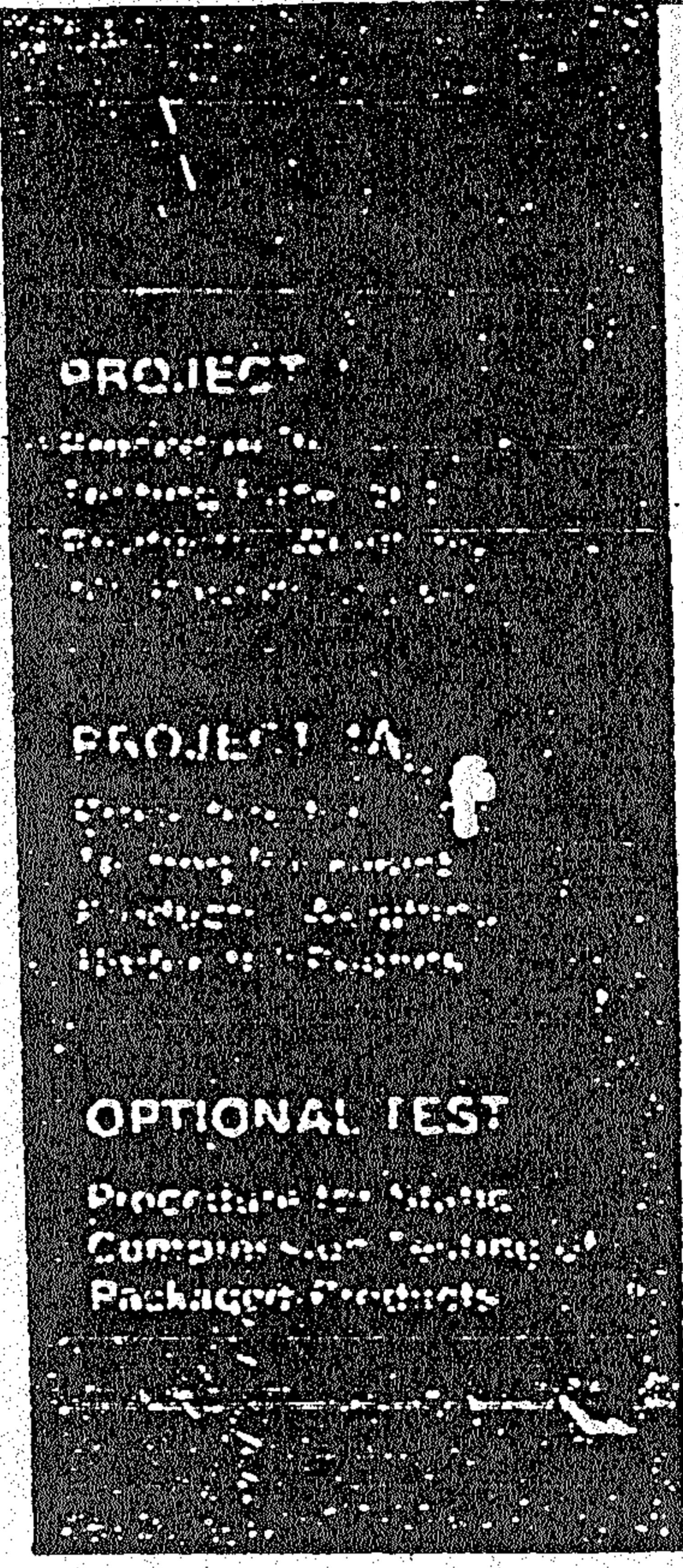
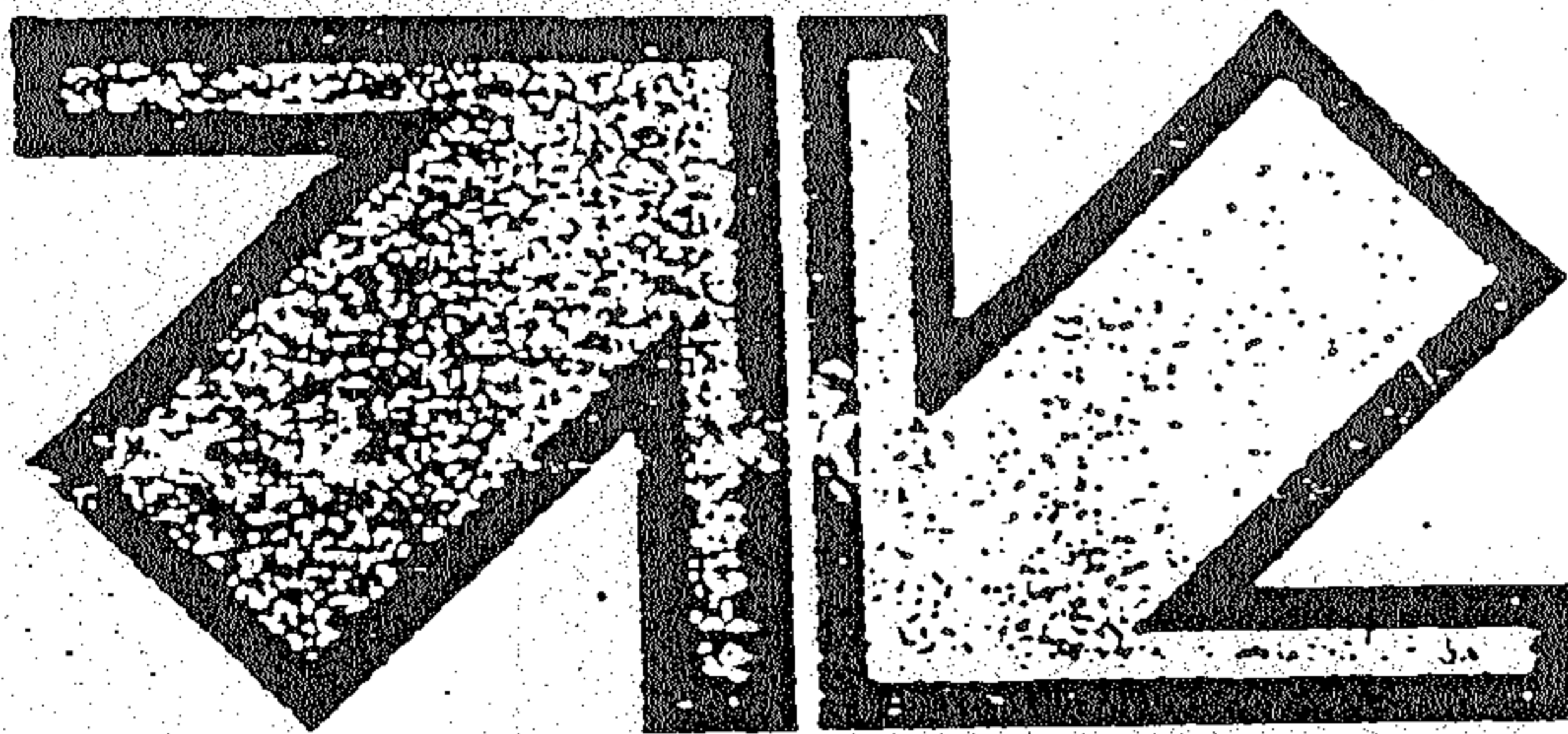


# PRE-SHIPMENT TEST PROCEDURES



**TRANSIT TESTED**



**NATIONAL SAFE TRANSIT ASSOCIATION**

First Printing	August 1948
Second Printing	July 1952
Revised	December 1956
Revised	June 1959
Revised	April 1962
Revised	October 1963
Revised	January 1968
Revised	June 1971
Revised	January 1972
Revised	December 1973
Revised	December 1975
Revised	March 1977
Revised	January 1979

**NATIONAL SAFE TRANSIT ASSOCIATION**

5940 W. Touhy Avenue, Chicago, Illinois 60648

© Copyright 1973, National Safe Transit Association



## NATIONAL SAFE TRANSIT ASSOCIATION PROGRAM

The National Safe Transit Association Program is based on the premise that "all manufacturing, engineering, and quality efforts are in vain if the product arrives at its destination in a damaged condition". The objective of NSTA is to reduce in-transit damage through a standardized program of preshipment testing, certification, and identification. Experience has shown that when the Program is conscientiously applied an economic balance between overall packaged-product costs and physical distribution adequacy will result.

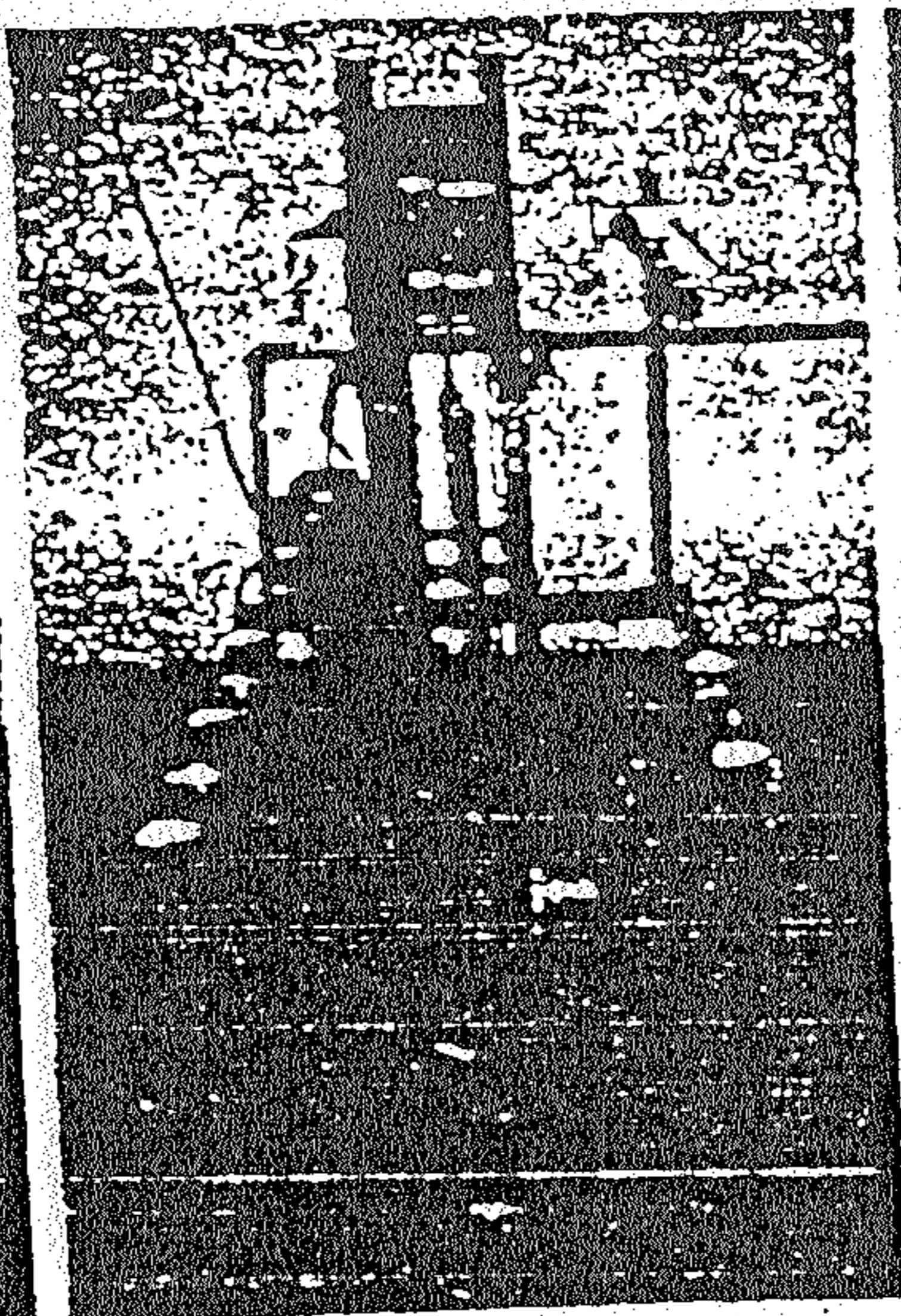
This voluntary, cooperative program—symbolized by the Safe Transit Seal—is based upon the joint efforts of NSTA Certified Manufacturers, Laboratories, and Sustaining Members. Carriers, trade associations, and other organizations concerned with the reduction of in-transit damage, participate in the program as Sustaining Members. Information concerning participation can be obtained by contacting NSTA Headquarters at 5940 W. Touhy Avenue, Chicago, Illinois 60648. Phone: (312) 763-7350.

NOTE: Packages shipped to certified laboratories for testing must be over-cartoned, in order to insure arrival in perfect condition. Packages which have already been subjected to the rigors of transportation cannot be assumed to represent standard conditions.

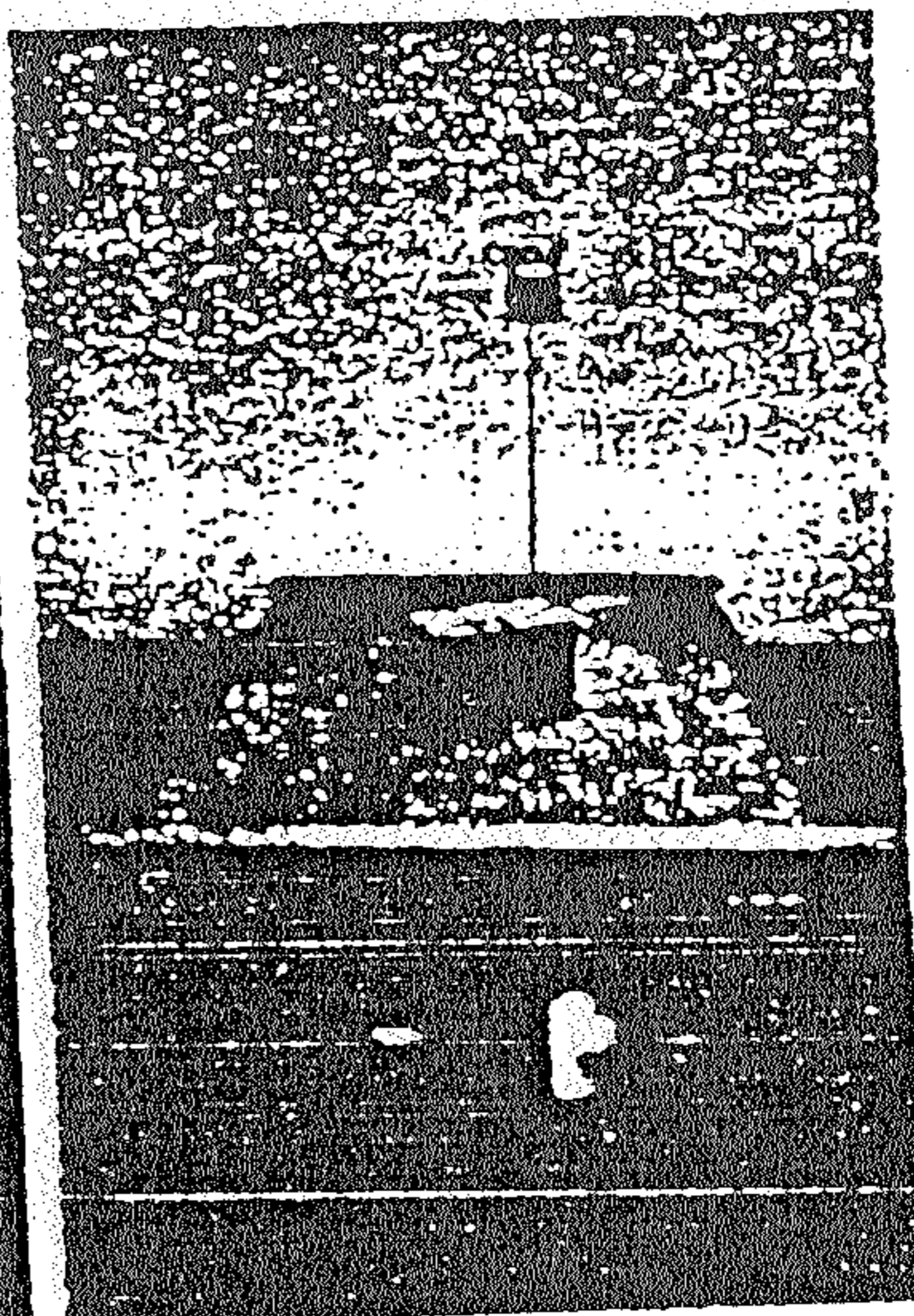
### TEST EQUIPMENT



Drop Tester



Heavy Duty  
Drop Tester



Vibration Tester

NSTA TEST Procedures — Price per copy: Members \$1.00; Non-Members \$25.00.



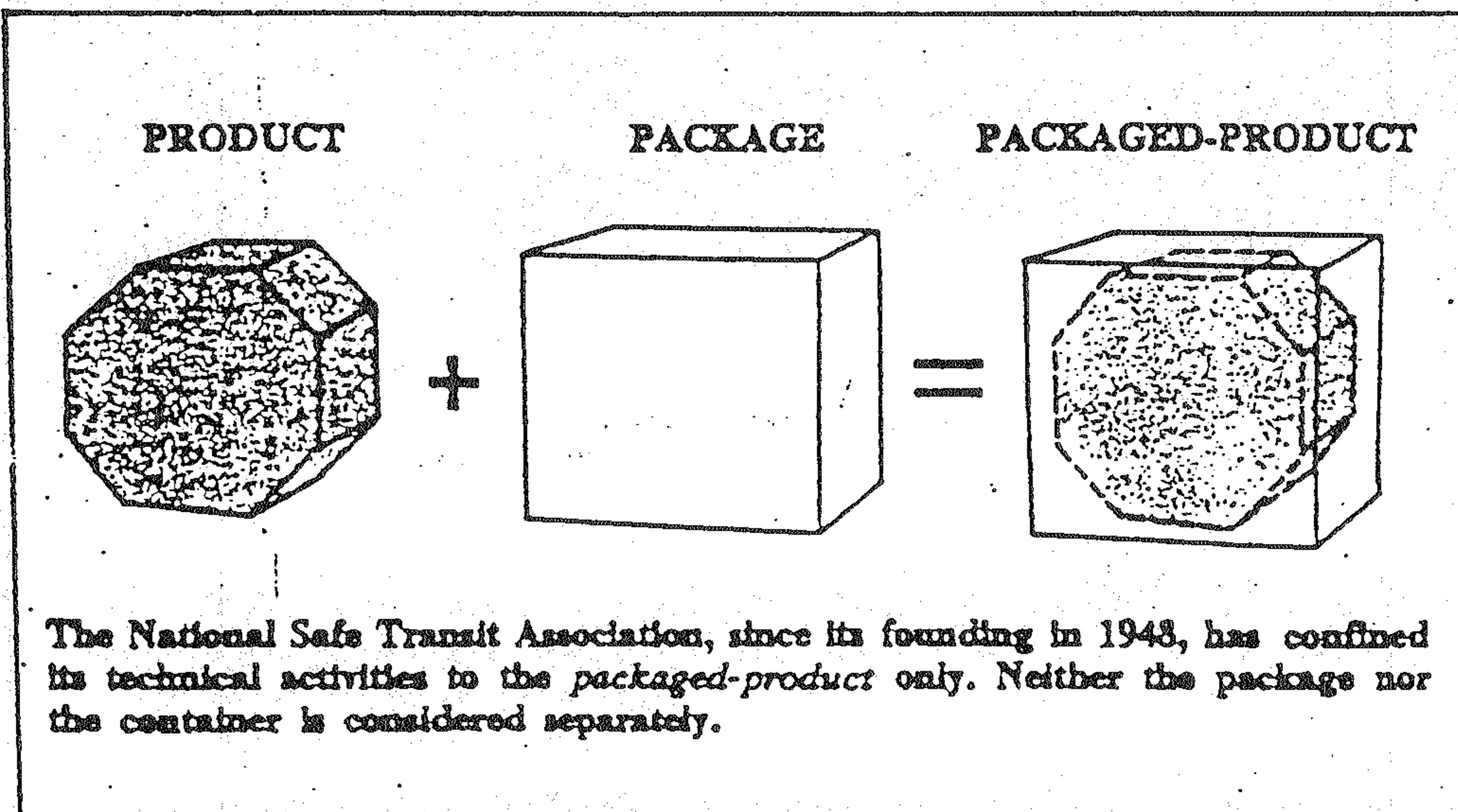
## PREFACE

The National Safe Transit Association (NSTA) Preshipment Test Procedures provide a means for a manufacturer to predetermine the probability of the safe arrival of his *packaged-products* at their destination through the utilization of tests developed to simulate the shocks and stresses normally encountered during handling and transportation. Project 1 covers preshipment test procedures for packaged-products weighing 100 pounds and over; Project 1A is intended for those weighing less than 100 pounds. The tests, it is stressed, are BASIC TESTS. Their severity should be increased to adapt to unusual distribution situations.

It may be advisable to test more than one packaged product in order to obtain an average result.

It is also emphasized that these procedures are not intended to evaluate the protection afforded packaged-products from other conditions such as moisture, corrosion, contaminating odors, etc. They may or may not comply with carrier requirements for packaging.

NSTA test procedures are in every sense performance tests and, when properly applied, will provide tangible benefits of reduced damage, economically balanced costs and improved customer good will.



## **TEST PROCEDURE Project 1A**

Procedure for testing packaged-products weighing under 100 pounds.

### A. INTRODUCTION

#### 1. Scope

This procedure for Project 1A of the National Safe Transit Association Program covers testing of packaged-products weighing under 100 pounds when prepared for shipment. The BASIC requirements of this procedure consist of vibration and drop tests—which must be performed in that sequence.



## 2. Frequency of the Complete Test Cycle

In order to maintain its certified status and eligibility for identification with the Safe Transit Seal, each packaged-product must be retested whenever a change is made in either the product or the package. Changes in the packaged-product include changes in the design, size and/or material. As a quality control procedure, packaged-products should be retested as frequently as feasible.

### B. TESTS

#### 1. Vibration Test

##### a. Test Equipment complying with ASTM D-999.

- (1) Vibration tester operating with synchronous motion and with a total excursion of one (1) inch.
- (2) Tachometer or speed indicator for determining shaft RPM.
- (3) Stop watch.
- (4) Metal shim 1/16" thick approximately two (2) inches wide.

##### b. Test Procedure

###### Step 1

Place the packaged-product on the table of the vibration tester in the position in which it is normally shipped. Fences may be attached when required to prevent excessive rocking or movement on the table.

###### Step 2

Set the vibration frequency at the minimum speed sufficient to cause the packaged-product to leave the table momentarily so that the shim may be inserted at least four (4) inches between the bottom of the packaged-product and the surface of the table. The piece of metal should be capable of being intermittently moved along one entire edge of the longest dimension of the packaged-product.

###### Step 3

Vibrate the packaged-product for a total of 14,200 vibratory impacts. (The total duration of the test time in minutes to meet this requirement is determined by dividing 14,200 by the cycles per minute frequency set in accordance with Step 2 above). A single 90° horizontal rotation should be effected after 1/2 of the vibration has been accomplished. If a single 90° horizontal rotation is impractical because of the size of the packaged-product, a 180° horizontal rotation will be permissible.

###### Step 4

Inspect the exterior of the container for visible damage. Check for looseness of product or components. (When practical, inspect the product and then reclose the container.)

#### 2. Drop Test

##### a. Test Equipment complying with ASTM D-775 and D-880; and TAPPI T-801 and T-802.

- (1) Drop tester, or hoist with suitable sling and tripping device. (Surface on which packaged-product is to be dropped must provide a flat, firm, non-yielding base such as steel, concrete, etc.)
- (2) Incline impact tester, alternative equipment for packaged-products weighing between 61 and 100 pounds.



**b. Test Procedure**

**Step 1**

With the packaged-product in its normal shipping position, face one end of the container and identify the surfaces as follows:

- top as one;
- right side as two;
- bottom as three;
- left side as four;
- near end as five;
- far end as six.

**Step 2**

Identify edges by the numbers of those two surfaces forming that edge. For example, the edge formed by the top and the right side is identified as 1-2.

**Step 3**

Identify corners by the numbers of those three surfaces which meet to form that corner. For example, the corner formed by the right side, bottom, and near end is identified as 2-3-5.

**Step 4**

The drop height shall be as follows:

- (1) Packaged Products less than 61 pounds.

**NO ALTERNATIVE**

- 1 Thru 20.99 Pounds — 30 inches
- 21 Thru 40.99 Pounds — 24 inches
- 41 Thru 60.99 Pounds — 18 inches
- 61 Pounds up to and including 100.00 Pounds — 12 inches

- (2) Packaged-product, 61 pounds and over, but under 100.00 pounds — 12 inches. As an alternative when the Packaged-product's configuration is such that dropping is impractical, ten (10) incline impacts from a height necessary to achieve a minimum impact velocity of 5.75 feet per second or 1.75 meters per second may be performed in lieu of 12" drops. The impact sequence is delineated under Step 5.

**Step 5**

Drop or impact the packaged-product as specified under Step 4 in the following sequence:

- (1) the 2-3-5 corner.
- (2) the shortest edge radiating from that corner.
- (3) the next longest edge radiating from that corner.
- (4) the longest edge radiating from that corner.
- (5) flat on one of the smallest faces.
- (6) flat on the opposite small face.
- (7) flat on one of the medium faces.
- (8) flat on the opposite medium face.
- (9) flat on one of the largest faces.
- (10) flat on the opposite large face.



### Step 6

Inspect both the package and the product. The packaged-product shall be considered to have satisfactorily passed the test if, upon examination, the product is free from damage and the container still affords reasonable protection to the contents.

### C. REPORT

1. NSTA Certified Laboratory Test Report forms are made available to participants in the National Safe Transit Program. When completing the form, the following supplementary information should be specifically reported:
  - a. Description of the product under test including model designation or other specific means of product identification.
  - b. Dimensions of the container under test; its structural specifications; kind of material; description of blocking and cushioning; spacing, size and type of fastenings; method of closing and strapping, if used; the gross weight; and special package numbers, when applicable.
  - c. If package is preconditioned, please report at what temperature and relative humidity that this was done in the comments section of the test report.
2. The original test report should be forwarded to the National Safe Transit Association, 5940 W. Touhy Avenue, Chicago, Illinois 60648.

## TEST PROCEDURE Project 1

Procedure for testing packaged-products weighing 100 pounds and over.

### A. INTRODUCTION

#### 1. Scope

The procedure for Project 1 of the National Safe Transit Association Program covers testing of packaged-products weighing 100 pounds and over when prepared for shipment. The BASIC requirements of this procedure consist of vibration and incline impact tests—which must be performed in that sequence.

#### 2. Frequency of the Complete Test Cycle

In order to maintain its certified status and eligibility for identification with the Safe Transit Seal, each packaged-product must be retested whenever a change is made in either the product or the package. Changes in the packaged-product include changes in the design, size and/or material. As a quality control procedure, packaged-products should be retested as frequently as feasible.

### B. TESTS

#### 1. Vibration Test

##### a. Test Equipment complying with ASTM D-999.

- (1) Vibration tester operating with synchronous motion and with a total excursion of one (1) inch.
- (2) Tachometer or speed indicator for determining shaft RPM.
- (3) Stop watch.
- (4) Metal Shim 1/16" thick, approximately two (2) inches wide.



## b. Test Procedure

### Step 1

Place the packaged-product on the table of the vibration tester in the position in which it is normally shipped. Fences may be attached when required to prevent excessive rocking or movement on the table.

### Step 2

Set the vibration frequency at the minimum speed sufficient to cause the packaged-product to leave the table momentarily so that the shim may be inserted at least four (4) inches between the bottom of the packaged-product and the surface of the table. The piece of metal should be capable of being intermittently moved along one entire edge of the longest dimension of the packaged-product.

### Step 3

Vibrate the packaged-product for a total of 11,800 vibratory impacts. (The total duration of the test time in minutes to meet this requirement is determined by dividing 11,800 by the cycles per minute frequency set in accordance with Step 2 above). A single 90° horizontal rotation should be effected after one half of the vibration has been accomplished. If a single 90° horizontal rotation is impractical because of the size of the packaged-product, a 180° horizontal rotation will be permissible.

### Step 4

Inspect the exterior of the container for visible damage. Check for looseness of product or components. (When practical, inspect the product and then reclose the container.)

## 2. Incline Impact Test—

### a. Test Equipment complying with ASTM D-880 and TAPPI T-801.

(1) Incline impact testing device.

(2) Velocity monitor device that records velocity of the dolly during the last 2 inches or 5 centimeters of travel prior to impact. This device should have an accuracy of 0.1 feet per second or .03 meters per second. This implies a system accuracy of 0.2 msec. for a timer with a 1 inch light interrupt.

### b. Test Procedure

#### Step 1

Release empty dolly from a height necessary to achieve a minimum impact velocity of 5.75 feet per second or 1.75 meters per second.

#### Step 2

Center the packaged-product on the dolly with the panel which is to receive the initial impact flush against the backstop and parallel to the leading edge of the dolly.

#### Step 3

Release the dolly from the height determined in Step 1.

#### Step 4

Record the impact velocity measured during each impact on the test record.



### Step 5

Complete the test by subjecting the remaining panels, bottom and top to impacts achieving the required minimum final velocity thereby resulting in a total of six (6) impacts and record all final velocity measurements on the test record for each impact. If any impact falls under the required final velocity, it must be repeated to achieve the final velocity needed.

If it is impractical to position the packaged-product to effect top and bottom impacts, the test specimen may be tested in the following manner. A top impact may be eliminated for packaged-products having a definite skid bottom on which the unit is intended to be shipped, or where the gross weight exceeds 500 pounds. However, in all instances the four vertical faces of the packaged-product must be subjected to impacts and the bottom surface must be subjected to either an impact of two (2) flat drops from a height of eight (8) inches or two (2) tilt drops from a height of eight (8) inches. [Each bottom tilt drop may be performed by raising one end (line perpendicular to the skid bottom's longest dimension) to the required height, while releasing the lifted end so that it falls freely on a flat, firm, non-yielding surface such as steel, concrete, etc.]

*The above drop alternative must only be used when it is impractical to position the packaged-product for a bottom impact.*

### Step 6

Inspect both the package and the product. The packaged-product shall be considered to have satisfactorily passed the test if, upon examination, the product is free from damage and the container still affords reasonable protection to the contents.

### C. REPORT

1. NSTA Certified Laboratory Test Report forms are made available to participants in the National Safe Transit Program. When completing the form, the following supplementary information should be specifically reported:
  - a. Description of the product under test including model designation or other specific means of product identification.
  - b. Dimensions of the container under test; its structural specifications; kind of material; description of blocking and cushioning; spacing, size and type of fastenings; method of closing and strapping, if used; the gross weight; and special package numbers, when applicable.
  - c. If package is preconditioned, please report at what temperature and relative humidity this was done in the comments section of the test report.
2. The original test report should be forwarded to the National Safe Transit Association, 5940 W. Touhy Avenue, Chicago, Illinois 60648.



## OPTIONAL TEST PROCEDURE

### Static Compression Test

#### A. INTRODUCTION

##### 1. Scope

The environment to which a packaged-product is exposed, during handling and transportation, very often includes temporary storage. In the best interest of conserving warehouse cube, packaged-products are stacked upon one another to a height which far exceeds that possible in a railcar, truck-trailer, aircraft or other conveyance.

When it is desirable to determine the effects of temporary warehousing on a packaged-product, the National Safe Transit Association recommends that a static compression test be performed in addition to the tests specified in Project 1 or Project 1A. This test should be considered optional and, when conducted, is to be performed on the packaged-product following tests conforming with either Project 1 or 1A. Either the Compression Tester or Dead Weight procedure should be utilized but not sequentially.

The height to which a packaged-product may be stacked will vary depending upon the warehouse ceiling height — seldom over twenty feet. The National Safe Transit Association recommends an average height of fifteen feet be considered in estimating load sustaining requirements for packaged-products. In the absence of more specific data, and the fact that the test unit has previously been subjected to either Project 1 or 1A; the National Safe Transit Association recommends that a factor of three (3) be used to compensate for such circumstances as adverse atmospheric conditions and duration of storage.

##### 2. Frequency of the Complete Test Cycle

Each packaged-product should be retested whenever a change is made in either the product or the package. Changes in the packaged-product include changes in the design, size and/or material. As a quality control procedure, packaged-products should be retested as frequently as feasible.

##### 3. Determination of Static Compression Load

In order to determine if a packaged-product will adequately withstand warehousing, the static compressive force applied should be derived from the following formula:

$$L = W \times \left( \frac{H-D}{D} \right) \times F$$

L = the load the packaged-product must withstand, in pounds.

W = the gross weight of the individual packaged-product, in pounds.

H = the stacking height, in inches.

D = the overall depth of the packaged-product, in inches.

F = compensating factor of three (3).



---

## B. TESTS

### 1. Static Compression Test

#### a. Test equipment complying with ASTM D-642 and TAPPI T-804.

- (1) Package compression tester with a load holding device, or
- (2) Dead weights.

#### b. Test Procedure—Compression Tester

##### Step 1

Center the packaged-product on the lower platen of the compression tester following the normal warehousing practice, using pallets above and below the packaged-product when applicable.

##### Step 2

Bring the platens together at the rate of one-half (0.5) inch per minute.

##### Step 3

Apply and maintain the test load for one (1) hour.

##### Step 4

Remove the test unit from the machine and inspect both the package and the product. The packaged-product shall be considered to have satisfactorily passed the test if, upon examination, the product is free from damage and the container still affords both reasonable protection to the contents and sufficient rigidity to assure safe stacking.

#### c. Test Procedure—Dead Weight

##### Step 1

Place the packaged-product on a flat, level area following the normal warehousing practice, using pallets above and below the packaged-product when applicable.

##### Step 2

Center a three-quarter inch or thicker sheet of plywood on top of the packaged-product, or on the super-imposed pallet, if used.

##### Step 3

Arrange the weight, determined by the formula in section A-3 of this Optional Test Procedure, on the sheet of plywood in order to achieve a uniform load distribution.

##### Step 4

Allow the load to remain in place for one (1) hour.

##### Step 5

Remove the weight and inspect both the package and the product. The packaged-product shall be considered to have satisfactorily passed the test if, upon examination, the product is free from damage and the container still affords reasonable protection to the contents and sufficient rigidity to assure safe stacking.



---

### C. REPORT

1. Enter the following data on the NSTA Certified Laboratory Test Report previously prepared in conjunction with either Project 1 or 1A:
  - a. Weight of applied load, in pounds.
  - b. Condition of the container after static compression test.
  - c. Condition of the product after static compression test.
  - d. Indication of safe stacking capability—passed or failed.
2. Reports, including the results of this optional test, should be forwarded to National Safe Transit Association, 3940 W. Touhy Avenue, Chicago, Illinois 60648.