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AFPEA PROJECT NO. 90-P-122

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Development of the Family of Munitions Container #3 for the BSU/49, BSU/50 and MXU/650 Airfoil Groups, CNU 534/E, CNU 335B/E, CNU 336B/E, and CNU 505/E

AFMC-LSO/LGTP
PACKAGING BRANCH
WRIGHT PATTERSON AFB, OH 45433-5540

December 1994

PROJECT: 90-P-122
TITLE: Family of Munitions Container #3

ABSTRACT

This project was initiated to design, fabricate, test and provide a production drawing package for the Family of Munitions Container (FMC) #3. This project was in support of Productivity, Reliability, Availability, Maintainability (PRAM) project 21989-01. FMC #3 is designed to hold 12 BSU/49, two (2) BSU/50 or six (6) MXU/650 Airfoil Groups. This will replace three different containers, all of which are top opening, therefore making it very difficult for the user to remove the airfoil group from the container.

FMC #3 (CNU 534/E) is a welded aluminum container. This container is not painted which reduces the original cost of the container, environmental hazardous waste, and the life-cycle costs of the container. FMC #3 is a bottom opening container, similar to a butter dish design. The fins sit on their aft end in the base of the container, this allows the user to easily prepare the fin for placement on the bomb.

The old containers for the BSU/49 Airfoil Group and BSU/50 Airfoil Group were painted single walled steel containers with the reinforcements on the outside of the container (CNU 335A/E and CNU 336A/E). The new containers uses CNU 534/E with its own unique cushioning system to hold the 12 BSU/49 fins in place (CNU 335B/E) or two (2) BSU/50 fins in place (CNU 336B/E) with its own unique cushioning system.

The old container for the MXU/650 Airfoil Group was a painted steel drum, similar to a 55 gallon drum that only holds one (1) fin and its associated accessories. The new container uses CNU 534/E with its own unique cushioning system to hold six (6) MXU/650 fins and their associated accessories in place (CNU 505/E).

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INTRODUCTION:

BACKGROUND:
An OO-ALC/MMW (presently OO-ALC/LIW) Process Action Team (PAT) came up with the idea to have a Family of Munition Containers (FMC) of three to six containers to replace most of the Air Force's 200 munition containers. OO-ALC realizing the potential of this idea initiated Productivity, Reliability, Availability, Maintainability (PRAM) project 21989-01. This report will deal with FMC number three (FMC #3), which is designed for the BSU/49, BSU/50 and MXU/650 Airfoil Groups, (fins). AFPEA's role was to design, fabricate, test and provide a Production Drawing Package to OO-ALC/LIW. FMC #3 is a bottom opening container, similar to a butter dish design. The fins sit on their aft end in the base of the container, this allows the user to easily prepare the fin for placement on the bomb, without having to move it out of the container or reorienting the fin.

The old containers for the BSU/49 Airfoil Group (CNU 335A/E) and BSU/50 Airfoil Group (CNU 336A/E) were painted single walled steel containers with the reinforcements on the outside of the container. The new containers uses the CNU 534/E with its own unique cushioning system to hold the 12 BSU/49 fins in place (CNU 335B/E) or two (2) BSU/50 fins in place (CNU 336B/E) with its own unique cushioning system.

The old container for the MXU/650 Airfoil Group was a painted steel drum, similar to a 55 gallon drum that only holds one fin and its associated accessories. The new container uses the CNU 534/E with its own unique cushioning system to hold six (6) MXU/650 fins in place and their associated accessories (CNU 505/E).

REQUIREMENTS:
AFPEA in union with OO-ALC/LIW developed a Statement of Work (SOW) for the design of the FMC. This was the tailoring of MIL-C-5584D, which was latter called the Design Criteria for Family Group of Munitions Containers. See Appendix 1 for the Design Criteria.

DESIGN:
The basic container without any cushioning is the Shipping and Storage Container CNU 534/E. This is a welded aluminum, controlled breathing, reusable container. The base is a one piece skid/double walled base extrusion with forklift openings, humidity indicator, pressure relief valve and desiccant port for easy replacement of desiccant (the desiccant controls dehumidification). A silicone rubber gasket and quick release latches create a seal at the base, lid interface. The lid is a single sheet of aluminum fit into channels in the corner post extrusions and the lid extrusion. Stacking pads on the lid allow stacking of like containers up to 16 feet in height. The

container is not painted which reduces the container's original cost, environmental hazardous waste, and the life-cycle cost of the container (see Appendix 3, figures 1 and 2).

The container for the BSU/49 Airfoil Group (BSU/49 fins)is the Shipping and Storage Container CNU 335B/E. This uses the CNU 534/E with a shock and vibration isolation system provided by a 3.6 pound per cubic foot (pcf) polyethylene base cushion, and a 2.0 pcf polyethylene top cushion(see Appendix 3, figures 9, 10 and 11).

The container for the BSU/50 Airfoil Group (BSU/50 fins)is the Shipping and Storage Container CNU 336B/E. The shock and vibration isolation system is similar to that used for the BSU/49 fins, with the CNU 534/E (see Appendix 3, figures 6, 7 and 8).

The container for the MXU/650 Airfoil Group (MXU/650 fins)is the Shipping and Storage Container CNU 505/E. The shock and vibration isolation system is similar to that used for the BSU/49 fins, with the CNU 534/E (see Appendix 3, figures 3, 4 and 5).

TESTING:

TEST SPECIMEN:
AFPEA fabricated two CNU 534/E prototype containers in house for testing (see Appendix 3, figures 1 and 2). The prototype containers were fabricated IAW all the requirements and tolerances of the container drawing package. The same drawing package that will be released, with some improvements, for the manufacture of production quantities of the container. Each face of the container was marked with a number for testing identification (see Appendix 3, figure 12).

The CNU 335B/E for the BSU/49 fins consists of the CNU 534/E container with the cushioning system as described above; likewise for the CNU 336B/E for the BSU/50 fins and the CNU 505/E for the MXU/650 fins.

TEST LOAD:
The test load consisted of the actual BSU/49, BSU/50 or MXU/650 fins and associated accessories as needed for the configuration. The CNU 335B/E holds 12 of the BSU/49 fins (see Appendix 3, figures 10 and 11). The CNU 336B/E holds two (2) of the BSU/50 fins (see Appendix 3, figures 7 and 8). The CNU 505/E holds six (6) of the MXU/650 fins, drums and fiberboard boxes holding airfoils and attachment hardware (see Appendix 3, figures 4 and 5).

TEST PLAN:
The test plan was designed, (IAW the Design Criteria for Family Group of Munitions Containers, MIL-C-5584, MIL-STD-648 and FED-STD-101), to qualify the CNU 335B/E for the BSU/49 fins, the CNU 336B/E for the BSU/50 fins and the CNU 505/E for the MXU/650 fins, for transportation and storage in a world-wide environment.

The test plan includes all test procedures, test equipment, and pass/fail performance criteria. See Appendix 2 for the complete test plan.

QUALIFICATION TESTS:
The prototype container passed all the tests in the CNU 505/E configuration for the MXU/650 fins. Then the same container was used in the CNU 336B/E configuration for the BSU/50 fins for the Rough Handling Tests, (tests 11 and 13), at high and low temperatures, and the vibration tests, (tests 15 and 17). This container was then used in the CNU 335B/E configuration for the BSU/49 fins for the Rough Handling Tests, (tests 11 and 13), at high and low temperatures, and the vibration tests, (tests 15 and 17). After all these tests were completed on the same container, an unofficial leak test, (identical to test 4), was conducted and the container passed.

The project engineer discussed the dents, scrapes, and punctured boxes with the OO-ALC/LIW program manager. The program manager stated the fins were like a hammer, and it did not matter if they received superficial damage (i.e.: scrapped paint or small dents. The objective is to keep the container design simple while satisfying the users needs of orientation and maintainability.

DISCUSSION:

The container cover forklift handles were replaced with tie-down rings due to the results of test 7c, and the recommendation of the test engineer. The user will now be able to lift the cover off of the container base by using a chain or strap between the two tie-down rings on the container cover. Due to the results of tests 6 and 7 the container cover lift test using the tie-down rings were not retested.

After all the testing was completed, an inspection reveled that the cause of the problems observed in the vibration tests were most likely due to the gap between the polyethylene top cushion and the container lid. This gap would allow the fins to freely bounce, in a vertical direction, inside the container. Even though all the results of the tests were acceptable the cushioning was changed to add a soft polyurethane cushion between the top cushion and the container lid. This will insure that the cushioning material is always in compression, and no gap exists between the cushioning and the container lid. Due to this being an improvement over the tested configuration, this improvement was not tested. The source of this gap was found to be a large tolerance buildup due to the way the extrusions were dimensioned, and the tolerances used in the drawing package. This tolerance buildup was reduced by changing the dimensioning of the extrusions, and reducing the tolerances on the piece parts and assemblies where possible. These improvements were put into the drawing packages for the BSU/49, BSU/50 and the MXU/650 fins.

APPENDIX 1

DESIGN CRITERIA
FOR
FAMILY OF MUNITIONS CONTAINERS

28 Aug 91

DESIGN CRITERIA

FOR

A FAMILY OF MUNITION CONTAINERS

1. The Air Force Packaging and Evaluation Agency (AFPEA) will design three specific containers following the applicable military standards for container design requirements as well as user and program manager in puts. The below listed sizes have been determined by the program manager along with specific design specifications as listed in the following paragraphs.

	INTERNAL DIMENSIONS			
SIZE	LENGTH	WIDTH	HEIGHT	ITEM MAX WEIGHT
1	12	8	9	25 lb.
2	20.5	16.5	14	150 lb. CNTR GROSS WT.
3	49	38	33	675 lb.
* 4	100	39	26	2,000 lb.
** 5	180	45	23	Unknown

* Use CNU-411/E for this container.
** Use the new AUR missile container.

2. These containers will be designed for the maximum load weight and/or items in each container as indicated:

SIZE	ITEM
1	Design to maximum content weight.
2	Design to maximum content weight.
3	BSU 49/50 and MXU 650 Airfoil Group.
4	Use CNU-411 container for CBU 87/89, SUU 30-type, Mk 20, and similar type/size CBU munitions.
5	Use CNU 407 type container for all present and or future air to air missiles or other air

munitions.

3. The Family of Munition Containers shall be designed in accordance with MIL-C-5584D and options in MIL-C-5584.

A. Par. 1.2; Classification.

Sizes 1, 2, 4, and 5 Type II - Horizontal Mount

Size 3 Type I - Vertical Mount

B. Par. 3.2; First article. One container of each size (1, 2, and 3) shall be provided for first article testing, for each container design. A second container of each design shall be provided after completion of first article testing.

C. Par. 3.4; Design and construction. These containers shall be designed in metric units in accordance with Public Law 94-168, as amended by Public Law 100-418.

D. Par. 3.4.2.2; Cure date on shock isolation system. This applies to rubber products only.

E. Par. 3.4.3.1; Desiccant receptacle. Container sizes 2 and 3 shall have desiccant receptacles. Container 1 would not have a desiccant receptacle because of its small size. If required, desiccant can be placed inside container 1 by removing the cover then resealing.

F. Par. 3.4.3.2; Humidity indicator. A humidity indicator shall be provided on sizes 2 and 3. Note: A humidity indicator card may always be placed inside container size 1.

G. Par. 3.4.3.3; Pressure equalizing valve. All containers shall have a pressure relief/equalizing valve, with the following characteristics:

Cracking Pressure = 1.0 to 1.5 PSID
Full Open Pressure = 2.5 PSID
Reseal Pressure $\geq$ 0.5 PSID

Minimum Flow Rate (cubic feet/minute) = Vc * (0.12)
Vc = Volume of the Container (cubic feet)
Ref. MIL-V-27166, Par. 3.6.3

H. Par. 3.4.3.4; Visual inspection ports. N/A

I. Par. 3.4.3.5; Air filling valve. An air filling valve will be provided on containers 1, 2, and 3.

J. Par. 3.4.3.6; Record receptacle. N/A

K. Par. 3.4.3.7; Drain plug. N/A

L. Par. 3.4.3.8; Fuel leak detector. N/A

M. Par. 3.4.4; Handling provisions. Investigate the use of spring loaded handles on container 1.

N. Par. 3.6.1; Item testing/inspection. N/A

O. Par. 3.6.2; Item uploading. N/A

P. Par. 3.6.3; Installation time. N/A

Q. Par. 3.6.5; Shock transmission. Container 3, BSU 49, 50 and MXU 650 fins, require physical and mechanical protection only. The other container designs require testing to the maximum weight, therefore, shock transmission is not a concern.

R. Par. 3.6.5.1; UN drop test. Container sizes 1 and 2 shall be tested to category A, at the maximum weight, unless actual items are used.

S. Par. 3.6.8; Size and weight. The containers shall be designed to the internal sizes and for the weights specified in paragraphs 1 and 2 above.

T. Par. 3.9.1; Aluminum. The container shall be treated as defined in 1 below. An alternate method of finishing aluminum products shall be as specified in 2 below.

(1) The exterior of the container shall be bead blasted with plastic media. NOTE: this is pending MAJCOM's approval.

(2) The painting of aluminum shall be as follows:

Aluminum surfaces shall be cleaned, pretreated, primed and painted in accordance with MIL-STD-171E. Cleaning shall be in accordance with Finish 5.2, MIL-STD-171E. The container shall have an immersion cleaning in accordance with TT-C-490C(1), Method III, Type III, then rinsed, followed by a force drying. This shall be followed by a spray application of wash primer DOD- P-15328D(1). Priming and finish shall be in accordance with Finish 20.9, MIL-STD-171E, see Section 5.3 of MIL-STD-171E. The primer used shall meet the requirements of MIL-P-23377F, followed with two (2) coats of topcoat TT-E-515A(1).

U. Par. 3.12; Installation instructions. N/A

V. Par. 4.7.7.1 & 4.7.7.2; Vibration tests will not be conducted unless the actual/dummy load is being tested. When testing to a maximum weight per container vibration tests will not be required.

W. Para. 4.7.5.2; Latch strength for containers 1 and 2 shall be 500 lbs.

APPENDIX 2

TEST PLAN

AIR FORCE PACKAGING EVALUATION ACTIVITY (CONTAINER TEST PLAN)	AFPEA PROJECT NUMBER: 90-P-122

CONTAINER SIZE (LxWxD)(INCHES) INTERIOR:	EXTERIOR:	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU.FT)	QUANTITY:	DATE:
48.4x 39x 34.5	52x 42.5x 40.5			51.8		11 MAY 92

ITEM NAME:	MANUFACTURER:
Bomb Fins: BSU/49, BSU/50, MXU/650	Prototype by AFPEA

CONTAINER NAME:	CONTAINER COST:
CNU-335B/E, CNU-336B/E, CNU-505/E	

PACK DESCRIPTION:
Aluminum Container

CONDITIONING:
As noted below.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU MENTATION

NOTE: Test #1 through #3 will be used to test all three (3) CNU configurations, CNU-335B/E for the BSU/49, CNU-336B/E for the BSU/50 , and CNU-505/E for the MXU/650. Tests #4 through #21 will be conducted in the CNU-505/E configuration (i.e.: loaded with the MXU/650 bomb fins). After test #21 is conducted, test #11, #13, #15, and #17 will be conducted for the CNU-336B/E configuration (i.e.: loaded with the BSU/50 bomb fins). After these tests are completed tests #11, #13, #15, and #17 shall be run for the CNU/335B/E configuration (i.e.: loaded with the BSU/49 bomb fins). The tests being run on the CNU-335B/E and CNU-336B/E configuration are tests to test the fin restraint system. These tests are not being run to test the container. Any failure of the container shall be contributed to a fatigue failure and shall not be criteria for failing the container.

COMMENTS:

PREPARED BY:	APPROVED BY:
James T. Steiger, Mechanical Engineer	Ted Hinds, Chief, Design Br., AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY (CONTAINER TEST PLAN)					AFPEA PROJECT NUMBER: 90-P-122	
CONTAINER SIZE (LxWxD)(INCHES) INTERIOR: 48.4x 39x 34.5	EXTERIOR: 52x 42.5x 40.5	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU.FT) 51.8	QUANTITY:	DATE: 11 MAY 92

ITEM NAME: Bomb Fins: BSU/49, BSU/50, MXU/650	MANUFACTURER: Prototype by AFPEA
CONTAINER NAME: CNU-335B/E, CNU-336 B/E, CNU-505/E	CONTAINER COST:
PACK DESCRIPTION: Aluminum Container	
CONDITIONING: As noted below.	

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU MENTATION
1.	EXAMINATION OF PRODUCT (4.7.1)* (4.8)	Container/drawings shall be examined to determine conformance with materials design, Table I of MIL-C-5584, Statement of Work dated 28 Aug 91, and drawings, including each container cushion configuration (see note page 1)	fully assembled container	Visual Inspection (VI)
2.	WEIGHT TEST (4.7.10)	Container lid weight shall be determined. Container base weight shall be determined. Fully assembled container weight shall be determined.	fully assembled container lid and base both with cushions	Scale
3.	FORM AND FIT TEST (4.7.3)	Install and remove item in accordance with the installation and removal instructions. The container shall be inspected for form and fit.	ambient	VI

COMMENTS:
* Figures in parenthesis () refer to paragraphs in MIL-C-5584D.

PREPARED BY:	APPROVED BY:
James T. Steiger, Mechanical Engineer	Ted Hinds, Chief, Design Br., AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY (CONTAINER TEST PLAN)						AFPEA PROJECT NUMBER: 90-P-122	
CONTAINER SIZE (LxWxD)(INCHES) INTERIOR: 48.4x 39x 34.5	EXTERIOR: 52x 42.5x 40.5	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU.FT) 51.8		QUANTITY:	DATE: 11 MAY 92
ITEM NAME: Bomb Fins: BSU/49, BSU/50, MXU/650				MANUFACTURER: Prototype by AFPEA			
CONTAINER NAME: CNU-335B/E, CNU-336B/E, CNU-505/E					CONTAINER COST:		
PACK DESCRIPTION: Aluminum Container							
CONDITIONING: As noted below.							

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU MENTATION
4.	<u>LEAK TEST</u> FED-STD-101 Method 5009 (4.7.2)	Pneumatic pressure at 1.500 PSI and vacuum retention at 1.500 PSI. After temperature stabilization, 0.025 PSI leakage allowed over 30 minutes test duration.	Test performed in ambient condition from compressed air supply/vacuum pump.	Water Manometer (WM) or Pressure Transducer (PT)
5.	<u>STAND-OFF TEST</u> (4.7.5.1)	Place load of one times the cover weight on the cover. The cover shall not deform or deflect. Slide cover on stand-offs five feet in each of four different directions. There shall be no damage to sealing surface or stand-offs.	Place container cover on a concrete floor resting on the stand-offs.	VI

COMMENTS:	
PREPARED BY: James T. Steiger, Mechanical Engineer	APPROVED BY: Ted Hinds, Chief, Design Br., AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY (CONTAINER TEST PLAN)	AFPEA PROJECT NUMBER: 90-P-122

CONTAINER SIZE (LxWxD)(INCHES) INTERIOR:	EXTERIOR:	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU.FT)	QUANTITY:	DATE:
48.4x 39x 34.5	52x 42.5x 40.5			51.8		11 MAY 92

ITEM NAME:	MANUFACTURER:
Bomb Fins: BSU/49, BSU/50, MXU/650	Prototype by AFPEA

CONTAINER NAME:	CONTAINER COST:
CNU-335B/E, CNU-336B/E, CNU-505/E	

PACK DESCRIPTION:
Aluminum Container

CONDITIONING:
As noted below.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU MENTATION
6.	<u>HOISTING STRENGTH TEST</u>			
a.	MIL-STD-648 Para. 5.8.5 (4.7.4)	Single Ring Hoisting Test. Hoist container at one lift point and leave hanging for five min. There shall be no damage or permanent deformation This test shall be performed on each lifting ring.	ambient	VI
b.	MIL-STD-648 Para 5.8.3 (4.7.4)	Four Ring Hoisting Test. Hoist container loaded to five times the gross weight of a single container by all lift points simultaneously and leave hanging for five min. There shall be no damage or permanent deformation. (Load is approximately 5000 Lbs)	ambient	VI
c.	MIL-STD-648 Para 5.8.4 (4.7.4)	Tiedown Strength Test. Apply load at an angle of 45 degrees downward from horzontal and simultaneously 45 degrees out-board from the container surface. (The load is approximately 3000 Lbs.)	ambient	VI

COMMENTS:

PREPARED BY:	APPROVED BY:
James T. Steiger, Mechanical Engineer	Ted Hinds, Chief, Design Br., AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY (CONTAINER TEST PLAN)	AFPEA PROJECT NUMBER: 90-P-122

CONTAINER SIZE (LxWxD)(INCHES) INTERIOR: 48.4x 39x 34.5	EXTERIOR: 52x 42.5x 40.5	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU.FT) 51.8	QUANTITY:	DATE: 11 MAY 92

ITEM NAME: Bomb Fins: BSU/49, BSU/50, MXU/650	MANUFACTURER: Prototype by AFPEA
CONTAINER NAME: CNU-335B/E, CNU-336B/E, CNU-505/E	CONTAINER COST:

PACK DESCRIPTION:
Aluminum Container

CONDITIONING:
As noted below.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU MENTATION
7.	COVER HANDLE PULL TEST			
a.		Apply a force of 250 Lbs. on a cover handle in four directions straight up, straight out, and to each side of the handle. Load shall be applied through a nominal two inch wide fabric strap. There shall be no damage or permanent deformation	ambient	Load Cell VI
b.	(4.7.4.1)	Lift cover by one handle using a hoist or sling for five min. There shall be no damage or permanent deformation.	ambient	VI
c.		Lift cover by one forklift handle using a forklift. Cover shall be lifted for five min. There shall be no damage or permanent deformation.	ambient	VI

COMMENTS:

PREPARED BY: James T. Steiger, Mechanical Engineer	APPROVED BY: Ted Hinds, Chief, Design Br., AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY (CONTAINER TEST PLAN)	AFPEA PROJECT NUMBER: 90-P-122

CONTAINER SIZE (LxWxD)(INCHES) INTERIOR:	EXTERIOR:	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU.FT)	QUANTITY:	DATE:
48.4x 39x 34.5	52x 42.5x 40.5			51.8		29 APR 92

ITEM NAME:	MANUFACTURER:
Bomb Fins: BSU/49, BSU/50, MXU/650	Prototype by AFPEA

CONTAINER NAME:	CONTAINER COST:
CNU-335B/E, CNU-336B/E, CNU-505/E	

PACK DESCRIPTION:
Aluminum Container

CONDITIONING:
As noted below.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU MENTATION
8.	<u>STACKING TEST</u>			
a.	FED-STD-101 Method 5016 S = 2.0 (4.7.6.1)	A prescribed load (W) shall be applied to the top of the container, in a manner simulating the stacking of similar containers. This load shall remain for a minimum of one hour. (W is approximately 7500 Lbs.)	ambient, on a flat, level rigid floor	VI
b.	FED-STD-101 Method 5017 S = 2.0 (4.7.6.1)	A load of 100 lbs/sqr ft. will be distributed over the top surface of the container. This load shall remain for a minimum of one hour.	ambient, on a flat, level rigid floor	VI
9.	<u>HANDLING TEST</u>			
a.	FED-STD-101 Method 5011.1 Para. 6.2 (4.7.5)	Forklift Handling Test. Run test as stated in Para. 6.2 of Method 5011.1.	ambient	VI
b.	FED-STD-101 Method 5011.1 Para. 6.5 (4.7.5)	Pushing Test. Run test as stated in Para. 6.5 of Method 5011.1.	ambient	VI

COMMENTS:

PREPARED BY:	APPROVED BY:
James T. Steiger, Mechanical Engineer	Ted Hinds, Chief, Design Br., AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY (CONTAINER TEST PLAN)	AFPEA PROJECT NUMBER: 90-P-122

CONTAINER SIZE (LxWxD)(INCHES) INTERIOR:	EXTERIOR:	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU.FT)	QUANTITY:	DATE:
48.4x 39x 34.5	52x 42.5x 40.5			51.8		11 MAY 92

ITEM NAME:	MANUFACTURER:
Bomb Fins: BSU/49, BSU/50, MXU/650	Prototype by AFPEA

CONTAINER NAME:	CONTAINER COST:
CNU-335B/E, CNU-336B/E, CNU-505/E	

PACK DESCRIPTION:
Aluminum Container

CONDITIONING:
As noted below.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU MENTATION
9.	HANDLING TEST			
c.	FED-STD-101 Method 5011.1 Para. 6.6 (4.7.5)	Towing Test. Run test as stated in Para. 6.6 of Method 5011.1.	ambient	VI
10.	LEAK TEST FED-STD-101 Method 5009 (4.7.2)	Pneumatic pressure at 1.500 PSI. After temperature stabilization, 0.025 PSI leakage allowed over 30 minute test duration.	Test perf. in ambient cond. from comp. air supply pump.	WM or PT VI
11.	ROUGH HANDLING TESTS (High Temperature +140 DEGREES F) *			
a.	FED-STD-101 Method 5005 (4.7.7.2.1) (4.7.8)	Cornerwise-drop (rotational) Test. Condition at +140 F for not less than 24 hours. Drop height 24".	One drop on diagonal opposite bottom corners. Total of two drops*	VI
b.	FED-STD-101 Method 5008 (4.7.7.2.2) (4.7.8)	Edgewise-drop (rotational) Test. Condition at +140 F for not less than 24 hours. Drop height 24".	One drop on adjacent bottom edges. Total of two drops*	VI
c.	FED-STD-101 Method 5012 (4.7.7.2.3) (4.7.8)	Pendulum-Impact Test. Condition at +165 F. Temp. of shock mitigation system at time of test shall be +140 F	One impact on a side and an end. Total of two impacts*	VI Thermocouples

COMMENTS:
* These drops are opposite those covered in test 13.

PREPARED BY:	APPROVED BY:
James T. Steiger, Mechanical Engineer	Ted Hinds, Chief, Design Br., AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY (CONTAINER TEST PLAN)	AFPEA PROJECT NUMBER: 90-P-122

CONTAINER SIZE (LxWxD)(INCHES) INTERIOR:	EXTERIOR:	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU.FT)	QUANTITY:	DATE:
48.4x 39x 34.5	52x 42.5x 40.5			51.8		11 MAY 92

ITEM NAME:	MANUFACTURER:
Bomb Fins: BSU/49, BSU/50, MXU/650	Prototype by AFPEA

CONTAINER NAME:	CONTAINER COST:
CNU-335B/E, CNU-336B/E, CNU-505/E	

PACK DESCRIPTION:
Aluminum Container

CONDITIONING:
As noted below.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU MENTATION
11. c.	Continued	(+10/-0 F). Impact velocity 7 ft/sec (drop height 9").		
12.	LEAK TEST FED-STD-101 Method 5009 (4.7.2)	Pneumatic pressure at 1.500 PSI. After temperature stabilization, 0.025 PSI leakage allowed over 30 minute test duration.	Test perf. in ambient cond. from comp. air supply pump.	WM or PT VI
13.	ROUGH HANDLING TESTS (Low Temperature -20 DEGREES F) **			
a.	FED-STD-101 Method 5005 (4.7.7.2.1) (4.7.8)	Cornerwise-drop (rotational) Test. Condition at -20 F for not less than 24 hours. Drop height 24".	One drop on diagonal opposite bottom corners. Total of two drops**	VI
b.	FED-STD-101 Method 5008 (4.7.7.2.2) (4.7.8)	Edgewise-drop (rotational) Test. Condition at -20 F for not less than 24 hours. Drop height 24".	One drop on adjacent bottom edges. Total of two drops**	VI
c.	FED-STD-101 Method 5012 (4.7.7.2.3) (4.7.8)	Pendulum-Impact Test. Condition at -65 F. Temp. of shock mitigation system at time of test shall be -20 F (+0/-10 F). Impact velocity 7 ft/sec (drop height 9")	One impact on a side and an end. Total of two impacts**	VI Thermocouples

COMMENTS:
** These drops are opposite those covered in test 11.

PREPARED BY:	APPROVED BY:
James T. Steiger, Mechanical Engineer	Ted Hinds, Chief, Design Br., AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY (CONTAINER TEST PLAN)					AFPEA PROJECT NUMBER: 90-P-122	
CONTAINER SIZE (LxWxD)(INCHES) INTERIOR: 48.4x 39x 34.5	EXTERIOR: 52x 42.5x 40.5	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU.FT) 51.8	QUANTITY:	DATE: 29 APR 92

ITEM NAME:	MANUFACTURER:
Bomb Fins: BSU/49, BSU/50, MXU/650	Prototype by AFPEA

CONTAINER NAME:	CONTAINER COST:
CNU-335B/E, CNU-336B/E, CNU-505/E	

PACK DESCRIPTION:
Aluminum Container

CONDITIONING:
As noted below.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU MENTATION
14.	<u>LEAK TEST</u> FED-STD-101 Method 5009 (4.7.2)	Pneumatic pressure at 1.500 PSI. After temperature stabilization, 0.025 PSI leakage allowed over 30 minute test duration.	Test perf. in ambient cond. from comp. air supply pump.	WM or PT VI
15.	<u>VIBRATION - RESONANCE DWELL TEST</u> MIL-STD-648 Para 5.3.2 (4.7.7.1)	Input excitation of 0.125" double amplitude or 1G whichever is less. Sweep approx. logarithmically from 5 to 50 Hz for 7.5 min. then dwell 30 min at resonance frequency. Transmissibility shall not exceed 5 at the resonance frequency.	Rigidly attach container to exciter.	Tri-axial accelerometers Thermocouples
16.	<u>Leak Test</u> FED-STD-101 Method 5009 (4.7.2)	Pneumatic pressure at 1.500 PSI. After temperature stabilization, 0.025 PSI leakage allowed over 30 minute test duration.	Test perf. in ampient cond. from comp. air supply pump.	WM or PT VI

COMMENTS:

PREPARED BY:	APPROVED BY:
James T. Steiger, Mechanical Engineer	Ted Hinds, Chief, Design Br., AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY (CONTAINER TEST PLAN)	AFPEA PROJECT NUMBER: 90-P-122

CONTAINER SIZE (LxWxD)(INCHES) INTERIOR:	EXTERIOR:	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU.FT)	QUANTITY:	DATE:
48.4x 39x 34.5	52x 42.5x 40.5			51.8		1 MAY 92

ITEM NAME:	MANUFACTURER:
Bomb Fins: BSU/49, BSU/50, MXU/650	Prototype by AFPEA

CONTAINER NAME:	CONTAINER COST:
CNU-335B/E, CNU-336B/E, CNU-505/E	

PACK DESCRIPTION:
Aluminum Container

CONDITIONING:
As noted below.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU MENTATION
17.	VIBRATION - REPETITIVE SHOCK TEST FED-STD-101 Method 5019 (4.7.7.3)	Test for not less then two hours as stated in FED-STD-101, Method 5019, Para 6.3	ambient Place not attach cntr on the exciter	Triaxial accelerometers VI
18.	LEAK TEST FED-STD-101 Method 5009 (4.7.2)	Pneumatic pressure at 1.500 PSI. After temperature stabilization, 0.025 PSI leakage allowed over 30 minute test duration.	Test perf. in ambient cond. from comp. air supply pump.	WM or PT VI
19.	STACKED PENDULUM-IMPACT TEST MIL-STD-648 Para 5.2.7.1 (4.7.6.2)	One impact shall be made on each end of the bottom container at 7 ft/sec. Load containers with MXU/650 bomb fins.	ambient Shipping configuration stacked two high and banded.	VI
20.	LEAK TEST FED-STD-101 Method 5009 (4.7.2)	Pneumatic pressure at 1.500 PSI. After temperature stabilization, 0.025 PSI leakage allowed over 30 minute test duration.	Test perf. in ambient cond. from comp. air supply pump.	WM or PT VI

COMMENTS:

PREPARED BY:	APPROVED BY:
James T. Steiger, Mechanical Engineer	Ted Hinds, Chief, Design Br., AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY (CONTAINER TEST PLAN)					AFPEA PROJECT NUMBER: 90-P-122	
CONTAINER SIZE (LxWxD)(INCHES) INTERIOR: 48.4x 39x 34.5	EXTERIOR: 52x 42.5x 40.5	WEIGHT (LBS) GROSS:	ITEM:	CUBE (CU.FT) 51.8	QUANTITY:	DATE: 1 MAY 92

ITEM NAME: Bomb Fins: BSU/49, BSU/50, MXU/650	MANUFACTURER: Prototype by AFPEA
CONTAINER NAME: CNU-335B/E, CNU-336B/E, CNU-505/E	CONTAINER COST:

PACK DESCRIPTION:
Aluminum Container

CONDITIONING:
As noted below.

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRU MENTATION
21.	STRUCTURAL PRESSURE TEST			
a.	MIL-STD-648 Para 5.5.2	Container shall be pressurized to 3.0 PSI. The container shall not fail in a dangerous or catastrophic manner (i.e.: loss of pressure and/or permanent deformation is acceptable).	ambient	Pressure Transducer
b.	MIL-STD-648 Para 5.5.3	Container shall be vacuum pressurized to -3.0 PSI. The container shall not fail in a dangerous or catastrophic manner (i.e.: loss of vacuum and/or permanent deformation is acceptable).	ambient	Pressure Transducer

COMMENTS:

PREPARED BY: James T. Steiger, Mechanical Engineer	APPROVED BY: Ted Hinds, Chief, Design Br., AFPEA

APPENDIX 3

QUALIFICATION TEST REPORT

APPROVED FOR PUBLIC RELEASE
DISTRIBUTION UNLIMITED

AFPEA PROJECT NO. 92-P-114

KEITH A. VOSSLER

Mechanical Engineer

Autovon 787-4519

Commercial (513) 257-4519

FAMILY OF MUNITIONS CONTAINER NUMBER 3. CNU 534/E with CNU-335B/E, CNU-336B/E, and CNU-505/E CONFIGURATIONS

HQ AFMC/LGTP
AIR FORCE PACKAGING EVALUATION ACTIVITY
WRIGHT-PATTERSON AFB, OH 45433-5999
FEBRUARY 1993

INTRODUCTION

The objective of this test series was to qualify the Family of Munitions Container Number 3, CNU-534/E, for production release by HQ AFMC/LGTP. The three container configurations passed the prescribed container test plan.

CONTAINER DESCRIPTION

The Family of Munitions Container Number 3, CNU-534/E, is a medium sized, sealed aluminum container (Figure 1). The container consists of a cover and a short base (Figure 2). Maximum outer container dimensions are 52 inches length, 42.5 inches width, and 40.5 inches depth.

There are three CNU-534/E container configurations. The CNU-505/E configuration holds six (6) MXU/650 bomb fins, drums, and fiberboard boxes (Figures 3, 4, 5). The CNU-336B/E configuration holds two (2) BSU/50 bomb fins (Figures 6, 7, and 8). The CNU-335B/E configuration holds twelve (12) BSU/49, bomb fins (Figures 9, 10, and 11).

A cover and base cushion molded of expanded polyethylene foam was designed for each specific configuration. The aft end of the fins are placed on the container base cushion with the fin forward end accessible to the user. The cover cushion is placed on the forward end of the fins.

TEST PROCEDURE

The CNU-534/E Container was tested in accordance with the Air Force Packaging Evaluation Activity (AFPEA) Test Plan, Project Number 90-P-122, dated 11 MAY 92. The AFPEA Test Project Number was 92-P-114. The test plan referenced MIL-C-5584D, MIL-STD-648A, and FED-STD-101C.

The test methods constitute both the procedure for performing the tests and performance criteria for evaluation of container acceptability. The tests are commonly applied to special shipping containers providing shock and vibration protection to sensitive items. The tests were performed at AFPEA, Wright-Patterson AFB, OH 45433.

Test Sequences 1 through 3 were performed on all three container configurations. Tests Sequences 4 through 21 were then performed with the CNU-534/E outer container using the CNU-505/E configuration with the MXU/650 bomb fins.

After Test Sequence 21, Test Sequences 11, 13, 15, and 17 were repeated with the same CNU-534/E outer container using the CNU-336B/E configuration with the BSU/50 bomb fins.

Test Sequences 11, 13, 15, and 17 were then repeated again with the same CNU-534/E outer container using the CNU-335B/E configuration with the BSU/49 bomb fins.

The actual sequence of testing is presented in Appendix A.

The test sequences repeated with the CNU-335B/E and the CNU-336B/E configurations were designed to test the fin restraint systems (cover and base cushions) and were not considered additional structural testing of the CNU-534/E configuration (aluminum cover and base).

The container was inspected for interior and exterior damage after each test sequence. Inspection included container surfaces and structures, fin, cushion, and contents (if applicable).

CONTAINER FACE IDENTIFICATION

The correlation between numbered and designated container sides is as follows (Figure 12):

Numbered Side	Designated Side
1	Top
2	Forward
3	Bottom
4	Aft (Desiccant Port)
5	Left
6	Right

TEST SEQUENCES

TEST SEQUENCE 1 - MIL-C-5584D, 4.7.1, <u>Examination of</u> Product, and 4.8, <u>Inspection of Packaging</u>.

A visual inspection of the container was made. The container was equipped with a pressure relief valve, Schrader 645E6 valve, humidity indicator, desiccant port, 10 latches, 4 hoisting/tie-down rings, 4 cover handles (manual lift), 2 forklift cover handles, 4 cover stacking pads, and skids.

Container workmanship was visually examined. The container was free of defects that would affect strength, durability, safety or serviceability. Container welds appeared uniform and the container was smooth and free of sharp or jagged edges.

Container color, finish, marking, identification, installation instructions, and drawings were not examined and inspection of packaging was not performed.

TEST SEQUENCE 2 - MIL-C-5584D, 4.7.10, Weight Test.

The following equipment was utilized:

Equipment	Manufacturer	Ser#	Cal Exp
Scale	Howe	A057229	01MAY93
Scale	Howe	A057232	01MAY93

The CNU-534/E and each container configuration and its components were weighted (pounds).

Container Designation	Fin Designation	Fin Weight	Cushioning Cover	Cushioning Base	Total Container Weight
CNU-335B/E	BSU/49	54.50	10.25	11.5	940.75
CNU-336B/E	BSU/50	98.25	6.75	11.5	479.75
CNU-505/E	MXU/650	94.75	10.00	12.5	856.00

	COMPONENT	Weight
CNU-534/E	Base	120.5
CNU-534/E	Cover	144.5

* Includes Box and Drum

TEST SEQUENCE 3 - MIL-C-5584D, 4.7.3, Form and Fit Test.

Each container configuration consisted of a different set of molded base and cover cushions. Each base cushion was placed in the container base and the appropriate fins (and hardware if necessary) were loaded in the container base. The cover cushion for each container configuration was placed on top of the fins. The cover was lowered manually (cover side handles) or with a forklift (handles on top of cover). The container closed and sealed for all configurations tested.

Each container configuration demonstrated interface compatibility with it's fin application. The pressure relief and Schrader valves, desiccant port, latches, hoisting/tie-down rings, and cover (manual and forklift) handles were examined and operated.

TEST SEQUENCE 4 - FED-STD-101C, Method 5009.3, Leaks in Containers and MIL-C-5584D, 4.7.2, Pressure Test.

The following equipment and instrumentation was utilized:

Equipment	Manufacturer	Model	Ser#	Cal Exp
Digital Manometer	Yokogawa	26555-22	82DJ6009	11JUN93
Vacuum/Pressure Pump	Gast Mfg	MOA-P109-AA	0485	N/A

The container pressure relief valve was removed and the relief valve hole used for attachment of the digital manometer and vacuum/pressure pump lines. The empty CNU-534/E Container was closed and sealed. The leak tests were conducted in accordance with FED-STD-101C, Method 5009.3, at ambient temperature and pressure.

The pneumatic pressure leak technique (Figure 13) was utilized and the container pressurized to 1.50 pounds per square inch (psi). The container leak rate was 0.028 psi/hour (psi/hr) which was less than the maximum allowable leakage rate of 0.05 psi/hr (reference Test Plan).

The vacuum retention leak technique was utilized and the container evacuated to -1.50 psi. The container leak rate was 0.025 psi/hr which was less than the maximum allowable leakage rate of 0.05 psi/hr (reference Test Plan).

TEST SEQUENCES FOR THE CNU-534/E CONTAINER UTILIZING THE CNU-505/E CONFIGURATION WITH THE MXU/650 FINS

The CNU-505/E configuration was placed in the CNU-534/E Container and loaded with the MXU/650 fins. All test sequences reference a loaded container. The Container Cover Side 6, rear latch (corner 236) pull down area (left of the latch) was sheared. This was repaired before testing resumed.

TEST SEQUENCE 4 - FED-STD-101C, Method 5009.3, Leaks in Containers and MIL-C-5584D, 4.7.2, Pressure Test.

Reference Test Sequence 4 (Initial test description).

The container leak rate for 30 minutes was 0.021 psi (0.042 psi/hr) when the container was pressurized to 1.50 psi. This leak rate was less than the maximum allowable leakage rate of 0.05 psi/hr (reference Test Plan).

The vacuum retention leak technique was utilized and the container evacuated to -1.50 psi. The container leak rate for 30 minutes was 0.020 (0.040 psi/hr). This leak rate was less than the maximum allowable leakage rate of 0.05 psi/hr (reference Test Plan).

TEST SEQUENCE 5 - MIL-C-5584D, 4.7.5.1, Cover Stand Off Test.

The container cover (resting on the container stand offs) was placed on a flat, level, rigid floor (Figure 14). A 297 pound load, representing at least twice the 120.5 pound gross container cover weight, was placed on top of the container cover.

The container cover and load were slid 5 feet across a concrete floor on the container stand offs in four different directions. The container stand offs and gasket sealing area did not deform or sustain damage.

TEST SEQUENCE 6 - MIL-STD-648A, 5.8 Hoisting Fitting and Tiedown Attachment Points, and MIL-C-5584D, 4.7.4, Handling Provisions Test.

The following equipment was utilized:

Equipment	Manufacturer	Model	Ser#	Cal Exp
Forklift Truck 4000 lb	Mercury	4018	117774	N/A
Hoist	Coffing	3 Ton	SRD-112-CP	N/A
Scale	Howe		A057229	01MAY93
Scale	Howe		A057232	01MAY93
Tie-down Tester	AFPEA	N/A	N/A	N/A

TEST SEQUENCE 6A - MIL-STD-648A, 5.8.5, Single Hoisting Fitting Strength Test.

The container was lifted completely off the ground for 5 minutes by each hoisting/tie-down ring (total of four lifts, Figure 15). There was no damage or permanent deformation to the rings, lifting ring bars, or container sidewalls. The forklift truck was used to complete the test due to a hoist malfunction during testing.

TEST SEQUENCE 6B - MIL-STD-648A, 5.8.3, Hoisting Fittings Strength Test.

A 4293 pound load (including additional container base), representing at least five times the 856 pound gross container weight, was placed on the container.

The container was lifted completely off the ground for 5 minutes utilizing all four (4) hoisting/tie-down rings (Figure 16).

There was no damage or permanent deformation to the rings, lifting ring bars, or container sidewalls.

TEST SEQUENCE 6C - MIL-STD-648A, 5.8.4, Tie Down Strength Test.

The container was placed on the AFPEA tie-down tester. The minimum required tie down force was calculated to be 2574 pounds. A force in excess of this was applied by each hydraulic cylinder/load cell through chain looped through each hoisting/tie-down ring (Figure 17). The load was applied to each ring at an angle of 45° downward from the horizontal and simultaneously 45° outboard from the container surface. The test duration was one minute.

Due to the actual test sequence (reference Appendix A), an additional leak test was conducted after Test Sequence 6C.

LEAK TEST - FED-STD-101C, Method 5009.3, Leaks in Containers and MIL-C-5584D, 4.7.2, Pressure Test.

Reference Test Sequence 4 (Initial test description).

The container leak rate was 0.046 psi/hr when the container was pressurized to 1.50 psi. This leak rate was less than the maximum allowable leakage rate of 0.05 psi/hr (reference Test Plan).

TEST SEQUENCE 7 - MIL-C-5584D, 4.7.4.1, Handle Strength Tests.

The following equipment and instrumentation was utilized:

Equipment	Manufacturer	Model	Ser#	Cal Exp
Forklift Truck 4000 lb	Mercury	4018	117774	N/A
Hoist	Coffing	3 Ton	SRD-112-CP	N/A
Tie-down Tester	AFPEA	N/A	N/A	N/A

TEST SEQUENCE 7A

The container was placed on the AFPEA tie-down tester. The minimum required force was 250 pounds. A force in excess of this was applied by a hydraulic cylinder/load cell through a two-inch cargo strap looped through a cover (manual lift) handle (Figure 18). The load was applied vertically, straight out, and to each side of the handle. The test duration was one minute in each direction.

When the force was applied, the free end of the handle deflected 1/4 inch and returned to the normal position when the force was released. The handle was still functional.

When the force was applied to stress the captured end of the handle, the handle bound up slightly so that it would not return to its free position without a slight force being applied. The handle was still functional.

No handle or supporting structure permanent deformation was observed.

TEST SEQUENCE 7B

One container cover handle (manual lift) was lifted by the forklift tine hook attachment and held completely off the ground for five minutes (Figure 19). No deformation of the container cover handle or its supporting structure was noted.

TEST SEQUENCE 7C

One container cover forklift handle was lifted by a forklift tine and held completely off the ground for five minutes (Figure 20). The handle bowed slightly and the handle free end almost pulled out (Figure 21). No deformation of the container cover handle or its supporting structure was noted.

TEST SEQUENCE 8 - Stacking Tests.

The following equipment and instrumentation was utilized:

Equipment	Manufacturer	Model	Ser#	Cal Exp
Forklift Truck 4000 lb	Mercury	4018	117774	N/A
Scale	Howe		A057229	01MAY93
Scale	Howe		A057232	01MAY93

TEST SEQUENCE 8A - FED-STD-101C, Method 5016.1, Superimposed-Load Test (Stackability, With Dunnage), MIL-STD-648A, 5.7.2, Load Test (Stackability) Test, and MIL-C-5584D, 4.7.6.1, Load Resistance.

The test was conducted in accordance with FED-STD-101C, Method 5016.1 with the constant "S" = 2.0 for the equation of Paragraph 6.1.

The container containing the MXU/650 fins, fiberboard boxes, and drums, was placed on a flat, level, rigid surface. An extra container base was placed upon the test container cover to simulate stacking of like containers. Wooden timbers were used as dunnage to distribute the load. A 7458 pound load (including container base and timbers) was applied to simulate a stacking load on the container top (Figure 22).

The load remained in place for one hour. A visual inspection of the container was made when the load was removed. No container cover deformation was noted and the container contents showed no functional or physical damage. The stacking pads restricted relative displacement of the stacked containers.

TEST SEQUENCE 8B - FED-STD-101C, Method 5017, Superimposed-Load Test (Uniformly Distributed, Without Dunnage), and MIL-C-5584D, 4.7.6.1, Load Resistance.

The test was conducted in accordance with FED-STD-101C, Method 5017 with the constant "S" = 2.0 for the equation of Paragraph 6.1.

The container containing the MXU/650 fins, boxes, and drums, was placed on a flat, level, rigid surface. The test required a 100 pounds per square foot load (1534 pound total load) be distributed over the container top surface. Fifty pound lead blocks (1600 pounds total weight) were arranged in a symmetrical pattern to provide uniform loading per square foot of container top surface (Figure 23) .

The load remained in place for one hour. When subjected to the superimposed loading, no container cover deformation was noted and the container contents showed no functional or physical damage.

TEST SEQUENCE 9 - FED-STD-101C, Method 5011.1, 6.0, Mechanical Handling Test (Forklift Truck) and MIL-C-5584D,, 4.7.5, Mechanical Handling Test.

The following equipment and instrumentation was utilized:

Equipment	Manufacturer	Model	Ser#	Cal Exp
Forklift Truck 4000 lb	Mercury	4018	117774	N/A

TEST SEQUENCE 9A - FED-STD-101C, Method 5011.1, 6.2 Lifting and Transporting.

The test was conducted in accordance with FED-STD-101C, Method 5011.1, Paragraph 6.2.

The container containing the MXU/650 fins, boxes, and drums, was lifted on Container Side 6 by the forklift truck so that the container was clear of the ground (Figure 24). The container was transported on the forks (40 inches in length) in the tilt-back position over the forklift course. The 100 foot course was traversed at walking speed and contained three sets of parallel 1 x 4 inch boards across the forklift truck's path.

The container was lowered to the ground and the forklift truck moved to Container End 2 and the container was again transported over the forklift course.

The container remained stable on the forklift tines. Visual inspection revealed no external damage to the container.

TEST SEQUENCE 9B - FED-STD-101C, Method 5011.1, 6.5 Pushing.

The test was conducted in accordance with FED-STD-101C, Method 5011.1, Paragraph 6.5.

The container containing the MXU/650 fins, boxes, and drums, was pushed from Side 6 by the forklift truck. The forklift mast was vertical and the fork tines extended beneath, but were not supporting the container. The container was pushed 35 feet at a uniform speed over hard, dry pavement.

The forklift truck moved to End 2 and the container was again pushed 35 feet (Figure 25).

The container was lifted to examine the bottom of, the skids. visual inspection revealed no external damage to the container or its skids.

TEST SEQUENCE 9C - FED-STD-101C, Method 5011.1, 6.6 Towing.

The test was conducted in accordance with FED-STD-101C, Method 5011.1, Paragraph 6.6.

The container containing the MXU/650 fins, boxes, and drums, was towed from Side 6 by the forklift truck. A cargo strap was attached to the hoisting/tie-down rings on Side 6 (side towed) and looped through the forklift truck hitch at the same height as the rings. The container was towed 100 feet at a uniform speed over hard, dry pavement.

The cargo strap was attached to the hoisting/tie-down rings on Sides 6 and 5 (End 4 towed) and the container was again towed 100 feet (Figure 26).

The container was lifted to examine the bottom of the skids. Visual inspection revealed no external damage to the container or its skids.

TEST SEQUENCE 10 - FED-STD-101C, Method 5009.3, Leaks in Containers and MIL-C-5584D, 4.7.2, Pressure Test.

Reference Test Sequence 4 (Initial test description).

The container leak rate for 30 minutes was 0.025 psi (0.050 psi/hr) when the container was pressurized to 1.50 psi. This leak rate was equal to the maximum allowable leakage rate of 0.05 psi/hr (reference Test Plan).

The container was opened and a visual inspection of the container interior and the MXU/650 fins, boxes, and drums was made.

The Fin 4 housing protrusion had abraded Box 1 (Figure 27). The Fin 6 quick release pin for blade restraint (hereafter referred to as the pin) had abraded Box 3 (Figure 28). Fin 1, when repositioned in the container after examination, had to be rotated so that it's housing protrusion would not contact Box 1.

The Design Engineer determined damage was not critical and testing could proceed.

MXU/650 Fin housing protrusions could interfere with adjacent fin housing protrusions, lowering the cover, and the fiberboard boxes. The fins were rotated to minimize these interferences.

TEST SEQUENCE 11 - Rough Handling Tests (High Temperature +140°F)

The container containing the appropriate fins (the CNU-505/E configuration also contained boxes and drums) was conditioned at +165°F.

The polyethylene cushioning temperature was measured using a thermocouple temperature probe.

The following equipment and instrumentation was utilized:

Equipment	Manufacturer	Model	Ser#	Cal Exp
Environment Chamber	Tenney Eng		BH1138	20JUL92
Thermocouple	Omega	650	0016A	16NOV92

TEST SEQUENCE 11A - FED-STD-101C, Method 5005.1, Cornerwise-Drop (Rotational) Test and MIL-C-5584D, 4.7.7.2.1, Cornerwise-Drop (Rotational) Test.

The cornerwise-drop tests were conducted in accordance with FED-STD-101C, Method 5005.1. The drop height was selected from Table I for 600-1000 pounds, Level A protection.

The container was dropped 24 inches onto a 1-inch thick steel plate inside the environmental chamber (Figure 29). One drop was made on each of the two diagonally opposite bottom Corners 236 and 345.

TEST SEQUENCE 11B - FED-STD-101C, Method 5008.1, Edgewise-Drop) (Rotational) Test and MIL-C-5584D, 4.7.7.2.2, Edgewise-Drop (Rotational) Test.

The edgewise-drop tests were conducted in accordance with FED-STD-101C, Method 5008.1. The drop height was selected from Table I for 600-1000 pounds, Level A protection.

The container was dropped 24 inches onto a 1-inch thick steel plate inside the environmental chamber (Figure 30). One drop was made on each of the two bottom adjacent Edges 23 and 35.

TEST SEQUENCE 11C - FED-STD-101C, Method 5012, Pendulum-Impact Test and MIL-C-5584D, 4.7.7.2.3, Impact Test.

The pendulum-impact tests were conducted in accordance with FED-STD-101C, Method 5012.

The container impact velocity was 7 feet/sec (9 inch drop height). One impact was made on End 2 and Side 6 (Figure 31).

TEST SEQUENCE 11 - Rough Handling Test Inspections.

A visual inspection of the container exterior, interior, and contents was made after the test sequence for each container configuration.

THE CNU-505/E CONFIGURATION WITH THE MXU/650 FINS

The initial chamber temperature was 165°F. The initial internal cushion temperature was 156°F and dropped to 154°F by test completion.

During Corner Drop 236, container cover Side 2 was impacted from inside the container. Fin 3 housing protrusion dented the container. Box 3 was punctured by Fin 4 pin. Polyethylene foam particles from the cover cushion were clinging to the fin tips. Fin 3 pin was almost out since its cotter pin was not engaged.

The Design Engineer determined that the damage was not critical and testing could proceed.

THE CNU-336B/E CONFIGURATION WITH THE BSU/50 FINS

The initial chamber temperature was 165°F. The initial internal cushion temperature was 160°F and dropped to 159°F by test completion.

The cover cushion remained in the container cover when the container was opened. The locating pins on the fin forward ends had torn the cover cushion slightly.

The Design Engineer determined that the damage was not critical and testing could proceed.

THE CNU-335B/E CONFIGURATION WITH THE BSU/49 FINS

The initial chamber temperature was 165°F. Initial internal cushion temperature was 153°F and dropped to 151°F by test completion.

After testing, photographic examination and subsequent container inspection revealed that the right forkwell skid areas of Side 6 and End 4 were damaged. The skids could have been damaged when the container was placed on the blocks for corner-wise drop testing The container was unstable in this configuration.

The Design Engineer determined that the skid damage did not influence container integrity

TEST SEQUENCE 12 - FED-STD-101C, Method 5009.3, Leaks in Containers and MIL-C-5584D, 4.7.2, Pressure Test.

Reference Test Sequence 4 (Initial test description).

The container leak rate for 30 minutes was 0.017 psi (0.034 psi/hr) when the container was pressurized to 1.50 psi. This leak rate was less than the maximum allowable leakage rate of 0.05 psi/hr (reference Test Plan).

TEST SEQUENCE 13 - Rough Handling Tests (Low Temperature -20°F).

Reference Test Sequence 11.

The container was conditioned at -65°F.

TEST SEQUENCE 13A - FED-STD-101C, Method 5005.1, Cornerwise-Drop (Rotational) Test and MIL-C-5584D, 4.7.7.2.1, Cornerwise-Drop (Rotational) Test.

Reference Test Sequence 11A.

Corners 235 and 346 were impacted.

TEST SEQUENCE 13B - FED-STD-101C, Method 5008.1, Edgewise-Drop (Rotational) Test and MIL-C-5584D, 4.7.7.2.2, Edgewise-Drop (Rotational) Test.

Reference Test Sequence 11B.

Edges 34 and 36 were impacted.

TEST SEQUENCE 13C - FED-STD-101C, Method 5012, Pendulum-Impact Test and MIL-C-5584D, 4.7.7.2.3, Impact Test.

Reference Test Sequence 11C.

End 4 and Side 6 were impacted.

TEST SEQUENCE 13 - Rough Handling Test Inspections.

Reference Test Sequence 11.

THE CNU-505/E CONFIGURATION WITH THE MXU/650 FINS

The initial chamber temperature was -68°F. The initial internal cushion temperature was -68°F and rose to -41°F by test completion.

The low temperature caused the cushions to shrink. The base cushion shrank approximately one inch on two container sides. Fin 3 did not sit perpendicular to the base cushion and interfered with the cover during closure.

The Design Engineer determined damage was not critical and testing could proceed.

THE CNU-336B/E CONFIGURATION WITH THE BSU/50 FINS

The initial chamber temperature was -66°F. The initial internal cushion temperature was -66°F and rose to -65°F by test end.

The cover cushion remained on the fins when the container was opened. A foam chunk tore off the base cushion at the base of a fin. The base cushion shrank approximately 1-1/8 inch on End 2 and approximately 3/4 inch on Side 5.

The Design Engineer determined damage was not critical and testing could proceed.

THE CNU-335B/E CONFIGURATION WITH THE BSU/49 FINS

The initial chamber temperature was -65°F. The initial internal cushion temperature was -61°F and rose to -54°F by test completion.

The cover cushion remained on the fins when the container was opened. The fins were not perpendicular in the container after the pendulum impact test and some fins were resting against each other (Figure 32).

A piece of fin hardware was found on the base cushion (Figure 33). The base cushion shrank approximately 1-1/8 to 1-1/4 inch on two container sides (Figure 34).

The Design Engineer determined that the damage was not critical and testing could proceed.

TEST SEQUENCE 14 - FED-STD-101C, Method 5009.3, Leaks in Containers and MIL-C-5584D,, 4.7,2, Pressure Test.

Reference Test Sequence 4 (Initial test description).

The container leak rate for 30 minutes was 0.024 psi (0.048 psi/hr) when the container was pressurized to 1.50 psi. This leak rate was less than the maximum allowable leakage rate of 0.05 psi/hr (reference Test Plan).

TEST SEQUENCE 15 - MIL-STD-648A, 5.3.2, Resonance Strength and Dwell Test, and MIL-C-5584D, 4.7.7.1, Vibration.

Accelerometer Orientation

The container was instrumented with a triaxial accelerometer. The accelerometer was mounted as close to the fin center of mass as possible. The instrumented fin was placed as close as possible to the container geometrical center (the molded base cushions determined fin location).

TEST EQUIPMENT

The acceleration pulses were recorded for each test sequence to determine the maximum acceleration sustained by the container. All signals were electronically filtered using a two pole Butterworth filter with a 290 Hz cutoff frequency.

The container containing the appropriate fins (the CNU-505/E configuration also contained boxes and drums) was rigidly attached to the vibration platform (Figure 35). A sinusoidal vibration excitation was applied in the vertical direction and cyclically swept for 7.5 minutes at 2 minutes per octave to locate the resonant frequency. Input vibration from 5 to 12.5 Hz was at 0.125 inch double amplitude. Input vibration from 12.5 to 50.0 Hz was at 1.0 G (O to peak). A 30 minute resonant dwell test was conducted at the predominant resonant frequency.

The polyethylene cushioning temperature was measured using a thermocouple temperature probe.

The following equipment and instrumentation was utilized:

Equipment	Manufacturer	Model	Ser#	Cal Exp
Vibration Machine	L.A.B. Div	41012432	89003	N/A
Vibration Meter	L.A.B. Div	487A02	0068	20APR92
Sweep Osc Servo	Spectral Dyn	SD1148B	528	N/A
Auto Level Programmer	Spectral Dyn	SD117A	1865	N/A
Filter	Krohn-Hite	3343	1943	N/A
Storage Oscilloscope	Tektronix	5115	B094122	09DEC92
Accelerometer	Endevoc	2223D	FF67	18JUL93
Charge Amplifier	Endevco	2740BT	FY65	21DEC92
Charge Amplifier	Endevco	2740BT	FW07	08NOV92
Charge Amplifier	Endevco	2740BT	FW23	06DEC92
Data Acquisition Sys	GHI Systems	Triad CAT	N/A	N/A
Thermocouple	Omega	650	0016A	16NOV92

THE CNU-505/E CONFIGURATION WITH THE MXU/650 FINS

Accelerometer positive axes orientations (Figure 36). Fin 2 was instrumented (Figure 37).

X Axis - Directed through container Side 4.
Y Axis - Directed through container Side 6.
Z Axis - Directed through container Side 3.

TEST RESULTS

			Table Input		Resonant	Response
Sample	Time	Freq	Disp	Accell	Accel	Trans
1	03:00	8.9	0.125	1.25	6.87	5.50
2	15:00	8.8	0.125	1.64	6.71	4.09
3	27:00	8.8	0.125	1.75	6.62	3.78

NOTE: Acceleration (Accel) based on Peak Amplitude of input and output.

At the resonant frequency of 8.9 Hz, the maximum vibration output was 6.87 G_{pp} with a 1.25 G_{pp} vibration input at 0.125 inch table displacement. The maximum transmissibility (trans) was 5.50 which exceeded the maximum permissible transmissibility of 5 at the resonance frequency (reference Test Plan). The Design Engineer determined that even though the transmissibility exceeded the Test Plan, this value was not critical since the fins were not susceptible to damage.

The test was conducted at ambient temperature. Initial internal cushion temperature was 73°F and rose to 74°F by the end of the test.

Visual inspection revealed no damage to the container exterior. The container was opened and a visual inspection of the container interior and the MXU/650 fins, boxes, and drums was made.

Fin 4 pin punctured Box 3 in two places (Figure 38). The forward and aft fin ends imprinted the cover and base cushions approximately 1/16 inch.

The Design Engineer determined that the damage was, not critical and testing could proceed.

THE CNU-336B/E CONFIGURATION WITH THE BSU/50 FINS

Accelerometer positive axes orientations (Figure 39).
Fin 1 was instrumented (Figure 40).

X Axis - Directed through container Side 4.
Y Axis - Directed through container Side 5.
Z Axis - Directed through container Side 1.

TEST RESULTS

		Table Input			Resonant Response	
Sample	Time	Freq	Disp	Accel	Accel	Trans
1	03:00	9.96	0.125	2.13	11.39	5.35
2	17:00	9.96	0.125	2.24	11.12	4.96
3	27:00	9.86	0.125	2.23	11.16	5.00

NOTE: Acceleration (Accel) based on Peak Amplitude of input and output.

At the resonant frequency of 9.96 Hz, the maximum vibration output was 11.39 G_{pp} with a 2.13 G_{pp} vibration input at 0.125 inch table displacement. The maximum transmissibility (trans) was 5.35 which exceeded the maximum permissible transmissibility of 5 at the resonance frequency (reference Test Plan). The Design Engineer determined that even though the transmissibility exceeded the Test Plan, this value was not critical since the fins were not susceptible to damage.

The test was conducted at ambient temperature. Initial internal cushion temperature was 73°F and rose to 74°F by the end of the test.

Visual inspection revealed no damage to the container exterior. The container was opened and a visual inspection of the container interior and the BSU/50 fins was made.

The forward fin ends imprinted the cover cushion approximately 1/16 inch. The aft fin ends imprinted the base cushions approximately 1/8 inch.

The polyethylene cover cushion is positioned on the forward end of the fins before cover closure. The cover cushion can shift when the cover is lowered onto the container base. When this happens, the cover must be removed and the cushion repositioned. A method to prevent cushion shift would alleviate this problem.

The Design Engineer noted the problem with the cover cushion and determined that the damage was not critical and testing could proceed.

THE CNU-335B/E CONFIGURATION WITH THE BSU/49 FINS

Accelerometer positive axes orientations (Figure 41).
Fin 6 was instrumented (Figure 42).

X Axis - Directed through container Side 4.
Y Axis - Directed through container Side 5.
Z Axis - Directed through container Side 1.

TEST RESULTS

			Table Input		Resonant Response	
Sample	Time	Freq	Disp	Accel	Accel	Trans
1	03:00	8.37	0.125	1.65	9.69	5.87
2	16:00	8.40	0.125	1.58	9.58	6.06
3	27:00	8.40	0.125	1.69	9.40	5.56

NOTE: Acceleration (Accel) based on Peak Amplitude of input and output.

At the resonant frequency of 8.40 Hz, the maximum vibration output was 9.58 G_{pp} with a 1.58 G_{pp} vibration input at 0.125 inch table displacement. The maximum transmissibility (trans) was

6.06 which exceeded the maximum permissible transmissibility of 5 at the resonance frequency (reference Test Plan). The Design Engineer determined that even though the transmissibility exceeded the Test Plan, this value was not critical since the fins were not susceptible to damage.

The test was conducted at ambient temperature. Initial internal cushion temperature was 72°F and rose to 75°F by the end of the test.

Visual inspection revealed no damage to the container exterior. The container was opened and an visual inspection of the container interior and the BSU/49 fins was made.

The forward and aft fin ends imprinted the cover and base cushions approximately 1/16 inch.

The Design Engineer determined that the damage was not critical and testing could proceed.

TEST SEQUENCE 16 - FED-STD-101C, Method 5009.3, Leaks in Containers and MIL-C-5584D, 4.7.2, Pressure Test.

Reference Test Sequence 4 (Initial test description).

THE CNU-505/E CONFIGURATION WITH THE MXU/650 FINS

The container failed the leak test and was examined and repaired. Leaks were found in the base corner side seams (345, 235, and 236) on the inner surface. The Design Engineer determined that the damage was not structural and testing could proceed.

After repair, the container leak rate for 30 minutes was 0.017 psi (0.034 psi/hr) when the container was pressurized to 1.50 psi. This leak rate was less than the maximum allowable leakage rate of 0.05 psi/hr (reference Test Plan).

TEST SEQUENCE 17 - MIL-STD-648A, 5.2.2, Repetitive Shock Test, FED-STD-101C Method 5019.1, Vibration (Repetitive Shock) Test, and MIL-C-5584D, 4.7.7.3, Repetitive Shock (Superimposed Loads).

The following equipment was utilized:

Equipment	Manufacturer	Model	Ser#	Cal Exp
Vibration Machine	L.A.B. Div	5000-96B	56801	N/A

The test was conducted in accordance with FED-STD-101C, Method 5019.1, at ambient temperature.

The container containing the appropriate fins,(CNU-505/E configuration also contained boxes and drums) was placed on the vibration table (Figure 43). Restraints were utilized that would prevent the container from sliding off the table. The container was allowed about 1/2 inch unrestricted movement in the horizontal direction from the centered position on the table.

The table frequency was increased from 0.0 Hertz (Hz) until the container left the table surface. Test duration was two hours.

THE CNU-505/E CONFIGURATION WITH THE MXU/650 FINS

At 4.6 Hz input vibration frequency, one inch double amplitude, a 1/16 inch thick bar could be slid freely between table and container under all points of the container.

After approximately 15 minutes, the container became extremely unstable on the table. The input vibration frequency was reduced to 4.5 Hz until test completion. The 1/16 inch thick bar could not be slid freely between table and container under all points of the container, but the input frequency could not be increased due to container instability.

Visual inspection revealed no damage to the container exterior. The container was opened and an visual inspection of the container interior and the MXU/650 fins, boxes, and drums was made.

Fin 1 pin became loose and vibrated out (Figure 44). Fin tips punctured the cover cushion approximately 1/16 to 1-1/2 inches Figure 45). Boxes 2 and 3 were punctured by fin pins (Figure 46). Boxes 4, 5, and 6 were punctured by the drums they were sitting upon (Figure 47).

Fin pin 1 rubbed Fin 5
Fin pin 2 rubbed Fin 1
Fin pin 3 rubbed Fin 2
Fin pin 5 rubbed Fin 6

(Figure 48 is a typical example)

Fin pin 4 scratched the end of Fin 5. Fin 4 aft end blades cut through the base cushion in four places. The base cushion side wall radius cracked. This radius consists of four circular segments located on the base cushion sidewall. The radius is the transition point from the base cushion sidewall circular cut out for the fin body and the relief area for the fin aft end. (Hereafter referred to as the base cushion radius).

Fin 1 base cushion radius cracked.

Fin 2 aft end blades through base cushion, one place; base cushion radius cracked.

Fin 3 aft end blades through base cushion, one place; base cushion radius cracked.

Fin 5 aft end blades through base cushion, one place; base cushion radius cracked.

Fin 6 aft end blades through base cushion, one place; base cushion radius cracked.

Fin 4 rubbed on a drum. The contents of Drum 3 emptied out when the drum was lifted from the base cushion (Figure 49). There was no foam in the bottom of the drum as there was in the other drums. Drum 2 was received and used empty.

Fins 2 and 4 access doors vibrated off. Fin 2 access door was reinstalled. Fin 4 access door was left off for additional testing since it was missing one fastener and nylon washer (Figure 50).

The Design Engineer determined that the damage was, not critical and testing could proceed.

THE CNU-336B/E CONFIGURATION WITH THE BSU/50 FINS

At 4.4 Hz input vibration frequency, one inch double amplitude, a 1/16-inch thick bar could be slid freely between table and container under all points of the container.

Visual inspection revealed no damage to the container exterior. The container was opened and an visual inspection revealed no damage to the container interior or the BSU/50 fins.

THE CNU-335B/E CONFIGURATION WITH THE BSU/49 FINS

At 4.7 Hz input vibration frequency, one-inch double amplitude, a 1/16 inch thick bar could be slid freely between the table and container under all points of the container. After approximately 75 minutes, the container became extremely unstable on the table. The input vibration frequency was reduced to 4.6 Hz until test completion. The 1/16 inch thick bar could not be slid freely between table and container under all points of the container, but the input frequency could not be increased due to container instability.

Visual inspection revealed that Corner 236 hoisting/tie-down ring screw had vibrated back from it's installed position (Figure 51).

The container was opened and an visual inspection of the container interior and the BSU/49 fins was made. The aft end fin blades imprinted the base cushion approximately 1/16 inch. The forward fin end pin imprinted the cover cushion approximately 1/16 inch.

The fin blade (sharp) edges (Figure 52) wore grooves in the container cover lower extrusion inner surface (Figure 53).

The Design Engineer determined damage was not critical and testing could proceed.

TEST SEQUENCE 18 - FED-STD-101C, Method 5009.3, Leaks in Containers and MIL-C-5584D, 4.7.2, Pressure Test.

Reference Test Sequence 4 (Initial test description).

The container leak rate for 30 minutes was 0.022 psi (0.044 psi/hr) when the container was pressurized to 1.50 psi. This leak rate was less than the maximum allowable leakage rate of 0.05 psi/hr (reference Test Plan).

TEST SEQUENCE 19 - MIL-STD-648A, 5.2.7.1, Impact Test (Stacked), MIL-C-5584D, 4.7.6.2, Stacking Strength, and MIL-C-5584D, 4.7.7.2.3, Impact Test, and FED-STD-101C, Method 5012, Pendulum-Impact Test.

The pendulum-impact tests were conducted in accordance with FED-STD-101C, Method 5012.

CNU-505/E container configuration with the MXU/650 fins, boxes and drums was utilized. A spare prototype container was used for the top container and was loaded with the same contents as the test container.

Heavy duty 3/4 inch steel strapping was used to band the containers together. Two straps were placed lengthwise and girthwise around the containers through the forklift pockets. The container impact velocity was 7 feet/sec (9 inch drop height). One impact was made on Side 5 and another impact on End 2 (Figure 54).

Upon Side 5 impact, all latches opened on Side 5 of the lower container (Figure 55). A cargo strap, used to lift the containers after impact, deformed the lower base extrusion (Side 4, left forklift pocket, top right side, Figure 56).

The Design Engineer determined that the damage was not critical and testing could proceed.

TEST SEQUENCE 20 - FED-STD-101C, Method 5009.3, Leaks in Containers and MIL-C-5584D, 4.7.2, Pressure Test.

Reference Test Sequence 4 (Initial test description).

The container leak rate for 30 minutes was 0.0243 psi (0.0486 psi/hr) when the container was pressurized to 1.50 psi. This leak rate was less than the maximum allowable leakage rate of 0.05 psi/hr (reference Test Plan).

TEST SEQUENCE 21 - MIL-STD-648, 5.5, Structural Integrity.

Reference Test Sequence 4 (Initial test description).

TEST SEQUENCE 21A - MIL-STD-648, 5.5.2, Pressure Test.

The container was pressurized to 3.0 psi. The container deformed but there was no failure of the latches,, fasteners, or container structure.

TEST SEQUENCE 21B - MIL-STD-648, 5.5.3, Vacuum Test.

The container was evacuated to -3.0 psi. The container deformed but there was no failure of the latches, fasteners, or container structure.

APPENDIX A

TEST SEQUENCE

TEST PLAN MATRIX

TEST NO.	CONFIGURATION	COMPLETED	COMMENTS
~~1~~	BSU/49	6 OCT 92	
	BSU/5Ø	6 OCT	
	MXU/65Ø	6 OCT	
~~2~~	BSU/49	6 OCT	
	BSU/5Ø	6 OCT	
	MXU/65Ø	6 OCT	
~~3~~	BSU/49	6 OCT	
	BSU/5Ø	6 OCT	
	MXU/65Ø	6 OCT	
~~4~~	MXU/65Ø	15/16 OCT	
~~5~~	MXU/65Ø	29 OCT	
~~6~~	MXU/65Ø	COMPLETE	a 29 OCT b 29 OCT c 19 NOV
~~7~~	MXU/65Ø	COMPLETE	b 29 OCT c 29 OCT a 19 NOV
~~8~~	MXU/65Ø	29 OCT	a 29 OCT b 29 OCT
~~9~~	MXU/65Ø	29 OCT	a 29 OCT b 29 OCT c 29 OCT
~~10~~	MXU/65Ø	30 OCT	
~~11~~	MXU/65Ø	4 NOV	a 4 NOV b 4 NOV c 4 NOV
~~12~~	MXU/65Ø	5 NOV	
~~13~~	MXU/65Ø	16 NOV	a 16 NOV b 16 NOV c 16 NOV
~~14~~	MXU/65Ø	2~~0~~ NOV	17 NOV
~~15~~	MXU/65Ø	30 OCT	
~~16~~	MXU/65Ø	2 NOV 92	

~~17~~	MXU/650	5NOV	
~~18~~	MXU/650	6NOV	
19	MXU/650	23NOV	
20	MXU/650	24NOV	
21	MXU/650	24NOV	
11	BSU/50	3DEC	
13	BSU/50	4DEC	
15	BSU/50	24NOV	
17	BSU/50	25NOV	
11	BSU/49	2DEC	
13	BSU/49	2DEC	
15	BSU/49	25NOV	
17	BSU/49	30NOV	

APPENDIX B

PHOTOGRAPHS

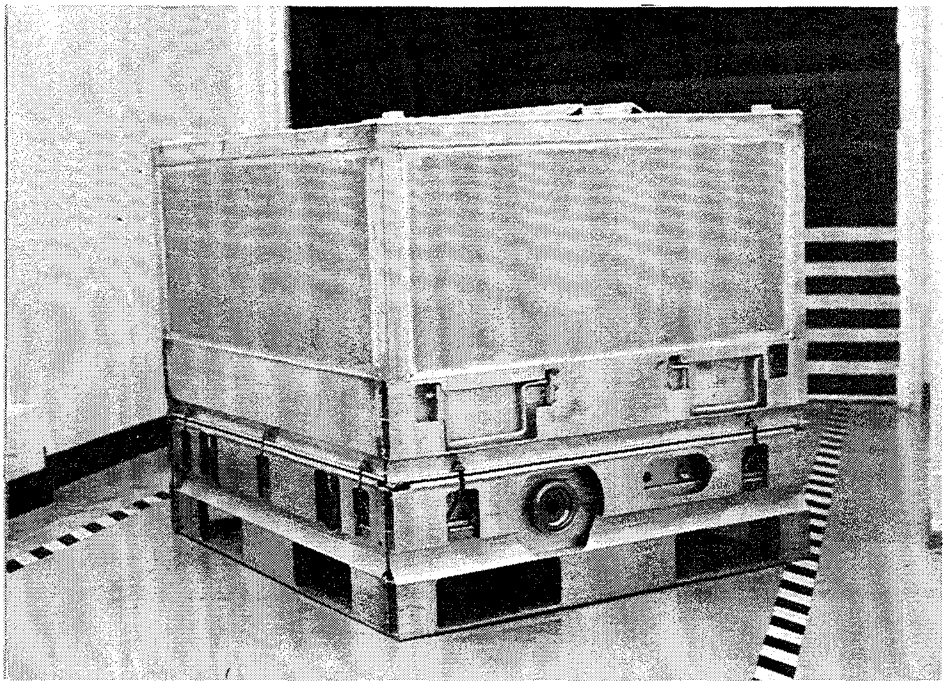

Figure 1. CNU-534/E - Container.

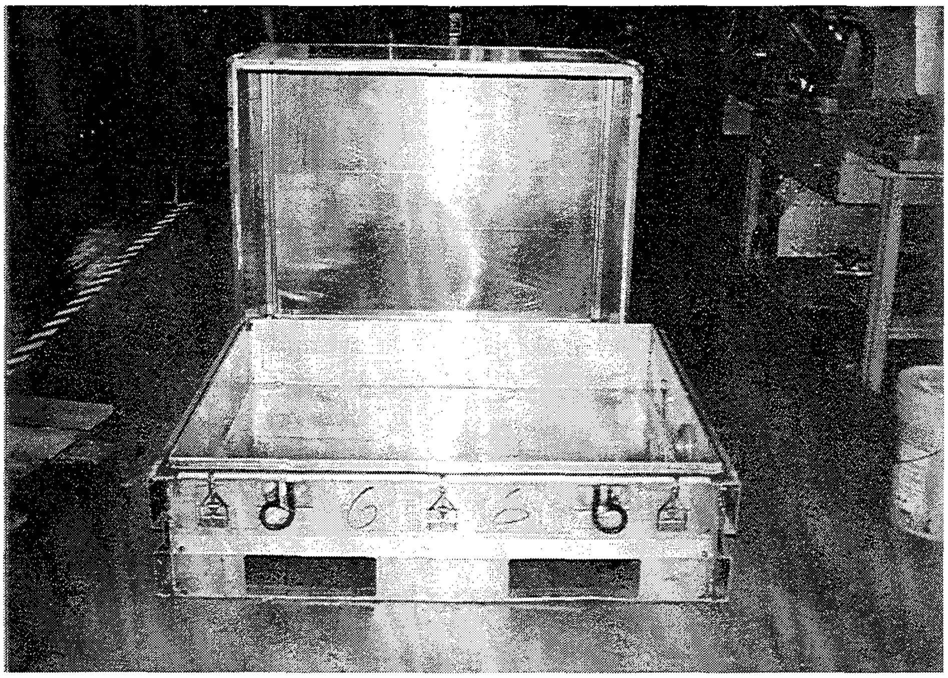

Figure 2. CNU-534/E - Cover and Base.

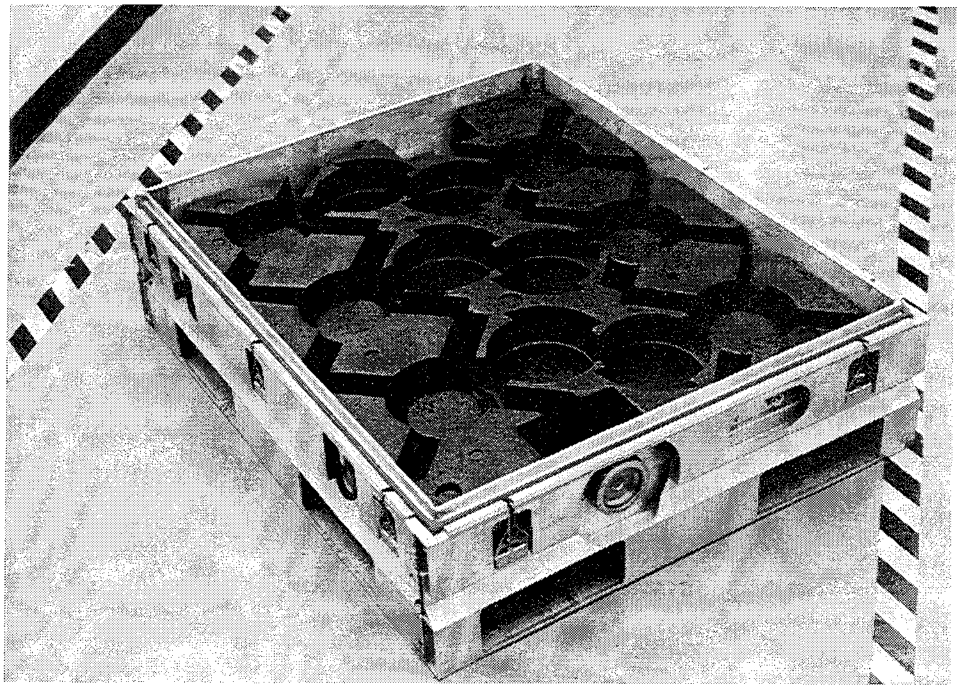

Figure 3. CNU-505/E - Base and Base Cushion.

Figure 4. CNU-505/E with MXU/650 Fins.

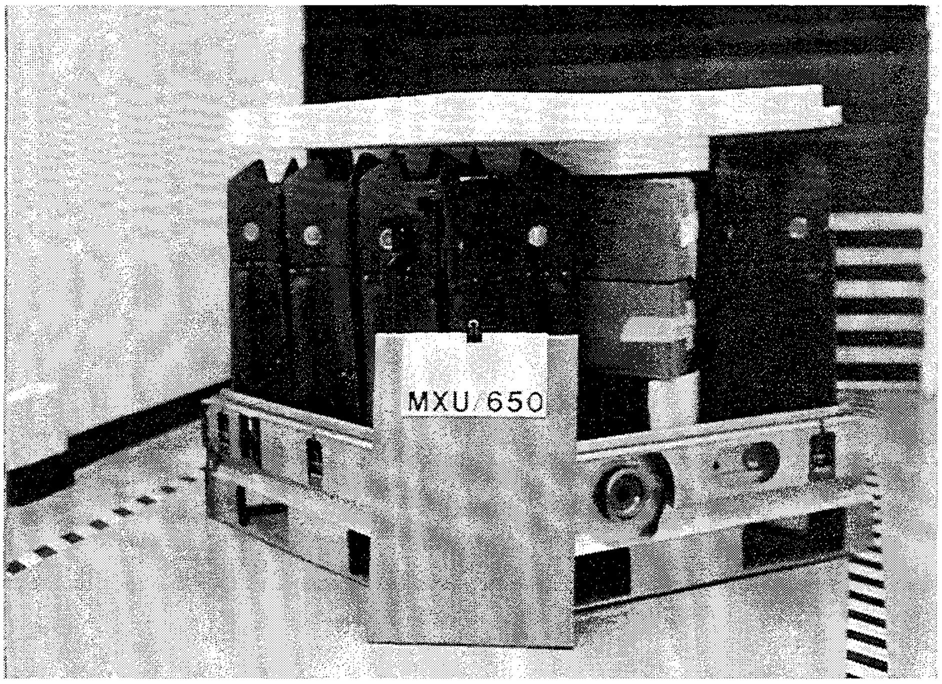

Figure 5. CNU-505/E, MXU/650 Fins, and Cover Cushion.

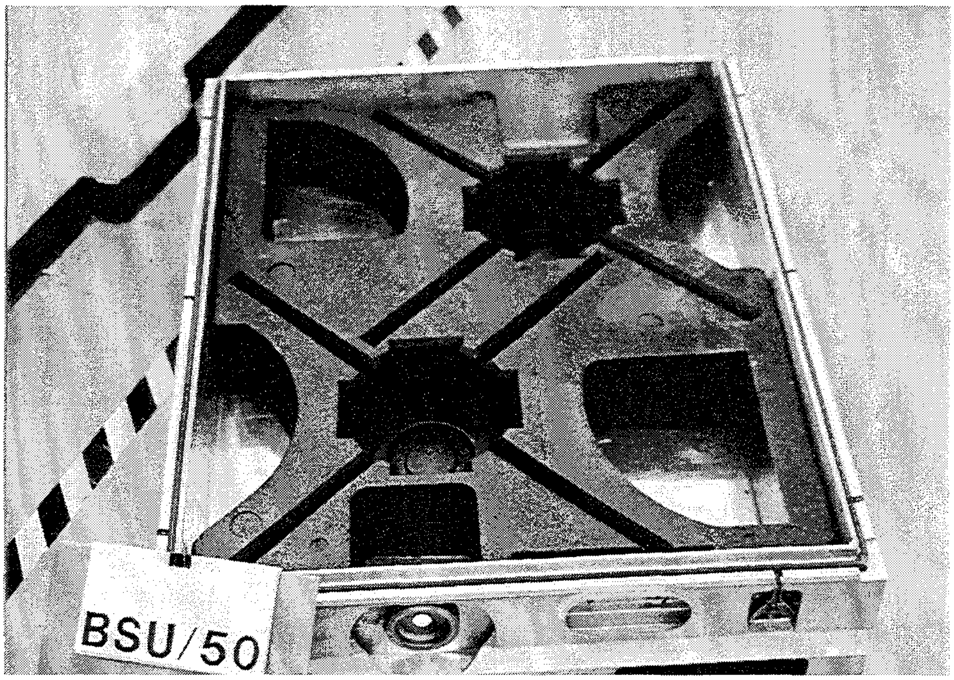

Figure 6. CNU-336B/E - Base and Base Cushion.

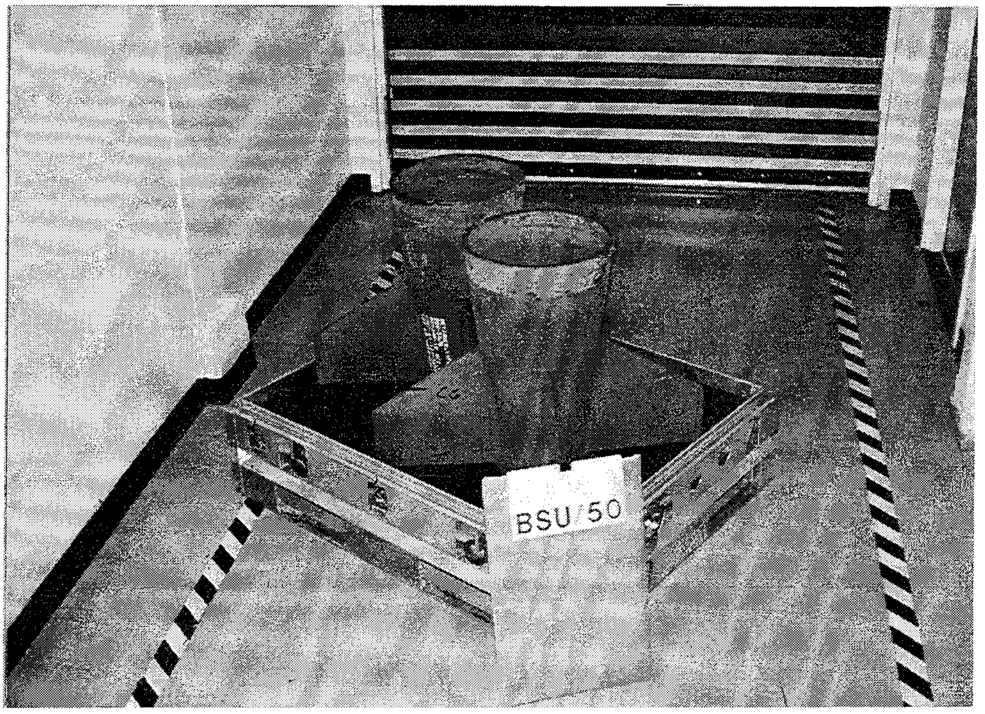

Figure 7. CNU-336B/E with BSU/50 Fins.

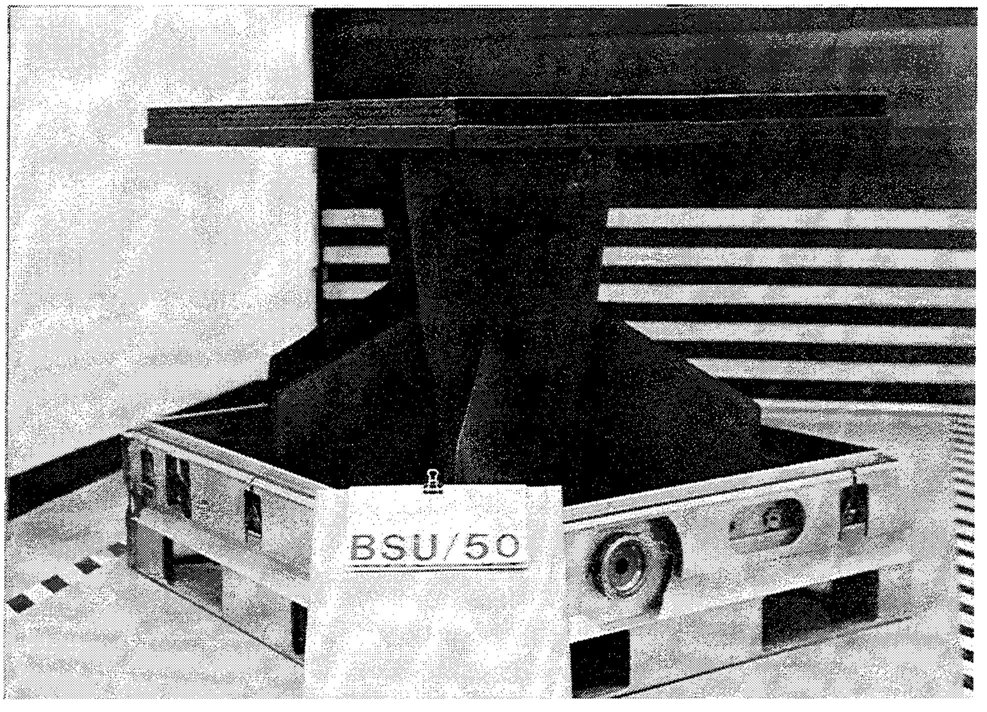

Figure 8. CNU-336B/E, BSU/50 Fins, and Cover Cushion.

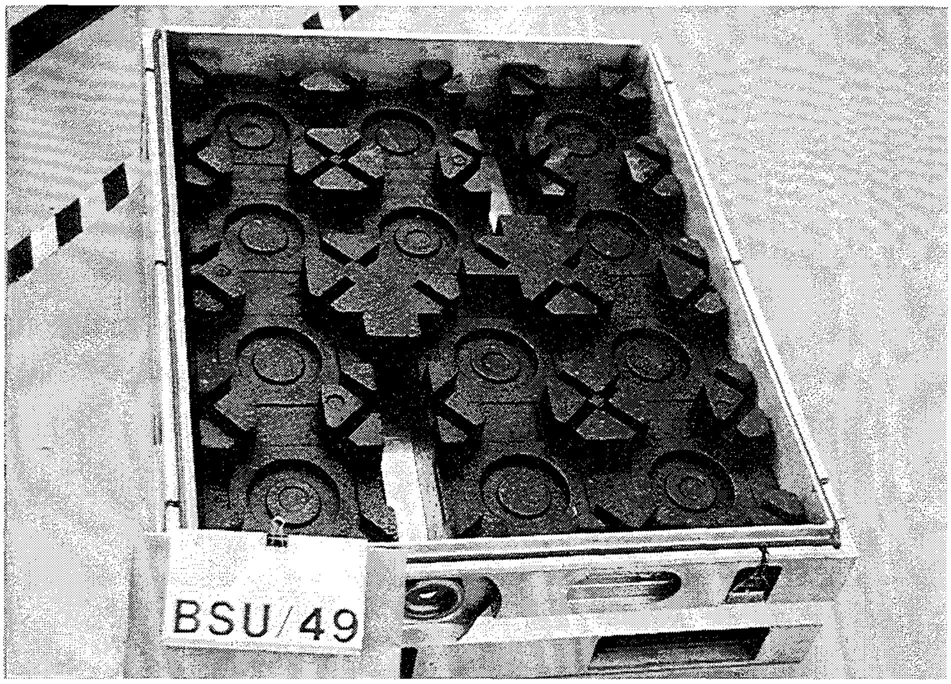

Figure 9. CNU-335B/E - Base and Base Cushion.

Figure 10. CNU-335B/E with BSU/49 Fins.

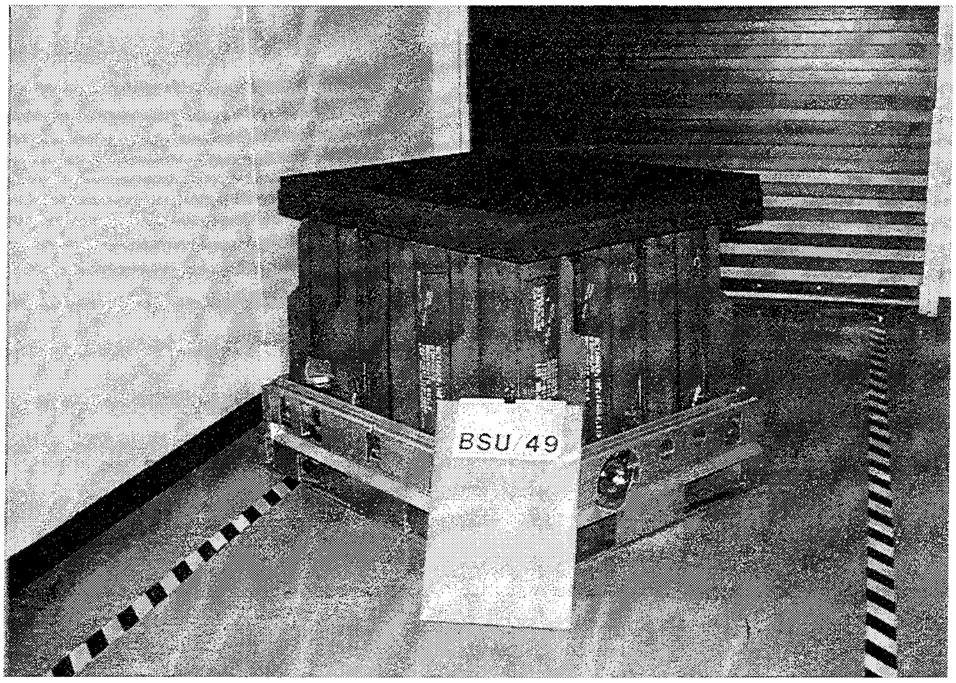

Figure 11. CNU-335B/E, BSU/49 Fins, and Cover Cushion.

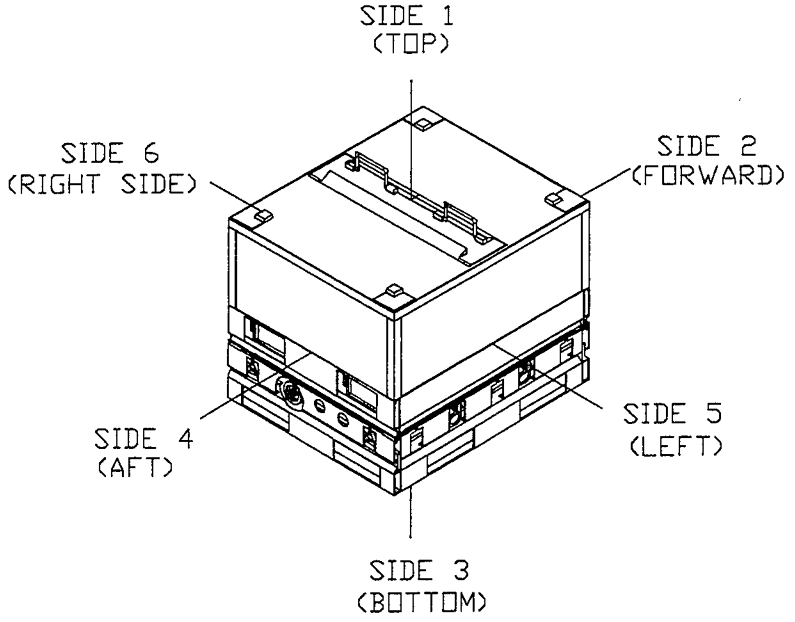

Figure 12. CNU-534/E Container Side Designation.

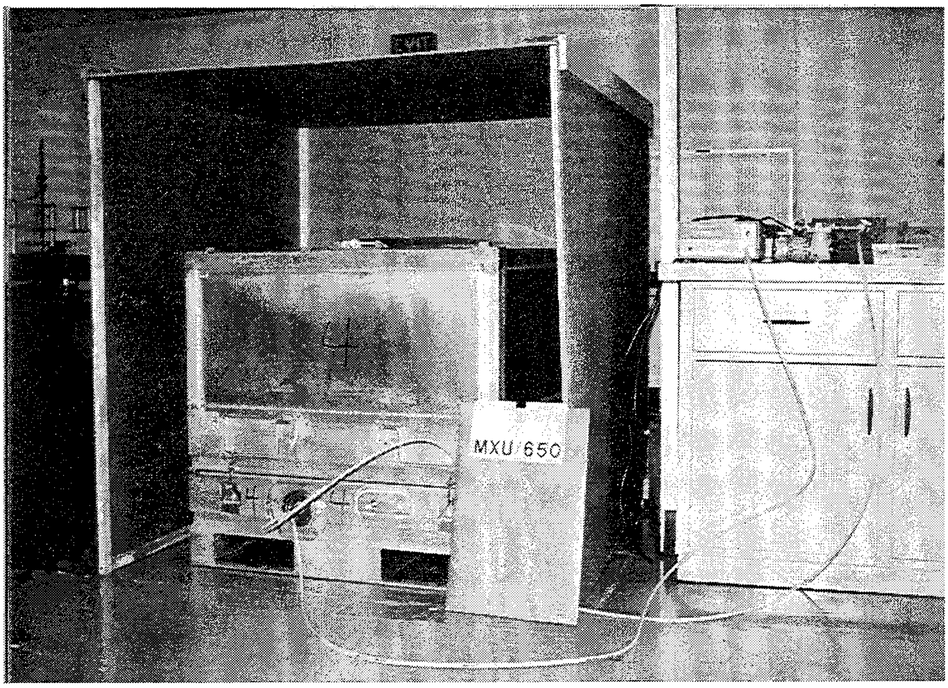

Figure 13. Pneumatic Pressure/Vacuum Retention Leak Test.

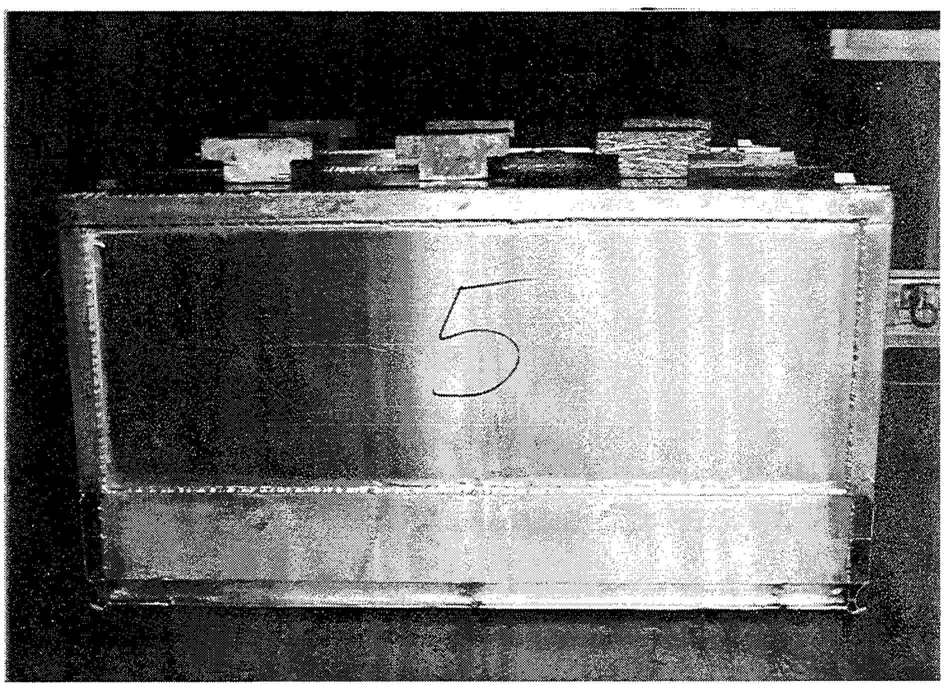

Figure 14. Cover Stand Off Test.

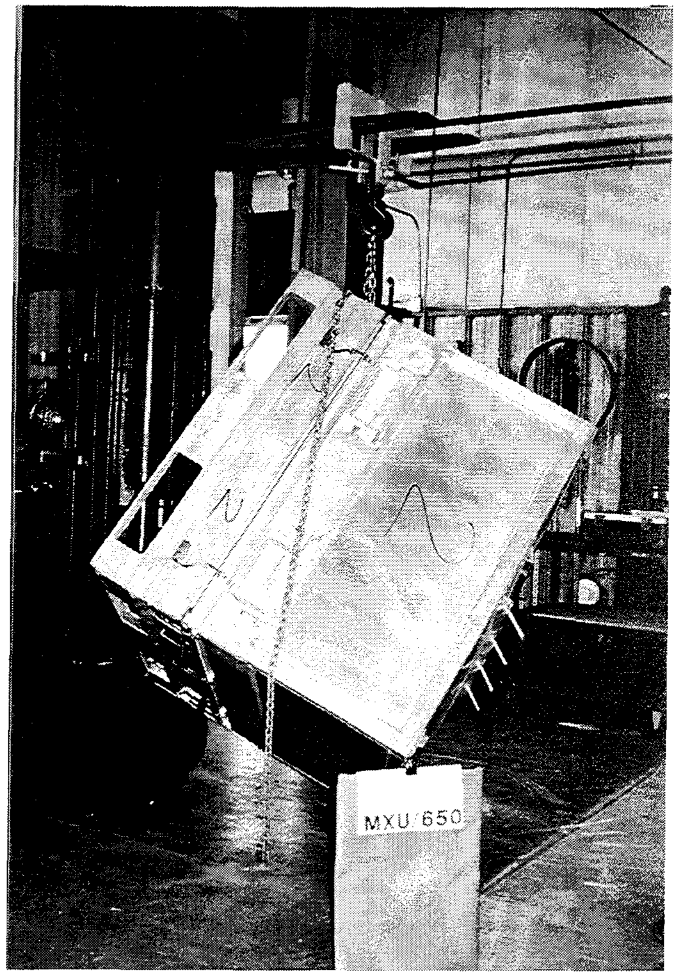

Figure 15. Single Hoisting Fitting Strength Test.

Figure 16. Hoisting Fittings (4) Strength Test.

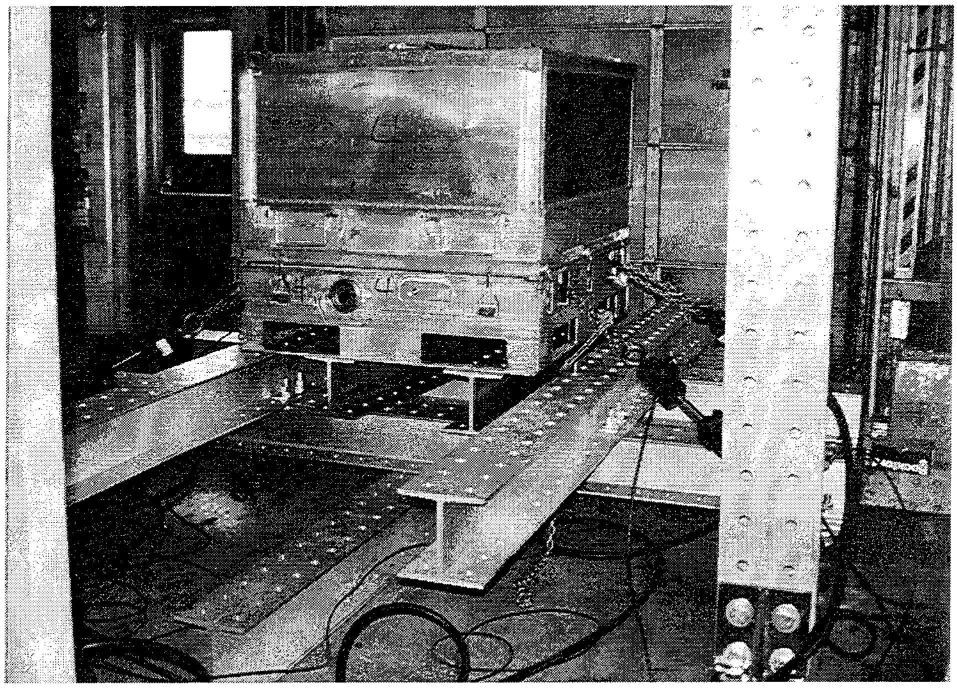

Figure 17. Tie Down Strength Test.

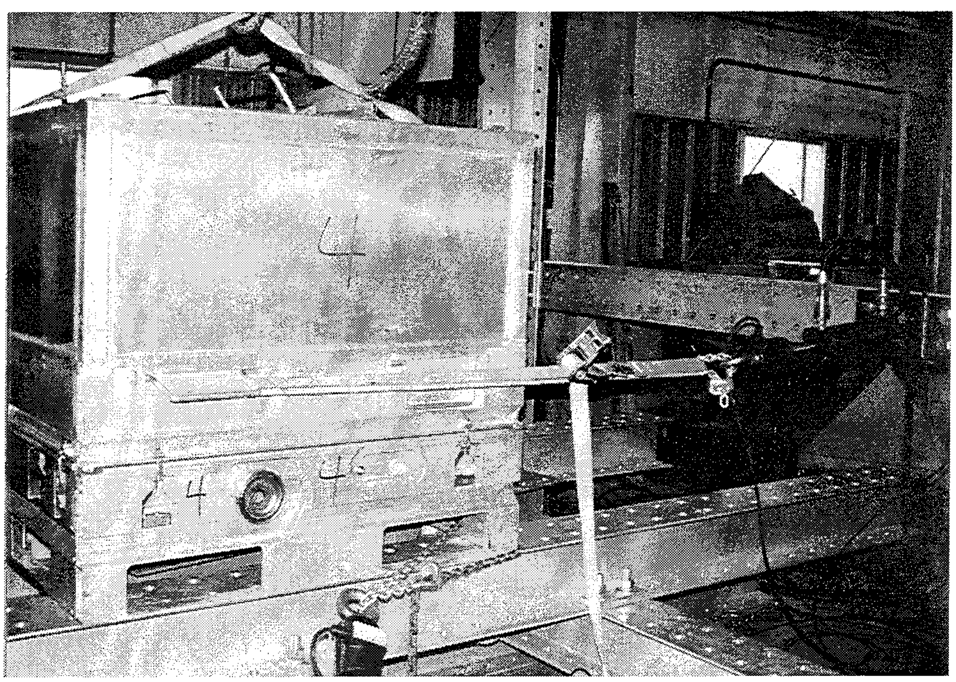

Figure 18. Handle Strength Test - Captured End.

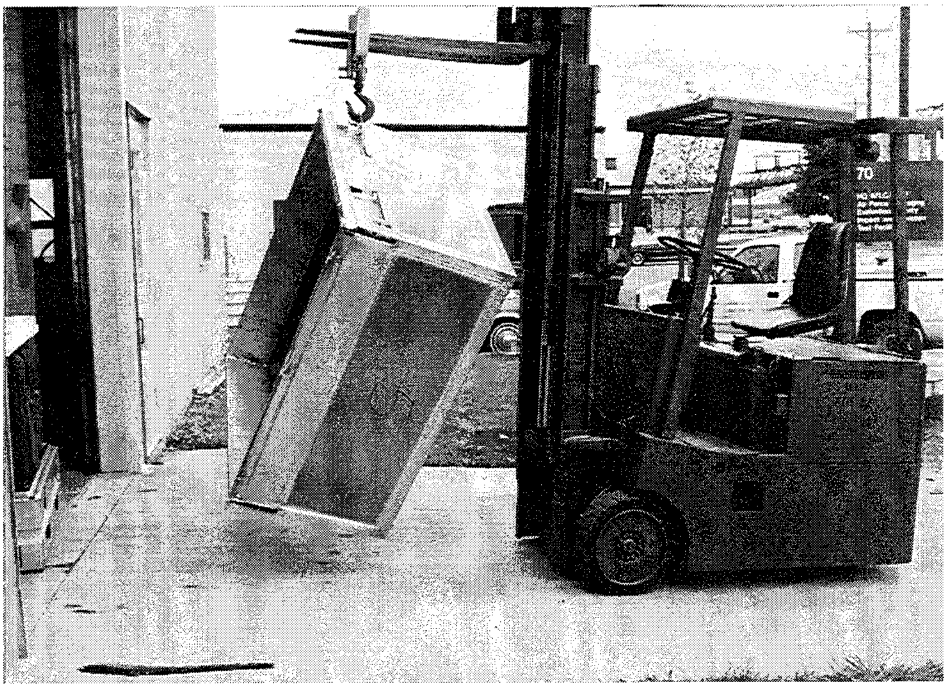

Figure 19. Handle Strength Test - Single Point.

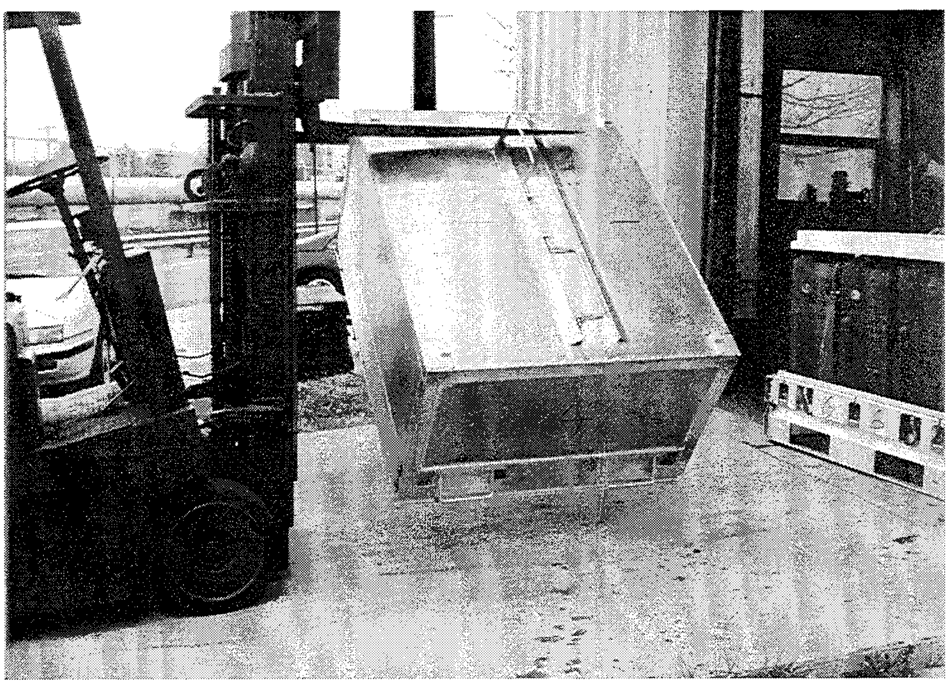

Figure 20. Handle Strength Test - Forklift Tine.

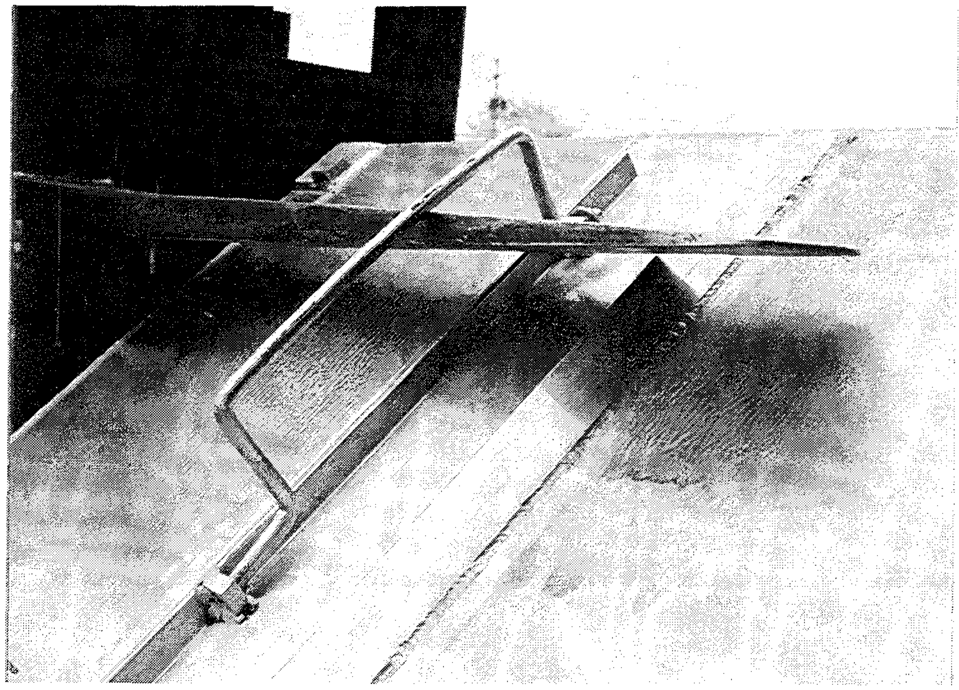

Figure 21. Forklift Tine Test - Handle Deformation.

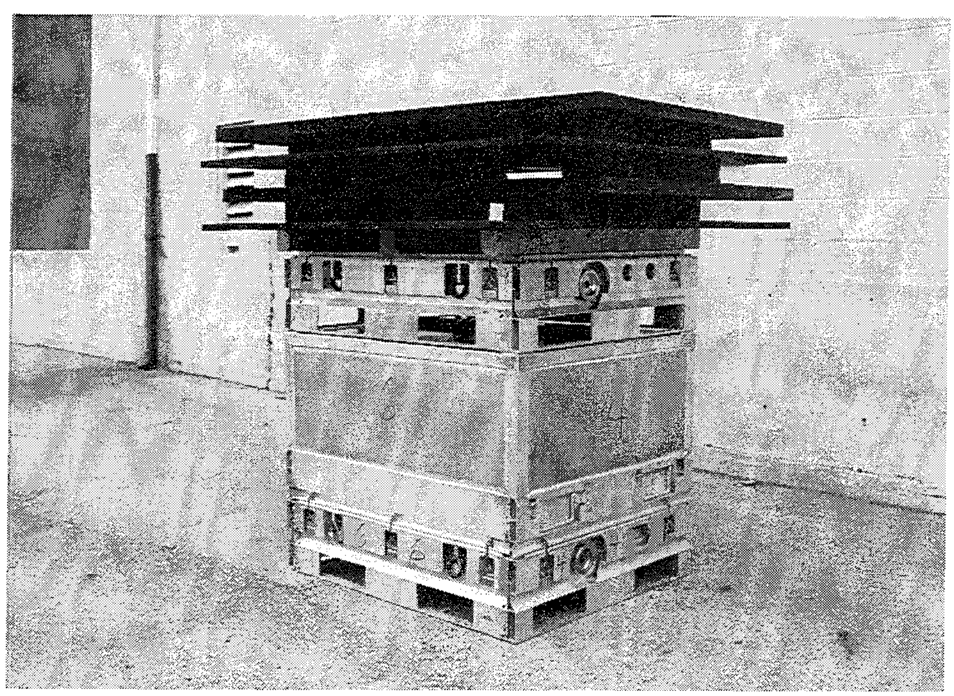

Figure 22. Superimposed Load Test - Stackability With Dunnage.

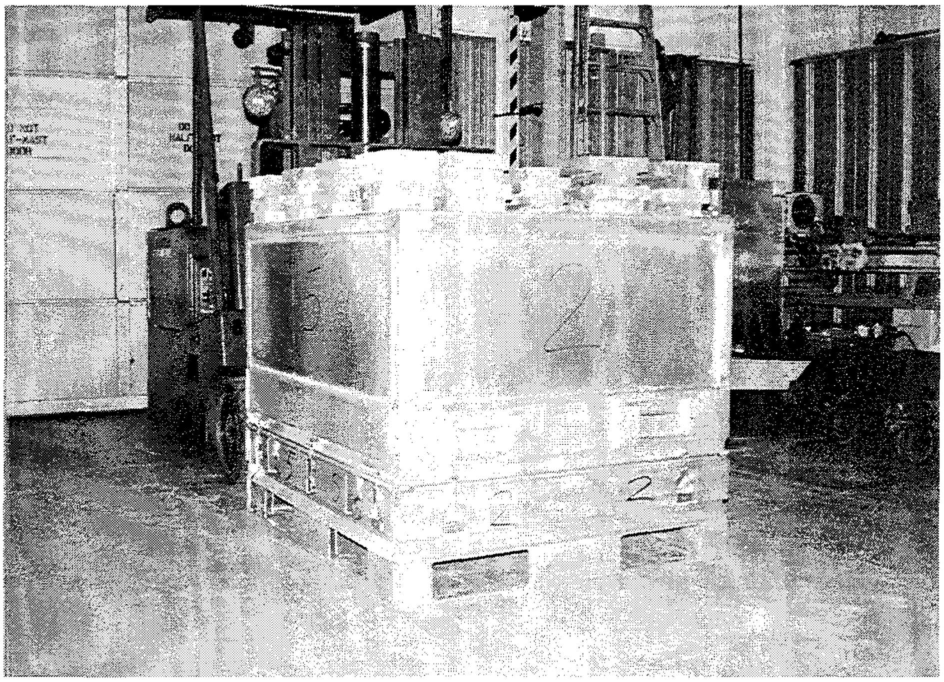

Figure 23. Superimposed Load Test - Uniformly Distributed, Without Dunnage.

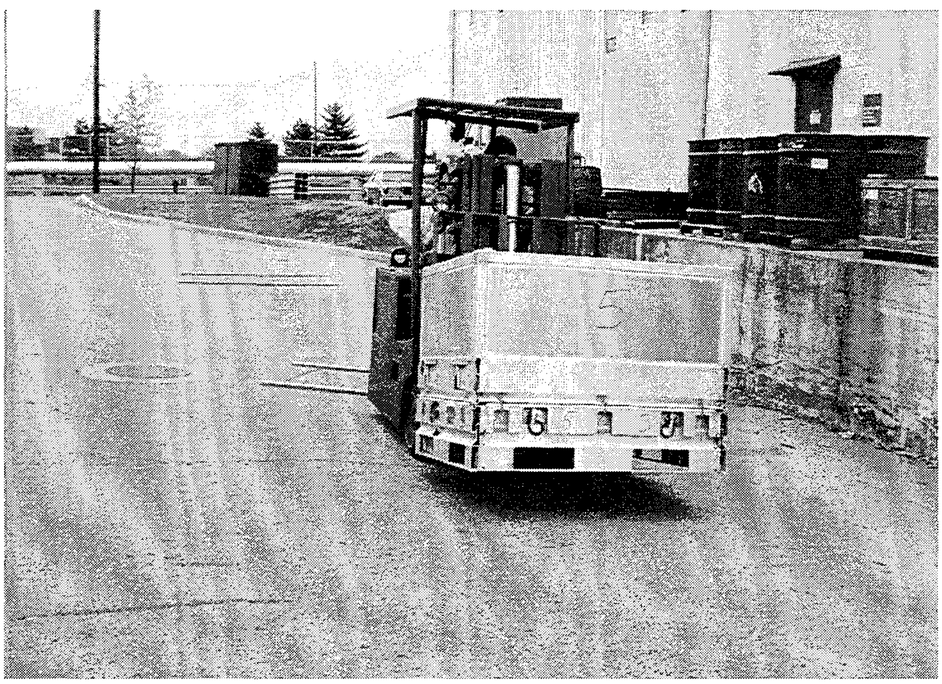

Figure 24. Mechanical Handling Test - Forklift.

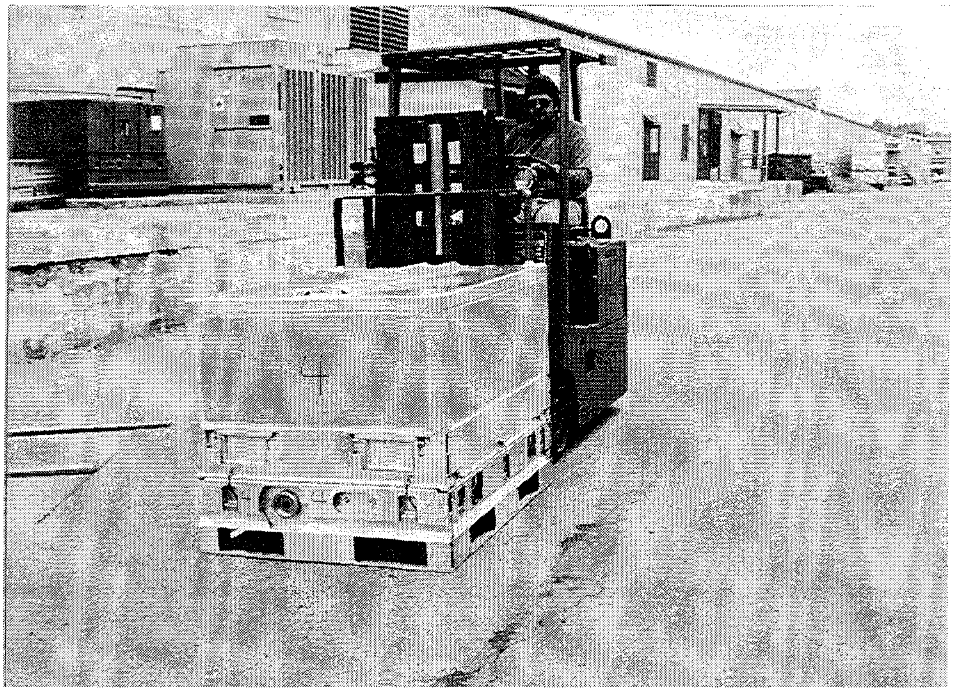

Figure 25. Mechanical Handling Test - Pushing.

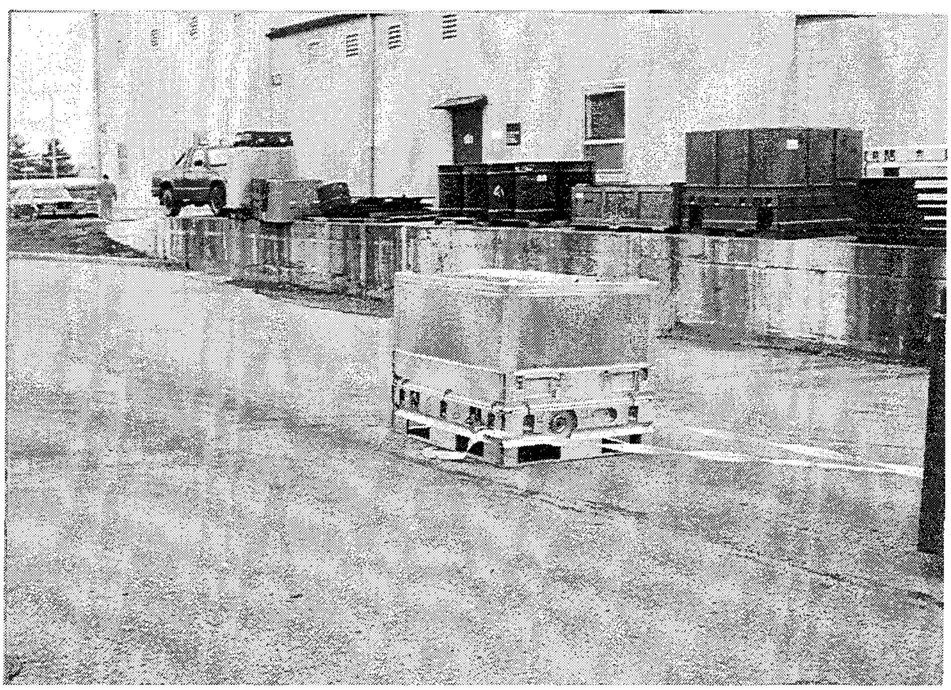

Figure 26. Mechanical Handling Test - Towing.

Figure 27. CNU-505/E - Box Abrasion by Fins.

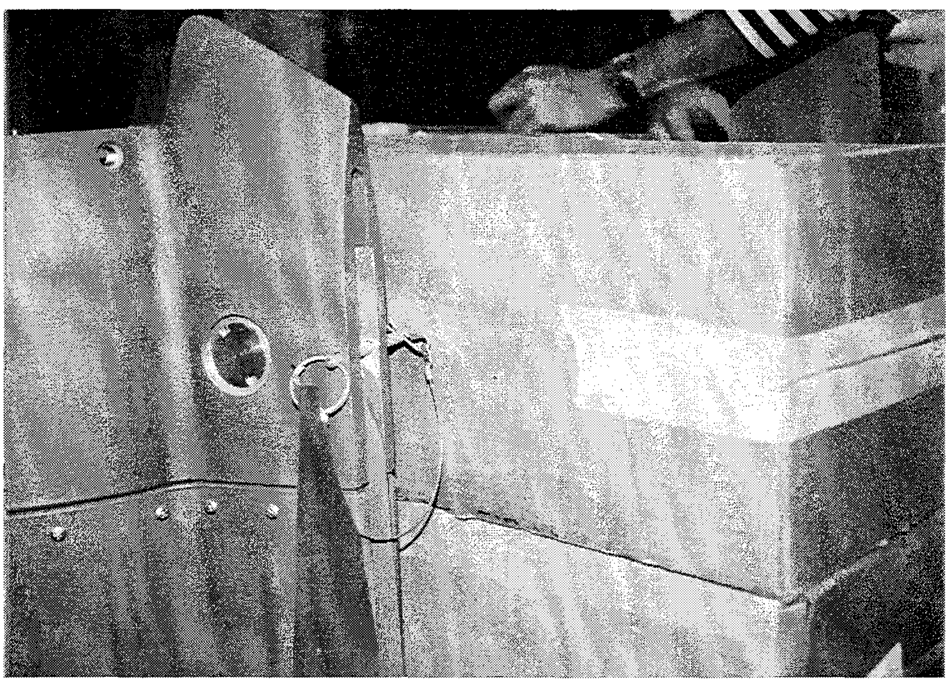

Figure 28. CNU-505/E - Box Abrasion by Release Pin.

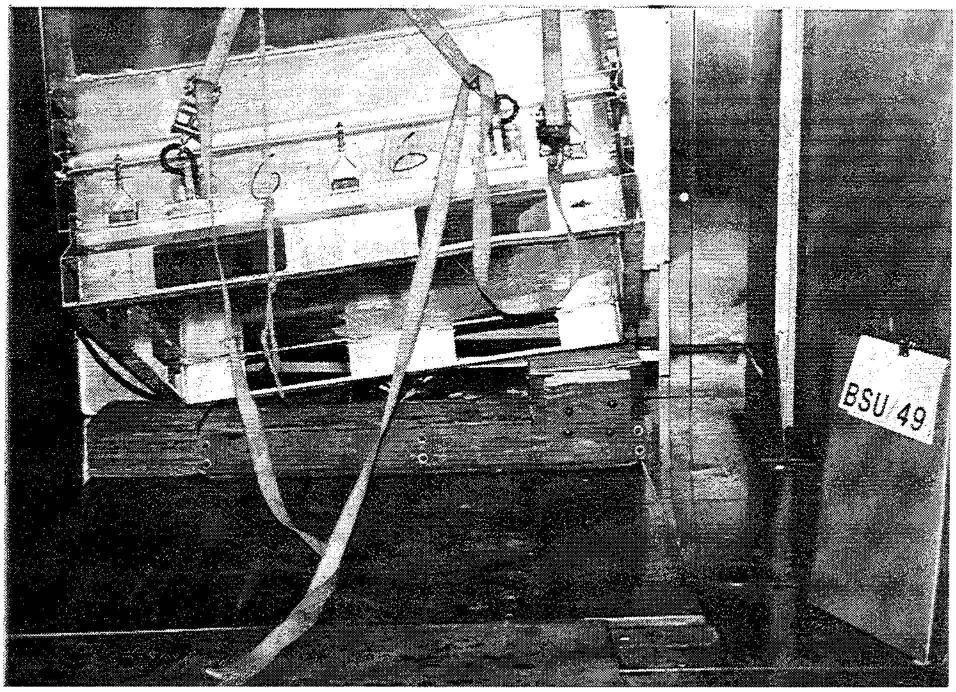

Figure 29. Rough Handling - Cornerwise-Drop Test.

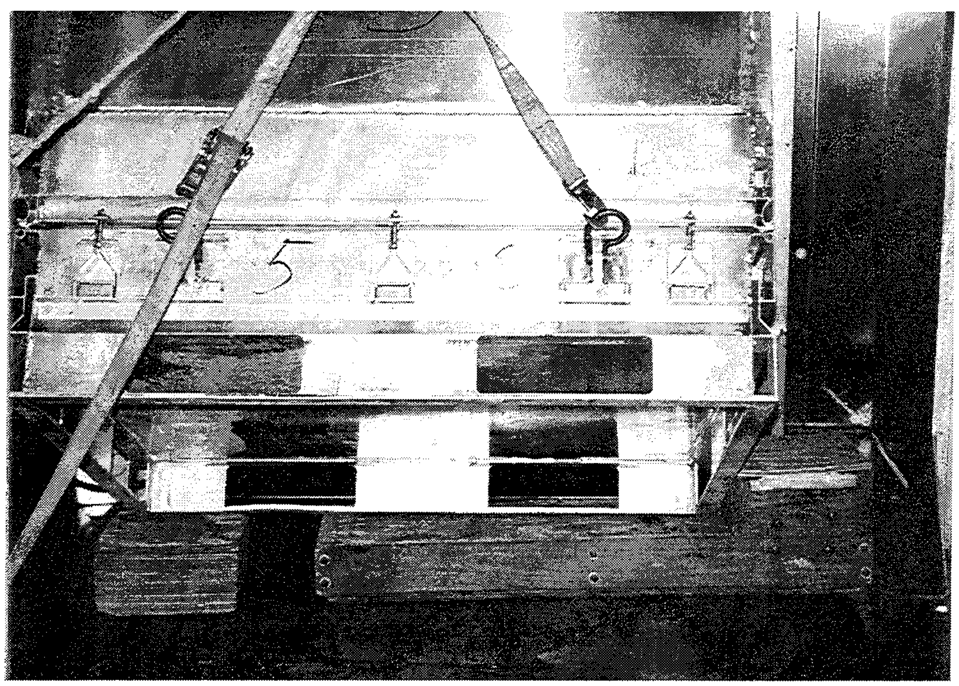

Figure 30. Rough Handling - Edgewise-Drop Test.

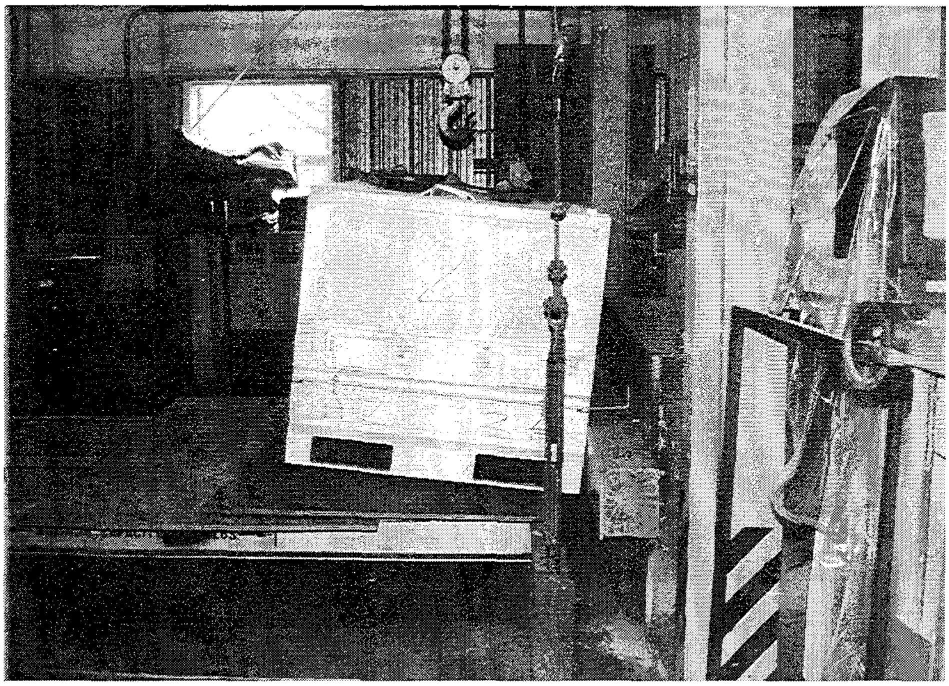

Figure 31. Rough Handling - Pendulum-Impact Test.

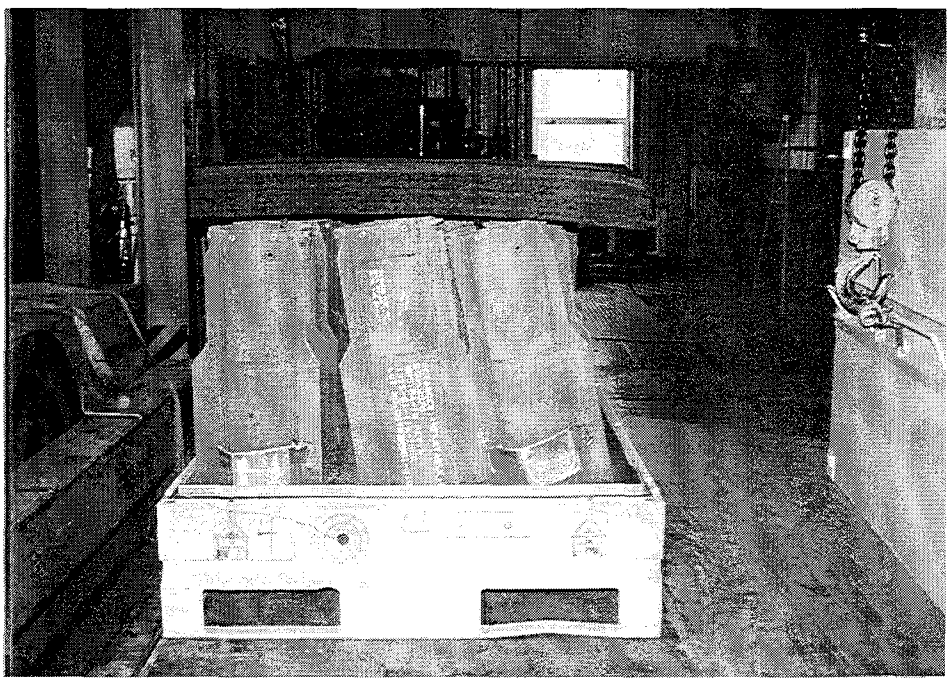

Figure 32. CNU-335B/E - Rough Handling - Pendulum-Impact Test.

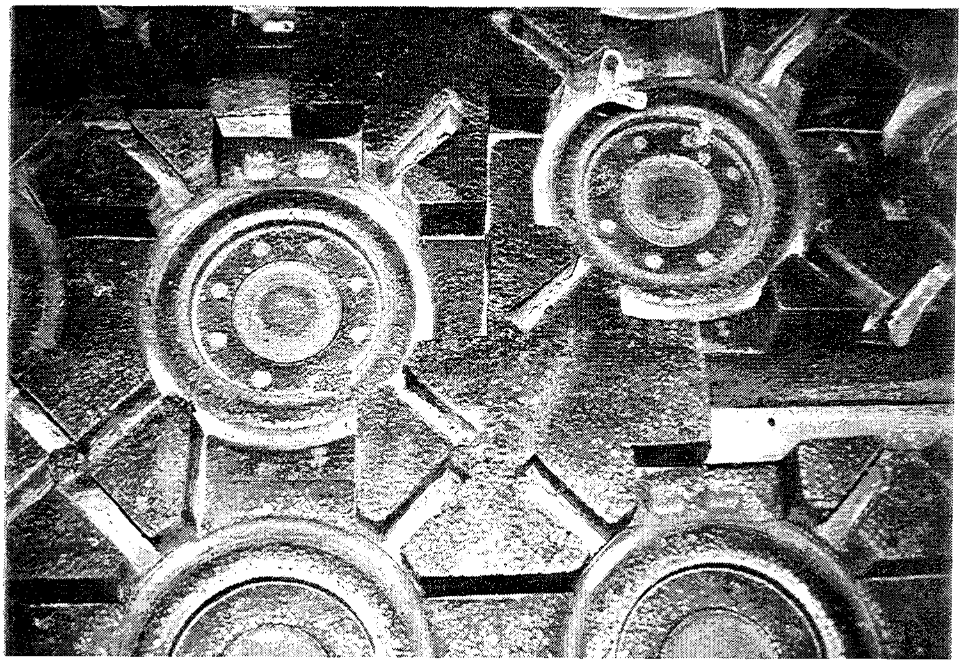

Figure 33. CNU-335B/E - BSU/49 Fin Hardware on Base Cushion.

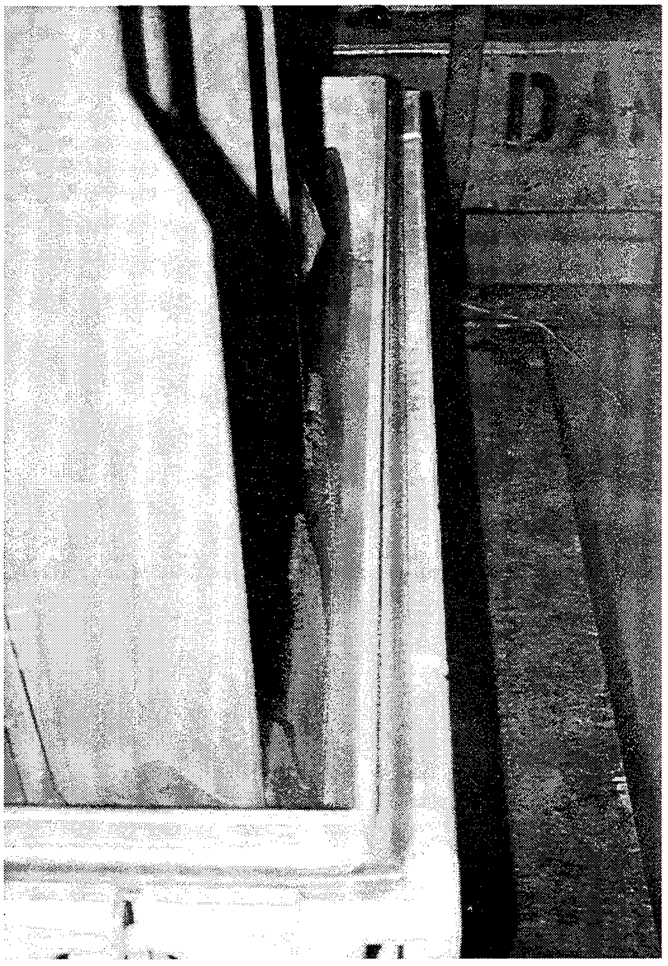

Figure 34. Foam Shrinkage Due to Exposure to Low Temperatures.

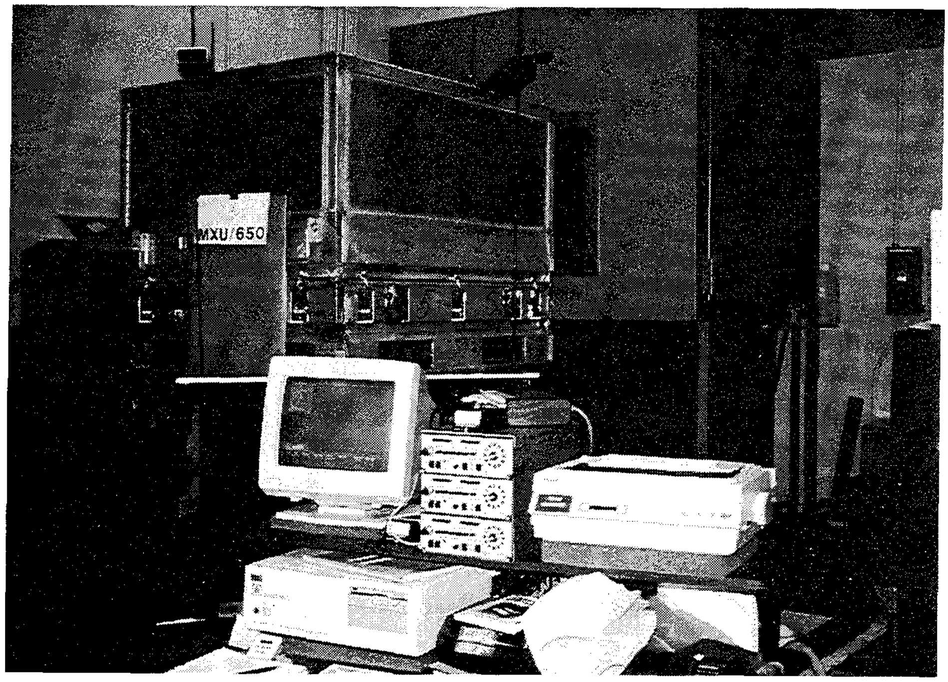

Figure 35. Resonance Strength and Dwell Test.

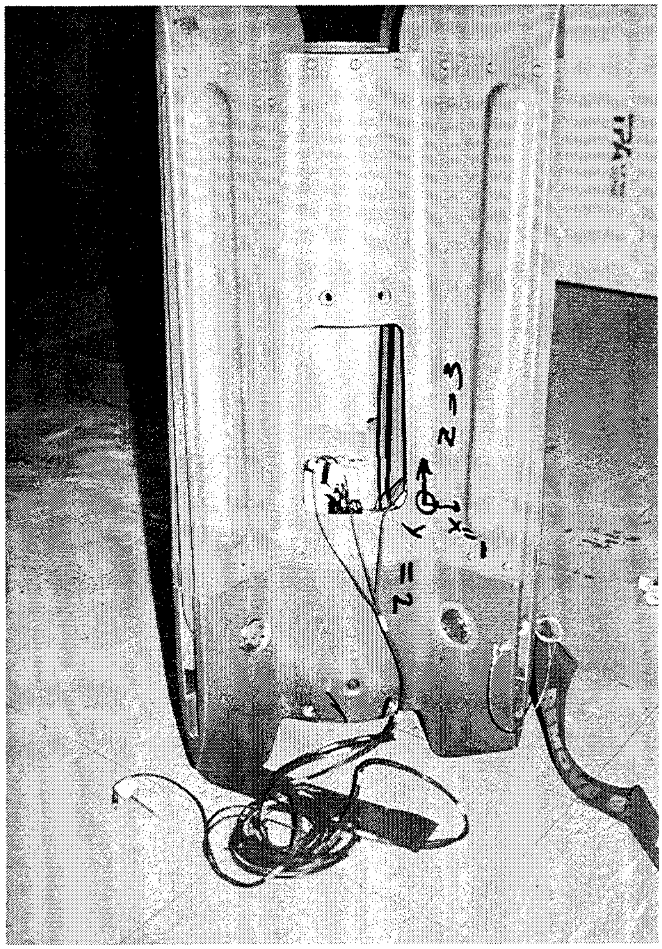

Figure 36. CNU-505/E - Instrumented MXU/650 Fin.

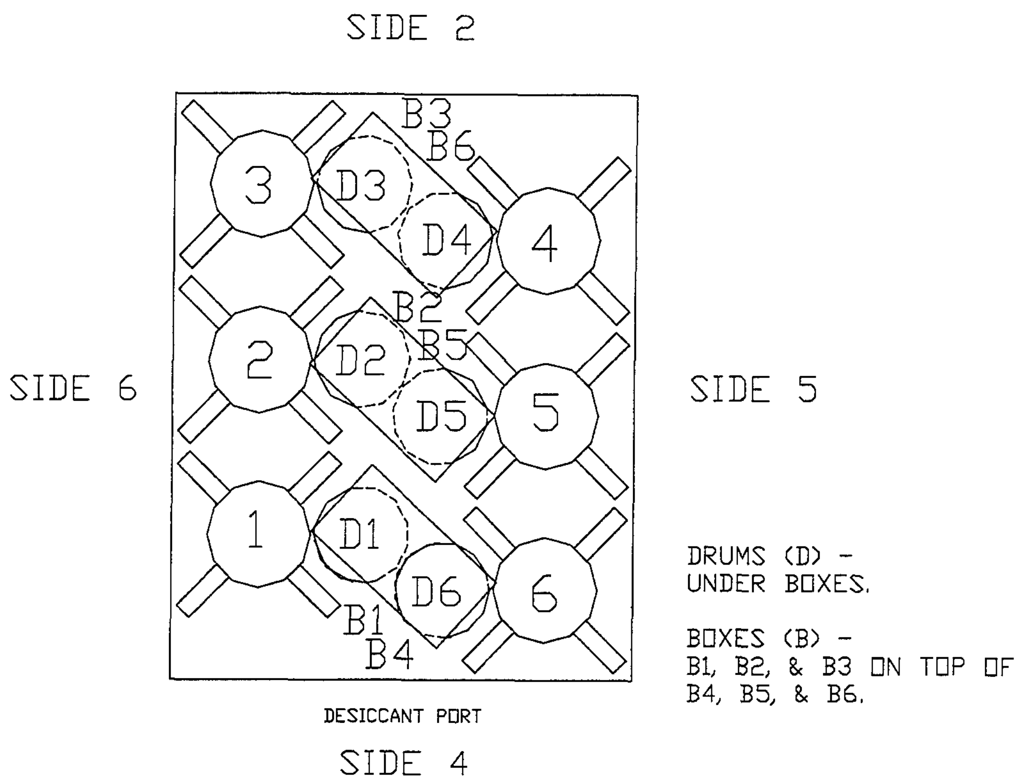

Figure 37. CNU-505/E - Fin Location and Designation.

Figure 38. CNU-505/E - Resonance Vibration Damage.

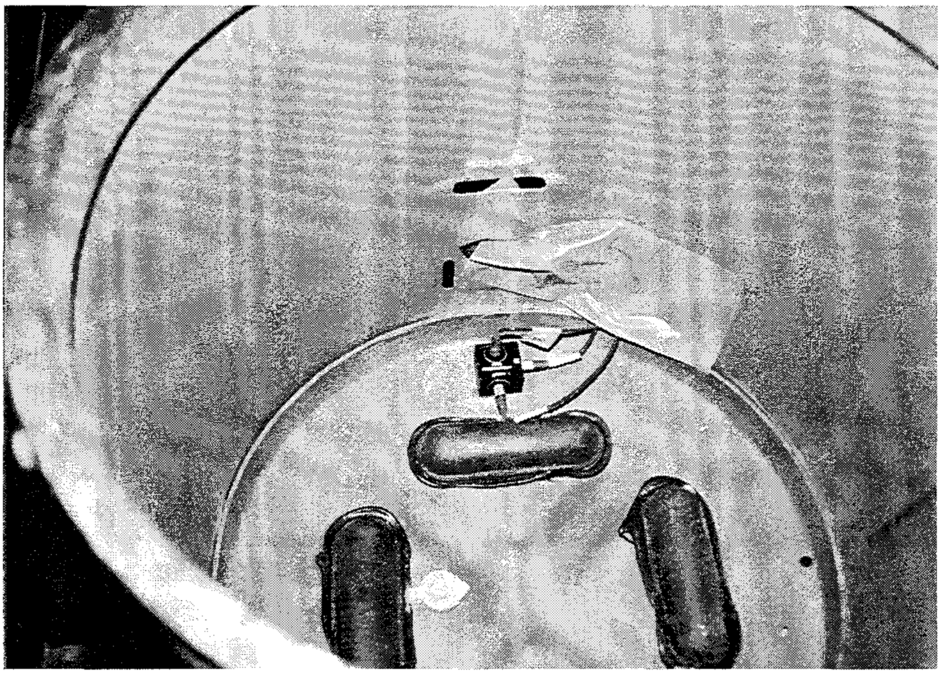

Figure 39. CNU-336B/E - Instrumented BSU/50 Fin.

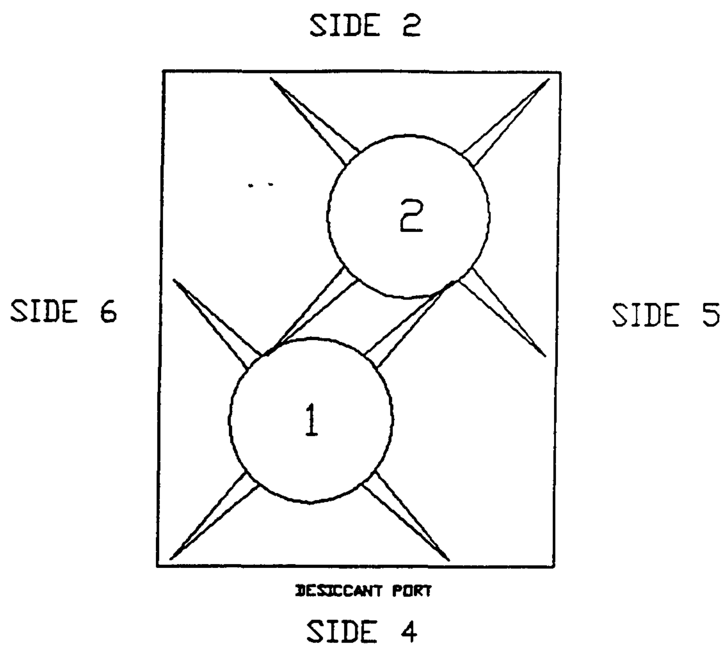

Figure 40. CNU-336B/E - Fin Location and Designation.

Figure 41. CNU-335B/E - Instrumented BSU/49 Fin.

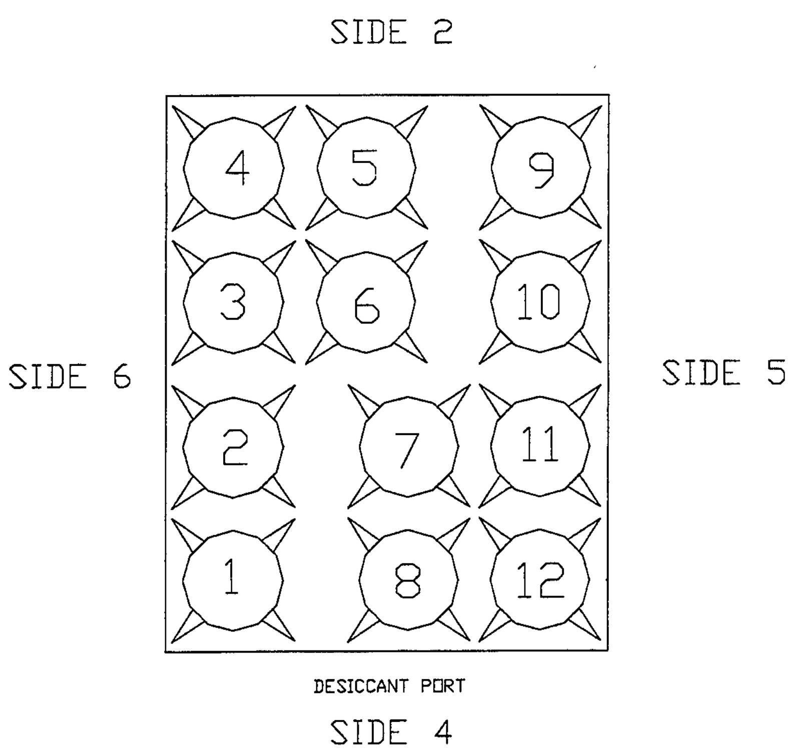

Figure 42. CNU-335B/E - Fin Location and Designation.

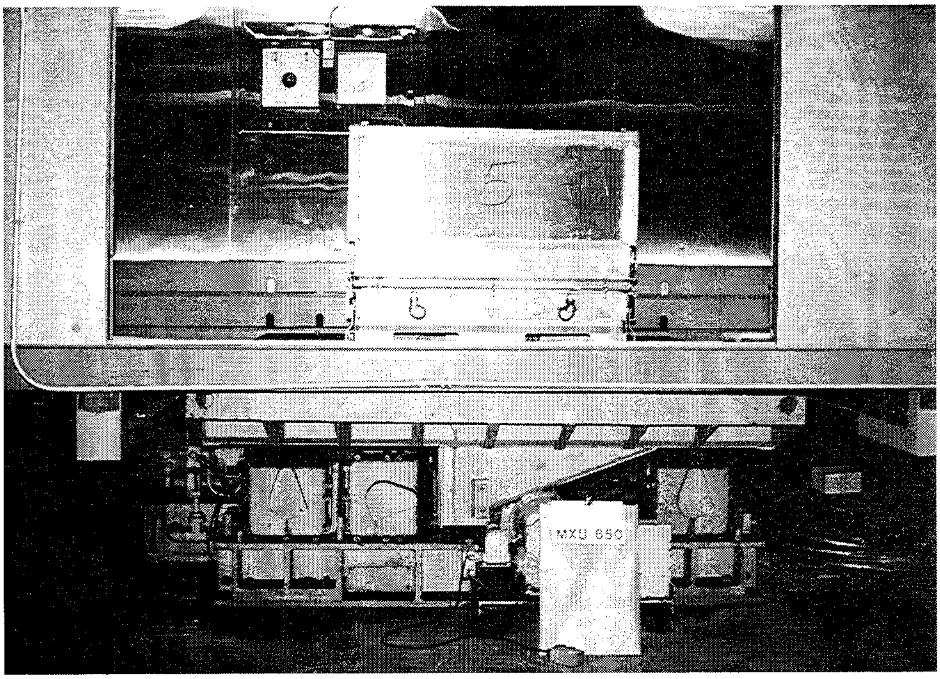

Figure 43. Repetitive Shock Test.

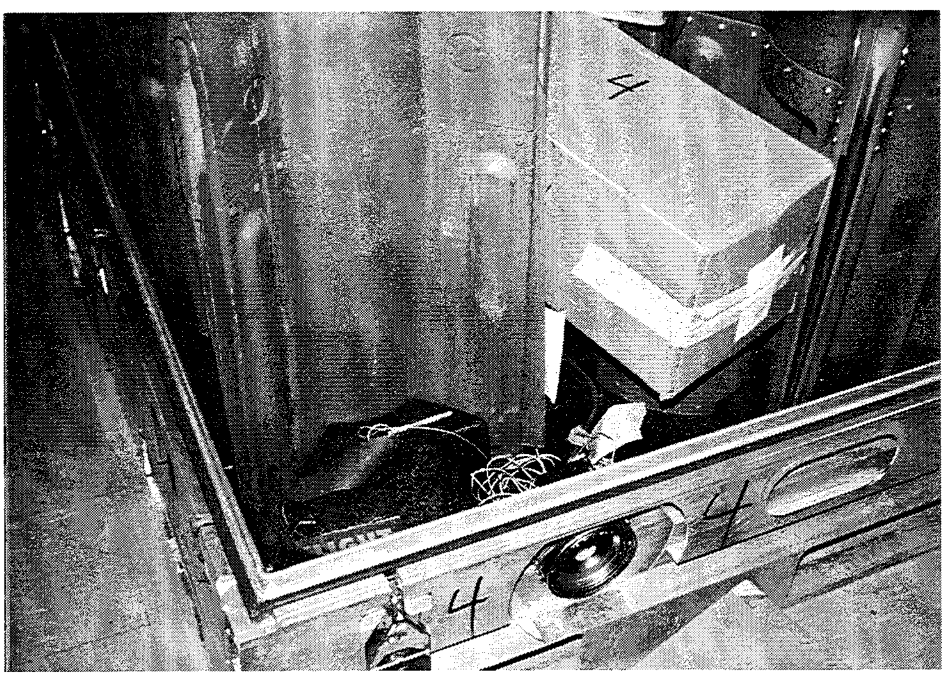

Figure 44. CNU-505/E - Repetitive Shock Test - Pin Disengagement.

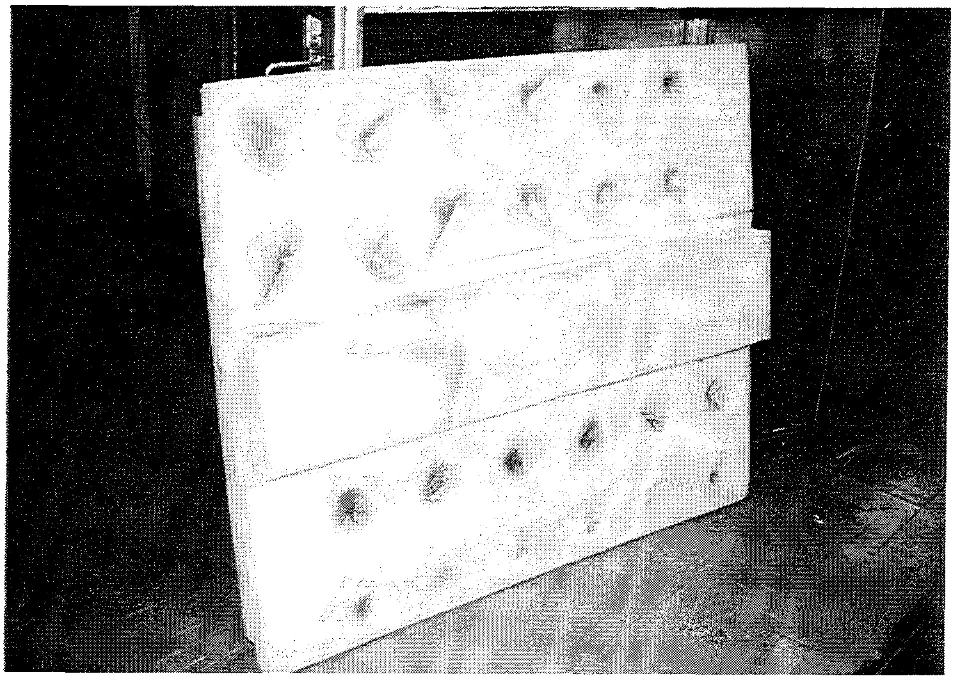

Figure 45. CNU-505/E - Repetitive Shock Test - Cover Cushion Damage.

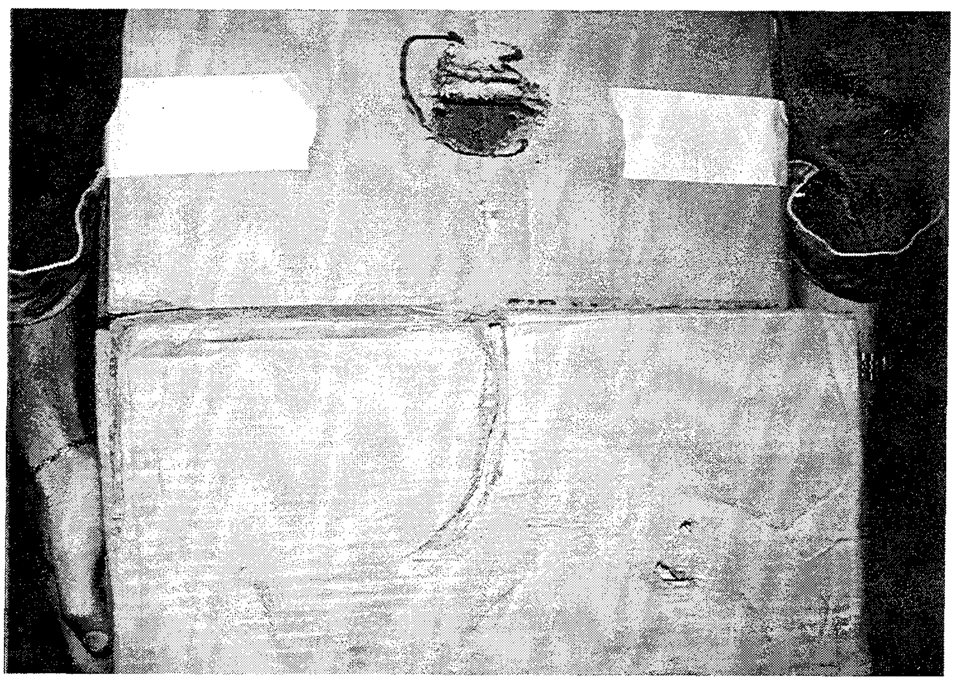

Figure 46. CNU-505/E - Repetitive Shock Test - Pin and Drum Damage to Boxes.

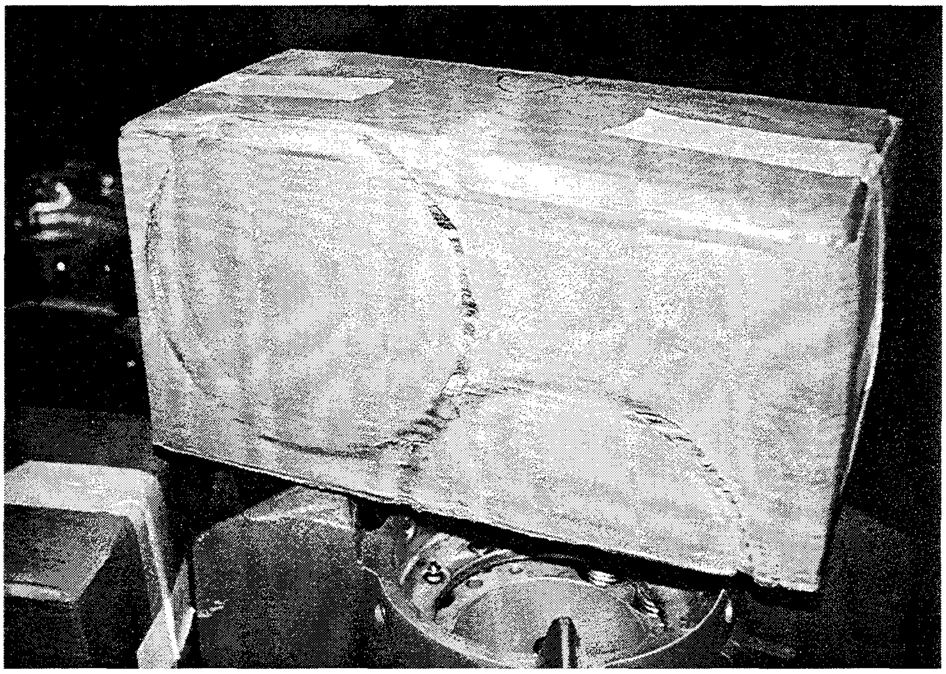

Figure 47. CNU-505/E - Repetitive Shock Test - Drum Damage to Boxes.

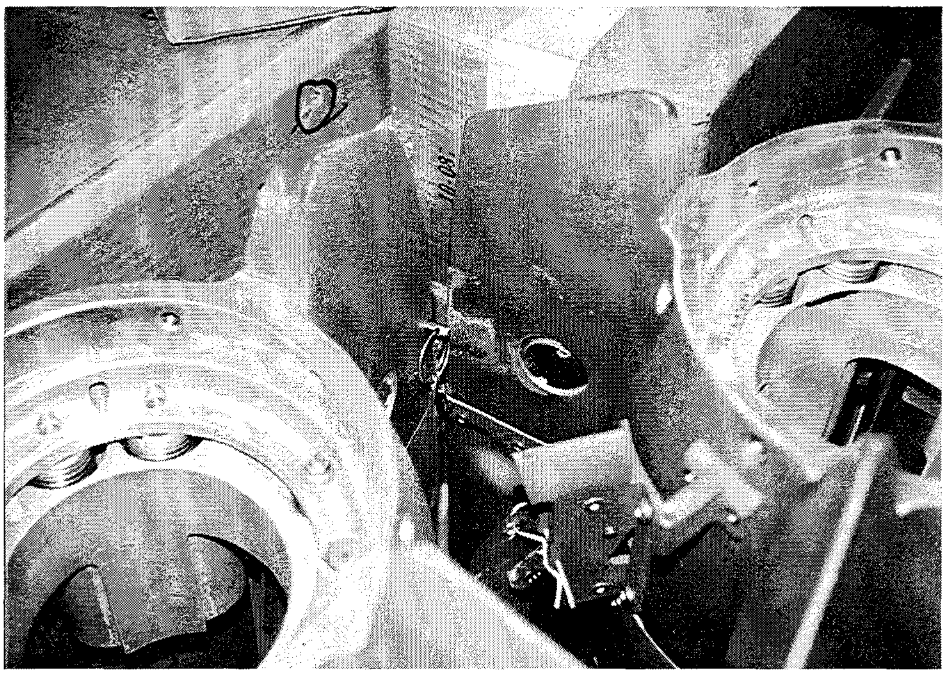

Figure 48. CNU-505/E - Repetitive Shock Test - Pin Damage to Fins.

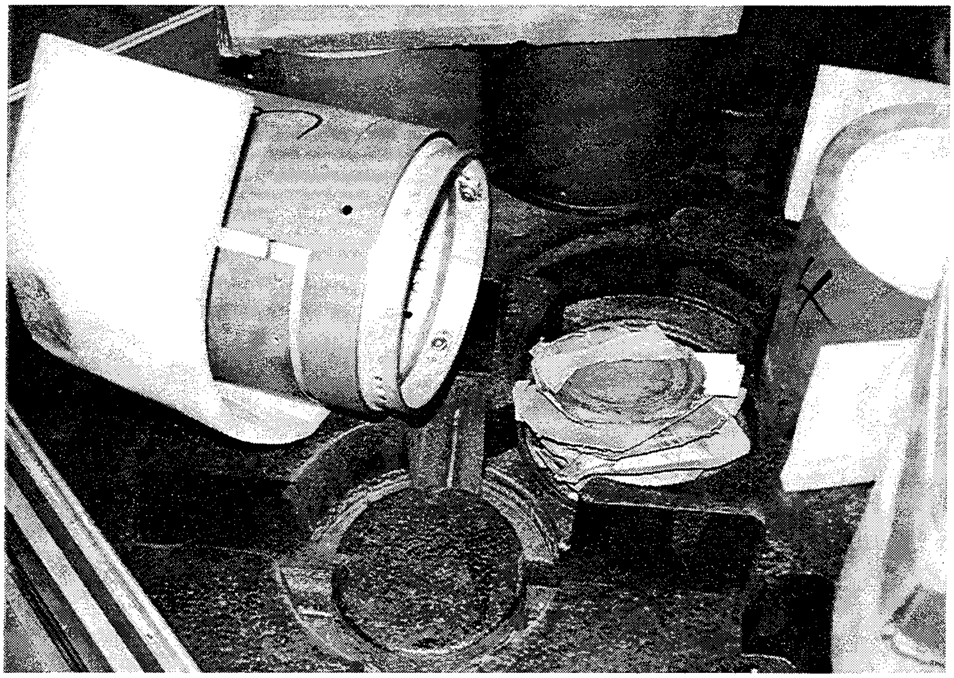

Figure 49. CNU-505/E - Repetitive Shock Test - Drum Contents Emptied.

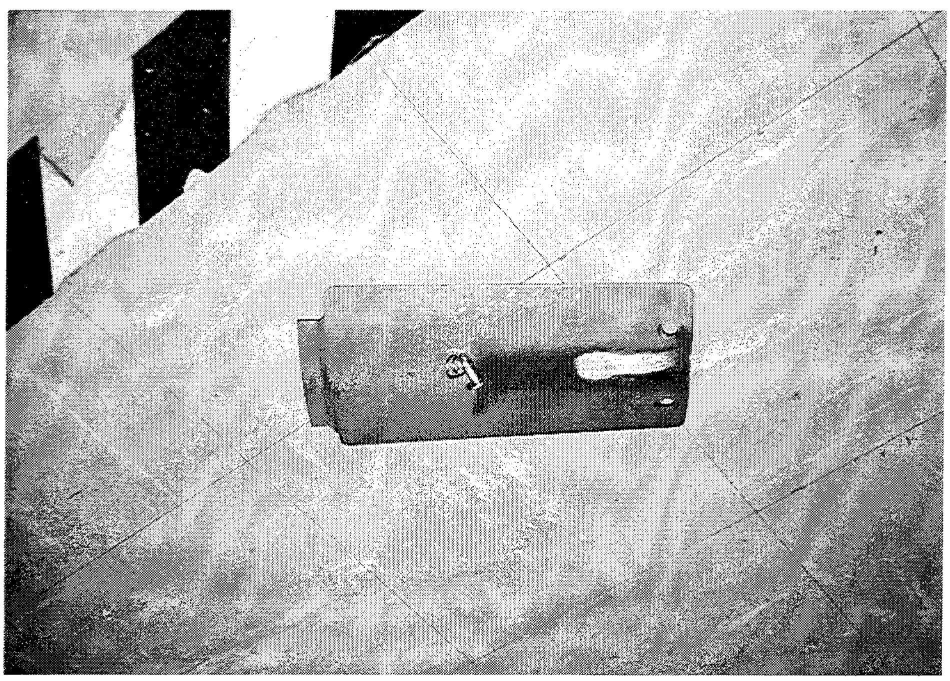

Figure 50. CNU-505/E - Repetitive Shock Test - Access Door Damage.

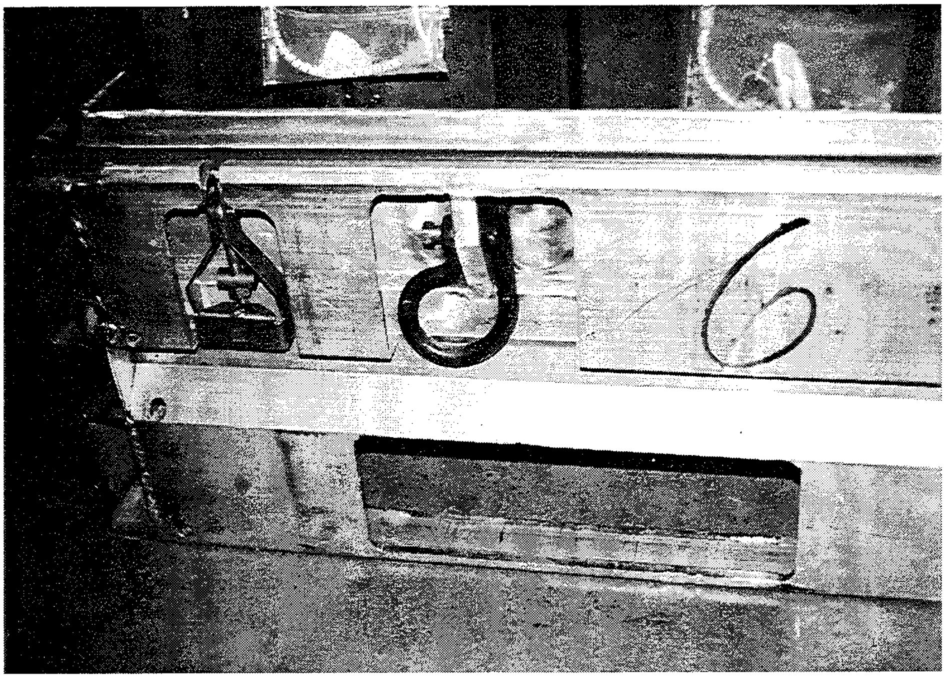

Figure 51. CNU-335B/E - Repetitive Shock Test - Loose Screw Due to Vibration.

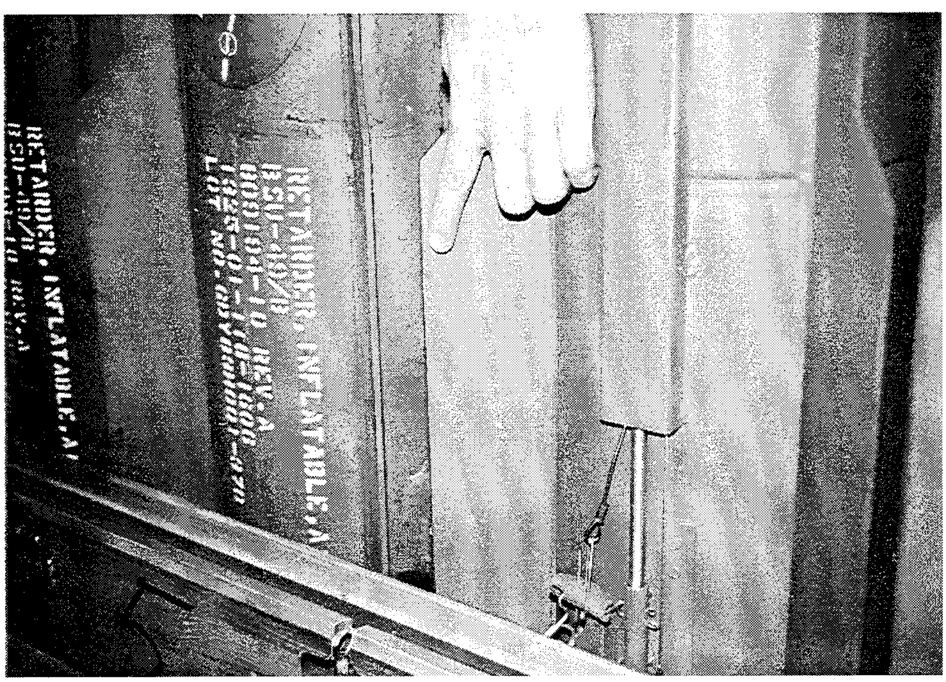

Figure 52. CNU-335B/E - Repetitive Shock Test - Fin Blade Edges.

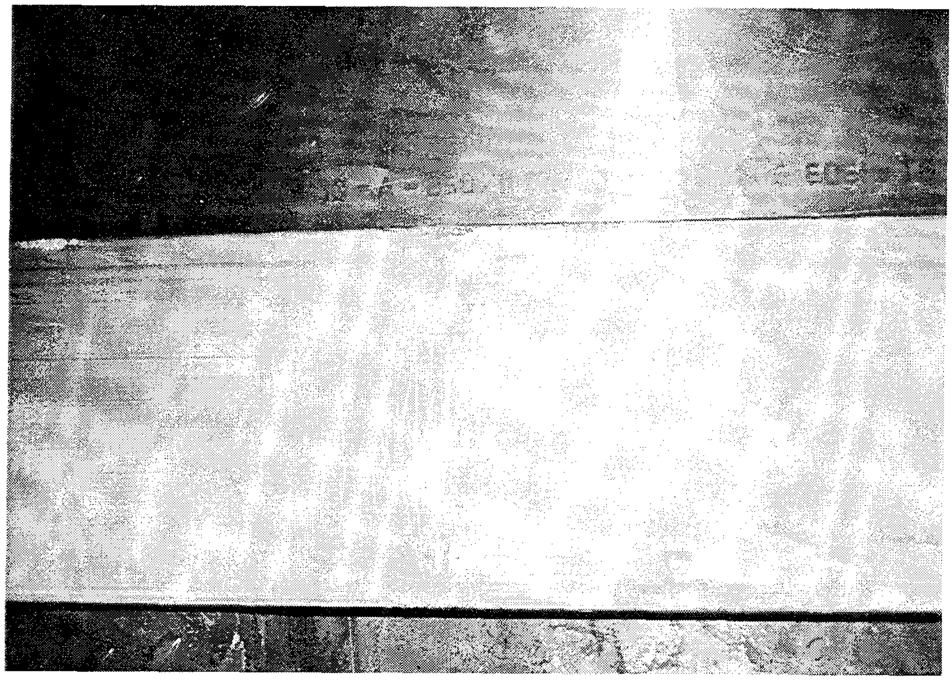

Figure 53. CNU-335B/E - Repetitive Shock Test - Cover Damage Due to Fin Blade Edges.

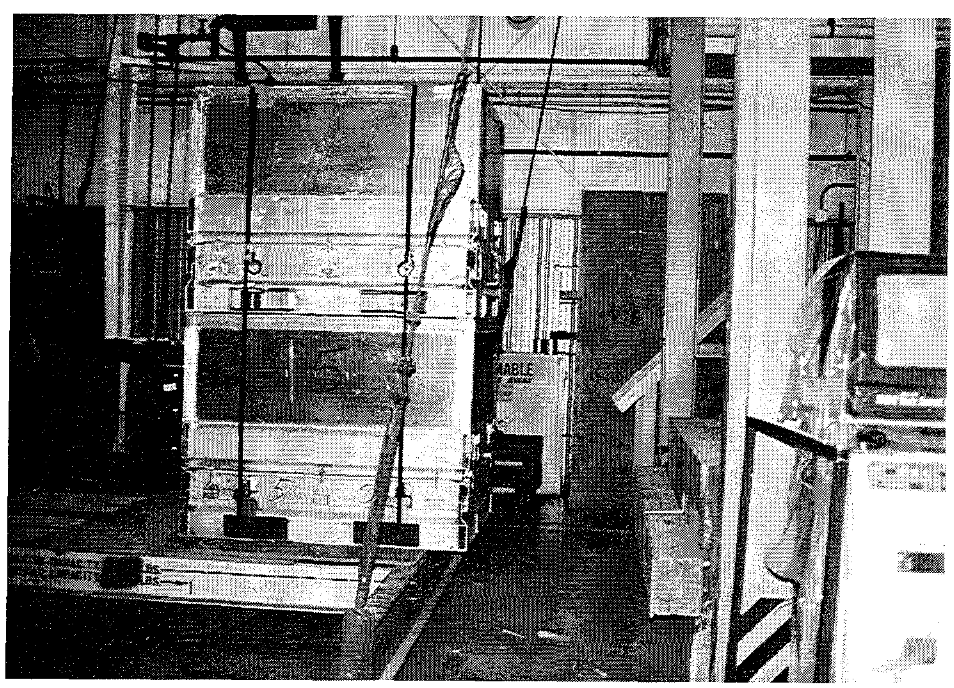

Figure 54. Stacked Pendulum-Impact Test.

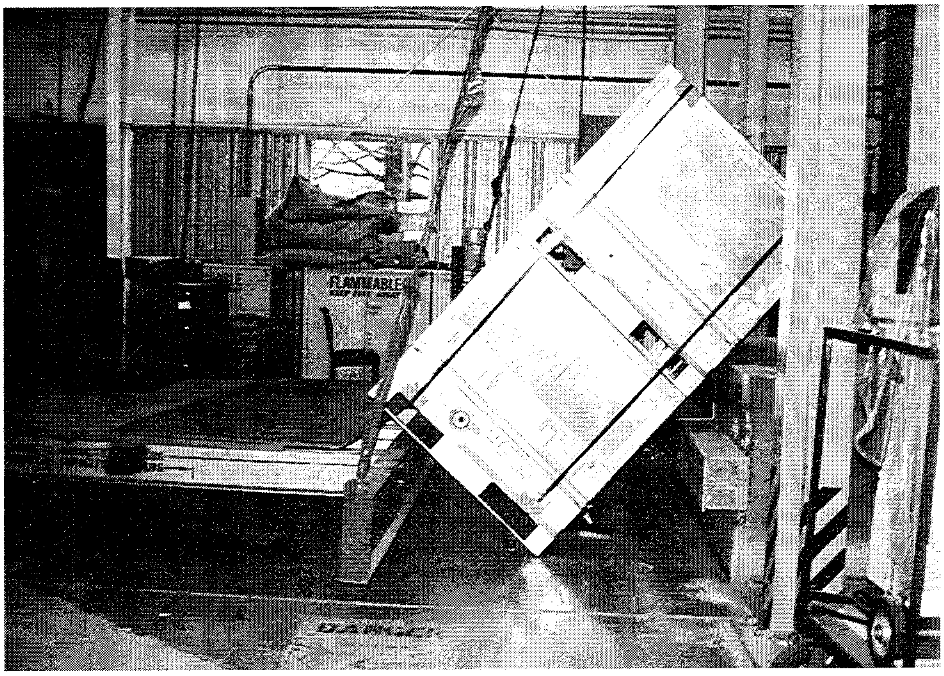

Figure 55. Stacked Pendulum-Impact Test - Container Latches Opened.

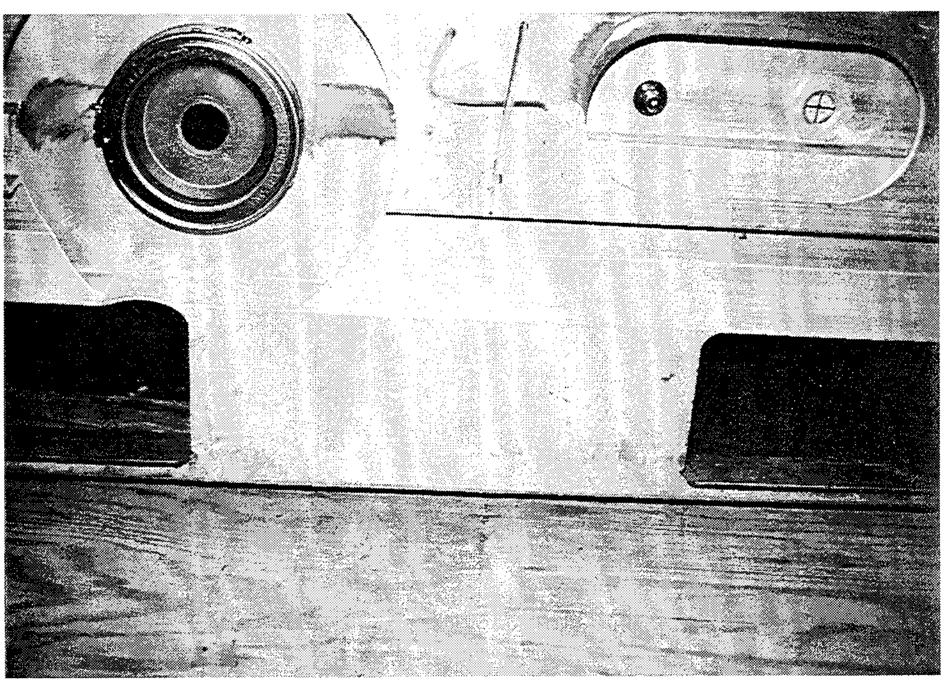

Figure 56. Stacked Pendulum-Impact Test - Cargo Strap Damage.

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REPORT DOCUMENTATION PAGE

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	Dec 94	Final; 25 Sep 90 - Dec 94

4. TITLE AND SUBTITLE
Development of the Family of Munitions Container #3 for BSU/49, BSU/50, and MXU/650 Airfoil Groups, CNU 534/E, CNU 335 B/E, CNU 336B/E and CNU 505/E

5. FUNDING NUMBERS

6. AUTHOR(S)
James T. Steiger

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
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Packaging Branch
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Wright-Patterson AFB OH 45433-5540

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11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for Public Release Distribution Unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

This project was initiated to design, fabricate, test and provide production drawing package for the Family of Munitions Container (FMC) #3. This project was in support of PRAM project 21989-01. FMC #3 is designed to hold 12 BSU/49, 2 BSU/50 or 6 MXU/650 Airfoil Groups. This will replace three different containers, all of which are top opening, therefore making it very difficult for the user to remove the airfoil group from the container.

FMC#3 (CNU 534/E) is a welded aluminum container. This container is not painted which reduces the original cost ofthe container, environmental hazardous waste and the life-cycle costs of the container. FMC#3 is a bottom opening container, similar to a butter dish design. The fins sit on their aft end in the base of the container this allows the user to easily prepare the fin for placement on the bomb.

The empty container (CNU 534/E) is made unique by each airfoil group's own unique cushioning system to hold each different type of airfoil group.

14. SUBJECT TERMS
CNU 534/E, CNU 335B/E, CNU 336B/E, CNU 505/E, BSU/49, BSU/50, MXU/650, Aluminum Container, Reusablr Container, Design, Test

15. NUMBER OF PAGES
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16. PRICE CODE

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NSN 7540-01-280-5500

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