

**FINAL REPORT  
August 2006**

**REPORT NO. 06-19**



**FIRST ARTICLE TESTS FOR THE 40"x 48" RECYCLED PLASTIC PALLET WITH  
CARTRIDGE, 20MM WITH 24 M548 METAL BOXES, MANUFACTURED BY  
ROTATIONAL MOLDING FROM BRIGHAM CITY, UTAH, IN ACCORDANCE WITH  
MIL-STD-1660,  
"DESIGN CRITERIA FOR AMMUNITION UNIT LOADS"**

Prepared for:

Distribution Unlimited

Program Manager-506<sup>th</sup> Combat Sustainment Squadron (CBSS)  
6033 Elm Lane  
Hill AFB, UT 84056



**DEFENSE AMMUNITION CENTER  
VALIDATION ENGINEERING DIVISION  
MCALESTER, OKLAHOMA 74501-9053**

**DISTRIBUTION STATEMENT A  
Approved for Public Release  
Distribution Unlimited**

## **AVAILABILITY NOTICE**

A copy of this report will be furnished each attendee on automatic distribution. Additional copies or authority for reprinting may be obtained by written request from:

Director  
U.S. Army Defense Ammunition Center  
ATTN: SJMAC-DEV  
1 C Tree Road, Bldg. 35  
McAlester, OK 74501-9053

## **DISTRIBUTION INSTRUCTIONS**

Destroy this report when no longer needed. Do not return.

\*\*\*

Citation of trade names in this report does not constitute an official endorsement.

\*\*\*

The information contained herein will not be used for advertising purposes.

REPORT NO. 06-19

August 2006

**FIRST ARTICLE TESTING FOR 40"x48" RECYCLED  
PLASTIC PALLET WITH CARTRIDGES, 20MM WITH 24 M548  
METAL BOXES, MANUFACTURED BY ROTATIONAL MOLDING FROM  
BRIGHAM CITY, UTAH, IN ACCORDANCE WITH MIL-STD-1660,  
"DESIGN CRITERIA FOR AMMUNITION UNIT LOADS"**

**ABSTRACT**

The U.S. Army Defense Ammunition Center (DAC), Validation Engineering Division (SJMAC-DEV) conducted First Article Tests for the 40"x48" Recycled Plastic Pallets with Cartridges, 20MM with 24 M548 metal boxes, manufactured by Rotational Molding from Brigham City, Utah, in accordance with MIL-STD-1660, "Design Criteria for Ammunition Unit Loads". Three test units were tested with a load of 4,030 lbs each. The tests that were to be accomplished on the test units were the stacking, repetitive shock, drop, incline impact, forklift handling, and disassembly tests.

Test Units #1 and #2 were tested in accordance with MIL-STD-1660 at ambient temperature, both test units failed during the first orientation of the repetitive shock test. The recycled plastic material could not withstand the heat generated by the friction created during the repetitive shock tests. The pallet posts were weakened from the heat and collapsed under the weight of the test load. Also, plastic deformation of the skids occurred as a result of the repetitive impacting of the skids to the vibration table. Test Unit #3 was drop tested, incline impacted, forklift hazard course tested, and disassembled for engineering evaluation purposes only. Test Unit #3 minimally passed the evaluation testing which excluded the stacking and repetitive shock tests. The pallet posts showed signs of failure from the weight of the test load. It should also be noted that the current pallet design is not a winged pallet.

The current design of the 40" x 48" Recycled Plastic Pallet manufactured by Rotational Molding from Brigham City, Utah, does not meet the requirements of MIL-STD-1660, and is not recommended for the unitization of ammunition loads.

Prepared by:



JEFFERY L. DUGAN  
Validation Engineer

Reviewed by:



JERRY W. BEAVER  
Chief, Validation Engineering Division

**U.S. ARMY DEFENSE AMMUNITION CENTER  
VALIDATION ENGINEERING DIVISION  
MCALESTER, OK 74501-9053**

**REPORT NO. 06-19**

**FIRST ARTICLE TESTING FOR 40"x48" RECYCLED  
PLASTIC PALLET WITH CARTRIDGES, 20MM WITH 24 M548  
METAL BOXES, MANUFACTURED BY ROTATIONAL MOLDING FROM  
BRIGHAM CITY, UTAH, IN ACCORDANCE WITH MIL-STD-1660,  
"DESIGN CRITERIA FOR AMMUNITION UNIT LOADS"**

**TABLE OF CONTENTS**

<b>PART</b>	<b>PAGE NO.</b>
1. INTRODUCTION .....	1-1
A. BACKGROUND .....	1-1
B. AUTHORITY .....	1-1
C. OBJECTIVE .....	1-1
D. CONCLUSION .....	1-1
2. ATTENDEES .....	2-1
3. TEST PROCEDURES.....	3-1
4. TEST EQUIPMENT .....	4-1
5. TEST RESULTS .....	5-1
6. DRAWINGS .....	6-1



## **PART 1 – INTRODUCTION**

**A. BACKGROUND.** The U.S. Army Defense Ammunition Center (DAC), Validation Engineering Division (SJMACE-DEV) conducted First Article Tests for the 40"x48" Recycled Plastic Pallets with cartridges, 20MM with 24 M548 metal boxes, Manufactured by Rotational Molding from Brigham City, Utah, in accordance with MIL-STD-1660, "Design Criteria for Ammunition Unit Loads". Three test units were tested with a load of 4,030 lbs each. The tests that were to be accomplished on the test units were the stacking, repetitive shock, drop, incline impact, forklift handling, and disassembly tests. The unitization procedures were provided by DAC, Transportation Engineering Division (SJMACE-DET).

**B. AUTHORITY.** This test was conducted IAW mission responsibilities delegated by the U.S. Army Joint Munitions Command (JMC), Rock Island, IL. Reference is made to the following:

1. AR 740-1, 15 June 2001, Storage and Supply Activity Operation
2. OSC-R, 10-23, Mission and Major Functions of U.S. Army Defense Ammunition Center (DAC) 21 Nov 2000.

**C. OBJECTIVE.** The objective of the tests was to determine if the Recycled Plastic Pallet could meet the MIL-STD-1660 test requirements prior to the acceptance of the unitization procedures by the U.S. Army.

**D. CONCLUSION.** Test Units #1 and #2 were tested in accordance with MIL-STD-1660 at ambient temperature, both test units failed during the first orientation of the repetitive shock test. The recycled plastic material could not withstand the heat generated by the friction created during the repetitive shock tests. The pallet posts were weakened from the heat and collapsed under the weight of the test load. Also, plastic deformation of the skids occurred as a result

of the repetitive impacting of the skids to the vibration table. Test Unit #3 was drop tested, incline impacted, forklift hazard course tested, and disassembled for engineering evaluation purposes only. Test Unit #3 minimally passed the evaluation testing which excluded the stacking and repetitive shock tests. The pallet posts showed signs of failure from the weight of the test load. It should also be noted that the current pallet design is not a winged pallet.

The current design of the 40" x 48" Recycled Plastic Pallet manufactured by Rotational Molding from Brigham City, Utah, does not meet the requirements of Mil-Std-1660, and is not recommended for the unitization of ammunition loads.

## **PART 2 - ATTENDEES**

### **DATE PERFORMED:**

Test Unit #1- June 21, 2006

Test Unit #2- June 21-22, 2006

Test Unit #3- June 22, 2006

### **ATTENDEE**

### **MAILING ADDRESS**

Jeff L. Dugan  
General Engineer  
DSN 956-8090  
(918) 420-8090

Director  
U.S. Army Defense Ammunition Center  
ATTN: SJMAC-DEV  
1 C Tree Road, Bldg. 35  
McAlester, OK 74501-9053

Cynthia Warr  
Program Manager  
DSN 775-4767

Program Manager  
506<sup>th</sup> Combat Sustainment Squadron  
6033 Elm Lane  
Hill AFB, UT 84056

Nick Trina  
Equipment Specialist  
DSN 777-9580

Program Manager  
506<sup>th</sup> Combat Sustainment Squadron  
6033 Elm Lane  
Hill AFB, UT 84056

Rechelle McClure  
Engineer  
DSN 775-6089

Program Manager  
506<sup>th</sup> Combat Sustainment Squadron  
6033 Elm Lane  
Hill AFB, UT 84056

Steve Marrufo  
TSgt USAF  
DSN 777-7743

NCOIC, AFloat Preposition Fleet  
505<sup>th</sup> Combat Sustainment Squadron  
6043 Elm Lane  
Hill AFB, UT 84056

Brian Brough  
Engineer

Rotational Molding of Utah  
1755 N. 2000 W.  
Brigham City, UT 84302

## **PART 3 - TEST PROCEDURES**

### **1. MIL-STD-1660 TEST.**

The test procedures outlined in this section from were extracted from the MIL-STD-1660. The tests are conducted on ammunition pallet units or unit loads and are summarized as follows:

**A. STACKING TEST.** The test unit will be tested to simulate a stack of identical items stacked 16 feet high, for a period of one hour. This stacking load will be simulated by subjecting the specimen to a compression weight equal to an equivalent 16-foot stacking height. Photo 1 below shows an example of a unit load in the compression tester.



**Photo 1. Example of Stacking Test.**

**(2.75-inch Hydra 70, PA151 Rocket Pallet in the Stacking Test.)**

**B. REPETITIVE SHOCK TEST.** The repetitive shock test is conducted IAW Method 5019, Federal Standard 101. The test procedure is as follows: The test unit will be placed on (not fastened to) the platform. With the test unit in one

position, the platform will be vibrated at ½-inch amplitude (1-inch double amplitude) starting at a frequency of approximately 3 cycles-per-second. The frequency will be steadily increased until the specimen leaves the platform. The resonant frequency is achieved when a 1/16-inch-thick feeler gage momentarily slides freely between every point on the specimen in contact with the platform at some instance during the cycle. Midway into the testing period, the specimen will be rotated 90 degrees, and the test continued for the duration. Unless failure occurs, the total time of vibration will be three hours. Photo 2 shows an example of the repetitive shock test.



**Photo 2. Example of the Repetitive Shock Test.  
(MSTF Low)**

**C. EDGEWISE-ROTATIONAL DROP TEST.** This test is conducted using the procedures of Method 5008, Federal Standard 101. The procedure for the edgewise-rotational drop test is as follows: The test unit will be placed on its skids with one end of the pallet supported on a beam 6 inches high. The height of the beam will be increased as necessary to ensure that there is no support for the skids between the ends of the specimen when the dropping takes place, but should not be high enough to cause the specimen to slide on the supports when the dropped end is raised for the drop. The unsupported end of the specimen is



then raised and allowed to fall freely to the concrete, pavement, or similar unyielding surface from a prescribed height. Unless otherwise specified, the height of drop for level A protection will conform to the following tabulation:

GROSS WEIGHT (WITHIN RANGE LIMITS) (Pounds)	DIMENSIONS OF ANY EDGE, HEIGHT OR WIDTH (WITHIN RANGE LIMITS) (Inches)	HEIGHT OF DROPS ON EDGES	
		Level A (Inches)	Level B (Inches)
150-250	60-66	36	27
250-400	66-72	32	24
400-600	72-80	28	21
600-1,000	80-95	24	18
1,000-1,500	95-114	20	16
1,500-2,000	114-144	17	14
2,000-3,000	Above 145- No limited	15	12
Above – 3,000		12	9

Figure 1.



Photo 3. Example of Edgewise-Rotational Drop Test  
(MSTF Low)



**D. INCLINE-IMPACT TEST.** This test is conducted by using the procedure of Method 5023, Incline-Impact Test of Federal Standard 101. The procedure for the incline-impact test is as follows: The test unit will be placed on the carriage with the surface or edge to be impacted projecting at least 2 inches beyond the front end of the carriage. The carriage will be brought to a predetermined position on the incline and released. If it were desired to concentrate the impact on any particular position on the container, a 4- x 4-inch timber may be attached to the bumper in the desired position before the test. The carriage will not strike any part of the timber. The position of the specimen on the carriage and the sequence in which surfaces and edges are subjected to impacts may be at the option of the testing activity and dependent upon the objective of the test. When the test is to determine satisfactory requirements for a container or pack, and, unless otherwise specified, the specimen will be subjected to one impact on each surface that has each dimension less than 9.5 feet. Unless otherwise specified, the velocity at the time of the impact will be 7 feet-per-second. Photo 4 shows an example of this test.



**Photo 4. Example of the Incline-Impact Test.  
(2.75-Inch, Hydra 70, PA151 Rocket Pallet on incline-impact tester.)**

**E. SLING COMPATIBILITY TEST.** The test unit utilizing special design or non-standard pallets will be lifted, swung, lowered and otherwise handled as necessary, using slings of the types normally used for handling the unit loads under consideration. Slings will be easily attached and removed. Danger of slippage or disengagement when load is suspended will be cause for rejection of the specimen.

**F. FORKLIFTING TESTS.** The test unit will be lifted clear of the ground by a forklift from the end of the test unit and transported on the forks in the level or back-tilt position. The forklift will pass over the Optional Rough Handling Course For Forklift Trucks as outlined in MIL-STD-1660. The course will consist of parallel pairs of 1-inch boards spaced 54 inches apart and will be laid flat wise on the pavement across the path of the forklift. One pair will be laid at an angle of approximately 60 degrees to the path so that the left wheel strikes first. Another pair will be laid securely across the path of the forklift so that the wheels strike simultaneously. Another pair will be laid at an angle of approximately 75 degrees to the path so that the right wheel strikes first. The test unit will be transported over the Optional Rough Handling Course. The test unit shall be observed for deflection and damage. The test unit will be rotated 90 degrees and the test unit lifted from the side and the above steps repeated.

**G. DISASSEMBLY TEST.** Following all rough handling tests the test unit may be squared up within 2 inches of its original shape and on a flat level surface. The strapping will then be cut and removed from the palletized load. Assembly of the test unit will be such that it retains its unity upon removal of the strapping.

## **PART 4 - TEST EQUIPMENT**

### **A. COMPRESSION TESTER.**

- |                       |                      |
|-----------------------|----------------------|
| 1. Manufacturer:      | Ormond Manufacturing |
| 2. Platform:          | 60- x 60-inches      |
| 3. Compression Limit: | 50,000 pounds        |
| 4. Tension Limit:     | 50,000 pounds        |

### **B. TRANSPORTATION SIMULATOR.**

- |                  |                     |
|------------------|---------------------|
| 1. Manufacturer: | Gaynes Laboratory   |
| 2. Capacity:     | 6,000-pound payload |
| 3. Displacement: | 1/2-inch amplitude  |
| 4. Speed:        | 50 to 400 RPM       |
| 5. Platform:     | 5- x 8-foot         |

### **C. INCLINED PLANE.**

- |                  |                    |
|------------------|--------------------|
| 1. Manufacturer: | Conbur Incline     |
| 2. Type:         | Impact Tester      |
| 3. Grade:        | 10 percent incline |
| 4. Length:       | 12-foot            |

## **PART 5 - TEST RESULTS**

**5.1. TEST UNIT DATA.** The test units were inertly loaded to the specified design weight using inert materials. The test units were prepared using the unitization procedures specified in Part 6 – Drawings. Special care was taken to ensure that each M548 Metal Box had the proper amount of weight in order to achieve a realistic pallet center of gravity (CG). Once properly prepared, Test Units #1 and #2 were tested using MIL-STD-1660 requirements. Test Unit #3 was tested to MIL-STD-1660 testing excluding stacking and repetitive shock tests for engineering evaluation purposes only.

### **TEST UNIT #1**

40" x 48" Recycled Plastic Pallet with 24 each M548 metal boxes loaded with 160 lbs each of inert material

Test Date: 21 June 2006 (MIL-STD-1660)

Gross Weight: 4,030 pounds

Length: 49 3/4 inches

Width: 40 1/4 inches

Height: 35 inches

Mfgr: Rotational Molding of Utah

### **TEST UNIT #2**

40" x 48" Recycled Plastic Pallet with 24 each M548 metal boxes loaded with 160 lbs each of inert material

Test Date: 21-22 June 2006 (MIL-STD-1660)

Gross Weight: 4,030 pounds

Length: 49 3/4 inches

Width: 40 1/4 inches

Height: 35 inches

Mfgr: Rotational Molding of Utah

### TEST UNIT #3

40" x 48" Recycled Plastic Pallet with 24 each M548 metal boxes loaded with 160 lbs each of inert material

Test Date: 22 June 2006 (MIL-STD-1660)

Gross Weight: 4,030 pounds

Length: 49 3/4 inches

Width: 40 1/4 inches

Height: 35 inches

Mfgr: Rotational Molding of Utah

#### A. MIL-STD-1660 TEST RESULTS TEST UNIT #1:

1. **STACKING TEST.** The test unit was compressed with a load force of **16,120** pounds for 60 minutes on 21 June 2006. No damage was noted as a result of this test. Photo 5 shows the test unit in the compression unit.



Photo 5. Test Unit in the Stacking Test.



**2. REPETITIVE SHOCK TEST.** Test Unit #1 was vibrated 90 minutes at 228 RPM in the longitudinal orientation on 21 June 2006. Test Unit #1 failed during the first orientation of the repetitive shock test. The recycled plastic material could not withstand the heat generated by the friction created during the repetitive shock tests. The pallet posts and bottom adapters were weakened from the heat and collapsed under the weight of the test load, see Photo 6. Also, plastic deformation of the skids occurred as a result of the repetitive impacting of the skids to the vibration table, see Photo 7. Photo 8 shows the test unit on the vibration platform. Test Unit #1 failed and testing was stopped on this test unit.



**Photo 6. Collapse of Pallet During Repetitive Shock Testing.**





**Photo 7. Melted Skid During Repetitive Shock Testing.**

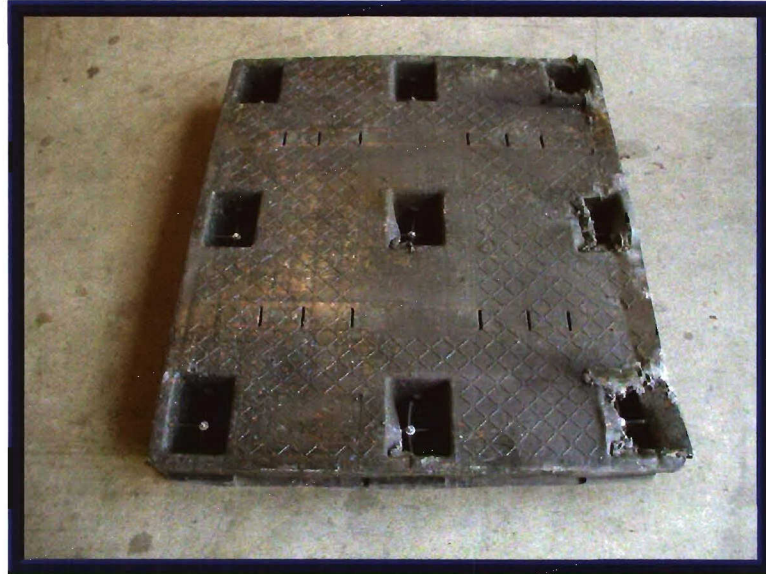


**Photo 8. Test Setup for Repetitive Shock Testing.**

**3. EDGEWISE ROTATIONAL DROP TEST. N/A**

**4. INCLINE-IMPACT TEST. N/A**

5. SLING COMPATIBILITY TEST. N/A.
6. FORKLIFTING TEST. N/A.
7. DISASSEMBLY TEST. See Photos 9 and 10 for additional damage discovered during disassembly.



**Photo 9. Additional Damage Noted after Disassembly.**



**Photo 10. Additional Damage Noted after Disassembly.**

8. **CONCLUSION.** Test Unit #1 failed and testing was stopped on this test unit during the first orientation of the repetitive shock testing.

**B. MIL-STD-1660 TEST RESULTS TEST UNIT#2:**

1. **STACKING TEST.** The test unit was compressed with a load force of 16,120 pounds for 60 minutes on 21 June 2006. No damage was noted as a result of this test.

2. **REPETITIVE SHOCK TEST.** The test unit was vibrated 90 minutes at 228 RPM in the longitudinal orientation on 22 June 2006. Test Unit #2 failed during the first orientation of the repetitive shock test. The damage noted was identical to the damage sustained to test unit #1 during the repetitive shock testing.

3. **EDGEWISE-ROTATIONAL DROP TEST.** N/A.

4. **INCLINE-IMPACT TEST.** N/A.

5. **SLING COMPATIBILITY TEST.** N/A.

6. **FORKLIFTING TEST.** N/A.

7. **DISASSEMBLY TEST.** Damage was identical to damage sustained during testing of Test Unit #1.

8. **CONCLUSION.** Test Unit #2 failed and testing was discontinued on this test unit during the first orientation of the repetitive shock testing. The current design of the 40" x 48" Recycled Plastic Pallet manufactured by Rotational



Molding from Brigham City, Utah, does not meet the requirements of Mil-Std-1660, and is not recommended for the unitization of ammunition loads.

**C. MIL-STD-1660 TEST RESULTS TEST UNIT#3:**

Note – Test Unit #3 was drop tested, incline impacted and taken over the forklift hazard course for engineering evaluation purposes only. The recycled plastic pallet had already failed the MIL-STD-1660 First Article Test.

**1. STACKING TEST.** N/A.

**2. REPETITIVE SHOCK TEST.** N/A.

**3. EDGEWISE-ROTATIONAL DROP TEST.** The test unit was edgewise rotationally dropped from a height of 12 inches on both longitudinal sides and both lateral sides. The pallet posts showed signs of failure from the impact of the drops. See photo11 for test setup.



**Photo 11. Test Setup for Edgewise Drop Tests.**

4. **INCLINE-IMPACT TEST.** The test unit was impact tested on both longitudinal sides and both lateral sides. No significant damage was noted as a result of this test. See Photo 12 for test setup.



**Photo 12. Test Setup for Incline Impact Tests.**

5. **SLING COMPATIBILITY TEST.** N/A.

6. **FORKLIFTING TEST.** The test unit was lifted clear of the ground by a forklift from both longitudinal sides and both lateral sides and transported on the Optional Rough Handling Course For Forklift Trucks. The test unit was carried over the course three times in the longitudinal and lateral orientations. No damage was noted as a result of this test.

7. **DISASSEMBLY TEST.** Inspection revealed no additional damage.

8. **CONCLUSION.** Test Unit #3 showed signs of failure in the pallet posts during the drop tests from the weight of the pallet. No further damage was noted during the incline impact or forklift hazard course tests.

## **PART 6- DRAWINGS**

The following test sketches represent the load configuration that was subjected to the test criteria.



# APPENDIX 15C

## UNITIZATION PROCEDURES FOR BOXED AMMUNITION AND COMPONENTS ON 4-WAY ENTRY PALLETS

CARTRIDGE, 20MM, PACKED VARIOUS QUANTITIES  
PER M548 METAL BOX, UNITIZED 24 BOXES PER  
40" X 48" PALLET; APPROX BOX SIZE 18-19/32" L  
X 8-19/64" W X 14-19/32" H

NOTICE: THIS APPENDIX CANNOT STAND ALONE BUT MUST BE USED IN CONJUNCTION WITH  
THE BASIC UNITIZATION PROCEDURES DRAWING 19-48-4116-20PA1002.

THIS APPENDIX SUPERSEDES THE TWO-LAYER UNITIZATION PROCEDURES OF INTERIM DRAWING  
19-48-4141-20PA1003, DATED FEBRUARY 1977.

DISTRIBUTION STATEMENT A.

APPROVED FOR PUBLIC RELEASE:  
DISTRIBUTION IS UNLIMITED.

U.S. ARMY MATERIEL COMMAND DRAWING			
APPROVED, U.S. ARMY INDUSTRIAL OPERATIONS COMMAND <i>David E. Ashworth</i> AMSTA-AR-ESK      AMSIO-TMJ	DRAFTSMAN ENGINEER BETTY J. KUNDERT SANDRA M. SCHULTZ		
APPROVED BY ORDER OF COMMANDING GENERAL, U.S. ARMY MATERIEL COMMAND <i>Larry V. Dulleger</i> U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL	SUPPLY ENGINEERING DIVISION <i>T. J. Nichols</i> TRANSPORTATION ENGINEERING DIVISION <i>W. J. Jurek</i> VALIDATION ENGINEERING DIVISION <i>D. H. Keenan</i> LOGISTICS ENGINEERING OFFICE <i>William J. Ernst</i>	JUNE 1981	
REVISION NO. 5      SEPTEMBER 1996 SEE THE REVISION LISTING ON PAGE 2	CLASS 19	DIVISION 48	DRAWING 4116/ 15C
			FILE 20PA 1002

DO NOT SCALE

PALLET UNIT DATA				
ITEMS INCLUDED		HAZARD CLASS AND DIVISION		APPROX WEIGHT LBS
NSN	DODIC	OD CLASS	COMP GROUP	
1305-				
00-522-3700	A651	1.4	C	3,647
00-785-2829	A651	1.4	C	3,647
01-118-9930	A651	1.4	C	4,000 *
00-935-6171	A659	(04)1.2	E	3,983
01-118-9929	A659	(04)1.2	E	4,000 *
00-926-9278	A791	(04)1.2	E	3,983
00-143-7050	A813	(04)1.2	G	3,983
00-143-7049	A814	(04)1.2	G	2,782
00-180-9271	A834	(04)1.2	E	2,782
00-143-7176	A835	(04)1.2	E	2,782
00-143-7167	A846	(04)1.2	G	2,782
00-143-7168	A846	(04)1.2	G	2,782
00-935-9104	A890	(04)1.2	E	3,983
01-116-3931	A890	(04)1.2	E	4,000 *
01-118-9928	A890	(04)1.2	E	4,000 *
00-752-8114	A891	1.4	C	3,599
01-116-4560	A891	1.4	C	4,000 *
00-935-2019	A892	1.4	C	3,743
01-116-3930	A892	1.4	C	4,000 *
00-799-8669	A924	---	-	3,983
01-116-3923	A924	---	-	4,000 *

● HAZARD CLASSIFICATION DATA CONTAINED IN THE ABOVE CHART IS FOR GUIDANCE AND INFORMATIONAL PURPOSES ONLY. VERIFICATION OF THE SPECIFIED DATA SHOULD BE MADE BY CONSULTING THE MOST RECENT JOINT HAZARD CLASSIFICATION SYSTEM LISTING OR OTHER APPROVED LISTING(S).

\* SEE GENERAL NOTE "K" ON PAGE 3.

#### REVISIONS

REVISION NO. 1, DATED NOVEMBER 1981, CONSISTS OF:

1. ADDING NATIONAL STOCK NUMBER TO THE "PALLET UNIT DATA" CHART.
2. REDESIGNING "FILLER ASSEMBLY".

REVISION NO. 2, DATED NOVEMBER 1982, CONSISTS OF:

1. ADDING NOTE "J" TO GENERAL NOTES SECTION ON PAGE 3.

REVISION NO. 3, DATED DECEMBER 1983, CONSISTS OF:

1. CHANGING BOX DIMENSIONS.

REVISION NO. 4, DATED AUGUST 1994, CONSISTS OF:

1. CHANGING WEIGHT OF NATIONAL STOCK NUMBERS ON THE "PALLET UNIT DATA" CHART.
2. ADDING NATIONAL STOCK NUMBER TO "PALLET UNIT DATA" CHART.

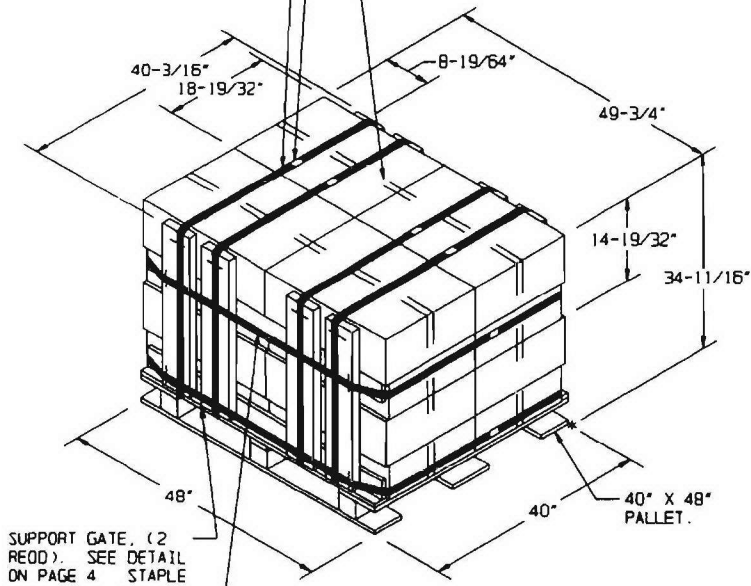
REVISION NO. 5, DATED SEPTEMBER 1996, CONSISTS OF:

1. CHANGING THE LOAD STRAP CALLOUT ON PAGE 3.
2. DELETING GENERAL NOTE RELATING TO STRAP CUTTER AND RE-LETTERING OTHER GENERAL NOTES.

TIEDOWN STRAP, 1-1/4" X .035" OR .031" X 12'-8" LONG STEEL STRAPPING (4 REOD). SEE GENERAL NOTE "D" AT RIGHT

SEAL FOR 1-1/4" STRAPPING (6 REOD, 1 PER STRAP). CRIMP EACH SEAL WITH TWO PAIR OF NOTCHES.

LOAD STRAP, (ALTERNATE FOR HORIZONTAL STRAP), 1-1/4" X .035" OR .031" X 14'-2" LONG STEEL STRAPPING (2 REOD). EACH LOAD STRAP MAY BE THREADED THRU THE PALLET STRAP SLOT OR PRE-POSITIONED ON THE PALLET DECK PRIOR TO PLACING BOXES ON THE PALLET.



SUPPORT GATE, (2 REOD). SEE DETAIL ON PAGE 4. STAPLE HORIZONTAL AND TIEDOWN STRAPS TO SUPPORT GATE AS SHOWN.

HORIZONTAL STRAP, 1-1/4" X .035" OR .031" X 16'-0" LONG STEEL STRAPPING (2 REOD). SEE GENERAL NOTE "C" AT RIGHT.

**PALLET UNIT**

SEE GENERAL NOTE "B" AT RIGHT.

24 BOXES OF 20MM CARTRIDGE (100 PER BOX) AT 160 LBS - - - 3,840 LBS (APPROX)  
 DUNNAGE - - - - - 63 LBS  
 PALLET - - - - - 80 LBS

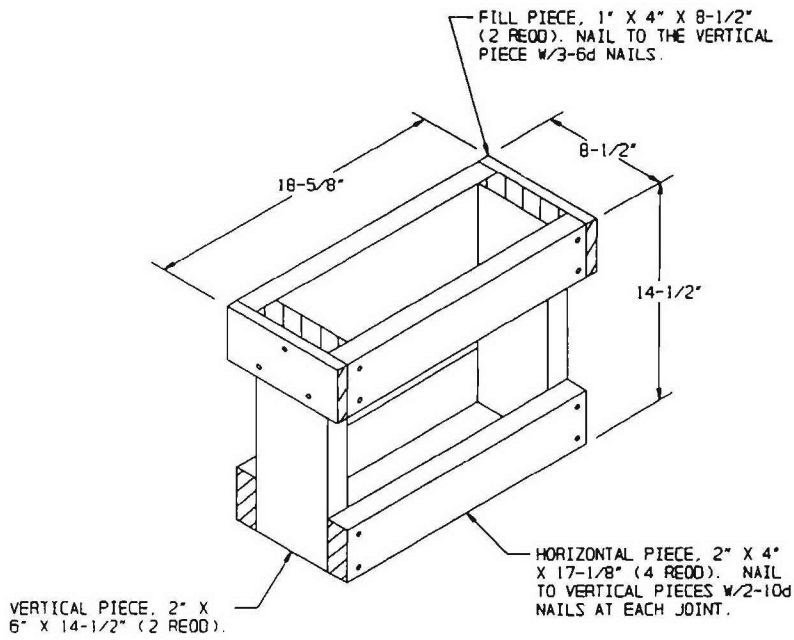
TOTAL WEIGHT - - - - - 3,983 LBS (APPROX)  
 CUBE - - - - - 40.2 CU FT (APPROX)

**BILL OF MATERIAL**

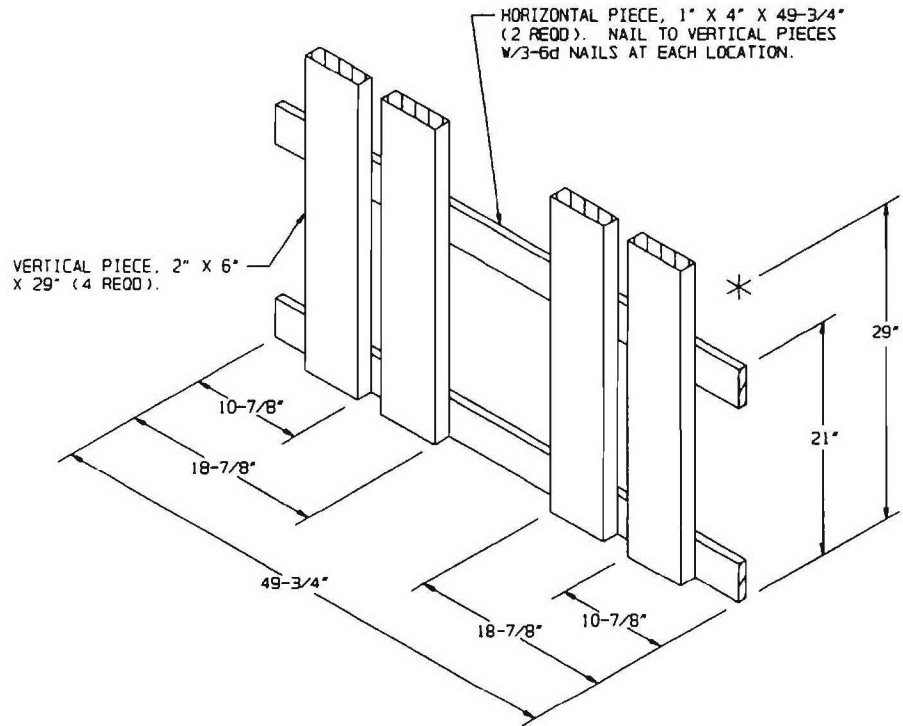
LUMBER	LINEAR FEET	BOARD FEET
1" X 4"	16.58	5.53
2" X 6"	19.33	19.33
NAILS	NO. REOD	POUNDS
6d(2")	48	0.28
PALLET, 40" X 48"	1 REOD	80 LBS
STEEL STRAPPING, 3/4"	82.67' REOD	12.53 LBS
SEAL FOR 3/4" STRAPPING	6 REOD	NIL
STAPLE	24 REOD	NIL

**GENERAL NOTES**

- A. THIS APPENDIX CANNOT STAND ALONE BUT MUST BE USED IN CONJUNCTION WITH THE BASIC UNITIZATION PROCEDURES DRAWING 19-48-4116-20PA1002. TO PRODUCE AN APPROVED UNIT LOAD, ALL PERTINENT PROCEDURES, SPECIFICATIONS AND CRITERIA SET FORTH WITHIN THE BASIC DRAWING WILL APPLY TO THE PROCEDURES DELINEATED IN THIS APPENDIX. ANY EXCEPTIONS TO THE BASIC PROCEDURES ARE SPECIFIED IN THIS APPENDIX.
- B. DIMENSIONS, CUBE AND WEIGHT OF A PALLET UNIT WILL VARY SLIGHTLY DEPENDING UPON THE ACTUAL DIMENSIONS OF THE BOXES AND THE WEIGHT OF THE SPECIFIC ITEM BEING UNITIZED.
- C. INSTALL EACH HORIZONTAL STRAP TO ENIRCLE A LAYER OF BOXES ON THE PALLET. NOTE THAT THE STRAPS WILL BE LOCATED AS SHOWN, ALIGNED WITH THE HORIZONTAL PIECE OF THE "SUPPORT GATE". HORIZONTAL STRAPS MUST BE TENSIONED AND SEALED PRIOR TO THE APPLICATION OF TIEDOWN STRAPS.
- D. INSTALL EACH TIEDOWN STRAP TO PASS UNDER THE TOP DECK BOARDS OF THE PALLET AND TO BE LOCATED AS SHOWN, ALIGNED WITH THE VERTICAL PIECES OF THE "SUPPORT GATE". TIEDOWN STRAPS WILL NOT BE APPLIED UNTIL THE HORIZONTAL STRAPS HAVE BEEN TENSIONED AND SEALED.
- E. THE FOLLOWING AMC DRAWINGS ARE APPLICABLE FOR OUTLOADING AND STORAGE OF THE ITEMS COVERED BY THIS APPENDIX.
  - CARLOADING - - - - 19-48-4115-SPA1002
  - TRUCKLOADING - - - 19-48-4117-11PA1003
  - STORAGE - - - - - 19-48-4118-1-2-3-4-14-22PA1002
  - END OPENING ISO CONTAINER - - - - 19-48-4153-15PA1002
  - MILVAN - - - - - 19-48-4166-15PA1003
  - SIDE OPENING ISO CONTAINER - - - - 19-48-4267-15PA1009
- F. IF ITEMS COVERED HEREIN ARE UNITIZED PRIOR TO ISSUANCE OF THIS APPENDIX, THE BOXES NEED NOT BE REUNITIZED SOLELY TO CONFORM TO THIS APPENDIX.
- G. THE UNITIZATION PROCEDURES DEPICTED HEREIN MAY ALSO BE USED FOR UNITIZING 20MM CARTRIDGES WHEN IDENTIFIED BY DIFFERENT NATIONAL STOCK NUMBERS (NSN) THAN WHAT IS SHOWN ON PAGE 2, PROVIDED THE BOX PACK DOES NOT VARY FROM WHAT IS DELINEATED HEREIN. THE EXPLOSIVE CLASSIFICATION OF OTHER ITEMS MAY BE DIFFERENT THAN WHAT IS SHOWN.
- H. THE STYLE 1 PALLET DELINEATED IN THE DETAIL AT LEFT NEED NOT HAVE CHAMFERS OR STRAP SLOTS AS SPECIFIED WITHIN MILITARY SPECIFICATION MIL-P-15011 WHEN USED FOR THE UNITIZATION OF ITEMS COVERED BY THIS APPENDIX.
- J. ALL DUNNAGE SHALL BE PRESERVATIVE TREATED IN ACCORDANCE WITH GENERAL NOTE "X" IN THE BASIC PROCEDURES.
- K. REGARDLESS OF THE QUANTITY OF BOXES TO BE PALLETIZED, THE TOTAL WEIGHT OF A FULLY LOADED PALLET UNIT WILL NOT EXCEED 4,000 POUNDS. WHEN THE TOTAL WEIGHT OF A FULLY LOADED PALLET UNIT EXCEEDS 4,000 POUNDS, ONE OR MORE LOADED BOXES MUST BE REMOVED, AND EITHER FILLER ASSEMBLIES, AS DEPICTED ON PAGE 4, OR EMPTY BOXES MUST BE SUBSTITUTED THEREFORE. FOR ADDITIONAL GUIDANCE, SEE THE "PROVISIONS FOR LESS-THAN-FULL-LAYER LOADS" IN THE BASIC UNITIZATION PROCEDURES DRAWING 19-48-4116-20PA1002.



**FILLER ASSEMBLY**  
(FOR MINUS ONE BOX)



**SUPPORT GATE**  
(2 REOD)