FINAL REPORT

DATE 1988

EVT NO. 14-88

MIL-STD-1660 TEST OF MO INDUSTRIES ALUMINUM 2,200 LB. PALLET

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Prepared for:
U.S. Army Armament Research,
Development and Engineering Center
ATTN: SMCAR-AEP
Picatinny Arsenal, NJ 07801-5000

MO Industries, Whippany, NJ

US ARMY
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EVALUATION DIVISION
SAVANNA, ILLINOIS 61074-9639

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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
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) EVT 14-88	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION U.S. Army Defense Ammunition Center and School 6b. OFFICE SYMBOL (If applicable) SMCAC-DEV	7a. NAME OF MONITORING ORGANIZATION U.S. Army Armament Research, Development and Engineering Center
6c. ADDRESS (City, State, and ZIP Code) Savanna, IL 61074-9639	7b. ADDRESS (City, State, and ZIP Code) ATTN: SMCAR-AEP Picatinny Arsenal, NJ 07801-5000
8a. NAME OF FUNDING/SPONSORING ORGANIZATION MO Industries 8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (City, State, and ZIP Code) Whippany, NJ	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO.
11. TITLE (Include Security Classification) MIL-STD-1660 Test of MO Industries Aluminum 2,200-lb Pallet	
12. PERSONAL AUTHOR(S) A. C. McIntosh, Jr.	
13a. TYPE OF REPORT FINAL 13b. TIME COVERED FROM _____ TO _____	14. DATE OF REPORT (Year, Month, Day) 1988 February 15. PAGE COUNT 17
16. SUPPLEMENTARY NOTATION	

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	MIL-STD-1660 metal pallet ammunition transportation

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 asked by MO Industries, Whippany, NJ, to evaluate their 2,200-lb capacity aluminum pallet in accordance with MIL-STD-1660, Design Criteria for Ammunition Unit Loads. The 2,200-lb pallet submitted for testing, MO Industries Part No. 512-1W, with a load capacity of 2,200 lbs, was tested in accordance with MIL-STD-1660 test criteria. The pallet was loaded to 2,200 lbs and subjected to a compression test and a transportation simulation test. Failure occurred in the upright posts connecting the skid to the pallet deck. The upright post punctured through the upper deck frame extrusions. This report details the test procedure, test results, photographic data and conclusions and recommendations for this pallet.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT ☐ UNCLASSIFIED/UNLIMITED ☒ SAME AS RPT. ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED
22a. NAME OF RESPONSIBLE INDIVIDUAL THOMAS J. MICHELS	22b. TELEPHONE (Include Area Code) AV 585-8928 22c. OFFICE SYMBOL SMCAC-DEV

DD Form 1473, JUN 86 *Previous editions are obsolete.*

SECURITY CLASSIFICATION OF THIS PAGE
UNCLASSIFIED

U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL
Evaluation Division
Savanna, IL 61074-9639

EVT 14-88

MIL-STD-1660 TEST OF

MO INDUSTRIES ALUMINUM

2200 LB. PALLET

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PART 1

INTRODUCTION

A. BACKGROUND. The U.S. Army Defense Ammunition Center and School (USADACS), Evaluation Division (SMCAC-DEV), in coordination with the U.S. Army Armament Research, Development and Engineering Center (ARDEC), SMCAR-AEP, was asked by MO Industries, Whippany, NJ, to test their aluminum pallet, Part No. 512-1W, and evaluate its compatibility to meeting the requirements of MIL-STD-1660.

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

C. OBJECTIVE. The objective of this test is to assess the MO Industries aluminum pallet for satisfying the capability to meet Army functional/ operational requirements of MIL-STD-1660.

PART 2

ATTENDEES

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PART 3

TEST PROCEDURES

The test procedures outlined in this section are 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 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 force of a 16 foot high load.

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. If 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.

PART 4.

TEST EQUIPMENT

1. TEST SPECIMEN.

   a. Width: 39-1/2 inches

   b. Length: 47-1/2 inches

   c. Height: 38-1/2 inches

   d. Weight: 2,150 pounds

2. COMPRESSION TESTER.

   a. Manufacturer: Ormond Scientific

   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. 1/2-inch Amplitude

   d. Speed: 50 to 3000 cpm

   e. Platform: 5 foot by 8 foot

PART 5

TEST RESULTS

1. STACKING TEST.

Pallet Weight: 2,150 lbs.

Pallet Height: 38-1/2 in.

Test Load Weight: 10,722 lbs.

The test pallet was loaded to 11,000 lbs. compression for a period of one hour. At the end of the one-hour period the compression load decreased to 9,500 lbs and the load compressed approximately 1/4 in. After the pallet was removed from the compression tester, no measurable deformation in the load was evident.

2. REPETITIVE SHOCK TEST. The test pallet failed to pass the longitudinal transportation simulation test. Failure occurred at the attachment point of the end post connecting the skid with the extruded pallet deck. The end post fatigued to a point where it fell into the circumferential molded aluminum pallet frame. In addition to the center post breaking, additional breaks were found after the test at welds on the center posts connecting the skid to the pallet deck.

PART 6

CONCLUSIONS AND RECOMMENDATIONS

1. CONCLUSIONS. The MO Industries 2,200-lb pallet, Part No. 512-1W, was found to be unsatisfactory for the transportation of ammunition. The pallet, though light in weight, does not have sufficient strength to withstand the mechanical vibration expected in a military transport environment.

2. RECOMMENDATIONS. If aluminum pallets are to be considered for use in the transportation of military ammunition, they must satisfactorily meet the criteria of MIL-STD-1660 and its recommended tests. This pallet has a potential of meeting these requirements provided that increased strengthening is accomplished in the pallet. The pallet can expect to see a static load weight of 10,000 lbs. or more and dynamic forces impinging on it of approximately 1G. These 1G forces are described as a sinusoidal pattern with a 1/2" double amplitude for a period of up to three hours.

PART 7

PHOTOGRAPHS

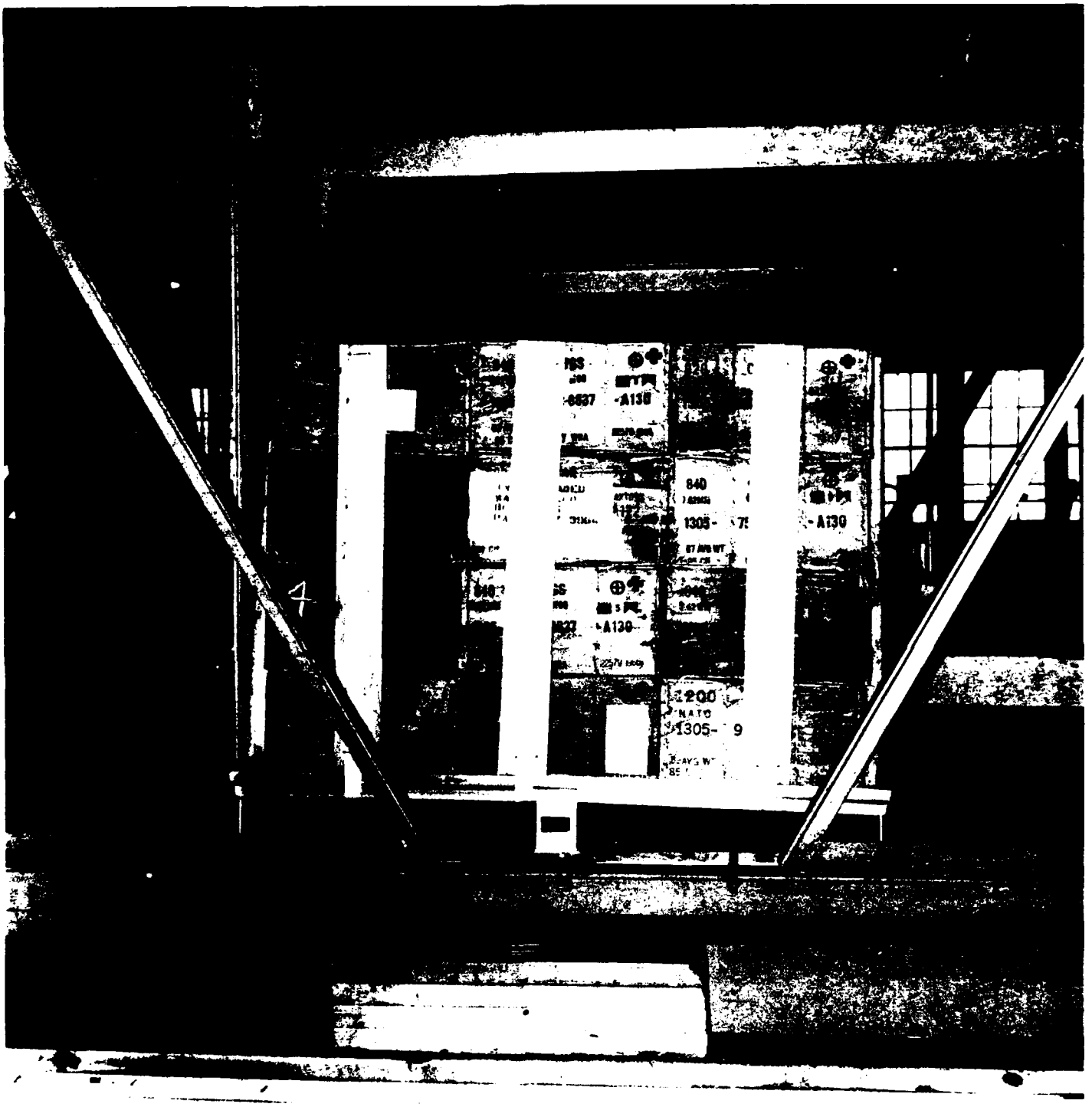

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Photo No. 1. This photo shows the MO Industries aluminum pallet in the transportation simulator. Note the right side of the pallet deck is lower than the left side. This is caused by the pallet posts punching through the deck attachment point.

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Photo No 2. This photo shows the MO Industries 2,200-lb aluminum pallet where the connecting posts between the skids and the deck have hammered through the attachment point at the upper deck.

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Photo No 3. This photo shows the MO Industries 2,200-lb aluminum pallet where the pallet post has punched through the pallet deck on the opposite side.

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Photo No 4. This photo shows a crack in the pallet deck frame extrusion just before the pallet post.

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Photo No 5. This photo shows the MO Industries 2,200-lb aluminum pallet with a crack in the deck extrusion. All cracks were caused by the transportation simulation test.