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REPORT NO. 95-01

PALLETIZED LOADING SYSTEM (PLS) FLATRACK SIDEBOARD KIT EVALUATION

Prepared for:
U.S. Army Defense Ammunition
Center and School
ATTN: SMCAC-DES
Savanna, IL 61074-9639

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The U.S. Army Defense Ammunition Center and School (USADACS), Validation Engineering Division (SMCAC-DEV), was tasked by USADACS, Supply Engineering Division (SMCAC-DES), to perform a sliding pallet test on the Palletized Loading System (PLS) flatrack sideboard kit (rear panel). One of the requirements of the PLS M1077 flatrack contract was for the fabrication of sideboards. The strength required of the sideboards could not be clearly defined as to the amount of loading that would be applied during loading/unloading and transporting of loose pallets; therefore, the position was taken that a severe or worst-case scenario was envisioned to establish a base line for sideboard/post/pocket design criteria.

The test consisted of placing a pallet, that was representative of those to be shipped, at the A-frame end of the flatrack and allowing it to slide down the flatrack into the candidate sideboard/post design. The representative pallet of PA116 containers, weighing 2,400 pounds, permanently deformed the lower end of the sideboard stakes and the stake pockets. The M1077 flatrack was raised 119 inches from the ground at the A-frame end before the pallet broke static friction. The incline was 30 degrees. As a result (continued)

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19. ABSTRACT (continued).

of testing the PLS flatrack sideboard kit failed. The plug end of the sideboard post must be strengthened to prevent damage from sliding pallets.

U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL
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PALLETIZED LOADING SYSTEM (PLS) FLATRACK SIDEBOARD KIT EVALUATION

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PART 1

INTRODUCTION

A. BACKGROUND. The U.S. Army Defense Ammunition Center and School (USADACS), Validation Engineering Division (SMCAC-DEV) was tasked by U.S. Army Tank-automotive and Armaments Command (TACOM) to design and test concepts for a sideboard kit for the M1077 Palletized Loading System (PLS) A-frame pallet. The basic design was forwarded by TACOM and the prototype developed by USADACS, Supply Engineering Division (SMCAC-DES). The PLS testing requirements outlined a requirement for the sideboard kit to retain a loose pallet as it slid from one end of an M1077 flatrack while it was being loaded onto the PLS truck.

B. AUTHORITY. This test was conducted IAW mission responsibilities delegated by U.S. Army Armament, Munitions and Chemical Command (AMCCOM), Rock Island, IL 61299-6000. Reference is made to Change 4, 4 October 1974, to AR 740-1, 23 April 1971, Storage and Supply Operations; AMCCOMR 10-17, 31 August 1991, Mission and Major Functions of USADACS.

C. OBJECTIVE. The objective of these tests was to validate the design strength of the rear side board panel and support stakes designed for the M1077 flatrack.

D. CONCLUSION. A loose 2,400-pound metal skid pallet of PA116 containers was restrained by one panel and mounted on two posts. The panel was positioned in an upright position. Even though the sliding pallet was prevented from falling off the end of the flatrack, the pockets, stakes, and panel were deformed. Thus, the side pockets on the M1077 flatrack are not strong enough to support impact torque produced from a loose pallet. The panel mounting stakes were

deformed where they were encased by the stake pockets. The panel was deformed from the impact, but not enough to prevent removal of the posts.

E. RECOMMENDATION. Deformation of the stake base provides information for determining how much force was delivered on impact. From this information, further engineering designs may be considered. Once the dynamic loading forces are determined, the proper choice of steel can be determined in redesign of the stakes.

PART 2

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PART 3

TEST PROCEDURES

A. EQUIPMENT.

1. PLS truck.
2. M1077 PLS flatrack.
3. Sliding pallet - PA116 metal skids. Loaded weight 2,400 pounds.
4. Sideboard stakes, two each, rear mounting.
5. Rear sideboard.

B. SETUP.

1. Place an M1077 PLS flatrack on the ground. The flatrack deck should be clear. The flatrack rollers must be mounted in the normal operating position.

2. Place the sliding pallet behind the flat rack A-frame. Longitudinal pallet skids are oriented laterally across the flatrack.

3. Place the sideboard stakes in two adjacent rear stake pockets, opposite the sliding pallet at the rear of the M1077 flatrack.

4. Place a rear sideboard panel on the rear stakes and pin in the upper position.

5. Using the PLS truck, connect the lifting hook to the bailbar and slowly raise the M1077 flatrack onto the PLS truck.

6. When the sliding pallet breaks static friction, stop loading.

7. Document the results.

PART 4

TEST RESULTS

The M1077 flatrack was raised to 119 inches before the pallet overcame static friction (see Figure 1, page 4-2). The pallet slide path was 185 inches to the rear sideboard. The critical angle was 31 degrees.

Pallet Orientation: The pallet was oriented so that the 44-inch side was parallel to the rear sideboard.

Damage:

1. Pallet - caused the upper two rows of PA116 containers to disengage from the locks on the lower rows.

2. Side Board Panel - minor deformation to the panel was incurred. The stakes could easily be removed from the sideboard.

3. Stakes - the upper part of the post had no permanent deformation. The base plug - which fits into the stake pocket - was permanently deformed to the plastic region. Due to the plasticity, finite element analysis (FEA) will be used to determine the load forces impacted into the plug. The model is a cantilevered beam.

4. M1077 stake pockets - permanent deformation and cracking was observed at the top of the two stake pockets which held the side boar posts. Cracked steel was also found on the top of the pocket corners where they were formed into a "U" shape. This deformation was caused by the torsional load of the stake when the sliding pallet struck the sideboard.

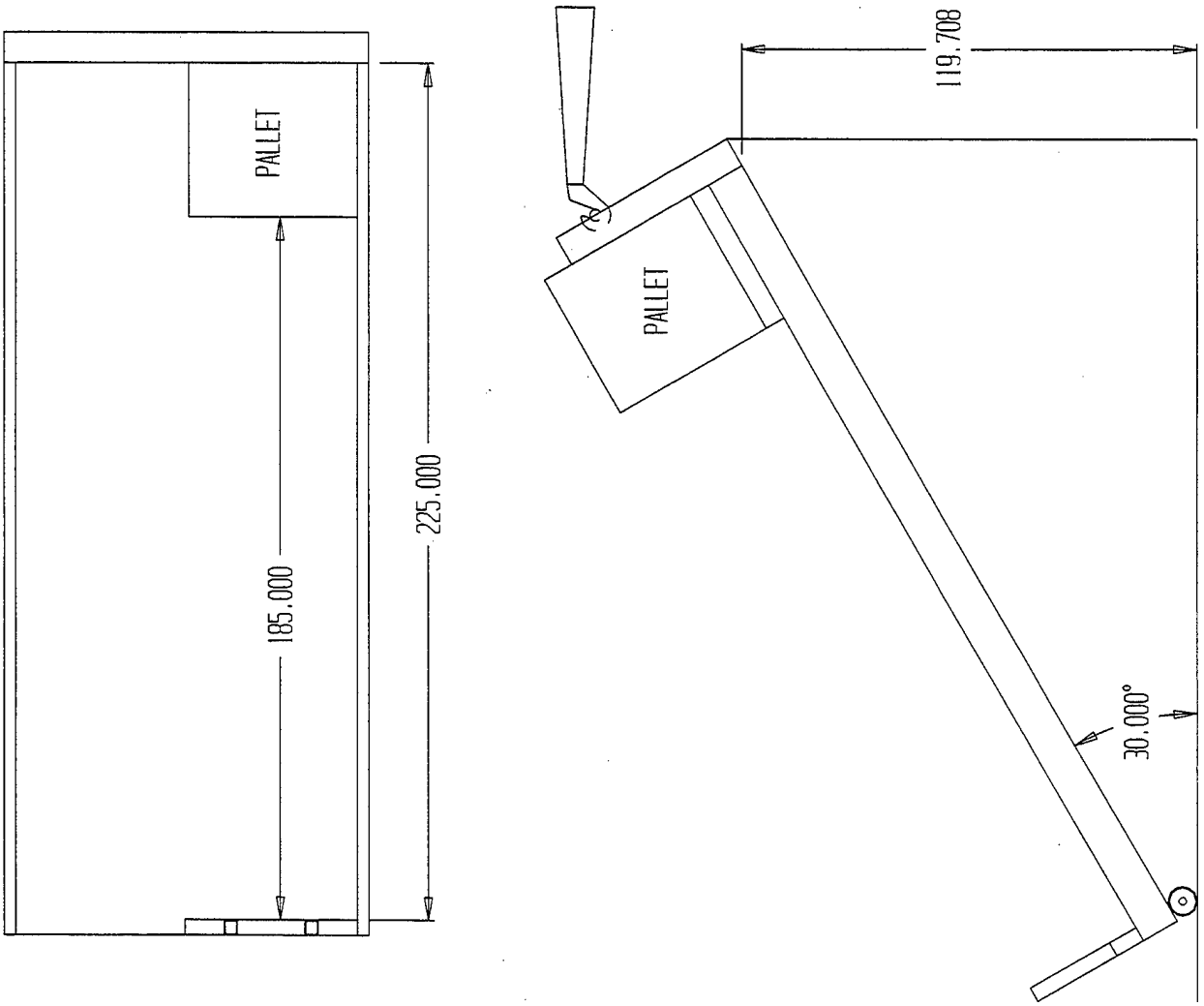

Figure 1