ALFRED J. SICARD
Mechanical Engineering Technician
Autovon 787-4519
Commercial (513) 257-4519

EVALUATION OF TYPE II FAST PACKS
FOR ELECTROSTATIC DISCHARGE PROPERTIES

HQ AFALD/PTPT
AIR FORCE PACKAGING EVALUATION AGENCY
WRIGHT-PATTERSON AFB OH 45433
August 1983
NOTICE

When government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related government procurement operation, the United States Government thereby incurs no responsibility whatsoever; and the fact that the government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto. This report is not to be used in whole or in part for advertising or sales purposes.

ABSTRACT

A commercially available cushioned, fiberboard pack was evaluated for both its electrostatic protection properties as well as its shock and vibration characteristics with regard to the critical protection of sensitive electronic components. The cushioning performance of the pack was compared with that of a similar size standard Type II Fast Pack (PPP-B-1672). The results of this evaluation indicated that the pack provided cushioning protection which, on average, was comparable to that obtained with the standard Type II Fast Pack. Using as a reference base, the static charge built up on a standard Type II Fast Pack, which contains no antistatic treated materials, it was determined that the pack having electrostatic protection properties avoided the development of electrostatic fields which measured as high as 4.5 KV in the standard pack. Other concepts are also currently being considered for providing electrostatic protection for the Type II Fast Pack. These include the use of conductive carbon impregnated polyurethane foams as well as foams treated with antistatic materials.

PREPARED BY: ALFRED J. SICARD
Mechanical Engineering Technician
AF Packaging Evaluation Agency

REVIEWED BY: MATTHEW A. VENETOS
Chief, Materials Engineering Division
AF Packaging Evaluation Agency

PUBLICATION DATE: APPROVED BY: J. E. THOMPSON
Director, Air Force Packaging Evaluation Agency
TABLE OF CONTENTS

Abstract ................................................. 1
Introduction .............................................. 1
Test Packs ............................................... 1
Test Load. ................................................ 1
Instrumentation and Equipment. ....................... 1
Test Procedures/Results
   a. Free Fall Drop Test. ............................. 2
   b. Vibration Test ................................... 2
   c. Results. ....................................... 2
Discussion/Conclusion. ................................ 3

FIGURES

FIGURE 1. Cancel Caddy Pack ......................... 4
FIGURE 2. Type II Fast Pack (PPP-B-1672) .......... 4

TABLES

TABLE I. Peak Shock Levels ........................... 5
TABLE II. Electrostatic Field Voltages ............... 5

Distribution List. .................................... 6-7
DD Form 1473 ....................................... 8
INTRODUCTION

ADE, Inc., Chicago, Illinois requested consideration of their Cancel Caddy Pack for protecting fragile electronic components from harmful static electricity as well as mechanical shocks.

TEST PACKS

The Cancel Caddy Pack (Figure 1) is a reusable, single wall fiberboard pack (12" x 8" x 1 3/4") consisting of a reclosable cushioned carrier which mates into an outer fiberboard sleeve. A cushioning insert is used consisting of a polyethylene (anti-static treated wrap) material of extruded hexagonal airtight cells. The pack's cushioning performance was rated for loads weighing up to one pound.

The PPP-B-1672, Type II, Fast Pack (Figure 2) is a reusable, single wall fiberboard pack (12" x 8" x 2 1/2") consisting of an inner slide and outer sleeve. The cushioning insert consists of polyurethane convoluted foam, Type I, Class 2, Grade B complying to MIL-P-26514E.

TEST LOAD

The simulated test load consisted of a masonite board (1/4" x 6" x 4 1/2") on which were mounted wooden shapes, representing solid state devices, and aluminum wiring to simulate a typical printed circuit board. Its weight was varied by adding additional masonite plates and components. Three mil thick polyethylene film was wrapped around the test load in order to avoid interference with the cushioning action of the pack inserts. The test load was instrumented with a tri-axial accelerometer.

INSTRUMENTATION AND EQUIPMENT

The following instrumentation and equipment were employed in this study:

1. Oscilloscope, 4 channel storage, Tektronix Model 564-B.
3. Amplifier (3 each), Endevco, Model 2614C.
4. Power Supply, Endevco, Model 2622C.
5. Gaynes Drop Tester, Model 125.
6. Electrodynamic Shaker, Unholtz Dickie, Model 640M.
TEST PROCEDURES/RESULTS

Free Fall Drop Test: The test packs were subjected to a 30 inch free fall drop test in accordance with Federal Test Method Standard 101C, Method 5007.1, Procedure B, Level A. A tri-axial accelerometer was secured near the center of gravity of the test load (Figure 1) to record impact shock (G's). The results of the drop tests are presented in Table I.

Vibration Test: The packs with test loads were subjected to a sinusoidal vibration test. The table operating frequency was maintained at 5HZ, 1.0 inch double amplitude for periods of five minutes for each of three pack orientation. The packs were strapped to the vibration table and tested in three different orientations, bottom, end and side surfaces. Immediately after vibration, each pack was opened, and at a distance of approximately six inches from the exposed cushioning surfaces, a hand held static sensor meter was used to measure the charge (KV) of the electrostatic field. The electrostatic field measurements are listed in Table II.

RESULTS

Prior to vibration, as indicated in Table II, the Cancel Caddy Pack had no electrostatic field charge based on measurements taken six inches from the surface of its cushioning insert; after vibration the static sensor meter also indicated an electrostatic free surface. In comparison, the Type II Fast Pack had an initial electrostatic field charge of 2 KV; however, the final charge after vibration was significantly increased to 4.5 kilovolts.

A comparison of the shock performance (see Table I) indicated that for all drop orientations, the Cancel Caddy Pack provided superior shock isolation in protecting the light (0.2 lb) test load; its shock performance in protecting the medium (0.50) and heavier (1.0) test loads was equivalent to the Type II Fast Pack except when dropped on its largest panel area in which case the shock levels were higher.

Visual inspection of both types of packs, after completion of the free-fall drop and vibration tests, indicated no significant damage to their fiberboard surfaces or cushioning inserts; however, after the first drop, the taped joint on the outer sleeve of the Type II, Fast Pack split open five inches. It was necessary to retape the joint in order to complete the testing. No significant load shift occurred in either pack during the drop and vibration tests.
DISCUSSION/CONCLUSION

The Cancel Caddy Pack provides an electrostatic free barrier in protecting shock sensitive electronic components from harmful electrical shock.

Even though shock protection levels aren't a requirement in MIL-STD-794 for Type II Fast Packs, it was considered important to evaluate the cushioning performance of both type packs to determine whether the Cancel Caddy Pack would provide shock protection levels comparable to the Type II Fast Pack during handling. Overall, the Cancel Caddy Pack provided adequate cushioning comparable to the Type II Fast Pack.

FUTURE ACTIONS

Additional approaches being considered for providing electrostatic protection to the Type II Fast Pack are the use of convoluted polyurethane cushion inserts which have been impregnated with either conductive carbon particles or "anti-stat" compounds. In addition, to electrostatic protection and cushioning, costs will be an important factor in determining the approach to be taken.
OUTER SLEEVE

REUSABLE, RECLOSABLE CUSHIONED CARRIER

TEST LOAD

FIGURE 1: Cancel Caddy Pack

OUTER SLEEVE

REUSABLE, CONVOLUTED CUSHIONED CARRIER

SIMULATED TEST LOAD

FIGURE 2: Type II Fast Pack (PPP-B-1672)
<table>
<thead>
<tr>
<th>IMPACT</th>
<th>TYPE II FAST PACK</th>
<th>CANCEL CADDY PACK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PEAK Gs</td>
<td>PEAK Gs</td>
</tr>
<tr>
<td></td>
<td>0.2 lb load</td>
<td>0.2 lb load</td>
</tr>
<tr>
<td></td>
<td>0.5 lb load</td>
<td>0.5 lb load</td>
</tr>
<tr>
<td></td>
<td>1.0 lb load</td>
<td>1.0 lb load</td>
</tr>
<tr>
<td>FACE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LARGEST SURFACE</td>
<td>70 Gs</td>
<td>59 Gs</td>
</tr>
<tr>
<td>LONG EDGE</td>
<td>88</td>
<td>48</td>
</tr>
<tr>
<td>SHORT EDGE</td>
<td>107</td>
<td>49</td>
</tr>
</tbody>
</table>

**TABLE I - PEAK SHOCK LEVELS**

<table>
<thead>
<tr>
<th>TEST</th>
<th>TYPE II FAST PACK</th>
<th>CANCEL CADDY PACK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial charge on opened pack prior to vibration test</td>
<td>2 KV</td>
<td>0 KV</td>
</tr>
<tr>
<td>Charge around closed pack prior to vibration test</td>
<td>0 KV</td>
<td>0 KV</td>
</tr>
<tr>
<td>Charge on opened pack after vibration test</td>
<td>2-4.5 KV</td>
<td>0 KV</td>
</tr>
</tbody>
</table>

**TABLE II - ELECTROSTATIC FIELD VOLTAGES**
<table>
<thead>
<tr>
<th>DISTRIBUTION LIST</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFALD/PT/PTPT</td>
</tr>
<tr>
<td>WPAFB OH 45433</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>AFALD/PTPP</td>
</tr>
<tr>
<td>WPAFB OH 45433</td>
</tr>
<tr>
<td>AFALD/PTPT Library</td>
</tr>
<tr>
<td>WPAFB OH 45433</td>
</tr>
<tr>
<td>HQ AFLC/LOZPP</td>
</tr>
<tr>
<td>WPAFB OH 45433</td>
</tr>
<tr>
<td>ASD/AEWS (D. Murray)</td>
</tr>
<tr>
<td>WPAFB OH 45433</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>WPAFB OH 45433</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>WPAFB OH 45433</td>
</tr>
<tr>
<td>HQ USAF/LETT</td>
</tr>
<tr>
<td>WASH DC 20330</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>OC-ALC/DSP</td>
</tr>
<tr>
<td>Tinker AFB OK 73145</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>OO-ALC/DSP</td>
</tr>
<tr>
<td>H11 AFB UT 84056</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>OO-ALC/DSTD</td>
</tr>
<tr>
<td>Attn: Robert Sorensen</td>
</tr>
<tr>
<td>H11 AFB UT 84056</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>SA-ALC/DSP</td>
</tr>
<tr>
<td>Kelly AFB TX 78241</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>SM-ALC/DSP</td>
</tr>
<tr>
<td>McClellan AFB CA 95652</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>AFCMD/PDT</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
GSA OPP-YCMP  
Attn: Julieann Wax  
Bldg #4, Crystal Mall 1941  
Jefferson Davis Highway  
Arlington VA 22210  

Naval Air Engineering Center  
Code 9181 BL562  
Perrelli 1  
Lake Hurst NJ 08733  

PRC  
13837 Bettencourt Street  
Cerritos CA 90701  

Naval Air Station  
Attn: Charles Fosmay  
Supply Officer  
Bldg V-53  
Norfolk VA 23511  

RADC-RBRAC  
Attn: Mr. Ike Rugne  
Griffiss AFB NY 13441  

Navy Ships and Parts  
Control Systems 561  
Attn: Jerry Thomas  
Mechanicsburg PA 17055  

Red River Army Depot (RRAD)  
SDSR-SP  
Attn: Al Bronz  
Texarkana TX 75507  

Naval Undersea War  
Engineering Station  
Attn: Mylo Erickson  
Mech Engineer C-2462  
Keyport WA 98345  

Sacramento Army Depot  
SDSA-QSM2  
Attn: Robert Budd  
Sacramento CA 95813  

Naval Weapons Center  
Code 3114 OPS, Manager F-A18 WSST  
Attn: 12C Buillard  
China Lake CA 93555  

SAMSO/AWL  
Norton AFB CA 92409  

TOSMAO OISHI  
Naval Sea Systems Command  
Department of the Navy  
WASH DC 20362  

U.S. Army Armament Research &  
Development Command  
Attn: DRDAR-TST-S  
Dover NJ 07801  

U.S. Army Natick Labs  
Attn: DRDNA-EPS  
Natick MA 01760  

NASA/GSFC  
Code 745  
Attn: R. J. Palace  
Green Belt MD 20771  

NAVSUPSYSCMD  
Attn: SUP-0321A  
WASH DC 20376  

Distribution List (Cont.)
### Evaluation of Type II Fast Packs for Electrostatic Discharge Properties

This evaluation revealed that the Cancel Caddy Pack will provide an electrostatic free enclosure and shock isolation protection of sensitive electronic components.