FINAL REPORT
JULY 1997

REPORT NO. 97-23

MCALESTER ARMY AMMUNITION PLANT (MCAAP) 40- BY 44-INCH WOODEN PALLET MIL-STD-1660 TESTS

Prepared for:
U.S. Army Armament Research, Development and Engineering Center
ATTN: AMSTA-AR-ESK
Rock Island, IL 61299-7300

Distribution Unlimited

VALIDATION ENGINEERING DIVISION
SAVANNA, ILLINOIS 61074-9639

U.S. ARMY
DEFENSE AMMUNITION CENTER
SAVANNA, ILLINOIS

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: SIOAC-DEV, Savanna, IL 61074-9639.

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 DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION / AVAILABILITY OF REPORT UNLIMITED
2b. DECLASSIFICATION / DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) 97-23	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION U.S. Army Defense Ammunition Center 6b. OFFICE SYMBOL (*if applicable*) SIOAC-DEV	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS (*City, State, and ZIP Code*) ATTN: SIOAC-DEV Savanna, IL 61074-9639	7b. ADDRESS (*City, State, and ZIP Code*)
8a. NAME OF FUNDING / SPONSORING ORGANIZATION U.S. Army Armament Research, Development and Engineering Center 8b. OFFICE SYMBOL (*if applicable*) AMSTA-AR-ESK	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (*City, State, and ZIP Code*) ATTN: AMSTA-AR-ESK Rock Island, IL 61299-7300	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO.
11. TITLE (*Include Security Classification*) McAlester Army Ammunition Plant (MCAAP) 40- by 44-inch Wooden Pallet MIL-STD-1660 Tests	
12. PERSONAL AUTHOR(S) Ejike J. Ajalla	
13a. TYPE OF REPORT Final 13b. TIME COVERED FROM _____ TO _____	14. DATE OF REPORT (*Year, Month, Day*) 1997 July 15. PAGE COUNT
16. SUPPLEMENTARY NOTATION	
17. COSATI CODES FIELD / GROUP / SUB-GROUP	18. SUBJECT TERMS (*Continue on reverse if necessary and identify by block number*)

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

The U.S. Army Defense Ammunition Center (DAC), Validation Engineering Division (SIOAC-DEV), was tasked by U.S. Army Armament Research, Development and Engineering Center (ARDEC) to conduct MIL-STD-1660 tests on a 40- by 44-inch wooden pallet (oak) manufactured by MCAAP. This report contains test results with the pallets provided meeting MIL-STD-1660, Design Criteria for Ammunition Unit Loads, requirements.

20. DISTRIBUTION / AVAILABILITY OF ABSTRACT XX UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED
22a. NAME OF RESPONSIBLE INDIVIDUAL JEROME H. KROHN	22b. TELEPHONE (*Include Area Code*) 815-273-8929 22c. OFFICE SYMBOL SIOAC-DEV

DD Form 1473, Jun 86 *Previous editions are obsolete*

U.S. ARMY DEFENSE AMMUNITION CENTER
VALIDATION ENGINEERING DIVISION
SAVANNA, IL 61074-9639

REPORT NO. 97-23

MCALESTER ARMY AMMUNITION PLANT (MCAAP)
40- BY 44-INCH WOODEN PALLET MIL-STD-1660 TESTS

TABLE OF CONTENTS

PART 1

INTRODUCTION

A. BACKGROUND. The U.S. Army Defense Ammunition Center (DAC), Validation Engineering Division (SIOAC-DEV), was tasked by U.S. Army Armament Research, Development and Engineering Center (ARDEC) to conduct MIL-STD-1660 tests on 40- by 44-inch oak pallets manufactured by Mcalester Army Ammunition Plant (MCAAP). This report contains test results with the pallets provided meeting MIL-STD-1660, Design Criteria for Ammunition Unit Loads, requirements.

B. AUTHORITY. These tests were conducted IAW mission responsibilities delegated by the U.S. Army Armament, Munitions and Chemical Command (AMCCOM), Rock Island, Illinois.

C. OBJECTIVE. The objective of these tests was to confirm that the enhanced wood pallet with modified metal bottom adapter (four corner end braces) meets MIL-STD-1660 performance requirements and is acceptable for use for storage and transportation of ammunition.

D. CONCLUSION. The oak pallets met MIL-STD-1660 requirements.

PART 2

6 - 9 JUNE 1997

ATTENDEES

Ejike J. Ajalla
Mechanical Engineer
DSN 585-8434
815-273-8434

Director
U.S. Army Defense Ammunition Center
3700 Army Depot Road
ATTN: SIOAC-DEV
Savanna, IL 61074-9639

PART 3

TEST PROCEDURES

The test procedures outlined in this section were extracted from MIL-STD-1660, Design Criteria for Ammunition Unit Loads, 8 April 1977. This standard identifies nine steps that a unitized load must undergo if it is to be considered acceptable. The four tests that were conducted on the test pallets are summarized below.

A. STACKING TEST. The unit load was loaded to simulate a stack of identical unit loads stacked 16 feet high, for a period of one hour. This stacking load was simulated by subjecting the unit load to a compression weight equal to an equivalent 16-foot stacking height. The compression load was calculated in the following manner. The unit load weight was divided by the unit load height in inches and multiplied by 192. The resulting number was the equivalent compressive force of a 16-foot-high load.

B. REPETITIVE SHOCK TEST. The repetitive shock test was conducted IAW Method 5019, Federal Standard 101. The test procedure is as follows: The test specimen was placed on, but not fastened to, the platform. With the specimen in one position, the platform was vibrated at 1/2-inch amplitude (1-inch double amplitude) starting at a frequency of approximately 3 cycles per second. The frequency was steadily increased until the package left the platform. The resonant frequency was achieved when a 1/16-inch-thick feeler gage momentarily slid freely between every point on the specimen in contact with the platform at some instance during the cycle or a platform acceleration achieved 1 +/- 0.1 Gs. Midway into the testing period, the specimen was rotated 90 degrees and the test continued for the duration. Unless failure occurred, the total time of vibration was two hours if the specimen was tested in one position and three hours for more than one position.

C. EDGEWISE ROTATIONAL DROP TEST. This test was conducted using the procedures of Method 5008, Federal Standard 101. The procedure for the edgewise rotational drop test is as follows: The specimen was placed on its skids with one end of the pallet supported on a beam 4-1/2 inches high. The height of the beam was increased if necessary to ensure that there was no support for the skids between the ends of the pallet when dropping took place, but was not high enough to cause the pallet to slide on the supports when the dropped end was raised for the drops. The unsupported end of the pallet was then raised and allowed to fall freely to the concrete, pavement, or similar underlying surface from a prescribed height. Unless otherwise specified, the height of drop for level A protection conforms 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 limit	15	12
Above - 3,000		12	9

D. INCLINE-IMPACT TEST. This test was 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 specimen was 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 was brought to a predetermined position on the incline and released. If it was desired to concentrate the impact on any particular position on the container, a 4- by 4-inch timber was attached to the bumper in the desired position before the test. No part of the timber was struck by the carriage. The position of the container on the carriage and the sequence in which surfaces and edges were subjected to impacts was at the option of the testing activity and depends upon the objective of the tests. This test was to determine satisfactory requirements for a container or pack, and, unless otherwise specified, the specimen was subjected to one impact on each surface that has each dimension less than 9.5 feet. Unless otherwise specified, the velocity at time of impact was 7 feet per second.

PART 4

TEST EQUIPMENT

A. Pallet A (Test Sample).

1. Size:	40- by 44- inch
2. Pallet Load:	PA116 containers
3. Quantity of Containers:	25
4. Weight Loaded:	2,490 pounds
5. Unit Load Height:	43.5 inches

B. Pallet B (Test Sample).

1. Size:	40- by 44- inch
2. Pallet Load:	PA116 containers
3. Quantity of Containers:	25
4. Weight Loaded:	2,500 pounds
5. Unit Load Height:	43.5 inches

C. Compression Tester.

1. Manufacturer:	Ormond Manufacturing
2. Platform:	60- by 60-inch
3. Compression Limit:	50,000 pounds
4. Tension Limit:	50,000 pounds

D. Transportation Simulator.

1. Manufacturer:	Gaynes Laboratory
2. Capacity:	6,000-pound pallet
3. Displacement:	1/2-inch amplitude
4. Speed:	50 to 400 rpm
5. Platform:	5- by 8-foot

E. Inclined Plane.

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

PART 5

PALLET NAILS

A. 1.	Length:	3-1/4 inches
2.	Diameter:	10 gauge
3.	Rockwell Hardness:	C37
4.	Nail Type:	Pallet nail
5.	Supplier:	Insteel Wire Products
6.	Quantity:	30 per pallet
B. 1.	Length:	2-1/4 inches
2.	Diameter:	11 gauge
3.	Rockwell Hardness:	C37
4.	Nail Type:	Drive screw pallet nail
5.	Supplier:	Stiff stock
6.	Quantity:	30 per pallet
C. 1.	Length:	1-5/8 inches
2.	Diameter:	11 gauge
3.	Rockwell Hardness:	C37
4.	Nail Type:	Drive screw pallet nail
5.	Supplier:	Stiff stock
6.	Quantity:	24 per pallet

Pallet Production.

The type of nail and nailing pattern used by MCAAP in fabricating the test pallets is detailed in the drawing on page 8-2.

Nails described in part 5-A were driven from the deck board through the stringer and into the post. Three nails were used to fasten the deck to each of the six posts in the two outside deck boards. A total of four nails were used to fasten the deck to each of the three posts above the center skid.

Nails described in part 5.B. fastened the skids to the posts. A total of three nails were used to fasten the outside skids to each post. The center skid consisted of one board and was fastened by five nails into each post. The pattern of these nails is shown in the drawing on page 8-2.

MIL-P-15011 states that each deck board is fastened to each stringer board using 1-5/8-inch nails. Nails described in 5.C. were used to fasten the deck boards to the stringer boards. For these pallets, a total of three nails were used to fasten each deckboard to each stringer board. At the locations that the three nails described in 5.A. are fastening the deck to the post, no nails described in 5.C. were used. Every place where two nails described in 5.A. were used in fastening the deck to the post, one nail described in 5.C. was also used to fasten the deck board to the post. At the locations where no post was under the stringer board, three nails described in 5.C. were used to fasten the deck board to the stringer board. The pattern of nails described in 5.C. is shown in the drawing on page 8-2.

PART 6

TEST RESULTS

TEST OBSERVATIONS. Each test pallet was loaded with 25 PA116 containers IAW DAC drawing 19-48-4079/7. Each container was filled with approximately 75 pounds of iron granules, creating a total 2,500-pound unitized load.

A. PALLET A:

1. STACKING TEST. The test sample was initially loaded to 2,490 pounds compression. After one hour the compression was released. No physical damage to the test sample was noticed.

2. REPETITIVE SHOCK TEST. The duration of the test was 90 minutes for each orientation of the test sample. In order to achieve the clearance between the test sample and the transportation simulator bed, the equipment was operated at 199 rpm for the lateral orientation and 202 rpm for the longitudinal orientation. No physical damage was noticed at the end of this test.

3. EDGEWISE ROTATIONAL DROP TEST. Each side of the pallet base was placed on a beam displacing it 4-1/2 inches above the floor. The ends of the test sample were raised to a height of 15 inches. The process was repeated in a clockwise direction until all four sides of the pallet had been tested. There was no physical damage noticed at the end of this test.

4. INCLINE IMPACT TEST. The incline-plane was set to allow the pallet to travel 8 feet prior to impacting a stationary wall. The pallet was rotated clockwise after each impact, until all four sides had been tested. No physical damage was noticed at the end of this test.

5. END OF TEST INSPECTION. During final inspection, there was no physical damage noticed on the test sample.

B. PALLET B:

1. STACKING TEST. The test sample was initially loaded to 2,500 pounds compression. No physical damage was noticed at the end of this test.

2. REPETITIVE SHOCK TEST. The duration of the test was 90 minutes for each orientation of the test sample. In order to achieve the clearance between the test sample and the transportation simulator bed, the equipment was operated at 184 rpm for the lateral orientation and 195 rpm for the longitudinal orientation. No physical damage was noticed at the end of this test.

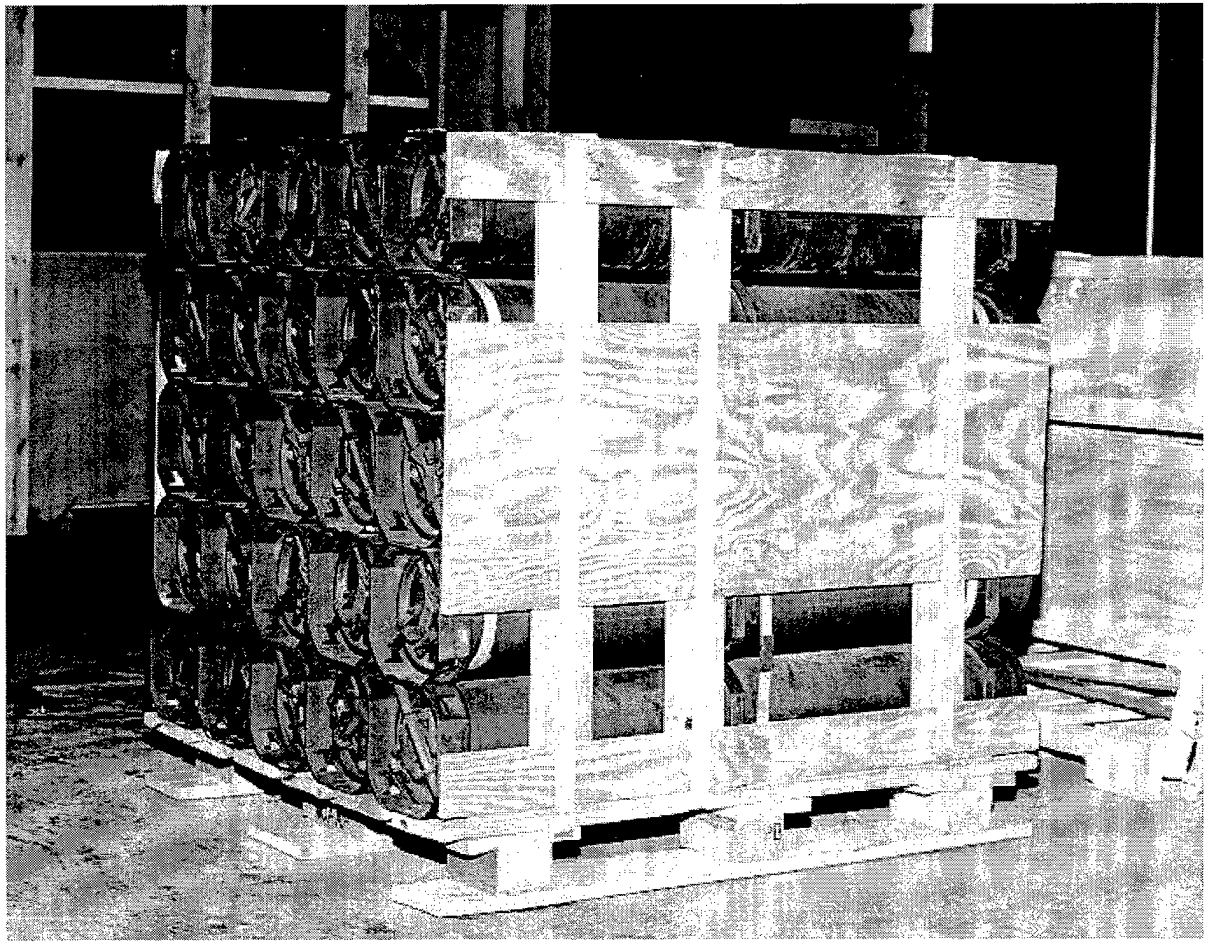
3. EDGEWISE ROTATIONAL DROP TEST. Each side of the pallet base was placed on a beam displacing it 4-1/2 inches above the floor. The ends of the test sample were raised to a height of 15 inches. The process was repeated in a clockwise direction until all four sides of the pallet had been tested. There was no physical damage noticed at the end of this test.

4. INCLINE IMPACT TEST. The incline-plane was set to allow the pallet to travel 8 feet prior to impacting a stationary wall. The pallet was rotated clockwise after each impact, until all four sides had been tested. No physical damage was noticed at the end of this test.

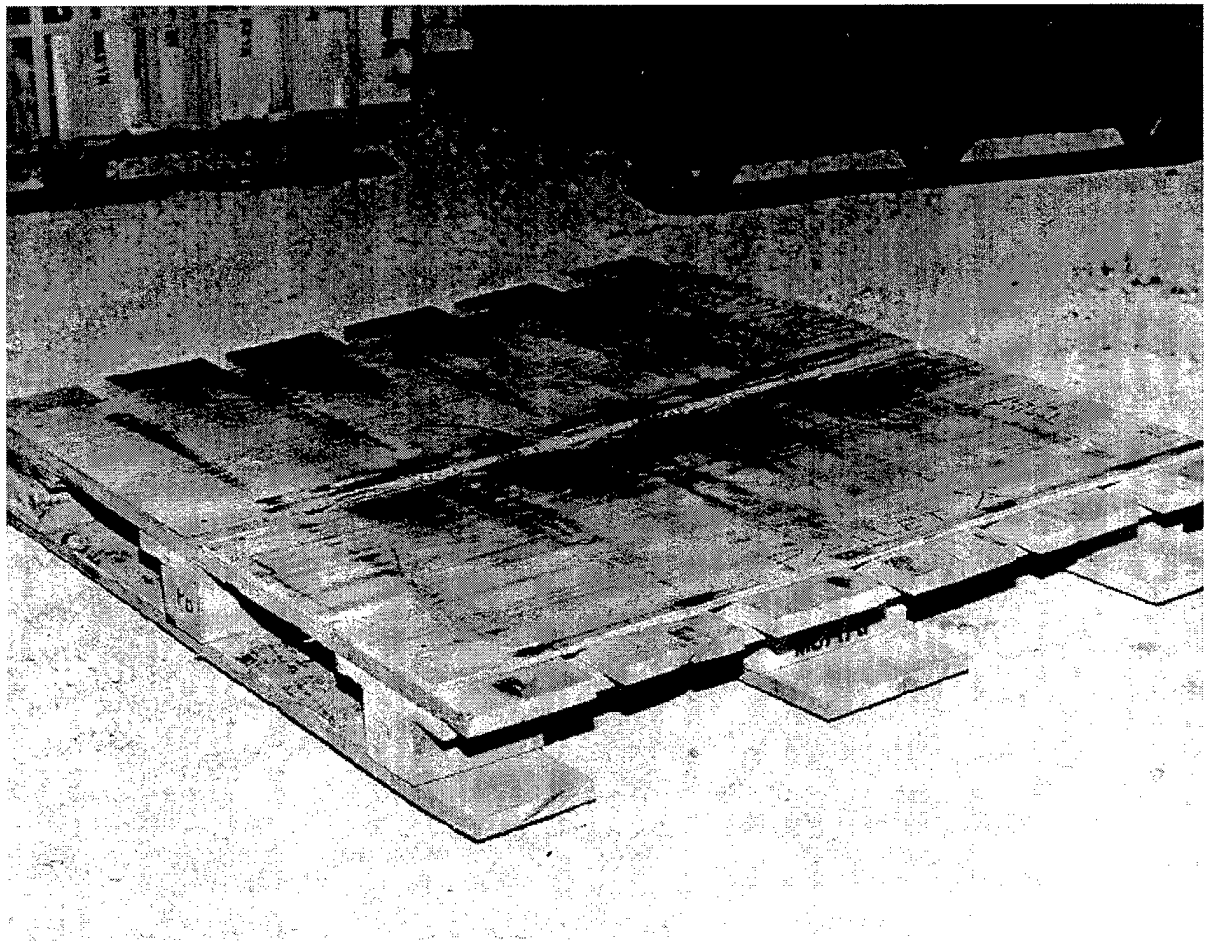
5. END OF TEST INSPECTION. During final inspection, there was no physical damage noticed on the test sample.

PART 7

PHOTOGRAPHS



	U.S. ARMY DEFENSE AMMUNITION CENTER SAVANNA, IL	
PHOTO NO. AO317-SCN-97-2912. This photo shows the palletized unit load of test sample "A" following the test.		

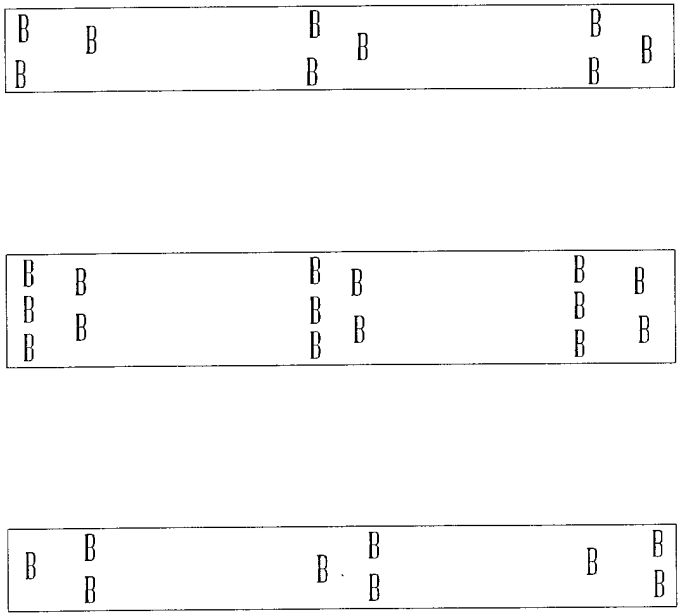


	U.S. ARMY DEFENSE AMMUNITION CENTER SAVANNA, IL	
PHOTO NO. AO317-SCN-97-2913. This photo shows the palletized unit load of test sample "A" following the test.		

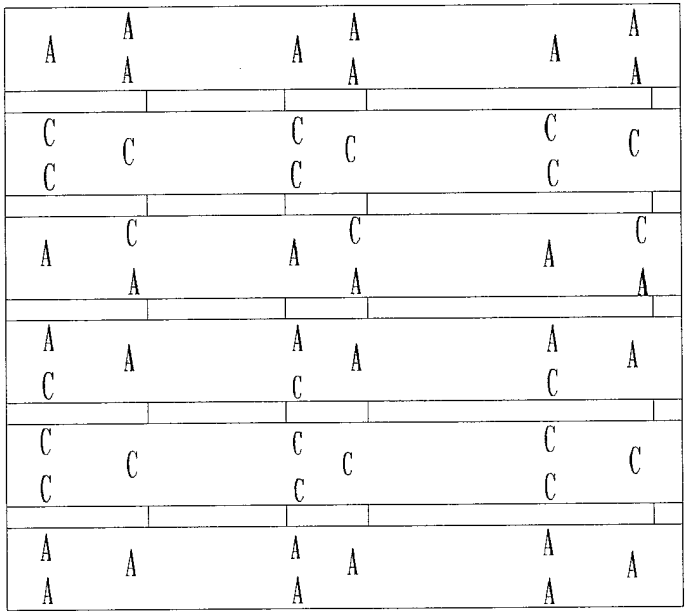
PART 8

DRAWING

PALLET MANUFACTURING NAILING DIAGRAM
MCAAP 40- BY 44-INCH PALLET



BOTTOM DECK BOARDS
(SKIDS)



TOP DECK BOARDS
(DECK)

NOTES:

A = 3- 1/4-inch nail
B = 2- 1/4-inch nail
C = 1- 5/8-inch nail

EJA
06/12/97

PART 9

APPENDIX

APPENDIX 7●

UNITIZING PROCEDURES FOR COMPLETE ROUNDS PACKED IN CYLINDRICAL METAL CONTAINERS ON 4-WAY ENTRY PALLETS*

PA116 SERIES CONTAINER

INDEX

● THE PROCEDURES DELINEATED WITHIN THIS APPENDIX FOR THE ITEMS SPECIFIED IN THE "PALLET UNIT DATA" CHART ARE FOR MARINE CORPS USE ONLY AND ARE NOT INTENDED TO BE USED BY ANY OTHER SERVICE WITHOUT APPROPRIATE COMMAND APPROVAL

*SEE GENERAL NOTE "J" ON PAGE 3.

NOTICE: THIS APPENDIX CANNOT STAND ALONE BUT MUST BE USED IN CONJUNCTION WITH THE BASIC UNITIZATION PROCEDURES DRAWING 19-48-4079-20PM1002.

DO NOT SCALE

U.S. ARMY MATERIEL COMMAND DRAWING

APPROVED, U.S. ARMY INDUSTRIAL OPERATIONS COMMAND

AMSTA-AR-ESK

AMSIO-TMJ

APPROVED BY ORDER OF COMMANDING GENERAL, U.S. ARMY MATERIEL COMMAND

U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL

DRAFTSMAN	D. WHITMORE
ENGINEER	SANDRA M. SCHULTZ

SUPPLY ENGINEERING DIVISION	TRANSPORTATION ENGINEERING DIVISION	VALIDATION ENGINEERING DIVISION

LOGISTICS ENGINEERING OFFICE

JUNE 1989

CLASS	DIVISION	DRAWING	FILE
19	48	4079/7	20PM 1002

REVISION NO. 3 APRIL 1996

SEE THE REVISION LISTING ON PAGE 2

PROJECT FSA 63/7-66

PALLET UNIT DATA					
ITEMS INCLUDED		HAZARD CLASS AND DIVISION		APPROX WEIGHT LBS	
NSN	DODIC	QD CLASS	COMP GROUP	UNIT A	UNIT B
1315-					
01-316-1211	C380	(08)1.2	C	1,886	1,779
01-292-7754	C784	(08)1.2	C	2,036	1,999
01-369-1901	C784	(08)1.2	C	2,036	1,999
01-292-7755	C785	(08)1.2	C	1,761	1,724
01-305-9252	C785	(08)1.2	C	1.761	1,724
01-292-7753	C786	(08)1.2	C	1,761	1,724
01-292-9868	C787	(08)1.2	E	2,036	1,999
01-333-0533	C791	(08)1.2	E	1,986	1,949

● 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).

REVISIONS

REVISION NO. 1, DATED JUNE 1989, CONSISTS OF:

1. ADDING PROCEDURES FOR A PALLET UNIT WITH TOP LIFT CAPABILITY (PALLET UNIT "A").

REVISION NO. 2, DATED SEPTEMBER 1993, CONSISTS OF:

1. MAKING CHANGES IN ACCORDANCE WITH ECP'S M0T3016 AND M3K3014.

REVISION NO. 3, DATED APRIL 1996, CONSISTS OF:

1. MAKING CHANGES IN ACCORDANCE WITH ECP'S M3T4321 AND M4T3007.
2. UPDATING GENERAL NOTES.

GENERAL NOTES

A. THIS APPENDIX CANNOT STAND ALONE BUT MUST BE USED IN CONJUNCTION WITH THE BASIC UNITIZATION PROCEDURES DRAWING 19-48-4079-20PM1002. 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 CONTAINER AND THE WEIGHT OF THE SPECIFIC ITEM BEING UNITIZED.

C. FOR OUTLOADING OF THE ITEMS COVERED BY THIS APPENDIX, CONTACT THE U.S. ARMY DEFENSE AMMUNITION CENTER AND AND SCHOOL, ATTN: SIOAC-DET, SAVANNA, IL. 61074-9639. FOR STORAGE OF THE ITEMS COVERED BY THIS APPENDIX, CONTACT THE U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL, ATTN: SIOAC-DES, SAVANNA, IL 61074-9639 FOR SPECIFIC PROCEDURAL GUIDANCE.

D. IF STRAP CUTTERS ARE SPECIFICALLY REQUIRED BY THE PROCURING ACTIVITY, REFER TO DARCOM DRAWING 19-48-4127-20P1000 FOR APPROPRIATE MEANS OF SECUREMENT TO THE PALLET UNIT.

E. IF ITEMS COVERED HEREIN ARE UNITIZED PRIOR TO ISSUANCE OF THIS APPENDIX, THE CONTAINERS NEED NOT BE REUNITIZED SOLELY TO CONFORM TO THIS APPENDIX.

F. FOR DETAILS OF THE PA116 SERIES CONTAINER, SEE U.S. ARMY ARMAMENT RESEARCH AND DEVELOPMENT CENTER DRAWING NO. 9386831.

CONTAINER DIMENSIONS - - - 44-1/2" LONG X 7-3/4" WIDE X 7-3/4" HIGH
CUBE - - - - - - 1.5 CUBIC FEET (APPROX)
WEIGHT (WITH ROUND) - - - - - - 64, 73 OR 75 POUNDS (APPROX)

G. THE UNITIZATION PROCEDURES DEPICTED HEREIN MAY ALSO BE USED FOR UNITIZING COMPLETE ROUNDS WHEN IDENTIFIED BY DIFFERENT NATIONAL STOCK NUMBERS (NSN) THAN THOSE SHOWN ON PAGE 2, PROVIDED THE ITEM IS PACKED IN THE SAME CONTAINER. THE EXPLOSIVE CLASSIFICATION OF OTHER ITEMS MAY BE DIFFERENT THAN WHAT IS SHOWN.

H. DIMENSIONS GIVEN FOR DUNNAGE PIECES WILL BE FIELD CHECKED PRIOR TO THEIR ASSEMBLY TO THE PALLET UNIT. CONTAINERS MUST FIT SNUGLY IN THE DUNNAGE ASSEMBLIES. ALSO, DUE TO THE VARIATION OF CONTAINER DIMENSIONS, ADJUSTMENTS MAY BE REQUIRED AS TO THE LOCATION OF CERTAIN PIECES OF DUNNAGE IN A DUNNAGE ASSEMBLY.

J. THE SPECIAL PALLET WILL BE CONSTRUCTED AND ASSEMBLED IN ACCORDANCE WITH A MILITARY SPECIFICATION MIL-P-15011, STYLE 1, TYPE I, CLASS 1 PALLET WITH THE EXCEPTION THAT THE TOP AND BOTTOM DECK BOARDS WILL BE 44" LONG INSTEAD OF 48". ALL OTHER REQUIREMENTS SPECIFIED WITHIN MIL-P-15011 FOR A STYLE 1, TYPE I, CLASS 1 PALLET WILL APPLY TO THE PALLET SPECIFIED WITHIN THIS DRAWING. SEE GENERAL NOTES "R" AND "S".

K. THE SPECIAL PALLET DELINEATED IN THE DETAIL ON PAGE 4 NEED NOT HAVE CHAMFERS OR STRAP SLOTS AS SPECIFIED WITHIN MILITARY SPECIFICATION MIL-P-15011 WHEN USED FOR THE UNITIZATION OF THE ITEMS COVERED BY THIS APPENDIX.

L. FULL IDENTIFICATION MARKINGS IN ACCORDANCE WITH MIL-STD-129-1, TO INCLUDE NSN AND DODIC, QUANTITY AND NOMENCLATURE, LOT NUMBER, AND GROSS WEIGHT OF THE LOAD, SHALL BE MARKED ON TAGS LOCATED ON OPPOSITE UPPER CORNERS OF THE LOAD.

M. BAR CODE LABELS ARE REQUIRED ON THE STRAPS OF OPPOSITE CORNERS. SEE MIL-STD-129-1.

N. THE THICKNESS OF THE PLYWOOD BUFFER PIECES DEPICTED IN THE "SIDE ASSEMBLY DETAIL" AND THE "PLYWOOD BUFFER DETAIL" ON PAGE 6 MUST BE ADJUSTED, AS REQUIRED, TO COMPLY WITH THE DIMENSIONAL VARIANCE OF THE PA116 CONTAINERS, SO AS TO COMPLETELY FILL OUT THE PALLET. THE LENGTH DIMENSION OF THE PALLET UNIT AT THE SIDE ASSEMBLIES MUST BE EQUAL TO OR GREATER THAN 40-1/8" (UNIT A) OR 40" (UNIT B). NOTE: NOMINAL 1" MATERIAL MAY BE SUBSTITUTED FOR THE PLYWOOD IF IT WILL CAUSE THE PALLET UNIT DIMENSIONS TO BE EQUAL OR GREATER THAN 40-1/8" (UNIT A) OR 40" (UNIT B) AND IF SO DESIRED. ALL THREE BUFFER PIECES MUST BE THE SAME THICKNESS, FOR EXAMPLE, IF 1" X 4" MATERIAL IS USED FOR THE TOP AND BOTTOM BUFFER PIECES, 3/4" PLYWOOD MUST BE USED FOR THE MIDDLE BUFFER PIECE.

(GENERAL NOTES CONTINUED AT RIGHT)

(GENERAL NOTES CONTINUED)

O. FOR DETAILS OF THE METAL LIFTING FRAME, SEE U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL DRAWING AC200000807 AND MILITARY SPECIFICATION MIL-A-70788.

P. PALLET UNIT "A" IS THE PREFERRED METHOD OF UNITIZATION AND SHALL BE UTILIZED UNLESS OTHERWISE DIRECTED BY THE RESPONSIBLE COMMAND.

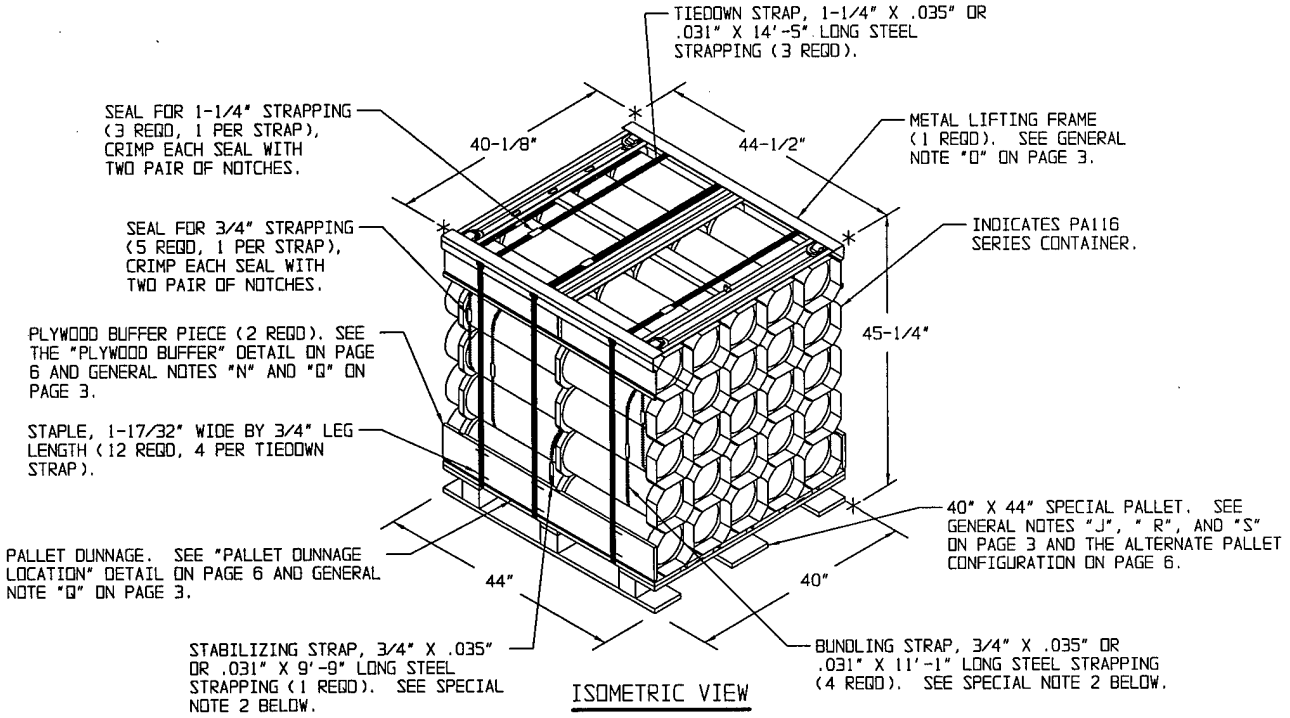
Q. ALL DUNNAGE SHALL BE PRESERVATIVE TREATED IN ACCORDANCE WITH GENERAL NOTE "X" IN THE BASIC PROCEDURES.

R. AS AN ALTERNATE, AND TO PROVIDE ADDITIONAL SUPPORT FOR THE STEEL BANDS, THE TWO OUTSIDE 1" X 8" STRINGER BOARDS ON THE MODIFIED PALLET MAY BE POSITIONED AS SHOWN ON PAGE 6.

S. AS AN ALTERNATE, AND TO PROVIDE ADDITIONAL SUPPORT FOR STEEL BANDS, THE 1" X 4" CENTER STRINGER BOARD ON MODIFIED PALLET MAY BE REPLACED BY A 1" X 6" POSITIONED AS SHOWN ON PAGE 6.

T. FOR DODICS C380, AND C786 ONLY, THE TOP COVER OF THE PALLET WILL BE MARKED "DOT-E-9649" IN ONE-INCH WHITE LETTERS NEAR THE CLOSED END OF THE CONTAINERS.

APPLICATIONS
M831/M831A1
M865
SLUGS



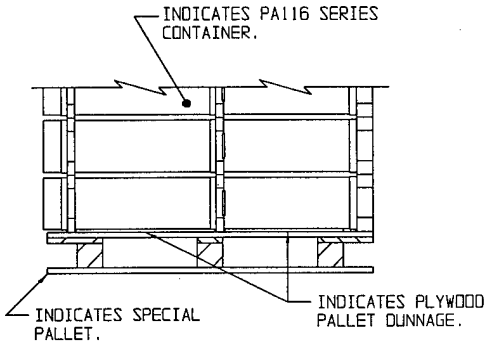
ISOMETRIC VIEW

SPECIAL NOTES:

1. ALTHOUGH THE CONTAINERS DEPICTED IN THE UNIT LOAD ABOVE ARE CONSTRUCTED WITH INTERLOCKING DEVICES, THE INTERLOCKS WILL NOT FUNCTION PROPERLY UNLESS THE CONTAINERS ARE POSITIONED SO THAT THE "PINS" OF THE INTERLOCKS ARE IN AN UPRIGHT ORIENTATION. THIS ORIENTATION WILL PRECLUDE INTERFERENCE OF THE "PINS" AND THE PLYWOOD PALLET DUNNAGE AND WILL AID IN THE PREVENTION OF CONTAINER MOVEMENT, BOTH LATERALLY AND LONGITUDINALLY, DURING SHIPMENT OF THE UNIT LOAD.

2. BUNDLING STRAPS AND STABILIZING STRAP MUST BE TENSIONED AND SEALED PRIOR TO THE APPLICATION OF THE TIEDOWN STRAPS. ALL STRAPS MUST BE INSTALLED AS CLOSE AS POSSIBLE TO THE CONTAINER RINGS. CAUTION: STRAPS MUST NOT BE ALLOWED TO OVERLAP.

3. IF DESIRED, ONE LAYER OF CONTAINERS MAY BE OMITTED FROM THE UNIT LOAD DEPICTED ABOVE. WHEN ONE LAYER OF CONTAINERS IS OMITTED, TIEDOWN STRAP LENGTHS MUST BE DECREASED TO 13'-2" AND TWO BUNDLING STRAPS MUST BE OMITTED (LOCATE REMAINING BUNDLING STRAPS TO SURROUND THE SECOND THROUGH FOURTH LAYERS OF CONTAINERS). THIS WILL RESULT IN AN OVERALL UNIT HEIGHT OF 37-1/2", A GROSS UNIT WEIGHT OF 1,659 POUNDS, AND A UNIT CUBE OF 38.8 CUBIC FEET. THE UNIT MAY BE MODIFIED AS DESCRIBED ONLY WHEN BEING SHIPPED BY MILVAN OR END OR SIDE OPENING INTERMODAL FREIGHT CONTAINERS. THE DETERMINATION TO REDUCE THE LOAD BY A LAYER FOR TRANSPORTATION WILL BE MADE BY THE RESPONSIBLE COMMAND AND WILL BE BASED UPON ECONOMICS OF TRANSPORTATION AND HANDLING.



PARTIAL VIEW

(PLYWOOD BUFFER HAS BEEN OMITTED FOR CLARITY).

BILL OF MATERIAL (UNIT A)		
NAILS	NO. REQD	POUNDS
6d (2")	12	0.07

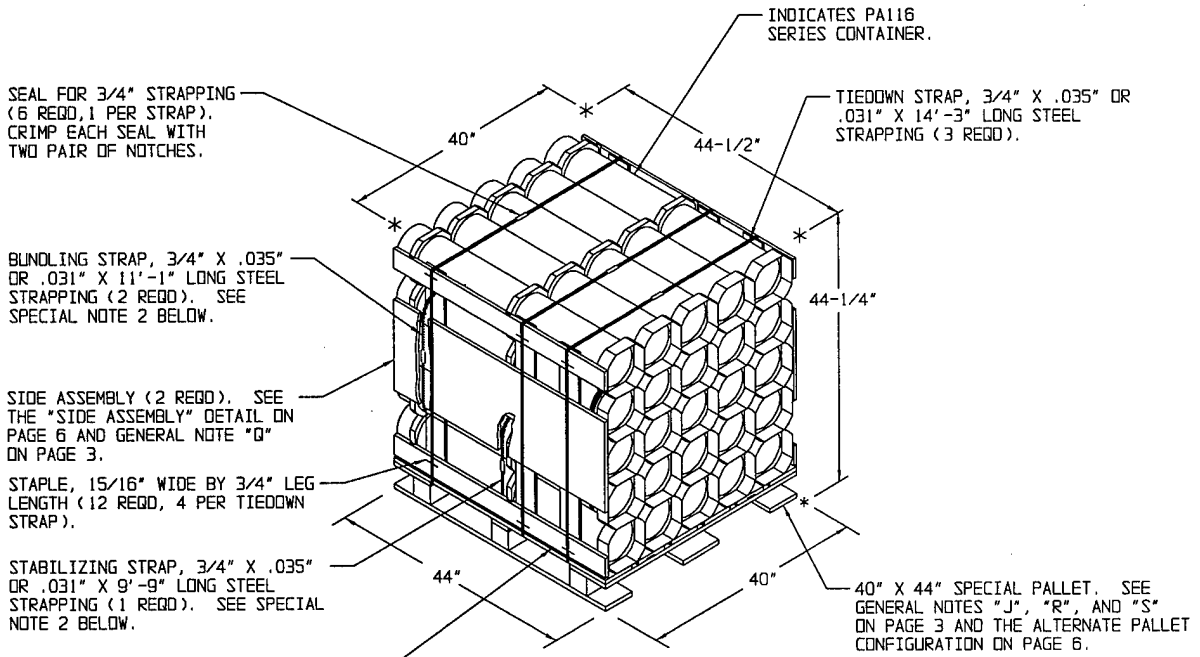
SPECIAL PALLET 40" X 44"	1 REQD	77 LBS
STEEL STRAPPING, 3/4"	54.08' REQD	3.86 LBS
SEAL FOR 3/4 STRAPPING	5 REQD	NIL
STEEL STRAPPING, 1-1/4"	43.25' REQD	6.18 LBS
SEAL FOR 1-1/4" STRAPPING	3 REQD	NIL
PLYWOOD, 3/8"	10.14 SQ FT REQD	10.46 LBS
PLYWOOD, 5/8"	3.67 SQ FT REQD	6.30 LBS
STRAP STAPLE, 1-17/32" X 3/4"	12 REQD	NIL
METAL LIFTING FRAME	1 REQD	57 LBS

UNIT DATA

	WEIGHT
CUBE	46.8 CUBIC FEET (APPROX)
CONTAINER, PA116 SERIES - 25 EA AT 75 LBS	1,875 LBS (APPROX)
DUNNAGE	84 LBS
PALLET	77 LBS
TOTAL WEIGHT	2,036 LBS (APPROX)

UNIT A (W/METAL LIFTING FRAME)

PROJECT FSA 63/7-66



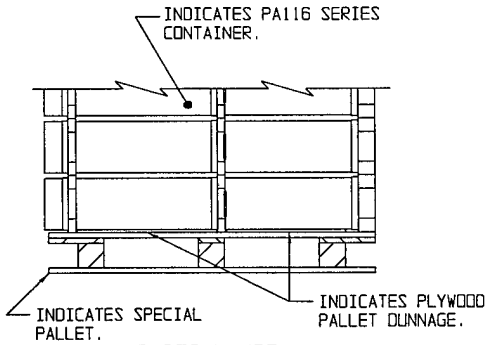
ISOMETRIC VIEW

SPECIAL NOTES:

1. ALTHOUGH THE CONTAINERS DEPICTED IN THE UNIT LOAD ABOVE ARE CONSTRUCTED WITH INTERLOCKING DEVICES, THE INTERLOCKS WILL NOT FUNCTION PROPERLY UNLESS THE CONTAINERS ARE POSITIONED SO THAT THE "PINS" OF THE INTERLOCKS ARE IN AN UPRIGHT ORIENTATION. THIS ORIENTATION WILL PRECLUDE INTERFERENCE OF THE "PINS" AND THE PLYWOOD PALLET DUNNAGE AND WILL AID IN THE PREVENTION OF CONTAINER MOVEMENT, BOTH LATERALLY AND LONGITUDINALLY, DURING SHIPMENT OF THE UNIT LOAD.

2. BUNDLING STRAPS AND STABLIZING STRAP MUST BE TENSIONED AND SEALED PRIOR TO THE APPLICATION OF THE TIEDOWN STRAPS. ALL STRAPS MUST BE INSTALLED AS CLOSE AS POSSIBLE TO THE CONTAINER RINGS. CAUTION: STRAPS MUST NOT BE ALLOWED TO OVERLAP.

3. IF DESIRED, ONE LAYER OF CONTAINERS MAY BE OMITTED FROM THE UNIT LOAD DEPICTED ABOVE. WHEN ONE LAYER OF CONTAINERS IS OMITTED, TIEDOWN STRAP LENGTHS MUST BE DECREASED TO 12'-11", BUNDLING STRAPS LENGTHS MUST BE DECREASED TO 9'-10" (LOCATED TO SURROUND THE SECOND AND THIRD LAYERS OF CONTAINERS ONLY) AND THE SIDE ASSEMBLY MUST BE MODIFIED. SIDE ASSEMBLY MODIFICATIONS INCLUDE SHORTENING THE VERTICAL PIECES TO 28-1/2", REDUCING THE MIDDLE BUFFER PIECE FROM 16" TO 10" HIGH, AND LOCATING THE MIDDLE BUFFER PIECE AT 20", INSTEAD OF 27-1/2". THIS WILL RESULT IN AN OVERALL UNIT HEIGHT OF 36-1/2", A GROSS UNIT WEIGHT OF 1,616 POUNDS, AND A UNIT CUBE OF 37.6 CUBIC FEET. THE UNIT MAY BE MODIFIED AS DESCRIBED ONLY WHEN BEING SHIPPED BY MILVAN OR END OR SIDE OPENING INTERMODAL FREIGHT CONTAINER. THE DETERMINATION TO REDUCE THE LOAD BY A LAYER FOR TRANSPORTATION WILL BE MADE BY THE RESPONSIBLE COMMAND AND WILL BE BASED UPON ECONOMICS OF TRANSPORTATION AND HANDLING.



PARTIAL VIEW

(SIDE ASSEMBLY HAS BEEN OMITTED FOR CLARITY).

BILL OF MATERIAL (UNIT B)

NAILS	NO. REQD	POUNDS
4d (1-1/2")	54	0.18
6d (2")	12	0.07

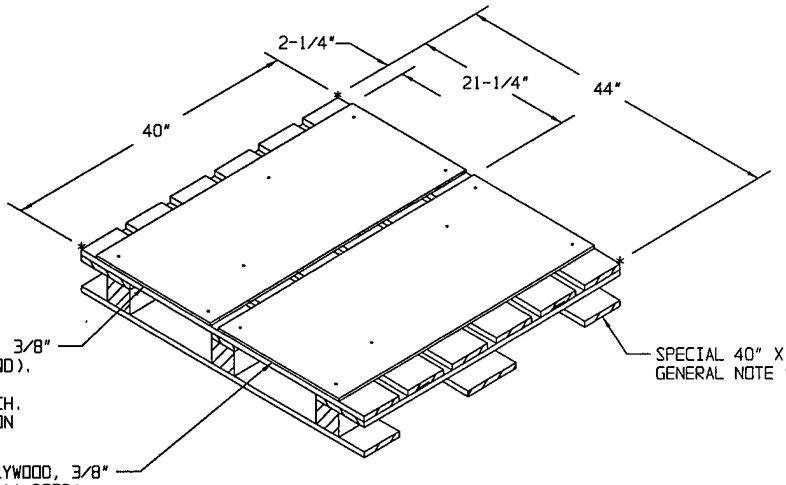
SPECIAL PALLET 40" X 44"	1 REQD	77 LBS
STEEL STRAPPING, 3/4"	74.67' REQD	5.33 LBS
SEAL FOR 3/4" STRAPPING	6 REQD	NIL
PLYWOOD, 3/8"	16.22 SQ FT REQD	16.73 LBS
PLYWOOD, 5/8"	14.06 SQ FT REQD	24.16 LBS
STRAP STAPLE, 15/16" X 3/4"	12 REQD	NIL

UNIT DATA

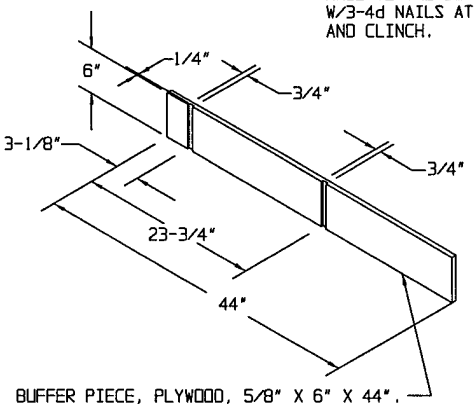
	WEIGHT
CUBE	45.6 CUBIC FEET (APPROX)
CONTAINER, PA116 SERIES	25 EA AT 75 LBS — 1,875 LBS (APPROX)
DUNNAGE	47 LBS
PALLET	77 LBS
TOTAL WEIGHT	1,999 LBS (APPROX)

UNIT B (W/O METAL LIFTING FRAME)

PROJECT FSA 63/7-66

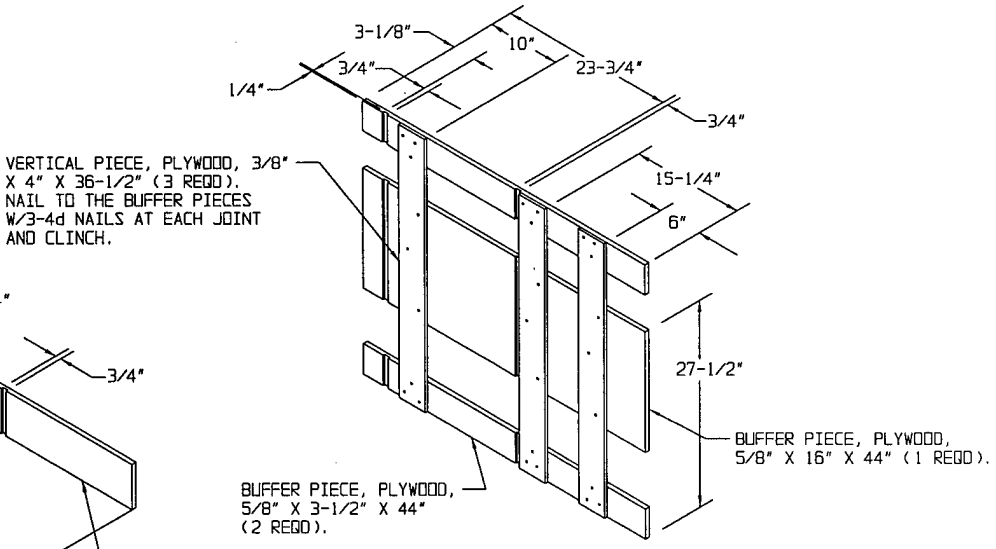


PALLET DUNNAGE LOCATION



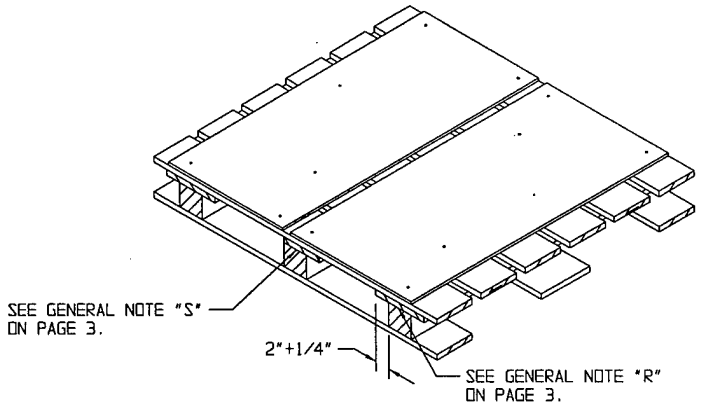
PLYWOOD BUFFER

A LEFT HAND PIECE IS DEPICTED.
A RIGHT HAND PIECE IS ALSO REQUIRED.
SEE GENERAL NOTES "N" AND "Q" ON PAGE 3.



SIDE ASSEMBLY

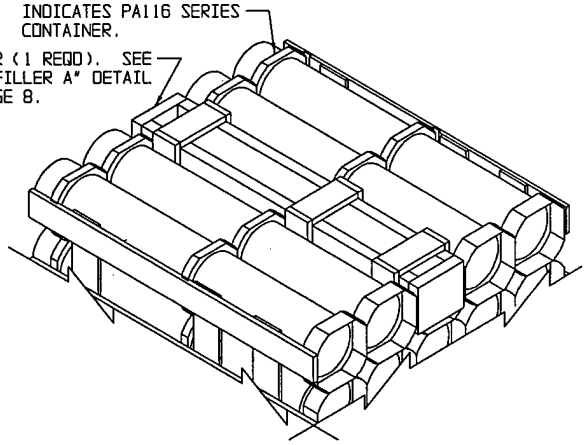
A LEFT HAND ASSEMBLY IS DEPICTED.
A RIGHT HAND IS ALSO REQUIRED.
SEE GENERAL NOTES "N" AND "Q" ON PAGE 3.



ALTERNATE PALLET CONFIGURATION

SEE GENERAL NOTE "J" ON PAGE 3.

DUNNAGE DETAILS

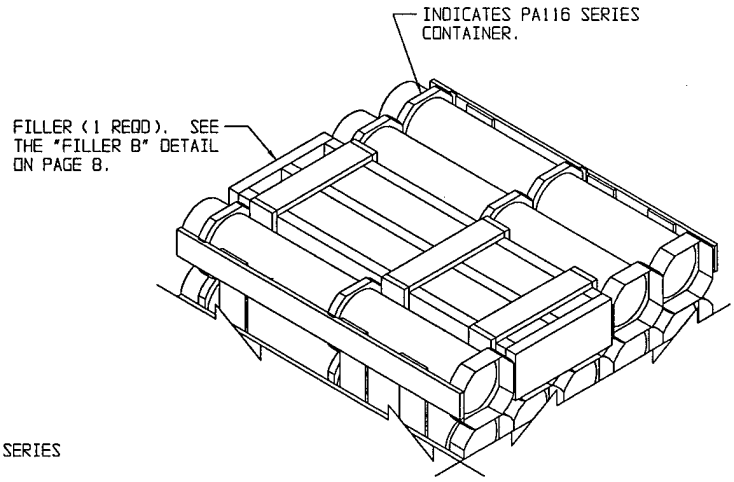


DETAIL A

THIS DETAIL DEPICTS PROCEDURES TO BE USED WHEN A STANDARD PALLET UNIT MINUS ONE CONTAINER IS TO BE UNITIZED. THE FILLER ASSEMBLY DEPICTED MUST BE INSTALLED IN THE MIDDLE OF THE TOP LAYER OF THE PALLET UNIT.

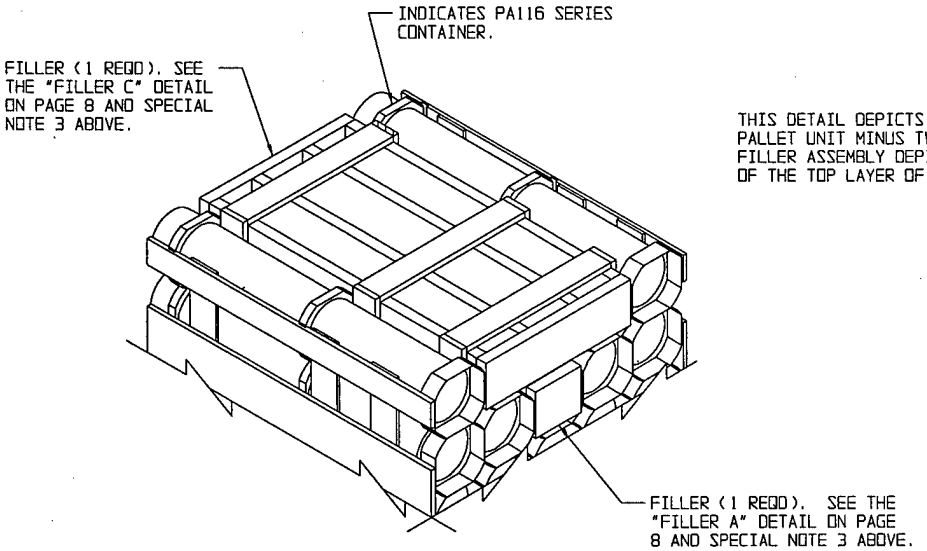
SPECIAL NOTES:

1. WHEN FIVE CONTAINERS ARE TO BE OMITTED FROM A PALLET UNIT, A COMPLETE LAYER OF CONTAINERS MUST BE OMITTED. WHEN FOUR CONTAINERS ARE TO BE OMITTED FROM A PALLET UNIT, A COMBINATION OF FILLER ASSEMBLIES DEPICTED ON PAGE 8 MUST BE USED. WHEN THREE OR LESS CONTAINERS ARE TO BE OMITTED FROM A PALLET UNIT, A COMBINATION OR ONE OF THE FILLER ASSEMBLIES DEPICTED ON PAGE 8 MAY BE USED. ALL FILLER ASSEMBLIES MUST BE INSTALLED IN THE MIDDLE OF THE TOP LAYER OR LAYERS OF A PALLET UNIT.
2. WHEN TWO "FILLER A" ASSEMBLIES ARE USED IN PLACE OF TWO OMITTED CONTAINERS, THE FILLER ASSEMBLIES WILL BE SEPARATED BY AT LEAST ONE CONTAINER TO INSURE PROPER FILLER ASSEMBLY RETENTION AND TO PRECLUDE ASSEMBLY INTERFERENCES.
3. WHEN A "FILLER A" ASSEMBLY IS USED IN CONJUNCTION WITH A "FILLER B" OR "FILLER C" ASSEMBLY, THE "FILLER A" ASSEMBLY MUST BE POSITIONED IN THE SECOND LAYER OF CONTAINERS FROM THE TOP OF THE PALLET UNIT AND MUST HAVE ITS OVERALL HEIGHT REDUCED FROM 7-3/4" TO 6-7/8" FOR PALLET UNIT B, AND FROM 7-1/4" TO 7" FOR PALLET UNIT A. NOTE: 2" X 6" MATERIAL WILL BE SUBSTITUTED FOR THE 2" X 8" MATERIAL RIPPED TO 5-3/4" PIECES USED WHEN THE FILLER ASSEMBLY IS CONSTRUCTED WITH A HEIGHT OF 7" (FOR PALLET UNIT A ONLY).
4. A FOUR LAYER UNIT WILL HAVE THE TWO BUNDLING STRAPS OMITTED THAT WERE AROUND THE THIRD, FOURTH AND FIFTH LAYERS. THE REMAINING BUNDLING STRAPS WILL SURROUND THE SECOND THROUGH FOURTH LAYERS. A UNIT WITH THREE OR LESS LAYERS, DOES NOT REQUIRE BUNDLING STRAPS. THERE WILL BE NO CHANGES IN THE STABILIZING STRAP REQUIREMENTS.



DETAIL B

THIS DETAIL DEPICTS PROCEDURES TO BE USED WHEN A STANDARD PALLET UNIT MINUS TWO CONTAINERS IS TO BE UNITIZED. THE FILLER ASSEMBLY DEPICTED MUST BE INSTALLED IN THE MIDDLE OF THE TOP LAYER OF THE PALLET UNIT.

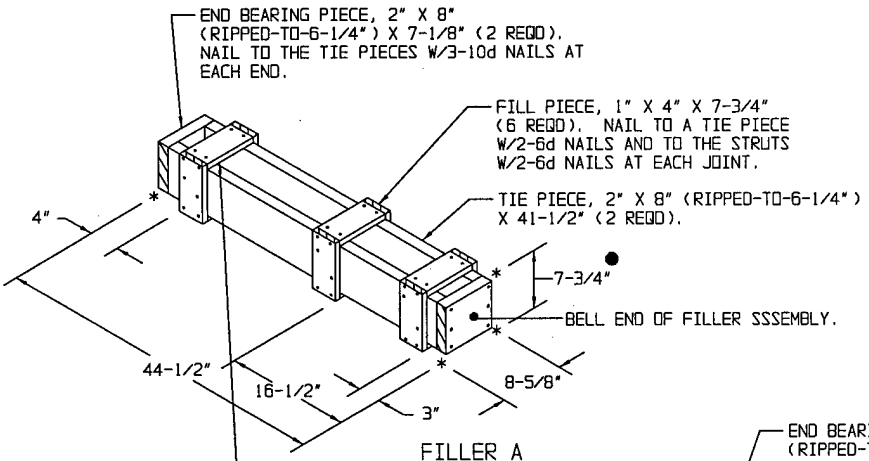


DETAIL C

THIS DETAIL DEPICTS PROCEDURES TO BE USED WHEN A STANDARD PALLET UNIT MINUS FOUR CONTAINERS IS TO BE UNITIZED. THE FILLER ASSEMBLIES DEPICTED MUST BE INSTALLED IN THE MIDDLE OF THE TOP LAYERS OF THE PALLET UNIT.

FILLERS AND INSTALLATION PROCEDURES FOR OMITTED CONTAINERS

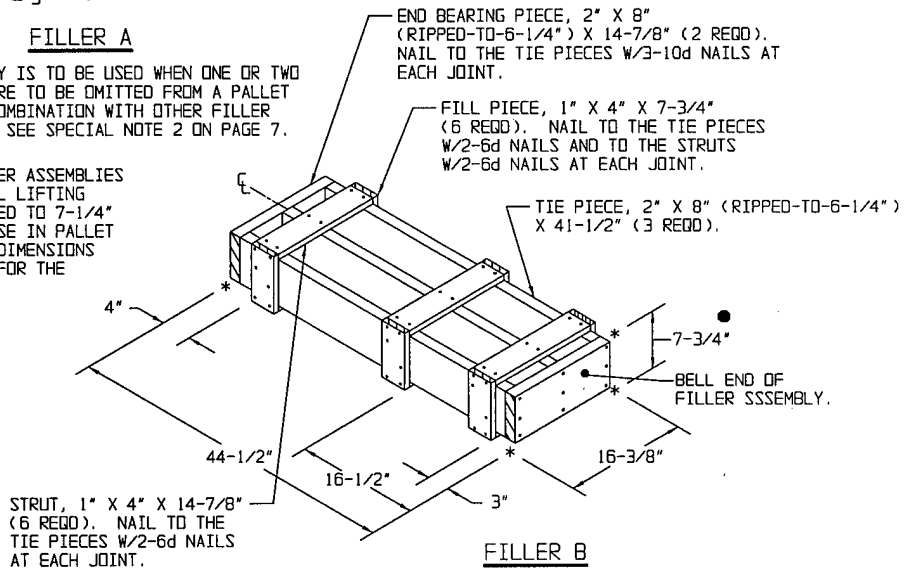
PROJECT FSA 63/7-66



FILLER A

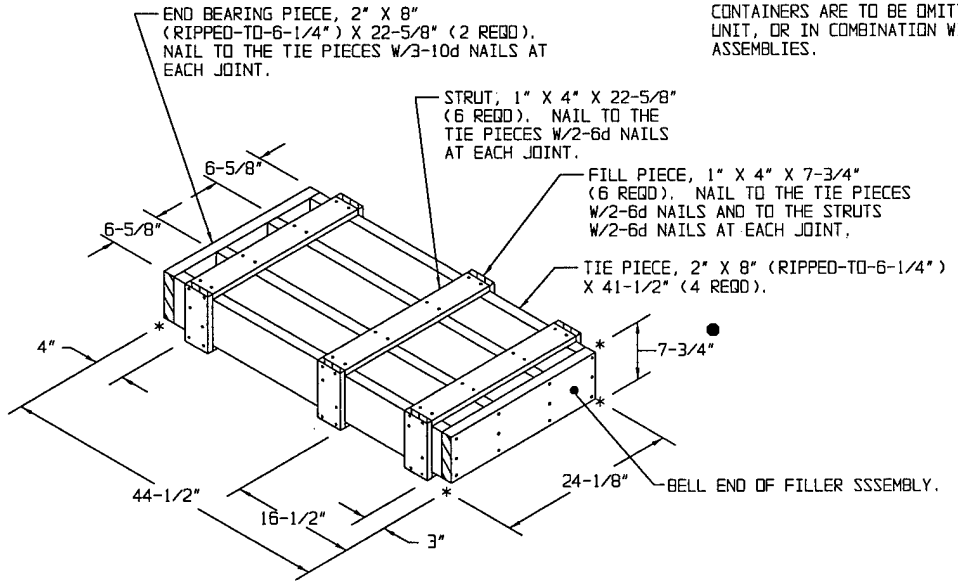
THIS ASSEMBLY IS TO BE USED WHEN ONE OR TWO CONTAINERS ARE TO BE OMITTED FROM A PALLET UNIT OR IN COMBINATION WITH OTHER FILLER ASSEMBLIES. SEE SPECIAL NOTE 2 ON PAGE 7.

● NOTE: THE 7-3/4" DIMENSION IS FOR FILLER ASSEMBLIES CONSTRUCTED FOR PALLET UNIT 8 (W/O METAL LIFTING FRAME). THIS DIMENSION MUST BE DECREASED TO 7-1/4" FOR FILLER ASSEMBLIES CONSTRUCTED FOR USE IN PALLET UNIT A (W/METAL LIFTING FRAME). OTHER DIMENSIONS MUST BE ADJUSTED AS NECESSARY TO ALLOW FOR THE 1/2" DECREASE IN HEIGHT.



FILLER B

THIS FILLER ASSEMBLY IS TO BE USED WHEN TWO CONTAINERS ARE TO BE OMITTED FROM A PALLET UNIT, OR IN COMBINATION WITH OTHER FILLER ASSEMBLIES.



FILLER C

THIS FILLER ASSEMBLY IS TO BE USED WHEN THREE CONTAINERS ARE TO BE OMITTED FROM A PALLET UNIT, OR IN COMBINATION WITH A "FILLER A" ASSEMBLY.

FILLERS AND INSTALLATION PROCEDURES FOR OMITTED CONTAINERS