PERFORMANCE ORIENTED PACKAGING TESTING
OF
CNU-405/E SHIPPING AND STORAGE CONTAINER
FOR
PACKING GROUP II
SOLID HAZARDOUS MATERIALS

Author:
LARRY J. BEDWELL

Performing Activity:
Naval Weapons Support Center Crane
Crane, Indiana 47522-5000

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FINAL

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**Title:** POP Test of CNU-405/E Shipping and Storage Container

**Personal Author(s):** Larry J. Bedwell

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**Abstract:** Qualification tests were performed to determine whether the reusable CNU-405/E Shipping and Storage Container meets the Performance Oriented Packaging (POP) requirements specified by the United Nations Recommendations on the Transportation of Dangerous Goods. The container loaded to a gross weight of 128 pounds successfully met the requirements and retained its contents throughout the tests.
INTRODUCTION

The CNU-405/E Shipping and Storage Container with a dummy load of 100 pounds enclosed and an overall weight of 128 pounds was tested to ascertain whether this standard container would meet the requirements of Performance Oriented Packaging (POP) as specified by the United Nations (UN) Recommendation on the Transportation of Dangerous Goods, Document ST/SG/AC.10/1, Revision 6, Chapters 4 and 9. A Base Level Vibration Test was also conducted in accordance with the proposed rulings specified in the Department of Transportation's (DOT) Performance Oriented Packaging Standards HM-181, and Requirements for Explosives HM-181A. The objectives were to evaluate the adequacy of the container in protecting explosive materials which are secured with appropriate dunnage.

TESTS PERFORMED

1. Stacking Test

   This test was performed in accordance with ST/SG/AC.10/1, Chapter 9, Paragraph 9.7.6. Three different containers were used, and subjected to a stack weight of 1,200 pounds. The test was performed for 24 hours. After the allowed time, the weight was removed and the containers examined. Any leakage, deterioration, or distortion which could adversely affect transport, reduce strength or cause instability in stacks of packages was considered cause for rejection.

2. Drop Test

   This test was performed in accordance with ST/SG/AC.10/1 Chapter 9, Paragraph 9.7.3. One of the three containers used during the stacking test was also used for the four flat drops and one corner drop instead of the required five containers (one for each drop). The drops were performed from a height of 4 feet in the following sequence:
   
   a. Flat Bottom
   b. Flat Top
   c. Flat on Long Side
   d. Flat on Short Side
   e. One Corner

   This test was performed at ambient, +70 ± 20 °F temperature. The contents of the container should be retained within its packaging and exhibit no damage liable to affect safety during transport.
3. **Base Level Vibration Test**

This test was performed in accordance with Appendix C of Federal Register / Vol 52, No 215 / Friday, November 6, 1987 / Proposed Rules. Three sample containers were filled to a gross weight of 128 pounds and closed for shipment using nonhazardous materials. One container was loaded with simulated brass weights used during the drop test. One container was loaded with 1 pound steel bars and the other container was loaded with the required weight of sand which would be the worst case scenario. The three containers were placed on a vibrating platform that had a vertical amplitude (peak-to-peak displacement) of one inch. The containers were not restrained during vibration except by a fence attached to the test surface to prevent them from falling off the table. The containers were tested for 60 minutes in their normal shipping position. The vibratory input to the container was at a frequency that caused the container to be raised from the vibrating platform to such a degree that a piece of material of approximately 1/16" (1.6mm) thickness could be passed between the bottom of the container and the platform.

**PASS/FAIL (UN CRITERIA)**

The criteria for passing the stacking test is outlined in Paragraph 9.7.6.3 of ST/SG/AC.10/1 and states the following: "No test sample should show any deterioration which could adversely affect transport safety or any distortion liable to reduce its strength or cause instability in stacks of packages".

The criteria for passing the drop test is outlined in Paragraph 9.7.3.5 of ST/SG/AC.10/1 and states the following: "Where a packaging for solids undergoes a drop test and its upper face strikes the target, the test sample passes the test if the entire contents are retained by an inner packaging or inner receptacle (e.g., a plastic bag), even if the closure is no longer sift-proof".

**PASS/FAIL (HM-181 CRITERIA)**

The criteria for passing the Base Level Vibration Test is outlined in Part 173 Appendix C Paragraphs 4 and 5, Docket No. HM-181, Notice No. 87-4, Federal Register / Vol 52, No. 215 / Friday, November 6, 1987 / Proposed Rules and states the following: "Immediately following the period of vibration, each package shall be removed from the platform, turned on its side and observed for any evidence of leakage. Rupture or leakage from any of the packages constitutes failure of the test".
TEST RESULTS

1. Stacking Test
   Satisfactory.

2. Drop Test
   Satisfactory, see Figure 1.

3. Base Level Vibration Test
   Satisfactory with no leakage.

DISCUSSION

1. Stacking Test

   The stacking test was performed with a load of 1200 pounds
   for 24 hours. Each container was visibly checked after the 24
   hour period was over. There was no leakage, distortion, or
deterioration to any of the containers as a result of this test.

2. Drop Test

   After each drop, the container was inspected for any damage
which would be a cause for rejection. Final inspection indicated
damage was minimal with only minor denting noted, particularly
after the final corner drop. The container remained intact and
serviceable on completion of the tests. The standard wire seal
(Drawing 19200-8794342) used to secure each end of the container
also remained intact during the entire test. An internal pressure
test at the end of the series of drops was conducted and the
container still maintained an internal pressure of 2.25 PSIG for
30 minutes.

3. Base Level Vibration Test

   Immediately after the vibration test was completed, each
container was removed from the platform, turned on its side and
observed for any evidence of leakage. The latches remained
intact, the seals were not broken, and there was no evidence of
leakage of the solid weights, steel bars, or the sand.
REFERENCE MATERIAL

United Nations "Recommendation on the Transportation of Dangerous Goods", ST/SG/AC.10/1, Revision 6


Docket No HM-181A; Notice No 90-5, Federal Register/ Vol. 55, No 85 / Wednesday May 2, 1990 / Requirements for Explosives ; Proposed Rule making

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TEST DATA SHEET

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<td><strong>Type:</strong> 4Al</td>
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<tr>
<td><strong>UN Code:</strong> See Table</td>
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<td><strong>Specification Number:</strong> NAVAIRSYSCOM DWG 986AS106</td>
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<td><strong>Material:</strong> Steel</td>
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<td><strong>Capacity:</strong> 58 kg (128 pounds)</td>
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<td><strong>Dimensions:</strong> .47 m (L) x .27 m (W) x .37 m (H)</td>
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<td><strong>(18.59&quot; L x 10.59&quot; W x 14.59&quot; H)</strong></td>
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<td><strong>Closure (Method/type): Removable lid</strong></td>
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<tr>
<td><strong>Tare Weight:</strong> 10.17 kg (22.45 pounds)</td>
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<td><strong>Additional Description:</strong> 25 MM SHIPPING AND STORAGE CONTAINER</td>
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**PRODUCT(S):** See Table

**Name:** See Table

**United Nations Numbers:** 0267, 0321, 0339, 0417

**United Nations Packing Group:** II

**Physical State:** Solid

**Vapor Pressure (Liquids Only):** N/A

**Consistency/Viscosity:** N/A

**Density/Specific Gravity:** N/A

**Amount Per Container:** See Table

**Net Weight:** See Table

**TEST PRODUCT:**

| **Name:** Simulated Weights of Metals (Brass or Steel) or Granular sand |
| **Physical State:** Solid |
| **Size:** |
| Brass 9.88" x 7.75" x 1.25" |
| or Steel .88" Diameter x 6.0" |
| **Quantity:** |
| Brass Four(4) or Steel 100 rods or Sand 100 lbs. |

**Density/Specific Gravity:** N/A

**Dunnage:** PPP-C-1752 FOAM POLYETHYLENE

**Gross Weight:** 58 KG (128 lbs.)
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