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

ISTA 3 Series tests are advanced tests and are designed to:

- Challenge the capability of the package and product to withstand transport hazards, but
- Utilize general simulation of actual transport hazards, and
- Do not necessarily comply with carrier packaging regulations.

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

- Product to market time reduced
- Confidence in product launch
- Reduction in damages and product loss
- Balanced distribution costs
- Customer satisfaction contributing to increased market share

There are three sections: Overview, Testing and Report

- Overview provides general knowledge required before testing and
- Testing presents the specific instructions to do laboratory testing 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: SI (Metric) or English system (Inch-Pound). Metric units are shown first followed by the Inch-Pound units in parentheses; there are exceptions in some tables (when showed separately).

Familiarity with the following units and symbols used in this document is required:

For measuring	Metric units and symbols	English units and symbols
Weight	kilograms (kg) or grams (gm)	pounds (lb)
Distance	meters (m) or millimeters (mm)	feet (ft) or inches (in.)
Volume	Cubic centimeters (cm^3)	Cubic inches ($in^{3)}$
Density	kilograms per cubic meter (kg/m^3)	pounds per cubic inch (lb/in^3)
Temperature	Centigrade (°C)	Fahrenheit (°F)
Absolute Pressure	Kilopascal (kPa)	Pounds per square inch (psi)

- 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.

NOTE:
In other ISTA Test Procedures 68 kilograms is used as the conversion from 150 pounds. In 3A, 70 kilograms and 150 pounds are used because it's a common dividing point found in parcel delivery systems from countries that use either metric (SI) or English (inch-pounds) units of measure.

VERY IMPORTANT:

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

3A

OVERVIEW OF PROCEDURE 3A

Preface

Test Procedure 3A is a general simulation test for individual packaged-products shipped through a parcel delivery system. The test is appropriate for four different types of packages commonly distributed as individual packages, either by air or ground. The types include standard, small, flat and elongated packages. 3A includes an optional combination of Vibration and Vacuum (high altitude's lowered air pressure) test. It tests the container's (whether primary package or transport package) ability to hold a seal or closure and the retention of contents (liquid, powder or gas) without leaking.

Standard packaged-products shall be defined as any packaged-product that does not meet any of the following definitions for small, flat or elongated packaged-product:

Small packaged-products shall be defined as any packaged-product where the:

- volume is less than 13,000 cm^3 (800 $in.^3$), and
- longest dimension is 350 mm (14 inches) or less and
- weight is 4.5 kg (10 lb) or less.

Flat packaged-products shall be defined as any packaged-product where the:

- shortest dimension is 200 mm (8 inches) or less and
- next shortest dimension is four (4) or more times larger than the shortest dimension, and
- volume is 13,000 cm^3 (800 in^3) or greater.

Elongated packaged-products shall be defined as any packaged-product where the:

- longest dimension is 900 mm (36 inches) or greater and
- both of the package's other dimensions are each 20 percent or less of that of the longest dimension.

Note:

If a packaged-product is both Flat and Elongated, the package should be tested as Elongated

- Testing can be used to evaluate the protective performance of a packaged-product related to vibrations, shocks and other stresses normally encountered during handling and transportation in a parcel delivery system.
- Test levels are based on general data and may not represent any specific 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.

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

NOTE:

Hazardous material packaging that pass this test procedure may not meet international, national or other regulatory requirements for the transport of hazardous materials. This test in not a substitute for United Nations and/or any other required test standards for the transport of hazardous materials, but should be used as additional test in conjunction with them.

Scope

Test Procedure 3A covers testing of individual packaged-products weighing 70 kilograms (150 pounds) or less when prepared for shipment via a parcel delivery carrier.

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*

OVERVIEW OF PROCEDURE 3A

Samples

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

One sample is required for this test procedure

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:
In order to ensure testing in perfect condition, product and packages shipped to an ISTA laboratory for testing shall be:

- Adequately over-packaged for shipment **or**
- Repackaged in new packaging at the laboratory.

Test Protocols

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

3A - Standard Packaged-Product Test

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 Individual Package	9 Drops - Height varies with packaged-product weight	Required
4	Vibration	Random With and without Top Load	Overall G_{rms} levels of .53 and 0.46.	Required
5	Vibration	Random under a Vacuum	Truck or Truck & Air Dependent	Optional
6	Shock	Drop Individual Package	8 Drops-Height varies with packaged-product weight. Includes drop on hazard	Required

3A – Small Packaged-Product Test

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 Individual Package	9 Drops - Height varies with packaged-product weight	Required
4	Vibration	Random With and without Top Load	Overall G_{rms} level of .53	Required
5	Vibration	Random under a Vacuum	Truck or Truck & Air Dependent	Optional
6	Shock	Drop In a Bag	7 Drops –Height varies with packaged-product weight	Required

OVERVIEW OF PROCEDURE 3A

3A – Flat Packaged-Product Test

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 Individual Package	9 Drops - Height varies with packaged-product weight	Required
4	Vibration	Random With and without Top Load	Overall G_{rms} levels of 0.53 and 0.46.	Required
5	Vibration	Random under a Vacuum	Truck or Truck & Air Dependent	Optional
6	Shock	Rotational Edge Drop	200 mm (8 in.)	Required
7	Shock	Full Rotational Flat Drop	Varies with packaged-product dimensions	Required
8	Shock	Hazard Impact	Hazard Box dropped 400 mm (16 in.)	Required

3A – Elongated Packaged-Product Test

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 Individual Package	9 Drops - Height varies with packaged-product weight	Required
4	Vibration	Random With and without Top Load	Overall G_{rms} levels of 0.53 and 0.46.	Required
5	Vibration	Random under a Vacuum	Truck or Truck & Air Dependent	Optional
6	Shock	Rotational Edge Drop	200 mm (8 in.)	Required
7	Shock	Full Rotational Flat Drop	Varies with packaged-product dimensions	Required
8	Shock	Bridge Impact	Hazard Box dropped 400 mm (16 in.)	Required

EQUIPMENT REQUIRED FOR PROCEDURE 3A

Equipment Required Atmospheric

Atmospheric Conditioning:

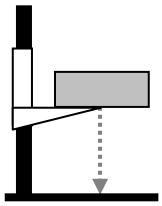
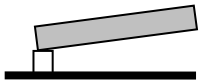
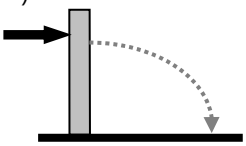
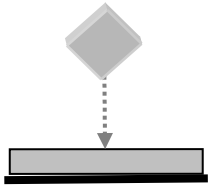
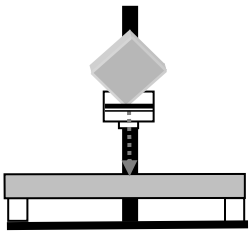
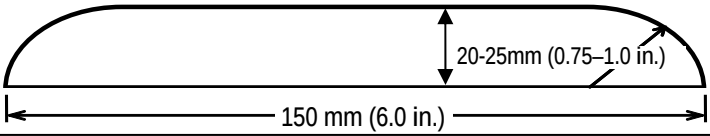
- Humidity recorder complying with of the apparatus section of ISO 2233-00 or ASTM D 4332-00(-01).
- Temperature recorder complying with the apparatus section of ISO 2233-00 or ASTM D 4332-00(-01).

Optional Atmospheric Conditioning

- Chamber and Control apparatus complying with the apparatus section of ISO 2233-00 or ASTM D 4332-00(-01).

Equipment Required Shock

Shock Tests:

	All Protocols	Flat and Elongated	Flat	Elongated
Type of Shock Test	Drop Test	Rotational Edge Drop Test Full Rotational Test	Hazard Impact Test	Bridge Impact Test
Type of Equipment	Free-fall drop tester 	1) Support Block  2) 	Hand Drop with Hazard Box 	Free-fall Drop Tester with Hazard Box 
In compliance with the apparatus section of...	ISO 2248-85 or ASTM D 5276-98	ISO 2876-85 or ASTM D 6179-97		ASTM D 5265-98 With the exception of the Hazard Box (Impactor) See below
Additional Required Equipment	Hazard block: 25 mm in height 150 mm in width (1 in. x 6 in.) and at least 200 mm (8 in.) longer than the second shortest package dimension.	Support block: 90 to 100 mm (3.5 to 4.0 in) in height and width and at least 200 mm (8 in) longer than the shortest dimension of face 3.	Hazard box 300 x 300 x 300 mm (12 x 12 x 12 in.) dense wooden box with a total weight of 4.1 kg (9 lb) The box shall have least one bottom edge covered by angle iron. The box should be filled with a sand bag and void fill to hold the bag in place.	
				Support blocks (2) 90 to 100 mm (3.5 to 4.0 in) in height and width and at least 200 mm (8 in) longer than the shortest dimension of face 3.
	Hazard block: The block shall be made of hardwood or metal. The height shall be 20 to 25 mm (0.75 to 1.0 in.) and the width 150 mm (6.0 in.). The length shall be at least 200 mm (8.0in.) longer that the second shortest package dimension of the length, width and height. The long top edges of the block shall be rounded to a radius equal to the height of the block ± 0.02mm (0.0625 in). 			

EQUIPMENT REQUIRED FOR PROCEDURE 3A

Equipment Required Vibration

Random Vibration Test:

- Random Vibration Test System complying with the apparatus section of ISO 13355-01 or ASTM D 4728-95(-01).
- Some form of column stack fixturing
- Top-Load RSC corrugated package
- Plastic bags
- Sand

Optional Random Vibration under Vacuum:

- Vacuum Chamber: complying with the apparatus section of ISO 2873-00 or ASTM D6653-01; able to fit on the vibration table; able to draw down the internal absolute pressure to 60 kPa (8.7 psi) for the truck and air test, or 70 kPa (10 psi) for the truck-only test; and able to withstand the air and/or truck random vibration input.

Equipment Required Additional

3A - Small

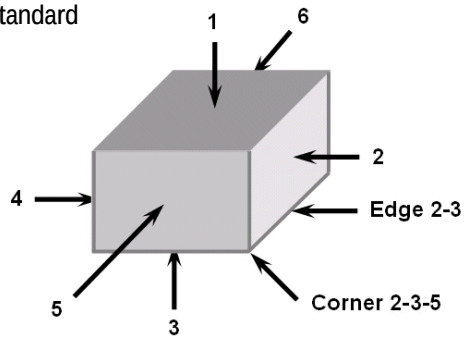
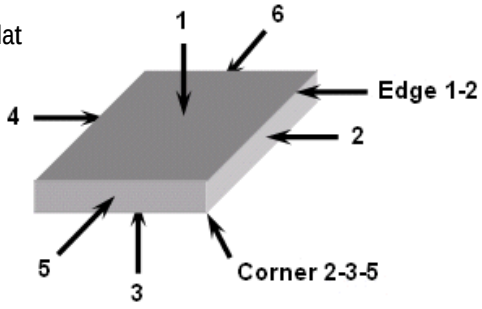
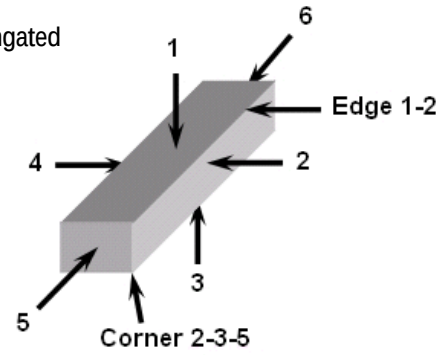
- Two United States Postal Service #1 Mailbags or equivalent [approximately 1.0 x 0.7 meters (39 x 27 inches)] are used throughout the testing sequence.
  - One bag is filled with 36 kilograms (80 pounds) of sand suitably packaged in smaller bags.
  - One bag is the Sample Bag to be filled with the Test Specimen and dunnage packages, to simulate a typical pack.
- Three over-night style envelopes, 1 #5 padded mailer and 1 #6 fiberboard mailer.
- Corrugated fiberboard containers as described in the table below are to be constructed of C-flute board with any of the following minimum values:
  - Burst Test: 1380 kPa or 14 kg/cm^2 or 200 lb/in^2 or
  - ECT Value: 7.0 kN/m width or 40 lb/in. width.
  - RSC style boxes shall be used for any dunnage package 125 mm (5 in.) or more in height and
  - Book-wrap or telescoping tray style may be used for any dunnage package less than 125 mm (5 in.) in height.
- Fill each envelop, mailer and corrugated container as indicated in the table below. Corrugated boxes and book wraps are filled until the desired weight is achieved.
  - It is allowable to substitute dunnage packages with Test Specimen packages or envelopes. The dunnage package that most closely represents the Test Specimen shall be substituted.

The following describes the numbers and sizes of each dunnage package:

Quantity	Package Type	Approximate Size L x W x H		Contents	Approximate Weight	
		Millimeters (mm)	Inches (in.)		Kilograms	Pounds
3	Over-night envelope			25 sheets of paper		
1	#5 Padded mailer			50 sheets of paper		
1	#6 Fiberboard mailer			50 sheets of paper		
1	Corrugated RSC or Book-wrap or Telescoping tray	200 x 125 x 50	8 x 5 x 2	Each corrugated package type and size shall be filled with foam, paper, sand, etc until the desired weight indicated in this table is achieved.	0.5	1.0
1		225 x 150 x 50	9 x 6 x 2		0.5	1.0
1		275 x 275 x 100	11 x 11 x 4		1.0	2.0
1		275 x 200 x 100	11 x 8 x 4		1.0	2.0
1		175 x 150 x 100	7 x 6 x 4		1.8	4.0
1		300 x 300 x 75	12 x 12 x 3		1.8	4.0
1	Corrugated RSC box	200 x 200 x 200	8 x 8 x 8		4.5	10.0
1		150 x 150 x 150	6 x 6 x 6		1.0	2.0
1		250 x 125 x 125	10 x 5 x 5		1.0	2.0

BEFORE YOU BEGIN PROCEDURE 3A

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

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td>1</td><td colspan="2">Place the packaged-product so the package is in its most stable orientation.</td></tr>
<tr><td></td><td>IF the test specimen is ...</td><td>IF the test specimen is ...</td></tr>
<tr><td></td><td>A Standard, Small, Flat or Elongated with only six faces (2 sides, 2 ends, top and bottom)</td><td>Turn the packaged-product so that one of the smallest side faces is directly in front of you. Now go to Step 2.</td></tr>
<tr><td></td><td>A Standard, Small, Flat or Elongated with less than or more than six faces</td><td>Develop a method to identify each face, edge and corner and document with a diagram. Now go to the next Block.</td></tr>
<tr><td></td><td>A filled #1 mail bag</td><td>Turn the filling end toward you and a side seam (if any) is on the right and downward (nearest the surface). A longitudinal seam (middle seam), if present should be downward and resting on the surface. Now go to Step 2.</td></tr>
<tr><td></td><td>An express envelope or similar type mailer</td><td>Position the envelope or mailer so that is it lying flat and the opening is toward you. Now go to Step 3.</td></tr>
<tr><td>2</td><td>Standard
 
</td><td>Filled #1 Mail Bag
 
</td></tr>
<tr><td></td><td>Flat
 
</td><td>Elongated
 
</td></tr>
<tr><td></td><td colspan="2">Identify faces according to the diagrams.
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.
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.
Identify orientation of the product inside the package as it rests on the vibration table.</td></tr>
<tr><td>3</td><td colspan="2">Mark the face that is up as 1.
The right end is 2.
The left end is 4
The opening of the envelope shall be 5 (top)
The end opposite 5 (top) shall be 6 (bottom).
Turn it over and mark the face opposite of face 1 as 3.
Express Envelope or Mailer
  </td></tr>
</table>

BEFORE YOU BEGIN PROCEDURE 3A

Packaged-Product Weight and Size Measurement

You shall know the packaged-products:

- Gross weight in kilograms (kg) for Metric and pounds (lb) for English units
- Outside dimensions of Length, Width and Height (L x W x H) in millimeters (mm) or meters (m) for Metric and inches (in.) or feet (ft) for English units.

Before You Begin Atmospheric Conditioning

Required Preconditioning:

Package Type:	
☑Standard	☑Small (not in bag)
☑Flat	☑Elongated

The packaged-product shall be preconditioned to laboratory ambient temperature and humidity for twelve (12) hours before 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 of the product, but
- Recommends that both the highest and lowest atmospheric conditions be used.

A separate 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	(73°F)	85% RH ±5%
Standard Laboratory*	8*	23°C	(73°F)	50% RH ±5%
Tropical (Wet) climate	72	38°C	(100°F)	85% RH ±5%
Tropical (Wet) then desert (Dry):	72 then 6	38°C then 60°C	(100°F) (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

* Conditioning of the test specimen only required before the start of the Optional Vibration under Vacuum Test Block.

Before You Begin Shock Testing

Drop heights and package orientations are determined by the package type and/or its weight:

Package Type		Weight	Drop Orientations
☑Standard ☑Flat	☑Small (not in bag) ☑Elongated	less than (<) 32 kg (70 lb) 32 kg (70 lb) to 70 kg (150 lb)	Faces, Edges and Corners
☐Standard ☐Flat	☑Small (in bag) ☐Elongated	Weight does not determine drop height	Faces, Top and Bottom
Additional drops			
☑Standard ☐Flat	☐Small ☐Elongated	less than (<) 32 kg (70 lb) 32 kg (70 lb) to 70 kg (150 lb)	Face 3 Package Drop on Hazard
☐Standard ☑Flat	☐Small ☑Elongated	Weight does not apply to this type of test	Rotational Edge Drop on 3 Face 3 edges
☐Standard ☑Flat	☐Small ☑Elongated	Weight does not apply to this type of test	Full Rotational Flat Drop on Face 3
☐Standard ☑Flat	☐Small ☐Elongated	Hazard Box is 4.1 kg (9 lb)	Concentrated Impact on Face 1 (top)
☐Standard ☐Flat	☐Small ☑Elongated	Hazard Box is 4.1 kg (9 lb)	Bridge Impact on Face 1 (top)

BEFORE YOU BEGIN PROCEDURE 3A

Before You Begin Shock Testing

NOTE:

When drop testing Flat or Elongated Packages on small or narrow faces, or edges and corners adjoining those faces, you should prevent the package from falling over and incurring a second impact unless safety is a major concern. You may use a restraining system or catch the package. Please make a note in the test report as to whether or not the package was caught.

CAUTION:

Catching a package after a drop test may be dangerous. Great care should be taken to insure the safety of anyone catching a package after an initial drop.

Before You Begin Vibration Under Dynamic Load Testing

CAUTION:

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

- Prevent the Top-Load from moving off the package being tested and
- Prevent the test specimen from moving off the platform and
- Maintain test orientation of the stack, but
- The device or devices shall not restrict the vertical motion of the test specimen during the test.

CAUTION:

When using weights and a load spreader use extreme caution to prevent injury during stacking, testing and removal.

Number of axes and package orientations to be tested:

Type of Package	Number of Axes to Test	Orientations to Test	Dynamic Top-Load Range
Standard	3	3	11 kg – 140 kg (25 lb – 300 lb)
Small in Bag	1	2	36 kg (80 lb)
Flat	3	3	11 kg – 140 kg (25 lb – 300 lb)
Elongated	3	3	11 kg – 140 kg (25 lb – 300 lb)

Dynamic Top-Load – Small

A #1 Mailbag or equivalent filled with 36 kg (80 lb.) of sand suitably packaged in smaller bags.

Sample Bag with Test Specimen - Small

Randomly fill the second #1 Mailbag or equivalent approximately one- half full of the filled dunnage packages described in the table found in the Vibration Equipment section, pack the test specimen into the middle of the bag and then insert the remaining dunnage packages into the bag to simulate a typical pack.

Dynamic Top-Load – Standard, Flat and Elongated

The Top-Load is to simulate the effect of 100 kg/m^3 (6 lb/ft^3 - .0035 lb/in^3) of assorted freight on top of a floor loaded shipping unit in an over-the-road trailer with an inside height of 2.7 m (108 in.).

The Dynamic Top-Load for each axis is determined by

- Starting with the possible height within a tractor trailer of 2.7 meters (108 inches) and
- Subtracting the vertical dimension of the package in the axis of the test and
- Taking the resultant and multiply it by each dimension of the other two axes, and
- Multiplying that resultant by the Loading Factor and
- That will be the Top-Load in kilograms (pounds) for the vibration test, unless
- That value is less than 11 Kilograms (25 pounds) then you will not use a Top-Load, or
- If that value is greater than 140 kilograms (300 pounds) you will use a Top-Load of 140 kilograms (300 pounds).

The Loading Factor has been determined by empirical testing that resulted in correlation between damage in the test lab and damage in the field. The Loading Factor is calculated by

- Starting with the estimated average density of a trailer of parcel packages at 200 kg/m^3 (12 lb/ft^3) and
- For Metric units use 200 kg/m^3 or
- For English units, divide 12 lb/ ft^3 by (1728 in^3/ft^3) to get .007 lb/in^3 and
- Multiply 200 kg/m^3 (0.007 lb/in^3) by 0.5 to get the Loading Factor of 100 kg/m^3 (.0035 lb/in^3).

Continued

BEFORE YOU BEGIN PROCEDURE 3A

The Top-Load package shall be

- A Regular Slotted Container (RSC) of sufficient strength and ability to hold a load spreader and required weight for each axis and
- The face dimensions of the Top-Load package which will be applied to the Top-Load shall not be shorter than the two dimensions of the test specimen's top face when positioned for testing, but
- The face dimensions may be longer by 25 mm (1 in.) than the two dimensions of the test specimen's top face when positioned for testing and
- Some means of adding additional weight so that the Top-Load (TL) is distributed evenly over the entire inside face area of the Top-Load package that will apply the Top-Load to the top face of the test specimen when it's positioned for testing and
- Adequate void fill that shall securely hold the weight in place to prevent the weight from moving or bouncing within the top-load package and
- The combined weight of the Top-Load package shall equal the Top-Load weight, ± three percent (3%) as determined in the following tables.

Familiarity with the following formulas is required:

Top-Load Formulas TL		Metric Units in Meters	English Units in Inches
Top-Load (TL–H) with face 3 down	TL1	(2.7 – H) x L x W x 100	(108 – H) x L x W x 0.0035
Top-Load(TL–W) with face 4 down	TL2	(2.7 – W) x L x H x 100	(108 – W) x L x H x 0.0035
Top-Load (TL–L) with face 6 down	TL3	(2.7 – L) x W x H x 100	(108 – L) x W x H x 0.0035

Where			
TL	Total Weight of the Top-Load Package	Kilograms	Pounds
2.7 m (108 in.)	Height of typical trailer	Meters	Inches
H	Height of shipping unit	Meters	Inches
L	Length of shipping unit	Meters	Inches
W	Width of shipping unit	Meters	Inches
Loading Factor	50% of the Average density of freight	0.0035 lb/in^3	100 kg/m^3

Determine the Maximum Top-Load weight with the following Table

Maximum Top-Load weight (TL) for any Axis	
Determine the Top-Load weight to be used for each axis by comparing the calculated TL against the following statements.	
IF the calculated Top-Load for an axis is ...	THEN ...
Less than 11kg (25 lb)	Do not use a Top-Load during vibration testing.
11 kg (25 lb) to 140 kg (300 lb)	Use the calculated Top-Load (TL) rounded up to the next closest increment of 11 kg (25 lb) for that axis.
Greater than 140 kg (300 lb)	Use 140 kg (300 lb) as the Top-Load (TL)

BEFORE YOU BEGIN PROCEDURE 3A

Determine the Maximum Vacuum Pressure with the following Table

Maximum Vacuum Pressure (VP)	
IF the Test Specimen will be shipped via...	THEN ...
Truck Only	Use an absolute pressure of 70 kPa (10 psi) (approximate altitude equivalent of 3000 m (10,000 ft))
Truck and Air	Use an absolute pressure of 60 kPa (8.7 psi) (approximate altitude equivalent of 4250 m (14,000 feet))

NOTE: There are two ways of measuring pressure (vacuum), absolute pressure or gage pressure. Both measure pressure in kilopascals (kPa) or pounds per square inch (psi). Absolute pressure is measured relative to absolute zero pressure. Gage Pressure uses atmospheric pressure (101.3 kPa, 14.7 psi) as a zero reference.

Examples:

Given a gage pressure reading, calculate absolute pressure as follows: Absolute pressure = gage pressure reading + atmospheric pressure [101.3 kPa (14.7 psi)]. Note: gage pressure readings for vacuum (altitudes above sea level) are negative. Given an absolute pressure reading, calculate gage pressure as follows: Gage pressure = absolute pressure – atmospheric pressure [101.3 kPa (14.7 psi)].

The following Table shows pressure conversions

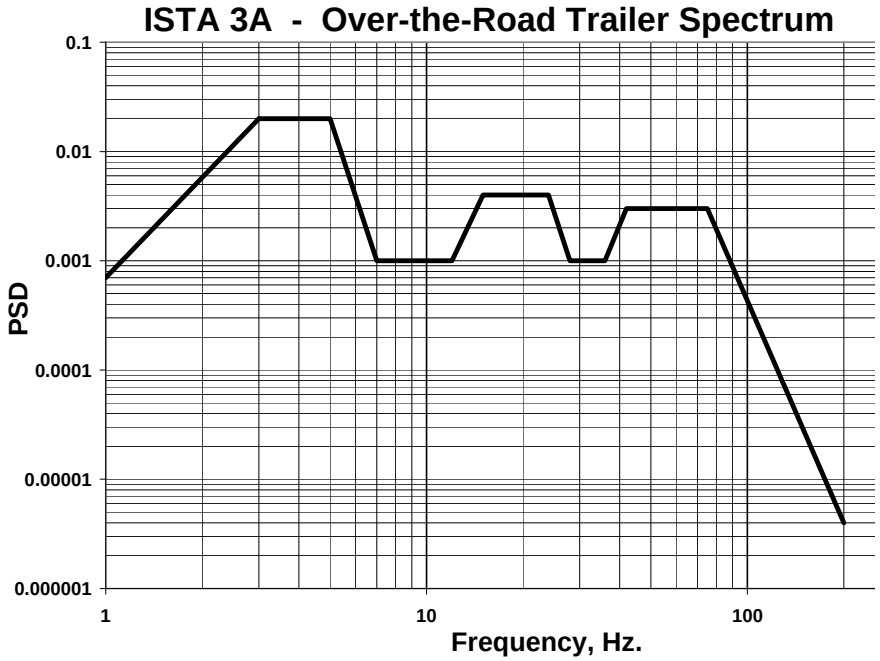
Metric Units				English Units			
Altitude Above Sea Level	Barometric Reading	Absolute Pressure	Gage Pressure	Altitude Above Sea Level	Barometric Reading	Absolute Pressure	Gage Pressure
Meters (m)	mm HG	kPa	kPa	Feet (ft)	In. HG	psi	psi
0	760	101.3	0	0	29.92	14.7	0
3,048	522.84	69.7	-31.6*	10,000	20.6	10.11	-4.59*
4,267	446.33	59.5	-41.8*	14,000	17.57	8.63	-6.07*

*Negative gage pressures are sometimes referred to as “vacuum kPa” or “vacuum psi”.

Over-the Road Trailer Simulation

The following breakpoints are for an over-the-road trailer typical for parcel delivery movement and shall be programmed into the vibration controller to produce the acceleration versus frequency profile (spectrum) with an overall G_{rms} level of 0.53 (see below). The theoretical stroke required to run this vibration profile is 1.855 inches (47.12 mm):

Frequency (Hz)	PSD Level, g^2/Hz
1	0.0007
3	0.02
5	0.02
7	0.001
12	0.001
15	0.004
24	0.004
28	0.001
36	0.001
42	0.003
75	0.003
200	0.000004



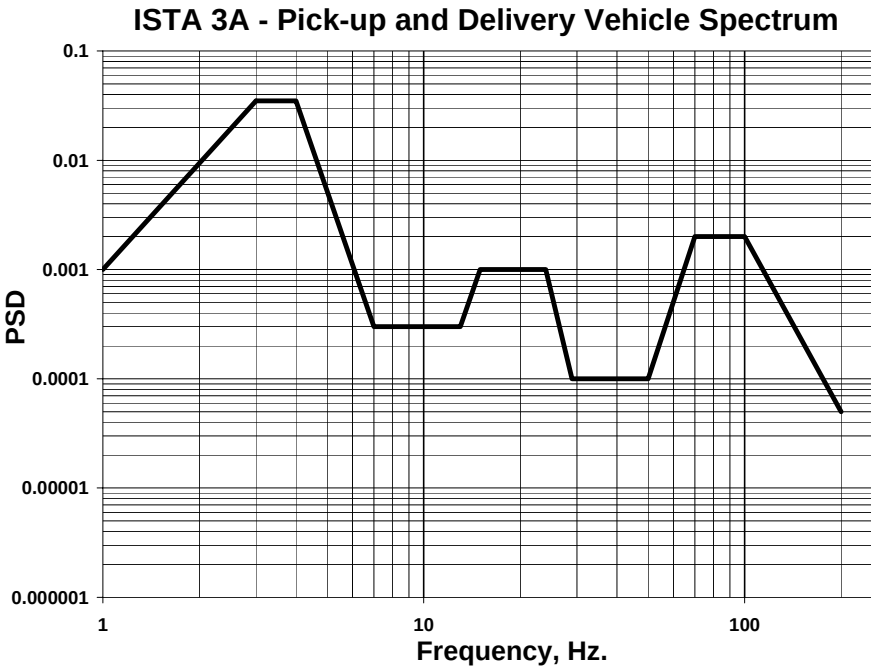
Continued

BEFORE YOU BEGIN PROCEDURE 3A

Pick-Up and Delivery Vehicle Simulation

The following breakpoints are for a pick-up and delivery vehicle and shall be programmed into the vibration controller to produce the acceleration versus frequency profile (spectrum) with an overall G_{rms} level of 0.46 (see below). The theoretical stroke required to run this vibration profile is 2.312 inches (58.72 mm):

Frequency (Hz)	PSD Level, g^2/Hz
1	0.001
3	0.035
4	0.035
7	0.0003
13	0.0003
15	0.001
24	0.001
29	0.0001
50	0.0001
70	0.002
100	0.002
200	0.00005



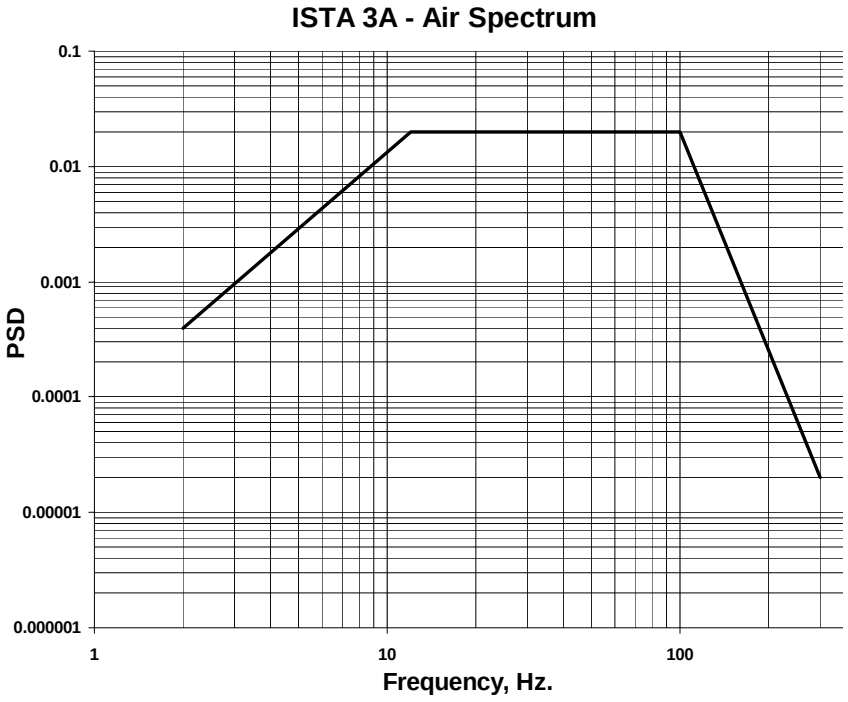
Air Simulation

The following breakpoints are for an air shipment and shall be programmed into the vibration controller to produce the acceleration versus frequency profile (spectrum) with an overall G_{rms} level of 1.05 (see below). The theoretical stroke required to run this vibration profile is 0.296 inches (7.52 mm):

NOTE:

- Because air shipments involves some truck transport, the Air test includes Truck and Air and portions.
- This spectrum is to be used for Vibration Under Vacuum only.

Frequency (Hz)	PSD Level, g^2/Hz
2	0.0002
12	0.01
100	0.01
300	0.00001



TEST SEQUENCE FOR PROCEDURE 3A

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

<table>
<tr><th colspan="4">TEMPERATURE AND HUMIDITY</th></tr>
<tr><th>Step</th><th colspan="3">Action</th></tr>
<tr><td>1</td><td colspan="3">The packaged-product should be stored at laboratory ambient temperature and humidity for twelve (12) hours.</td></tr>
<tr><td>2</td><td colspan="3">Is optional conditioning or vibration under vacuum going to be performed?
• If Yes, go to Step 6.
• If No, go to the next Step.</td></tr>
<tr><td>3</td><td colspan="3">Record the ambient laboratory temperature and humidity when testing starts.</td></tr>
<tr><td>4</td><td colspan="3">At the end of all testing record temperature and humidity.</td></tr>
<tr><td>5</td><td colspan="3">Go to the next First Shock Test Block.</td></tr>
<tr><td>6</td><td colspan="3">Select an anticipated condition from the Before You Begin Block.</td></tr>
<tr><td>7</td><td colspan="3">Check the conditioning apparatus to insure that the temperature and humidity are at the required levels.</td></tr>
<tr><td>8</td><td colspan="3">Place the packaged-product in the conditioning.</td></tr>
<tr><td>9</td><td colspan="3">At the completion of the required conditioning time remove the packaged-product from the conditioning apparatus.</td></tr>
<tr><td rowspan="3">10</td><td colspan="3">Condition is complete. Determine the next Test Block according to the following table:</td></tr>
<tr><td colspan="2">IF the testing …</td><td>THEN …</td></tr>
<tr><td colspan="2">Will not include the Optional Vibration under Vacuum Test</td><td>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.</td></tr>
<tr><td colspan="2">Will include the Optional Vibration under Vacuum Test</td><td>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. Then after the completion of the Random Vibration test block, come back to the Conditioning for Optional Vibration under Vacuum in the following test block.</td></tr>
</table>

TEMPERATURE AND HUMIDITY FOR VIBRATION UNDER VACUUM	
Step	Action
1	Set the temperature and humidity according to the Standard Laboratory values in the Before You Begin Atmospheric Conditioning (23°C (73°F) and 50% RH).
2	Check the conditioning apparatus to insure that the temperature and humidity are at the required levels.
3	Place the packaged-product in the conditioning.
4	At the completion of the required conditioning (8 hours) remove the packaged-product from the conditioning apparatus.
5	Record the ambient laboratory temperature and humidity when testing starts. Go to the Vibration under Vacuum Test Block and perform the remaining test sequence as quickly as possible.

3A

First Shock Test Block

For STANDARD, SMALL, FLAT and ELONGATED

TEST SEQUENCE FOR PROCEDURE 3A

DROP						
Step	Action					
1	Complete the following test sequence for each type of package that has a check in the box:			☑Standard ☑Small (do not test in bag) ☑Flat ☑Elongated		
2	Follow the table below to determine the height and orientation for the first 9 drops.					
	Drop Number	< 32 kg (70 lb)	32-70 kg (70-150 lb)	Standard	Flat	Elongated	Small (out of bag)
	1	460 mm. (18 in)	300 mm (12 in.)	Edge 3-4			
	2	460 mm. (18 in)	300 mm (12 in.)	Edge 3-6			
	3	460 mm. (18 in)	300 mm (12 in.)	Edge 4-6			
	4	460 mm. (18 in)	300 mm (12 in.)	Corner 3-4-6			
	5	460 mm. (18 in)	300 mm (12 in.)	Corner 2-3-5			
	6	460 mm. (18 in)	300 mm (12 in.)	Edge 2-3			
	7	460 mm. (18 in)	300 mm (12 in.)	Edge 1-2			
	8	910 mm (36 in.)	600 mm (24 in.)	Face 3			
	9	460 mm. (18 in)	300 mm (12 in.)	Face 3			
3	Shock test is now complete. Go to the Vibration Under Dynamic Load Test Block						

Vibration Test Block

For STANDARD, FLAT and ELONGATED

DYNAMIC LOAD –RANDOM		
Step	Action	
1	Complete the following test sequence for each type of package that has a check in the box:	☑Standard ☐Small ☑Flat ☑Elongated
2	Place the packaged-product on the center of the vibration table so that face-3 rests on the platform.	
3	Place the Dynamic Top-Load package as determined in the Before You Begin Vibration Under Dynamic Load Testing Block for TL-H on top of the test specimen.	
4	Using some form of column stack fixturing to make sure that the stack maintains its orientation without restricting the vertical motion of the Top-Load package or the test specimen.	
5	Start the vibration machine to produce the Over-the-Road random vibration spectrum indicated in the Before You Begin Block.	
6	After 60 minutes, stop the vibration testing and remove the Dynamic Top-Load package(s).	
7	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).	
8	Rotate the test specimen so that face-4 rests on the center of the vibration table platform.	
9	Place the Dynamic Top-Load package as determined in the Before You Begin Vibration Under Dynamic Load Testing Block for TL-L on top of the test specimen.	
10	Using some form of column stack fixturing to make sure that the stack maintains its orientation without restricting the vertical motion of the Top-Load package or the test specimen.	

Continued

3A

Vibration Test Block Continued

For STANDARD, FLAT and ELONGATED

TEST SEQUENCE FOR PROCEDURE 3A

11	Start the vibration machine to produce the Over-the-Road random vibration spectrum indicated in the Before You Begin Block.	
12	After 30 minutes, stop the vibration testing and remove the Dynamic Top-Load package(s).	
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	Rotate the test specimen so that face-6 rests on the center of the vibration table platform.	
15	Place the Dynamic Top-Load package as determined in the Before You Begin Vibration Under Dynamic Load Testing Block for TL-W on top of the test specimen.	
16	Using some form of column stack fixturing to make sure that the stack maintains its orientation without restricting the vertical motion of the Top-Load package or the test specimen.	
17	Start the vibration machine to produce the Over-the-Road random vibration spectrum indicated in the Before You Begin Block.	
18	After the completion of 30 minutes, stop the vibration testing and remove the Dynamic Top-Load package(s).	
19	Testing is complete. Determine the next Test Block according to the following table:	
	IF the test specimen type is ...	THEN ...
	Small	Go to the next Vibration Test Block.
	Standard, Flat or Elongated	Skip the next Test Block and go to the Random Test Block

Vibration Test Block

For SMALL

DYNAMIC LOAD AND RANDOM		
Step	Action	
1	Complete the following test sequence for each type of package that has a check in the box:	☐Standard ☑Small (test in bag) ☐Flat ☐Elongated
2	Place the specimen bag on the center of the vibration table with face 1 in the down orientation.	
3	Place a #1 mailbag filled with 36 kg (80 pounds) of sand on top of the test specimen.	
4	Start the vibration machine to produce the Over-the-Road random vibration spectrum indicated in the Before You Begin Block.	
5	Stop the vibration machine at the completion of 30 minutes.	
6	Turn the bag over so that face 2 is in the down orientation.	
7	Place a #1 mailbag filled with 36 kg (80 pounds) of sand on top of the test specimen.	
8	Start the vibration machine to produce the Over-the-Road random vibration spectrum indicated in the Before You Begin Block.	
9	Stop the vibration testing at the end of 30 minutes.	
10	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).	
11	Vibration testing is now complete. Go to the next Vibration Test.	

3A

TEST SEQUENCE FOR PROCEDURE 3A

Vibration Test Block

For STANDARD, SMALL, FLAT and ELONGATED

RANDOM			
Action			
1	Complete the following test sequence for each type of package that has a check in the box:	☑Standard ☑Small (do not test in bag) ☑Flat ☑Elongated	
2	Place the packaged-product on the center of the vibration table so that face-3 rests on the platform.		
3	Do not place a Dynamic Top-Load package on top of the test specimen.		
4	Start the vibration machine to produce the Pick-Up and Delivery Vehicle random vibration spectrum indicated in the Before You Begin Block.		
5	After the completion of 30 minutes, stop the vibration testing.		
6	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).		
7	Testing is complete. Determine the next Test Block according to the following table:		
	IF you choose…	THEN …	
	To conduct the Optional Vibration under Vacuum testing.	Go to the next Vibration Test Block.	
	Not to conduct the Optional Vibration under Vacuum testing.	Vibration testing is complete. Go to the appropriate Second Shock Test Block.	

Optional Vibration Test Block

For STANDARD, SMALL, FLAT and ELONGATED

OPTIONAL VACUUM AND RANDOM			
Action			
1	Note: This Test Block is optional. Condition the test specimen according to the Temperature and Humidity for Vibration under Vacuum test block. Complete the following test sequence for each type of package that has a check in the box:	OPTIONAL TEST ☑Standard ☑Small (test in bag) ☑Flat ☑Elongated	
2	Place test specimen so that face-6 rests in the center of the bottom surface of the vacuum chamber. Do not place a Dynamic Top-Load package on top of the test specimen.		
3	Place the vacuum chamber on the vibration table platform and seal the vacuum chamber.		
4	Turn the vacuum source on and adjust it to reduce the pressure at a rate of 305 meters (1000 feet) per 30-60 seconds. Stop and hold the vacuum at an absolute pressure of 70 kPa (10 psi), approximately equal to an altitude equivalent of 3000 m (10,000 ft.).		
5	Maintain the vacuum, start the vibration machine to produce the Over-the-Road random vibration spectrum according to the table below and indicated in the Before You Begin Block.		
6	Stop the vibration testing after the completion of 60 minutes.		
7	Release the vacuum at a rate of 305 meters (1000 feet) per 30-60 seconds. Then remove the vacuum chamber from the vibration platform and then the test specimen from the vacuum chamber.		
8	Inspection of the packaged-product for leakage or 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).		
	IF the Test Specimen will be shipped via…	Then…	
	Truck Only	Vibration testing is now complete. Go to the appropriate Second Shock Test Block	
	Air	Go to the next Step.	

TEST SEQUENCE FOR PROCEDURE 3A

9	Place test specimen so that face-6 rests in the center of the bottom surface of the vacuum chamber. Do not place a Dynamic Top-Load package on top of the test specimen
10	Place the vacuum chamber on the vibration table platform and seal the vacuum chamber.
11	Turn the vacuum source on and adjust it to reduce the pressure at a rate of 305 meters (1000 feet) per 30-60 seconds. Stop and hold the vacuum at an absolute pressure of 60 kPa (8.7 psi) approximately equal to an altitude of 4200 m (14,000 ft.)
12	Maintain the vacuum, start the vibration machine to produce the Air random vibration spectrum according to the table below and indicated in the Before You Begin Block.
13	Stop the vibration testing after the completion of 60 minutes.
14	Release the vacuum at a rate of 305 meters (1000 feet) per 30-60 seconds. Then remove the vacuum chamber from the vibration platform and then the test specimen from the vacuum chamber.
15	Inspection of the packaged-product for leakage or 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).
16	Vibration testing is now complete. Go to the appropriate Second Shock Test Block

Second Shock Test Block

For STANDARD and SMALL

DROP

Step	Action		
1	Complete the following test sequence for each type of package that has a check in the box:	☑Standard ☐Flat	☑Small (test in bag) ☐Elongated

2 Follow the table below to determine the height and orientation for the final set of 8 drops for Standard packages and 7 drops for Small packages in a bag.

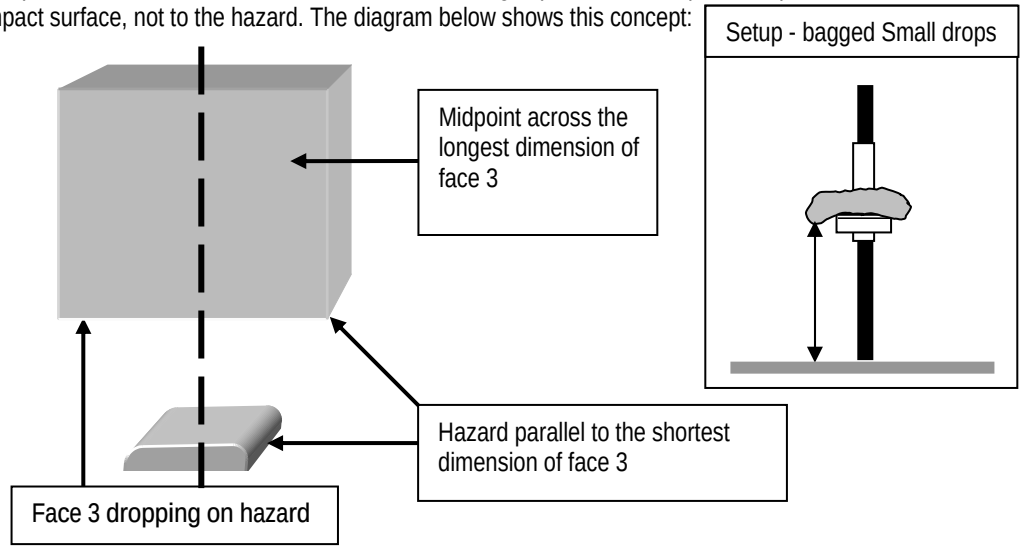
Drop Number	Drop Height			Test Specimen	
	< 32 kg (70 lb)	32-70 kg (70-150 lb)	Small (in a bag)	Standard	Small (in a bag)
10	460 mm. (18 in)	300 mm (12 in.)	24 in. (760 mm)	Edge 3-4	Bottom
11	460 mm. (18 in)	300 mm (12 in.)	24 in. (760 mm)	Edge 3-6	Face 1
12	460 mm. (18 in)	300 mm (12 in.)	24 in. (760 mm)	Edge 1-5	Face 2
13	460 mm. (18 in)	300 mm (12 in.)	24 in. (760 mm)	Corner 3-4-6	Top
14	460 mm. (18 in)	300 mm (12 in.)	24 in. (760 mm)	Corner 1-2-6	Face 1
15	460 mm. (18 in)	300 mm (12 in.)	24 in. (760 mm)	Corner 1-4-5	Face 2
16 Standard	910 mm (36 in.)	600 mm (24 in.)	NA	Most critical or damage-prone flat orientation	NA
16 Small (in bag)	NA	NA	24 in. (760 mm)	Face 4	Bottom

Continued

TEST SEQUENCE FOR PROCEDURE 3A

	17 Standard	460 mm. (18 in)	300 mm (12 in.)	NA	Face 3 on hazard	NA

For drop 17, the test specimen should strike the hazard midpoint across the longest dimension of the face and parallel to the shortest dimension of the face being impacted. The required drop distance is to the impact surface, not to the hazard. The diagram below shows this concept:



3	All testing is now complete. Go to the Test Report Block.

ROTATIONAL EDGE DROP			
Step	**Action**		
1	Complete the following test sequence for each type of package that has a check in the box:	☐Standard ☑Flat	☐Small ☑Elongated
2	Place the package with face 3 down onto a flat, rigid surface such as steel or concrete.		
3	Perform three rotational edge drops according to the sequence in the table below.		

Sequence #	Orientation	**Specific face, edge or corner**
1	Edge	One of the longest face 3 edges
2	Edge	next longest edge radiating 90° from the edge just tested
3	Edge	The opposite edge tested in Sequence 2.

4	Support the face 3 edge that is opposite to the face 3 edge that is to be tested with a timber or support 90 to 100 mm (3.5 to 4.0 inches) in height and width.
5	Lift the face 3 edge that is to be tested according to sequence in Step 2 to 200 mm (8 inches) off the surface.
6	Release the edge that is to be tested so that it falls freely onto a flat, rigid surface.
7	Repeat Step 3 through Step 5 for the other two edges according to the sequence in Step 2.
8	Testing is complete. Go to the Third Shock Test Block.

3A

Third Shock Test Block

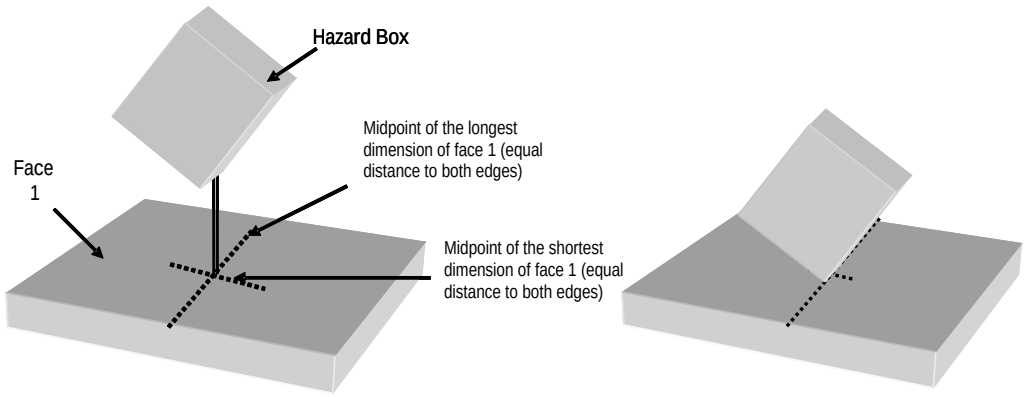
For FLAT and ELONGATED

TEST SEQUENCE FOR PROCEDURE 3A

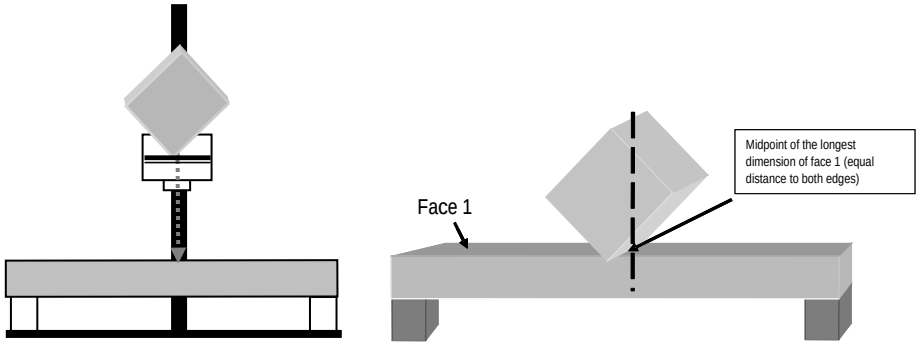
FULL ROTATIONAL FLAT DROP			
Step	Action		
1	Complete the following test sequence for each type of package that has a check in the box:	☐Standard ☑Flat	☐Small ☑Elongated
2	Place the packaged-product so that one of the smallest faces rests on a rigid surface such as steel or concrete and in a position that when pushed over the face 3 surface will impact the rigid surface.		
3	Using any method apply just enough force to the upper half of face 1 to push over the packaged-product without moving the packaged-product from its position.		
4	Place the packaged-product so that one of the next largest faces rests on a rigid surface such as steel or concrete and in a position that when pushed over the face 3 surface will impact the rigid surface.		
5	Using any method apply just enough force to the upper half of face 1 to push over the packaged-product without moving the packaged-product from its position.		
6	Go to the next Shock Test Block.		
7	Testing is complete. Determine the next Shock Test according to the following table:		
	IF the test specimen type is ...	THEN ...	
	Flat	Go to the next Shock Block that is for Flat Packages.	
	Elongated	Go to the Shock Block that is for Elongated Packages.	

Fourth Shock Test Block

For FLAT

CONCENTRATED IMPACT			
Step	Action		
1	Complete the following test sequence for each type of package that has a check in the box:	☐Standard ☑Flat	☐Small ☐Elongated
2	Place the packaged-product so that face 3 rests on a rigid surface such as steel or concrete.		
3	Draw a pencil line parallel to the longest dimension of face 1 and across midpoint of the longest dimension of face 1. Mark the midpoint of the pencil line across the shortest dimension of face 1.		
4	Mark the midpoint of a bottom edge of the hazard box that has the angle iron attached. Tape a string to this point that measures 400 mm (16 inches) from the midpoint of the bottom edge of the hazard box to the other end of the string.		
5	Hold the hazard box so that the angle iron bottom edge with the string attached is parallel to the shortest dimension of face 1 and the string just touches the midpoint of face 1. The diagram below shows this concept:  		
6	Drop the hazard box without attempting to catch any rebound of the hazard box.		
7	All testing is complete. Go to Test Report Block.		

TEST SEQUENCE FOR PROCEDURE 3A

BRIDGE IMPACT		
Step	Action	
1	Complete the following test sequence for each type of package that has a check in the box:	☐Standard ☐Small ☐Flat ☑Elongated
2	Place the packaged-product so that face 3 rests on two separate support blocks, which are on opposite ends of the longest dimension parallel to each other and the shortest edges. The midpoint of the packaged-product face 1 shall be directly under the midpoint of the end edge of the drop test platen when in the dropping position.	
3	Set the platen of the drop test machine to drop the hazard box from a height that is 400 mm (16 inches) above face 1.	
4	Hold the hazard box on the drop test machine platen so an angle iron bottom edge is parallel the length of the platen and parallel to the shortest dimension of face 1. Drop the hazard box parallel to the shortest dimension of face 1 and impact the midpoint across the longest dimension of face 1. 	
6	All testing is complete. Go to the Test Report Block.	

TEST REPORT FOR PROCEDURE 3A

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 printed on certified packages 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.

TRANSIT TESTED

INTERNATIONAL SAFE TRANSIT ASSOCIATION

MANUFACTURER'S LICENSE NUMBER:

☐ ☐ ☐ ☐ ☐

The manufacturer certifies that this PACKAGED-PRODUCT has passed preshipment testing requirements established by ISTA.

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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