

ISTA 1 Series
Non-
Simulation
Integrity
Performance
Test
Procedure

VERSION
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Last
TECHNICAL
Change:
MARCH
2014

Last
EDITORIAL
Change:
JULY
2022

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

Preface

ISTA, Distributing Confidence, Worldwide™

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 two sections: Overview and Testing

- **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.

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 1G

Test Procedure 1G 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 fixed displacement vibration instead of random vibration, use ISTA Test Procedure 1A and not 1G.
- 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 3A.

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

OVERVIEW OF PROCEDURE 1G

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

EXCEPTION:

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

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.

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	Vibration	Random	Overall G_{rms} level of 1.15	Required
3	Shock (Alternative methods allowed – select one test type)	Drop	Height varies with packaged-product weight	Required
		Incline Impact (Conbur)	Impact Velocity varies with packaged-product weight	
		Horizontal Impact	Impact Velocity varies with packaged-product weight	

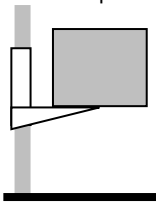
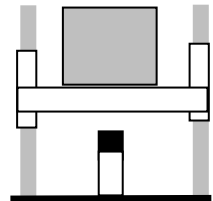
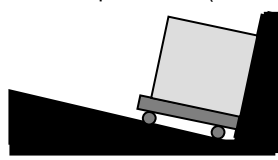
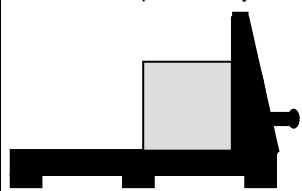
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EQUIPMENT REQUIRED FOR PROCEDURE 1G

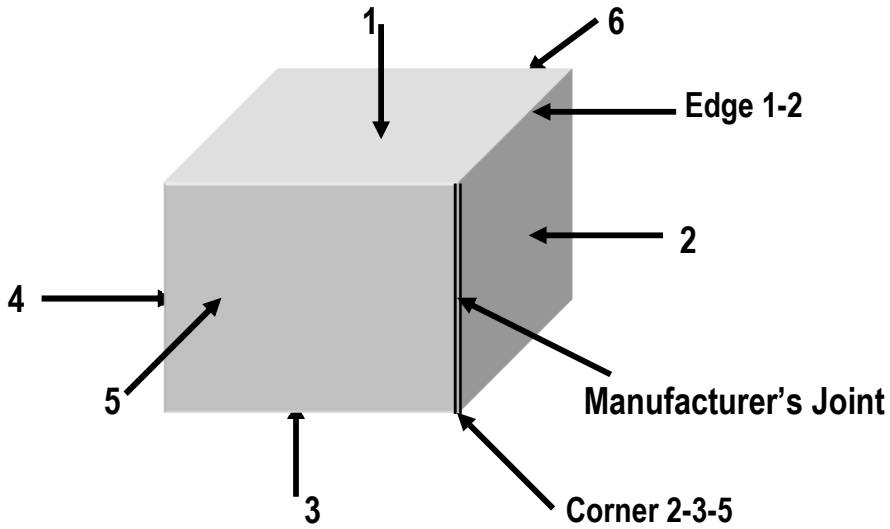
Random Vibration Test:

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

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
Vertical Shock Test	Shock test machine 	ASTM D 5487
Alternative Incline Test	Incline impact tester (conbur) 	ASTM D 880
Alternative Horizontal Test	Horizontal impact test system 	ASTM D 4003

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.

Weight and Size Measurement

Before You Begin Atmospheric Conditioning

Before You Begin Vibration Testing

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 shall be preconditioned to laboratory ambient temperature and humidity for twelve (12) hours prior to testing.

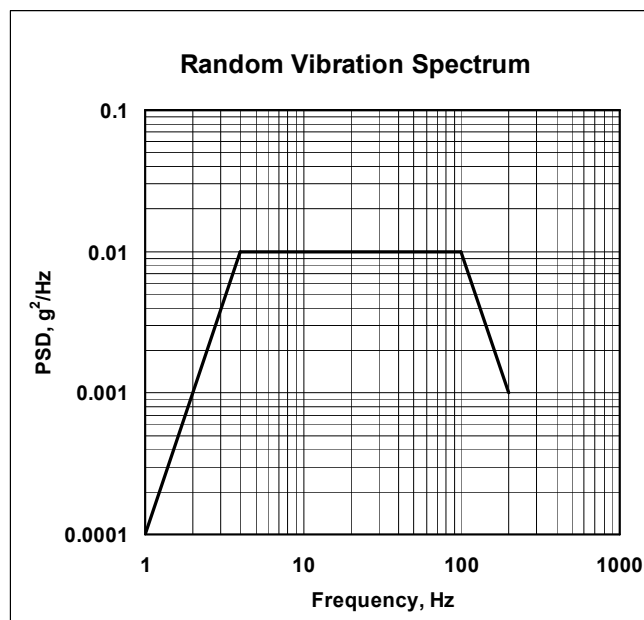
CAUTION:

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.

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



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 or velocity change 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 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.

TEST BLOCK 1
 Atmospheric
 Conditioning
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The test blocks that follow contain tables that indicate the required steps for each test in the procedure.

TEMPERATURE AND HUMIDITY	
Step	Action
1	PRE-CONDITIONING: The packaged-product should be stored at laboratory ambient temperature and humidity for twelve (12) hours prior to testing.
2	Record the ambient laboratory temperature and humidity when testing starts.
3	At the end of testing record temperature and humidity.
4	Go to TEST BLOCK 2 (Vibration).

TEST BLOCK 2
 Vibration

VIBRATION - RANDOM			
Step	Action	TESTING ORIENTATION	VIBRATION DURATION
1	Put the packaged-product on the vibration table so that face 3 rests on the platform.	FACE 3 on table surface	30 MINUTES
2	Start the vibration system to produce the random vibration spectrum indicated in Before You Begin Vibration Testing.		
3	Stop the vibration system after the completion of 30 minutes. Invert the packaged-product so that face 1 (top) rests on the platform.	FACE 1 on table surface	10 MINUTES
4	Begin the vibration duration for this orientation.		
5	Stop the vibration system after the completion of 10 minutes. Place the packaged-product so that either face 2 or 4 rests on the platform.	FACE 2 or 4 on table surface	10 MINUTES
6	Begin the vibration duration for this orientation.		
7	Stop the vibration system after the completion of 10 minutes. Place the packaged-product so that either face 5 or 6 rests on the platform.	FACE 5 or 6 on table surface	10 MINUTES
8	Begin the vibration duration for this orientation.		
9	Stop the vibration testing at the end of 10 minutes.		
10	Vibration testing is now complete. Go to the TEST BLOCK 2 (Shock).		

TEST SEQUENCE FOR PROCEDURE 1G

SHOCK - DROP			
Step	Action		
1	Determine the method(s) of test and the required drop height or impact velocity in Before You Begin Shock Testing.		
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"> If Yes, continue with the next Step. If No, then go to Step 6. 		
3	Test the packaged-product according to the method(s) and level(s) determined in Step 1. Follow the sequence in the table on the next page.		
4	Sequence #	Orientation	Specific face, edge or corner
	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 Reporting an ISTA Test section at the end of this Procedure.		
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.		

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