



ISTA, Your Alliance in Transport Packaging, is the world leader in Performance Tests for Packaged-Products.

ISTA 3 Series tests are advanced tests.

- They challenge the capability of the package and product to withstand transport hazards, **but**
- They use general simulation of 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 3F

Preface

Test Procedure 3F is a general simulation test for packaged-products that are shipped as an individual package from a distribution center to a retail outlet.

- It can be used to evaluate the protective performance of packaged-products related to vibrations, shocks and other stresses normally encountered during handling and transportation.
- The test levels are based on general data and may not represent any specific retail distribution system.
- 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 test unitized loads of this packaged-product being transported to the distribution center, use ISTA Test Procedure 3E.
- Refer to *Guidelines for Selecting and Using ISTA Procedures and Projects* for additional information.

OVERVIEW OF PROCEDURE 3F

Scope

Test Procedure 3F covers testing of individual packaged-products weighing 100 pounds (45 kg) or less shipped as part of a non-unitized load from a distribution center (DC) to a retail facility.

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 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:

Six samples are 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	Optional
3	Shock	Drop	12 and 30 inches (310 and 760 mm)	Required
4	Compression	Machine	Calculated or maximum Test Force	Required
5	Vibration	Random	Overall G_{rms} level of .51	Required
6	Shock	Drop	18 and 24 inches (460 and 610 mm)	Required

EQUIPMENT REQUIRED FOR PROCEDURE 3F

Equipment Required Atmospheric

Atmospheric Conditioning:

- Humidity recording apparatus complying with of the apparatus section of ASTM D 4332-01.
- Temperature recording apparatus complying with the apparatus section of ASTM D 4332-01.

Optional Atmospheric Conditioning

- Chamber and Control apparatus complying with the apparatus section of ASTM D 4332-01.
-

Equipment Required Shock

Free Fall Drop Test:

- Free Fall Drop Test System complying with of the apparatus section of ASTM D 5276-98.
-

Equipment Required Compression

Apply and Release Compression Test:

- Compression Test System complying with the apparatus section of ASTM D 642-00.
-

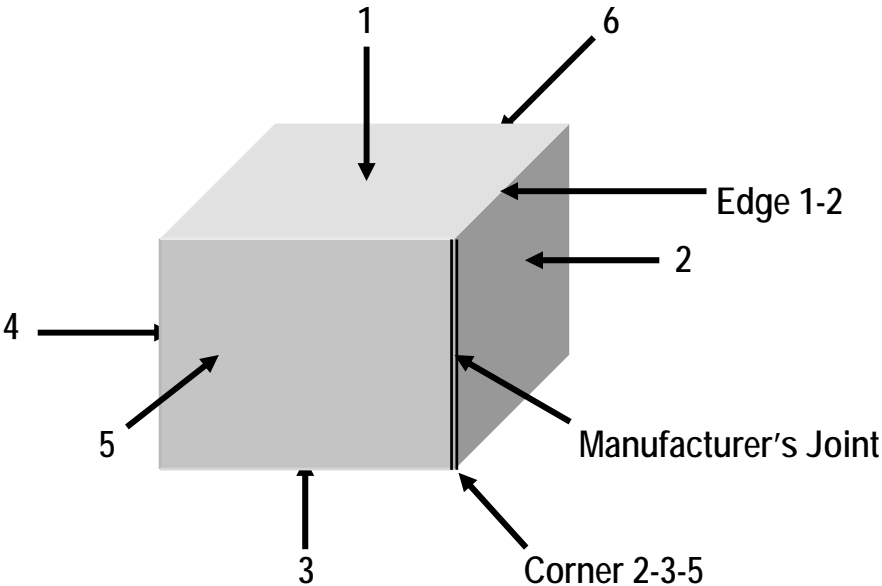
Equipment Required Vibration

Random Vibration Test:

- Random Vibration Test System complying with the apparatus section of ASTM D 4728-01.

BEFORE YOU BEGIN PROCEDURE 3F

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 the next Block.
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 Block.

BEFORE YOU BEGIN PROCEDURE 3F

Packaged-Product
Weight and Size
Measurement

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)

Before You Begin
Atmospheric
Conditioning**Required Preconditioning:**

The packaged-product should be stored prior to climate conditioning at laboratory ambient temperature and humidity for twelve (12) hours.

Before You Begin
Atmospheric
Conditioning
Testing**Optional Conditioning Recommended:** After the required precondition

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 shall be used, **but**
- **Recommends** that both the highest and lowest atmospheric conditions be used.

A separate 3F test sequence should be conducted following each atmospheric condition selected from the table below:

Anticipated Conditions	Time in Hours	Temperature in °C ±2°C (°F ±4°F)	Humidity in %
Frozen or winter ambient	72	-29°C (-20°F)	uncontrolled RH
Refrigerated packages	72	5°C (40°F)	85% RH ±5%
Controlled temperature	72	23°C (72°F)	85% RH ±5%
Tropical (Wet) climate	72	38°C (100°F)	85% RH ±5%
Tropical (Wet) then desert (Dry):	72 then 6	38°C (100°F) then 60°C (140°F)	85% RH ±5% then 30% RH ±5%
Desert or summer ambient	72	50°C (120°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
Compression
Testing

BEFORE YOU BEGIN PROCEDURE 3F

NOTE:

This compression requirement is:

- a performance test, **but not**
- a predictor of warehouse stacking capability.

This is a compression test to simulate 12-pounds/cubic foot (190 kg/m³) of assorted freight on top of a floor loaded shipping unit in a 108-inch (2.7 m) trailer.

Familiarity with the following formula is required:

Compression Test Formula		English Units	Metric Units
Compression - Test Load (C-TF) =		$0.007 \times (108 - H) \times L \times W \times 5$	$190 \times (2.7 - H) \times L \times W \times 5 \times 9.8$
Where			
C-TF	Calculated Compression Test Force	Pounds Force (lbf)	Newtons
	Average density of freight	0.007 lb/in ³	190 kg/m ³
	Height stacked above shipping unit	108 inches	2.7 meters
H	Height of shipping unit	Inches	Meters
L	Length of shipping unit	Inches	Meters
W	Width of shipping unit	Inches	Meters
5	Compensating factor	5	5
	Metric conversion factor	NA	9.8

Use the following table to determine what calculated test load to use in the Compression Test Block.

Step	Action	
1	Calculate a test load using Compression Test Formula in the Before You Begin Block. Then go to the next Step.	
2	Is the package height over 60 inches (1.5 m)? <ul style="list-style-type: none"> • If Yes, then go to Step 4. • If No, then continue with next Step. 	
3	Determine the minimum test force to be used by performing the appropriate action as indicated in the table below:	
	IF the calculated test force from Step 1 is ...	Then use...
	Less than 2000 lbf (8900 Newtons)	the calculated test force as the test force in the Compression Test Block..
	Equal to or greater than 2000 lbf (8900 Newtons)	2000 lbf (8900 Newtons) as the test force in the Compression Test Block.
4	Determine the minimum test force to be used by performing the appropriate action as indicated in the table below:	
	IF the calculated test force from Step 1 is ...	Then use...
	Less than 600 lbf (2700 Newtons)	the calculated test force as the test force in the Compression Test Block.
	Equal to or greater than 600 lbf (2700 Newtons)	600 lbf (2700 Newtons) as the test force in the Compression Test Block.

Before You Begin Vibration Testing

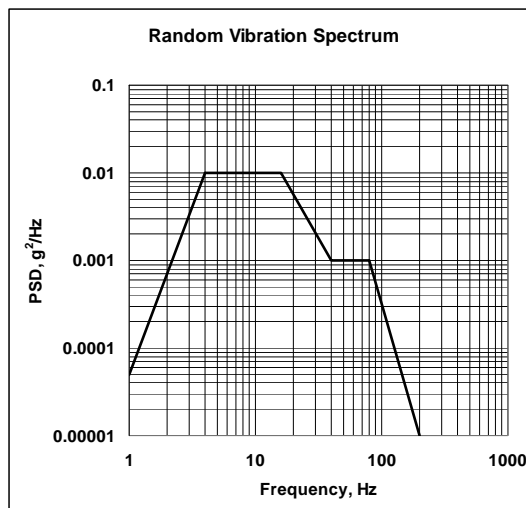
CAUTION:

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 or stack, **but**
- The restraining 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 0.52

Frequency (Hz)	PSD Level, g^2/Hz



Atmospheric
Conditioning
Test Block

TEST SEQUENCE FOR PROCEDURE 3F

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 at laboratory ambient temperature and humidity for twelve (12) hours.
2	Is optional conditioning going to be performed? <ul style="list-style-type: none"> • If Yes, go to Step 6. • If No, go to the next Step.
3	Record the ambient laboratory temperature and humidity when testing starts.
4	At the end of all testing record temperature and humidity.
5	Go to the next First Shock Test Block.
6	Select an anticipated condition from the Before You Begin Block.
7	Check the conditioning apparatus to insure that the temperature and humidity are at the required levels.
8	Place the packaged-product in the conditioning.
9	At the completion of the required conditioning time remove the packaged-product from the conditioning apparatus.
10	Record the ambient laboratory temperature and humidity when testing starts. Go to the First Shock Test Block and perform the remaining test sequence as quickly as possible.

First Shock
Test Block

DROP	
Step	Action
1	Perform a 12-inch (310 mm) face drop on face 3 for all specimens.
2	Perform a 30-inch (760 mm) face drop on face 3 for all specimens.
3	Shock testing is now complete. Go to the Compression Test Block.

Compression
Test Block

COMPRESSION	
Step	Action
1	Center the packaged-product with face 3 resting on the lower platen of the compression tester.
2	Start the test machine and bring the platens together at the rate of one-half (0.5) inch (13 mm) per minute.
3	Increase the force until it reaches the test force determined in the Before You Begin Compression Testing Block and then release the force.
4	Separately repeat Steps 1 through 3 on the five remaining specimens.
5	Is the product damaged? <ul style="list-style-type: none"> • If Yes, then the packaged-product has failed the test, go the Test Report Block. • If No, then go to the Vibration Test Block.

Vibration
Test Block

TEST SEQUENCE FOR PROCEDURE 3F

RANDOM		
Step	Action	
1	Using some form of column stack fixturing, stack specimens 1, 2 & 3 on the center of the vibration table with the all of the face 3's in the down orientation in the following order:	
	Specimen Number	Stack Order
	1	Bottom of Stack
	2	Middle of Stack
	3	Top of Stack
2	Place specimens 4, 5 and 6, each in the orientation shown below (not stacked), somewhere on the remaining vibration surface:	
	Specimen Number	Orientation
	4	Face 3 down
	5	Face 4 down
	6	Face 6 down
3	Start the vibration machine to produce the random vibration spectrum indicated in the Before You Begin Block.	
4	Stop the vibration testing at the end of 30 minutes.	
5	Inspection of the package-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).	
6	Vibration testing is now complete go to Second Shock Test Block.	

Second Shock
Test Block

DROP							
Step	Action						
1	Perform an 18-inch (460 mm) face drop on face 3 for all specimens.						
2	Perform a 24-inch (610 mm) drop. Follow the table below to determine the orientation of the drop.						
	Specimen #	1	2	3	4	5	6
	Orientation	3 face	3-4-5 corner	3-6 edge	2-3-5 corner	2-3 edge	2-5 edge
3	All Testing is now complete. Go to the Test Report Block.						

TEST REPORT FOR PROCEDURE 3F

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 Procedures and Projects*.

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.

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