APPENDIX C

PEMCO ENGINEERING PALLET LOCKING ASSEMBLY REPORT

15062 Bolsa Chica, Huntington Beach, CA 92649 **Ph:** (714) 892-1961 **Fx:** (714) 892-8159 •2 Pheasant Run, Newtown, PA 18940, **Ph:** (215) 579-7500 **Fx:** (215) 579-7591

Pemco Engineering
Pallet Locking Assembly
Report

MMLaboratories, Inc.

15062 Bolsa Chica, Huntington Beach, CA 92649 **Ph:** (714) 892-1961 **Fx:** (714) 892-8159 • 2 Pheasant Run, Newtown, PA 18940, Ph: (215) 579-7500 Fx: (215) 579-7591

Client: Pemco Engineers
2398 Railroad Street
Corona, Ca 91720
Attention: Steve Olsen

Date: September 18, 1997
P.O. No: Verbal
Work Order No: GML-09-08-54406

National Transportation Safety Board
8405 N.W. 53rd Street B-103
Miami, Florida 33166
Attention: Carrol A. Smith

Case No.: DCA97MA059
Accident Location: Miami, Florida
Date of Accident: August 7, 1997
Air Carrier: Fine Air Inc.
Air Craft: DC-8-61
Tail No.: N27UA

Exemplar Samples: 2 ea. Pallet Lock Assemblies - No Rollers
Pemco No.: 50044-501
Eligible For: DC-8, 727, 737

Evidentiary Sample: Pallet Lock Assembly - With Rollers
17/18 Pallet Lock
(18-4) Position Failed
Pemco No.: 50044-1

Investigation: Proof/Destructive Load Tests of Pallet Lock Assembly
Fractographic Analysis of Broken Pallet Lock Assembly

Witnesses to Test: Steve Olsen, Manager - Engineering, Pemco Engineers
Donald M. Spengler, Sales Manager, Pemco Engineers
Carrol A. (Corky) Smith., Air Safety Investigator, National Transportation SafetyBoard

Test Equipment: Compression Testing Machine
Manufacturer: Satec
Model: 100UD
Serial No.: 1107, MMA No. P075
Capacity: 100,000 lbf
Calibration Date: August 15, 1997
Calibration Due: February 15, 1998

Background:

On September 10, 1997 MMA Laboratories, Inc. (MMA) received for testing two exemplar pallet lock assemblies for proof/destructive load testing and one evidentiary assembly for fractographic analysis. The two exemplar assemblies were provided by Pemco Engineers, while the evidentiary locking assembly was provided by Carrol A. (Corky) Smith, a representative of the United States National Transportation Safety Board. MMA arbitrarily numbered the samples no. 1 and no. 2. We were requested to perform load tests on the exemplar pallet locking assemblies provided by Pemco Engineering and a fractographic analysis on the evidentiary locking assembly provided by Mr. Smith. Initial disassembly and examination of the evidentiary locking assembly was performed in the presence of Mr. Smith. The exemplar and evidentiary lock assembly were identical with the exception of rollers.

Fully Locked Position Shear Load Test

Exemplar sample no. 1 pallet locking assembly was secured in the forward position to test fixturing (Figure 2).The locking pawls of the assembly were placed in the fully locked position. Using a loading block, the forward locking pawl was loaded at 0.1 inch per minute until failure (Figure 3). Load measurements were recorded and graphed as load versus crosshead deflection (Appendix A). The pallet locking assembly was then removed and examined for failure mode. Visual examination of the pallet assembly showed breakage of the lock base at the shear pin (Figure 4). No shearing or disengagement of the locking pawls were observed; the pawls of the assembly were manually operated from the locked to the unlocked positions with no problems. Breakage of the lock base occurred at approximately 12, 400 lbf at 0.40 inches of crosshead travel.

Partially Locked Position Shear Load Test

Exemplar sample no. 2 pallet locking assembly was secured in the forward position to test fixturing. The locking pawls of the assembly were placed in the partially locked position (Figure 5). The partially locked position was established by placing the release pawl at the mid point position of its travel (Figure 6). Using a loading block, the forward locking pawl was loaded at 0.1 inch per minute. Load measurements were recorded and graphed as load versus crosshead deflection (Appendix A). Loading was suspended at 5,300 lbf for examination to locate permanently deformed material. The examination showed rounding of the backside edges of the forward locking pawl (Figure 7). This deformation was located at the point of contact between the release pawl and the forward locking pawl. The rounding or deformation of the pawl occurred at approximately 4,800 lbf. No shearing or disengagement of the locking pawls were observed; the pawls of the assembly were manually operated from the locked to the unlocked positions with no problems.

Inverted Vertical Compressive Load Test

Exemplar sample no. 1 was subjected to compressive load testing subsequent to the fully locked position shear load test (12,400 lbf). The pallet lock assembly was placed inverted on a test platform in the fully locked position. Using a self-leveling loading platen, the pallet locking pawls were loaded at 0.1 inch per minute simultaneously until failure (Figure 8). Load measurements were recorded and graphed as load versus crosshead deflection (Appendix A). The pallet was able to withstand a compressive load of 4,000 lbf. Visual examination of the pallet assembly showed no breakage or disengagement of the locking pawls. At 4,000 lbf further deformation of the material associated with the failure in the previous test occurred. The pawls of the assembly were manually operated from the locked to the unlocked positions with no problems.