

ISTA 6 Series
Member
Performance
Test
PROJECT*

VERSION
DATE
Last
TECHNICAL
Change:
AUGUST
2016

Last
EDITORIAL
Change:
OCTOBER
2017

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

ISTA, Distributing Confidence, Worldwide™

ISTA 6 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 reduction
- Confidence in product launch
- Reduction in damages and product loss
- Balanced distribution costs
- Customer satisfaction contributing to increased market share

There are three sections to this Procedure: Overview, Testing and Reporting

- **Overview** provides general knowledge required before testing **and**
- **Testing** presents the specific instructions to do laboratory testing **and**
- **Reporting** 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 shown 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.

VERY IMPORTANT:

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

* Notes Regarding ISTA “Projects” and “Procedures”

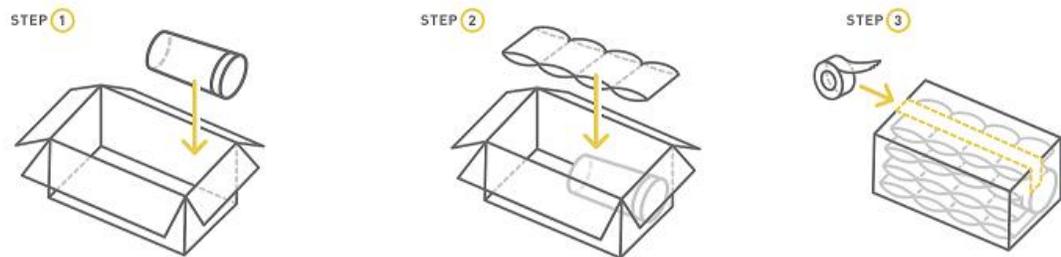
- ISTA® 6-Amazon.com-Over Boxing is currently an ISTA “Project”, first released in August 2016. New ISTA test protocols are given the designation "Project" during their implementation phase. After a minimum one-year period and required evaluation, a "Project" will either be adopted as an established "Procedure", revised and kept as a "Project" for another period of time, or be dropped. Therefore, a “Project” is potentially subject to greater and more frequent revision than a “Procedure”.
- ISTA members may use either Procedures or Projects for package certification.
- Comments regarding this Project and its use are encouraged and welcome. Please contact ista@ista.org.

Preface

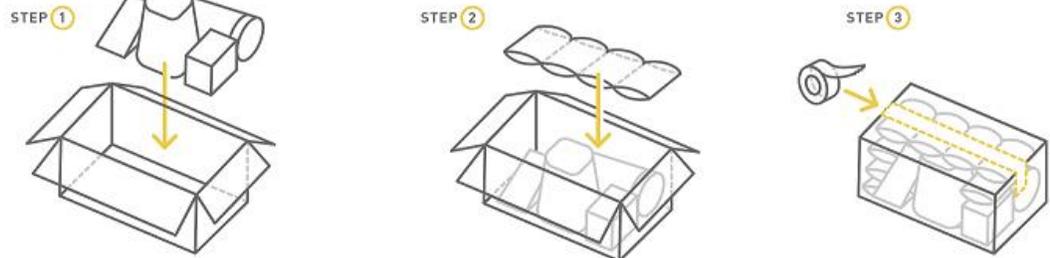
Test Project 6-Amazon.com-Over Boxing is a general simulation test for e-Commerce fulfillment. In comparison to items ready to ship in its own packaging (Test Project 6-Amazon.com- SIOC), this kind of e-Commerce fulfillment comprises an individual retail packaged-product being placed into a master shipping container (Over Box) either by itself with the addition of dunnage (air pillows or Kraft paper) or with multiple individual retail packaged-products with dunnage for shipment from Amazon.com to an end consumer through a parcel delivery system which could include modes of air, rail, or truck. This test challenges the packaging and/or products, whether primary package or transport package, ability to withstand the general damage-producing motions, forces, conditions, and sequences of this environment.

- **e-Commerce Fulfillment** shipment shall be defined as any packaged-product configuration where: The retail individual packaged-product is not intended to ship in its own shipping container
- Single or multiple retail packaged-products are placed into a corrugated shipping container (“over-box”) with dunnage for shipment to an end customer from an e-retailer or distribution center
- **Single item or Multiple item order. Examples below:**

SINGLE



MULTI



Definitions:

- **Dunnage** - loose materials used to support and protect product in a shipping container - for example- air pillows or Kraft paper.
- **Air Pillows** - inflatable void fill typically made of LDPE #4 or HDPE #2 plastics. Air pillows shall have dimensions of 8 in x 4 in (203 mm x 102 mm) and have a maximum thickness of 1.0 mil.
- **Fragile Products** – **Liquids** and other items that could easily break when dropped without having protective packaging; for example- glass, ceramics, porcelains, clay, electronics, etc. See below for **Liquids** definition.
- **Hazards Products** - Hazard products are reusable items to simulate other packaged products in a multiple shipment.
- **Kraft Paper** - paper dunnage used to fill void space and protect products within e-Commerce shipments.
- **Liquids** - or semi-liquids or solids that can become liquid at high temperatures (above 70 degrees Fahrenheit) which can leak from a primary vessel within e-Commerce shipments.
- **Multiple Product Shipment** - more than one product ordered online and has been consolidated into one shipping container.
- **Non-Fragile Products** - items that are not considered Fragile or Liquids- see above for **Fragile Product** and **Liquids** definition.
- **Over-Boxing** - placement of a shipping container/carton around a single product or multiple products for intent to ship via single parcel delivery.

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Definitions (continued):

- **Single Product Shipment** - single product order online that cannot be shipped as-is without the need of being placed into a shipping container/carton.
- **Tertiary Carton** - shipping container/carton made of corrugated board.
- **Test Specimen** - item being tested and evaluated- for example- bottle of shampoo.

General Considerations:

- 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 (Dangerous Goods) packaging that passes this test procedure may not meet international, national or other regulatory requirements for the transport of Hazardous Materials (Dangerous Goods). **This test is not a substitute** for United Nations and/or any other required test standards for the transport of Hazardous Materials (Dangerous Goods), but may be used as an additional test in conjunction with them.

Scope

Test Project 6-Amazon.com-Over Boxing covers testing of individual packaged-products weighing 70 pounds (32 kilograms) or less when prepared for e-Commerce fulfillment by being over-boxed and shipped via a parcel delivery carrier.

Product Damage Tolerance and Package Degradation Allowance

The shipper and Amazon.com shall determine the following prior to testing:

- what constitutes damage to the product (test specimen) **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.

Acceptance Criteria:

Not meeting the criteria below will result in a **Failed** test (Test Specimen Only):

- Product is fully functional in its intended use
- No leaks
- Any Tamper Evident application is not compromised- seal integrity is intact
- Any secondary packaging that is considered part of the product is free from serious damage/indentations/scratching

The Hazard products, dunnage, or tertiary packaging are not to be considered in the acceptance criteria.

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

OVERVIEW OF PROJECT 6-Amazon.com

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.

Samples

The table below provides the Total Samples Required for this test based upon Test Specimen Weight and Product Type (Non-Fragile or Fragile). Fragile items include such things as glass, ceramics, porcelains, clay, electronics, etc. as well as Liquids. See Glossary of Definitions at the end of this procedure.

Shipment Configuration	Test Specimen Weight			
	Less Than 15 lbs (6.80 kg)		15 lbs (6.80 kg) or Greater	
	Non-Fragile	Fragile	Non-Fragile	Fragile
Single Item	1	2	1	5
Multiple Item	1	3	0	0
Total Samples Required	2	5	1	5

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

Documentation

In order to ensure testing in perfect condition, products and packages shipped to an ISTA Certified Laboratory for testing shall be:

- Adequately over-packaged for shipment **or**
- Repackaged in new packaging at the laboratory.
- It is important to thoroughly document the configuration, materials, and construction of the tested product and package. Significant variations in performance can sometimes be caused by seemingly insignificant differences. Photo documentation is required to supplement detailed written descriptions and should include pre-test, during testing and post test images.

Basis Weights of Corrugated Board

When the outer package is a corrugated box, it is strongly recommended that the basis weights of the papers/paperboards used to make the box be determined and documented. If the nominal basis weights change, even if the board is rated for the same performance, a retest is appropriate.

Basis Weight

Refer to *Guidelines for Selecting and Using ISTA Procedures and Projects* for additional information on documentation and basis weight determination.

Test Sequence

Sequence Number	Test Category	Test Type	Test Level	For ISTA Certification
1	Atmospheric Preconditioning TEST BLOCK 1	Temperature and Humidity	Ambient	Required
2	Atmospheric Conditioning TEST BLOCK 1	Controlled Temperature and Humidity	Temperature and Humidity chosen from chart	Optional
3	Shock TEST BLOCK 2	Drop	9 Drops	Required
4	Vibration TEST BLOCK 3	Random With Top-Load	Overall G _{rms} level of 0.53	Required
5	Shock TEST BLOCK 4	Drop	8 Drops	Required
6	Integrity TEST BLOCK 5	Leak Test	8 hours	Required for Liquids ONLY

Equipment
Required
Atmospheric
Conditioning

Atmospheric Conditioning:

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

Optional Atmospheric Conditioning

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

Equipment
Required
Shock

All Protocols	
Type of Shock Test	Drop Test
Type of Equipment	Free-fall drop tester
In compliance with the apparatus section of...	ISO 2248 or ASTM D 5276
Additional Required Equipment	<p>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 (8.0 in) longer than 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 ± 2.0 mm (0.0625 in).</p>

Equipment
Required
Vibration

Random Vibration Test:

- Random Vibration Test System complying with the apparatus section of ISO 13355 or ASTM D 4728.
- A form of column stack fixturing
- Top-Load Apparatus
- Plastic bags
- Sand or other dense, flowable material

Equipment
Required
Additional

SINGLE & MULTI-PRODUCT Shipment – Over Box

- A corrugated Over Box is needed to simulate a typical pack out.
- See Before You Begin – Pack Out for details on Over Box material construction.
- 2 in (50.8 mm) wide poly tape is used to seal an Over Box.

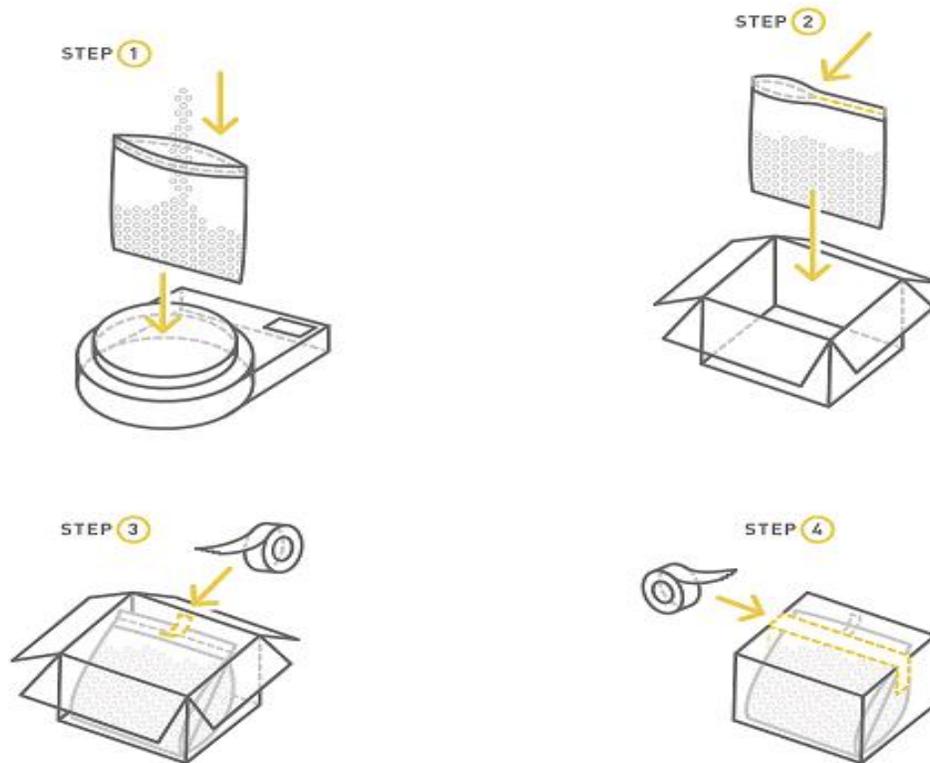
SINGLE & MULTI-PRODUCT Shipment – Dunnage

- Air Pillow dunnage is used to simulate a typical pack out.
- See Before You Begin Testing – Pack Out and Preface - Definitions for details on Air Pillow dunnage material construction.

MULTI-PRODUCT Shipment – Hazard Products

Constructing hazard products for multiple item shipment

- Hazard products are reusable items to simulate other packaged products in a multiple shipment.
- Construct hazard products by adding sand or cat litter (or other flowable dry products) into a plastic bag to reach intended desired weight. Seal the bag and place into an RSC/RET carton (or like) and brace the weight with paper dunnage to prevent the weight from sliding within each hazard carton and eliminate concentrated load.
- Minimum board to be used in making the Hazard Products is 32 ECT C-Flute.
- If the Hazard Products are reused, insure that the carton is not heavily worn (rounded edges, fatigued corrugate). Periodic replacement will be needed for consistent testing.



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MULTI-PRODUCT Shipment – Hazard Products

Constructing hazard products for multiple item shipment - CONTINUED

Equipment
Required
Additional
Continued

The following describes the weights and sizes of each Hazard Product for **Multiple Product shipments**:

- The following describes the name and sizes of each hazard product. It is suggested to make multiple quantities of each size for testing purposes.
- Hazard Product Packages can be constructed from a fiberboard box of any style.
- The contents within the Hazard Product Package shall be sand, cat litter or other flowable material.
- “**Custom**” Hazard Products shall be constructed with vary dimensions, allowing for the Hazard Product(s) to fit into the designated Over Box. The *Custom* Hazard Product must contain the specified *Approximate Weight* from the table below.

Name	Approximate Size LxWxH		Approximate Weight*	
	Millimeters (mm)	Inches (in)	Kilograms (kg)	Pounds (lb)
A	102 x 102 x 25	4.0 x 4.0 x 1.0	0.23	0.5
B	76 x 76 x 76	3.0 x 3.0 x 3.0	0.45	1.0
C	76 x 76 x 76	3.0 x 3.0 x 3.0	0.68	1.5
D	102 x 76 x 76	4.0 x 3.0 x 3.0	1.0	2.0
E	152 x 102 x 102	6.0 x 4.0 x 4.0	1.13	2.5
F	102 x 102 x 102	4.0 x 4.0 x 4.0	1.36	3.0
G	102 x 76 x 51	4.0 x 3.0 x 2.0	1.59	3.5
H	152 x 152 x 21	6.0 x 6.0 x 2.0	1.81	4.0
I	<i>Custom</i>	<i>Custom</i>	2.04	4.5
J	<i>Custom</i>	<i>Custom</i>	2.49	5.5

NOTE:

*A tolerance of ±3% is allowed for this specified Hazard Product weight.

Before You
Begin
Pack-out

Determine the number of Hazard Products to place in the test box (Over Box) along with the TEST SPECIMEN

- The Over Box should be filled with the Test Specimen and dunnage material, to simulate a typical pack out.
- It is **not** acceptable to substitute hazard products with additional or multiple Test Specimen packages.
- The chart below outlines the number of items inside the Over Box, including the Test Specimen as well as the potential Over Box sizes utilized for this test.
- Over Boxes shall be constructed from C-Flute corrugated board.
- Over Boxes for Test Items weighing 15.0 lbs (6.80 kg) or greater shall be constructed with dimensions that are 2.0 in (50.8 mm) greater than the largest Test Specimen Length, Width & Height dimension.
- *Example:* If the Test Specimen has dimensions of (LxWxH) 30.0 in x 22.0 in x 12.0 in, then the Over Box should have dimensions of 32.0 in x 24.0 in x 14.0 in.
- **Single Product Shipment:** An Over Box should be selected from the table below starting with the smallest carton then defaulting to the next sized carton until the Test Specimen fits with the Over Box. See Before You Begin Testing – Pack Out for instructions on how to place the Test Specimen in the Over Box.
- **Multi-Product Shipment:** Fill each corrugated Over Box as indicated in the table below. See Before You Begin Testing – Pack Out for instructions on how to place the Test Specimen and Hazard Products in the Over Box.

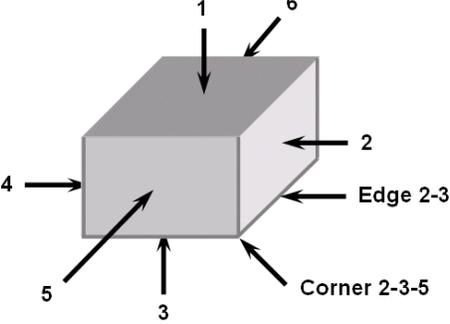
NOTE: If the Test Specimen and Hazard Products do not fit in the smallest carton, default to the next sized carton until all the items fit.

Weight of Test Specimen	Hazard Name	Test Specimen	Number of Items Inside Shipment Over Box Including Test Specimen	Over Box			
				Internal Length (in)	Internal Width (in)	Internal Height (in)	Style and ECT Rating
0 to < 0.5 lbs (0 kg to <0.23 kg)	A,B,D	1	4	10.0	7.0	3.0	RSC/29
0.5 lbs to < 1.5 lbs (0.23 kg to < 0.68 kg)	A,C,D	1	4	13.0	9.0	4.0	RSC/32
1.5 to < 2.5 lbs (0.68 kg to < 1.13 kg)	B,C,D	1	4	16.0	12.0	3.0	RSC/32
2.5 lbs to < 3.0 lbs (1.13 kg to < 1.36 kg)	B,C,D	1	4	14.0	10.0	5.0	RSC/32
3.0 lbs to < 4.0 lbs (1.36 kg to < 1.81 kg)	B,D,D	1	4	14.0	8.0	7.0	RSC/32
4.0 lbs to < 5.0 lbs (1.81 kg to < 2.27 kg)	D,D,D	1	4	19.0	12.0	4.0	RSC/32
5.0 to < 6.0 lbs (2.27 kg to < 2.72 kg)	F,H	1	3	16.0	12.0	6.0	RSC/32
6.0 lbs to < 7.0 lbs (2.72 kg to < 3.18 kg)	F,G	1	3	18.0	9.0	8.5	RSC/32
7.0 lbs to < 8.0 lbs (3.18 kg to < 3.63 kg)	F,H	1	3	19.0	13.0	6.0	RSC/32
8.0 lbs to < 9.0 lbs (3.63 kg to < 4.08 kg)	E,H	1	3	14.0	12.0	10.0	RSC/32
9.0 to < 10.0 lbs (4.08 kg to < 4.54 kg)	J,H	1	3	18.0	14.0	8.0	RSC/32
10.0 lbs to < 11.5 lbs (4.54 kg to < 5.22 kg)	I,J	1	3	22.0	18.0	12.0	RSC/44
11.5 lbs to < 13.0 lbs (5.22 kg to < 5.90 kg)	J,G	1	3	22.0	18.0	12.0	RSC/44
13.0 lbs to < 15.0 lbs (5.90 kg to < 6.80 kg)	I,F	1	3	22.0	18.0	12.0	RSC/44
15.0 lbs to ≤ 70.0 lbs (6.80 kg to ≤ 32.00 kg)	None	1	1	Product + 2.0	Product + 2.0	Product + 2.0	RSC/32

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

Before You
Begin
Testing

Identification
of OVER BOX
Faces, Edges
and Corners

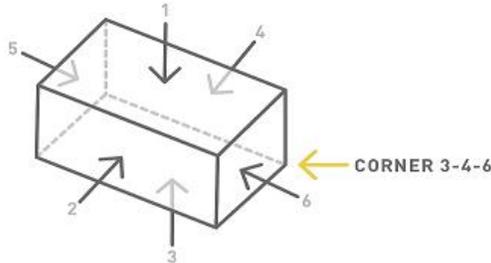
Step	Action	
1	Place the OVER BOX so it is in the most stable orientation (NOTE: most stable orientation may be different than intended shipping orientation. The most stable orientation is the orientation where the center of gravity is the lowest. If the center of gravity is unknown for a packaged-product then the packaged-product should be placed with its largest face down.)	
2	Turn the OVER BOX so that one of the smallest faces is directly in front of you. If the one end of the package is noticeably heavier than the other, then position the smallest face with the heaviest end directly in front of you. See Step 3.	
3	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.	

Before You
Begin
Testing

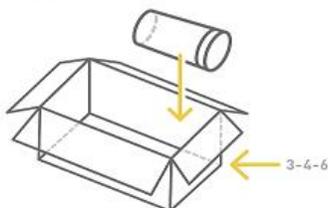
Pack Out

Preparing the Over Box – SINGLE ITEM SHIPMENT

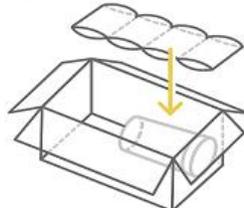
- Mark faces and corners of the Over Box (tertiary carton) based on the Identify the Faces, Edges and Corners instructions of this protocol.
- Place Test Specimen in the Over Box and move to corner 3-4-6 based on the Identify the Faces, Edges and Corners instructions of this protocol. Orient the Test Specimen with the most damage-susceptible region facing the 3-4-6 corner.
Example: Most damage-susceptible region for liquid products is the closure, especially dispensing pumps and trigger sprayers. The closure should be placed in the Over Box so that it contacts Face 4 & 6.
- Fill remaining space with air pillow dunnage so the Test Specimen is appropriately blocked and braced and the Over Box can be closed and sealed with a single strip on the top and bottom of 2 in (50.8 mm) wide poly tape.
- Sample is ready to be tested as a **SINGLE ITEM SHIPMENT**.



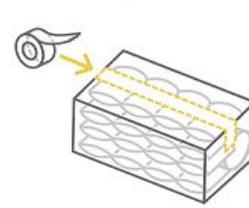
STEP 1



STEP 2



STEP 3

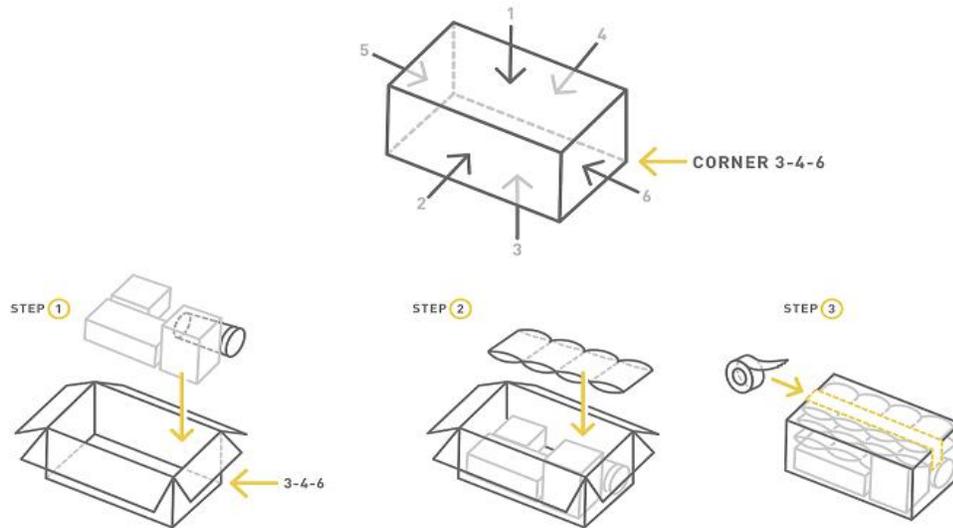


Before You
Begin
Testing

Pack Out
CONTINUED

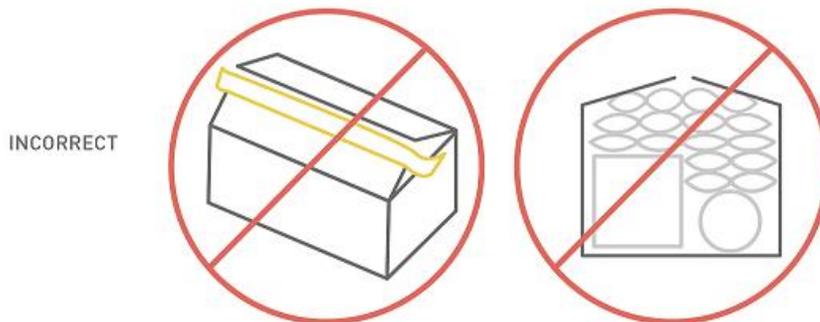
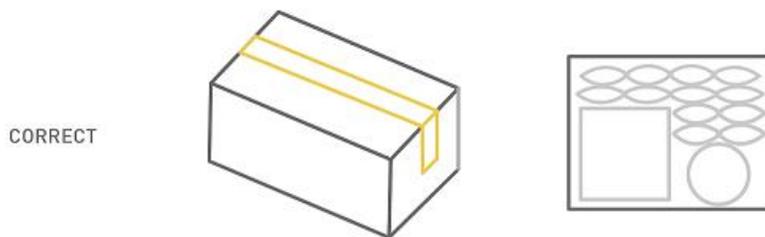
Preparing the Over Box – MULTIPLE ITEM SHIPMENT

- Mark faces and corners of the Over Box (tertiary carton) based on the Identify the Faces, Edges and Corners instructions of this protocol.
- **Do not reuse** Test Specimen from the Single Item test sequence for the Multiple Item test sequence.
- Place Test Specimen in the Over Box and move to corner 3-4-6 based on the Identify the Faces, Edges and Corners instructions of this protocol. Add the determined amount of Hazard Products based on table in Before You Begin – Hazard Products. Orient the Test Specimen with the most damage-susceptible region facing the 3-4-6 corner.
Example: Most damage-susceptible region for liquid products is the closure, especially dispensing pumps and trigger sprayers. The closure should be placed in the Over Box so that it contacts Face 4 & 6.
- Fill remaining space with air pillow dunnage so the Test Specimen is appropriately blocked and braced and the Over Box can be closed and sealed with a single strip on the top and bottom of 2 in (50.8 mm) wide poly tape. Close and seal the Over Box.
- Sample is ready to be tested as a **MULTIPLE ITEM SHIPMENT**.



NOTE:

Avoid over packaging dunnage - Over Box should close without excessive force or pressure needed to hold flaps down while taping it closed.



Note: Air pillows are the only allowed method for dunnage within the Over Box. Air pillows shall have dimensions of 8 in x 4 in (203 mm x 102 mm) and have a maximum thickness of 1.0 mil.

You shall know the Test Specimen and Over Boxed packaged-product's:

- Gross weight in kilograms (kg) for Metric and pounds (lb) for English units
- Exterior 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.

Required Preconditioning:

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

Conditioning

Optional Conditioning Recommended (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.

NOTE: 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

NOTE: Conditioning of the test specimen is optional in the overall Test Sequences.

Catching or Restraining Packaged-Products After Free-Fall Drop Testing

Refer to *Guidelines for Selecting and Using ISTA Test Procedures and Projects* for recommendations, cautions, and documentation requirements. Also follow your company policies when making the decisions to catch or restrain.

CAUTION:

A restraining device or devices (fixturing) 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:

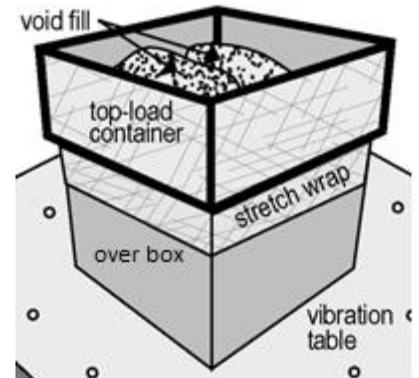
Type of Package	Number of Axes to Test	Orientations to Test	Dynamic Top-Load Range
Standard	3	3	11 kg – 140 kg (25 lb – 300 lb)

The **Top-Load** is to simulate the effect of 100 kg/m³ (6 lb/ft³ - 0.0035 lb/in³) 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 **Loading Factor** has been determined by empirical testing that resulted in correlation between damage in the test lab and damage in the field.

The Top-Load Apparatus shall be: (see Figure below for example of Top-Load Apparatus)

- A fiberboard box, or other container, of sufficient strength and ability to hold a load spreader (such as a 3/4"(19 mm) piece of plywood or a plate of steel that is the same length and width as the inside dimensions of the load apparatus) and required weight for each axis **and**
- The length and width dimensions of the Top-Load package or apparatus which will be applied to the test specimen shall each be a minimum of 50 mm (2 in) longer than each of the two dimensions of the test specimen's top face when positioned for testing [i.e., a minimum of 25 mm (1 in) overhang on each side] **but**
- The length and width dimensions of the Top-Load package or apparatus may each be longer by a maximum of 150 mm (6 in) than each of the two dimensions of the test specimen's top face when positioned for testing [i.e., a maximum of 75 mm (3 in) overhang on each side] **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 apparatus that will apply the Top-Load to the entire 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 apparatus (it is also required to use stretch wrap around the test specimen and the top-load apparatus to prevent the top-load apparatus from bouncing on top of the test specimen) **and**
- The top-load apparatus shall never be smaller than the test face; the calculated weight must cover the entire surface of the test face during the testing.



Determination of Top-Load Weight:

- Determine the proper top-load weight for the OVER BOX by first using the "Top-Load Formulas TL" chart found in the Before You Begin section of this protocol, then following instructions in the "Top-Load weight (TL) for any Axis" table to determine the specified Top-Load. A tolerance of ±3% is allowed for this specified Top-Load.

Continued on next page

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Familiarity with the following formulas is required:

Note: Dimensions for “Top-Load Formulas TL” are based upon the OVER BOX being in the most stable orientation which could be different than the intended shipping orientation.

Top-Load Formulas TL		Metric Units (m and kg)	English Units (in and lb)
Top-Load (TL-H) with face 3 down		$(2.7 - H) \times L \times W \times 100$	$(108 - H) \times L \times W \times 0.0035$
Top-Load (TL-W) with face 4 down		$(2.7 - W) \times L \times H \times 100$	$(108 - W) \times L \times H \times 0.0035$
Top-Load (TL-L) with face 6 down		$(2.7 - L) \times W \times H \times 100$	$(108 - L) \times W \times H \times 0.0035$
Where	Represents		
TL	Total Weight of the Top-Load Apparatus	Kilograms (kg)	Pounds (lb)
2.7 and 108	Height of typical trailer	Meters (m)	Inches (in)
H	Height of shipping unit (OVER BOX)	Meters (m)	Inches (in)
L	Length of shipping unit (OVER BOX)	Meters (m)	Inches (in)
W	Width of shipping unit (OVER BOX)	Meters (m)	Inches (in)
100 and 0.0035	Loading Factor: 50% of the average density of freight*	100 kg/m ³	0.0035 lb/in ³

Determine the Top-Load weight using the following table:

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 2 kg (5 lb) for that axis. <i>Examples:</i> If the calculated Top-Load is 21 kg you would round up and use 22 kg as the Top-Load; If the calculated Top-Load is 32 lb you would round up and use 35 lb as the Top-Load.
Greater than 140 kg (300 lb)	Use 140 kg (300 lb) as the Top-Load (TL).

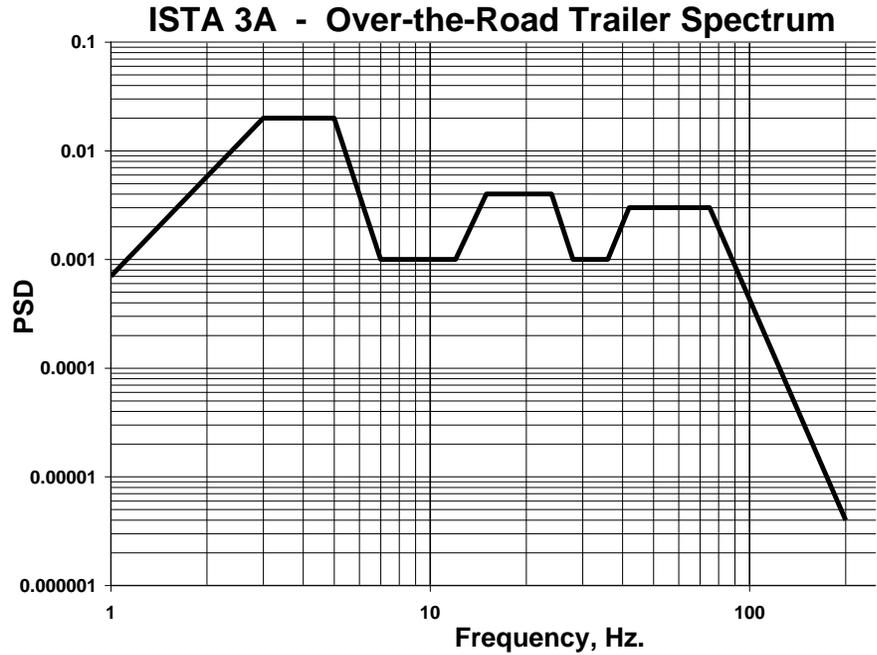
* The **Loading Factor** has been determined by empirical testing that resulted in correlation between damage in the test lab and damage in the field.

Before You
Begin
Vibration
Testing

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 47.12 mm (1.855 in) peak to peak:

Frequency (Hz)	PSD Level, g^2/Hz
1.0	0.0007
3.0	0.02
5.0	0.02
7.0	0.001
12.0	0.001
15.0	0.004
24.0	0.004
28.0	0.001
36.0	0.001
42.0	0.003
75.0	0.003
200.0	0.000004



TEST SEQUENCE FOR PROJECT 6-Amazon.com

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	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 testing record temperature and humidity.
5	Go to TEST BLOCK 2 (Shock: First Sequence – Drop).
6	Select an anticipated condition from Before You Begin Atmospheric Conditioning.
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 apparatus.
9	At the completion of the required conditioning time remove the packaged-product from the conditioning apparatus.
10	Conditioning is now complete. When testing starts, record the ambient temperature and humidity. Go to TEST BLOCK 2 (Shock: First Sequence – Drop) and perform the remaining test sequence as quickly as possible.

TEST BLOCK 2

Shock:
First Sequence
(Drop)

SHOCK - DROP			
Step	Action		
1	Follow the table below to determine the height and orientation for the first 9 drops.		
	Drop Number	< 32 kg (70 lb)	Standard
	1	460 mm (18 in)	Edge 3-4
	2	460 mm (18 in)	Edge 3-6
	3	460 mm (18 in)	Edge 4-6
	4	460 mm (18 in)	Corner 3-4-6
	5	460 mm (18 in)	Corner 2-3-5
	6	460 mm (18 in)	Edge 2-3
	7	460 mm (18 in)	Edge 1-2
	8	910 mm (36 in)	Face 3
9	460 mm (18 in)	Face 3	
2	Shock test is now complete. Go to TEST BLOCK 3 (Vibration Under Dynamic Load).		

TEST SEQUENCE FOR PROJECT 6-Amazon.com

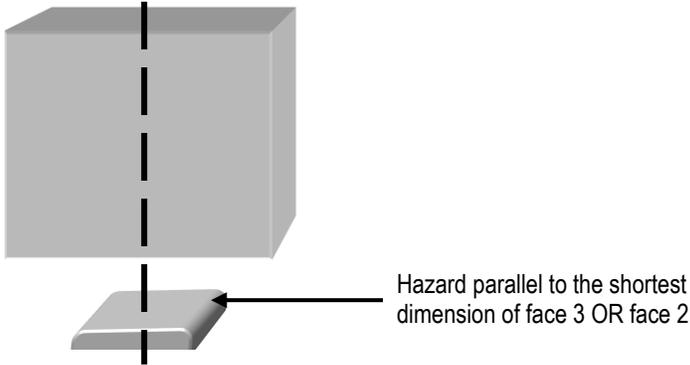
TEST BLOCK 3

Vibration:
Under Dynamic
Load
(Over-The-Road
spectrum)

VIBRATION - DYNAMIC LOAD, RANDOM (using OVER-THE-ROAD spectrum)			
Step	Action	Testing Orientation	Vibration Duration
1	Place the packaged-product (Over Box) on the vibration table so that face-3 rests on the center of the platform.	FACE 3 on table surface	60 MINUTES
2	Place the Dynamic Top-Load apparatus as determined in Before You Begin Vibration Under Dynamic Load for TL-H on top of the Over Box.		
3	Using some form of column stack fixturing, make sure that the stack will maintain its orientation without restricting the vertical motion of the Top-Load apparatus or the Over Box.		
4	Start the vibration machine to produce the Over-the-Road random vibration spectrum indicated in Before You Begin Vibration Testing.		
5	After 60 minutes, stop the vibration testing and remove the Dynamic Top-Load apparatus.		
6	Rotate the Over Box so that face-4 rests on the center of the vibration table platform.	FACE 4 on table surface	30 MINUTES
7	Place the Dynamic Top-Load apparatus as determined in Before You Begin Vibration Under Dynamic Load Testing for TL-W on top of the Over Box.		
8	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 apparatus or the Over Box.		
9	Start the vibration machine to produce the Over-the-Road random vibration spectrum indicated in Before You Begin Testing.		
10	After 30 minutes, stop the vibration testing and remove the Dynamic Top-Load apparatus.		
11	Rotate the Over Box so that face-6 rests on the center of the vibration table platform.	FACE 6 on table surface	30 MINUTES
12	Place the Dynamic Top-Load apparatus as determined in Before You Begin Vibration Under Dynamic Load for TL-L on top of the Over Box.		
13	Using some form of column stack fixturing, make sure that the stack will maintain its orientation without restricting the vertical motion of the Top-Load apparatus or the Over Box.		
14	Start the vibration machine to produce the Over-the-Road random vibration spectrum indicated in Before You Begin Vibration Testing.		
15	After 30 minutes, stop the vibration testing and remove the Dynamic Top-Load apparatus.		
16	This vibration testing is complete. Go to TEST BLOCK 4 (Shock: Second Sequence – Drop).		

TEST BLOCK 4

Shock:
Second
Sequence
(Drop)

SHOCK - DROP			
STEP	ACTION		
1	Follow the table below to determine the height and orientation for the final set of 8 drops.		
	Drop Number	Drop Height	Over Box Containing Test Specimen
	10	460 mm (18 in)	Edge 3-4
	11	460 mm (18 in)	Edge 3-6
	12	460 mm (18 in)	Edge 1-5
	13	460 mm (18 in)	Corner 3-4-6
	14	460 mm (18 in)	Corner 1-2-6
	15	460 mm (18 in)	Corner 1-4-5
	16	910 mm (36 in)	Face 6 or Face 4 - Most critical or damage-prone flat orientation
	17	460 mm (18 in)	Face 3 on hazard
<p>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:</p> 			
2	IF the test specimen type is: Does NOT Contain Liquids	THEN: All testing is now complete. Go to the Reporting an ISTA Test section at the end of this test.	
	Contains Liquids	This Shock test is complete. Go to TEST BLOCK 5 (Integrity – Leak Test).	

TEST BLOCK 5

Integrity:
Leak Testing
(For LIQUIDS)

INTEGRITY – LEAK TEST		
STEP	ACTION	EXAMPLE
1	Open the Over Box and remove the TEST SPECIMEN (primary package) that contain liquids.	
2	Place the primary liquid package(s) on their side ensuring that the liquid product is in contact with the closure, challenging the closure's ability to contain the liquid product in the package.	
3	Do not place a top-load on the Test Specimen.	
4	After the completion of eight (8) hours, inspect the primary liquid container for any leakage. Note: If leaking occurs prior to the eight (8) hours being complete, the leak test can be terminated.	
5	All testing is now complete. Go to the Reporting an ISTA Test section at the end of this test.	

Reporting an
ISTA Test:
Completing
and
Submitting
an ISTA Test
Report

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 include pictures and 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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