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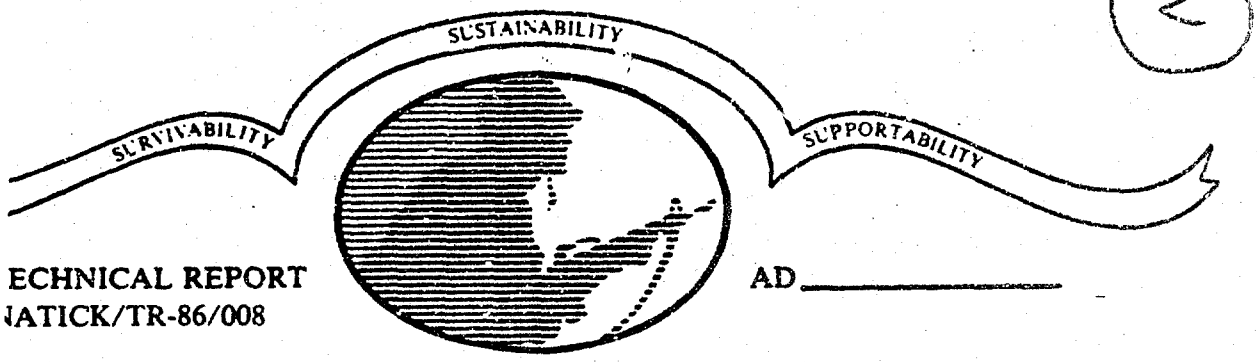

ECHNICAL REPORT
JATICK/TR-86/008

AD_____

DESIGN AND PRODUCTION OF DAMAGE-RESISTANT TRAY PACK CONTAINERS

BY

RICHARD D. CUMMINGS

JULY 1985
FINAL REPORT 1984-1985

CUMMINGS SOLAR CORPORATION
WILMINGTON, MASSACHUSETTS

Prepared for

UNITED STATES ARMY NATICK
RESEARCH, DEVELOPMENT AND ENGINEERING CENTER
NATICK, MASSACHUSETTS 01760-5000

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On 1 Oct 86 the name of U.S. Army Natick R&D Center was changed to U.S. Army Natick Research, Development and Engineering Center.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

TRAY PACK(S)	LOADS
CONTAINERS	DAMAGE
PACKAGING	LOADING (HANDLING)
SHIPPING	TESTS

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The causes of Tray Pack damage were determined to be: prestressing caused by vacuum packing and underfilling; hydrodynamic forces induced by relative fluid motion whithin the Tray Pack at the moment of impact during dropping; and denting of the thin tray body material. The inability of the Tray Pack shipping container to withstand stacking loads was determined to be caused by poor tolerances of the shipping containers and denting of separation pads by the tray lid sealing seam. Test results show that damage can be prevented by avoiding vacuum packing, making the Tray Packs from 98-pound material, using

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a Tray Pack design employing reinforcing beads, using pads that nest within the sealing seam of the Tray Pack, and packing the Tray Packs so that the lids of the bottom two face down and top two face up. Test results also show that unit loads of Tray Packs can be stacked four high by using a properly dimensioned telescoping shipping container, the nesting pads and the two-up, two-down packing technique described above.

SUMMARY

The following steps are recommended to avoid Tray Pack damage and to enable stacking of unit loads four Tray Packs high.

(1) Avoid vacuum packing.
(2) Utilize 98-pound material for both tray bodies and tray lids.
(3) Utilize a design employing reinforcing beads for both tray body and tray lid.
(4) Utilize tray lid reinforcing design having a 5" x 5" label space at the center.
(5) Utilize a shipping container with proper tolerances for packing Tray Packs.
(6) Utilize pads that nest within the sealing seam of the Tray Pack when packing the Tray Packs in a shipping container.
(7) Pack Tray Packs in a shipping container with the bottom two facing down and the top two facing up.

Test results for drop tests on vacuum packed and non-vacuum packed shipping containers show that elimination of vacuum packing greatly reduces damage to the Tray Pack.

Inspection of incoming Tray Packs indicates that utilization of 98-pound material greatly reduces both denting and paneling (inward buckling) damage.

Test results for drop tests show that the drop height required to cause damage to the Tray Pack is greatly increased by utilizing the combination of tray bodies and tray lids with reinforcing beads, nesting packing separation pads within the shipping container, a packing technique wherein the bottom two Tray Pack lids face down and the top two Tray Pack lids face up.

Test results also show that unit loads of Tray Packs can be stacked four high by utilization of a telescoping container with proper tolerances, nesting pads, and the two-up, two-down packing technique previously described.

These results were developed in a program that began with the procurement of tray bodies and tray lids from Central States Can Co., Massillon, Ohio. The units procured were both reinforced and unreinforced and had a material base weight of both 90 pounds and 98 pounds. Central States Can Co. developed tooling to match the reinforced design developed by Cummings Solar Corporation These units were delivered to Cummings Solar Corporation for testing.

Some of the units delivered were lidded empty or filled with water and lidded at U.S. Army Natick R&D Center and then later returned to Cummings Solar Corporation for testing. Cummings Solar Corporation performed a series of evaluation tests on these units including vacuum tests, Tray Pack side drop tests, and shipping container side drop tests.

Other units were shipped to Vanee Foods Co., Berkeley, Illinois where they were filled with water, or corn, or cut beans and returned to Cummings Solar Corporation. These units were subjected to incoming inspection. The food filled units were then shipped to U.S. Army Natick R&D Center for shelf life testing. The water filled units were subjected to Acceptance Testing.

Two shipping container concepts were developed during the program: a double liner shipping container and a telescoping single liner shipping container. Both shipping containers were proven to be capable of sustaining a crushing load equivalent to stacking unit loads four high. The telescoping container was recommended because it was felt to be easier to fabricate and less expensive than the double liner container.

Cummings Solar Corporation feels confident that a low incidence of Tray Pack damage will result from following the recommendations developed during this program.

PREFACE

This report was prepared to satisfy the Statement of Work Item C-5, Technical Data, under contract DAAK60-84-C-0011. The intent of the work was to manufacture with production equipment, prototype Tray Packs of the most durable design to be used in field testing. The primary goal was to improve strength characteristics. The work was a follow-up to contract work reported in the Technical Report Tray Pack Improved Durability Packaging Rough Handling Test Results, by Richard D. Cummings, NATICK/TR-85/026, June 1983 (AD B095 881L).

The contract work covered by this report was performed during 1984 and 1985 under Project 1L162724AH99, Joint Services Food/Nutrition Technology, Task area BC-Food Packaging, AMAFN 81-20(V). The contract Project Officer was Joseph W. Szczeblowski.

Because the Tray Packs are used with U.S. food service, U.S. customary measurement units are used in this report.

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1. TRAY PACK PACKAGING SYSTEM

Tray Pack description

The Tray Pack is a food container that serves the functions of:

a. food storage vessel,
b. food heating vessel
c. food serving vessel.

The Tray Pack holds 6 lb 10 ounces (3 kg) of food. The Tray Pack as made by Central States Can Co. is shown in Figure 1.

It has the shape of a rectangular solid being roughly 12" long by 10" wide by 2" deep with a shoulder approximately 1/4" wide all around at the 1½" height level to accommodate insertion into a steam table heater. The shallow thickness allows rapid and even heating of the food while the large top area allows for easy and convenient serving.

The Tray Pack consists of two parts: the lid or top end and the can or bottom. The sides of the Tray Pack are part of the can or bottom.

The ~~top end~~ or lid is drawn from 90-pound per base box (0.010-inch-thick) steel. The lid material has an inner polymeric liner to prevent reaction with the product and an outer organic coating to retard corrosion and oxidation. The lid is nearly flat across its entire surface.

The bottom or can is drawn from 90-pound per base box (0.010-inch-thick) steel. ~~The bottom also has~~ both top and bottom have a polymeric inner liner and an outer organic coating. The drawing process on the bottom results in numerous material excesses and these are drawn into a regular pattern by means of vertically oriented indentations and beads of approximately 0.070" depth around the perimeter of the can. Around the corners these indentations and bulges are sinusoidal in cross section, but on the sides they have a rectangular cross section.

The material used for making the can and the lid is generically called a "tin mill" product. It comes in coils and is des-

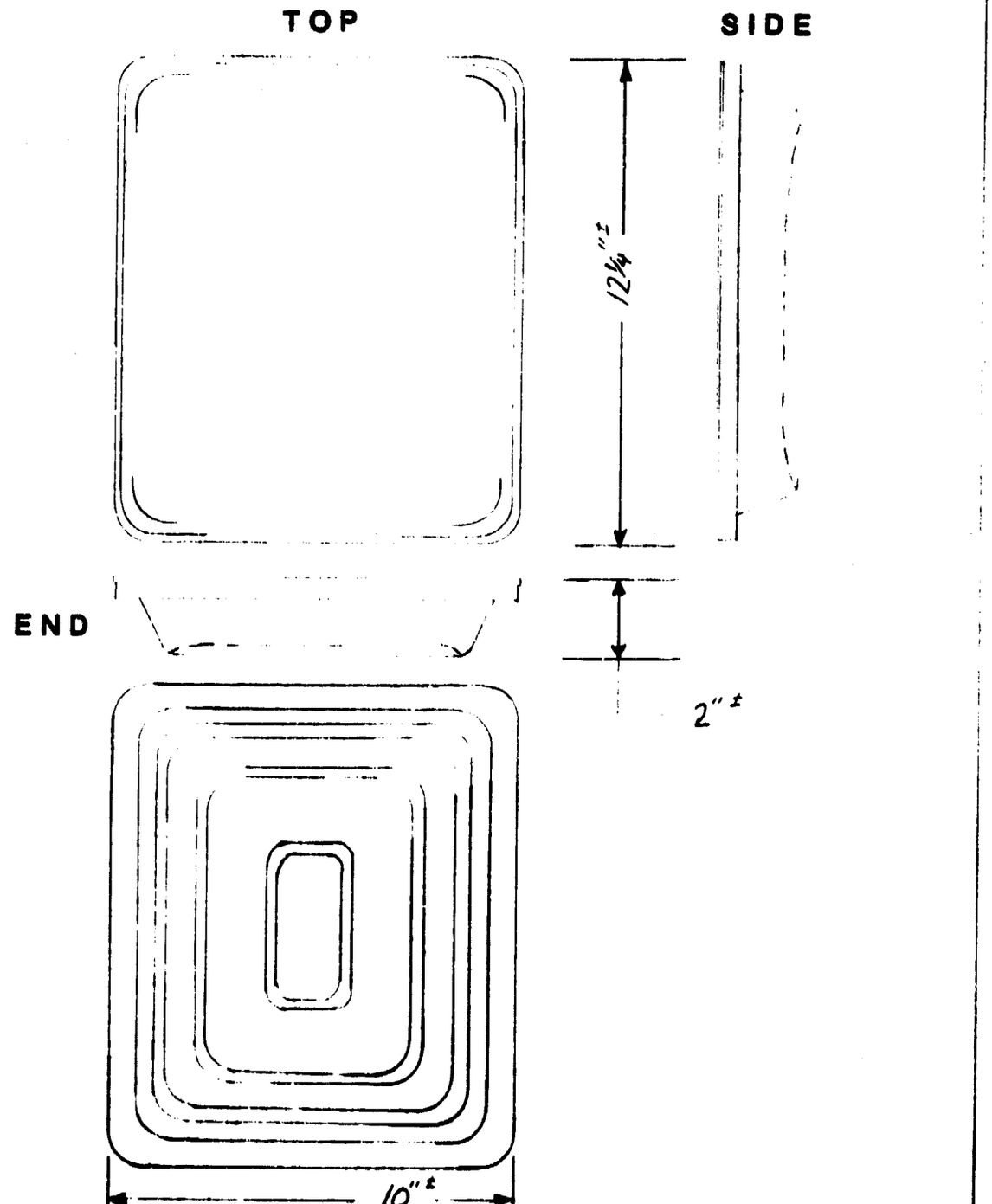


FIGURE 1. THE TRAY PACK FOOD CONTAINER

ignated either T-4-CA or T-5-CA, which denotes its temper and hardness--the T-4-CA material having a hardness of 58-64 on the Rockwell 30-T scale and T-5-CA a hardness of 62-68. The T-5-CA material is stiffer and has greater resistance to buckling while the T-4-CA is easier to form. Central States is currently using the T-4-CA material for both the can and the lid. The tensile strength of the material is approximately 60,000 psi.

Shipping container description

Tray Pack shipping containers serve a number of functions. First they act as a container allowing the easy manual handling and stacking of multiple Tray Packs. Second, the shipping container materials act to cushion the shock imposed on Tray Packs by rough handling impacts. Third, they act to support the load imposed when Tray Packs are stacked.

Tray Packs are packed four to a shipping container one on top of another to make a handling load of approximately 30 pounds. The dimensions of the shipping container are 13½" long by 11-1/8" wide by 9-3/4" deep. The arrangement of materials within the container is shown in Figure 2.

The shipping container material is Level B packing material designated V3c (corrugated fiberboard) made in accordance with Federal Specification PPP-B-636. This is a single wall weather resistant, corrugated fiberboard with a minimum dry bursting strength of 400 psi and a wall thickness 0.153". It is manufactured by St. Regis Paper Company's container division, located in Pittsburgh, Pennsylvania.

The sides of the shipping container are reinforced by means of an inner liner that increases its buckling resistance. A protective pad is placed on the bottom of the container, between each Tray Pack, and at the top of the container, a total of five pads for each shipping container. The liner and pads are made of the same material as the shipping container.

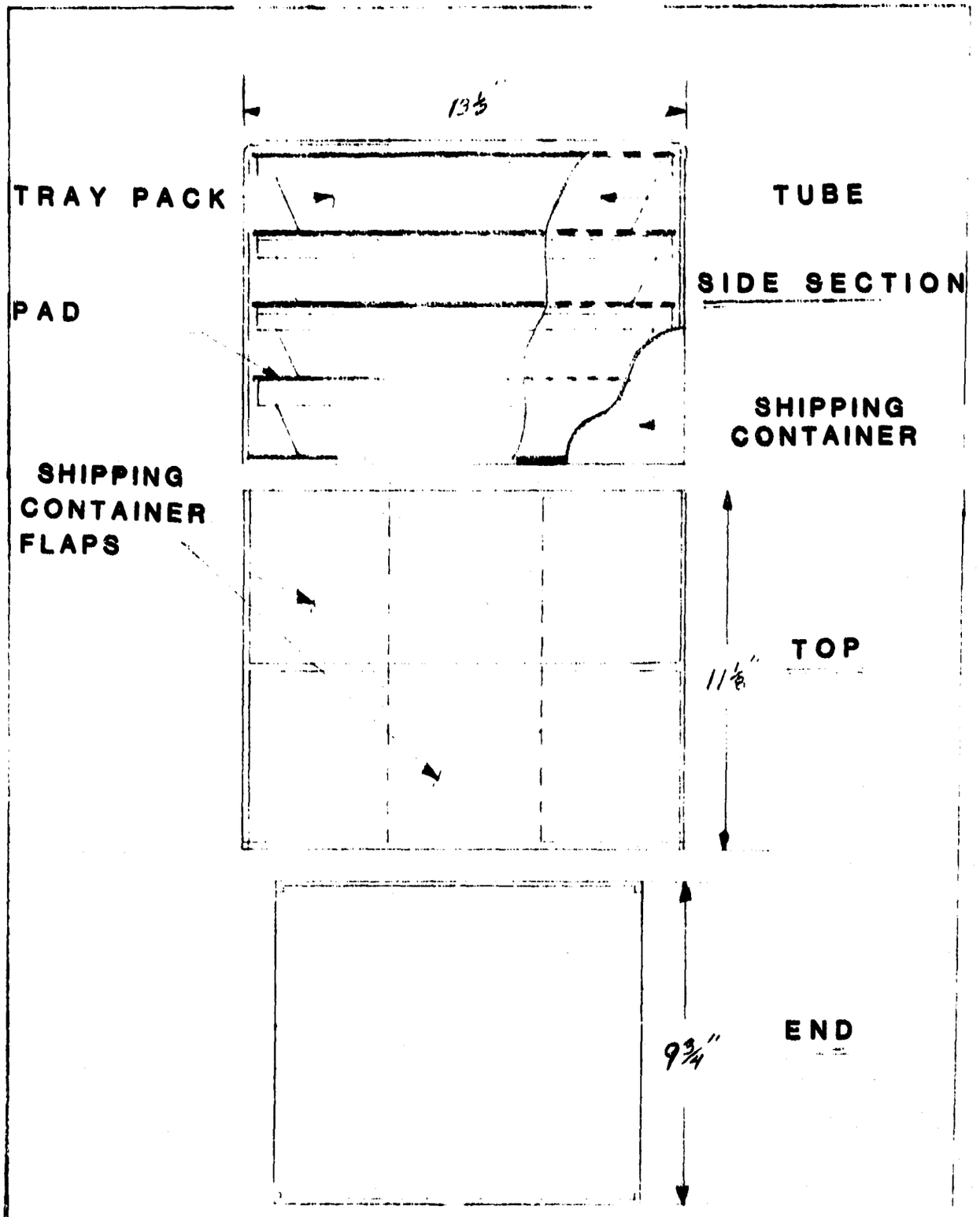
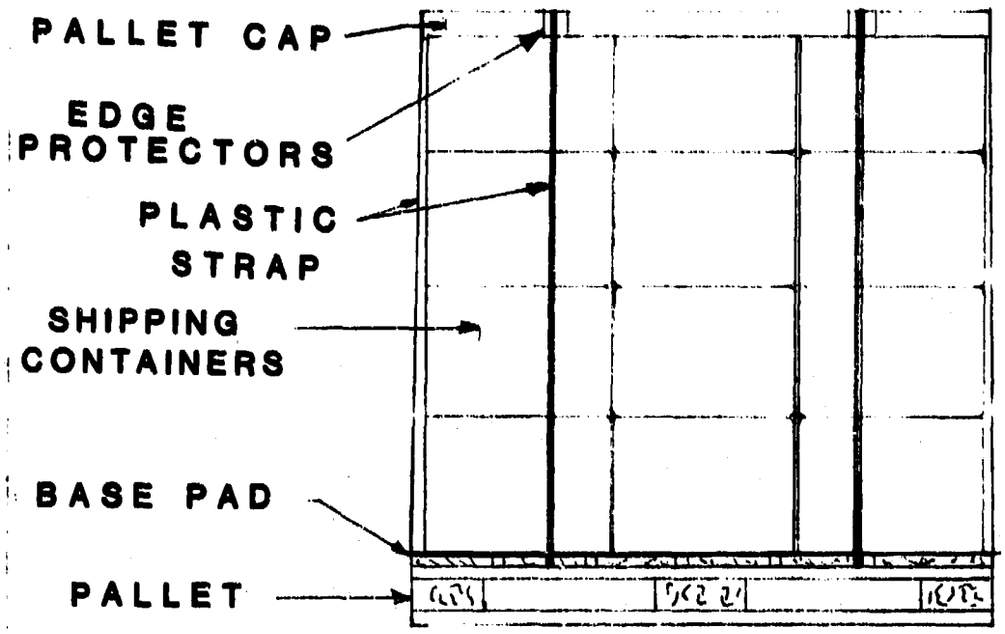


FIGURE 2. TRAY PACK SHIPPING CONTAINER

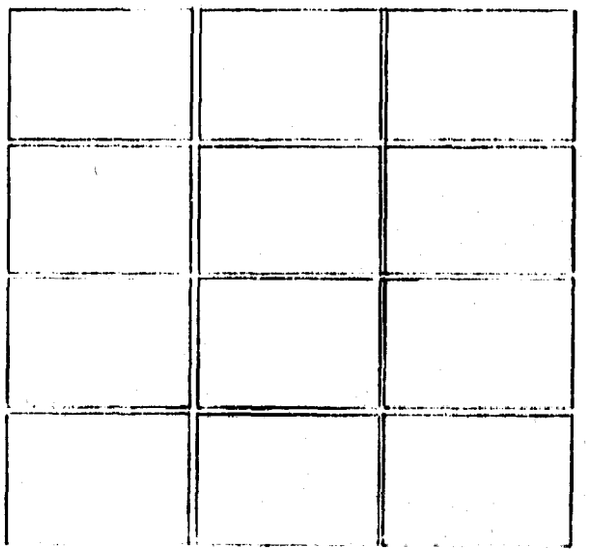
The unit load description

The shipping containers are packed into unit loads consisting of 48 shipping containers, 12 per layer, 4 layers high atop a pallet. The assembly is covered with a V2s corrugated fiberboard cap and is strapped together as shown in Figure 3.

The assembled weight of the unit load is approximately 1540 lbs. The volume is approximately 48" long by 41" wide by 46" high.



PALLET ELEVATION



UNIT LOAD FOOT PRINT

FIGURE 3. TRAY PACK CONTAINER UNIT LOAD

2. TYPES AND CAUSES OF DAMAGE

Types and causes of Tray Pack damage

The types of damage to the Tray Pack container found when shipped from Berkeley, Illinois under this program were:

(1) Buckling (bulging) of the Tray Pack lid;
(2) Buckling (bulging) and paneling (inward buckling) of the Tray Pack body bottom;
(3) Buckling (bulging) of the Tray Pack body sides;
(4) Denting of the Tray Pack body bottom edges.

The causes of these forms of damage are:

(1) Vacuum sealing combined with underfilling of the container;
(2) Hydrodynamic forces created within the container by relative fluid motion;
(3) Impact against relatively sharp objects.

When all the air is removed from a Tray Pack container filled with liquid, the atmosphere presses against the container with a pressure of 14.7 psi or a crushing force of about 2000 pounds across the lid and body of the Tray Pack. This force is opposed by a vapor pressure of 0.4 psi from the water in the food packed a total of 36 pounds. The container itself is made of steel 0.010" thick in a configuration that is not stiff or rigid.

Until the atmospheric pressure on the container is opposed by resistance forces from the food packed inside, the Tray Pack container will collapse at both top and bottom causing damage to the bottom corners in the form of buckling. When the Tray Pack is completely filled with incompressible food, there is no deflection of the Tray Pack and the fluid opposes the atmospheric forces without any deflection (collapse) of the Tray Pack.

However, in practice, it is extremely difficult for the food packer to fill the Tray Pack to the top. Consequently,

each container is usually partially unfilled to a degree resulting in some deflection (collapse) of the Tray Pack. In some cases the underfilling is such that paneling (inward buckling) of the tray body bottom takes place as soon as the Tray Pack contents cool. In other cases, while there is deflection, there is not enough deflection to cause damage at the time of packing. Nevertheless, the deflection is such that the amount of additional force required to cause damage is reduced and in some cases so much reduced that a small amount of additional force from handling will result in a large amount of damage to the Tray Pack body bottom and sides in the form of paneling (inward buckling) of the bottom and buckling (outward bulging) of the sides.

Additional force within the Tray Pack container during handling results from hydrodynamic forces due to fluid motion. These forces are on the order of 0.5 psi additionally imposed on the Tray Pack. Experimentation at Cummings Solar Corporation shows that the tray body can withstand a vacuum force of 2 psi without failure. Therefore, the fluid motion forces within the Tray Pack are not sufficient to cause damage, but when combined with a vacuum of 1 psi (2" mercury), damage can result.

Buckling and paneling of the Tray Pack top and bottom are depicted in Figure 4.

As stated previously the causes of this damage are a combination of the vacuum in the container and the hydrodynamic forces in the fluid (food) packed in the container. Cummings Solar Corporation results show that the greater the vacuum, the larger the paneling (inward buckling) of the tray body. Similarly, if an overpressure is applied to the container, Cummings Solar Corporation found that the greater the overpressure, the larger the buckling (outward bulging) of the lid.

Buckling (bulging) of the Tray Pack sides is also caused by excessive vacuum. As stated previously, vacuum packing of Tray Packs results in atmospheric forces crushing the tray body

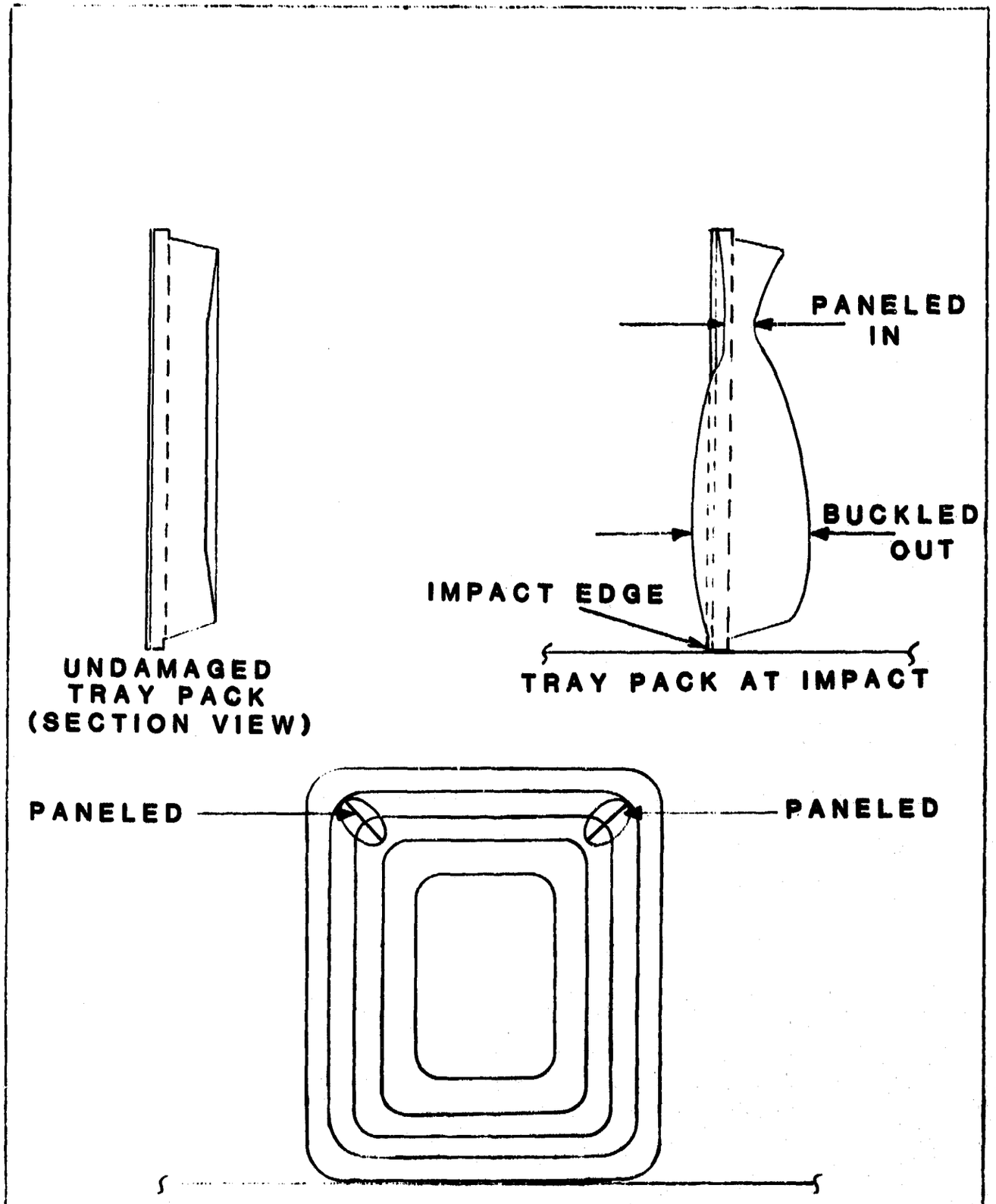


FIGURE 4.
TRAY PACK BUCKLING AND PANELING DAMAGE

and lid together until these crushing forces are resisted by the fluid (food) in the Tray Pack. When a Tray Pack which is underfilled and vacuum-packed is dropped on its bottom, the fluid in the Tray Pack creates an overpressure on the sides causing them to buckle (bulge) outward.

Denting of Tray Packs is caused by striking sharp objects. The heavier weight materials have less susceptibility to denting than lighter weight materials.

Types and causes of shipping container damage

The most important defect of the current shipping container design is its inability to sustain crushing loads. This defect makes it impossible to stack unit loads.

The first defect in the current design is the mismatch in the sizes of the parts of the shipping container and its contents. Specifically, the fiberboard shipping container sidewalls are taller than the liner sidewalls and the liner sidewalls are taller than the ensemble of Tray Packs and fiberboard pads. Therefore, a crushing load is first applied to the shipping container sidewalls. These sidewalls buckle when the load exceeds their strength and the entire load is shifted to the fiberboard liner. The load then collapses the liner and the load is shifted to the ensemble of Tray Packs and fiberboard pads. The pads are then dented along the perimeter of the sealing seam leading to more deflection. The Tray Pack ensemble then bears the entire load. However, at this point, the shipping container has been deflected by as much as an inch.

When Tray Pack shipping containers are packed in unit loads, they are packed 4x3x4 high (Figure 3). The crushing load is applied to the outside shipping containers so that when one of these fails, it leads to tilting of the stacked unit loads to the extent that if the unit loads were stacked four high, they would topple.

A second design defect is the concept of the pads being sized to the inside dimensions of the liner so that they rest

on the sealing seam. As soon as the shipping container is dropped, the pads are dented around the perimeter of the sealing seam so that even if every part fitted perfectly at the time of packing, the Tray Packs are now loose in the shipping container due to the deflection. This then leads to the load being applied to the shipping container sidewalls and the liner but not to the Tray Packs. The container sidewalls and the liner then collapse again tilting the load.

A third design defect is that the sidewall and the liner are really not sufficiently strong to bear the stacking load and three layers of fiberboard rather than two are needed.

3. TRAY PACK ROUGH HANDLING LOADS IN RELATION TO TESTING PROGRAM

The rough handling environments of importance to the Tray Pack program are:

(1) Dropping of Tray Packs on their sides
(2) Dropping of shipping containers
(3) Stacking of unit loads.

In addition, for purposes of evaluation, a fourth environment is important:

(4) Vacuum level in Tray Pack.

For purposes of completeness, testing of certain other environments was conducted. Nevertheless, these environments are not important because they are not the source of either Tray Pack damage or shipping container failure:

(5) Dropping of unit loads;
(6) Vibration of unit loads.

Testing to determine the vacuum level that can be sustained by the Tray Pack container is very important because it pinpoints the allowable level of vacuum packing.

Testing to determine the side drop height that can be sustained without Tray Pack damage is important because dropping of Tray Packs so that they impact on their sides is the primary cause of tray body paneling and tray lid buckling. Such testing should include side dropping of Tray Packs outside of shipping containers and when packaged in shipping containers.

Testing to determine the crushing load that can be sustained by shipping container configurations is important because shipping container failure is the reason why unit loads cannot be stacked.

The testing under this program was divided into two areas: Evaluation Testing (see Appendix B) and Acceptance Testing (see Appendix C). The Evaluation Testing was used to determine the levels of exposure that could be sustained

without damage. The Acceptance Testing was used to determine whether or not the Tray Packs and shipping containers can sustain expected levels of exposure to rough handling without failure. The procedures for these tests are listed below in Tables 1 to 8 and illustrated in Figures 5 to 12.

TABLE 1

TRAY PACK VACUUM TEST PROCEDURE

Test samples shall be Tray Packs of various reinforcement concepts filled with air.

Procedure:

(1) Install sample in test setup (Figure 5).
(2) Turn on pump with isolation valve closed.
(3) Crack isolation valve and apply 1" Hg.
(4) Examine sample for buckling.
(5) If sample has buckled:
    a. Number and mark sample and record on data sheet.
    b. Discontinue test and disconnect Tray Pack from equipment.
(6) If sample has <u>not</u> buckled:
    a. Record result on data sheet.
    b. Crack valve and increase vacuum by 1" Hg.
(7) Repeat procedure until:
    a. Failure
    b. 7" Hg vacuum is reached.

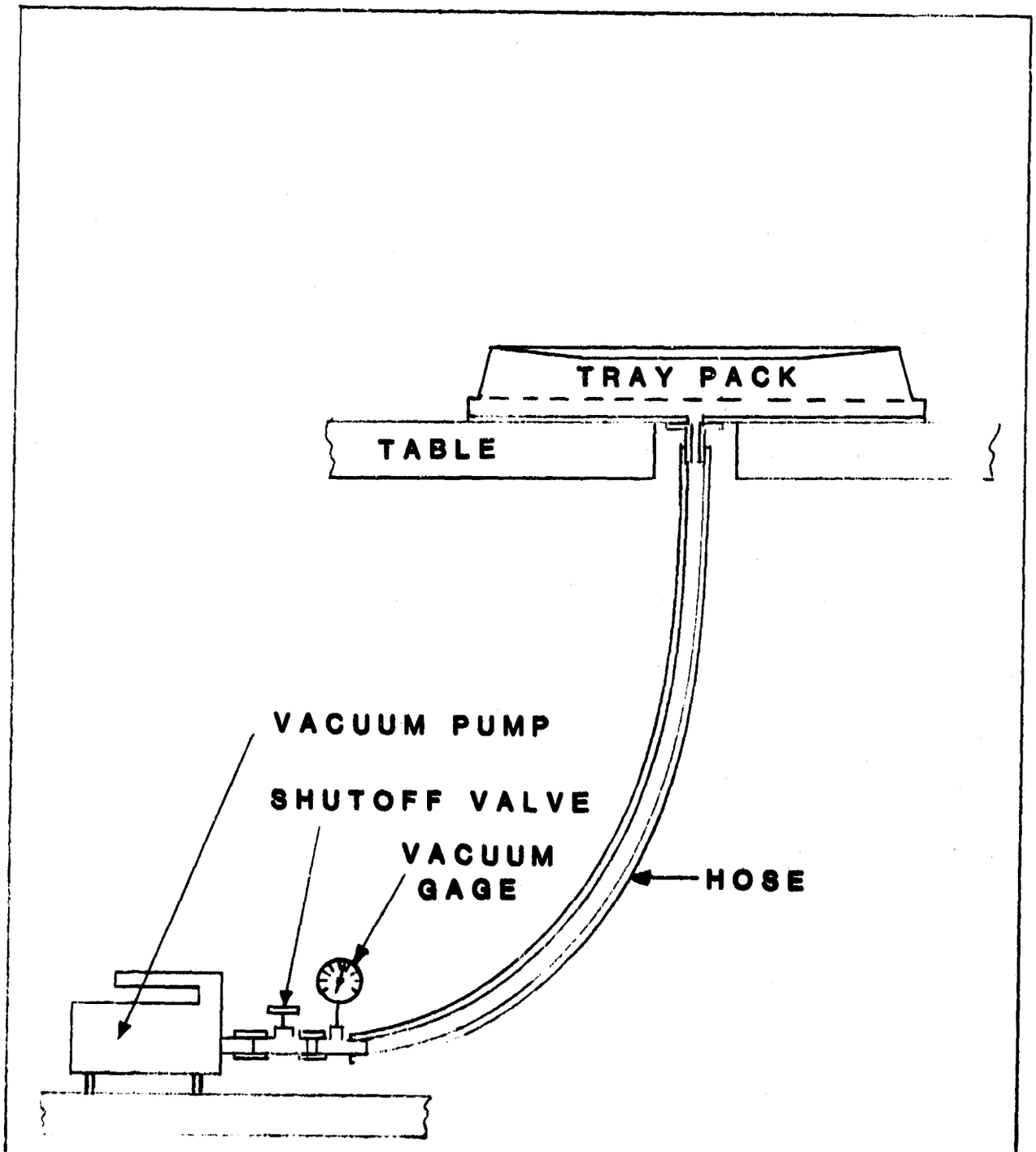


FIGURE 5
TRAY PACK VACUUM TEST SETUP

TABLE 2

TRAY PACK SIDE DROP TEST PROCEDURE

Test samples shall be Tray Packs of various reinforcement concepts filled with water and packed foods.

Procedure:

(1) Raise the sample such that the shorter side is parallel to and 3" above the floor.

(2) Release the sample evenly and allow the sample to drop on its side to impact the floor.

(3) Examine the sample for buckling.

(4) If sample has buckled:
   a. Mark and number sample and record results on data sheet.
   b. Discontinue test.

(5) If sample has not buckled

(6) Raise sample by 3".

(7) Repeat procedure until:
   a. Failure
   b. 21" drop height test is complete.

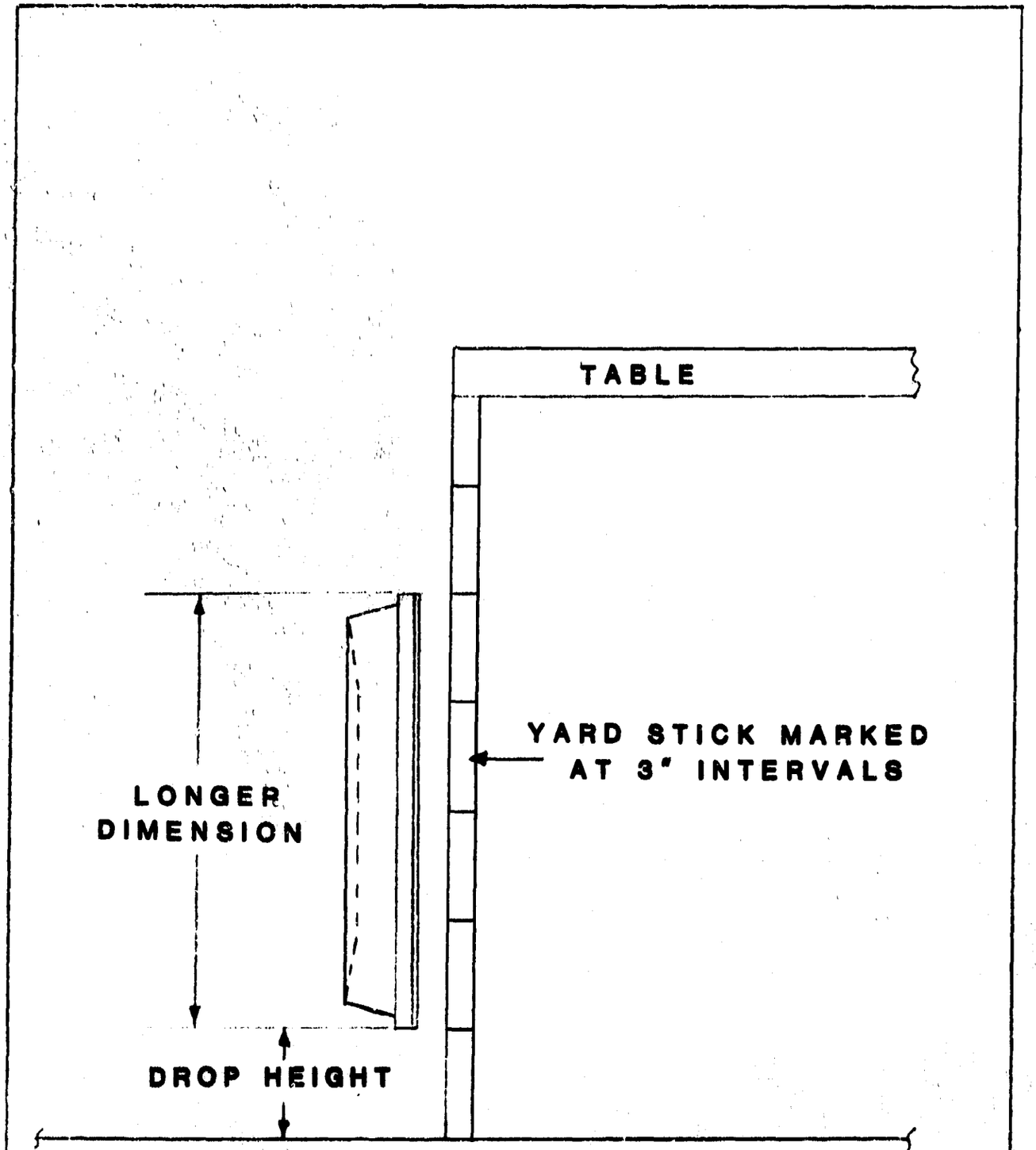


FIGURE 6.

TRAY PACK SIDE DROP TEST SETUP

TABLE 3

SHIPPING CONTAINER SIDE DROP TEST PROCEDURE

Test samples shall be shipping containers of various shock absorbing concepts packed with Tray Packs of various reinforcement concepts and filled with water or foods.

Procedure:

(1) Install sample in sling with shorter side parallel to floor.
(2) Level sample.
(3) Raise to 3" above floor and relevel sample if necessary.
(4) Using torch, melt suspension line allowing sample to drop.
(5) Carefully unpack the Tray Packs marking the impact side and marking any damage.
(6) Record results on data sheet.
(7) If samples have been damaged:
    a. Discontinue test.
    b. Repack samples.
(8) If samples have <u>not</u> been damaged:
    a. Carefully repack samples as before.
    b. Reinstall sample in sling and increase height by 3".
    c. Repeat procedure until testing of 30" height is reached.

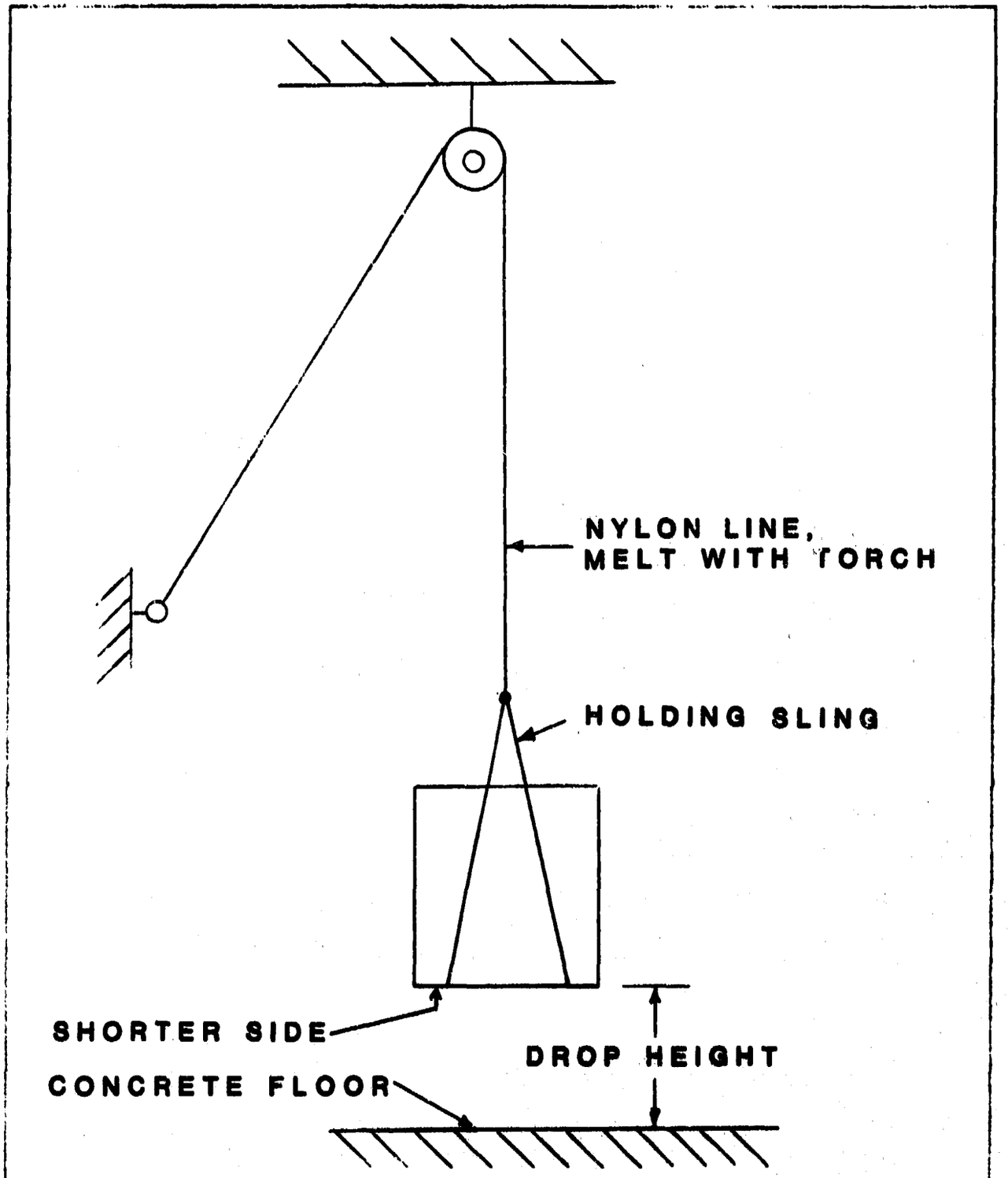


FIGURE 7.

SHIPPING CONTAINER SIDE DROP TEST SETUP

TABLE 4

SHIPPING CONTAINER COMPRESSION TEST PROCEDURE

Test samples shall be various shock absorbing shipping container configurations including the current configuration.

Procedure:

(1) Place carton on floor.
(2) Place load holding fixture on carton centering it to assure that load will be evenly applied.
(3) Measure height of fixture above floor.
(4) Apply load.
(5) Measure change of height fixture above floor.
(6) Inspect carton for damage.
(7) Leave sample overnight and reinspect the next day - remeasure height.
(8) Increase load and remeasure.
(9) Continue until carton fails.

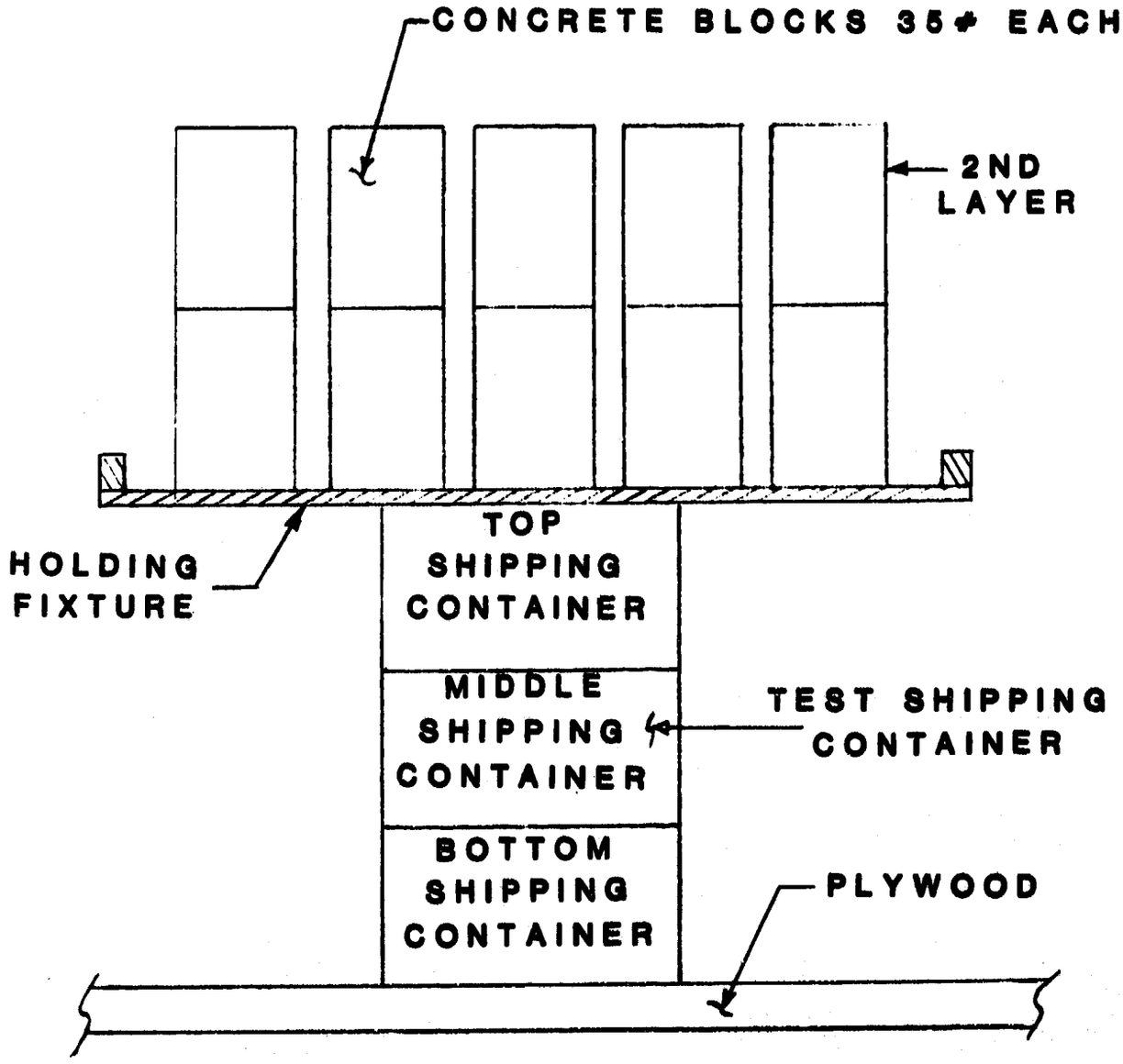


FIGURE 8.

SHIPPING CONTAINER COMPRESSION TEST SETUP

TABLE 5
ACCEPTANCE TEST
SHIPPING CONTAINER DROP TEST PROCEDURE

(1) The shipping container shall be dropped in sequence as listed below:

DROP #	IMPACT SURFACE	DROP HEIGHT
1	BOTTOM	26"
2	BOTTOM/#3 SIDE - EDGE	13"
3	BOTTOM/#2 SIDE - EDGE	13"
4	BOTTOM/#2, #3 SIDE - CORNER	13"
5	BOTTOM/#1, #4 SIDE - CORNER	13"
6	TOP	13"
7	BOTTOM/#1, SIDE - EDGE	13"
8	BOTTOM/#4 SIDE - EDGE	13"
9	BOTTOM/#1, #4 SIDE - CORNER	13"
10	BOTTOM/#3, #4 SIDE - CORNER	13"
11	SIDE/#1	13"

(2) The sample shall be placed in the sling and placed in the correct orientation using as applicable:
   a. The level
   b. The edge drop fixture
   c. The corner drop fixture.

(3) The sample shall be raised to the required height.

(4) Using torch, melt the suspension line allowing the sample to drop.

(5) Note any damage to the shipping container on the data sheet.

(6) Repeat the above procedure until test sequence number 11 is complete.

(7) Remove the Tray Packs from the shipping container. Mark any damage and record same on the data sheet.

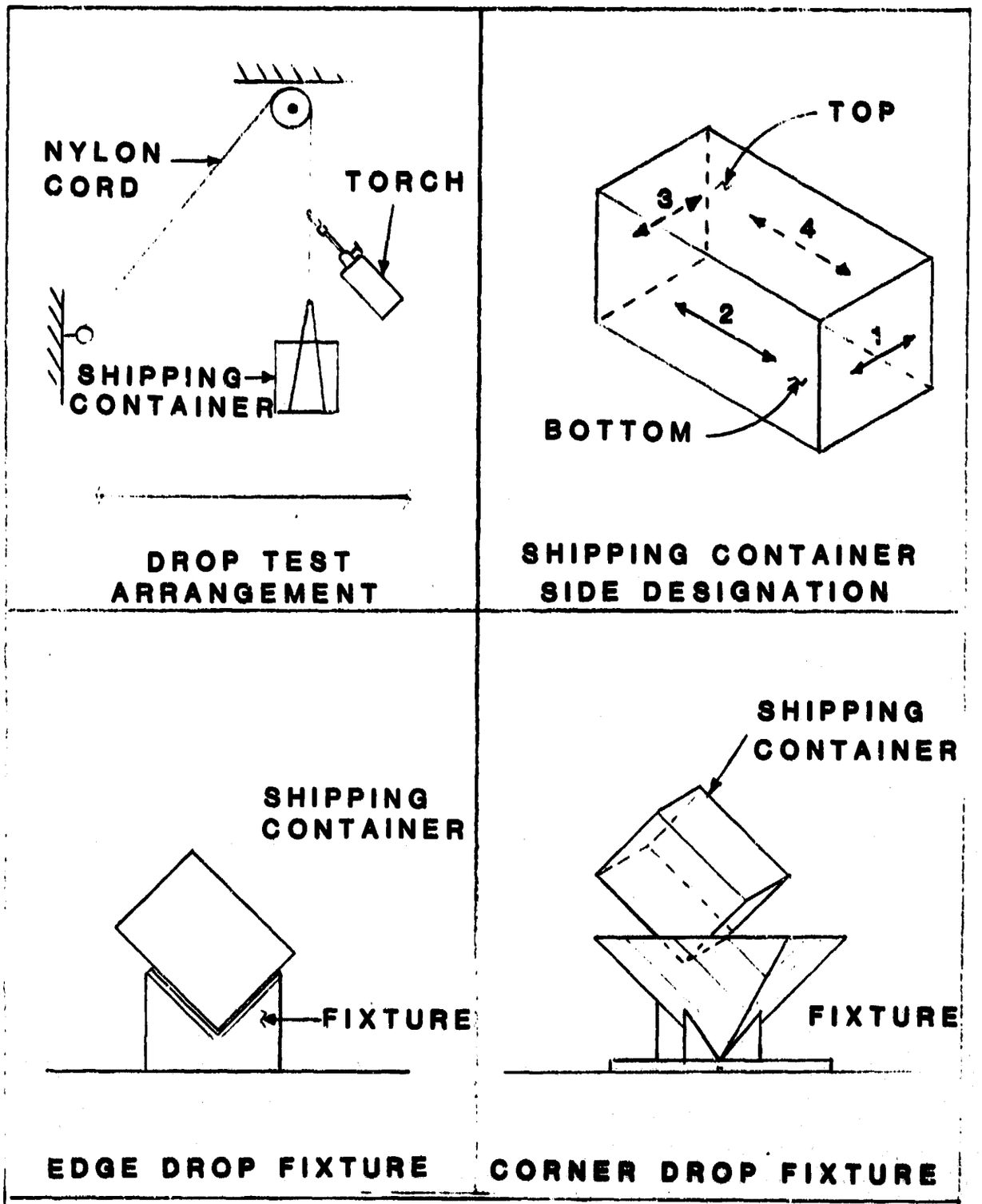


FIGURE 9. ACCEPTANCE TEST SHIPPING CONTAINER DROP TEST SETUP

TABLE 6

ACCEPTANCE TEST

UNIT LOAD DROP TEST PROCEDURE

(1) The unit load shall be lifted to a 6" height by a chain pull. After lifting a 6" shim shall be placed under that side of the unit load.

(2) The opposite side of the unit load shall then be lifted to 6" height.

(3) The torch shall be used to melt the lifting cord releasing the unit load.

(4) Any damage shall be recorded on the data sheet.

(5) This procedure shall be repeated until all sides of the unit load have been dropped.

(6) The unit load shall then be unpacked shipping container by shipping container and the contents inspected for damage.

(7) Any damage shall be marked and recorded on the data sheet.

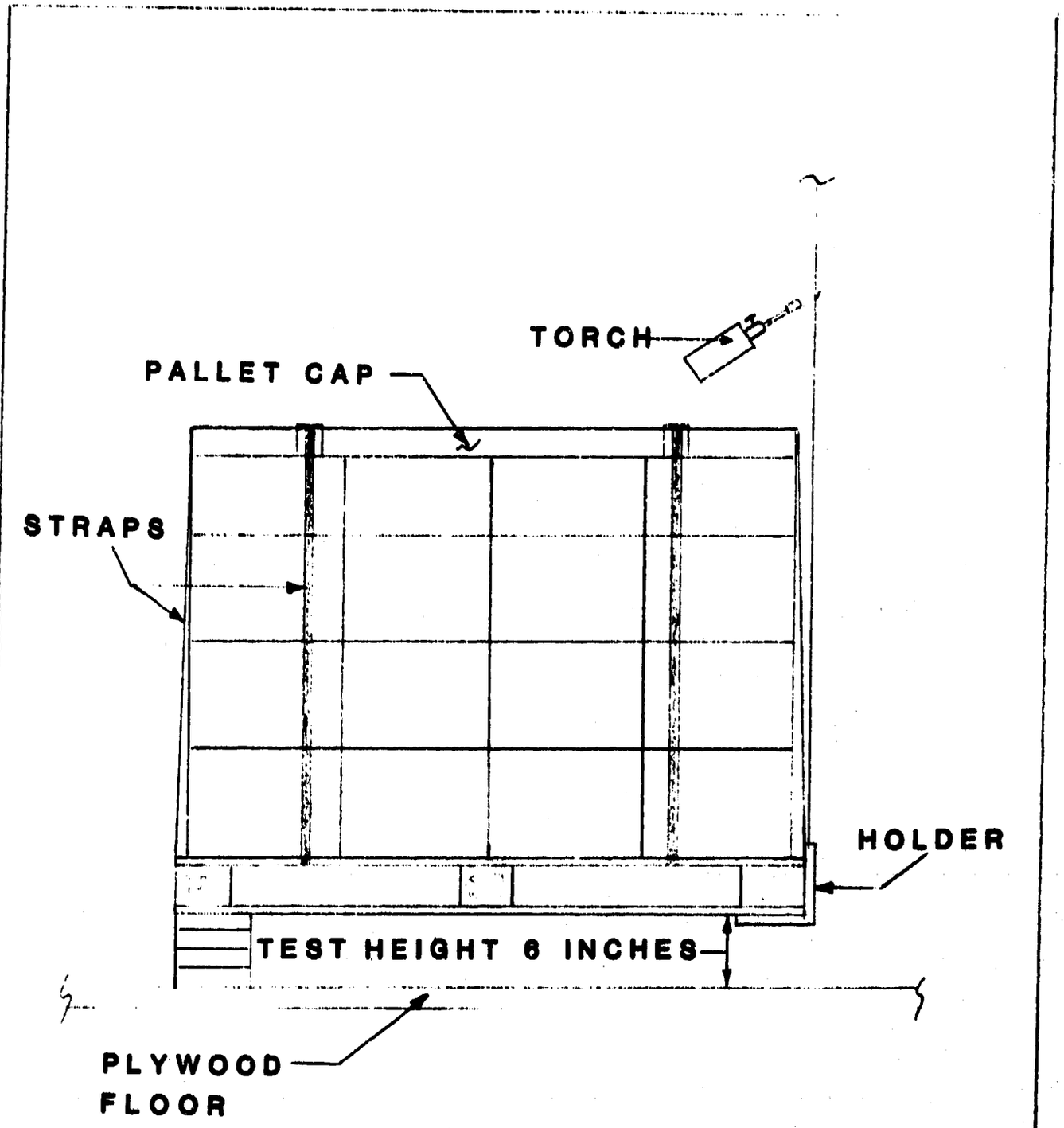


FIGURE 10. ACCEPTANCE TEST UNIT LOAD DROP TEST

TABLE 7

ACCEPTANCE TEST

UNIT LOAD COMPRESSION TEST PROCEDURE

Procedure:

(1) The load fixture shall be centered on the unit load.

(2) Concrete blocks shall be added gradually until the weight of one unit load is atop the test unit.

(3) The height of the unit load from the floor shall be measured and the results recorded on the data sheet.

(4) The load shall be left for 24 hours.

(5) The load shall be inspected for damage and if it has not failed the height shall be remeasured. The results shall be recorded on the data sheet.

(6) If the unit has failed, discontinue the test.

(7) If the unit has not failed, add concrete blocks to the weight of a second unit load and repeat procedure.

(8) Discontinue test after a test level of three unit loads weight has been placed atop the test unit.

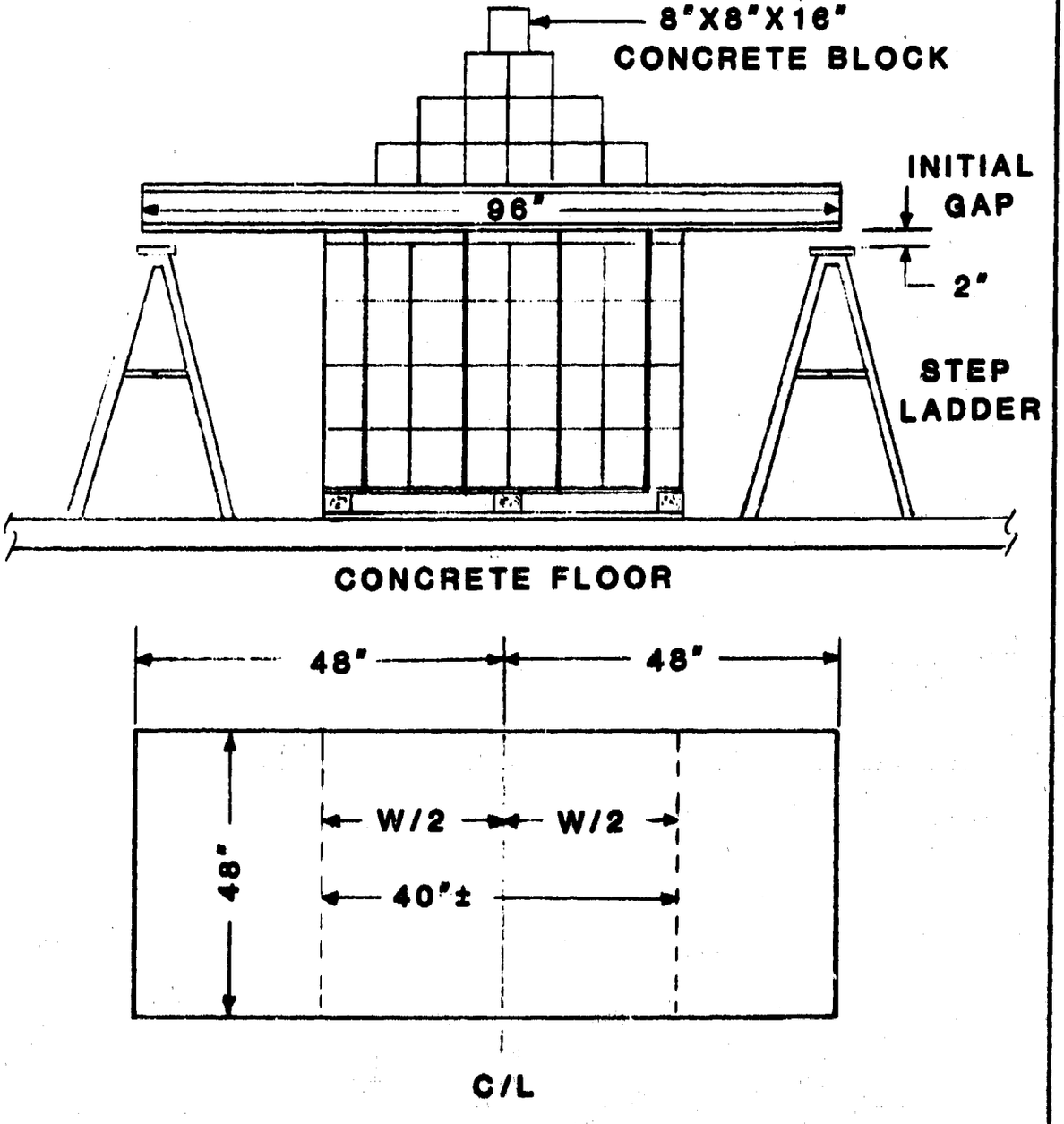


FIGURE 11. ACCEPTANCE TEST UNIT LOAD COMPRESSION TEST SETUP

TABLE 8

ACCEPTANCE TEST

UNIT LOAD VIBRATION TEST PROCEDURE

(1) Mount unit load on shaker table. Do not strap down.

(2) Adjust shaker for 175 cycles per minute

(3) Increase amplitude until 1.0 g is reached and unit load leaves table surface by 1/16".

(4) Dwell 60 minutes at this condition.

(5) Unpack unit load, mark damage, and record in log.

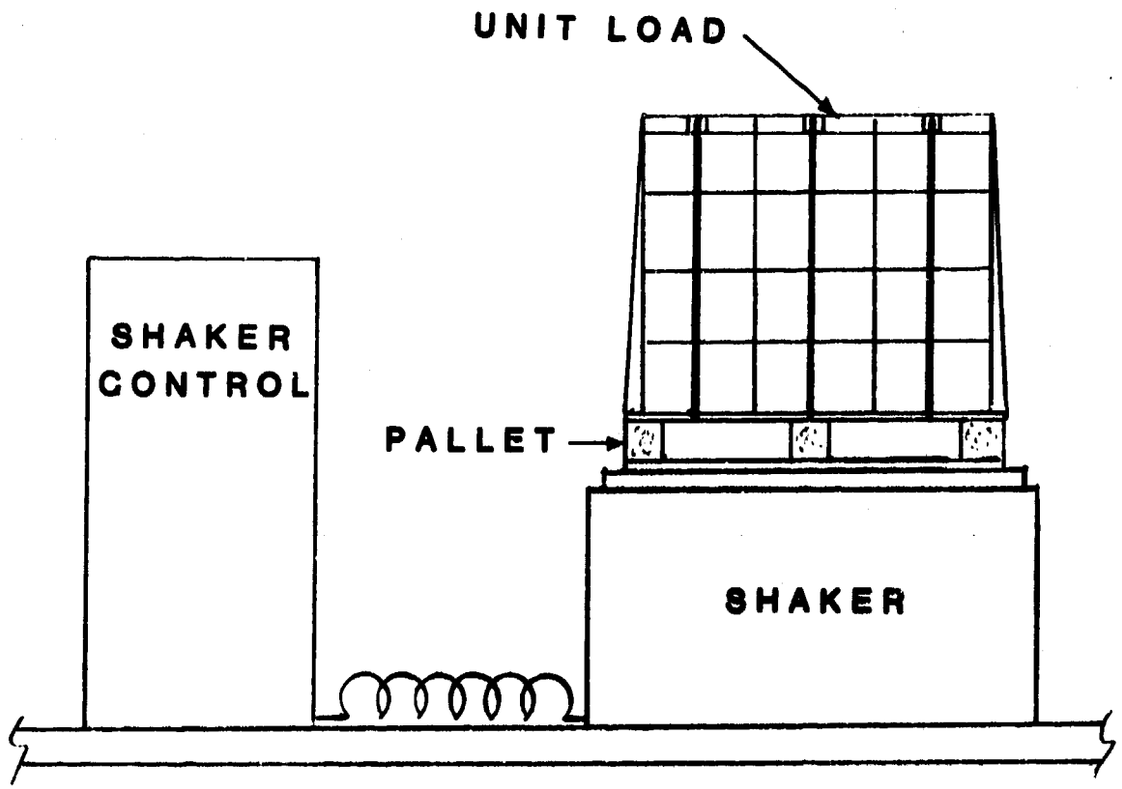


FIGURE 12. ACCEPTANCE TEST UNIT LOAD VIBRATION TEST SETUP

4. IMPROVED DURABILITY DESIGN CONCEPTS

The Improved Durability Design Concepts developed during this program include:

(1) Development and manufacture of Tray Pack bodies and lids with reinforcing beads.

(2) Development of 98-pound weight tray bodies and tray lids.

(3) Recommendation to pack Tray Packs without vacuum.

(4) Development of the telescoping shipping container.

(5) Development of the nesting pad.

(6) Development of a shipping container packing technique whereby the bottom two Tray Packs are placed lid down and the top two are placed lid up.

The concept of the reinforced Tray Pack was conceived at Cummings Solar Corporation. The reinforced tray bodies and tray lids are shown in Figures 13 and 14. Test units in this configuration were manufactured by Central States Can Co., Massillon, Ohio. The beads for the tray bodies were 0.050" deep while the beads for the tray lids were a maximum of 0.018" deep.

The concept of the telescoping shipping container was conceived at U.S. Army Natick R&D Center, Natick, Mass. An alternate concept, a double-liner shipping container was developed at Cummings Solar Corporation. Both concepts were manufactured for testing by the Horn Corporation of Natick, Mass.

The concept of the nesting pads and the concept of packing Tray Packs with the bottom two facing down and the top two facing up were both investigated at Cummings Solar Corporation. The combined concept utilizing nesting pads, the telescoping container, and the two-up/two-down packing concept are shown in Figure 15.

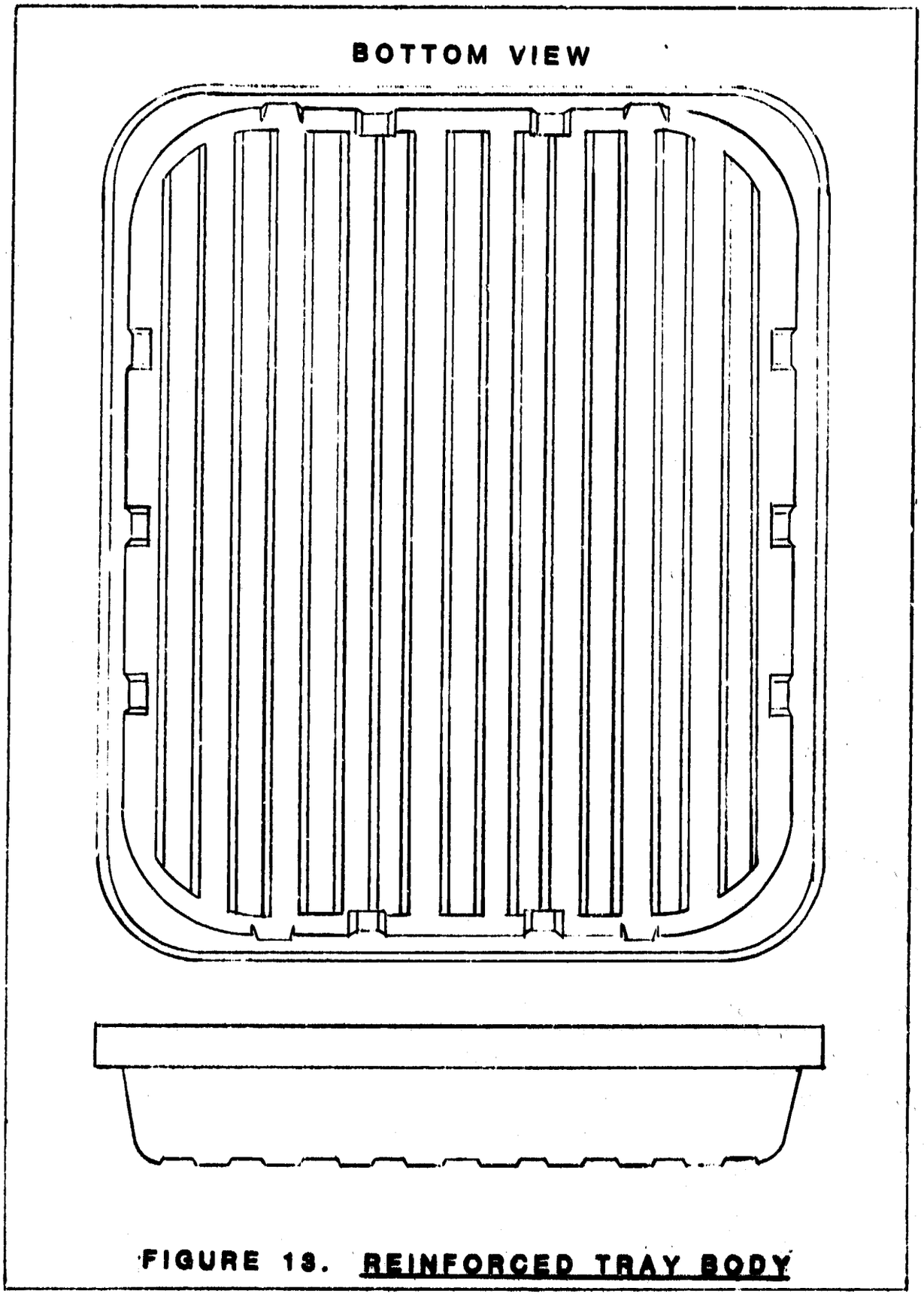


FIGURE 13. REINFORCED TRAY BODY

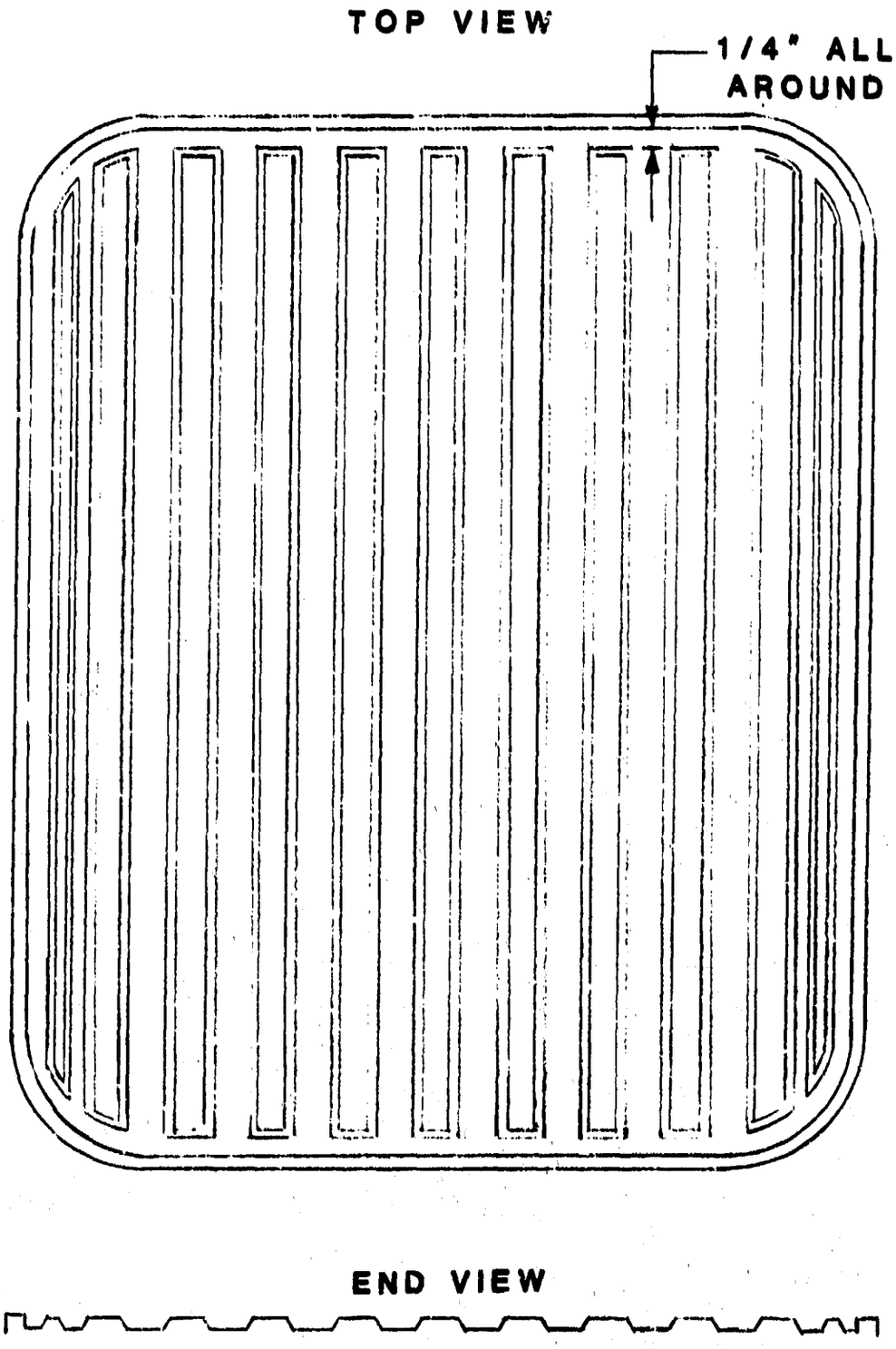


FIGURE 14. REINFORCED TRAY LID

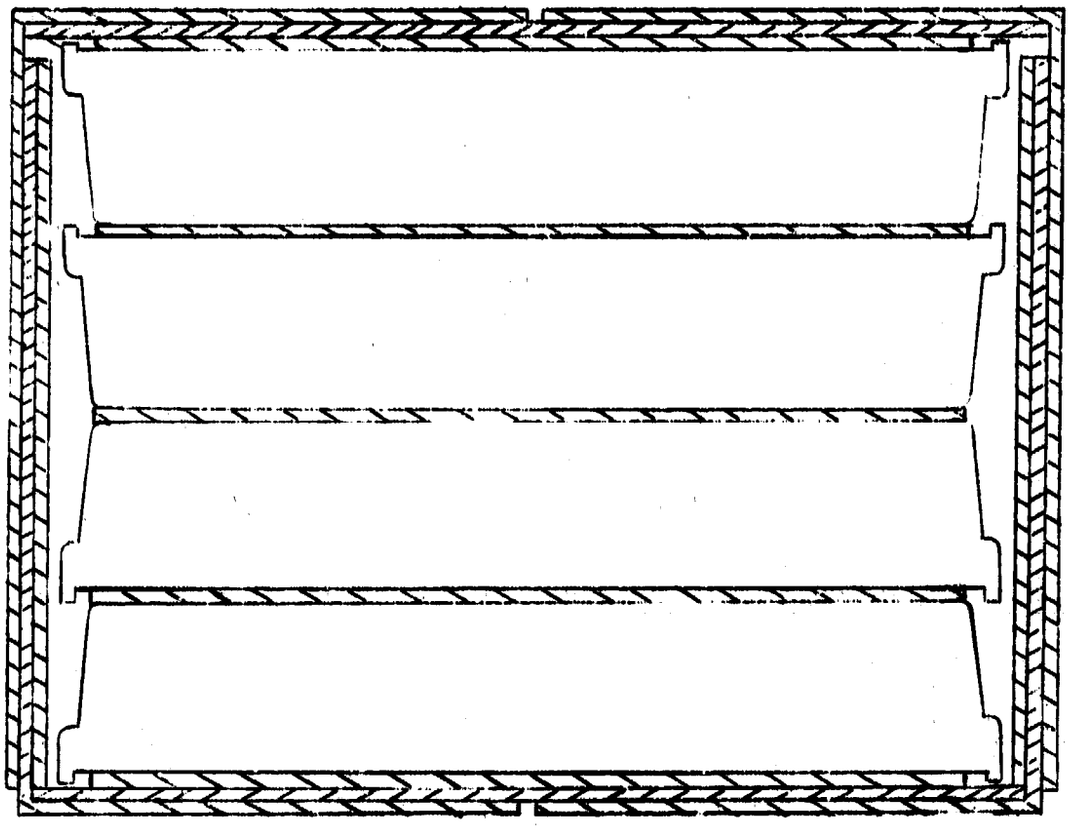


FIGURE 15. TELESCOPING SHIPPING CONTAINER WITH NESTING PADS AND 2 DOWN, 2 UP PACKING OF TRAY PACKS

The dimensions of the shipping container components are:

Cover	-	13"	x	10 3/4"	x	8 11/16"
Liner	-	12 5/16"	x	10 1/16"	x	8 3/8"
Bottom	-	12 11/16"	x	10 3/8"	x	8 3/8"
Pads	-	11 1/4"	x	9 1/4"		

It is important that these dimensions are used so that the shipping container will fit together properly for stacking strength.

5. RESULTS OF INCOMING INSPECTION

Incoming inspection was conducted on the following types of Tray Packs.

(1) 98# Tray Packs, with reinforced lids and trays filled with water.

(2) 90# Tray Packs, with reinforced lids and trays filled with water.

(3) 90# Tray Packs, Baseline (unreinforced) configuration filled with cut beans.

(4) 90# Tray Packs, with reinforced lids and trays filled with corn.

(5) 90# Tray Packs, with reinforced lids and trays filled with cut beans.

(6) 90# Tray Packs, baseline (unreinforced) configuration filled with corn.

The inspection sheets are presented in Appendix A.

All of the damage found was to the Tray bodies, none to the lids. Note that the vacuum placed on the Tray Pack during packing inhibited damage to the lid and caused the damage to the body. Nevertheless, the extent of the damage was minor. The damage found was of two types:

(1) Dents

(2) Tray body paneling (inward buckling).

Table 9 is a presentation of the distribution of damage. With the exception of the Tray Packs packed with corn, only 4% to 5% of the containers sustained major damage. Cummings Solar Corporation suspects, but cannot prove, that the corn-filled containers were not filled as full as the other containers and possibly filled at a higher vacuum.

Table 10 is a presentation of distribution of Tray Pack damage types found during incoming inspection. The only trend evident from this is that the minor damage exceeds the major damage for both panels and dents.

TABLE 9

DISTRIBUTION OF DAMAGE

TRAY PACK TYPE	NUMBER RECEIVED	UNDAMAGED	MINOR DAMAGE	MAJOR DAMAGE
90# BASELINE CORN	29	55%	31%	14%
90# BASELINE CUT BEANS	28	79%	18%	4%
90# REINFORCED CORN	20	60%	25%	15%
90# REINFORCED CUT BEANS	24	79%	17%	4%
90# REINFORCED WATER	172	88%	7%	5%
98# REINFORCED WATER	171	88%	8%	4%

TABLE 10

DISTRIBUTION OF TRAY PACK DAMAGE TYPES FOUND DURING INCOMING INSPECTION

TRAY PACK TYPE	NUMBER RECEIVED	MINOR PANEL	MAJOR PANEL	SLIGHT DENT	PRONOUNCED DENT
98# REINFORCED WATER FILL	175	3%	0.6%	5%	3%
90# REINFORCED WATER FILL	176	1%	0.6%	5%	4%
90# BASELINE CUT BEANS	28	11%	0%	7%	4%
90# REINFORCED CUT BEANS	24	8%	0%	8%	4%
90# BASELINE CORN	32	19%	12%	12%	0%
90# REINFORCED CORN	20	10%	0%	20%	15%

6. RESULTS OF EVALUATION TESTS

Four types of evaluation testing were conducted.

(1) Vacuum tests on Tray Packs.
(2) Side drop tests on Tray Packs.
(3) Side drop tests on shipping containers.
(4) Crush tests on shipping containers.

The data sheets for these tests are presented in Appendix B.

The Tray Pack vacuum tests were conducted in order to observe paneling failure of the tray bodies and to compare the level of vacuum required to induce failure for improved durability concepts vs the baseline concept.

The basis of our concern with vacuum is, first, failures induced by vacuum packing and, second, failures resulting from hydrodynamic vacuum forces. At the moment of impact, when a Tray Pack is dropped on its side, a hydrodynamic vacuum force is induced at the end opposite the side of impact and a hydrodynamic pressure force is induced at the impact side.

Table 11 is a summary of the prefailure vacuum levels achieved by the samples tested. The reinforced samples were able to sustain a vacuum of about 2.0 psi before failure. The hydrodynamic forces induced in a 13" side drop are calculated to be 0.47 psi from $\Delta P = \rho gh$

where
P = Pressure or vacuum
ρ = density of the Tray Pack contents
g = acceleration of gravity
h = height of Tray Pack drop.

Consequently, Tray Packs packed with a vacuum of approximately 1.5 psi (3 inches of mercury) or greater, can be expected to fail. Therefore, failure can be avoided by packing in a vacuum of 1" of mercury or less.

The test results show that the reinforcing technique has increased the vacuum to fail from about 1.5 psi to about 2.0 psi and that it has also changed the character of the failure such that the paneling tends to be less severe and without the very sharp folds that existed previously.

TABLE 11

TRAY PACK INTERIOR AVERAGE VACUUM LEVELS ACHIEVED BEFORE FAILURE

TRAY PACK CONCEPT	VACUUM LEVEL	FAILURE COMMENTS
90# BASELINE	1.59 psi	
90#, 0.050" REINFORCED	1.96 psi	ALL REINFORCED SAMPLES PANELED VERY GRADUALLY RATHER THAN WITH A SHARP SNAP AND THE ULTIMATE DAMAGE WAS LESS SEVERE.
90#, 0.040" REINFORCED	1.59 psi	
90#, 0.06" REINFORCED	2.02 psi	
98#,0.04" REINFORCED	1.96 psi	
98#, 0.05" REINFORCED	1.96 psi	
98#, 0.06" REINFORCED	2.08 psi	

Table 12 describes the results of side drop tests conducted on a variety of Tray Pack configurations filled with water. As can be seen from this testing, the heavier weight samples with deeper reinforcing beads were able to sustain greater drop heights without damage.

TABLE 12

AVERAGE HEIGHT TO FAILURE

TRAY PACK SIDE DROP TESTS

* All Tray Packs filled with water - no vacuum packing

CONFIGURATION	HEIGHT TO CAUSE TRAY BODY PANELING
90# BASELINE	9.75"
90# REINFORCED/0.040" BEADS	9.75"
90# REINFORCED/0.050" BEADS	11.25"
90# REINFORCED/0.060" BEADS	12.75"
98# REINFORCED/0.040" BEADS	14.25"
98# REINFORCED/0.050" BEADS	15.00"
98# REINFORCED/0.060" BEADS	17.25"

Table 13 describes the results of testing to determine the drop height to cause failure of tray bodies of various configurations. This table shows that the heavier weight, more deeply reinforced tray bodies can withstand a greater drop height without damage.

Table 14 describes the results of testing to determine the drop height to cause failure of tray lids of various configurations. The first of these tests, with the lids failing at a 9" drop height shows the vulnerability of the lid because it is indented below the sealing seam with nothing to support it. By adding nesting pads we were able to provide some support to the lids and increase the drop height to failure. At the same time we found that we had a consistent failure of the tray body of the bottom Tray Pack in the stack. Cummings Solar Corporation then reversed the bottom two Tray Packs so that the lids faced down and repeated the tests. The failure of the bottom tray body was eliminated and the height to first failure was increased to 21" which is 8" higher than the ASTM Assurance Level II required drop height. Cummings Solar repeated this test using a baseline lid and the first damage to the lid occurred at a 15" drop height rather than the 21" of the previous test. This proved that the reinforcing beads on the lid had increased the drop height to cause damage from 15" to 21". This test was later repeated using a lid with a 5" by 5" label space interrupting the reinforcing beads. The drop height required to cause lid damage was 18" or halfway between the 15" for the baseline lid and the 21" of the completely beaded lid.

TABLE 13

DROP HEIGHT CAUSING FIRST FAILURE

SHIPPING CONTAINER SIDE DROP TESTS

(1) Tray Packs of various configurations filled with water - no vacuum packing.

(2) Double liner shipping container with nesting pads.

TRAY PACK CONFIGURATION	HEIGHT FOR FIRST TRAY PACK PANELING FAILURE
90# BASELINE	9"
90# REINFORCED, 0.040" BEADS	15"
90# REINFORCED, 0.050" BEADS	12"
90# REINFORCED, 0.060" BEADS	15"
98# REINFORCED, 0.040" BEADS	15"
98# REINFORCED, 0.050" BEADS	18"
98# REINFORCED, 0.060" BEADS	15"

TABLE 14

DROP HEIGHT TO CAUSE FIRST FAILURE

SHIPPING CONTAINER SIDE DROP TESTS

(1) All trays 98#, 0.050" Reinforcing Bead Configuration.

(2) Shipping container, telescoping configuration with nesting pads.

(3) Tray Packs filled with water - no vacuum.

SHIPPING CONTAINER AND TRAY LID CONFIGURATION	DROP HEIGHT TO FIRST FAILURE	
	LID	TRAY
NO PADS 98#, 0.022" - 0.023" BEAD LID	9"	15"
3 PADS 98#, 0.019" BEAD LID	9"	12"
3 PADS 98#, 0.015" BEAD LID	9"	9"
3 PADS 90#, 0.014" BEAD LID	9"	12"
3 PADS 90#, 0.018" BEAD LID	9"	12"
4 PADS 90#, 0.022" BEAD LID	21"	12"
5 PADS 90#, 0.022" BEAD LID	18"	12"
5 PADS TRAY PACKS - TWO FACING UP, TWO FACING DOWN. 98#, 0.022" BEAD LID	21"	21"
5 PADS TRAY PACKS - TWO FACING UP, TWO FACING DOWN. 98# BASELINE LID	15"	21"
5 PADS TRAY PACKS - TWO FACING UP. TWO FACING DOWN. 98#, 0.018" LID WITH 5" X 5" LABEL SPACE NTER	18"	30"

Table 15 presents the results of a series of shipping container crush tests. The first two samples tested were not fitted properly. The container did not match the liners and the liners did not match the Tray Packs packed. Consequently, the maximum force sustainable was 762 lb. The third sample tested was a reinforced (two-liner) shipping container of correct size so that the shipping container, liner, and the contents all fit together. The maximum force sustainable was 1,322 lb or almost twice as much. Following this we tested a number of telescoping shipping containers including one with nesting pads and two Tray Packs facing down and two up. All were able to sustain over 1,000 lb load.

When shipping containers are packed in unit loads stacked four high, the load on the bottom of shipping containers is an average of about 500 lb. In order to feel confident that a shipping container can be used in unit loads stacked four high, a crush strength in excess of twice that level or 1,000 lb is desired.

While both the telescoping and the double liner shipping containers will sustain such a load, they both require the Tray Pack to bear a part of the load without damage or leakage. Table 16 shows the results of a Tray Pack crush test to determine whether or not the Tray Pack could sustain such a load. As shown, both the baseline and the reinforced concepts were able to sustain over 900 lb of force without any damage at all.

TABLE 15

SHIPPING CONTAINER CRUSH TEST

MAXIMUM WEIGHT SUSTAINABLE BY

VARIOUS SHIPPING CONTAINER CONFIGURATIONS

SHIPPING CONTAINER	MAXIMUM WEIGHT SUSTAINED WITHOUT TIPPING - (LISTING)
REINFORCED (2 LINER) CONTAINER OF INCORRECT SIZE (TOO LARGE) WITH NESTING PADS	762 lb
BASELINE CONTAINER 1 LINER WITH FULL SIZE PADS (ILL FITTING)	762 lb
REINFORCED (2 LINER) CONTAINER OF CORRECT SIZE AND NESTING PADS	1,322 lb
TELESCOPING CONTAINER WITH NO PADS	1,462 lb
TELESCOPING CONTAINER WITH NESTING PADS	1,182 lb.
TELESCOPING CONTAINER WITH NESTING PADS AND 2 TRAY PACKS FACING UP AND 2 TRAY PACKS FACING DOWN	1,082 lb

TABLE 16

TRAY PACK CRUSH TEST

FORCE SUSTAINED WITHOUT DAMAGE

TRAY PACK CONFIGURATION	MAXIMUM WEIGHT SUSTAINED WITHOUT SEAM LEAKAGE
98# TRAY WITH 0.040 REINFORCING BEADS	4,706 lb mass *
BASELINE TRAY PACK	986 lb mass
98# TRAY WITH 0.050 REINFORCING BEADS 98# LID WITH 0.022 REINFORCING BEADS	948 lb mass

* NO SEAM LEAKAGE BUT TRAY PACK SIDES WERE BUCKLED.

7. RESULTS OF ACCEPTANCE TESTS

The Acceptance Tests conducted were:

(1) Shipping container drop test;
(2) Unit load drop test;
(3) Unit load compression test;
(4) Unit load vibration test.

The data sheets for these tests are presented in Appendix C.

Table 17 summarizes the results of the shipping container drop tests. The Tray Packs used in these tests were originally vacuum packed. When they were tested in the as-received condition, the Tray Packs sustained damage no matter how they were packed. When the vacuum was released from the Tray Packs by drilling a small hole in the center and glue gunning the opening shut, there was no damage to any Tray Pack. Consequently, we have concluded that Tray Packs must be packed without vacuum or with much reduced vacuum.

The unit load compression test was conducted on telescoping shipping containers packed with Tray Packs two facing up and two facing down spaced by means of five nesting pads. The unit load comprising 48 shipping containers in four layers of 12 each, sustained a load of 5000 pounds for three days without the slightest tip, tilt or buckling of any shipping container. At the end of the test the unit load appeared to be able to easily sustain more load. There was no damage to any Tray Packs in the unit load.

This same unit load was subject to a unit load drop test. There was no damage to any Tray Pack.

This same unit load was subject to a unit load vibration test at one G acceleration and 175 cycles per minute frequency for one hour. There was no damage to any Tray Pack.

TABLE 17

SHIPPING CONTAINER DROP TEST RESULTS

*All Tray Packs packed with water

*All shipping containers were telescoping type

PACKING CONFIGURATION	VACUUM PACKED	RESULTS
2 UP, 2 DOWN PACKING OF TRAY PACKS 5 NESTING PADS 90# REINFORCED TRAY PACKS	YES	DAMAGE TO BOTTOM AND TOP TRAY PACKS
BASELINE PADS ALL TRAY PACKS FACING UP 90# REINFORCED TRAY PACKS	YES	ALL TRAY PACKS DAMAGED
ALL TRAY PACKS FACING UP 5 NESTING PADS 90# REINFORCED TRAY PACKS	YES	ALL TRAY PACKS DAMAGED
ALL TRAY PACKS FACING UP 5 NESTING PADS 90# REINFORCED TRAY PACKS	YES	ALL TRAY PACKS DAMAGED
ALL TRAY PACKS FACING UP 5 LARGE PADS, 4 NESTING PADS 90# REINFORCED TRAY PACKS	YES	ALL TRAY PACKS DAMAGED
2 UP, 2 DOWN PACKING OF TRAY PACKS 5 NESTING PADS 98# REINFORCED TRAY PACKS	YES	BOTTOM 3 TRAY PACKS DAMAGED
ALL TRAY PACKS FACING UP 5 LARGE PADS 98# REINFORCED TRAY PACKS	YES	ALL TRAY PACKS DAMAGED
2 UP, 2 DOWN PACKING OF TRAY PACKS 5 NESTING PADS 98# REINFORCED TRAY PACKS	NO	NO BUCKLING OR PANELING DAMAGE
ALL TRAY PACKS FACING UP 5 LARGE PADS 98# REINFORCED TRAY PACKS	NO	NO DAMAGE
ALL TRAY PACKS FACING UP 5 NESTING PADS 98# REINFORCED TRAY PACKS	NO	NO DAMAGE

8. CONCLUSIONS

Cummings Solar Corporation has learned that vacuum packing causes either immediate tray body paneling or causes the potential for tray body paneling when combined with low levels of rough handling. Cummings Solar Corporation has learned that the forces imposed on the Tray Pack by vacuum packing are much larger than any force induced by rough handling.

Cummings Solar Corporation learned that heavier weight reinforced Tray Packs are more damage resistant. The heavier weight greatly reduces denting damage. The heavier weight reinforced Tray Packs have less incidence of damage, and the level of damage, when sustained, is less severe.

Cummings Solar Corporation has learned that reinforced Tray lids have superior damage resistance to nonreinforced lids, even when a 5" X 5" label space at the center of the lid interrupts the reinforcing beads.

Cummings Solar Corporation has learned that it is possible to greatly increase the drop height required to cause Tray Pack buckling and paneling damage by packing the Tray Pack such that neither body nor lid can flex. The major problems in preventing flexing are that the flat lid is recessed from the sealing seam and that tray body's failure is by paneling (inward buckling). Cummings Solar Corporation has learned that these two problems can be overcome by means of packing pads that nest into the sealing seam rather than sitting on top of it and by packing the Tray Packs so that the bottom two face down and the top two face up. In Cummings' experience the tray body of the bottom Tray Pack in the shipping container is the first to be damaged. By placing the lids two facing up and two facing down with each lid restrained by a nesting pad, the flexibility of the outside surface is greatly reduced and the potential for damage thereby greatly decreased.

Cummings Solar Corporation learned that by designing the shipping container so that the stacking load is shared simultane-

ously between the Tray Packs, the liner(s), and the shipping container side walls leads to greatly increased stacking strength. Cummings Solar Corporation has learned that this can be accomplished by dimensioning the shipping container so that all parts, the container, the liner, and the Tray Pack/nesting pad ensemble fit together evenly and snugly. This means that the liner height exactly equals the shipping container inside height and that that height is equal to or slightly less than the height of the Tray Pack/nesting pad ensemble.

Cummings Solar Corporation has learned that a telescoping shipping container can be configured for stacking strength. Cummings Solar has proved that unit loads can easily sustain the force imposed by stacking four high when the unit loads are composed of telescoping shipping containers with a single liner containing Tray Packs and nesting pads packed with the bottom two lids facing down and the top two lids facing up.

9. RECOMMENDATIONS

Cummings Solar Corporation recommends the following:

(1) Require that all Tray Packs supplied to the Army be made from 98-pound material.

(2) Require that all tray bodies be configured with 0.050" reinforcing beads.

(3) Require that all tray lids be configured with 0.018" reinforcing beads interrupted by a 5" X 5" label space placed at the center of the lid.

(4) Require that all Tray Packs be packed with no vacuum.

(5) Require that all Tray Pack shipping containers be telescoping shipping containers constructed to the dimensions prescribed in this document.

(6) Require that all Tray Packs be packed with nesting pads.

(7) Require that all Tray Packs be packed with the bottom two lids facing down and the top two lids facing up.

(8) Initiate a long-term, unit-load stacking test at Natick with unit loads stacked two high, three high, and four high to assure that there is no tipping over the period of one year. Use the Tray Packs and the shipping containers recommended above.

(9) Initiate a long-term food preservation test at Natick to assure that the tray body and tray lid reinforcing beads do not cause degradation of the Tray Pack inner liner and lead to food contamination or degradation.

(10) Devise a method of labeling the reinforced lid or perfect the development of a small flat label space in the reinforced lid. Reduce the amount of printing required on each label.

This document reports research undertaken at the US Army Natick Research and Development Command and has been assigned No. NATICK/TR-96/002 in the series of reports approved for publication.

APPENDIX A

INCOMING INSPECTION REPORTS OF TRAY PACKS FILLED AT VANEE FOODS CO., BERKELEY, ILLINOIS

CUMMINGS SOLAR CORPORATION
323 ANDOVER STREET
WILMINGTON, MASSACHUSETTS 01887

DATE _____
NAME _____
SHEET # _____

DESIGN WORK SHEET

SUBJECT: DAMAGE TO TRAY PACKS
ALL REINFORCED WATER (CONTINUED)

BOX #	TRAY PACK TYPE	TRAY PACKS INCIPIENT BUCKLES	TRAY PACKS BUCKLES	TRAY PACKS SLIGHT DENTS	TRAY PACKS DENTS
24	90# REINFORCED WATER 4" TRAY PACKS	-	1	-	-
25	90# " "	-	-	-	-
26	90# " "	-	-	-	-
27	90# " "	-	-	-	-
28	98# " "	1	-	1	-
29	98# " "	-	-	1	-
30	90# " "	-	-	-	-
31	90# " "	-	-	1	-
32	90# " "	-	-	-	-
33	98# " "	-	-	-	-
34	98# " "	1	-	-	-
35	98# " "	-	-	-	-
36	98# " "	-	-	-	1
37	98# " "	-	-	-	-
38	98# " "	-	-	-	-
39	98# " "	-	-	-	-
40	90# " "	-	-	-	-
41	90# " "	-	-	-	-
42	90# " "	-	-	1	-
43	90# " "	-	-	-	-
44	90# " "	-	-	-	-
45	90# " "	-	-	-	-
46	98# " "	-	-	-	-

CUMMINGS SOLAR CORPORATION
323 ANDOVER STREET
WILMINGTON, MASSACHUSETTS 01887

DATE _____

NAME _____

SHEET # _____

DESIGN WORK SHEET

SUBJECT: DAMAGE TO TRAY PACKS ALL REINFORCED WATER 4 TRAY PACKS

BOX #	TRAY PACK TYPE	TRAY PACKS INCIPIENT BUCKLES	TRAY PACKS BUCKLES	TRAY PACKS SLIGHT DENTS	TRAY PACKS DENTS
1	98# REINFORCED WATER	-	-	-	-
2	90# " "	-	-	-	-
3	90# " "	-	-	1	-
4	90# " "	-	-	-	-
5	90# " "	-	-	-	-
6	98# " "	-	-	-	-
7	98# " "	-	-	1	-
8	98# " "	-	-	-	-
9	98# " "	-	-	2	-
10	98# " "	-	-	2	-
11	98# " "	-	-	-	-
12	98# " "	-	-	-	-
13	90# " "	-	-	-	-
14	98# " "	-	-	-	-
15	90# " "	-	-	-	-
16	98# " "	-	-	-	-
17	90# " "	1	-	-	-
18	98# " "	1	-	-	-
19	90# " "	-	-	1	-
20	98# " "	-	-	-	-
21	98# " "	-	-	-	-
22	90# " "	-	-	-	-
23	98# " "	-	-	-	-

CUMMINGS SOLAR CORPORATION
323 ANDOVER STREET
WILMINGTON, MASSACHUSETTS 01887

DATE _____

NAME _____

DESIGN WORK SHEET SHEET # _____

SUBJECT DAMAGE TO TRAY PACKS
ALL REINFORCED WATER (CONTINUED)

BOX #	TRAY PACK TYPE	TRAY PACKS INCIPIENT BUCKLES	TRAY PACKS BUCKLES	TRAY PACKS SLIGHT DENTS	TRAY PACKS DENTS
47	90# REINFORCED WATER	-	-	-	-
48	90# 4 TRAY PACKS	-	-	-	-
49	90# " "	-	-	-	-
50	98# " "	-	-	-	-
51	90# " "	-	-	-	-
52	90# " "	-	-	-	-
53	98# " "	-	-	-	1
54	98# " "	-	-	-	1
55	90# " "	-	-	-	-
56	90# " "	-	-	-	-
57	90# " "	-	-	-	-
58	98# " "	-	-	-	-
59	98# " "	-	-	-	-
60	90# " "	-	-	-	-
61	98# " "	-	-	-	-
62	98# " "	1	-	-	-
63	90# " "	-	-	-	-
64	98# " "	-	-	-	-
65	98# " "	1	-	-	-
66	90# " "	1	-	-	-
67	98# " "	-	-	-	-
68	90# " "	-	-	1	-
69	90# " "	-	-	-	1

CUMMINGS SOLAR CORPORATION
323 ANDOVER STREET
WILMINGTON, MASSACHUSETTS 01887

DATE _____

NAME _____

DESIGN WORK SHEET SHEET # _____

SUBJECT DAMAGE TO TRAY PACKS
ALL REINFORCED WATER (CONTINUED)

BOX #	TRAY PACK TYPE	TRAY PACKS INCIPIENT BUCKLES	TRAY PACKS BUCKLES	TRAY PACKS SLIGHT DENTS	TRAY PACKS DENTS
70	90# REINFORCED WATER 4" TRAY PACKS	-	-	-	-
71	98# " "	-	-	-	1
72	98# " "	-	-	-	-
73	90# " "	-	-	-	1
74	98# " "	-	1	-	-
75	90# " "	-	-	-	1
76	90# " "	-	-	-	-
77	98# " "	-	-	-	-
78	98# " "	-	-	2	-
79	90# " "	-	-	1	-
80	90# " "	-	-	1	1
81	98# " "	-	-	-	-
82	93# " "	-	-	-	-
83	90# " "	-	-	-	1
84	98# " "	-	-	-	1
85	90# " "	-	-	1	1
86	90# " "	-	-	1	-
87	90# " "	-	-	-	1
88	98# 3 TRAY PACKS	-	-	-	-
	TOTALS	7	2	18	12
	351 TRAY PACKS				

CUMMINGS SOLAR CORPORATION
323 ANDOVER STREET
WILMINGTON, MASSACHUSETTS 01887

DATE _____

NAME _____

DESIGN WORK SHEET SHEET # _____

SUBJECT DAMAGE TO TRAY PACKS

CORN

BOX #	TRAY PACK TYPE	TRAY PACKS INCIPIENT BUCKLES	TRAY PACKS BUCKLES	TRAY PACKS SLIGHT DENTS	TRAY PACKS DENTS
1	BASELINE CORN 4 TRAY PACKS	-	-	1	-
2	BASELINE CORN 4 TRAY PACKS	-	3	-	-
3	BASELINE CORN 4 TRAY PACKS	1	-	-	-
4	BASELINE CORN 4 TRAY PACKS	1	-	-	-
5	BASELINE CORN 4 TRAY PACKS	3	-	2	-
6	BASELINE CORN 4 TRAY PACKS	-	1	-	-
7	BASELINE CORN 4 TRAY PACKS	1	-	1	-
8	REINFORCED 4 TRAY PACKS	-	-	-	-
9	REINFORCED 4 TRAY PACKS	1	-	-	1
10	REINFORCED 4 TRAY PACKS	1	-	1	-
11	REINFORCED 4 TRAY PACKS	-	-	1	1
12	REINFORCED 4 TRAY PACKS	-	-	2	1
13	BASELINE CORN 1 TRAY PACK	-	-	-	-
	TOTALS	8	4	8	3
	49 TRAY PACKS				

CUMMINGS SOLAR CORPORATION
323 ANDOVER STREET
WILMINGTON, MASSACHUSETTS 01887

DATE _____

NAME _____

DESIGN WORK SHEET SHEET # _____

SUBJECT DAMAGE TO TRAY PACKS
BEANS

BOX #	TRAY PACK TYPE	TRAY PACKS INCIPIENT BUCKLES	TRAY PACKS BUCKLES	TRAY PACKS SLIGHT DENTS	TRAY PACKS DENTS
14	REINFORCED BEANS 4 TRAY PACKS	-	-	-	1
15	REINFORCED BEANS 4 TRAY PACKS	2	-	-	-
16	REINFORCED BEANS 4 TRAY PACKS	-	-	-	-
17	BASELINE BEANS 4 TRAY PACKS	2	-	-	-
18	BASELINE BEANS 4 TRAY PACKS	-	-	1	-
19	BASELINE BEANS 4 TRAY PACKS	-	-	-	-
20	BASELINE BEANS 4 TRAY PACKS	-	-	-	-
21	BASELINE BEANS 4 TRAY PACKS	-	-	-	1
22	BASELINE BEANS 4 TRAY PACKS	-	-	-	-
23	REINFORCED BEANS 4 TRAY PACKS	-	-	1	-
24	BASELINE BEANS 4 TRAY PACKS	1	-	1	-
25	REINFORCED BEANS 4 TRAY PACKS	-	-	1	-
26	REINFORCED BEANS 4 TRAY PACKS	-	-	-	-
	TOTALS	5	0	4	2
	52 TRAY PACKS				

APPENDIX B

TRAY PACK EVALUATION TESTS

DATE 8-28-84

SAMPLE # 1

TEST TYPE VACUUM-TRAY PACK

SAMPLE 90#-BASELINE

* Inches of Water

TEST LEVEL VACUUM *	PANEL		COMMENT
	YES	NO	
34.5		X	
35.0		X	
36.0		X	
36.5		X	
37.0		X	
37.5		X	22 Ma after failure
38.0		X	Local Red stain @ buckle paint.
39.0		X	
39.5		X	
41.0		X	
45.0		X	
49.5 66.0 "	X "	X	SEE NOTE ON SAMPLE # 30

DATE 8-28-84

SAMPLE # 2

TEST TYPE VACUUM-TRAY PACK

SAMPLE 90#-BASELINE

TEST LEVEL VACUUM	PANEL		COMMENT
	YES	NO	
2"		X	
3"		X	
4"		X	
4.5"	X		
			27 Ma with Red spot @
			wrinkle.

DATE 8-29-84

SAMPLE # 3

TEST TYPE VACUUM-TRAY PACK

SAMPLE 90#/0.050" REINFORCED

TEST LEVEL VACUUM	PANEL		COMMENT
	YES	NO	
2"		X	
3"		X	
4"		X	
4.5	X		
WACO TEST:			32.5 Ma Red spot @
			buckle.

DATE 8-29-84

SAMPLE # 4

TEST TYPE VACUUM-TRAY PACK

SAMPLE 90#-BASELINE

TEST LEVEL VACUUM	PANEL		COMMENT
	YES	NO	
2"		X	
3"		X	
4"	X		
WACO TEST:			27.5 Ma
			Red spots at buckles.

DATE 8-29-84

SAMPLE # 5

TEST TYPE VACUUM-TRAY PACK

SAMPLE 90#-BASELINE

TEST LEVEL VACUUM	PANEL		COMMENT
	YES	NO	
2"		X	
3"		X	
4"	X		30.2 Ma
			Red spots @ buckles

DATE 8-29-84

SAMPLE # 6

TEST TYPE VACUUM-TRAY PACK

SAMPLE 90#-BASELINE

TEST LEVEL VACUUM	PANEL		COMMENT
	YES	NO	
2"		X	
3"		X	
4"	X		
WACO TEST:			65.5 Ma
			Red spots @ buckles.
			Also, scratches in the
			center of tray.

DATE 8-29-84

SAMPLE # 7

TEST TYPE VACUUM-TRAY PACK

SAMPLE 90#/.04/REINFORCED

TEST LEVEL VACUUM	PANEL		COMMENT
	YES	NO	
2"		X	
3"		X	
4"	X		
WACO TEST:			65 Ma
			Red spots @ buckles.

DATE 8-29-84

SAMPLE # 8

TEST TYPE VACUUM-TRAY PACK

SAMPLE 90#/0.04/REINFORCED

TEST LEVEL VACUUM	PANEL		COMMENT
	YES	NO	
2"		X	
3"		X	
4"	X		
WACO TEST			35 Ma
			Red spots @ buckles.

DATE 8-29-84

SAMPLE # 9

TEST TYPE VACUUM-TRAY PACK

SAMPLE 90#/0.04/REINFORCED

TEST LEVEL VACUUM	PANEL		COMMENT
	YES	NO	
2"		X	
3"		X	
4"		X	
4.5"	X		
WACO TEST:			35 Ma
			Red spots @ buckle.

DATE 8-29-84

SAMPLE # 10

TEST TYPE VACUUM-TRAY PACK

SAMPLE 90#/0.04/REINFORCED

TEST LEVEL VACUUM	PANEL		COMMENT
	YES	NO	
2"		X	
3"		X	
3.5"	X		Evidence of handling damage at point of failure.
WACO TEST			50 Ma Red spots @ buckle.

DATE 8-29-84

SAMPLE # 11

TEST TYPE VACUUM-TRAY PACK

SAMPLE 90#/0.05/REINFORCED

TEST LEVEL VACUUM	PANEL		COMMENT
	YES	NO	
2"		X	
3"		X	
4"		X	
4.5"	X		
WACO TEST:			40 Ma
			Red spots @ buckle

DATE 8-29-84

SAMPLE # 12

TEST TYPE VACUUM-TRAY PACK

SAMPLE 90#/0.05/REINFORCED

TEST LEVEL VACUUM	PANEL		COMMENT
	YES	NO	
2"		X	
3"		X	
4"		X	
4.5"	X		
WACO TEST:			29 Ma
			Red spots @ buckles.

DATE 8-29-84

SAMPLE # 13

TEST TYPE VACUUM-TRAY PACK

SAMPLE 90#/0.05/REINFORCED

TEST LEVEL VACUUM	PANEL		COMMENT
	YES	NO	
2"		X	
3"		X	
4"		X	
4.5"	X		
WACO TEST:			45 Ma
			Red spots @ buckle.

DATE 8-29-84

SAMPLE # 14

TEST TYPE VACUUM-TRAY PACK

SAMPLE 90#/0.05/REINFORCED

TEST LEVEL VACUUM	PANEL		COMMENT
	YES	NO	
2"		X	
3"		X	
4"		X	
4.5"	X		
WACO TEST:			55.5 Ma
			Red spots @ buckle.

DATE 8-29-84

SAMPLE # 15

TEST TYPE VACUUM-TRAY PACK

SAMPLE 90#/0.06/REINFORCED

TEST LEVEL VACUUM	PANEL		COMMENT
	YES	NO	
2"		X	
3"		X	
4"		X	
4.5"	X		
WACO TEST:			25 Ma
			Slight Red spots @ buckle.

DATE 8-29-84

SAMPLE # 16

TEST TYPE VACUUM-TRAY PACK

SAMPLE 90#/0.06/REINFORCED

TEST LEVEL VACUUM	PANEL		COMMENT
	YES	NO	
2"		X	
3"		X	
4"		X	
4.5"		X	
5"	X		
WACO TEST:			45 Ma
			Red spots @ buckle.

DATE 8-29-84

SAMPLE # 17

TEST TYPE VACUUM-TRAY PACK

SAMPLE 90#/0.06/REINFORCED

TEST LEVEL VACUUM	PANEL		COMMENT
	YES	NO	
2"		X	
3"		X	
4"		X	
4.5"	X		
WACO TEST:			48 Ma
			Red spot @ buckle.

DATE 8-29-84

SAMPLE # 18

TEST TYPE VACUUM-TRAY PACK

SAMPLE 90#/0.06/REINFORCED

TEST LEVEL VACUUM	PANEL		COMMENT
	YES	NO	
2"		X	
3"		X	
4"		X	
4.5"	X		
WACO TEST:			60 Ma
			Red spots @ buckle.

DATE 8-29-84

SAMPLE # 19

TEST TYPE VACUUM-TRAY PACK

SAMPLE 98#/0.04/REINFORCED

TEST LEVEL VACUUM	PANEL		COMMENT
	YES	NO	
2"		X	
3"		X	
4"		X	
5"	X		

DATE 8-29-84

SAMPLE # 20

TEST TYPE VACUUM-TRAY PACK

SAMPLE 98#/0.04/REINFORCED

TEST LEVEL VACUUM	PANEL		COMMENT
	YES	NO	
2"		X	
3"		X	
4"		X	
5"	X		

DATE 8-29-84

SAMPLE # 21

TEST TYPE VACUUM-TRAY PACK

SAMPLE 98#/0.04/REINFORCED

TEST LEVEL VACUUM	PANEL		COMMENT
	YES	NO	
2"		X	
3"		X	
4"		X	
5"	X		

DATE 8-29-84

SAMPLE # 22

TEST TYPE VACUUM-TRAY PACK

SAMPLE 98#/0.04/REINFORCED

TEST LEVEL VACUUM	PANEL		COMMENT
	YES	NO	
2"		X	
3"		X	
4"		X	
5"	X		

DATE 8-29-84

SAMPLE # 23

TEST TYPE VACUUM-TRAY PACK

SAMPLE 98#/0.05/REINFORCED

TEST LEVEL VACUUM	PANEL		COMMENT
	YES	NO	
2"		X	
3"		X	
4"		X	
5"	X		

DATE 8-29-84

SAMPLE # 24

TEST TYPE VACUUM-TRAY PACK

SAMPLE 98#/0.05/REINFORCED

TEST LEVEL VACUUM	PANEL		COMMENT
	YES	NO	
2"		X	
3"		X	
4"		X	
5"	X		

DATE 8-29-84

SAMPLE # 25

TEST TYPE VACUUM-TRAY PACK

SAMPLE 98#/0.05/REINFORCED

TEST LEVEL VACUUM	PANEL		COMMENT
	YES	NO	
2"		X	
3"		X	
4"		X	
5"	X		

DATE 8-29-84

SAMPLE # 26

TEST TYPE VACUUM-TRAY PACK

SAMPLE 98#/0.05/REINFORCED

TEST LEVEL VACUUM	PANEL		COMMENT
	YES	NO	
2"		X	
3"		X	
4"		X	
5"	X		

DATE 8-29-84

SAMPLE # 27

TEST TYPE VACUUM-TRAY PACK

SAMPLE 98#/0.06/REINFORCED

TEST LEVEL VACUUM	PANEL		COMMENT
	YES	NO	
2"		X	
3"		X	
4"		X	
5"	X		

DATE 8-29-84

SAMPLE # 28

TEST TYPE VACUUM TRAY PACK

SAMPLE 98#/0.06/REINFORCED

TEST LEVEL VACUUM	PANEL		COMMENT
	YES	NO	
2"		X	
3"		X	
4"		X	
5"		X	
5.5"	X		

DATE 8-29-84

SAMPLE # 29

TEST TYPE VACUUM-TRAY PACK

SAMPLE 98#/0.06/REINFORCED

TEST LEVEL VACUUM	PANEL		COMMENT
	YES	NO	
2"		X	
3"		X	
4"		X	
5"	X		

DATE 8-29-84

SAMPLE # 30

TEST TYPE VACUUM-TRAY PACK

SAMPLE 98#/0.06/REINFORCED

TEST LEVEL VACUUM	PANEL		COMMENT
	YES	NO	
2"		X	
3"		X	
4"		X	
5"	X		
NOTE: Generally it was observed that the Baseline Tray gave off an "oil canning" sound at 2" or 3" of H_2O of vacuum and paneling at the corners of the trays occurred with a snap. On all reinforced trays there was no "oilcanning" sound heard, and paneling occurred very gradually and formed less of a sharp crease.			

DATE 8-31-84

SAMPLE # 31

TEST TYPE SIDE DROP-TRAY PACK

SAMPLE CONFIGURATION: 90#/BASELINE

TEST LEVEL	DAMAGE		COMMENT
	YES	NO	
3"		X	
6"	XX		Lid impact edge starting to buckle. Tray showed slight paneling
9"	XX		Lid impact edge buckling getting worse. Paneling failure of tray - two upper corners.
SEE NOTES ON SAMPLE # 58			
WACO TEST:			15 Ma
SEE NOTES ON SAMPLE # 46			No red spot @ buckle.

DATE 8-31-84

SAMPLE # 32

TEST TYPE SIDE DROP-TRAY PACK

SAMPLE CONFIGURATION: 90#/ BASELINE

TEST LEVEL	DAMAGE		COMMENT
	YES	NO	
3"		X	
6"		X	
9"	XX		Lid slight buckling also paneling of one corner of tray top end.
WACO TEST:			25 Ma
			No red spot @ buckle.

DATE 8-31-84

SAMPLE # 33

TEST TYPE SIDE DROP-TRAY PACK

SAMPLE CONFIGURATION: 90#/BASELINE

TEST LEVEL	DAMAGE		COMMENT
	YES	NO	
3"		X	
6"	X		Slight buckling on the lid - impact end.
9"	X		Buckling of lid increasing.
12"	XX		Paneling of two corners of tray - top end.
WACO TEST			15 Ma
			No red spots at buckle.

DATE 8-31-84

SAMPLE # 34

TEST TYPE SIDE DROP-TRAY PACK

SAMPLE CONFIGURATION: 90#/BASELINE

TEST LEVEL	DAMAGE		COMMENTS
	YES	NO	
3"		X	
6"	XX		Lid buckling. Tray showing signs of paneling - impact end.
9"	XX		Paneling of two tray corners - top end.
WACO TEST:			20 Ma
			No red spots at buckle

DATE 8-31-84

SAMPLE # 35

TEST TYPE SIDE DROP-TRAY PACK

SAMPLE CONFIGURATION: 90#/0.040/REINFORCED

TEST LEVEL	DAMAGE		COMMENT
	YES	NO	
3"	X		Slight buckling of lid corners - impact end.
6"	X		Lid getting worse.
9"	XX		Slight paneling one corner of tray - top end.
WACO TEST			35 Ma
			No red spots at buckle.

DATE 8-31-84

SAMPLE # 36

TEST TYPE SIDE DROP-TRAY PACK

SAMPLE CONFIGURATION: 90#/0.40/REINFORCED

TEST LEVEL	DAMAGE		COMMENT
	YES	NO	
3"		X	
6"	X		Lid buckling at corners impact edge.
9"	X		No change
12"	XX		Small amount of paneling over corner of tray - top end.
WACO TEST:			24 Ma
			No red spots at buckle

DATE 8-31-84

SAMPLE # 37

TEST TYPE SIDE DROP-TRAY PACK

SAMPLE CONFIGURATION: 90#/0.040/REINFORCED

TEST LEVEL	DAMAGE		COMMENT
	YES	NO	
3"		X	
6"	X		Lid showing signs of buckling at corners - impact end
9"	XX		Small amount of paneling to both corners of tray - top end.
WACO TEST			50 Ma
			No red spots at buckle.

DATE 8-31-84

SAMPLE # 38

TEST TYPE SIDE DROP-TRAY PACK

SAMPLE CONFIGURATION: 90#/0.040/REINFORCED

TEST LEVEL	DAMAGE		COMMENT
	YES	NO	
3"		X	
6"	X		Slight lid buckling corners - impact end
9"	XX		small amount of paneling over corner of tray top end.
WACO TEST:			25 Ma
			No red spots at buckle.

DATE 8-31-84

SAMPLE # 39

TEST TYPE SIDE DROP-TRAY PACK

SAMPLE CONFIGURATION: 90#/0.050/REINFORCED

TEST LEVEL	DAMAGE		COMMENT
	YES	NO	
3"		X	
6"	X		Slight buckling on lid corners - impact end.
9"	X		No change
12"	XX		Small amount of paneling both corners of tray - top end.
WACO TEST:			45 Ma
			No red spots at buckle.

DATE 8-31-84

SAMPLE # 40

TEST TYPE SIDE DROP-TRAY PACK

SAMPLE CONFIGURATION: 90#/0.050/REINFORCED

TEST LEVEL	DAMAGE		COMMENT
	YES	NO	
3"	X		Very slight lid buckling corners - impact end
6"	X		No change
9"	X		No change
12"	XX		Small amount of paneling to one corner of tray - top end.
WACO TEST:			30 Ma
			No red spots at buckle.

DATE 8-31-84

SAMPLE # 41

TEST TYPE SIDE DROP-TRAY PACK

SAMPLE CONFIGURATION: 90#/0.050/REINFORCED

TEST LEVEL	DAMAGE		COMMENTS
	YES	NO	
3"		X	
6"	X		Slight buckling of lid corners - impact end.
9"	X		buckling on lid getting worse.
12"	XX		Small amount of paneling to corners of tray - top end.
WACO TEST:			30 Ma
			No red spots at buckle

DATE 8-31-84

SAMPLE # 42

TEST TYPE SIDE DROP-TRAY PACK

SAMPLE CONFIGURATION: 90#/0.050/REINFORCED

TEST LEVEL	DAMAGE		COMMENT
	YES	NO	
3"		X	
6"	X		Slight buckling of lid corners - impact end.
9"	XX		Small amount of paneling to tray corners - top end.
WACO TEST:			30 Ma
			No red spots at buckle.

DATE 8-31-84

SAMPLE # 43

TEST TYPE SIDE DROP-TRAY PACK

SAMPLE 90#/0.060/REINFORCED

TEST LEVEL	DAMAGE		COMMENT
	YES	NO	
3"		X	
6"	X		Slight buckling to lid corners -impact end.
9"	XX		Small amount of paneling to one corner of tray - top end.
WACO TEST:			45 Ma
			No red spots at buckle

DATE 8-31-84

SAMPLE # 44

TEST TYPE SIDE DROP-TRAY PACK

SAMPLE 90#/0.060/REINFORCED

TEST LEVEL	DAMAGE		COMMENT
	YES	NO	
3"		X	
6"	X		Slight buckling of lid corners - impact end.
9"	X		No change
12"	XX		Small amount of paneling to one corner of tray - top end.
WACO TEST:			45 Ma
			No red spots at buckle.

DATE 8-31-84

SAMPLE # 45

TEST TYPE SIDE DROP-TRAY PACK

SAMPLE 90#/0.060/REINFORCED

TEST LEVEL	DAMAGE		COMMENT
	YES	NO	
3"		X	
6"	X		Corners of lid buckling slightly - impact end.
9"	X		No change
12"	X		No change except lid worse.
15"	XX		Small paneling to both corners - tray top end.
WACO TEST:			35 Ma
			No red spots at buckle

DATE 8-31-84

SAMPLE # 46

TEST TYPE SIDE DROP-TRAY PACK

SAMPLE 90#/0.060/REINFORCED

TEST LEVEL	DAMAGE		COMMENT
	YES	NO	
3"		X	
6"	X		Slight buckling on lid corners - impact end
9"	X		No change.
12"	X		Lid getting worse.
15"	XX		Slight paneling of corners of tray top end.
WACO TEST:			45 Ma
			No red spots at buckle.
NOTE: All chemical tests showed No red spots at any buckles. All trays had red spots across the bottom of tray.			

DATE 9-5-84

SAMPLE # 47

TEST TYPE SIDE DROP-TRAY PACK

SAMPLE 98#/0.040/REINFORCED

TEST LEVEL	DAMAGE		COMMENT
	YES	NO	
3"		X	
6"	X		Slight buckling of lid corners - impact end.
9"	X		Lid gets worse
12"	X		Lid gets worse
15"	XX		Both upper corners slight paneled - tray top end. Cover continues to get worse.

DATE 8-31-84

SAMPLE # 50

TEST TYPE SIDE DROP-TRAY PACK

SAMPLE CONFIGURATION: 98#/0.040/REINFORCED

TEST LEVEL	DAMAGE		COMMENT
	YES	NO	
3"		X	
6"		X	Cover okay.
9"	X		Cover begins to show signs of buckling at impact end.
12"	X		Cover gets worse
15"	XX		Cover gets worse. Very slight paneling at both upper corners of tray.

DATE 8-31-84

SAMPLE # 51

TEST TYPE SIDE DROP-TRAY PACK

SAMPLE CONFIGURATION: 98#/0.050/REINFORCED

TEST LEVEL	DAMAGE		COMMENT
	YES	NO	
3"		X	
6"	X		Lid slight buckling of corners - impact end.
9"	X		No change
12"	X		Lid getting worse.
15"	XX		Paneling at one corner of tray-top end.

DATE 9-5-84

SAMPLE # 48

TEST TYPE SIDE DROP-TRAY PACK

SAMPLE 98#/0.040/REINFORCED

TEST LEVEL VACUUM	DAMAGE		COMMENT
	YES	NO	
3"		X	
6"	X		Cover beginning to show some buckling at the edge.
9"	X		Cover gets worse.
12"	X		- " -
15"	XX		Both upper corners slight paneling of tray. Cover continues to get worse.

DATE 8-31-84

SAMPLE # 49

TEST TYPE SIDE DROP-TRAY PACK

SAMPLE CONFIGURATION: 98#/0.040/REINFORCED

TEST LEVEL	DAMAGE		COMMENT
	YES	NO	
3"		X	
6"	X		Cover begins to show some buckling of corners - drop edge.
9"	XX		Cover gets worse. Very slight paneling at one corner of tray.
12"	XX		Cover gets worse. Slight paneling at both upper corners of tray.

DATE 8-31-84

SAMPLE # 52

TEST TYPE SIDE DROP-TRAY PACK

SAMPLE CONFIGURATION: 98#/0.050/REINFORCED

TEST LEVEL	DAMAGE		COMMENT
	YES	NO	
3"		X	
6"	X		Lid slight buckling to impact end.
9"	X		Lid getting worse
12"	X		Lid getting worse
15"	XX		Very slight paneling at both corners of tray top end.
18"	XX		Paneling to both tray corners - top end.

DATE 8-31-84

SAMPLE # 53

TEST TYPE SIDE DROP-TRAY PACK

SAMPLE CONFIGURATION: 98#/0.050/REINFORCED

TEST LEVEL	DAMAGE		COMMENT
	YES	NO	
3"		X	
6"	X		Slight buckling on lid corners - impact end.
9"	X		Lid getting worse.
12"	X		Lid getting worse.
15"	XX		Slight paneling two corners of tray.
18"	XX		Paneling of both corners at tray-top ends.

DATE 8-31-84

SAMPLE # 54

TEST TYPE SIDE DROP-TRAY PACK

SAMPLE CONFIGURATION: 98#/0.050/REINFORCED

TEST LEVEL	DAMAGE		COMMENT
	YES	NO	
3"		X	
6"	X		Slight buckling of lid corners - impact end.
9"	X		Lid getting worse.
12"	XX		Slight paneling to tray two corners - top end.
15"	XX		Paneling to two corners of tray - top end.

DATE 8-31-84

SAMPLE # 55

TEST TYPE SIDE DROP-TRAY PACK

SAMPLE CONFIGURATION: 98#/0.060/REINFORCED

TEST LEVEL	DAMAGE		COMMENT
	YES	NO	
3"		X	
6"	X		Slight buckling of lid corners - impact end.
9"	X		Lid getting worse.
12"	X		Lid getting worse.
15"	X		Lid getting worse.
18"	XX		Paneling to both corners of tray top end.

DATE 8-31-84

SAMPLE # 56

TEST TYPE SIDE DROP-TRAY PACK

SAMPLE CONFIGURATION: 98#/0.060/REINFORCED

TEST LEVEL	DAMAGE		COMMENT
	YES	NO	
3"	X		Slight lid buckling
6"	X		Lid getting worse.
9"	X		Lid getting worse.
12"	X		Lid getting worse.
15"	X		Lid getting worse.
18"	X		Lid getting worse.
21"	X		Lid getting worse.
24"	XX		Bad paneling along top edge of tray bottom.

DATE 8-31-84

SAMPLE # 57

TEST TYPE SIDE DROP - TRAY PACK

SAMPLE CONFIGURATION: 98#/0.060/REINFORCED

TEST LEVEL	DAMAGE		COMMENT
	YES	NO	
3"		X	
6"	X		Slight lid buckling at corners - impact end.
9"	X		Lid getting worse
12"	XX		Small paneling to one corner of tray top end.
15"	XX		No change.
18"	XX		Paneling to both corners and buckle along edge of tray top end.

DATE 8-31-84

SAMPLE # 58

TEST TYPE SIDE DROP-TRAY PACK

SAMPLE CONFIGURATION: 98#/0.060/REINFORCED

TEST LEVEL	DAMAGE		COMMENT
	YES	NO	
3"		X	
6"	X		Lid buckling at corners impact end.
9"	X		Lid getting worse.
12"	X		Lid getting worse.
15"	XX		Slight paneling at one corner of tray-top.
18"	XX		No change.
21" (2 drops)	XX		Paneling of both corners of tray-top end.
NOTES: (1) Damage YES/NO relates to tray only.			
(2) See comments on lid failure of samples #47, #48, #49, and #50. They apply to all Tray Packs subjected to the Side Drop Test.			
(3) X in Damage Column indicates lid damage. XX in Damage Column indicates tray damage.			

TRAY PACK TESTS

SAMPLE # 59 DATE: 9-5-84

TEST TYPE: SIDE DROP - SHIPPING CONTAINER

SAMPLE CONFIGURATION: SHIPPING CONTAINER

BASELINE - TRAYS

TEST LEVEL		DAMAGE		COMMENT
		YES	NO	
6"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
9"	TP #4	X		Very slight paneling in left upper corner. (No damage on lids.)
	#3		X	
	#2		X	
	#1		X	
12"	TP #4	XX		All trays panel at both corners top edge. Least paneling observed on #2. (No damage on lids.)
	#3	XX		
	#2	XX		
	#1	XX		
15"	TP #4	NOTE: SEE SAMPLE #65 PAGE 2.		
	#3			
	#2			
	#1			

TRAY PACK TESTS

SAMPLE # 60 DATE: 9-5-84

TEST TYPE: SIDE DROP - SHIPPING CONTAINER

SAMPLE CONFIGURATION: SHIPPING CONTAINER

90#/0.050"/REINFORCED TRAYS

TEST LEVEL		DAMAGE		COMMENT
		YES	NO	
6"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
9"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
12"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
15"	TP #4		X	#1, some evidence of paneling approximately at center of upper edge. (No damage to lid.)
	#3		X	
	#2		X	
	#1	XX		
18"	TP #4	X		#1, paneling at the same location has become worse. (Slight buckling along both sides of #4 lid.)
	#3		X	
	#2		X	
	#1	XX		

TRAY PACK TESTS

SAMPLE # 60 (cont.) DATE: 9-5-84

TEST TYPE: SIDE DROP - SHIPPING CONTAINER

SAMPLE CONFIGURATION: SHIPPING CONTAINER

90#/0.050"/ REINFORCED TRAYS

TEST LEVEL		DAMAGE		COMMENT
		YES	NO	
18"	TP #4	X		#4, slight buckling of lid.
	#3		X	
	#2		X	
	#1A		X	
21"	TP #4	X		#1 & #2 lids slight crease along the impact edge. #3 & #4 lids buckling at lower two corners. #1 tray paneling at one top corner and some paneling at center.
	#3	X		
	#2	X		
	#1A	XX		
24"	TP #4	X		#4 lid buckling because we forgot cardboard spacers. No change to lid damage. #1 tray paneling became worse at corners-top. Note: Replaced #1A by #1B for the 27" drop.
	#3	X		
	#2	X		
	#1A	XX		
27"	TP #1	X		#1 lid buckling two corners - impact edge; #1 tray no additional damage. #3 tray buckling at impact edge. #2 lid very slight paneling in both corners at impact edge. #2 tray paneling at impact edge. #1B lid slight crease along impact edge. #1B tray one upper cover very slight buckled.
	#3	XX		
	#2	XX		
	#1B	XX		
30"	TP #1	X		#1 lid considerable buckling. #3 & #2 tray buckling somewhat worse. #1B tray paneled both corners - top end, no additional paneling at center.
	#3	XX		
	#2	XX		
	#1B	XX		

TRAY PACK TESTS

SAMPLE # 01

TEST TYPE: SIDE DROP - SHIPPING CONTAINER

SAMPLE CONFIGURATION: SHIPPING CONTAINER

98#/0.04/REINFORCED TRAYS

TEST LEVEL		DAMAGE		COMMENT
		YES	NO	
6"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
9"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
12"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
15"	TP #4		X	#1 buckling of lid top corners tray showing signs of paneling - top end.
	#3		X	
	#2		X	
	#1	XX		
18"	TP #4	X		#4 slight lid buckling corners - impact end.
	#3		X	
	#2		X	#1 slight increase of paneling of tray corners. - top end.
	#1	XX		

TRAY PACK TESTS

SAMPLE # 61 (Cont'd.) DATE: 9-7-84

TEST TYPE: SIDE DROP - SHIPPING CONTAINER

SAMPLE CONFIGURATION: SHIPPING CONTAINER

98#/0.04/REINFORCED TRAYS

TEST LEVEL		DAMAGE		COMMENT
		YES	NO	
21"	TP #4	X		#4 increase buckling to lid.
	#3		X	
	#2		X	
	#1	XX		#1 increased paneling to tray top - end corners.
24"	TP #4	X		#4 Increase buckling to lid.
	#3	XX		#3 slight buckle of tray - impact end.
	#2		X	
	#1	XX		#1 increase buckle to tray - top end.
27"	TP #4	XX		#4 increase to lid buckling. Slight paneling of tray corner - top end.
	#3	XX		#3 slight crease to lid - impact end, tray getting worse.
	#2	X		#2 slight crease along lid - impact end.
	#1	XX		#1 extensive tray paneling - top end.

TRAY PACK TESTS

SAMPLE # 62 DATE: 9-6-84

TEST TYPE: SIDE DROP - SHIPPING CONTAINER

SAMPLE CONFIGURATION: SHIPPING CONTAINER

98#/0.05/REINFORCED TRAYS

TEST LEVEL		DAMAGE		COMMENT
		YES	NO	
6"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
9"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
12"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
15"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
18"	TP #4	X		#4 lid on #3 & 4 slightly buckled - impact corners.
	#3	X		#3 slight lid buckling - impact end.
	#2		X	
	#1	XX		#1 paneling of tray top - end corners.

TRAY PACK TESTS

SAMPLE # 62 (cont'd.) DATE: 9-6-84

TEST TYPE: SIDE DROP - SHIPPING CONTAINER

SAMPLE CONFIGURATION: SHIPPING CONTAINER

98#/0.05/REINFORCED TRAYS

TEST LEVEL		DAMAGE		COMMENT
		YES	NO	
21"	TP #4	X		#4 additional buckling to lid - impact end.
	#3	X		#3 same as #4.
	#2		X	
	#1	XX		#1 paneling of tray increased to corners - top end.
24"	#4	X		#4 additional buckling to lid.
	#3	X		#3 same as #4.
	#2	XX		#2 slight buckle of tray - impact end.
	#1	XX		#1 slight crease along impact edge of lid.
27"	#4	X		#4 additional buckling to lid sides.
	#3	XX		#3 slight buckling tray - impact edge.
	#2	XX		#2 slight buckling tray - impact edge.
	#1	XX		#1 increase in panel of tray.
30"	#4	X		#4 extensive buckling to lid.
	#3	XX		#3 increase buckling of tray - impact end.
	#2	XX		#2 crease along lid - impact edge. Tray buckling increased - impact end.
	#1	XX		#4 increase in paneling of tray as well as the lid - impact end & top end.

TRAY PACK TESTS

SAMPLE # 63 DATE: 9-6-84

TEST TYPE: SIDE DROP - SHIPPING CONTAINER

SAMPLE CONFIGURATION: SHIPPING CONTAINER

90#/0.04/REINFORCED TRAYS

TEST LEVEL		DAMAGE		COMMENT
		YES	NO	
6"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
9"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
12"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
15"	TP #4	X		#4 slight buckling to lid corner impact edge.
	#3		X	
	#2		X	
	#1	XX		#1 slight paneling to tray corners - top end.
18"	TP #4	X		#4 increase buckling to lid - impact end.
	#3	X		#3 slight buckling to lid corners - impact edge.
	#2		X	
	#1	XX		#1 increase to paneling of two corners - top end.

TRAY PACK TESTS

SAMPLE # 63 (Cont'd.) DATE: 9-6-84

TEST TYPE: SIDE DROP - SHIPPING CONTAINER

SAMPLE CONFIGURATION: SHIPPING CONTAINER

90#/0.04/REINFORCED TRAYS

TEST LEVEL		DAMAGE		COMMENT
		YES	NO	
21"	TP #4	X		#4 slight increase to lid buckle.
	#3	X		#3 slight buckle to lid corners-impact edge.
	#2		X	
	#1	XX		#1 increase paneling to tray corners - top slight lid buckling increase.
24"	#4	X		#4 increase buckling to lid corners - impact edge.
	#3	X		#3 Same as #4.
	#2	XX		#2 buckle of tray impact end developing.
	#1	XX		#1 extensive paneling to corners tray top end.
27"	#4	X		#4 tray top end paneling corner.
	#3	X		#3 buckle tray impact end corners.
	#2	XX		#2 buckle tray impact end, additional paneling to lid 3 & 2.
	#1	XX		#1 extensive paneling to corners tray top end.

TRAY PACK TESTS

SAMPLE # 64 DATE: 9-7-84

TEST TYPE: SIDE DROP - SHIPPING CONTAINER

SAMPLE CONFIGURATION: SHIPPING CONTAINER

90#/0.05/REINFORCED TRAYS

TEST LEVEL		DAMAGE		COMMENT
		YES	NO	
6"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
9"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
12"	TP #4		X	
	#3		X	
	#2		X	
	#1	XX		#1 slight paneling of tray corners - top end.
15"	TP #4		X	
	#3		X	
	#2		X	
	#1	XX		#1 paneling of tray increased both corners now effected - top end.
18"	TP #4	X		#4 buckling to lid corners - impact end.
	#3	X		#3 same as #4
	#2		X	
	#1	XX		#1 extensive paneling to tray corners - top end.

TRAY PACK TESTS

SAMPLE # 64 (Cont'd.) DATE: 9-7-84

TEST TYPE: SIDE DROP - SHIPPING CONTAINER

SAMPLE CONFIGURATION: SHIPPING CONTAINER

90#/0.05/REINFORCED TRAYS

TEST LEVEL		DAMAGE		COMMENT
		YES	NO	
21"	TP #4	XX		#4 increase to lid buckling - same areas. Slight paneling in tray corners - top end.
	#3	XX		#3 same as #4
	#2		X	#1 increase paneling to tray corners - top end. Slight lid buckling - top end.
	#1	XX		

TRAY PACK TESTS

SAMPLE # 65 DATE: 9-6-84

TEST TYPE: SIDE DROP - SHIPPING CONTAINER

SAMPLE CONFIGURATION: SHIPPING CONTAINER

90#/0.06/REINFORCED TRAYS

TEST LEVEL		DAMAGE		COMMENT
		YES	NO	
6"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
9"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
12"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
15"	TP #4	X		#4 slight buckle of lid at impact end corners.
	#3		X	
	#2		X	
	#1		X	
18"	TP #4	X		#4 lid buckling getting worse same areas.
	#3		X	
	#2		X	
	#1	XX		#1 slight paneling in tray-top end along bottom edge.

TRAY PACK TESTS

SAMPLE # 65 (Cont'd) DATE: 9-6-84

TEST TYPE: SIDE DROP - SHIPPING CONTAINER

SAMPLE CONFIGURATION: SHIPPING CONTAINER

90#/0.06/REINFORCED TRAYS

TEST LEVEL		DAMAGE		COMMENT
		YES	NO	
21"	TP #4	X		#4 lid buckling slightly increased.
	#3	X		#3 slight lid buckling at corners - impact end.
	#2	XX		#2 slight paneling tray corners-impact end.
	#1	XX		#1 steady increase paneling to tray bottom - top end.
24"	TP #4	XX		#4 slight paneling to tray - top end.
	#3	X		#3 lid buckling slightly increased.
	#2	XX		#2 Paneling to tray at impact end increased.
	#1	XX		#1 extensive paneling to tray corners - top end.
27"	TP #4			
	#3			
	#2			
	#1			

NOTE:
(1) When the shipping container was dropped approximately 3 times (12") there was approximately 3/8" difference in the height at the impact end compared to the top end. The impact end was higher.
(2) Also, every test showed extensive paneling to the tray corners of the # 1 Tray Pack of each container.
(3) Tray Packs labeled #1 - bottom of shipping container.
(4) XX in damage column indicates tray damage.

TRAY PACK TESTS

SAMPLE # 66 DATE: 12-27-84

TEST TYPE: SIDE DROP-TRAY PACK

SAMPLE CONFIGURATION: 90#/0.014 LID - 98#/0.050 TRAY

TEST LEVEL	DAMAGED YES	DAMAGED NO	COMMENTS
3"		X	
6"	X		Impact end - slight buckling of lid.
9"	X		Impact end - slight increase of buckling.
12"	X		Slight paneling on top corner of tray. Increase of buckling of lid.
15"	X		Increase damage to tray bottom. Increased buckling of lid.

TRAY PACK TESTS

SAMPLE # 67 DATE: 12-27-84

TEST TYPE: SIDE DROP - TRAY PACK

SAMPLE CONFIGURATION: 90#/0.014 LID - 98#/0.050 TRAY

TEST LEVEL	DAMAGED YES	DAMAGED NO	COMMENTS
3"		X	
6"		X	
9"	X		Slight dent in tray - impact edge.
12"	X		Slight buckling - impact end.
15"	X		Increased buckling - impact end. Slight paneling of Tray corner - top end.
18"			

TRAY PACK TESTS

SAMPLE # 68 DATE: 12-27-84

TEST TYPE: SIDE DROP - TRAY PACK

SAMPLE CONFIGURATION: 90#/0.014 LID - 98#/0.050 TRAY

TEST LEVEL	DAMAGED YES	DAMAGED NO	COMMENTS
3"		X	
6"		X	
9"	X		Slight buckling of lid - impact end.
12"	X		Increase in buckling of lid.
15"	X		Steady increase in lid damage.
18"			

TRAY PACK TESTS

SAMPLE # 69 DATE: 12-27-84

TEST TYPE: SIDE DROP - TRAY PACK

SAMPLE CONFIGURATION: 90#/0.014 LID - 98#/0.050 TRAY

TEST LEVEL	DAMAGED YES	DAMAGED NO	COMMENTS
3"		X	
6"	X		Slight buckling of one corner - impact end.
9"	X		Increase in lid damage.
12"	X		Increase in lid damage.
15"	X		Increase in lid damage.
18"	X		Paneling of tray bottom at top end corners, increase in buckling.

TRAY PACK TESTS

SAMPLE # 70 DATE: 12-27-84

TEST TYPE: SIDE DROP - TRAY PACK

SAMPLE CONFIGURATION: 90#/0.018 LID - 98#/0.050 TRAY

TEST LEVEL	DAMAGED YES	DAMAGED NO	COMMENTS
3"		X	
6"		X	
9"	X		Slight buckling of lid - impact end.
12"	X		Increased lid damage.
15"	X		Paneling of tray corners - top end. Increase in lid damage.

TRAY PACK TESTS

SAMPLE # 71 DATE: 12-27-84

TEST TYPE: SIDE DROP - TRAY PACK

SAMPLE CONFIGURATION: 90#/0.018 LID - 98#/0.050 TRAY

TEST LEVEL	DAMAGED YES	DAMAGED NO	COMMENTS
3"		X	
6"		X	
9"	X		Slight buckling of lid - impact end.
12"	X		Increased damage to lid.
15"	X		Slight paneling to tray corners - top end. Increased damage to lid.

TRAY PACK TESTS

SAMPLE # 72 DATE: 12-27-84

TEST TYPE: SIDE DROP - TRAY PACK

SAMPLE CONFIGURATION: 90#/0.018 LID - 98#/0.050 TRAY

TEST LEVEL	DAMAGED YES	DAMAGED NO	COMMENTS
3"		X	
6"	X		Slight buckling of lid - impact end.
9"	X		Increased lid damage.
12"	X		Increased lid damage
15"	X		Paneling of tray corners - top end. Increased lid buckling.
18"	X		Steady increase in damage to lid and tray.

TRAY PACK TESTS

SAMPLE # 73 DATE: 12-27-84

TEST TYPE: SIDE DROP - TRAY PACK

SAMPLE CONFIGURATION: 90#/0.018 LID - 98#/0.050 TRAY

TEST LEVEL	DAMAGED YES	DAMAGED NO	COMMENTS
3"		X	
6"	X		Slight buckling of lid - impact end.
9"	X		Increased buckling of lid.
12"	X		Increased buckling of lid.
15"	X		Paneling of tray corners - top end. Increased damage to lid.

TRAY PACK TESTS

SAMPLE # 74 DATE: 12-27-84

TEST TYPE: SIDE DROP - TRAY PACK

SAMPLE CONFIGURATION: 90#/0.022 LID - 98#/0.050 TRAY

TEST LEVEL	DAMAGED YES	DAMAGED NO	COMMENTS
3"		X	
6"	X		Slight buckling of lid - impact end.
9"	X		Increased damage to lid.
12"	X		Increased damage to lid.
15"	X		Slight paneling of tray corners - top end. Increased damage to lid.
18"	X		Increase in paneling at tray corner. Increase in buckling of lid.

TRAY PACK TESTS

SAMPLE # 75 DATE: 12-27-84

TEST TYPE: SIDE DROP - TRAY PACK

SAMPLE CONFIGURATION: 90#/0.022 LID - 98#/0.050 TRAY

TEST LEVEL	DAMAGED YES	DAMAGED NO	COMMENTS
3"		X	
6"	X		Slight buckling of lid - impact edge.
9"	X		Increase in lid damage.
12"	X		Increase in lid damage.
15"	X		Paneling of tray corners - top end. Increase in lid damage.
18"	X		Increase in paneling of tray corners. Increase in buckling of lid.

TRAY PACK TESTS

SAMPLE # 76 DATE: 12-27-84

TEST TYPE: SIDE DROP - TRAY PACK

SAMPLE CONFIGURATION: 90#/0.022 LID - 98#/0.030 TRAY

TEST LEVEL	DAMAGED YES	DAMAGED NO	COMMENTS
3"		X	
6"	X		Slight buckling of lid - impact edge.
9"	X		Increase in lid buckling. Slight paneling in tray bottom - top end.
12"	X		Increase in lid damage. Increase in paneling - tray bottom.
15"	X		Increase in lid damage. Increase in paneling of tray bottom
18"			

TRAY PACK TESTS

SAMPLE # 77 DATE: 12-27-84

TEST TYPE: SIDE DROP - TRAY PACK

SAMPLE CONFIGURATION: 90#/0.022 LID - 98#/0.050 TRAY

TEST LEVEL	DAMAGED YES	DAMAGED NO	COMMENTS
3"		X	
6"	X		Slight buckling of lid - impact end.
9"	X		Increase to buckling of lid.
12"	X		Increase in buckling of lid. Slight paneling of tray bottom - top end.
15"	X		Increase in buckling of lid Increase in paneling
18"	X		Increase in paneling of tray corner - top end. Increase in buckling - impact end.

TRAY PACK TESTS

SAMPLE # 78 DATE: 12-27-84

TEST TYPE: SIDE DROP - TRAY PACK

SAMPLE CONFIGURATION: 98# BASELINE LID - 98# BASELINE TRAY

TEST LEVEL	DAMAGE? YES	NO	COMMENTS
3"		X	
6"	X		Very slight buckling of lid - impact end.
9"	X		Paneling to tray bottom at top end corner. Increased buckling of lid.
12"	X		Increased tray damage. Increased lid damage.
15"	X		Increase in tray damage. Increase in buckling of lid.

TRAY PACK TESTS

SAMPLE # 79 DATE: 12-27-84

TEST TYPE: SIDE DROP - TRAY PACK

SAMPLE CONFIGURATION: 98# BASELINE LID - 98# BASELINE TRAY

TEST LEVEL	DAMAGED YES	DAMAGED NO	COMMENTS
3"		X	
6"		X	
9"	X		Slight buckling of lid - impact end. Slight paneling of tray bottom - top end.
12"	X		Increased buckling of lid. Increased paneling of tray.
15"	X		Increased buckling of lid. Increased paneling of tray.

TRAY PACK TESTS

SAMPLE # 80 DATE: 12-27-84

TEST TYPE: SIDE DROP - TRAY PACK

SAMPLE CONFIGURATION: 98# BASELINE LID - 98# BASELINE TRAY

TEST LEVEL	DAMAGED YES	DAMAGED NO	COMMENTS
3"		X	
6"	X		Slight buckling of lid - impact end.
9"	X		Increased buckling of lid. Very slight paneling of tray - top end.
12"	X		Increased buckling of lid. Increased paneling of Tray.
15"	X		Increased buckling of lid Increased paneling of tray.

TRAY PACK TESTS

SAMPLE # 81 DATE: 12-27-84

TEST TYPE: SIDE DROP - TRAY PACK

SAMPLE CONFIGURATION: 98# BASELINE LID - 98# BASELINE TRAY

TEST LEVEL	DAMAGED YES	DAMAGED NO	COMMENTS
3"		X	
6"		X	
9"	X		light buckling of lid - impact end. Slight paneling of tray - top end.
12"	X		Increased lid damage. Increased tray damage.
15"	X		Steady increase in buckling of lid. Steady increase in paneling of tray.

TRAY PACK TESTS

SAMPLE # 82 DATE: 12-27-84

TEST TYPE: SIDE DROP-TRAY PACK

SAMPLE CONFIGURATION: 98#/0.015-0.016 LID - 98#/0.050 TRAY

TEST LEVEL	DAMAGED YES	DAMAGED NO	COMMENTS
3"		X	
6"		X	
9"	X		Very slight buckling of lid - impact end.
12"	X		Slight increase in lid damage. Slight paneling of tray corner - top end.
15"	X		Steady increase in lid damage. Increase in paneling.
18"	X		Increase in buckling of lid. Increase in paneling - top end.

TRAY PACK TESTS

SAMPLE # 83 DATE: 12-27-84

TEST TYPE: SIDE DROP - TRAY PACK

SAMPLE CONFIGURATION: 98#/0.015-0.016 LID - 98#/0.050 TRAY

TEST LEVEL	DAMAGED		COMMENTS
	YES	NO	
3"		X	
6"		X	
9"	X		Slight buckling of lid - impact edge. Slight paneling of tray corner - top end.
12"	X		Increase in buckling of lid. Increase in paneling of tray.
15"	X		Increase in buckling of lid. Increase in paneling of tray.
18"	X		Increase in buckling of lid. Increase in paneling of tray.

TRAY PACK TESTS

SAMPLE # 84 DATE: 12-27-84

TEST TYPE: SIDE DROP - TRAY PACK

SAMPLE CONFIGURATION: 98#/0.015-0.016 LID - 98#/0.050 TRAY

TEST LEVEL	DAMAGED		COMMENTS
	YES	NO	
3"		X	
6"		X	
9"	X		Very slight buckling of lid - impact end.
12"	X		Increase in lid buckling. Slight paneling of tray corner - top end.
15"	X		Increase in lid damage Increase in paneling of tray.
18"	X		Increase in buckling of lid. Increase in paneling - all damage is to one corner.

TRAY PACK TESTS

SAMPLE # 85 DATE: 12-27-84

TEST TYPE: SIDE DROP - TRAY PACK

SAMPLE CONFIGURATION: 98#/0.015-0.016 LID - 98#/0.050 TRAY

TEST LEVEL	DAMAGED YES	DAMAGED NO	COMMENTS
3"		X	
6"		X	
9"	X		Very slight buckling of lid - impact end. Very slight paneling of tray corners - top end.
12"	X		Increased lid damage Increased paneling of tray
15"	X		Increased lid damage Increased tray damage.
18"	X		Increased lid damage. Increased tray damage.

TRAY PACK TESTS

SAMPLE # 86 DATE: 12-27-84

TEST TYPE: SIDE DROP - TRAY PACK

SAMPLE CONFIGURATION: 98#/0.019 LID - 98#/0.050 TRAY

TEST LEVEL	DAMAGED		COMMENTS
	YES	NO	
3"		X	
6"		X	
9"	X		Slight lid buckling - impact end. Slight tray paneling at corners - top end.
12"	X		Increase in buckling. Increase in paneling.
15"	X		Increased lid damage - slight buckling of tray bottom - top end.
18"	X		Increase of buckling of lid. Extensive paneling of tray - top end.

TRAY PACK TESTS

SAMPLE # 87 DATE: 12-27-84

TEST TYPE: SIDE DROP - TRAY PACK

SAMPLE CONFIGURATION: 98#/0.019 LID - 98#/0.050 TRAY

TEST LEVEL	DAMAGED YES	DAMAGED NO	COMMENTS
3"		X	
6"	X		Very slight buckling - impact edge.
9"	X		Slight increase of lid buckling.
12"	X		Steady increase in lid damage. Slight paneling of tray corners - top end.
15"	X		Steady increase in lid damage. Increase in tray paneling.

TRAY PACK TESTS

SAMPLE # 88 DATE: 12-27-84

TEST TYPE: SIDE DROP - TRAY PACK

SAMPLE CONFIGURATION: 98#/0.019 LID - 98#/0.050 TRAY

TEST LEVEL	DAMAGED YES	DAMAGED NO	COMMENTS
3"		X	
6"		X	
9"	X		Slight buckling of lid - impact end.
12"	X		Increase in buckling of lid. Slight paneling of tray corners - top end.
15"	X		Increase in buckling of lid. Increase in paneling of tray corners - top end.

TRAY PACK TESTS

SAMPLE # 89 DATE: 12-27-84

TEST TYPE: SIDE DROP - TRAY PACK

SAMPLE CONFIGURATION: 98#/0.019 LID - 98#/0.050 TRAY

TEST LEVEL	DAMAGED		COMMENTS
	YES	NO	
3"		X	
6"		X	
9"	X		Slight buckling of lid corners - impact end.
12"	X		Increase in lid damage.
15"	X		Increased lid damage. Very slight paneling of tray corner - top end.
18"	X		Steady increase in lid damage. Steady increase in paneling.
21"	X		Extensive damage to tray & lid.

TRAY PACK TESTS

SAMPLE # 90 DATE: 12-27-84

TEST TYPE: SIDE DROP - TRAY PACK

SAMPLE CONFIGURATION: 98#/0.022-0.023 LID - 98#/0.050 TRAY

TEST LEVEL	DAMAGED YES	DAMAGED NO	COMMENTS
3"		X	
6"	X		Very slight lid buckling - impact end.
9"	X		Slight increase in lid buckling.
12"	X		Increased lid damage
15"	X		Increased lid buckling Paneling of tray corners - top end.
18"	X		Steady increase in lid damage. Steady increase in tray paneling.

TRAY PACK TESTS

SAMPLE # 91 DATE: 12-27-84

TEST TYPE: SIDE DROP - TRAY PACK

SAMPLE CONFIGURATION: 98#/0.022-0.023 LID - 98#/0.050 TRAY

TEST LEVEL	DAMAGED		COMMENTS
	YES	NO	
3"		X	
6"		X	
9"	X		Slight buckling of lid corners - impact end.
12"	X		Increase in lid damage. Paneling of one corner of tray - top end.
15"	X		Increase in lid damage. Paneling of both corners of tray - top end.

TRAY PACK TESTS

SAMPLE # 92 DATE: 12-27-84

TEST TYPE: SIDE DROP - TRAY PACK

SAMPLE CONFIGURATION: 98#/0.022-0.023 LID - 98#/0.050 TRAY

TEST LEVEL	DAMAGED YES	DAMAGED NO	COMMENTS
3"		X	
6"	X		Very slight buckling of lid - impact end.
9"	X		Slight increase in lid buckling. Slight paneling one corner tray - top end.
12"	X		Increase in buckling. Increase in paneling of one corner.
18"	X		Increase in buckling of lid. Paneling of other corner of tray - top end.

TRAY PACK TESTS

SAMPLE # 93 DATE: 12-27-84

TEST TYPE: SIDE DROP - TRAY PACK

SAMPLE CONFIGURATION: 98#/0.022-0.023 LID - 98#/0.050 TRAY

TEST LEVEL	DAMAGED YES	DAMAGED NO	COMMENTS
3"		X	
6"		X	
9"	X		Slight buckling of lid corners - impact end.
12"	X		Increase in lid buckling.
15"	X		Increase in lid buckling Paneling of tray corners - top end.
18"	X		Increase in buckling of lid. Increase in paneling of tray.

TRAY PACK TESTS

SAMPLE # 94 DATE: 12-27-84

TEST TYPE: SIDE DROP - SHIPPING CONTAINER

SAMPLE CONFIGURATION: TELESCOPING 7 5/8" NO LINERS

NO LINERS 98#/0.022-0.023 LID
98#/0.050 TRAY

TEST LEVEL		DAMAGE		COMMENT
		YES	NO	
3"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
6"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
9"	TP #4	X		Lid buckling at impact end.
	#3		X	
	#2		X	
	#1		X	
12"	TP #4	X		Increased lid buckling.
	#3		X	
	#2		X	
	#1		X	
15"	TP #4	X		Tape broke at top end of container. Increased buckling of lid, slight paneling of tray corner-top end.
	#3	X		
	#2		X	
	#1		X	#3 Lid dented by top Tray Pack bottom.

TRAY PACK TESTS

SAMPLE # 94 (Cont'd.) DATE: 12-27-84

TEST TYPE: SIDE DROP - SHIPPING CONTAINER

SAMPLE CONFIGURATION: TELESCOPING 7 5/8" No liners

98#/0.022-0.023 LID 98#/0.050 TRAY

TEST LEVEL		DAMAGE		COMMENT
		YES	NO	
18"	TP #4	X		#4 Tape broken on case - top end.
	#3	X		#3 No change.
	#2	X		#2 Tray lid dented by tray 3 bottom.
	#1		X	
21"	TP #4	X		#4 Tape broken on case - top end. Extensive buckling of lid increased paneling of tray.
	#3	X		#3 No change.
	#2	X		#2 No change.
	#1	X		#1 Slight dent in lid from tray 2 bottom. Paneling on tray corners - top end.

TRAY PACK TESTS

SAMPLE # 95 DATE: 12-27-84

TEST TYPE: SIDE DROP - SHIPPING CONTAINER

SAMPLE CONFIGURATION: TELESCOPING 7 5/8" WITH 3 LINERS

98#/0.019 LID - 98#/0.050 TRAY

TEST LEVEL		DAMAGED		COMMENT
		YES	NO	
6"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
9"	TP #4	X		#4 Very slight buckling at lid corners - impact edge.
	#3		X	
	#2		X	
	#1		X	
12"	TP #4	X		#4 Increased buckling at lid corners - impact edge.
	#3		X	
	#2		X	
	#1	X		#1 Paneling of tray corners - top end.
15"	TP #4	X		#4 Broke the tape on top end, increased lid buckling.
	#3		X	
	#2		X	
	#1	X		#1 Increased paneling of tray corners - top end.
18"	TP #4	X		#4 Increased buckling of lid at corners.
	#3		X	
	#2		X	
	#1	X		#1 increased paneling of tray corners - top end.

TRAY PACK TESTS

SAMPLE # 96 DATE: 12-27-84

TEST TYPE: SIDE DROP - SHIPPING CONTAINER

SAMPLE CONFIGURATION: TELESCOPING 7 5/8" WITH 3 LINERS

98#/0.015-0.016 LID - 98#/0.050 TRAY

TEST LEVEL		DAMAGED		COMMENT
		YES	NO	
6"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
9"	TP #4	X		#4 Very slight buckling at lid corners - impact edge.
	#3		X	
	#2		X	
	#1	X		#1 Slight paneling at tray corner - top end.
12"	TP #4	X		#4 Increased damage to lid.
	#3		X	
	#2		X	
	#1	X		#1 Paneling of both tray corners top end.
15"	TP #4	X		#4 Increased lid damage - impact edge.
	#3		X	
	#2		X	
	#1	X		#1 Increased paneling at tray corners - top end.
18"	TP #4	X		#4 Increased lid buckling. Very slight paneling on one corner of tray - top end.
	#3		X	
	#2		X	
	#1	X		#1 Increase in paneling of tray corners - top end.

TRAY PACK TESTS

SAMPLE # 96 (Cont'd.) DATE: 12-27-84

TEST TYPE: SIDE DROP - SHIPPING CONTAINER

SAMPLE CONFIGURATION: TELESCOPING 7 5/8" WITH 3 LINERS

98#/0.015-0.016 LID - 98#/0.050 TRAY

TEST LEVEL		DAMAGED		COMMENT
		YES	NO	
21"	TP #4	X		#4 Tape broke on top end, also broke on outer box - extensive buckling of lid. Increase in paneling.
	#3	X		#3 Slight bulge in tray - impact edge.
	#2	X		#2 Very slight bulge in tray - impact edge.
	#1	X		#1 Extensive paneling of tray corners - top end.

TRAY PACK TESTS

SAMPLE # 97 DATE: 12-27-84

TEST TYPE: SIDE DROP - SHIPPING CONTAINER

SAMPLE CONFIGURATION: TELESCOPING 7 5/8" WITH 3 LINERS

98# BASELINE TRAY & LID

TEST LEVEL		DAMAGED YES	DAMAGED NO	COMMENT
6"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
9"	TP #4	X		#4 One corner slightly buckling-impact edge. Very slight paneling of tray corners - top end.
	#3	X		#3 Very slight paneling of tray corners - top end.
	#2		X	
	#1	X		#1 Very slight paneling of tray corners - top end.
12"	TP #4	X		#4 Increased lid damage - impact end. Increased tray damage - top end.
	#3	X		#3 Increased tray paneling - top end.
	#2	X		#2 Paneling to tray corners - top end.
	#1	X		#1 Increased paneling damage top end.
15"	TP #4	X		#4 Increased lid damage.
	#3	X		#3 Increased paneling
	#2	X		#2 Increased paneling
	#1	X		#1 Extensive paneling to tray corners.
18"	TP #4			
	#3			
	#2			
	#1			

Tray Packs #4 only ones to sustain lid damage.

TRAY PACK TESTS

SAMPLE # 98 DATE: 12-27-84

TEST TYPE: SIDE DROP - SHIPPING CONTAINER

SAMPLE CONFIGURATION: TELESCOPING 7 5/8" WITH 3 LINERS

90#/0.014 LID - 98#/0.050 TRAY

TEST LEVEL		DAMAGED		COMMENT
		YES	NO	
6"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
9"	TP #4	X		#4 Slight buckling both corners - impact edge
	#3		X	
	#2		X	
	#1		X	
12"	TP #4	X		#4 Increased Lid buckling
	#3		X	
	#2		X	
	#1	X		#1 Slight paneling of tray corners - top end.
15"	TP #4	X		#4 Increased damage to lid.
	#3		X	
	#2		X	
	#1	X		#1 Slight increase in paneling.
18"	TP #4	X		#4 Increase in buckling of lid. Slight paneling of lid and paneling of tray corner - top end.
	#3		X	
	#2		X	
	#1	X		#1 Increased paneling of tray corner - top end.

TRAY PACK TESTS

SAMPLE # 98 (Cont'd.) DATE: 12-27-84

TEST TYPE: SIDE DROP - SHIPPING CONTAINER

SAMPLE CONFIGURATION: TELESCOPING 7 5/8" WITH 3 LINERS

90#/0.014 LID - 98#/0.050 TRAY

TEST LEVEL		DAMAGED		COMMENT
		YES	NO	
21"	TP #4	X		#4 Increase buckling of lid - impact edge. Increase paneling of tray top end.
	#3		X	
	#2		X	
	#1	X		#1 Increased paneling of tray corners - top end.
24"	TP #4	X		#4 Extensive lid damage. Increase in paneling.
	#3	X		#3 Very slight buckling of lid - impact end.
	#2	X		#2 Crease along edge of lid - impact edge.
	#1	X		#1 Extensive tray paneling - top end.

TRAY PACK TESTS

SAMPLE # 99 DATE: 12-27-84

TEST TYPE: SIDE DROP -- SHIPPING CONTAINER

SAMPLE CONFIGURATION: TELESCOPING 7 5/8" WITH 3 LINERS

90#/0.018 LID - 98#/0.050 TRAY

TEST LEVEL		DAMAGED		COMMENT
		YES	NO	
6"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
9"	TP #4	X		#4 Buckling of lid corners - impact end.
	#3		X	
	#2		X	
	#1		X	
12"	TP #4	X		#4 Increased lid damage.
	#3		X	
	#2		X	
	#1	X		#1 Slight paneling at one tray corner - top end.
15"	TP #4	X		#4 Increased buckling of lid - impact edge. Paneling of tray corners - top end.
	#3		X	
	#2		X	
	#1	X		#1 Increased paneling of corner top end.
18"	TP #4	X		#4 Extensive damage to lid. Increased paneling to tray corners.
	#3		X	
	#2		X	
	#1	X		#1 Increase in paneling of corner.

TRAY PACK TESTS

SAMPLE # 100 DATE: 12-28-84

TEST TYPE: SIDE DROP - SHIPPING CONTAINER

SAMPLE CONFIGURATION: TELESCOPING 7 5/8" WITH 4 LINERS

90#/0.022 LID - 98#/0.050 TRAY

TEST LEVEL		DAMAGE		COMMENT
		YES	NO	
6"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
9"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
12"	TP #4		X	
	#3		X	
	#2		X	
	#1	X		#1 Paneling of Tray* corner - top end. *FIRST TRAY DAMAGE.
15"	TP #4		X	#4 Incipient paneling tray corner - top end.
	#3		X	
	#2		X	
	#1	X		#1 Paneling of both tray corners top end.
18"	TP #4	X		#4 Paneling of tray corner - top end.
	#3		X	
	#2		X	
	#1	X		#1 Increase in paneling of tray corners.

TRAY PACK TESTS

SAMPLE # 100 (Cont'd.) DATE: 12-28-84

TEST TYPE: SIDE DROP - SHIPPING CONTAINER

SAMPLE CONFIGURATION: TELESCOPING 7 5/8" WITH 4 LINERS

90#/0.022 LID - 98#/0.050 TRAY

TEST LEVEL		DAMAGED		COMMENT
		YES	NO	
	TP #4	X		#4 Buckling of lid* - impact end.
21"	#3		X	*FIRST LID DAMAGE.
	#2		X	Paneling of lid - top end.
	#1	X		#1 Extreme paneling of tray corners - top end.

TRAY PACK TESTS

SAMPLE # 101 DATE: 12-28-84

TEST TYPE: SIDE DROP - SHIPPING CONTAINER

SAMPLE CONFIGURATION: TELESCOPING 7 5/8" WITH 5 LINERS

90#/0.022 LID - 98#/0.050 TRAY

TEST LEVEL		DAMAGE		COMMENT
		YES	NO	
6"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
9"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
12"	TP #4		X	
	#3		X	
	#2		X	
	#1	X		#1 Paneling of tray* corner - top end. *FIRST TRAY DAMAGE.
15"	TP #4		X	
	#3		X	
	#2		X	
	#1	X		#1 No change.
18"	TP #4	X		#4 Buckling of lid* both corners impact end.
	#3		X	*FIRST LID DAMAGE.
	#2		X	
	#1	X		#1 Increased paneling of tray corner - top end.

TRAY PACK TESTS

SAMPLE # 101 (Cont'd.) DATE: 12-28-84

TEST TYPE: SIDE DROP - SHIPPING CONTAINER

SAMPLE CONFIGURATION: TELESCOPING 7 5/8" WITH 5 LINERS

90#/0.022 LID - 98#/0.050 TRAY

TEST LEVEL		DAMAGED		COMMENT
		YES	NO	
21"	TP #4	X		#4 Slight increase in buckling of lid - impact end. Paneling of tray corners - top end.
	#3		X	#3 Incipient paneling of tray corners.
	#2		X	
	#1	X		#1 Increased paneling of tray corner - top end.

TRAY PACK TESTS

SAMPLE # 102 DATE: 12-27-84

TEST TYPE: SIDE DROP - SHIPPING CONTAINER

SAMPLE CONFIGURATION: TELESCOPING 7 5/8" WITH 5 LINERS
TWO UP - TWO DOWN
98#/0.019 LID - 98#/0.050 TRAY

TEST LEVEL		DAMAGED		COMMENT
		YES	NO	
21"	TP #4	X		#4 Slight buckling of lid - impact edge. Slight paneling of tray - top end.
	#3		X	#3 No change.
	#2		X	
	#1	X		#1 Buckling of lid along impact edge.

TRAY PACK TESTS

SAMPLE # 103 DATE: 12-28-84

TEST TYPE: SIDE DROP - SHIPPING CONTAINER

SAMPLE CONFIGURATION: TELESCOPING 7 5/8" WITH 5 LINERS
TWO UP - TWO DOWN
1 & 2 98#/BASELINE
2 & 3 98#/0.022-0.023 LID - ALL TRAYS 98#/0.050

TEST LEVEL		DAMAGE		COMMENT
		YES	NO	
6"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
9"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
12"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
15"	TP #4		X	
	#3		X	
	#2		X	
	#1	X		#1 Very slight paneling one corner of lid - top end.
18"	TP #4	X		#4 Very slight buckling one corner of lid - inpact edge.
	#3		X	
	#2		X	
	#1	X		#1 Buckling of lid corners - impact edge. Increase paneling of lid corner - top end.

TRAY PACK TESTS

SAMPLE # 103 (Cont'd.) DATE: 12-28-84

TEST TYPE: SIDE DROP - SHIPPING CONTAINER

SAMPLE CONFIGURATION: TELESCOPING 7 5/8" WITH 5 LINERS
TWO UP - TWO DOWN
1&2 98# BASELINE
2&3 98#/0.022-0.023 LID - ALL TRAYS 98#/0.050

TEST LEVEL		DAMAGED		COMMENT
		YES	NO	
21"	TP #4	X		#4 Incipient paneling tray corners - top end. Slight increase in buckling.
	#3		X	#3 Incipient damage to lid - impact edge.
	#2	X		#2 Crease along lid - impact edge.
	#1	X		#1 Increase in buckling & paneling tray corner - top end.

TRAY PACK TESTS

SAMPLE # 104 BOX #1 DATE: 6-16-85

TEST TYPE: SIDE DROP TEST

SAMPLE CONFIGURATION: 90# LABELED LID - REINFORCED

TEST TECH: WM

90#/.050 REINFORCED TRAYS - WATER FILLED

2X2 PACKING
5 LINERS

TEST LEVEL		DAMAGED		COMMENT
		YES	NO	
9"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
12"	#4	X		SLIGHT BUCKLE OF LID
	#3		X	
	#2		X	
	#1		X	
15"	#4	X		INCREASE IN BUCKLING OF LID
	#3		X	
	#2		X	
	#1		X	
18"	#4	X		INCREASE IN BUCKLING OF LID
	#3		X	
	#2		X	
	#1	X		SLIGHT BUCKLING OF LID
21"	#4	X		INCREASE IN BUCKLING OF LID
	#3		X	
	#2		X	
	#1	X		SLIGHT INCREASE IN BUCKLE

TRAY PACK TESTS

SAMPLE # 104 BOX #1 DATE: 6-16-85

TEST TYPE: SIDE DROP TEST

SAMPLE CONFIGURATION: 90# LABELED LID - REINFORCED

TEST TECH: WM

2X2 PACKING
5 LINERS

90#/.050 REINFORCED TRAYS - WATER FILLED

TEST LEVEL		DAMAGED		COMMENT
		YES	NO	
	TP #4	X		DISTORTION OF SEAL SEAM
24"	#3		X	
	#2		X	
	#1	X		INCREASE IN BUCKLING

TRAY PACK TESTS

SAMPLE # 105 BOX #2 DATE: 6-16-85

TEST TYPE: SIDE DROP TEST

SAMPLE CONFIGURATION: 98# LABEL TYPE LID - REINFORCED

TEST TECH: WM

2X2 PACKING
5 LINERS

98#/.050 REINFORCED TRAYS - WATER FILLED

TEST LEVEL		DAMAGED		COMMENT
		YES	NO	
9"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
12"	#4		X	
	#3		X	
	#2		X	
	#1		X	
15"	#4		X	
	#3		X	
	#2		X	
	#1		X	
18"	#4	X		VERY SLIGHT BUCKLE OF LID
	#3		X	
	#2		X	
	#1		X	
21"	#4	X		INCREASE IN BUCKLE OF LID
	#3		X	
	#2		X	
	#1	X		SLIGHT BUCKLE OF LID

TRAY PACK TESTS

SAMPLE # 105 BOX #2 DATE: 6-16-85

TEST TYPE: SIDE DROP TEST

SAMPLE CONFIGURATION: 98# LABEL TYPE LID - REINFORCED

TEST TECH: WM

2X2 PACKING
5 LINERS

98#/.050 REINFORCED TRAYS - WATER FILLED

TEST LEVEL		DAMAGED		COMMENT
		YES	NO	
	TP #4	X		BUCKLE IS BEGINNING TO DISTORT SEAL SEAM
24"	#3		X	
	#2		X	
	#1	X		INCREASE IN BUCKLE OF LID

TRAY PACK TESTS

SAMPLE # 106 BOX #3 DATE: 6-18-85

TEST TYPE: SIDE DROP TEST

SAMPLE CONFIGURATION: 90# LABELED LID - REINFORCED

2X2 PACKING
5 LINERS

90#/.050 REINFORCED TRAYS - WATER FILLED

TEST LEVEL		DAMAGED		COMMENT
		YES	NO	
9"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
12"	#4	X		SLIGHT BUCKLE OF LID
	#3		X	
	#2		X	
	#1		X	
15"	#4	X		INCREASED BUCKLE OF LID
	#3		X	
	#2		X	
	#1		X	
18"	#4	X		BUCKLE LARGE ENOUGH TO BEGIN TO INTERFERE WITH OPENING LID
	#3		X	
	#2		X	
	#1	X		SLIGHT BUCKLE OF LID
21"	#4	X		LID BUCKLES BOTH ENDS
	#3		X	
	#2		X	
	#1	X		INCREASED LID BUCKLE

TRAY PACK TESTS

SAMPLE # 106 BOX #3 DATE: 6-18-85

TEST TYPE: SIDE DROP TEST

SAMPLE CONFIGURATION: 90# LABELED LID - REINFORCED

TEST TECH: _____

90#/.050" REINFORCED TRAYS - WATER FILLED

2X2 PACKING
5 LINERS

TEST LEVEL		DAMAGED		COMMENT
		YES	NO	
24"	TP #4	X		LIDS BUCKLED, TRAY PANELED
	#3		X	
	#2		X	
	#1	X		LID BUCKLED
28"	#4			
	#3			
	#2			
	#1			
32"	#4			
	#3			
	#2			
	#1			

TRAY PACK TESTS

SAMPLE # 107 BOX #4 DATE: 6-18-85

TEST TYPE: SIDE DROP TEST

SAMPLE CONFIGURATION: 98# LABELED LID - REINFORCED

TEST TECH: _____

98#/.050 REINFORCED TRAYS - WATER FILLED

2X2 PACKING
5 LINERS

TEST LEVEL		DAMAGED		COMMENT
		YES	NO	
12"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
15"	#4		X	
	#3		X	
	#2		X	
	#1		X	
18"	#4	X		SLIGHT LID BUCKLE
	#3		X	
	#2		X	
	#1		X	
21"	#4	X		LARGE LID BUCKLE
	#3		X	
	#2		X	
	#1	X		SLIGHT LID BUCKLE
24"	#4	X		LARGE LID BUCKLE
	#3		X	
	#2		X	
	#1	X		SLIGHT LID BUCKLE

TRAY PACK TESTS

SAMPLE #: 107 BOX #4 DATE: 6-18-85

TEST TYPE: SIDE DROP TEST

SAMPLE CONFIGURATION: 98# LABELED LID - REINFORCED

TEST TECH: _____ 98#/.050 REINFORCED TRAYS - WATER FILLED

2X2 PACKING
5 LINERS

TEST LEVEL		DAMAGED		COMMENT
		YES	NO	
27"	TP #4	X		LID BADLY BUCKLED
	#3	X		SLIGHT LID BUCKLE
	#2		X	
	#1	X		LID BUCKLED
30"	#4	X		LID VERY BADLY BUCKLED, SLIGHT TRAY PANEL
	#3	X		SLIGHT LID BUCKLE
	#2		X	
	#1	X		LID BADLY BUCKLED, SLIGHT TRAY PANEL

TRAY PACK TESTS

SAMPLE # 108 ~~BOX~~ #5 DATE: 6-18-85

TEST TYPE: SIDE DROP TEST

SAMPLE CONFIGURATION: 90# LABELED LID - REINFORCED

90#/.050 REINFORCED - WATER FILLED

TEST LEVEL		DAMAGED		COMMENT
		YES	NO	
9"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
12"	#4		X	
	#3		X	
	#2		X	
	#1		X	
15"	#4	X		VERY SLIGHT BUCKLE OF LID
	#3		X	
	#2		X	
	#1		X	
18"	#4	X		SLIGHT BUCKLE OF LID
	#3		X	
	#2		X	
	#1	X		VERY SLIGHT BUCKLE OF LID
21"	#4	X		BUCKLING OF LID CORNER
	#3		X	
	#2		X	
	#1	X		SLIGHT BUCKLE OF LID

TRAY PACK TESTS

SAMPLE # 108 BOX #5 DATE: 6-18-85

TEST TYPE: SIDE DROP TEST

SAMPLE CONFIGURATION: 90# LABELED LID - REINFORCED

TEST TECH: _____

90#/.050 REINFORCED - WATER FILLED

TEST LEVEL		DAMAGED		COMMENT
		YES	NO	
24"	TP #4	X		SEVERE BUCKLING OF LID SLIGHT PANELING OF TRAY
	#3		X	
	#2	X		VERY SLIGHT BUCKLING OF LID
	#1	X		SLIGHT BUCKLING OF LID PANELING OF TRAY BOTTOM

TRAY PACK TESTS

SAMPLE # 109 BOX #6 DATE: 6-18-85

TEST TYPE: SIDE DROP TEST

SAMPLE CONFIGURATION: 98# LABELED LID - REINFORCED

2X2 PACKING
5 LINERS

98#/.050 REINFORCED TRAY - WATER FILLED

TEST LEVEL		DAMAGED		COMMENT
		YES	NO	
9"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
12"	#4		X	
	#3		X	
	#2		X	
	#1		X	
15"	#4		X	
	#3		X	
	#2		X	
	#1		X	
18"	#4	X		SLIGHT BUCKLE OF LID
	#3		X	
	#2		X	
	#1		X	
21"	#4	X		INCREASE IN BUCKLING OF LID
	#3		X	
	#2		X	
	#1	X		SLIGHT BUCKLING OF LID

TRAY PACK TESTS

SAMPLE # 109 BOX #6 DATE: 6-18-85

TEST TYPE: SIDE DROP TEST

SAMPLE CONFIGURATION: 98# LABELED LID - REINFORCED

TEST TECH: _____

2X2 PACKING
5 LINERS

98#/.050 REINFORCED TRAY - WATER FILLED

TEST LEVEL		DAMAGED		COMMENT
		YES	NO	
24"	TP #4	X		INCREASE IN BUCKLING OF LID
	#3		X	
	#2		X	
	#1	X		INCREASE IN BUCKLING OF LID
27"	#4	X		SUBSTANTIAL BUCKLING OF LID
	#3		X	
	#2		X	
	#1	X		INCREASE IN BUCKLING OF LID
30"	#4	X		SEVERE BUCKLING OF LID. SLIGHT PANELING ONE TRAY CORNER
	#3		X	
	#2		X	
	#1	X		INCREASE IN BUCKLING OF LID

TRAY PACK TESTS

SAMPLE # 110 BOX #7 DATE: 6-14-85

TEST TYPE: SIDE DROP TEST

SAMPLE CONFIGURATION: 90#, LABELED LID, REINFORCED

2X2 PACKING
5 LINERS

90#m .050 REINFORCED TRAYS - WATER FILL

TEST LEVEL		DAMAGED YES	DAMAGED NO	COMMENT
9"	TP #4		X	NO DAMAGE
	#3		X	
	#2		X	
	#1		X	
12"	TP #4	X		SLIGHT BUCKLING OF LID NO DAMAGE TO ANY TRAYS CARTON MAY BE OVERSIZED
	#3		X	
	#2		X	
	#1		X	
15"	TP #4	X		SLIGHT INCREASE IN BUCKLE
	#3		X	
	#2		X	
	#1		X	
18"	TP #4	X		BUCKLE BEGINNING TO BE LARGE ENOUGH TO INTERFERE WITH OPENING
	#3		X	
	#2		X	
	#1		X	
21"	TP #4	X		LID DAMAGE HAS DISTORTED SEALING SEAM
	#3		X	
	#2		X	
	#1	X		SLIGHT TRAY PANEL

TRAY PACK TESTS

SAMPLE # 111 BOX #8 DATE: 6-14-85

TEST TYPE: SIDE DROP

SAMPLE CONFIGURATION: 98# LID - LABEL SPACE REINFORCED

2X2 PACKING
5 PADS

98# TRAY REINFORCED

TEST LEVEL		DAMAGED		COMMENT
		YES	NO	
9"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
12"	#4		X	
	#3		X	
	#2		X	
	#1		X	
15"	#4		X	
	#3		X	
	#2		X	
	#1		X	
18"	#4	X		SLIGHT BUCKLING OF LID
	#3		X	
	#2		X	
	#1		X	
21"	#4	X		SLIGHT INCREASE IN BUCKLING OF LID. NO TRAY DAMAGE
	#3		X	
	#2		X	
	#1	X		SLIGHT BUCKLING OF LID

TRAY PACK TESTS

SAMPLE # 112 BOX #9 DATE: 6-18-85

TEST TYPE: SIDE DROP TEST

SAMPLE CONFIGURATION: 98# LABELED LID - REINFORCED

2X2 PACKING
5 LINERS

98#/.050 REINFORCED TRAYS - WATER FILLED

TEST LEVEL		DAMAGED		COMMENT
		YES	NO	
9"	TP #4		X	
	#3		X	
	#2		X	
	#1		X	
12"	#4		X	
	#3		X	
	#2		X	
	#1		X	
15"	#4		X	
	#3		X	
	#2		X	
	#1		X	
18"	#4		X	
	#3		X	
	#2		X	
	#1		X	
21"	#4	X		SLIGHT BUCKLING OF LID
	#3		X	
	#2		X	
	#1	X		VERY SLIGHT BUCKLING OF LID

TRAY PACK TESTS

SAMPLE # 112 BOX #9 DATE: 6-18-85

TEST TYPE: SIDE DROP TEST

SAMPLE CONFIGURATION: 98# LABELED LID - REINFORCED

TEST TECH: _____

2X2 PACKING
5 LINERS

98#/.050 REINFORCED TRAYS - WATER FILLED

TEST LEVEL		DAMAGED		COMMENT
		YES	NO	
24"	TP #4	X		INCREASE IN BUCKLING AT LID
	#3		X	
	#2		X	
	#1	X		SLIGHT BUCKLING OF LID
27"	#4	X		SUBSTANTIAL BUCKLING OF LID VERY SLIGHT PANELING OF TRAY
	#3		X	
	#2		X	
	#1	X		INCREASE IN BUCKLING OF LID VERY SLIGHT PANELING OF TRAY

CRUSH TEST

SHIPPING CONTAINER

SAMPLE # 1-B/2-M/3-T SAMPLE CONFIGURATION: REINFORCED CONCEPT SHIPPING CONTAINER

DATE	TIME	WEIGHT	HEIGHT "				DEFLECTION "				COMMENT	TEST TECH.	CHECKED BY
			LF	RF	LR	RR	LF	RF	LR	RR			
9-10-84	12:30	202	27 3/4	27¼	27	27¼	0	0	0	0	No signs of stress	JK	SK
9-11-84	12:30	202	27½	27¼	27	27¼	¼	0	0	0	No signs of stress	JK	SK
9-11-84	12:30	342	27½	27¼	27	27¼	¼	0	0	0	No signs of stress	JK	SK
9-12-84	12:30	342	27½	27¼	27	27	¼	0	0	¼	No signs of stress	JK	SK
9-12-84	12:30	482	27½	27¼	27	27	¼	0	0	¼	No signs of stress	JK	SK
9-13-84	12:30	482	27½	27¼	26½	26 3/4	¼	0	½	½	No signs of stress	JK	SK
9-13-84	12:30	622	27½	27¼	26½	26 3/4	¼	0	½	½	No signs of stress	JK	SK
9-14-84	12:30	622	27½	27	26¼	26½	¼	¼	3/4	3/4	Some evidence of bulging on all 4 sides.	JK	SK
9-14-84	12:30	762	27½	27	26¼	26½	¼	¼	3/4	3/4	on shipping cont. #1&2 No further change	JK	SK
9-18-84	9:00	762	27½	27	26	26½	¼	¼	1	3/4	No further change	JK	SK
9-18-84	9:30	Weights removed - bulge receded noticably on the left side (stiched joint of container) and on the back side. Container #3 is about ¼" shorter (13") than container #1 and has therefore penetrated (about 1/8") on the right side into the #2 container.											
9-18-84	3:00	202	27 5/8	27¼	26 3/8	26½					The 4 pads were not compressed after removal from container.		
	DEFLECTION FROM BEGINNING 9-10-84		1/8		5/8	5/8							

CRUSH TEST

SHIPPING CONTAINER

SAMPLE # 1-B/2-M/3-T SAMPLE CONFIGURATION: REINFORCED CONCEPT SHIPPING CONTAINER

#2 SHIPPING CONTAINER EXAMINATION

(1) One edge of the shipping container #3 (resting on top) was misaligned by about ½" inboard resulting an 1/8" deep indentation along this edge.

(2) After opening it was determined that the dual (inner & outer) liners were intact and the indentation was into the space between the 4 pads and inside wall of the liners.

(3) There was no evidence of any damage to the Tray Packs.

(4) The thickness of the 4 pads was measured and compared with unstressed pads. There was no compression set evident.

CRUSH TEST

SHIPPING CONTAINER

SAMPLE # 2-1/2-2/2-3 SAMPLE CONFIGURATION: BASELINE SHIPPING CONTAINER

DATE	TIME	WEIGHT	HEIGHT "				DEFLECTION "				COMMENT	TEST TECH.	CHECKED BY
			LF	RF	LR	RR	LF	RF	LR	RR			
9-19-84	2:00 PM	202	31½	31 1/8	31 3/8	31 5/8					Measurement right after application of initial load	JK	SK
9-20-84	10:00 AM	202	31 5/16	31	31 1/4	31 5/8	3/16	1/8	1/8	0	# 3 container missing staples along upper half of seam.	JK	SK
9-20-84	10:15 AM	342	31 1/8	31	30 7/8	31 7/16	3/8	1/8 +	1/2	3/16	Measured right after application of load.	JK	SK
9-21-84	10:00 AM	342	30 15/16	30 13/16	30 13/16	31 5/16	9/16	5/16	9/16	5/16	No evidence of bulging	JK	SK
9-21-84	10:15 AM	482	30 7/8	30 11/16	30 3/4	31 1/4	5/8	7/16	5/8	3/8	No evidence of bulging	JK	SK
9-24-84	10:00 AM	482	30 13/16	30 1/2	30 3/4	31 3/16	11/16 +	5/8 +	5/8 +	7/16	#2 container very slight bulging of left and right sides only.	JK	SK
9-24-84	10:15 AM	622	30 11/16	30 3/8+	30 11/16	31 1/8	13/16	3/4 -	11/16	1/2	No change	JK	SK
9-25-84	8:20 AM	622	30 3/4 -	30 3/8	30 5/8	31	3/4+	3/4	3/4	5/8	No change	JK	SK
9-25-84	8:25 AM	762	30 11/16	30 5/16	30 5/8	31	13/16	13/16	3/4	5/8	No change	JK	SK
9-26-84	11:00 AM	762	30 11/16	30 7/16	30 3/16	30 11/16	13/16	11/16	1 3/16	15/16	All containers show start of fracture at all 4 vert. edges; ~~Cont. #2 shows horiz.~~ crease on rear side.	JK	SK
9-26-84	11:10 AM	902	30 11/16	30 7/16	30 1/16	30 1/2	13/16	11/16	1 5/16+	1 1/8	No change	JK	SK
9-26-84	11:45 AM	902	29 9/16	29 5/16	30 3/4	30 1/4					Container #2 left side bulged out; left front edge (stiched) buckled. # 2 penetrated about ½" into # 1 container. 5 min. later platform came to ~~rest on front auxilliary support.~~	JK	SK

CRUSH TEST

SHIPPING CONTAINER

Bot. Mid. Top

SAMPLE # 1-3/2-3/3-3 SAMPLE CONFIGURATION: REINFORCED CONCEPT (8¼" DP) SHIPPING CONTAINER

DATE	TIME	WEIGHT	HEIGHT "				DEFLECTION "				COMMENT	TEST TECH.	CHECKED BY
			LF	RF	LR	RR	LF	RF	LR	RR			
9-27-84	3:00 PM	202	27 ½	27 3/16+	27 5/16+	27 5/8					Initial condition.	JK	SK
9-28-84	8:30 AM	202	27 3/8	27 1/8	27 5/16	27 5/8-	1/8	1/16	0 +	0 +	Containers ok.	JK	SK
9-28-84	8:35 AM	342	27 3/8	27 +	27 3/16	27 ½	1/8	3/16 -	1/8 -	1/8	No change	JK	SK
10-1-84	8:35 AM	342	27 5/16	26 15/16	27 3/16	27 7/16	3/16	1/4	1/8 -	3/16	All containers ok.	SK	SK
10-1-84	8:40 AM	482	27 1/4	26 7/8+	27 1/8+	27 7/16-	1/4	5/16 -	3/16 -	3/16 +	No change	SK	SK
10-2-84	8:30 AM	482	27 1/4	26 3/4	27 1/16	27 1/4	1/4	7/16	1/4	3/8	No change	JK	SK
10-2-84	8:35 AM	622	27 3/16	26 3/4-	27 1/16-	27 3/16	5/16	7/16	1/4 +	7/16	No change	JK	SK
10-3-84	8:40 AM	622	27 1/4	26 11/16	26 7/8+	27	1/4	1/2 -	7/16	5/8	No change		SK
10-3-84	8:45 AM	762	27 3/16+	26 5/8+	26 7/8-	26 15/16	5/16 -	1/2	1/2	11/16 -	No change		SK
10-4-84	8:55 AM	762	27 3/16+	26 11/16	26 11/16	26 13/16+	5/16 -	7/16	5/8	13/16	No change	SK	SK
10-5-84	10:00 AM	762	27 3/16+	26 11/16	26 11/16	26 13/16	5/16 -	7/16	5/8 +	13/16	No change	JK	SK
10-5-84	10:05 AM	902	27 3/16+	26 11/16	26 5/8+	26 3/4	5/16 -	1/2	11/16	7/8	No change	JK	SK
10-9-84	8:30 AM	902	27 3/16	26 5/8	26 1/2	26 11/16	5/16	9/16 -	13/16+	15/16	No change	JK	SK

CRUSH TEST

SHIPPING CONTAINER

SAMPLE #1-3/2-3/3-3 SAMPLE CONFIGURATION: REINFORCED CONCEPT (8½" DP) SHIPPING CONTAINER

(Cont'd)

DATE	TIME	WEIGHT	HEIGHT "				DEFLECTION "				COMMENT	TEST TECH.	CHECKED BY
			LF	RF	LR	RR	LF	RF	LR	RR			
10-9-84	8:45 AM	1,042	27 1/8+	26 5/8+	26 1/2	26 5/8	3/8-	1/2	13/16 +	1	No change	JK	SK
10-10-84	8:35 AM	1,042	27 1/8+	26 11/16+	26 3/8	26 9/16	3/8 -	7/16	15/16+	1 1/16	No change	JK	SK
10-10-84	8:45 AM	1,182	27 1/8+	26 11/16	26 3/8-	26 1/2	3/8 -	1/2 -	1	1 1/8	No change	JK	SK
10-11-84	10:00 AM	1,182	27 3/16	26 11/16+	26 1/4	26 3/8-	5/16	7/16	1 1/16+	1 1/4	No change	JK	SK
10-11-84	10:05 AM	1,322	27 1/8+	26 11/16+	26 3/16	26 3/8	3/8 -	7/16	1 1/8+	1 1/4	No change	JK	SK
10-12-84	8:30 AM	1,322	27 3/16+	26 3/4+	26 1/16	26 3/16+	5/16 -	3/8	1 1/4	1 7/16	Test terminated 1" list, front to back.		

CRUSH TEST

SHIPPING CONTAINER

Bot. Mid. Top

SAMPLE #5-1/5-2/5-3 SAMPLE CONFIGURATION: 7 5/8" TELESCOPING CONTAINER - NO LINERS

DATE	TIME	WEIGHT	HEIGHT "				DEFLECTION "				COMMENT	TEST TECH.	CHECKED BY
			LF	RF	LR	RR	LF	RF	LR	RR			
11-27-84	9:00	202	25 5/8	25 7/16	25 1/8	25 1/2	0	0	0	0		JK	SK
11-28-84	9:00	202	25 1/2	25 7/16	25 3/16+	25 1/2+	1/8-	0	+1/8	0		JK	SK
11-28-84	9:00	342	25 3/8	25 5/16	25	25 1/2-	1/4-	1/16	1/8-	0		JK	SK
11-29-84	9:00	342	25 5/16	25 5/16	25	25 1/2-	5/16-	1/8 -	1/8 -	0		JK	SK
11-29-84	9:00	482	25 1/4	25 1/4	24 15/16	25 7/16	3/8 -	3/16 -	3/16 -	1/16		JK	SK
11-30-84	10:00	482	25 3/16-	25 3/16-	24 15/16-	25 7/16	7/16	1/4	3/16	1/16		JK	SK
11-30-84	10:00	622	25 +	25 1/8	24 2/8	25 7/16	5/8	5/16 -	1/4 -	1/16		JK	SK
12-3-84	9:00	622	24 15/16-	25 1/16+	24 3/4+	25 7/16	11/16	3/8	3/8-	1/16		JK	JK
12-3-84	9:00	762	24 7/8	25 1/16	24 3/4	25 3/8	3/4	3/8	3/8-	1/8	Appears to be tipping slightly to the left front.	JK	JK
12-4-84	9:00	762	24 13/16	25 +	24 11/16	25 3/8+	13/16	3/16 +	5/16	1/8 +		JK	JK
12-4-84	9:00	902	24 13/16-	25 +	24 5/8	25 5/16	13/16 -	5/16 +	3/8-	3/16+	Tipping slightly to the L.F. No signs of container failure.	JK	JK
12-5-84	9:30	902	24 3/4-	25 1/16+	24 1/2	25 3/8	7/8 -	3/8 +	1/2-	1/8 +		JK	JK
12-5-84	9:30	1,042	24 11/16	25	24 1/2	25 1/4	15/16-	7/16 +	1/2-	1/4 +	Bottom corners of the #2 container getting crushed.	JK	JK

CRUSH TEST

SHIPPING CONTAINER

SAMPLE # 5-1/5-2/5-3 SAMPLE CONFIGURATION: 7 5/8 TELESCOPING CONTAINER - NO LINERS

(Cont'd.)

DATE	TIME	WEIGHT	HEIGHT "				DEFLECTION "				COMMENT	TEST TECH.	CHECKED BY
			LF	RF	LR	RR	LF	RF	LR	RR			
12-6-84	9:30	1,042	24 9/16	24 15/16	24 7/16	25 1/4	1 1/16 -	1/2 +	9/16 -	1/4 +	Tipping to L.F but not too bad. Very solid	JK	JK
12-7-84	9:00	1,042	24 9/16	24 15/16	24 3/8	25 1/4	1 1/16 -	1/2 +	5/8 -	1/4 +		JK	JK
12-7-84	9:00	1,182	24 1/2	24 15/16	24 3/8	25 3/16	1 1/8	1/2 +	5/8 -	5/16	Still standing solid but slight tipping has increased L. F.	JK	JK
12-10-84	10:00	1,182	24 1/2	24 15/16	24 3/8	24 3/8 +	1 1/8	1/2 +	5/8	5/16 +	All containers slightly bulging.	JK	JK

CRUSH TEST

SHIPPING CONTAINER

SAMPLE # 1 SAMPLE CONFIGURATION: TELESCOPING SHIPPING CONTAINER 12 5/16"L; 10 1/16"W; 7 7/8" DEPTH

DATE	TIME	WEIGHT **	HEIGHT "				DEFLECTION "				COMMENT	TEST TECH.	CHECKED BY
			LF	RF	LR	RR	LF	RF	LR	RR			
10-19-84	12:00	202	27 -	26 1/2	26	26 3/8	0	0	0	0	Load platform is "tippey" NOTE: Tops of all three containers were rounded previous to weight addition.	JK	SK
10-22-84	9:00	202	27	26 1/2	25 15/16	26 3/16	0	0	1/16	3/16	No change	JK	SK
10-22-84	9:00	342	26 7/8-	26 1/8	26 1/16	26 1/16	1/8	3/8	+1/16	5/16	Outer box of # 1 container bottomed out.	JK	SK
10-23-84	9:00	342	26 3/16-	26 1/16	26 1/16-	26 1/16	3/16	7/16	+ 1/16	5/16	All outer boxes bottomed out.	JK	SK
10-23-84	9:10	482	26 5/8+	25 7/8+	26 1/16-	26 1/16-	5/16	5/8 -	+1/16	5/16 +	All outer boxes bottomed out.	JK	SK
10-24-84	8:45	482	26 5/8-	25 7/8	26	26	3/8	5/8	0	3/8	No evidence of damage	JK	SK
10-24-84	9:00	622	26 1/2	25 3/4-	26 1/16+	26	1/2-	3/4-	+1/16 +	3/8	No damage	JK	SK
10-25-84	8:30	622	26 5/16	25 11/16	26	26	11/16-	13/16	0	3/8	No change	JK	SK
10-25-84	8:30	762	26 5/16+	25 5/8+	25 15/16-	26 1/16	5/8	7/8-	1/16+	5/16	No change	JK	SK
10-26-84	8:45	762	26 1/4+	25 5/8+	25 7/8+	26	11/16	7/8-	1/8-	3/8	No change	JK	SK
10-26-84	8:45	902	26 1/4+	25 5/8	25 7/8	25 15/16	11/16	7/8	1/8	7/16	No change	JK	SK
10-29-84	8:45	902	26 3/16-	25 1/2	25 7/8+	26 -	13/16	1	1/8-	3/8+	#1 (bottom) container stapled flap (RF) is bulging out.	JK	SK
10-29-84	8:50	1,042	26 1/8	25 1/2-	25 7/8+	26 -	7/8-	1 +	1/8-	3/8+		JK	SK

CRUSH TEST

SHIPPING CONTAINER

SAMPLE # 1 SAMPLE CONFIGURATION: TELESCOPING SHIPPING CONTAINER 12 5/16"L; 10 1/16"W; 7 7/8"DEPTH

DATE	TIME	WEIGHT **	HEIGHT "				DEFLECTION "				COMMENT	TEST TECH.	CHECKED BY
			LF	RF	LR	RR	LF	RF	LR	RR			
10-30-84	8:35	1,042	26 +	25 5/16 -	26 -	26 -	15/16	1 3/16 +	0 +	3/8 +	No change	JK	SK
10-30-84	8:45	1,182	26	25 1/4	26 -	25 15/16 -	1 -	1 1/4	0 +	7/16 +	No change	JK	SK
10-31-84	9:15	1,182	25 7/8 -	25 1/16 -	26 1/16 +	26 -	1 1/8	1 7/16 +	+ 1/16 -	3/8 +	No change		SK
11-1-84	9:00	1,182	25 13/16 +	25	26 1/16 +	26	1 1/8	1 1/2	+ 1/16	3/8	TEST TERMINATED		SK
											NOTE: Ref. mark on the load supporting platform is 1 3/16 from the bottom surface.		
											** The actual weight applied was about 10% greater than listed.		

CRUSH TEST

SHIPPING CONTAINER

SAMPLE # 2 SAMPLE CONFIGURATION: FINAL TELESCOPE DESIGN - BOXES TRIMMED 1/8"

DATE	TIME	WEIGHT	HEIGHT "				DEFLECTION "				COMMENT	TEST TECH.	CHECKED BY
			LF	RF	LR	RR	LF	RF	LR	RR			
2-11-85	3:10	202	27 12/16	27 3/16	26 10/16	27 1/16	--	--	--	--		WM	JC
2-12-85	3:10	202	27 12/16	27 1/16	26 11/16	27	0	2/16	1/16	1/16		WM	JC
2-12-85	3:15	342	27 11/16	26 14/16	26 10/16	26 13/16	1/16	3/16	0	4/16		WM	JC
2-13-85	3:55	342	27 11/16	26 13/16	26 10/16	26 12/16	1/16	6/16	1/16	5/16		WM	JC
2-13-85	4:00	482	27 11/16	26 10/16	26 10/16	26 10/16	1/16	9/16	0	7/16		WM	JC
2-14-85	3:20	482	27 12/16	26 10/16	26 10/16	26 8/16	0	9/16	0	9/16		WM	JC
2-14-85	3:30	522	27 11/16	26 7/16	26 11/16	26 6/16	1/16	12/16	1/16	11/16		WM	JC
2-15-85	2:50	522	27 11/16	26 6/16	26 11/16	26 5/16	1/16	13/16	1/16	12/16		WM	JC
2-15-85	2:55	662	27 11/16	26 5/16	26 11/16	26 4/16	1/16	14/16	1/16	13/16		WM	JC
2-19-85	4:00	662	27 10/16	26 2/16	26 12/16	26 3/16	2/16	1 1/16	2/16	14/16		WM	JC
2-19-85	4:05	802	27 9/16	26 1/16	26 11/16	26 2/16	3/16	1 2/16	1/16	15/16	Slight bulging on all boxes.	WM	JC
2-20-85	3:40	802	27 9/16	26 0/16	26 13/16	26 2/16	3/16	1 3/16	3/16	15/16		WM	JC
2-20-85	3:50	942	27 9/16	26	26 12/16	26 1/16	3/16	1 3/16	2/16	16/16		WM	JC

CRUSH TEST

SHIPPING CONTAINER

SAMPLE # 2 (Cont'd.) SAMPLE CONFIGURATION: FINAL TELESCOPE DESIGN - BOXES TRIMMED 1/8"

DATE	TIME	WEIGHT	HEIGHT "				DEFLECTION "				COMMENT	TEST TECH.	CHECKED BY
			LF	RF	LR	RR	LF	RF	LR	RR			
12-21-85	4:00	942	27 4/16	25 15/16	26 11/16	26 3/16	8/16	1 4/16	- 1/16	14/16		WM	JC
2-21-85	4:05	1,082	27 3/16	25 14/16	26 11/16	26 3/16	9/16	1 5/16	- 1/16	14/16		WM	JC
2-22-85	4:20	1,082	27 3/16	25 15/16	26 8/16	26 3/16	9/16	1 4/16	2/16	14/16		WM	JC

TRAY PACK SEAM TEST

SAMPLE # TEST

SAMPLE CONFIGURATION: BASELINE LID - 98#/0.04 TRAY ARM (L") 32"

DATE	TIME	SCALE READING	LB	COMMENTS
12-12-84	2:15	70 Lb.	1372.70 X 2	All 4 sides of the tray are paneling.
		80	1568.80 X 2	Increasing damage to sides of tray. No signs of seam leakage.
		90	1764.90 X 2	Same
		100	1961.00 X 2	Same - Cannot hold 90 lb. Scale reading drops slowly as tray panels.
		110	2157.10 X 2	Same
		120	2353.20 X 2	Still no signs of seam leakage. Extensive damage to tray sides.
		125	2451.25 X 2	Seam leagage - Extensive damage to tray sides. Seam leakage after a few minutes at this level.

TRAY PACK SEAM TEST

SAMPLE # TEST 1

SAMPLE CONFIGURATION: BASELINE LID - 98#/0.04 TRAY ARM (L") 32"

DATE	TIME	SCALE READING	LB	COMMENTS
2-12-84	3:15	51	1000 X 2	Tray Pack holding weight - steady. No signs of seam separation.
	8:30			After night no seam leakage but top and bottom are dented and buckled.

TRAY PACK SEAM TEST

SAMPLE # TEST 2

SAMPLE CONFIGURATION: BASELINE ARM (L") 32"

DATE	TIME	SCALE READING	LB	COMMENTS
12-19-84	10:00	26 Lb.	986	No signs of leakage.

TRAY PACK SEAM TEST

SAMPLE #_____

SAMPLE CONFIGURATION: 98#/0.022-0.023 LID - 98#/0.05 TRAY ARM (L") 32"

DATE	TIME	SCALE READING	LB	COMMENTS
Start 12-31-84	11:00	25 Lb.	948	
Stop 1-2-84	11:00			No damage - No leakage.

APPENDIX C

SHIPPING CONTAINER AND UNIT LOAD ACCEPTANCE TESTS

TEST 1

DROP TEST DATA SHEET

TEST CARTON DESCRIPTION: FINAL TELESCOPE DESIGN DATE: 2-19-85
90#/0.050 WATER FILLED

TEST CARTON CODE: 2X2 PACKING 5 PADS

TEST TECH. WM VERIFIED JC

DROP		DONE	COMMENT
CARTON BOTTOM	26"	X	SLIGHT BULGING OF SEAM SHOULDERS ON TRAY PACK 3 & 4.
BOTTOM SIDE 3 EDGE	13"	X	SLIGHT PANELING OF TRAY CORNERS - TOP EDGE #4. CARTON OK.
BOTTOM SIDE 2 EDGE	13"	X	PANELING OF TRAY CORNERS - TOP EDGE #4. CARTON OK.
BOTTOM SIDE 2-3 CORNER	13"	X	CRUSHED 2-3 CORNER IN - ½"
BOTTOM SIDE 1-4 CORNER	13"	X	SLIGHT PANELING TRAY CORNERS OPPOSITE IMPACT CORNER #4. CARTON CORNERS CRUSHED - ½"
CARTON TOP	13"	X	CARTON OK
BOTTOM SIDE 1 EDGE	13"	X	PANELING OF TRAY CORNERS OPPOSITE IMPACT EDGE #4. CARTON OK
BOTTOM SIDE 4 EDGE	13"	X	SLIGHT PANELING OF TRAY CORNERS OPPOSITE IMPACT EDGE #4. CARTON OK.
BOTTOM SIDE 1-2 CORNER	13"	X	INCIPIENT PANELING OF ONE TRAY CORNER OPPOSITE IMPACT CORNER. #4 CARTON CRUSHED - ½".
BOTTOM SIDE 3-4 CORNER	13"	X	CORNER CRUSHED - ½"
FACE/#1 - IMPACT	13"	X	#1 PANELING BOTH TOP TRAY CORNERS. #2 INCIPIENT PANEL ONE TOP TRAY CORNER. #3 OK #4 PANELING ONE TOP TRAY CORNER.

INSPECTION:

CARTON: 4 BOTTOM CORNERS SLIGHTLY CRUSHED. NO BUCKLING OF SIDES.

LINER: NO DAMAGE.

PADS: NO DAMAGE.

TRAY PACK	INSPECTION COMMENTS
#4	SUFFERED DAMAGE IN 8 OF THE TESTS.
#3	NO DAMAGE. ONLY SLIGHT BULGING OF SEAM SHOULDER IN 26" DROP.
#2	NO DAMAGE. INCIPIENT PANELING IN ONE CORNER DROP.
#1	PANELING IN THE FACE #1 IMPACT DROP.

TEST 2

DROP TEST DATA SHEET

TEST CARTON DESCRIPTION: FINAL TELESCOPE DESIGN DATE: 2-20-85
90#/REINFORCED WATER FILLED

TEST CARTON CODE: BASELINE PACKING - 5 LARGE PADS

TEST TECH. WM VERIFIED JC

DROP		DONE	COMMENT
CARTON BOTTOM	26"	X	
BOTTOM SIDE 3 EDGE	13"	X	
BOTTOM SIDE 2 EDGE	13"	X	
BOTTOM SIDE 2-3 CORNER	13"	X	SLIGHT CRUSHING OF CARTON CORNER.
BOTTOM SIDE 1-4 CORNER	13"	X	SLIGHT CRUSHING OF CARTON CORNER.
CARTON TOP	13"	X	
BOTTOM SIDE 1 EDGE	13"	X	
BOTTOM SIDE 4 EDGE	13"	X	
BOTTOM SIDE 1-2 CORNER	13"	X	SLIGHT CRUSHING OF CARTON CORNER.
BOTTOM SIDE 3-4 CORNER	13"	X	SLIGHT CRUSHING OF CARTON CORNER.
FACE/#1 - IMPACT	13"	X	#1 SLIGHT BUCKLE TRAY CORNERS - TOP EDGE. #2 SLIGHT BUCKLE TRAY CORNERS - TOP EDGE. #3 BUCKLING OF TRAY CORNERS - TOP EDGE. #4 BUCKLING OF TRAY CORNERS - TOP EDGE.

INSPECTION:

CARTON: SLIGHT CRUSHING OF CORNERS.

LINER: NO DAMAGE.

PADS: SLIGHT COMPRESSION FROM SEALING BEAD.

TRAY PACK	INSPECTION COMMENTS
#4	BUCKLING OF TRAY CORNERS - TOP EDGE. DAMAGE OCCURRED IN FACE #1 - IMPACT TEST.
#3	BUCKLING OF TRAY CORNERS - TOP EDGE. DAMAGE OCCURRED IN FACE #1 - IMPACT TEST.
#2	BUCKLING OF TRAY CORNERS - TOP EDGE. DAMAGE OCCURRED IN FACE #1 - IMPACT TEST.
#1	BUCKLING OF TRAY CORNERS - TOP EDGE. DAMAGE OCCURRED IN FACE #1 - IMPACT TEST.

TEST 3

DROP TEST DATA SHEET

TEST CARTON DESCRIPTION: FINAL TELESCOPE DESIGN DATE: 2-20-85
90#/REINFORCED WATER FILLED

TEST CARTON CODE: BASELINE PACKING - 5 NESTING PADS

TEST TECH. WM VERIFIED JC

DROP		DONE	COMMENT
CARTON BOTTOM	26"	X	#3 BULGING AT SEAM SHOULDERS. #4 BULGING AT SEAM SHOULDER & BUCKLING OF ONE TRAY CORNER.
BOTTOM SIDE 3 EDGE	13"	X	NO CHANGE.
BOTTOM SIDE 2 EDGE	13"	X	NO CHANGE.
BOTTOM SIDE 2-3 CORNER	13"	X	NO CHANGE.
BOTTOM SIDE 1-4 CORNER	13"	X	NO CHANGE.
CARTON TOP	13"	X	NO CHANGE.
BOTTOM SIDE 1 EDGE	13"	X	NO CHANGE.
BOTTOM SIDE 4 EDGE	13"	X	NO CHANGE.
BOTTOM SIDE 1-2 CORNER	13"	X	NO CHANGE.
BOTTOM SIDE 3-4 CORNER	13"	X	NO CHANGE.
FACE/#1 - IMPACT	13"	X	#1 BUCKLING OF ONE TRAY CORNER - TOP EDGE - LID BULGED. #2 SLIGHT BUCKLING ONE TRAY CORNER #3 BUCKLING ONE TRAY CORNER #4 BUCKLING OF TRAY CORNERS - TOP EDGE.

INSPECTION:

CARTON: SLIGHT CRUSHING OF CORNERS.

LINER: SLIGHT CRUSHING OF CORNERS.

PADS: NO DAMAGE.

TRAY PACK	INSPECTION COMMENTS
#4	BULGING AT SEAM SHOULDERS & ONE CORNER. BUCKLE IN FIRST DROP. BUCKLING OF TRAY CORNERS TOP - EDGE IN FACE #1 - IMPACT TEST.
#3	BUCKLE IN ONE CORNER TOP - EDGE IN FACE #1 - IMPACT TEST.
#2	SLIGHT BUCKLE IN ONE CORNER TOP - EDGE IN FACE #1 - IMPACT TEST.
#1	SLIGHT BUCKLE IN ONE CORNER TOP - EDGE IN FACE #1 - IMPACT TEST.

TEST 4

DROP TEST DATA SHEET

TEST CARTON DESCRIPTION: FINAL TELESCOPE DESIGN DATE: 2-21-85

90#/REINFORCED WATER FILLED

TEST CARTON CODE: BASELINE PACKING - 5 NESTING PADS

TEST TECH. WM VERIFIED JC

DROP		DONE	COMMENT
CARTON BOTTOM	26"	X	#3 SLIGHT BULGING OF SEAM SHOULDERS. #4 SLIGHT BULGING OF SEAM SHOULDERS.
BOTTOM SIDE 3 EDGE	13"	X	NO CHANGE.
BOTTOM SIDE 2 EDGE	13"	X	NO CHANGE.
BOTTOM SIDE 2-3 CORNER	13"	X	NO CHANGE. SLIGHT CRUSHING OF CARTON CORNER.
BOTTOM SIDE 1-4 CORNER	13"	X	NO CHANGE. SLIGHT CRUSHING OF CARTON CORNER.
CARTON TOP	13"	X	NO CHANGE.
BOTTOM SIDE 1 EDGE	13"	X	NO CHANGE.
BOTTOM SIDE 4 EDGE	13"	X	NO CHANGE.
BOTTOM SIDE 1-2 CORNER	13"	X	NO CHANGE SLIGHT CRUSHING OF CARTON CORNER.
BOTTOM SIDE 3-4 CORNER	13"	X	NO CHANGE SLIGHT CRUSHING OF CARTON CORNER.
FACE/#1 - IMPACT	13"	X	#1 SLIGHT BUCKLE TRAY CORNERS - TOP EDGE. #2 INCIPIENT BUCKLE ONE CORNER. #3 SLIGHT BUCKLE BOTH CORNERS - TOP EDGE. #4 BUCKLING BOTH CORNERS TOP - TOP EDGE.

INSPECTION:

CARTON: 4 BOTTOM CORNERS CRUSHED IN - ¼" NO BUCKLING.

LINER: NO DAMAGE.

PADS: NO DAMAGE.

TRAY PACK	INSPECTION COMMENTS
#4	SLIGHT BULGING OF SEAM SHOULDERS IN 26" DROP - BUCKLING OF TRAY CORNERS - TOP - EDGE IN FACE #1 - IMPACT.
#3	SLIGHT BULGING OF SEAM SHOULDERS IN 26" DROP - SLIGHT BUCKLING OF TRAY CORNERS TOP - EDGE IN FACE #1 - IMPACT.
#2	INCIPIENT BUCKLING ONE TRAY CORNER - TOP - EDGE IN FACE #1 - IMPACT.
#1	SLIGHT BUCKLING OF TRAY CORNERS TOP - EDGE IN FACE #1 - IMPACT.

TEST 5

DROP TEST DATA SHEET

TEST CARTON DESCRIPTION: FINAL TELESCOPE DESIGN DATE: 2-21-85
90#/REINFORCED WATER FILLED

TEST CARTON CODE: BASELINE PACKING - 5 LARGE PADS - 4 NESTING PADS

TEST TECH. WM VERIFIED JC

DROP		DONE	COMMENT
CARTON BOTTOM	26"	X	#3 SLIGHT BULGING OF SEAM SHOULDER. #4 SLIGHT BULGING OF SEAM SHOULDER.
BOTTOM SIDE 3 EDGE	13"	X	NO CHANGE.
BOTTOM SIDE 2 EDGE	13"	X	NO CHANGE.
BOTTOM SIDE 2-3 CORNER	13"	X	NO CHANGE. SLIGHT CRUSHING OF CARTON CORNER.
BOTTOM SIDE 1-4 CORNER	13"	X	NO CHANGE. SLIGHT CRUSHING OF CARTON CORNER.
CARTON TOP	13"	X	NO CHANGE.
BOTTOM SIDE 1 EDGE	13"	X	NO CHANGE.
BOTTOM SIDE 4 EDGE	13"	X	NO CHANGE.
BOTTOM SIDE 1-2 CORNER	13"	X	NO CHANGE. SLIGHT CRUSHING OF CARTON CORNER.
BOTTOM SIDE 3-4 CORNER	13"	X	NO CHANGE. SLIGHT CRUSHING OF CARTON CORNER.
FACE/#1 - IMPACT	13"	X	#1 VERY SLIGHT BUCKLE ONE CORNER. #2 SLIGHT BUCKLE ONE CORNER. #3 SLIGHT BUCKLE TWO CORNERS. #4 SLIGHT BUCKLE ONE CORNER. BUCKLE ON IMPACT EDGE.

INSPECTION:

CARTON: SLIGHT CRUSHING OF CORNERS.

LINER: NO DAMAGE.

PADS: NO DAMAGE.

TRAY PACK	INSPECTION COMMENTS
#4	SLIGHT BULGING OF SEAM SHOULDERS FROM 26" DROP. BUCKLING OF TRAY CORNERS FROM FACE DROP.
#3	SLIGHT BULGING OF SEAM SHOULDERS FROM 26" DROP. SLIGHT BUCKLING OF ONE TRAY CORNER FROM FACE DROP.
#2	SLIGHT BUCKLE ONE CORNER FROM FACE DROP.
#1	VERY SLIGHT BUCKLE ONE CORNER FROM FACE DROP.

TEST 1

DROP TEST DATA SHEET

TEST CARTON DESCRIPTION: FINAL TELESCOPE DESIGN DATE: 2-21-85

98#/REINFORCED WATER FILLED

TEST CARTON CODE: 2X2 PACKING - 5 NESTING PADS

TEST TECH. WM VERIFIED JC

DROP		DONE	COMMENT
CARTON BOTTOM	26"	X	#3 INCIPIENT BUCKLE ONE TRAY CORNER - TOP EDGE.SLIGHT BULGE OF SHOULDER ON 3 & 4.
BOTTOM SIDE 3 EDGE	13"	X	#4 SLIGHT CORNER BUCKLE - TOP EDGE.
BOTTOM SIDE 2 EDGE	13"	X	#2 INCIPIENT BUCKLE TOP CORNER. #4 SLIGHT BUCKLE TOP CORNER.
BOTTOM SIDE 2-3 CORNER	13"	X	NO CHANGE. SLIGHT CRUSHING OF CARTON CORNER.
BOTTOM SIDE 1-4 CORNER	13"	X	NO CHANGE. SLIGHT CRUSHING OF CARTON CORNER.
CARTON TOP	13"	X	NO CHANGE.
BOTTOM SIDE 1 EDGE	13"	X	NO CHANGE.
BOTTOM SIDE 4 EDGE	13"	X	#4 SLIGHT BUCKLE TOP TRAY CORNER.
BOTTOM SIDE 1-2 CORNER	13"	X	NO CHANGE. SLIGHT CRUSHING OF CARTON CORNER.
BOTTOM SIDE 3-4 CORNER	13"	X	NO CHANGE. SLIGHT CRUSHING OF CARTON CORNER.
FACE/#1 - IMPACT	13"	X	#3 INCIPIENT BUCKLE ONE TRAY CORNER.

INSPECTION:

CARTON: SLIGHT CRUSHING OF CORNERS - ⅛"

LINER: NO DAMAGE.

PADS: NO DAMAGE.

TRAY PACK	INSPECTION COMMENTS
#4	SLIGHT BUCKLING ON 3 BOTTOM EDGE DROP.
#3	INCIPIENT BUCKLE ONE CORNER ON 26" BOTTOM DROP. INCIPIENT BUCKLE ONE CORNER ON FACE DROP.
#2	INCIPIENT BUCKLE ONE CORNER ON SIDE TWO EDGE.
#1	NO DAMAGE.

TEST 2

DROP TEST DATA SHEET

TEST CARTON DESCRIPTION: FINAL TELESCOPE DESIGN DATE: 2-21-85
98#/REINFORCED WATER FILLED

TEST CARTON CODE: CONVENTIONAL PACKING - 5 LARGE PADS

TEST TECH. WM VERIFIED JC

DROP		DONE	COMMENT
CARTON BOTTOM	26"	X	#4 VERY SLIGHT BULGE AT SEAM SHOULDERS.
BOTTOM SIDE 3 EDGE	13"	X	NO DAMAGE.
BOTTOM SIDE 2 EDGE	13"	X	NO DAMAGE.
BOTTOM SIDE 2-3 CORNER	13"	X	NO DAMAGE. CARTON & LINER CORNERS CRUSHED.
BOTTOM SIDE 1-4 CORNER	13"	X	NO DAMAGE. CARTON & LINER CORNERS CRUSHED.
CARTON TOP	13"	X	NO DAMAGE.
BOTTOM SIDE 1 EDGE	13"	X	NO DAMAGE.
BOTTOM SIDE 4 EDGE	13"	X	NO DAMAGE.
BOTTOM SIDE 1-2 CORNER	13"	X	NO DAMAGE. CARTON & LINER CORNERS CRUSHED.
BOTTOM SIDE 3-4 CORNER	13"	X	NO DAMAGE. CARTON & LINER CORNERS CRUSHED.
FACE/#1 - IMPACT	13"	X	#1 SLIGHT CORNER BUCKLES - TOP EDGE. #2 SLIGHT BUCKLE ONE CORNER. #3 SLIGHT BUCKLE ONE CORNER. #4 BUCKLE IN ONE CORNER - SLIGHT BUCKLE IN ONE CORNER.

INSPECTION:

CARTON: 4 CORNERS CRUSHED IN - ¼".

LINER: 4 CORNERS SLIGHTLY CRUSHED.

PADS: BOTTOM PAD CORNERS SLIGHTLY CRUSHED.

TRAY PACK	INSPECTION COMMENTS
#4	VERY SLIGHT BULGE AT SEAM SHOULDERS IN 26" BOTTOM DROP. BUCKLING IN TRAY CORNERS - TOP EDGE IN FACE IMPACT TEST.
#3	SLIGHT BUCKLE ONE CORNER - TOP EDGE IN FACE IMPACT TEST.
#2	SLIGHT BUCKLE ONE CORNER - TOP EDGE IN FACE IMPACT TEST.
#1	SLIGHT BUCKLES IN BOTH CORNERS - TOP EDGE IN FACE DROP TEST.

TEST 3

DROP TEST DATA SHEET

TEST CARTON DESCRIPTION: FINAL TELESCOPE DESIGN DATE: 2-22-85
98#/REINFORCED WATER FILLED - VACUUM RELEASED

TEST CARTON CODE: 2X2 PACKING - 5 NESTING PADS

TEST TECH. WM VERIFIED JC

DROP		DONE	COMMENT
CARTON BOTTOM	26"	X	NO DAMAGE.
BOTTOM SIDE 3 EDGE	13"	X	NO DAMAGE.
BOTTOM SIDE 2 EDGE	13"	X	NO DAMAGE.
BOTTOM SIDE 2-3 CORNER	13"	X	NO DAMAGE. CRUSHING OF CARTON CORNER.
BOTTOM SIDE 1-4 CORNER	13"	X	NO DAMAGE. SLIGHT CRUSHING OF CARTON CORNER.
CARTON TOP	13"	X	NO DAMAGE.
BOTTOM SIDE 1 EDGE	13"	X	NO DAMAGE.
BOTTOM SIDE 4 EDGE	13"	X	#4 BULGE OF LID CORNERS - IMPACT EDGE.
BOTTOM SIDE 1-2 CORNER	13"	X	NO DAMAGE. CRUSHING OF CARTON CORNER.
BOTTOM SIDE 3-4 CORNER	13"	X	NO DAMAGE.
FACE/#1 - IMPACT	13"	X	NO DAMAGE.

INSPECTION:

CARTON: CORNERS CRUSHED - ¼"

LINER: NO DAMAGE.

PADS: NO DAMAGE.

TRAY PACK	INSPECTION COMMENTS
#4	SLIGHT BULGING OF LID CORNERS AT IMPACT EDGE IN SIDE 4 DROP.
#3	NO DAMAGE.
#2	NO DAMAGE.
#1	NO DAMAGE.

TEST 4

DROP TEST DATA SHEET

TEST CARTON DESCRIPTION: FINAL TELESCOPE DESIGN DATE: 2-22-85
98#/REINFORCED WATER FILLED - VACUUM RELEASED

TEST CARTON CODE: CONVENTIONAL PACKING - 5 LARGE PADS

TEST TECH. WM VERIFIED JC

DROP		DONE	COMMENT
CARTON BOTTOM	26"	X	NO DAMAGE.
BOTTOM SIDE 3 EDGE	13"	X	NO DAMAGE.
BOTTOM SIDE 2 EDGE	13"	X	NO DAMAGE.
BOTTOM SIDE 2-3 CORNER	13"	X	NO DAMAGE. CRUSHING OF CARTON CORNER.
BOTTOM SIDE 1-4 CORNER	13"	X	NO DAMAGE. CRUSHING OF CARTON CORNER.
CARTON TOP	13"	X	NO DAMAGE.
BOTTOM SIDE 1 EDGE	13"	X	NO DAMAGE.
BOTTOM SIDE 4 EDGE	13"	X	NO DAMAGE.
BOTTOM SIDE 1-2 CORNER	13"	X	NO DAMAGE. CRUSHING OF CARTON CORNER.
BOTTOM SIDE 3-4 CORNER	13"	X	NO DAMAGE. CRUSHING OF CARTON CORNER.
FACE/#1 - IMPACT	13"	X	NO DAMAGE.

INSPECTION:

CARTON: CARTON CORNERS CRUSHED - ¼"

LINER: NO DAMAGE.

PADS: NO DAMAGE.

TRAY PACK	INSPECTION COMMENTS
#4	NO DAMAGE.
#3	NO DAMAGE.
#2	NO DAMAGE.
#1	NO DAMAGE.

TEST 5

DROP TEST DATA SHEET

TEST CARTON DESCRIPTION: FINAL TELESCOPE DESIGN DATE: 2-22-85

98#/REINFORCED WATER FILLED

TEST CARTON CODE: CONVENTIONAL PACKING - 5 NESTING PADS - VACUUM RELEASED

TEST TECH. WM VERIFIED JC

DROP		DONE	COMMENT
CARTON BOTTOM	26"	X	#3 & #4 VERY SLIGHT BULGING OF SEAM SHOULDERS.
BOTTOM SIDE 3 EDGE	13"	X	NO DAMAGE.
BOTTOM SIDE 2 EDGE	13"	X	NO DAMAGE.
BOTTOM SIDE 2-3 CORNER	13"	X	NO DAMAGE. CRUSHING OF CARTON CORNER.
BOTTOM SIDE 1-4 CORNER	13"	X	NO DAMAGE. CRUSHING OF CARTON CORNER.
CARTON TOP	13"	X	NO DAMAGE.
BOTTOM SIDE 1 EDGE	13"	X	NO DAMAGE.
BOTTOM SIDE 4 EDGE	13"	X	NO DAMAGE.
BOTTOM SIDE 1-2 CORNER	13"	X	NO DAMAGE. CRUSHING OF CARTON CORNER.
BOTTOM SIDE 3-4 CORNER	13"	X	NO DAMAGE. CRUSHING OF CARTON CORNER.
FACE/#1 - IMPACT	13"	X	NO DAMAGE.

INSPECTION:

CARTON: CORNERS CRUSHED - ¼".

LINER: NO DAMAGE.

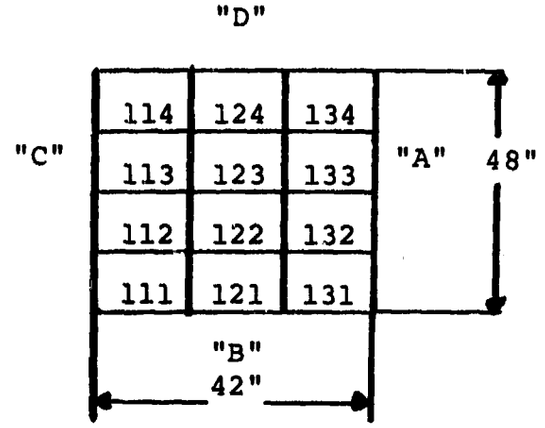
PADS: NO DAMAGE.

TRAY PACK	INSPECTION COMMENTS
#4	NO DAMAGE.
#3	NO DAMAGE.
#2	NO DAMAGE.
#1	NO DAMAGE.

3. UNIT LOAD DROP TEST DATA

UNIT LOAD TYPE: 2X2 CONFIGURATION DATE: 2-26-85

EDGE IDENTIFICATION:



TEST TECH. WM
VERIFIED JC

EDGE	OBSERVATIONS
6" DROP EDGE "B"	LOAD SHIFTED SLIGHTLY TOWARD DROP EDGE. CENTER TIER WITH NO STRAP SHIFTED ½" MORE THAN REST OF LOAD.
6" DROP EDGE "D"	TIERS 2, 3 & 4 RETURNED TO CENTER. TOP TIER SHIFTED SLIGHTLY TOWARD DROP EDGE.
6" DROP EDGE "C"	LOAD SHIFTED SLIGHTLY TOWARD DROP EDGE. SOME CARTON SEPARATION IN ROWS 1 & 2.
6" DROP EDGE "A"	LOAD RETURNED TO CENTER. SOME SLIGHT MIS-ALIGNMENT OF CARTONS IN 1ST TIER.

TRAY PACK DAMAGE FOUND DURING POST TEST INSPECTION: NONE

DATE: 2-26-85

TEST TECH. WM

VERIFIED JC

DAMAGE TO UNIT LOAD

6" DROP TEST

FINAL TELESCOPE DESIGN 2X2 PACKING CONFIGURATION

IF OK ---

IF NOT LIST DAMAGE

CARTON NUMBER	TRAY PACK				CARTON			
	#1	#2	#3	#4	TOP	BOTTOM	LINER	PADS
111	---	---	---	---	---	---	---	---
112	---	---	---	---	---	---	---	---
113	---	---	---	---	---	---	---	---
114	---	---	---	---	---	---	---	---
121	---	---	---	---	---	---	---	---
122	---	---	---	---	---	---	---	---
123	---	---	---	---	---	---	---	---
124	---	---	---	---	---	---	---	---
131	---	---	---	---	---	---	---	---
132	---	---	---	---	---	---	---	---
133	---	---	---	---	---	---	---	---
134	---	---	---	---	---	---	---	---
211	---	---	---	---	---	---	---	---
212	---	---	---	---	---	---	---	---
213	---	---	---	---	---	---	---	---
214	---	---	---	---	---	---	---	---
221	---	---	---	---	---	---	---	---
222	---	---	---	---	---	---	---	---
223	---	---	---	---	---	---	---	---
224	---	---	---	---	---	---	---	---
231	---	---	---	---	---	---	---	---
232	---	---	---	---	---	---	---	---
233	---	---	---	---	---	---	---	---
234	---	---	---	---	---	---	---	---

DATE: 2-26-85

TEST TECH. WM

VERIFIED JC

DAMAGE TO UNIT LOAD (CONT'D)

6" DROP TEST

FINAL TELESCOPE DESIGN 2X2 PACKING CONFIGURATION

IF OK ---

IF NOT LIST DAMAGE

CARTON NUMBER	TRAY PACK				CARTON			
	#1	#2	#3	#4	TOP	BOTTOM	LINER	PADS
311	---	---	---	---	---	---	---	---
312	---	---	---	---	---	---	---	---
313	---	---	---	---	---	---	---	---
314	---	---	---	---	---	---	---	---
321	---	---	---	---	---	---	---	---
322	---	---	---	---	---	---	---	---
323	---	---	---	---	---	---	---	---
324	---	---	---	---	---	---	---	---
331	---	---	---	---	---	---	---	---
332	---	---	---	---	---	---	---	---
333	---	---	---	---	---	---	---	---
334	---	---	---	---	---	---	---	---
411	---	---	---	---	---	---	---	---
412	---	---	---	---	---	---	---	---
413	---	---	---	---	---	---	---	---
414	---	---	---	---	---	---	---	---
421	---	---	---	---	---	---	---	---
422	---	---	---	---	---	---	---	---
423	---	---	---	---	---	---	---	---
424	---	---	---	---	---	---	---	---
431	---	---	---	---	---	---	---	---
432	---	---	---	---	---	---	---	---
433	---	---	---	---	---	---	---	---
434	---	---	---	---	---	---	---	---

DATE: 2-27-85

UNIT LOAD COMPRESSION TEST

CONFIGURATION - 2X2 WITH 5 PADS

98# & 90# WATER FILLED CHECKERBOARD PATTERN

TEST TECH. WM

VERIFIED JC

Sheet #1

DATE	TIME	LOAD	DISTANCE				TILT			
			RF	LF	RR	LR	RF	LF	RR	LR
2-27	2:00 PM	2350	56 3/16	56 3/16	56 5/16	56 6/16				
2-28	9:02 AM	2350	56 2/16	56 2/16	56 4/16	56 4/16	1/16	1/16	1/16	2/16
2-28	9:37 AM	3925	55 15/16	56	56 2/16	56 2/16	4/16	3/16	3/16	4/16
3-1	9:00 AM	3925	55 13/16	55 14/16	55 15/16	56	6/16	5/16	6/16	6/16
3-1	9:30 AM	5000	55 12/16	55 13/16	55 14/16	55 15/16	8/16	6/16	7/16	7/16
3-4	10:10 AM	5000	55 10/16	55 9/16	55 11/16	55 11/16	9/16	10/16	10/16	11/16

DATE: 3-4-85
TEST TECH. WM
VERIFIED JC
SHEET #1

DAMAGE TO UNIT LOAD COMPRESSION TEST

FINAL TELESCOPE DESIGN 2X2 PACKING - 5 PADS

98# & 90# ALTERNATING CHECKERBOARD PATTERN TOTAL WT. 5000 LB.

IF OK ---
IF NOT LIST DAMAGE

CARTON NUMBER	#	TRAY PACK				CARTON			
		#1	#2	#3	#4	TOP	BOTTOM	LINER	PADS
111	90	---	---	---	---	---	---	---	---
112	98	---	---	---	---	---	---	---	---
113	90	---	---	---	---	---	---	---	---
114	98	---	---	---	---	---	---	---	---
121	98	---	---	---	---	---	---	---	---
122	90	---	---	---	---	---	---	---	---
123	98	---	---	---	---	---	---	---	---
124	90	---	---	---	---	---	---	---	---
131	90	---	---	---	---	---	---	---	---
132	98	---	---	---	---	---	---	---	---
133	90	---	---	---	---	---	---	---	---
134	98	---	---	---	---	---	---	---	---
211	98	---	---	---	---	---	---	---	---
212	90	---	---	---	---	---	---	---	---
213	98	---	---	---	---	---	---	---	---
214	90	---	---	---	---	---	---	---	---
221	90	---	---	---	---	---	---	---	---
222	98	---	---	---	---	---	---	---	---
223	90	---	---	---	---	---	---	---	---
224	98	---	---	---	---	---	---	---	---
231	98	---	---	---	---	---	---	---	---
232	90	---	---	---	---	---	---	---	---
233	98	---	---	---	---	---	---	---	---

DATE: 3-4-85
TEST TECH. WM
VERIFIED JC
SHEET # 1 (CONT'D.)

DAMAGE TO UNIT LOAD COMPRESSION TEST

FINAL TELESCOPE DESIGN 2X2 PACKING - 5 PADS

98# & 90# ALTERNATING CHECKERBOARD PATTERN TOTAL WT. 5000 LB.

IF OK ---
IF NOT LIST DAMAGE

CARTON NUMBER	#	TRAY PACK				CARTON			
		#1	#2	#3	#4	TOP	BOTTOM	LINER	PADS
234	90	---	---	---	---	---	---	---	---
311	90	---	---	---	---	---	---	---	---
312	98	---	---	---	---	---	---	---	---
313	90	---	---	---	---	---	---	---	---
314	98	---	---	---	---	---	---	---	---
321	98	---	---	---	---	---	---	---	---
322	90	---	---	---	---	---	---	---	---
323	98	---	---	---	---	---	---	---	---
324	90	---	---	---	---	---	---	---	---
331	90	---	---	---	---	---	---	---	---
332	98	---	---	---	---	---	---	---	---
333	90	---	---	---	---	---	---	---	---
334	98	---	---	---	---	---	---	---	---
411	98	---	---	---	---	---	---	---	---
412	90	---	---	---	---	---	---	---	---
413	98	---	---	---	---	---	---	---	---
414	90	---	---	---	---	---	---	---	---
421	90	---	---	---	---	---	---	---	---
422	98	---	---	---	---	---	---	---	---
423	90	---	---	---	---	---	---	---	---
424	98	---	---	---	---	---	---	---	---
431	98	---	---	---	---	---	---	---	---
432	90	---	---	---	---	---	---	---	---

DATE: 3-4-85
TEST TECH. WM
VERIFIED JC
SHEET #1 (CONT'D.)

DAMAGE TO UNIT LOAD COMPRESSION TEST

FINAL TELESCOPE DESIGN 2X2 PACKING - 5 PADS

98# & 90# ALTERNATING CHECKERBOARD PATTERN TOTAL WT. 5000 LB.

IF OK ---
IF NOT LIST DAMAGE

CARTON NUMBER	#	TRAY PACK				CARTON			
		#1	#2	#3	#4	TOP	BOTTOM	LINER	PADS
433	98	---	---	---	---	---	---	---	---
434	90	---	---	---	---	---	---	---	---

DATE: 3-6-85

TEST TECH. WM

VERIFIED JC

UNIT LOAD VIBRATION TEST

1G ACCELERATION (175 CYCLES/MIN.) - 1 HOUR

ELAPSED TIME 30 MIN.

5 STRAPS

IF OK ---

IF NOT LIST DAMAGE

CARTON NUMBER	TRAY PACK #1	#2	#3	#4	CARTON TOP	BOTTOM	LINER	PADS
431	---	INCIPIENT PANELING	---	---				
434	---	SLIGHT DENT OR PANELING	---	*LID CORNER DENT				
411	---	---	---	---				
414	---	---	---	---				
214	---	---	---	---				
332	---	---	---	---				
333	---	---	---	---				
				LOAD CREPT FORWARD				
421, 422, 423, 431, 432, 433,				WITH 5 STRAPS THE TWO CENTER ROWS ~~OF TIERS 2,3 & 4 BOUNCED OUT~~				
321, 322, 323, 331, 332, 333,				TIME ELAPSED 5 MINUTES.				
221, 222, 223, 231, 232, 233								
LOAD WAS RESTRAPPED THE SAME				LOAD CREPT FORWARD ALMOST OFF PLATFORM. CENTER ROWS OF TIERS ~~2, 3 & 4 STILL BOUNCED OUT.~~ TIME ELAPSED 5 MINUTES				
LOAD WAS RESTRAPPED THE SAME PALLET WAS TURNED 90°.				LOAD CREPT SIDEWAYS TO THE RIGHT NO CARTONS BOUNCED OUT. ONE STRAP ~~BROKE. TIME ELAPSED 20 MINUTES.~~				
TRAY PACKS WERE INSPECTED FOR DAMAGE.								
*434	DID NOT FALL OUT. LID DENT OCCURRED WHEN BOTTOM OF							
	CARTON STRUCK THE PALLET.							

DATE: 3-7-85

TEST TECH. WM

VERIFIED JC

UNIT LOAD VIBRATION TEST

1G ACCELERATION 175 CYCLES/MIN - 30 MIN.

SEVEN STRAPS

IF OK ---
IF NOT LIST DAMAGE

CARTON NUMBER	#	TRAY PACK				CARTON			
		#1	#2	#3	#4	TOP	BOTTOM	LINER	PADS
111	90	---	---	---	---	---	---	---	---
112	98	---	---	---	---	---	---	---	---
113	90	---	---	---	---	---	---	---	---
114	98	---	---	---	---	---	---	---	---
121	98	---	---	---	---	---	---	---	---
122	90	---	---	---	---	---	---	---	---
123	98	---	---	---	---	---	---	---	---
124	90	---	---	---	---	---	---	---	---
131	90	---	---	---	---	---	---	---	---
132	98	---	---	---	---	---	---	---	---
133	90	---	---	---	---	---	---	---	---
134	98	---	---	---	---	---	---	---	---
211	98	---	---	---	---	---	---	---	---
212	90	---	---	---	---	---	---	---	---
213	98	---	---	---	---	---	---	---	---
214	90	---	---	---	---	---	---	---	---
221	90	---	---	---	---	---	---	---	---
222	98	---	---	---	---	---	---	---	---
223	90	---	---	---	---	---	---	---	---
224	98	---	---	---	---	---	---	---	---
231	98	---	---	---	---	---	---	---	---
232	90	---	---	---	---	---	---	---	---
233	98	Slight panel[illegible] to two tray corners.		---		---	---	---	---

DATE: 3-7-85

TEST TECH. WM

VERIFIED JC

UNIT LOAD VIBRATION TEST

1G ACCELERATION 175 CYCLES/MIN. - 30 MIN.

SEVEN STRAPS

IF OK ---
IF NOT LIST DAMAGE

CARTON NUMBER	#	TRAY PACK				CARTON			
		#1	#2	#3	#4	TOP	BOTTOM	LINER	PADS
234	90	---	---	---	---	---	---	---	---
311	90	---	---	---	---	---	---	---	---
312	98	---	---	---	---	---	---	---	---
313	90	---	---	---	---	---	---	---	---
314	98	---	---	---	---	---	---	---	---
321	98	---	---	---	---	---	---	---	---
322	90	---	---	---	---	---	---	---	---
323	98	---	---	---	---	---	---	---	---
324	90	---	---	---	---	---	---	---	---
331	90	---	---	---	---	---	---	---	---
332	98	---	---	---	---	---	---	---	---
333	90	---	---	---	---	---	---	---	---
334	98	---	---	---	---	---	---	---	---
411	98	---	---	---	---	---	---	---	---
412	90	---	---	---	---	---	---	---	---
413	98	---	---	---	---	---	---	---	---
414	90	---	---	---	---	---	---	---	---
421	90	---	---	---	---	---	---	---	---
422	98	---	---	---	---	---	---	---	---
423	90	---	---	---	---	---	---	---	---
424	98	---	---	---	---	---	---	---	---
431	98	---	*INCIPIENT PANELING	---	---	---	---	---	---
432	90	---	---	---	---	---	---	---	---

DATE: 3-7-85
TEST TECH. WM
VERIFIED JC

UNIT LOAD VIBRATION TEST

1G ACCELERATION 175 CYCLES/MIN. - 30 MIN.

SEVEN STRAPS

IF OK ---
IF NOT LIST DAMAGE

CARTON NUMBER	#	TRAY PACK				CARTON			
		#1	#2	#3	#4	TOP	BOTTOM	LINER	PADS
433	98	---	---	---	---	---	---	---	---
434	90	---	SLIGHT PANELING	---	LID CORNER DENT	---	---	---	---
*233	DAMAGE OCCURRED ON SECOND TEST.								
	NO FURTHER DAMAGE ON THIS TEST.								
*431 & 434	TRAY PACKS DAMAGE OCCURRED ON SECOND TEST WHEN CARTONS BOUNCED OUT OF UNIT LOAD.								

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