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**DODPOPHM/USA/DOD/NADTR92101
REVISION A**

**PERFORMANCE ORIENTED PACKAGING TESTING
OF
M2A1 AMMUNITION BOX
FOR
FOR PACKING GROUP II SOLID HAZARDOUS MATERIALS**

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**Performing Activity:
Naval Surface Warfare Center
Code 4045
Crane, Indiana 47522-5001**

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**Date
November 1993**

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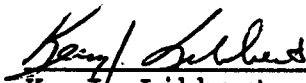
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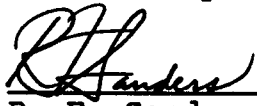
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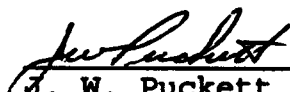
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REPORT DOCUMENTATION PAGE		Form Approved OMB No 0704-0188	
Public reporting burden of this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.			
1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE November 1993	3. REPORT TYPE AND DATES COVERED POP Test, Revision A	
4. TITLE AND SUBTITLE Performance Oriented Packaging Testing of M2A1 Ammunition Box for Packing Group II Solid Hazardous Materials		5. FUNDING NUMBERS	
6. AUTHOR(S) Kerry J. Libbert			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Surface Warfare Center Packaging and Plastics Applications Branch (Code 4045) 300 Highway 361 Crane, Indiana 47522-5001		8. PERFORMING ORGANIZATION REPORT NUMBER DODPOPHM/USA/DOD/NADTR92101 Revision A	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Naval Surface Warfare Center Pyrotechnics/Demolition Branch (Code 4027) 300 Highway 361 Crane, Indiana 47522-5001		10. SPONSORING/MONITORING AGENCY REPORT NUMBER Same as above	
11. SUPPLEMENTARY NOTES N/A			
12a. DISTRIBUTION/AVAILABILITY STATEMENT Unlimited distribution		12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) Qualification tests were performed to determine whether the in-service M2A1 Ammunition Box could be utilized to contain properly dunnaged solid type hazardous materials weighing up to a gross weight of 15 kg (33 pounds). The tests were conducted in accordance with Performance Oriented Packaging (POP) requirements specified by the United Nations Recommendations on the Transportation of Dangerous Goods, ST/SG/AC.10/1 and the Code of Federal Regulations, Title 49 CFR, Parts 107 through 178. The M2A1 box has conformed to the POP performance requirements; i.e., the box successfully retained its contents throughout the specified tests.			
14. SUBJECT TERMS POP Test of M2A1 Ammunition Box		15. NUMBER OF PAGES 8	
		16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE UL	19. SECURITY CLASSIFICATION OF ABSTRACT UL	20. LIMITATION OF ABSTRACT UL

INTRODUCTION

This Performance Oriented Packaging (POP) test was performed to ascertain whether the M2A1 Ammunition Box meets the Packing Group II requirements specified by the Code of Federal Regulations, Title 49 CFR, Parts 107 through 178, dated 31 December 1991. The objectives were to evaluate the adequacy of the container in protecting hazardous materials.

The M2A1 is a steel container with a hinged lid and a handle on top. The box is shown in figure 1.

TESTS PERFORMED

1. Drop Test

This 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 and the drop sequence was as follows:

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

The test was performed at ambient temperature ($70^{\circ} \pm 20^{\circ}\text{F}$). The corner drop was performed on a corner of the lid near the latch. The contents of the container should be retained within its packaging and exhibit no damage liable to affect safety during transport.

2. Stacking Test

This test was performed in accordance with Title 49 CFR, Part 178, Subpart M, Sec. 178.606. Three different containers were used, each with a stack weight of 830 pounds. This represents the weight imposed on the bottom container of a sixteen-foot stack of like containers weighing 33 pounds. The test was performed for 24 hours. After the allowed time, the weight was removed and the container examined. Any leakage, deterioration, or distortion which could adversely affect transport or reduce its strength or cause instability in stacks of packages is cause for rejection.

3. Base Level Vibration Test

This test was performed in accordance with Title 49 CFR, Part 178, Subpart M, Sec. 178.608. Three sample containers were loaded with steel weights and closed as for shipment. Each container was placed on a vibrating platform that had a vertical double-amplitude (peak-to-peak displacement) of one inch. The packages were constrained horizontally to prevent them from falling off the platform, but were free to move vertically,

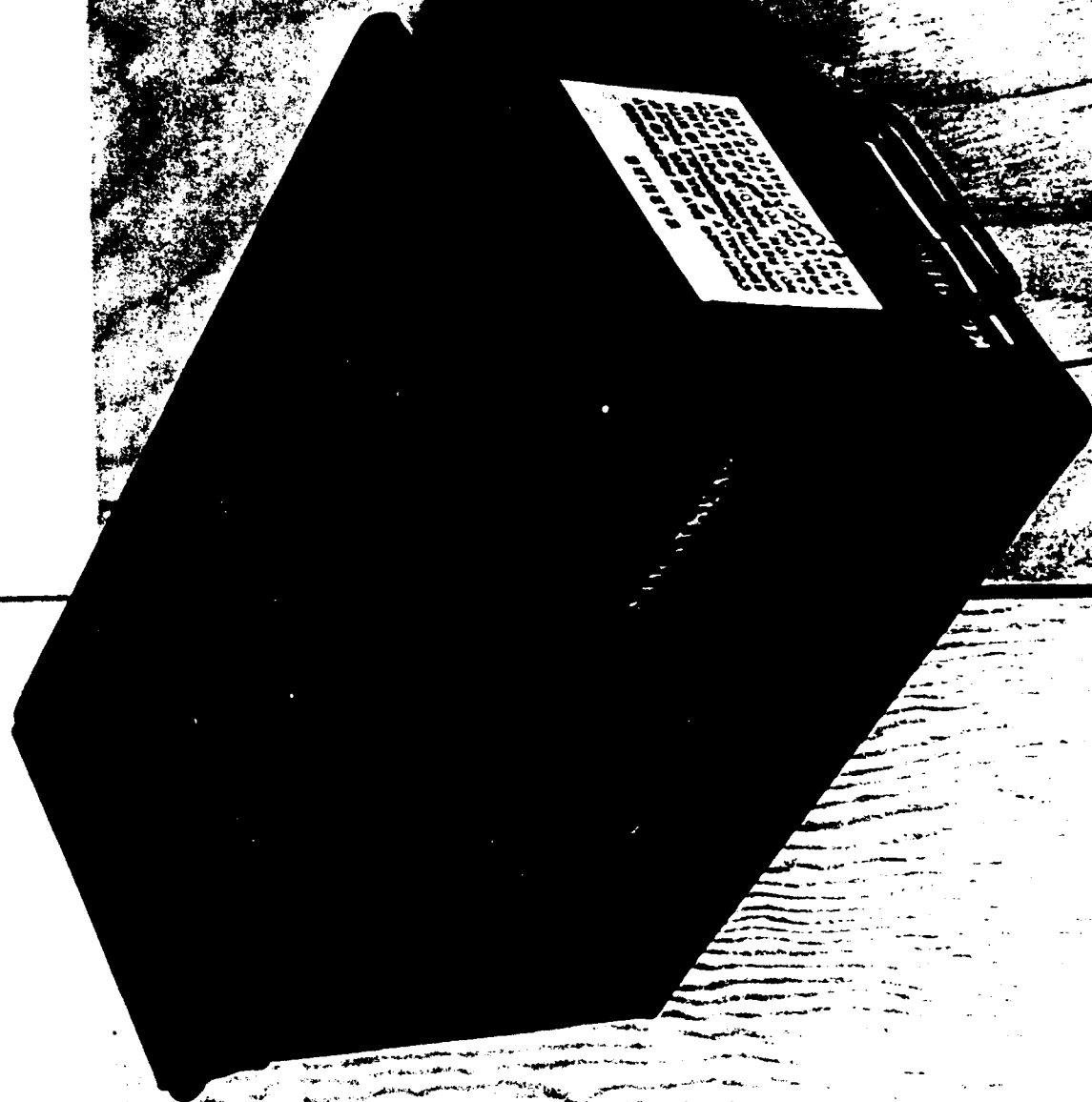


Figure 1. M2A1 Ammunition Box.

bounce and rotate. The test was performed for one hour at a frequency that caused each point of the container bottom to be raised from the platform 1.6 mm. A 1.6 mm thick metal strip was passed between the bottom of the container and the platform.

PASS/FAIL

1. Drop Test

The criteria for passing the drop test is outlined in Title 49 CFR, Part 178, Subpart M, Sec. 178.603(f): A package is considered to successfully pass the drop test if for each sample tested, no rupture occurs which would permit spillage of loose explosive substances or articles from the outer packaging.

2. Stacking Test

The criteria for passing the stacking test is outlined in Title 49 CFR, Part 178, Subpart M, Sec. 178.606: No test sample may show any deterioration which could adversely affect transportation safety or any distortion likely to reduce its strength, cause instability in stacks of packages, or cause damage to inner packagings likely to reduce safety in transportation.

3. Base Level Vibration Test

The criteria for passing the Base Level Vibration Test is outlined Title 49 CFR, Part 178, Subpart M, Sec. 178.608: Immediately following the period of vibration, each package must be removed from the platform, turned on its side and observed for any evidence of leakage. A packaging passes the vibration test if there is no rupture or leakage from any of the packages. No test sample should show any deterioration which could adversely affect transportation safety or any distortion liable to reduce packaging strength.

TEST RESULTS

1. Drop Test

Satisfactory.

2. Stacking Test

Satisfactory.

3. Base Level Vibration Test

Satisfactory.

DISCUSSION

1. Drop Test

After each drop the container was inspected for any damage which would be cause for rejection. The container was only slightly dented and scratched during the tests, and there was no spillage of contents.

2. Stacking Test

Three containers were individually tested. Each container was visibly inspected after the 24-hour period was over. There was no leakage, distortion, or deterioration to the container as a result of this test.

3. Base Level Vibration Test

Immediately following the vibration test, each container was removed from the 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.

REFERENCE MATERIAL

Code of Federal Regulations Title 49 CFR, Parts 107-178.

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DATA SHEET

CONTAINER:	POP MARKING:
M2A1 Ammunition Box	u n 4A1/Y15/S/** USA/DOD/NAD
Type: 4A1	UN Code: See Table
Specification Number: Drawing 19200-7553296	Material: Steel
Gross Weight: 15 kg (33.0 pounds)	Dimensions: .30m L x .15m W x .19m H (12.00" L x 6.09" W x 7.50" H)
Closure (Method/type): One latch	Tare Weight: 2.4 kg (5.2 pounds)
Additional Description:	

PACKAGED COMMODITY: See Table I	

Proper Shipping Name: See Table II	
United Nations Number: See Table I	
United Nations Packing Group: II	
Physical State: Solid	
Amount Per Container: See Table I	
Net Weight: Varies	

PACKAGED COMMODITY USED FOR TEST: Name: Steel rods Physical State: Solid	

Size : .11m L x .02m Dia (4.50" L x 1.00" Dia)	
Quantity : 27	
Net Weight: 12.6 kg (27.8 pounds)	

Dunnage: Polyethylene foam	

TABLE I

DODIC OR NALC	NSN	ITEM	PACKING DRAWING	HAZ. CL.	UN NO.	# CNTR.	PER CNTR.	GROSS WT. (KG)
	2W89	1370-01-239-9544	MJU-8A/B FLARE	2816235	1.3G	0093	21	9.0
	3W92	1370-01-251-5792	MK137-0 SIGNAL	6537416	1.4G	0312	12	4.5
*	DWAU	1375-01-379-6323	MK26-0 DELAY EL.	6859880			10	
*	DWAV	1375-01-380-7324	MK27-0 DELAY EL.	6859880			10	
*	DWAW	1375-01-380-7320	MK28-0 DELAY EL.	6859880			10	
*	DWAX	1375-01-380-7323	MK29-0 DELAY EL.	6859880			10	
*	DWAY	1375-01-380-9633	MK30-0 DELAY EL.	6859880			10	
*	DWAZ	1375-01-380-7321	MK31-0 DELAY EL.	6859880			10	
*	DWBA	1375-01-379-6324	MK32-0 DELAY EL.	6859880			10	
	LW60	1370-01-032-7028	MK46-1C FLARE	2816235	1.3G	0093	21	9.0
	LW62	1370-01-041-2629	MJU-8/B FLARE	2816235	1.3G	0093	21	9.0
	L161	1370-01-252-0318	MK131-0 SIGNAL	6263403			10	6.3
	L273	1370-01-177-4072	MK99-3 SIGNAL	6118534	1.4G	0191	5	6.0
*	L332	1370-00-804-4468	MK122-0 SIGNAL	2127795	1.4G	0312	1250	12.4
	L451	1370-01-252-0317	MK132-0 SIGNAL	6263400			10	6.1
*	M020	1375-00-781-9066	MK45-0 DEMO CHG.	2113327	1.1D	0048	12	5.2
*	M174	1377-00-512-2886	IMPULSE CRTRG.	2193708	1.4C	0276	77	9.3
	M862	1377-00-806-4886	S-75 SQUIB	2128480	1.4S	0454	500	4.0
	M997	1375-01-068-3984	MK88-0 CHARGE	5206228	1.4D	0410	5	8.5
*	ML04	1375-01-037-5428	MK23-0 CUTTER	5012952	1.1D	0048	6	4.2
*	ML05	1375-01-037-5429	MK24-0 CUTTER	5012939	1.1D	0048	2	4.2
*	MM30	1375-01-281-8696	MK140-0 BOOSTER	6545553	1.1D	0048	240	7.7
	MW86	1375-01-020-8907	MK48-0 FIR. DEV.	3192610	1.4S	0367	2	4.9
	N250	1390-00-451-8695	MK342-1 FUZE	2513109	1.4S	0349	8	8.2
	N259	1390-00-563-7712	MK393-0 FUZE	2513109	1.2(04)D	0409	8	8.2
	N457	1390-01-146-7620	MK417-0 FUZE	2513109	1.2(04)D	0409	8	10.4
	N458	1390-00-488-1010	MK404-0 FUZE	2513109	1.2(04)D	0409	8	10.4
*	N458	1390-00-488-3993	MK404-0 FUZE	2513109			8	10.4
	N618	1390-01-043-1683	MK407-1 FUZE	2513109	1.2(04)D	0409	8	10.4
	N670	1390-01-178-8609	MK418-0 FUZE	2513109	1.2(04)D	0409	8	10.0
*	XW64	1375-01-081-2758	MK2-0 TORCH	5206374	1.4G	0325	1	12.0
*			MK48-2 FIR. DEV.	5619746	1.4B	0365	3	4.4
*			MK51-1 FIR. DEV.	5918542	1.4B	0257	12	3.2

* DENOTES ITEMS ADDED IN REVISION A

TABLE II

UN SERIAL NUMBER	PROPER SHIPPING NAME
0048	CHARGES, DEMOLITION
0093	FLARES, AERIAL
0191	SIGNAL DEVICES, HAND
0257	FUZES, DETONATING
0276	CARTRIDGES, POWER DEVICE
0312	CARTRIDGES, SIGNAL
0325	IGNITERS
0349	ARTICLES, EXPLOSIVE, N.O.S.
0365	DETONATORS FOR AMMUNITION
0367	FUZES, DETONATING
0409	FUZES, DETONATING
0410	FUZES, DETONATING
0454	IGNITERS