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AFPEA PROJECT NO. 88-P-103

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Larry M. Nugent
Mechanical Engineer

AUTOVON 787-3734

Commercial (513) 257-3734

QUALIFICATION TESTING OF THE
CNU-459/E KU-BAND ANTENNA CONTAINER

HQ AFLC/DSTZ
AIR FORCE PACKAGING EVALUATION ACTIVITY
Wright-Patterson AFB OH 45433-5999

June 1989

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ABSTRACT

Aeronautical Systems Division, ASD/VXAL, requested assistance from the Air Force Packaging Evaluation Activity (AFPEA) to design, prototype, and qualify a container for the ku-band antenna used on Combat Talon II aircraft.

The CNU-459/E prototype container was designed, fabricated and tested at the AFPEA, HQ AFLC/DSTZ, Wright-Patterson AFB, OH 45433-5999. The container is environmentally sealed with a humidity indicator, desiccant port, and pressure relief valve. The container base has wheels and the cover doubles as a transport stand to eliminate the need for ground support equipment. The container is designed to protect one ku-band antenna during worldwide shipment, storage, and handling.

The container test plan was derived from Military Specification MIL-C-5584D. The tests were conducted in accordance with Federal Test Method Standard No. 101, Military Standard 648, Military Standard 1489, and Military Specification MIL-C-5584D.

Results of the tests conducted on the prototype container are acceptable. The container design will adequately protect one ku-band antenna during worldwide shipment and storage.

PREPARED BY:

Larry M. Nugent
LARRY M. NUGENT
Mechanical Engineer
AF Packaging Evaluation Activity

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27 JUN 1989

REVIEWED BY:

Ted Hinds
TED HINDS
Chief, Design Branch
AF Packaging Evaluation Activity

APPROVED BY:

Charlie P. Edmonson
CHARLIE P. EDMONSON
Chief,
AF Packaging Evaluation Activity

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INTRODUCTION

BACKGROUND: Aeronautical Systems Division (ASD/VXAL), Wright-Patterson AFB OH 45433-5000 requested assistance from the Air Force Packaging Evaluation Activity (AFPEA) to design, prototype, and perform qualification testing on a ku-band antenna container. The CNU-459/E prototype was designed and fabricated at the AFPEA, HQ AFLC/DSTZ, Wright-Patterson AFB, OH 45433-5999.

PURPOSE: The purpose of this project was to determine if the CNU-459/E container design will protect the contents, one ku-band antenna for Combat Talon II aircraft, during worldwide shipment, storage, and handling.

TEST SPECIMEN

The CNU-459/E prototype was subjected to extensive testing. The corners of the container were numbered counterclockwise from the left aft corner as shown in figure 1.

Design: The CNU-459/E prototype is a controlled-breathing container with a pressure relief valve, humidity indicator, and desiccant port (see figure 2). The container is designed to limit the transmission of shocks to the ku-band antenna to 25 Gs when subjected to the conditions in Military Specification MIL-C-5584D. Twelve wide-handle latches are designed to allow quick access to the container contents without the use of tools. The antenna is attached to a yoke in the container by five bolts. The yoke is attached to the cradle by four wide-handle latches (see figure 3). The antenna can rest on the cradle without the yoke during aircraft installation and removal. Wheels on the base may be lowered to allow the container to be towed or pushed with minimal effort. Cover wheels and resting posts stowed in the container base may be attached to the container cover so it may be similarly used to transport or hold one antenna (see figure 4).

Construction: The container consists of aluminum extrusions for the base walls, the lower cover walls, the wall stiffeners, the stacking interface, the skid base, the yoke, and the cradle. Sheet aluminum is used for the upper cover walls and the top and bottom surfaces. Rubber pads on the cradle and cover resting posts prevent damage to the antenna while resting there. PPP-C-1752, Type II, Class 1, (two pound density polyethylene foam) provides cushioning between the cradle assembly and the floor, and the yoke assembly and the cover of the container. A silicone gasket provides a seal between the container base and the container cover.

The CNU-459/E prototype container tested differs from the proposed production container in the following aspects:

- a. Sixteen latches (four per side) will be used instead of twelve (three per side) to secure the cover to base.
- b. A frame has been added around the yoke to prevent bumping the cover into the antenna when the cover is being removed from the container (see figure 5).
- c. The desiccant port and pressure relief valve have been moved from the cover to the base.
- d. Towbar attachments and cover lifting rings were added and tested after all other testing was complete.
- e. Cover and base have been rotated 90° relative to the antenna, the yoke and the cradle.
- f. The cushions may not be glued sections; must be either one solid piece or heat bonded.

TEST OUTLINE AND TEST EQUIPMENT

Test Plan: Tests were conducted in accordance with AFPEA Test Plan 88-P-103 (see table 1). The tests used were selected to meet the qualification requirements in Military Specification MIL-C-5584D. Test methods and procedures used were as outlined in Federal Test Method Standard No. 101 (FED-STD-101), Military Standard 648 (MIL-STD-648), Military Standard 1489 (MIL-STD-1489), and Military Specification MIL-C-5584D. Any modifications to the standard procedures are noted in the test plan or the results.

Test Loads: All tests were conducted using the ku-band antenna test load fabricated at the AFPEA (see figure 6). The test load weighs 206 pounds and simulates the center of gravity and the mass moment of inertia of a ku-band antenna as closely as possible.

Test Site: All testing was conducted at the AFPEA, HQ AFLC/DSTZ, Building 70, Area C, Wright-Patterson AFB OH 45433-5999. The equipment required for each test is noted in the test plan.

TEST PROCEDURES AND RESULTS

1. Weight Test

Test Plan No. 1: The container was weighed to determine weight compliance.

Results: The cover weighed 230 pounds, the base weighed 506 pounds, total tare weight of 736 pounds. The results of this test are acceptable.

2. Leak Test

Test Plan No. 2: The pneumatic pressure test was conducted in accordance with FED-STD-101, Method 5009.2 at 1.00 psig. The vacuum retention test was conducted in accordance with FED-STD-101, Method 5009.2 at 1.00 psig. The failure criteria for the test was 0.0250 psig loss during a 30 minute period, after teperature and pressure stabilization.

Results: At the end of the 30 minute test period the pressure loss was 0.007 psig. At the end of the 30 minute test period the vacuum loss was .012 psig. The results of this test are acceptable.

3. Rough Handling Tests (+140°F)

a. Test Plan No. 3a: The high temperature cornerwise-drop (rotational) test was conducted in accordance with FED-STD-101, Method 5005.1. The height of the drop was 20 inches.

Results: Visual inspection revealed no external damage to the container. A maximum of 10 Gs was obtained during the test.

b. Test Plan No. 3b: The high temperature edgewise-drop (rotational) test was conducted in accordance with FED-STD-101, Method 5008.1. The height of the drop was 20 inches.

Results: Visual inspection revealed no external damage to the container. A maximum of 10 Gs was obtained during the test.

c. Test Plan No. 3c: The high temperature pendulum-impact test was conducted in accordance with FED-STD-101, Method 5012. The impact velocity was 7 ft/sec, the height of the drop was 9 inches (see figure 7).

Results: Visual inspection revealed no external damage to the container. A maximum of 19 Gs was obtained during the test.

The container was opened after the pendulum-impact test. Visual inspection revealed no damage to the container or the test load. The results of these tests are acceptable. See appendix 1 for detailed acceleration results.

4. Leak Test

Test Plan No. 4: The pneumatic pressure test was conducted in accordance with FED-STD-101, Method 5009.2. The test was performed at 1.00 psig. The failure criteria for the test was a 0.0125 psig loss during a 15 minute period.

Results: At the end of the 15 minute test period the pressure loss was 0.004 psig. The results of this test are acceptable.

5. Rough Handling Tests (-20°F)

a. Test Plan No. 5a: The low temperature cornerwise-drop (rotational) test was conducted in accordance with FED-STD-101, Method 5005.1. The height of the drop was 20 inches.

Results: Visual inspection revealed no external damage to the container. A maximum of 20 Gs was obtained during the test.

b. Test Plan No. 5b: The low temperature edgewise-drop (rotational) test was conducted in accordance with FED-STD-101, Method 5008.1. The height of the drop was 20 inches.

Results: Visual inspection revealed no external damage to the container. A maximum of 20 Gs was obtained during the test.

c. Test Plan No. 5c: The low temperature pendulum-impact test was conducted in accordance with FED-STD-101, Method 5012. The impact velocity was 7 ft/sec, the height of the drop was 9 inches.

Results: Visual inspection revealed no external damage to the container. A maximum of 23 Gs was obtained during the test.

The container was opened after the pendulum-impact test. Visual inspection revealed no damage to the container or the test load. Upper cushion became unglued at the glue line. The results of this test are acceptable.

6. Leak Test

Test Plan No. 6: The pneumatic pressure test was conducted in accordance with FED-STD-101, Method 5009.2. The test was performed at 1.00 psig. The failure criteria for the test was a 0.0125 psig loss during a 15 minute period.

Results: At the end of the 15 minute test period the pressure loss was 0.001 psig. The results of this test are acceptable.

7. Vibration Fatigue Test

Test Plan No. 7: The vibration fatigue test was conducted in accordance with MIL-STD-648, paragraph 5.3.2. The container was rigidly attached to the 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.

Results: Visual inspection revealed no damage to the container or the test load. A maximum of 3.8 Gs was obtained at the resonant frequency of 7.7 Hz. The maximum transmissibility obtained was 5.0. The results of this test are acceptable.

8. Leak Test

Test Plan No. 8: The pneumatic pressure test was conducted in accordance with FED-STD-101, Method 5009.2. The test was performed at 1.00 psig. The failure criteria for the test was a 0.0125 psig loss during a 15 minute period.

Results: At the end of the 15 minute test period the pressure loss was 0.005 psig. The results of this test are acceptable.

9. Repetitive Shock (Superimposed Load) Test

Test Plan No. 9: The repetitive shock test was conducted in accordance with MIL-STD-648, paragraph 5.2.2.1 and FED-STD-101, Method 5019.1. 926 pounds of steel plate was banded to the top of the container to simulate a stacked load. The container was not attached to the platform, but restraining blocks were attached to the platform to prevent the container from moving off the platform. The platform was vibrated at 3 to 5 Hz until the container raised from the platform (1/16 inch feeler gauge clearance between the container bottom and the platform), or a maximum platform acceleration of 1.0 G +/- .1 G was achieved. The test was run at the determined frequency for a period of two hours.

Results: Visual inspection revealed no damage to the container or the test load. A maximum of 10.5 Gs was obtained during the test. The results of this test are acceptable.

10. Leak Test

Test Plan No. 10: The pneumatic pressure test was conducted in accordance with FED-STD-101, Method 5009.2. The test was performed at 1.00 psig. The failure criteria for the test was a 0.0125 psig loss during a 15 minute period.

Results: At the end of the 15 minute test period the pressure loss was 0.006 psig. The results of this test are acceptable.

11. Superimposed Load Test

Test Plan No. 11: The superimposed load test was conducted in accordance with FED-STD-101, Method 5016.1. A load of 5542 pounds was placed on top of the container through beams placed to simulate actual loading on the bottom container of a stack of four with a factor of safety of two.

Results: Visual inspection revealed no damage to the container. The results of this test are acceptable.

12. Leak Test

Test Plan No. 12: The pneumatic pressure test was conducted in accordance with FED-STD-101, Method 5009.2. The test was performed at 1.00 psig. The failure criteria for the test was a 0.0125 psig loss during a 15 minute period.

Results: At the end of the 15 minute test period the pressure loss was 0.005 psig. The results of this test are acceptable.

13. Stand Off Test

Test Plan No. 13: The stand off test was conducted in accordance with paragraph 4.7.5.1 of MIL-C-5584D. The cover was set on a concrete surface with the stand offs in contact with the floor. A load of 465 pounds was then placed on top of the cover. With the load removed, the cover was then slid on the stand offs five feet in each of four directions.

Results: Visual inspection revealed no deflection or deformation with the 465 pound load on top. No physical damage resulting in a loss of functional performance was found following the sliding. The results of this test are acceptable.

14. Mechanical Handling Tests

a. Test Plan No. 14a: The forklift handling test was conducted in accordance with FED-STD-101, Method 5011.1, paragraph 6.2 (see figure 8). 1x4 inch boards were used since the forklift used has hard rubber tires. Stack one container on another container and verify forklift entry from all four sides.

Results: During the test the container was stable riding on the tines. Visual inspection revealed no damage to the container. Forklift entry was possible on all four sides. The results of this test are acceptable.

b. Test Plan No. 14b: The forklift pushing test was conducted in accordance with FED-STD-101, Method 5011.1, paragraph 6.5.

Results: Visual inspection revealed no functional damage to the container. The results of this test are acceptable.

c. Test Plan No. 14c: The forklift towing test was conducted in accordance with FED-STD-101, Method 5011.1, paragraph 6.6.

Results: Visual inspection revealed no functional damage to the container. The results of this test are acceptable.

15. Hoisting Strength Test

a. Test Plan No. 15a: The single ring hoisting test was conducted in accordance with MIL-STD-648, paragraph 5.8.5. The loaded container was lifted by a lift ring and suspended for five minutes.

Results: Visual inspection of the container revealed no damage or deformation. The results of this test are acceptable.

b. Test Plan No. 15b: The 4 ring hoisting strength test was conducted in accordance with MIL-STD-648, paragraph 5.8.3. The container was loaded with 4030 additional pounds and hoisted by all four lift points on the container base simultaneously and left hanging for five minutes (see figure 9).

Results: Visual inspection revealed no damage to the container. The results of this test are acceptable.

c. Test Plan No. 15c: The 4 ring hoisting strength test was conducted in accordance with a modified version of MIL-STD-648, paragraph 5.8.3. This test was conducted because the container cover also has lift rings, however it requires only the weight of one container instead of five. The container cover was loaded with 712 additional pounds and hoisted by all four lift points simultaneously and left hanging for five minutes.

Results: Visual inspection revealed no damage to the container. The results of this test are acceptable.

16. Leak Test

Test Plan No. 16: The pneumatic pressure test was conducted in accordance with FED-STD-101, Method 5009.2. The test was performed at 1.00 psig. The failure criteria for the test was a 0.0125 psig loss during a 15 minute period.

Results: At the end of the 15 minute test period the pressure loss was 0.004 psig. The results of this test are acceptable.

17. Cover Handle Pull Test

Test Plan No. 17: The cover handle pull test was conducted in accordance with paragraph 4.7.4.1 of MIL-C-5584D. One handle was used to lift the 230 pound cover off the ground. A 20 pound weight was placed in the cover to give a total weight of 250 pounds. The cover was maintained in that position for 5 minutes (see figure 10).

Results: Visual inspection revealed no deflection or permanent deformation to the cover handle or the container cover. The results of this test are acceptable.

18. Puncture Resistance Test

Test Plan No. 18: The pendulum puncture test was conducted in accordance with MIL-STD-1489A, Method 505. The test apparatus used was a simulated forklift tine weighing 70 pounds suspended by wire cables. The tine was pulled straight back until it reached a height of 28 inches above its equilibrium height and released. The tine impact was made to each side and end of the unrestrained container at one inch above the forklift pocket.

Results: Visual inspection revealed no functional damage to the container. The results of this test are acceptable.

19. Leak Test

Test Plan No. 19: The pneumatic pressure test was conducted in accordance with FED-STD-101, Method 5009.2. The test was performed at 1.00 psig. The failure criteria for the test was a 0.0125 psig loss during a 15 minute period.

Results: At the end of the 15 minute test period the pressure loss was 0.005 psig. The results of this test are acceptable.

20. Towing Test

Test Plan No. 20: The towing test was conducted in accordance with FED-STD-101, Method 5011.2. The test apparatus used was a mobility container towbar (part number 305435-1). This was attached to the towbar attachment points on the container. The container was towed for 22 feet in one minute and was turned twice at 180°. The container shall not sway more than two feet in any direction.

Results: The container rolled smoothly without excessive yawing when towed. Visual inspection revealed no damage to the container. The results of this test are acceptable.

21. Structural Integrity Test

Test Plan No. 21: The structural integrity test was conducted in accordance with MIL-STD-648, paragraphs 5.5.2 and 5.5.3. The pressure relief valve was removed and the loaded container was sealed. The container was pressurized to 3.5 psig. The pressure was not maintained for any length of time and leakage was not monitored. The test was conducted to determine if permanent structural deformation, deformation that prevented removal of the contents, or any potentially unsafe conditions occurred. Similarly, the container was subjected to a vacuum of 2.5 psig and observed for the same failure criteria as above.

Results: Visual inspection revealed no damage or permanent deformation to the container. The results of this test are acceptable.

CONCLUSIONS

The CNU-459/E prototype container provided protection for the contents when tested in accordance with the container test plan.

RECOMMENDATIONS

Safe for worldwide shipment and storage of one ku-band antenna.

Table 1. Test Plan

AIR FORCE PACKAGING EVALUATION ACTIVITY (Container Test Plan)					AFPEA PROJECT NUMBER 88-P-103	
CONTAINER SIZE (L x W x D) (INCHES)		WEIGHT (LBS)		CUBE (CU. FT.)	QUANTITY	DATE
INTERIOR:	EXTERIOR:	GROSS:	ITEM:			
	64 x 62 x 52	942	206	119	1	26 May 89
ITEM NAME Combat Talon II Ku-band Antenna				MANUFACTURER Emerson Electric		
CONTAINER NAME CNU-459/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	INSTRUMENTATION	
1.	<u>WEIGHT TEST</u> (1) [4.7.10]	Container cover weight shall not be greater than 240 lbs. Total container weight should not be greater than 750 lbs.		Fully assembled container including shock isolation system.	Scale	
2.	<u>LEAK TEST</u> FED-STD-101 Method 5009.2 [4.7.2]	Pneumatic pressure at 1.00 PSI and vacuum retention at 1.00 PSI. .025 PSI leakage allowed after temperature stabilization. Test duration to be a minimum of 30 minutes.		Test performed in ambient condition from compressed air supply/vacuum pump.	Water manometer	
3.	<u>ROUGH HANDLING TESTS (HIGH TEMPERATURE +140°F)</u>					
a.	FED-STD-101 Method 5005.1 [4.7.3]	Cornerwise-drop (rotational) test. Condition at +140°F for not less than 24 hours. Drop height 20 inches.(4)		One drop on diagonal bottom corners, total of two drops.(2)	Tri-axial accelerometers	
	FED-STD-101 Method 5008.1 [4.7.3]	Edgewise-drop (rotational) test. Condition at +140°F for not less than 24 hours. Drop height 20 inches.(4)		One drop on two adjacent bottom edges, total of two drops.(3)	Tri-axial accelerometers	

1. Figures in brackets [] refer to paragraphs in MIL-C-5584D.
 2. Corner drops to be performed in Test No. 5a.
 3. Edge drops to be performed in Test No. 5b or 5c.
 4. Maximum acceleration shall not exceed 25 G's.

APPROVED BY: *Caroline Buckey* *Ted Hinds*
 Caroline Buckey, Mechanical Engineer Ted Hinds, Chief, Design Br., AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY

(Container Test Plan)

AFPEA PROJECT NUMBER

88-P-103

CONTAINER SIZE (L x W x D) (INCHES)
INTERIOR: EXTERIOR:

64 x 62 x 52

WEIGHT (LBS)
GROSS: ITEM:

942

206

CUBE (CU. FT.)

119

QUANTITY

1

DATE

26 May 89

ITEM NAME

Combat Talon II Ku-band Antenna

MANUFACTURER

Emerson Electric

CONTAINER NAME

CNU-459/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	INSTRUMENTATION
c.	FED-STD-101 Method 5012 [4.7.8]	Pendulum-impact test. Condition at +165°F. Temperature of shock mitigation system at time of test shall be +140°F (+10/-0°F). Impact velocity 7 ft/sec, drop height 9 inches.(4)	One impact on one side and one end, total of two impacts.(3)	Tri-axial accelerometers, Thermocouples
4.	<u>LEAK TEST</u> FED-STD-101 Method 5009.2 [4.7.2]	Pneumatic pressure with 1.00 PSI. Test duration not less than 15 minutes with .0125 PSI leakage allowed.	Ambient	Water manometer
5.	<u>ROUGH HANDLING TESTS (LOW TEMPERATURE -20°F)</u>			
a.	FED-STD-101 Method 5005.1 [4.7.8]	Cornerwise-drop (rotational) test. Condition at -20°F for not less than 24 hours. Drop height 20 inches.(4)	One drop on diagonal bottom corners, total of two drops.(5)	Tri-axial accelerometers
b.	FED-STD-101 Method 5008.1 [4.7.8]	Edgewise-drop (rotational) test. Condition at -20°F for not less than 24 hours. Drop height 20 inches.(4)	One drop on two bottom edges, total of two drops.(6)	Tri-axial accelerometers

COMMENTS:

(5) These corners are opposite those impacted in Test No. 3a.

(6) These edges are opposite those impacted in Test No. 3b or 3c.

PREPARED BY:

Caroline Buckey, Mechanical Engineer

APPROVED BY:

Ted Hinds, Chief, Design Br., AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY (Container Test Plan)					AFPEA PROJECT NUMBER	
CONTAINER SIZE (L x W x D) (INCHES)			WEIGHT (LBS)	CUBE (CU. FT.)	QUANTITY	DATE
INTERIOR: 64 x 62 x 52			GROSS: 942	ITEM: 206	119	1
26 May 89						
ITEM NAME				MANUFACTURER		
Combat Talon II Ku-band Antenna				Emerson Electric		
CONTAINER NAME				CONTAINER COST		
CNU-459/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	INSTRUMENTATION		
c.	FED-STD-101 Method 5012 [4.7.8]	Pendulum-impact test. Condition at -65°F. Temperature of shock mitigation system at time of test shall be -20°F (+0/-10°F). Impact velocity 7 ft/sec, drop height 9 inches.(4)	One impact on one side and one end, total of two impacts.(6)	Tri-axial accelerometers, Thermo-couples		
d.	<u>LEAK TEST</u> FED-STD-101 Method 5009.2 [4.7.2]	Pneumatic pressure with 1.00 PSI. Test duration not less than 15 minutes with .0125 PSI leakage allowed.	Ambient	Water manometer		
	<u>VIBRATION FATIGUE TEST</u> MIL-STD-648 Para 5.3.2 [4.7.7.1]	Input excitation of 0.125 inch double amplitude or 1G, whichever is less. Sweep approximately logarithmically from 5 to 50 Hz (about 1/2 octave/min) for 7 1/2 minutes. Then dwell 30 minutes at the resonant frequency. The test may be interrupted to prevent excessive	Rigidly attach container to exciter. The use of straps is prohibited.	Tri-axial accelerometers, Thermo-couples		
PREPARED BY:				APPROVED BY:		
Caroline Buckey, Mechanical Engineer				Ted Hinds, Chief, Design Br., AFPEA		

AIR FORCE PACKAGING EVALUATION ACTIVITY

(Container Test Plan)

AFPEA PROJECT NUMBER

88-P-103

CONTAINER SIZE (L x W x D) (INCHES)
INTERIOR:

64 x 62 x 52

WEIGHT (LBS)
GROSS: ITEM:

942

206

CUBE (CU. FT.)

119

QUANTITY

1

DATE

26 May 89

ITEM NAME

Combat Talon II Ku-band Antenna

MANUFACTURER

Emerson Electric

CONTAINER NAME

CNU-459/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	INSTRUMENTATION
8.	<u>LEAK TEST</u> FED-STD-101 Method 5009.2 [4.7.2]	temperature rise in materials. Transmissibility shall not exceed 5 at the resonant frequency. Pneumatic pressure with 1.00 PSI. Test duration not less than 15 minutes with .0125 PSI leakage allowed.	Ambient	Water manometer
9.	<u>REPETITIVE SHOCK</u> MIL-STD-648 Para 5.2.2.1 FED-STD-101 Method 5019.1 [4.7.7.3]	(SUPERIMPOSED LOAD) Test using vertical motion for two hours at 1 G or 1/16" bounce between 3 to 5 Hz (whichever is less). Banding of containers shall be through the forklift pockets and in the channels across the top of the container.(4)	Ambient	Tri-axial accelerometers
10.	<u>LEAK TEST</u> FED-STD-101 Method 5009.2 [4.7.2]	Pneumatic pressure with 1.00 PSI. Test duration not less than 15 minutes with .0125 PSI leakage allowed.	Ambient	Water manometer

COMMENTS:

PREPARED BY:

Caroline Buckey, Mechanical Engineer

APPROVED BY:

Ted Hinds, Chief, Design Br., AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY

(Container Test Plan)

AFPEA PROJECT NUMBER

88-P-103

CONTAINER SIZE (L x W x D) (INCHES)

INTERIOR:

EXTERIOR:

64 x 62 x 52

WEIGHT (LBS)

GROSS:

ITEM:

942

206

CUBE (CU. FT.)

119

QUANTITY

1

DATE

26 May 89

ITEM NAME

Combat Talon II Ku-band Antenna

MANUFACTURER

Emerson Electric

CONTAINER NAME

CONTAINER COST

CNU-459/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	INSTRUMENTATION
11.	<u>SUPERIMPOSED LOAD</u> FED-STD-101 Method 5016.1 [4.7.6.1]	Stack 4 containers or 16 ft high, whichever is greater. Load equals load on bottom container times a factor of safety of 2, leave stacked for 60 minutes at ambient temperature.	Bottom container is container under test.	Record changes, i.e. buckling, deformations.
12.	<u>LEAK TEST</u> FED-STD-101 Method 5009.2 [4.7.2]	Pneumatic pressure with 1.00 PSI. Test duration not less than 15 minutes with .0125 PSI leakage allowed.	Ambient	Water manometer
13.	<u>STAND-OFF TEST</u> [4.7.5.1]	Place load two times the cover weight on cover. The cover shall not deform or deflect. With load removed, slide cover on the stand-offs five feet in each of four different directions. There shall be no damage to the sealing surface.	Place container cover on a concrete floor resting on the stand-offs.	Visual inspection

PREPARED BY:

William Buckey, Mechanical Engineer

APPROVED BY:

Ted Hinds, Chief, Design Br., AFPEA

AFALL 13, 4

14

PAGE 5 OF 11

AIR FORCE PACKAGING EVALUATION ACTIVITY (Container Test Plan)						AFPEA PROJECT NUMBER 88-P-103	
CONTAINER SIZE (L x W x D) (INCHES)			WEIGHT (LBS)		CUBE (CU. FT.)	QUANTITY	DATE
INTERIOR:		EXTERIOR:	GROSS:	ITEM:			
64 x 62 x 52			942	206	119	1	26 May 89
ITEM NAME Combat Talon II Ku-band Antenna				MANUFACTURER Emerson Electric			
CONTAINER NAME CNU-459/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	INSTRUMENTATION	
14.	<u>HANDLING TESTS</u>						
a.	FED-STD-101 Method 5011.1 Paragraph 6.2 [4.7.5]	Forklift handling test. Lift container off ground with tines inclined 15 degrees and stack restrained to prevent sliding. Carry 100 ft in 23 seconds. Place two parallel 2x4s 54 inches apart in the path as follows: 30 ft from the start, square to the path; 60 ft from the start, at a 60° angle such that the left wheel strikes first; 90 ft from the start, at a 75° angle such that the right wheel strikes first. The container(s) shall remain stable on the tines during the test. There shall be no structural damage. Stack one container on top of another container and verify fork tine entry capability from each of 4 sides.			Ambient	Visual inspection	
COMMENTS:							
PREPARED BY: Caroline Buckey, Mechanical Engineer					APPROVED BY: Ted Hinds, Chief, Design Br., AFPEA		

AIR FORCE PACKAGING EVALUATION ACTIVITY (Container Test Plan)						AFPEA PROJECT NUMBER 88-P-103	
CONTAINER SIZE (L x W x D) (INCHES)		WEIGHT (LBS)		CUBE (CU. FT.)	QUANTITY	DATE	
INTERIOR: 64 x 62 x 52		GROSS: 942	ITEM: 206	119	1	26 May 89	
ITEM NAME Combat Talon II Ku-band Antenna				MANUFACTURER Emerson Electric			
CONTAINER NAME CNU-459/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	INSTRUMENTATION		
b.	FED-STD-101 Method 5011.1 Paragraph 6.5 [4.7.5]	Forklift pushing test. The forklift tines should extend under but not support the container. Push on hard surface 35 ft in 85 seconds. There shall be no structural damage.		From one side and one end of container.	Visual inspection		
c.	FED-STD-101 Method 5011.1 Paragraph 6.6 [4.7.5]	Forklift towing test. Pull by towing rings 100 ft in 23 seconds. There shall be no structural damage.		From ends of container only.	Visual inspection		
15. <u>HOISTING STRENGTH TEST</u>							
a.	MIL-STD-648 Para 5.8.5 [4.7.4]	Single ring hoisting test. Hoist container from each lift point in turn and suspend for five minutes. There shall be no damage or permanent deformation.		Ambient	Visual inspection		
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 5 minutes. There shall be		Ambient	Visual inspection		
APPROVED BY:				APPROVED BY:			
Caroline Buckey, Mechanical Engineer				Ted Hinds, Chief, Design Br., AFPEA			

AIR FORCE PACKAGING EVALUATION ACTIVITY (Container Test Plan)						AFPEA PROJECT NUMBER	
						88-P-103	
CONTAINER SIZE (L x W x D) (INCHES)			WEIGHT (LBS)		CUBE (CU. FT.)	QUANTITY	DATE
INTERIOR: 64 x 62 x 52			GROSS: 942	ITEM: 206	119	1	26 May 89
ITEM NAME					MANUFACTURER		
Combat Talon II Ku-band Antenna					Emerson Electric		
CONTAINER NAME						CONTAINER COST	
CNU-459/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			INSTRUMENTATION	
		no damage or permanent deformation. (Legs of the sling should be 30° from the horizontal).					
c.	MIL-STD-648 Para 5.8.3 (Modified for cover lift rings) [4.7.4]	Four ring hoisting test for cover lift rings. Hoist container loaded to one times the gross weight of a single container by all lift points simultaneously and leave hanging for 5 minutes. There shall be no damage or permanent deformation. (Legs of the sling should be 30° from the horizontal).	Ambient			Visual inspection	
16.	<u>LEAK TEST</u> FED-STD-101 Method 5009.2 [4.7.2]	Pneumatic pressure with 1.00 PSI. Test duration not less than 15 minutes with .0125 PSI leakage allowed.	Ambient			Water manometer	
COMMENTS:							
PREPARED BY:					APPROVED BY:		
Caroline Buckey, Mechanical Engineer					Ted Hinds, Chief, Design Br., AFPEA		

AIR FORCE PACKAGING EVALUATION ACTIVITY

(Container Test Plan)

AFPEA PROJECT NUMBER

88-P-103

CONTAINER SIZE 'L x W x D' (INCHES)

INTERIOR:

EXTERIOR:

64 x 62 x 52

WEIGHT (LBS)

GROSS:

ITEM:

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Combat Talon II Ku-band Antenna

MANUFACTURER

Emerson Electric

CONTAINER NAME

CNU-459/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	INSTRUMENTATION
17.	<u>COVER HANDLE PULL TEST</u> [4.7.4.1]	Apply a force of 250 lbs on a cover handle in four directions that service loads are possible. There shall be no damage or permanent deformation.	Ambient	Scale
18.	<u>PUNCTURE RESISTANCE TEST</u> MIL-STD-1489A Method 505.1 [4.7.4]	Impact will be made at a point 1/2 inch above the enclosed forklift pocket of the container base. There shall not be any damage affecting container performance.	One impact to one side and one end of the container base, total of two impacts.	Visual inspection
	<u>LEAK TEST</u> MIL-STD-101 Method 5009.2 [4.7.2]	Pneumatic pressure with 1.00 PSI. Test duration not less than 15 minutes with .0125 PSI leakage allowed.	Ambient	Water manometer

APPROVED BY:

Carol A. Suckey, Mechanical Engineer

Ted Hinds, Chief, Design Br., AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY

(Container Test Plan)

AFPEA PROJECT NUMBER

88-P-103

CONTAINER SIZE (L x W x D) (INCHES)

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TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION	INSTRUMENTATION
20.	<u>TOWING TEST</u> FED-STD-101 Method 5011.2	The container shall be towed behind a forklift using a mobility container towbar (305435-1) attached to the towbar attachment points on the container. Tow the container for at least 200 ft. in 1 minute turning 180° at least twice during the 200 ft. There shall be no damage to the towbar attachment points and the container shall not sway more than 2 ft. in any direction.	Ambient	Visual Inspection

COMMENTS:

PREPARED BY:

Caroline Buckey, Mechanical Engineer

APPROVED BY:

Ted Hinds, Chief, Design Br., AFPEA

AIR FORCE PACKAGING EVALUATION ACTIVITY (Container Test Plan)					AFPEA PROJECT NUMBER 88-P-103	
CONTAINER SIZE (L x W x D) (INCHES)		WEIGHT (LBS)		CUBE (CU. FT.)	QUANTITY	DATE
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CONTAINER NAME CNU-459/E				CONTAINER COST		
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CONDITIONING As noted below.						
TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS		CONTAINER ORIENTATION	INSTRUMENTATION	
011	<u>STRUCTURAL INTEGRITY TEST</u> MIL-STD-648 Paragraphs 5.5.2. & 5.5.3 [4.2.2.1.16]	Pressurize container to 3.5 PSI momentarily and return to ambient. Apply a vacuum of 2.5 PSI momentarily and return to ambient. Any failure resulting in or causing an unsafe condition shall be cause for rejection. Permanent deformation of the container structure sufficient to prevent the safe removal of the antenna shall also be cause for rejection.		Ambient	Water manometer	

APPROVED BY:

Ted Hinds, Chief, Design Br., AFPEA

APPROVED BY:

Ted Hinds, Chief, Design Br., AFPEA

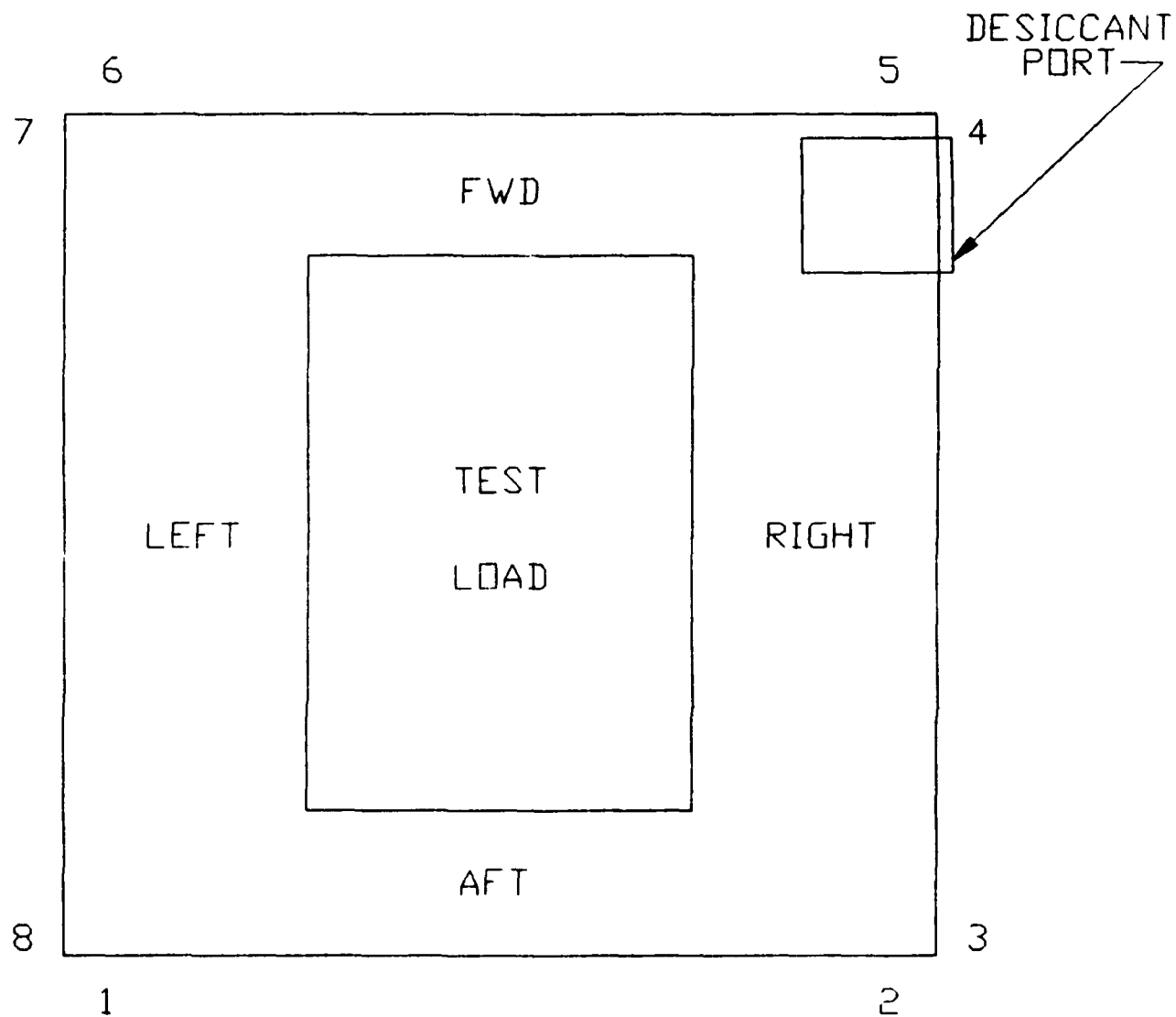


FIGURE 1 - CNU-459/E Corner Numbering

Figure 2

CNU-459/E
Prototype
Container.

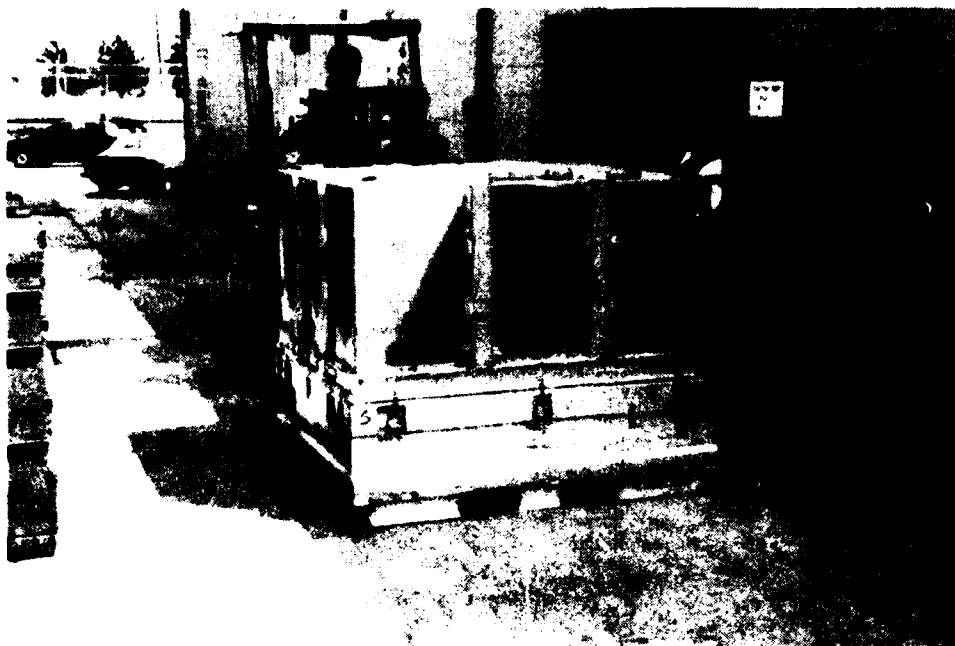


Figure 3

CNU-459/E
Yoke
Assembly
Attachment.



Figure 4

CNU-459/E
Cover Wheel
Storage.

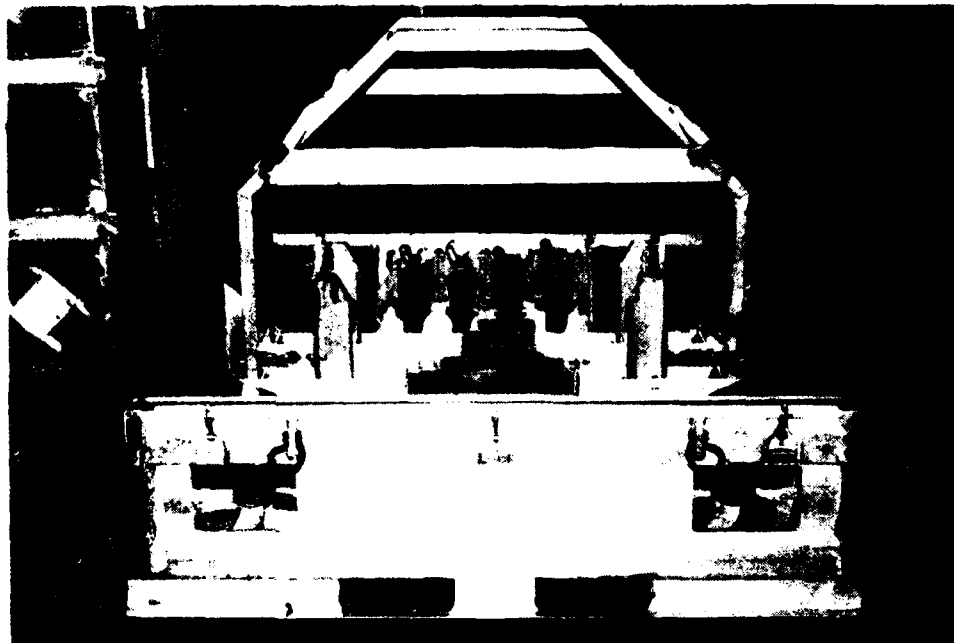


Figure 5

CNU-459/E
Yoke Frame.

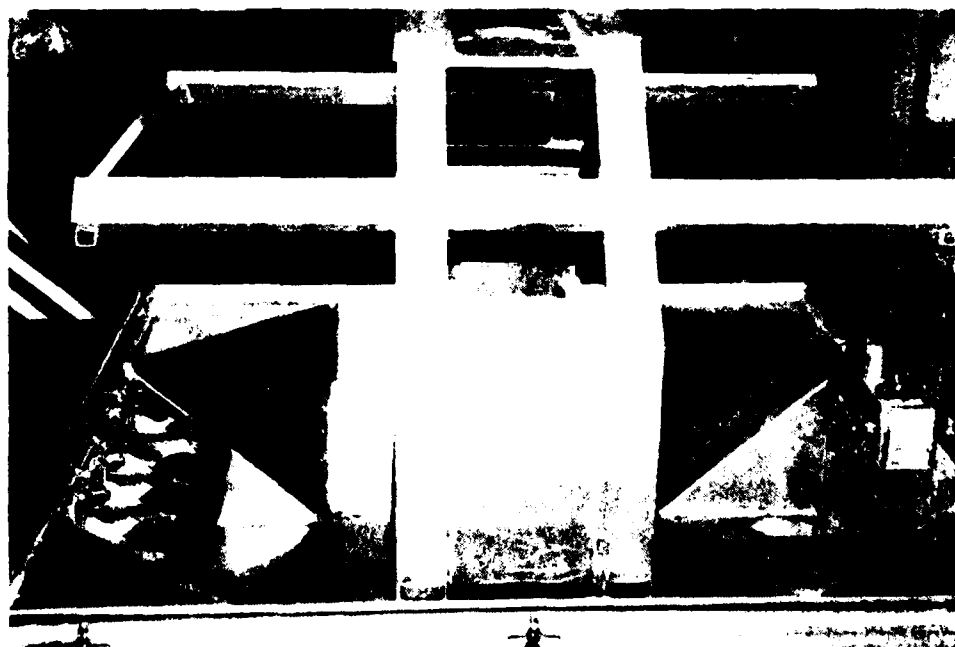


Figure 6

CNU-459/E
Test Load.

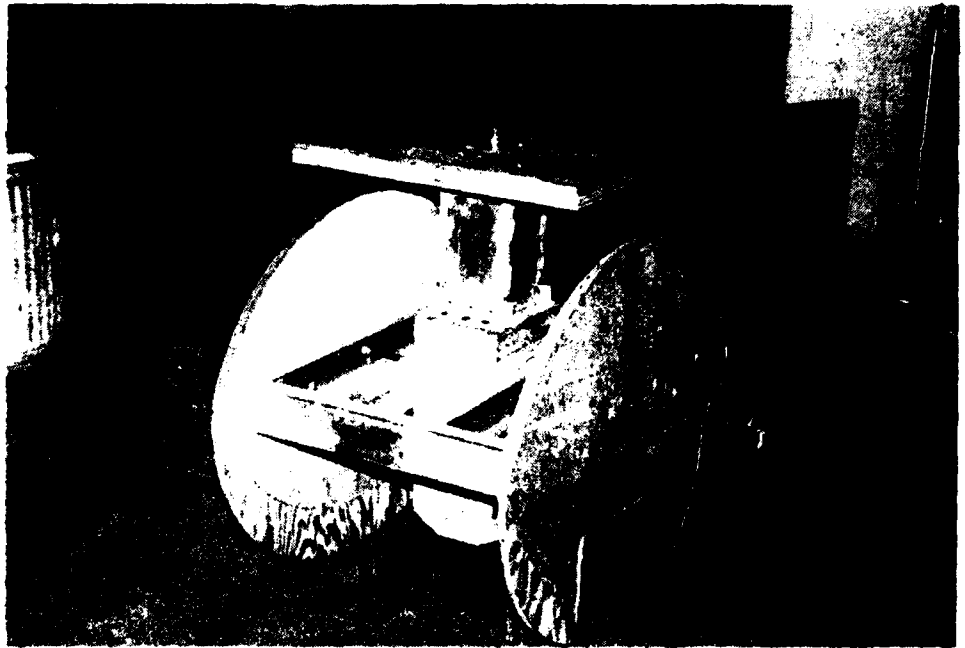


Figure 7

High Temperature
Pendulum-Impact
Test.



Figure 8

Forklift
Handling
Test.



Figure 9

Four Ring
Hoisting
Test.

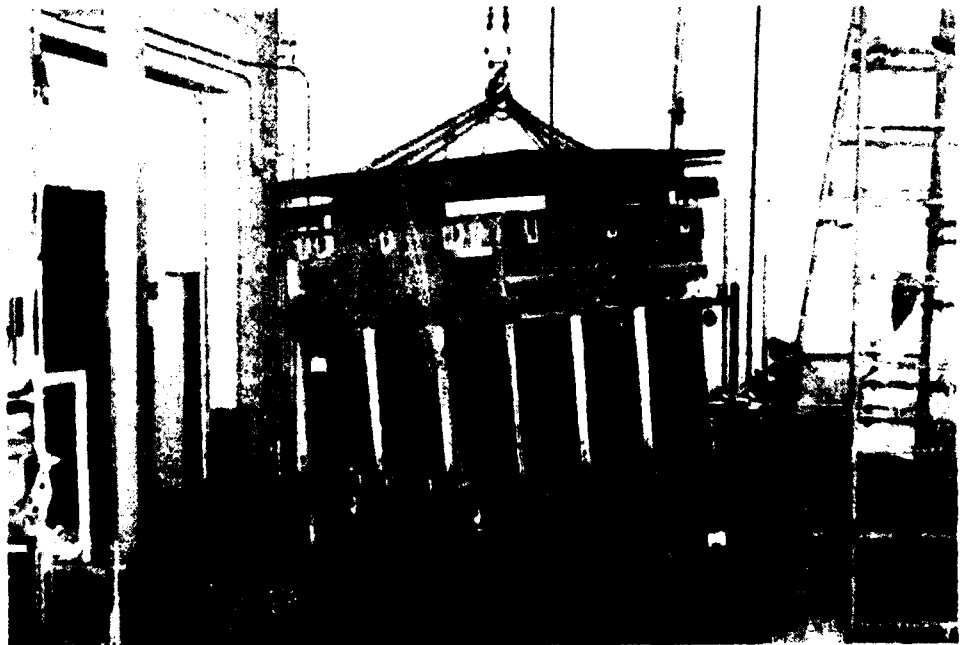


Figure 10

Cover Handle
Pull Test.



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CNU-459/E CONTAINER - DETAILED ACCELERATION RESULTS

HIGH TEMPERATURE ROUGH HANDLING TESTS (+140^o F)

Impact	Position	Accelerometer readings (Gs)		
		Right	CG	Left
20" rotational drop	Corner 2-3	9	8	8
20" rotational drop	Corner 6-7	7	7	10
20" rotational drop	Side 5-6	7	N/A	7
20" rotational drop	Side 7-8	8	7	10
7 ft/sec pendulum-impact	Side 1-2	12	4	7
7 ft/sec pendulum-impact	Side 3-4	19	7	11

1. No damage to the container or the test load.

LOW TEMPERATURE ROUGH HANDLING TESTS (-20^o F)

Impact	Position	Accelerometer readings (Gs)		
		Right	CG	Left
20" rotational drop	Corner 2-3	19	12	14
20" rotational drop	Corner 6-7	20	14	14
20" rotational drop	Side 5-6	16	16	13
20" rotational drop	Side 7-8	20	11	13
7 ft/sec pendulum-impact	Side 1-2	18	11	23
7 ft/sec pendulum-impact	Side 3-4	17	8	16

1. No damage to the container or the test load.

VIBRATION FATIGUE TEST

Natural frequency 7.7 Hz

(input: 0.38 G peak, 0.125 inch double amplitude)

	Lower CG	Upper CG	Left Dish
Maximum Acceleration (Gs, peak to peak)	3.7	3.8	3.6
Maximum Transmissibility	4.9	5.0	4.7

1. No damage to the container or the test load.