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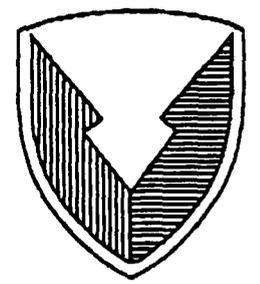
MIL-STD-1660 TEST OF
UNITIZATION PROCEDURES FOR
GROUND EMPLACED MINE
SCATTERING SYSTEM (GEMSS)

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U.S. Army Armament Research, Development and
Engineering Center
ATTN: SMCAR-ESK
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US ARMY
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EVALUATION DIVISION
SAVANNA, ILLINOIS 61074-9639

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19. ABSTRACT (Continue on reverse if necessary and identify by block number) The U.S. Army Defense Ammunition Center and School (USADACS), Evaluation Division (SMCAC-DEV), has been tasked by the U.S. Army Armament Research, Development and Engineering Center (ARDEC), Rock Island, IL, to test unitization procedures for shipping GEMSS mine containers in a configuration of 3-wide by 2-high. The methods and results of MIL-STD-1660 testing of the unitization procedures developed by the Storage and Outloading Division (SMCAC-DEO) are contained within this report. As a result of these tests, the Evaluation Division is recommending that this unitization procedure be approved for Army-wide use in storing and shipping GEMSS mine containers.			
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REPORT NO. EVT 41-88
ENGINEERING TEST OF UNITIZATION PROCEDURES FOR GEMSS
MINE CONTAINERS

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PART 1

INTRODUCTION

A. BACKGROUND. The U.S. Army Defense Ammunition Center and School (USADACS), Evaluation Division, was tasked by the U.S. Army Armament Research, Development and Engineering Center (ARDEC), SMCAR-ESK, to test unitization procedures for GEMSS mine containers. Unitization procedures for GEMSS mine containers in configurations of 3 wide by 2 high were developed by the Storage and Outloading Division, SMCAC-DEO. The testing procedures that were used for evaluating the GEMSS unitization procedures consisted of MIL-STD-1660, Design Criteria for Ammunition Unit Loads.

B. AUTHORITY. This test was conducted in accordance with mission responsibilities delegated by the U.S. Army Armament, Munitions and Chemical Command (AMCCOM), Rock Island, IL.

C. OBJECTIVE. The objective of these tests is to assess the capability of the GEMSS unitization procedures to meet Army functional/operational requirements for MIL-STD-1660, Design Criteria for Ammunition Unit Loads.

Legend: Test results

PART 2

ATTENDEES

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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). MIL-STD-1660 identifies four steps the unitized load must undergo if it is considered to be acceptable. These tests are synopsized below:

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

2. REPETITIVE SHOCK TEST. The repetitive shock test shall be conducted in accordance with Method 5019, Federal Standard 101. The test procedure is as follows: The test specimen shall be placed on, but not fastened to, the platform. With the specimen in one position, vibrate the platform at 1/2-inch amplitude (1-inch double amplitude) starting at a frequency of about 3-cycles-per-second. Steadily increase the frequency until the package leaves the platform. The resonant frequency is achieved when a 1/16-inch-thick feeler may be momentarily slid freely between every point on

the specimen in contact with the platform at some instance during the cycle or a platform acceleration achieves one plus or minus zero point one G. Midway into the testing period the specimen shall be rotated 90 degrees and the test continued for the duration. Unless failure occurs, the total time of vibration shall be two hours if the specimen is tested in one position; and, if tested in more than one position, the total time shall be three hours.

3. EDGEWISE DROP TEST. This test shall be conducted by using the procedures of Method 5008, Federal Standard 101. The procedure for the Edgewise Drop (Rotational) Test is as follows: The specimen shall be placed on its bottom with one end of the base of the container supported on a sill nominally 6 inches high. The height of the sill shall be increased, if necessary, to ensure that there will be no support for the base between the ends of the container when dropping takes place, but should not be high enough to cause the container to slide on the supports when the dropped end is raised. The unsupported end of the container shall then be 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 shall conform to the following tabulation:

Table 1: Drop Levels

<u>GROSS WEIGHT</u> <u>NOT EXCEEDING</u>	<u>DIMENSIONS ON ANY EDGE</u> <u>NOT EXCEEDING</u>	<u>HEIGHT OF DROP LEVEL</u> <u>A PROTECTION</u>
600 lbs.	72 inches	36 inches
3,000 lbs.	no limit	24 inches
no limit	no limit	12 inches

4. IMPACT TEST. This test shall be 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 shall be placed on the carriage with the surface or edge which is to be impacted projecting at least 2 inches beyond the front end of the carriage. The carriage shall be brought to a predetermined position on the incline and released. If it is desired to concentrate the impact on any particular position on the container, a 4x4-inch timber may be attached to the bumper in the desired position before the test. No part of the timber shall be struck by the carriage. The position of the container 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 will depend upon the objective of the tests. When the test is to determine satisfactory requirements for a container or pack, and, unless otherwise specified, the specimen shall be 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 shall be 7-feet-per-second.

PART 4

TEST EQUIPMENT

1. TEST SPECIMEN.

- a. Drawing Number: 19-48-4138/89
- b. Width: 28-1/2 inches
- c. Length: 39-1/2 inches
- d. Height: 39-1/2 inches
- e. Weight: 1495 pounds

2. COMPRESSION TESTER.

- a. Manufacturer: Ormond Manufacturing
- b. Platform: 60 inches by 60 inches
- c. Compression Limit: 50,000 pounds
- d. Tension Limit: 50,000 pounds

3. TRANSPORTATION SIMULATOR.

- a. Manufacturer: Gaynes Laboratory
- b. Capacity: 6,000-pound pallet
- c. Displacement: 1/2-inch Amplitude
- d. Speed: 50 to 400 rpm
- e. Platform: 5 foot by 8 foot

4. INCLINED RAMP.

- a. Manufacturer: Conbur Incline
- b. Type: Impact Tester
- c. Grade: 10 percent Incline
- d. Length: 12-foot Incline

PART 5

TEST RESULTS

1. STACKING TEST. The test pallet was loaded to 7,300 pounds compression for a period of one hour. At the end of the one hour period, the compression load had decreased to 6,300 pounds, but the unit load had not measurably compressed.

2. REPETITIVE SHOCK TEST. The test pallet successfully passed both the longitudinal and lateral transportation simulation. Duration of the test was 90 minutes for each orientation of the pallet. In order to achieve the required 1/16-inch clearance between the pallet and the Transportation Simulator bed, the equipment was operated at 260 rpm for the longitudinal orientation and 235 rpm for the lateral orientation. The only damage noted during the test was the displacement of several of the nails that held the riser and side pieces in place.

3. EDGEWISE DROP TEST. Each side of the pallet base was placed on a beam displacing it 6 inches above the floor. The opposite side was raised to a height of 24 inches above the floor and then dropped. This process was repeated in a clockwise direction until all four sides of the pallet had been tested. The damage to the pallet was limited to broken skid tips on both sides of the pallet.

4. IMPACT TEST. The incline impact tester was set to allow the pallet to travel 8 feet before impacting the bumper of the impact tester. In between impacts, the pallet

was rotated in a clockwise direction until all four sides of the pallet had been impacted.

No damage was sustained during the test.

PART 6

CONCLUSIONS AND RECOMMENDATIONS

1. CONCLUSIONS. The test pallet successfully passed all phases of the MIL-STD-1660 criteria for ammunition unit loads. The only damage to the pallet was noted during the edgewise drop test. The damage consisted of broken wing tips and was not considered as a basis for rejecting the pallet.

2. APPROVAL. Since the pallet successfully passed all phases of the MIL-STD-1660 test, the unitization procedures tested for GEMSS containers are approved for Army-wide use.

PART 7

PHOTOGRAPHS

Photos unavailable due to camera malfunction.

PART 8

DRAWINGS

APPENDIX 89

UNITIZATION PROCEDURES FOR BOXED AMMUNITION AND COMPONENTS ON SKIDDED BASES

MINES, M74, M75 AND M79, PACKED 40 PER
METAL BOX, UNITIZED 6 BOXES PER TYPE II
SKID BASE; APPROX BOX SIZE $27\frac{3}{8}$ " L X $13\frac{3}{4}$ " W
X $13\frac{3}{8}$ " H

SKIDDED UNIT DATA						
ITEMS INCLUDED		HAZARD CLASSIFICATION ①				WEIGHT (LBS)
NSN	DODIC	DOT CLASS	CG CLASS	QD CLASS	COMP GROUP	
1345-						
01-076-3497	K151	A	VII	1.1	D	1,222
01-078-4104	K184	A	VII	1.1	D	1,438
01-074-9370	K234	INERT				1,330

NOTICE: THIS APPENDIX CANNOT STAND ALONE BUT MUST BE USED
IN CONJUNCTION WITH THE BASIC UNITIZATION PROCEDURES
DRAWING 19-48-4138-20PA1000.

① 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				DATE	BY	APPROVED BY	TITLE

TIEDOWN STRAP, 3/4" X .035" OR .031" X 13'-2" LONG STEEL STRAPPING (4 REQD.). SEE GENERAL NOTE "K" AT RIGHT.

SEAL FOR 3/4" STRAPPING (6 REQD., 1 PER STRAP). CRIMP EACH SEAL WITH TWO PAIR OF NOTCHES.

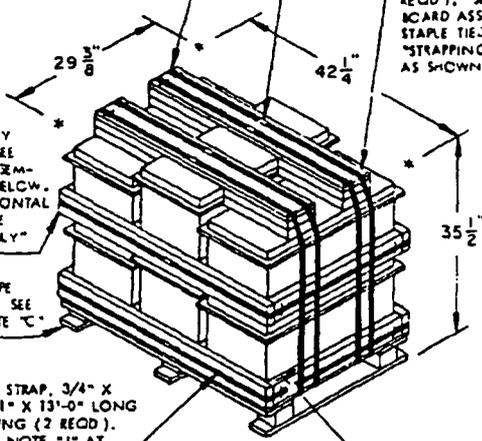
STRAPPING BOARD ASSEMBLY (2 REQD.). SEE THE "STRAPPING BOARD ASSEMBLY" DETAIL BELOW. STAPLE TIEDOWN STRAPS TO "STRAPPING BOARD ASSEMBLY" AS SHOWN.

RISE R ASSEMBLY (2 REQD.). SEE THE "RISE R ASSEMBLY" DETAIL BELOW. STAPLE HORIZONTAL STRAPS TO THE "RISE R ASSEMBLY" AS SHOWN.

INDICATES TYPE II SKID BASE. SEE GENERAL NOTE "C" AT RIGHT.

HORIZONTAL STRAP, 3/4" X .035" OR .031" X 13'-0" LONG STEEL STRAPPING (2 REQD.). SEE GENERAL NOTE "J" AT RIGHT.

TYPICAL LOCATION FOR SECUREMENT OF A STRAP CUTTER, SEE GENERAL NOTE "E" AT RIGHT.



SKIDDED UNIT

SEE GENERAL NOTE "B" AT RIGHT.

4 BOXES OF MINES (40 PER METAL BOX) @ 219 LBS	1,314 LBS (APPROX)
DUNNAGE	91 LBS
SKID	33 LBS
TOTAL WEIGHT	1,438 LBS (APPROX)
CUBE	25.3 CU FT (APPROX)

GENERAL NOTES

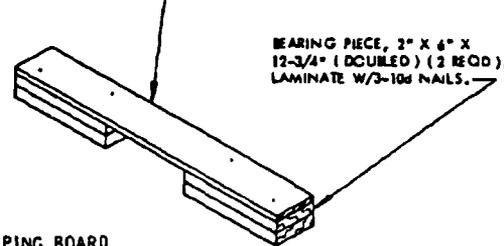
- THIS APPENDIX CANNOT STAND ALONE BUT MUST BE USED IN CONJUNCTION WITH THE BASIC UNITIZATION PROCEDURES DRAWING 19-48-4136-20PA1000. TO PRODUCE AN APPROVED UNIT LOAD, ALL PERTINENT PROCEDURES, SPECIFICATIONS AND CRITERIA SET FORTH WITHIN THE BASIC DRAWING WILL APPLY TO THE PROCEDURES DELINEATED IN THIS APPENDIX. ANY EXCEPTIONS TO THE BASIC PROCEDURES ARE SPECIFIED IN THIS APPENDIX.
- DIMENSIONS, CUBE AND WEIGHT OF A SKIDDED UNIT WILL VARY SLIGHTLY DEPENDING UPON THE ACTUAL DIMENSIONS OF THE BOXES AND THE WEIGHT OF THE SPECIFIC ITEM BEING UNITIZED.
- ONLY A TYPE II SKID BASE WILL BE USED TO ASSEMBLE THIS UNIT. THE "W" DIMENSION OF THE SKID BASE WILL BE 29" AND THE "L" DIMENSION WILL BE 42". **NOTE:** A TYPE I SKID BASE IS NOT APPROVED FOR USE IN UNITIZING THIS ITEM.
- THE FOLLOWING AMC (DARCOM) DRAWINGS ARE APPLICABLE FOR OUTLOADING AND STORAGE OF THE ITEMS COVERED BY THIS APPENDIX.
 CARLOADING -----DRAWING 19-48-4123-SPA1000.
 TRUCKLOADING -----DRAWING 19-48-4124-11PA1000.
 STORAGE -----DRAWING 19-48-4125-1-2-3-4-14-22PA1000.
- FOR METHOD OF SECURING A STRAP CUTTER TO THE PALLET UNIT, SEE DARCOM DRAWING 19-48-4127-20P1000.
- IF ITEMS COVERED HEREIN ARE UNITIZED PRIOR TO ISSUANCE OF THIS APPENDIX, THE BOXES NEED NOT BE REUNITIZED SOLELY TO CONFORM TO THIS APPENDIX.
- THE UNITIZATION PROCEDURES DEPICTED HEREIN MAY ALSO BE USED FOR UNITIZING MINES WHEN IDENTIFIED BY DIFFERENT NATIONAL STOCK NUMBERS (NSN) THAN WHAT IS SHOWN ON THE TITLE PAGE, PROVIDED THE BOX PACKAGES NOT VARY FROM WHAT IS DELINEATED HEREIN. THE EXPLOSIVES CLASSIFICATION OF OTHER ITEMS MAY BE DIFFERENT THAT WHAT IS SHOWN.
- POSITION THE METAL BOXES WITH THE HUMIDITY INDICATORS LOCATED ON ONLY ONE SIDE OF THE SKIDDED UNIT.
- INSTALL EACH HORIZONTAL STRAP TO ENIRCLE EACH DUNNAGE ASSEMBLY. HORIZONTAL STRAPS MUST BE TENSIONED AND SEALED PRIOR TO APPLICATION OF TIEDOWN STRAPS.
- INSTALL EACH TIEDOWN STRAP TO PASS UNDER THE TOP DECK BOARDS OF THE SKID BASE AND TO BE LOCATED AS SHOWN. TIEDOWN STRAPS WILL NOT BE APPLIED UNTIL THE HORIZONTAL STRAPS HAVE BEEN TENSIONED AND SEALED.

BILL OF MATERIAL

LUMBER	LINEAR FEET	BOARD FEET
1" X 6"	6.54	3.27
2" X 4"	77.67	77.67
2" X 6"	77.29	77.29
NAILS		POUNDS
6d (2")	8	0.05
10d (3")	72	1.11
TYPE II SKID BASE, 29" W X 42" L -- 1 REQD.		33 LBS
STEEL STRAPPING, 3/4" -- 78.67 REQD.		5.62 LBS
SEAL FOR 3/4" STRAPPING -- 6 REQD.		NIL
STAPLE -- 16 REQD.		NIL

TIE PIECE, 1" X 6" X 39-1/4" (1 REQD.). NAIL TO THE BEARING PIECES W/2-6d NAILS AT EACH LOCATION.

BEARING PIECE, 2" X 6" X 12-3/4" (DUGLED) (2 REQD.). LAMINATE W/3-10d NAILS.



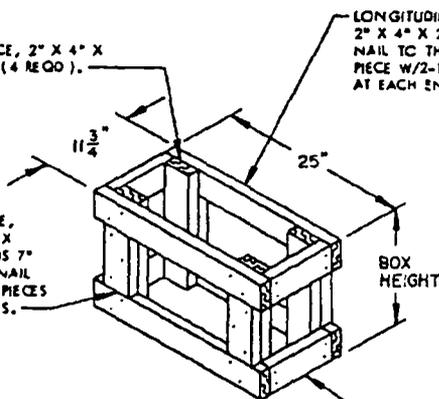
STRAPPING BOARD

(2 REQD)

VERTICAL PIECE, 2" X 4" X BOX HEIGHT (4 REQD.).

LONGITUDINAL PIECE, 2" X 4" X 25" (4 REQD.). NAIL TO THE VERTICAL PIECE W/2-10d NAILS AT EACH END.

SUPPORT PIECE, 2" X 4" X BOX HEIGHT MINUS 7" (4 REQD.). NAIL TO VERTICAL PIECES W/3-10d NAILS.



FILLER ASSEMBLY

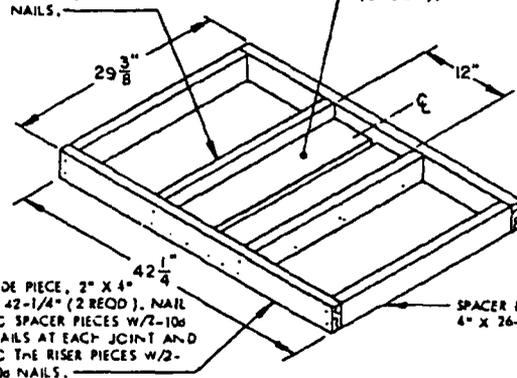
(FOR MINUS ONE BOX)

SPACER PIECE, 2" X 4" X 26-3/8" (2 REQD.). NAIL TO THE RISER PIECES W/3-10d NAILS.

RISE R PIECE, 2" X 6" X 26-3/8" (2 REQD.).

SIDE PIECE, 2" X 4" X 42-1/4" (2 REQD.). NAIL TO SPACER PIECES W/2-10d NAILS AT EACH JOINT AND TO THE RISER PIECES W/2-10d NAILS.

SPACER PIECE, 2" X 6" X 26-3/8" (2 REQD.).



RISE R ASSEMBLY

(2 REQD)