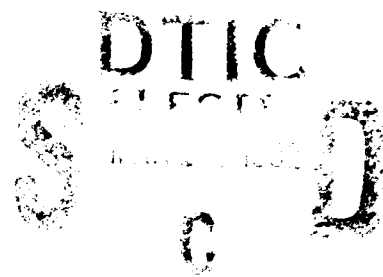


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LGTPM REPORT NO. 91-R-05
AFPEA PROJECT NO. 91-P-114

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KEITH A. VOSSLER

Mechanical Engineer

Autovon 787-4519
Commercial (513) 257-4519

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QUALIFICATION TESTING OF THE CNU-502/E CONTAINER
FOR THE BSU-93/B RETARDERS (FINS)

HQ AFLC/LGTPM
AIR FORCE PACKAGING EVALUATION AGENCY
WRIGHT-PATTERSON AFB, OH 45433-5999
February 1992

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PROJECT NO. 91-P-114

TITLE: Qualification testing of the CNU-502/E Container

ABSTRACT

The objective of this test series is to qualify the CNU-502/E container for production release by ASD/YJA. The CNU-502/E is a reusable, welded aluminum, controlled breathing style container with a removable cover. The container is designed to hold up to six BSU-93/B, air inflatable retarders (fins). The fins are aligned vertically with the fins up and the fin wiring orientated towards the container sidewalls for servicing. As tested, the two prototype cover cushions used polypropylene load spreaders to constrain the aft end of the fin to prevent fin rotation during shipment. The forward end of the fin fits over polyethylene disks mounted to the polyethylene bottom cushion to constrain and provide vertical alignment. The qualification test series is derived from MIL-STD-648A, FED-STD-101C, Eglin (18894) Specification No. SP919450, and consists of -25⁰ F free fall drops, sinusoidal vibrations, structural strength, and leak tests. The test series was performed at the Air Force Packaging Evaluation Activity, Wright-Patterson AFB, Ohio.

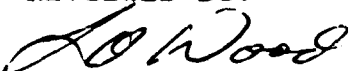
PREPARED BY:


Keith Vossler
Mechanical Engineer
AFPEA

PUBLICATION DATE:

14 FEB 1992

REVIEWED BY:


Larry Wood
Ch, Materials Branch
AFPEA

APPROVED BY:

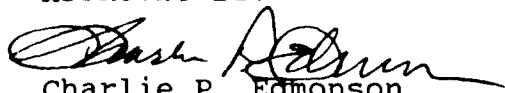

Charlie P. Edmonson
Chief, AF Packaging
Evaluation Activity

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INTRODUCTION

The objective of this test series is to qualify the CNU-502/E container for production release by ASD/YJA. The tests performed are specified by ASD/YJA, Eglin AFB, FL in the Test Plan (Appendix 1) and are derived from MIL-STD 648A, Fed-Std-101C, and Eglin (18894) Specification No. SP919450. The test methods constitute both procedure for performing the tests and performance criteria for evaluating container acceptability. The tests are commonly applied to special shipping containers providing shock and vibration protection to sensitive items. The facilities at which the tests were performed are located at the Air Force Packaging Evaluation Activity (AFPEA), Wright-Patterson AFB, OH.

ITEM DESCRIPTION

The CNU-502/E (Figure 1.) is a container designed to hold up to six BSU-93/B, air inflatable retarders (fins) constrained between top and bottom cushions. Exterior dimensions are length 54.5 inches, width 37.0 inches, and depth 47.0 inches. Loaded gross weight is 850 pounds. The container tested and the six BSU-93/B fins were provided by ASD/YJA.

The CNU-502/E is a reusable, welded aluminum, controlled-breathing container. The container is equipped with a pressure relief valve, humidity indicator and desiccant port. The cover is removable. The container top frame is fabricated from double walled aluminum extrusions with single wall stamped aluminum sheet sides. The base is fabricated from double walled aluminum extrusions. Top and bottom are flat aluminum sheet. Closure is achieved by ten toggle mechanism latches. A silicone gasket provides a seal between the container base and cover.

Shock and vibration isolation is provided by 9 pound per cubic foot (pfc) polyethylene foam cushions fabricated from sheet material. Six round 9 pfc polyethylene disks (Figure 2.) are mounted to the base cushion of like material to allow the forward end of the fin to fit over and constrain the fin. Two separate rectangular cover cushions (Figure 3.) are constructed of 9 pfc polyethylene with three recesses to fit over the aft end of the fin (Figure 4.) to prevent fin rotation. As tested, the two prototype cover cushions used polypropylene load spreaders. As tested, the cover cushions were mirror images of each other but were not interchangeable due to a desiccant port cut out at one end.

INSTRUMENTATION

The correlation between numbered (AFPEA) and designated (Eglin) container faces or sides is as follows (Figure 5.):

Numbered Side	Designated Side	Notes
1	Top	
2	Starboard	
3	Bottom	
4	Port	
5	Aft	Desiccant Port
6	Forward	

Container Side 2 (starboard) Number 5 fin (Figure 6.) was instrumented with a single axis piezoelectric accelerometer. The accelerometer (Figure 7.) was located 22 inches from the fin forward end (at the fin center of gravity), on the fin side wall (Area a-b) 3 1/2 inches from the fin center line. The accelerometer location in the container was 24 inches from Side 5 (aft), 4 1/2 inches from the container longitudinal center line and 27 3/8 inches from the bottom of the skids. The accelerometer principal axis was aligned vertically; parallel to the fin center line.

The accelerometer output was amplified by an Endevco model 2740B charge amplifier. The signal was recorded and processed by a GHI Systems Triads CAT data acquisition system. Prior to test, the system calibration was determined to be within ± 5 percent of input by inserting a known charge into each charge amplifier and then reading the associated Triads CAT channel response. As a final product, the Triads CAT printed graphic amplitude-time peak acceleration traces of the input signal and output (fin) response (Appendix 3).

TEST EQUIPMENT

The following instrumentation and equipment were used in this test:

Item	Manufacturer	Model	Serial	Cal Exp.
Data Acquisition Sys	GHI Systems	Triad CAT	Version 2	8 Aug 92
Charge Amplifier	Endevco	2740BT	FW13	4 Feb 92
Accelerometer	Endevco	2223E	AY29	10 Oct 92
Vibration Meter	L.A.B. Div.	487A02	0068	20 Apr 92
Vibration Machine	L.A.B. Div.	41012	89003	N/A
Filter	Krohn-Hite	3343	1943	N/A
Storage Oscilloscope	Tektroniks	5115	B094122	7 Nov 91
Test Cham -100, 375 ⁰ F	Tenney Eng		BH1138	21 Dec 91
Manometer, 0-60 in H ₂ O	Meriam Inst.	30EB25IM	154591	N/A
Manometer, 0-84 in H ₂ O	AFPEA	1	N/A	N/A
Halogen Leak Detector	General Elec	42081	9M09	N/A
Vacuum Pump	Precision	PV35	22AN6/12	N/A
Forklift Truck 4000 lb	Mercury	4018	117774	N/A
Pallet Truck 2200 lb	Multiton	HU23	83262	N/A
Thermocouple-	Omega	650	0016	25 Jul 91
Thermometers	Omega	650	0016A	10 Aug 92

TEST PROCEDURE

The container with the six BSU-93/B fins as provided by ASD/YJA was tested in accordance with the modified ASD/YJA Test Plan and referenced methods of MIL-STD 648A, Fed-Std-101C, and Eglin (18894) Specification NO. SP919450.

CONCLUSIONS AND RESULTS

Test Sequence 1, Fed-Std-101C, Method 5009.1, Leaks in Containers, 6.2, Pneumatic Pressurization Technique.

The CNU-502/E container with six fins (Figure 8.) incurred a leak rate of 0.00 psi for 15 minutes when pressurized to 1.99 psig (55.42 in. H₂O) internal pressure. The CNU-502/E container complies with the requirement that the maximum leak rate shall not exceed 0.04 psi per hour (1.11 in. H₂O).

Test Sequence 2, MIL-STD-648A, 5.3.2, Resonance Strength and Dwell Test, ambient temperature.

The container with six fins (Figure 9.) was rigidly attached to the vibration platform. A sinusoidal vibration excitation was applied in a vertical direction and cyclically swept for 7.5 minutes at 2 minutes per octave to locate the resonant frequency. Input from 5 to 12.5 Hz was at 0.125 inch double amplitude and input from 12.5 to 50.0 Hz was at 1.0 G. A 30 minute dwell test

was conducted at the resonant frequency.

Visual inspection revealed no damage to either the container or the six fins. The fins were adequately constrained by the cover and base polyethylene cushions. A maximum of 2.57 G_{pp} output was obtained at the resonant frequency of 11.2 Hz. The maximum transmissibility obtained was 1.40. Performance requirements were not stated in the Test Plan.

Test Sequence 3, Fed-Std-101C, Method 5009.1, Leaks in Containers, 6.2, Pneumatic Pressurization Technique.

The CNU-502/E container with six fins incurred a leak rate of 0.0014 psi (0.039 in. H₂O) for 15 minutes (0.0056 psi per hour) when pressurized to 1.9951 psig (55.42 in. H₂O) internal pressure. The CNU-502/E container complies with the requirement that the maximum leak rate shall not exceed 0.04 psi per hour.

Test Sequence 4, Fed-Std-101C, Method 5016.1, Superimposed Load Test, ambient temperature.

The top of the container (Figure 10.) was weighted with a 3750 pound load. This weight was uniformly distributed over dunnage to simulate container stacking for 5 minutes at ambient temperature. The CNU-502/E container and six fins incurred no damage or permanent deformation. Visual inspection revealed no damage to the container. The results of this test were acceptable.

Test Sequence 5, MIL-STD-648A, 4.17.2.1, Handle Characteristics, ambient temperature.

The container cover (Figure 11.) was weighed with a 150 pound load centered on the container top. The container cover was hoisted by straps attached at two points on each of the two handles for 35 minutes. Visual inspection revealed no deflection or permanent deformation to the cover handles or the container cover. The results of this test were acceptable.

The handle depth measurement was 1 3/4 inches when extended to approximately a 90° angle. MIL-STD-648A, 4.17.2.1., Paragraph 4.17.2.1.a, notes a clear inside dimension of 2 inches. Paragraph 4.17.2.1.b, notes a dimension of 3 inches for use with artic mittens.

Test Sequence 6, SP919450, 4.2.2.2.5.1. Forklift Handles, ambient temperature.

The container cover (Figure 12.) was weighted with a 150 pound load centered on the container top. A forklift lifted the container by the four forklift cover handles for 5 minutes. Visual inspection revealed no permanent deformation to the forklift cover handles or the container cover. The results of this test were acceptable.

Test Sequence 7, Fed-Std-101C, Method 5009.1, Leaks in Containers, 6.2, Pneumatic Pressurization Technique.

The CNU-502/E container with six fins incurred a leak rate of 0.00 psi for 15 minutes when pressurized to 2.0005 psig (55.57 in. H₂O) internal pressure. The CNU-502/E container complies with the requirement that the maximum leak rate shall not exceed 0.04 psi per hour.

Test Sequence 8, Fed-Std-101, Method 5005.1, Cornerwise-Drop (Rotational), -25⁰ F temperature.

The container and six fins were conditioned at -25⁰ F for 19 hours. The container (Figure 13.) was constrained to prevent rotation but allowed the 24 inch free-fall drop height. The corner drop sequence was 3-4-5, then 3-2-5, then 3-4-6, and finally 3-2-6. Visual inspection revealed no major external damage to the container such as weld cracks. Latches remained closed during the drops.

Test Sequences 9, Fed-Std-101, Method 5008.1, Edgewise-Drop (Rotational), -25⁰ F temperature.

Test Sequence 9 was performed immediately following Test Sequence 8. The container (Figure 14.) was constrained to prevent rotation but allowed the 24 inch free-fall drop height. The edge drop sequence was 6-3, then 5-3, then 2-3, and finally 4-3. Visual inspection revealed no major external damage to the container such as weld cracks. Latches remained closed during the drops.

The base cushion temperature was measured with a temperature probe (Figure 15.) inserted through the desiccant port. Cushion temperature at the start of Test Sequence 8 was -28⁰ F with a chamber temperature of -30⁰ F. Cushion temperature at the end of Test Sequence 9 was -12⁰ F with a chamber temperature of 55⁰ F. Personnel were in the chamber for a period of 45 minutes continuously to conduct Test Sequences 8 and 9. Instrumentation of these test sequences was not required.

Test Sequence 10, Fed-Std-101, Method 5012, Pendulum-Impact Test, -25⁰ F temperature.

The container and fins (Figure 16.) were conditioned at -25⁰ F for 2 hours after Test Sequence 9. The container impact velocity was 7 feet per second; the height of the drop was 9 inches. The side impact sequence was 6, then 5, then 2, and finally 4. Visual inspection revealed no major external damage to the container such as weld cracks. Latches remained closed during the impacts.

The base cushion temperature was measured with a temperature probe inserted through the desiccant port. Cushion temperature at the start of the sequence was -25⁰ F with a chamber temperature of -25⁰ F. Cushion temperature at the end of the sequence was -5⁰ F. Instrumentation of this test sequence was not required.

The container cover was taken off after Test Sequence 9. The two polyethylene cover cushions remained on the fins. Visual inspection of these as tested, prototype cover cushions revealed an adhesive bond break between polyethylene sidewall pieces of the tray. This occurred in the a-b area of fin 6, near the desiccant port. Cracks were noted in the polypropylene load spreaders in the b-c area of fin 3 and the d-a area of fin 6. Chips of polypropylene load spreader were missing in the a-b and b-c areas of fin 1; the a-b, c-d, and d-a areas of fin 2; the d-a area of fin 3; and the c-d area of fin 4.

The sidewall of the polyethylene base had pulled away from the inner aluminum container sidewall. The test results for the aluminum portion of the container were acceptable.

Test Sequences 11, MIL-STD-648A, 5.9, Forklift Truck Compatibility Test, Fed-Std-101C, Method 5011.1, Mechanical Handling Test, 6.2, 6.5, 6.6, ambient temperature.

Handling The forklift course used 1 x 4 inch boards. Forklift entry (Figure 17.) was tested on Side 6 and Side 2. The container bounced, but remained stable while riding on the forklift tines. The results of this test were acceptable.

Pushing The forklift pushed the container (Figure 18.) on Side 6 and Side 4. Visual inspection of the skids revealed no functional damage to the container. The results of this test were acceptable.

Towing The forklift towed the container (Figure 19.) on Side 6 and Side 4 utilizing the tie-down rings. Visual inspection of the skids revealed no functional damage to the container. The results of this test were acceptable.

Test Sequence 12, SP919450, 4.2.1.2.2.2, Hand Pallet Truck, ambient temperature.

Container Side 6 (Figure 20.) was fully engaged and lifted by the hand pallet truck. Container Side 4 (Figure 21.) and Side 3 could not be engaged by the hand pallet truck. The clear distance (Figure 22.) between the hand pallet truck tines is 7 3/4 inches. The distance between the container skid forkwells is 10 1/4 inches. SP919450 does not require 4-way entry by hand pallet truck. This portion of the test was completed and is reported as engineering information only. The results of the test were acceptable.

Test Sequence 13, Examination.

A detailed inspection of the container, as tested, was made. Weld break-out was noted on the weld seam located on Side 6, 10 1/4 inches from Edge 2-6 and 19 inches from the bottom of the skids. Weld break-out was also noted on the weld seam located on

Side 4, 11 1/2 inches from Edge 6-4 and 19 inches from the bottom of the skids. In both cases, container integrity was not compromised.

The bottom of the skid (Figure 23.) on Corner 4-5-3, 3 3/4 inches from the end was dented. This did not affect container functionality.

Test Sequence 14, Fed-Std-101C, Method 5009.1, Leaks in Containers, 6.2, Pneumatic Pressurization Technique.

The CNU-502/E container with six fins incurred a leak rate of 0.01 psi (0.278 in. H₂O) for 30 minutes (0.020 psi per hour) when pressurized to 1.994 psig (55.4 in. H₂O) internal pressure. The CNU-502/E container complies with the requirement that the maximum leak rate shall not exceed 0.04 psig per hour.

Test Sequence 15, MIL-STD-648A, 5.3.2, Resonance Strength and Dwell Test, Partial Load, ambient temperature.

The Side 2 (starboard) Number 5 fin, instrumented with a single axis piezoelectric accelerometer in area a-b remained in the container (Figure 24.) while all other fins were removed. The fin cover cushion was placed on the fin. The other cover cushion was placed on its side diagonally on the base cushion.

The container was rigidly attached to the vibration platform. A sinusoidal vibration excitation was applied in a vertical direction and cyclically swept for 7.5 minutes at 2 minutes per octave to locate the resonant frequency. Input from 5 to 12.5 Hz was at 0.125 inch double amplitude and input from 12.5 to 50.0 Hz was at 1.0 G. A 30 minute dwell test was conducted at the resonant frequency.

Visual inspection revealed no damage either to the container or the fin. The fin was adequately constrained by the cover and base cushion. The cover cushion on the fin did not shift or move in the container. The cover cushion on the base cushion did not shift or move. A maximum of 2.79 G_{pp} output was obtained at the resonant frequency of 11.3 Hz. The maximum transmissibility obtained was 1.39. Performance requirements were not stated in the Test Plan.

Test Sequence 16, MIL-STD-648A, 5.5.2, Structural Integrity Test.

The loaded CNU-502/E container was pressurized to +2.538 psig (70.5 in. H₂O) for 5 minutes. Pressure remained constant throughout the test. Slight bowing of the container top was noted. The container was then depressurized to a vacuum of -1.0076 psig (-27.9 in. H₂O) for 5 minutes. Vacuum held throughout the test. Post-test inspection indicated that the container incurred no failure of closure latches or gasket, damage to, or permanent deformation of, the container or contents. The CNU-502/E container complies with the performance requirement

implied by 5.5.2.

CONCLUSIONS

The CNU-502/E container provided protection for the BSU-93/B, air inflatable retarders (fins) when tested in accordance with the container test plan.

RECOMMENDATIONS

One flat forklift handle on the container cover was bent during shipment.

The stamped aluminum side panels may lower resonance frequencies.

AFPEA's opinion is that the requirement to remove the cover tray cushions from the container cover is a time consuming process. A forklift greatly simplifies the process to position and lower the cover steadily to prevent cushion dislocation during closure. Repeated cushion insertion and removal during the life of the container may result in cushion wear that would not properly retain the fins. A self-guiding (locating) cushion attached to the cover could alleviate this problem.

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APPENDIX 1
TEST PLAN

YJEM TEST PROCEDURES
BSU-93/B
SHIPPING AND STORAGE CONTAINER (CNU-502/E)

1.0 OBJECTIVE

The objective of these tests is to qualify the CNU-502/E container for shipping and storage of the BSU-93/B retarder. The purpose is to test for conformance to those requirements listed in the Container Development Specification SP919450 whose verification method is listed as test.

2.0 DESCRIPTION

The container is a welded-aluminum, controlled-breathing style with a removable cover. It is designed to hold six BSU-93/B retarders. Shock and vibration isolation is provided by polyethylene foam cushions. The container envelope dimensions are 54.5 inches long X 37.0 inches wide X 47.0 inches high and will have a gross weight of 835 pounds (estimated).

3.0 PASS/FAIL CRITERIA

The pass/fail criteria for the following tests will be in accordance with the referenced test method, (see Table I), unless otherwise specified.

4.0 TEST SEQUENCE NUMBER AND DESCRIPTIONN

Unless otherwise specified, the sequence of the tests will be conducted as presented in Table I. The YJEM test engineer may authorize deviations to expedite the test series. (This revised test plan reflects these changes).

5.0 INSTRUMENTATION

The retarders will not be instrumented except to determine resonant frequency. Visual and audio methods will be used to determine areas of critical response.

6.0 TEST FACILITY AND REPORT

The tests, as listed in Table I, will be conducted by the Air Force Packaging Evaluation Agency (AFPEA), Wright-Patterson Air Force Base OH. Test facilities shall be approved by and tests witnessed by YJEM personnel. A test report will be prepared and submitted to the Packaging Engineering Division (YJEM), Eglin AFB FL within 30 days after test completion. The report will contain, but is not limited to, tests conducted, criteria, test set-up (with photographs or illustrations, as appropriate), test conditions, and pass/fail analysis (with photographs, as appropriate).

TABLE I
YJEM TEST SEQUENCE NUMBER AND DESCRIPTION

SEQ. NO.	DESCRIPTION	STD	METHOD/ PARA.	⁰ F
1	LEAK TEST - Pressurize to 2.0 psig and monitor loss for 15 minutes. The pressure monitor must have an accuracy of at least ± 0.005 psig. If no loss, terminate test. If loss, continue for a total time of 60 min. Total loss cannot exceed .04 psig. (2%)	FTMS-101C	5009.3 6.2	AMB
2	VIBRATION - Sweep from 5-50 Hz. conduct a 30 min. dwell at peak resonance. (Vertical axis only).	MIL-STD-648A	5.3.2	AMB
3	LEAK TEST - Same conditions as Test No. 1.	FTMS-101C	5009.3 6.2	AMB
4	SUPERIMPOSED-LOAD TEST - Load container to 3750 lbs and allow to stand for 5 minutes.	FTMS-101C	5016.1	AMB
5	HANDLE COVER - Place 150 lbs (est) on cover and suspend using handles for 5 minutes.	MIL-STD-648A	4.17.2.1	AMB
6	FORKLIFT HANDLES - Place 150 lbs (est) on cover and suspend using forklift handles for 5 minutes.	SP919450	4.2.2.2.5.1	AMB
7	LEAK TEST - Same conditions as Test No. 1.	FTMS-101C	5009.3 6.2	AMB
8	CORNERWISE DROP TEST - All four corners at 24 in. Level A protection.	FTMS-101C	5005.1	-20 ⁰ +0 ⁰ -10 ⁰
9	EDGEWISE DROP TEST - All four edges at 24 in. Level A protection.	FTMS-101C	5008.1	-20 ⁰ +0 ⁰ -10 ⁰

TABLE I (cont'd)

YJEM TEST SEQUENCE NUMBER AND DESCRIPTION

SEQ. NO.	DESCRIPTION	STD	METHOD/ PARA.	⁰ F
10	PENDULUM IMPACT TEST - All four sides at 7 ft per second.	FTMS-101C	5012	-20 ⁰ +0 ⁰ -10 ⁰
11	FORKLIFT HANDLING TEST - Fully loaded container.	MIL-STD-648A	5.9	AMB
12	HAND PALLET TRUCK - Transport 25 feet with two 90 ⁰ turns.	SP919450	4.2.1.2.2.2	AMB
13	EXAMINATION - Inspect container and contents for damage.	N/A	N/A	N/A
14	LEAK TEST - Same conditions as Test No. 1.	FTMS-101C	5009.3 6.2	AMB
15	PARTIAL LOAD TEST - Place one fin in middle position on port side. Conduct vibration test as in No. 2.	MIL-STD-648A	5.3.2	AMB
16	STRUCTURAL INTEGRITY TEST - Apply a pressure of +2.5 psig and then vacuum -1.0 to the container.	MIL-STD-648A	5.5.2	AMB

APPENDIX 2
FIGURES



Figure 1. CNU-502/E Container.

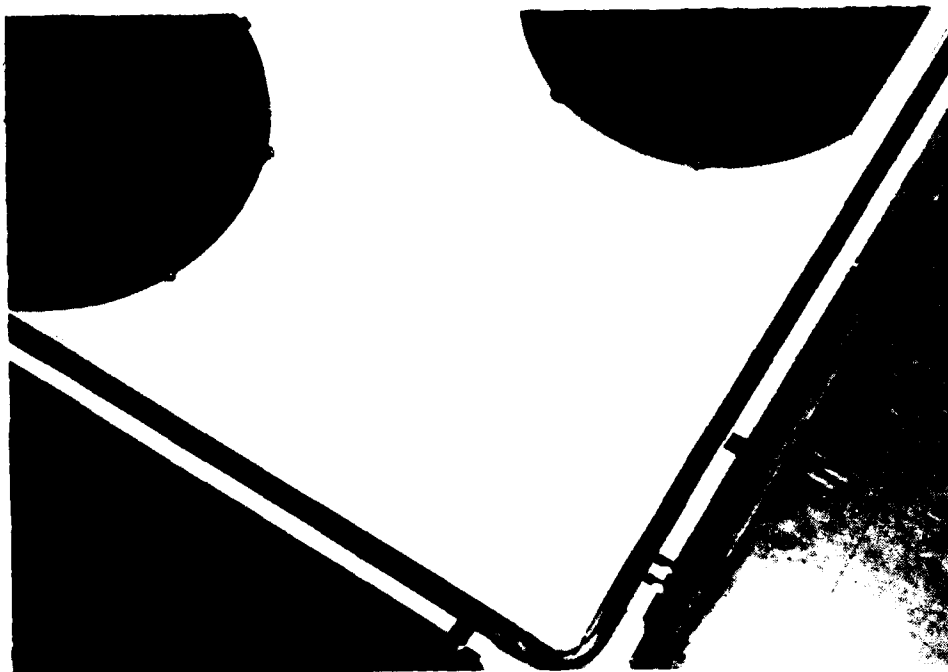


Figure 2. Polyethylene Base Cushion and Disk to Constrain Forward End of Fin.

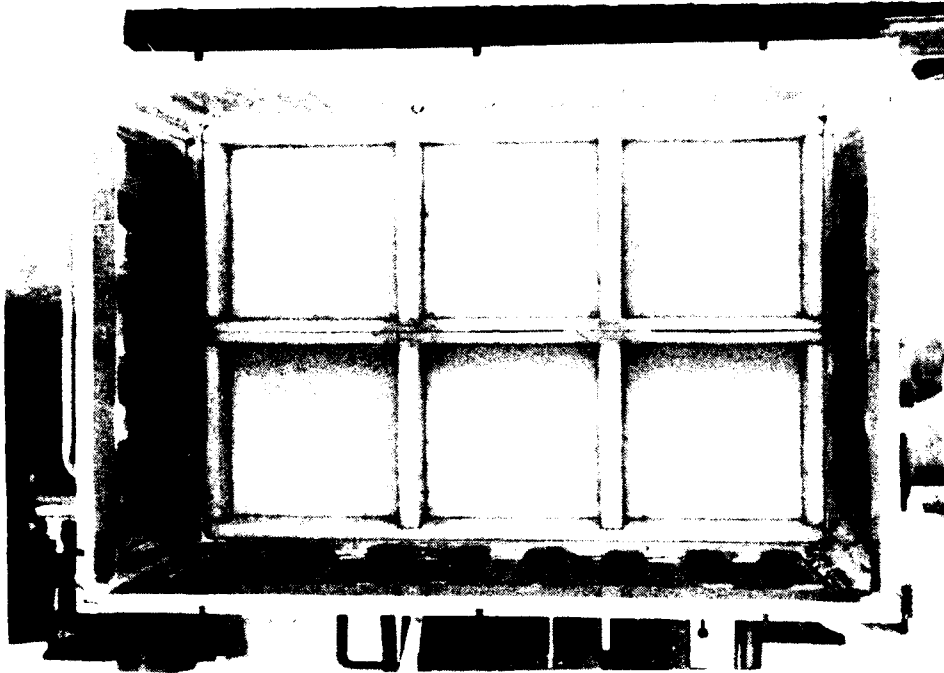


Figure 3. Polyethylene Cover Cushions in Container Cover.

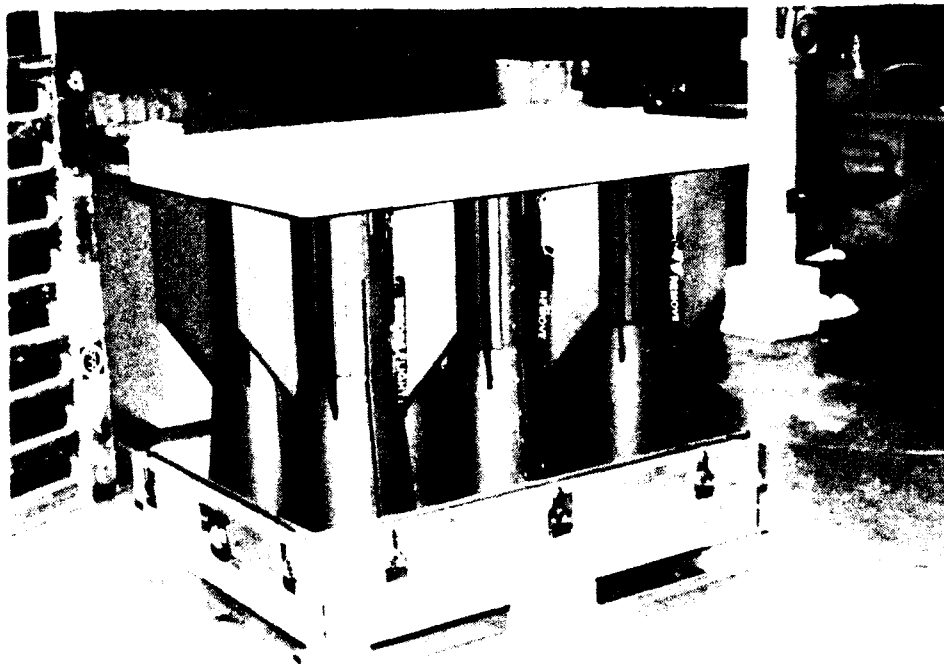


Figure 4. Cover Cushions to Constrain Aft End of Fin. (Removed from Container Lid.)

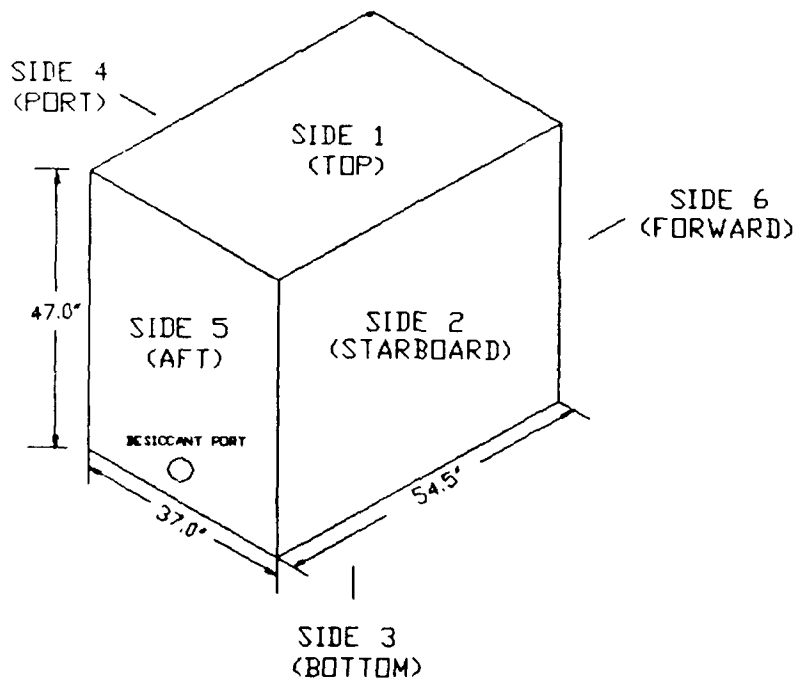


Figure 5. CNU-502/E Container Side Designations.

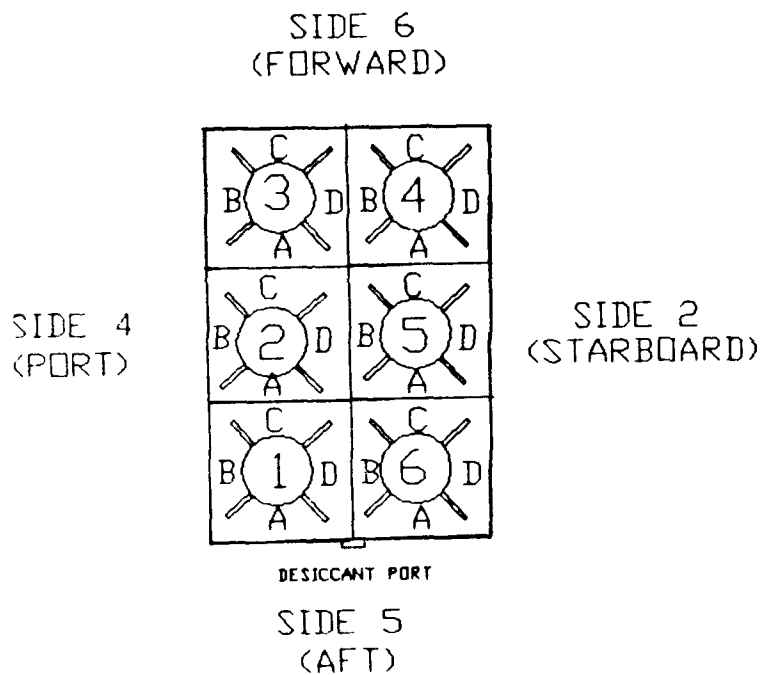


Figure 6. Fin Location and Designation in Container.



Figure 7. Accelerometer Location on Fin.

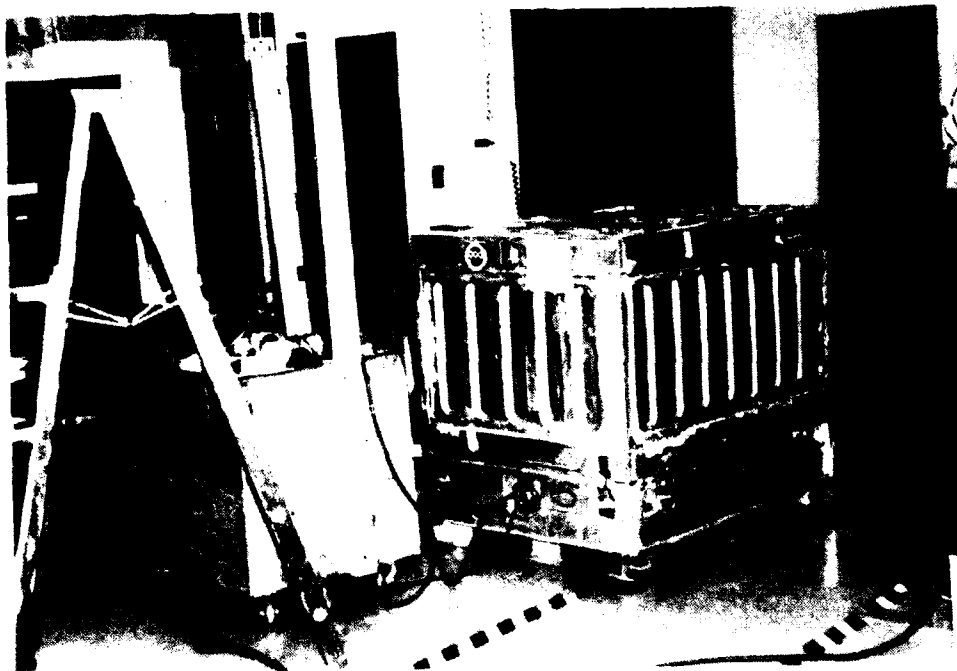


Figure 8. Leak Test and Structural Integrity Test, MIL-STD-648A, 5.5.2, Fed-Std-101C, Method 5009.1.

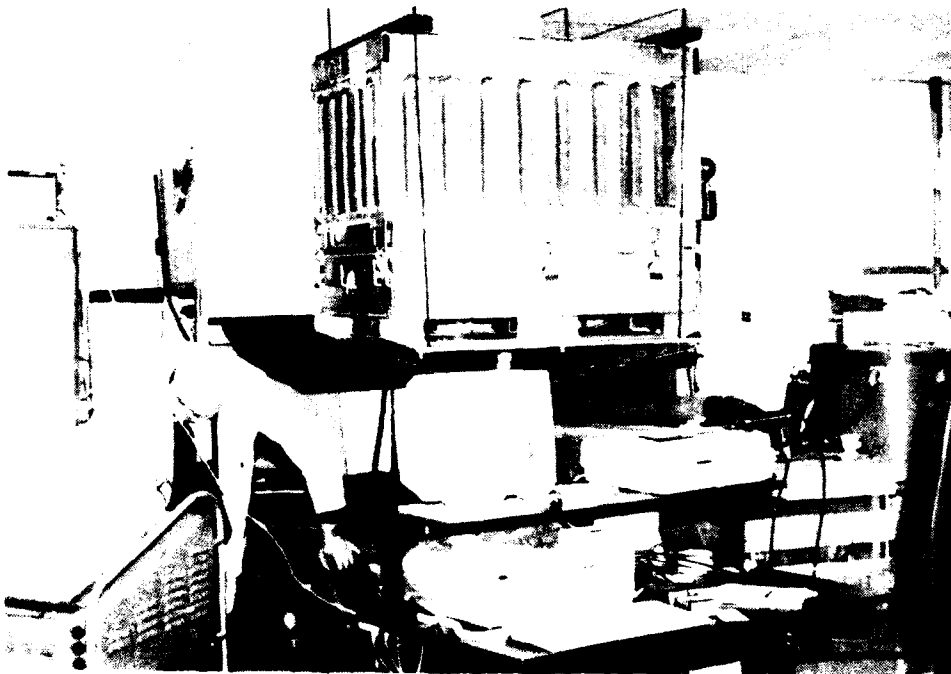


Figure 9. Resonance Strength and Dwell Test,
Vertical Axis, MIL-STD-648A, 5.3.2.

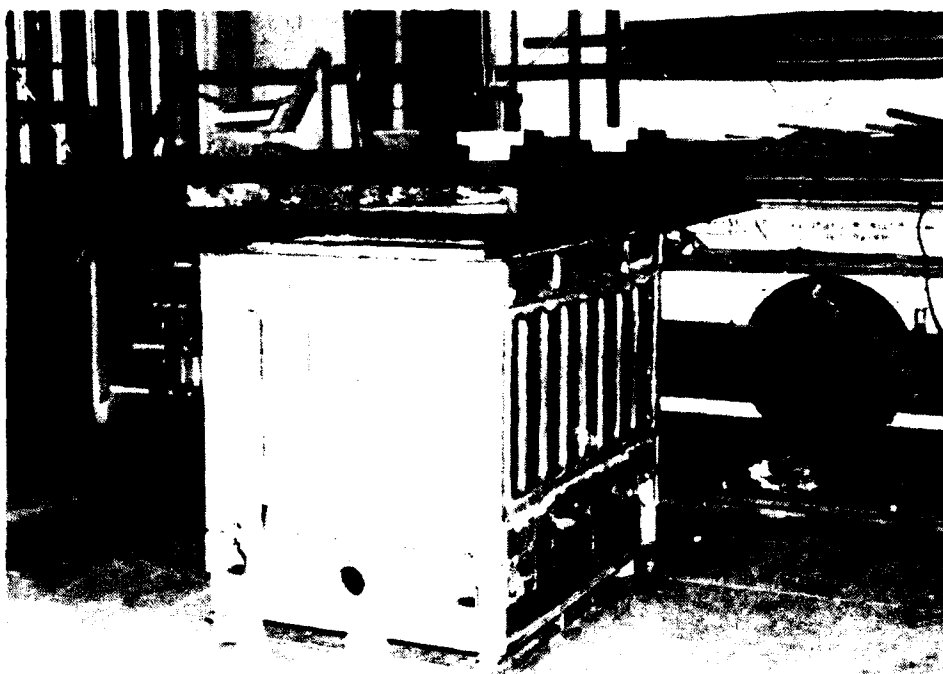


Figure 10. Superimposed Load Test,
Fed-Std-101C, Method 5016.1.

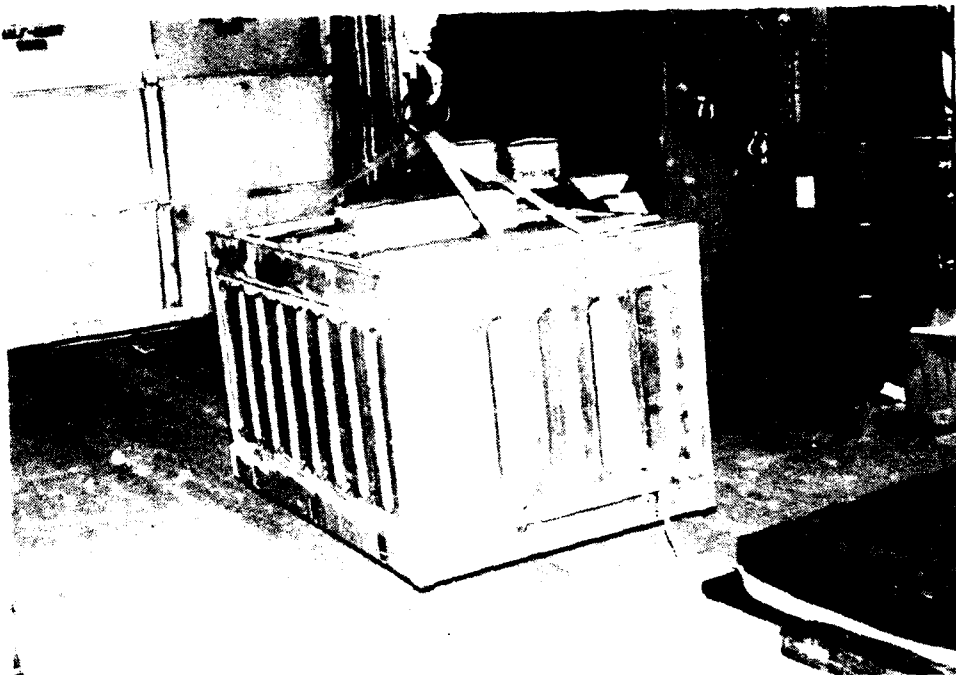


Figure 11. Handle Characteristics,
MIL-STD-648A, 4.17.2.1.

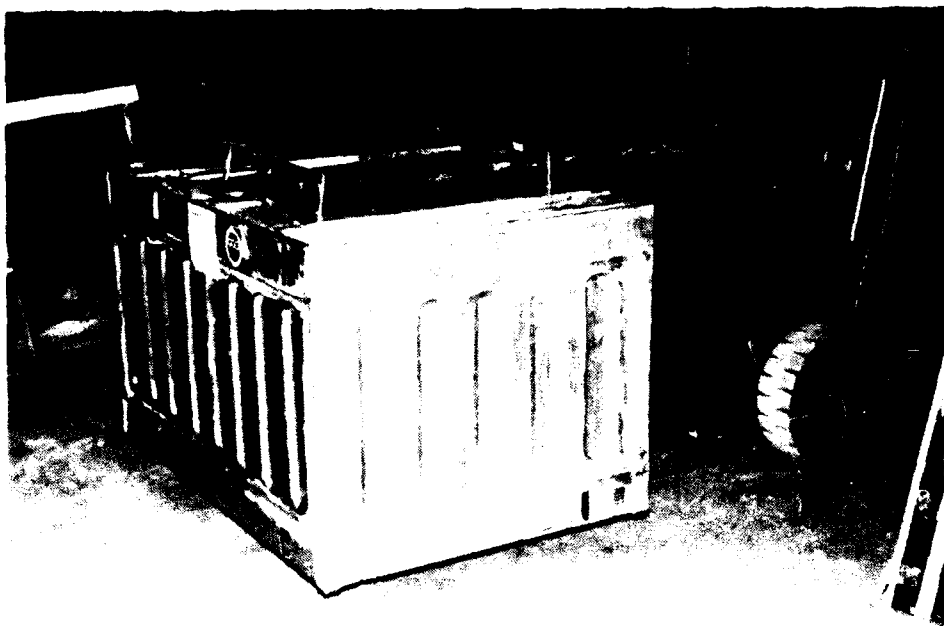


Figure 12. Forklift Handles,
SP919450, 4.2.2.2.5.1.

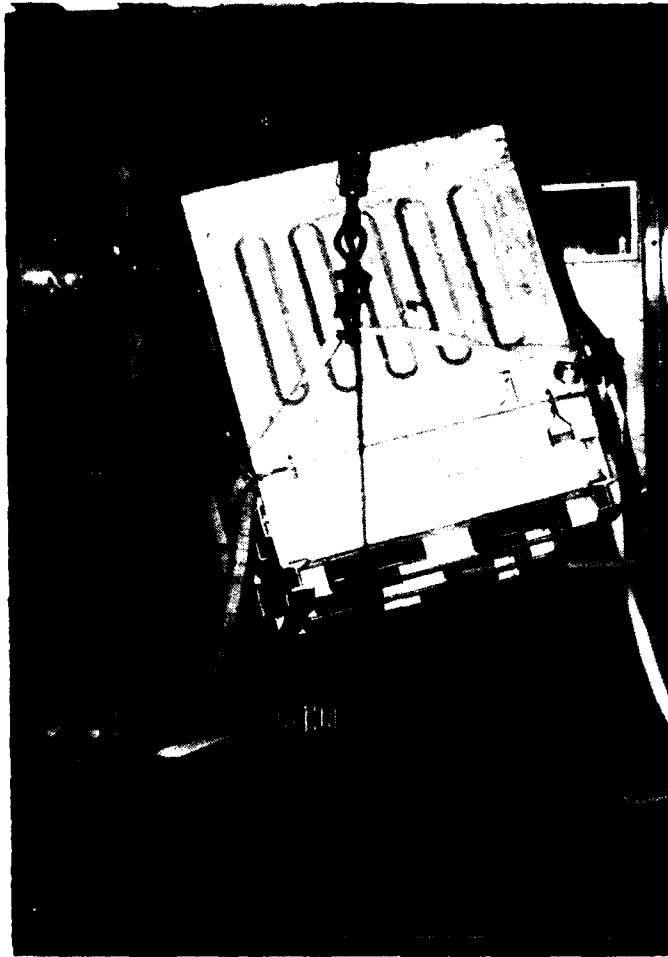


Figure 13. Cornerwise-Drop Test -25° F,
Fed-Std-101, Method 5005.1.

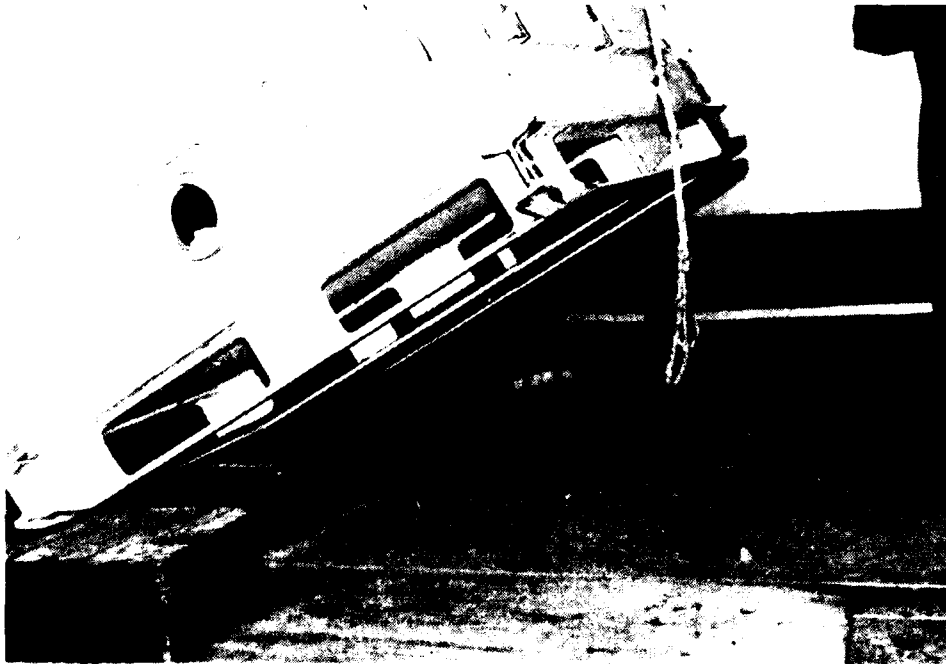


Figure 14. Edgewise-Drop Test -25° F,
Fed-Std-101, Method 5008.1.

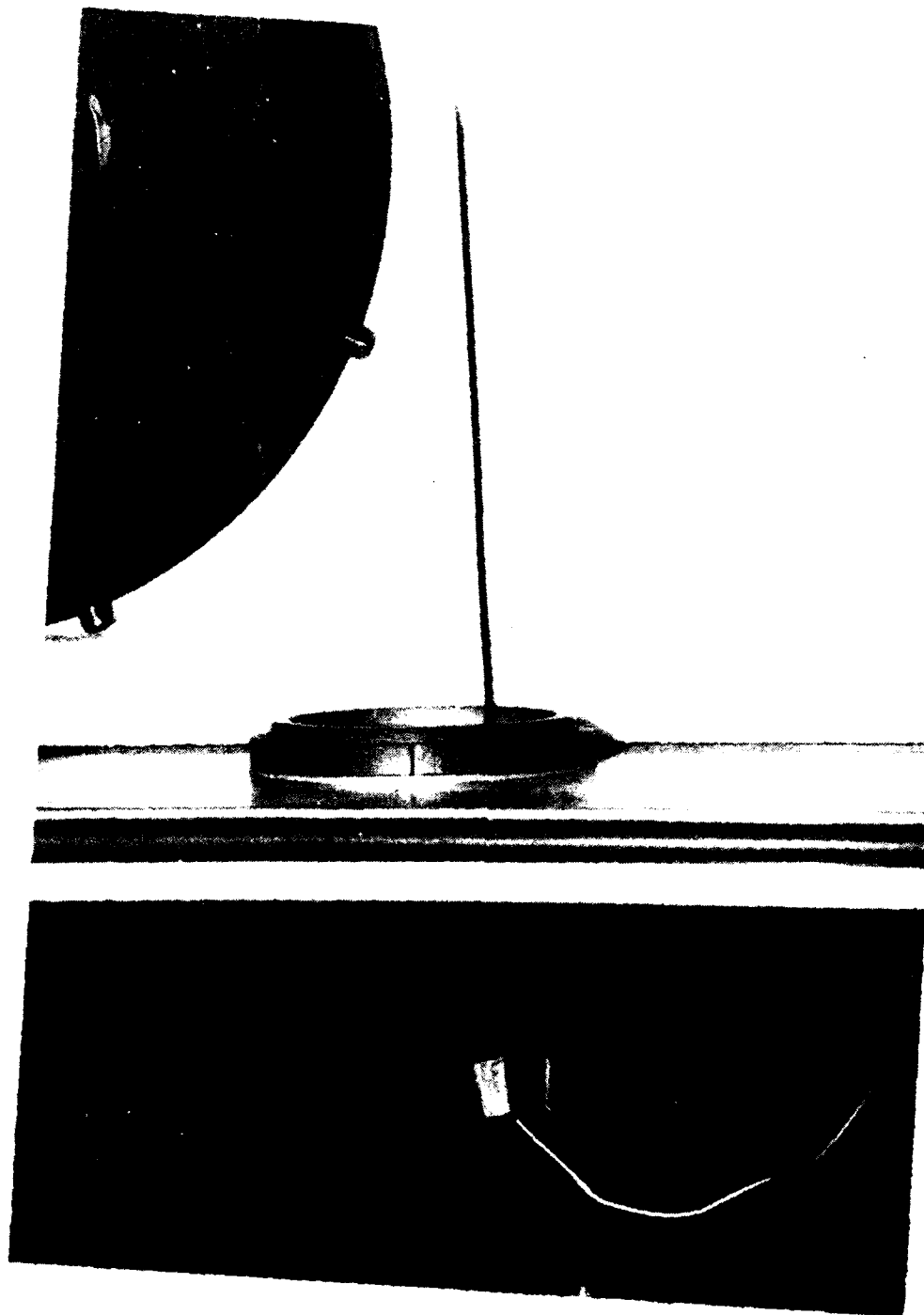


Figure 15. Temperature Probe Location - Base Cushion

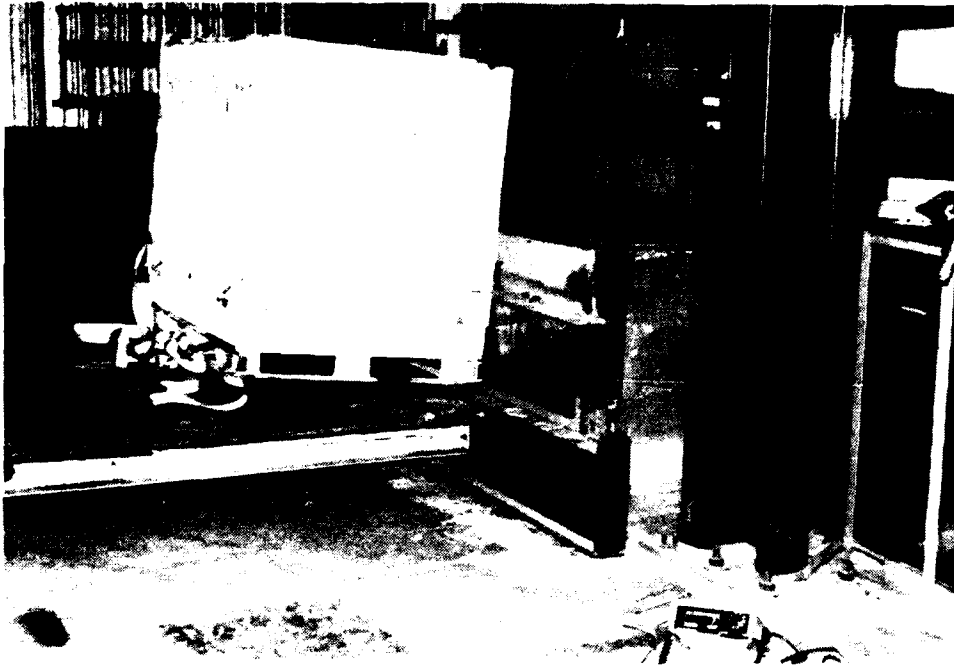


Figure 16. Pendulum-Impact Test, -25° F,
Fed-Std-101, Method 5012.



Figure 17. Forklift Handling - Handling,
MIL-STD-648A, 5.9, Fed-Std-101C, Method 5011.1.



Figure 18. Forklift Handling - Pushing,
MIL-STD-648A, 5.9, Fed-Std-101C, Method 5011.1.



Figure 19. Forklift Handling - Towing,
MIL-STD-648A, 5.9, Fed-Std-101C, Method 5011.1.

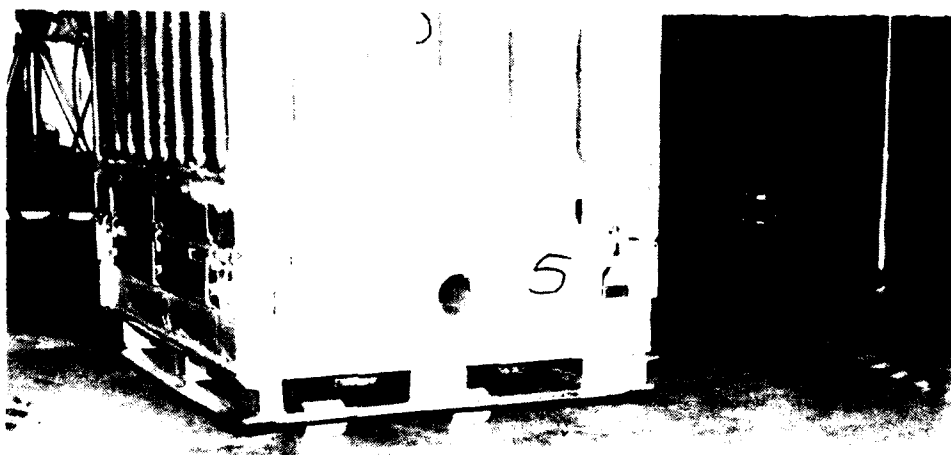


Figure 20. Hand Pallet Truck,
SP919450, 4.2.1.2.2.2.



Figure 21. Hand Pallet Truck,
SP919450, 4.2.1.2.2.2.

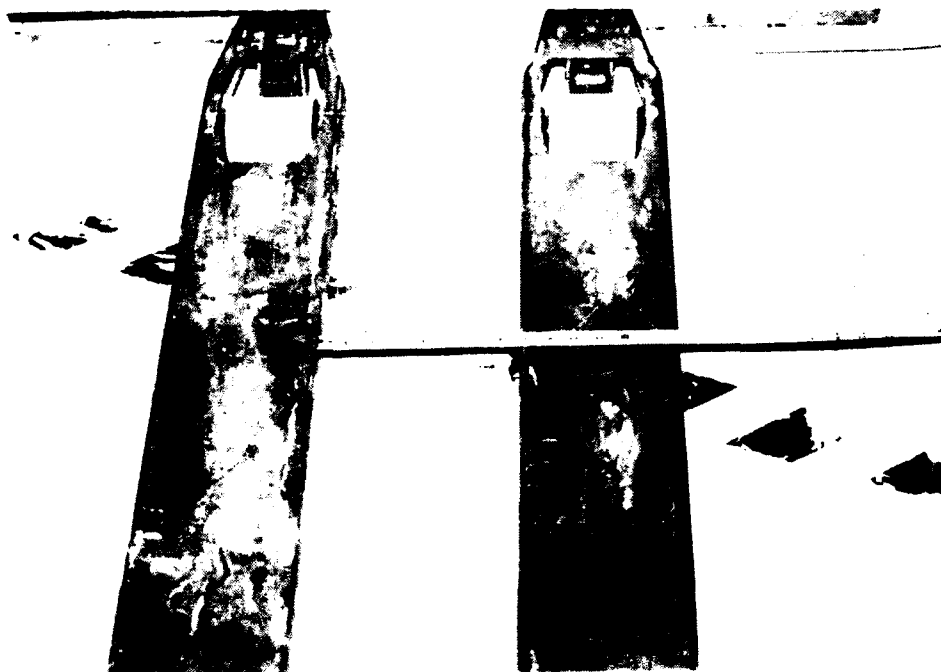


Figure 22. Hand Pallet Truck Tine Spread



Figure 23. Examination - Skid Damage



Figure 24. Resonance Strength and Dwell Test,
Partial Load, MIL-STD-648A, 5.3.2.

APPENDIX 3
TEST DATA

Test Sequence 1, Fed-Std-101C, Method 5009.1, Leaks in Containers, 6.2, Pneumatic Pressurization Technique.

Test Time Minutes	Test Pressure In Water	(psig)	Leak Rate Psi Per Hour
00	55.42	1.9951	- - - -
15	55.43*	1.9955	- - - -

*Pressure increase due to room temperature change.

Test Sequence 2, MIL-STD-648A, 5.3.2, Resonance Strength and Dwell Test, ambient temperature.

Sample	Table Input				Resonant Reponse	
	Time Min	Freq Hz	Disp In DA	Accel G _{pp}	Accel G _{pp}	Trans
1	1:30	11.2	0.125	1.84	2.57	1.40
2	5:45	11.2	0.125	1.44	1.95	1.35
3	14:35	11.2	0.125	1.75	2.06	1.18
4	27:30	11.2	0.125	1.74	2.00	1.15

Note: Prior to resonance dwell, the vertical axis was swept over the frequency range 5-50 Hz at a rate of 2 minutes per octave for 7.5 minutes with an input of 0.125 inches DA from 5 to 12.5 Hz and 1.0 G_p from 12.5 to 50 Hz.

Waveform Test Report

GHI SYSTEMS, INC. TRIAD CAT SYSTEM

Date : 5 Nov 1991
 TEST ITEM : CNU-502/E Container
 IMPACT LOC. : CNU502E 5Nov91 1:30

TEST ENGINEER : Vossler/Finsinger
 TEST TYPE : Transmissibility
 TEST MACHINE : Electro-Hydraulic

Sensitivity:

1. 1: 1.25 g's/Div
 1. 2: 1.00 g's/Div

Filter:

1. 1: 130 Hz

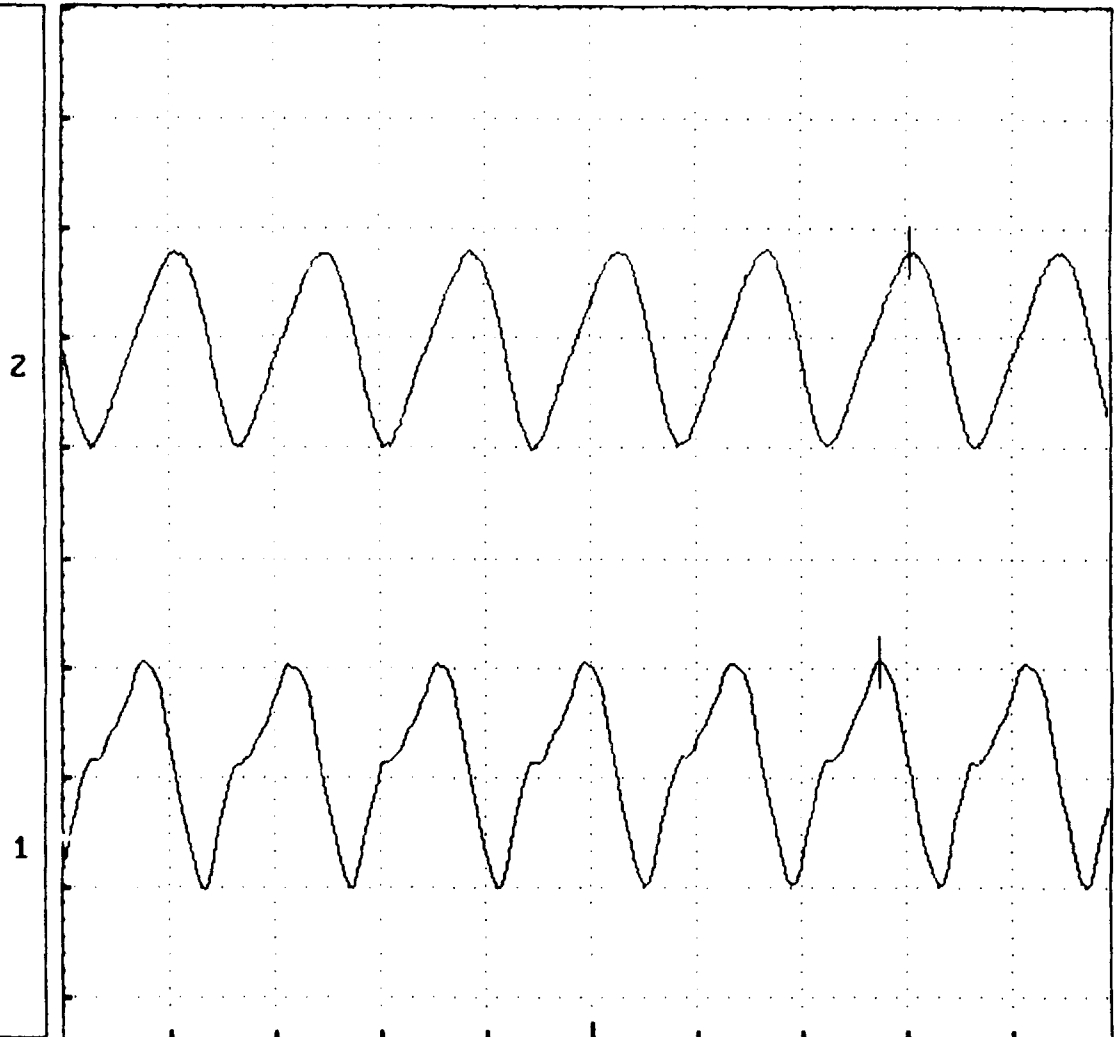


Fig. Ch. : ALL
 Polarity : Window
 Level : 0.12 g's
 Mode : Single Event
 Retrigger : 1 %

CH	TIME	CUR AMP	PEAK AMP	1ST INT	2ND INT	TIME/DIV
1	1.46 S	2.57 g's	2.57 g's	274.72 In/s		64 mS
2	1.47 S	1.81 g's	1.84 g's	187.99 In/s		64 mS

Remarks

CNU-502/E Container - Full Load Test
 MIL-STD-648, 5.3.2, Resonance Strength and Dwell Test, ambient temperature
 Response: Ch 1 - Fin, CH 2 - Input. Frequency: 11.2 Hz.
 Time: 1 min. 30 sec., after start of Resonance Dwell.

Waveform Test Report

GHI SYSTEMS, INC. TRIAD CAT SYSTEM

Date : 5 Nov 1991
 TEST ITEM : CMU-502/E Container
 IMPACT LOC. : CMU502E 5Nov91 5:45

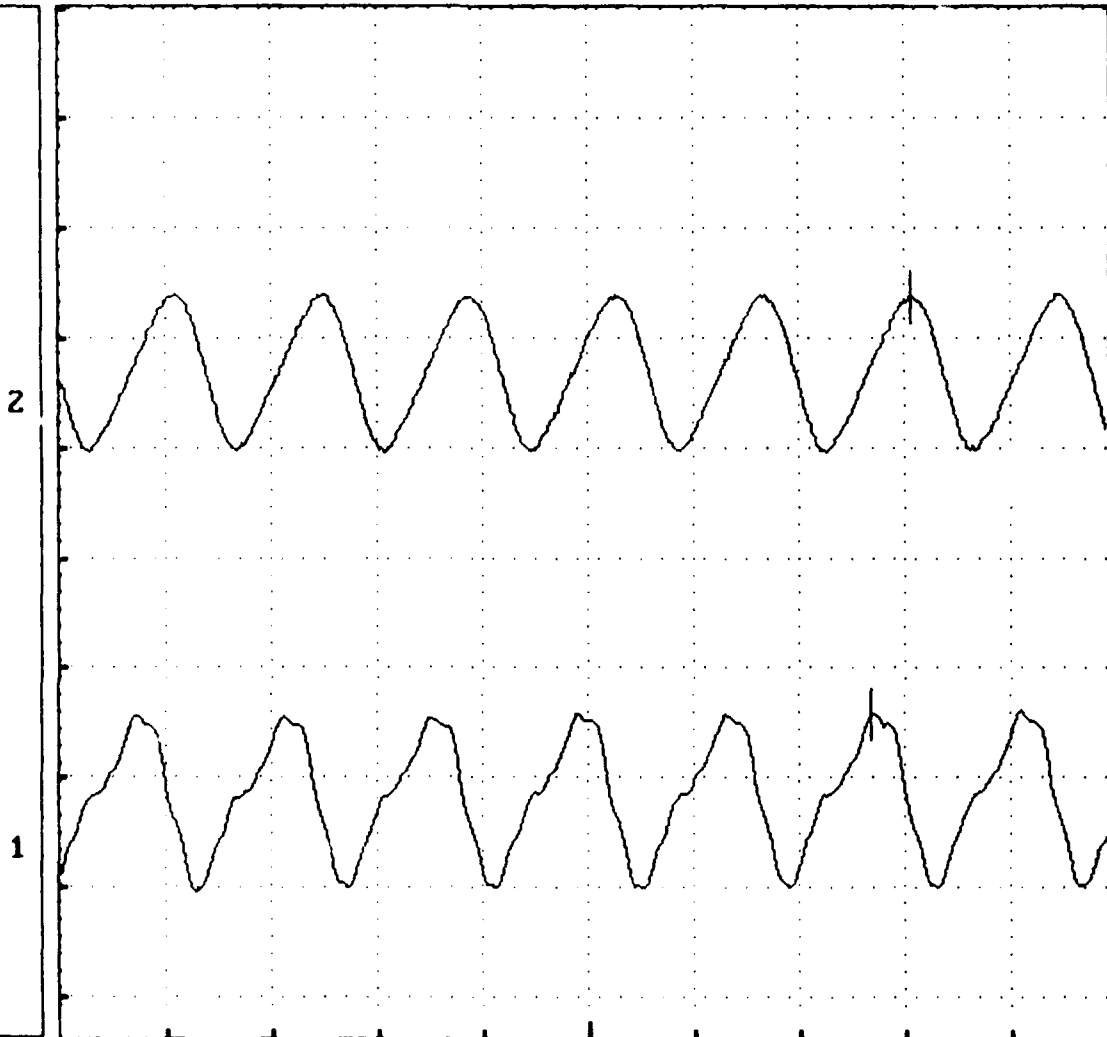
TEST ENGINEER : Vossler/Filsinger
 TEST TYPE : Transmissibility
 TEST MACHINE : Electro-Hydraulic

Sensitivity:

1: 1.25 g's/Div
 2: 1.00 g's/Div

Trigger:

1: 130 Hz



sig. Ch. : ALL
 Clarity : Window
 vel : 0.12 g's
 de : **Single Event**
 trigger : 1 %

CH	TIME	CUR AMP	PEAK AMP	1ST INT	2ND INT	TIME/DIV
1	1.45 S	1.95 g's	1.95 g's	193.70 In/s		64 mS
2	1.48 S	1.40 g's	1.44 g's	140.90 In/s		64 mS

Remarks

CMU-502/E Container - Full Load Test
 MIL-STD-648, 5.3.2, Resonance Strength and Dwell Test, ambient temperature
 Response: CH 1 - Fin, CH 2 - Input. Frequency: 11.2 Hz.
 Time: 5 min. 45 sec., after start of Resonance Dwell.

Waveform Test Report

GHI SYSTEMS, INC. TRIAD CAT SYSTEM

Date : 5 Nov 1991
TEST ITEM : CMU-502/E Container
IMPACT LOC. : CMU502E 5Nov91 14:35

TEST ENGINEER : Vossler/Filsinger
TEST TYPE : Transmissibility
TEST MACHINE : Electro-Hydraulic

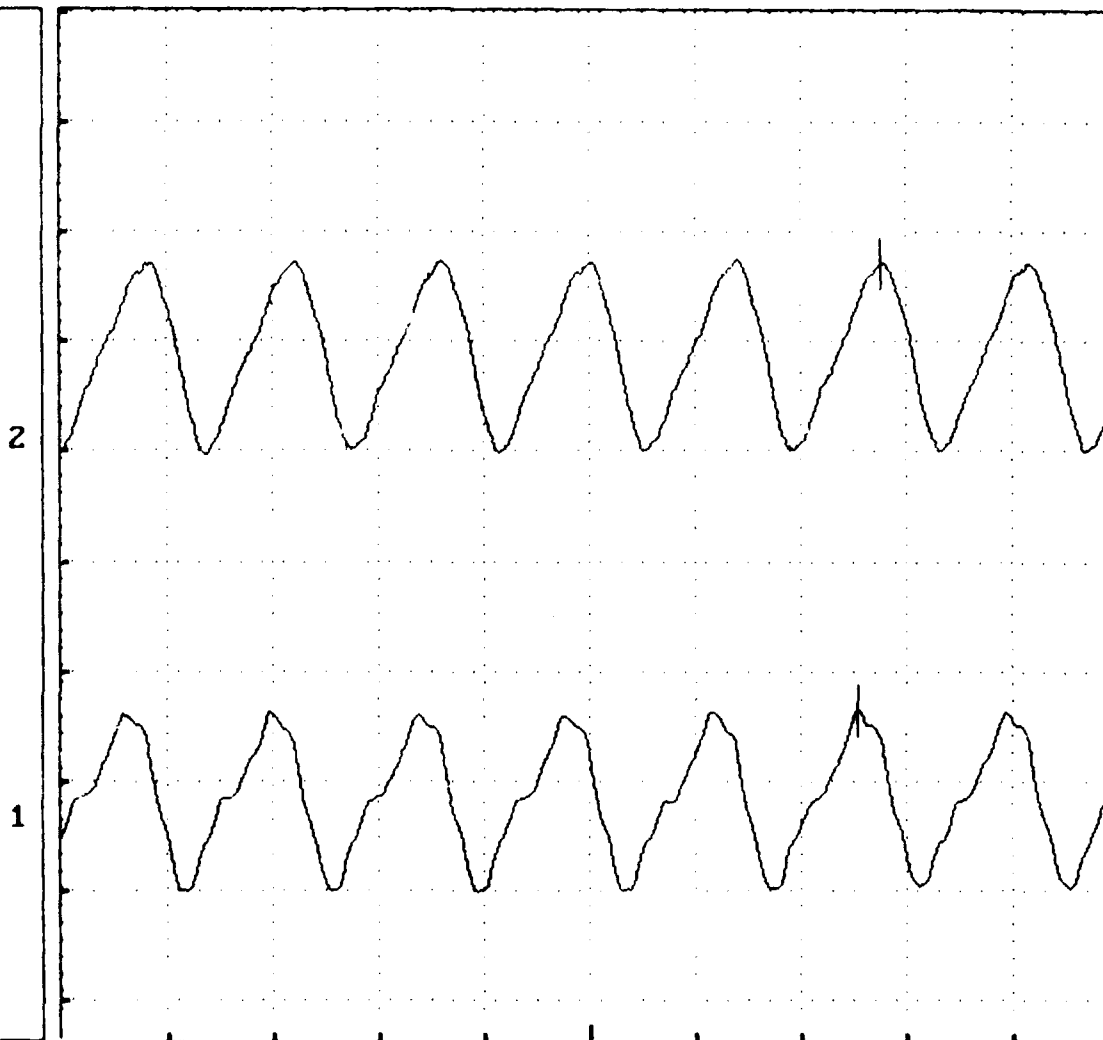
Sensitivity:

1: 1.25 g's/Div
2: 1.00 g's/Div

Filter:

1: 130 Hz

Fig. Ch. : ALL
Polarity : Window
Level : 0.12 g's
Mode : ~~Single~~ ~~Normal~~
Retrigger : 1 %



CH	TIME	CUR AMP	PEAK AMP	1ST INT	2ND INT	TIME/DIV
1	1.44 S	2.06 g's	2.06 g's	200.02 In/s		64 mS
2	1.46 S	1.71 g's	1.75 g's	172.12 In/s		64 mS

Remarks

CMU-502/E Container - Full Load Test
MIL-STD-648, 5.3.2, Resonance Strength and Dwell Test, ambient temperature
Response: CH 1 - Fin, CH 2 - Input. Frequency: 11.2 Hz.
Time: 14 min. 35 sec., after start of Resonance Dwell.

Waveform Test Report

GHI SYSTEMS, INC. TRIAD CAT SYSTEM

Date : 5 Nov 1991

TEST ENGINEER : Vossler/Filsinger

TEST ITEM : CMU-502/E Container

TEST TYPE : Transmissibility

IMPACT LOC. : CMU502E 5NOV91 27:30

TEST MACHINE : Electro-Hydraulic

sensitivity:

. 1: 1.25 g's/Div

. 2: 1.00 g's/Div

filter:

. 1: 130 Hz

2

1

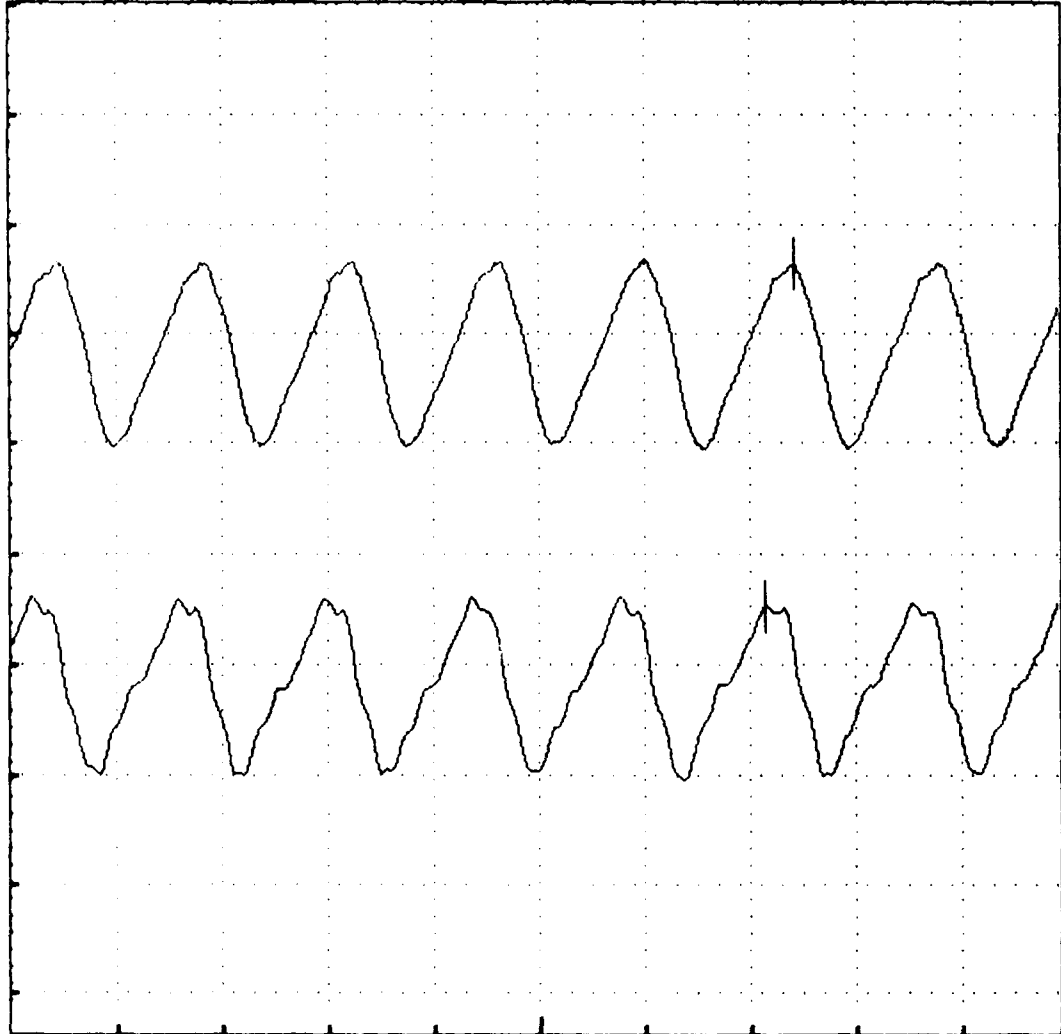
sig. Ch. : ALL

clarity : Window

vel : 0.12 g's

de : Single Event

trigger : 1 %



CH	TIME	CUR AMP	PEAK AMP	1ST INT	2ND INT	TIME/DIV
1	1.42 S	1.91 g's	2.00 g's	185.35 In/s		64 mS
2	1.43 S	1.68 g's	1.74 g's	166.55 In/s		64 mS

Remarks

CMU-502/E Container - Full Load Test

MIL-STD-648, 5.3.2, Resonance Strength and Dwell Test, ambient temperature

Response: CH 1 - Fin, CH 2 - Input. Frequency: 11.2 Hz.

Time: 27 min. 30 sec., after start of Resonance Dwell.

Test Sequence 3, Fed-Std-101C, Method 5009.1, Leaks in Containers, 6.2, Pneumatic Pressurization Technique.

Test Time Minutes	Test Pressure In Water (psig)		Leak Rate Psi Per Hour
00	55.42	1.9951	- - - -
15	55.38	1.9937	0.0058

Test Sequence 7, Fed-Std-101C, Method 5009.1, Leaks in Containers, 6.2, Pneumatic Pressurization Technique.

Test Time Minutes	Test Pressure In Water (psig)		Leak Rate Psi Per Hour
00	55.57	2.0005	- - - -
15	55.65*	2.0034	- - - -

*Pressure increase due to container warm-up, annex to test lab.

Test Sequence 14, Fed-Std-101C, Method 5009.1, Leaks in Containers, 6.2, Pneumatic Pressurization Technique.

Test Time Minutes	Test Pressure In Water (psig)		Leak Rate Psi Per Hour
00:00	55.4	1.994	- - -
15:00	55.19	1.986	0.0302
25:30	55.15	1.985	0.0211
30:00	55.12	1.984	0.0200

Test Sequence 15, MIL-STD-648A, 5.3.2, Resonance Strength and Dwell Test, Partial Load, ambient temperature.

Table Input					Resonant Reponse	
Sample	Time Min	Freq Hz	Disp In DA	Accel G _{pp}	Accel G _{pp}	Trans
1	2:40	11.3	0.125	2.07	2.63	1.27
2	6:00	11.3	0.125	2.04	2.70	1.32
3	13:22	11.3	0.125	2.01	2.79	1.39
4	29:00	11.3	0.125	1.99	2.76	1.39

Note: Prior to resonance dwell, the vertical axis was swept over the frequency range 5-50 Hz at a rate of 2 minutes per octave for 7.5 minutes with an input of 0.125 inches DA from 5 to 12.5 Hz and 1.0 G_p from 12.5 to 50 Hz.

Waveform Test Report

GHI SYSTEMS, INC. TRIAD CAT SYSTEM

Date : 7 Nov 1991
 TEST ITEM : CNU-502/E Container
 IMPACT LOC. : CNU502E 7Nov91 2:40

TEST ENGINEER : Vossler/Filsinger
 TEST TYPE : Transmissibility
 TEST MACHINE : Electro-Hydraulic

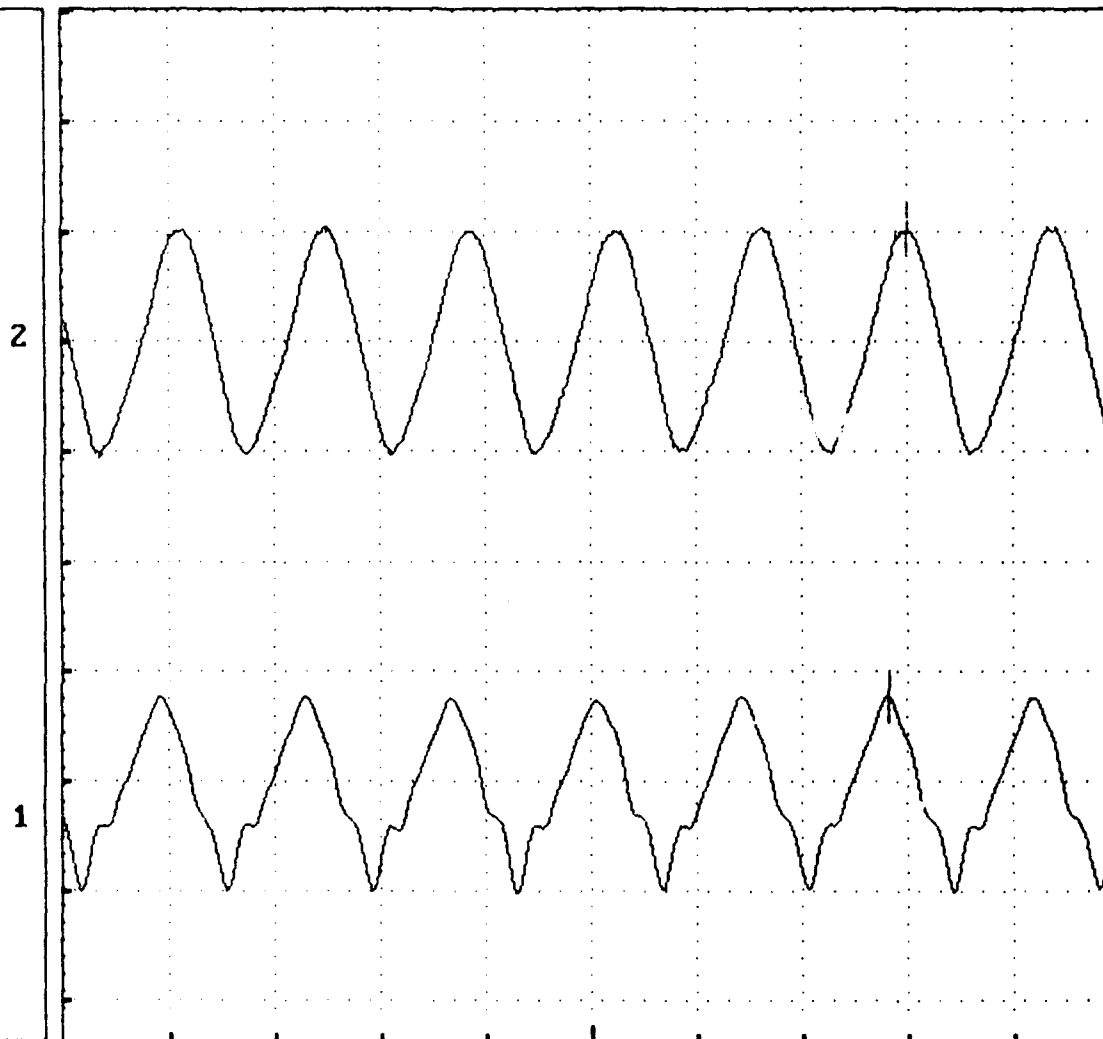
Sensitivity:

Ch. 1: 1.50 g's/Div
 Ch. 2: 1.00 g's/Div

Filter:

Ch. 1: 130 Hz

Trig. Ch. : ALL
 Polarity : Window
 Level : 0.07 g's
 Mode : Single Event
 Pretrigger : 1 %



CH	TIME	CUR AMP	PEAK AMP	1ST INT	2ND INT	TIME/DIV
1	1.46 S	2.62 g's	2.63 g's	266.59 In/s		64 mS
2	1.47 S	2.03 g's	2.07 g's	198.97 In/s		64 mS

Remarks

CNU-502/E Container - Partial Load Test
 MIL-STD-648, 5.3.2, Resonance Strength and Dwell Test, ambient temperature
 Response: CH 1 - Fin, CH 2 - Input. Frequency: 11.3 Hz.
 Time: 2 min. 40 sec., after start of Resonance Dwell.

Waveform Test Report

GHI SYSTEMS, INC. TRIAD CAT SYSTEM

Date : 7 Nov 1991
TEST ITEM : CMU-502/E Container
IMPACT LOC. : CMU502E 7Nov91 6:00

TEST ENGINEER : Vossler/Filsinger
TEST TYPE : Transmissibility
TEST MACHINE : Electro-Hydraulic

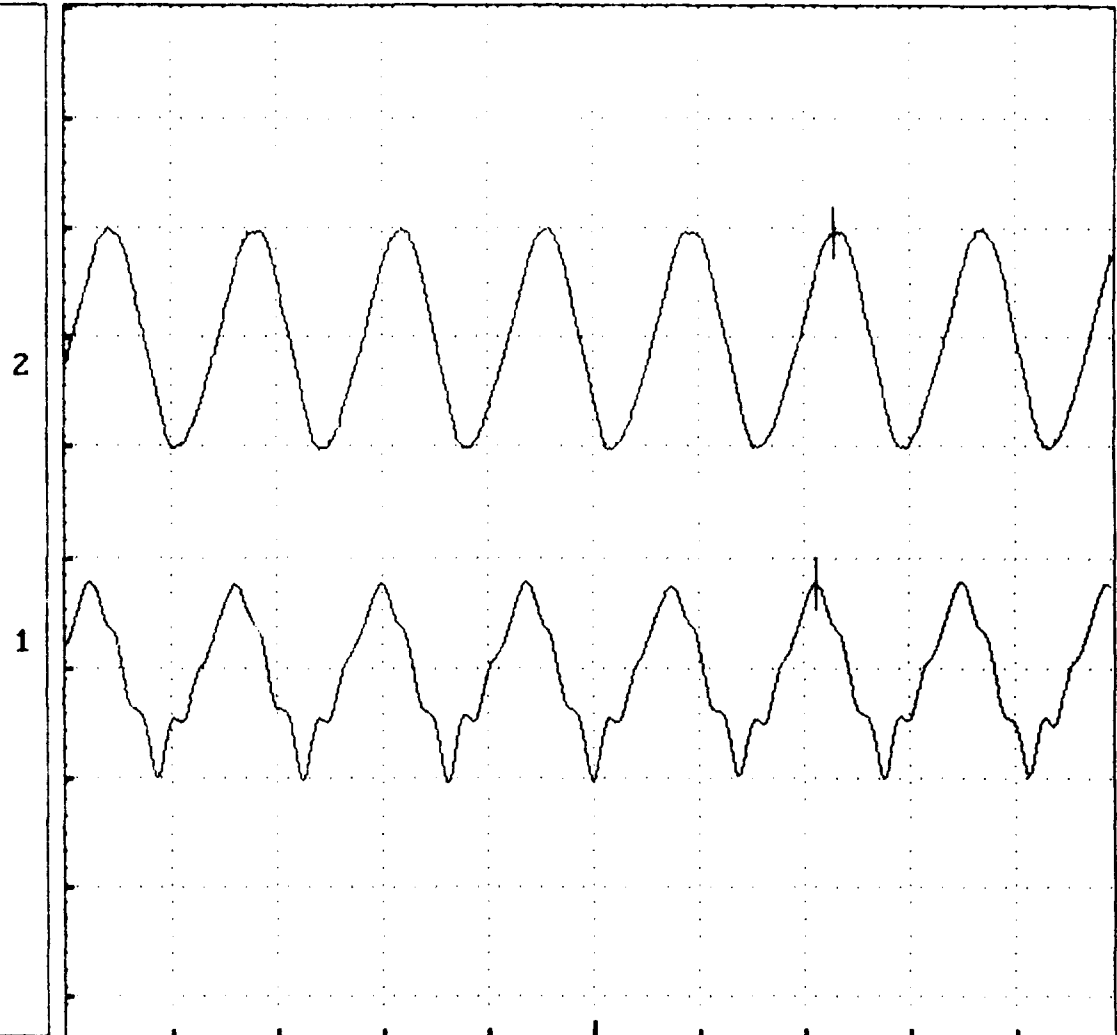
Sensitivity:

Ch. 1: 1.50 g's/Div
Ch. 2: 1.00 g's/Div

Filter:

Ch. 1: 130 Hz

Trig. Ch. : ALL
Polarity : Window
Level : 0.07 g's
Mode : **Single Event**
Pretrigger : 1 %



CH	TIME	CUR AMP	PEAK AMP	1ST INT	2ND INT	TIME/DIV
1	1.42 S	2.67 g's	2.70 g's	257.20 In/s		64 mS
2	1.43 S	1.99 g's	2.04 g's	186.79 In/s		64 mS

Remarks

CMU-502/E Container - Partial Load Test
MIL-STD-640, 5.3.2, Resonance Strength and Dwell Test, ambient temperature
Response: CH 1 - Fin, CH 2 - Input. Frequency: 11.3 Hz.
Time: 6 min., after start of Resonance Dwell.

Waveform Test Report

GHI SYSTEMS, INC. TRIAD CAT SYSTEM

Date : 7 Nov 91
TEST ITEM : CMU-502/E Container
IMPACT LOC. : CMU502E 7Nov91

TEST ENGINEER : Vossler/Filsinger
TEST TYPE : Transmissibility
TEST MACHINE : Electro-Hydraulic

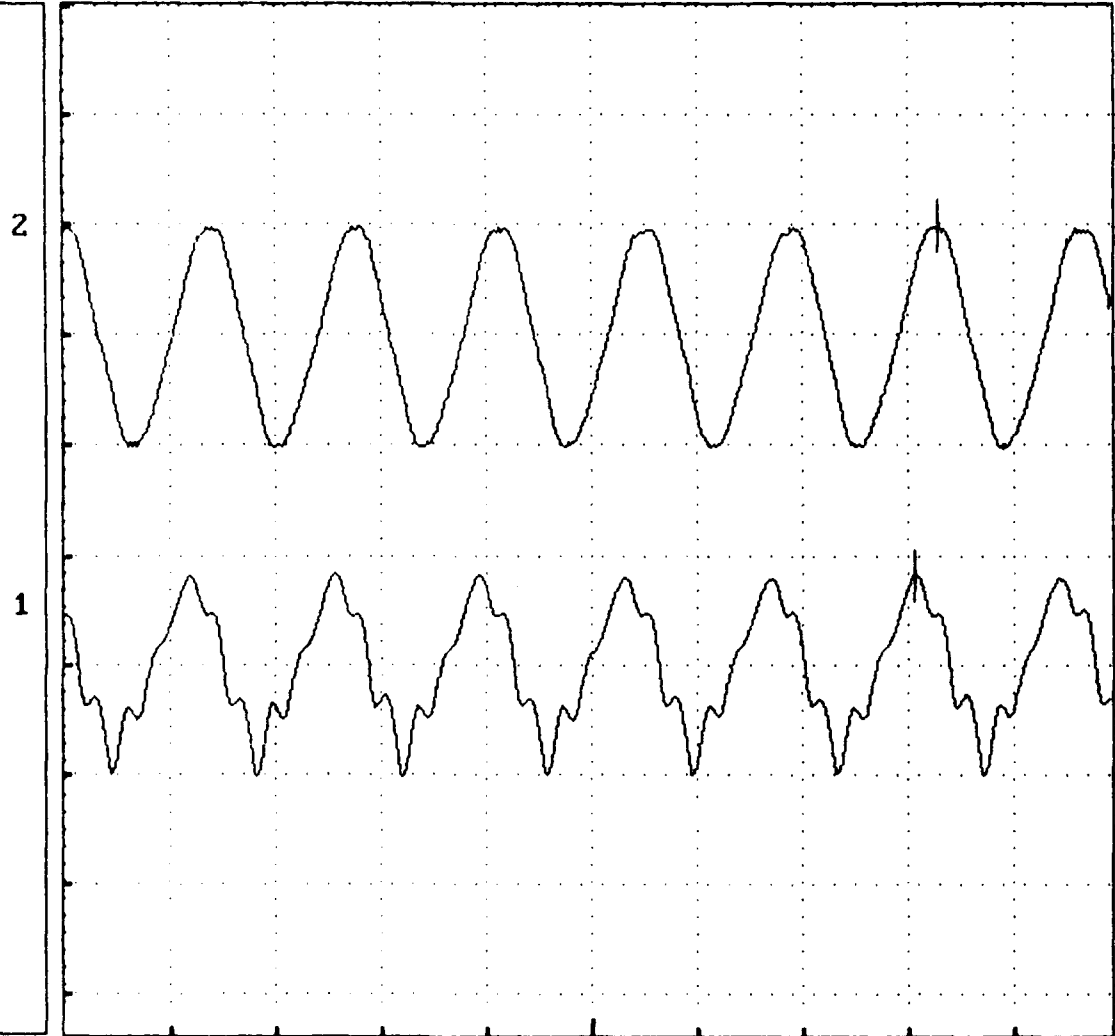
Sensitivity:

Ch. 1: 1.50 g's/Div
Ch. 2: 1.00 g's/Div

Filter:

Ch. 1: 130 Hz

Trig. Ch. : ALL
Polarity : Window
Level : 0.07 g's
Mode : Single Event
Pretrigger : 1 %



CH	TIME	CUR AMP	PEAK AMP	1ST INT	2ND INT	TIME/DIV
1	1.48 S	2.78 g's	2.79 g's	297.66 In/s		64 nS
2	1.49 S	1.98 g's	2.01 g's	204.67 In/s		64 nS

Remarks

CMU-502/E Container - Partial Load Test
MIL-STD-648, 5.3.2, Resonance Strength and Dwell Test, ambient temperature
Response: CH 1 - Fin, CH 2 - Input. Frequency: 11.3 Hz.
Time: 13 min. 22 sec., after start of Resonance Dwell.

Waveform Test Report

GHI SYSTEMS, INC. TRIAD CAT SYSTEM

Date : 7 Nov 1991

TEST ENGINEER : Vossler/Filsinger

TEST ITEM : CMU-502/E Container

TEST TYPE : Transmissibility

IMPACT LOC. : CMU502E 7Nov91 29:00

TEST MACHINE : Electro-Hydraulic

Sensitivity:

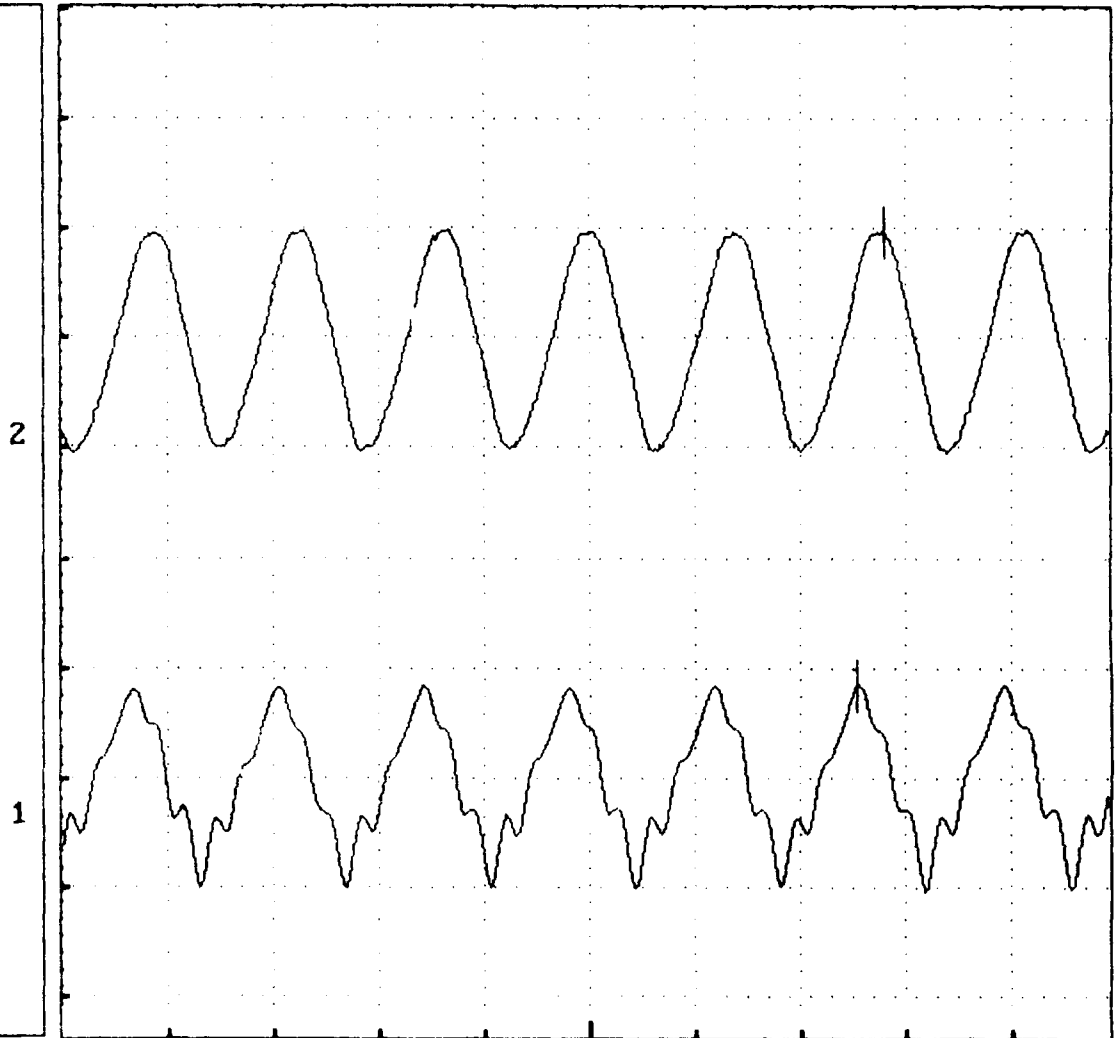
Ch. 1: 1.50 g's/Div

Ch. 2: 1.00 g's/Div

Filter:

Ch. 1: 130 Hz

Trig. Ch. : ALL
Polarity : Window
Level : 0.07 g's
Mode : Single Event
Pretrigger : 1 %



CH	TIME	CUR AMP	PEAK AMP	1ST INT	2ND INT	TIME/DIV
1	1.44 S	2.76 g's	2.76 g's	278.62 In/s		64 mS
2	1.46 S	1.96 g's	1.99 g's	186.30 In/s		64 mS

Remarks

CMU-502/E Container - Partial Load Test

MIL-STD-648, 5.3.2, Resonance Strength and Dwell Test, ambient temperature

Response: CH 1 - Fin, CH 2 - Input. Frequency: 11.3 Hz.

Time: 29 min., after start of Resonance Dwell.

Test Sequence 16, MIL-STD-648A, 5.5.2, Structural Integrity Test,

Test Time Minutes	Test Pressure In Water	(psig)	Leak Rate Psi Per Hour
----------------------	---------------------------	--------	---------------------------

PRESSURE

00:00	70.5	2.538	- - - -
05:00	70.5	2.538	- - - -

VACUUM

00:00	-27.9	-1.0076	- - - -
05:00	-27.9	-1.0076	- - - -

APPENDIX 4
REPORT DOCUMENTATION

REPORT DOCUMENTATION PAGE

Form Approved
 OMB No. 0704-0188

REPORT SECURITY CLASSIFICATION Unclassified		1b RESTRICTIVE MARKINGS	
SECURITY CLASSIFICATION AUTHORITY None		3 DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release distribution unlimited	
DECLASSIFICATION/DOWNGRADING SCHEDULE			
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ADDRESS (City, State, and ZIP Code) HQ AFLC/LGTP Wright-Patterson AFB, OH 45433-5999		7b ADDRESS (City, State, and ZIP Code)	
NAME OF FUNDING/SPONSORING ORGANIZATION	8b OFFICE SYMBOL (If applicable)	9 PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER	
ADDRESS (City, State, and ZIP Code)		10 SOURCE OF FUNDING NUMBERS	
		PROGRAM ELEMENT NO.	PROJECT NO.
		TASK NO.	WORK UNIT ACCESSION NO.
1 TITLE (Include Security Classification) Qualification Testing of the CNU-502/E Container for the BSU-93/B Retarders (Fins).			
2 PERSONAL AUTHOR(S) Keith A. Vossler			
3a TYPE OF REPORT Final	13b TIME COVERED FROM Nov 91 to Dec 91	14. DATE OF REPORT (Year, Month, Day) 92Feb 14	15. PAGE COUNT 47
6 SUPPLEMENTARY NOTATION			
7 COSATI CODES		18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)	
FIELD	GROUP	SUB-GROUP	
9 ABSTRACT (Continue on reverse if necessary and identify by block number) This test report documents the testing to qualify the CNU-502/E container for production release by ASD/YJA. The CNU-502/E is a reusable, welded aluminum, controlled breathing style container with a removable cover. The container is designed to hold up to six BSU-93/B, air inflatable retarders (fins). The fins are aligned vertically with the fins up and the fin wiring orientated towards the container sidewalls for servicing. The qualification test series is derived from MIL-STD-648A, FED-STD-101C, Eglin (18894) Specification Number SP919450, and consists of -25° F free fall drops, sinusoidal vibrations, structural strength, and leak tests. The test series was performed at the Air Force Packaging Evaluation Activity (AFPEA), Wright-Patterson AFB, OH 45433-5999.			
20 DISTRIBUTION/AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS		21 ABSTRACT SECURITY CLASSIFICATION Unclassified	
22a NAME OF RESPONSIBLE INDIVIDUAL Keith A. Vossler		22b TELEPHONE (Include Area Code) (513) 257-4519	22c OFFICE SYMBOL HQ AFLC/LGTP