36Z	PBPS	

TABLE I.A.5-3
(Continued)

Accelerometer Number	Section	Component
101R,101T,101Z	R/S	Interface Ring
102R,102T,102Z	R/S	Interface Ring
103R,103T,103Z	R/S	Bulkhead
104R,104T,104Z	R/S	Bulkhead
105R,105T,105Z	R/S	Bulkhead
106R,106T,106Z	R/S	Dispenser
107R,107T,107Z	R/S	Dispenser
108R,108T,108Z	R/S	Minicoder
109R,109T, 109Z	R/S	Bulkhead
110Z	R/S	Programmer Flange
111Z	R/S	Cone Skin (Near Programmer)
112X,112Y,112Z	R/S	Top of Programmer
113X,113Y,113Z	R/S	Cone Skin (Near Programmer)
114Z	R/S	Ballast "A" on 2-42 Pad
115Z	R/S	Ballast "C" on 2-42 Pad
116Z	R/S	Dispenser

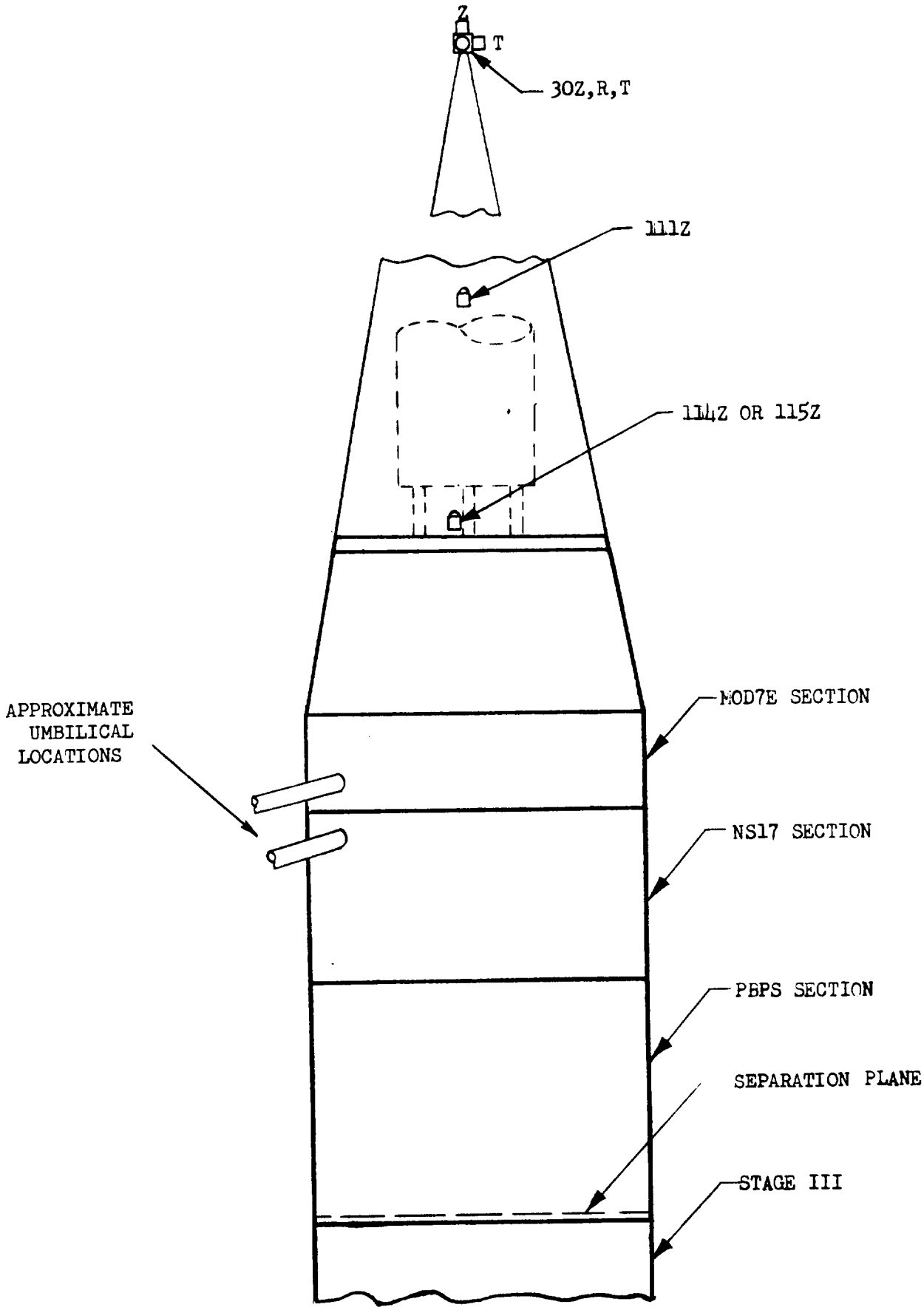


FIGURE I.A.5-1 CONFIGURATION OF PBV SEPARATION TESTS

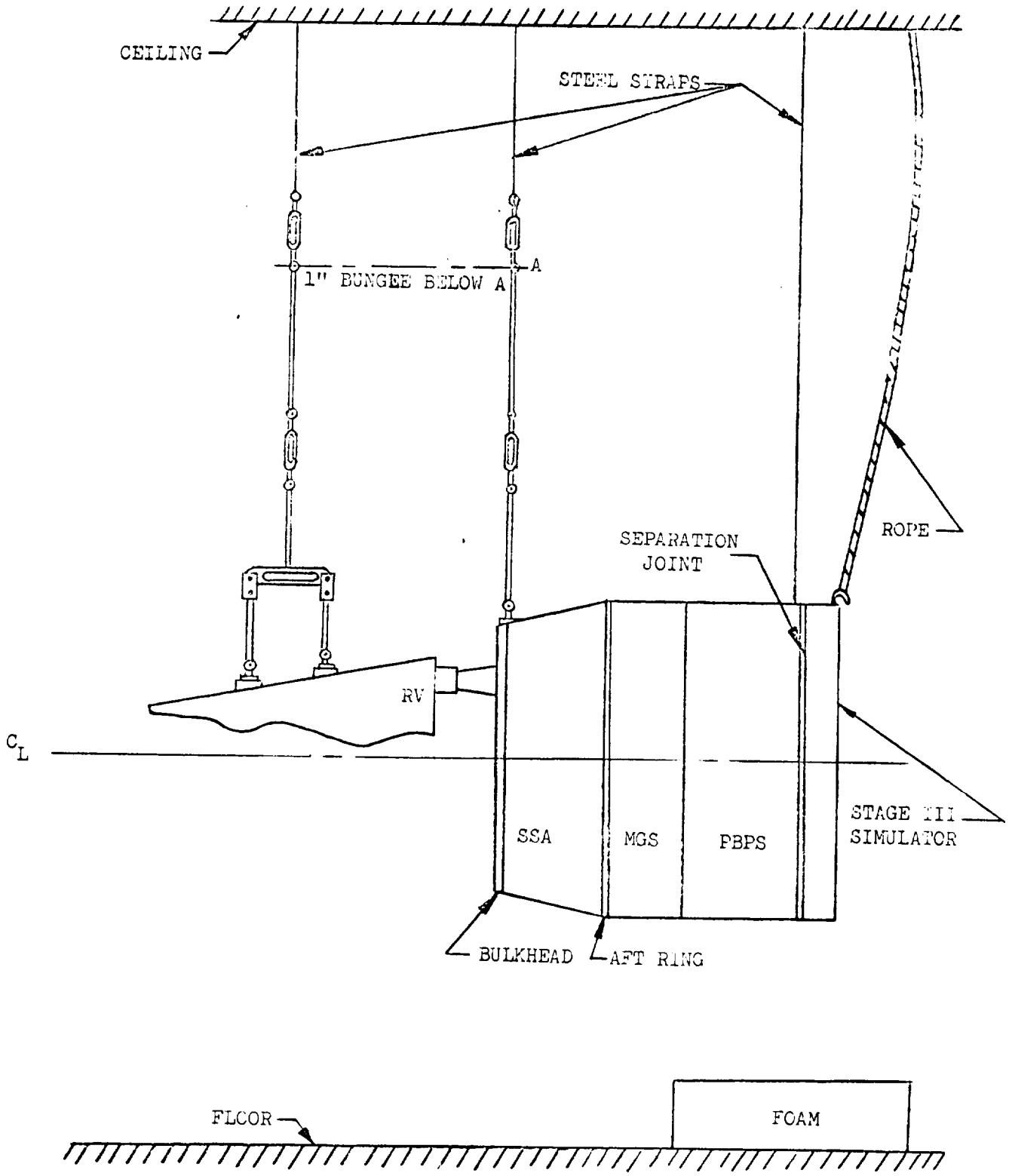


Figure I.A.5-2. Test Configuration for Stage III/PBV Separation

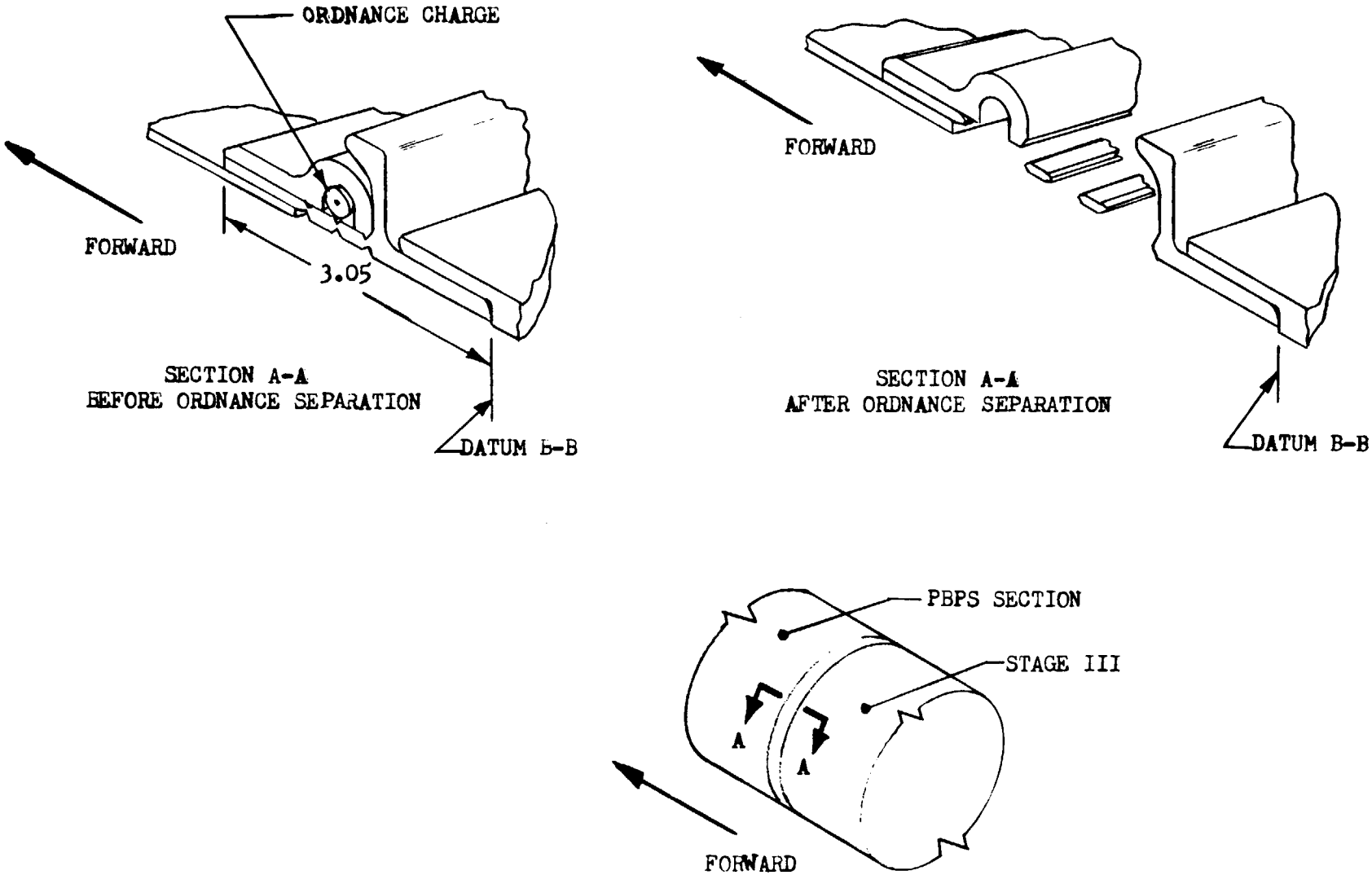
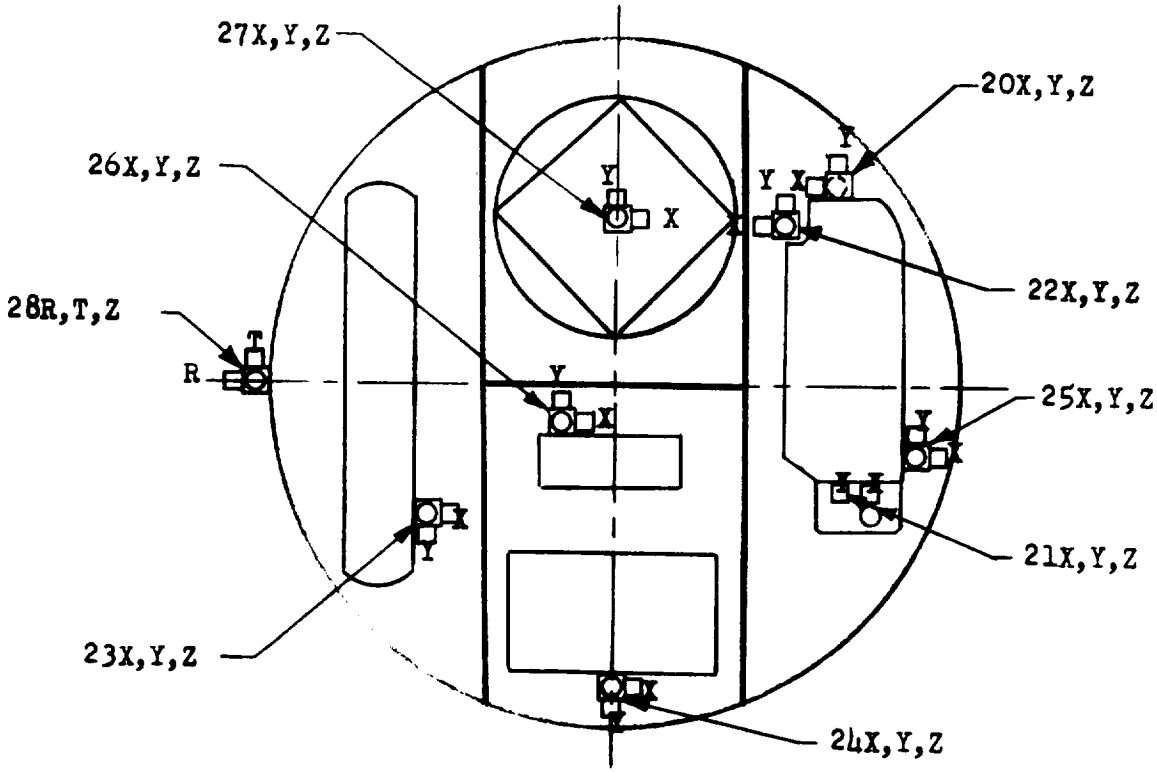
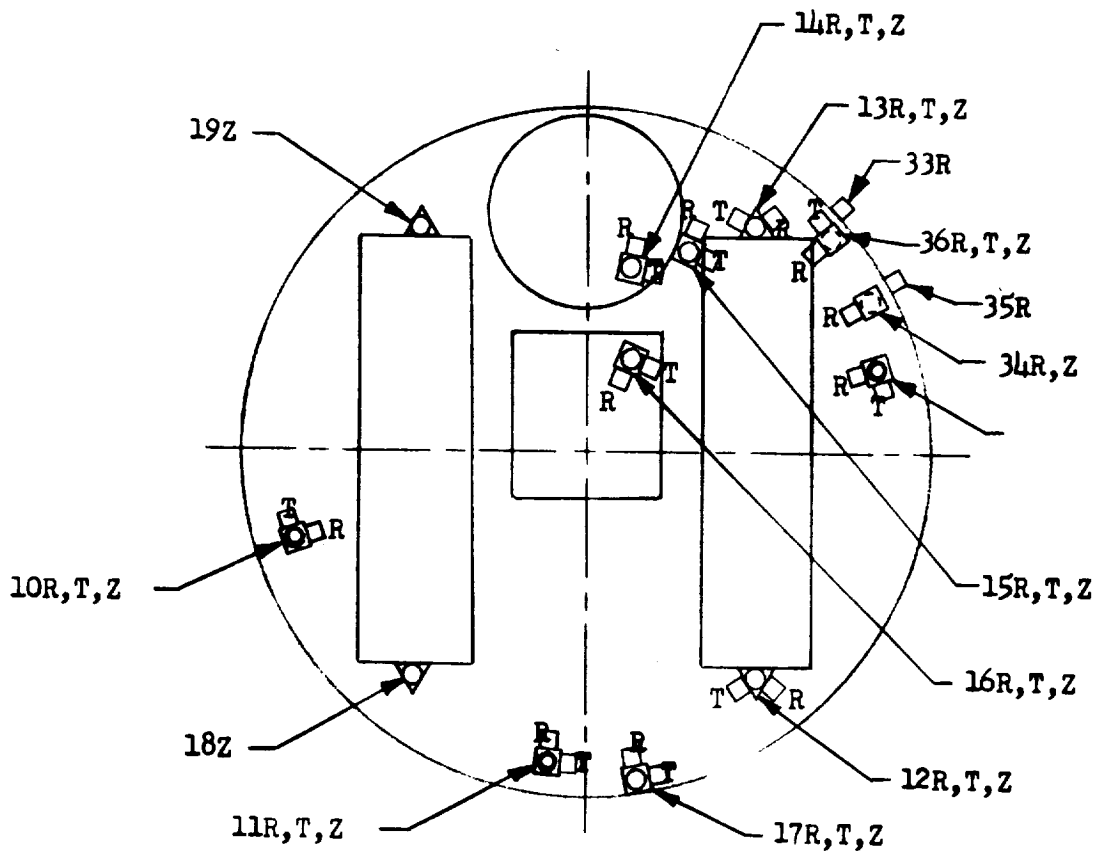


FIGURE I.A.5-3

SCHEMATIC DIAGRAM OF STAGE III/PBV SEPARATION JOINT

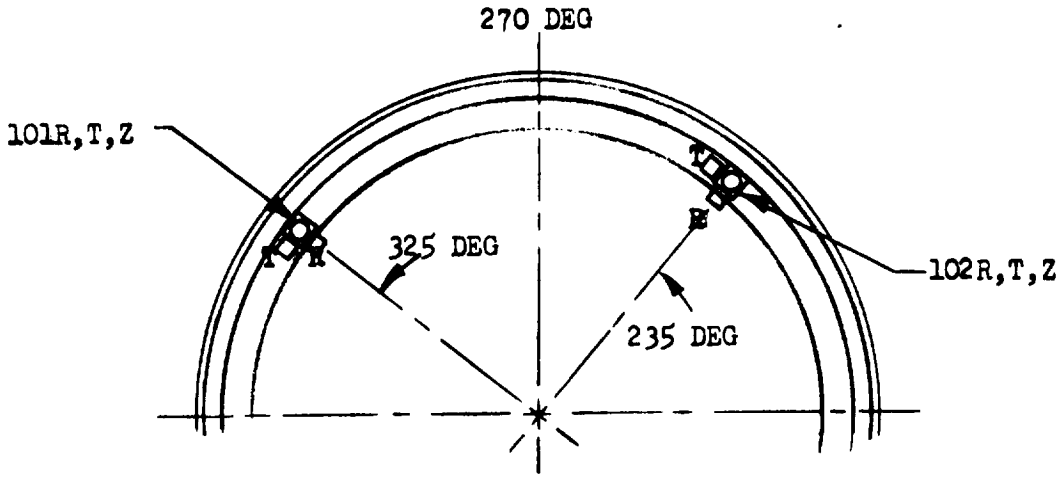


NS17 SECTION
PLAN VIEW LOOKING AFT

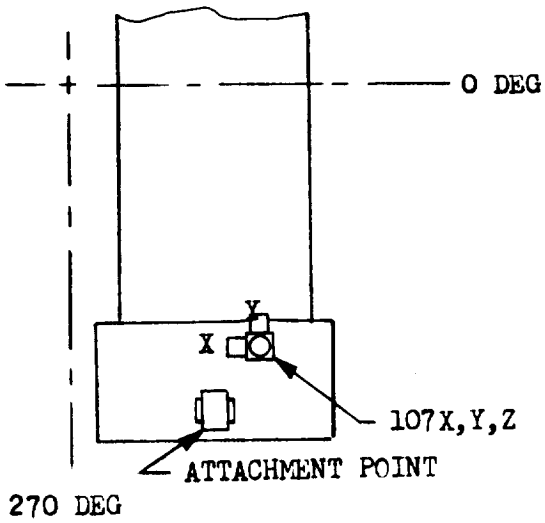


PbPS SECTION

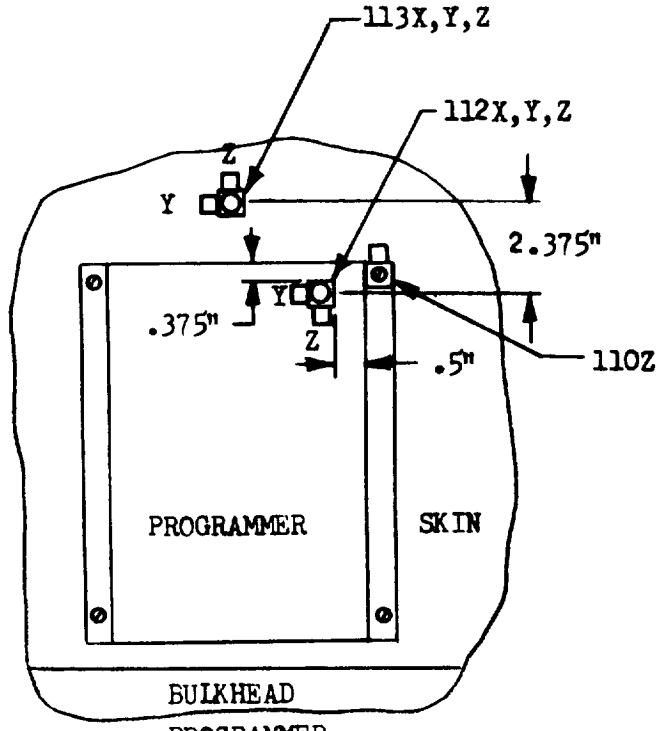
Figure I.A.5-4. Accelerometer Locations



AFT SIDE OF INTERFACE RING
VIEW LOOKING AFT

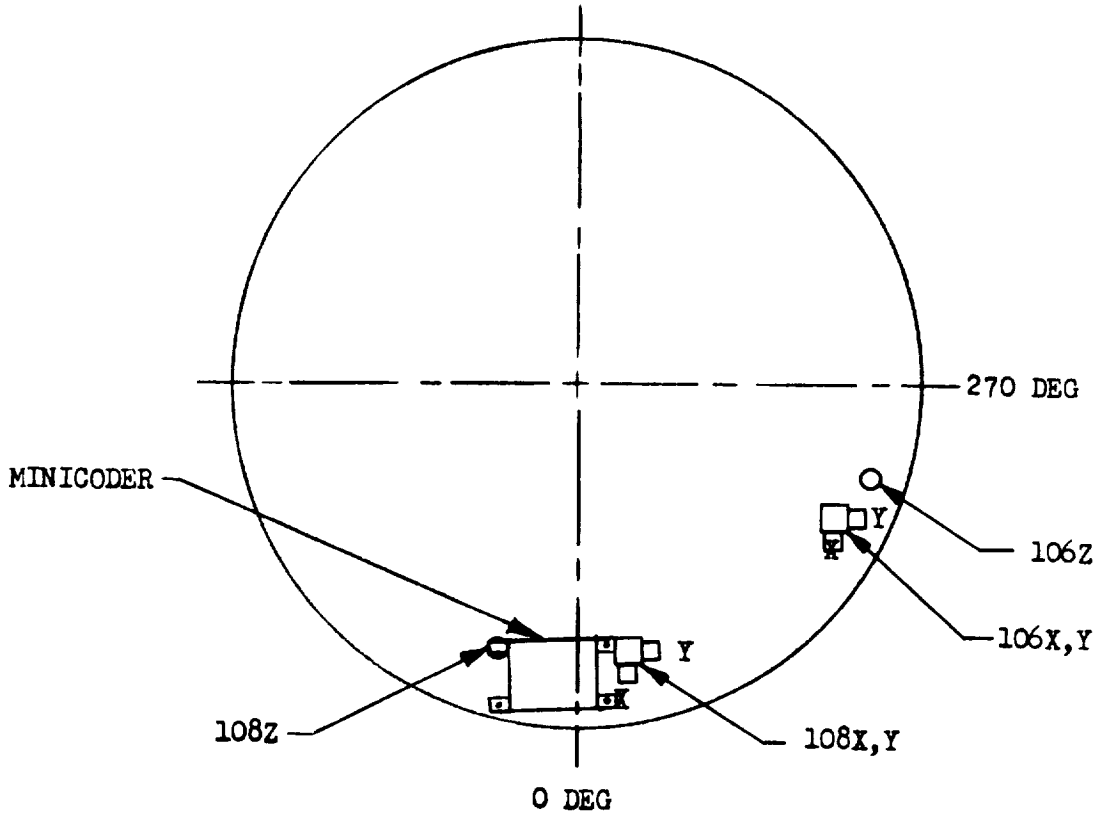


FORWARD SIDE OF DISPENSER
VIEW LOOKING AFT

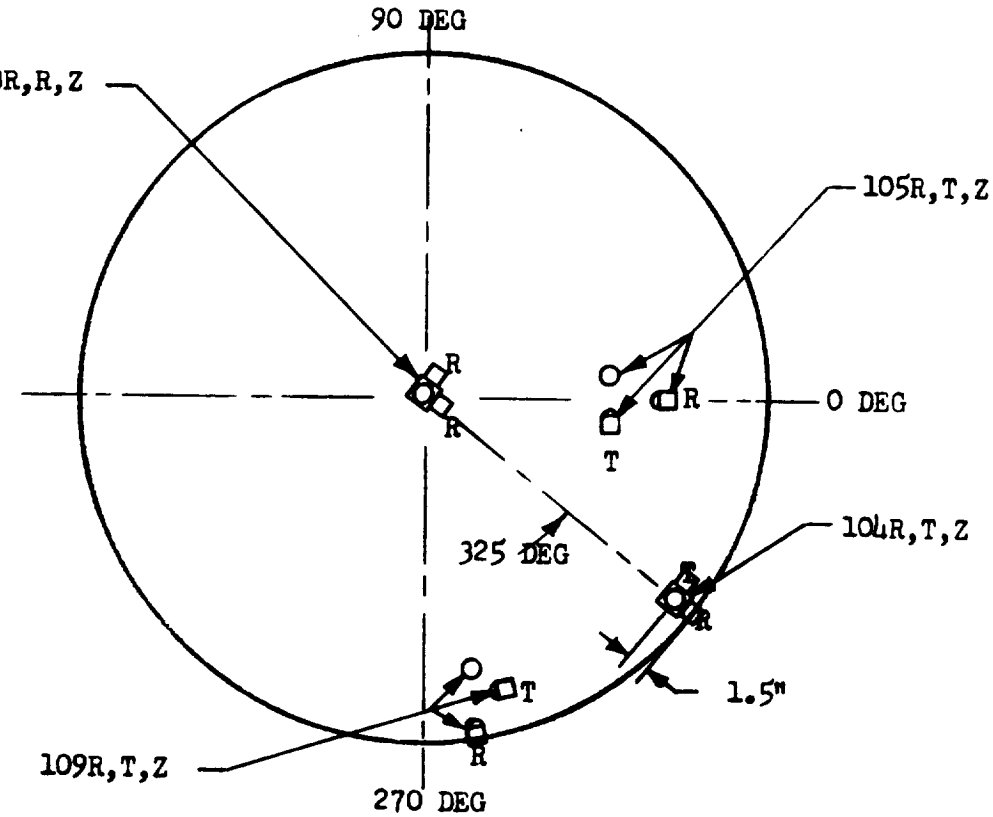


PROGRAMMER
INSIDE VIEW

Figure I.A.5-5. Accelerometer Locations

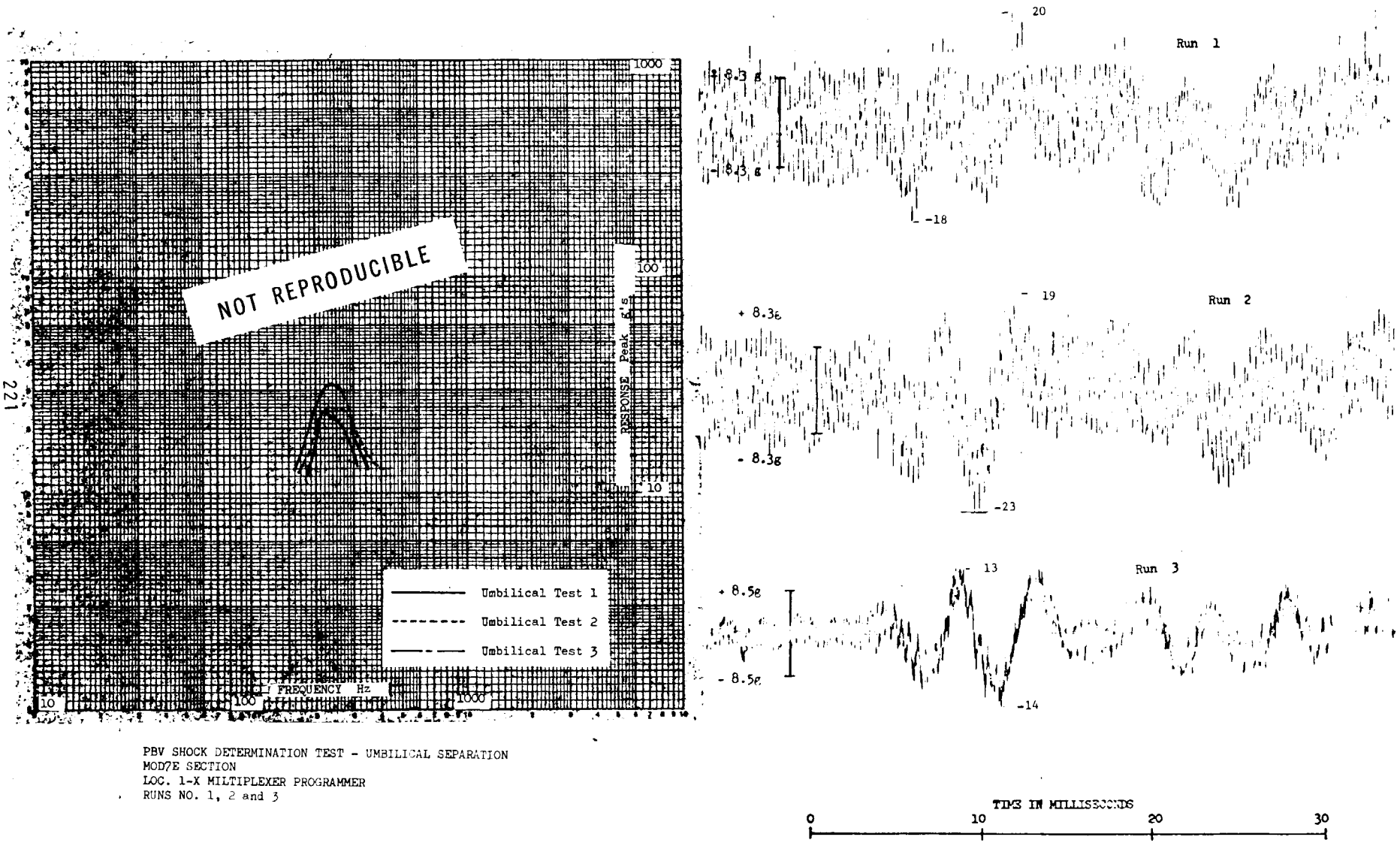


AFT SIDE OF BULKHEAD
VIEW LOOKING FWD



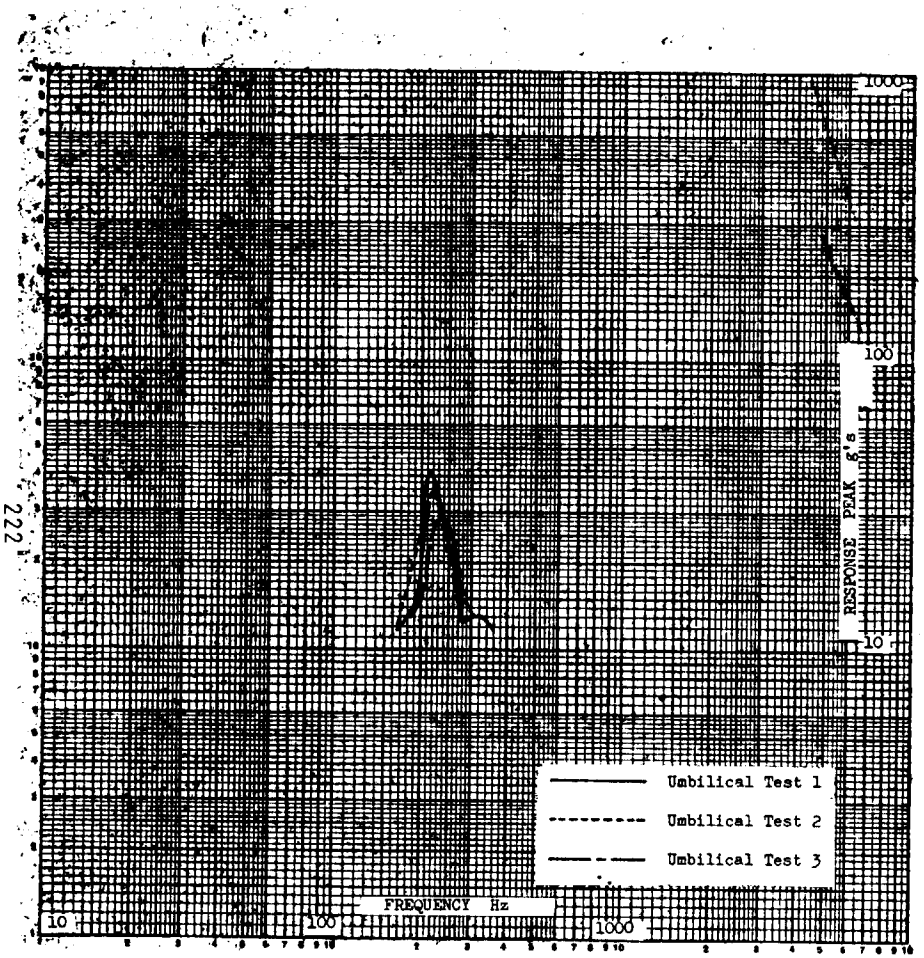
TOPSIDE OF BULKHEAD
VIEW LOOKING AFT.

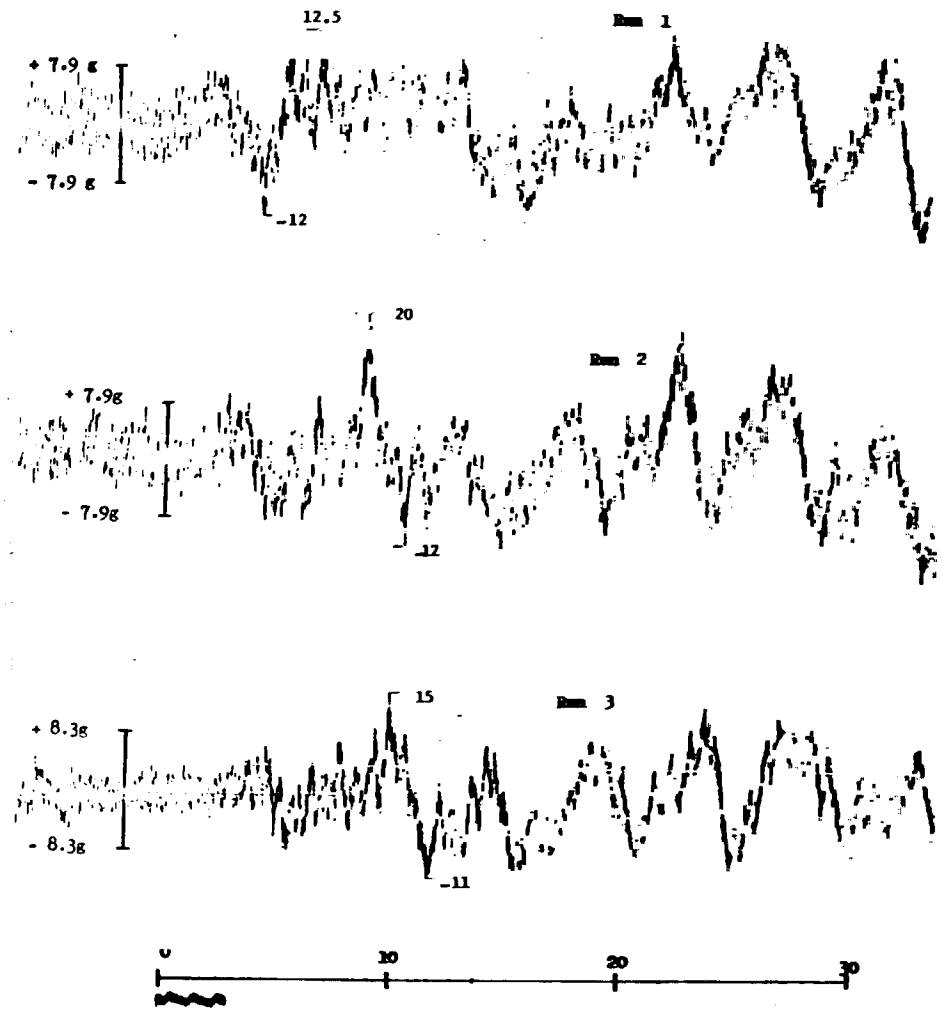
Figure I.A.5-6. Accelerometer Locations



PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
MOD7E SECTION
LOC. 1-X MILTIPLEXER PROGRAMMER
RUNS NO. 1, 2 and 3

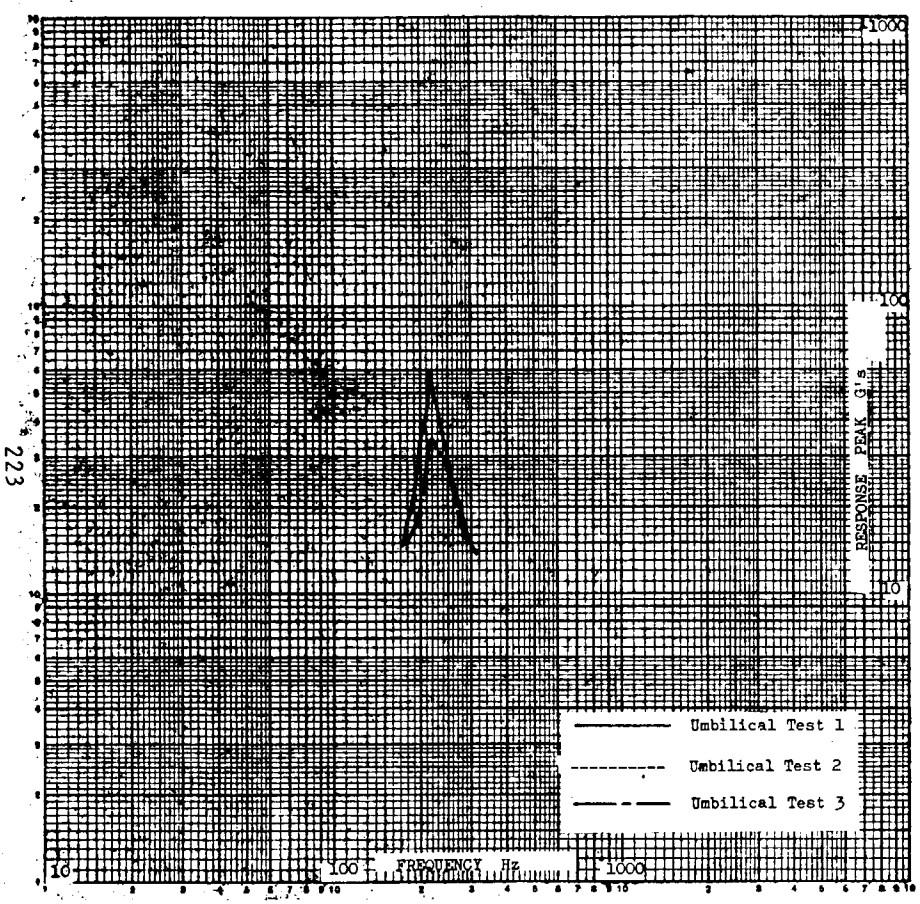
FIGURE I.A.5-7

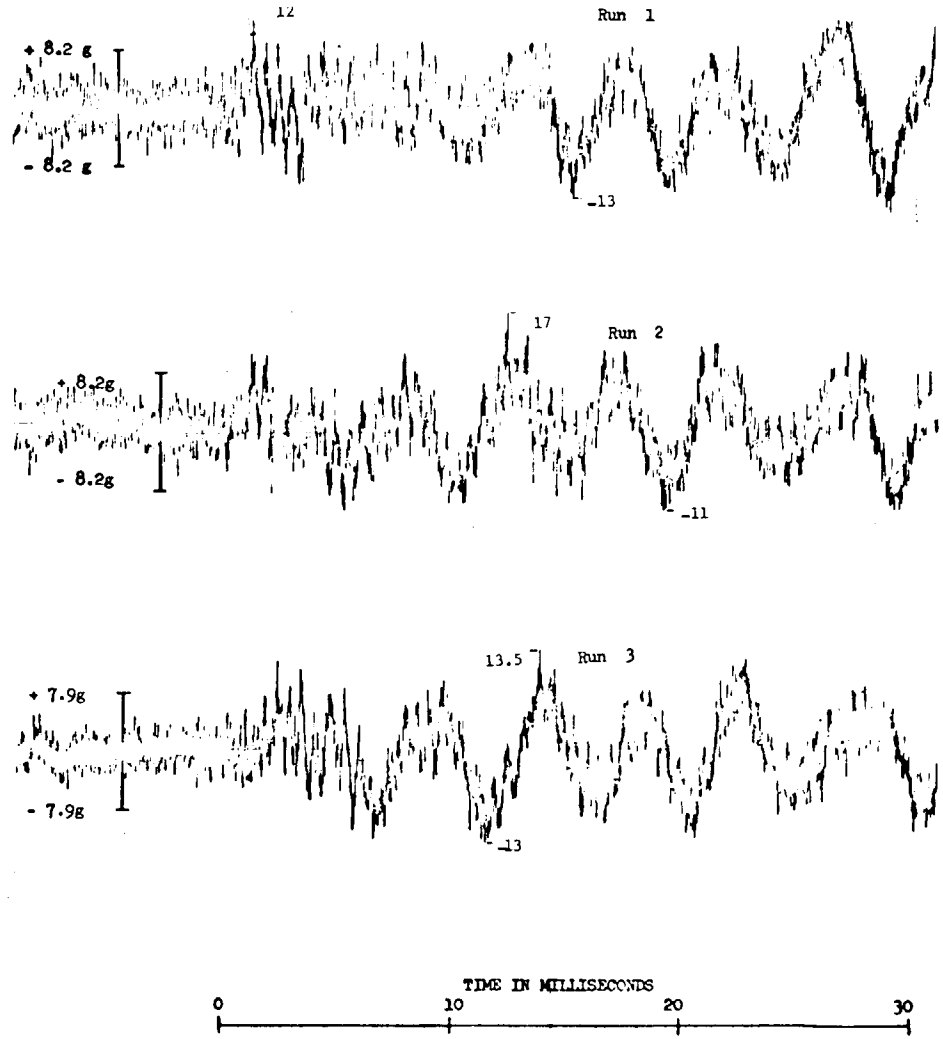




PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
MOD7E SECTION
LOC. 1-Y MULTIPLEXER PROGRAMMER
RUNS NO. 1, 2 and 3

FIGURE I.A.5-8



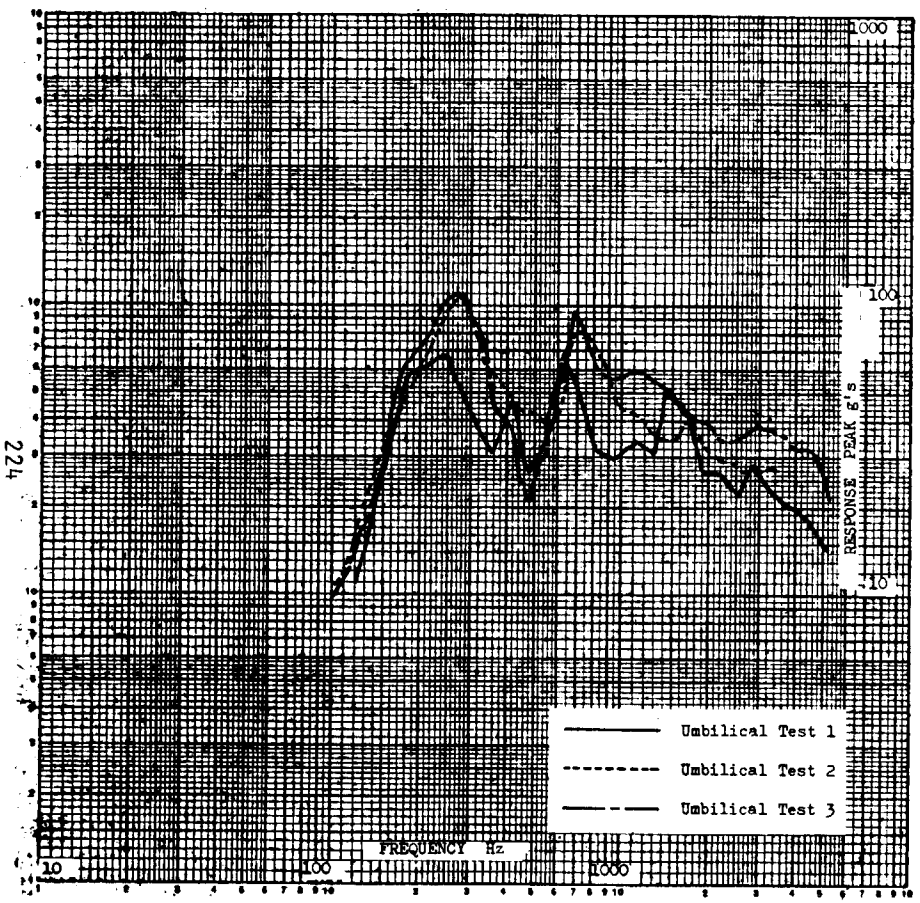


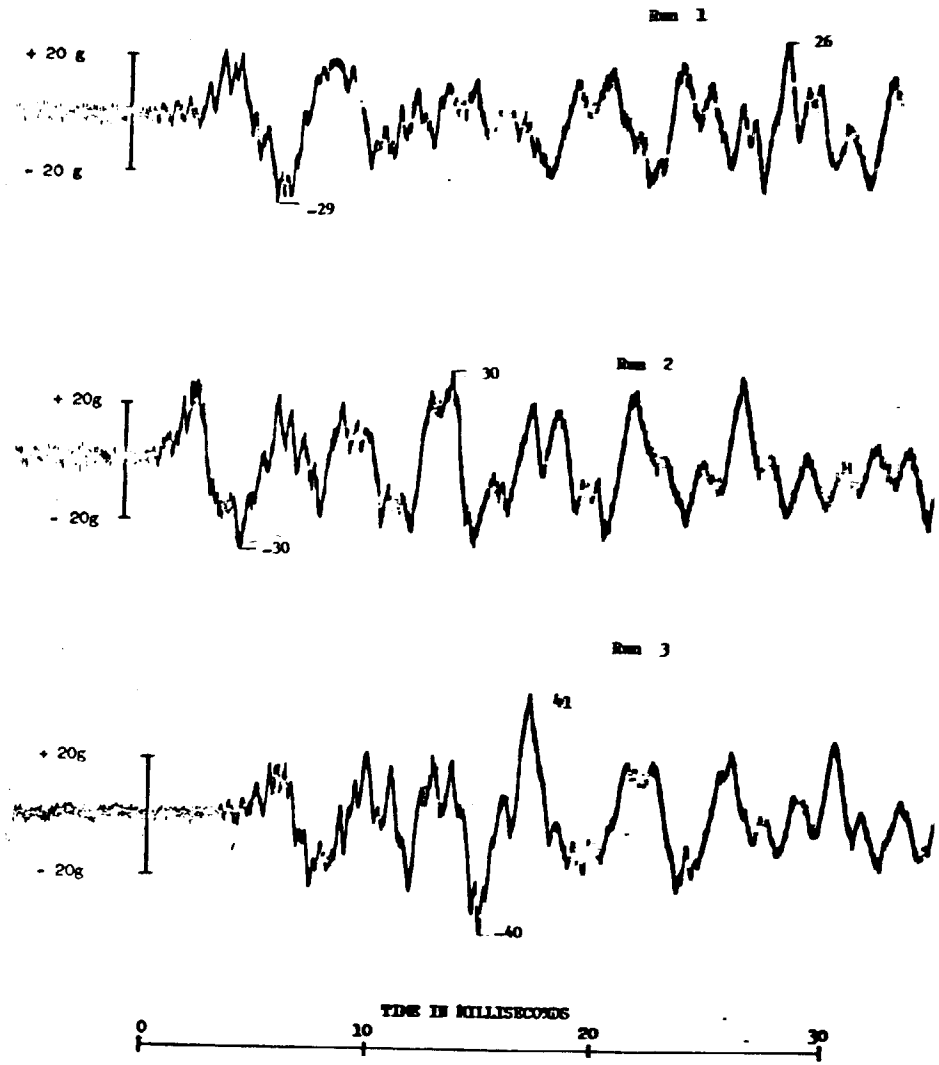
PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
MOD7E SECTION
LOC. 1-Z MULTIPLEXER PROGRAMMER
RUNS NO. 1, 2 and 3

FIGURE I.A.5-9

NOT REPRODUCIBLE

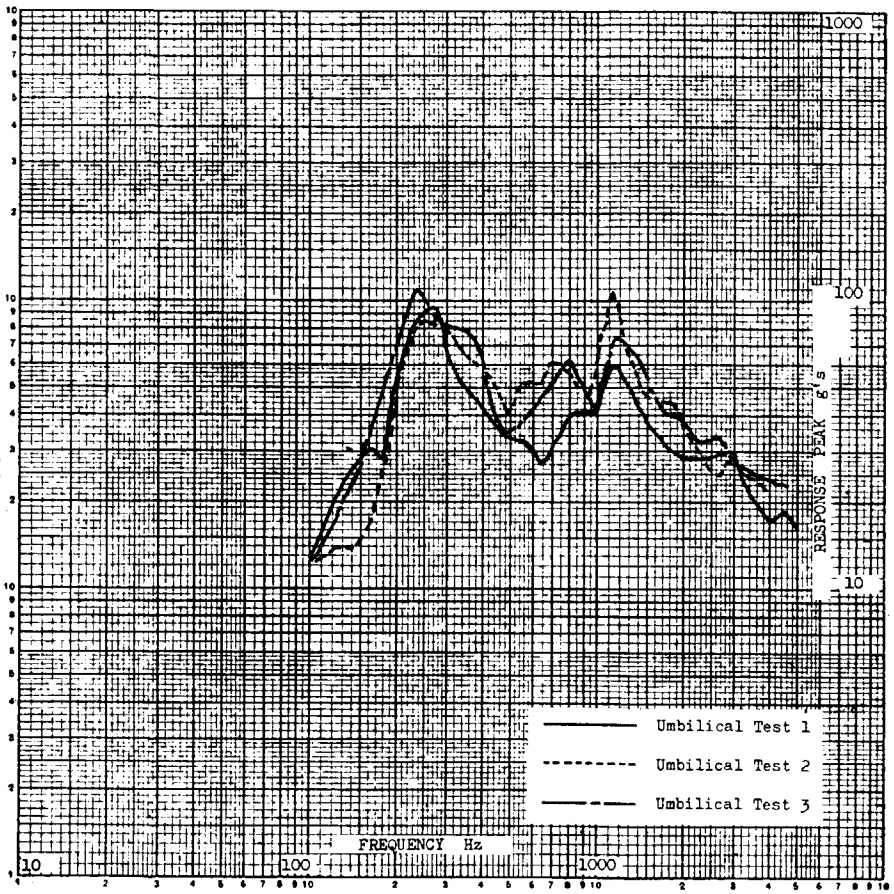
NOT REPRODUCIBLE





PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
MOD7E SECTION
LOC. 2-X C-BAND TRANSPONDER
RUNS NO. 1, 2 and 3

FIGURE I.A.5-10



PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
MOD7E SECTION
LOC. 2-Y C-BAND TRANSPONDER
RUNS NO. 1, 2 and 3

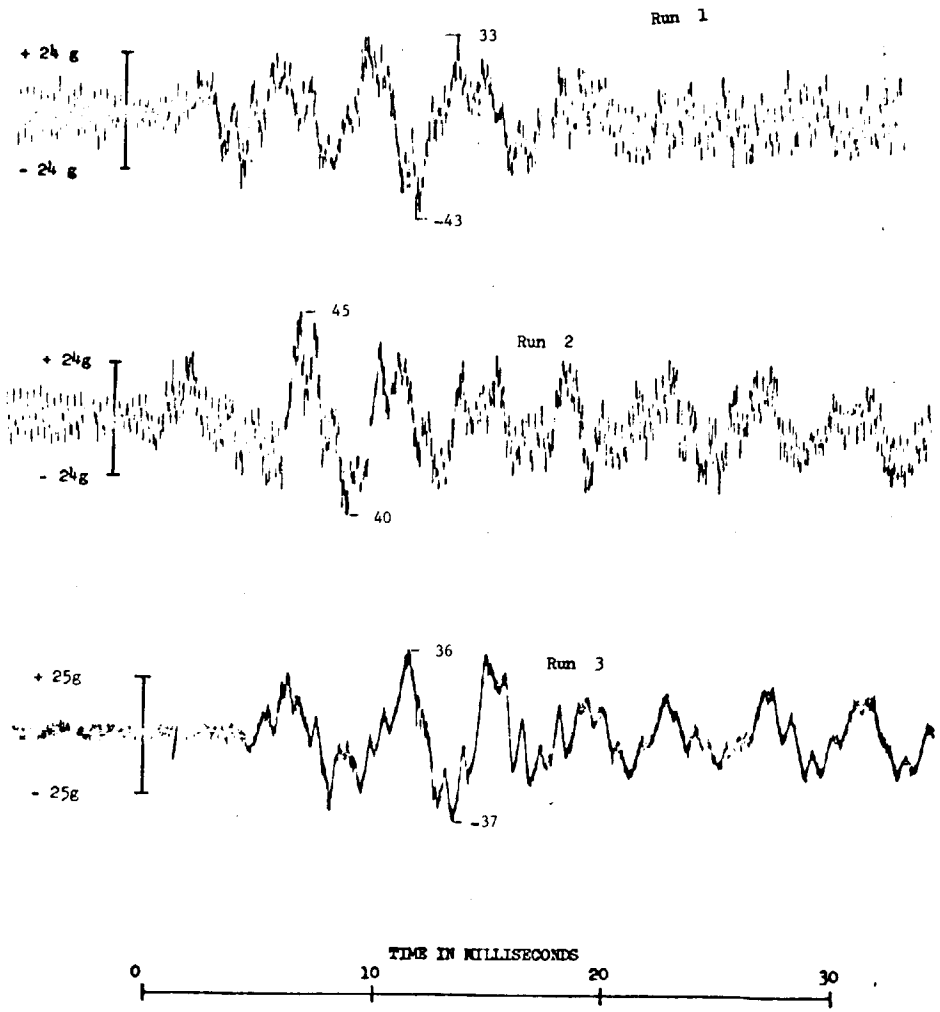
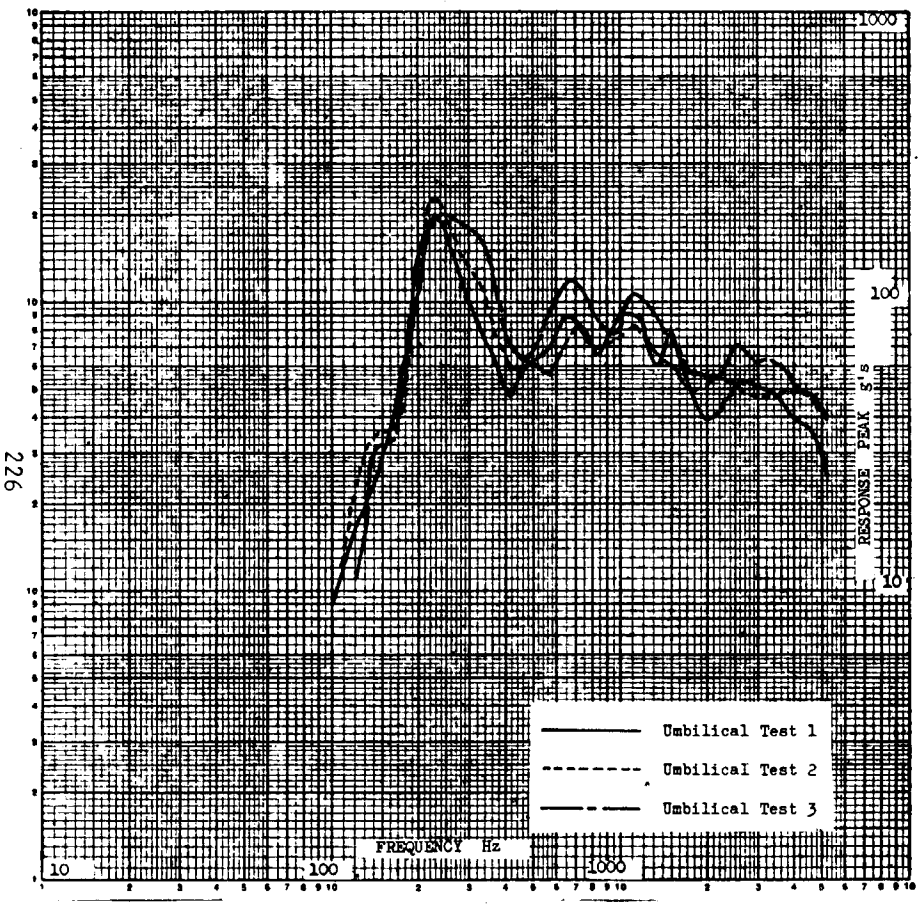
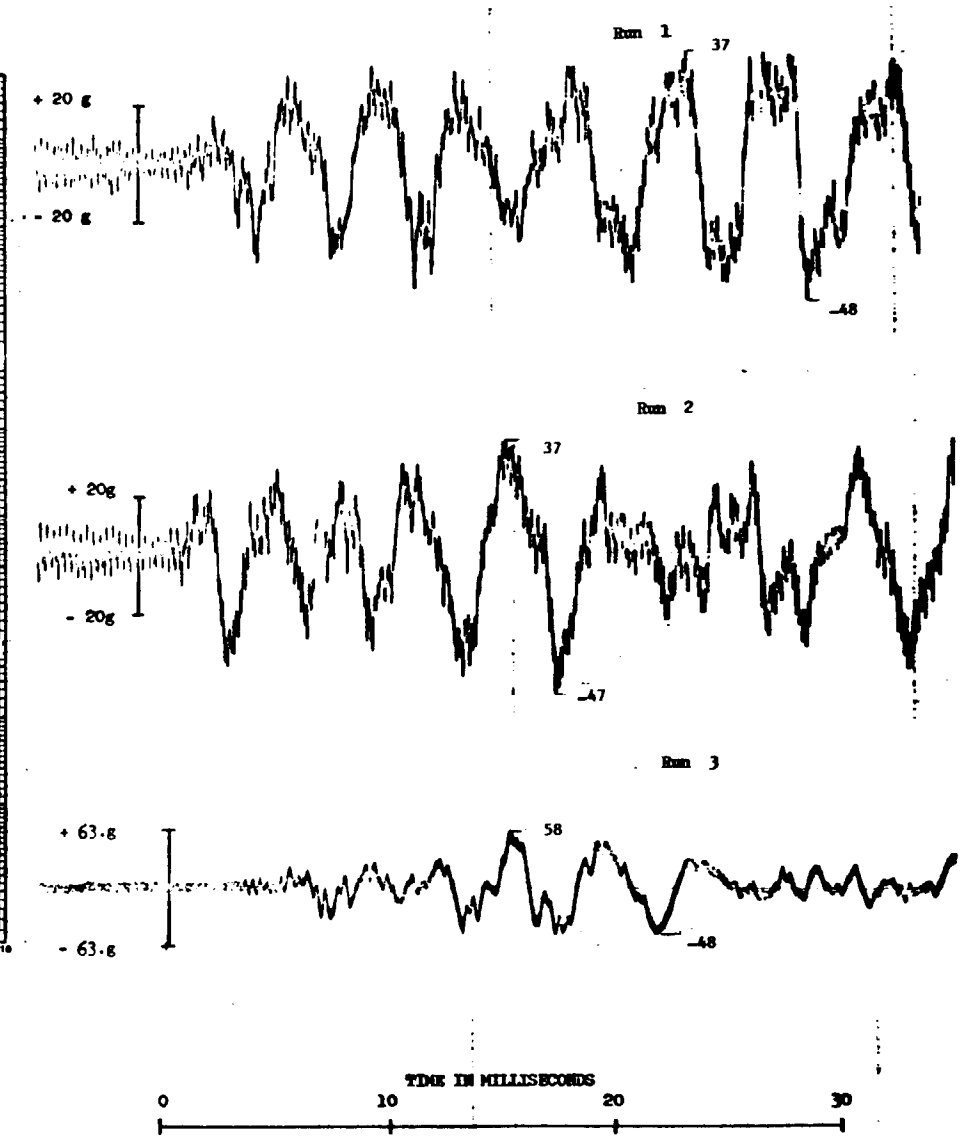


FIGURE I.A.5-11

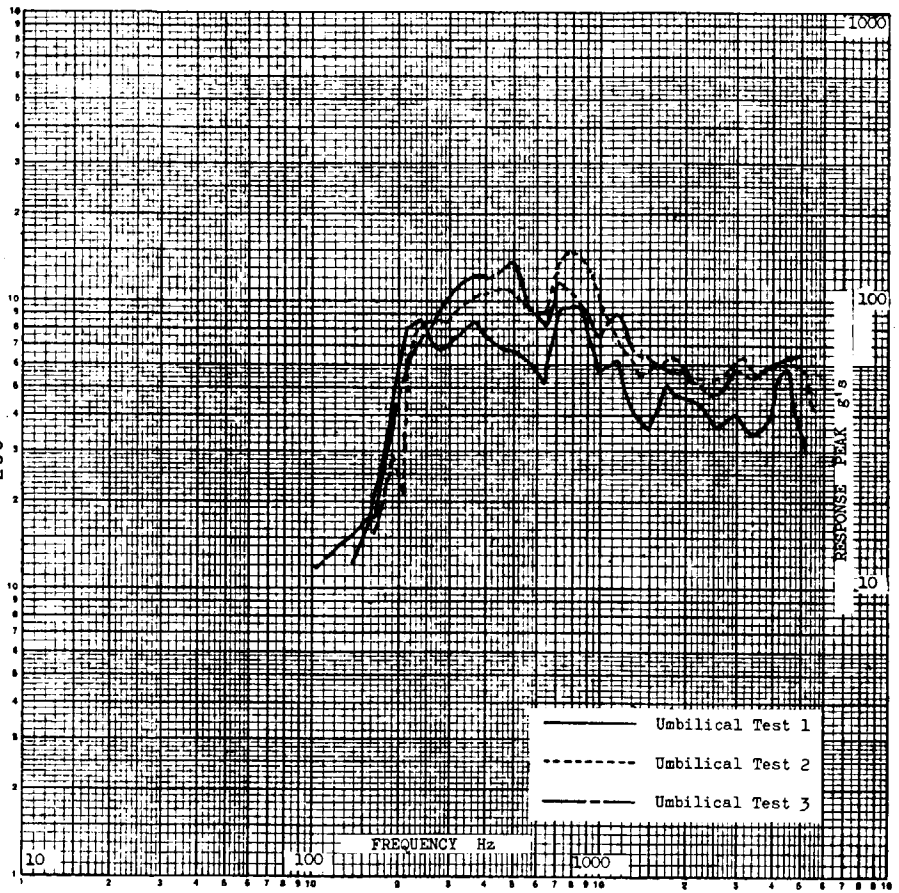
NOT REPRODUCIBLE

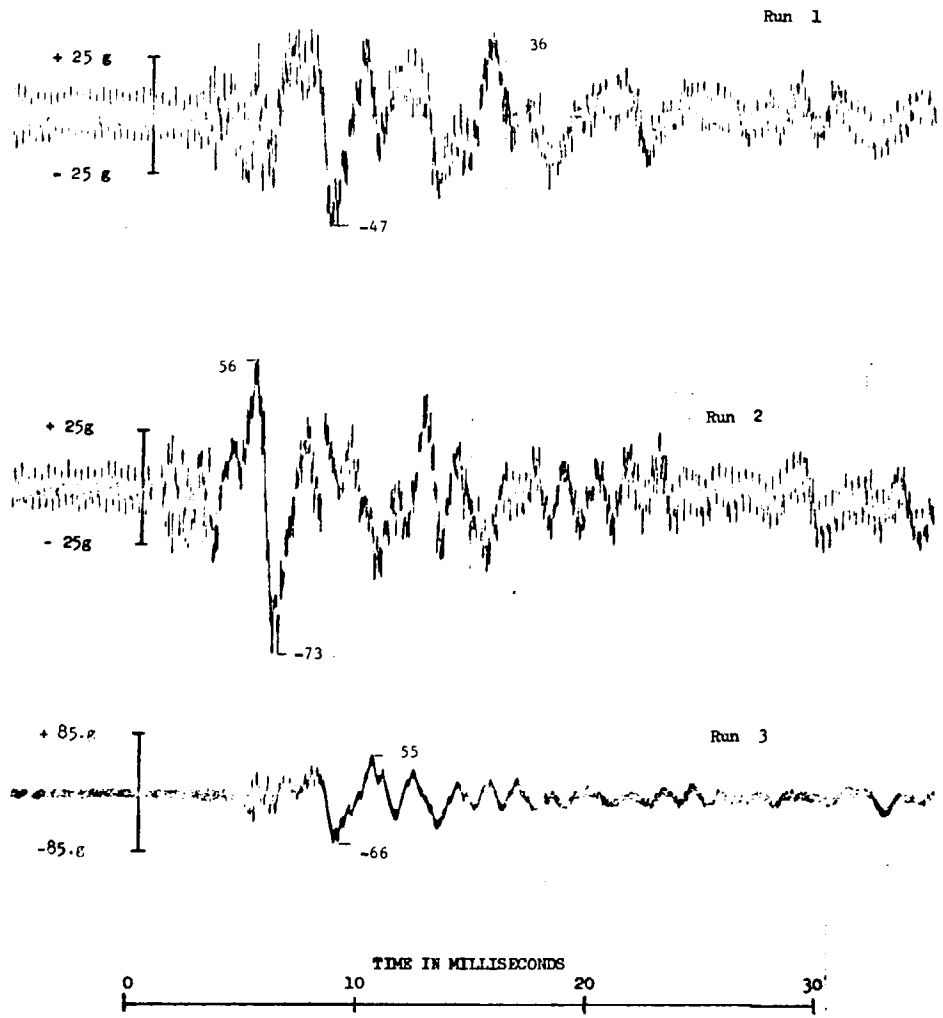




PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
MOD7E SECTION
LOC. 2-Z C-BAND TRANSPONDER
RUNS NO. 1, 2 and 3

FIGURE I.A.5-12

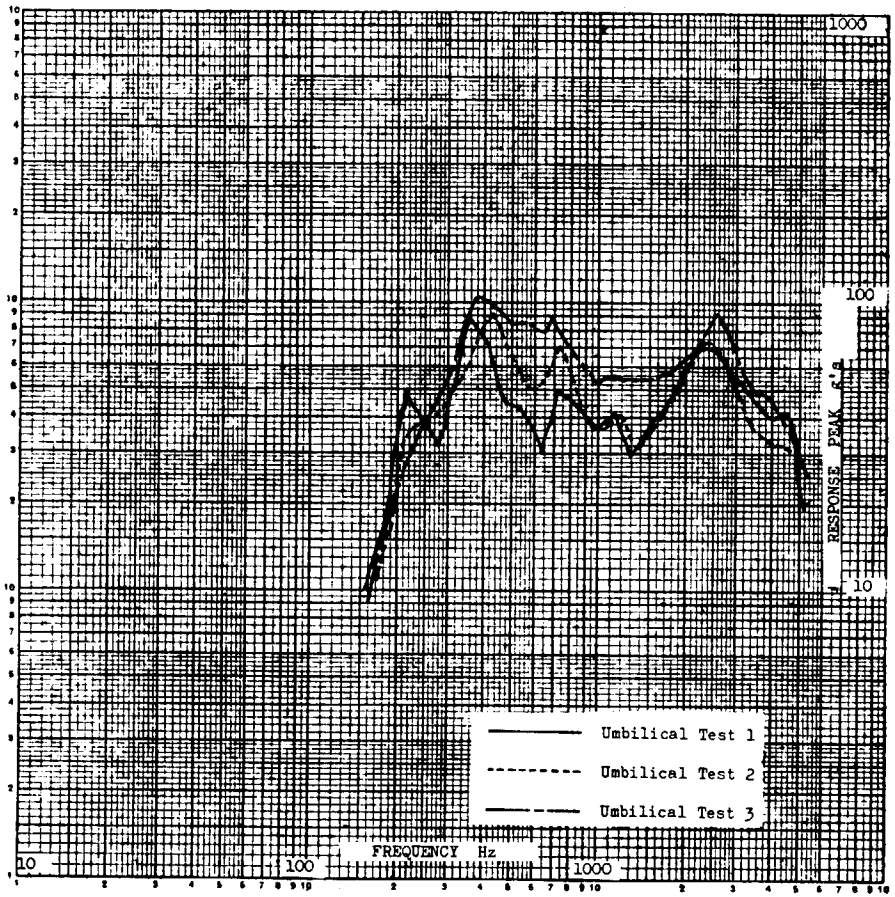




PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
MOD7E SECTION
LOC. 3-X D-93 SC AMP.
RUNS NO. 1, 2 and 3

FIGURE I.A.5-13

NOT REPRODUCIBLE



PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
MOD7E SECTION
LOC. 3-Y D-93 SC AMP.
RUNS NO. 1, 2 and 3

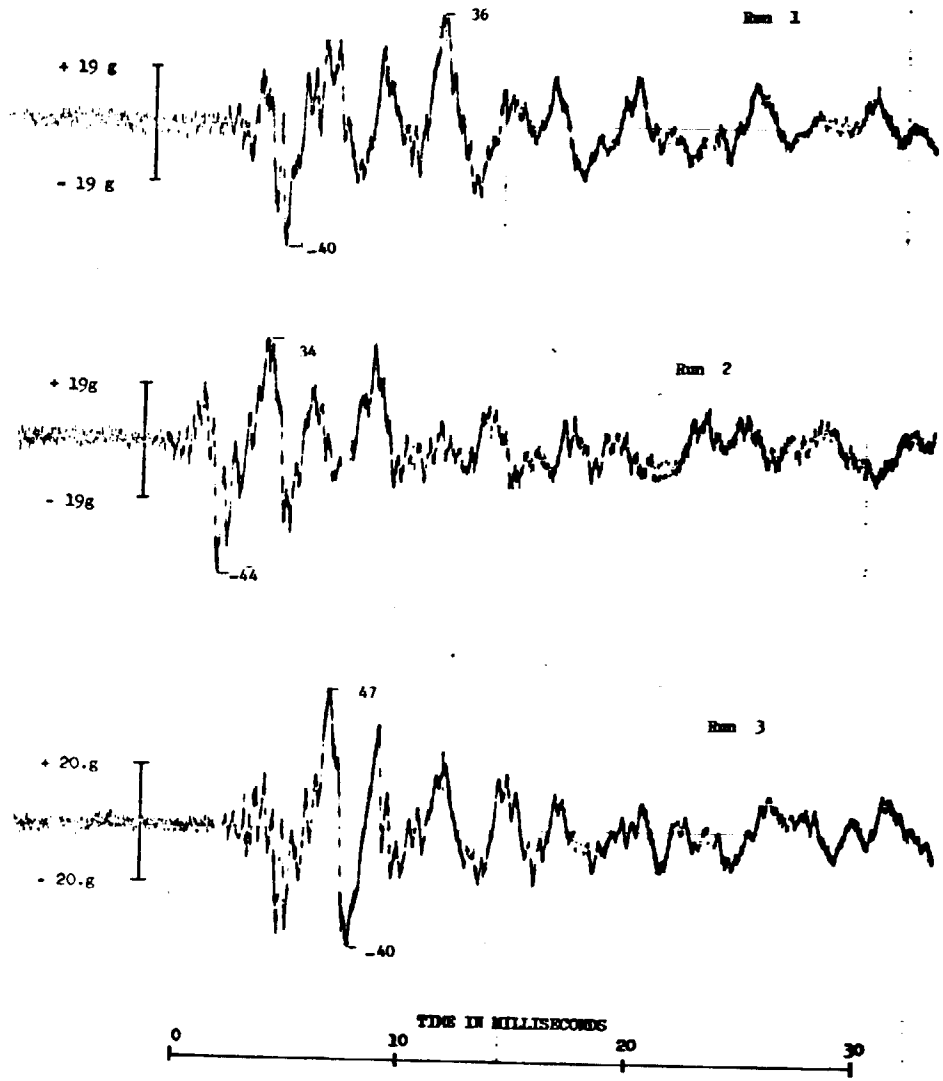
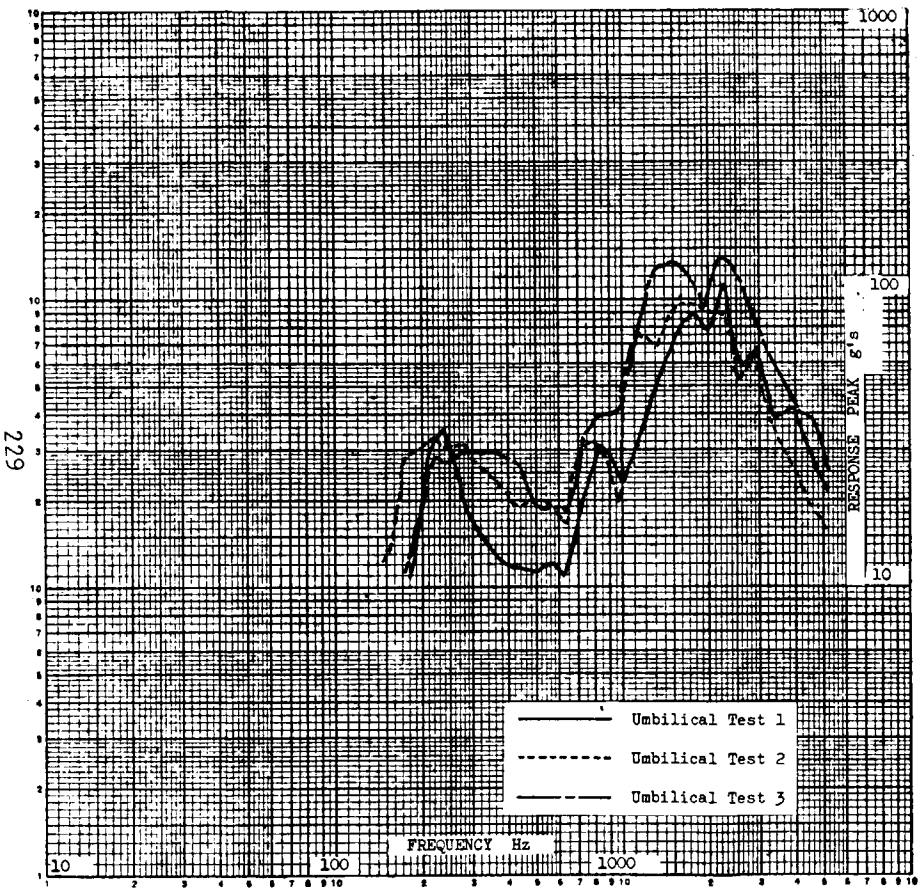


FIGURE I.A.5-14



PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
MOD7E SECTION
LOC. 3-Z D-93 SC AMP.
RUNS NO. 1, 2 and 3

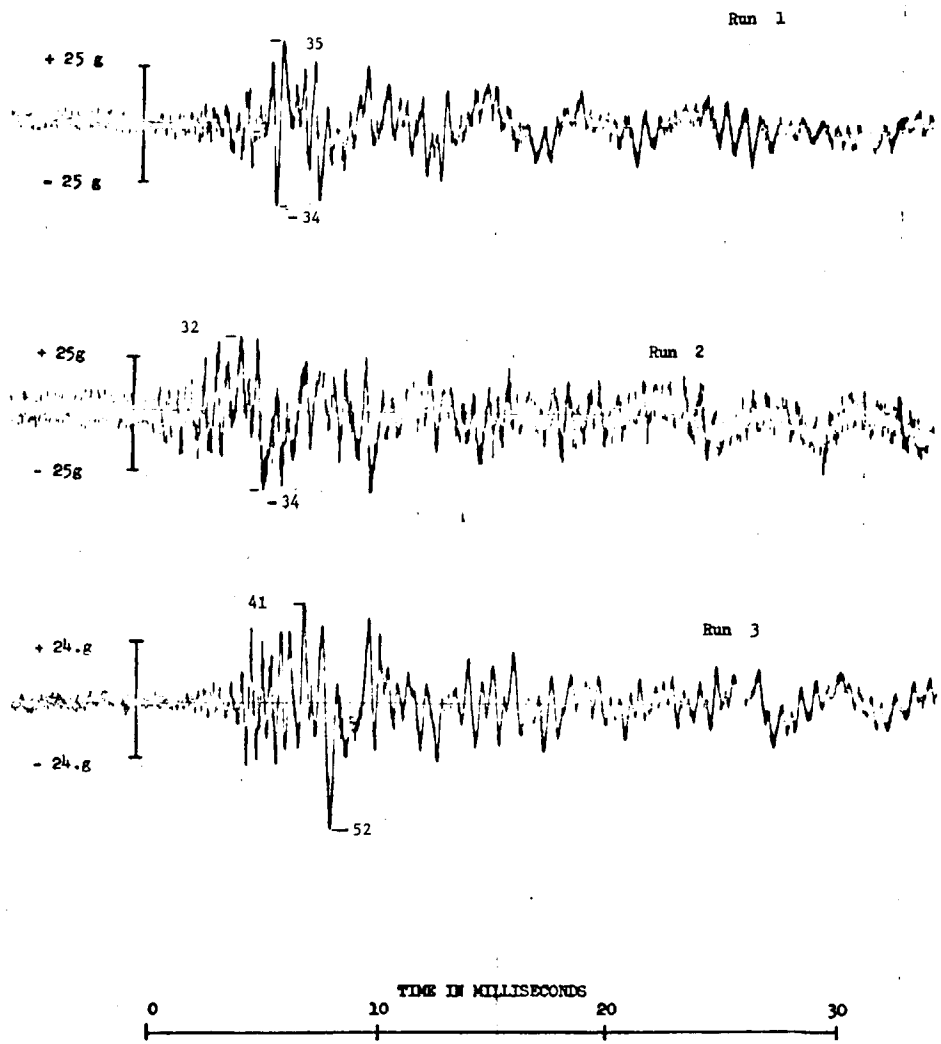
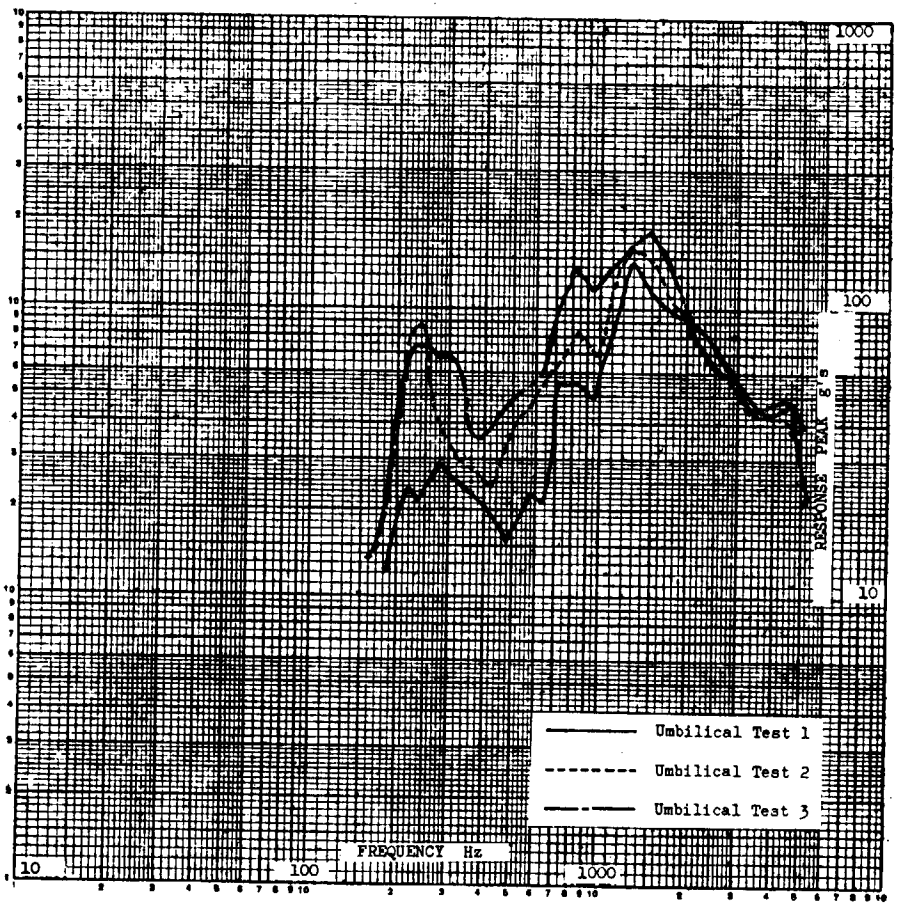
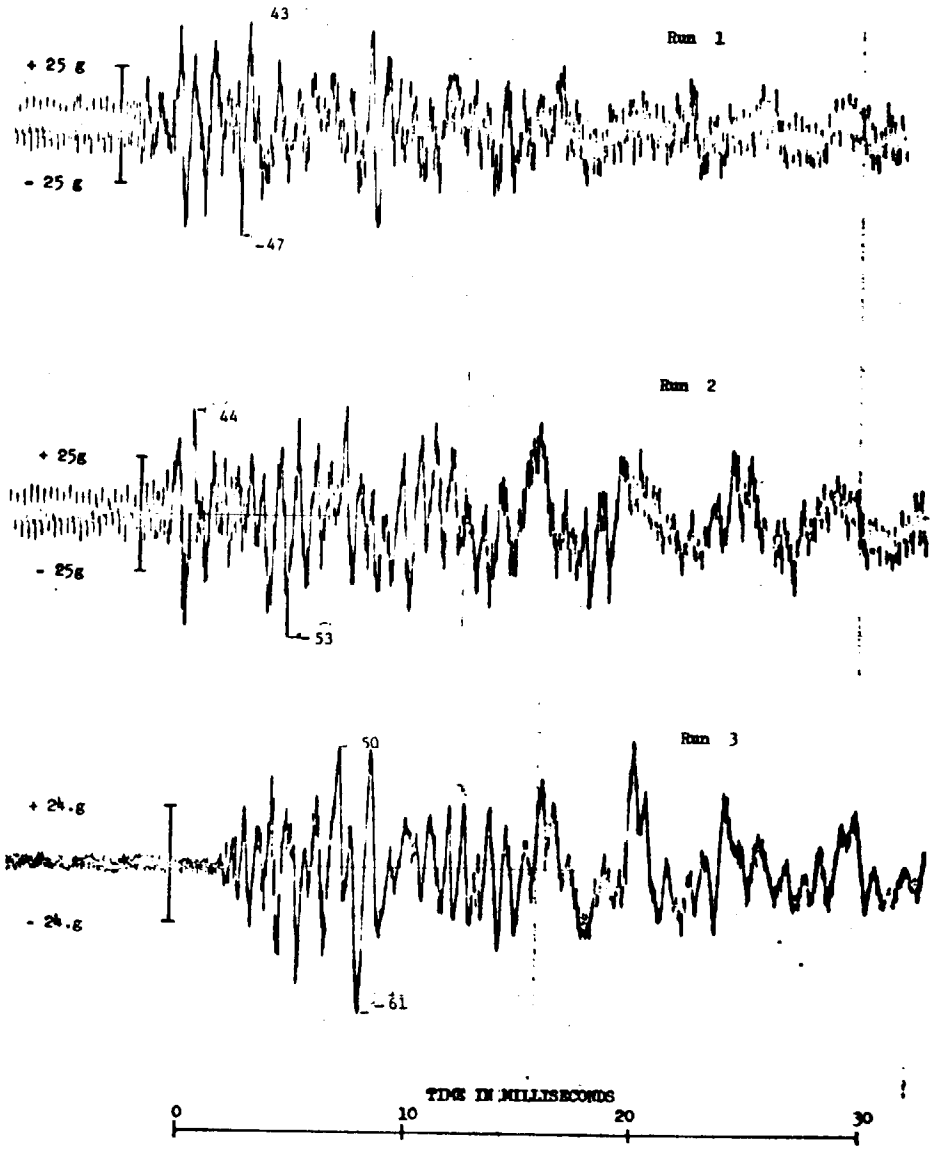


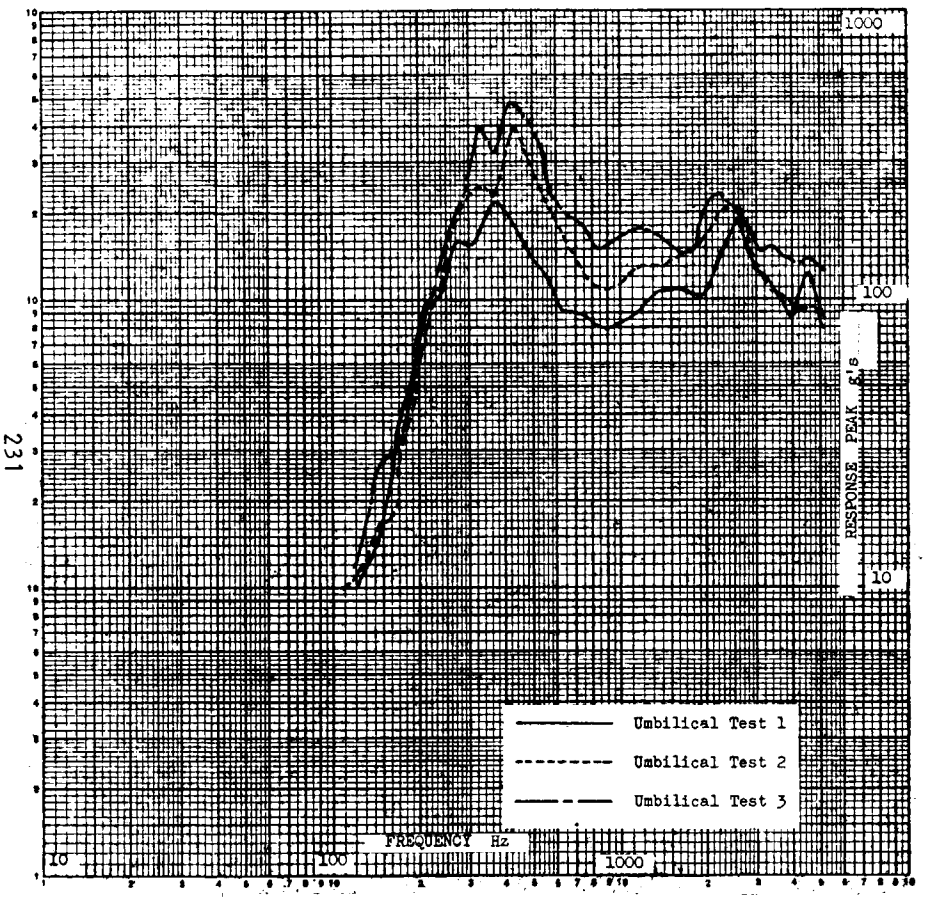
FIGURE 1.A.5-15





PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
MOD7E SECTION
LOC. 4-Z C/D ANTENNA
RUNS NO. 1, 2 and 3

FIGURE I.A.5-16



PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
MOD7E SECTION
LOC. 4-R C/D ANTENNA
RUN NO. 1, 2 and 3

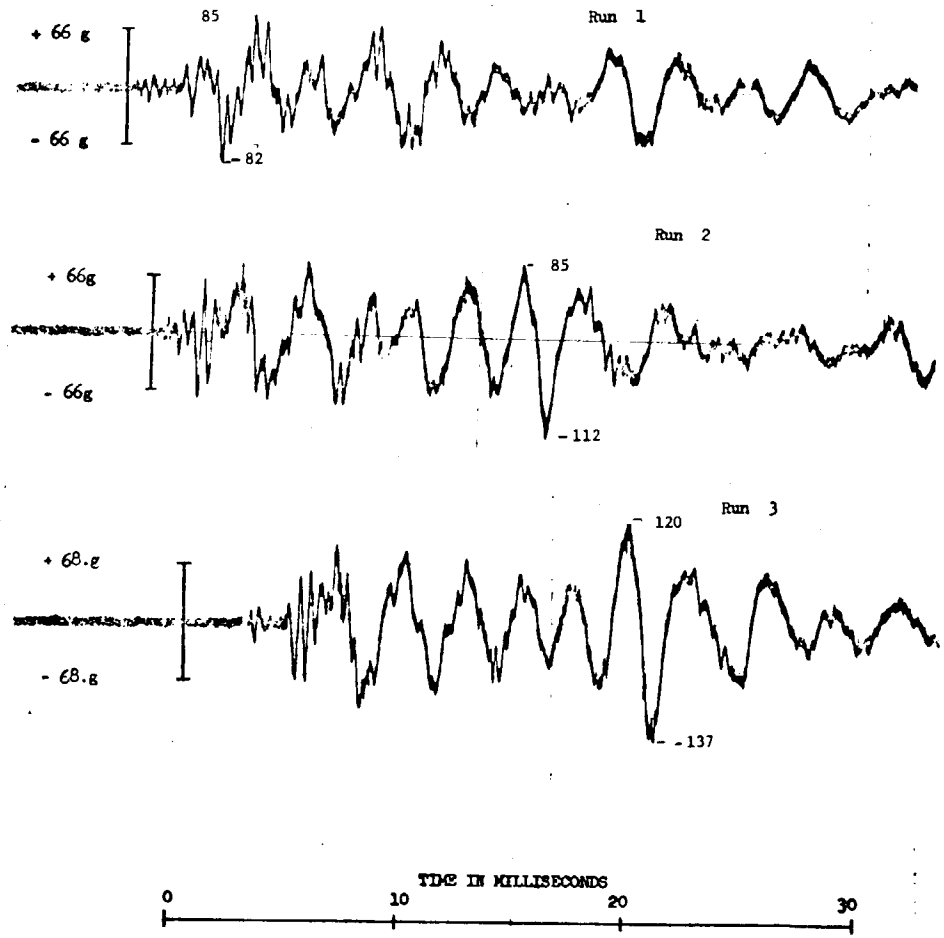
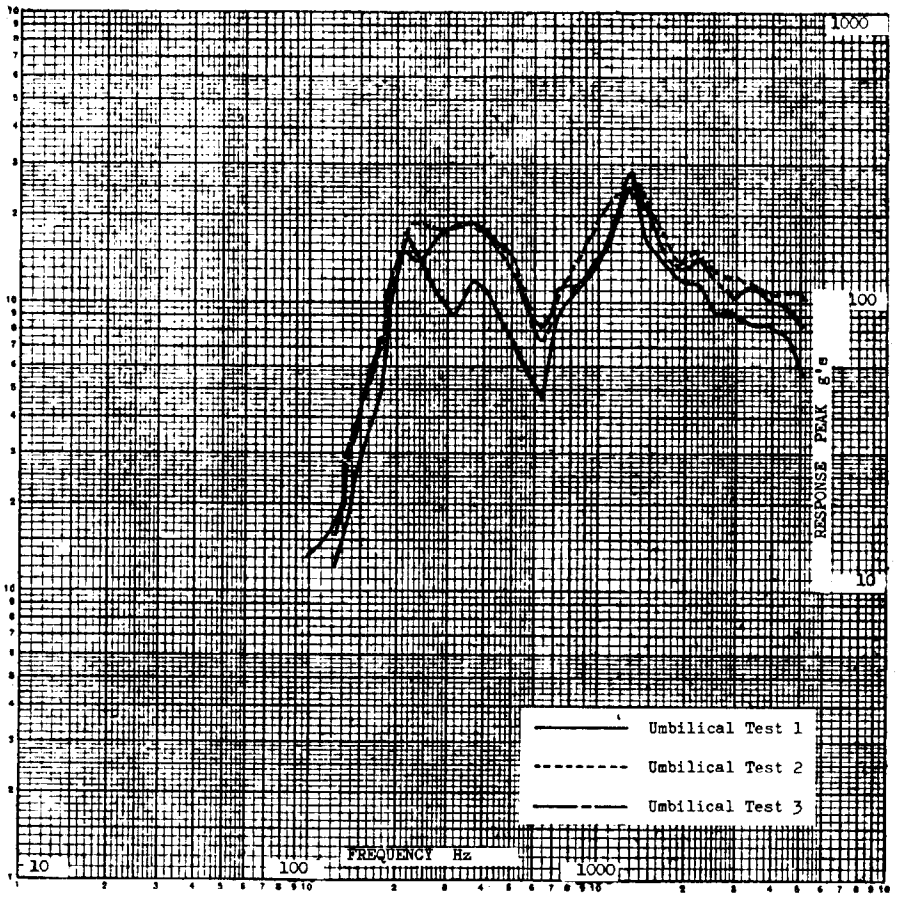


FIGURE I.A.5-17



PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
MOD7E SECTION
LOC. 4-T C/D ANTENNA
RUNS NO. 1, 2 and 3

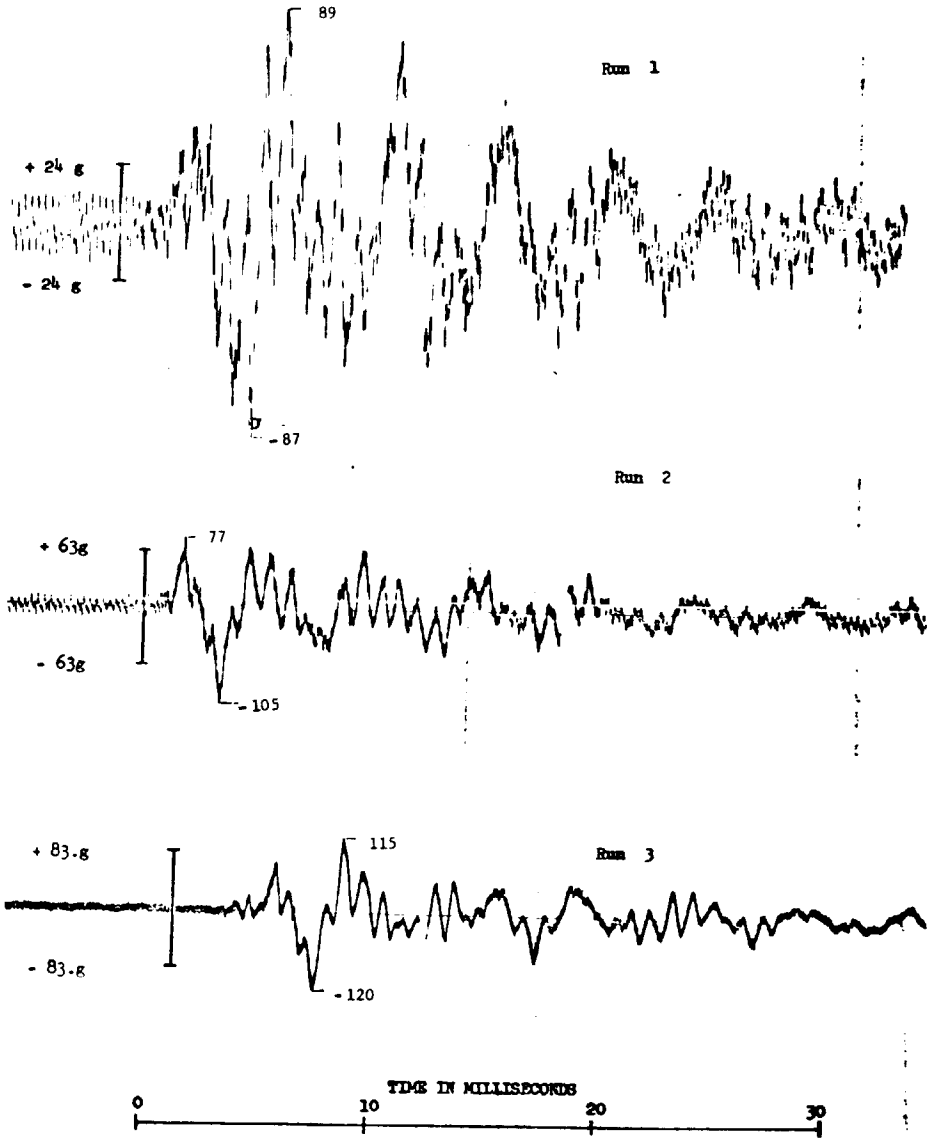
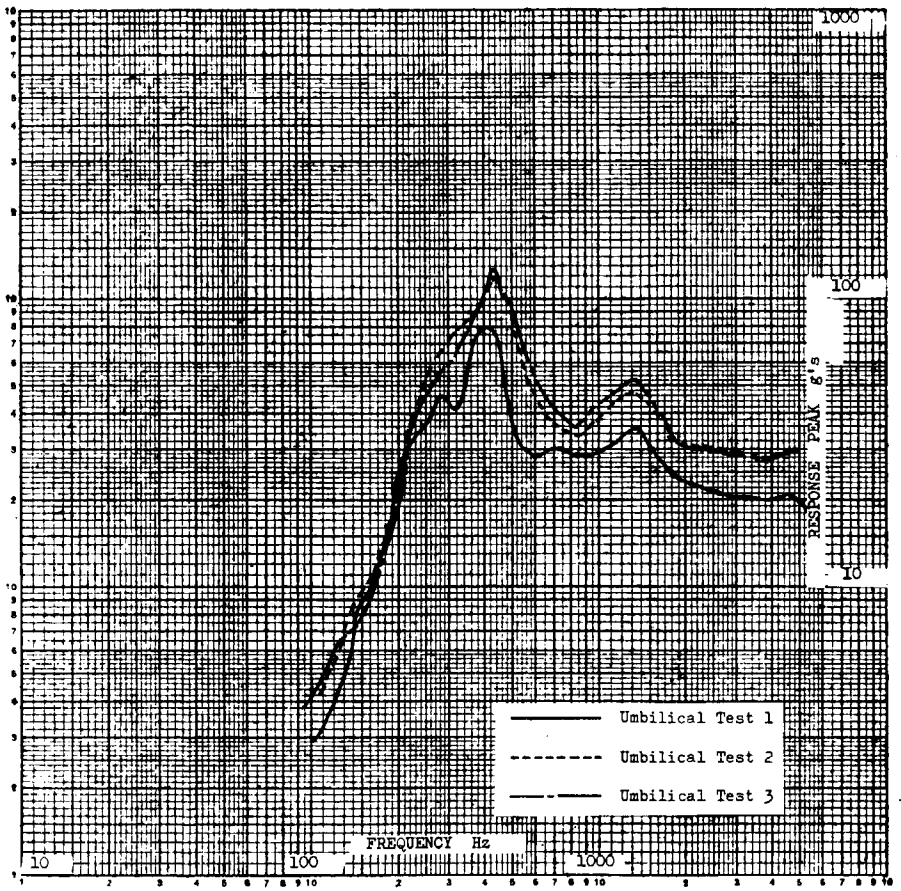


FIGURE I.A.5-18



PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
MOD7E SECTION
LOC. 5-X PGM SC
RUNS NO. 1, 2 and 3

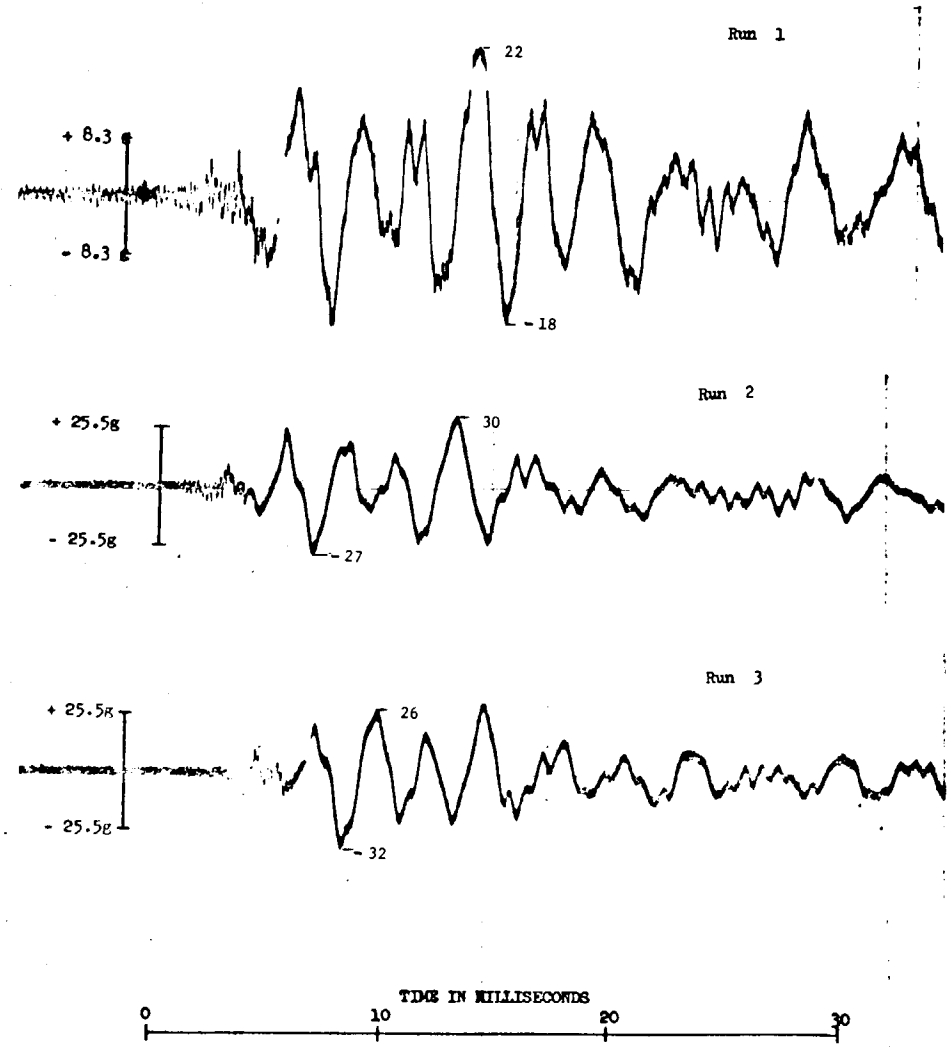
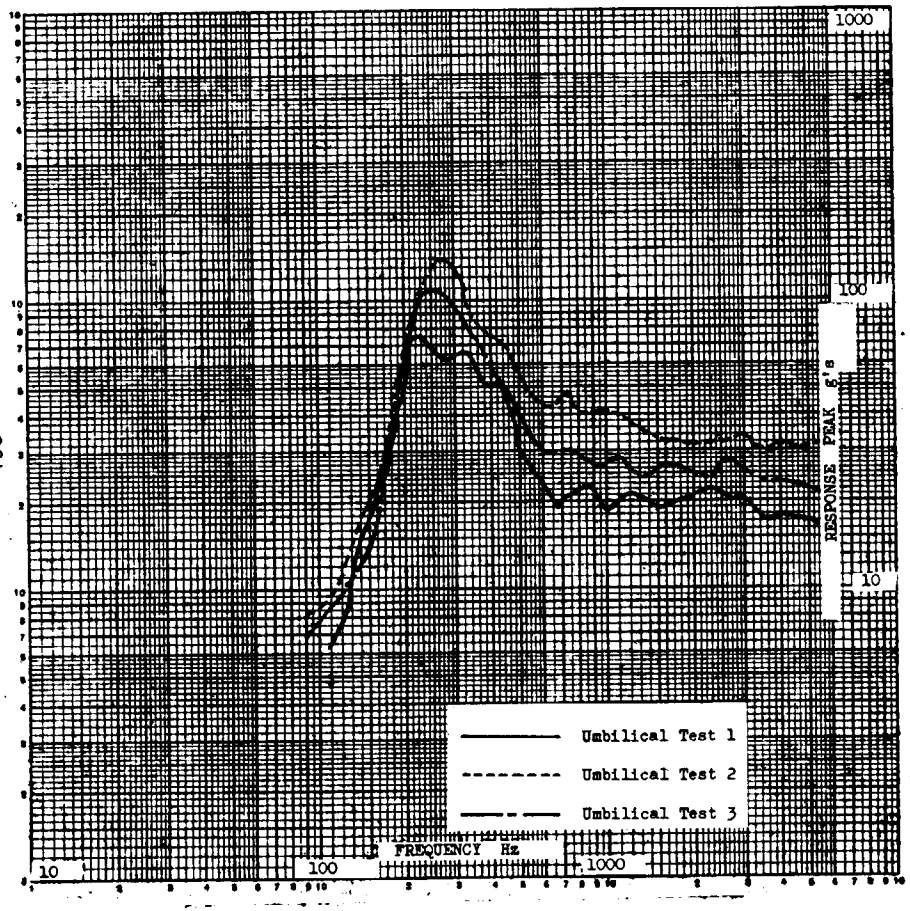
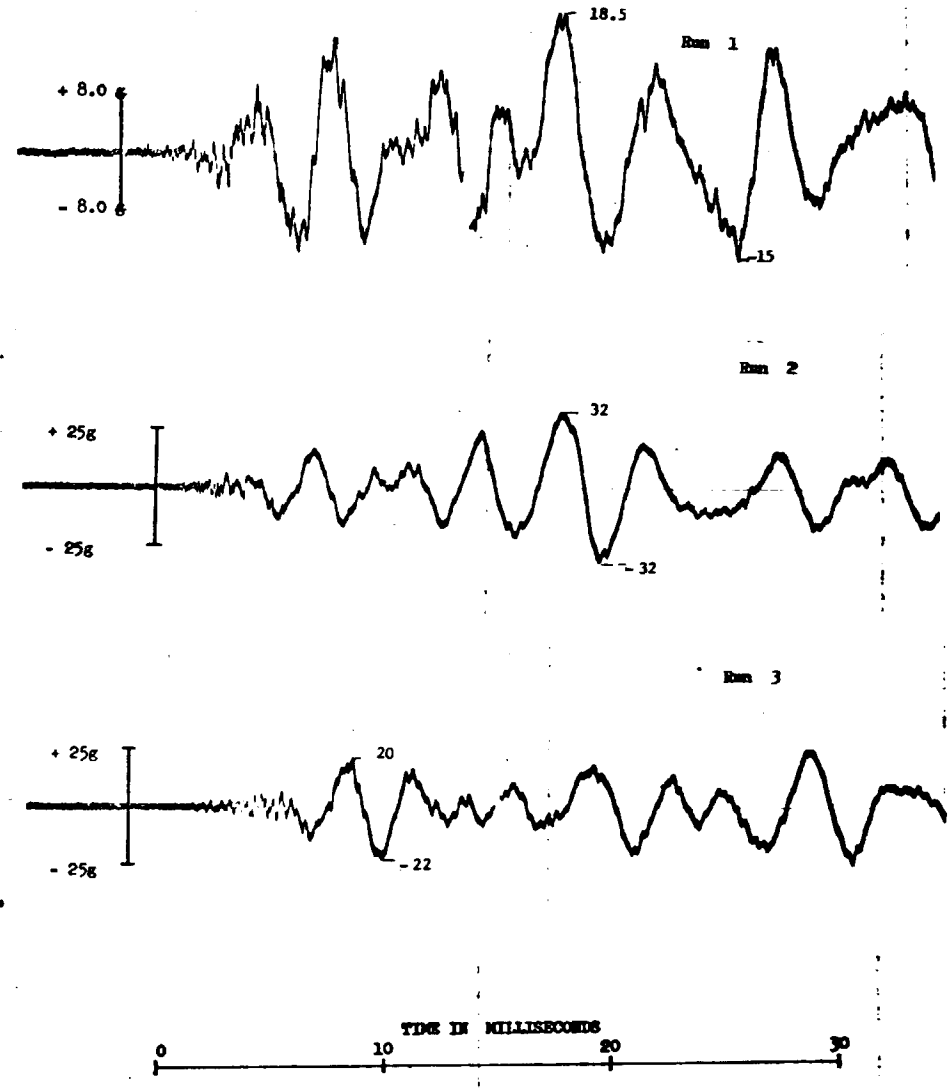


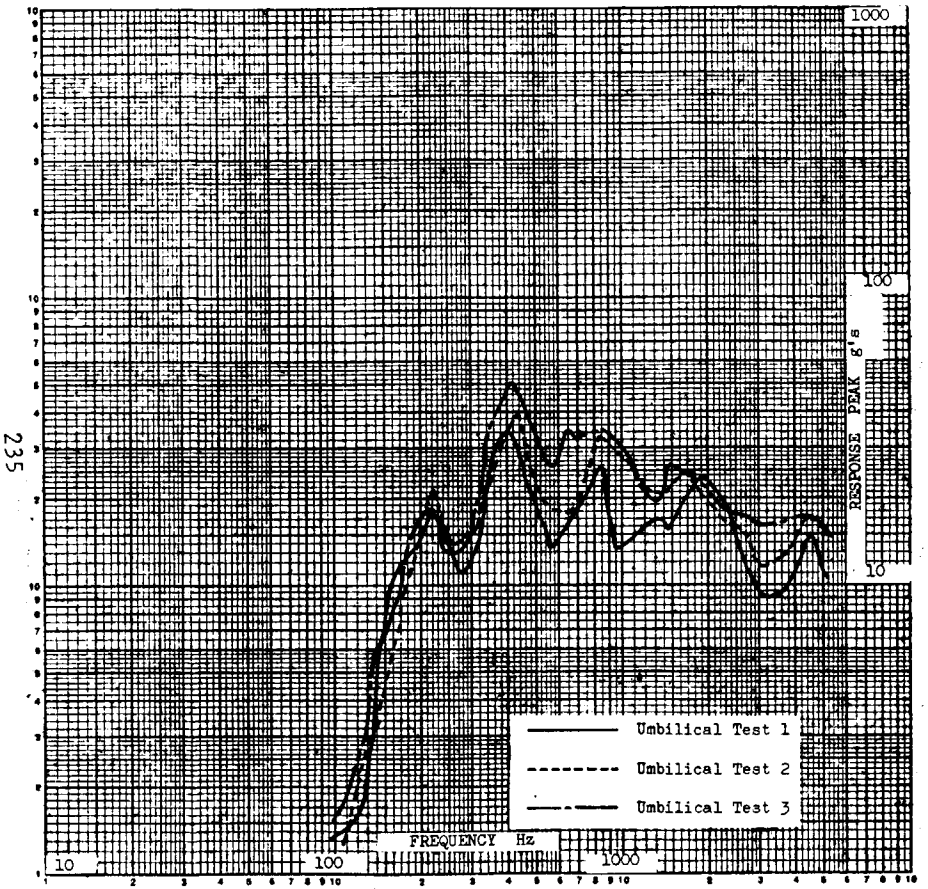
FIGURE I.A.5-19

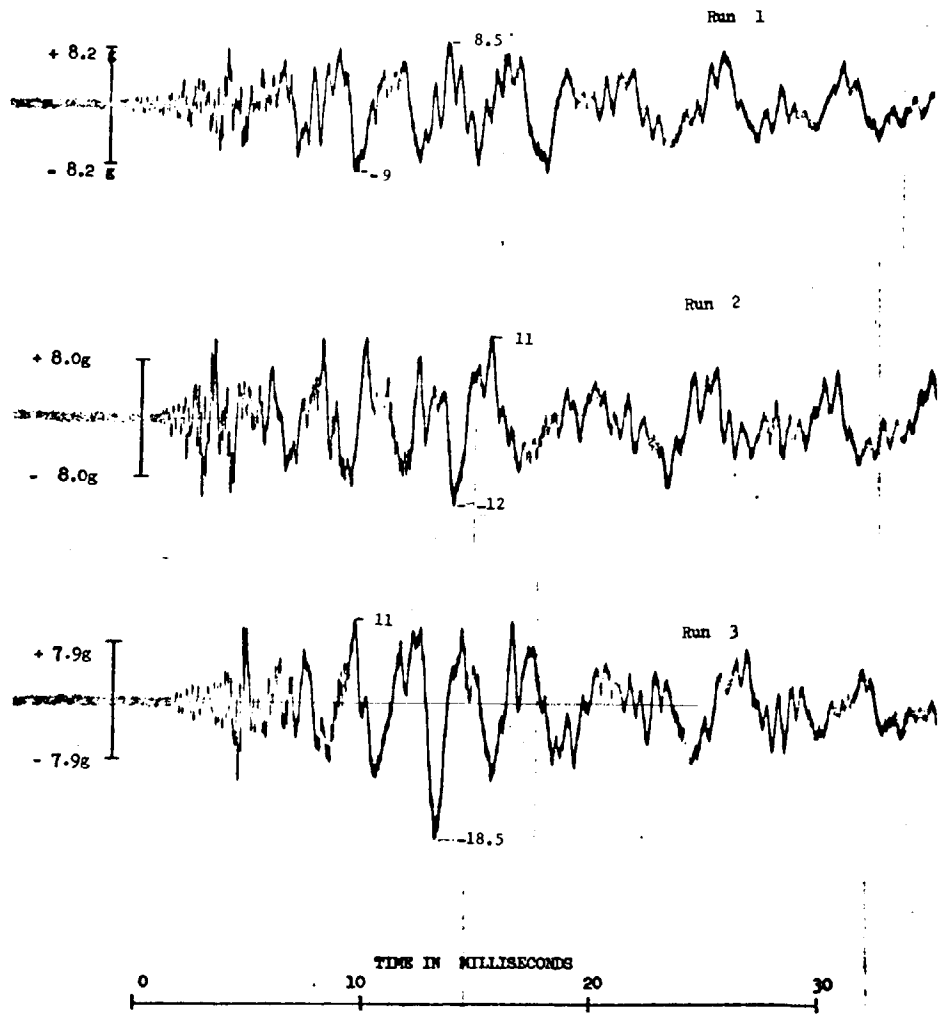




PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
MOD7E SECTION
LOC. 5-Y PCM SC
RUNS NO. 1, 2 AND 3

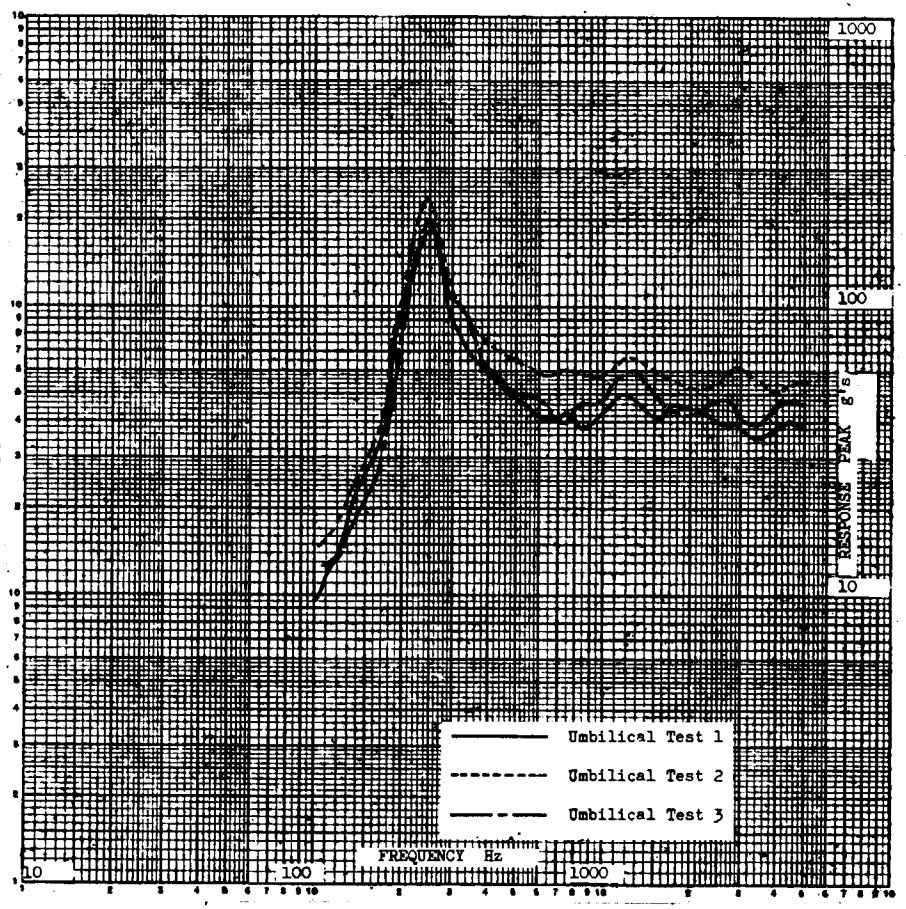
FIGURE I.A.5-20





PBV SHOCK DETERMINATION TEST - UMBILCAL SEPARATION
MOD7E SECTION
LOC. 5-Z PCM SC
RUNS NO. 1, 2 AND 3

FIGURE I.A.5-21



PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
MOD7E SECTION
LOC. 6-X UDOP TRANSPONDER
RUNS NO. 1, 2 AND 3

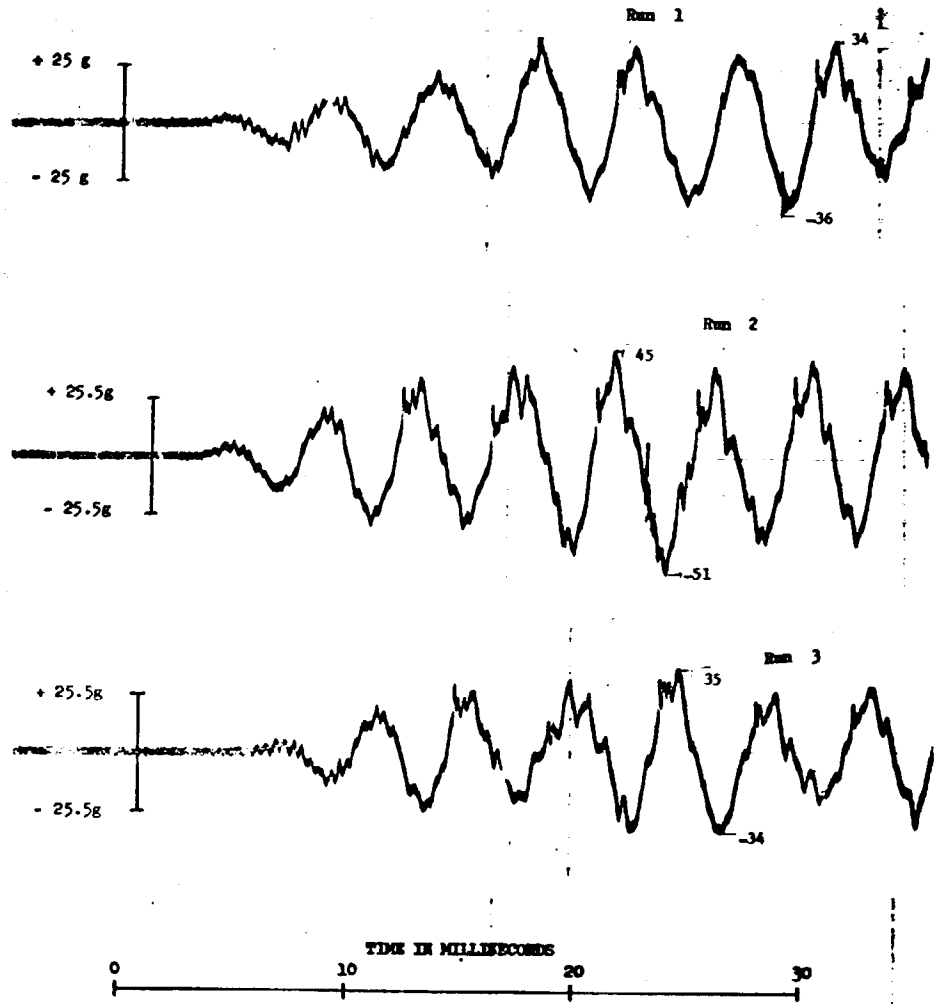
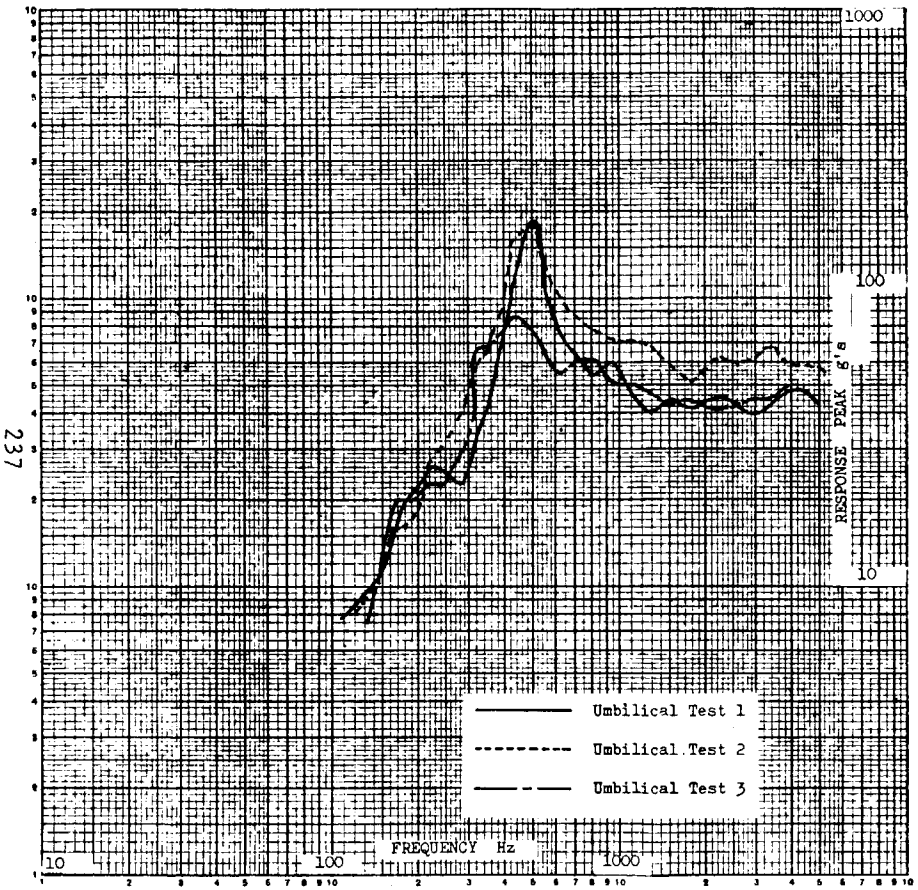
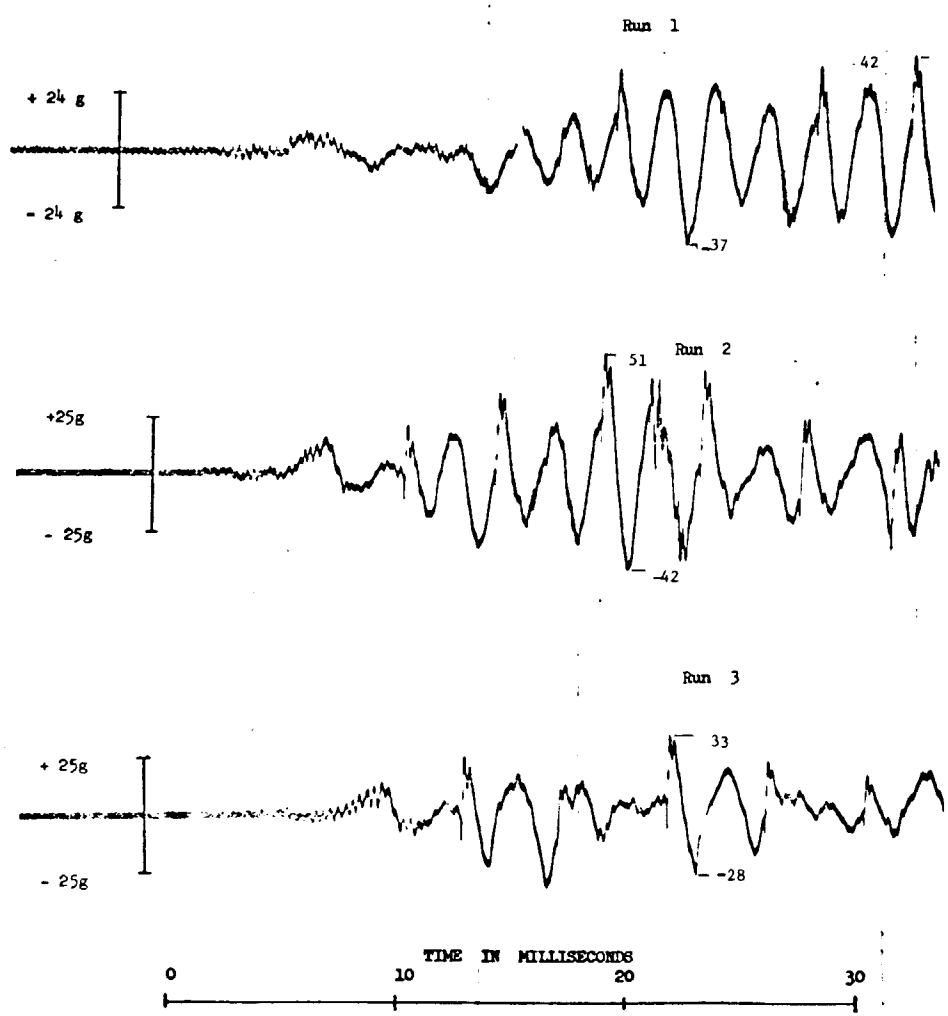


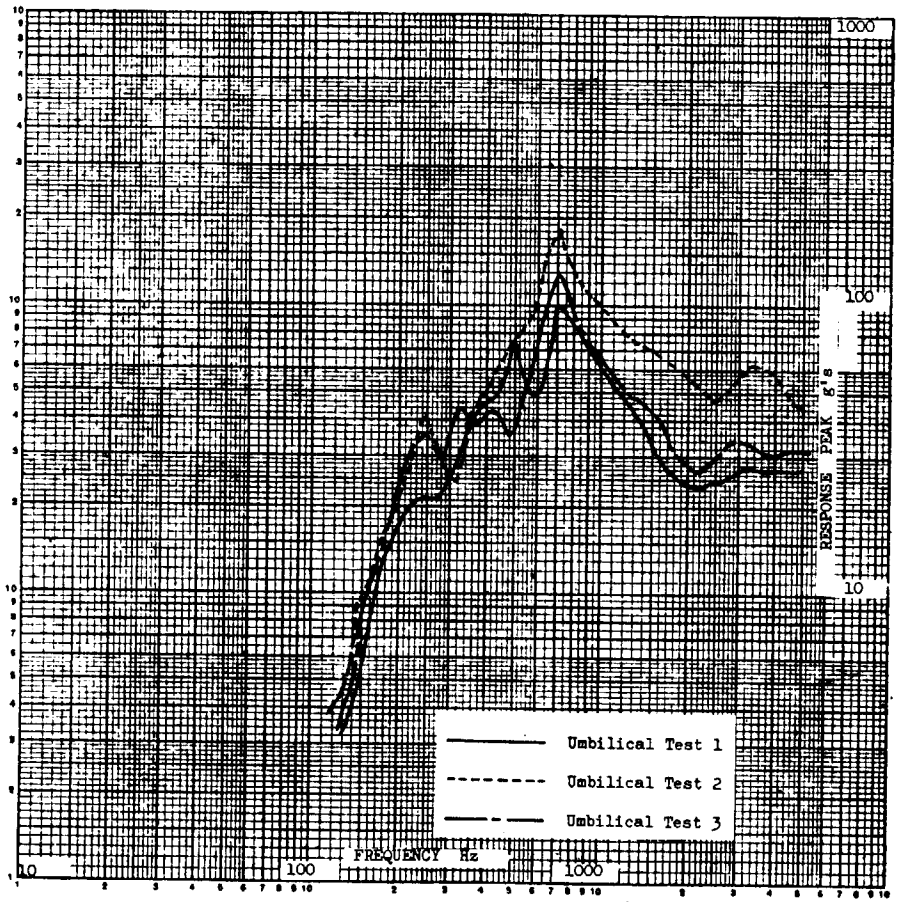
FIGURE I.A.5-22





PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
MOD7E SECTION
LOC. 6-Y UDOP TRANSPONDER
RUNS NO. 1, 2 AND 3

FIGURE 1.A.5-23



PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
MOD7E SECTION
LOC. 6-Z UDOP TRANSPONDER
RUNS NO. 1, 2 AND 3

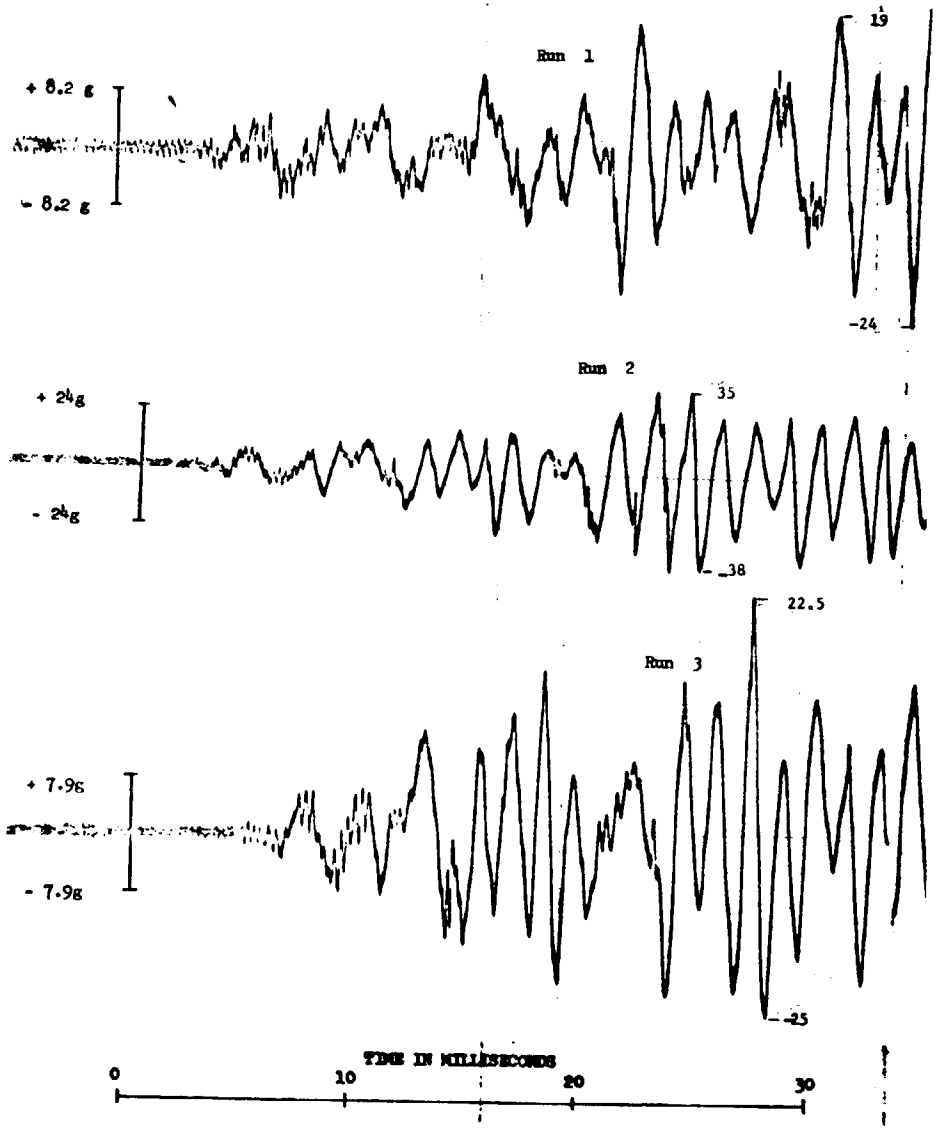
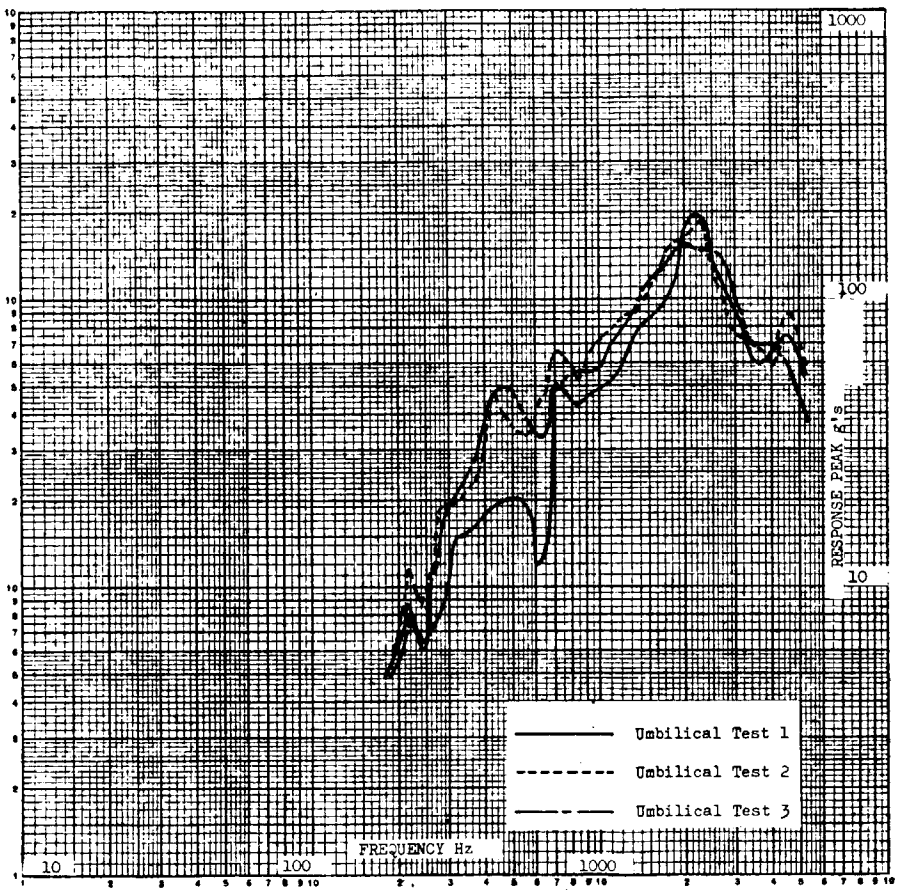
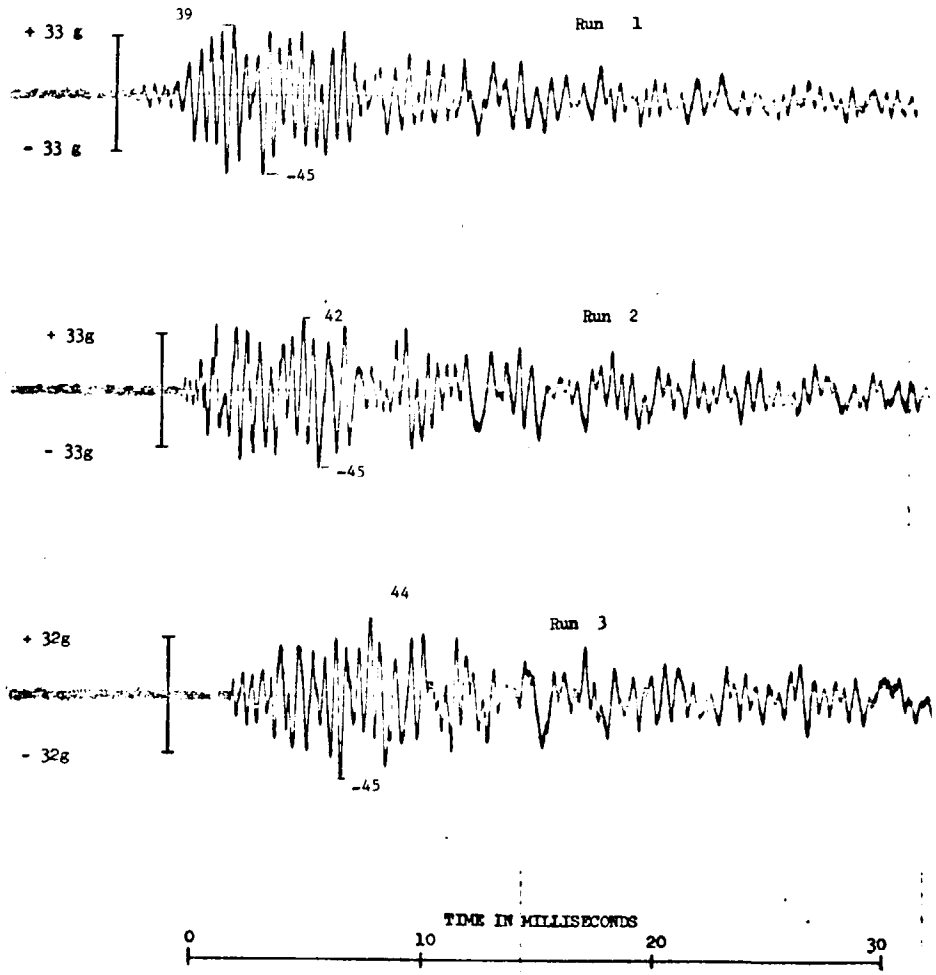


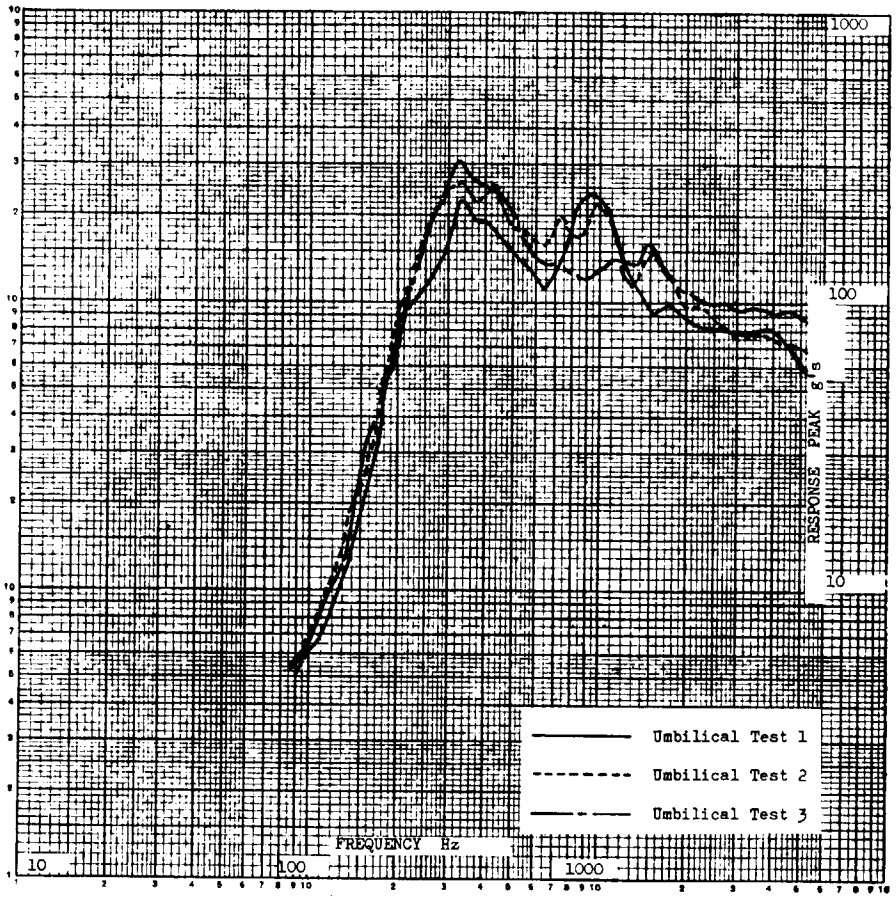
FIGURE I.A.5-24





PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
MOD7E SECTION
LOC. 7-Z C-BAND ANTENNA
RUNS 1, 2 AND 3

FIGURE I.A.5-25



PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
MOD7E SECTION
LOC. 7-R C-BAND ANTENNA
RUNS NO. 1, 2 AND 3

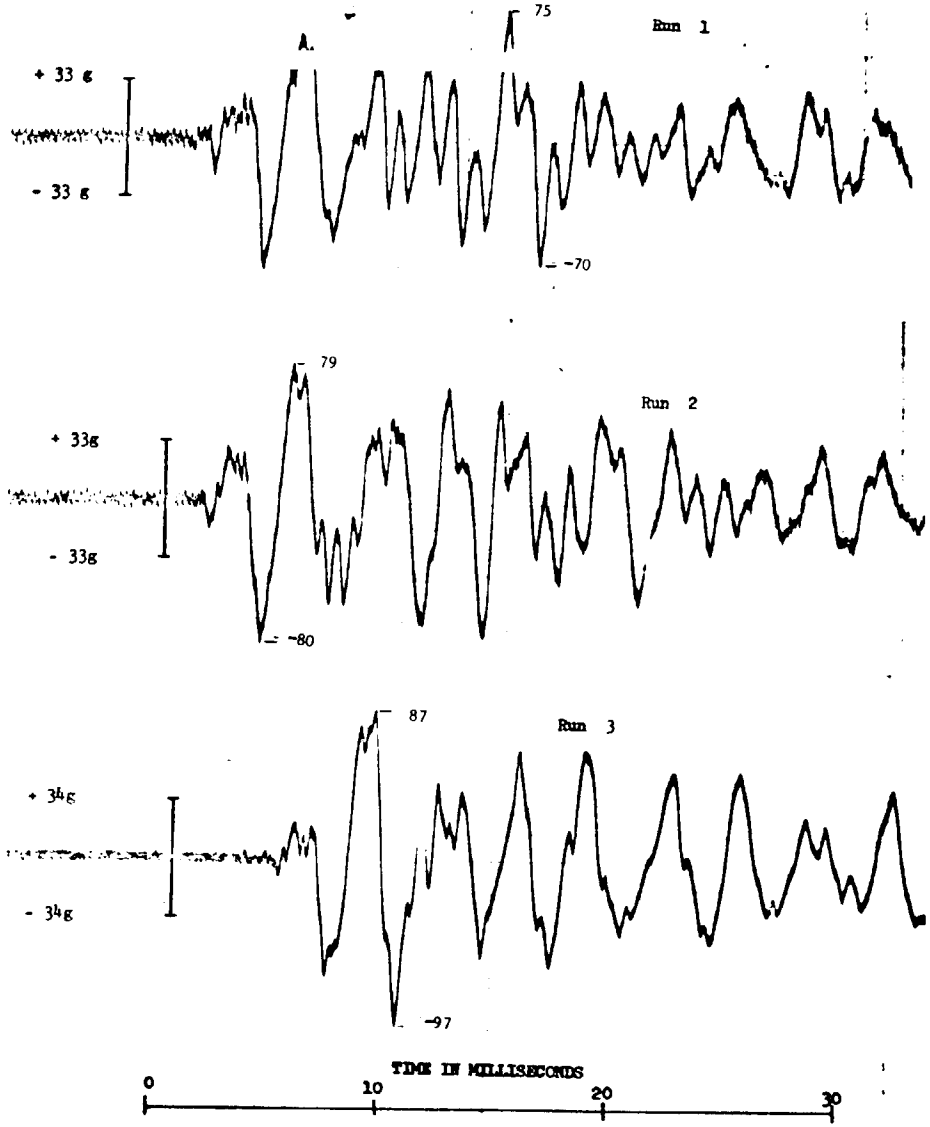
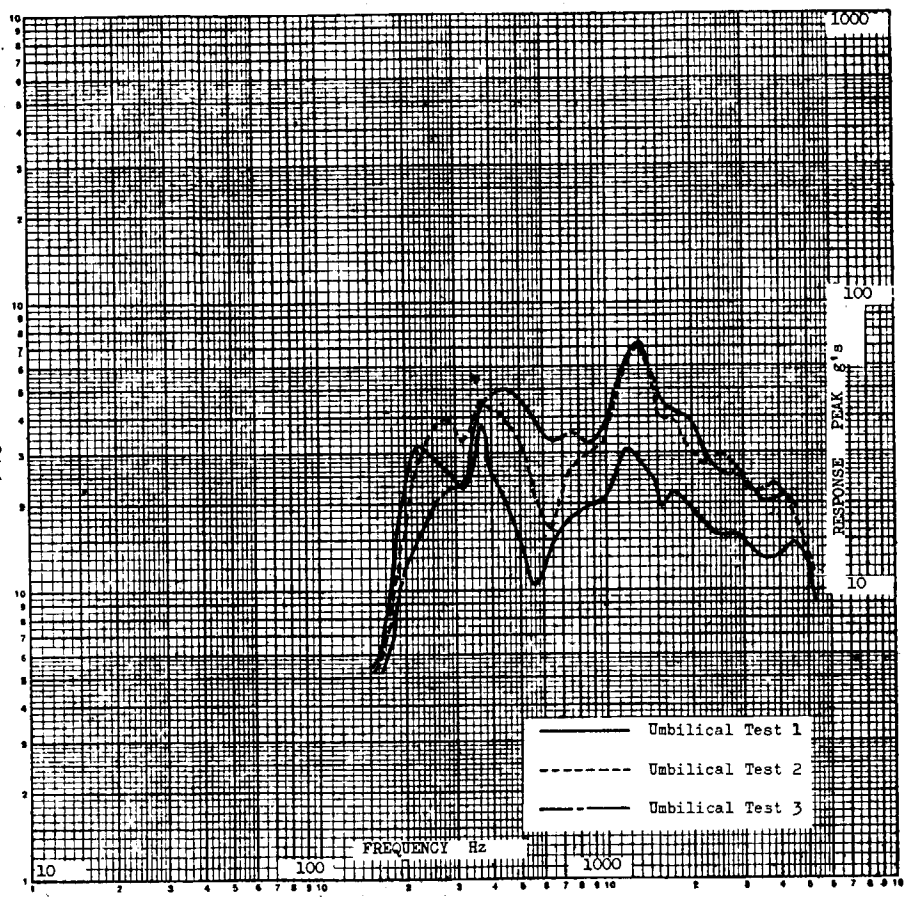


FIGURE I.A.5-26



PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
MOD7E SECTION
LOC. 7-T C-BAND ANTENNA
RUNS 1, 2 AND 3

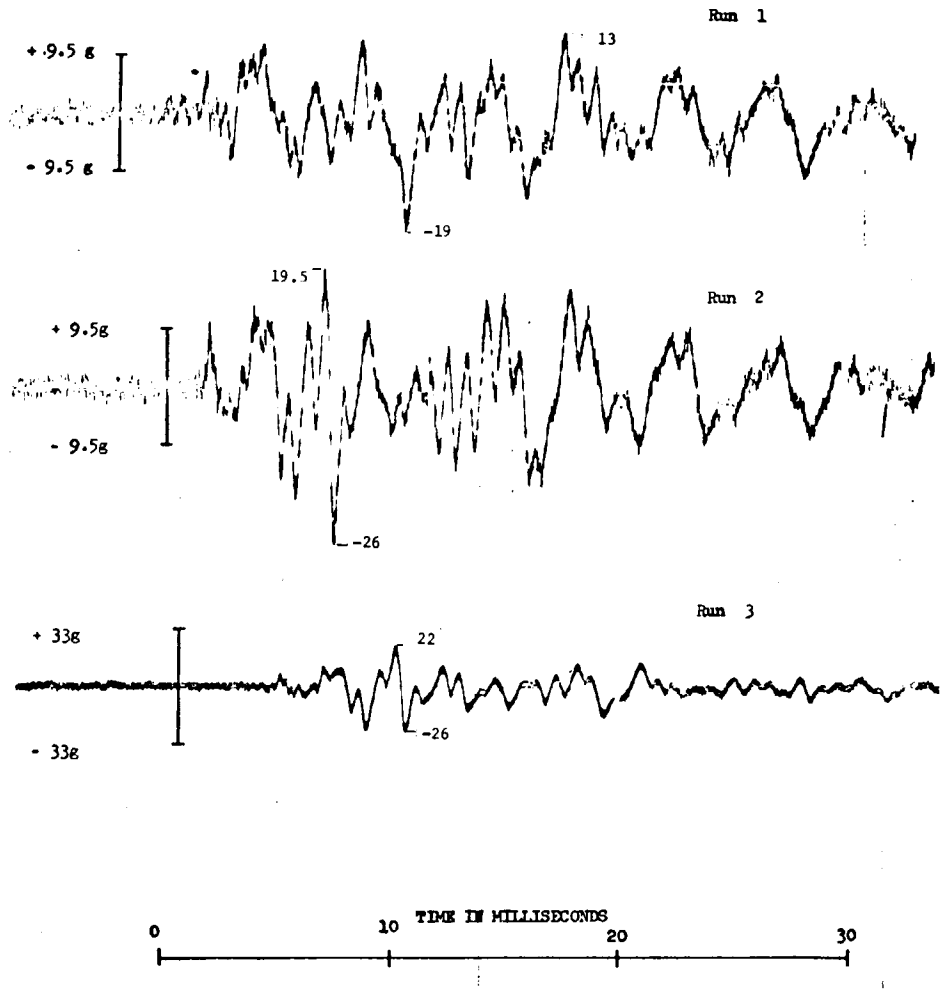
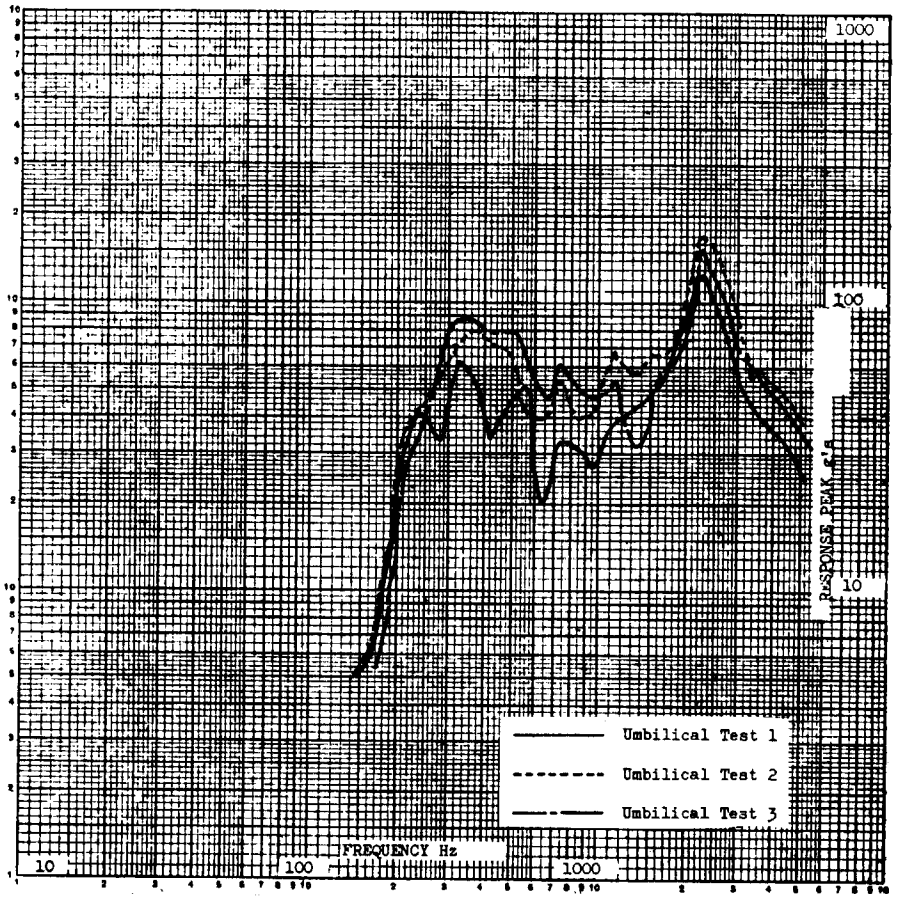
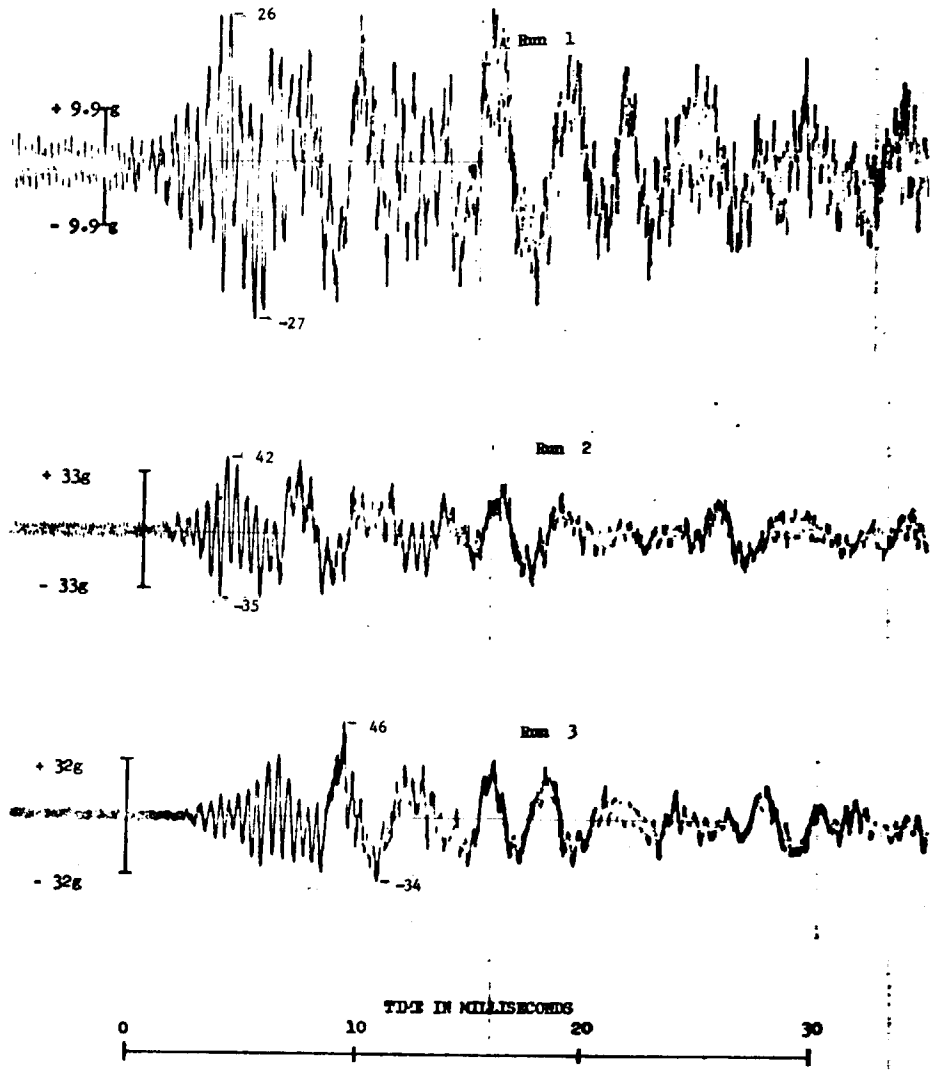


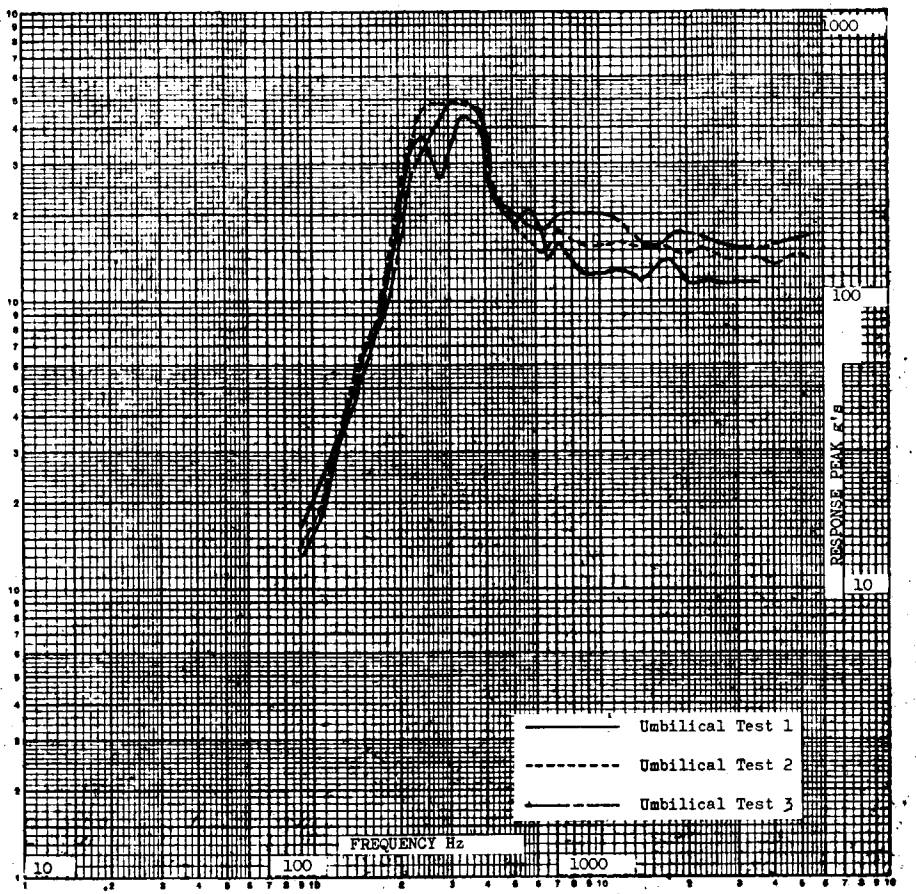
FIGURE I.A.5-27

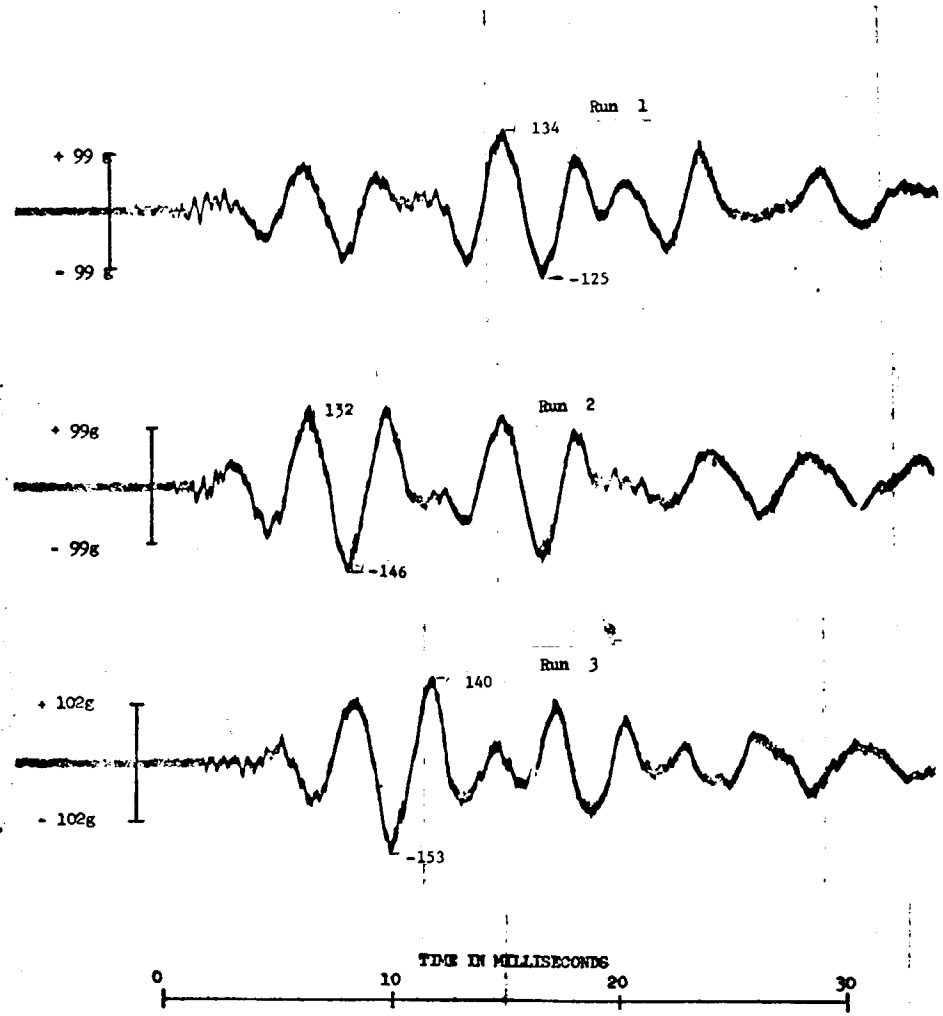




PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
MOD7E SECTION
LOC. 8-Z UDOP ANTENNA
RUNS 1, 2, AND 3

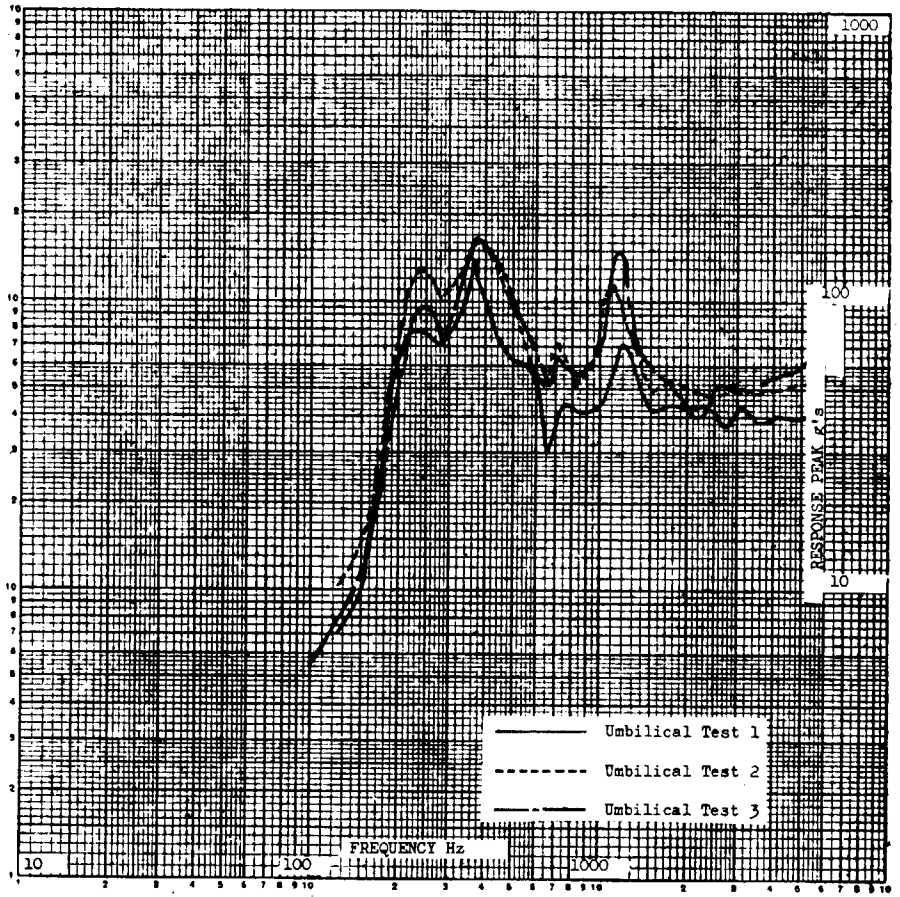
FIGURE I.A.5-28





PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
MOD7E SECTION
LOC. 8-R UDOP ANTENNA
RUNS 1, 2 AND 3

FIGURE I.A.5-29



PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
MOD7E SECTION
LOC. 8-T UDOP ANTENNA
RUNS NO. 1, 2 AND 3

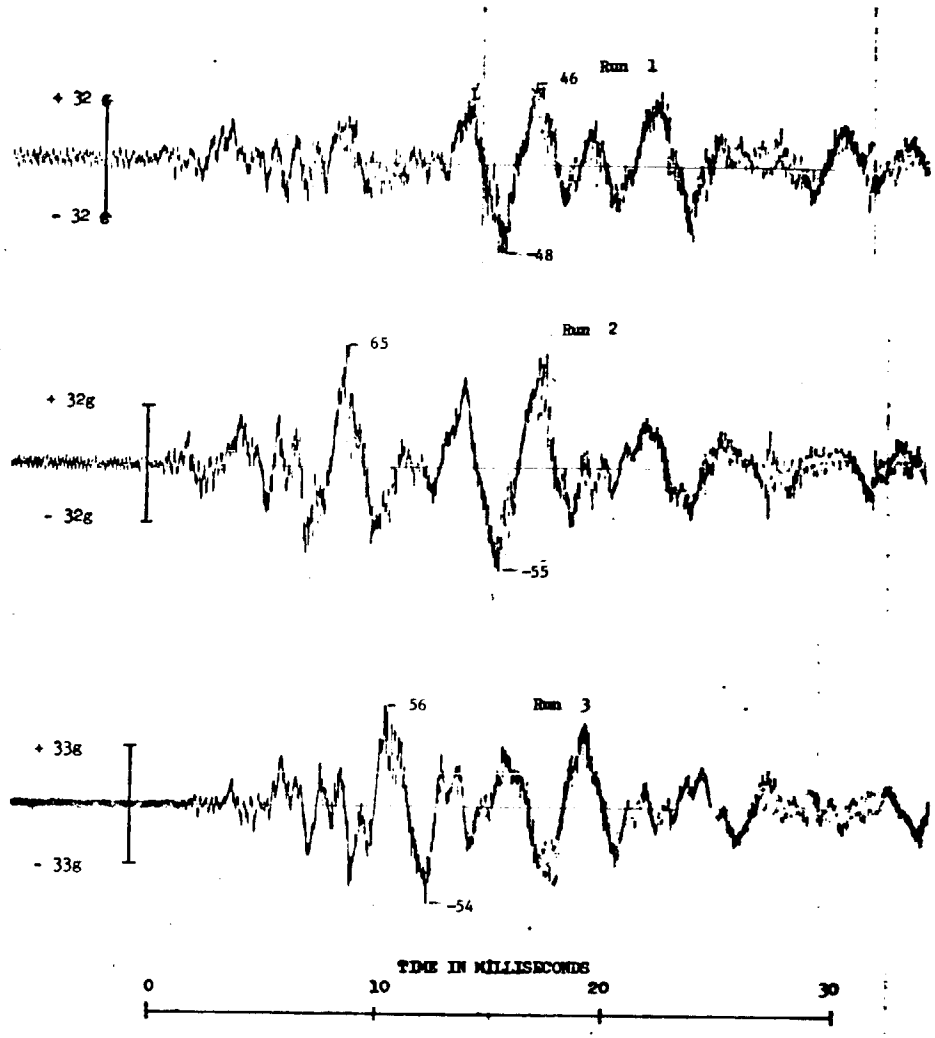
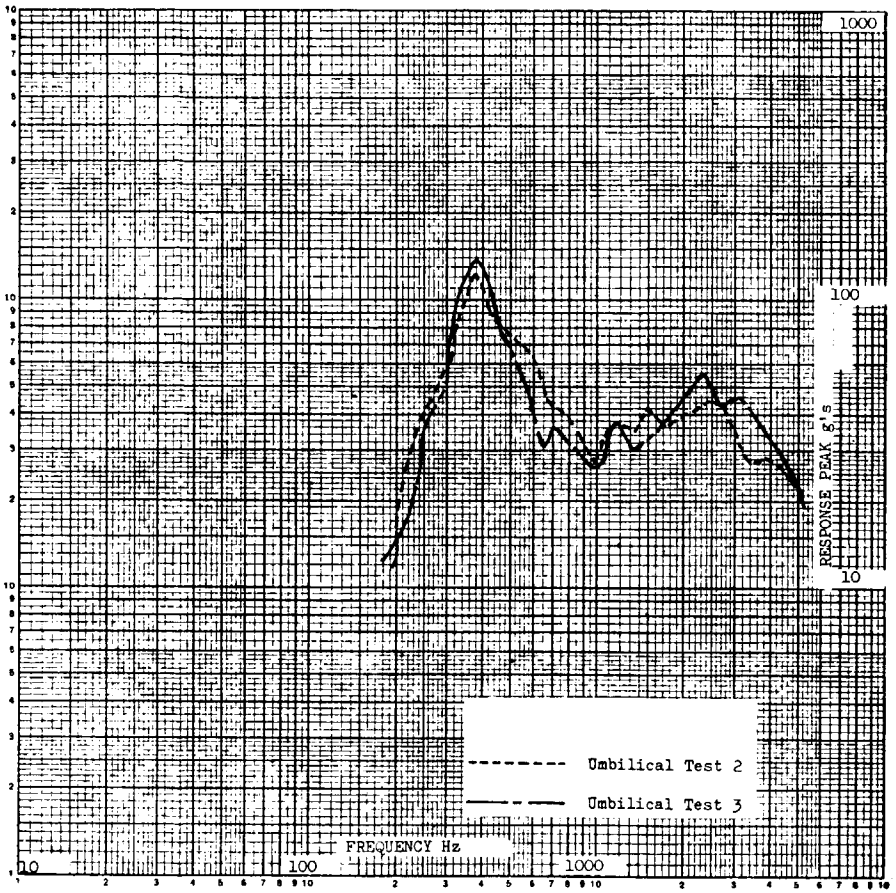


FIGURE I.A.5-30



PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
PBPS SECTION
LOCATION 9-Z ROLL ENGINE #2
RUNS NO. 2 AND 3

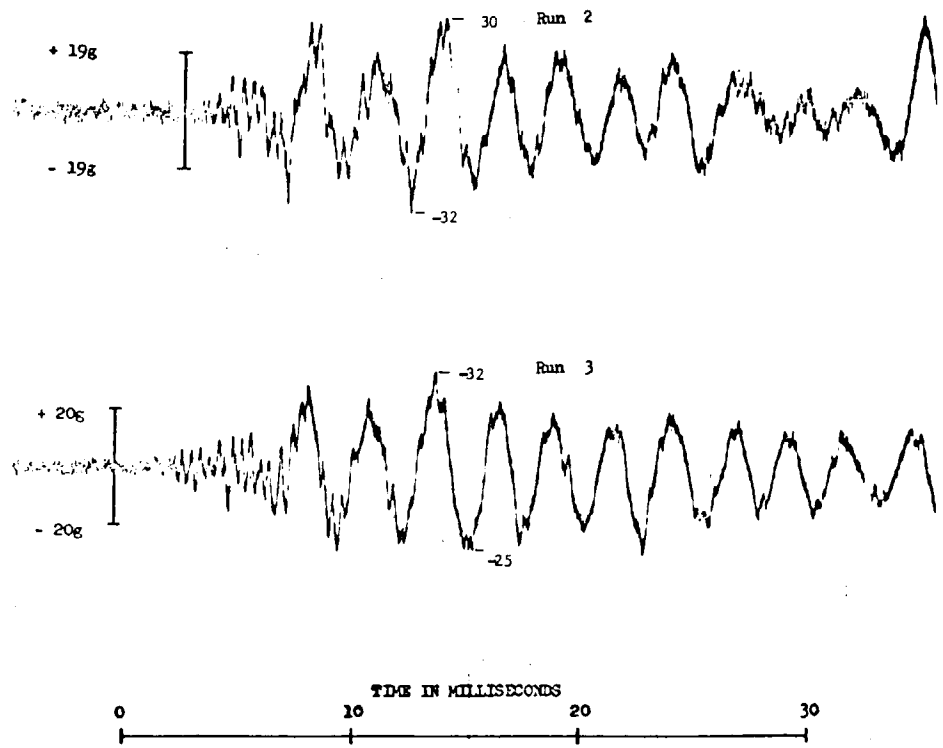
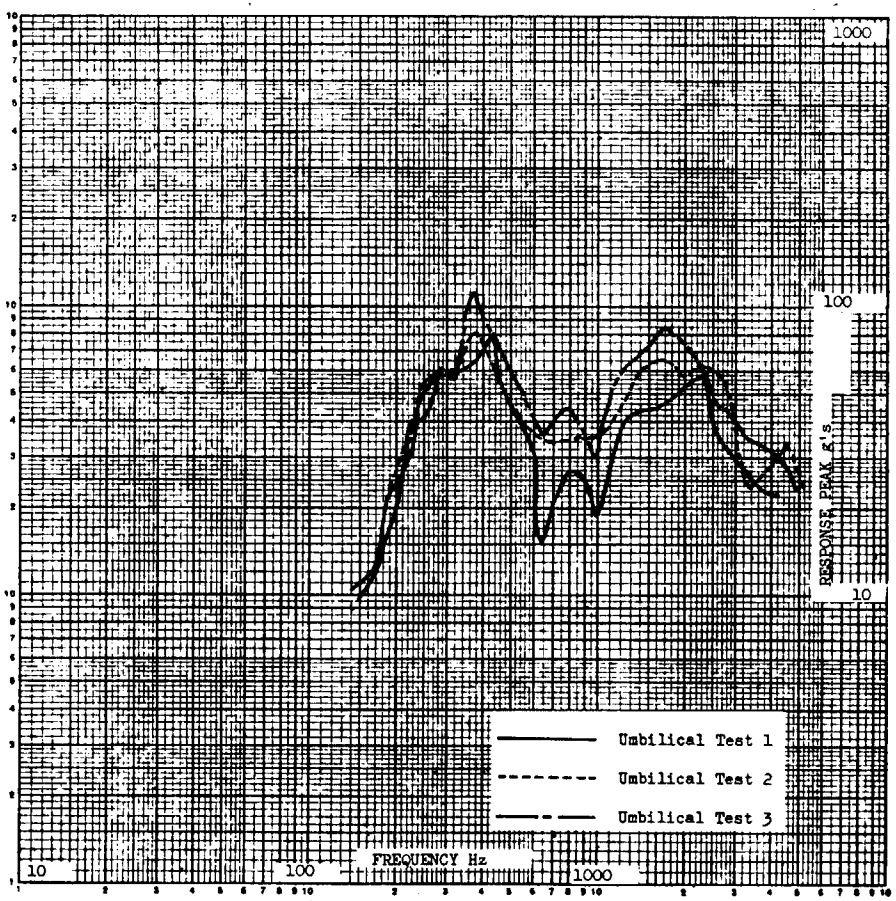


FIGURE I.A.5-31



PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
PBPS SECTION
LOC. 9-R ROLL ENGINE #2
RUNS NO. 1, 2 AND 3

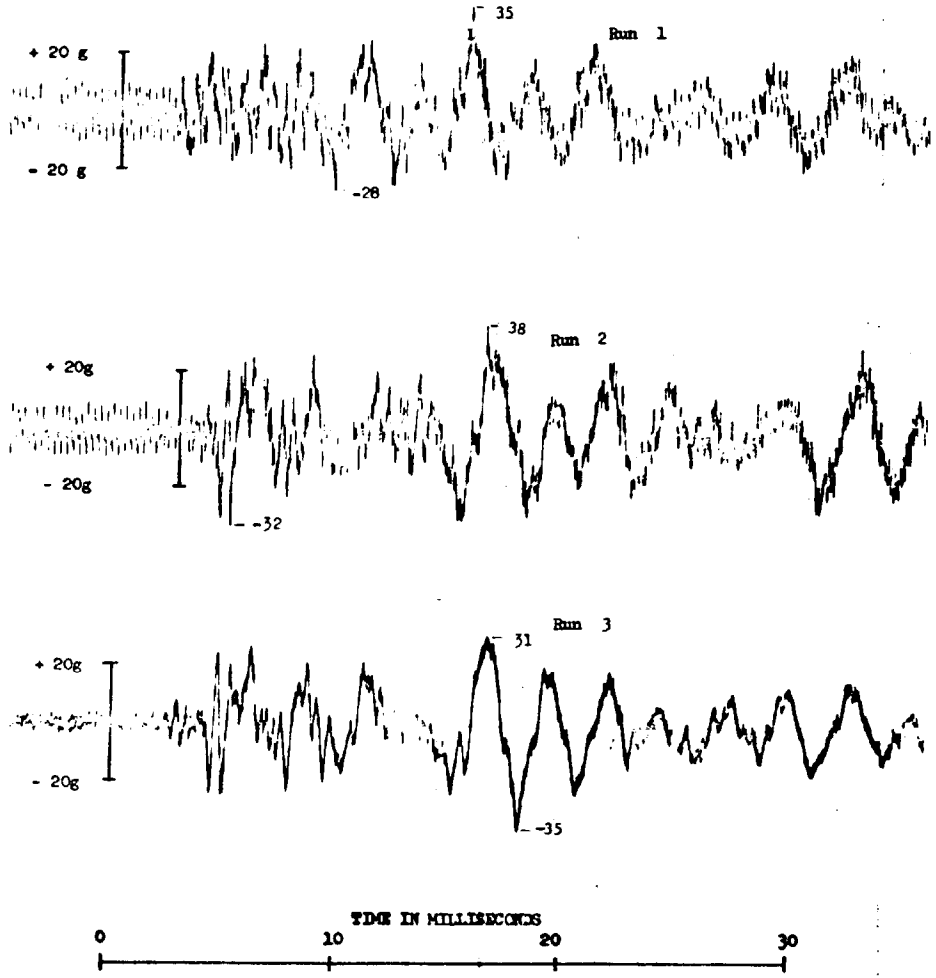
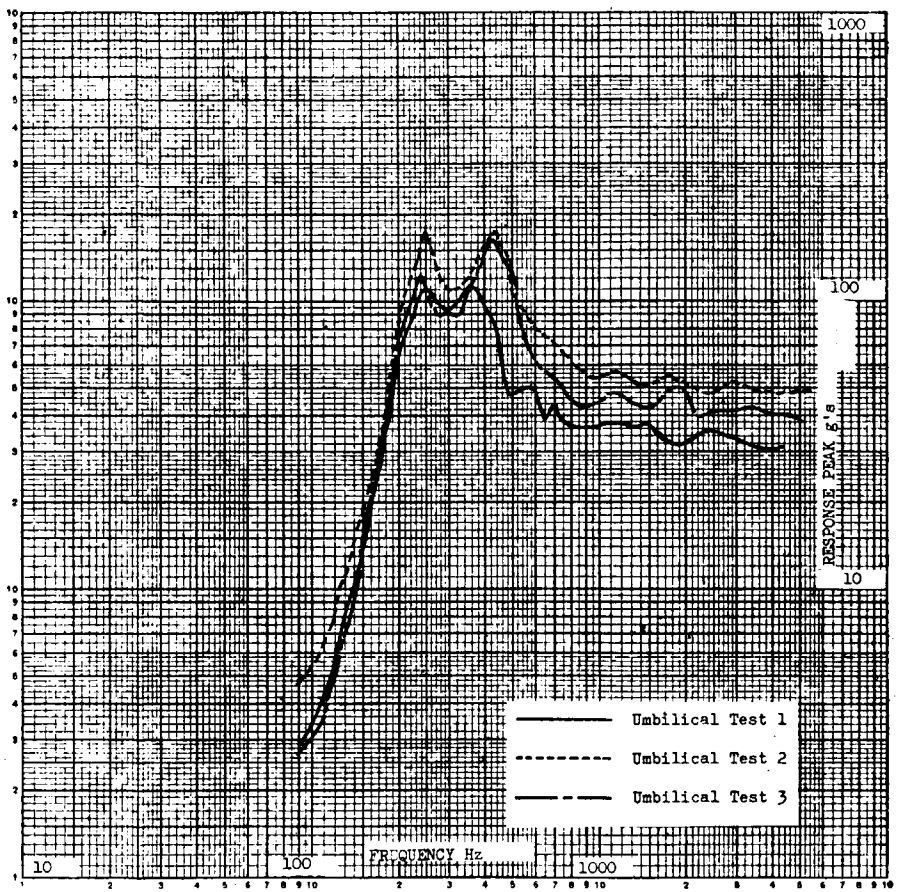


FIGURE 1.A.5-32



PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
PBPS SECTION
LOC. 10-Z ROLL ENGINE #4
RUNS 1, 2 AND 3

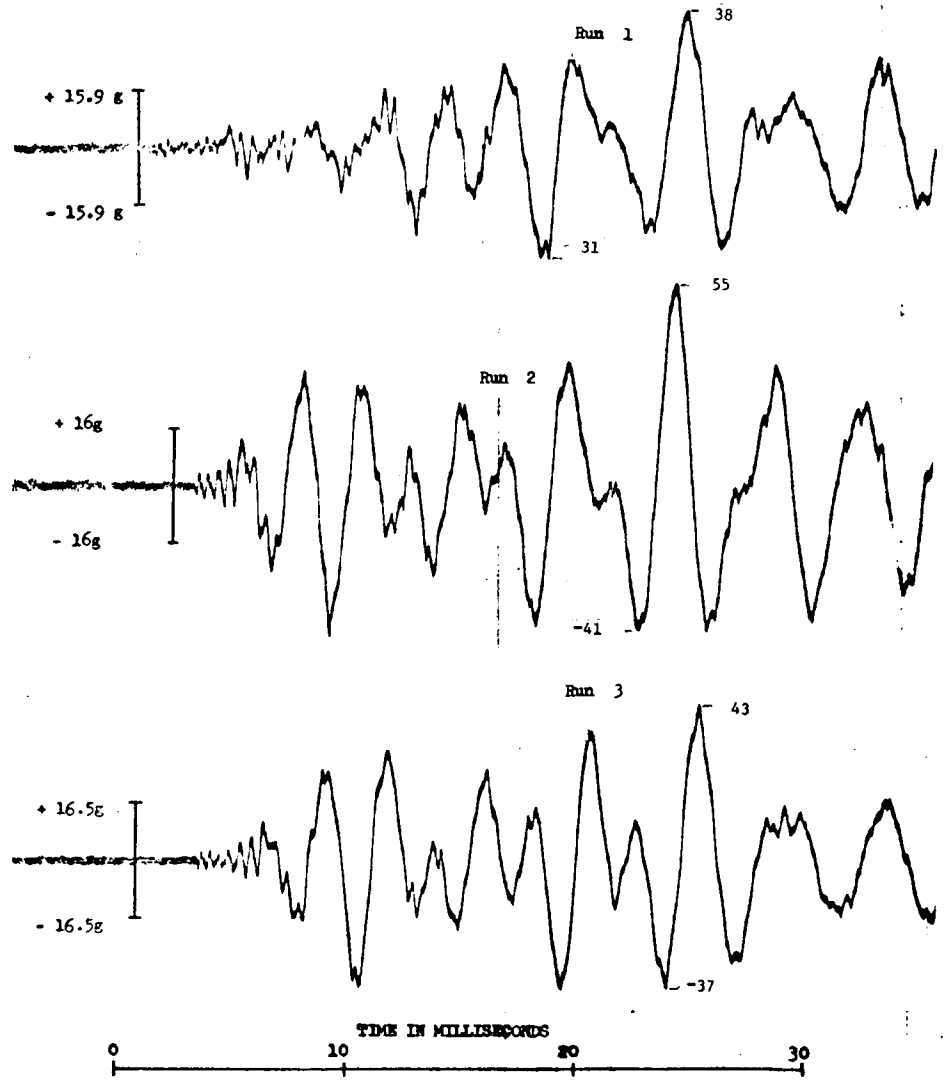
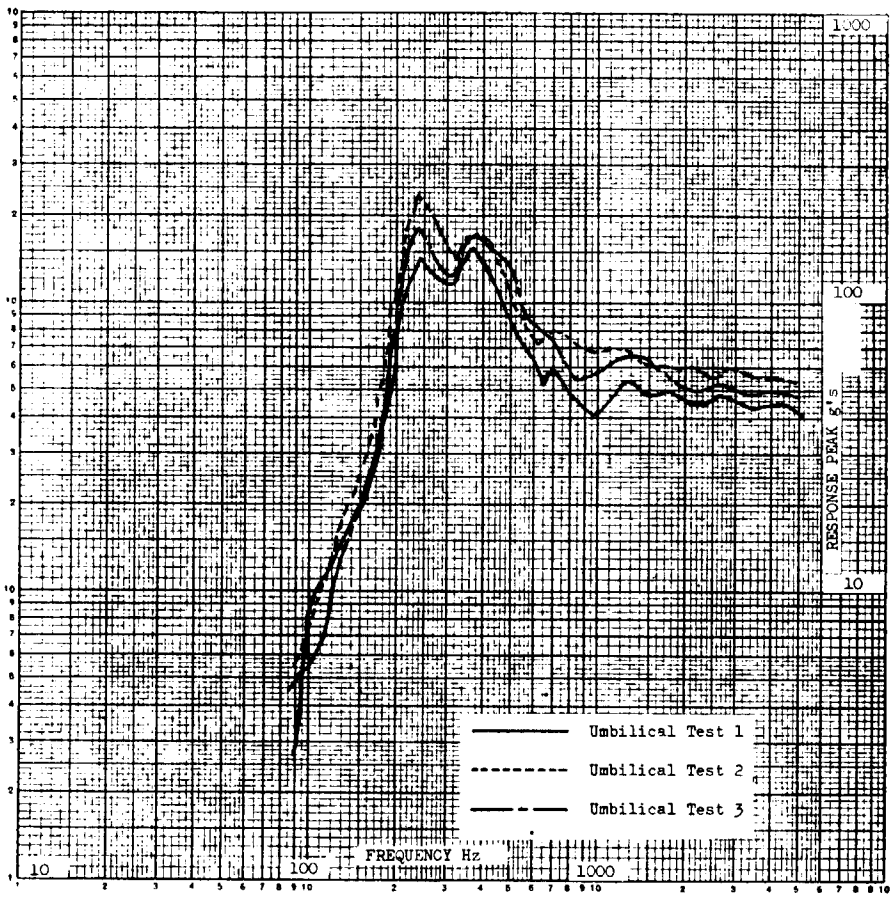


FIGURE I.A.5-33



PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
PBPS SECTION
ROLL ENGINE #4 LOC. 10-R
RUNS NO. 1, 2 AND 3

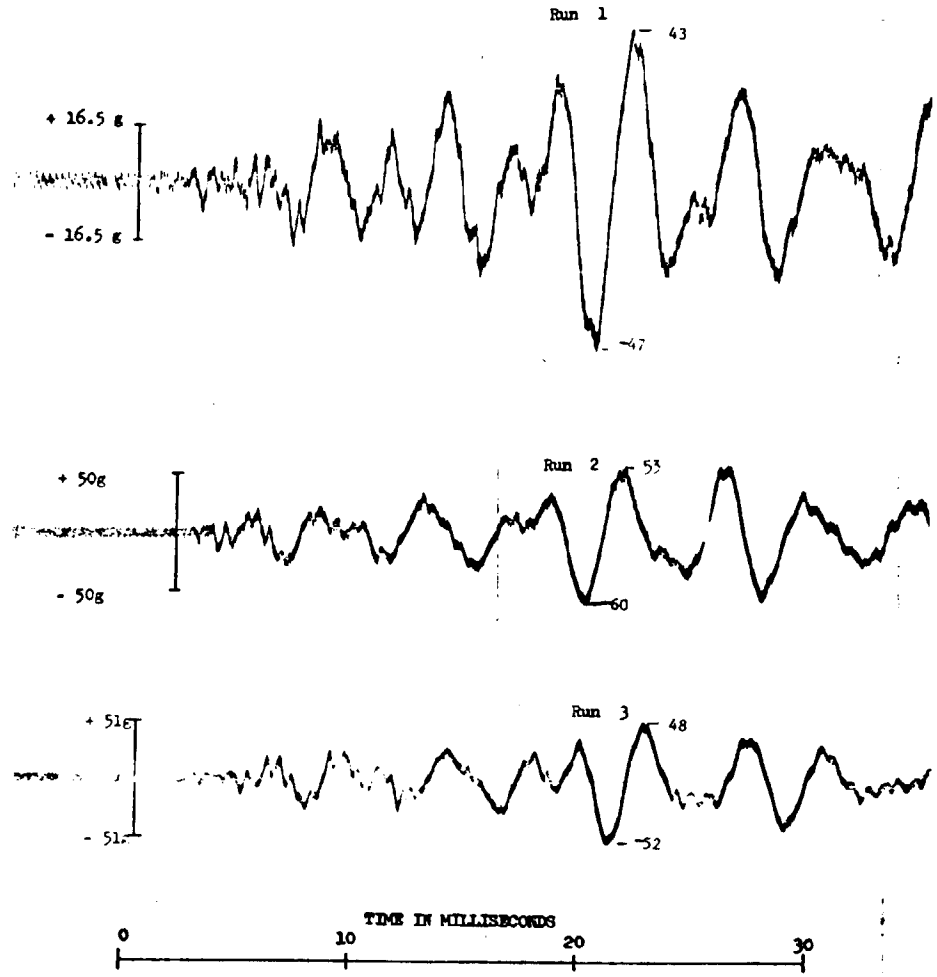
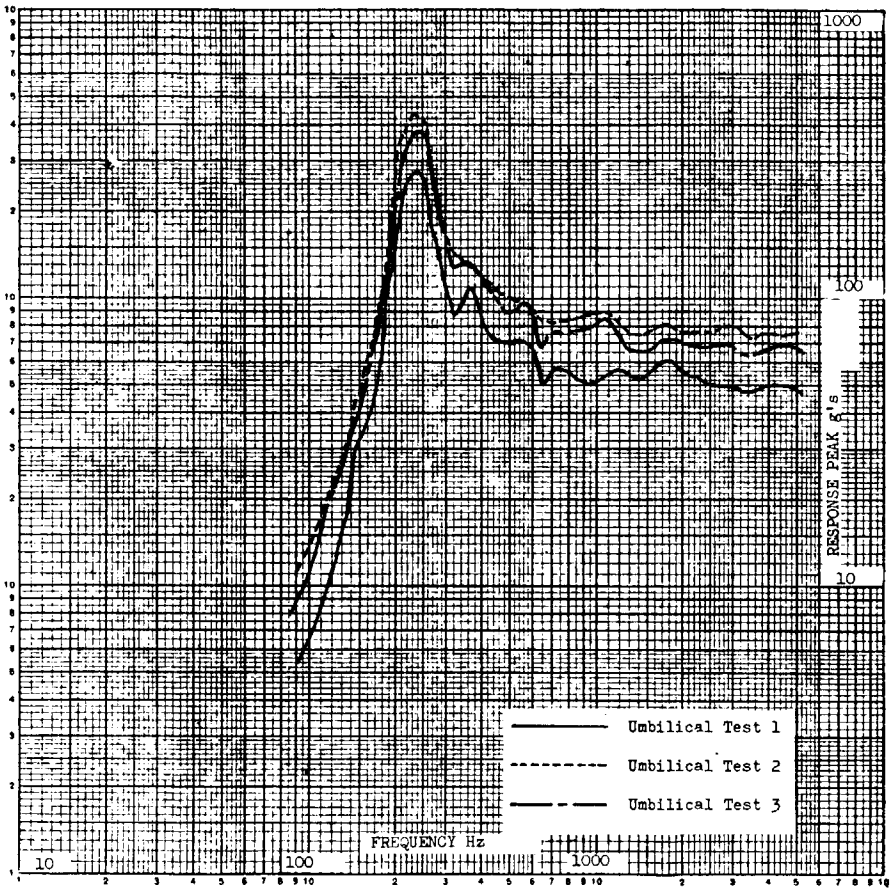
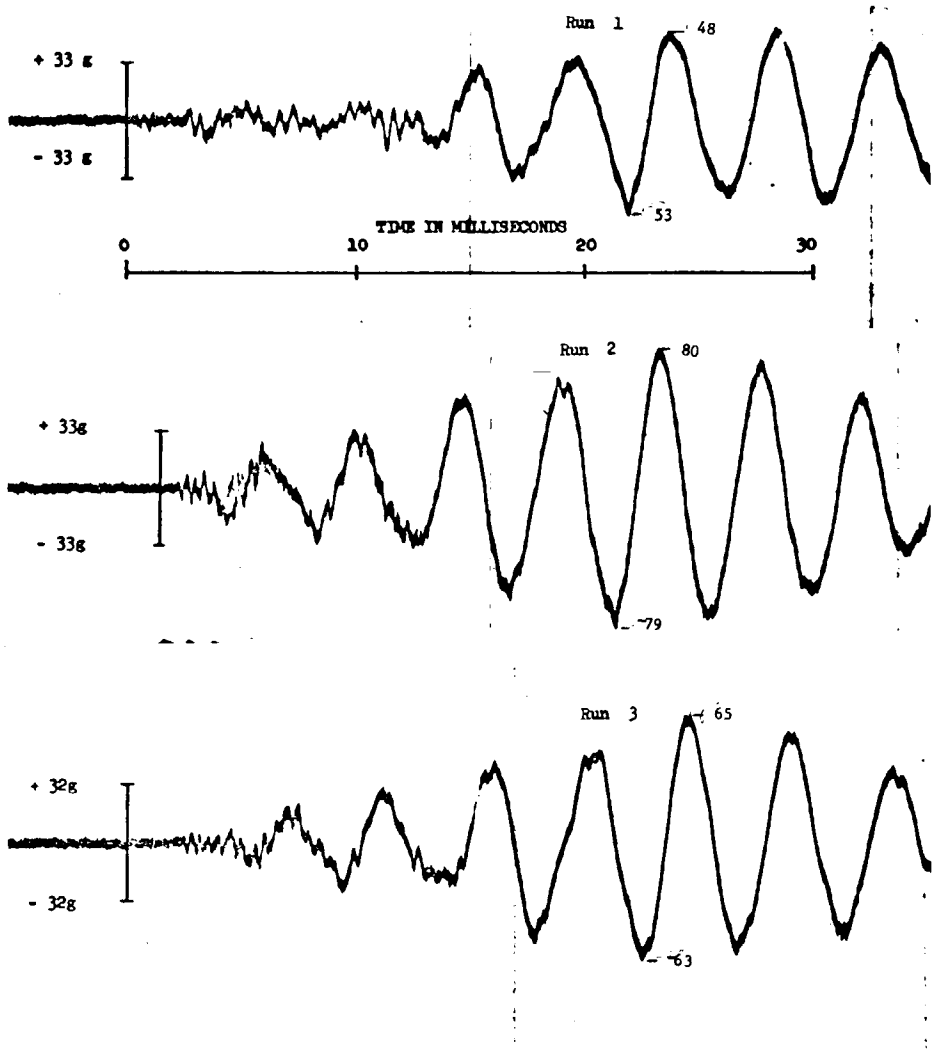


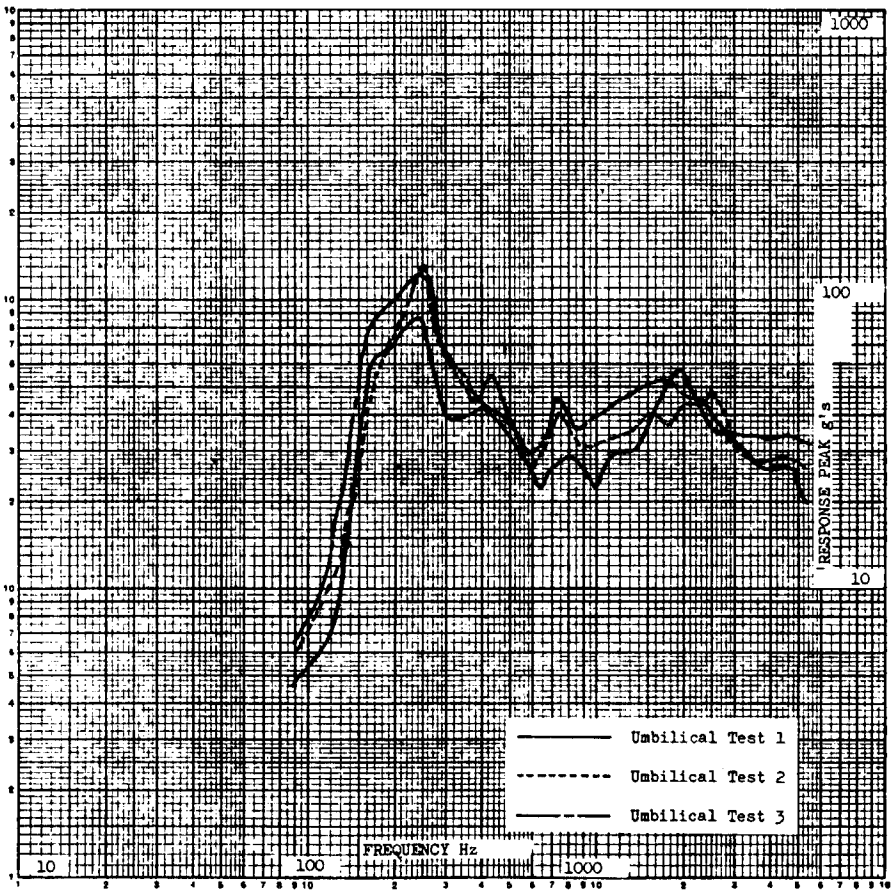
FIGURE I.A.5-34

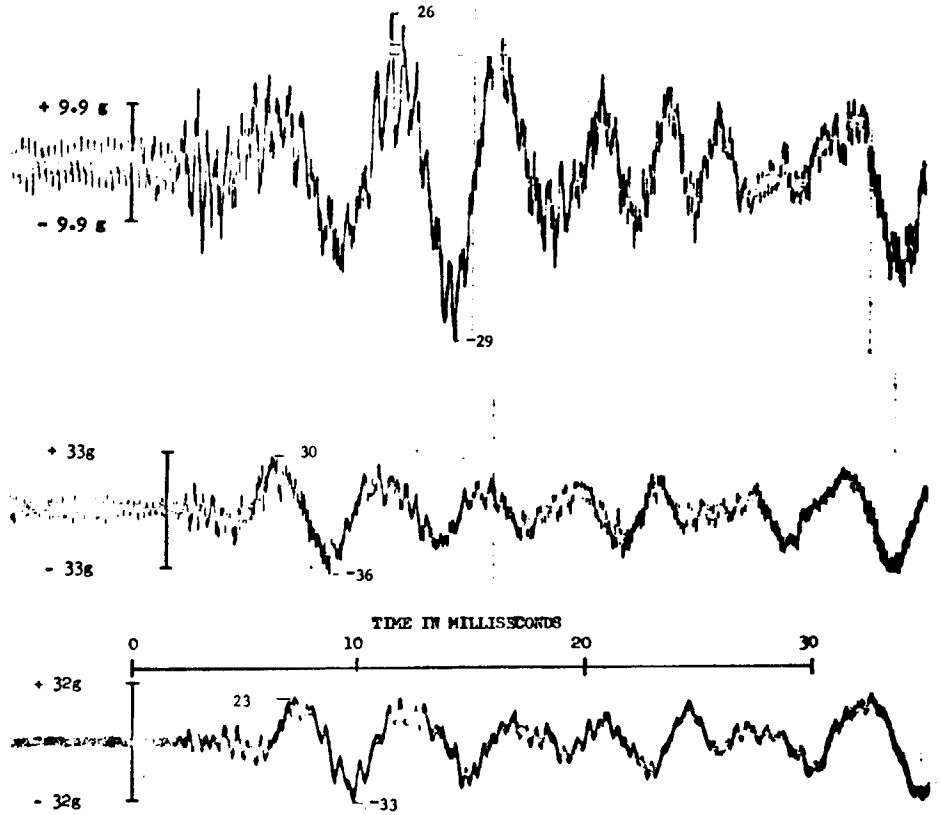




PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
PBPS SECTION
LOC. 11-Z YAW ENGINE #2
RUNS NO. 1, 2 AND 3

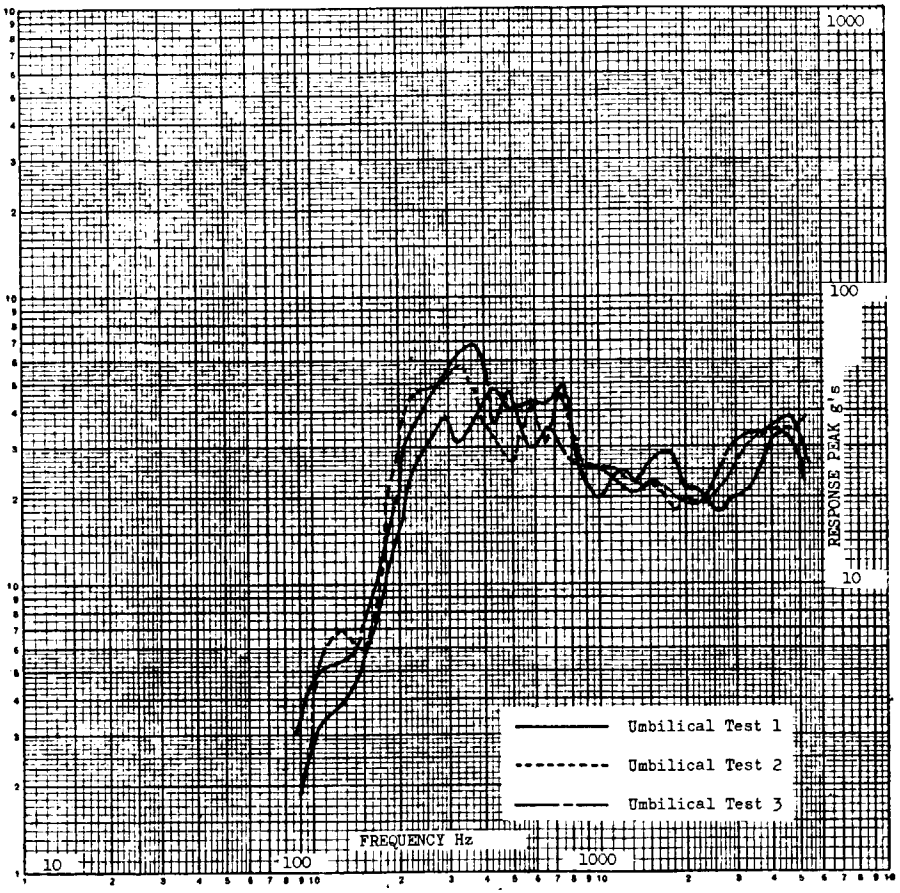
FIGURE I.A.5-35





PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
PBPS SECTION
LOC 11-R YAW ENGINE #2
RUNS NO. 1, 2 AND 3

FIGURE 1.A.5-36



PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
PBPS SECTION
LOC. 12-Z FUEL TANK @ GAS END
RUNS NO. 1, 2 AND 3

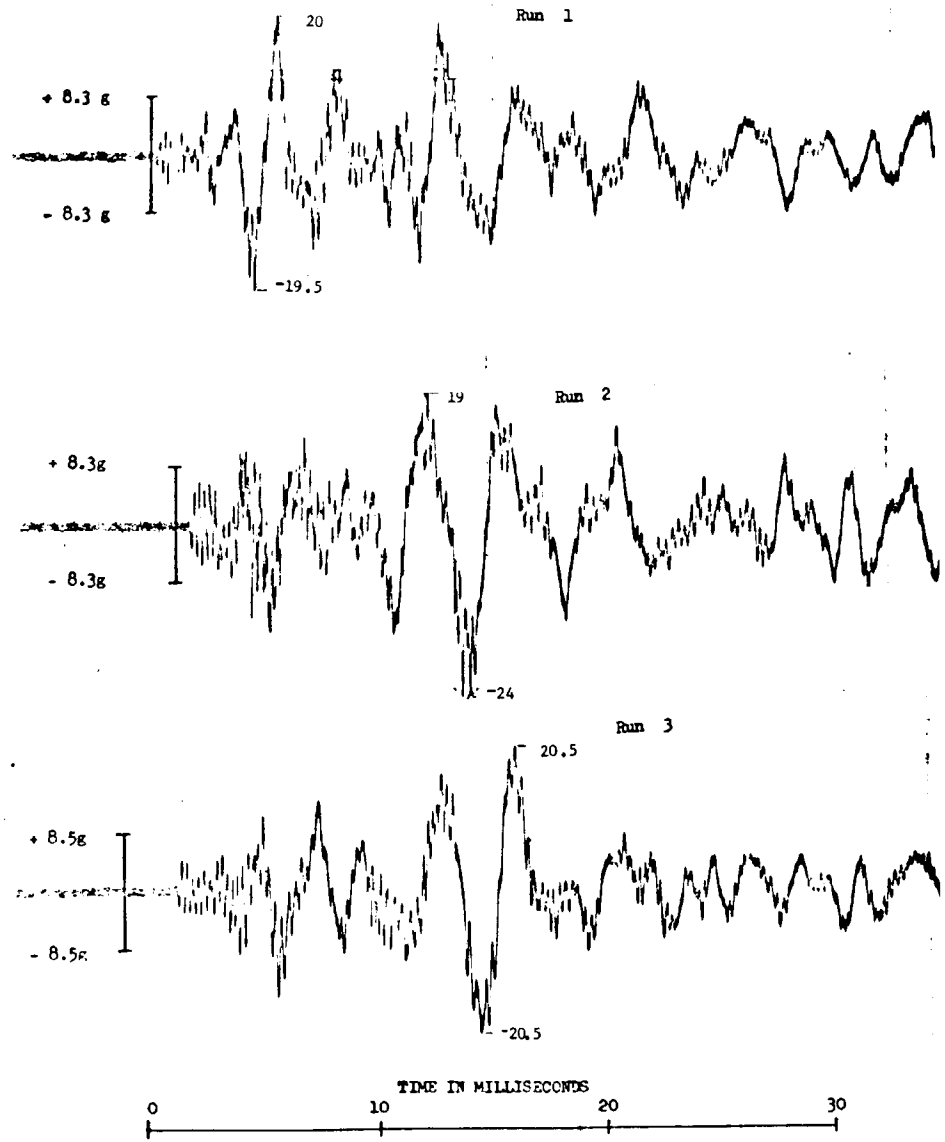
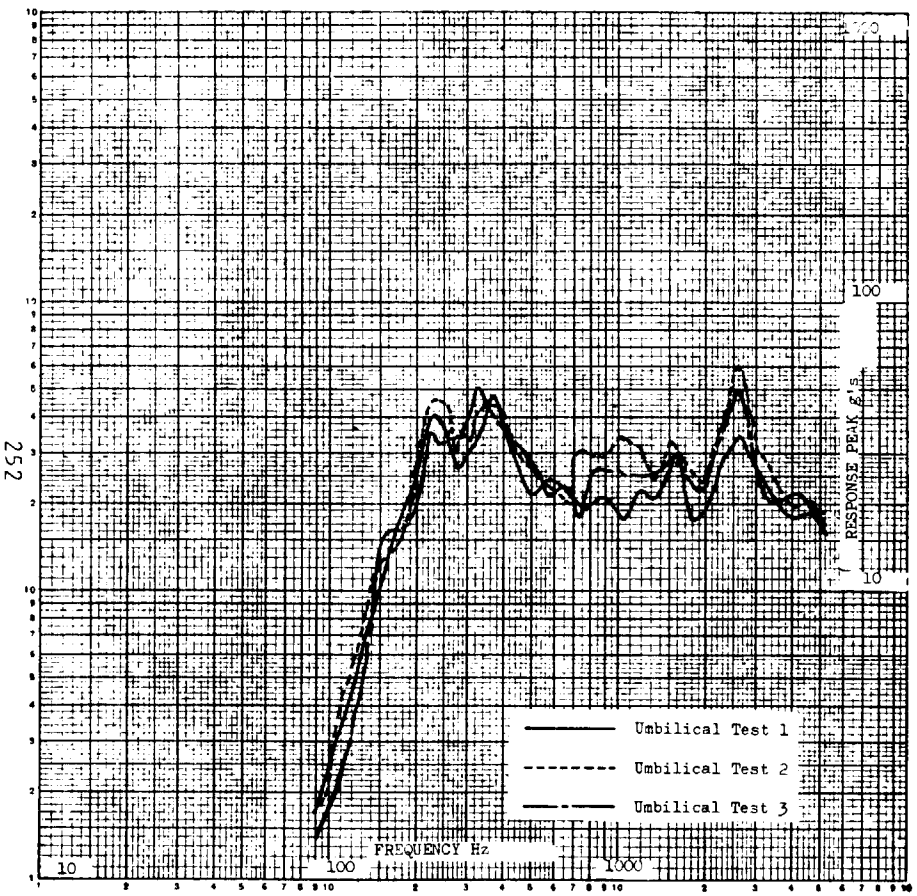
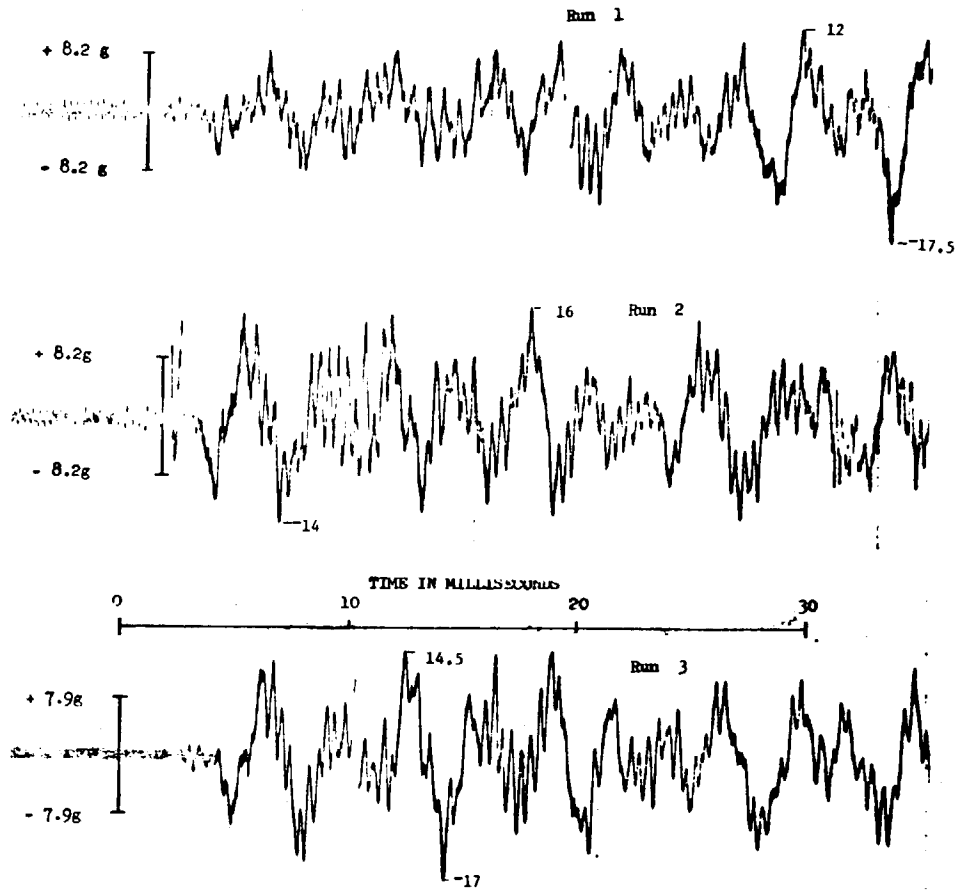


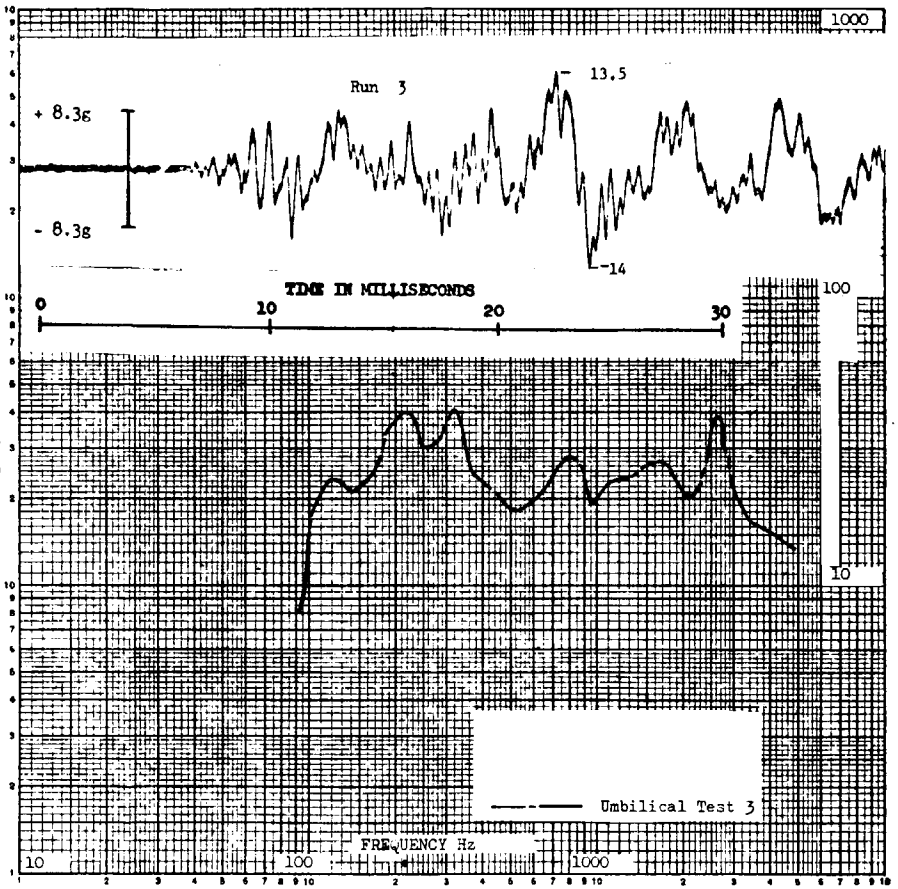
FIGURE I.A.5-37





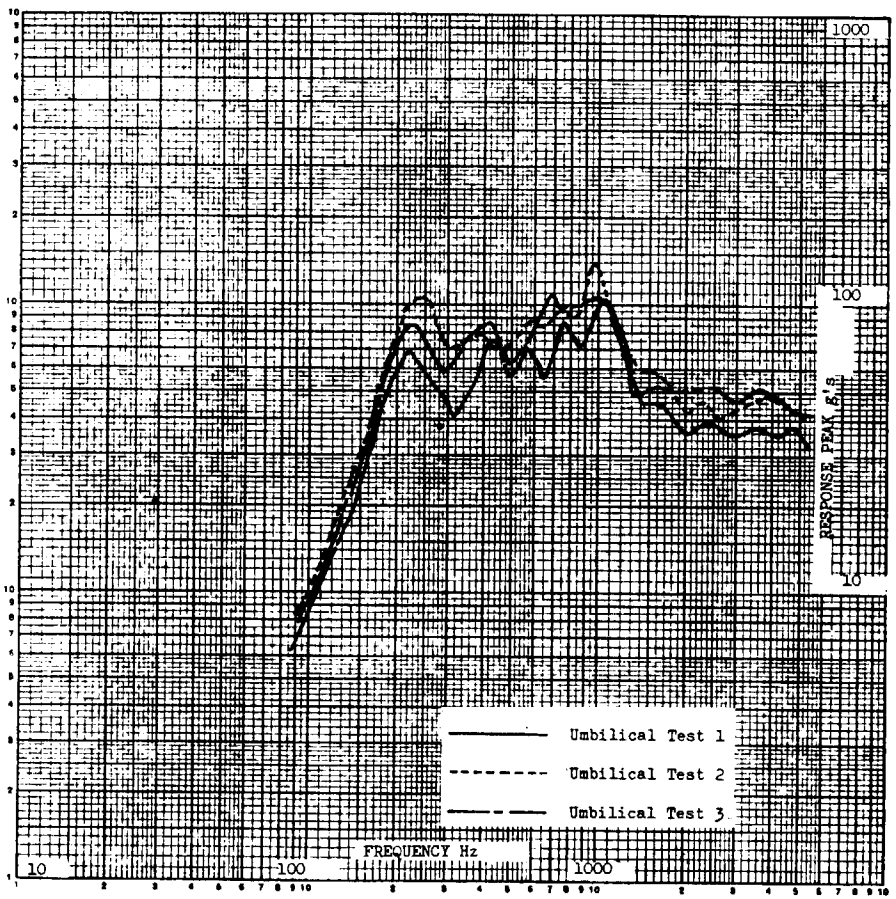
PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
PBPS SECTION
LOC. 14-Z PS ASS-REG.
RUNS NO. 1, 2 AND 3

FIGURE I.A.5-38



PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
PBPS SECTION
LOC. 14-R PS ASS-REG.
RUNS NO. 3

FIGURE I.A.5-39



PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
PBPS SECTION
LOC. 16-Z YAW ACTUATOR
RUNS NO. 1, 2 AND 3

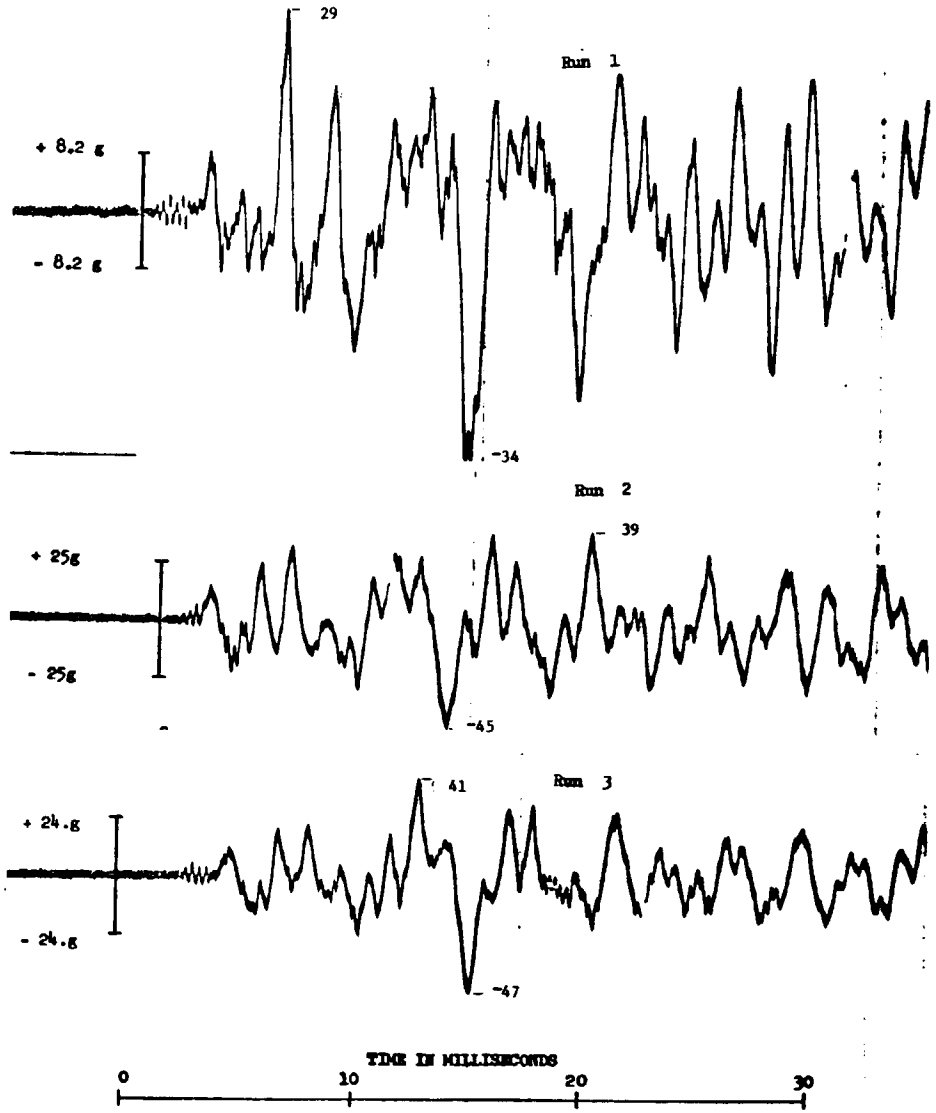
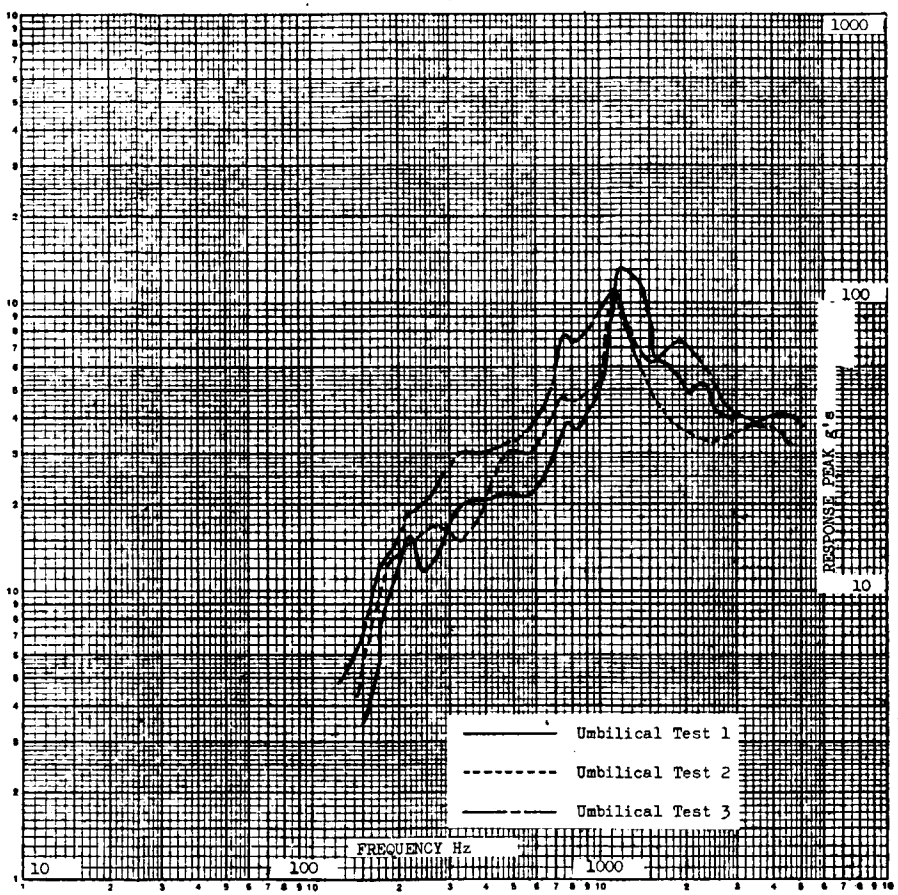
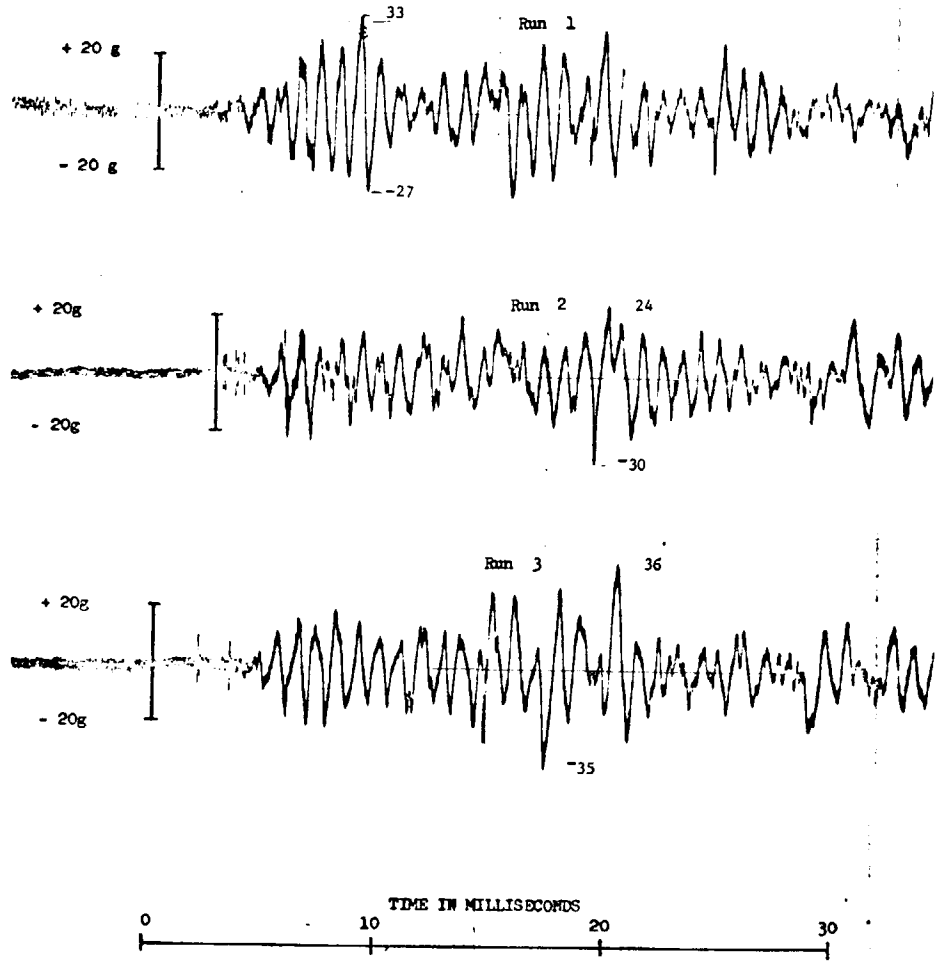


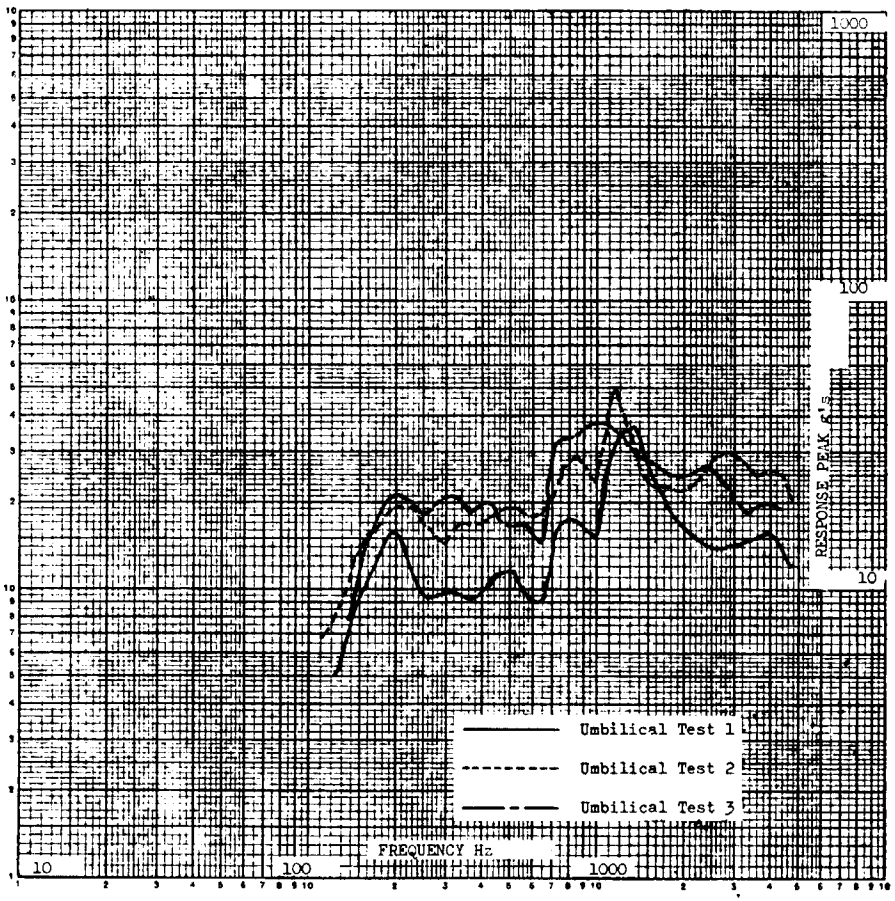
FIGURE I.A.5-40





PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
NS 17 SECTION
LOC. 23-X MGSC
RUNS NO. 1, 2 AND 3

FIGURE I.A.5-41



PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
NS 17 SECTION
LOC. 23-Y MGSC
RUNS NO. 1, 2 AND 3

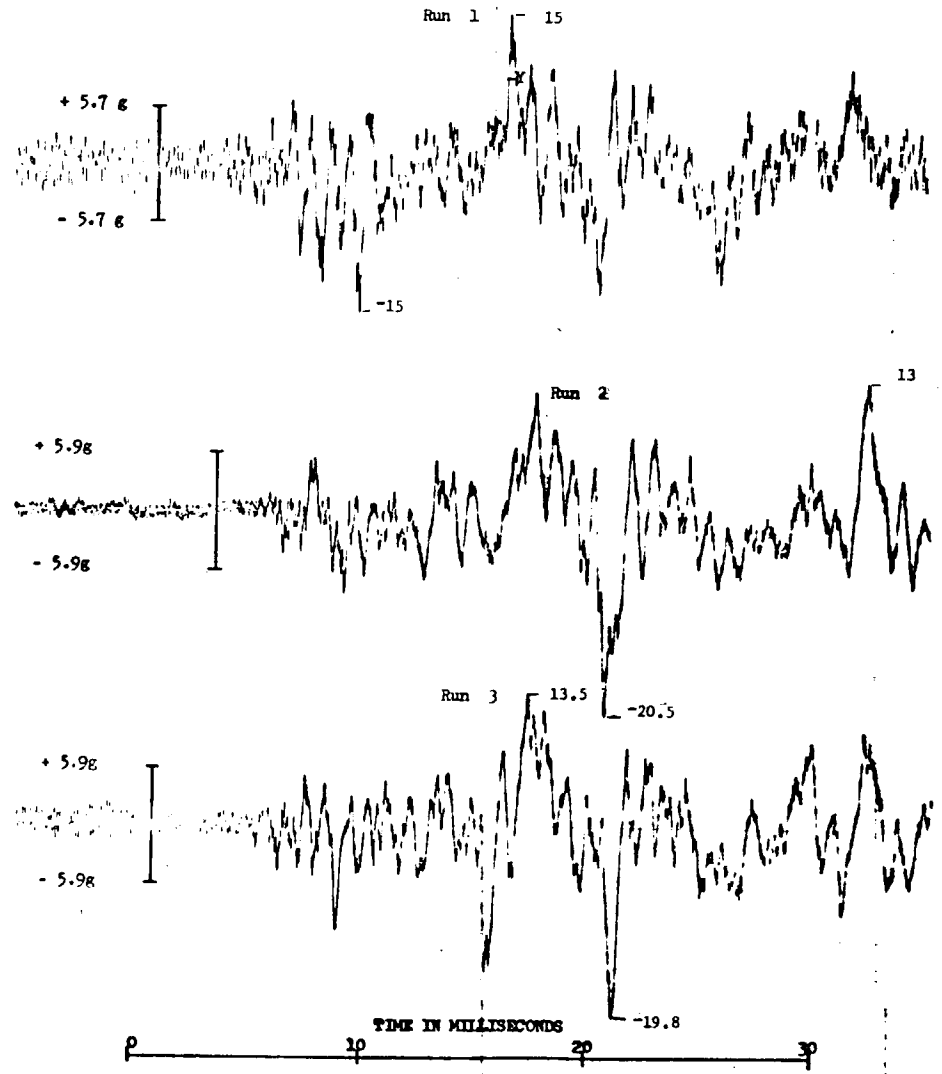
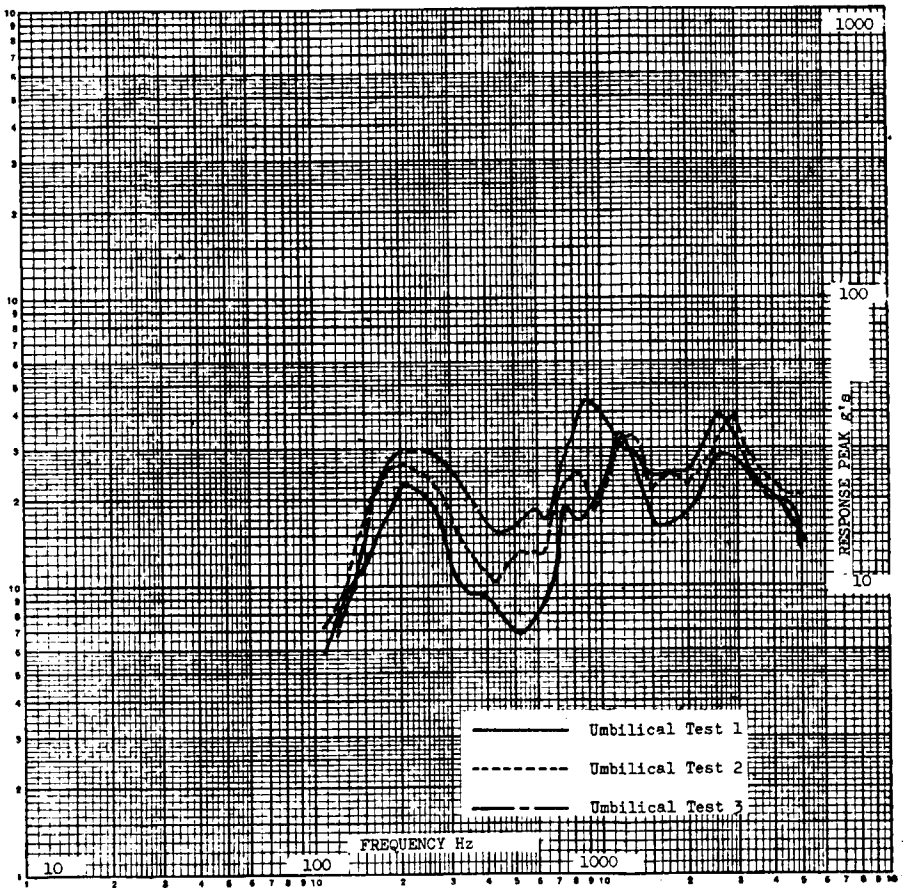
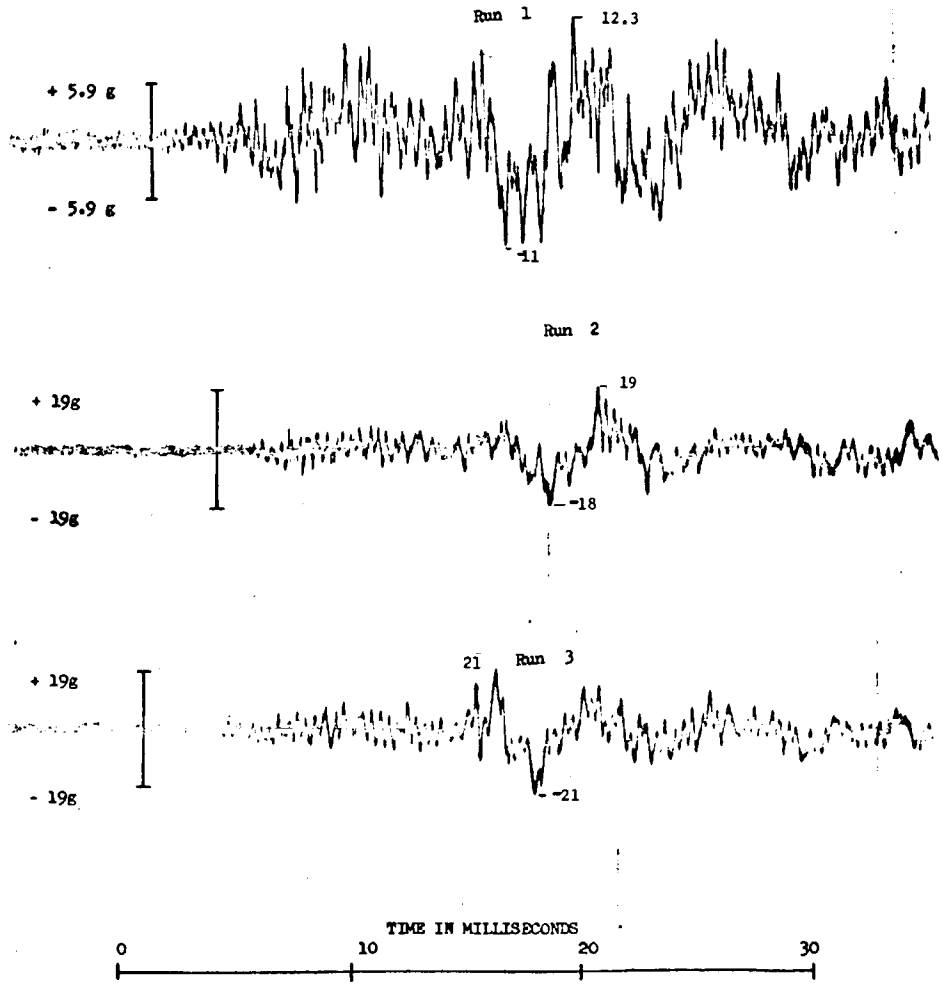


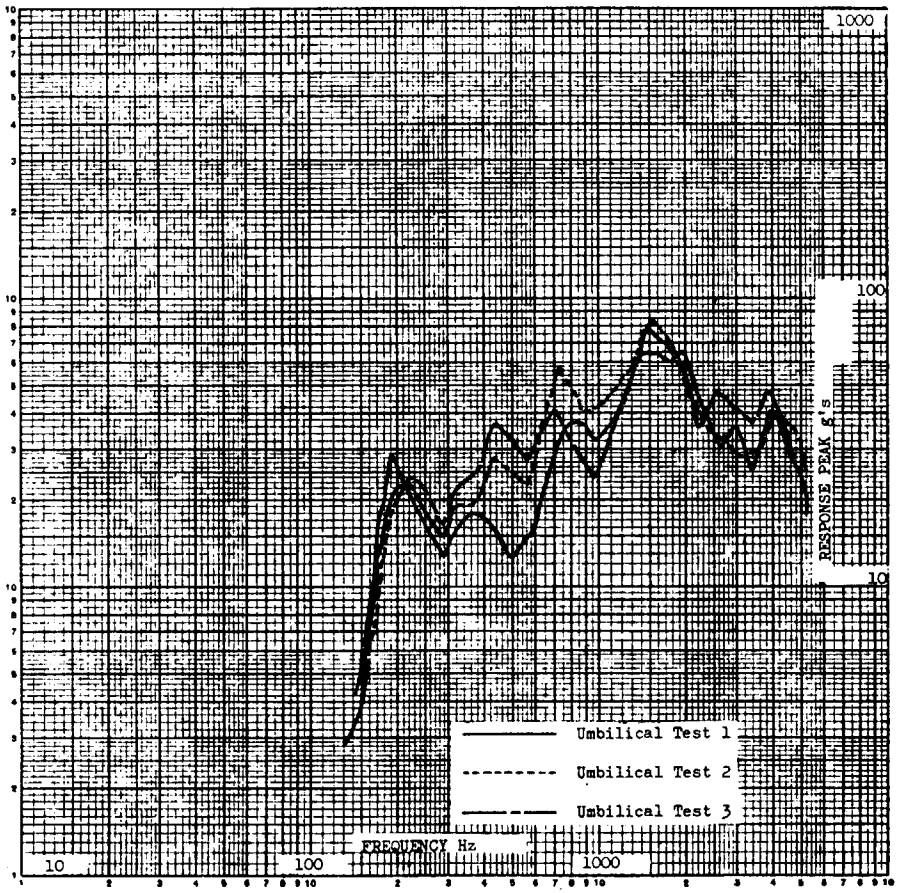
FIGURE I.A.5-42

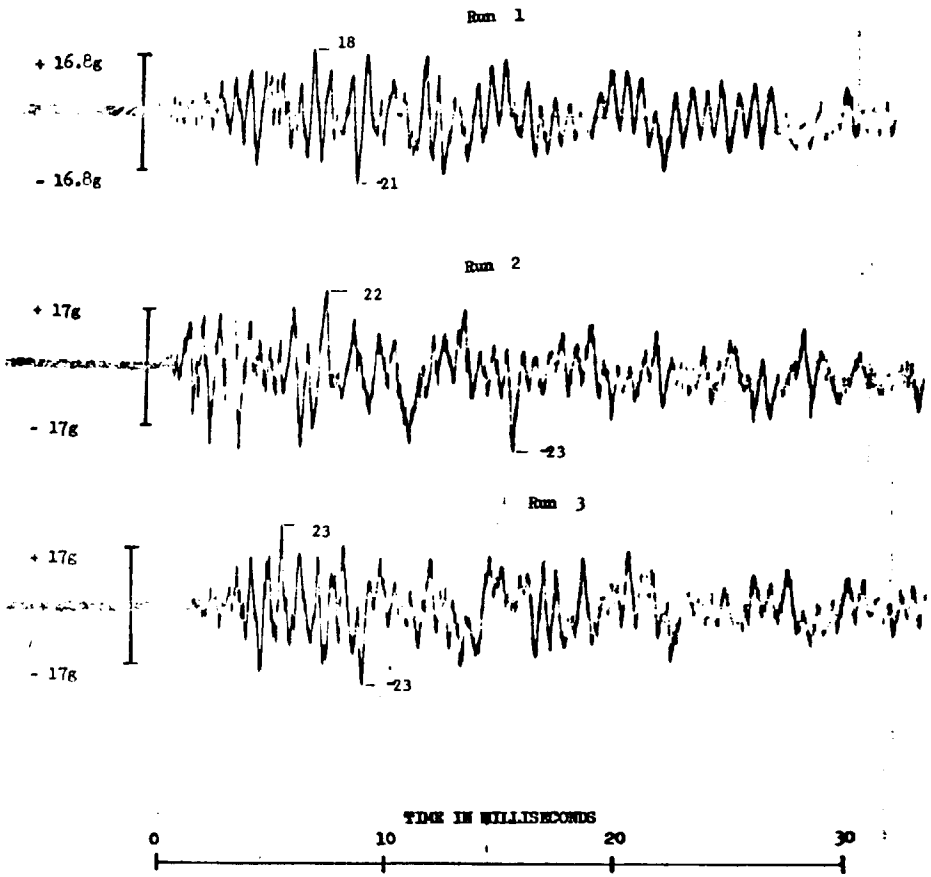




PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
NS 17 SECTION
LOC. 23-Z MGSC
RUNS NO. 1, 2 AND 3

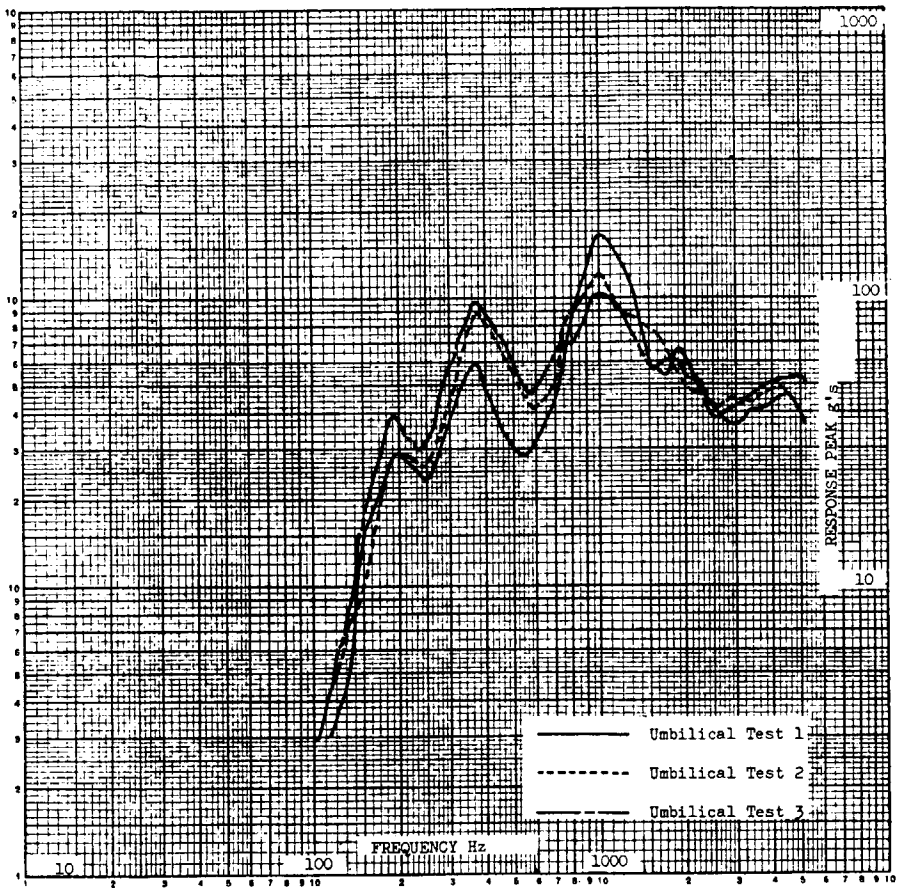
FIGURE 1.A.5-43





PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
NS 17 SECTION
LOC. 24-X P92
RUNS NO. 1, 2 and 3

FIGURE I.A.5-44



PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
NS 17 SECTION
LOC. 24-Y P92
RUNS NO. 1, 2 AND 3

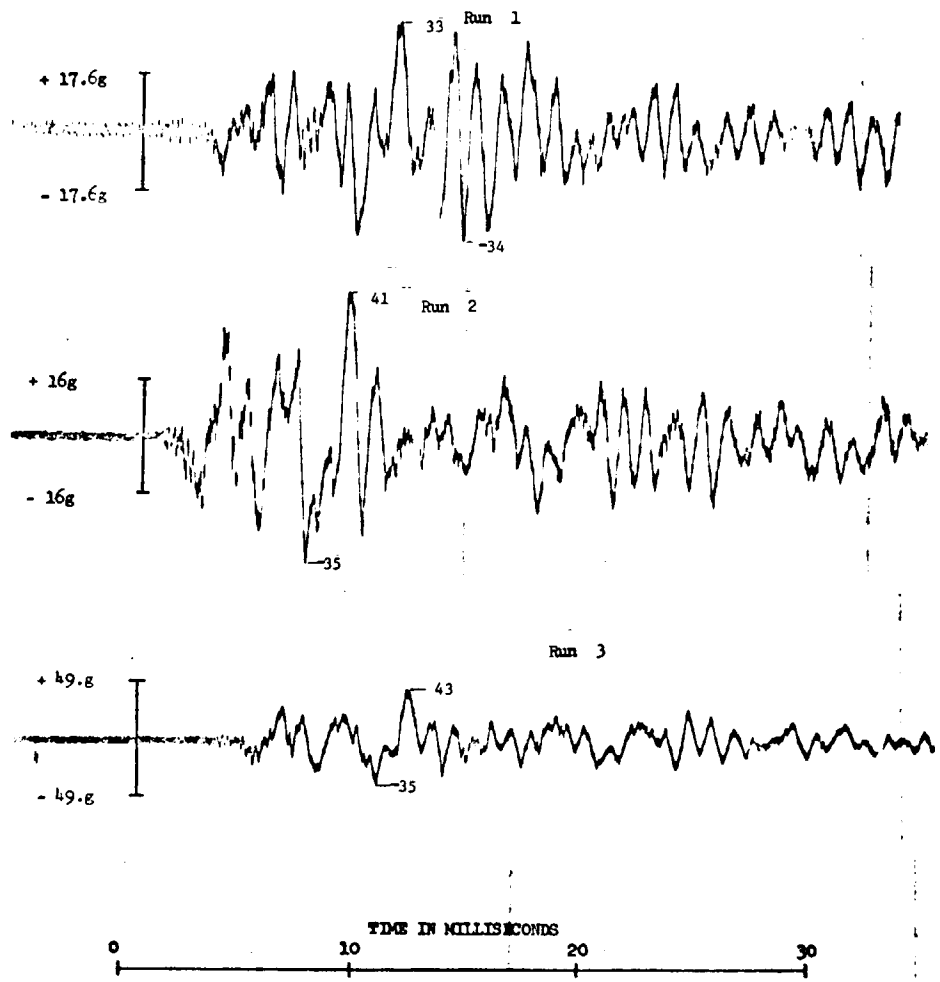
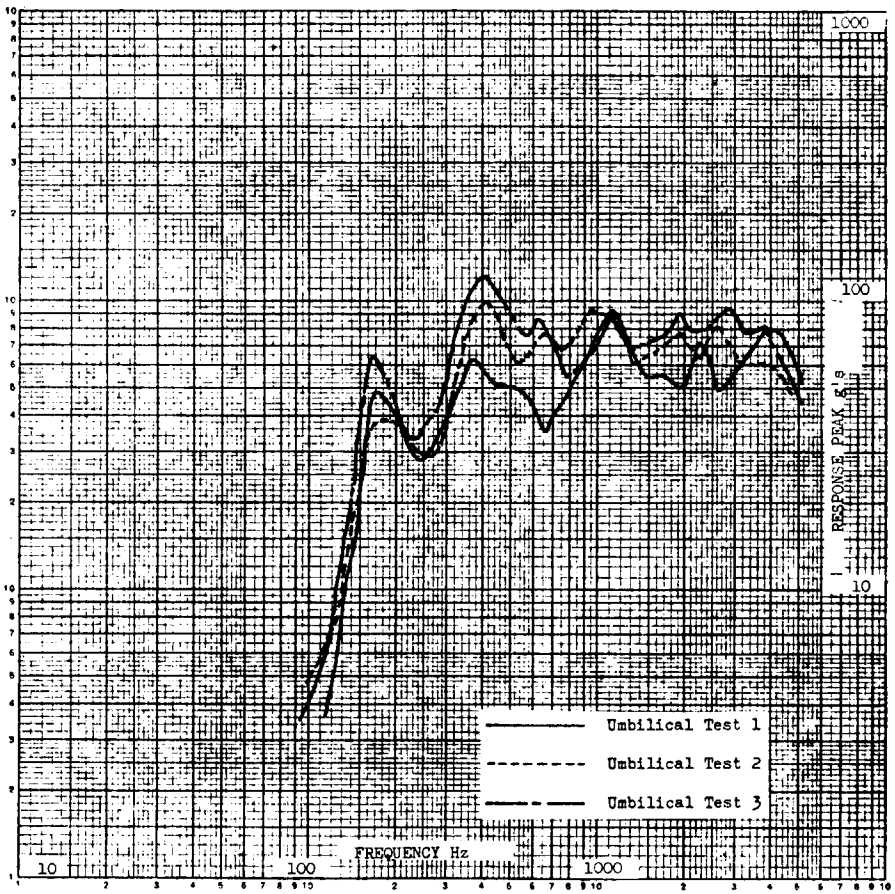


FIGURE I.A.5-45



PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
NS 17 SECTION
LOC. 24-Z P92
RUNS NO. 1, 2 and 3

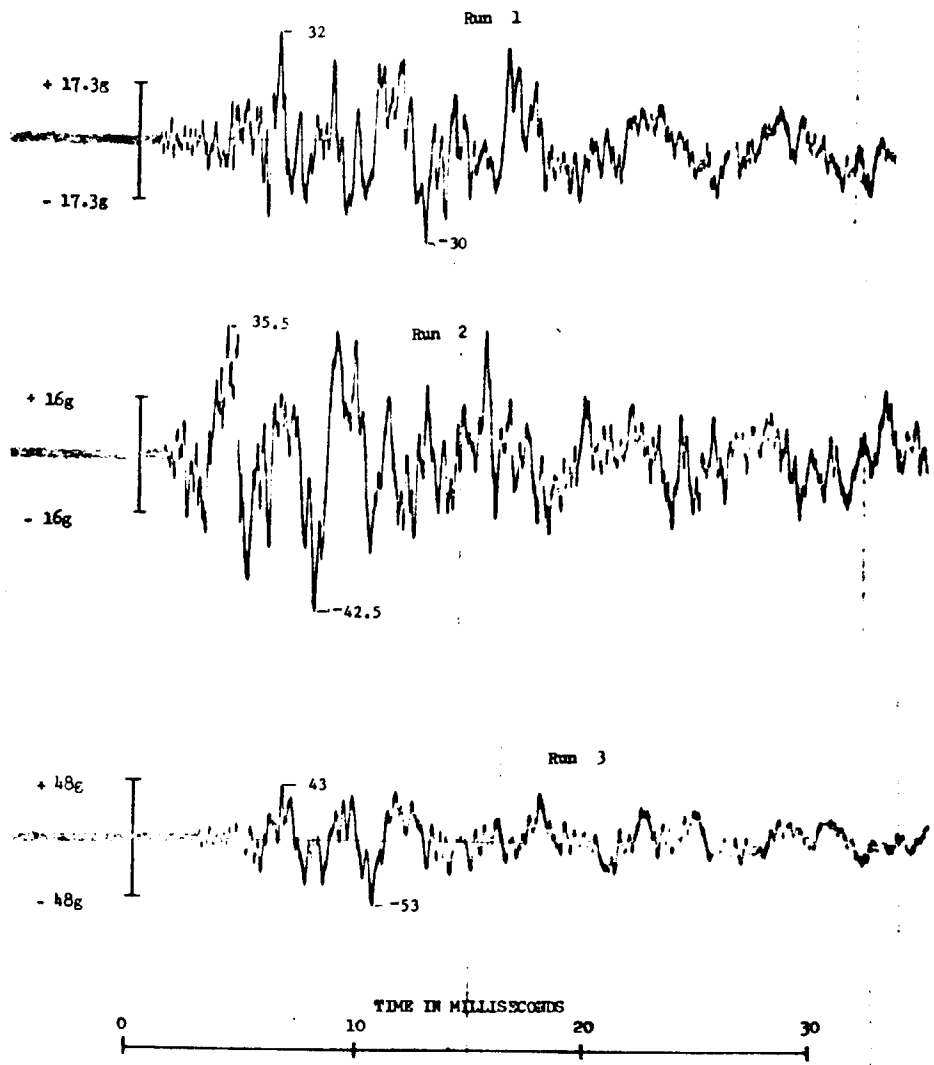
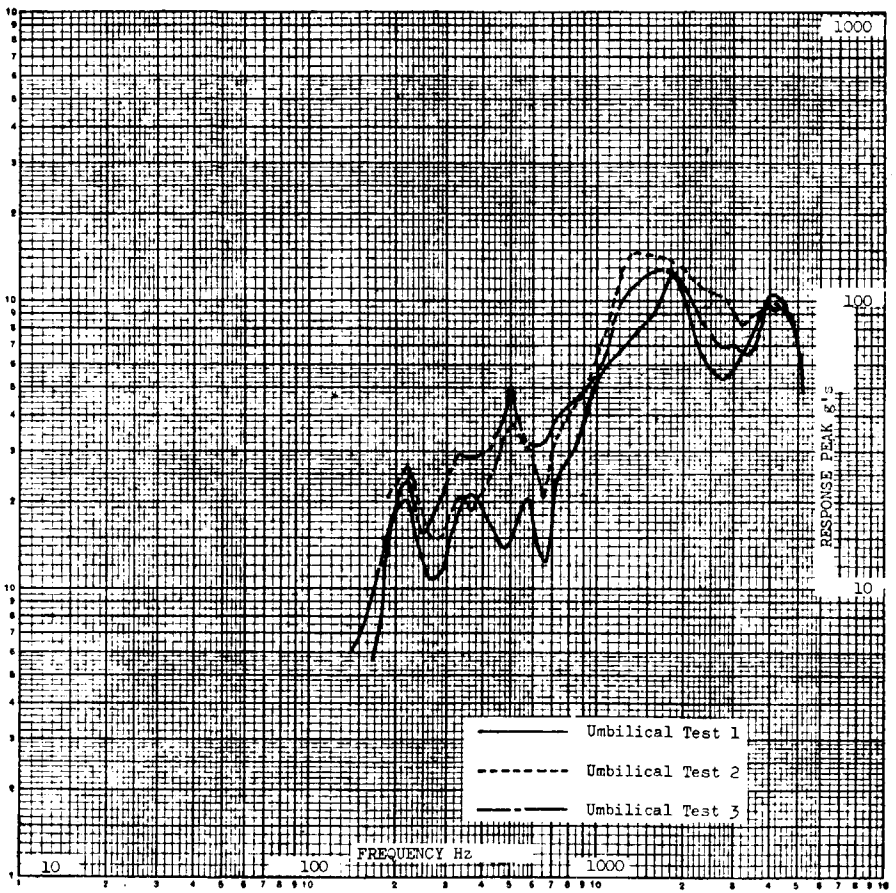
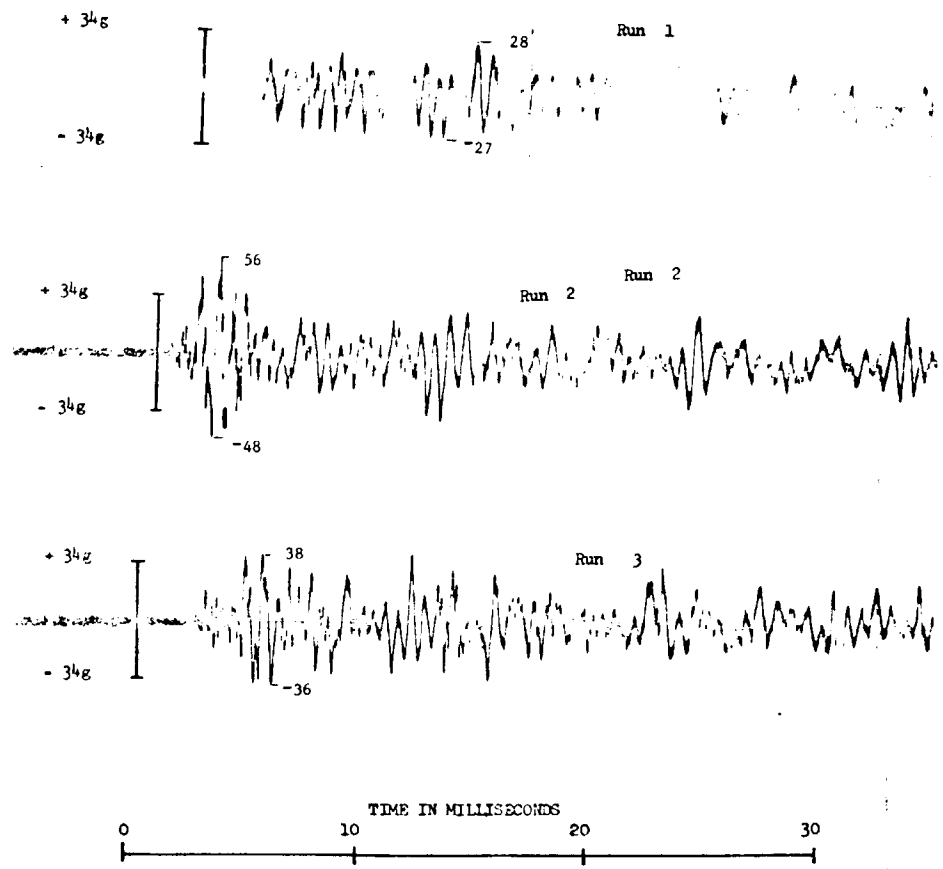


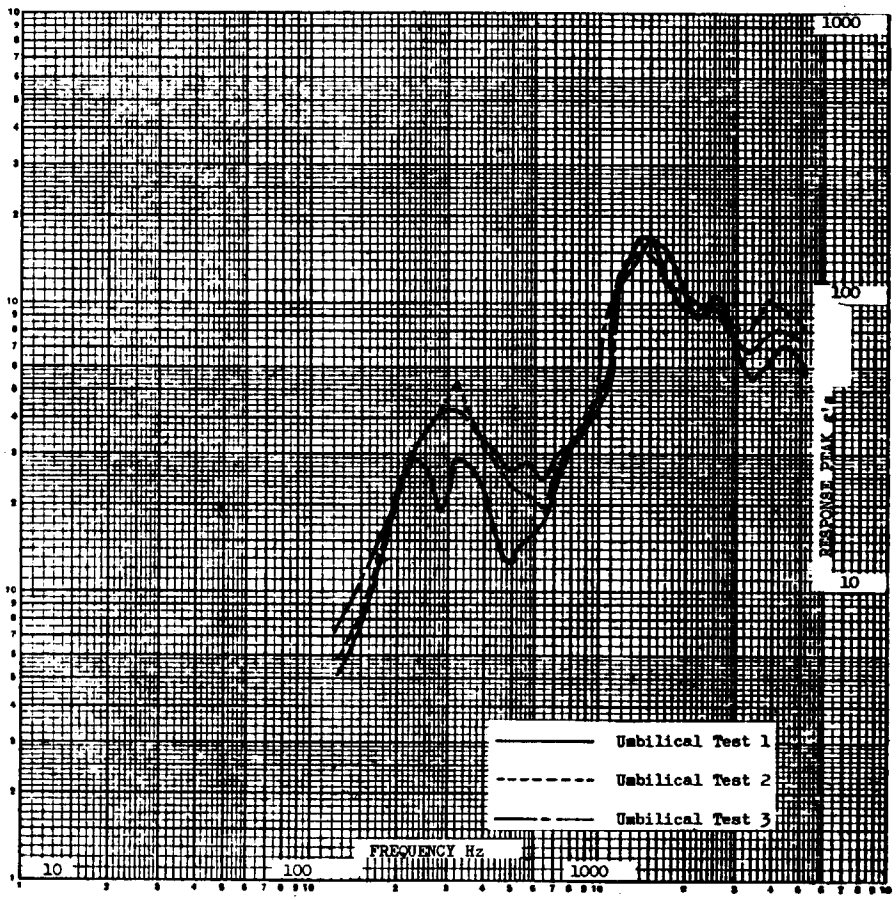
FIGURE 1.A.5-46





PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
NS 17 SECTION
LOC. 25-X COMPUTER, FOOT
RUNS NO. 1, 2 AND 3

FIGURE I.A.5-47



PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
NS 17 SECTION
LOC. 25-Y COMPUTER, FOOT
RUNS NO. 1, 2 AND 3

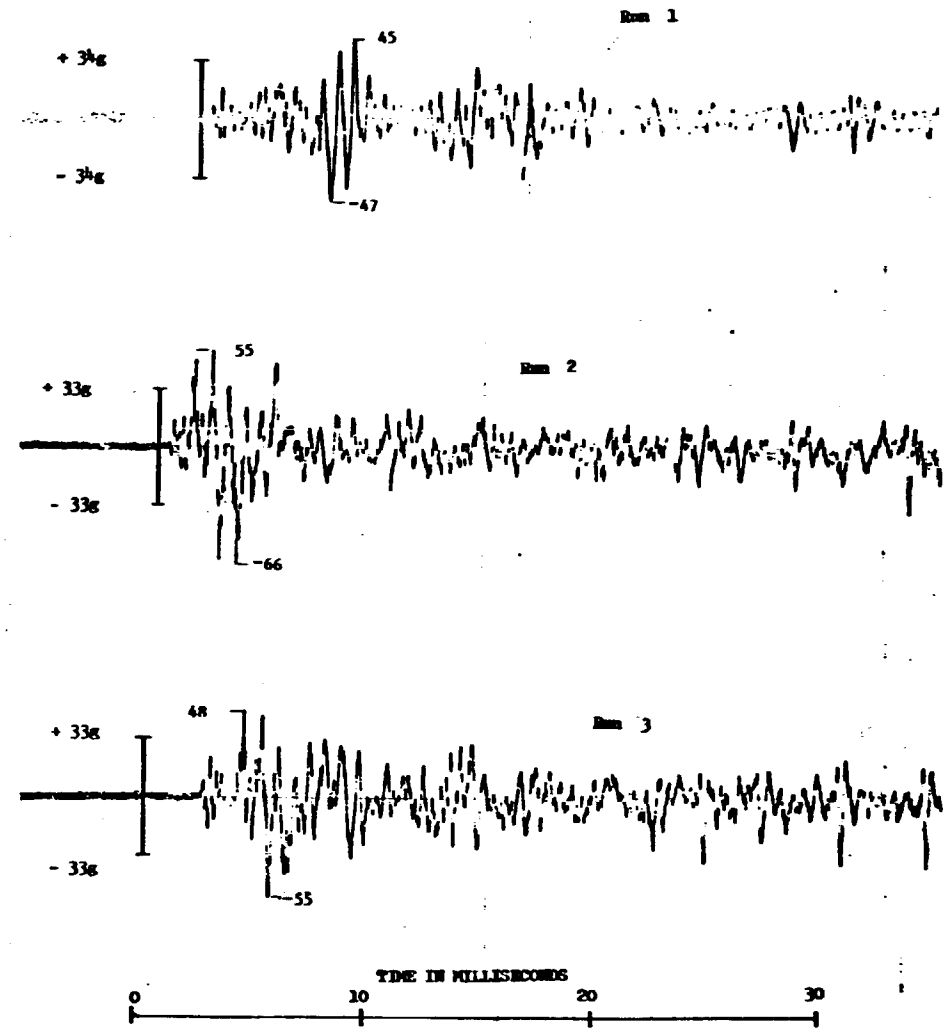
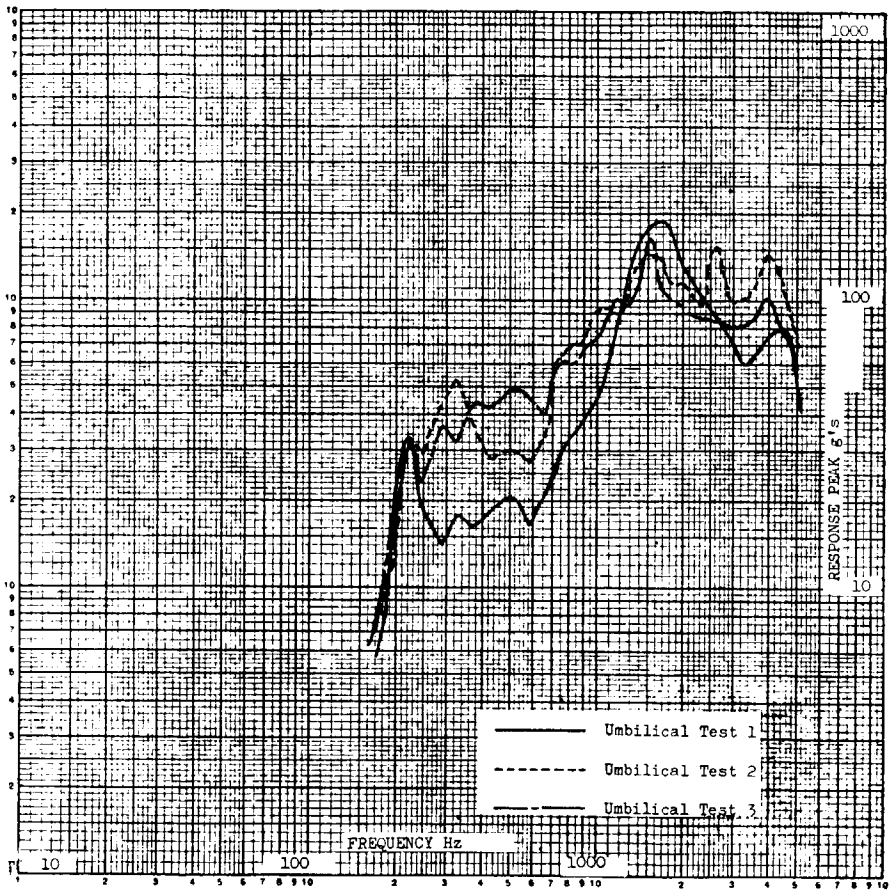


FIGURE 1.A.5-48



PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
NS 17 SECTION
LOC. 25-Z COMPUTER, FOOT
RUNS NO. 1, 2 AND 3

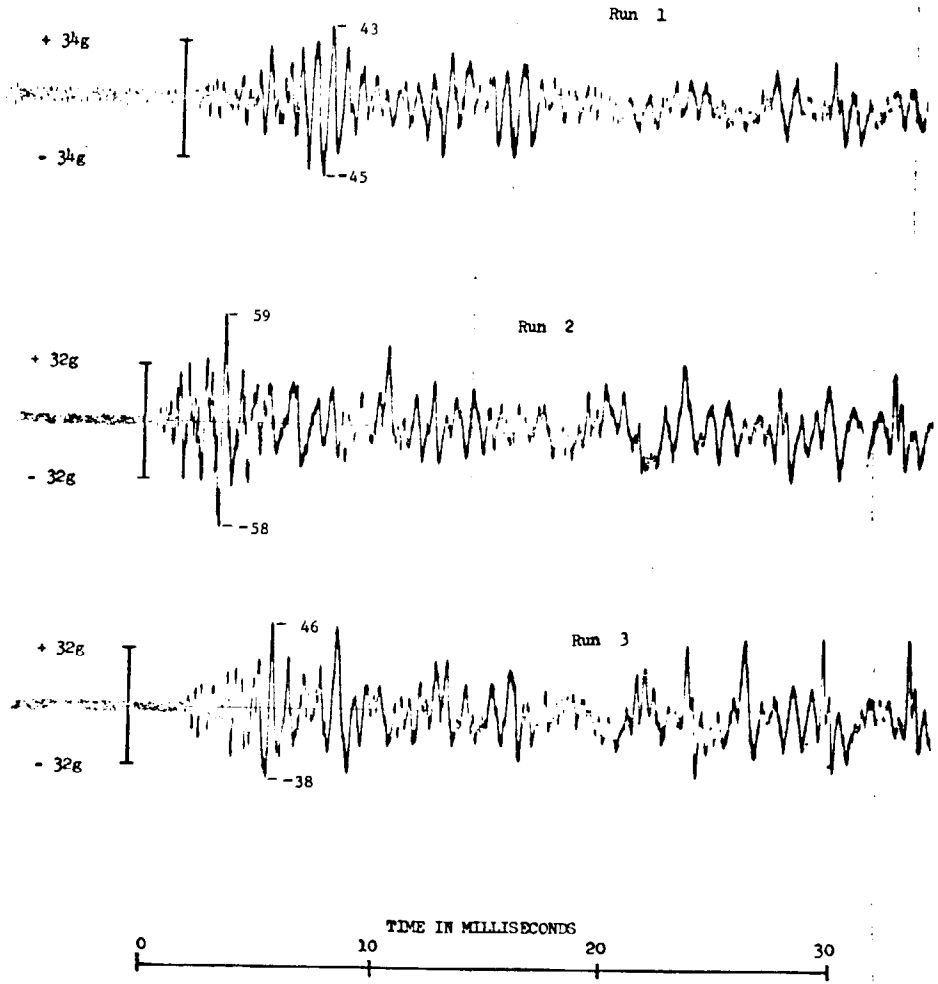
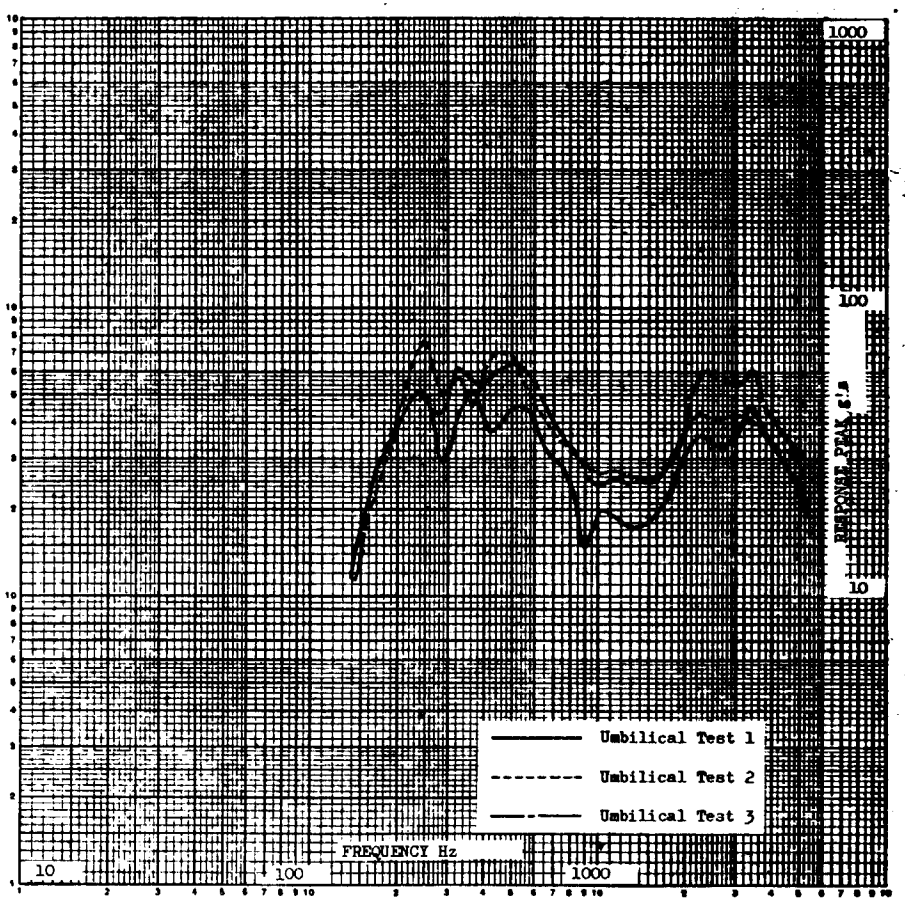
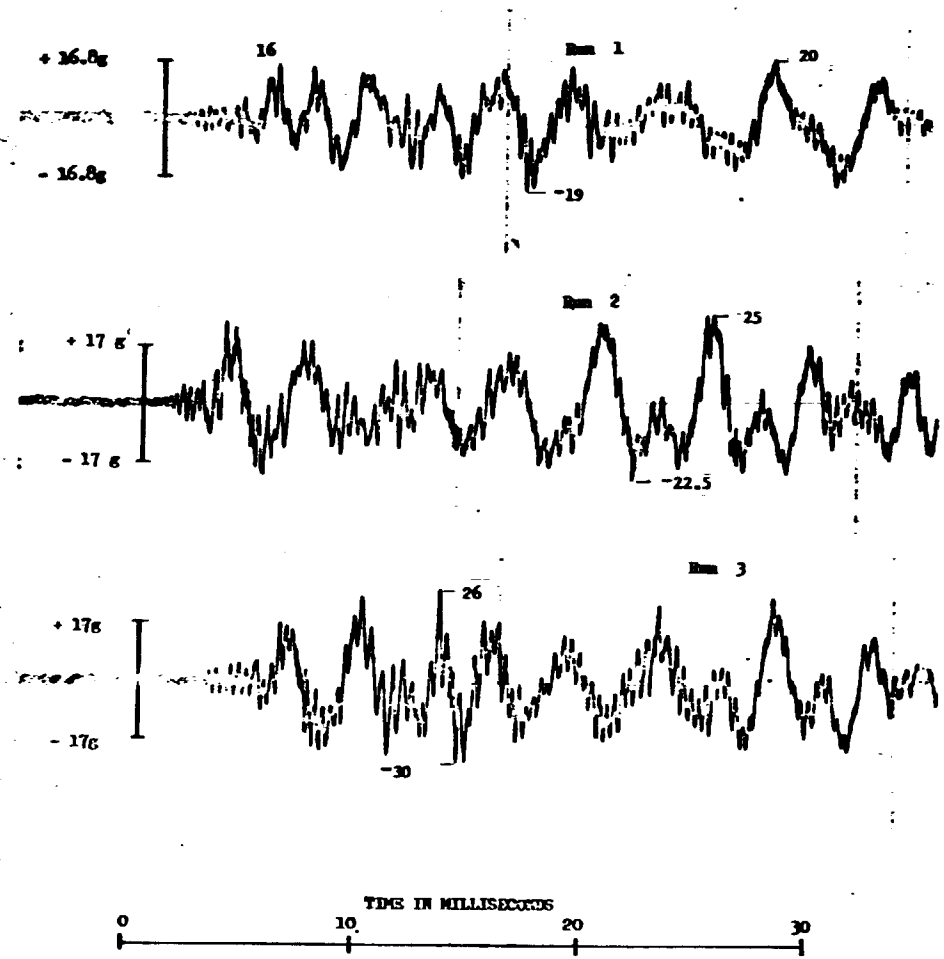


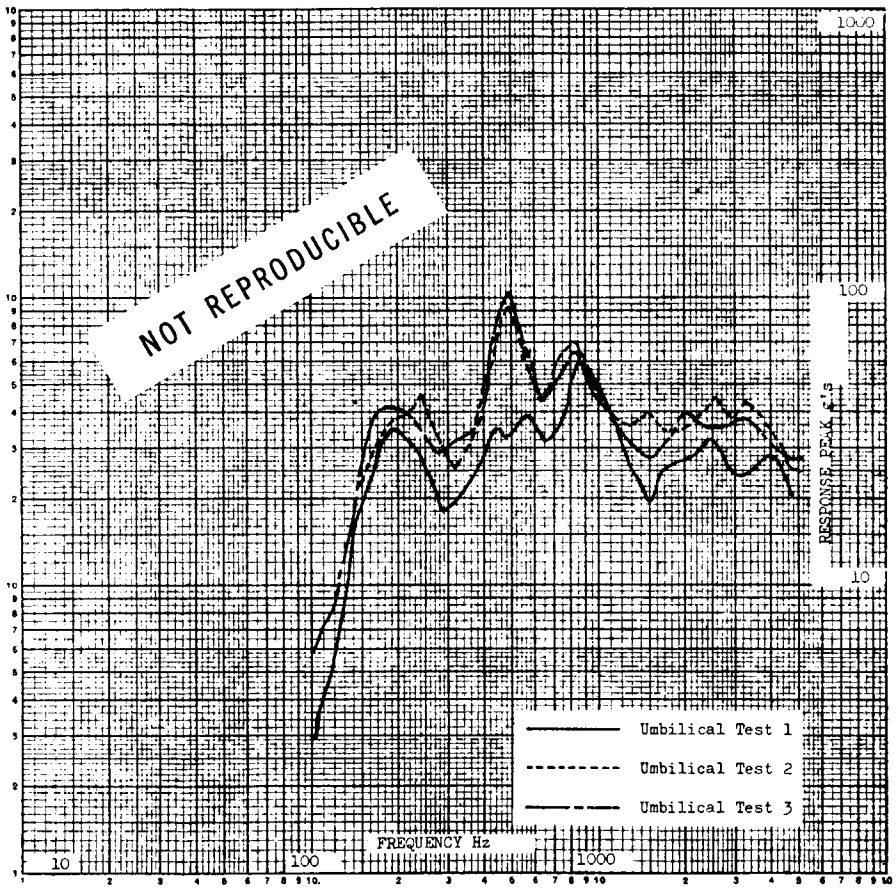
FIGURE I.A.5-49

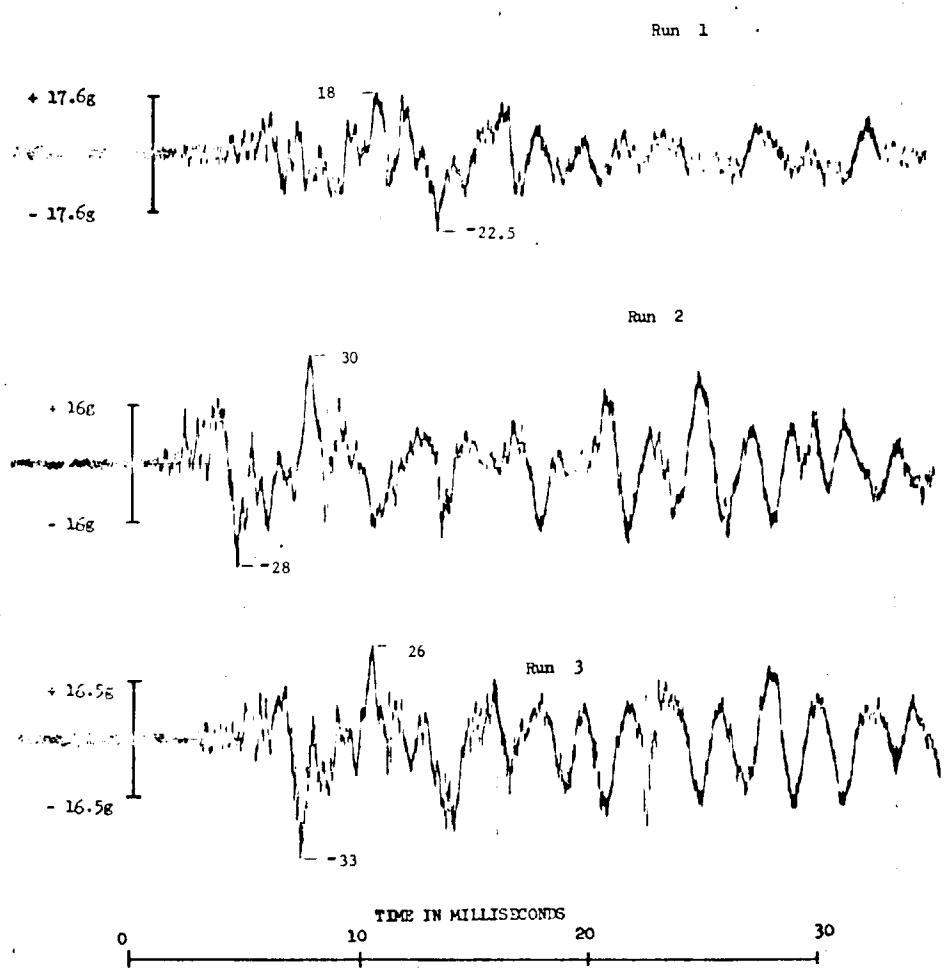




PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
NS 17 SECTION
LOC. 26-X BATTERY
RUNS NO. 1, 2 AND 3

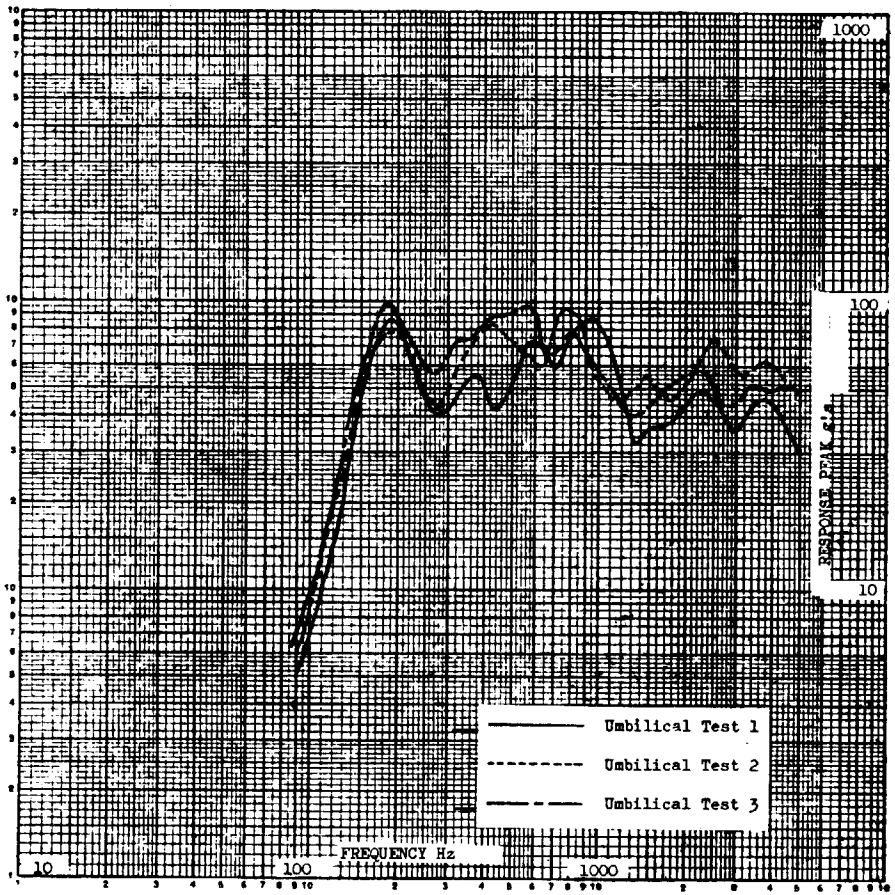
FIGURE I.A.5-50

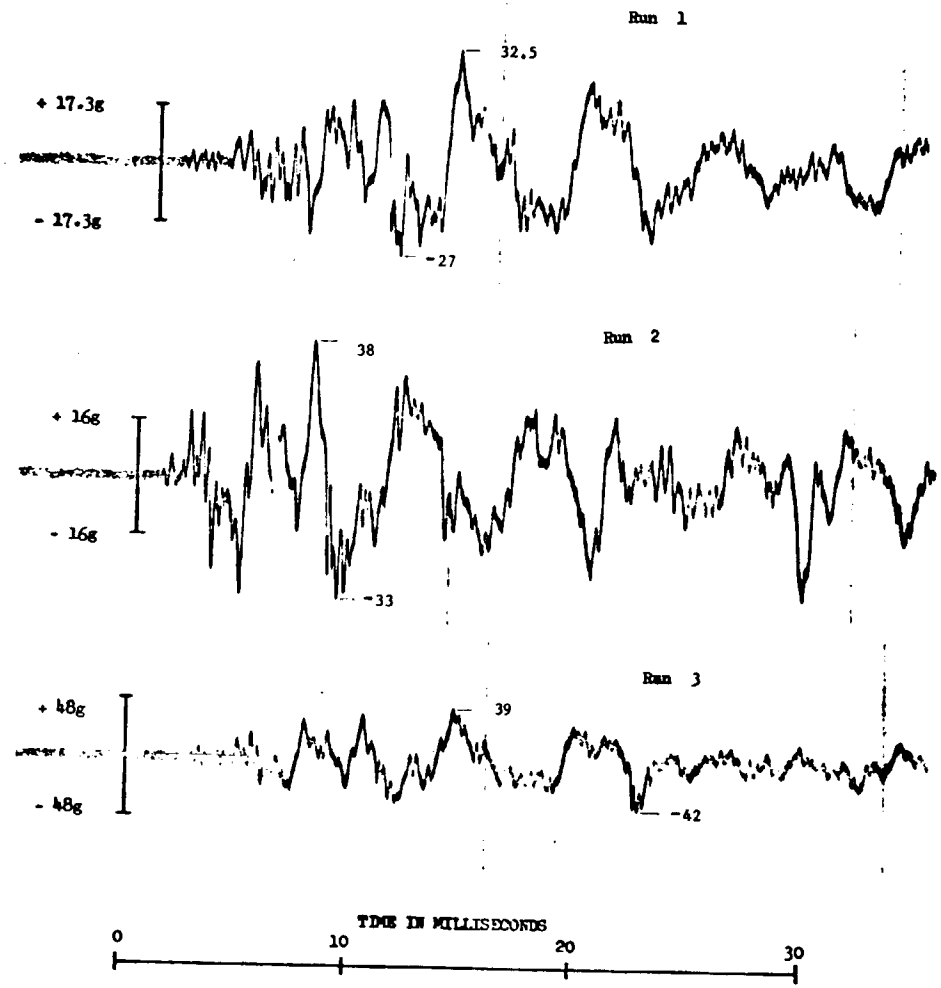




PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
NS 17 SECTION
LOC. 26-Y BATTERY
RUNS NO. 1, 2 AND 3

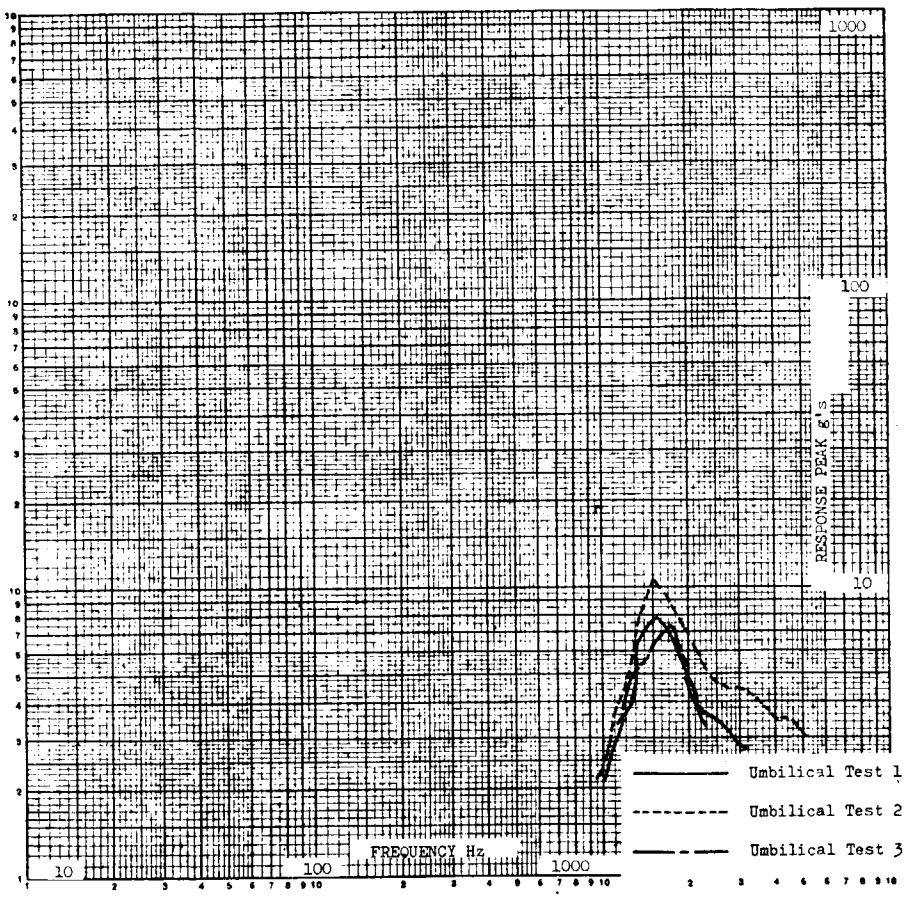
FIGURE I.A.5-51





PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
NS 17 SECTION
LOC. 26-Z BATTERY
RUNS NO. 1, 2 AND 3

FIGURE 1.A.5-52



PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
NS 17 SECTION
LOC. 27-X GSP
RUNS NO. 1, 2 AND 3

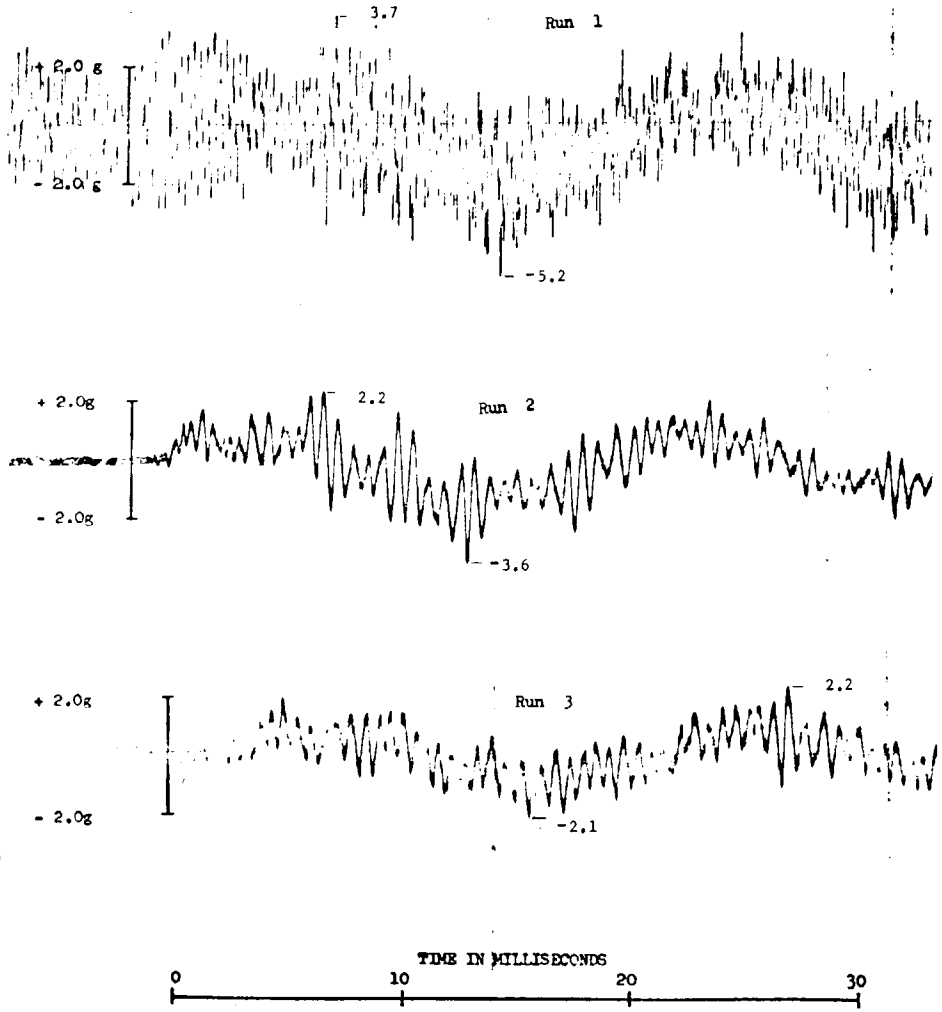
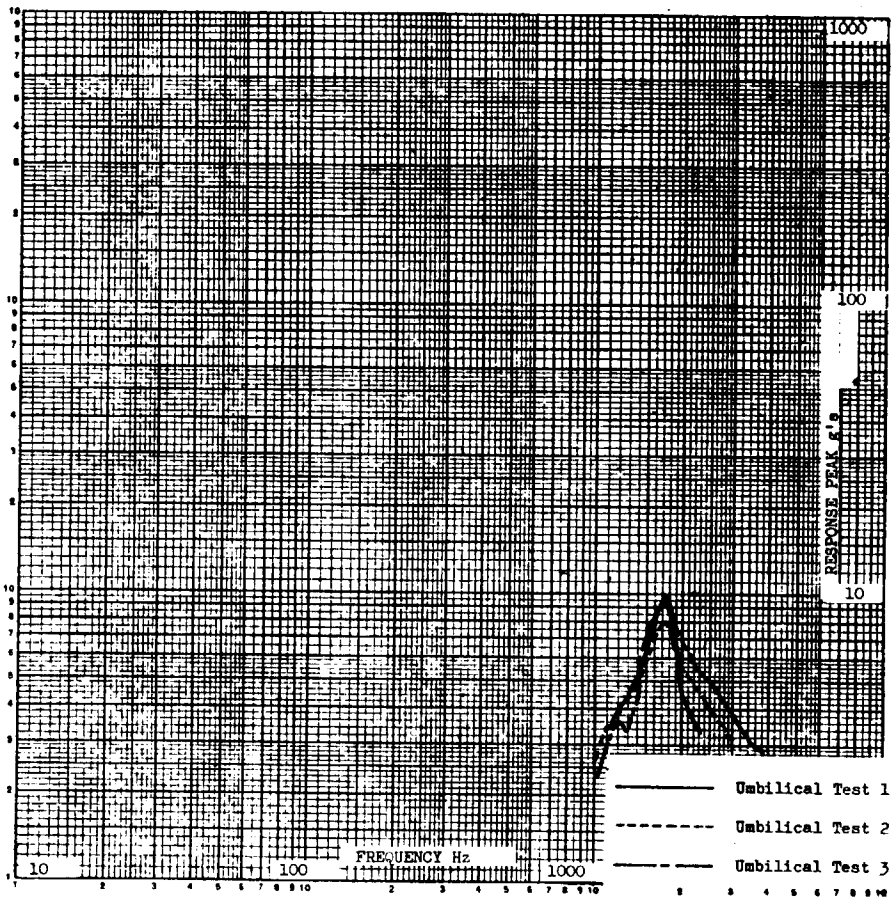


FIGURE I.A.5-53



PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
NS 17 SECTION
LOC. 27-Y GSP
RUNS NO. 1, 2 AND 3

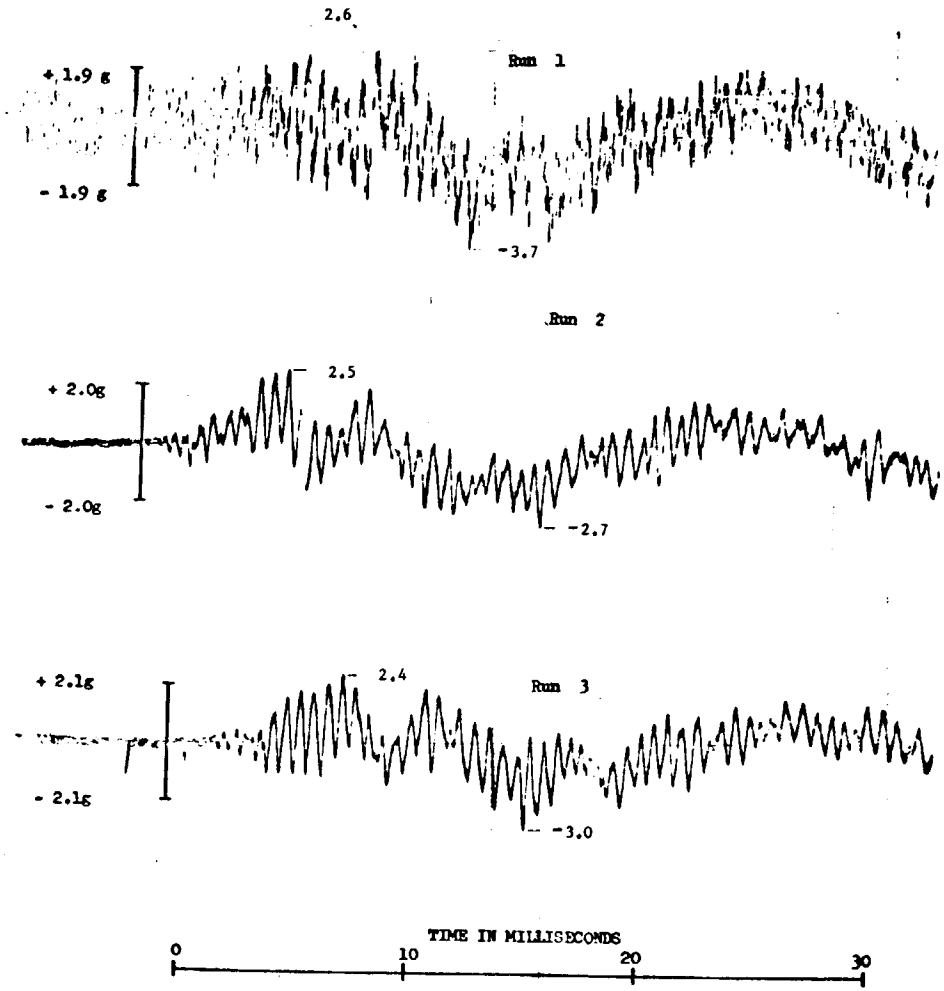
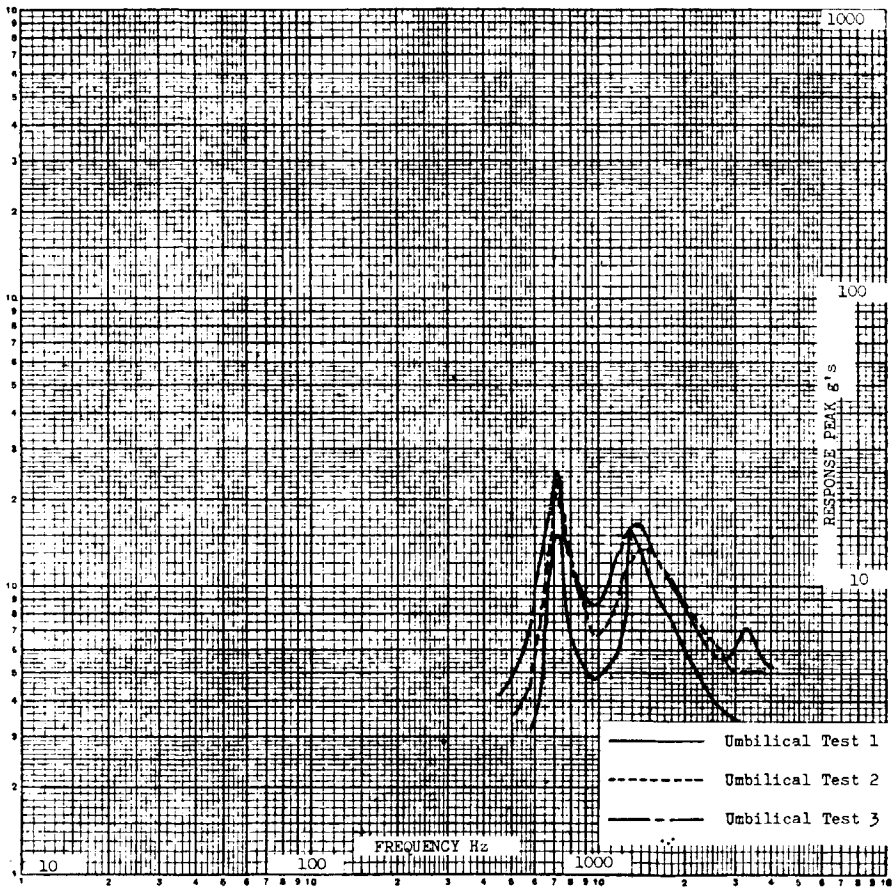


FIGURE I.A.5-54



PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
NS 17 SECTION
LOC. 27-Z GSP
RUNS NO. 1, 2 AND 3

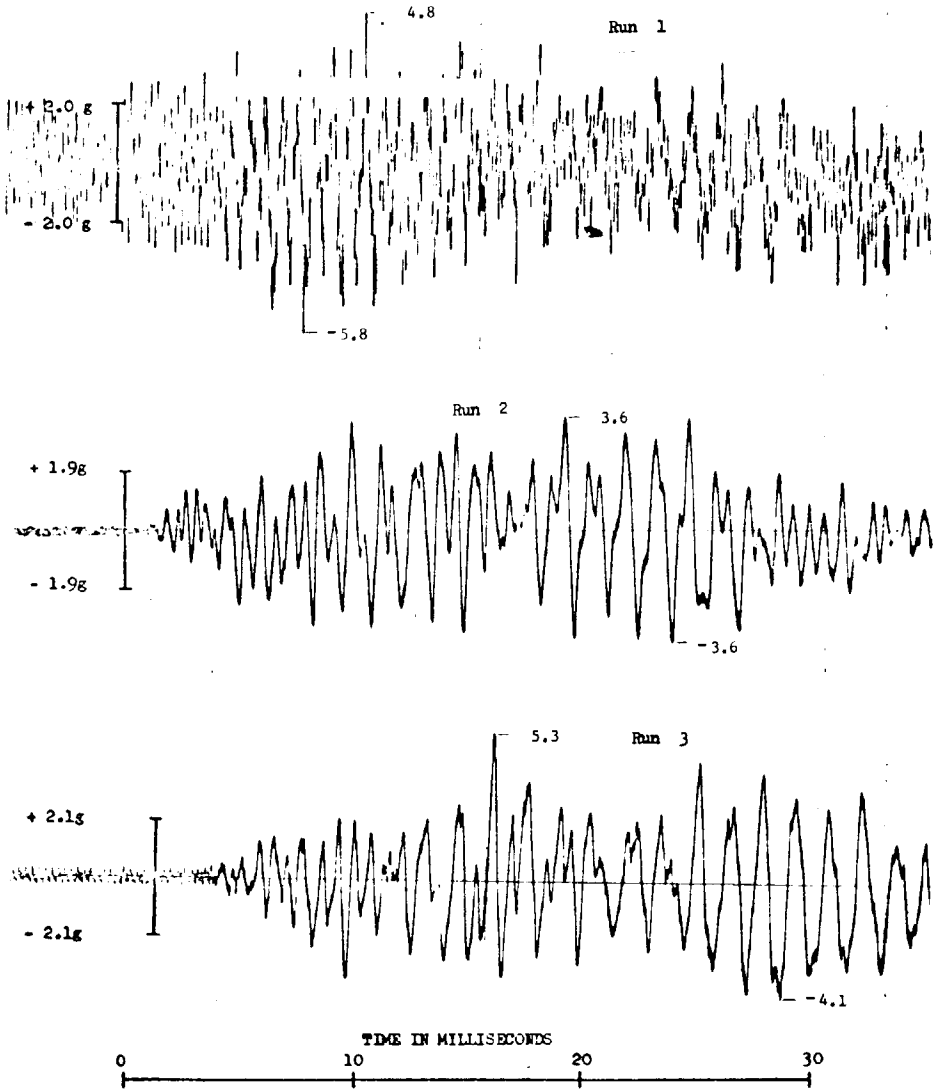
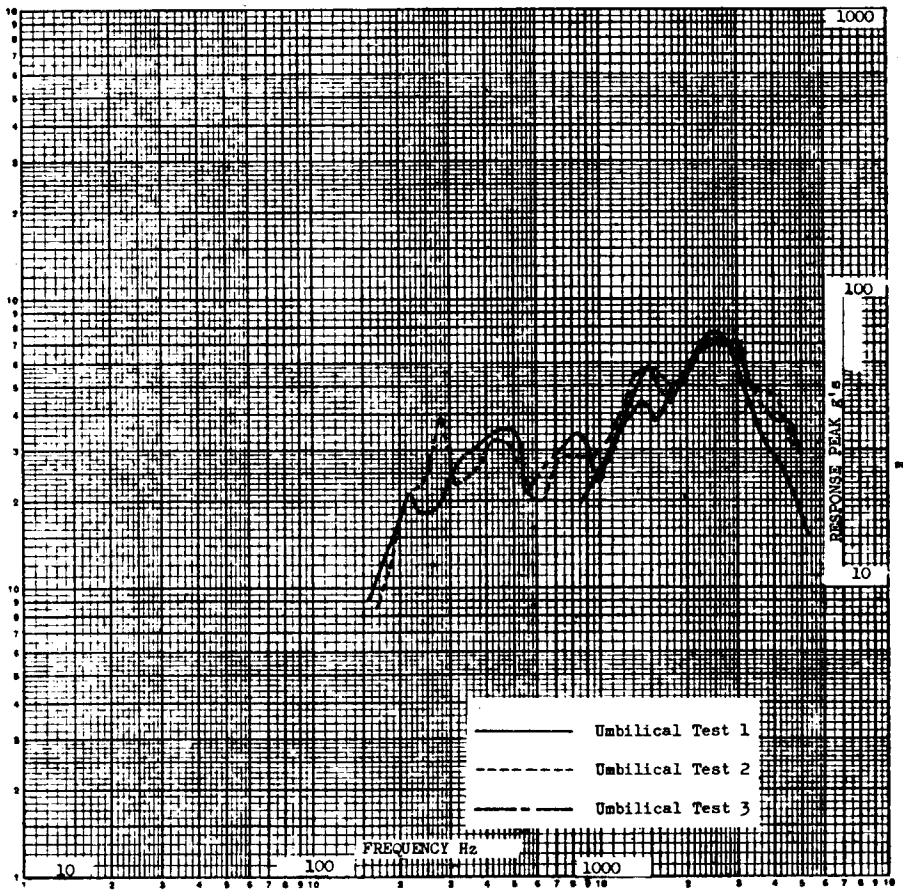
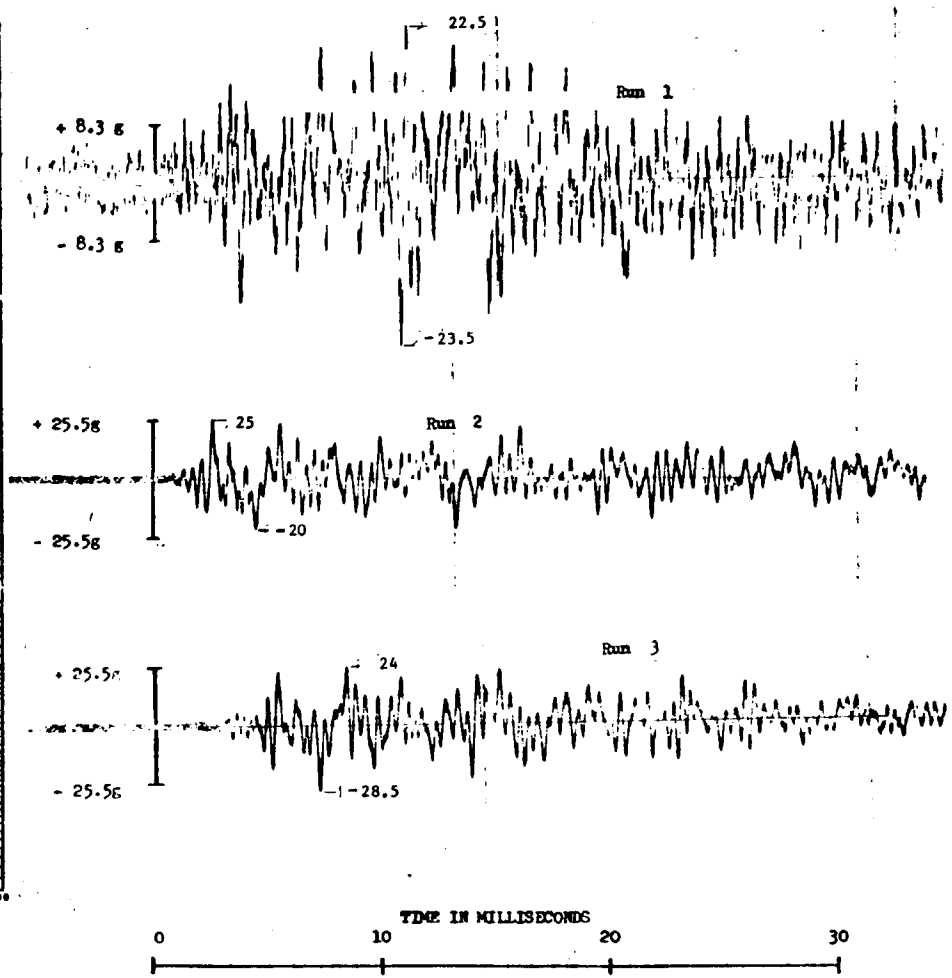


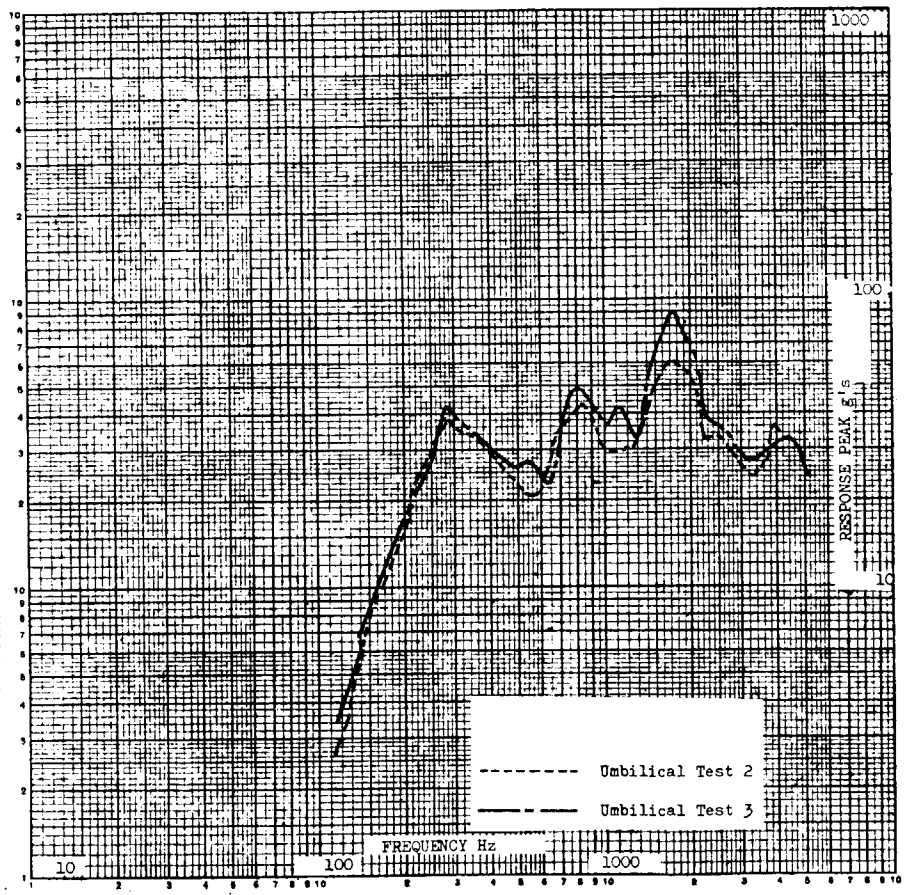
FIGURE I.A.5-55





PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
NS 17 SECTION
LOC. 28-X CD-3A SKIN
RUNS NO. 1, 2 AND 3

FIGURE I.A.5-56



PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
NS 17 SECTION
LOC. 28-Y CD-3A SKIN
RUNS NO. 2 AND 3

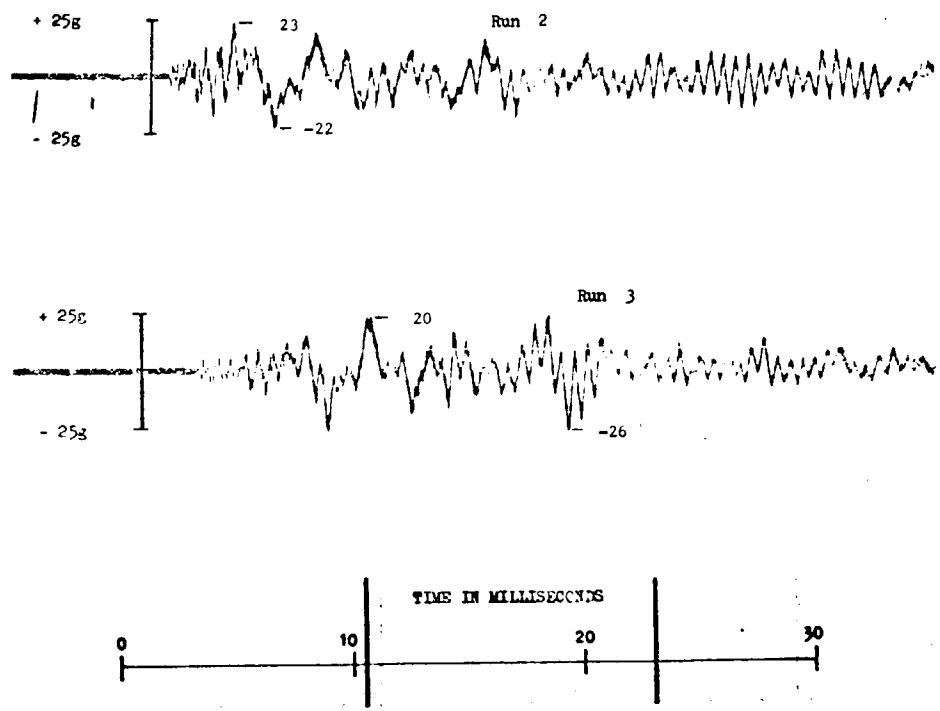
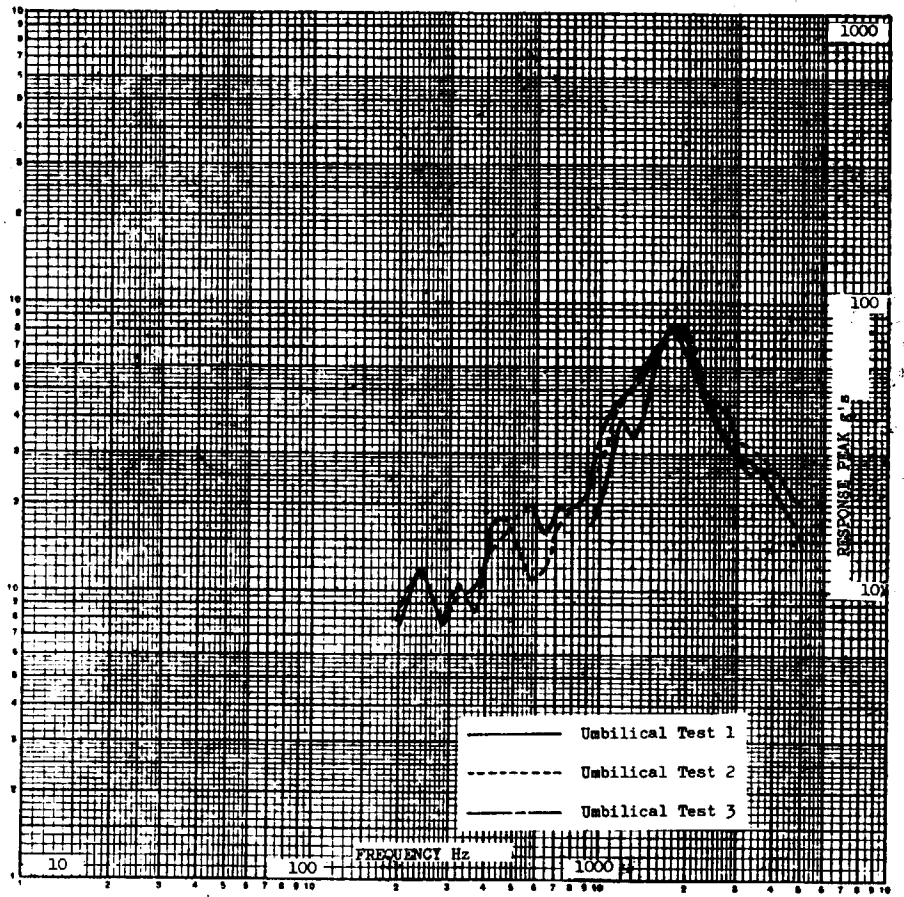


FIGURE I.A.5-57



PBV SHOCK DETERMINATION TEST - UMBILICAL SEPARATION
NS 17 SECTION
LOC. 28-Z CD-3A SKIN
RUNS NO. 1, 2 AND 3

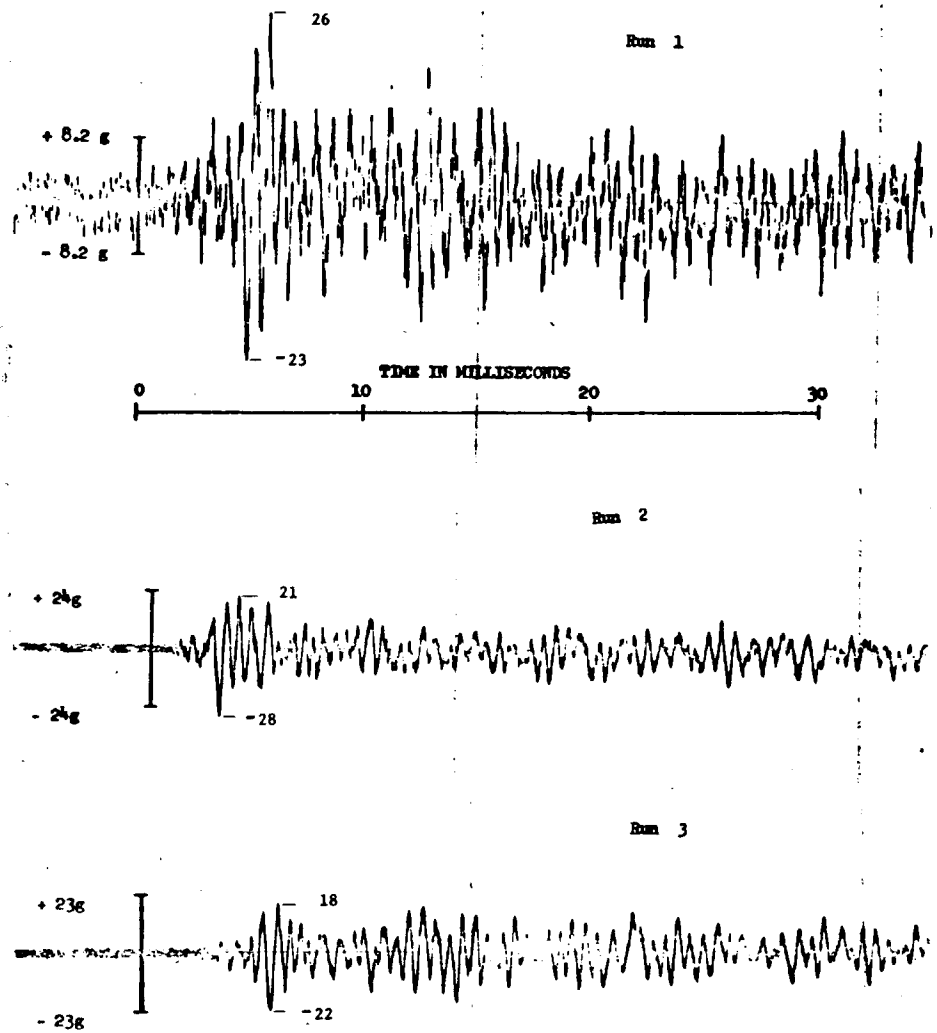
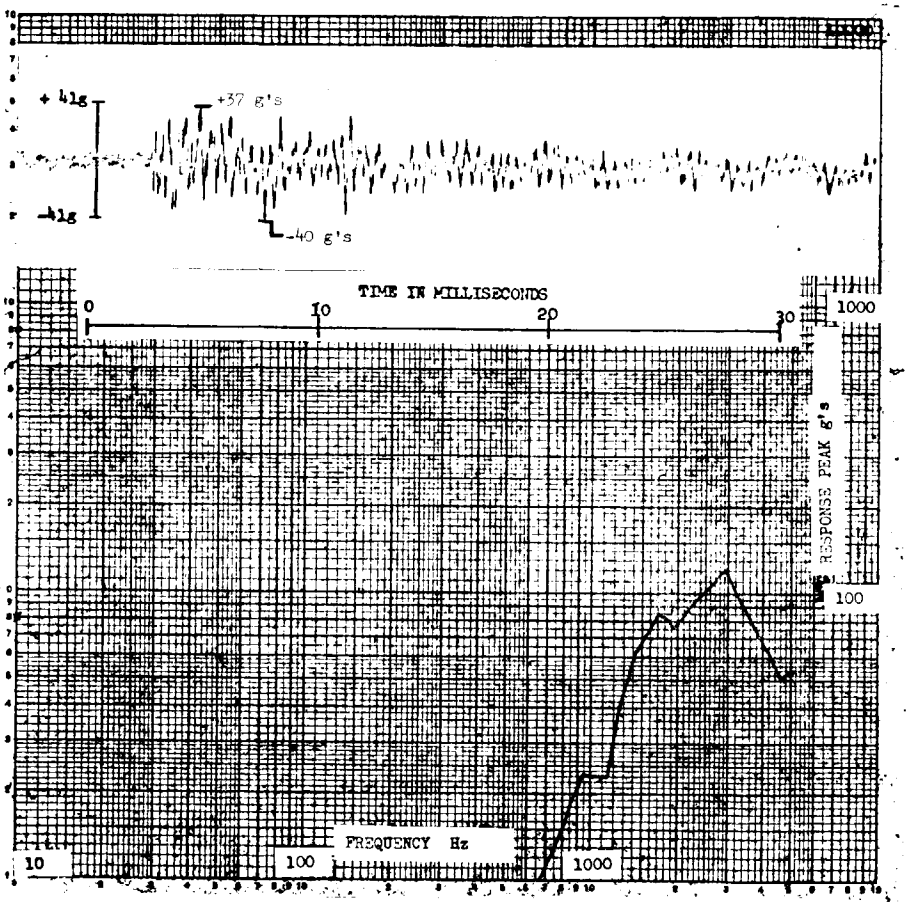
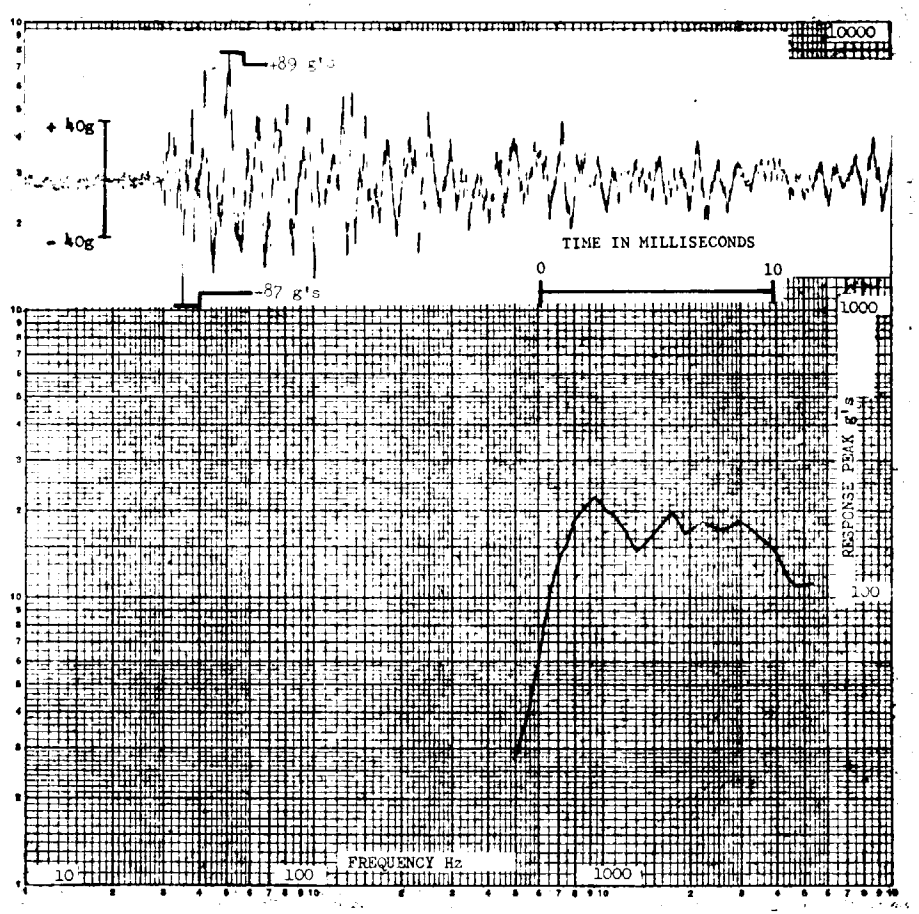


FIGURE I.A.5-58

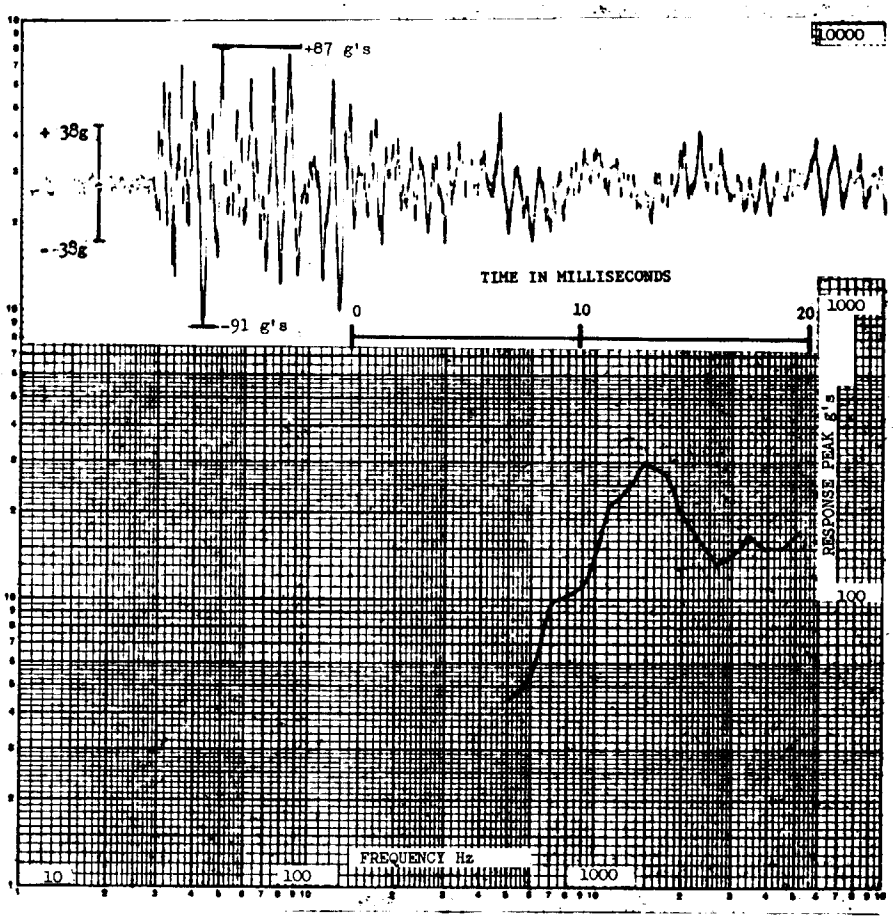


PBV SHOCK DETERMINATION TEST
-- STAGE III/PBV STAGING
MOD7E SECTION
LOC. 1-X MULTIPLEXER PROGRAMMER
RUN NO. 4

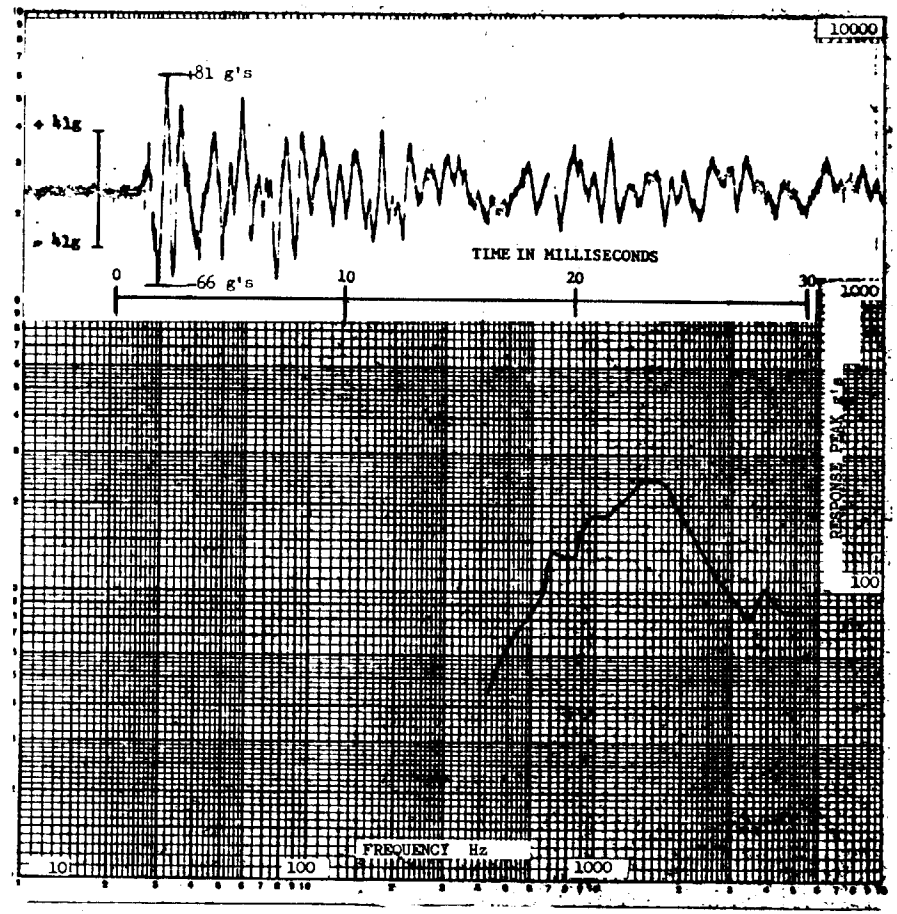


PBV SHOCK DETERMINATION TEST
-- STAGE III/PBV STAGING
MOD7E SECTION
LOC. 1-Y MULTIPLEXER PROGRAMMER
RUN NO. 4

FIGURE I.A.5-59

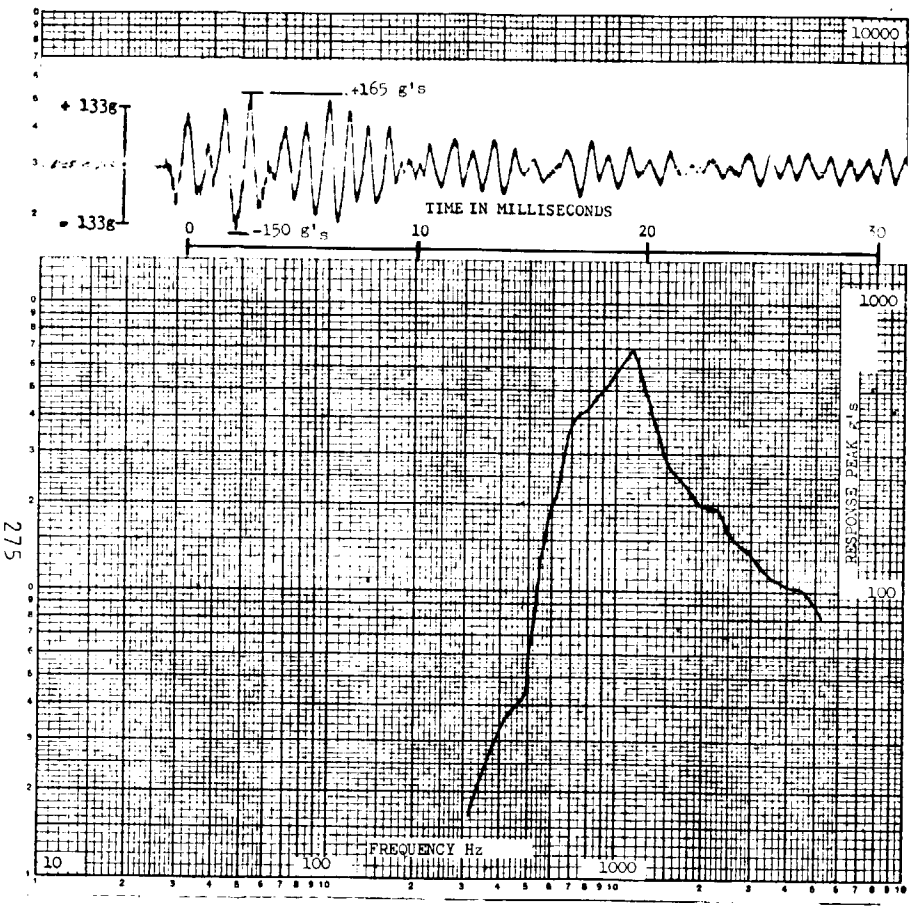


PBV SHOCK DETERMINATION TEST
-- STAGE III/PBV STAGING
MOD7E SECTION
LOC. 1-Z MULTIPLEXER PROGRAMMER
RUN NO. 4

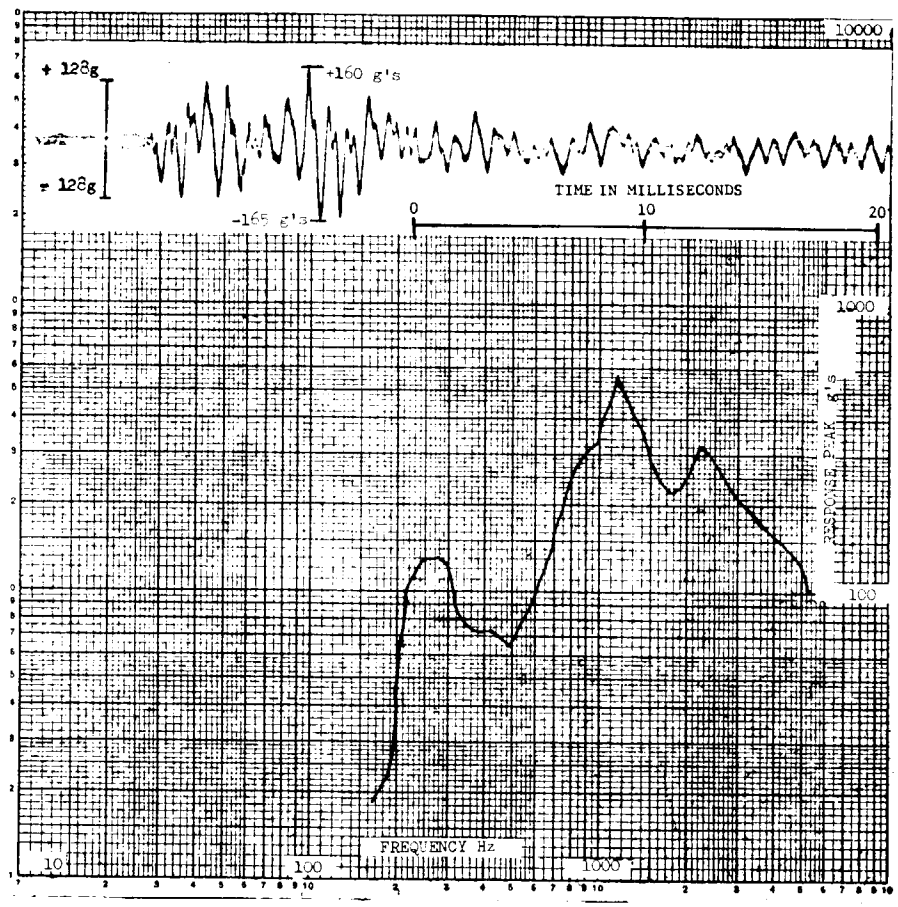


PBV SHOCK DETERMINATION TEST
-- STAGE III/PBV STAGING
MOD7E SECTION
LOC. 2-X C-BAND TRANSPONDER
RUN NO. 4

FIGURE I.A.5-60

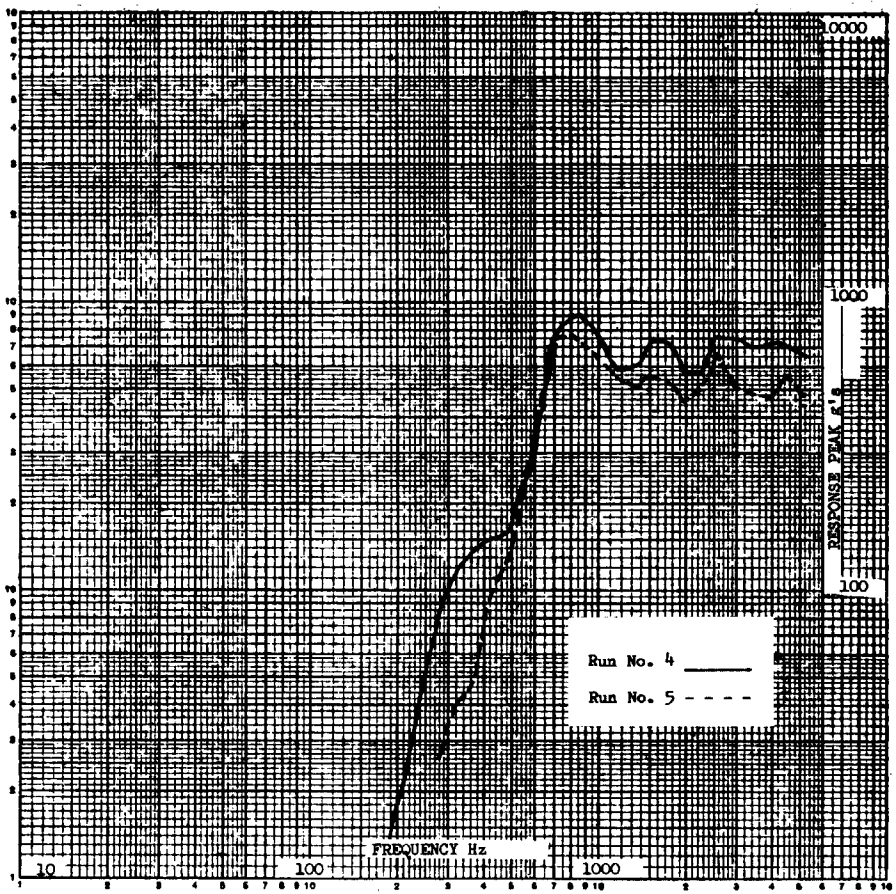


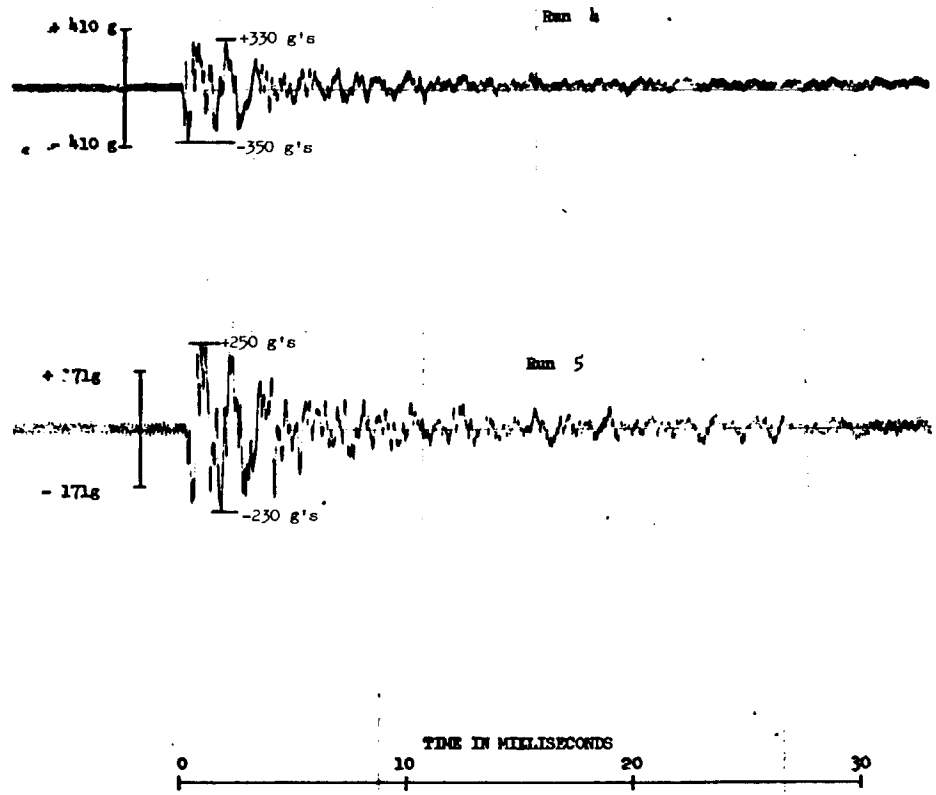
PBV SHOCK DETERMINATION TEST
-- STAGE III/PBV STAGING
MOD7E SECTION
LOC. 2-Y C-BAND TRANSPONDER
RUN NO. 4



PBV SHOCK DETERMINATION TEST
-- STAGE III/PBV STAGING
MOD7E SECTION
LOC. 2-Z C-BAND TRANSPONDER
RUN NO. 4

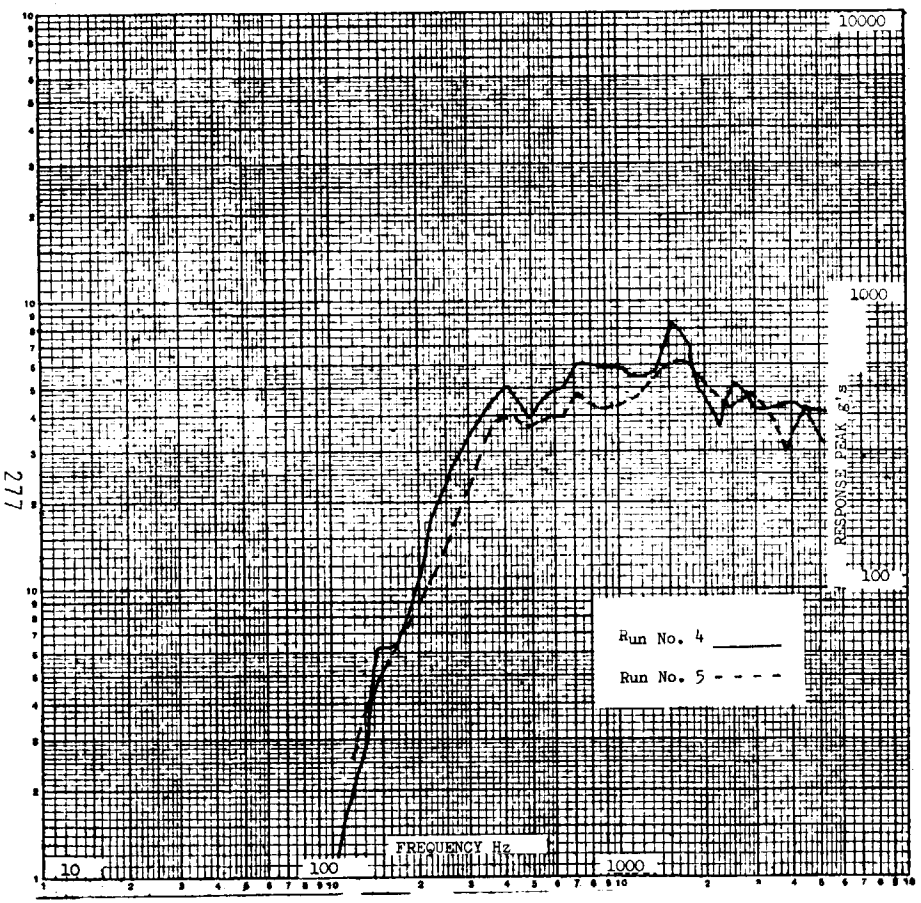
FIGURE I.A.5-61

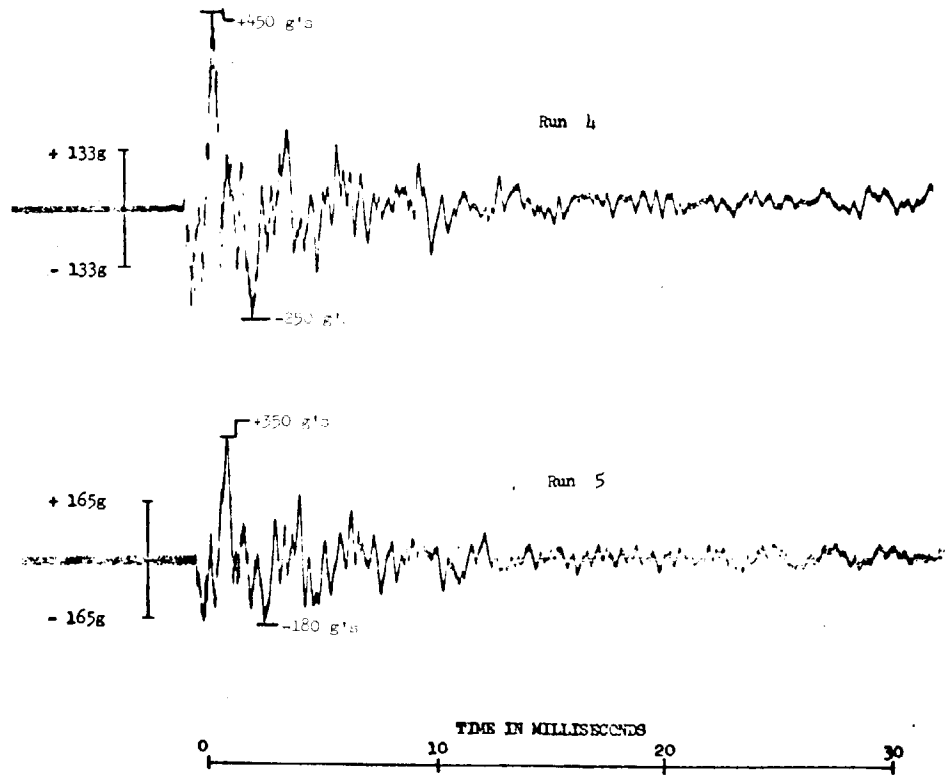




PBV SHOCK DETERMINATION TEST
STAGE III/PBV STAGING
LOC. 3-X D93 SC AMP.
MOD7E SECTION
RUN NO. 4,5

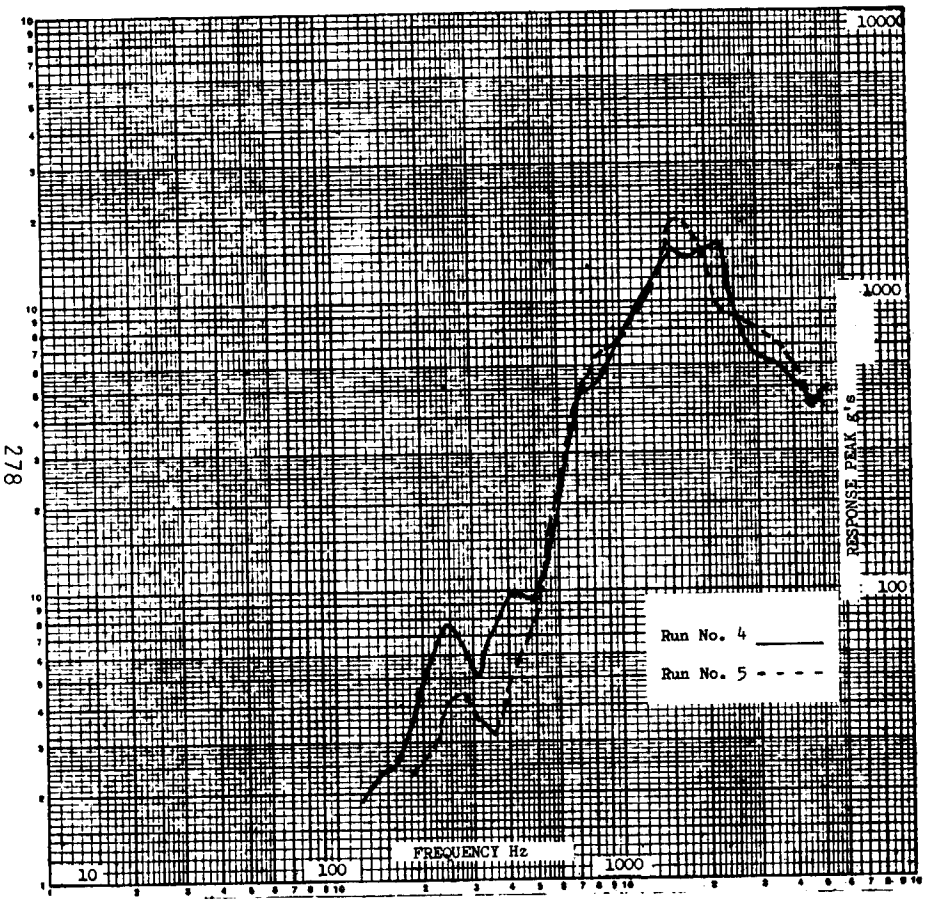
FIGURE I.A.5-62





PBV SHOCK DETERMINATION TEST
-- STAGE III/PBV STAGING
MOD7E SECTION
LOC. 3-Y D-93 SC AMP.
RUN NO. 4,5

FIGURE I.A.5-63



PBV SHOCK DETERMINATION TEST
-- STAGE III/PBV STAGING
MOD7E SECTION
LOC. 3-Z D-93 SC AMP.
RUN NO. 4,5

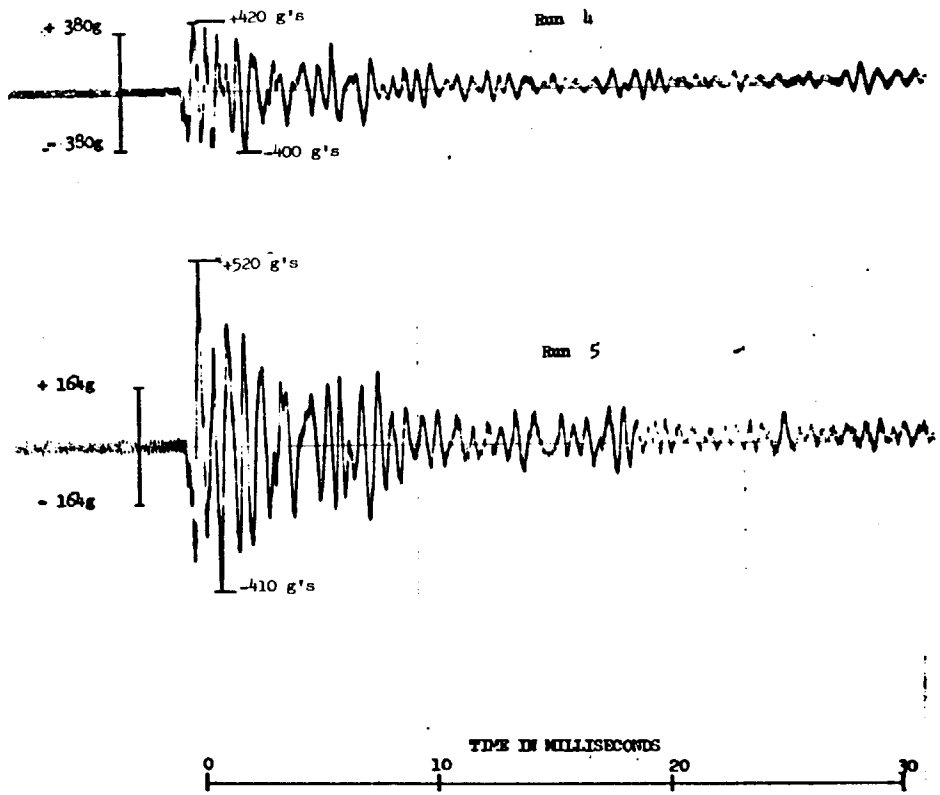
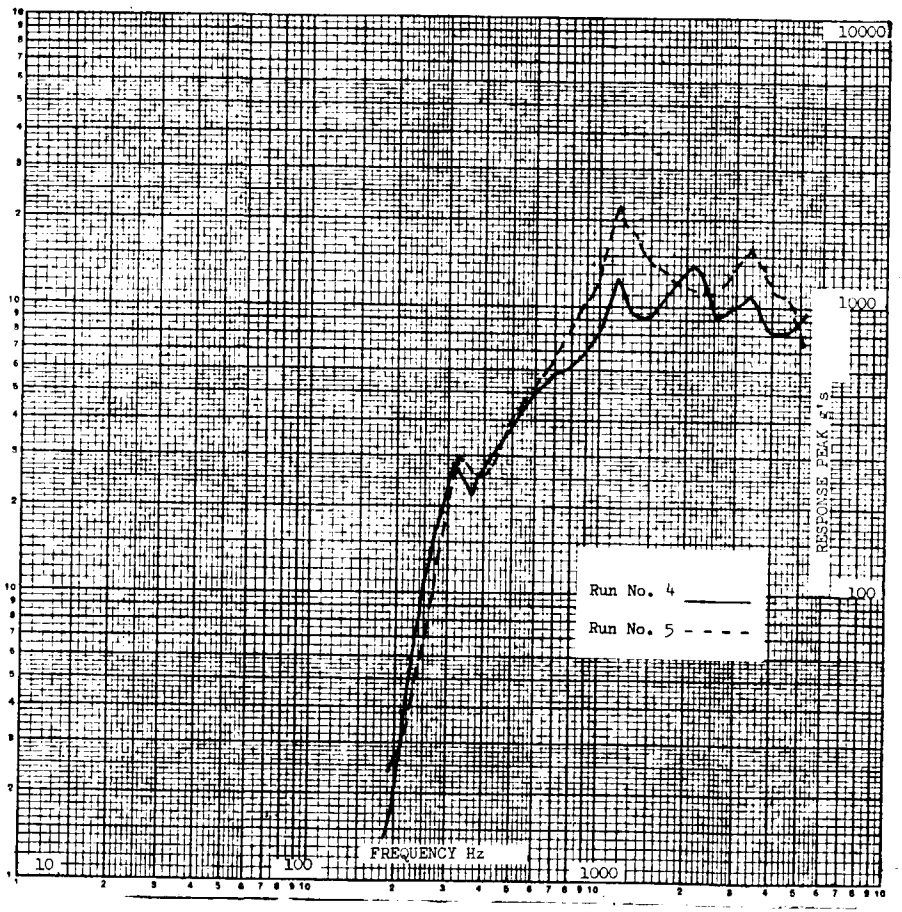


FIGURE 1.A.5-64



PBV SHOCK DETERMINATION TEST
-- STAGE III/PBV STAGING
MOD7E SECTION
LOC. 4-R C/D ANTENNA
RUN NO. 4,5

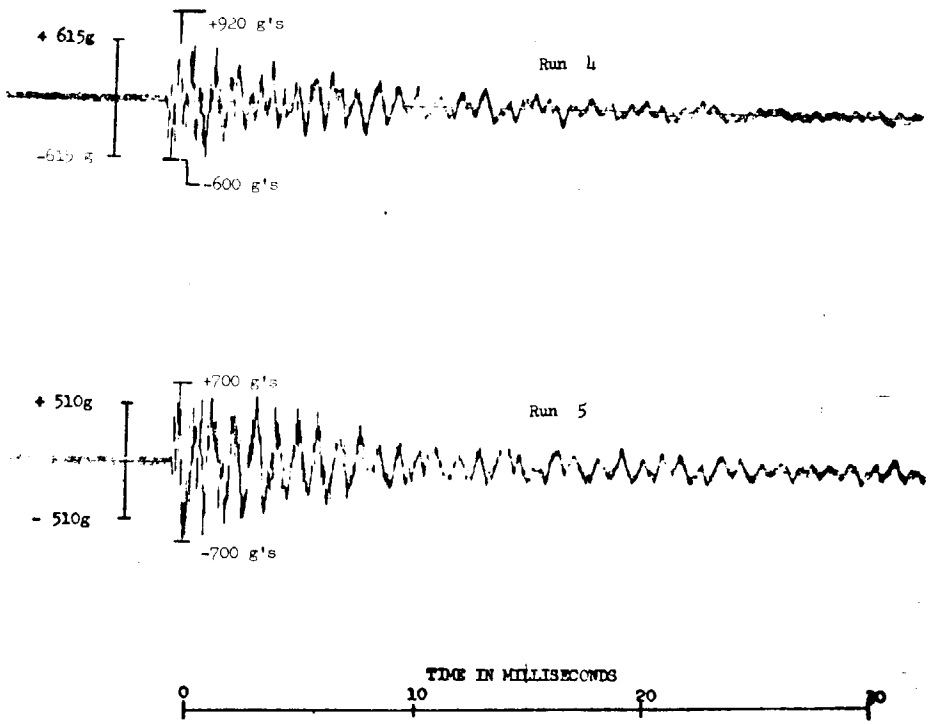
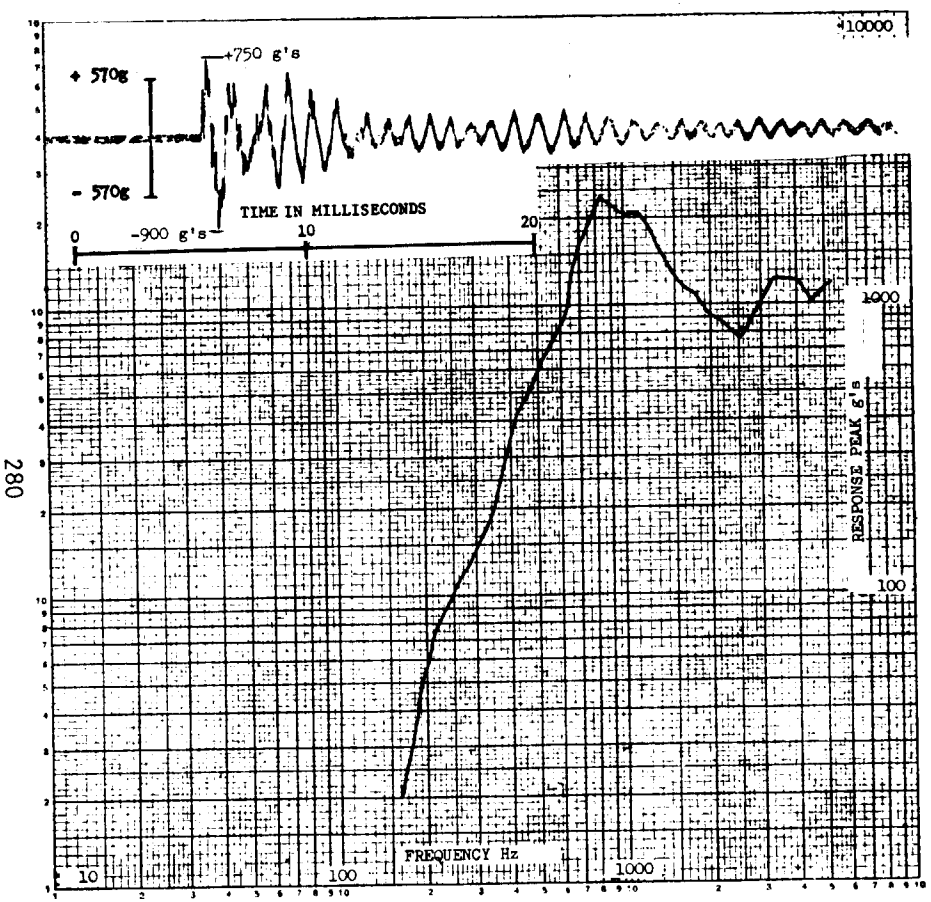
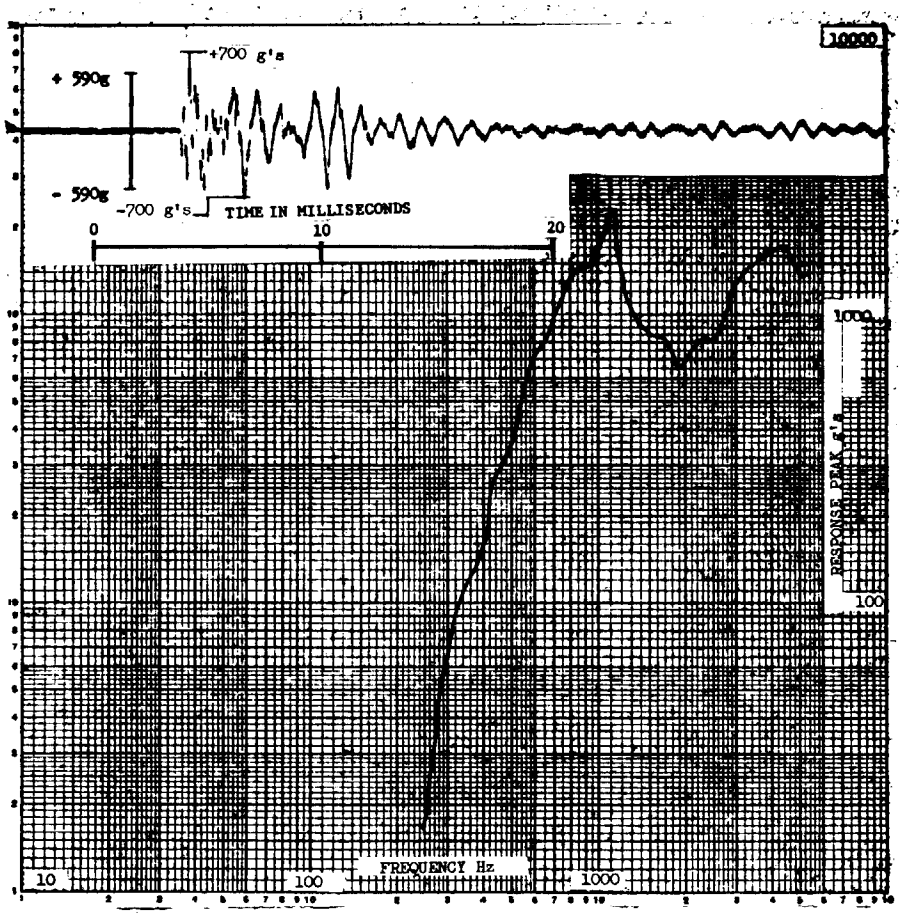


FIGURE I.A.5-65

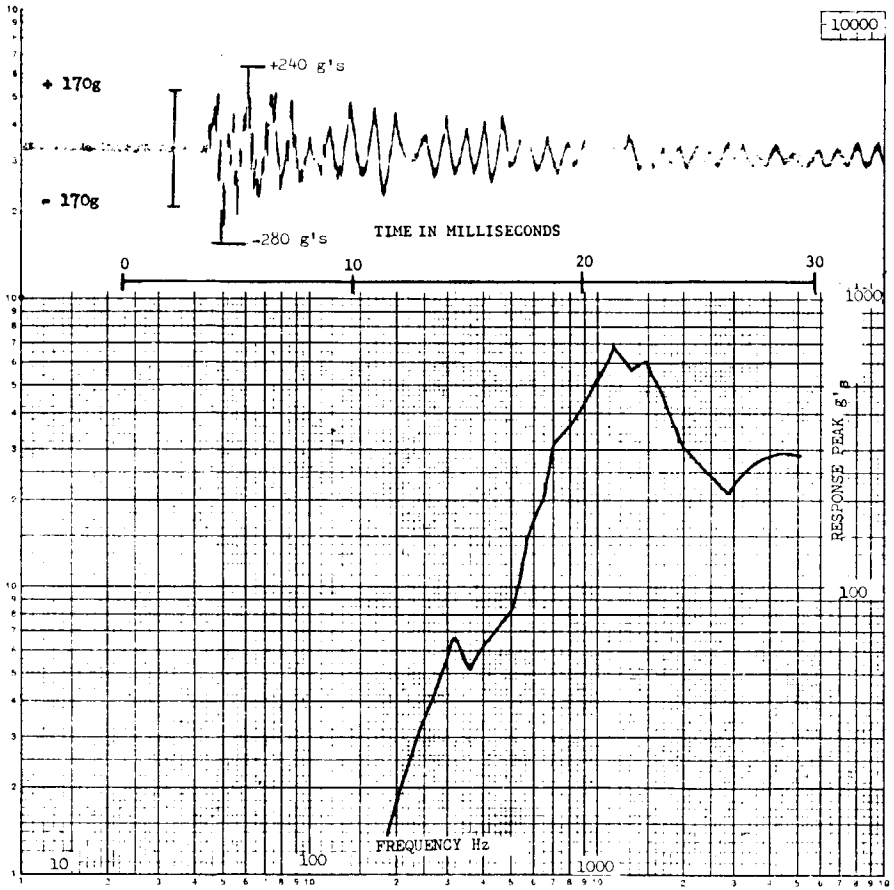


PBV SHOCK DETERMINATION TEST
-- STAGE III/PBV STAGING
MOD7E SECTION
LOC. 4-Z C/D ANTENNA
RUN NO. 4

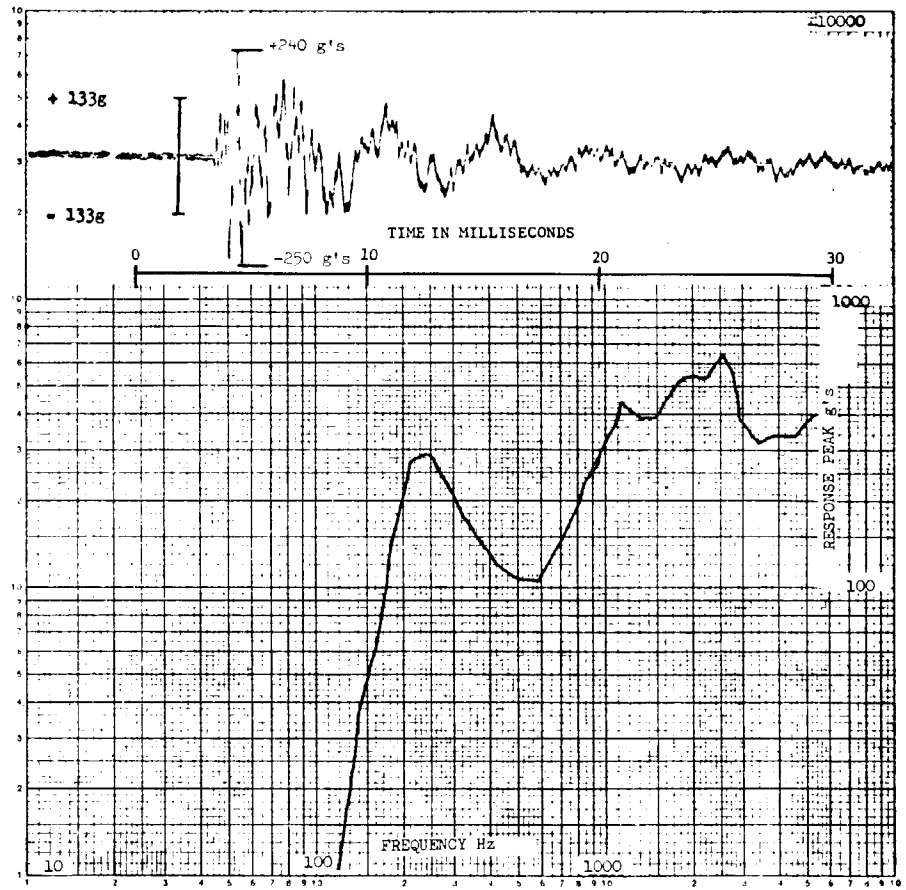


PBV SHOCK DETERMINATION TEST
-- STAGE III/PBV STAGING
MOD7E SECTION
LOC. 4-T C/D ANTENNA
RUN NO. 4

FIGURE I.A.5-66

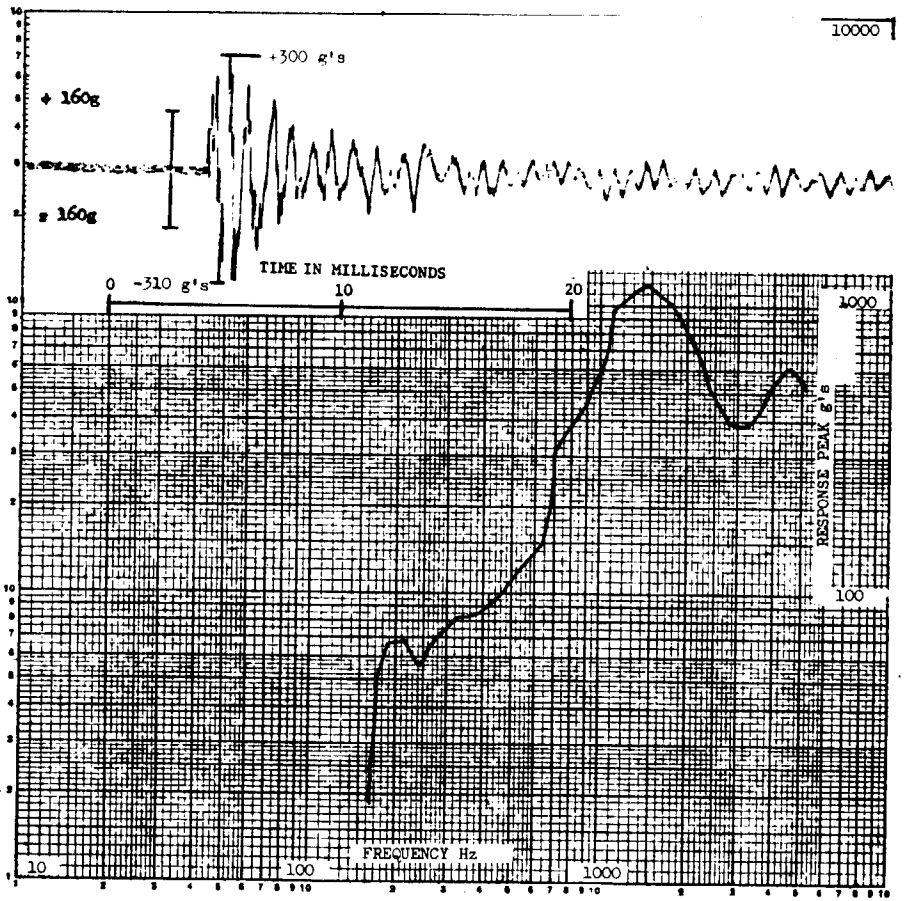


PBV SHOCK DETERMINATION TEST
-- STAGE III/PBV STAGING
MOD7E SECTION
LOC. 5-X PCM 3C
RUN NO. 4

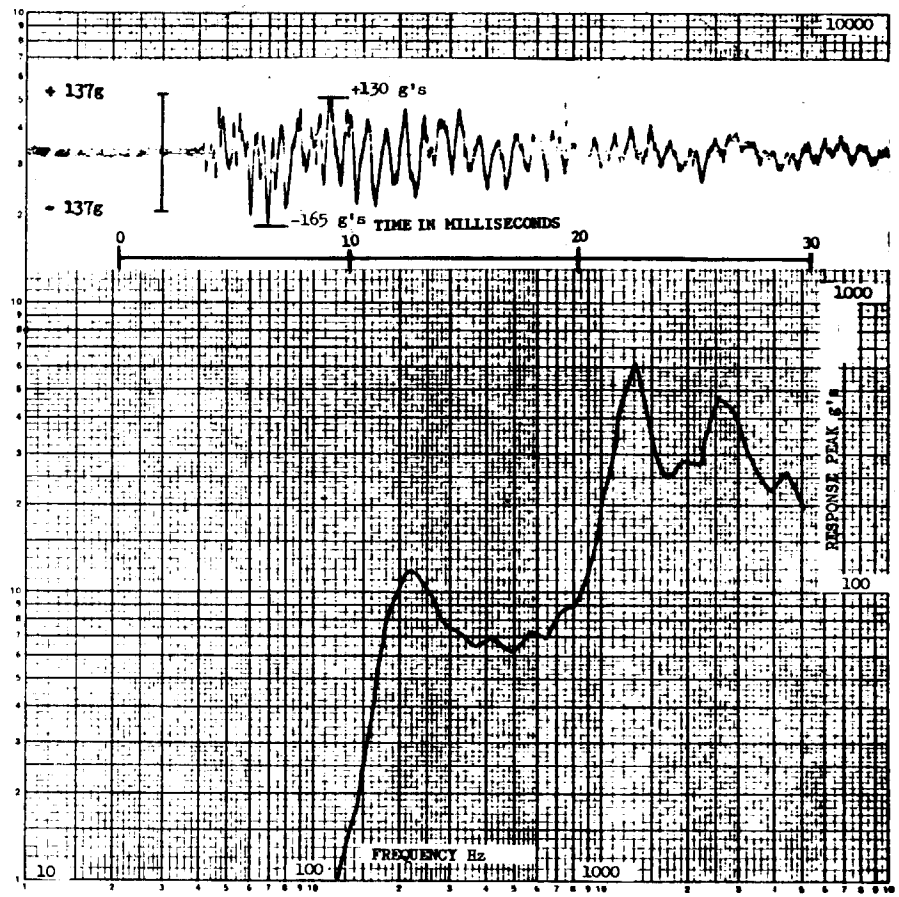


PBV SHOCK DETERMINATION TEST
-- STAGE III/PBV STAGING
MOD7E SECTION
LOC. 5-Y PCM 3C
RUN NO. 4

FIGURE I.A.5-67

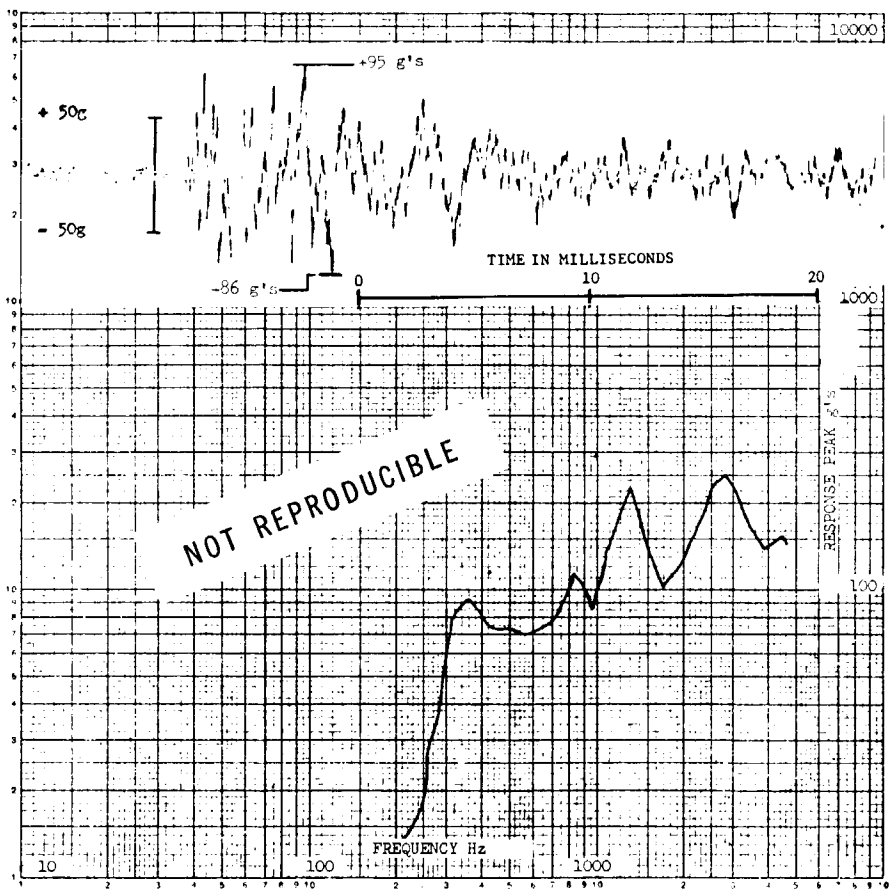


PBV SHOCK DETERMINATION TEST
-- STAGE III/PBV STAGING
MOD7E SECTION
LOC. 5-Z PCM SC
RUN NO. 4

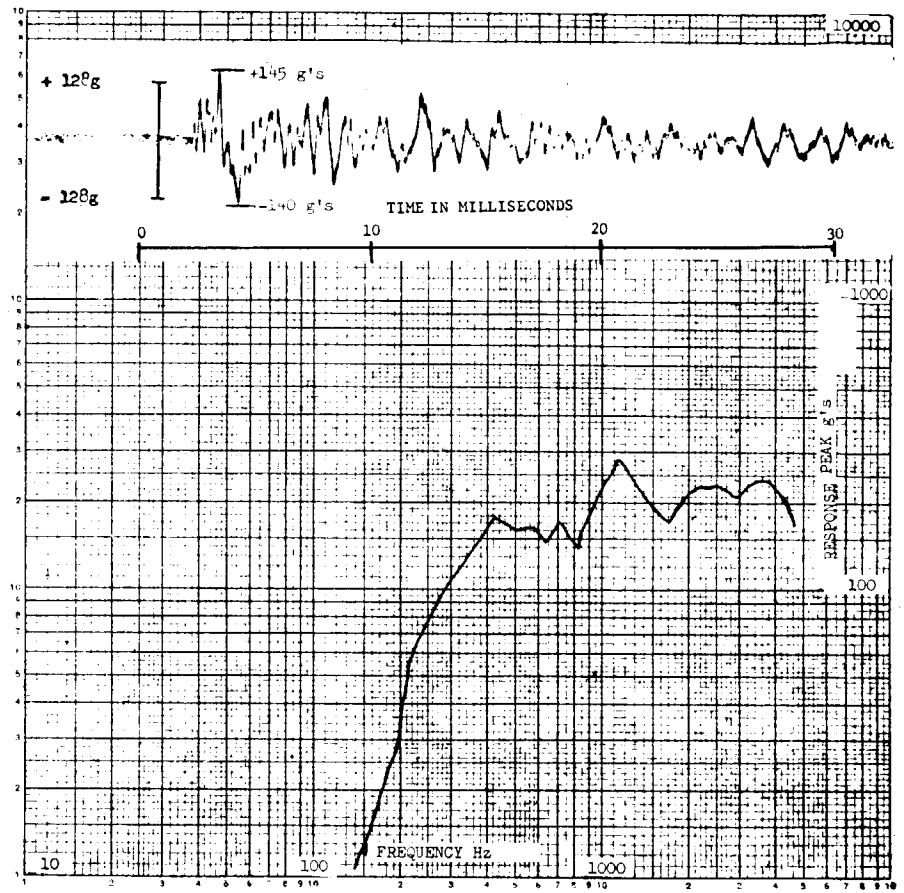


PBV SHOCK DETERMINATION TEST
-- STAGE III/PBV STAGING
MOD7E SECTION
LOC. 6-X UDOP TRANSPONDER
RUN NO. 4

FIGURE I.A.5-68

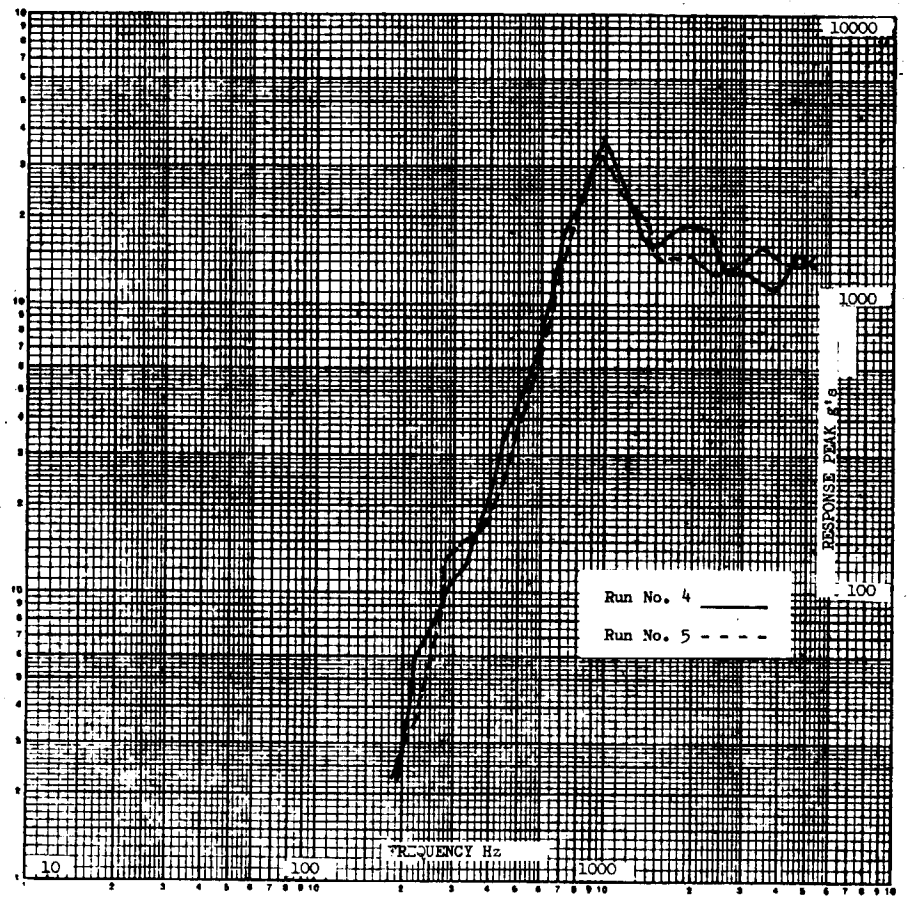


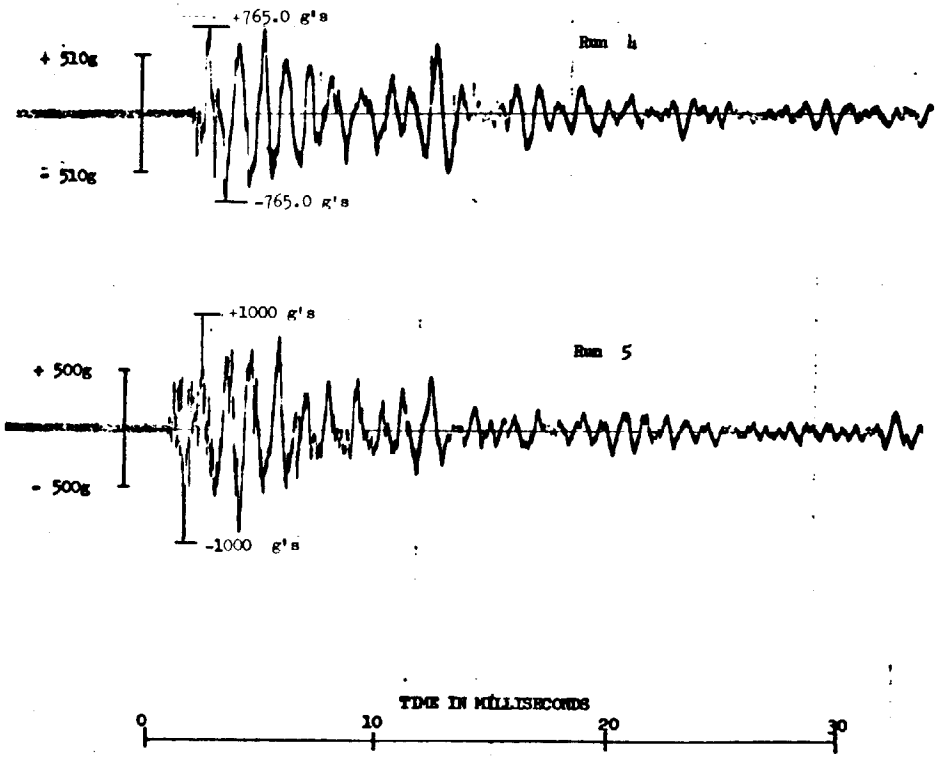
PBV SHOCK DETERMINATION TEST
-- STAGE III/PBV STAGING
MOD7E SECTION
LOC. 6-Y UDOP TRANSPONDER
RUN NO. 4



PBV SHOCK DETERMINATION TEST
-- STAGE III/PBV STAGING
MOD7E SECTION
LOC. 6-Z UDOP TRANSPONDER
RUN NO. 4

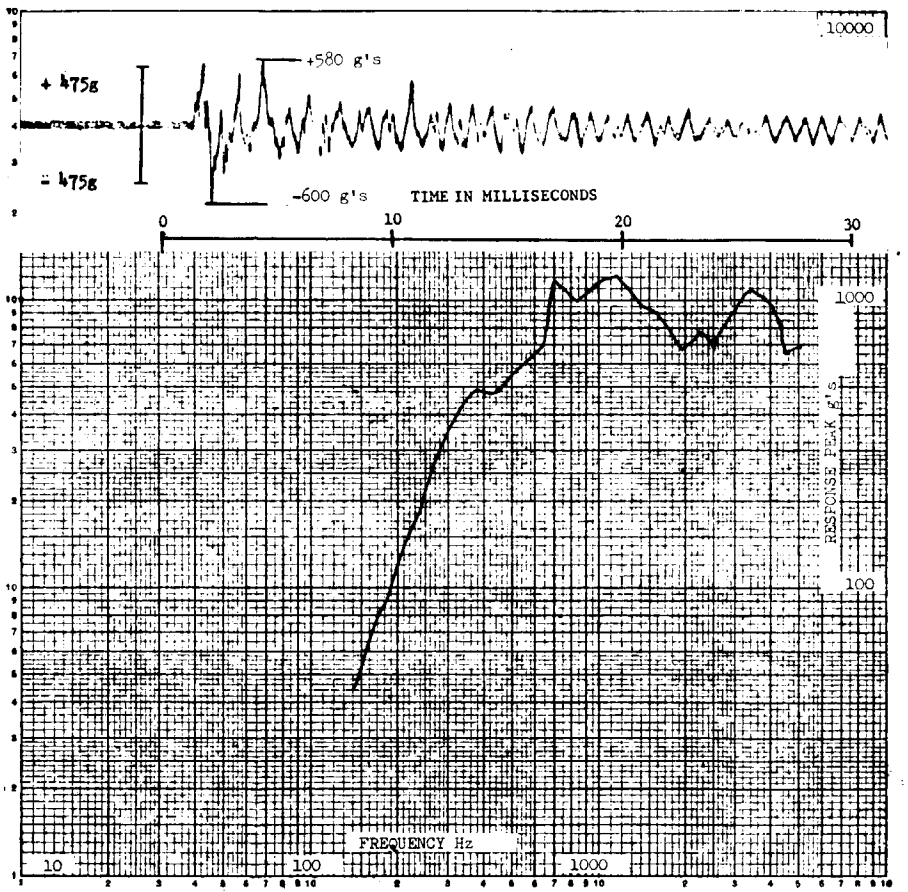
FIGURE I.A.5-69



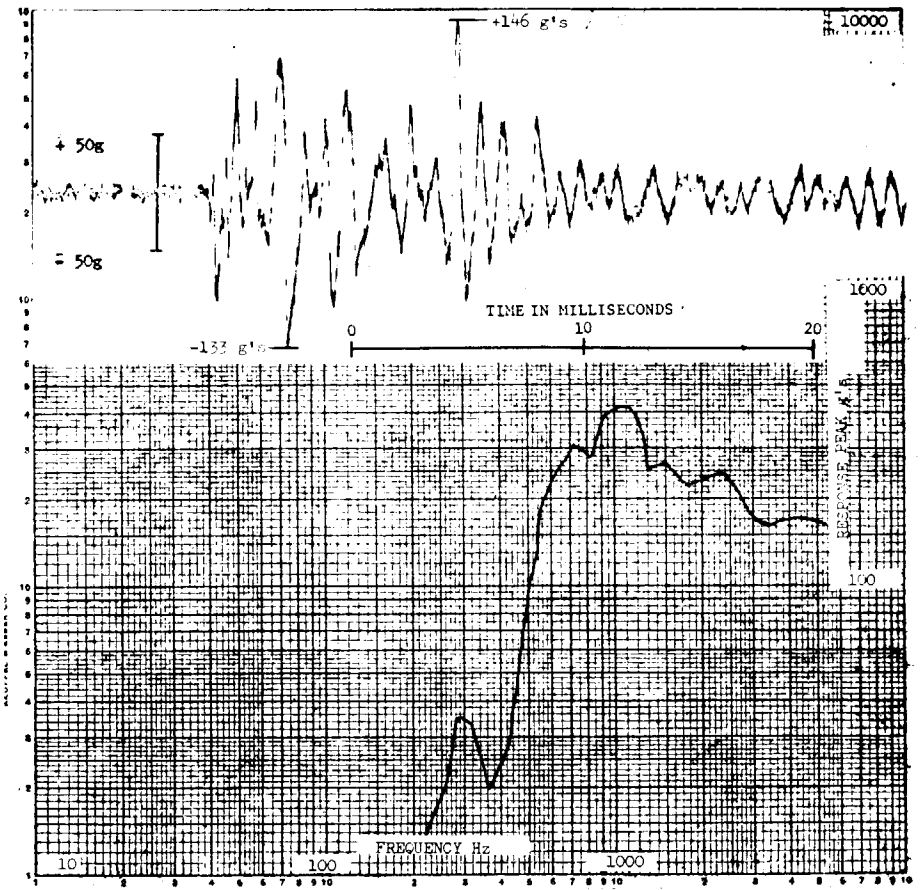


PBV SHOCK DETERMINATION TEST
-- STAGE III/PBV STAGING
MOD7E SECTION
LOC. 7-R C-BAND ANTENNA
RUN NO. 4,5

FIGURE I.A.5-70

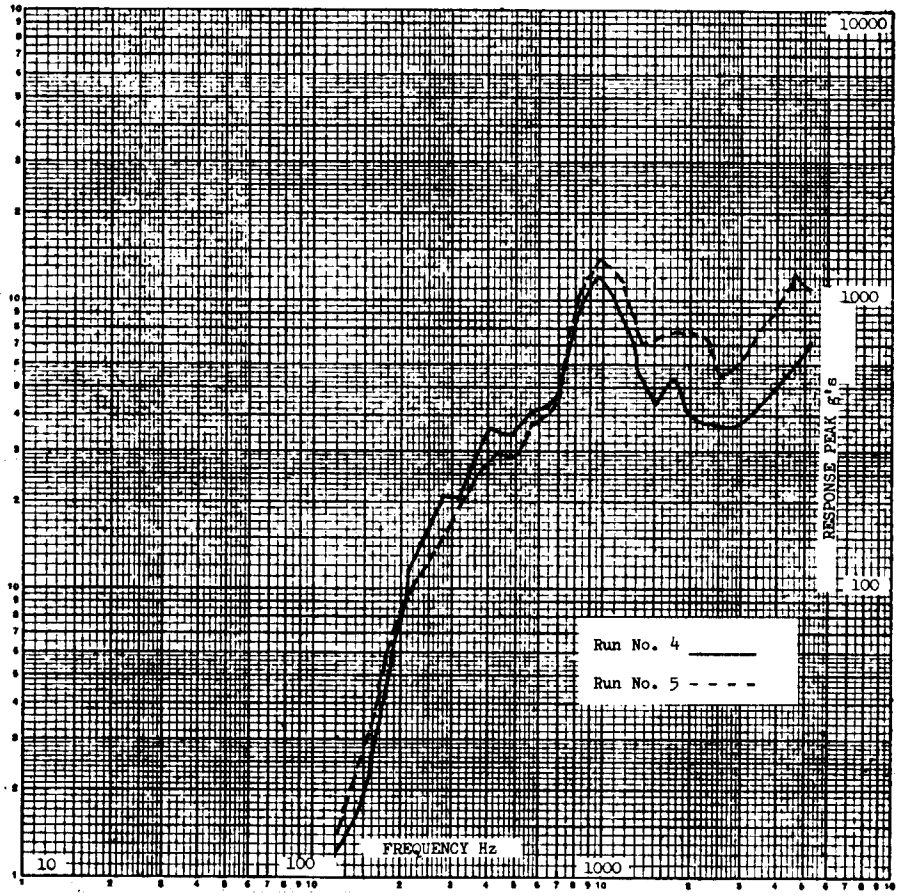


PBV SHOCK DETERMINATION TEST
-- STAGE III/PBV STAGING
MOD7E SECTION
LOC. 7-Z C-BAND ANTENNA
RUN NO. 4



PBV SHOCK DETERMINATION TEST
-- STAGE III/PBV STAGING
MOD7E SECTION
LOC. 7-T C-BAND ANTENNA
RUN NO. 4

FIGURE I.A.5-71



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
MOD7E SECTION
LOC.8-Z UDOP ANTENNA
RUN NO. 4,5

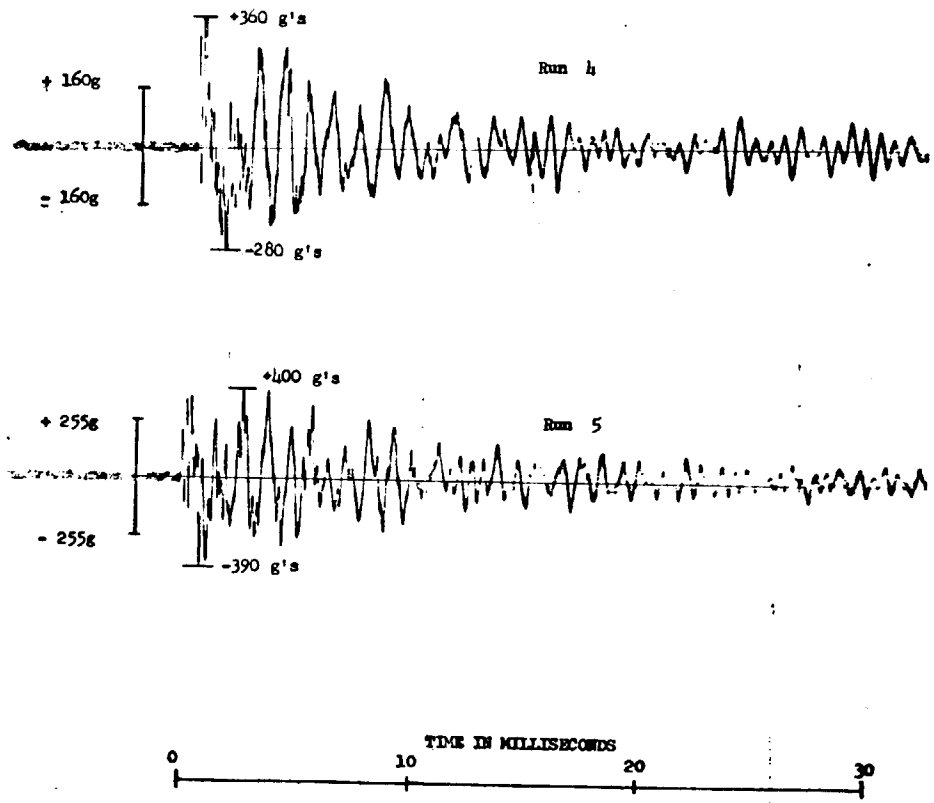
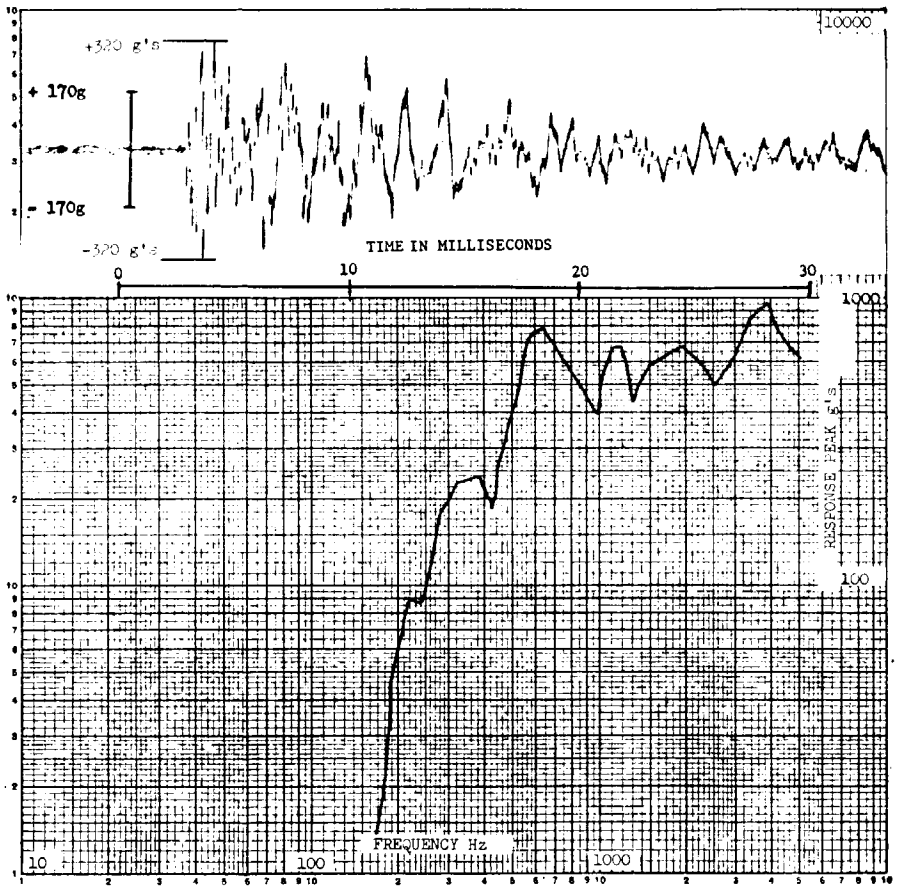
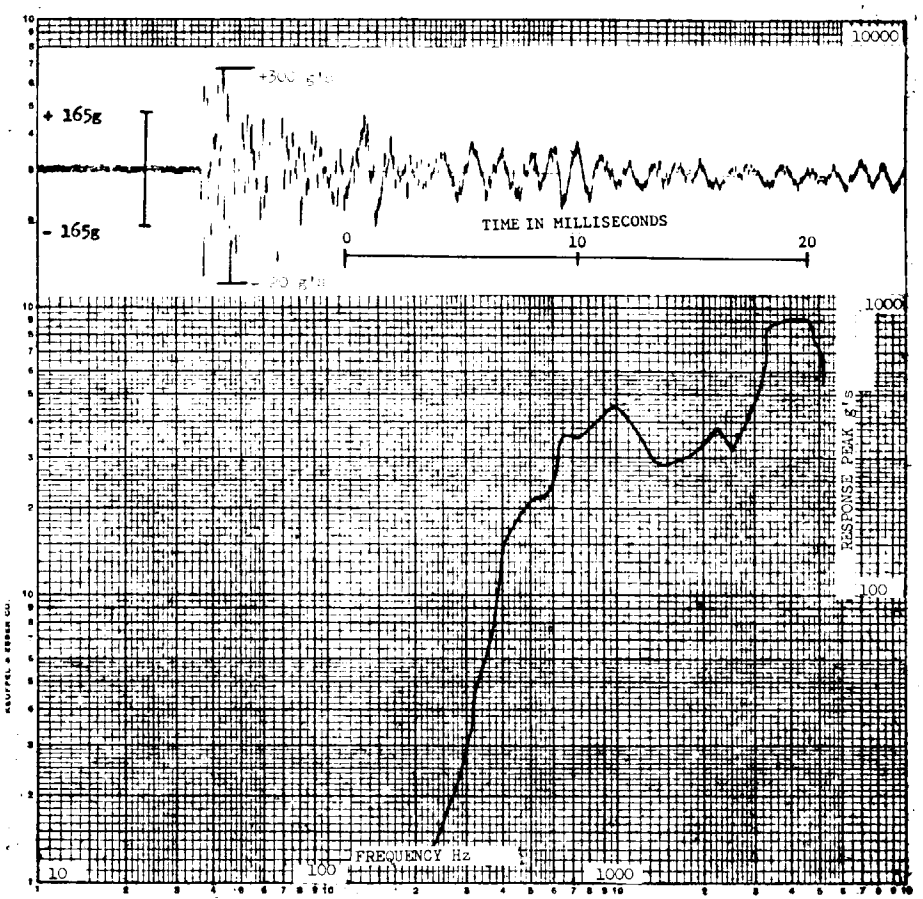


FIGURE I.A.5-72



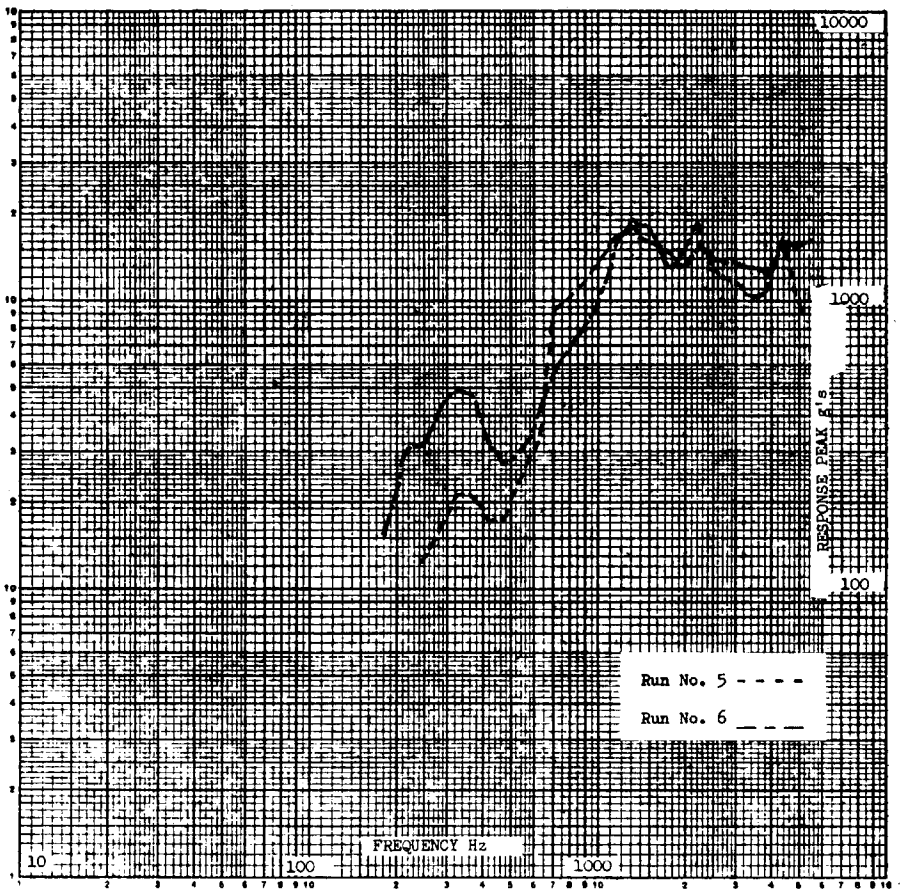
PBV SHOCK DETERMINATION TEST
-- STAGE III/PBV STAGING
MOD7E SECTION
LOC. 8-R UDOP ANTENNA
RUN NO. 4

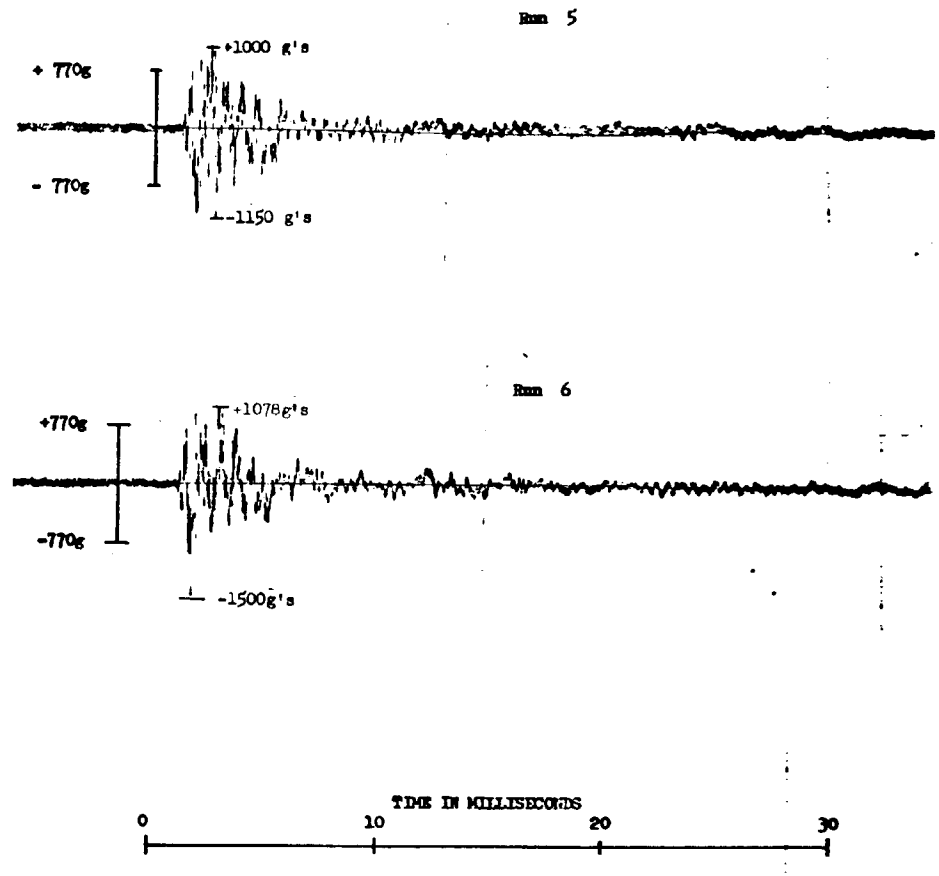


PBV SHOCK DETERMINATION TEST
-- STAGE III/PBV STAGING
MOD7E SECTION
LOC. 8-T UDOP ANTENNA
RUN NO. 4

FIGURE I.A.5-73

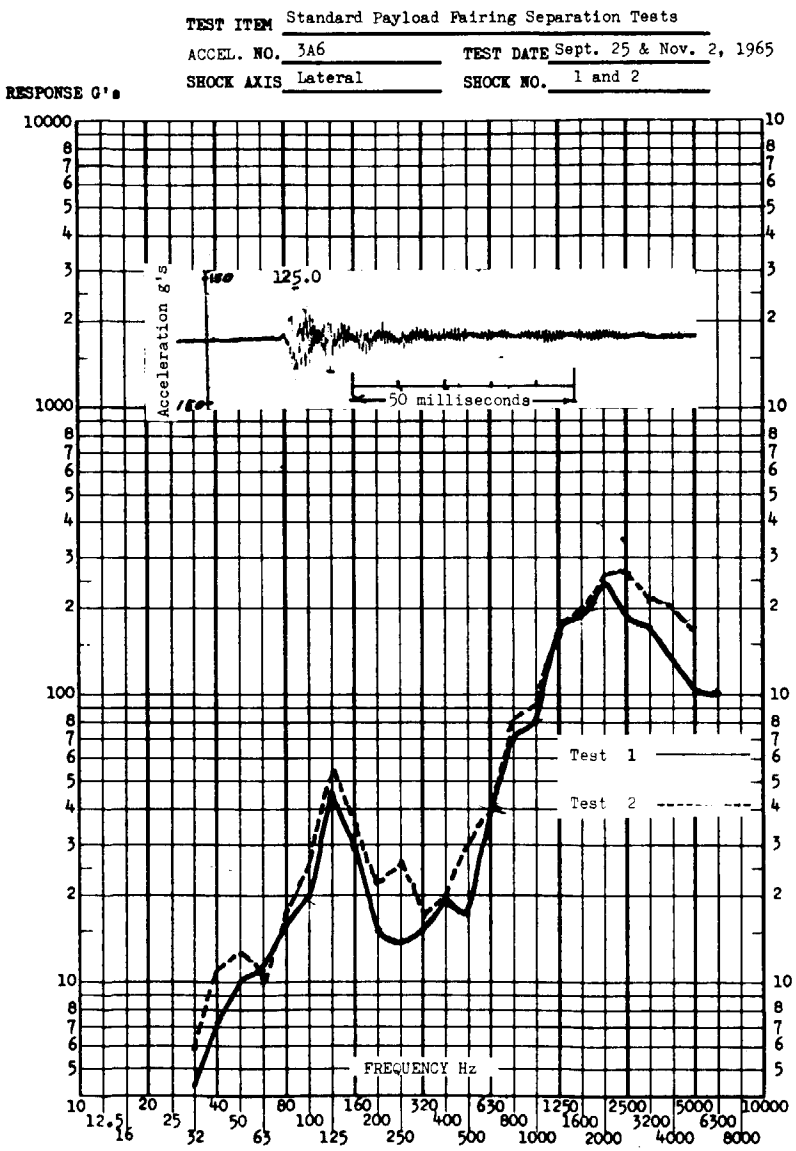
FIGURE 2-331





PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 9-Z PBPS
ROLL ENGINE #2
RUN NO. 5,6

FIGURE I.A.5-74


TEST ITEM Standard Payload Fairing Separation Tests
ACCEL. NO. 3A6
TEST DATE Sept. 25 & Nov. 2, 1965
SHOCK AXIS Lateral
SHOCK NO. 1 and 2
RESPONSE G's
Acceleration g's
125.0
50 milliseconds
Test 1
Test 2
FREQUENCY Hz

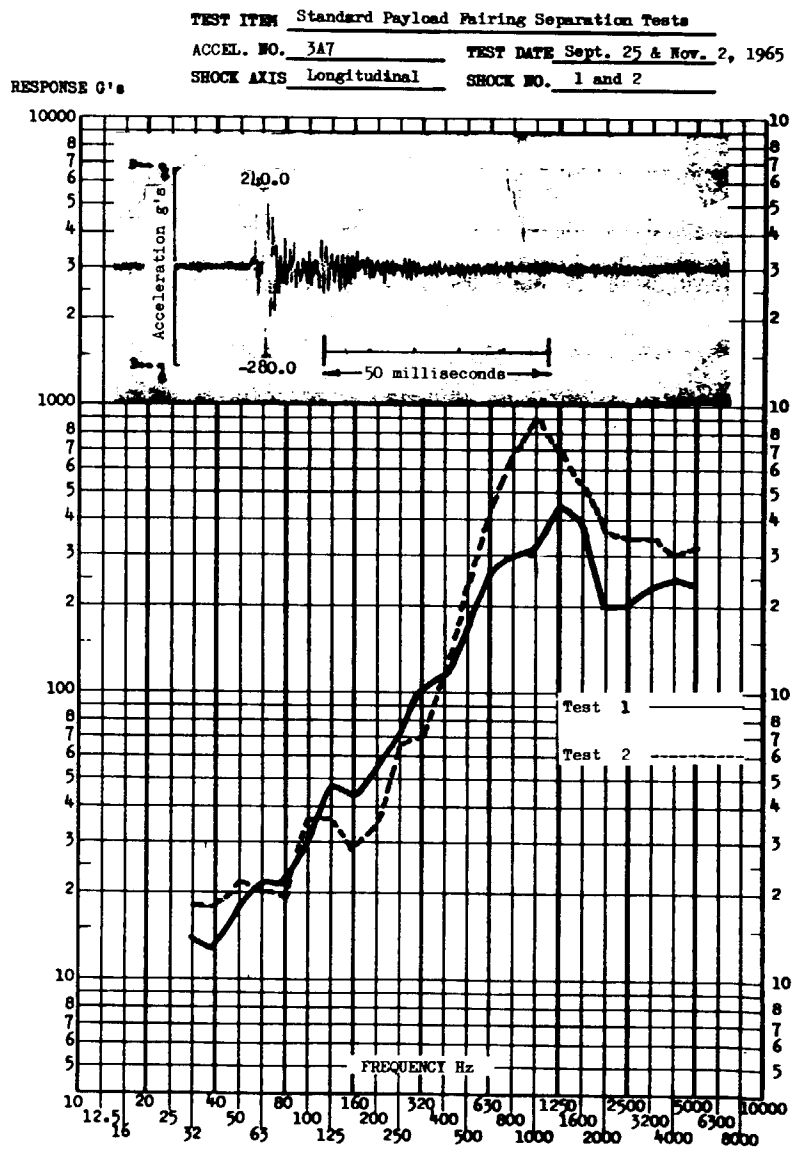
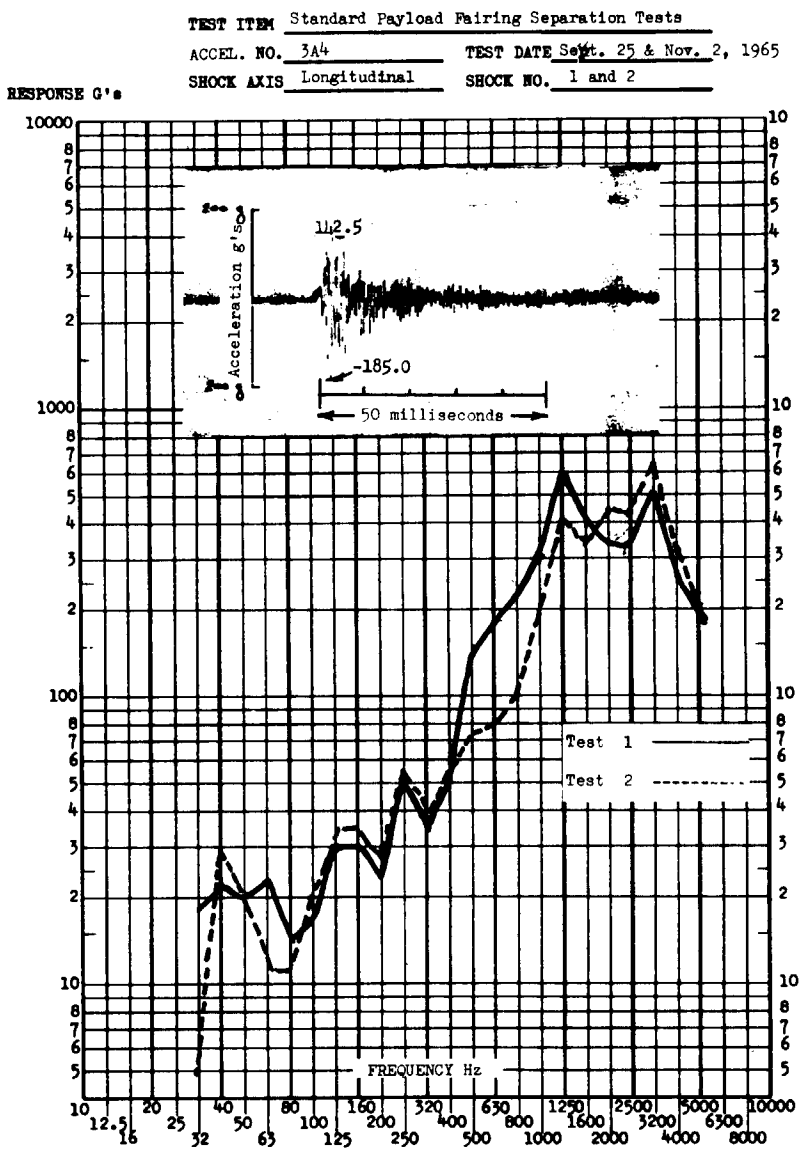

TEST ITEM Standard Payload Fairing Separation Tests
ACCEL. NO. 3A7
TEST DATE Sept. 25 & Nov. 2, 1965
SHOCK AXIS Longitudinal
SHOCK NO. 1 and 2
RESPONSE G's
Acceleration g's
240.0
-280.0
50 milliseconds
Test 1
Test 2
FREQUENCY Hz

FIGURE I.B.1-9


TEST ITEM Standard Payload Fairing Separation Tests
ACCEL. NO. 3A4
TEST DATE Sept. 25 & Nov. 2, 1965
SHOCK AXIS Longitudinal
SHOCK NO. 1 and 2
RESPONSE G's
Acceleration g's
142.5
-185.0
50 milliseconds
Test 1
Test 2
FREQUENCY Hz

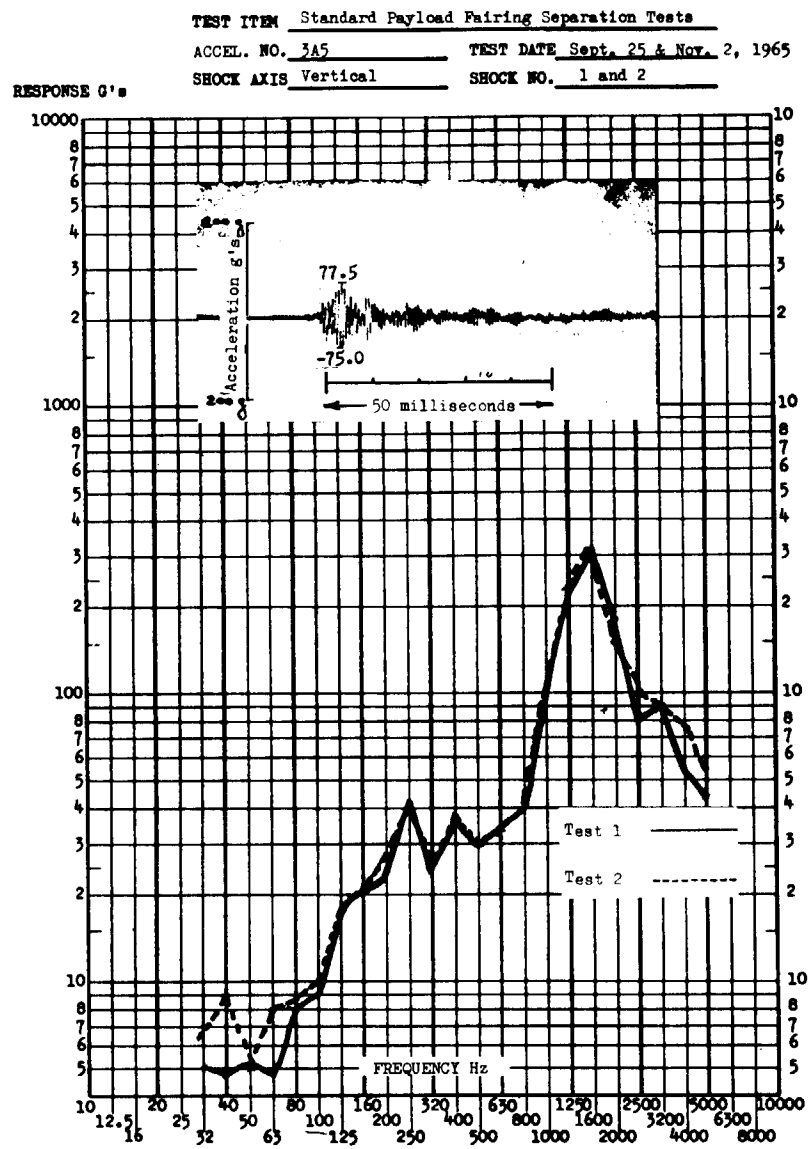
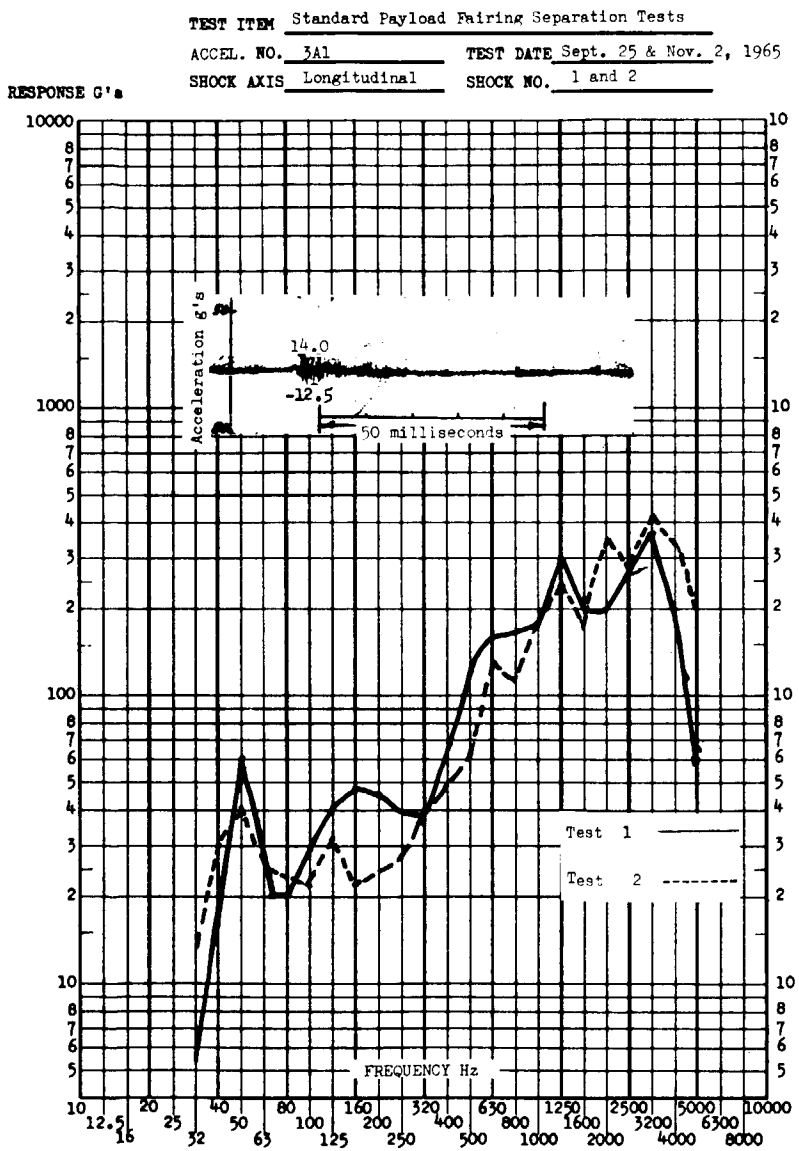

TEST ITEM Standard Payload Fairing Separation Tests
ACCEL. NO. 3A5
TEST DATE Sept. 25 & Nov. 2, 1965
SHOCK AXIS Vertical
SHOCK NO. 1 and 2
RESPONSE G's
Acceleration g's
77.5
-75.0
50 milliseconds
Test 1
Test 2
FREQUENCY Hz

FIGURE I.B.1-8


TEST ITEM Standard Payload Fairing Separation Tests
ACCEL. NO. 3A1
TEST DATE Sept. 25 & Nov. 2, 1965
SHOCK AXIS Longitudinal
SHOCK NO. 1 and 2
RESPONSE G's
Acceleration g's
14.0
-12.5
50 milliseconds
Test 1
Test 2
FREQUENCY Hz

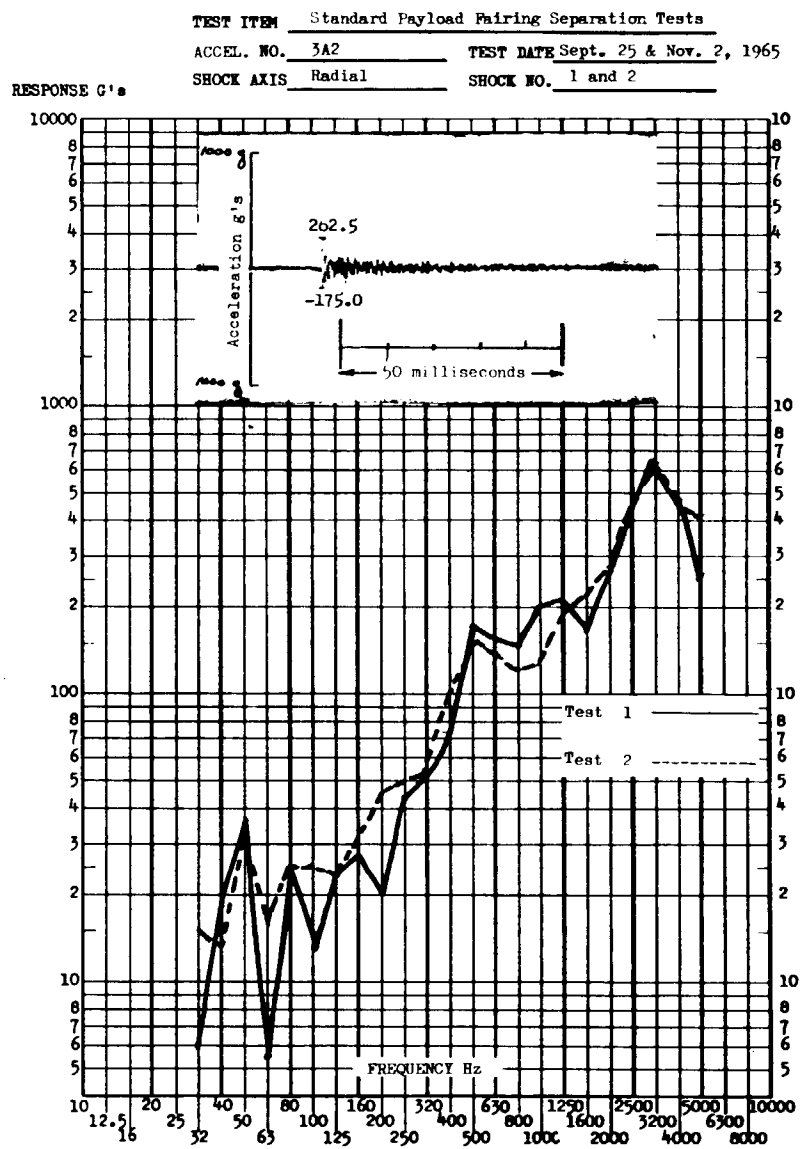
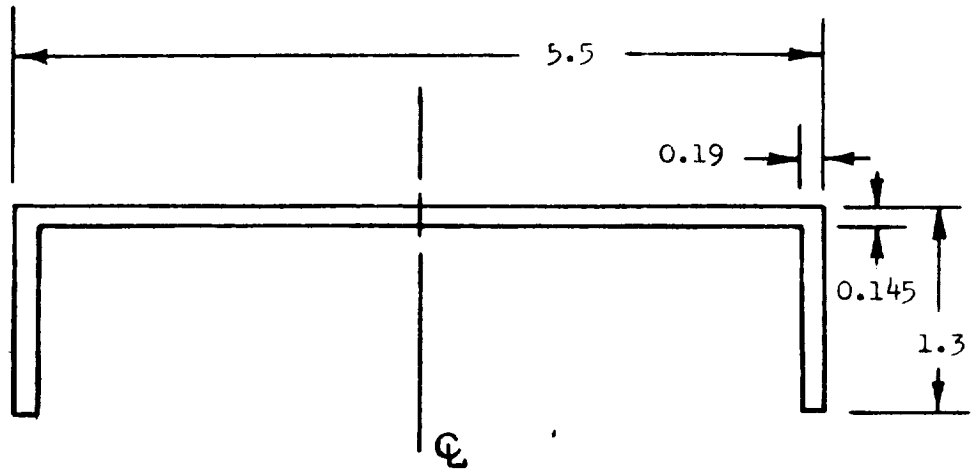
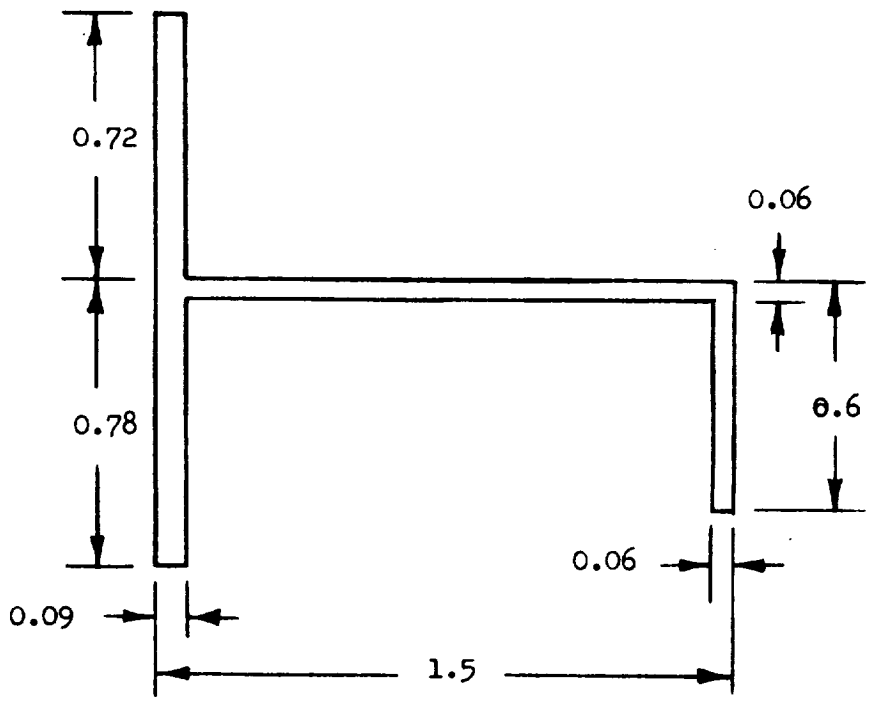

TEST ITEM Standard Payload Fairing Separation Tests
ACCEL. NO. 3A2
TEST DATE Sept. 25 & Nov. 2, 1965
SHOCK AXIS Radial
SHOCK NO. 1 and 2
RESPONSE G's
Acceleration g's
262.5
-175.0
50 milliseconds
Test 1
Test 2
FREQUENCY Hz

FIGURE I.B.1-7



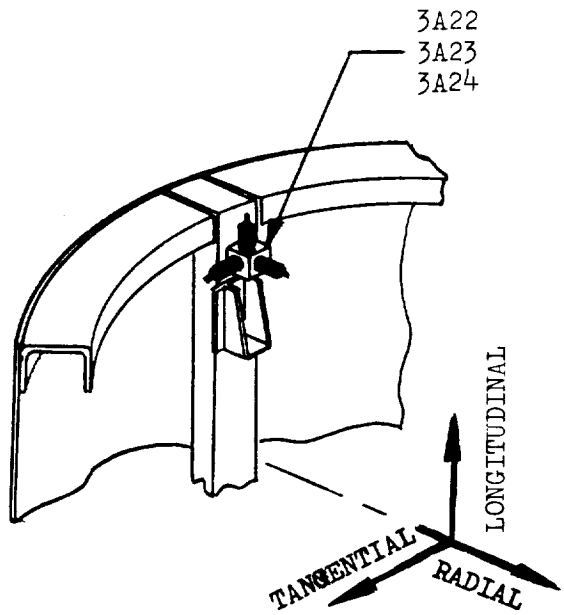
RING-FRAME

DIMENSION OF SECTION AT STATION 77



DIMENSIONS OF LONGERON SECTION

Figure I.B.1-6. Sectional Dimensions



VIEW B-B
LONGERON 26C

FIGURE I.B.1-5. LOCATION OF ACCELEROMETERS

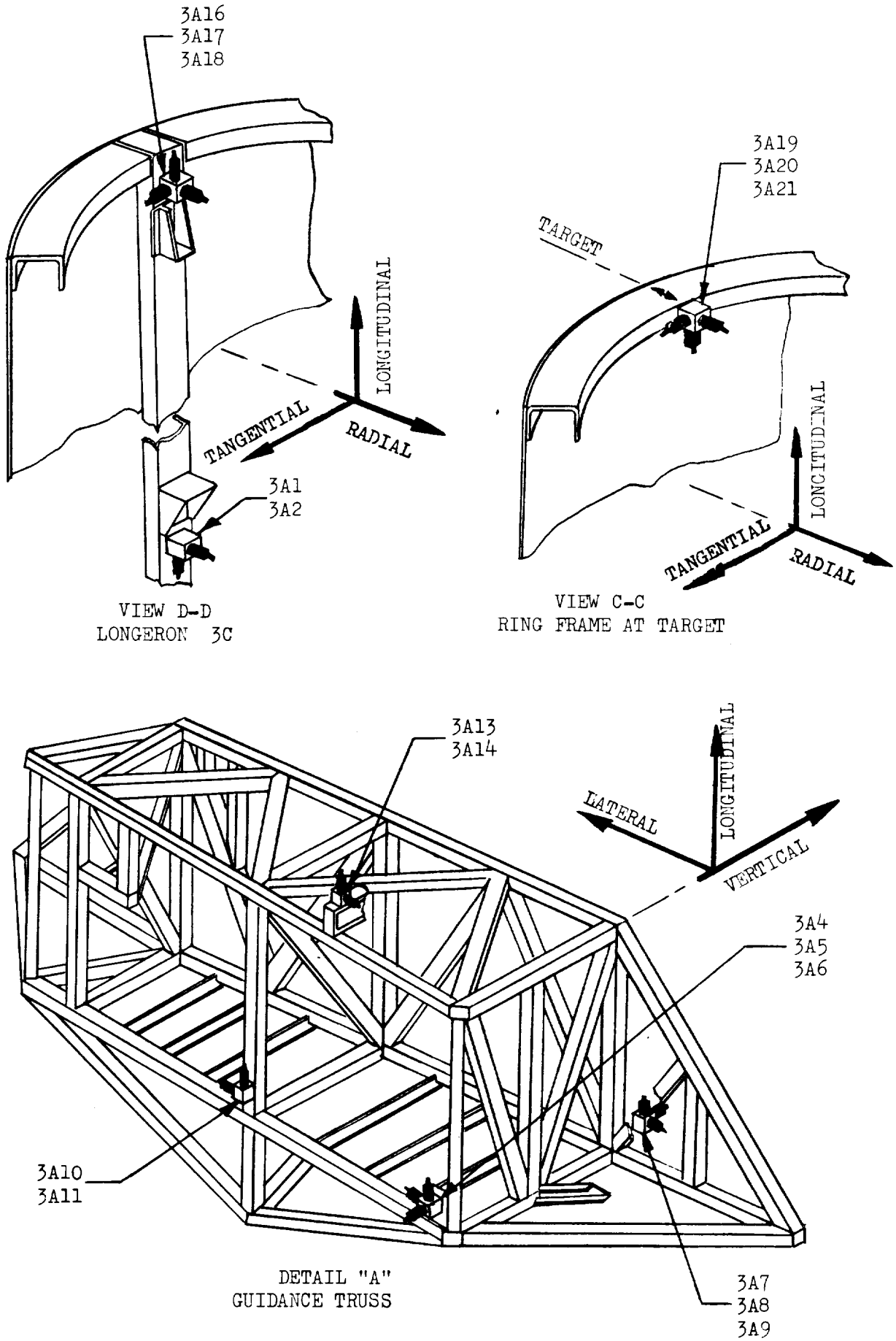


Figure I.B.1-4. Accelerometer Locations

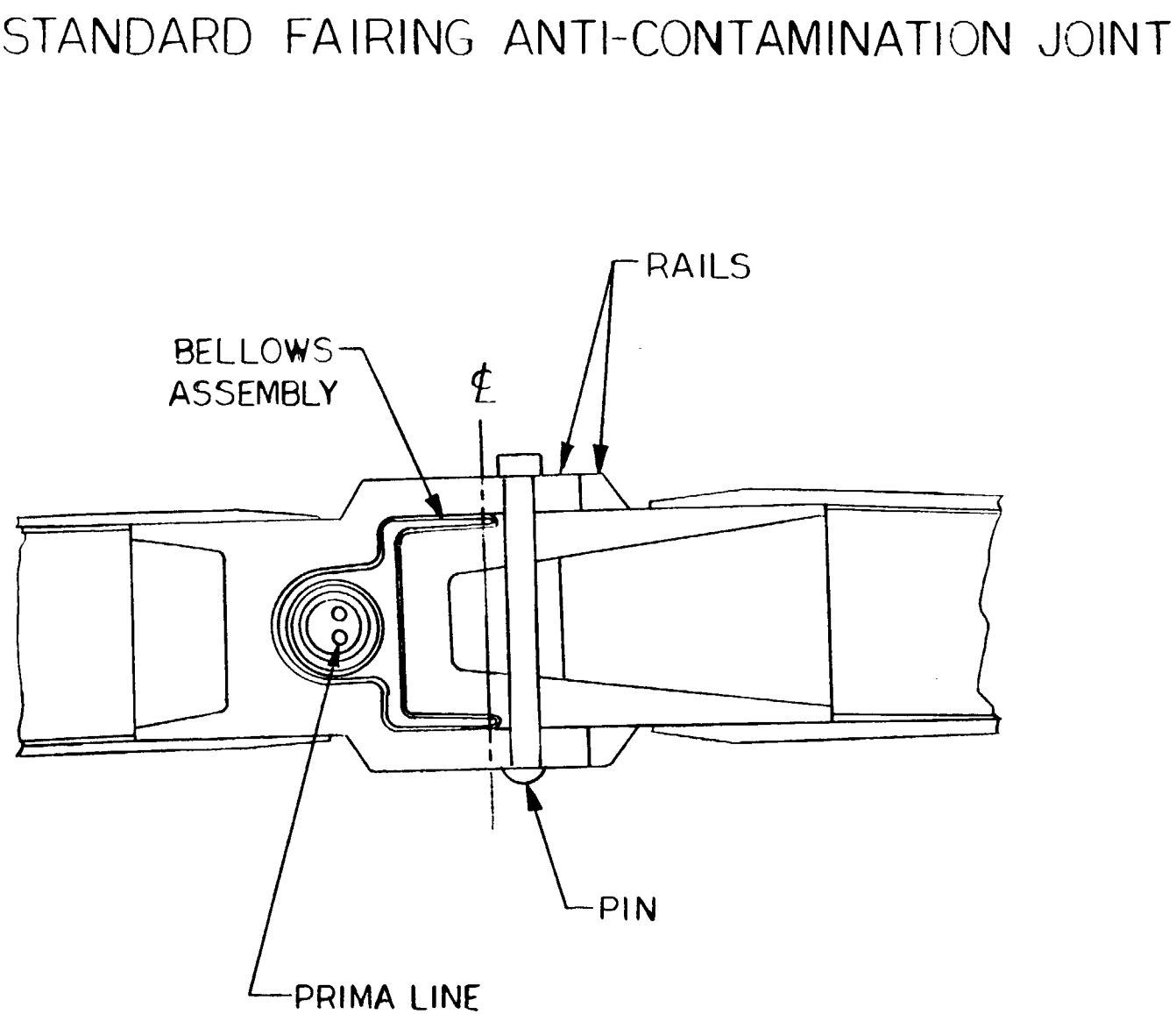


Figure I.B.1-3. Standard Fairing Anti-Contamination Joint

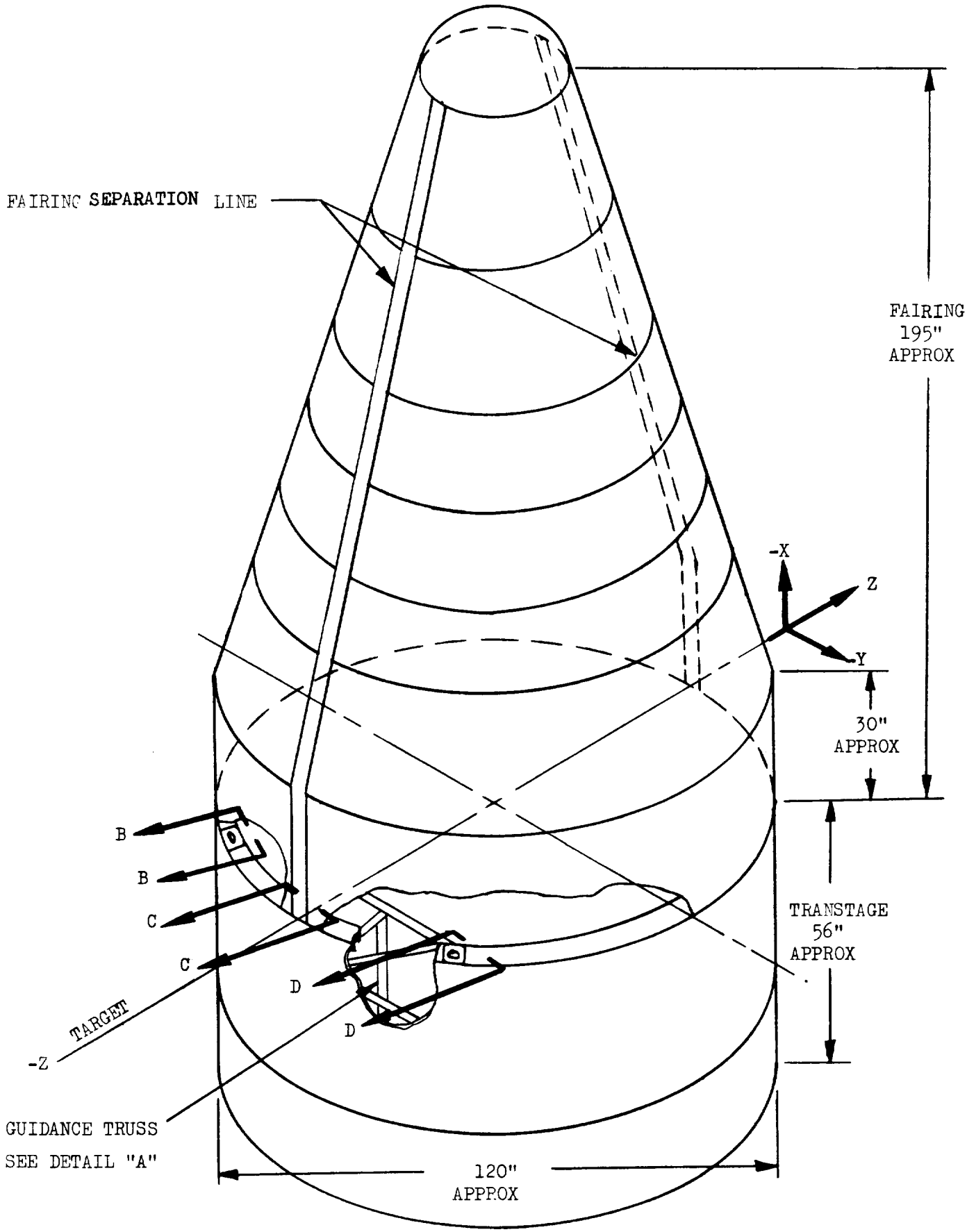


Figure I.B.1-2. Titan III-C Transtage with Standard Payload Fairing

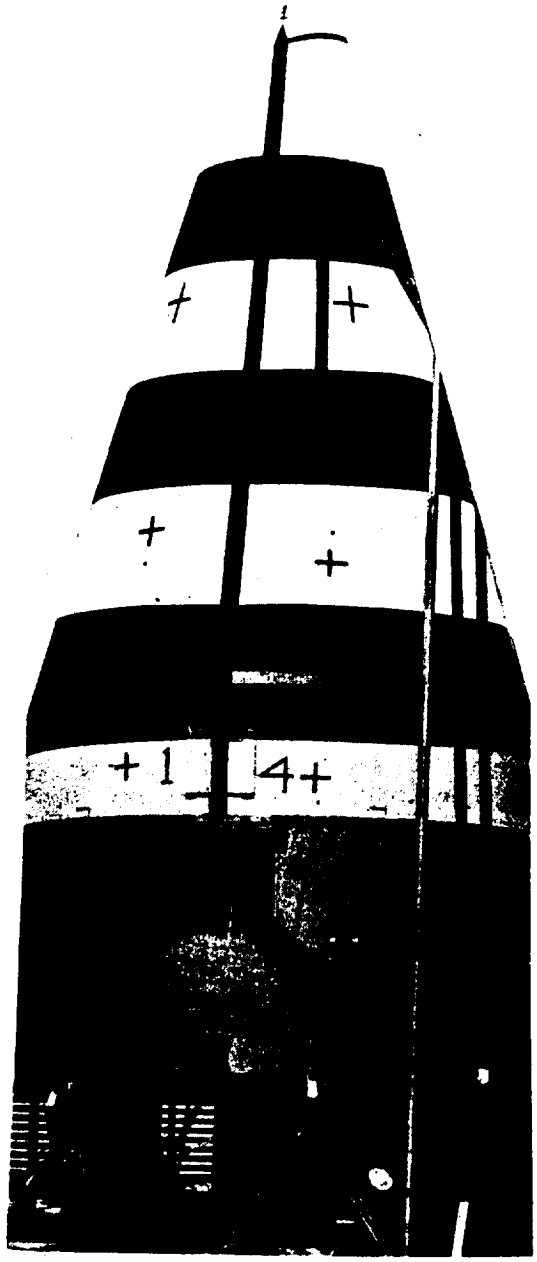


FIGURE I.B.1-1. 624A PAYLOAD FAIRING PRE-TEST CONFIGURATION

TABLE I.B.1-2 (continued)

(DOUGLAS) PAYLOAD FAIRING SEPARATION
TEST MEASUREMENT DESCRIPTIONS

MEASUREMENT NUMBER	LOCATION	SENSITIVE AXIS	FIGURE NUMBER
3A19	On Ring Frame at Target	LONG	I.B.1-14
3A20	Station 77 Under Fair-	RAD	-15
3A21	ing Attach Point	TANG	-15
3A22	Stringer 26C Longeron	LONG	-16
3A23	Station 77 Under Fair-	RAD	-16
3A24	ing Attach Point	TANG	-17
3A25	On Simulated Payload	LONG	-17
3A26	Mounted on Payload Truss	RAD	-18
3A27	Frame (Approx. Sta. 42)		-18

TABLE I.B.1-2

(DOUGLAS) PAYLOAD FAIRING SEPARATION
TEST MEASUREMENT DESCRIPTIONS

MEASUREMENT NUMBER	LOCATION	SENSITIVE AXIS	FIGURE NUMBER
3A1	Stringer 3C on Longeron	LONG	I.B.1-7
3A2	Station 114 at Guidance Truss Attach Point	RAD	-7
3A4	Guidance Truss at Mounting Point of IMU Nearest the Truss Frame Attach	LONG	-8
3A5		VERT	-8
3A6		LAT	-9
3A7	Guidance Truss at Mounting of ACSP Pulse Code Modulator	LONG	-9
3A8		LAT	-10
3A9		VERT	-10
3A10	Guidance Truss at Mounting Point of Airborne Digital Computer	LONG	-11
3A11		LAT	-11
3A13	Guidance Truss at Mounting Point of Adapter Programmer	LONG	-12
3A14		LAT	-12
3A16	Stringer 3C on Longeron Station 77 Under Fairing Attach Point	LONG	-13
3A17		RAD	-13
3A18		TANG	-14

TABLE I.B.1-1

(DOUGLAS) PAYLOAD FAIRING SEPARATION

TEST ANALYSIS DURATION

MEASUREMENT NUMBER	FIRST TEST ANALYSIS TIME PERIOD (ms)*	SECOND TEST ANALYSIS TIME PERIOD (ms)*
3A1	20	20
3A2	20	20
3A4	50	30
3A5	50	30
3A6	50	40
3A7	50	40
3A8	50	40
3A9	50	30
3A10	50	40
3A11	No good	40
3A13	50	50
3A14	50	50
3A16	20	20
3A17	20	20
3A18	20	20
3A19	20	40
3A20	20	50
3A21	20	50
3A22	20	20
3A23	20	30
3A24	20	20
3A25	10	20
3A26	10	20
3A27	10	20

* Time after initiation of separation

COMMENTS (CONT.)

Some of the data presented in this section appear questionable. It appears that a factor of ten error has been made in the annotation of the time history for measurement 3A1. Measurements 3A19, 3A20 and 3A23 exhibit rather poor correlation between the time history and its corresponding shock spectrum. It appears that this lack correlation in measurements 3A19 and 3A23 is a result of the fact that the high levels in the time histories occur at frequencies well above the frequency range for which the shock spectra were determined. However, this explanation cannot apply to measurement 3A20. Finally, much of the data indicates less repeatability than would normally be expected between two identical tests.

DESCRIPTION OF ACCELEROMETERS

Type: Endevco model 2225

Locations: Table I.B.1-2 and Figures I.B.1-4 and I.B.1-5

Axis of sensitivity: Table I.B.1-2

DESCRIPTION OF DATA ACQUISITION SYSTEM

Tape recorders: Ampex ES-100 (0-20,000 Hz frequency response)

Voltage amplifiers: Endevco model 2614A (2-20,000 Hz, ± 3% frequency response)

Power supply: Endevco model 2622

COMMENTS

Since the accelerometers 3A1, 3A2 and 3A16 through 3A24 were mounted on skin-ring-frame structure, the data for these measurements would logically fit in Part I.A while the data for the remaining measurements were taken from a truss structure and belong in Part I.B.

Under "Description of Data" the frequency range of the shock spectra is indicated as 32-5,000 Hz. However, due to the rather low 12,500/second sampling rate, these shock spectra are probably not valid for frequencies above 1250 to 1600 Hz.

Number of shock spectra	48
Type of analysis	digital (absolute response spectra)
Sample rate	12,500/sec
Frequency range	32-5000 Hz
Frequency increments	3 points per octave
Damping	Q = 10

These shock spectra are presented along with their corresponding time histories as Figures I.B.1-7 through I.B.1-18.

DESCRIPTION OF PYROTECHNIC

Type: Primaline linear explosive within a bellows assembly Figure I.B.1-3

Size of charge: Twin strands at 4 grains per foot per strand

Location: Figures I.B.1-1 and I.B.1-2

DESCRIPTION OF STRUCTURE

Transtage skirt: Aluminum sking-ring frame with skin thickness 0.028 inch. See Figure I.B.1-6 for cross-sections of ring-frame and longerons (stringers)

Transtage guidance truss: Aluminum members of square cross-section 1.5 inch outer diameter and 0.0625 inch wall thickness.

SECTION I.B.I

TITAN IIIC DOUGLAS STANDARD PAYLOAD FAIRING SEPARATION TESTS

PURPOSE OF TESTS

The purpose of these two tests was to obtain the shock levels produced in the Titan IIIC transtage by the pyrotechnic separation of the Douglas Standard Payload Fairing.

DESCRIPTION OF EVENT

In both tests the Douglas Standard Payload Fairing was mounted over a dummy payload atop a Titan IIIC transtage in the vertical orientation as illustrated in Figures I.B.1-1 and I.B.1-2. The fairing was then separated into two longitudinal segments by means of twin strands of primaline at four grains per foot housed within a bellows assembly. The expanding bellows then caused the rivets in the separation joint to shear, and continued expansion of the bellows forced the fairing halves to drop away from the instrumented transtage where the data were recorded.

DESCRIPTION OF DATA

Twenty-four accelerometers were monitered during each test. Shock spectra are presented for both tests, but only the time histories for the first test are presented. Information regarding these data are tabulated below:

Number of time histories	24
Duration	Table I.B.1-1

TABLE OF CONTENTS

PART I.B
Truss Structures

SECTION	TITLE	PYROTECHNIC DEVICE	NUMBER OF SHOCK SPECTRA	Page No.
I.B.1	Titan III-C Standard Payload Fairing Separation Tests	Primaline	48	443
I.B.2	Titan III-C Metal Fairing Separation Test	Primaline	48	468
I.B.3	Titan III-C Universal Payload Fairing Separation Tests	Primaline	144	494
	Location of Additional Data			557
	Location of Related Lockheed Data			558

PART I.B

PYROTECHNIC SHOCK DATA COMPILED FOR STRUCTURE CUTTING CHARGES FOR PROPAGATION IN A TRUSS STRUCTURE

LOCATION OF RELATED LOCKHEED DATA

Additional pyrotechnic shock data compiled for structure cutting charges with propagation in a skin-ring-frame structure may be found in the following sections of the Lockheed data compilation:

II.A.3
II.A.4
II.A.6
II.E.1
II.E.2
II.E.3
II.E.4
II.E.5
II.F.2

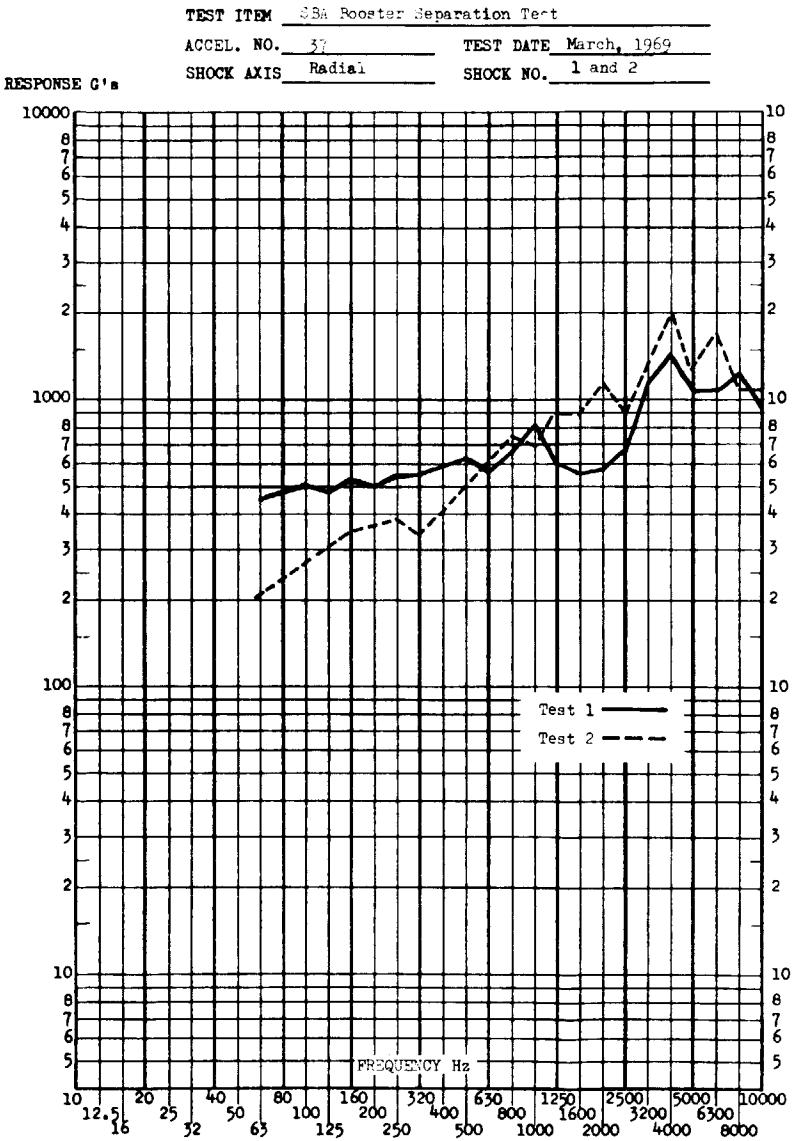
LOCATION OF ADDITIONAL DATA

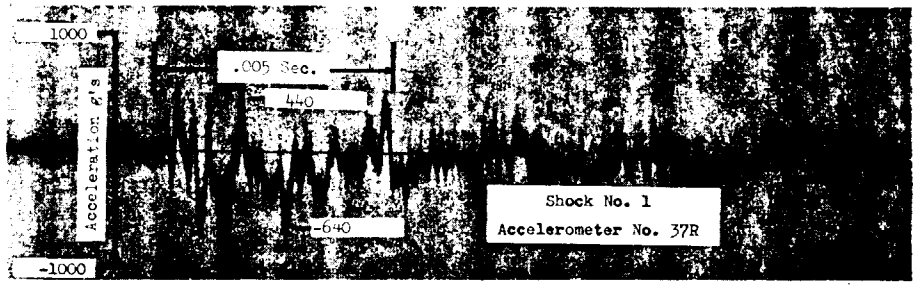
Additional pryotechnic shock data compiled for structure cutting charges for propagation in a skin-ring-frame structure may be found in the following sections of this data volume:

I.B.1 Figures 7, 13 through 17

I.B.2 Figures 6, 12 through 16

I.B.3 Figures 34, 35, 46 through 57.





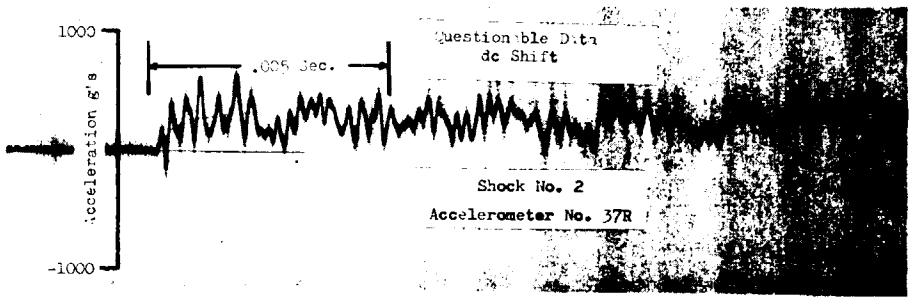
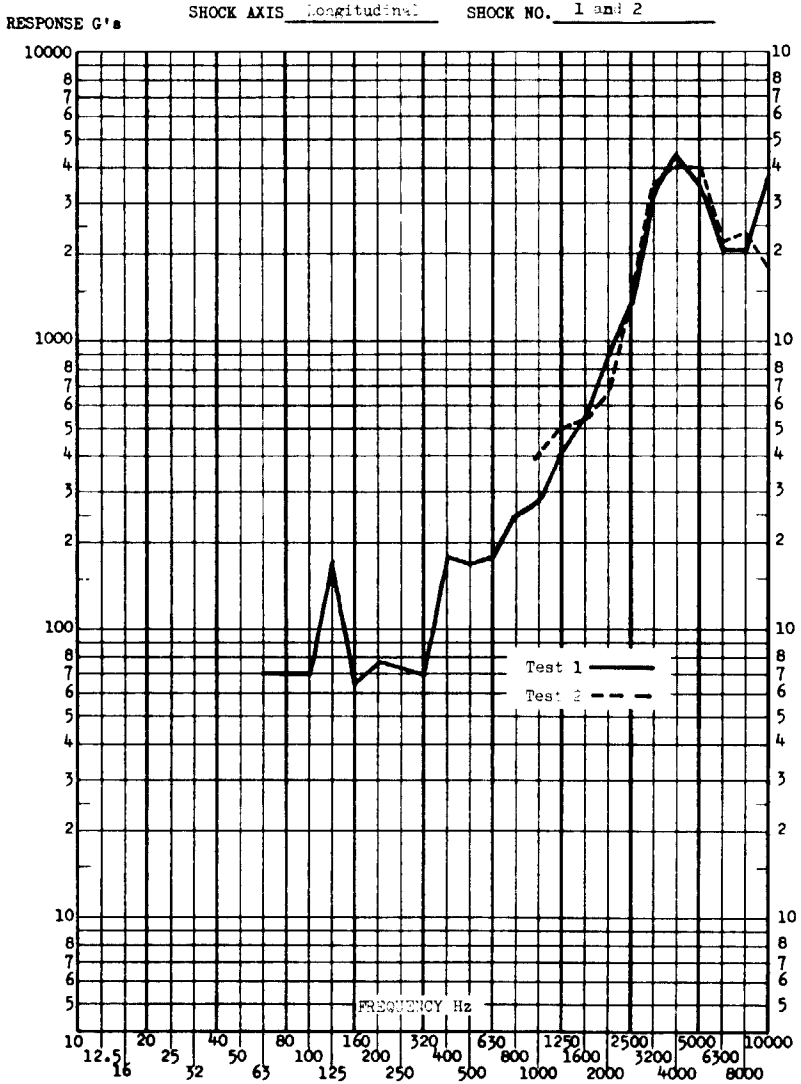


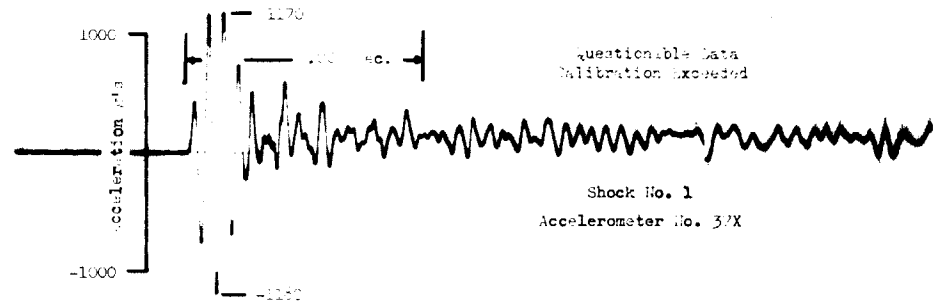
FIGURE I.A.7-11

TEST ITEM [illegible] Booster Separation Test

ACCEL. NO. 37 TEST DATE March, 1962

SHOCK AXIS Longitudinal SHOCK NO. 1 and 2





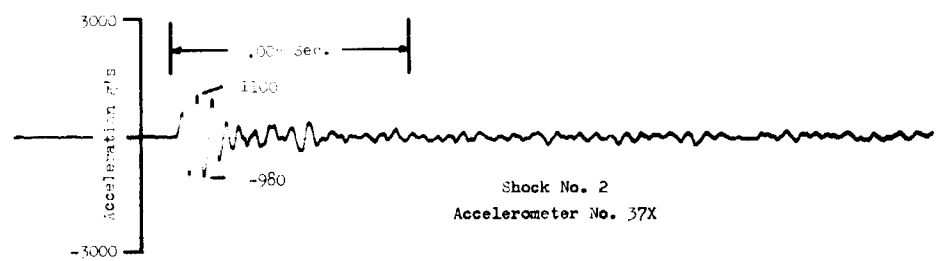
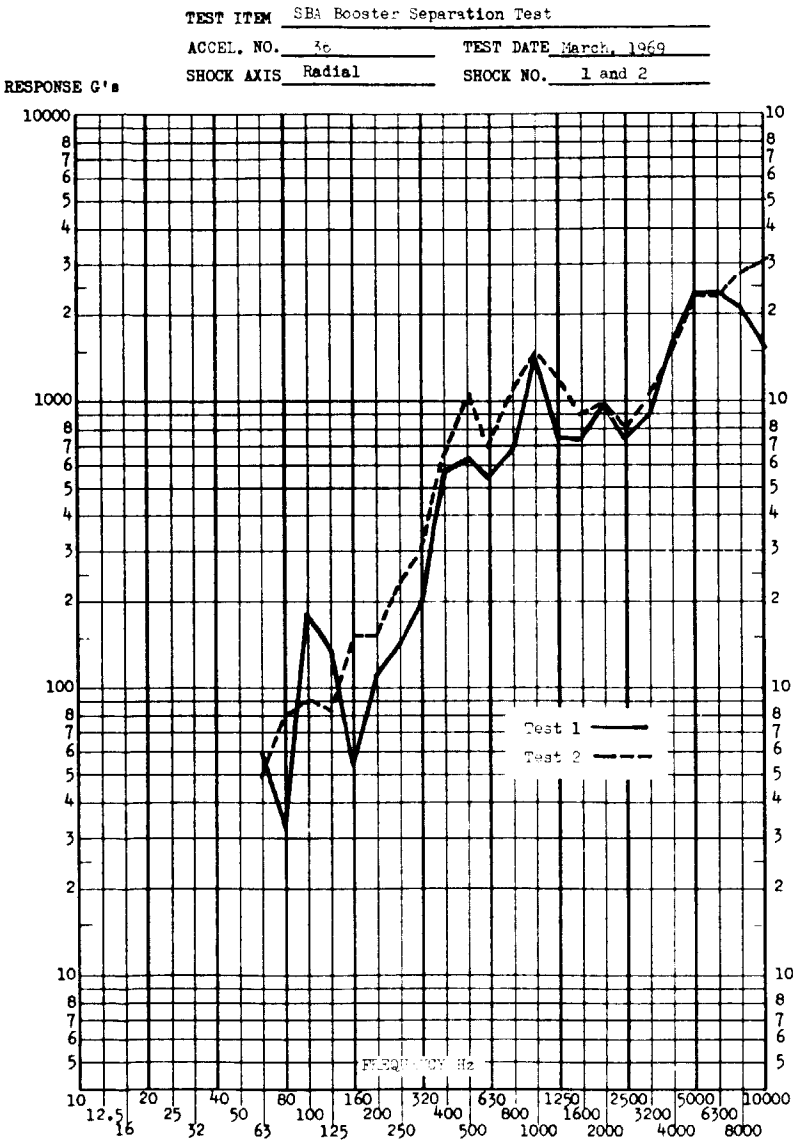
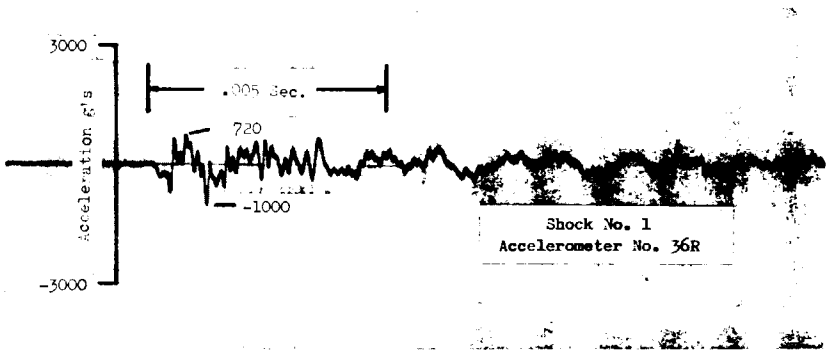


FIGURE I.A.7-10


TEST ITEM SBA Booster Separation Test
ACCEL. NO. 36
TEST DATE March, 1969
SHOCK AXIS Radial
SHOCK NO. 1 and 2
RESPONSE G's
Test 1
Test 2
FREQUENCY Hz


3000
-3000
Acceleration g's
.005 Sec.
720
-1000
Shock No. 1
Accelerometer No. 36R

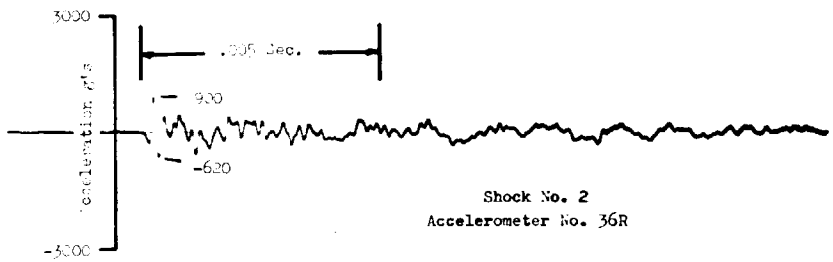

3000
-3000
.005 Sec.
900
-620
Shock No. 2
Accelerometer No. 36R

FIGURE I.A.7-9

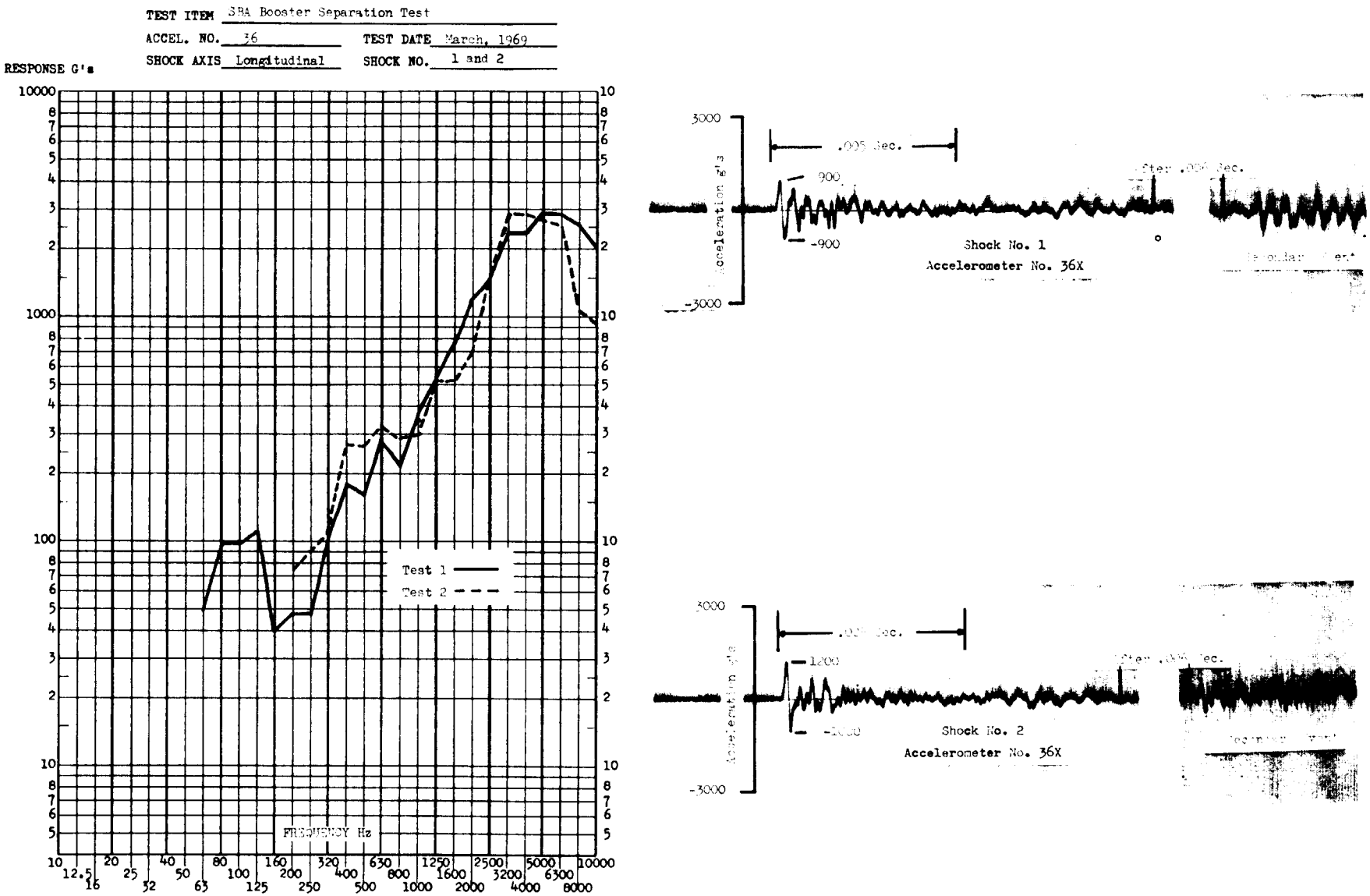
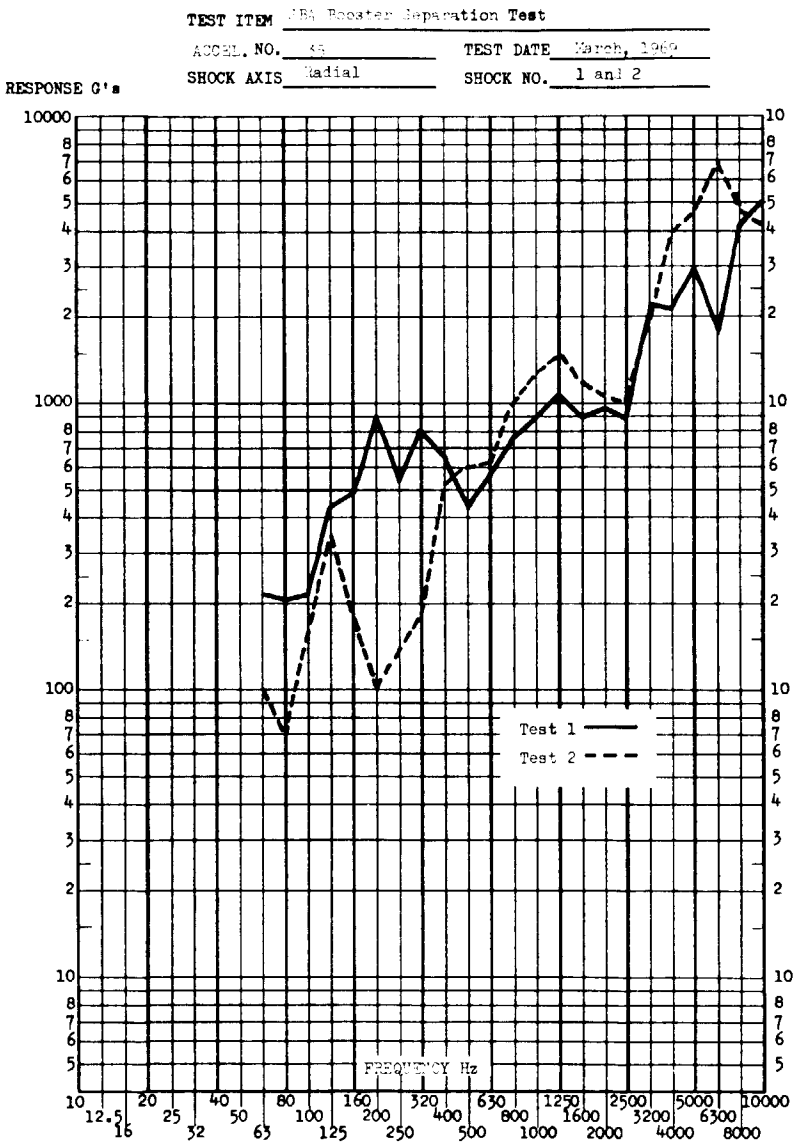
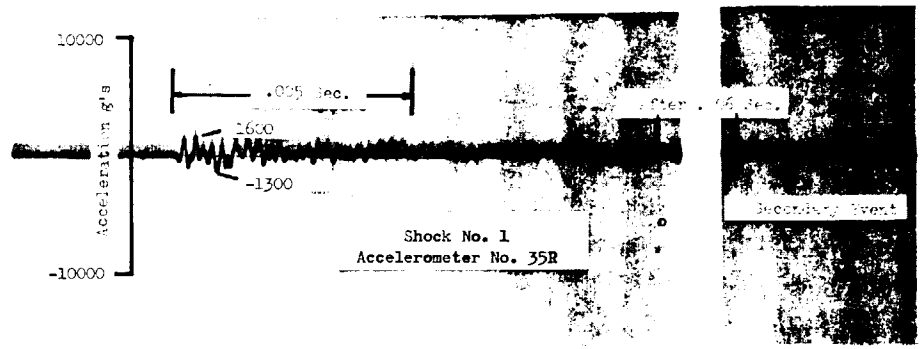

TEST ITEM SBA Booster Separation Test
ACCEL. NO. 36
TEST DATE March, 1969
SHOCK AXIS Longitudinal
SHOCK NO. 1 and 2
RESPONSE G's
Test 1
Test 2
FREQUENCY Hz
Shock No. 1
Accelerometer No. 36X
Shock No. 2
Accelerometer No. 36X

FIGURE I.A.7-8


TEST ITEM LBA Booster Separation Test
ACCEL. NO. 35
TEST DATE March, 1969
SHOCK AXIS Radial
SHOCK NO. 1 and 2
RESPONSE G's
10000
1000
100
10
Test 1
Test 2
FREQUENCY Hz
10 12.5 16 20 25 32 40 50 63 80 100 125 160 200 250 320 400 500 630 800 1000 1250 1600 2000 2500 3200 4000 5000 6300 8000 10000


10000
-10000
Acceleration g's
.005 Sec.
1600
-1300
Shock No. 1
Accelerometer No. 35R

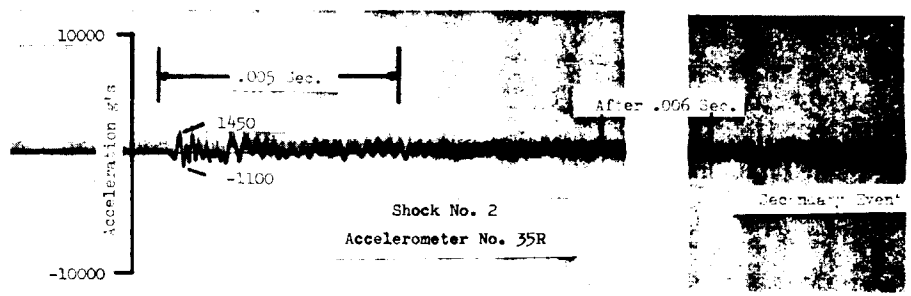
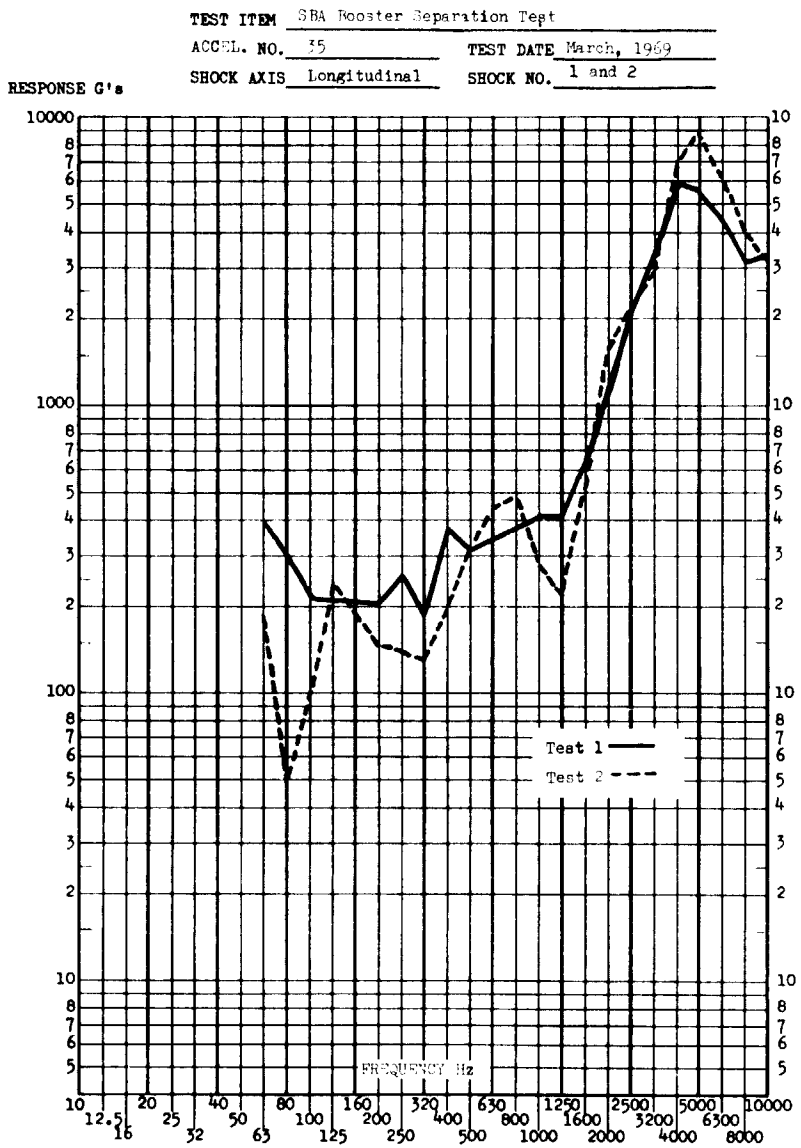
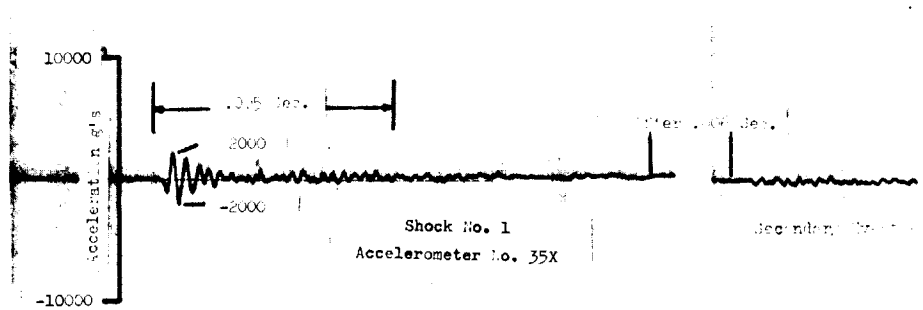

10000
-10000
Acceleration g's
.005 Sec.
1450
-1100
After .006 Sec.
Shock No. 2
Accelerometer No. 35R

FIGURE I.A.7-7


TEST ITEM SBA Booster Separation Test
ACCEL. NO. 35
TEST DATE March, 1969
SHOCK AXIS Longitudinal
SHOCK NO. 1 and 2
RESPONSE G's
10000
1000
100
10
Test 1
Test 2
FREQUENCY Hz
10
12.5
16
20
25
32
40
50
63
80
100
125
160
200
250
320
400
500
630
800
1000
1250
1600
2000
2500
3200
4000
5000
6300
8000
10000


10000
-10000
2000
-2000
Shock No. 1
Accelerometer No. 35X

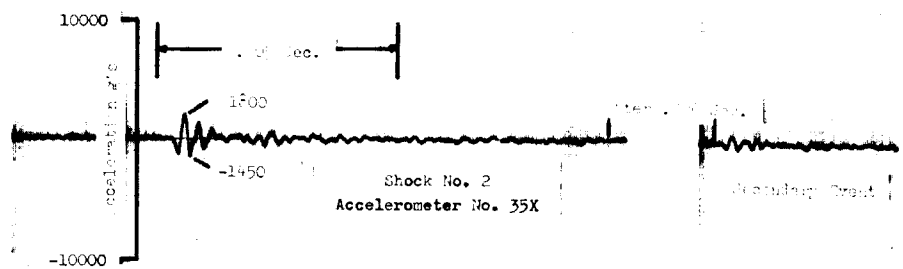
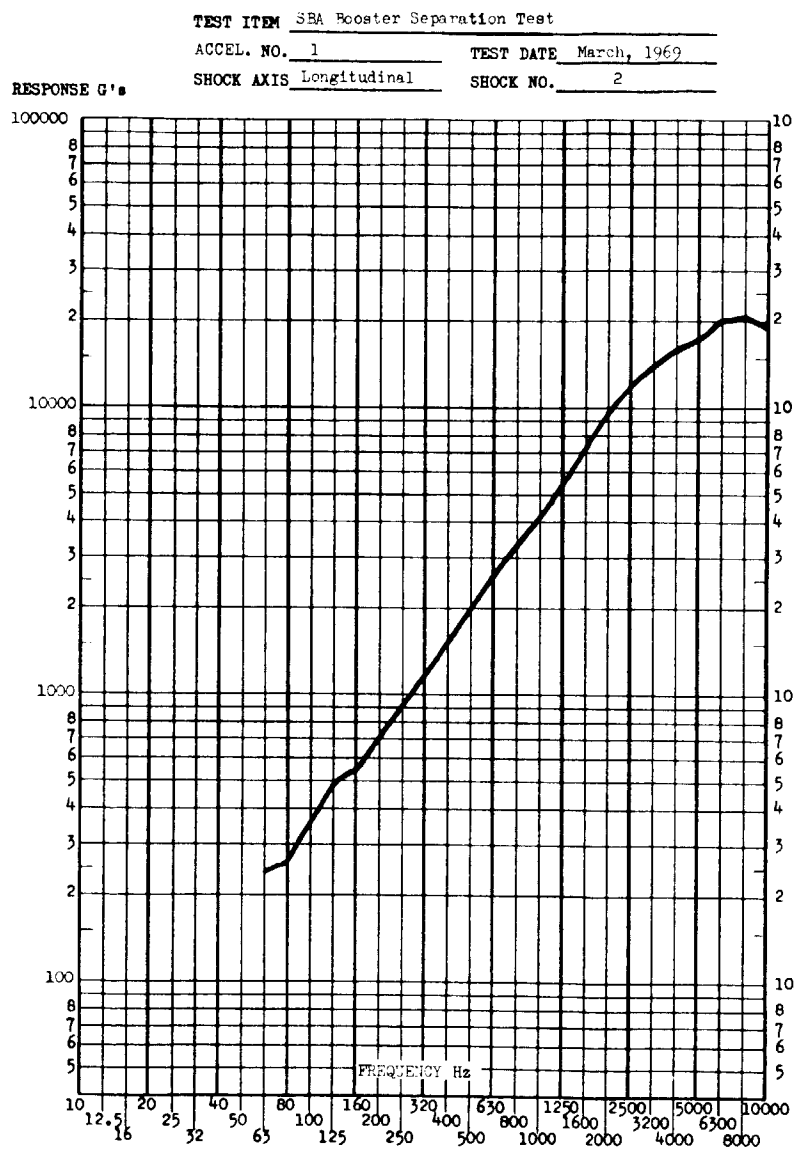

10000
-10000
1450
-1450
Shock No. 2
Accelerometer No. 35X

FIGURE I.A.7-6


TEST ITEM SBA Booster Separation Test
ACCEL. NO. 1
TEST DATE March, 1969
SHOCK AXIS Longitudinal
SHOCK NO. 2
RESPONSE G's
100000
10000
1000
100
10
FREQUENCY Hz
10 12.5 16 20 25 32 40 50 63 80 100 125 160 200 250 320 400 500 630 800 1000 1250 1600 2000 2500 3200 4000 5000 6300 8000 10000

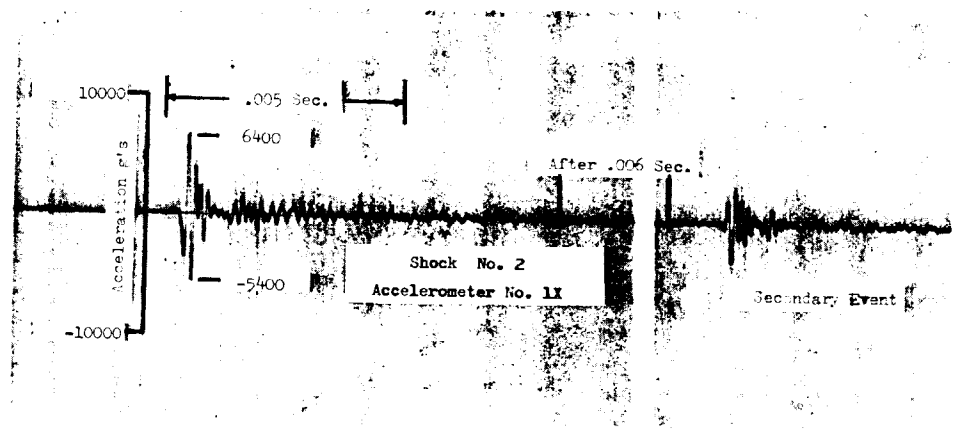

10000
.005 Sec.
6400
Acceleration g's
After .006 Sec.
Shock No. 2
Accelerometer No. 1X
-5400
-10000
Secondary Event

FIGURE 1.A.7-5

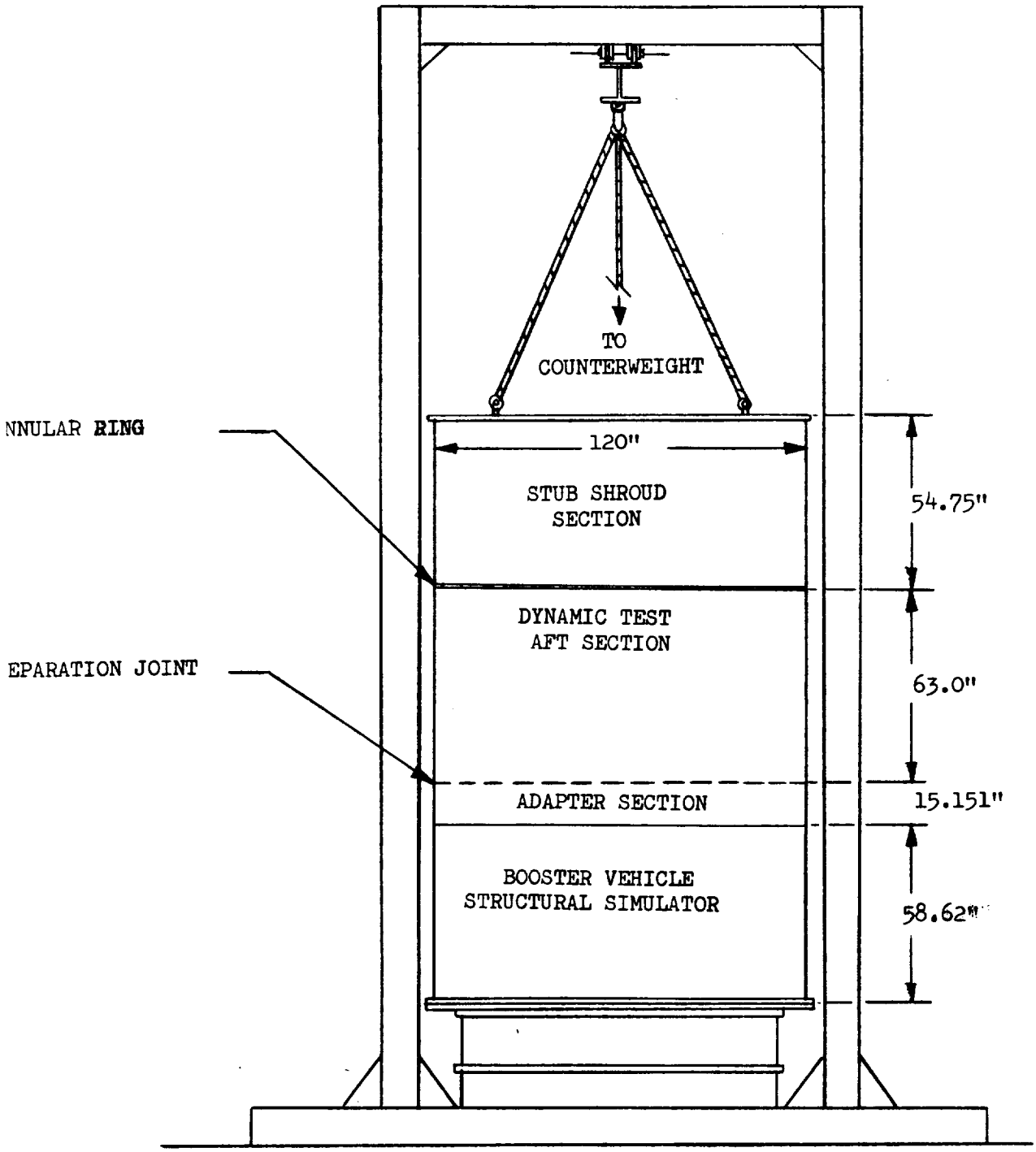


FIGURE I.A.7-4. TEST SET-UP

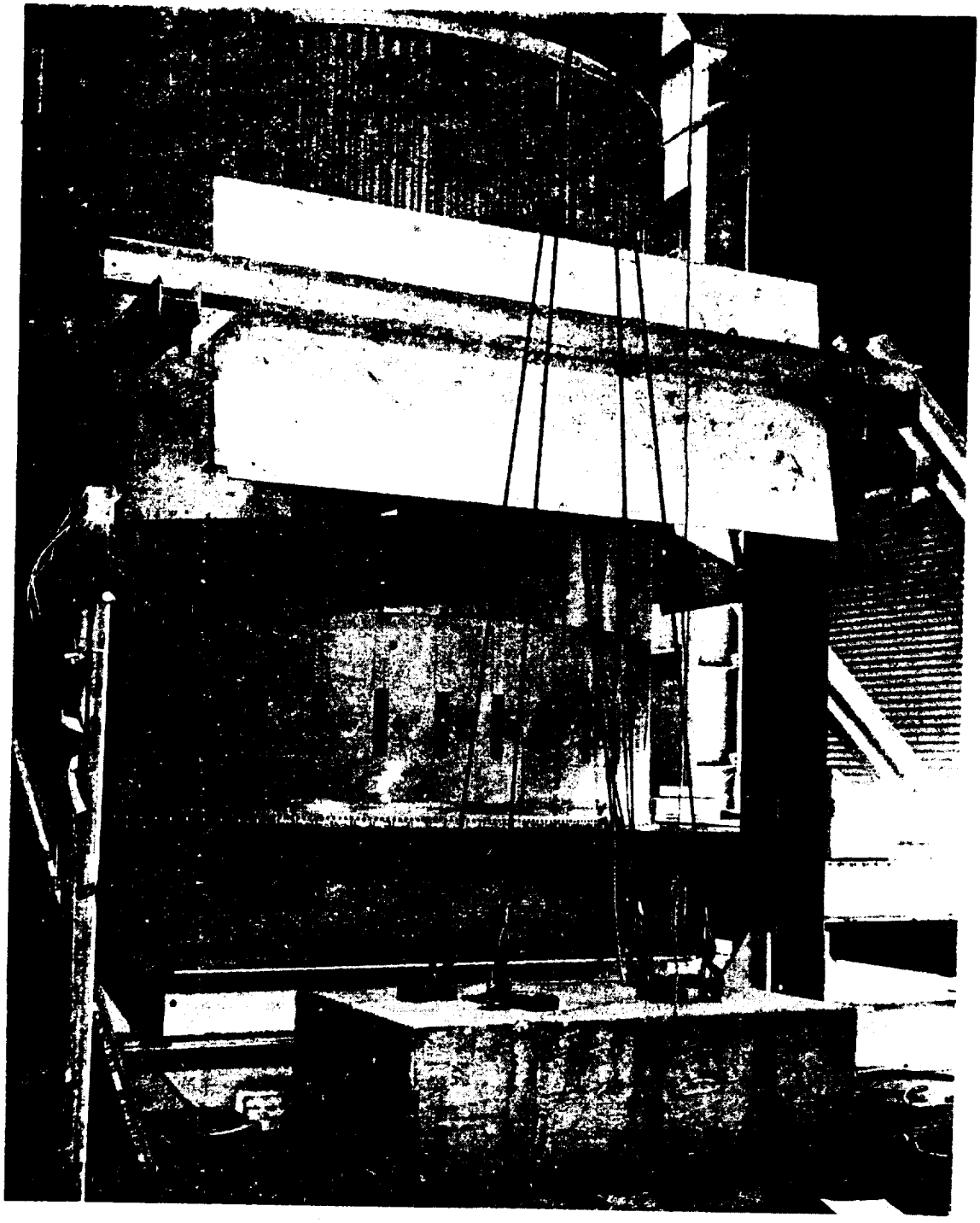


FIGURE 1.A.7-3. COUNTER WEIGHT WITH TEST SPECIMEN IN BACKGROUND

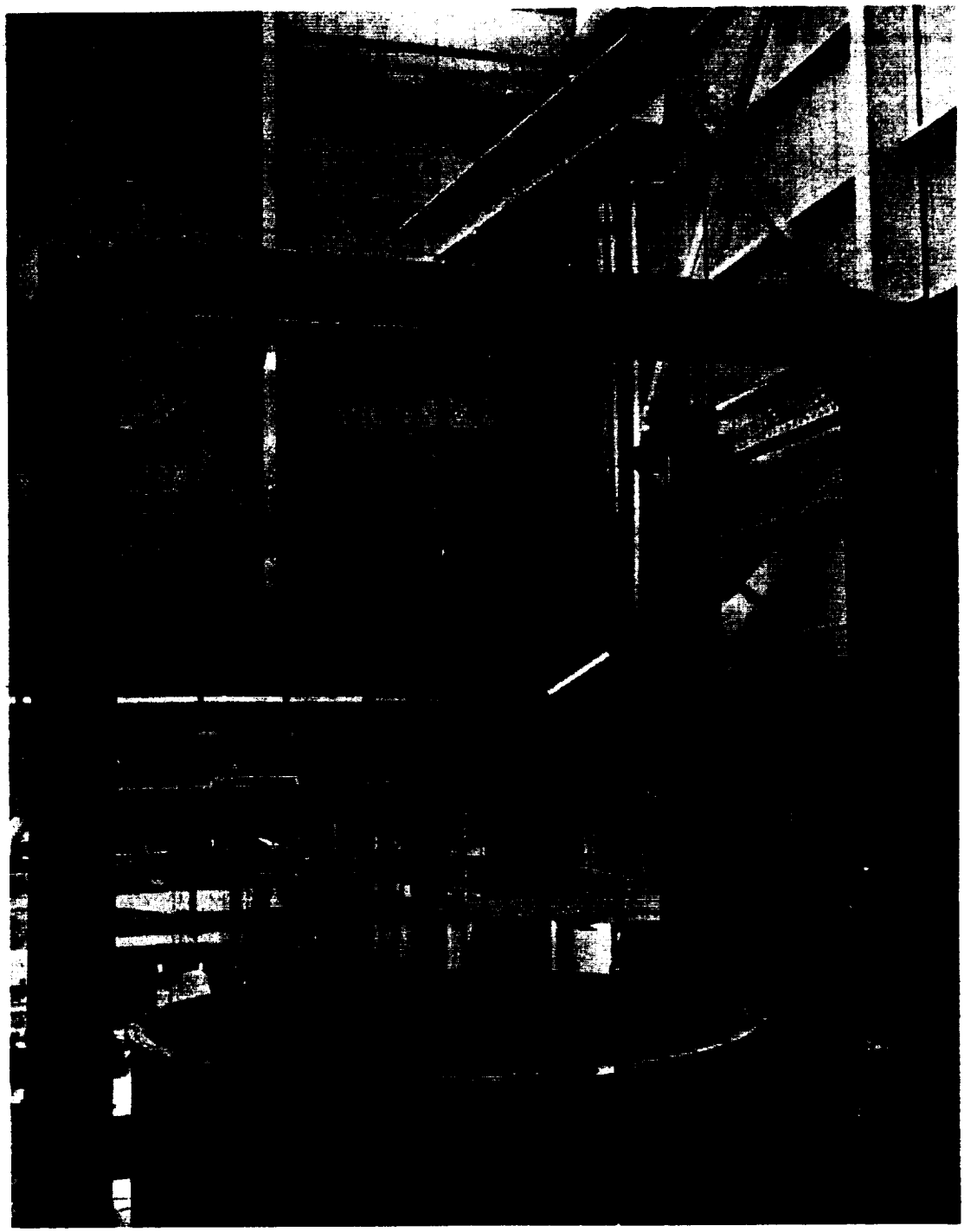


FIGURE I.A.7-2. LEVER SUSPENSION SYSTEM

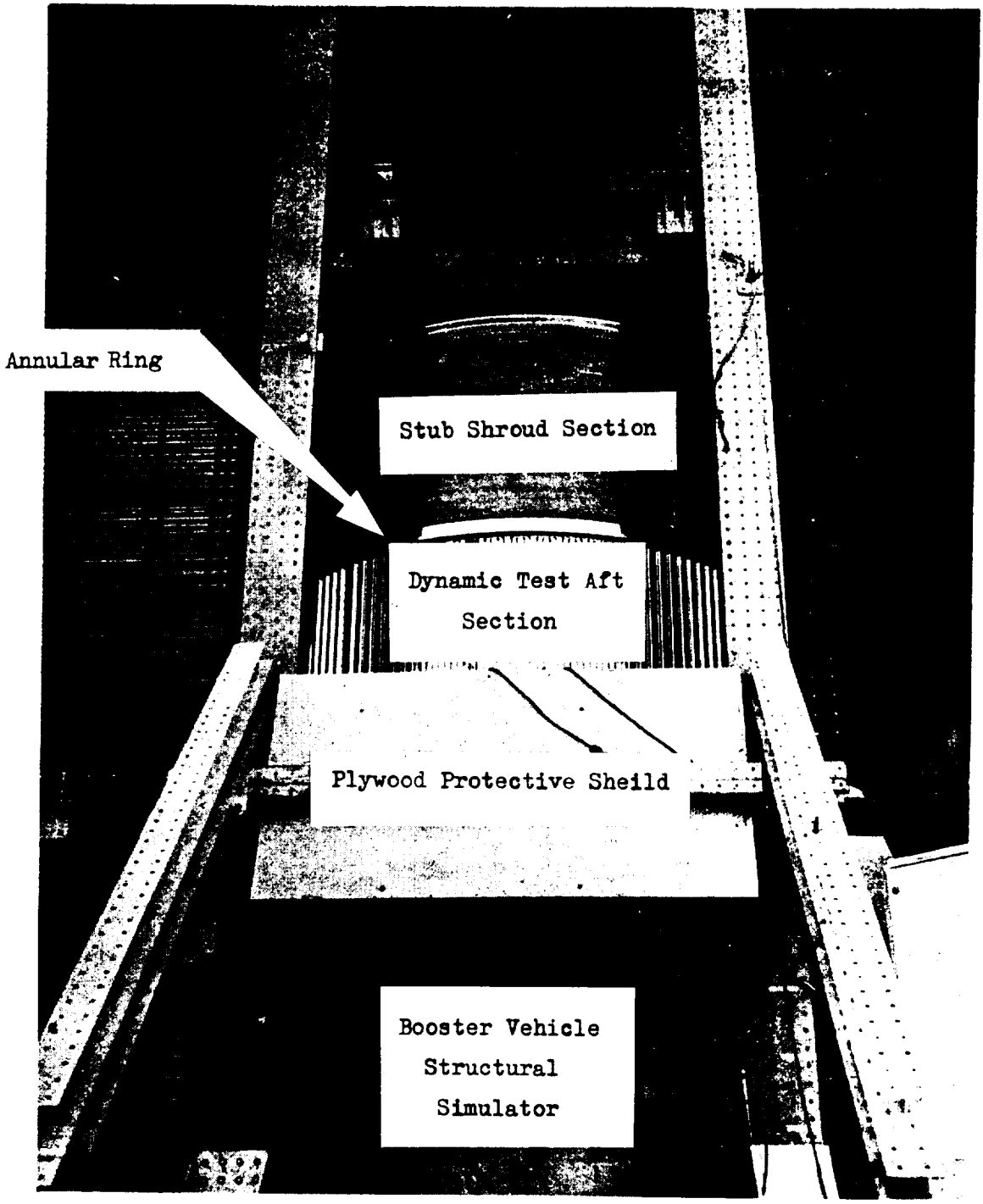


FIGURE I.A.7-1. TEST CONFIGURATION PRIOR TO SEPARATION

TABLE I.A.7-1

DESCRIPTION OF ACCELEROMETERS

Measurement Number	Accelerometer Locations	Model of Endevco Accelero-meter	Sensitive Axis	Figure Number
1X	On skin 5 inches above sep. plane	2225	longitudinal	I.A.7-5
35X	On stringer 15 inches below sep. plane	2225	longitudinal	I.A.7-6
35R	On stringer 15, inches below sep. plane	2225	radial	I.A.7-7
36X	On stringer 24 inches below sep. plane	2225	longitudinal	I.A.7-8
36R	On stringer 24 inches below sep. plane	2225	radial	I.A.7-9
37X	On stringer 52 inches below sep. plane	2220	longitudinal	I.A.7-10
37R	On stringer 52 inches below sep. plane	2220	radial	I.A.7-11

COMMENTS (CONT.)

by roughly thirteen milliseconds. The source of the secondary event is not known. It may be the result of a reflected shock wave or an extraneous shock induced by the action of the suspension system. In any event the shock spectra presented are based on the entire time history including both events.

Frequency range	63-10,000 Hz
Frequency increments	3 points per octave
Damping	Q = 10

These shock spectra are presented with their corresponding time histories as Figures I.A.7-5 through I.A.7-11.

DESCRIPTION OF PYROTECHNIC

Type: MDF in beryllium separation joint

Size of charge: 2 ½ grains per foot

Location: Figure I.A.7-4

DESCRIPTION OF STRUCTURE

Figures I.A.7-1 through I.A.7-4

DESCRIPTION OF ACCELEROMETERS

Type: Table I.A.7-1

Locations: Table I.A.7-1

Axis of sensitivity: Table I.A.7-1

DESCRIPTION OF DATA ACQUISITION SYSTEM

Tape recorder: CEC model 5119-P4

Amplifiers: Dynamic Instruments 7514 B

Power supply: Trygon

Galvanometers: CEC models 7-323, 7-326 and 7-361

COMMENTS

Notice that some of the time histories presented in this section show two events separated

SECTION I.A.7

SBA (SATELLITE BASIC ASSEMBLY) BOOSTER SEPARATION TESTS

PURPOSE OF TESTS

The SBA Booster Separation Tests were conducted to obtain shock and contamination data for evaluation of separation system performance.

DESCRIPTION OF EVENT

The test specimen consisted of a Booster Vehicle Structural Simulator, a Dynamic Test Aft Section, a Stub Shroud Section, and an Annular Ring. This test structure was mounted vertically on a test stand. A "lever" type suspension system, with a counterweight, was used to support the separated section following the firing of the circumferential MDF separation joint. The test specimen, the suspension system, and the counterweight are illustrated in Figures I.A.7-1 through I.A.7-4. Data from two tests are presented.

DESCRIPTION OF DATA

No. of time histories	13
No. of shock spectra	13
Type of analysis	analog (absolute response spectra)
Analog system	Ling SSA-100

TEST ITEM Centaur Panel Separation

ACCEL. NO. 33 TEST DATE April 1966

SHOCK AXIS Z SHOCK NO. 3

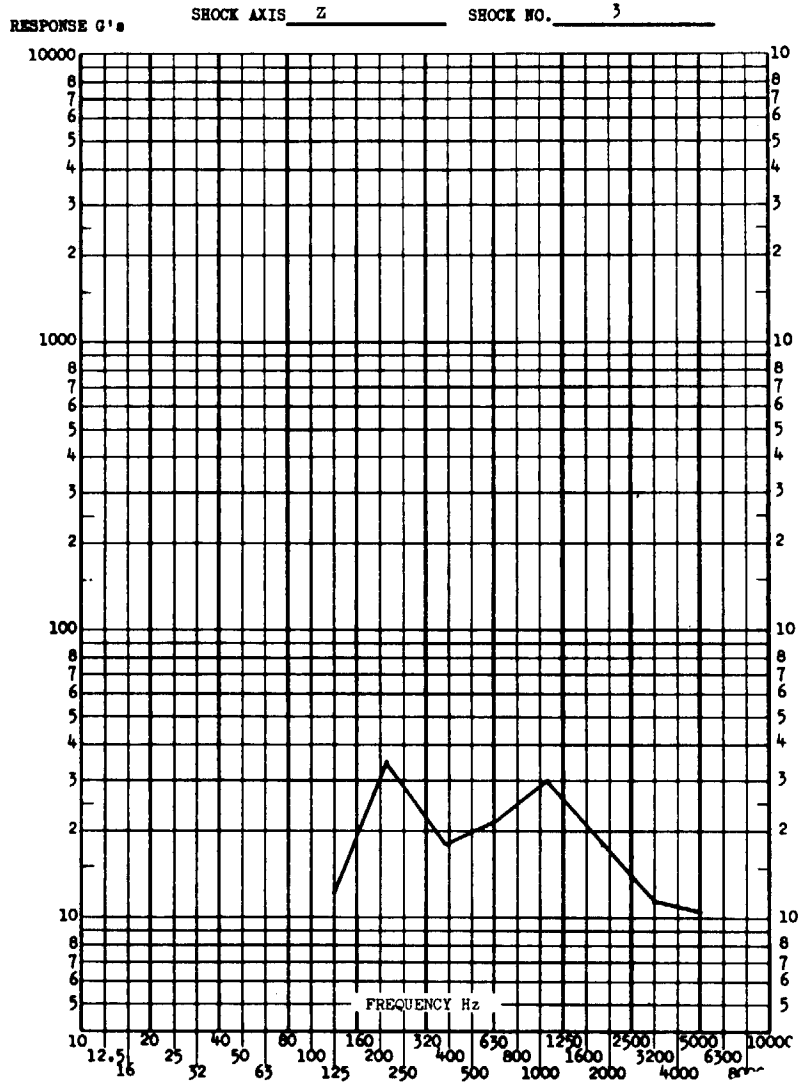
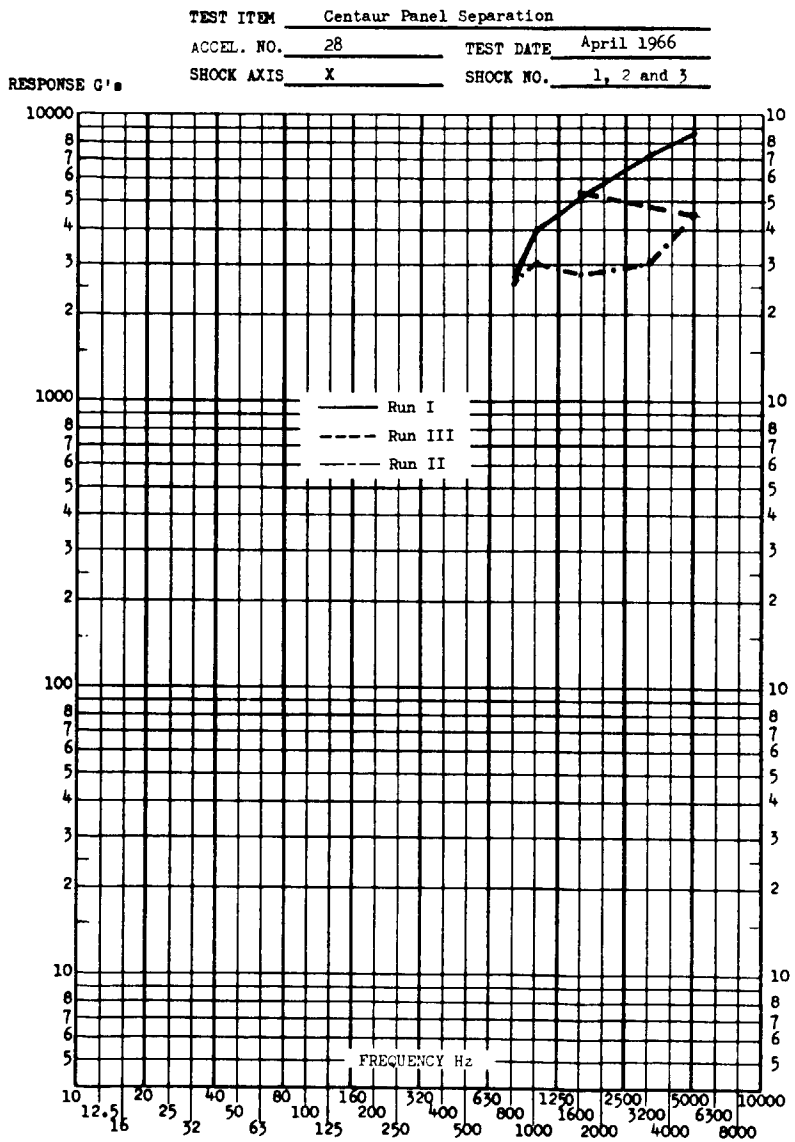


FIGURE I.A.6-16



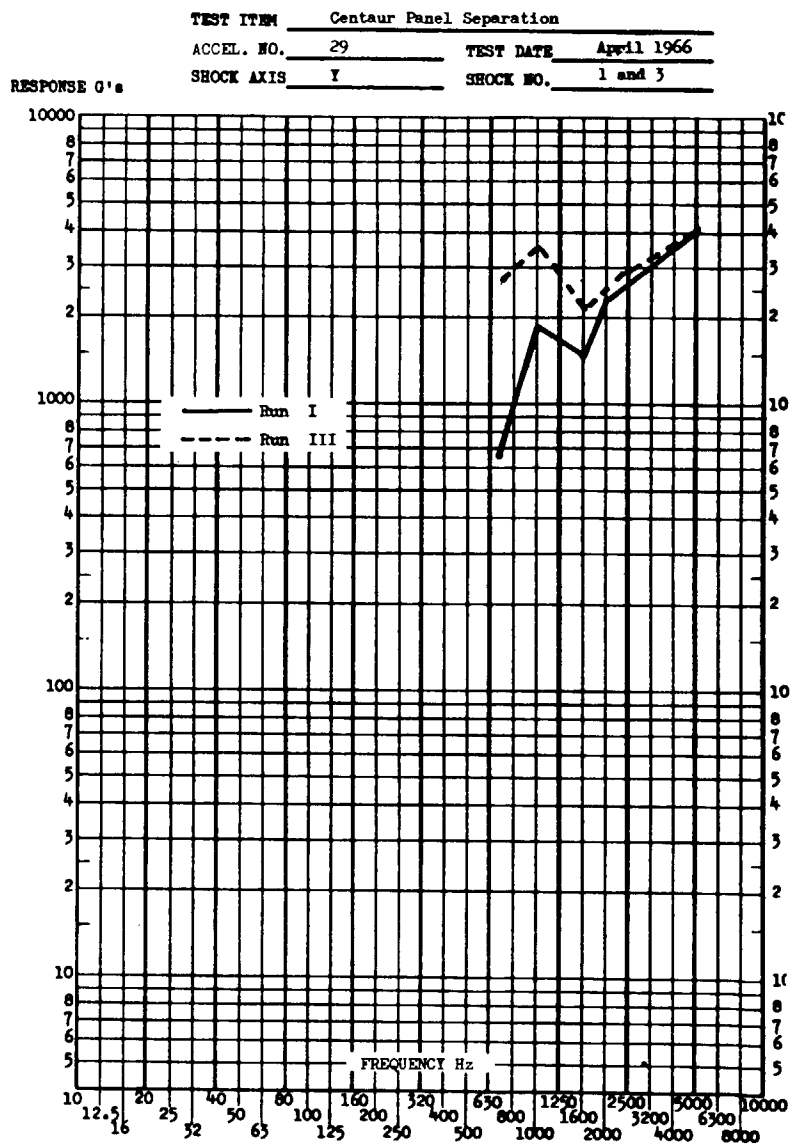
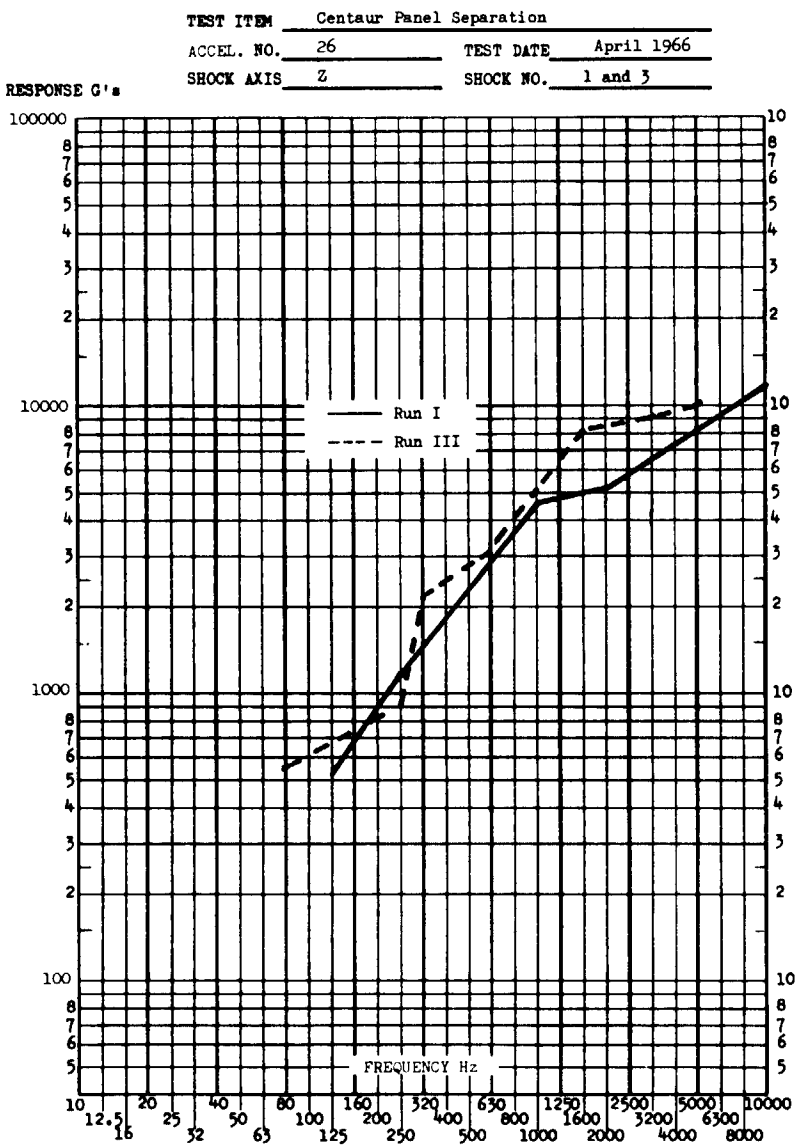


FIGURE I.A.6-15



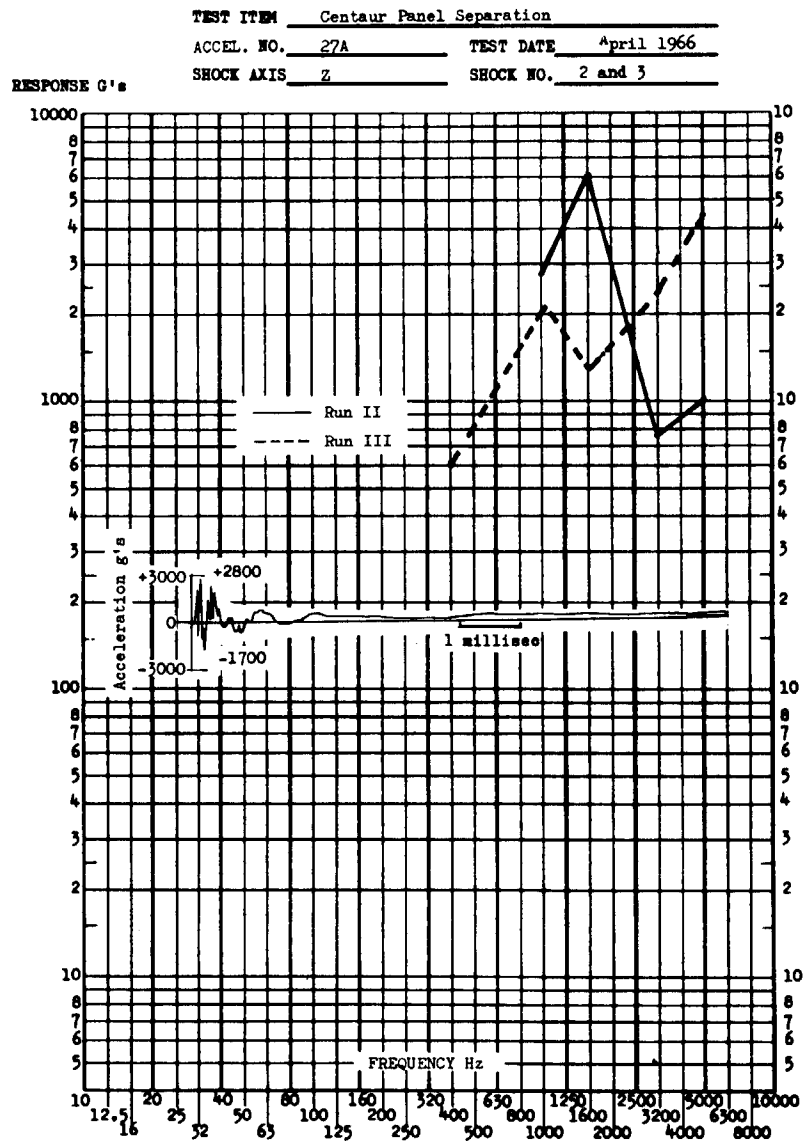


FIGURE I.A.6-14

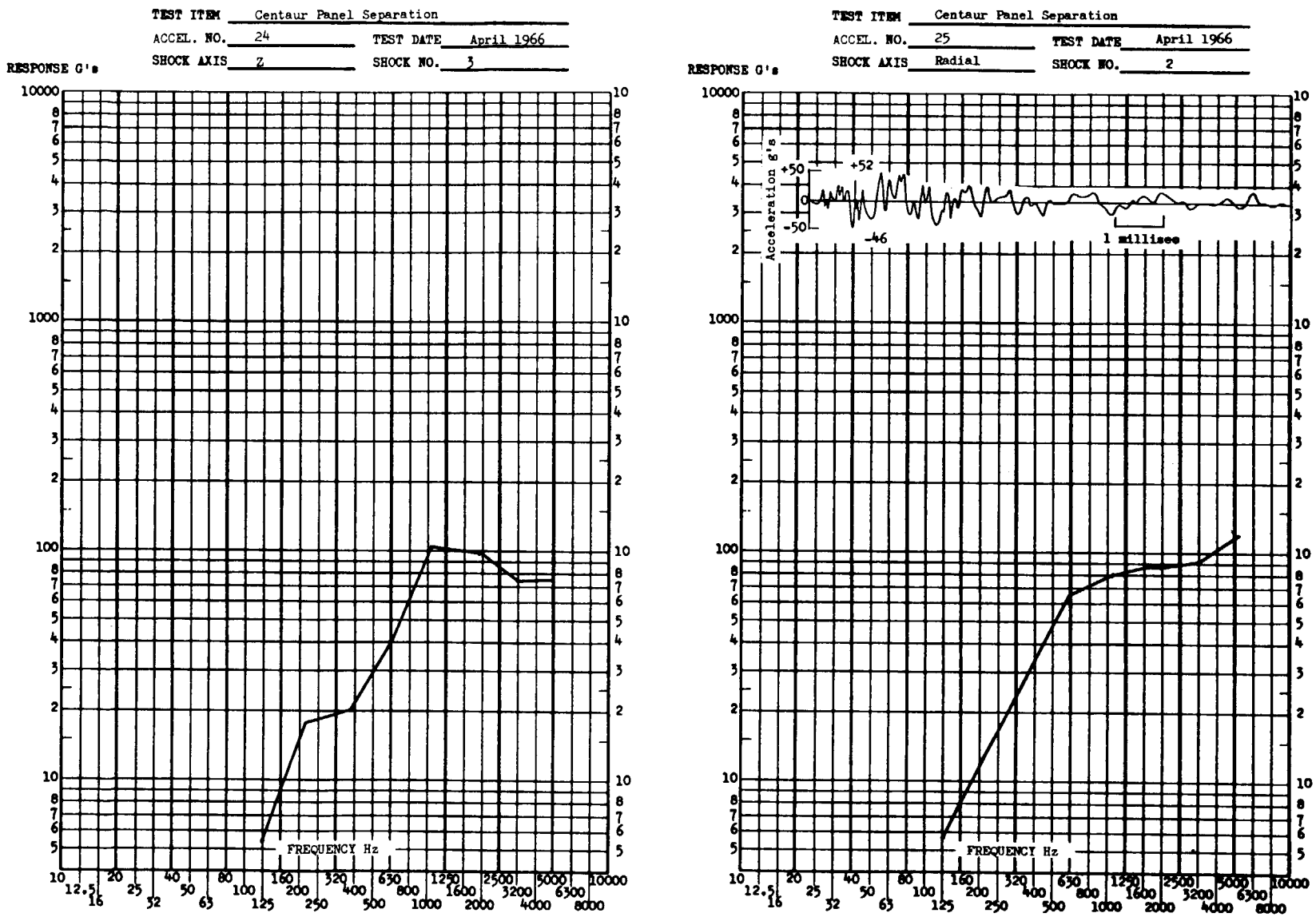
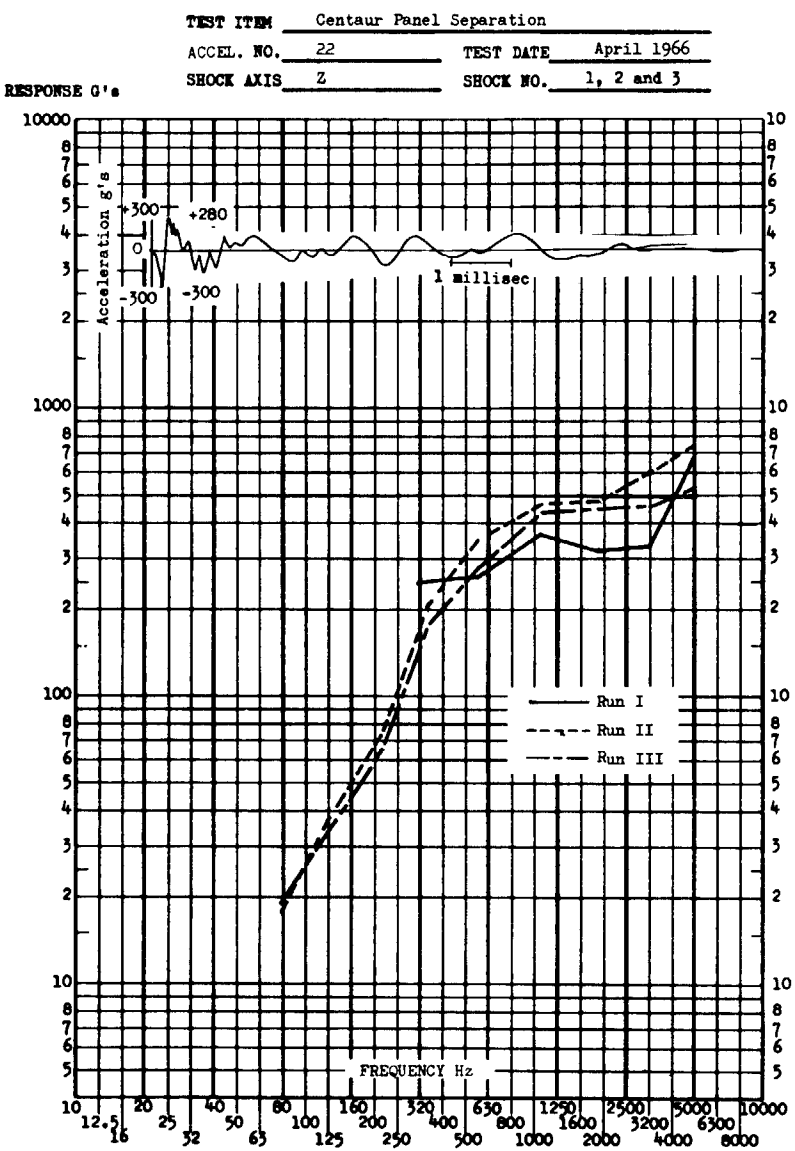


FIGURE I.A.6-13



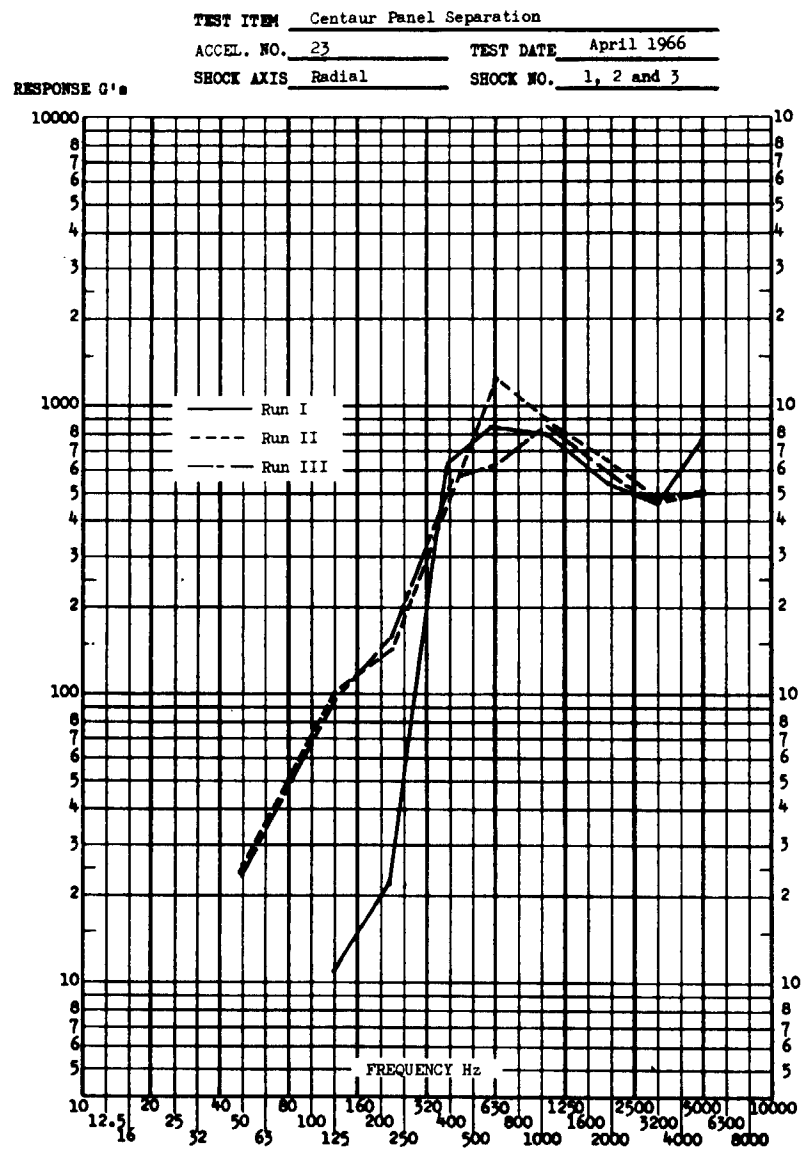
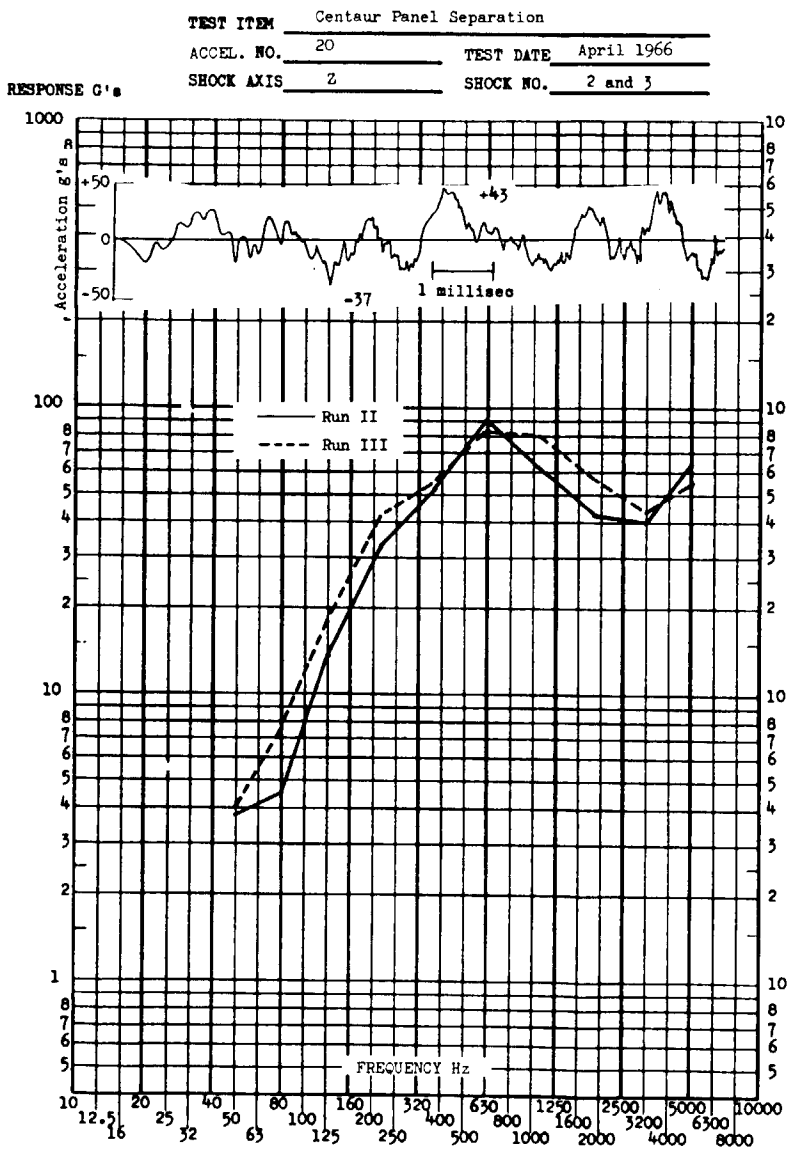


FIGURE I.A.6-12



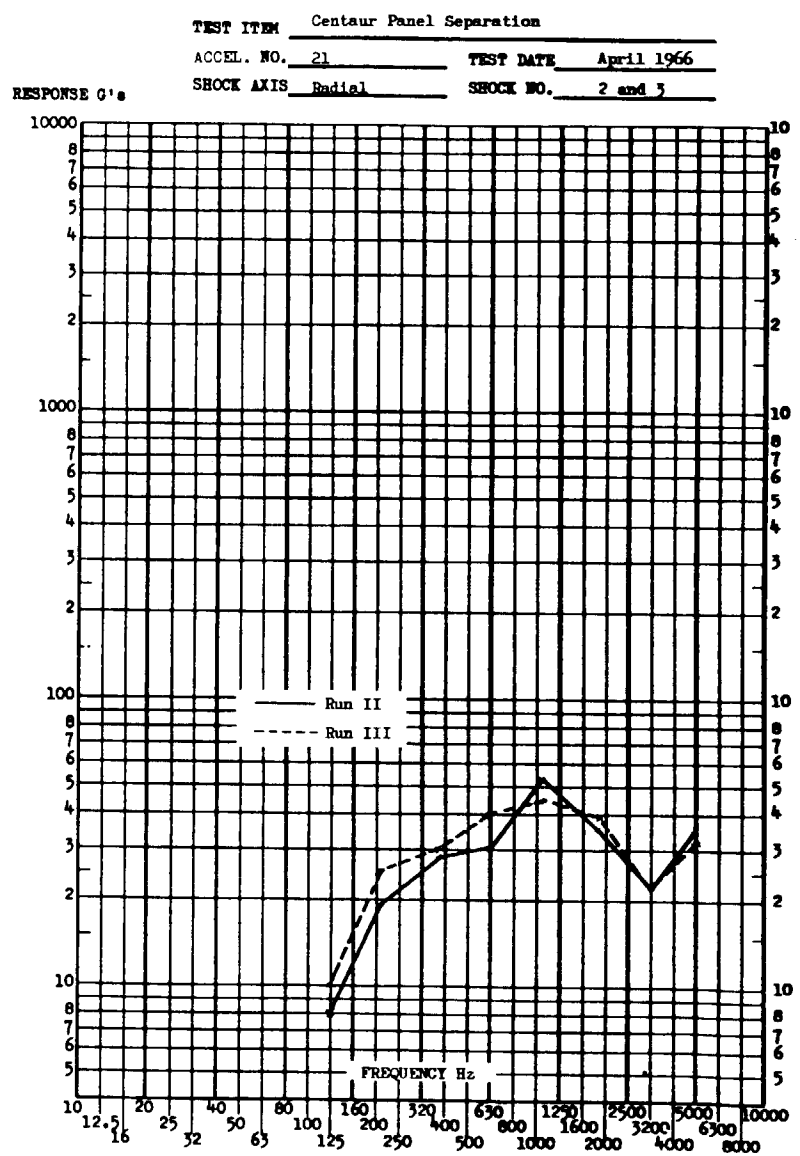
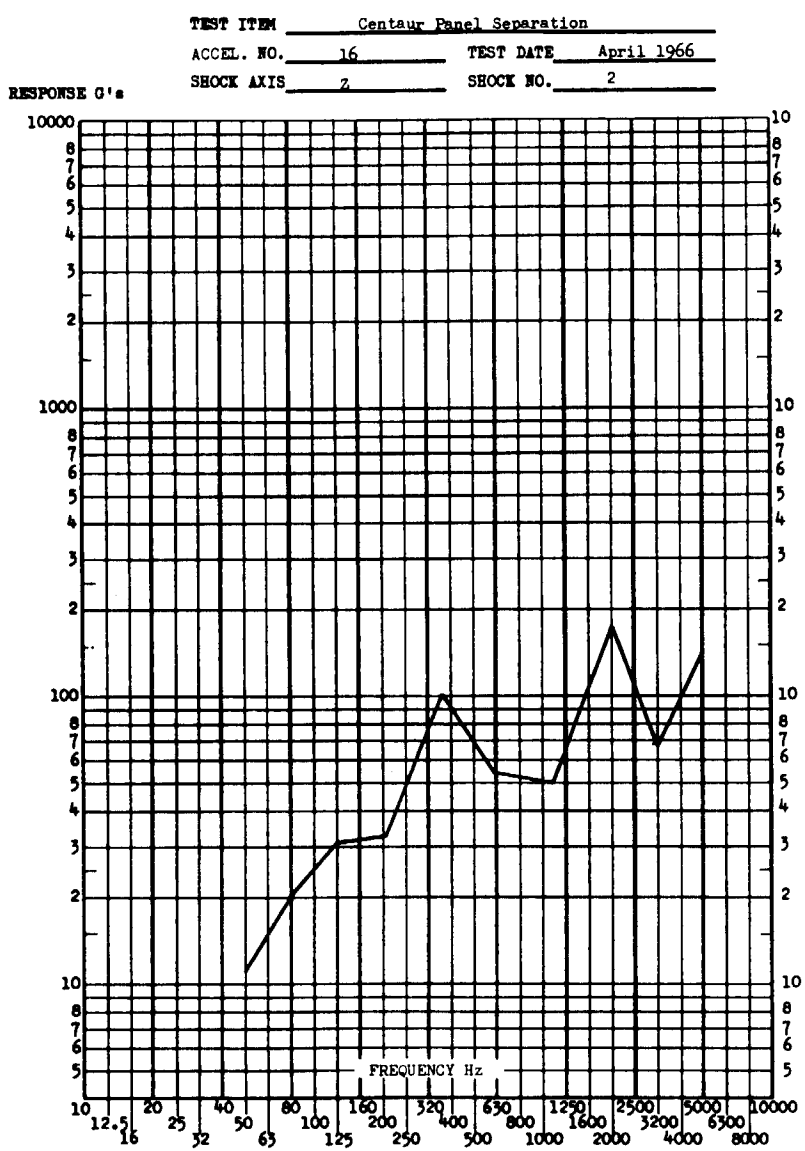


FIGURE I.A.6-11



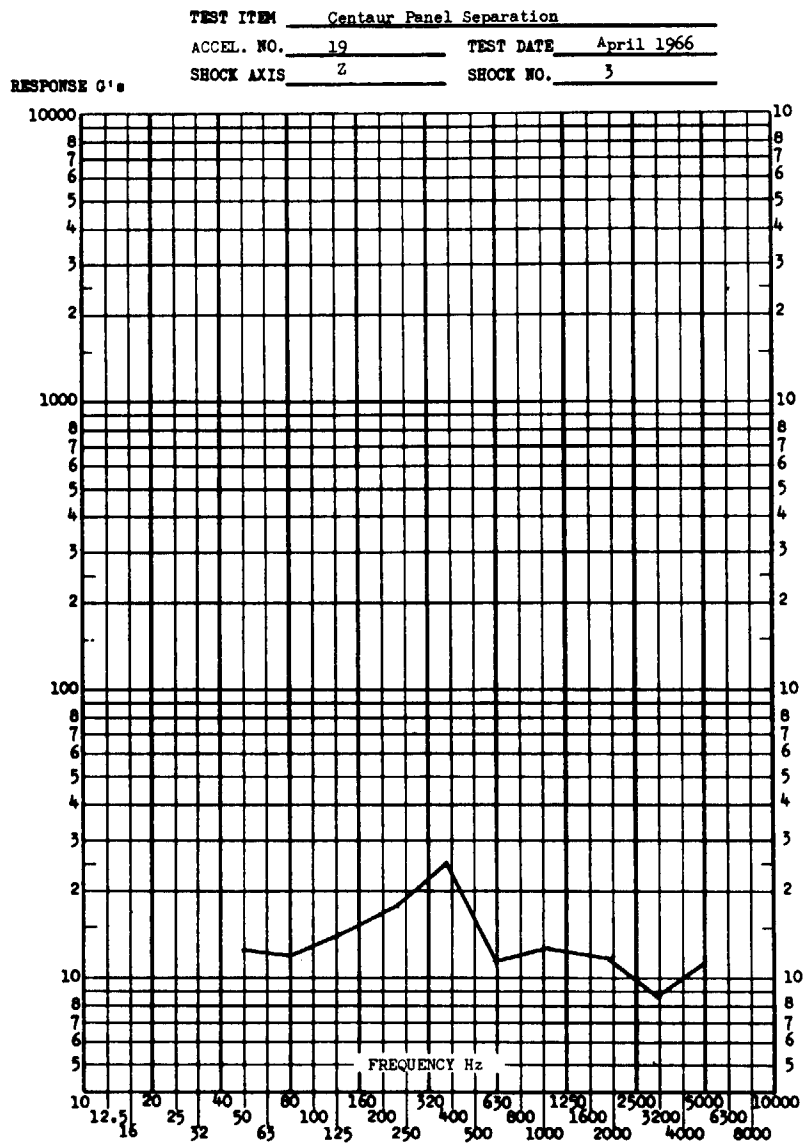
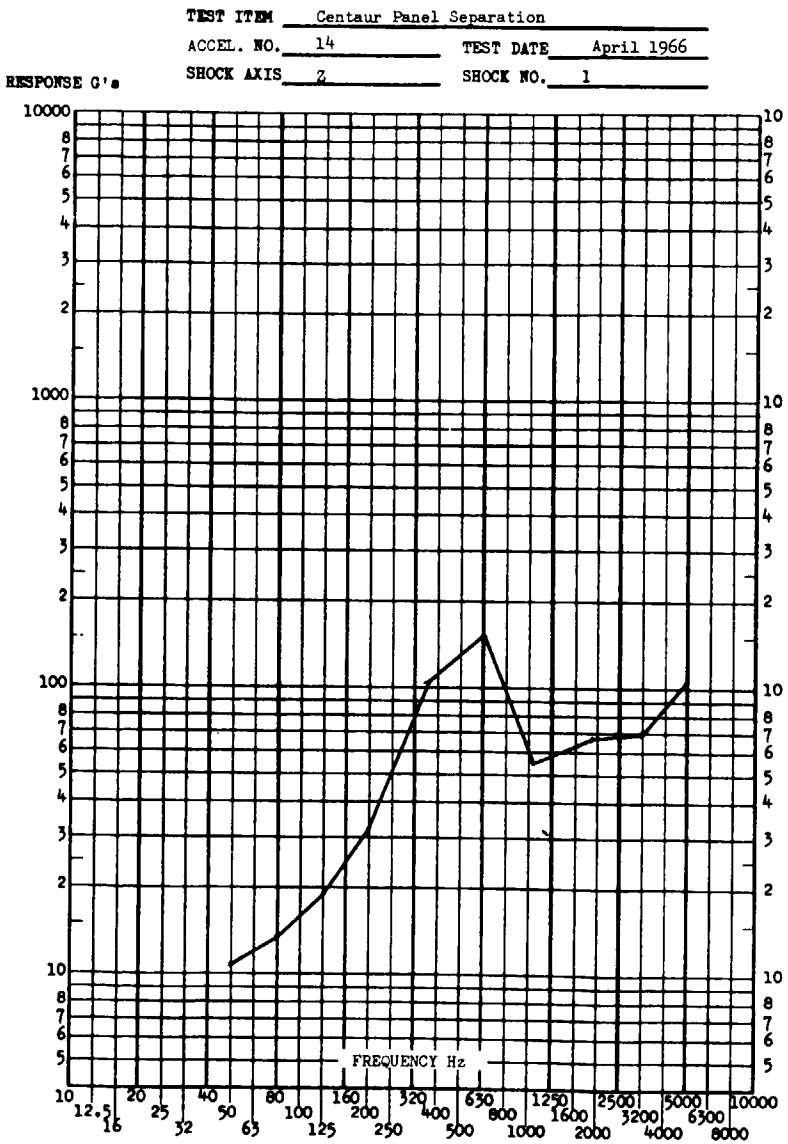


FIGURE I.A.6-10


TEST ITEM Centaur Panel Separation
ACCEL. NO. 14
TEST DATE April 1966
SHOCK AXIS Z
SHOCK NO. 1
RESPONSE G's
FREQUENCY Hz

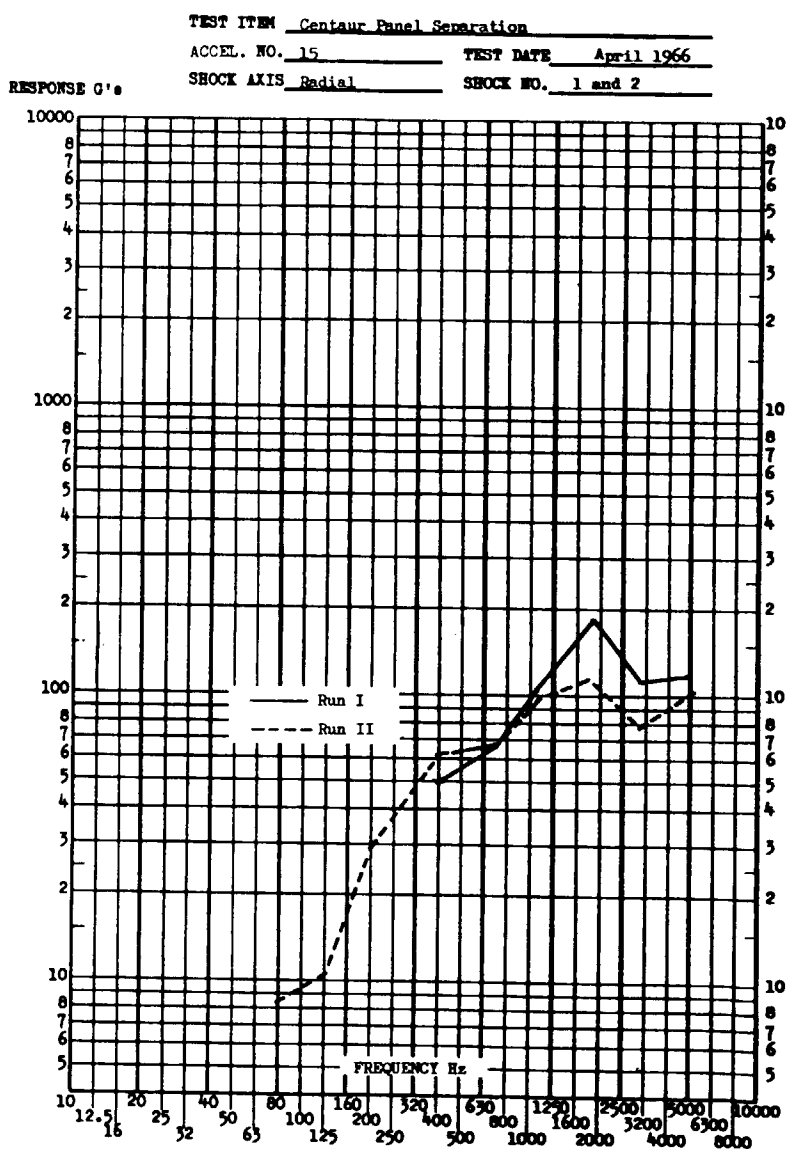
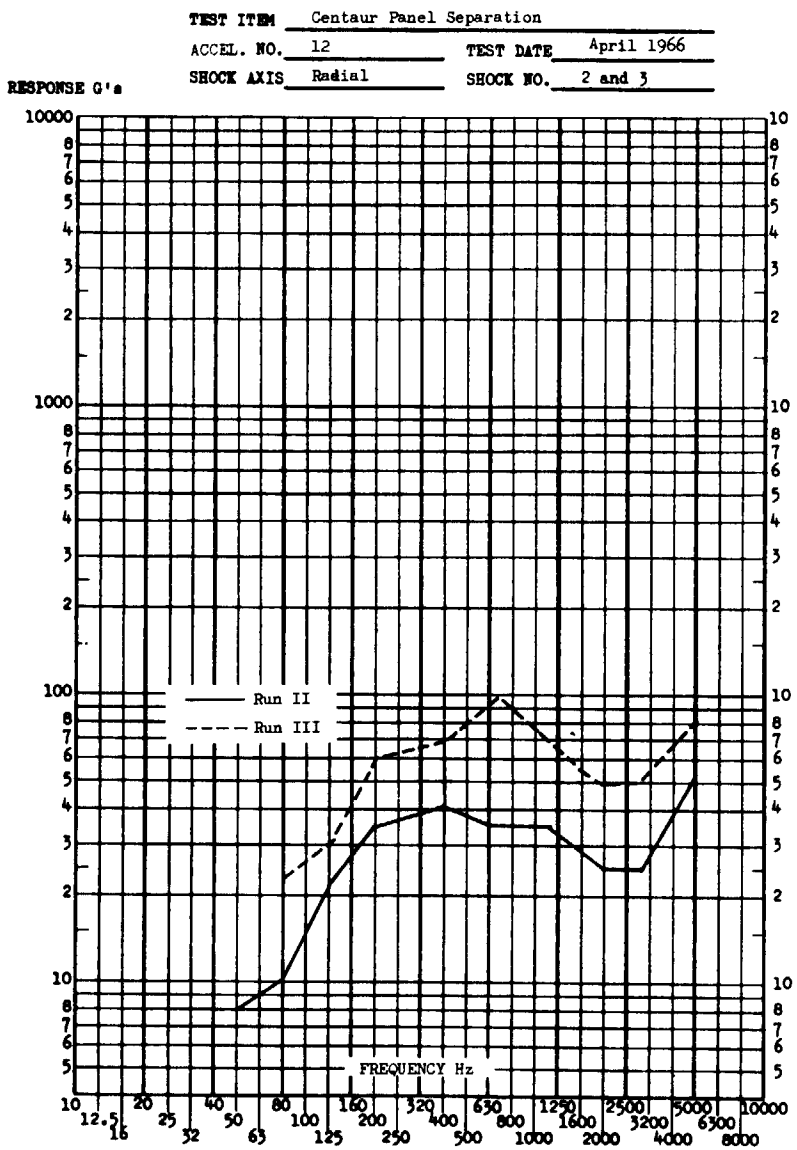

TEST ITEM Centaur Panel Separation
ACCEL. NO. 15
TEST DATE April 1966
SHOCK AXIS Radial
SHOCK NO. 1 and 2
RESPONSE G's
Run I
Run II
FREQUENCY Hz

FIGURE I.A.6-9


TEST ITEM Centaur Panel Separation
ACCEL. NO. 12
TEST DATE April 1966
SHOCK AXIS Radial
SHOCK NO. 2 and 3
RESPONSE G's
Run II
Run III
FREQUENCY Hz

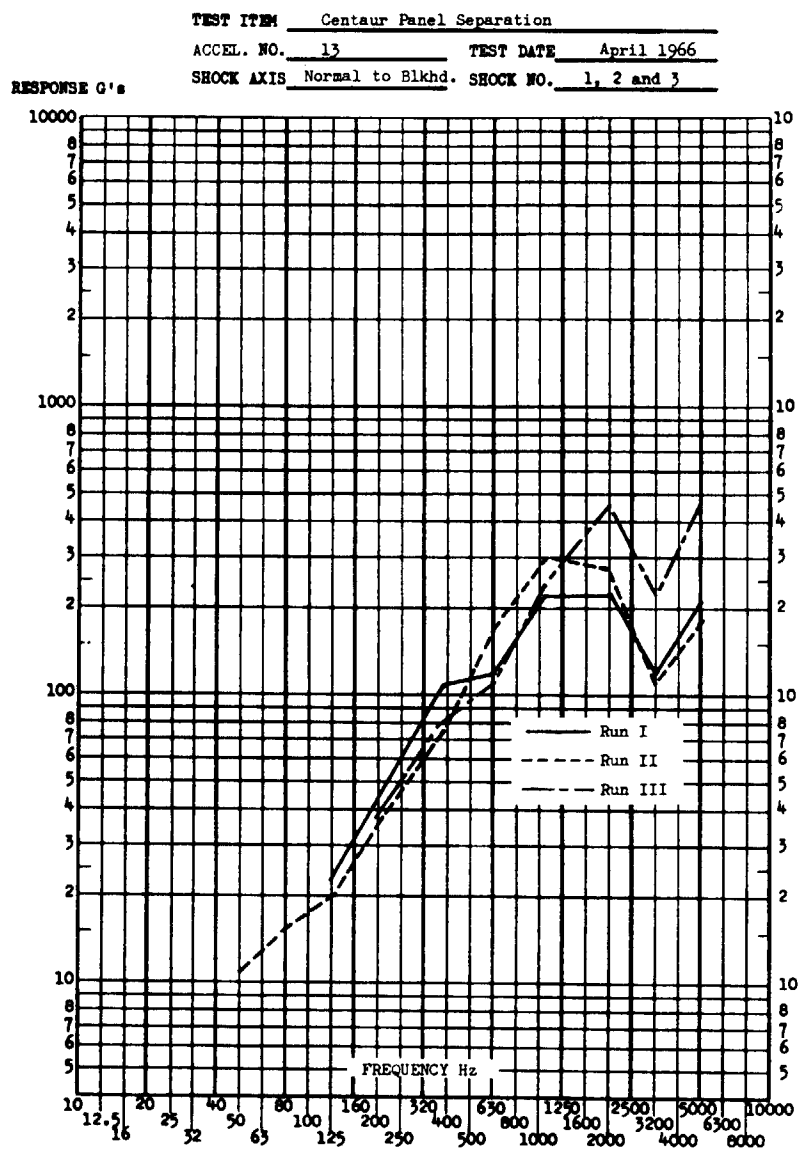
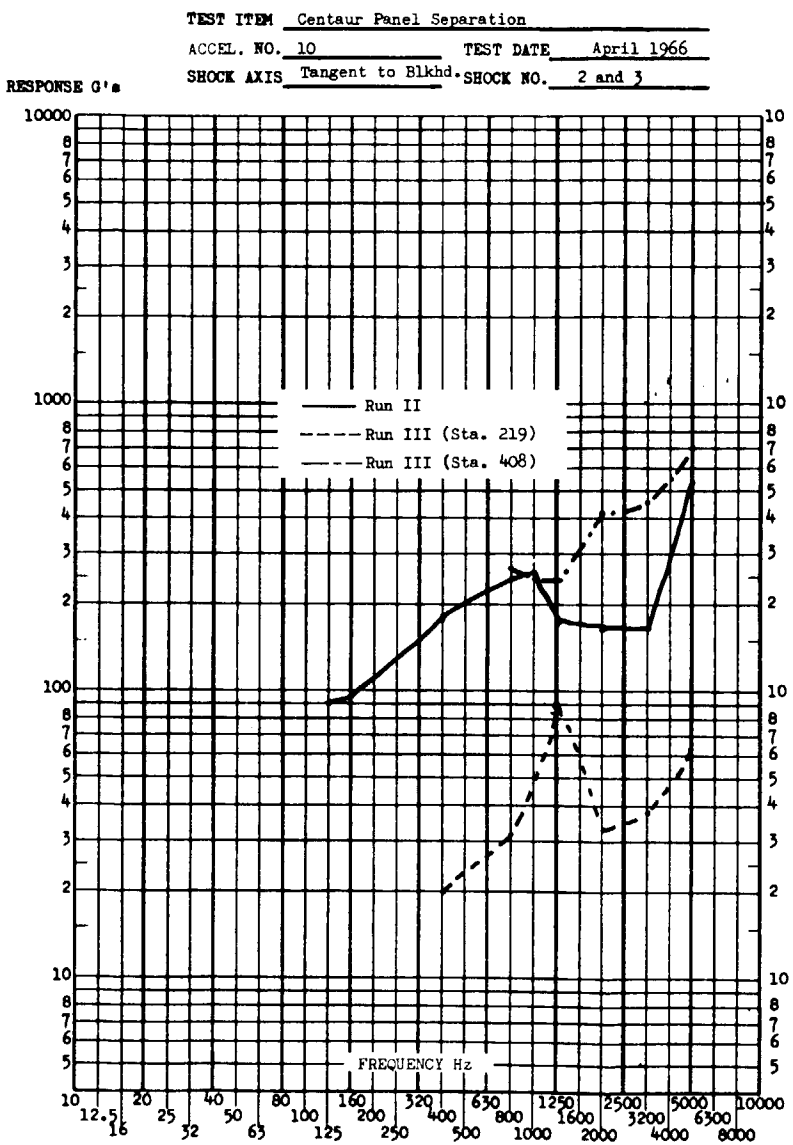

TEST ITEM Centaur Panel Separation
ACCEL. NO. 13
TEST DATE April 1966
SHOCK AXIS Normal to Blkhd.
SHOCK NO. 1, 2 and 3
RESPONSE G's
Run I
Run II
Run III
FREQUENCY Hz

FIGURE I.A.6-8


TEST ITEM Centaur Panel Separation
ACCEL. NO. 10
TEST DATE April 1966
SHOCK AXIS Tangent to Blkhd.
SHOCK NO. 2 and 3
RESPONSE G's
Run II
Run III (Sta. 219)
Run III (Sta. 408)
FREQUENCY Hz

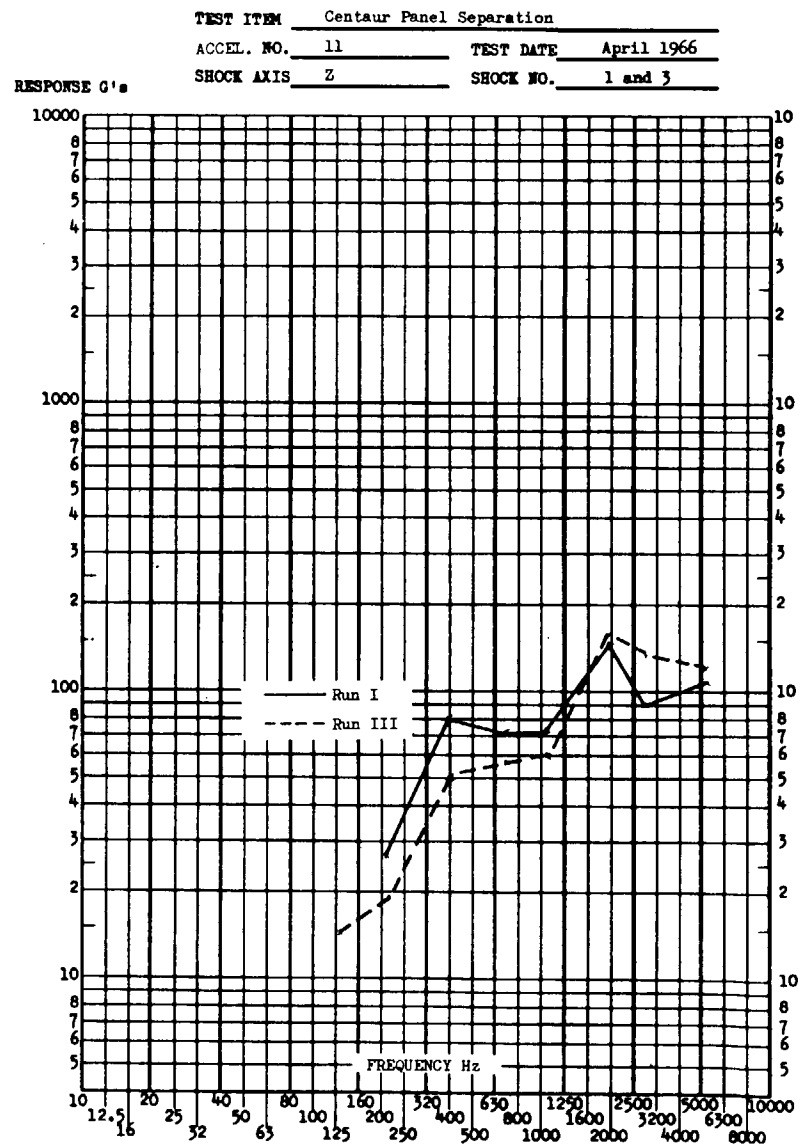
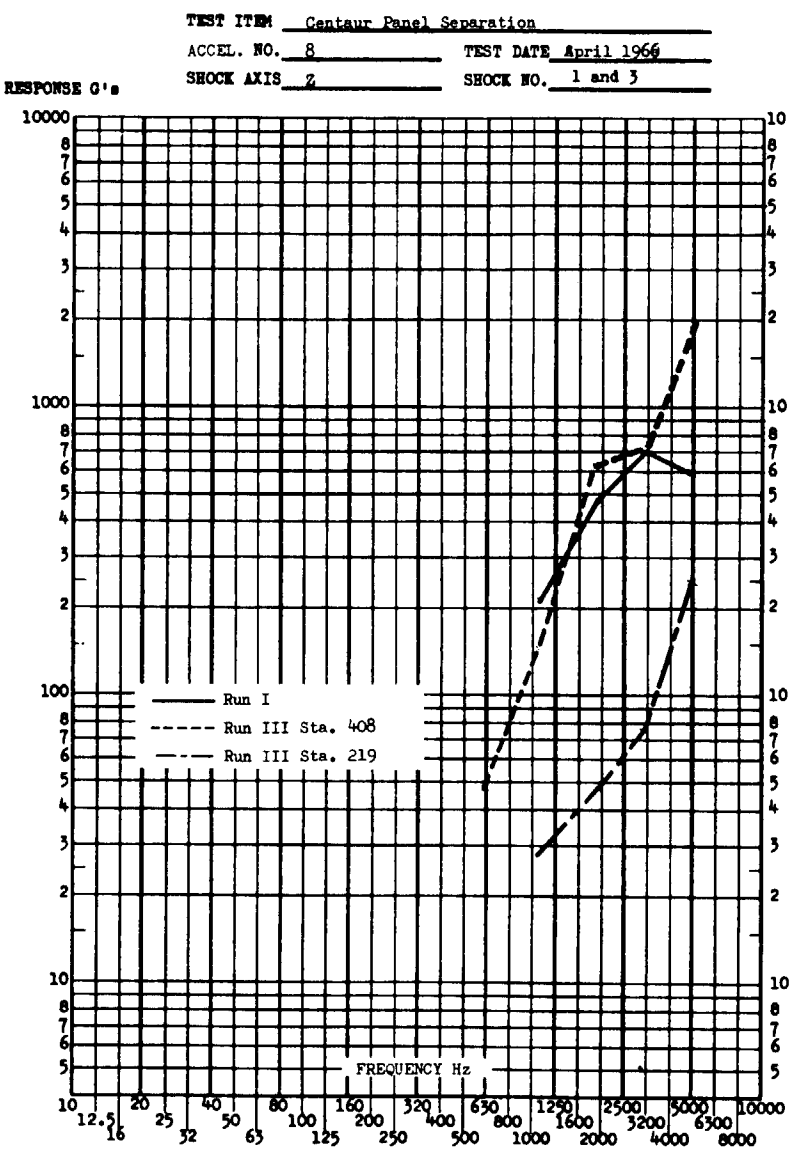

TEST ITEM Centaur Panel Separation
ACCEL. NO. 11
TEST DATE April 1966
SHOCK AXIS Z
SHOCK NO. 1 and 3
RESPONSE G's
Run I
Run III
FREQUENCY Hz

FIGURE I.A.6-7


TEST ITEM Centaur Panel Separation
ACCEL. NO. 8
TEST DATE April 1966
SHOCK AXIS Z
SHOCK NO. 1 and 3
RESPONSE G's
Run I
Run III Sta. 408
Run III Sta. 219
FREQUENCY Hz

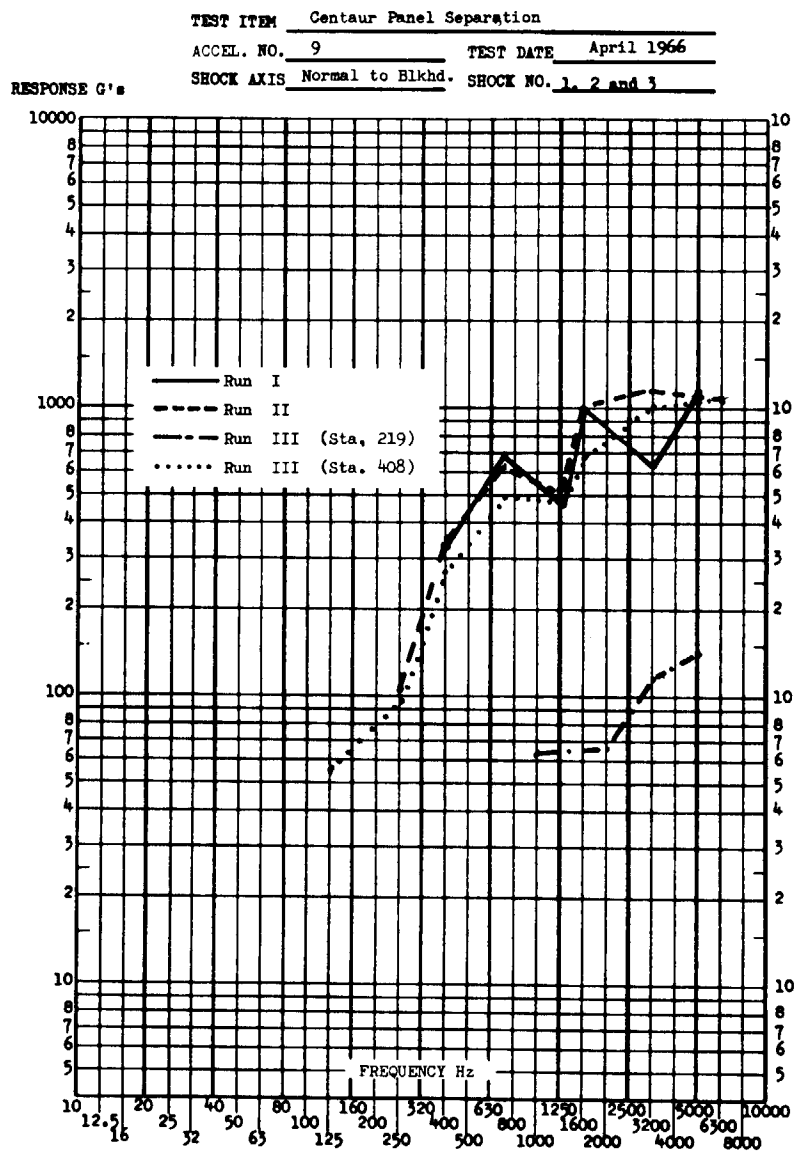
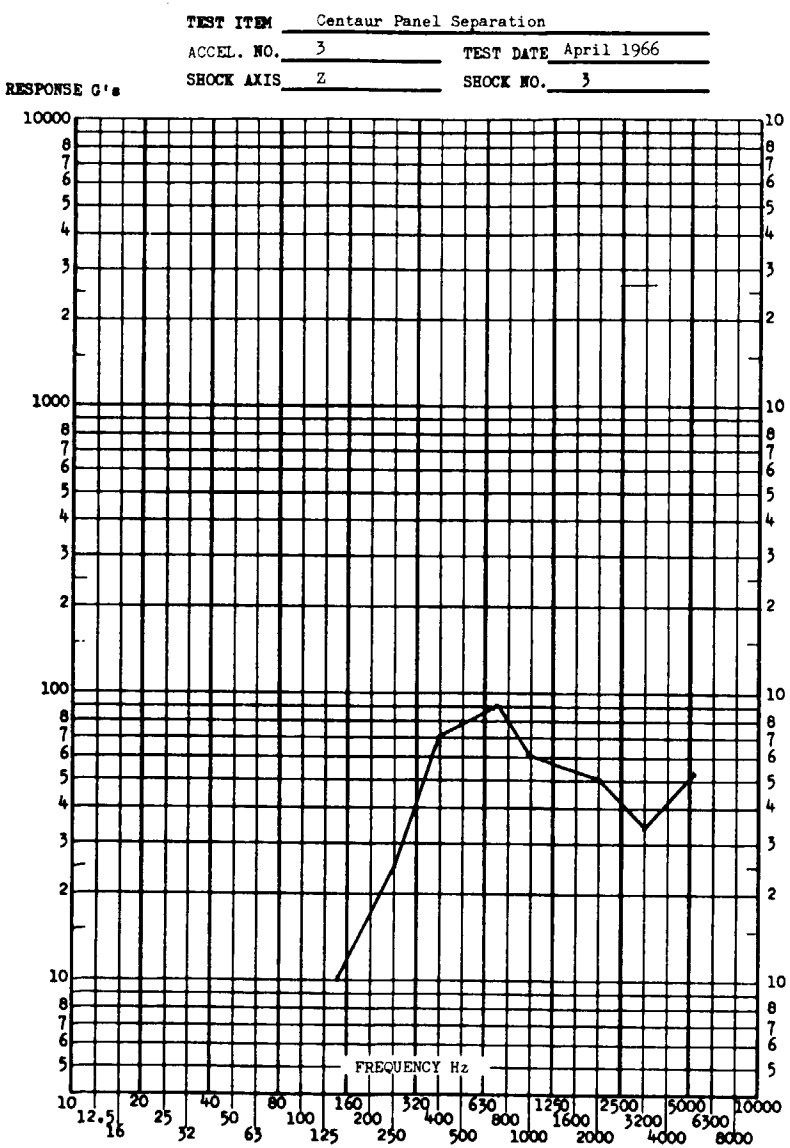

TEST ITEM Centaur Panel Separation
ACCEL. NO. 9
TEST DATE April 1966
SHOCK AXIS Normal to Blkhd.
SHOCK NO. 1, 2 and 3
RESPONSE G's
Run I
Run II
Run III (Sta. 219)
Run III (Sta. 408)
FREQUENCY Hz

FIGURE I.A.6-6


TEST ITEM Centaur Panel Separation
ACCEL. NO. 3
TEST DATE April 1966
SHOCK AXIS Z
SHOCK NO. 3
RESPONSE G's
FREQUENCY Hz

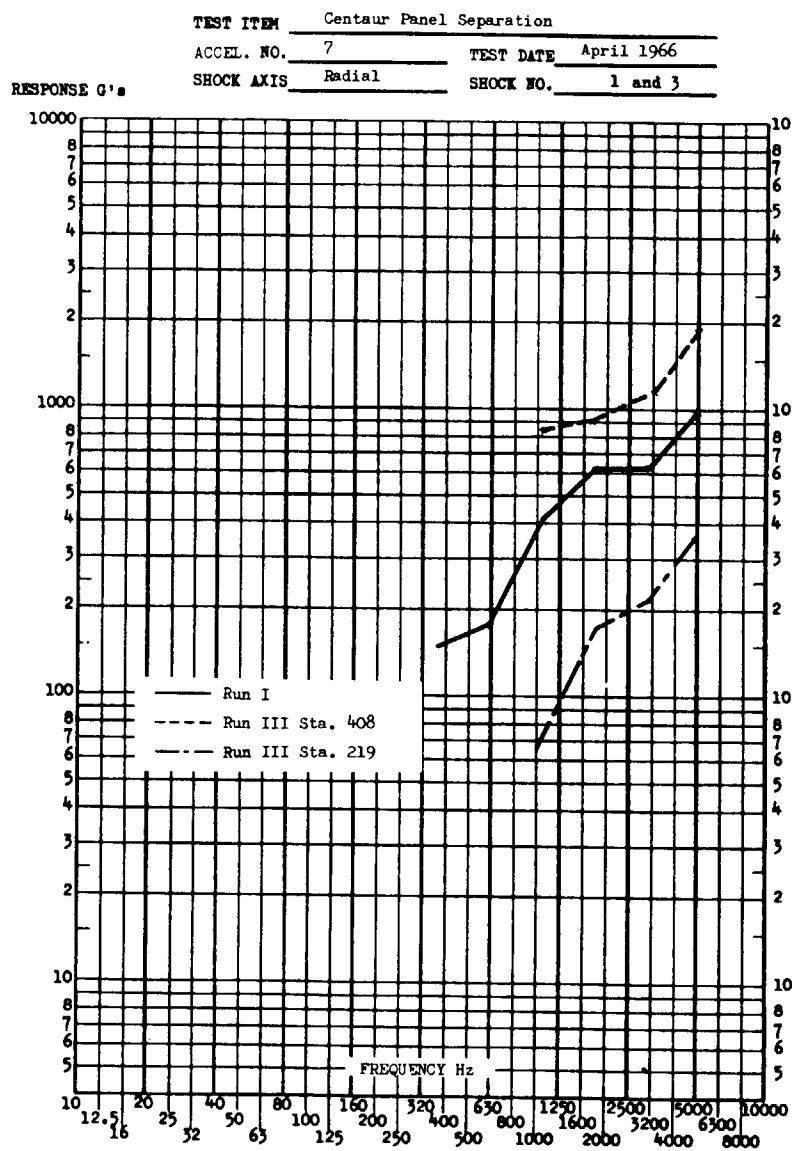
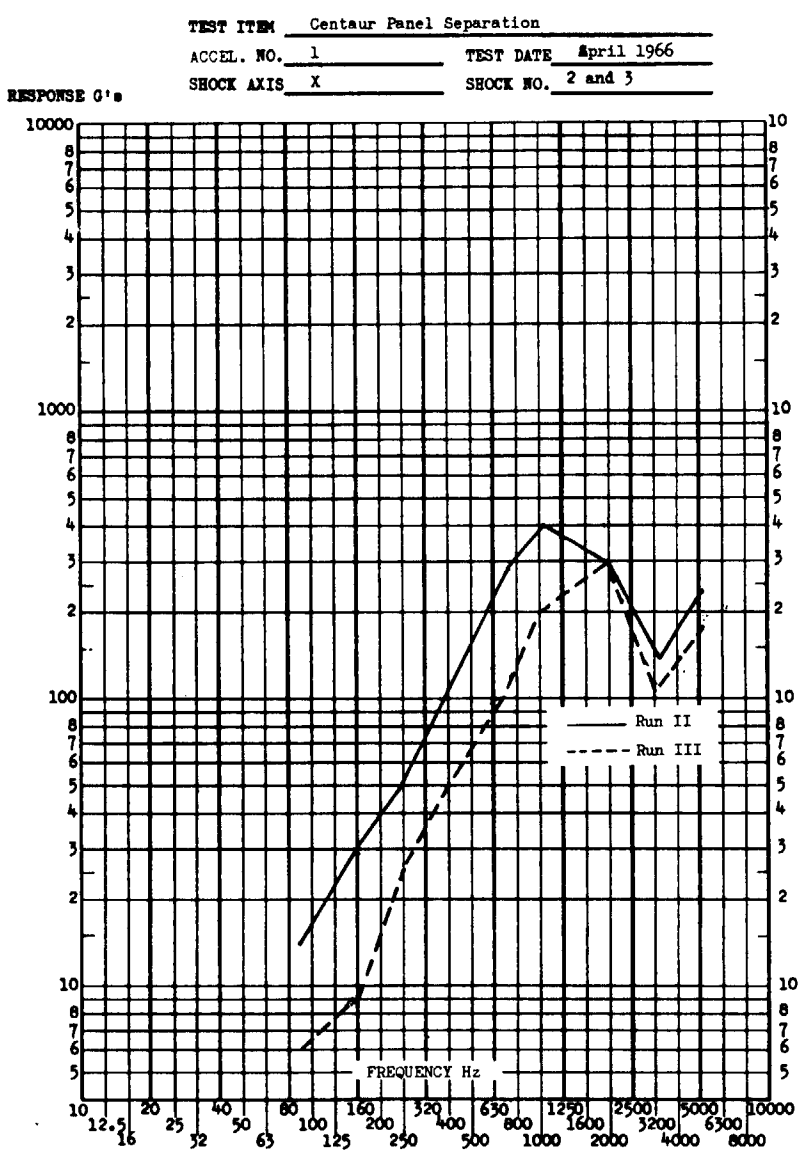

TEST ITEM Centaur Panel Separation
ACCEL. NO. 7
TEST DATE April 1966
SHOCK AXIS Radial
SHOCK NO. 1 and 3
RESPONSE G's
Run I
Run III Sta. 408
Run III Sta. 219
FREQUENCY Hz

FIGURE I.A.6-5


TEST ITEM Centaur Panel Separation
ACCEL. NO. 1
TEST DATE April 1966
SHOCK AXIS X
SHOCK NO. 2 and 3
RESPONSE G's
FREQUENCY Hz
Run II
Run III

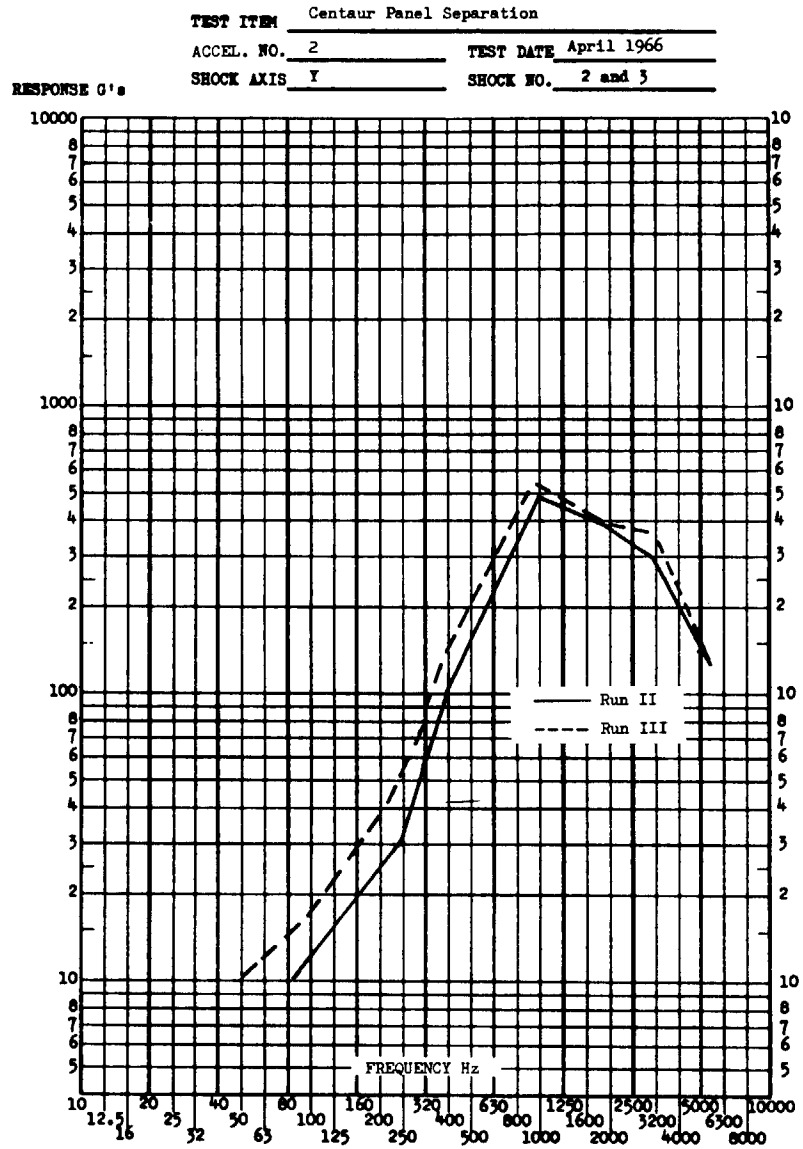
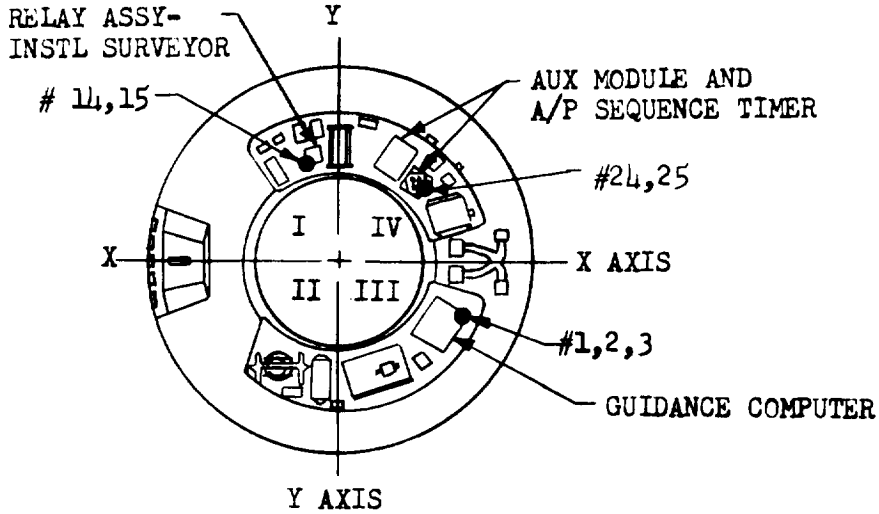
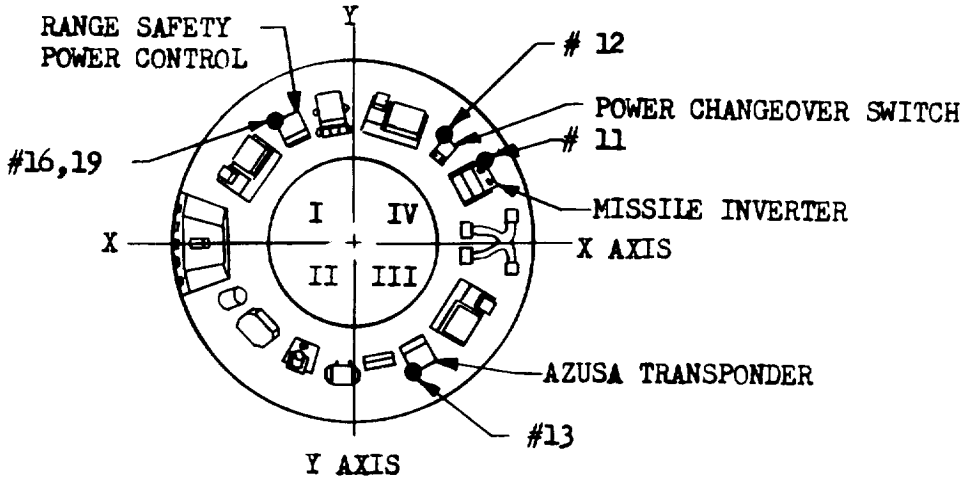

TEST ITEM Centaur Panel Separation
ACCEL. NO. 2
TEST DATE April 1966
SHOCK AXIS Y
SHOCK NO. 2 and 3
RESPONSE G's
FREQUENCY Hz
Run II
Run III

FIGURE I.A.6-4



FORWARD EQUIPMENT SHELVES
(VIEW LOOKING AFT)



AFT EQUITMENT INSTALLATIONS
(VIEW LOOKING AFT)

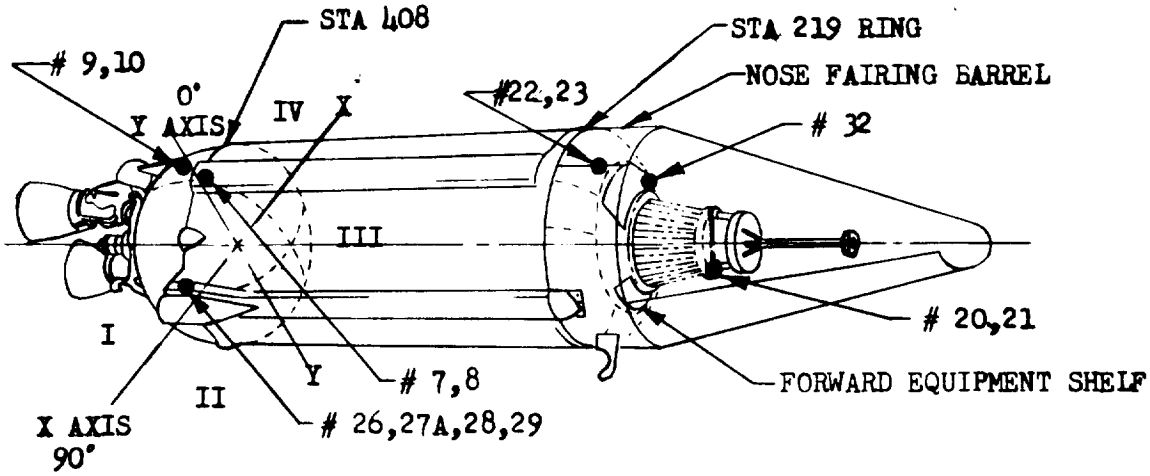


FIGURE I.A.6-3

ACCELEROMETER LOCATIONS FOR CENTAUR AC-6 INSULATION PANEL JETTISON TEST

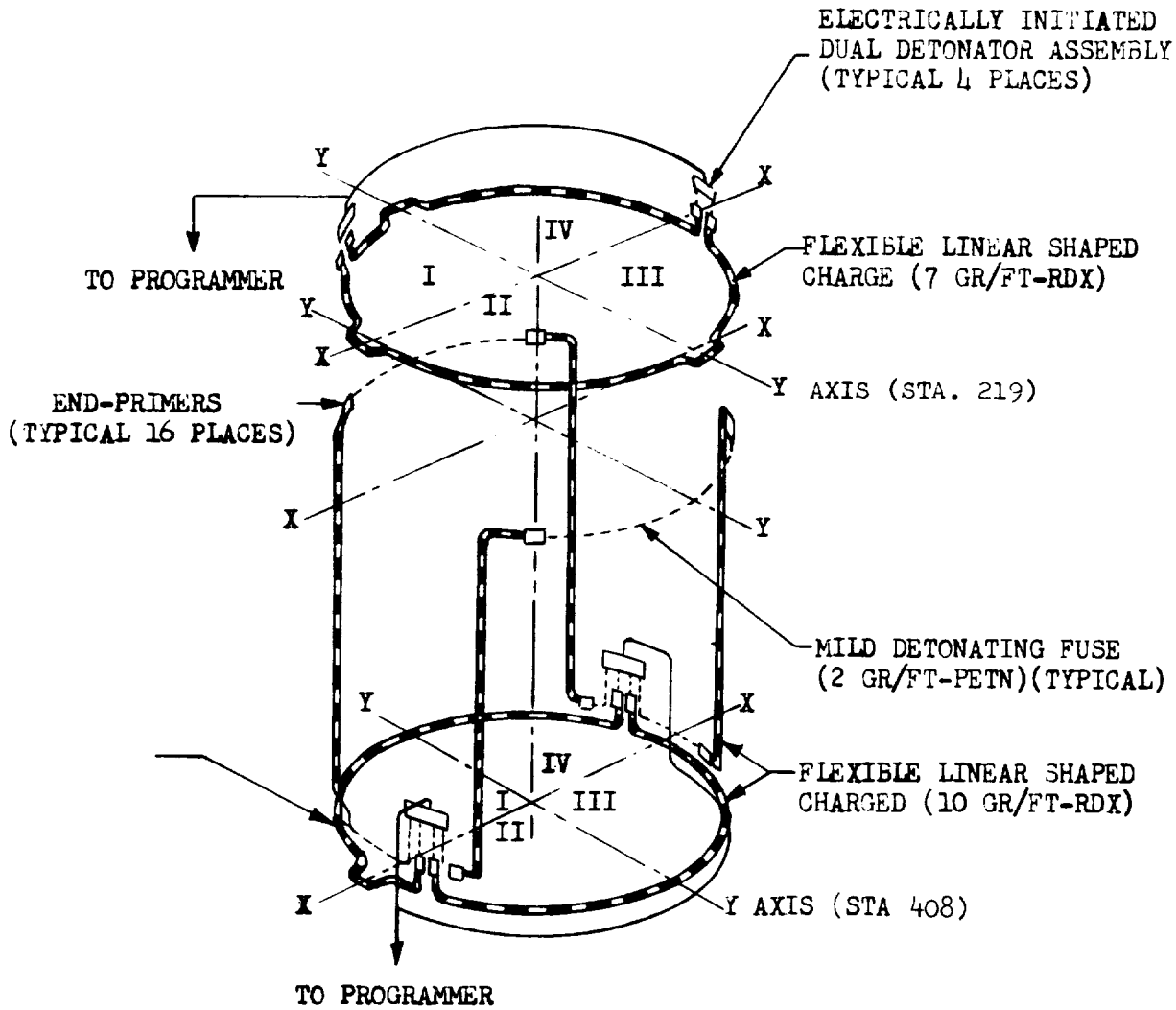


Figure I.A.6-2. Shaped Charge Separation System for Centaur Panel Jettison

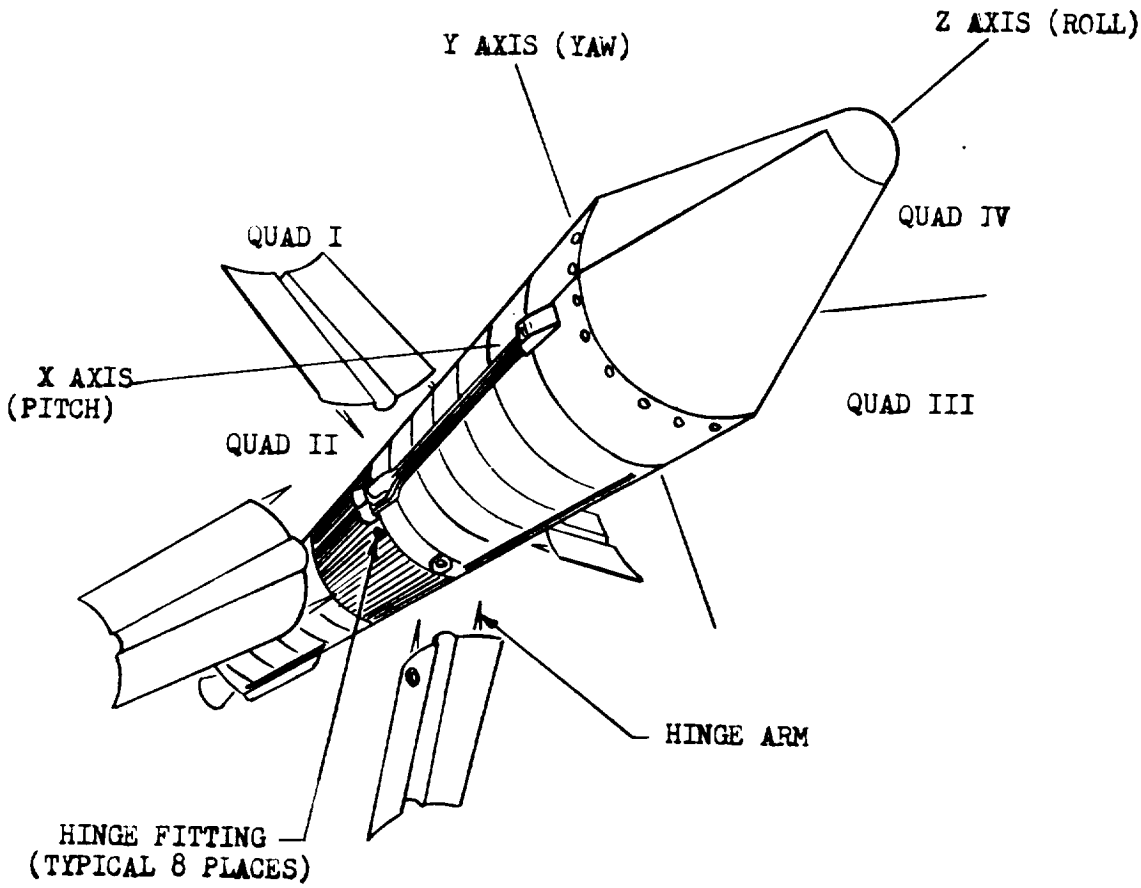


FIGURE I.A.6-1

CENTAUR JETTISONABLE INSULATION SYSTEM

TABLE I.A.6-1
(Continued)

Measurement Number	Location	Sensitive Axis	Station	Quad.	Type of Endevco Accel.	Figure Number
16	Range safety power control box	Z		I	2221D	I.A.6-10
19	Inside range safety power control box next to relay		180	I	2221D	I.A.6-10
20	Near payload latch	Z	128	III	2221D	I.A.6-11
21	Near payload latch	Radial	128	III	2221D	I.A.6-11
22	Nose fairing barrel near relays	Z	169	I-IV	2221D	I.A.6-12
23	Nose fairing barrel near relays	Radial	169	I-IV	2221D	I.A.6-12
24	A/P sequence timer base	Z	172	IV	2221D	I.A.6-13
25	A/P sequence timer base	Radial	172	IV	2225 Run I - 2242C Run II	I.A.6-13
26	AFT seal plate near staging disconnect	Z	408	II-III	2252	I.A.6-14
27A	Staging disconnect mount	Z	408	II-III	2252 Run II - 2225 Run III	I.A.6-14
28	AFT seal plate near staging disconnect	X	408	II-III	2252	I.A.6-15
29	AFT seal plate near staging disconnect	Y	408	II-III	2252	I.A.6-15
33	Base of relay inside Telepak	Z	170		2221D	I.A.6.16

TABLE I.A.6-1

ACCELEROMETER LOCATION

Measurement Number	Location	Sensitive Axis	Station	Quad.	Type of Endevco Accel.	Figure Number
1	Guidance computer base	X	172	III	2221D	I.A.6-4
2	Guidance computer base	Y	172	III	2221D	I.A.6-4
3	Guidance computer base	Z	172	II[I]	2221D	I.A.6-5
7	Destruct package	Radial	400	I-IV	2252	I.A.6-5
8	Destruct package	Z	400		2252	I.A.6-6
9	Propellant Utilization electronics package	Normal to blkhd.	437	IV	2252 Run I & II 2225 Run III	I.A.6-6
10	Propellant utilization electronics package	Tangent to blkhd	437	IV	2252	I.A.6-7
11	Missile inverter base	Z	184	IV	2221D	I.A.6-7
12	Power changeover switch	Radial	184	IV	2242C Run II - 2215 Run III	I.A.6-8
13	Azusa transponder dummy package	Normal to blkhd	184	III	221D	I.A.6-8
14	Payload separation and electrical disconnect relay	Z	172	I	2242C	I.A.6-9
15	Payload separation and electrical disconnect relay	Radial	172	I	2221D	I.A.6-9

calculating the absolute response spectra.

Some accelerometer locations were positioned such that there was evidence of distinct shock transients corresponding to both the firing of the pyrotechnic at Station 219 and at Station 408. In some of these cases, a shock spectrum is presented for both transients. When this happens, the data are anotated accordingly as in Figure I.A.6-5.

The shock spectra are presented as Figures I.A.6-4 through I.A.6-16.

DESCRIPTION OF PYROTECHNICS

See Figure I.A.6-2

DESCRIPTION OF STRUCTURE

The Centaur vehicle as depicted in Figures I.A.6-1 and I.A.6-3.

DESCRIPTION OF ACCELEROMETERS

Type: Table I.A.6-1

Locations: Table I.A.6-1 and Figure I.A.6-3

Axis of sensitivity: Table I.A.6-1

COMMENTS

No information about these tests beyond that presented above was available.

SECTION I.A.6

CENTAUR PANEL SEPARATION TESTS

PURPOSE OF TESTS

The purpose of these tests was to determine the shock environment at equipment mounts of the Centaur vehicle due to insulation panel jettison.

DESCRIPTION OF EVENT

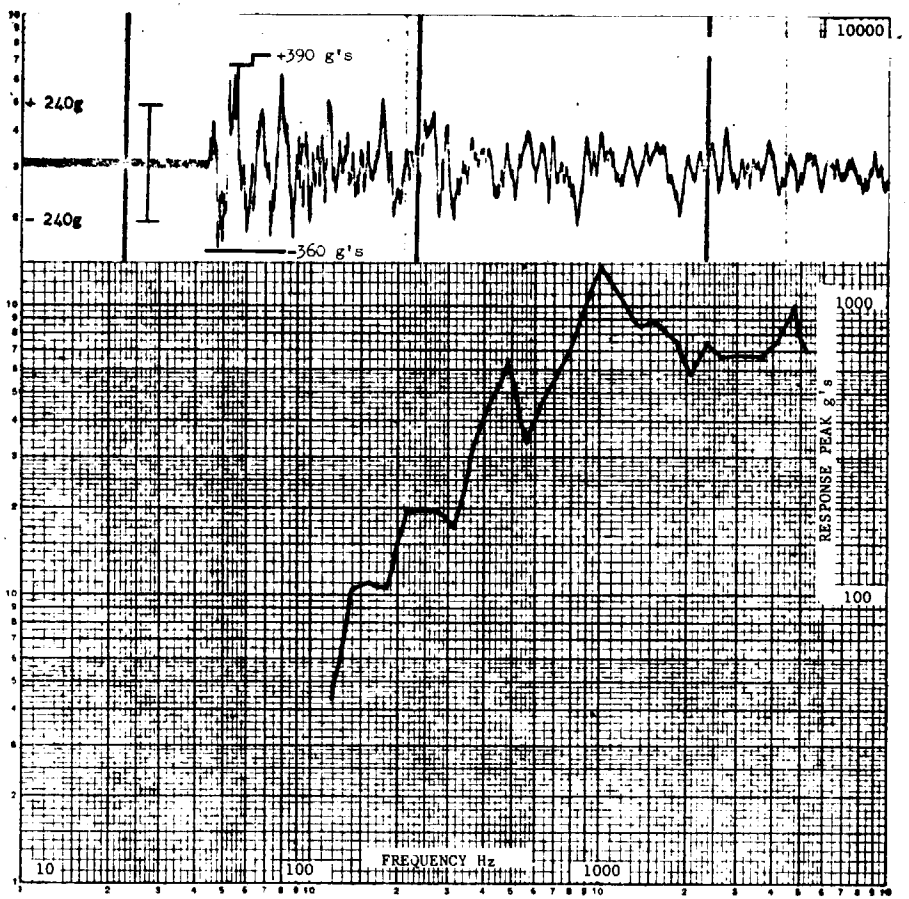
The Centaur insulation panel separation event is illustrated schematically in Figure I.A.6-1. Three types of pyrotechnic devices as depicted in Figure I.A.6-2 were used to perform the separation. Three of these tests were conducted.

DESCRIPTION OF DATA

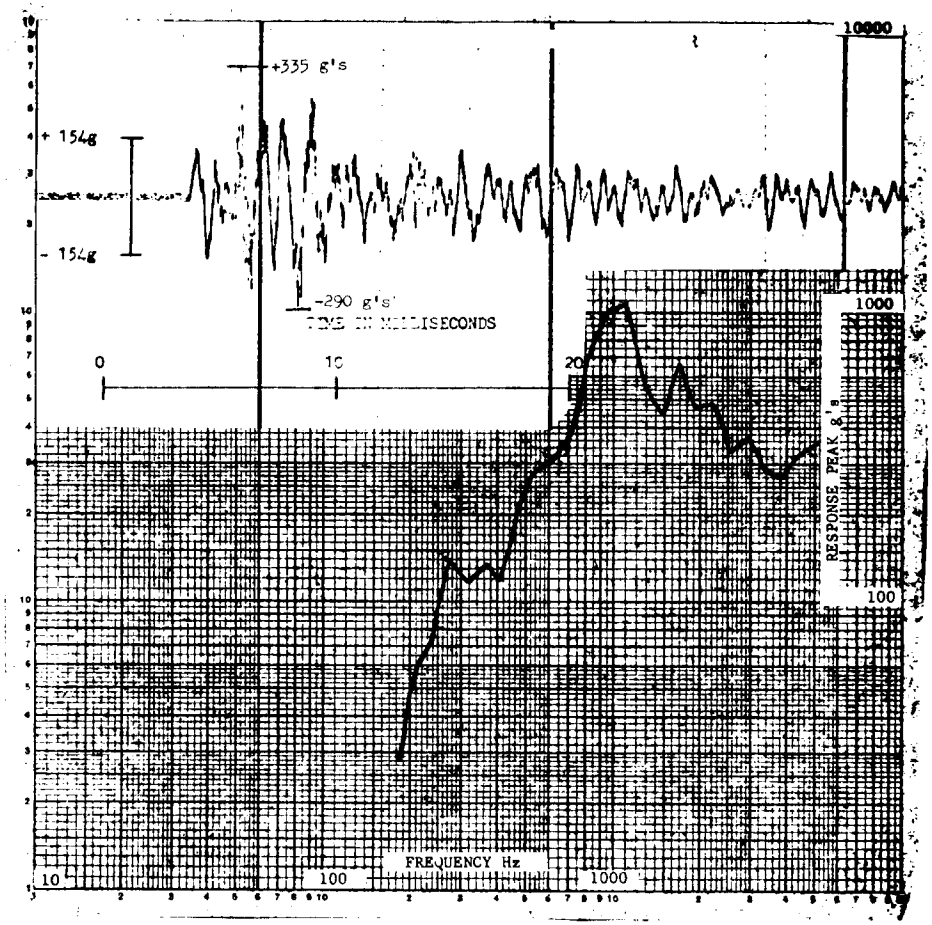
Useable data were obtained for twenty-five of the accelerometers monitored. Information about the data is itemized below:

No. of time histories	4
No. of shock spectra	52
Type of analysis	analog
Frequency range	5000 Hz maximum
Frequency increment	5 points per decade
Damping	Q = 5

The analog system of computing shock spectra was specifically designed for these tests and consisted of the traditional operational amplifier circuitry



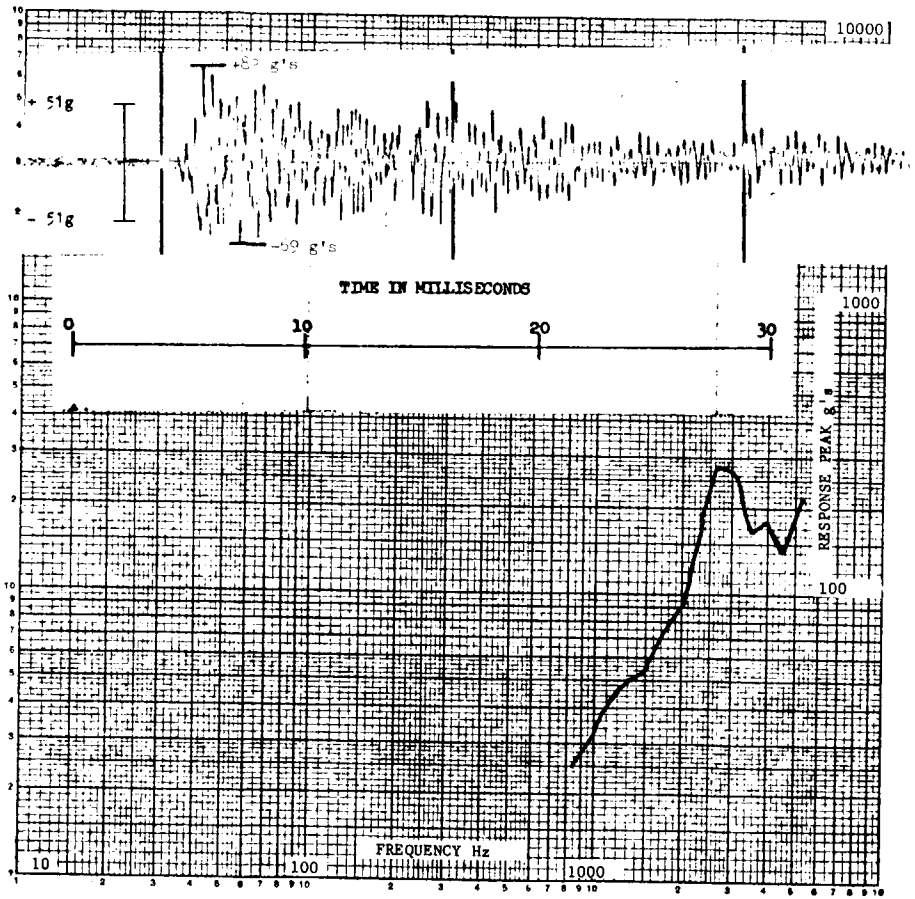
PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 112Y R/S
TOP OF PROGRAMMER
RUN 9



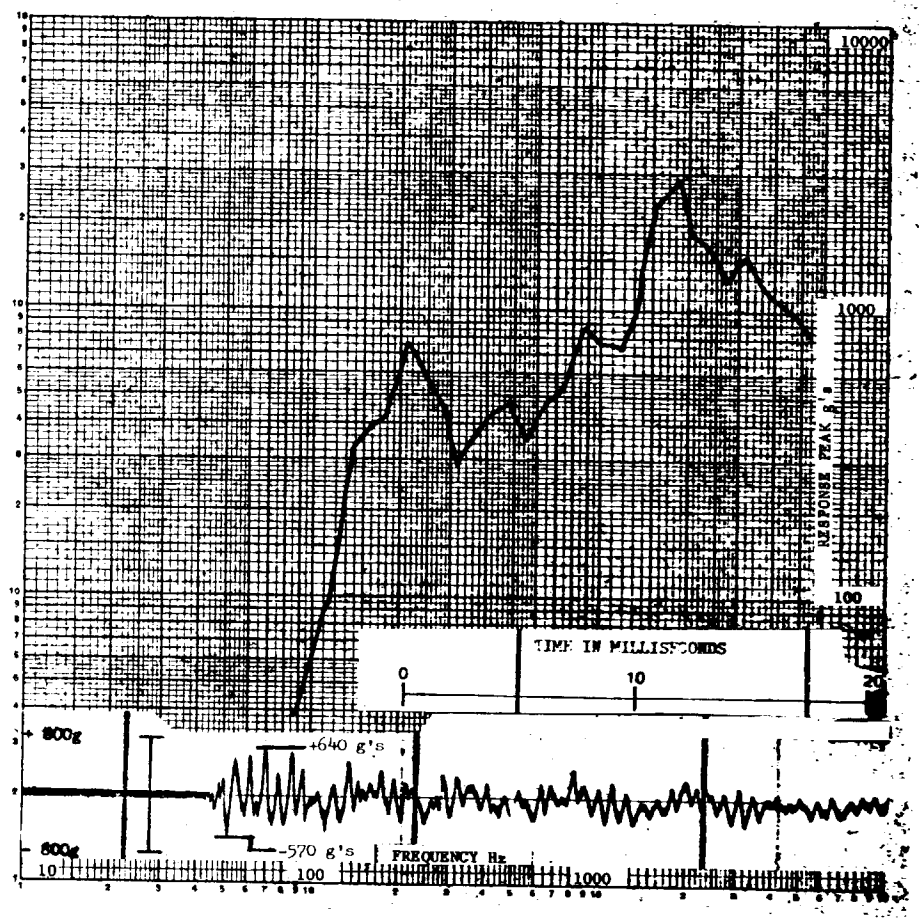
PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 116Z R/S
CHAFF DISPENSER
RUN 9

NOT REPRODUCIBLE

FIGURE I.A.5-189

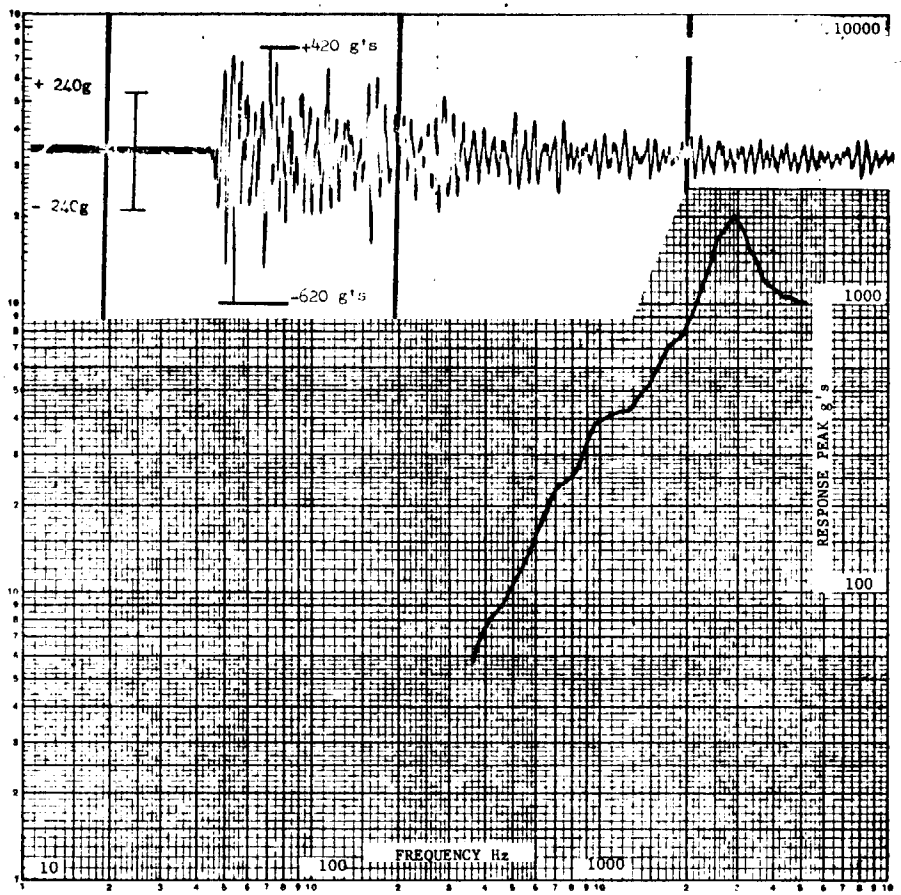


PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 111Z R/S
CONE SKIN (NEAR PROGRAMMER)
RUN 9

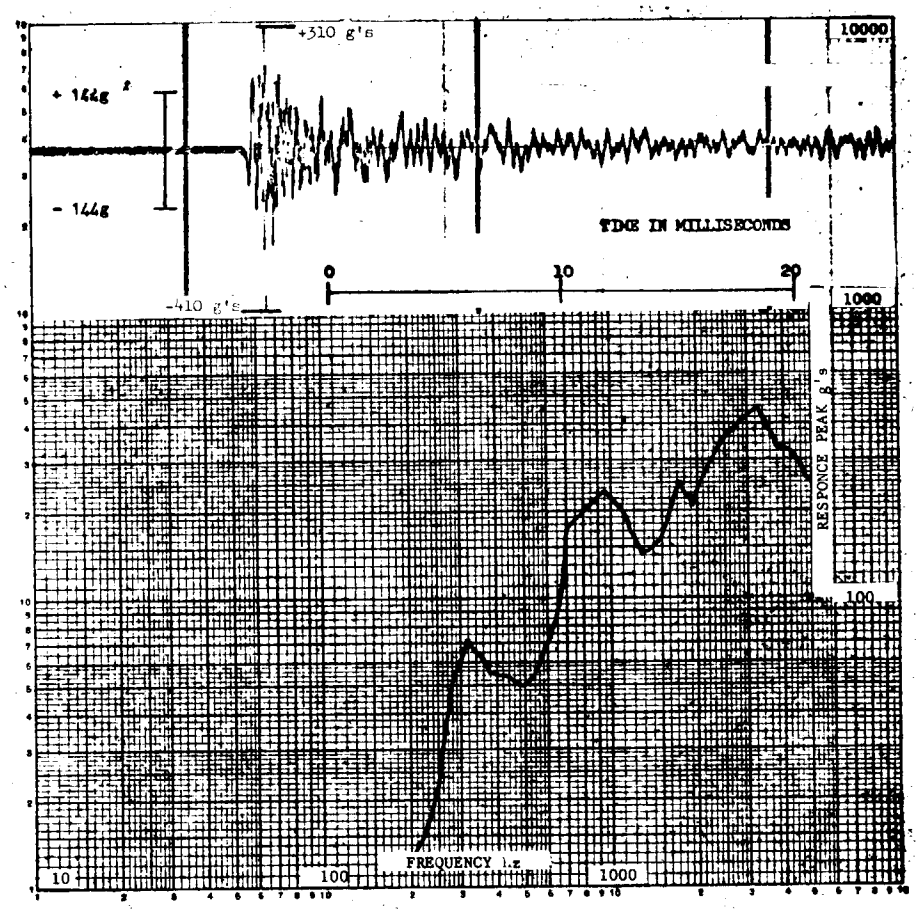


PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 112X
TOP OF PROGRAMMER
RUN 9

FIGURE I.A.5-188

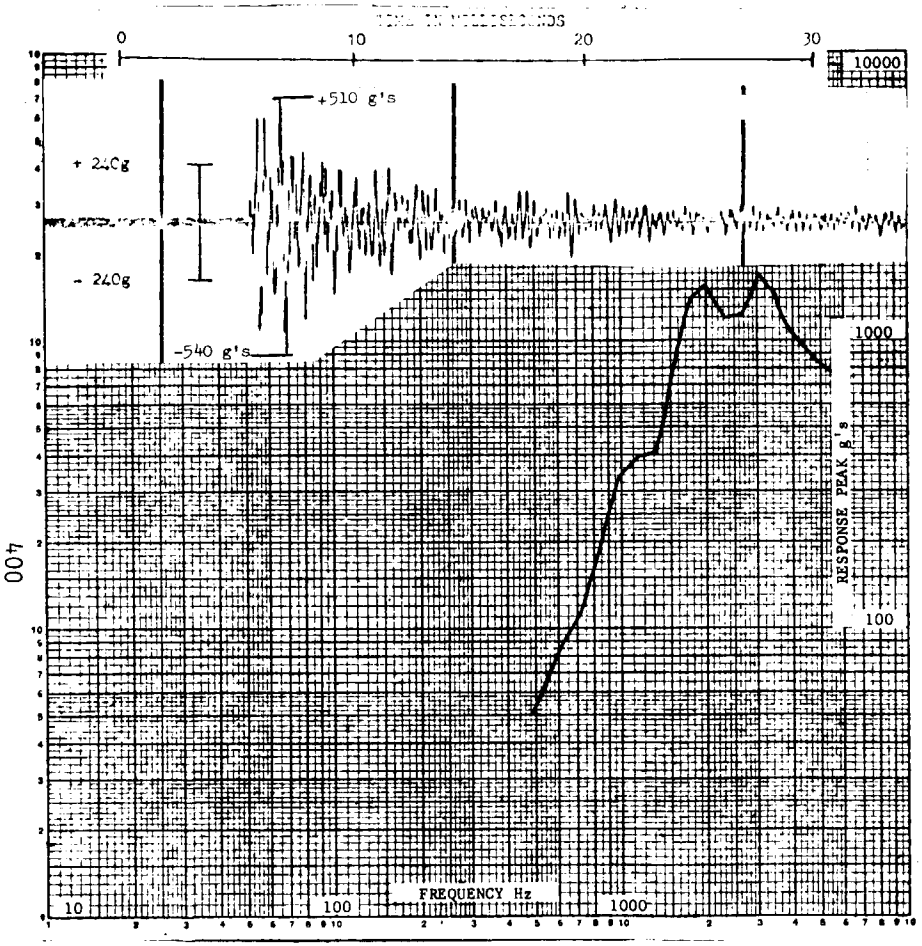


PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 105R
FLANGE OF PEDESTAL #1
RUN 9

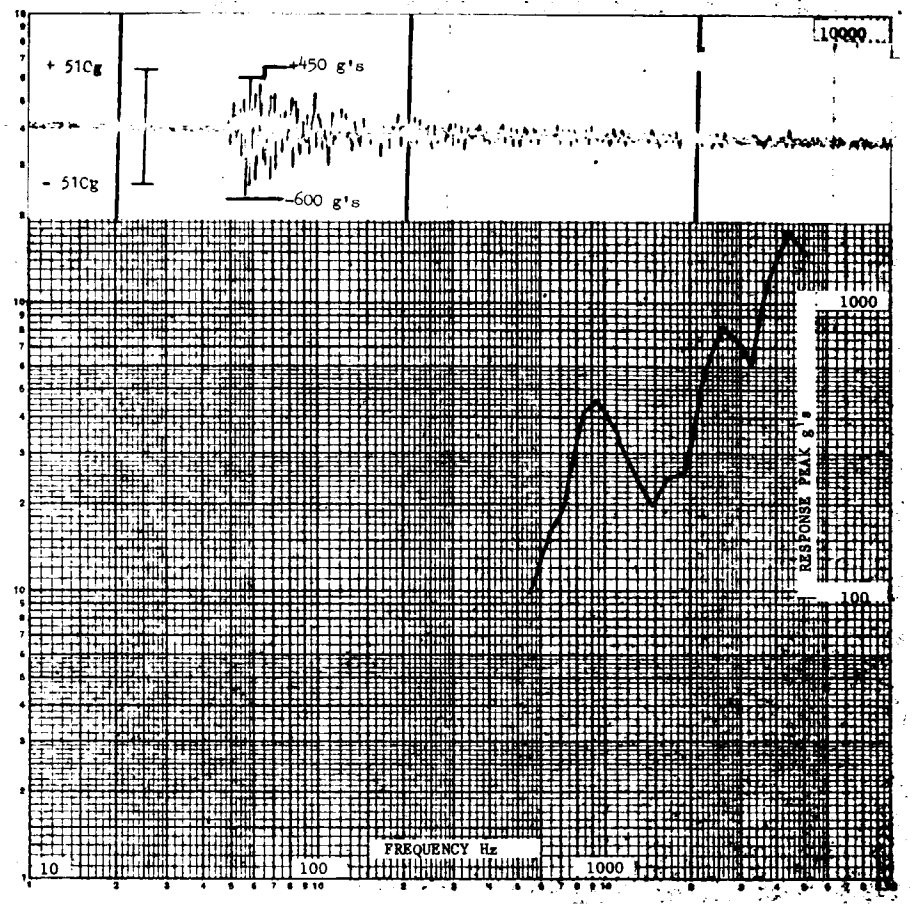


PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 107X
DISPENSER
RUN 9

FIGURE I.A.5-187

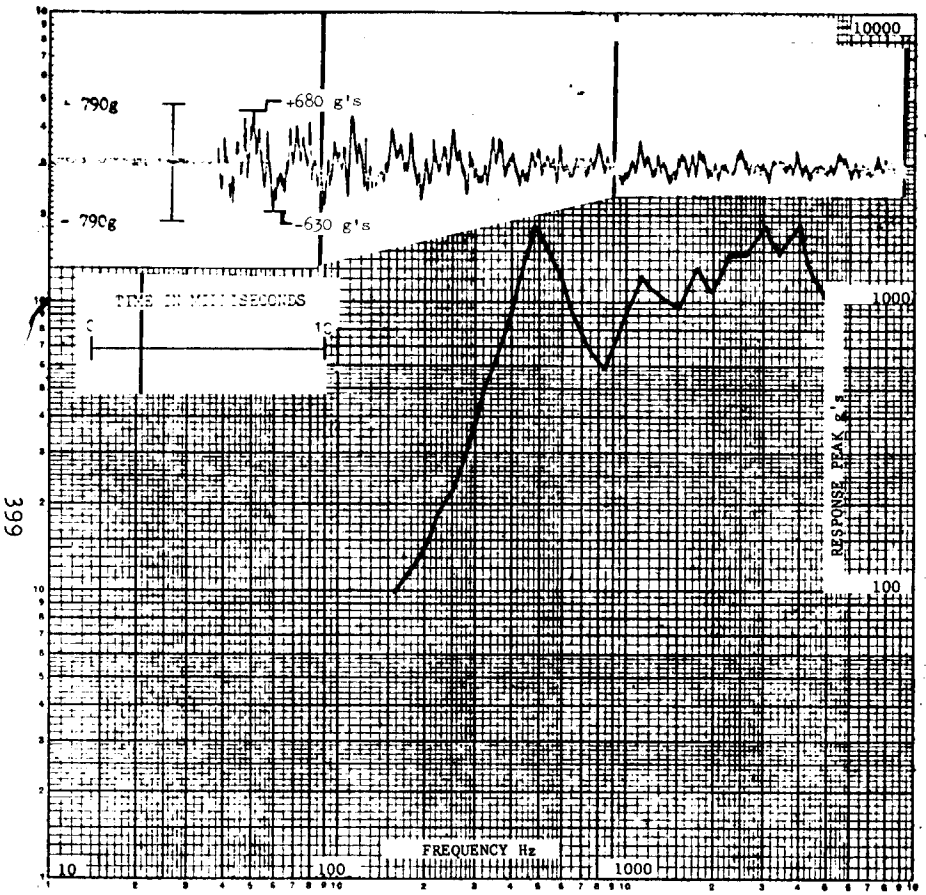


PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 104T
EDGE OF BULKHEAD @ 325°
RUN 9

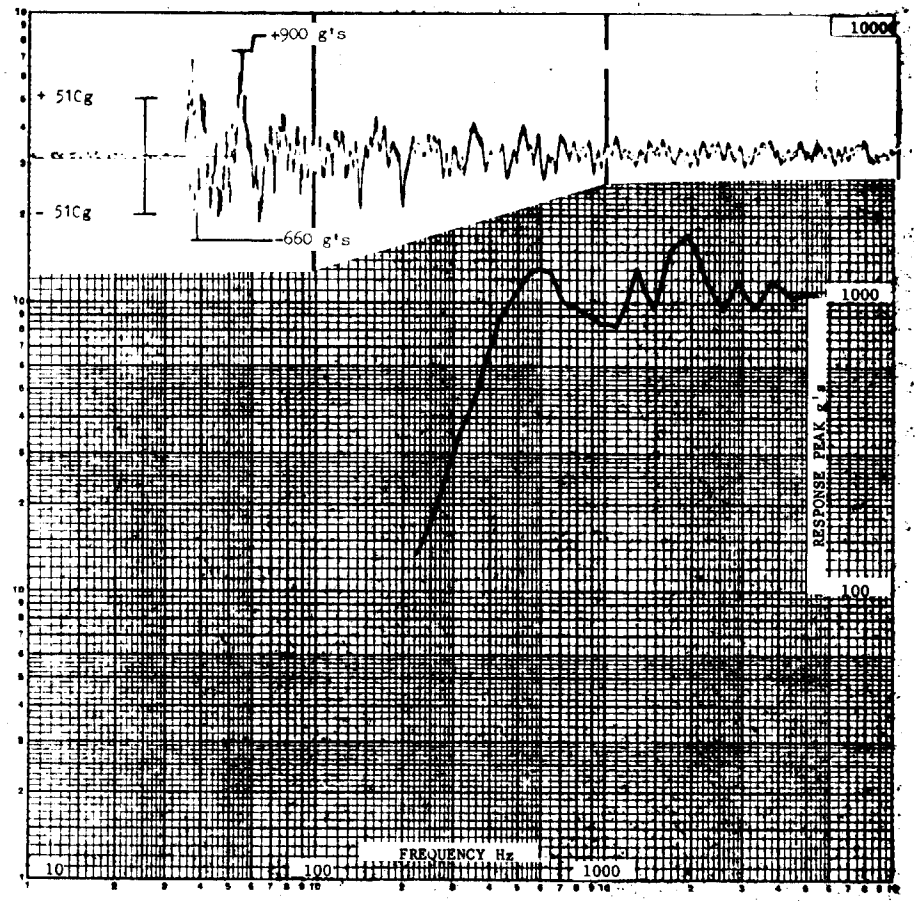


PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 105Z
FLANGE OF PEDESTAL #1
RUN 9

FIGURE I.A.5-186

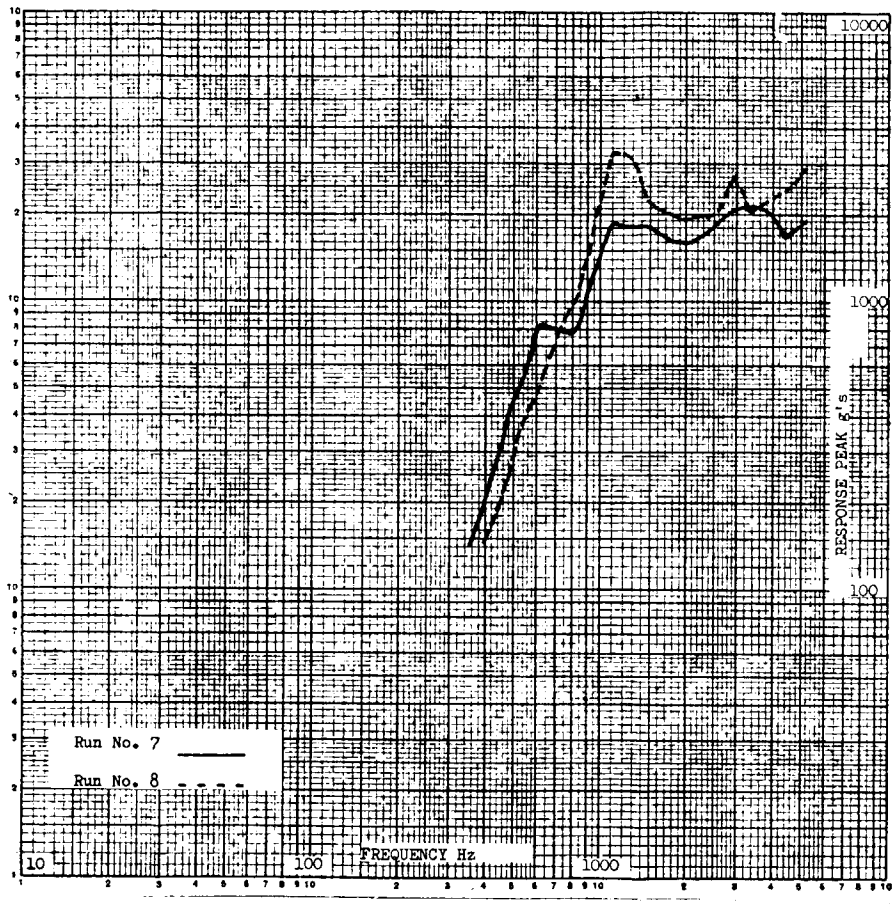


PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 101Z R/S
INTERFACE RING @ 325°
RUN 9



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 102Z R/S
INTERFACE RING @ 235°
RUN 9

FIGURE I.A.5-185



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
PBPS SECTION
LOC. 36R UNFILTERED
RUN NO. 7,8

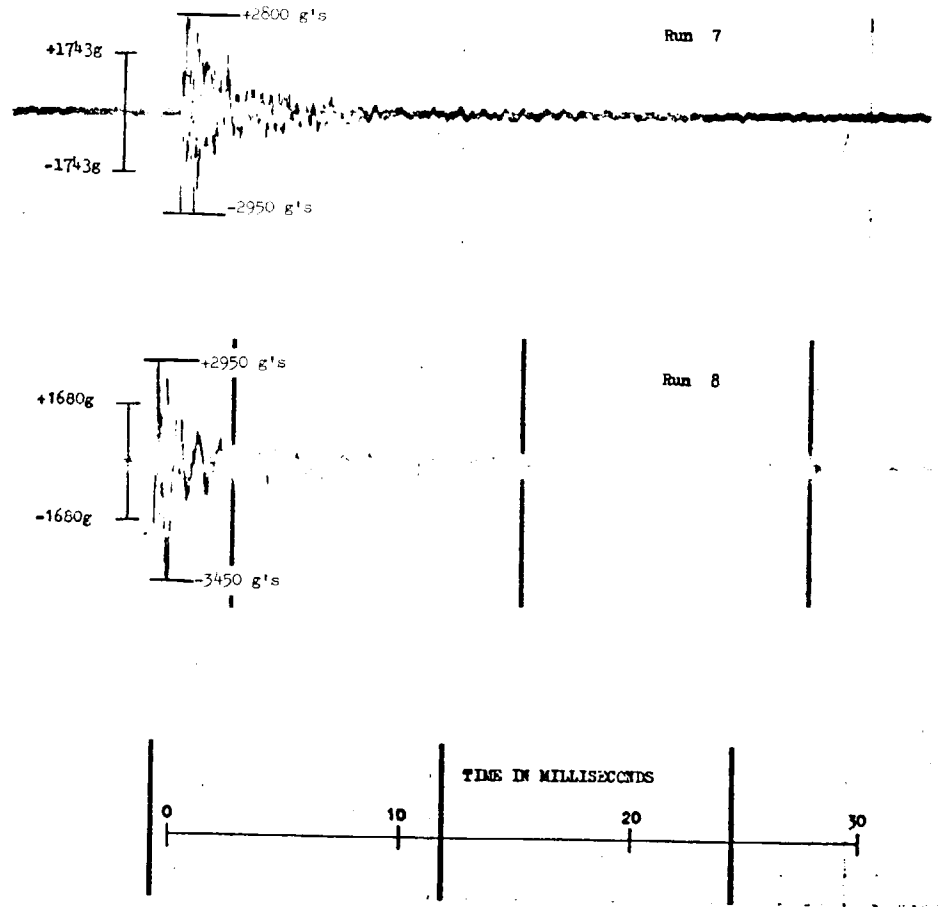
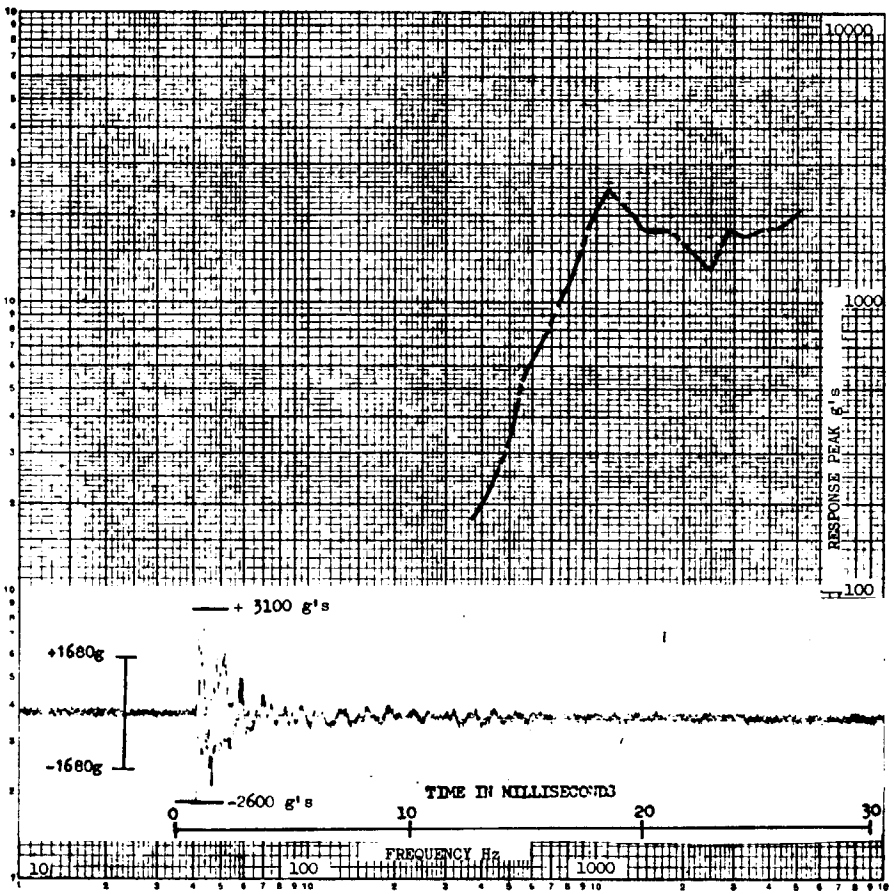
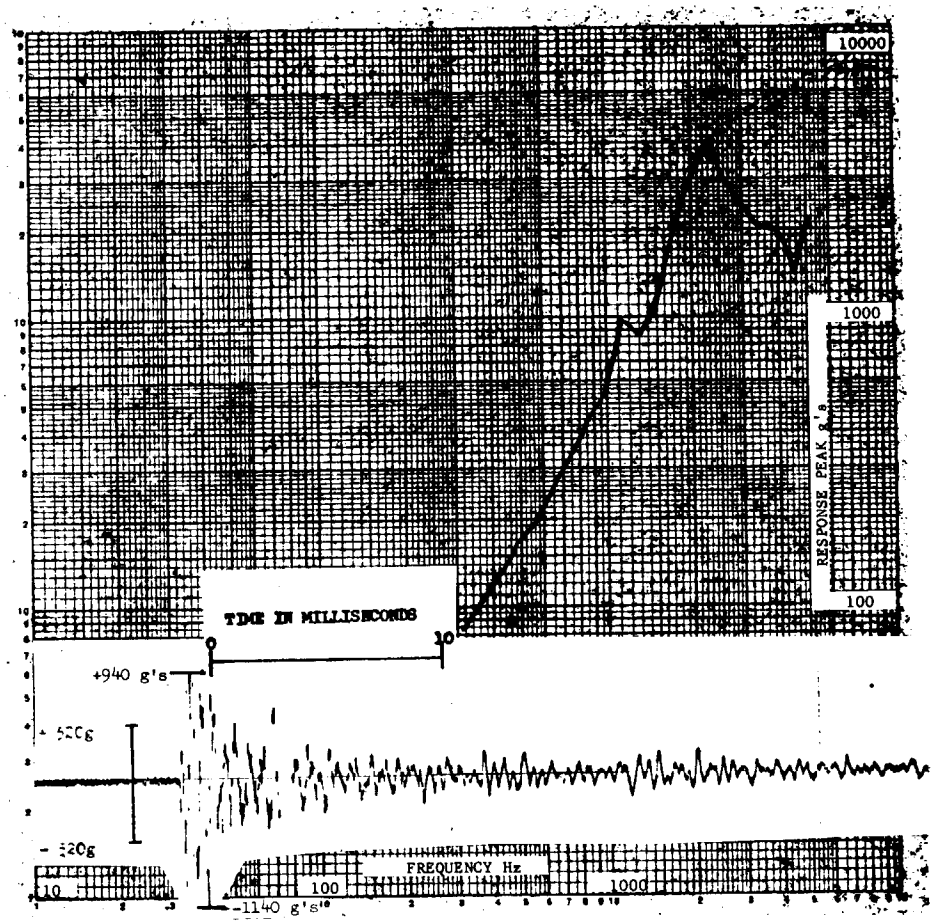


FIGURE I.A.5-184

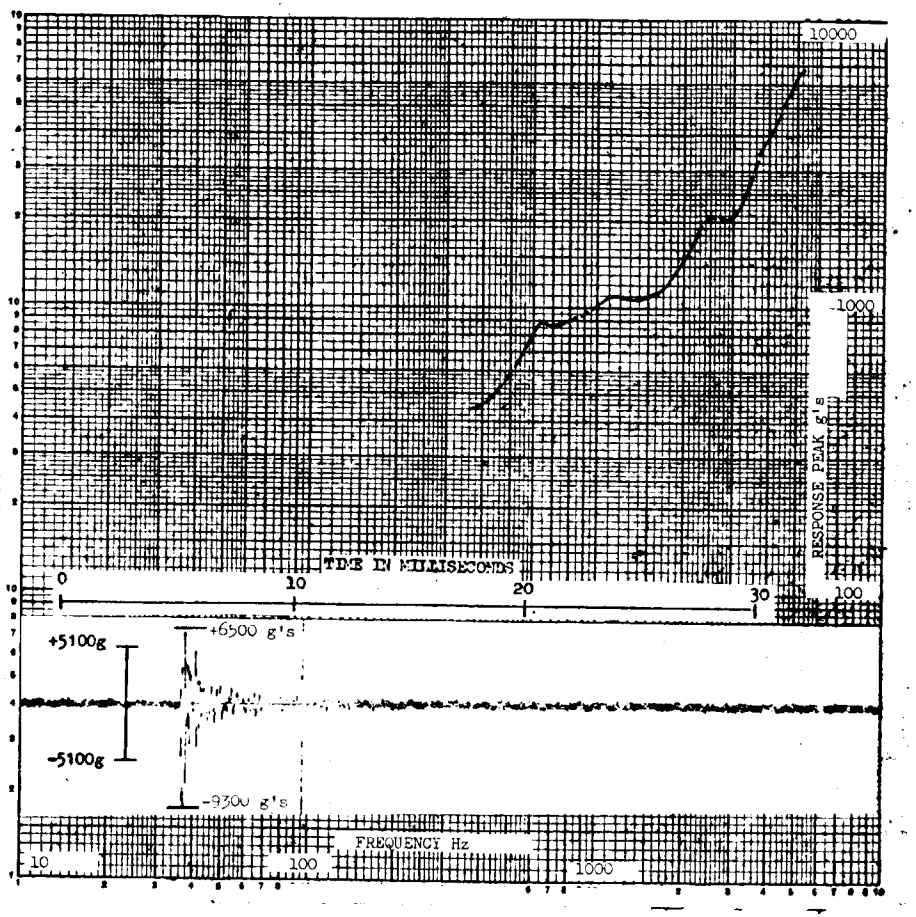


PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
PBPS SECTION
LOC. 35R UNFILTERED
RUN NO. 6

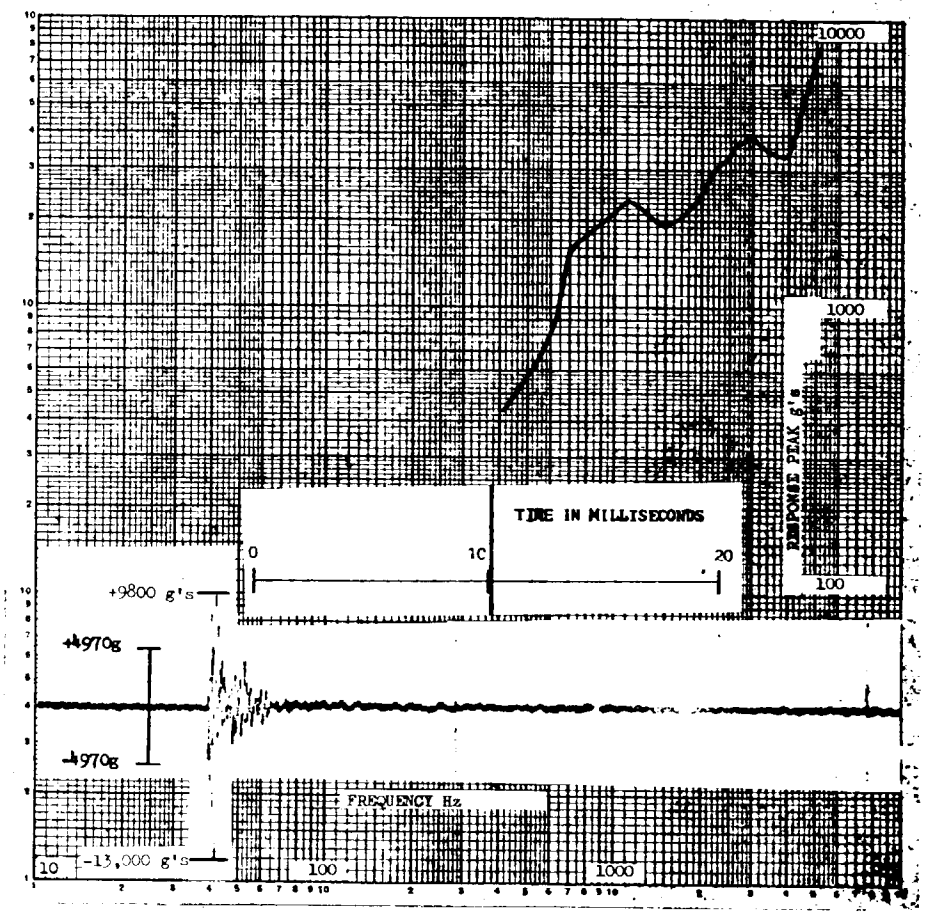


PBV SHOCK DETERMINATION TEST
--STAGE III / PBV STAGING
LOC. 101T R/S
INTERFACE RING @ 325°
RUN 9

FIGURE I.A.5-183

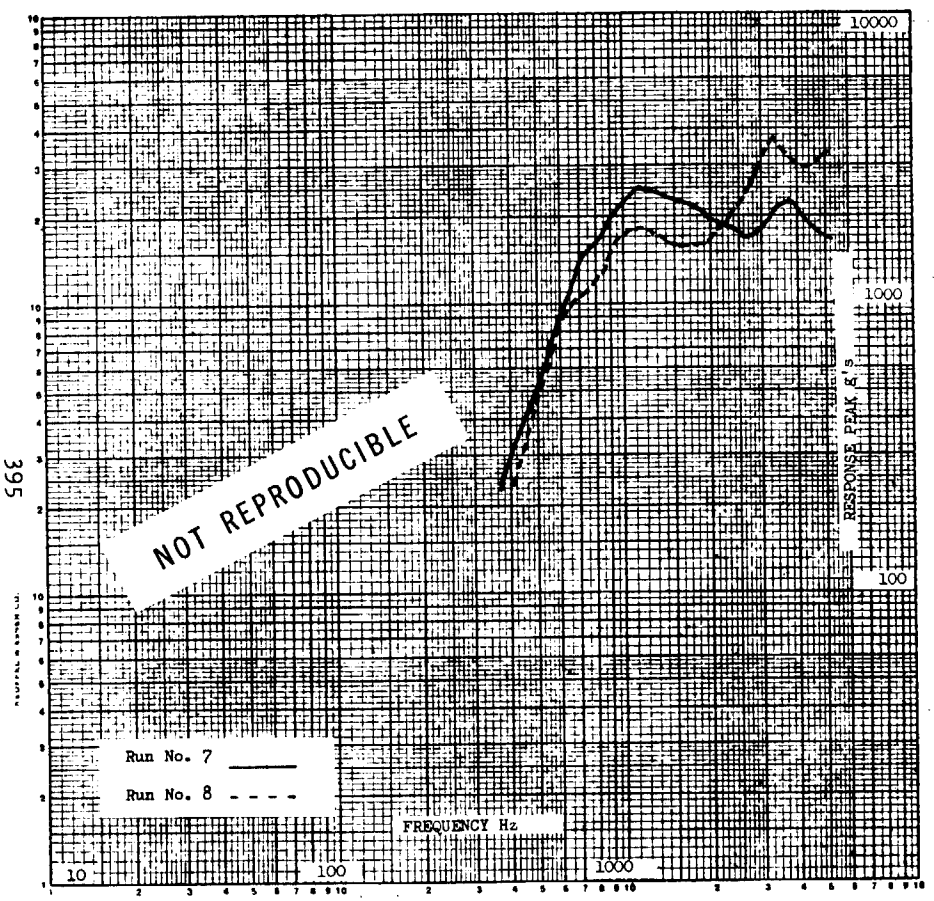


PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
PBPS SECTION
LOC. 35R UNFILTERED
RUN NO. 6



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
PBPS SECTION
LOC. 35R UNFILTERED
RUN NO. 7

FIGURE I.A.5-182



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
PBPS SECTION
LOC. 34R UNFILTERED
RUN NO. 7,8

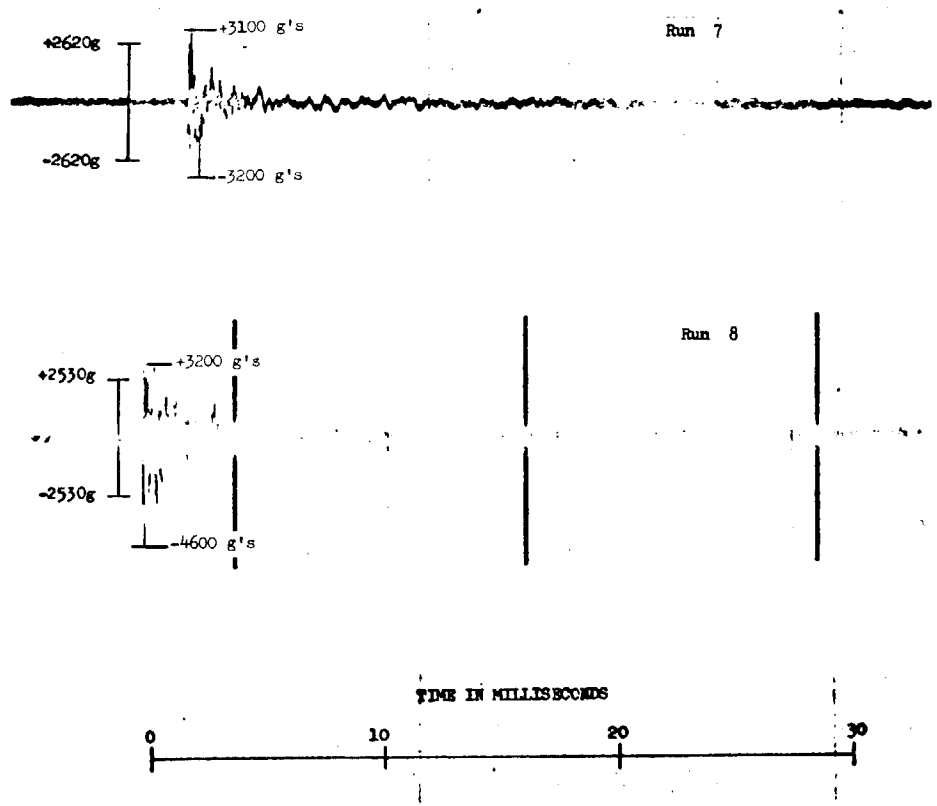
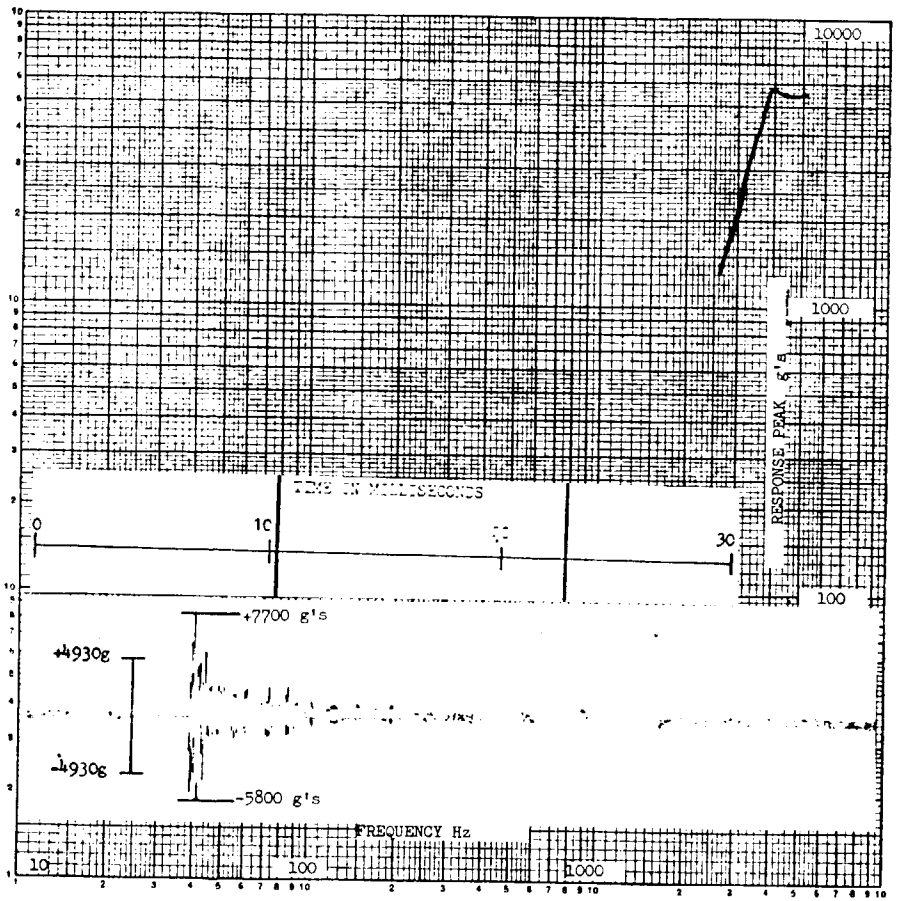
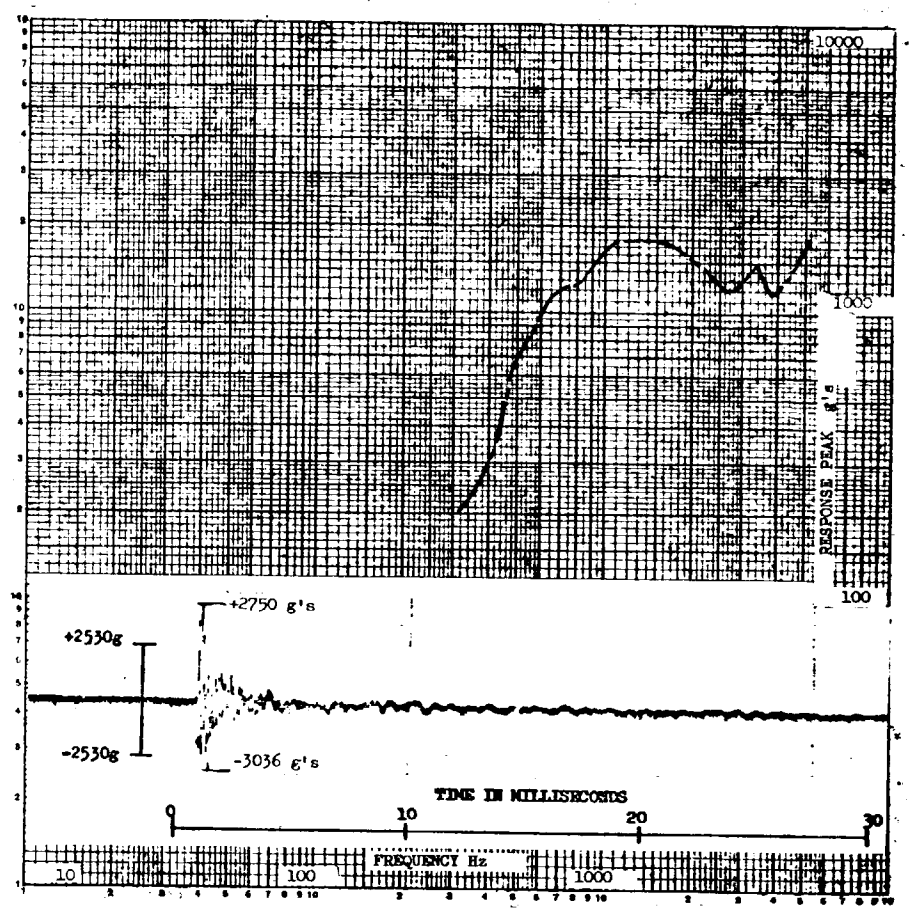


FIGURE I.A.5-181

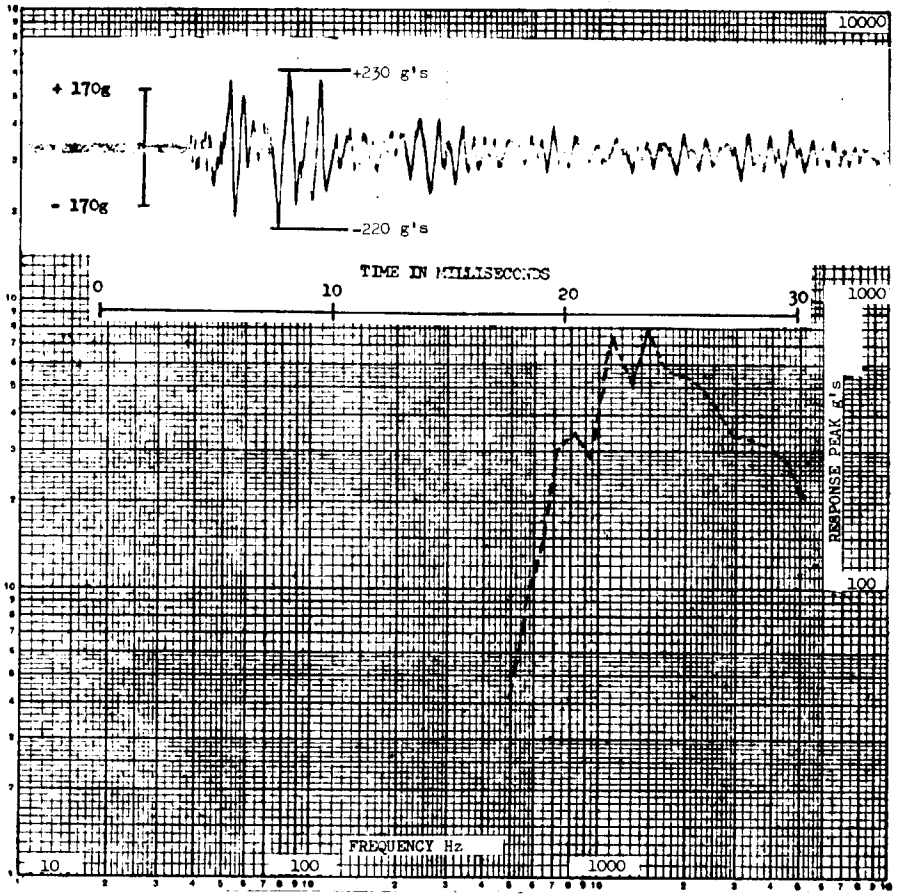


PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
PBPS SECTION
LOC. 33R UNFILTERED
RUN NO. 7

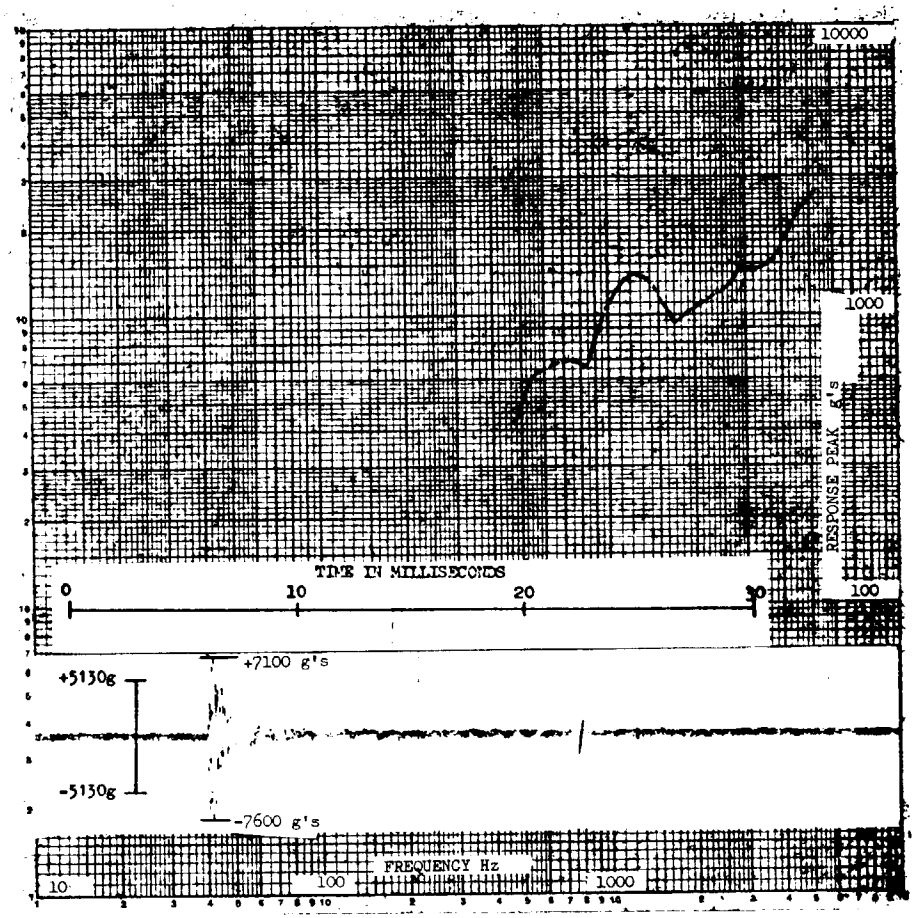


PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
PBPS SECTION
LOC. 34R UNFILTERED
RUN NO. 6

FIGURE I.A.5-180

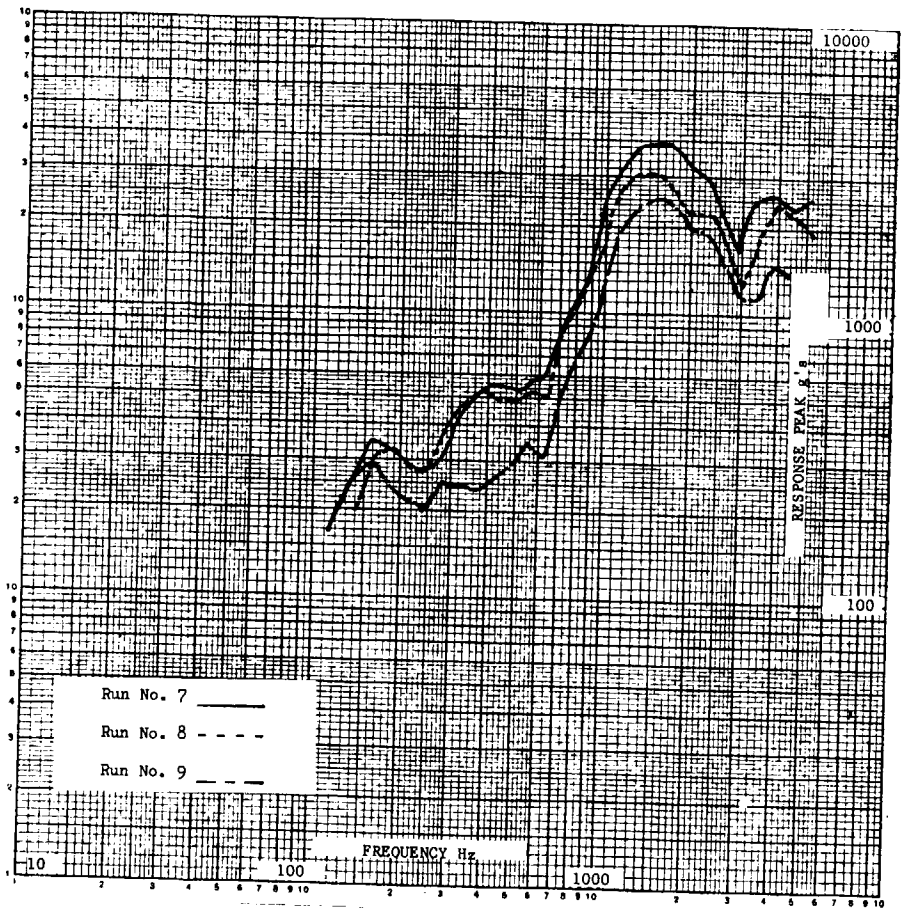


PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 32-X MOD7E
MISTRAM TRANSPONDER
RUN NO. 5



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
P&PS SECTION
LOC. 33R UNFILTERED
RUN NO. 6

FIGURE 1.A.5-179



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 31-T PBPS
PITCH ENGINE #4
RUN NO. 7, 8, 9

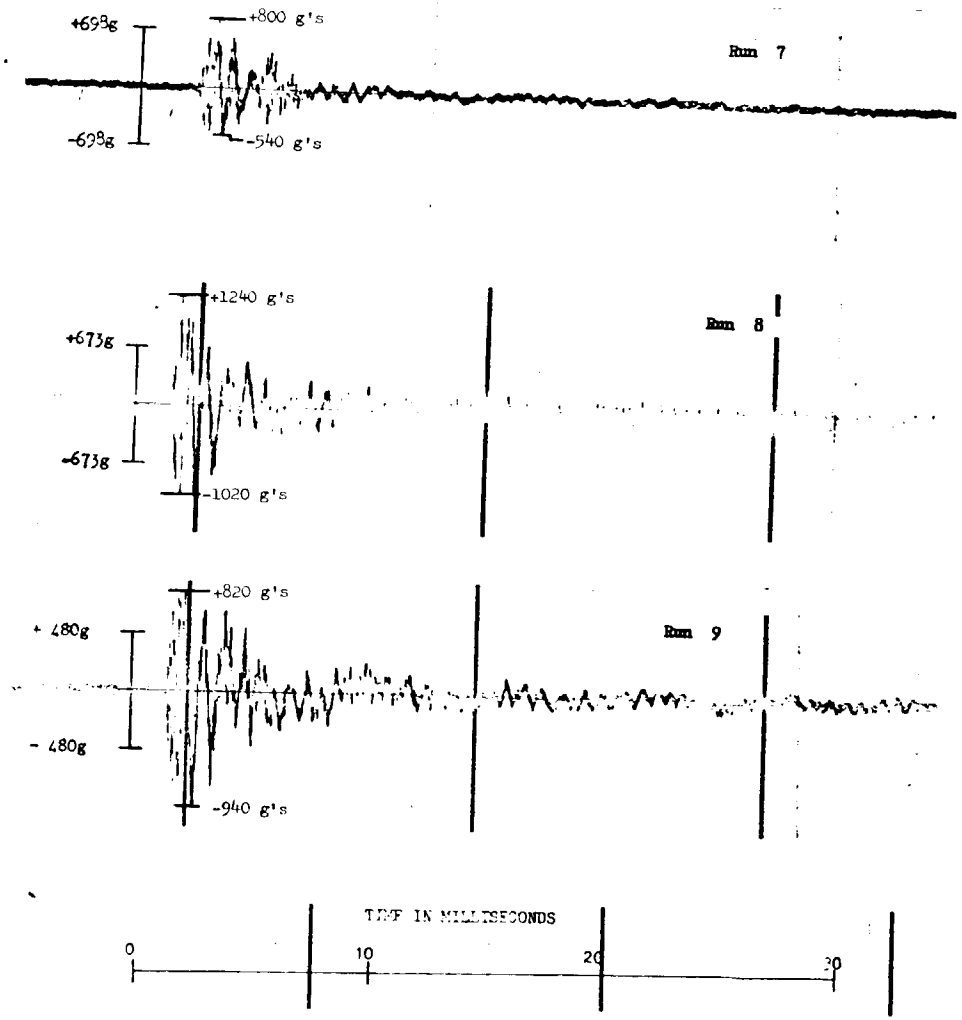
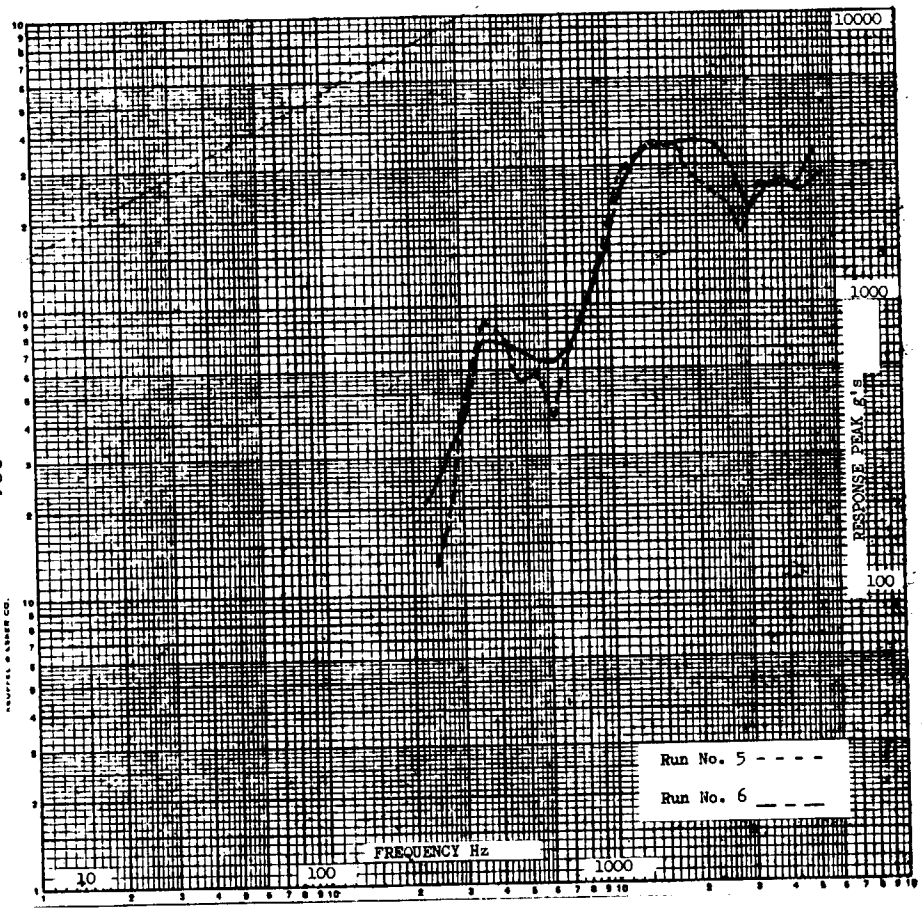
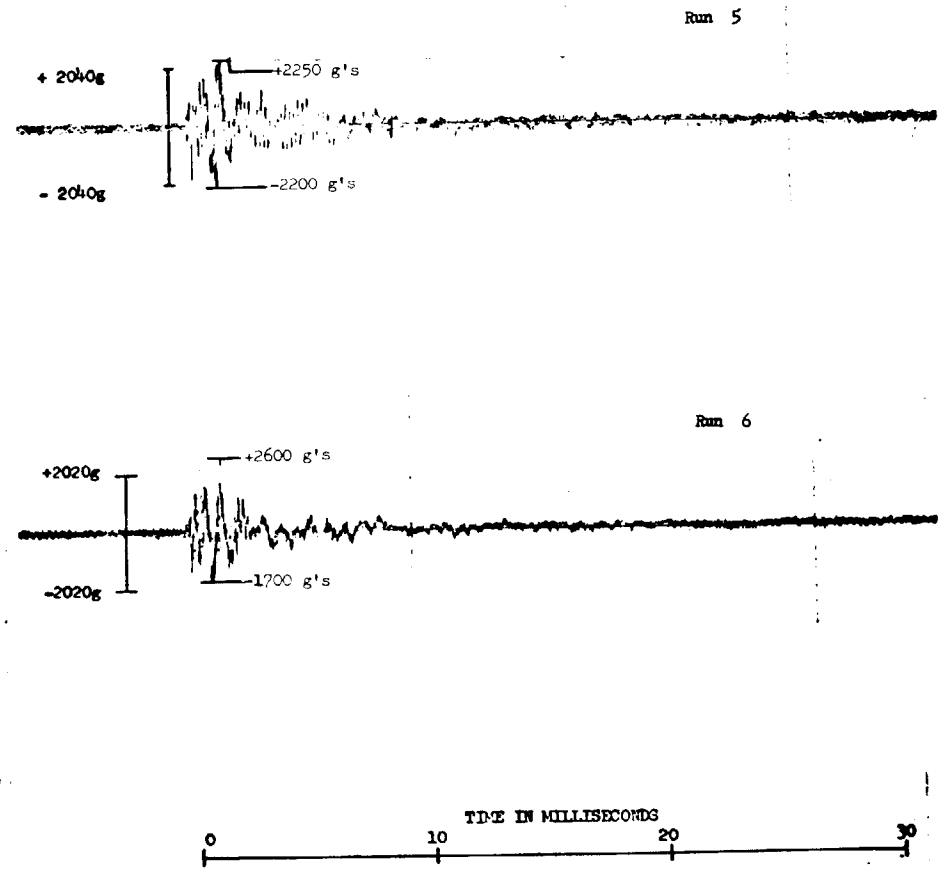


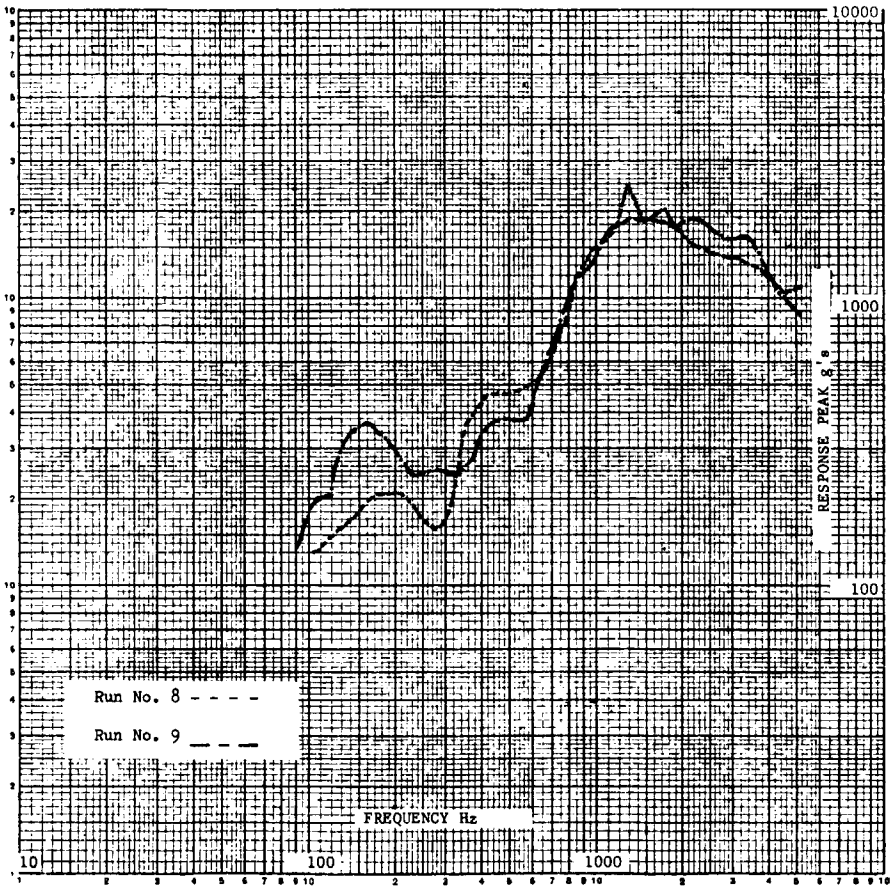
FIGURE 1.A.5-178

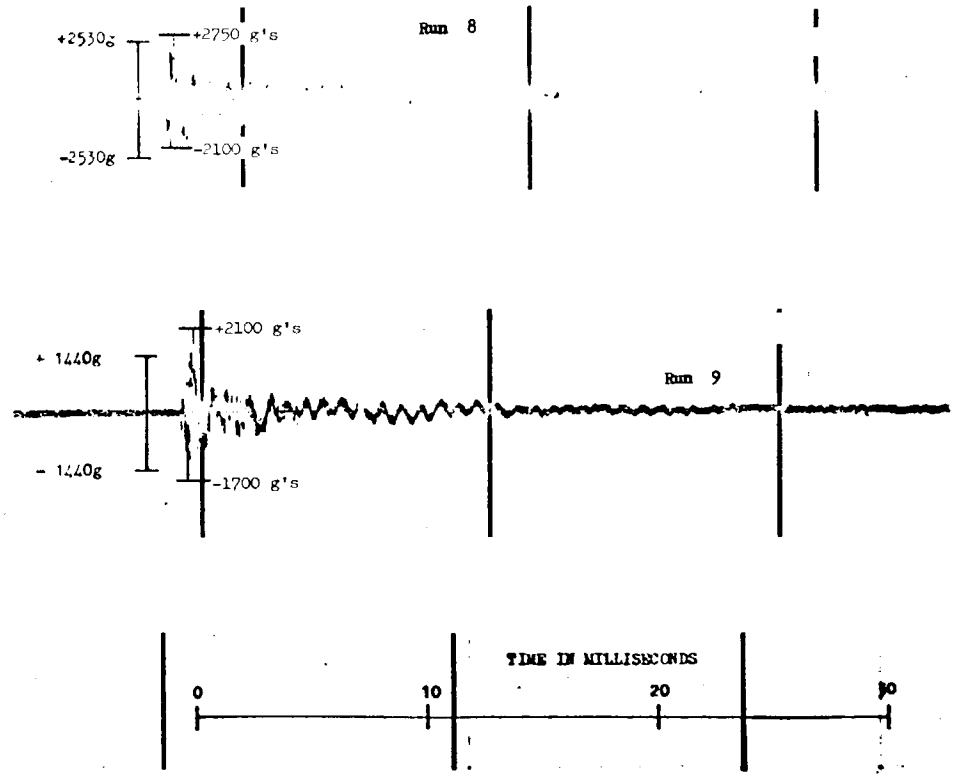




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 31-T PBPS
PITCH ENGINE #4
RUN NO. 5,6

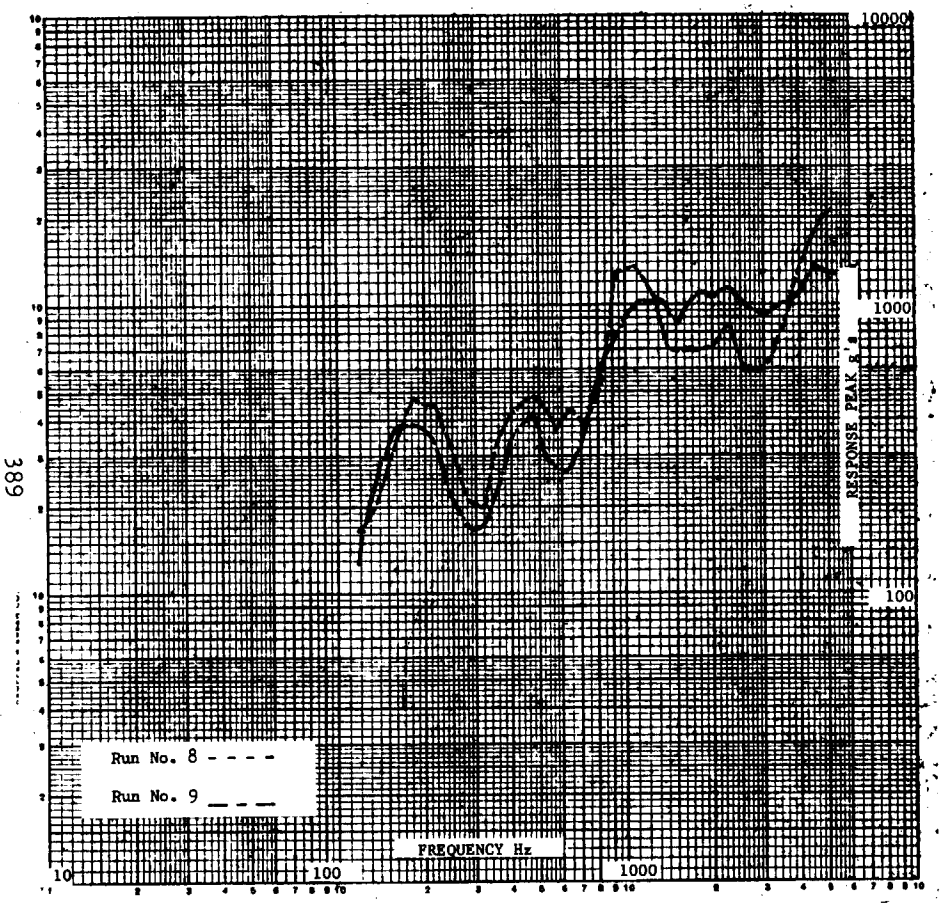
FIGURE 1.A.5-177

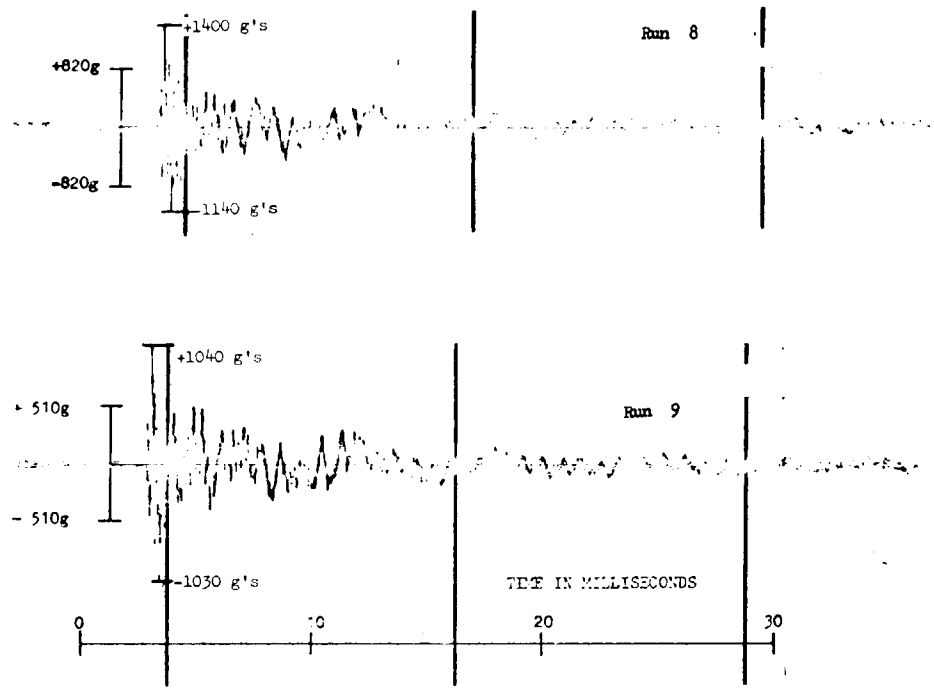




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 31-R PBPS
PITCH ENGINE #4
RUN NO. 8,9

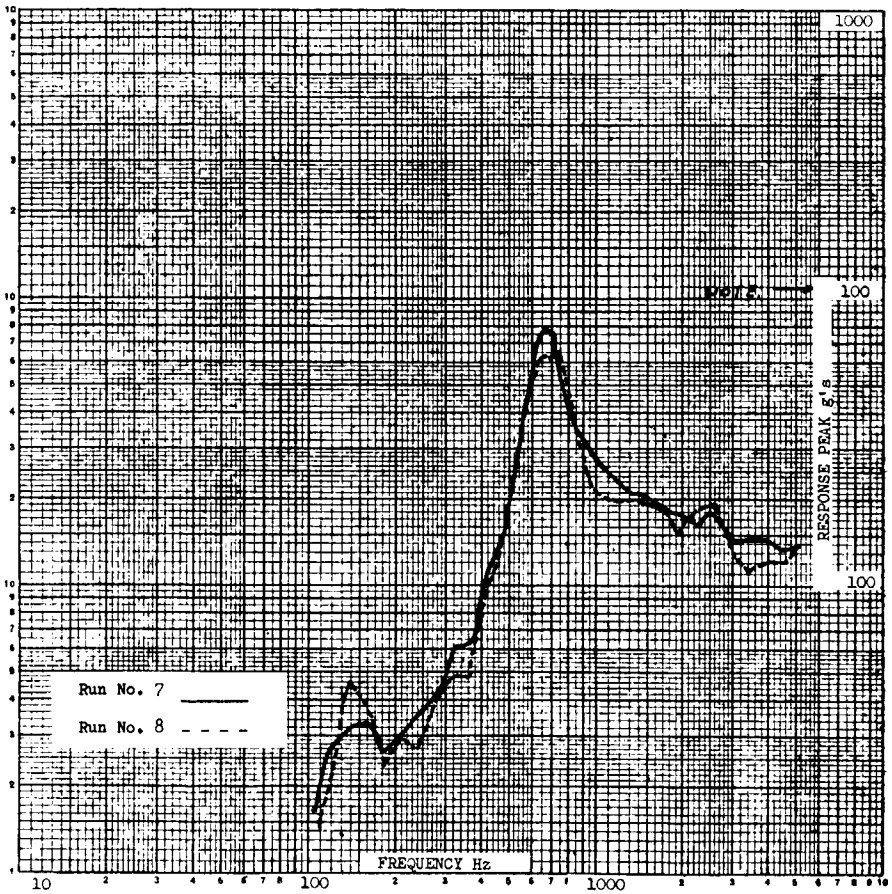
FIGURE I.A.5-176

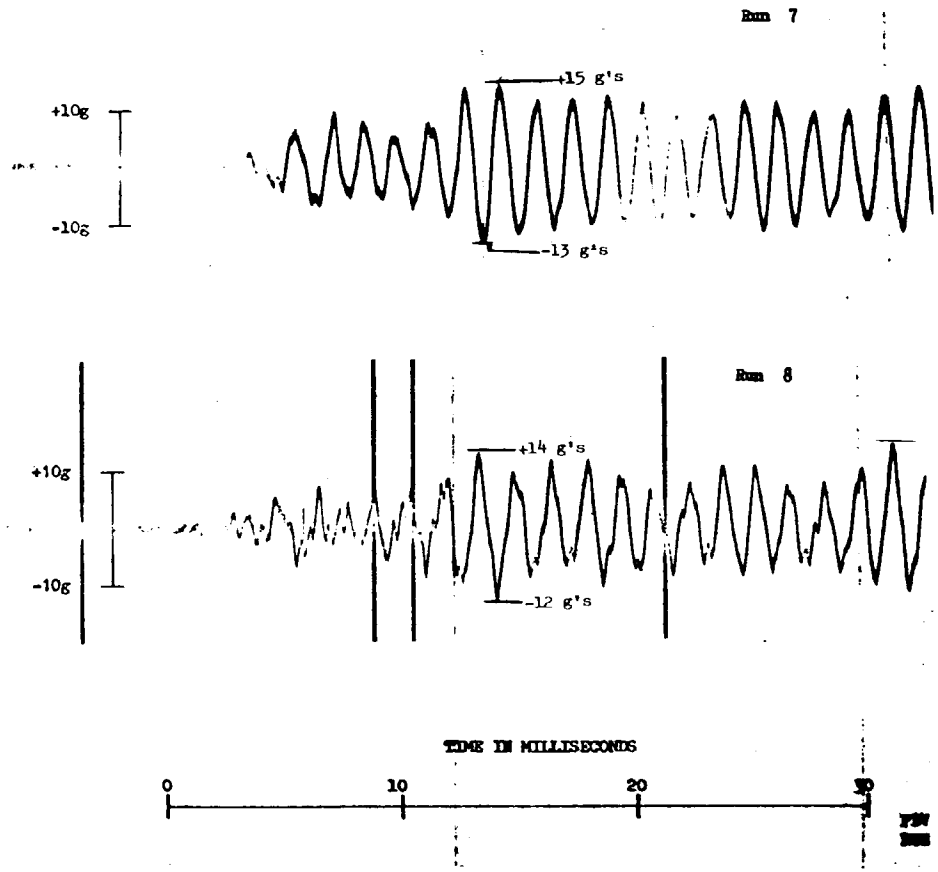




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 31-Z PBPS
PITCH ENGINE #4
RUN NO. 8,9

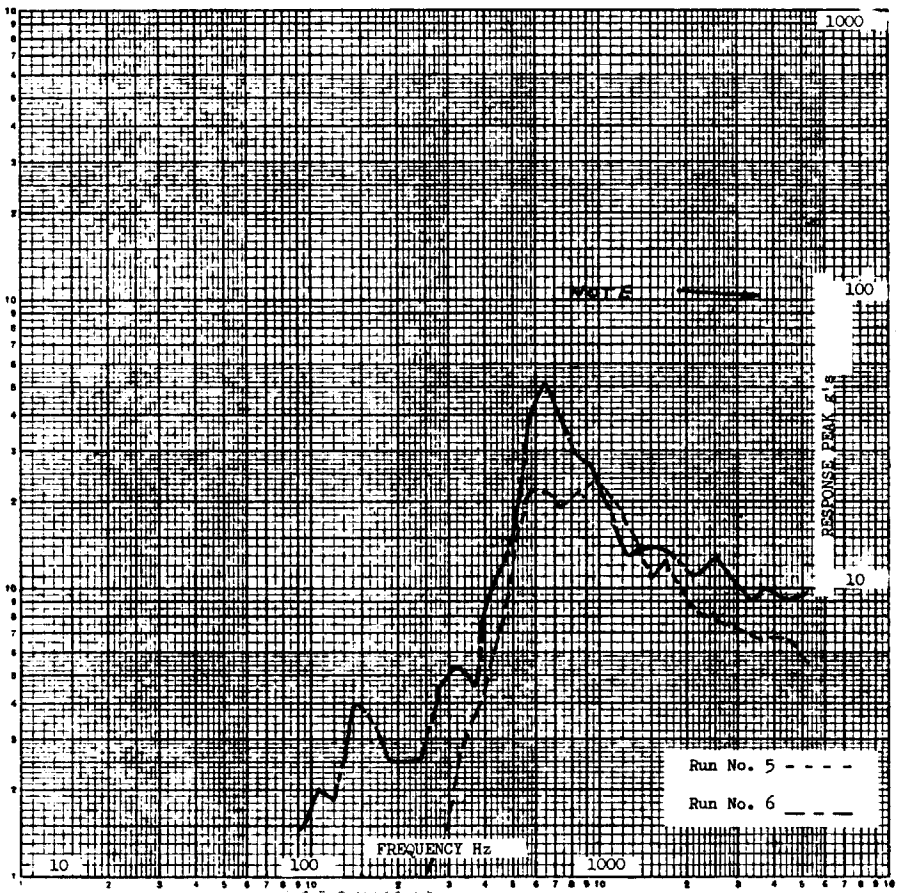
FIGURE I.A.5-175

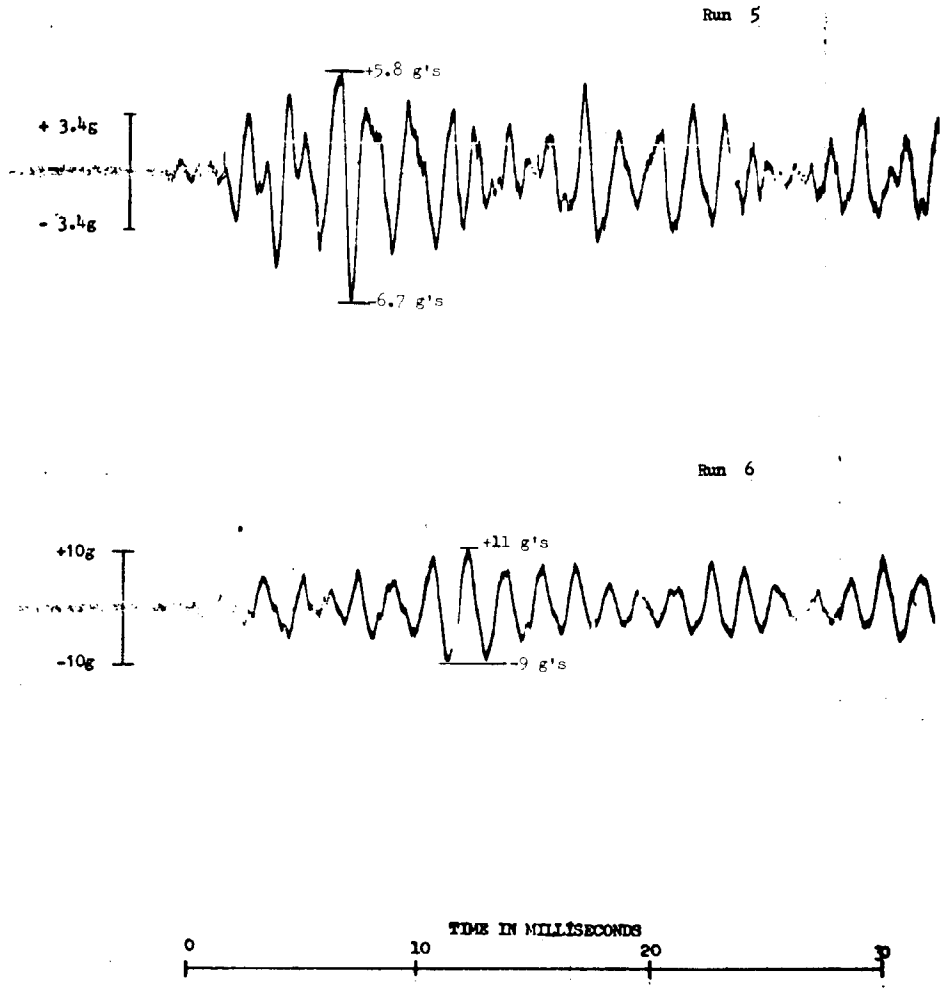




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 30-T RV
RUN NO. 7,8

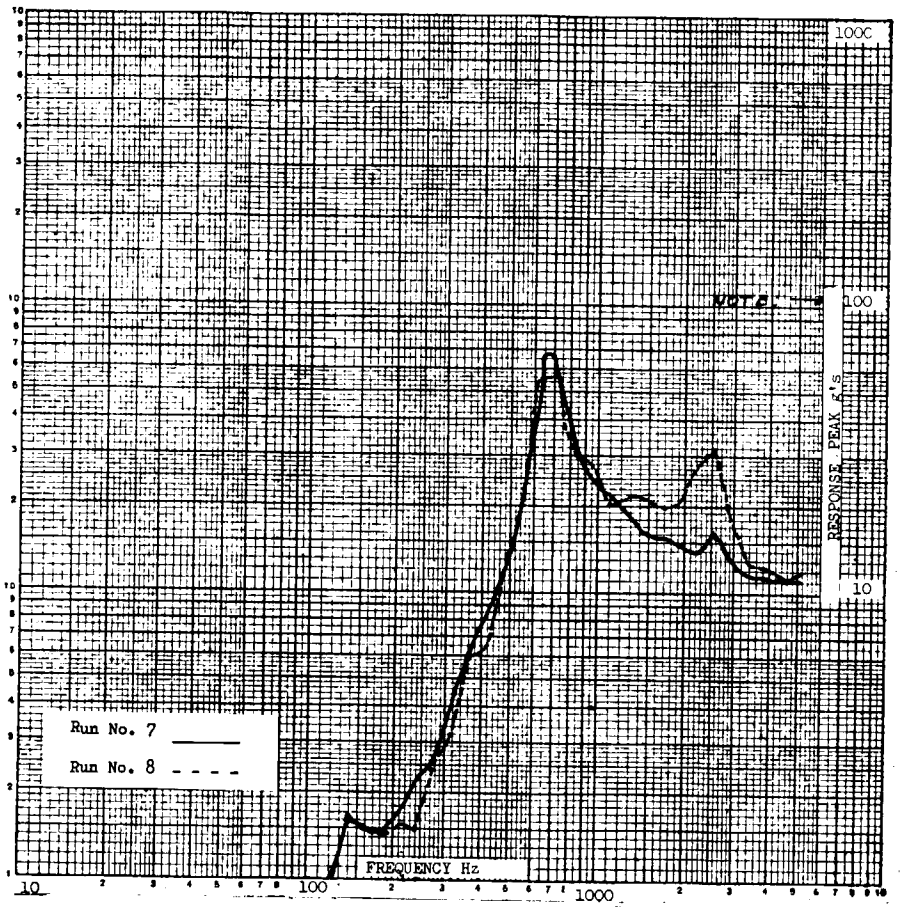
FIGURE I.A.5-174

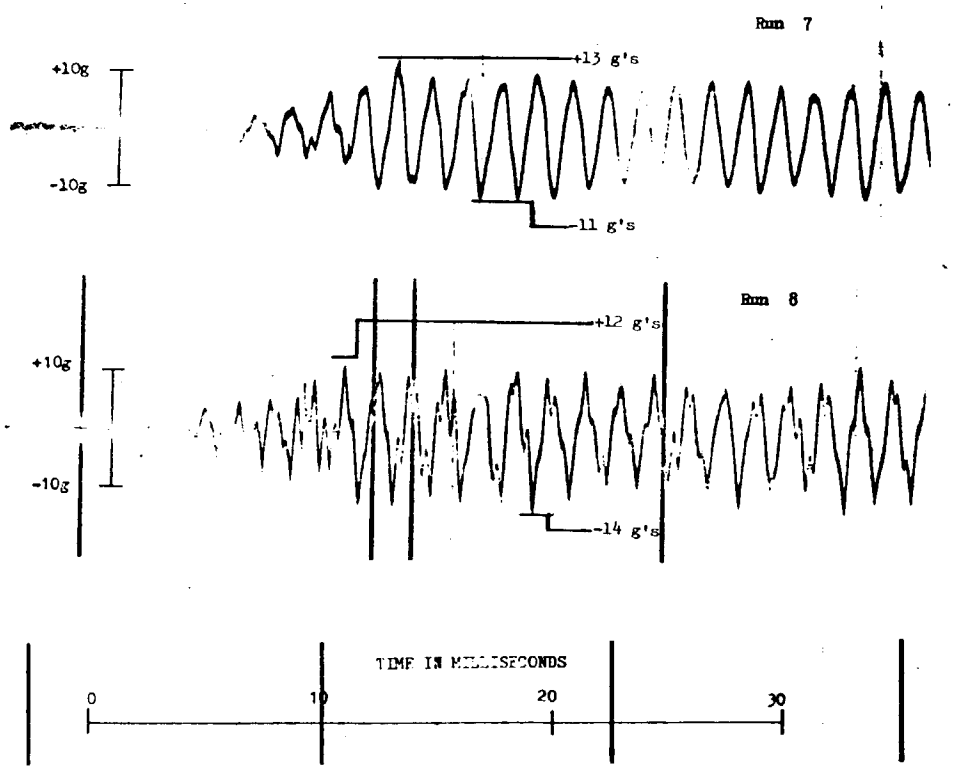




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 30-T RV
RUN NO. 5,6

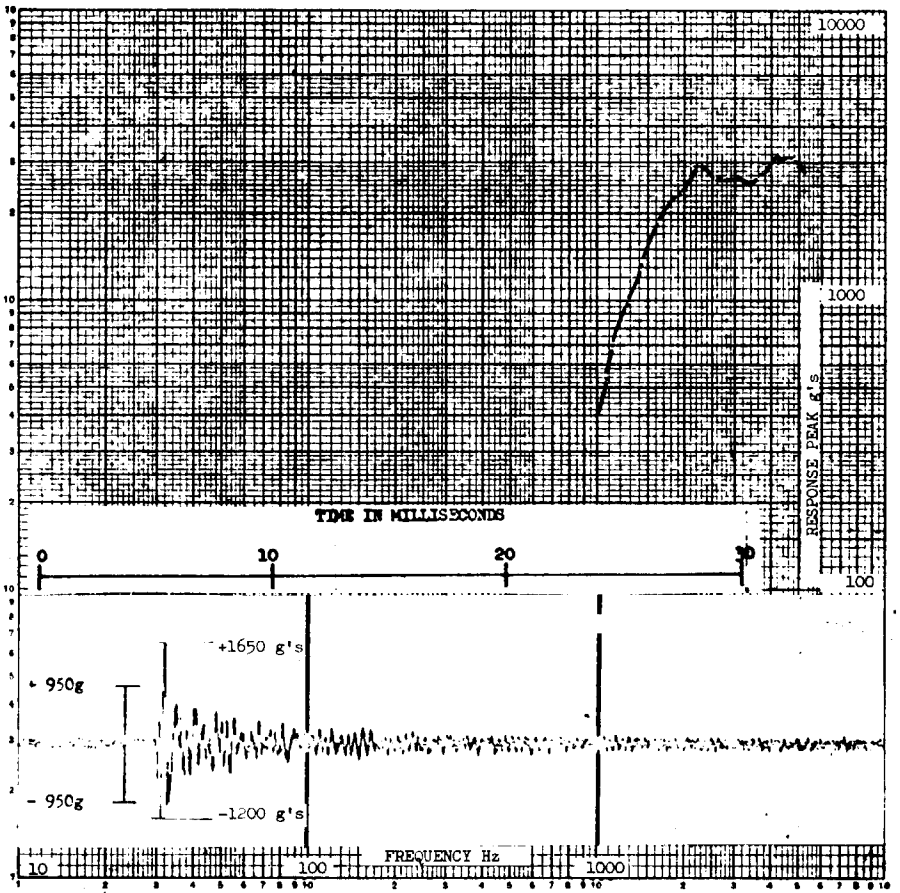
FIGURE I.A.5-173



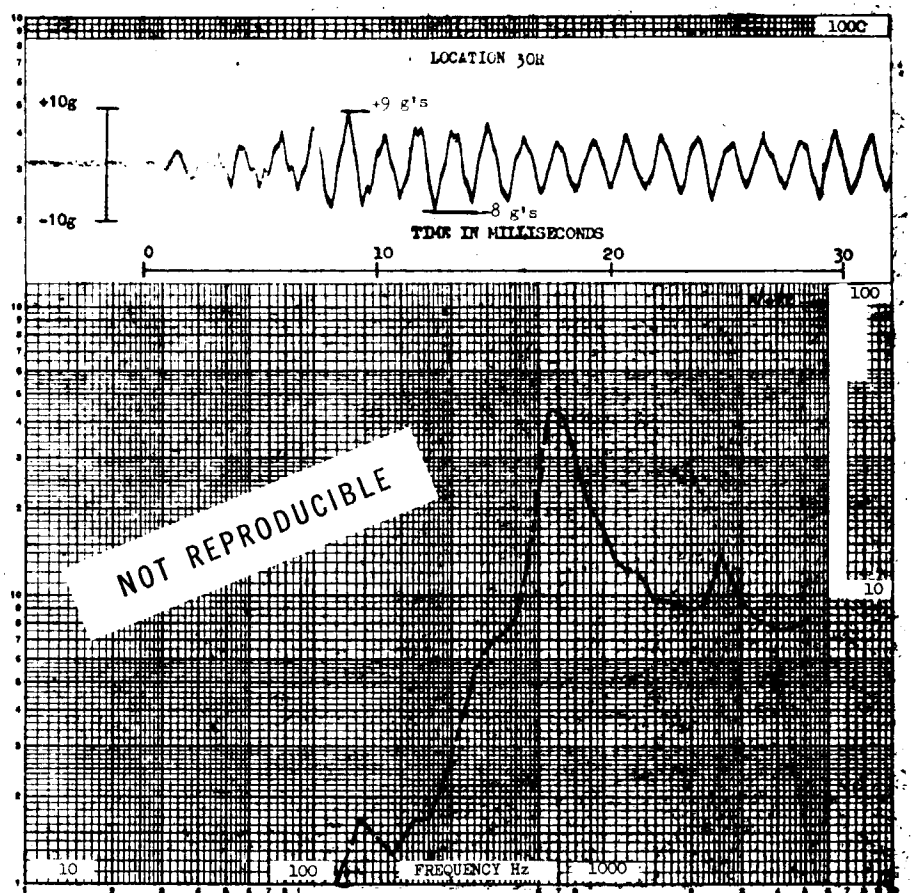


PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 30-R RV
RUN NO. 7,8

FIGURE I.A.5-172

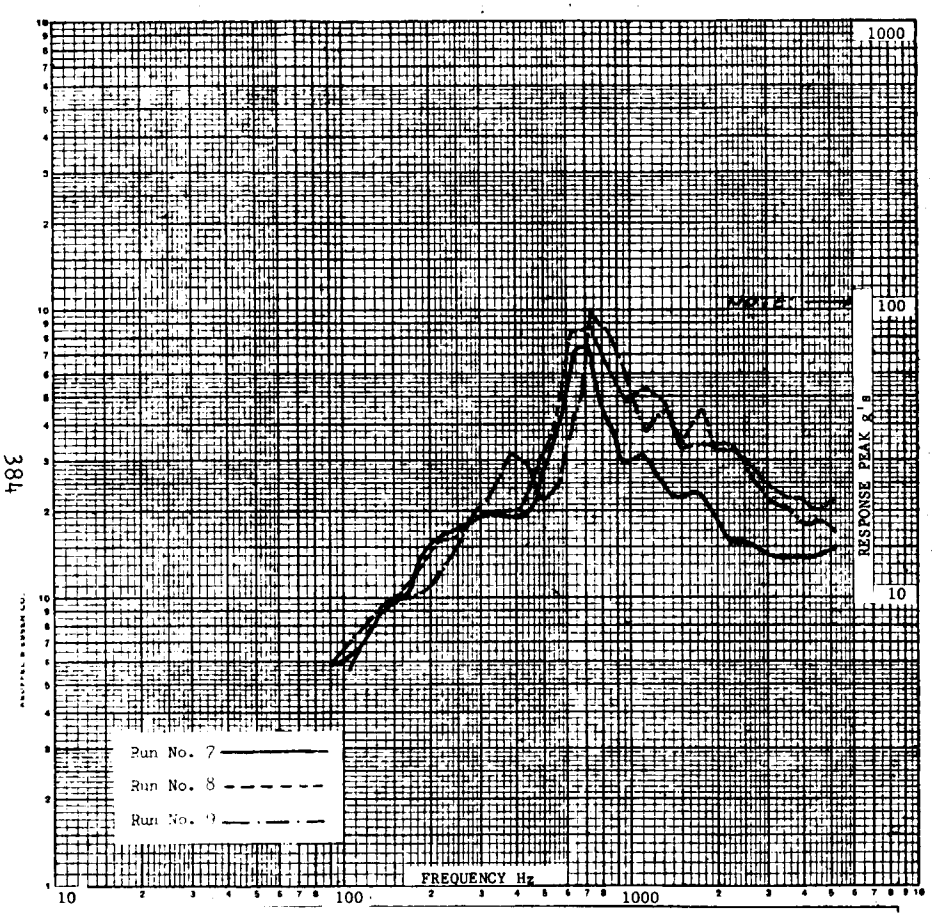


PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 25Y NS17
COMPUTER, FOOT
RUN NO. 9



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 30-R RV
RUN NO. 6

FIGURE I.A.5-171



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 30-Z RV
RUN NO. 7, 8, 9

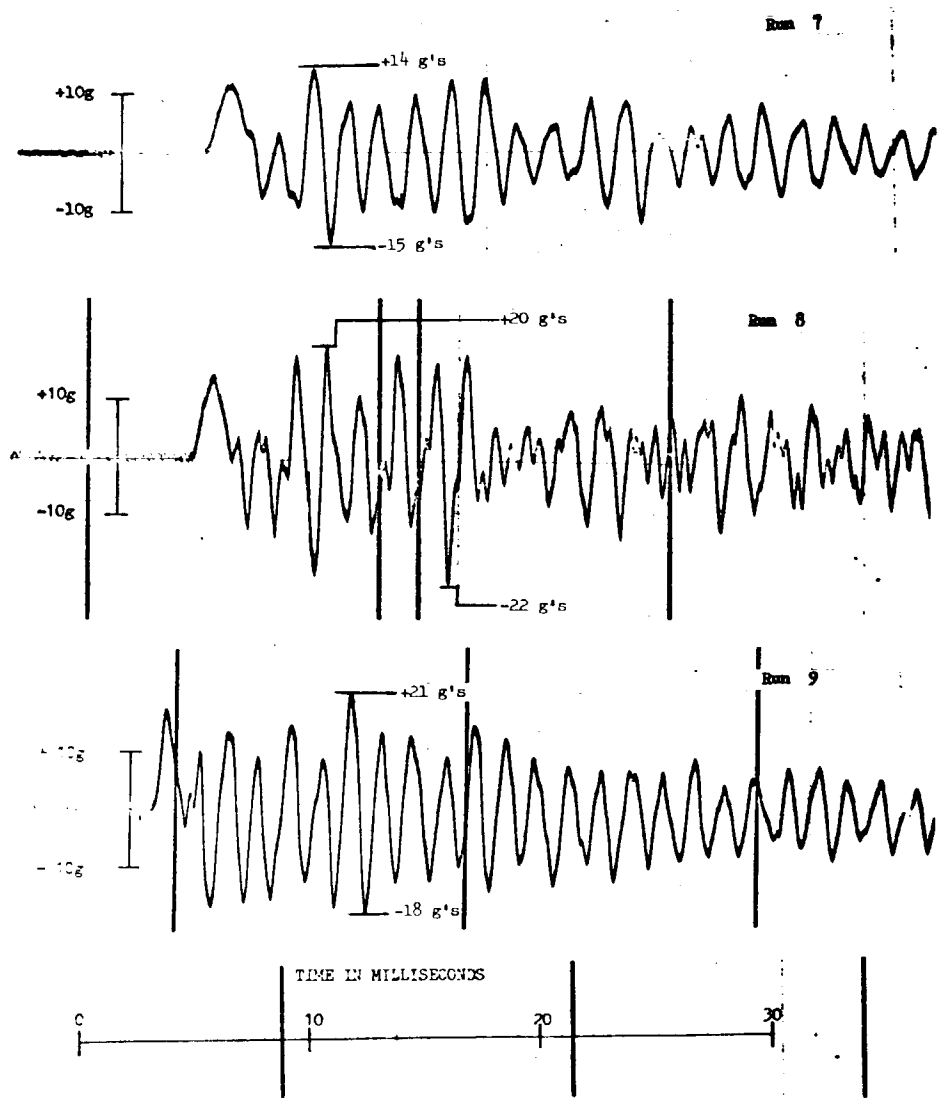
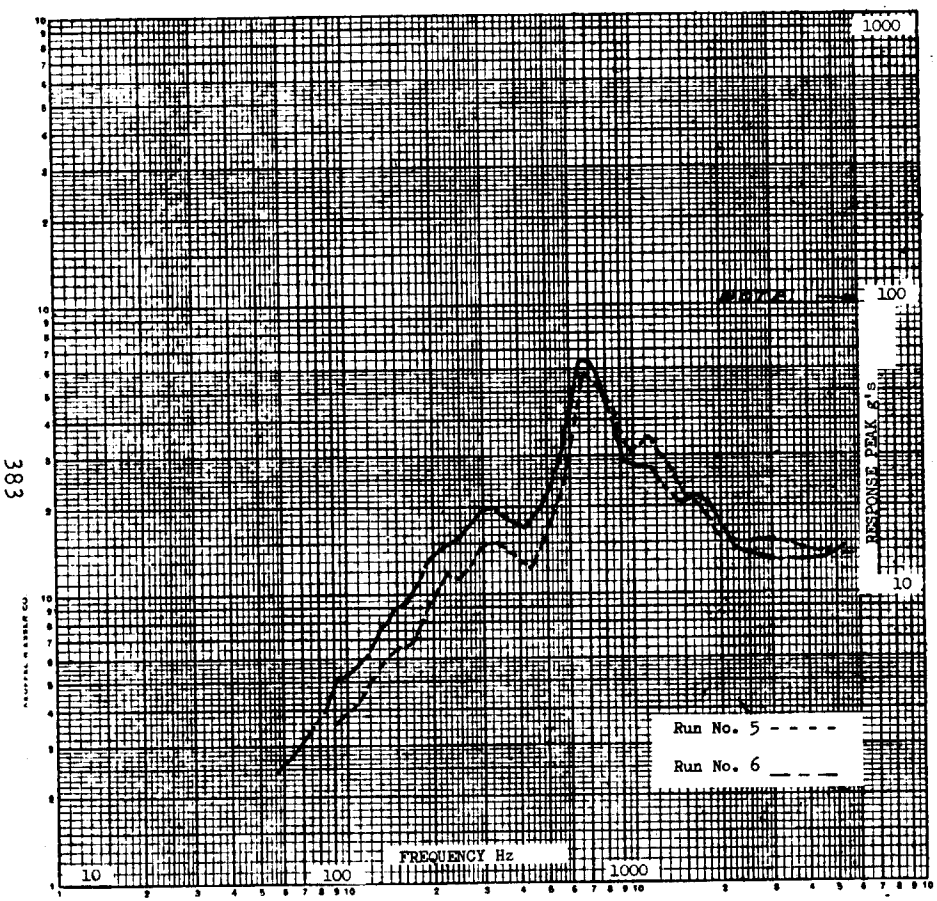


FIGURE I.A.5-170



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 30-Z RV
RUN NO. 5,6

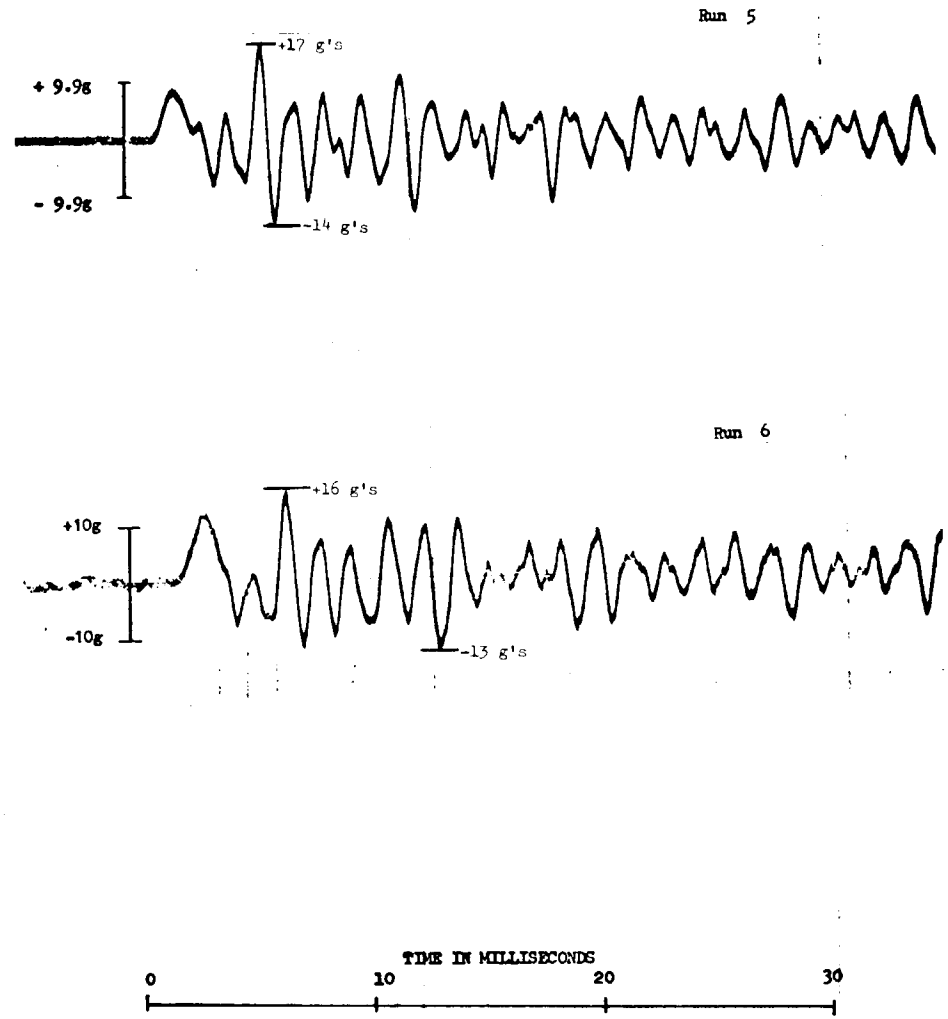
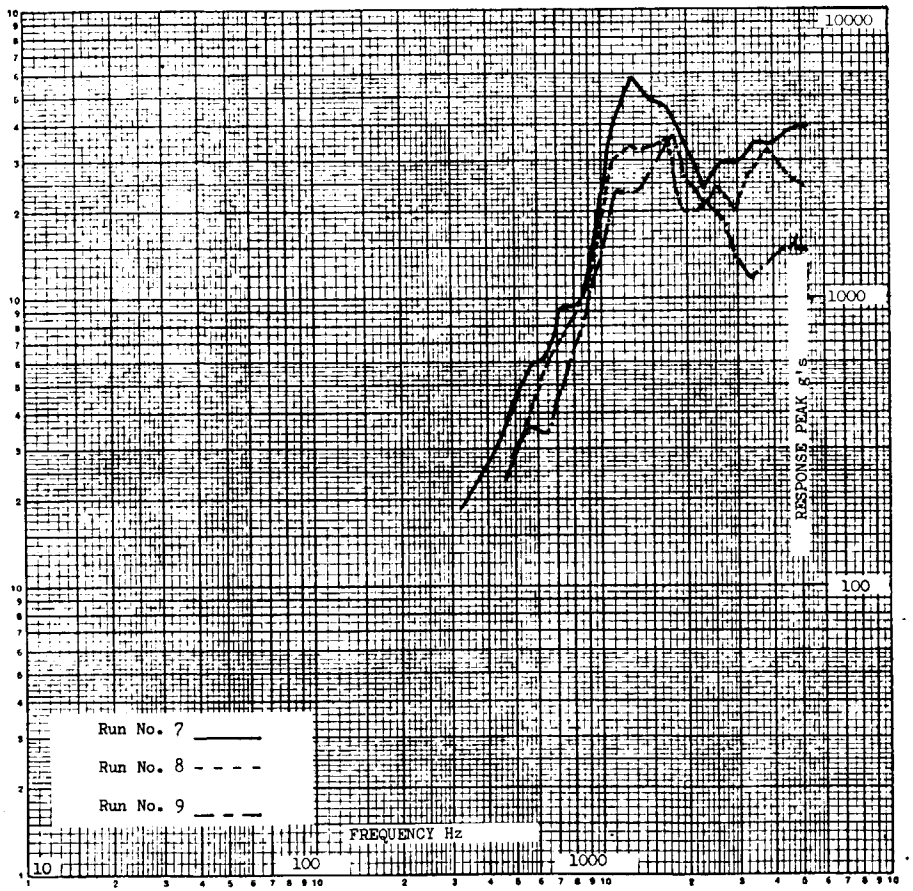
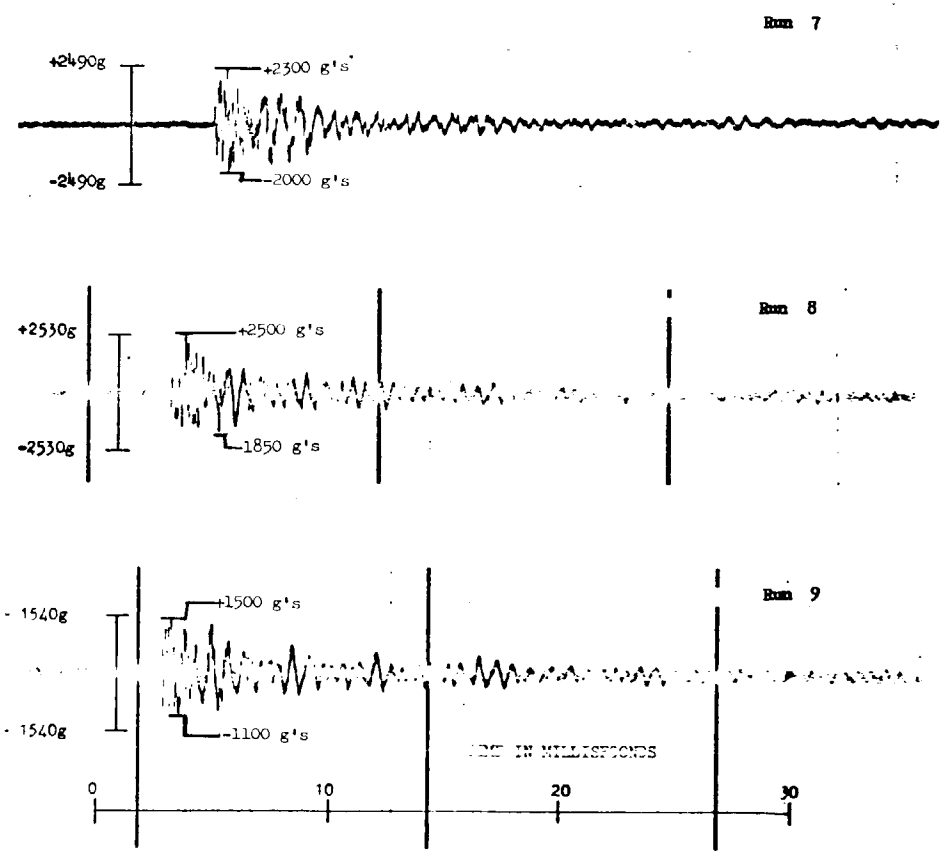


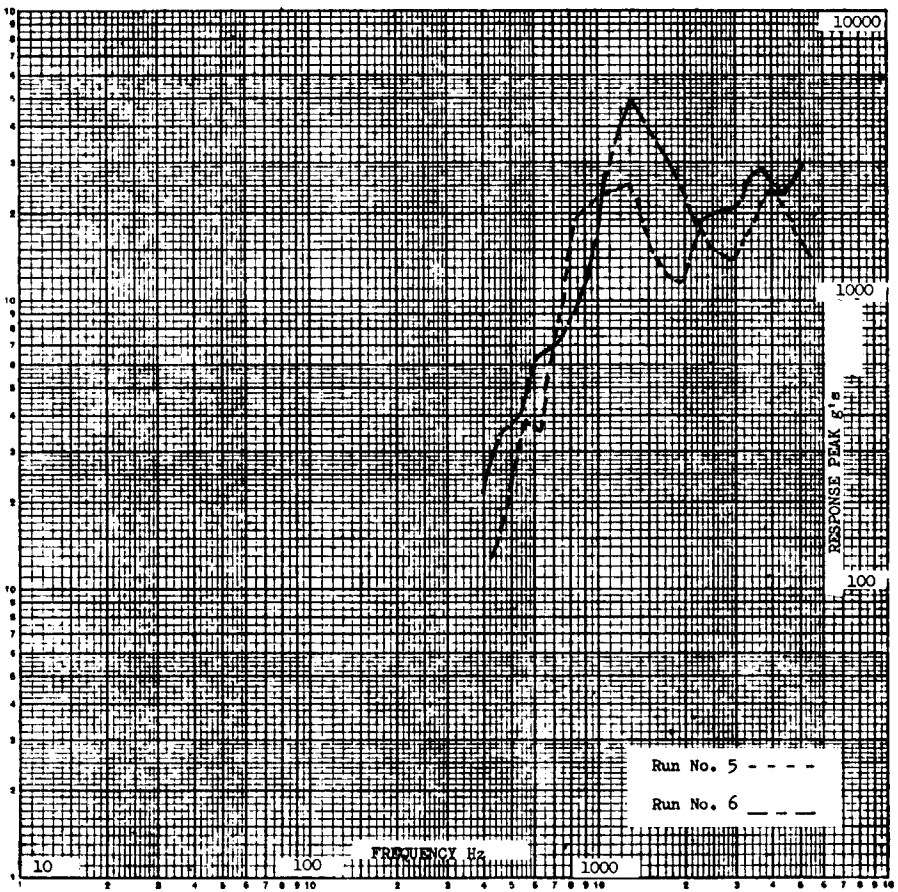
FIGURE I.A.5-169





PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 28-Z NS 17
CD2-3A SKIN
RUN NO. 7, 8, 9

FIGURE I.A.5-168



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 28-Z NS 17
CD2-3A SKIN
RUN NO. 5,6

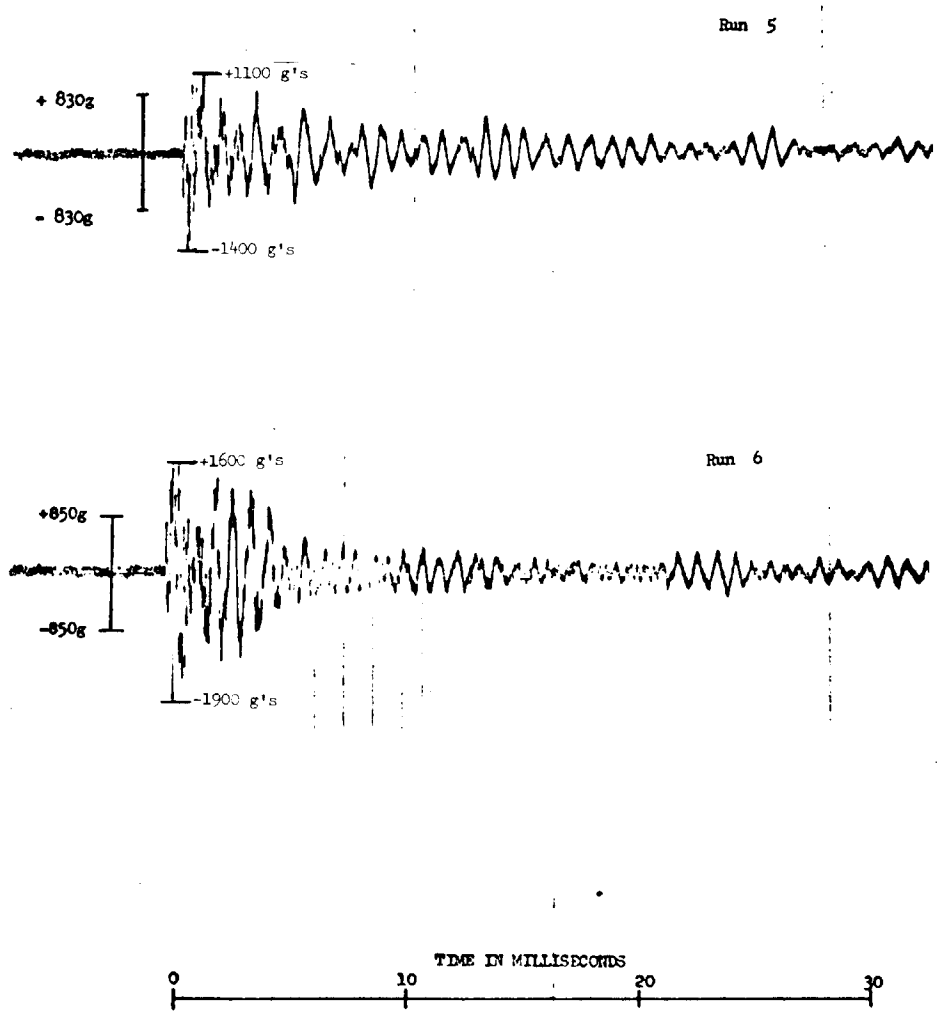
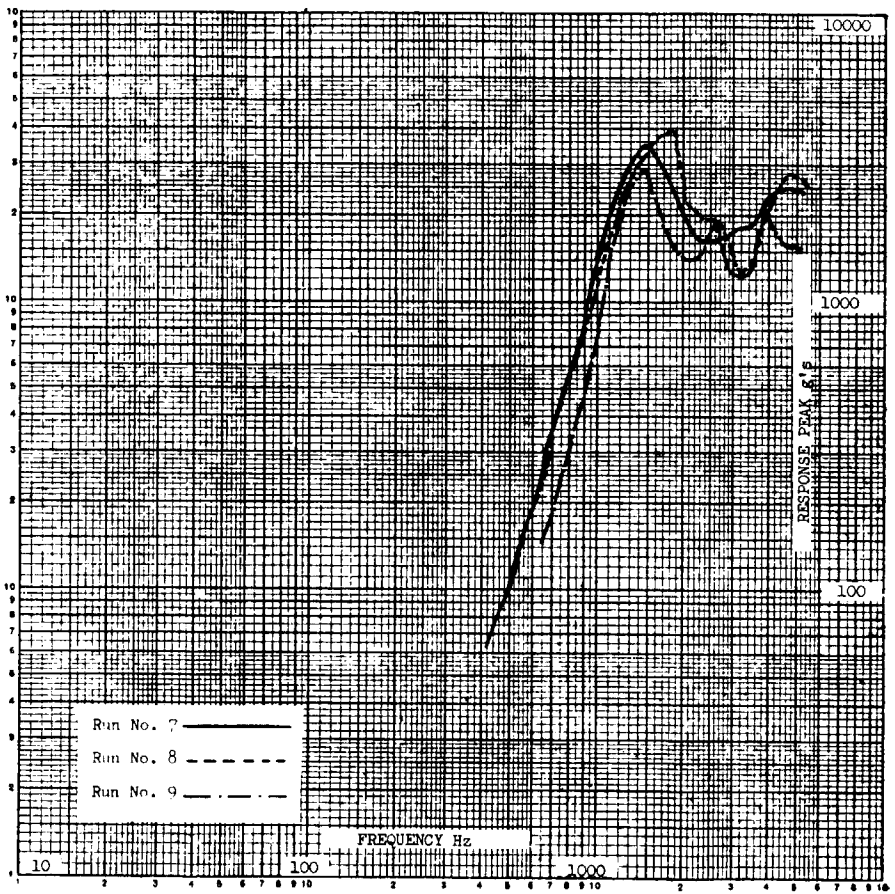


FIGURE I.A.5-167



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 28-Y NS 17
CD-3A SKIN
RUN NO. 7, 8, 9

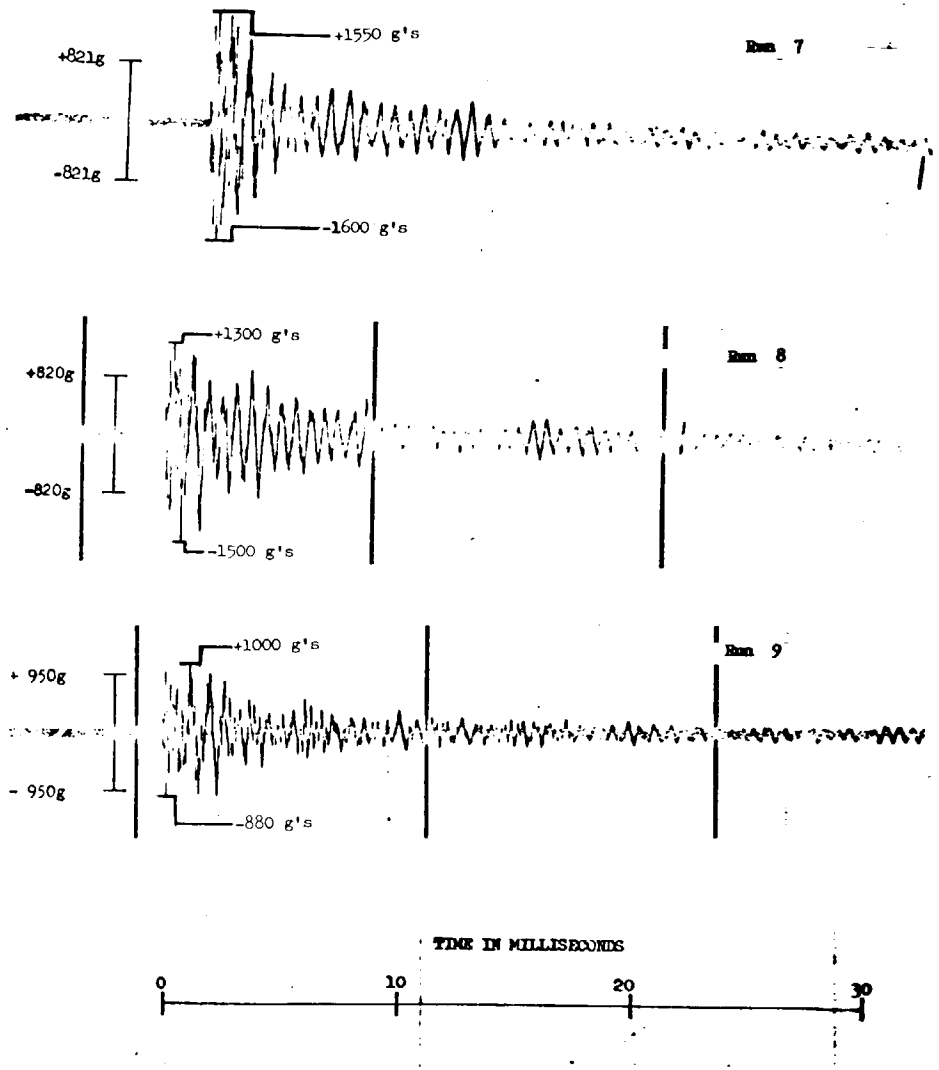
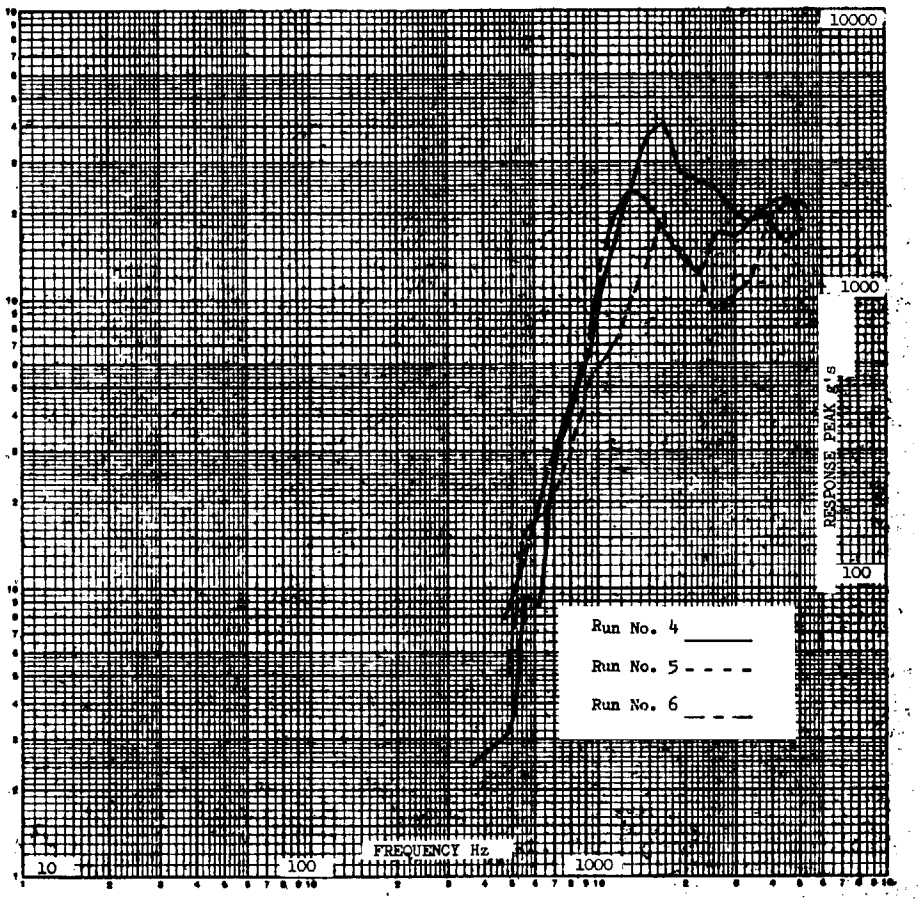
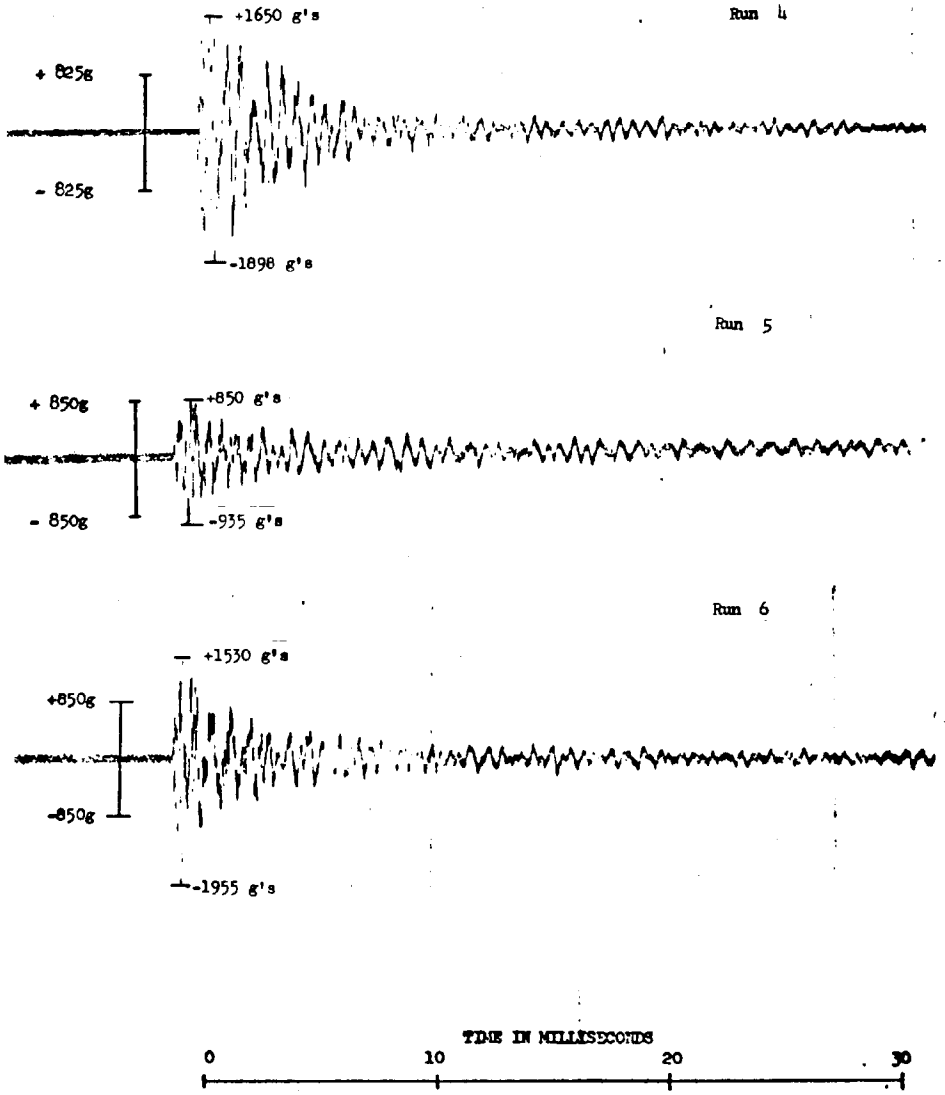


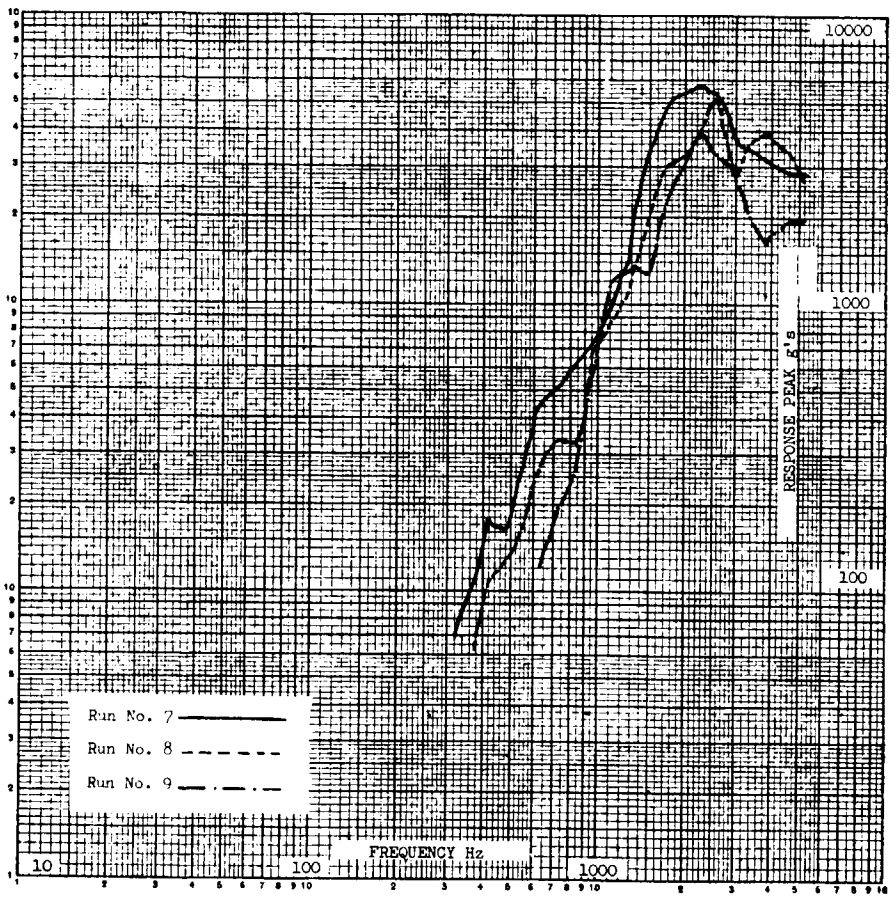
FIGURE I.A.5-166

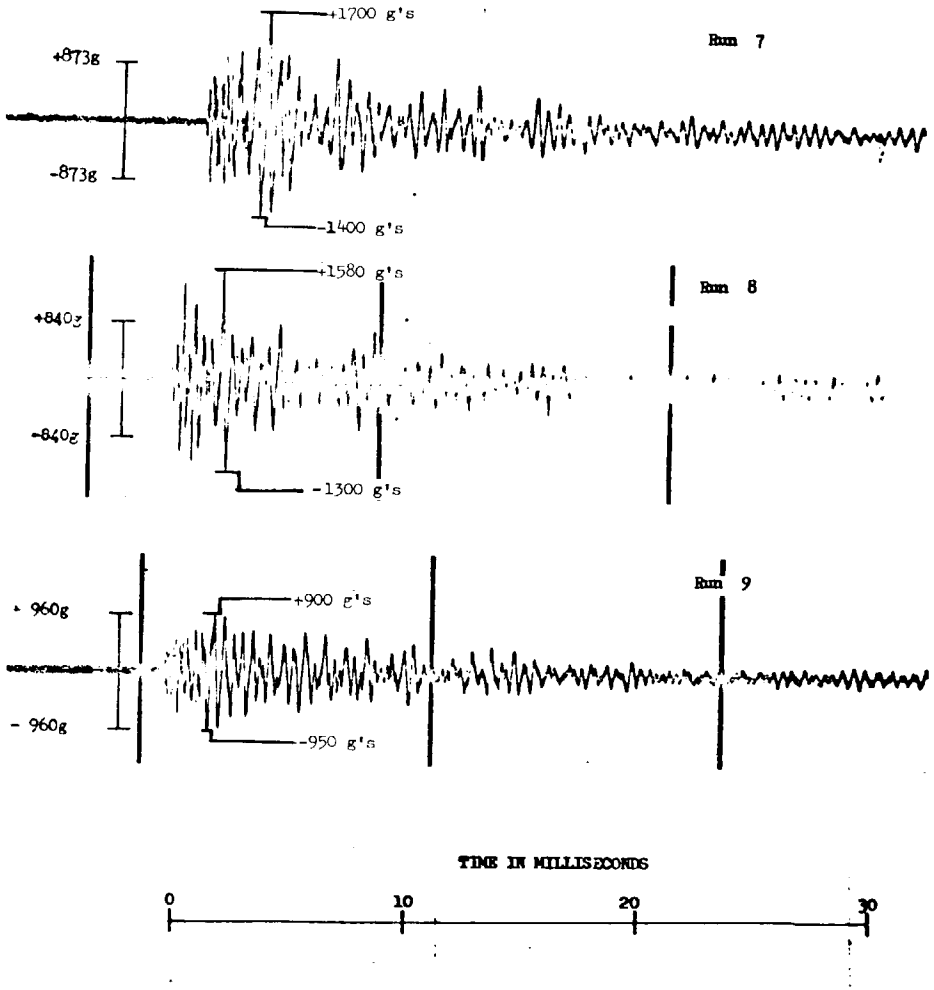




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 28-Y NS 17
CD-3A SKIN
RUN NO. 4, 5, 6

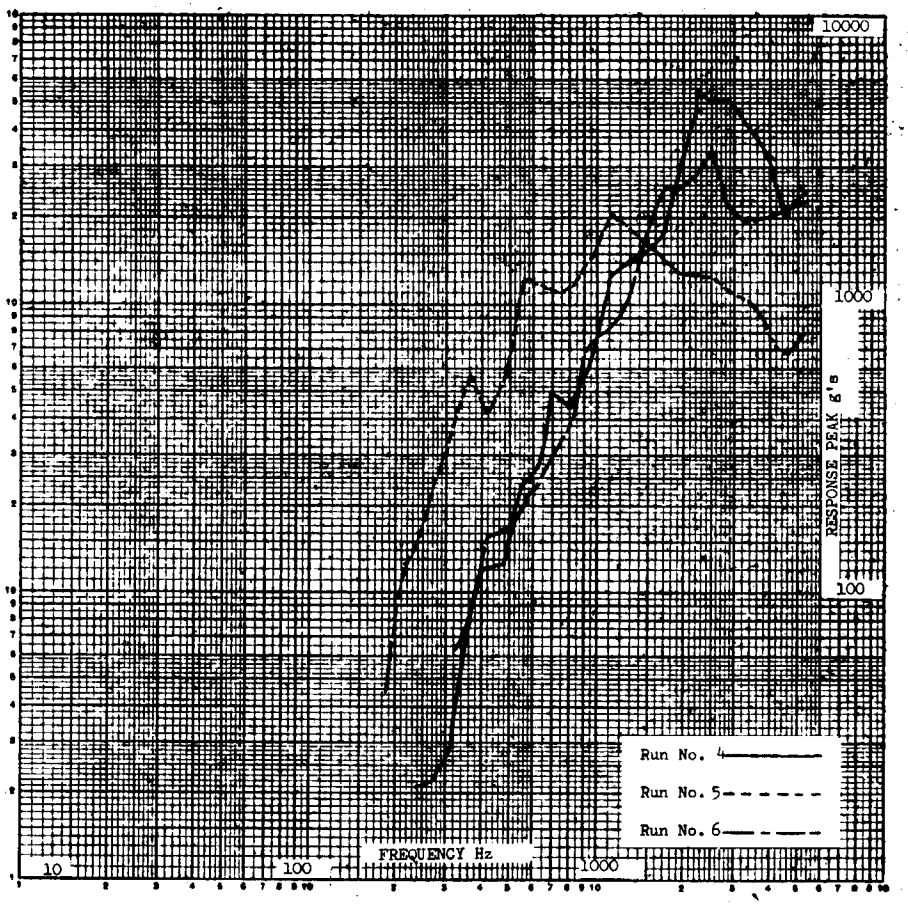
FIGURE I.A.5-165

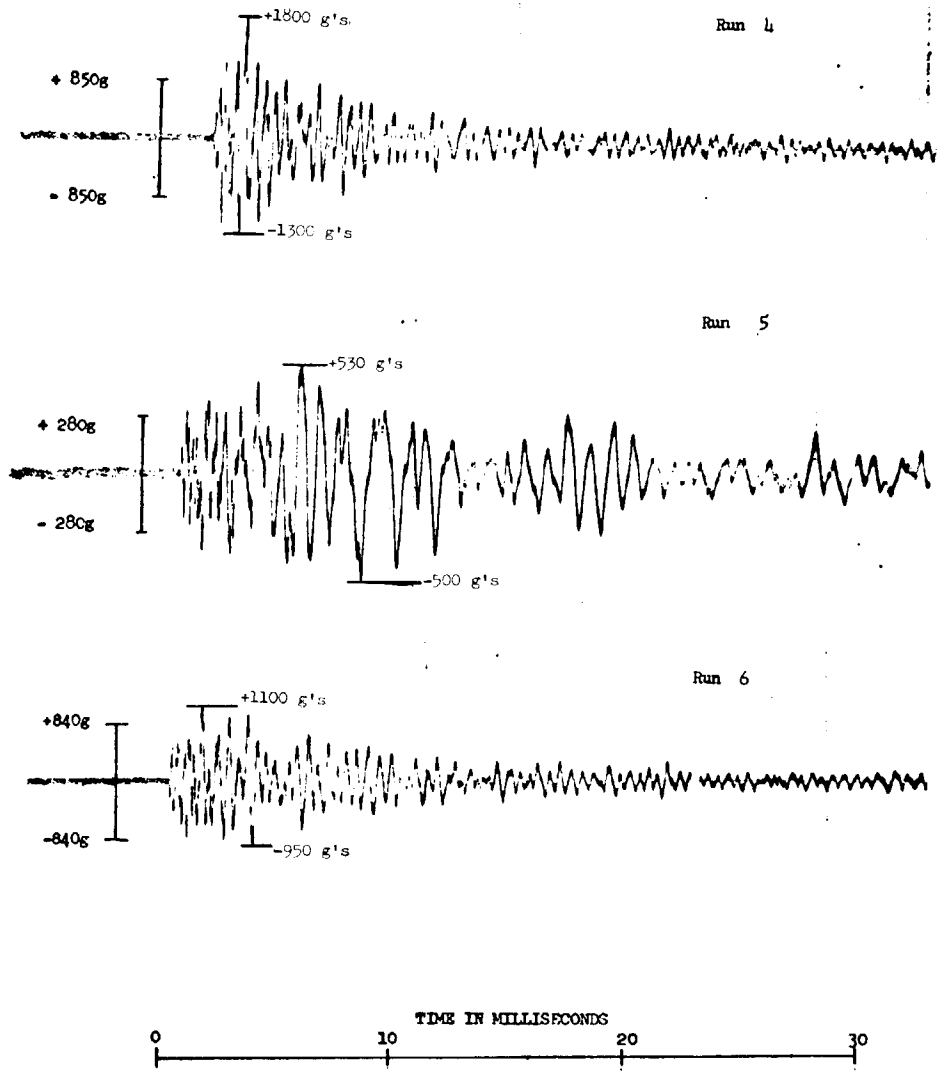




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 28-X NS 17
CD-3A SKIN
RUN NO. 7, 8, 9

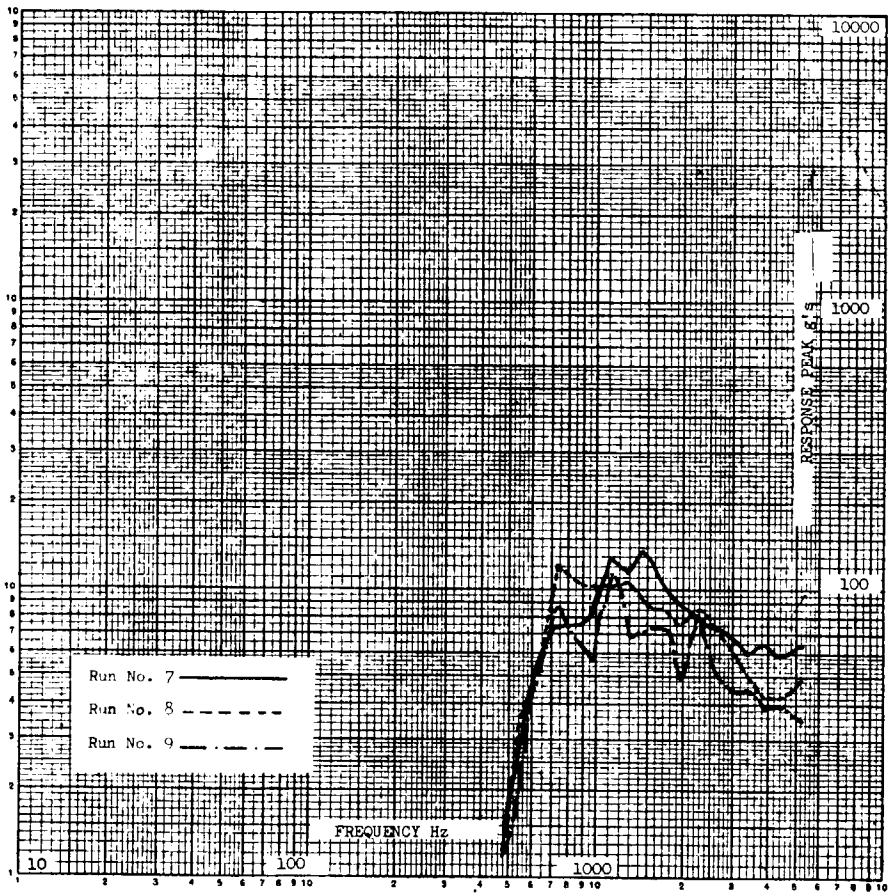
FIGURE I.A.5-164





PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 28-X NS 17
CD-3A SKIN
RUN, NO. 4, 5, 6

FIGURE I.A.5-163



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 27-Z NS 17
GSP
RUN NO. 7, 8, 9

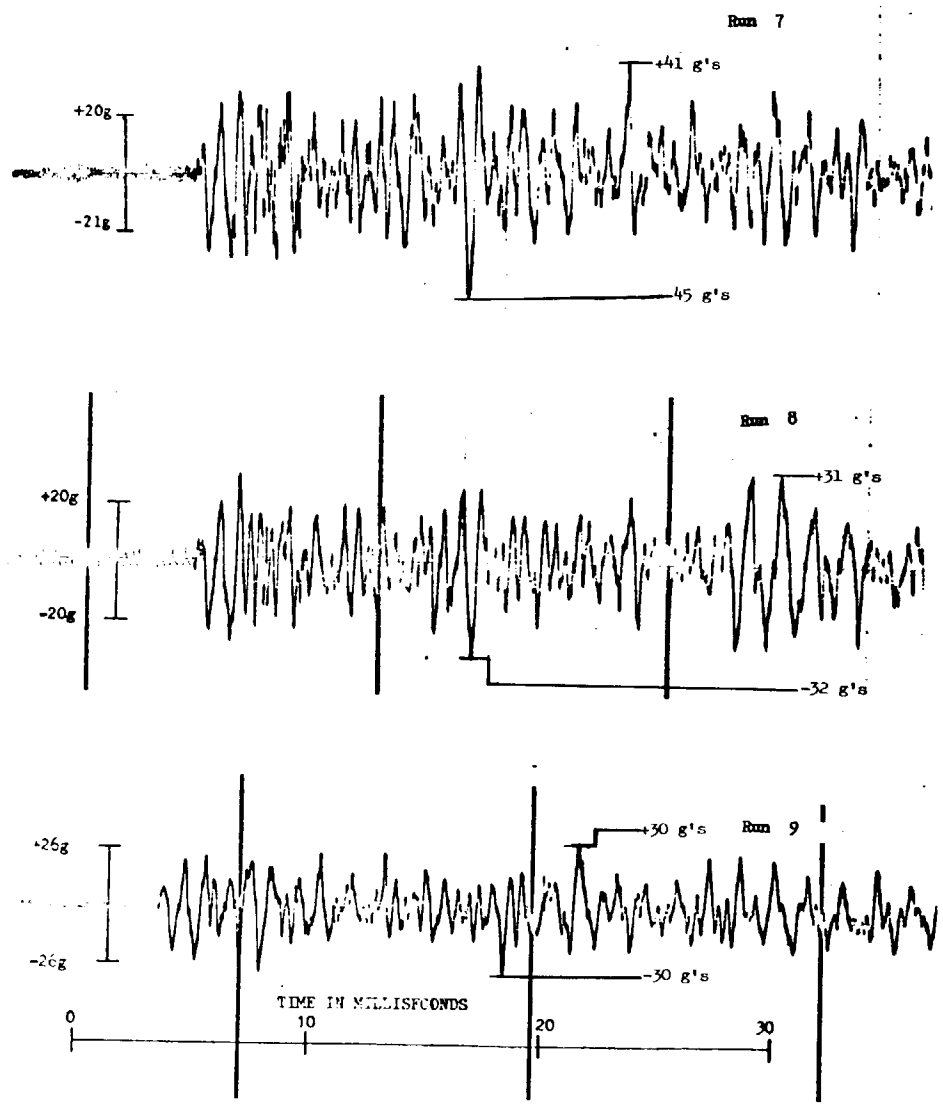
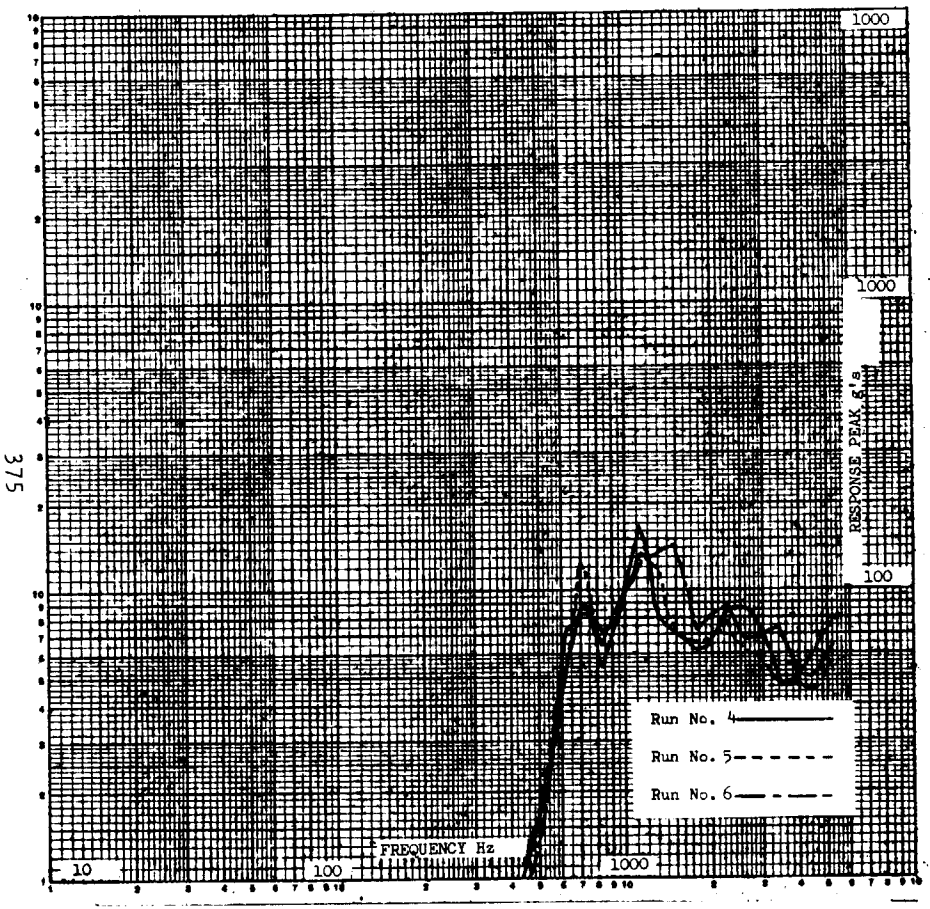


FIGURE I.A.5-162



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 27-Z NS 17
GSP
RUN NO. 4, 5, 6

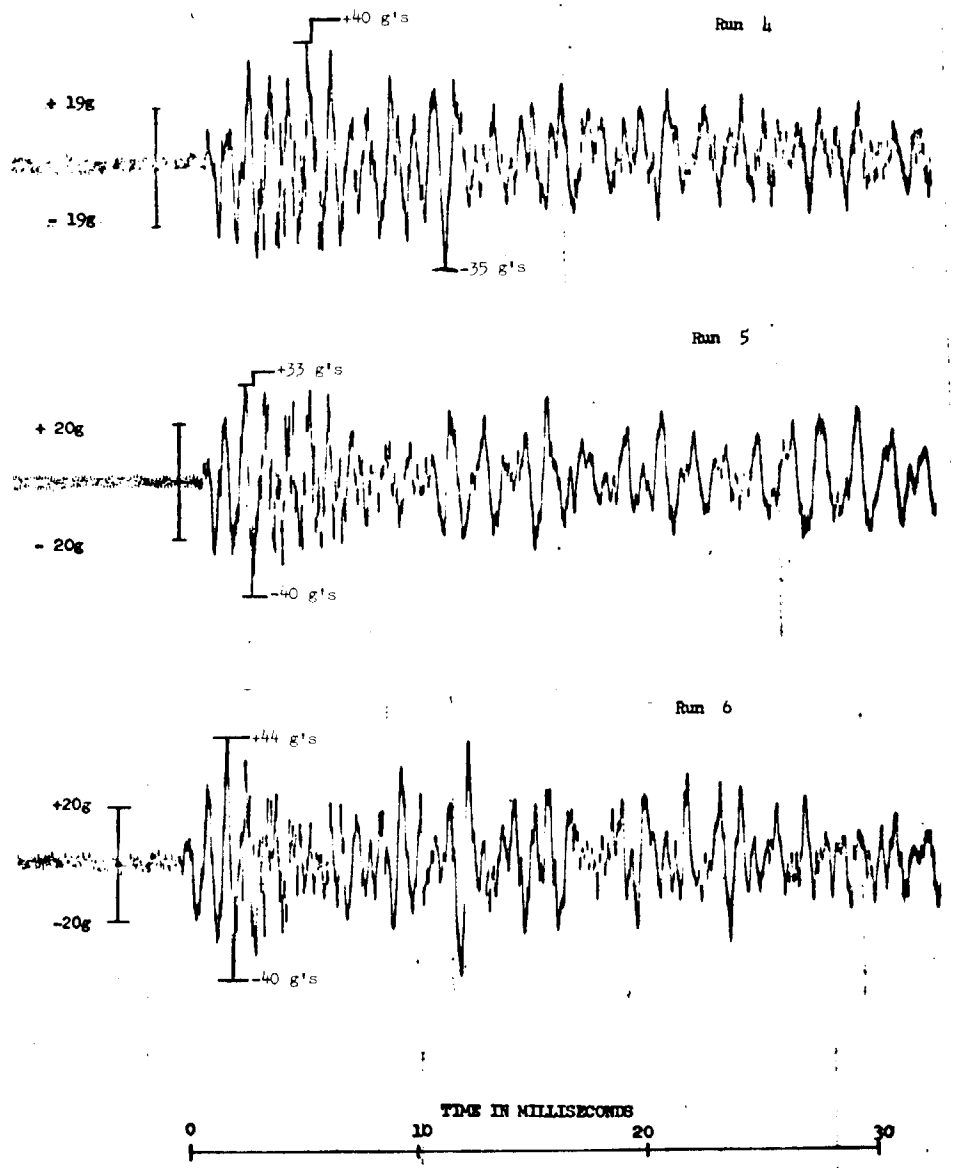
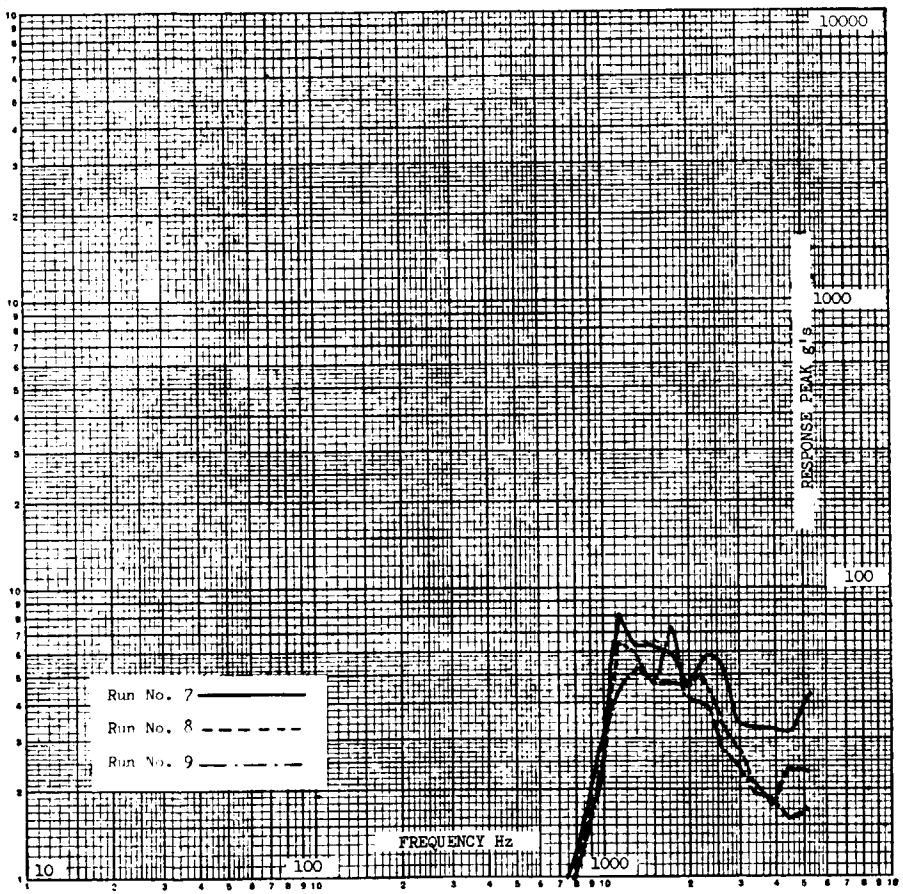
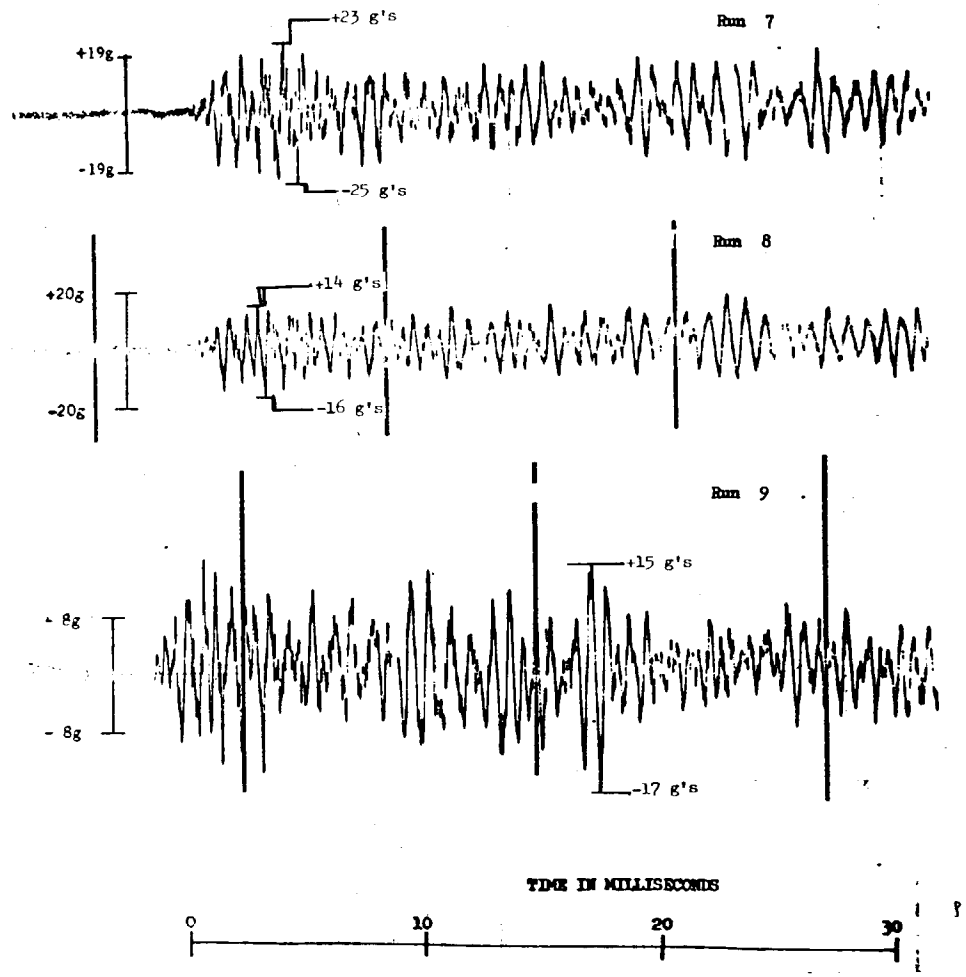


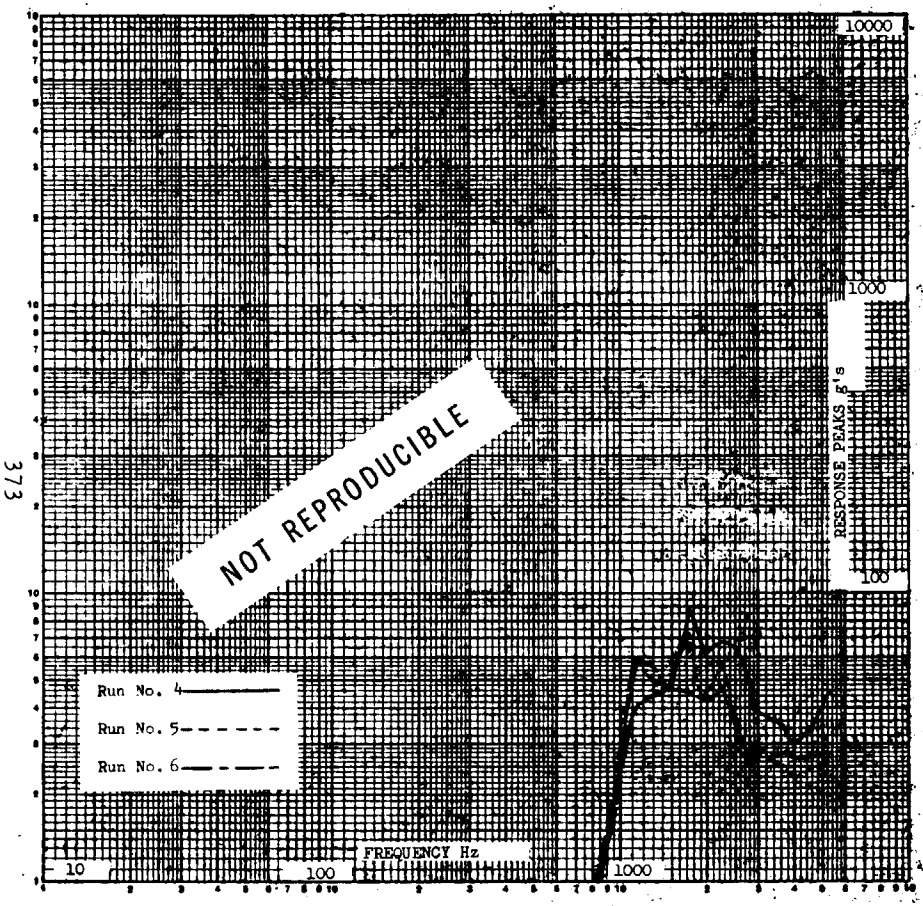
FIGURE I.A.5-161

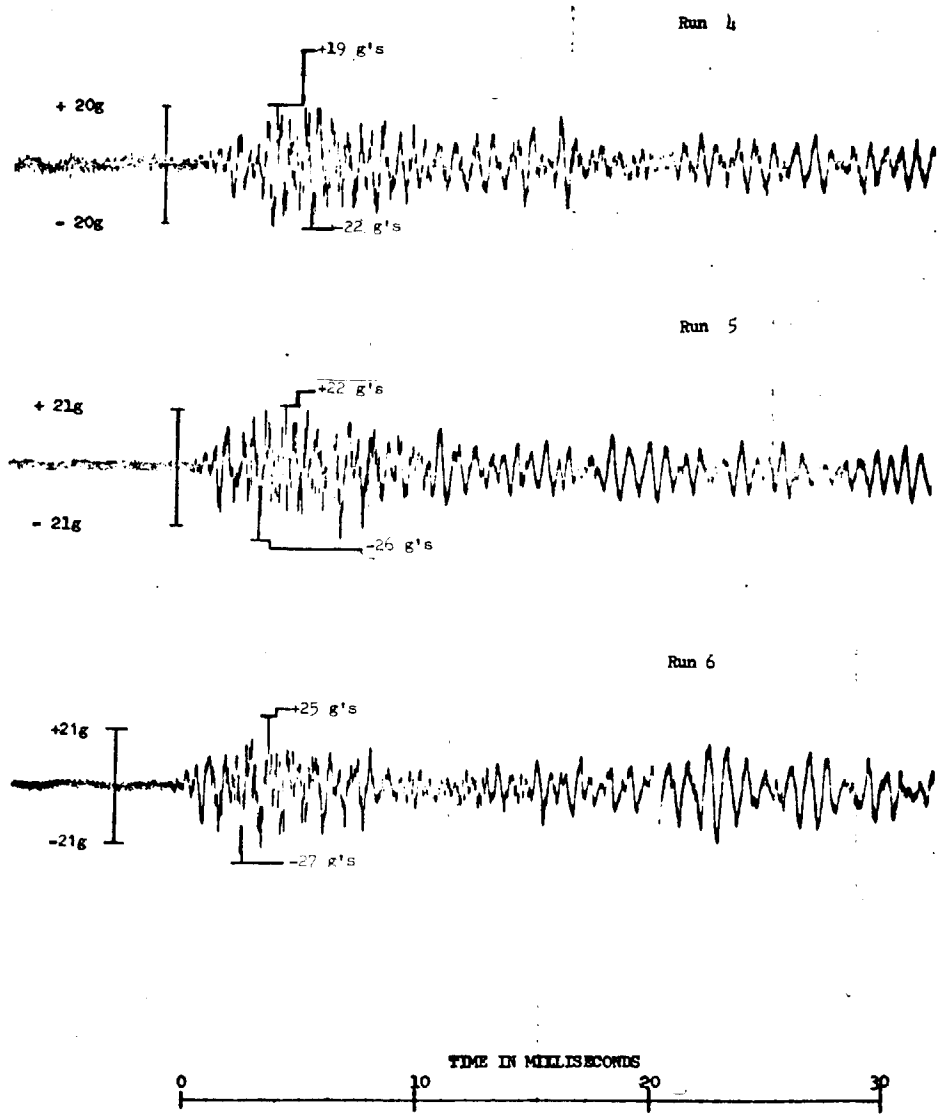




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 27-Y NS 17
GSP
RUN NO. 7, 8, 9

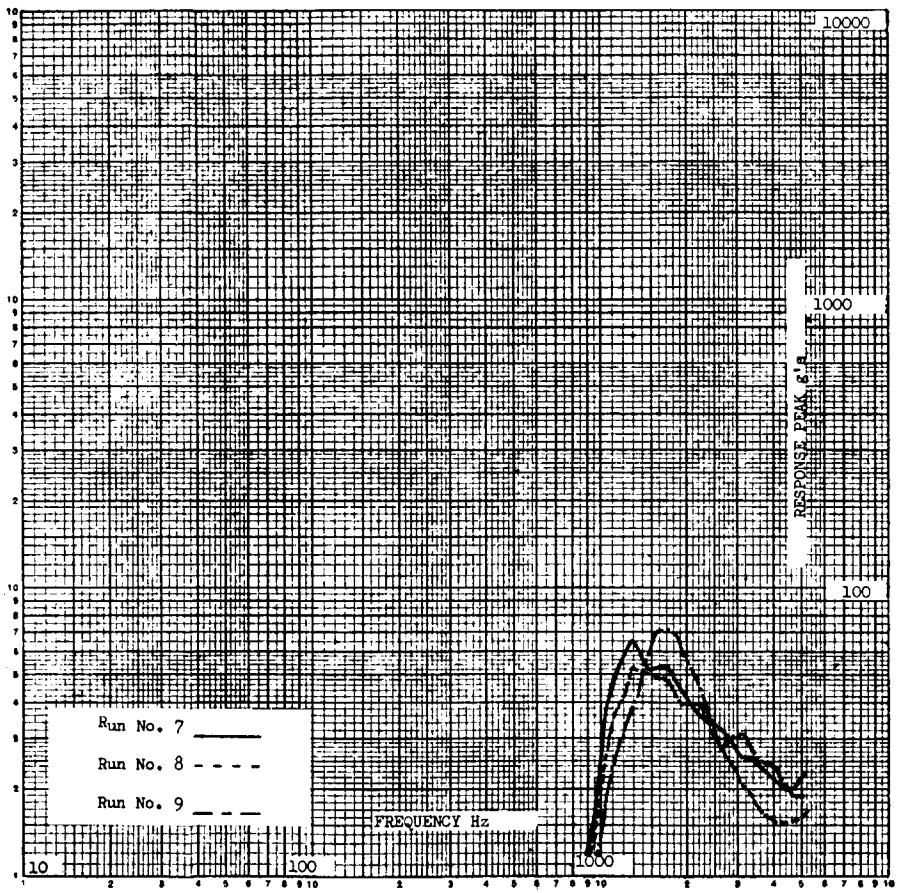
FIGURE I.A.5-160

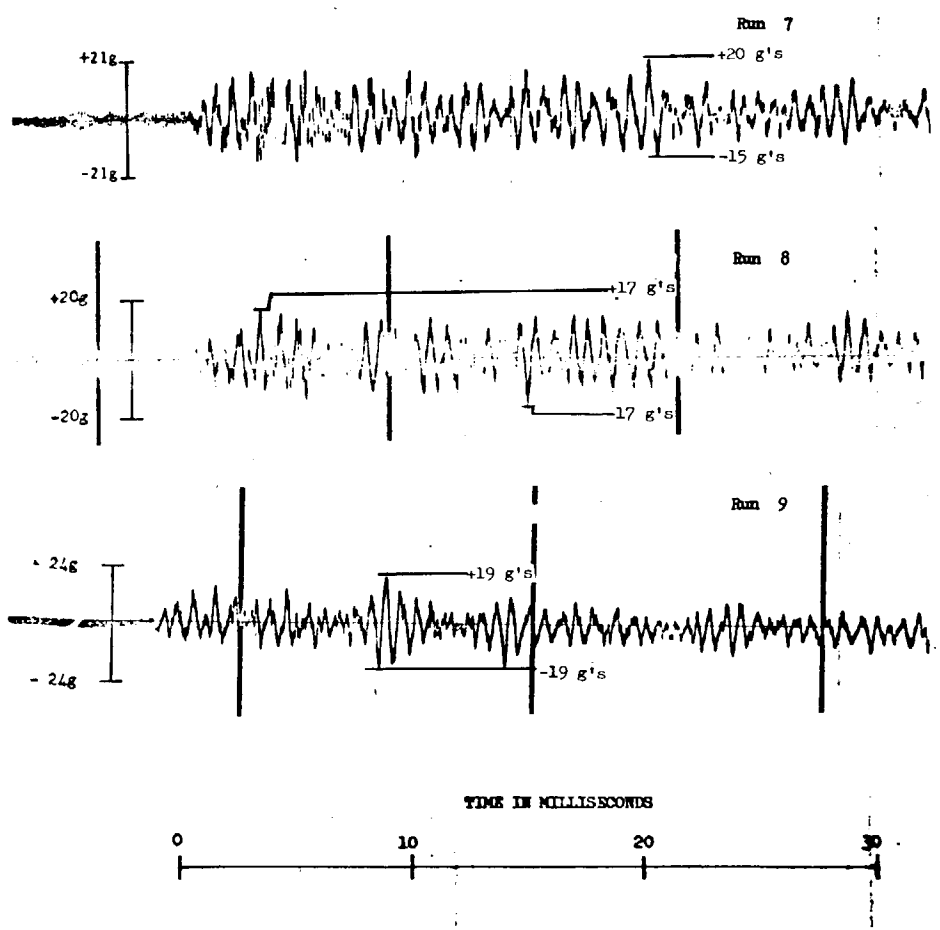




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 27-Y NS 17
GSP
RUN NO. 4, 5, 6

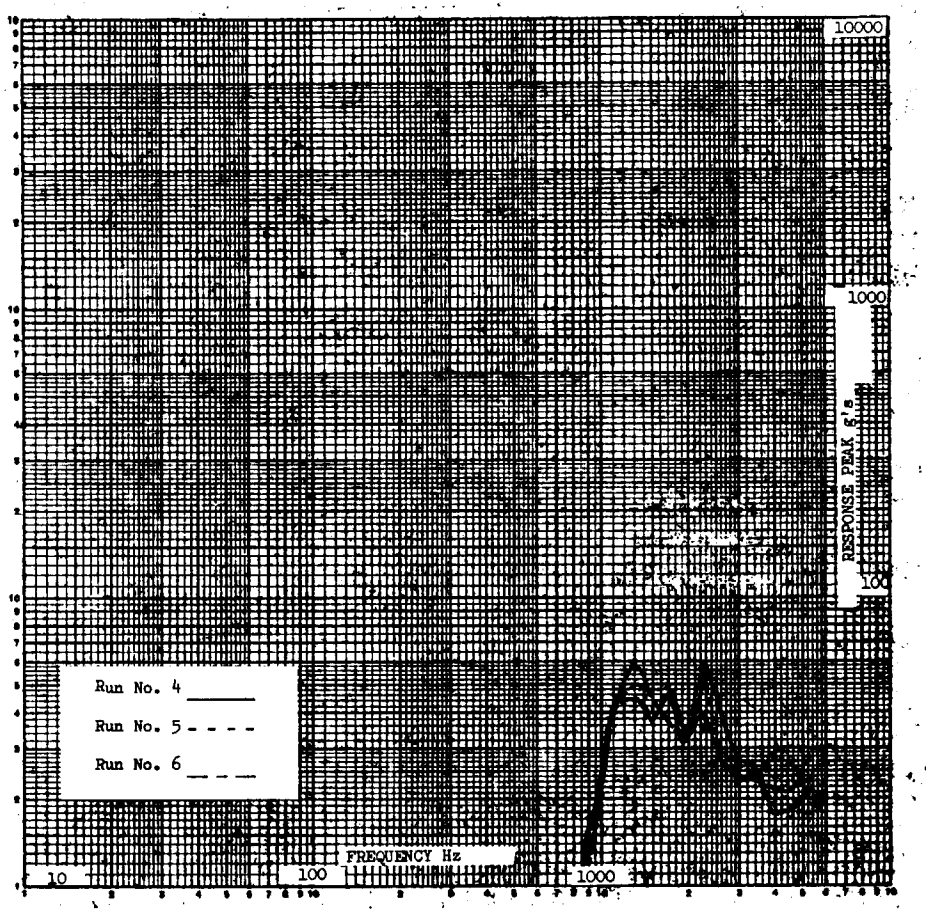
FIGURE I.A.5-159

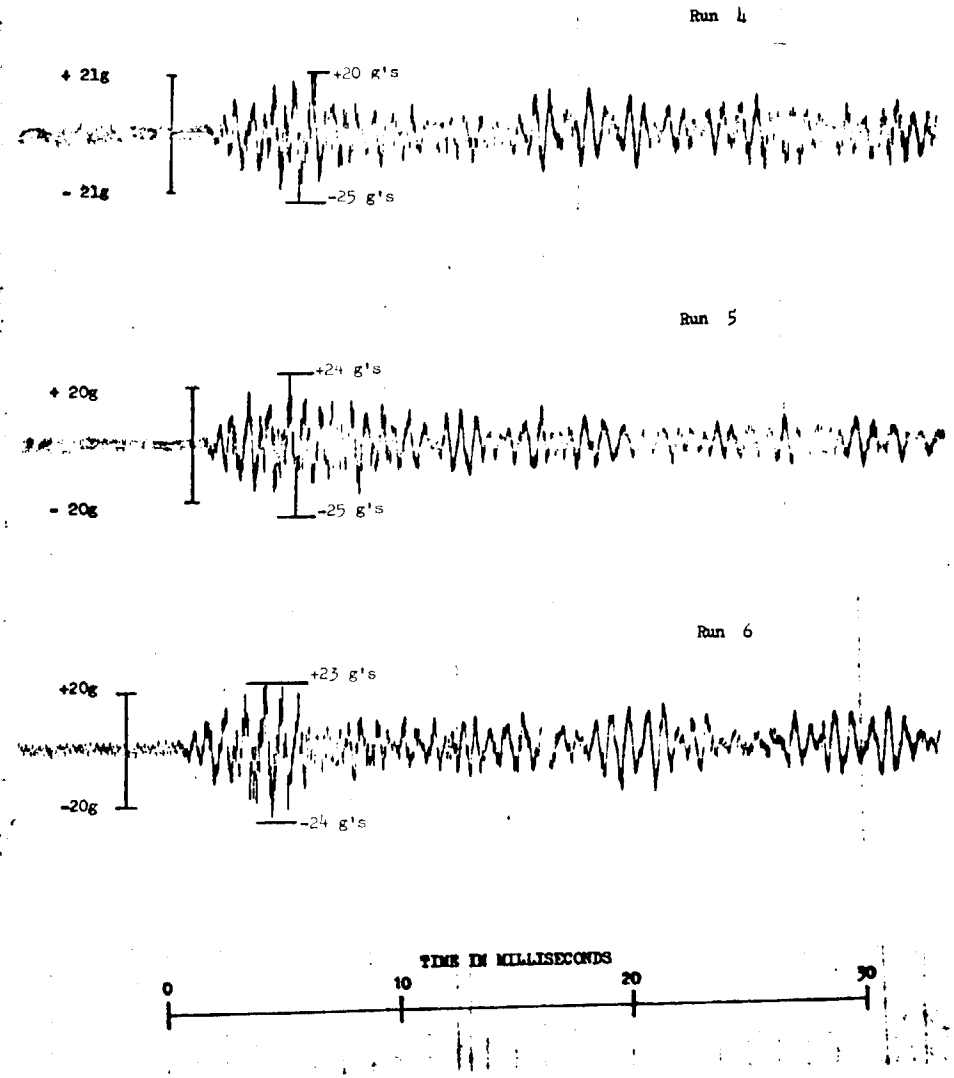




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 27-X NS 17
GSP
RUN NO. 7, 8, 9

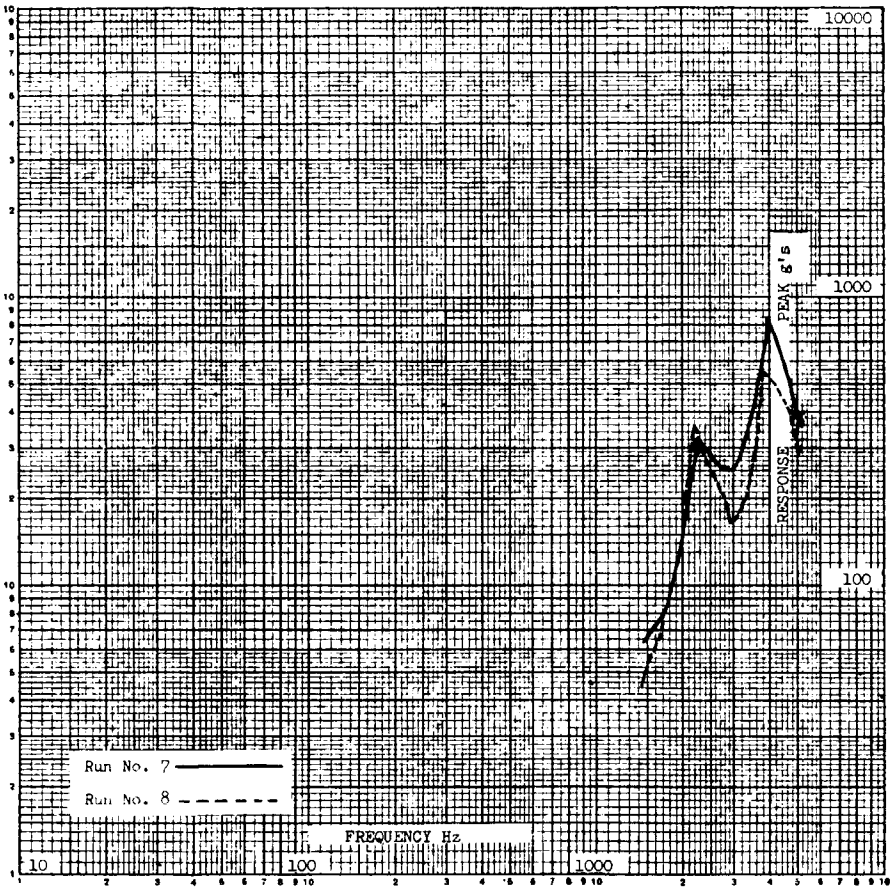
FIGURE I.A.5-158

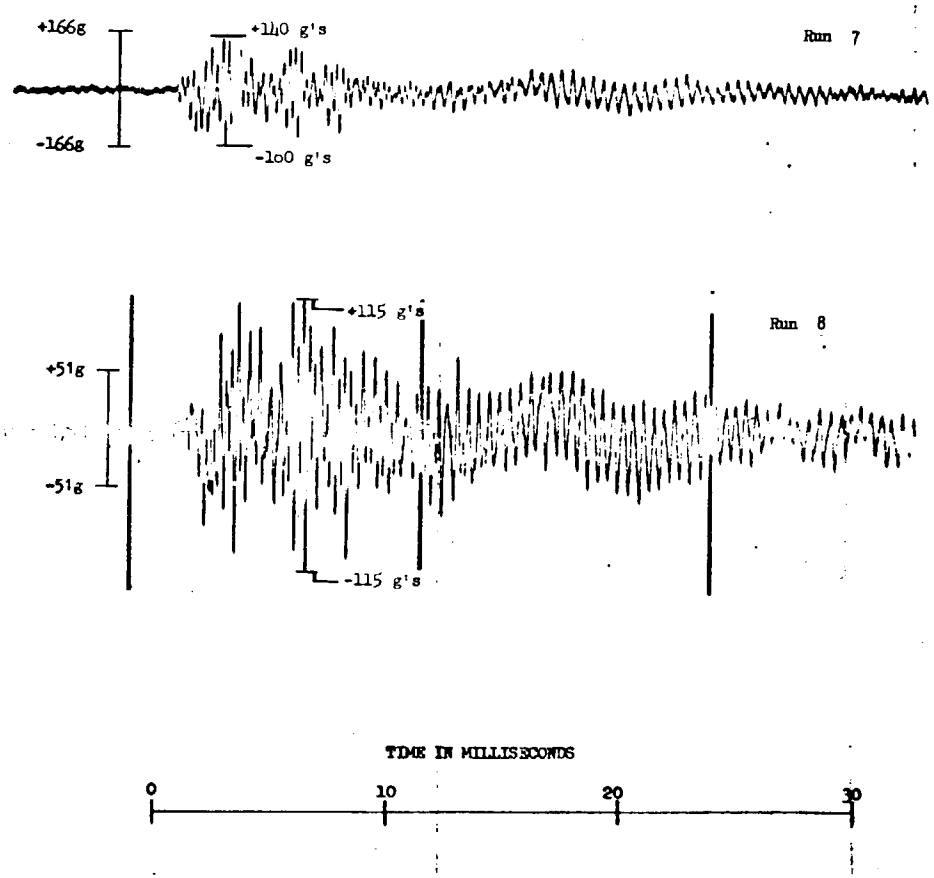




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 27-X NS17
GSP
RUN NO. 4, 5, 6

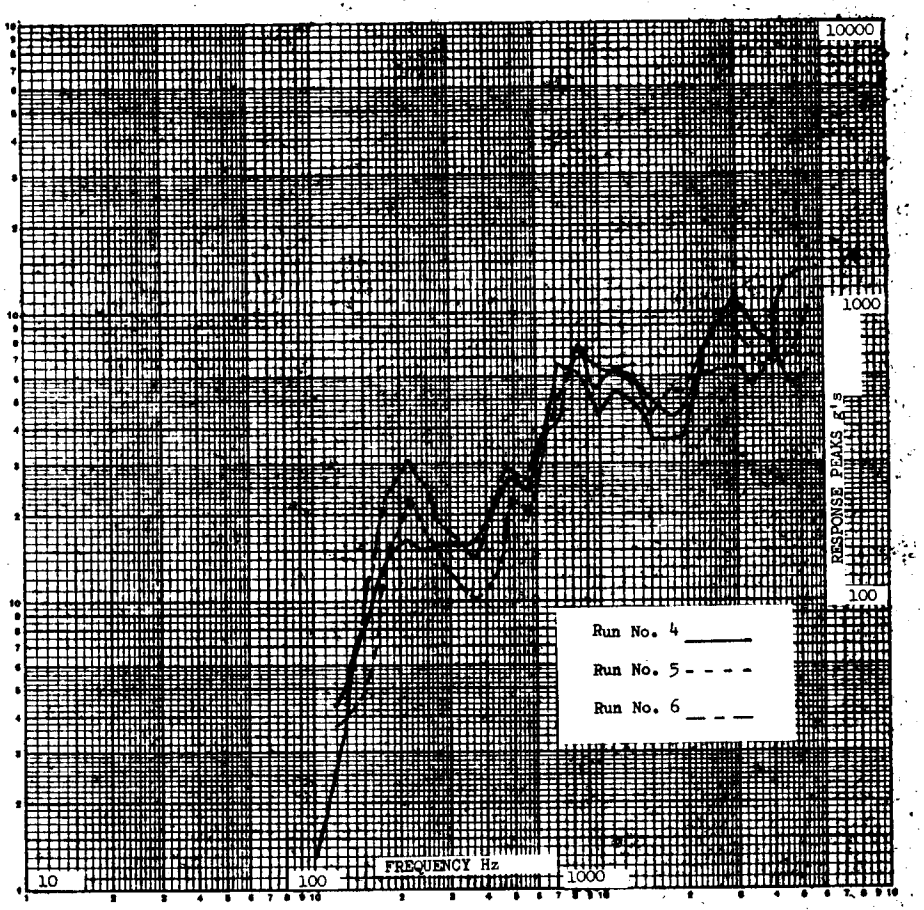
FIGURE I.A.5-157

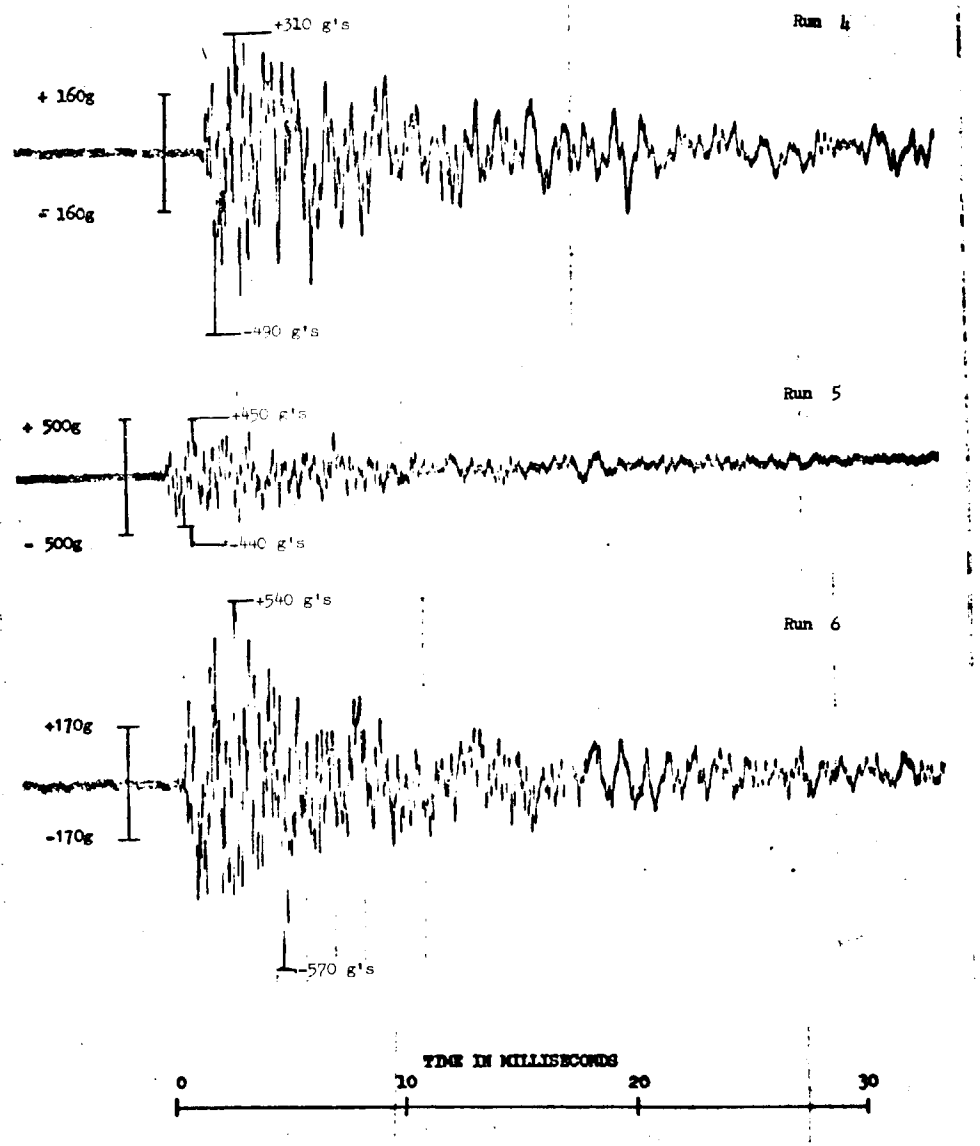




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 26-Z NS 17
BATTERY
RUN NO. 7,8

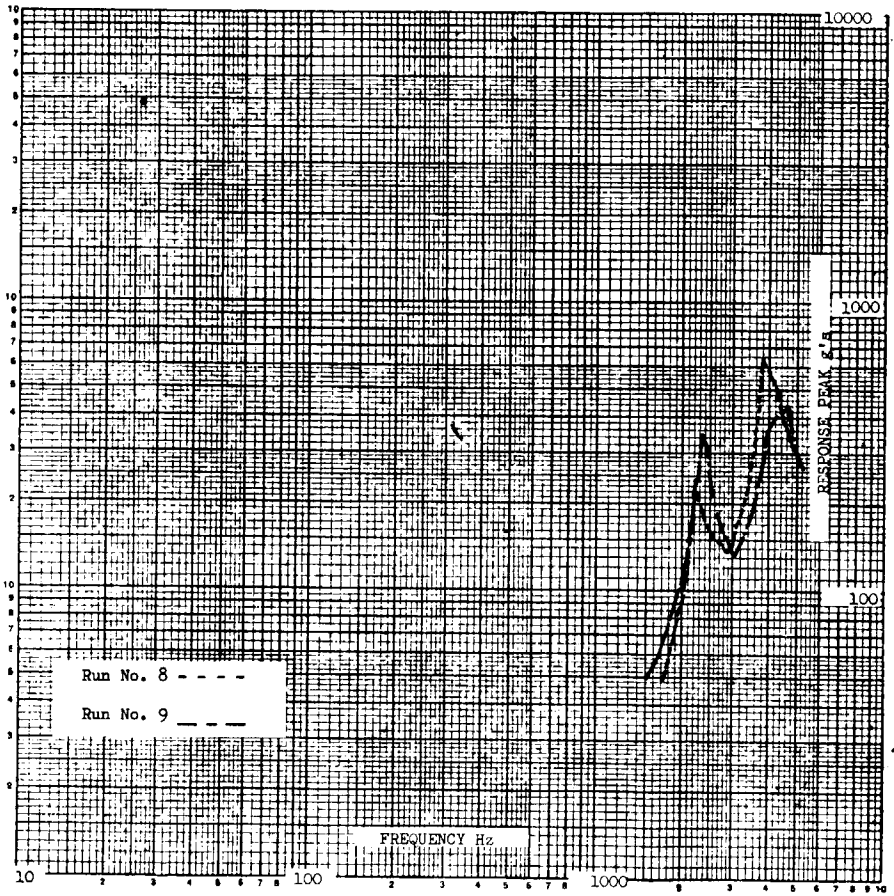
FIGURE I.A.5-156

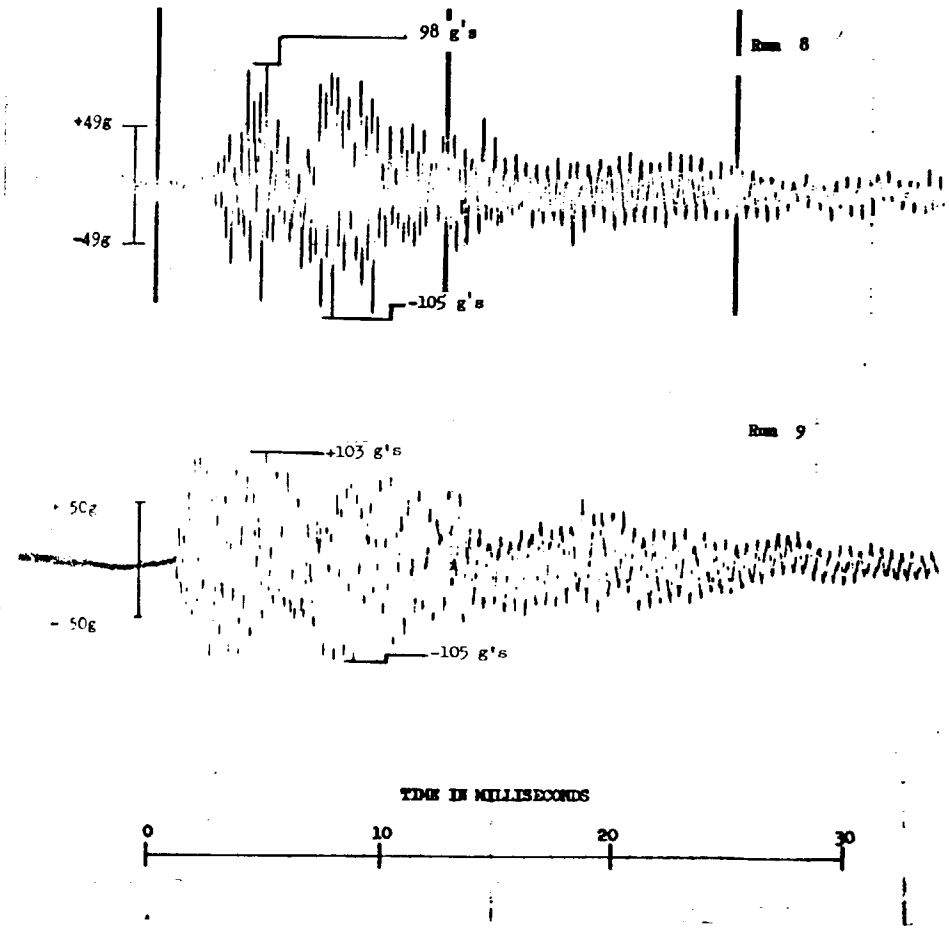




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 26-Z NS 17
BATTERY
RUN NO. 4, 5, 6

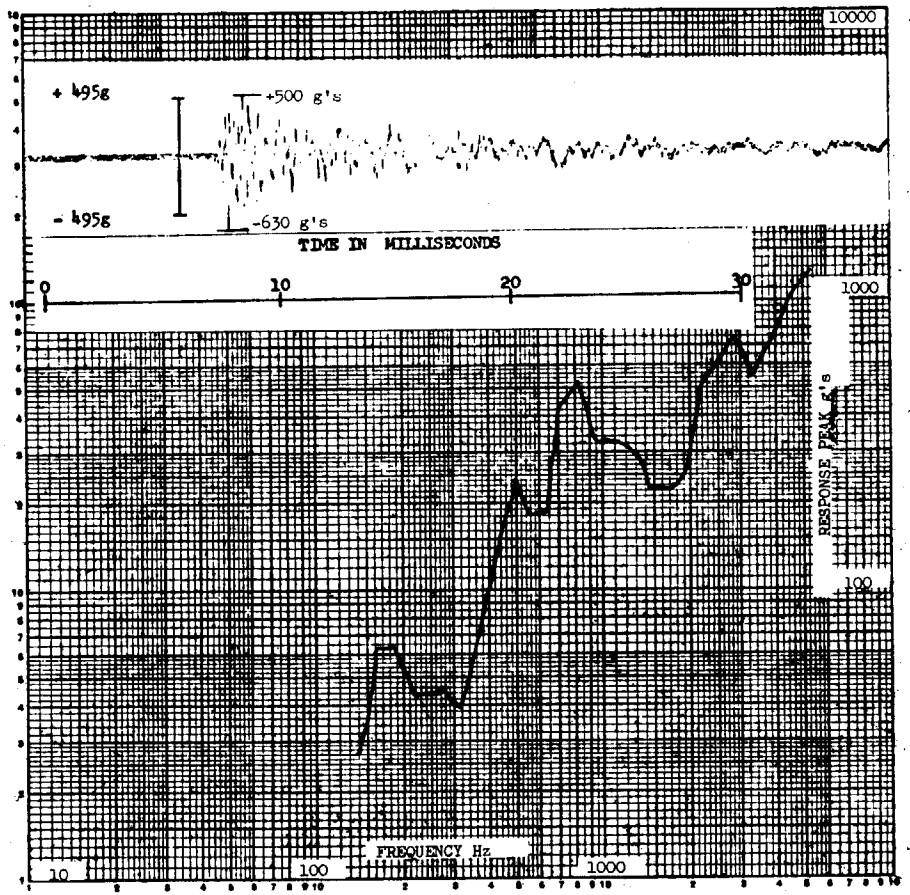
FIGURE 1.A.5-155





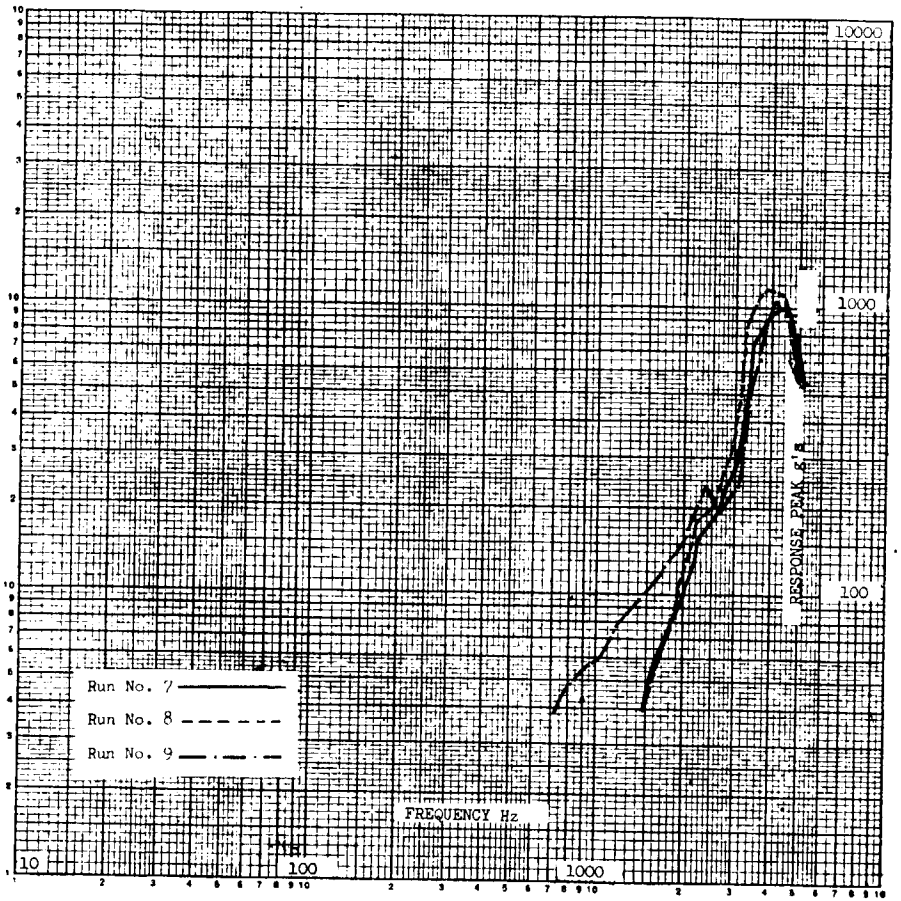
PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 26-Y NS 17
BATTERY
RUN NO. 8,9

FIGURE I.A.5-154



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 26-f NS 17
BATTERY
RUN NO. 4

FIGURE 1.A.5-153



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 26-X NS 17
BATTERY
RUNS NO. 7, 8, 9

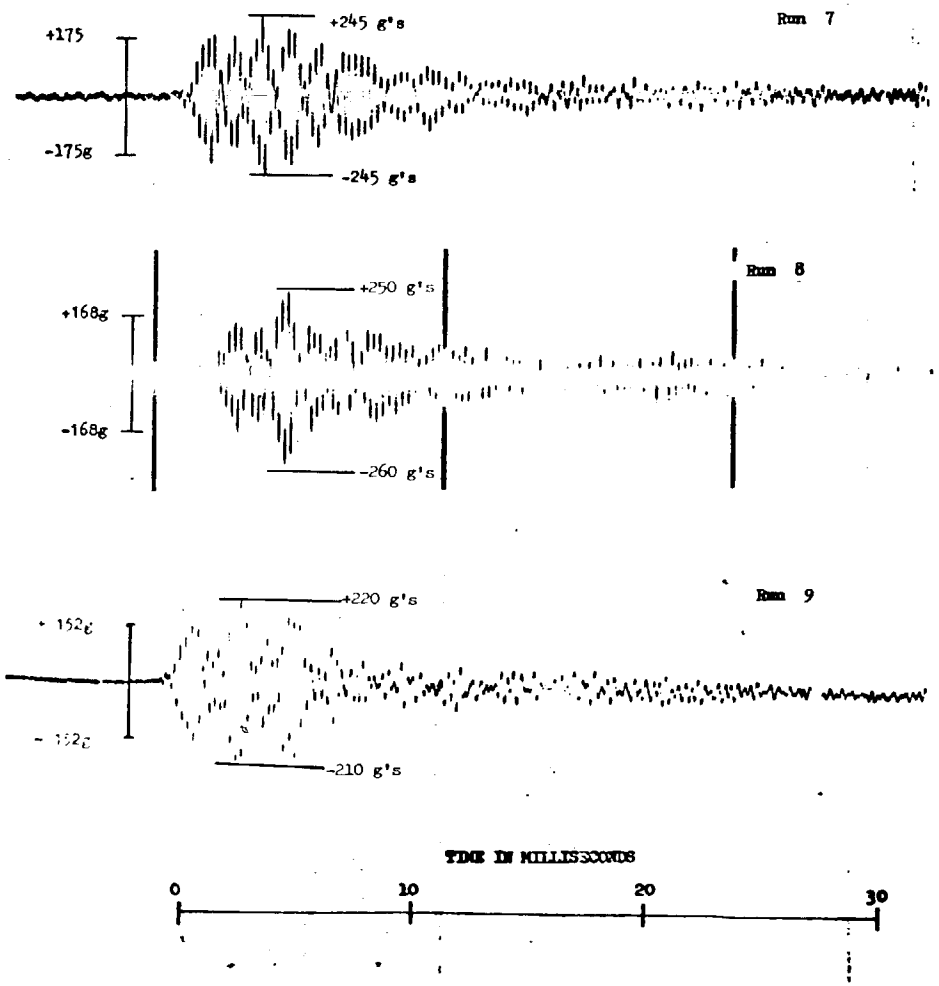
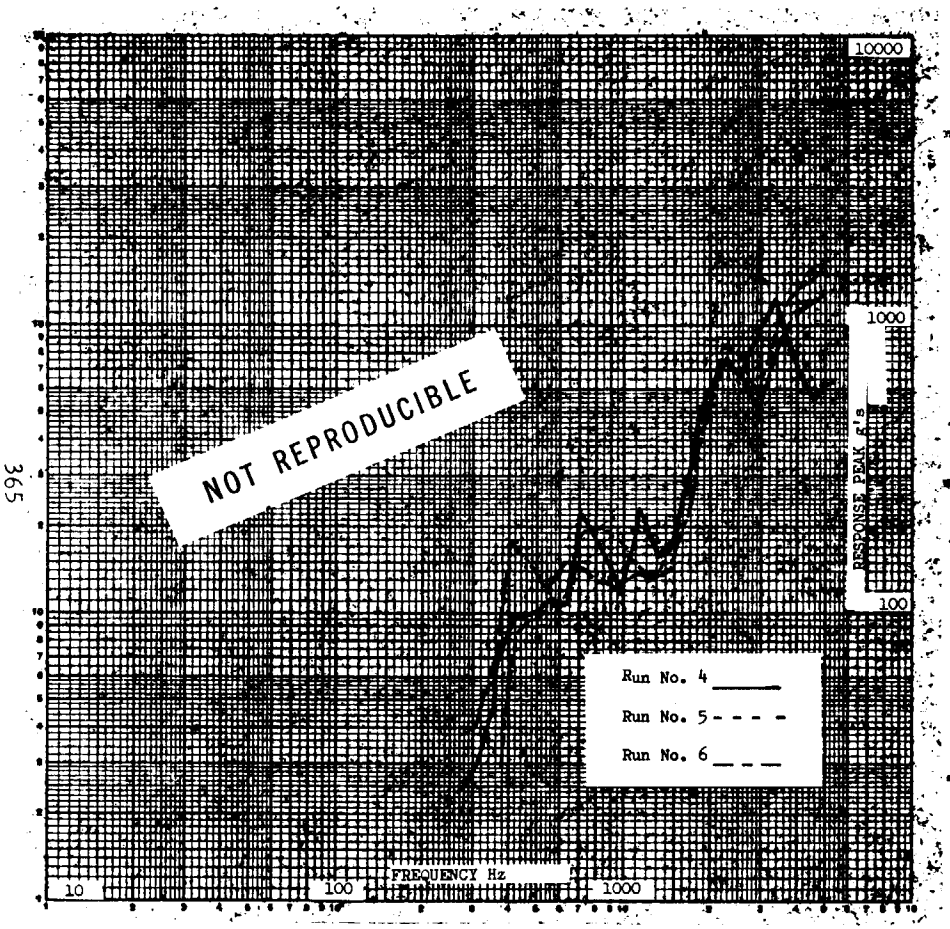
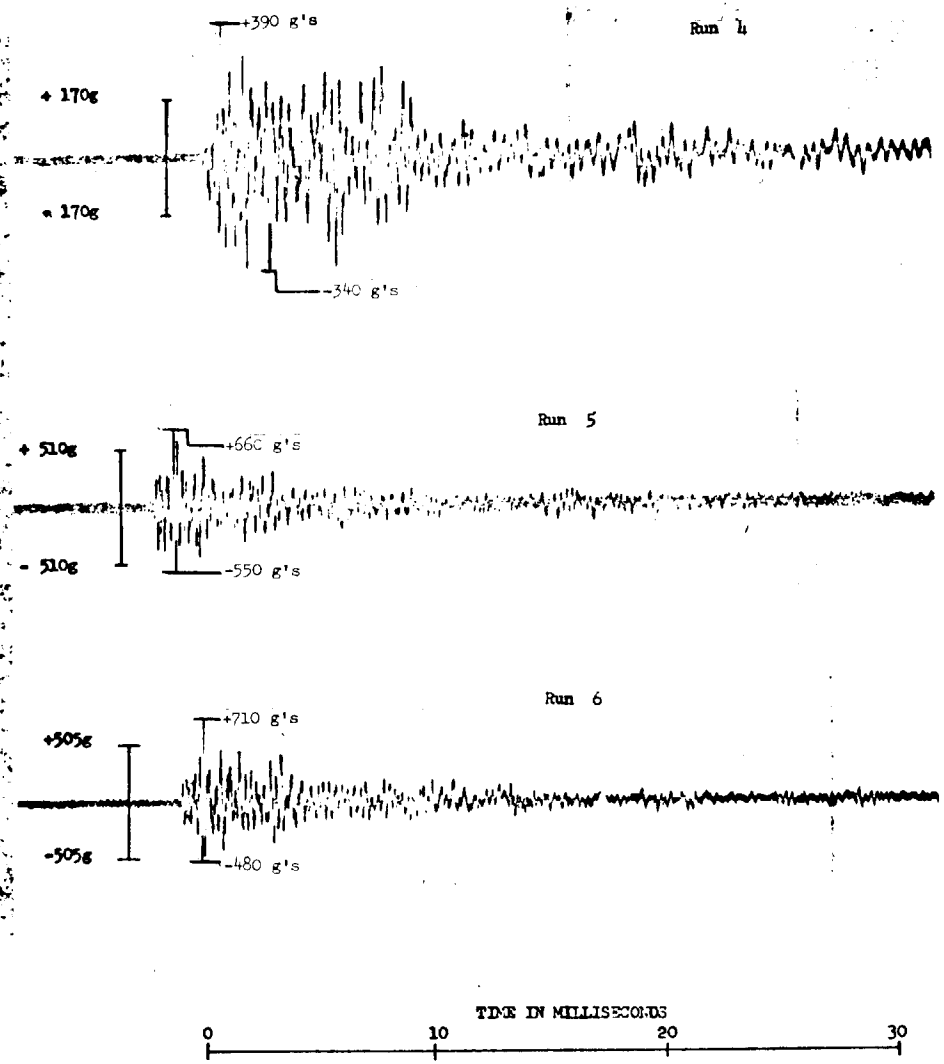


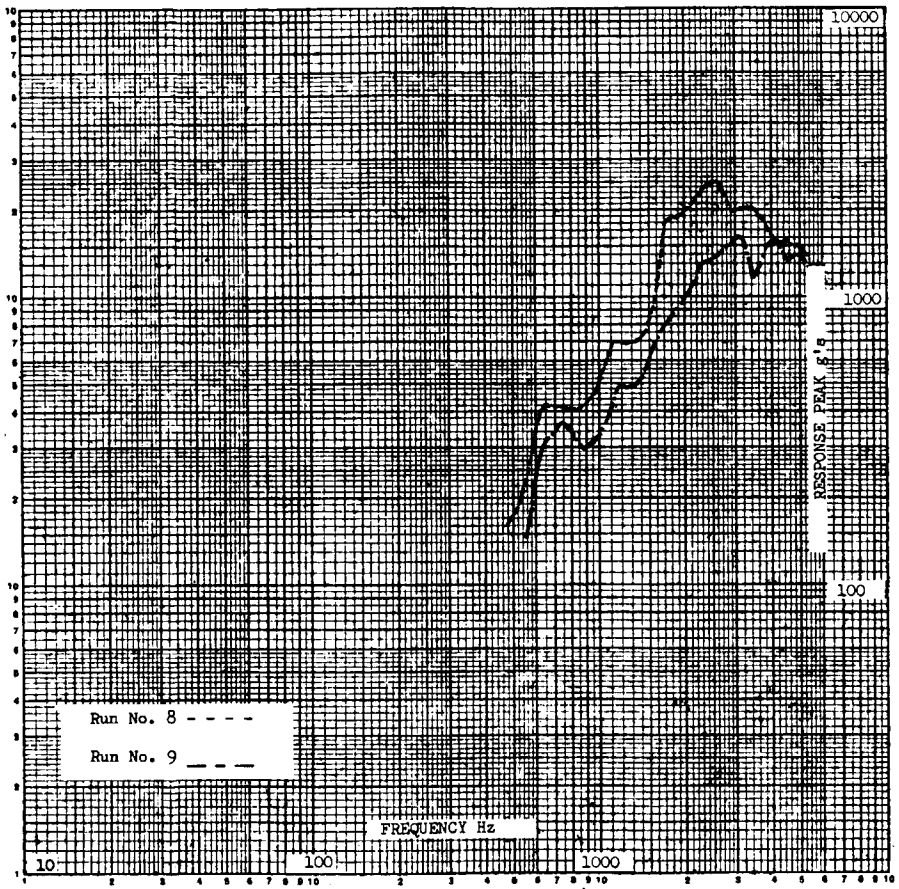
FIGURE I.A.5-152

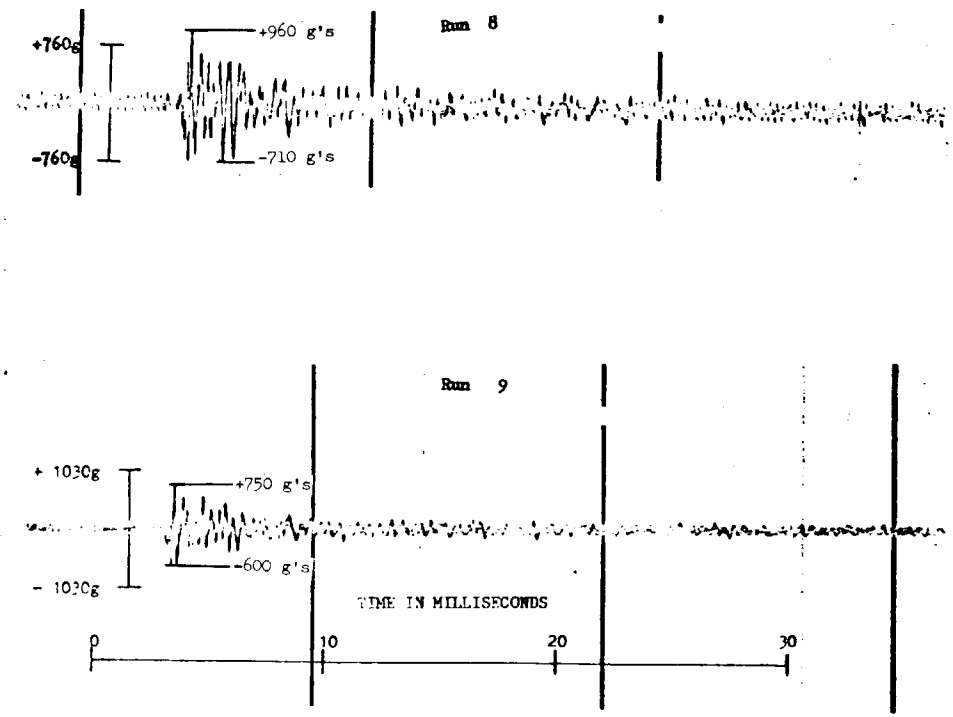




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 26-X NS 17
BATTERY
RUNS NO. 4, 5, 6

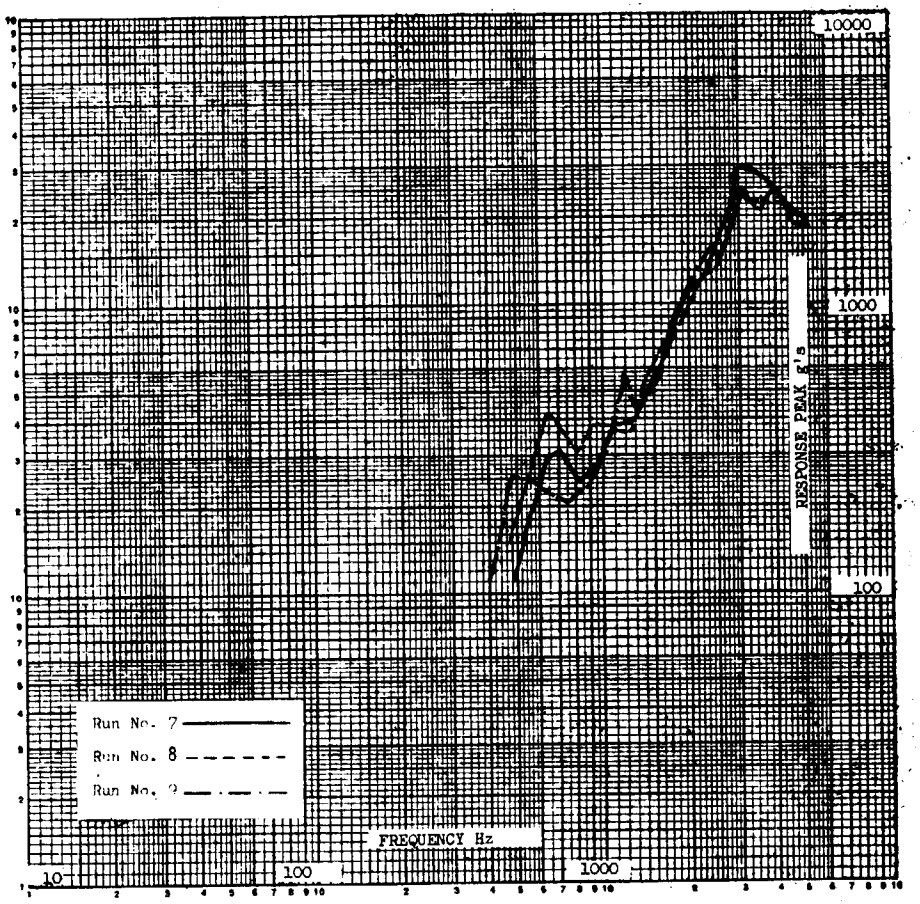
FIGURE I.A.5-151

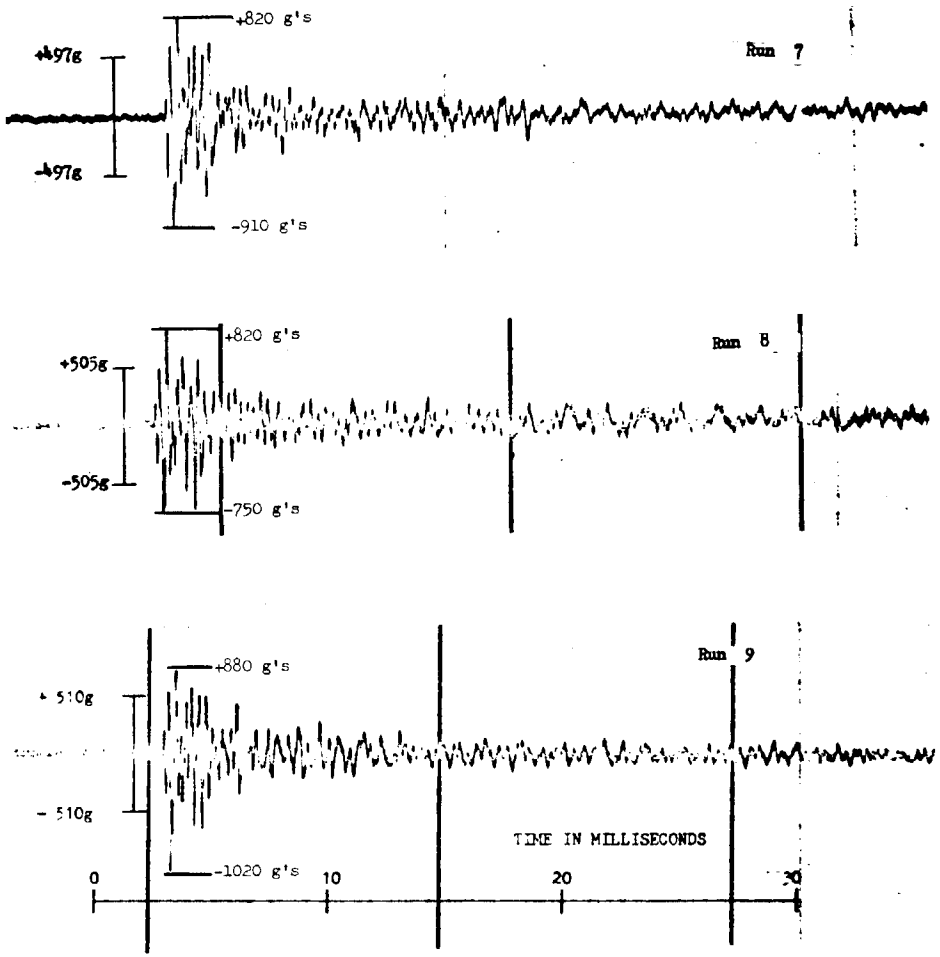




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 25-Z NS 17
COMPUTER, FOOT
RUN NO. 8,9

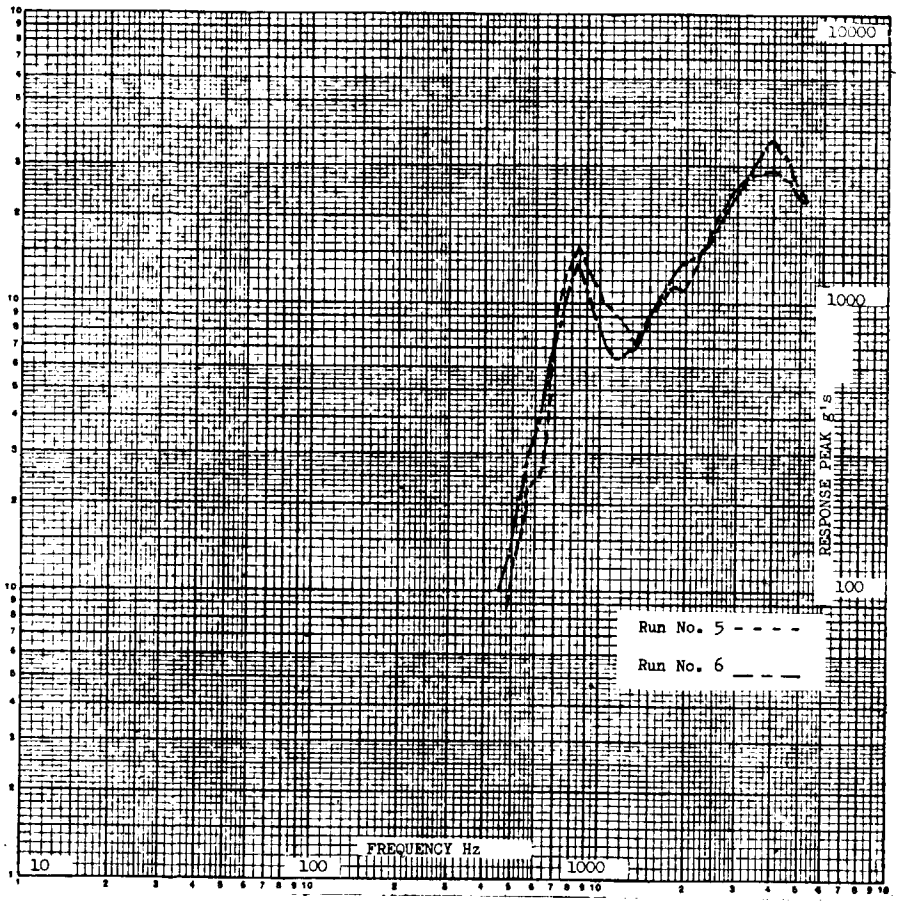
FIGURE I.A.5-150





PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 24-Z NS17
P92
RUN NO. 7, 8, 9

FIGURE I.A.5-149



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 24-Z NS-17
P92
RUN NO. 5,6

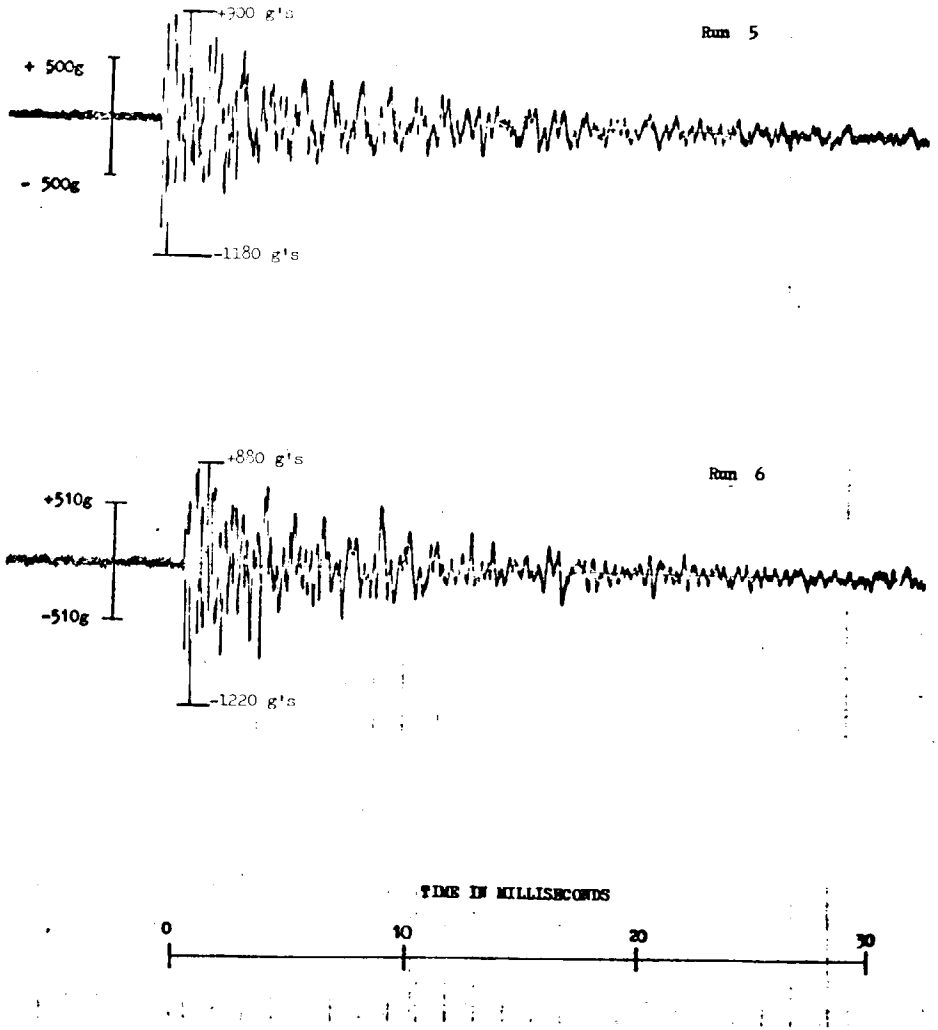
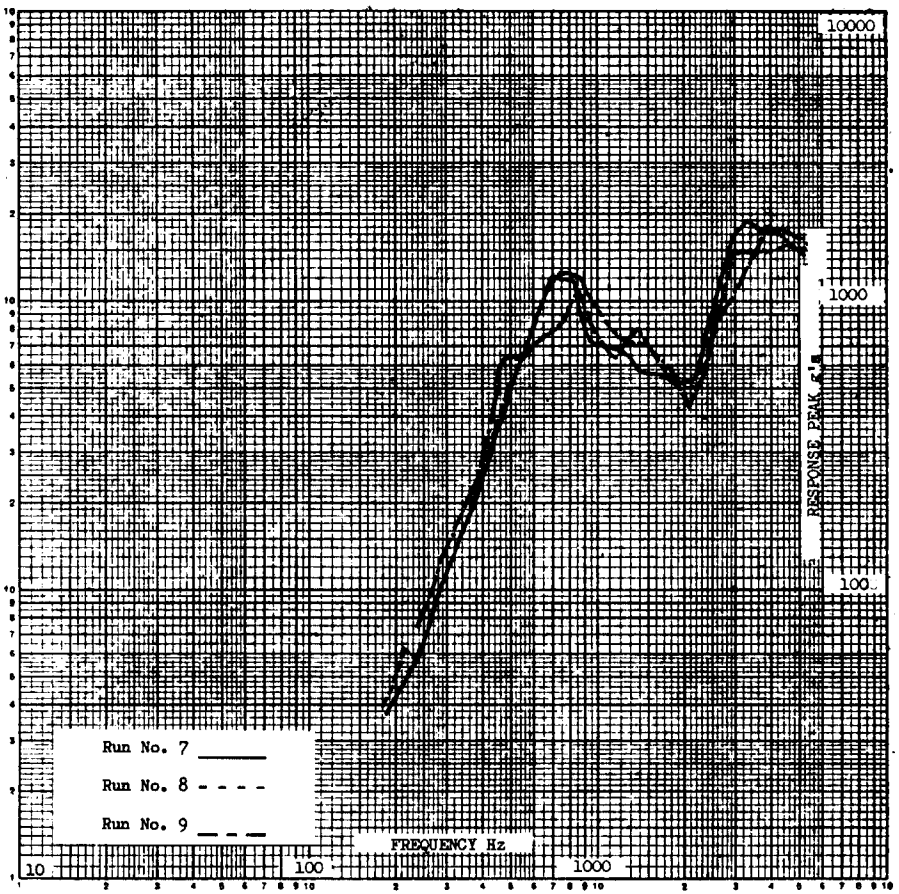
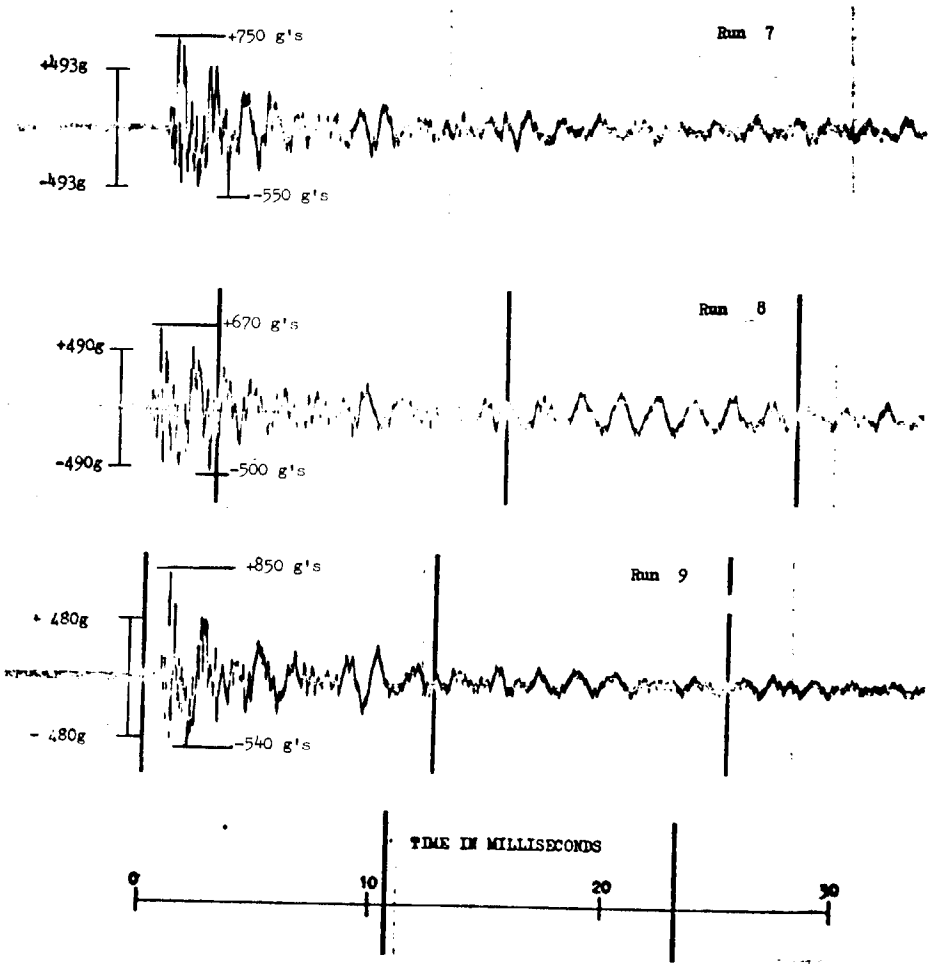


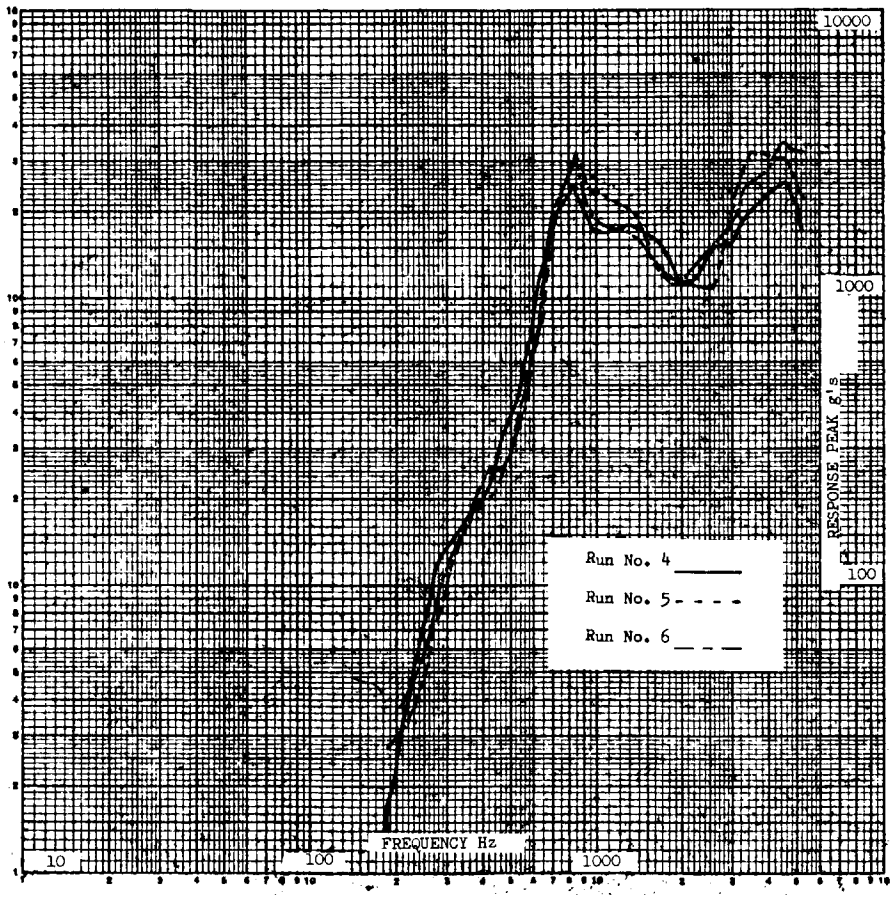
FIGURE I.A.5-148





PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 24-Y NS 17
P92
RUN NO. 7, 8, 9

FIGURE I.A.5-147



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 24-Y NS17
P92
RUN NO. 4, 5, 6

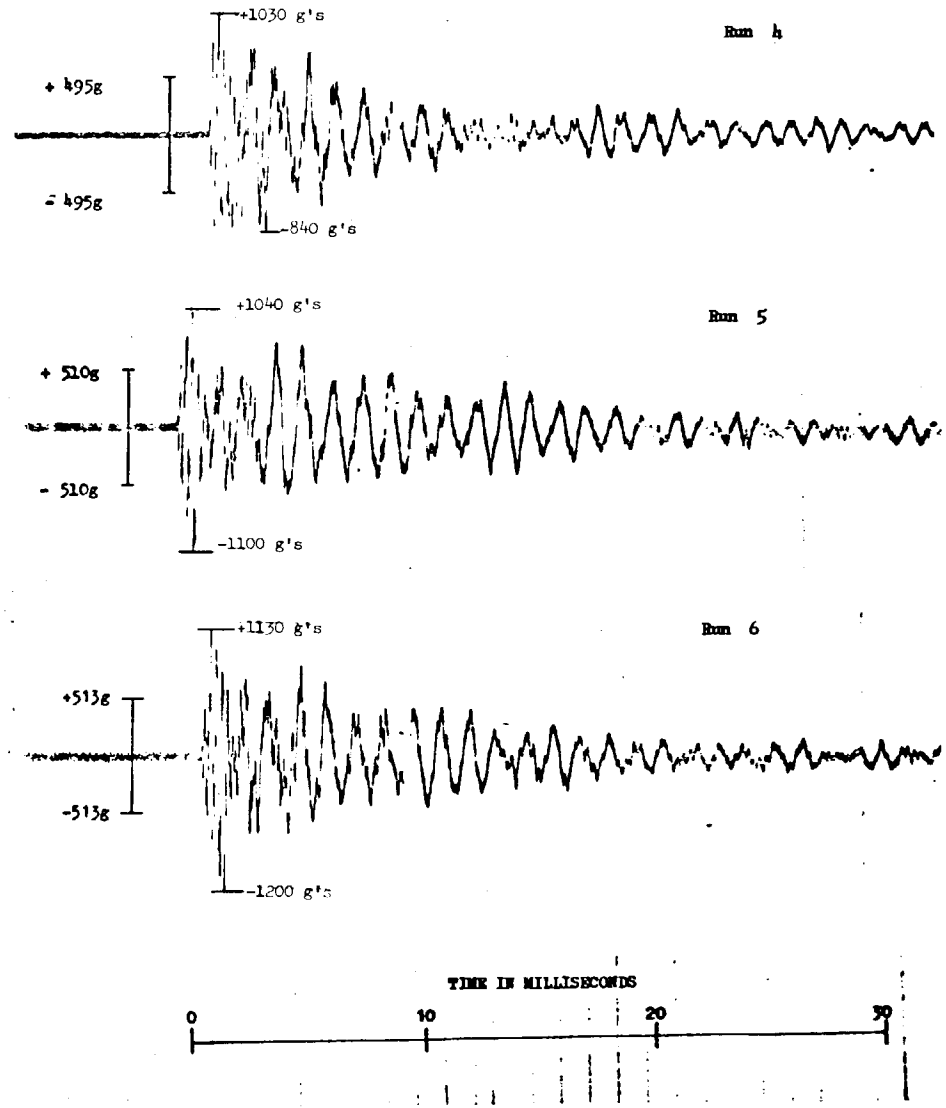
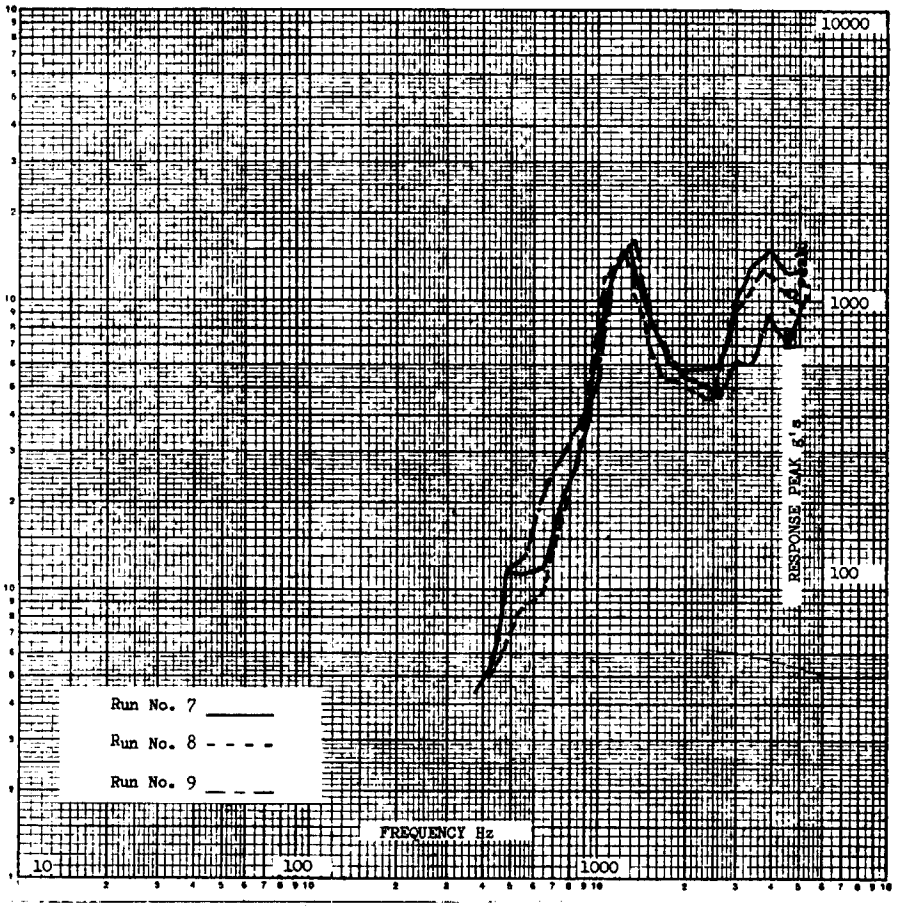
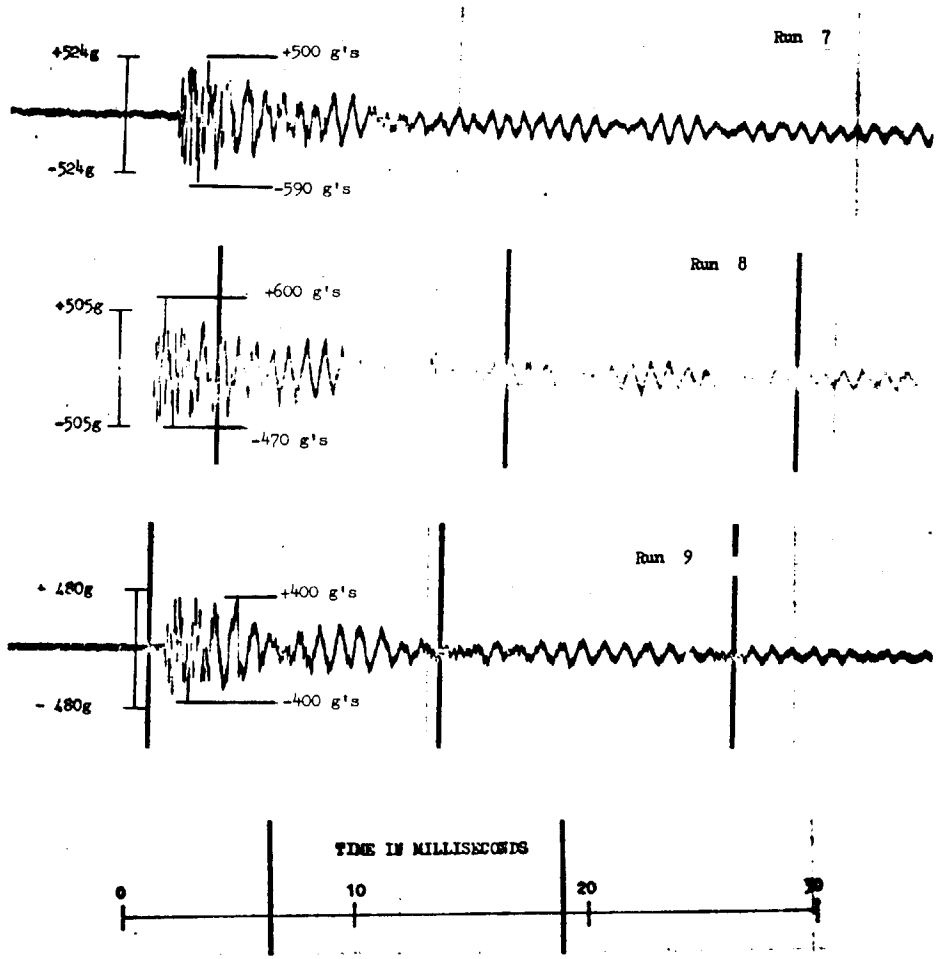


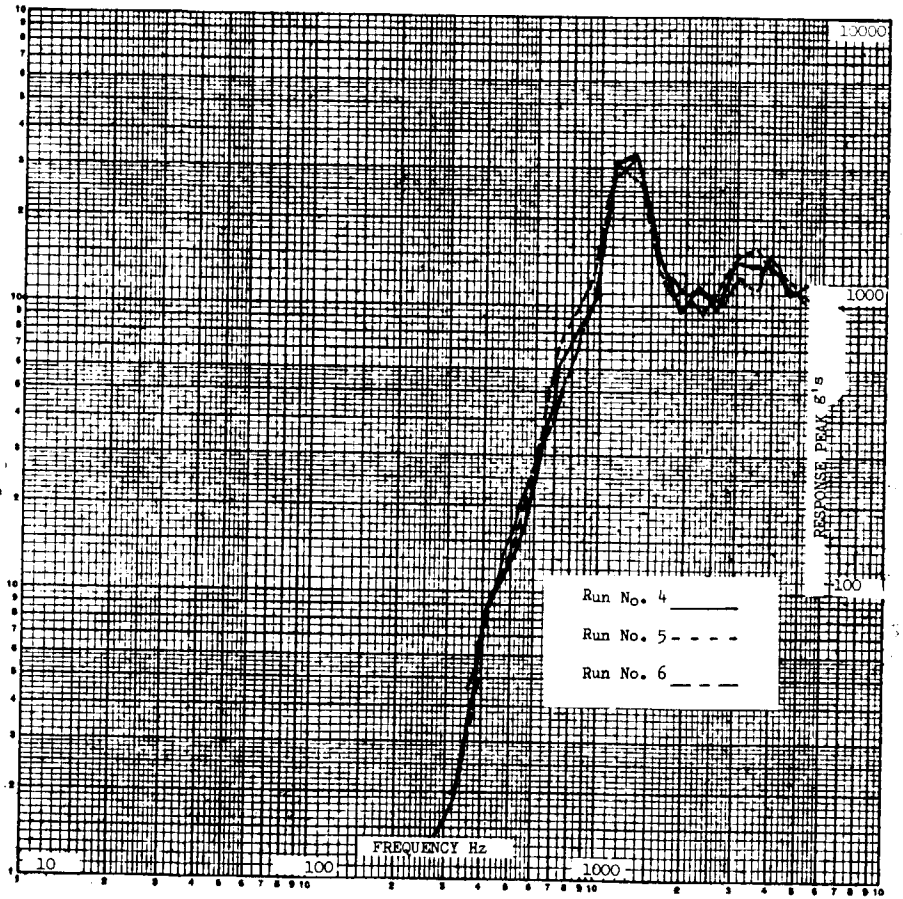
FIGURE 1.A.5-146





PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 24-X NS 17
P92
RUN NO. 7, 8, 9

FIGURE I.A.5-145



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 24-X NS 17
P92
RUN NO. 4, 5, 6

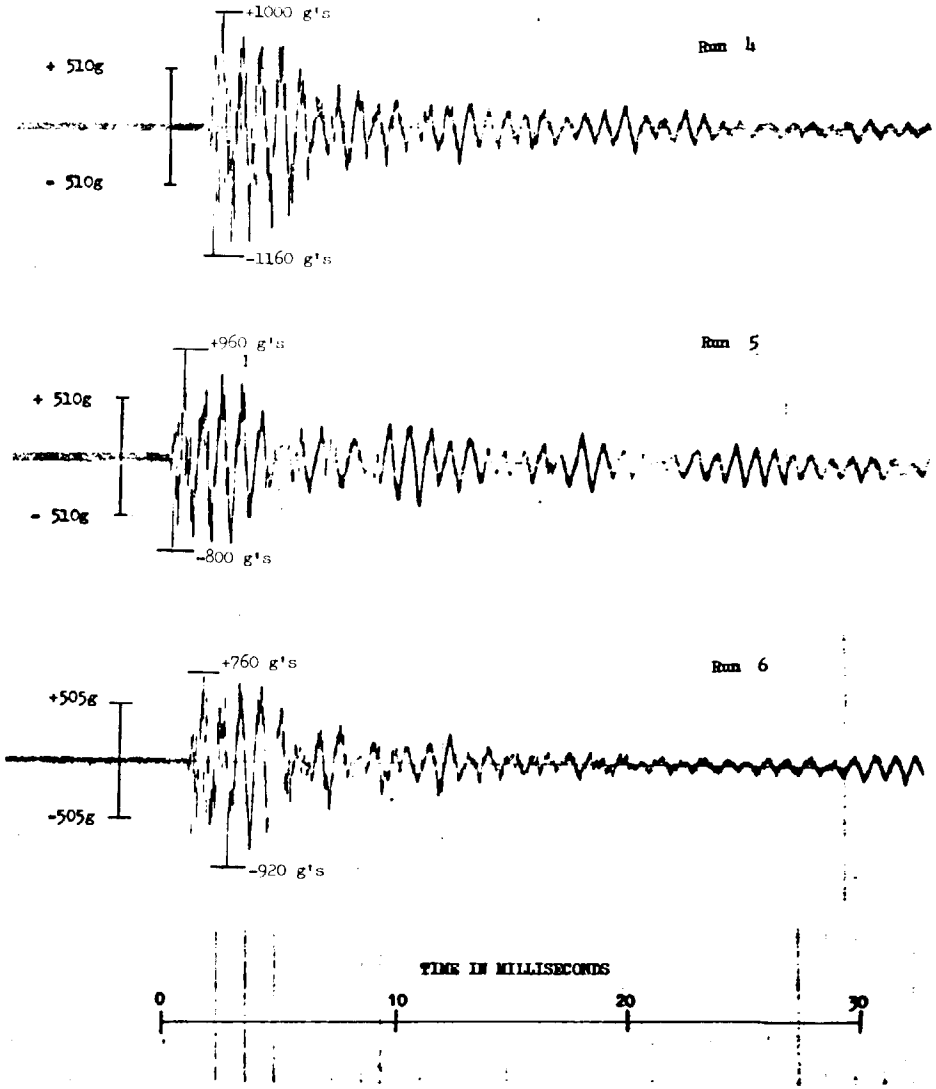
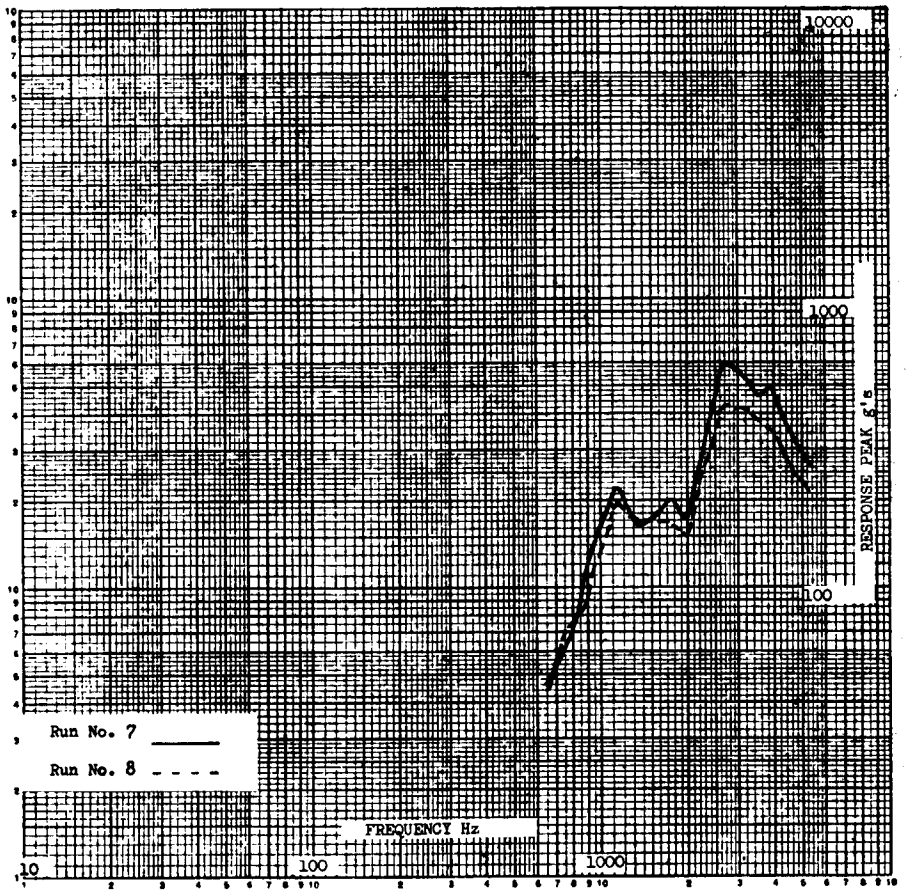
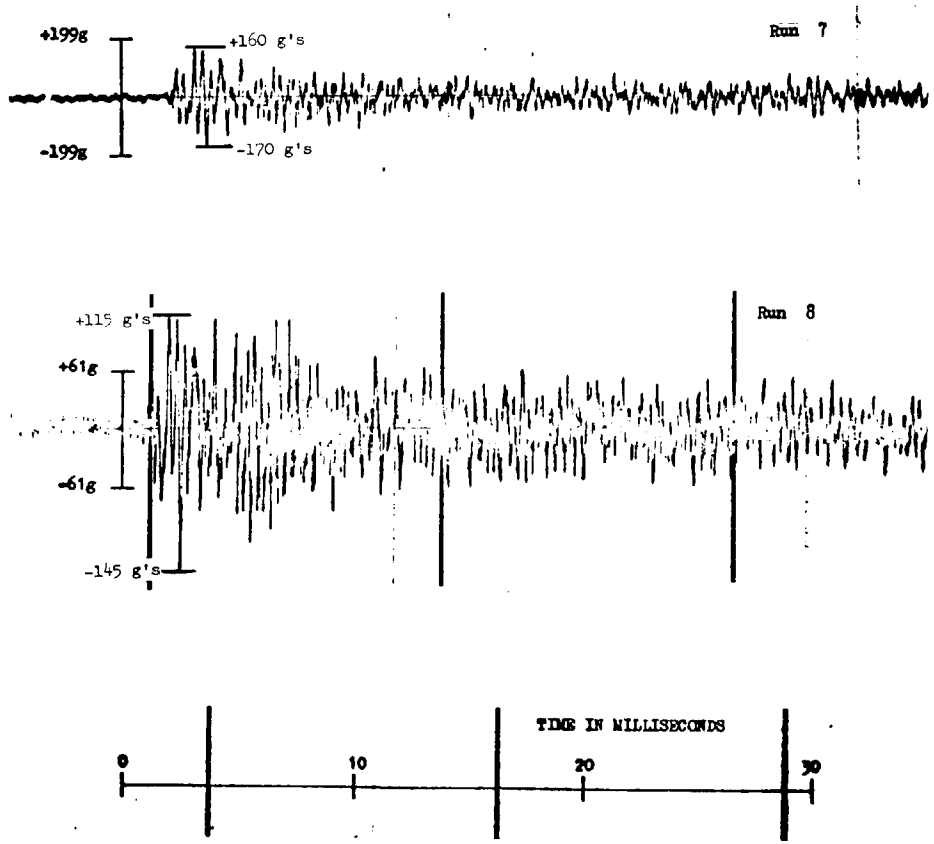


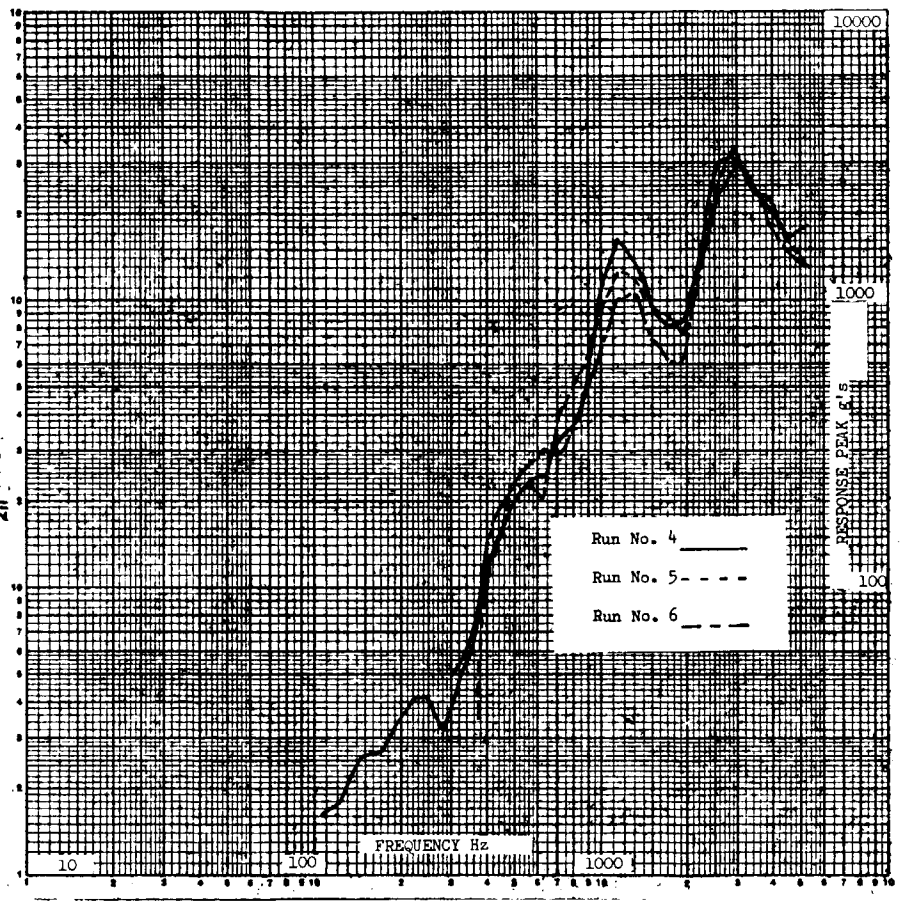
FIGURE I.A.5-144





PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 23-Z NS-17
MGSC
RUN NO. 7, 8

FIGURE I.A.5-143



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 23-Z NS17
MGSC
RUN NO. 4, 5, 6

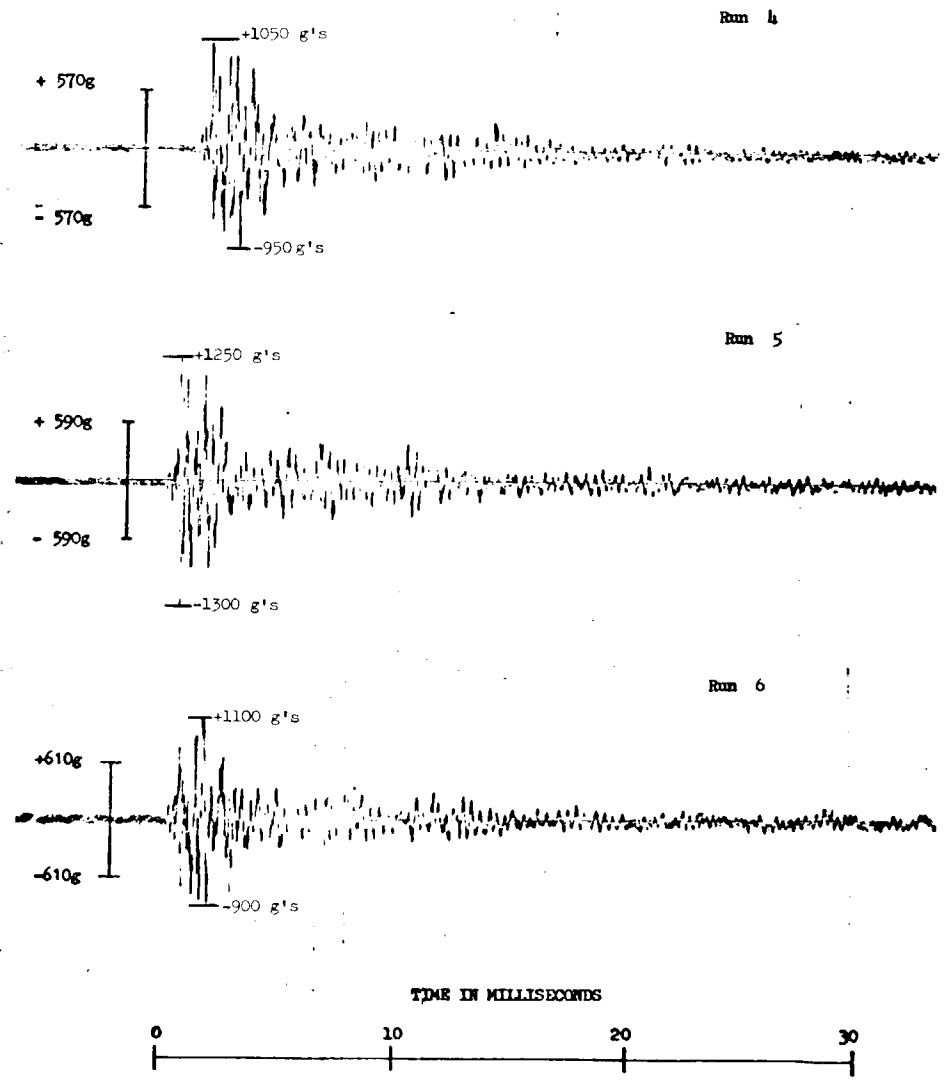
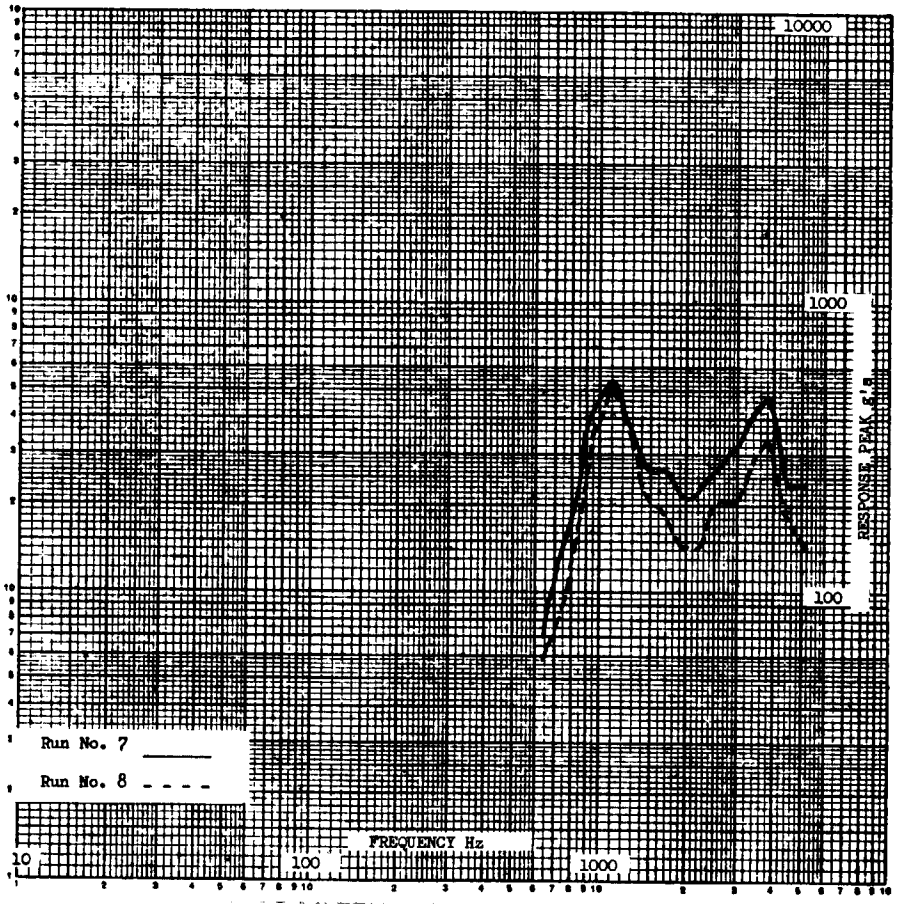
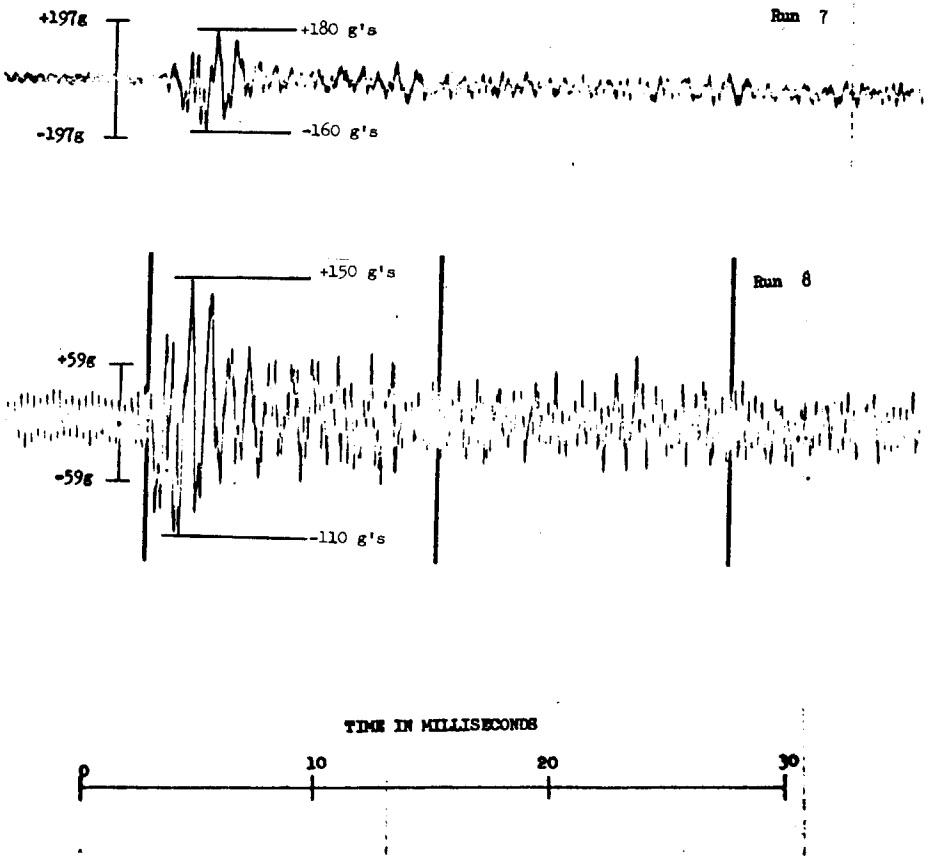


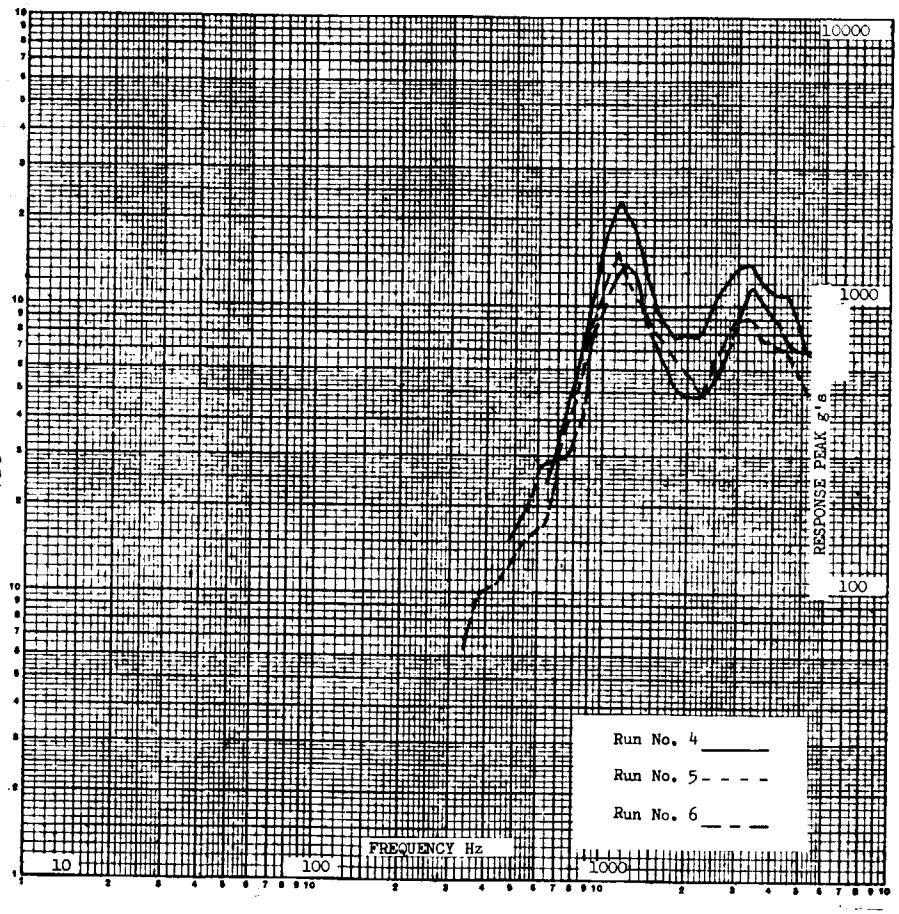
FIGURE 1.A.5-142

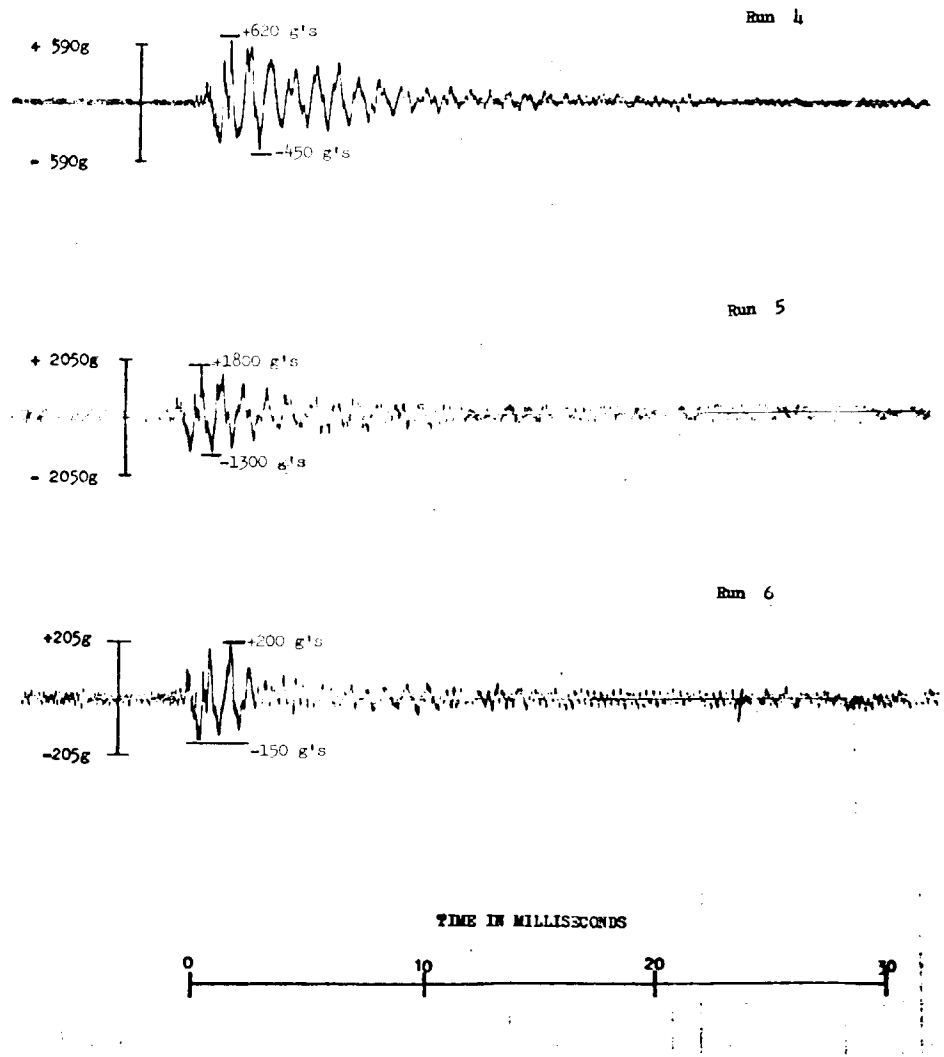




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 23-Y NS-17
MGSC
RUN NO. 7, 8

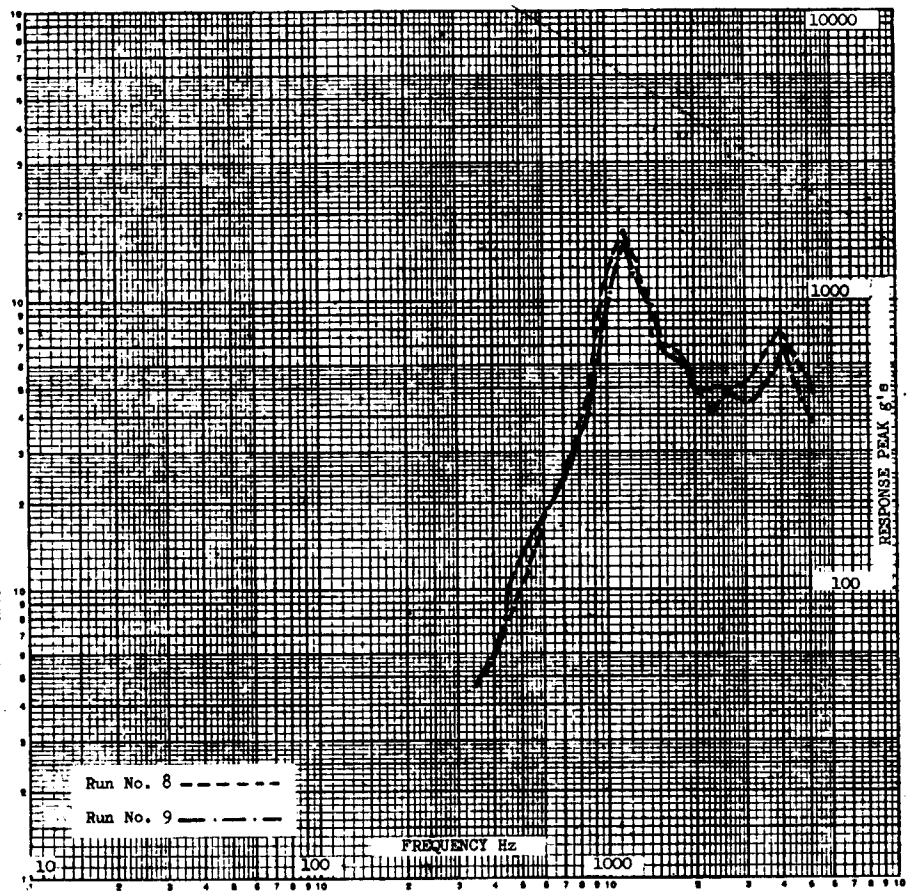
FIGURE I.A.5-141





PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 23-Y NS17
MGSC
RUN NO. 4, 5, 6

FIGURE I.A.5-140



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 23-X NS-17 MGSC
RUN NO. 8,9

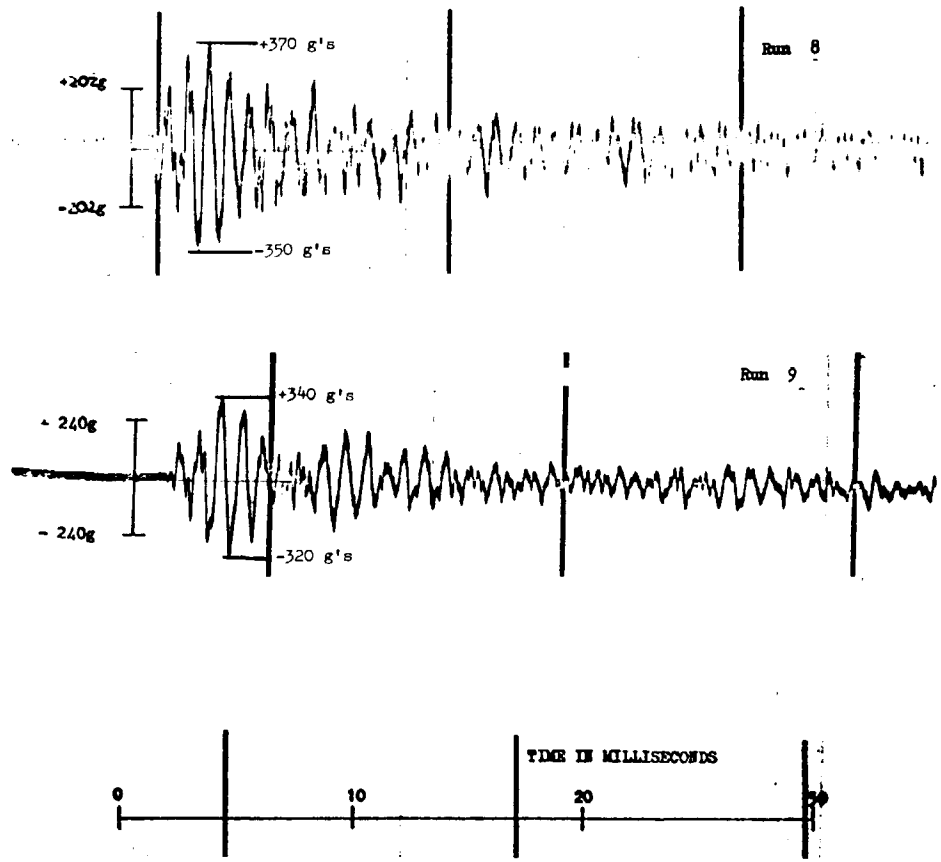
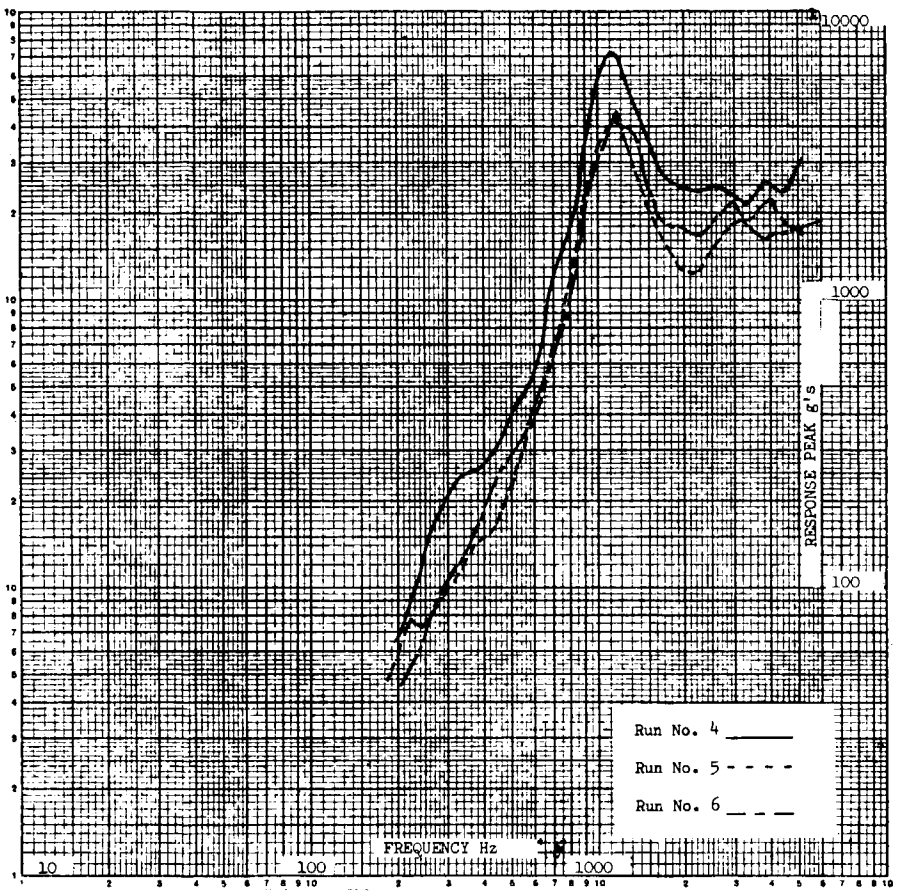


FIGURE I.A.5-139



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 23X NS-17
MGSC
RUN NO. 4, 5, 6

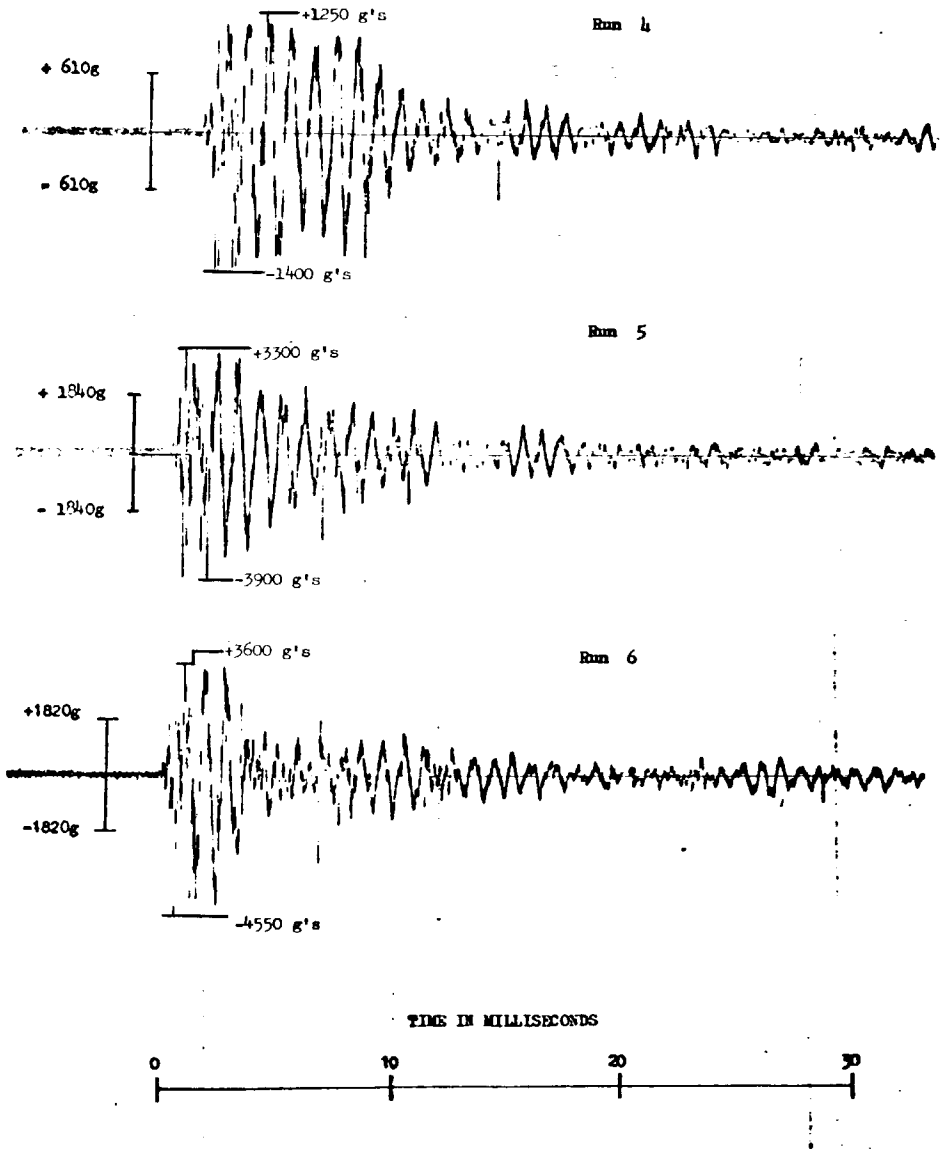
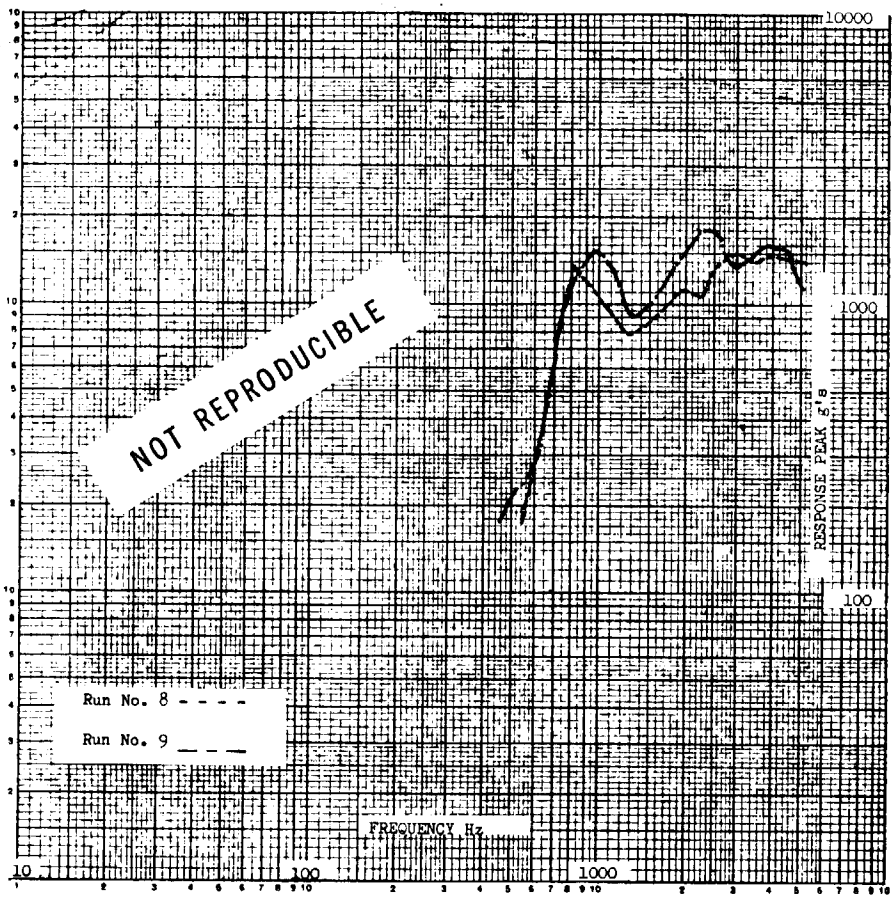
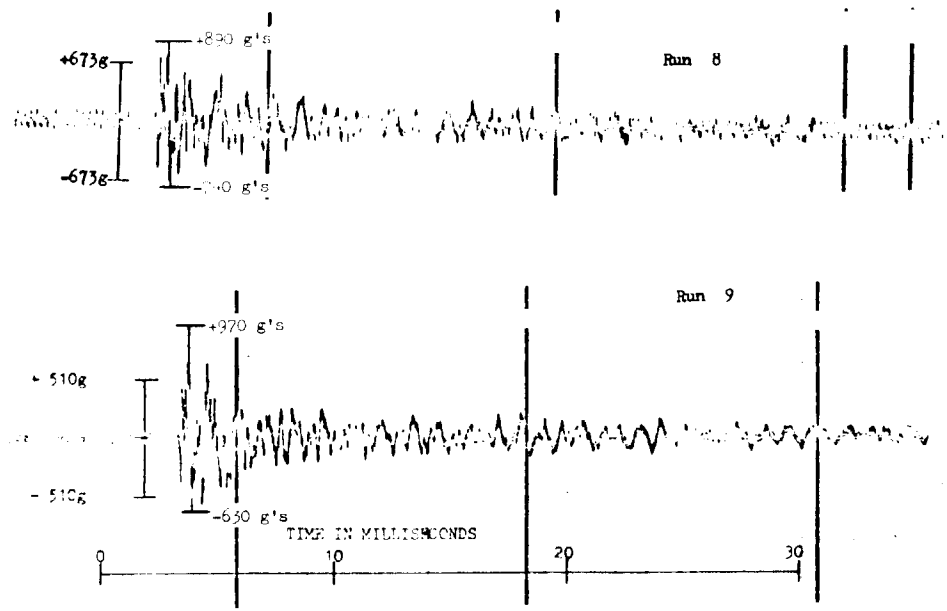


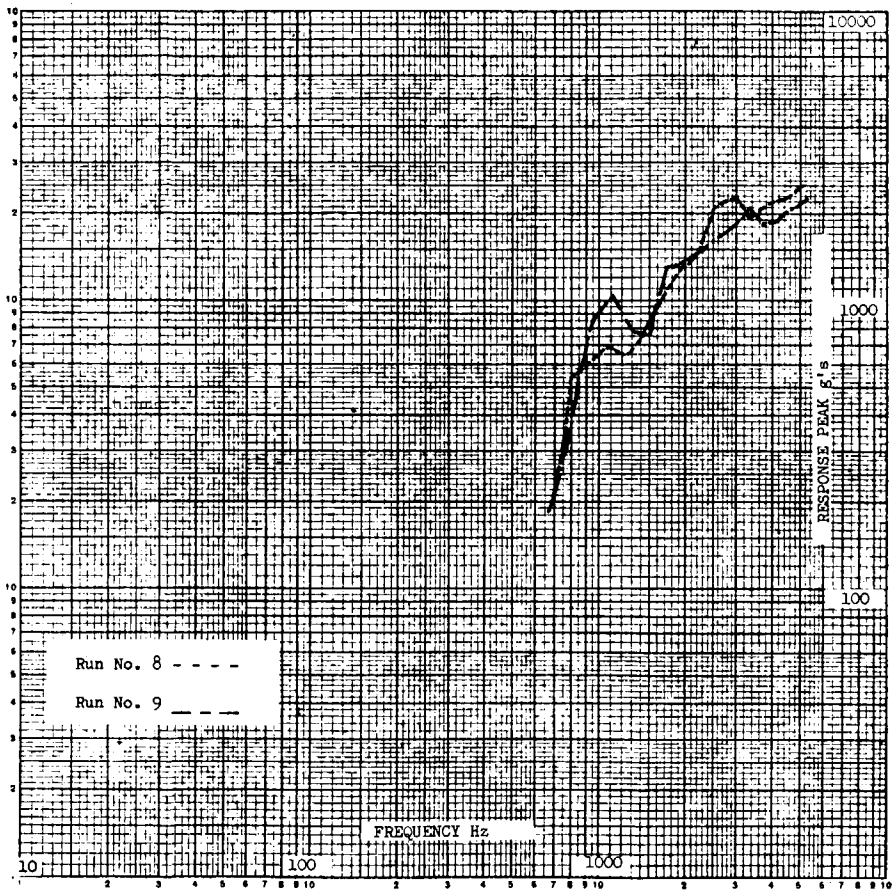
FIGURE I.A.5-138

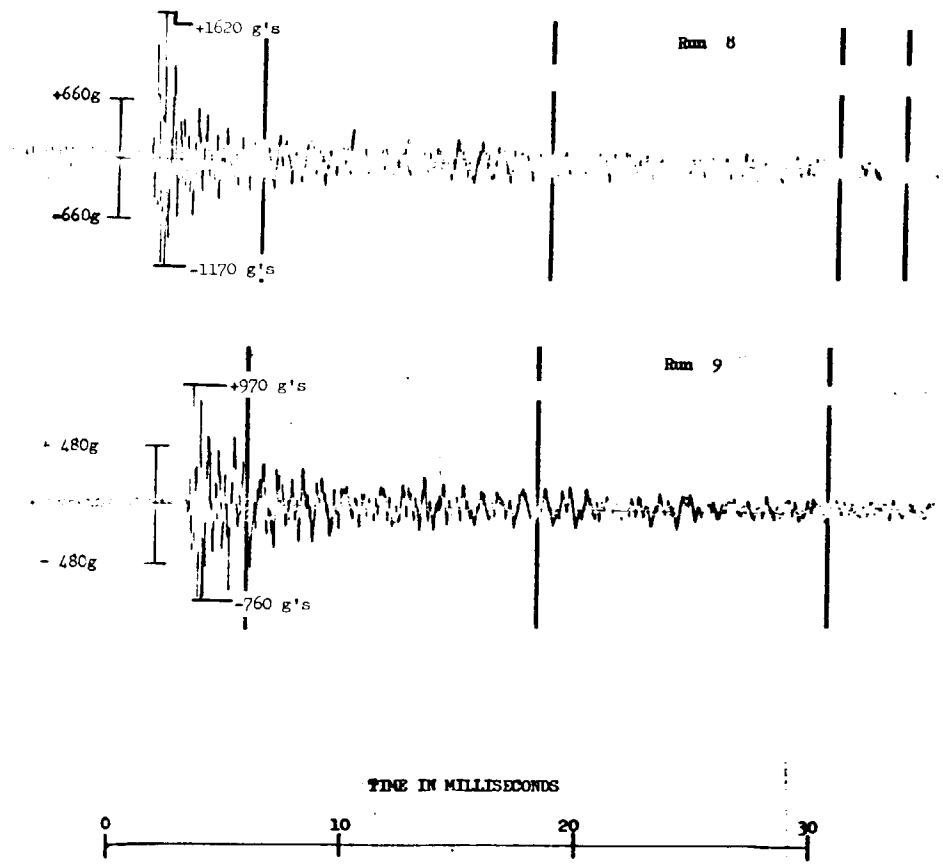




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 22-Z NS 17
COMPUTER, DIAGONAL FOOT
RUN NO. 8, 9

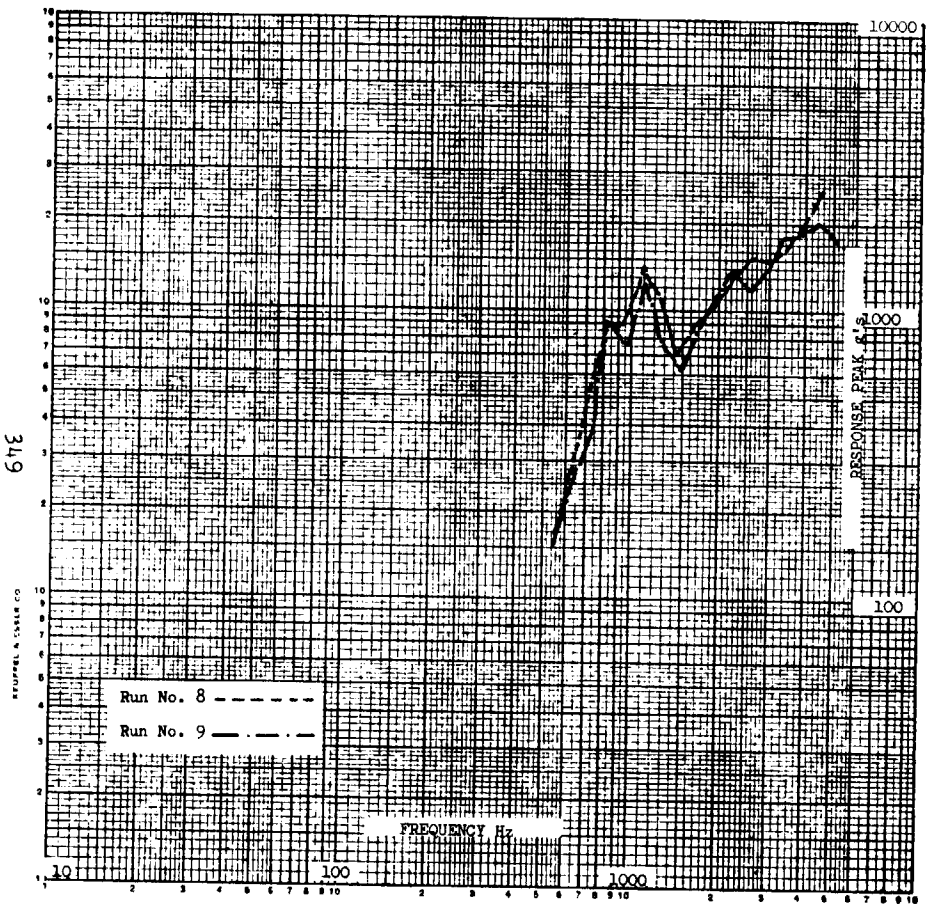
FIGURE I.A.5-137

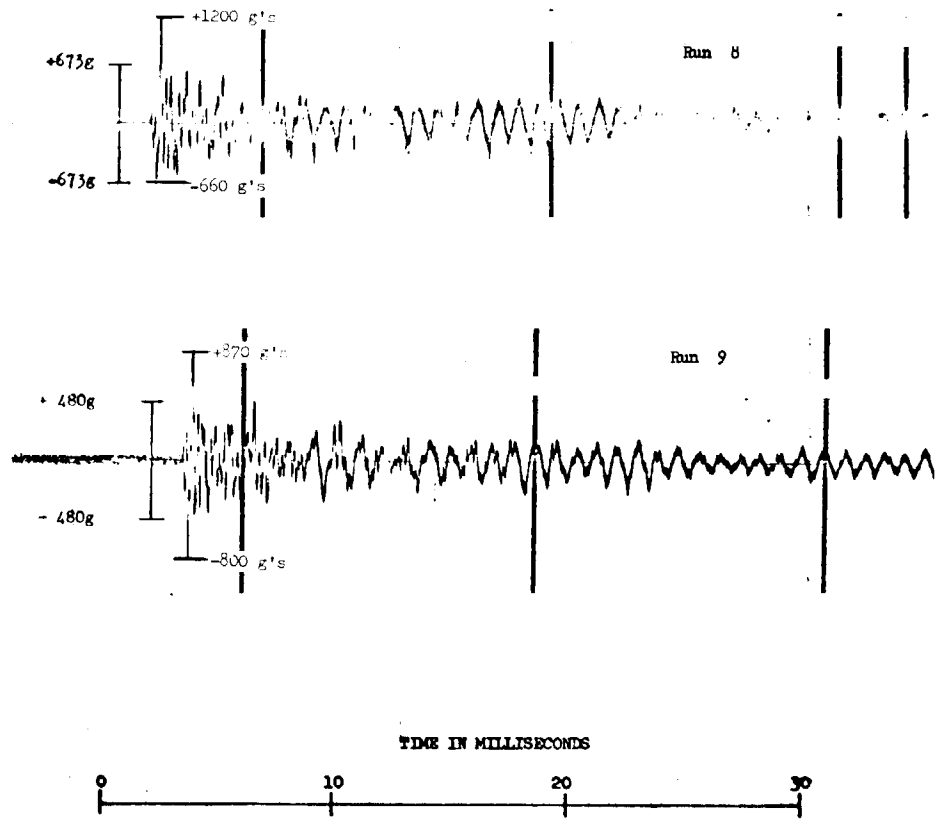




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 22-Y NS-17
COMPUTER, DIAGONAL FOOT
RUN NO. 8,9

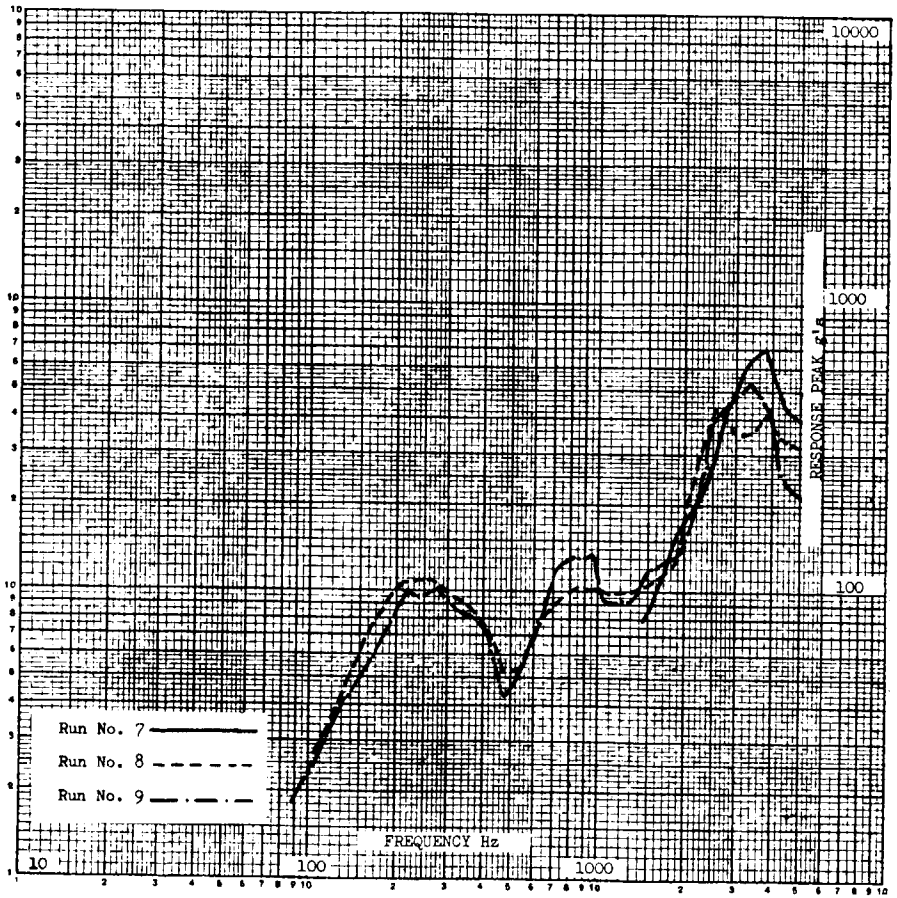
FIGURE I.A.5-136





PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 22-X NS 17
COMPUTER, DIAGONAL FOOT
RUN NO. 8,9

FIGURE I.A.5-135



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC 21-Z NS 17
COMPUTER, MEMORY HOUSING
RUN NO. 7, 8, 9

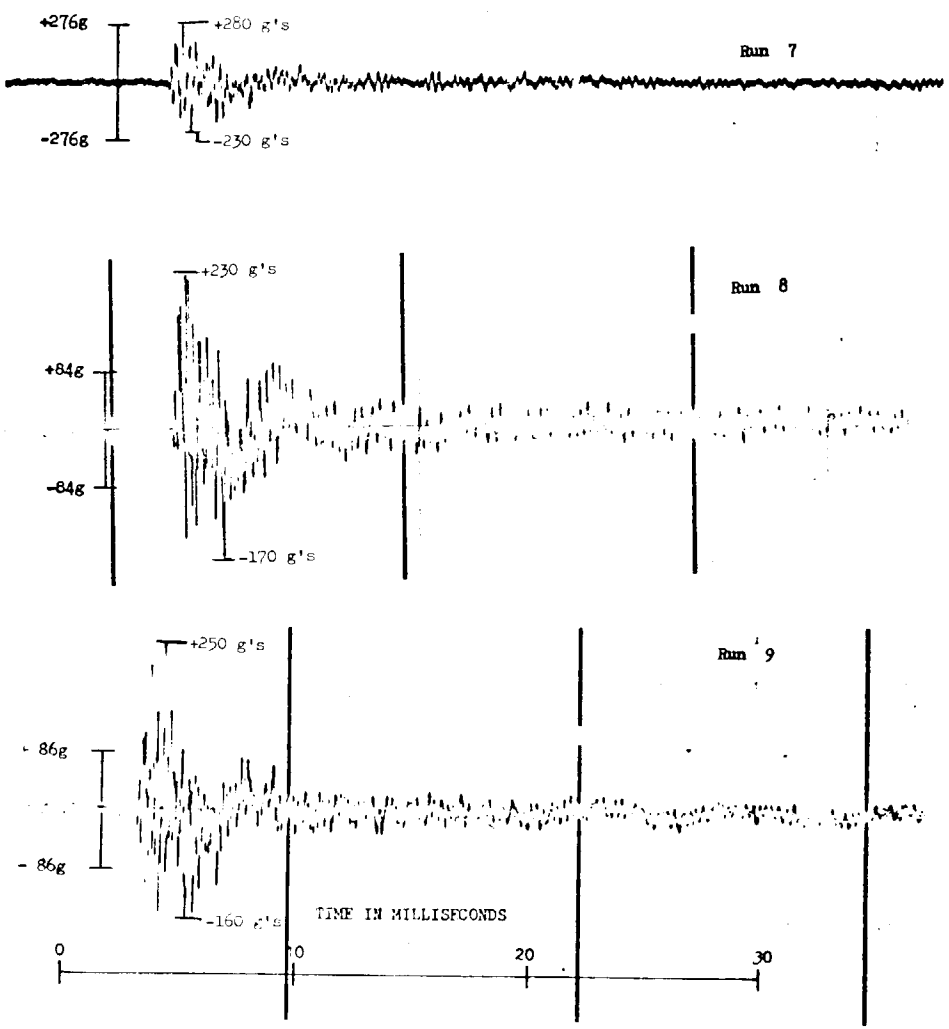
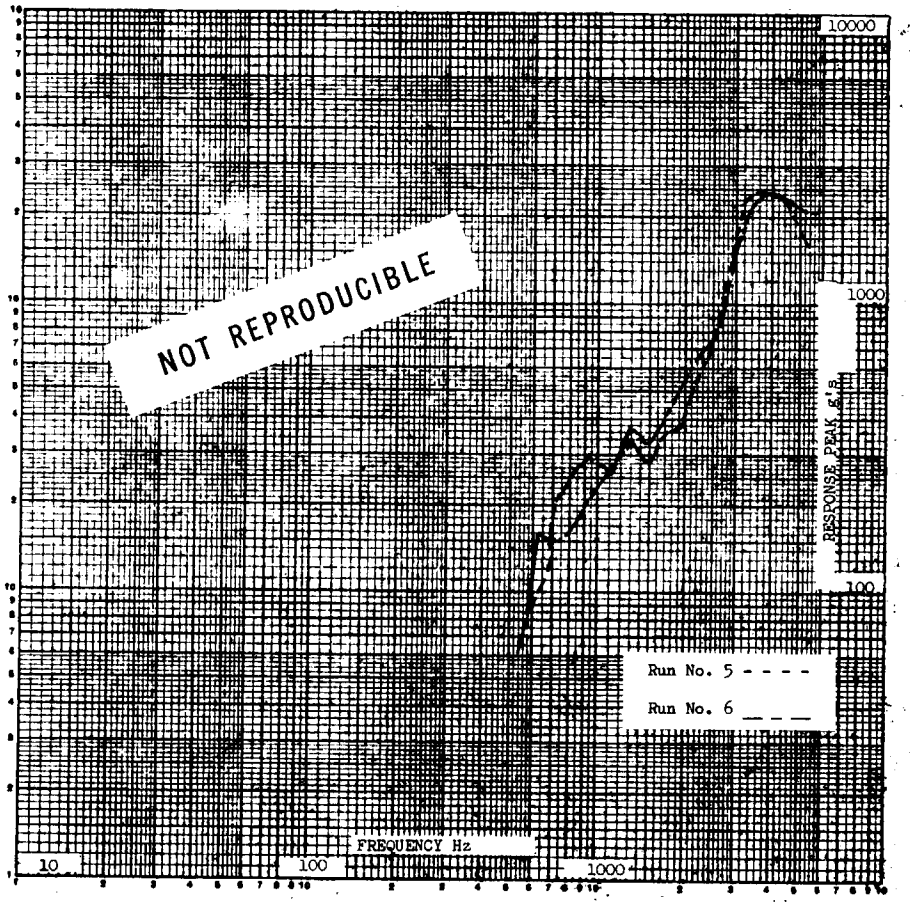
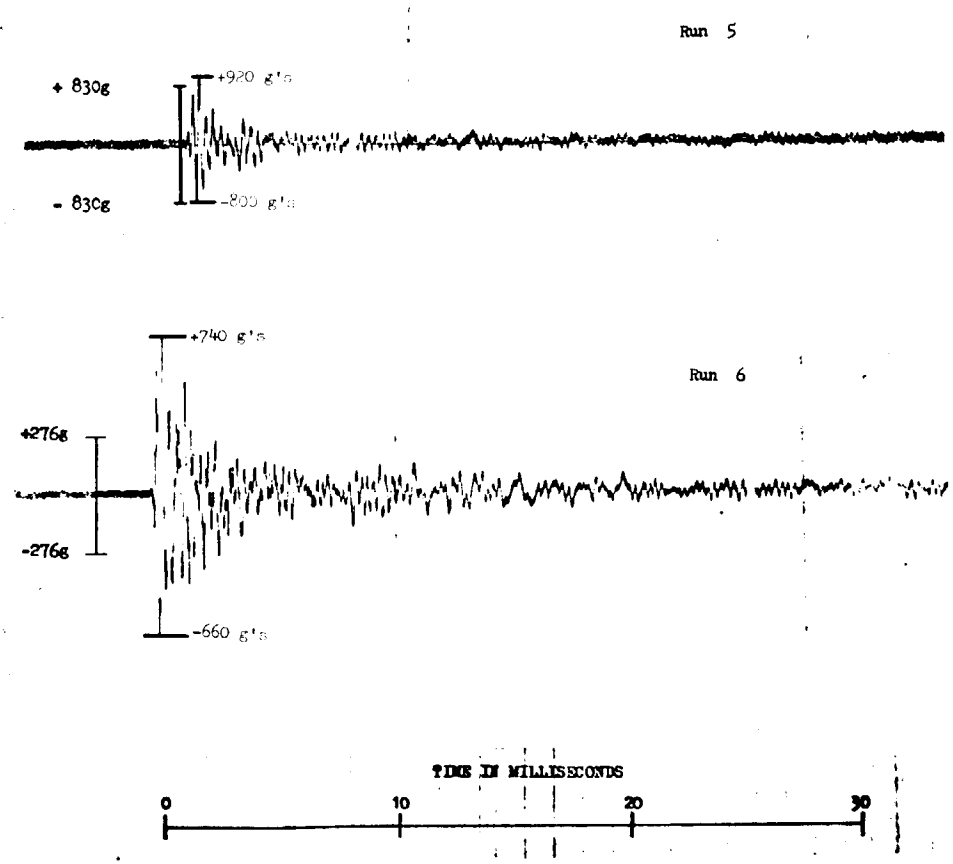


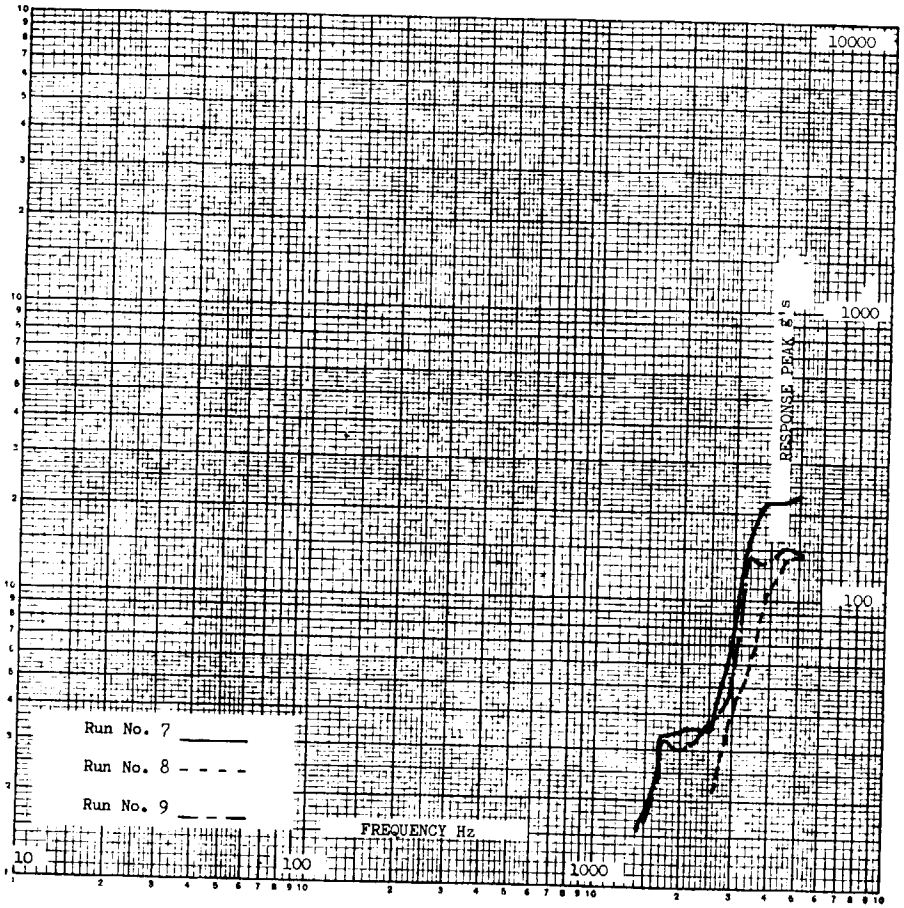
FIGURE I.A.5-134





PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 21-Z NS-17
COMPUTER MEMORY HOUSING
RUN NO. 5, 6

FIGURE I.A.5-133



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 21-Y NS 17
COMPUTER, MEMORY HOUSING
RUN NO. 7, 8, 9

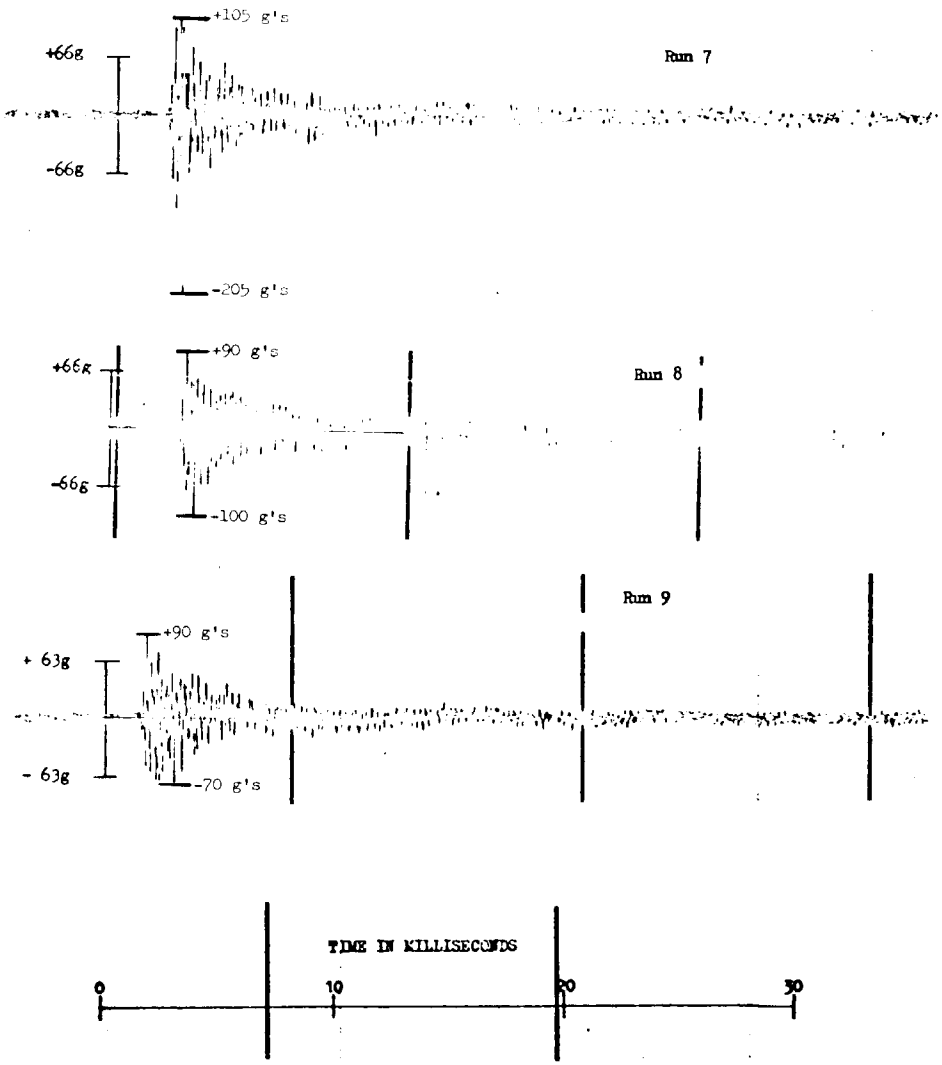
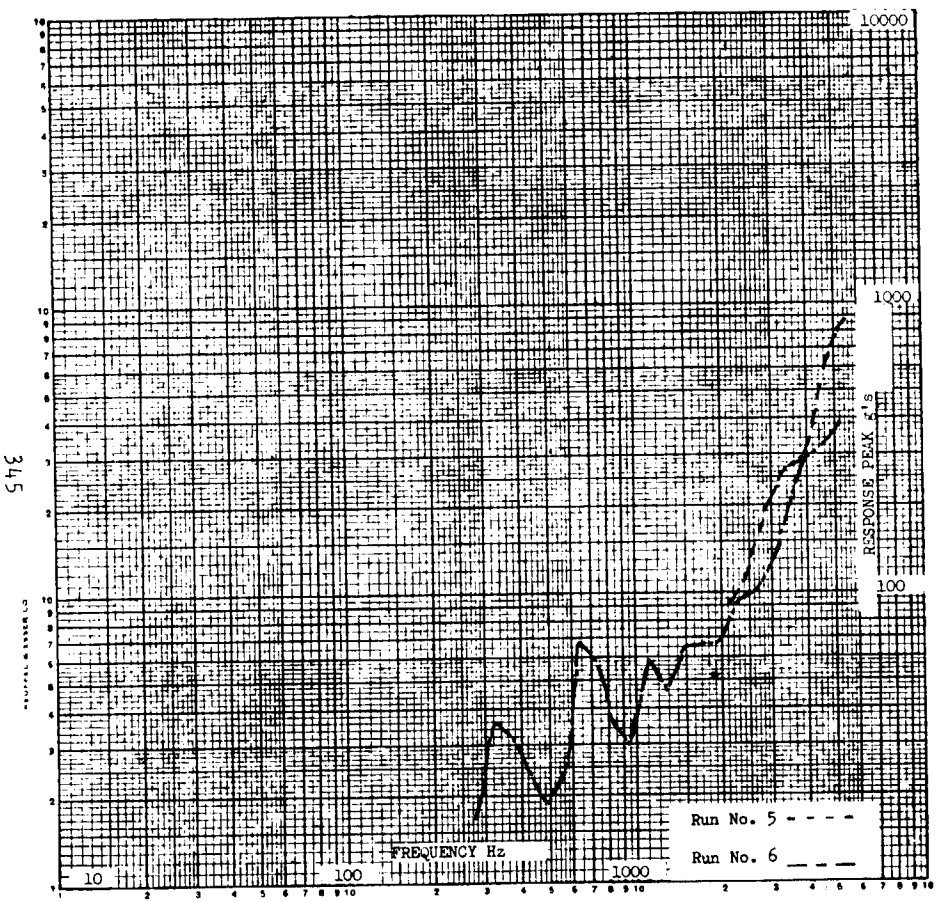
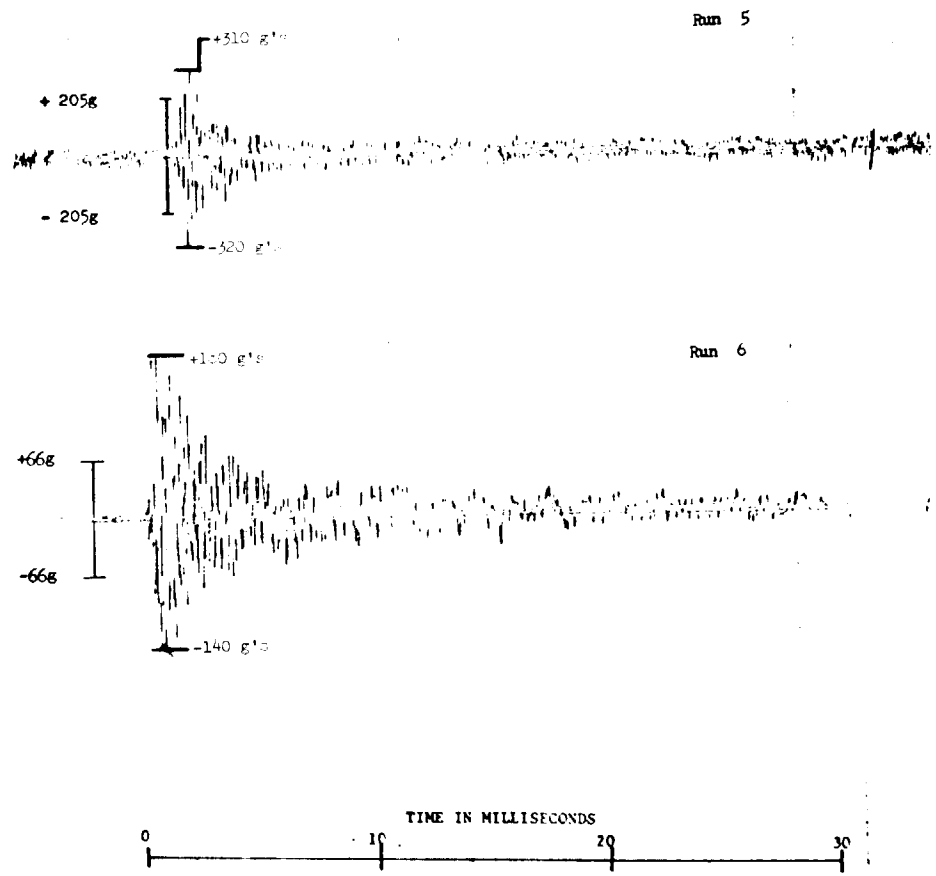


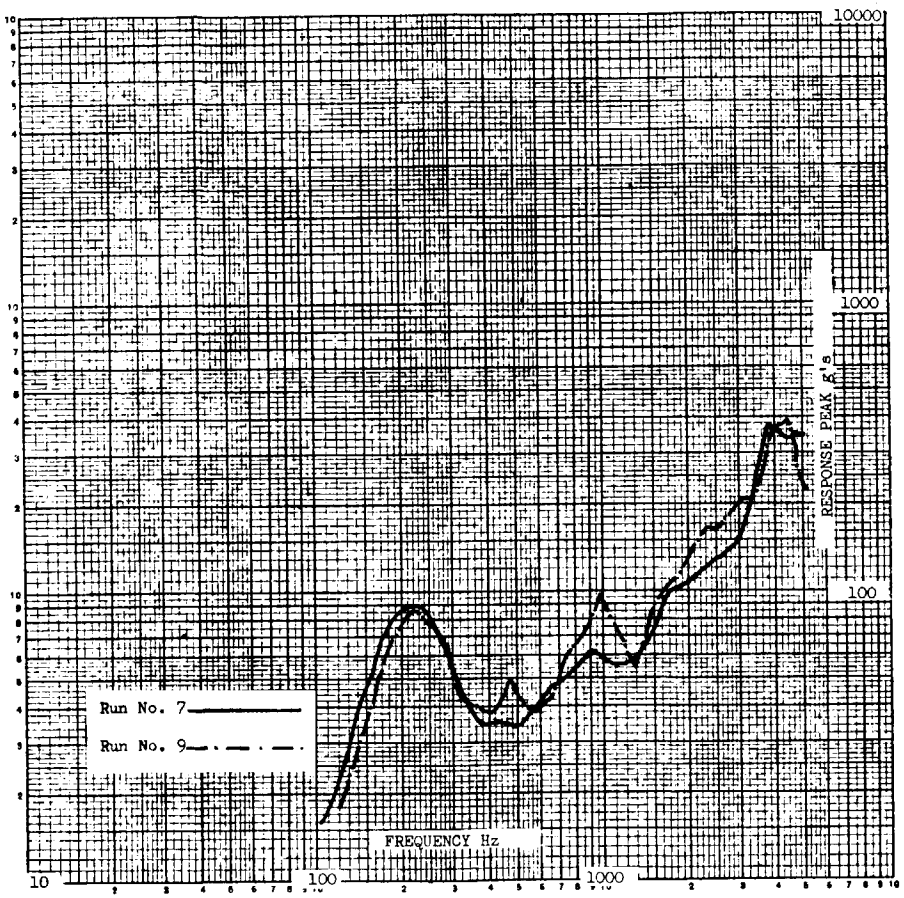
FIGURE I.A.5-132





PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 21-Y NS 17
COMPUTER, MEMORY HOUSING
RUN NO. 5,6

FIGURE I.A.5-131



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 21-X NS 17
COMPUTER, MEMORY HOUSING
RUN NO. 7, 9

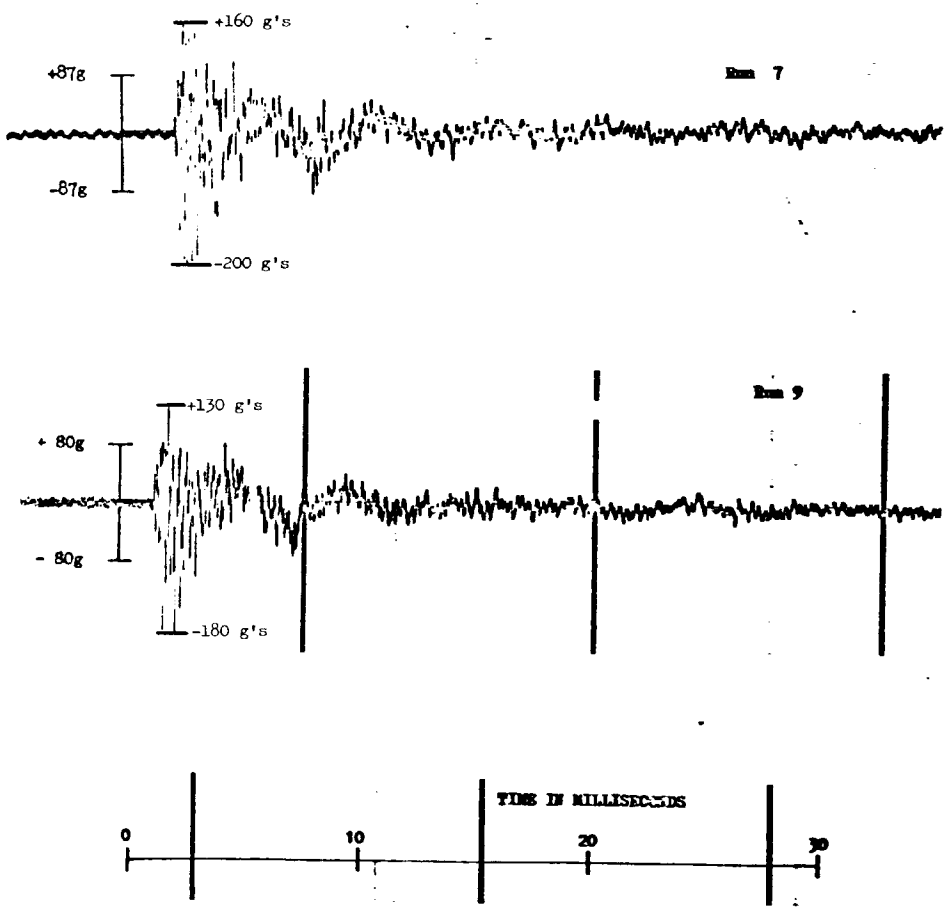
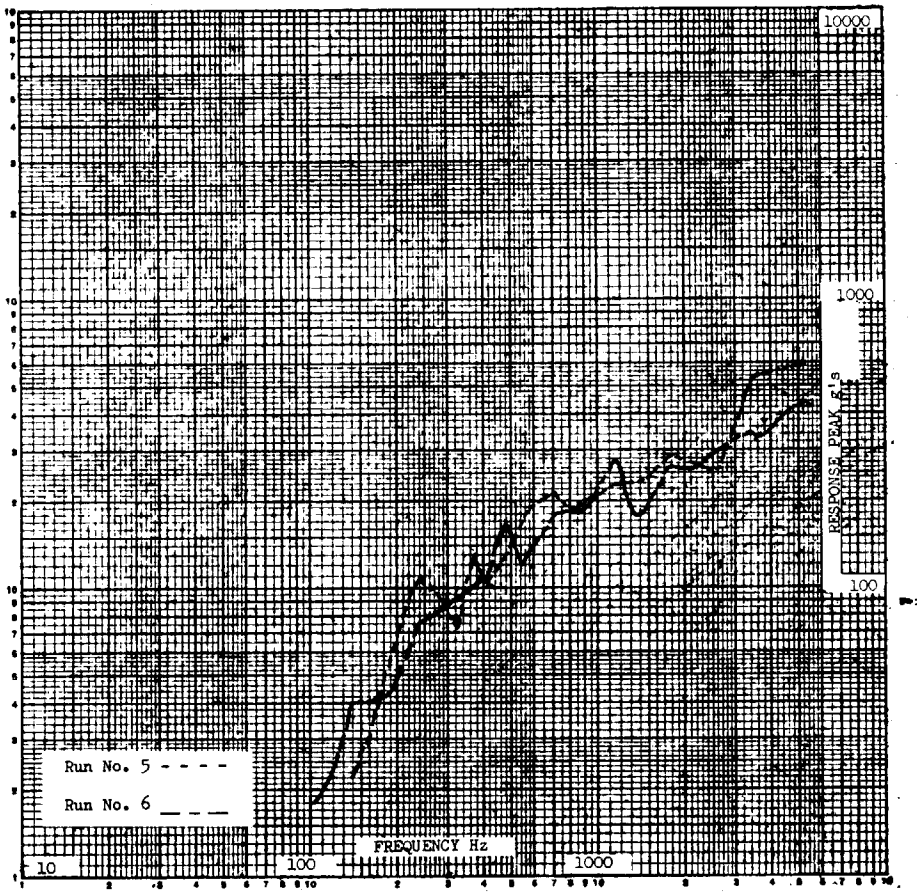
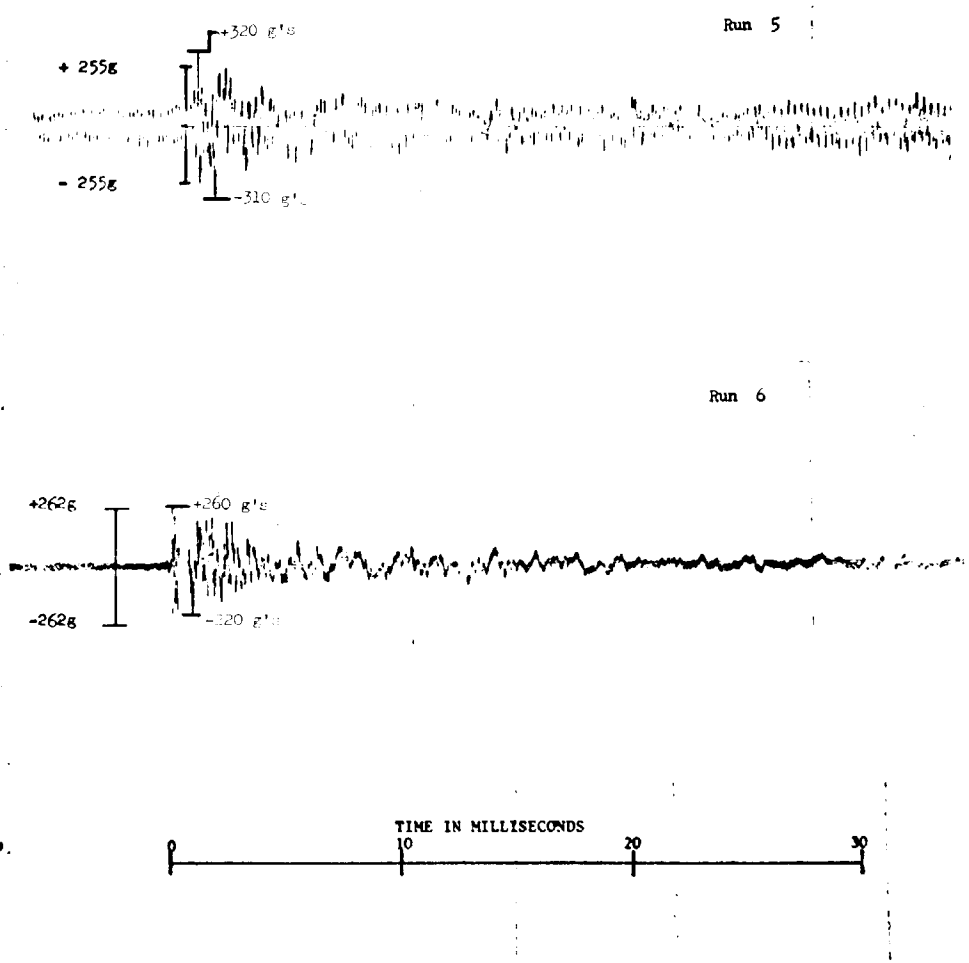


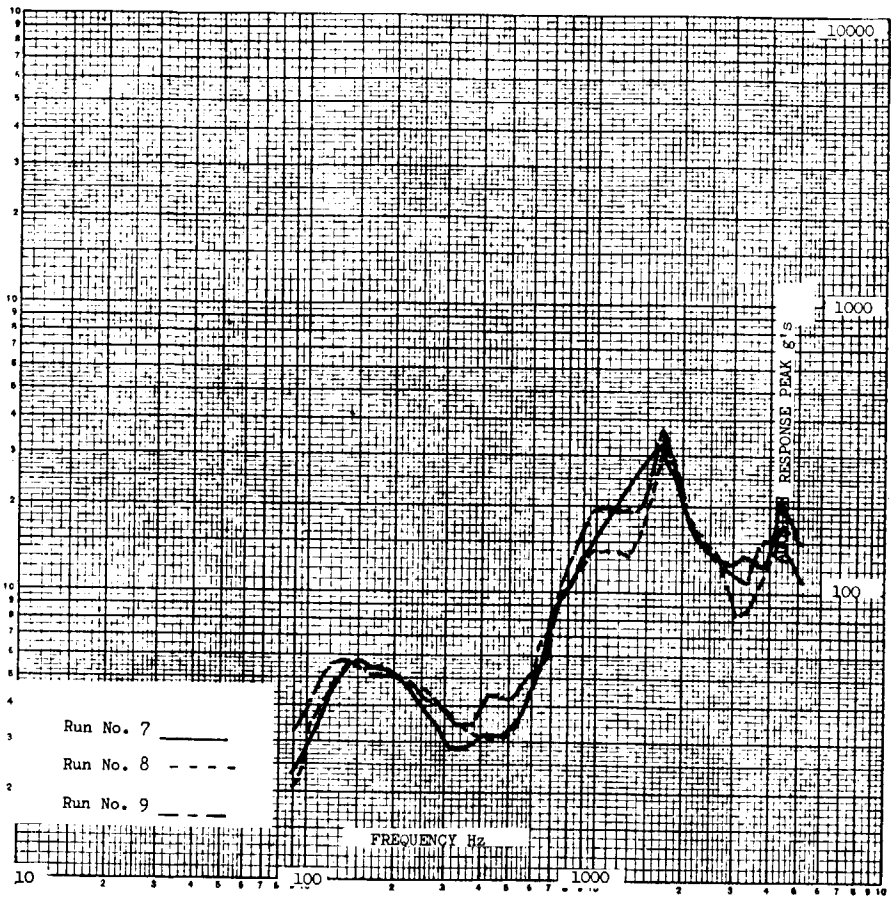
FIGURE I.A.5-130





PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 21-X NS 17
COMPUTER, MEMORY HOUSING
RUN NO. 5, 6

FIGURE I.A.5-129



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 20-Z NS 17
COMPUTER
RUN NO. 7, 8, 9

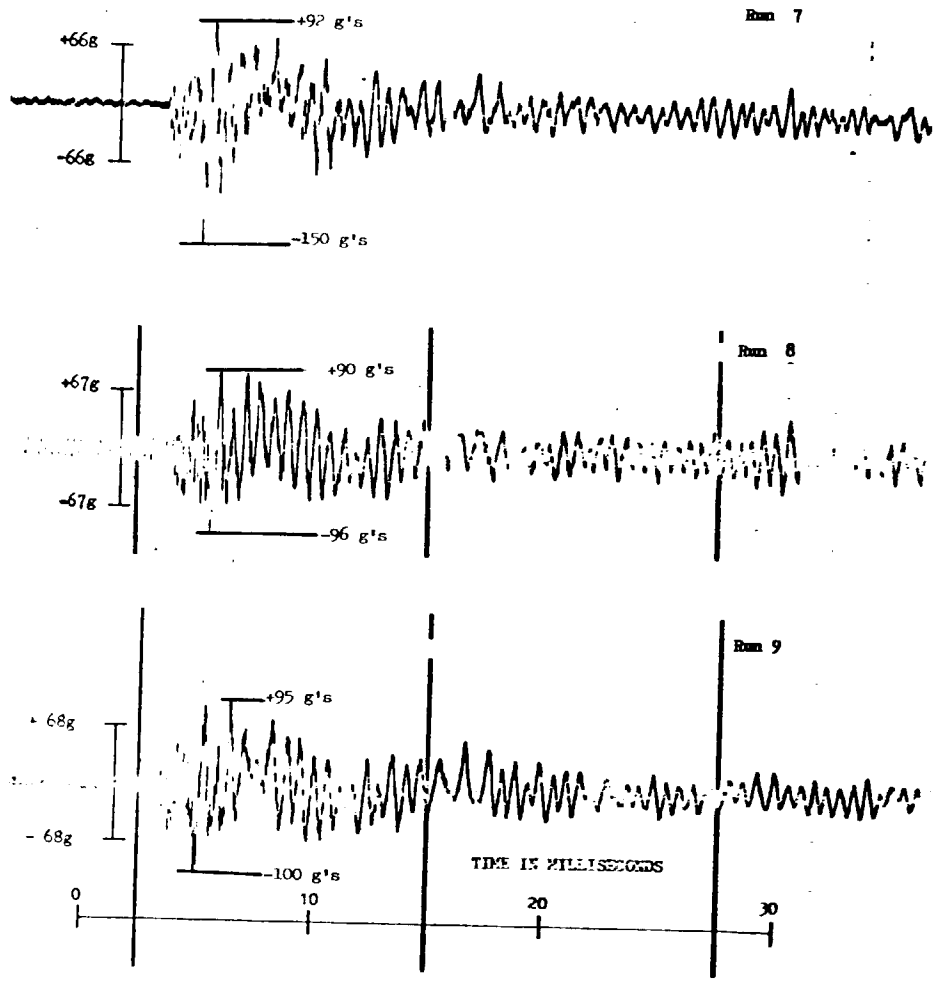
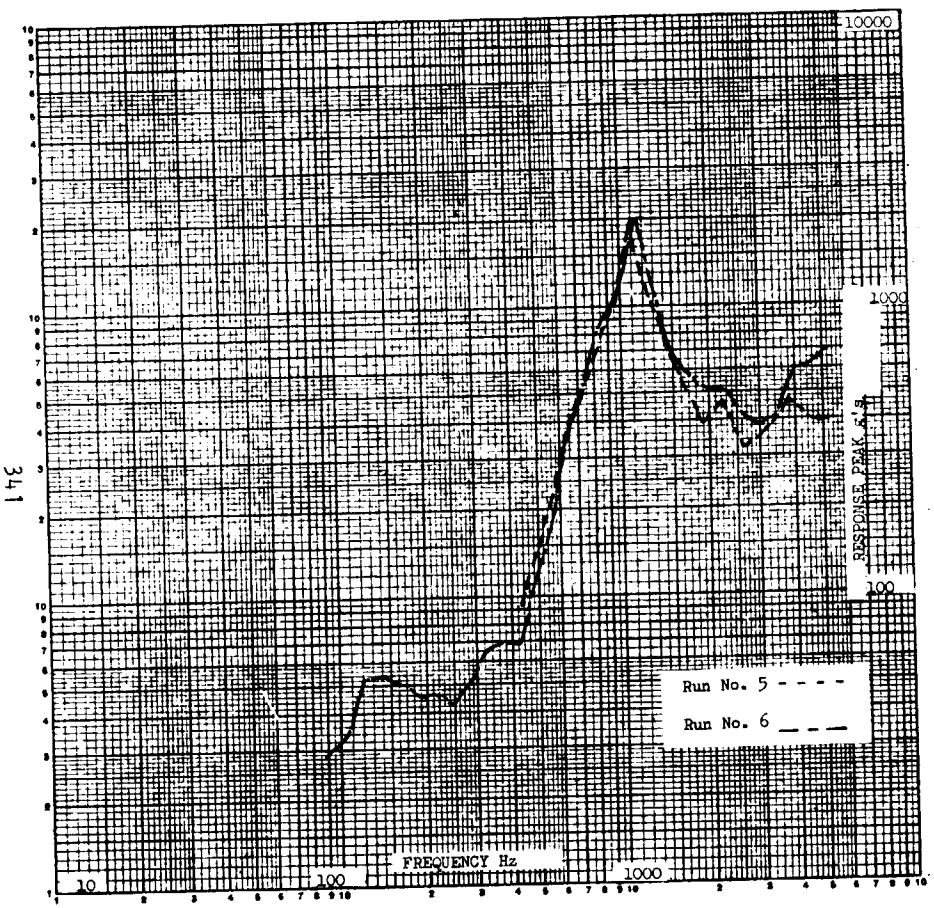
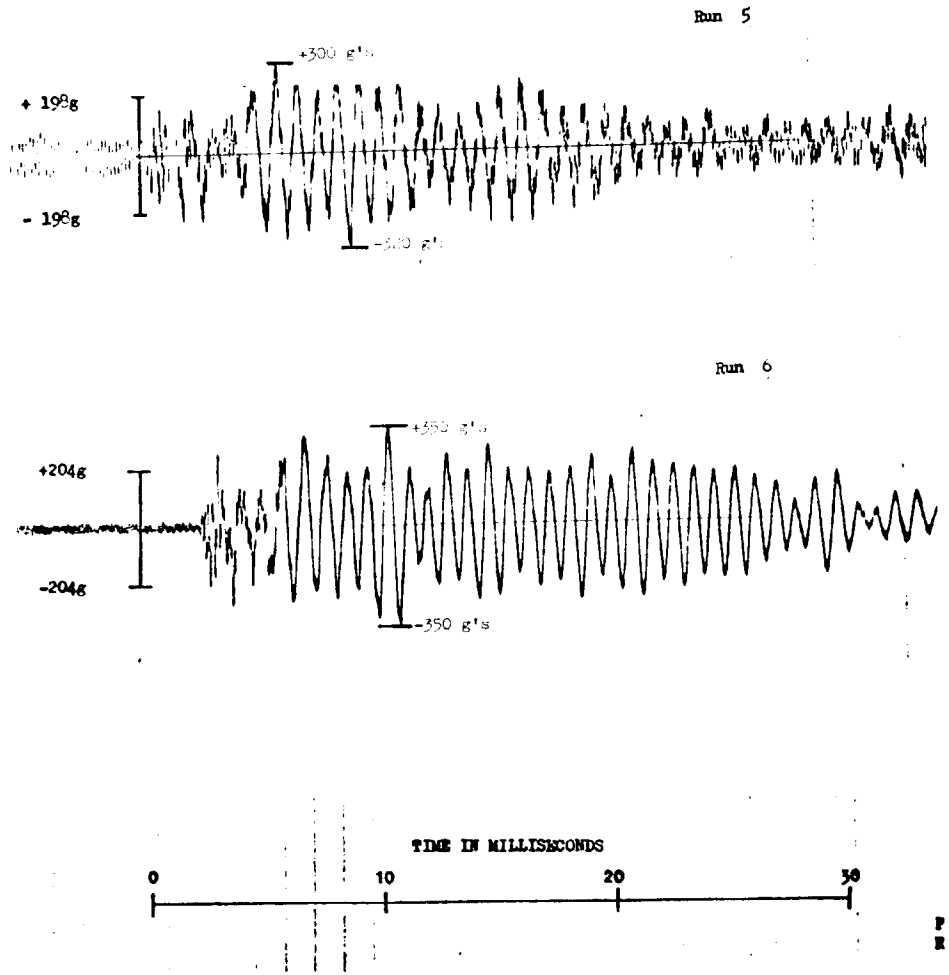


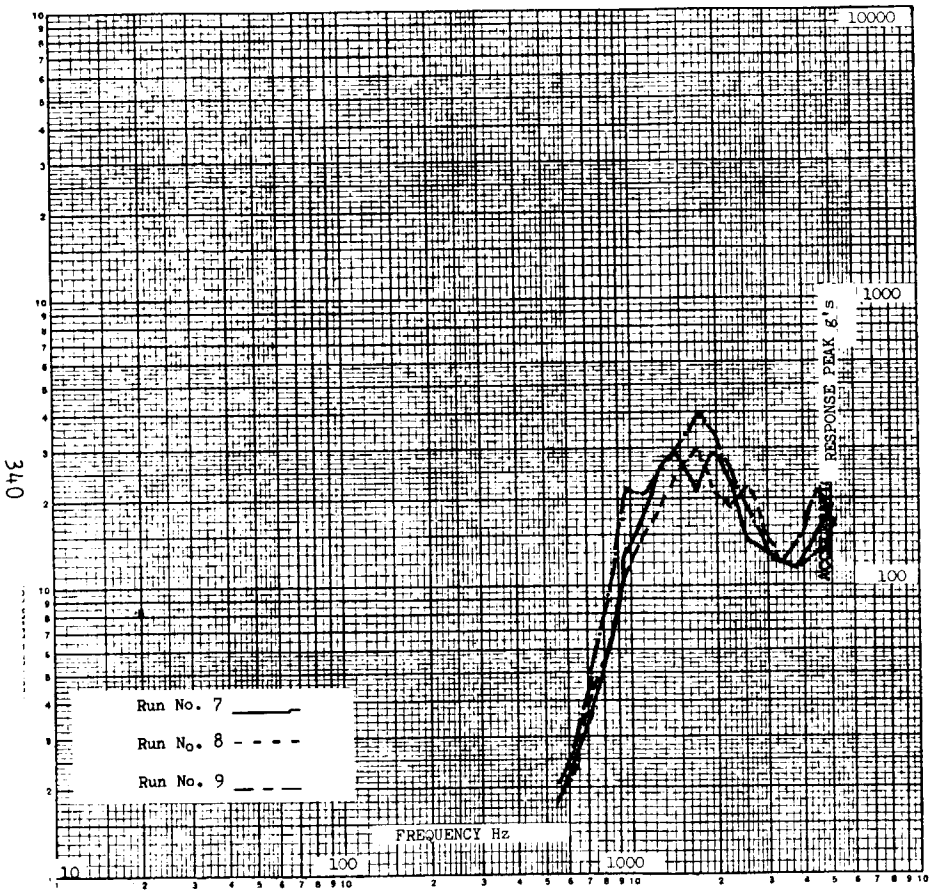
FIGURE I.A.5-128

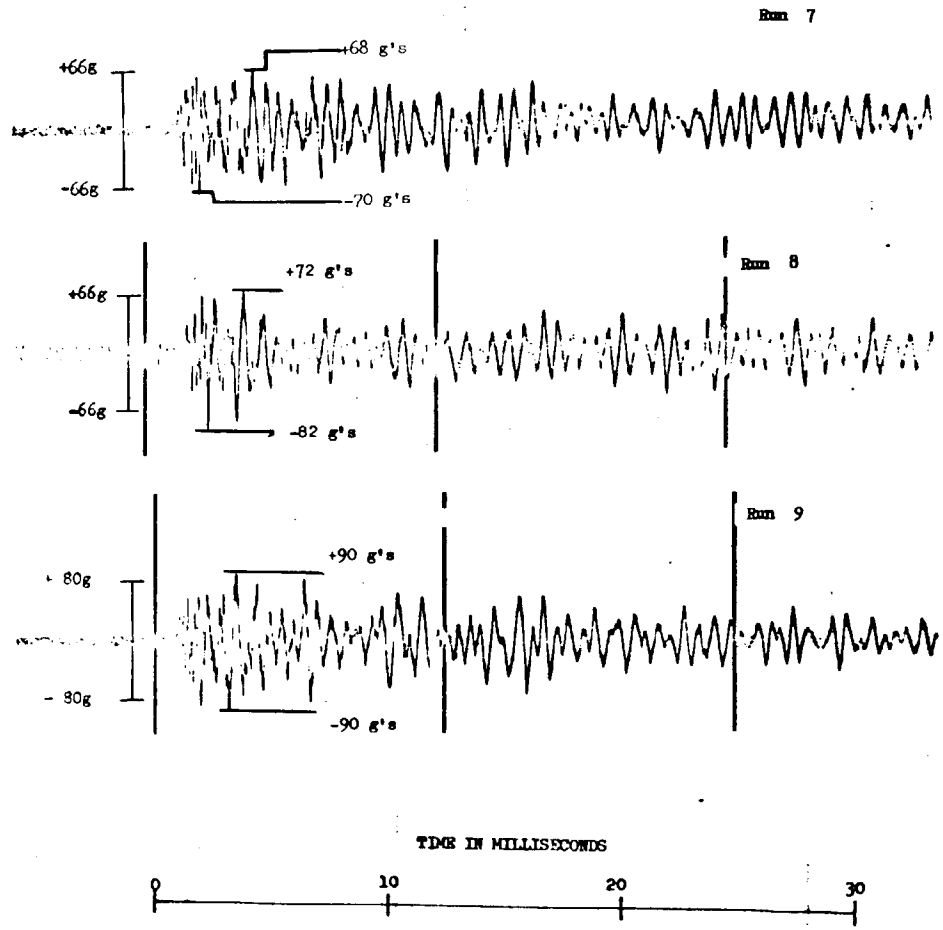




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 20-Z NS 17
COMPUTER
RUN NO. 5,6

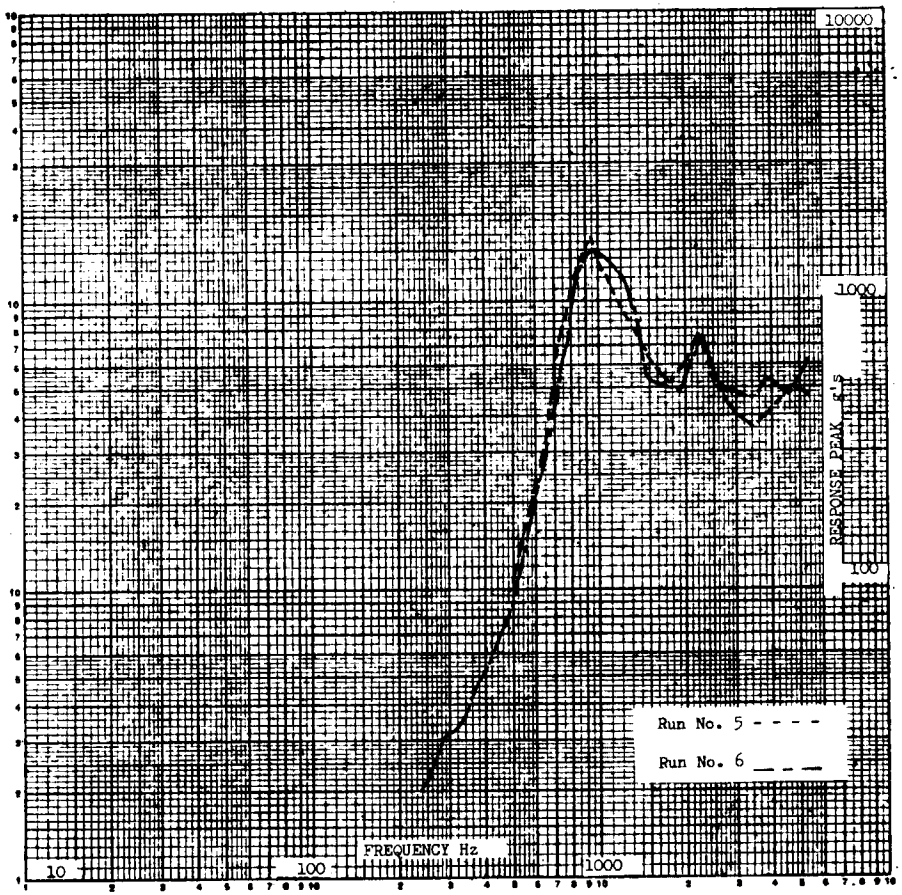
FIGURE I.A.5-127

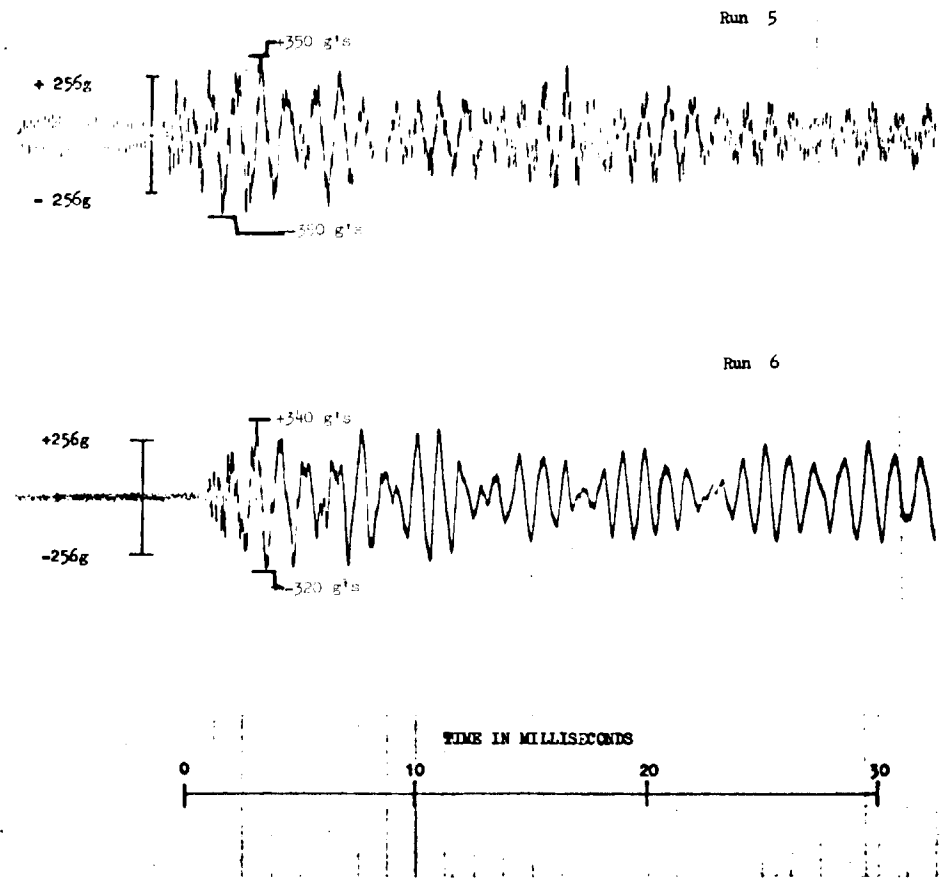




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 20-Y NS 17
COMPUTER
RUN NO. 7, 8, 9

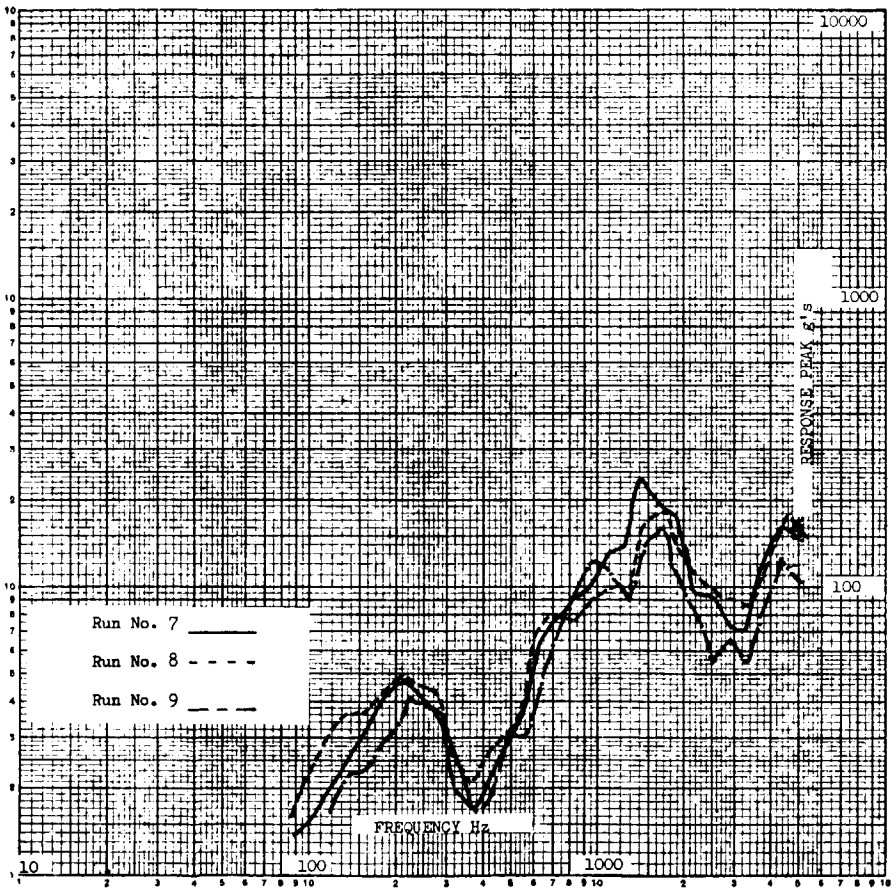
FIGURE I,A.5-126





PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC.20-Y NS 17
COMPUTER
RUN NO. 5,6

FIGURE I.A.5-125



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 20-X NS 17
COMPUTER
RUN NO. 7,8,9

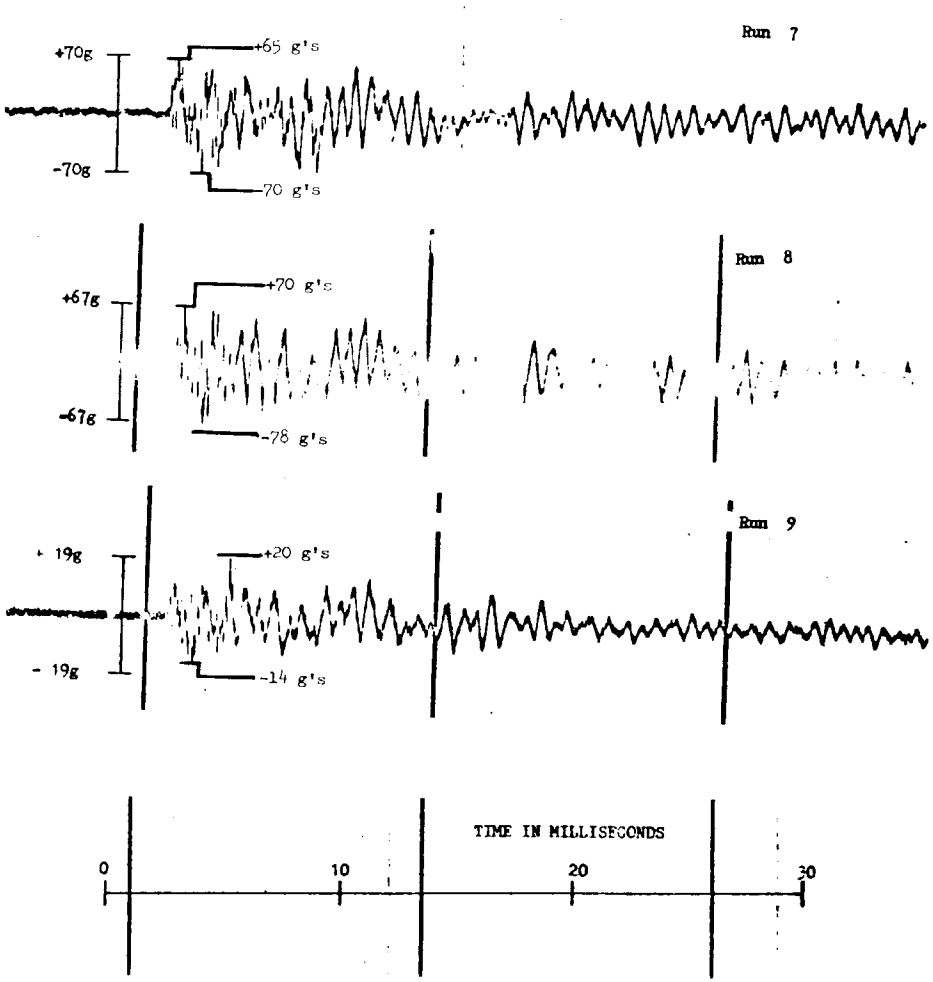
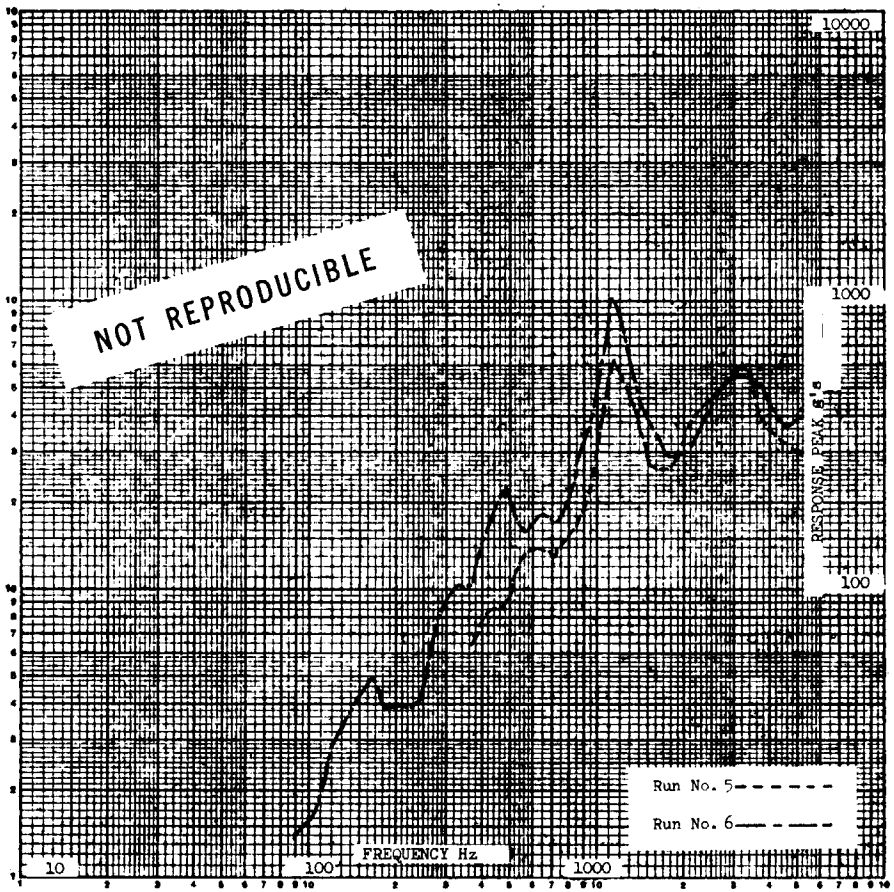
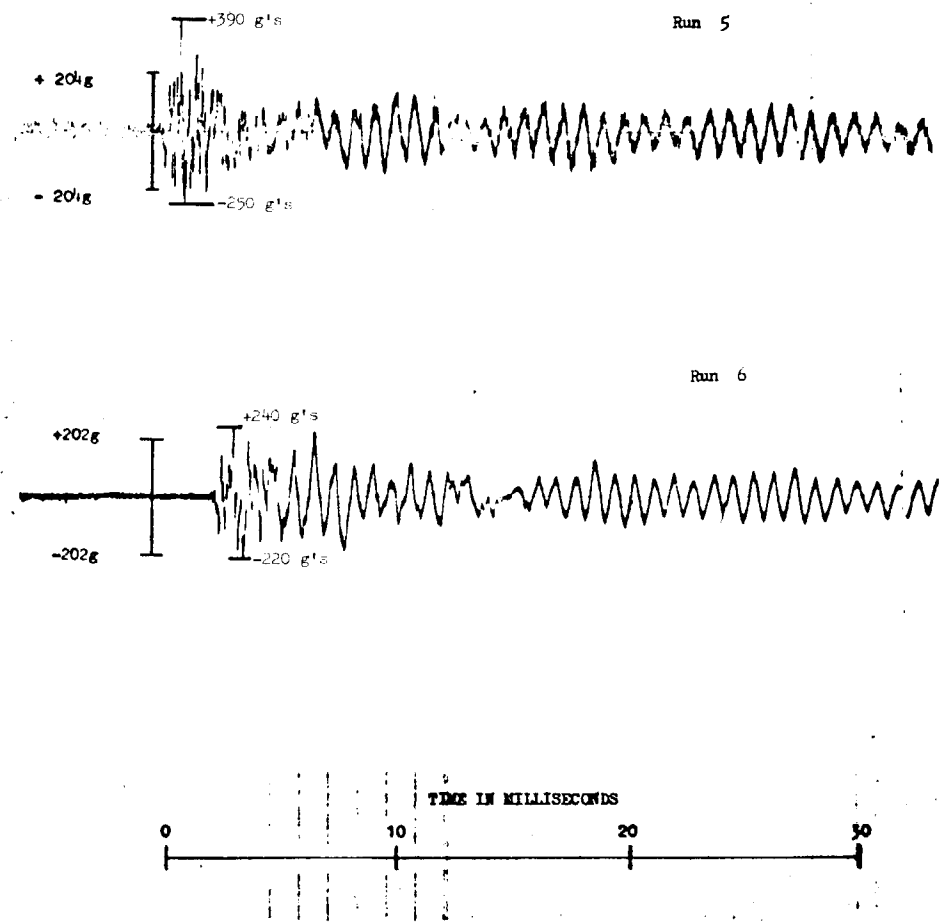


FIGURE 1.A.5-124

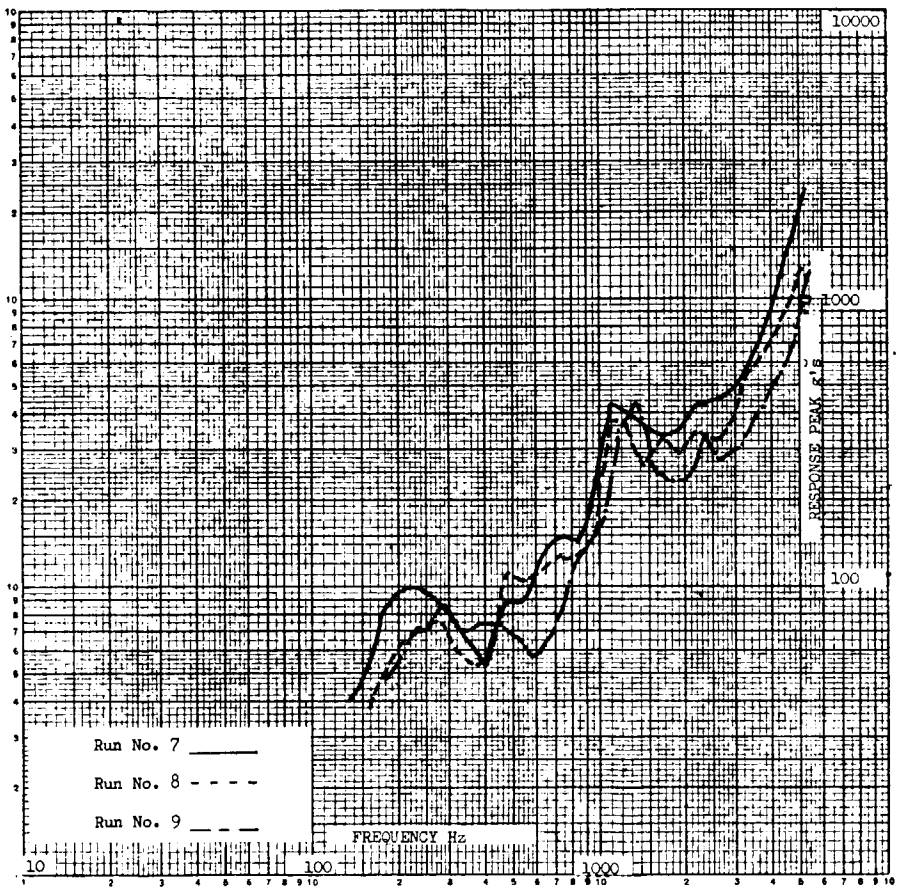


NOT REPRODUCIBLE



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 20-X NS 17
COMPUTER
RUN NO. 5,6

FIGURE 1.A.5-123



FBV SHOCK DETERMINATION TEST
--STAGE III/FBV STAGING
LOC. 19-7 FBES
SYSTEM TEST AT PROPELLED
RUN NO. 7, 8, 9

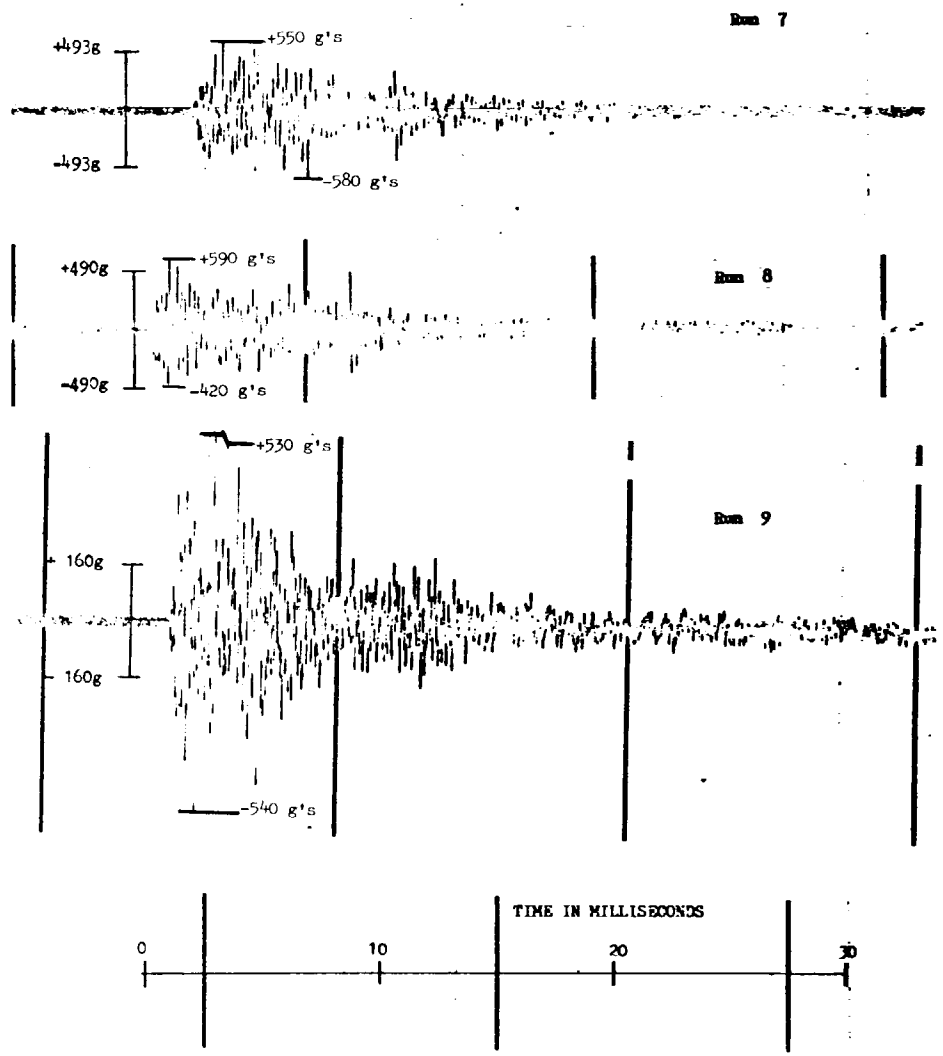
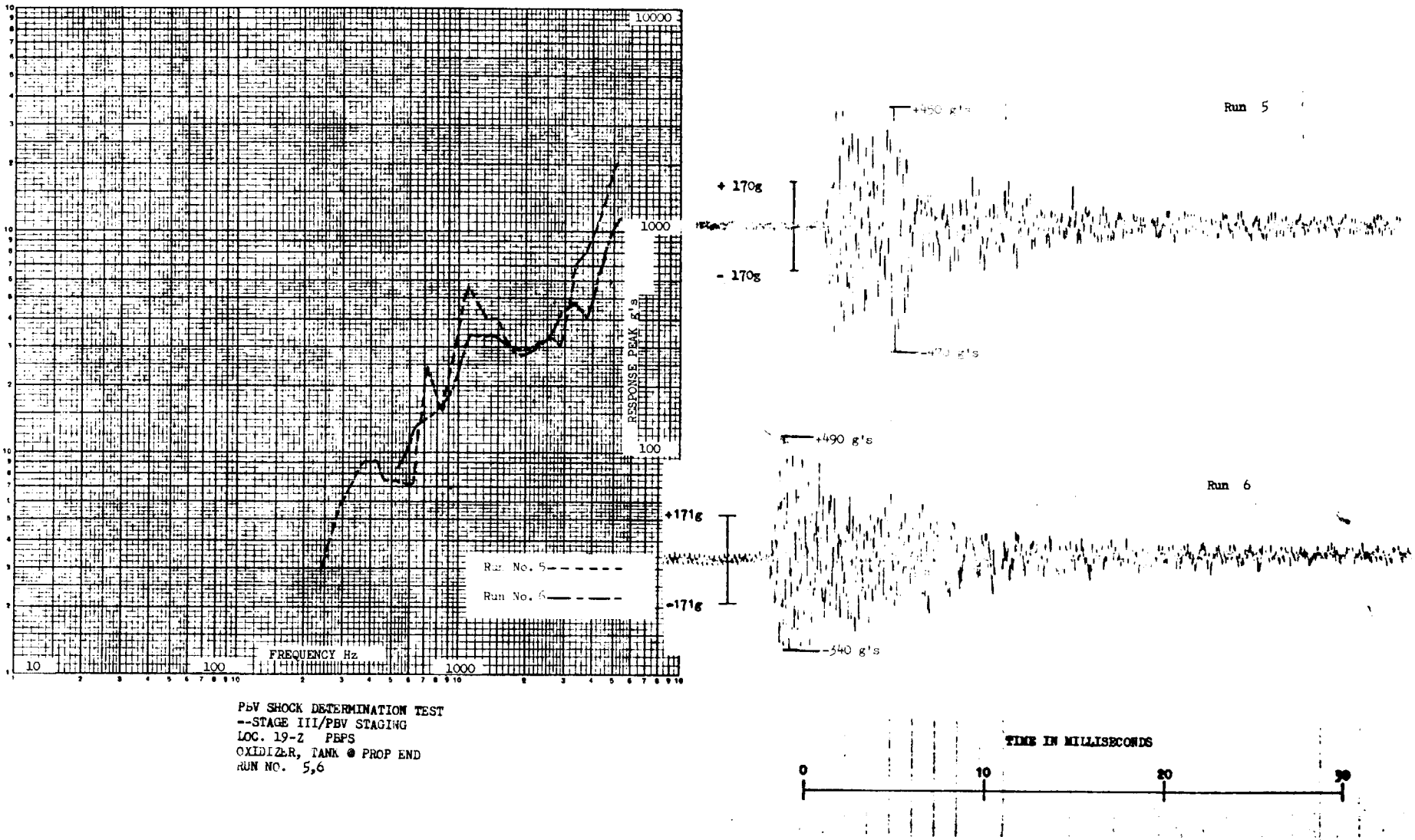
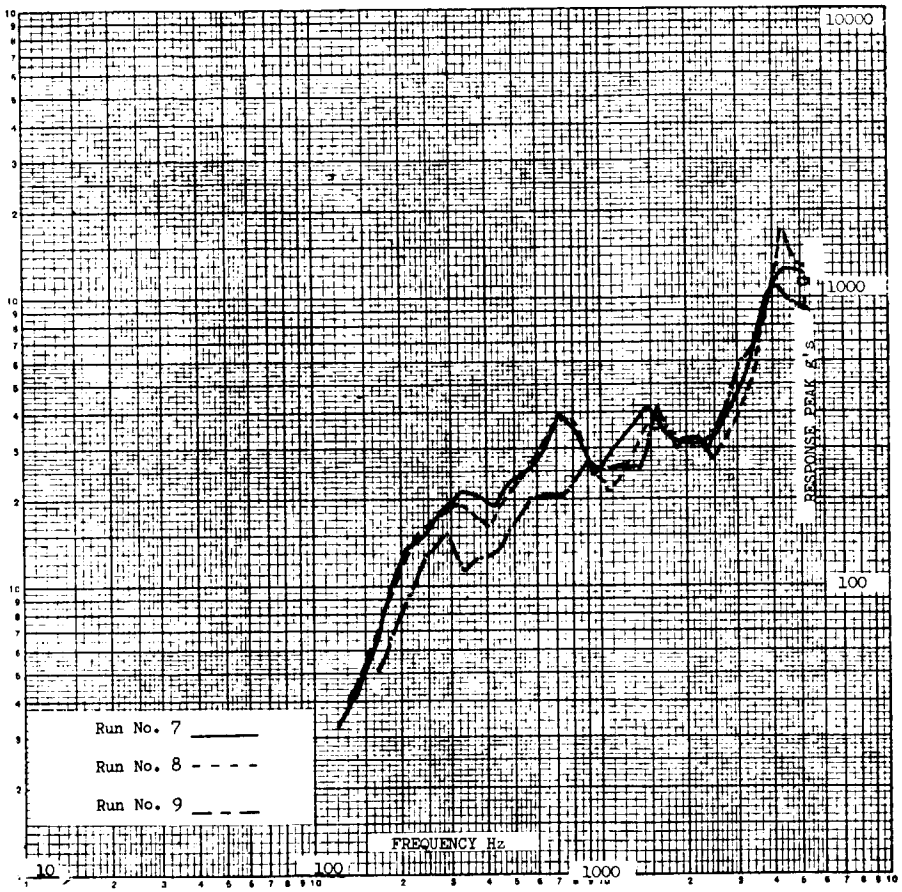


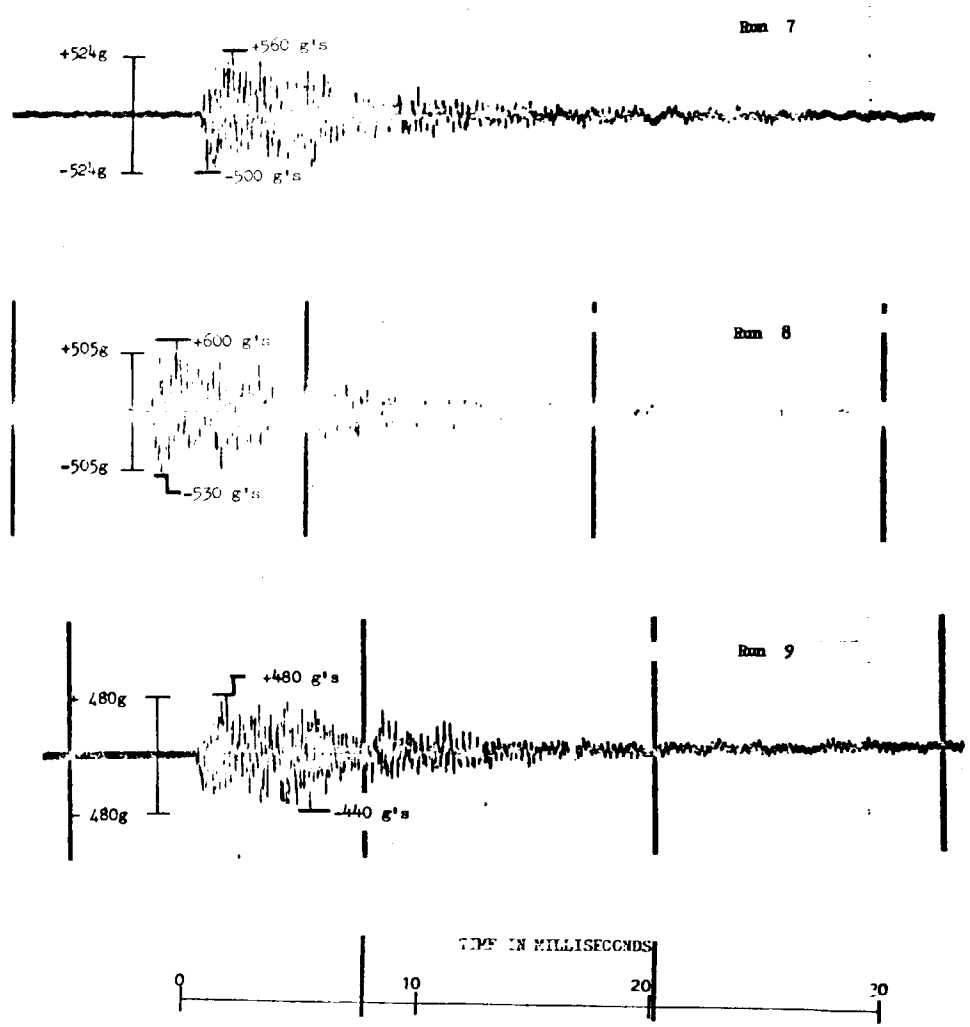
FIGURE I.A.5-122



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 19-Z PBPS
OXIDIZER, TANK @ PROP END
RUN NO. 5,6

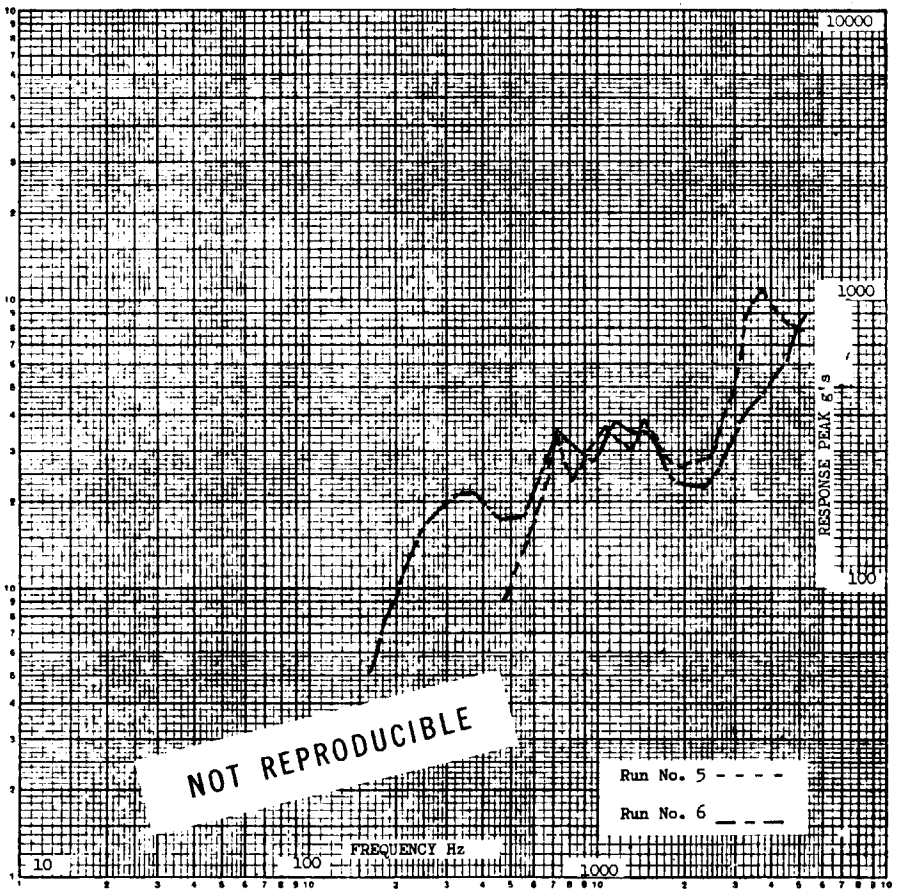
FIGURE I.A.5-121

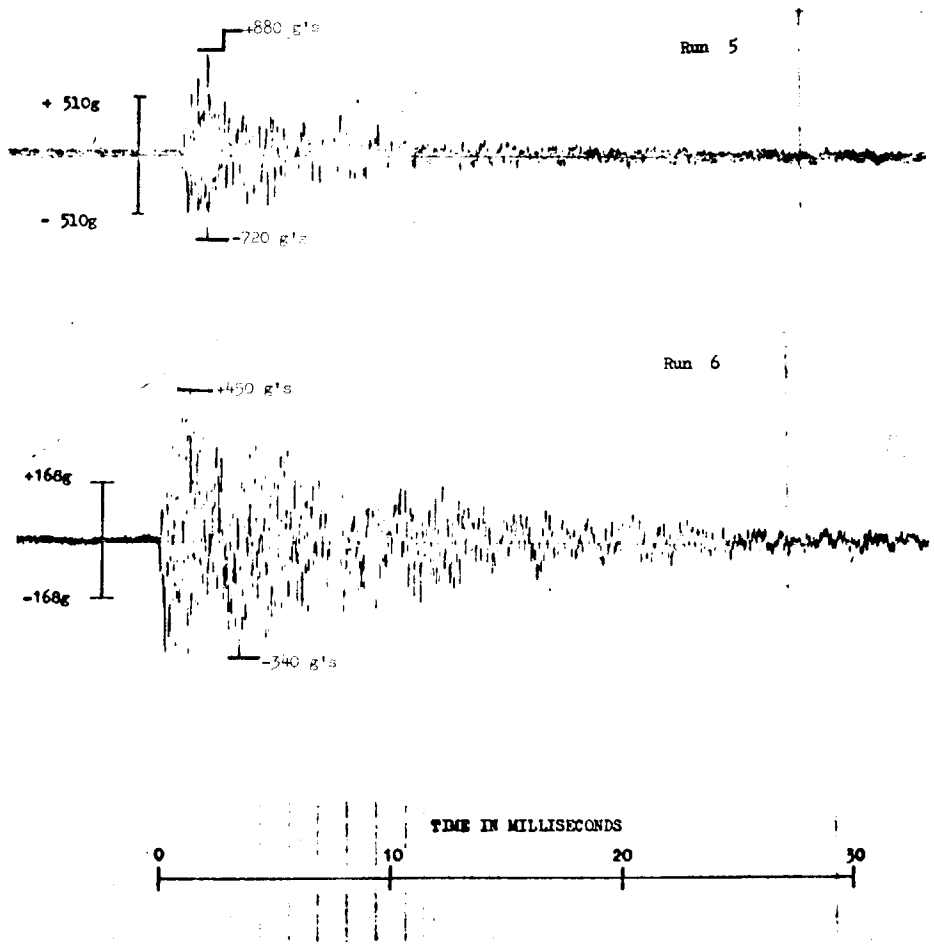




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 18-Z PBPS
OXIDIZER TANK AT GAS END
RUN NO. 7, 8, 9

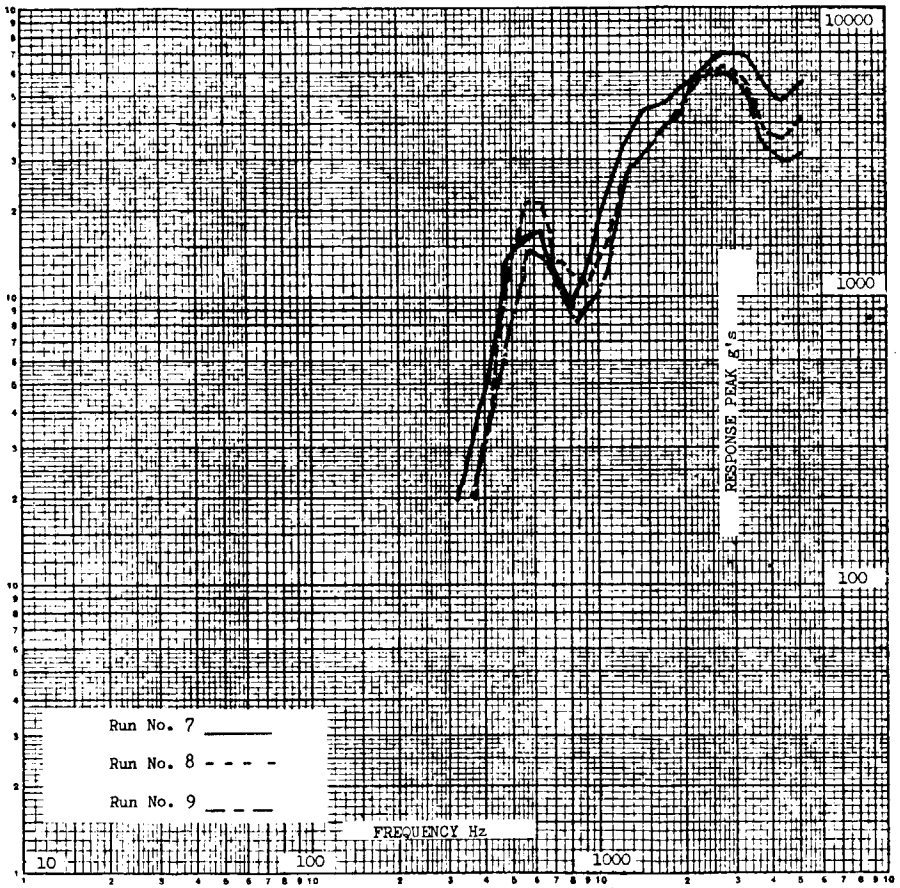
FIGURE I.A.5-120

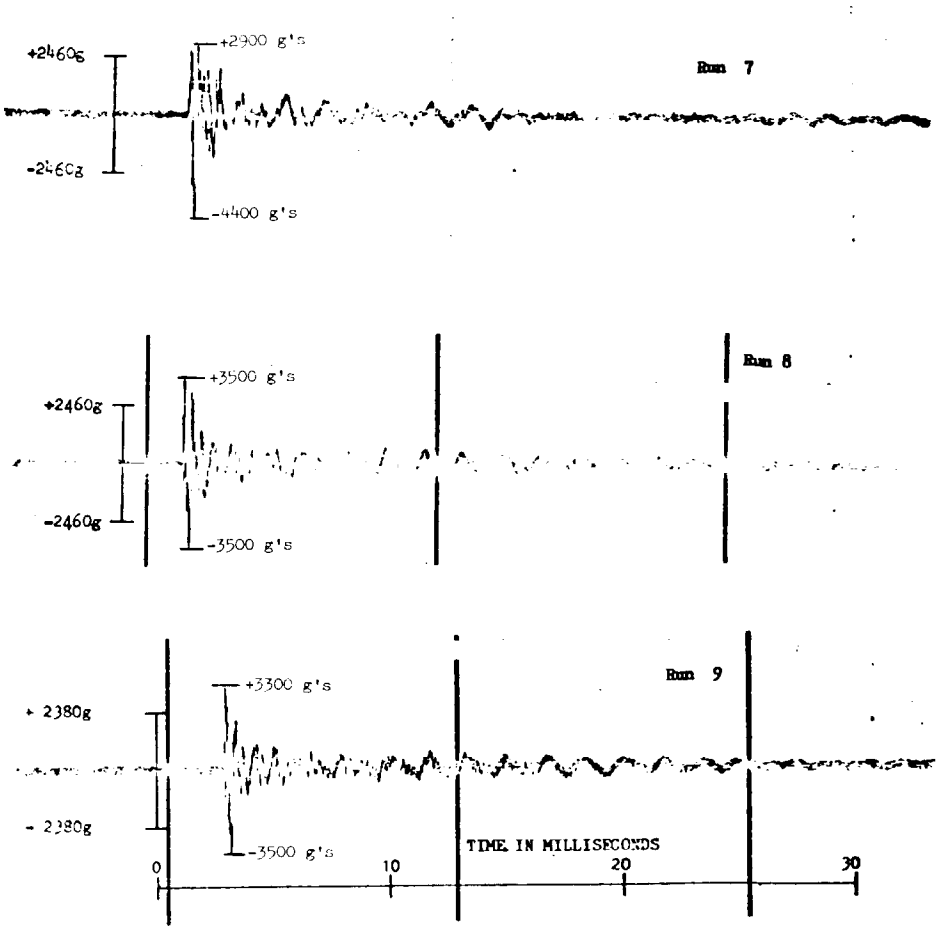




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 18-Z PBPS
OXIDIZER TANK @ GAS END
RUN NO. 5,6

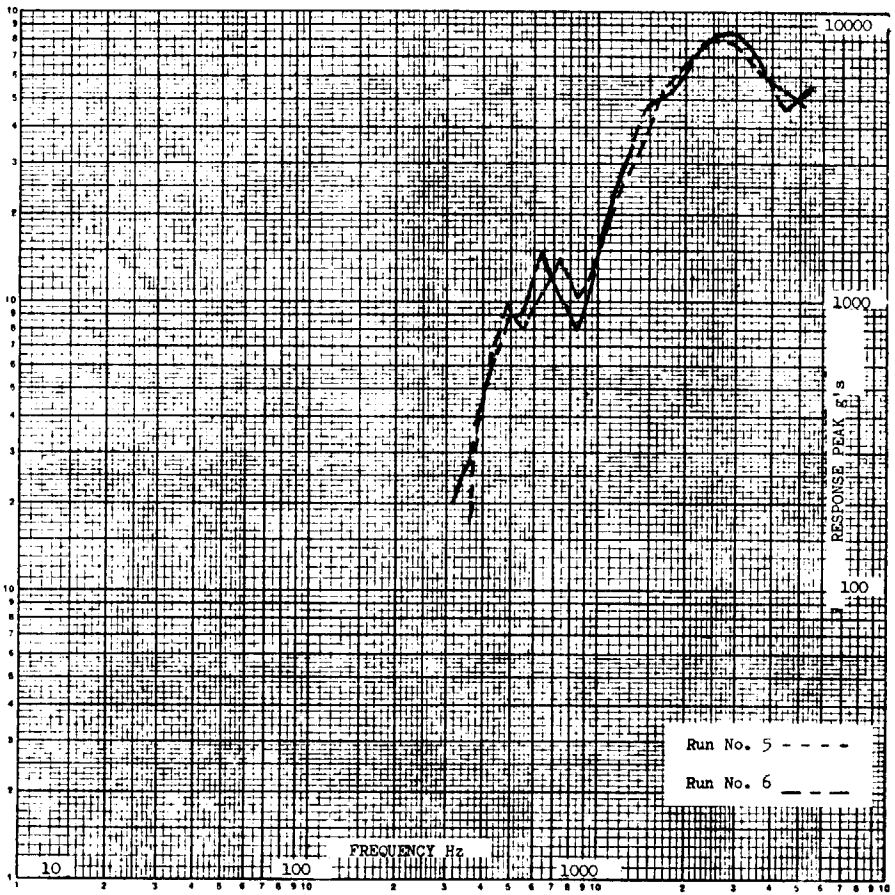
FIGURE I.A.5-119





PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 17-T PBPS
CD 2-4 SKIN
RUN NO. 7, 8, 9

FIGURE I.A.5-118



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 17-T PBPS
CD 2-4 SKIN
RUN NO. 5,6

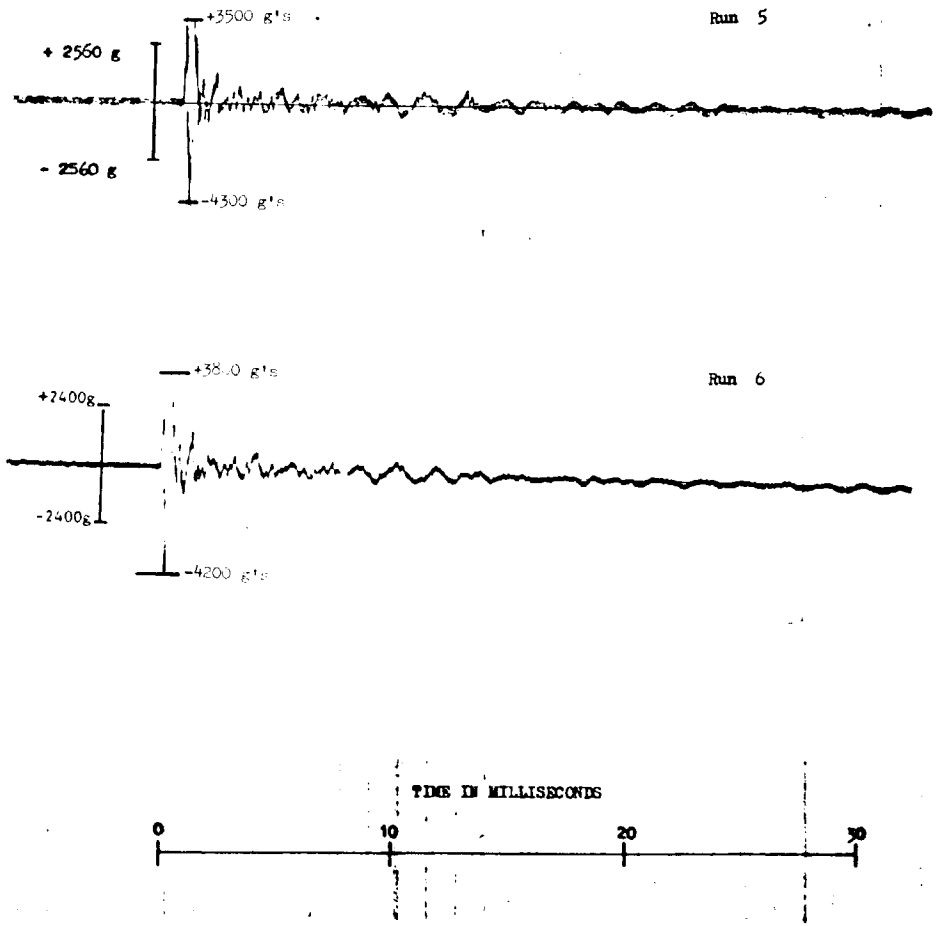
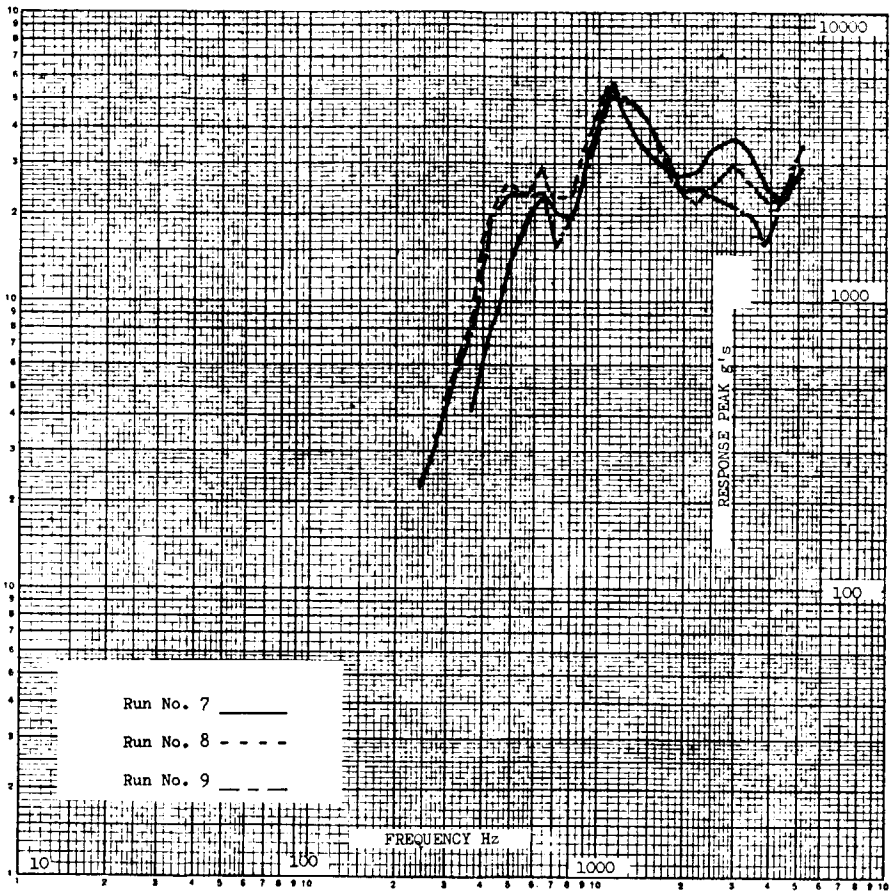


FIGURE I.A.5-117



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 17-5 PBPS
CD2-4 SKIN
RUN NO. 7,8,9

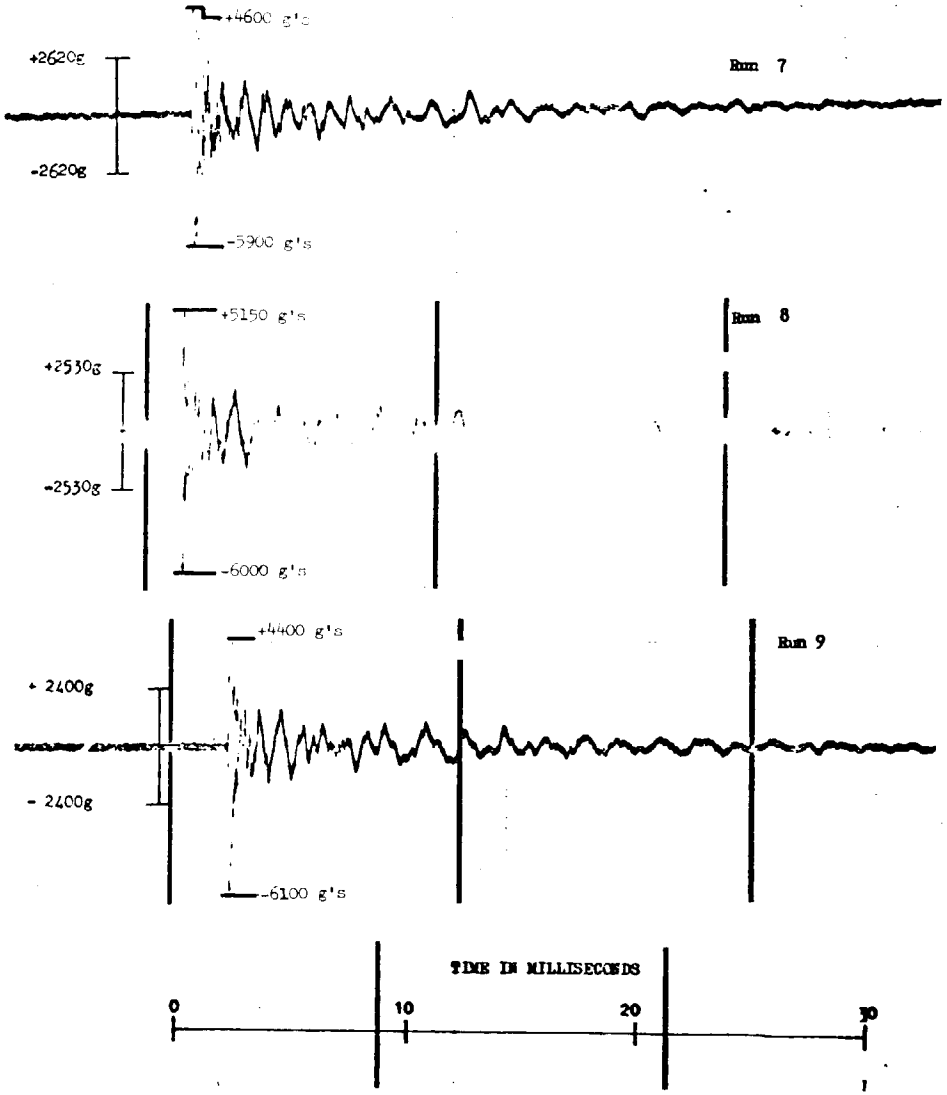
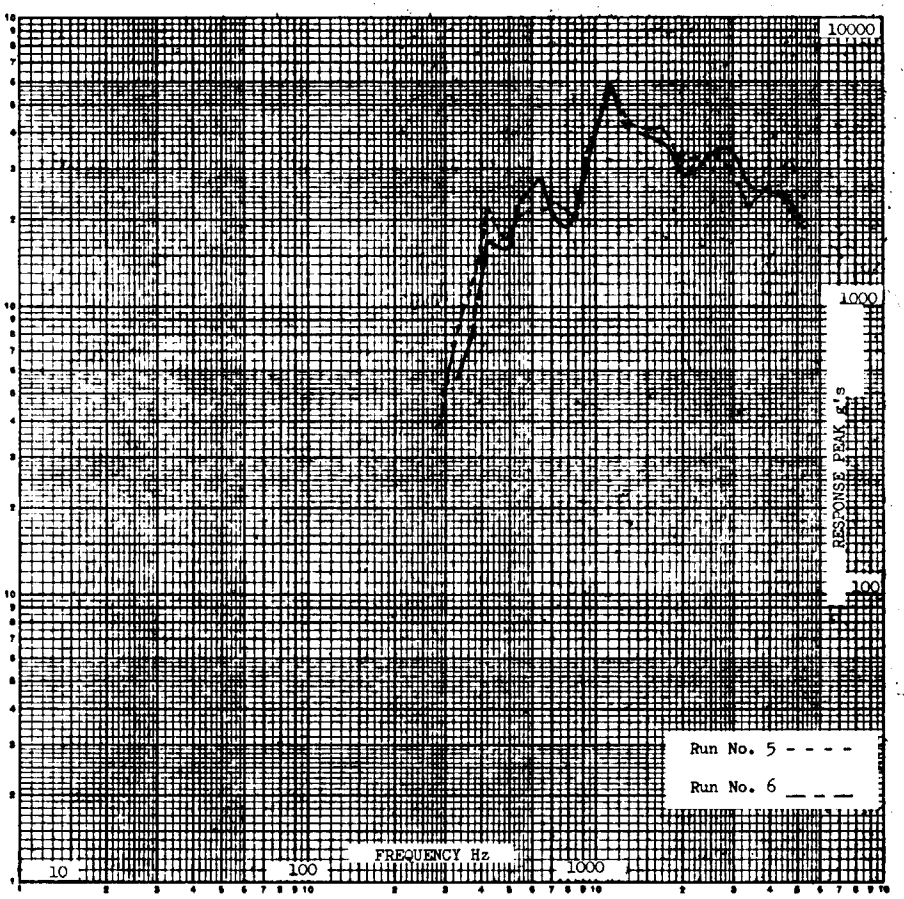
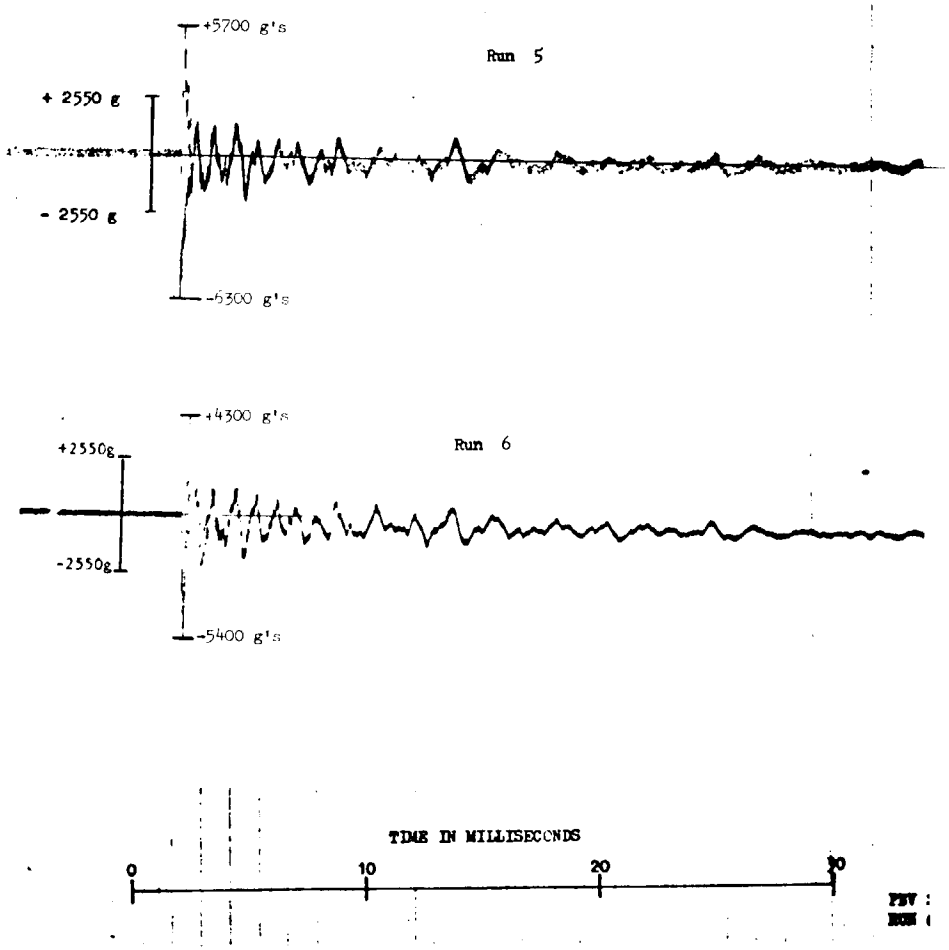


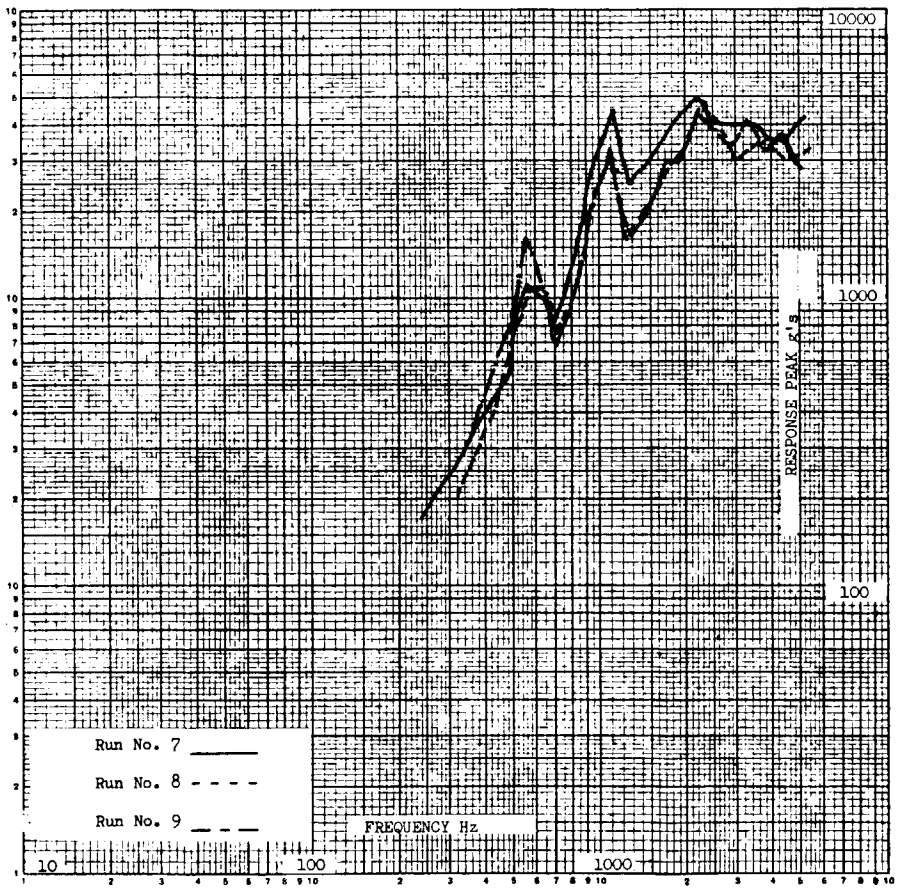
FIGURE I.A.5-116





PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 17-R PBPS
CD24 SKIN
RUN NO. 5,6

FIGURE I.A.5-115



PBV SHOCK DETERMINATION TEST
--STAGE III PBV STAGING
LOC. 17-Z PBPS
CD 2-4 SKIN
RUN NO. 7, 8, 9

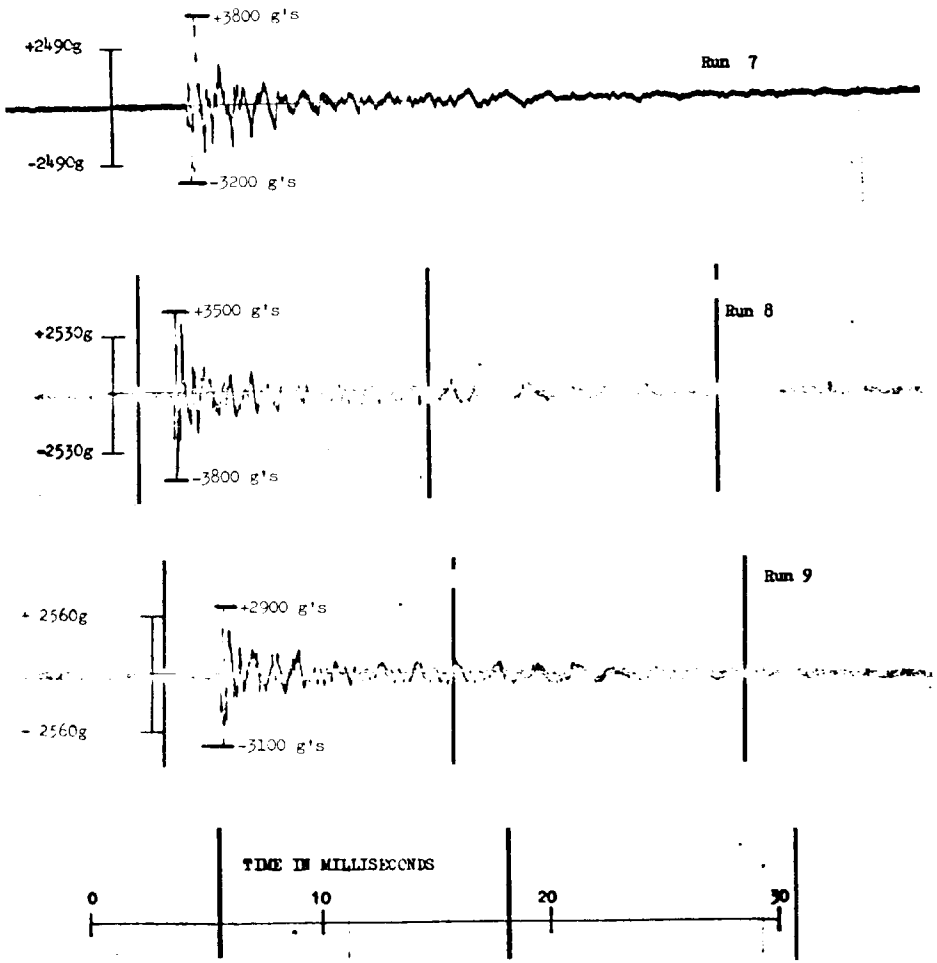
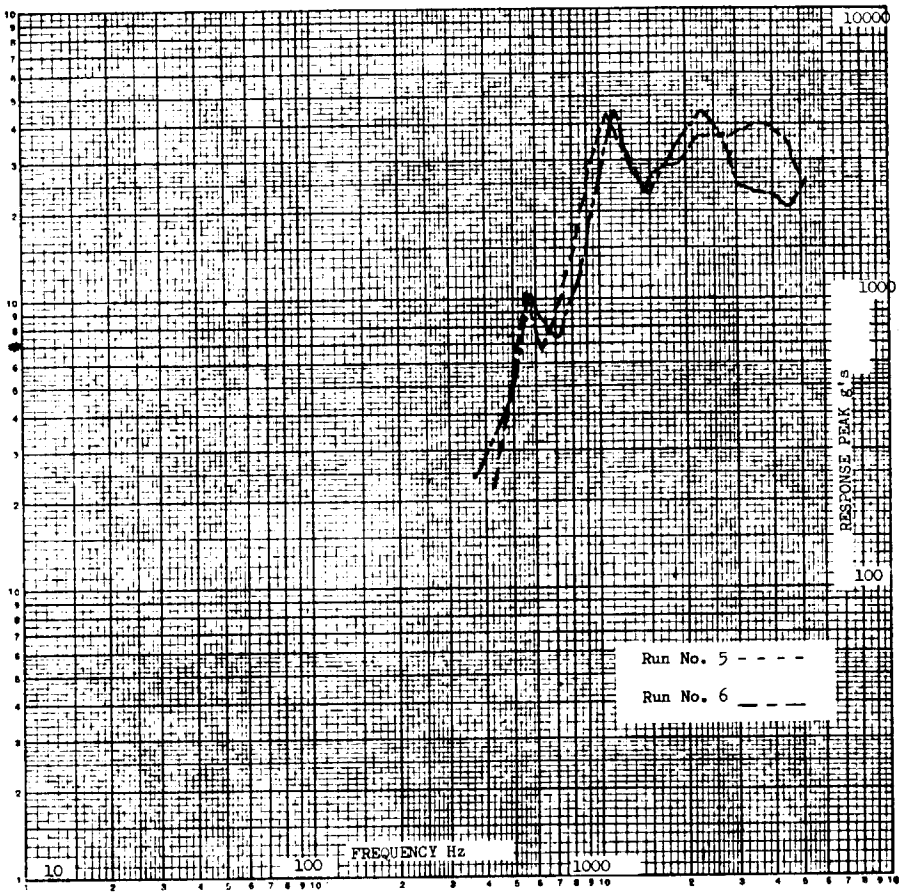
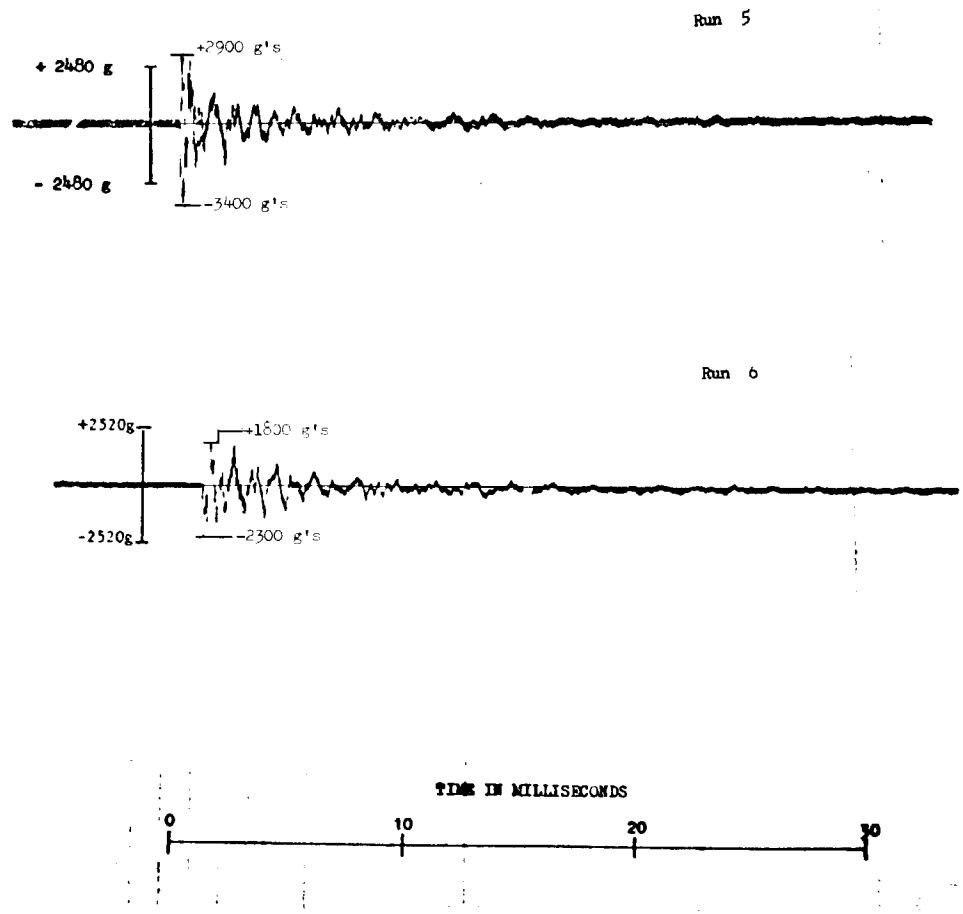


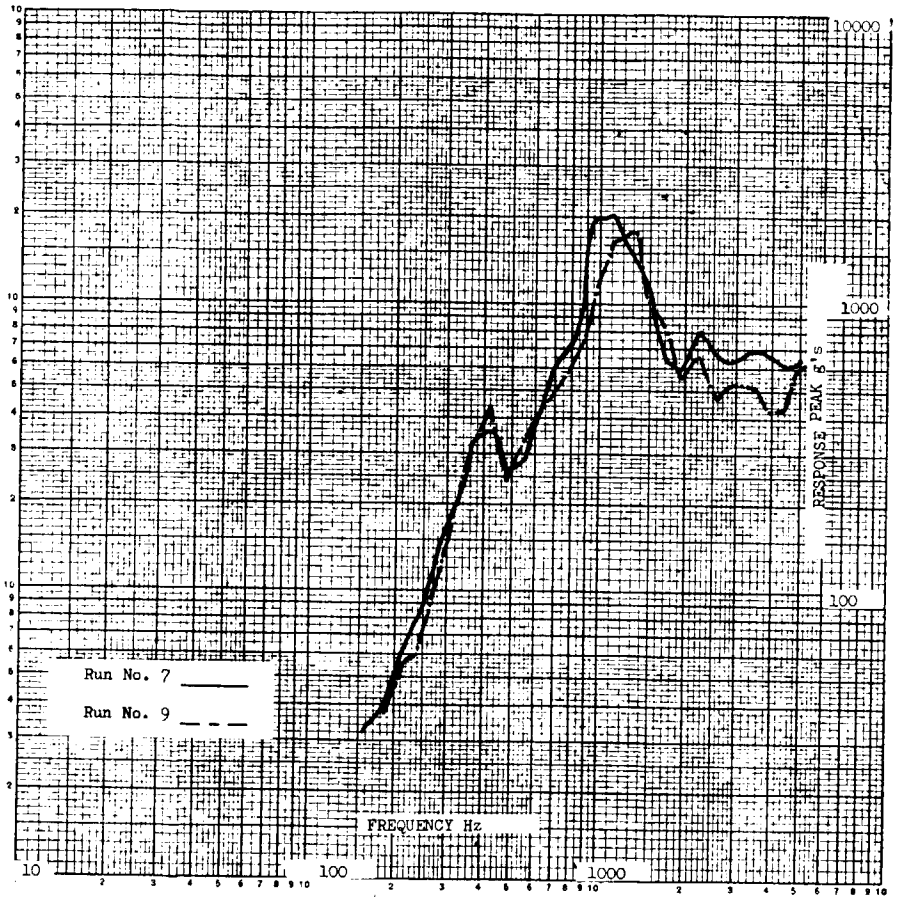
FIGURE I.A.5-114

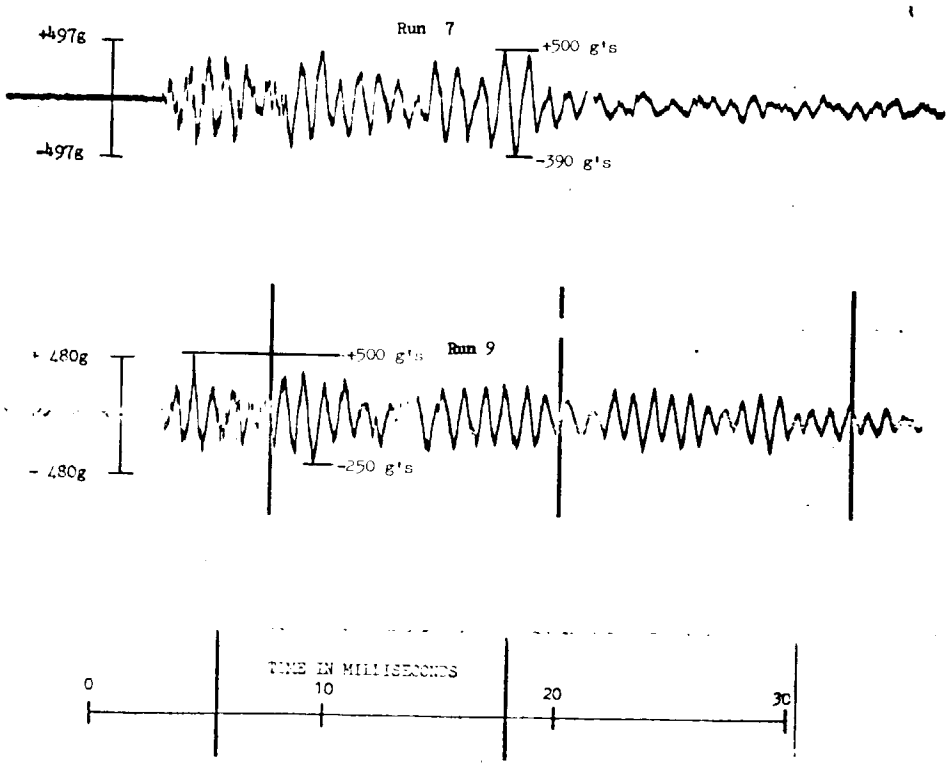




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 17-Z PBPS
CD 2-4 SKIN
RUN NO. 5,6

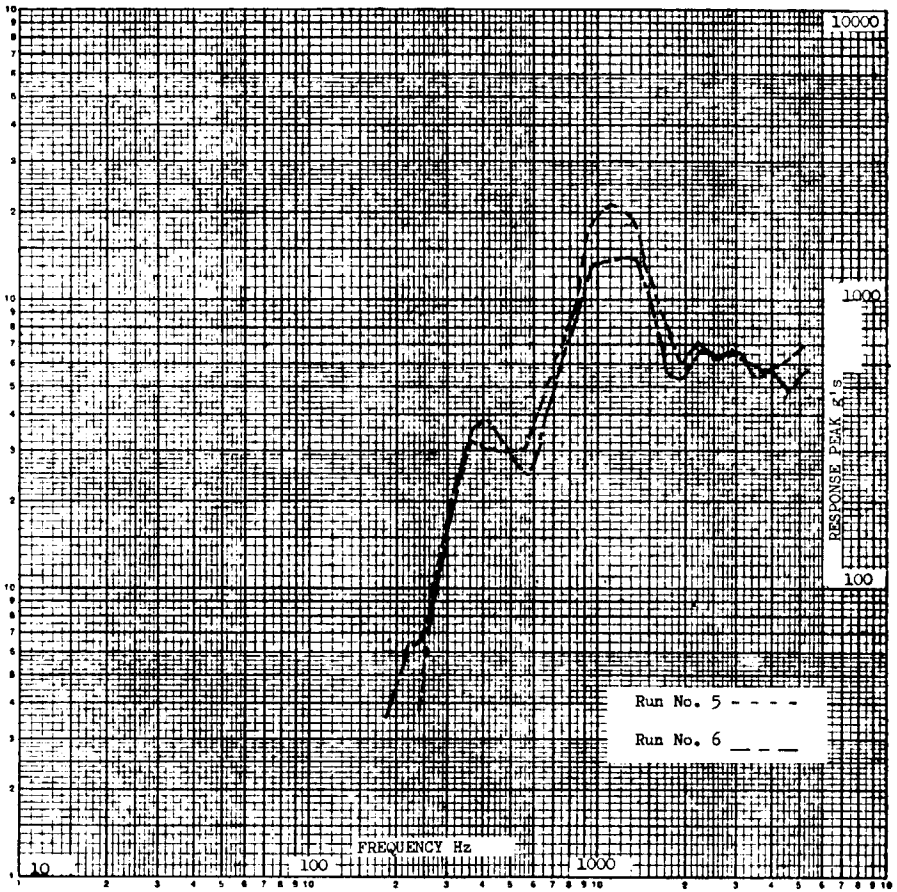
FIGURE I.A.5-113

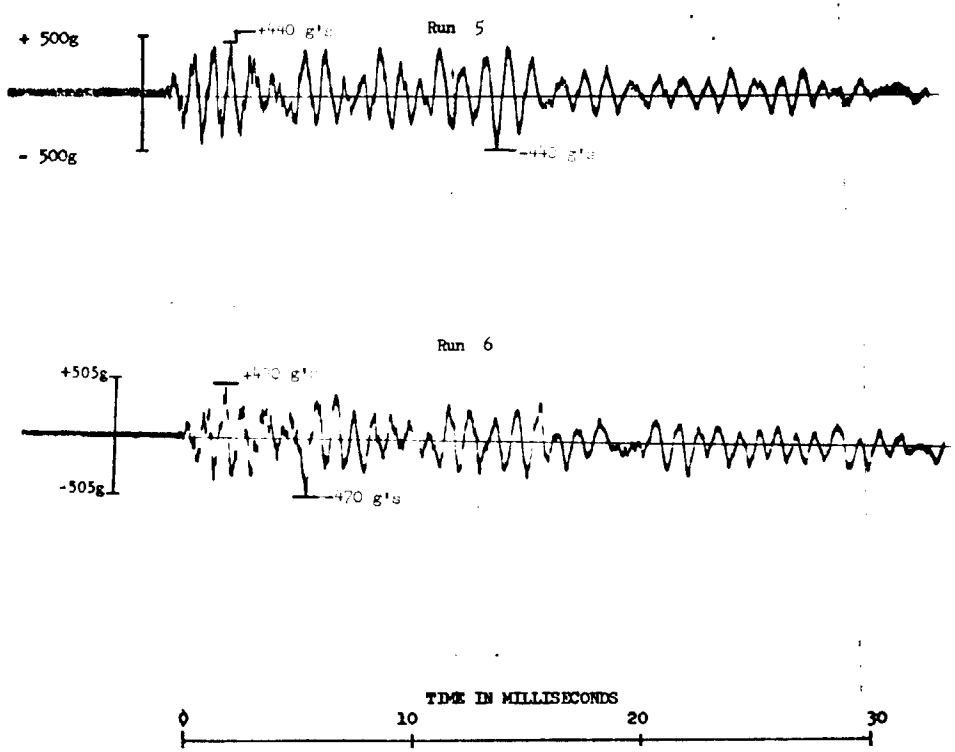




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 16-T PBPS
YAW ACTUATOR
RUN NO. 7, 9

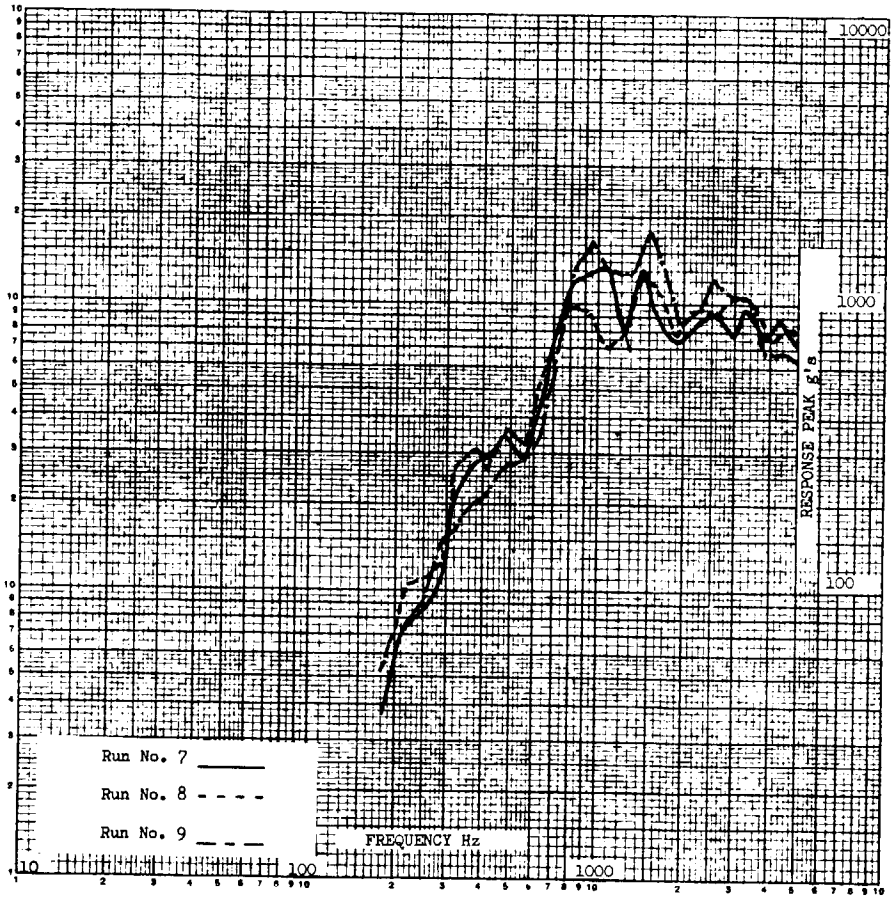
FIGURE I.A.5-112





PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 16-T PBPS
YAW ACTUATOR
RUN NO. 5,6

FIGURE 1.A.5-111



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 16-R PBPS
YAW ACTUATOR
RUN NO. 7, 8, 9

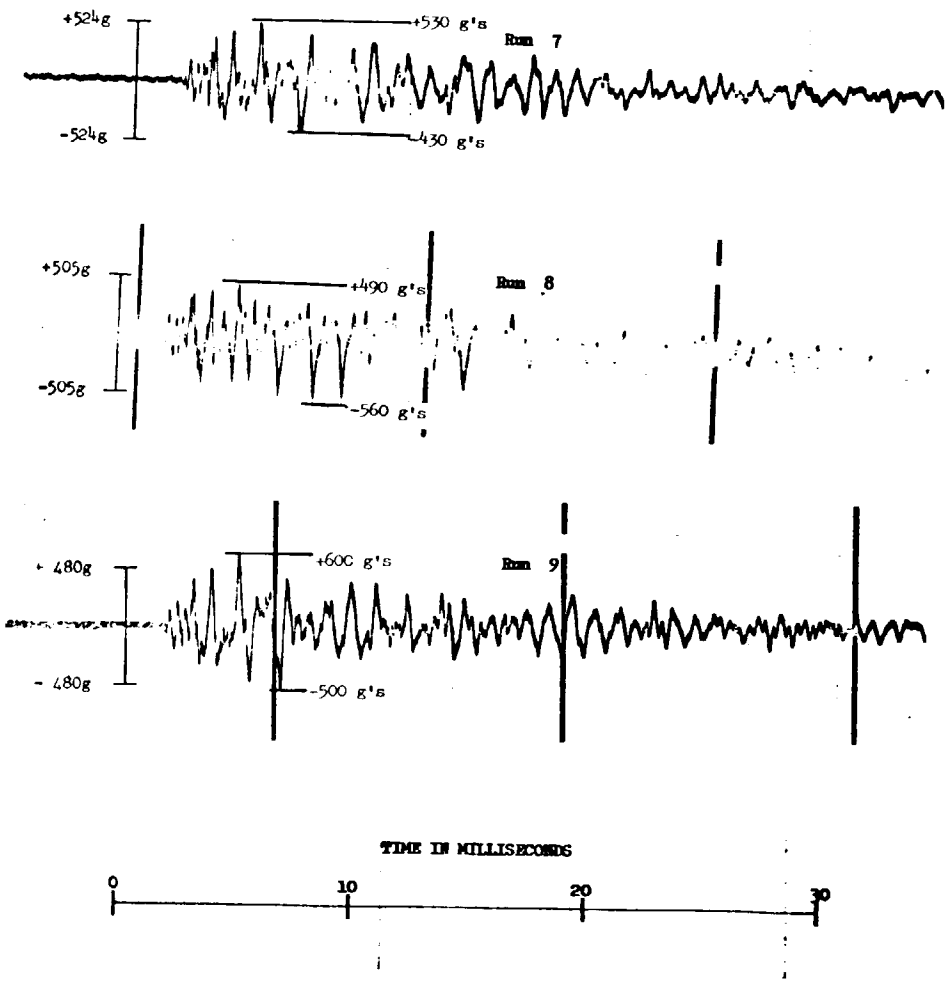
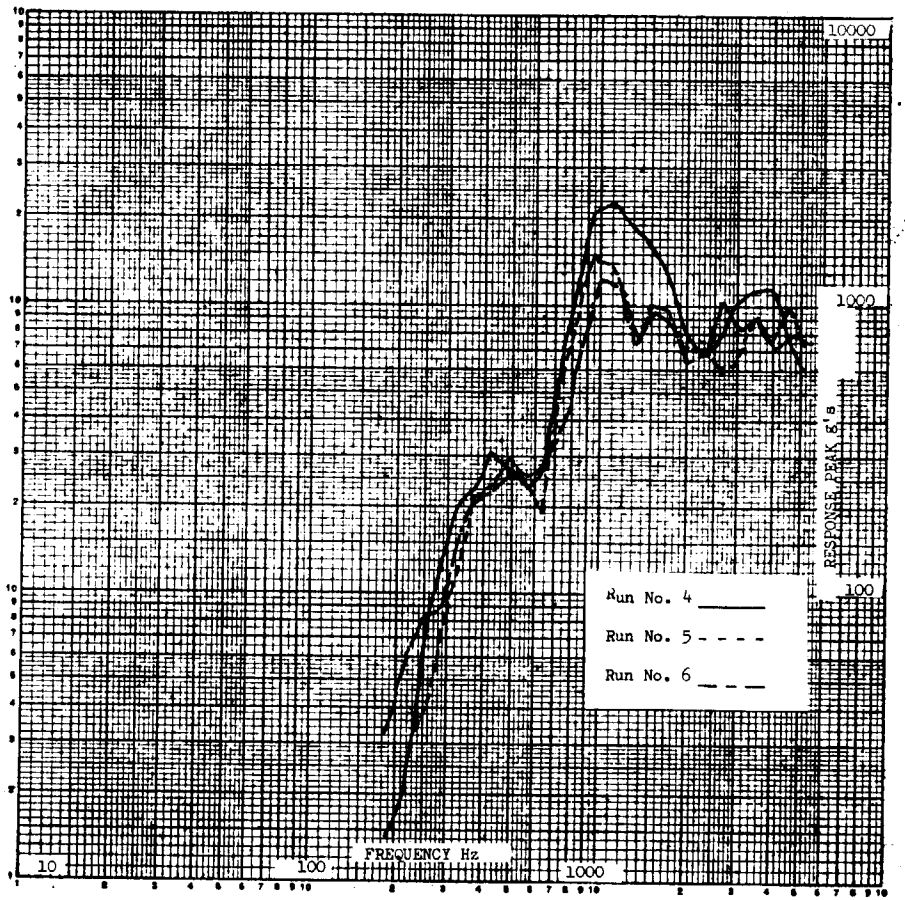
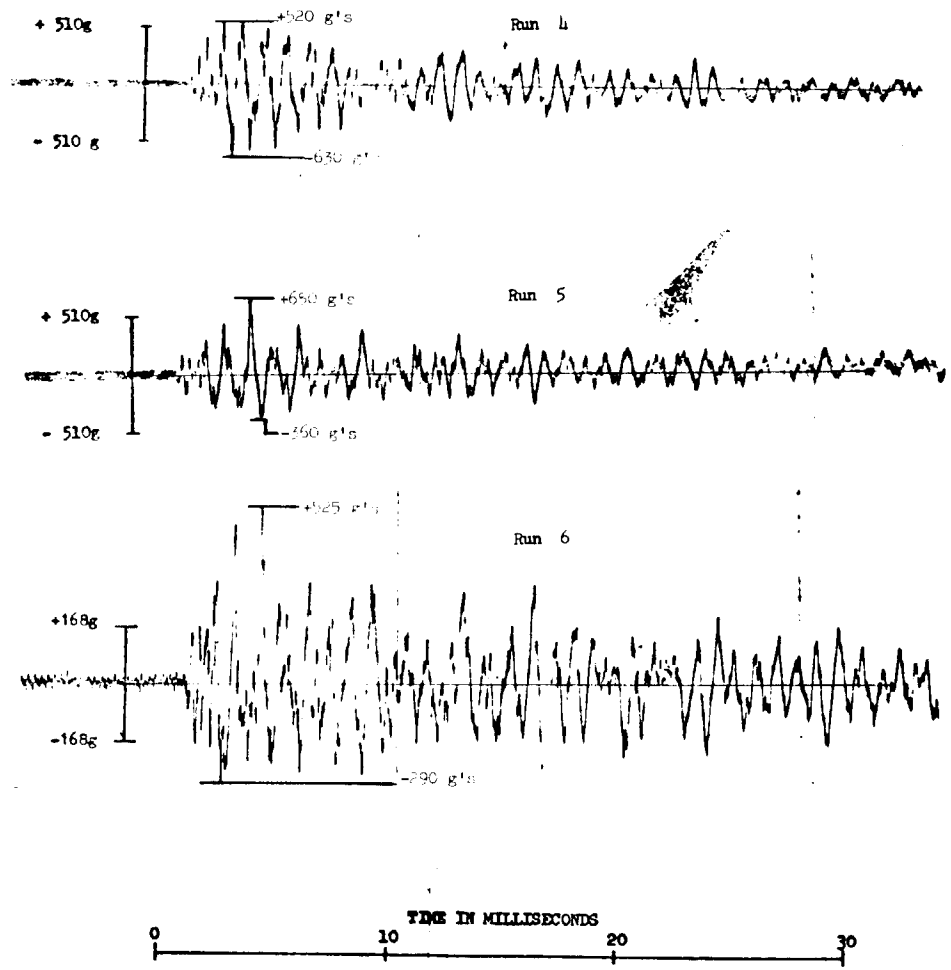


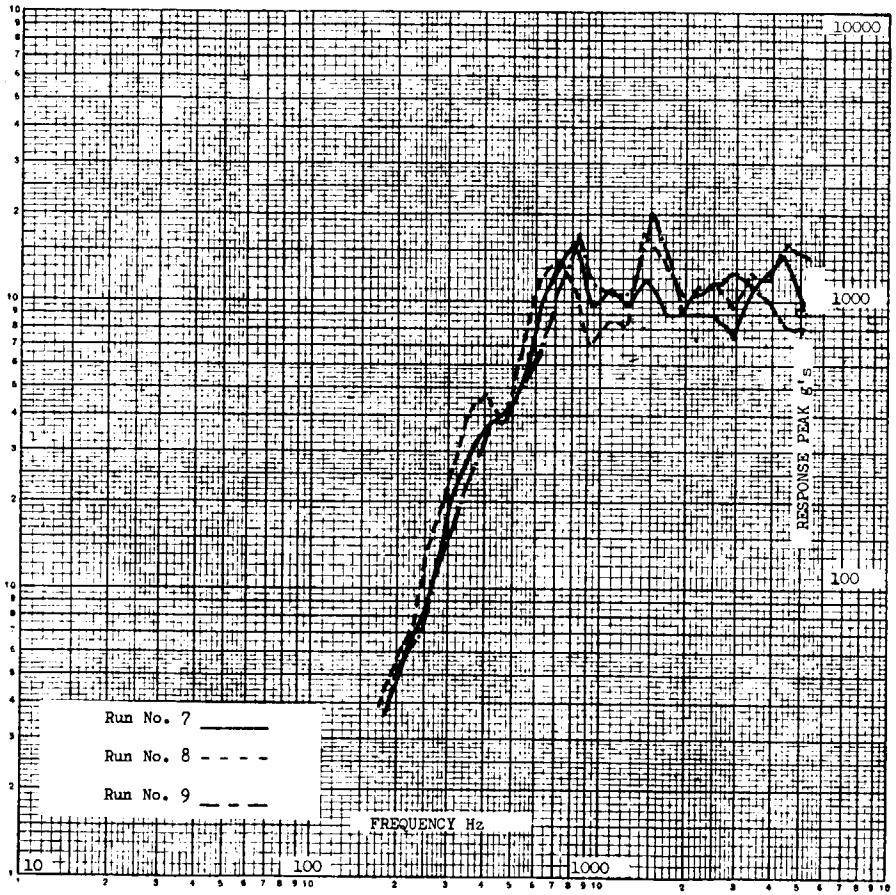
FIGURE I.A.5-110





PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 16-R PBPS
YAW ACTUATOR
RUN NO. 4, 5, 6

FIGURE 1.A.5-109



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 16-Z PBPS
YAW ACTUATOR
RUN NO. 7, 8, 9

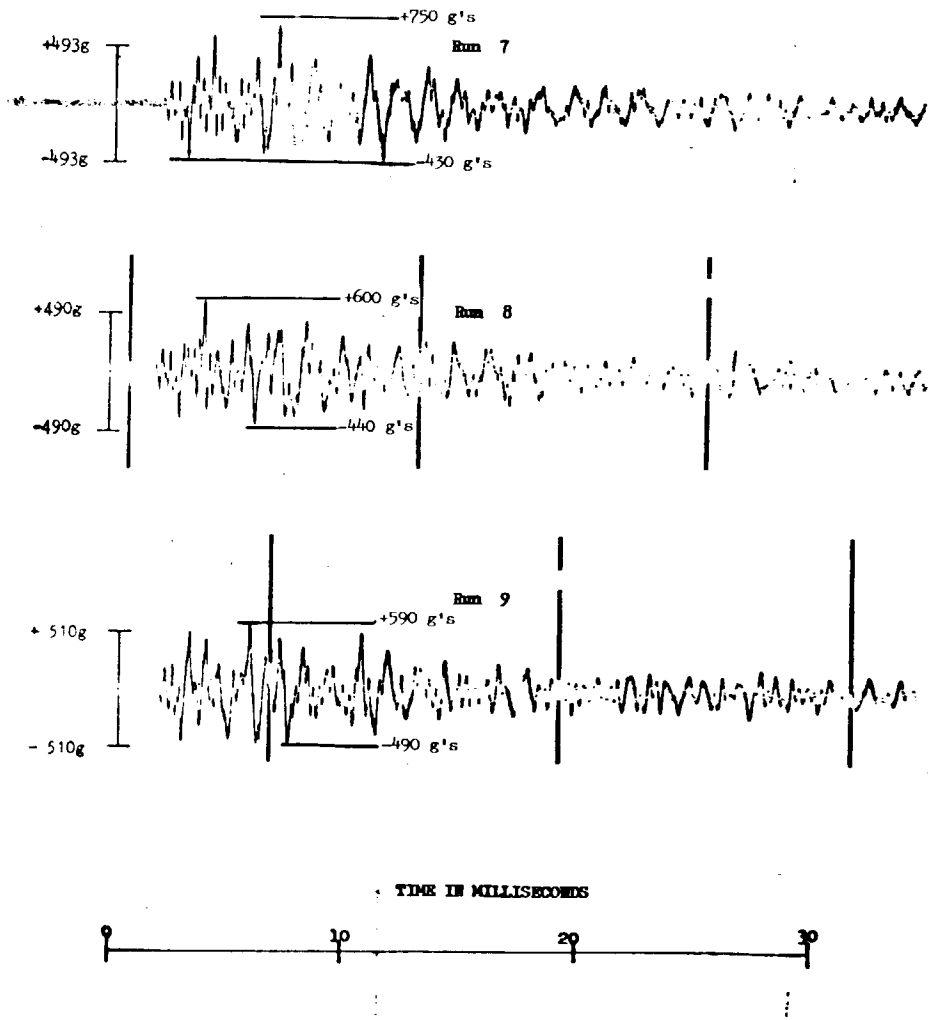
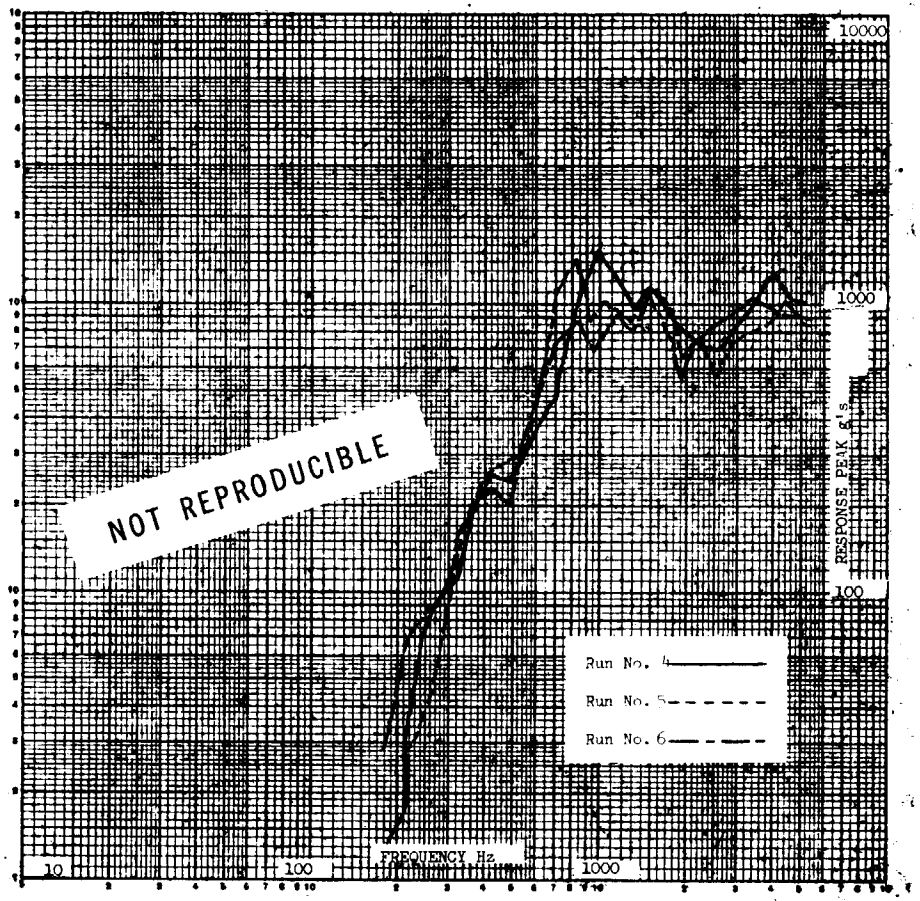


FIGURE I.A.5-108



NOT REPRODUCIBLE

PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 16-Z PBPS
YAW ACTUATOR
RUN NO. 4, 5, 6

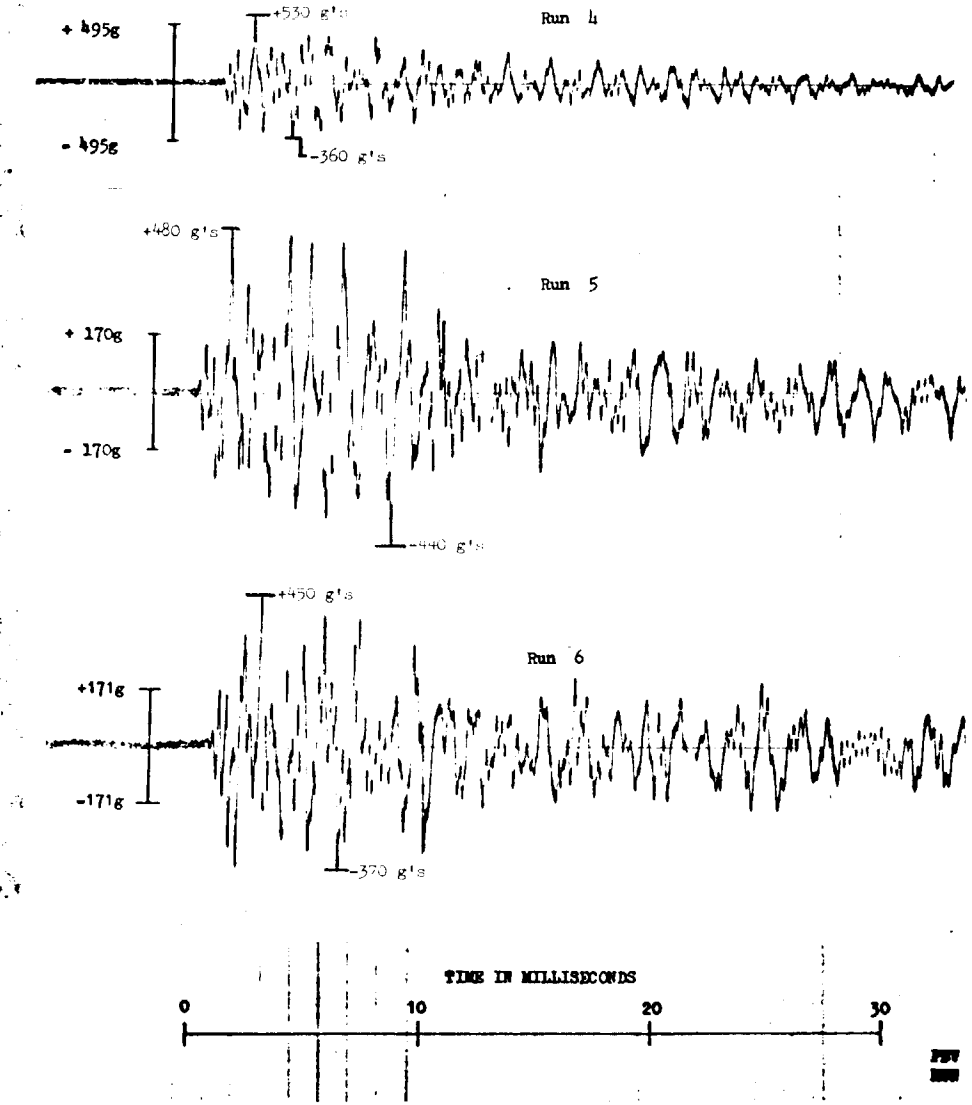
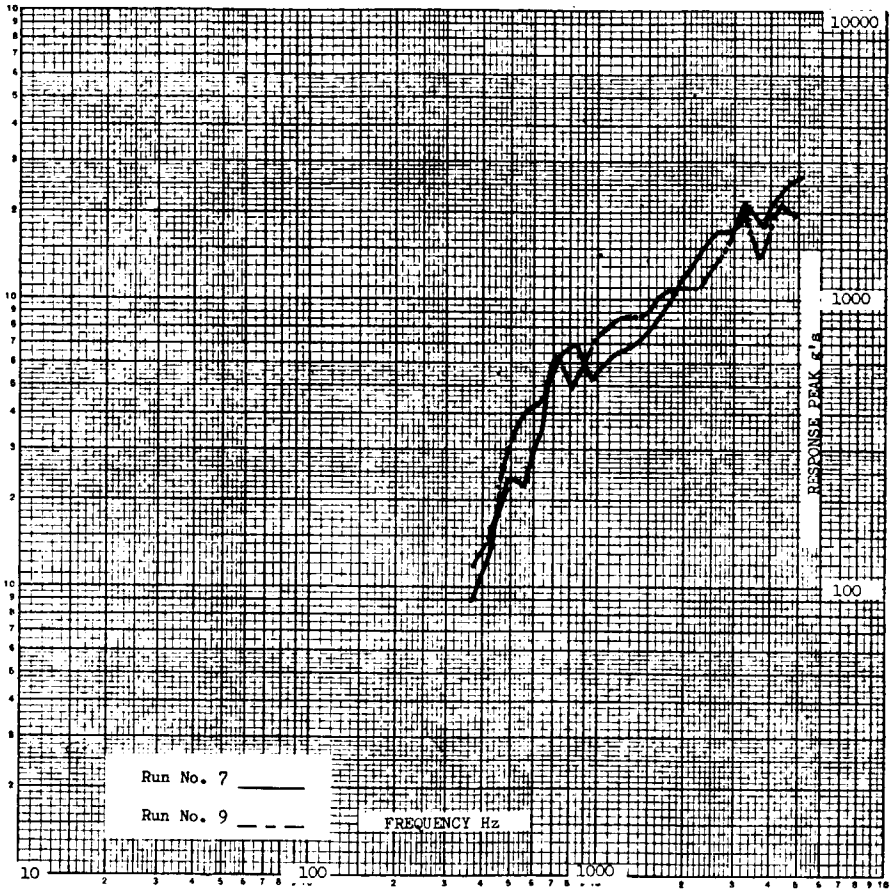
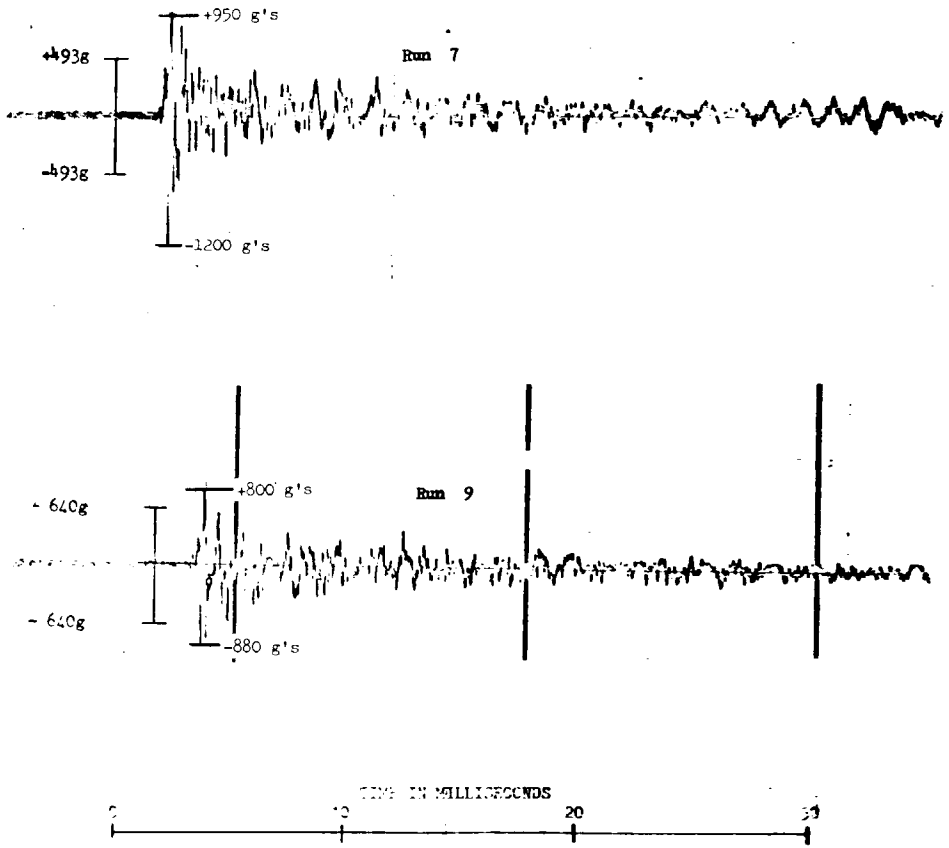


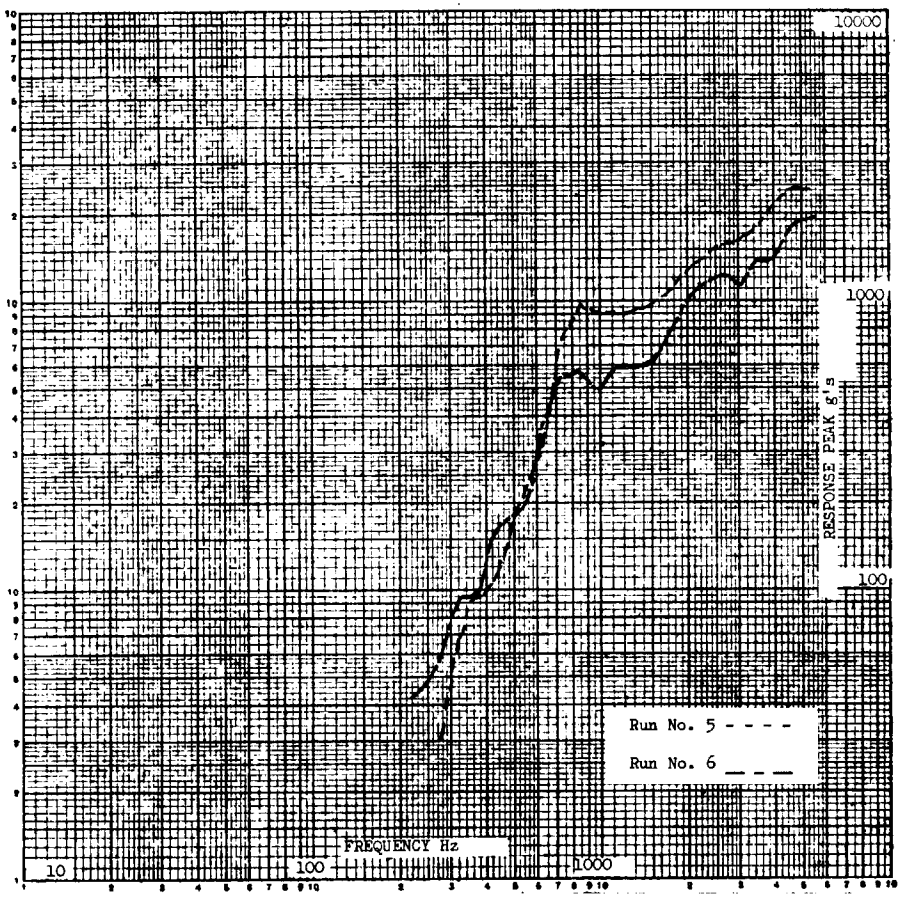
FIGURE I.A.5-107

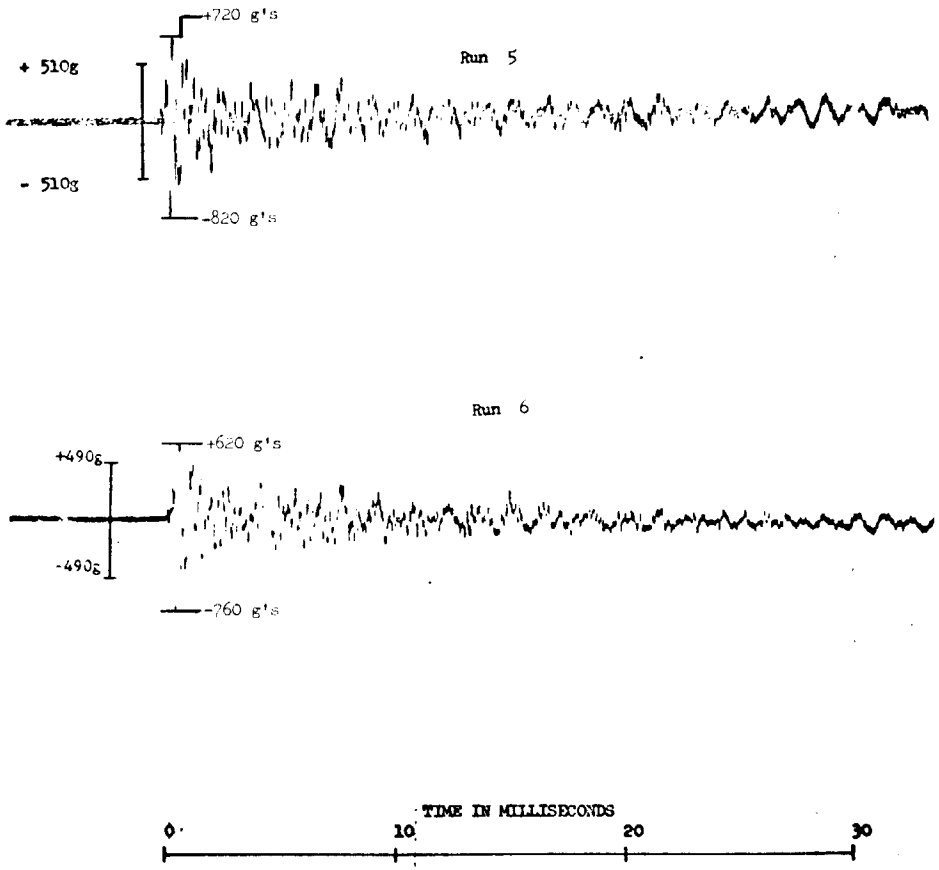




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 15-T PBPS
PS ASS-WEB.
RUN NO. 7, 9

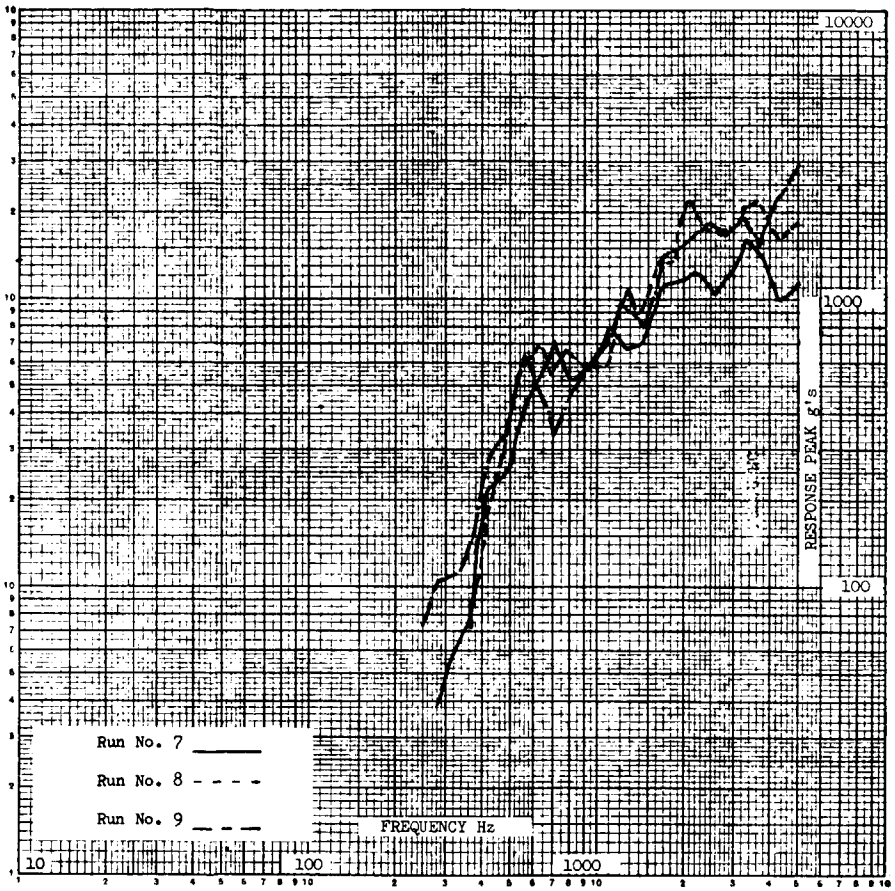
FIGURE I.A.5-106





PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 15-T P8PS
PS ASS-WEB.
RUN NO. 5, 6

FIGURE I.A.5-105



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 15-R PBPS
PS ASS-WEB.
RUN NO. 7, 8, 9

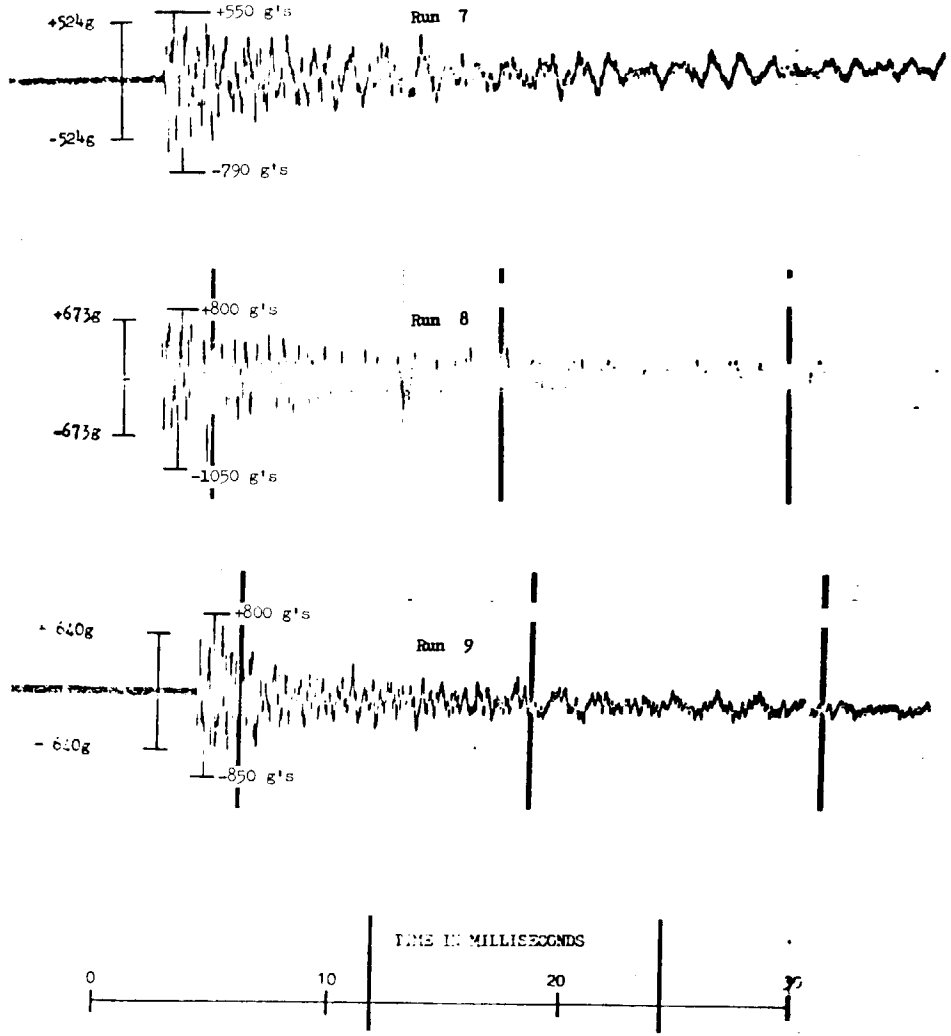
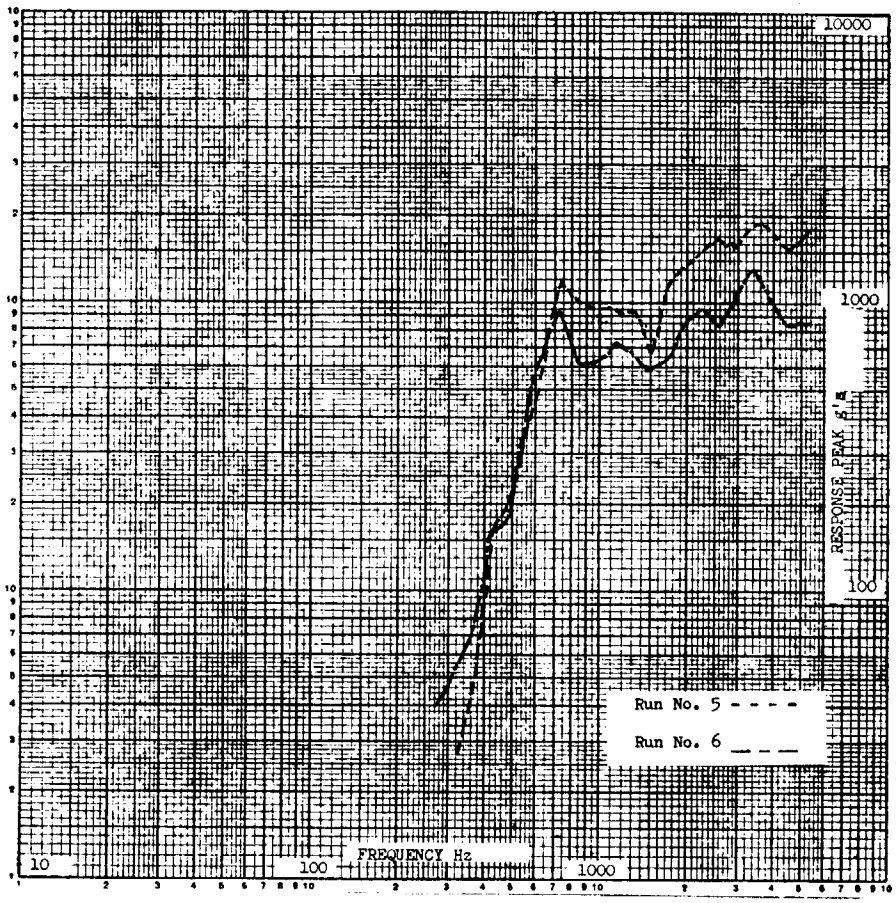
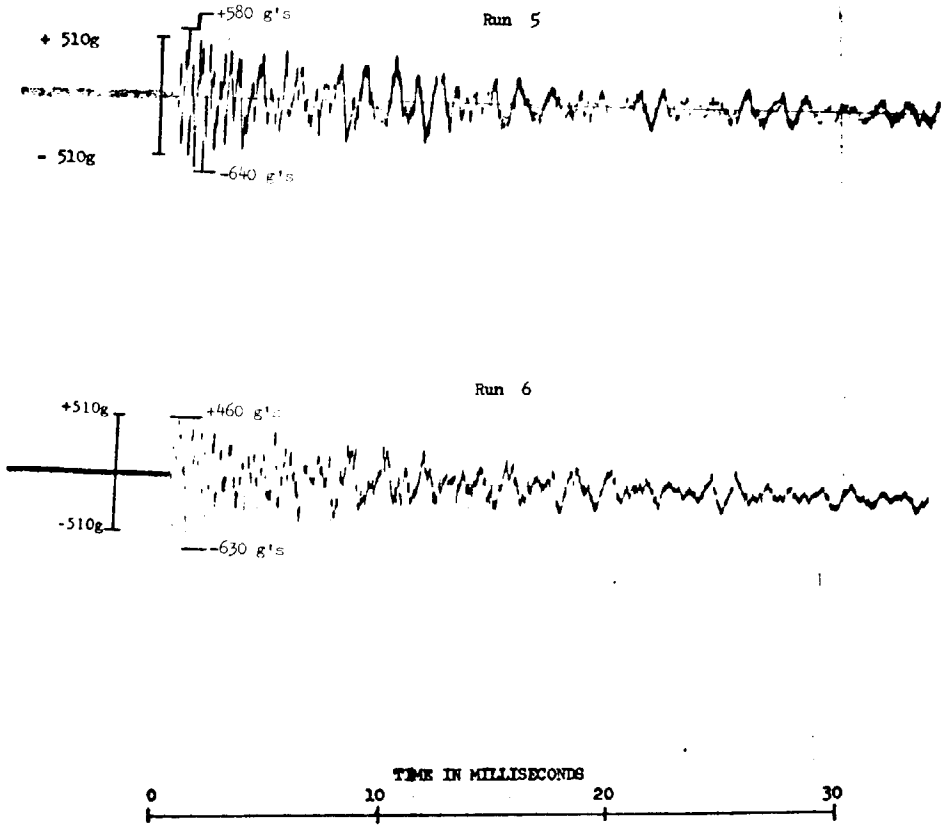


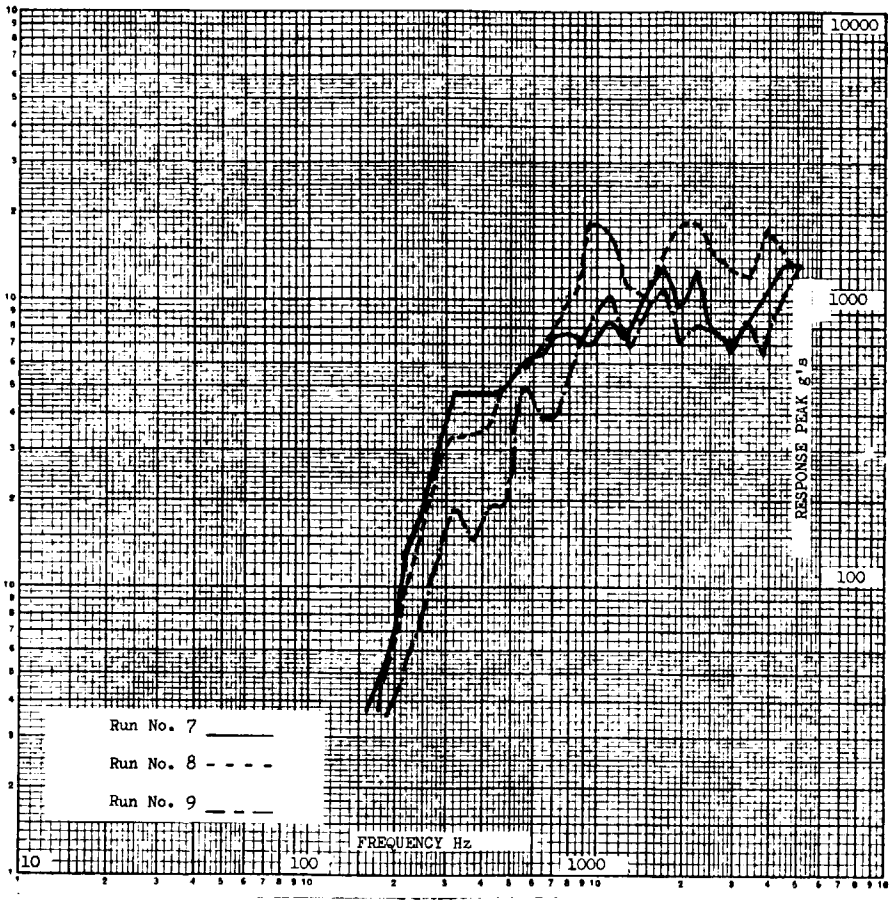
FIGURE I.A.5-104





PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 15-R PBPS
PS ASS-WEB.
RUN NO. 5,6

FIGURE I.A.5-103



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 15-Z PBPS
PS ASS-WEB.
RUN NO. 7, 8, 9

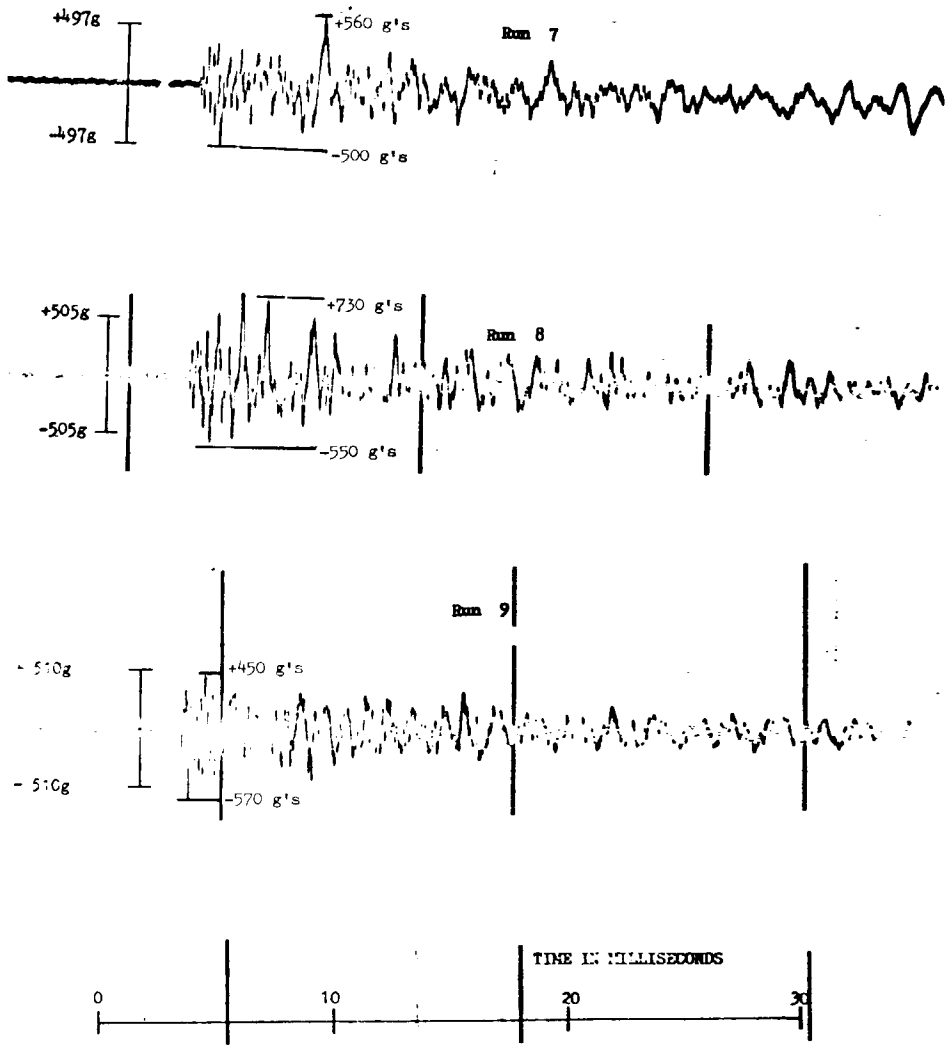
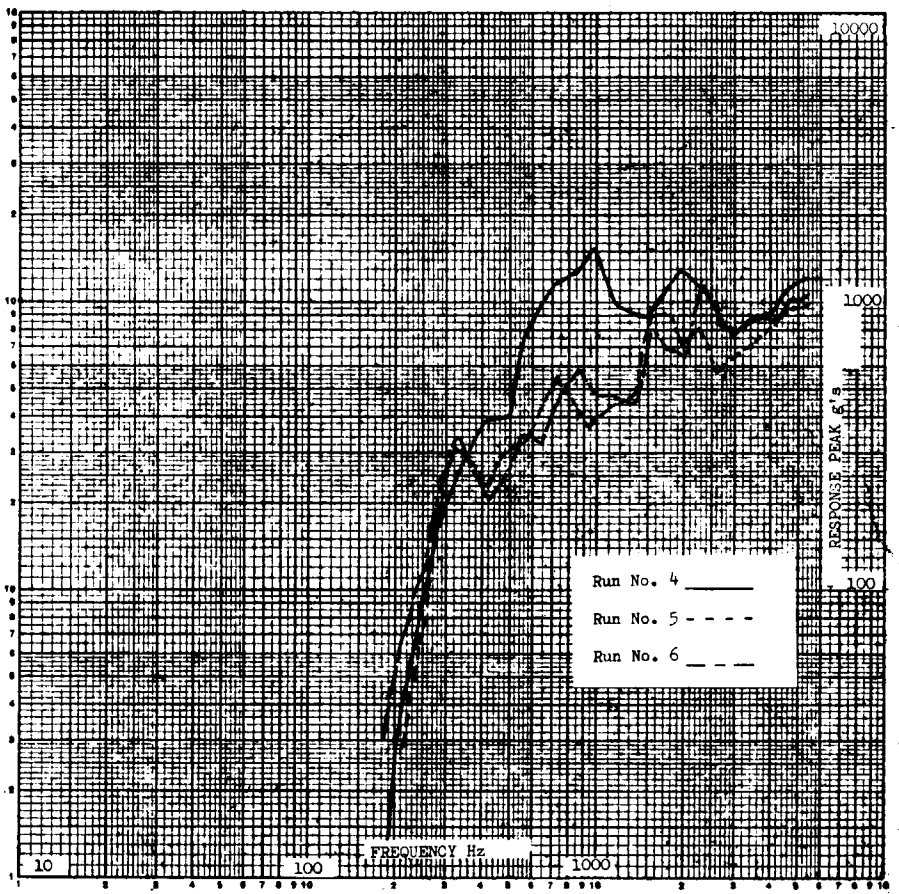
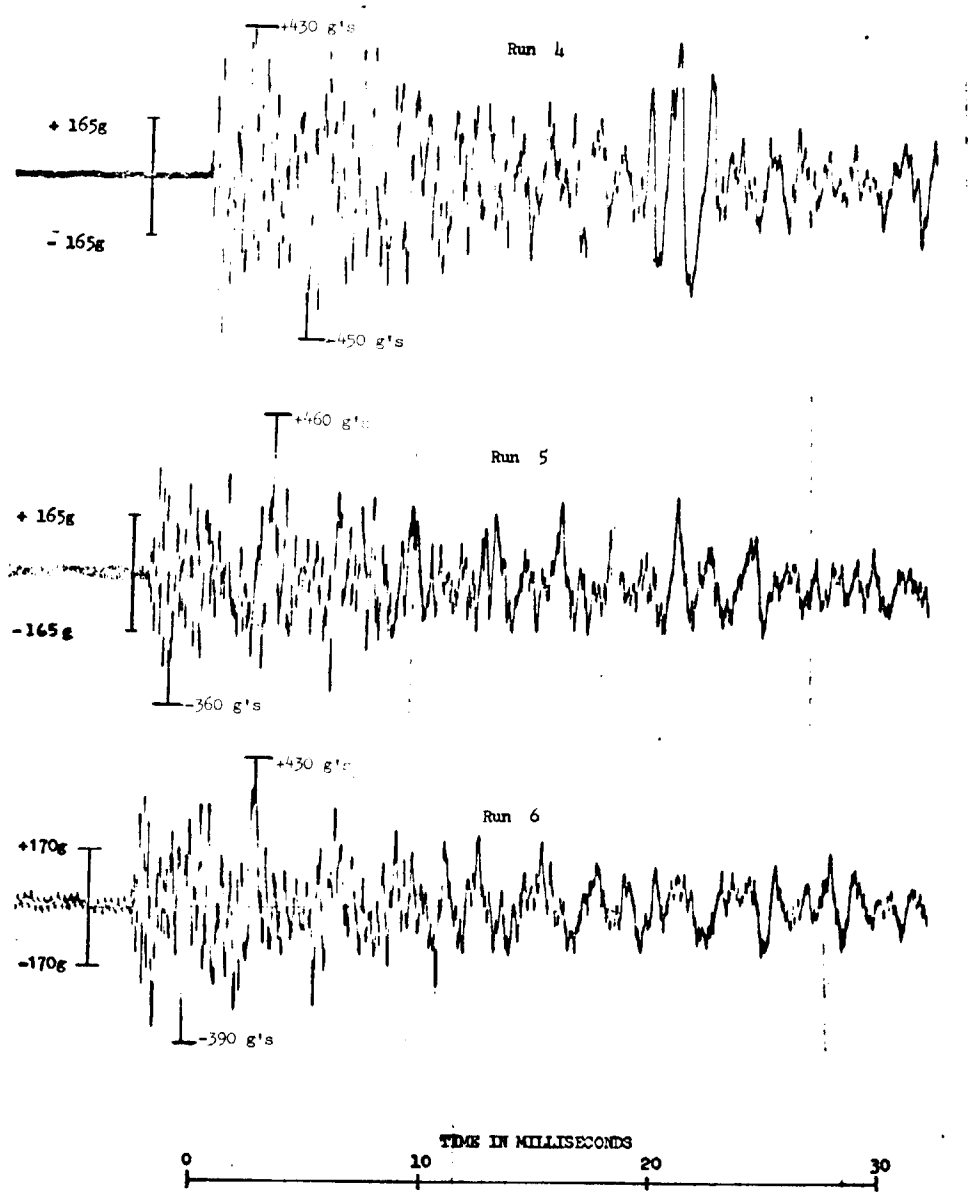


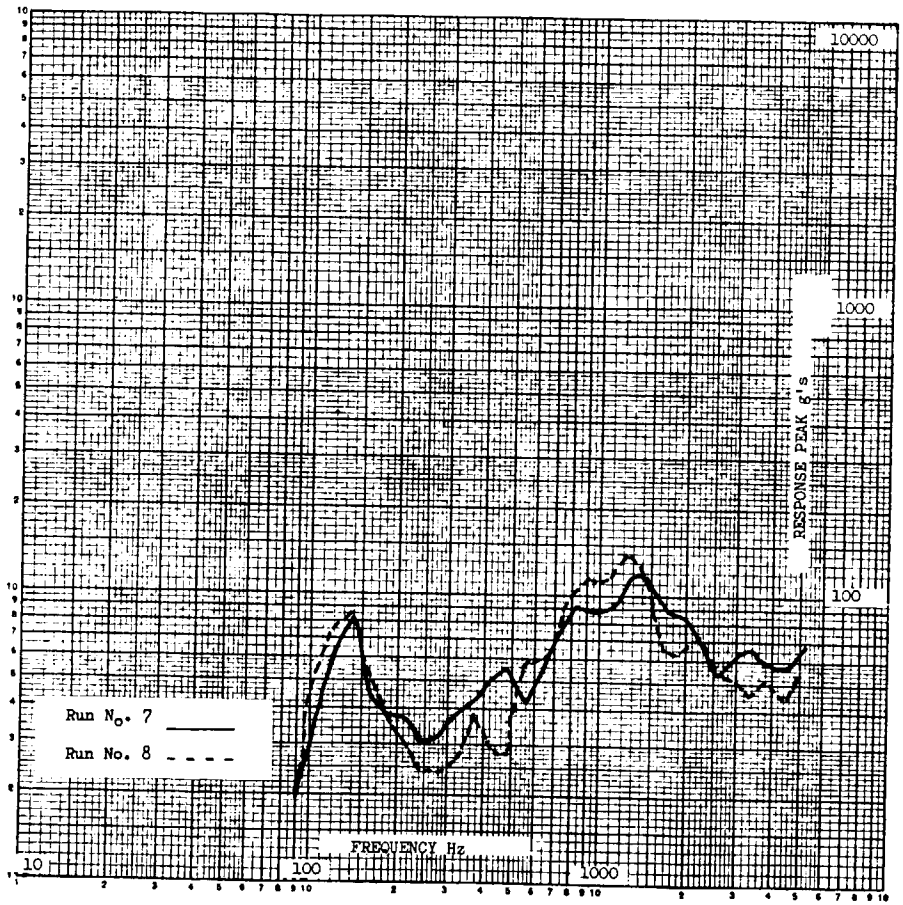
FIGURE I.A.5-102

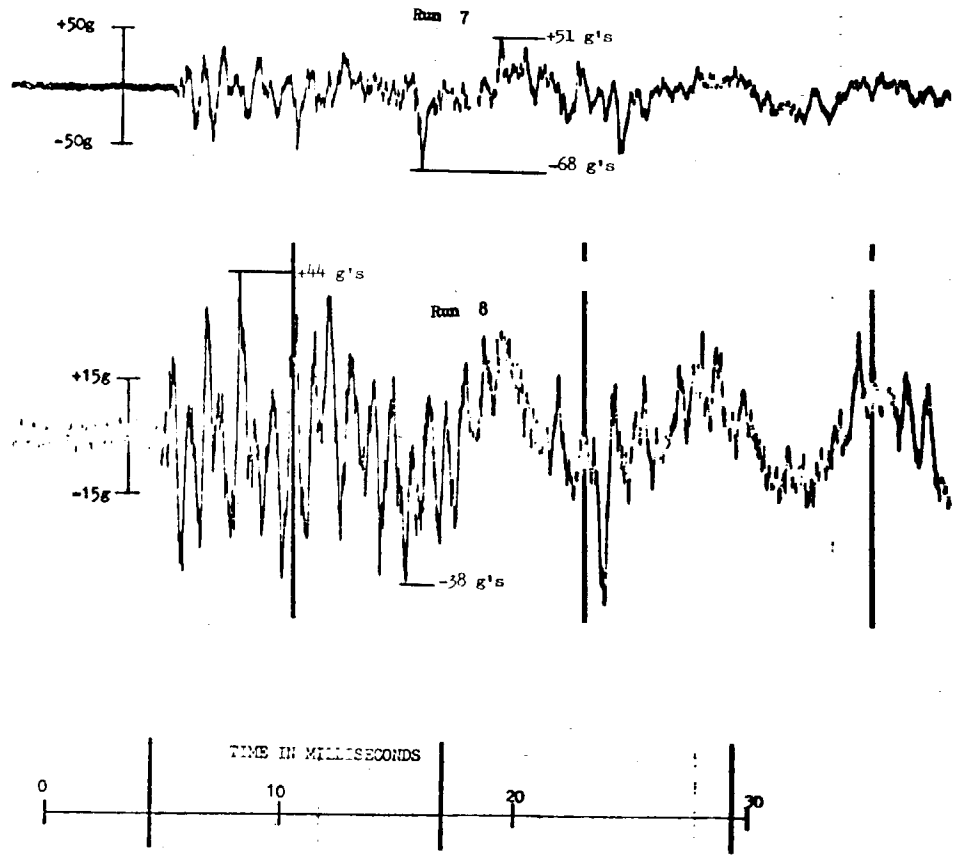




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 15-Z PBPS
PS ASS-WEB.
RUN NO. 4, 5, 6

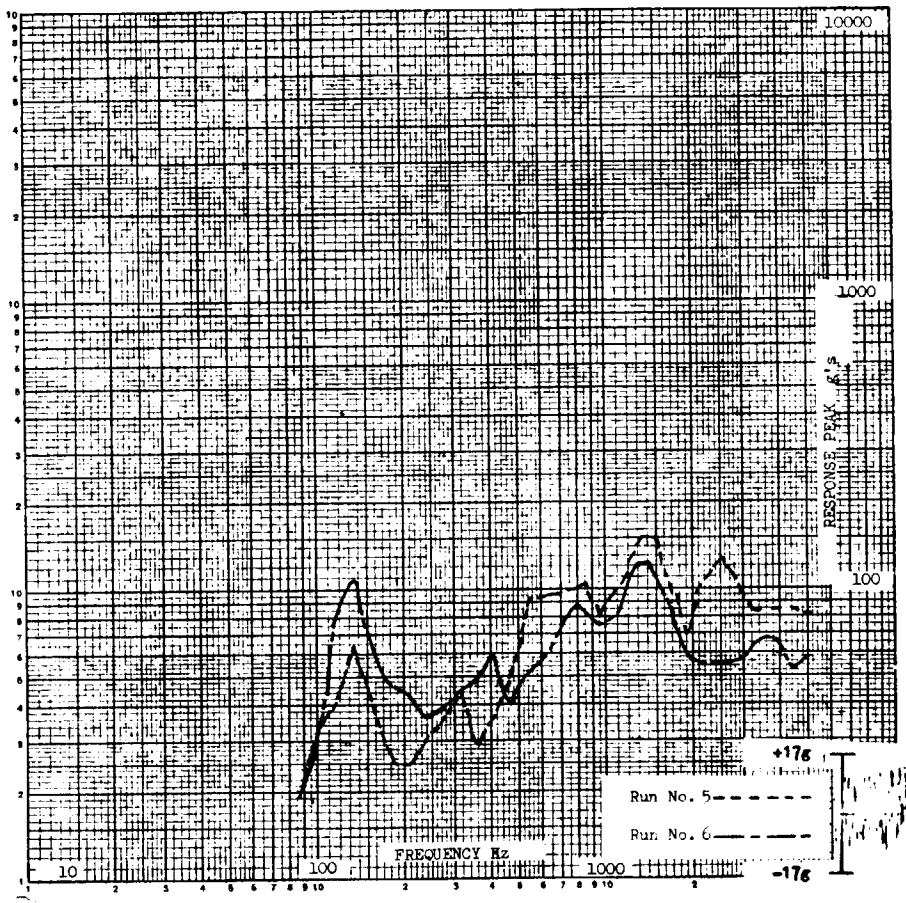
FIGURE I.A.5-101

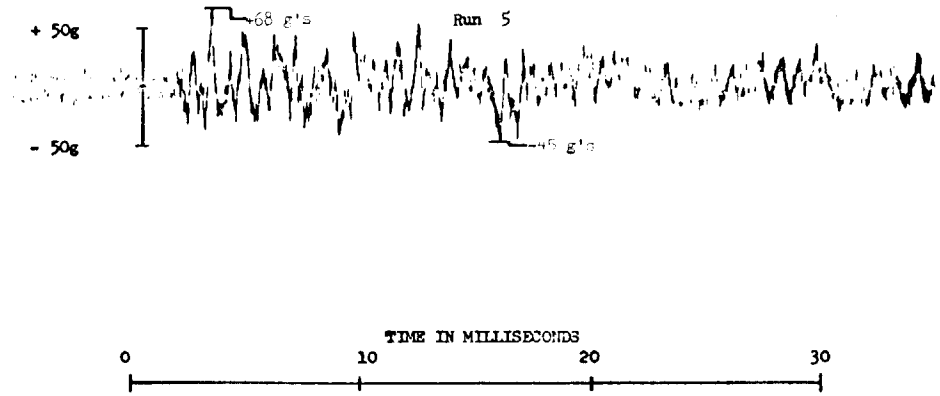


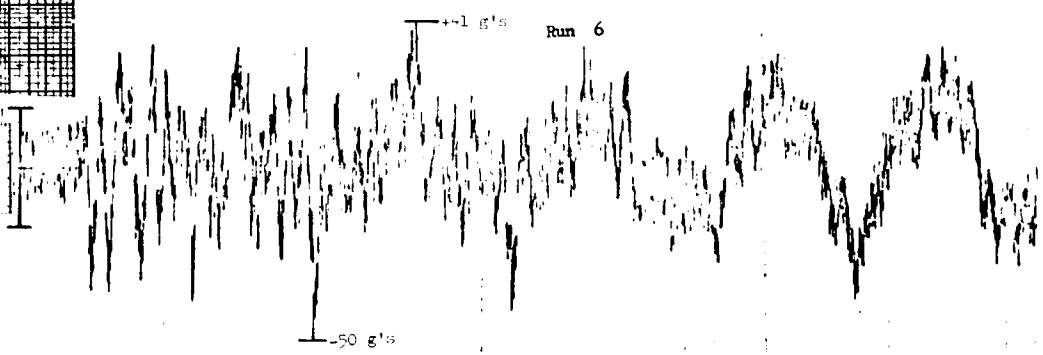


PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 14-T PBPS
PS ASS-REG.
RUN NO. 7, 8

FIGURE I.A.5-100

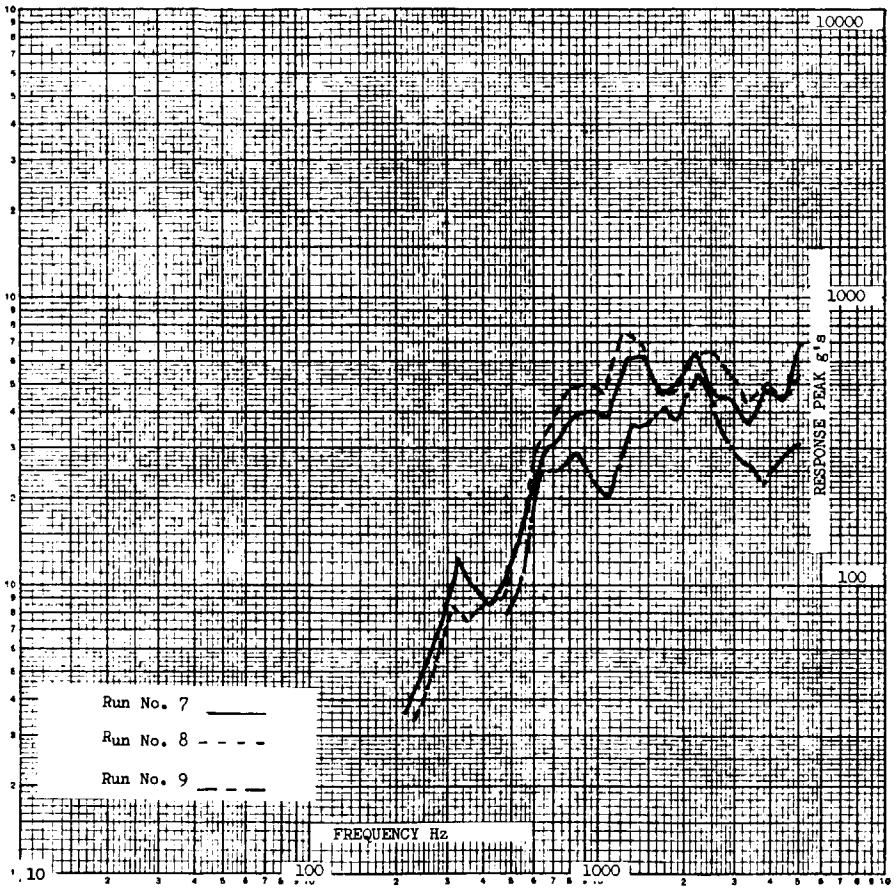


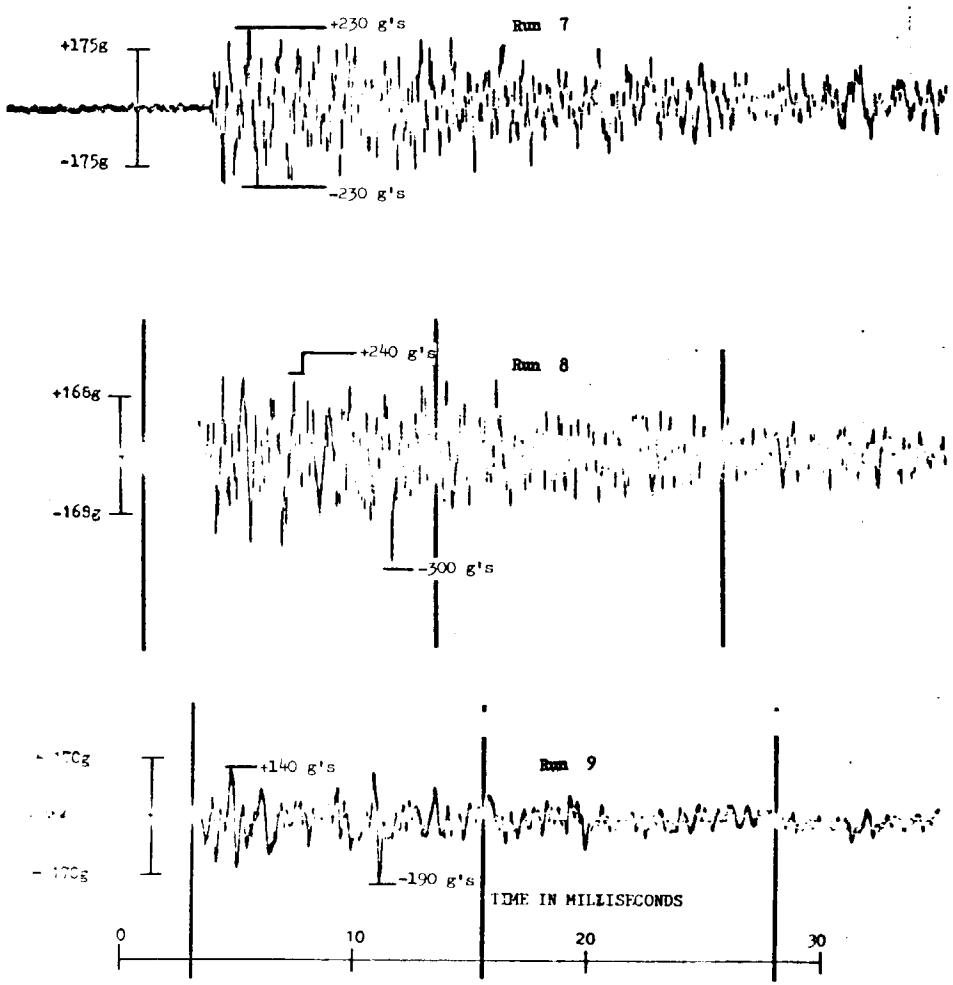




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 14-T PBPS
PS ASS-REG.
RUN NO. 5, 6

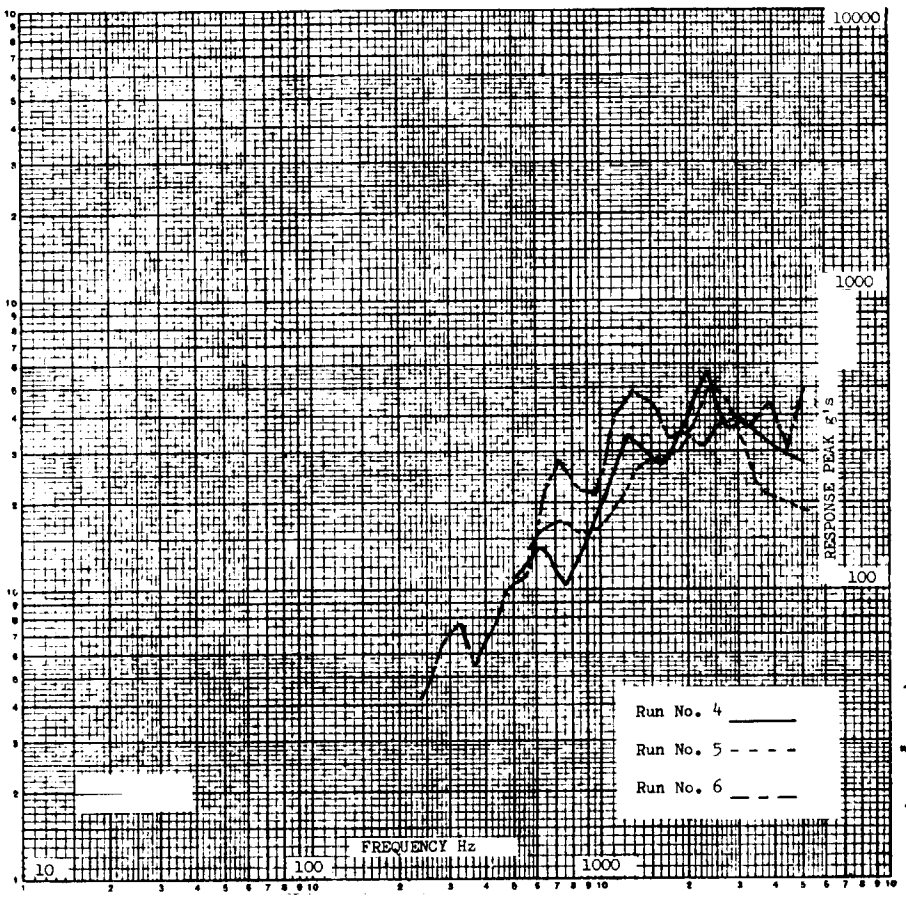
FIGURE 1.A.5-99

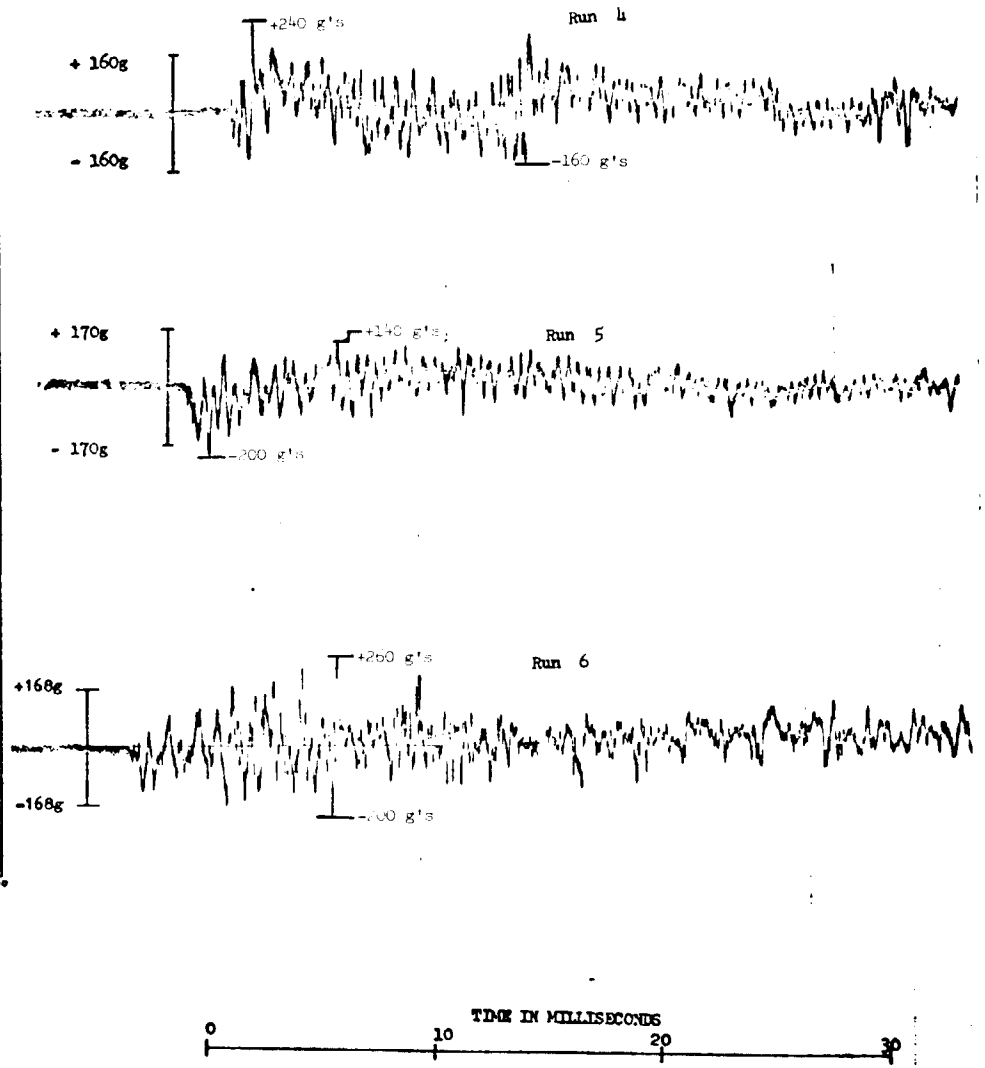




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 14-R PBPS
PS ASS-REG.
RUN NO. 7, 8, 9

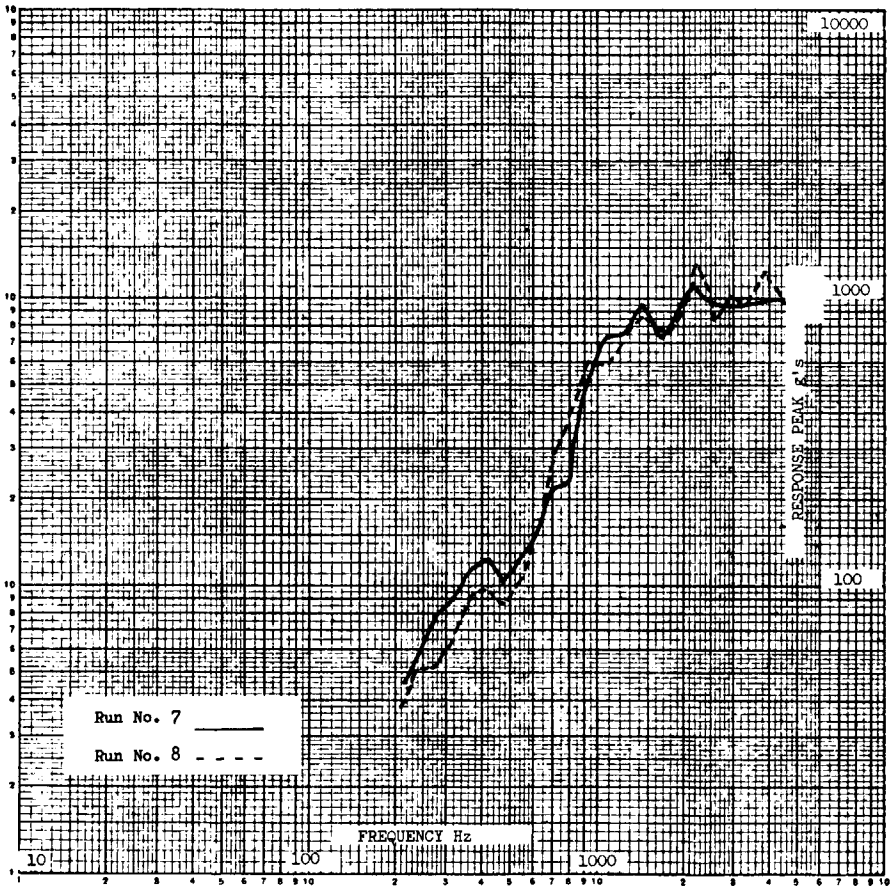
FIGURE I.A.5-98

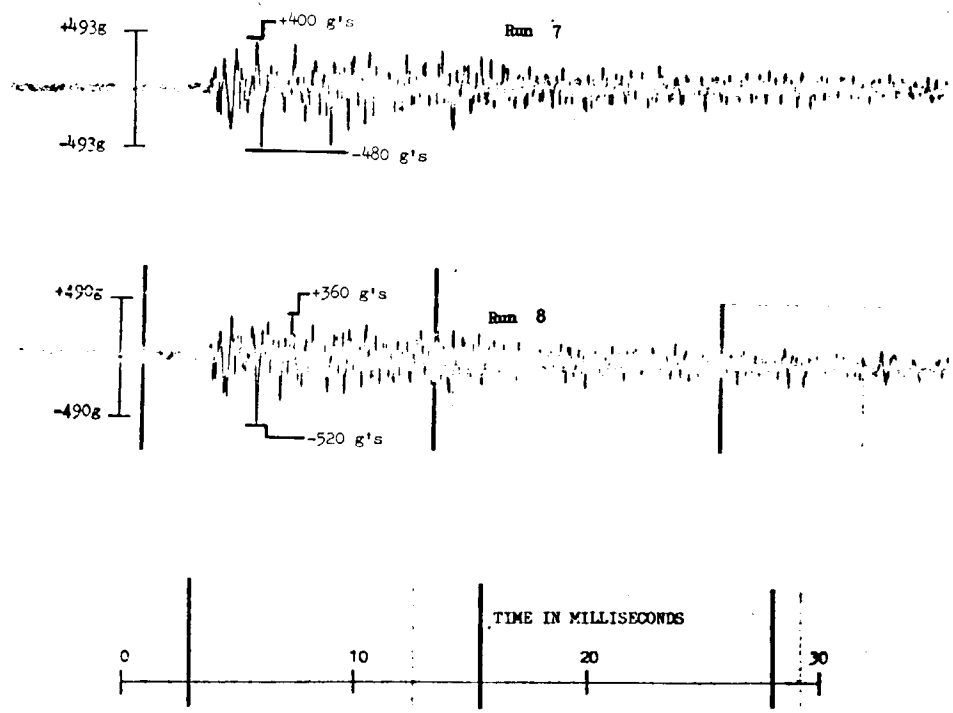




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 14-R PBPS
PS ASS-REG.
RUN NO. 4, 5, 6

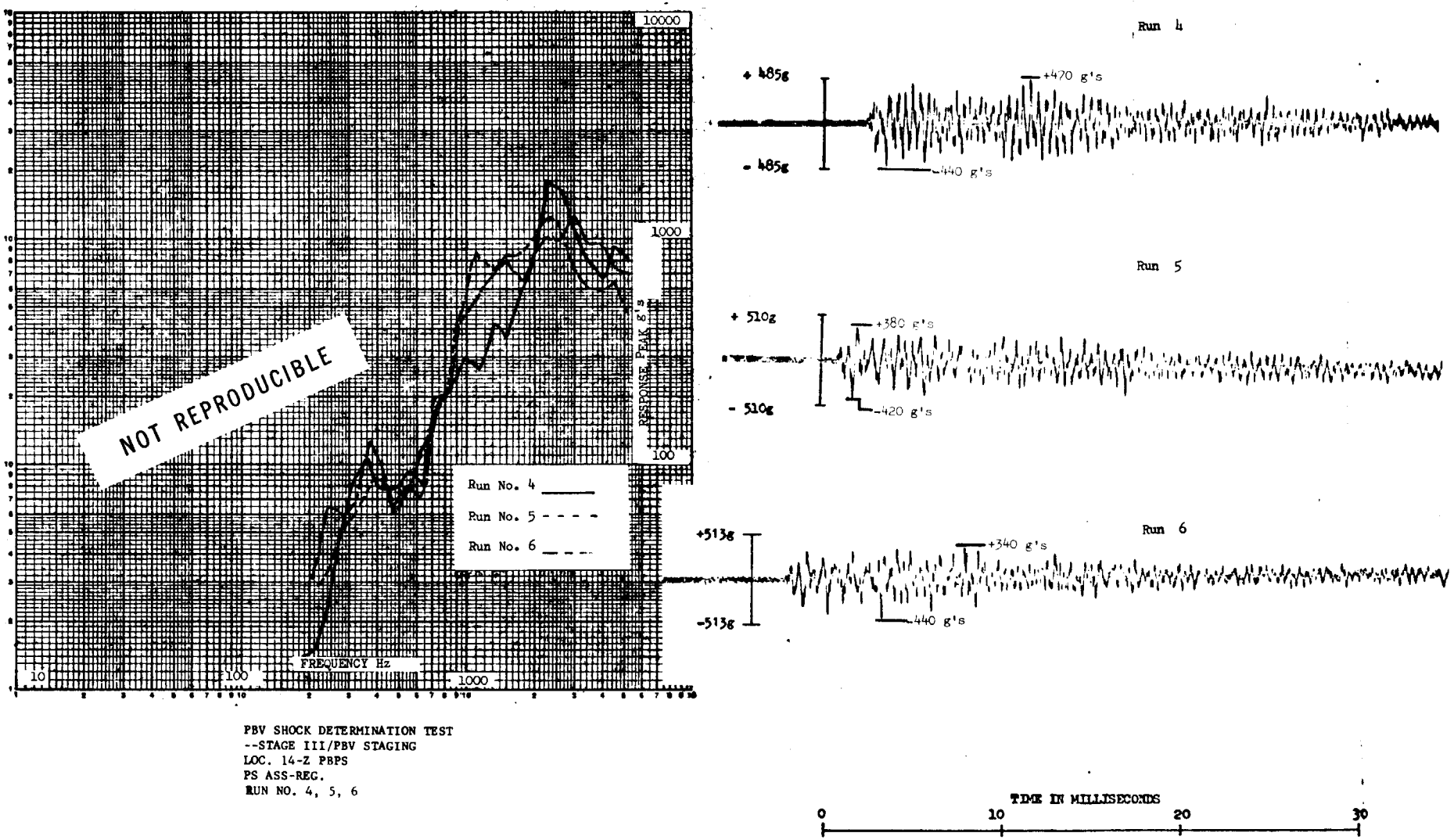
FIGURE 1.A.5-97





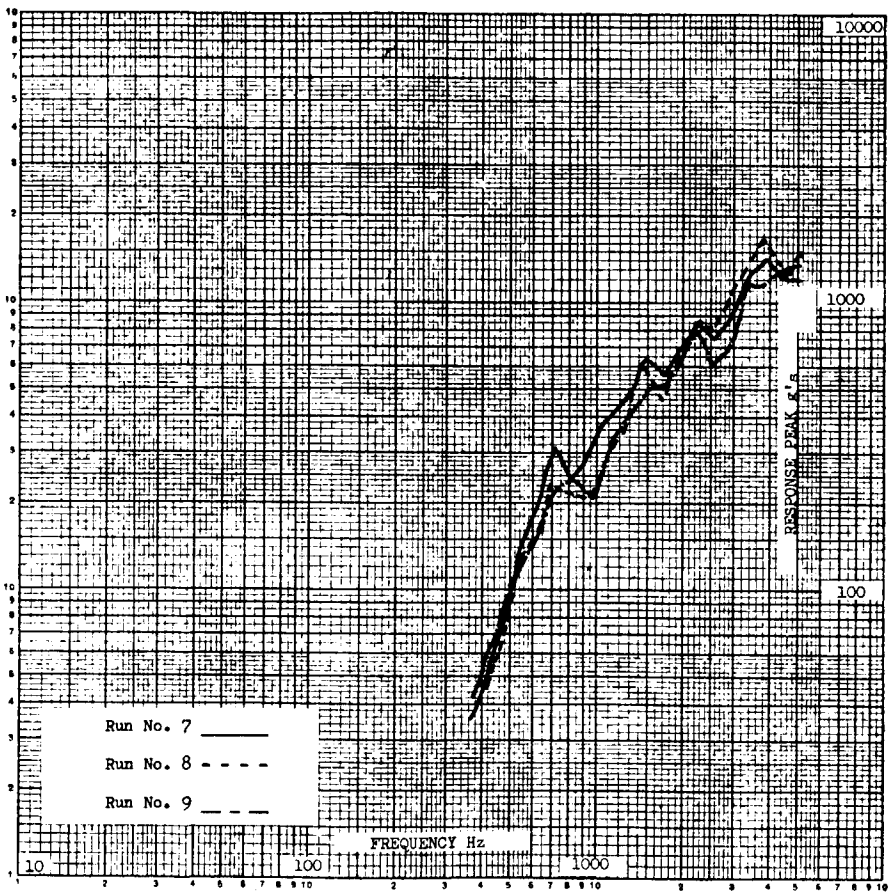
PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC 14-Z PBPS
PS ASS-REG
RUN NO. 7, 8

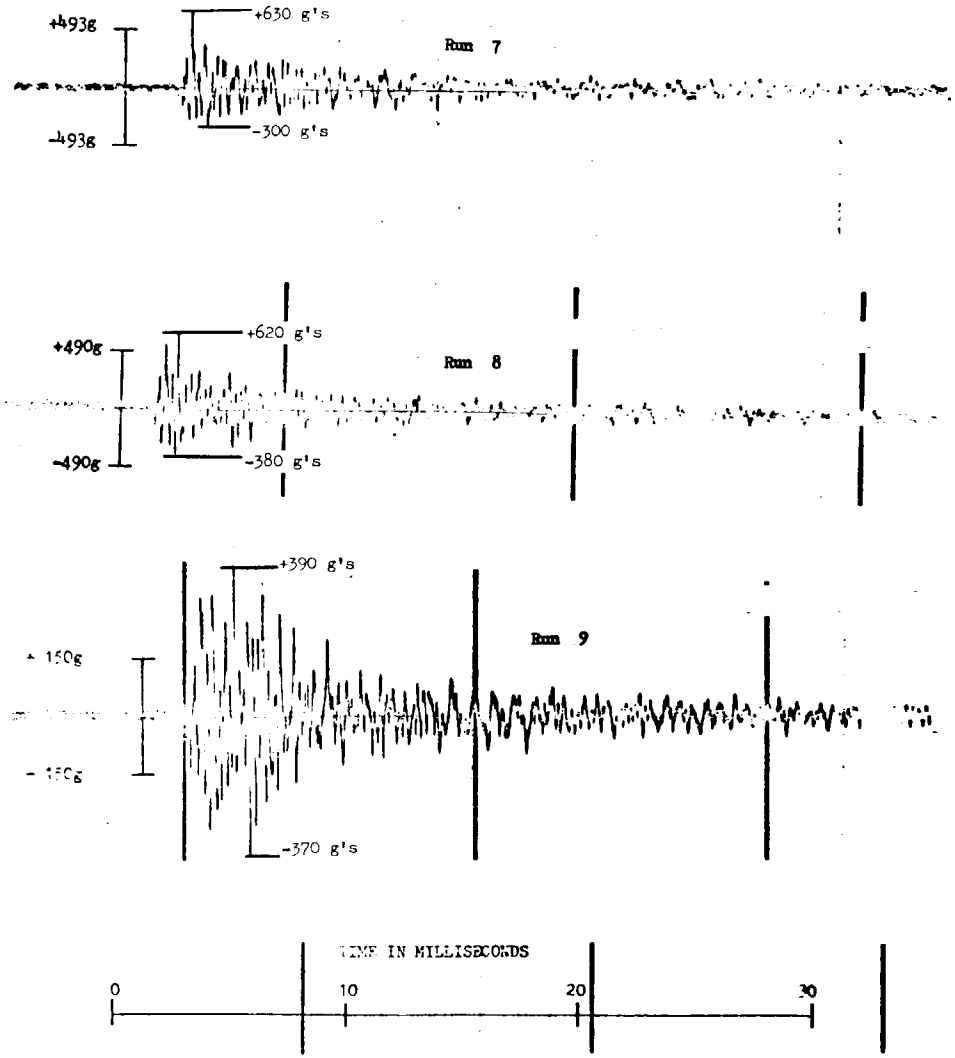
FIGURE I.A.5-96



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 14-Z PBPS
PS ASS-REG.
RUN NO. 4, 5, 6

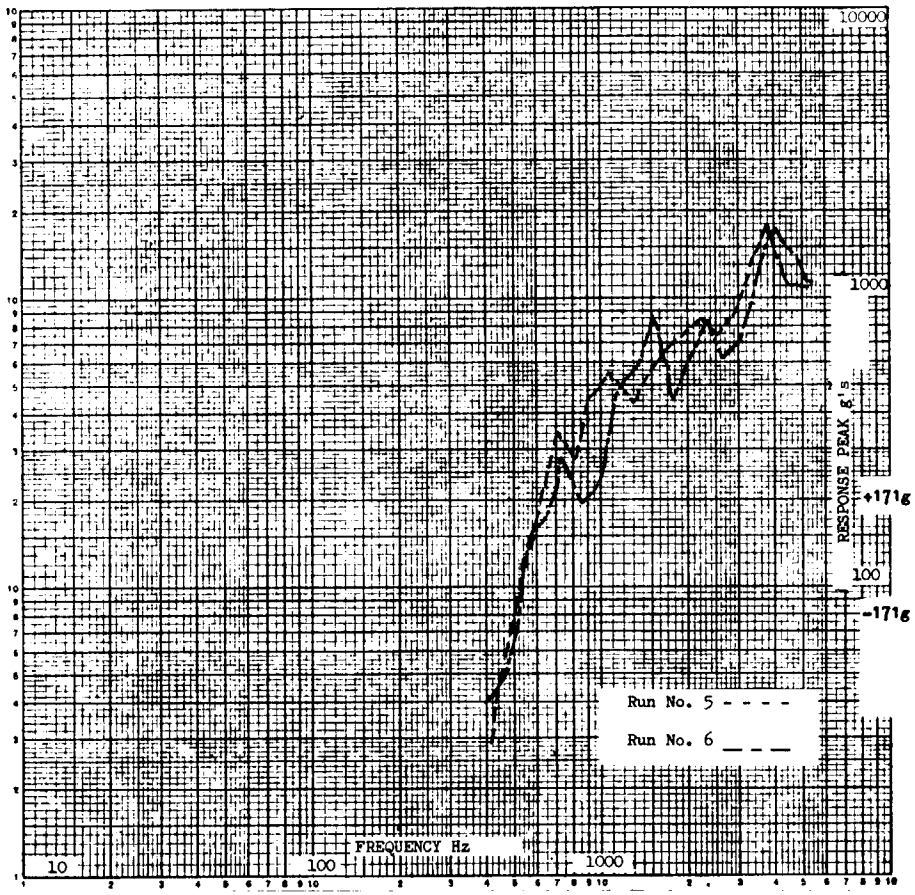
FIGURE I.A.5-95

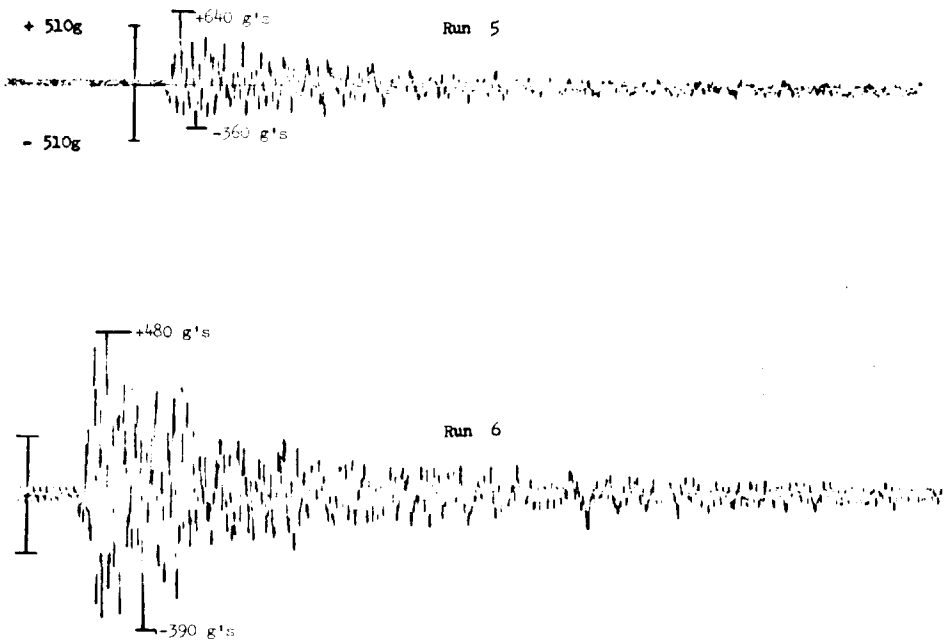


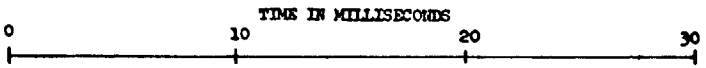


PBV SHOCK DETERMINATION TEST
STAGE III/PBV STAGING
LOC. 13-T PBPS
FUEL TANK AT PROP. END
RUN NO. 7, 8, 9

FIGURE I.A.5-94

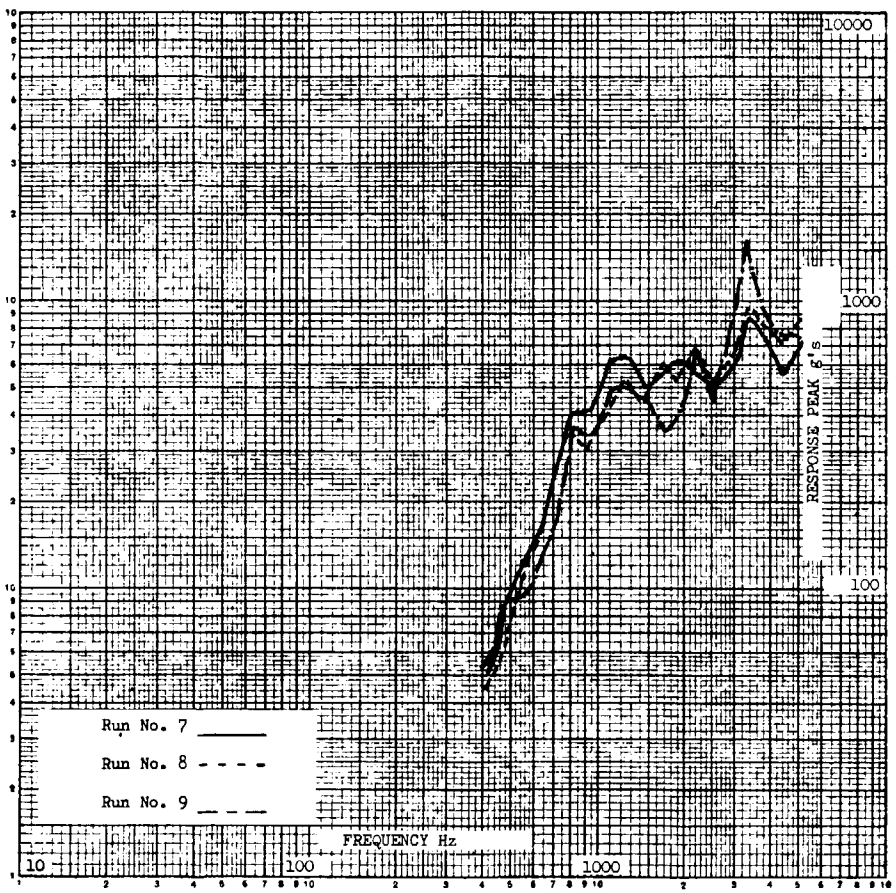






PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 13-T PBPS
FUEL TANK @ PROP. END
RUN NO. 5,6

FIGURE I.A.5-93



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 13-R PBPS
FUEL TANK AT PROP. END
RUN NO. 7, 8, 9

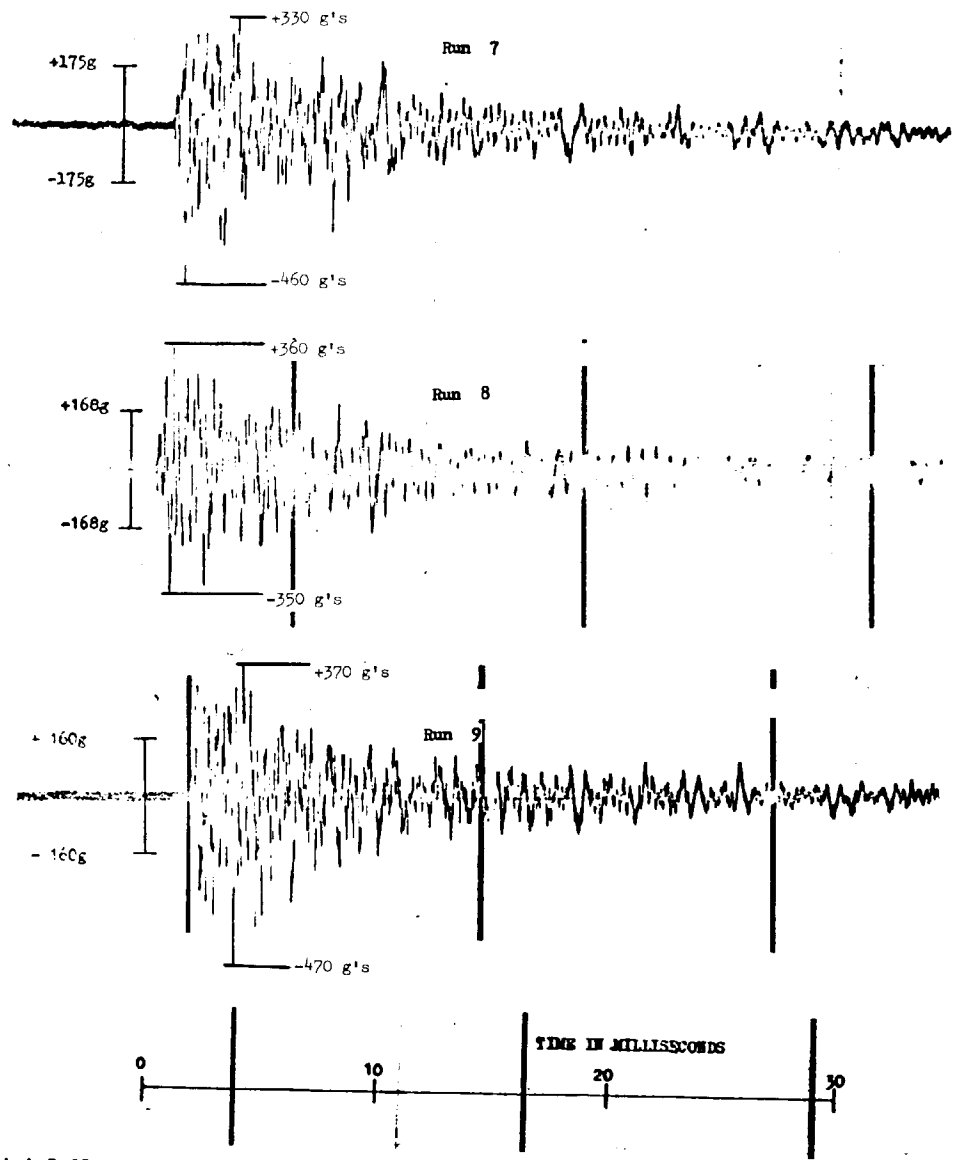
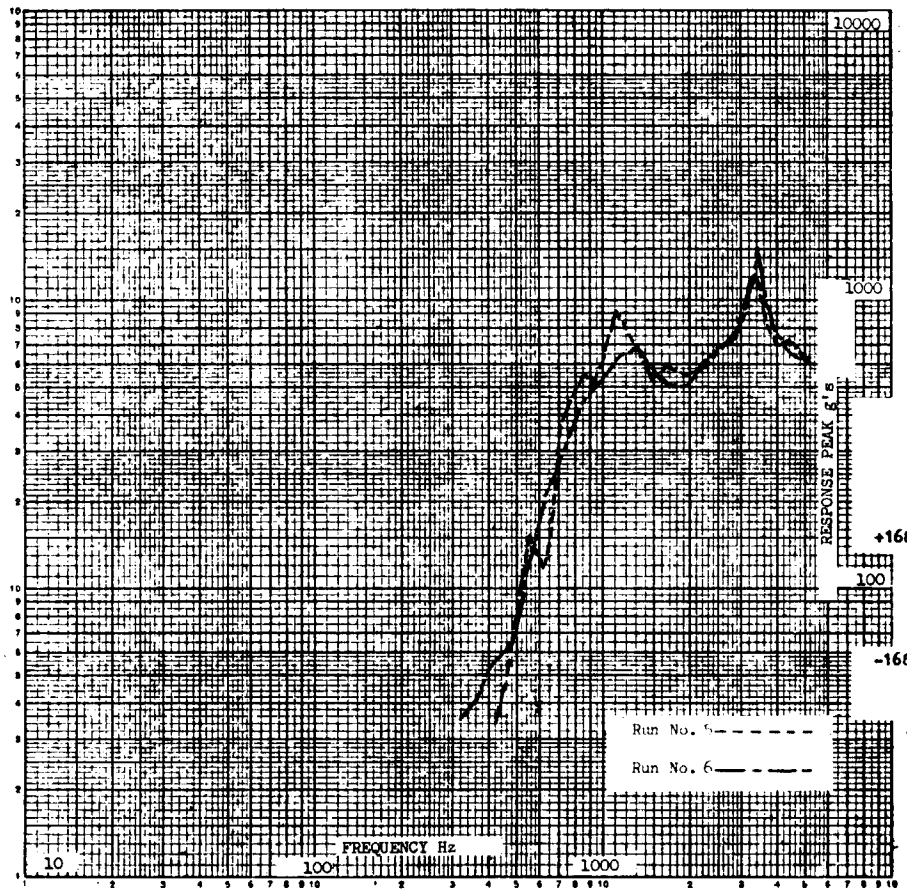
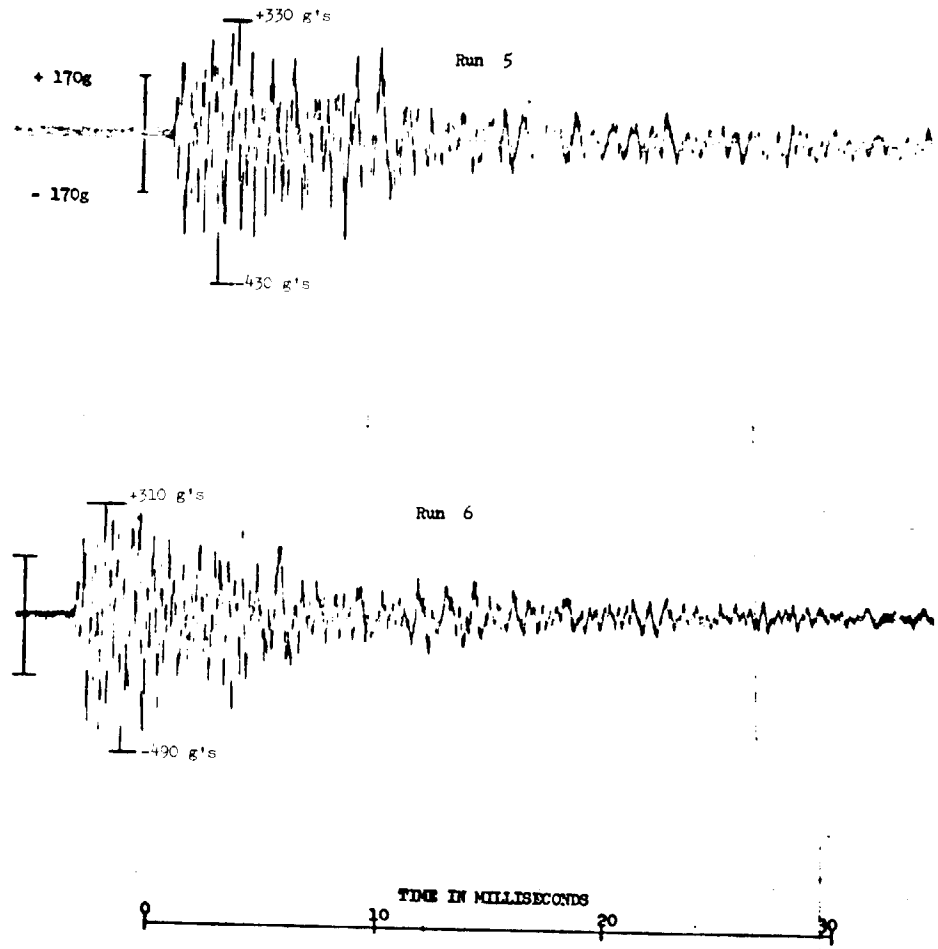


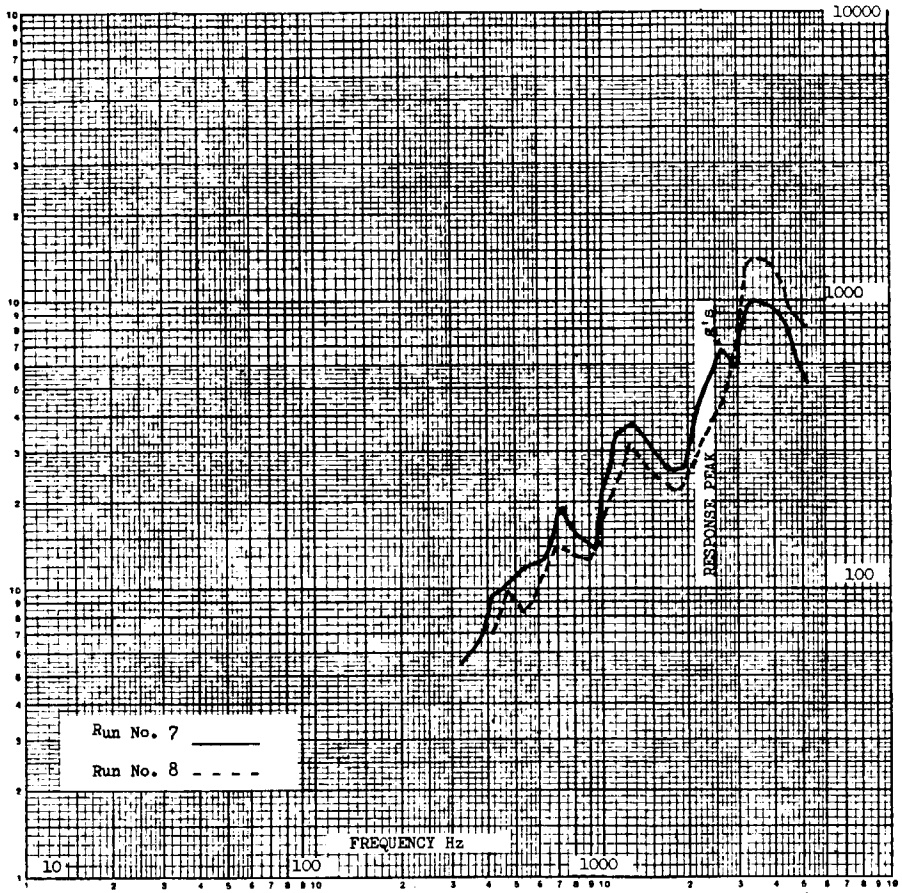
FIGURE I.A.5-92

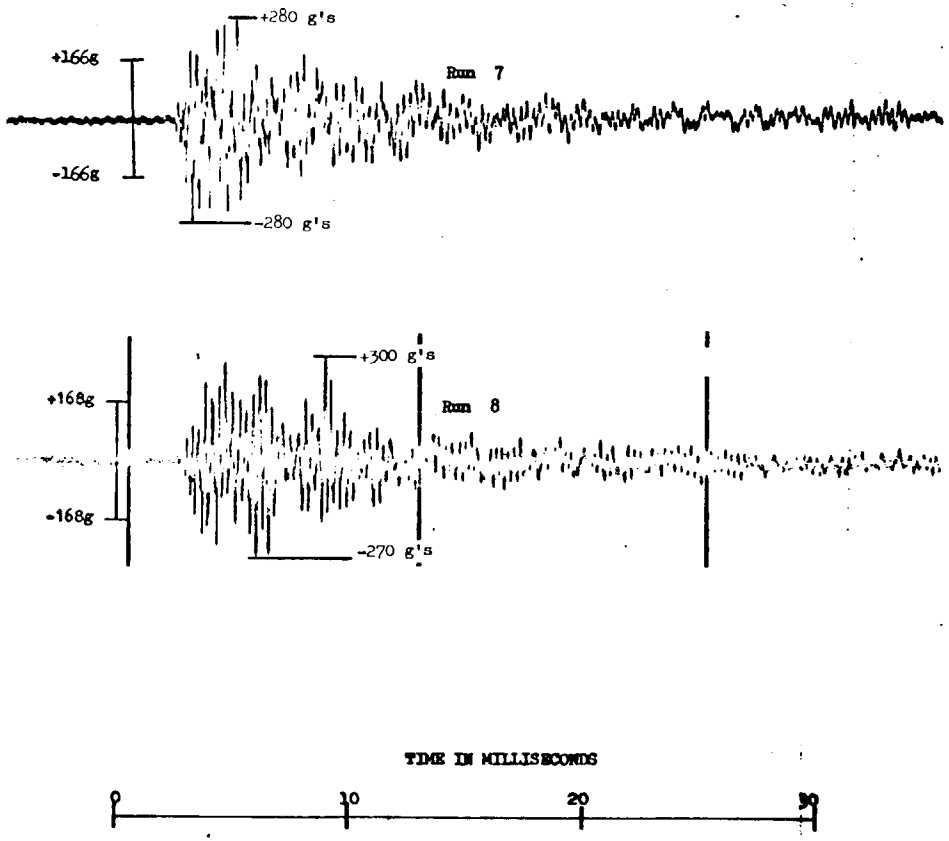




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 13-R PBPS
FUEL TANK @ PROP. END
RUN NO. 5,6

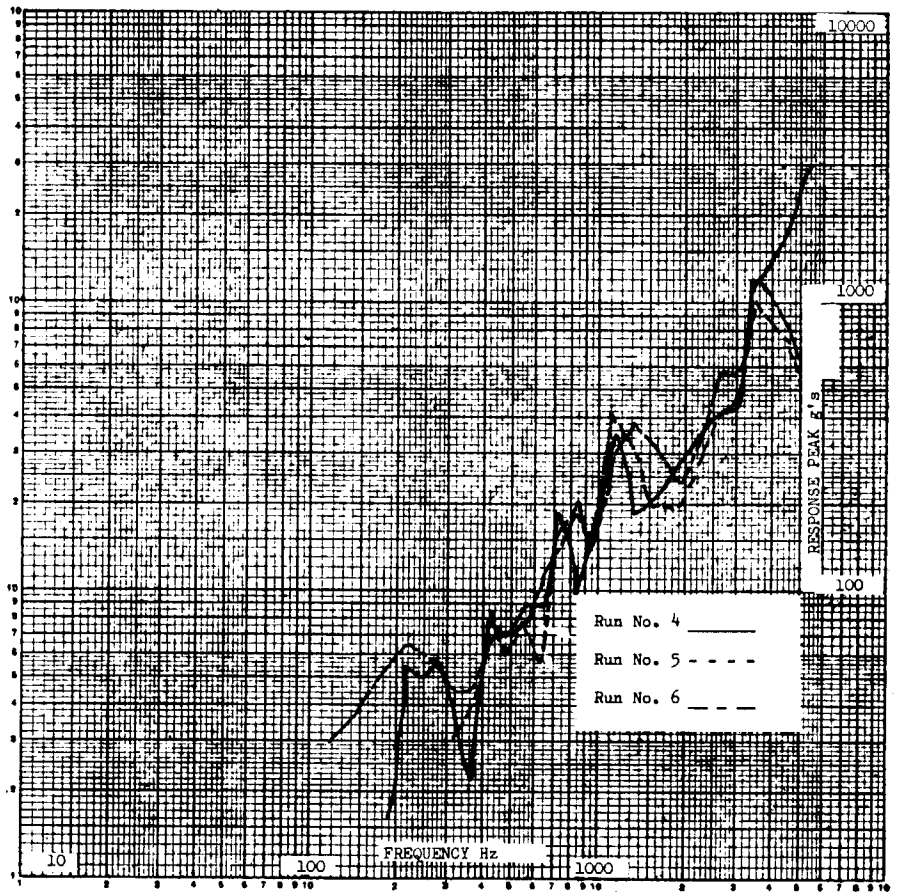
FIGURE I.A.5-91





PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 13-Z PBPS
FUEL TANK AT PROP. END
RUNS NO. 7, 8

FIGURE I.A.5-90



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 13-Z PBPS
FUEL TANK @ PROP. END
RUNS 4, 5, 6

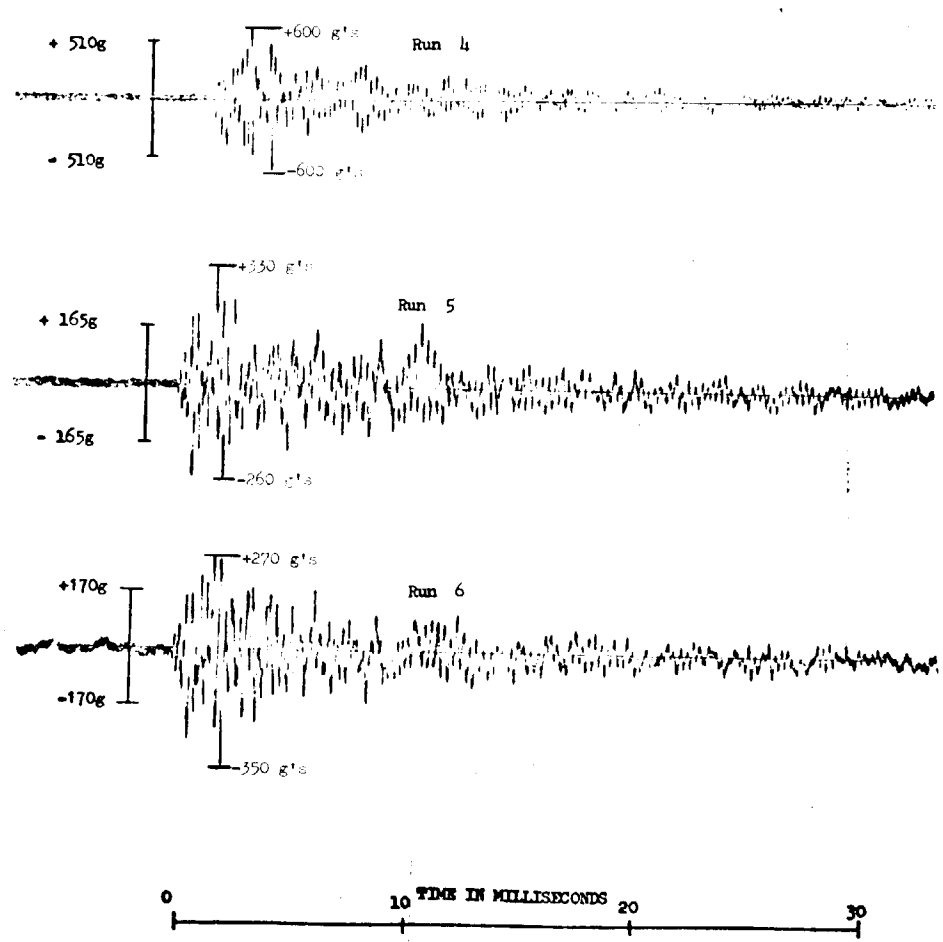
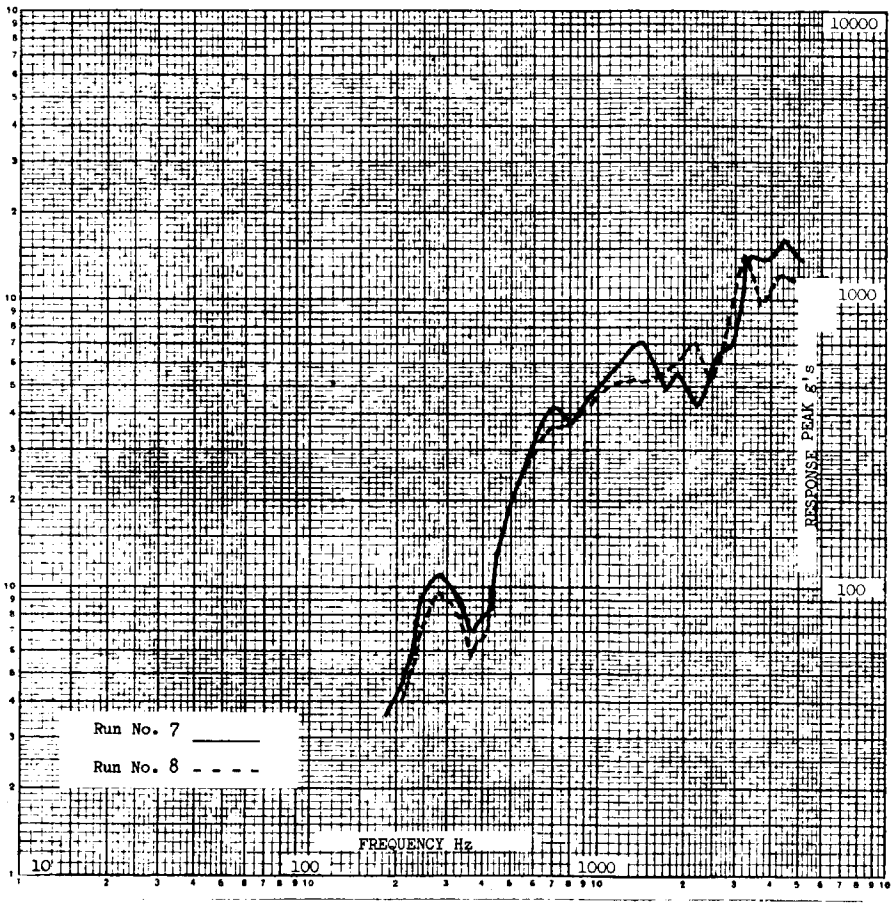


FIGURE I.A.5-89



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 12-T PBPS
FUEL TANK AT GAS END
RUN NO. 7,8

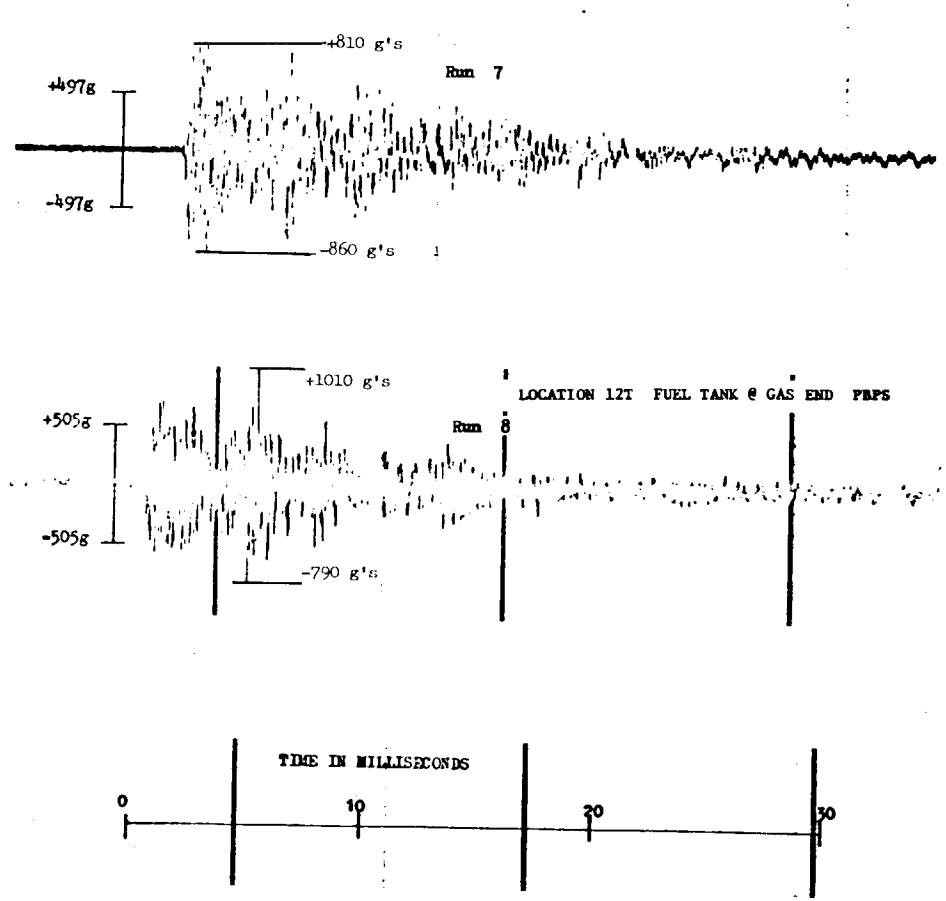
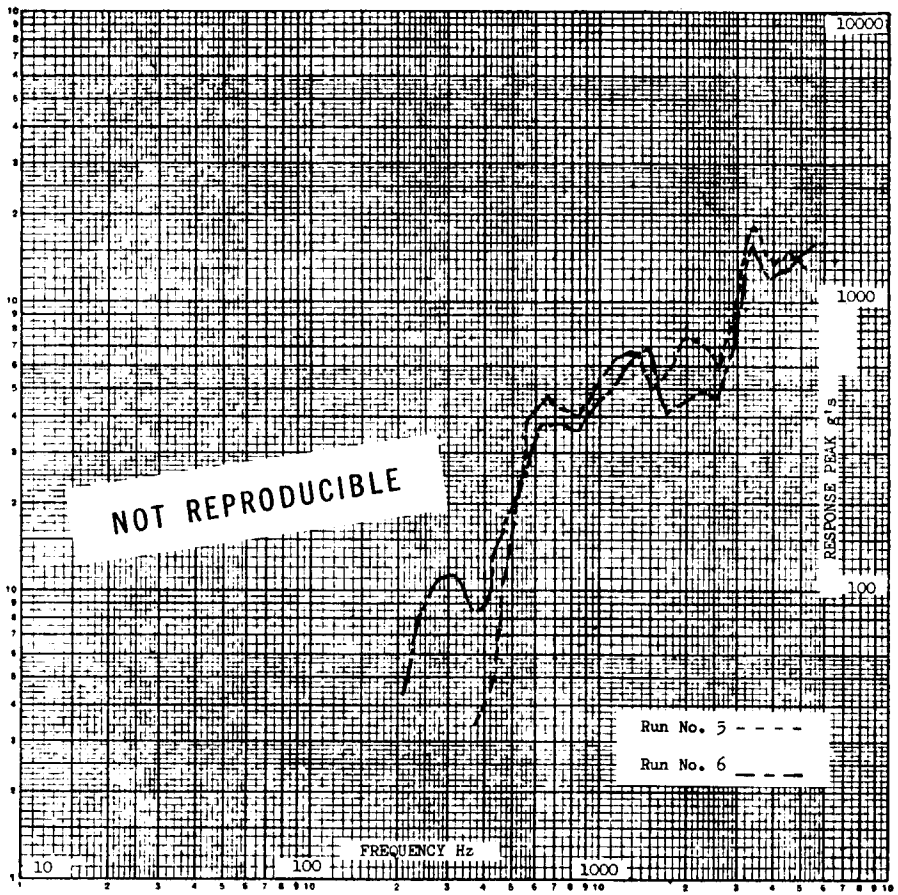
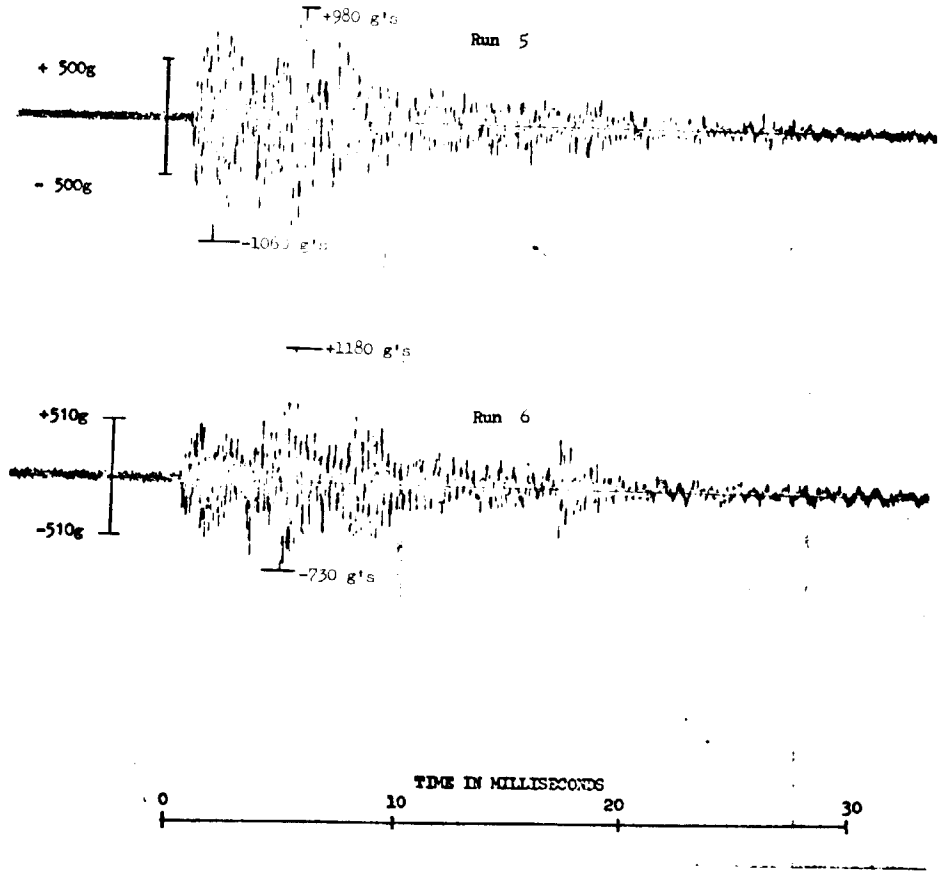


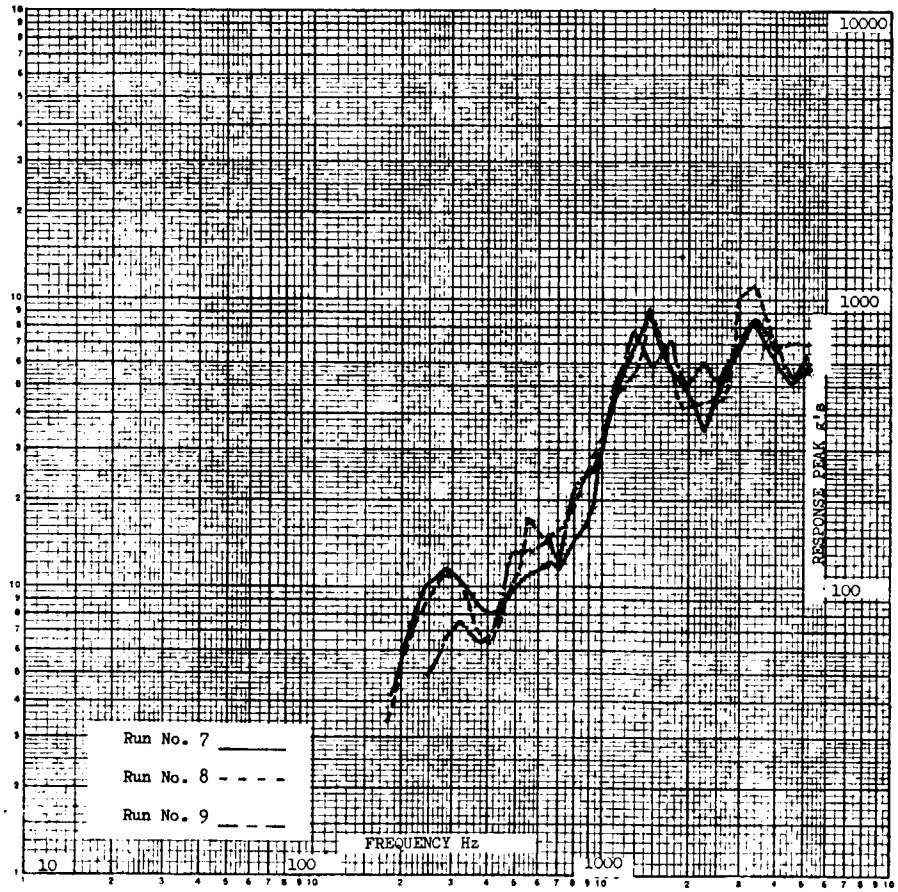
FIGURE I.A.5-88

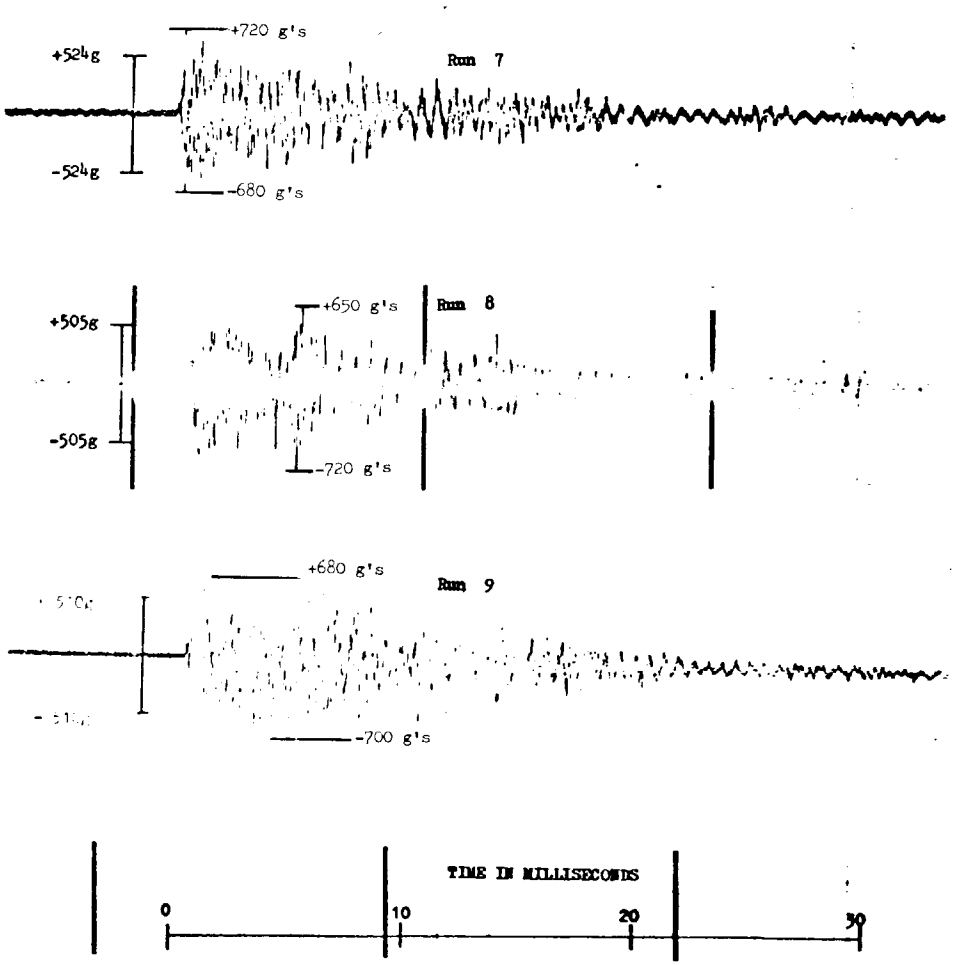




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 12-T PBPS
FUEL TANK @ GAS END
RUN NO. 5,6

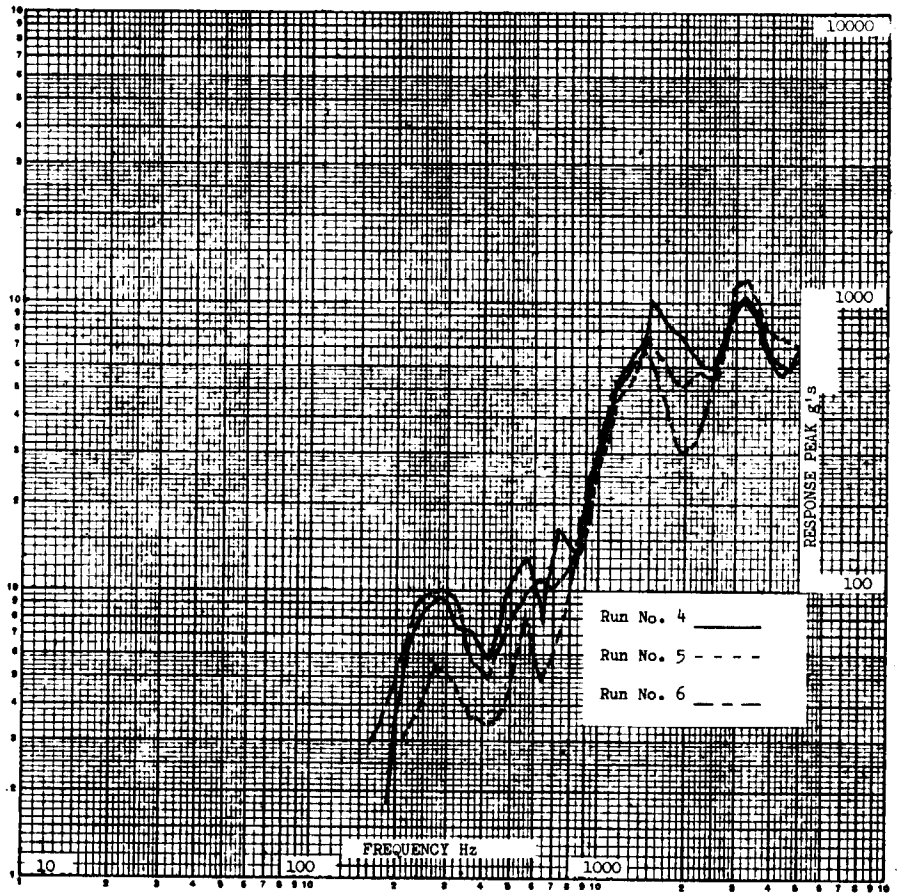
FIGURE I.A.5-87

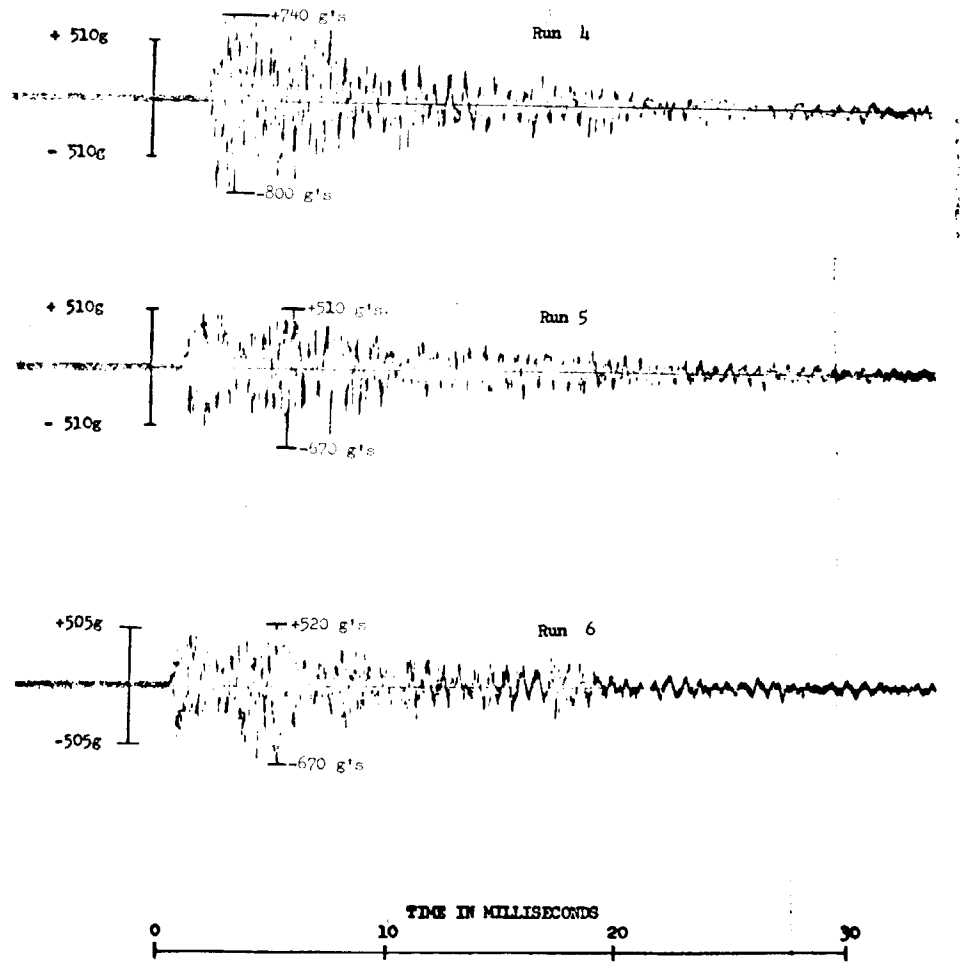




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 12-R PBPS
FUEL TANK AT GAS END
RUN NO. 7, 8, 9

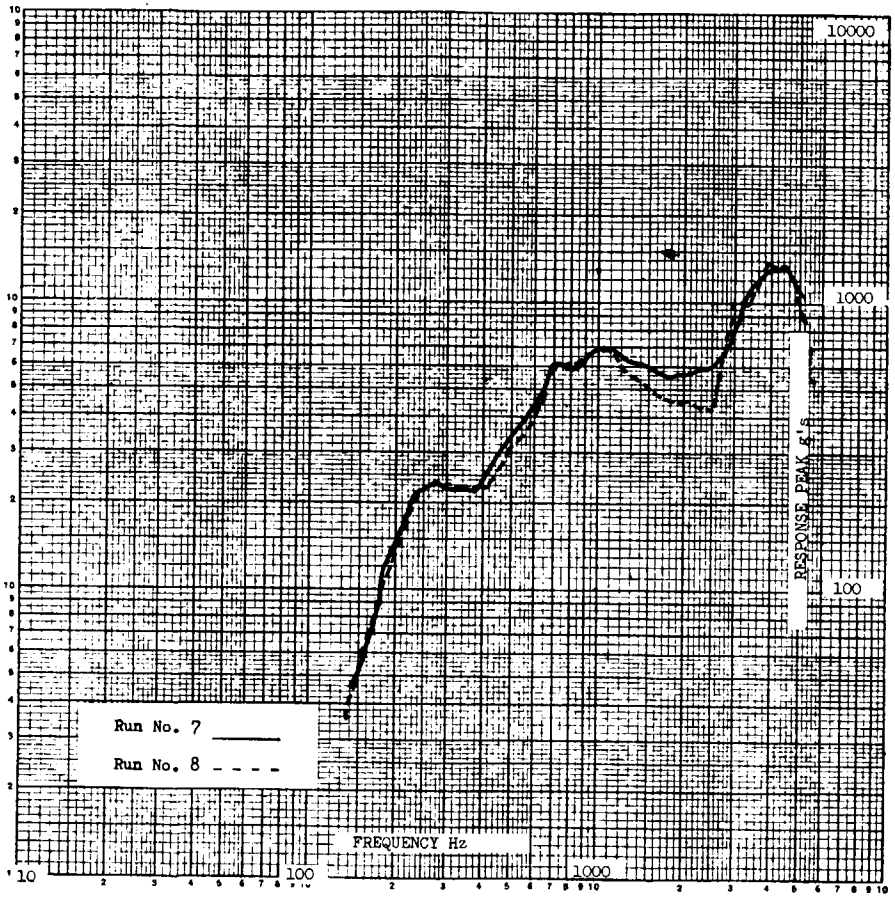
FIGURE I.A.5-86

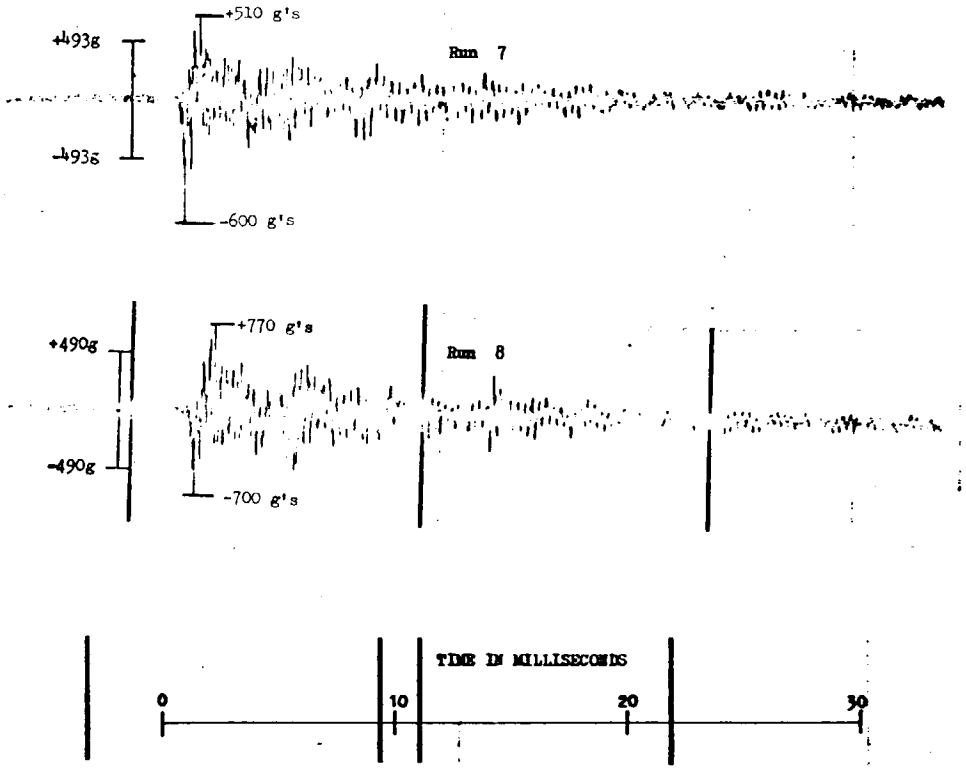




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 12-R PBPS
FUEL TANK @ GAS END
RUN NO. 4, 5, 6

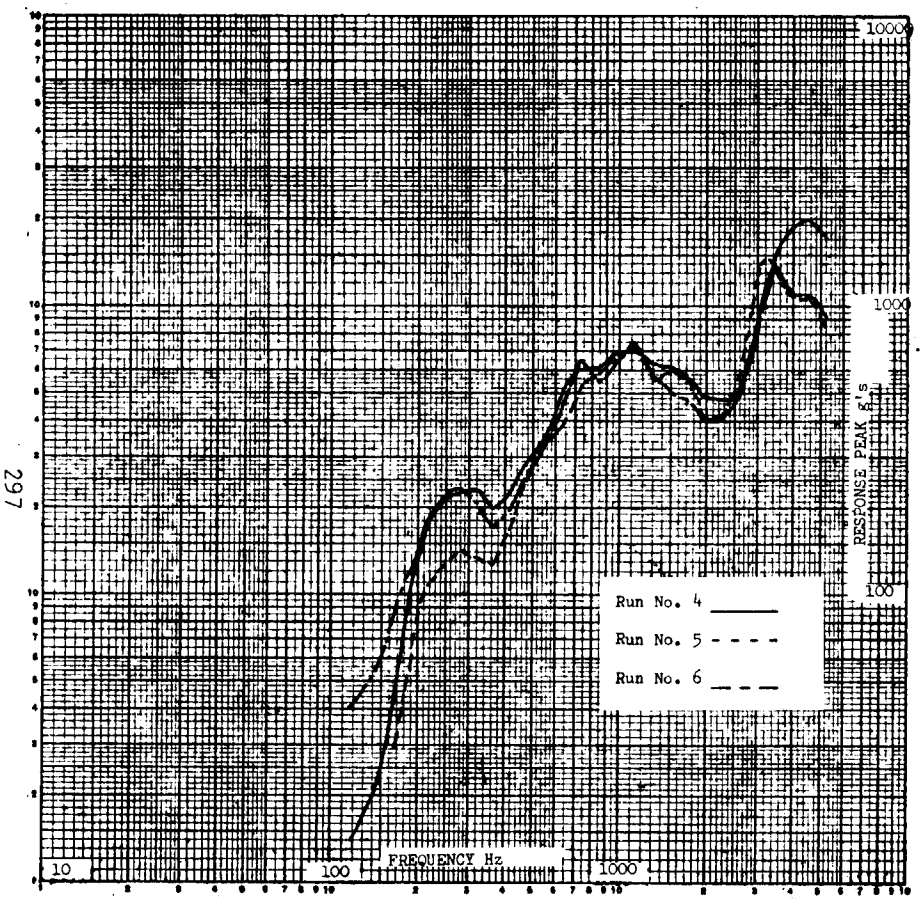
FIGURE 1.A.5-85





PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 12-Z PBPS
FUEL TANK AT GAS END
RUN NO. 7,8

FIGURE 1.A.5-84



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 12-Z PBPS
FUEL TANK @ GAS END
RUN NO. 4, 5, 6

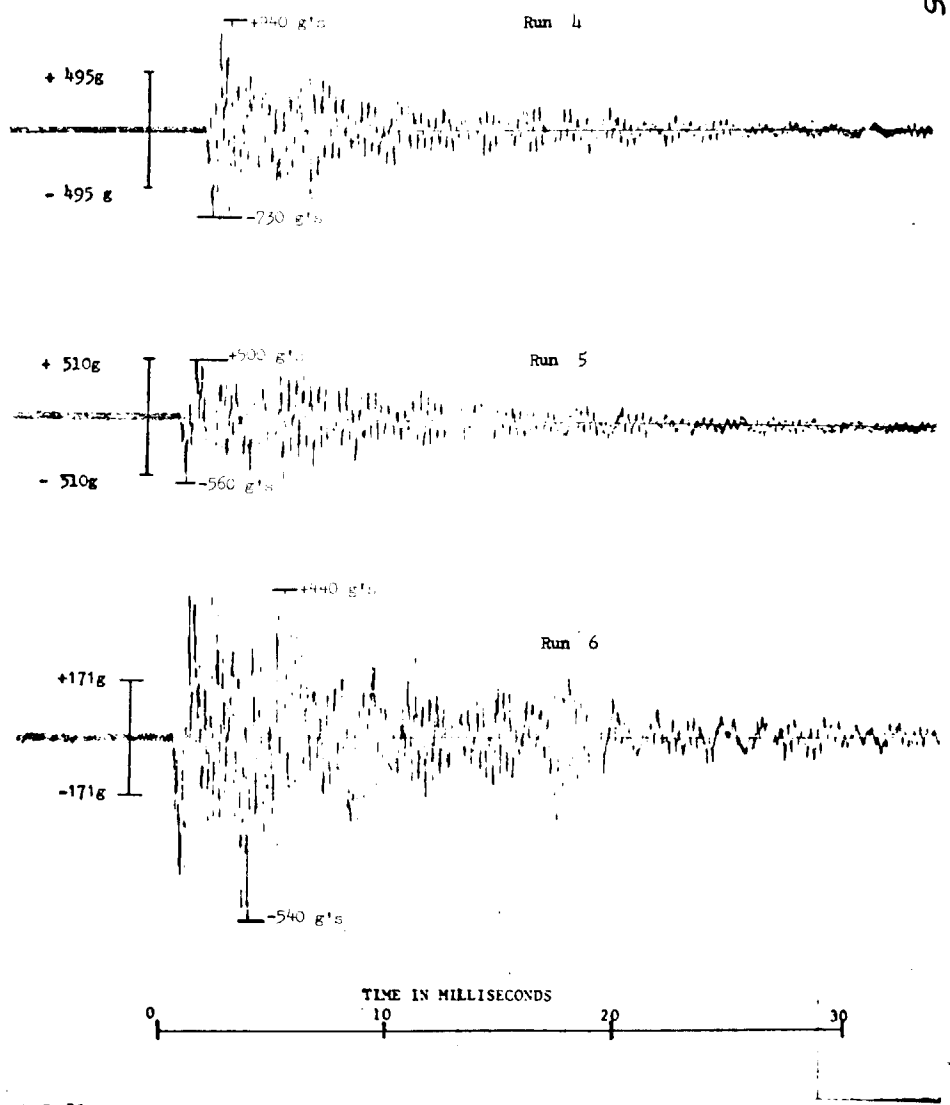
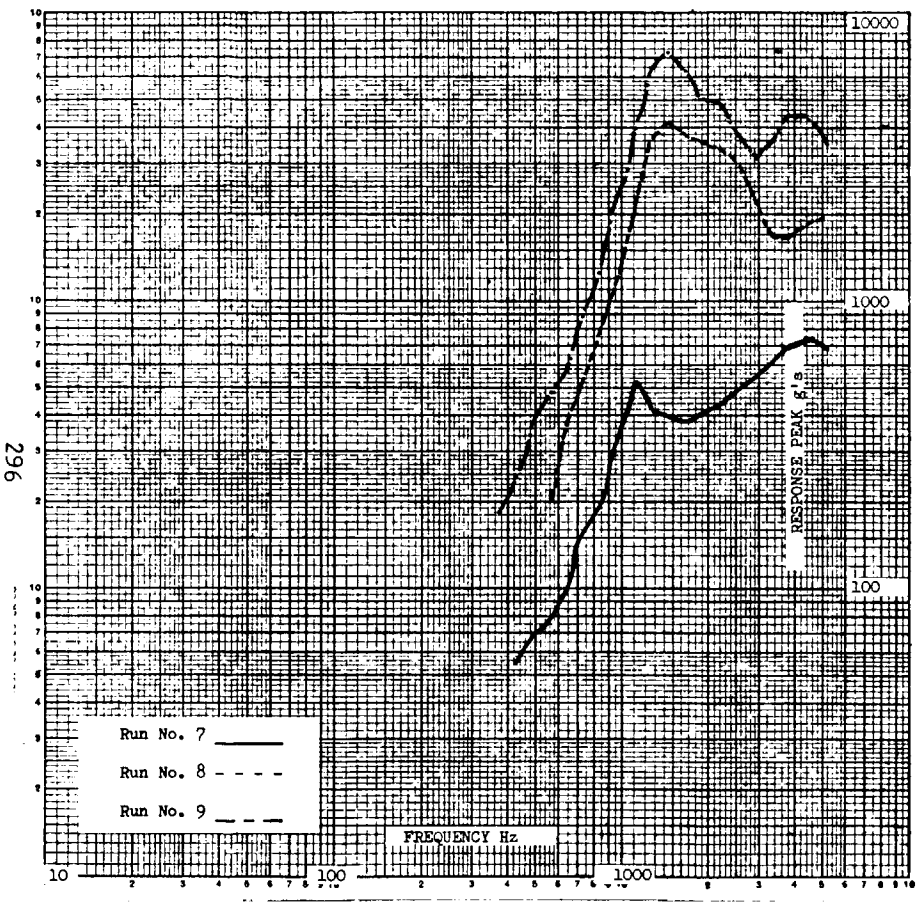


FIGURE I.A.5-83



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 11-T PBPS
YAW ENGINE #2
RUN NO. 7, 8, 9

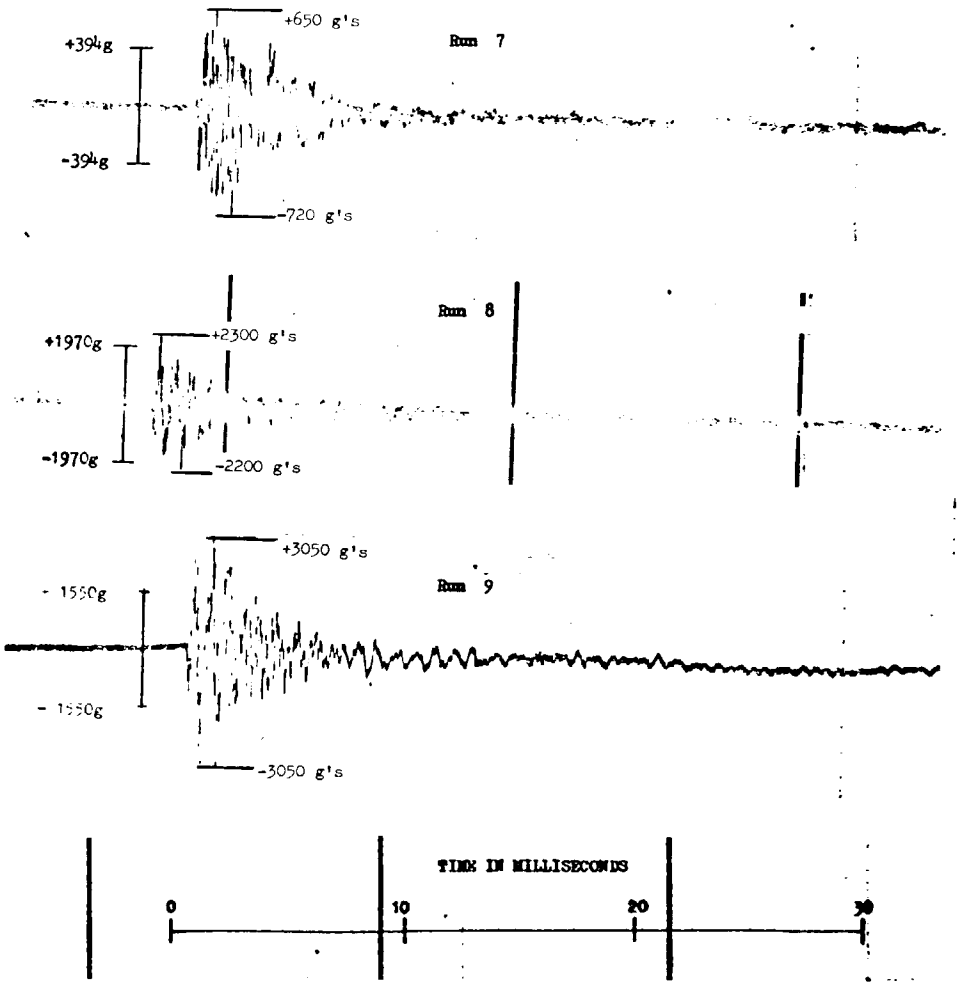
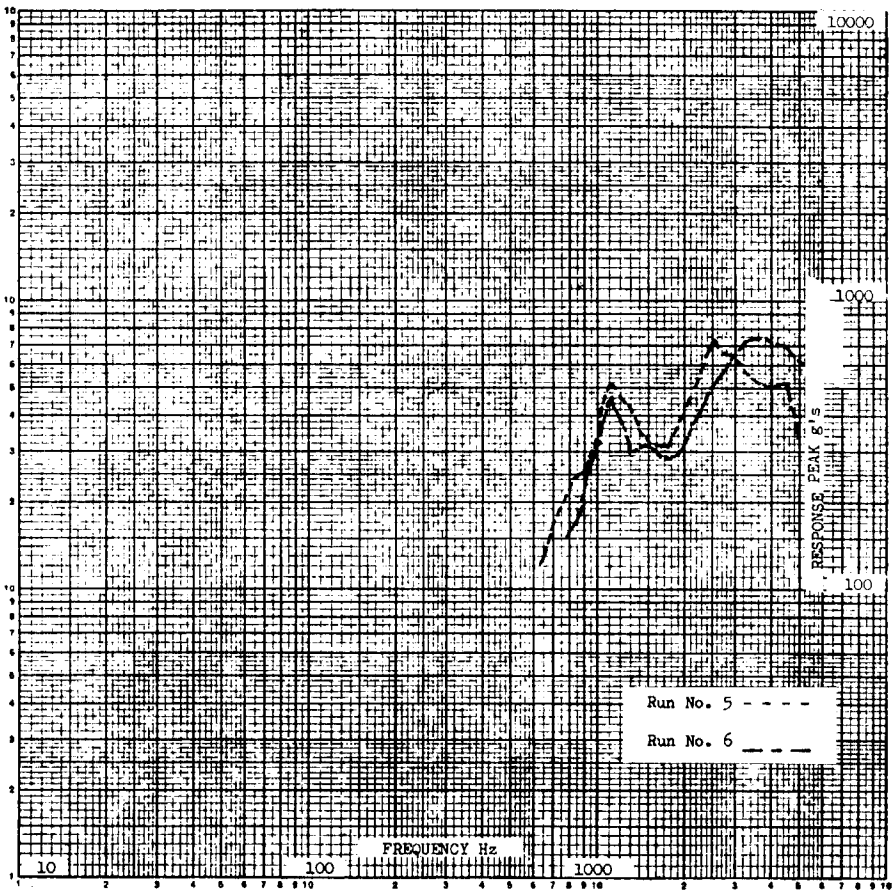
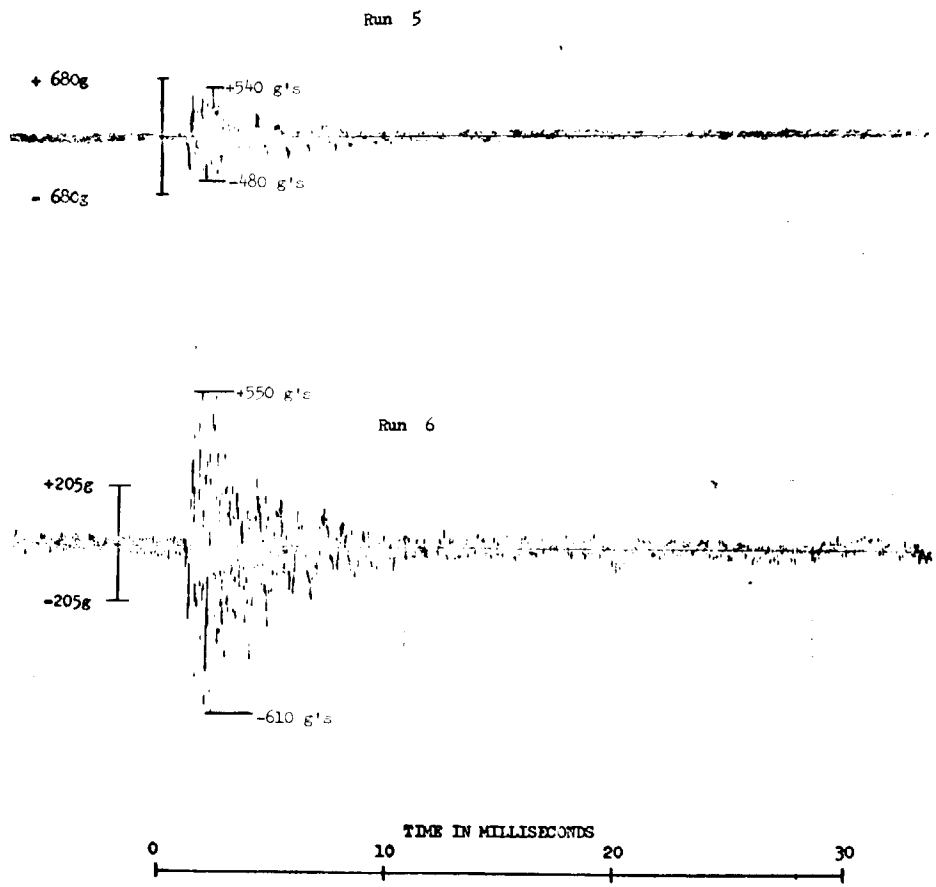


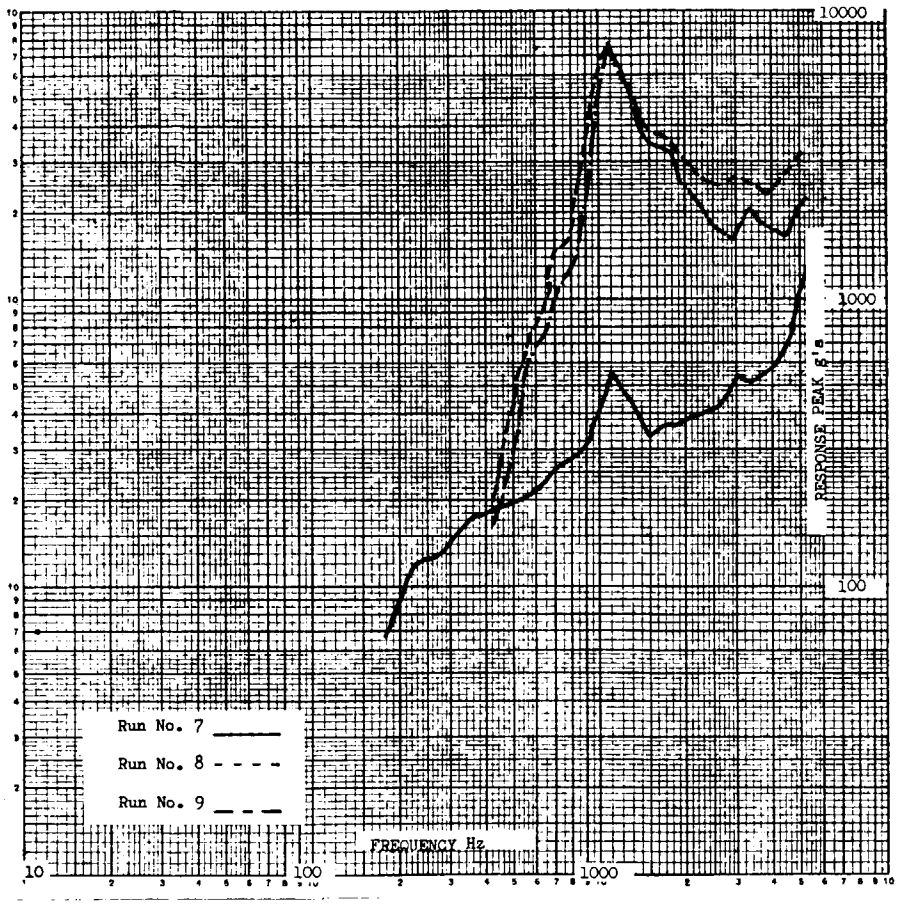
FIGURE I.A.5-82

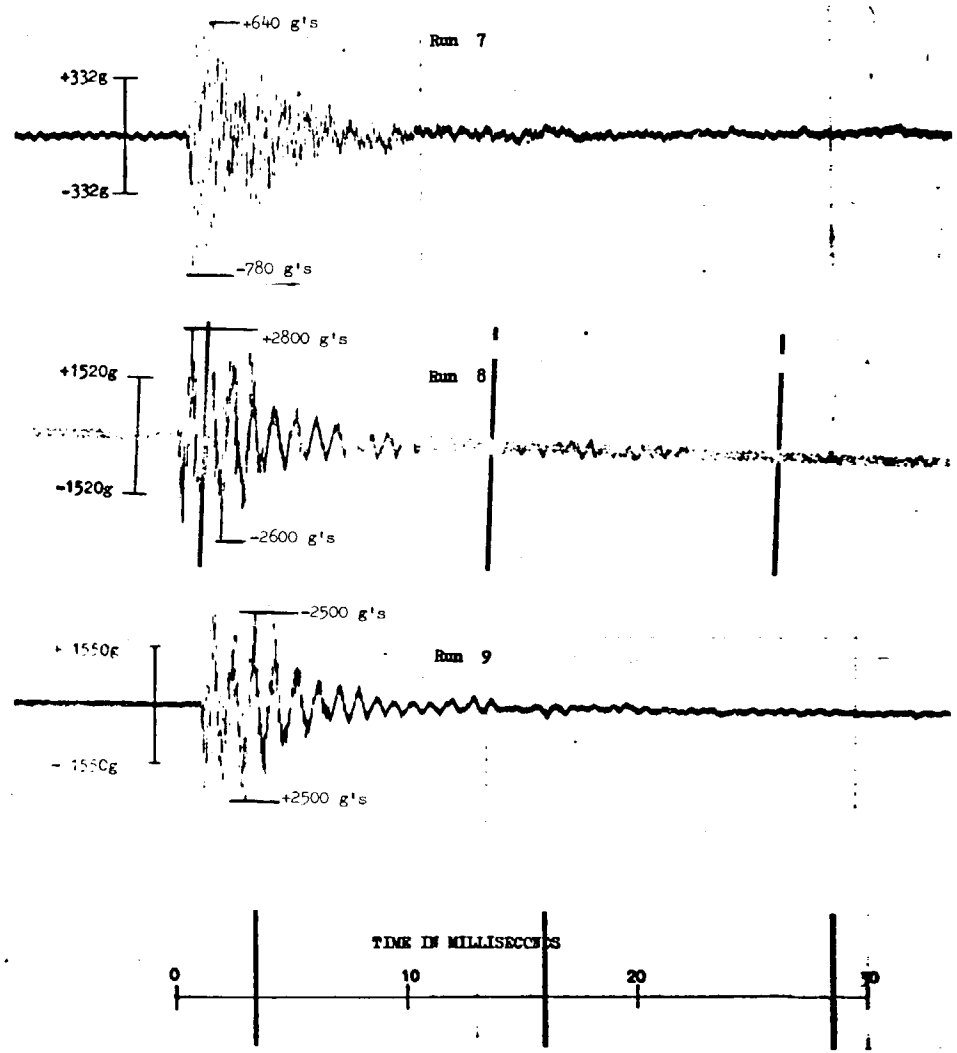




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 11-T PBPS
YAW ENGINE #2
RUN NO. 5,6

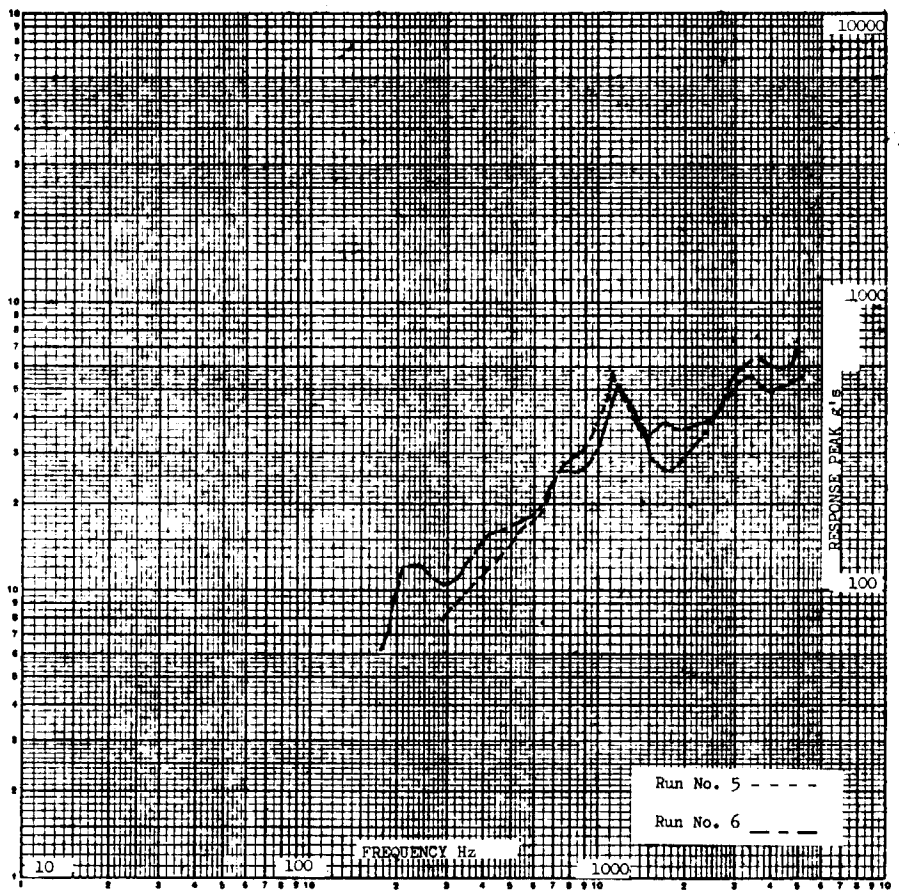
FIGURE 1.A.5-81

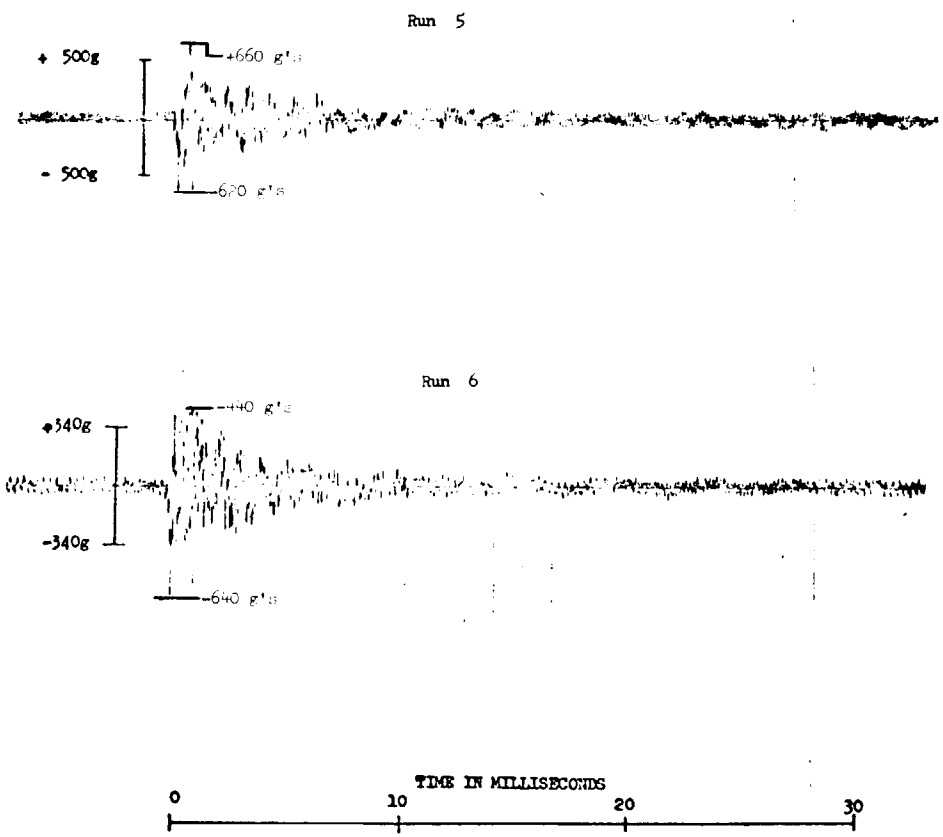




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 11-R PBPS
YAW ENGINE #2
RUN NO. 7, 8, 9

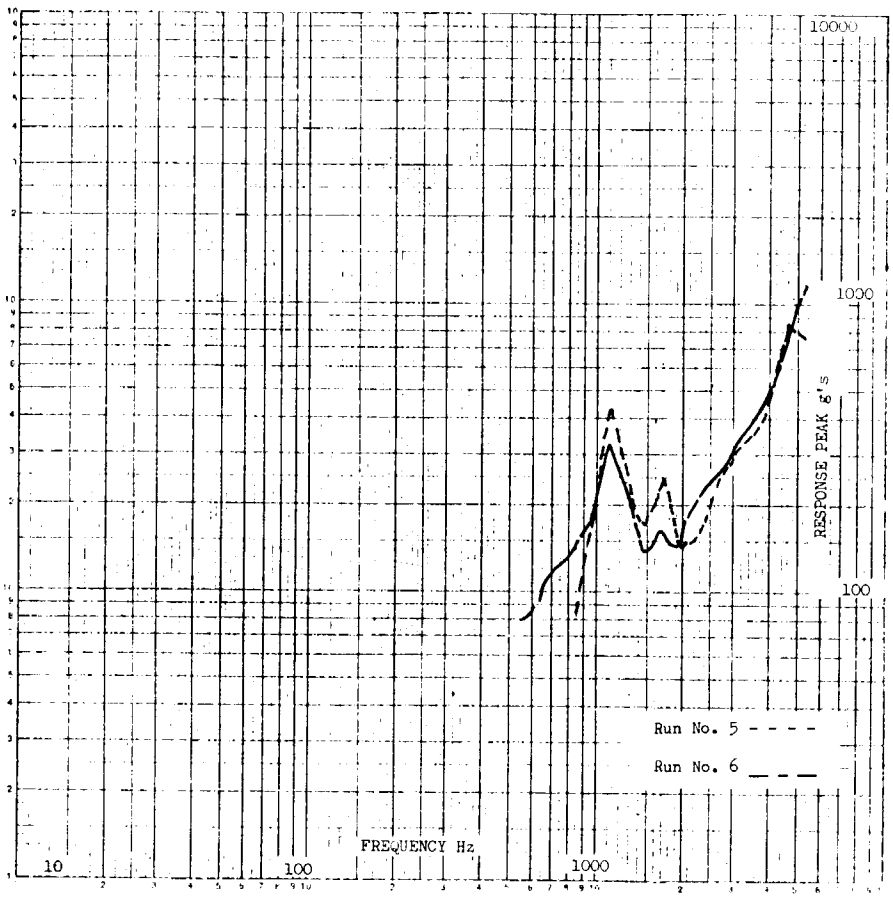
FIGURE I.A.5-80

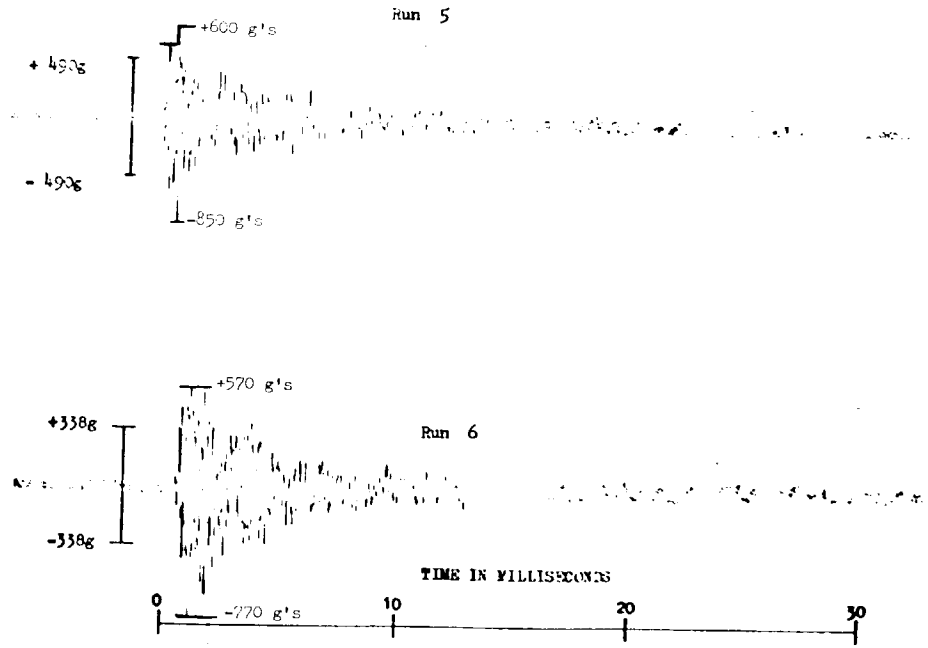




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 11-R PBPS
YAW ENGINE #2
RUN NO. 5,6

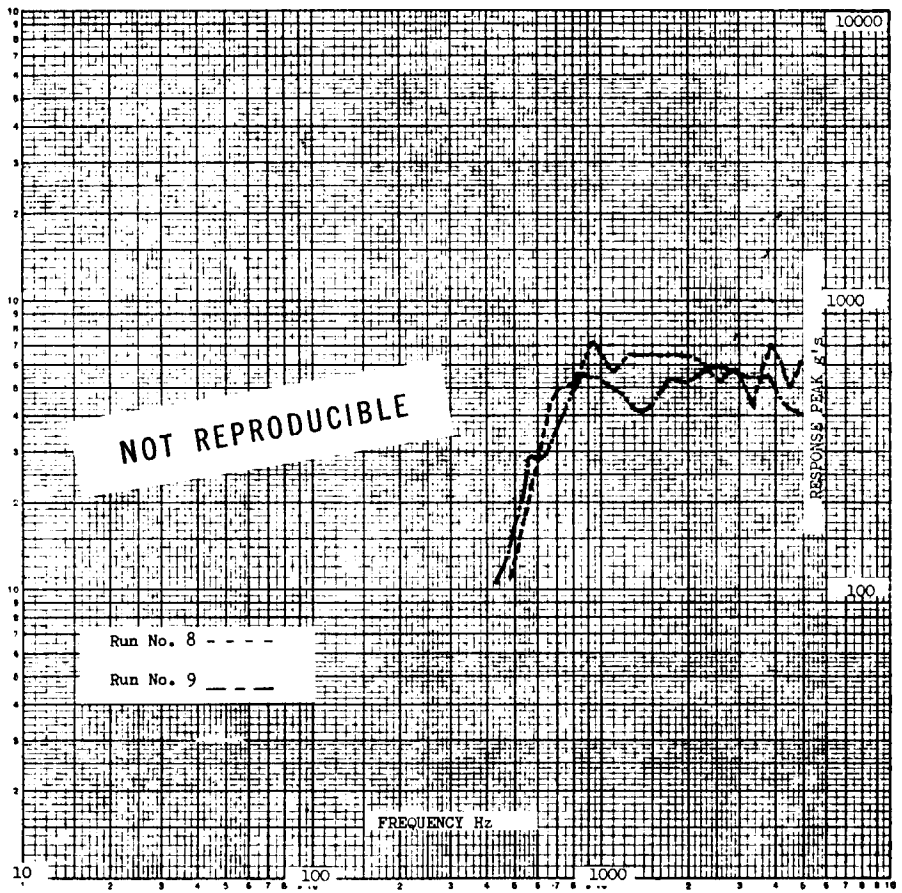
FIGURE I.A.5-79

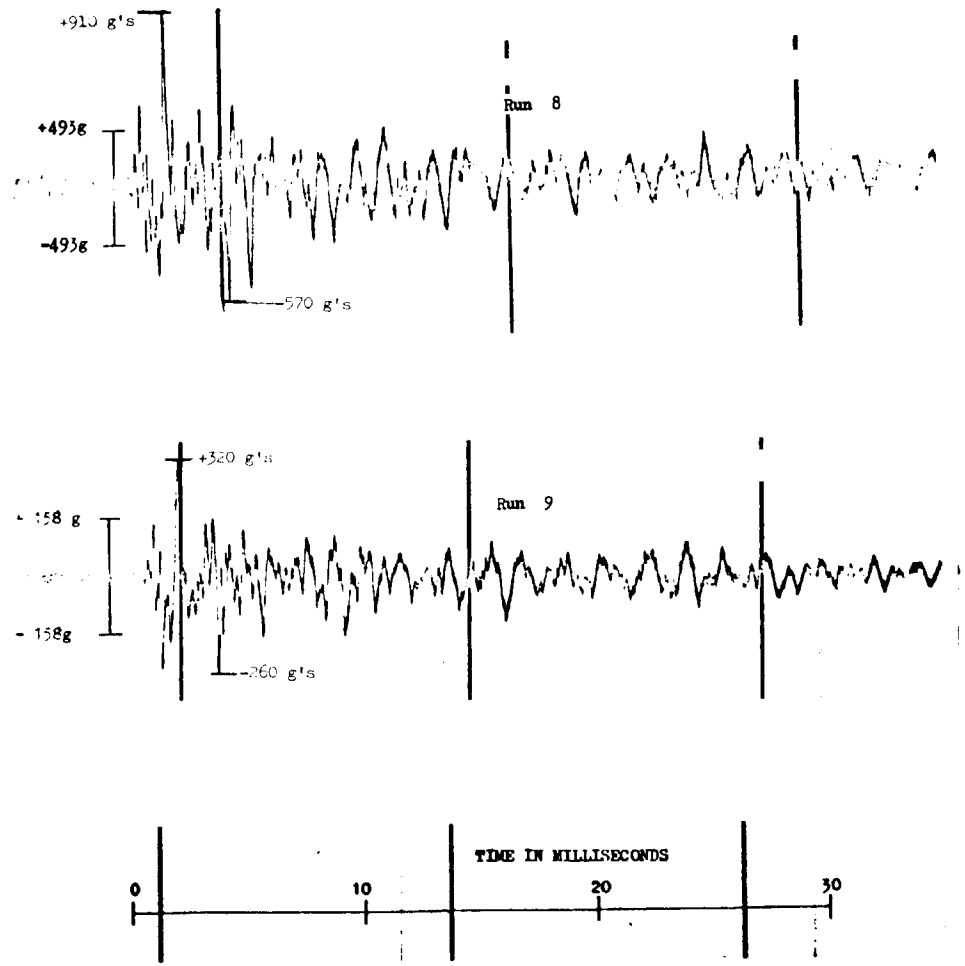




PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 11-Z PBPS
YAW ENGINE #2
RUN NO. 5,6

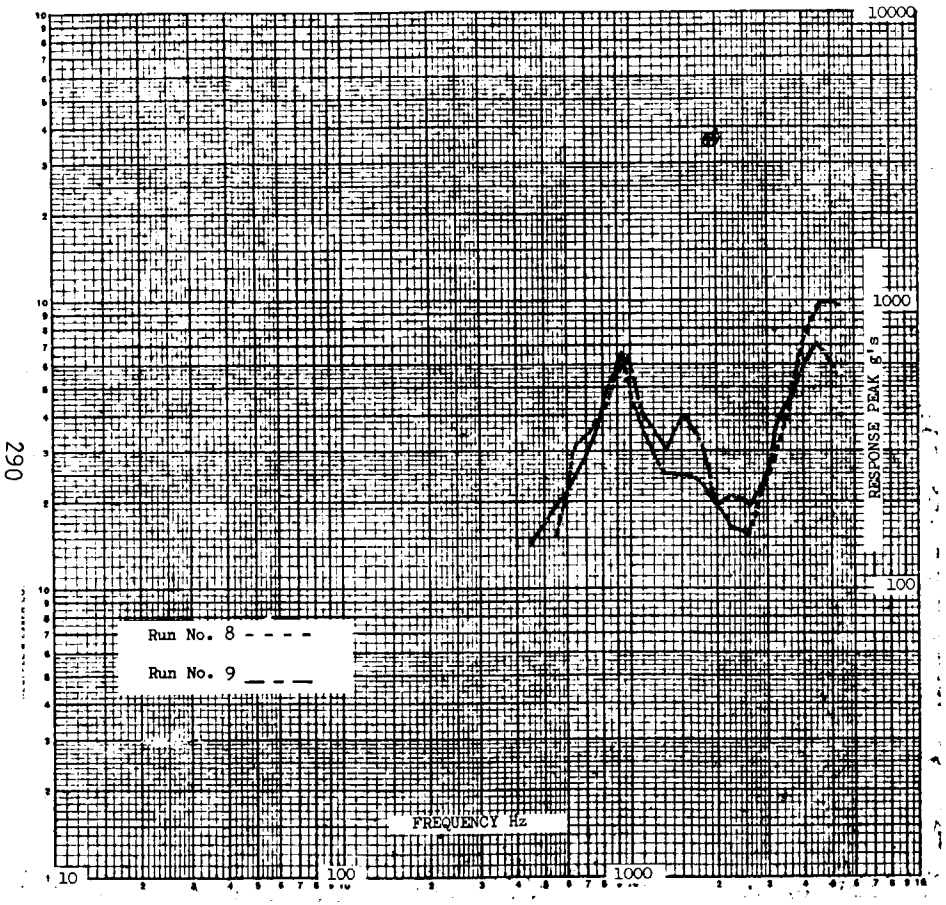
FIGURE I.A.5-78





PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 9-T PBPS
ROLL ENGINE #2
RUN NO. 8,9

FIGURE I.A.5-77



PBV SHOCK DETERMINATION TEST
--SYAGE III/PBV STAGING
LOC. 9-R PBPS
ROLL ENGINE #2
RUN 8,9

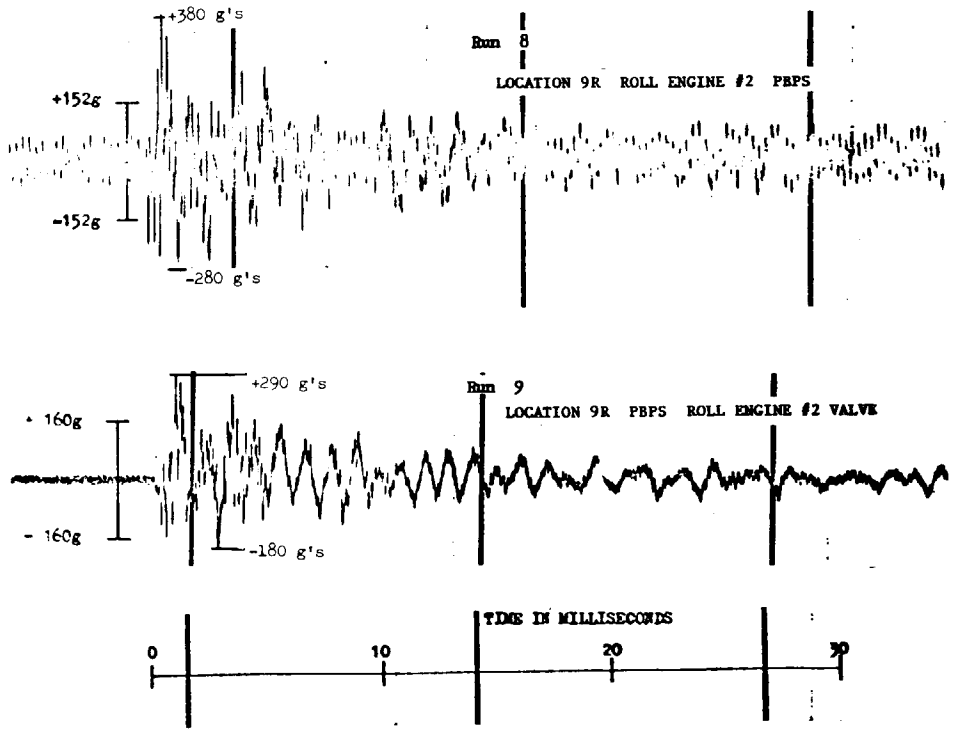
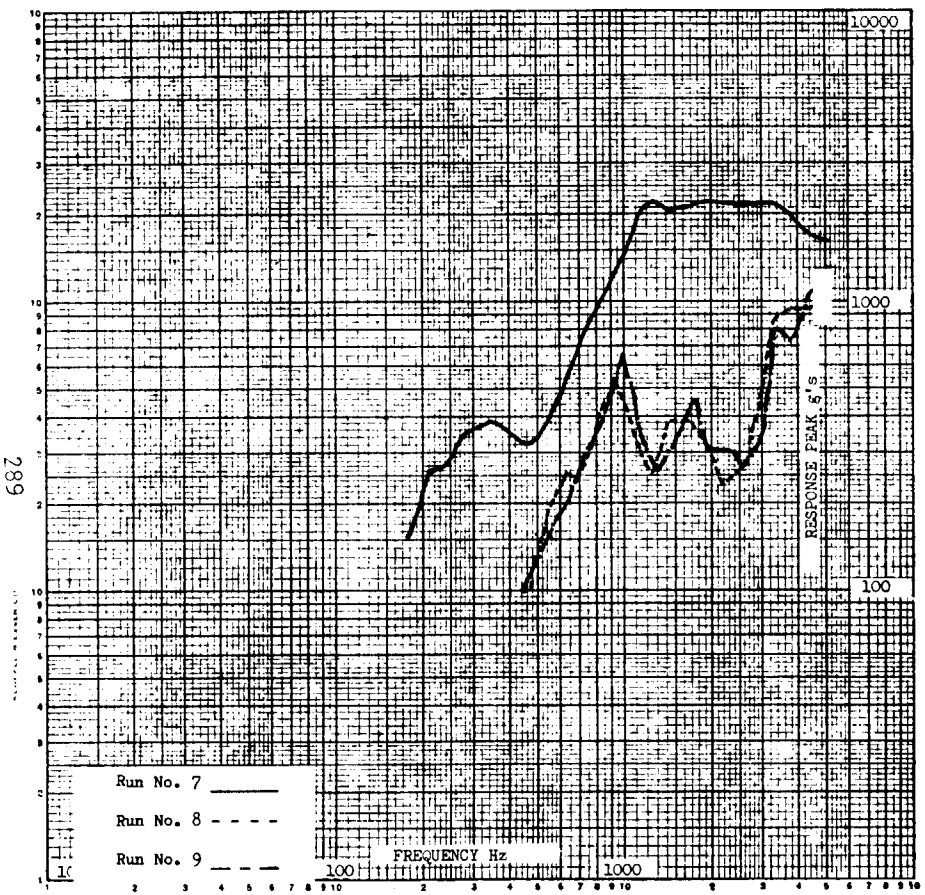


FIGURE 1.A.5-76



PBV SHOCK DETERMINATION TEST
--STAGE III/PBV STAGING
LOC. 9-Z PBPS
ROLL ENGINE #2
RUN NO. 7, 8, 9

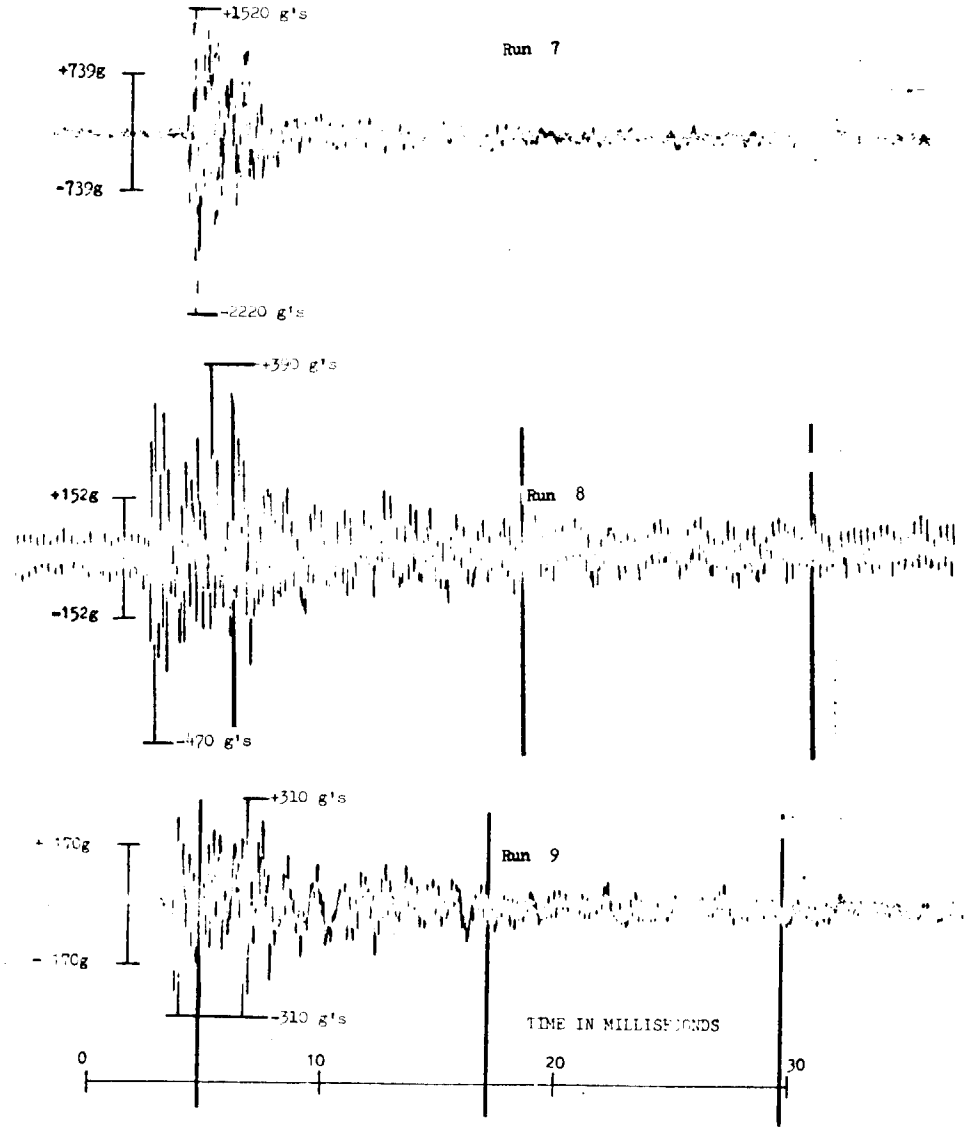
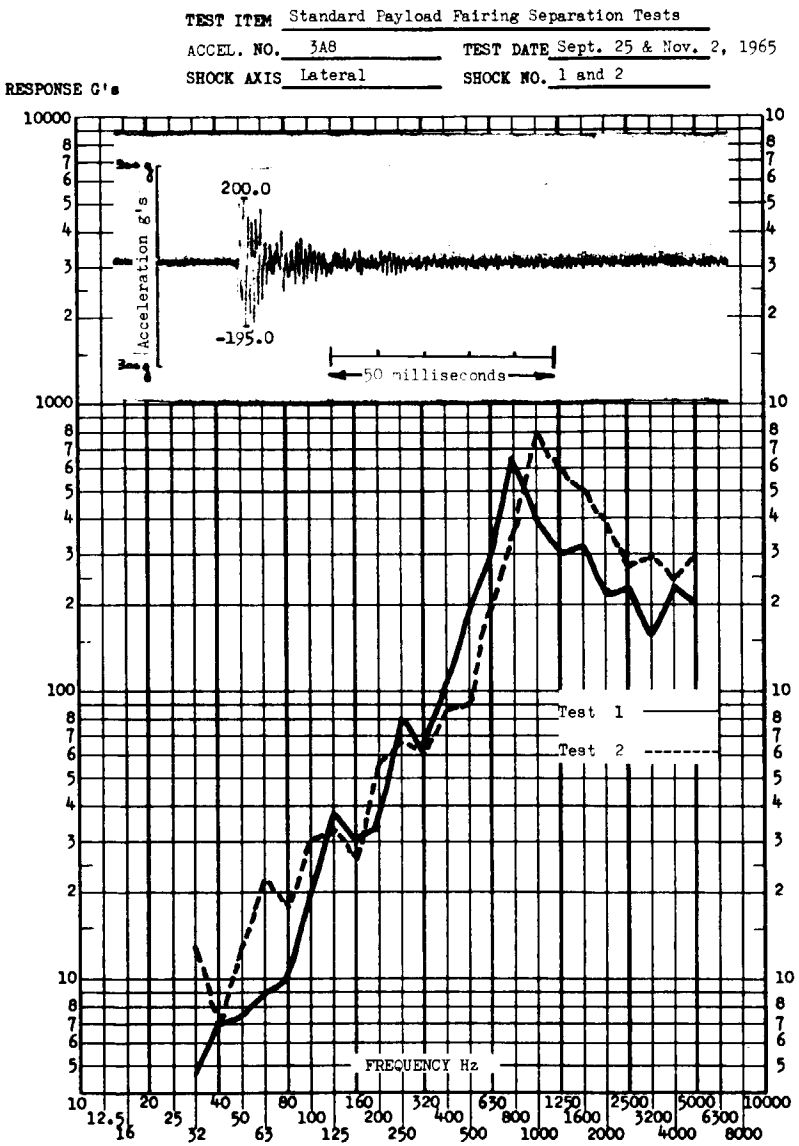


FIGURE I.A.5-75



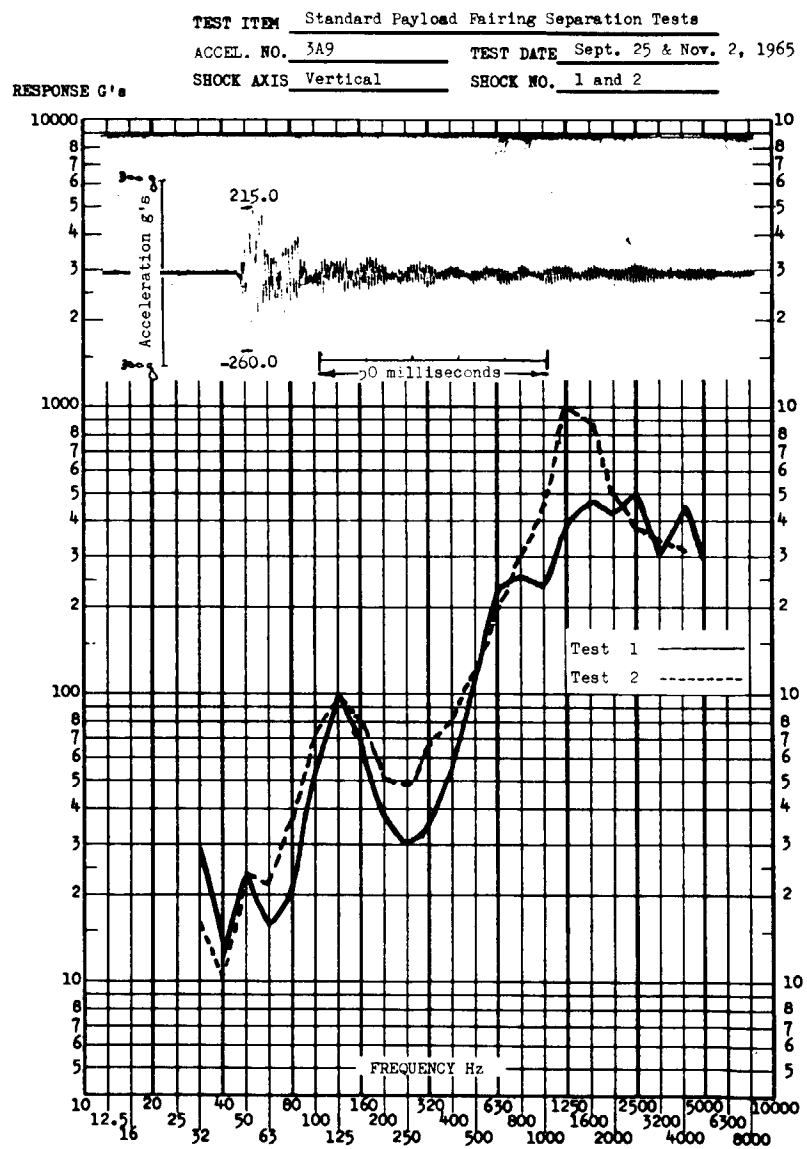
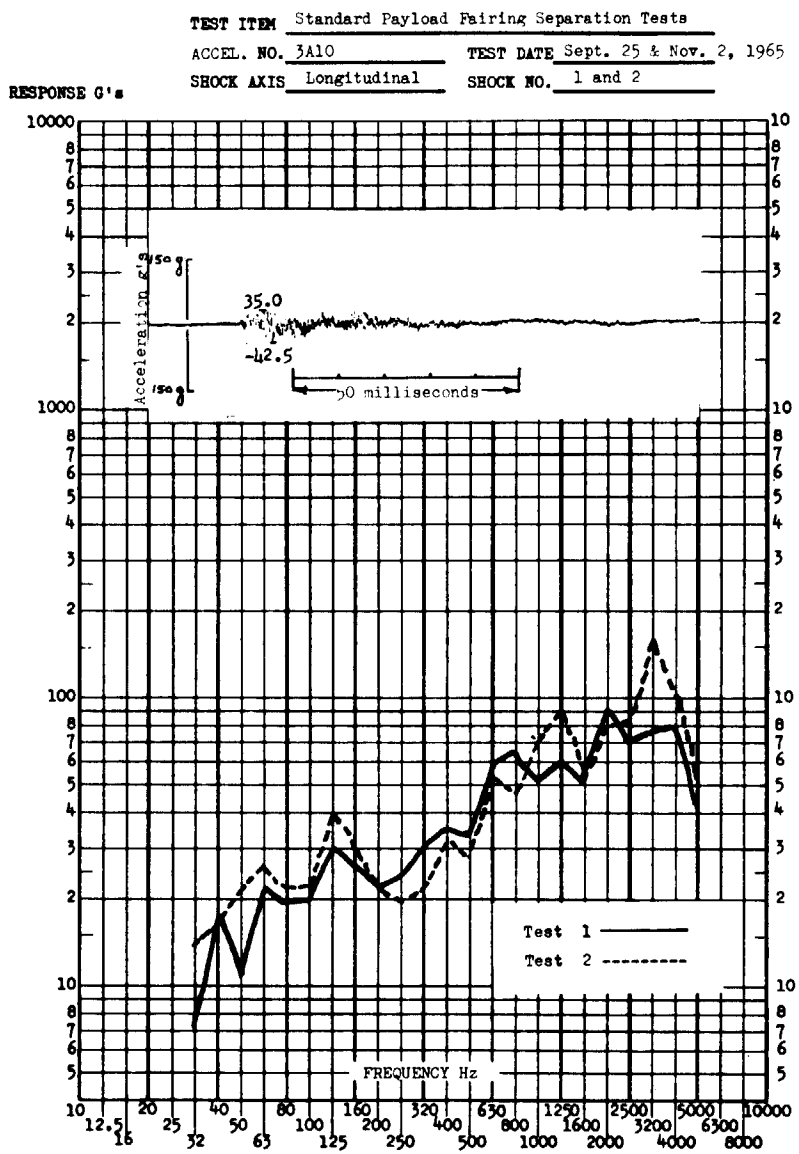


FIGURE I.B.1-10



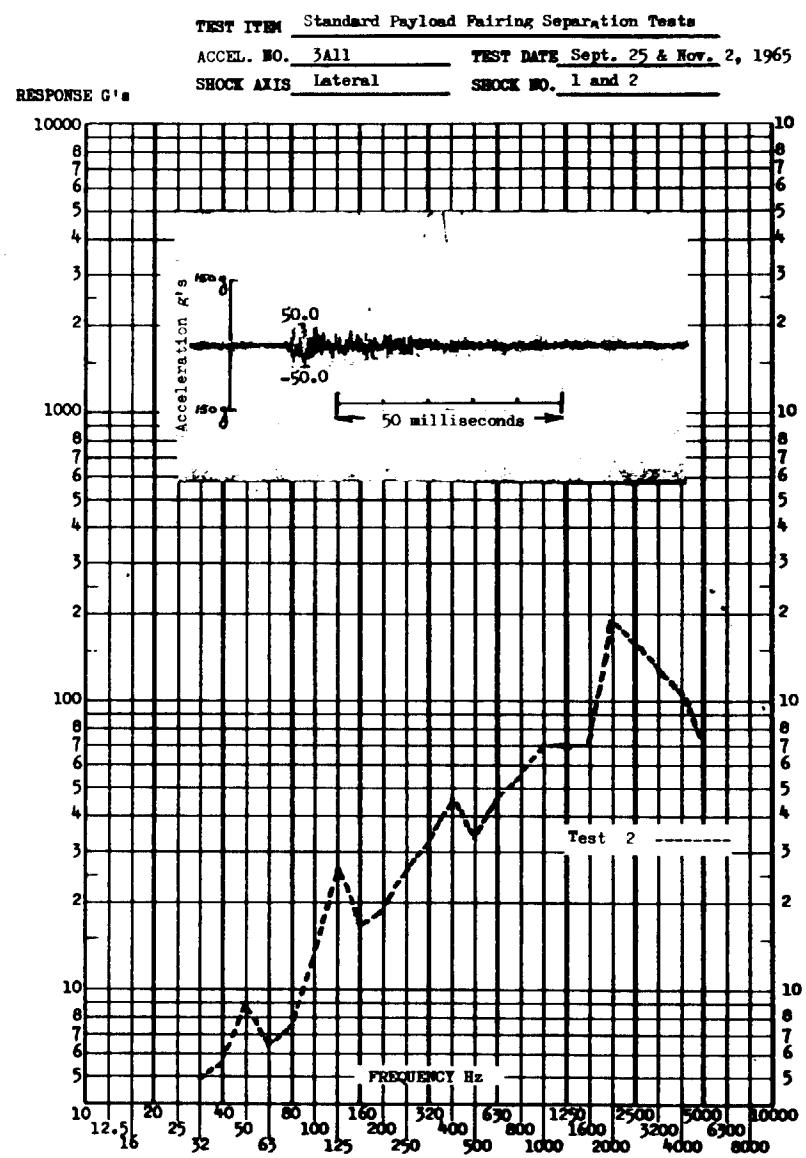
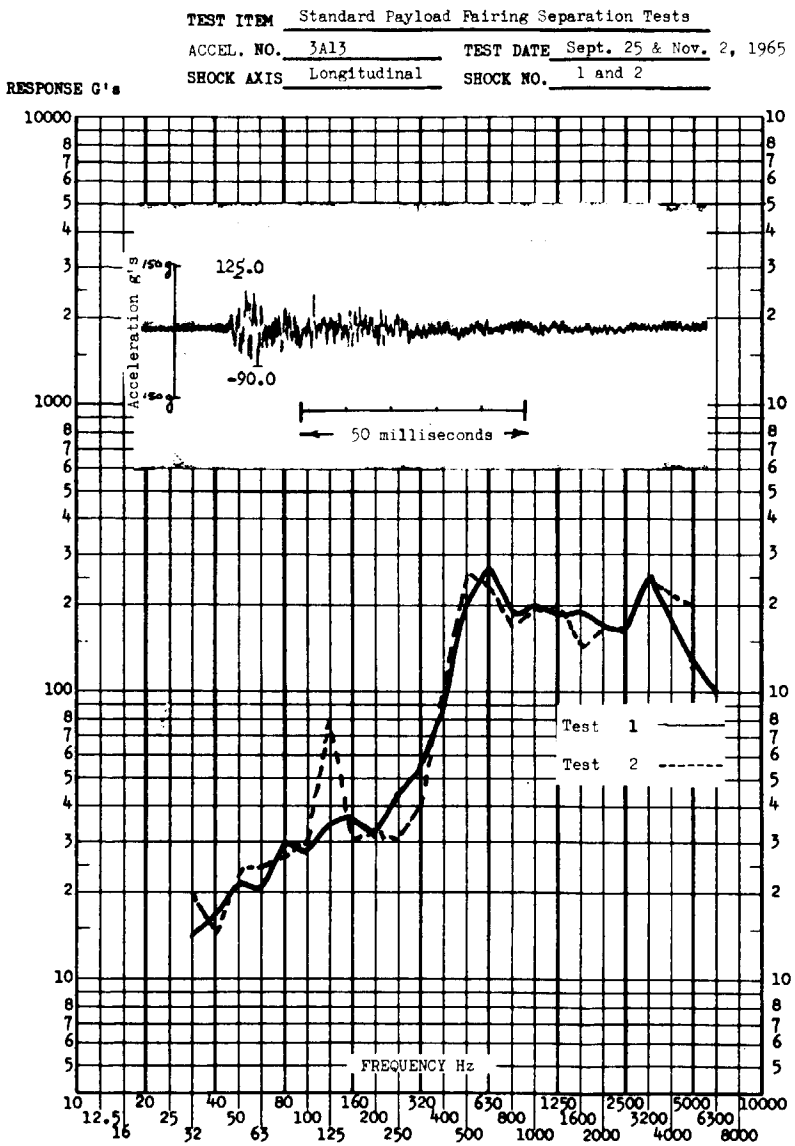


FIGURE 1.B.1-11



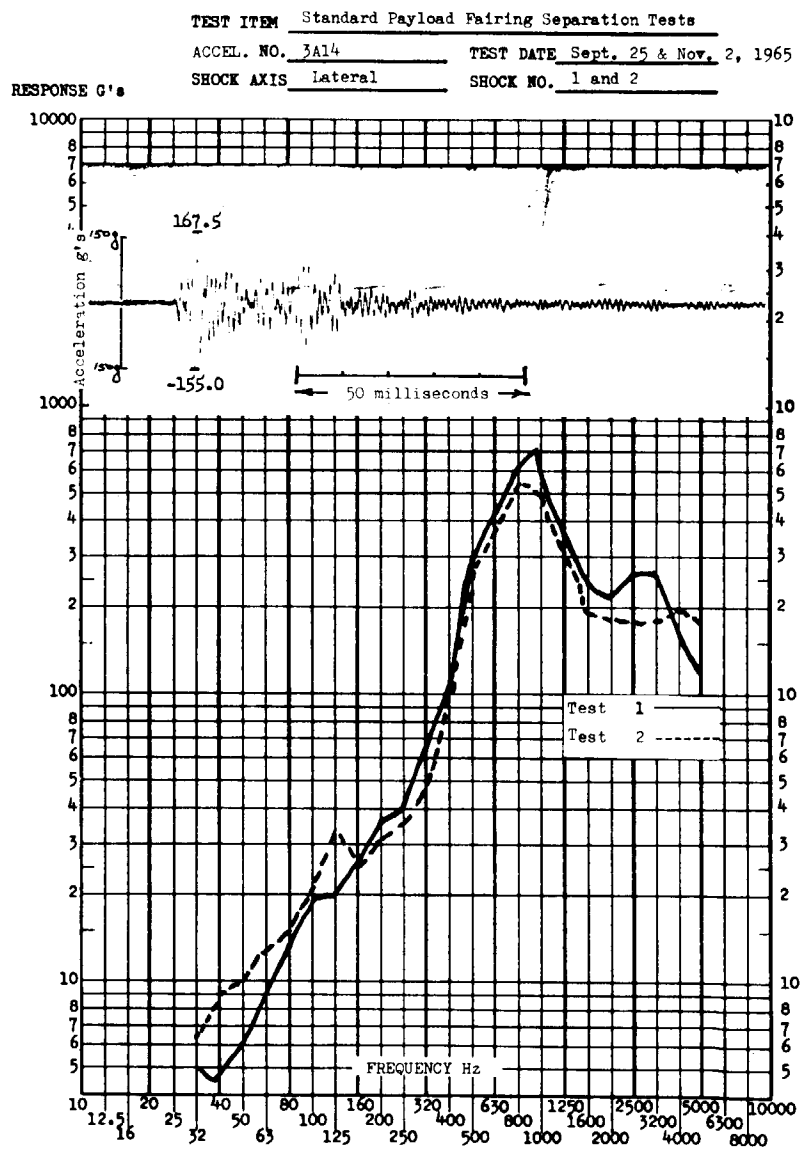
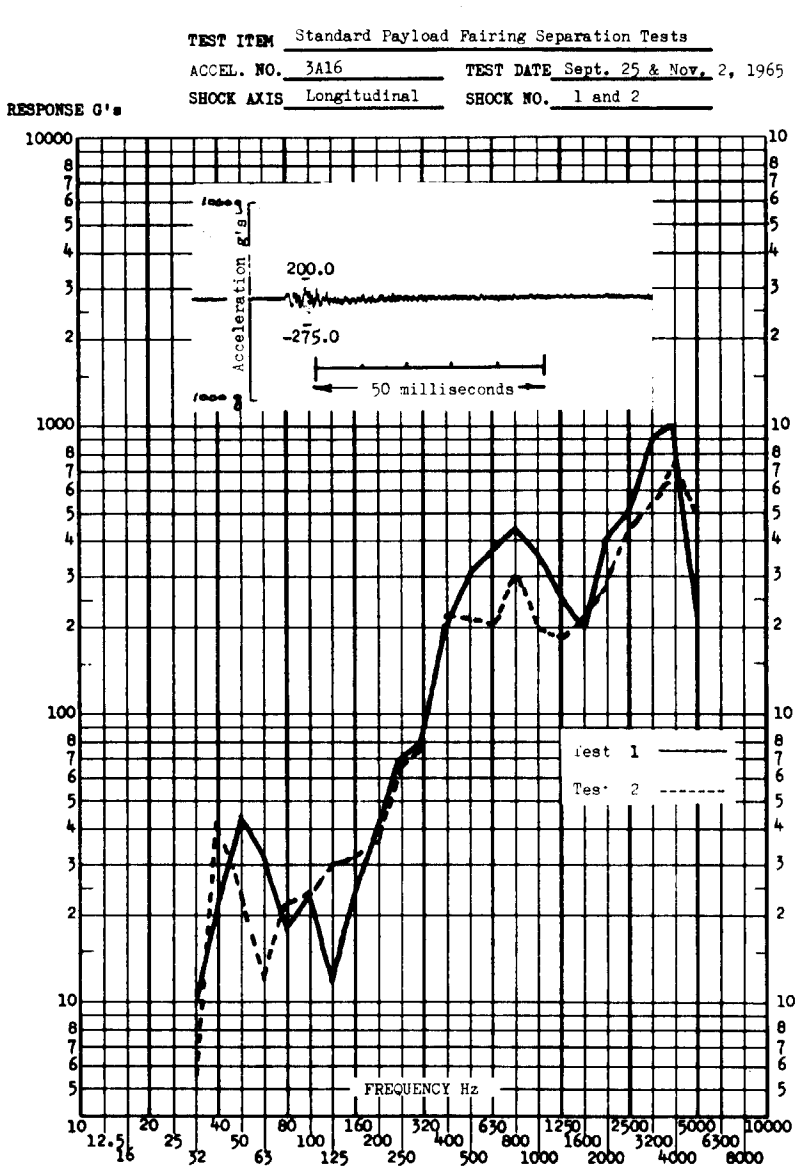


FIGURE I.B.1-12



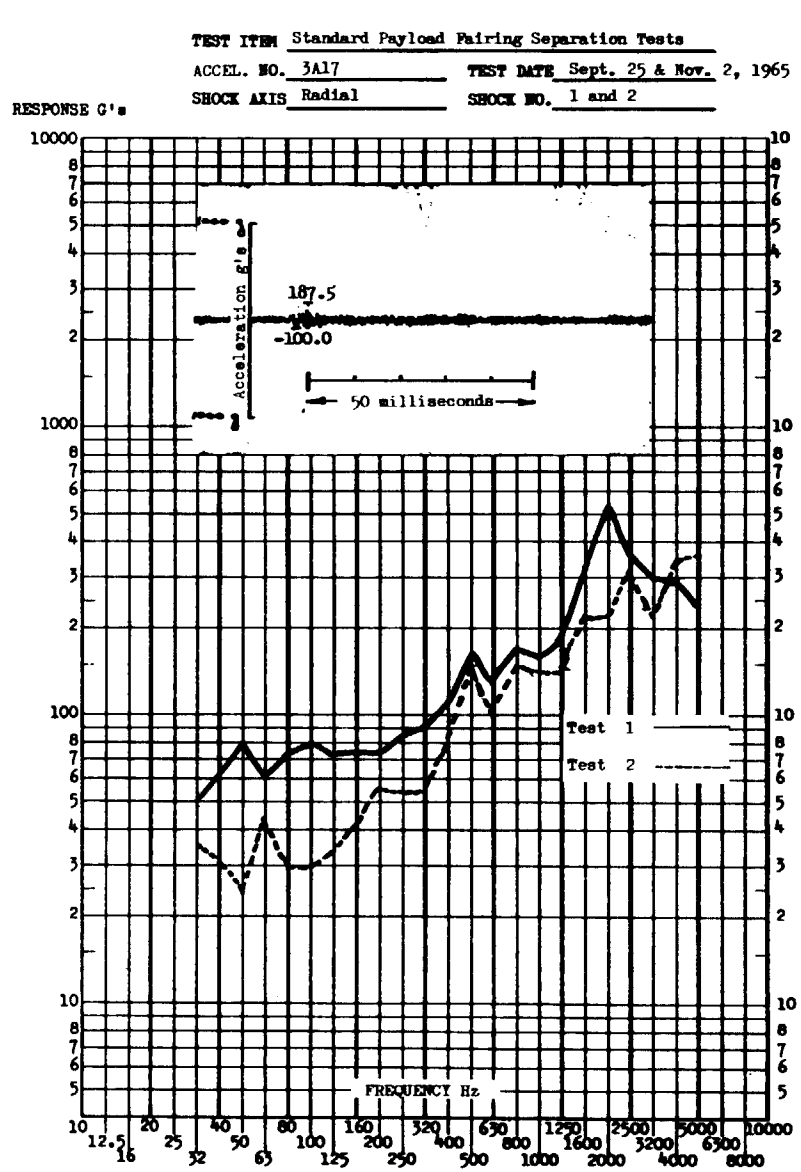
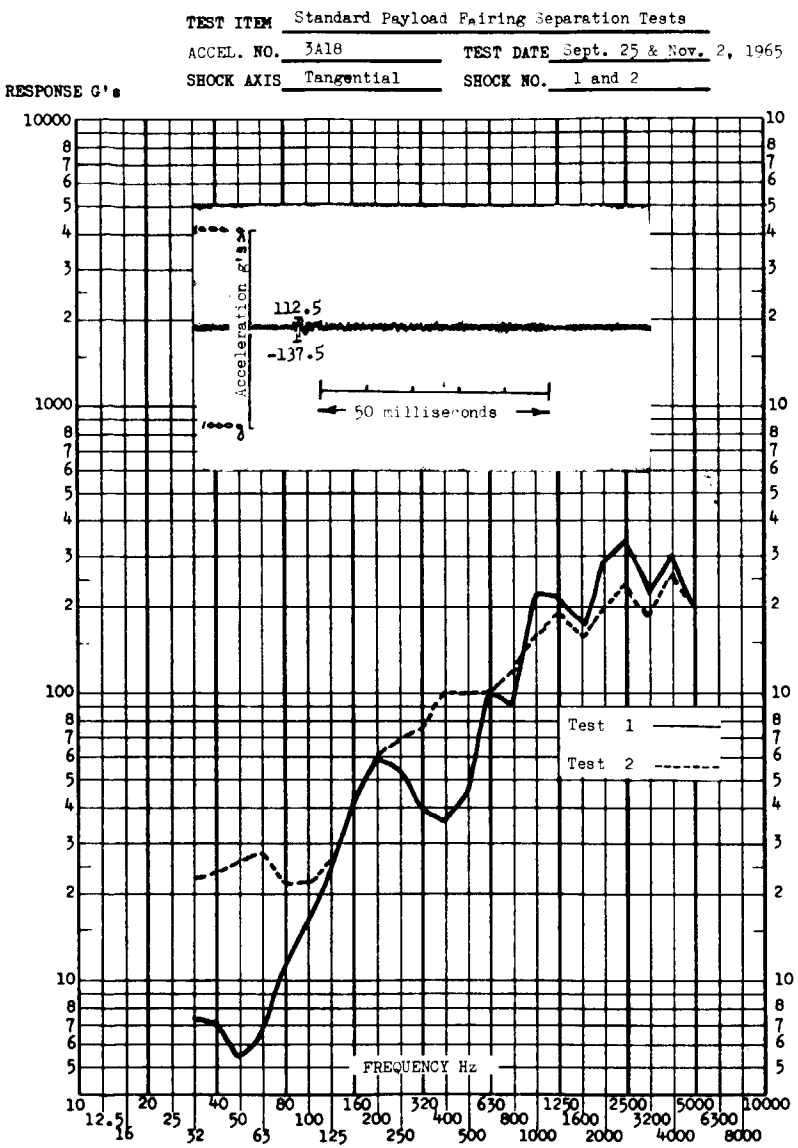


FIGURE 1.B.1-13



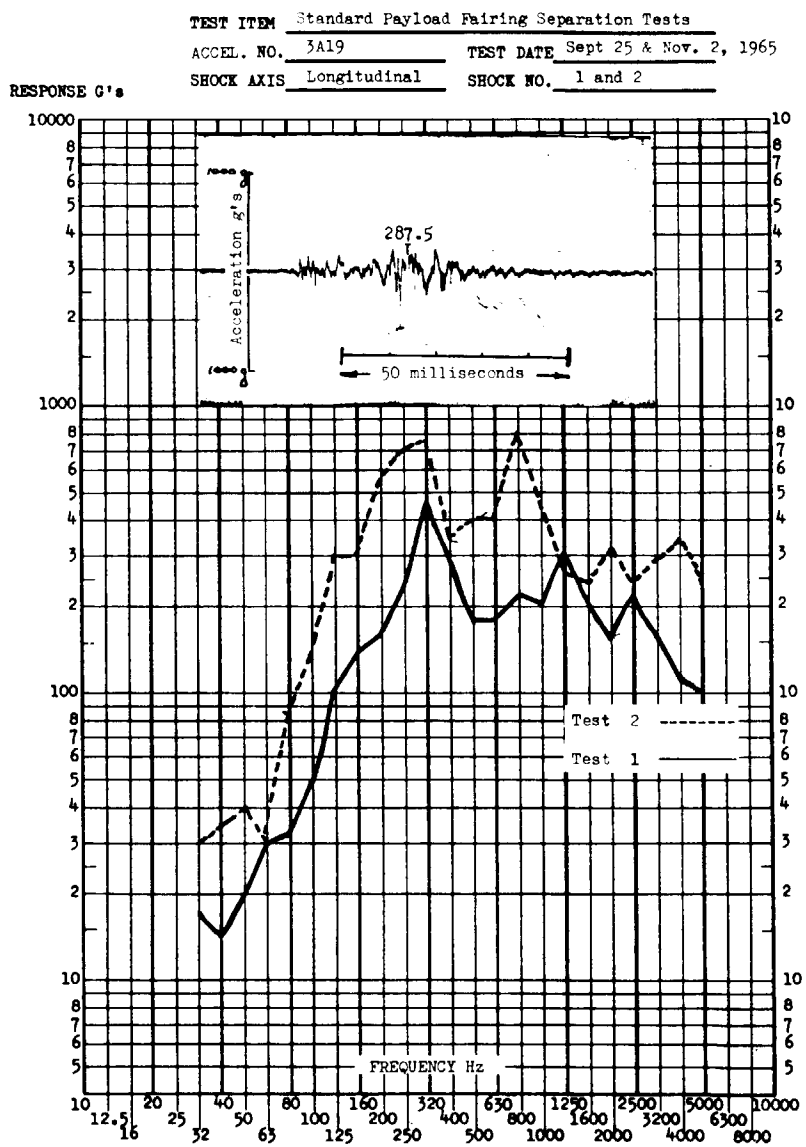
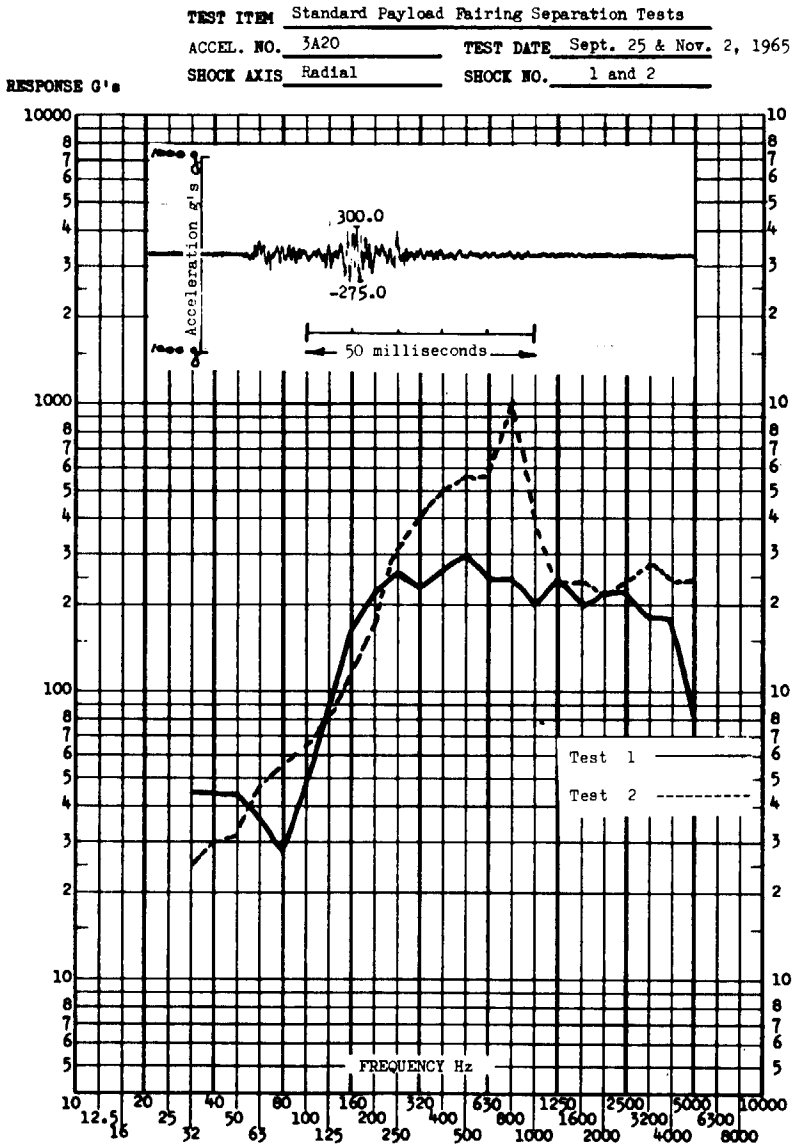


FIGURE I.B.1-14



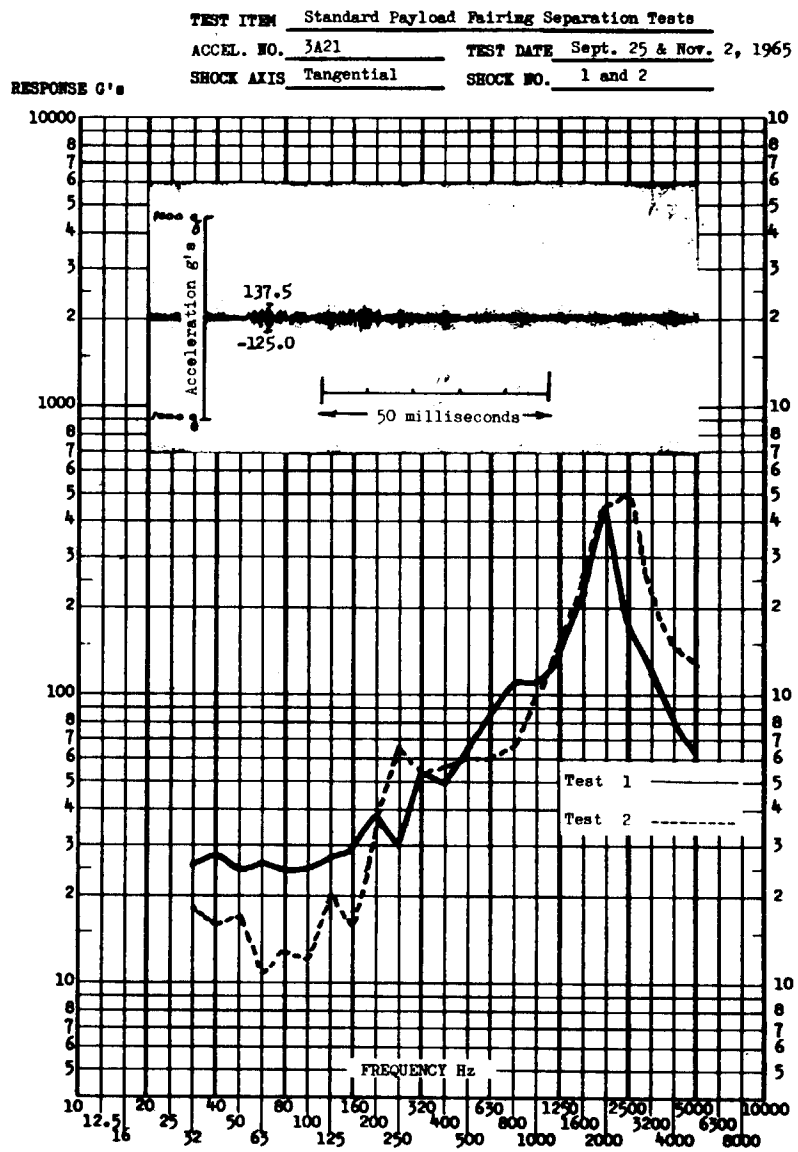
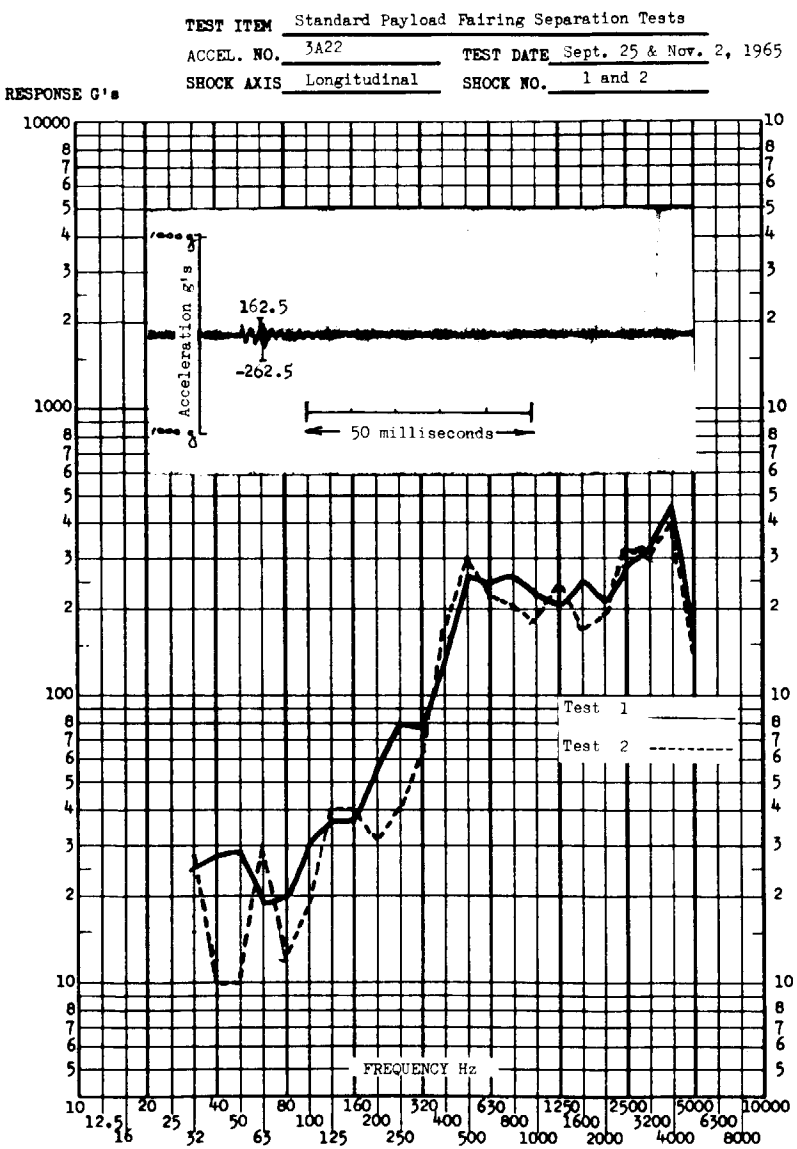


FIGURE I.B.1-15



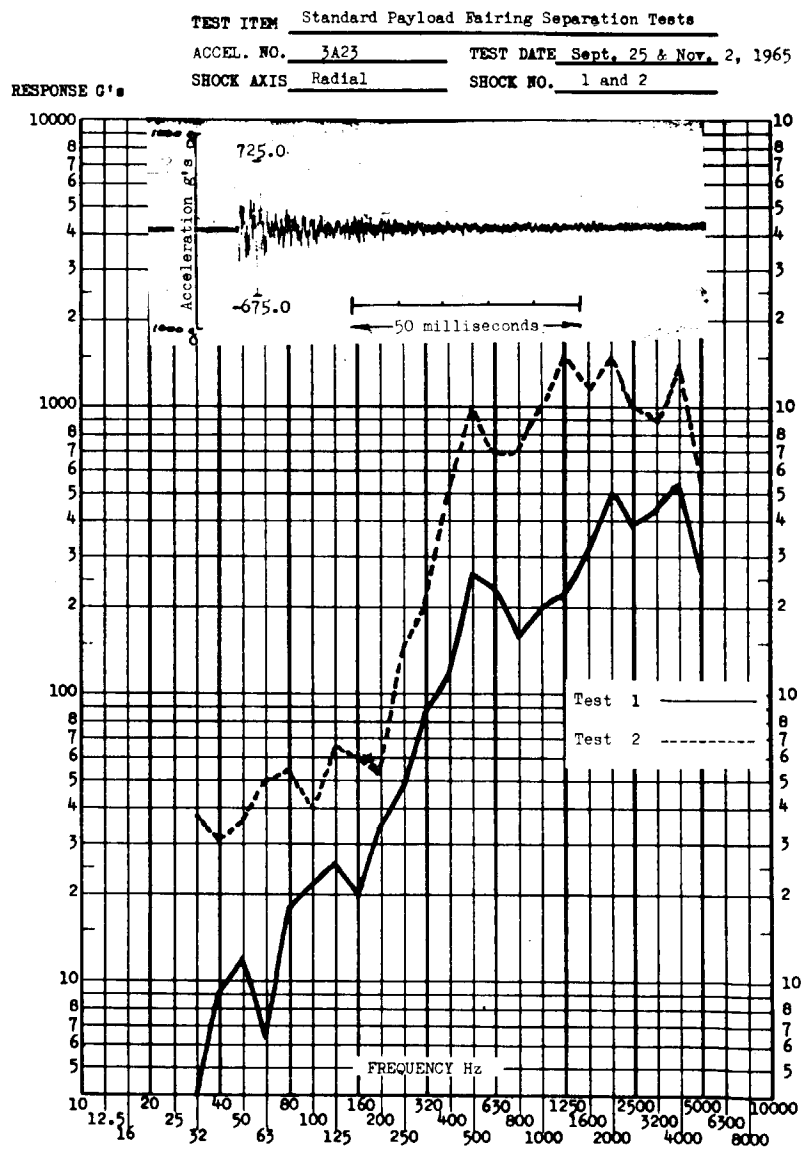
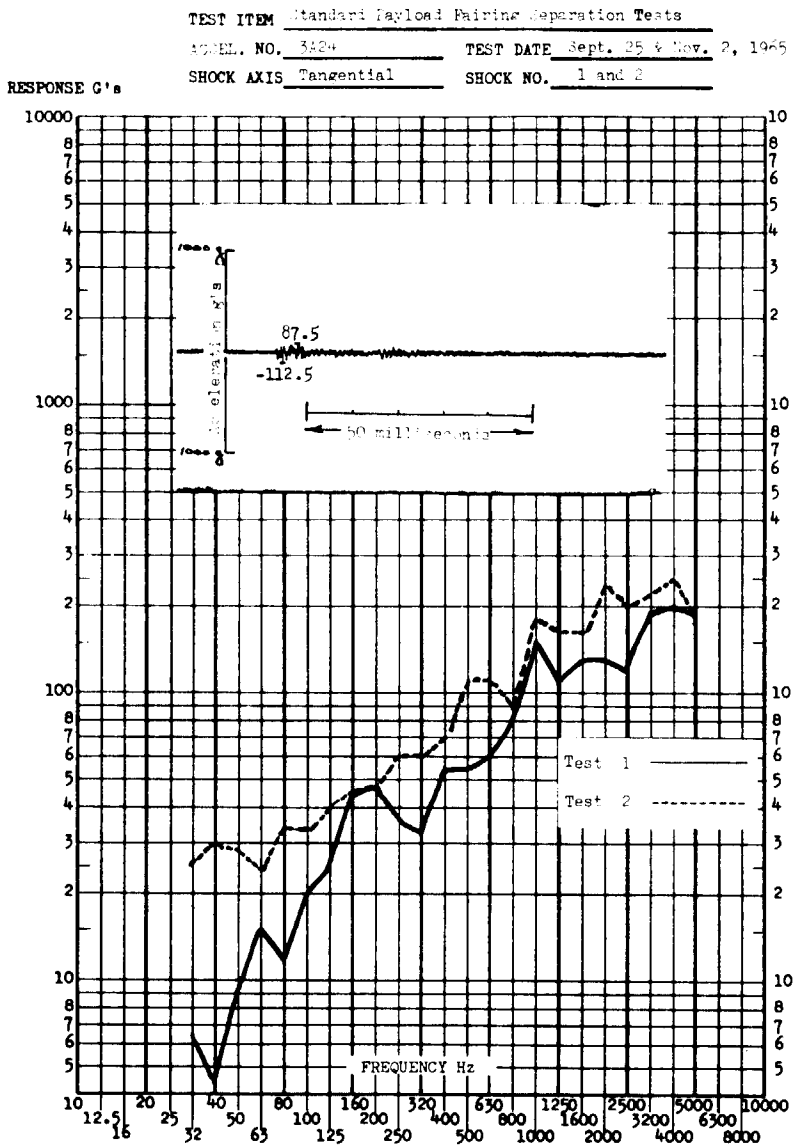


FIGURE I.B.1-16



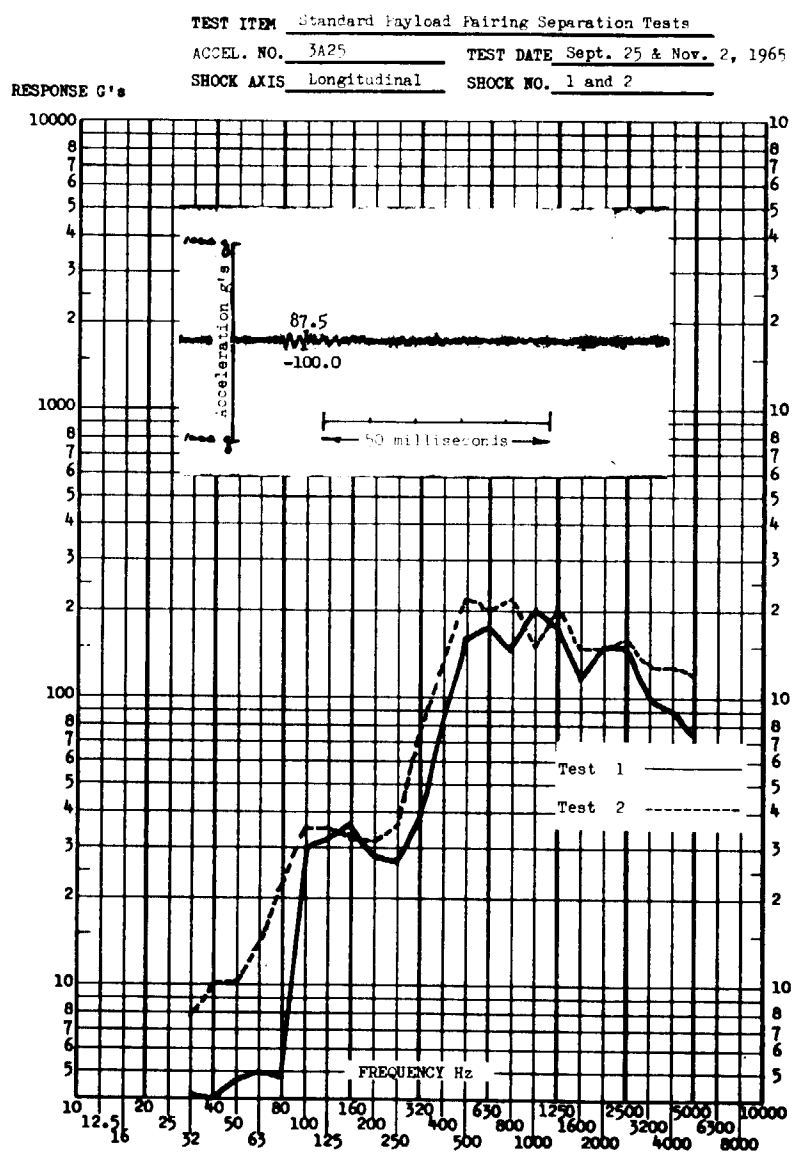
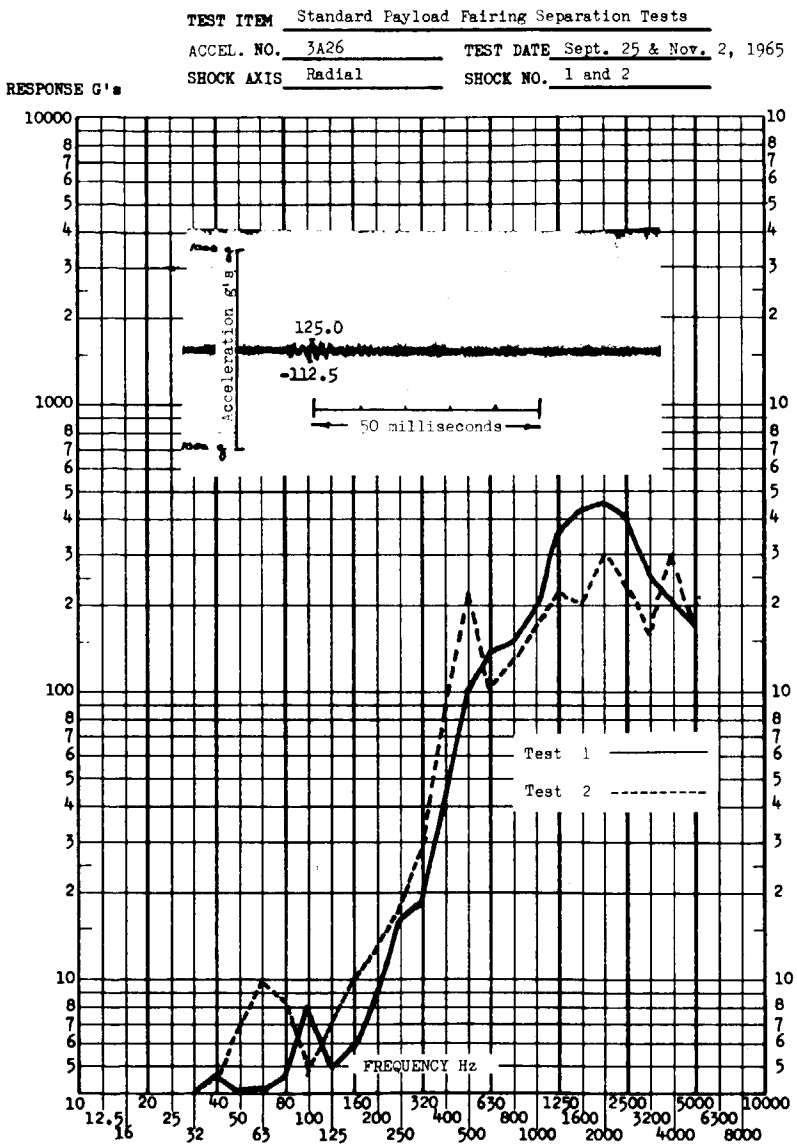


FIGURE I.B.1-17



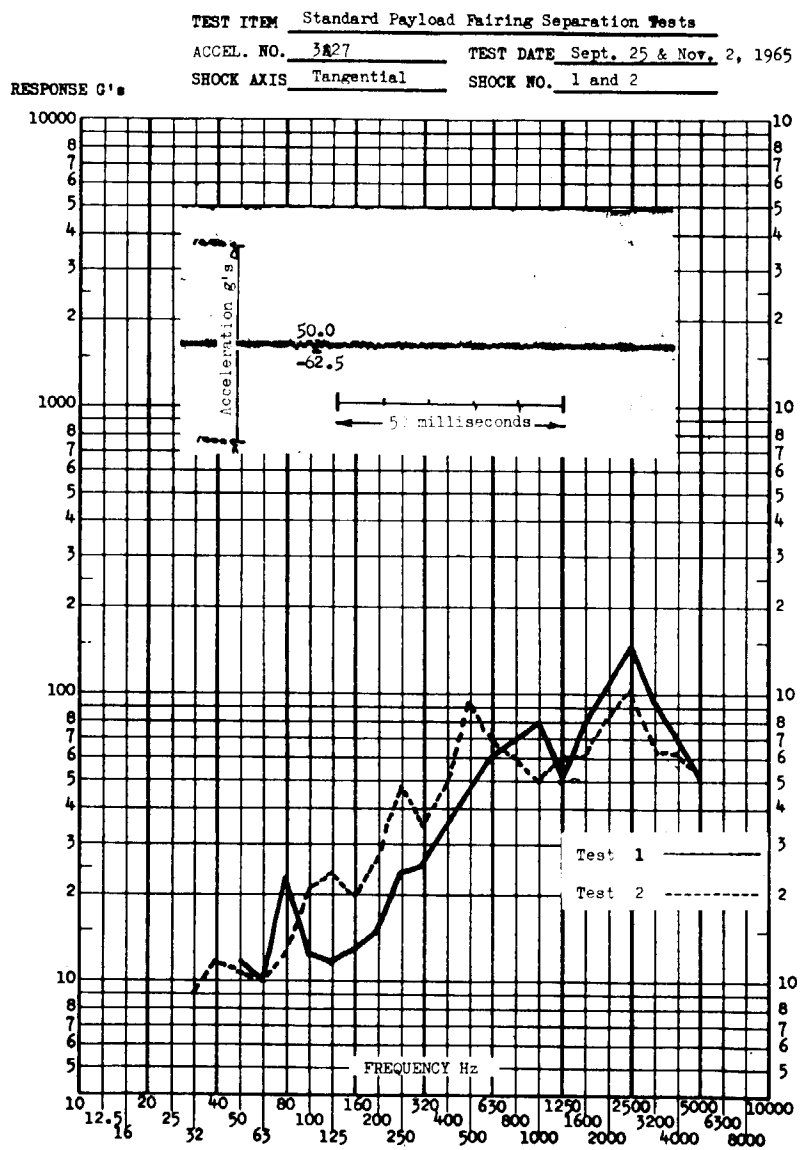


FIGURE I.B.1-18

SECTION I.B.2

TITAN IIIC DOUGLAS METAL FAIRING SEPARATION TEST

PURPOSE OF TEST

The purpose of this test was to obtain the shock levels produced in the Titan IIIC transtage by the pyrotechnic separation of the Metal Fairing.

DESCRIPTION OF EVENT

In this test the Douglas Metal Fairing was mounted over a dummy payload atop a Titan IIIC transtage in the vertical orientation as illustrated in Figures I.B.2-1 and I.B.2-2. The fairing was then separated into two longitudinal segments by means of twin strands of primaline at four grains per foot housed within a bellows assembly. The expanding bellows then caused the rivets in the separation joint to shear, and continued expansion of the bellows forced the fairing halves to drop away from the instrumented transtage where the data were recorded.

DESCRIPTION OF DATA

Twenty-four accelerometers were monitored during the test. Time histories and the results of both digital and analog shock spectrum analyses are presented. Various information about the data are listed below:

Number of time histories 24

Duration	Table I.B.2-1
Number of digital shock spectra	24
Sample rate	12,500/sec
Frequency range	30-5000 Hz
Frequency increments	3 points per octave
Damping	Q=10
Number of analog shock spectra	24
Analog machine	Ling SSA-100
Frequency range	50-10,000 Hz
Frequency increments	3 points per octave
Damping	Q=10

These shock spectra are presented with their corresponding time histories as Figures I.B.2-7 through I.B.2-18. All shock spectra consist of absolute response accelerations.

DESCRIPTION OF PYROTECHNIC

Type: Primaline linear explosive within a bellows assembly Figure I.B.2-3

Size of charge: Twin strands at 4 grains per foot per strand

Location: Figures I.B.2-1 and I.B.2-2

DESCRIPTION OF STRUCTURE

Transtage skirt: Aluminum skin-ring frame with 0.028 skin thickness. See Figure I.B.2-6 for cross-sections of ring-frame and longerons (stringers).

Transtage guidance truss: Aluminum members of square cross-section 1.5 inch outer diameter and 0.0625 inch wall thickness.

DESCRIPTION OF ACCELEROMETERS

Type: Endevco model 2225

Locations: Table I.B.2-2 and Figures I.B.2-4 and I.B.2-5.

Axis of sensitivity: Table I.B.2-2

DESCRIPTION OF DATA ACQUISITION SYSTEM

Tape recorders: Ampex ES-100 (0-20,000 Hz frequency response).

Voltage amplifiers: Endevco model 2614A (2-20,000 Hz frequency response).

Power supply: Endevco model 2262

COMMENTS

Since the accelerometers 3A1, 3A2 and 3A16 through 3A24 were mounted on skin-ring-frame structure, the data for these measurements would logically fit in Part I.A while the data for the remaining measurements were taken from a truss structure and belong in Part I.B.

COMMENTS (CONT.)

Under "Description of Data" the frequency range for the digital shock spectra is indicated as 30-5,000 Hz. However, due to the rather low 12,500/second sampling rate, these shock spectra are probably not valid for frequencies above 1250 to 1600 Hz.

The data presented in this section include both analog and digital shock spectra for each of twenty-four measurements. The data for measurements 3A1, 3A5, 3A6, and 3A19 through 3A27 exhibit a definite lack of correlation between the two shock spectrum analyses. Since these inconsistancies are not confined to frequencies above 1250 Hz, they cannot be rationalized as inadequacies in the digital analysis.

TABLE I.B.2-1

DOUGLAS METAL PAYLOAD FAIRING SEPARATION

TEST ANALYSES TIME PERIOD

MEASUREMENT NUMBER	ANALYSIS TIME PERIOD (ms)*
3A1	20
3A2	20
3A4	40
3A5	40
3A6	40
3A7	40
3A8	40
3A9	40
3A10	40
3A11	40
3A13	40
3A14	40
3A16	20
3A17	20
3A18	20
3A19	30
3A20	40

TABLE I.B.2-1
(CONT.)

DOUGLAS METAL PAYLOAD FAIRING SEPARATION

TEST ANALYSES TIME PERIOD

MEASUREMENT NUMBER	ANALYSIS TIME PERIOD (ms)*
3A21	30
3A22	20
3A23	20
3A24	20
3A25	20
3A26	50
3A27	20

* Time after initiation of separation.

TABLE I.B.2-2

DOUGLAS METAL PAYLOAD FAIRING SEPARATION
TEST MEASUREMENT DESCRIPTION

Measurement Number	Location	Distance* (inches)	Sensitive Axis	Figure Number
3A1	Stringer 3C on Longeron	72	Long.	I.B.2-6
3A2	Station 114 at Guidance Truss Attach Point		Rad.	I.B.2-6
3A4	Guidance Truss at Mounting	68	Long.	I.B.2-7
3A5	Point of IMU Nearest the Truss		Vert.	I.B.2-7
3A6	Frame Attach		Lat.	I.B.2-8
3A7	Guidance Truss at Mounting Point	84	Long.	I.B.2-8
3A8	of ACSP Pulse Code		Lat.	I.B.2-9
3A9	Modulator		Vert.	I.B.2-9
3A10	Guidance Truss at Mounting	73	Long.	I.B.2-10
3A11	Point of Airborne Digital Computer	(48**)	Lat.	I.B.2-10
3A13	Guidance Truss at Mounting	63	Long.	I.B.2-11
3A14	Point of Adapter Programmer	(39**)	Lat.	I.B.2-11
3A16	Stringer 3C on Longeron		Long.	I.B.2-12
3A17	Station 77 Under Fairing Attach	36	Rad.	I.B.2-12
3A18	Point		Tang.	I.B.2-13
3A19	On Ring Frame at Target		Long.	I.B.2-13
3A20	Station 77 Under Fairing	3	Rad.	I.B.2-14
3A21	Attach Point		Tang.	I.B.2-14

TABLE I.B.2-2
(Continued)

Measurement Number	Location	Distance* (inches)	Sensitive Axis	Figure Number
3A22	Stringer 26C on Longeron	44	Long.	I.B.2-15
3A23	Station 77 Under Fairing		Rad.	I.B.2-15
3A24	Attach Point		Tang.	I.B.2-16
3A25	Payload Truss	132	Long.	I.B.2-16
3A26	Fairing - Adjacent to Separation Plane	73	Rad.	I.B.2-17
3A27	Payload Truss	132	Rad.	I.B.2-17

* Distance from shock source along solid frame members.

** Distance via removable stringer.

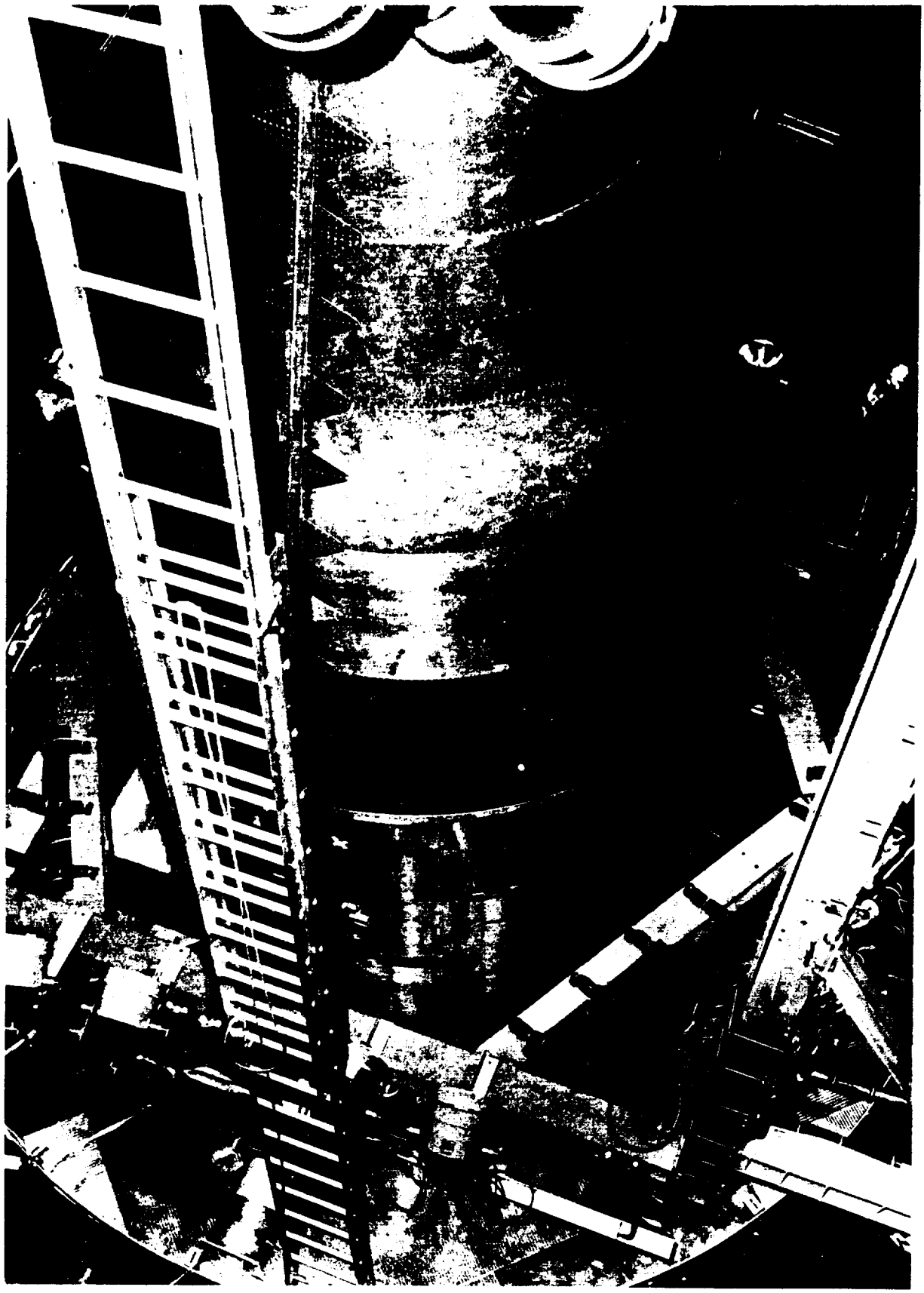


FIGURE I.B.2-1. FAIRING MOUNTED TO TRANSTAGE

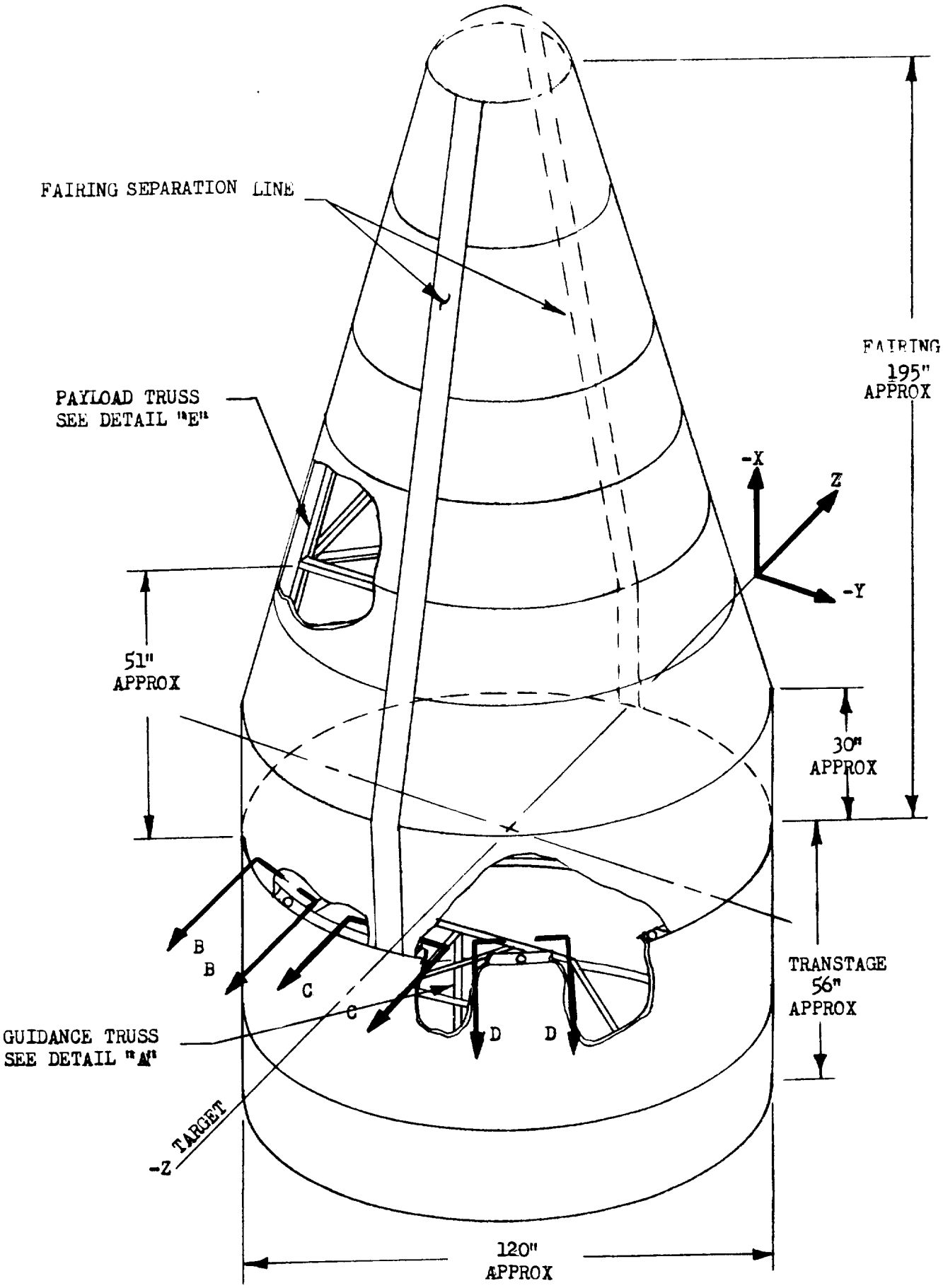


Figure I.B.2-2. Titan III-C Transtage with Metal Fairing

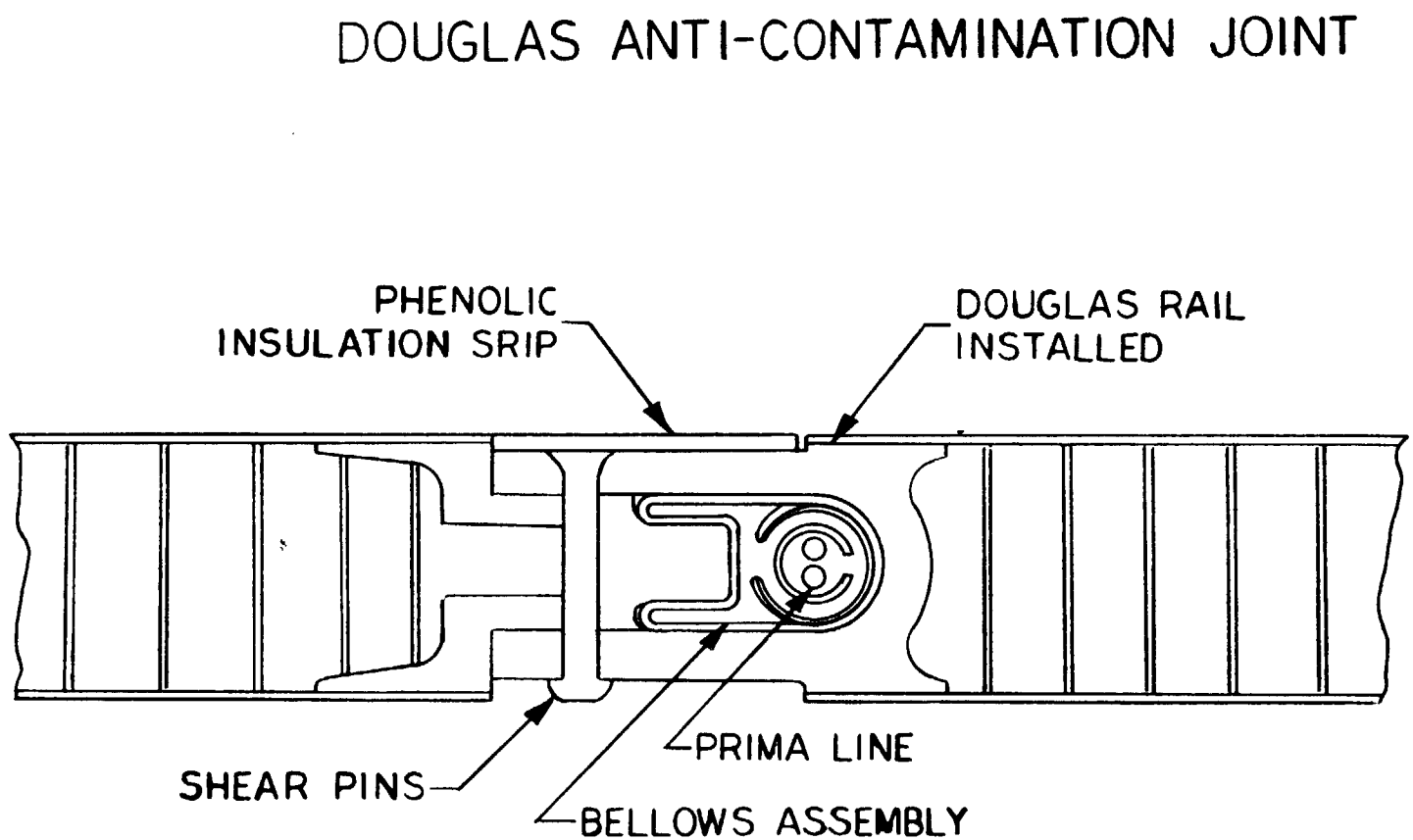
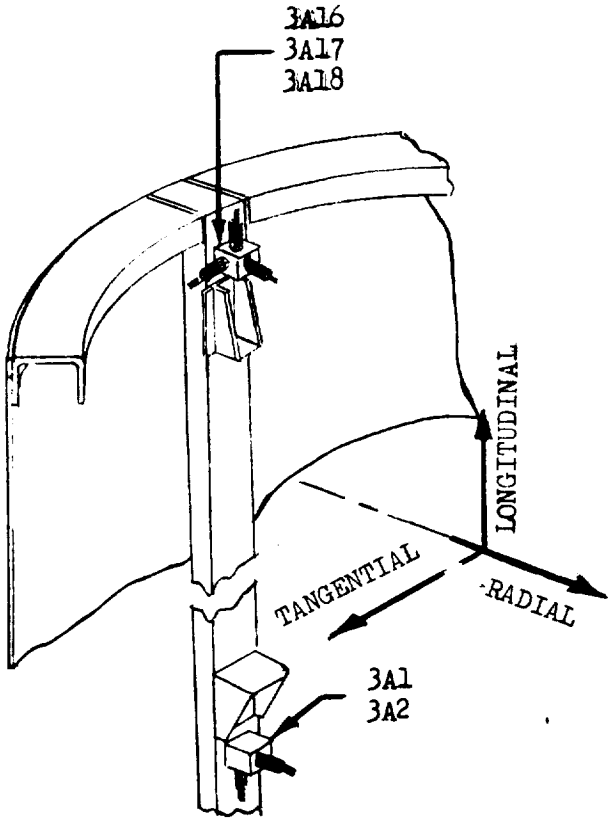
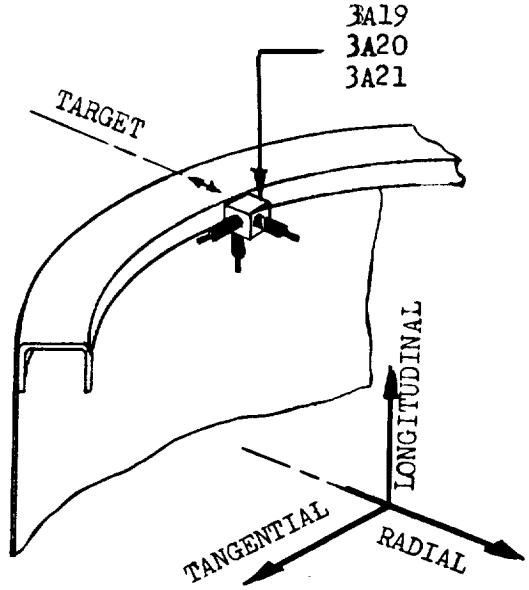


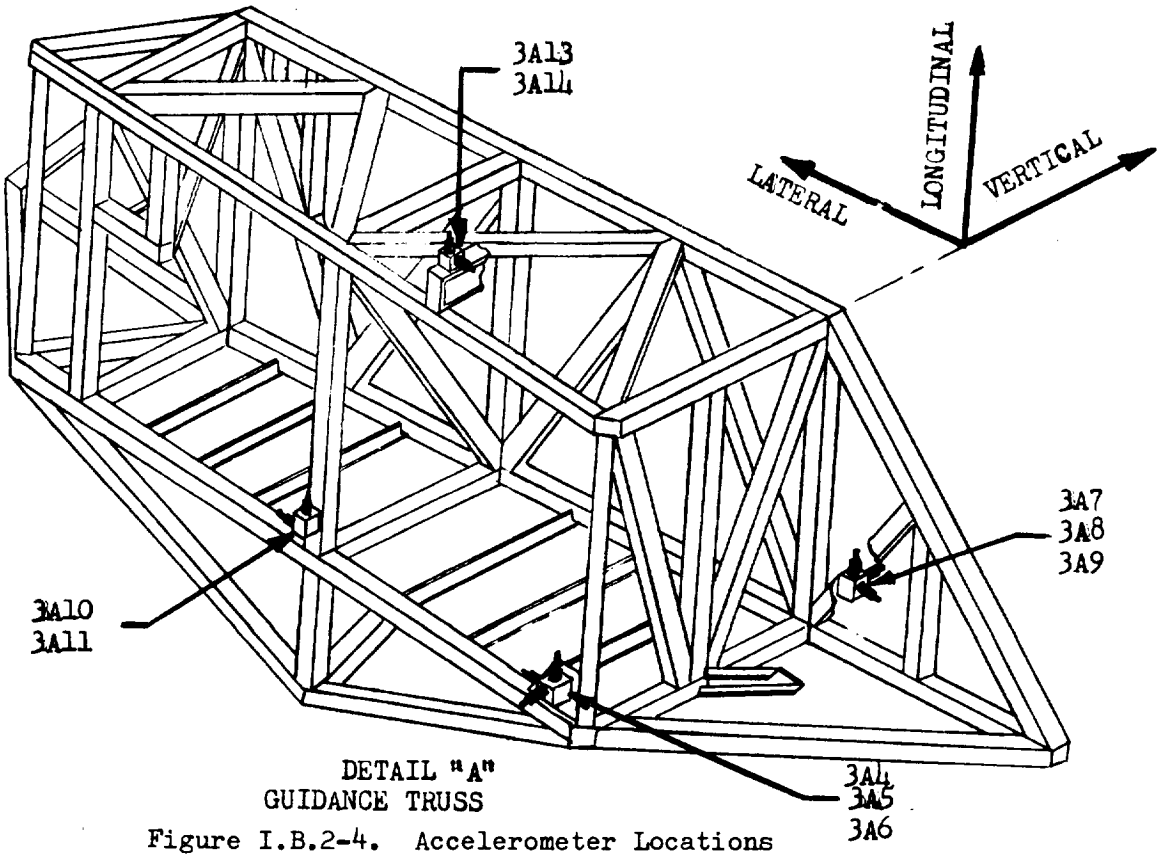
Figure I.B.2-3. Metal Fairing Anti-Contamination Joint



VIEW D-D
LONGERON 4F

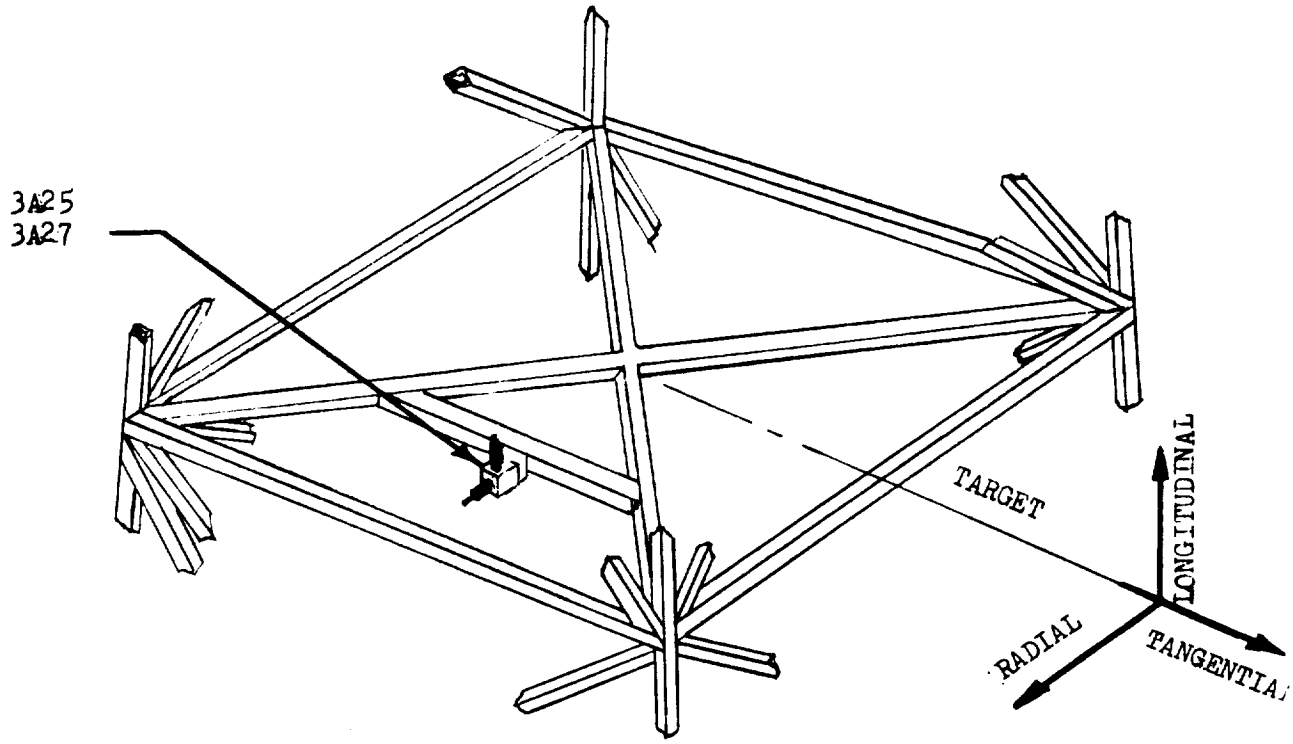


VIEW C-C
RING FRAME AT TARGET

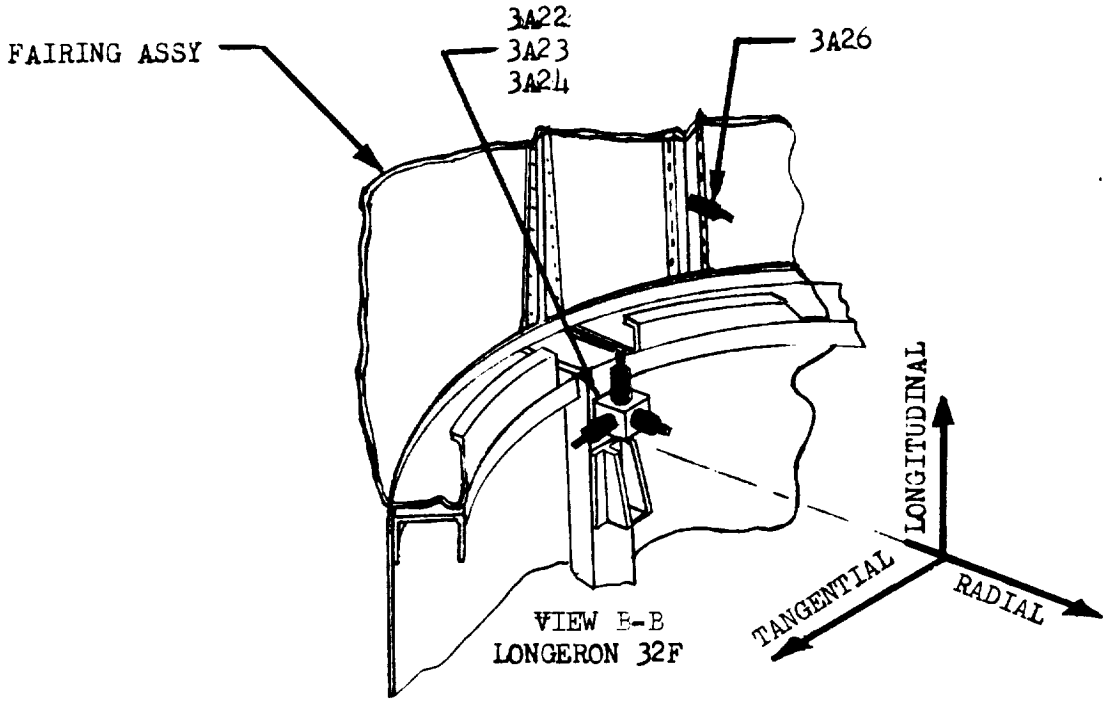


DETAIL "A"
GUIDANCE TRUSS

Figure I.B.2-4. Accelerometer Locations

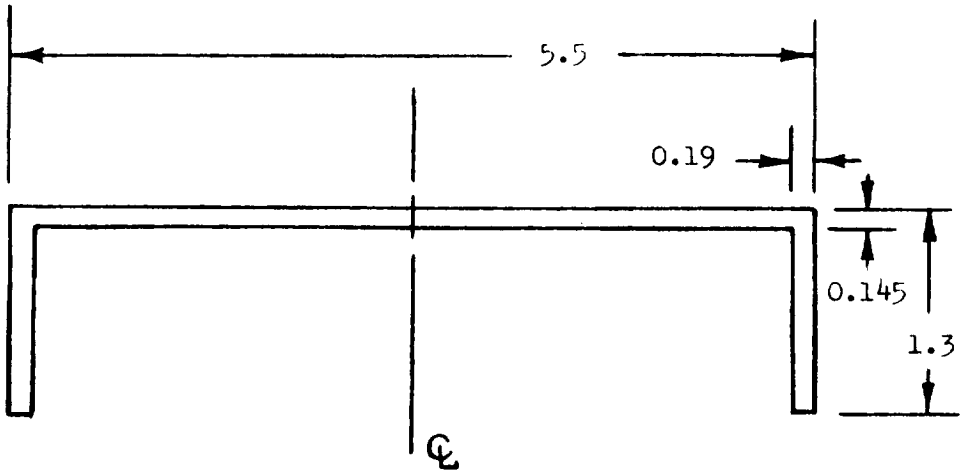


DETAIL "E"
PAYLOAD TRUSS



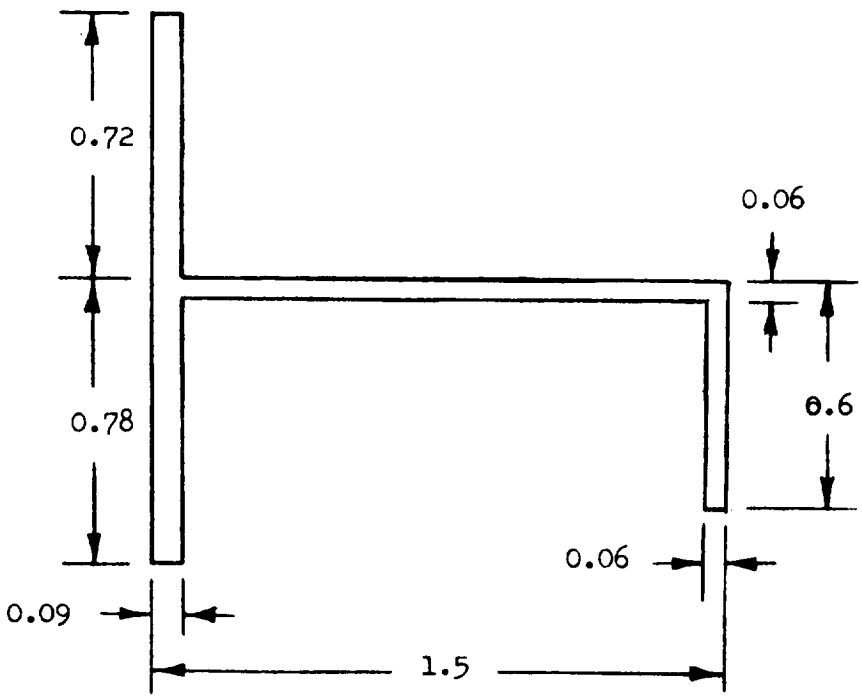
VIEW B-B
LONGERON 32F

Figure I.B.2-5. Accelerometer Locations



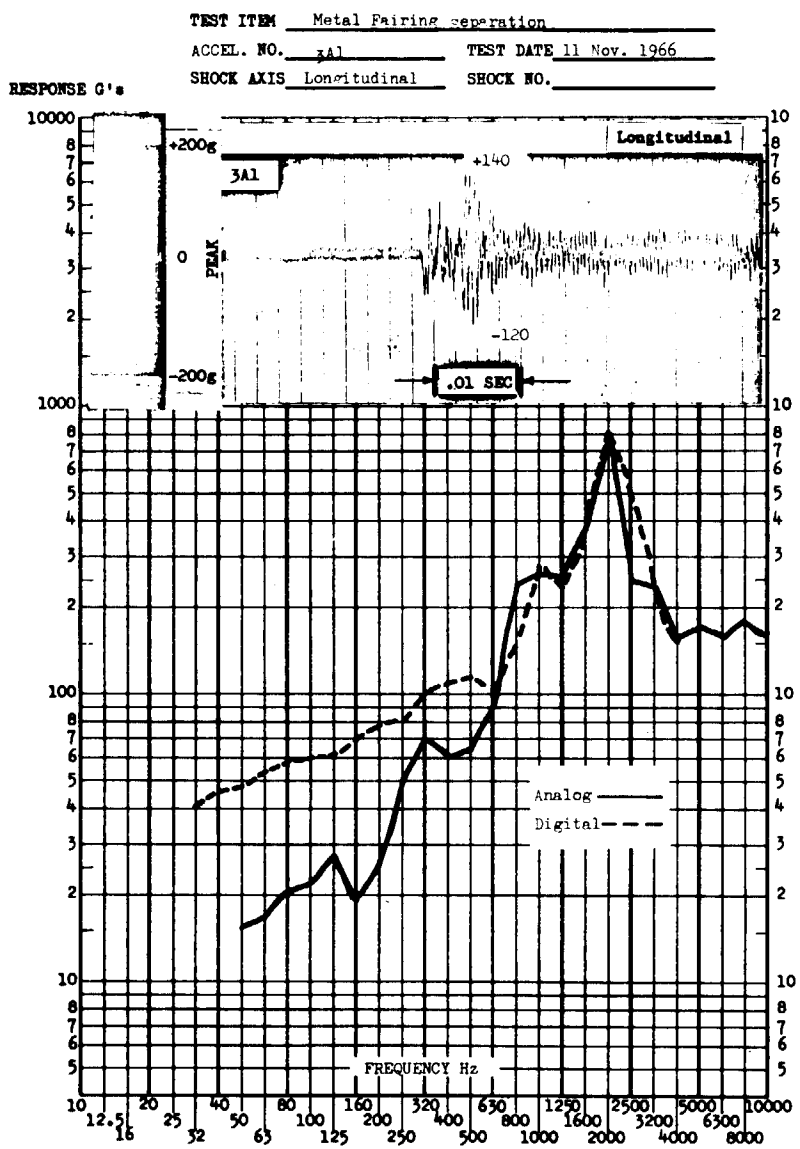
RING-FRAME

DIMENSION OF SECTION AT STATION 77



DIMENSIONS OF LONGERON SECTION

Figure I.B.2-6. Sectional Dimensions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ACCEL. NO. 3A1
TEST DATE 11 Nov. 1966
SHOCK AXIS Longitudinal
SHOCK NO.
RESPONSE G's
Longitudinal
3A1
+200g
0
-200g
PEAK
+140
-120
.01 SEC
Analog
Digital
FREQUENCY Hz

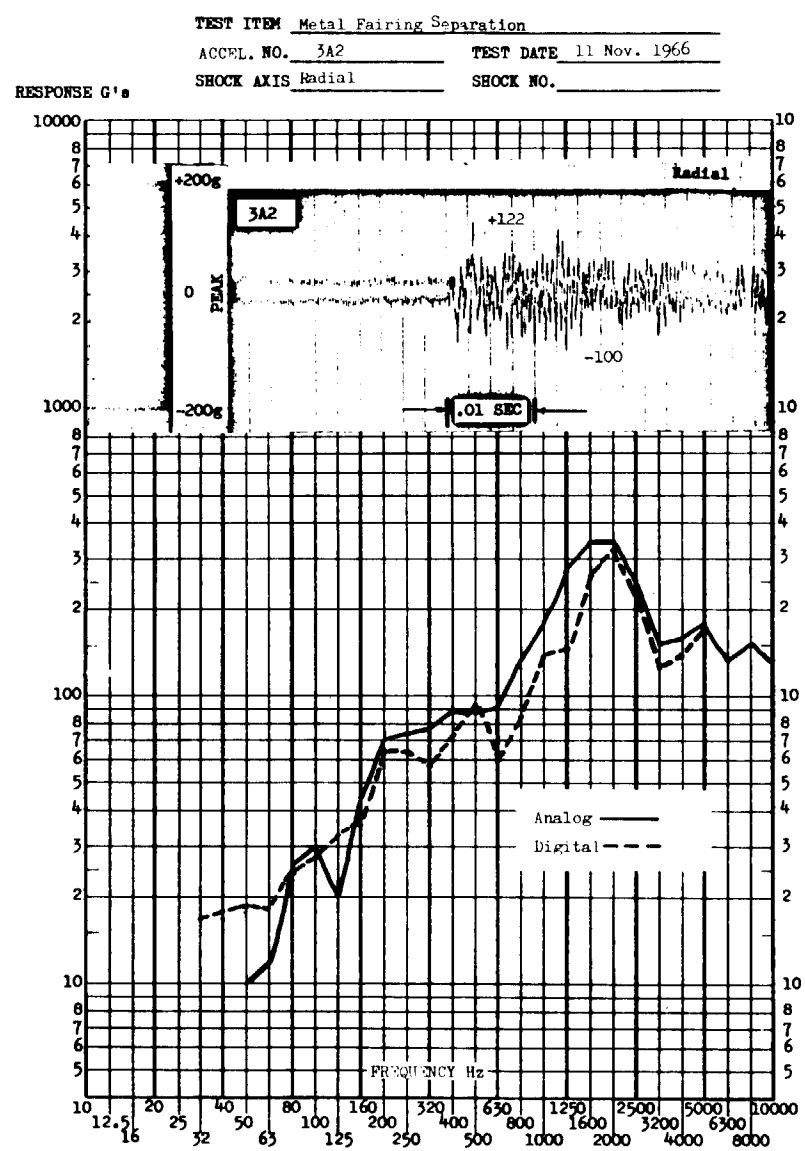

TEST ITEM Metal Fairing Separation
ACCEL. NO. 3A2
TEST DATE 11 Nov. 1966
SHOCK AXIS Radial
SHOCK NO.
RESPONSE G's
Radial
3A2
+200g
0
-200g
PEAK
+122
-100
.01 SEC
Analog
Digital
FREQUENCY Hz

FIGURE I.B.2-7

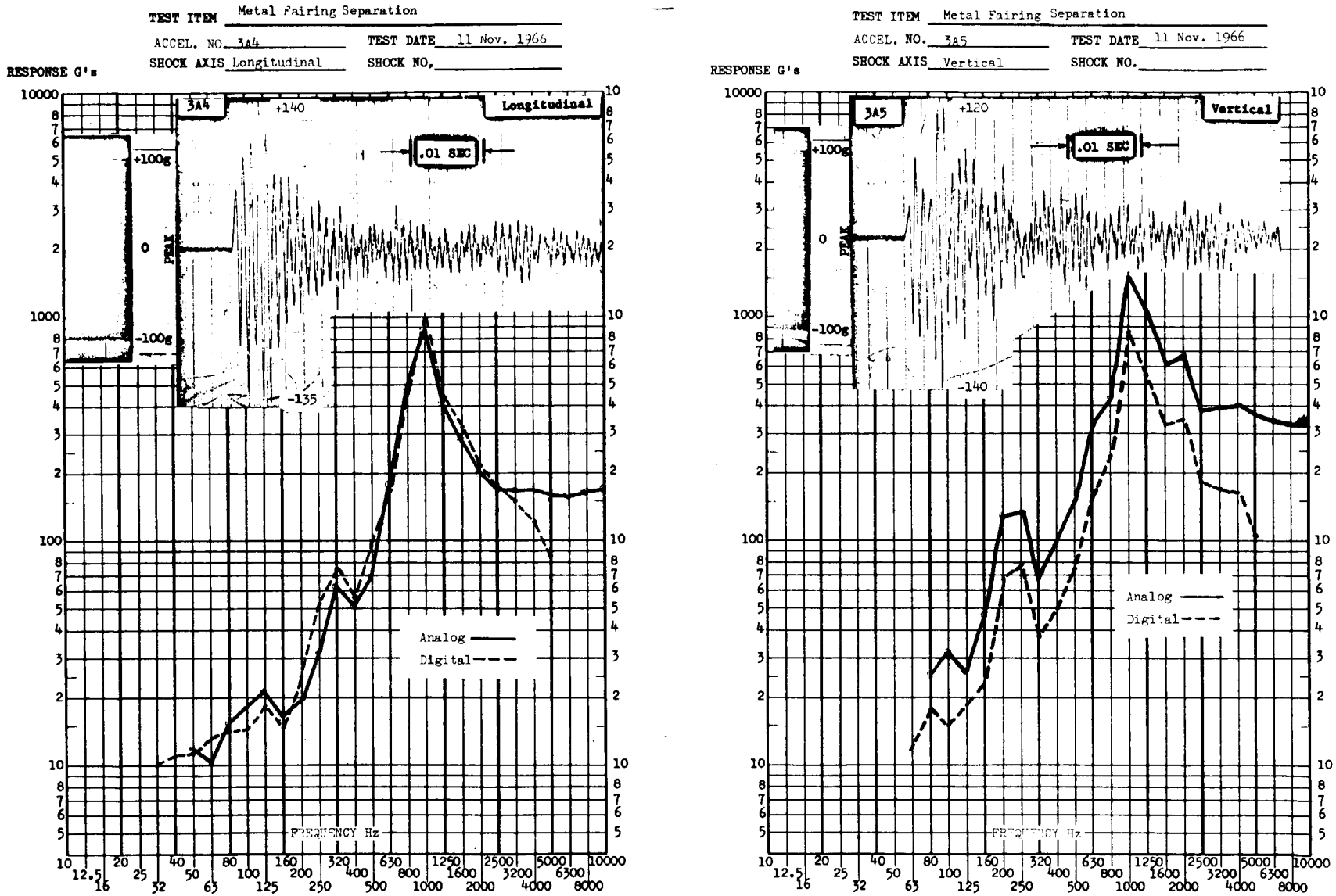
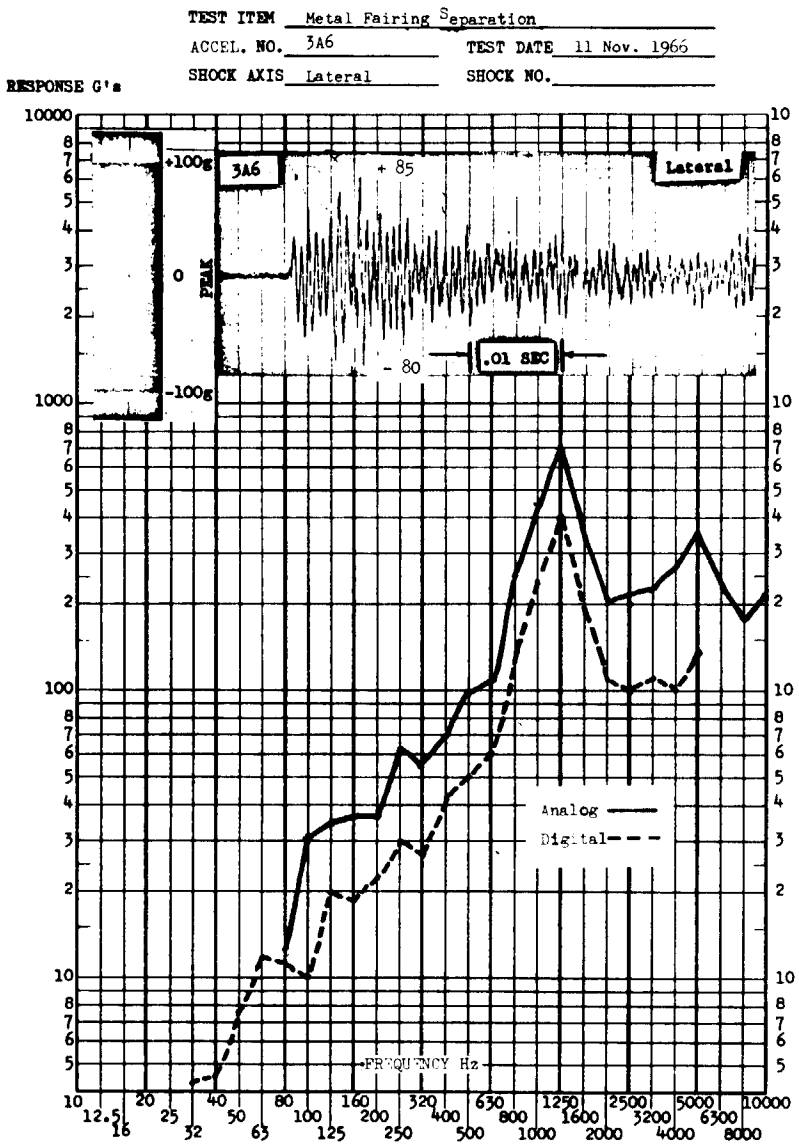

TEST ITEM Metal Fairing Separation
ACCEL. NO. 3A4
TEST DATE 11 Nov. 1966
SHOCK AXIS Longitudinal
SHOCK NO.
RESPONSE G's
3A4
Longitudinal
+140
.01 SEC
+100g
0
-100g
PEAK
-135
Analog
Digital
FREQUENCY Hz
TEST ITEM Metal Fairing Separation
ACCEL. NO. 3A5
TEST DATE 11 Nov. 1966
SHOCK AXIS Vertical
SHOCK NO.
RESPONSE G's
3A5
Vertical
+120
.01 SEC
+100g
0
-100g
PEAK
-140
Analog
Digital
FREQUENCY Hz

FIGURE 1.B.2-8


TEST ITEM Metal Fairing Separation
ACCEL. NO. 3A6
TEST DATE 11 Nov. 1966
SHOCK AXIS Lateral
SHOCK NO.
RESPONSE G's
+100g
0
-100g
PEAK
3A6
+85
-80
Lateral
.01 SEC
Analog
Digital
FREQUENCY Hz

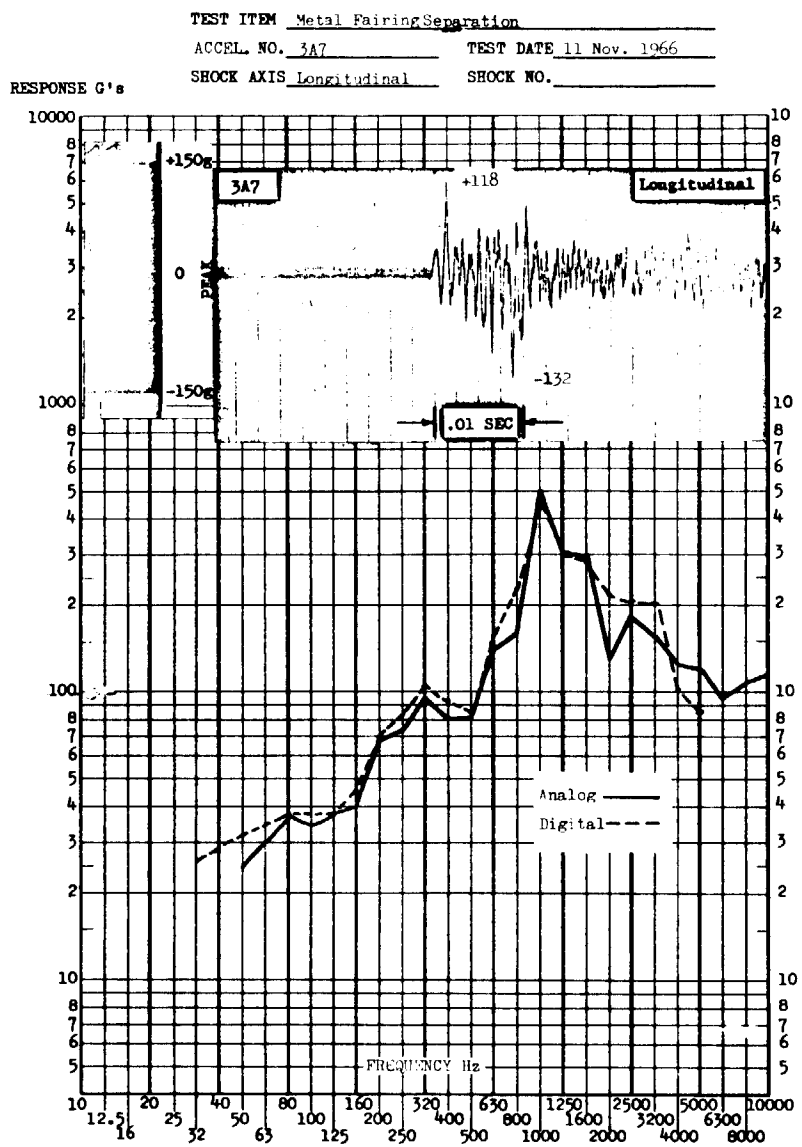
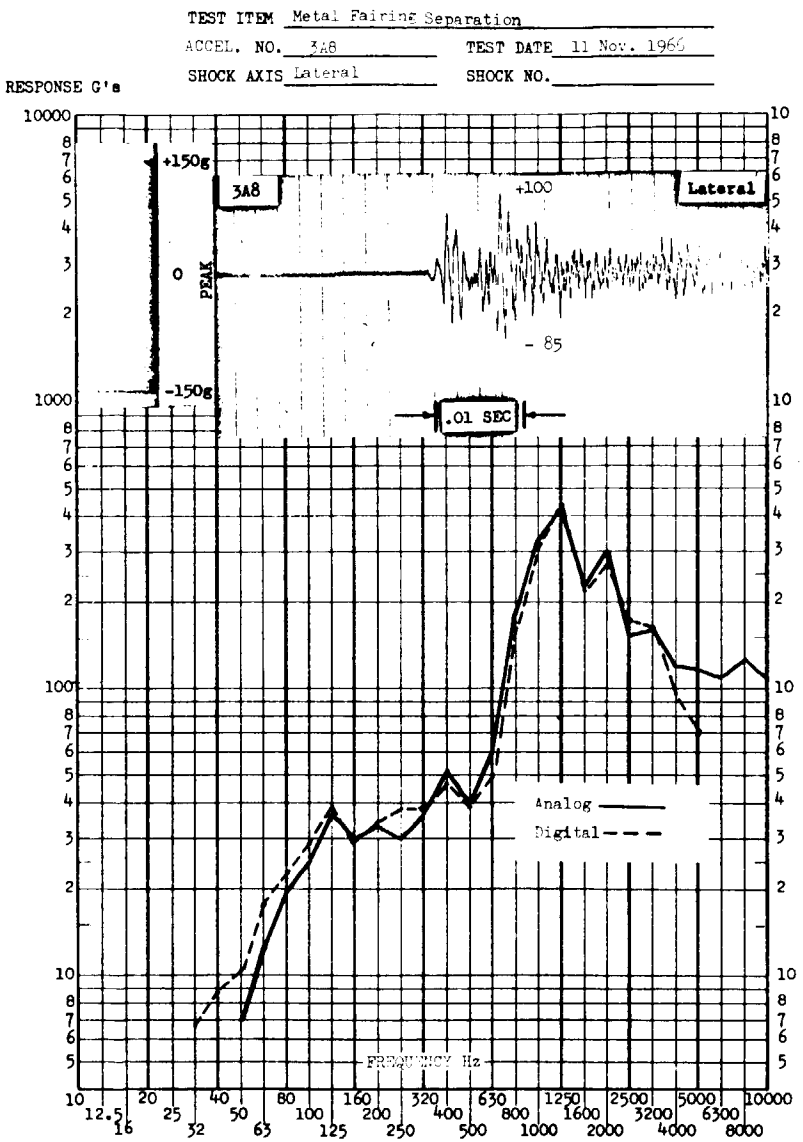

TEST ITEM Metal Fairing Separation
ACCEL. NO. 3A7
TEST DATE 11 Nov. 1966
SHOCK AXIS Longitudinal
SHOCK NO.
RESPONSE G's
+150g
0
-150g
PEAK
3A7
+118
-132
Longitudinal
.01 SEC
Analog
Digital
FREQUENCY Hz

FIGURE 1.B.2-9



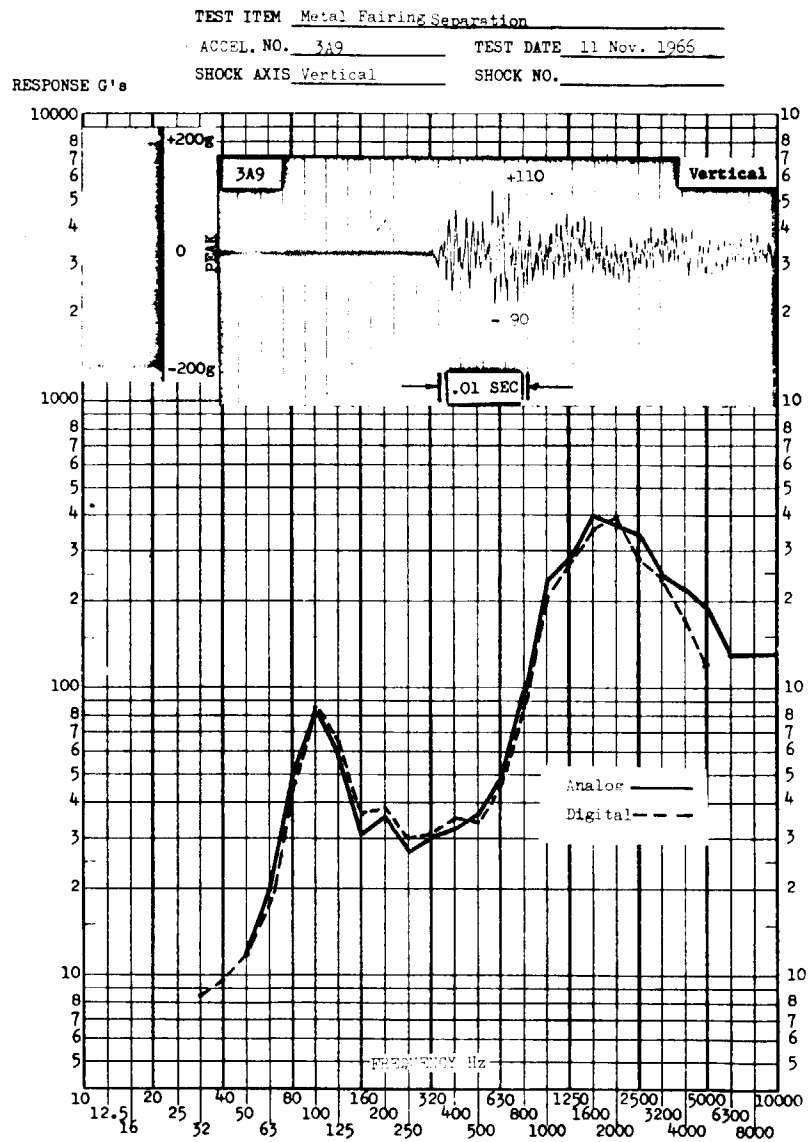
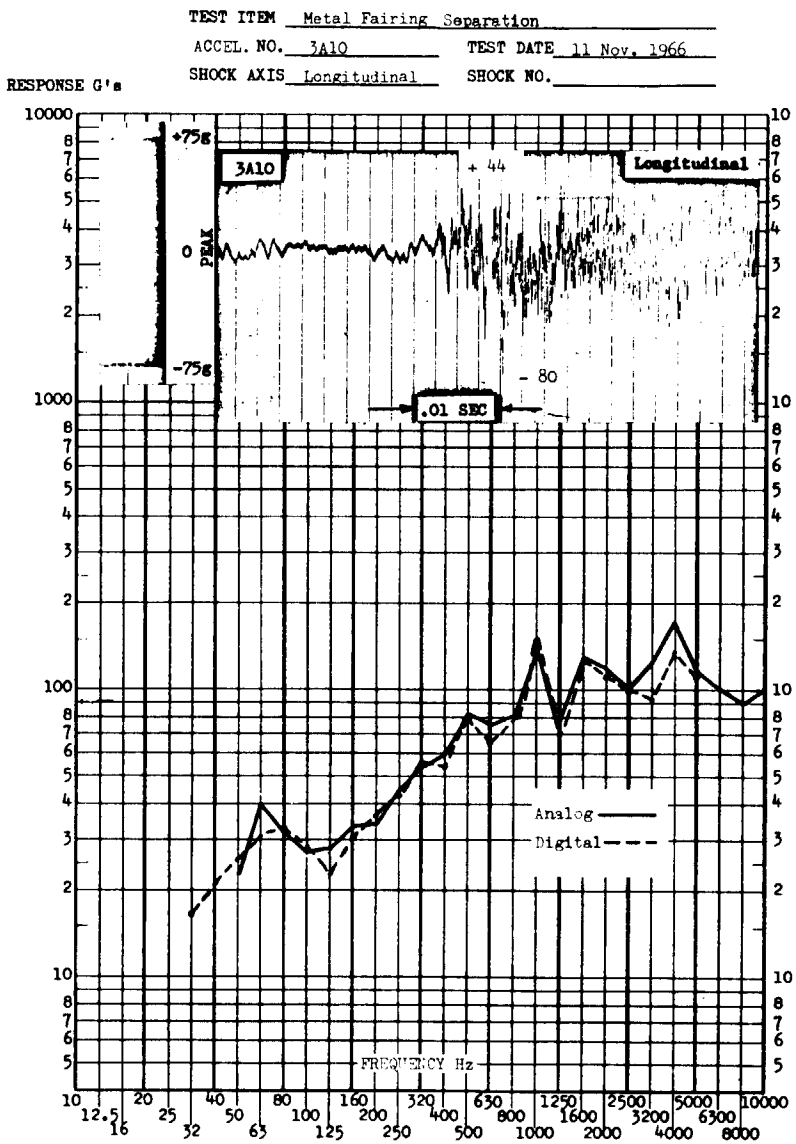


FIGURE I.B.2-10



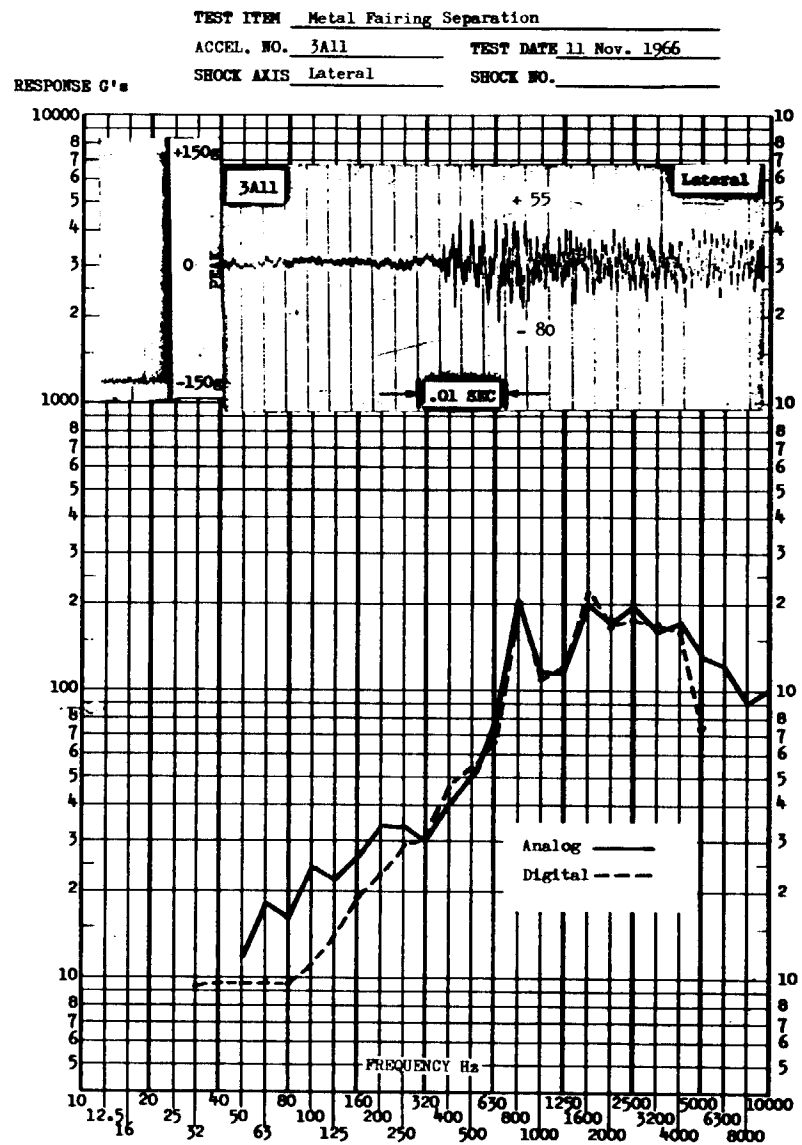
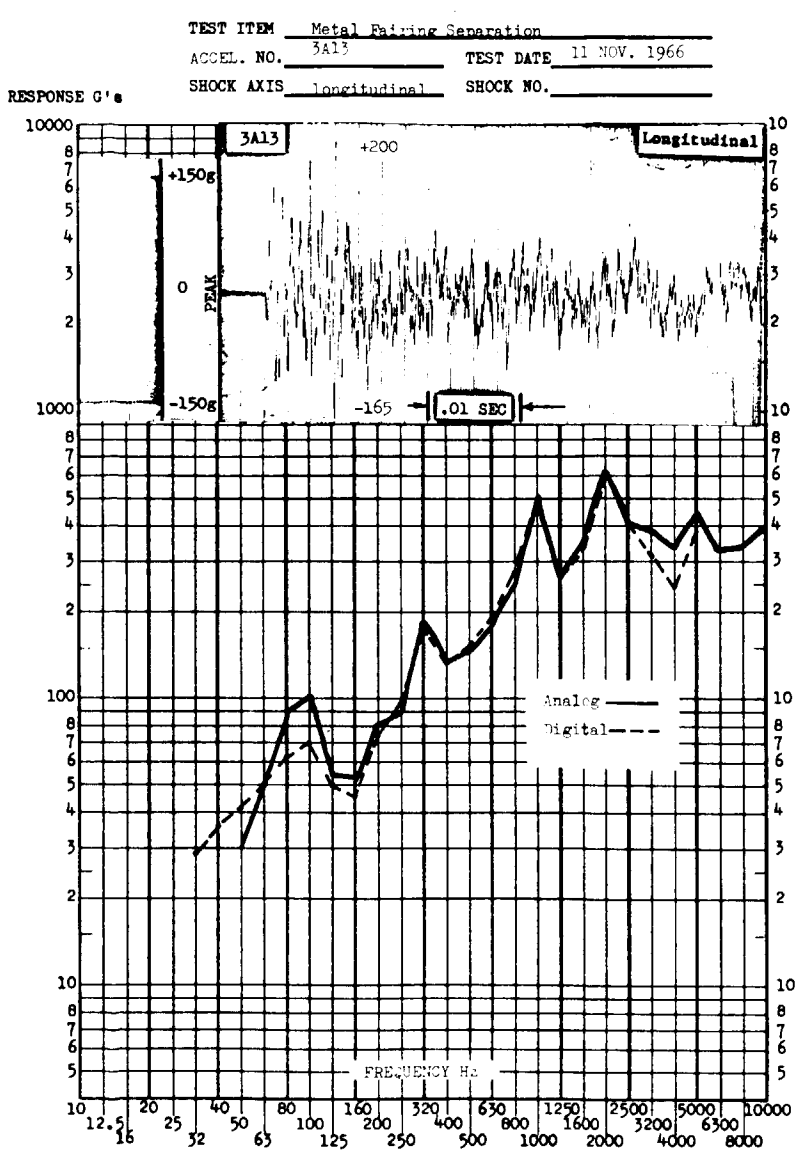


FIGURE 1.B.2-11



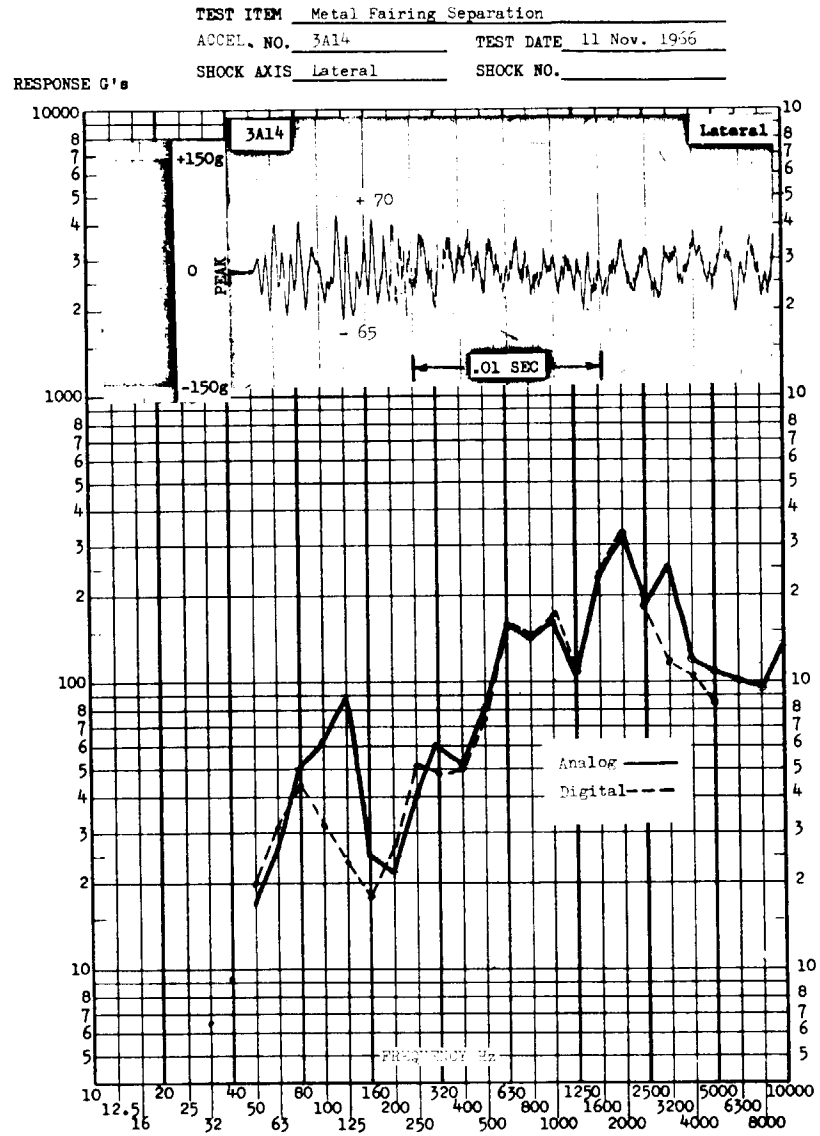
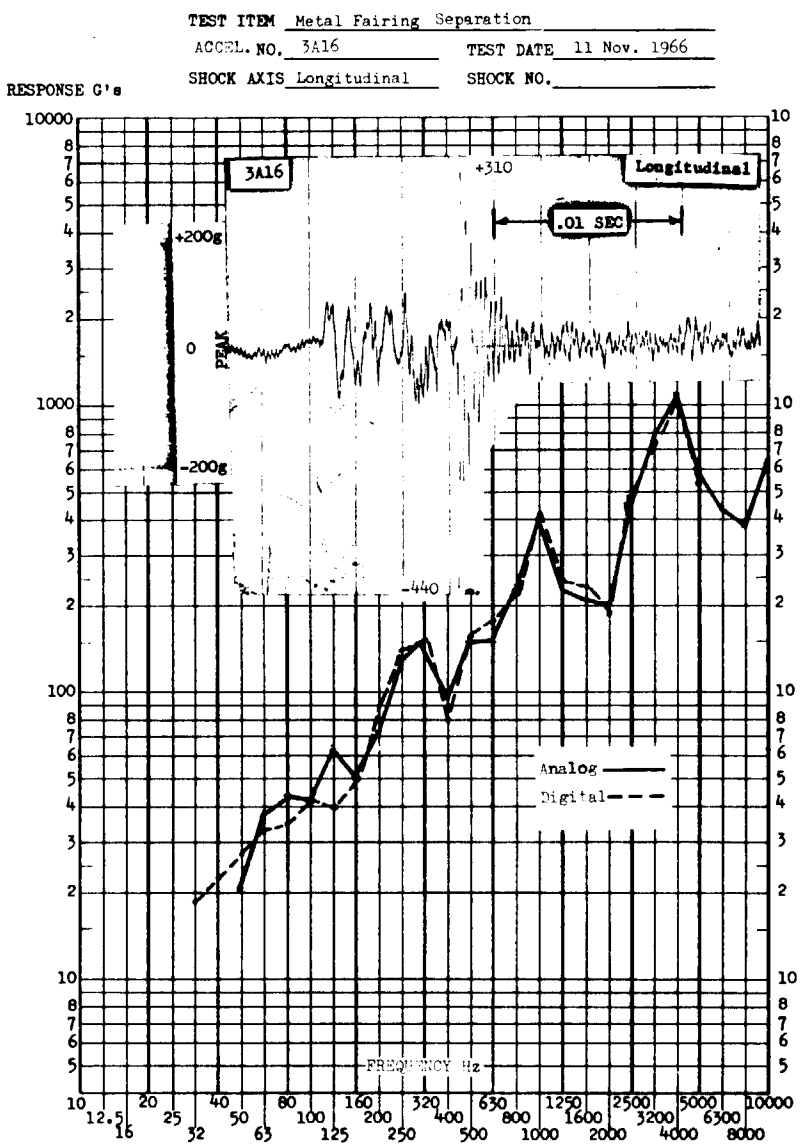


FIGURE I.B.2-12



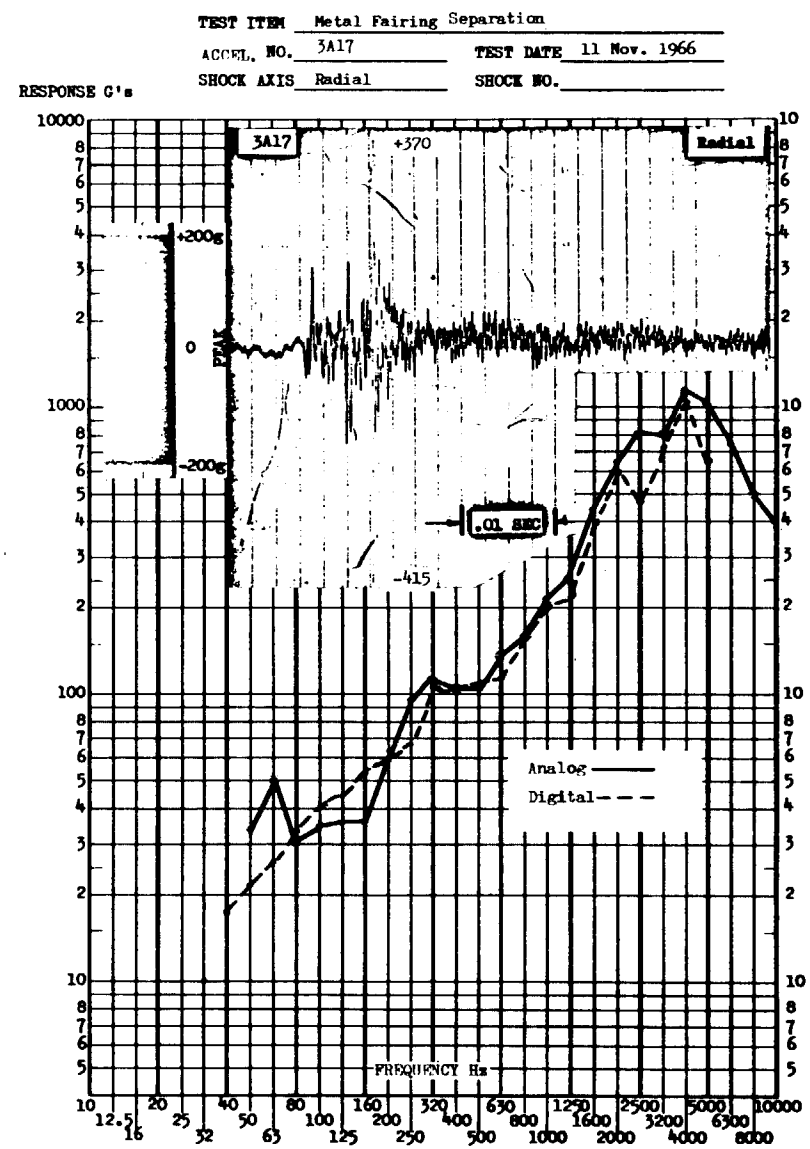
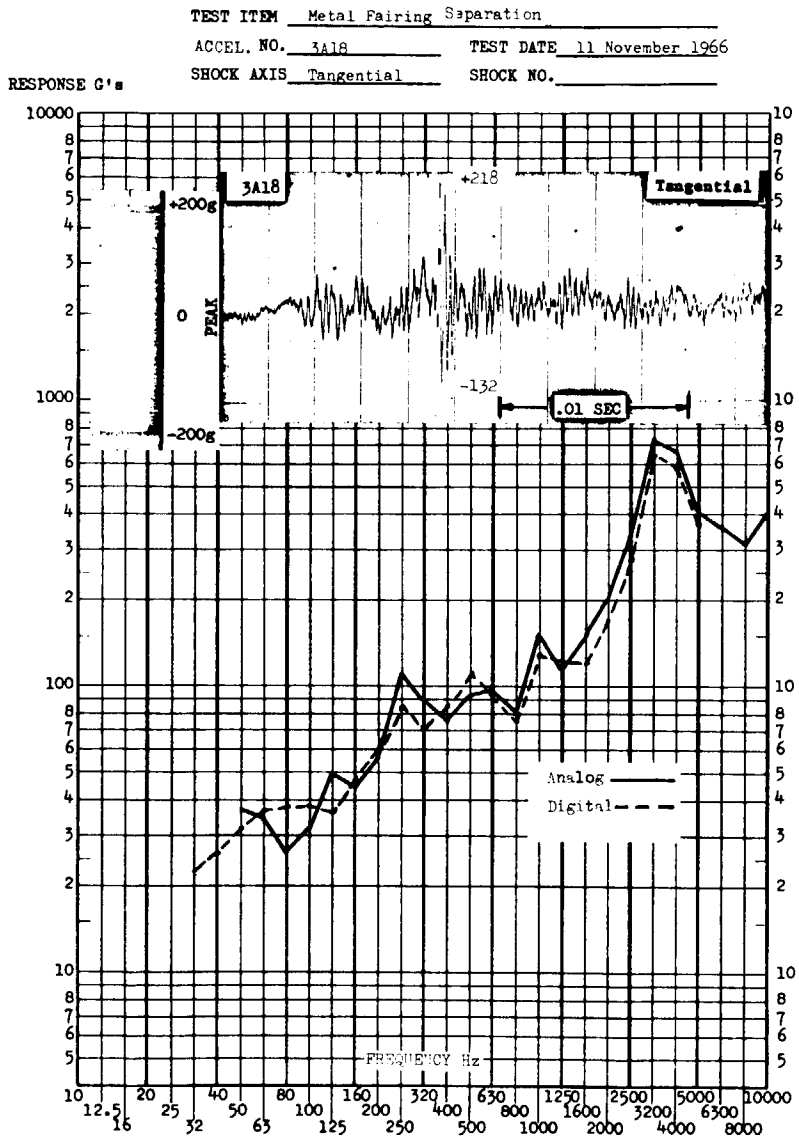


FIGURE 1.B.2-13



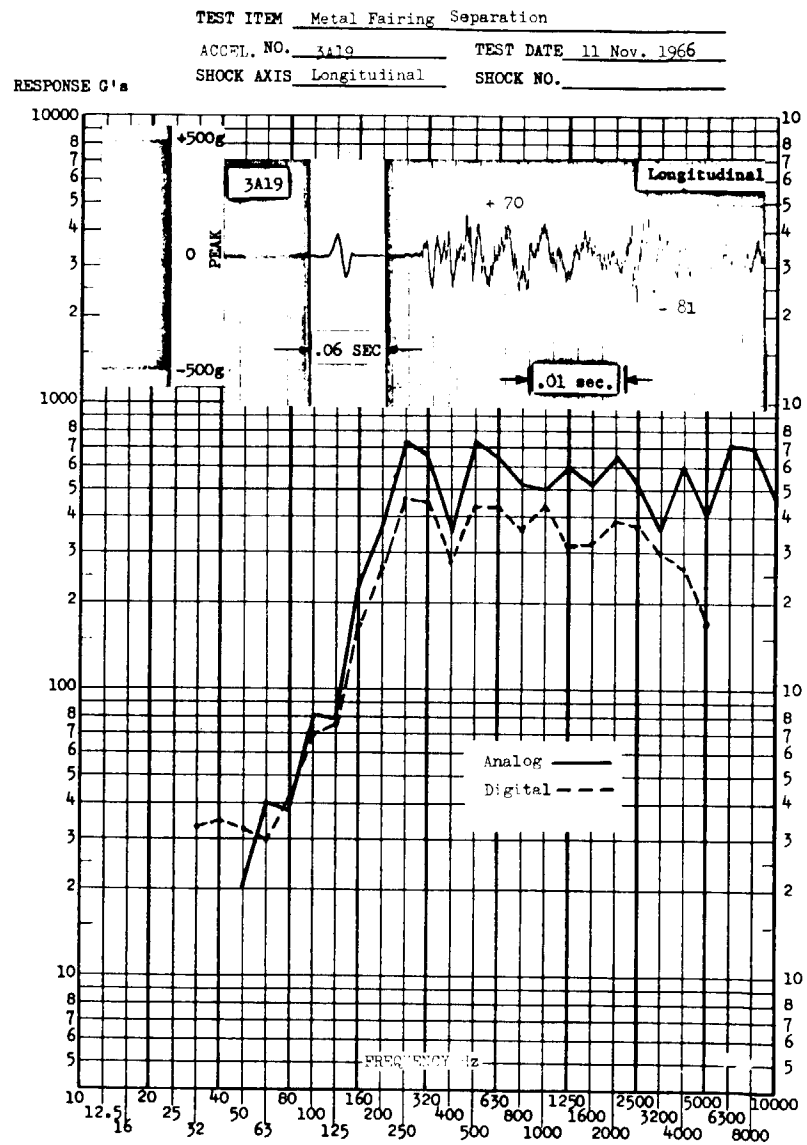
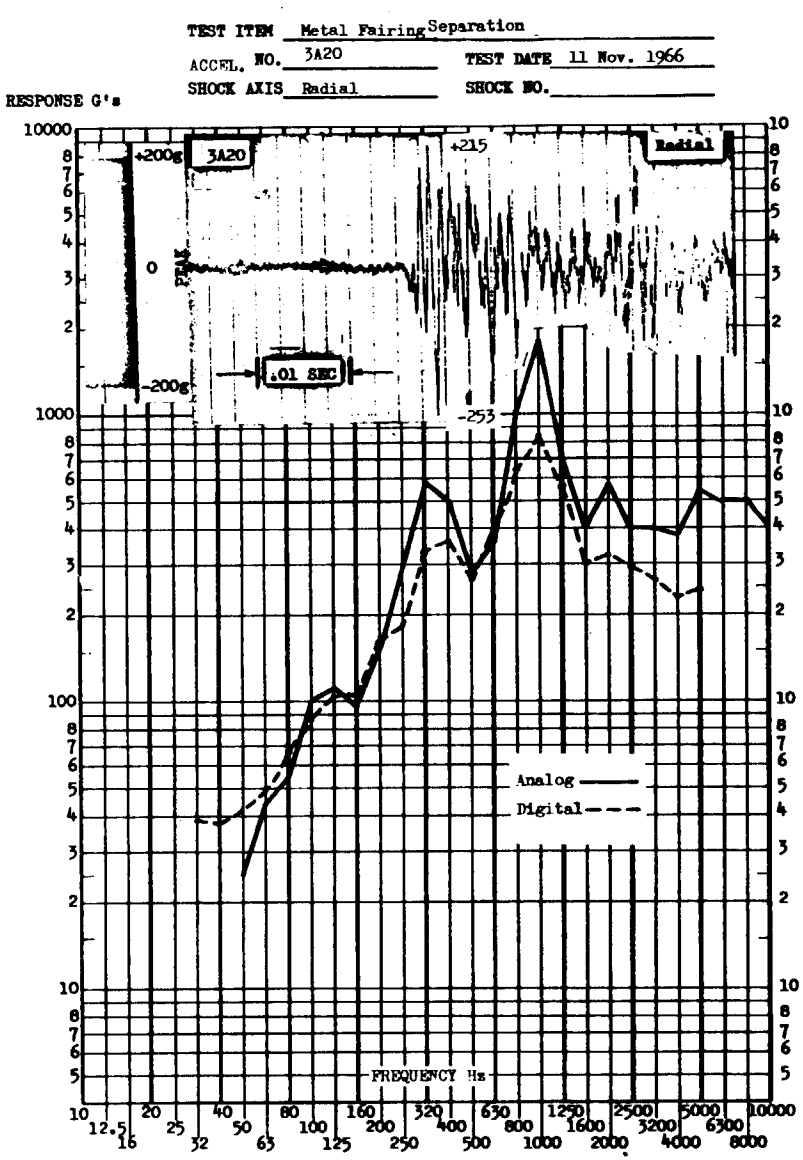


FIGURE I.B.2-14



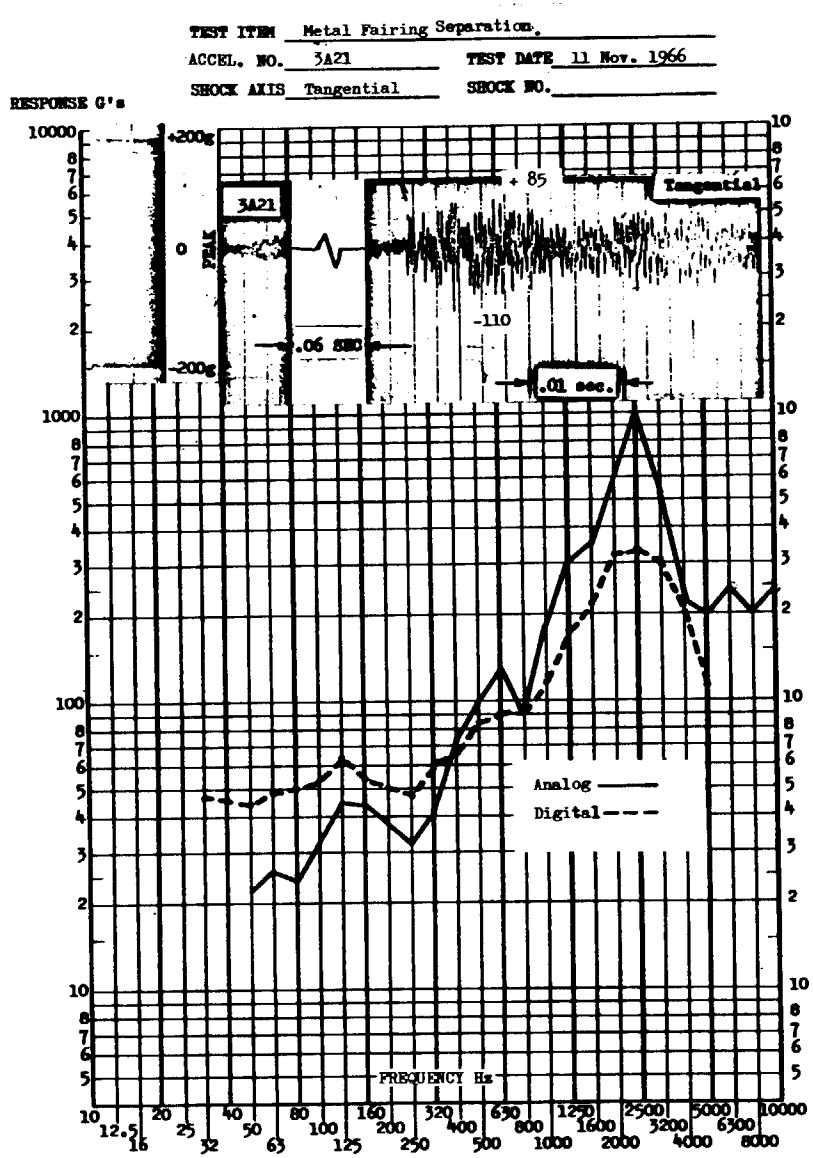
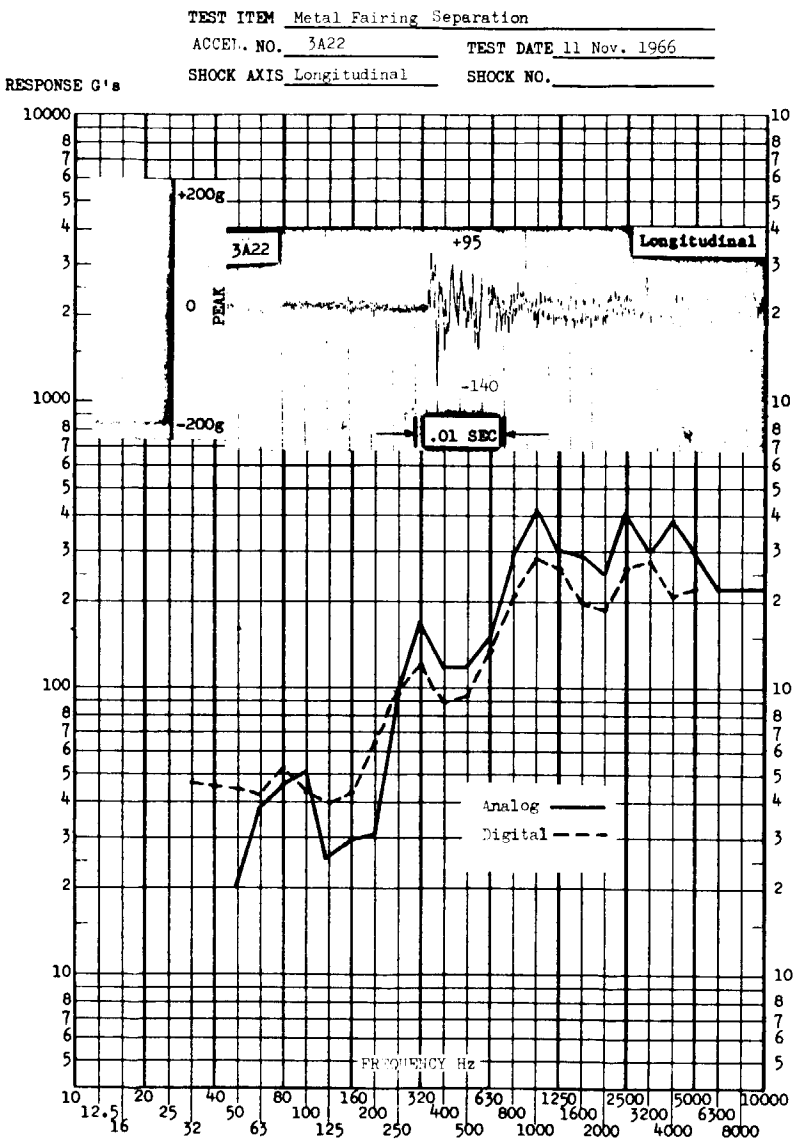


FIGURE 1.B.2-15



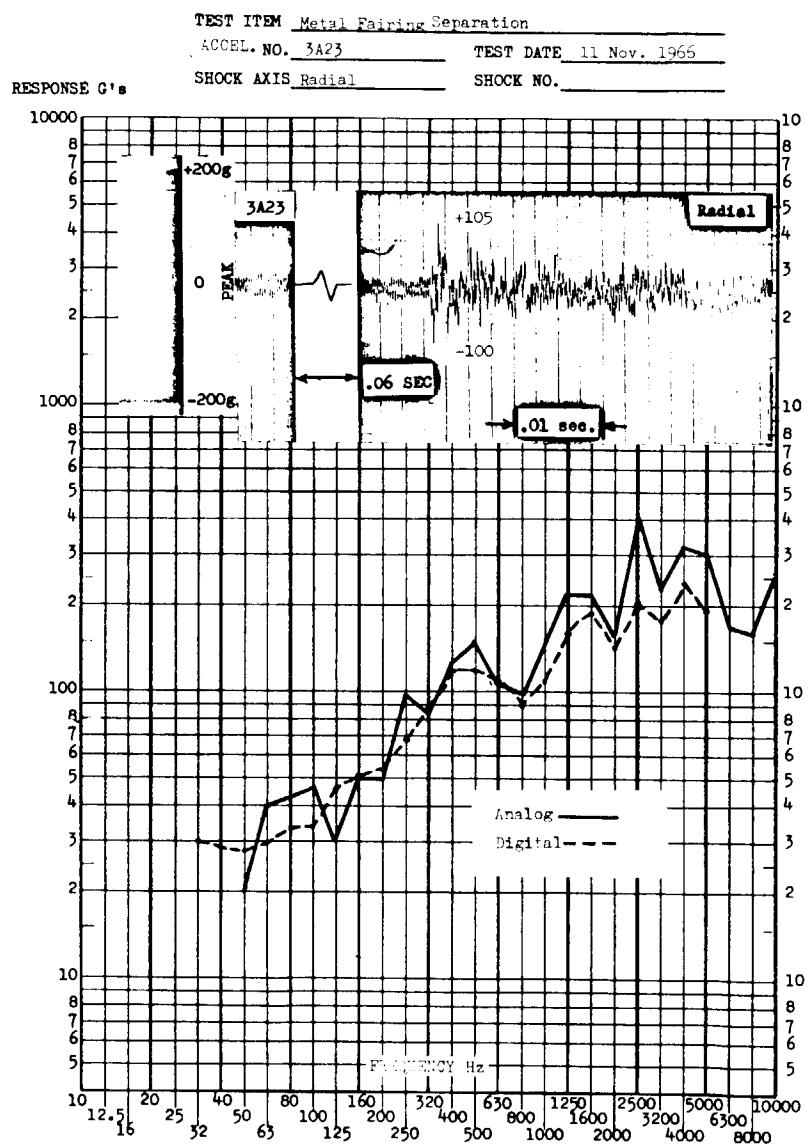
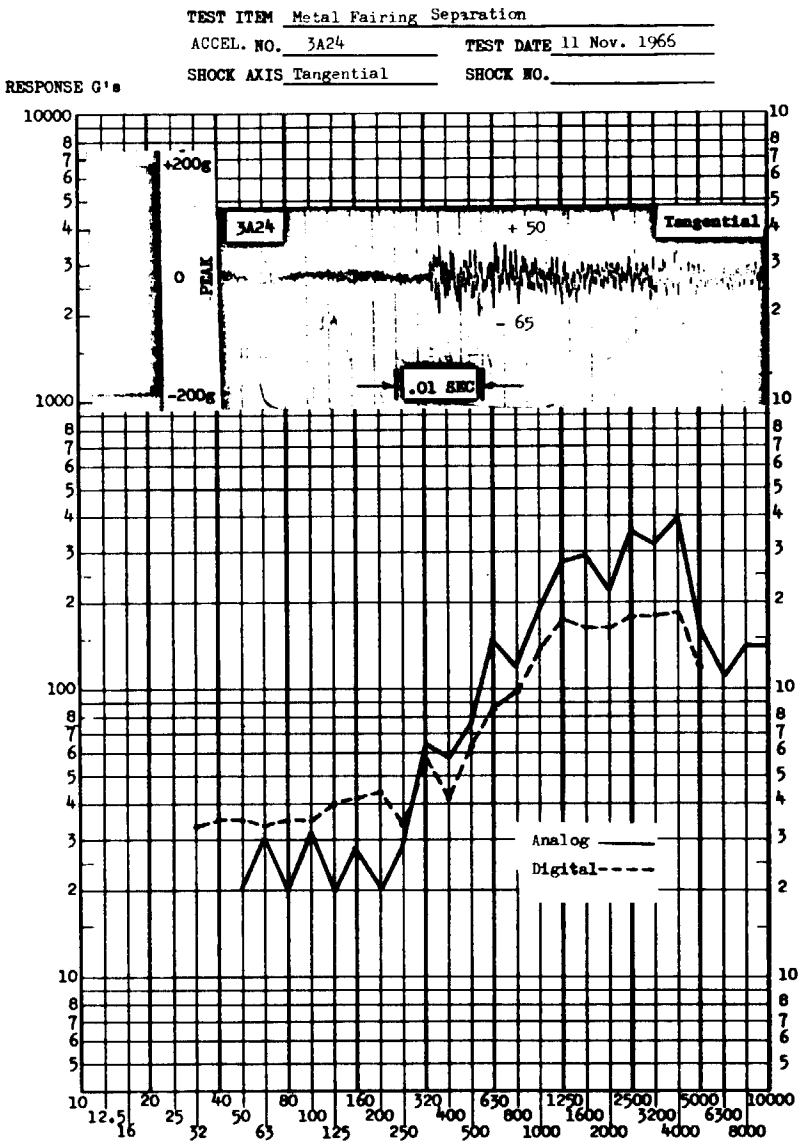


FIGURE I.B.2-16



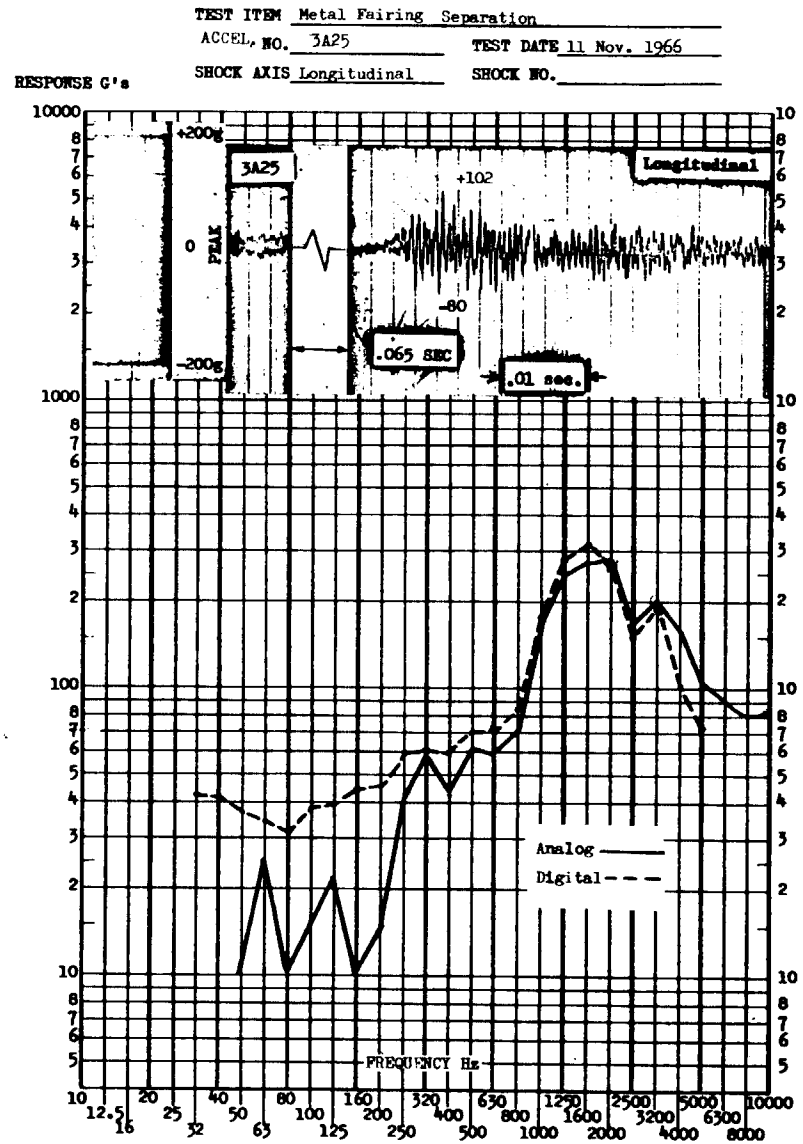
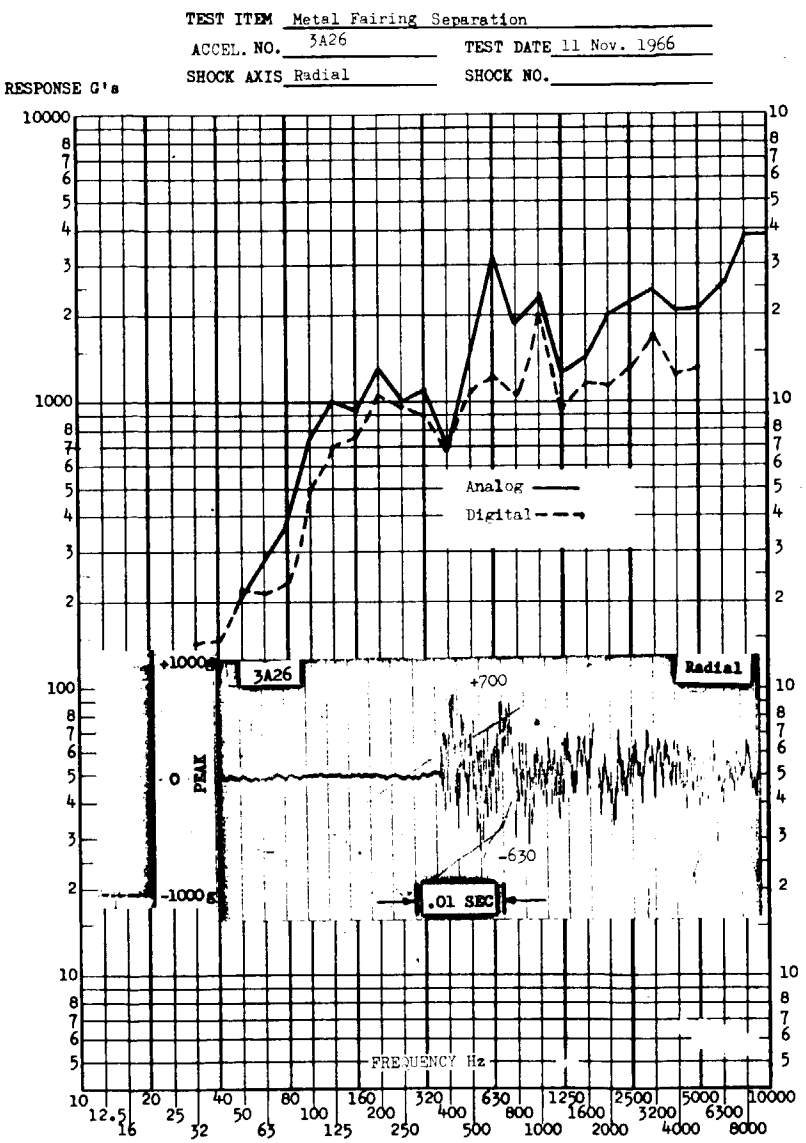


FIGURE I.B.2-17



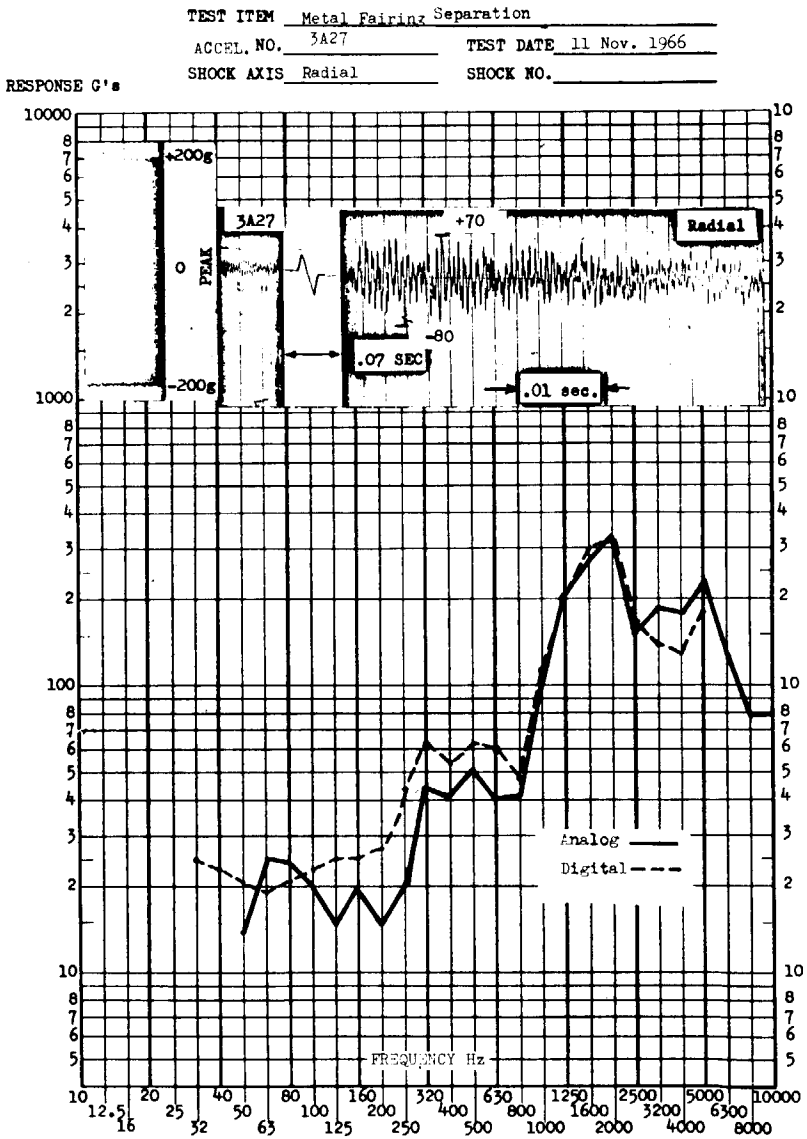


FIGURE I.B.2-18

SECTION I.B.3

TITAN IIIC UNIVERSAL PAYLOAD FAIRING SEPARATION TESTS

PURPOSE OF TESTS

The purpose of these three tests was to obtain a measure of the shock levels produced in the Titan IIIC transtage by the pyrotechnic separation of three representative configurations for the Universal Payload Fairing.

DESCRIPTION OF EVENTS

Three separation tests were conducted on the Universal Payload Fairing. Since the Universal Fairing can vary in five foot increments from 15 to 50 feet in length, the 15, 35 and 50 foot lengths were considered representative for the tests. For each test the fairing was mounted over a dummy payload atop a Titan IIIC transtage in the vertical orientation as illustrated in Figures I.B.3-1 through I.B.3-3. Separation consisted of two distinct pyrotechnic events. First a cartridge actuated cable cutting device allowed the release of 18 spring loaded pins. This event was followed (approximately 1.5 seconds later) by the fairing separation during which the fairing was separated into equal longitudinal tri-sections as depicted in Figure I.B.3-4. The de-

tonation of twin strands of primaline at four grains per foot housed within a bellows assembly (Figure I.B.3-5) caused the rivets in the separation joint to shear. Continued expansion of the bellows forced the three fairing segments to drop away from the instrumented transtage where the data were recorded.

DESCRIPTION OF DATA

Twenty-four accelerometers were monitored during each test. Information regarding the data for both events is tabulated below.

No. of time histories	144
No. of shock spectra	144
Type of analysis	digital (absolute response spectra)
Sample rate	12,500/sec
Frequency range	100-5000 Hz
Frequency increments	3 points per octave
Damping	Q = 10

The shock spectra for the pin release events are presented with their corresponding time histories as Figures I.B.3-10 through I.B.3-33. The data associated with the fairing separation events are presented in like manner as Figures I.B.3-34 through I.B.3-57.

DESCRIPTION OF PYROTECHNIC

Type: Primaline linear explosive within a bellows assembly Figure I.B.3-5

Size of charge: twin strands at four grains per foot per strand

Location: Figure I.B.3-1

DESCRIPTION OF STRUCTURE

Transtage skirt: Aluminum skin-ring-frame with 0.028 inch skin thickness. See Figure I.B.3-9 for cross-sections of ring-frame and longerons (stringers).

Transtage guidance truss: Aluminum members of square cross-section 1.5 inch outer diameter and 0.0625 inch wall thickness.

DESCRIPTION OF ACCELEROMETERS

Type: Endevco model 2225

Location: Table I.B.3-1 and Figures I.B.3-6 through I.B.3-8.

Axis of sensitivity: Table I.B.3-1

DESCRIPTION OF DATA ACQUISITION SYSTEM

Tape recorders: Ampex ES-100 (0-20,000 Hz Frequency response)

Amplifiers: Kistler 504A (0-100,000 Hz Frequency response)

COMMENTS

Since the pin release event is the result of a cartridge actuated pyrotechnic, the data associated with this event would logically fit in Division III. Due to the types of structure at the measurement locations, the logical breakdown of the pin release data would be as follows:

Part III.A - Data contained in Figures I.B.3-10, I.B.3-11, and I.B.3-22 through I.B.3-33.

Part III.B - Data contained in Figures I.B.3-12 through I.B.3-21

Also, since measurements 3A1, 3A2 and 3A16 through 3A27 are located on skin-ring-frame structure, the data contained in Figures I.B.3-34, I.B.3-35 and I.B.3-46 through I.B.3-57 would most logically fit in Part I.A.

Under "Description of Data" the frequency range of the shock spectra is indicated as 100-5,000 Hz. However, due to the rather low 12,500/second sampling

COMMENTS (CONT.)

rate, these shock spectra are probably not valid for frequencies above 1250 to 1600 Hz.

The time histories presented in this section are generally difficult to read. Therefore, to avoid presentation of misleading information, the peak g's of some of the time histories are not labeled. Also, several of the times histories associated with the 50 foot fairing test have a questionable relationship to their respective shock spectra. The particular measurements in question are listed below:

Pin release event - 3A14, 3A16, 3A18, 3A26

Fairing release event - 3A2, 3A4, 3A7, 3A8
3A9, 3A21, 3A23, 3A24.

In conclusion, it might be said that the shock spectra tend to be a more believable presentation of the data for these tests than are the time histories.

TABLE I.B.3-1

MEASUREMENT DESCRIPTIONS

Measurement Number	Location/Description	Sensitive Axis	Figure Number Pin Event	Figure Number Fairing Event
3A1	Stringer 4F on Long-	Long.	I.B.3-10	I.B.3-34
3A2	eron Station 114 at Guidance Truss Attach Point	Rad.	I.B.3-11	I.B.3-35
3A4	Guidance Truss at	Long.	I.B.3-12	I.B.3-36
3A5	Mounting Point of	Vert.	I.B.3-13	I.B.3-37
3A6	IMU Nearest the Truss Frame Attach	Lat.	I.B.3-14	I.B.3-38
3A7	Guidance Truss at	Long	I.B.3-15	I.B.3-39
3A8	Mounting Point of	Lat.	I.B.3-16	I.B.3-40
3A9	Pulse Code Modula- tor	Vert.	I.B.3-17	I.B.3-41
3A10	Guidance Truss at	Long.	I.B.3-18	I.B.3-42
3A11	Mounting Point of Airborne Digital Computer	Lat.	I.B.3-19	I.B.3-43
3A13	Guidance Truss at	Long.	I.B.3-20	I.B.3-44
3A14	Mounting Point of Adapter Programmer	Lat.	I.B.3-21	I.B.3-45
3A16	Stringer 4F on	Long.	I.B.3-22	I.B.3-46
3A17	Longeron Station 77	Rad.	I.B.3-23	I.B.3-47
3A18	Under Fairing Attach Point	Tang.	I.B.3-24	I.B.3-48
3A19	On Ring Frame at Tar-	Long.	I.B.3-25	I.B.3-49
3A20	get Station 77 Under	Rad.	I.B.3-26	I.B.3-50
3A21	Fairing Attach Point	Tang.	I.B.3-27	I.B.3-51
3A22	Stringer 32F on Long-	Long.	I.B.3-28	I.B.3-52
3A23	eron Station 77 Under	Rad.	I.B.3-29	I.B.3-53
3A24	Fairing Attach Point	Tang.	I.B.3-30	I.B.3-54
3A25	Stringer 4F on Long-	Long.	I.B.3-31	I.B.3-55
3A26	eron Station 97	Rad.	I.B.3-32	I.B.3-56
3A27		Tang.	I.B.3-33	I.B.3-57

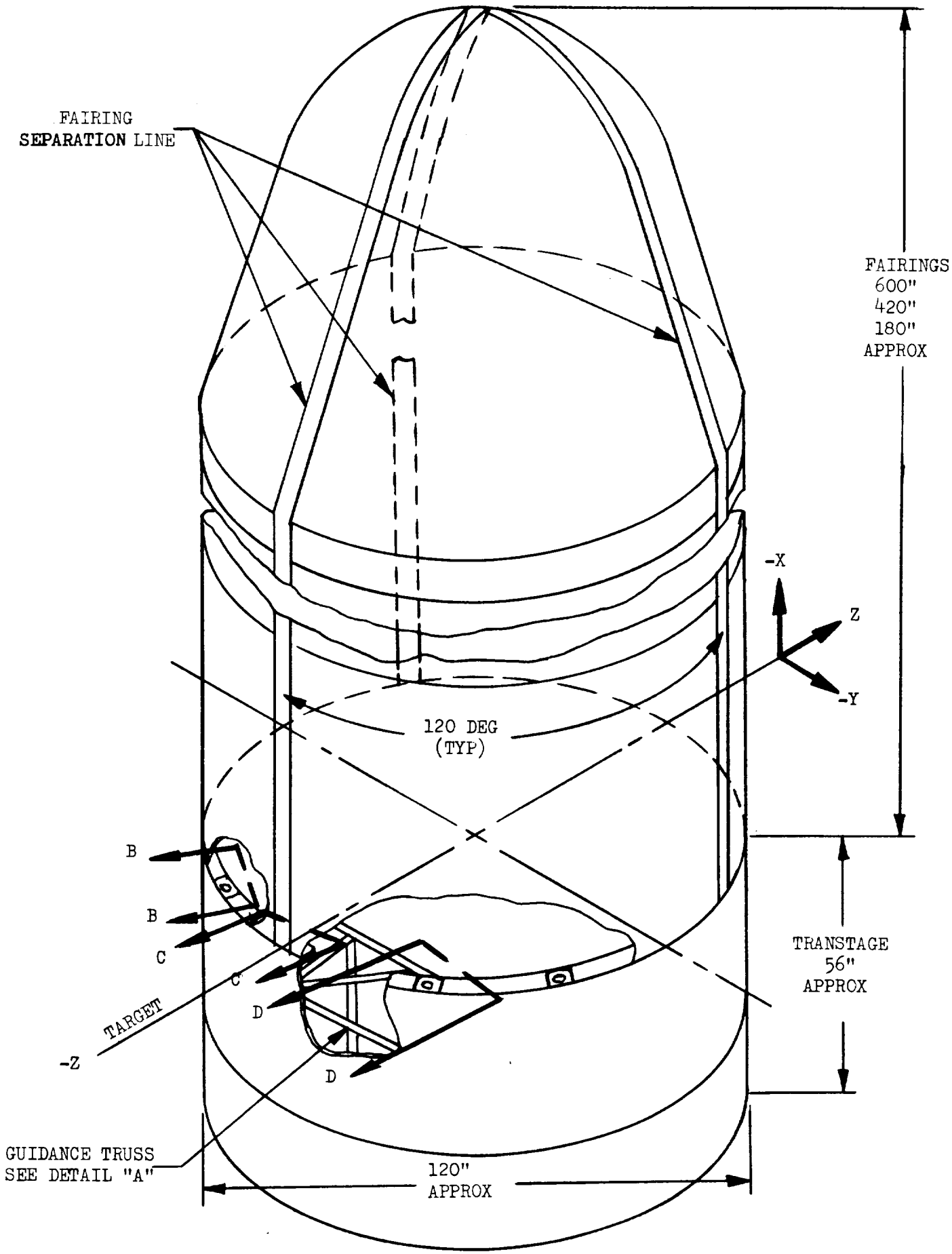


Figure I.B.3-1. Titan III-C Transtage with Universal Fairing

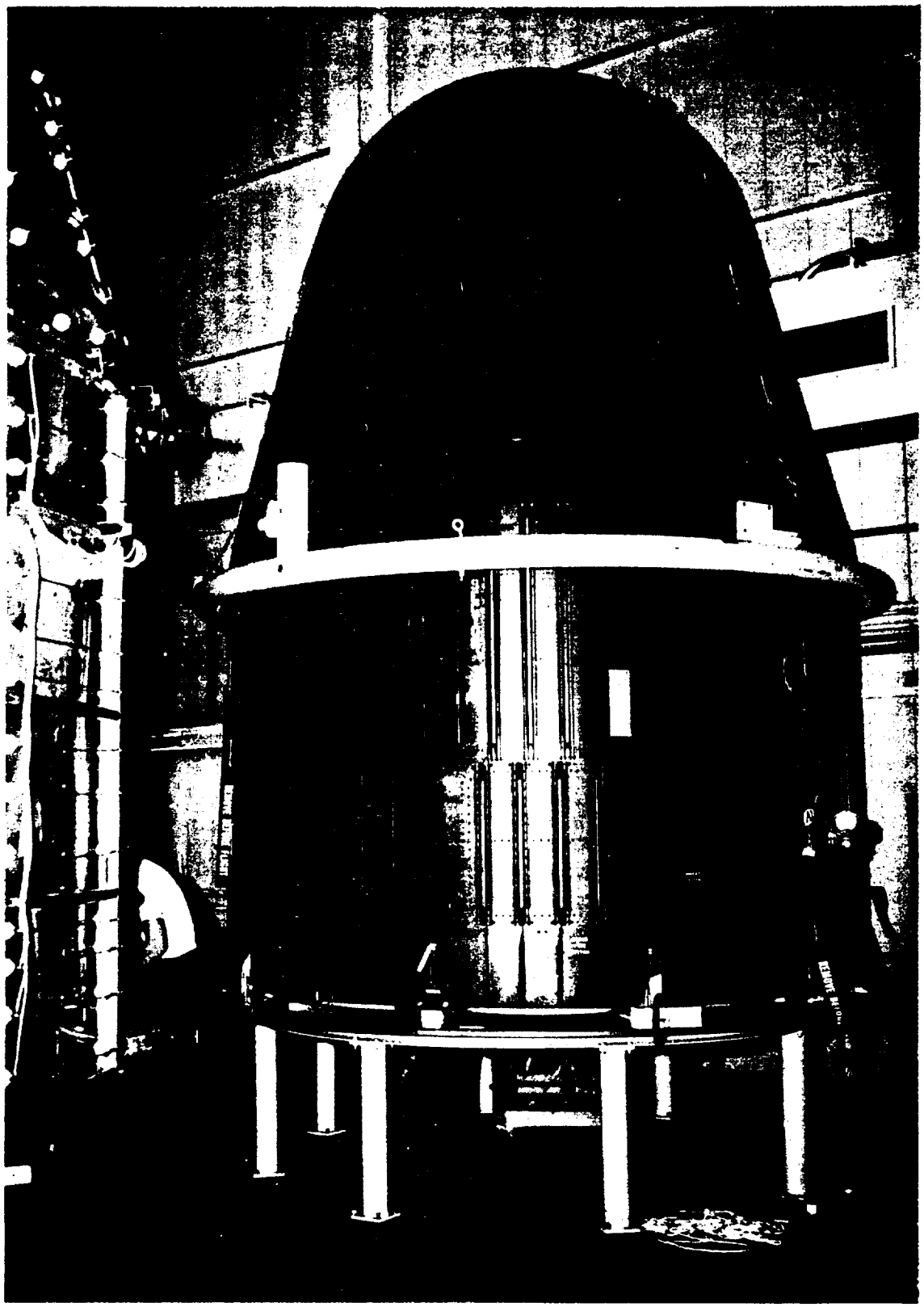


FIGURE I.B.3-2. 15 FOOT FAIRING

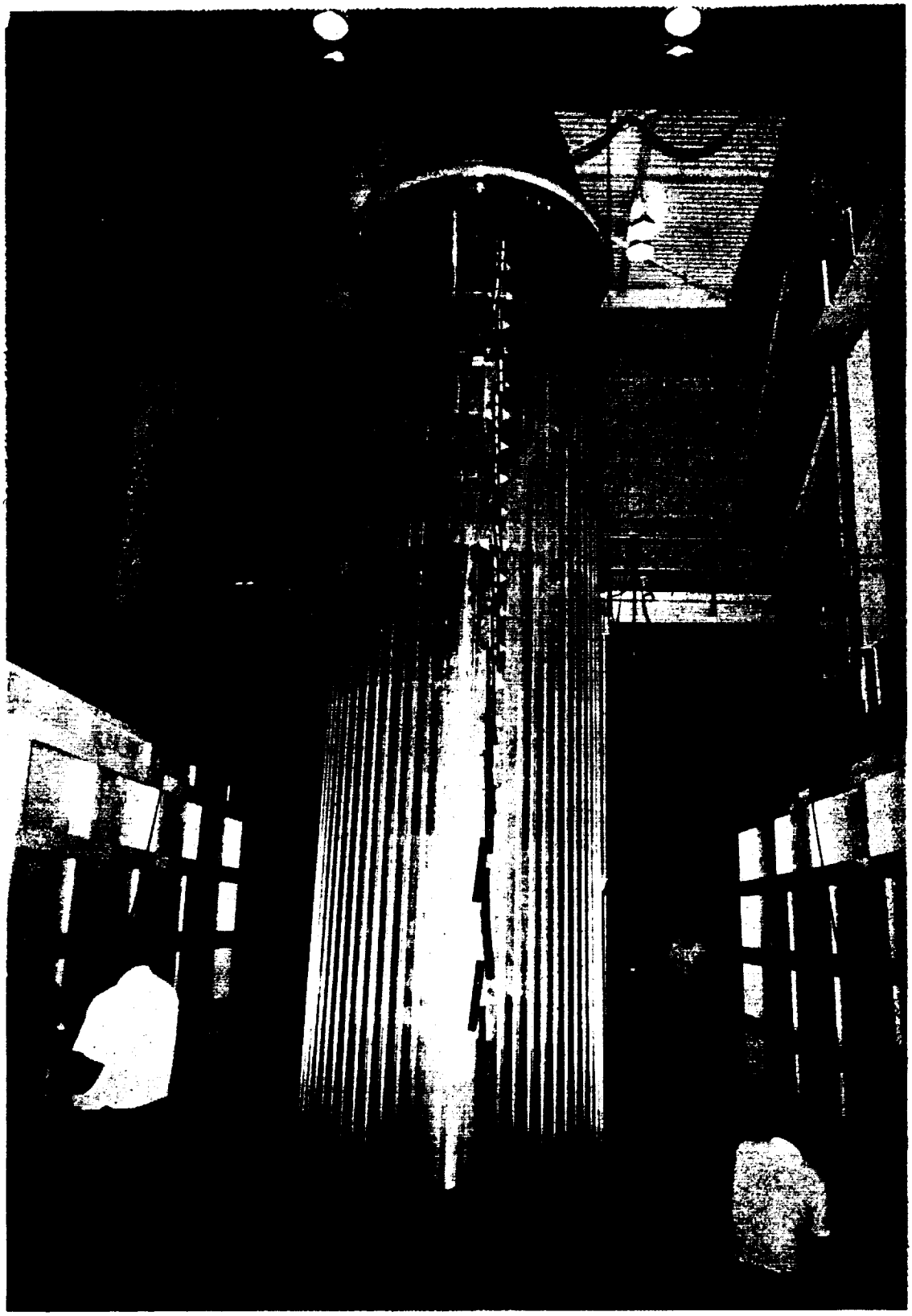


FIGURE I.B.3-3. 50 FOOT FAIRING

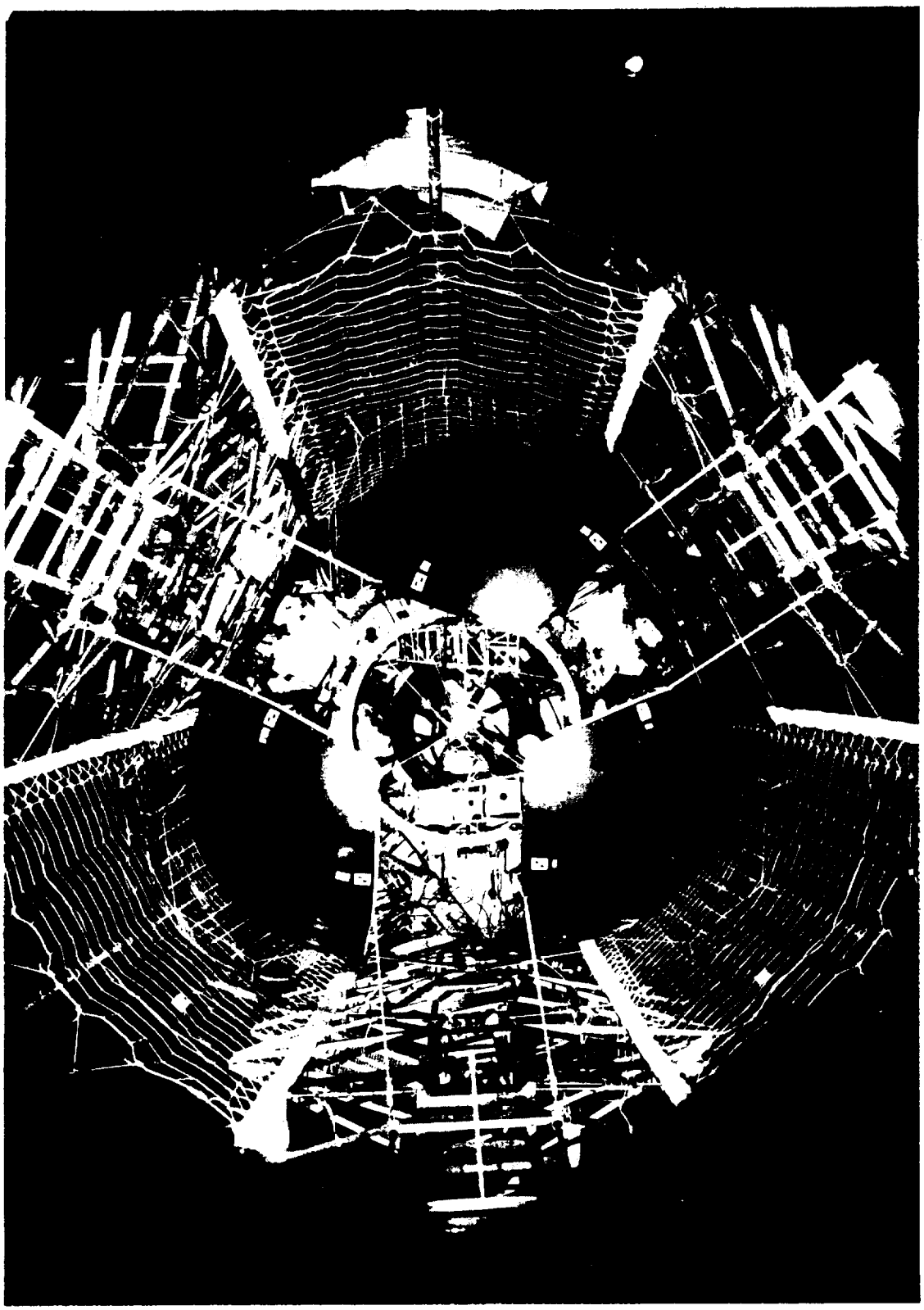


FIGURE I.B.3-4. SEPARATED TRI-SECTIONS

UNIVERSAL FAIRING ANTI-CONTAMINATION JOINT

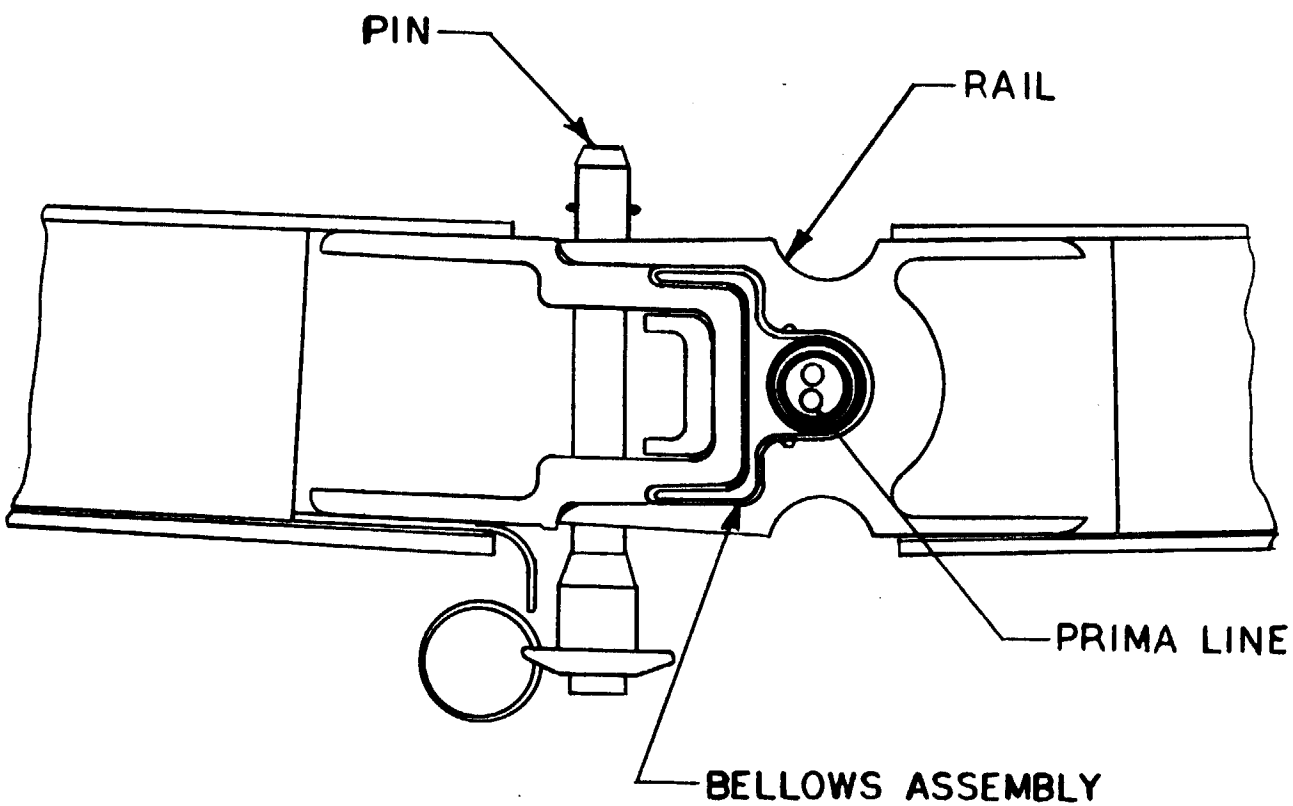
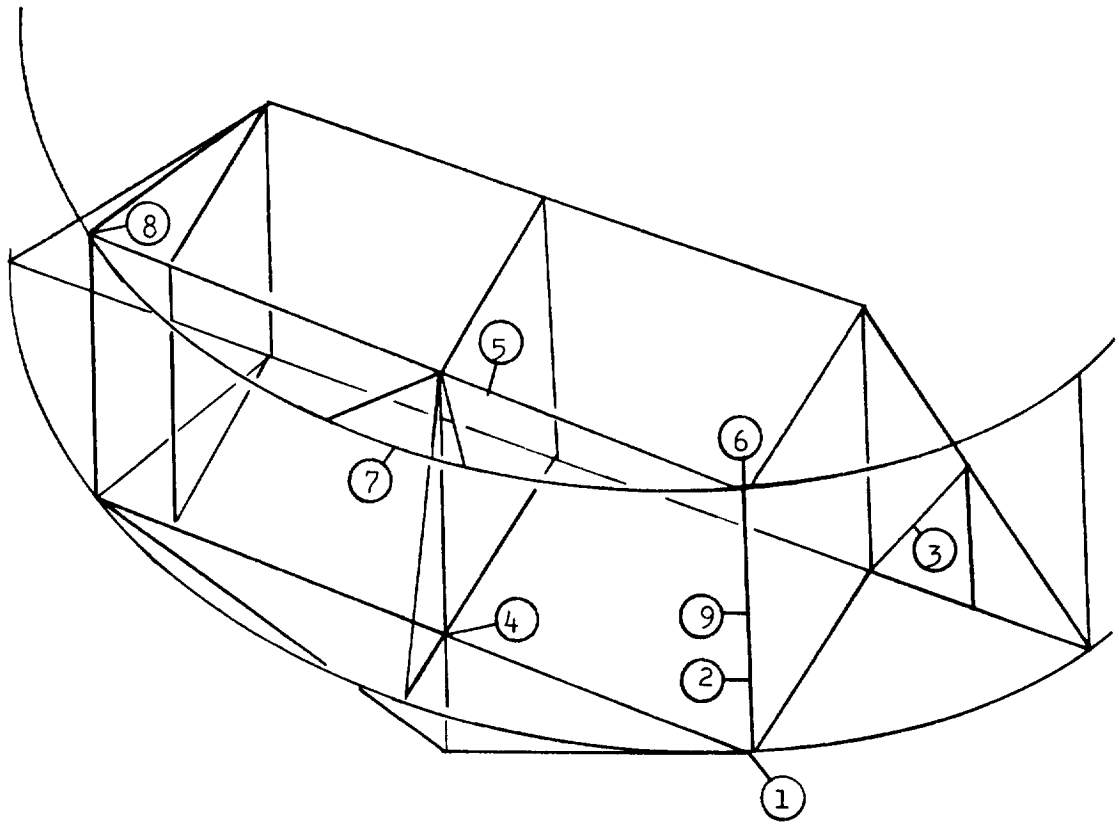
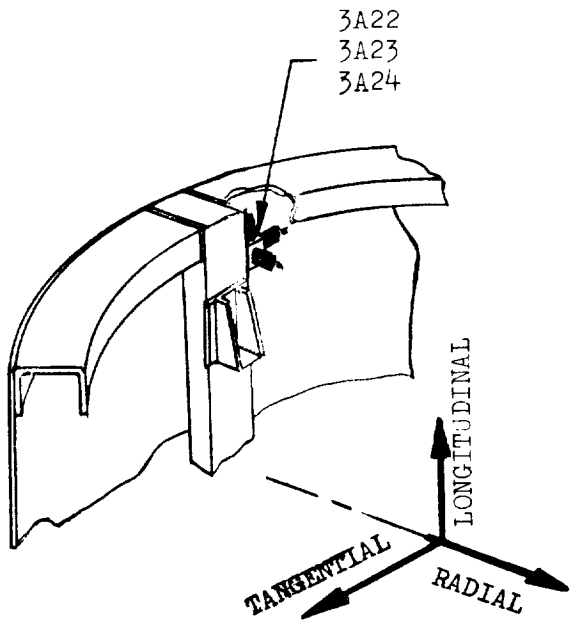


Figure I.B.3-5. Universal Fairing Anti-Contamination Joint

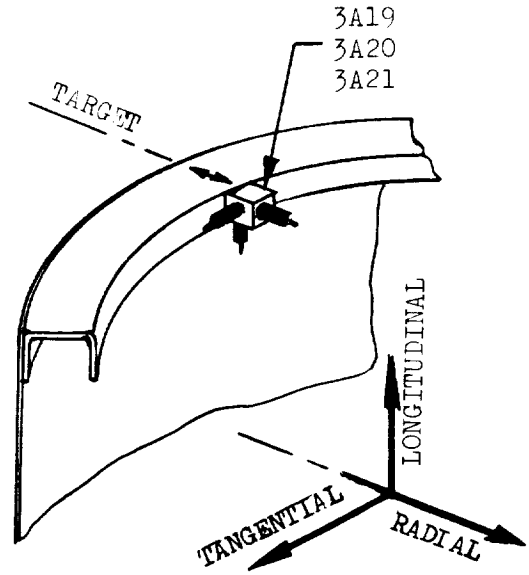


1	3A1, 3A2
2	3A4, 3A5, 3A6
3	3A7, 3A8, 3A9
4	3A10, 3A11
5	3A13, 3A14
6	3A16, 3A17, 3A18
7	3A19, 3A20, 3A21
8	3A22, 3A23, 3A24
9	3A25, 3A26, 3A27

Figure I.B.3-6. Accelerometer Locations Relative to Guidance Truss



VIEW B-B
LONGERON 32F



VIEW C-C
RING FRAME AT TARGET

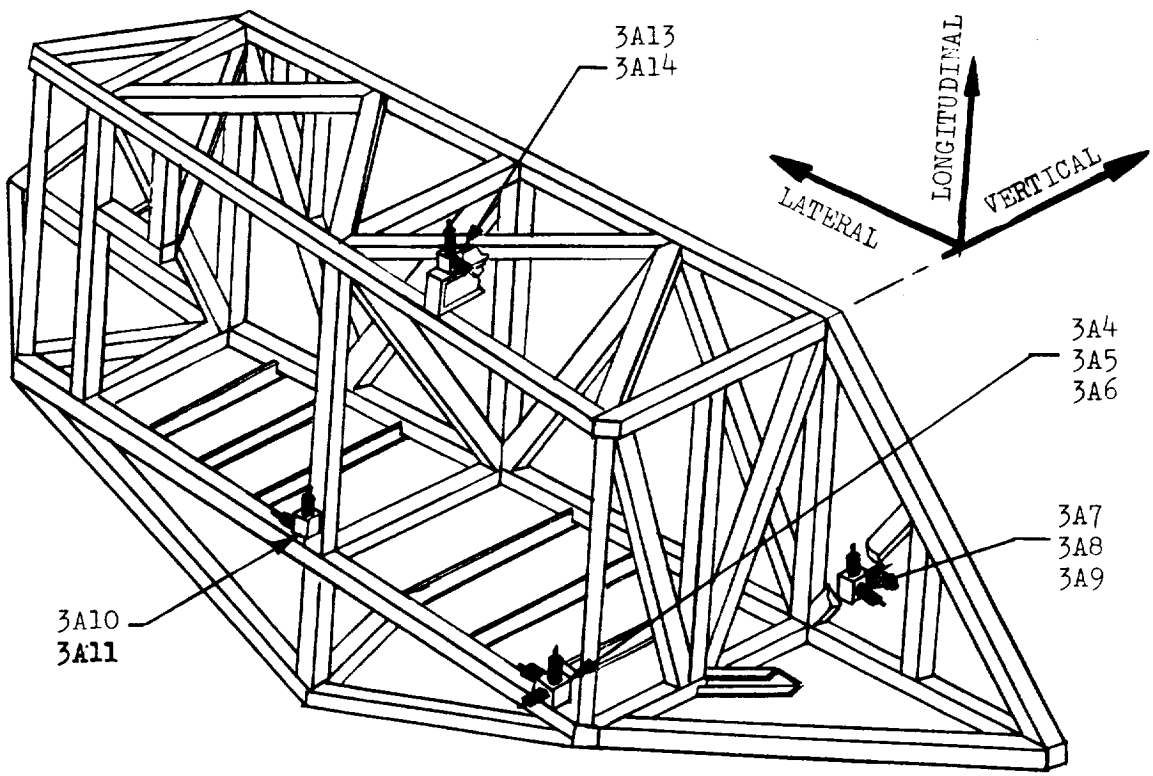
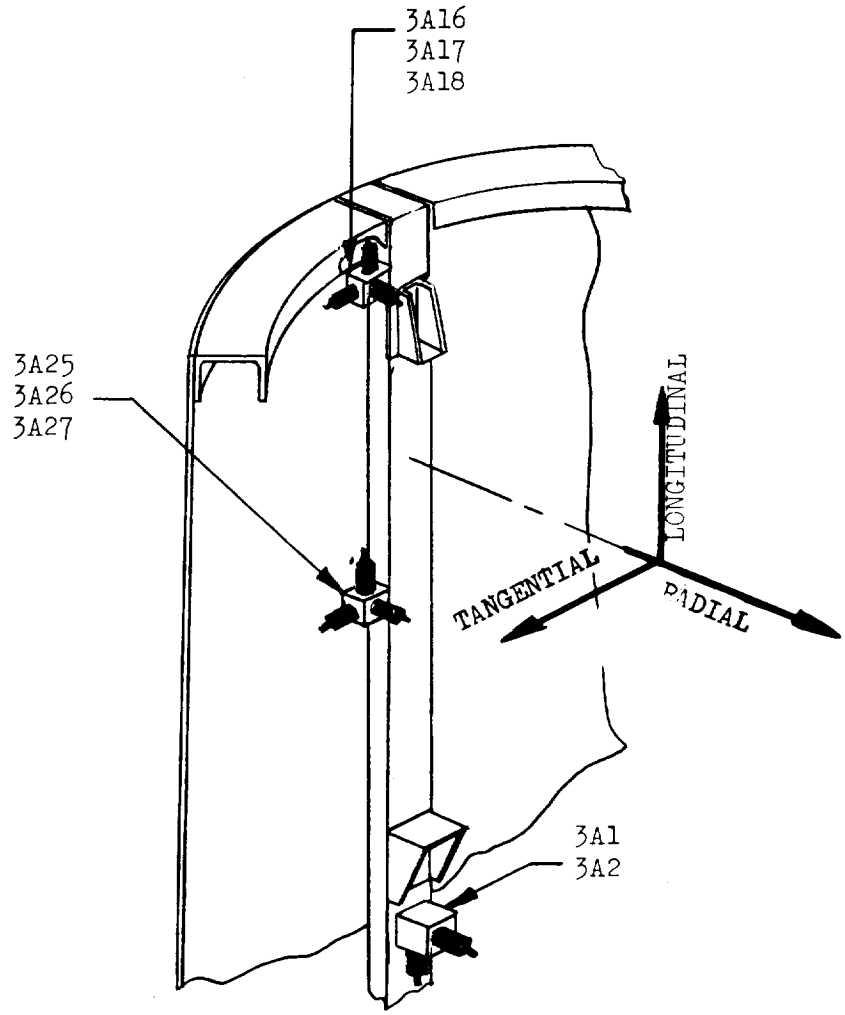
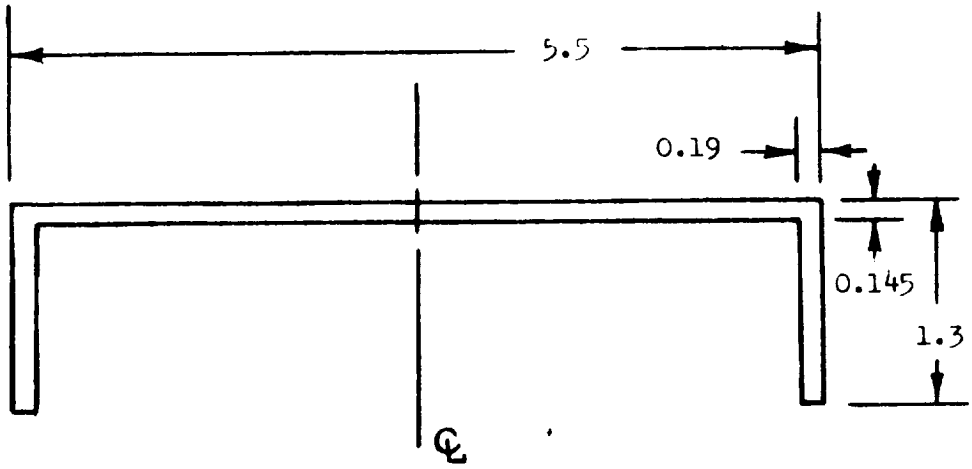


Figure I.B.3-7. Accelerometer Locations



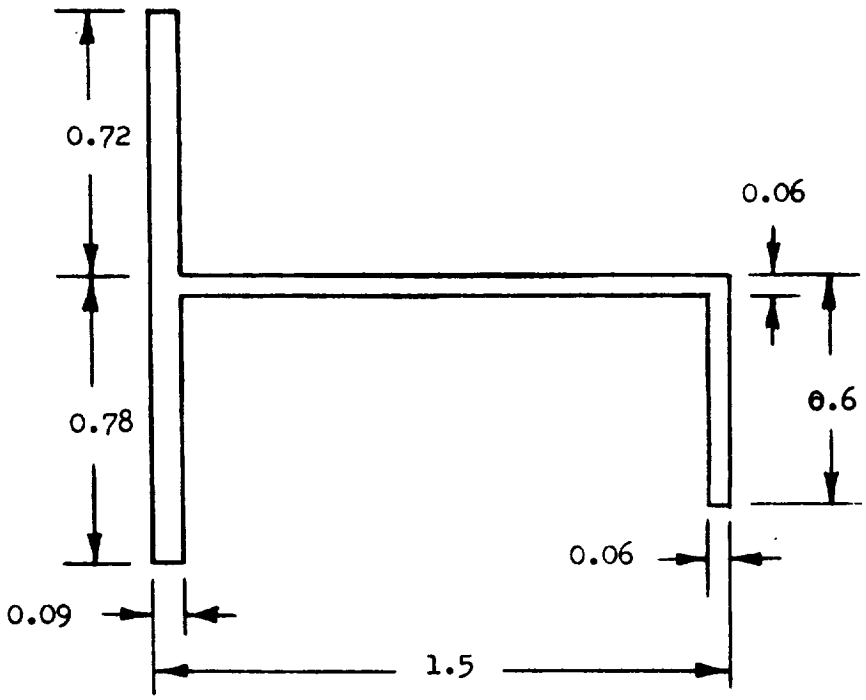
VIEW D-D
LONGERON 4F

Figure I.B.3-8. Accelerometer Locations



RING-FRAME

DIMENSION OF SECTION AT STATION 77



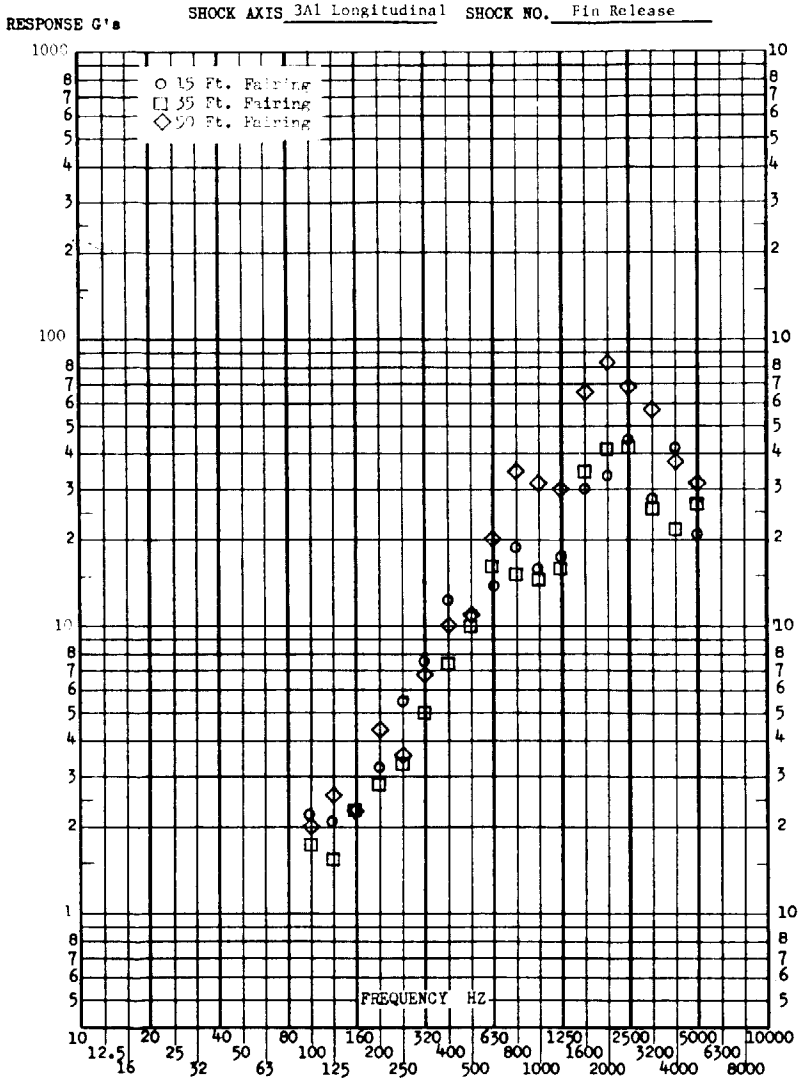
DIMENSIONS OF LONGERON SECTION

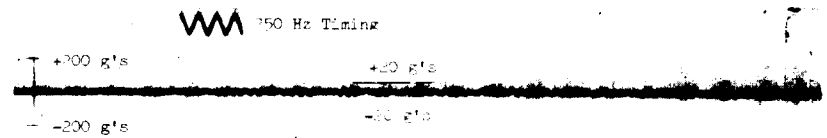
Figure I.B.3-9. Sectional Dimensions

TEST ITEM UPLF PART NO.

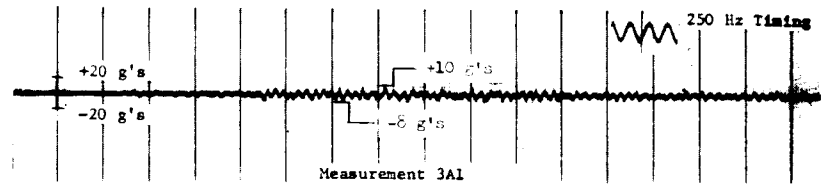
SERIAL NO. TEST DATE July 1968

SHOCK AXIS 3A1 Longitudinal SHOCK NO. Fin Release

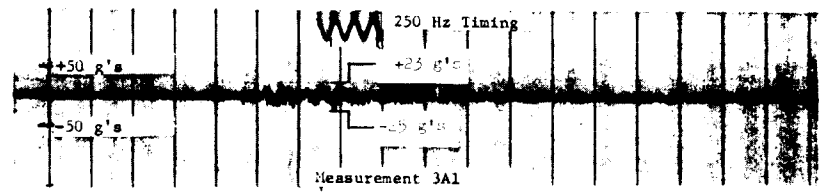




15 Ft.



35 Ft.



50 Ft.

FIGURE I.B.3-10

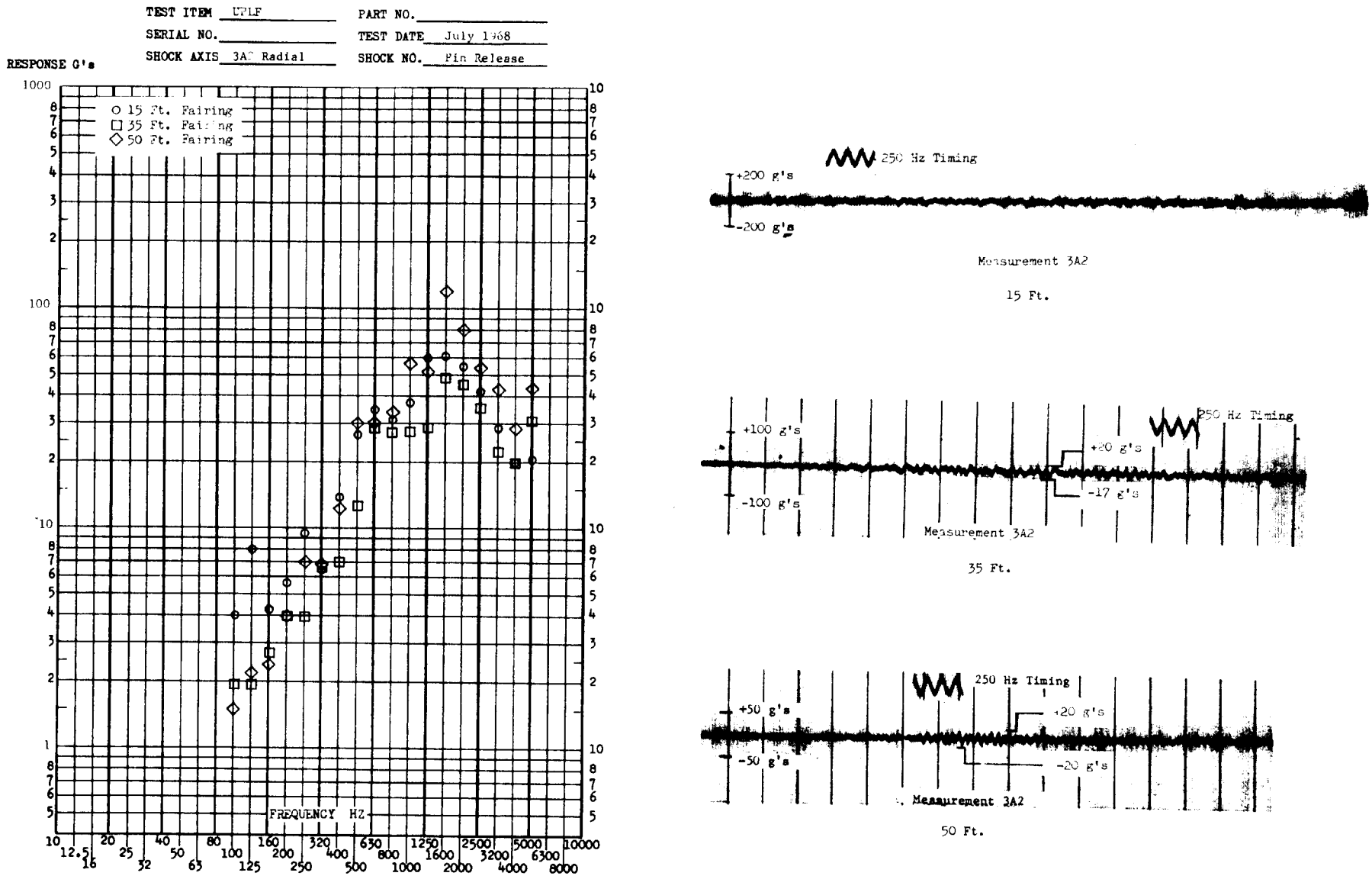
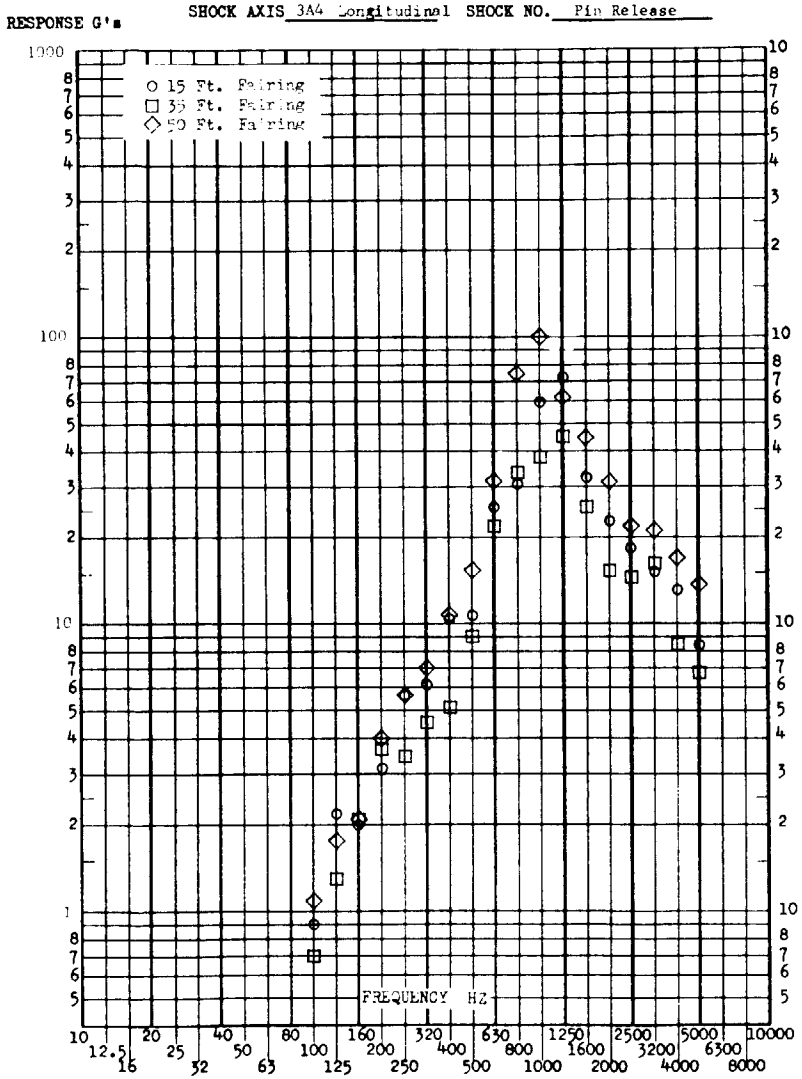
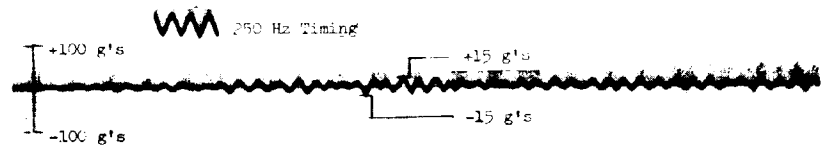


FIGURE I.B.3-11

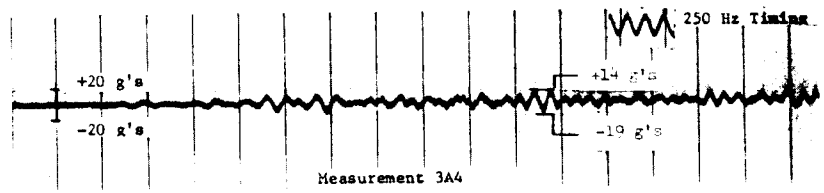
TEST ITEM UPLF PART NO.
SERIAL NO. TEST DATE July 1968
SHOCK AXIS 3A4 Longitudinal SHOCK NO. Pin Release



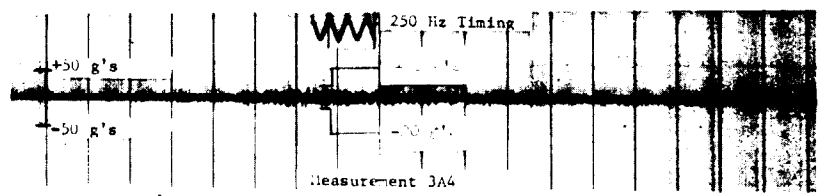


Measurement 3A4

15 Ft.

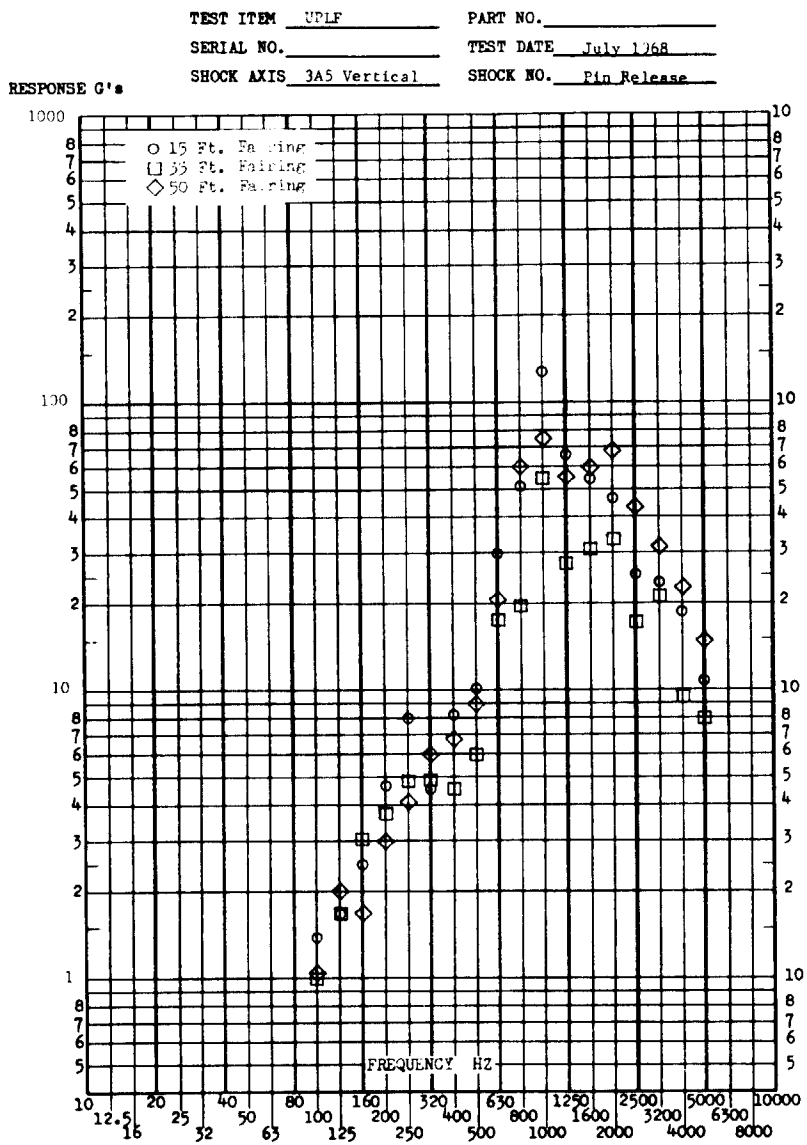


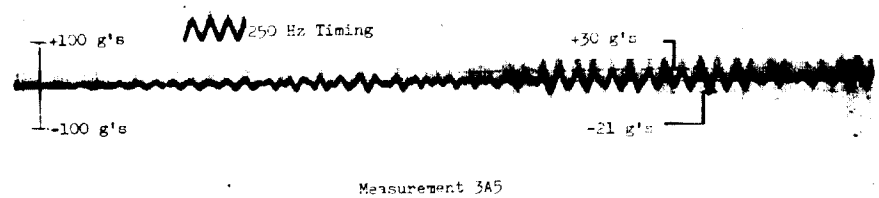
35 Ft.



50 Ft.

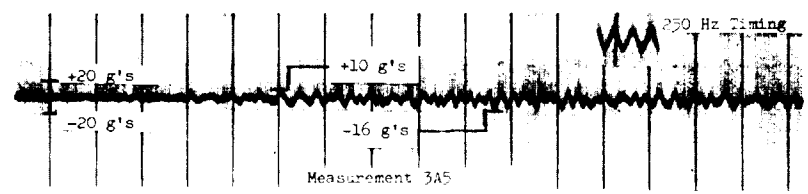
FIGURE 1.B.3-12





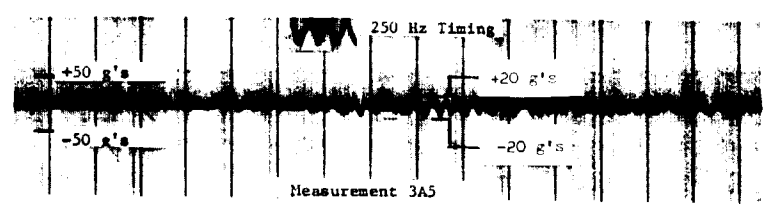
Measurement 3A5

15 Ft.



Measurement 3A5

35 Ft.



Measurement 3A5

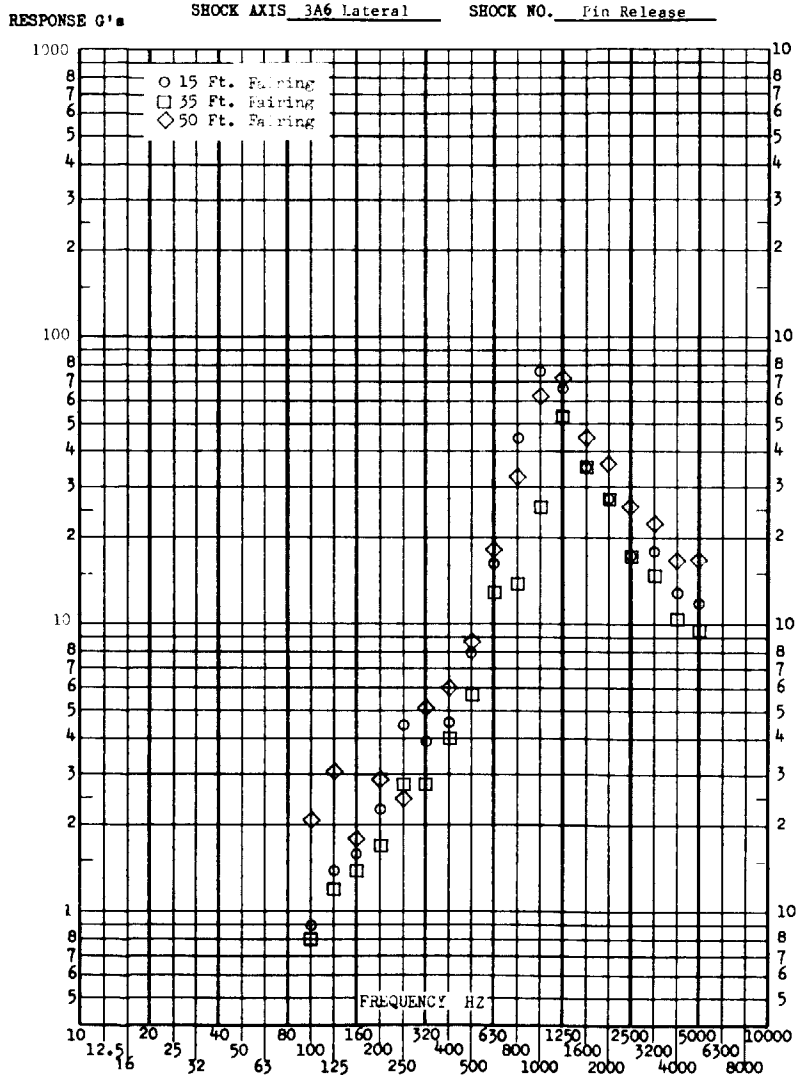
50 Ft.

FIGURE I.B.3-13

TEST ITEM UPLF PART NO.

SERIAL NO. TEST DATE July 1968

SHOCK AXIS 3A6 Lateral SHOCK NO. Pin Release



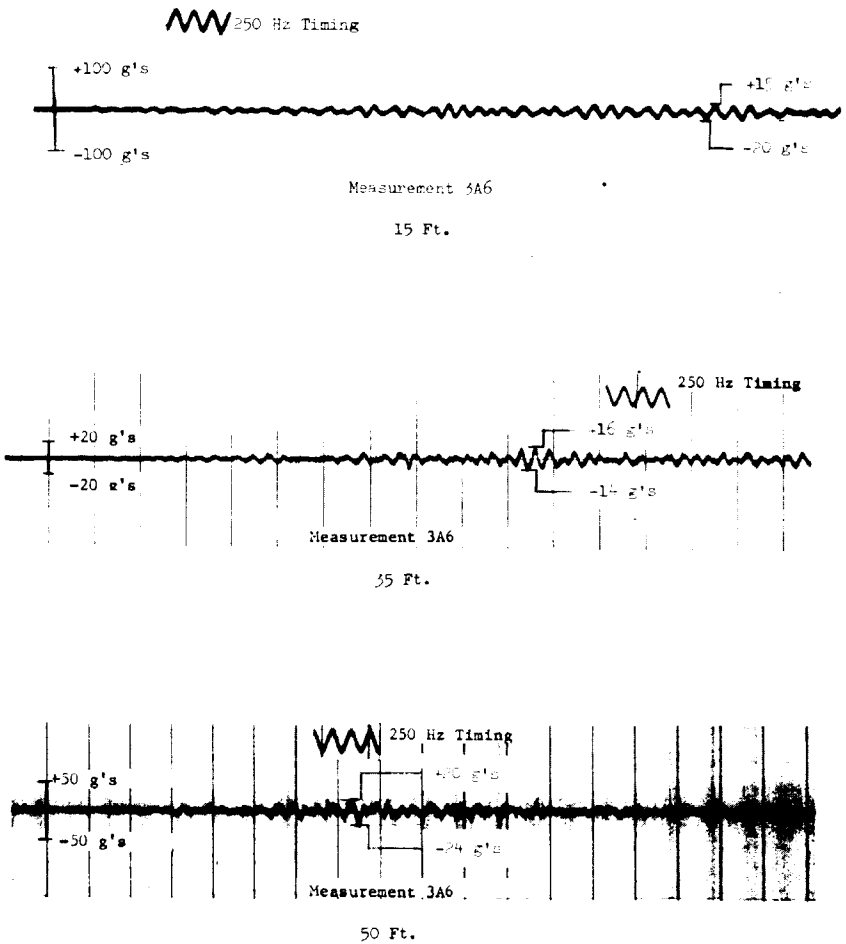


FIGURE 1.B.3-14

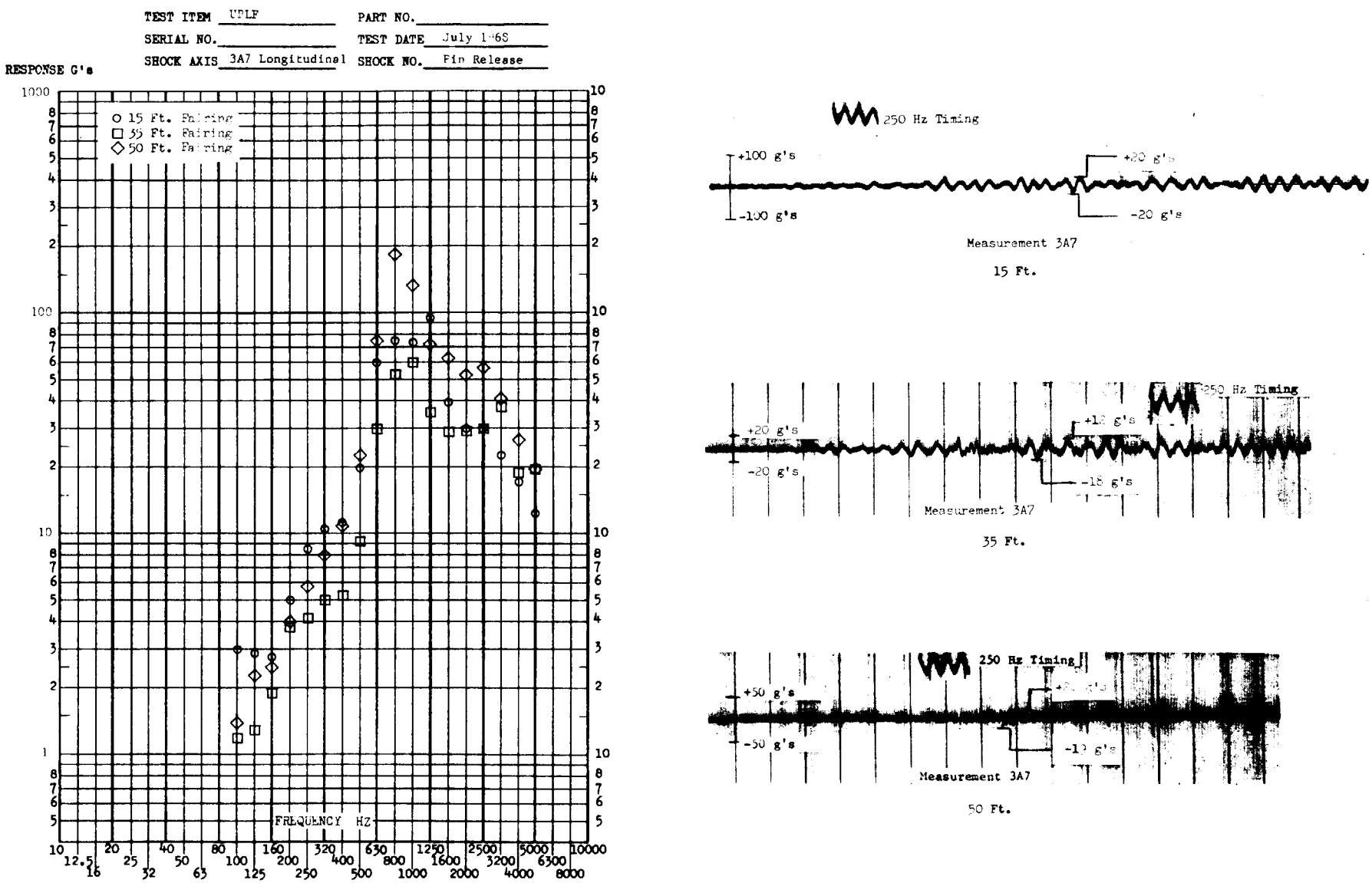
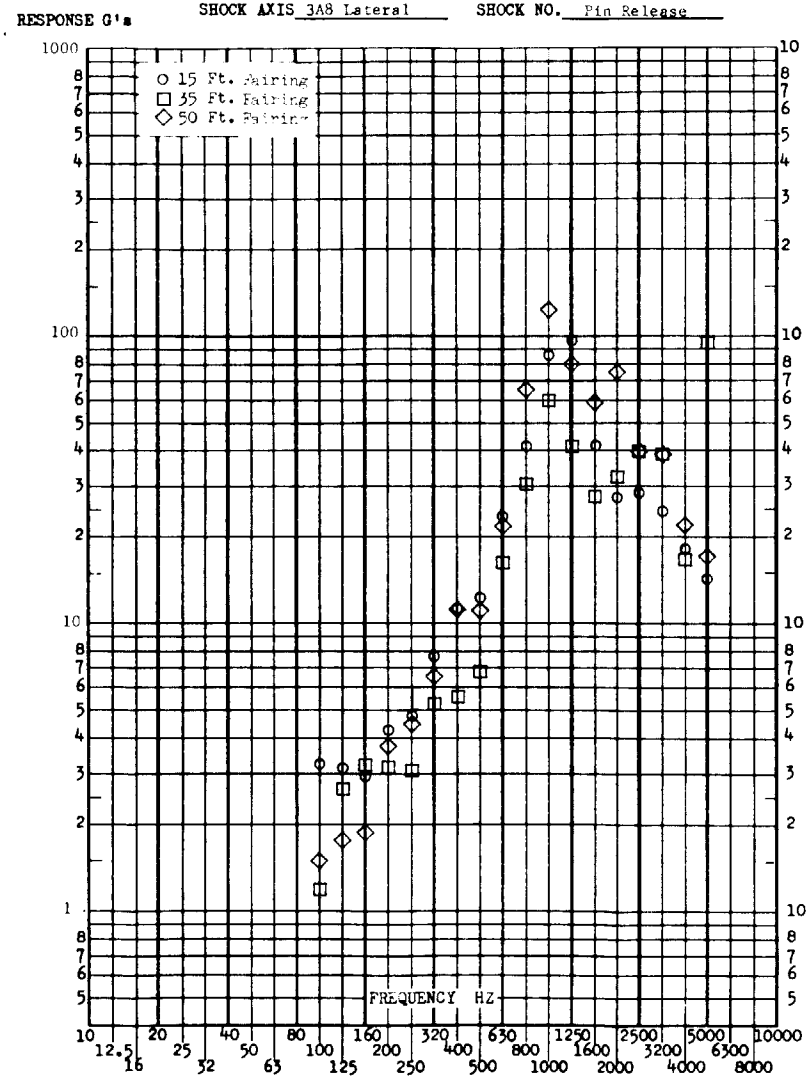


FIGURE 1.B.3-15

TEST ITEM UPLF PART NO.

SERIAL NO. TEST DATE July 1968

SHOCK AXIS 3A8 Lateral SHOCK NO. Pin Release



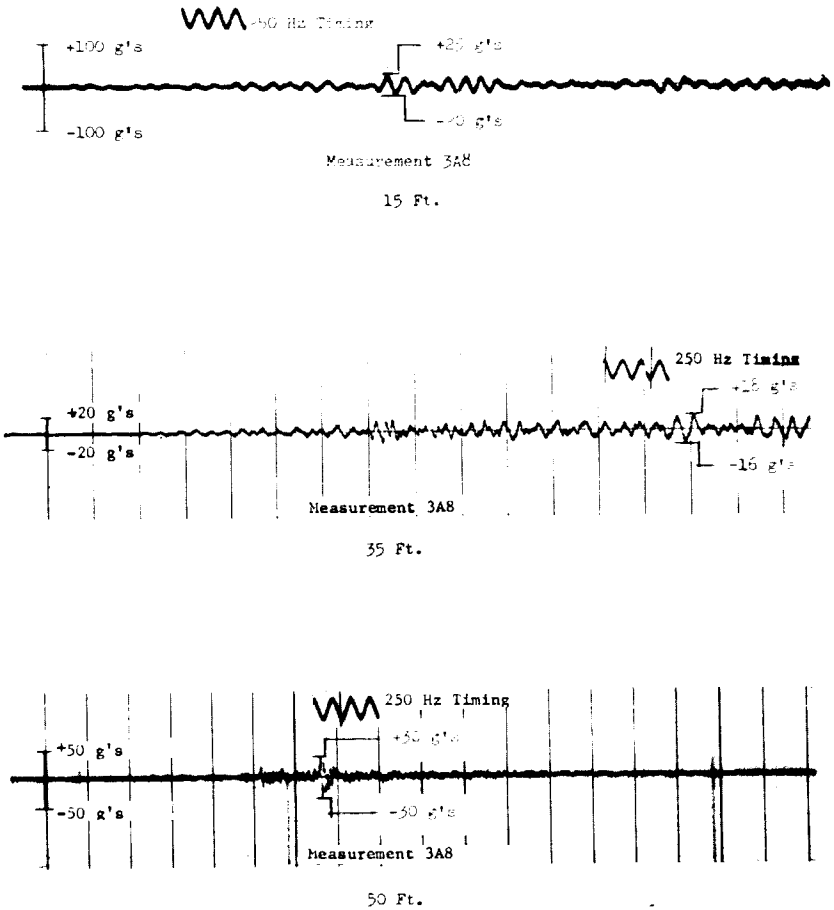
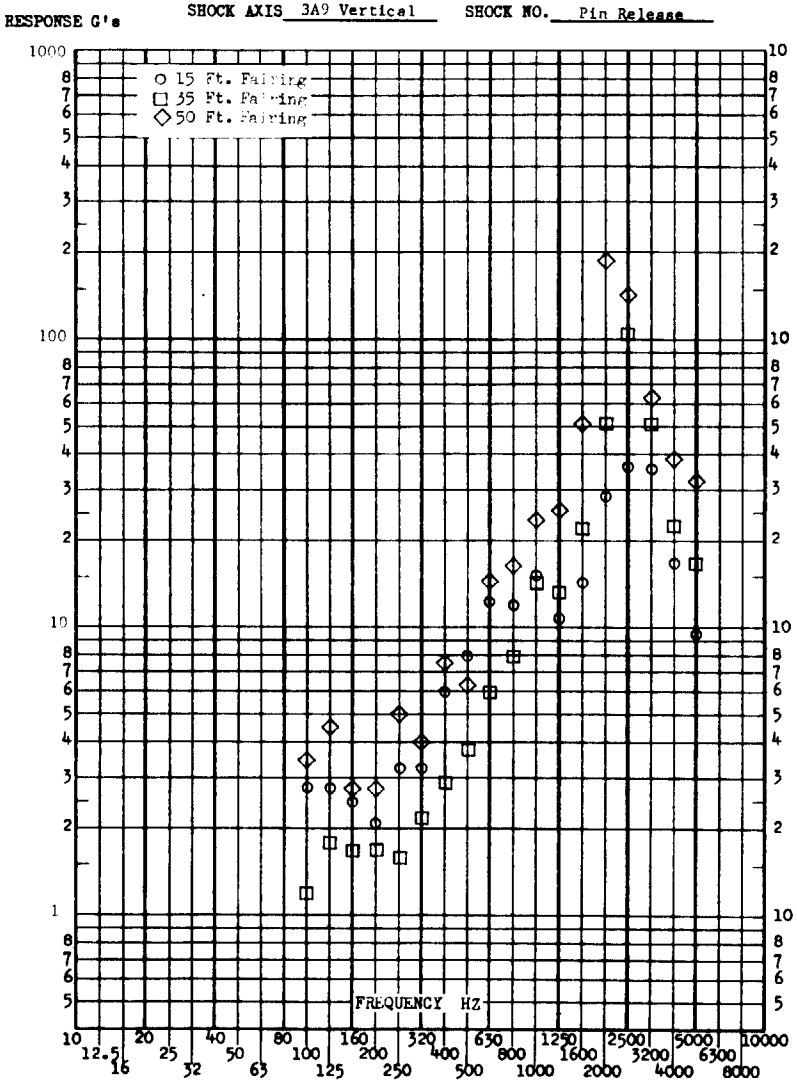


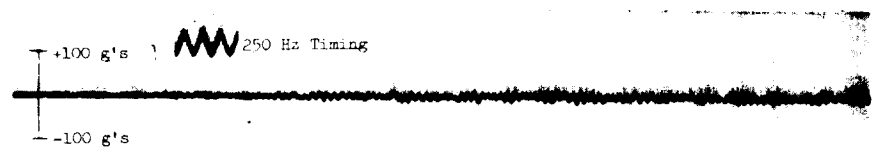
FIGURE I.B.3-16

TEST ITEM UPLF PART NO.

SERIAL NO. TEST DATE July 1968

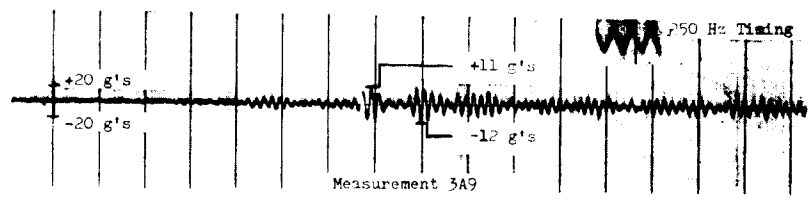
SHOCK AXIS 3A9 Vertical SHOCK NO. Pin Release





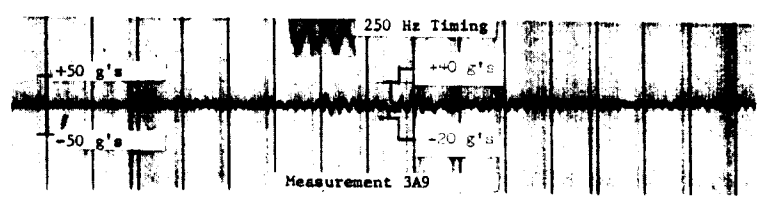
Measurement 3A9

15 Ft.



Measurement 3A9

35 Ft.



Measurement 3A9

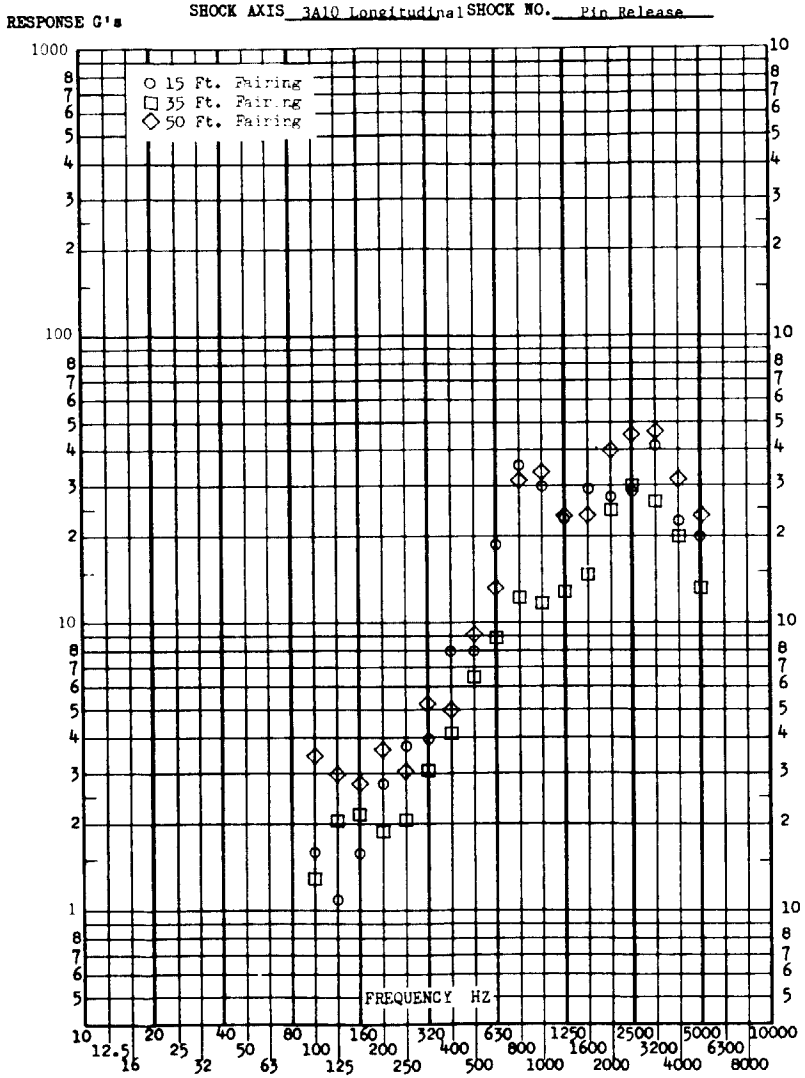
50 Ft.

FIGURE 1.B.3-17

TEST ITEM UPLF PART NO.

SERIAL NO. TEST DATE July 1968

SHOCK AXIS 3A10 Longitudinal SHOCK NO. Pin Release



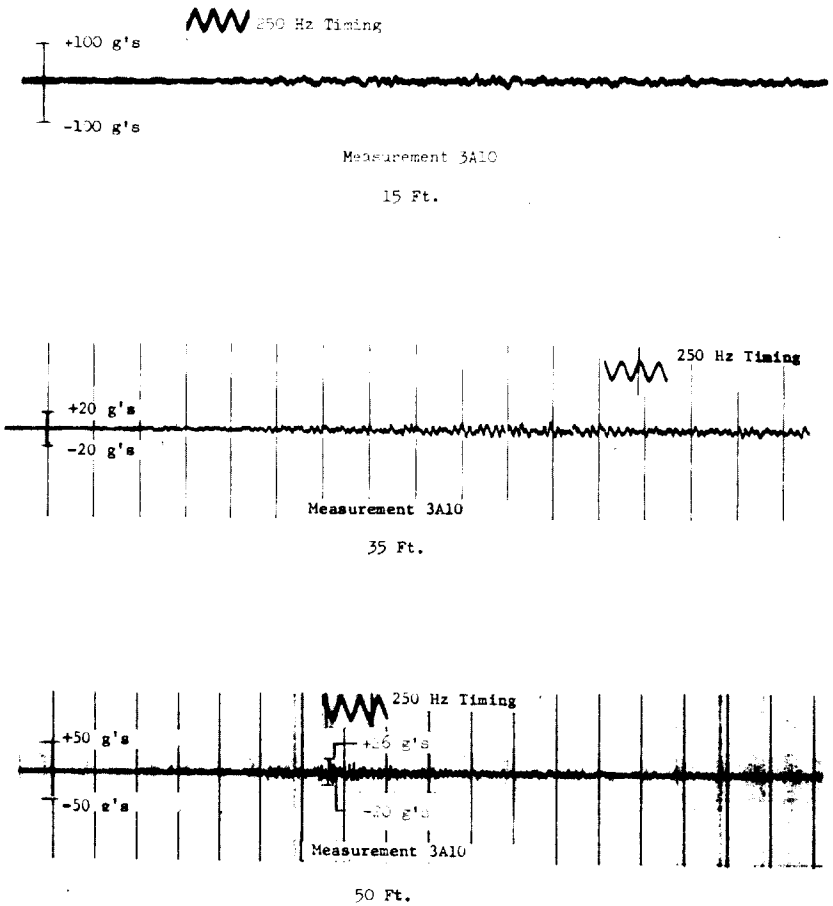
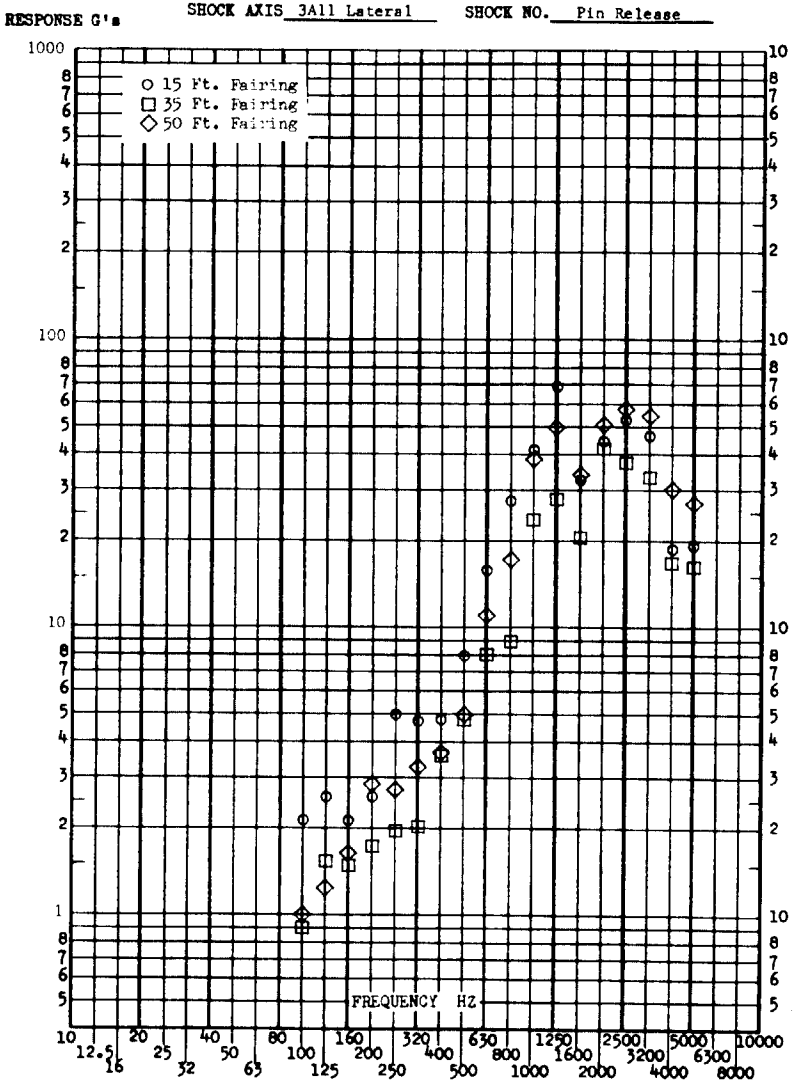
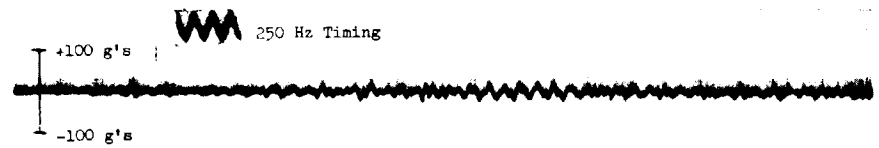


FIGURE 1.B.3-18

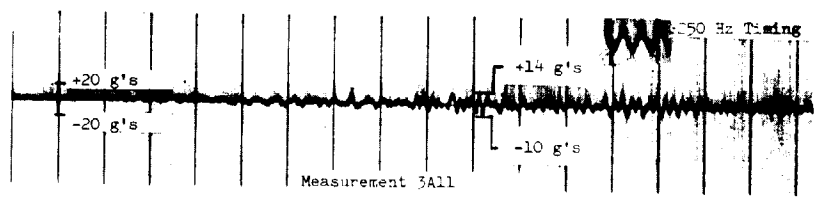
TEST ITEM UPLF PART NO.
SERIAL NO. TEST DATE July 1 68
SHOCK AXIS 3A11 Lateral SHOCK NO. Pin Release





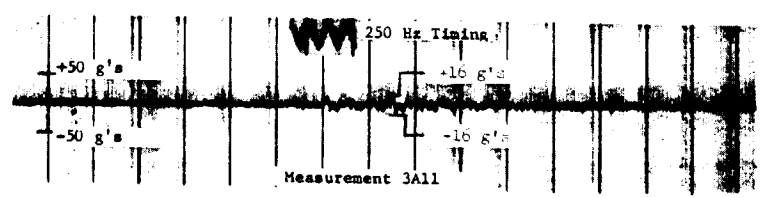
Measurement 3A11

15 Ft.



Measurement 3A11

35 Ft.



Measurement 3A11

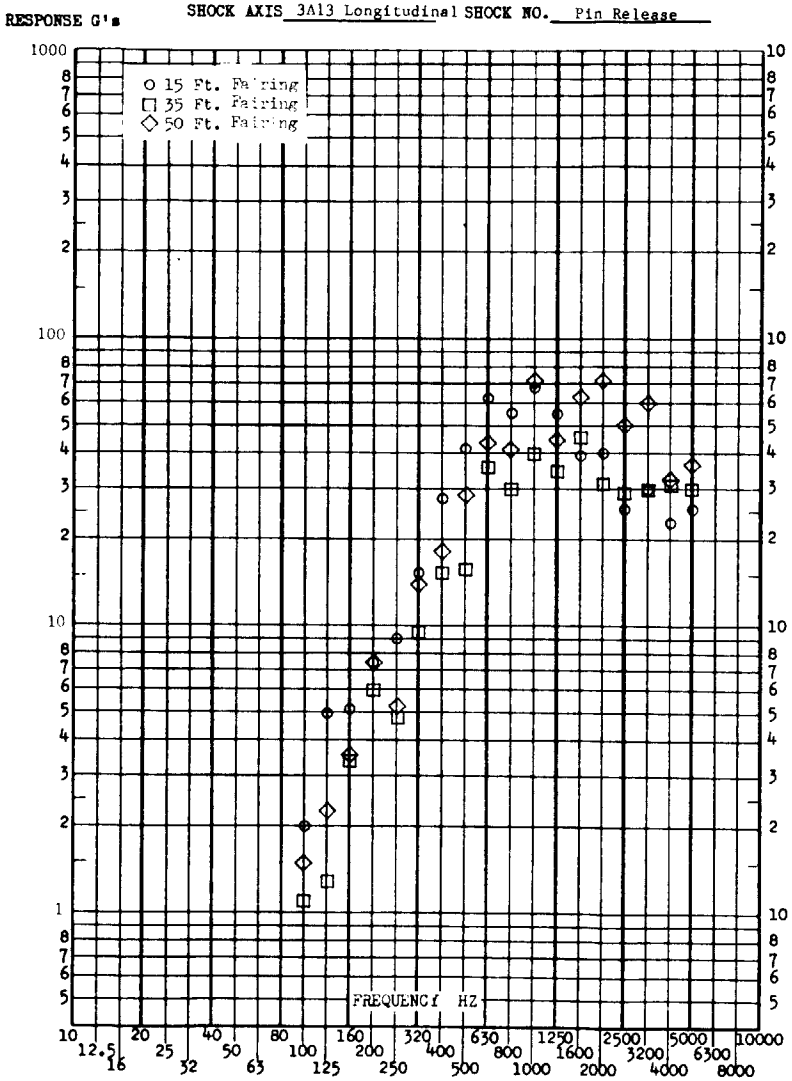
50 Ft.

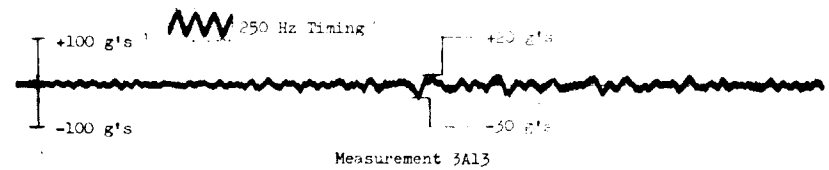
FIGURE 1.B.3-19

TEST ITEM UPLF PART NO.

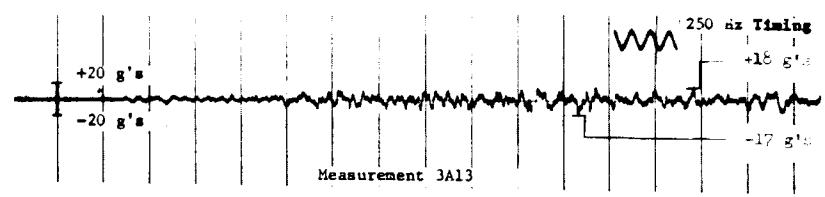
SERIAL NO. TEST DATE July 1968

SHOCK AXIS 3A13 Longitudinal SHOCK NO. Pin Release

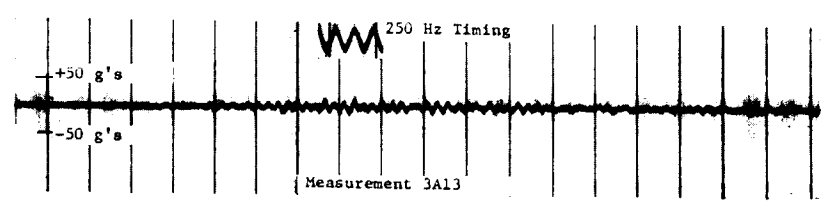




15 Ft.



35 Ft.



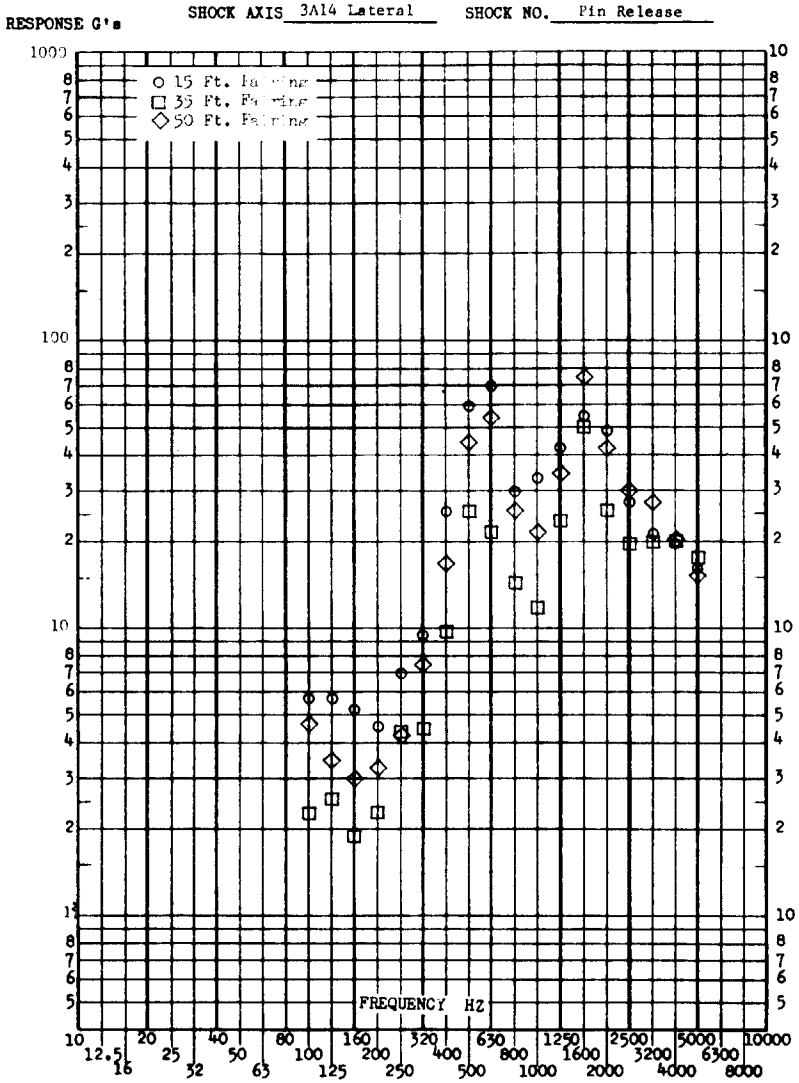
50 Ft.

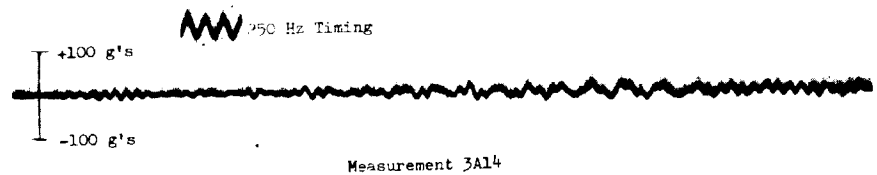
FIGURE I.B.3-20

TEST ITEM UPLF PART NO.

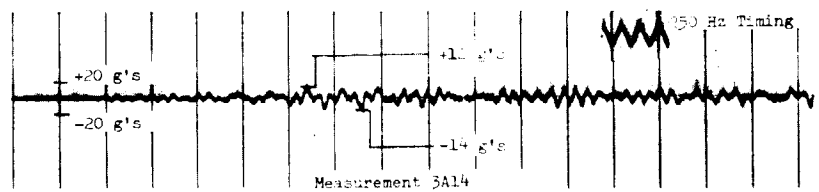
SERIAL NO. TEST DATE July 1968

SHOCK AXIS 3A14 Lateral SHOCK NO. Pin Release

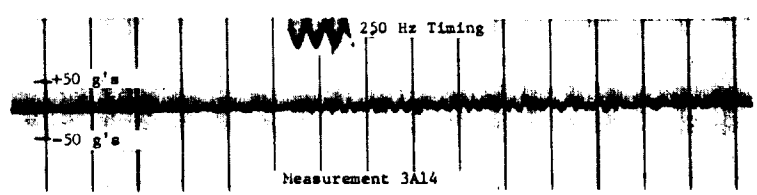




15 Ft.



35 Ft.



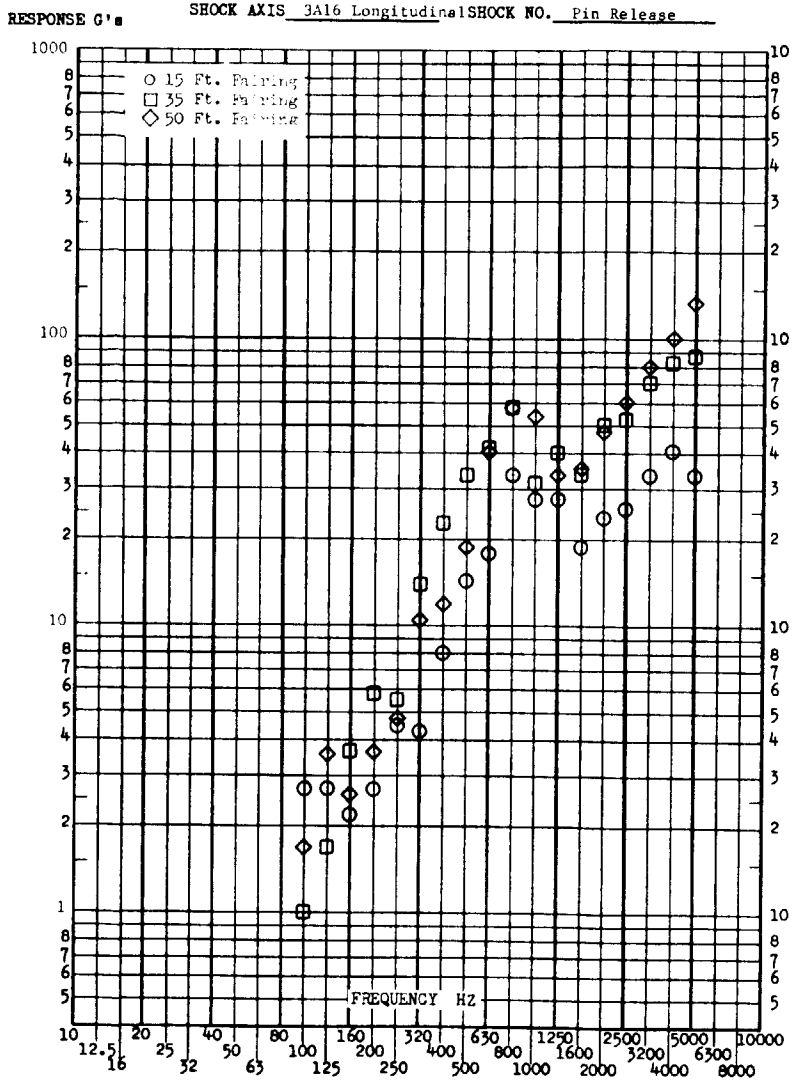
50 Ft.

FIGURE I.B.3-21

TEST ITEM UPLF PART NO.

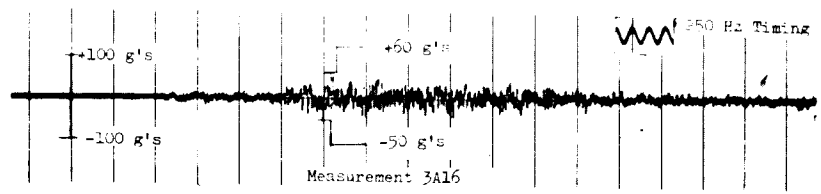
SERIAL NO. TEST DATE July 1968

SHOCK AXIS 3A16 Longitudinal SHOCK NO. Pin Release

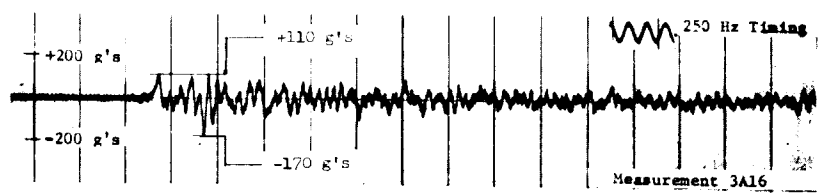


Measurement 3A16

15 Ft.

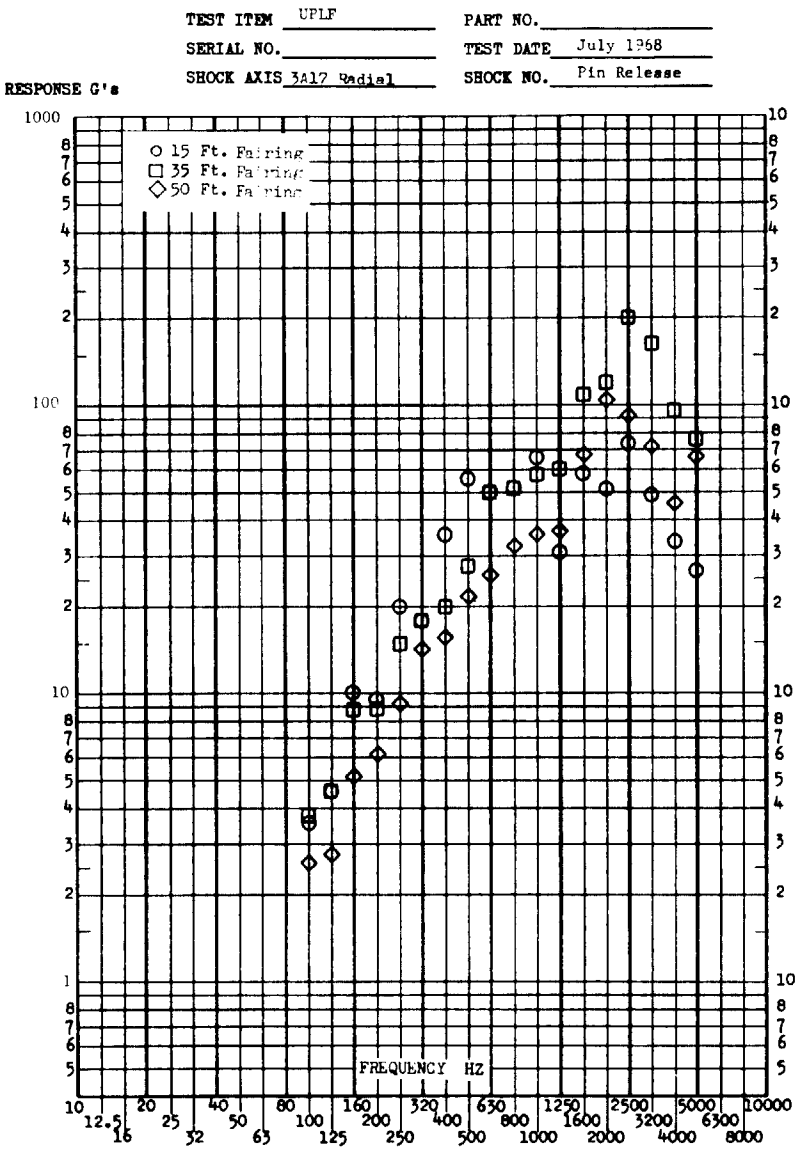


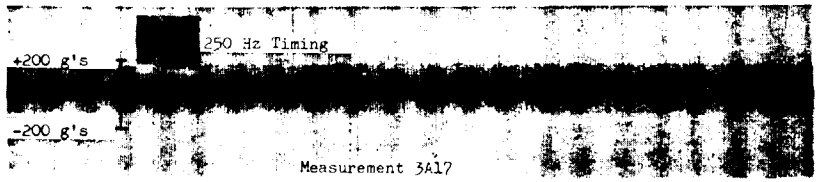
35 Ft.



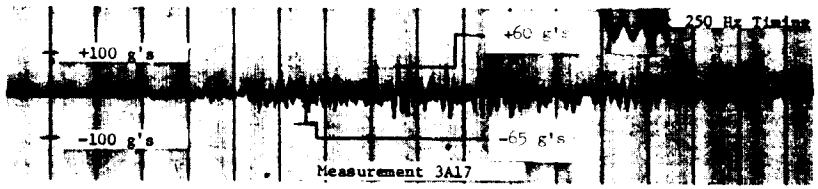
50 Ft.

FIGURE I.B.3-22

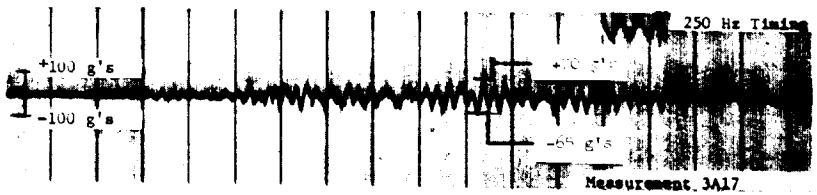




15 Ft.



35 Ft.



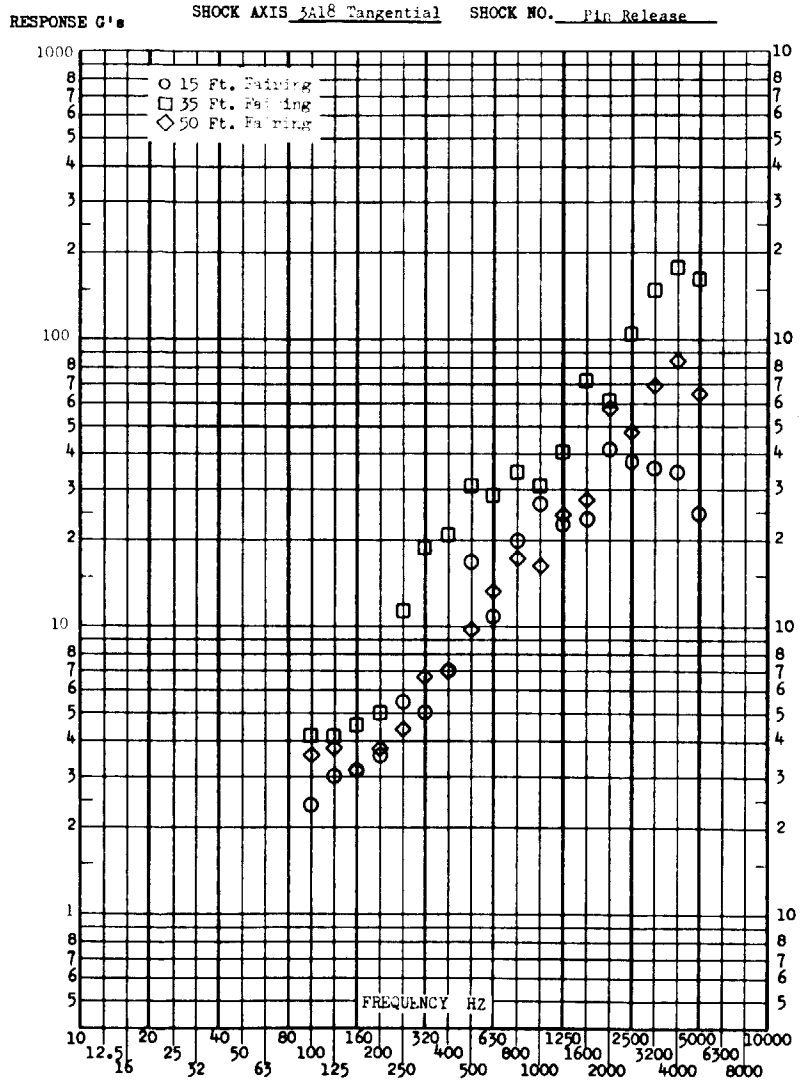
50 Ft.

FIGURE I.B.3-23

TEST ITEM UPLF PART NO.

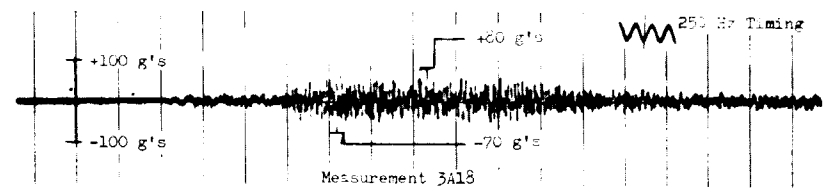
SERIAL NO. TEST DATE July 1968

SHOCK AXIS 3A18 Tangential SHOCK NO. Pin Release

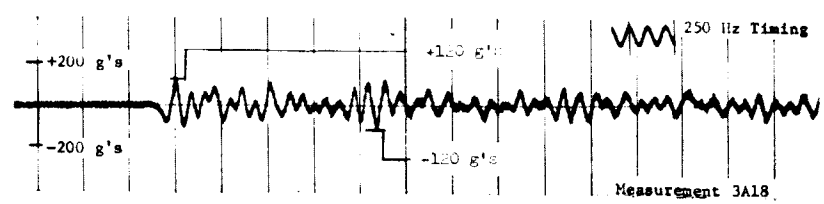


Measurement 3A18

15 Ft.



35 Ft.



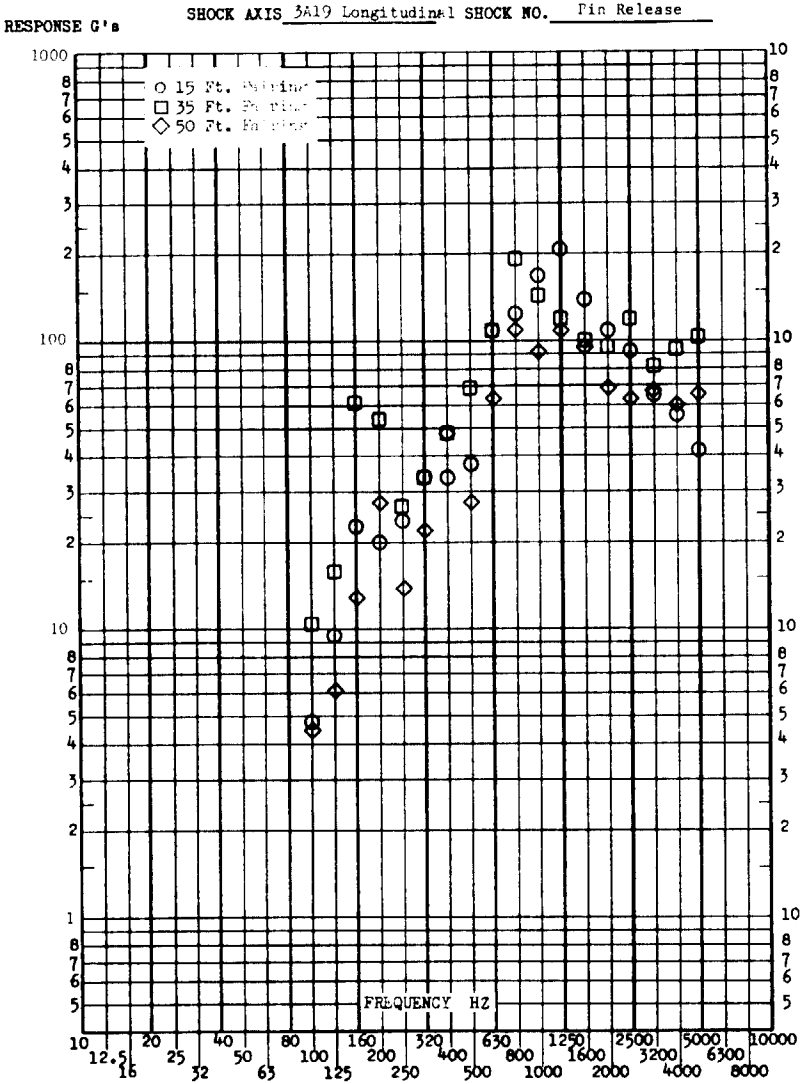
50 Ft.

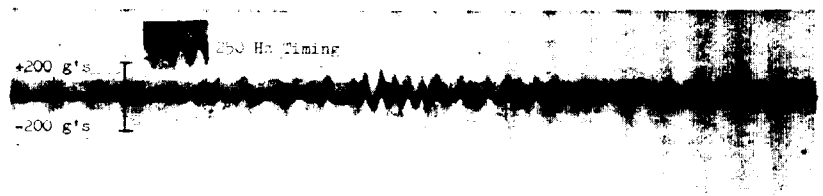
FIGURE I.B.3-24

TEST ITEM UPLF PART NO.

SERIAL NO. TEST DATE July 1 68

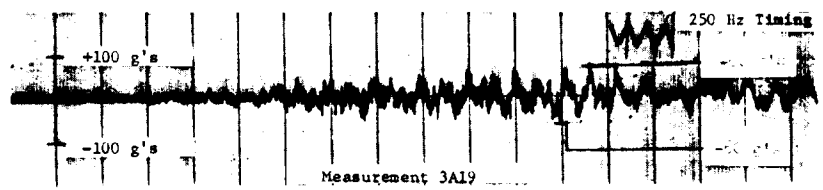
SHOCK AXIS 3A19 Longitudinal SHOCK NO. Pin Release



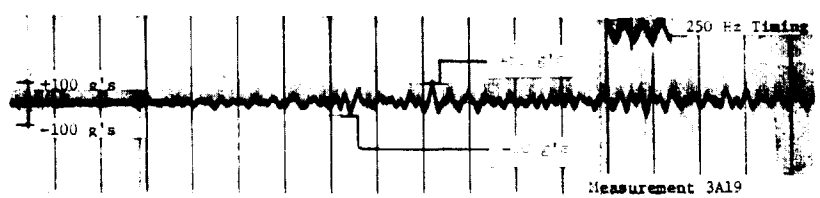


Measurement 3A19

15 Ft.

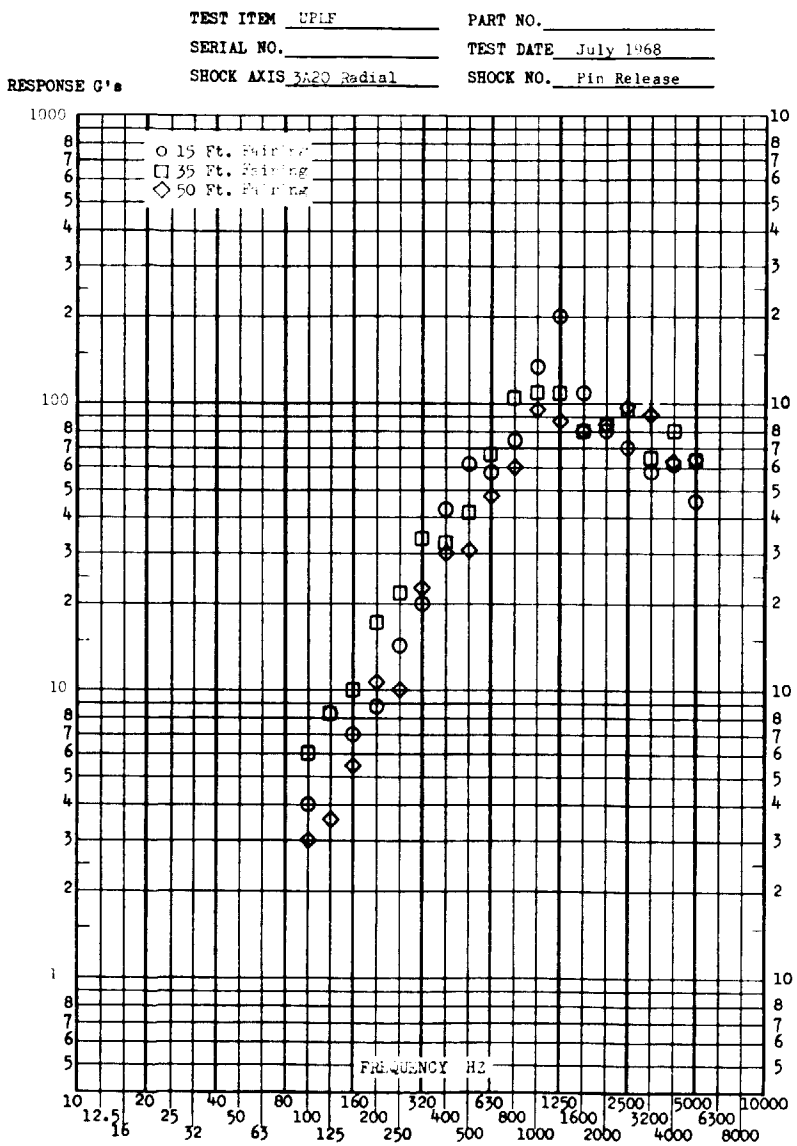


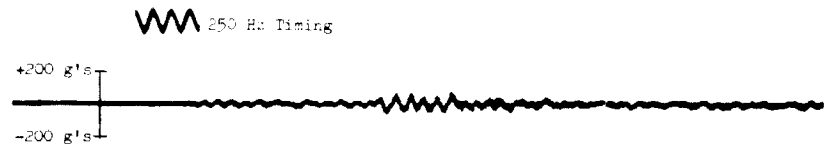
35 Ft.



50 Ft.

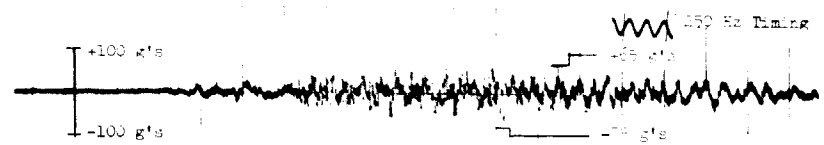
FIGURE I.B.3-25





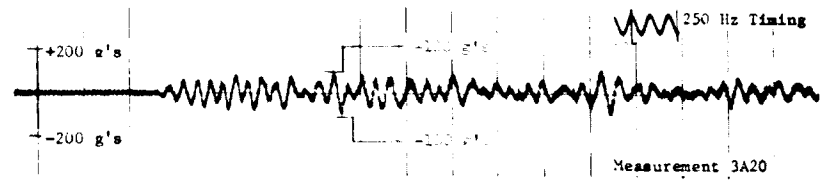
Measurement 3A20

15 Ft.



Measurement 3A20

35 Ft.



Measurement 3A20

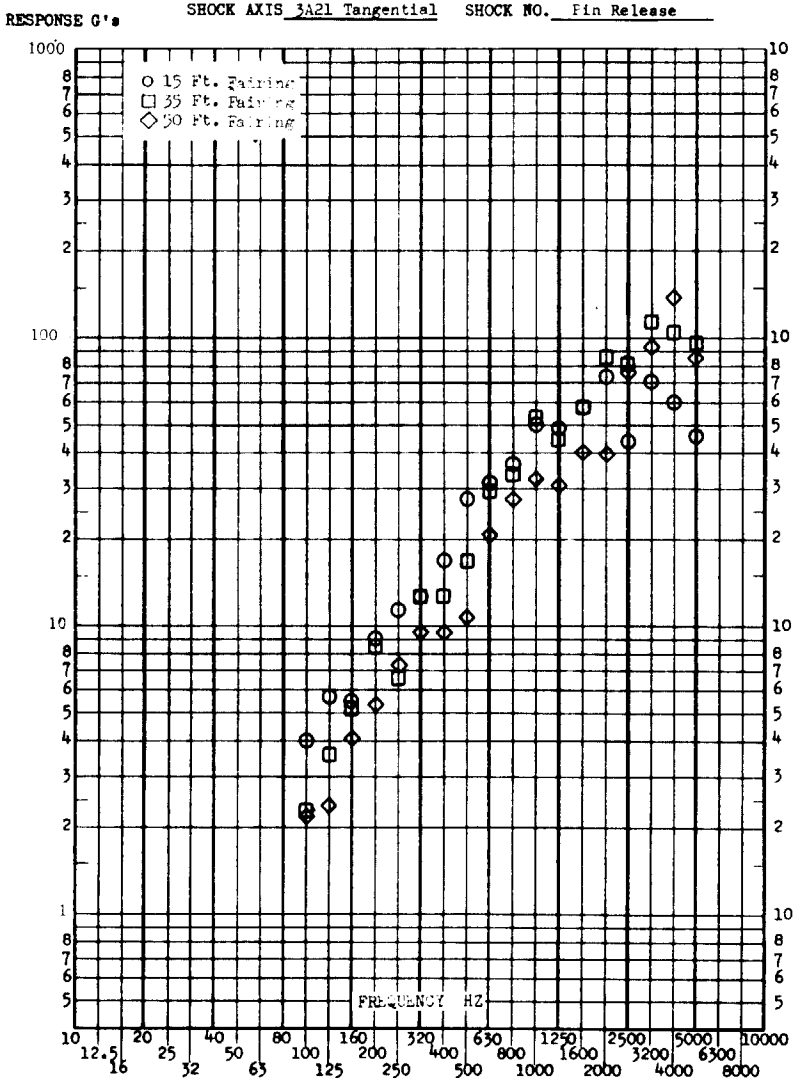
50 Ft.

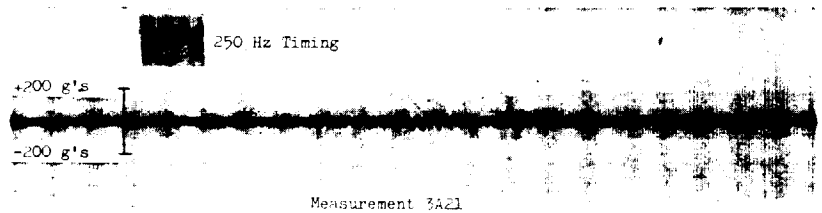
FIGURE 1.B.3-26

TEST ITEM UPLF PART NO.

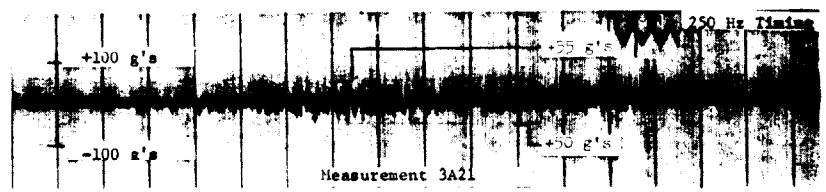
SERIAL NO. TEST DATE July 1968

SHOCK AXIS 3A21 Tangential SHOCK NO. Fin Release

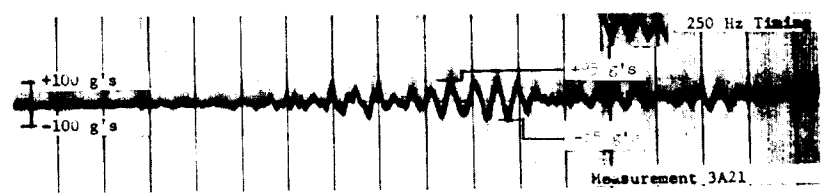




15 Ft.



35 Ft.



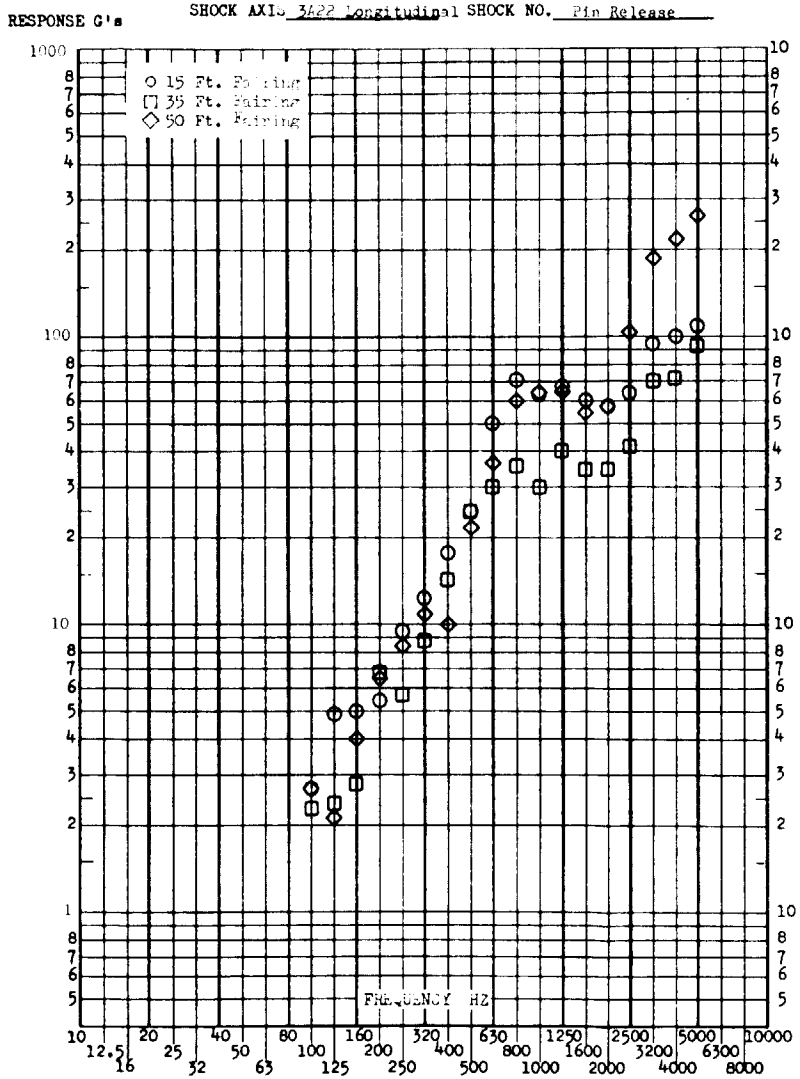
50 Ft.

FIGURE I.B.3-27

TEST ITEM UPLF PART NO.

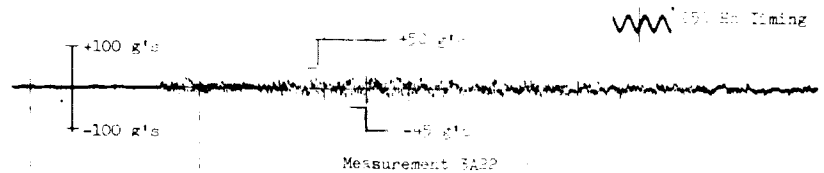
SERIAL NO. TEST DATE July 1968

SHOCK AXIS 3A22 Longitudinal SHOCK NO. Pin Release



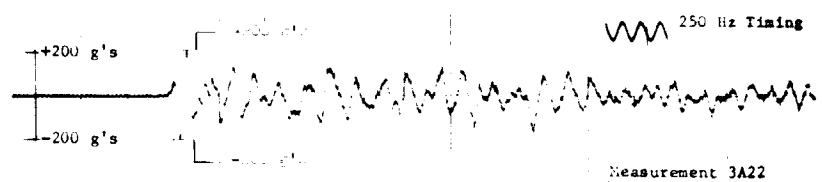
Measurement 3A22

15 Ft.



Measurement 3A22

35 Ft.



Measurement 3A22

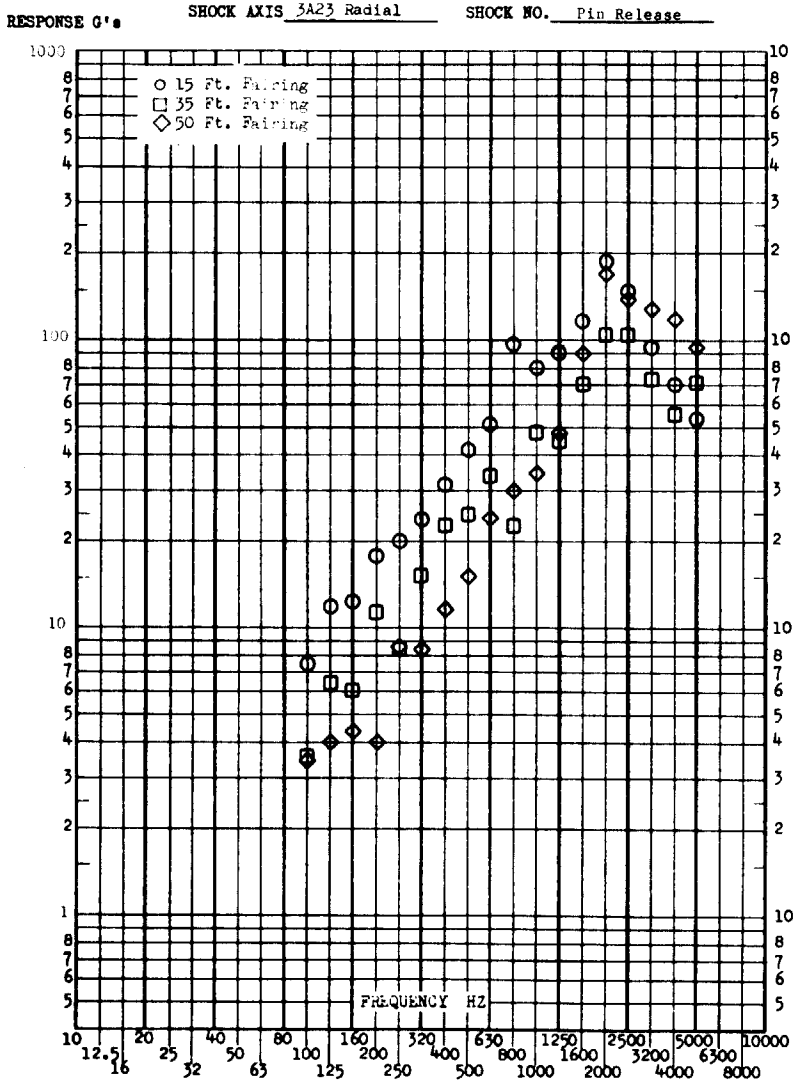
50 Ft.

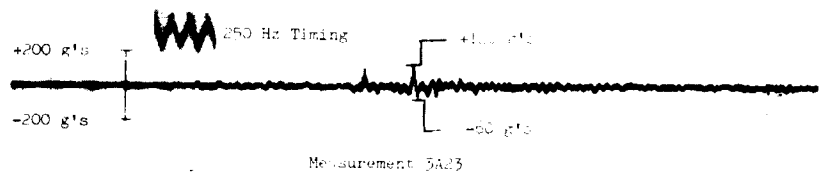
FIGURE I.B.3-29

TEST ITEM UPLF PART NO.

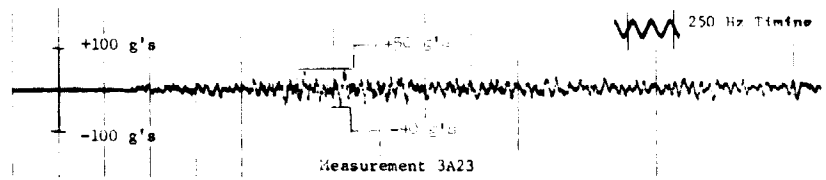
SERIAL NO. TEST DATE July 1968

SHOCK AXIS 3A23 Radial SHOCK NO. Pin Release

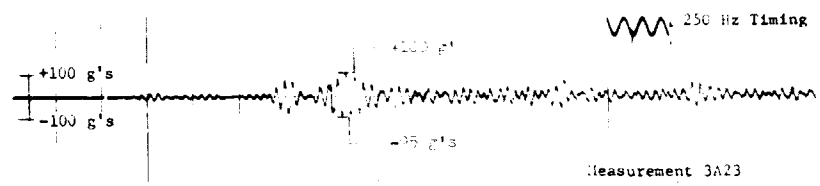




15 Ft.

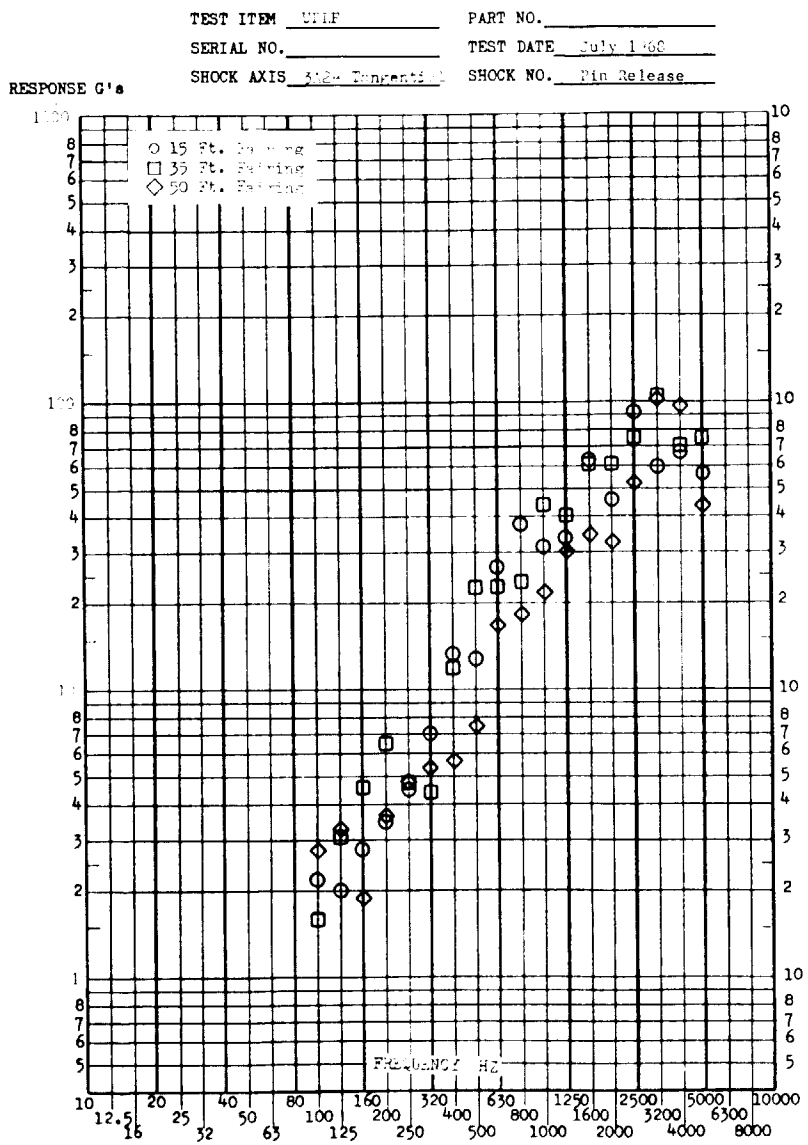


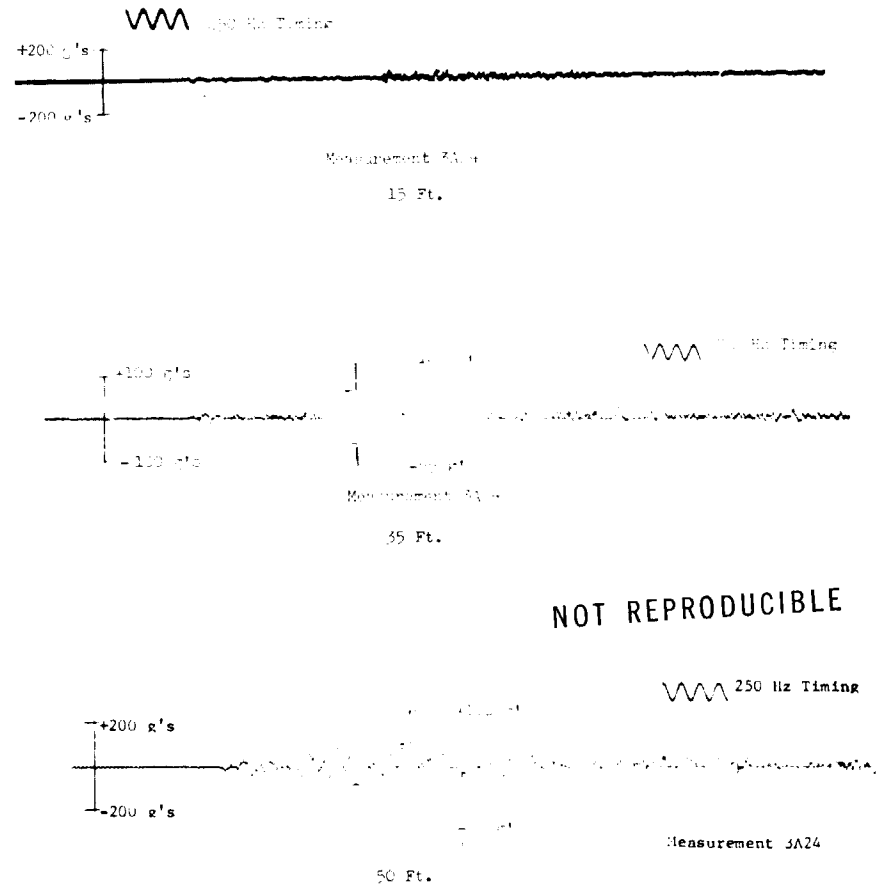
35 Ft.



50 Ft.

FIGURE I.B.3-29





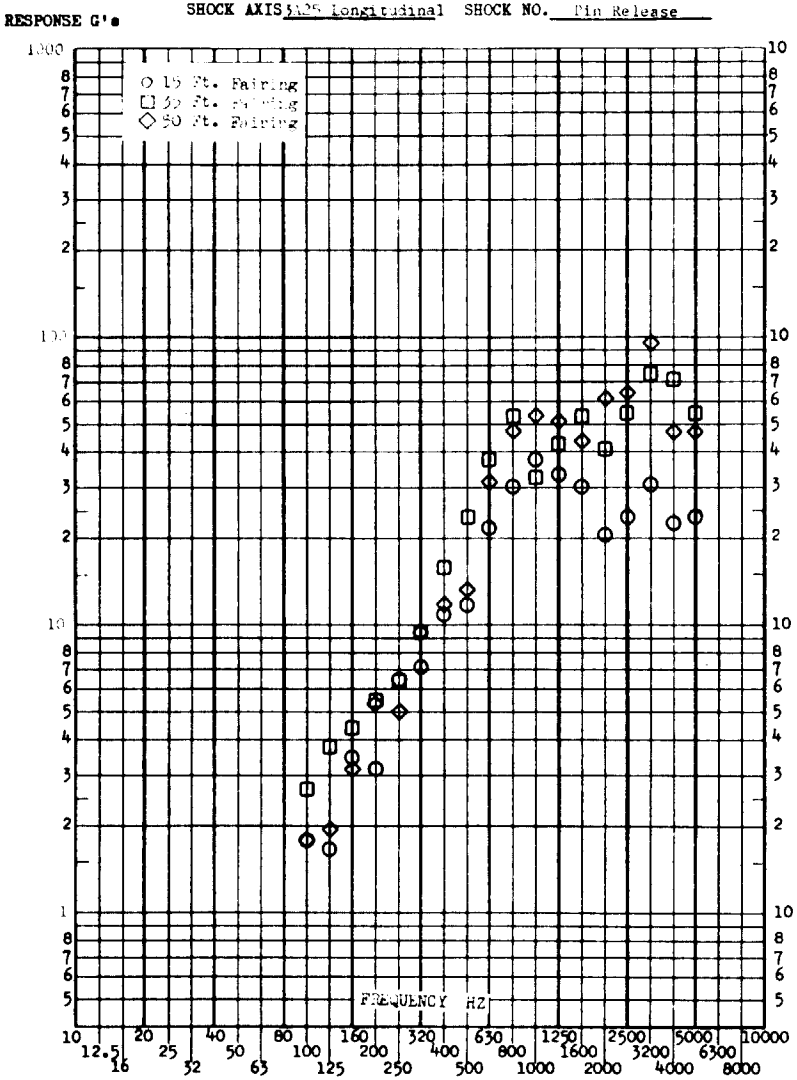
NOT REPRODUCIBLE

FIGURE 1.B.3-30

TEST ITEM UFLF PART NO.

SERIAL NO. TEST DATE July 1 68

SHOCK AXIS 3A25 Longitudinal SHOCK NO. Pin Release



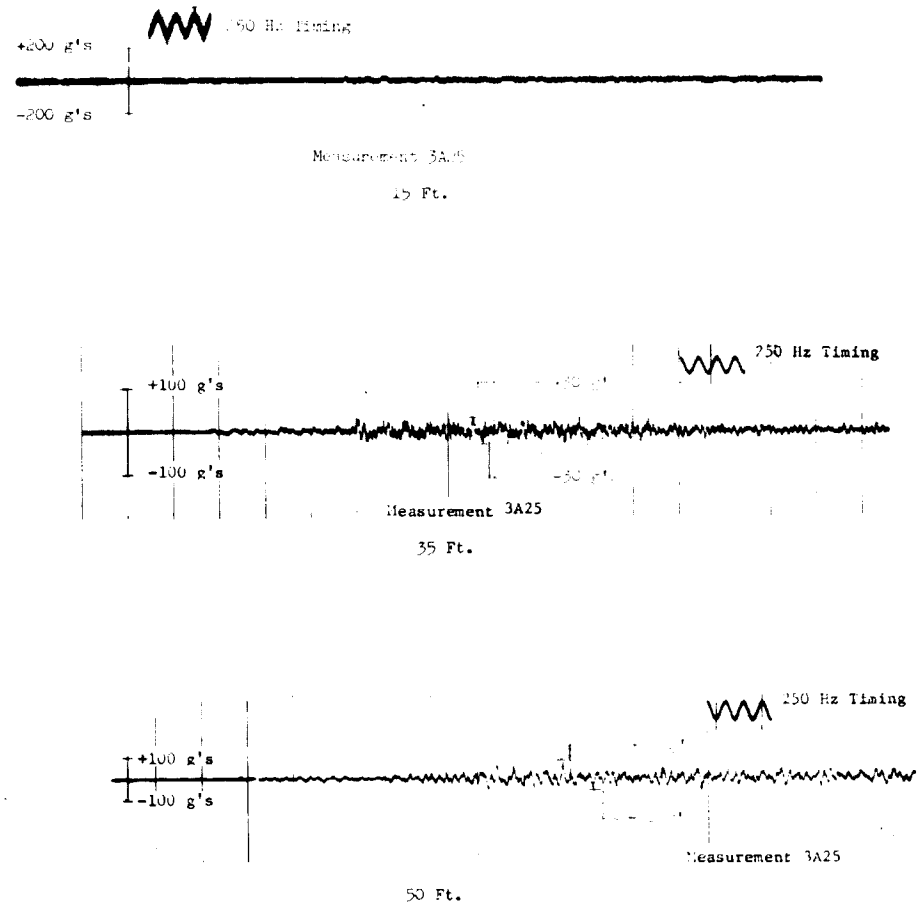
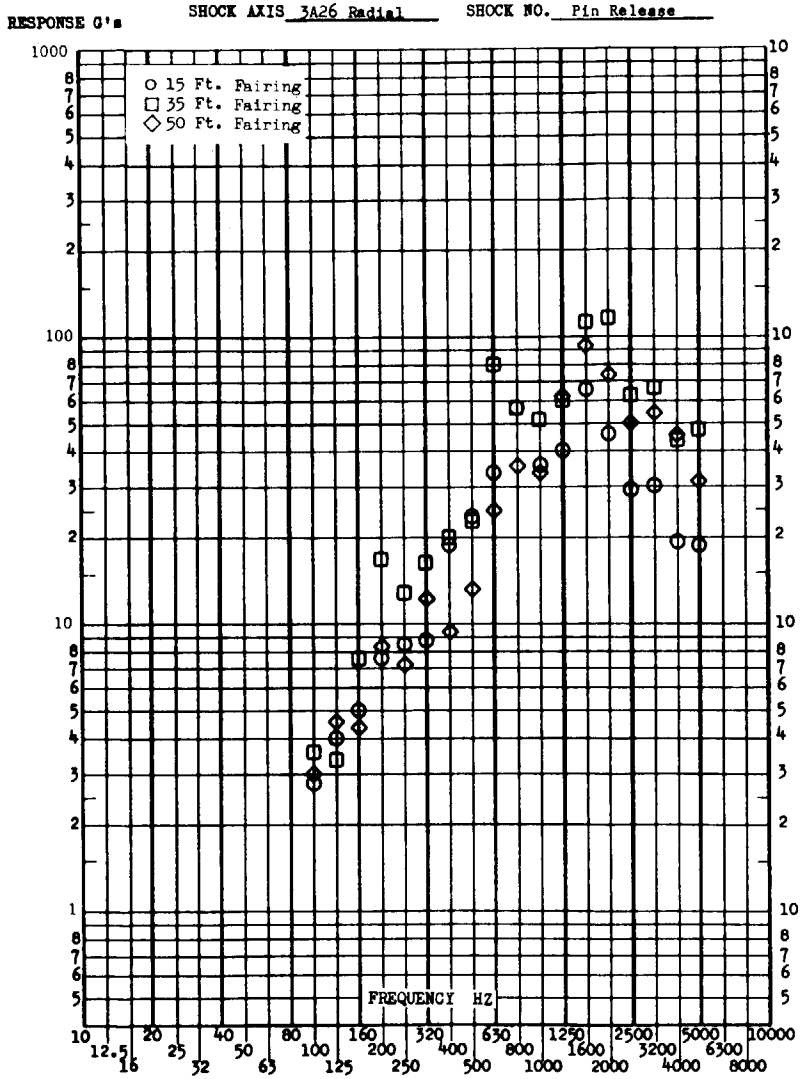


FIGURE 1.B.3-31

TEST ITEM UPLF PART NO.

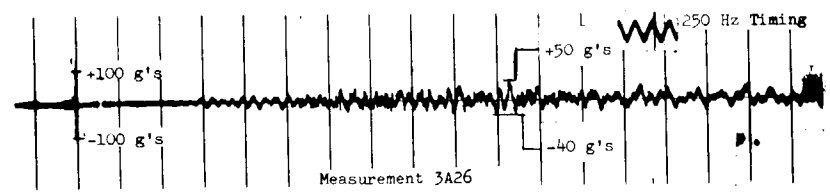
SERIAL NO. TEST DATE July 1968

SHOCK AXIS 3A26 Radial SHOCK NO. Pin Release



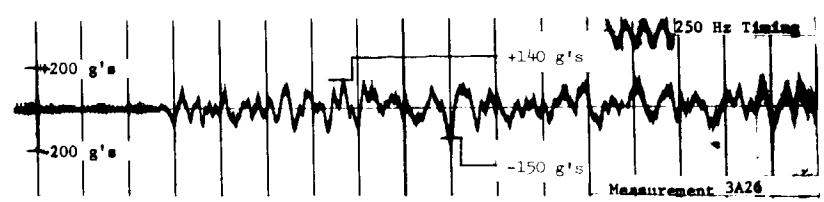
Measurement 3A26

15 Ft.



Measurement 3A26

35 Ft.



Measurement 3A26

50 Ft.

FIGURE I.B.3-32

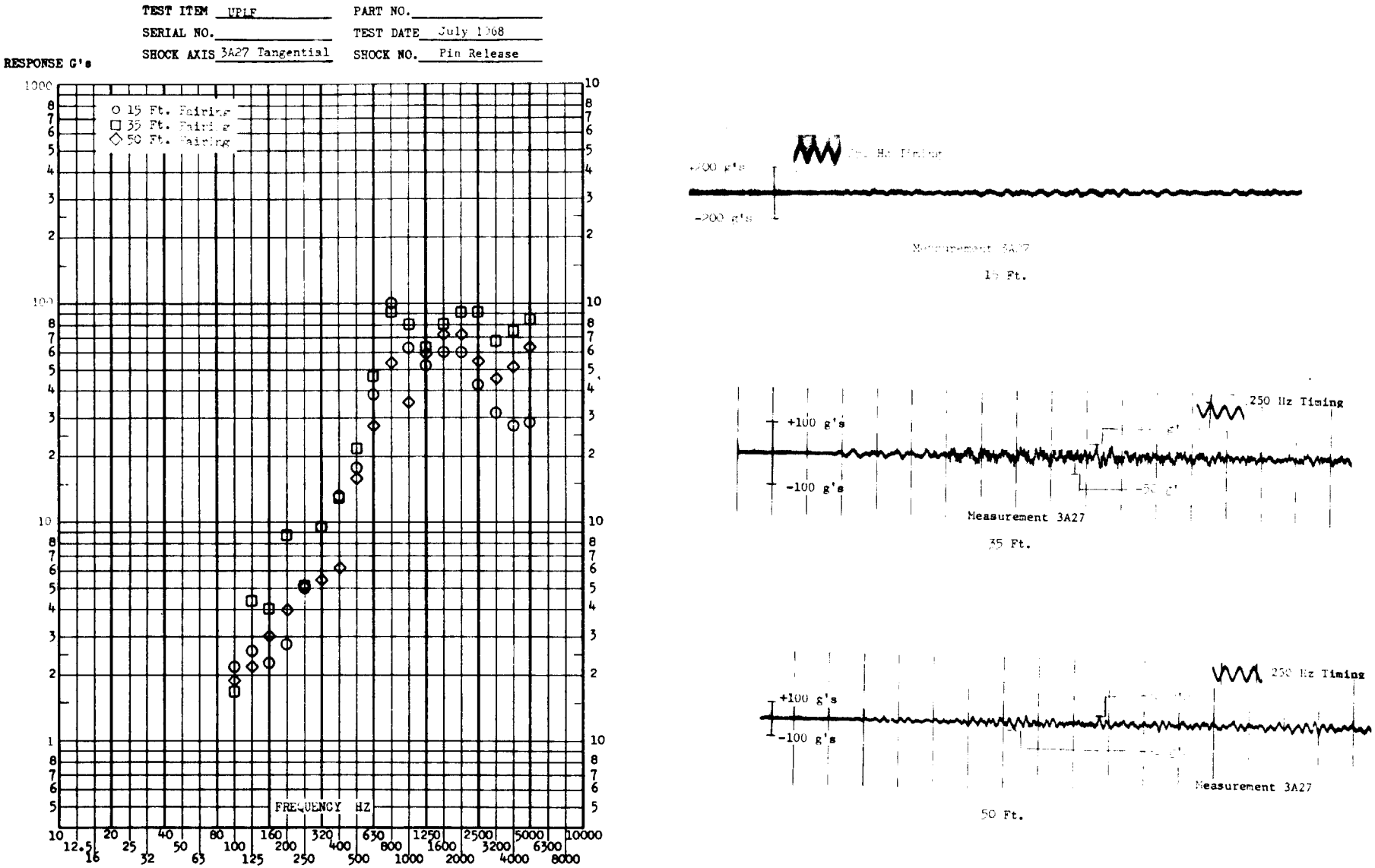
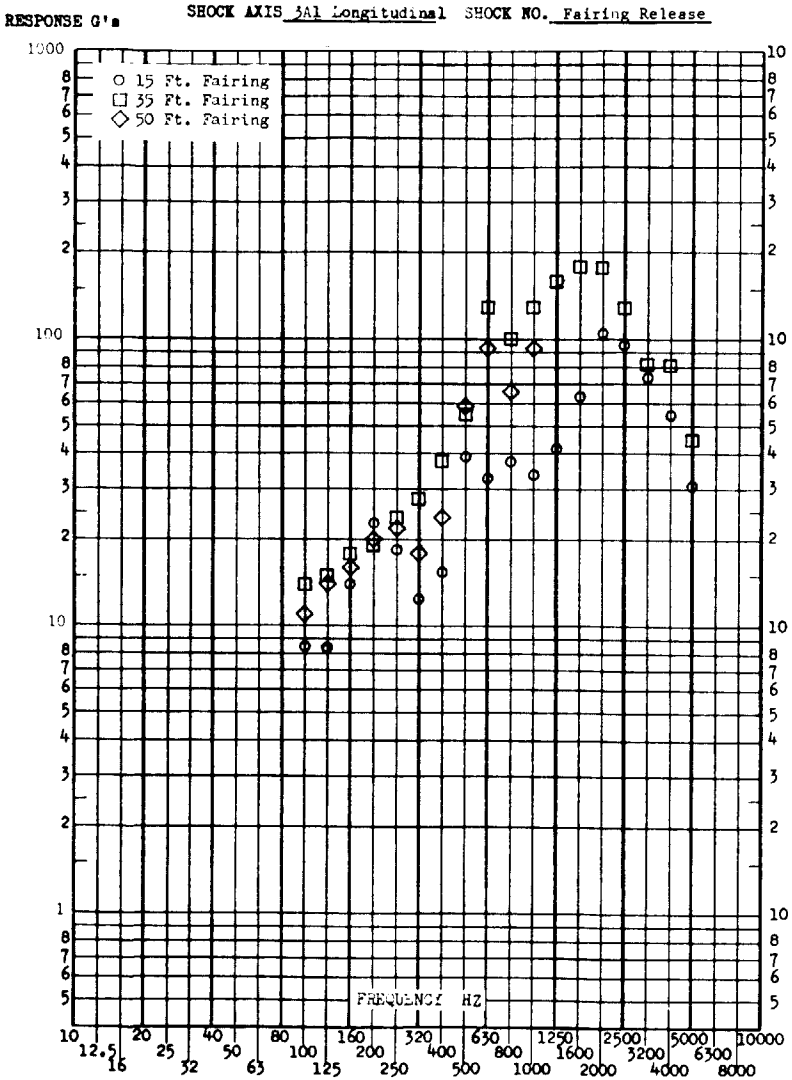


FIGURE I.B.3-33

TEST ITEM UPLF PART NO.

SERIAL NO. TEST DATE July 1968

SHOCK AXIS 3A1 Longitudinal SHOCK NO. Fairing Release



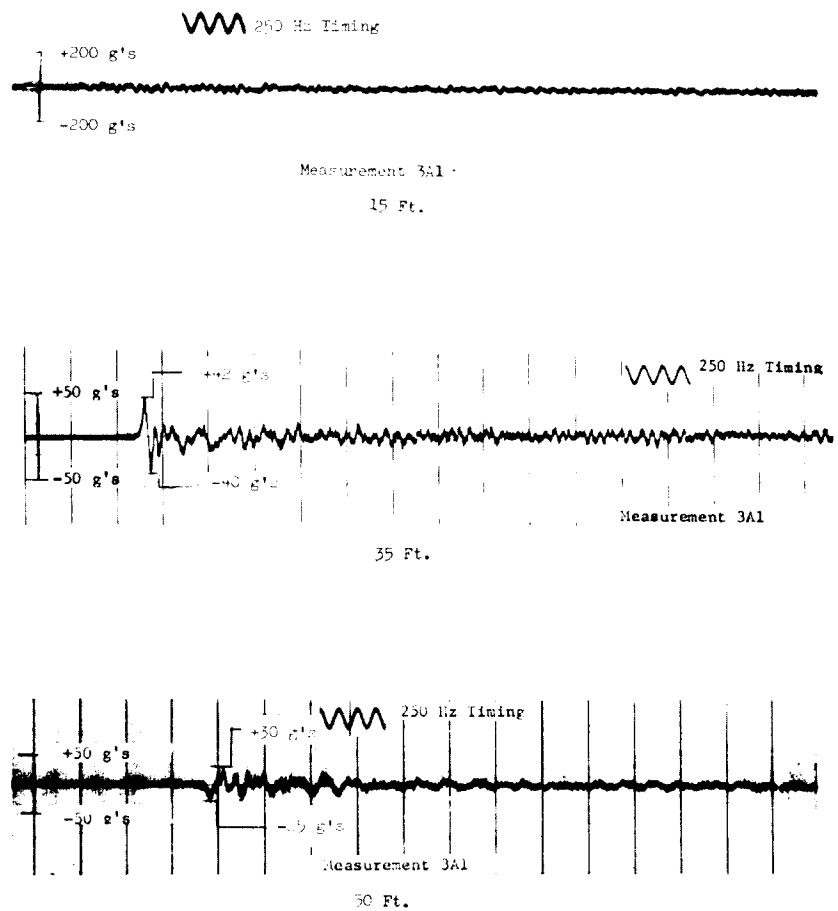
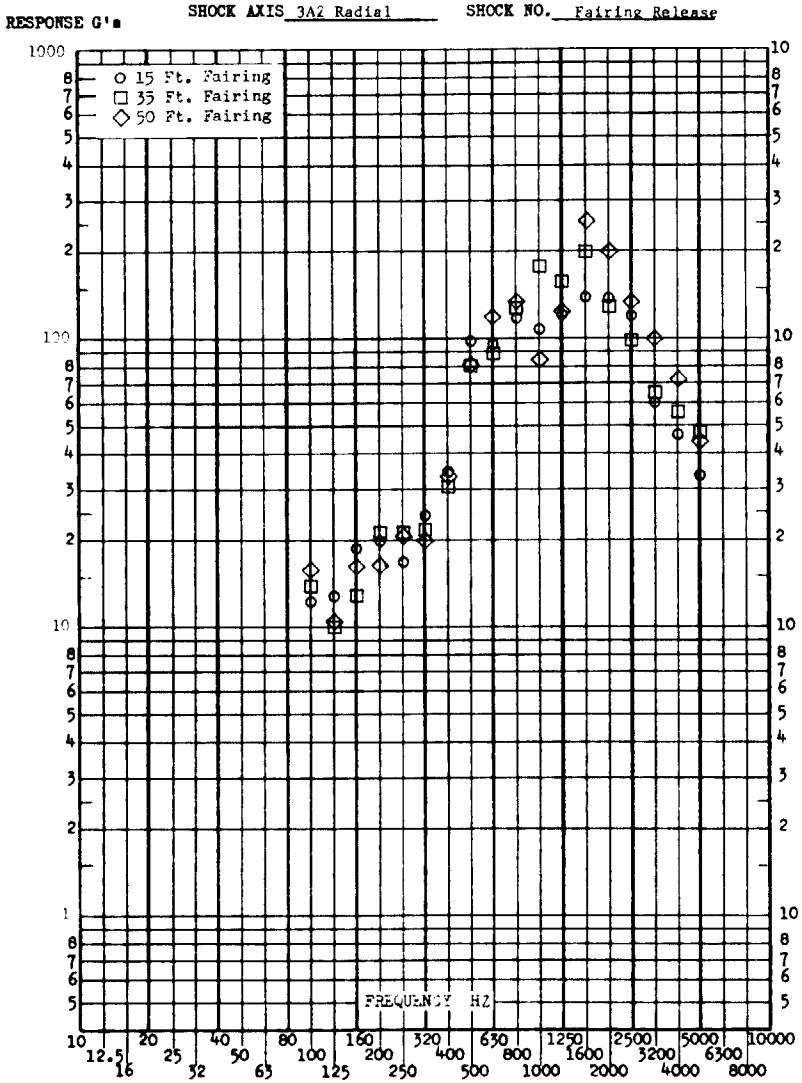


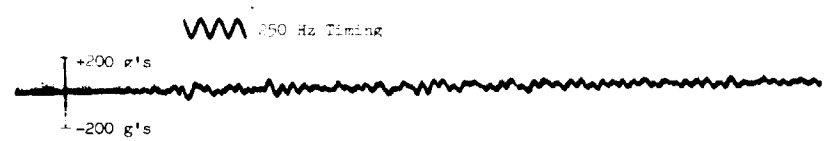
FIGURE I.B.3-34

TEST ITEM UPLF PART NO.

SERIAL NO. TEST DATE July, 1968

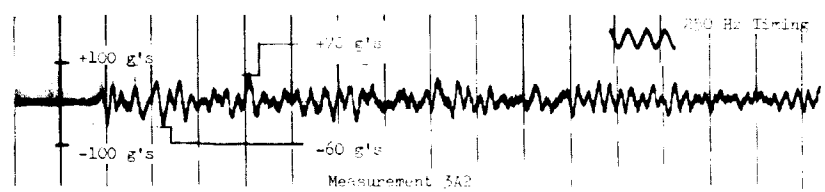
SHOCK AXIS 3A2 Radial SHOCK NO. Fairing Release





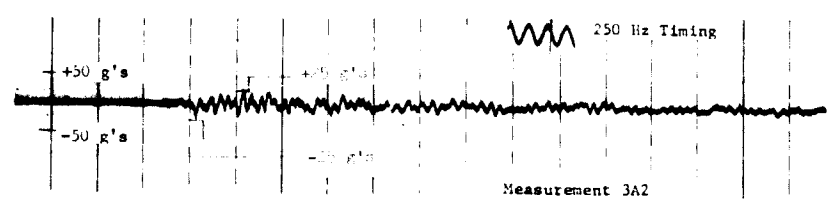
Measurement 3A2

15 Ft.



Measurement 3A2

35 Ft.



Measurement 3A2

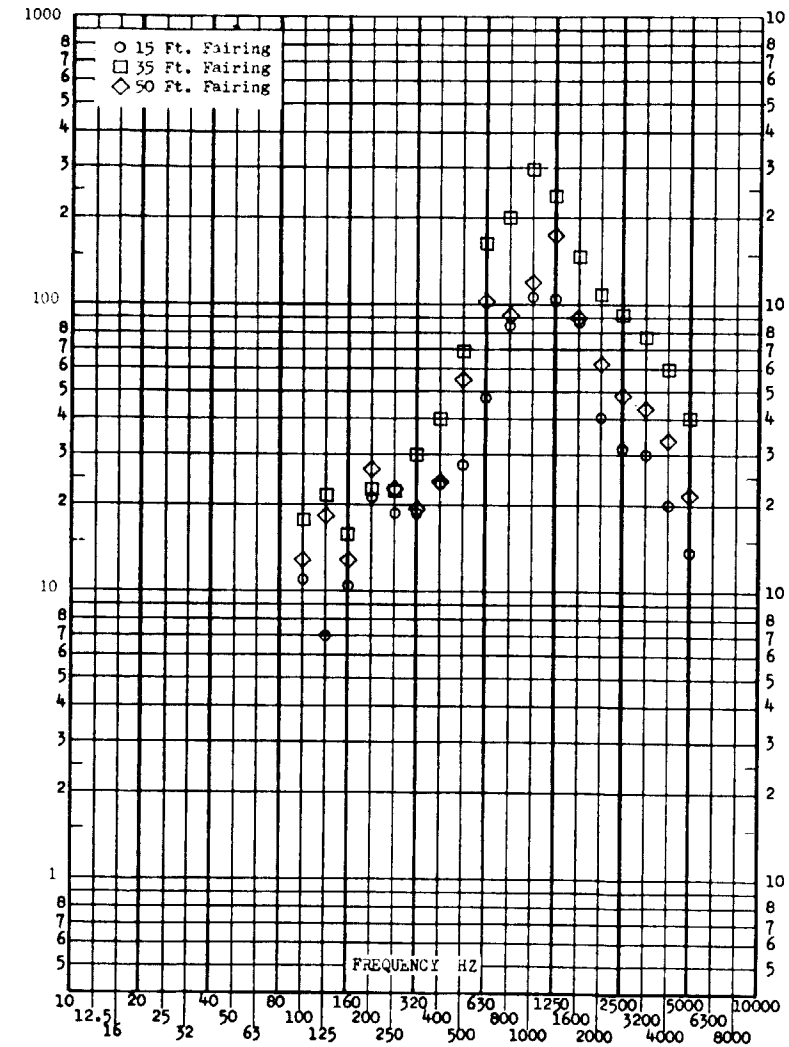
50 Ft.

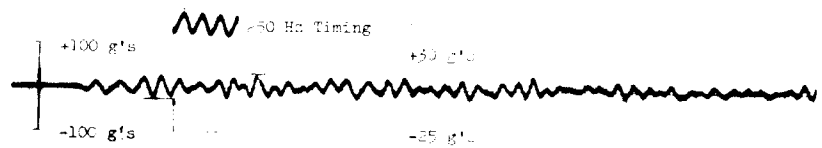
FIGURE I.B.3-35

TEST ITEM UPLF PART NO.

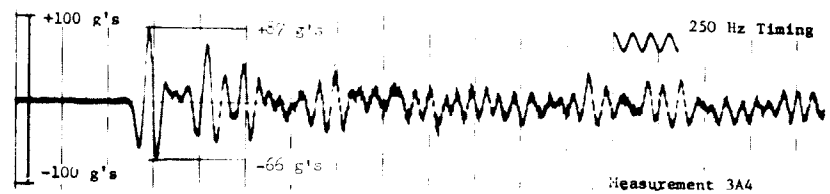
SERIAL NO. TEST DATE July, 1968

SHOCK AXIS 3A4 Longitudinal SHOCK NO. Fairing Release

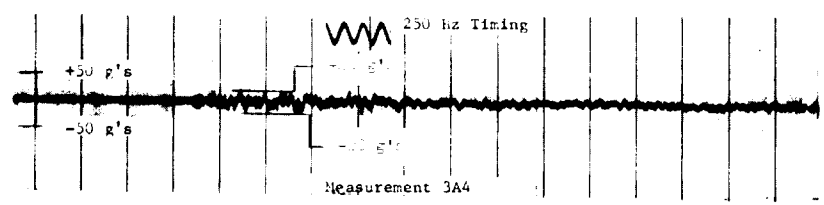




15 Ft.



35 Ft.



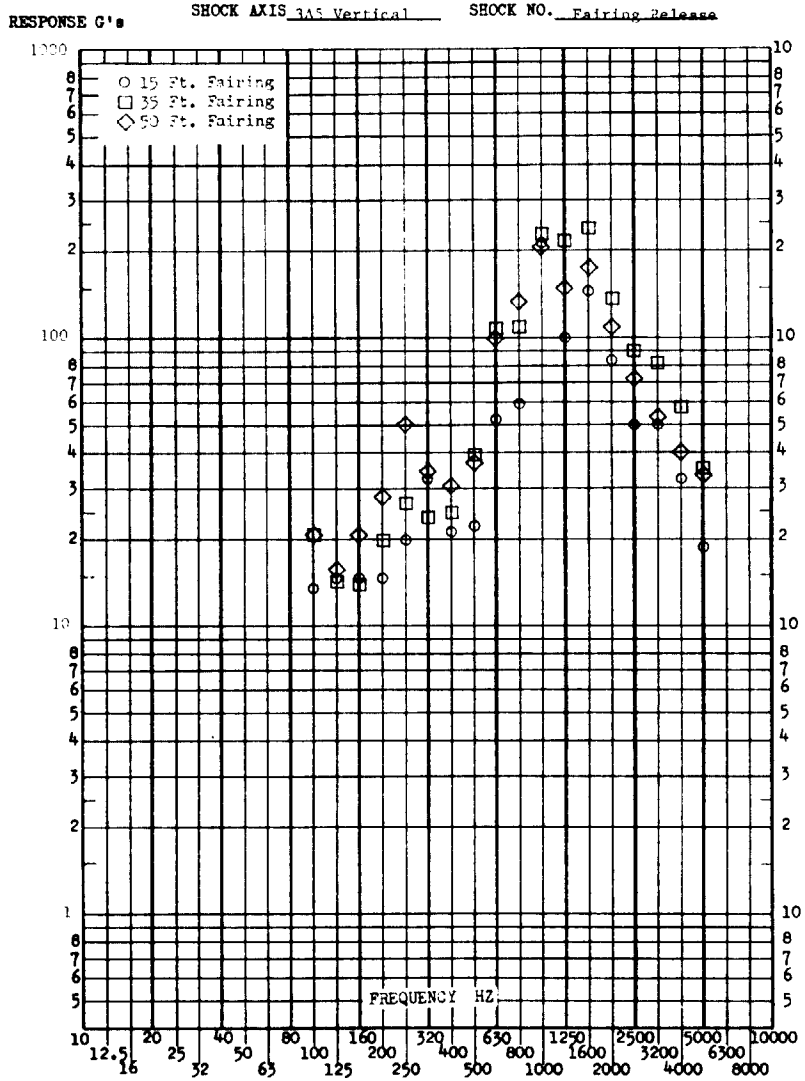
50 Ft.

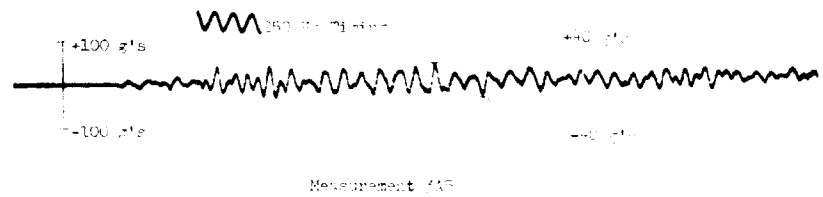
FIGURE 1.B.3-36

TEST ITEM UFLF PART NO.

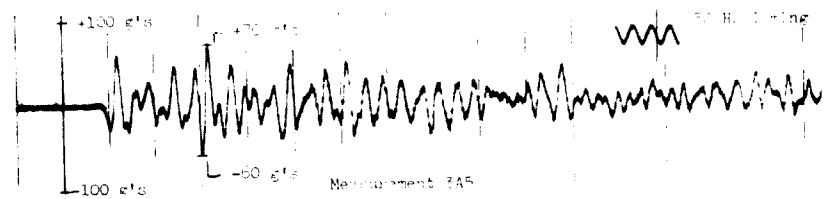
SERIAL NO. TEST DATE July 1968

SHOCK AXIS 3A5 Vertical SHOCK NO. Fairing Release

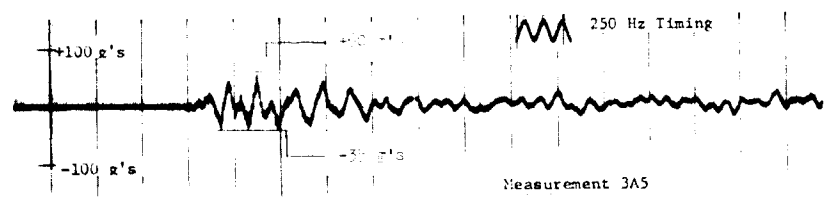




15 Ft.



35 Ft.



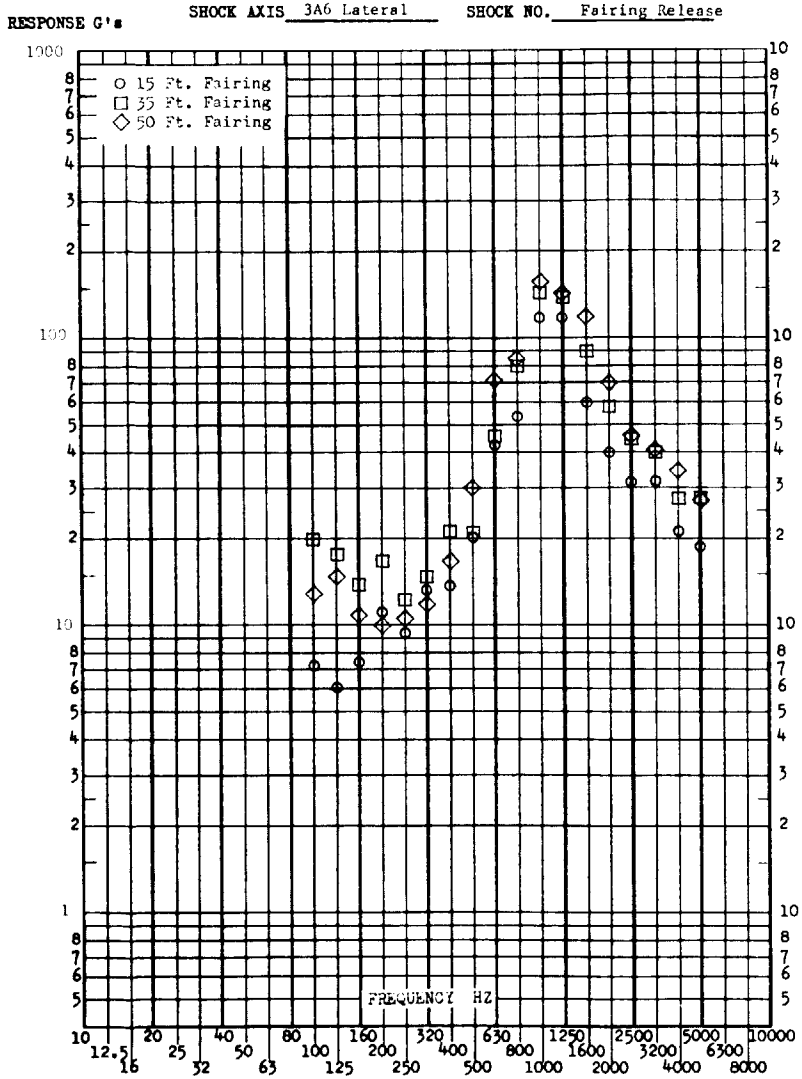
50 Ft.

FIGURE I.B.3-37

TEST ITEM UPLF PART NO.

SERIAL NO. TEST DATE July, 1968

SHOCK AXIS 3A6 Lateral SHOCK NO. Fairing Release



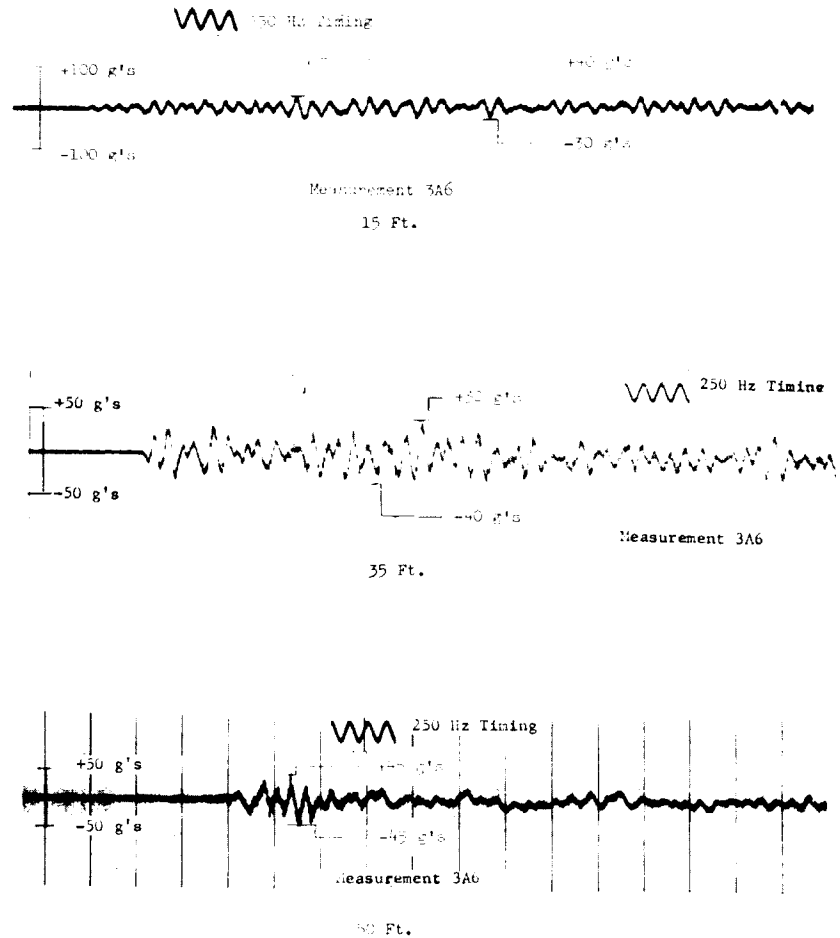
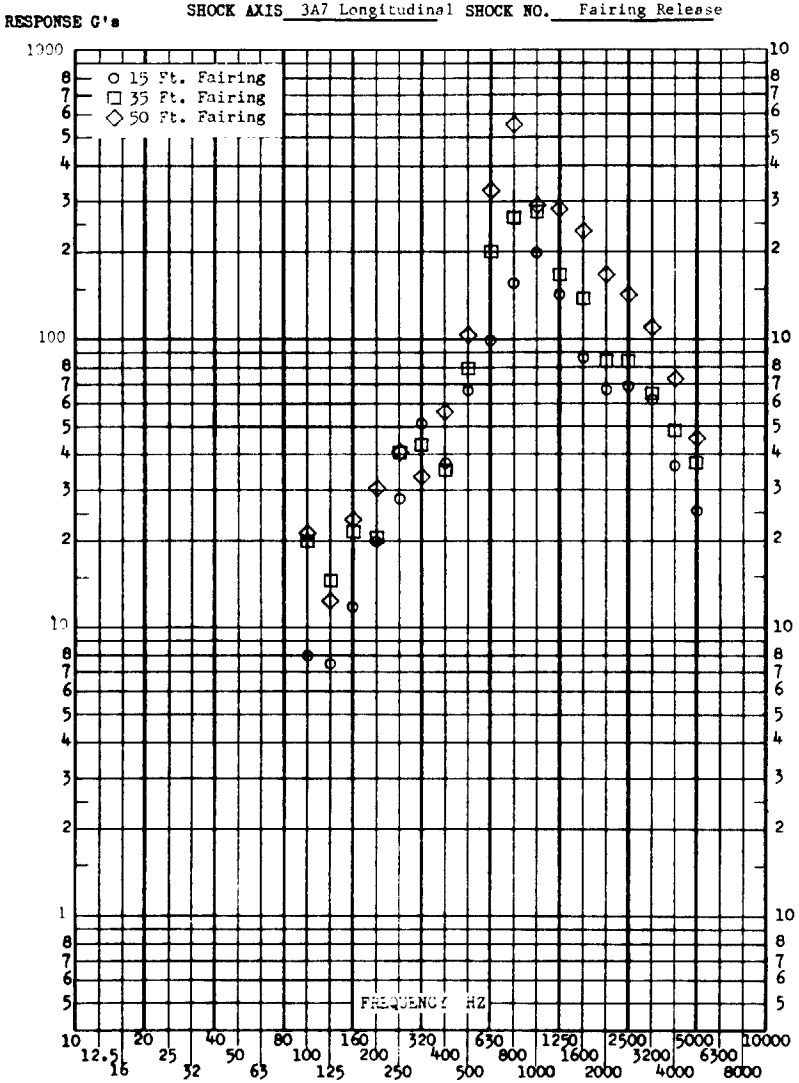


FIGURE I.B.3-38

TEST ITEM UP1F PART NO.

SERIAL NO. TEST DATE July, 1 68

SHOCK AXIS 3A7 Longitudinal SHOCK NO. Fairing Release



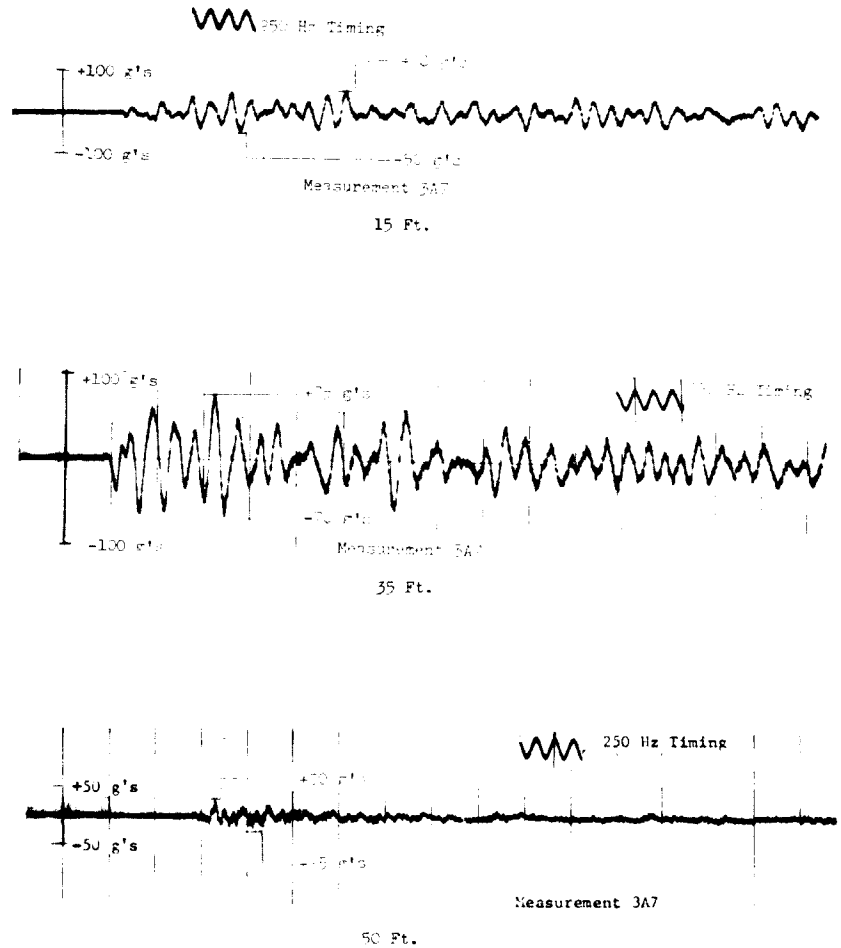


FIGURE I.B.3-39

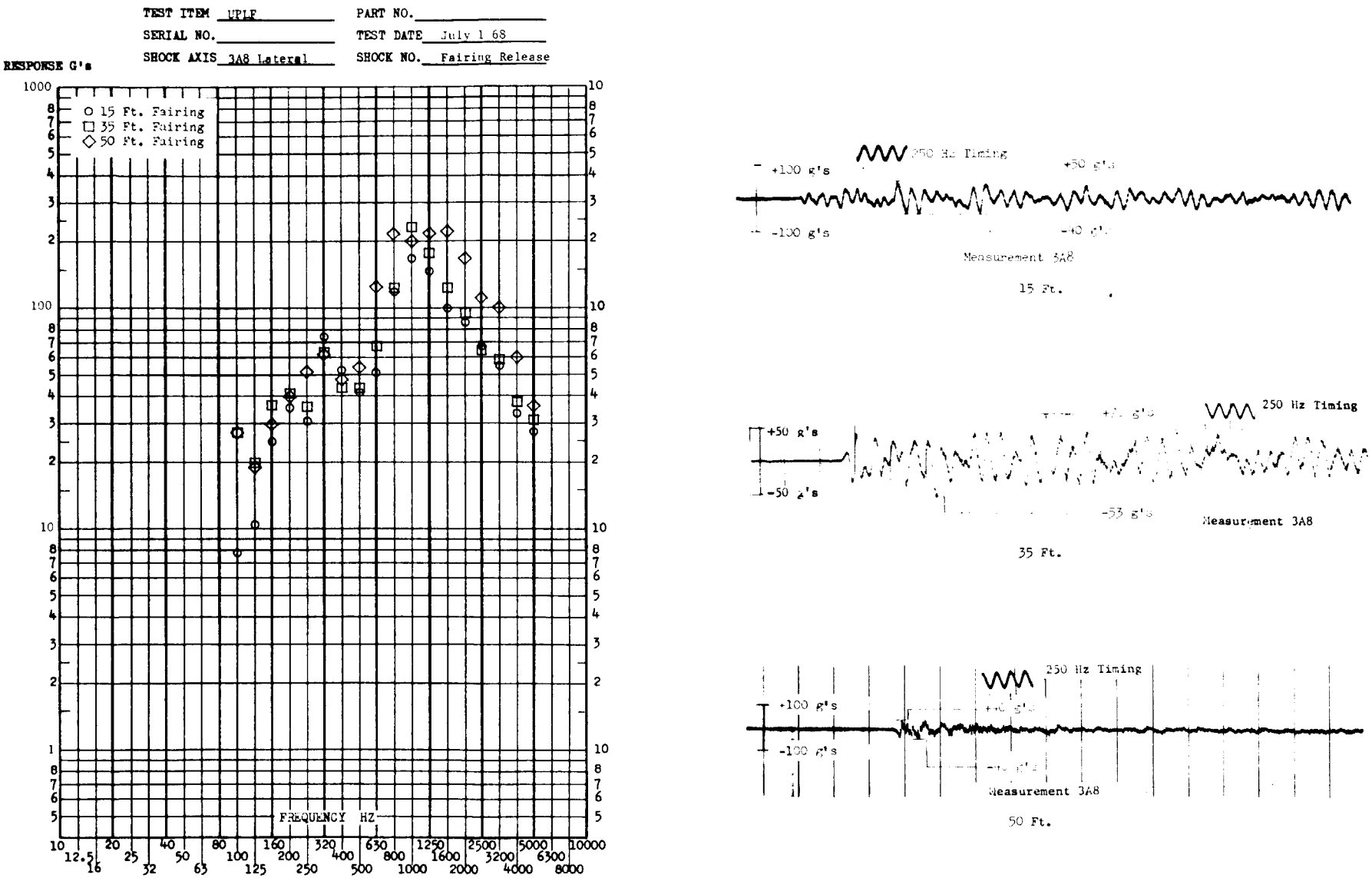
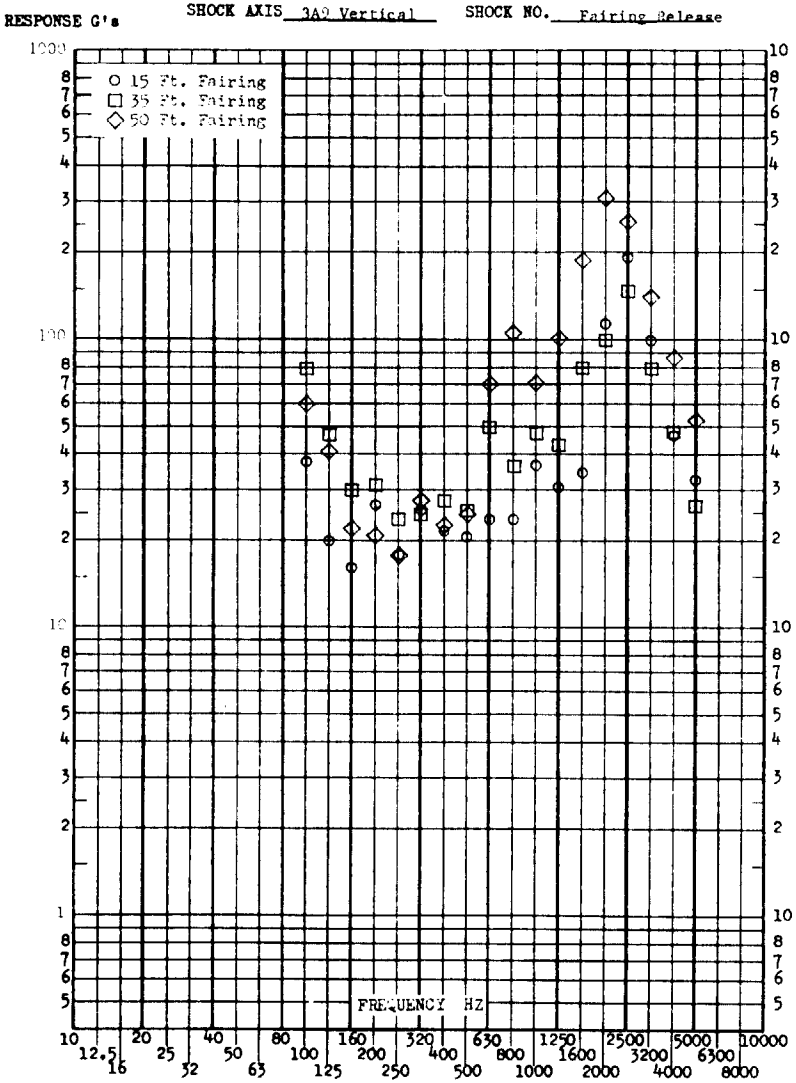


FIGURE 1.B.3-40

TEST ITEM [illegible] PART NO.

SERIAL NO. TEST DATE July, 1968

SHOCK AXIS 3A9 Vertical SHOCK NO. Fairing Release



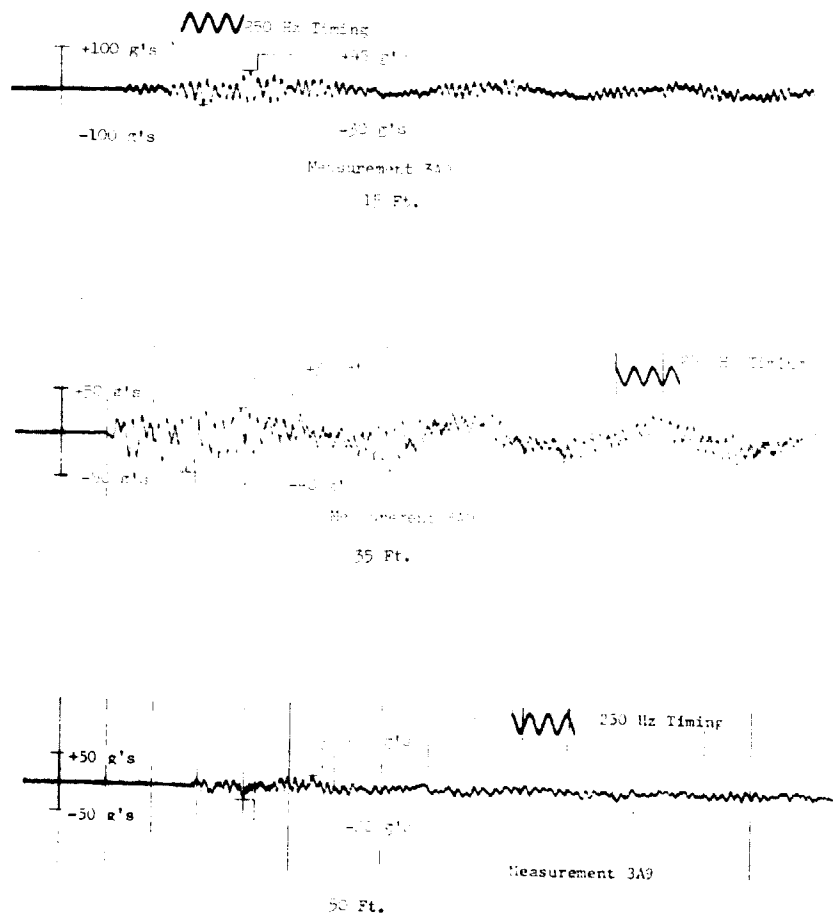
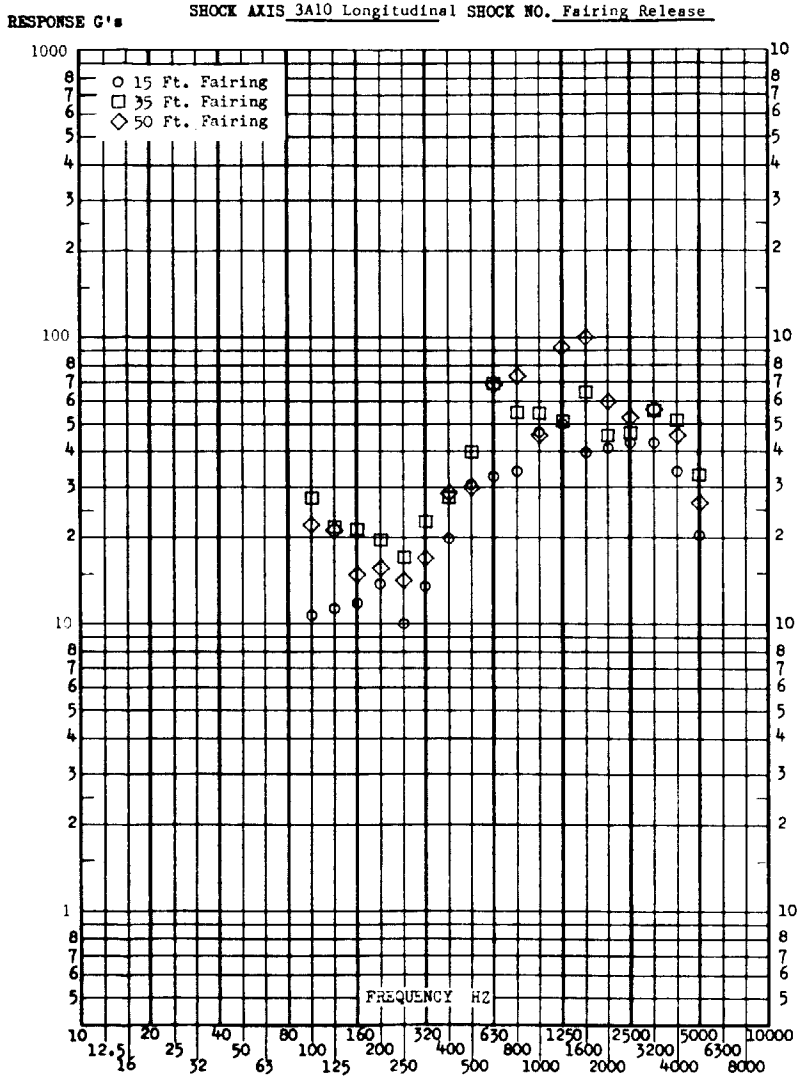


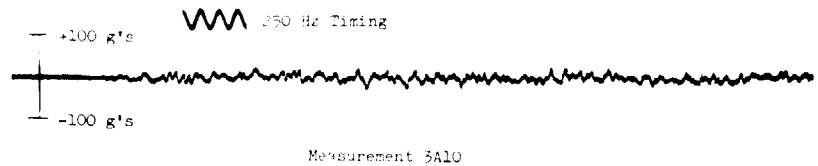
FIGURE 1.B.3-41

TEST ITEM UPLF PART NO.

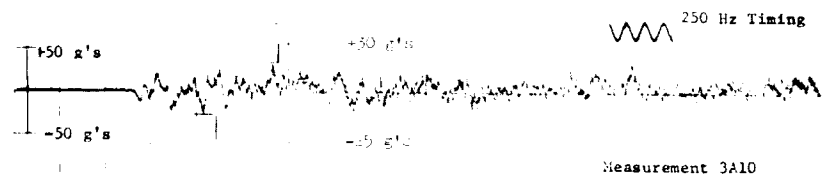
SERIAL NO. TEST DATE July, 1968

SHOCK AXIS 3A10 Longitudinal SHOCK NO. Fairing Release





15 Ft.



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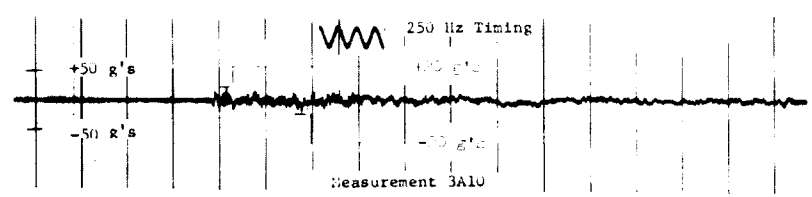


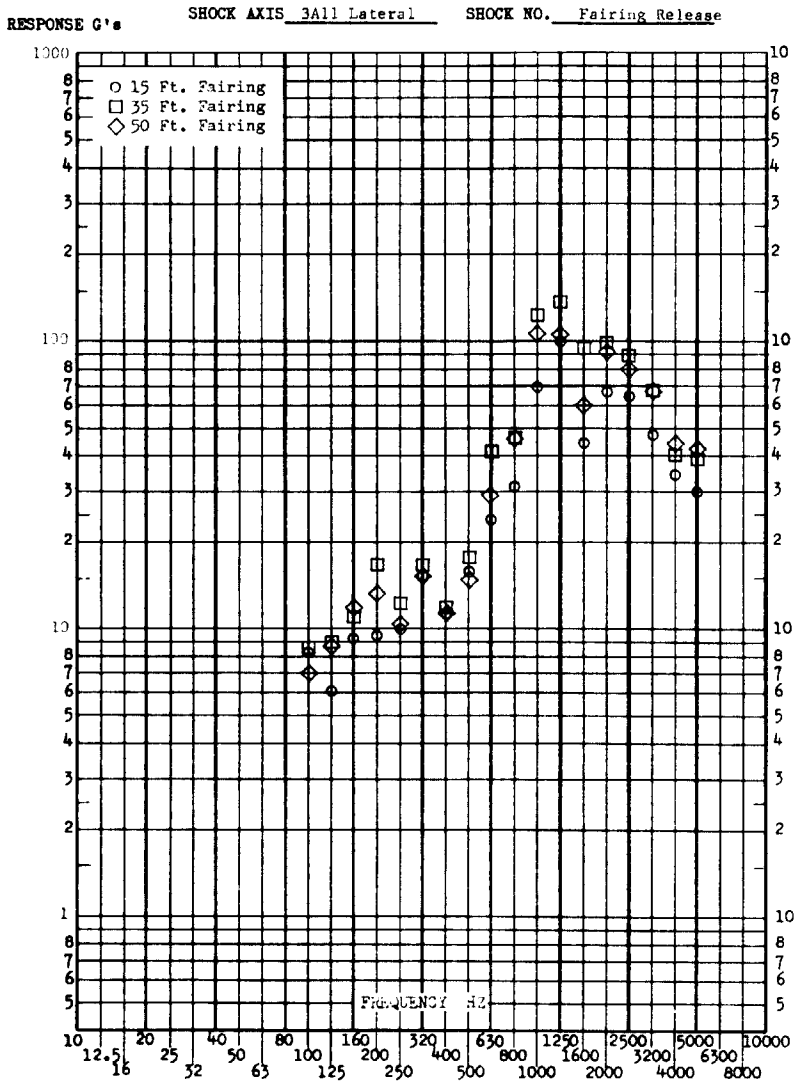
50 Ft.

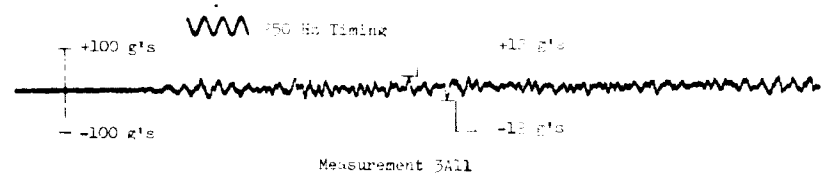
FIGURE 1.3.3-42

TEST ITEM UPLF PART NO.

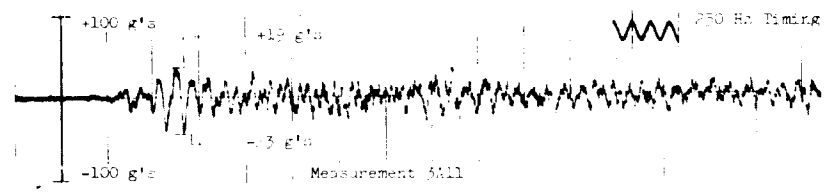
SERIAL NO. TEST DATE July, 1968

SHOCK AXIS 3A11 Lateral SHOCK NO. Fairing Release

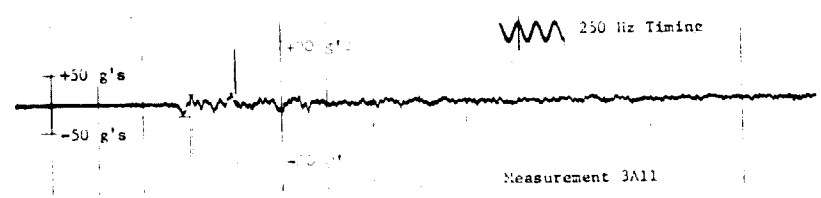




15 Ft.



35 Ft.



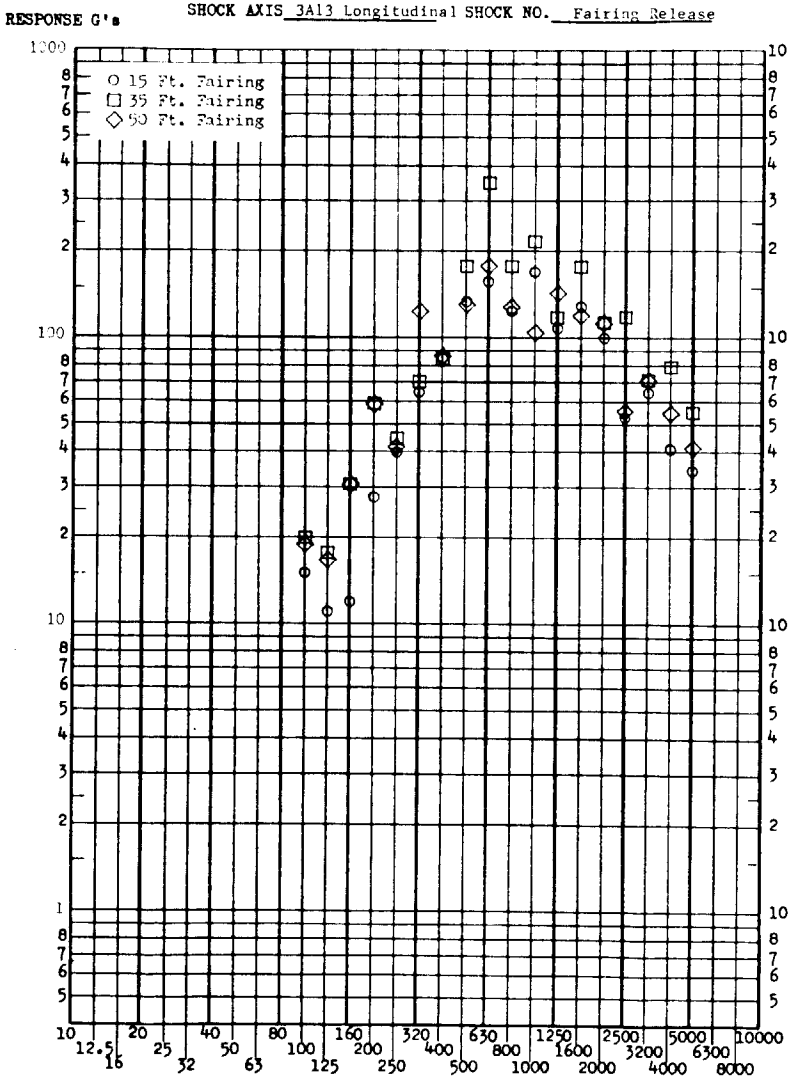
50 Ft.

FIGURE 1.B.3-43

TEST ITEM UPLF PART NO.

SERIAL NO. TEST DATE July 1968

SHOCK AXIS 3A13 Longitudinal SHOCK NO. Fairing Release



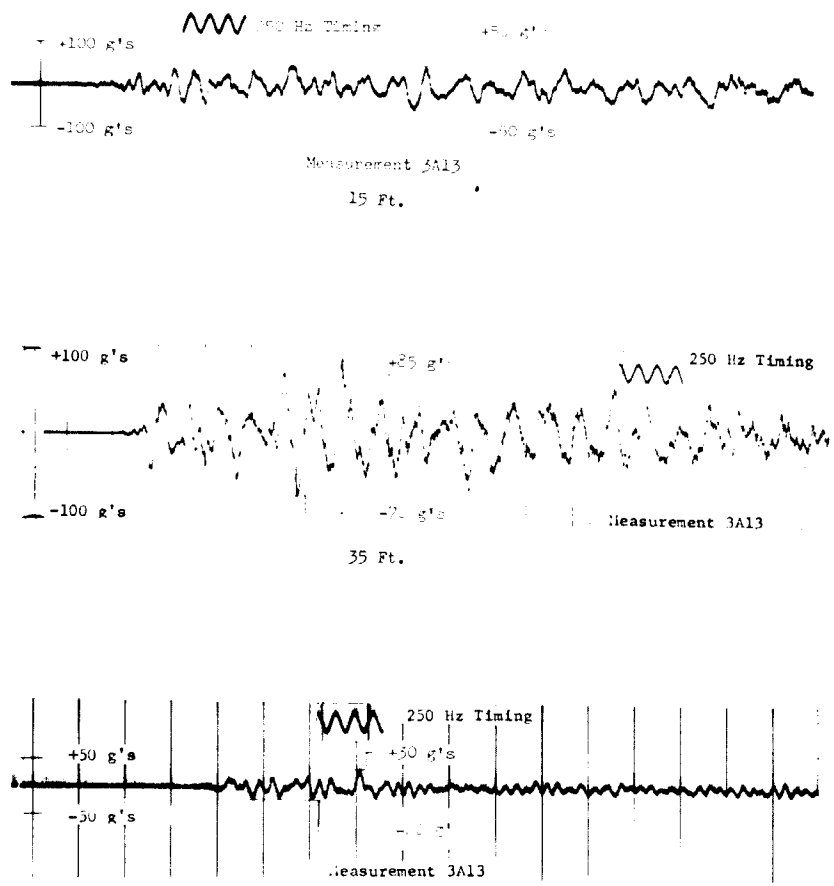
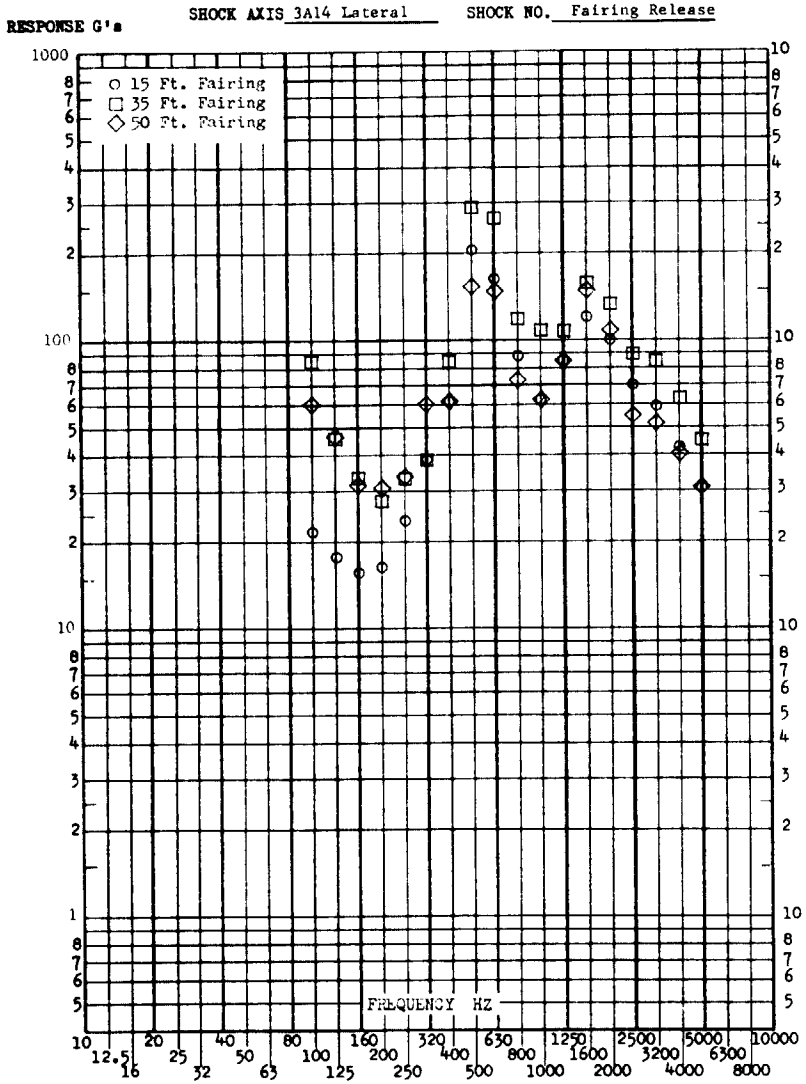
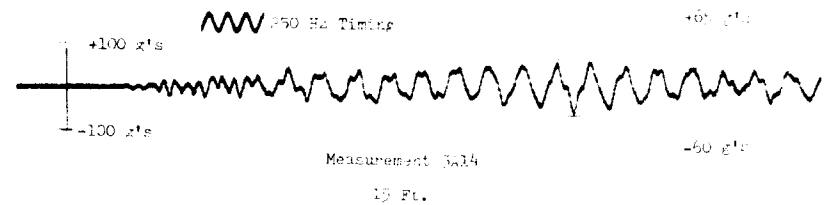


FIGURE I.B.3-44

PAGE NO. _____
TEST NO. _____

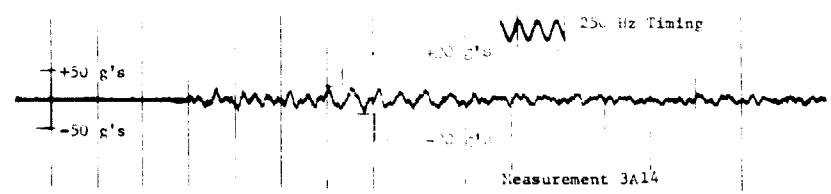
TEST ITEM UPLF PART NO. _____
SERIAL NO. _____ TEST DATE July 1968
SHOCK AXIS 3A14 Lateral SHOCK NO. Fairing Release





15 Ft.

35 Ft.



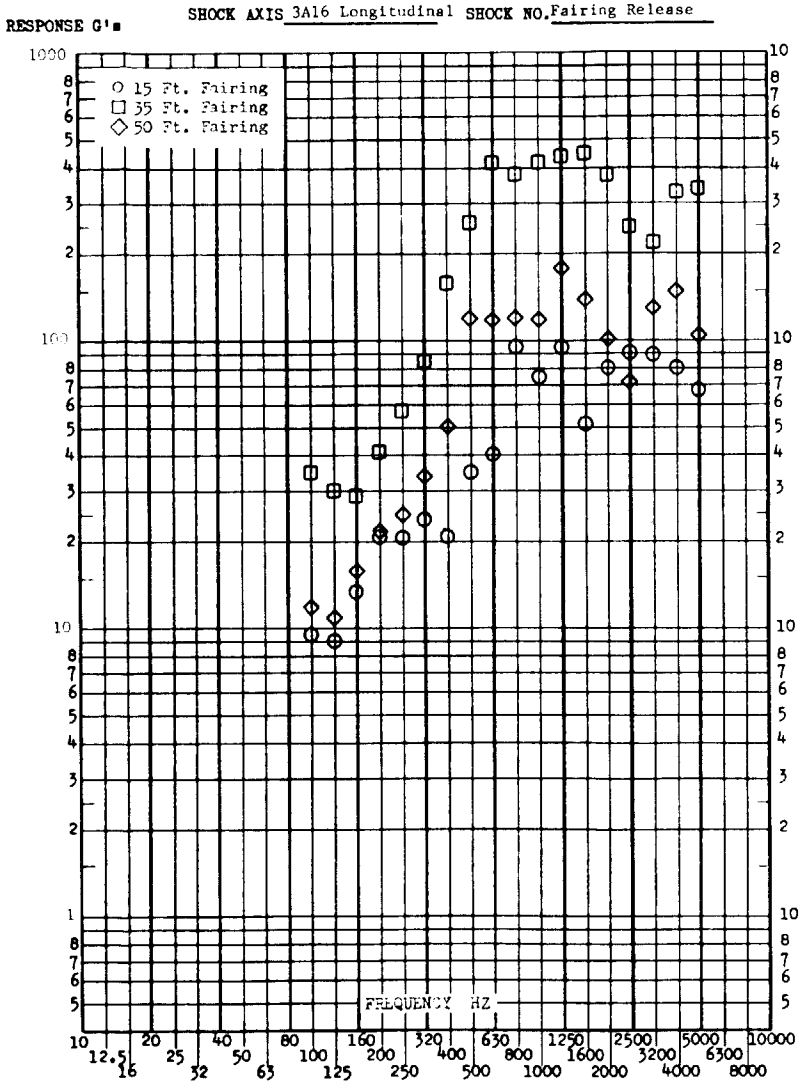
50 Ft.

FIGURE I.B.3-45

TEST ITEM UPLF PART NO.

SERIAL NO. TEST DATE July 1968

SHOCK AXIS 3A16 Longitudinal SHOCK NO. Fairing Release



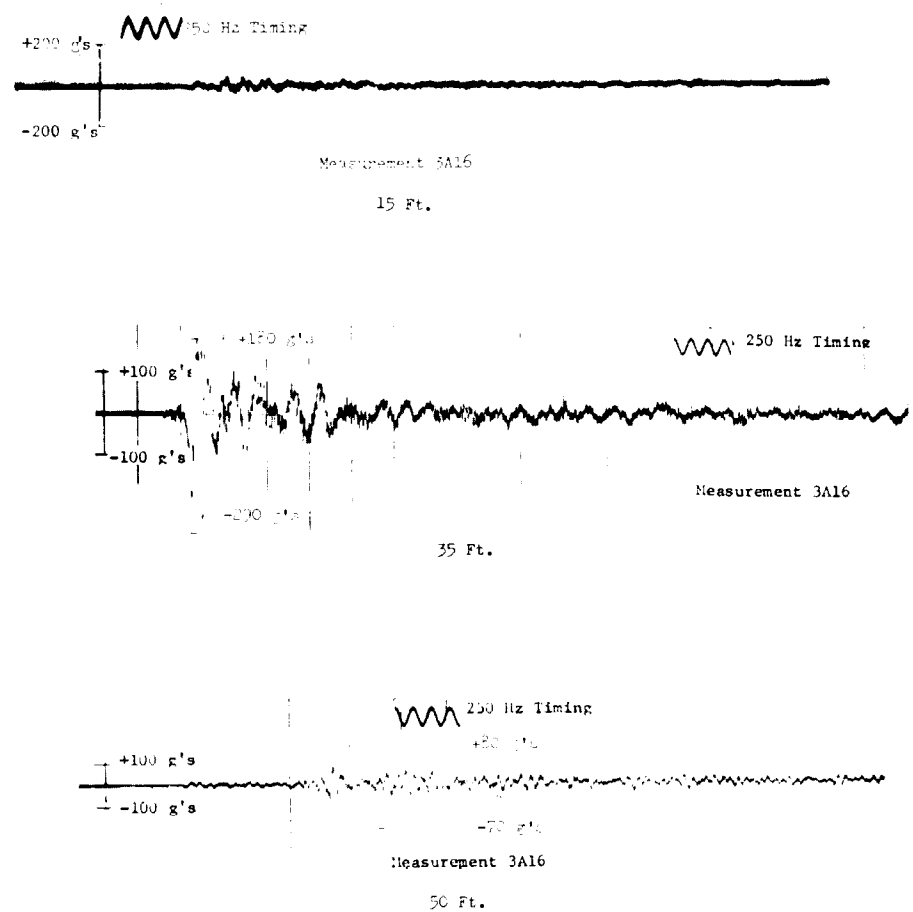
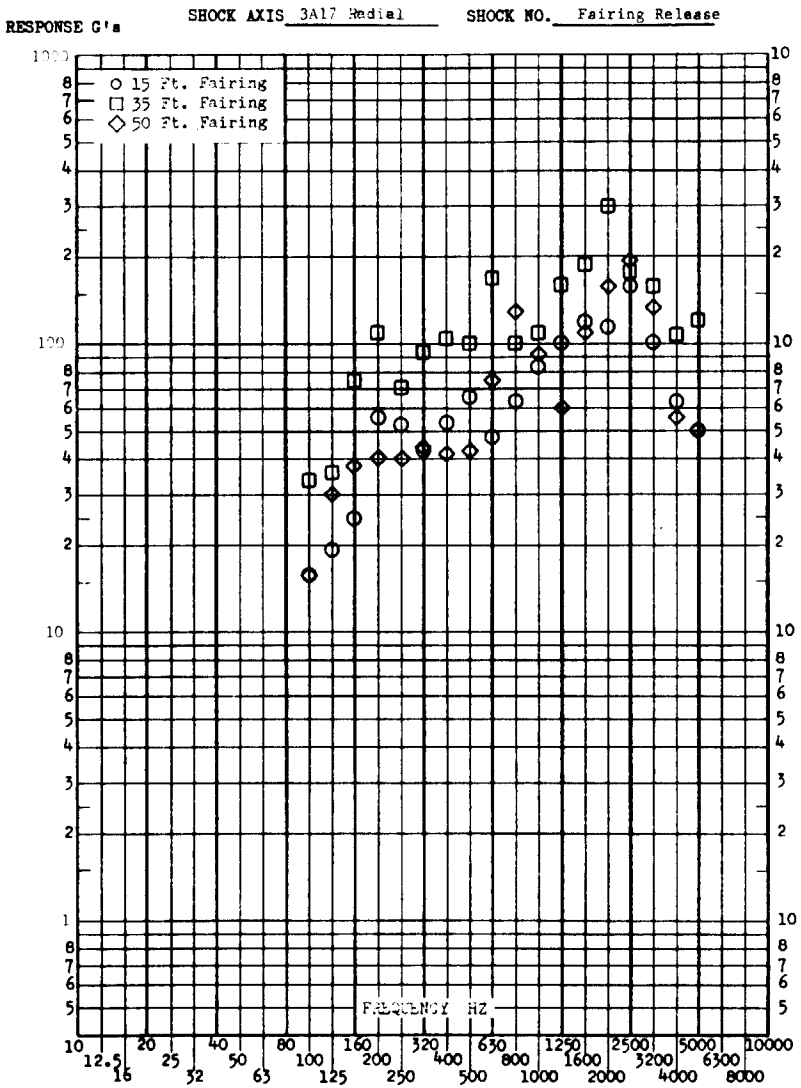


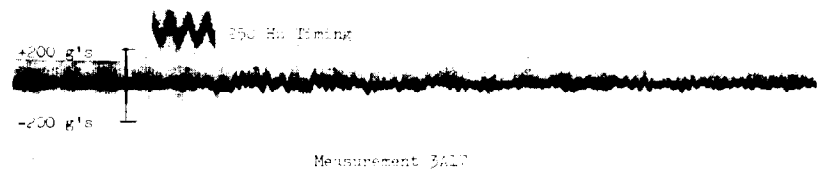
FIGURE 1.B.3-46

TEST ITEM UPLF PART NO.

SERIAL NO. TEST DATE July, 1968

SHOCK AXIS 3A17 Radial SHOCK NO. Fairing Release





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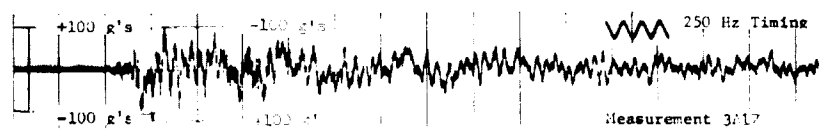
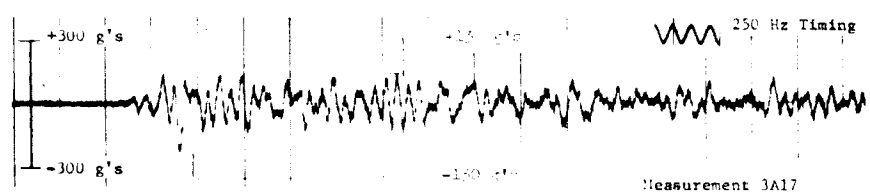


35 Ft.



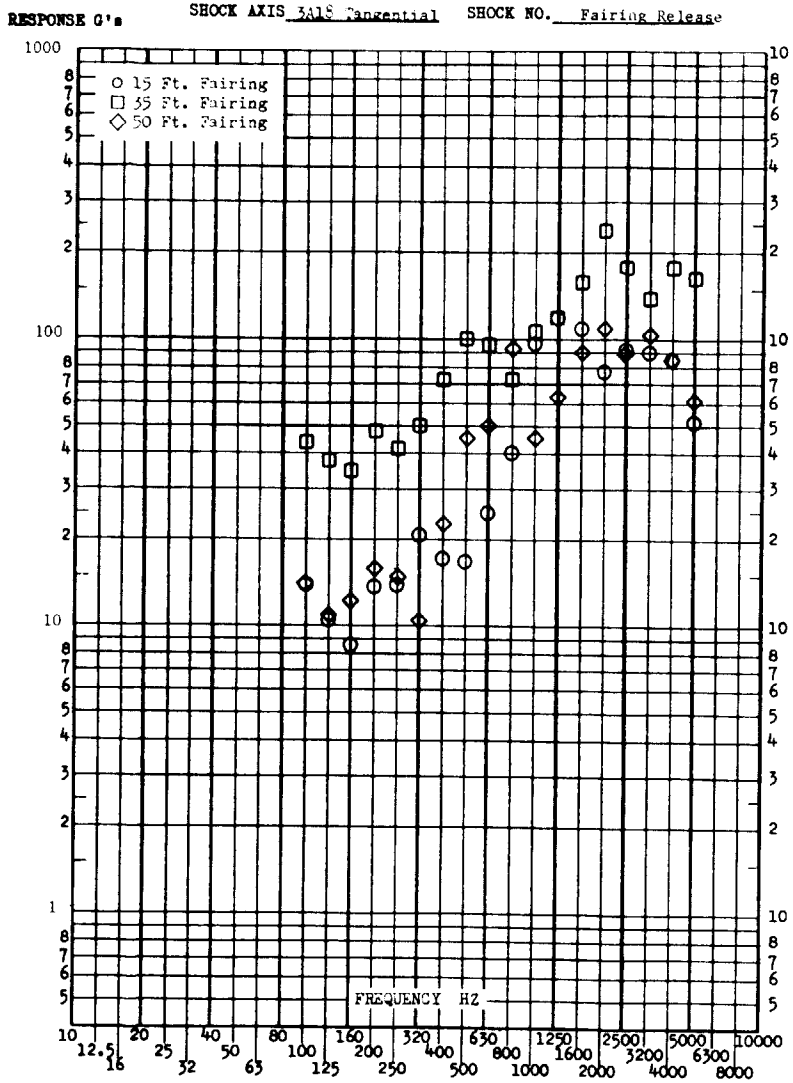
50 Ft.

FIGURE 1.B.3-47

TEST ITEM UPLF PART NO.

SERIAL NO. TEST DATE July 1968

SHOCK AXIS 3A18 Tangential SHOCK NO. Fairing Release



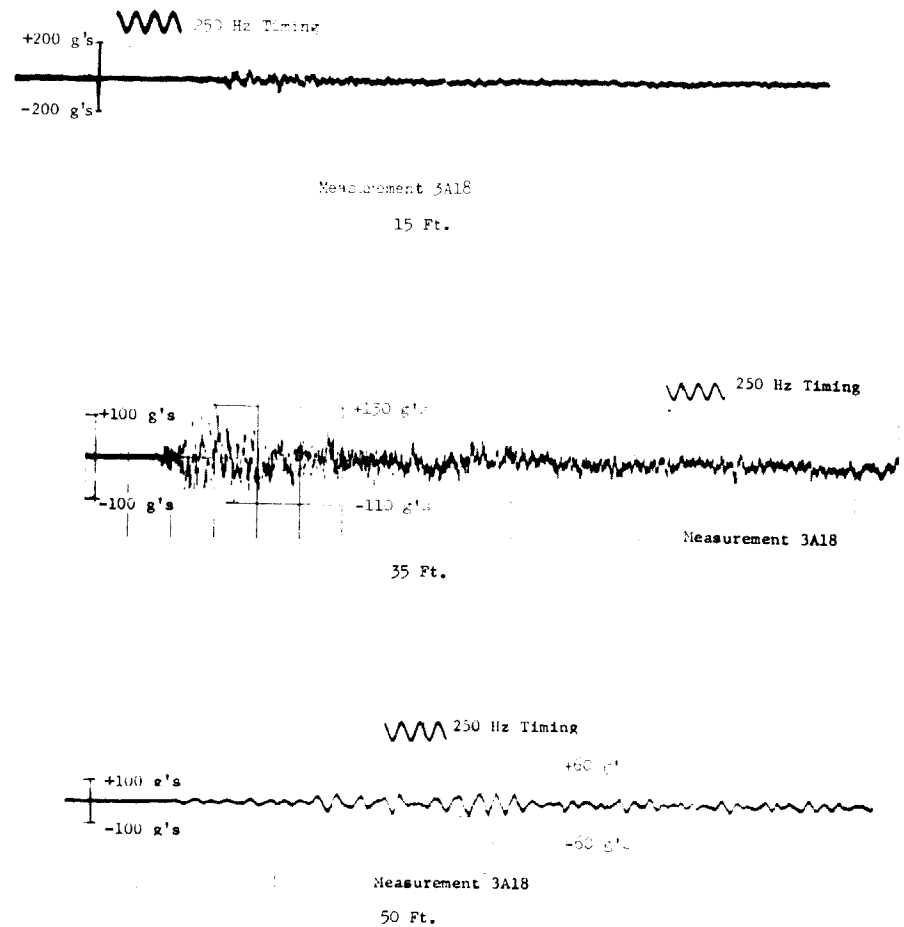
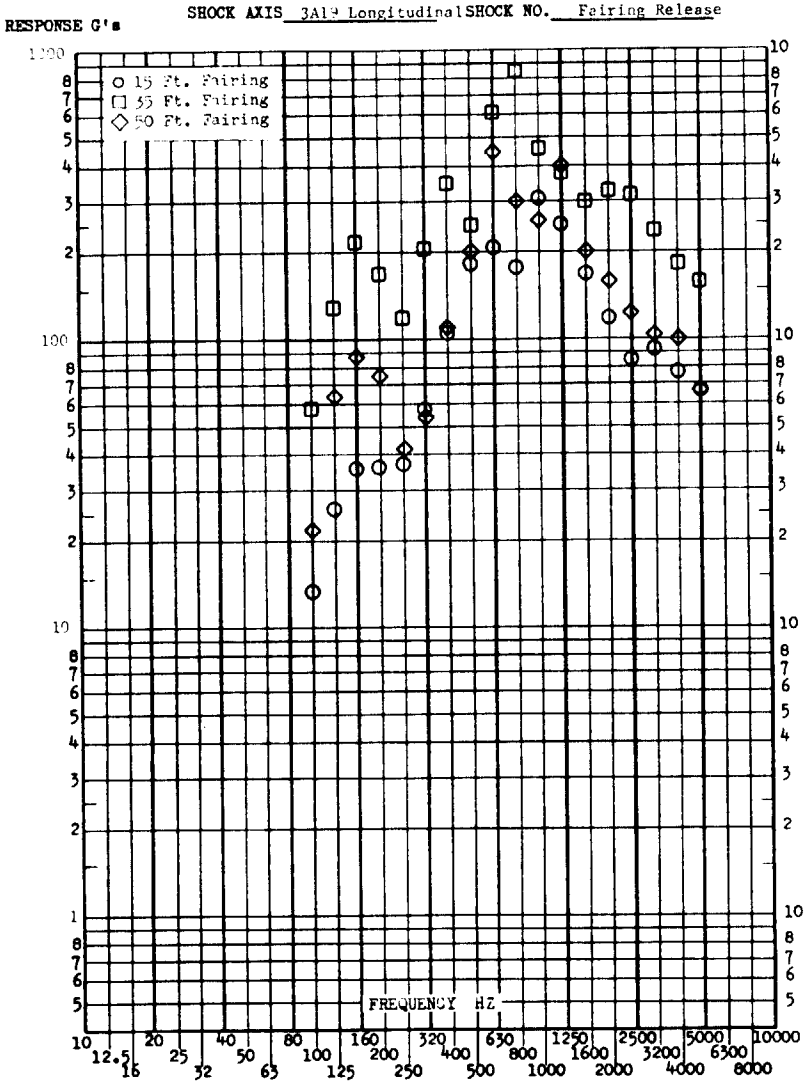


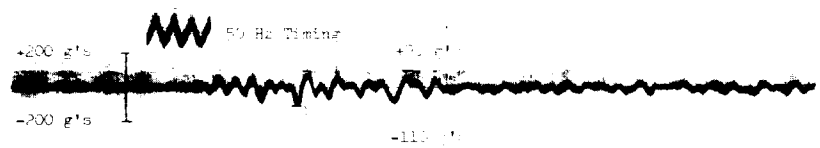
FIGURE 1.B.3-48

TEST ITEM UPLF PART NO.

SERIAL NO. TEST DATE July 1968

SHOCK AXIS 3A19 Longitudinal SHOCK NO. Fairing Release





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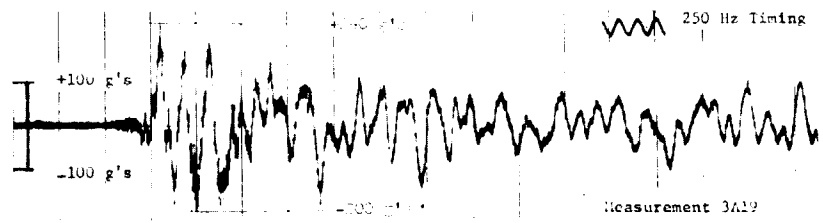
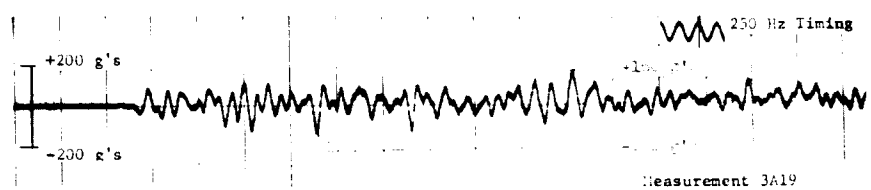


35 Ft.



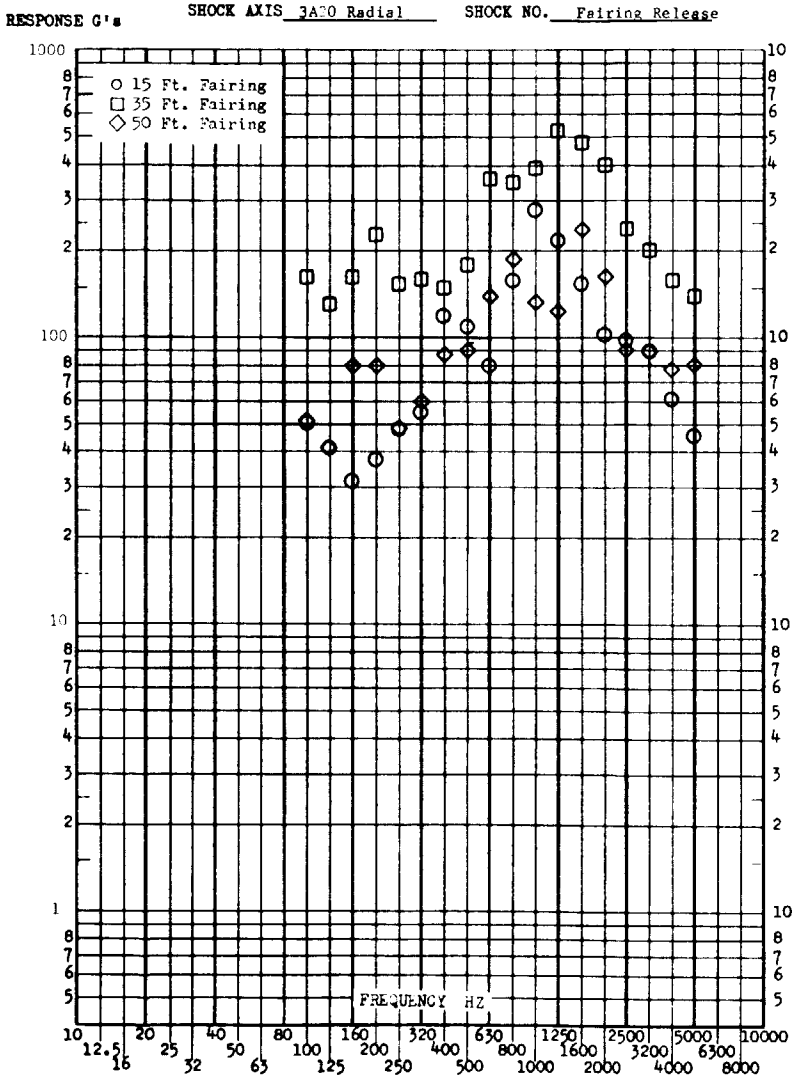
50 Ft.

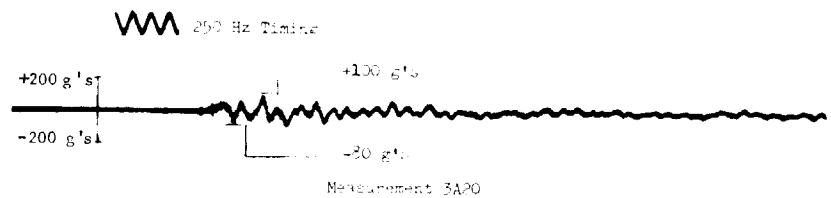
FIGURE 1.B.3-49

TEST ITEM UPLF PART NO.

SERIAL NO. TEST DATE July, 1968

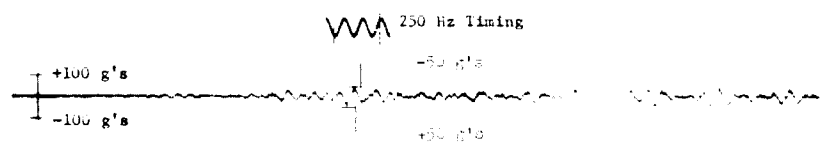
SHOCK AXIS 3A20 Radial SHOCK NO. Fairing Release





15 Ft.

35 Ft.



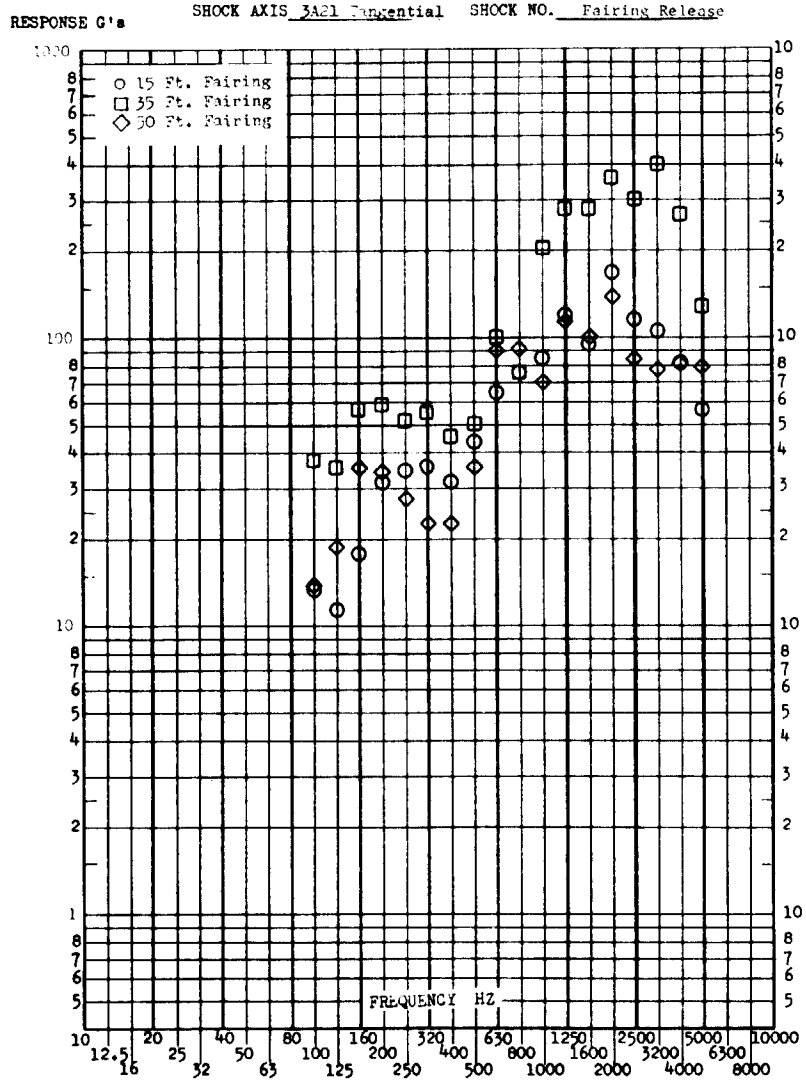
50 Ft.

FIGURE 1.B.3-50

TEST ITEM UPLF PART NO.

SERIAL NO. TEST DATE July, 1 68

SHOCK AXIS 3A21 Tangential SHOCK NO. Fairing Release



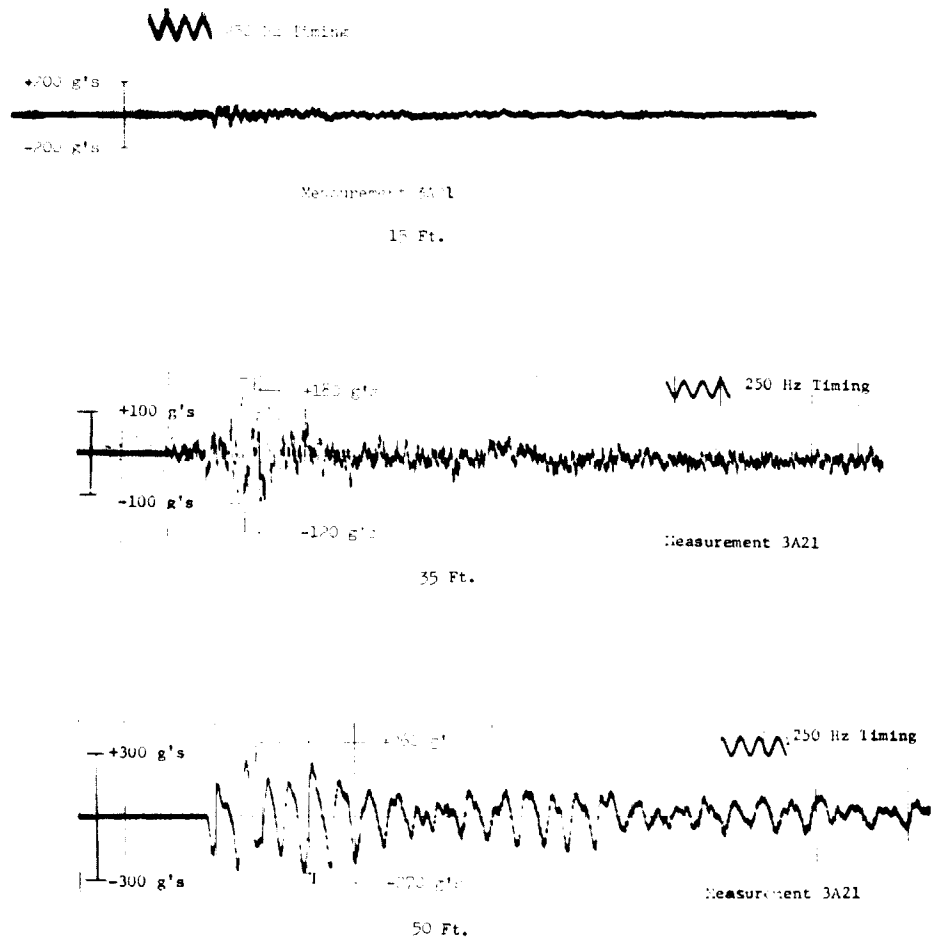
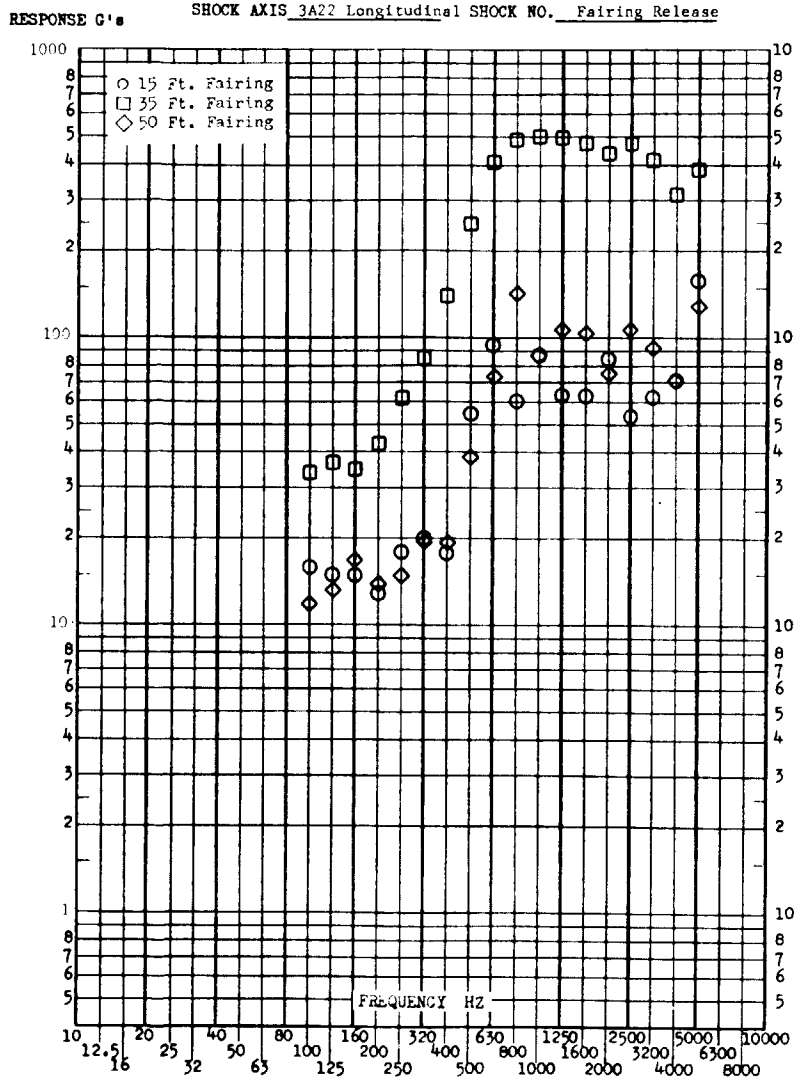


FIGURE I.B.3-51

TEST ITEM UPLF PART NO.

SERIAL NO. TEST DATE July, 1968

SHOCK AXIS 3A22 Longitudinal SHOCK NO. Fairing Release



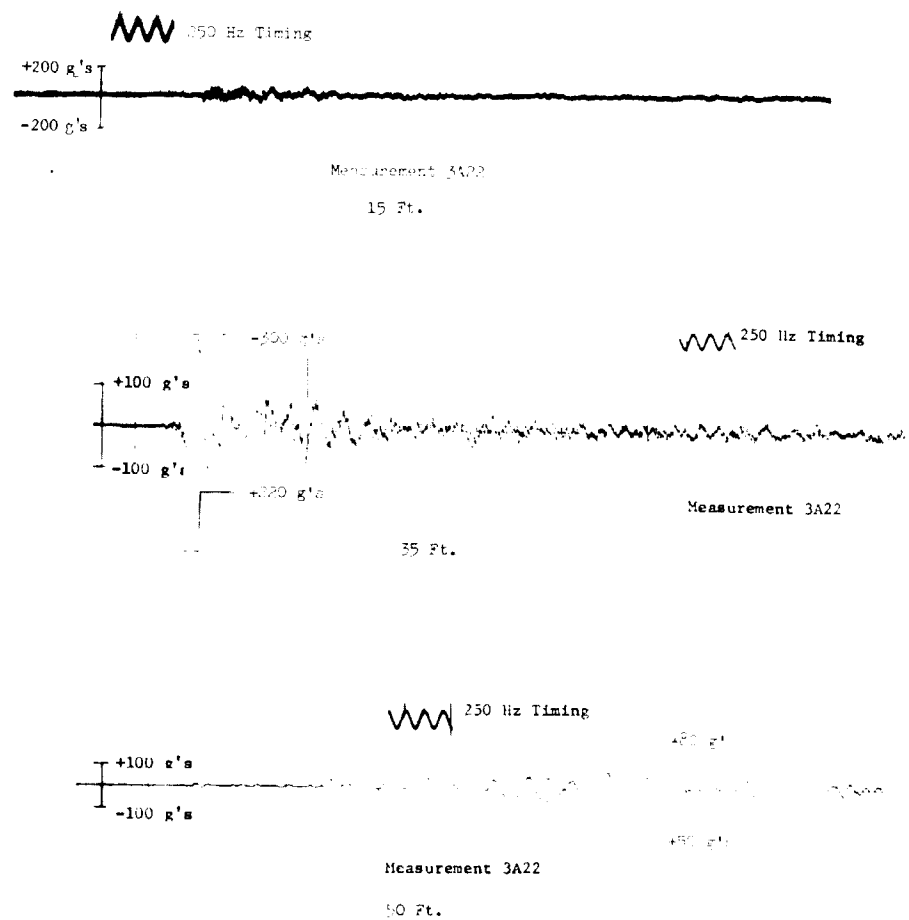
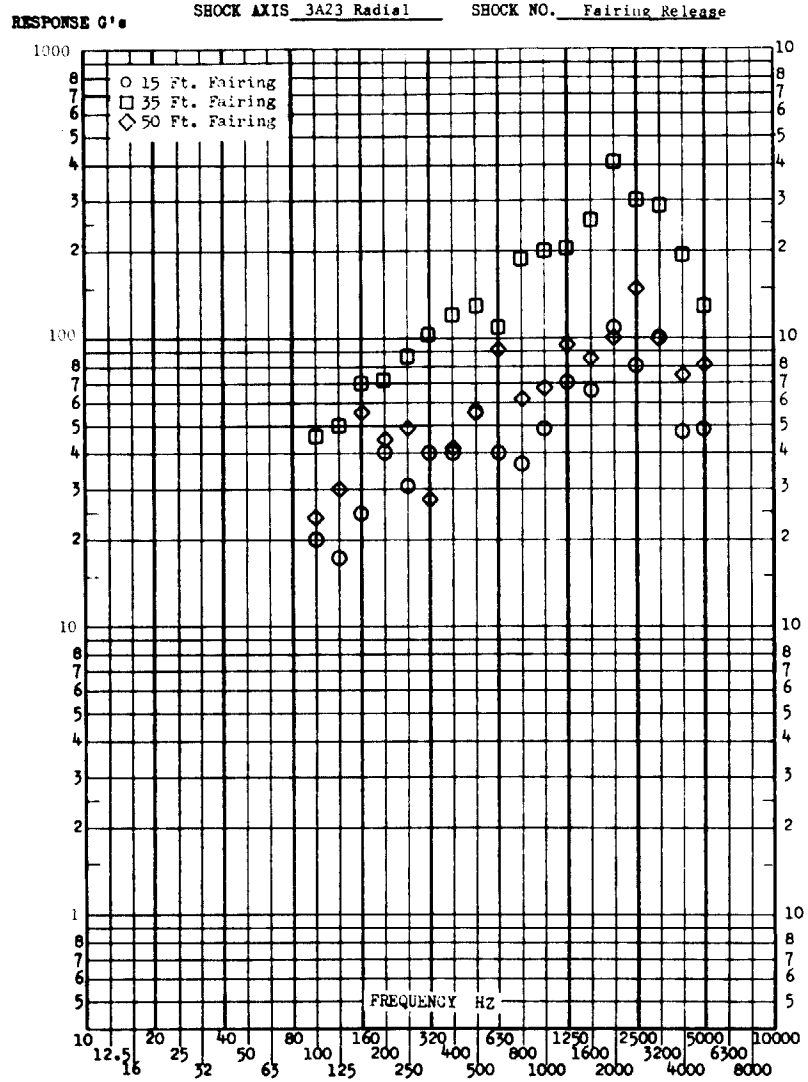


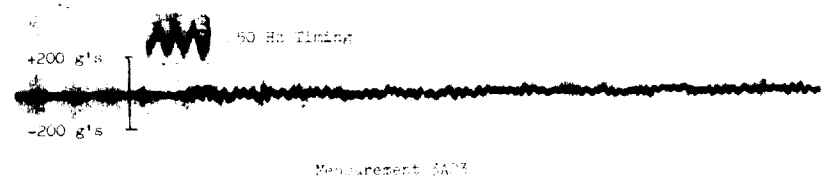
FIGURE I.B.3-52

TEST ITEM UPLF PART NO.

SERIAL NO. TEST DATE July, 1968

SHOCK AXIS 3A23 Radial SHOCK NO. Fairing Release





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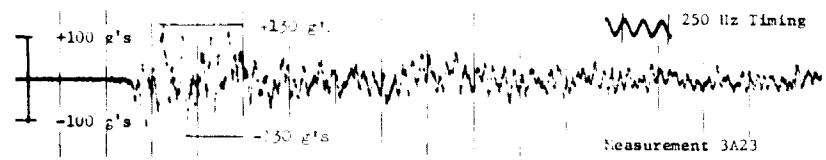
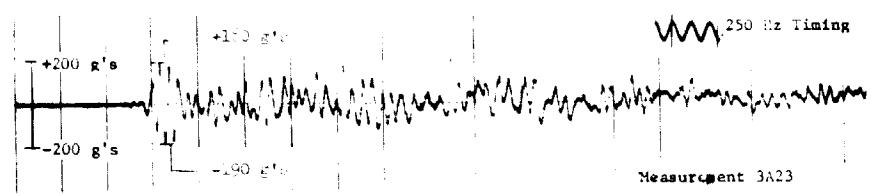


35 Ft.



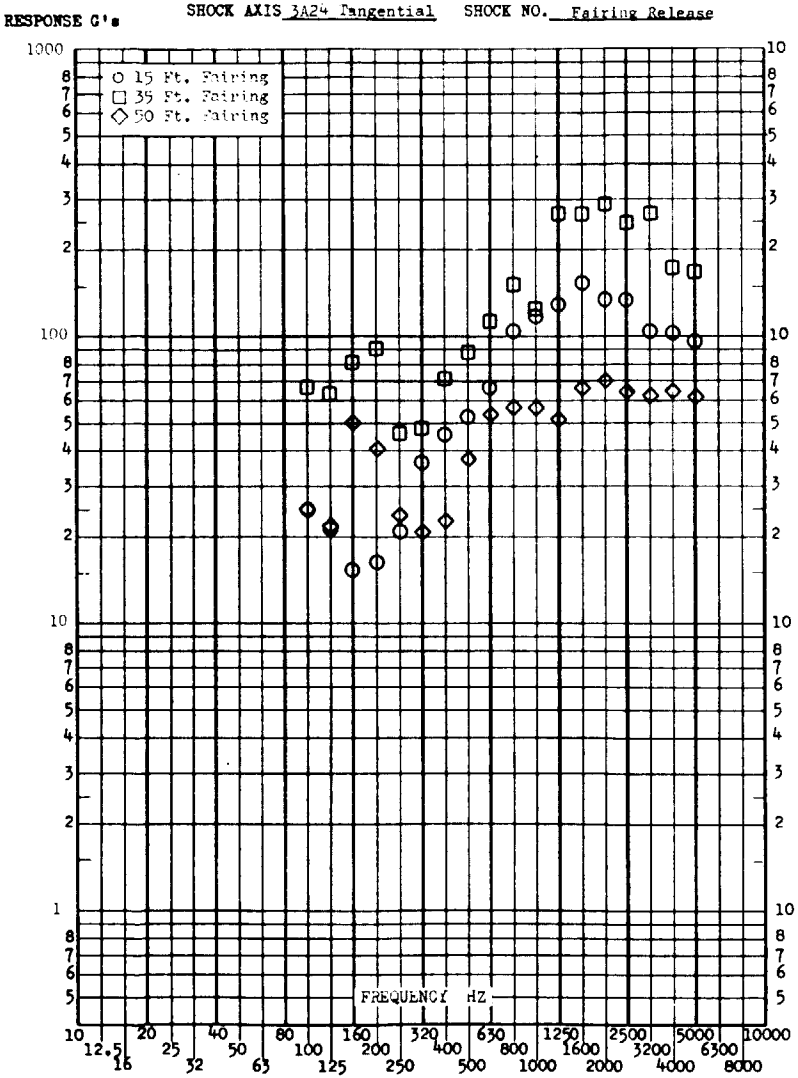
50 Ft.

FIGURE I.B.3-53

TEST ITEM UPLF PART NO.

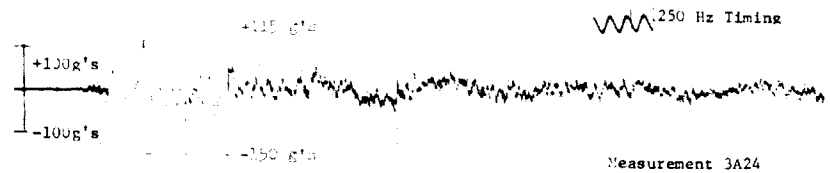
SERIAL NO. TEST DATE July 1968

SHOCK AXIS 3A24 Tangential SHOCK NO. Fairing Release



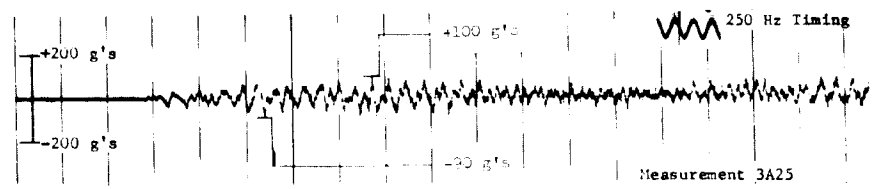
Measurement 3A24

15 Ft.



35 Ft.

NOT REPRODUCIBLE



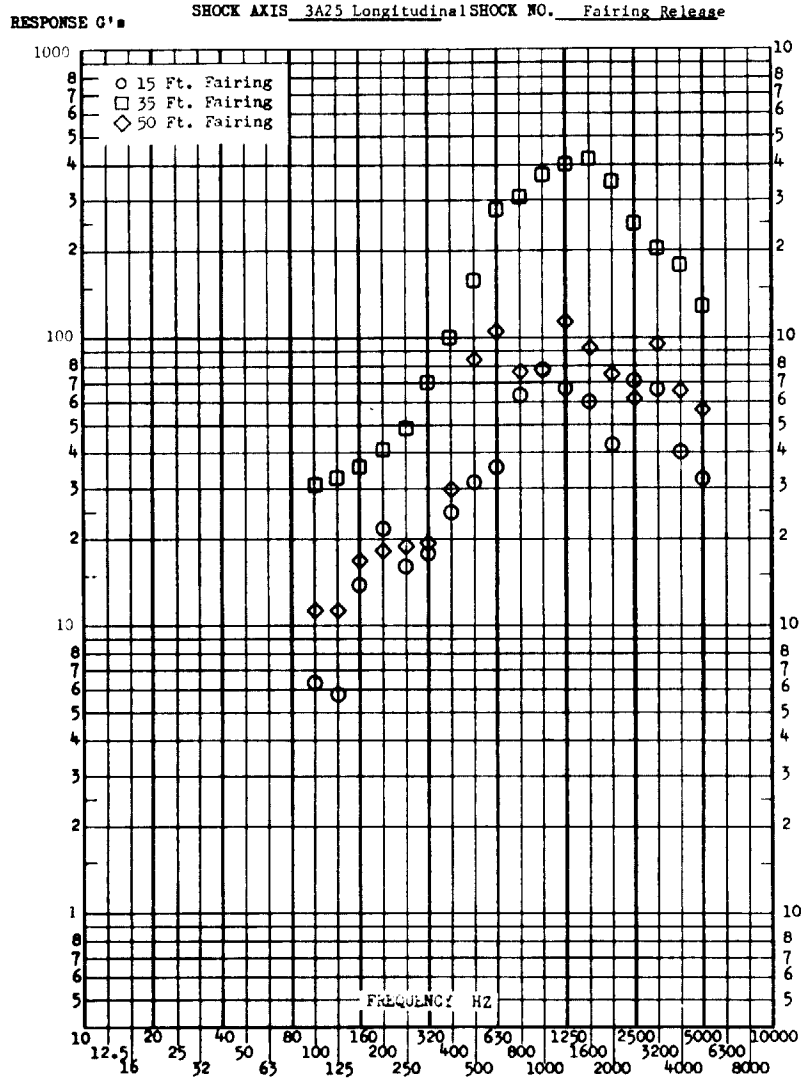
50 Ft.

FIGURE I.B.3-54

TEST ITEM UPLF PART NO.

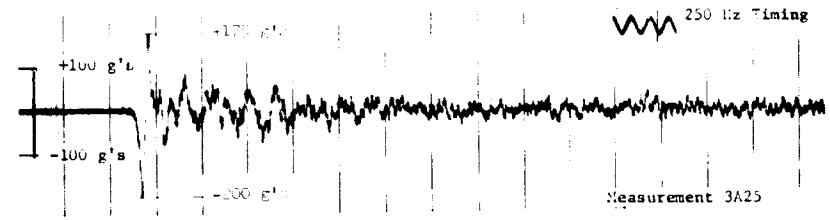
SERIAL NO. TEST DATE July 1968

SHOCK AXIS 3A25 Longitudinal SHOCK NO. Fairing Release

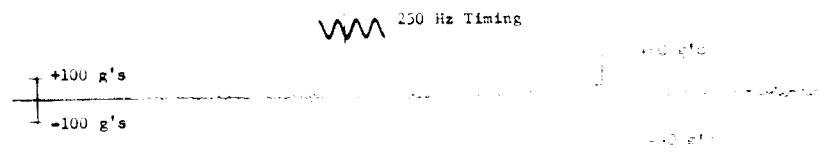


Measurement 3A25

15 Ft.



35 Ft.



Measurement 3A24

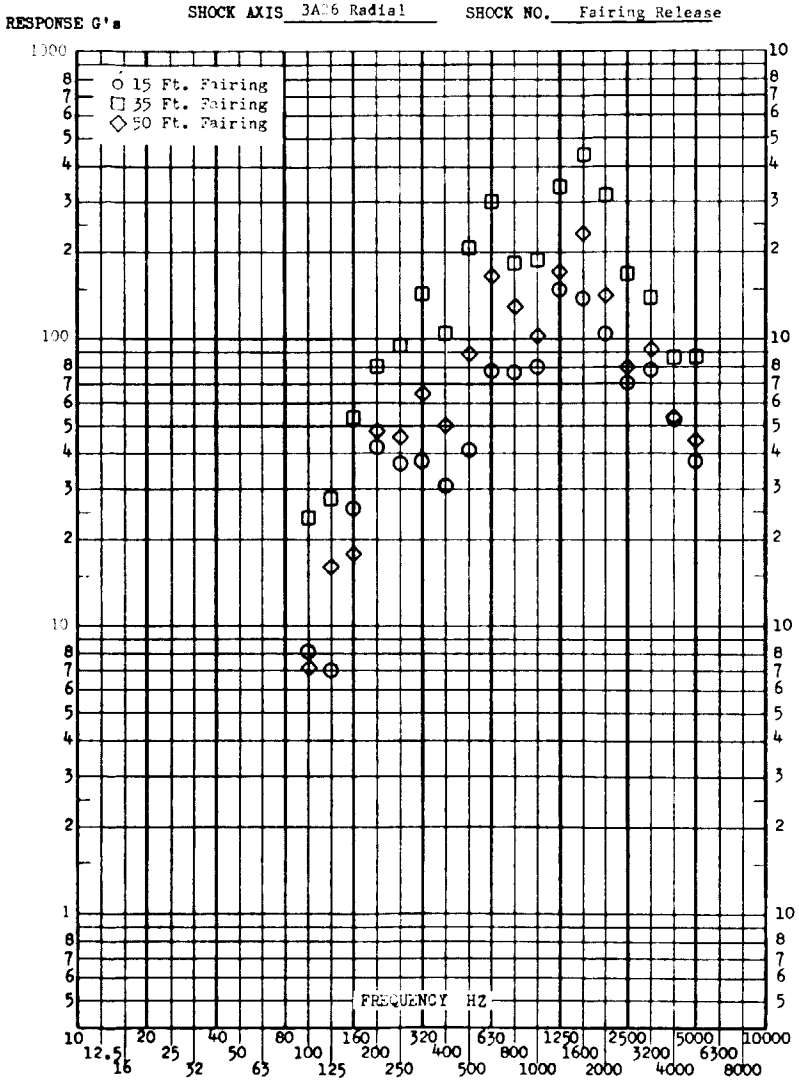
50 Ft.

FIGURE 1.B.3-55

TEST ITEM UPLF PART NO.

SERIAL NO. TEST DATE July 1968

SHOCK AXIS 3A26 Radial SHOCK NO. Fairing Release



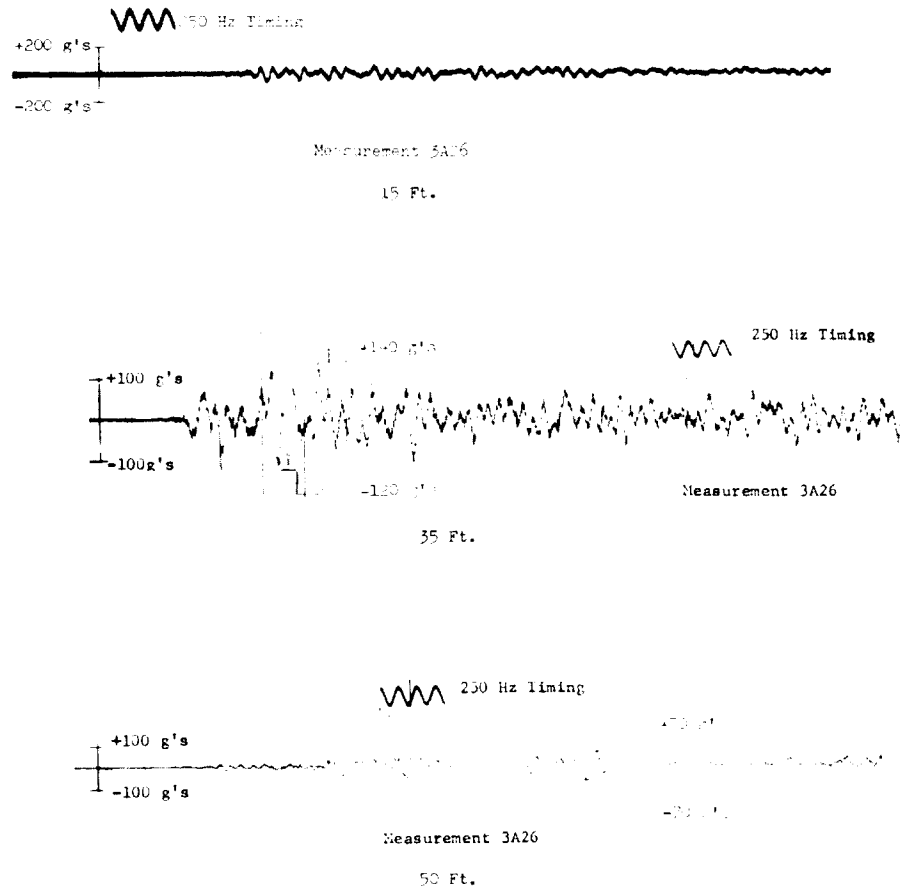
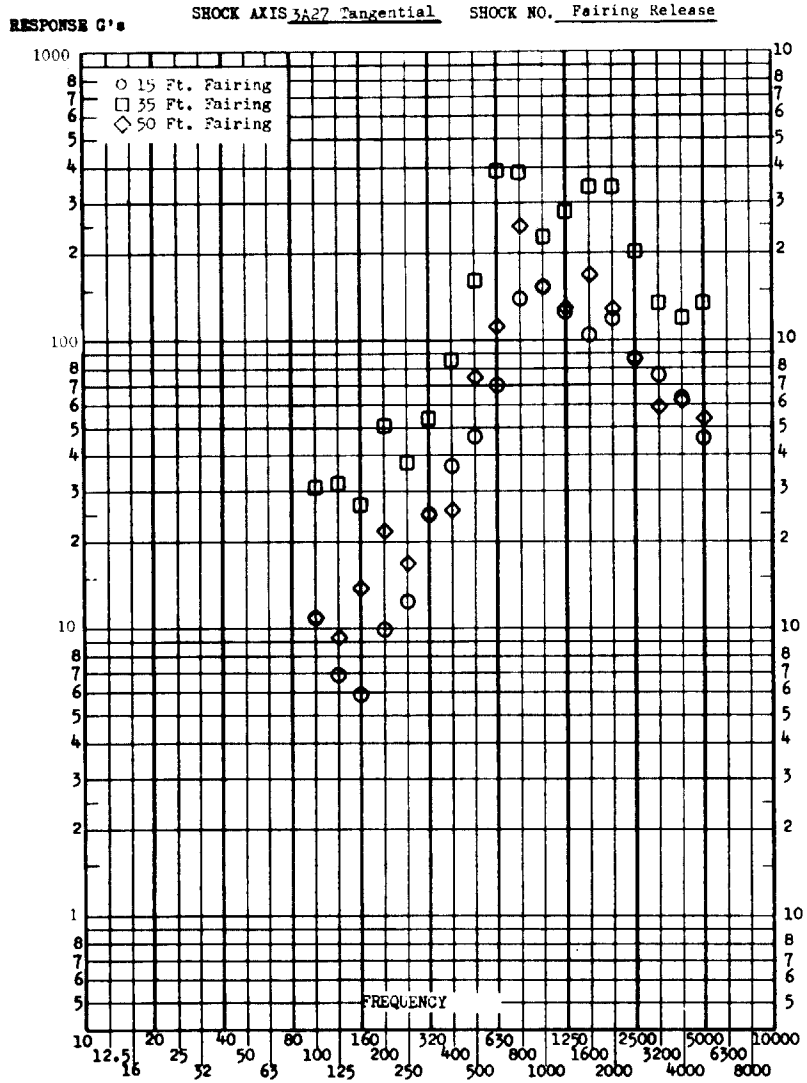


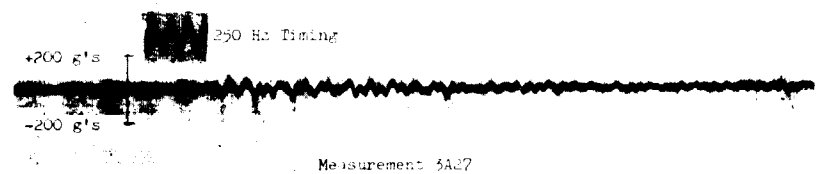
FIGURE I.B.3-56

TEST ITEM UPLF PART NO.

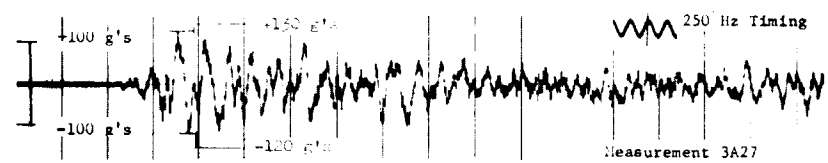
SERIAL NO. TEST DATE July 1968

SHOCK AXIS 3A27 Tangential SHOCK NO. Fairing Release

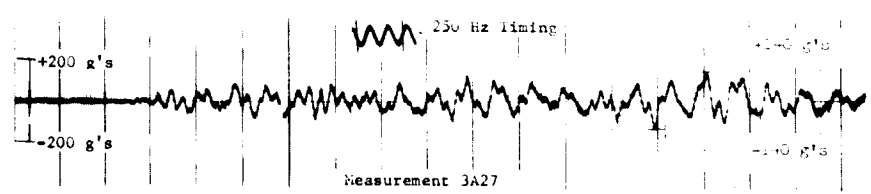




15 Ft.



35 Ft.



50 Ft.

FIGURE 1.B.3-57

LOCATION OF ADDITIONAL DATA

Additional pyrotechnic shock data for structure cutting charges with propagation in a truss structure may be found in the following section of this data volume:

I.C.1 Figures 13 through 18

LOCATION OF RELATED LOCKHEED DATA

Additional pyrotechnic shock data compiled for structure cutting charges with propagation in a truss structure may be found in the following sections of the Lockheed data compilation:

II.A.3
II.A.4
II.A.5
II.A.6
II.A.7

PART I.C

PYROTECHNIC SHOCK DATA COMPILED FOR STRUCTURE CUTTING CHARGES FOR PROPAGATION IN A STRUCTURE OTHER THAN SKIN-RING-FRAME OR TRUSS

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PART I.C
Structures Other Than Skin-Ring-Frame or Truss

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SECTION I.C.1

MULTI-MISSION SUPPORT STAGE SHROUD SEPARATION TEST

PURPOSE OF TEST

The overall objective of the test program was to verify total adequacy of the snubber system between the solar arrays and shroud and between the simulated payload and shroud. Part of this test program included the pyrotechnic separation of the shroud.

DESCRIPTION OF EVENT

A shroud separation test was conducted on an engineering model of the Multi-mission Support Stage with a simulated payload assembly. Connection of the shroud to the assembly was severed via MDF separating the shroud into two longitudinal segments as shown in Figures I.C.1-1 and I.C.1-2. Accelerometer data were obtained for measurements on a honeycomb platform, two solar arrays, and a strut assembly.

DESCRIPTION OF DATA

Twenty accelerometers were monitored during the separation test. Two of the accelerometers (1 and 4) displayed two distinct shock transients. In both cases, shock spectra analyses were performed on all

three transients: the combined, the primary (first), and the secondary transients. The characteristics of the data are as follows:

No. of time histories	24
No. of shock spectra	24
Type of analysis	analog (absolute response spectra)
Analog machine:	MB Electronics N980 SSA
Frequency range	10-10,000 Hz
Frequency increments	6 Points per octave
Damping	Q = 10

These shock spectra are presented with their corresponding time histories as Figures I.C.1-6 through I.C.1-18.

DESCRIPTION OF PYROTECHNIC

Type: MDF

Size of charge: 10 grains per foot

Location: Figure I.C.1-2

DESCRIPTION OF STRUCTURE

Shroud: 346 inches long, 62 inch diameter

See also Figures I.C.1-2 through I.C.1-5.

DESCRIPTION OF ACCELEROMETERS

Type: Table I.C.1-1

Locations: Table I.C.1-1 and Figures I.C.1-3 through I.C.1-5

Axis of sensitivity: Table I.C.1-1

DESCRIPTION OF DATA ACQUISITION SYSTEM

Tape recorders: Ampex CP 100

Amplitier: Endevco charge type amplifiers model 2711B

COMMENTS

Measurements 1 through 9 would logically fit in Part I.C while measurements 10 through 20 would logically fit in Part I.B.

TABLE I.C.1-1

DESCRIPTION OF ACCELEROMETERS

Accelerometer Number	Measurement Location	Endevco Model	Sensitive Axis	Figure Number
1 combined	Shock Spectra +Y Axis Solar Array Spar	2220C	Y	I.C.1-6
1 primary				I.C.1-7
1 secondary				I.C.1-7
2	Shock Spectra +Y Axis Solar Array Live Panel	2220C	Y	I.C.1-6
3	Shock Spectra -Y Axis Solar Array Proto Type Panel	2220C	Y	I.C.1-8
4 combined	Shock Spectra -Y Axis Solar Array Spar	2220C	Y	I.C.1-8
4 primary				I.C.1-9
4 secondary				I.C.1-9
5	Shock Spectra - Honeycomb Platform	2225	Z	I.C.1-10
6	Shock Spectra - Honeycomb Platform	2225	Z	I.C.1-10
7	Shock Spectra - Honeycomb Platform	2225	Z	I.C.1-11
8	Shock Spectra - Honeycomb Platform	2225	Z	I.C.1-11
9	Shock Spectra - Honeycomb Platform	2225	Z	I.C.1-12
10	Foot Strut Assembly	2225	Z	I.C.1-13
11	Foot Strut Assembly	2220C	Y	I.C.1-14
12	Foot Strut Assembly	2225	Z	I.C.1-14

TABLE I.C.1-1
(Continued)

Accelerometer Number	Measurement Location	Endevco Model	Sensitive Axis	Figure Number
13	Center Strut Cross	2225	X	I.C.1-15
14	Center Strut Cross	2225	Z	I.C.1-15
15	Center Strut Cross	2225	Z	I.C.1-16
16	Center Strut Cross	2225	X	I.C.1-16
17	Foot Strut Assembly	2225	Z	I.C.1-17
18	Foot Strut Assembly	2220C	X	I.C.1-17
19	Foot Strut Assembly	2220C	Y	I.C.1-18
20	LMSC Interface Ring	2225	Z	I.C.1-18

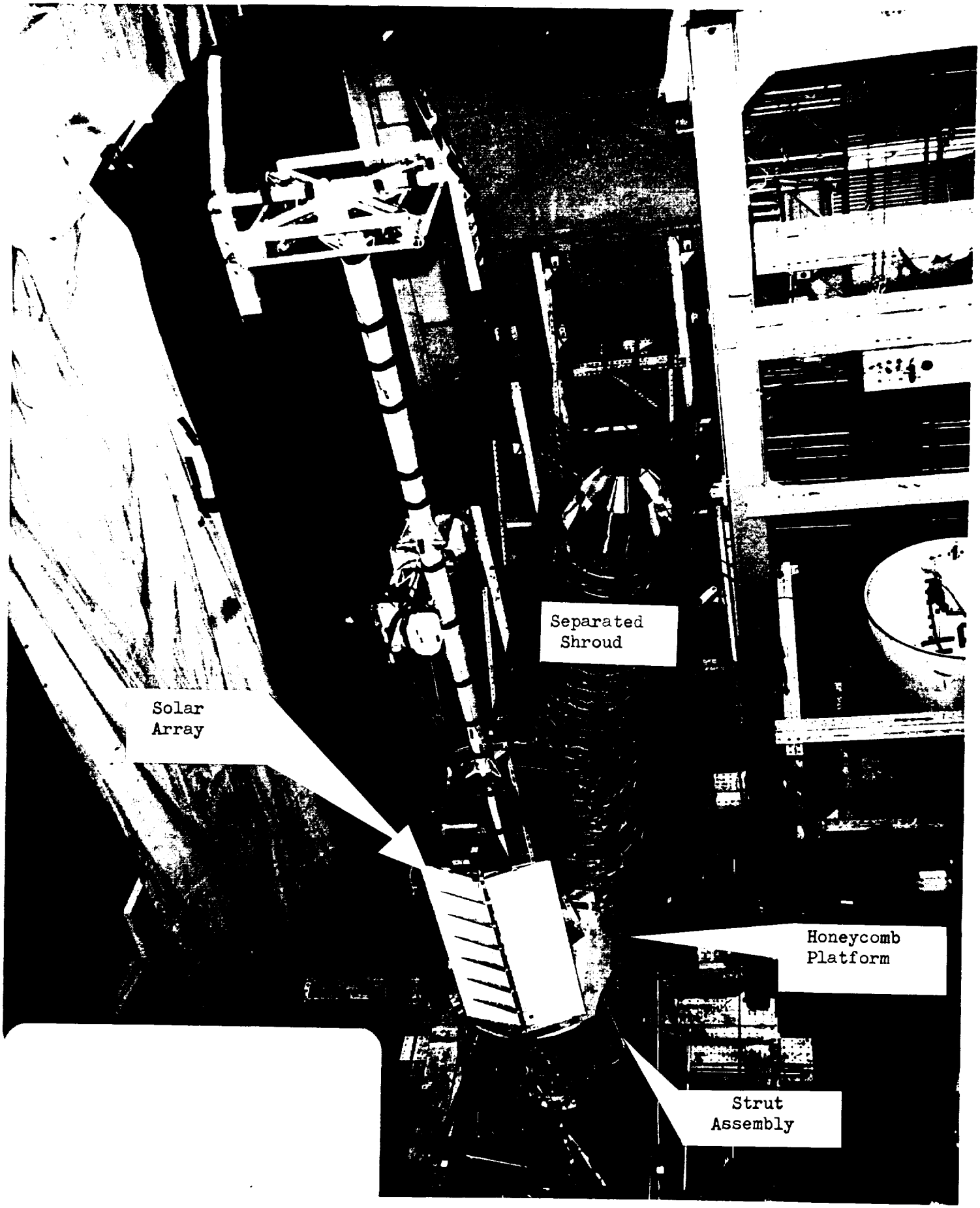


FIGURE I.C.1-1. Photograph of Shroud Separation Test Assembly

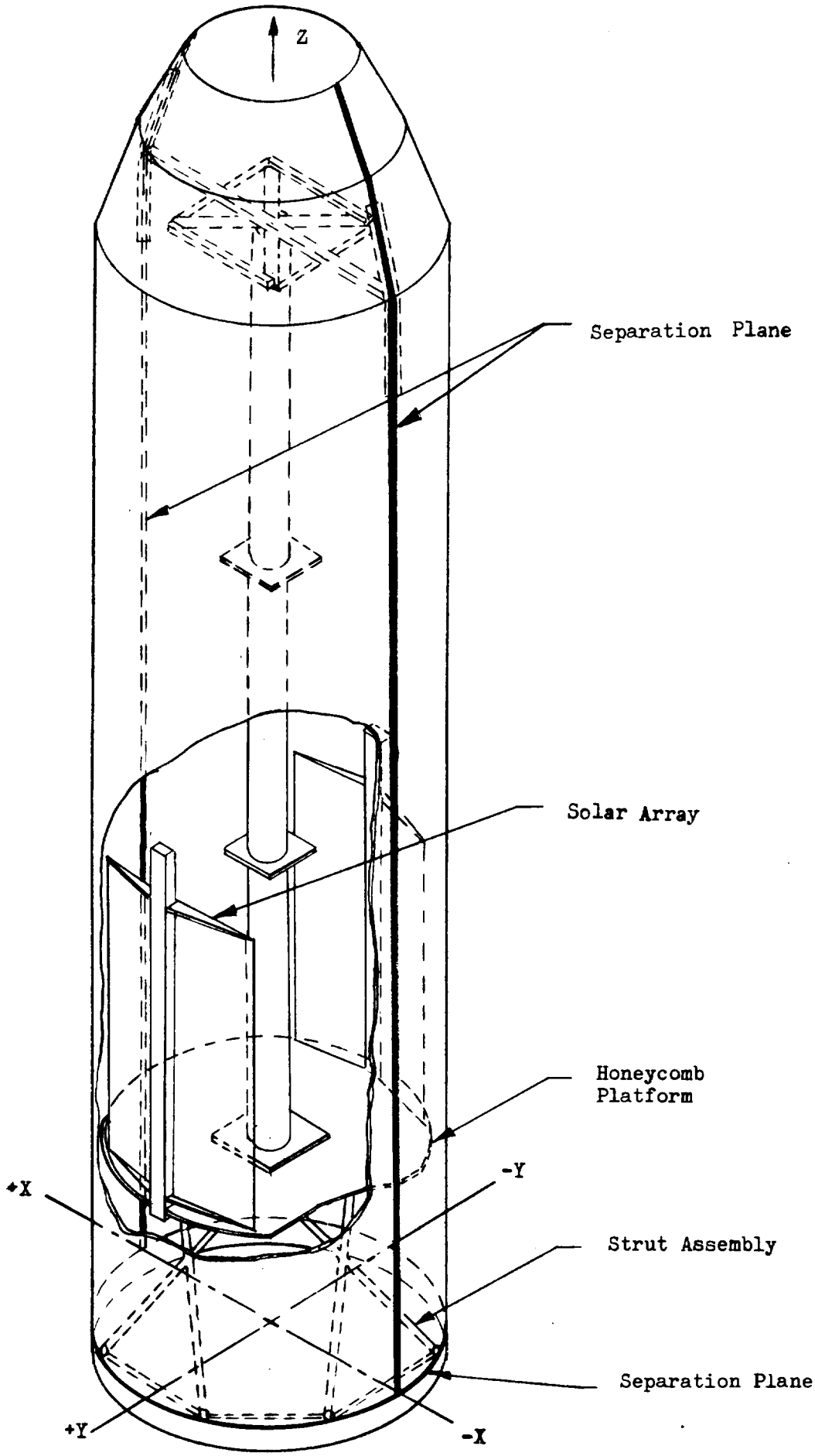


Figure I.C.1-2. Configuration of Shroud Separation Test Assembly

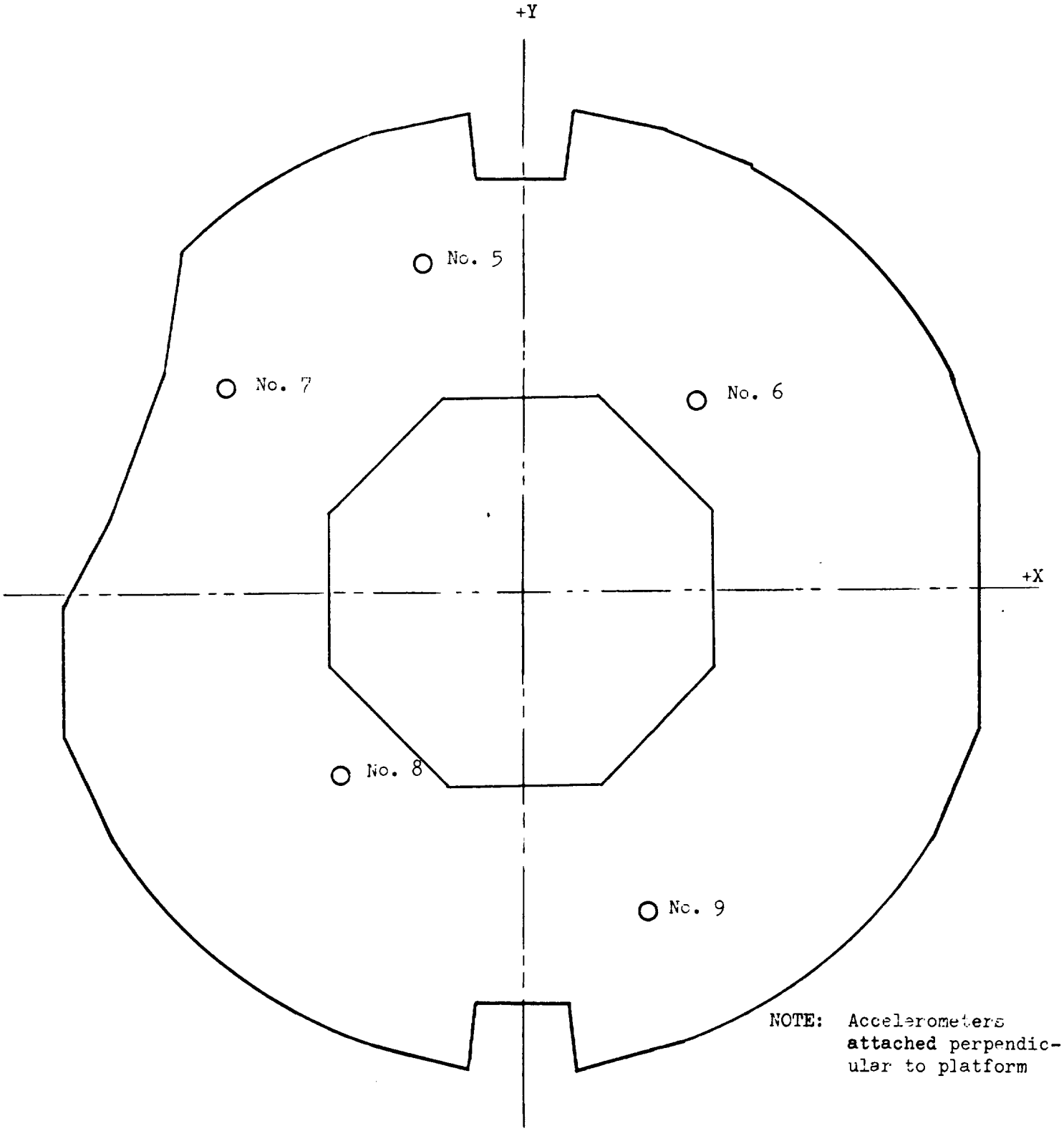


FIGURE I.C.1-3. Honeycomb Platform Accelerometer Locations

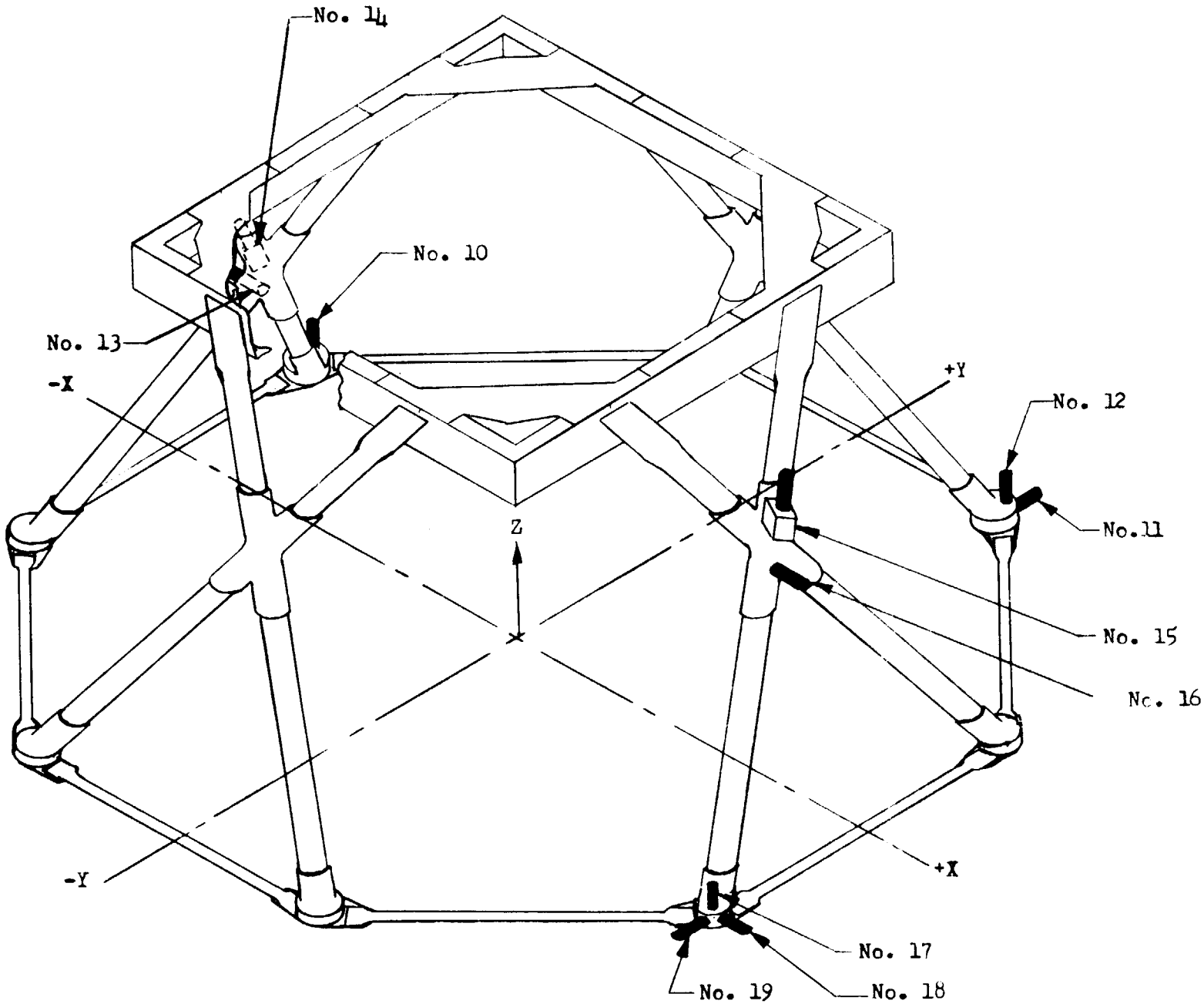


Figure I.C.1-4. Accelerometer Locations on Strut Assembly

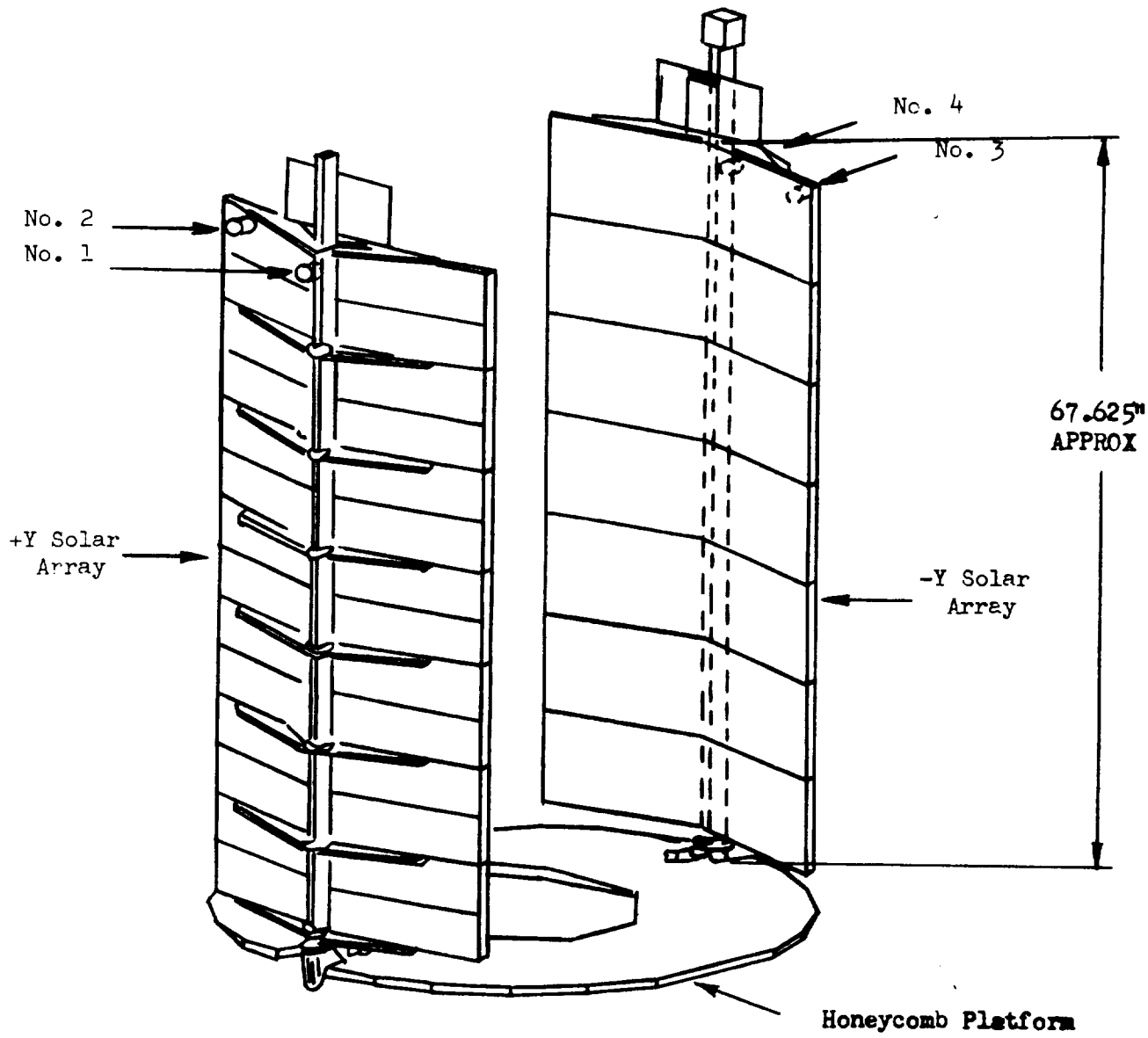
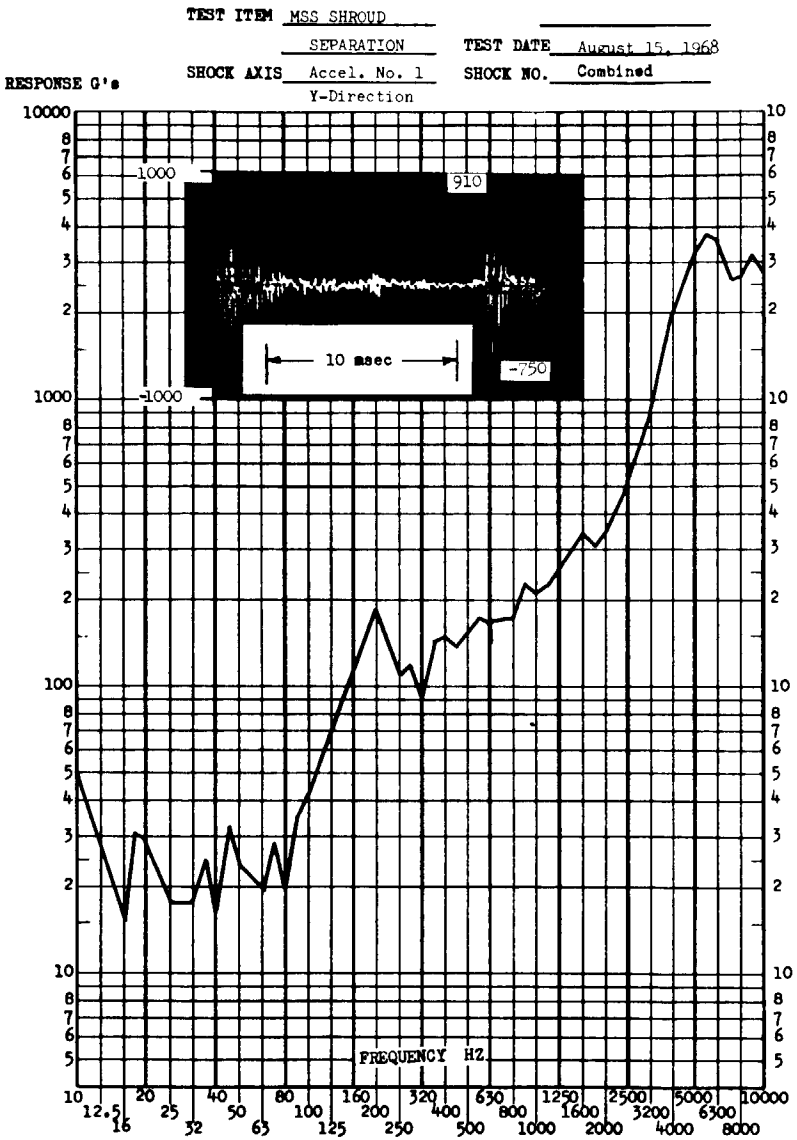


Figure I.C.1-5. Accelerometer Locations on Solar Arrays


TEST ITEM MSS SHROUD SEPARATION
TEST DATE August 15, 1968
SHOCK AXIS Accel. No. 1 Y-Direction
SHOCK NO. Combined
RESPONSE G's
1000
-1000
910
-750
10 msec
FREQUENCY HZ

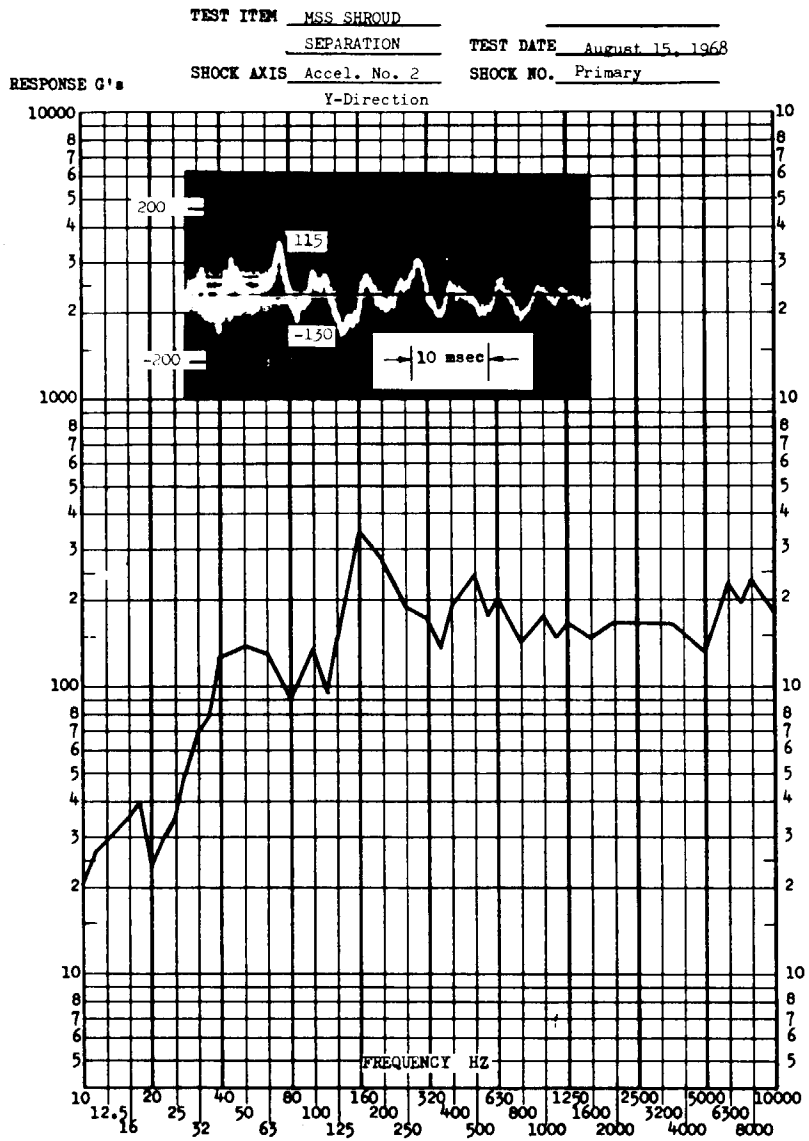
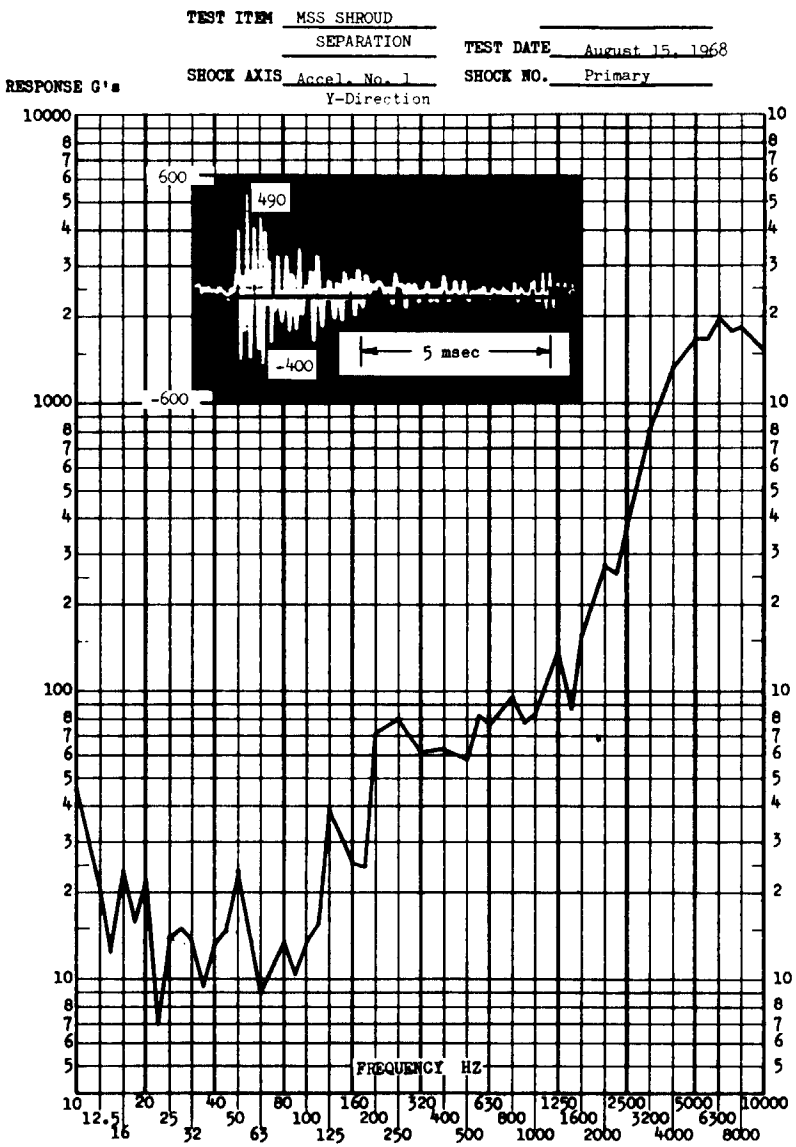

TEST ITEM MSS SHROUD SEPARATION
TEST DATE August 15, 1968
SHOCK AXIS Accel. No. 2 Y-Direction
SHOCK NO. Primary
RESPONSE G's
200
-200
115
-130
10 msec
FREQUENCY HZ

FIGURE I.C.1-6


TEST ITEM MSS SHROUD SEPARATION
TEST DATE August 15, 1968
SHOCK AXIS Accel. No. 1 Y-Direction
SHOCK NO. Primary
RESPONSE G's
600
490
-400
-600
5 msec
FREQUENCY HZ

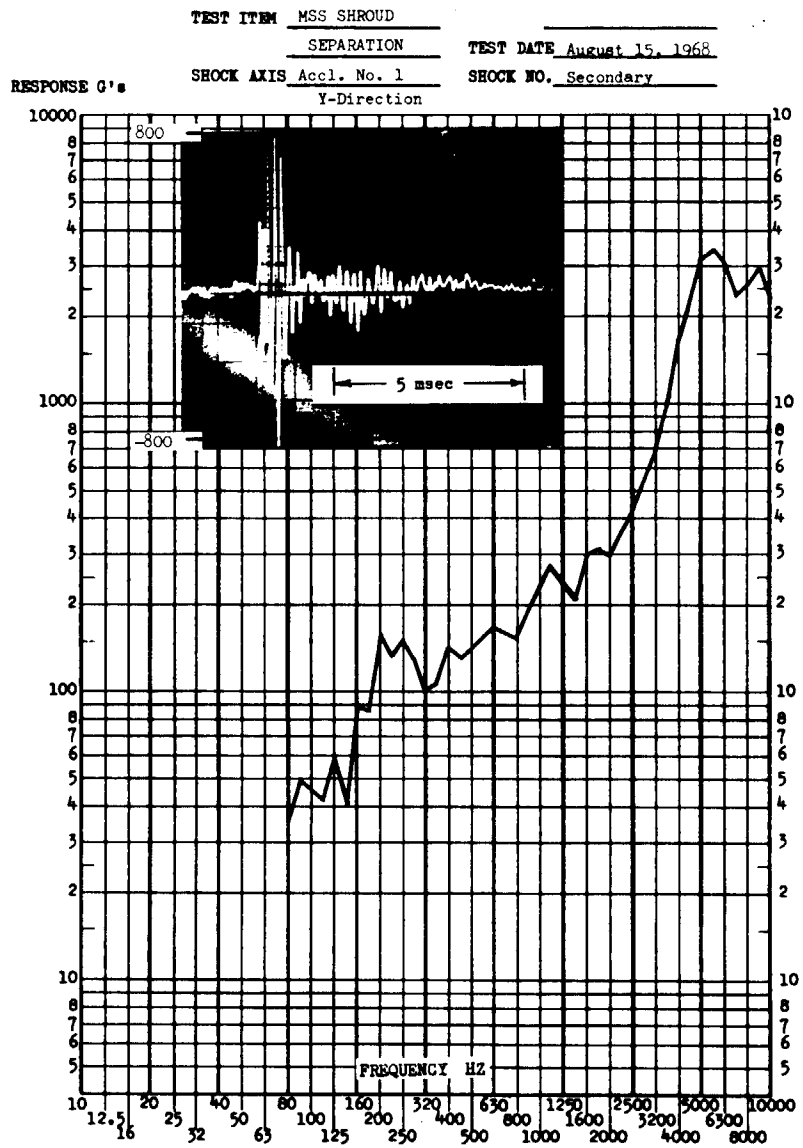
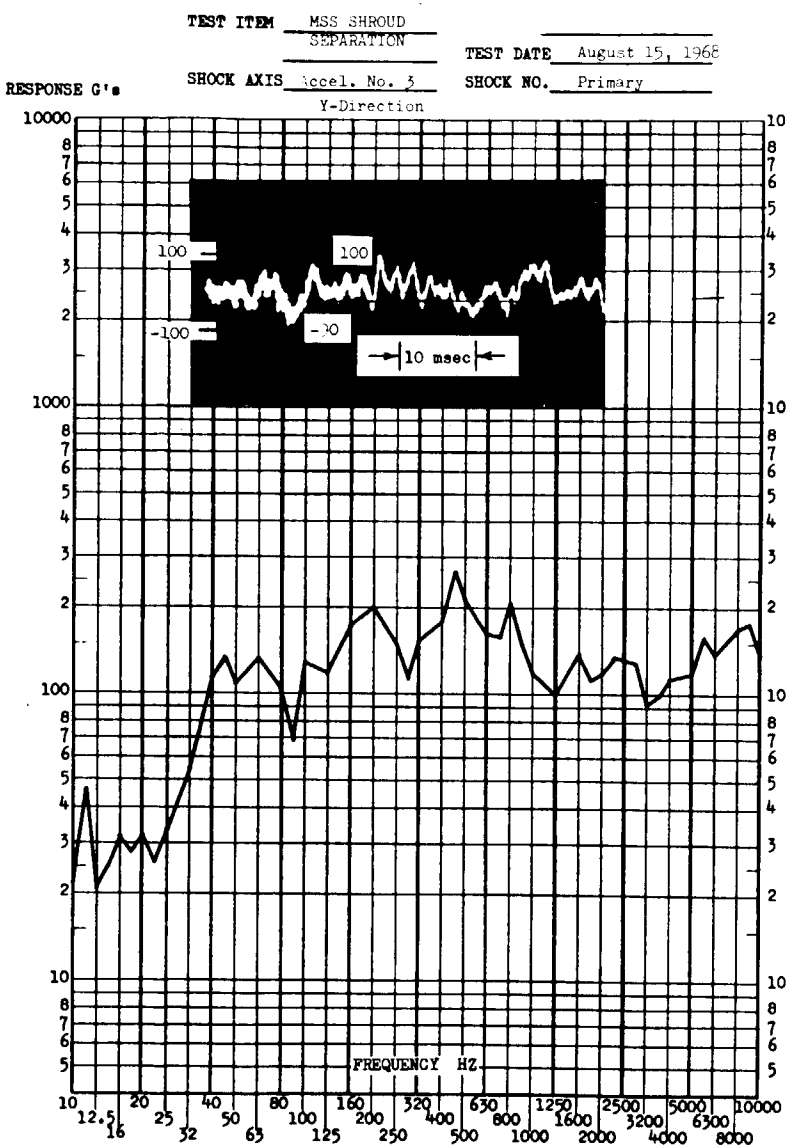

TEST ITEM MSS SHROUD SEPARATION
TEST DATE August 15, 1968
SHOCK AXIS Accl. No. 1 Y-Direction
SHOCK NO. Secondary
RESPONSE G's
800
-800
5 msec
FREQUENCY HZ

FIGURE I.C.1-7


TEST ITEM MSS SHROUD SEPARATION
TEST DATE August 15, 1968
SHOCK AXIS Accel. No. 3 Y-Direction
SHOCK NO. Primary
RESPONSE G's
100
-100
10 msec
FREQUENCY HZ

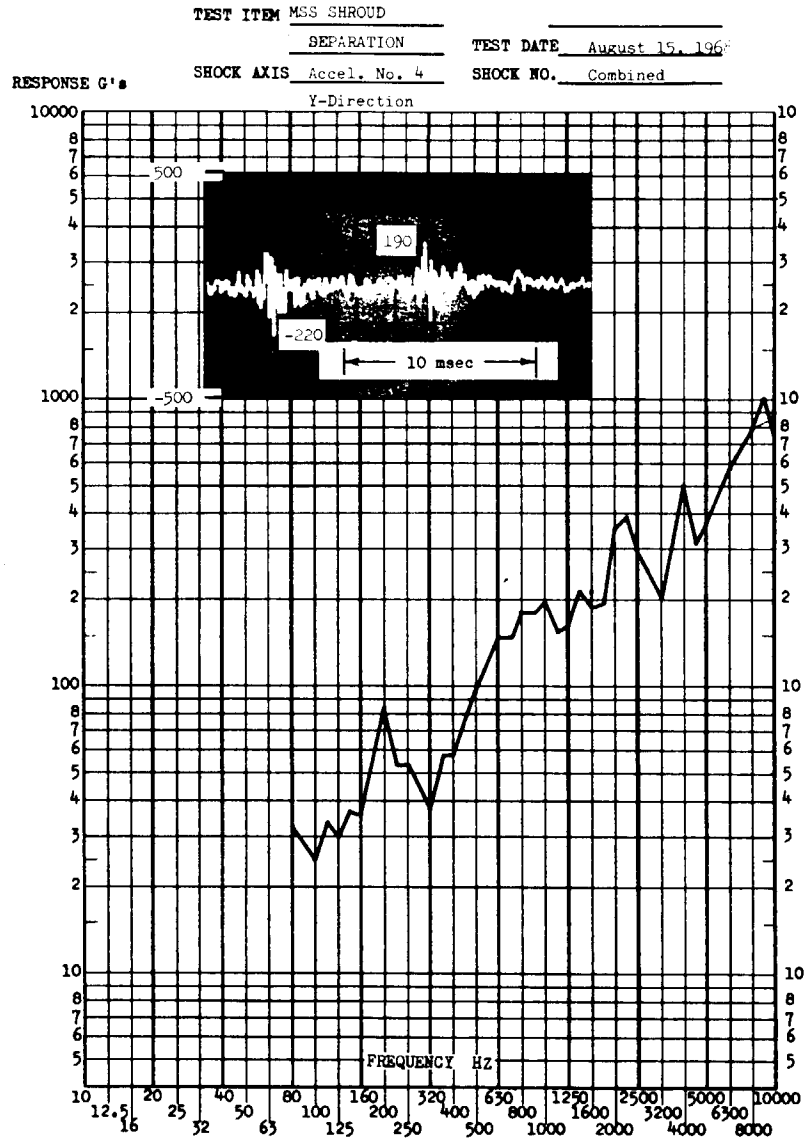
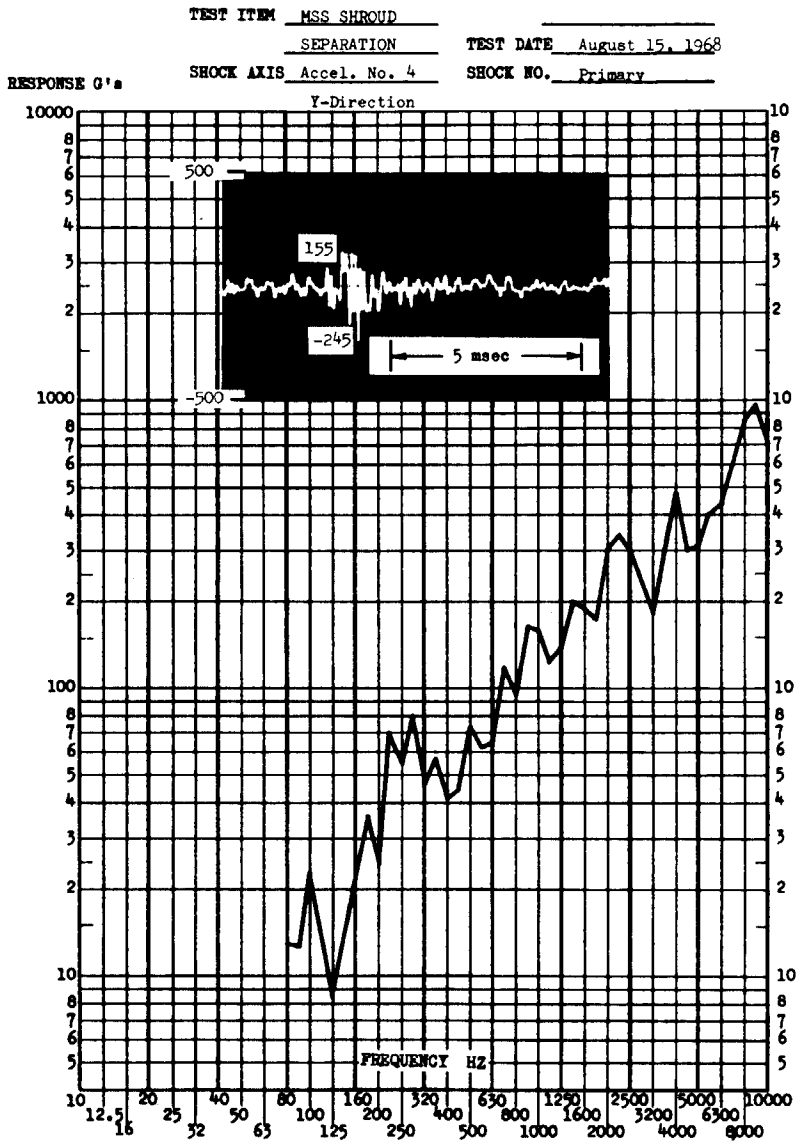

TEST ITEM MSS SHROUD SEPARATION
TEST DATE August 15, 1968
SHOCK AXIS Accel. No. 4 Y-Direction
SHOCK NO. Combined
RESPONSE G's
500
190
-220
-500
10 msec
FREQUENCY HZ

FIGURE I.C.1-8


TEST ITEM MSS SHROUD
SEPARATION
TEST DATE August 15, 1968
SHOCK AXIS Accel. No. 4
SHOCK NO. Primary
RESPONSE G's
Y-Direction
500
155
-245
-500
5 msec
FREQUENCY HZ

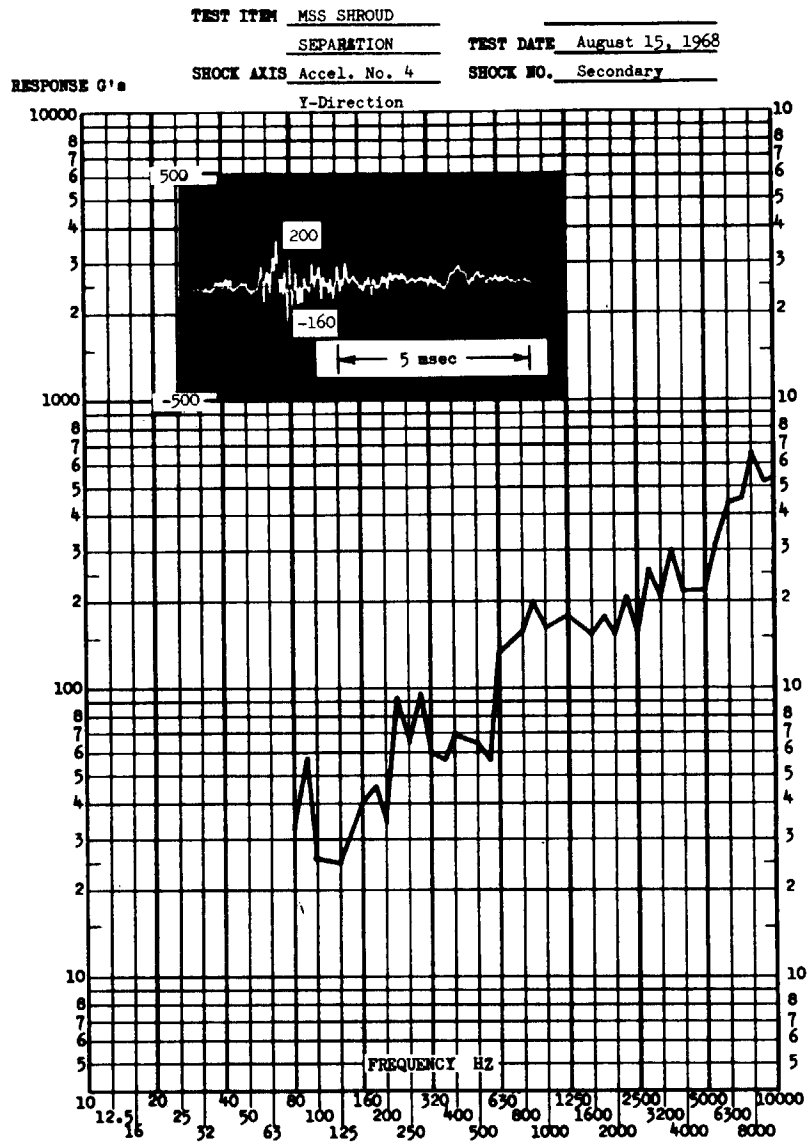
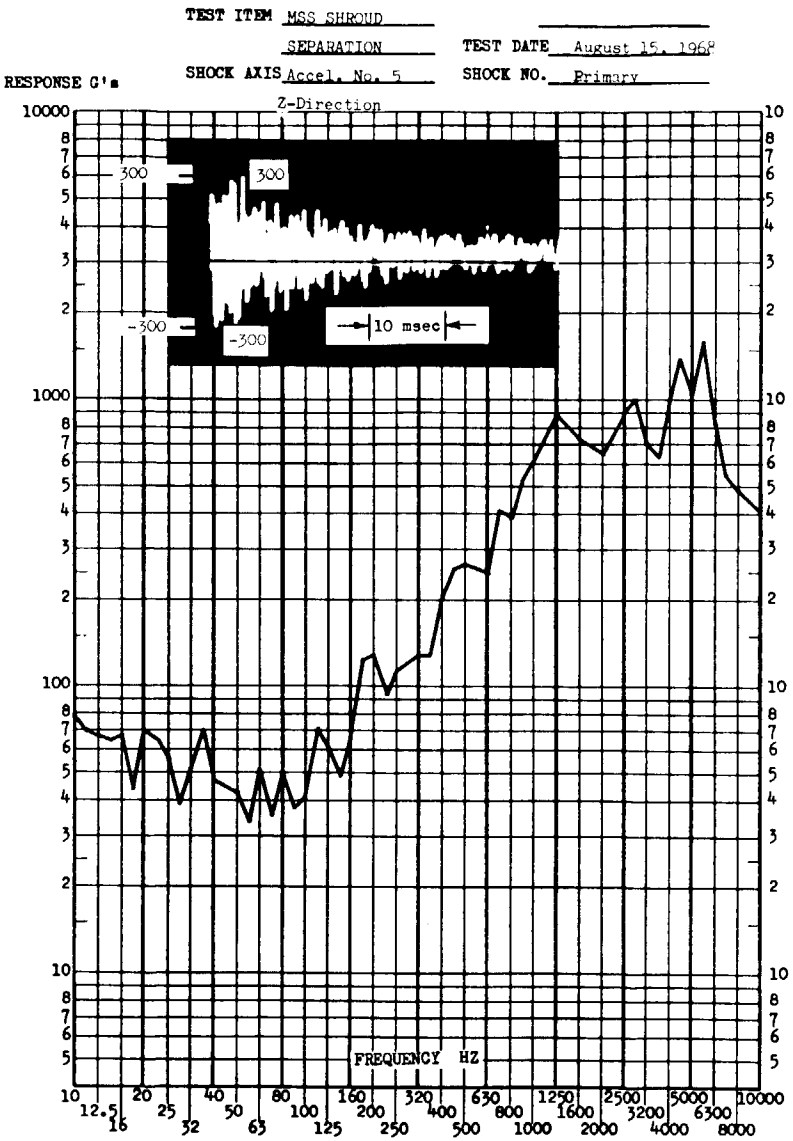

TEST ITEM MSS SHROUD
SEPARATION
TEST DATE August 15, 1968
SHOCK AXIS Accel. No. 4
SHOCK NO. Secondary
RESPONSE G's
Y-Direction
500
200
-160
-500
5 msec
FREQUENCY HZ

FIGURE I.C.1-9



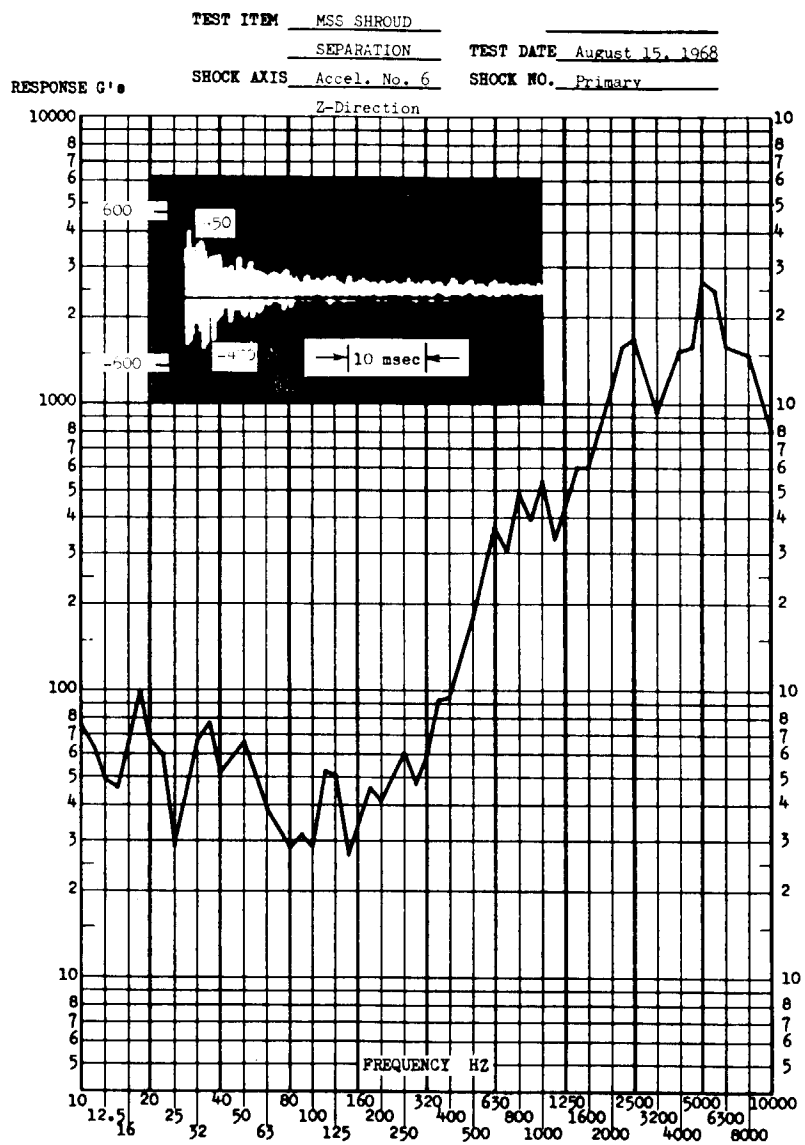
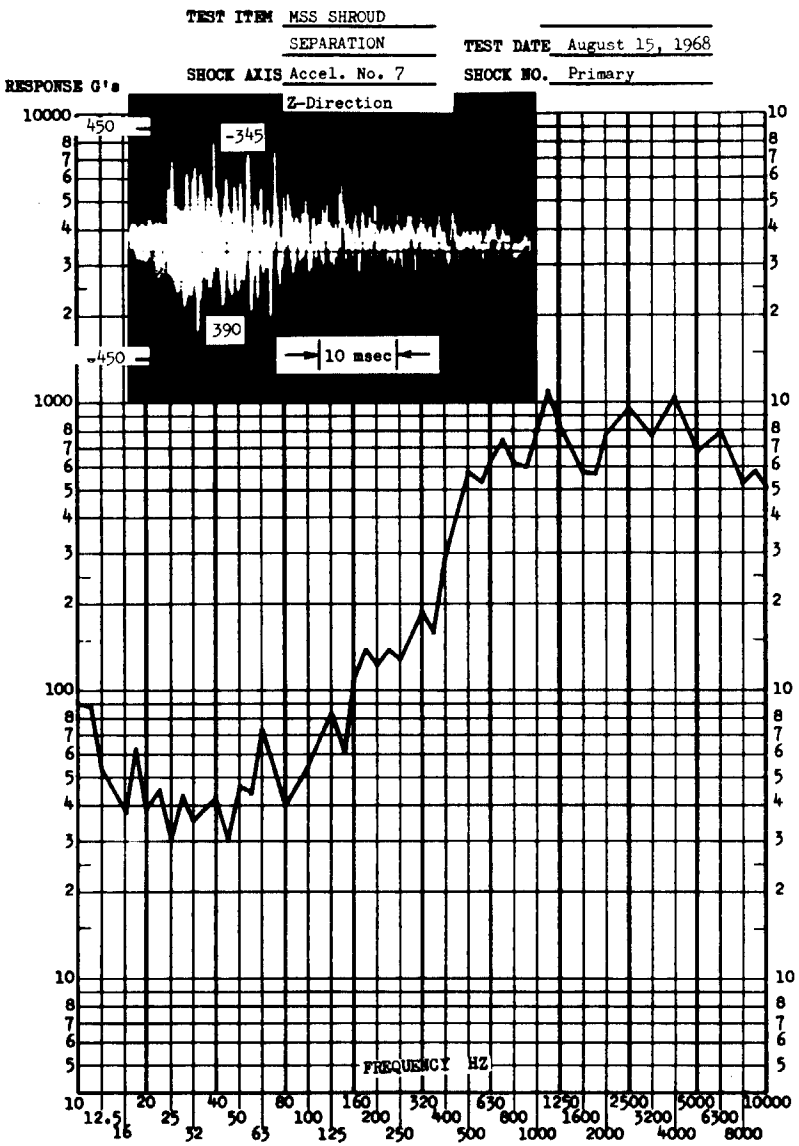


FIGURE I.C.1-10



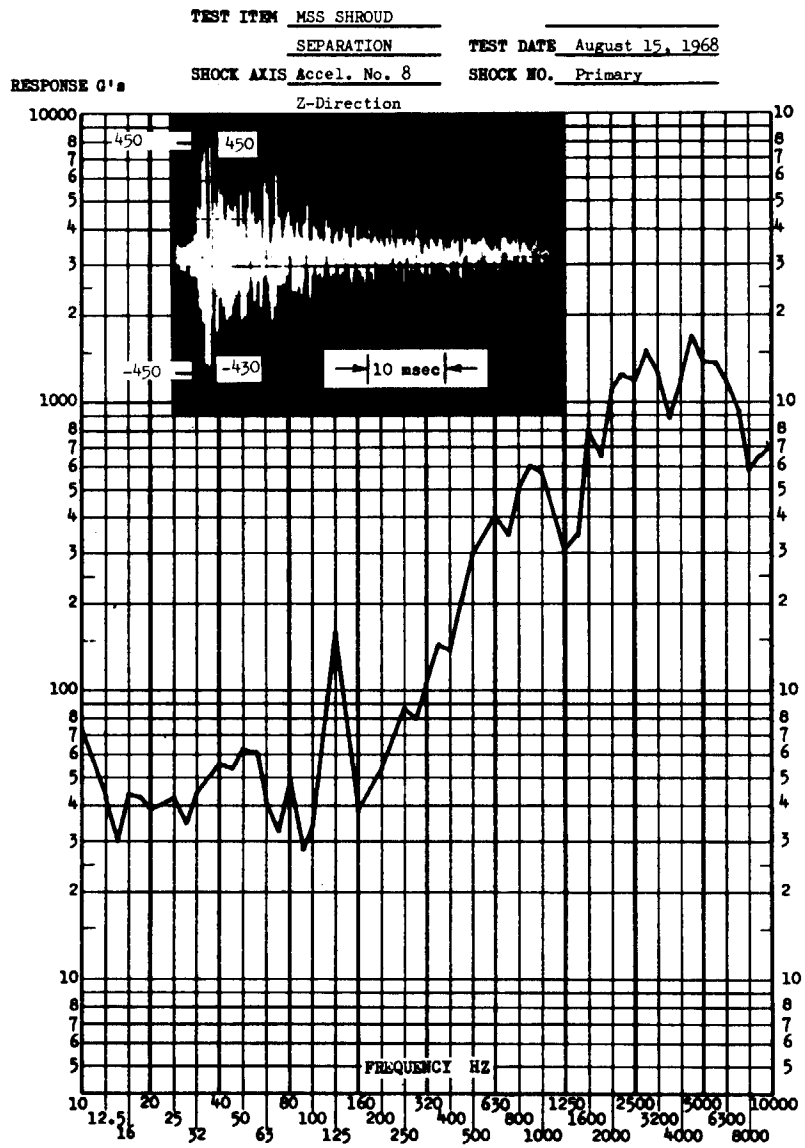


FIGURE I.C.1-11

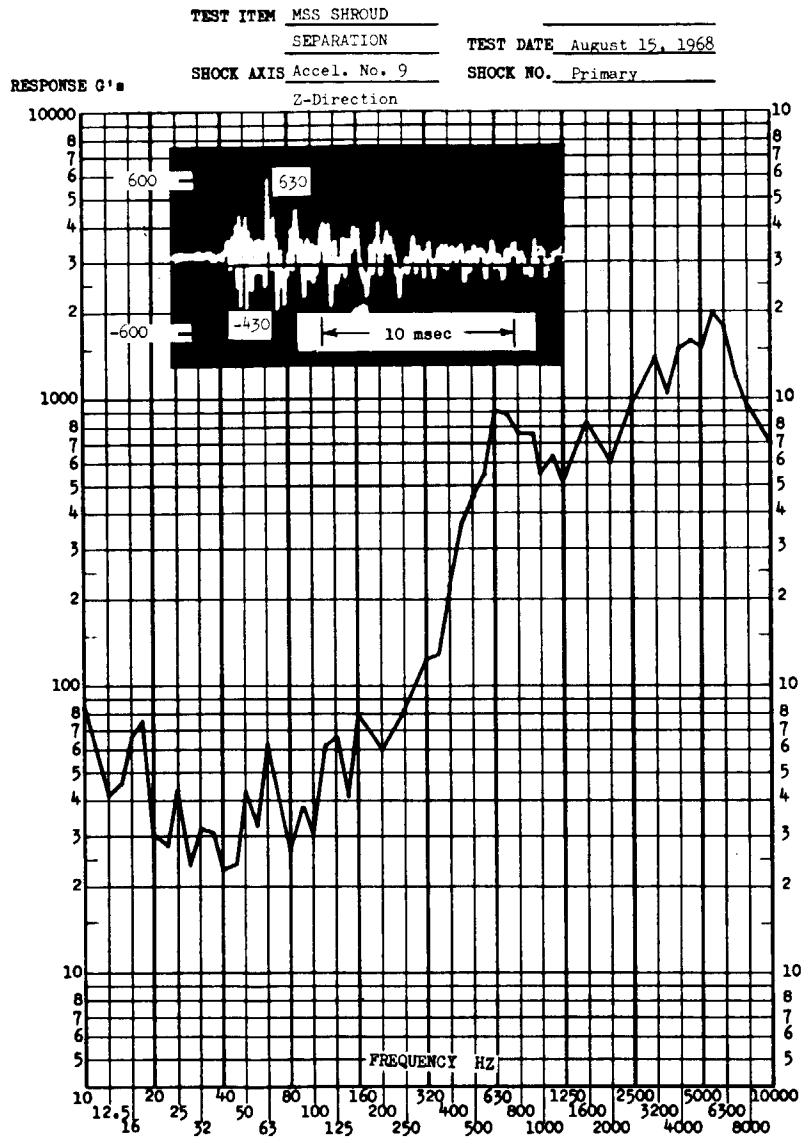


FIGURE I.C.1-12

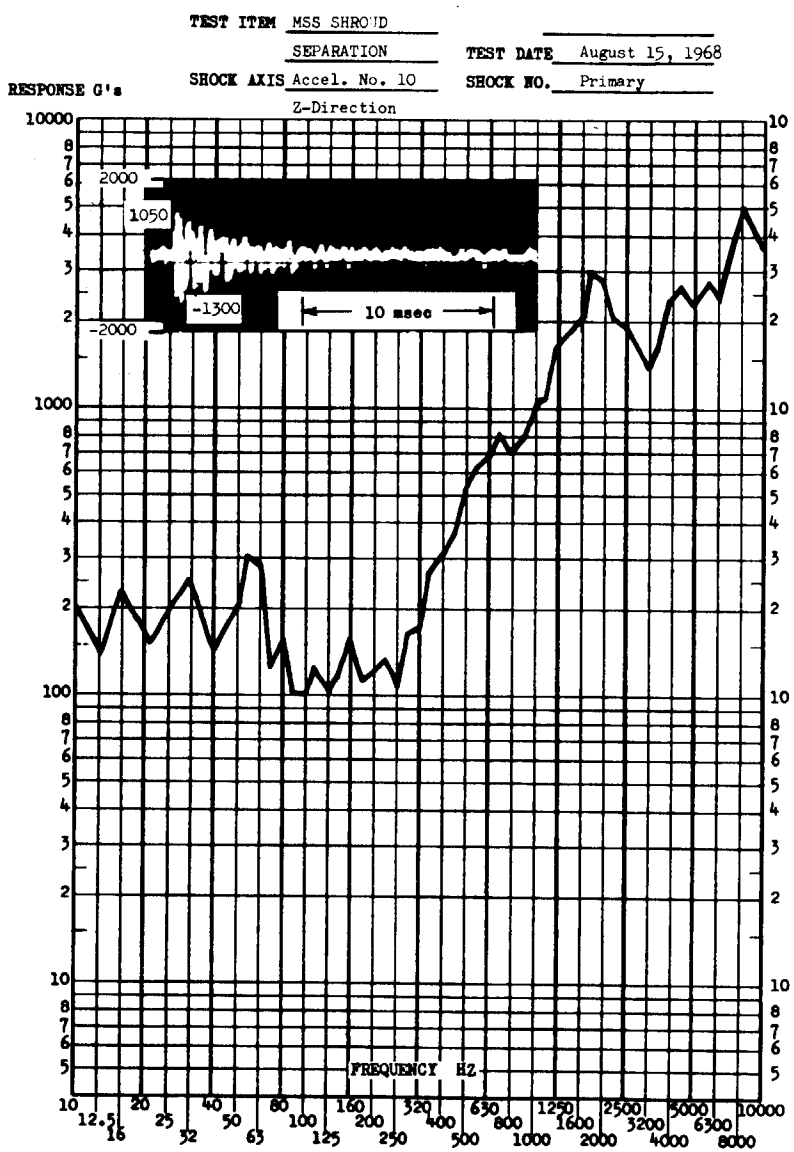
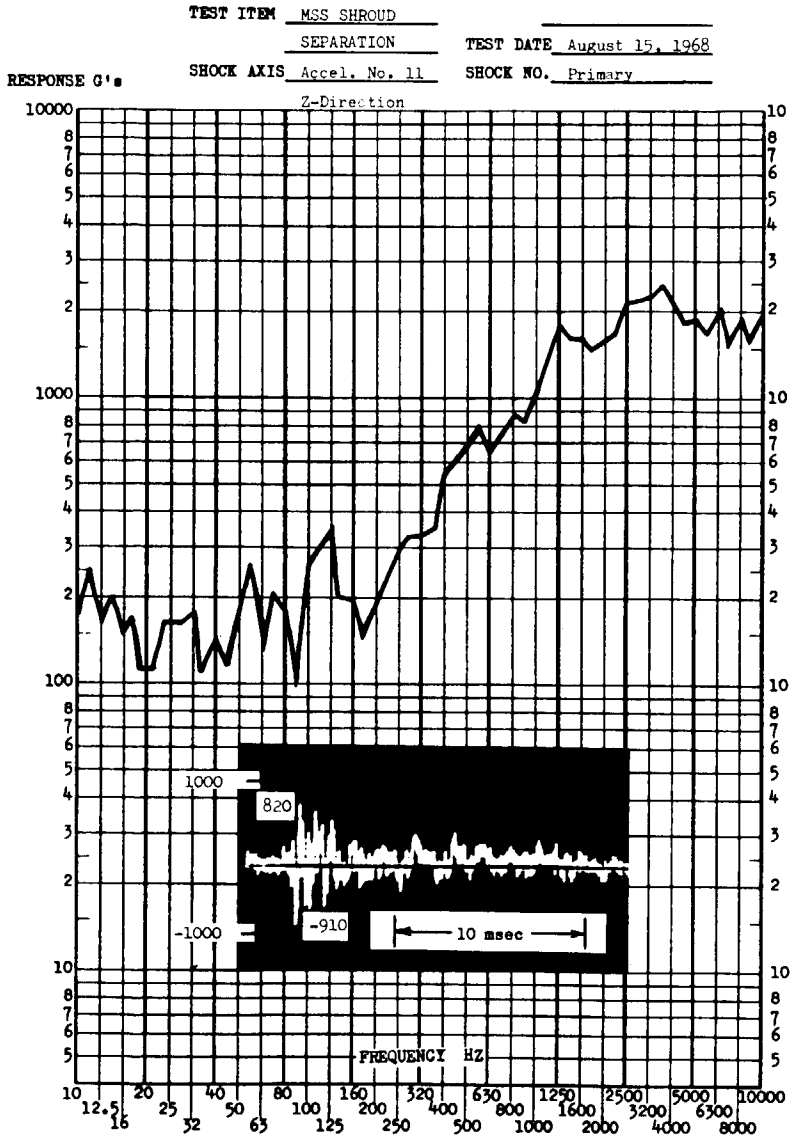


FIGURE I.C.1-13



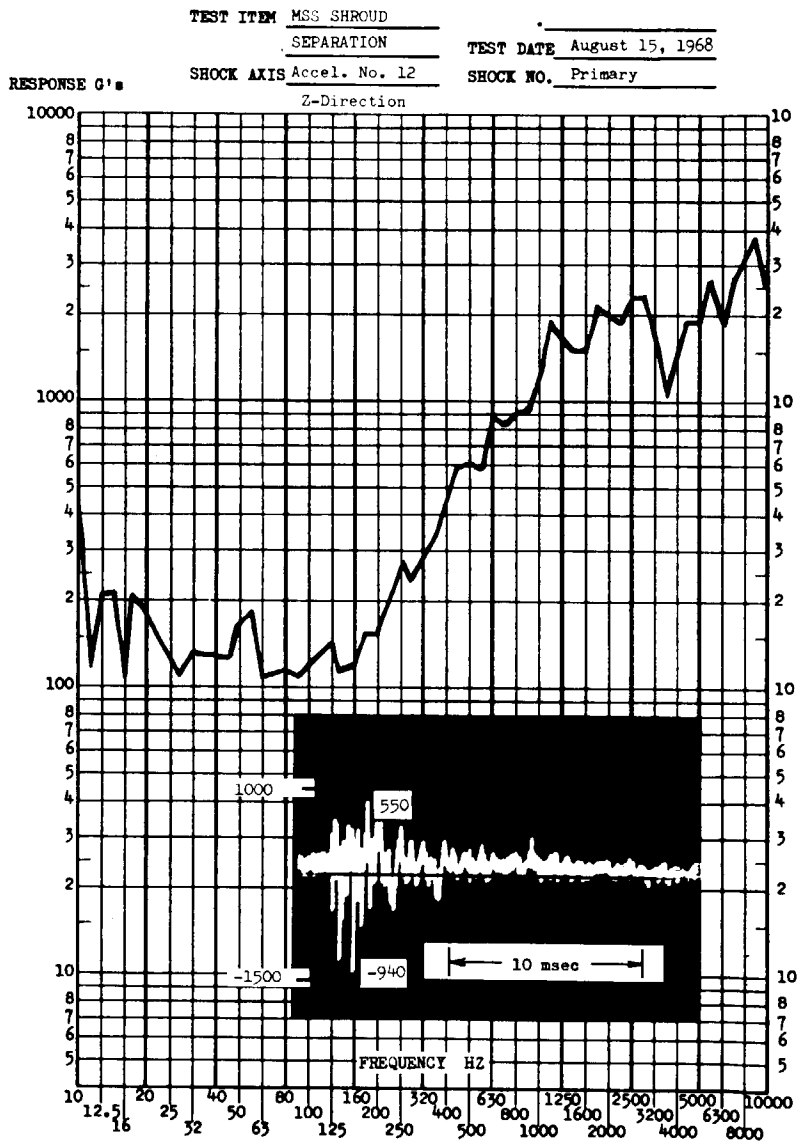
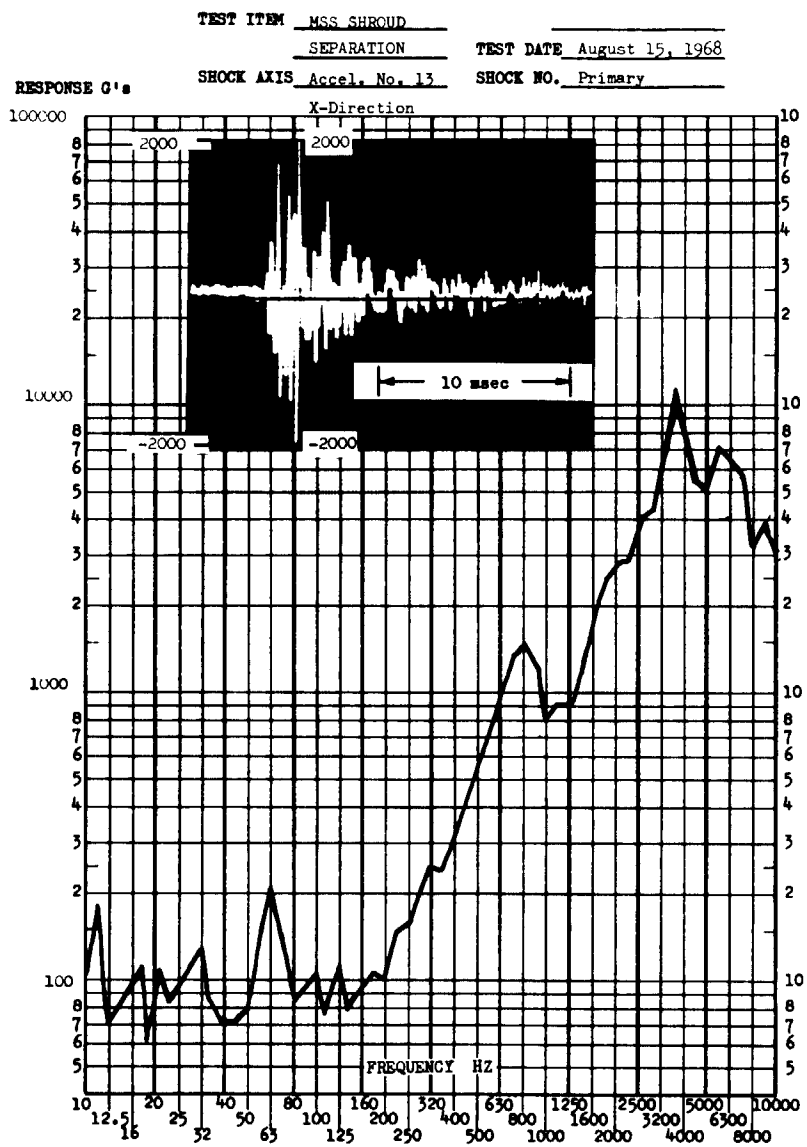


FIGURE I.C.1-14



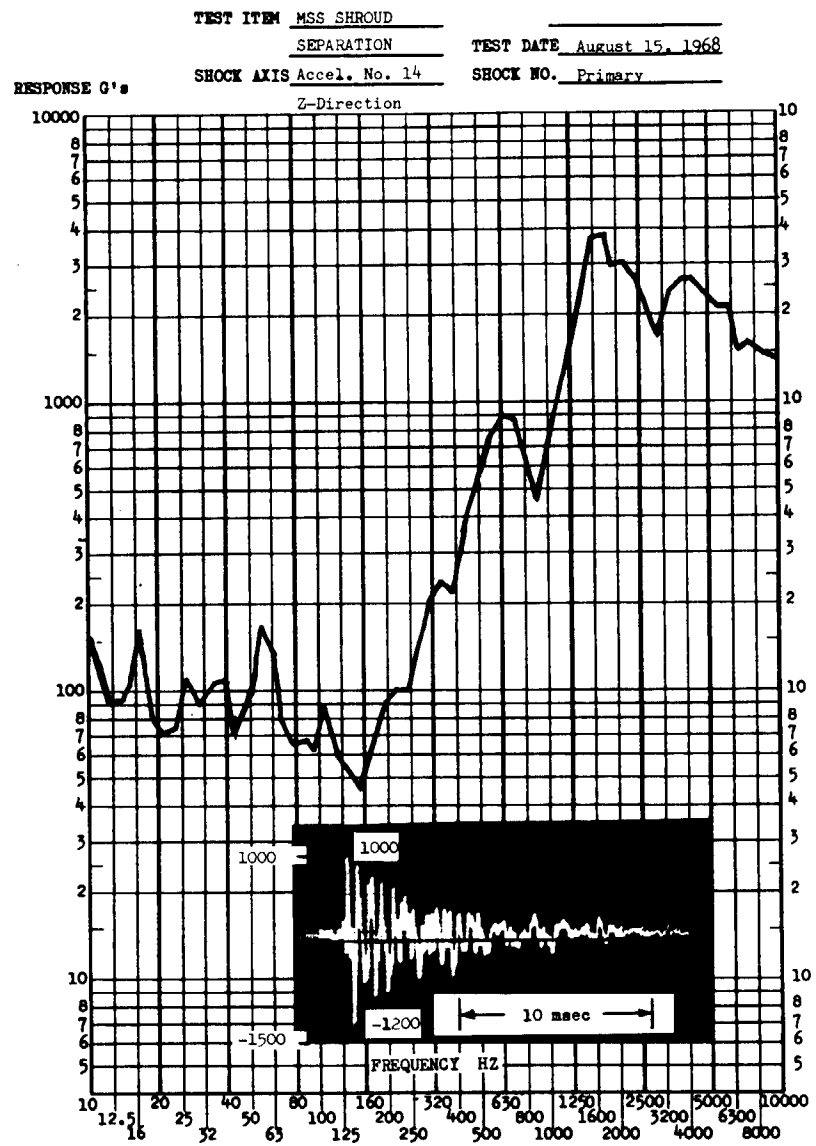
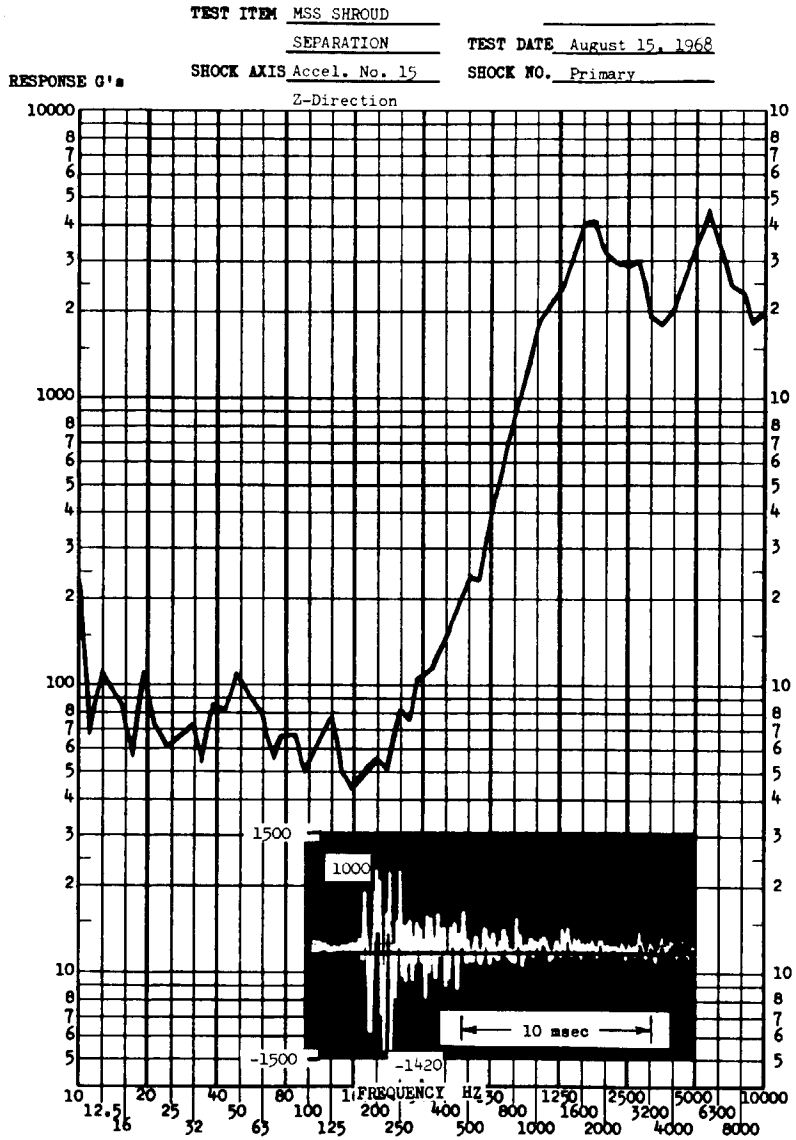


FIGURE I.C.1-15



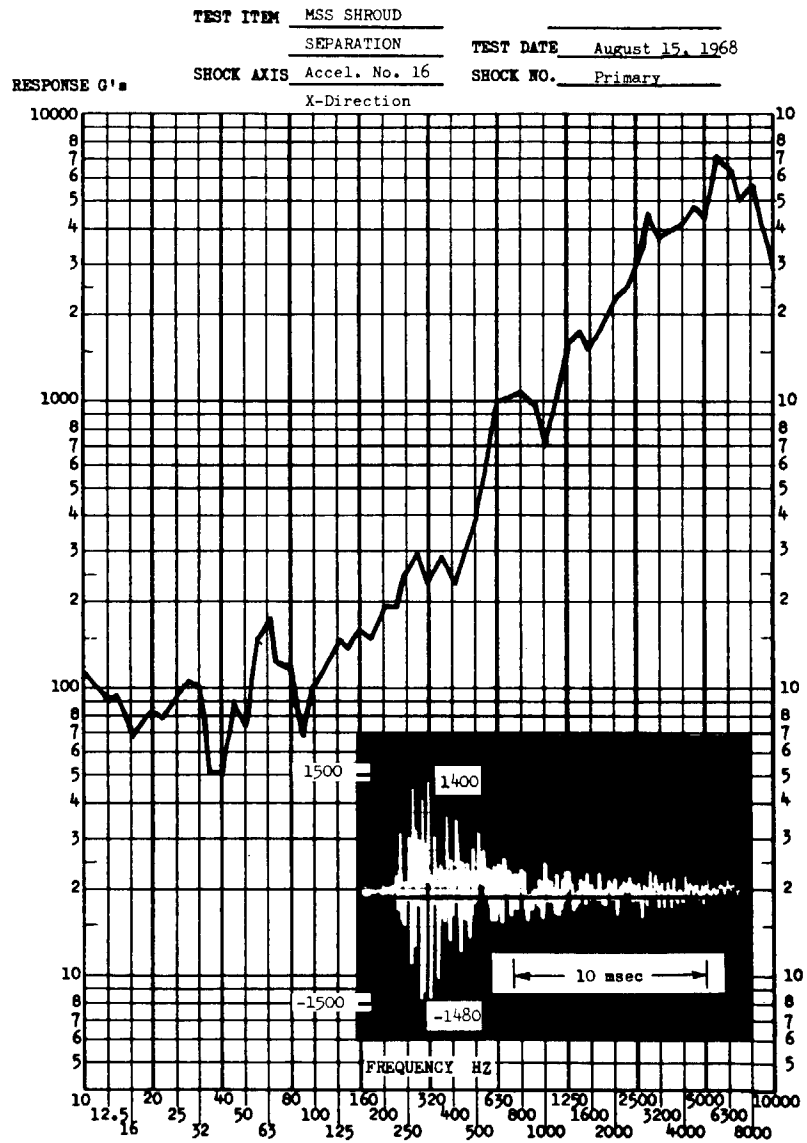
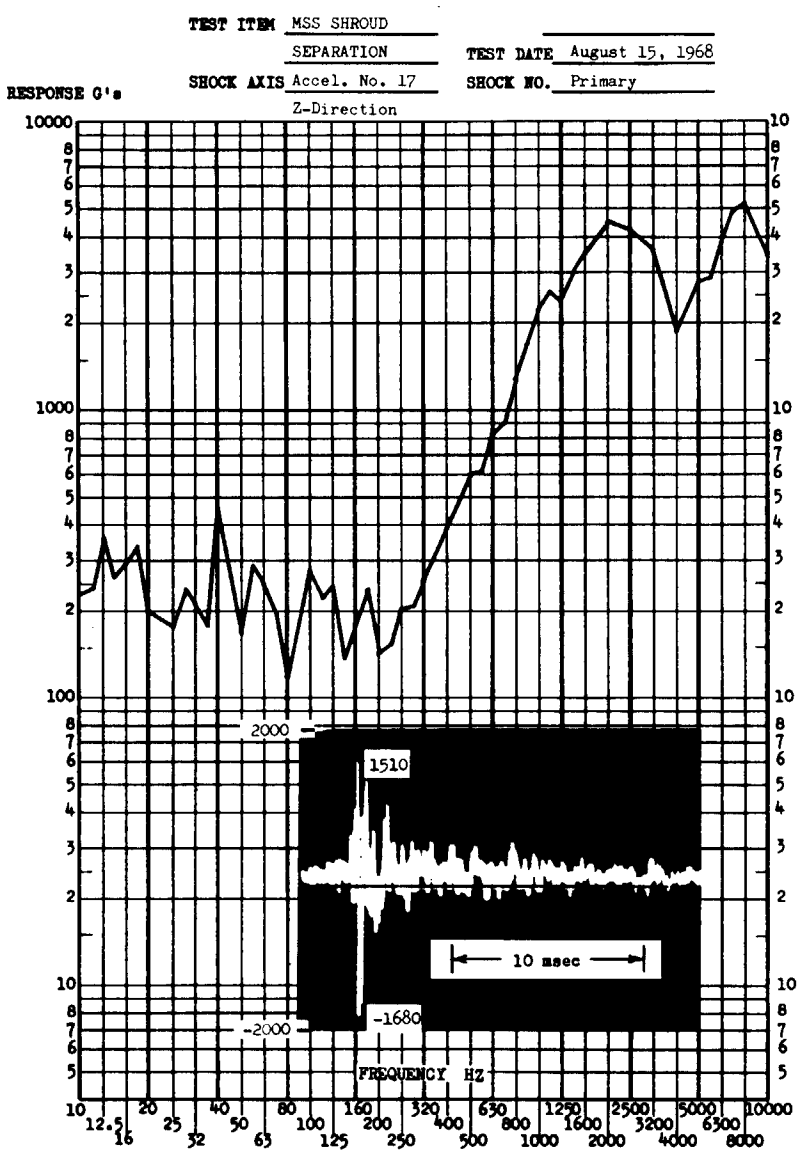


FIGURE I.C.1-16



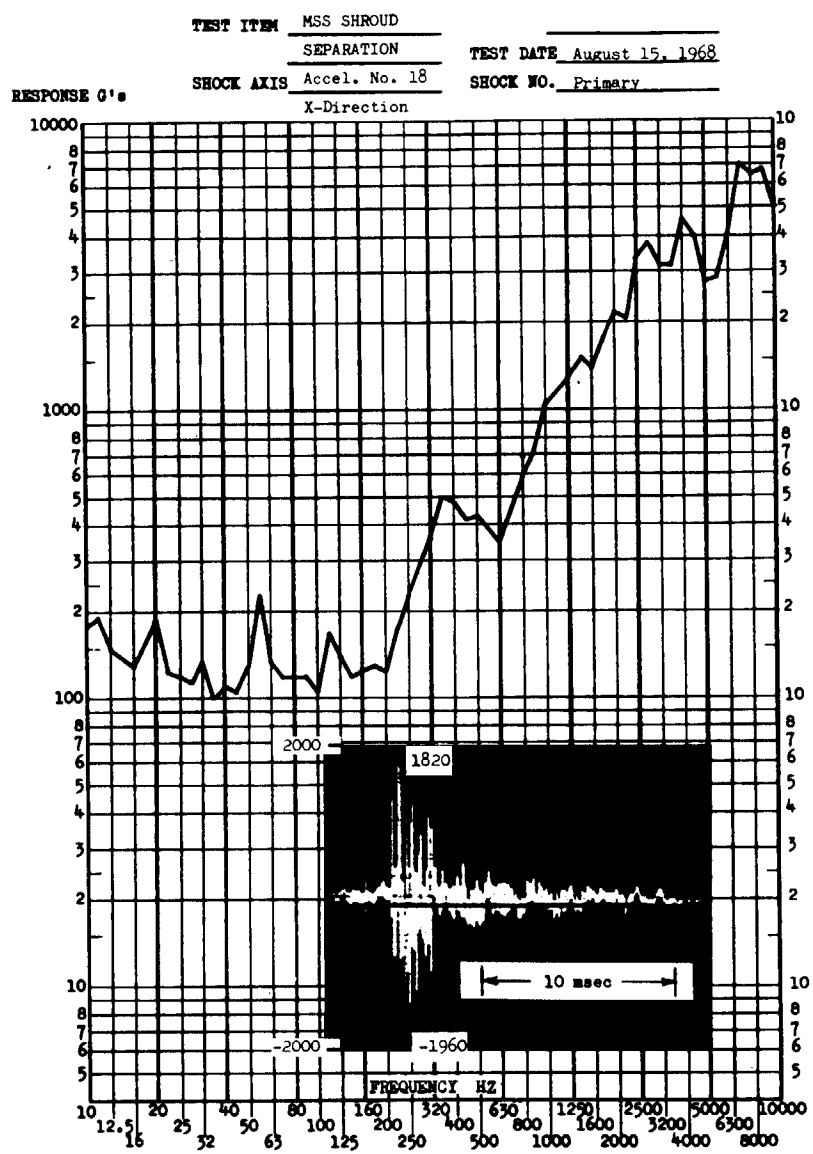
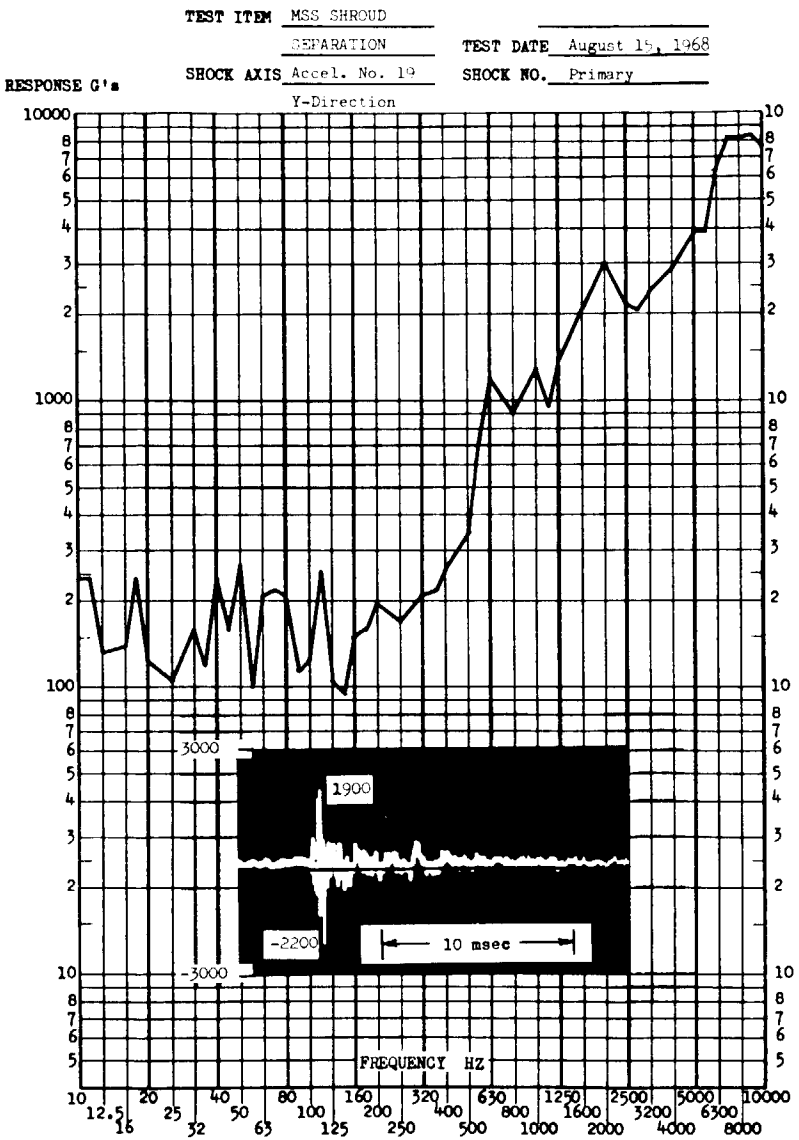


FIGURE I.C.1-17



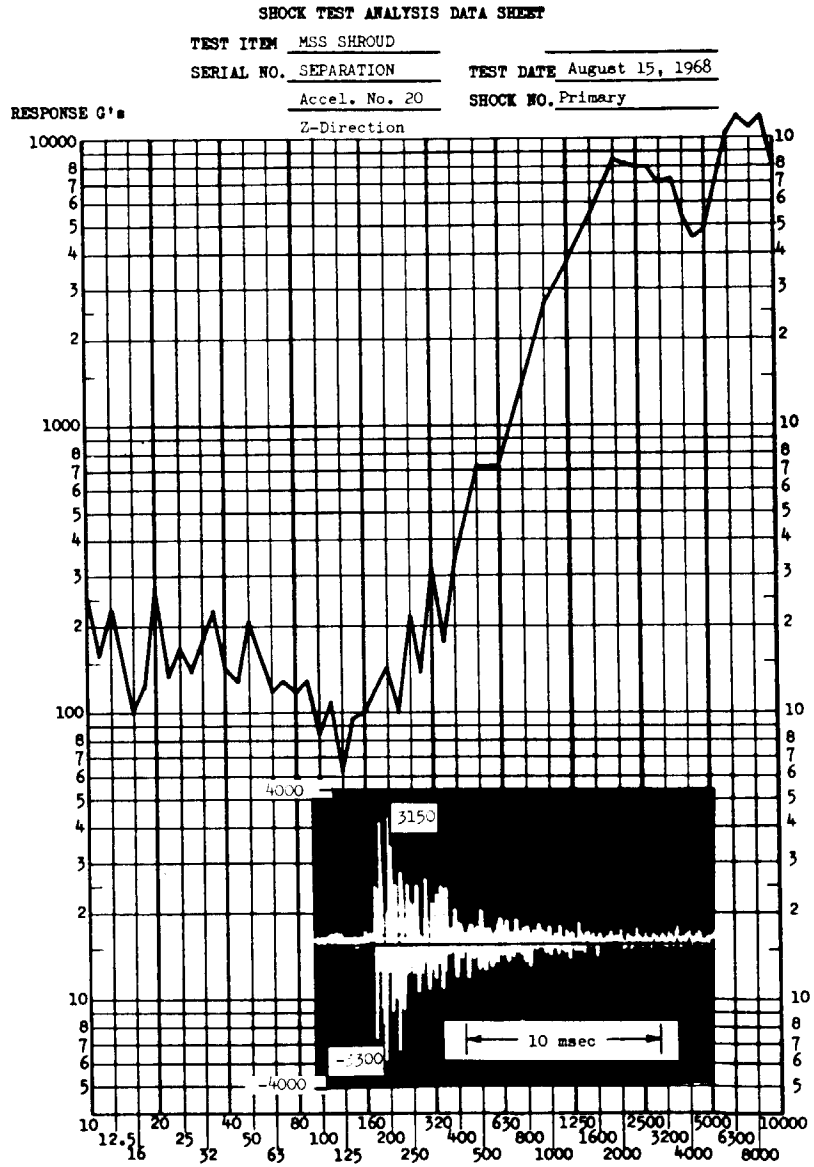


FIGURE I.C.1-18

SECTION I.C.2

APOLLO PANEL SEPARATION TEST

PURPOSE OF TEST

The objective of this test was to determine the susceptibility of equipment locations in the Apollo Service Module to damaging shock levels due to the deployment of panels housing the lunar spacecraft. The flight configuration is illustrated in Figure I.C.2-1.

DESCRIPTION OF EVENT

A simulated panel-adapter separation test was performed on one-half of an Apollo Service Module. Instead of physically deploying the panels, the test utilized the detonation of twin strands of MDF at the upper separation line. It was assumed that this test configuration would adequately simulate the full-scale event. The configuration of the half module used is shown in Figure I.C.2-2.

DESCRIPTION OF DATA

No. of time histories	4
No. of shock spectra	11
Type of analysis	analog (absolute response spectra)
Analog system	MB Electronics N980 SSA

Frequency range	10-10,000 Hz
Frequency increments	6 points per octave
Damping	Q = 10

These shock spectra are presented with their corresponding time histories as Figures I.C.2-5 through I.C.2-10.

DESCRIPTION OF PYROTECHNIC

Type: MDF (twin strands)

Size of charge: 7 grains per foot per strand

Location: Upper separation line, Figure I.C.2-3

DESCRIPTION OF STRUCTURE

Basically honeycomb material (See Table I.C.2-1)

Overall diameter = 154 inches

Length (between bulkheads) = 155 inches

DESCRIPTION OF ACCELEROMETERS

Type: Endevco model 2225

Locations: Table I.C.2-2 and Figures I.C.2-3 and I.C.2-4

Axis of sensitivity: Table I.C.2-2

TABLE I.C.2-1

DESCRIPTION OF STRUCTURAL COMPONENTS

Outer Panel of Service Module

Bonded aluminum honeycomb with 16 mil face sheets of 7178-T6 and 1 inch thick core of 3/16 inch x 3 mil 5052 H39.

Radial Beams

7075-T6 aluminum chem-milled to form stiffeners 2 inches deep and a web thickness of 18 mil.

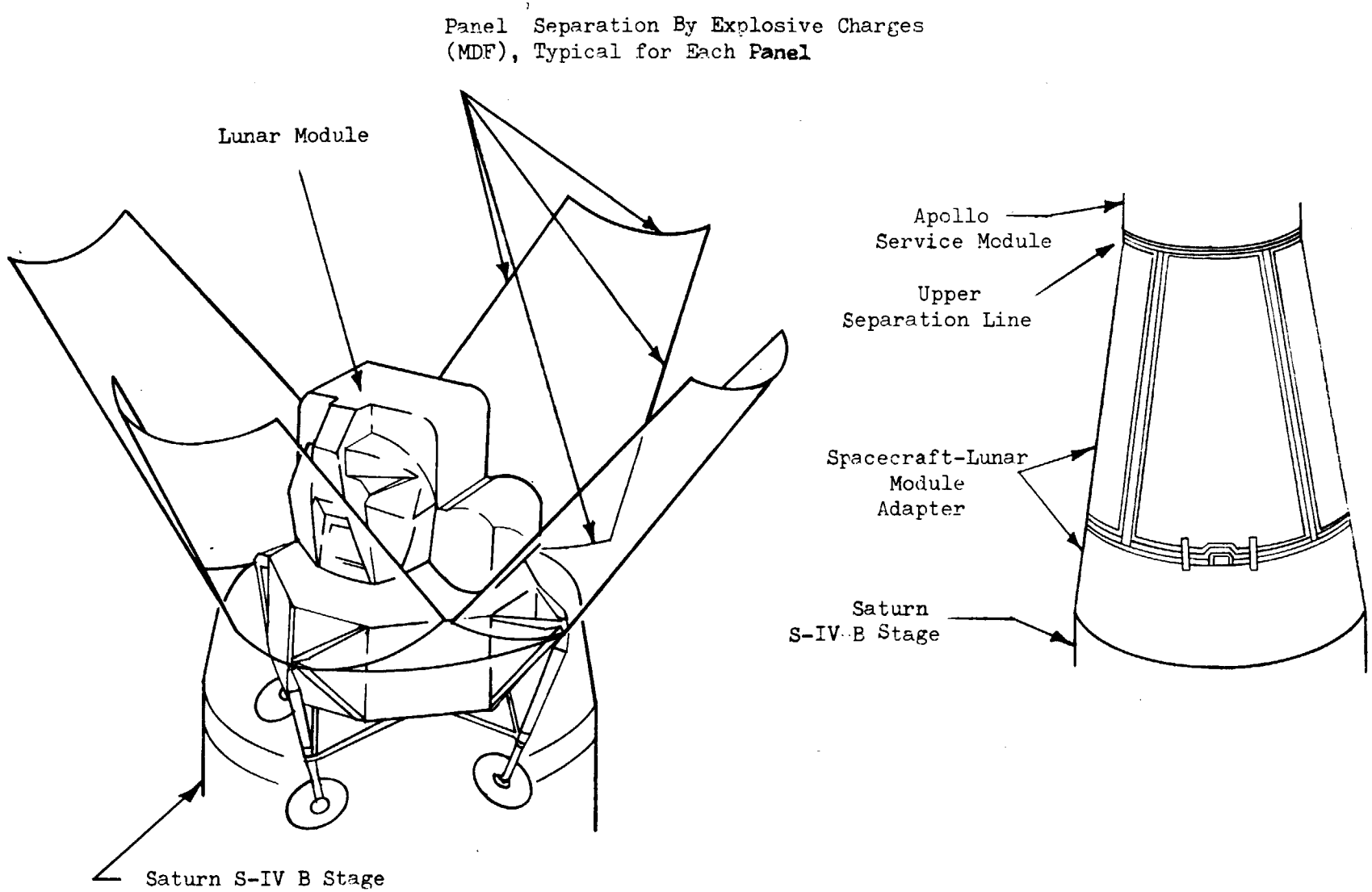
Aft Bulkhead

Bonded aluminum honeycomb with 63 mil face sheets of 7178-T6 and 2.88 inch core of 1/4 inch x 4 mil 5052 H39

TABLE I.C.2-2

APOLLO SERVICE MODULE ACCELEROMETER LOCATIONS

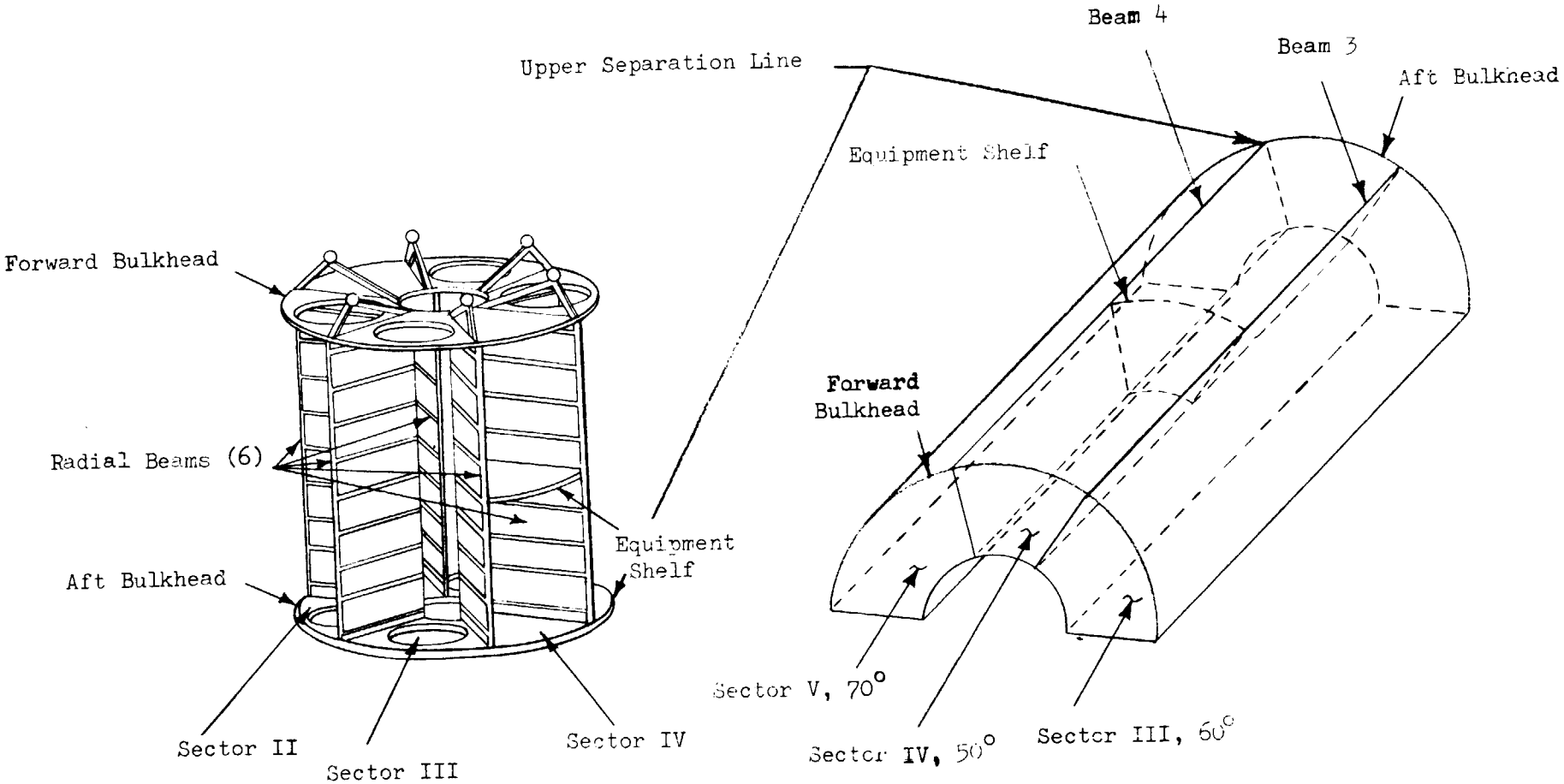
Accelerometer Number	Location	Sensitive Axis	Figure Number
4	50° Outer Panel, X_s 206	Longitudinal	I.C.2-5
6	Radial Beam X 242, R 75	Longitudinal	I.C.2-5
7	Aft Bulkhead, R 75	Radial	I.C.2-6
9	CM/SM Fairing, X_s 366, R 77	Longitudinal	I.C.2-6
10	Radial Beam X_s 210, R 75	Longitudinal	I.C.2-7
14	Radial Beam X_s 270, R 35	Longitudinal	I.C.2-7
20	Fwd Bulkhead, R 45	Longitudinal	I.C.2-8
22	Aft Bulkhead, R 45	Radial	I.C.2-8
23	Radial Beam X_s 278, R 23	Longitudinal	I.C.2-9
24	SMJC, Fwd Bulkhead	Longitudinal	I.C.2-9
25	Sector IV Shelf, R 48	Longitudinal	I.C.2-10



Spacecraft - Lunar Module Panels
In Deployed Position

Details of Separation Lines and
Spacecraft

Figure I.C.2-1. Schematic Illustrating Actual Panel Separation Event



Service Module with Engine, Equipment, and Skin Removed for Clarity.

Half of Service Module Used for Panel Separation Test.

Figure I.C.2-2. Illustration Actual Service Module Compared with the Half Module Used for Shock Testing

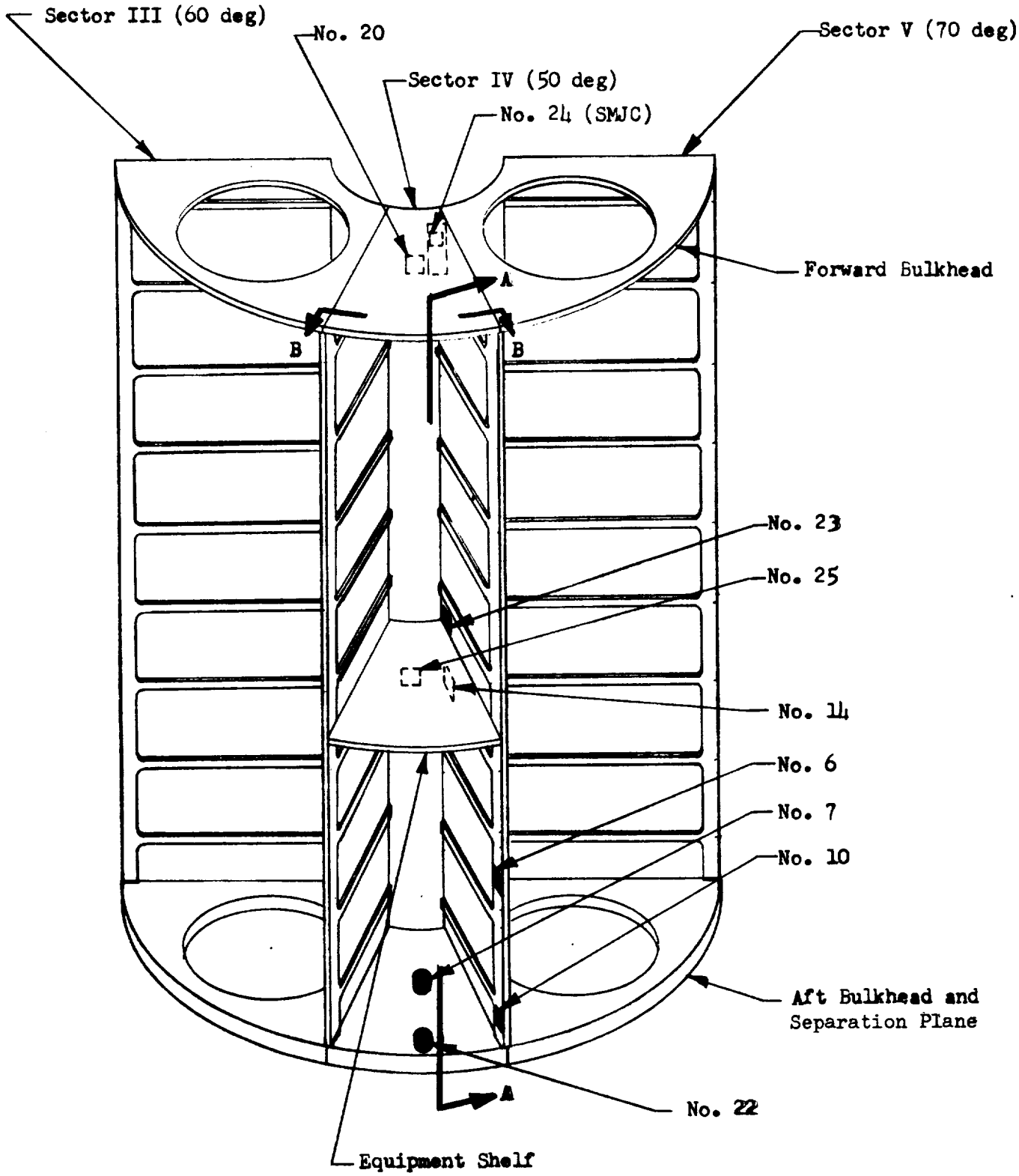


Figure I.C.2-3. Accelerometer Locations (Outer Panels Removed)

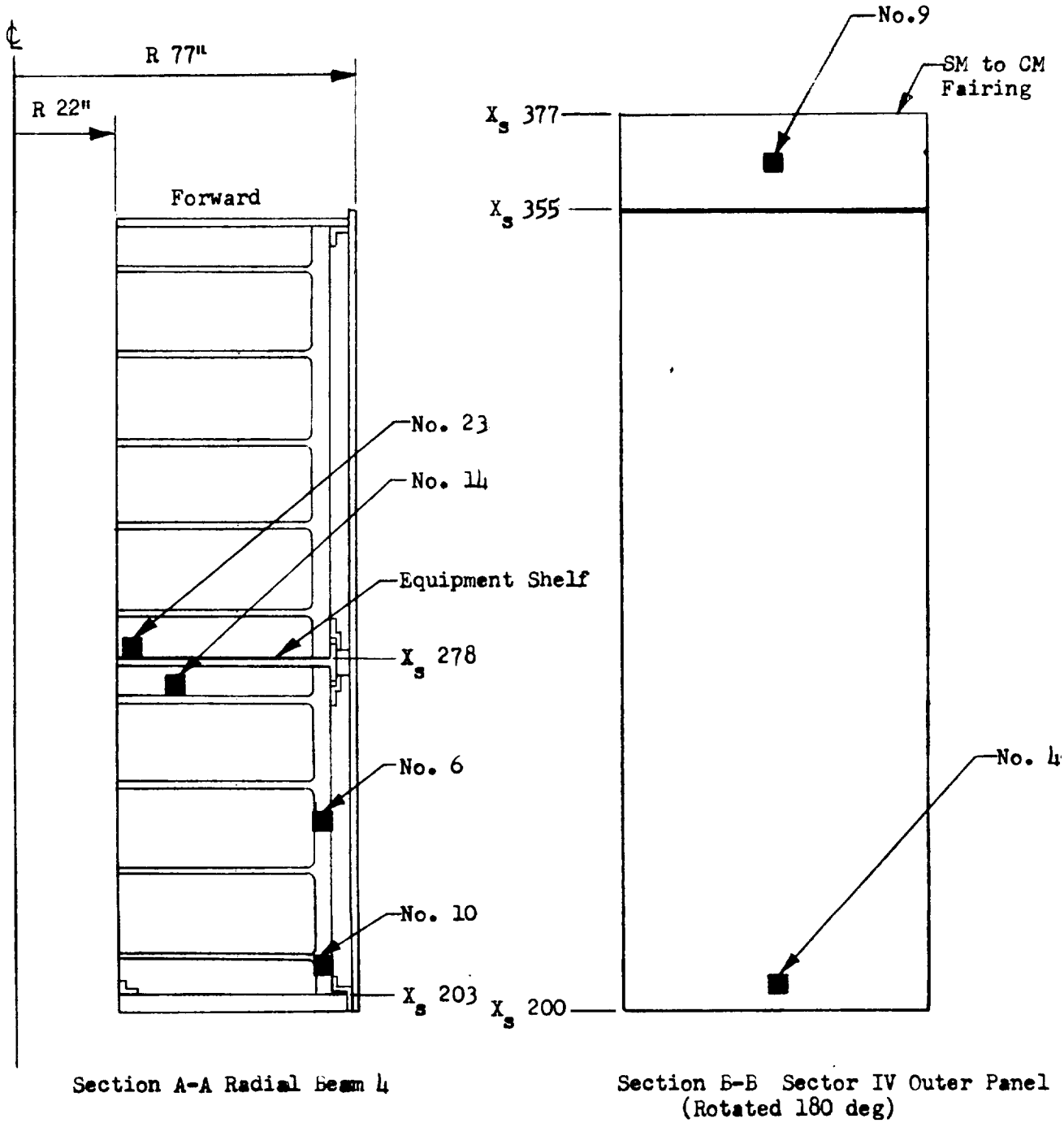
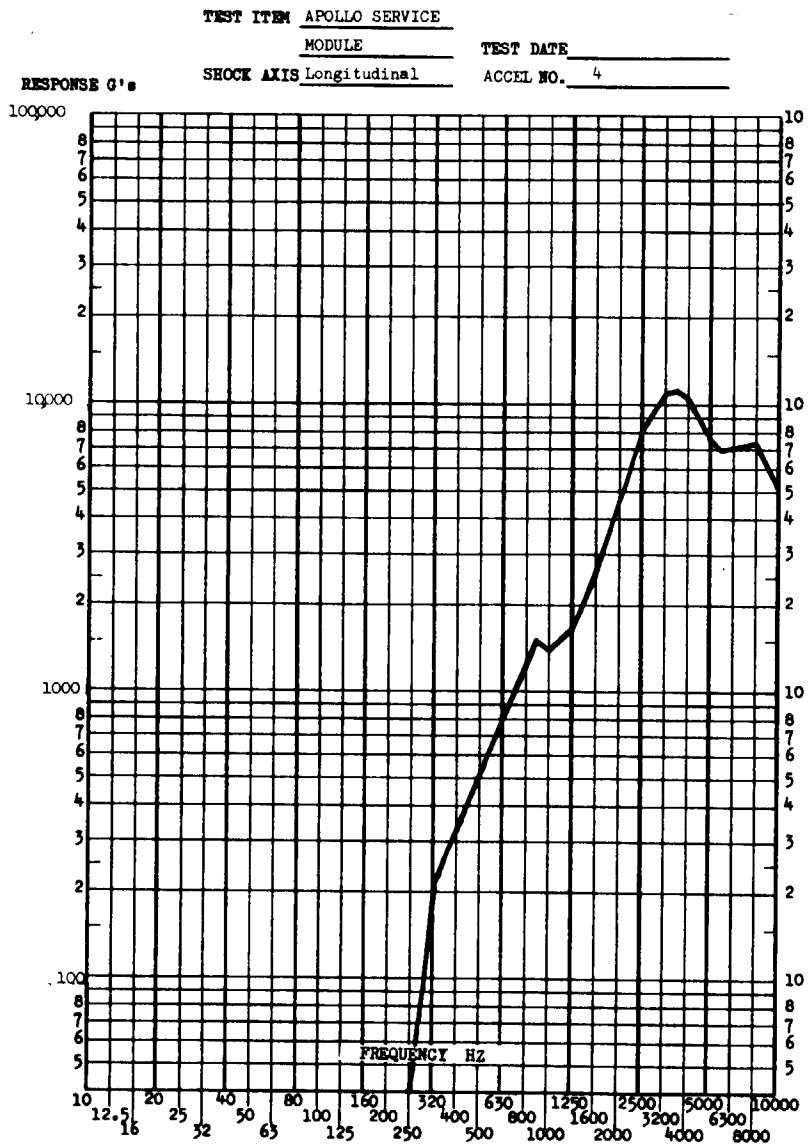


Figure I.C.2-4. Accelerometer Locations on Radial Beam and Outer Panel


TEST ITEM APOLLO SERVICE MODULE
TEST DATE
SHOCK AXIS Longitudinal
ACCEL NO. 4
RESPONSE G's
100000
10000
1000
100
FREQUENCY HZ
10 12.5 16 20 25 32 40 50 63 80 100 125 160 200 250 320 400 500 630 800 1000 1250 1600 2000 2500 3200 4000 5000 6300 8000 10000

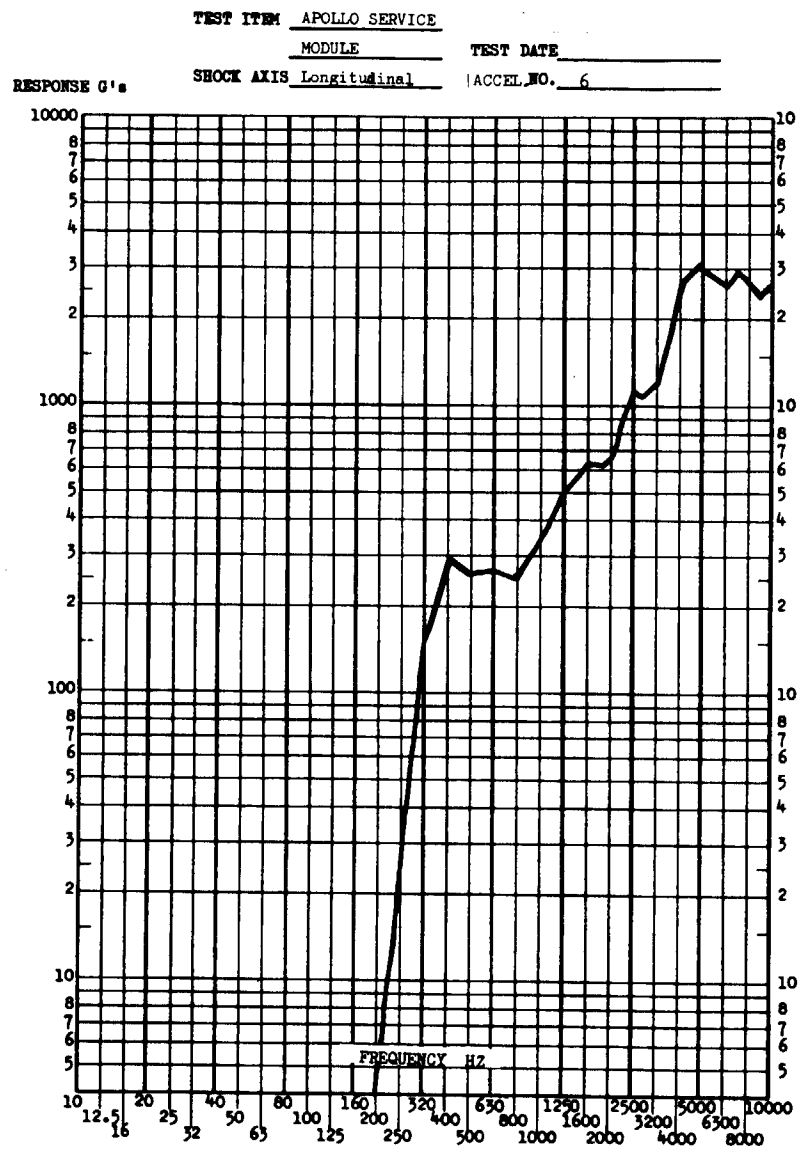
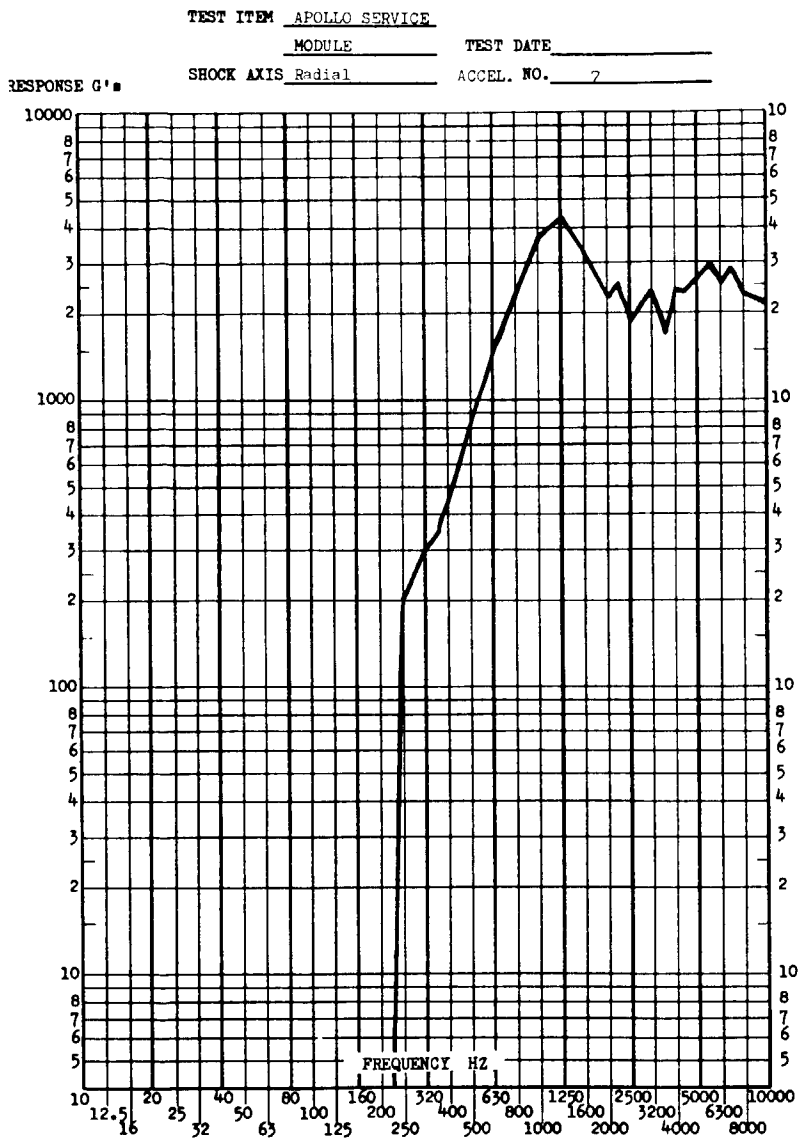

TEST ITEM APOLLO SERVICE MODULE
TEST DATE
SHOCK AXIS Longitudinal
ACCEL NO. 6
RESPONSE G's
10000
1000
100
10
FREQUENCY HZ
10 12.5 16 20 25 32 40 50 63 80 100 125 160 200 250 320 400 500 630 800 1000 1250 1600 2000 2500 3200 4000 5000 6300 8000 10000

FIGURE I.C.2-5


TEST ITEM APOLLO SERVICE
MODULE
TEST DATE
SHOCK AXIS Radial
ACCEL. NO. 7
RESPONSE G's
FREQUENCY HZ

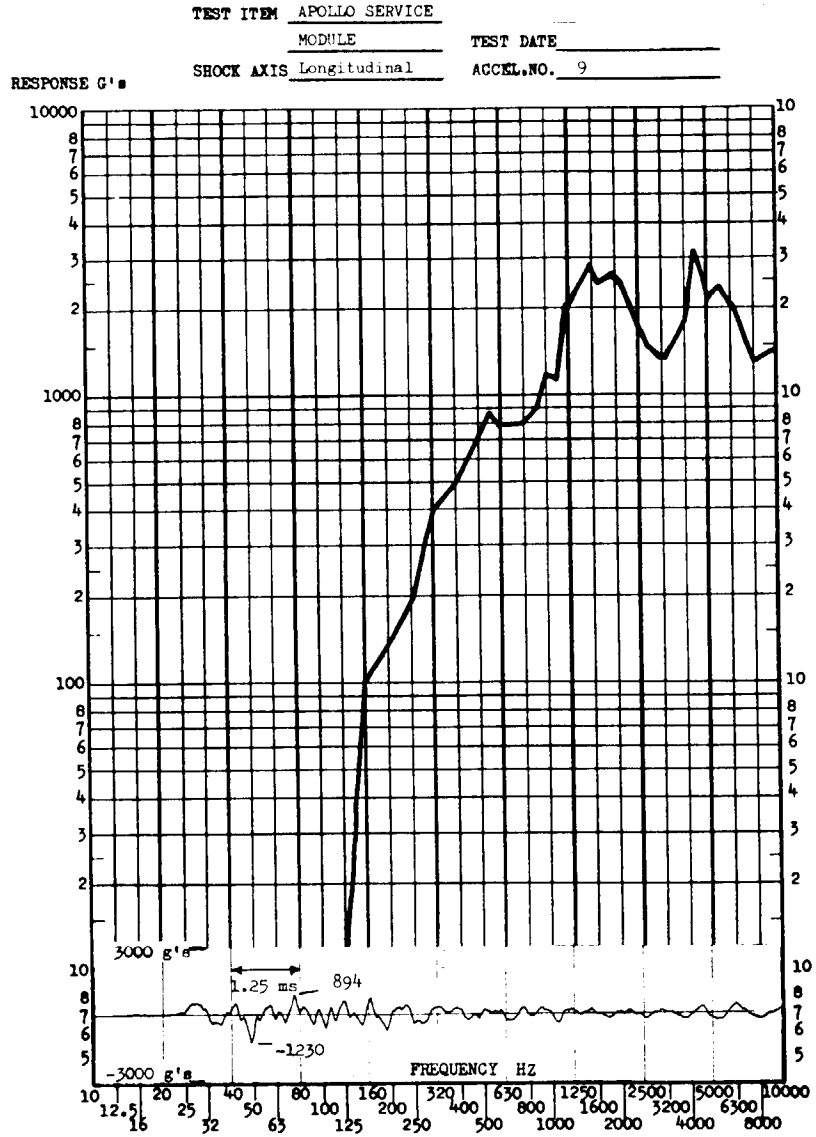
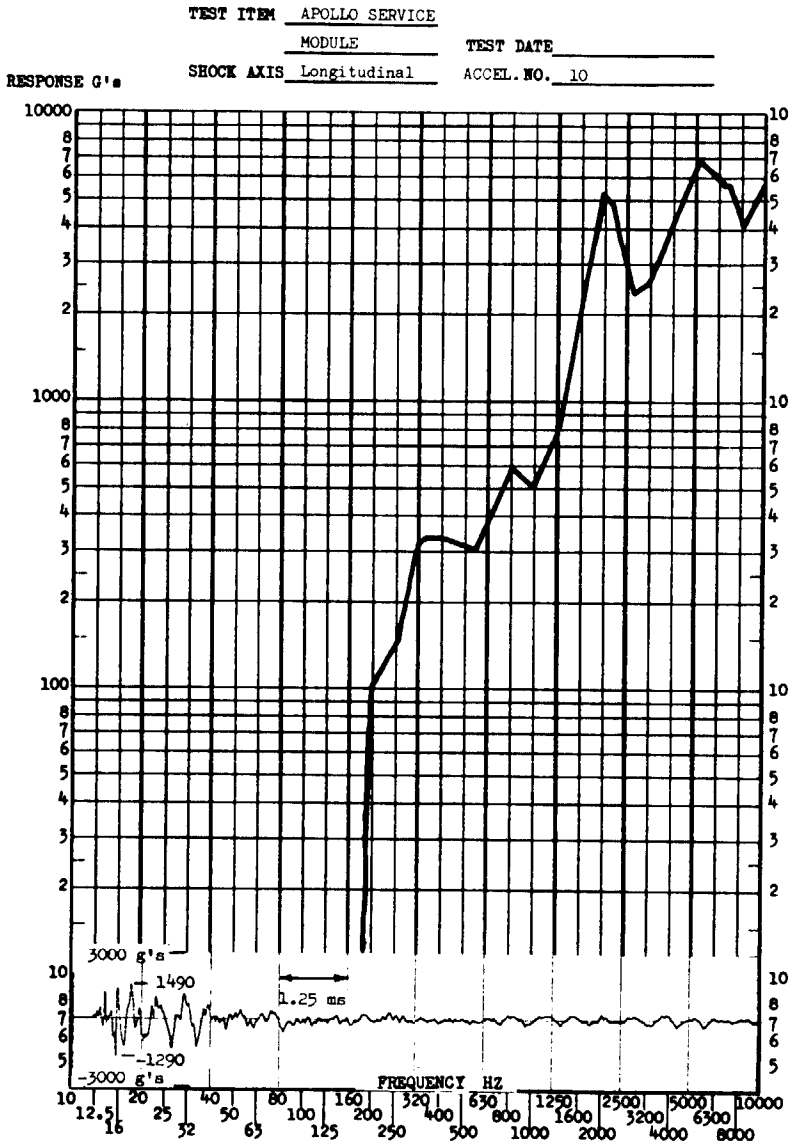

TEST ITEM APOLLO SERVICE
MODULE
TEST DATE
SHOCK AXIS Longitudinal
ACCEL.NO. 9
RESPONSE G's
3000 g's
1.25 ms
894
-1230
-3000 g's
FREQUENCY HZ

FIGURE I.C.2-6


TEST ITEM APOLLO SERVICE MODULE
TEST DATE
SHOCK AXIS Longitudinal
ACCEL. NO. 10
RESPONSE G's
3000 g's
1490
1.25 ms
-1290
-3000 g's
FREQUENCY HZ

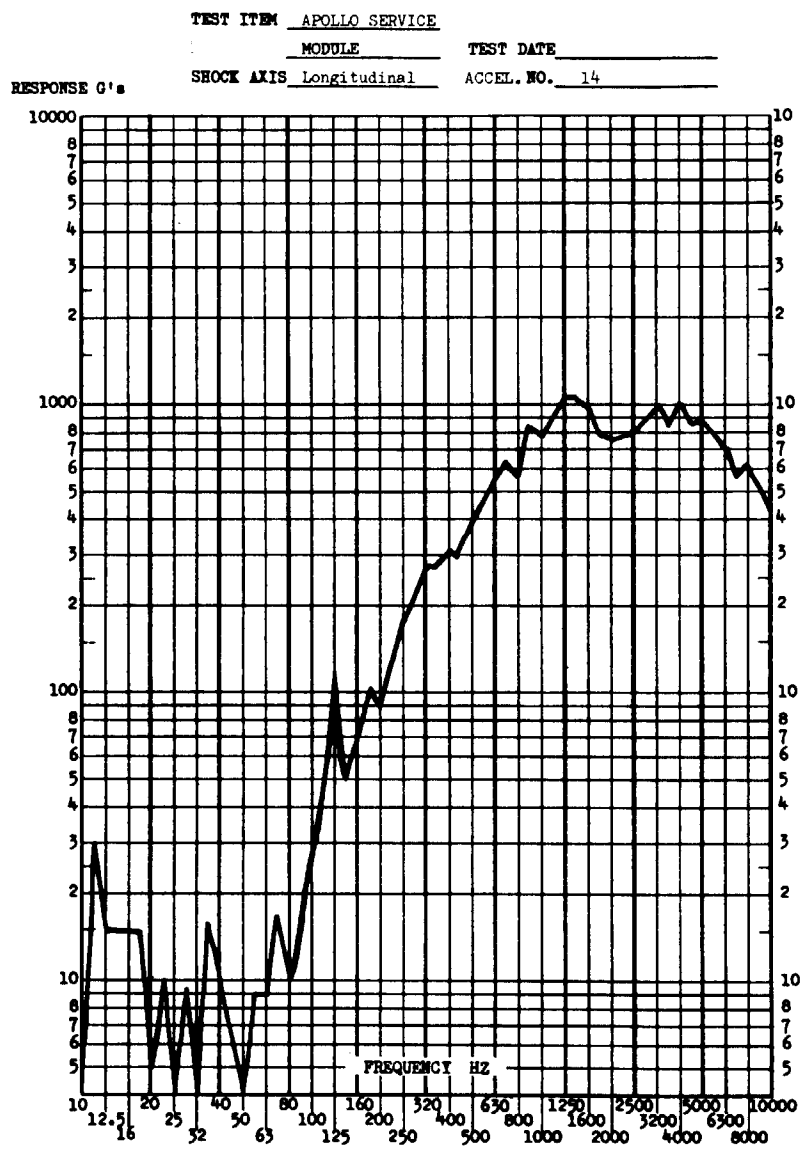
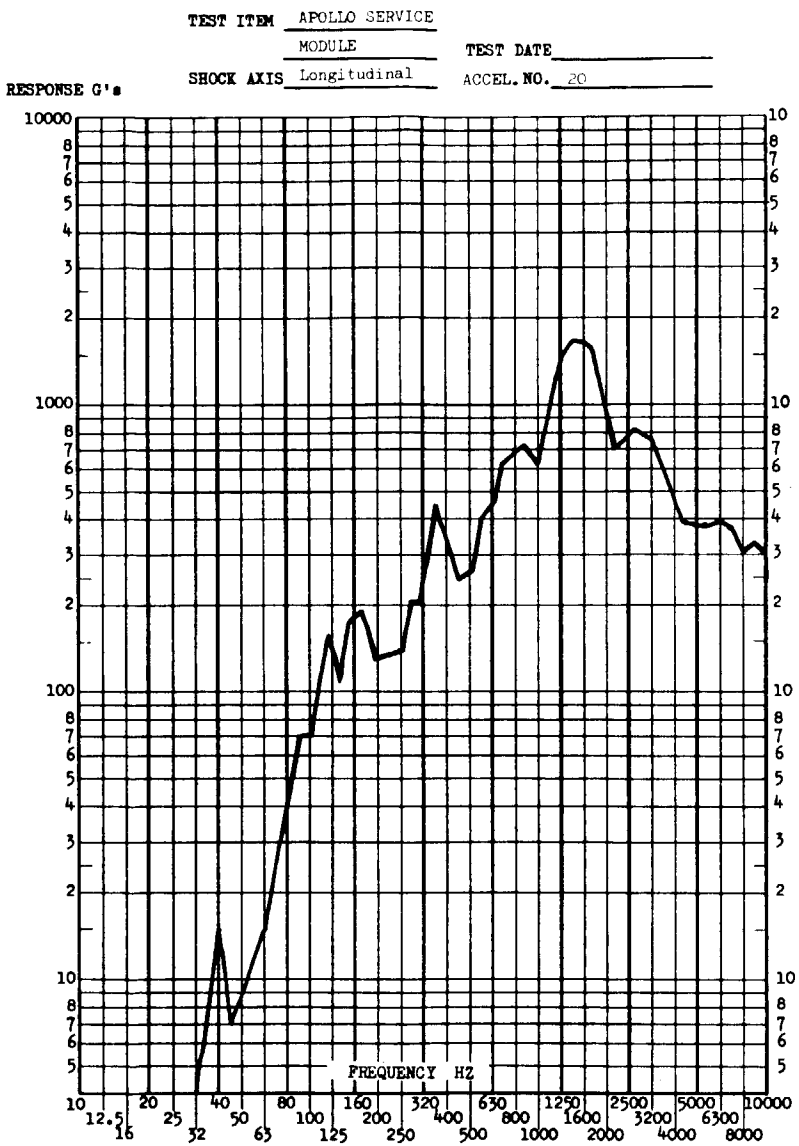

TEST ITEM APOLLO SERVICE MODULE
TEST DATE
SHOCK AXIS Longitudinal
ACCEL. NO. 14
RESPONSE G's
FREQUENCY HZ

FIGURE I.C.2-7


TEST ITEM APOLLO SERVICE
MODULE
TEST DATE
SHOCK AXIS Longitudinal
ACCEL. NO. 20
RESPONSE G's
FREQUENCY HZ

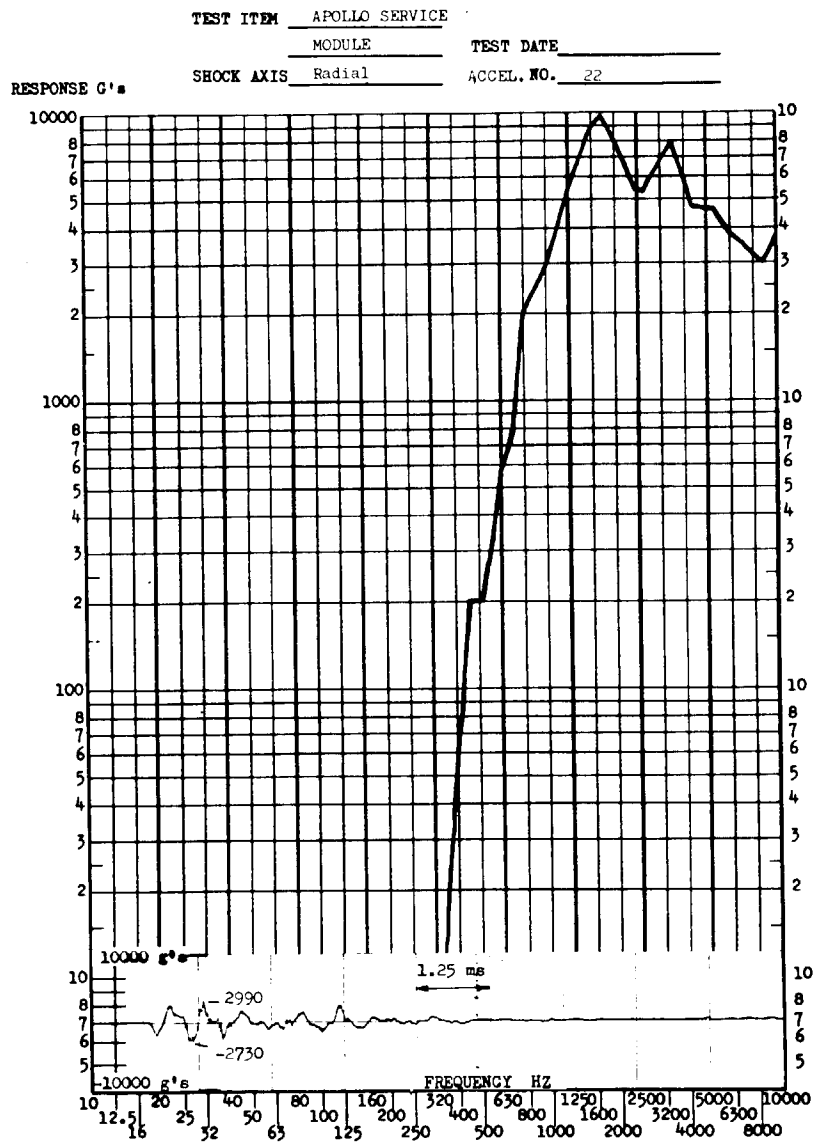
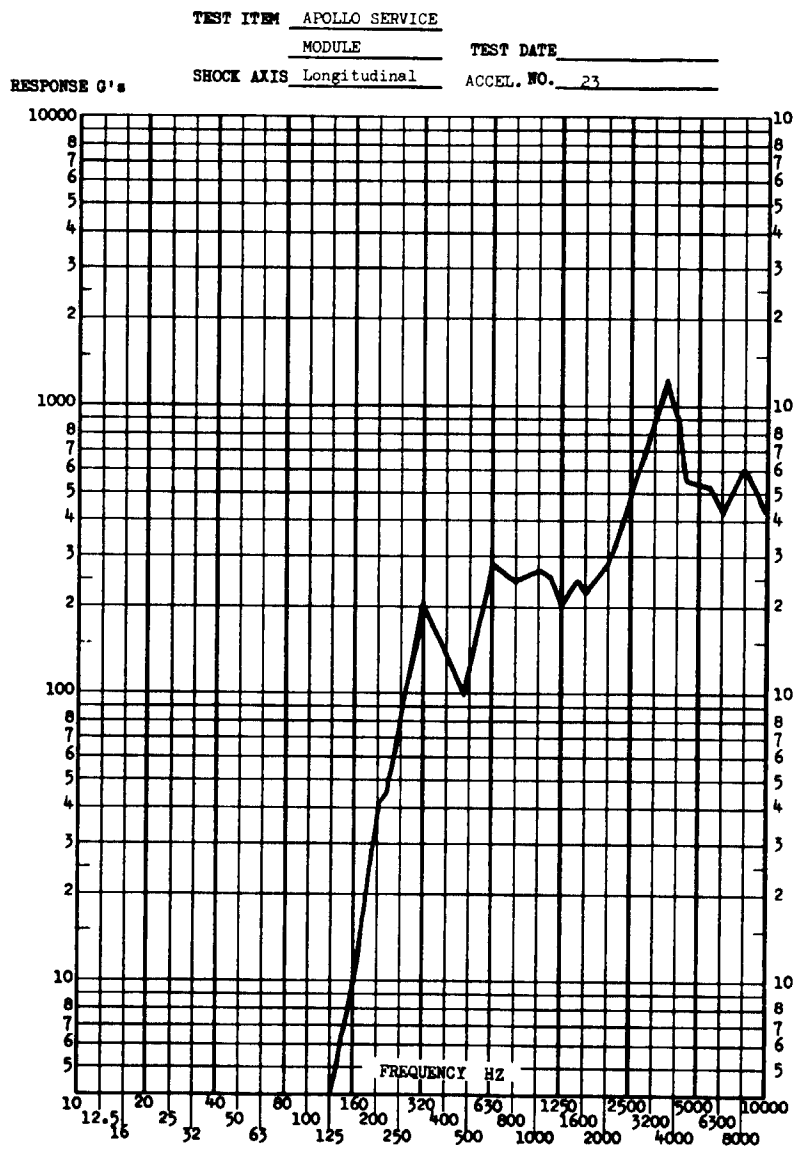

TEST ITEM APOLLO SERVICE
MODULE
TEST DATE
SHOCK AXIS Radial
ACCEL. NO. 22
RESPONSE G's
10000 g's
1.25 ms
2990
-2730
-10000 g's
FREQUENCY HZ

FIGURE I.C.2-8


TEST ITEM APOLLO SERVICE MODULE
TEST DATE
SHOCK AXIS Longitudinal
ACCEL. NO. 23
RESPONSE G's
FREQUENCY HZ

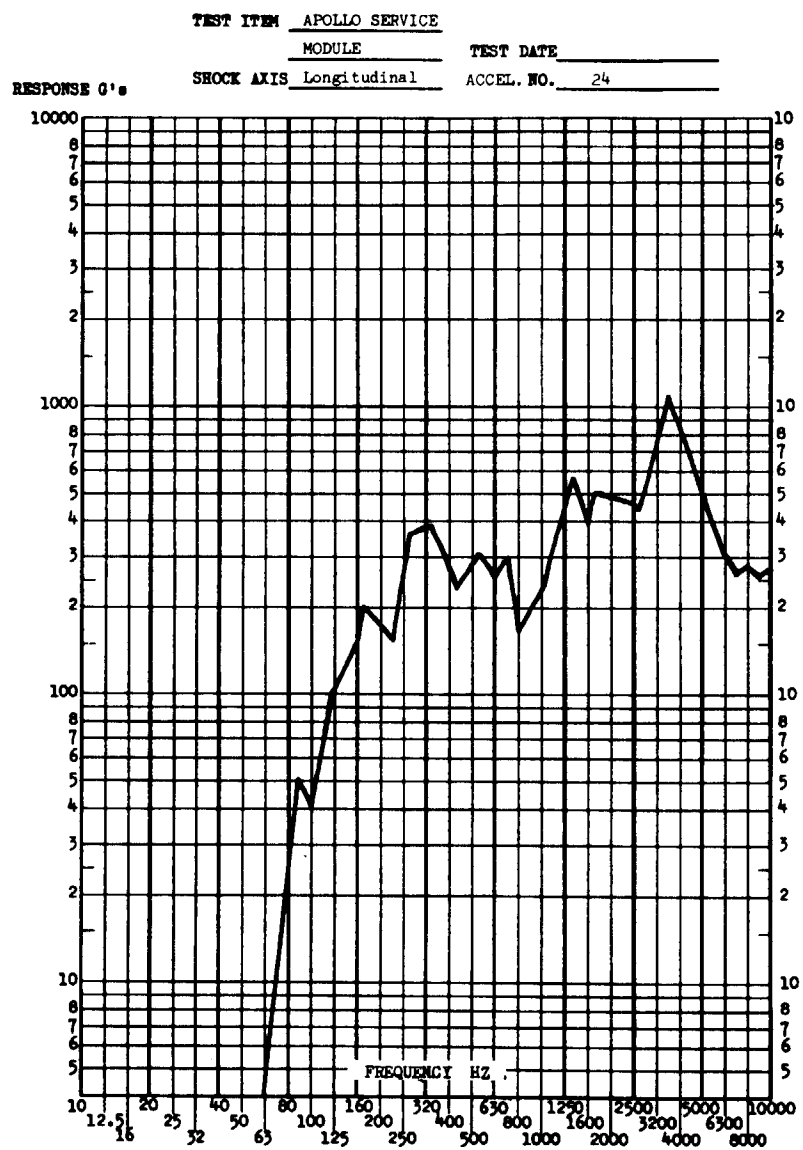

TEST ITEM APOLLO SERVICE MODULE
TEST DATE
SHOCK AXIS Longitudinal
ACCEL. NO. 24
RESPONSE G's
FREQUENCY HZ

FIGURE I.C.2-9

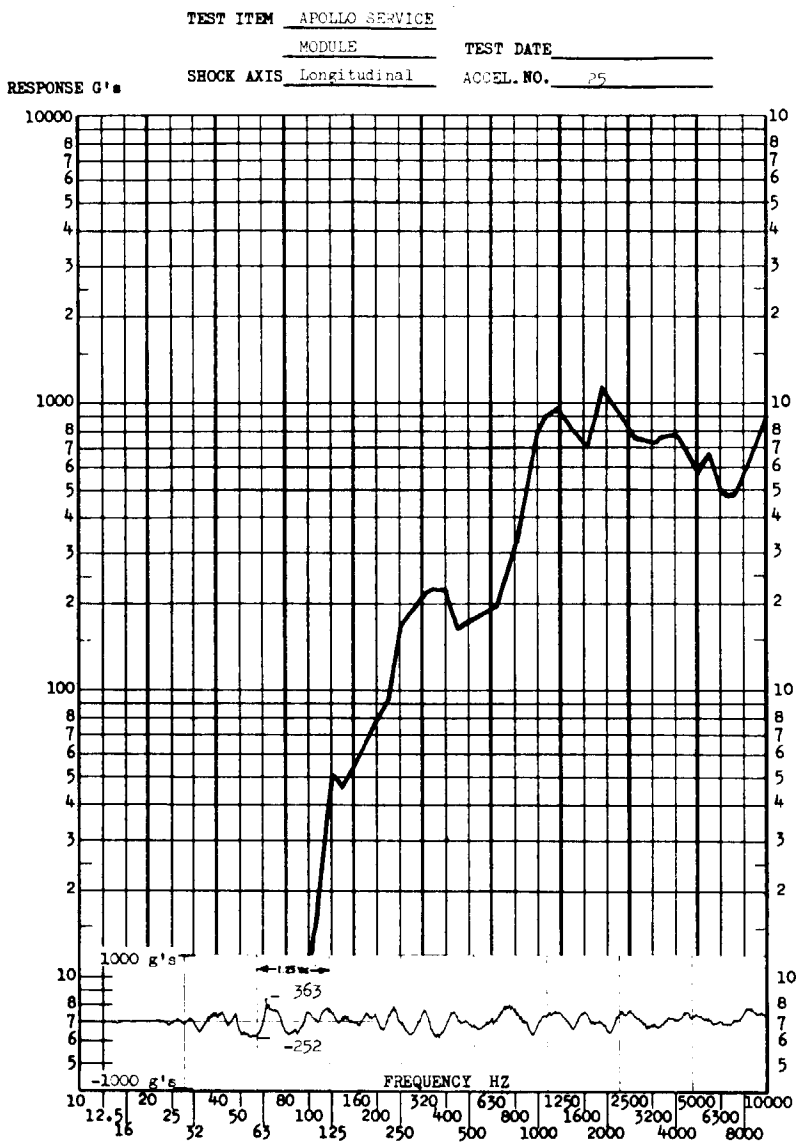


FIGURE I.C.2-10

SECTION I.C.3

ATHENA RE-ENTRY VEHICLE SEPARATION TEST

PURPOSE OF TEST

This test was conducted to determine the shock levels produced during the pyrotechnic separation of the Athena re-entry vehicle from the 4th Stage.

DESCRIPTION OF EVENT

The separation was affected by the severing of several L shaped supports with one strand of primachord at 9 grains per foot on each support. The primachords were packaged in elastic tubes which were wrapped around the supports. Upon detonation of the pyrotechnics, the elastic tubes expanded without bursting and fractured the supports in tension.

The test was conducted on a full-scale specimen as shown in Figure I.C.2-1.

DESCRIPTION OF DATA

No. shock spectra	8
Type of analysis	digital
Frequency range	0-5000 Hz
Damping	Q = 10

These shock spectra are presented as Figures I.C.3-2 through I.C.3-5.

DESCRIPTION OF PYROTECHNIC

Type: Primachord

Size of charge: 9 grains per foot

Explosive core: RMX

DESCRIPTION OF STRUCTURE

Figure I.C.3-1

DESCRIPTION OF ACCELEROMETERS

Type: Endevco model 2225

Locations: Table I.C.3-1

Axis of sensitivity: Table I.C.3-1

COMMENTS

Two possible sources of further information were contacted regarding this test; however, no information beyond that presented above was available.

TABLE I.C.3-1

GROUND SEPARATION MEASUREMENTS ON ATHENA BOOSTER

Measurement Number	Location and Orientation	Approx. Axial Dist. from Shock	Figure Number
V-1	Re-entry Body - Transverse	10 in	I.C.3-2
V-2	Re-entry Body - Roll	10 in	I.C.3-2
V-3	4th Stage Airframe - Roll	35 in	I.C.3-3
V-8	4th Stage Airframe, Transverse, 135°	25 in	I.C.3-5
V-9	4th Stage Airframe - Transverse, 225°	25 in	I.C.3-5
V-4	4th Stage T/M Tray - Transverse, 225°	20 in	I.C.3-3
V-5	4th Stage T/M Tray - Transverse, 135°	20 in	I.C.3-4
V-6	4th Stage T/M Tray - Roll	20 in	I.C.3-4

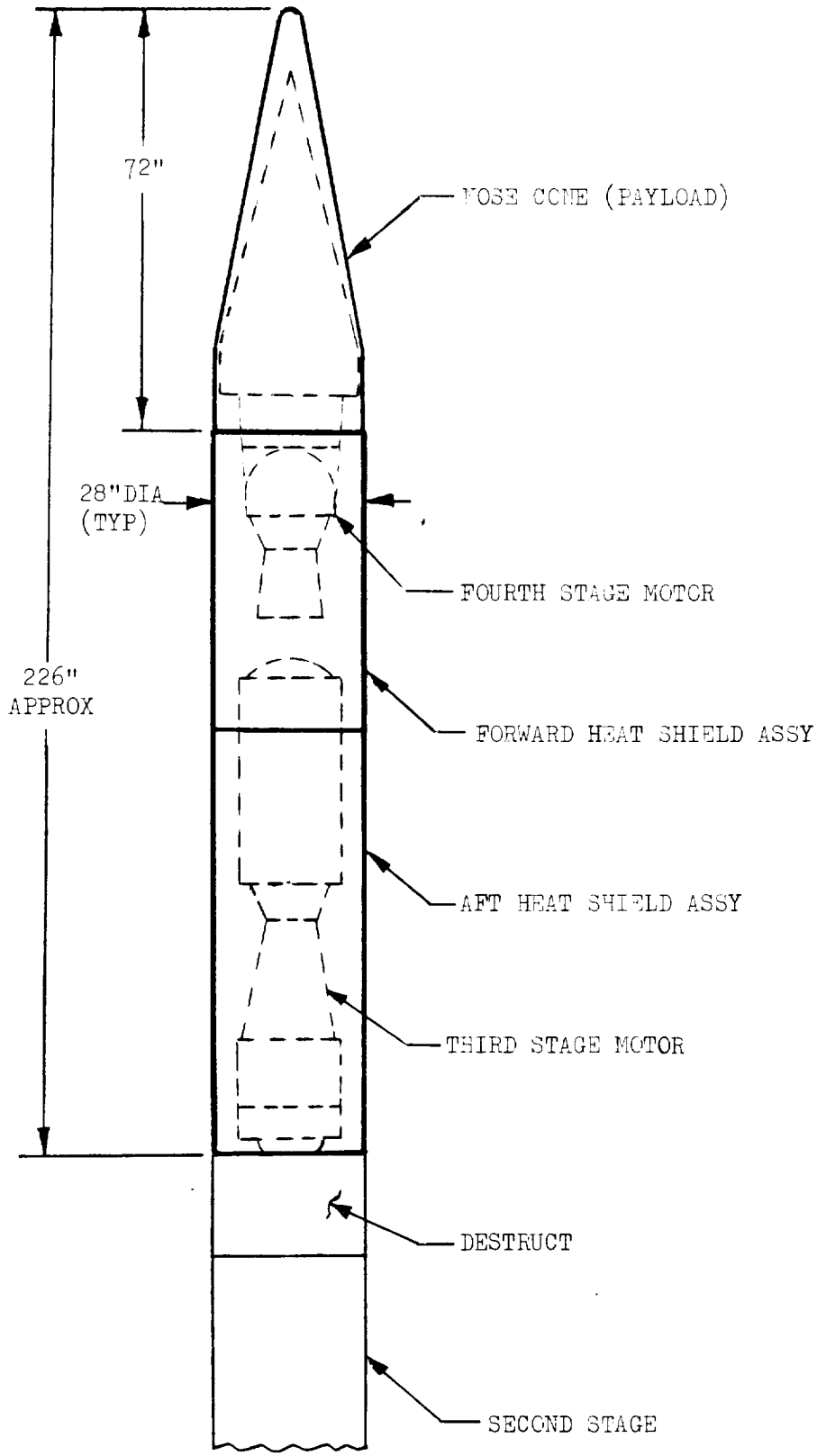
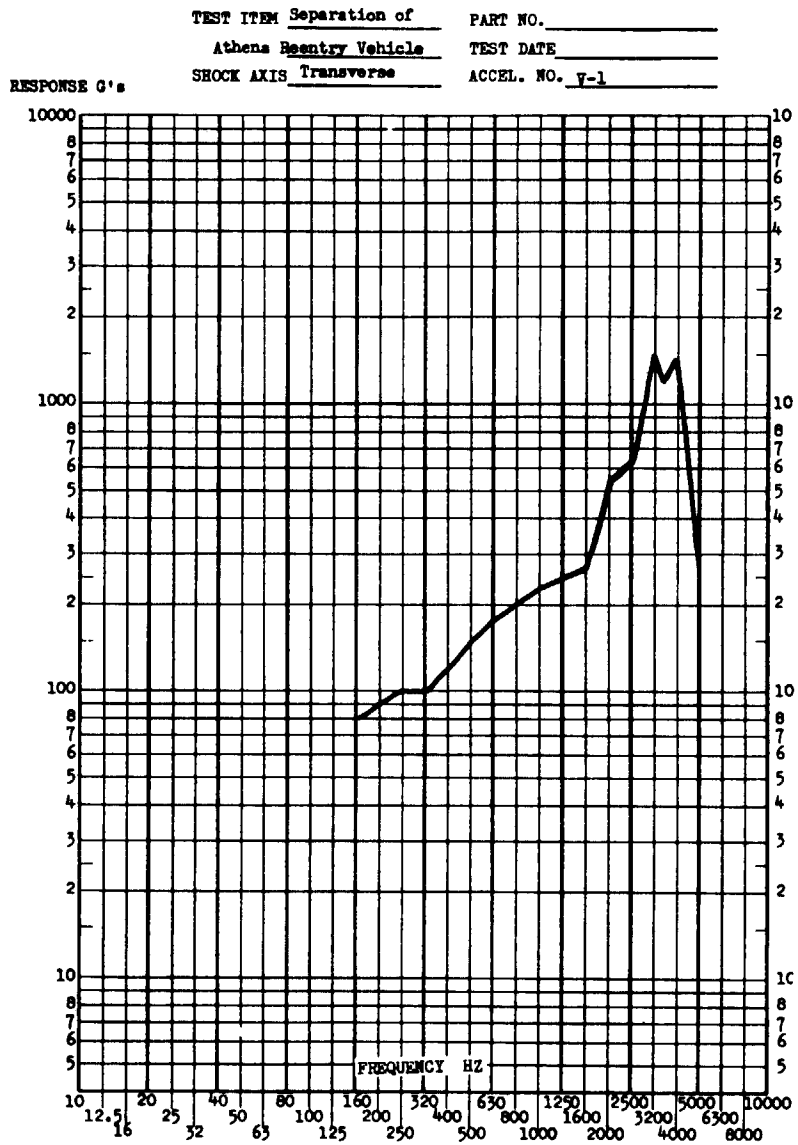


Figure I.C.3-1

HEAT SHIELD AND NOSE CONE ASSEMBLY OF ATHENA VEHICLE


TEST ITEM Separation of
Athena Reentry Vehicle
SHOCK AXIS Transverse
PART NO.
TEST DATE
ACCEL. NO. V-1
RESPONSE G's
FREQUENCY HZ

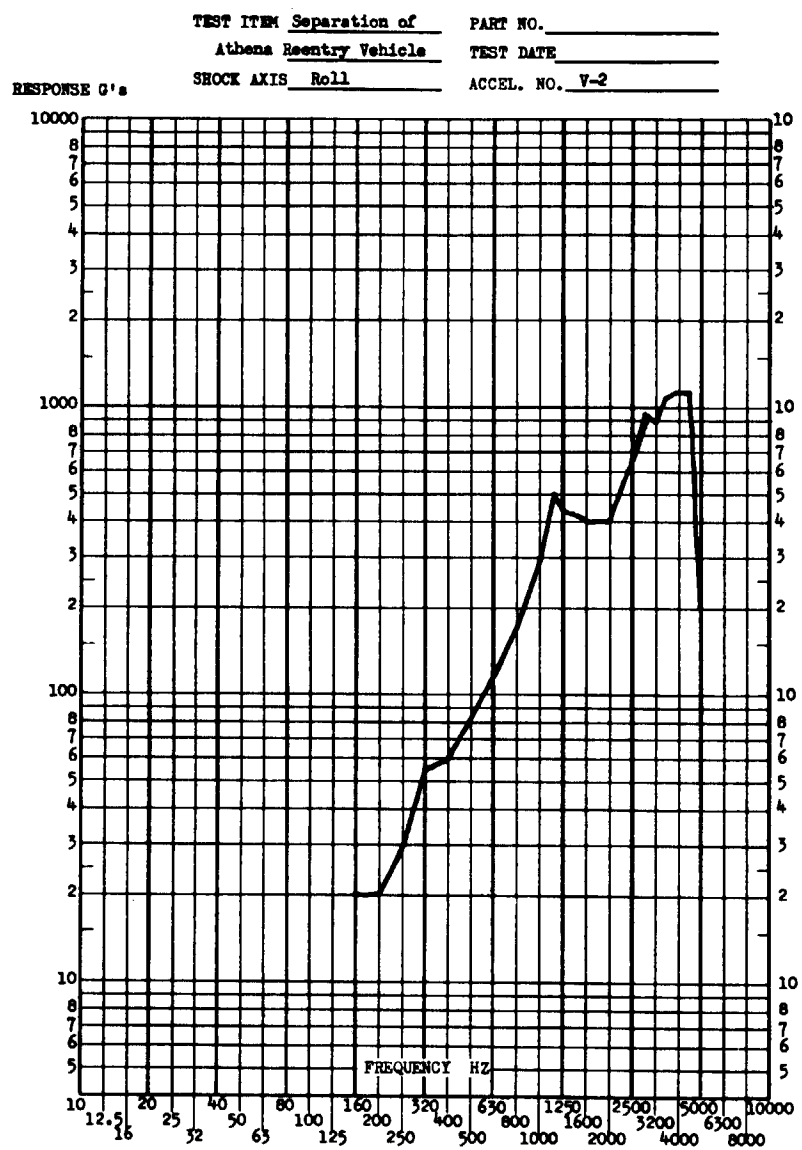
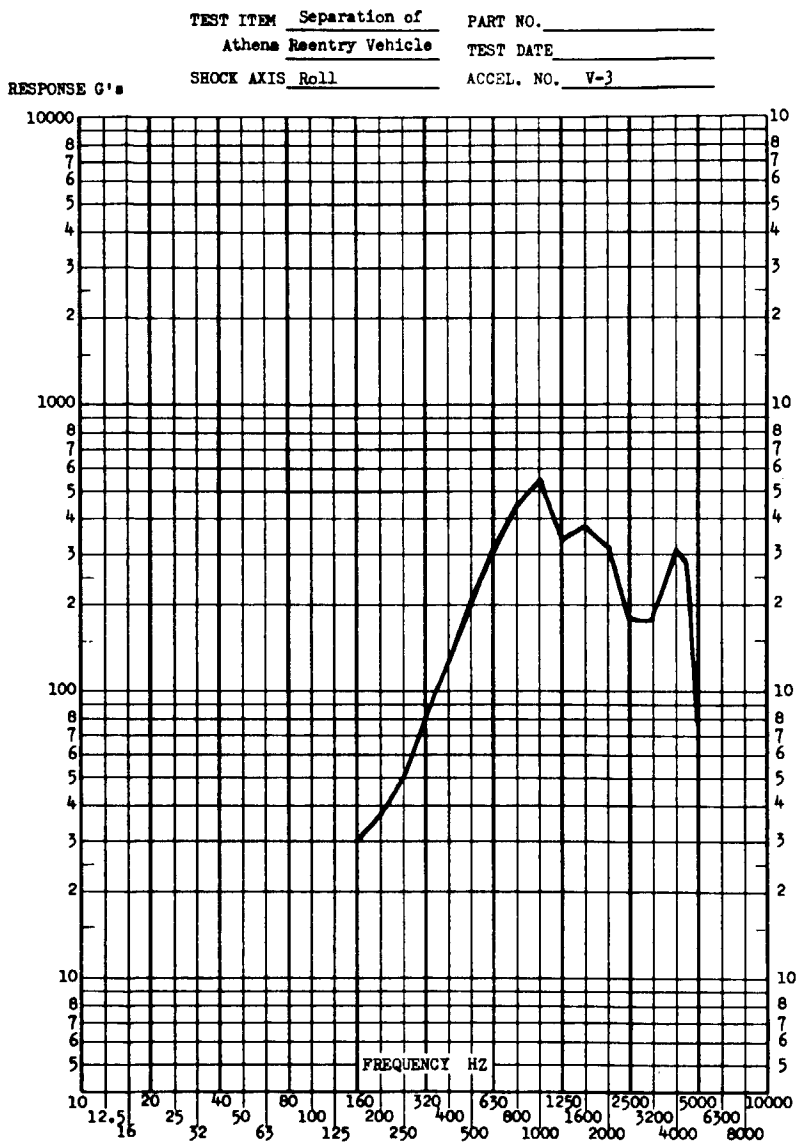

TEST ITEM Separation of
Athena Reentry Vehicle
SHOCK AXIS Roll
PART NO.
TEST DATE
ACCEL. NO. V-2
RESPONSE G's
FREQUENCY HZ

FIGURE I.C.3-2


TEST ITEM Separation of Athena Reentry Vehicle
PART NO.
TEST DATE
SHOCK AXIS Roll
ACCEL. NO. V-3
RESPONSE G's
FREQUENCY HZ

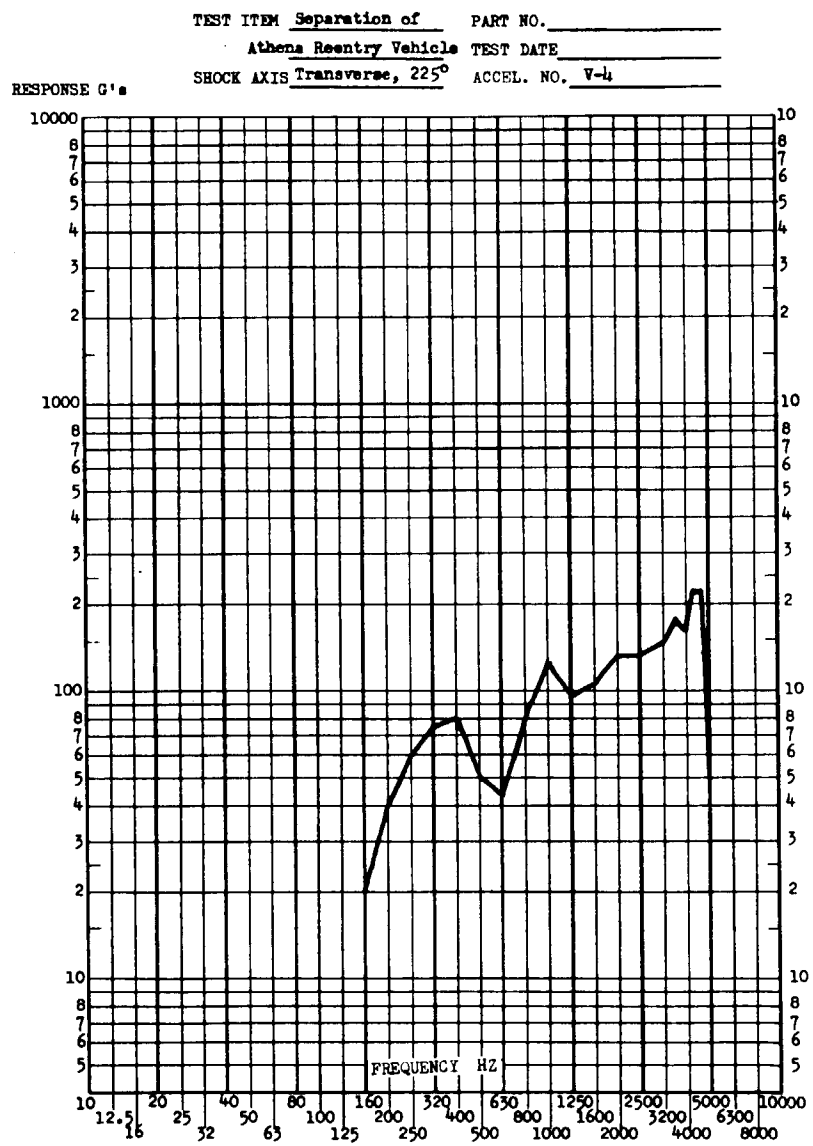
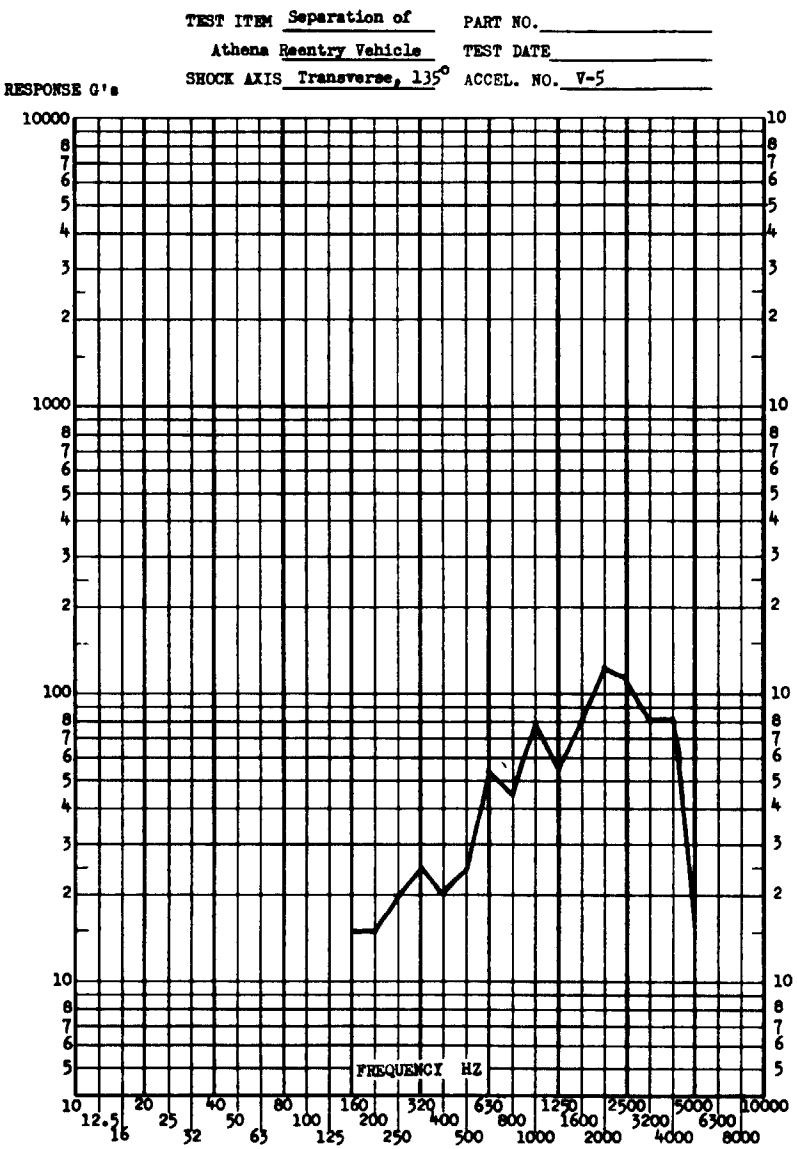

TEST ITEM Separation of Athena Reentry Vehicle
PART NO.
TEST DATE
SHOCK AXIS Transverse, 225°
ACCEL. NO. V-4
RESPONSE G's
FREQUENCY HZ

FIGURE I.C.3-3


TEST ITEM Separation of
Athena Reentry Vehicle
SHOCK AXIS Transverse, 135°
PART NO.
TEST DATE
ACCEL. NO. V-5
RESPONSE G's
FREQUENCY HZ

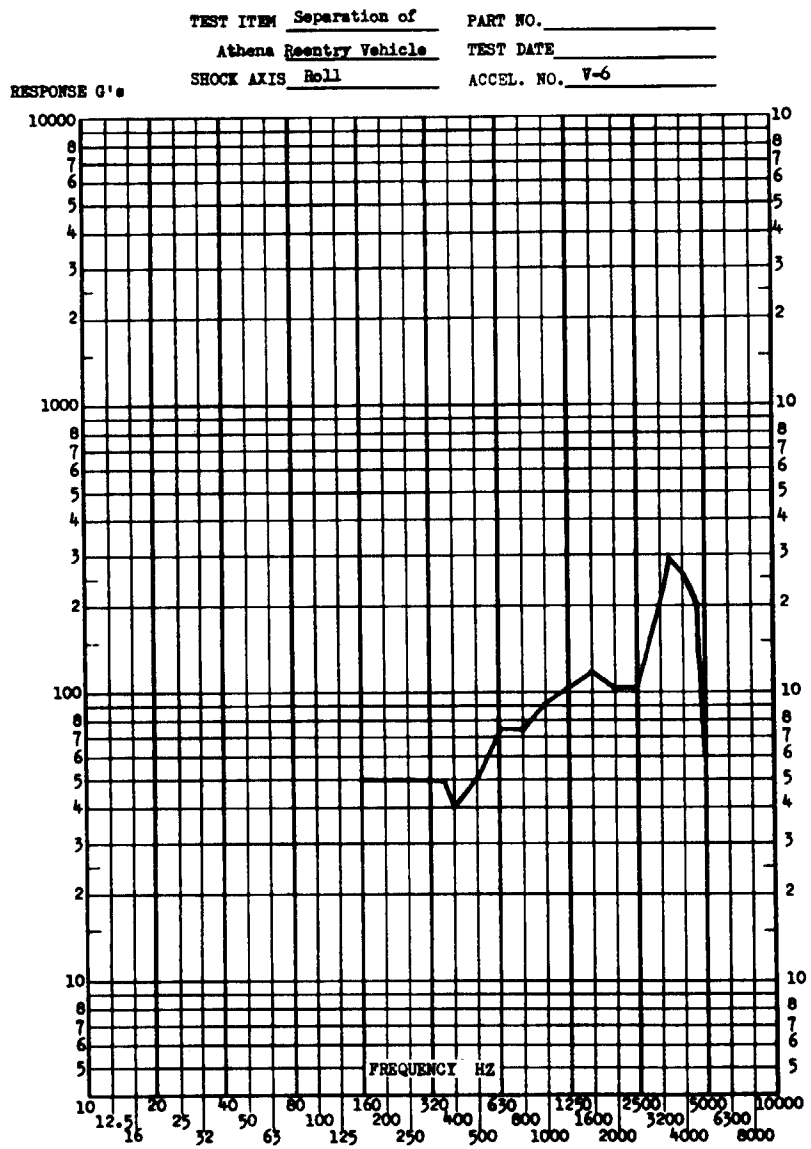
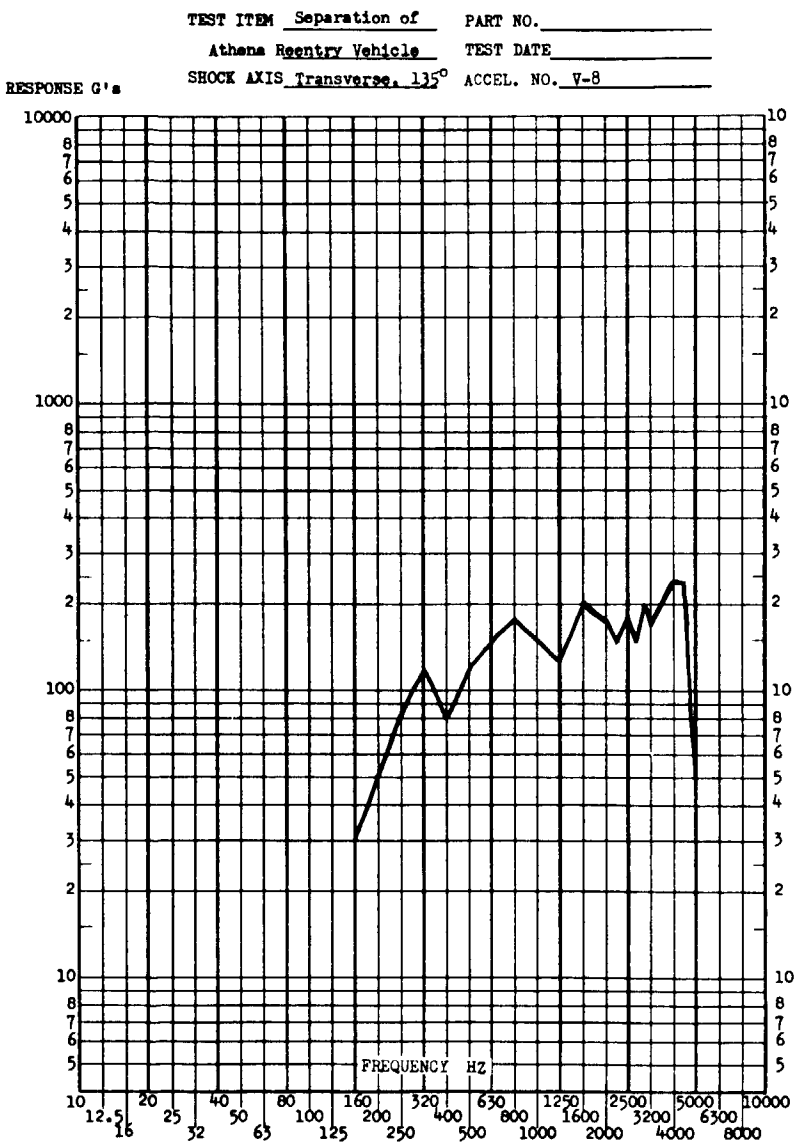

TEST ITEM Separation of
Athena Reentry Vehicle
SHOCK AXIS Roll
PART NO.
TEST DATE
ACCEL. NO. V-6
RESPONSE G's
FREQUENCY HZ

FIGURE 1.C.3-4


TEST ITEM Separation of
Athena Reentry Vehicle
SHOCK AXIS Transverse, 135°
PART NO.
TEST DATE
ACCEL. NO. V-8
RESPONSE G's
FREQUENCY HZ

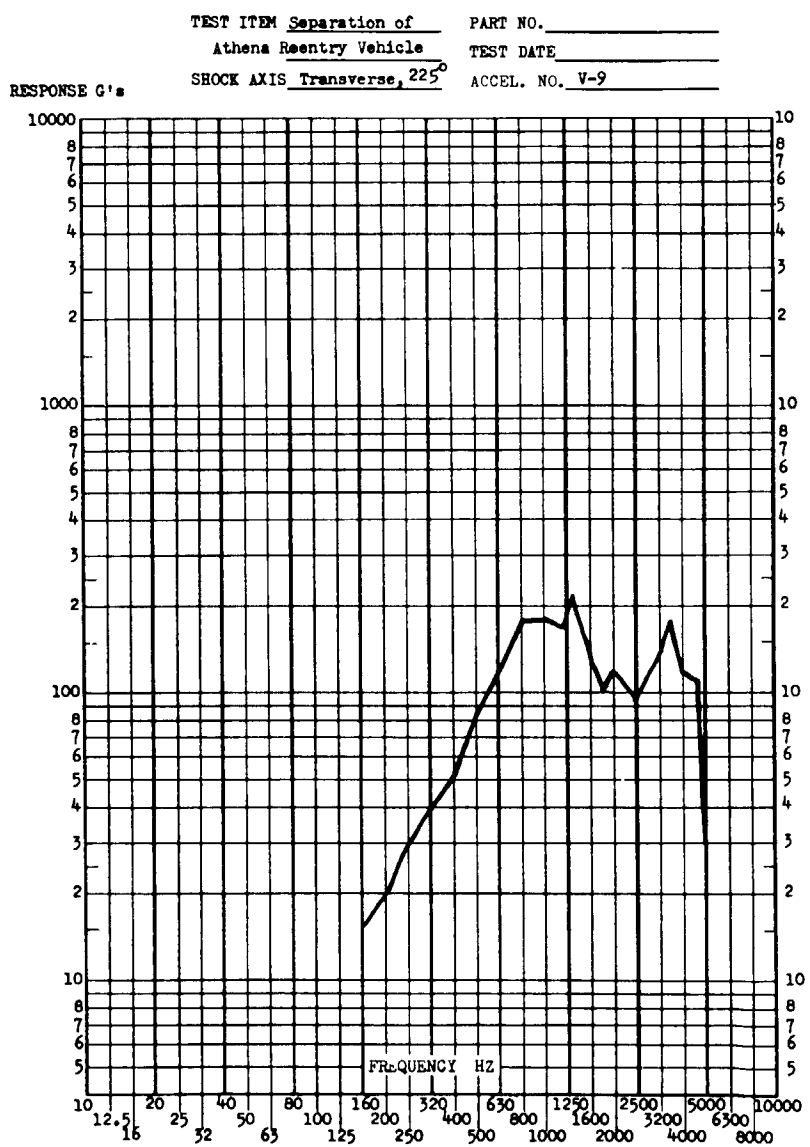

TEST ITEM Separation of
Athena Reentry Vehicle
SHOCK AXIS Transverse, 225°
PART NO.
TEST DATE
ACCEL. NO. V-9
RESPONSE G's
FREQUENCY HZ

FIGURE I.C.3-5

LOCATION OF ADDITIONAL DATA

Additional pyrotechnic shock data for structure cutting charges with propagation in a structure other than skin-ring-frame or truss may be found in the following sections of Volume III:

IV.A.2 Figures 1 through 19

IV.C.1 Entire section

IV.C.3 Entire section

LOCATION OF RELATED LOCKHEED DATA

Additional pyrotechnic shock data compiled for structure cutting charges with propagation in a structure other than skin-ring-frame or truss may be found in the following sections of the Lockheed data compilation:

II.A.1
II.A.2
II.A.3
II.A.4
II.A.5
II.A.6
II.D.1
II.D.2
II.E.1
II.E.2
II.E.3
II.E.4
II.E.5
II.E.6