

ISTA 2 Series
Partial
Simulation
Performance
Test
Procedure

VERSION
DATE
Last
TECHNICAL
Change:
JANUARY
2011

Last
EDITORIAL
Change:
OCTOBER
2012

For complete
listing of
Procedure
Changes and
Version Dates
go to
www.ista.org

Preface

ISTA, Distributing Confidence, Worldwide™

ISTA 2 Series tests are a combination of basic test elements from ISTA 1 Series (Non-Simulation Integrity Performance Testing) and advanced test elements from ISTA 3 Series (General Simulation Performance Testing).

- They challenge the capability of the package and product to withstand transport hazards, **but**
- They only simulate some actual transport hazards, **and**
- They 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 2B

Test Procedure 2B is a partial simulation 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.
- It should be considered for the evaluation of packaged-products intended for international distribution.
- 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.

Refer to *Guidelines for Selecting and Using ISTA Procedures and Projects* for additional information.

Scope

Test Procedure 2B covers testing of individual packaged-products weighing more than 150 lb (68 kg) when prepared for shipment.

EXCEPTION:

Individual packaged-products on a visible skid or pallet may be tested according to ISTA Non-Simulation Integrity Performance Test Procedure 1E or ISTA General Simulation Performance Test Procedure 3E.

Product Damage
Tolerance and
Package
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.

NOTE:

When conducting the Compression Test:

- box failure that could result in a stacking failure is considered a failed test, **if**
- the packaged-product may be warehoused during distribution.
- box failure is allowed if the packaged-product provided is not warehoused, **and**
- at the conclusion of all testing, the product is not damaged according the Product Damage Tolerance established **and**
- the package still meets the acceptable package condition, both of which are determined above.

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

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	Atmospheric Preconditioning	Temperature and Humidity	Ambient	Required
2	Atmospheric Conditioning	Controlled Temperature and Humidity	Temperature and Humidity chosen from chart	Required
3	Compression (Alternative methods allowed – select one test type)	Machine Apply and Release	Calculated Test Force x 1.4	Required
		Machine Apply and Hold	Calculated Test Force	
		Weight and Load Spreader	Calculated Test Load	
4	Vibration (Alternative methods allowed – select one test type)	Fixed Displacement	1 in (25mm) peak to peak at a frequency to be determined	Required
		Random	Overall G_{rms} level of 1.15	
5	Shock (Alternative methods allowed – select one test type)	Drop	6 in (150 mm)	Required
		Incline Impact (Conbur)	69 in (1.7 m) per second velocity change	
		Horizontal Impact	69 in (1.7 m) per second velocity change	
6	Shock	Rotational Edge Drop	8 in (200 mm)	Required when not testing face 1
7	Vibration (Alternative methods allowed – select one test type)	Fixed Displacement	1 in (25mm) peak to peak at a frequency to be determined	Required
		Random	Overall G_{rms} level of 1.15	

*** Note:** It is permissible to use either the same method of vibration or different methods of vibration in Sequences #4 and #7. Both Sequences may use Fixed Displacement vibration, both may use Random vibration, or one may use Fixed Displacement and the other Random. The Test Report should clearly document which type of vibration was used for each Sequence number.

Equipment
Required
Atmospheric
Conditioning

Atmospheric Conditioning:

- Chamber and Control apparatus complying with the apparatus section of ASTM D 4332.
- Humidity recording apparatus complying with the apparatus section of ASTM D 4332.
- Temperature recording apparatus complying with the apparatus section of ASTM D 4332.

Equipment
Required
Compression

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

Type of Compression Test	Equipment	In compliance with the apparatus section of:
Apply and Release Test	Compression test system	ASTM D 642 Fixed or Floating platen acceptable
Apply and Hold Test	Compression test system	
Apply and Hold Test	Weight and load spreader	NA

Equipment
Required
Vibration

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

Fixed Displacement Vibration Test:

- Vibration Test System with a 1 in (25 mm) fixed or controlled displacement complying with Method A1 or A2 of the apparatus section of ASTM D 999.
Rotary or vertical linear motion of the platform is acceptable.
- Metal shim 0.06 in (1.5 mm), thick approximately 2 in (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.

Random Vibration Test:

Random Vibration Test System complying with the apparatus section of ASTM D 4728.

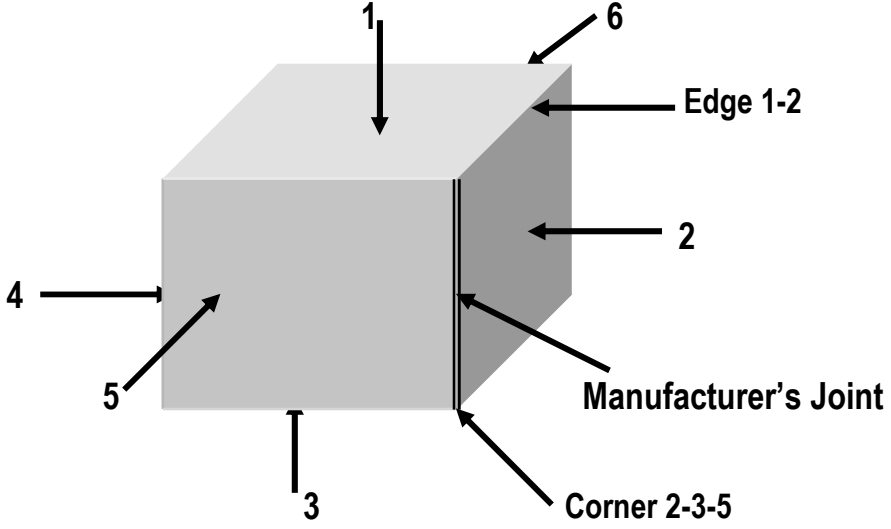
Equipment
Required
Shock

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

Type of Shock Test	Equipment	In compliance with the apparatus section of:
Drop Test	Free fall drop tester	ASTM D 5276
Vertical Shock Test	Shock test machine	ASTM D 5487
Incline Test	Incline impact tester (conbur)	ASTM D 880
Horizontal Test	Horizontal impact test system	ASTM D 4003
Rotational Test	Rotational drop	ASTM D 6179

BEFORE YOU BEGIN PROCEDURE 2B

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"> If Yes, then go to Step 5. If No, continue to next Step.
3	Develop a method to identify each face, edge and corner and document with a diagram.
4	Go to next page for further Before You Begin details.
5	Is the package a corrugated container? <ul style="list-style-type: none"> If Yes, continue to next Step. If No, then go to Step 8.
6	Does the package have a manufacturer's joint connecting a side and an end face? <ul style="list-style-type: none"> If Yes, continue to next Step. If No, then go to Step 8.
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>Identify faces according to the diagram below.</p> 
10	Identify edges 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	Identify corners 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 page for further Before You Begin details.

You shall know the packaged-product's:

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

Required Preconditioning:

The packaged-product should be stored prior to climate conditioning at laboratory ambient temperature and humidity for six (6) hours.

Required Conditioning (to be performed after the required preconditioning):

To permit an adequate determination of packaged-product performance at anticipated atmospheric limits and where it is known that the atmospheric extremes are detrimental to the product, ISTA:

- **Requires** the highest temperature and humidity limits of the product be used, **but**
- **Recommends** that both the highest and lowest atmospheric conditions be used.

Condition packaged-products according to one or more of the conditions listed in the table below.

- Remaining test requirements should be performed as soon as possible after removing the packaged-product from environmental conditioning apparatus.
- If more than one conditioning sequence is selected, a new and complete test should be performed following each sequence.

Anticipated Conditions	Time in Hours	Temperature in °C ±2°C (°F ±4°F)	Humidity in %
Extreme Cold, Uncontrolled RH	72	-29°C (-20°F)	uncontrolled RH
Cold, Humid	72	5°C (40°F)	85% RH ±5%
Controlled Conditions	72	23°C (73°F)	50% RH ±5%
Hot, Humid	72	38°C (100°F)	85% RH ±5%
Hot, Humid then Extreme Heat, Moderate RH:	72 then 6	38°C (100°F) then 60°C (140°F)	85% RH ±5% then 30% RH ±5%
Elevated Temperature, Uncontrolled RH	72	50°C (120°F)	uncontrolled RH
Extreme Heat, Dry	72	60°C (140°F)	15% RH +/- 5%
Severe Cold, Uncontrolled RH	72	-18°C (0°F)	uncontrolled RH
User Defined High Limit	72	Based upon known conditions	Known conditions
User Defined Low Limit	72	Based upon known conditions	Known conditions
User Defined Cycle	72	Based upon known conditions	Known conditions

BEFORE YOU BEGIN PROCEDURE 2B

CAUTION:

When using weights and a load spreader use extreme care to prevent injury.

Familiarity with the following formulas is required:

Compression Test System	Test Force	English Units - Pounds Force (lbf)	Metric Units - Newtons(N)
Apply and Release Test Force	AR	$[W_t \times (S - 1) \times F] \times 1.4$	$[W_t \times (S - 1) \times F \times 9.8] \times 1.4$
Apply and Hold Test Force	AH	$W_t \times (S - 1) \times F$	$W_t \times (S - 1) \times F \times 9.8$
Weight & Load Spreader	Test Load	English Units Pounds (lb)	Metric Units – Kilograms (kg)
Dead Weight AH Test Load	DW-AH	$W_t \times (S - 1) \times F$	$W_t \times (S - 1) \times F$
Where			
AR	Test Load for Apply and Release	Pounds Force (lbf)	Newtons
AH	Test Load for Apply and Hold -Machine	Pounds Force (lbf)	Newtons
DW-AH	Test Load for Apply and Hold -Dead Weight	Pounds (lb)	Kilograms (kg)
W_t	Total weight of the packaged-product	Pounds	Kilograms
S	Total number of packaged-products in a stack NOTE: If nothing is stacked on the packaged-product, then the S value = 1 (one), the test load or force = 0 (zero) and no compression test is required. See below if you do not know the number of packaged-products that may be in a stack.		
1	Represents the bottom container in a Stack	1	1
F	Compensating factor	Typical range 3-6, ISTA recommends a minimum of 5 if the packaged-product may be warehoused during distribution; otherwise a minimum of 4 is recommended.*	
1.4	Compensating Factor for time of compression	1.4	1.4
9.8	Metric conversion factor (Kilograms to Newtons)	NA	9.8

* Compensating factors account for effects not tested, such as temperature/humidity, stacking patterns, long-duration loading, etc. Other factors may be used in certain situations, **including reduced factors**.

For example, if compression testing is performed in conjunction with atmospheric conditioning which reduces container strength (e.g. corrugated containers under high humidity, plastic containers under high temperature), **Compensating Factors may be reduced**. If the ISTA recommendations above are not followed, sufficient justification must be included in the Test Report.

If you do not know the number of packaged-products that may be in a stack (S) determine the number to use by performing the appropriate action as indicated below:

Step	Action
1	Will the packaged-product be warehoused during distribution? <ul style="list-style-type: none"> If Yes, or if not known, then go to the next Step. If No, then go to Step 3.
2	Divide 196 in (5 m) by the height of one packaged-product in inches (m). Round the value calculated up to a whole number and use the number just determined as "S" in the appropriate formula above. $S = 196 \text{ in} \div H$ (Metric: $S = 5 \div H$) Note: 196 in (5 m) represents a high warehouse stack, but stacks may be even higher in some situations. The best approach is to determine S from actual field knowledge.
3	Divide 90 inches (2.3 m) by the height of one packaged-product in inches (m). Round the value calculated up to a whole number and use the number just determined as "S" in the appropriate formula above. $S = 90 \text{ in} \div H$ (Metric $S = 2.3 \div H$) Note: 90 in (2.3 m) represents a reasonable stack in a vehicle or ocean container, but stacks may be higher or lower in given situations. The best approach is to determine S from actual field knowledge.

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.

Select Fixed Displacement Vibration or Random Vibration as a test method.

For Fixed Displacement Vibration:

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:

$$\text{Test Duration in Minutes} = \frac{11,800 \text{ Vibratory Impacts}}{\text{Cycles Per Minute (CPM) or [Cycles Per Second (Hz) x 60]}}$$

NOTE:

The test duration for the Second Vibration Test Block may be different from that calculated for the First Vibration Test Block because the frequency required to bounce the packaged-product in the Second Vibration Test Block may be different.

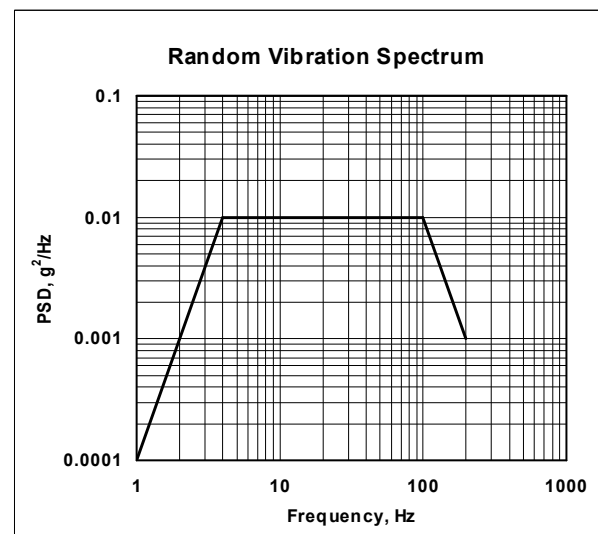
The chart below shows **example** Test Duration's calculated for several frequencies:

CPM	Hz	Test Duration in Minutes
150	2.5	79
180	3.0	66
210	3.5	57
240	4.0	50
270	4.5	44
300	5.0	40

For Random Vibration:

The following breakpoints shall be programmed into the vibration controller to produce the acceleration versus frequency profile (spectrum) below with an overall G_{rms} level of 1.15. The theoretical stroke required to run this vibration profile is 22.45 mm (0.884 in) peak to peak.

Frequency (Hz)	PSD Level, g^2/Hz
1.0	0.0001
4.0	0.01
100.0	0.01
200.0	0.001



Select Drop, Incline or Horizontal as a test method.

For Drop Test Method the drop height shall be 6 in (150 mm) for Free Fall Drop, Shock Machine Equivalent Free Fall Drop, or Sling Drops.

For Incline Test Method the minimum impact velocity is 69 in per second (1.7 m per second).

For Horizontal Test Method the minimum velocity change is 69 in per second (1.7 m per second).

NOTE:

69 in per second is equal to 5.75 ft per second.

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

EXCEPTION:

You do not have to conduct a shock test on face 1 (top) if:

- the packaged-product has a visible skid or pallet, **or**
- positioning or testing the packaged-product in this orientation would be unsafe.

CAUTION:

If the test item is large and:

- has a length equal to or greater than twice the width **and**
- has a center of gravity above the midpoint of the height.
- there is the possibility that it could tip over when testing one of the longest edges, **therefore**
- you may conduct the Rotational Edge Drop test on both of the shortest edges.

TEST BLOCK 1
Atmospheric
Conditioning

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

TEMPERATURE AND HUMIDITY	
Step	Action
1	The packaged-product should be stored prior to climate conditioning at laboratory ambient temperature and humidity for six (6) hours.
2	Select an anticipated condition from Before You Begin Atmospheric Conditioning.
3	Check the conditioning apparatus to insure that the temperature and humidity are at the required levels.
4	Place the packaged-product in the conditioning.
5	At the completion of the required conditioning time period remove the packaged-product from the conditioning apparatus.
6	Record the ambient laboratory temperature and humidity when testing starts. Go to TEST BLOCK 2 (Compression) and perform the remaining test sequences as quickly as possible.

TEST BLOCK 2
Compression

COMPRESSION							
Step	Action						
1	Testing is to be conducted using the test force or load from Before You Begin Compression Testing and by performing the appropriate action as indicated in the table below: <table border="1"> <tr> <th>IF the testing equipment to be used is a ...</th><th>THEN go to ...</th></tr> <tr> <td>Compression Test System</td><td>Step 2.</td></tr> <tr> <td>Weight and load spreader</td><td>Step 7.</td></tr> </table>	IF the testing equipment to be used is a ...	THEN go to ...	Compression Test System	Step 2.	Weight and load spreader	Step 7.
IF the testing equipment to be used is a ...	THEN go to ...						
Compression Test System	Step 2.						
Weight and load spreader	Step 7.						
2	Center the packaged-product with face 3 resting on the lower platen of the compression tester.						
3	Start the test machine and bring the platens together at the rate of one-half (0.5) in (13 mm) per minute.						
4	Perform the appropriate action as indicated in the table below: <table border="1"> <tr> <th>IF the compression test is a...</th><th>THEN ...</th></tr> <tr> <td>Apply and Release Test</td><td>Increase the force until it reaches the AR Test Force value determined in Before You Begin Compression Testing, then go to Step 5.</td></tr> <tr> <td>Apply and Hold Test</td><td>Increase the force until it reaches the AH Test Force value determined in Before You Begin Compression Testing, then go to Step 6.</td></tr> </table>	IF the compression test is a...	THEN ...	Apply and Release Test	Increase the force until it reaches the AR Test Force value determined in Before You Begin Compression Testing, then go to Step 5.	Apply and Hold Test	Increase the force until it reaches the AH Test Force value determined in Before You Begin Compression Testing, then go to Step 6.
IF the compression test is a...	THEN ...						
Apply and Release Test	Increase the force until it reaches the AR Test Force value determined in Before You Begin Compression Testing, then go to Step 5.						
Apply and Hold Test	Increase the force until it reaches the AH Test Force value determined in Before You Begin Compression Testing, then go to Step 6.						
5	Release the force. Go to Step 11.						
6	Maintain the force for one (1) hour, and then release the force. Go to Step 11.						
7	Place the packaged-product with face 3 resting on a smooth, flat, rigid surface.						
8	Place a rigid load spreader that is larger than the top face of the test specimen on the packaged-product.						
9	Add weight to the load spreader to bring the total weight up to the DW-AH Test Load determined in Before You Begin Compression Testing and maintain for one (1) hour.						
10	Remove the weight and load spreader.						
11	Is the product damaged or the package degraded according to the Product Damage Tolerance and Package degradation Allowance? <ul style="list-style-type: none"> If Yes, then the packaged-product has failed the test, go to the Reporting an ISTA Test section at the end of this Procedure. If No, then go to TEST BLOCK 3 (Vibration). 						

TEST BLOCK 3
Vibration:
First
Sequence
(Fixed
Displacement)

VIBRATION - FIXED DISPLACEMENT		
Step	Action	
1	Determine if testing is going to be Fixed Displacement or Random Vibration.	
	IF Vibration testing is going to be ...	THEN go to ...
	Fixed Displacement	Step 2.
	Random	TEST BLOCK 4 (Vibration – Random)
2	Put the packaged-product on the vibration table so that face 3 rests on the platform.	
3	Start the vibration system to vibrate at 1 in (25 mm) total displacement at the machine's lowest frequency.	
4	Maintain a fixed displacement at 1 in (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.	
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"> • If Yes, hold that frequency and then continue to the next Step (Step 6). • If No, then slowly increase the frequency until the requirement of this Step (Step 5) is met, and hold that vibration frequency. 	
6	Determine the test duration in minutes using the formula indicated in Before You Begin Vibration testing and the CPM or Hz frequency identified in Step 5.	
7	Begin timing the vibration test duration.	
8	Are you using a vertical linear motion on the vibration system? <ul style="list-style-type: none"> • If Yes, then go to Step 13. • If No, then continue with the next Step. 	
9	Stop the vibration test after completion of one-half ($\frac{1}{2}$) of the total minutes of test 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	Re-start the vibration system to vibrate at 1.0 in (25 mm) total displacement at the machine's lowest frequency.	
11	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.	
12	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"> • If Yes, hold that frequency and then continue to the next step (Step 13). • If No, then slowly increase the frequency until the requirement of this Step (Step 12) is met, and hold that vibration frequency. 	
13	Resume or continue timing the test, and complete the second half of the vibration duration.	
14	Vibration testing is now complete. Go to TEST BLOCK 5 (Shock).	

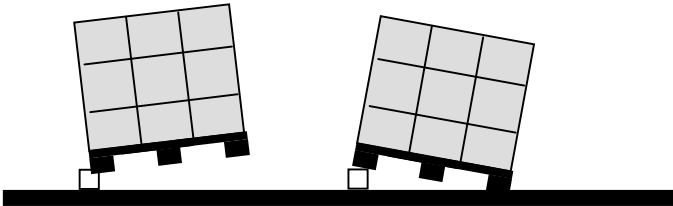
TEST BLOCK 4
Vibration:
First
Sequence
(Random)

VIBRATION - RANDOM	
Step	Action
1	Put the packaged-product on the vibration table so that face 3 rests on the platform.
2	Start the vibration machine to produce the random vibration spectrum indicated in Before You Begin Vibration Testing.
3	Stop the vibration testing at the end of 60 minutes.
4	Vibration testing is now complete. Go to TEST BLOCK 5 (Shock).

TEST BLOCK 5
Shock
(Impact)

SHOCK - IMPACT			
Step	Action		
1	Did you determine in Before You Begin Shock Testing not to shock test face 1 (top)? <ul style="list-style-type: none"> If Yes, then perform impacts on faces 2, 4, 5 and 6 only and then proceed to TEST BLOCK 6 (Shock Testing – Rotational Edge Drop). If No, go to the next Step. 		
2	Determine the drop height, impact velocity or velocity change using the information in Before You Begin Shock Testing.		
3	Test the packaged-product according to the level in Step 2. Follow the sequence in the table below.		
	Sequence #	Orientation	Specific face
	1	Face	one of the smallest faces
	2	Face	opposite small face
	3	Face	one of the medium faces
	4	Face	opposite medium face
	5	Face	one of the largest faces
	6	Face	opposite large face
4	Is the packaged-product shipped in a Containerized Shipment? <ul style="list-style-type: none"> If Yes, Impact testing is now complete. Go to TEST BLOCK 7 (Vibration – Fixed Displacement) or TEST BLOCK 8 (Vibration - Random). If No, conduct a second sequence of tests by repeating Step 3 and then go to Step 5. 		
5	Testing is now complete. Go to TEST BLOCK 7 (Vibration – Fixed Displacement) or TEST BLOCK 8 (Vibration - Random).		

TEST BLOCK 6
Shock
(Rotational
Edge Drop)

SHOCK - ROTATIONAL EDGE DROP		
Step	Action	
1	Perform a rotational edge drop. Follow the sequence in the table below.	
	Sequence #	Action
	1	Place the unitized load onto a flat, rigid surface such as steel or concrete.
	2	Support one of the shortest face 3 edges with a timber or support 3.5 to 4.0 in (90 to 100 mm) in height and width.
	3	Lift the opposite face 3 edge to 8 in (200 mm) off the surface.
	4	Release the edge so that it falls freely onto the flat, rigid surface.
		
2	Does the Unit Load have a length equal to or greater than twice the width and a center of gravity above the midpoint of the height? <ul style="list-style-type: none"> • If Yes, then go to Step 4. • If No, then continue with the next step. 	
3	Repeat Step 1 on one of the face 3 edges radiating 90° from the edge just tested in Step 1 Sequence 4. Then go to Step 5.	
4	Repeat Step 1 on the face 3 edge opposite the edge just tested in Step 1 Sequence 4. Then go to the next Step.	
5	This rotational edge drop testing is now complete. Go to TEST BLOCK 7 (Vibration – Fixed Displacement) or TEST BLOCK 8 (Vibration - Random).	

TEST BLOCK 7
Vibration:
Second
Sequence
(Fixed
Displacement)

VIBRATION - FIXED DISPLACEMENT		
Step	Action	
1	Determine if testing is going to be Fixed Displacement or Random Vibration.	
	IF Vibration testing is going to be ...	THEN go to ...
	Fixed Displacement	Step 2.
	Random	TEST BLOCK 4 (Vibration – Random)
2	Put the packaged-product on the vibration table so that face 3 rests on the platform.	
3	Start the vibration system to vibrate at 1 in (25 mm) total displacement at the machine's lowest frequency.	
4	Maintain a fixed displacement at 1 in (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.	
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"> • If Yes, hold that frequency and then continue to the next Step (Step 6). • If No, then slowly increase the frequency until the requirement of this Step (Step 5) is met, and hold that vibration frequency. 	

Continued on next page

TEST BLOCK 7
CONTINUED
Vibration:
Second
Sequence
(Fixed
Displacement)

Continued from previous page

Continued from previous page

Step	Action						
6	Determine the test duration in minutes using the formula indicated in Before You Begin Vibration testing and the CPM or Hz frequency identified in Step 5.						
7	Begin timing the vibration test duration.						
8	Are you using a vertical linear motion on the vibration system? <ul style="list-style-type: none">• If Yes, then go to Step 13.• If No, then continue with the next Step.						
9	Stop the vibration test after completion of one-half ($\frac{1}{2}$) of the total minutes of test duration and perform the appropriate action as indicated in the table below:						
	<table><tr><th>IF a single 90° horizontal rotation is...</th><th>THEN perform a horizontal rotation of ...</th></tr><tr><td>Possible</td><td>90° as the specimen rests on the platform.</td></tr><tr><td>Not practical because of the size of the packaged-product or the stability of the packaged-product.</td><td>180° as the specimen rests on the platform.</td></tr></table>	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.
	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	Re-start the vibration system to vibrate at 1.0 in (25 mm) total displacement at the machine's lowest frequency.						
11	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.						
12	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">• If Yes, hold that frequency and then continue to the next step (Step 13).• If No, then slowly increase the frequency until the requirement of this Step (Step 12) is met, and hold that vibration frequency.						
13	Resume or continue timing the test, and complete the second half of the vibration duration.						
14	All testing is now complete. Go to the Reporting an ISTA Test section at the end of this Procedure.						

TEST BLOCK 8
Vibration:
Second
Sequence
(Random)

VIBRATION - RANDOM	
Step	Action
1	Put the packaged-product on the vibration table so that face 3 rests on the platform.
2	Start the vibration machine to produce the random vibration spectrum indicated in the Before You Begin Block.
3	Stop the vibration testing at the end of 60 minutes.
4	All testing is now complete. Go to the Reporting an ISTA Test section at the end of this Procedure.

ISTA Test Report Forms may be downloaded by members through the online ISTA Member Center (www.ista.org/members/). Custom forms are also acceptable, but information on an official ISTA Report Form is considered to be the minimum required for any test report submission and consideration. Test report forms should be submitted to ISTA Headquarters by mail, fax or electronically. Test reports should be detailed enough for accurate repeatability of the test.

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

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.

To submit a test report form:

- Email to ista@ista.org
- Mail to address shown below
- Fax to +1 517-333-3813.

ISTA Transit Tested Program: Packaged-Product Certification

The ISTA Transit Tested Certification Mark as shown:

- is a registered certification mark **and**
- can only be printed on certified packages **and**
- can only be used by license agreement **and**
- by a Shipper member of the International Safe Transit Association.



When a Shipper member prints this certification mark on a packaged-product, with their manufacturer's license number, they are showing their customer, vendors and carriers that it has passed the requirements of ISTA preshipment testing.

To obtain initial certification of a packaged-product:

- the product manufacturer must be a Shipper member of ISTA in good-standing and with a valid License Agreement on file
- the testing laboratory must be a member of ISTA in good-standing and have a valid lab certification date
- a test report must be submitted by the laboratory to ISTA Headquarters.

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.

If corrugated packaging is used, it is recommended that the basis weights of the constituent papers/paperboards be determined after testing and documented to provide the best indicator of equivalence or change.

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

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

ISTA Membership information is available at www.ista.org.

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