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11. TITLE (Include Security Classification)
Performance Oriented Packaging (POP) Testing of 60mm SMOKE WP M302A1 Mortar Cartridge, Packed nine (9) in a Nailed Wood Box

12. PERSONAL AUTHOR(S)
Oltea L. Bogdan

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16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)	
FIELD	GROUP	SUB-GROUP	1. Performance Oriented Packaging	4. Jungle Wrap
			2. Nailed Wood Box	
			3. M567 Fiber Container	DTIC QUALITY INSPECTED 2

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

This report covers the POP tests performed on nailed wood box fabricated per MIL-B-2427. This nailed wood box is being used as shipping and storage container of various 60mm Mortar Cartridges. The nailed wood box tested (P/N 9215577) contained nine spirally wound fiber containers M567 (P/N 9215576). Tests were conducted using containers containing additional weights to insure that tested weight is higher than the packaged cartridges. The tests were conducted in accordance with Performance Oriented Packaging (POP) requirements specified by the United Nations, "Transportation of Dangerous Goods" and the Code of Federal Regulations, Title 49 CFR, Parts 107 through 178.

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22a. NAME OF RESPONSIBLE INDIVIDUAL Oltea L. Bogdan		22b. TELEPHONE (Include Area Code) 201-724-2220	22c. OFFICE SYMBOL SMCAR-AEP

94 6 10 152

Report Number: DOD POP HMTR/AYD 94-015

II. Title: Performance Oriented Packaging (POP) Testing of 60mm
SMOKE WP M302A1 Mortar Cartridge, Packed nine (9) in
a Nailed Wood Box

Drawing Number: 9215577

Author: Oltea L. Bogdan

Performing Activity: U.S. Army Armament Research, Development
and Engineering Center (ARDEC)

Address: Department of the Army
Commander, U.S. Army ARDEC
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Date: May 1994

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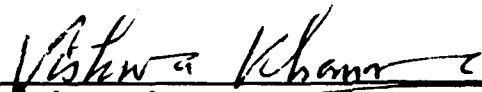
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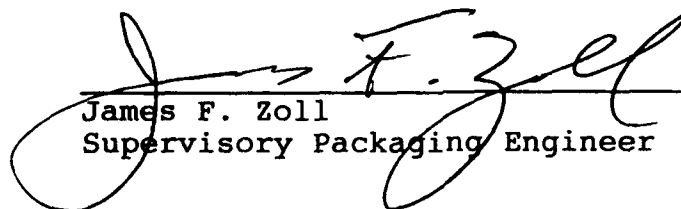
Oltea I. Bogdan
Packaging Engineer

REVIEWED BY:



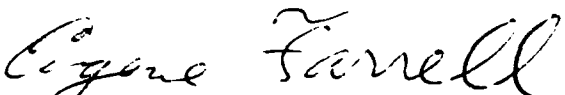
Vishwa Khanna
Project Leader

REVIEWED BY:



James F. Zoll
Supervisory Packaging Engineer

APPROVED BY:



Gene Farrell
Acting Chief, Packaging Division

I. Data:

Container:

Type: Box, Nailed
 Code: 4C1
 Specification: MIL-B-2427
 Drawing Number: 9215577
 Material: Wood
 Capacity: 21.20 liters
 Dimensions:
 Inside: 37.15 cm X 23.65 cm X 24.13 cm
 (14 5/8 in X 9 5/16 in X 9 1/2 in)
 Outside: 44.13 cm X 27.15 cm X 29.37 cm
 (17 3/8 in X 10 11/16 in X 11 9/16 in)
 Closure Method/Type: 1 Flat strapping
 Gross Weight: 35 kg (77 pounds)
 Tare Weight: 6.4 kg (14 pounds)

Additional description: Each cartridge is packed in M567 Fiber Container and jungle wrap in accordance with drawing 9215576. Nine fiber containers are packed in nailed wood box in accordance with drawing 9215577.

Product:

1. Name: Cartridge 60MM, Smoke WP, M302A1 W/Fuze PD M527B1
 Drawing Number: 9215575
 Cage Code: 19203
 National Stock Number: 1310-00-935-9129
 DOD Identification Code: B630
2. Name: Cartridge 60MM, Smoke WP, M302A2 W/Fuze PD M936
 Drawing Number: 12903088
 Cage Code: 19200
 National Stock Number: 1310-01-240-9252
 DOD Identification Code: B630

Proper Shipping Name: AMMUNITION SMOKE, WHITE PHOSPHORUS
 United Nation Identification Number: 0245
 United Nation Packaging Group: II
 Physical State: Solid

Test Materials:

Name: Simulated Weights and Sand

Physical State: Solid
Quantity: 54 pounds
Dunnage: Filler Sheet Form per MIL-F-50499
Gross Weight: 77 pounds (35 kg)

II. Reference Material:

- a. Federal Register, "49 CFR Part 107-179"
- b. United Nations, "Transport of Dangerous Goods"

III. Background:

This Performance-Oriented Packaging (POP) test was performed to ascertain whether the MIL-B-2427 nailed wood box used for shipping and storage of various 60MM Cartridges meet the Packaging Group II requirements specified by the Code of Federal Regulations Title 49, Part 107 through 179 dated 1 October 1993.

The box tested conforms to MIL-B-2427, Type II, Class 2, Grade A and contains nine cartridges. Each cartridge is packed in a fiber container and jungle wrapped. One steel strap is used to secure the wood box during the tests.

IV. Tests Performed

The following POP tests were performed at ambient temperature:

1. Vibration Test

Procedure:

This test was performed in accordance with Title 49 CFR, Part 178, Subpart M, Sec. 178.608. Three boxes loaded and closed as for shipment were placed on a vibrating platform. The vertical double-amplitude of vibrating platform was one inch at a frequency of 275 cycle per minute for one hour. The frequency was sufficient to allow the package to become completely airborne and enable a 1/16" piece of strapping material to be slid underneath the package during vibration.

Discussion:

Immediately following the vibration test, each container was removed from platform, turned on its side and observed for any

evidence of leakage. All containers remained securely closed and there was no evidence of leakage of contents.

Results:

After the tests, the boxes experienced no structural damage; there was no spillage of contents; the passing criteria was met.

2. Stacking Test

Procedure:

This test was performed in accordance with Title 49 CFR, Part 178, Subpart M, Sec. 178.606. Three different nailed boxes were used. Each box was loaded with a stack weight of 960 pounds. This simulates the weight imposed on the bottom container of a ten-foot stack of identical containers. The test was performed for 24 hours.

Discussion:

After the allowed time, the weight was removed and the container was observed for any evidence of leakage, deterioration or distortion.

Results:

During test, the container supported the total load adequately. No structural damages were found on the tested container. The passing criteria was met.

3. Drop Test

Procedure:

The test was performed in accordance with Title 49 CFR, Part 178, Subpart M, Sec. 178.603. One container was used for each drop orientation. The drop height was 1.2 meters (four feet) with the following sequence:

- a. Flat on Bottom
- b. Flat on Top
- c. Flat on Long Side
- d. Flat on Short Side
- e. One Corner

Discussion:

The contents of the container were retained within its

package and exhibited no damage liable to affect safety during the transportation.

Results:

There were no visible damages on the flat drops. The corner drop orientation produced an indentation of the box and a small crack at the joint less than a one quarter of an inch.

However, the container was in a sound condition. All contents remained inside the container and package was capable of being handled without danger of spillage. The container exceeded the passing criteria of CFR 49.

V. Based on the above POP testing, the following POP symbol has been applied to the nailed wood box in accordance with drawing 9215577.

(u
n) 4C1/Y35/S/[--]

Insert the last two digits
of year packed.