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TEST AND EVALUATION OF PROTOTYPE CONTAINER MK 620 MOD 0 FOR HARPOON CONTROL SECTION, BOATTAIL, GUIDED MISSILE WCU-1/B

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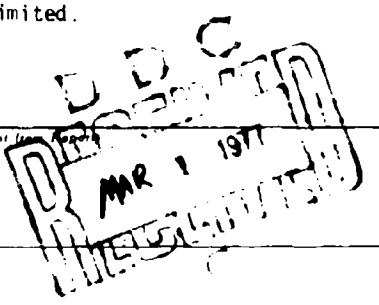

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9 November 1976

TEST AND EVALUATION

OF

PROTOTYPE CONTAINER MK 620 MOD 0

FOR

HARPOON CONTROL SECTION, BOATTAIL, GUIDED MISSILE, WCU-1/B

Abstract

This report details the test and evaluation of a prototype Container MK 620 MOD 0, designed to protect a HARPOON Control Section, Boattail for fleet use. Test results indicated that the container is suitable for its intended use.

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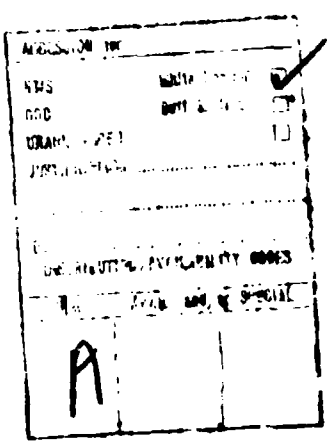


INTRODUCTION

The Naval Weapons Handling Center, WPNSTA Earle was tasked to design, develop and document a shipping and storage container for the HARPOON, Control Section, Boattail. As a result of this request a prototype container was fabricated and tested in accordance with specification XAS 4315.

The primary objective of the tests was to evaluate the adequacy of the container in providing protection for a packaged HARPOON, Control Section, Boattail. The tests conducted simulated rough handling treatment as may be encountered during fleet shipment.

ITEM DESCRIPTION

The test specimen, Container MK 620 MOD 0, DL 2645575, is comprised of an MS Steel Drum, and a quantity of shock mitigating cushion assemblies as shown in Figure 1. The Boattail section is shown packaged in the cushioning system (Figure 2) in the same sequence used when packaged into the metal drum. With the exception of a column of polyurethane foam in the upper cushion assembly (Figure 3) that is used for controlling creep, the remaining cushions are fabricated from unicellular polyethylene foam having a nominal density of 2.0 pounds per cubic foot. The MS Drum has an overall outside diameter of 24-1/8 inches, is 24-1/8 inches high and incorporates two handling handles and a breather valve TA 333-20-20R. Following are the weights of the components used in the test program:

Steel Drum MS 27683-11		43.0 pounds
Cushioning System		7.5 pounds
HARPOON Boattail Section		45.5 pounds
	Gross Weight	96.0 pounds

TEST EQUIPMENT AND INSTRUMENTATION

A piezoelectric triaxial accelerometer and appropriate signal conditioning equipment was used to monitor the shock and vibration response. The accelerometer was mounted to the body of the Boattail Section (Figure 4) at a location approximately one inch from the horizontal center of gravity. Shock pulses were recorded on magnetic tape at a speed of 30 inches per second. Visual records were produced by playback at 3-3/4 inches per second into a moving pen recorder with a chart speed of 25 millimeters per second. A list of the major items of instrumentation used in the shock and vibration tests is offered in Table I.

TEST PROCEDURES AND RESULTS

Tests and results are presented in the sequence conducted. All tests were performed on the container loaded with a HARPOON Control Section Boattail removed from Missile PM-15.

1. Acceptance Inspection. The container was dimensionally checked for conformance to the drawing package and also examined for workmanship.

Results - Dimensions were within the tolerances specified and the workmanship was considered good.

2. Form, Fit and Function Test.

Results - The HARPOON Boattail Section was manually packaged into the cushioning system with relative ease. The low profile container and light weight of the Boattail simplified the loading procedure. Installation of the cover and closure ring was accomplished by one person with no abnormal difficulties experienced.

3. Leakage Test (Initial). Conducted at an ambient temperature of approximately 70°F using the pneumatic pressure technique outlined in Method 5009 of FED-STD-101B.

In preparation for the Leak Test, the container was fitted with an apparatus consisting of tubing, a shut off valve and an air pressure gage for determining the internal container pressure (Figure 5). An external source of compressed air was piped through the apparatus into the closed container. When the air pressure gage (Wallace and Tiernan, Model No. FA145) recorded the nominal specified container pressure of 2.5 psi, the external air supply was shut off. Air pressure corrections were made to compensate for temperature changes in the container before monitoring the leak rate.

Container Test Criteria. The pressure drop shall not exceed 0.05 psig during an elapsed time of one hour after pressurizing the container to 2.5 ± 0.5 psig.

Results - No pressure drop was detected during an elapsed time of one hour.

4. Repetitive Shock Test. This test was conducted at an ambient temperature of approximately 70°F, in accordance with Method 5019 of FED-STD-101B as modified by paragraph 5.2.2 of MIL-STD-648.

The loaded container was placed (base down) on a vibration table having a vertical linear motion of 1" double amplitude (Figure 6). The frequency of the table motion was increased until the container base left the table by 1/16" at some instant during each cycle. The container was vibrated for two hours under these conditions with an input vibrational shock frequency of 3.8 Hz.

Results - Post test examination disclosed no visible damage to either the HARPOON Boattail Section or container.

5. Vibration-Resonance Search and Fatigue Test. Conducted in accordance with paragraph 5.3.2 of MIL-STD-648 at an ambient temperature of approximately 70°F. The vibration excitation was applied in the vertical axis only, as specified by the design activity.

The loaded container was rigidly secured to a reaction type vibration machine, LAB RVH-72-5000, in its shipping and storage position (base down). A sinusoidal vibration sweep from 5 to 50 Hz was then conducted with the sensitive axis in the vertical direction monitored. The alternate sweep syllabus for reaction type test machines as indicated in Table A-II of Naval Ordnance Requirements OR-11 was used to determine the resonant frequency and peak transmissibility. The container was then subjected to a fatigue test by vibrating for 30 minutes (uninterrupted) at the resonant frequency with a table input of .125 inch double amplitude.

Results - The resonant frequency was determined to be 12.9 Hz. The peak transmissibility before and after the 30 minute dwell was respectively 4.0 and 4.2. These results are acceptable and meet the requirements of allowable transmissibility curve Figure 3 of XAS 4315. (See Appendix A.) Inspection of the Boattail Section and container indicated that no damage occurred as a result of this test.

6. Vertical Shock Test. This test was conducted at an ambient temperature of approximately 70°F. The loaded container (base down) was raised in a level attitude to a height of 21" and allowed to free fall and impact a concrete surface.

Results - The peak shock (g's) monitored in the vertical axis was 19.4 g's with a pulse duration of 52 MS. These results are acceptable and meet the requirements of the Shock Spectra envelope, Figure 1 of XAS 4315. (See Appendix A.) No damage was evident to either the container or Boattail Section.

7. Drop Test (Free Fall). This test was performed at extreme temperatures of -20°F and 140°F as specified in XAS 4315. The drop procedure was conducted in accordance with paragraph 5.2.3 (modified) of MIL-STD-648 to the Level "A" Drop Height specified in Method 5007 of FED-STD-101B which is 21 inches. The container surfaces impacted (See Table II) were points, 2, 5, 4 and 7; edges 1-2, 3-4 and 5-6 and the bottom face. The apparatus used to perform this test was

a Gaynes drop table, which permits control of the drop height and allows the container to be placed in position prior to its release and free fall. The container was positioned so that the center of gravity is directly above the striking point of the container at the instant of release and free fall. The second temperature drops were performed at locations other than those impacted in the first temperature test except for the bottom face.

Results - As generally expected from this test, the usual type of minor damage to the drum occurred as evidenced by slight indentations at the impacted locations. However, no detrimental effects to the container or Boattail Section resulted. The shock levels recorded at both specified temperature tests were within the parameters given in the Shock Spectra Envelope, Figure 1 of XAS 4315. (See Appendix A.) The resultant peak shock (g's) are tabulated in Table II with the major deceleration-time curves shown in Figure 7.

8. Strength of Handles Test. Conducted in accordance with the requirements of Paragraph 4.17.2.1 of MIL-STD-648 and Specification XAS 4315.

a. Single Point Suspension. The loaded container (96 pounds) was hoisted clear of the deck and held in the suspended condition for a duration of 5 minutes. Each handle was tested in this manner.

b. Double Point Suspension. An overload weight of 384 pounds was added to the loaded container weight of 96 pounds and the entire

load, 480 pounds, was lifted by the pair of handlift handles for a suspended duration of 5 minutes.

Results - (a and b) - Each handling handle and adjacent attachment areas were examined with no visible structural degradation noted.

9. Leakage Test (Final). The same procedures and inputs as previously described in the initial leak test conducted were followed.

Results - No pressure drop was detected during an elapsed time of one hour.

CONCLUSIONS

The results of this evaluation indicate that the prototype Container MK 620 MOD 0, meets the required criteria and is suitable for its intended purpose as a shipping and storage container for the HARPOON Control Section, Boattail. Test results indicate that the cushion system employed in the container provides adequate isolation from the shock and vibration inputs specified. The condition of the container after completion of all tests was good and was considered as structurally capable of being reusable.

TABLE I

Shock and Vibration Instrumentation

ITEMS	MANUFACTURER	MODEL	SERIAL NO.
Accelerometer (Triaxial-Crystal)	Endevco	2223C	LA 80
Accelerometer	Endevco	2221D	JB 80
Vibration Meter	MB Mfg Co.	M-6	777
Vibration Pick-Up	MB Mfg Co.	Type 126	16418R
Magnetic Tape Recorder	Sangamo	4700	
Pen Recorder	Beckman	Type RS (Dynograph)	
Oscilloscope	Textronix	Type 545A	039670

FIG. 1 CONTAINER MK 620 MOD 0.

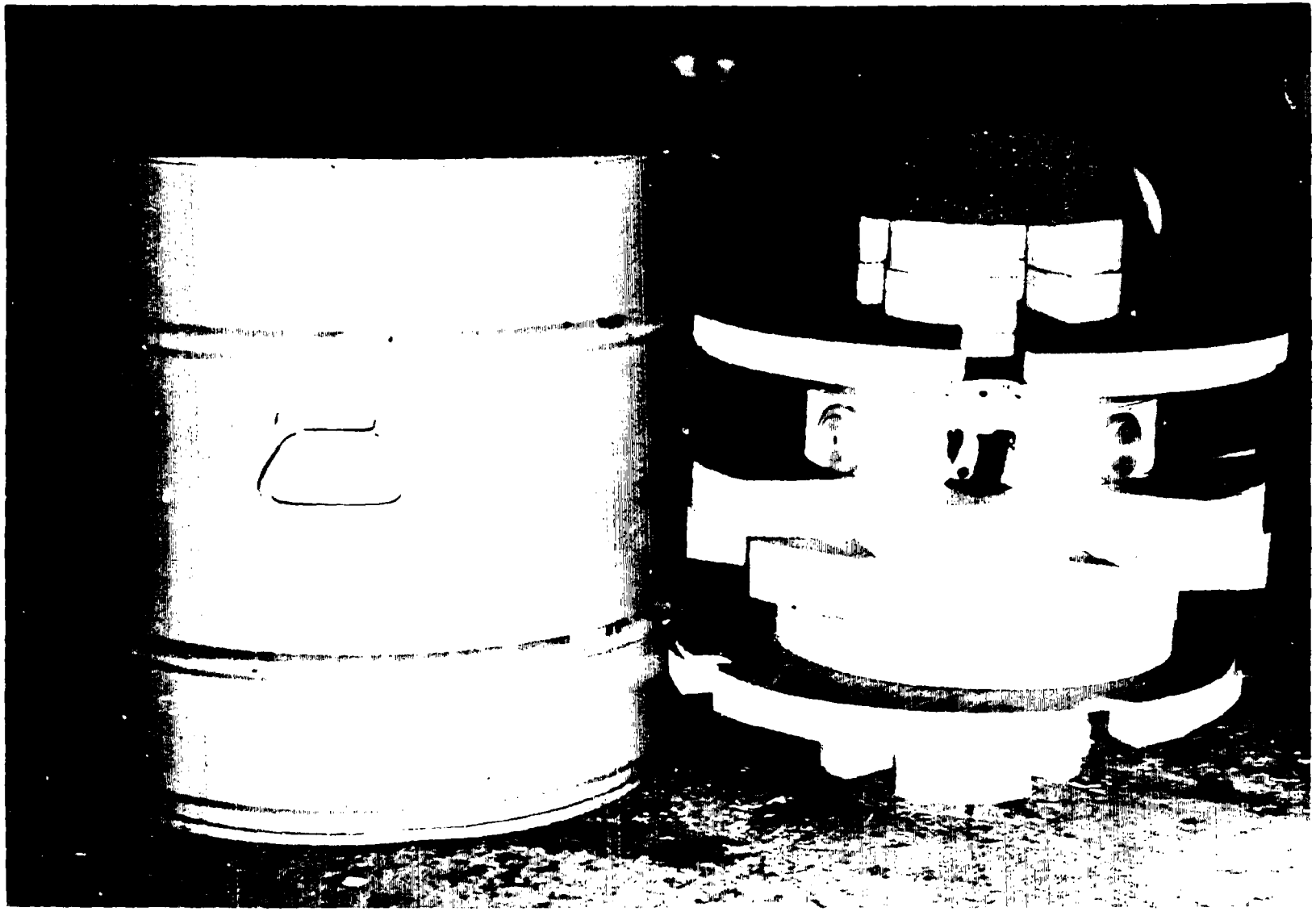


FIG. 2 PACKAGING SEQUENCE.

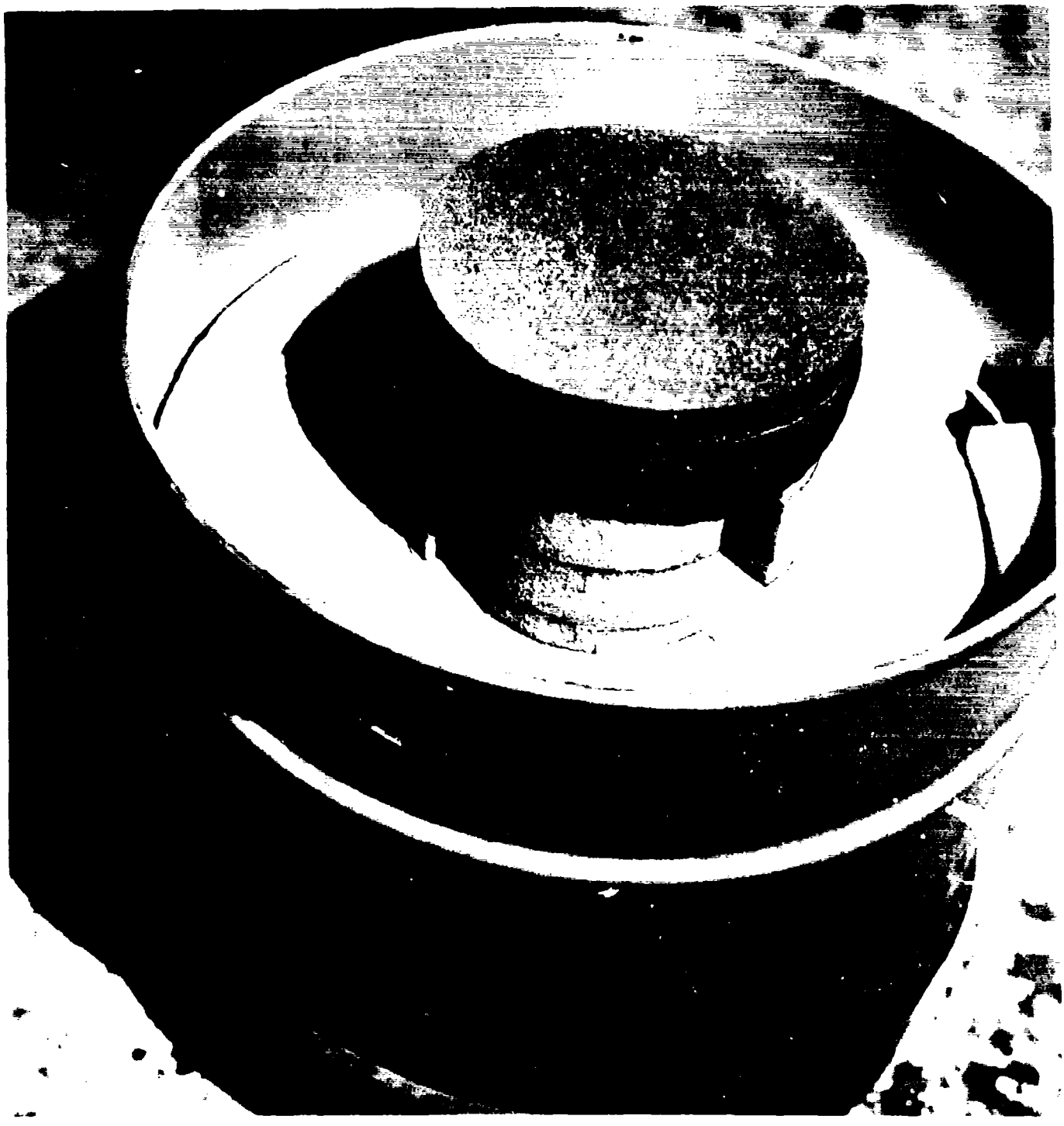


FIG. 3 UPPER CUSHION ASSEMBLY.

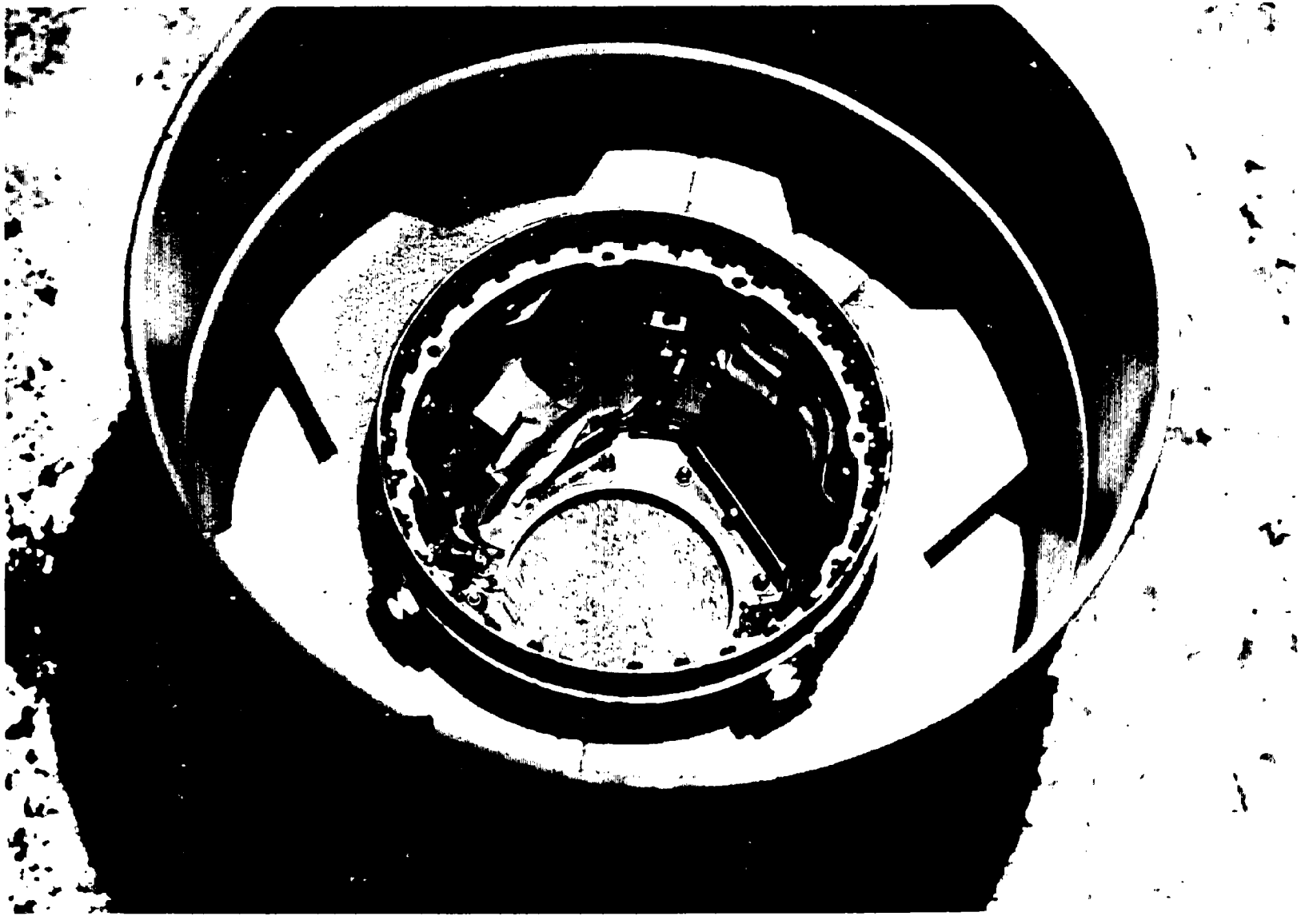


FIG. 4 ACCELEROMETER LOCATION.

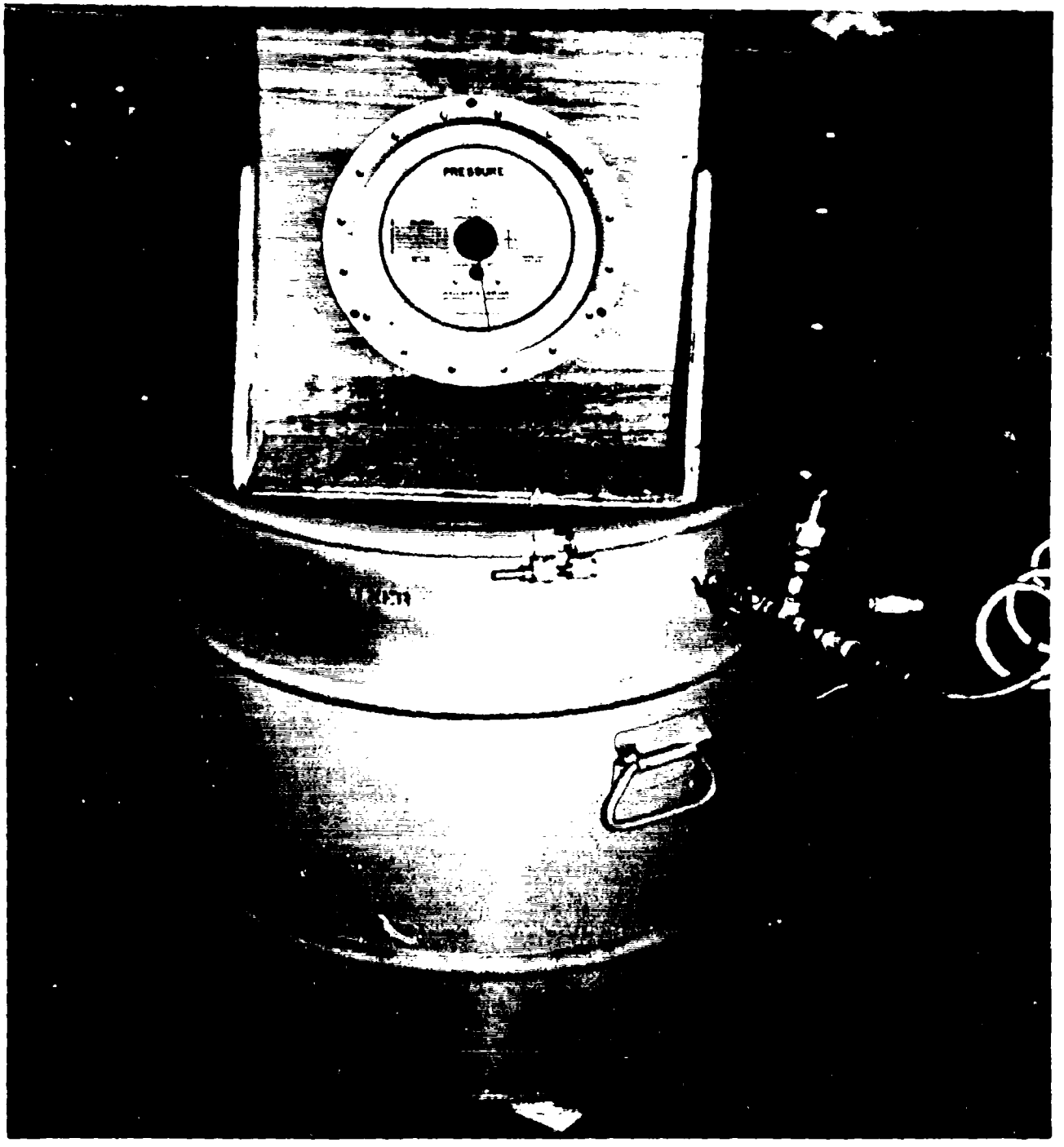


FIG. 5 LEAK TEST APPARATUS.

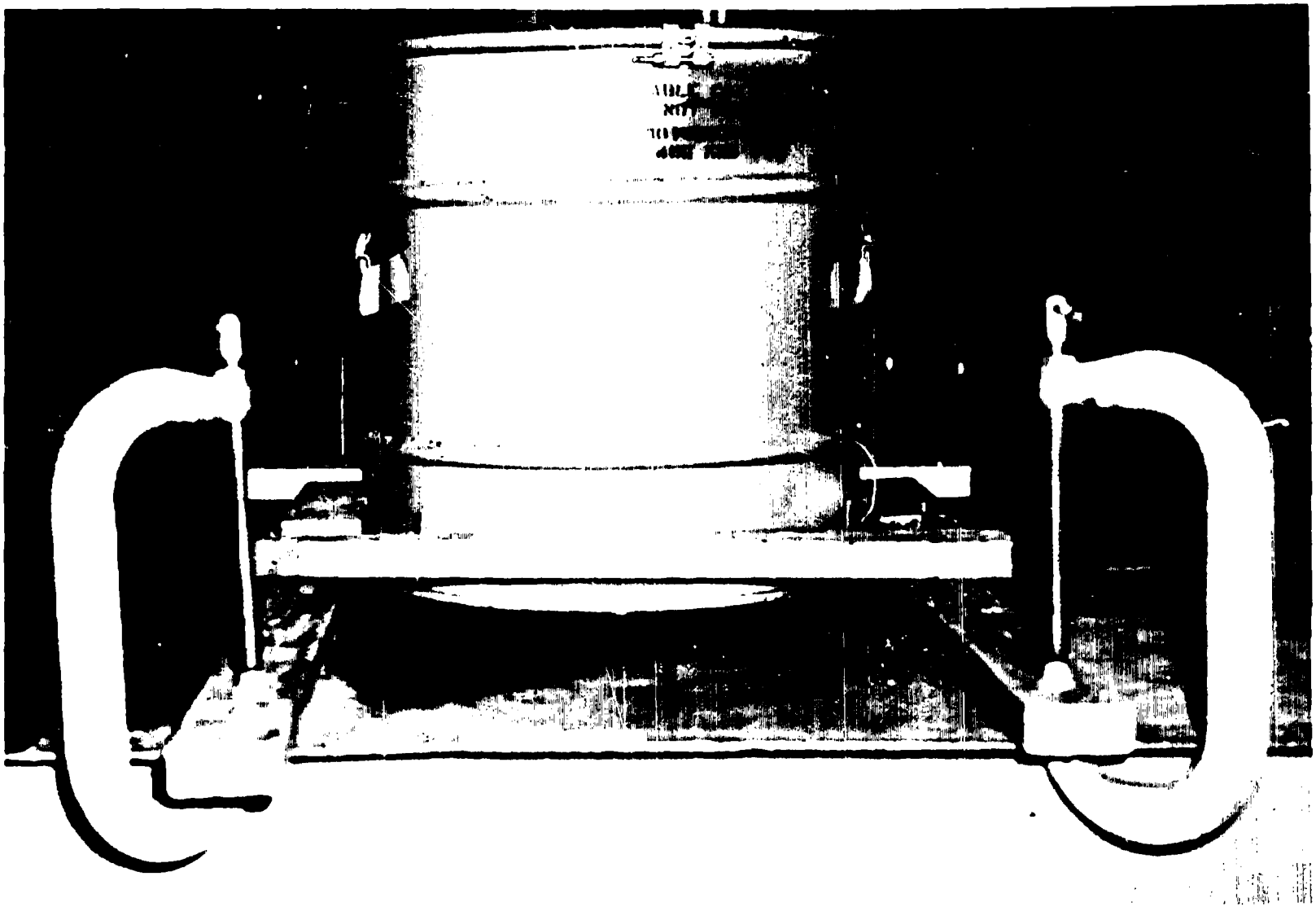
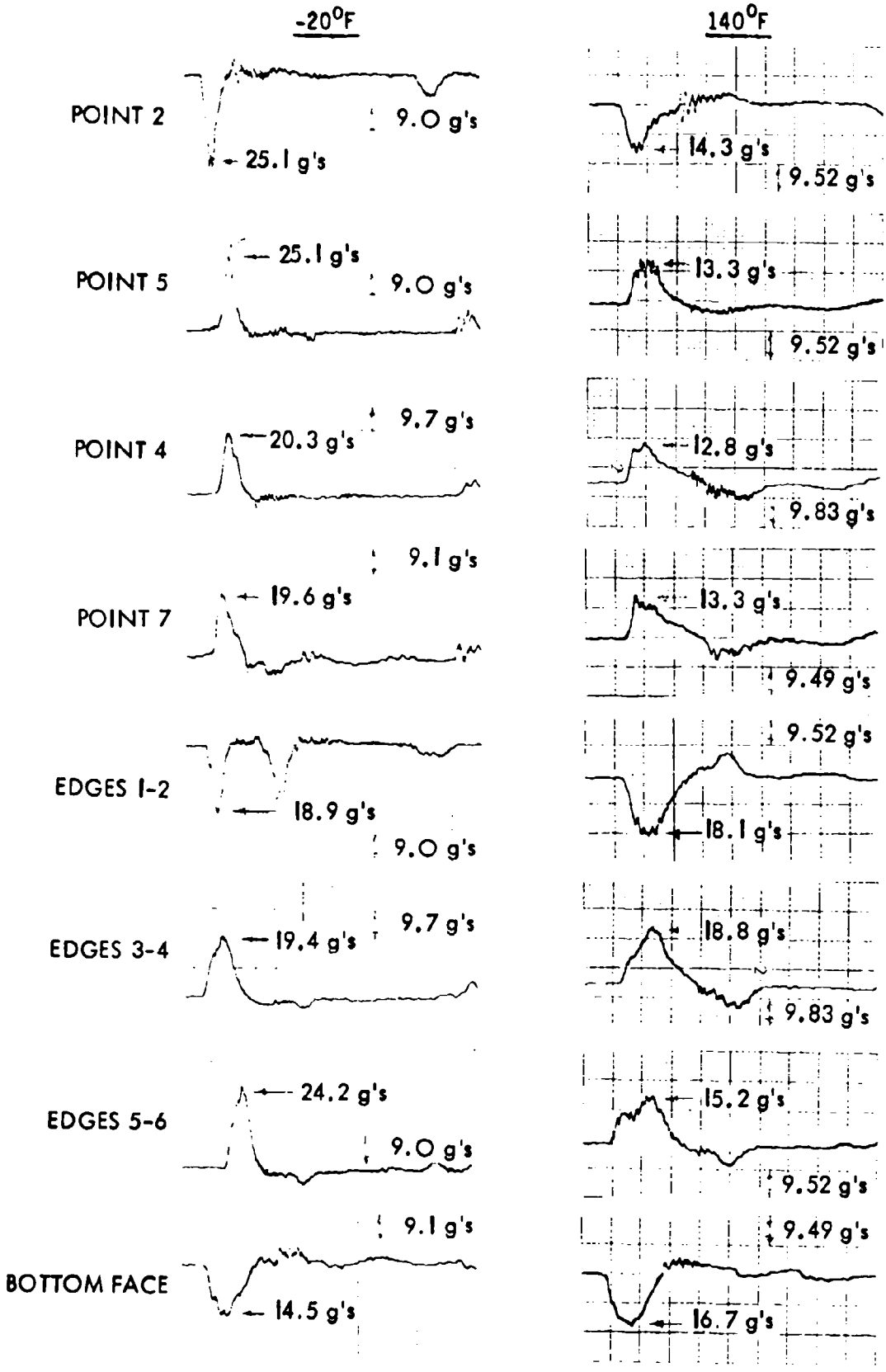


FIG. 6 REPETITIVE SHOCK TEST.



NOTE: HORIZONTAL SCALE = 5ms/mm

FIG. 7. MAJOR SHOCK PULSES.

APPENDIX A

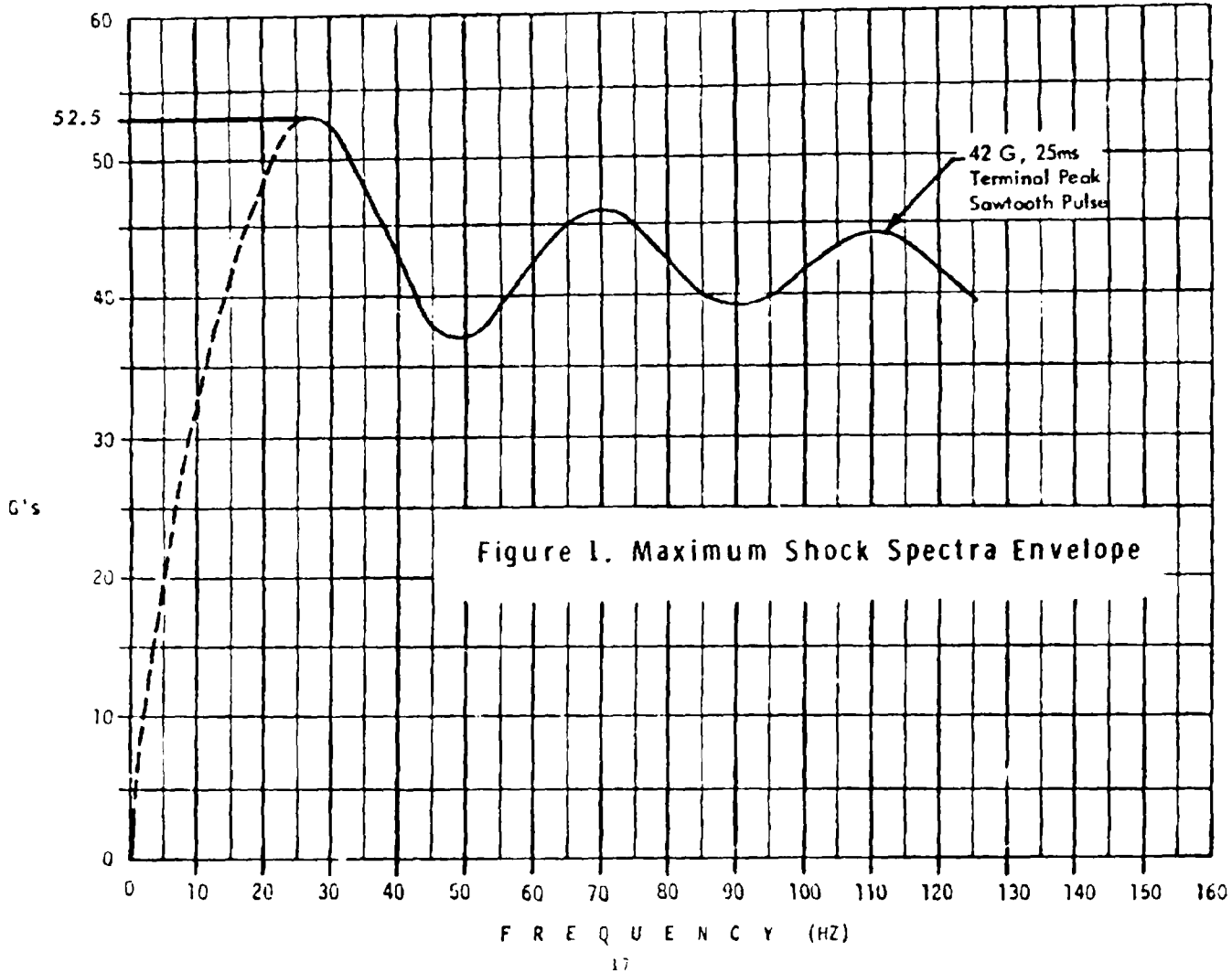


Figure 1. Maximum Shock Spectra Envelope

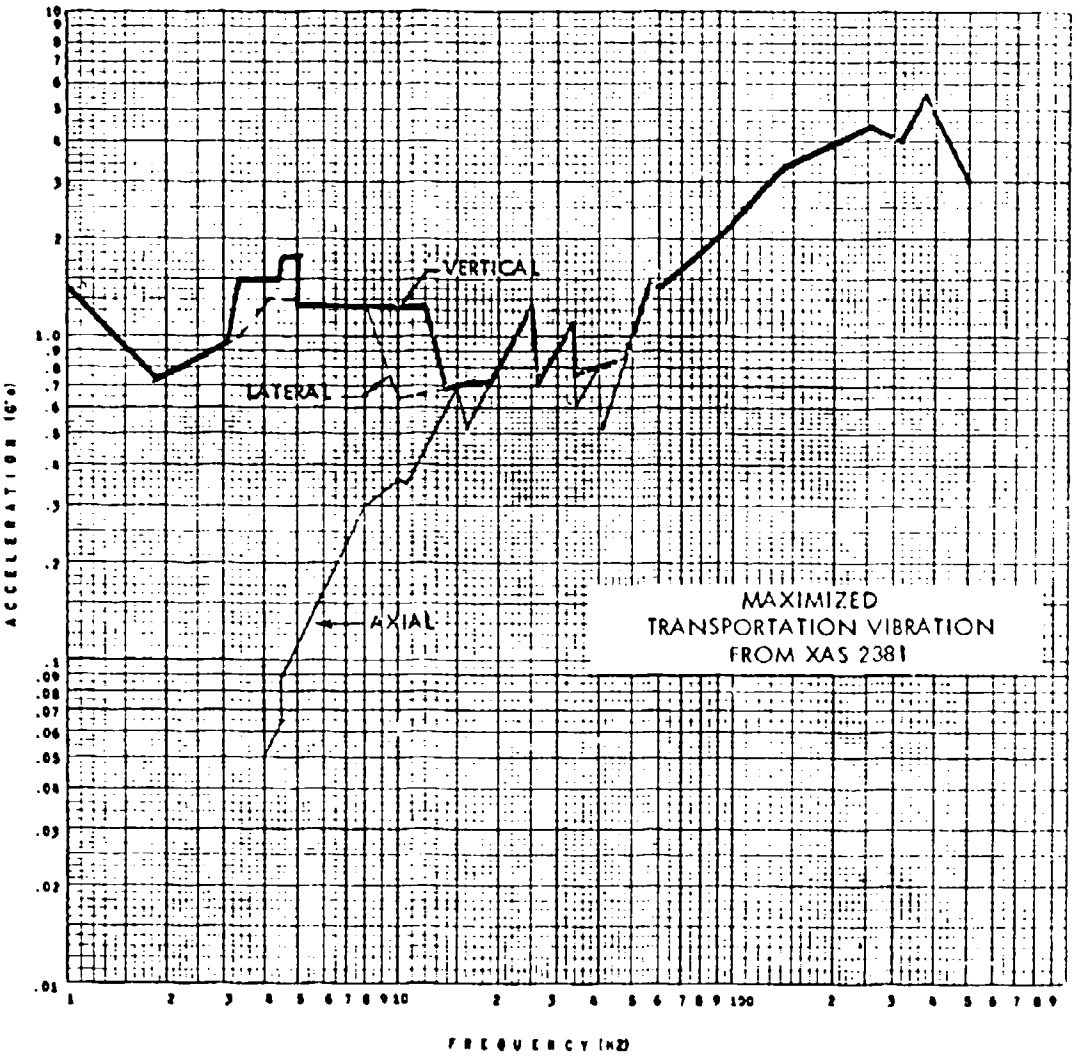

VERTICAL
LATERAL
AXIAL
MAXIMIZED
TRANSPORTATION VIBRATION
FROM XAS 2381
ACCELERATION (G's)
FREQUENCY (HZ)

Figure 2

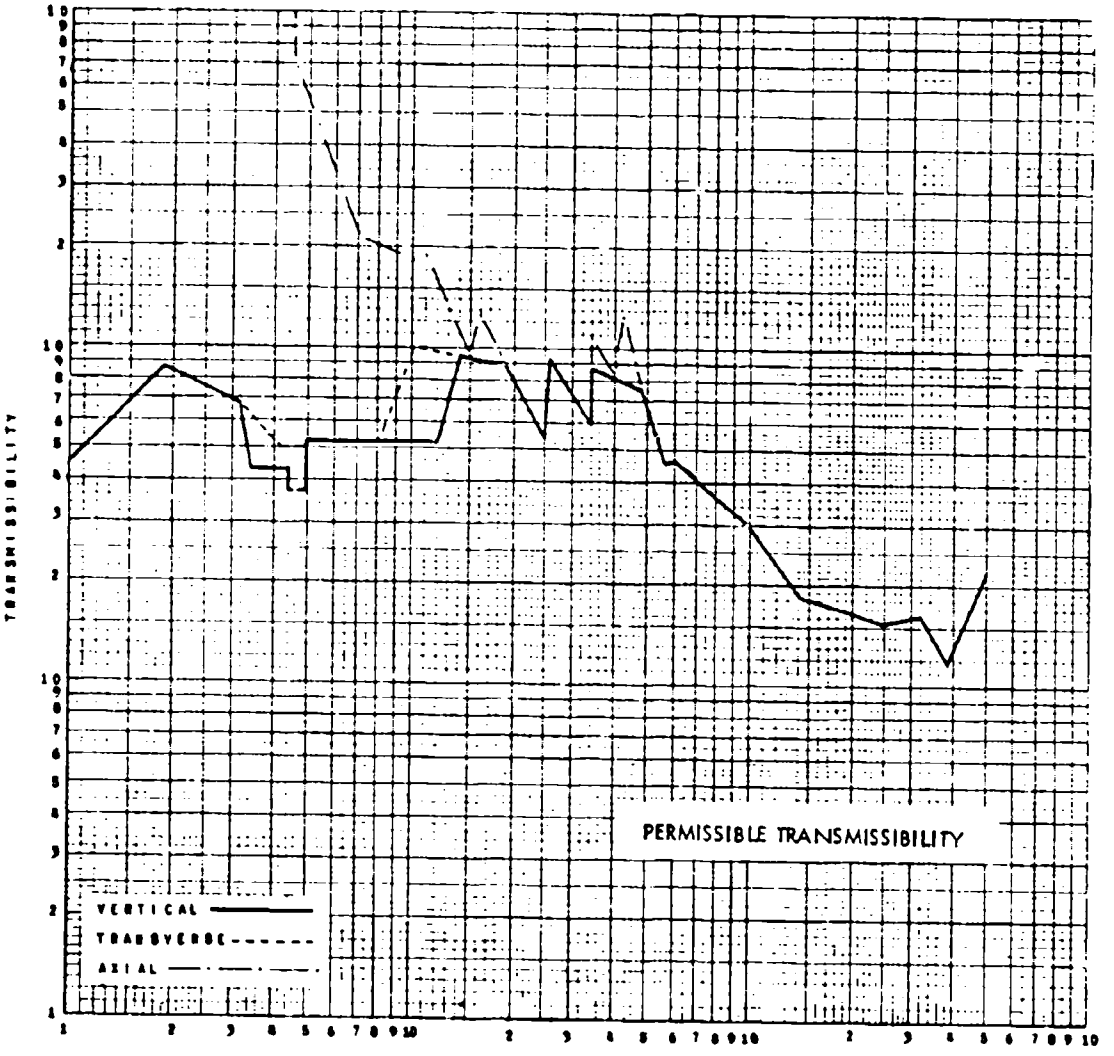

TRANSMISSIBILITY
PERMISSIBLE TRANSMISSIBILITY
VERTICAL
TRANSVERSE
AXIAL
FREQUENCY (HZ)

FIGURE 3