FINAL REPORT
NOVEMBER 2004

REPORT NO. 04-30

NATO PALLET WITH JAVELIN MISSILES, MIL-STD-1660 TESTS

Prepared for:

Distribution Unlimited

Lockheed Martin Javelin Joint Venture
5600 Sand Lake Road
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VALIDATION ENGINEERING DIVISION
MCALESTER, OKLAHOMA 74501-9053

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Chief, Validation Engineering Division

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REPORT NO. 04-30 **NOVEMBER 2004**
NATO PALLET WITH JAVELIN MISSILES,
MIL-STD-1660 TESTS

ABSTRACT

The U.S. Army Defense Ammunition Center (DAC), Validation Engineering Division (SJMAC-DEV) conducted tests in accordance with MIL-STD-1660, "Design Criteria for Ammunition Unit Loads" on the NATO pallet with Javelin missiles. The NATO pallet was manufactured for the Lockheed Martin Javelin Joint Venture Office, Orlando, Florida. The Test Units were loaded to the correct weight of 660 lbs. The tests accomplished on the Test Units were the stacking, repetitive shock, edgewise-rotational drop, incline-impact, forklifting, and disassembly tests. The unitization procedures were provided by DAC, Transportation Engineering Division (SJMAC-DET).

Test Units #1, and #2 sustained minor damage during the repetitive shock and edgewise-rotational drop tests. The minor damage included cracking of the stringer boards and skid boards. The Test Units were incline-impacted with a block to allow direct impact on the pallet in lieu of impact on the containers. No significant damage was noted as a result of the incline-impact testing. During the forklifting tests, it was noted that the pallet bounced more that normally expected. Since the pallet only weighs 660 lbs., the pallet will move more than a heavier test load over a rough surface. One of the bottom skid boards was loose due to the pallet movement, but it was still intact. Caution should be taken when moving the pallet with a forklift over any rough surfaces.

As a result of the performance of the Test Units, the NATO pallet with Javelin missiles is recommended for use by Lockheed Martin Javelin Joint Venture Office.

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Reviewed by:

JERRY W. BEAVER
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U.S. ARMY DEFENSE AMMUNITION CENTER

VALIDATION ENGINEERING DIVISION
MCALESTER, OK 74501-9053

REPORT NO. 04-30

NATO PALLET WITH JAVELIN MISSILES, MIL-STD-1660 TESTS

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PART 1 – INTRODUCTION

A. BACKGROUND. The U.S. Army Defense Ammunition Center (DAC), Validation Engineering Division (SJMAC-DEV) conducted Engineering Evaluation Tests in accordance with MIL-STD-1660, "Design Criteria for Ammunition Unit Loads" on the NATO pallet with Javelin missiles. The NATO pallet was manufactured for the Lockheed Martin Javelin Joint Venture Office, Orlando, Florida. The Test Units were loaded to the correct weight of 660 lbs. The tests accomplished on the Test Units were the stacking, repetitive shock, edgewise-rotational drop, incline-impact, forklifting, and disassembly tests. The unitization procedures were provided by DAC, Transportation Engineering Division (SJMAC-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 the U.S. Army Defense Ammunition Center (DAC) 21 Nov 2000.

C. OBJECTIVE. The objective of the tests was to determine if the NATO pallet with Javelin missiles met the MIL-STD-1660 test requirements prior to the acceptance of the unitization procedures by the U.S. Army.

D. CONCLUSION. As a result of the performance of the Test Units, the NATO pallet with Javelin missiles is recommended for use by Lockheed Martin Javelin Joint Venture Office

PART 2 - ATTENDEES

DATE PERFORMED:

Test Unit 1 – 5-6 October, 2004

Test Unit 2 – 6-7 October, 2004

ATTENDEES	MAILING ADDRESS
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PART 3 - TEST PROCEDURES

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

A. STACKING TEST. The specimen will be tested to simulate a stack of identical unit loads stacked 16 feet high, for a period of one hour. This stacking load will be simulated by subjecting the unit load 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.

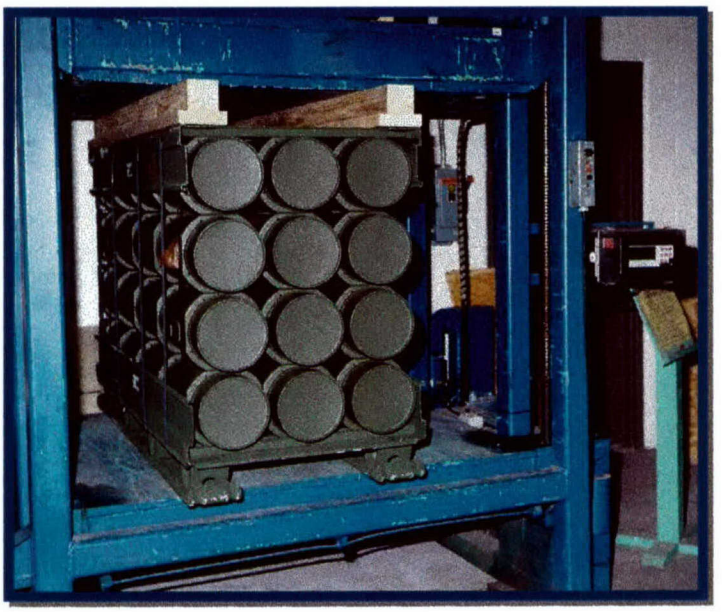

Photo 1. Example of Compression Tester.
(2.75-inch Hydra 70, PA151 Rocket Pallet in the compression tester.)

B. <u>REPETITIVE SHOCK TEST</u>. The repetitive shock test is conducted IAW Method 5019, Federal Standard 101. The test procedure is as follows: The test specimen will be placed on (not fastened to) the platform. With the load in one position, the platform will be vibrated at 1/2-inch amplitude (1-inch double amplitude) starting at a frequency of approximately 3 cycles-per-second. The frequency will be steadily increased until the package leaves the platform. The resonant frequency is 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. Midway into the testing period, the specimen will be rotated 90 degrees, and the test continued for the duration. Unless failure occurred, the total time of vibration will be three hours. Photo 2 shows an example of the repetitive shock test.

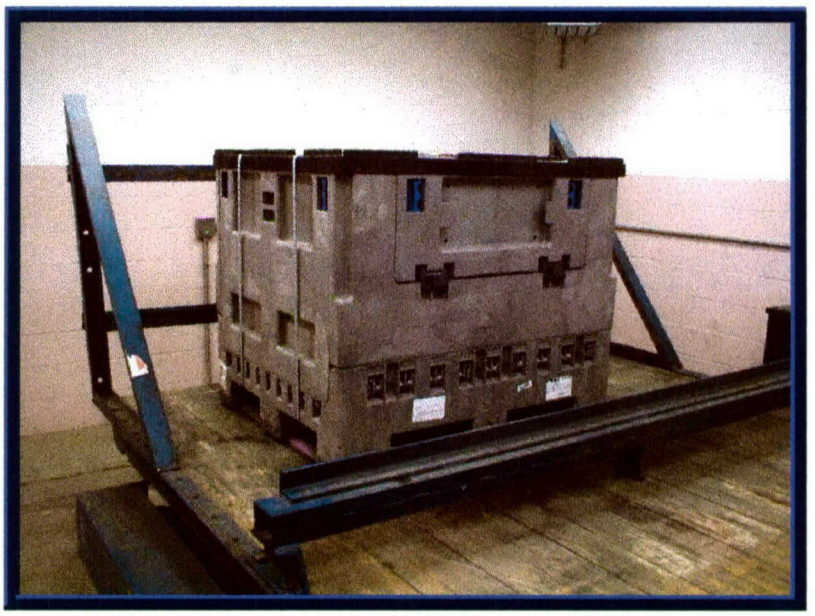

Photo 2. Example of the Repetitive Shock Test.
(Plastic Gemini Pallet Box)

C. <u>EDGEWISE ROTATIONAL DROP TEST</u>. 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 specimen 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 dropping takes place, but was not 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 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 limited	15	12
Above – 3,000		12	9

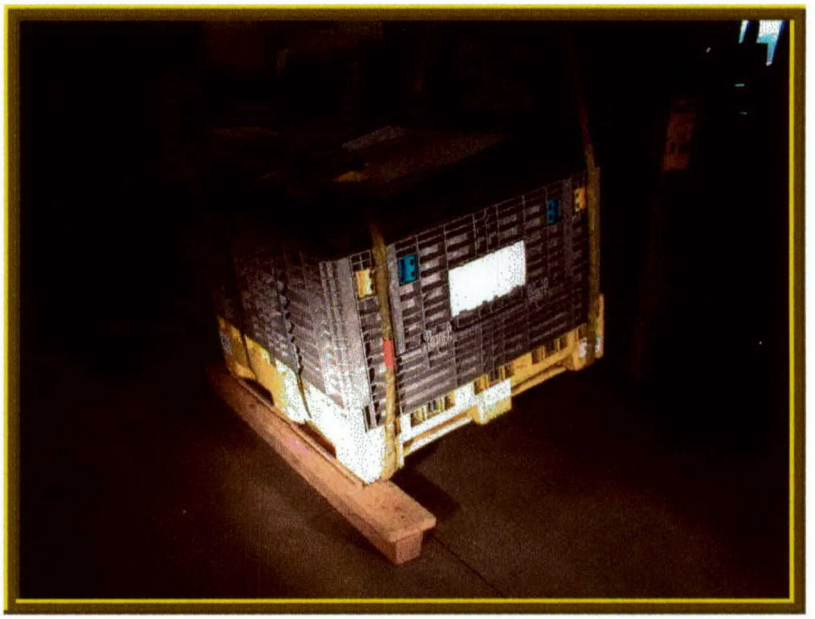

Photo 3. Example of Edgewise Rotational Drop Test (Plastic XYTEC 4845 Pallet Box)

D. <u>INCLINE-IMPACT TEST</u>. 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 specimen is 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 struck no part of the timber. The position of the container on the carriage and the sequence in which surfaces and edges were 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 was 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. <u>FORKLIFTING TESTS.</u> The specimen shall be lifted clear of the ground by a forklift from the end of the specimen and transported on the forks in the level or back-tilt position across a hard pavement for a distance of not less than 100 feet. The forklift will pass over the forklift hazard course as outlined in MIL-STD-1660. The hazard course will consist of parallel pairs of 1-inch boards spaced 54 inches apart and will be laid flatwise on the pavement across the path of the forklift. The first pair will be placed securely across the forklift's path and centered 30 feet from the starting point; the second pair will be laid 60 feet from the starting point at an angle of approximately 60 degrees to the path so the first wheel strikes first; and the third pair will be laid 90 feet from the starting point approximately 75 degrees to the path so the right wheel strikes first. The forklift will pass over the forklift hazard course 3 times in approximately 23 seconds, and then be brought to a stop. The load shall be observed for deflection and damage. The specimen will be rotated 90 degrees and the load lifted from the side and the above steps repeated.

F. <u>DISASSEMBLY TEST.</u> Following all rough handling tests the specimen 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 load will be such that it retains its unity upon removal of the strapping.

PART 4 - TEST EQUIPMENT

A. COMPRESSION TESTER.

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

B. TRANSPORTATION (REPETITIVE SHOCK) SIMULATOR.

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

C. INCLINED PLANE.

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

PART 5 - TEST RESULTS

A. CONTAINER DATA. The Test Units were inertly loaded to the specified design weight. Special care was taken to ensure that each individual interior ammunition container had the proper amount of weight in order to achieve a realistic pallet center of gravity (CG). Once properly prepared, the Test Unit was tested using MIL-STD-1660, "Design Criteria for Ammunition Unit Loads," requirements.

TEST UNIT #1:

Test Date:	23 March 2004	Container inertly loaded with:
Weight:	660 pounds	Sawdust and cardboard
Length:	55-1/2 inches	
Width:	45-5/8 inches	
Height:	42-3/8 inches	

TEST UNIT #2:

Test Date:	23 March 2004	Container inertly loaded with:
Weight:	660 pounds	Sawdust and cardboard
Length:	55-1/2 inches	
Width:	45-5/8 inches	
Height:	42-3/8 inches	

B. TEST RESULTS of TEST UNIT #1:

1. STACKING TEST. Test Unit #1 was compressed with a load force of 2,660 pounds for 60 minutes on 5 October 2004. There was no damage noted to the Test Unit as a result of this test. See Photo 5 below for a typical picture of the Test Unit in the compression tester.

Photo 5. Test Setup for Stacking Test.

2. **REPETITIVE SHOCK TEST**. Test Unit #1 was vibrated 90 minutes at 221 RPM in the longitudinal orientation and 90 minutes at 191 RPM in the lateral orientation on 5 October 2004. Minor damage occurred during the repetitive shock tests, including cracking of the stringer boards and skid boards. See Photo 6 for the test setup for the repetitive shock test.

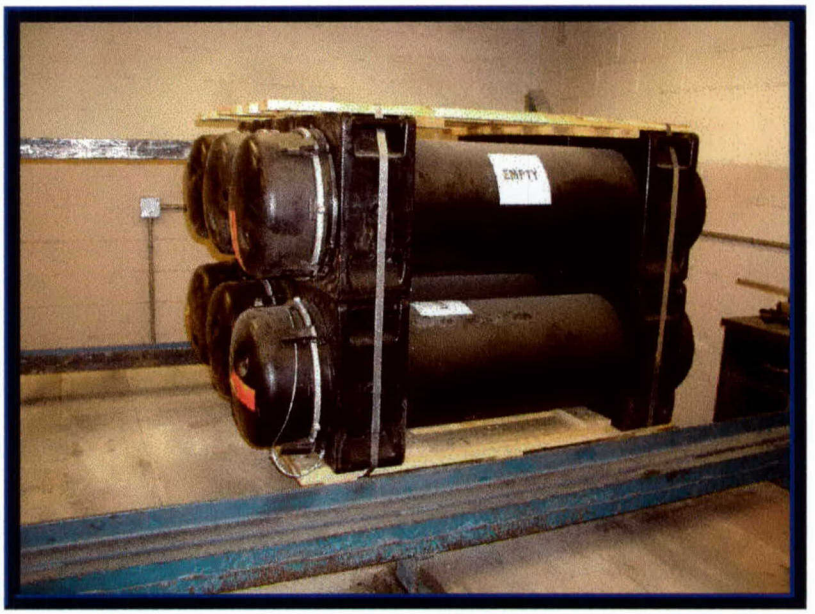

Photo 6. Test Setup for Repetitive Shock Tests.

3. **EDGEWISE ROTATIONAL DROP TEST**. Test Unit #1 was edgewise rotationally dropped from a height of 24 inches on both longitudinal sides and both lateral sides. Additional minor damage occurred during the drop tests, including the continued cracking of the stringer boards and skid boards. See Photo 7 for the test setup for the drop tests.

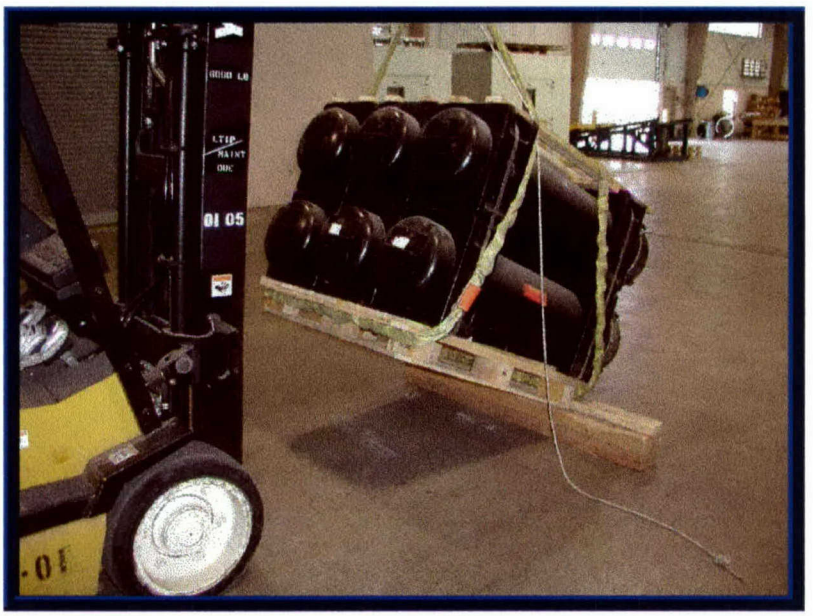

Photo 7. Test Setup for Edgewise Rotational Drop Testing.

4. **INCLINE-IMPACT TEST**. Test Unit #1 was incline-impacted on all four sides with the pallet impacting the stationary wall with a block placed to impact the pallet and not the container from a distance of 8 feet. No additional problems were encountered. See Photo 8 for test setup for incline-impact testing.

Photo 8. Test Setup for Incline-Impact Testing.

5. **FORKLIFTING TEST**. Test Unit #1 was lifted from the end of the pallet on the forks of the forklift truck and carried over the hazard course three times. During the forklifting tests it was noted that the pallet bounced more that normally expected. Since the pallet only weighs 660 lbs., the pallet will move more than a heavier test load over a rough surface. One of the bottom skid boards was loose due to the pallet movement, but it was still intact. Caution should be taken when moving the pallet with a forklift over any rough surfaces. The Test Unit was lifted from the opposite end of the pallet and the above steps accomplished with no additional problems encountered. See Photo 9 for the test setup during the forklifting test.

Photo 9. Test Setup for Forklifting Testing.

6. **SLING COMPATAIBILITY TEST:** No provision for utilizing slings. Test is not required.

7. **DISASSEMBLY TEST**. During the disassembly of Test Unit #1, no additional problems were noted.

8. **CONCLUSION**. Test Unit #1 passed all required tests.

C. TEST RESULTS of TEST UNIT #2:

1. **STACKING TEST**. Test Unit #2 was compressed with a load force of 2,660 pounds for 60 minutes on 6 October 2004. No damage was noted as a result of this test.

2. **REPETITIVE SHOCK TEST**. Test Unit #2 was vibrated 90 minutes at 221 RPM in the longitudinal orientation and 191 RPM in the lateral orientation. Minor

damage occurred during the repetitive shock tests including cracking of the stringer boards and skid boards.

3. **EDGEWISE ROTATIONAL DROP TEST**. Test Unit #2 was edgewise rotationally dropped from a height of 24 inches on both longitudinal sides and both lateral sides. Additional minor damage occurred during the drop tests, including the continued cracking of the stringer boards and skid boards.

4. **INCLINE-IMPACT TEST**. Test Unit #2 was incline-impacted on all four sides with the pallet impacting the stationary wall with a block placed to impact the pallet and not the container from a distance of 8 feet. No additional problems were encountered.

5. **FORKLIFTING TEST**. Test Unit #2 was lifted from the end of the pallet on the forks of the forklift truck and carried over the hazard course three times with the same results as with Test Unit #1. The Test Unit was lifted from the opposite end of the pallet and the above steps accomplished with no new problems encountered. Again, caution should be taken when moving the pallet on a forklift over any rough surfaces.

6. **SLING COMPATAIBILITY TEST:** No provision for utilizing slings. Test is not required.

7. **DISASSEMBLY TEST**. During the disassembly of Test Unit #2, no additional problems were noted.

8. **CONCLUSION**. Test Unit #2 passed all required tests.

PART 6– DRAWINGS

The following drawing represents the load configuration that was subjected to the test criteria.

JAVELIN

UNITIZATION PROCEDURES FOR GUIDED MISSILES PACKED ONE PER CYLINDRICAL PLASTIC CONTAINER, UNITIZED SIX CONTAINERS PER 4-WAY ENTRY NATO PALLET

INDEX

U.S. ARMY MATERIEL COMMAND DRAWING

APPROVED, U.S. ARMY AVIATION AND MISSILE COMMAND

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

U.S. ARMY DEFENSE AMMUNITION CENTER

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NOVEMBER 2004

CLASS	DIVISION	DRAWING	FILE
19	48	5275	GM20JV3

PROJECT GM 909-04

GENERAL NOTES

A. THIS DOCUMENT HAS BEEN PREPARED AND ISSUED IN ACCORDANCE WITH AR 740-1, AND AUGMENTS TM 743-200-1 (CHAPTER 5) AND CONFORMS TO MIL-STD-1660. THESE PROCEDURES ARE ONLY APPLICABLE TO FMS ITEMS, AND ARE NOT TO BE USED FOR U.S. STOCKS.

B. FOR DETAIL OF THE JAVELIN MISSILE ROUND SHIPPING CONTAINER, SEE MICOM DRAWING NO. 13303015.

CONTAINER DIMENSIONS - - 55.50" LONG X 15.20" WIDE X 18.24" HIGH (17.36" STACKING)

CONTAINER GROSS WEIGHT - - - - 88 LBS (APPROX)

CONTAINER MAXIMUM WEIGHT - - - 96 LBS

CONTAINER CUBE - - - - - - - - 8.90 CU FT (APPROX)

C. CAUTION: THIS ITEM IS IN A "PROPULSIVE STATE" AND MUST BE LOADED ON THE PALLET WITH THE FORWARD END OF ALL CONTAINERS FACING IN ONE DIRECTION.

D. THE FOLLOWING AMC DRAWINGS ARE APPLICABLE FOR OUTLOADING AND STORAGE OF THE ITEMS COVERED BY THIS DRAWING.

CARLOADING - - - - - - - - - - - - - -	19-48-5995-GM5JV2
TRUCKLOADING - - - - - - - - - - - - -	19-48-5996-GM11JV2
STORAGE - - - - - - - - - -	19-48-5271-GM1-3-4-14-22JV2
END OPENING ISO CONTAINER - - - -	19-48-5998-GM15JV5
MILVAN - - - - - - - - - - - - - - -	19-48-5997-GM15JV4
SIDE OPENING ISO CONTAINER - - - -	19-48-5999-GM15JV6
TACTICAL VEHICLE - - - - - - - - - -	19-48-8218-GM17JV2

E. 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.

F. DIMENSIONAL LUMBER SPECIFIED THROUGHOUT THIS PROCEDURAL DRAWING IS OF A NOMINAL SIZE, UNLESS OTHERWISE SPECIFIED. FOR EXAMPLE, 1" X 4" MATERIAL IS ACTUALLY 3/4" THICK BY 3-1/2" WIDE AND 2" X 4" MATERIAL IS ACTUALLY 1-1/2" THICK BY 3-1/2" WIDE.

G. CONVERSION TO METRIC EQUIVALENTS: DIMENSIONS WITHIN THIS DOCUMENT ARE EXPRESSED IN INCHES AND WEIGHTS ARE EXPRESSED IN POUNDS. WHEN NECESSARY, THE METRIC EQUIVALENTS MAY BE COMPUTED ON THE BASIS OF ONE INCH EQUALS 25.4MM, AND ONE POUND EQUALS 0.454 KG.

H. ALTHOUGH THE CONTAINERS DEPICTED IN THE UNIT LOAD ON PAGE 3 ARE CONSTRUCTED WITH INTERLOCKING DEVICES, THE INTERLOCKS WILL NOT FUNCTION PROPERLY UNLESS THE CONTAINERS ARE POSITIONED SO THAT THE PINS OF THE INTERLOCKS ARE FACING UPWARD. THIS ORIENTATION WILL AID IN THE PREVENTION OF CONTAINER MOVEMENT, BOTH LATERALLY AND LONGITUDINALLY, DURING SHIPMENT OF THE UNIT LOAD.

(CONTINUED AT RIGHT)

MATERIAL SPECIFICATIONS

PALLET - - - - - - -:	NATO STANDARD, 1814KG. SEE DEFENCE CLOTHING AND TEXTILES AGENGY (S&TD) DRAWING AO/11130.
LUMBER - - - - - - -:	SEE TM 743-200-1 (DUNNAGE LUMBER) AND VOLUNTARY PRODUCT STANDARD PS 20.
NAILS - - - - - - -:	ASTM F1667; COMMON STEEL NAIL (NLCMS OR NLCMMS). ALT: UNDERLAYMENT NAIL (NLUL), PALLET NAIL (NLPL), OR COOLER NAIL (NLCL) OF SAME SIZE.
STRAPPING, STEEL -:	ASTM D3953; FLAT STRAPPING, TYPE 1, HEAVY DUTY, FINISH B (GRADE 1 OR 2), SIZE 3/4" X .035" OR .031".
SEAL, STRAP - - - -:	ASTM D3953; CLASS H, FINISH B (GRADE 1 OR 2), DOUBLE NOTCH TYPE, STYLE I, II, III, OR IV. ALTERNATIVE SEAL FINISH: SIGNODE PAINTED SEALS MAY BE USED AS AN ALTERNATIVE IF ALL SURFACES ARE PAINTED. GRITTED BACKING IS NOT PERMITTED.
STAPLE - - - - - - -:	ASTM F1667; STFCS-189 OR STFCS-207, 15/16" OR 1" CROWN WIDTH X 3/4" LEG LENGTH TYPE IV, STYLE 3, ANY FINISH.
ANTI-CHAFING MATERIAL - - - - - -:	MIL-B-121 (OR EQUAL); NEUTRAL BARRIER MATERIAL.

(GENERAL NOTES CONTINUED)

J. WHEN ASSEMBLING A COMPLETE PALLET UNIT, CARE SHALL BE TAKEN TO ENSURE THAT THE CONTAINERS AND DUNNAGE ASSEMBLIES OR PIECES ARE EVENLY ALIGNED SO THAT THE SIDES AND ENDS OF THE PALLET UNIT DO NOT EXCEED A 1/2" TOLERANCE, RELATIVE TO THE PALLET.

K. INSTALL EACH TIEDOWN STRAP TO PASS UNDER THE DECK BOARDS OF THE PALLET. NOTE THAT THE STRAPS WILL BE LOCATED APPROXIMATELY AS SHOWN, THREADED THROUGH THE TOP CONTAINER HANDLES. STRAP ALIGNMENT MUST CONFORM WITH THE TOLERANCE STANDARDS SPECIFIED ON PAGE 5.

L. WHEN APPLYING ANY STRAP, CARE MUST BE EXERCISED TO ASSURE THAT THE END OF THE STRAP ON THE UNDERSIDE OF THE JOINT EXTENDS AT LEAST 6" BEYOND THE SEAL. THIS EXTRA MINIMUM LENGTH OF STRAP IS REQUIRED TO PERMIT SUBSEQUENT TIGHTENING OF LOOSENED STRAPPING. RETENSIONING CAN BE ACCOMPLISHED WITHOUT REPLACING STRAPPING OR SPLICING STRAPPING THROUGH THE USE OF A MANUAL OR PNEUMATIC FEEDWHEEL TYPE TENSIONING TOOL AND THE APPLICATION OF ONE ADDITIONAL SEAL.

M. IN ORDER TO OBTAIN COMPACT (SOUND) UNITS, ALL STRAPS SHALL BE LOCATED IN PROPER ALIGNMENT AND TENSIONED UNTIL THEY CUT INTO THE EDGE OF THE DUNNAGE ASSEMBLY AND THE PALLET DECK. AFTER TENSIONING, ALL STRAPS WILL BE SECURED USING ONE SEAL AND TWO PAIR OF NOTCHES PER SEAL. ALL STRAPPING MUST BE STRAIGHT WITHIN 1" ON ANY SURFACE OF THE UNITIZED LOAD I.E., TOP, BOTTOM, SIDES, OR ENDS THAT IT ENCOMPASSES.

N. REFER TO DAC DRAWING ACV00617 FOR APPROVED SOURCES FOR SEALLESS (CLIPLESS) SEALING TOOL. THESE APPROVED SEALING TOOLS CAN BE USED IN PLACE OF SEAL CURRENTLY SPECIFIED IN THE MATERIAL SPECIFICATIONS LISTED AT LEFT.

O. 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.

P. DIMENSIONS GIVEN FOR DUNNAGE ASSEMBLIES AND THE PALLET DUNNAGE LOCATION WILL BE FIELD CHECKED PRIOR TO ASSEMBLY OF PALLET UNITS. CONTAINERS MUST FIT SNUGLY AGAINST THE DUNNAGE ASSEMBLIES.

Q. UNLESS OTHERWISE SPECIFIED, A PLUS-OR-MINUS 1/4" IS ALLOWED ON OVERALL DIMENSIONS OF ANY PIECE OF DUNNAGE OR DUNNAGE ASSEMBLY. HOWEVER, SIMILAR PIECES IN AN ASSEMBLY MUST BE WITHIN 1/8" OF THE SAME DIMENSION.

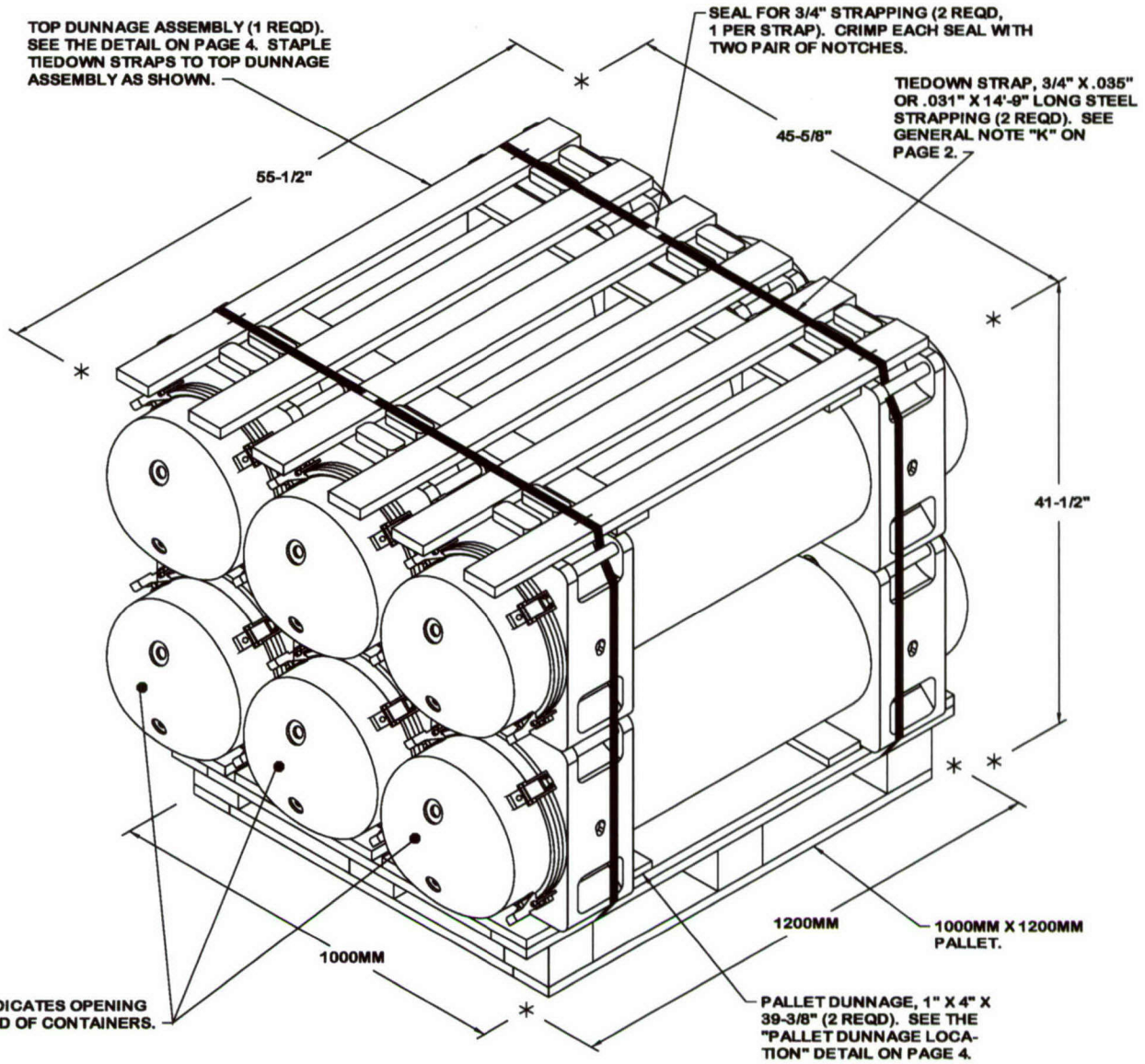
R. ALL NON-MANUFACTURED WOOD USED IN THE PALLETIZED LOAD SHALL BE HEAT TREATED TO A CORE TEMPERATURE OF 56 DEGREES CELSIUS FOR A MINIMUM OF 30 MINUTES OR BE FUMIGATED WITH METHYL BROMIDE IAW THE REQUIREMENTS OF ISPM PUBLICATION NO. 15. THE PALLET MANUFACTURER AND THE MANUFACTURER OF WOOD USED TO BUILD FILLER ASSEMBLIES AND DUNNAGE ASSEMBLIES FOR THE PALLETIZED LOAD SHALL ENSURE TRACEABILITY TO THE ORIGINAL SOURCE OF HEAT TREATMENT. EACH PALLET, FILLER ASSEMBLY, OR DUNNAGE ASSEMBLY SHALL BE MARKED TO SHOW THE CONFORMANCE TO THE INTERNATIONAL PLANT PROTECTION CONVENTION STANDARD. PALLETS, FILLER ASSEMBLIES, AND DUNNAGE ASSEMBLIES MADE OF NON-MANUFACTURED WOOD SHALL BE HEAT TREATED AND MARKED APPROPRIATELY. THE QUALITY MARK FOR THE PALLET SHALL BE PLACED ON TWO OPPOSITE END POSTS. THE QUALITY MARK FOR THE FILLER ASSEMBLIES AND DUNNAGE ASSEMBLIES SHALL BE PLACED ON TWO OPPOSITE SIDES, AND BE VIEWABLE WHEN INSTALLED.

S. ALL NAILS DRIVEN INTO THE DUNNAGE ASSEMBLIES, FILLER ASSEMBLIES, OR PALLET SHALL BE DRIVEN SO THAT THE NAILHEADS ARE FLUSH OR SLIGHTLY BELOW THE SURFACE OF THE PIECE THAT THEY ARE BEING DRIVEN THROUGH.

T. ANTI-CHAFING MATERIAL MAY BE INSTALLED AT POINTS OF CONTACT BETWEEN CONTAINERS, BETWEEN CONTAINERS AND DUNNAGE, AND BETWEEN CONTAINERS AND STEEL STRAPPING, TO PREVENT CHAFING DAMAGE TO CONTAINER AND MARKINGS.

U. A UNIT LOAD, SUCH AS THE LAST UNIT LOAD FOR AN AMMUNITION LOT, CAN BE ASSEMBLED WITH FEWER LAYERS THAN SPECIFIED FOR THE BASIC UNIT LOAD. THE UNIT LOAD CAN ALSO BE ASSEMBLED WITH A PARTIAL TOP LAYER PROVIDING IT IS TO BE SHIPPED WITHIN CONUS TO A DEPOT, DEPOT ACTIVITY, POST, CAMP, OR STATION. FOR OCONUS OR FOREIGN MILITARY SALES (FMS) SHIPMENTS, HOWEVER, THE UNIT LOAD MUST NOT BE ASSEMBLED WITH A PARTIAL LAYER. EMPTY CONTAINERS OR FILLER ASSEMBLIES WILL BE USED TO ACHIEVE FULL-LAYER CONFIGURATION. FOR ADDITIONAL GUIDANCE, SEE GENERAL NOTE "V" ON PAGE 3 AND THE DETAILS ON PAGES 5 AND 6.

(CONTINUED ON PAGE 3)



(GENERAL NOTES CONTINUED FROM PAGE 2)

V. IF LESS THAN SIX CONTAINERS ARE TO BE LOADED ON A PALLET, IT SHALL BE ACCOMPLISHED BY SUBSTITUTING FILLER ASSEMBLIES, AS DEPICTED ON PAGE 5, FOR ONE OR TWO OMITTED CONTAINERS, EXCEPT AS OTHERWISE STATED WITHIN GENERAL NOTE "U" ON PAGE 2. HOWEVER, IF MORE THAN TWO CONTAINERS ARE TO BE OMITTED, A COMPLETE LAYER OF CONTAINERS MUST BE OMITTED. FILLER ASSEMBLIES WILL BE POSITIONED WITHIN THE UNIT LOAD AS DEPICTED IN THE DETAILS ON PAGE 6. NOTE: EMPTY OR REJECT CONTAINERS MAY BE USED IN PLACE OF FILLER ASSEMBLIES AS NECESSARY. WHEN (EMPTY) FILLER CONTAINERS ARE USED IN PLACE OF OMITTED CONTAINERS TO COMPLETELY FILL OUT A LAYER ON A PALLET, THEY WILL BE MARKED AS SPECIFIED IN ARDEC DRAWING NO. 12982865.

W. IF UNITIZING OPERATIONS ARE BEING PERFORMED IN SUPPORT OF A SHIPMENT OF ITEMS FOR TROOP USE AT A CAMP, POST OR STATION, AND, IF IN ADDITION TO FULL LAYER UNITS SPECIFIED IN GENERAL NOTE "U" ON PAGE 2, A FEW LOOSE CONTAINERS ARE REQUIRED TO SATISFY THE QUANTITY REQUISITIONED, THE LOOSE CONTAINERS NEED NOT BE UNITIZED. HOWEVER, THE METHOD FOR BRACING AND STAYING OF THE LOOSE CONTAINERS WITHIN THE LOAD TO BE SHIPPED MUST COMPLY WITH THE METHODS SPECIFIED WITHIN THE APPLICABLE 19-48 SERIES OUTLOADING PROCEDURAL DRAWING.

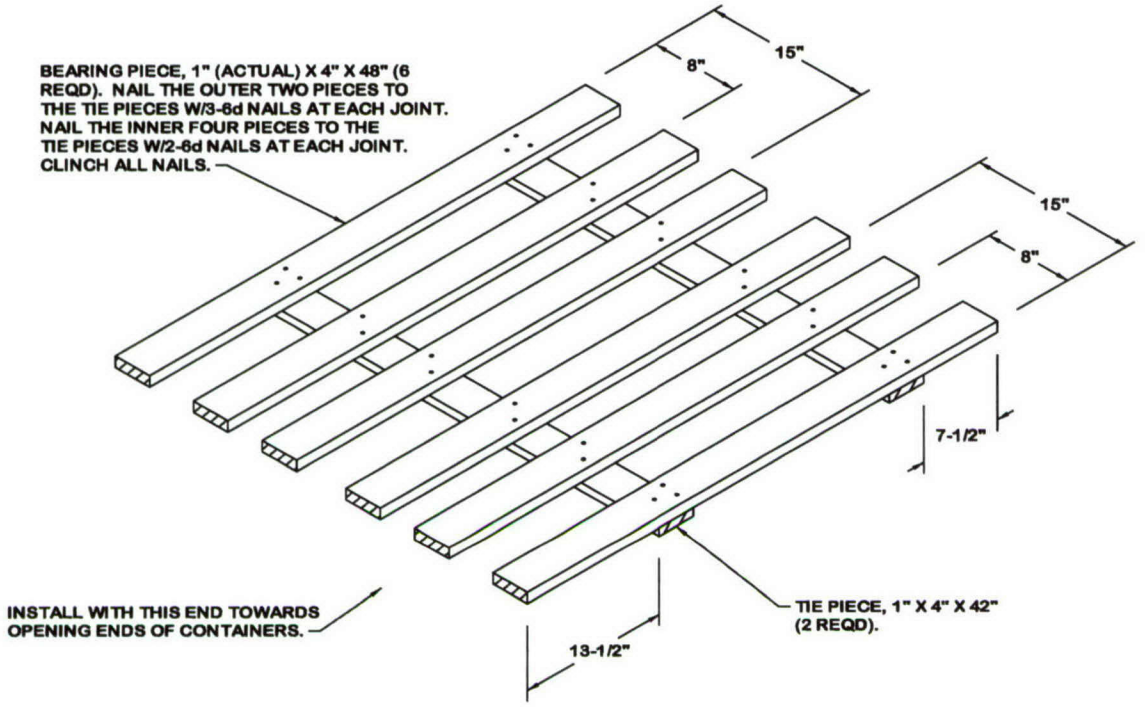
X. PALLETIZED UNITS OF MISSILES ARE LIMITED TO ONE LOT PER PALLET UNIT, EXCEPT WHERE REQUIRED BY BALLISTIC SAMPLE SHIPMENT OR TROOP USE AT POST, CAMP, OR STATION, OR AS REQUIRED WITHIN GOVERNMENT CONTRACT PRIOR TO GOVERNMENT ACCEPTANCE.

PALLET UNIT

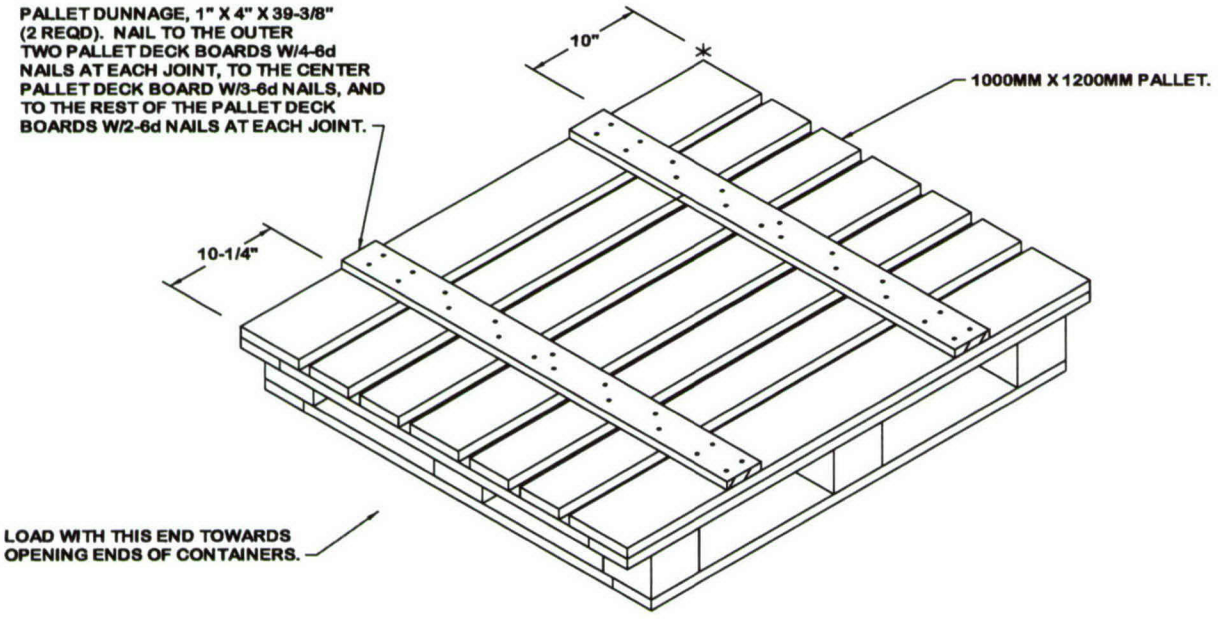
SEE GENERAL NOTE "E" ON PAGE 2.

6 JAVELIN CONTAINERS @ 88 LBS	528 LBS (APPROX)
DUNNAGE	34 LBS
PALLET	57 LBS
TOTAL WEIGHT	619 LBS (APPROX)
CUBE	60.8 CU FT (APPROX)

BILL OF MATERIAL		
LUMBER	LINEAR FEET	BOARD FEET
1" X 4" 1" (ACTUAL) X 4"	13.56 24.00	4.52 10.67
NAILS	NO. REQD	POUNDS
6d (2")	66	0.39
PALLET, 1000MM X 1200MM - - - 1 REQD - - - -		57 LBS
STEEL STRAPPING, 3/4" - 29.67' REQD - - - -		2.65 LBS
SEAL FOR 3/4" STRAPPING - - - 2 REQD - - - - -		NIL
STAPLE, 15/16" X 3/4" - - - - 4 REQD - - - - -		NIL

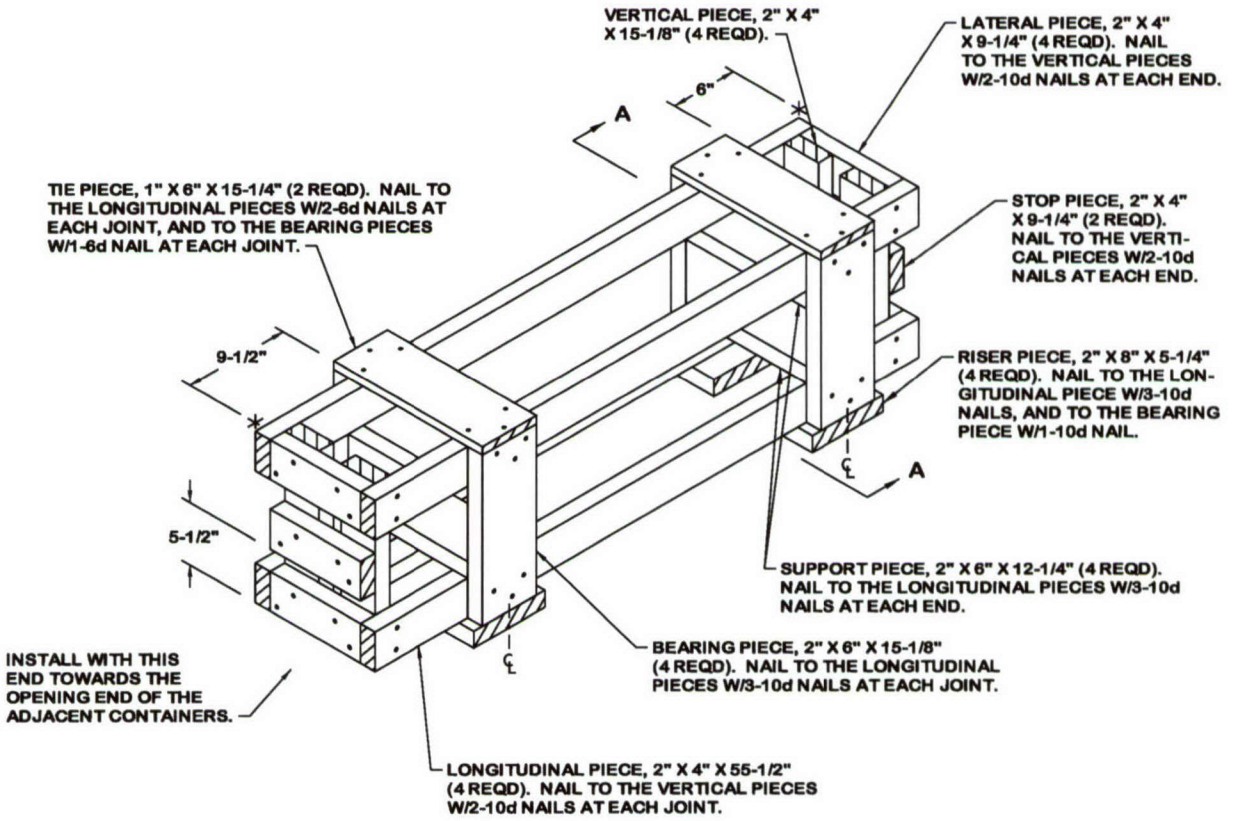


TOP DUNNAGE ASSEMBLY



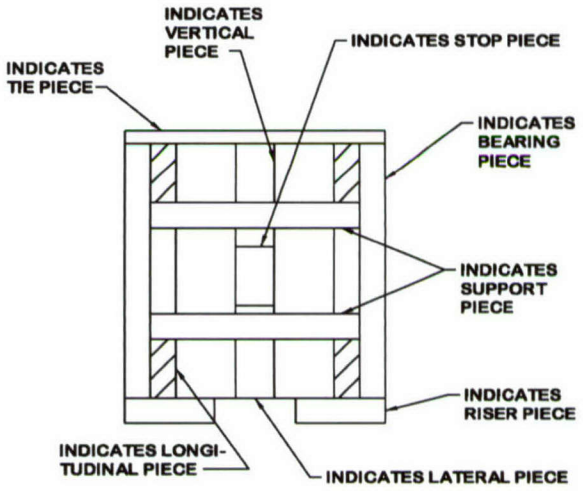
PALLET DUNNAGE LOCATION

NOTE: THE QUANTITY OF NAILS USED TO SECURE THE PALLET DUNNAGE DEPICTED ABOVE MAY BE INCREASED, IF DESIRED. DO NOT, HOWEVER, EXCEED 4-6d NAILS PER DECK BOARD/PALLET DUNNAGE JOINT.

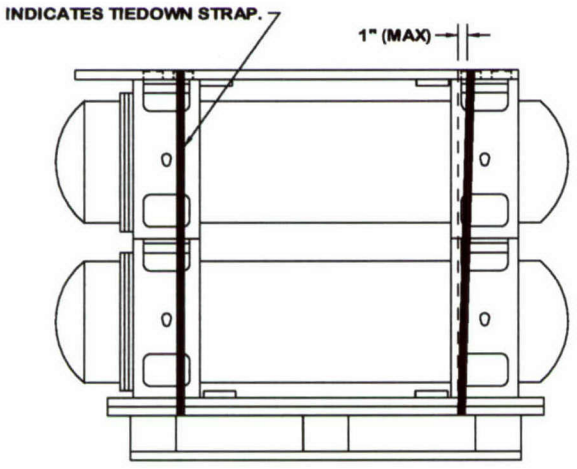


FILLER ASSEMBLY

THIS ASSEMBLY IS TO BE USED WHEN ONE CONTAINER IS TO BE OMITTED FROM A PALLET UNIT OR IN COMBINATION WITH OTHER FILLER ASSEMBLIES. NOTE: FILLER ASSEMBLY DIMENSIONS MUST BE FIELD CHECKED PRIOR TO ASSEMBLY.



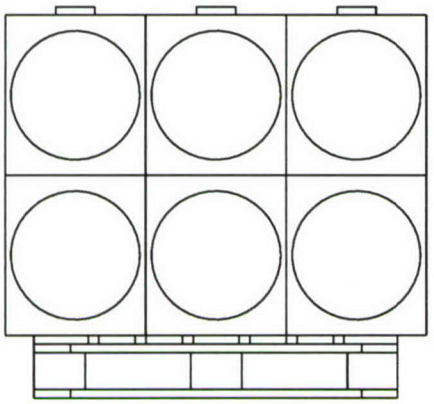
VIEW A-A



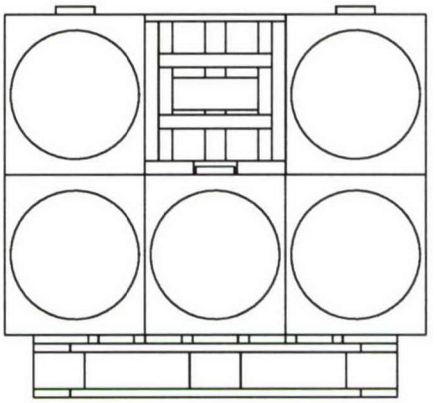
STRAP ALIGNMENT TOLERANCE

TIEDOWN STRAPS MUST BE WITHIN 1" OF VERTICAL ALIGNMENT.

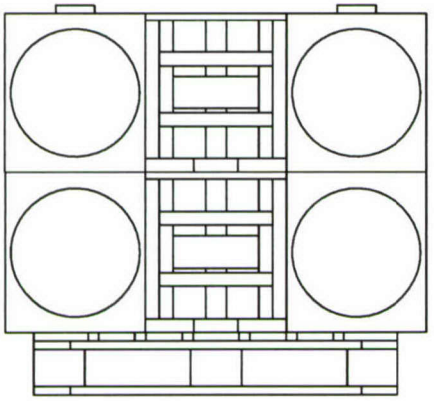
NOTE: ALL DUNNAGE AND STRAPPING HAVE BEEN OMITTED FROM THE SIX PALLET UNITS BELOW FOR CLARITY PURPOSES.



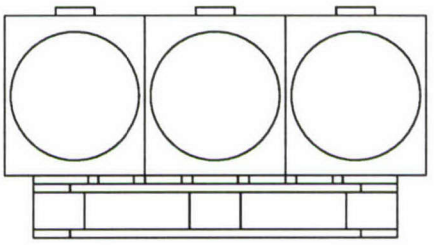
FULL PALLET UNIT



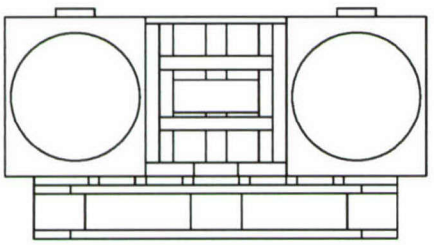
PALLET UNIT MINUS ONE CONTAINER



PALLET UNIT MINUS TWO CONTAINERS

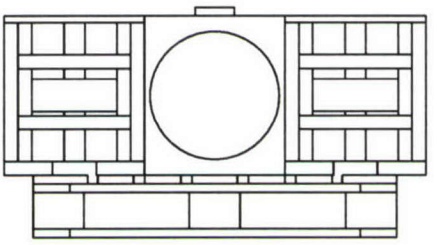


PALLET UNIT MINUS THREE CONTAINERS



PALLET UNIT MINUS FOUR CONTAINERS

NOTE: THE "PROCEDURES FOR SHIPMENT OF LEFTOVER CONTAINERS" DEPICTED IN THE PERTINENT OUTLOADING DRAWINGS MAY BE USED TO TRANSPORT TWO LEFTOVER CONTAINERS INSTEAD OF THE PROCEDURES SHOWN ABOVE. SEE GENERAL NOTE "W" ON PAGE 3.



PALLET UNIT MINUS FIVE CONTAINERS

NOTE: THE "PROCEDURES FOR SHIPMENT OF LEFTOVER CONTAINERS" DEPICTED IN THE PERTINENT OUTLOADING DRAWINGS MAY BE USED TO TRANSPORT ONE LEFTOVER CONTAINERS INSTEAD OF THE PROCEDURES SHOWN ABOVE. SEE GENERAL NOTE "W" ON PAGE 3.

ASSEMBLY OF FULL AND LESS-THAN-FULL PALLET UNITS