

## Packaged-Products 150 lb (68 kg) or Less

ISTA 1 Series  
Non-Simulation  
Integrity  
Performance  
Test Procedure

ISTA, *The Association for Transport Packaging* is the world leader in Performance Tests for Packaged-Products.

ISTA 1 Series are the most basic category of performance tests.

- They challenge the capability of the package and product to withstand transport hazards, **but**
- They are not simulations of actual transport hazards, **and**
- Do not necessarily comply with carrier packaging regulations.

When properly applied, ISTA procedures will provide tangible benefits of:

- Shortened packaged development time and confidence in product launch
- Protection of products and profits with reduced damage and product loss
- Economically balanced distribution costs
- Customer satisfaction and continued business.

There are three sections: Overview, Testing and Report

- **Overview** provides the general knowledge required before going into the testing laboratory **and**
- **Testing** presents the specific instructions to do the testing in the laboratory **and**
- **Report** indicates what data shall be recorded to submit a test report to ISTA.

Two systems of weights and measures are presented in ISTA test procedures. They are the English system (Inch-Pound) and the international system SI (Metric). Inch-Pound units are shown first with Metric units in brackets, except in some tables where they are shown separately.

- Either system may be used as the unit of measure (standard units), **but**
- The standard units chosen shall be used consistently throughout the procedure.
- Units are converted to two significant figures **and**
- Not exact equivalents.

### VERY IMPORTANT:

**The entire document shall be read and understood before proceeding with a test.**

## OVERVIEW OF PROCEDURE 1A

### Preface

Test Procedure 1A is an integrity test for individual packaged-products.

- It can be used to evaluate the performance of a packaged-product.
- It can be used to compare relative performance of package and product design alternatives.
- The package and product are considered together and not separately.
- Some conditions of transit, such as moisture, pressure or unusual handling, may not be covered.

Other ISTA Procedures may be appropriate for different conditions or to meet different objectives.

Specific suggestions:

- To use random vibration instead of fixed displacement vibration, use ISTA Test Procedure 1G and not 1A.
- For packaged-products where a minimum compression value should be tested, use ISTA Test Procedure 1C.
- For packaged-products intended for international distribution consider ISTA Partial-Simulation Performance Test Procedure 2A.
- For packaged-products that may be transported in a small parcel delivery system consider ISTA General Simulation Performance Test Procedure 3C.
- Refer to *Guidelines for Selecting and Using ISTA Projects and Procedures* for additional information.

Copyright ©2001 by International Safe Transit Association. All rights Reserved.



## OVERVIEW OF PROCEDURE 1A

## Scope

Test Procedure 1A covers testing of individual packaged-products weighing 150 pounds (68kg) or less when prepared for shipment.

**EXCEPTION:**

Individual packaged-products on a visible skid or pallet and that weigh more than 100 pounds (45 kg) may be tested according to Test Procedure 1B.

Product Damage  
Tolerance and  
Degradation  
Allowance

The shipper shall determine the following prior to testing:

- What constitutes damage to the product **and**
- what damage tolerance level is allowable, if any, **and**
- the correct methodology to determine product condition at the conclusion of the test **and**
- the acceptable package condition at the conclusion of the test.

For additional information on this determination process refer to *Guidelines for Selecting and Using ISTA Projects and Procedures*.

## Samples

Samples should be the untested actual package and product, but if one or both are not available, the substitutes shall be as identical as possible to actual items.

Number of samples required:

- One sample is required for the tests in this procedure.

Replicate Testing Recommended:

To permit an adequate determination of representative performance of the packaged-product, ISTA:

- Requires the procedure to be performed one time, **but**
- Recommends performing the procedure five or more times using new samples with each test.

**NOTE:**

Packages that have already been subjected to the rigors of transportation cannot be assumed to represent standard conditions. In order to insure testing in perfect condition, products and packages shipped to certified laboratories for testing must be:

- over-packaged for shipment to the laboratory **or**
- repackaged in new packaging at the laboratory.

## Test Sequence

The tests shall be performed on each test sample in the sequence indicated in the following table:

Sequence #	Test Category	Test Type	Test Level	For ISTA Certification
1	Vibration	Fixed Displacement	1 in. (25mm) peak to peak at a freq. to be determined	Required
2	Shock	Drop	Height varies with packaged-product weight	Required
		Alternative Incline (Conbur)	Impact Velocity varies with packaged-product weight	
		Alternative Horizontal Impact	Impact Velocity varies with packaged-product weight	

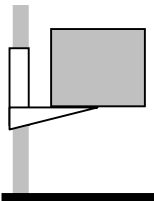
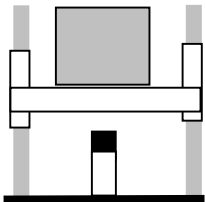
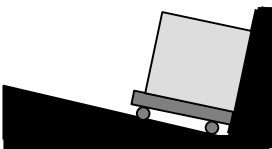
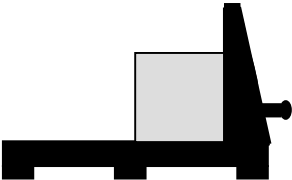
## EQUIPMENT REQUIRED FOR PROCEDURE 1A

## Fixed Displacement Vibration Test:

- Vibration Test System with a 1 inch (25 mm) fixed or controlled displacement complying with Method A1 or A2 of the apparatus section of ASTM D 999-96(-01).  
Rotary or vertical linear motion of the platform is acceptable.
- Metal shim 0.06 inch (1.5 mm), thick approximately 2.0 inches (50 mm) wide and at a convenient length.
- Tachometer or suitable indicator for determining vibration frequency in cycles per second (Hz) or cycles per minute (CPM).
- Automatic timer or stopwatch.

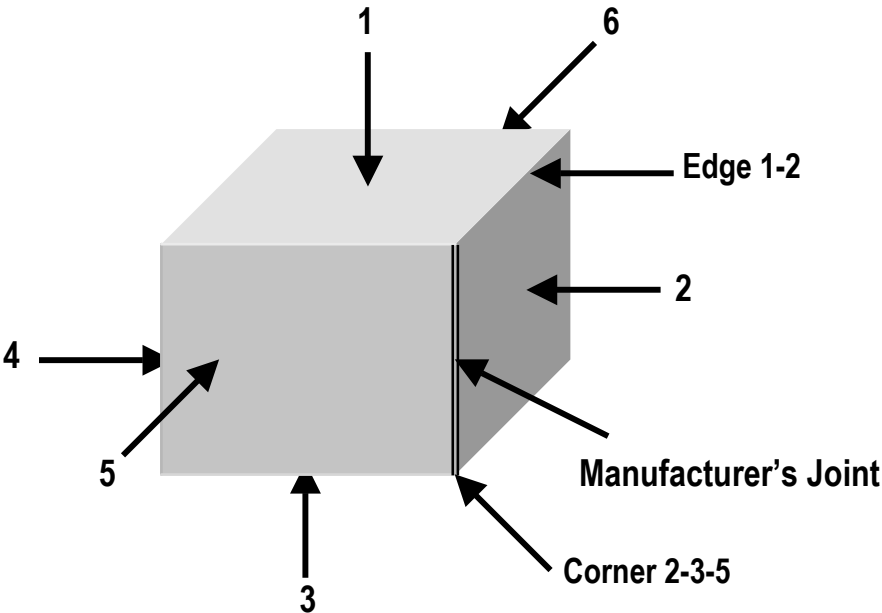
## Shock

The following alternatives are acceptable for the equipment required for the Shock Test:

Type of Shock Test	Type of Equipment	In compliance with the apparatus section of ...
Drop Test	Free fall drop tester 	ASTM D 5276-98
Vertical Shock Test	Shock test machine 	ASTM D 5487-98
Alternative Incline Test	Incline impact tester (conbur) 	ASTM D 880-92(-97)
Alternative Horizontal Test	Horizontal impact test system 	ASTM D 4003-98

## BEFORE YOU BEGIN PROCEDURE 1A

Prior to beginning the tests identify the faces, edges and corners according to the procedure below.

Step	Action
1	Place the packaged-product in its intended shipping position as determined by shipper. If the shipping position can be variable, place the packaged-product so that the primary shipping label location is on the top face.
2	Does the packaged-product have only six faces (2 sides, 2 ends, top and bottom)? <ul style="list-style-type: none"> <li>• If <b>Yes</b>, then go to Step 5.</li> <li>• If <b>No</b>, continue to next Step.</li> </ul>
3	Develop a method to identify each face, edge and corner and document with a diagram.
4	Go to the next Block.
5	Is the package a corrugated container? <ul style="list-style-type: none"> <li>• If <b>Yes</b>, continue to next Step.</li> <li>• If <b>No</b>, then go to Step 8.</li> </ul>
6	Does the package have a manufacturer's joint connecting a side and an end face? <ul style="list-style-type: none"> <li>• If <b>Yes</b>, continue to next Step.</li> <li>• If <b>No</b>, then go to Step 8.</li> </ul>
7	Turn the packaged-product so that you are looking directly at a face with the manufacturer's joint on the observer's right and go to Step 9.
8	Position one of the smallest width faces of the packaged-product directly in front of you.
9	<p><b>Identify faces</b> according to the diagram below.</p> 
10	<b>Identify edges</b> using the numbers of the two faces forming that edge. Example: Edge 1-2 is the edge formed by face 1 and face 2 of the packaged-product.
11	<b>Identify corners</b> using the numbers of the three faces that meet to form that corner. Example: Corner 2-3-5 is the corner formed by face 2, face 3, and face 5 of the packaged-product.
12	Go to next Block.

### Packaged-Product Weight and Size Measurement

### Before You Begin Vibration Testing

You shall know the packaged-products:

- gross weight in pounds (kg), **and**
- outside dimensions of Length, Width and Height (L x W x H) in inches (mm or m)

#### CAUTION:

A restraining device or devices shall be used with the vibration test system to:

- Prevent the test specimen from moving off the platform **and**
- Maintain test orientation of the packaged-product, **but**
- The device or devices shall not restrict the vertical motion of the test specimen during the test.

Familiarity with the following formula is required to calculate the test duration after the frequency required to bounce the packaged-product is determined in the Vibration Test Block:

$$\text{Test Duration in Minutes} = \frac{14,200 \text{ Vibratory Impacts}}{\text{Cycles Per Minute (CPM) or [Cycles Per Second (Hz) x 60]}}$$

The chart below shows example Test Duration's calculated for several frequencies:

CPM	Hz	Test Duration in Minutes
150	2.5	95
180	3.0	79
210	3.5	68
240	4.0	60
270	4.5	53
300	5.0	48

### Before You Begin Shock Testing

The test drop height varies with the weight of the packaged-product. Find the weight of the packaged-product in the following chart to determine a drop height or an equivalent impact velocity to be used for a substituted drop:

Packaged-Product Weight				Drop Height			Impact Velocity	
Equal to or greater than		But Less than		Free Fall			Incline or Horizontal	
lb	kg	lb	kg	in.	mm		ft/s	m/s
0	0	21	10	30	760		13	3.9
21	10	41	19	24	610		11	3.5
41	19	61	28	18	460		10	3.0
61	28	100	45	12	310		8.0	2.5
100	45	150	68	8	200		6.6	2.0

The test method requires the packaged-product to be dropped in several different package orientations.

A drop test must be performed in all required orientations where dropping the packaged-product is practical.

If dropping in a required orientation is not practical an equivalent incline or horizontal test can be substituted for that orientation.

When using impact velocity, if any test in a Test Sequence is below the required minimum level, that sequence event must be repeated until the test impact velocity meets the minimum.

## TEST SEQUENCE FOR PROCEDURE 1A

The test blocks that follow contain tables that indicate the required steps for each test in the procedure.

FIXED DISPLACEMENT		
Step	Action	
1	Put the packaged-product on the vibration table so that face 3 rests on the platform.	
2	Start the vibration system to vibrate at 1.0 inches (25 mm) total displacement at the machine's lowest frequency.	
3	Maintain a fixed displacement at 1 inch (25 mm) and slowly increase the frequency (speed) of the vibration table until the packaged-product begins to momentarily leave the surface of the platform.	
4	Hold the vibration frequency to that determined in Step 3.	
5	Can a metal shim be intermittently moved between the bottom of the longest dimension of the packaged-product and the surface of the platform? <ul style="list-style-type: none"> <li>• If <b>Yes</b>, hold that frequency and then continue to next Step.</li> <li>• If <b>No</b>, then increase the frequency until the requirement of Step 5 is met and hold that vibration frequency.</li> </ul>	
6	Determine the test duration in minutes using the formula indicated in the Before You Begin Block and the CPM or Hz frequency identified in Step 5.	
7	Begin the vibration duration.	
8	Are you using a vertical linear motion on the vibration system? <ul style="list-style-type: none"> <li>• If <b>Yes</b>, then go to Step 12.</li> <li>• If <b>No</b>, then continue with the next Step.</li> </ul>	
9	Stop the vibration test half way through the vibration duration and perform the appropriate action as indicated in the table below:	
	IF a single 90° horizontal rotation is...	THEN perform a horizontal rotation of ...
	Possible	90° as the specimen rests on the platform.
	Not practical because of the size of the packaged-product or the stability of the packaged-product.	180° as the specimen rests on the platform.
10	Start the vibration system and continue the vibration test at the frequency used in Step 7.	
11	Can a metal shim be intermittently moved between the bottom of the longest dimension of the packaged-product and the surface of the platform? <ul style="list-style-type: none"> <li>• If <b>Yes</b>, then continue to next Step.</li> <li>• If <b>No</b>, then slowly increase the frequency until the requirement of Step 11 is met.</li> </ul>	
12	Complete the vibration duration.	
13	Inspection of the packaged-product for visible damage is allowed, provided inspection does not alter, in any way, the current condition of the package or the condition or position of the product(s).	
14	Vibration testing is now complete. Go to the Shock Test Block.	

## TEST SEQUENCE FOR PROCEDURE 1A

DROP			
Step	Action		
1	Determine the method(s) of test and the required drop height or impact velocity in the Before You Begin Block.		
2	Do you have a packaged-product with only 6 faces as identified in the Face, Edge and Corner Identification Block? <ul style="list-style-type: none"> <li>If <b>Yes</b>, continue with the next Step.</li> <li>If <b>No</b>, then go to Step 6.</li> </ul>		
3	Test the packaged-product according to the method(s) and level(s) determined in Step 1. Follow the sequence in the table below.		
4	<b>Sequence #</b>	<b>Orientation</b>	<b>Specific face, edge or corner</b>
	1	Corner	most fragile face-3 corner, if not known, test 2-3-5
	2	Edge	shortest edge radiating from the corner tested
	3	Edge	next longest edge radiating from the corner tested
	4	Edge	longest edge radiating from the corner tested
	5	Face	one of the smallest faces
	6	Face	opposite small face
	7	Face	one of the medium faces
	8	Face	opposite medium face
	9	Face	one of the largest faces
	10	Face	opposite large face
5	All testing is now complete. Go to the Test Report Block.		
6	Select a bottom face corner to replace the corner required in Step 4 Sequence 1 to begin the test.		
7	Identify the edges of the packaged-product that meet the Step 4 Sequence 2 through 4 requirements.		
8	Select any 6 faces to replace the faces required in Step 4 Sequence 5 through 10.		
9	Using the corner, edges and faces from Steps 6 through 8 go to Step 3 and proceed.		
10	All testing is now complete. Go to the Test Report Block.		

# TEST REPORT FOR PROCEDURE 1A

The packaged-product has satisfactorily passed the test if, upon examination, it meets the Product Damage Tolerance and Package Degradation Allowance.

ISTA Certified Testing Laboratories:

- Should file a test report on all ISTA Test Procedures or Projects conducted.
- Shall file a test report on all ISTA Test Procedures or Projects conducted to obtain Transit Tested Package Certification or Acknowledgement.

For additional information, refer to *Guidelines for Selecting and Using ISTA Test Projects and Procedures*.

## ISTA Transit Tested Program

The ISTA Transit Tested Certification Mark as shown is a:

- registered certification mark **and**
- can only be used by license agreement **and**
- by a member of the International Safe Transit Association.

When a member prints this certification mark on a packaged-product with their license number they are showing their customer and the carrier that it has passed the requirements of ISTA preshipment testing.



In order to maintain its certified status and eligibility for identification with the TRANSIT TESTED Certification Mark, each packaged-product must be re-tested whenever a change is made in the:

- Product **or**
- Process **or**
- Package.

Changes in the product include changes in:

- Design **or**
- Size **or**
- Materials.

Changes in the process include changes in:

- Manufacturing **or**
- Assembly **or**
- Filling.

Changes in the package include changes in:

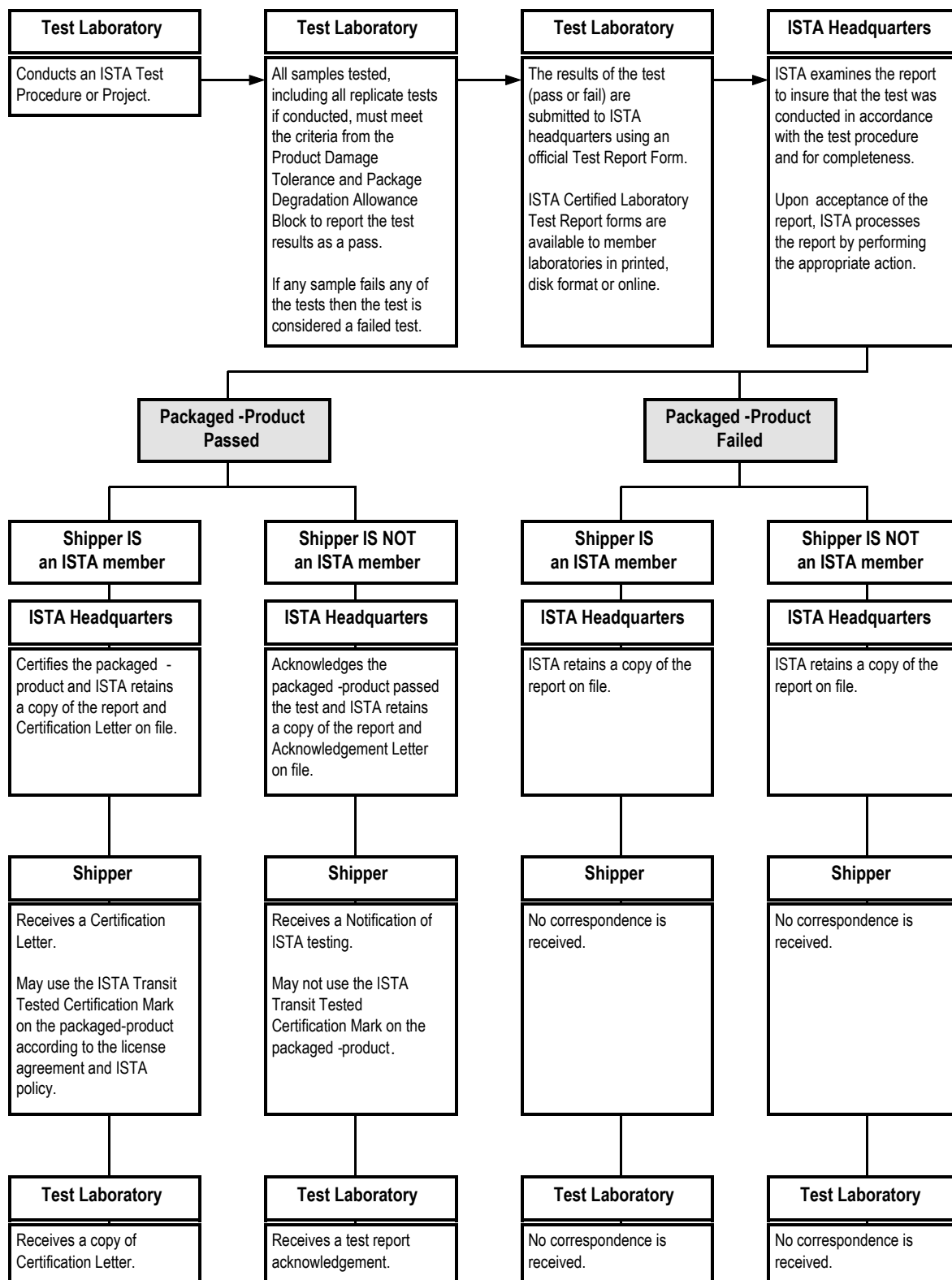
- Configuration **or**
- Dimensions **or**
- Weight **or**
- Materials **or**
- Components.

As a quality control procedure, packaged-products should be re-tested frequently, for example, yearly.



# TEST REPORT FOR PROCEDURE 1A

The diagram below indicates the steps in ISTA Test Report Processing.



# TEST REPORT FOR PROCEDURE 1A

The following information is required when completing the Certified Laboratory Test Report:

**ISTA Certified Testing Laboratory Information**

- Complete laboratory name and address
- Test Laboratory ID number
- Test Technician who performed the test
- Test Report submitted by: name and signature

**Product Manufacturer/Shipper Information**

- Manufacturer/Shipper company name and address
- Test requested by (individuals name)
- Manufacturer/Shipper ISTA License Number, if applicable and known

**Third-party Test Request Information**

- Test conducted for company name and address
- Test requested by (individuals name)
- Relationship to the product manufacturer/shipper

**Test Information**

- Test Procedure or Project performed
- Date tested
- Number of samples tested
- Number of replicate tests performed
- Test Number(s) assigned by test laboratory, if applicable

**Product Description**

- Detailed description of the product under test, including model designation or other specific means of product identification that distinguishes it from any other product.

**Package Description**

- Describe entire shipping unit
- Type or style of package
- List materials used inside the package, if applicable
- Pallet or skid, if applicable
- Picture or drawing of any interior cushioning, if applicable
- Method of closure, if applicable

**Packaged-Product Tested**

- Gross weight of packaged-product
- External container size in inches (mm or m): Length x Width x Depth (L x W x D)
- A picture should be included

**Product Damage Tolerance Criteria**

- Definition of product damage tolerance
- Name of who determined definition of product damage tolerance
- Description of the method of determining product damage

**Package Degradation Allowance Criteria**

- Definition of package degradation allowance
- Name of who determined definition of package degradation allowance
- Description of the method of determining package degradation

# TEST REPORT FOR PROCEDURE 1A

The following information is specific to this test procedure and shall be reported with the required general information when completing the Certified Laboratory Test Report:

## Test Results:

Report if the packaged-product(s):

- Passed or
- Failed

## Test Plan:

- Report which unit of measure was used, English or Metric
- Report any deviations from the required test plan.
- Include an explanation as to why the test was conducted differently.

## Test Laboratory Comments:

- As a result of the testing, report any recommendations for packaged-product improvement.
- Any general comments.

## Vibration Test:

- Describe restraining device or devices used
- First test orientation
  - Orientation of specimen tested
  - Test frequency in Hz or CPM
- Second test orientation
- Report the degrees of rotation, if applicable:
  - 90° or
  - 180°
  - Test frequency in Hz or CPM
- Test duration in minutes
- Number of vibratory impacts, **and**
- Results of visual inspection for damage, if applicable

## Shock Test:

Report the following:

- Orientation of each shock
- Severity of each shock recorded:
  - For Drop Test as drop height in inches (mm)
  - For Free fall equivalent as velocity change in inches per second (m/s)
  - For Incline as impact velocity in inches per second (m/s)
  - Horizontal equivalent as velocity change in inches per second (m/s)

Report if an incline or horizontal shock was substituted for any test orientation

- Which orientation
- Which test method was used
  - Free fall equivalent shock, incline or horizontal
- Explain the reason for the substitution for each orientation.

*This Test Procedure is published by:  
International Safe Transit Association  
1400 Abbott Road, Suite 160, East Lansing, MI 48823-1900 USA*

*Copyright © 2001 by International Safe Transit Association. All rights Reserved*

*No part of the contents of this Test Procedure may be reproduced or transmitted in any form or by any means without the written permission of the publisher.*

*Order Information: Additional copies of this Test Procedure, the ISTA RESOURCE BOOK (in print or on CD ROM) may be ordered by contacting ISTA at 517.333.3437 or by downloading an order form at [www.ista.org](http://www.ista.org)*